



## Test Report

Product Name	Mini RISC-based Ready-to-Run Wireless Embedded Computer
Model No	ThinkCore W311, ThinkCore W311-LX
FCC ID	SLEW311

Applicant	Moxa Technologies Co., Ltd
Address	Fl.4, No. 135, Lane 235, Pao-Chiao Rd., Shing Tien City, Taipei, Taiwan, R.O.C.

Date of Receipt	Aug. 06, 2007
Issued Date	Oct. 25, 2007
Report No.	078123R-RFUSP09V01

The test results relate only to the samples tested.

The test report shall not be reproduced except in full without the written approval of Quietek Corporation.

This report must not be used to claim product endorsement by NVLAP any agency of the U.S. Government

# Test Report Certification

Issued Date: Oct. 25, 2007

Rport No.: 078123R-RFUSP09V01



Product Name	Mini RISC-based Ready-to-Run Wireless Embedded Computer
Applicant	Moxa Technologies Co., Ltd
Address	F1.4, No. 135, Lane 235, Pao-Chiao Rd., Shing Tien City, Taipei, Taiwan, R.O.C.
Manufacturer	Moxa Technologies Co., Ltd
Model No.	ThinkCore W311, ThinkCore W311-LX
FCC ID.	SLEW311
Rated Voltage	AC 120V/60Hz
Working Voltage	DC 12V
Trade Name	Moxa
Applicable Standard	FCC CFR Title 47 Part 15 Subpart E: 2006 ANSI C63.4: 2003
Test Result	Complied



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Tested By : Molin Huang  
( Engineer / Molin Huang )



Approved By : Vincent Lin  
( Deputy Manager / Vincent Lin )

0914

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## 1. GENERAL INFORMATION

### 1.1. EUT Description

Product Name	Mini RISC-based Ready-to-Run Wireless Embedded Computer
Trade Name	Moxa
FCC ID.	SLEW311
Model No.	ThinkCore W311, ThinkCore W311-LX
Frequency Range	2412MHz - 2462MHz, 5150-5250MHz, 5725-5825MHz
Number of Channels	11 in 2.4GHz band, 8 in 5GHz band
Channel Separation	5MHz in 2.4GHz band, 20MHz in 5GHz band
Channel Control	Auto
Data Rate	802.11b – 1, 2, 5.5, 11Mbps
	802.11a/g – 6, 9, 12, 18, 24, 36, 48, 54Mbps
Type of Modulation	DSSS/ OFDM
Antenna type	Connector (Reverse SMA)
Antenna Gain	Refer to the table “Antenna List”
Power Adapter	MFR: ENG, M/N: 3A-161DA12 Cable in: Shielded, 1.5m Cable out: Non-Shielded, 1.6m with one ferrite core bonded.

#### Antenna List

No.	Manufacturer	Part No.	Peak Gain
1	SmartAnt	SAA05-220420	2.0 dBi for 2.4 GHz 2.0 dBi for 5.0 GHz

#### 2.4GHz Band Frequency of Each Channel:

Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 1:	2412 MHz	Channel 5:	2432 MHz	Channel 9:	2452 MHz
Channel 2:	2417 MHz	Channel 6:	2437 MHz	Channel 10:	2457 MHz
Channel 3:	2422 MHz	Channel 7:	2442 MHz	Channel 11:	2462 MHz
Channel 4:	2427 MHz	Channel 8:	2447 MHz		

#### 5GHz Band Frequency of Each Channel:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 1	5180 MHz	Channel 2	5200 MHz	Channel 3	5220 MHz	Channel 4	5240 MHz
Channel 5	5745 MHz	Channel 6	5765 MHz	Channel 7	5785 MHz	Channel 8	5805 MHz

Note:

1. This device is a Mini RISC-based Ready-to-Run Wireless Embedded Computer with a built-in 2.4GHz and 5GHz transceiver.
2. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test. Lowest and highest data rates are tested in each mode. Only worst case is shown in the report. (802.11b is 1Mbps and 802.11a/g is 6Mbps)
3. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15 Subpart E for Unlicensed National Information Infrastructure devices.

**1.2. Operational Description**

EUT is a Mini RISC-based Ready-to-Run Wireless Embedded Computer with a built-in 2.4GHz and 5GHz transceiver.

There are 11 channels in 2412 – 2462MHz, 4 channels in 5180 – 5240MHz and 4 channels in 5745-5805MHz.

The channels are separated by 5MHz. This device supports the data rates of 1, 2, 5.5, 11Mbps in 802.11b mode and 6, 9, 12, 18, 24, 36, 48, 54Mbps in 802.11g mode. The signals are modulated by DSSS in 802.11b mode and OFDM in 802.11g mode. The antennas are Connector and use diversity to improve the receiving sensitivity.

This Mini RISC-based Ready-to-Run Wireless Embedded Computer, complied with IEEE 802.11b and IEEE 802.11g, is a high-efficiency Wireless LAN adapter. It allows your computer to connect to a wireless network and to share resources, such as files or printers without network wires. Wired Equivalent Protection (WEP) algorithm is used. In addition, its standard compliance ensures that it can communicate with any IEEE 802.11b+g and IEEE 802.11a network.

Test Mode	Mode 1: Transmitter 802.11a
-----------	-----------------------------

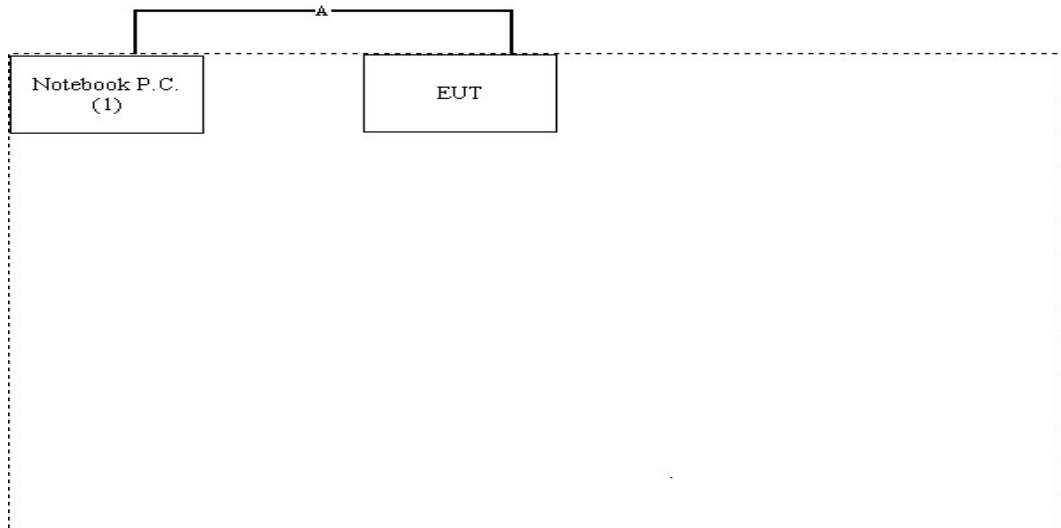
### 1.3. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
1   Notebook PC	DELL	PP18L	42649348672	Non-Shielded, 0.8m

Signal Cable Type	Signal cable Description
A   RS-232 Cable	Non-Shielded, 1.0m

### 1.4. Configuration of tested System



### 1.5. EUT Exercise Software

- (1) Setup the EUT as shown in Section 1.4
- (2) Execute Telnet IP 192.168.126.254 on the notebook.
- (3) Configure the test mode, the test channel, and the data rate.
- (4) Press “OK” to start the continuous transmission.
- (5) Verify that the EUT works properly.

**1.6. Test Facility**

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	50-65
Barometric pressure (mbar)	860-1060	950-1000

Site Description: File on  
 Federal Communications Commission  
 FCC Engineering Laboratory  
 7435 Oakland Mills Road  
 Columbia, MD 21046  
 Reference 31040/SIT1300F2



Accreditation on NVLAP  
 NVLAP Lab Code: 200533-0



Site Name: Quietek Corporation  
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**0914**

FCC Accreditation Number: TW1014



## 2. Conducted Emission

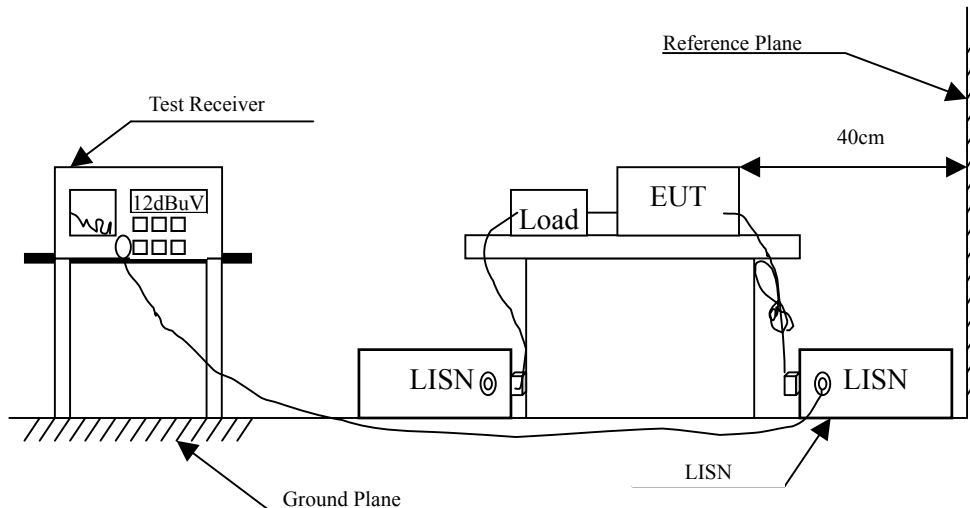
### 2.1. Test Equipment

The following test equipment are used during the conducted emission test:

Item	Instrument	Manufacturer	Type No./Serial No	Last Cal.	Remark
1	Test Receiver	R & S	ESCS 30/825442/17	May, 2007	
2	L.I.S.N.	R & S	ESH3-Z5/825016/6	May, 2007	EUT
3	L.I.S.N.	Kyoritsu	KNW-407/8-1420-3	May, 2007	Peripherals
4	Pulse Limiter	R & S	ESH3-Z2	May, 2007	
5	No.1 Shielded Room			N/A	

Note: All equipments are calibrated every one year.

### 2.2. Test Setup



### 2.3. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dBuV) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56	56-46
0.50-5.0	56	46
5.0 - 30	60	50

Remarks : In the above table, the tighter limit applies at the band edges.

## 2.4. 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 /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs.)

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 investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

## 2.5. Uncertainty

± 2.26 dB

## 2.6. Test Result of Conducted Emission

Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Conducted Emission Test  
 Power Line : Line 1  
 Test Mode : Mode 1: Transmitter 802.11a (5220MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV	Margin dB	Limit dBuV
<b>LINE 1</b>					
<b>Quasi-Peak</b>					
0.388	0.300	46.940	47.240	-11.960	59.200
0.908	0.310	43.470	43.780	-12.220	56.000
1.494	0.330	39.650	39.980	-16.020	56.000
2.150	0.350	41.470	41.820	-14.180	56.000
3.466	0.380	38.310	38.690	-17.310	56.000
9.994	0.600	37.800	38.400	-21.600	60.000
<b>Average</b>					
0.388	0.300	39.330	39.630	-9.570	49.200
0.908	0.310	38.120	38.430	-7.570	46.000
1.494	0.330	34.490	34.820	-11.180	46.000
2.150	0.350	36.740	37.090	-8.910	46.000
3.466	0.380	33.370	33.750	-12.250	46.000
9.994	0.600	32.440	33.040	-16.960	50.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. "■" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Conducted Emission Test  
 Power Line : Line 2  
 Test Mode : Mode 1: Transmitter 802.11a (5220MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV	Margin dB	Limit dBuV
<b>LINE 2</b>					
<b>Quasi-Peak</b>					
0.263	0.300	39.330	39.630	-23.141	62.771
0.384	0.310	46.880	47.190	-12.124	59.314
0.912	0.320	43.380	43.700	-12.300	56.000
1.490	0.330	39.540	39.870	-16.130	56.000
2.146	0.350	41.510	41.860	-14.140	56.000
10.173	0.508	38.380	38.888	-21.112	60.000
<b>Average</b>					
0.263	0.300	36.900	37.200	-15.571	52.771
0.384	0.310	40.570	40.880	-8.434	49.314
0.912	0.320	38.330	38.650	-7.350	46.000
1.490	0.330	34.490	34.820	-11.180	46.000
2.146	0.350	36.300	36.650	-9.350	46.000
10.173	0.508	33.290	33.798	-16.202	50.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. "■" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Conducted Emission Test  
 Power Line : Line 1  
 Test Mode : Mode 1: Transmitter 802.11a (5785MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV	Margin dB	Limit dBuV
<b>LINE 1</b>					
<b>Quasi-Peak</b>					
0.380	0.300	42.250	42.550	-16.879	59.429
0.923	0.310	33.890	34.200	-21.800	56.000
1.478	0.330	32.830	33.160	-22.840	56.000
2.123	0.350	37.620	37.970	-18.030	56.000
5.396	0.447	30.520	30.967	-29.033	60.000
20.439	1.110	27.820	28.930	-31.070	60.000
<b>Average</b>					
0.380	0.300	39.520	39.820	-9.609	49.429
0.923	0.310	27.480	27.790	-18.210	46.000
1.478	0.330	27.200	27.530	-18.470	46.000
2.123	0.350	32.540	32.890	-13.110	46.000
5.396	0.447	23.900	24.347	-25.653	50.000
20.439	1.110	25.640	26.750	-23.250	50.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. “ “ means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Conducted Emission Test  
 Power Line : Line 2  
 Test Mode : Mode 1: Transmitter 802.11a (5785MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV	Margin dB	Limit dBuV
<b>LINE 2</b>					
<b>Quasi-Peak</b>					
0.255	0.300	37.060	37.360	-25.640	63.000
0.369	0.310	45.010	45.320	-14.423	59.743
0.947	0.320	39.900	40.220	-15.780	56.000
2.146	0.350	38.930	39.280	-16.720	56.000
3.476	0.390	35.180	35.570	-20.430	56.000
11.892	0.642	34.300	34.941	-25.059	60.000
<b>Average</b>					
0.255	0.300	29.220	29.520	-23.480	53.000
0.369	0.310	37.540	37.850	-11.893	49.743
0.947	0.320	34.680	35.000	-11.000	46.000
2.146	0.350	33.920	34.270	-11.730	46.000
3.476	0.390	30.160	30.550	-15.450	46.000
11.892	0.642	29.320	29.961	-20.039	50.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. "■" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

