

FCC TEST REPORT

for

47 CFR Part 15 Subpart C

Equipment : 802.11b wireless router
Model No. : WR1230
FCC ID : KFY-WR1230
Filing Type : Certification
Applicant : **Runtop Inc.**
1, Ln. 21, Hsin Hua Rd., Kueishan Industrial park,
Taoyuan City, Taiwan

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SPORTON International Inc.

6F, No.106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.

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CERTIFICATE OF COMPLIANCE

for

47 CFR Part 15 Subpart C

Equipment : 802.11b wireless router
Model No. : WR1230
FCC ID : KFY-WR1230
Filing Type : Certification
Applicant : **Runtop Inc.**
1, Ln. 21, Hsin Hua Rd., Kueishan Industrial park,
Taoyuan City, Taiwan

I **HEREBY** CERTIFY THAT :

The measurements shown in this test report were made in accordance with the procedures given in **ANSI C63.4 - 2001** and the equipment under test was **passed** all test items required in **47CFR Part 15 subpart C**, relative to the equipment under test. Testing was carried out on Nov. 13, 2003 at **SPORTON International Inc.** LAB.



Alex Chen
Manager

SPORTON International Inc.

6F, No.106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.

SPORTON International Inc.

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FCC ID : KFY-WR1230
Page No. : 1 of 39
Issued Date : Nov. 14, 2003

1. General Description of Equipment under Test

1.1. Applicant

Runtop Inc.
1, Ln. 21, Hsin Hua Rd., Kueishan Industrial park, Taoyuan City, Taiwan

1.2. Manufacturer

Same as 1.1

1.3. Basic Description of Equipment under Test

Equipment : 802.11b wireless router
Model No. : WR1230
FCC ID. : KFY-WR1230
Trade Name : Runtop
TP Cable x 4 : Non-Shielded, 1m
TP Cable : Non-Shielded, 13m
Power Supply Type : Linear
AC Power Input : Wall-Mount, 2pin
DC Power Cable : Non-Shielded, 1.8m

1.4. Feature of Equipment under Test

Product Feature & Specification	
1. Host/Radio Interface	DSSS
2. Type of Modulation	BPSK/QPSK/CCK
3. Number of Channels	11
4. Frequency Band	2.4GHz~2.4835GHz
5. Carrier Frequency of each channel	2.412GHz+(CH-1)*5MHz
6. Bandwidth of each channel	22MHz
7. Maximum Output Power to Antenna	16.94dBm
8. IF & L.O. Frequency	748MHz / 2.038 to 2.098GHz
9. Type of Antenna Connector (Ex: SMA, TNC, MCX, MMCX, UFC.....etc)	U-FL.R-SMT
10. Antenna Type / Class and Gain	Dipole antenna @ 2dBi
11. Function Type	Transceiver
12. Power Rating (DC/AC, Voltage)	XEPEX / WP4810050D DC 5V / 2A
13. Duty Cycle	100%
14. Basic function of product	Transceiver

2. Test Configuration of Equipment under Test

2.1. Test Manner

- a. The EUT has been associated with notebook and peripherals pursuant to ANSI C63.4-2001 and configuration operated in a manner, which tended to maximize its emission characteristics in a typical application.
- b. The complete test system included remote COMPAQ Notebook, COMPAQ Notebook, VIEWSONIC Monitor, LOGITECH PS/2 Keyboard, LOGITECH USB Mouse, EPSON Printer and EUT for EMI test.
- c. For EMI test, vertical polarity of RF antenna generates worse case, so the following test modes were tested with vertical:
 - Mode 1: CH01 (2412MHz)
 - Mode 2: CH06 (2437MHz)
 - Mode 3: CH11 (2462MHz)
- d. Frequency range investigated: conduction 150 KHz to 30 MHz, radiation 30 MHz to 25000MHz.

2.2. Description of Test System

Support Unit 1. -- Notebook (COMPAQ) – for local and remote workstation

FCC ID	: N/A
Model No.	: PRESARIO 1500
Power Supply Type	: Switching
Power Cord	: Non-Shielded
Serial No.	: SP0127
Remark	: This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

Support Unit 2. -- Monitor (VIEWSONIC) – for local workstation

FCC ID	: N/A
Model No.	: VCDTS21553-3P
Power Supply Type	: Switching
Power Cord	: Non-Shielded
Serial No.	: SP0051
Data Cable	: Shielded, 1.7m
Remark	: This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

Support Unit 3. – PS/2 Keyboard (LOGITECH) – for local workstation

FCC ID : N/A
Model No. : Y-SJ17
Serial No. : SP0054
Data Cable : Shielded, 360 degree via metal backshells, 1.7m
Remark : This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

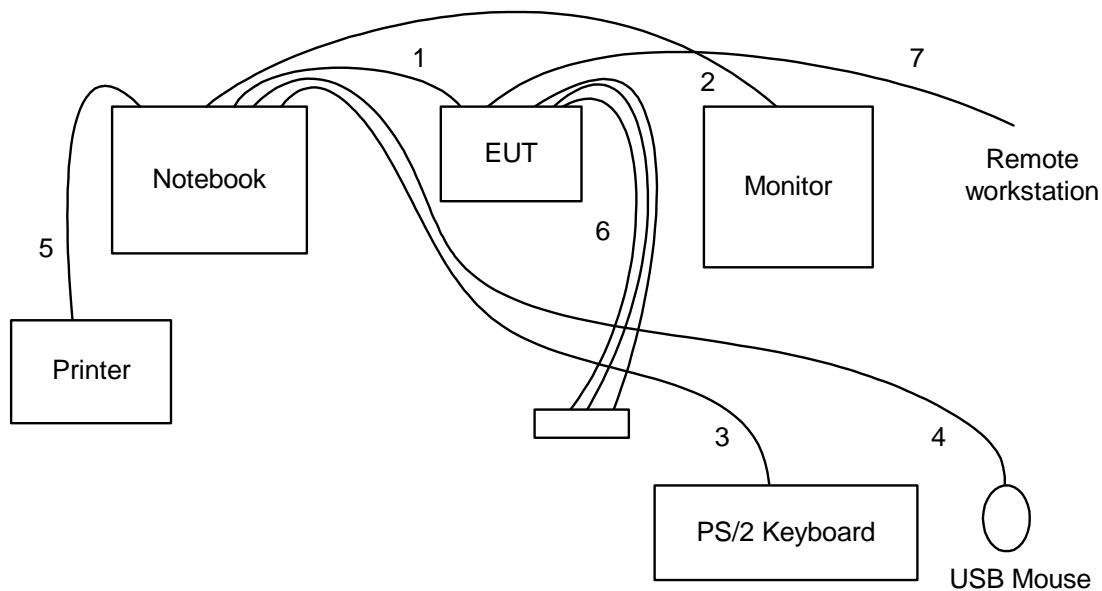
Support Unit 4. – USB Mouse (LOGITECH) – for local workstation

