

FCC Test Report (Class II Permissive Change)

Product Name	IEEE 802.11a/b/g miniPCI module
Model No	WAPA003
FCC ID	SLE-WAPA003

Applicant	MOXA Inc.
Address	FL.4, NO. 135. LANE 235, BAOQIAO RD. XINDIAN
	DIST.,NEW TAIPEI CITY, TAIWAN

Date of Receipt	Mar. 16, 2015
Issued Date	May 08, 2015
Report No.	1530322R-RFUSP06V00
Report Version	V1.0
and and a start of the	



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.

This report must not be used to claim product endorsement by TAF or any agency of the government.

The test report shall not be reproduced without the written approval of QuieTek Corporation.

Test Report

Issued Date: May 08, 2015 Report No.: 1530322R-RFUSP06V00



Product Name	IEEE 802.11a/b/g miniPCI module	
Applicant	MOXA Inc.	
A Junear	FL.4, NO. 135. LANE 235, BAOQIAO RD. XINDIAN DIST.,NEW	
Address	TAIPEI CITY, TAIWAN	
Manufacturer	MOXA Inc.	
Model No.	WAPA003	
FCC ID.	SLE-WAPA003	
EUT Rated Voltage	DC 3.3V(Power by PCI-E)	
EUT Test Voltage	DC 3.3V(Power by PCI-E)	
Trade Name	MOXA	
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2014	
	ANSI C63.4: 2009, C63.10: 2009	
	789033 D02 General UNII Test Procedures New Rules v01	
Test Result	Complied	
Documented By	Joanne liv	
	(Senior Adm. Specialist / Joanne Lin)	
Tested By	Jack Hou	
	(Engineer / Jack Hsu)	
Approved By	Hand	
	(Director / Vincent Lin)	

TABLE OF CONTENTS

	Desc	ription	Page
1.	GEN	NERAL INFORMATION	5
	1.1.	EUT Description	5
	1.2.	Operational Description	7
	1.3.	Tested System Datails	
	1.4.	Configuration of tested System	
	1.5.	EUT Exercise Software	
	1.6.	Test Facility	9
2.	Max	imun conducted output power	10
	2.1.	Test Equipment	
	2.2.	Test Setup	
	2.3.	Limits	11
	2.4.	Test Procedure	
	2.5.	Uncertainty	
	2.6.	Test Result of Maximum conducted output power	
3.	Peak	k Power Spectral Density	14
	3.1.	Test Equipment	14
	3.2.	Test Setup	14
	3.3.	Limits	14
	3.4.	Test Procedure	
	3.5.	Uncertainty	15
	3.6.	Test Result of Peak Power Spectral Density	16
4.	Rad	iated Emission	20
	4.1.	Test Equipment	
	4.2.	Test Setup	
	4.3.	Limits	
	4.4.	Test Procedure	
	4.5.	Uncertainty	
	4.6.	Test Result of Radiated Emission	
5.	Ban	d Edge	
	5.1.	Test Equipment	
	5.2.	Test Setup	
	5.3.	Limits	
	5.4.	Test Procedure	
	5.5.	Uncertainty	
	5.6.	Test Result of Band Edge	
6.	Осси	upied Bandwidth	40

	6.1.	Test Equipment	
	6.2.	Test Setup	40
	6.3.	Limits	40
	6.4.	Test Procedure	40
	6.5.	Uncertainty	40
	6.6.	Test Result of Occupied Bandwidth	41
7.	Frequency Stability		43
	7.1.	Test Equipment	43
	7.2.	Test Setup	43
	7.3.	Limits	
	7.4.	Test Procedure	
	7.5.	Uncertainty	
	7.6.	Test Result of Frequency Stability	44
8.	EMI	I Reduction Method During Compliance Testing	45

Attachment 1:EUT Test PhotographsAttachment 2:EUT Detailed Photographs

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	IEEE 802.11a/b/g miniPCI module
Trade Name	MOXA
FCC ID.	SLE-WAPA003
Model No.	WAPA003
Frequency Range	802.11a: 5180-5240MHz, 5745-5825MHz
Number of Channels	802.11a: 9
Data Rate	802.11a: 6 - 54Mbps
Type of Modulation	802.11a: OFDM, BPSK, QPSK, 16QAM, 64QAM
Antenna type	Dipole Antenna
Channel Control	Auto
Antenna Gain	Refer to the table "Antenna List"

Antenna List

No.	Manufacturer	Part No.	Antenna type	Peak Gain
1	KINSUN	SMA-Male-RP (main)(aux)	Dipole	2dBi for 2.4GHz
				2dBi for 5GHz
2	KINSUN	ANT-WSB-ANM-05 (main)(aux)	Dipole	5dBi for 2.4GHz
3	KINSUN	ANT-WDB-ANM-0609 (main)(aux)	Dipole	6dBi for 2.4GHz
				9dBi for 5GHz

- 1. The antenna of EUT is conform to FCC 15.203
- 2. Only the higher gain antenna was tested and recorded in this report.
- 3. When the device equipped with single band antenna (2.4GHz band only), then the 5GHz band function will be disabled.

802.11a Center Working Frequency of Each Channel:

Channel Frequency Channel Frequency Channel Frequency Channel Frequency Channel 36: 5180 MHz Channel 40: 5200 MHz Channel 44: 5220 MHz Channel 48: 5240 MHz Channel 149: 5745 MHz Channel 153: 5765 MHz Channel 157: 5785 MHz Channel 161: 5805 MHz Channel 165: 5825 MHz

Note:

- 1. This device is a IEEE 802.11a/b/g miniPCI module with a built-in 2.4GHz and 5GHz WLAN transceiver, this report for 5GHz.
- 2. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
- 3. At result of pretests, module supports dual-channel transmission, only the worst case is shown in the report. (802.11a is chain A)
- 4. Lowest and highest data rates are tested in each mode. Only worst case is shown in the report. (802.11a is 6Mbps)
- 5. 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.
- 6. This is requesting a Class II permissive change for FCC ID: SLE-WAPA003. The differences are listed as below:
- (1) Original grant compliance band 1 and band 3 are following old rule of UNII requirements, changed to meet the requirements of the new rules, and all other hardware is identical with original granted.
- (2) Band 2a and Band 2c UNII requirements haven't changed, the test data is not presented in the test report.

