FCC 47 CFR PART 15 SUBPART C: 2014 AND ANSI C63.10: 2013

TEST REPORT

For

Guitar Processor

Model:HEADRUSH PEDALBOARD

Data Applies to: N/A

Brand: HEADRUSH

Issued for

inMusic Brands, Inc.

200 Scenic View Drive, Cumberland, RI 02864, U.S.A.

Issued by

Compliance Certification Services Inc.
Tainan Lab.
No.8,Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)
TEL: 886-6-580-2201
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Date of Issue: December 15, 2016

REVISION HISTORY

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	December 15, 2016	Initial Issue	ALL	Daphne Liang

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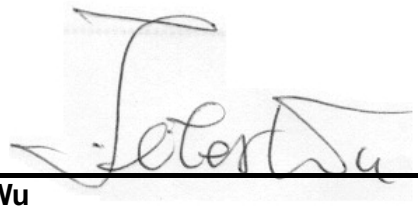
1. TEST REPORT CERTIFICATION

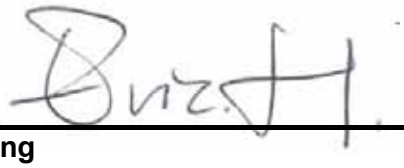
Applicant	:	**inMusic Brands, Inc.** 200 Scenic View Drive, Cumberland, RI 02864, U.S.A.
Manufacturer	:	**inMusic Brands, Inc.** 200 Scenic View Drive, Cumberland, RI 02864, U.S.A.
Equipment Under Test	:	Guitar Processor
Model	:	HEADRUSH PEDALBOARD
Data Applies To	:	N/A
Brand	:	HEADRUSH
Date of Test	:	August 18, 2016 ~ December 09, 2016

APPLICABLE STANDARD	
STANDARD	**TEST RESULT**
FCC Part 15 Subpart C: 2014 AND ANSI C63.10: 2013	No non-compliance noted

Approved by: ***Reviewed by:***



Jeter Wu
Assistant Manager



Eric Huang
Assistant Section Manager

2. EUT DESCRIPTION

Product Name	Guitar Processor
Model	HEADRUSH PEDALBOARD
Data Applies To	N/A
Brand	HEADRUSH
Received Date	August 18, 2016
Frequency Range	IEEE 802.11b/g, 802.11n HT20: 2412MHz~2462MHz Bluetooth 4.0: 2402MHz~2480MHz
Transmit Power	IEEE 802.11b Mode: 11.61dBm (14.4877mW) IEEE 802.11g Mode: 16.38dBm (43.4510mW) IEEE 802.11n HT20 Mode: 16.27dBm (42.3643mW) Bluetooth 4.0 Mode: 2.35Bm (1.71633mW)
Channel Spacing	IEEE 802.11b/g, 802.11n HT20: 5MHz Bluetooth 4.0: 2MHz
Channel Number	IEEE 802.11b/g, 802.11n HT20: 11 Channels Bluetooth 4.0 : 40 Channels
Transmit Data Rate	IEEE 802.11b : 11, 5.5, 2, 1 Mbps IEEE 802.11g : 54, 48 ,36, 24, 18, 12, 9, 6 Mbps IEEE 802.11n HT20 : 130, 117 ,104, 78, 65, 58.5, 52, 39, 26, 19.5,13, 6.5 Mbps Bluetooth 4.0: 1 Mbps
Type of Modulation	IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK, BPSK) Bluetooth 4.0: GFSK
Frequency Selection	By software / firmware
Antenna Type	Type: PCB Antenna Model: WLA-EM-1508-0008-B Manufacturer: BRITO Gain: 4.6 dBi
Hardware Version	AZ01:AZ01CRB06F
Software Version	MG01-11373c9-develop-MykolaShaforostov.tar
Power Rating	AC 100-240V, 50/60Hz
Temperature Range	25°C

REMARK:

1. The sample **(HEADRUSH PEDALBOARD)** selected for test was engineering sample that approximated to production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for FCC ID: **Y4O-MG01** filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.
3. For more details, please refer to the User's manual of the EUT.