FCC ID : N/A
Model No. : M-BE58
Serial No. : SP0041
Data Cable : Shielded, 1.7m
Remark : This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

Support Unit 5. -- Printer (EPSON) – for local workstation

FCC ID : N/A
Model No. : STYLUS COLOR 680
Power Supply Type : Linear
Power Cord : Non-Shielded
Serial No. : SP0048
Data Cable : Shielded, 1.35m
Remark : This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

2.3. Connection Diagram of Test System



1. The TP cable is connected from the Notebook to the EUT.
2. The I/O cable is connected from the Notebook to the support unit 2.
3. The I/O cable is connected from the Notebook to the support unit 3.
4. The I/O cable is connected from the Notebook to the support unit 4.
5. The I/O cable is connected from the Notebook to the support unit 5.
6. These are loop-back TP cables.
7. The TP cable is connected from the EUT to the remote workstation.

3. Test Software

An executive programs, EMCTEST.EXE under WIN XP, which generate a complete line of continuously repeating " H " pattern was used as the test software.

The program was executed as follows:

- a. Turn on the power of all equipment.
- b. The PC reads the test program from the hard disk drive and runs it.
- c. The PC sends " H " messages to the monitor, and the monitor displays " H " patterns on the screen.
- d. The PC sends " H " messages to the printer, then the printer prints them on the paper.
- e. The PC sends " H " messages to the internal Hard Disk, and the Hard Disk reads and writes the message.
- f. Repeat the steps from c to e.

At the same time, the EUT kept transmitting signals at fixed frequency.

4. General Information of Test

Test Site Location : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park,
Kwei-Shan Hsiag, Tao Yuan Hsien, Taiwan, R.O.C.
TEL : 886-3-327-3456
FAX : 886-3-318-0055
Test Site No : CO01-HY, 03CH03-HY

4.1. Test Voltage

110V/60Hz

4.2. Standard for Methods of Measurement

ANSI C63.4-2001 for conducted power line test and radiated emission test,
"Guidance on Measurements for Direct Sequence Spread Spectrum Systems" for test of 6dB Bandwidth
"Guidance on Measurements for Direct Sequence Spread Spectrum Systems" for test of Maximum Peak Output Power
"Guidance on Measurements for Direct Sequence Spread Spectrum Systems" for test of 100kHz Bandwidth of Frequency Band Edges
"Guidance on Measurements for Direct Sequence Spread Spectrum Systems" for test of Power Spectral Density

4.3. Test in Compliance with

47CFR Part 15 Subpart C (Section 15.247)

4.4. Frequency Range Investigated

- a. Conduction: from 150 kHz to 30 MHz
- b. Radiation: from 30 MHz to 25000MHz

4.5. Test Distance

The test distance of radiated emission from antenna to EUT is 3 M.

5. Report of Measurements and Examinations

5.1. List of Measurements and Examinations

FCC Rule	Description of Test	Result
15.207	Conducted Emission	Pass
<u>15.247(a)(2)</u>	6dB Bandwidth	Pass
<u>15.247(b)</u>	Maximum Peak Output Power	Pass
<u>15.247(c)</u>	Radiated Emission	Pass
<u>15.247(c)</u>	100kHz Bandwidth of Frequency Band Edges	Pass
<u>15.247(d)</u>	Peak Power Spectral Density	Pass
<u>15.203</u>	Antenna Requirement	Pass
1.1307 1.1310 2.1091 2.1093	RF Exposure Compliance	Pass

5.2. 6dB Bandwidth

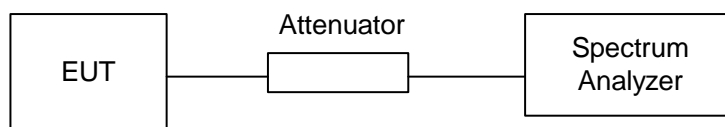
5.2.1. Measuring Instruments :

As described in chapter 7 of this test report.

5.2.2. Test Procedure :

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 100KHz and VBW to 100KHz.
3. The 6 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6 dB.

5.2.3. Test Setup Layout :



5.2.4. Test Result : The spectrum analyzer plots are attached as below

- Temperature: 27 °C
- Relative Humidity: 63%

Channel	Frequency (MHz)	6dB Emission bandwidth (MHz)	Limits (MHz)	Plot Ref. No.
01	2412	8.80	0.5	1
06	2437	8.76	0.5	2
11	2462	8.76	0.5	3

5.3. Peak Output Power

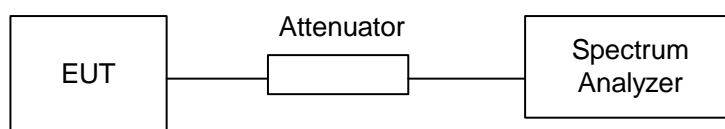
5.3.1. Measuring Instruments :

As described in chapter 7 of this test report.

5.3.2. Test Procedure :

The antenna port (RF output) of the EUT was connected to the input (RF input) of a power meter. Power was read directly from the meter and cable loss connection was added to the reading to obtain power at the EUT antenna terminal. The EUT Output Power was set to maximum to produce the worse case test result.

5.3.3. Test Setup Layout :



5.3.4. Test Result : See spectrum analyzer plots below

- Temperature: 27°C
- Relative Humidity: 63 %

Channel	Frequency (MHz)	Measured Output Power (dBm)	Measured Output Power (mW)	Limits (Watt/dBm)
01	2412	15.79	37.93149850	1W/30 dBm
06	2437	16.94	49.43106870	1W/30 dBm
11	2462	15.83	38.28247433	1W/30 dBm

- Comments : Maximum Peak Output Power < 30dBm (1Watt)

5.4. Power Spectral Density

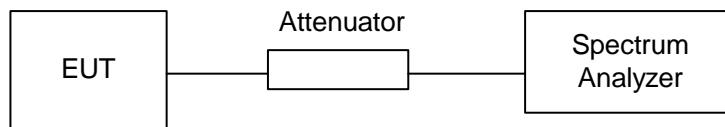
5.4.1. Measuring Instruments :

As described in chapter 7 of this test report.

