

FCC 47 CFR PART 15 SUBPART E

Product Type : Rugged Handheld Computer
Applicant : Unitech Electronics Co., Ltd.
Address : 5F., No.136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan 231, R.O.C.
Trade Name : unitech
Model Number : PA820
Test Specification : FCC 47 CFR PART 15 SUBPART E
ANSI C63.10:2013
Application Purpose : Original
Receive Date : Mar. 19, 2015
Test Period : Mar. 25 ~ Sep. 27, 2015
Issue Date : Oct. 27, 2015

Issue by

A Test Lab Techno Corp.
No. 140-1, Changan Street, Bade City,
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Taiwan Accreditation Foundation accreditation number: 1330

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Revision History

Rev.	Issue Date	Revisions	Revised By
00	Oct. 27, 2015	Initial Issue	

Verification of Compliance

Issued Date: 10/27/2015

Product Type : Rugged Handheld Computer
Applicant : Unitech Electronics Co., Ltd.
Address : 5F., No.136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan 231, R.O.C.
Trade Name : unitech
Model Number : PA820
FCC ID : HLEPA820BTNP
EUT Rated Voltage : DC 5V, 1A
Test Voltage : 120 Vac / 60 Hz, DC 3.50V / 3.70V / 4.25V
Applicable Standard : FCC 47 CFR PART 15 SUBPART E
ANSI C63.10:2013
Test Result : Complied
Application Purpose : Original
Performing Lab. : A Test Lab Techno Corp.

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<http://www.atl-lab.com.tw/e-index.htm>



A Test Lab Techno Corp. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by A Test Lab Techno Corp. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

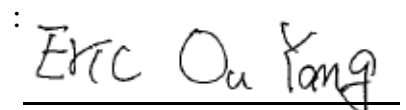
Approved By :



(Manager)

(Fly Lu)

Reviewed By :



(Testing Engineer)

(Eric Ou Yang)

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1 General Information

1.1. Summary of Test Result

Standard	Item	Result	Remark
FCC			
15.407(b)(6) 15.207	AC Power Conducted Emission	PASS	---
15.407(b) 15.205 / 15.209	Transmitter Radiated Emissions	PASS	---
15.407(a)	Maximum Conducted Output Power	PASS	---
15.407(a)	26dB RF Bandwidth	Reference	---
15.407(a)	6dB RF Bandwidth	PASS	-----
15.407(a)	Peak Power Spectral Density	PASS	---
15.407(g)	Frequency Stability	PASS	---
15.407(a) 15.203	Antenna Requirement	PASS	---

The test results of this report relate only to the tested sample(s) identified in this report. Manufacturer or whom it may concern should recognize the pass or fail of the test result.

1.2. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty (dB)
Conducted Emission	9kHz ~ 150KHz	2.7
	150kHz ~ 30MHz	2.8
Radiated Emission	30MHz ~ 1000MHz	6.300
	1000MHz ~ 18000MHz	5.474
	18000MHz ~ 26500MHz	5.630
	26500MHz ~ 40000MHz	5.054

2 EUT Description

Applicant	Unitech Electronics Co., Ltd. 5F., No.136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan 231, R.O.C.			
Manufacturer	Unitech Electronics Co., Ltd. 5F., No.136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan 231, R.O.C.			
Product Type	Rugged Handheld Computer			
Trade Name	unitech			
Model No.	PA820			
IMEI No.	359998040102016			
FCC ID	HLEPA820BTNP			
Frequency Range	Band	Mode	Frequency Range (MHz)	Number of Channels
	U-NII Band I	IEEE 802.11a	5180 – 5240	4 Channels
		IEEE 802.11n 20 MHz	5180 – 5240	4 Channels
	U-NII Band III	IEEE 802.11a	5745 – 5825	5 Channels
		IEEE 802.11n 20 MHz	5745 – 5825	5 Channels
Modulation Type	OFDM			
Equipment Type	Client			
Antenna Type	FPCB Antenna			
Antenna Gain	3.3 dBi			
Antenna Delivery	1TX + 1RX			
RF Output Power	IEEE 802.11a U-NII Band I : 0.008 W / 8.77 dBm IEEE 802.11a U-NII Band III : 0.010 W / 10.03 dBm IEEE 802.11n 20MHz U-NII Band I: 0.008 W / 9.19 dBm IEEE 802.11n 20MHz U-NII Band III: 0.007 W / 8.20 dBm			

3 Test Methodology

3.1. Mode of Operation

Decision of Test ATL has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode
Mode 1: Normal Operation Mode
Mode 2: IEEE 802.11a Link Mode
Mode 3: IEEE 802.11n 20MHz Link Mode

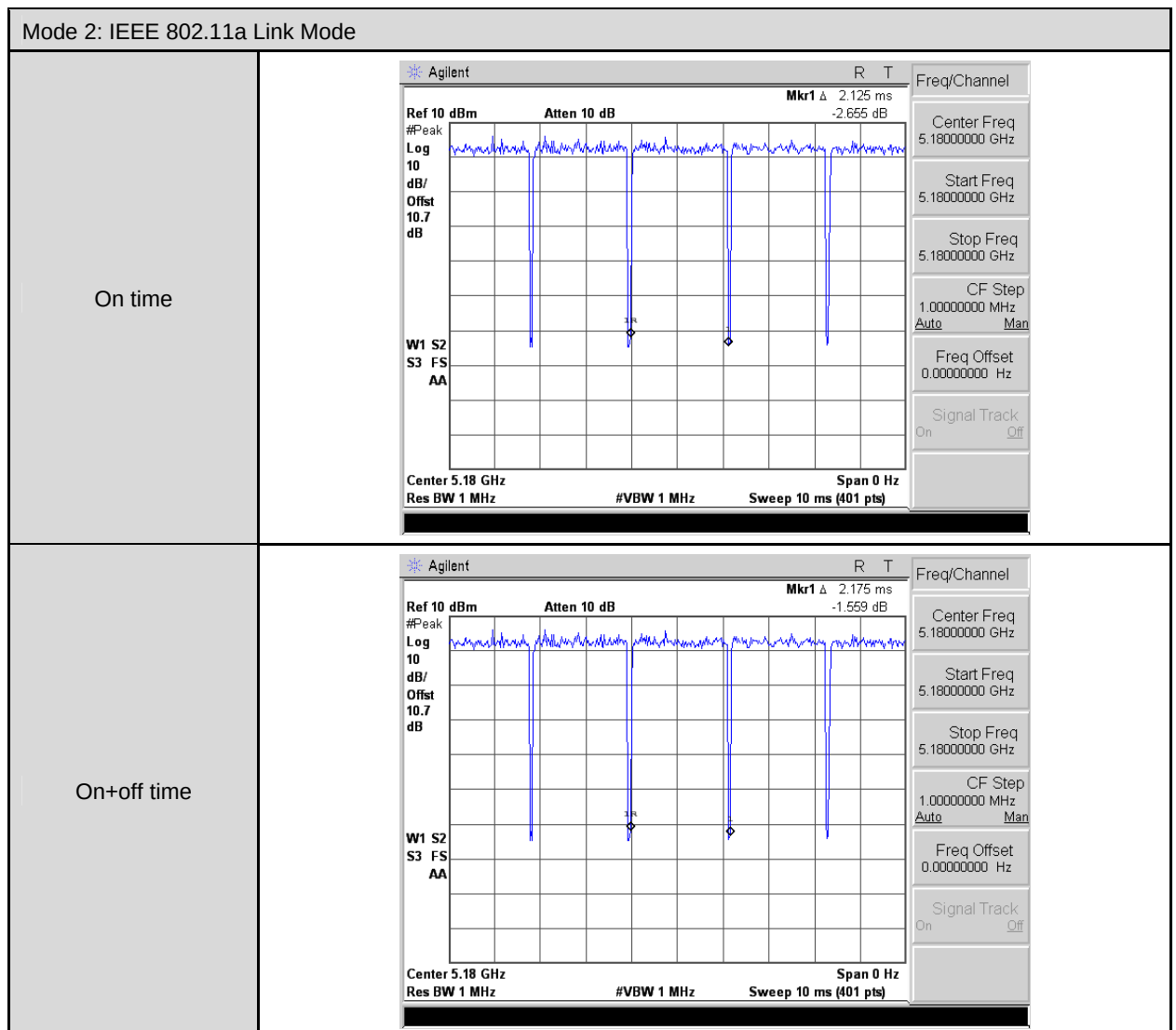
Software used to control the EUT for staying in continuous transmitting mode was programmed.

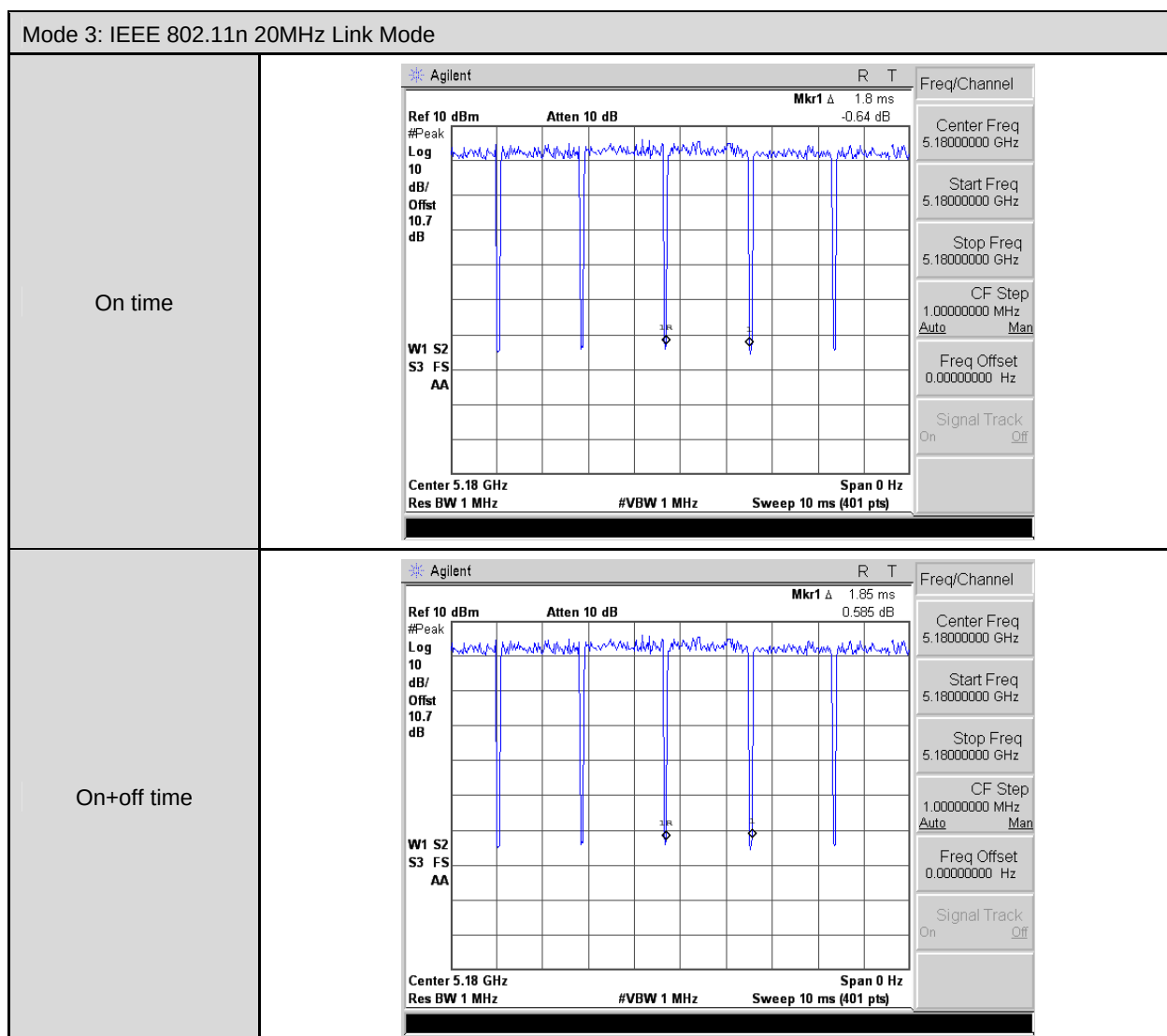
After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz and power line conducted emissions below 30MHz, which worst case was in normal link mode only.