3. DESCRIPTION OF TEST MODES

The EUT is a 11n router. It has two transmitter chains and two receive chains (2x2 configurations). The 2x2 configuration is implemented with two outside chains (Chain 0).

The RF chipset is manufactured by Realtek Corporation.

The antenna peak gain 4.6dBi (highest gain) were chosen for full testing.

IEEE 802.11 b ,802.11g ,802.11n HT20 mode (DTS Band)

The EUT had been tested under operating condition.

There are three channels have been tested as following:

Channel	Frequency (MHz)
Low	2412
Middle	2437
High	2462

IEEE 802.11b mode: 1Mbps long data rate (worst case) were chosen for full testing.

IEEE 802.11g mode: 6Mbps data rate (worst case) were chosen for full testing.

IEEE 802.11n HT20 mode: 6.5Mbps data rate (worst case) were chosen for full testing.

GFSK mode

The EUT had been tested under operating condition.

There are three channels have been tested as following:

Channel	Frequency (MHz)
Low	2402
Middle	2442
High	2480

Bluetooth 4.0 (GFSK) mode: 1Mbps data rate (worst case) were chosen for full testing.

The worst-case data rates are determined according to the description above, based on the investigations by measuring the PSD, peak power and average power across all the data rates, bandwidths, modulations and spatial stream modes.

4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10 and FCC CFR 47 15.207, 15.209 and 15.247.

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

No.8,Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

5.3 LABORATORY ACCREDITATIONS LISTINGS

The test facilities used to perform radiated and conducted emissions tests are accredited by Taiwan Accreditation Foundation for the specific scope of accreditation under Lab Code: 1109 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by TAF or any agency of the Government. In addition, the test facilities are listed with Federal Communications Commission (registration no: TW-1037 and 455173).

5.4 TABLE OF ACCREDITATIONS AND LISTINGS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

Taiwan	TAF

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada	Industry Canada
Germany	TUV NORD
Taiwan	BSMI
USA	FCC

Copies of granted accreditation certificates are available for downloading from our web site, http://www.ccsrf.com

6. CALIBRATION AND UNCERTAINTY

6.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

6.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

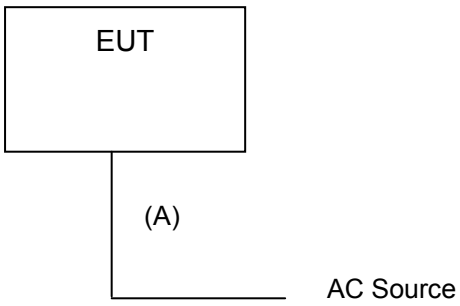
PARAMETER	UNCERTAINTY
Radiated Emission, 150kHz to 30 MHz Test Site : Chamber 966	±5.2dB
Radiated Emission, 30 to 200 MHz Test Site : Chamber 966	±3.21dB
Radiated Emission, 200 to 1000 MHz Test Site : Chamber 966	±3.09dB
Radiated Emission, 1 to 8 GHz	± 2.65dB
Radiated Emission, 8 to 18 GHz	± 2.66dB
Radiated Emission, 18 to 26.5 GHz	± 2.65dB
Radiated Emission, 26 to 40 GHz	± 3.03dB
Power Line Conducted Emission	±1.91dB
Band Width	136.49kHz
Peak Output Power MU	±1.34dB
Band Edge MU	±0.30dBuV
Channel Separation MU	361.69Hz
Duty Cycle MU	0.064ms
Frequency Stability MU	0.223kHz