5.4.2. Test Procedure :

1. The transmitter output was connected to spectrum analyzer through an attenuator.
2. The spectrum analyzer's resolution bandwidth were set at 3KHz RBW and 30KHz VBW as that of the fundamental frequency. Set the sweep time=span/3KHz.
3. The power spectral density was measured and recorded.
4. The Sweep time is allowed to be longer than span/3KHz for a full response of the mixer in the spectrum analyzer.

5.4.3. Test Setup Layout :



5.4.4. Test Result : See spectrum analyzer plots below

- Temperature: 27°C
- Relative Humidity: 63 %

Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limits (dBm)	Plot Ref. No.
01	2412	-9.00	8	1
06	2437	-9.43	8	2
11	2462	-8.37	8	3

5.5. Test of Conducted Emission

Conducted Emissions were measured from 150 KHz to 30 MHz with a bandwidth of 9 KHz and return leads of the EUT according to the methods defined in ANSI C63.4-2001 Section 3.1. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

5.5.1. Major Measuring Instruments :

● Test Receiver	(R&S ESCS 30)
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 KHz

5.5.2. Test Procedures :

- a. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- b. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- c. All the support units are connect to the other LISN.
- d. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- e. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
- f. Both sides of AC line were checked for maximum conducted interference.
- g. The frequency range from 150 KHz to 30 MHz was searched.
- h. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

5.5.3. Test Result of Conducted Emission :

- Test Mode: Mode 1
- Frequency Range of Test: from 150KHz to 30 MHz
- Temperature: 23°C
- Relative Humidity: 54 %

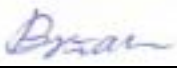
The test was passed at the minimum margin that marked by the frame in the following table

Site : C001-HY
 Condition : CNS/VCCI/CISPR-B 2003 2001/008 LINE
 EUT : Wireless Router
 Power : 110V/60Hz
 Model : WR1230
 Memo : TX CH01 2412MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.160	40.05	-16.21	65.06	40.70	0.10	0.05	QP
2	0.168	20.28	-34.78	55.06	20.13	0.10	0.05	Average
3	0.259	42.95	-18.51	61.46	42.76	0.10	0.09	QP
4	0.259	15.37	-36.09	51.46	15.10	0.10	0.09	Average
5	0.589	33.71	-22.29	56.00	33.47	0.10	0.14	QP
6	0.589	9.35	-36.65	46.00	9.11	0.10	0.14	Average
7	1.340	25.24	-30.76	56.00	25.06	0.10	0.08	QP
8	1.340	6.24	-39.76	46.00	6.06	0.10	0.08	Average
9	12.766	28.54	-31.46	60.00	28.09	0.20	0.25	QP
10	12.766	23.20	-26.72	50.00	22.03	0.20	0.25	Average
11	17.755	20.74	-39.26	60.00	20.17	0.26	0.31	QP
12	17.755	16.05	-33.95	50.00	15.48	0.26	0.31	Average

Site : C001-HY
 Condition : CNS/VCCI/CISPR-B 2003 2001/008 NEUTRAL
 EUT : Wireless Router
 Power : 110V/60Hz
 Model : WR1230
 Memo : TX CH01 2412MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.162	48.44	-15.92	65.36	48.29	0.10	0.05	QP
2	0.162	21.60	-33.76	55.36	21.45	0.10	0.05	Average
3	0.259	42.61	-18.05	61.46	42.42	0.10	0.09	QP
4	0.259	15.16	-36.30	51.46	14.97	0.10	0.09	Average
5	0.621	33.01	-22.99	56.00	32.77	0.10	0.14	QP
6	0.621	9.17	-36.03	46.00	8.93	0.10	0.14	Average
7	1.400	24.18	-31.82	56.00	24.01	0.10	0.07	QP
8	1.400	6.29	-39.71	46.00	6.12	0.10	0.07	Average
9	12.450	25.01	-34.99	60.00	24.52	0.25	0.24	QP
10	12.450	19.87	-30.13	50.00	19.38	0.25	0.24	Average
11	24.400	15.44	-44.56	60.00	14.58	0.48	0.38	QP
12	24.400	11.14	-38.06	50.00	10.20	0.48	0.38	Average

Test Engineer: 
 Brian Lin

- Test Mode: Mode 2
- Frequency Range of Test: from 150KHz to 30 MHz
- Temperature: 23°C
- Relative Humidity: 54 %


The test was passed at the minimum margin that marked by the frame in the following table

Site : C001-HY
 Condition : CNS/VCCI/CISPR-B 2003 2001/008 LINE
 EUT : Wireless Router
 Power : 110V/60Hz
 Model : WR1230
 Memo : TX CH06 2437MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.164	48.72	-16.54	65.26	48.57	0.10	0.05	QP
2	0.164	21.20	-34.06	55.26	21.05	0.10	0.05	Average
3	0.264	42.63	-18.67	61.30	42.44	0.10	0.09	QP
4	0.264	15.21	-36.09	51.30	15.02	0.10	0.09	Average
5	0.598	33.69	-22.31	56.00	33.45	0.10	0.14	QP
6	0.598	9.50	-36.50	46.00	9.26	0.10	0.14	Average
7	1.340	24.51	-31.49	56.00	24.33	0.10	0.08	QP
8	1.340	6.18	-39.82	46.00	6.00	0.10	0.08	Average
9	12.320	30.37	-29.63	60.00	29.93	0.20	0.24	QP
10	12.320	25.45	-24.55	50.00	25.01	0.20	0.24	Average
11	17.750	18.25	-41.75	60.00	17.68	0.26	0.31	QP
12	17.750	12.75	-37.25	50.00	12.18	0.26	0.31	Average