### 3. Peak Transmit Power

#### 3.1. Test Equipment

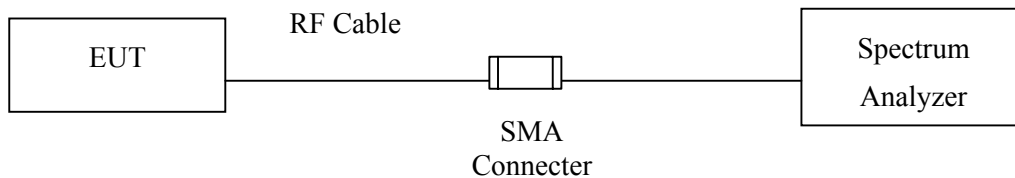
The following test equipments are used during the radiated emission tests:

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Spectrum Analyzer	R&S	FSP40 / 100170	Nov, 2007

- Note:
1. All equipments are calibrated every one year.
  2. The test instruments marked by “X” are used to measure the final test results.

#### 3.2. Test Setup

##### Conduction Power Measurement



#### 3.3. Limits

- (1) For the band 5.15-5.25 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 50 mW or  $4 \text{ dBm} + 10\log B$ , where B is the 26-dB emission bandwidth in MHz. If transmitting antenna of directional gain greater than 6 dBi are used, the peak transmit power shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.
- (2) For the band 5.25-5.35 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10\log B$ , where B is the 26-dB emission bandwidth in MHz. If transmitting antenna of directional gain greater than 6 dBi are used, the peak transmit power shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.
- (3) For the band 5.725-5.825 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 1W or  $17 \text{ dBm} + 10\log B$ , where B is the 26-dB emission bandwidth in MHz. If transmitting antenna of directional gain greater than 6 dBi are used, the peak transmit power shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.

#### 3.4. Uncertainty

$\pm 1.27 \text{ dB}$

### 3.5. Test Result of Peak Transmit Power

Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Peak Transmit Power  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5180MHz)

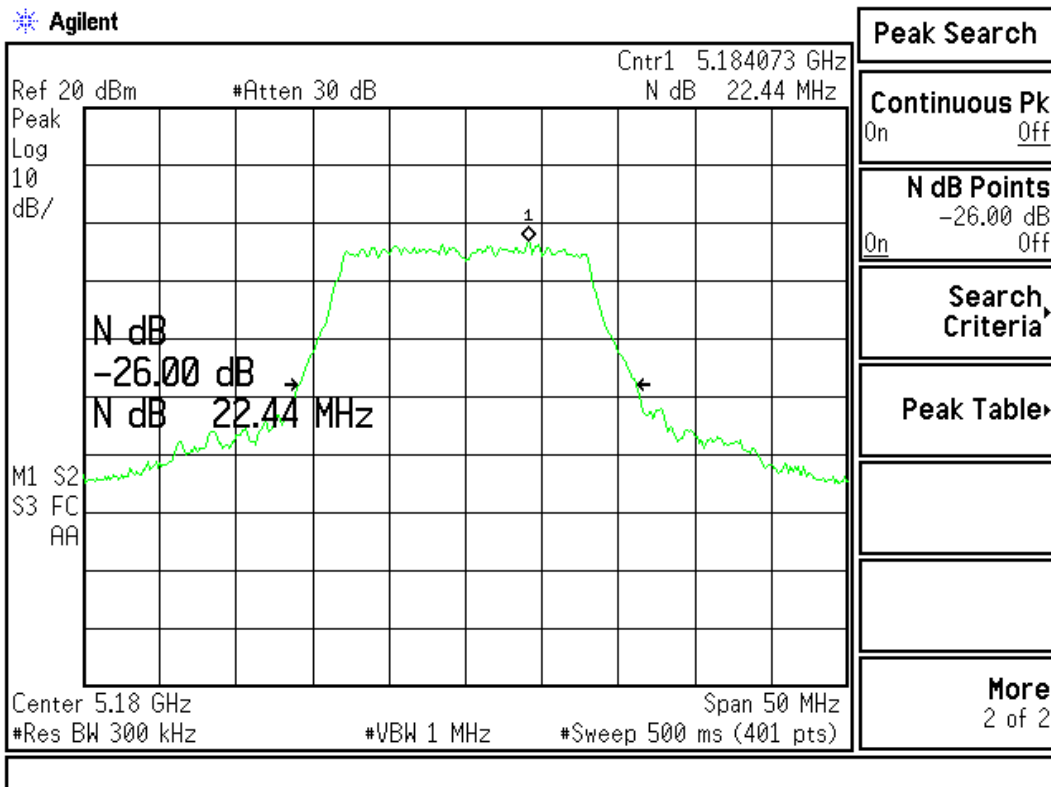
#### Peak Transmit Power Measurement:

Channel No.	Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	Measurement Level (dBm)
1	5180	22.44	14.75

Limits (dBm)	Result
50mW (17dBm) or 4dBm+10 log (B= 22.44MHz)=17.51dBm	Pass

#### 26dBc Occupied Bandwidth:

##### Channel 1





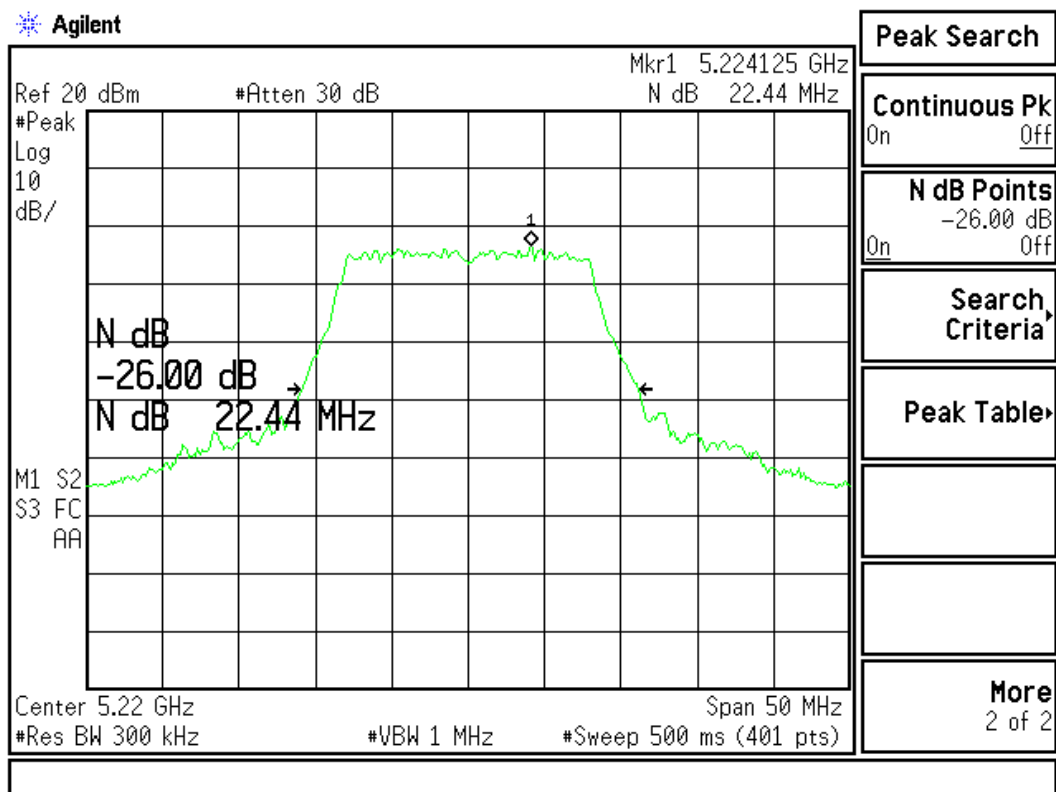
Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Peak Transmit Power  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5220MHz)

**Peak Transmit Power Measurement:**

Channel No.	Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	Measurement Level (dBm)
3	5220	22.44	14.86

Limits (dBm)	Result
50mW (17dBm) or 4dBm+10 log (B= 22.44MHz)=17.512dBm	Pass

**26dBc Occupied Bandwidth:  
Channel 3**



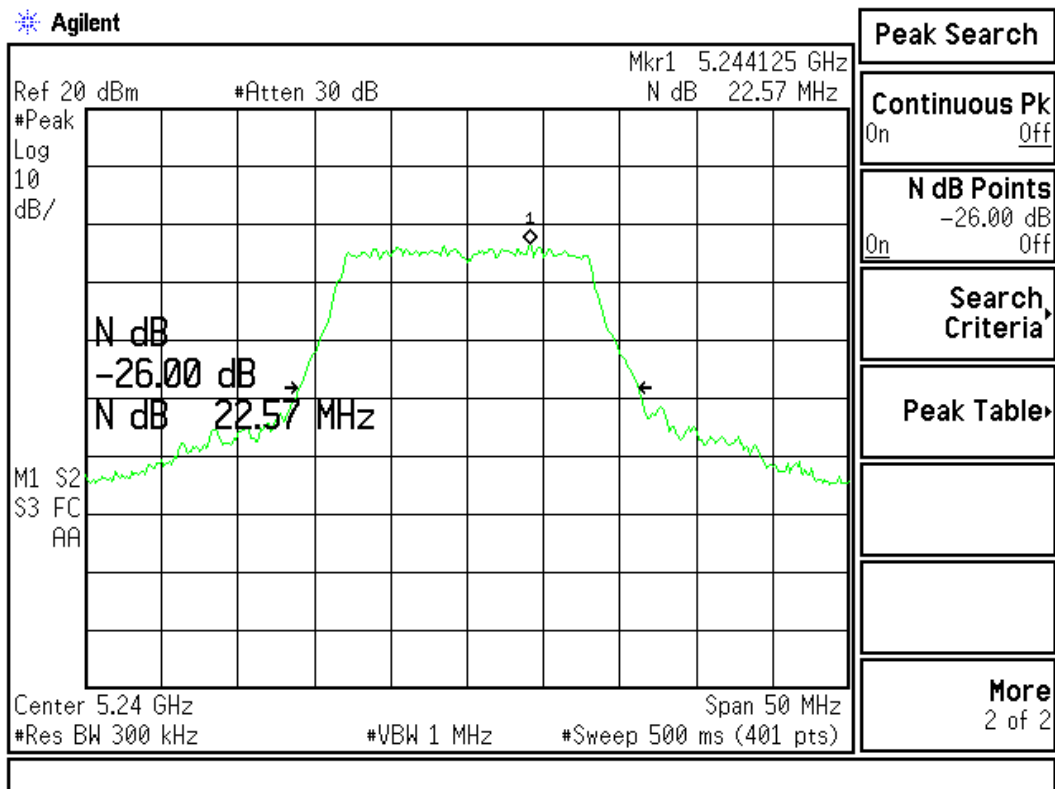
Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Peak Transmit Power  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5240MHz)

**Peak Transmit Power Measurement:**

Channel No.	Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	Measurement Level (dBm)
4	5240	22.57	14.80

