FCC TEST REPORT

For

ENSAMBLADORA Y DISTRIBUIDORA DE TECNOLOGIA S.A.

4G Smart phone Athos Pro

Model No.: QA5616

Additional Model No.: WF5003

Prepared for	:	ENSAMBLADORA Y DISTRIBUIDORA DE TECNOLOGIA S.A.
Address	:	OFICINA 440, EDIFICIO TRADE BUILDING, AV. JOAQUIN ORRANTIA Y LEOPOLDO BENITEZ, GUAYAQUIL, Ecuador
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Date of receipt of test sample	:	June 13, 2016
Number of tested samples	:	1
Serial number	:	Prototype
Date of Test	:	June 13, 2016~July 02, 2016
Date of Report	:	July 02, 2016

FCC TEST REPORT
FCC CFR 47 PART 15 C(15.247): 2015

Report Reference No.	**:**	**LCS1606141030E**
Date of Issue	:	July 02, 2016
Testing Laboratory Name.....	**:**	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address	:	1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China
Testing Location/ Procedure.....	:	Full application of Harmonised standards ■ Partial application of Harmonised standards ☐ Other standard testing method ☐
Applicant's Name.....	**:**	**ENSAMBLADORA Y DISTRIBUIDORA DE TECNOLOGIA S.A.**
Address	:	OFICINA 440, EDIFICIO TRADE BUILDING, AV. JOAQUIN ORRANTIA Y LEOPOLDO BENITEZ, GUAYAQUIL, Ecuador
Test Specification		
Standard	:	FCC CFR 47 PART 15 C(15.247): 2015
Test Report Form No.....	**:**	LCSEMC-1.0
TRF Originator	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF	:	Dated 2011-03

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Test Item Description.	**:**	**4G Smart phone Athos Pro**
Trade Mark	:	QUADE
Model/ Type reference.....	:	QA5616
Ratings	:	DC 3.7V by battery(2000mAh); Charging Voltage: DC 5V, 1A
Result	:	**Positive**

Compiled by:	Supervised by:	Approved by:
Jacky Li	Glin Lu	Gavin Liang
Jacky Li/ File administrators	Glin Lu/ Technique principal	Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : LCS1606141030E	July 02, 2016 Date of issue

Type / Model.....	: QA5616
EUT.....	: 4G Smart phone Athos Pro
Applicant.....	**: ENSAMBLADORA Y DISTRIBUIDORA DE TECNOLOGIA S.A.**
Address.....	: OFICINA 440, EDIFICIO TRADE BUILDING, AV. JOAQUIN ORRANTIA Y LEOPOLDO BENITEZ, GUAYAQUIL, Ecuador
Telephone.....	: +59345103027
Fax.....	: +59342004140-104
Manufacturer.....	**: Neway Communication Co., Limited**
Address.....	: 15/b—15/F Cheuk Nang Plaza 250 Hennessy Road, Hong Kong
Telephone.....	: 00852-21349819
Fax.....	: 00852-30697659
Factory.....	**: Neway Communication Co., Limited**
Address.....	: 15/b—15/F Cheuk Nang Plaza 250 Hennessy Road, Hong Kong
Telephone.....	: 00852-21349819
Fax.....	: 00852-30697659

Test Result	**Positive**

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Revision	Issue Date	Revisions	Revised By
00	2016-06-30	Initial Issue	Gavin Liang

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1. GENERAL INFORMATION

1.1. Description of Device (EUT)

Name of EUT	4G Smart phone Athos Pro
Model Number	QA5616, WF5003
Model Declaration	PCB board, structure and internal of these model(s) are the same, So no additional models were tested
Test Model	QA5616
Hardware version	1490SF_MMI_V01
Software version	WD_B258
Android version	5.1
GSM/EDGE/GPRS Operation Frequency Band	GSM850/PCS1900/GPRS850/GPRS1900/EDGE850/EDGE1900
UMTS Operation Frequency Band	UMTS FDD Band II/V
LTE Operation Frequency Band	LTE FDD band 2, FDD band 4
GSM/EDGE/GPRS	Supported GSM/GPRS/EDGE
GSM Release Version	R99
GSM/EDGE/GPRS Power Class	GSM850:Power Class 4/ PCS1900:Power Class 1
GPRS/EDGE Multislot Class	GPRS/EDGE: Multi-slot Class 12
GPRS operation mode	Class B
WCDMA Release Version	R99
HSDPA Release Version	Release 10
HSUPA Release Version	Release 6
DC-HSUPA Release Version	Not Supported
LTE Release Version	R8
LTE/UMTS Power Class	Level 3
WLAN	Supported 802.11b/802.11g/802.11n
WLAN Modilation Type	GMSK for GSM/GPRS, 8-PSK for EDGE,QPSK for UMTS, QPSK, 16QAM for LTE
WLAN FCC Operation frequency	IEEE 802.11b:2412-2462MHz IEEE 802.11g:2412-2462MHz IEEE 802.11n HT20:2412-2462MHz IEEE 802.11n HT40:2422-2452MHz
WLAN FCC Modulation Type	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK) IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK,BPSK)
Bluetooth	Supported BT 4.0/BT 3.0+EDR
Bluetooth Operation frequency	2402MHz-2480MHz
Bluetooth Modulation Type	GFSK,π/4DQPSK, 8DPSK
GPS function	Supported and only RX
Antenna Type	PIFA Antenna
Antenna Gain	1.12dBi (max.) For GSM 850; 1.12dBi (max.) For PCS 1900; 1.12dBi (max.) For WCDMA Band II 1.12dBi (max.) For WCDMA Band V 1.12dBi (max.) For LTE FDD Band 2; 1.12dBi (max.) For LTE FDD Band 4 -0.5 dBi (max.) For WIFI/BT
Extreme temp. Tolerance	-30°C to +50°C
Extreme vol. Limits	3.40VDC to 4.20VDC (nominal: 3.70VDC)

1.2. Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate
--	AC Adapter	QA5616	--	VOC

1.3. External I/O Cable

I/O Port Description	Quantity	Cable
USB	1	Shielded, 0.8m
Earphone	1	1.2m

1.4. Description of Test Facility

Site Description
EMC Lab. : CNAS Registration Number. is L4595.
FCC Registration Number. is 899208.
Industry Canada Registration Number. is 9642A-1.
VCCI Registration Number. is C-4260 and R-3804.
ESMD Registration Number. is ARCB0108.
UL Registration Number. is 100571-492.
TUV SUD Registration Number. is SCN1081.
TUV RH Registration Number. is UA 50296516-001

There is one 3m semi-anechoic chamber and one line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.10:2013, CISPR 22/EN 55022 and CISPR16-1-4:2010 SVSWR requirements.

1.5. Statement of the Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

1.6. Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	±3.10dB	(1)
		30MHz~200MHz	±2.96dB	(1)
		200MHz~1000MHz	±3.10dB	(1)
		1GHz~26.5GHz	±3.80dB	(1)
		26.5GHz~40GHz	±3.90dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	±1.63dB	(1)
Power disturbance	:	30MHz~300MHz	±1.60dB	(1)

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.7. Description of Test Modes

The EUT has been tested under operating condition.

This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.

Worst-case mode and channel used for 150 kHz-30 MHz power line conducted emissions was the mode and channel with the highest output power, which was determined to be 802.11b mode (Low Channel).

Worst-case mode and channel used for 9kHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be 802.11b mode(Low Channel).

Pre-test AC conducted emission at both power adapter and charge from PC mode, recorded worst case.

Pre-test AC conducted emission at both voltage AC 120V/60Hz and AC 240V/50Hz, recorded worst case.

Worst-Case data rates were utilized from preliminary testing of the Chipset, worst-case data rates used during the testing are as follows:
802.11b Mode : 1 Mbps, DSSS.
802.11g Mode : 6 Mbps, OFDM.
802.11n Mode HT20:.MCS0, OFDM.
802.11n Mode HT20:.MCS15, OFDM.
BT V4.0 : 1 Mbps, GFSK.

Note: The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

Channel List & Frequency

802.11b/g/n(HT20)

Frequency Band	Channel No.	Frequency(MHz)	Channel No.	Frequency(MHz)
2412~2462MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437	--	--

802.11n(HT40)

Frequency Band	Channel No.	Frequency(MHz)	Channel No.	Frequency(MHz)
2422~2452MHz	1	--	7	2442
	2	--	8	2447
	3	2422	9	2452
	4	2427	10	--
	5	2432	11	--
	6	2437	--	--

BT V4.0

Mode of Operations	Frequency Range (MHz)	Data Rate (Mbps)
GFSK	2402	1
	2440	1
	2480	1
For Conducted Emission		
Test Mode	TX Mode(Continuously)	
For Radiated Emission		
Test Mode	TX Mode(Continuously)	

2. TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10: 2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen LCS Compliance Testing Laboratory Ltd.

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to FCC's request, Test Procedure KDB558074 D01 DTS Meas. Guidance v03r05 is required to be used for this kind of FCC 15.247 digital modulation device.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

2.3. General Test Procedures

2.3.1 Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013

3. SYSTEM TEST CONFIGURATION

3.1. Justification

The system was configured for testing in a continuous transmits condition.

3.2. EUT Exercise Software

N/A

3.3. Special Accessories

N/A

3.4. Block Diagram/Schematics

Please refer to the related document

3.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6. Test Setup

Please refer to the test setup photo.

4. SUMMARY OF TEST RESULTS

Applied Standard: FCC Part 15 Subpart C		
FCC Rules	**Description of Test**	**Result**
§15.247(b)	Maximum Conducted Output Power	Compliant
§15.247(e)	Power Spectral Density	Compliant
§15.247(a)(2)	6dB Bandwidth	Compliant
§15.247(a)	Occupied Bandwidth	Compliant
§15.209, §15.247(d)	Radiated and Conducted Spurious Emissions	Compliant
§15.205	Emissions at Restricted Band	Compliant
§15.207(a)	Conducted Emissions	Compliant
§15.203	Antenna Requirements	Compliant

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5. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Cal Date	Due Date
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1	Power Sensor	R&S	NRV-Z51	100458	2016-06-18	2017-06-17
2	Power Sensor	R&S	NRV-Z32	10057	2016-06-18	2017-06-17
3	Power Meter	R&S	NRVS	100444	2016-06-18	2017-06-17
4	DC Filter	MPE	23872C	N/A	2016-06-18	2017-06-17
5	RF Cable	Harbour Industries	1452	N/A	2016-06-18	2017-06-17
6	SMA Connector	Harbour Industries	9625	N/A	2016-06-18	2017-06-17
7	Spectrum Analyzer	Agilent	N9020A	MY50510140	2015-10-27	2016-10-26
8	Signal analyzer	Agilent	E4448A(External mixers to	US44300469	2016-06-16	2017-06-15
9	RF Cable	Hubersuhne	Sucoflex104	FP2RX2	2016-06-18	2017-06-17
10	3m Semi Anechoic	SIDT FRANKONI	SAC-3M	03CH03-HY	2016-06-18	2017-06-17
11	Amplifier	SCHAFFNER	COA9231A	18667	2016-06-18	2017-06-17
12	Amplifier	Agilent	8449B	3008A02120	2016-06-16	2017-06-15
13	Amplifier	MITEQ	AMF-6F-260400	9121372	2016-06-16	2017-06-15
14	Loop Antenna	R&S	HFH2-Z2	860004/001	2016-06-18	2017-06-17
15	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2016-06-10	2017-06-09
16	Horn Antenna	EMCO	3115	6741	2016-06-10	2017-06-09
17	Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	2016-06-10	2017-06-09
18	RF Cable-R03m	Jye Bao	RG142	CB021	2016-06-18	2017-06-17
19	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2016-06-18	2017-06-17
20	EMI Test Receiver	ROHDE & SCHWARZ	ESCI	101142	2016-06-18	2017-06-17
21	EMI Test Receiver	ROHDE & SCHWARZ	ESPI	101840	2016-06-18	2017-06-17
22	Artificial Mains	ROHDE & SCHWARZ	ENV216	101288	2016-06-18	2017-06-17
23	EMI Test Software	AUDIX	E3	N/A	2016-06-18	2017-06-17
Note: All equipment through GRGT EST calibration						

6. TEST RESULT

6.1. Maximum Conducted Output Power Measurement

6.1.1. Standard Applicable

According to §15.247(b): For systems using digital modulation in the 2400-2483.5 MHz and 5725-5850 MHz band, the limit for maximum peak conducted output power is 30dBm. The limited has to be reduced by the amount in dB that the gain of the antenna exceeds 6dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi without any corresponding reduction in transmitter peak output power.

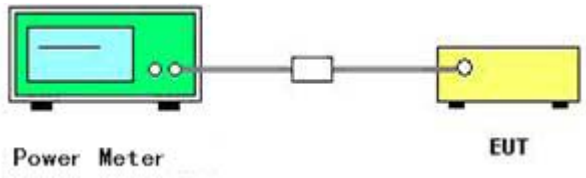
6.1.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of the power meter.

6.1.3. Test Procedures

The transmitter output (antenna port) was connected to the power meter.

6.1.4. Test Setup Layout



6.1.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

6.1.6. Test Result of Maximum Conducted Output Power

Temperature	25˚C	Humidty	60%
Test Engineer	Jacky	Configurations	802.11b/g/n/BT V4.0

802.11b				
Channel	Frequency (MHz)	Conducted Peak Power (dBm)	Max. Limit (dBm)	Result
1	2412	20.87	30	Complies
6	2437	20.78	30	Complies
11	2462	20.93	30	Complies

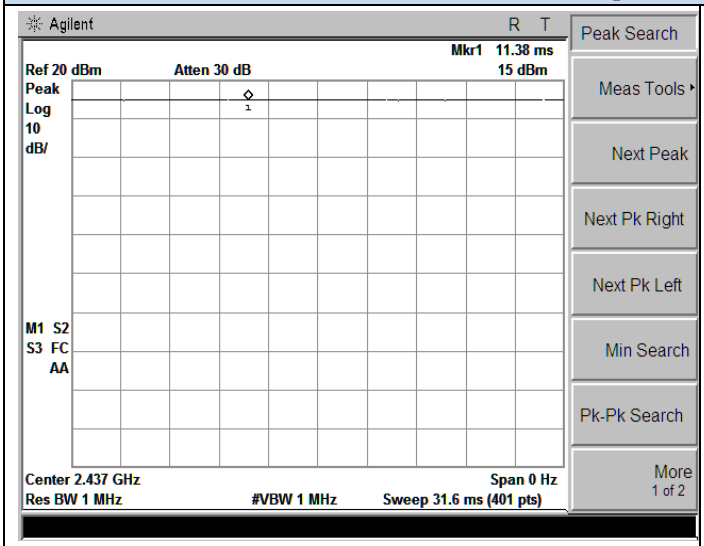
802.11g				
Channel	Frequency (MHz)	Conducted Peak Power (dBm)	Max. Limit (dBm)	Result
1	2412	17.64	30	Complies
6	2437	19.82	30	Complies
11	2462	18.15	30	Complies

802.11n HT20				
Channel	Frequency (MHz)	Conducted Peak Power (dBm)	Max. Limit (dBm)	Result
1	2412	17.56	30	Complies
6	2437	19.58	30	Complies
11	2462	17.97	30	Complies

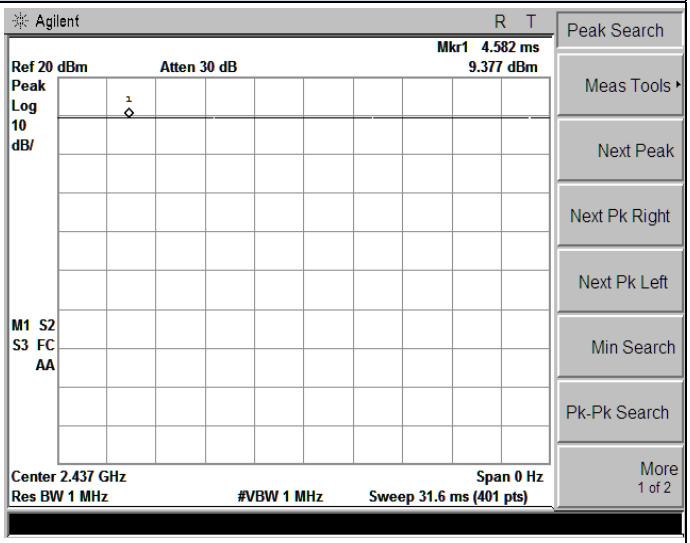
802.11n HT40				
Channel	Frequency (MHz)	Conducted Peak Power (dBm)	Max. Limit (dBm)	Result
3	2422	15.37	30	Complies
6	2437	17.89	30	Complies
9	2452	15.77	30	Complies

BT V4.0				
Channel	Frequency (MHz)	Conducted Peak Power (dBm)	Max. Limit (dBm)	Result
1	2402	-2.91	30	Complies
20	2440	-1.24	30	Complies
40	2480	-1.43	30	Complies