Site : C001-HY
 Condition : CNS/VCCI/CISPR-B 2003 2001/008 NEUTRAL
 EUT : Wireless Router
 Power : 110V/60Hz
 Model : WR1230
 Memo : TX CH06 2437MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.168	48.53	-16.53	65.06	48.38	0.10	0.05	QP
2	0.168	19.87	-35.19	55.06	19.72	0.10	0.05	Average
3	0.318	40.30	-19.46	59.76	40.08	0.10	0.12	QP
4	0.318	13.64	-36.12	49.76	13.42	0.10	0.12	Average
5	0.604	33.35	-22.65	56.00	33.11	0.10	0.14	QP
6	0.604	9.17	-36.83	46.00	8.93	0.10	0.14	Average
7	1.550	22.44	-33.56	56.00	22.28	0.10	0.06	QP
8	1.550	6.17	-39.83	46.00	6.01	0.10	0.06	Average
9	12.990	22.10	-37.90	60.00	21.59	0.26	0.25	QP
10	12.990	16.31	-33.69	50.00	15.80	0.26	0.25	Average
11	17.750	16.66	-43.34	60.00	16.05	0.30	0.31	QP
12	17.750	11.58	-38.42	50.00	10.97	0.30	0.31	Average

Test Engineer: 
 Brian Lin

- Test Mode: Mode 3
- Frequency Range of Test: from 150KHz to 30 MHz
- Temperature: 23°C
- Relative Humidity: 54 %

The test was passed at the minimum margin that marked by the frame in the following table

Site : C001-HY
 Condition : CNS/VCCI/CISPR-B 2003 2001/008 LINE
 EUT : Wireless Router
 Power : 110V/60Hz
 Model : WR1230
 Memo : TX CH11 2462MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.165	48.72	-16.49	65.21	48.57	0.10	0.05	QP
2	0.165	20.96	-34.25	55.21	20.81	0.10	0.05	Average
3	0.288	41.81	-18.77	60.58	41.61	0.10	0.10	QP
4	0.288	14.68	-35.90	50.58	14.48	0.10	0.10	Average
5	0.552	33.53	-22.47	56.00	33.29	0.10	0.14	QP
6	0.552	9.50	-36.50	46.00	9.26	0.10	0.14	Average
7	1.320	24.39	-31.61	56.00	24.21	0.10	0.08	QP
8	1.320	6.18	-39.82	46.00	6.00	0.10	0.08	Average
9	12.520	30.06	-29.94	60.00	29.62	0.20	0.24	QP
10	12.520	22.67	-27.33	50.00	22.23	0.20	0.24	Average
11	17.750	18.90	-41.10	60.00	18.33	0.26	0.31	QP
12	17.750	13.57	-36.43	50.00	13.00	0.26	0.31	Average

Site : C001-HY
 Condition : CNS/VCCI/CISPR-B 2003 2001/008 NEUTRAL
 EUT : Wireless Router
 Power : 110V/60Hz
 Model : WR1230
 Memo : TX CH11 2462MHz

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.168	48.43	-16.63	65.06	48.28	0.10	0.05	QP
2	0.168	19.81	-35.25	55.06	19.66	0.10	0.05	Average
3	0.267	42.13	-19.08	61.21	41.94	0.10	0.09	QP
4	0.267	14.96	-36.25	51.21	14.77	0.10	0.09	Average
5	0.595	33.53	-22.47	56.00	33.29	0.10	0.14	QP
6	0.595	9.17	-36.83	46.00	8.93	0.10	0.14	Average
7	1.420	23.28	-32.72	56.00	23.11	0.10	0.07	QP
8	1.420	5.95	-40.05	46.00	5.78	0.10	0.07	Average
9	11.810	24.39	-35.61	60.00	23.92	0.24	0.23	QP
10	11.810	18.71	-31.29	50.00	18.24	0.24	0.23	Average
11	17.750	17.62	-42.38	60.00	17.01	0.30	0.31	QP
12	17.750	12.54	-37.46	50.00	11.93	0.30	0.31	Average

Test Engineer: Brian Lin
 Brian Lin

5.6. Test of Radiated Emission

Radiated emissions from 30 MHz to 25 GHz were measured according to the methods defines in ANSI C63.4-2001. The EUT was placed, 0.8 meter above the ground plane, as shown in section 5.6.3. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions

5.6.1. Major Measuring Instruments

- Amplifier (HP 8447D)
 - RF Gain 30 dB
 - Signal Input 100 KHz to 1.3 GHz

- Amplifier (MITEQ AFS44)
 - RF Gain 40 dB
 - Signal Input 100 MHz to 26.5 GHz

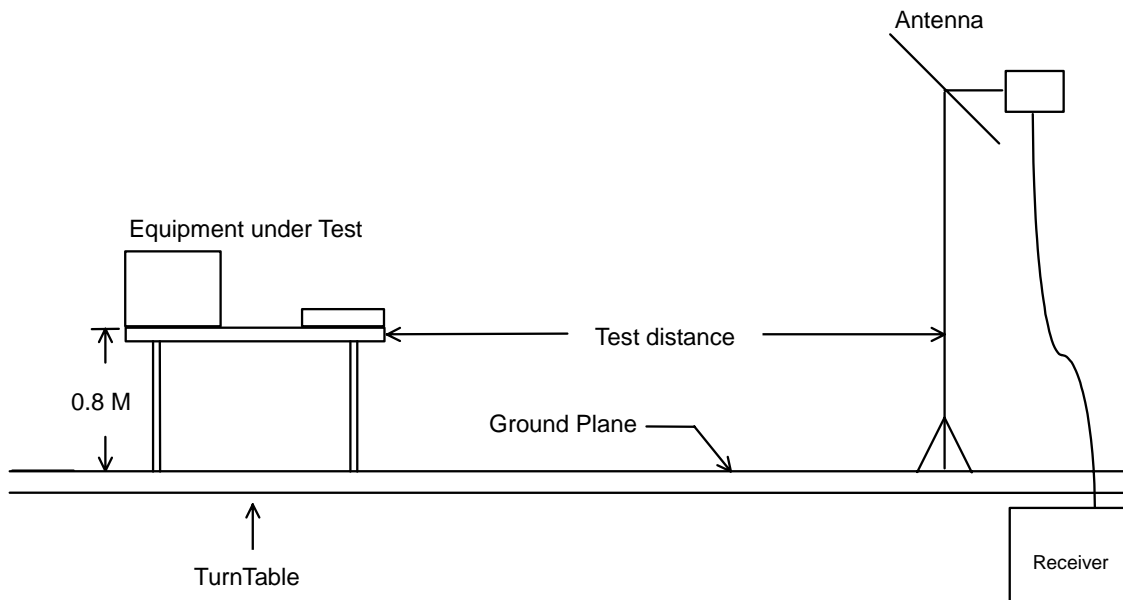
- Spectrum analyzer (R&S FSEK30)
 - Attenuation 10 dB
 - Start Frequency 1 GHz
 - Stop Frequency 25 GHz
 - Resolution Bandwidth 1 MHz
 - Video Bandwidth 1 MHz
 - Signal Input 20 Hz to 40 GHz