Test Mode	Band	Data Rate	Test Channel
IEEE 802.11a Link Mode	U-NII Band I	6M	36, 44, 48
	U-NII Band III		149, 157, 165
IEEE 802.11n 20MHz Link Mode	U-NII Band I	6.5M	36, 44, 48
	U-NII Band III		149, 157, 165

Duty cycle

Test Mode	Frequency (MHz)	on time (ms)	on+off time (ms)	Duty cycle	Duty Factor (dB)	1/T Minimum VBW (kHz)
Mode 2: IEEE 802.11a Link Mode	5180.0	2.125	2.175	0.977	0.101	0.471
Mode 3: IEEE 802.11n 20MHz Link Mode	5180.0	1.800	1.850	0.973	0.119	0.556





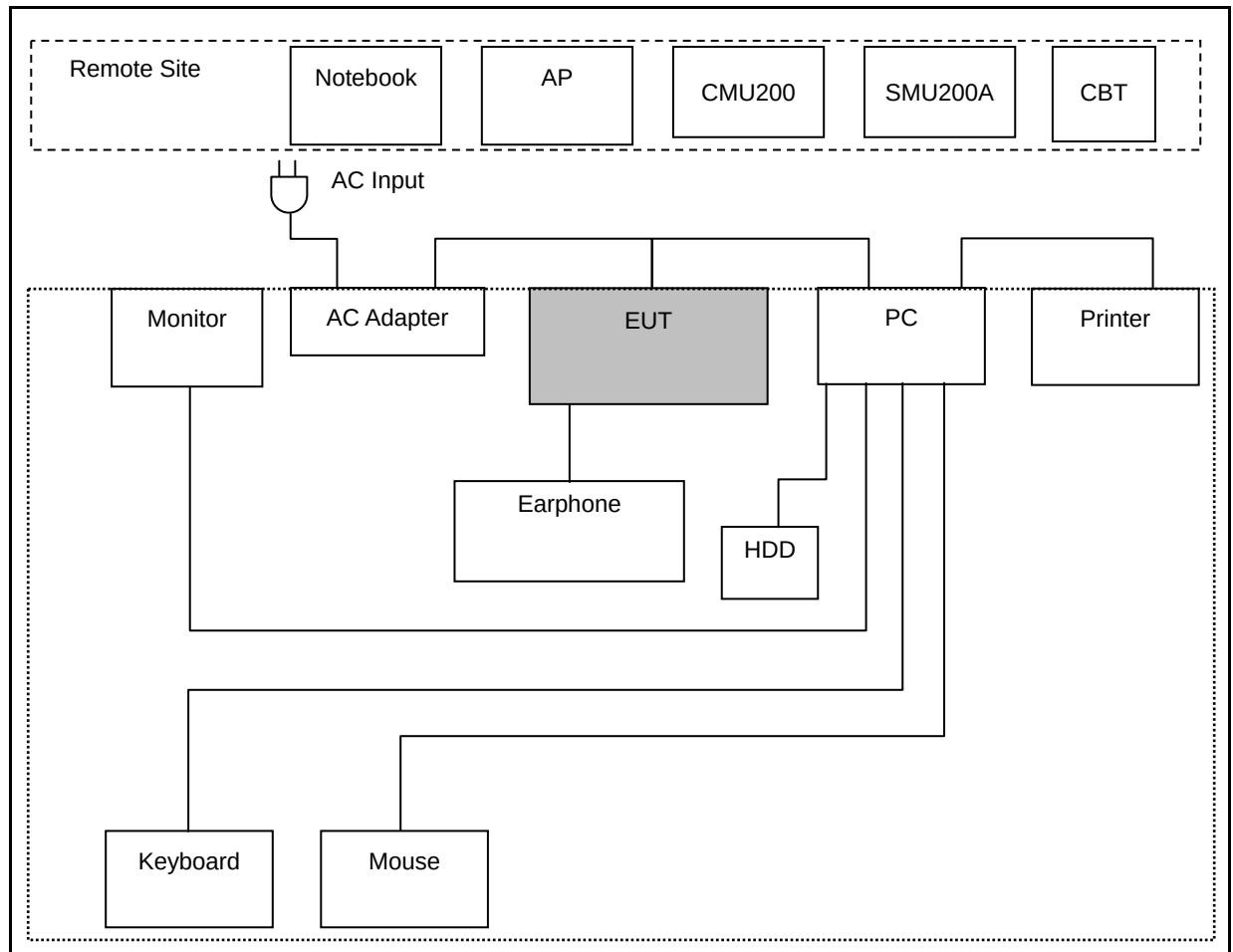
3.2. EUT Exercise Software

The EUT is operated in the engineering mode to fix the TX frequency for the purposes of measurement. According to its specifications, the EUT must comply with the requirements of Section 15.407 under the FCC Rules Part 15 Subpart E.

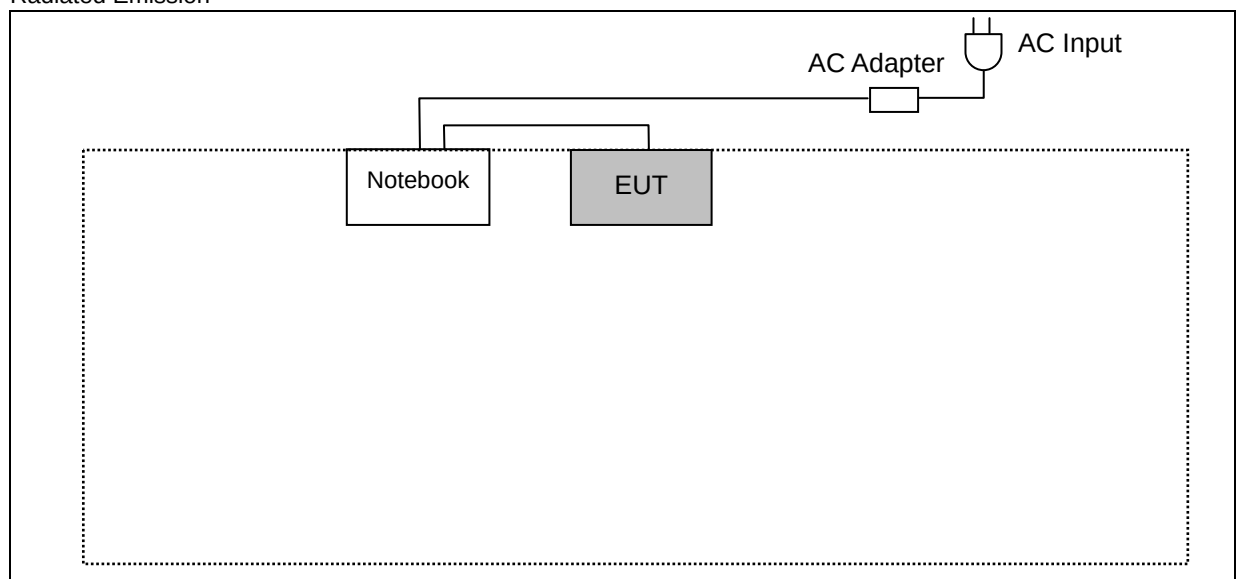
1.	Setup the EUT shown on 3.3.
2.	Turn on the power of all equipment.
3.	Turn on Wi-Fi function link to Notebook.
4.	EUT run test program.

3.3. Configuration of Test System Details

Conducted Emission



Radiated Emission



3.4. Test Site Environment

Items	Required (IEC 60068-1)	Actual
Temperature (°C)	15-35	26
Humidity (%RH)	25-75	60
Barometric pressure (mbar)	860-1060	950

4 AC Power Conducted Emission Measurement

4.1. Limit

Frequency (MHz)	Quasi-peak	Average
0.15 - 0.5	66 to 56	56 to 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

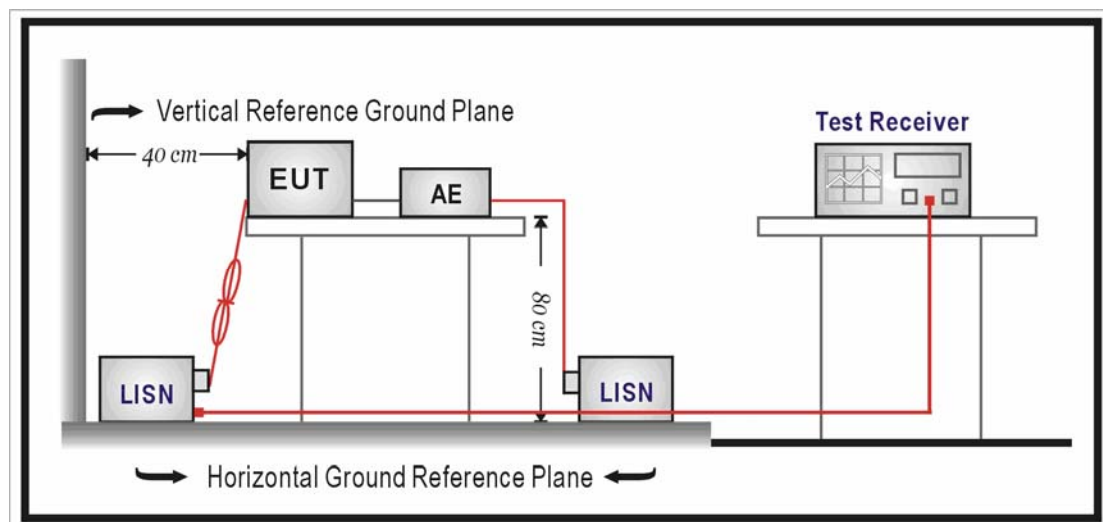
4.2. Test Instruments

Describe	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Test Receiver	R&S	ESCI	100367	06/25/2015	(1)
LISN	R&S	ENV216	101040	03/10/2015	(1)
LISN	R&S	ENV216	101041	03/06/2015	(1)
Test Site	ATL	TE05	TE05	N.C.R.	-----

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years.

Note: N.C.R. = No Calibration Request.

4.3. Test Setup



4.4. Test Procedure

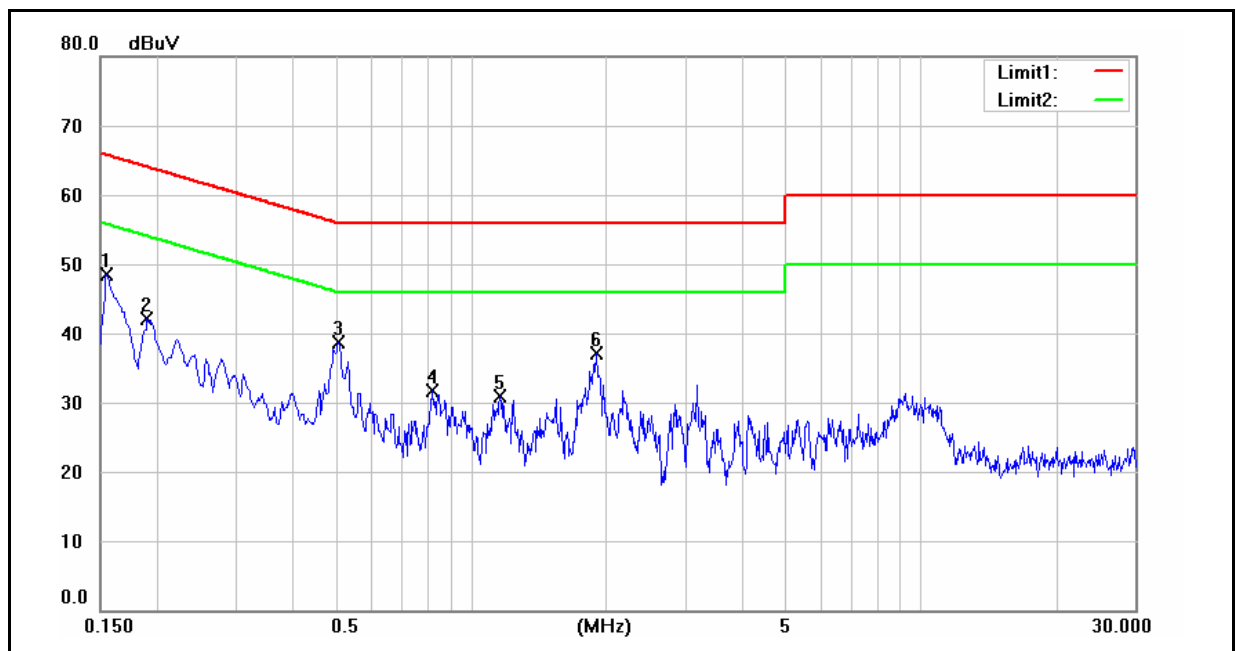
The power line conducted emission measurements were performed in a shielded enclosure. The EUT was assembled on a wooden table which is 80 centimeters high, was placed 40 centimeters from the back wall and at least 1 meter from the sidewall.