Uncertainty figures are valid to a confidence level of 95%, K=2

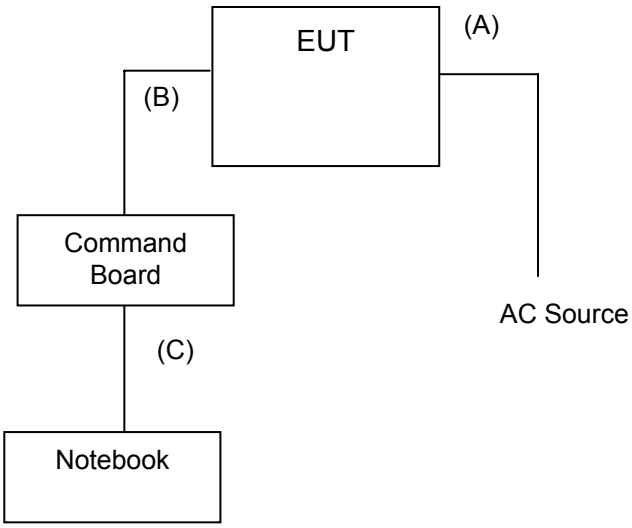
7. SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

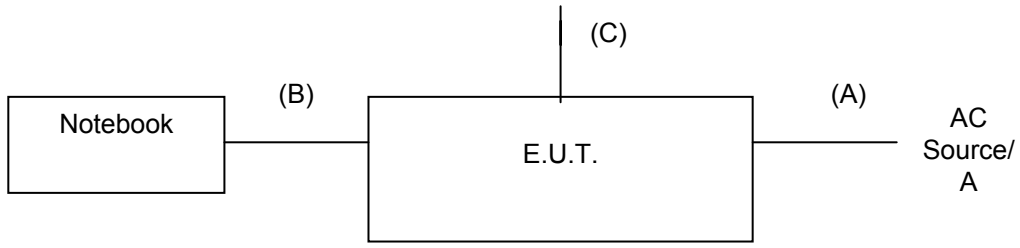
FOR RF TEST
WIFI:



BLUETOOTH:



FOR EMI TEST



7.2 SUPPORT EQUIPMENT

RF test

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1	Notebook	Acer	AS 3830TG	DOC	Power cable, unshd, 1.6m

No.	Signal cable description	
A	Power	Unshielded, 1.9m, 1pcs.
B	Command	Unshielded, 0.4m, 1pcs.
C	USB	Shielded, 1.8m, 1pcs.

EMI test

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1	Notebook	Acer	AS 3830TG	DOC	Power cable, unshd, 1.6m

No.	Signal cable description	
A	AC Power	Unshielded, 1.8m, 1pcs.
B	USB	Shielded, 2.0m, 1pcs, with one core.
C	AUDIO	Shielded, 1.0m, 14pcs.

REMARK:

1. All the above equipment/cables were placed in worse case positions to maximize emission signals during emission test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

7.3 EUT OPERATING CONDITION

RF Setup

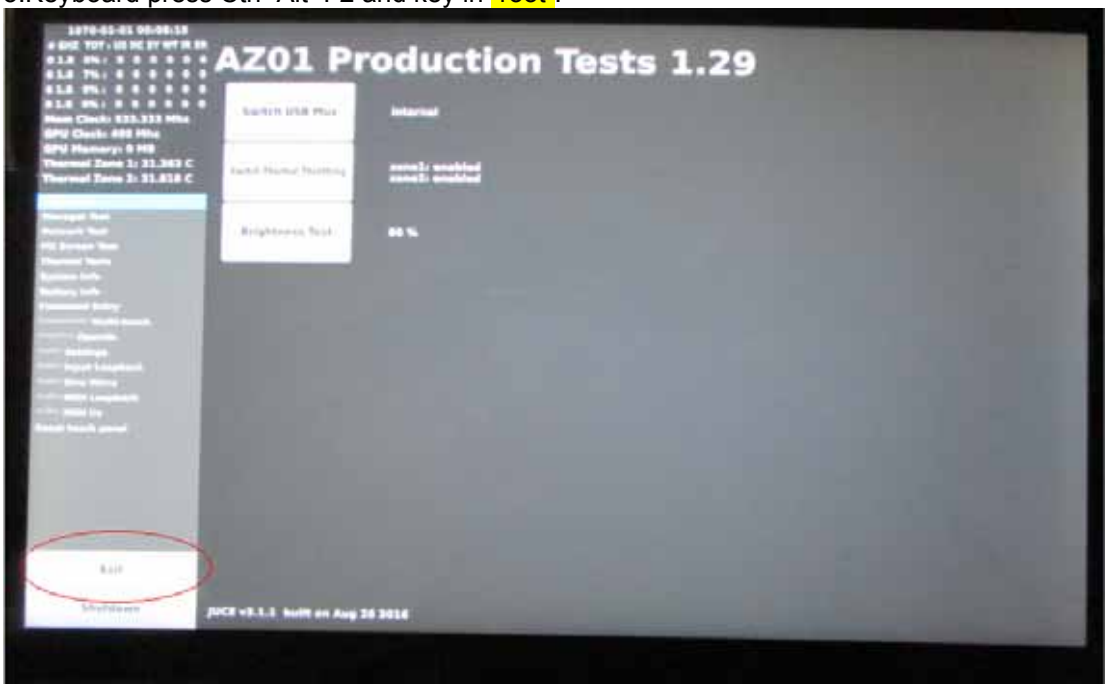
WIFI :