- Test Receiver (SCHAFFNER SCR3501)
 - Resolution Bandwidth 120 KHz
 - Frequency Band 9 K – 1 GHz
 - Quasi-Peak Detector ON for Quasi-Peak Mode
OFF for Peak Mode

5.6.2. Test Procedures

1. The EUT was placed on a rotatable table top 0.8 meter above ground.
2. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation.
4. The antenna is a broadband antenna and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
5. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.
7. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
8. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

5.6.3. Typical Test Setup Layout of Radiated Emission



5.6.4. Test Result of Radiated Emission

- Test Mode: Mode 1
- Test Distance: 3 M
- Temperature: 27 °C
- Relative Humidity: 63 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading : Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

The test was passed at the minimum margin that marked by the frame in the following table

■ Spurious Emission

Site : 03CH03-HY
 Condition : 3m 03CH03-MAT HORIZONTAL
 EUT : Wireless AP
 Power : 110V/60Hz
 MODEL : WR1230
 MEMO : TX CH01 2412MHz
 : F300609

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	89.940	33.06	-9.64	43.50	50.67	8.78	1.43	27.02	Peak	---	---
2	98.580	34.61	-8.89	43.50	50.62	9.28	1.71	27.00	Peak	---	---
3	250.050	35.29	-10.71	46.00	47.94	11.34	2.61	26.60	Peak	---	---

Site : 03CH03-HY
 Condition : 3m 03CH03-MAT HORIZONTAL
 EUT : Wireless AP
 Power : 110V/60Hz
 MODEL : WR1230
 MEMO : TX CH01 2412MHz
 : F300609

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	394.500	42.05	-3.95	46.00	51.26	14.45	3.51	27.17	QP	---	---
2	659.800	39.92	-6.08	46.00	45.56	17.71	4.65	28.00	Peak	---	---
3	923.700	42.95	-3.05	46.00	45.53	19.50	5.65	27.73	QP	---	---

Site : 03CH03-HY
 Condition : 3a 03CH03-MAT VERTICAL
 EUT : Wireless AP
 Power : 110V/60Hz
 MODEL : WR1230
 MEMO : TX CH01 2412MHz
 : F300609

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	32.970	35.91	-4.09	40.00	48.18	13.80	1.03	27.10	Peak	---	---
2	81.570	34.32	-5.68	40.00	53.23	6.55	1.58	27.04	Peak	---	---
3	132.060	36.49	-7.01	43.50	50.94	10.46	1.96	26.07	Peak	---	---

Site : 03CH03-HY
 Condition : 3a 03CH03-MAT VERTICAL
 EUT : Wireless AP
 Power : 110V/60Hz
 MODEL : WR1230
 MEMO : TX CH01 2412MHz
 : F300609

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	394.500	38.16	-7.84	46.00	47.37	14.45	3.51	27.17	Peak	---	---
2	659.800	39.28	-6.72	46.00	44.92	17.71	4.65	28.00	Peak	---	---
3	923.700	44.48	-1.52	46.00	47.06	19.50	5.65	27.73	QF	100	105

Site : 03CH03-HY
 Condition : 3m HORN-ANT-6741 HORIZONTAL
 EUT : Wireless AP
 Power : 110V/60Hz
 MODEL : WR1230
 MEMO : TX CH01 2412MHz
 : F300609

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	1590.000	46.85	-27.15	74.00	56.90	25.73	4.88	40.66	Peak	---	---
2	1590.000	30.07	-23.93	54.00	40.12	25.73	4.88	40.66	Average	---	---

Site : 03CH03-HY
 Condition : 3m HORN-ANT-6741 VERTICAL
 EUT : Wireless AP
 Power : 110V/60Hz
 MODEL : WR1230
 MEMO : TX CH01 2412MHz
 : F300609

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	1590.000	47.71	-26.29	74.00	57.76	25.73	4.88	40.66	Peak	---	---
2	1590.000	32.14	-21.86	54.00	42.19	25.73	4.88	40.66	Average	---	---

- For 5GHz ~ 25GHz
 Remark: Frequency from 5000MHz to 25000MHz, the emission emitted by the EUT is too low to be measured

■ Field strength of fundamental and harmonics

Frequency (MHz)	Antenna Polarity	Cable Factor (dB/m)	Reading Loss (dB)	Reading (dBuV)	Limits (dBuV/m)	Emission (uV/m)	Level (dBuV/m)	Margin (uV/m)	Detect (dB)	Mode
2414.000	H	28.25	6.23	57.93	-	-	92.41	41734.96		AV
2414.000	H	28.25	6.23	65.95	-	-	100.43	105075.15		Peak
2412.000	V	28.24	6.22	63.98	-	-	98.44	83560.30		AV
2412.000	V	28.24	6.22	71.39	-	-	105.85	196110.12		Peak
4824.000	V/H						-			AV/Peak
7236.000	V/H						-			AV/Peak
9648.000	V/H						-			AV/Peak
12060.000	V/H						-			AV/Peak
14472.000	V/H						-			AV/Peak
16884.000	V/H						-			AV/Peak
19296.000	V/H						-			AV/Peak
21708.000	V/H						-			AV/Peak
24120.000	V/H						-			AV/Peak

Remark: The emission emitted by the EUT is too low to be measured except the emission listed above,

Test Engineer: Steve
Steve Chen

- Test Mode: Mode 2
- Test Distance: 3 M
- Temperature: 27 °C
- Relative Humidity: 63 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading : Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

The test was passed at the minimum margin that marked by the frame in the following table

■ Spurious Emission

Site : 03CH03-HY
 Condition : 3m 03CH03-MAT HORIZONTAL
 EUT : Wireless AP
 Power : 110V/60Hz
 MODEL : WR1230
 MEMO : TX CH06 2437MHz
 : F300609

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	98.580	34.17	-9.33	43.50	50.18	9.28	1.71	27.00	Peak	---	---
2	158.250	31.56	-11.94	43.50	47.91	8.29	2.12	26.76	Peak	---	---
3	250.050	35.01	-10.99	46.00	47.66	11.34	2.61	26.60	Peak	---	---

Site : 03CH03-HY
 Condition : 3m 03CH03-MAT HORIZONTAL
 EUT : Wireless AP
 Power : 110V/60Hz
 MODEL : WR1230
 MEMO : TX CH06 2437MHz
 : F300609