Limits (dBm)	Result
50mW (17dBm) or 4dBm+10 log (B=22.57MHz)=17.54dBm	Pass

**26dBc Occupied Bandwidth:  
Channel 4**



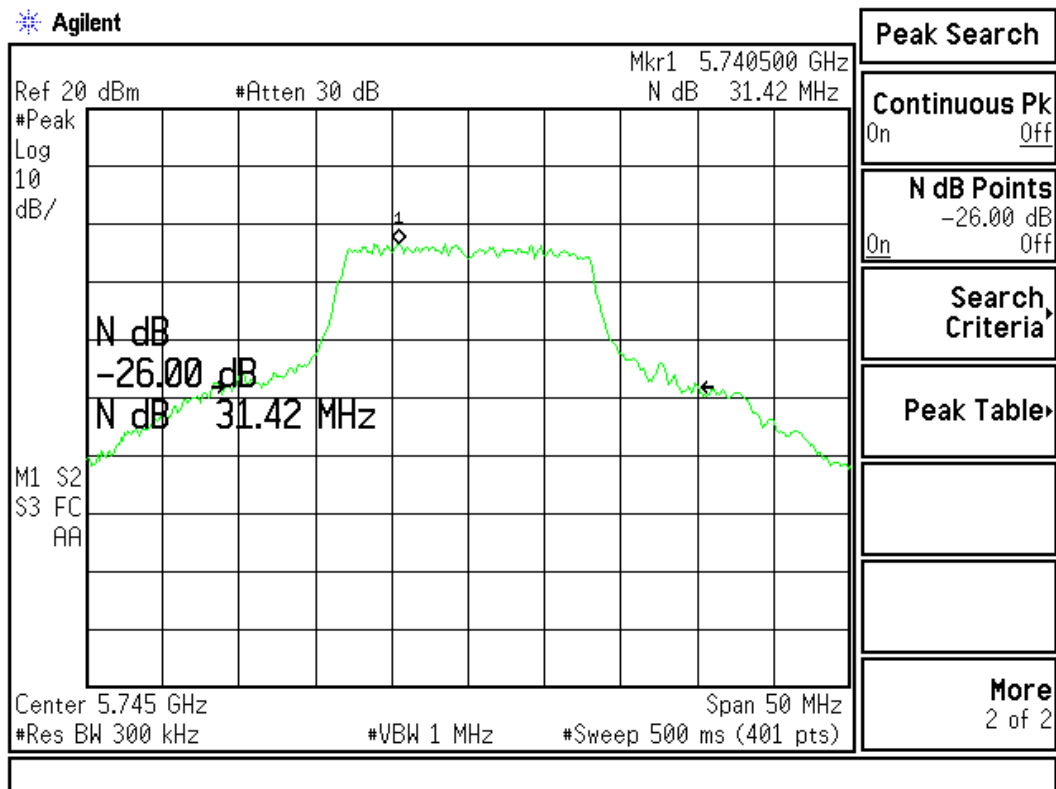
Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Peak Transmit Power  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5745MHz)

**Peak Transmit Power Measurement:**

Channel No.	Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	Measurement Level (dBm)
5	5745	31.42	14.92

Limits (dBm)	Result
1W (30dBm) or 17dBm+10 log (B= 31.42MHz)=25.97dBm	Pass

**26dBc Occupied Bandwidth:  
Channel 5**



Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Peak Transmit Power  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5785MHz)

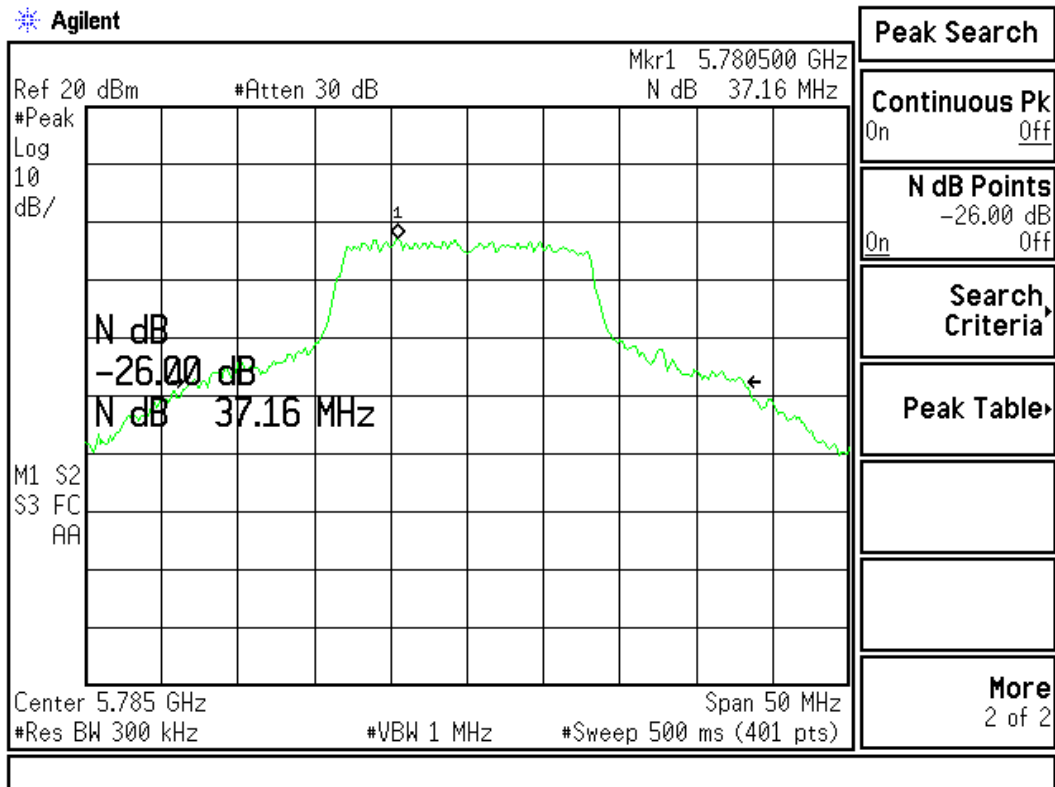
**Peak Transmit Power Measurement:**

Channel No.	Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	Measurement Level (dBm)
7	5785	37.16	14.95

Limits (dBm)	Result
1W (30dBm) or 17dBm+10 log (B=37.16MHz)=26.70dBm	Pass

**26dBc Occupied Bandwidth:**

**Channel 7**



Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Peak Transmit Power  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5805MHz)

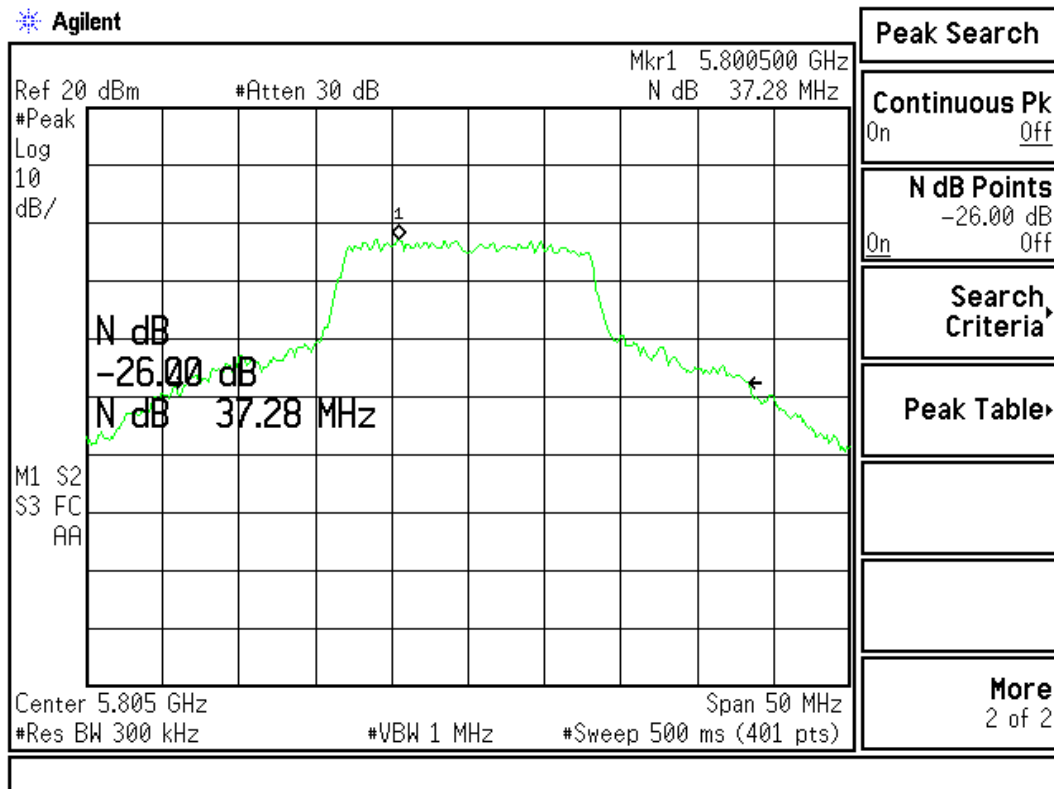
**Peak Transmit Power Measurement:**

Channel No.	Frequency (MHz)	26dBc Occupied Bandwidth (MHz)	Measurement Level (dBm)
8	5805	37.28	14.98

Limits (dBm)	Result
1W (30dBm) or $17\text{dBm} + 10 \log(B=37.28\text{MHz}) = 26.71\text{dBm}$	Pass

**26dBc Occupied Bandwidth:**

**Channel 8**



## 4. Peak Power Spectral Density

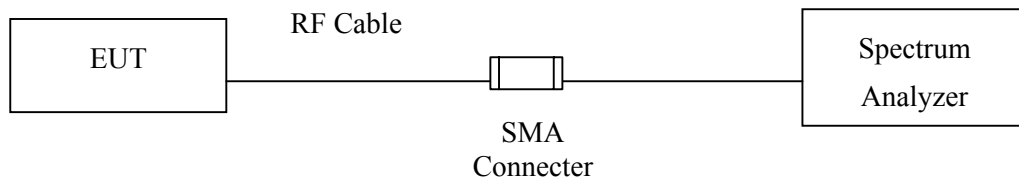
### 4.1. Test Equipment

The following test equipments are used during the radiated emission tests:

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Spectrum Analyzer	R&S	FSP40 / 100170	Nov, 2007

- Note:
1. All equipments are calibrated every one year.
  2. The test instruments marked by “X” are used to measure the final test results.

### 4.2. Test Setup



### 4.3. Limits

- (4) For the band 5.15-5.25 GHz, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antenna of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.
- (5) For the band 5.25-5.35 GHz, the peak power spectral density shall not exceed 11 dBm in any 1-MHz band. If transmitting antenna of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.
- (6) For the band 5.725-5.825 GHz, the peak power spectral density shall not exceed 17 dBm in any 1-MHz band. If transmitting antenna of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi.