Test Mode 1: Transmit (802.11a-6Mbps)

1.3. Tested System Datails

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	PPT	N/A	Non-Shielded, 0.8m
2	Test Fixture	MOXA	N/A	N/A	N/A
L		I	I		

Signal Cable Type	Signal cable Description
N/A	A

1.4. Configuration of tested System



1.5. EUT Exercise Software

- (1) Setup the EUT as shown in Section 1.4
- (2) Execute "Hyperterminal V5.1" program on the Notebook PC.
- (3) Configure the test mode, the test channel, and the data rate.
- (4) 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

The related certificate for our laboratories about the test site and management system can be downloaded from QuieTek Corporation's Web Site : <u>http://www.quietek.com/chinese/about/certificates.aspx?bval=5</u> The address and introduction of QuieTek Corporation's laboratories can be founded in our Web site : <u>http://www.quietek.com/</u>

Site Description:	File on
	Federal Communications Commission
	FCC Engineering Laboratory
	7435 Oakland Mills Road
	Columbia, MD 21046
	Registration Number: 92195
Cita Nama a	
Site Name:	No. 5. 22 Puisbukeng Linkou Dist. Now Tainai City
Sile Auuress.	24451 Taiwan B O C
	24451, Taiwan, K.O.C.
	TEL: 886-2-8601-3788 / FAX : 886-2-8601-3789
	E-Mail : <u>service@quietek.com</u>

FCC Accreditation Number: TW1014

2. Maximun conducted output power

2.1. **Test Equipment**

_	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
Х	Power Meter	Anritsu	ML2495A/6K00003357	May, 2015
Х	Power Sensor	Anritsu	MA2411B/0738448	Jun., 2014
Х	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2015
Note	.			

Note:

All equipments are calibrated with traceable calibrations. Each calibration is traceable 1. to the national or international standards.

The test instruments marked with "X" are used to measure the final test results. 2.

2.2. **Test Setup**

26dBc Occupied Bandwidth



Conduction Power Measurement (for 802.11an)



2.3. Limits

2.3.1. For the band 5.15-5.25 GHz,

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-topoint U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

- 2.3.2. For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm 10 log B, where B is the 26 dB emission bandwidth in megahertz. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
- 2.3.3. For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point UNII devices operating in

this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

2.4. Test Procedure

As an alternative to FCC KDB-789033, the EUT maximum conducted output power was measured with an average power meter employing a video bandwidth greater the 6dB BW of the emission under test. Maximum conducted output power was read directly from the meter across all data rates, and across three channels within each sub-band. Special care was used to make sure that the EUT was transmitting in continuous mode. This method exceeds the limitations of FCC KDB-789033, and provides more accurate measurements.

802.11an (BW \leq 40MHz) Maximum conducted output power using KDB 789033 section E)3)b) Method PM-G (Measurement using a gated RF average power meter) <u>Note: the power meter have a video bandwidth that is greater than or equal to the measurement</u> <u>bandwidth, (Anritsu/MA2411B video bandwidth: 65MHz)</u>

802.11ac (BW=80MHz) Maximum conducted output power using KDB 789033 section E)2)b) Method SA-1 (trace averaging with the EUT transmitting at full power throughout each sweep).

When transmitted signals consist of two or more non-contiguous spectrum segments (e.g., 80+80 MHz mode) or when a single spectrum segment of a transmission crosses the boundary between two adjacent U-NII bands, KDB 644545 D01 section F) procedure is used for measurements.

2.5. Uncertainty

± 1.27 dB

2.6. Test Result of Maximum conducted output power

Product	:	IEEE 802.11a/b/g miniPCI module
Test Item	:	Maximum conducted output power
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit (802.11a-6Mbps)

Chain A

Cable	e loss=1dB		Maximum conducted output power							
			Data Rate (Mbps)							
Channel No.	Frequency (MHz)	6	9	12	18	24	36	48	54	Required Limit
				Meas	suremen	t Level	(dBm)			
36	5180	16.31								<21dBm
40	5200	16.35	16.22	16.15	16.09	15.96	15.88	15.81	15.74	<21dBm
48	5240	16.03								<21dBm
149	5745	12.16								<27dBm
157	5785	12.57	12.44	12.34	12.17	11.94	11.70	11.47	11.23	<27dBm
165	5825	12.57								<27dBm

Note:

1. Maximum conducted output power Value =Reading value on average power meter + cable loss

2. The maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3. Peak Power Spectral Density

3.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun., 2014
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun., 2014
Х	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr, 2015

Note:

- 1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
- 2. The test instruments marked with "X" are used to measure the final test results.

3.2. Test Setup



3.3. Limits

(1) For the band 5.15-5.25 GHz,

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-topoint U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the

equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations. (**iv**) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

- (2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
- (3) For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point UNII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

3.4. Test Procedure

The EUT was setup to ANSI C63.10, 2009; tested to UNII test procedure of FCC KDB-789033 for compliance to FCC 47CFR Subpart E requirements.

The Peak Power Spectral Density using KDB 789033 section F) procedure, Create an average power spectrum for the EUT operating mode being tested by following the instructions in section E)2) for measuring maximum conducted output power using a spectrum analyzer.

SA-1 method is selected to run the test.