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	394.500	42.68	-3.32	46.00	51.89	14.45	3.51	27.17	Peak	---	---
2	659.800	40.18	-5.82	46.00	45.82	17.71	4.65	28.00	Peak	---	---
3	923.700	42.75	-3.25	46.00	45.33	19.50	5.65	27.73	QP	---	---

FCC TEST REPORT

Report No. : F300609

Site : 03CH03-HY
 Condition : 3m 03CH03-MAT VERTICAL
 EUT : Wireless AP
 Power : 110V/60Hz
 MODEL : WR1230
 MEMO : TX CH06 2437MHz
 : F300609

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1 !	30.000	35.17	-4.83	40.00	45.91	15.35	1.01	27.10	Peak	---	---
2 !	82.650	36.20	-3.80	40.00	54.01	6.83	1.59	27.03	Peak	---	---
3	132.330	36.57	-6.93	43.50	51.03	10.45	1.96	26.87	Peak	---	---

Site : 03CH03-HY
 Condition : 3m 03CH03-MAT VERTICAL
 EUT : Wireless AP
 Power : 110V/60Hz
 MODEL : WR1230
 MEMO : TX CH06 2437MHz
 : F300609

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	394.500	38.06	-7.94	46.00	47.27	14.45	3.51	27.17	Peak	---	---
2	659.800	39.42	-6.58	46.00	45.06	17.71	4.65	28.00	Peak	---	---
3 !	923.700	44.63	-1.37	46.00	47.21	19.50	5.65	27.73	QP	100	105

Site : 03CH03-NY
 Condition : 3m HORN-ANT-6741 HORIZONTAL
 EUT : Wireless AP
 Power : 110V/60Hz
 MODEL : WR1230
 MEMO : TX CH06 2437MHz
 : F300609

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	1588.000	46.65	-27.95	74.00	56.71	25.72	4.88	40.66	Peak	---	---
2	1588.000	33.60	-20.40	54.00	43.66	25.72	4.88	40.66	Average	---	---

Site : 03CH03-NY
 Condition : 3m HORN-ANT-6741 VERTICAL
 EUT : Wireless AP
 Power : 110V/60Hz
 MODEL : WR1230
 MEMO : TX CH06 2437MHz
 : F300609

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	1590.000	47.21	-26.79	74.00	57.26	25.73	4.88	40.66	Peak	---	---
2	1590.000	34.03	-19.97	54.00	44.08	25.73	4.88	40.66	Average	---	---

- For 5GHz ~ 25GHz
 Remark: Frequency from 5000MHz to 25000MHz, the emission emitted by the EUT is too low to be measured

■ Field strength of fundamental and harmonics

Frequency (MHz)	Antenna Polarity	Cable Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Limits (dBuV/m)	Emission (uV/m)	Level (dBuV/m)	Margin (uV/m)	Detect (dB)	Mode
2438.000	H	28.30	6.26	59.04	-	-	93.60	47863.01		AV
2438.000	H	28.30	6.26	67.18	-	-	101.74	122179.97		Peak
2436.000	V	28.29	6.26	64.29	-	-	98.84	87498.38		AV
2436.000	V	28.29	6.26	71.42	-	-	105.97	198838.28		Peak
4874.000	V/H						-			AV/Peak
7311.000	V/H						-			AV/Peak
9748.000	V/H						-			AV/Peak
12185.000	V/H						-			AV/Peak
14622.000	V/H						-			AV/Peak
17059.000	V/H						-			AV/Peak
19496.000	V/H						-			AV/Peak
21933.000	V/H						-			AV/Peak
24370.000	V/H						-			AV/Peak

Remark: The emission emitted by the EUT is too low to be measured except the emission listed above,

Test Engineer: Steve Chen
Steve Chen

- Test Mode: Mode 3
- Test Distance: 3 M
- Temperature: 27 °C
- Relative Humidity: 63 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading : Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

The test was passed at the minimum margin that marked by the frame in the following table

■ Spurious Emission

Site : 03CH03-HY
 Condition : 3m 03CH03-MAT HORIZONTAL
 EUT : Wireless AP
 Power : 110V/60Hz
 MODEL : WR1230
 MEMO : TX CH11 2462MHz
 : F300609

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	31.890	31.46	-8.54	40.00	43.25	14.29	1.02	27.10	Peak	---	---
2	90.210	33.03	-9.67	43.50	50.60	8.80	1.45	27.02	Peak	---	---
3	97.770	34.81	-8.69	43.50	50.85	9.23	1.73	27.00	Peak	---	---

Site : 03CH03-HY
 Condition : 3m 03CH03-MAT HORIZONTAL
 EUT : Wireless AP
 Power : 110V/60Hz
 MODEL : WR1230
 MEMO : TX CH11 2462MHz
 : F300609

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	394.500	42.80	-3.20	46.00	52.01	14.45	3.51	27.17	Peak	---	---
2	659.800	40.02	-5.98	46.00	45.66	17.71	4.65	28.00	Peak	---	---
3	923.700	42.71	-3.29	46.00	45.29	19.50	5.65	27.73	QP	---	---

Site : 03CH03-HY
 Condition : 3a 03CH03-MAT VERTICAL
 EUT : Wireless AP
 Power : 110V/60Hz
 MODEL : WR1230
 MEMO : TX CH11 2462MHz
 : F300609

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	32.970	36.23	-3.77	40.00	48.50	13.80	1.03	27.10	Peak	---	---
2	82.650	34.32	-5.68	40.00	52.93	6.83	1.59	27.03	Peak	---	---
3	132.330	37.26	-6.24	43.50	51.72	10.45	1.96	26.07	Peak	---	---

Site : 03CH03-HY
 Condition : 3a 03CH03-MAT VERTICAL
 EUT : Wireless AP
 Power : 110V/60Hz
 MODEL : WR1230
 MEMO : TX CH11 2462MHz
 : F300609

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	394.600	37.95	-8.05	46.00	47.16	14.45	3.51	27.17	Peak	---	---
2	659.800	39.38	-6.62	46.00	45.02	17.71	4.65	28.00	Peak	---	---
3	923.700	44.05	-1.15	46.00	47.43	19.50	5.65	27.73	QP	100	102

Site : 03CH03-HY
 Condition : 3m HORN-ANT-6741 HORIZONTAL
 EUT : Wireless AP
 Power : 110V/60Hz
 MODEL : WR1230
 MEMO : TX CH11 2462MHz
 : F300609