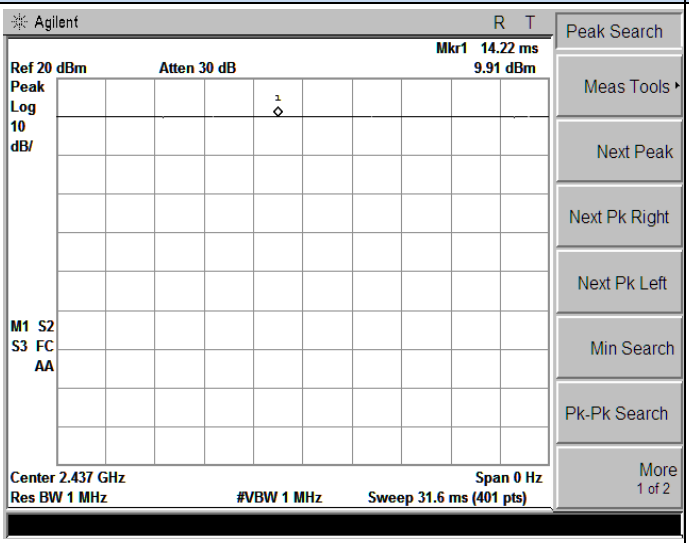
Tet plot of Duty Cycle



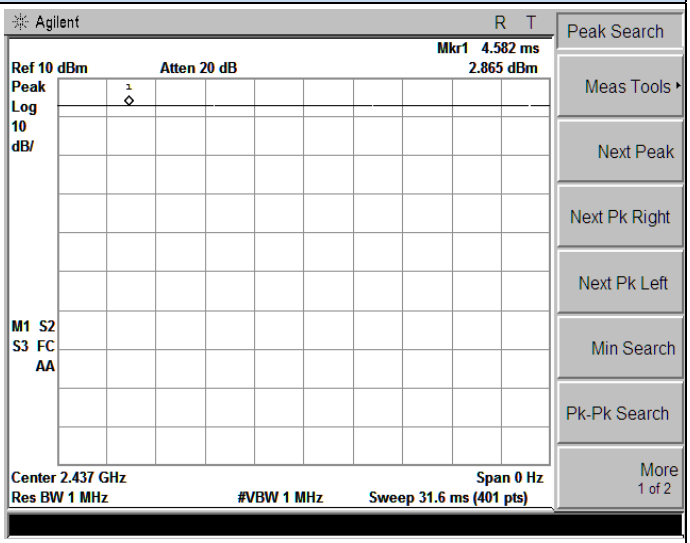
802.11b



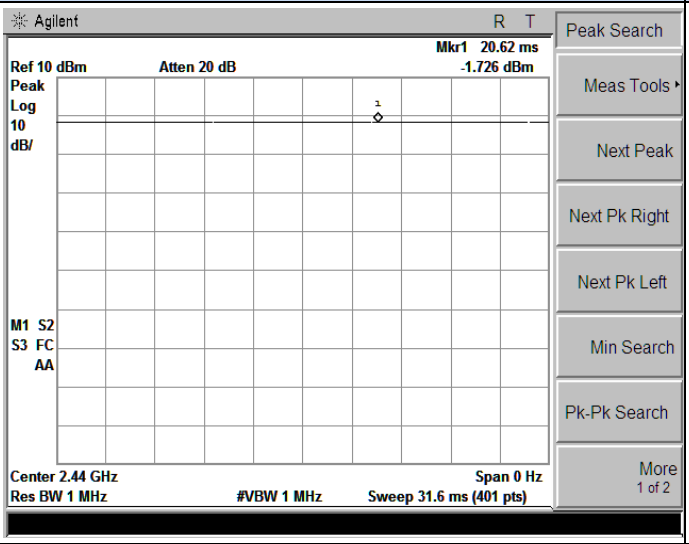
802.11g



802.11n(HT20)



802.11n(HT40)



BT LE

Note: The duty cycle is 100%

6.2. Power Spectral Density Measurement

6.2.1. Standard Applicable

According to §15.247(e): For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

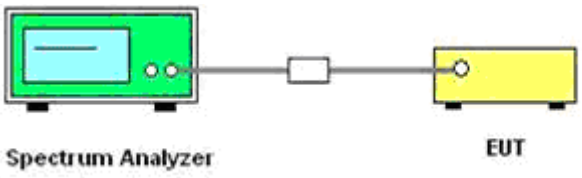
6.2.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of Spectrum Analyzer.

6.2.3. Test Procedures

1. The transmitter was connected directly to a Spectrum Analyzer through a directional couple.
2. The power was monitored at the coupler port with a Spectrum Analyzer. The power level was set to the maximum level.
3. Set the RBW, 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3*RBW
5. Set the span to 1.5 times the DTS channel bandwidth.
6. Detector = peak.
7. Sweep time = auto couple.
8. Trace mode = max hold.
9. Allow trace to fully stabilize.
10. Use the peak marker function to determine the maximum amplitude level within the RBW.
11. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

6.2.4. Test Setup Layout



6.2.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

6.2.6. Test Result of Power Spectral Density

Temperature	25˚C	Humidity	60%
Test Engineer	Jacky	Configurations	802.11b/g/n/BT V4.0

802.11b

Channel	Frequency (MHz)	Power Density (dBm/3KHz)	Max. Limit (dBm/3KHz)	Result
1	2412	-6.518	8	Complies
6	2437	-6.278	8	Complies
11	2462	-6.037	8	Complies

802.11g

Channel	Frequency (MHz)	Power Density (dBm/3KHz)	Max. Limit (dBm/3KHz)	Result
1	2412	-9.233	8	Complies
6	2437	-9.783	8	Complies
11	2462	-10.850	8	Complies

802.11n HT20

Channel	Frequency (MHz)	Power Density (dBm/3KHz)	Max. Limit (dBm/3KHz)	Result
1	2412	-11.670	8	Complies
6	2437	-9.270	8	Complies
11	2462	-11.410	8	Complies

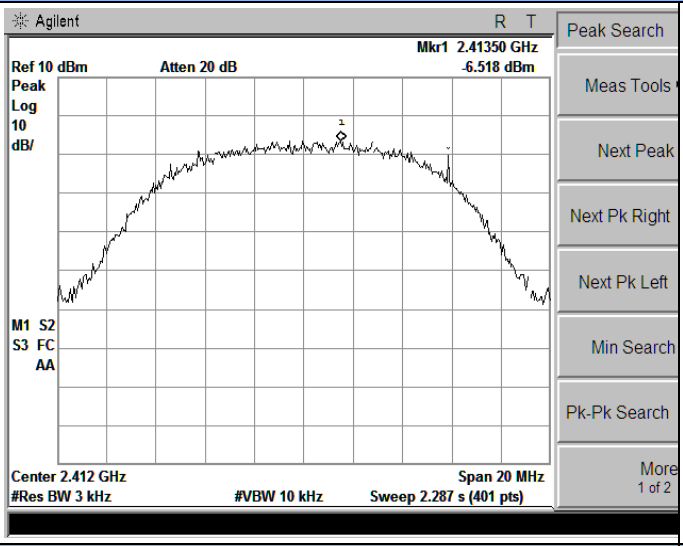
802.11n HT40

Channel	Frequency (MHz)	Power Density (dBm/3KHz)	Max. Limit (dBm/3KHz)	Result
3	2422	-16.720	8	Complies
6	2437	-13.450	8	Complies
8	2452	-15.980	8	Complies

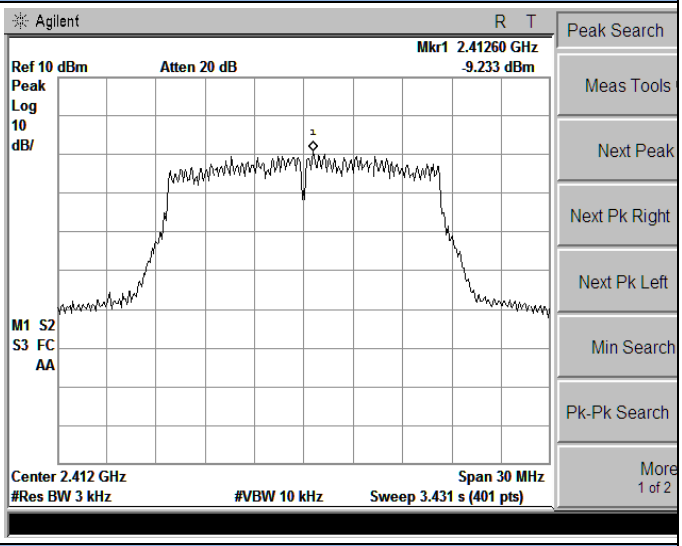
BT V4.0

Channel	Frequency (MHz)	Power Density (dBm/3KHz)	Max. Limit (dBm/3KHz)	Result
1	2402	-17.290	8	Complies
20	2440	-16.360	8	Complies
40	2480	-15.800	8	Complies