RF Setup

1. Set up a whole system as the setup diagram.

2. Turn on power and press "Exit"

3.Keyboard press Ctrl+Alt+F2 and key in "root".



TX Mode Key in

B Mode : wl down
wl mpc 0
wl country ALL
wl band b
wl up
wl 2g_rate –r 01 –b 20
wl channel 01 (01,06,11)
wl phy_watchdog 0
wl scansuppress 1
wl phy_forcecal 1
wl phy_txpwrctrl 1
wl txpwr1 -0 –d 10
wl pkteng_start 00:90:4c:14:43:19 tx 100 1000 0

G Mode : wl down
wl mpc 0
wl country ALL

wl band b
wl up
wl 2g_rate –r 06 –b 20
wl channel 01 (01,06,11)
wl phy_watchdog 0
wl scansuppress 1
wl phy_forcecal 1
wl phy_txpwrctrl 1
wl txpwr1 -0 –d 10
wl pkteng_start 00:90:4c:14:43:19 tx 100 1000 0

HT20 Mode : wl down
wl mpc 0
wl country ALL
wl band b
wl up
wl 2g_rate –h 0 –b 20
wl channel 01/20 (01,06,11)
wl phy_watchdog 0
wl scansuppress 1
wl phy_forcecal 1
wl phy_txpwrctrl 1
wl txpwr1 -0 –d 10 (9,10)
wl pkteng_start 00:90:4c:14:43:19 tx 100 1000 0

RX Mode Key in

wl down
wl band auto
wl mpc 0
wl country ALL
wl channel 01 (01,06,11)
wl bi 65535
wl up
wl phy_watchdog 0
wl scansuppress 1
wl phy_forcecal 1

4. All of the function are under run.
5. Start test.

BLUETOOTH :

RF Setup

1. Set up a whole system as the setup diagram.
2. The “putty.exe” software was used for testing
3. Key in “root”.

TX Mode Key in

hciconfig hci0 up
hcitool cmd 0x03 0x0003
hcitool cmd 0x08 0X0001e 00(00,14,27) 25 00

RX Mode Key in

hciconfig hci0 up
hcitool cmd 0x03 0x0003
hcitool cmd 0x3f 0x0052 EE FF C0 88 00 00 E8 03 00(00,27,4E) 04 00 01 FF FF

4. All of the function are under run.
5. Start test.

8. APPLICABLE LIMITS AND TEST RESULTS

8.1 6DB BANDWIDTH

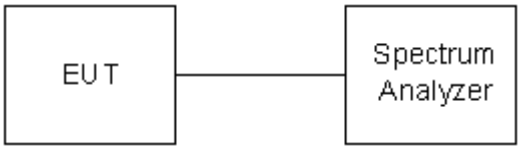
LIMIT

§ 15.247(a) (2) For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz

TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	04/29/2017

TEST SETUP



TEST PROCEDURE

1. Set resolution bandwidth (RBW) = 1-5 % of the emission bandwidth (EBW).
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. Compare the resultant bandwidth with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is 1-5 %.

TEST RESULTS

No non-compliance noted.