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	1588.000	47.54	-26.46	74.00	57.60	25.72	4.88	40.66	Peak	---	---
2	1588.000	31.01	-22.19	54.00	41.07	25.72	4.88	40.66	Average	---	---

Site : 03CH03-HY
 Condition : 3m HORN-ANT-6741 VERTICAL
 EUT : Wireless AP
 Power : 110V/60Hz
 MODEL : WR1230
 MEMO : TX CH11 2462MHz
 : F300609

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	1590.000	48.62	-25.38	74.00	58.67	25.73	4.88	40.66	Peak	---	---
2	1590.000	34.21	-19.79	54.00	44.26	25.73	4.88	40.66	Average	---	---

- For 5GHz ~ 25GHz
 Remark: Frequency from 5000MHz to 25000MHz, the emission emitted by the EUT is too low to be measured

■ Field strength of fundamental and harmonics

Frequency (MHz)	Antenna Polarity	Cable Factor (dB/m)	Reading Loss (dB)	Limits (dBuV)	Emission (dBuV/m)	Level (uV/m)	Margin (dB)	Detect Mode
2462.000	H	28.35	6.29	60.03	94.67	54137.72	-	AV
2462.000	H	28.35	6.29	67.91	102.55	134121.99	-	Peak
2460.000	V	28.34	6.29	64.44	99.07	89846.26	-	AV
2460.000	V	28.34	6.29	71.68	106.31	206775.94	-	Peak
4924.000	V/H				-			AV/Peak
7386.000	V/H				-			AV/Peak
9848.000	V/H				-			AV/Peak
12310.000	V/H				-			AV/Peak
14772.000	V/H				-			AV/Peak
17234.000	V/H				-			AV/Peak
19696.000	V/H				-			AV/Peak
22158.000	V/H				-			AV/Peak
24620.000	V/H				-			AV/Peak

Remark: The emission emitted by the EUT is too low to be measured except the emission listed above,

Test Engineer: Steve Chen
Steve Chen

5.7. Band Edges Measurement

5.7.1. Measuring Instruments :

As described in chapter 7 of this test report.

5.7.2. Test Procedure :

1. The transmitter output was connected to the spectrum analyzer via a low lose cable.
2. Set both RBW and VBW of spectrum analyzer to 100KHz with convenient frequency span including 100 KHz bandwidth from band edge.
3. The band edges was measured and recorded.

5.7.3. Test Result :

- Test Result in lower band (Channel 1) : **PASS**
- Test Result in higher band(Channel 11) : **PASS**

5.7.4. Note on Band edge Emission

The band edge emission plot on appendix B page B7. shows 56.15dB delta between carrier maximum power and local maximum emission in the restricted band (2.376GHz).

The band edge emission plot on appendix B page B8. shows 60.12dB delta between carrier maximum power and local maximum emission in the restricted band (2.486GHz).

Channel	The emission of carrier power strength (dB μ V/m)	The maximum field strength in restrict band (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
1	98.44	42.29	54.00	-11.71	Average
11	99.07	38.95	54.00	-15.05	Average

* The maximum field strength in restricted band is the emission of carrier power strength subtract to the delta between carrier maximum power and local maximum emission in the restricted band.

5.8. Antenna Requirements

The EUT use a undetachable Dipole antenna via U.FL external connector. It is considered meet antenna requirement of FCC.

5.8.1. Standard Applicable

For intentional device, according to **47CFR Part 15 Subpart C 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.

And according to **47CFR Part 15 Subpart C** Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

5.8.2. Antenna Connected Construction

The maximum Gain antenna used in this product is dipole antenna. The antenna connector type is U.FL. The coaxial cable of the antenna is fixed to the antenna.

5.9. RF Exposure

FCC Rules and Regulations Part 1.1307,1.1310,2.1091,2.1093:

RF Exposure Compliance

5.9.1. Limit For Maximum Permissible Exposure (MPE)

(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

F=frequency in MHz

*Plane-wave equivalent power density

5.9.2. MPE Calculations

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

- E = Electric field (V/m)
- P = Peak output power (mW)
- G = Antenna numeric gain (numeric)
- d = Separation distance (m)

Because the EUT is belong to General Population/ Uncontrolled Exposure. So the Limit of Power Density is 1.0 mW/cm². We can change the formula to:

$$d = \sqrt{\frac{30 \times P \times G}{377}}$$

Channel NO.	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Calculated RF Exposure Separation Distance (cm)	Minimum RF Exposure Separation Distance (cm)
Channel 1	2.00	1.58	15.79	37.90	2.19	20
Channel 6	2.00	1.58	16.94	49.40	2.50	20
Channel 11	2.00	1.58	15.83	38.30	2.20	20

5.9.3. FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20cm (8 inches) during normal operation. Proposed RF exposure safety information to include in User's Manual.

6. EMI Suppression Component List

No EMI suppression components.

7. Antenna Factor & Cable Loss

Frequency (MHz)	Antenna Factor (dB)	Cable Loss (dB)	Frequency (MHz)	Antenna Factor (dB)	Cable Loss (dB)
30	15.35	1.01	1000	24.10	3.92
35	13.63	1.04	2000	27.40	5.66
40	11.11	1.09	3000	30.00	7.20
45	10.59	1.24	4000	32.60	9.36
50	6.47	1.43	5000	33.40	9.16
55	5.83	1.39	6000	34.20	10.70
60	5.18	1.59	7000	35.30	12.16
65	4.81	1.41	8000	36.90	13.12
70	4.43	1.43	9000	38.10	13.81
75	5.10	1.55	10000	39.00	14.83
80	5.91	1.56	11000	38.60	15.83
85	7.33	1.62	12000	39.50	17.11
90	8.74	1.41	13000	39.30	17.62
95	9.05	1.81	14000	41.60	18.37
100	9.36	1.68	15000	40.60	19.10
110	9.65	1.73	16000	37.20	19.72
120	9.97	1.79	17000	40.20	21.98
130	10.51	1.93	18000	48.90	21.22
140	10.32	2.06	19000	37.60	23.90
150	9.42	2.09	20000	37.30	24.07
160	8.09	2.12	21000	37.00	25.49
170	7.43	2.12	22000	38.00	24.92
180	7.60	2.12	23000	38.70	25.60
190	7.43	2.21	24000	38.60	25.70
200	7.26	2.29	25000	38.90	26.54
220	9.11	2.42			
240	10.88	2.54			
260	11.75	2.66			
280	11.55	2.76			
300	11.36	2.85			
320	12.03	3.10			
340	12.69	3.36			
360	13.33	3.49			
380	14.00	3.50			
400	14.63	3.51			
450	15.33	3.55			
500	16.03	3.81			
550	16.65	4.05			
600	17.29	4.23			
650	17.64	4.63			
700	18.00	4.74			
750	18.39	4.95			
800	18.79	5.06			
850	19.10	5.18			
900	19.42	5.40			
950	19.58	5.91			
1000	19.75	5.58			