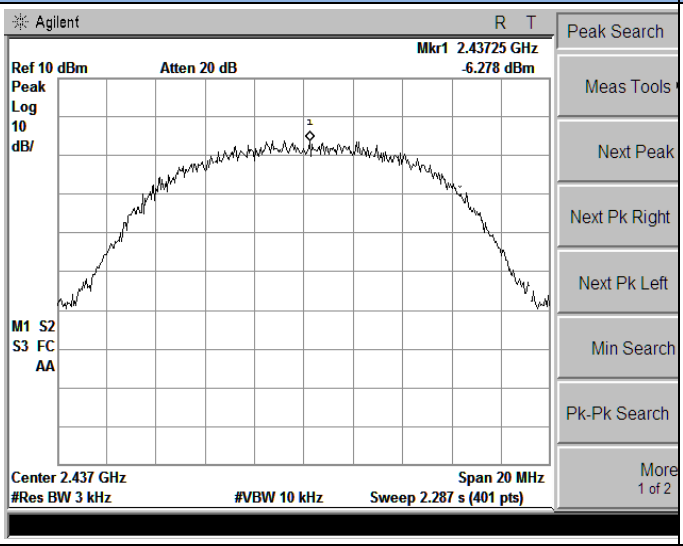
Test Plots of Power Spectral Density



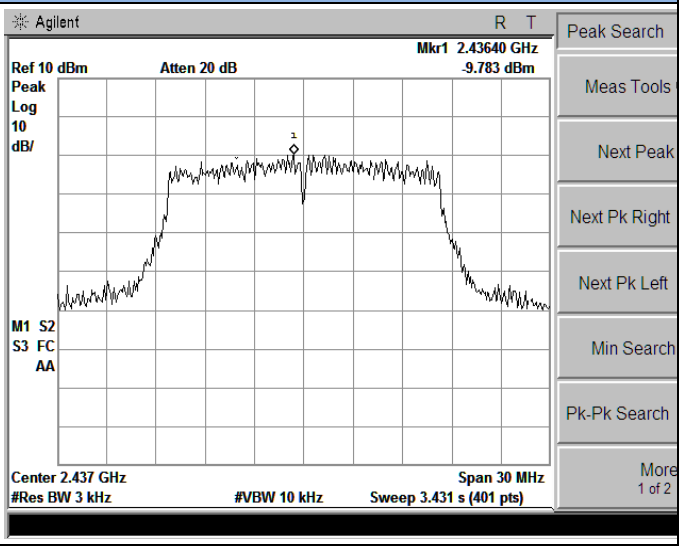
802.11b-Low Channel, 2412MHz



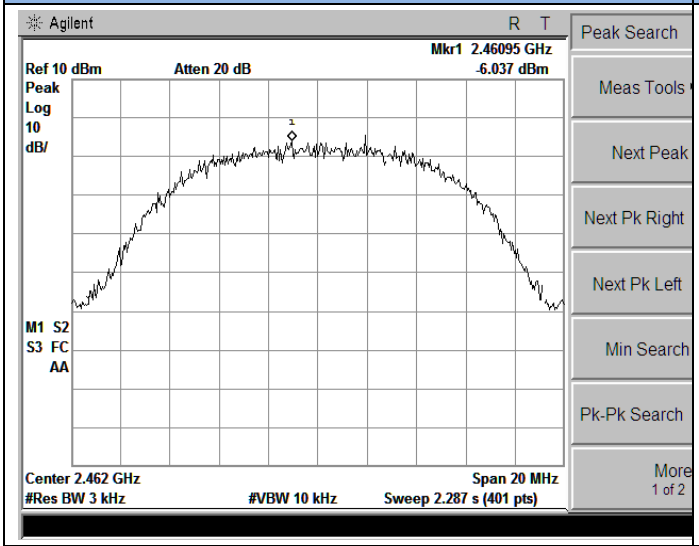
802.11g-Low Channel, 2412MHz



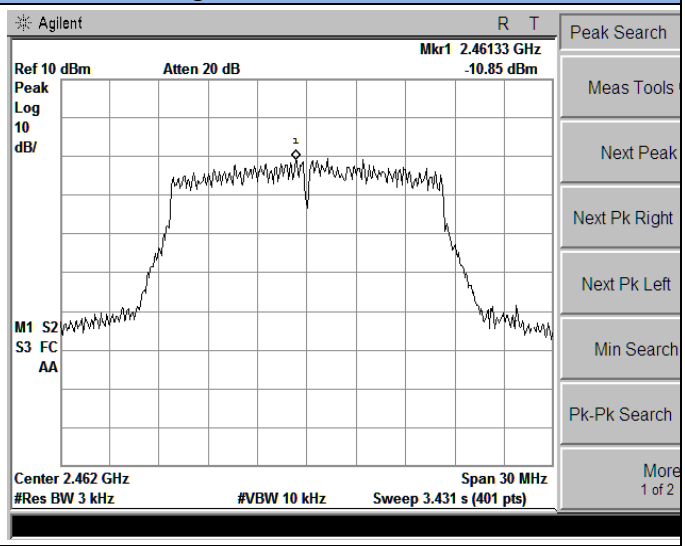
802.11b-Middle Channel, 2437MHz



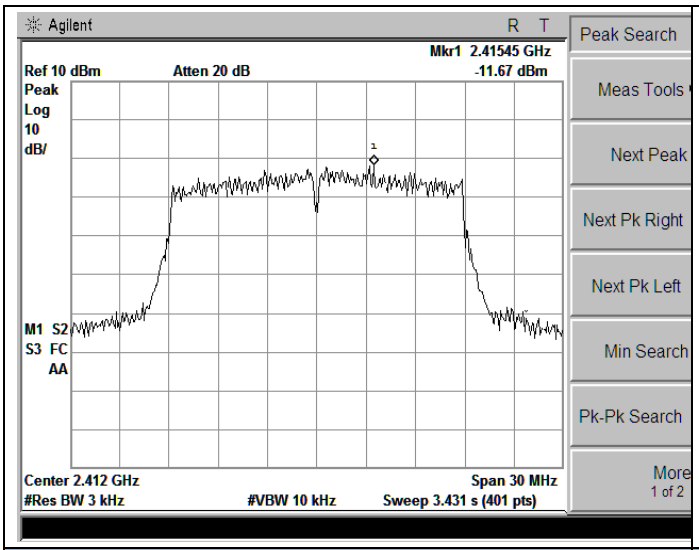
802.11g-Middle Channel, 2437MHz



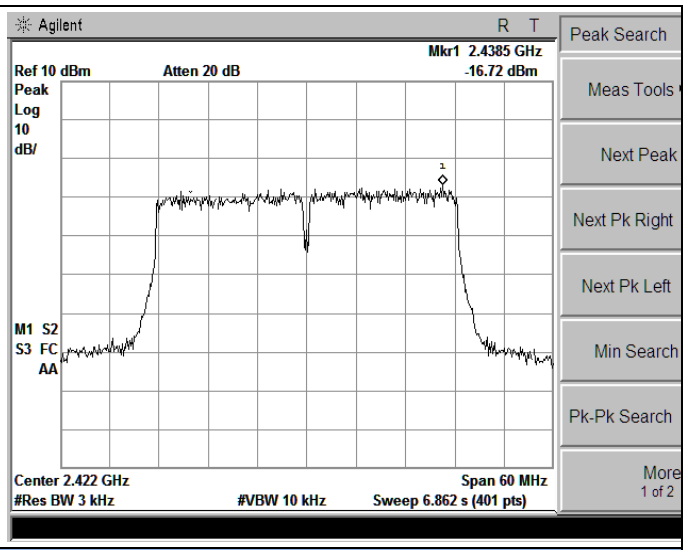
802.11b-High Channel, 2462MHz



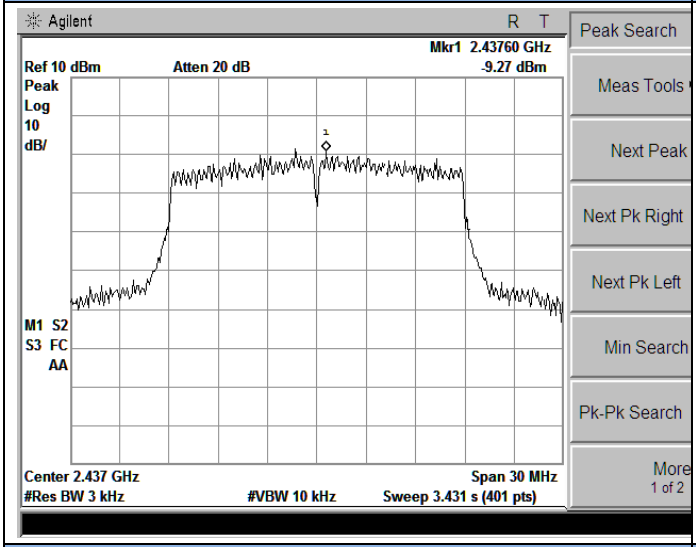
802.11g-High Channel, 2462MHz



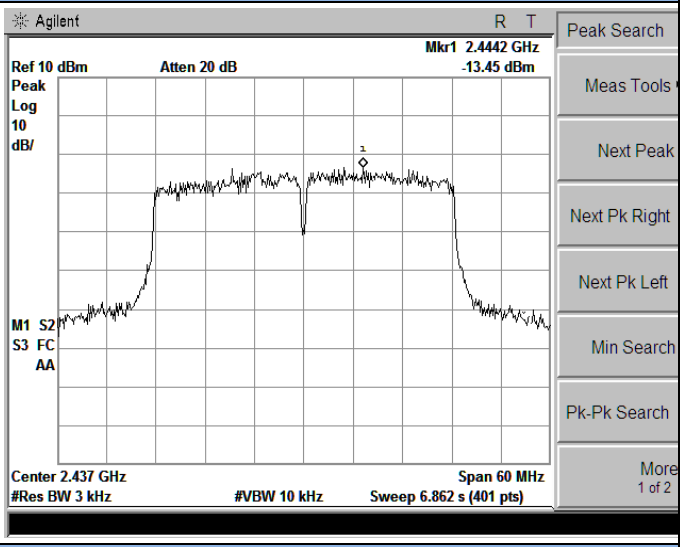
802.11n-HT20-Low Channel, 2412MHz



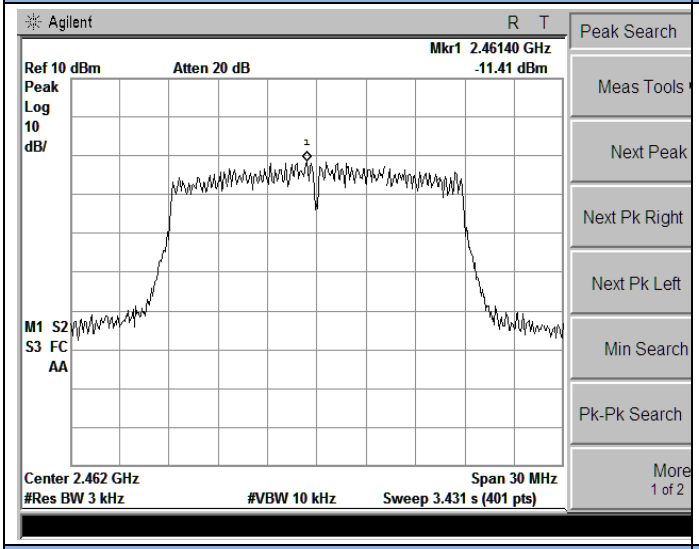
802.11n-HT40-Low Channel, 2422MHz



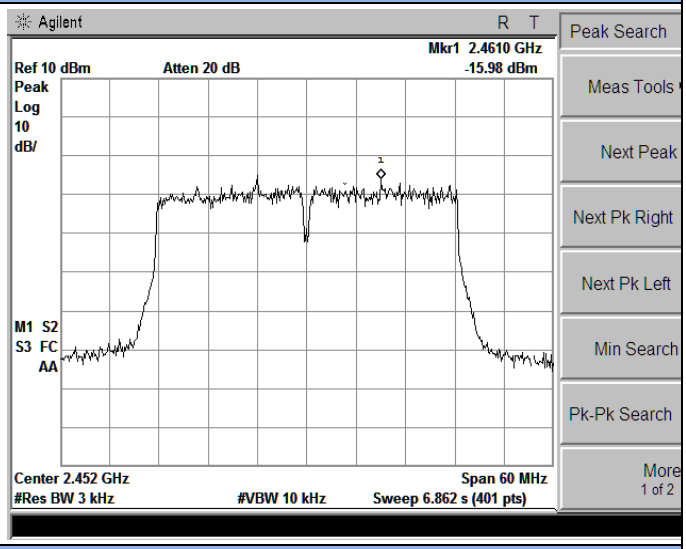
802.11n-HT20-Middle Channel, 2437MHz



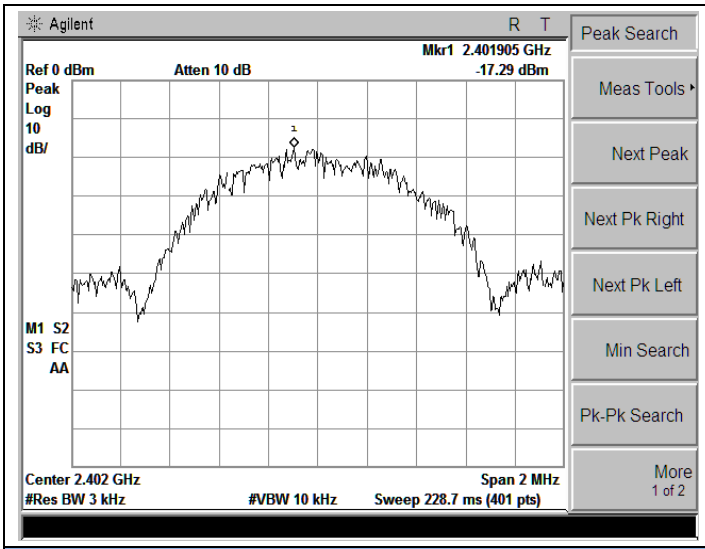
802.11n-HT40-Middle Channel, 2437MHz



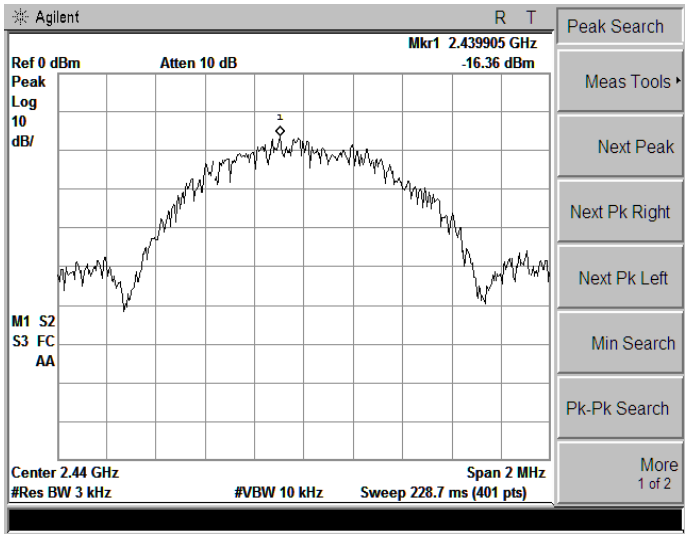
802.11n-HT20-High Channel, 2462MHz



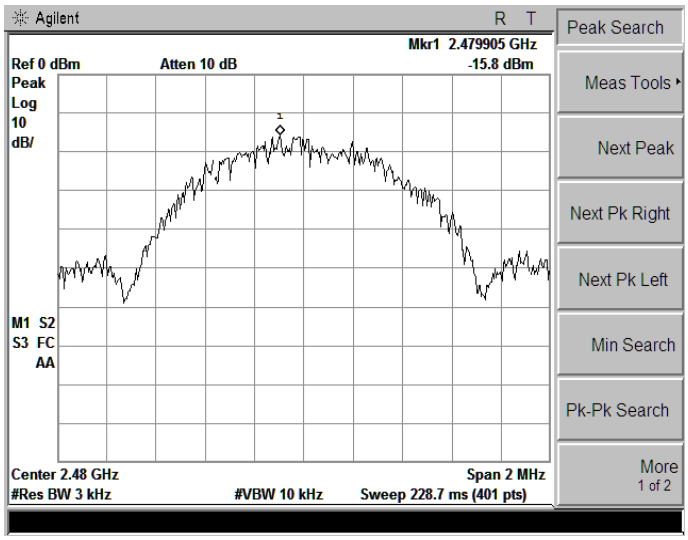
802.11n-HT40-High Channel, 2452MHz



BT V4.0-Low Channel, 2402MHz



BT V4.0-Middle Channel, 2440MHz



BT V4.0-High Channel, 2480MHz

6.3. 6 dB Spectrum Bandwidth Measurement

6.3.1. Standard Applicable

According to §15.247(a)(2): For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

6.3.2. Measuring Instruments and Setting

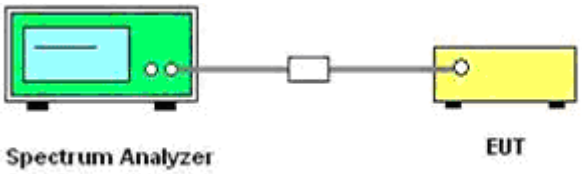
Please refer to section 6 of equipments list in this report. The following table is the setting of the Spectrum Analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> RBW
Detector	Peak
Trace	Max Hold
Sweep Time	100ms

6.3.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. The resolution bandwidth and the video bandwidth were set according to KDB558074.
3. Measured the spectrum width with power higher than 6dB below carrier.

6.3.4. Test Setup Layout



6.3.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

5.3.6. Test Result of 6dB Spectrum Bandwidth

Temperature	25˚C	Humidity	60%
Test Engineer	Jacky	Configurations	802.11b/g/n/BT V4.0

802.11b

Channel	Frequency	6dB Bandwidth (MHz)	Min. Limit (kHz)	Result
1	2412	9.337	500	Complies
6	2437	9.070	500	Complies
11	2462	9.192	500	Complies

802.11g

Channel	Frequency	6dB Bandwidth (MHz)	Min. Limit (kHz)	Result
1	2412	16.047	500	Complies
6	2437	15.779	500	Complies
11	2462	14.733	500	Complies

802.11n HT20

Channel	Frequency	6dB Bandwidth (MHz)	Min. Limit (kHz)	Result
1	2412	16.063	500	Complies
6	2437	16.249	500	Complies
11	2462	15.985	500	Complies

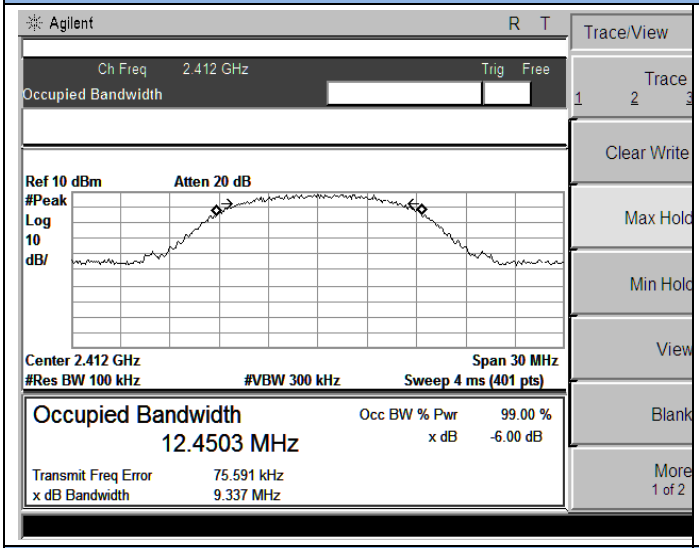
802.11n HT40

Channel	Frequency	6dB Bandwidth (MHz)	Min. Limit (kHz)	Result
3	2422	35.946	500	Complies
6	2437	35.412	500	Complies
9	2452	36.053	500	Complies

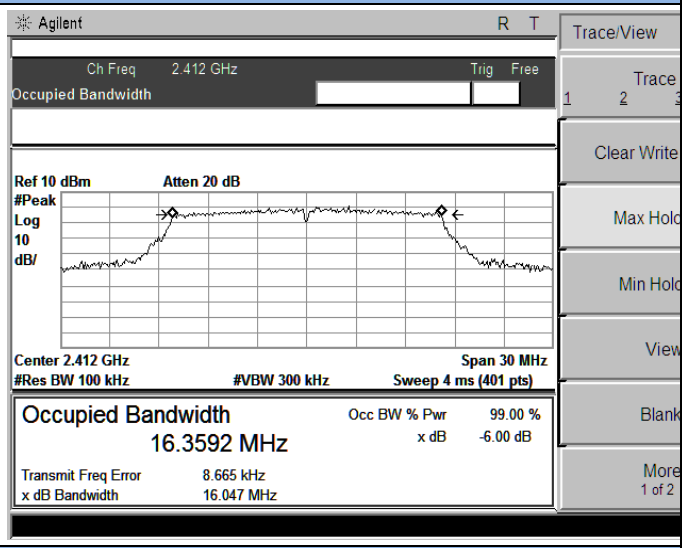
BT V4.0

Channel	Frequency	6dB Bandwidth (kHz)	Min. Limit (kHz)	Result
1	2402	668.738	500	Complies
20	2440	671.934	500	Complies
40	2480	672.467	500	Complies