### 4.4. Uncertainty

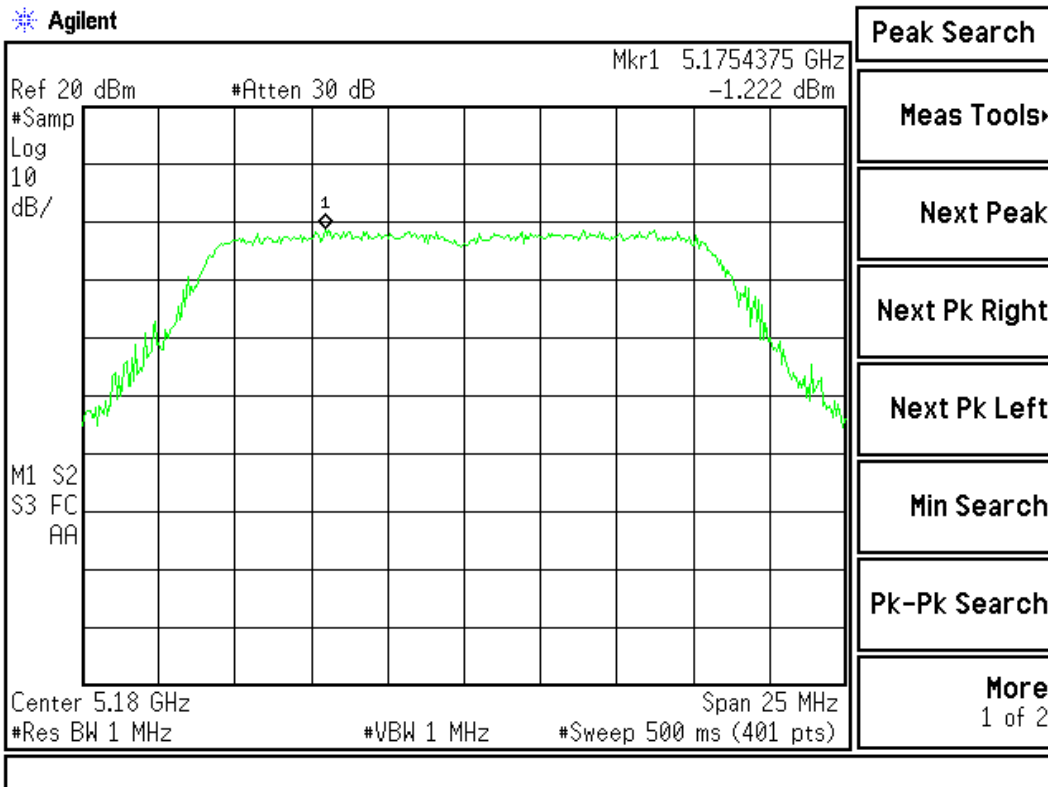
± 1.27 dB

#### 4.5. Test Result of Peak Power Spectral Density

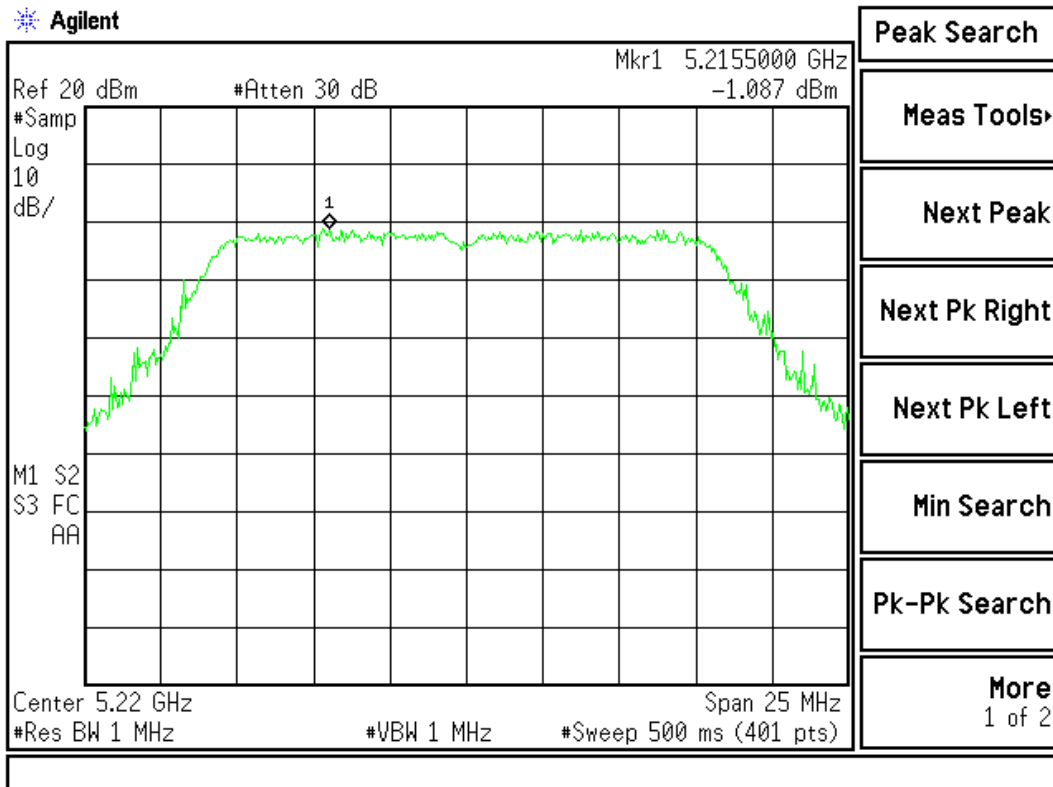
Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Peak Power Spectral Density  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
1	5180.00	-1.222	< 4	Pass
3	5220.00	-1.087	< 4	Pass
4	5240.00	-0.66	< 4	Pass
5	5745.00	-1.438	< 17	Pass
7	5785.00	-0.486	< 17	Pass
8	5805.00	-0.341	< 17	Pass

**Channel 1:**

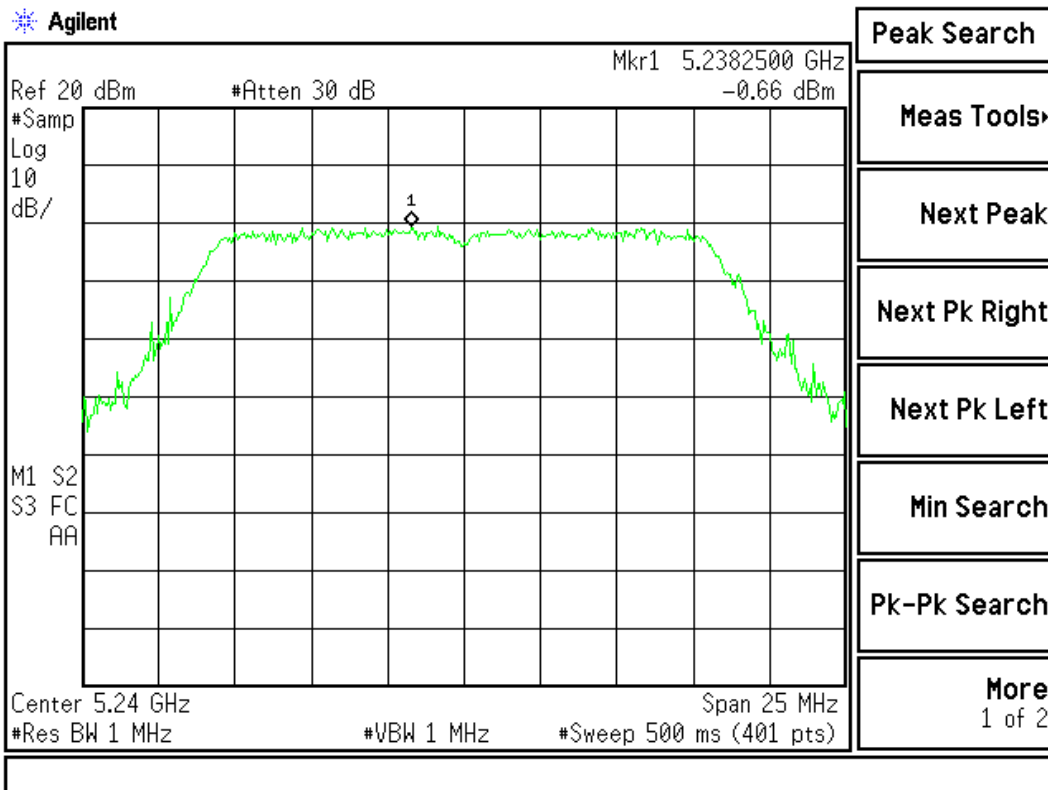


**Channel 3:**

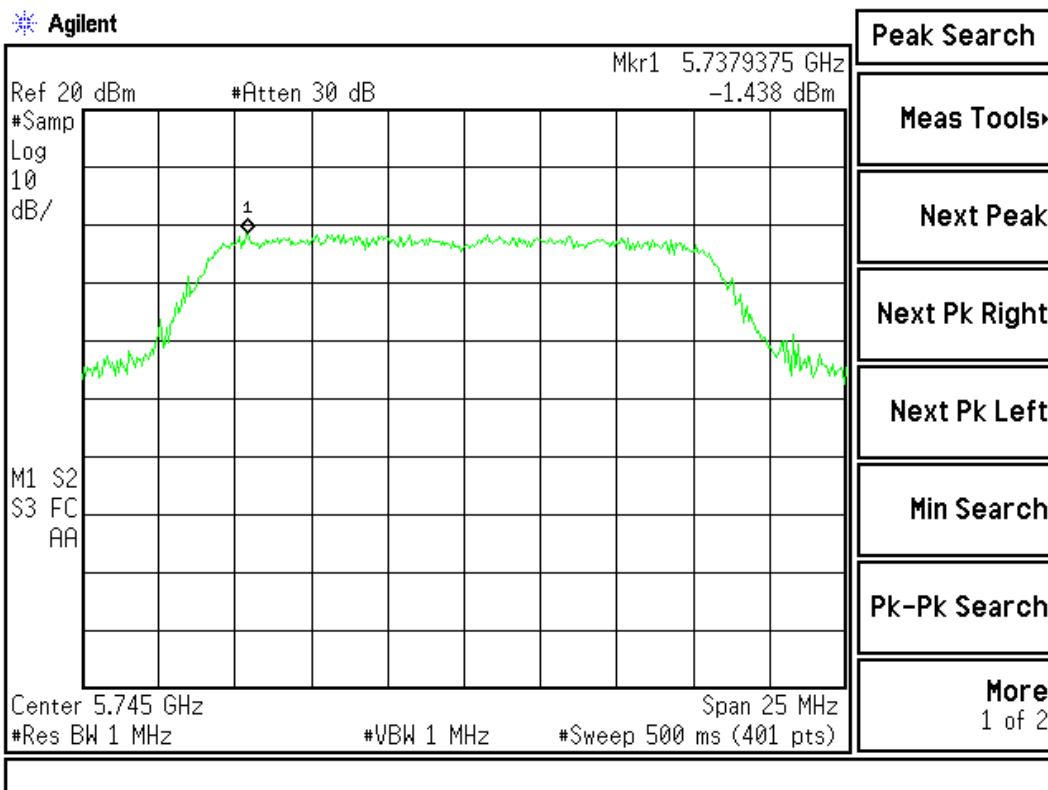




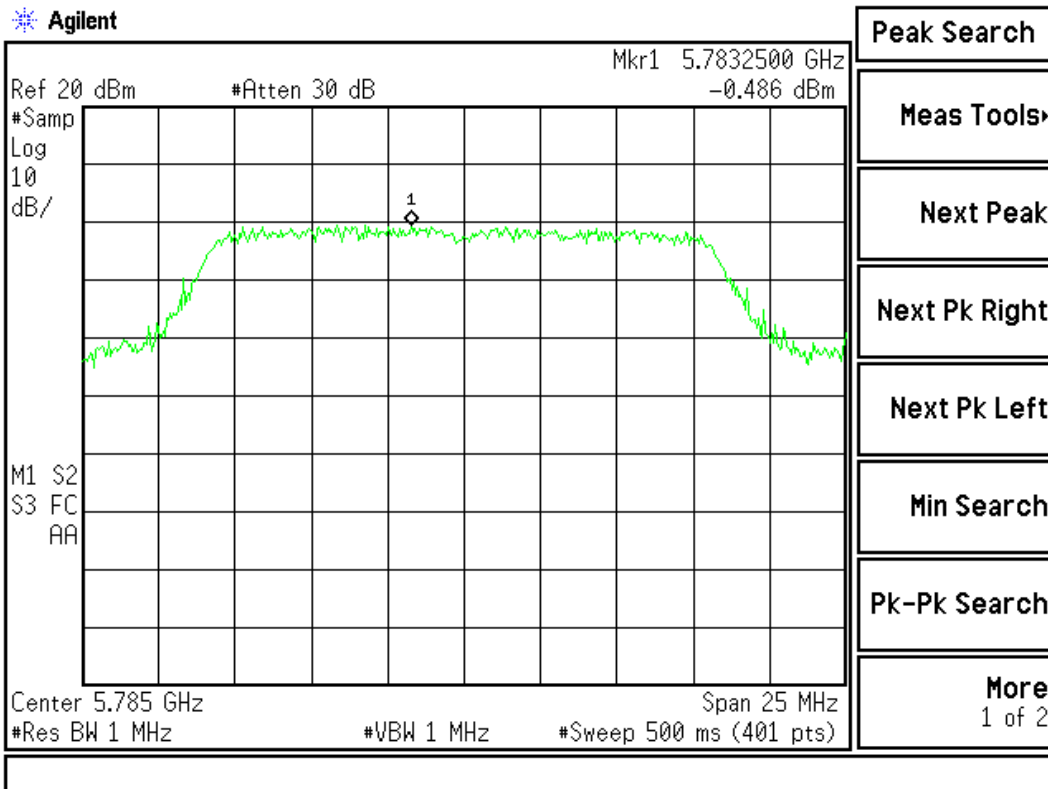
**Channel 4:**



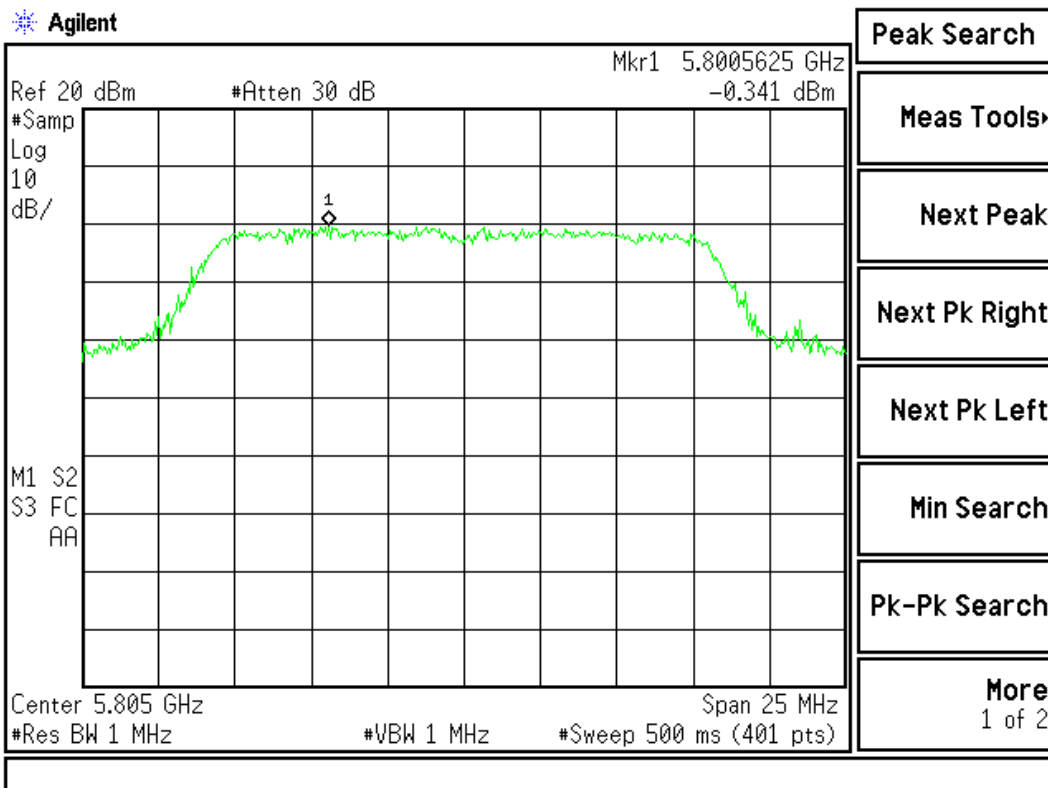
**Channel 5:**



**Channel7:**



**Channel 8:**



**5. Peak Excursion**

**5.1. Test Equipment**

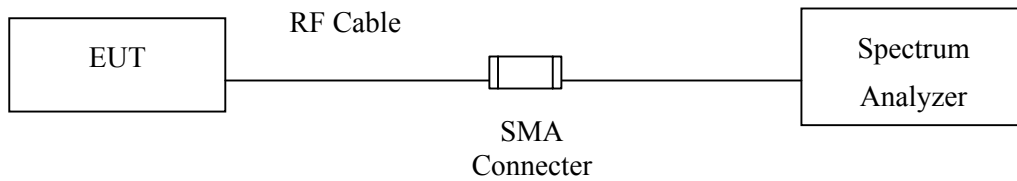
The following test equipments are used during the radiated emission tests:

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
X	Spectrum Analyzer	R&S	FSP40 / 100170	Nov, 2007

Note: 1. All equipments are calibrated every one year.  
 2. The test instruments marked by “X” are used to measure the final test results.