For the band 5.725-5.85 GHz, Scale the observed power level to an equivalent value in 500 kHz by adjusting (increase) the measured power by a bandwidth correction factor (BWCF) where $BWCF = 10\log (500 \text{ kHz}/100 \text{ kHz}) = 6.98 \text{ dB}.$

3.5. Uncertainty

 $\pm 1.27 \ dB$

3.6. Test Result of Peak Power Spectral Density

Product	:	IEEE 802.11a/b/g miniPCI module
Test Item	:	Peak Power Spectral Density
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit (802.11a-6Mbps)

Channel Number	Frequency (MHz)	Data Rata (Mbps)	Measurement Level (dBm)	Required Limit (dBm)	Result
36	5180	6	1.42	8	Pass
40	5200	6	1.24	8	Pass
48	5240	6	1.02	8	Pass

Channel Number	Frequency (MHz)	Data Rata (Mbps)	PPSD (dBm)	BWCF (dB)	Total PPSD (dBm)	Required Limit (dBm)	Result
149	5745	6	0.180	6.980	7.160	27	Pass
157	5785	6	-0.490	6.980	6.490	27	Pass
165	5825	6	-1.040	6.980	5.940	27	Pass

Note 1: The maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



								Chain					
Agiler	t Spectru	n Analyze	er - Swe	ept SA									
K R Cen	ter Fre	RF 9q 5.1	50 ຊ 8000	AC 0000	GHz		S Tria: Fr		#Avg T	ALIGN AUTO ype: RMS) 01:56:59 A TRA	M May 08, 2015 CE 1 2 3 4 5 6	Frequency
					IFGain	:Low 🗣	#Atten:	30 dB		Males	4 5 400 0		Auto Tune
10 di	3/div	Ref Off: Ref 21	set 1.5 .50 d	dB I Bm						IVIKI	1 5.182 8 1.	42 dBm	
LUg													Center Freq
11.5									-				5.18000000 GHz
1.50						lagal ghave a	Paperte Land June		 	All and the second s	* due		
													Start Freq
-8.50		1	/										3.107300000 GHz
-18.5		- July										ML .	Stop Freq
-28.5	and and and	ent										"May the lat where	5.192500000 GHz
	ľ												CE Oton
-38.5													2.500000 MHz
-48.5													<u>Auto</u> Man
-68.6													Freq Offset
-30.5													0 Hz
-68.5													
.	ton E 44	2000 0	-U									5 00 MU-	
uen #Re	ter 5.18 s BW 1	.0 MHz	nz z			#VBW	/ 3.0 MH	z		Sweep	span 2 1.000 ms	(1001 pts)	
MSG										STAT	TUS		<u> </u>

Channel 36:

Channel 40:

Agiler	it Spectru	ım Analyzer - Sw	ept SA								
اللا Cen	ter Fr	RF 50 Ω eq 5.20000	AC 00000 GH	łz		ISE:INT	#Avg Type	ALIGN AUTO e: RMS	01:58:45 AF	M May 08, 2015	Frequency
10 di	3/div	Ref Offset 1.8 Ref 21.50	iFi 5 dB d Bm	Gain:Low	#Atten: 30) dB		Mkr1	5.201 8 1.	25 GHz 24 dBm	Auto Tune
Log 11.5						▲1					Center Freq 5.20000000 GHz
1.50 -8.50				n. i se na se							Start Freq 5.187500000 GHz
-18.5 -28.5	white Harrison	Net we								La Detroite and the second	Stop Freq 5.212500000 GHz
-38.5 -48.5											CF Step 2.500000 MHz <u>Auto</u> Man
-58.5											Freq Offset 0 Hz
-68.5 Cen	ter 5.2	0000 GHz		#\/D\\					Span 2	5.00 MHz	
#RC MSG	S BW	1.U IVI H Z		#VBW	3.0 IVIHZ			Sweep 1	.000 ms (iour pts)	



		C	nannei 40.			
Agilent	Spectrum Analyzer - Swept SA					
LXI RL	RF 50 Ω AC	SENS	SE:INT /	ALIGNAUTO 02:00:30 A	M May 08, 2015	Frequency
Cent	ter Freq 5.24000000	GHZ IFGain:Low #Atten: 30	Run dB	TY D	ET A N N N N N	
10 dB	Ref Offset 1.5 dB div Ref 21.50 dBm			Mkr1 5.244 2 1.	200 GHz 02 dBm	Auto Tune
11.5 -						Center Freq 5.240000000 GHz
1.50 - -8.50 -						Start Freq 5.227500000 GHz
-18.5 -	Served Constraint Street				hiplan way appropriate	Stop Freq 5.252500000 GHz
-38.5 -						CF Step 2.500000 MHz <u>Auto</u> Man
-58.5 -						Freq Offset 0 Hz
-68.5 -						
Cento #Res	er 5.24000 GHz BW 1.0 MHz	#VBW 3.0 MHz	:	Span 2 Sweep 1.000 ms (5.00 MHz 1001 pts)	
MSG				STATUS		

Channel 48:

Channel 149:

Agiler	nt Spectrur	m Analyzer - Sw	vept SA								
Cen	ter Fre	RF 50 G	00000 GH	łz			#Avg Type	ALIGNAUTO e: RMS	02:02:47 A	M May 08, 2015 CE 1 2 3 4 5 6	Frequency
		Ref Offset 8.	IF: 48 dB	Gain:Low	#Atten: 30) dB		Mkr1	5.746 2	225 GHz	Auto Tune
10 at Log		Rei 28.48									Center Freq 5.745000000 GHz
8.48 -1.52		- N	᠊ᡝᢧᠶᡐᢦᡐᡐᡐᡐ	ᡐᡐᡐᡐᡐᡐ	www		hhrow	www.	M		Start Freq 5.732500000 GHz
-11.5 -21.5									- L		Stop Freq 5.757500000 GHz
-31.5 -41.5	www	~~~								Murah where	CF Step 2.500000 MHz <u>Auto</u> Man
-51.5											Freq Offset 0 Hz
-61.5 Cen	ter 5.74	1500 GHz							Span 2	5.00 MHz	
#Re MSG	s BW 1	00 kHz		#VBW	3.0 MHz			Sweep 3	.000 ms ((1001 pts)	



								ept SA	n Analyzer - Sw	Agilent Spectru
Frequency	M May 08, 2015	02:04:48 Af	ERMS	#Avg Typ	ISE:INT	SEN	z	AC 00000 GH	RF 50 Ω sq 5.78500	Center Fr
Auto Tune	25 GHz 49 dBm	5.783 7 -0.4	Mkr1) dB	#Atten: 30	Gain:Low	1FC 18 dB IBm	Ref Offset 8.4 Ref 28.48 (10 dB/div
Center Freq 5.785000000 GHz										18.5
Start Freq 5.772500000 GHz		M	wwwww	~~~~~	www		<u>₽₽₽₽</u>	VVVVVV	M	-1.52
Stop Freq 5.797500000 GHz		4				\				-11.5
CF Step 2.500000 MHz <u>Auto</u> Man	Www. Www. www.	~~~							~~~	-31.5
Freq Offset 0 Hz										-51.5
	5.00 MHz 1001 pts)	Span 2 .000 ms (Sweep 3			3.0 MHz	#VBW		3500 GHz 00 kHz	-61.5 Center 5.73 #Res BW 1
			STATUS							MSG