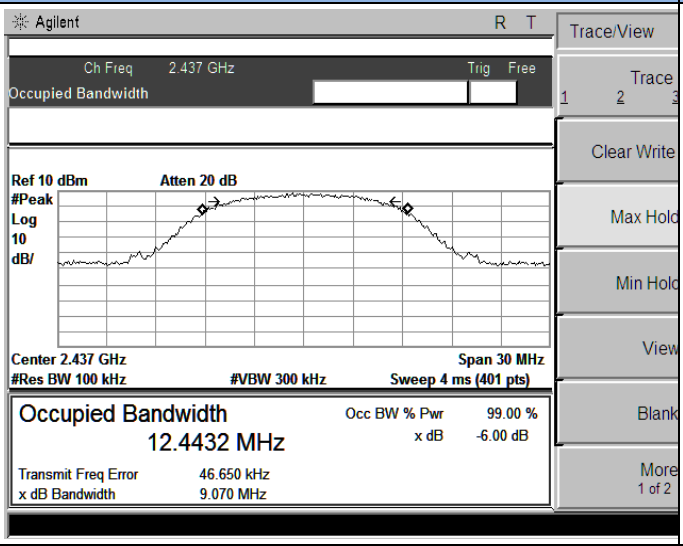
Test Plot of 6dB Spectrum Bandwidth



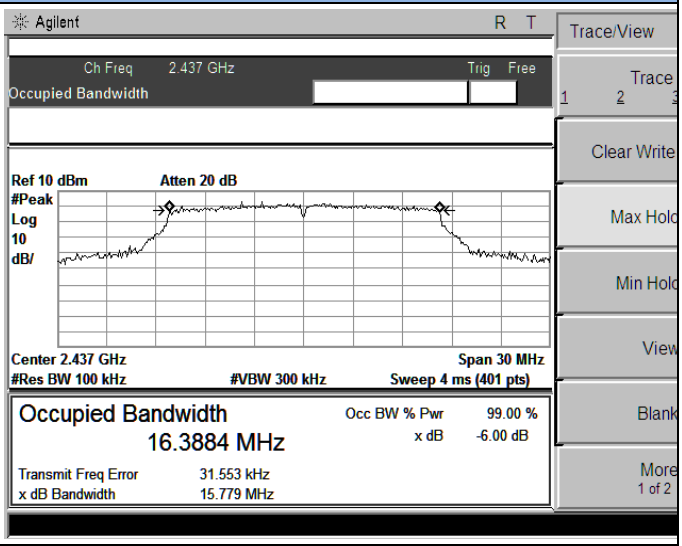
802.11b-Low Channel, 2412MHz



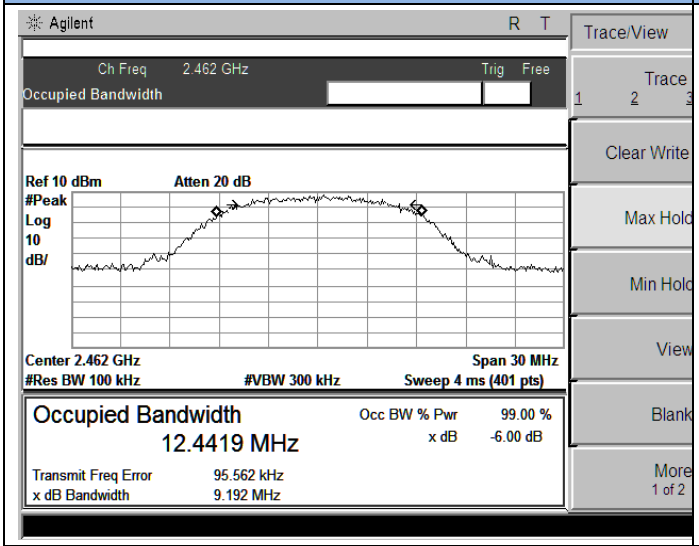
802.11g-Low Channel, 2412MHz



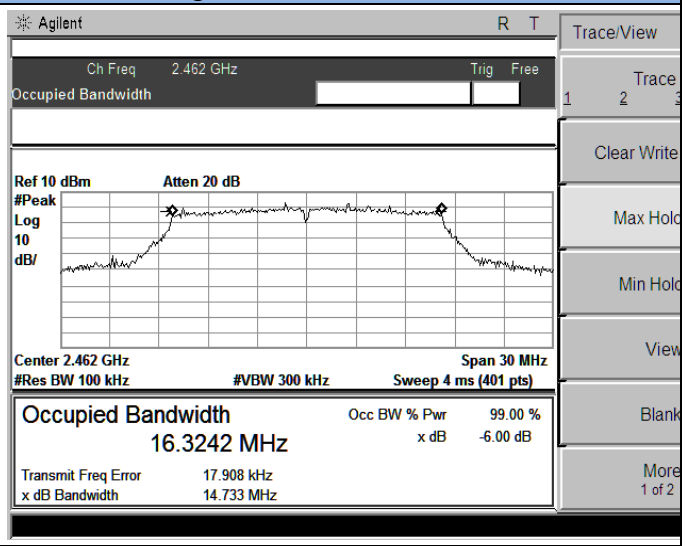
802.11b-Middle Channel, 2437MHz



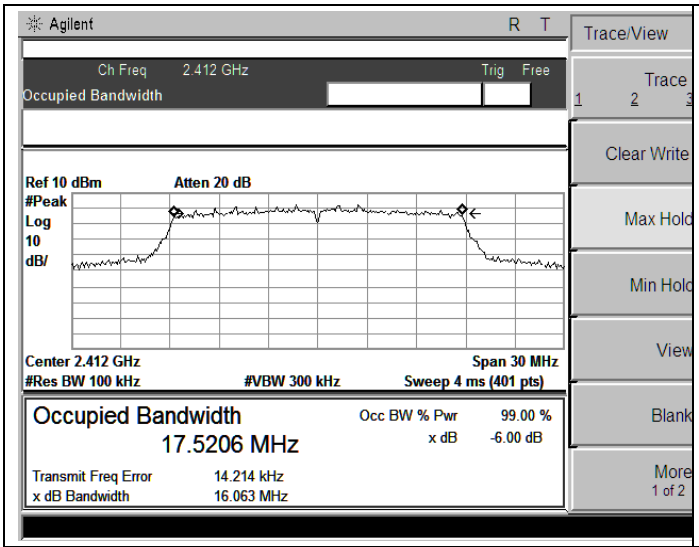
802.11g-Middle Channel, 2437MHz



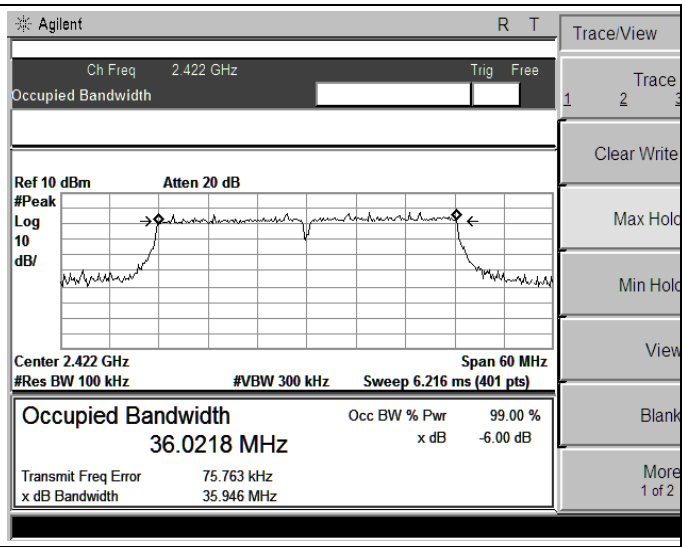
802.11b-High Channel, 2462MHz



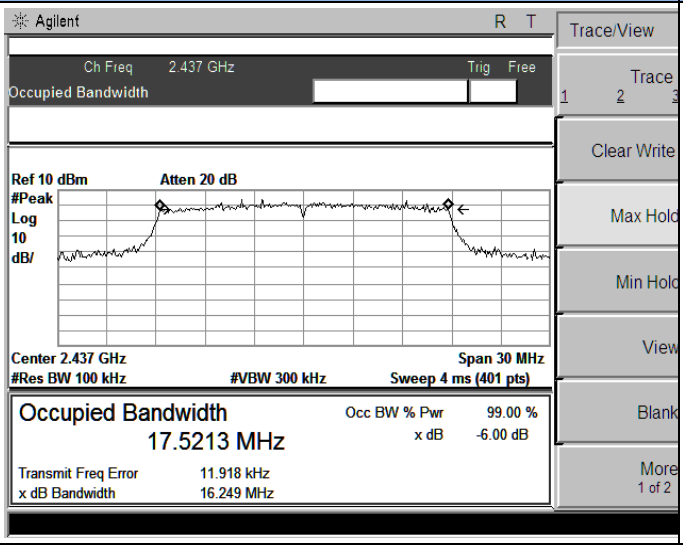
802.11g-High Channel, 2462MHz



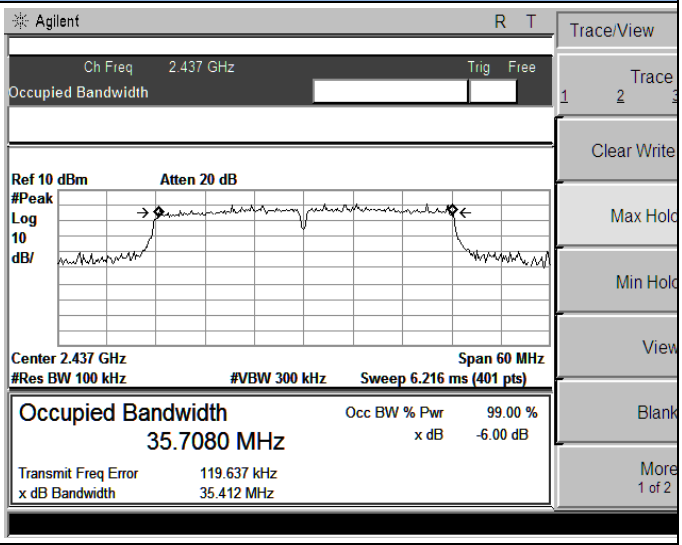
802.11n-HT20-Low Channel, 2412MHz



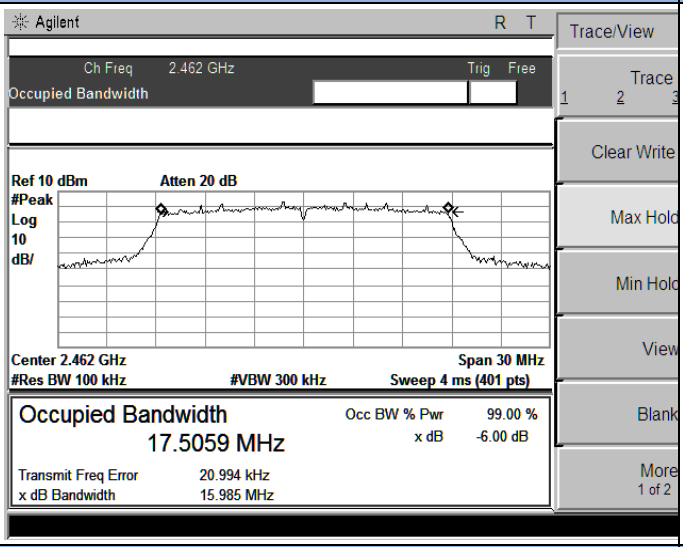
802.11n-HT40-Low Channel, 2422MHz



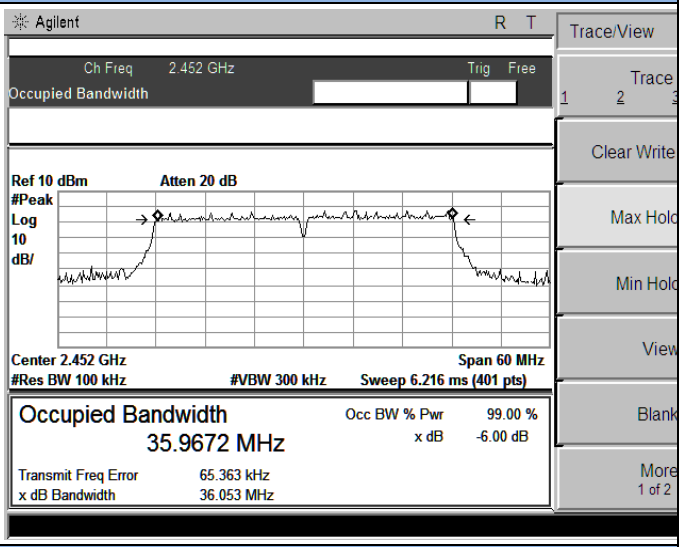
802.11n-HT20-Middle Channel, 2437MHz



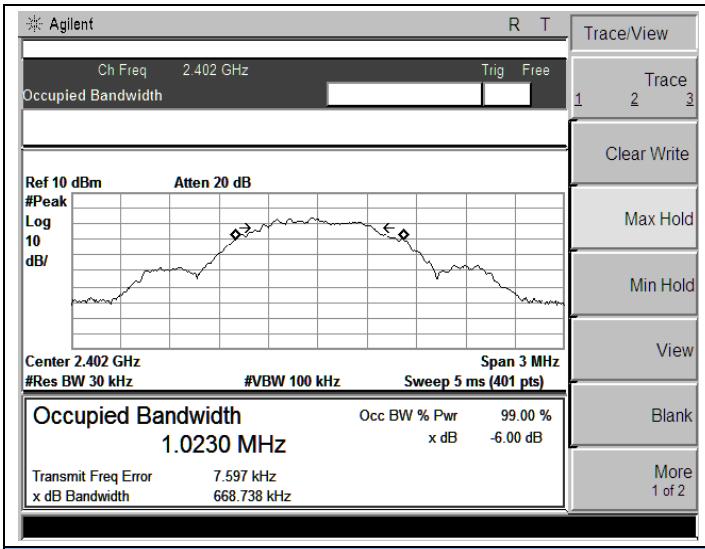
802.11n-HT40-Middle Channel, 2437MHz



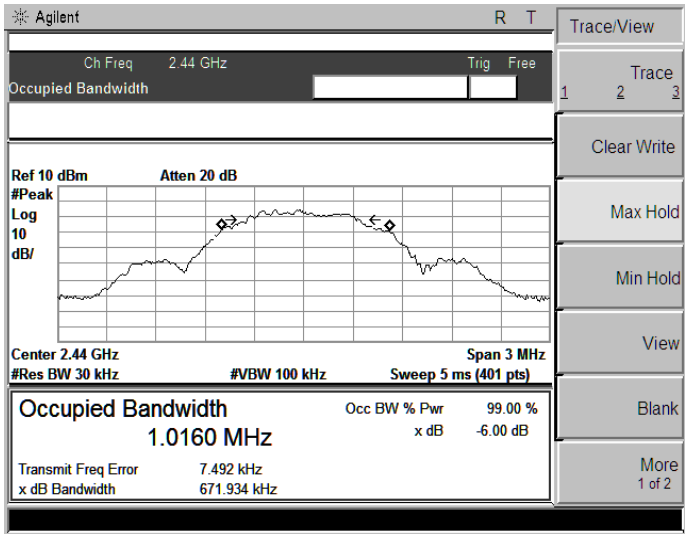
802.11n-HT20-High Channel, 2462MHz



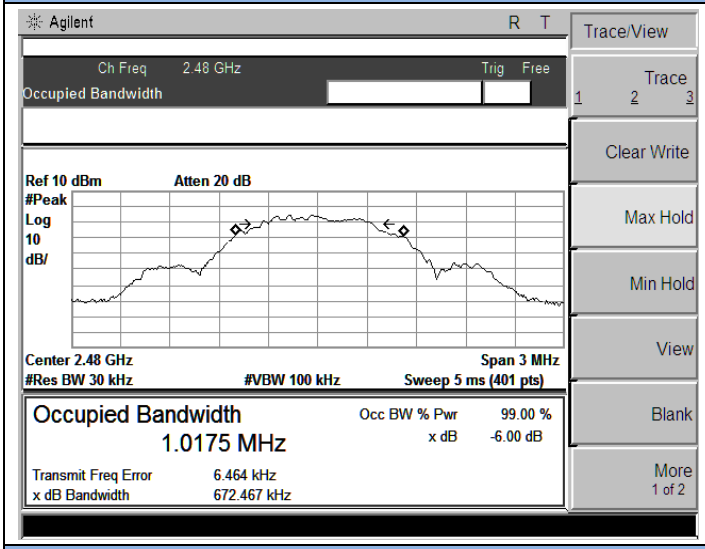
802.11n-HT40-High Channel, 2452MHz



BT V4.0-Low Channel, 2402MHz



BT V4.0-Middle Channel, 2440MHz



BT V4.0-High Channel, 2480MHz

6.4. Occupied Bandwidth

6.4.1. Standard Applicable

According to §15.247(a): Operation under the provisions of this section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

For systems using digital modulation techniques, the EUT may operate in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands. The minimum 6dB bandwidth shall be at least 500 kHz.

6.4.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of the Spectrum Analyzer.

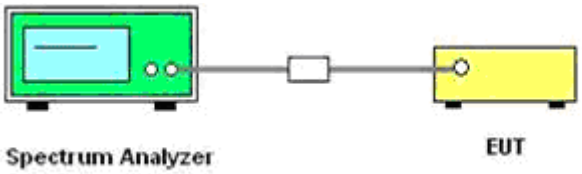
Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> RBW
RBW	1% to 3% of the band
VBW	3 times the RBW
Detector	Peak
Trace	Max Hold
Sweep Time	100ms

6

6.4.3. Test Procedures

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth measurement function is utilized.

5.4.4. Test Setup Layout



6.4.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

6.4.6. Test Result of 99% Occupied Bandwidth.

Temperature	25˚C	Humidity	60%
Test Engineer	Jacky	Configurations	802.11b/g/n/BT V4.0

802.11b

Channel	Frequency (MHz)	99% OBW (MHz)
1	2412	12.4503
6	2437	12.4432
11	2462	12.4419

802.11g

Channel	Frequency (MHz)	99% OBW (MHz)
1	2412	16.3592
6	2437	16.3884
11	2462	16.3242

802.11n HT20

Channel	Frequency (MHz)	99% OBW (MHz)
1	2412	17.5206
6	2437	17.5213
11	2462	17.5059

802.11n HT40

Channel	Frequency (MHz)	99% OBW (MHz)
3	2422	36.0218
6	2437	35.7080
9	2452	35.9672

BT V4.0

Channel	Frequency (MHz)	99% OBW (MHz)
1	2402	1.0230
20	2440	1.0160
40	2480	1.0175

Test plots: Please refer to clause 5.3.6

6.5. Radiated Emissions Measurement

6.5.1. Standard Applicable

According to §15.247 (d): 20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies(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	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

6.5.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/Average
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/Average
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

6.5.3. Test Procedures

1) **Sequence of testing 9 kHz to 30 MHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 1.5 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) **Sequence of testing 30 MHz to 1 GHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) **Sequence of testing 1 GHz to 18 GHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) **Sequence of testing above 18 GHz**

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

--- The antenna is moved spherical over the EUT in different polarisations of the antenna.

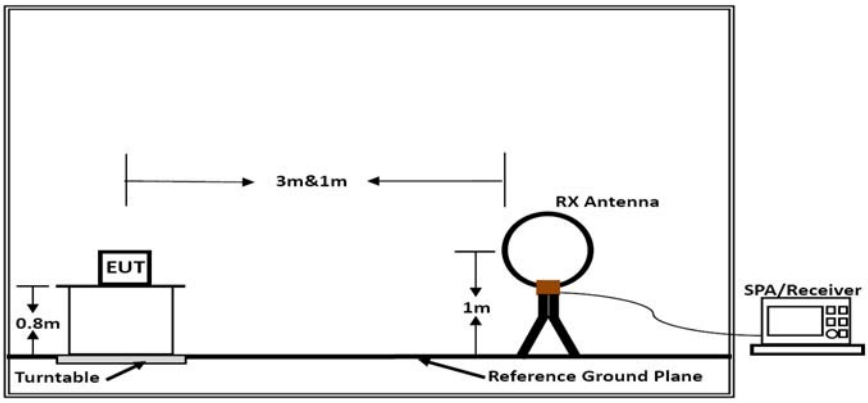
Final measurement:

--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

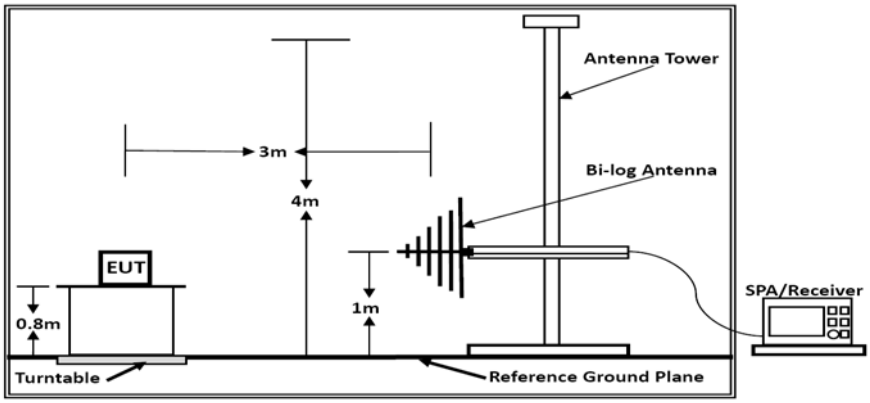
--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

6.5.4. Test Setup Layout

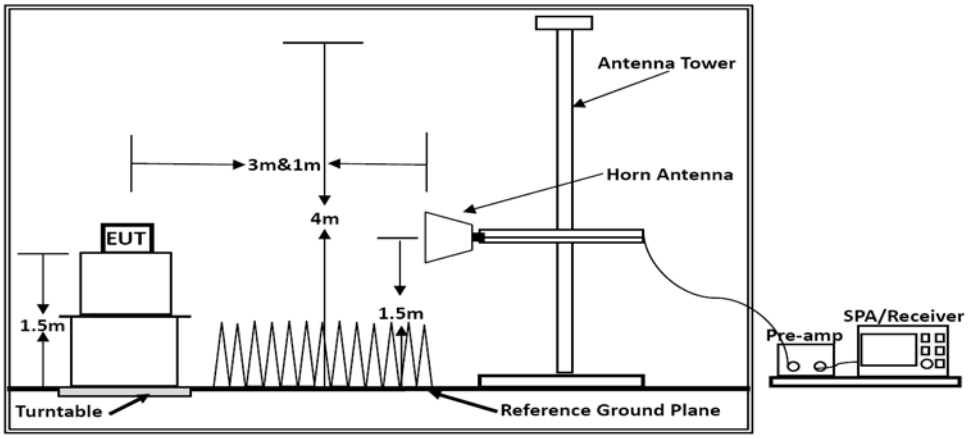
For radiated emissions below 30MHz



Below 30MHz



Below 1GHz



Above 1GHz

Above 10 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1.5m.