Power was fed to the EUT from the public utility power grid through a line filter and EMCO Model 3162/2 SH Line Impedance Stabilization Networks (LISN). The LISN housing, measuring instrumentation case, ground plane, etc., were electrically bonded together at the same RF potential. The Spectrum analyzer was connected to the AC line through an isolation transformer. The 50-ohm output of the LISN was connected to the spectrum analyzer directly. Conducted emission levels were in the CISPR quasi-peak detection mode. The analyzer's 6 dB bandwidth was set to 9 KHz. No post-detector video filter was used.

The spectrum was scanned from 150 KHz to 30 MHz. The physical arrangement of the test system and associated cabling was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude and frequency. All spurious emission frequencies were observed. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in paragraph 4.1.

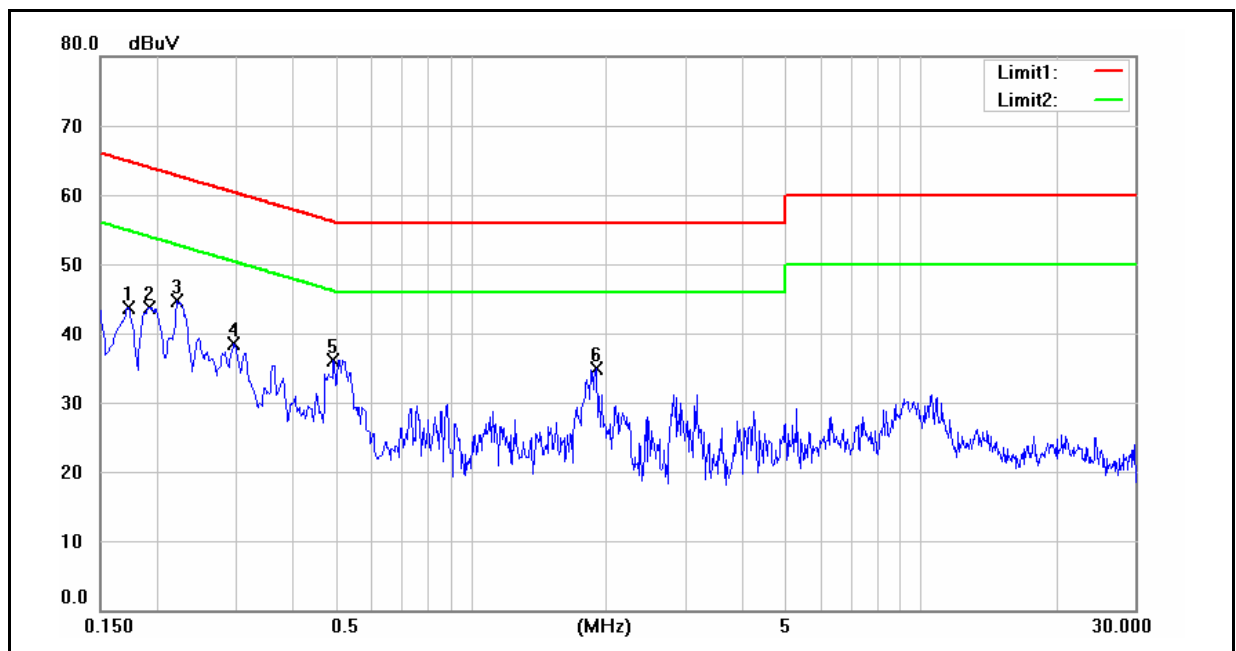
4.5. Test Result

Standard:	FCC Part 15E	Line:	L1
Test item:	Conducted Emission	Power:	AC 120V/60Hz
Model Number:	PA820	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Test Mode:	Mode 1	Date:	03/25/2015
		Test By:	Eric Ou Yang
Description:			



No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
1	0.1548	36.24	24.20	9.60	45.84	33.80	65.74	55.74	-19.90	-21.94	Pass
2	0.1905	33.31	23.47	9.60	42.91	33.07	64.01	54.01	-21.10	-20.94	Pass
3	0.5101	26.39	18.30	9.62	36.01	27.92	56.00	46.00	-19.99	-18.08	Pass
4	0.8251	19.10	11.05	9.64	28.74	20.69	56.00	46.00	-27.26	-25.31	Pass
5	1.1627	17.88	9.98	9.66	27.54	19.64	56.00	46.00	-28.46	-26.36	Pass
6	1.9054	24.39	13.46	9.69	34.08	23.15	56.00	46.00	-21.92	-22.85	Pass

Standard:	FCC Part 15E	Line:	N
Test item:	Conducted Emission	Power:	AC 120V/60Hz
Model Number:	PA820	Temp.(°C)/Hum.(%RH):	26(°C)/60%RH
Test Mode:	Mode 1	Date:	03/25/2015
		Test By:	Eric Ou Yang
Description:			



No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
1	0.1731	35.36	24.53	9.60	44.96	34.13	64.81	54.81	-19.85	-20.68	Pass
2	0.1924	32.42	23.46	9.60	42.02	33.06	63.93	53.93	-21.91	-20.87	Pass
3	0.2220	28.98	19.42	9.60	38.58	29.02	62.74	52.74	-24.16	-23.72	Pass
4	0.2985	21.89	14.49	9.61	31.50	24.10	60.28	50.28	-28.78	-26.18	Pass
5	0.4966	26.14	17.90	9.62	35.76	27.52	56.06	46.06	-20.30	-18.54	Pass
6	1.9010	22.25	13.70	9.70	31.95	23.40	56.00	46.00	-24.05	-22.60	Pass

5 Radiated Emission Measurement

5.1. Limit

Limits of Radiated Emission Measurement

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

Frequency Range (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	10	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

Note: 1. The lower limit shall apply at the transition frequencies.

2. Emission level (dBuV/m) = 20 log Emission level (uV/m).

3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

5.2. Test Instruments

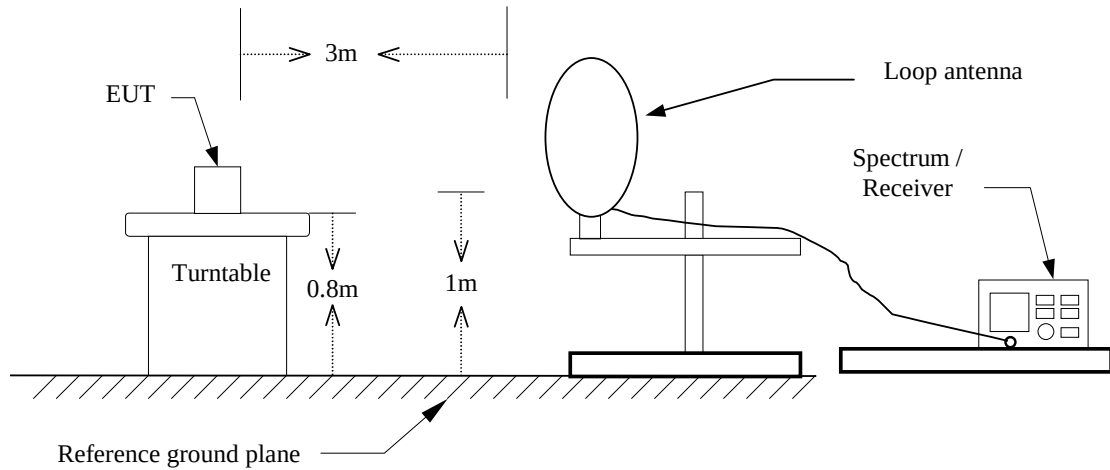
3 Meter Chamber					
Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
RF Pre-selector	Agilent	N9039A	MY46520256	01/06/2015	(1)
Spectrum Analyzer	Agilent	E4446A	MY46180578	01/06/2015	(1)
Pre Amplifier	Agilent	8449B	3008A02237	02/24/2015	(1)
Pre Amplifier	Agilent	8447D	2944A10961	02/24/2015	(1)
Broadband Antenna (30MHz~1GHz)	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	9163-270	08/11/2015	(1)
Horn Antenna (1~18GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D	9120D-550	06/12/2015	(1)
Horn Antenna (18~40GHz)	SCHWARZBECK MESS-ELEKTRONIK	BBHA9170	9170-320	07/06/2015	(1)
Test Site	ATL	TE01	888001	08/27/2015	(1)

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years.

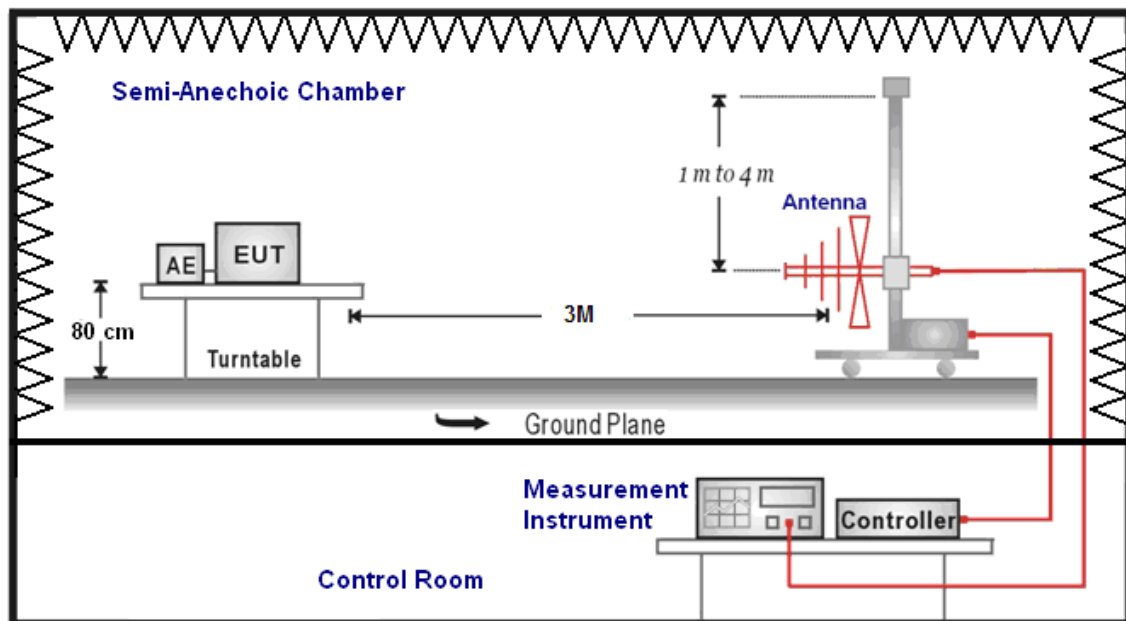
Note: N.C.R. = No Calibration Request.