Channel 157:

Channel 165:

Agilen	t Spectru	m Analyzer - Sv	vept SA								
Cen	ter Fre	RF 50 S eq 5.8250	00000 GI	Hz		ISE:INT	#Avg Type	ALIGNAUTO e: RMS	02:12:44 A	M May 08, 2015	Frequency
10 dE	3/div	Ref Offset 8. Ref 28.48	1F 48 dB d Bm	Gain:Low	#Atten: 30	dB		Mkr1	5.827 7 -1.	75 GHz 04 dBm	Auto Tune
Log 18.5											Center Freq 5.825000000 GHz
8.48 -1.52		N	www		www	1000000		wwww	M		Start Freq 5.812500000 GHz
-11.5									h h		Stop Freq 5.837500000 GHz
-31.5	- market								~	monte	CF Step 2.500000 MHz <u>Auto</u> Man
-51.5											Freq Offset 0 Hz
-61.5 Cen	ter 5.8	2500 GHz		#) (P)4	2.0 8447			Swaan 2	Span 2	5.00 MHz	
MSG	5 044 1	00 112		#VDV	J.U IVINZ			STATUS	.000 ms ((1001 pts)	

4. Radiated Emission

4.1. Test Equipment

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

Test Site	Equipment		Manufacturer	Model No./Serial No.	Last Cal.
Site # 3	X Magnetic Loop Antenna		Teseq	HLA6121/ 37133	Sep., 2014
	Х	Bilog Antenna	Schaffner Chase	CBL6112B/ 2707	Jun., 2014
	Х	EMI Test Receiver	R&S	ESCS 30/838251/ 001	Jun., 2014
	Х	Coaxial Cable	QTK(Arnist)	RG 214/ LC003-RG	Jun., 2014
	Х	Coaxial signal switch	Arnist	MP59B/ 6200798682	Jun., 2014

Test Site		Equipment	Manufacturer	Model No./Serial No.	Last Cal.
CB # 8	Х	Spectrum Analyzer	R&S	FSP40/ 100339	Oct., 2014
	Х	Horn Antenna	ETS-Lindgren	3117/ 35205	Mar., 2015
	XHorn AntennaXHorn Antenna		Schwarzbeck	BBHA9170/209	Jan., 2015
			TRC	AH-0801/95051	Aug., 2014
Х		Pre-Amplifier	EMCI	EMC012630SE/980210	Jan., 2015
	Х	Pre-Amplifier	MITEQ	JS41-001040000-58-5P/153945	Jul., 2014
	Х	Pre-Amplifier	NARDA	DBL-1840N506/013	Jul., 2014

- Note: 1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
 - 2. The test instruments marked with "X" are used to measure the final test results.



4.2. Test Setup

Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



4.3. Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209(a) Limits							
Frequency MHz	Field strength	Measurement distance (meter)					
11112	(microvolts/meter)	(ineter)					
0.009-0.490	2400/F(kHz)	300					
0.490-1.705	24000/F(kHz)	30					
1.705-30	30	30					
30-88	100	3					
88-216	150	3					
216-960	200	3					
Above 960	500	3					

Remarks: E field strength $(dB\mu V/m) = 20 \log E$ field strength (uV/m)

4.4. Test Procedure

The EUT was setup according to ANSI C63.10, 2009 and tested according to FCC KDB-789033 test procedure for compliance to FCC 47CFR 15. 407 requirements.

The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 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 is scanned between 1 meter and 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10: 2009 on radiated measurement.

The resolution bandwidth below 30MHz setting on the field strength meter is 9kHz and 30MHz~1GHz is 120kHz and above 1GHz is 1MHz.

Radiated emission measurements below 30MHz are made using Loop Antenna and 30MHz~1GHz are made using broadband Bilog antenna and above 1GHz are made using Horn Antennas. The measurement is divided into the Preliminary Measurement and the Final Measurement. The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna. The worst radiated emission is measured in the Open Area Test Site on the Final Measurement.

4.5. Uncertainty

 \pm 3.8 dB below 1GHz \pm 3.9 dB above 1GHz

4.6. Test Result of Radiated Emission

Product	:	IEEE 802.11a/b/g miniPCI module
Test Item	:	Harmonic Radiated Emission Data
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit (802.11a-6Mbps) (5180MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit	
	Factor	Level	Level			
MHz	dB	dBµV	$dB\mu V/m$	dB	dBµV/m	
Horizontal						
Peak Detector:						
10360.000	12.930	33.106	46.036	-27.964	74.000	
15540.000	*	*	*	*	74.000	
20720.000	*	*	*	*	74.000	
25900.000	*	*	*	*	74.000	
31080.000	*	*	*	*	74.000	
36260.000	*	*	*	*	74.000	
Average						
Detector:						
Vertical						
Peak Detector:						
10360.000	13.724	32.949	46.673	-27.327	74.000	
15540.000	*	*	*	*	74.000	
20720.000	*	*	*	*	74.000	
25900.000	*	*	*	*	74.000	
31080.000	*	*	*	*	74.000	
36260.000	*	*	*	*	74.000	
Average						
Detector:						

Note:

- 1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
- 2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- 3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- 4. Measurement Level = Reading Level + Correct Factor.
- 5. Correct Factor = Antenna factor + Cable loss Amplifier gain.
- 6. The average measurement was not performed when the peak measured data under the limit of average detection.
- 7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product	Product:IEEE 802.11a/b/g miniPCI moduleTest Item:Harmonic Radiated Emission Data					
Test Item						
Test Site	: No.3 OA	ATS				
Test Mode	: Mode 1	Transmit (802.11	a-6Mbps) (5200MHz	2)		
Frequency	Correct	Reading	Measurement	Margin	Limit	
1 5	Factor	Level	Level	C		
MHz	dB	dBμV	$dB\mu V/m$	dB	dBµV/m	
Horizontal						
Peak Detector:						
10400.000	12.959	34.510	47.469	-26.531	74.000	
15660.000	*	*	*	*	74.000	
20880.000	*	*	*	*	74.000	
26100.000	*	*	*	*	74.000	
Average						
Detector:						
Vertical						
Peak Detector:						
10400.000	13.877	33.284	47.161	-26.839	74.000	
15660.000	*	*	*	*	74.000	
20880.000	*	*	*	*	74.000	
26100.000	*	*	*	*	74.000	
Average						
-						

Detector:

Note:

=

- 1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
- 2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- 3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- 4. Measurement Level = Reading Level + Correct Factor.
- 5. Correct Factor = Antenna factor + Cable loss Amplifier gain.
- 6. The average measurement was not performed when the peak measured data under the limit of average detection.
- 7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product	:	IEEE 802.11a/b/g miniPCI module
Test Item	:	Harmonic Radiated Emission Data
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit (802.11a-6Mbps) (5240MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dBµV	$dB\mu V/m$	dB	dBµV/m
Horizontal					
Peak Detector:					
10480.000	13.693	35.779	49.473	-24.527	74.000
15720.000	*	*	*	*	74.000
20960.000	*	*	*	*	74.000
26200.000	*	*	*	*	74.000
Average					
Detector:					
Vertical					
Peak Detector:					
10480.000	14.620	36.313	50.934	-23.066	74.000
15720.000	*	*	*	*	74.000
20960.000	*	*	*	*	74.000
26200.000	*	*	*	*	74.000
Average					
Detector:					

- 1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
- 2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- 3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- 4. Measurement Level = Reading Level + Correct Factor.
- 5. Correct Factor = Antenna factor + Cable loss Amplifier gain.
- 6. The average measurement was not performed when the peak measured data under the limit of average detection.
- 7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product	:	IEEE 802.11a/b/g miniPCI module
Test Item	:	Harmonic Radiated Emission Data
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit (802.11a-6Mbps) (5745MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector:					
11490.000	17.106	38.202	55.309	-18.691	74.000
17235.000	*	*	*	*	74.000
20720.000	*	*	*	*	74.000
25900.000	*	*	*	*	74.000
31080.000	*	*	*	*	74.000
36260.000	*	*	*	*	74.000
Average Detector:					
11490.000	17.106	22.698	39.805	-14.195	54.000
Vertical					
Peak Detector:					
11490.000	18.034	41.493	59.528	-14.472	74.000
17235.000	*	*	*	*	74.000
20720.000	*	*	*	*	74.000
25900.000	*	*	*	*	74.000
31080.000	*	*	*	*	74.000
36260.000	*	*	*	*	74.000
Average Detector:					
11490.000	18.034	24.138	42.173	-11.827	54.000

- 1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
- 2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- 3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- 4. Measurement Level = Reading Level + Correct Factor.
- 5. Correct Factor = Antenna factor + Cable loss Amplifier gain.
- 6. The average measurement was not performed when the peak measured data under the limit of average detection.
- 7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product	: IEEE 802.11a/b/g miniPCI module								
Test Item	: Harmonic Radiated Emission Data								
Test Site	: No.3 O	ATS							
Test Mode	: Mode 1	Mode 1: Transmit (802.11a-6Mbps) (5785MHz)							
Frequency	Correct	Reading Measurement		Margin	Limit				
requency	Factor	Level	I evel	Margin	Liiiit				
MHz	dB	dBuV	dBuV/m	dB	dBuV/m				
Horizontal									
Peak Detector:									
11570.000	16.809	42.354	59.163	-14.837	74.000				
17355.000	*	*	*	*	74.000				
20800.000	*	*	*	*	74.000				
26000.000	*	*	*	*	74.000				
31200.000	*	*	*	*	74.000				
36400.000	*	*	*	*	74.000				
Average									
Detector:									
11570.000	16.809	26.345	43.154	-10.846	54.000				
Vertical									
Peak Detector:									
11570.000	17.698	46.129	63.827	-10.173	74.000				
17355.000	*	*	*	*	74.000				
20800.000	*	*	*	*	74.000				
26000.000	*	*	*	*	74.000				
31200.000	*	*	*	*	74.000				
36400.000	*	*	*	*	74.000				
Average									
Detector:									
11570.000	17.698	28.716	46.414	-7.586	54.000				

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.

- 2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- 3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- 4. Measurement Level = Reading Level + Correct Factor.

- 5. Correct Factor = Antenna factor + Cable loss Amplifier gain.
- 6. The average measurement was not performed when the peak measured data under the limit of average detection.
- 7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product	: IEEE 802.11a/b/g miniPCI module						
Test Item	Harmonic Radiated Emission Data						
Test Site	No 3 OATS						
Test Mode	: Mode 1	Transmit (802.11	a-6Mbps) (5825MHz	z)			
				,			
Frequency	Correct	Reading	Measurement	Margin	Limit		
	Factor	Level	Level				
MHz	dB	dBuV	dBuV/m	dB	dBuV/m		
Horizontal							
Peak Detector:							
11650.000	16.158	42.473	58.631	-15.369	74.000		
17475.000	*	*	*	*	74.000		
20960.000	*	*	*	*	74.000		
26200.000	*	*	*	*	74.000		
31440000	*	*	*	*	74.000		
36680.000	*	*	*	*	74.000		
Average							
Detector:							
11650.000	16.158	26.850	43.008	-10.992	54.000		
Vertical							
Peak Detector:							
11650.000	17.274	45.564	62.839	-11.161	74.000		
17475.000	*	*	*	*	74.000		
20960.000	*	*	*	*	74.000		
26200.000	*	*	*	*	74.000		
31440000	*	*	*	*	74.000		
36680.000	*	*	*	*	74.000		
Average							
Detector:							
11650.000	17.274	28.608	45.883	-8.117	54.000		