Distance extrapolation factor = 20 log (specific distance [3m] / test distance [1.5m]) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

6.5.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

6.5.6. Results of Radiated Emissions (9 kHz~30MHz)

Temperature	25℃	Humidty	60%
Test Engineer	Jacky	Configurations	802.11b/g/n/BT V4.0

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

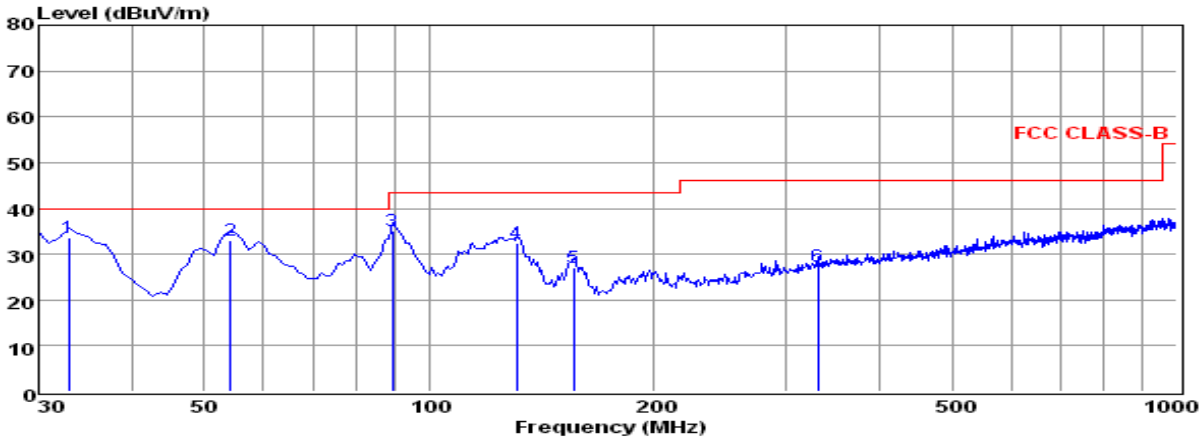
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

6.5.7. Results of Radiated Emissions (30MHz~1GHz)

Temperature	25℃	Humidty	60%
Test Engineer	Jacky	Configurations	802.11b (Low CH)

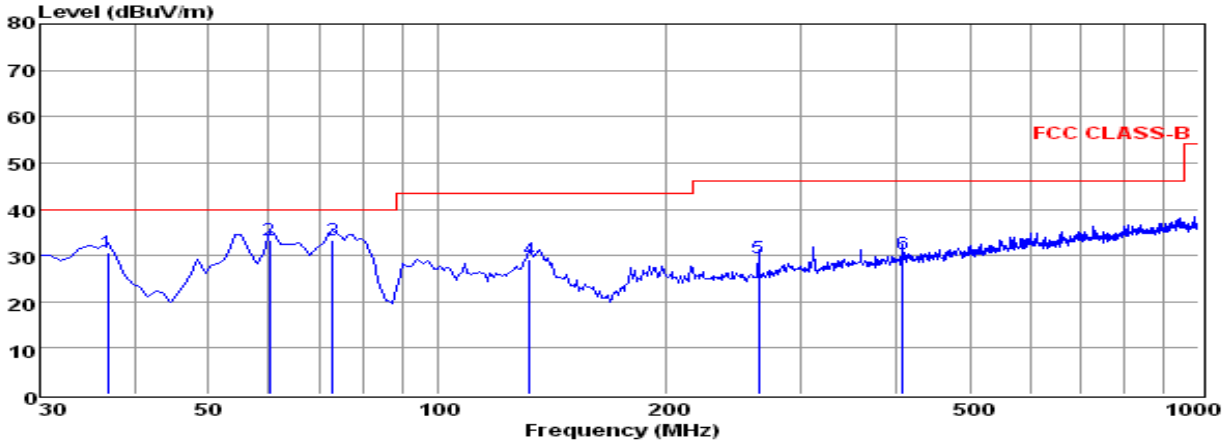
Test result for 802.11b (Low Channel)



Env./Ins: 24℃/56%
pol: VERTICAL

	Freq MHz	Reading dBuV	CabLos dB	Antfac dB/m	Measured dBuV/m	Limit dBuV/m	Over dB	Remark
1	32.91	20.89	0.37	12.31	33.57	40.00	-6.43	QP
2	54.25	19.52	0.46	13.05	33.03	40.00	-6.97	QP
3	89.17	22.67	0.68	11.64	34.99	43.50	-8.51	QP
4	130.88	22.67	0.76	8.86	32.29	43.50	-11.21	QP
5	156.10	17.75	0.76	8.51	27.02	43.50	-16.48	QP
6	330.70	12.48	1.17	13.75	27.40	46.00	-18.60	QP

Note: 1. All readings are Quasi-peak values.
2. Measured= Reading + Antenna Factor + Cable Loss
3. The emission that ate 20db blow the offficial limit are not reported



Env./Ins: 24℃/56%
pol: HORIZONTAL

	Freq	Reading	CabLos	Antfac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	36.79	17.59	0.41	12.76	30.76	40.00	-9.24	QP
2	60.07	20.17	0.49	12.66	33.32	40.00	-6.68	QP
3	72.68	24.72	0.55	8.19	33.46	40.00	-6.54	QP
4	131.85	19.59	0.76	8.79	29.14	43.50	-14.36	QP
5	263.77	16.11	1.03	12.17	29.31	46.00	-16.69	QP
6	408.30	14.05	1.17	15.23	30.45	46.00	-15.55	QP

Note: 1. All readings are Quasi-peak values.
2. Measured= Reading + Antenna Factor + Cable Loss
3. The emission that ate 20db blow the offficial limit are not reported

Note:

Pre-scan all modes and recorded the worst case results in this report (802.11b (Low Channel)).

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

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

6.5.8. Results for Radiated Emissions (Above 1GHz)

802.11b

Channel 1

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4824.00	56.86	33.06	35.04	3.94	58.82	74	-15.18	Peak	Horizontal
4824.00	41.26	33.06	35.04	3.94	43.22	54	-10.78	Average	Horizontal
4824.00	54.21	33.06	35.04	3.94	56.17	74	-17.83	Peak	Vertical
4824.00	40.28	33.06	35.04	3.94	42.24	54	-11.76	Average	Vertical

Channel 6

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4874.00	56.31	33.16	35.15	3.96	58.28	74	-15.72	Peak	Horizontal
4874.00	41.29	33.16	35.15	3.96	43.26	54	-10.74	Average	Horizontal
4874.00	55.80	33.16	35.15	3.96	57.77	74	-16.23	Peak	Vertical
4874.00	40.24	33.16	35.15	3.96	42.21	54	-11.79	Average	Vertical

Channel 11

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4924.00	56.44	33.26	35.14	3.98	58.54	74	-15.46	Peak	Horizontal
4924.00	39.97	33.26	35.14	3.98	42.07	54	-11.93	Average	Horizontal
4924.00	55.15	33.26	35.14	3.98	57.25	74	-16.75	Peak	Vertical
4924.00	39.93	33.26	35.14	3.98	42.03	54	-11.97	Average	Vertical

802.11g

Channel 1

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4824.00	54.50	33.06	35.04	3.94	56.46	74	-17.54	Peak	Horizontal
4824.00	39.26	33.06	35.04	3.94	41.22	54	-12.78	Average	Horizontal
4824.00	53.05	33.06	35.04	3.94	55.01	74	-18.99	Peak	Vertical
4824.00	38.49	33.06	35.04	3.94	40.45	54	-13.55	Average	Vertical

Channel 6

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4874.00	54.49	33.16	35.15	3.96	56.46	74	-17.54	Peak	Horizontal
4874.00	39.23	33.16	35.15	3.96	41.20	54	-12.80	Average	Horizontal
4874.00	53.29	33.16	35.15	3.96	55.26	74	-18.74	Peak	Vertical
4874.00	38.81	33.16	35.15	3.96	40.78	54	-13.22	Average	Vertical

Channel 11

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4924.00	54.12	33.26	35.14	3.98	56.22	74	-17.78	Peak	Horizontal
4924.00	37.92	33.26	35.14	3.98	40.02	54	-13.98	Average	Horizontal
4924.00	53.68	33.26	35.14	3.98	55.78	74	-18.22	Peak	Vertical
4924.00	38.06	33.26	35.14	3.98	40.16	54	-13.84	Average	Vertical

802.11n HT20

Channel 1

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4824.00	54.26	33.06	35.04	3.94	56.22	74	-17.78	Peak	Horizontal
4824.00	38.07	33.06	35.04	3.94	40.03	54	-13.97	Average	Horizontal
4824.00	53.49	33.06	35.04	3.94	55.45	74	-18.55	Peak	Vertical
4824.00	38.05	33.06	35.04	3.94	40.01	54	-13.99	Average	Vertical

Channel 6

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4874.00	54.72	33.16	35.15	3.96	56.69	74	-17.31	Peak	Horizontal
4874.00	38.04	33.16	35.15	3.96	40.01	54	-13.99	Average	Horizontal
4874.00	53.61	33.16	35.15	3.96	55.58	74	-18.42	Peak	Vertical
4874.00	38.46	33.16	35.15	3.96	40.43	54	-13.57	Average	Vertical

Channel 11

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4924.00	54.68	33.26	35.14	3.98	56.78	74	-17.22	Peak	Horizontal
4924.00	39.19	33.26	35.14	3.98	41.29	54	-12.71	Average	Horizontal
4924.00	53.35	33.26	35.14	3.98	55.45	74	-18.55	Peak	Vertical
4924.00	38.01	33.26	35.14	3.98	40.11	54	-13.89	Average	Vertical

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802.11n HT40

Channel 3

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4824.00	53.16	33.06	35.04	3.94	55.12	74	-18.88	Peak	Horizontal
4824.00	38.26	33.06	35.04	3.94	40.22	54	-13.78	Average	Horizontal
4824.00	52.07	33.06	35.04	3.94	54.03	74	-19.97	Peak	Vertical
4824.00	37.49	33.06	35.04	3.94	39.45	54	-14.55	Average	Vertical

Channel 6

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4874.00	53.44	33.16	35.15	3.96	55.41	74	-18.59	Peak	Horizontal
4874.00	38.81	33.16	35.15	3.96	40.78	54	-13.22	Average	Horizontal
4874.00	52.04	33.16	35.15	3.96	54.01	74	-19.99	Peak	Vertical
4874.00	37.39	33.16	35.15	3.96	39.36	54	-14.64	Average	Vertical

Channel 9

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4924.00	52.92	33.26	35.14	3.98	55.02	74	-18.98	Peak	Horizontal
4924.00	38.01	33.26	35.14	3.98	40.11	54	-13.89	Average	Horizontal
4924.00	51.92	33.26	35.14	3.98	54.02	74	-19.98	Peak	Vertical
4924.00	37.49	33.26	35.14	3.98	39.59	54	-14.41	Average	Vertical

BT V4.0

Channel 1

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4804.00	52.93	33.06	35.04	3.94	54.89	74	-19.11	Peak	Horizontal
4804.00	38.30	33.06	35.04	3.94	40.26	54	-13.74	Average	Horizontal
4804.00	52.05	33.06	35.04	3.94	54.01	74	-19.99	Peak	Vertical
4804.00	38.49	33.06	35.04	3.94	40.45	54	-13.55	Average	Vertical

Channel 20

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4880.00	52.13	33.16	35.15	3.96	54.10	74	-19.90	Peak	Horizontal
4880.00	38.81	33.16	35.15	3.96	40.78	54	-13.22	Average	Horizontal
4880.00	52.28	33.16	35.15	3.96	54.25	74	-19.75	Peak	Vertical
4880.00	38.05	33.16	35.15	3.96	40.02	54	-13.98	Average	Vertical

Channel 40

Freq. MHz	Reading dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
4960.00	52.75	33.26	35.14	3.98	54.85	74	-19.15	Peak	Horizontal
4960.00	37.93	33.26	35.14	3.98	40.03	54	-13.97	Average	Horizontal
4960.00	52.36	33.26	35.14	3.98	54.46	74	-19.54	Peak	Vertical
4960.00	37.00	33.26	35.14	3.98	39.10	54	-14.90	Average	Vertical

Notes:

1. *Measuring frequencies from 9k~10th harmonic or 26 GHz (which is less), No emission found between lowest internal used/generated frequency to 30MHz.*
2. *Radiated emissions measured in frequency range from 9k~10th harmonic or 26GHz (which is less) were made with an instrument using Peak detector mode.*
3. *Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*

6.5.9. Results of Band Edges Test (Radiated)

802.11b

Tx-2412

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2390.00	49.30	32.89	35.16	3.51	50.54	74	-23.46	Peak	Horizontal
2390.00	34.09	32.89	35.16	3.51	35.33	54	-18.67	Average	Horizontal
2400.00	51.72	32.92	35.16	3.54	53.02	74	-20.98	Peak	Horizontal
2400.00	36.81	32.92	35.16	3.54	38.11	54	-15.89	Average	Horizontal
2390.00	48.78	32.89	35.16	3.51	50.02	74	-23.98	Peak	Vertical
2390.00	34.33	32.89	35.16	3.51	35.57	54	-18.43	Average	Vertical
2400.00	50.98	32.92	35.16	3.54	52.28	74	-21.72	Peak	Vertical
2400.00	36.01	32.92	35.16	3.54	37.31	54	-16.69	Average	Vertical

Tx-2462

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2483.50	49.28	33.06	35.18	3.60	50.76	74	-23.24	Peak	Horizontal
2483.50	33.74	33.06	35.18	3.60	35.22	54	-18.78	Average	Horizontal
2483.50	47.53	33.06	35.18	3.60	49.01	74	-24.99	Peak	Vertical
2483.50	33.97	33.06	35.18	3.60	35.45	54	-18.55	Average	Vertical

802.11g

Tx-2412

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2390.00	49.54	32.89	35.16	3.51	50.78	74	-23.22	Peak	Horizontal
2390.00	34.02	32.89	35.16	3.51	35.26	54	-18.74	Average	Horizontal
2400.00	51.71	32.92	35.16	3.54	53.01	74	-20.99	Peak	Horizontal
2400.00	37.34	32.92	35.16	3.54	38.64	54	-15.36	Average	Horizontal
2390.00	49.04	32.89	35.16	3.51	50.28	74	-23.72	Peak	Vertical
2390.00	34.09	32.89	35.16	3.51	35.33	54	-18.67	Average	Vertical
2400.00	51.46	32.92	35.16	3.54	52.76	74	-21.24	Peak	Vertical
2400.00	37.15	32.92	35.16	3.54	38.45	54	-15.55	Average	Vertical

Tx-2462

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2483.50	48.68	33.06	35.18	3.60	50.16	74	-23.84	Peak	Horizontal
2483.50	33.96	33.06	35.18	3.60	35.44	54	-18.56	Average	Horizontal
2483.50	49.04	33.06	35.18	3.60	50.52	74	-23.48	Peak	Vertical
2483.50	34.31	33.06	35.18	3.60	35.79	54	-18.21	Average	Vertical

802.11n (HT20)

Tx-2412

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2390.00	49.45	32.89	35.16	3.51	50.69	74	-23.31	Peak	Horizontal
2390.00	35.54	32.89	35.16	3.51	36.78	54	-17.22	Average	Horizontal
2400.00	51.22	32.92	35.16	3.54	52.52	74	-21.48	Peak	Horizontal
2400.00	37.46	32.92	35.16	3.54	38.76	54	-15.24	Average	Horizontal
2390.00	48.99	32.89	35.16	3.51	50.23	74	-23.77	Peak	Vertical
2390.00	33.87	32.89	35.16	3.51	35.11	54	-18.89	Average	Vertical
2400.00	50.72	32.92	35.16	3.54	52.02	74	-21.98	Peak	Vertical
2400.00	36.17	32.92	35.16	3.54	37.47	54	-16.53	Average	Vertical