**5.2. Test Setup**

**Conduction Power Measurement**



**5.3. Limits**

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

**5.4. Uncertainty**

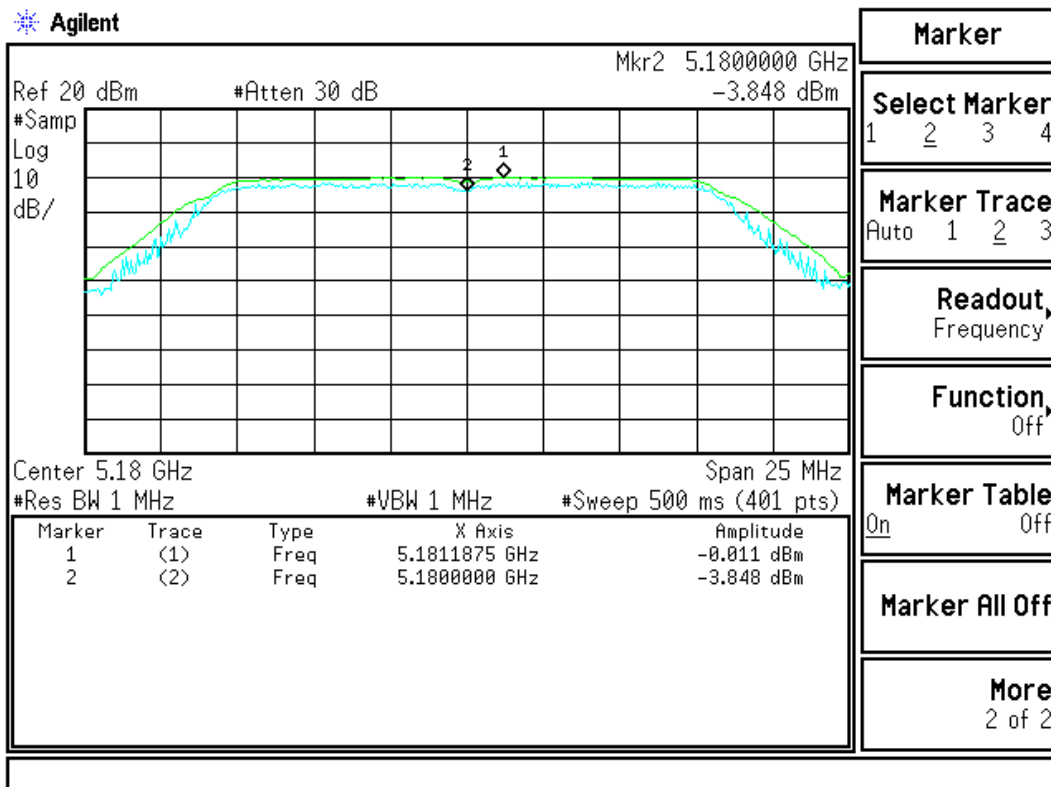
± 1.27 dB

**5.5. Test Result of Peak Excursion**

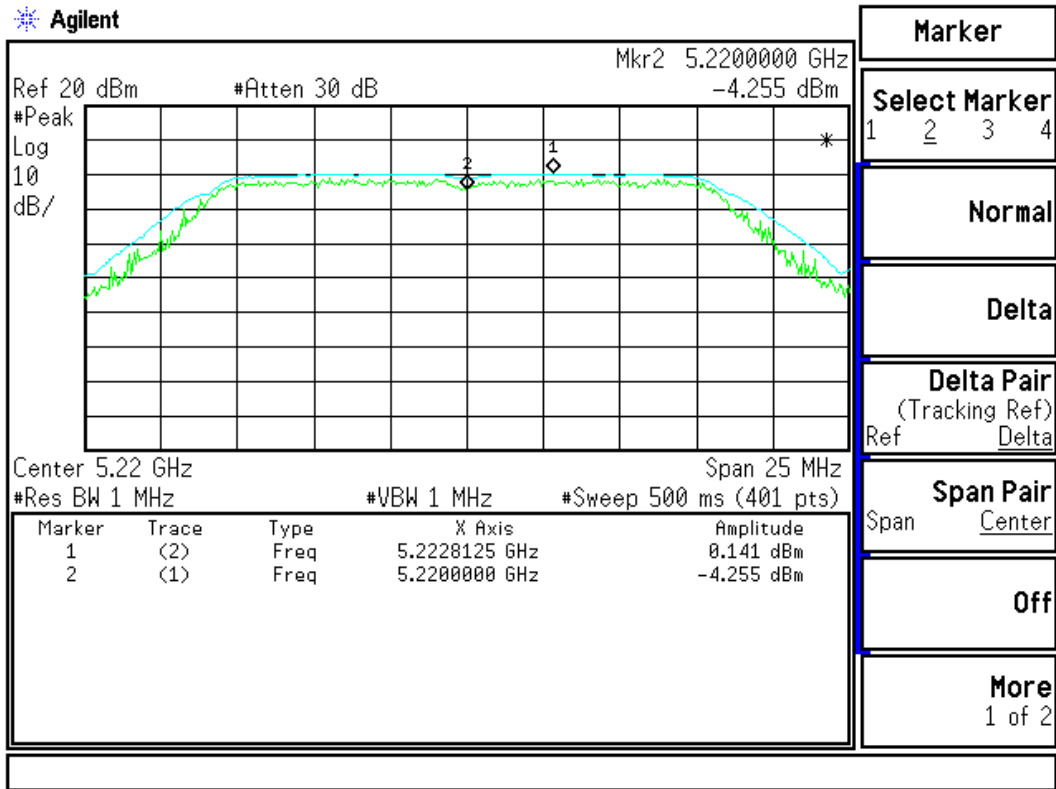
Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Peak Excursion  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a

Channel No.	Frequency (MHz)	Measurement Level (dB)	Required Limit (dB)	Result
1	5180.00	3.859	≤ 13	Pass
3	5220.00	4.114	≤ 13	Pass
4	5240.00	2.878	≤ 13	Pass
5	5745.00	3.898	≤ 13	Pass
7	5785.00	2.266	≤ 13	Pass
8	5805.00	2.512	≤ 13	Pass