- 1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
- 2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- 3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- 4. Measurement Level = Reading Level + Correct Factor.
- 5. Correct Factor = Antenna factor + Cable loss Amplifier gain.
- 6. The average measurement was not performed when the peak measured data under the limit of average detection.
- 7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product	: IEEE 802.11a/b/g miniPCI module						
Test Item	: General Radiated Emission						
Test Site	: No.3 O	ATS					
Test Mode	: Mode 1	: Transmit (802.11a	a-6Mbps) (5200MHz	2)			
Frequency	Correct	Reading	Measurement	Margin	Limit		
	Factor	Level	Level				
MHz	dB	dBµV	$dB\mu V/m$	dB	$dB\mu V/m$		
Horizontal							
Peak Detector							
148.340	-7.806	38.372	30.566	-12.934	43.500		
359.800	-0.226	40.965	40.739	-5.261	46.000		
551.860	3.390	35.682	39.072	-6.928	46.000		
697.360	3.231	35.001	38.232	-7.768	46.000		
840.920	6.064	27.870	33.934	-12.066	46.000		
965.080	7.222	24.792	32.014	-21.986	54.000		
Vertical							
Peak Detector							
144.460	-5.503	41.471	35.968	-7.532	43.500		
398.600	-2.371	37.383	35.012	-10.988	46.000		
499.480	-0.199	40.559	40.359	-5.641	46.000		
600.360	1.302	31.830	33.132	-12.868	46.000		
833.160	1.716	35.355	37.071	-8.929	46.000		
901.060	1.858	26.910	28.768	-17.232	46.000		

- 1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
- 2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- 3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- 4. Measurement Level = Reading Level + Correct Factor.
- 5. Correct Factor = Antenna factor + Cable loss Amplifier gain.
- 6. The average measurement was not performed when the peak measured data under the limit of average detection.
- 7. The emission levels of other frequencies are very lower than the limit and not show in test report.
- 8. No emission found between lowest internal used/generated frequency to 30MHz.

Product	: IEEE 802.11a/b/g miniPCI module					
Test Item	: General Radiated Emission					
Test Site	: No.3 OA	ATS				
Test Mode	: Mode 1	: Transmit (802.11	a-6Mbps) (5785MHz	2)		
Frequency	Correct	Reading	Measurement	Margin	Limit	
	Factor	Level	Level			
MHz	dB	dBµV	dBµV/m	dB	dBµV/m	
Horizontal						
Peak Detector						
117.300	-9.196	47.333	38.137	-5.363	43.500	
282.200	-5.211	43.485	38.274	-7.726	46.000	
449.040	-2.238	39.290	37.052	-8.948	46.000	
650.800	2.175	31.921	34.096	-11.904	46.000	
811.820	5.081	32.485	37.565	-8.435	46.000	
955.380	6.247	28.702	34.949	-11.051	46.000	
Vertical						
Peak Detector						
107.600	-0.318	39.374	39.056	-4.444	43.500	
227.880	-8.519	47.062	38.544	-7.456	46.000	
406.360	-6.660	39.695	33.035	-12.965	46.000	
540.220	0.121	29.639	29.760	-16.240	46.000	
668.260	-1.694	40.358	38.664	-7.336	46.000	
901.060	3.331	32.854	36.185	-9.815	46.000	

- 1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
- 2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- 3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- 4. Measurement Level = Reading Level + Correct Factor.
- 5. Correct Factor = Antenna factor + Cable loss Amplifier gain.
- 6. The average measurement was not performed when the peak measured data under the limit of average detection.
- 7. The emission levels of other frequencies are very lower than the limit and not show in test report.
- 8. No emission found between lowest internal used/generated frequency to 30MHz.

5. Band Edge

5.1. Test Equipment

RF Radiated Measurement:

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

Test Site	Equipment		Manufacturer	Model No./Serial No.	Last Cal.
CB # 8	Х	Spectrum Analyzer	R&S	FSP40/ 100339	Oct., 2014
	Х	Horn Antenna	ETS-Lindgren	3117/ 35205	Mar., 2015
	Х	Horn Antenna	Schwarzbeck	BBHA9170/209	Jan., 2015
	Х	Horn Antenna	TRC	AH-0801/95051	Aug., 2014
	Х	Pre-Amplifier	EMCI	EMC012630SE/980210	Jan., 2015
	Х	Pre-Amplifier	MITEQ	JS41-001040000-58-5P/153945	Jul., 2014
	Х	Pre-Amplifier	NARDA	DBL-1840N506/013	Jul., 2014

Note: 1. All instruments are calibrated every one year.

2. The test instruments marked by "X" are used to measure the final test results.

5.2. Test Setup

RF Radiated Measurement:



5.3. 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:

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

Remarks : 1. RF Voltage $(dB\mu V) = 20 \log RF$ 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.

5.4. Test Procedure

The EUT is 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 C63.10:2009 on radiated measurement.

The bandwidth below 1GHz setting on the field strength meter is 120 kHz, above 1GHz are 1 MHz. The EUT was setup to ANSI C63.10, 2009; tested to UNII test procedure of FCC KDB-789033 for compliance to FCC 47CFR Subpart E requirements.