Tx-2462

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2483.50	48.74	33.06	35.18	3.60	50.22	74	-23.78	Peak	Horizontal
2483.50	34.30	33.06	35.18	3.60	35.78	54	-18.22	Average	Horizontal
2483.50	47.53	33.06	35.18	3.60	49.01	74	-24.99	Peak	Vertical
2483.50	33.97	33.06	35.18	3.60	35.45	54	-18.55	Average	Vertical

802.11n (HT40)

Tx-2422

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2390.00	48.88	32.89	35.16	3.51	50.12	74	-23.88	Peak	Horizontal
2390.00	35.21	32.89	35.16	3.51	36.45	54	-17.55	Average	Horizontal
2400.00	52.58	32.92	35.16	3.54	53.88	74	-20.12	Peak	Horizontal
2400.00	36.99	32.92	35.16	3.54	38.29	54	-15.71	Average	Horizontal
2390.00	49.11	32.89	35.16	3.51	50.35	74	-23.65	Peak	Vertical
2390.00	34.13	32.89	35.16	3.51	35.37	54	-18.63	Average	Vertical
2400.00	50.86	32.92	35.16	3.54	52.16	74	-21.84	Peak	Vertical
2400.00	37.15	32.92	35.16	3.54	38.45	54	-15.55	Average	Vertical

Tx-2452

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2483.50	49.14	33.06	35.18	3.60	50.62	74	-23.38	Peak	Horizontal
2483.50	33.95	33.06	35.18	3.60	35.43	54	-18.57	Average	Horizontal
2483.50	48.67	33.06	35.18	3.60	50.15	74	-23.85	Peak	Vertical
2483.50	33.98	33.06	35.18	3.60	35.46	54	-18.54	Average	Vertical

BT V4.0

Tx-2402

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2390.00	48.78	32.89	35.16	3.51	50.02	74	-23.98	Peak	Horizontal
2390.00	35.55	32.89	35.16	3.51	36.79	54	-17.21	Average	Horizontal
2400.00	51.58	32.92	35.16	3.54	52.88	74	-21.12	Peak	Horizontal
2400.00	35.76	32.92	35.16	3.54	37.06	54	-16.94	Average	Horizontal
2390.00	49.12	32.89	35.16	3.51	50.36	74	-23.64	Peak	Vertical
2390.00	33.78	32.89	35.16	3.51	35.02	54	-18.98	Average	Vertical
2400.00	51.11	32.92	35.16	3.54	52.41	74	-21.59	Peak	Vertical
2400.00	36.45	32.92	35.16	3.54	37.75	54	-16.25	Average	Vertical

Tx-2480

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2483.50	48.77	33.06	35.18	3.60	50.25	74	-23.75	Peak	Horizontal
2483.50	33.55	33.06	35.18	3.60	35.03	54	-18.97	Average	Horizontal
2483.50	48.63	33.06	35.18	3.60	50.11	74	-23.89	Peak	Vertical
2483.50	33.93	33.06	35.18	3.60	35.41	54	-18.59	Average	Vertical

6.6. Conducted Spurious Emissions and Band Edges Test

6.6.1. Standard Applicable

According to §15.247 (d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

6.6.2. Measuring Instruments and Setting

Please refer to section 6 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Detector	Peak
Attenuation	Auto
RB / VB (Emission in restricted band)	100KHz/300KHz
RB / VB (Emission in non-restricted band)	100KHz/300KHz

6.6.3. Test Procedures

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz

The spectrum from 9 kHz to 40GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

6.6.4. Test Setup Layout

This test setup layout is the same as that shown in section 5.4.4.

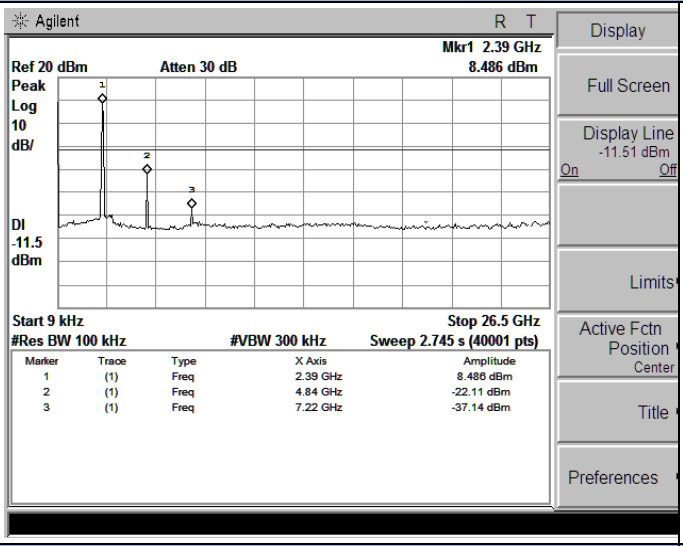
6.6.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

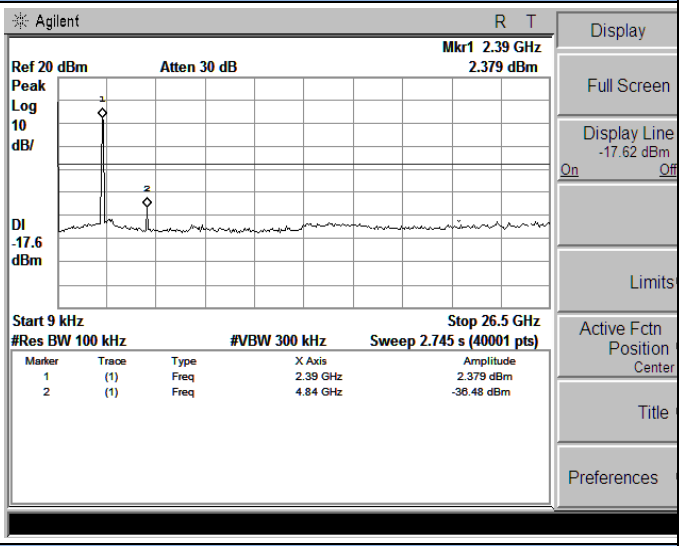
6.6.6. Test Results of Conducted Spurious Emissions

Please refer to the following page.

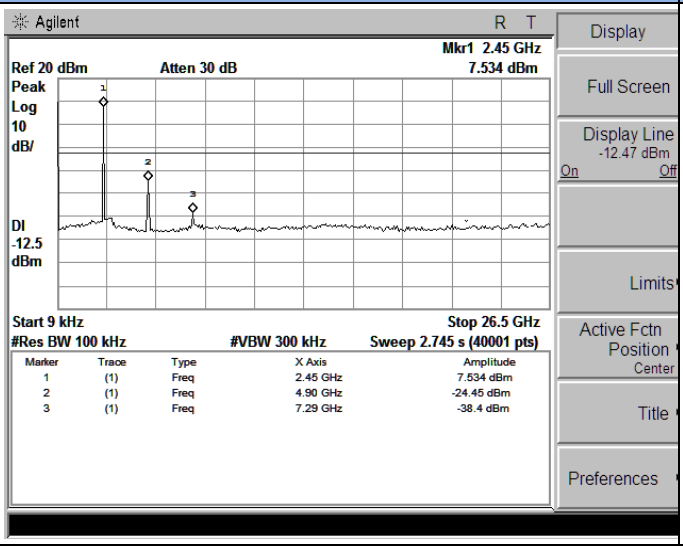
Test Plots of Conducted Spurious Emissions