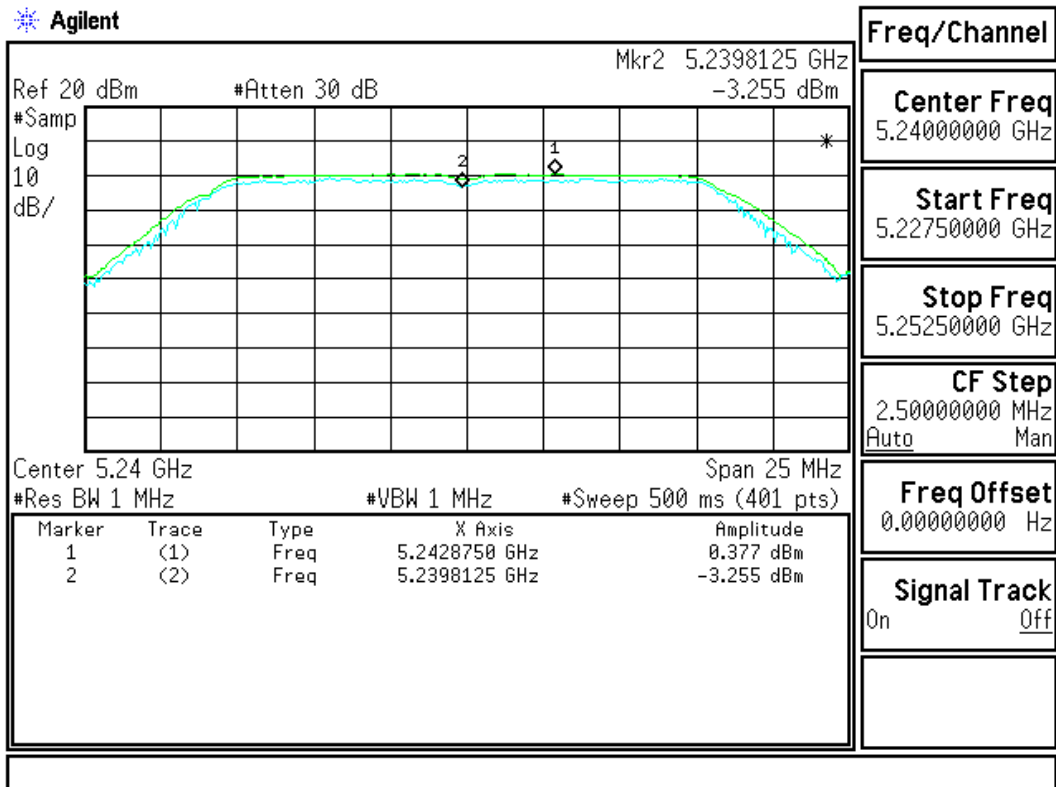
**Channel 1:**



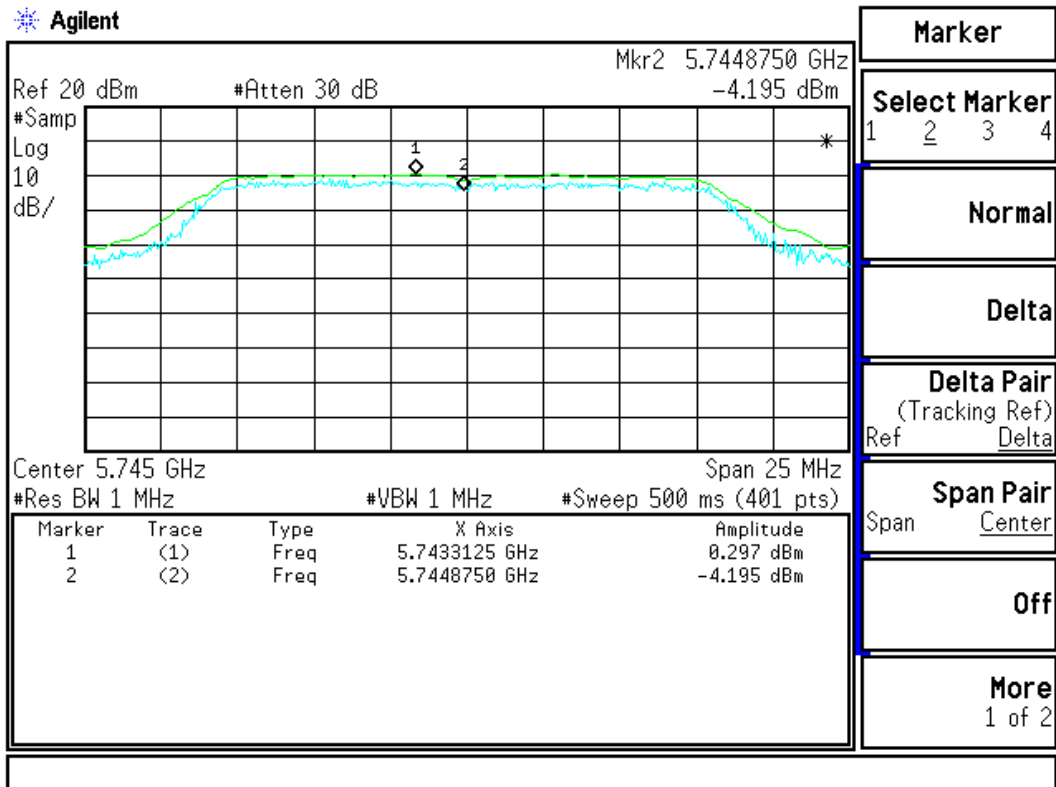
**Channel 3:**



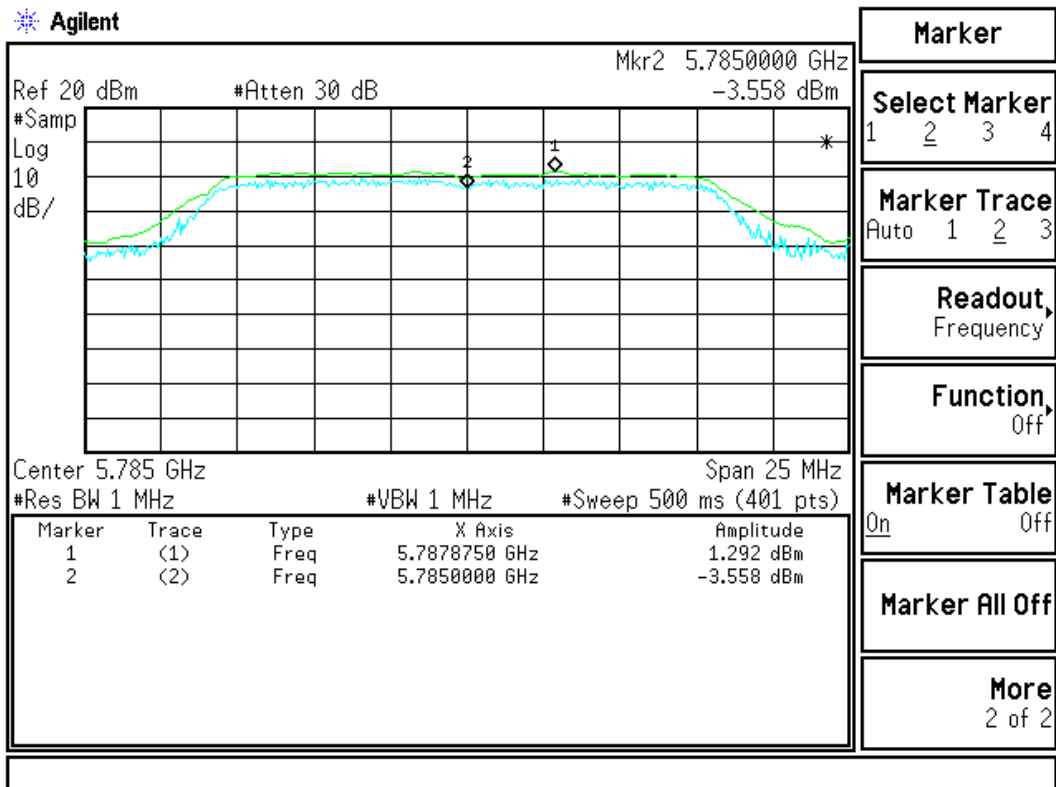
**Channel 4:**



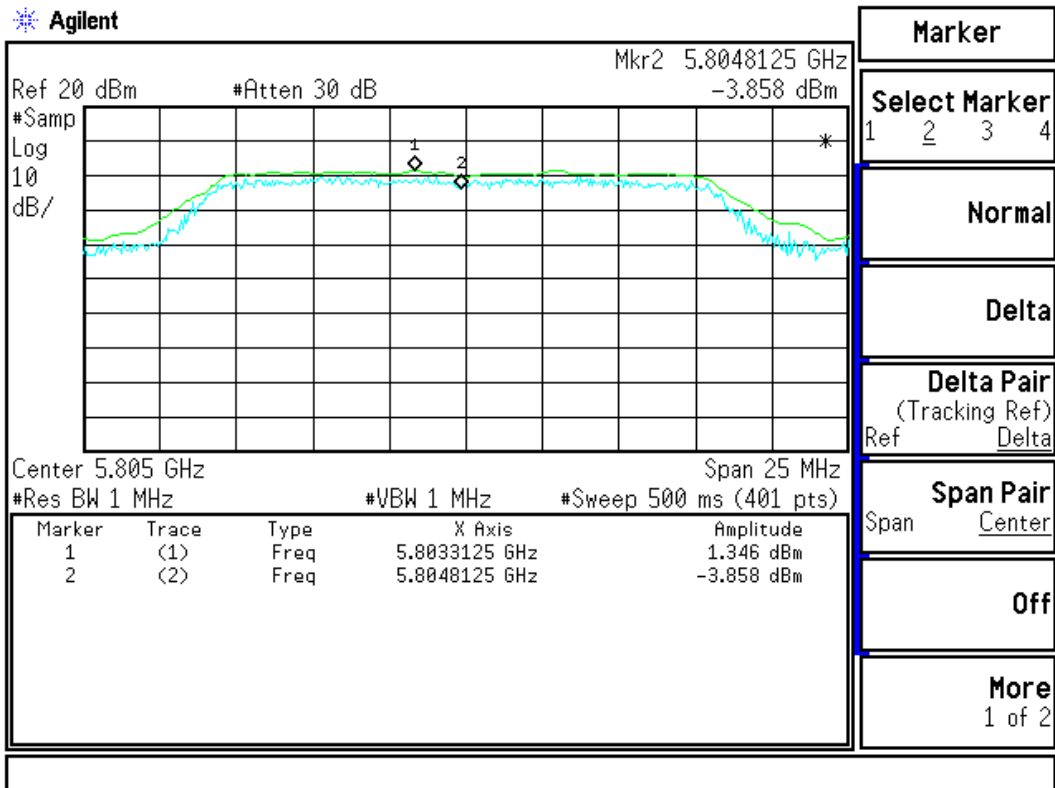
**Channel 5:**



**Channel 7:**



**Channel 8:**



## 6. Undesirable Emission

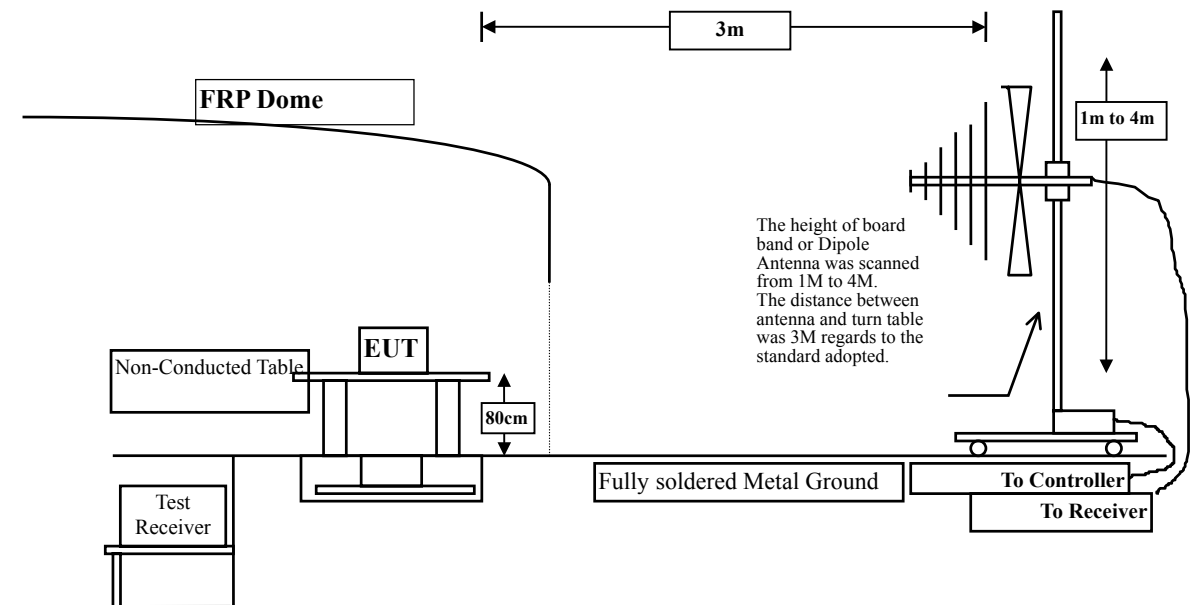
### 6.1. Test Equipment

The following test equipment are used during the radiated emission test:

Test Site	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
Site # 3	X Test Receiver	R & S	ESI 26 / 838786 / 004	May, 2007
	X Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2007
	X Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2007
	X Bilog Antenna	SCHAFFNER	CBL6112B / 2697	May, 2007
	X Horn Antenna	ETS	3115 / 0005-6160	July, 2007
	X Pre-Amplifier	QTK	QTK-AMP-01 / 0001	July, 2007

- Note:
1. All equipments are calibrated every one year.
  2. The test instruments marked by "X" are used to measure the final test results.

### 6.2. Test Setup





**6.3. Limits**

- (1) For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.
- (2) For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.
- (3) For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27 dBm/MHz.
- (4) The field strength of emissions appearing within restricted bands of operation shall not exceed the limits in the Section 15.209.
- (5) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Section 15.209:

<b>FCC Part 15 Subpart C Paragraph 15.209 Limits</b>		
Frequency MHz	uV/m @3m	dBuV/m@3m
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

- Remarks :
- 1. RF Voltage (dBuV) = 20 log 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 and the closed point of any part of the device or system.

#### 6.4. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.4:2003 on radiated measurement.

The additional latch filter below 1GHz was used to measure the level of harmonics radiated emission during field strength of harmonics measurement.

The bandwidth below 1GHz setting on the field strength meter is 120 kHz, above 1GHz are 1 MHz. The frequency range from 30MHz to 10th harmonics is checked.

#### 6.5. Uncertainty

± 3.8 dB below 1GHz

± 3.9 dB above 1GHz

## 6.6. Test Result of Undesirable Emission

Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Undesirable Emission  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5180MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
<b>Horizontal</b>					
<b>Peak Detector</b>					
10360.000	13.127	37.794	50.920	-23.080	74.000
15540.000	15.491	37.495	52.986	-21.014	74.000
<b>Average Detector</b>					
--					
<b>Vertical</b>					
<b>Peak Detector</b>					
10360.000	13.127	37.424	50.550	-23.450	74.000
15540.000	15.491	37.042	52.533	-21.467	74.000
<b>Average Detector</b>					
--					

Note:

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

Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Undesirable Emission  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5220MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
<b>Horizontal</b>					
<b>Peak Detector</b>					
10440.000	13.354	37.656	51.010	-22.990	74.000
15660.000	15.184	38.397	53.581	-20.419	74.000
<b>Average Detector</b>					
--					
<b>Vertical</b>					
<b>Peak Detector</b>					
10440.000	13.354	37.767	51.121	-22.879	74.000
15660.000	15.184	38.196	53.380	-20.620	74.000
<b>Average Detector</b>					
--					

Note:

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

Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Undesirable Emission  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5240MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
------------------	-------------------------	--------------------------	--------------------------------	--------------	-----------------

**Horizontal**
**Peak Detector**

10480.000	13.473	38.807	52.279	-21.721	74.000
15720.000	14.910	38.014	52.923	-21.077	74.000

**Average Detector**

--

**Vertical**
**Peak Detector**

10480.000	13.473	38.107	51.579	-22.421	74.000
15720.000	14.910	38.278	53.187	-20.813	74.000

**Average Detector**

--

**Note:**

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:100MHz ◦
3. Receiver setting (AVG Detector) : RBW:1MHz; VBW:30Hz; Span:20MHz ◦
4. Measurement Level = Reading Level + Correct Factor.
5. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Undesirable Emission  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5745Hz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
<b>Horizontal</b>					
<b>Peak Detector</b>					
11510.000	15.300	37.488	52.787	-21.213	74.000
17255.000	14.351	39.457	53.807	-20.193	74.000
<b>Average Detector</b>					
--					
<b>Vertical</b>					
<b>Peak Detector</b>					
11510.000	15.300	37.899	53.198	-20.802	74.000
17255.000	14.351	38.230	52.580	-21.420	74.000
<b>Average Detector</b>					
--					

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:100MHz ◦
3. Receiver setting (AVG Detector) : RBW:1MHz; VBW:30Hz; Span:20MHz ◦
4. Measurement Level = Reading Level + Correct Factor.
5. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied

Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Undesirable Emission  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5785MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level	dB	dBuV/m
	dB	dBuV	dBuV/m		

**Horizontal**
**Peak Detector**

11590.000	14.688	38.178	52.866	-21.134	74.000
17375.000	14.223	37.968	52.191	-21.809	74.000

**Average Detector**

--

**Vertical**
**Peak Detector**

11590.000	14.688	38.409	53.097	-20.903	74.000
17375.000	14.223	38.567	52.790	-21.210	74.000

**Average Detector**

--

**Note:**

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:100MHz ◦
3. Receiver setting (AVG Detector) : RBW:1MHz; VBW:30Hz; Span:20MHz ◦
4. Measurement Level = Reading Level + Correct Factor.
5. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied

Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Undesirable Emission  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5805MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level	dB	dBuV/m
	dB	dBuV	dBuV/m		

**Horizontal**
**Peak Detector**

11611.901	14.595	42.575	57.170	-16.830	74.000
17416.901	14.148	37.710	51.857	-22.143	74.000

**Average Detector**

--

**Vertical**
**Peak Detector**

11611.901	14.595	40.654	55.249	-18.751	74.000
17416.901	14.148	37.199	51.346	-22.654	74.000

**Average Detector**

--

**Note:**

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. Receiver setting (Peak Detector) : RBW:1MHz; VBW:1MHz; Span:100MHz ◦
3. Receiver setting (AVG Detector) : RBW:1MHz; VBW:30Hz; Span:20MHz ◦
4. Measurement Level = Reading Level + Correct Factor.
5. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied



Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Undesirable Emission  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5220MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
<b>Horizontal</b>					
<b>Peak Detector</b>					
240.975	12.077	19.586	31.663	-14.337	46.000
390.950	15.958	16.708	32.666	-13.334	46.000
507.520	18.805	14.652	33.456	-12.544	46.000
648.375	20.951	11.634	32.585	-13.415	46.000
810.800	21.606	7.060	28.666	-17.334	46.000
915.129	22.438	12.229	34.666	-11.334	46.000
<b>Vertical</b>					
<b>Peak Detector</b>					
287.050	13.637	11.951	25.588	-20.412	46.000
481.050	18.586	11.304	29.890	-16.110	46.000
565.925	21.227	12.427	33.654	-12.346	46.000
698.500	20.486	9.479	29.965	-16.035	46.000
864.200	21.968	11.476	33.444	-12.556	46.000
925.000	24.099	8.567	32.666	-13.334	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. "█" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor
4. The radiated emissions below 1GHz of the lowest, middle, highest frequency are pretested. Only the worst case is shown on the report.

Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Undesirable Emission  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5785MHz)

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
<b>Horizontal</b>					
<b>Peak Detector</b>					
204.600	9.806	21.157	30.963	-12.537	43.500
316.150	13.704	11.470	25.174	-20.826	46.000
527.152	18.482	10.483	28.965	-17.035	46.000
648.375	20.951	4.034	24.985	-21.015	46.000
767.200	22.117	11.868	33.985	-12.015	46.000
927.250	23.115	8.870	31.985	-14.015	46.000
<b>Vertical</b>					
<b>Peak Detector</b>					
192.478	9.382	20.608	29.990	-13.510	43.500
384.050	16.822	13.352	30.174	-15.826	46.000
481.050	18.586	16.464	35.050	-10.950	46.000
575.625	21.418	10.437	31.855	-14.145	46.000
685.974	20.305	9.349	29.654	-16.346	46.000
767.200	22.767	9.218	31.985	-14.015	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. "█" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor
4. The radiated emissions below 1GHz of the lowest, middle, highest frequency are pretested. Only the worst case is shown on the report.

## 7. Band Edge

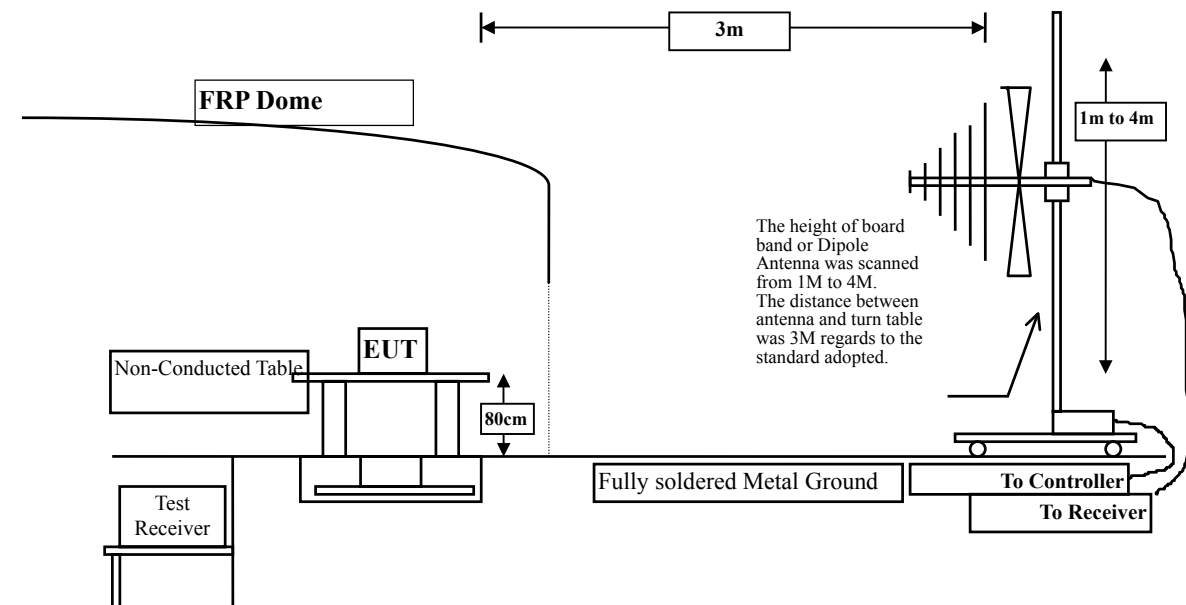
### 7.1. Test Equipment

The following test equipments are used during the band edge tests:

Test Site	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
Site # 3	X Test Receiver	R & S	ESI 26 / 838786 / 004	May, 2007
	X Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2007
	X Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2007
	X Bilog Antenna	SCHAFFNER	CBL6112B / 2697	May, 2007
	X Horn Antenna	ETS	3115 / 0005-6160	July, 2007
	X Pre-Amplifier	QTK	QTK-AMP-01 / 0001	July, 2007

### 7.2. Test Setup

#### RF Radiated Measurement:



### 7.3. Limits

The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.

Radiated emissions which fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209:

<b>FCC Part 15 Subpart C Paragraph 15.209 Limits</b>		
Frequency MHz	uV/m @3m	dBuV/m@3m
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

- Remarks :
1. RF Voltage (dBuV) = 20 log 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 and the closed point of any part of the device or system.

### 7.4. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters. The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.4:1992 on radiated measurement.

The bandwidth below 1GHz setting on the field strength meter is 120 kHz, above 1GHz are 1 MHz.

### 7.5. Uncertainty

± 3.8 dB below 1GHz

± 3.9 dB above 1GHz

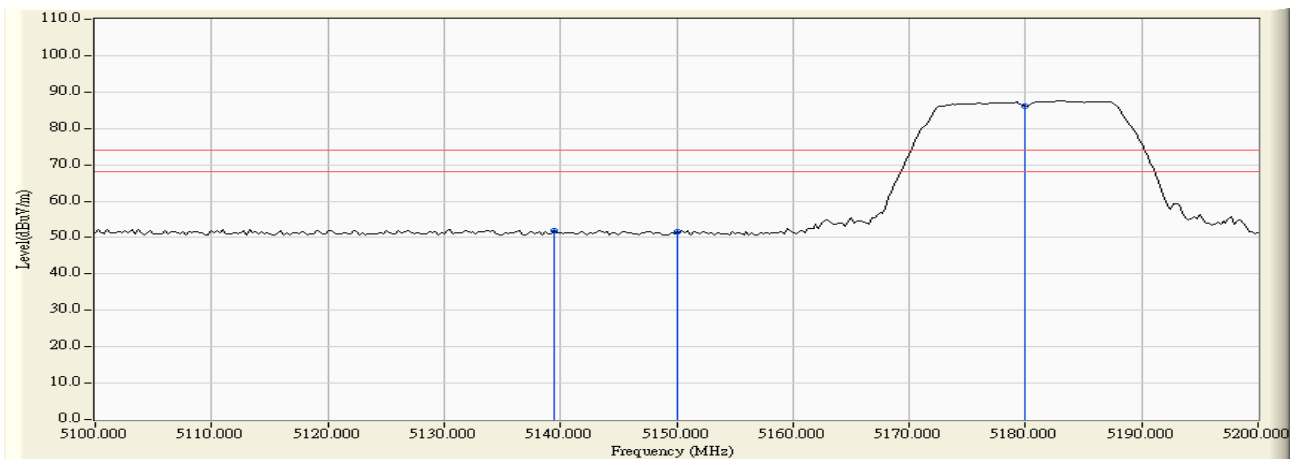
**7.6. Test Result of Band Edge**

Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5180MHz)

**RF Radiated Measurement (Horizontal):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
1 (Peak)	5139.500	4.302	47.740	52.042	74.00	54.00	Pass
1 (Peak)	5150.000	4.305	47.442	51.747	74.00	54.00	Pass
1 (Peak)	5180.000	4.308	81.745	86.053	74.00	54.00	Pass

**Figure Channel 1: Horizontal (Peak)**



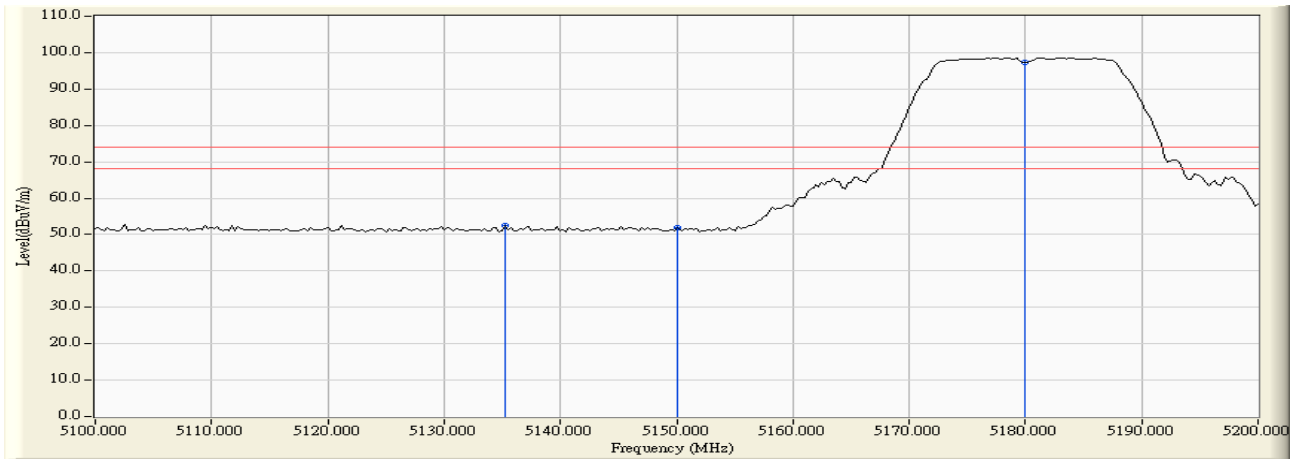
Note: RBW=1MHz, VBW=1MHz, Sweep=500ms

Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5180MHz)

**RF Radiated Measurement (Vertical):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
1 (Peak)	5135.250	4.300	48.219	52.519	74.00	54.00	Pass
1 (Peak)	5150.000	4.305	47.491	51.796	74.00	54.00	Pass
1 (Peak)	5180.000	4.308	92.991	97.299	74.00	54.00	Pass

**Figure Channel 1: Vertical (Peak)**



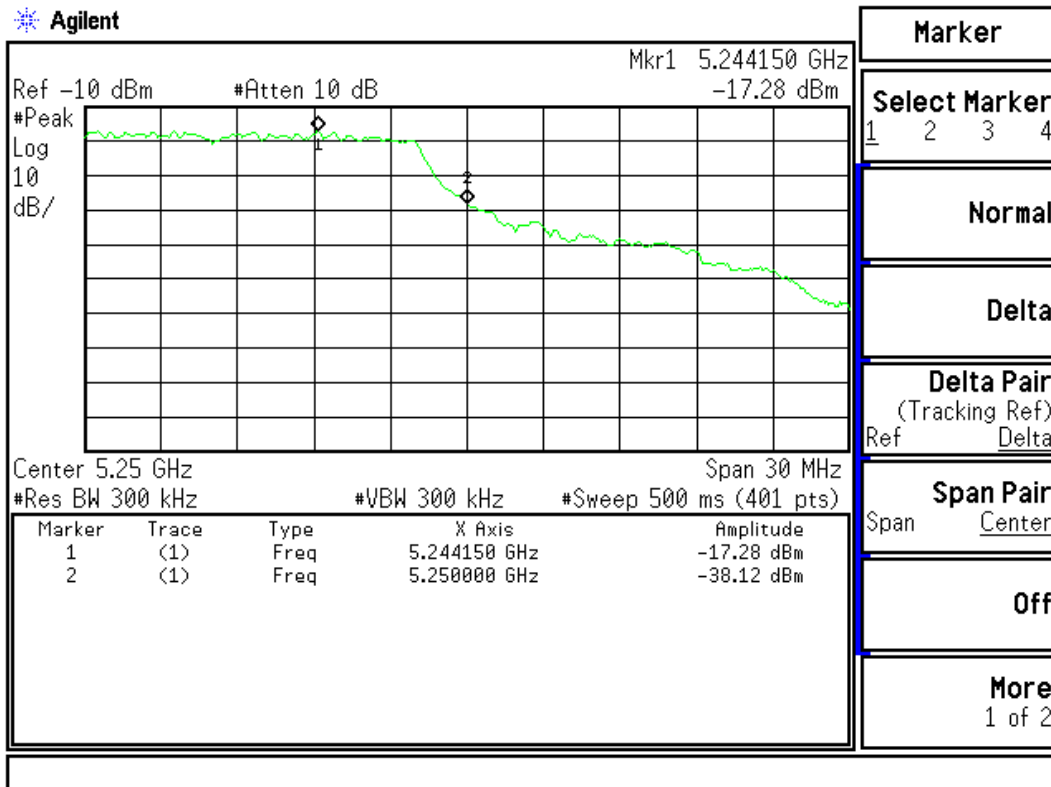
Note: RBW=1MHz, VBW=1MHz, Sweep=500ms

Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5240MHz)