Model Name	HEADRUSH PEDALBOARD	Test By	Ted Huang
Temp & Humidity	24.3℃, 48%	Test Date	2016/12/08

IEEE 802.11b mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2412	8.08	500	PASS
Middle	2437	8.07	500	PASS
High	2462	8.08	500	PASS

NOTE : 1. At finial test to get the worst-case emission at 1Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11g mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2412	16.39	500	PASS
Middle	2437	16.39	500	PASS
High	2462	16.39	500	PASS

NOTE : 1. At finial test to get the worst-case emission at 6Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11n HT20 mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (kHz)	Pass / Fail
Low	2412	17.64	500	PASS
Middle	2437	17.63	500	PASS
High	2462	17.63	500	PASS

NOTE : 1. At finial test to get the worst-case emission at 6.5Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

Model Name	HEADRUSH PEDALBOARD	Test By	Ted Huang
Temp & Humidity	24.3℃, 48%	Test Date	2016/12/08

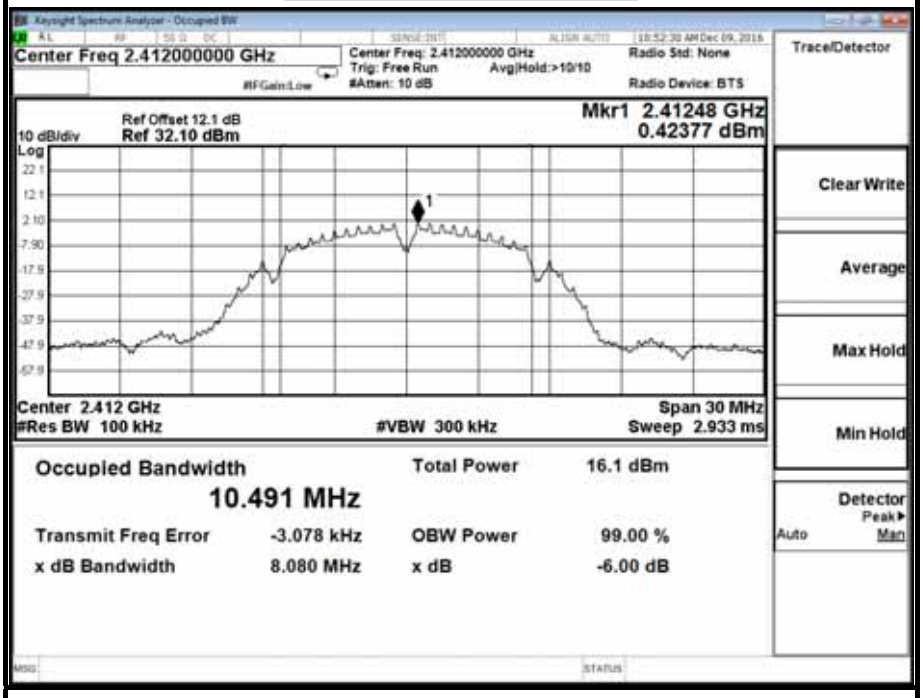
Bluetooth 4.0 (GFSK) mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (kHz)	Minimum Limit (kHz)	Pass / Fail
Low	2402	710.50	500	PASS
Middle	2440	711.18	500	PASS
High	2480	707.67	500	PASS