5.5. Uncertainty

- \pm 3.8 dB below 1GHz
- ± 3.9 dB above 1GHz



5.6. Test Result of Band Edge

Product	:	IEEE 802.11a/b/g miniPCI module
Test Item	:	Band Edge Data
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit (802.11a-6Mbps) -Channel 36

RF Radiated Measurement (Horizontal):

Channel No.	Frequency	Correct Factor	Reading Level	Emission Level	Peak Limit	Average Limit	Dogult
	(MHz)	(dB)	(dBµV)	$(dB\mu V/m)$	$(dB\mu V/m)$	$(dB\mu V/m)$	Result
36 (Peak)	5150.000	3.340	40.424	43.764	74.00	54.00	Pass
36 (Peak)	5182.900	3.224	84.953	88.177			
36 (Average)	5150.000	3.340	28.466	31.806	74.00	54.00	Pass
36 (Average)	5182.000	3.227	74.282	77.509			

Figure Channel 36:

Horizontal (Peak)





Horizontal (Average)



- 1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
- 2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- 3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- 4. "*", means this data is the worst emission level.
- 5. Measurement Level = Reading Level + Correct Factor.
- 6. The average measurement was not performed when the peak measured data under the limit of average detection.



Product	:	IEEE 802.11a/b/g miniPCI module
Test Item	:	Band Edge Data
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit (802.11a-6Mbps) -Channel 36

RF Radiated Measurement (Vertical):

Channal No.	Frequency	Correct Factor	Reading Level	Emission Level	Peak Limit	Average Limit	Dogult
Channel NO.	(MHz)	(dB)	(dBµV)	$(dB\mu V/m)$	$(dB\mu V/m)$	$(dB\mu V/m)$	Result
36 (Peak)	5145.200	5.247	46.381	51.628	74.00	54.00	Pass
36 (Peak)	5150.000	5.260	45.826	51.086	74.00	54.00	Pass
36 (Peak)	5182.400	5.348	96.369	101.717			
36 (Average)	5120.000	5.177	32.648	37.826	74.00	54.00	Pass
36 (Average)	5150.000	5.260	30.218	35.478	74.00	54.00	Pass
36 (Average)	5184.400	5.353	85.524	90.878			

Figure Channel 36:

Vertical (Peak)





Vertical (Average)



- 1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
- 2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
- 3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
- 4. "*", means this data is the worst emission level.
- 5. Measurement Level = Reading Level + Correct Factor.
- 6. The average measurement was not performed when the peak measured data under the limit of average detection.



Product	:	IEEE 802.11a/b/g miniPCI module
Test Item	:	Band Edge Data
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit (802.11a-6Mbps) -Channel 149

RF Radiated Measurement (Horizontal):

	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBm)	Measure Level (dBm/m)	Margin (dB)	Limit (dBm/m)	Result
Horizontal	5706.200	4.643	35.338	39.981	-28.239	68.220	Pass
Horizontal	5715.000	4.652	34.817	39.469	-28.751	68.220	Pass
Horizontal	5725.000	4.654	39.778	44.432	-33.788	78.220	Pass
Horizontal	5747.800	4.658	79.776	84.433			Pass





Product	:	IEEE 802.11a/b/g miniPCI module
Test Item	:	Band Edge Data
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit (802.11a-6Mbps) -Channel 149

RF Radiated Measurement (Vertical):

	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBm)	Measure Level (dBm/m)	Margin (dB)	Limit (dBm/m)	Result
Vertical	5712.900	5.994	43.567	49.561	-18.659	68.220	Pass
Vertical	5715.000	5.994	41.907	47.901	-20.319	68.220	Pass
Vertical	5725.000	5.992	52.317	58.310	-19.910	78.220	Pass
Vertical	5747.600	5.988	91.881	97.869			Pass



Product	:	IEEE 802.11a/b/g miniPCI module
Test Item	:	Band Edge Data
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit (802.11a-6Mbps) -Channel 165

RF Radiated Measurement (Horizontal):

	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBm)	Measure Level (dBm/m)	Margin (dB)	Limit (dBm/m)	Result
Horizontal	5827.900	4.831	79.114	83.945			Pass
Horizontal	5850.000	4.964	40.625	45.589	-32.631	78.220	Pass
Horizontal	5860.000	5.023	40.221	45.244	-22.976	68.220	Pass
Horizontal	5863.300	5.042	42.171	47.213	-21.007	68.220	Pass





Product	:	IEEE 802.11a/b/g miniPCI module
Test Item	:	Band Edge Data
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit (802.11a-6Mbps) -Channel 165

RF Radiated Measurement (Vertical):

	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBm)	Measure Level (dBm/m)	Margin (dB)	Limit (dBm/m)	Result
Vertical	5827.900	6.011	90.639	96.650			Pass
Vertical	5850.000	6.037	44.993	51.030	-27.190	78.220	Pass
Vertical	5860.000	6.047	42.054	48.101	-20.119	68.220	Pass
Vertical	5870.500	6.058	42.509	48.568	-19.652	68.220	Pass



6. Occupied Bandwidth

6.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun., 2014
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun., 2014
Х	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2015

Note:

- 1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
- 2. The test instruments marked with "X" are used to measure the final test results.

6.2. Test Setup



6.3. Limits

For the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz

6.4. Test Procedure

The EUT was setup to ANSI C63.10, 2009; tested to UNII test procedure of FCC KDB-789033 for compliance to FCC 47CFR Subpart E requirements.

6.5. Uncertainty

 $\pm \, 150 Hz$

6.6. Test Result of Occupied Bandwidth

Product	:	IEEE 802.11a/b/g miniPCI module
Test Item	:	Occupied Bandwidth Data
Test Site	:	No.3 OATS
Test Mode	:	Mode 1: Transmit (802.11a-6Mbps)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
149	5745	16450	>500	Pass
157	5785	16500	>500	Pass
165	5825	16450	>500	Pass

Figure Channel 149:

Agilen	it Spec	strum	i Ana	ilyzer - Sw	ept SA										
Cen	ter	Fre	RF q 5	50 Ω 5.74500	AC 00000	Hz		SEI		Avg	Туре	ALIGN AUTO : Log-Pwr	02:02:30 A TRA	M May 08, 2015 E 1 2 3 4 5 6	Frequency
10 di	B/div	F	Ref Ref	Offset 1.	5 dB d B m	IFGain:Lo	ow	#Atten: 3	0 dB			Mkr	2 5.736 -4.	75 GHz 08 dBm	Auto Tune
Log 11.5 1.50 -8.50						•	2	1 Inthorna	mbartu	mharmls	3			-3.86 dBm	Center Freq 5.745000000 GHz
-18.5 -28.5 -38.5	methy	af Willia	.405-20	NWWAAN	holder a stand	Northered					1 Port	Www.de- Autorbeth	Winnischarts	29 minuter Martin	Start Freq 5.72000000 GHz
-48.5 -58.5 -68.5															Stop Freq 5.770000000 GHz
Cen #Re:	ter (s BV	5.74 N 10	50 00	0 GHz kHz		#	VBW	/ 300 kHz		Span 50.00 MHz Sweep 4.800 ms (1001 pts)				CF Step 5.000000 MHz Auto Man	
1 2 3 4 5 6 7 8 9 10 11					× 5.739 5.736 5.753	95 GH7 75 GH2 20 GH2		¥ 2.14 dl 4.08 dl 4.81 dl	Bm Bm Bm A Bm A Bm A Bm A Bm A Bm A Bm	FUNCTION			FUNCTI		Freq Offset 0 Hz
MSG												STATUS	5		



Agiler	it Spec	trum /	Anal	yzer - Swe	ept SA											
Cen	ter I	Frec	RF 15.	50 Ω 78500	AC 0000	GHz		Tri	SENS	E:INT	Avg	Туре	LIGNAUTO Log-Pwr	02:04:31 A TRA TY	M May 08, 2015 CE 1 2 3 4 5 6 PE M WWWWW	Frequency
_						IFGai	in:Low	#At	ten: 30	dB			Mkr	2 5 776	70 GHz	Auto Tune
10 d Log	B/div	R R	ef C ef	offset 1.5 21.50 c	dB 1Bm									-5.	79 dBm	
11.5			-				(, 1								Center Freq
1.50 -8.50							min	Muntha	worthey	mark	whentered,	⊘			-5.18 dBm	5.785000000 GHz
-18.5						and the	1					a day	K .			Start Freq
-28.5 -38.5				while prover	www.								mar would be	www.wa		5.760000000 GHz
-48.5	when	-Wayhan	ww.	les.										- "newyou	MAN Contraction	Stop Frog
-58.5 -68.5																5.810000000 GHz
Cen	tor 5	784	500	CH7										Snan A	0.00 MHz	05.04-2
#Re	s BV	V 10	0 k	Hz			#VB	W 300	kHz			5	Sweep 4	.800 ms ((1001 pts)	5.000000 MHz
MKR 1	MODE N	TRC S	CL f		× 5.77	8 70 G	GHz	0	.82 dB	m FL	INCTION	FUN	CTION WIDTH	FUNCTI	ON VALUE 🔼 🔨	Auto Mari
2 3 4	N	1	f f		<u>5.77</u> 5.79	670 G 320 G	GHZ GHZ	-5 -6	<u>.79 dB</u> .19 dB	m m					_	Freq Offset
5															=	0 Hz
7 8 9		-													_	
10 11															~	
MSG													STATU	s		

Figure Channel 157:

Figure Channel 165:



7. Frequency Stability

7.1. Test Equipment

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun., 2014
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun., 2014
Х	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2015

Note:

- 1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
- 2. The test instruments marked with "X" are used to measure the final test results.

7.2. Test Setup



7.3. 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

7.4. Test Procedure

The EUT was setup to ANSI C63.10, 2009; tested to UNII test procedure of FCC KDB-789033 for compliance to FCC 47CFR Subpart E requirements.

7.5. Uncertainty

 $\pm 150 \text{ Hz}$

7.6. Test Result of Frequency Stability

Product :	IEEE 802.11a/b/g miniPCI module
-----------	---------------------------------

- Test Item : Frequency Stability
- Test Site : Temperature Chamber
- Test Mode : Carrier Wave

Test Conditions		Channel	Frequency	Frequency	ΔF (MHz)
			(MHz)	(MHz)	
Tnom (20) °C	Vnom (120)V	36	5180.0000	5180.0068	-0.0068
		44	5200.0000	5200.0082	-0.0082
		48	5240.0000	5240.0077	-0.0077
		149	5745.0000	5745.0105	-0.0105
		157	5785.0000	5785.0101	-0.0101
		165	5825.0000	5825.0097	-0.0097
Tmax (50) °C	Vmax (126.5)V	36	5180.0000	5180.0068	-0.0068
		44	5200.0000	5200.0082	-0.0082
		48	5240.0000	5240.0077	-0.0077
		149	5745.0000	5745.0109	-0.0109
		157	5785.0000	5785.0105	-0.0105
		165	5825.0000	5825.0100	-0.0100
Tnom (50) °C	Vnom (93.5)V	36	5180.0000	5180.0064	-0.0064
		44	5200.0000	5200.0094	-0.0094
		48	5240.0000	5240.0082	-0.0082
		149	5745.0000	5745.0109	-0.0109
		157	5785.0000	5785.0105	-0.0105
		165	5825.0000	5825.0100	-0.0100
Tnom (0) °C	Vnom (126.5)V	36	5180.0000	5180.0064	-0.0064
		44	5200.0000	5200.0094	-0.0094
		48	5240.0000	5240.0082	-0.0082
		149	5745.0000	5745.0109	-0.0109
		157	5785.0000	5785.0089	-0.0089
		165	5825.0000	5825.0081	-0.0081
Tnom (0) oC	Vnom (93.5)V	36	5180.0000	5180.0000	0.0000
		44	5200.0000	5200.0000	0.0000
		48	5240.0000	5240.0000	0.0000
		149	5745.0000	5745.0109	-0.0109
		157	5785.0000	5785.0089	-0.0089
		165	5825.0000	5825.0081	-0.0081



8. EMI Reduction Method During Compliance Testing

No modification was made during testing.



Attachment 1: EUT Test Photographs



Attachment 2: EUT Detailed Photographs