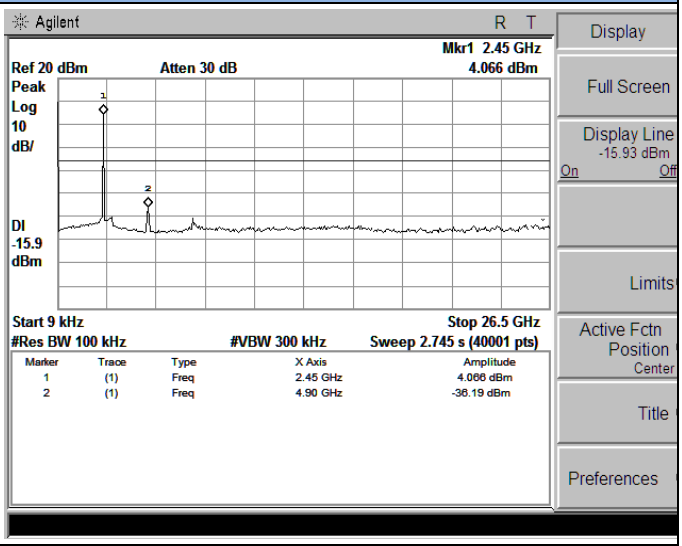
802.11b-Low Channel, 2412MHz



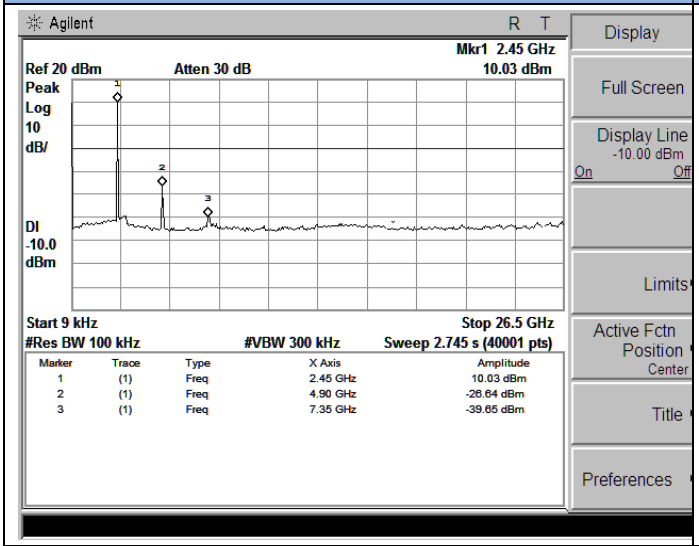
802.11g-Low Channel, 2412MHz



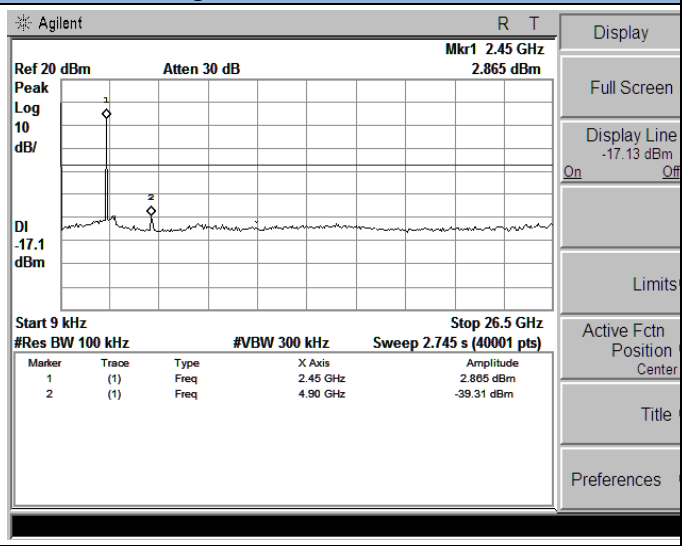
802.11b-Middle Channel, 2437MHz



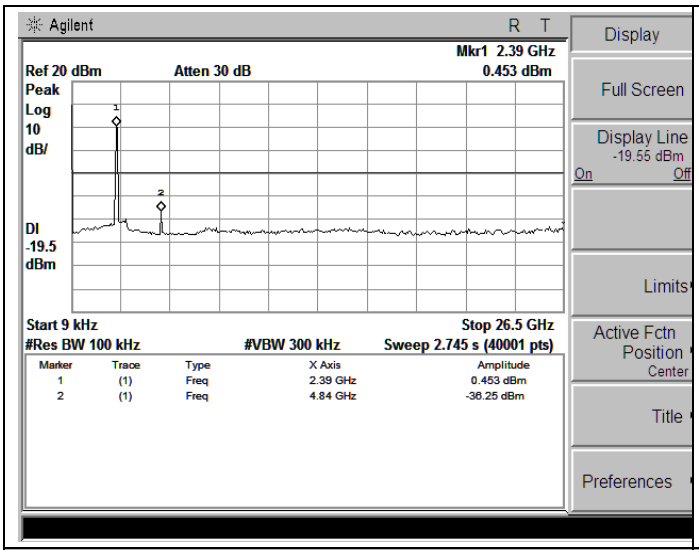
802.11g-Middle Channel, 2437MHz



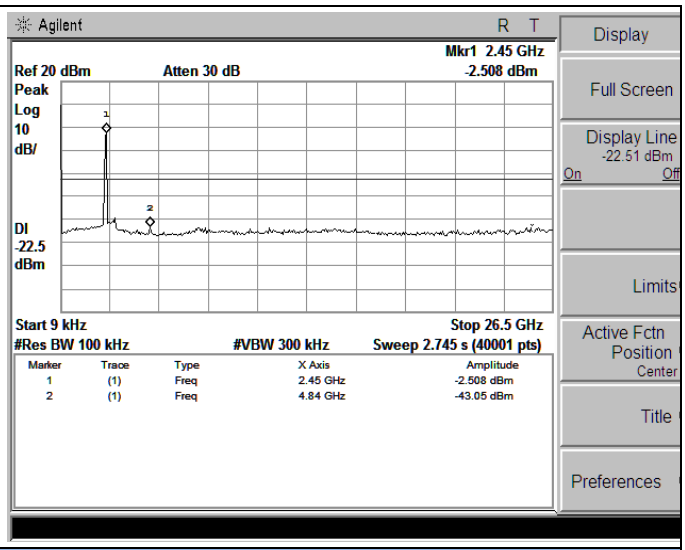
802.11b-High Channel, 2462MHz



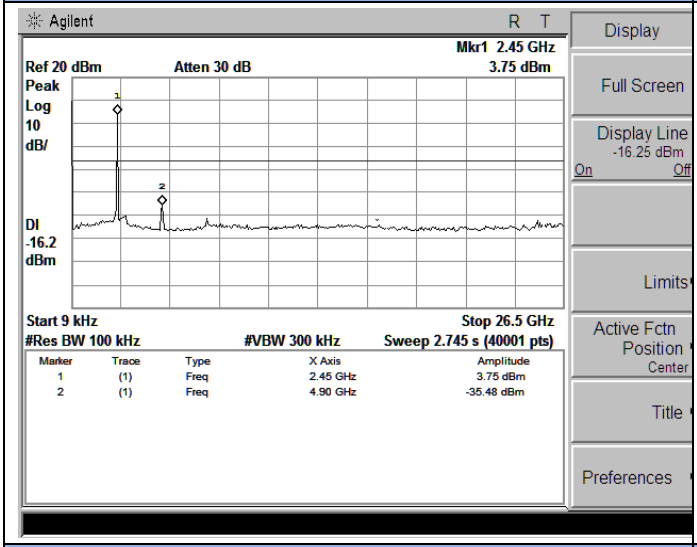
802.11g-High Channel, 2462MHz



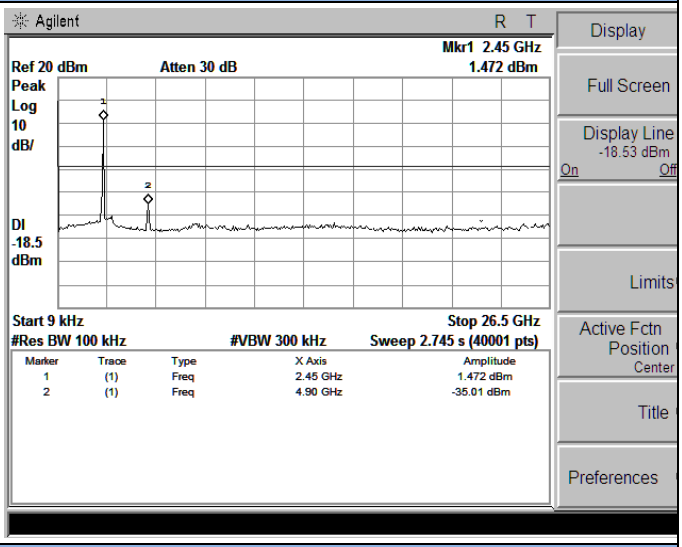
802.11n-HT20-Low Channel, 2412MHz



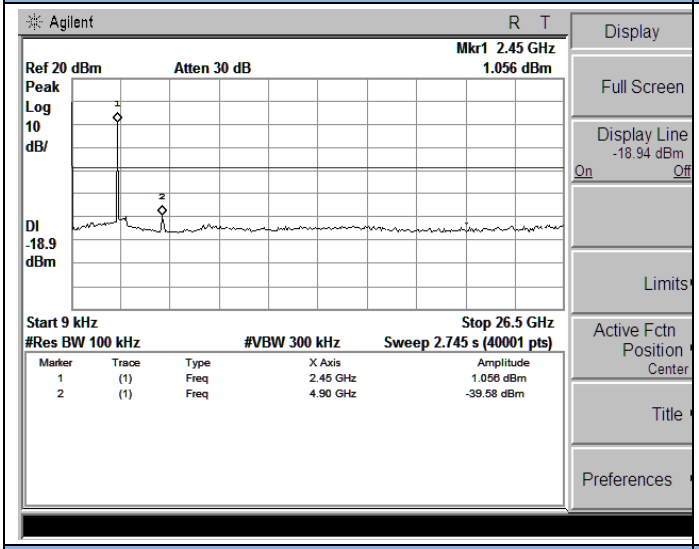
802.11n-HT40-Low Channel, 2422MHz



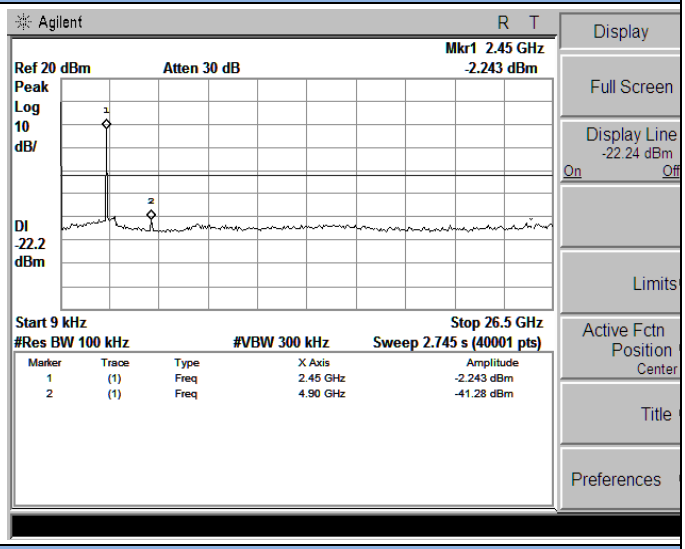
802.11n-HT20-Middle Channel, 2437MHz



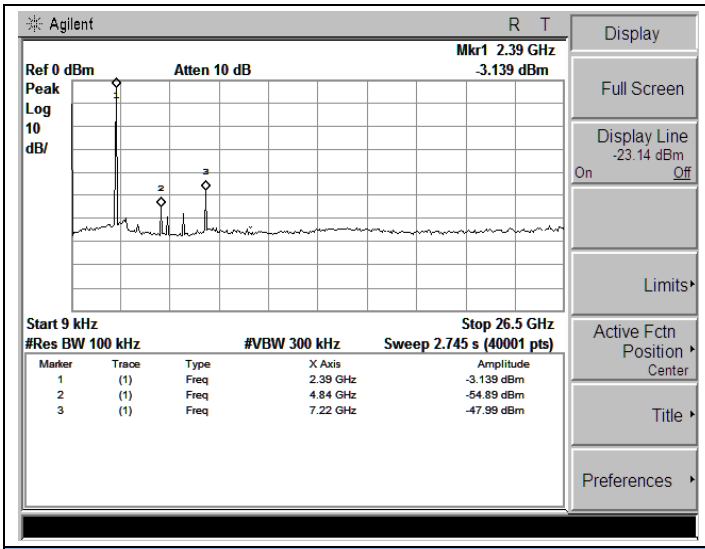
802.11n-HT40-Middle Channel, 2437MHz



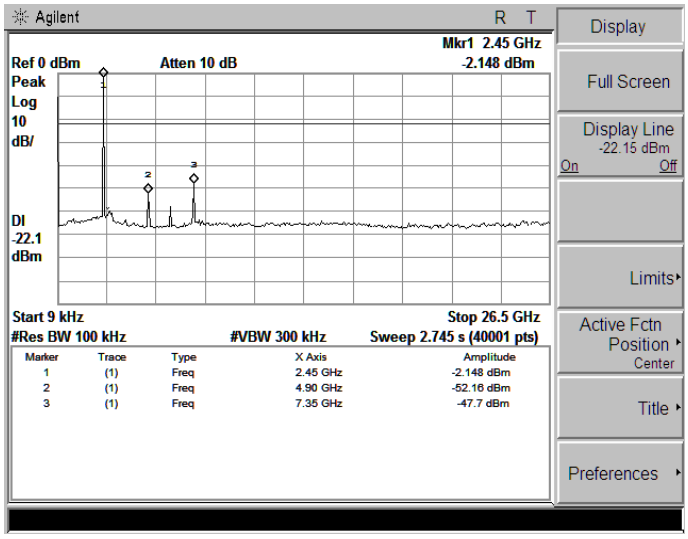
802.11n-HT20-High Channel, 2462MHz



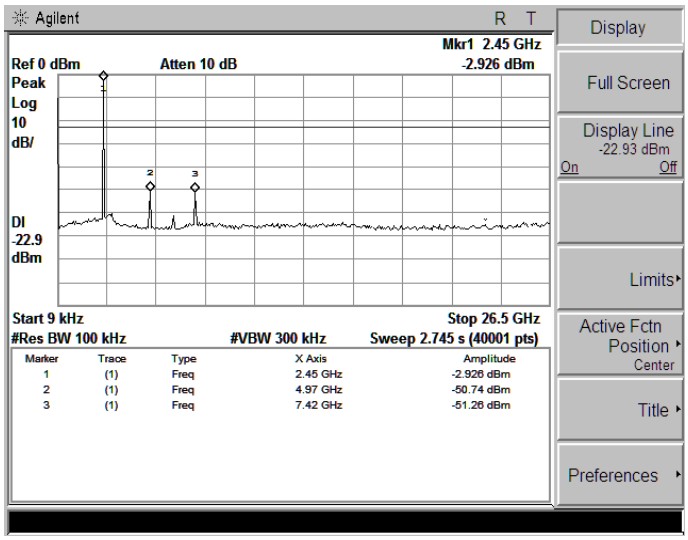
802.11n-HT40-High Channel, 2452MHz



BT V4.0-Low Channel, 2402MHz

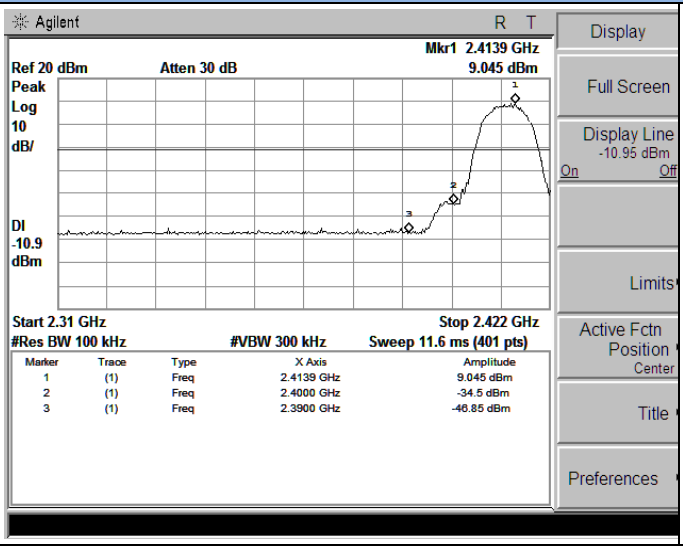
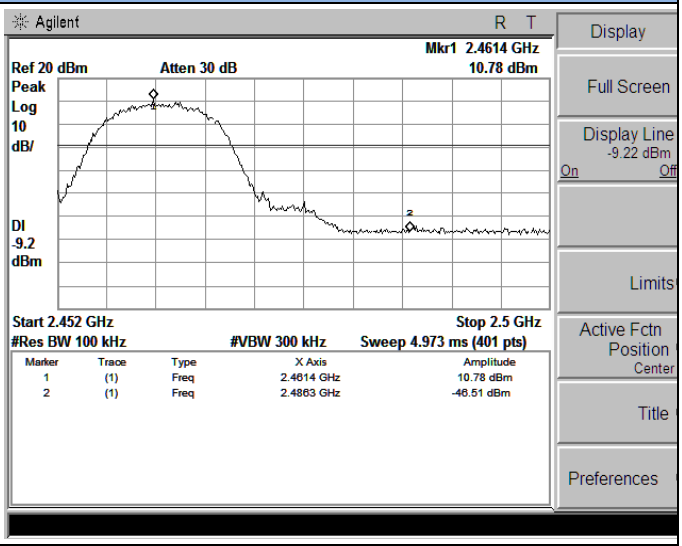
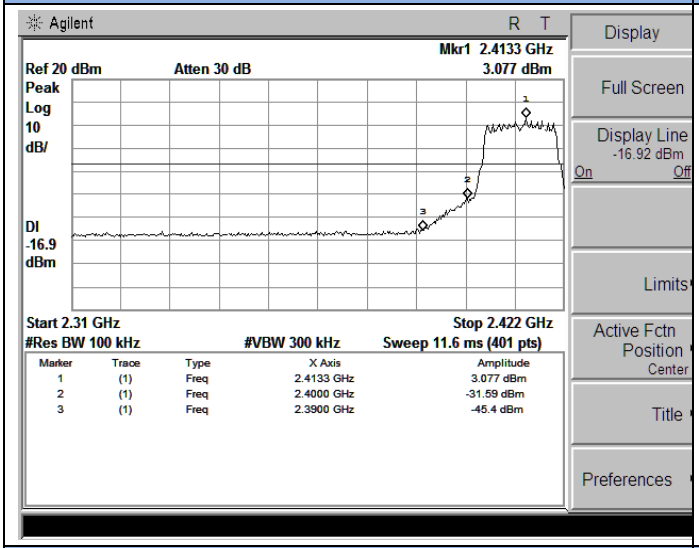
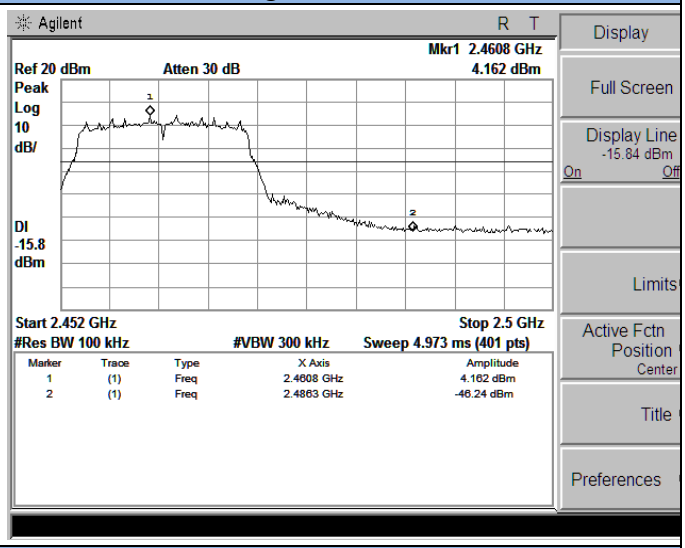
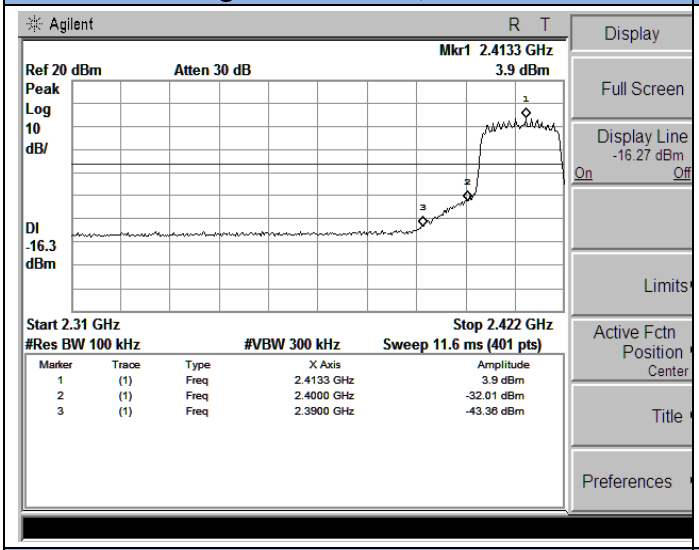
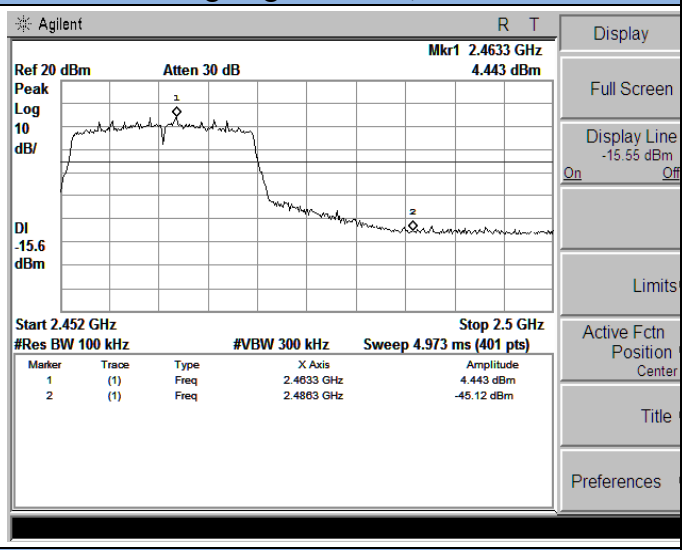