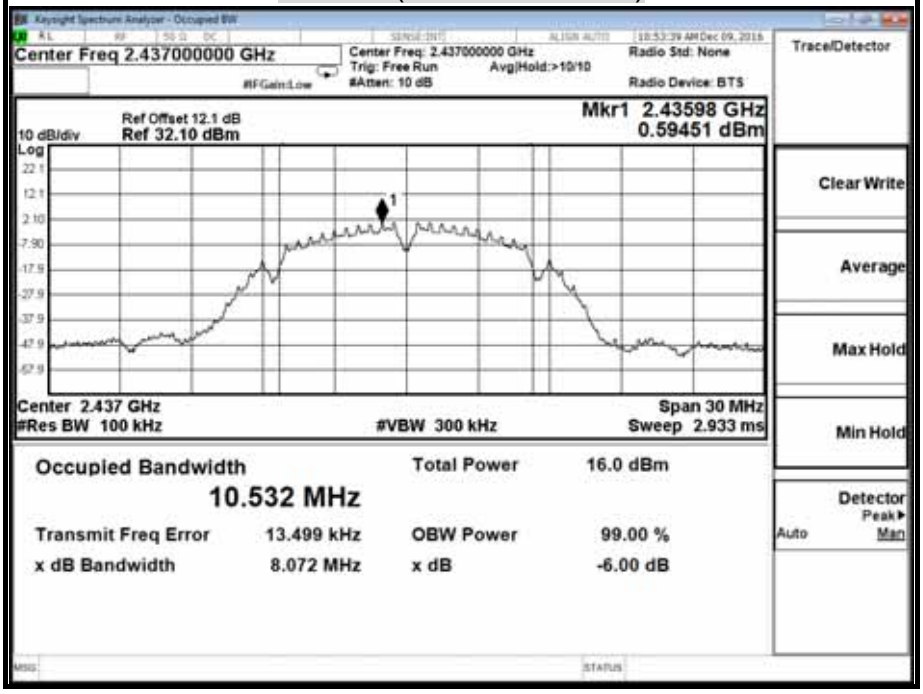
NOTE : 1. At finial test to get the worst-case emission at 1Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

6dB BANDWIDTH (802.11b MODE)

CH Low (802.11b MODE)



CH Mid (802.11b MODE)