5.3. Setup

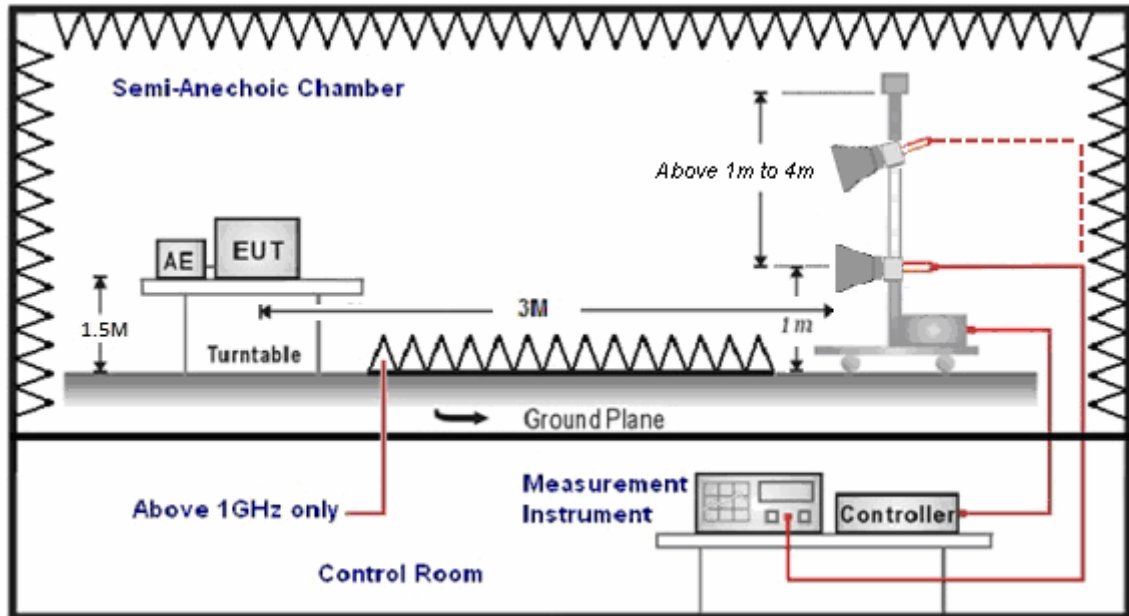
9kHz ~ 30MHz



30MHz ~ 1GHz



Above 1GHz



5.4. Test Procedure

Final radiation measurements were made on a three-meter, Semi Anechoic Chamber. The EUT system was placed on a nonconductive turntable which is 0.8 or 1.5 meters height (below 1GHz use 0.8m turntable / above 1GHz use 1.5m turntable), top surface 1.0 x 1.5 meter. The spectrum was examined from 250 MHz to 2.5 GHz in order to cover the whole spectrum below 10th harmonic which could generate from the EUT. During the test, EUT was set to transmit continuously & Measurements spectrum range from 9 kHz to 40 GHz is investigated.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For restricted measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 3 MHz for peak measurements and 10 Hz for average measurements when Duty cycle > 0.98 / 1/T for average measurements when Duty cycle < 0.98.

For out of band measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 3 MHz for peak measurements.

A nonconductive material surrounded the EUT to supporting the EUT for standing on three orthogonal planes. At each condition, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization.

SCHWARZBECK MESS-ELEKTRONIK Trilog-Broadband Antenna (mode SB AC VULB) at 3 Meter and the ETS-Lindgren Double-Ridged Waveguide Horn antenna (model 3117) Schwarzbeck Mess-Elektronik Broadband Horn Antenna (BBHA 9170) was used in frequencies 1 – 40 GHz at a distance of 3 meter. The antenna at an angle toward the source of the emission. All test results were extrapolated to equivalent signal at 3 meters utilizing an inverse linear distance extrapolation Factor (20dB/decade).

For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. No post – detector video filters were used in the test.

The spectrum analyzer's 6 dB bandwidth was set to 1 MHz, and the analyzer was operated in the peak detection mode, for frequencies both below and up 1 GHz. The average levels were obtained by subtracting the duty cycle correction factor from the peak readings.

The following procedures were used to convert the emission levels measured in decibels referenced to 1 microvolt (dBuV) into field intensity in micro volts per meter (uV/m).

The actual field intensity in decibels referenced to 1 microvolt in to field intensity in micro volts per meter (dBuV/m).

The actual field intensity in referenced to 1 microvolt per meter (dBuV/m) is determined by algebraically adding the measured reading in dBuV, the antenna factor (dB), and cable loss (dB) and Subtracting the gain of preamplifier (dB) is auto calculate in spectrum analyzer.

- (1) Amplitude (dBuV/m) = FI (dBuV) +AF (dBuV) +CL (dBuV)-Gain (dB)

FI= Reading of the field intensity.

AF= Antenna factor.

CL= Cable loss.

P.S Amplitude is auto calculate in spectrum analyzer.

- (2) Actual Amplitude (dBuV/m) = Amplitude (dBuV)-Dis(dB)

The FCC specified emission limits were calculated according the EUT operating frequency and by following linear interpolation equations:

(a) For fundamental frequency : Transmitter Output < +30dBm

(b) For spurious frequency : Spurious emission limits = fundamental emission limit /10

5.5. Test Result

Below 1GHz

Standard:		FCC Part 15E		Test Distance:		3m	
Test item:		Radiated Emission		Power:		AC 120V/60Hz	
Model Number:		PA820		Temp.(°C)/Hum.(%RH):		26(°C)/60%RH	
Test Mode:		Mode 1		Date:		09/12/2015	
				Test By:		Eric Ou Yang	
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
202.5000	38.42	-13.71	24.71	43.50	-18.79	QP	H
264.0000	42.61	-10.85	31.76	46.00	-14.24	QP	H
381.0000	38.72	-7.77	30.95	46.00	-15.05	QP	H
531.0000	26.76	-4.84	21.92	46.00	-24.08	QP	H
712.5000	27.58	-1.16	26.42	46.00	-19.58	QP	H
844.5000	26.58	1.21	27.79	46.00	-18.21	QP	H
158.5000	34.44	-11.39	23.05	43.50	-20.45	QP	V
229.0000	40.95	-12.59	28.36	46.00	-17.64	QP	V
339.5000	34.19	-8.68	25.51	46.00	-20.49	QP	V
384.5000	37.06	-7.70	29.36	46.00	-16.64	QP	V
648.5000	26.77	-2.56	24.21	46.00	-21.79	QP	V
812.0000	27.67	0.65	28.32	46.00	-17.68	QP	V

Note: No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).

Above 1GHz

Standard:		FCC Part 15E		Test Distance:		3m	
Test item:		Radiated Emission		Power:		AC 120V/60Hz	
Model Number:		PA820		Temp.(℃)/Hum.(%RH):		26(℃)/60%RH	
Test Mode:		Mode 2		Date:		09/12/2015	
Frequency:		5180MHz		Test By:		Eric Ou Yang	
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
2806.000	34.53	1.05	35.58	74.00	-38.42	peak	H
4577.000	31.17	6.69	37.86	74.00	-36.14	peak	H
7650.000	28.93	14.26	43.19	74.00	-30.81	peak	H
2785.000	36.18	0.97	37.15	74.00	-36.85	peak	V
4577.000	31.87	6.69	38.56	74.00	-35.44	peak	V
7657.000	30.98	14.28	45.26	74.00	-28.74	peak	V

Standard:	FCC Part 15E			Test Distance:	3m		
Test item:	Radiated Emission			Power:	AC 120V/60Hz		
Model Number:	PA820			Temp.(℃)/Hum.(%RH):	26(℃)/60%RH		
Test Mode:	Mode 2			Date:	09/12/2015		
Frequency:	5200MHz			Test By:	Eric Ou Yang		
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
2834.000	35.56	1.14	36.70	74.00	-37.30	peak	H
4591.000	32.20	6.74	38.94	74.00	-35.06	peak	H
7650.000	30.75	14.26	45.01	74.00	-28.99	peak	H
2827.000	33.79	1.12	34.91	74.00	-39.09	peak	V
4283.000	30.99	5.91	36.90	74.00	-37.10	peak	V
7622.000	31.72	14.22	45.94	74.00	-28.06	peak	V

Standard:	FCC Part 15E			Test Distance:	3m		
Test item:	Radiated Emission			Power:	AC 120V/60Hz		
Model Number:	PA820			Temp.(°C)/Hum.(%RH):	26(°C)/60%RH		
Test Mode:	Mode 2			Date:	09/12/2015		
Frequency:	5240MHz			Test By:	Eric Ou Yang		
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
2799.000	35.15	1.03	36.18	74.00	-37.82	peak	H
4605.000	32.78	6.79	39.57	74.00	-34.43	peak	H
7657.000	29.73	14.28	44.01	74.00	-29.99	peak	H
2806.000	35.54	1.05	36.59	74.00	-37.41	peak	V
4591.000	35.16	6.74	41.90	74.00	-32.10	peak	V
7671.000	29.68	14.30	43.98	74.00	-30.02	peak	V

Standard:	FCC Part 15E			Test Distance:	3m		
Test item:	Radiated Emission			Power:	AC 120V/60Hz		
Model Number:	PA820			Temp.(°C)/Hum.(%RH):	26(°C)/60%RH		
Test Mode:	Mode 3			Date:	09/12/2015		
Frequency:	5180MHz			Test By:	Eric Ou Yang		
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
2806.000	34.72	1.05	35.77	74.00	-38.23	peak	H
4563.000	30.90	6.66	37.56	74.00	-36.44	peak	H
7657.000	30.54	14.28	44.82	74.00	-29.18	peak	H
2806.000	36.35	1.05	37.40	74.00	-36.60	peak	V
4563.000	31.66	6.66	38.32	74.00	-35.68	peak	V
7699.000	30.75	14.35	45.10	74.00	-28.90	peak	V

Standard:		FCC Part 15E		Test Distance:		3m	
Test item:		Radiated Emission		Power:		AC 120V/60Hz	
Model Number:		PA820		Temp.(℃)/Hum.(%RH):		26(℃)/60%RH	
Test Mode:		Mode 3		Date:		09/12/2015	
Frequency:		5200MHz		Test By:		Eric Ou Yang	
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
2799.000	35.01	1.03	36.04	74.00	-37.96	peak	H
4598.000	31.49	6.77	38.26	74.00	-35.74	peak	H
7671.000	30.24	14.30	44.54	74.00	-29.46	peak	H
2806.000	36.11	1.05	37.16	74.00	-36.84	peak	V
4325.000	30.18	6.01	36.19	74.00	-37.81	peak	V
7615.000	29.85	14.21	44.06	74.00	-29.94	peak	V

Standard:		FCC Part 15E		Test Distance:		3m	
Test item:		Radiated Emission		Power:		AC 120V/60Hz	
Model Number:		PA820		Temp.(℃)/Hum.(%RH):		26(℃)/60%RH	
Test Mode:		Mode 3		Date:		09/12/2015	
Frequency:		5240MHz		Test By:		Eric Ou Yang	
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
2778.000	35.22	0.96	36.18	74.00	-37.82	peak	H
4633.000	31.42	6.88	38.30	74.00	-35.70	peak	H
7671.000	30.73	14.30	45.03	74.00	-28.97	peak	H
2799.000	35.72	1.03	36.75	74.00	-37.25	peak	V
4605.000	33.42	6.79	40.21	74.00	-33.79	peak	V
7678.000	30.57	14.31	44.88	74.00	-29.12	peak	V

Band Edge

Standard:		FCC Part 15E		Test Distance:		3m	
Test item:		Radiated Emission		Power:		AC 120V/60Hz	
Model Number:		PA820		Temp.(°C)/Hum.(%RH):		26(°C)/60%RH	
Test Mode:		Mode 2		Date:		09/27/2015	
Frequency:		5180 MHz		Test By:		Eric Ou Yang	
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
5102.700	46.14	8.16	54.30	74.00	-19.70	peak	H
5102.700	35.10	8.16	43.26	54.00	-10.74	AVG	H
5150.000	42.89	8.21	51.10	74.00	-22.90	peak	H
5099.200	47.34	8.15	55.49	74.00	-18.51	peak	V
5099.200	35.90	8.15	44.05	54.00	-9.95	AVG	V
5150.000	47.91	8.21	56.12	74.00	-17.88	peak	V
5150.000	35.90	8.21	44.11	54.00	-9.89	AVG	V