8. List of Measuring Equipments Used

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMC Receiver	R&S	ESCS 30	100132	9 KHz – 2.75 GHz	Jun. 12, 2003	Conduction (CO01-HY)
LISN	MessTec	NNB-2/16Z	2001-008	9 KHz – 30 MHz	Apr. 29, 2003	Conduction (CO01-HY)
LISN (Support Unit)	MessTec	NNB-2/16Z	2001-009	9 KHz – 30 MHz	Apr. 29, 2003	Conduction (CO01-HY)
EMI Filter	LINDGREN	LRE-2060	1004	< 450 Hz	N/A	Conduction (CO01-HY)
EMI Filter	LINDGREN	N6006	201052	0 ~ 60 Hz	N/A	Conduction (CO01-HY)
RF Cable-CON	Suhner Switzerland	RG223/U	CB029	9KHz~30MHz	Jan. 07, 2003	Conduction (CO01-HY)
50 ohm BNC type Terminal	NOBLE	50ohm	TM013	50 ohm	Apr. 24, 2003	Conduction (CO01-HY)
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz~1GHz 3m	Jun. 21, 2003	Radiation (03CH03-HY)
Spectrum analyzer	R&S	FSEK30	100189	20Hz~40GHz	Jul. 22, 2003	Radiation (03CH03-HY)
Receiver	SCHAFFNER	SCR 3501	417	9 KHz –1GHz	Feb. 20, 2003	Radiation (03CH03-HY)
Amplifier	HP	8447D	2944A09072	100KHz – 1.3GHz	Oct. 21, 2002	Radiation (03CH03-HY)
Bilog Antenna	SCHAFFNER	CBL6112B	2687	30MHz –2GHz	Dec. 21, 2002	Radiation (03CH03-HY)
RF Cable-R03m	Jye Bao	RG142	CB021	30MHz~1GHz	Jan. 02, 2003	Radiation (03CH03-HY)
Amplifier	MITEQ	NSP2650-NF	805858	100MHz~26.5GHz	Jul. 10, 2003	Radiation (03CH03-HY)
Horn Antenna	COM-POWER	AH-118	10094	1GHz – 18GHz	Apr. 10, 2003	Radiation (03CH03-HY)
Turn Table	HD	DS 420	420/650/00	0 ~ 360 degree	N/A	Radiation (03CH03-HY)
Antenna Mast	HD	MA 240	240/560/00	1 m - 4 m	N/A	Radiation (03CH03-HY)
Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170154	15GHz~40GHz	Jun. 02, 2003	Radiation (03CH03-HY)
RF Cable-HIGH	Jye Bao	RG142	CB030-HIGH	1GHz~29.5GHz	Mar. 14, 2003	Radiation (03CH03-HY)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Spectrum analyzer	R&S	FSP7	838858/014	9KHZ~7GHZ	Sep. 03, 2003	Conducted
Power meter	R&S	NRVS	100444	DC~40GHz	May 28, 2003	Conducted
Power sensor	R&S	NRV-Z55	100049	DC~40GHz	May 28, 2003	Conducted
Power Sensor	R&S	NRV-Z32	100057	30MHz-6GHz	May 28, 2003	Conducted
AC power source	HPC	HPA-500W	HPA-9100024	AC 0~300V	May 27, 2003	Conducted
Temp. and Humidity Chamber	KSON	THS-C3L	612	N/A	Oct. 01, 2003	Conducted
RF CABLE-1m	Jye Bao	RG142	CB034-1m	20MHz~7GHz	Jan. 01, 2003	Conducted
RF CABLE-2m	Jye Bao	RG142	CB035-2m	20MHz~1GHz	Jan. 01, 2003	Conducted

Calibration Interval of instruments listed above is one year.

9. Uncertainty of Test Site

Uncertainty of Radiated Emission Measurement

Contribution	Probability Distribution	3m
Antenna factor calibration	normal(k=2)	±1
cable loss calibration	normal(k=2)	±0.3
RCV/SPA specification	rectangular	±2
Antenna Directivity	rectangular	±3
Antenna Factor V.S. Height	rectangular	±2
Antenna Factor Interpolation for Frequency	rectangular	±0.25
site imperfection	rectangular	±2
Mismatch Receiver VSWR $\Gamma_1=0.09$ Antenna VSWR $\Gamma_2=0.67$ Uncertainty= $20\log(1-\Gamma_1*\Gamma_2)$	U-shaped	±0.54
combined standard uncertainty Ue(y)	normal	±2.7
Measuring uncertainty for a level of confidence of 95% U=2Ue(y)	normal (k=2)	±5.4

$U = \{((1/2)^2+(0.3/2)^2+(2^2+0.5^2+2^2+0.25^2+2^2)/3+(0.54)^2/2)\} = 2.2$ for 10m test distance

$U = \{((1/2)^2+(0.3/2)^2+(2^2+3^2+2^2+0.25^2+2^2)/3+(0.54)^2/2)\} = 2.7$ for 3m test distance

Uncertainty of Conducted Emission Measurement

Contribution	Probability Distribution	150KHz – 30MHz
Cable and I/P attenuator calibration	normal(k=2)	±0.3
RCV/SPA specification	rectangular	±2
LISN coupling specification	rectangular	±1.5
Transducer factor frequency interpolation	rectangular	±0.2
Mismatch Receiver VSWR $\Gamma_1=0.09$ LISN VSWR $\Gamma_2=0.33$ Uncertainty= $20\log(1-\Gamma_1*\Gamma_2)$	U-shaped	0.2
combined standard uncertainty Ue(y)	normal	±1.66
Measuring uncertainty for a level of confidence of 95% U=2Ue(y)	normal (k=2)	±3.32

$U = \{(0.3/2)^2 + (2^2+1.5^2+0.2^2)/3+(0.2)^2/2\} = 1.66$