Channel No.	Frequency (MHz)	Required Limit (dBc)	Result
4	>5250	>20	Pass

**RF Conduction Measurement:**

**Figure Channel 4:**



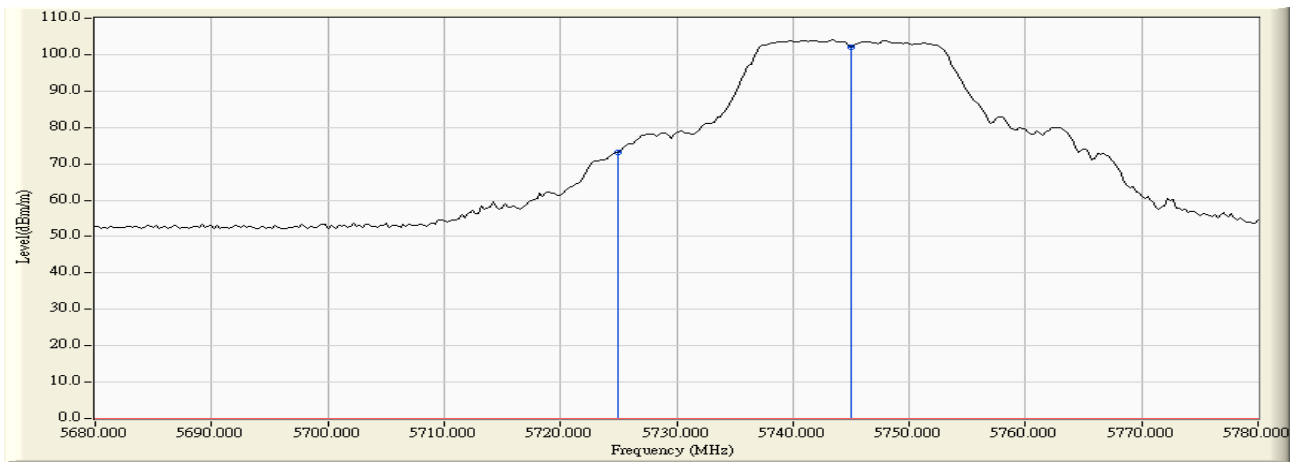
Note: RBW=300kHz, VBW=300kHz, Sweep=500ms

Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5745MHz)

**RF Radiated Measurement (Horizontal):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
5 (Peak)	5725.000	4.802	68.449	73.251	74.00	54.00	Pass
5 (Peak)	5745.000	4.830	97.228	102.058	74.00	54.00	Pass

**Figure Channel 5: Horizontal (Peak)**



Note: RBW=1MHz, VBW=1MHz, Sweep=500ms

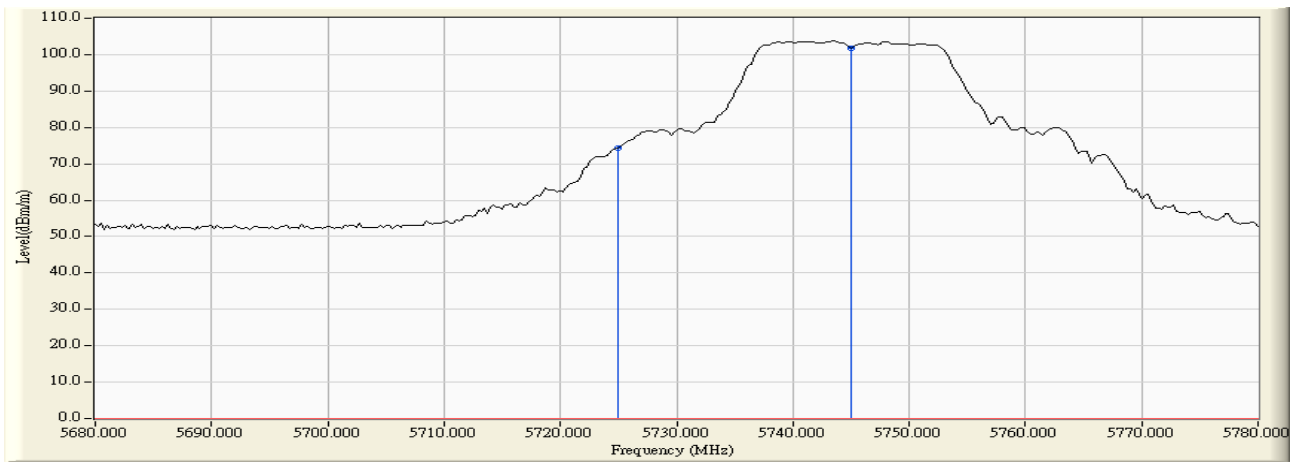


Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5745MHz)

**RF Radiated Measurement (VERTICAL):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
5 (Peak)	5725.000	4.802	69.571	74.373	74.00	54.00	Pass
5 (Peak)	5745.000	4.830	97.008	101.838	74.00	54.00	Pass

**Figure Channel 5: VERTICAL (Peak)**



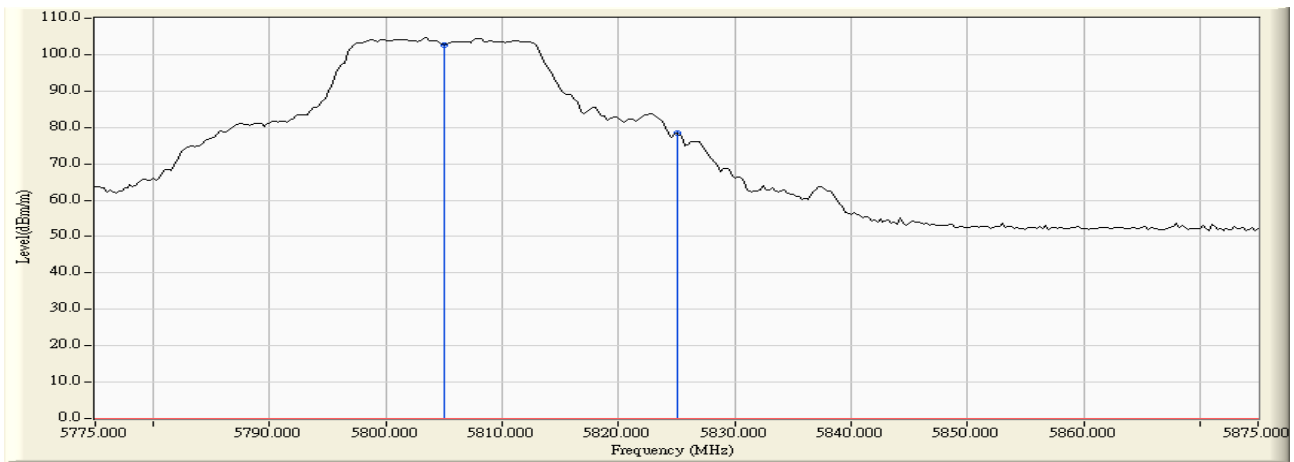
Note: RBW=1MHz, VBW=1MHz, Sweep=500ms

Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5805MHz)

**RF Radiated Measurement (Horizontal):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
8 (Peak)	5805.000	4.922	97.605	102.527	74.00	54.00	Pass
8 (Peak)	5825.000	4.946	73.485	78.431	74.00	54.00	Pass

**Figure Channel 8: Horizontal (Peak)**



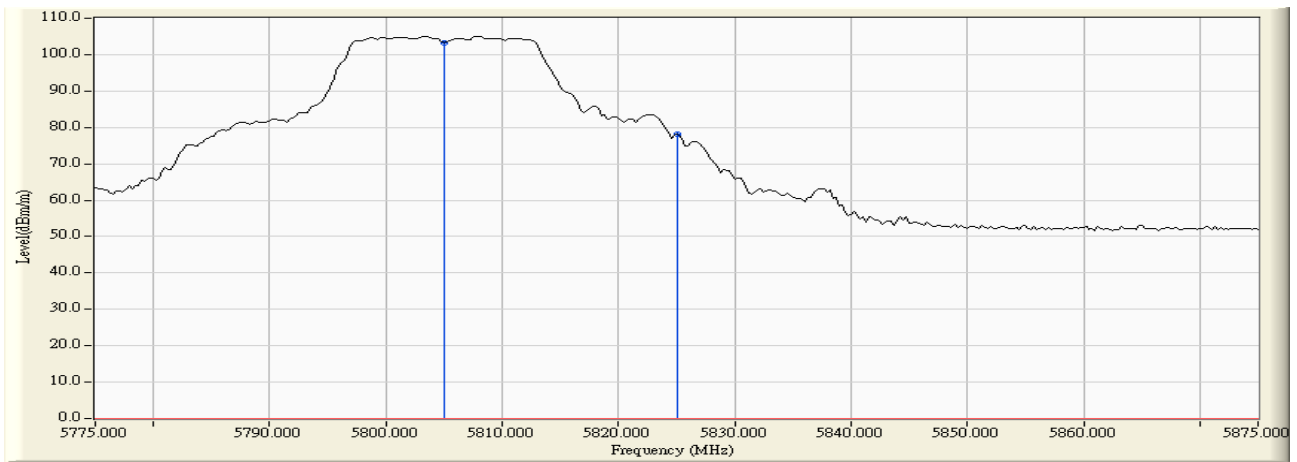
Note: RBW=1MHz, VBW=1MHz, Sweep=500ms

Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Band Edge  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmitter 802.11a (5805MHz)

**RF Radiated Measurement (VERTICAL):**

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
8 (Peak)	5805.000	4.922	98.242	103.164	74.00	54.00	Pass
8 (Peak)	5825.000	4.946	73.301	78.247	74.00	54.00	Pass

**Figure Channel 8: VERTICAL (Peak)**



Note: RBW=1MHz, VBW=1MHz, Sweep=500ms

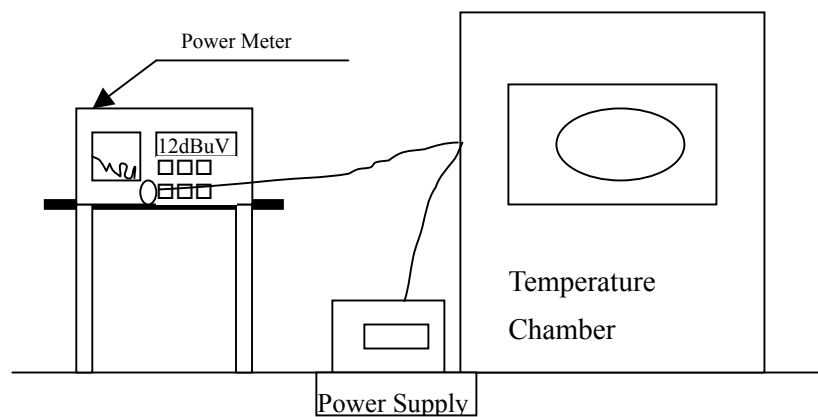
## 8. Frequency Stability

### 8.1. Test Equipment

Equipment	Manufacturer	Model No./Serial No.	Last Cal.	Remark
Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2007	
Temperature Chamber	WIT GROUP	TH-1S-B / WIT-02121901	June, 2007	

Note: All equipments are calibrated every one year.

### 8.2. Test Setup



### 8.3. Limits

Manufactures of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified

### 8.4. Uncertainty

± 150 Hz

### 8.5. Test Result of Frequency Stability

Product : Mini RISC-based Ready-to-Run Wireless Embedded Computer  
 Test Item : Frequency Stability  
 Test Site : Temperature Chamber  
 Test Mode : Mode 1: Transmitter 802.11a

Test Conditions		Channel	Frequency (MHz)	Frequency (MHz)	$\Delta F$ (MHz)
Tnom (20) °C	Vnom (110)V	1	5180.00	5180.00	0.00
		3	5220.00	5220.00	0.00
		4	5240.00	5240.00	0.00
		5	5745.00	5745.00	0.00
		7	5785.00	5785.00	0.00
		8	5805.00	5805.00	0.00
Tmax (50) °C	Vmax (126.5)V	1	5180.00	5180.00	0.00
		3	5220.00	5220.00	0.00
		4	5240.00	5240.00	0.00
		5	5745.00	5745.00	0.00
		7	5785.00	5785.00	0.00
		8	5805.00	5805.00	0.00
Tmax (50) °C	Vnim (93.5)V	1	5180.00	5180.00	0.00
		3	5220.00	5220.00	0.00
		4	5240.00	5240.00	0.00
		5	5745.00	5745.00	0.00
		7	5785.00	5785.00	0.00
		8	5805.00	5805.00	0.00
Tnim (0) °C	Vmax (126.5)V	1	5180.00	5180.00	0.00
		3	5220.00	5220.00	0.00
		4	5240.00	5240.00	0.00
		5	5745.00	5745.00	0.00
		7	5785.00	5785.00	0.00
		8	5805.00	5805.00	0.00
Tnim (0) °C	Vnim (93.5)V	1	5180.00	5180.00	0.00
		3	5220.00	5220.00	0.00
		4	5240.00	5240.00	0.00
		5	5745.00	5745.00	0.00
		7	5785.00	5785.00	0.00
		8	5805.00	5805.00	0.00

## 9. EMI Reduction Method During Compliance Testing

No modification was made during testing.