Standard:	FCC Part 15E			Test Distance:	3m		
Test item:	Radiated Emission			Power:	AC 120V/60Hz		
Model Number:	PA820			Temp.(°C)/Hum.(%RH):	26(°C)/60%RH		
Test Mode:	Mode 2			Date:	09/27/2015		
Frequency:	5320 MHz			Test By:	Eric Ou Yang		
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
5350.000	43.07	8.68	51.75	74.00	-22.25	peak	H
5381.020	46.51	8.72	55.23	74.00	-18.77	peak	H
5381.020	35.20	8.72	43.92	54.00	-10.08	AVG	H
5350.000	42.52	8.68	51.20	74.00	-22.80	peak	V
5356.820	44.76	8.68	53.44	74.00	-20.56	peak	H
5356.820	34.95	8.68	43.63	54.00	-10.37	AVG	V

Standard:	FCC Part 15E			Test Distance:	3m		
Test item:	Radiated Emission			Power:	AC 120V/60Hz		
Model Number:	PA820			Temp.(°C)/Hum.(%RH):	26(°C)/60%RH		
Test Mode:	Mode 3			Date:	09/12/2015		
Frequency:	5180 MHz			Test By:	Eric Ou Yang		
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4947.300	44.63	7.85	52.48	74.00	-21.52	peak	H
4947.300	36.27	7.85	44.12	54.00	-9.88	AVG	H
5150.000	42.46	8.21	50.67	74.00	-23.33	peak	H
5020.100	46.49	8.04	54.53	74.00	-19.47	peak	V
5020.100	36.30	8.04	44.34	54.00	-9.66	AVG	V
5150.000	42.47	8.21	50.68	74.00	-23.32	peak	V

Standard:	FCC Part 15E			Test Distance:	3m		
Test item:	Radiated Emission			Power:	AC 120V/60Hz		
Model Number:	PA820			Temp.(°C)/Hum.(%RH):	26(°C)/60%RH		
Test Mode:	Mode 3			Date:	09/12/2015		
Frequency:	5320 MHz			Test By:	Eric Ou Yang		
Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
5350.000	44.33	8.68	53.01	74.00	-20.99	peak	H
5350.000	35.01	8.68	43.69	54.00	-10.31	AVG	H
5360.560	46.68	8.69	55.37	74.00	-18.63	peak	H
5360.560	34.64	8.69	43.33	54.00	-10.67	AVG	H
5350.000	42.85	8.68	51.53	74.00	-22.47	peak	V
5368.700	46.25	8.70	54.95	74.00	-19.05	peak	V
5368.700	34.87	8.70	43.57	54.00	-10.43	AVG	V

6 Maximum Conducted Output Power Measurement

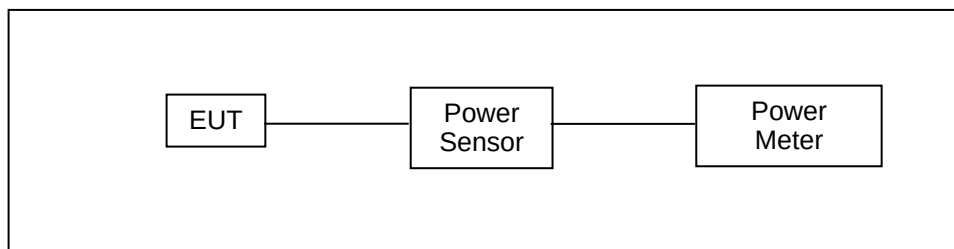
6.1. Limit

Conducted Output Power

Frequency Range (MHz)	FCC Limit
5.150 ~ 5.250 GHz	The lesser of 250mW (24dBm)
5.250 ~ 5.350 GHz	The lesser of 250mW (24dBm) or 11dBm + 10log (B)
5.470 ~ 5.725 GHz	The lesser of 250mW (24dBm) or 11dBm + 10log (B)
5.725 ~ 5.850 GHz	The lesser of 1000mW (30dBm)

Note: Where B is the 26dB emission bandwidth in MHz.

6.2. Test Setup



6.3. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Power Sensor	Anritsu	MA2411B	1126022	08/24/2015	(1)
Power Meter	Anritsu	ML2495A	1135009	08/24/2015	(1)
Test Site	ATL	TE02	TE02	N.C.R.	-----

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years.

Note: N.C.R. = No Calibration Request.

6.4. Test Procedure

The test is performed in accordance with KDB789033: D02 General UNII Test Procedures New Rules v01, Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E.

6.5. Test Result

Model Number		PA820		
Test Item		Maximum Conducted Output Power		
Test Mode		Mode 2: IEEE 802.11a Link Mode		
Date of Test		03/25/2015	Test Site	TE02
Frequency (MHz)	Data Rate	Max. Output Power		FCC Limit (dBm)
		(dBm)	(W)	
5180.0	6M	8.77	0.008	< 24
5200.0		8.48	0.007	
5220.0		8.05	0.006	
5240.0		8.50	0.007	
5745.0		10.03	0.010	< 30
5765.0		9.75	0.009	
5785.0		9.55	0.009	
5805.0		9.08	0.008	
5825.0		9.06	0.008	
5180.0	54M	8.69	0.007	< 24
5200.0		8.45	0.007	
5220.0		7.96	0.006	
5240.0		8.47	0.007	
5745.0		9.96	0.010	< 30
5765.0		9.70	0.009	
5785.0		9.49	0.009	
5805.0		9.02	0.008	
5825.0		8.99	0.008	

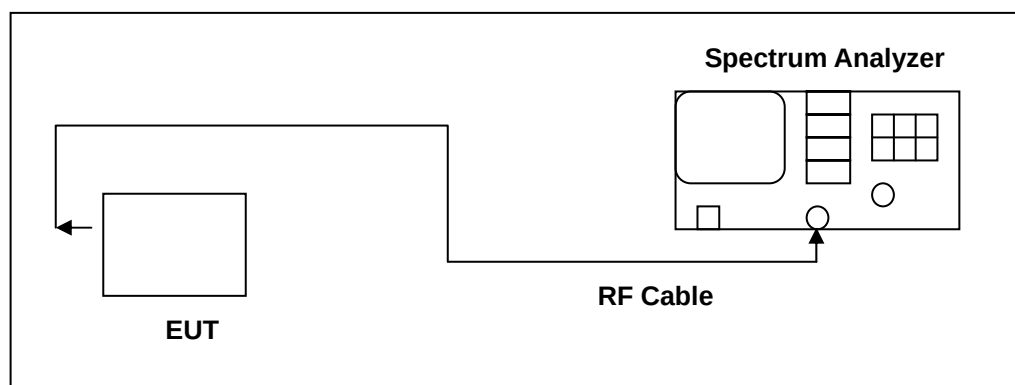
Model Number		PA820		
Test Item		Maximum Conducted Output Power		
Test Mode		Mode 3: IEEE 802.11n 20MHz Link Mode		
Date of Test		03/25/2015	Test Site	TE02
Frequency (MHz)	Data Rate	Max. Output Power		FCC Limit (dBm)
		(dBm)	(W)	
5180.0	6.5M	9.19	0.008	< 24
5200.0		8.96	0.008	
5220.0		9.17	0.008	
5240.0		9.08	0.008	
5745.0		8.17	0.007	< 30
5765.0		8.20	0.007	
5785.0		7.68	0.006	
5805.0		7.60	0.006	
5825.0		7.23	0.005	
5180.0	65M	9.11	0.008	< 24
5200.0		8.91	0.008	
5220.0		9.13	0.008	
5240.0		9.05	0.008	
5745.0		8.09	0.006	< 30
5765.0		8.11	0.006	
5785.0		7.62	0.006	
5805.0		7.55	0.006	
5825.0		7.15	0.005	

7 26dB RF Bandwidth & 99 % Occupied Bandwidth Measurement

7.1. Limit

N/A

7.2. Test Setup



7.3. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Spectrum Analyzer	Agilent	E4445A	MY45300744	12/16/2014	(1)
Test Site	ATL	TE02	TE02	N.C.R.	-----

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years.

Note: N.C.R. = No Calibration Request.

7.4. Test Procedure

The test is performed in accordance with KDB789033: D02 General UNII Test Procedures New Rules v01, Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E.

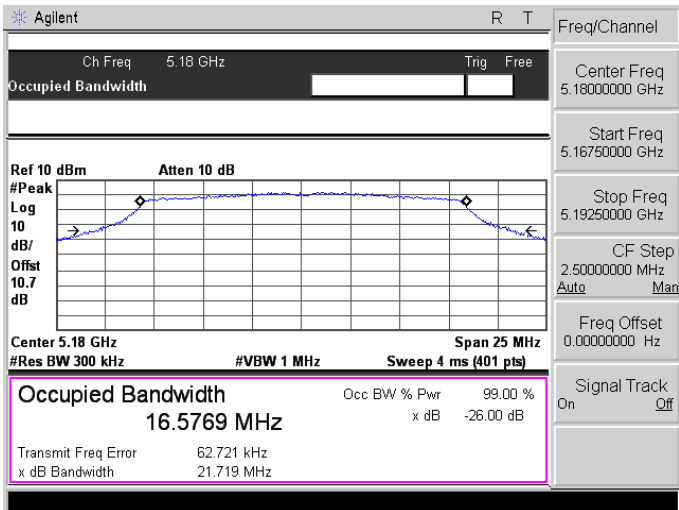
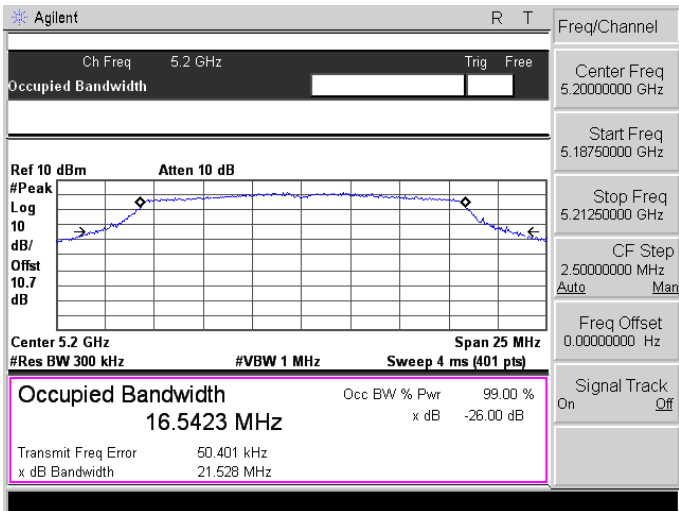
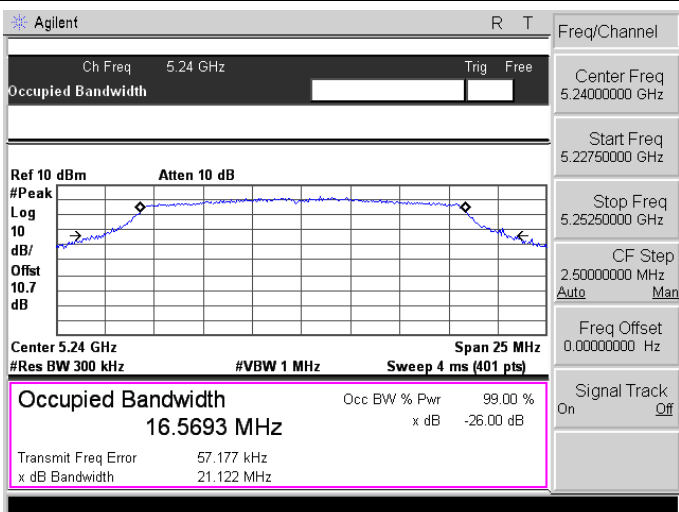
7.5. Test Result