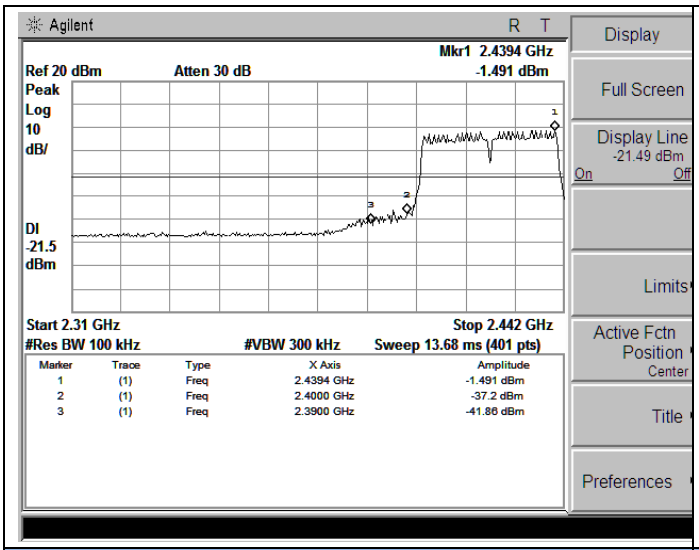
BT V4.0-Middle Channel, 2440MHz

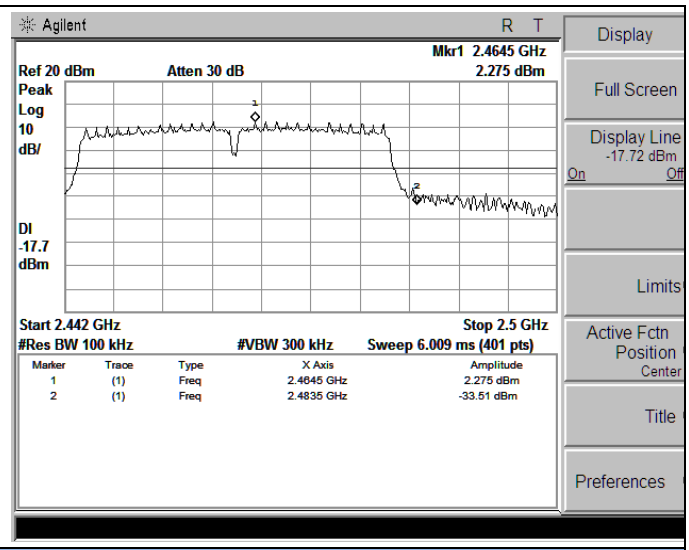


BT V4.0-High Channel, 2480MHz

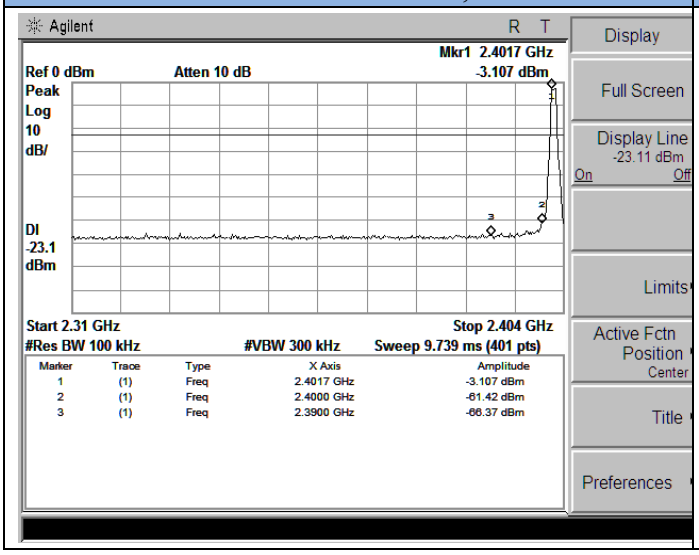
6.6.7. Test Results of Band Edges Test

Test Plots of Band Edges Test	
	
802.11b-Low Channel, 2412MHz	802.11b-High Channel, 2462MHz
	
802.11g-Low Channel, 2412MHz	802.11g-High Channel, 2462MHz
	
802.11n-HT20-Low Channel, 2412MHz	802.11n-HT20-High Channel, 2462MHz

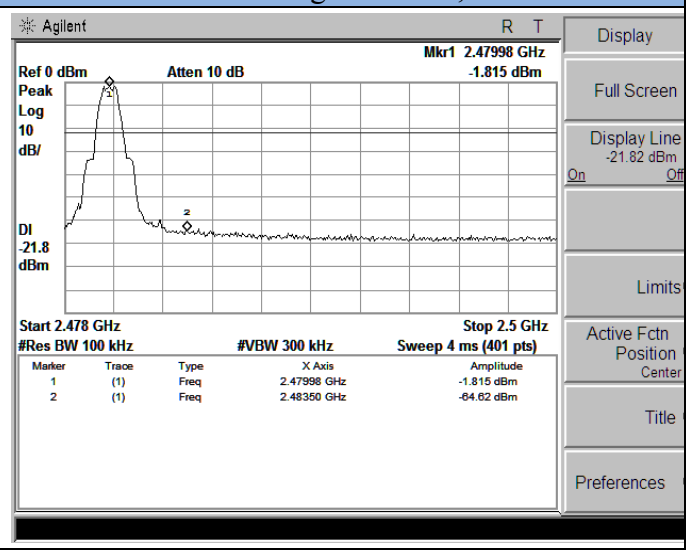




802.11n-HT40-Low Channel, 2422MHz



802.11n-HT40-High Channel, 2452MHz



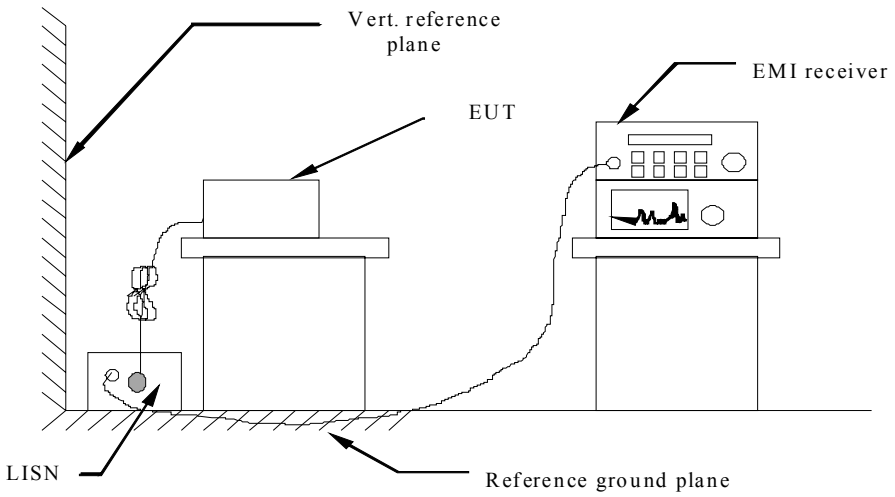
6.7. Power line conducted emissions

6.7.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

6.7.2 Block Diagram of Test Setup



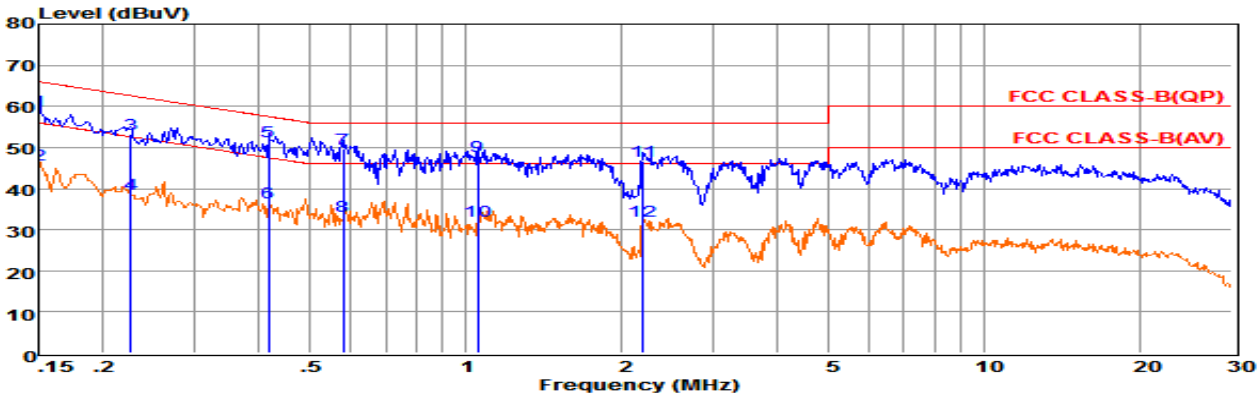
6.7.3 Test Results

PASS.

The test data please refer to following page.

AC Conducted Emission of power adapter

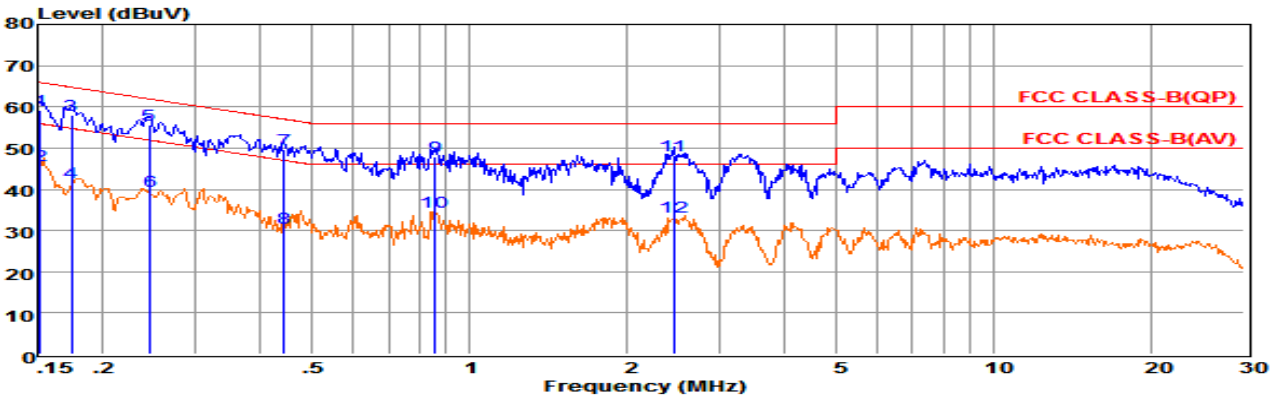
Test result for 802.11b (AC 120V/60Hz)



Env. Ins: 24*/56%
Pol: NEUTRAL

	Freq MHz	Reading dBuV	LisnFac dB	CabLos dB	Atten_Fac dB	Measured dBuV	Limit dBuV	Over dB	Remark
1	0.15000	39.27	9.70	0.02	10.00	58.99	66.00	-7.01	QP
2	0.15010	26.19	9.70	0.02	10.00	45.91	55.99	-10.08	Average
3	0.22556	33.50	9.59	0.03	10.00	53.12	62.61	-9.49	QP
4	0.22566	19.13	9.59	0.03	10.00	38.75	52.61	-13.86	Average
5	0.41705	31.89	9.61	0.04	10.00	51.54	57.51	-5.97	QP
6	0.41715	16.85	9.61	0.04	10.00	36.50	47.50	-11.00	Average
7	0.57923	30.05	9.62	0.04	10.00	49.71	56.00	-6.29	QP
8	0.57933	13.74	9.62	0.04	10.00	33.40	46.00	-12.60	Average
9	1.05407	28.15	9.63	0.05	10.00	47.83	56.00	-8.17	QP
10	1.05507	12.44	9.63	0.05	10.00	32.12	46.00	-13.88	Average
11	2.20147	27.15	9.63	0.05	10.00	46.83	56.00	-9.17	QP
12	2.20247	12.57	9.63	0.05	10.00	32.25	46.00	-13.75	Average

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten_Fac.
2. The emission levels that are 20dB below the official limit are not reported.

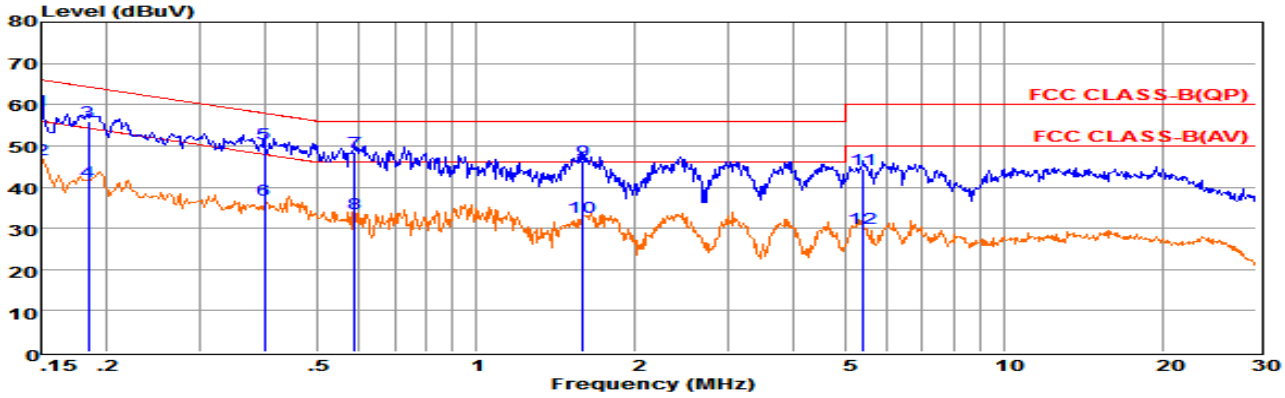


Env. Ins: 24*/56%
Pol: LINE

	Freq MHz	Reading dBuV	LisnFac dB	CabLos dB	Atten_Fac dB	Measured dBuV	Limit dBuV	Over dB	Remark
1	0.15160	39.64	9.57	0.02	10.00	59.23	65.91	-6.68	QP
2	0.15170	26.08	9.57	0.02	10.00	45.67	55.91	-10.24	Average
3	0.17399	38.43	9.60	0.02	10.00	58.05	64.77	-6.72	QP
4	0.17409	21.99	9.60	0.02	10.00	41.61	54.76	-13.15	Average
5	0.24552	35.98	9.63	0.03	10.00	55.64	61.91	-6.27	QP
6	0.24562	19.90	9.63	0.03	10.00	39.56	51.90	-12.34	Average
7	0.44208	30.02	9.62	0.04	10.00	49.68	57.02	-7.34	QP
8	0.44218	10.93	9.62	0.04	10.00	30.59	47.02	-16.43	Average
9	0.86185	28.26	9.63	0.04	10.00	47.93	56.00	-8.07	QP
10	0.86195	14.83	9.63	0.04	10.00	34.50	46.00	-11.50	Average
11	2.44756	28.52	9.64	0.05	10.00	48.21	56.00	-7.79	QP
12	2.44856	13.72	9.64	0.05	10.00	33.41	46.00	-12.59	Average

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten_Fac.
2. The emission levels that are 20dB below the official limit are not reported.

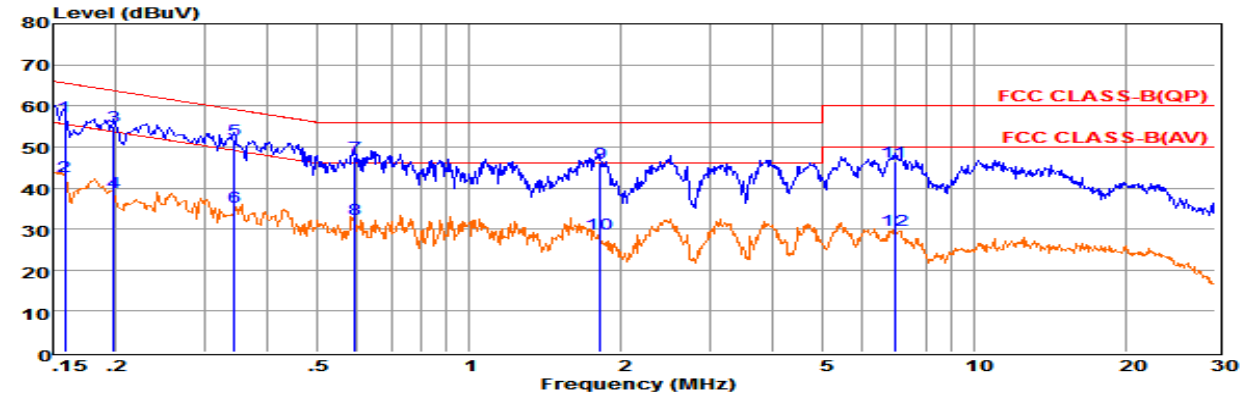
Test result for 802.11b (AC 240V/50Hz)



Env. Ins: 24*/56%
Pol: LINE

	Freq MHz	Reading dBuV	LisnFac dB	CabLos dB	Atten_Fac dB	Measured dBuV	Limit dBuV	Over dB	Remark
1	0.15000	38.96	9.57	0.02	10.00	58.55	66.00	-7.45	QP
2	0.15010	27.22	9.57	0.02	10.00	46.81	55.99	-9.18	Average
3	0.18443	36.13	9.61	0.02	10.00	55.76	64.28	-8.52	QP
4	0.18453	21.71	9.61	0.02	10.00	41.34	54.28	-12.94	Average
5	0.39763	30.96	9.62	0.04	10.00	50.62	57.90	-7.28	QP
6	0.39773	17.11	9.62	0.04	10.00	36.77	47.90	-11.13	Average
7	0.58851	28.85	9.63	0.04	10.00	48.52	56.00	-7.48	QP
8	0.58861	14.03	9.63	0.04	10.00	33.70	46.00	-12.30	Average
9	1.59350	26.63	9.64	0.05	10.00	46.32	56.00	-9.68	QP
10	1.59450	12.99	9.64	0.05	10.00	32.68	46.00	-13.32	Average
11	5.41862	24.56	9.66	0.06	10.00	44.28	60.00	-15.72	QP
12	5.41962	10.22	9.66	0.06	10.00	29.94	50.00	-20.06	Average

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten_Fac.
2. The emission levels that are 20dB below the official limit are not reported.



Env. Ins: 24*/56%
Pol: NEUTRAL

	Freq MHz	Reading dBuV	LisnFac dB	CabLos dB	Atten_Fac dB	Measured dBuV	Limit dBuV	Over dB	Remark
1	0.15816	37.71	9.68	0.02	10.00	57.41	65.56	-8.15	QP
2	0.15826	23.20	9.68	0.02	10.00	42.90	55.55	-12.65	Average
3	0.19758	35.29	9.59	0.02	10.00	54.90	63.71	-8.81	QP
4	0.19768	19.33	9.59	0.02	10.00	38.94	53.71	-14.77	Average
5	0.34281	31.99	9.61	0.03	10.00	51.63	59.13	-7.50	QP
6	0.34291	15.89	9.61	0.03	10.00	35.53	49.13	-13.60	Average
7	0.59478	27.98	9.63	0.04	10.00	47.65	56.00	-8.35	QP
8	0.59488	12.70	9.63	0.04	10.00	32.37	46.00	-13.63	Average
9	1.81918	26.53	9.63	0.05	10.00	46.21	56.00	-9.79	QP
10	1.82018	9.15	9.63	0.05	10.00	28.83	46.00	-17.17	Average
11	6.95084	26.75	9.69	0.07	10.00	46.51	60.00	-13.49	QP
12	6.95184	10.08	9.69	0.07	10.00	29.84	50.00	-20.16	Average

Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten_Fac.
2. The emission levels that are 20dB below the official limit are not reported.

****Note: Pre-scan all modes and recorded the worst case results in this report (802.11b (Low Channel)).*

6.8. Antenna Requirements

6.8.1 Standard Applicable

According to antenna requirement of §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

6.8.2 Antenna Connected Construction

6.8.2.1. Standard Applicable

According to § 15.203 & RSS-Gen, 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.

6.8.2.2. Antenna Connector Construction

The sample use PIFA antenna and maximum antenna gain is -0.5dBi. Please see EUT photo for details.

The WLAN and Bluetooth share same modular and same antenna.

6.8.2.3. Results: Compliance.

Measurement

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.

Conducted power refers ANSI C63.10:2013 Output power test procedure for DTS devices.

Radiated power refers to ANSI C63.10:2013 Radiated emissions tests.

Measurement parameters

Measurement parameter	
Detector:	Peak
Sweep Time:	Auto
Resolution bandwidth:	1MHz
Video bandwidth:	3MHz
Trace-Mode:	Max hold

Limits

FCC	IC
Antenna Gain	
6 dBi	

Note: The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module. For WLAN devices, the DSSS mode is used;

T_{nom}	V_{nom}	Lowest Channel 2412 MHz	Middle Channel 2437 MHz	Highest Channel 2462 MHz
Conducted power [dBm] Measured with DSSS modulation		12.26	12.22	12.30
Radiated power [dBm] Measured with DSSS modulation		11.20	11.39	11.03
Gain [dBi] Calculated		-1.06	-0.83	-1.27
Measurement uncertainty			± 1.6 dB (cond.) / ± 3.8 dB (rad.)	

T_{nom}	V_{nom}	Lowest Channel 2402 MHz	Middle Channel 2440 MHz	Highest Channel 2480 MHz
Conducted power [dBm] Measured with GFSK modulation		-2.88	-1.22	-1.44
Radiated power [dBm] Measured with GFSK modulation		-4.01	-2.05	-2.79
Gain [dBi] Calculated		-1.13	-0.83	-1.35
Measurement uncertainty			± 1.6 dB (cond.) / ± 3.8 dB (rad.)	

Result: -/-

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