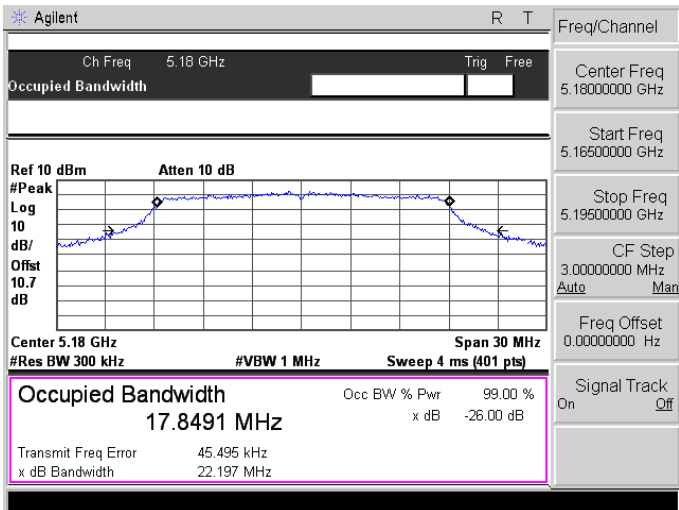
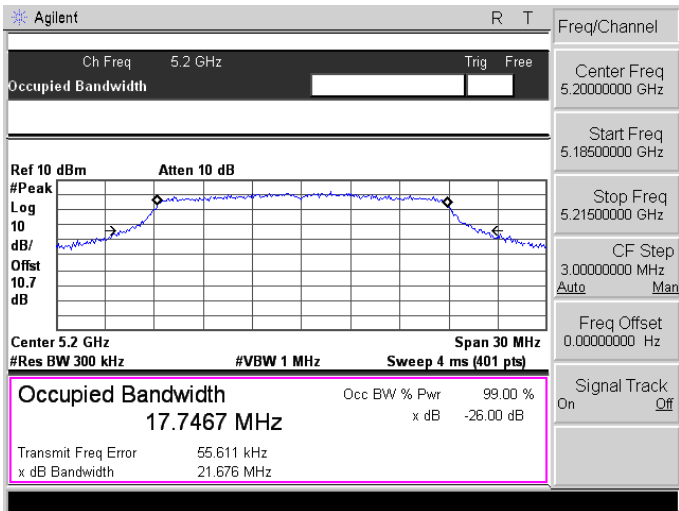
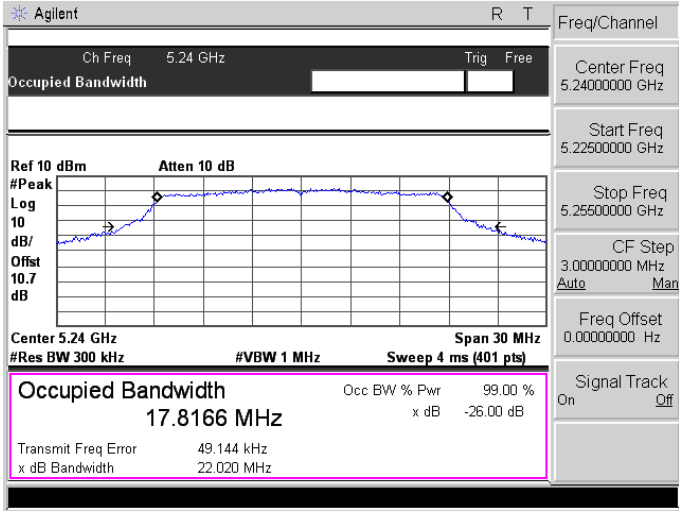
Model Number	PA820		
Test Item	26dB RF Bandwidth & 99 % Occupied Bandwidth Measurement		
Test Mode	Mode 2: IEEE 802.11a Link Mode		
Date of Test	09/13/2015	Test Site	TE02
Frequency (MHz)	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	
5180	21.719	16.5769	
5200	21.528	16.5423	
5240	21.122	16.5693	

Model Number	PA820		
Test Item	26dB RF Bandwidth & 99 % Occupied Bandwidth Measurement		
Test Mode	Mode 3: IEEE 802.11n 20MHz Link Mode		
Date of Test	09/13/2015	Test Site	TE02
Frequency (MHz)	26dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	
5180	22.197	17.8491	
5200	21.676	17.7467	
5240	22.020	17.8166	

Note: The 99% occupied bandwidth not crossed 5250MHz.

7.6. Test Graphs

5180	Mode 2: IEEE 802.11a Link Mode  Agilent R T Ch Freq 5.18 GHz Trng Free Occupied Bandwidth Ref 10 dBm Atten 10 dB #Peak Log 10 dB/Offset 10.7 dB Center 5.18 GHz Span 25 MHz #Res BW 300 kHz #VBW 1 MHz Sweep 4 ms (401 pts) Occupied Bandwidth 16.5769 MHz Occ BW % Pwr 99.00 % x dB -26.00 dB Transmit Freq Error 62.721 kHz x dB Bandwidth 21.719 MHz Freq/Channel Center Freq 5.18000000 GHz Start Freq 5.16750000 GHz Stop Freq 5.19250000 GHz CF Step 2.50000000 MHz Auto Man Freq Offset 0.00000000 Hz Signal Track On Off
5200	 Agilent R T Ch Freq 5.2 GHz Trng Free Occupied Bandwidth Ref 10 dBm Atten 10 dB #Peak Log 10 dB/Offset 10.7 dB Center 5.2 GHz Span 25 MHz #Res BW 300 kHz #VBW 1 MHz Sweep 4 ms (401 pts) Occupied Bandwidth 16.5423 MHz Occ BW % Pwr 99.00 % x dB -26.00 dB Transmit Freq Error 50.401 kHz x dB Bandwidth 21.528 MHz Freq/Channel Center Freq 5.20000000 GHz Start Freq 5.18750000 GHz Stop Freq 5.21250000 GHz CF Step 2.50000000 MHz Auto Man Freq Offset 0.00000000 Hz Signal Track On Off
5240	 Agilent R T Ch Freq 5.24 GHz Trng Free Occupied Bandwidth Ref 10 dBm Atten 10 dB #Peak Log 10 dB/Offset 10.7 dB Center 5.24 GHz Span 25 MHz #Res BW 300 kHz #VBW 1 MHz Sweep 4 ms (401 pts) Occupied Bandwidth 16.5693 MHz Occ BW % Pwr 99.00 % x dB -26.00 dB Transmit Freq Error 57.177 kHz x dB Bandwidth 21.122 MHz Freq/Channel Center Freq 5.24000000 GHz Start Freq 5.22750000 GHz Stop Freq 5.25250000 GHz CF Step 2.50000000 MHz Auto Man Freq Offset 0.00000000 Hz Signal Track On Off

Mode 3: IEEE 802.11n 20MHz Link Mode	
5180	
5200	
5240	

8 6dB RF Bandwidth & 99 % Occupied Bandwidth Measurement

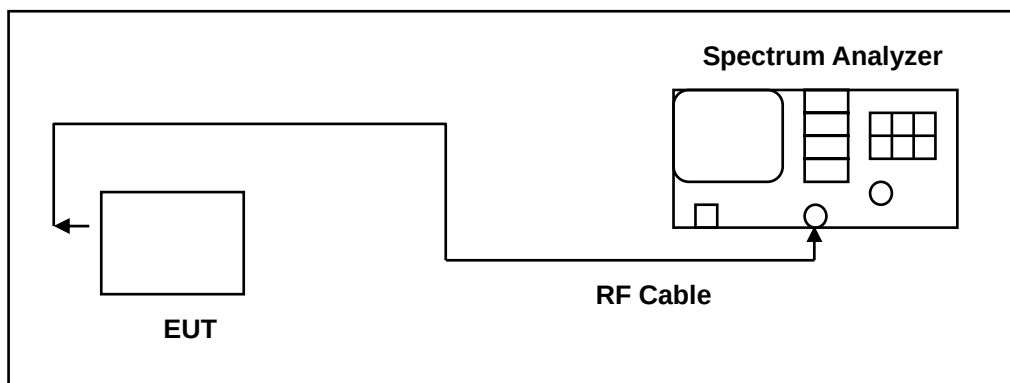
8.1. Limit

6dB RF Bandwidth

Systems using digital modulation techniques may operate in the 5725~5850MHz bands. The minimum 6 dB band-width shall be at least 500 kHz.

N/A

8.2. Test Setup



8.3. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Spectrum Analyzer	Agilent	E4445A	MY45300744	12/16/2014	(1)
Test Site	ATL	TE05	TE05	N.C.R.	-----

dRemark: (1) Calibration period 1 year. (2) Calibration period 2 years. (3) Calibration period 3 years.

Note: N.C.R. = No Calibration Request.

8.4. Test Procedure

6dB RF Bandwidth

The EUT tested to UNII test procedure of KDB789033 D02 for compliance to FCC 47CFR 15.407 requirements.

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RES BW was set to 100 kHz. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A peak output reading was taken, a DISPLAY line was drawn 6 dB lower than peak level. The 6 dB bandwidth was determined from where the channel output spectrum intersected the display line.

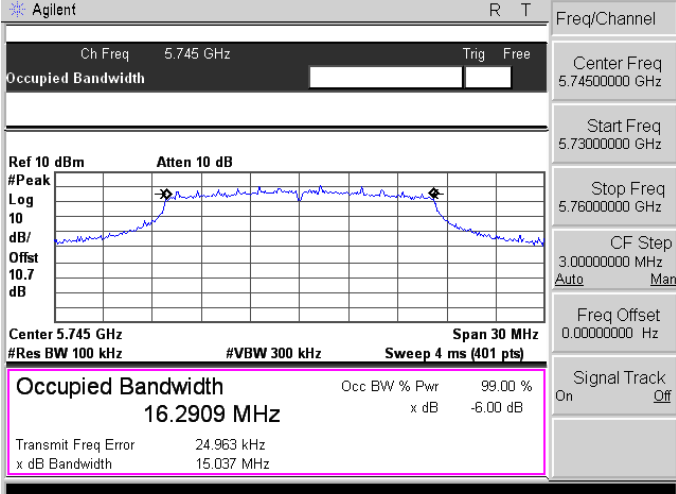
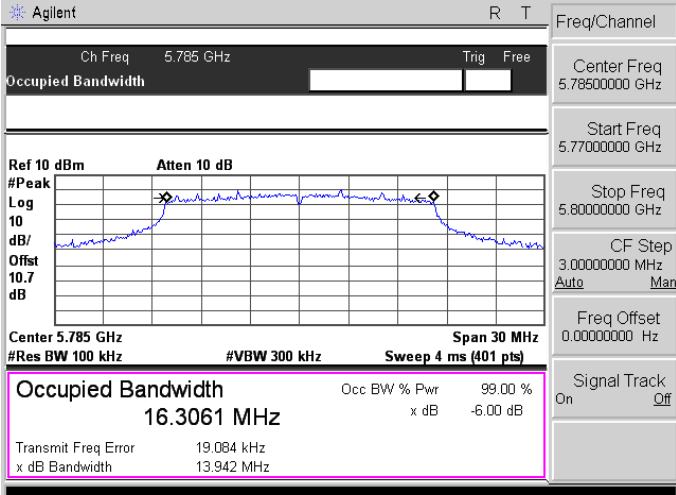
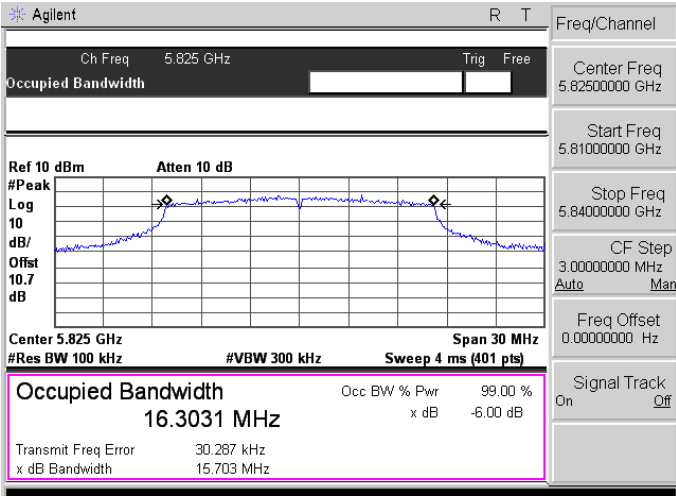
The test was performed at 3 channels.

8.5. Test Result

Model Number	PA820		
Test Item	6dB RF Bandwidth & 99 % Occupied Bandwidth		
Test Mode	Mode 2: IEEE 802.11a Link Mode		
Date of Test	09/13/2015	Test Site	TE05
Frequency (MHz)	6dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	6dB Bandwidth Limit (kHz)
5745	15.037	16.2909	> 500
5785	13.942	16.3061	> 500
5825	15.703	16.3031	> 500

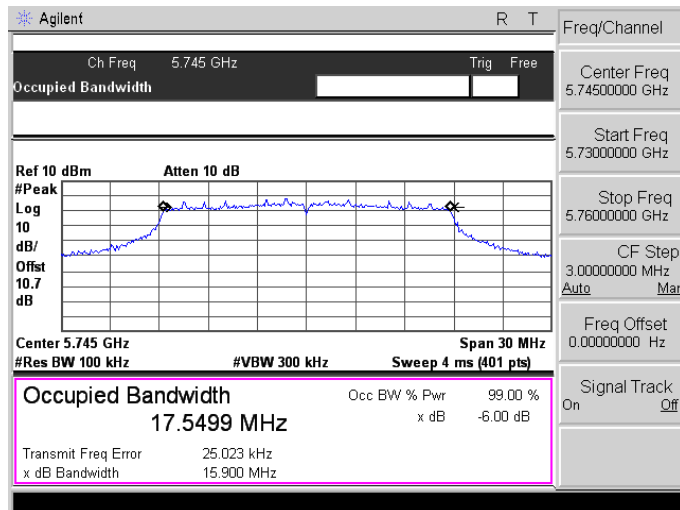
Model Number	PA820		
Test Item	6dB RF Bandwidth & 99 % Occupied Bandwidth		
Test Mode	Mode 3: IEEE 802.11n 20MHz Link Mode		
Date of Test	09/13/2015	Test Site	TE05
Frequency (MHz)	6dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	6dB Bandwidth Limit (kHz)
5745	15.900	17.5499	> 500
5785	15.660	17.5384	> 500
5825	14.011	17.5258	> 500

8.6. Test Graphs

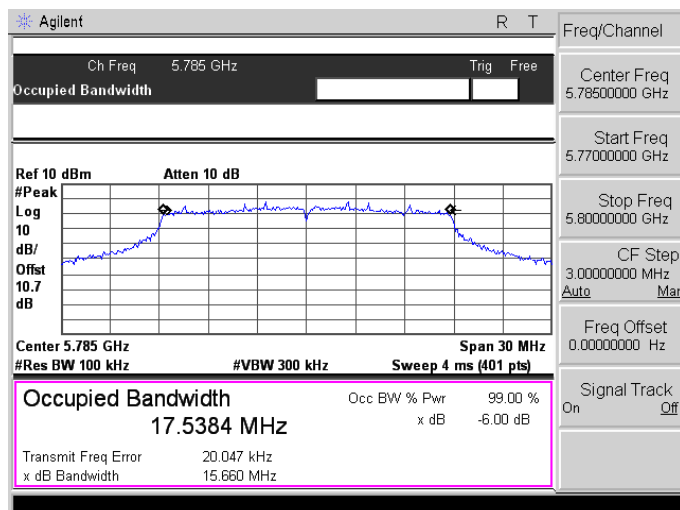
Mode 2: IEEE 802.11a Link Mode	
5745	
5785	
5825	

Mode 3: IEEE 802.11n 20MHz Link Mode

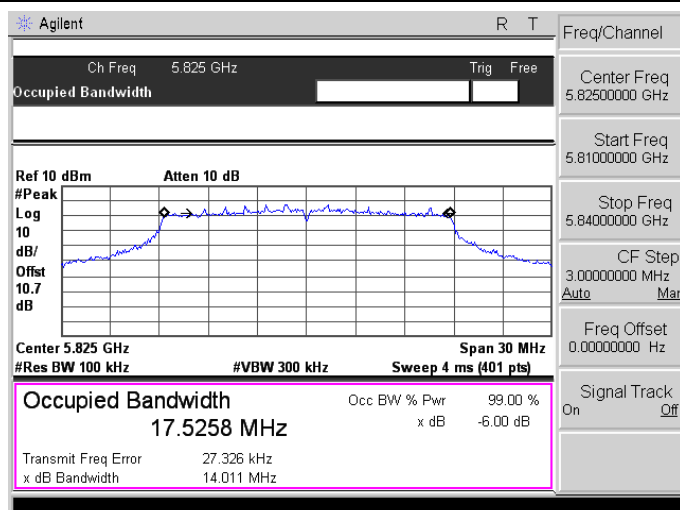
5745



5785



5825



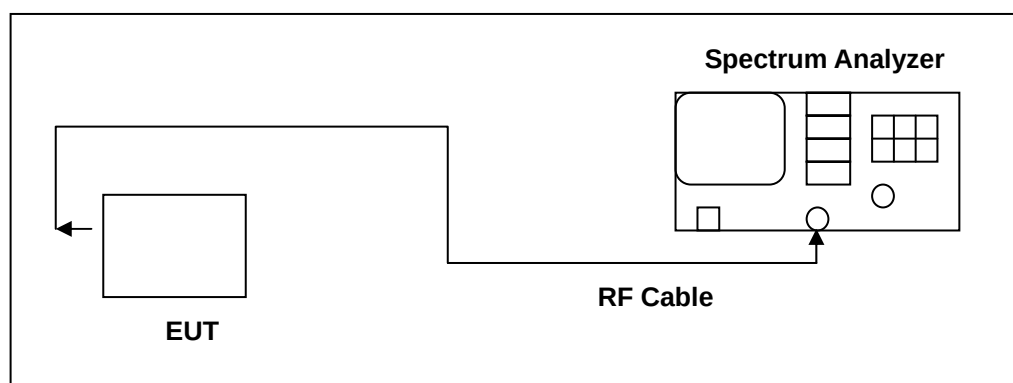
9 Peak Power Spectral Density Measurement

9.1. Limit

Conducted power spectral density

Frequency Range (MHz)	FCC Limit
5.150 ~ 5.250 GHz	11 dBm/MHz
5.250 ~ 5.350 GHz	11 dBm/MHz
5.470 ~ 5.725 GHz	11 dBm/MHz
5.725 ~ 5.850 GHz	30 dBm/500KHz

9.2. Test Setup



9.3. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Spectrum Analyzer	Agilent	E4445A	MY45300744	12/16/2014	(1)
Test Site	ATL	TE02	TE02	N.C.R.	-----

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years.

Note: N.C.R. = No Calibration Request.

9.4. Test Procedure

The test is performed in accordance with KDB789033: D02 General UNII Test Procedures New Rules v01, Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E.

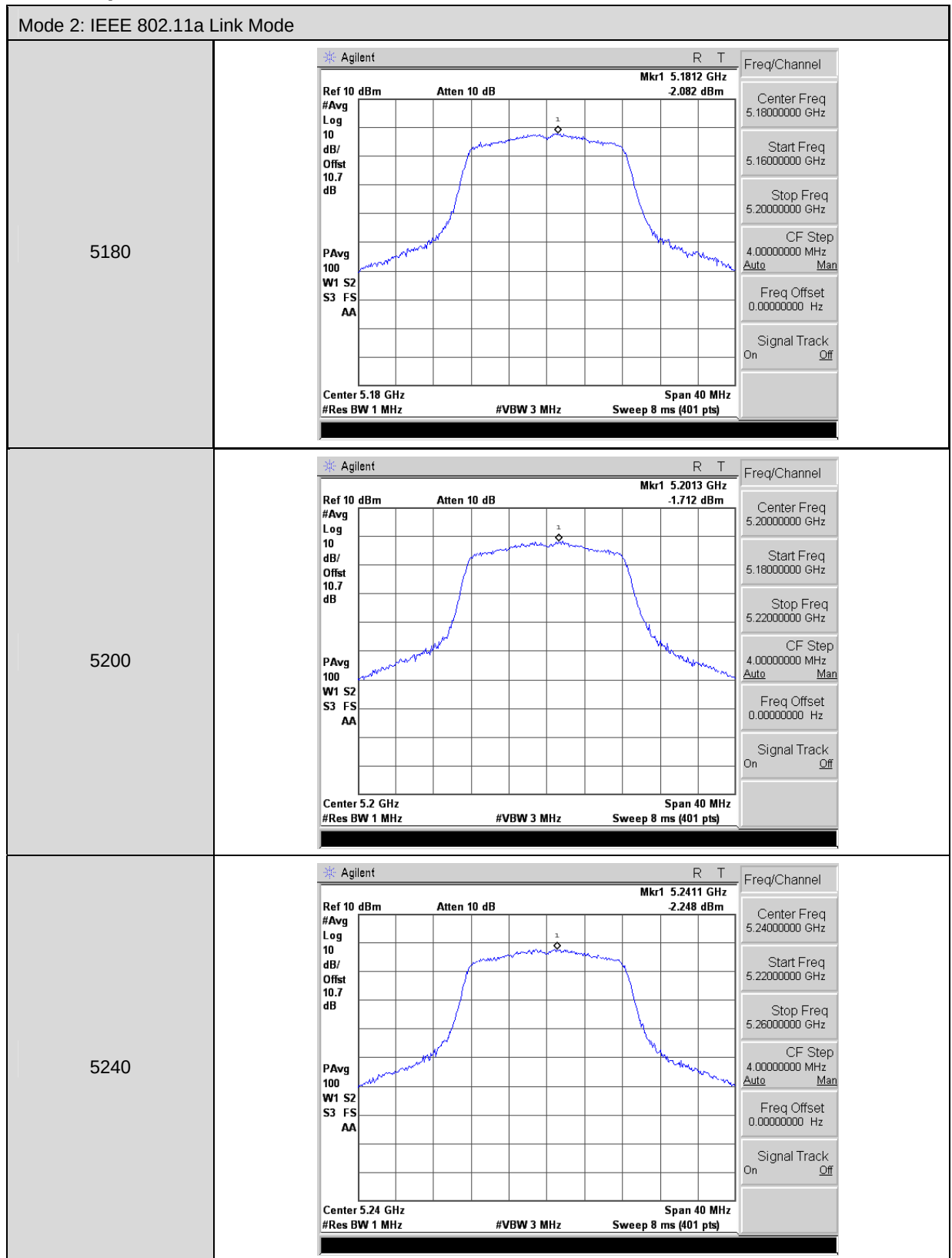
9.5. Test Result

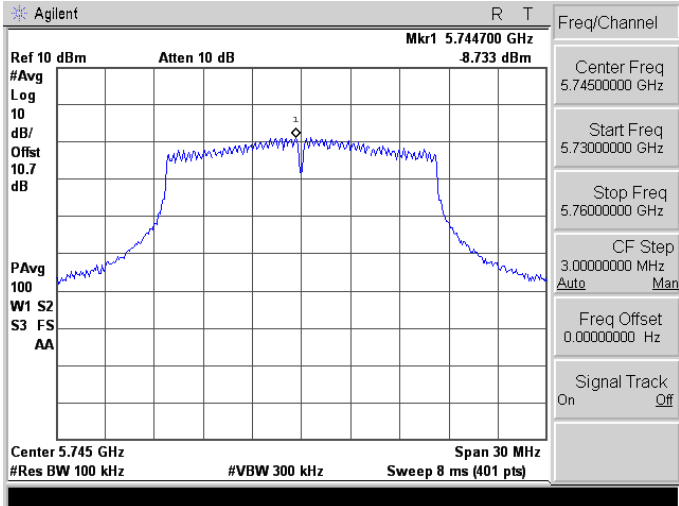
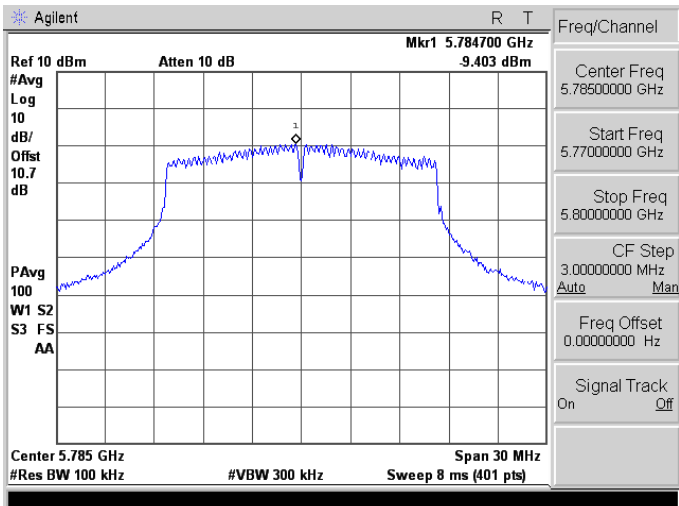
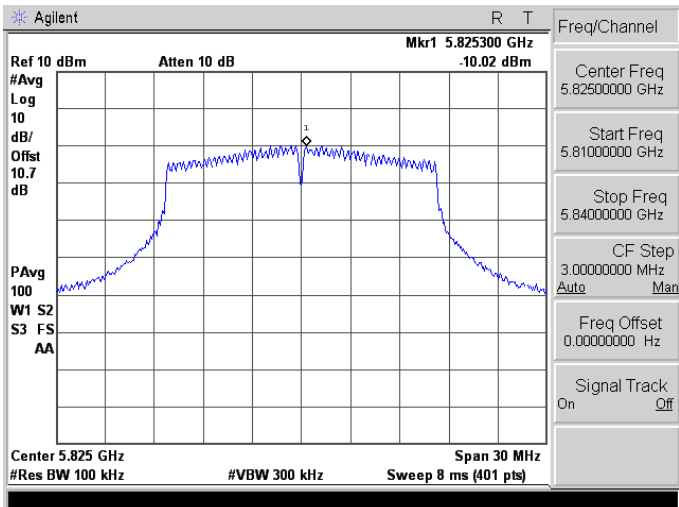
Model Number	PA820		
Test Item	Conducted power spectral density		
Test Mode	Mode 2: IEEE 802.11a Link Mode		
Date of Test	09/13/2015	Test Site	TE02
Frequency (MHz)	Power spectral density (dBm/MHz)		FCC Limit (dBm/MHz)
5180	-1.981		< 11
5200	-1.611		
5240	-2.147		
Frequency (MHz)	Power spectral density (dBm/500KHz)		FCC Limit (dBm/500KHz)
5745	-1.642		< 30
5785	-2.312		
5825	-2.929		

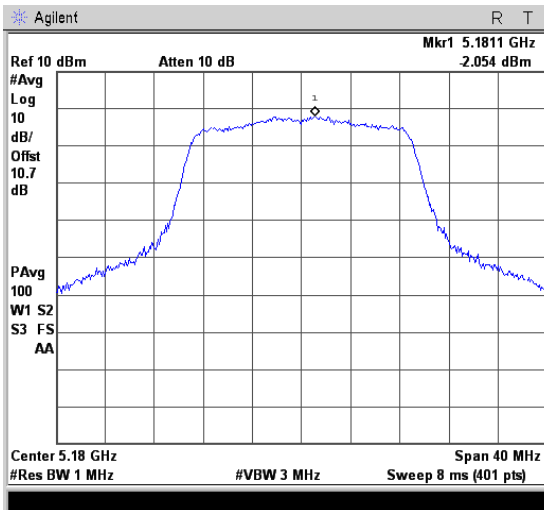
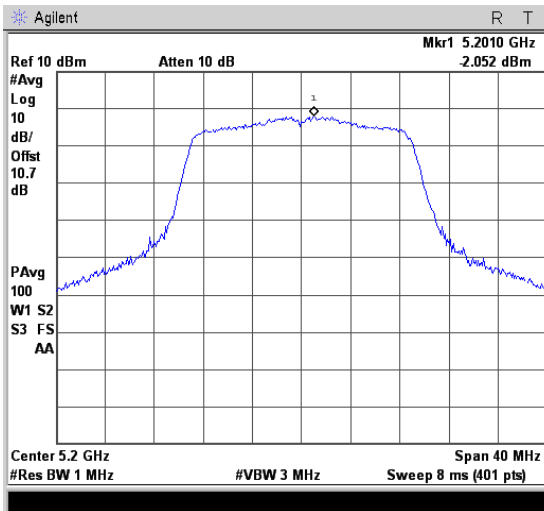
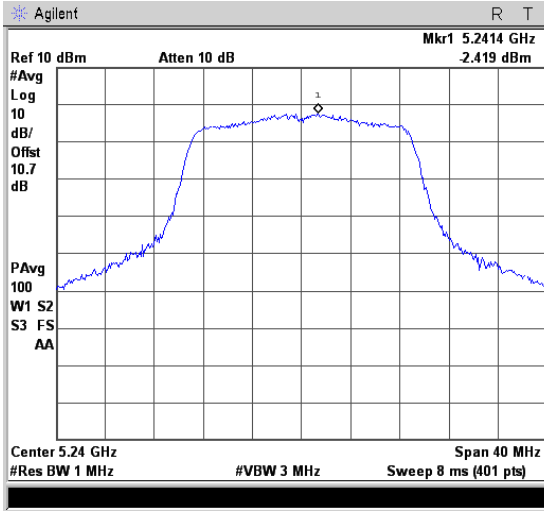
Model Number	PA820		
Test Item	Conducted power spectral density		
Test Mode	Mode 3: IEEE 802.11n 20MHz Link Mode		
Date of Test	09/13/2015	Test Site	TE02
Frequency (MHz)	Power spectral density (dBm/MHz)		FCC Limit (dBm/MHz)
5180	-1.935		< 11
5200	-1.933		
5240	-2.300		
Frequency (MHz)	Power spectral density (dBm/500KHz)		FCC Limit (dBm/500KHz)
5745	-4.591		< 30
5785	-4.461		
5825	-4.811		

Note: Method SA-2, Power density = measured result + $10\log(1/\text{duty cycle})$ = measured result + duty factor.

9.6. Test Graphs



Mode 2: IEEE 802.11a Link Mode	
5745	
5785	
5825	

Mode 3: IEEE 802.11n 20MHz Link Mode	
5180	 Agilent R T Ref 10 dBm Atten 10 dB Mkr1 5.1811 GHz -2.054 dBm #Avg Log 10 dB/Offset 10.7 dB PAvg 100 W1 S2 S3 FS AA Center 5.18 GHz Span 40 MHz #Res BW 1 MHz #VBW 3 MHz Sweep 8 ms (401 pts) Freq/Channel Center Freq 5.18000000 GHz Start Freq 5.16000000 GHz Stop Freq 5.20000000 GHz CF Step 4.00000000 MHz Auto Man Freq Offset 0.00000000 Hz Signal Track On Off
5200	 Agilent R T Ref 10 dBm Atten 10 dB Mkr1 5.2010 GHz -2.052 dBm #Avg Log 10 dB/Offset 10.7 dB PAvg 100 W1 S2 S3 FS AA Center 5.2 GHz Span 40 MHz #Res BW 1 MHz #VBW 3 MHz Sweep 8 ms (401 pts) Freq/Channel Center Freq 5.20000000 GHz Start Freq 5.18000000 GHz Stop Freq 5.22000000 GHz CF Step 4.00000000 MHz Auto Man Freq Offset 0.00000000 Hz Signal Track On Off
5240	 Agilent R T Ref 10 dBm Atten 10 dB Mkr1 5.2414 GHz -2.419 dBm #Avg Log 10 dB/Offset 10.7 dB PAvg 100 W1 S2 S3 FS AA Center 5.24 GHz Span 40 MHz #Res BW 1 MHz #VBW 3 MHz Sweep 8 ms (401 pts) Freq/Channel Center Freq 5.24000000 GHz Start Freq 5.22000000 GHz Stop Freq 5.26000000 GHz CF Step 4.00000000 MHz Auto Man Freq Offset 0.00000000 Hz Signal Track On Off

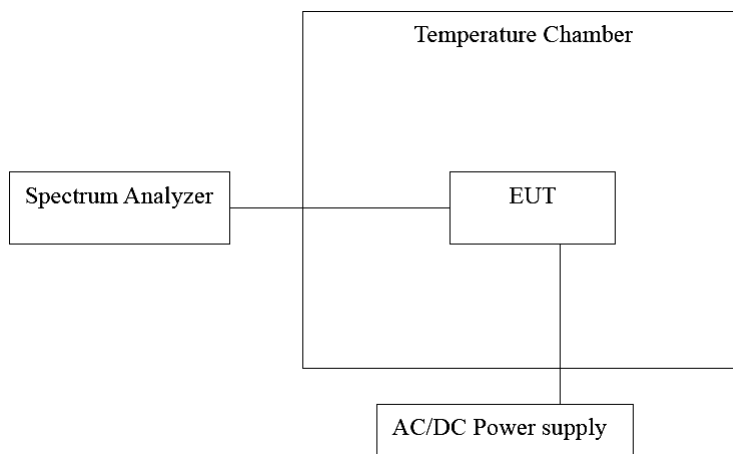
Mode 3: IEEE 802.11n 20MHz Link Mode	
5745	
5785	
5825	

10 Frequency Stability Measurement

10.1. Limit

The frequency tolerance of the carrier signal shall be maintained within the band of operation frequency over a temperature variation of –30 degrees to 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

10.2. Test Setup



10.3. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Remark
Spectrum Analyzer	Agilent	E4408B	MY45107753	07/27/2015	(1)
Temperature & Humidity Chamber	TAICHY	MHU-225LA	980729	04/27/2015	(1)
Test Site	ATL	TE02	TE02	N.C.R.	-----

Remark: (1) Calibration period 1 year. (2) Calibration period 2 years.

Note: N.C.R. = No Calibration Request.

10.4. Test Procedure

1. The EUT was placed inside the environmental test chamber and powered by nominal AC/DC voltage.
2. Turn the EUT on and couple its output to a spectrum analyzer.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize.
5. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
6. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

10.5. Test Result

Temperature Variations

Model Number	PA820					
Test Item	Frequency Stability					
Date of Test	03/25/2015					
Frequency	Temp. (°C)	Voltage (Vdc)	Measured Freq. (MHz)	Delta Freq. (Hz)	Tolerance (ppm)	Result (Pass/Fail)
5200 MHz	-20	3.70	5200.0002	200	0.038	Pass
	-10		5200.0085	8500	1.635	Pass
	0		5200.0186	18600	3.577	Pass
	10		5200.0228	22800	4.385	Pass
	20		5200.0225	22500	4.327	Pass
	30		5200.022	22000	4.231	Pass
	40		5200.0249	24900	4.788	Pass
	50		5200.0425	42500	8.173	Pass
	60		5200.0554	55400	10.654	Pass
5785 MHz	-20	3.70	5785.0098	9800	1.694	Pass
	-10		5785.0161	16100	2.783	Pass
	0		5785.0308	30800	5.324	Pass
	10		5785.0382	38200	6.603	Pass
	20		5785.024	24000	4.149	Pass
	30		5785.0009	900	0.156	Pass
	40		5785.0092	9200	1.590	Pass
	50		5785.02	20000	3.457	Pass
	60		5785.0255	25500	4.408	Pass

Voltage Variations

Model Number	PA820					
Test Item	Frequency Stability					
Date of Test	03/25/2015					
Frequency	Temp. (°C)	Voltage (Vac)	Measured Freq. (MHz)	Delta Freq. (Hz)	Tolerance (ppm)	Result (Pass/Fail)
5200 MHz	20	4.25	5200.0038	3800	0.731	Pass
		3.70	5200.0161	16100	3.096	Pass
		3.50	5200.0235	23500	4.519	Pass
5785 MHz	20	4.25	5785.0267	26700	4.615	Pass
		3.70	5785.037	37000	6.396	Pass
		3.50	5785.058	58000	10.026	Pass

Note: The manufacturer's frequency stability specification is better than 20ppm.

Note 2: The EUT operating temperature is -20°C ~ 60°C.

11 Antenna Requirement

11.1. Limit

For intentional device, according to 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And According to 15.407 (a), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

11.2. Antenna Connector Construction

The antenna used in this product is FPCB Antenna. And the maximum Gain of this antenna is only 3.3 dBi.