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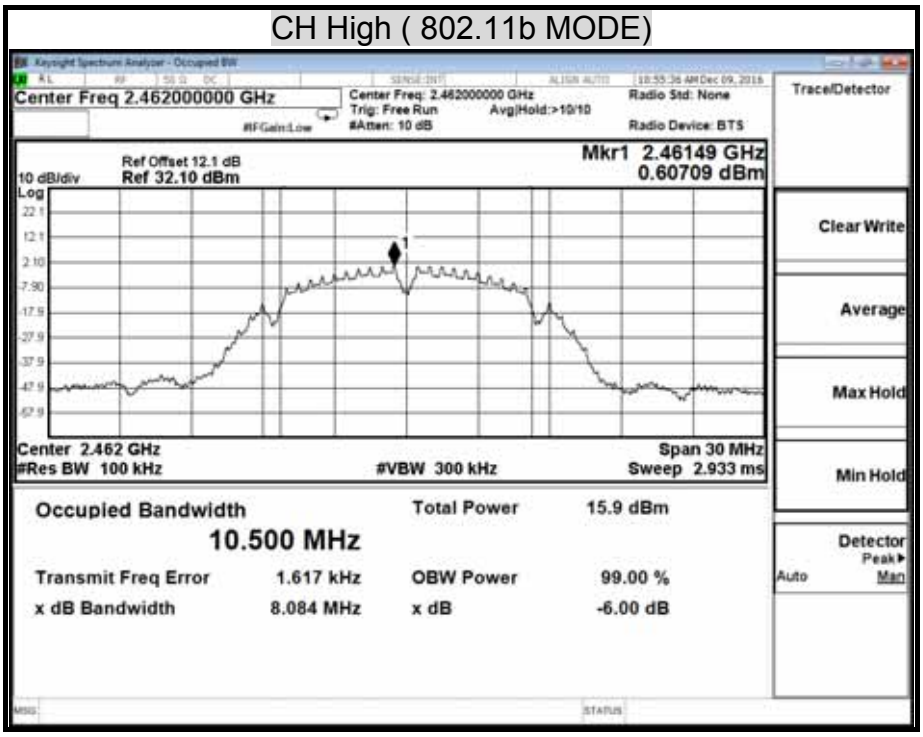
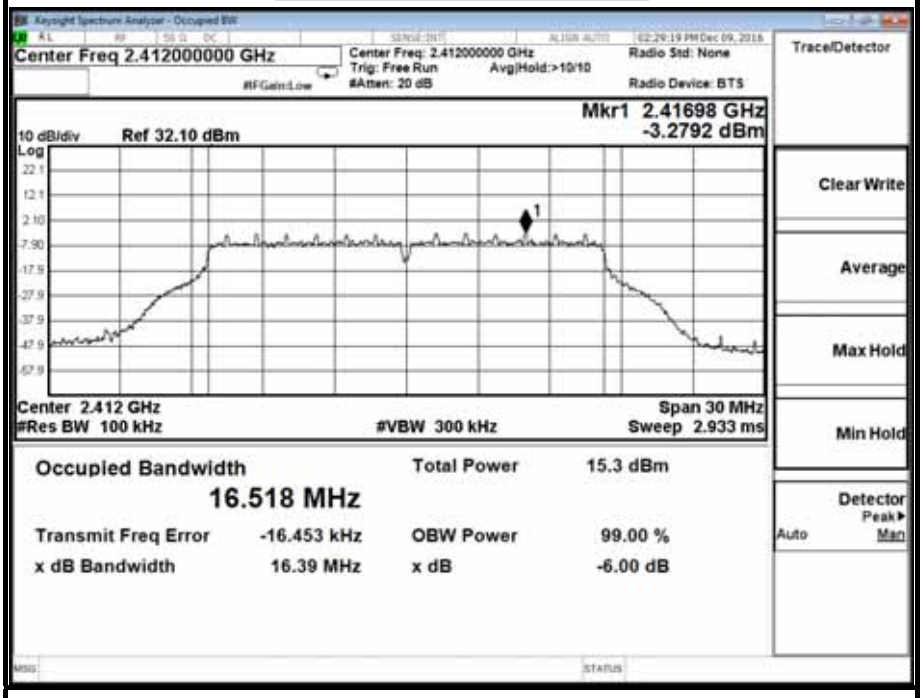
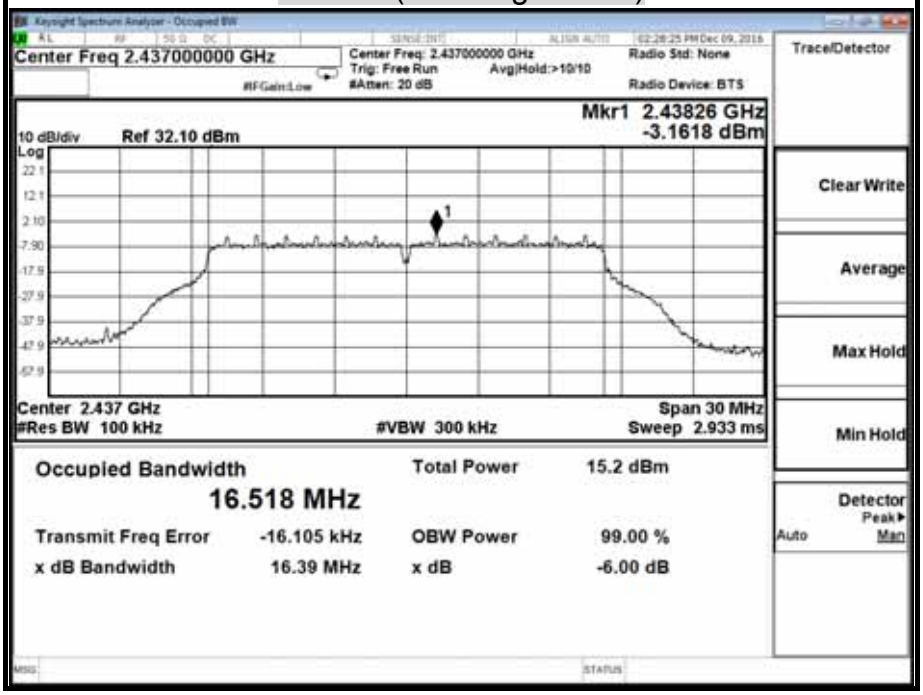


6dB BANDWIDTH (802.11g MODE)

CH Low (802.11g MODE)



CH Mid (802.11g MODE)



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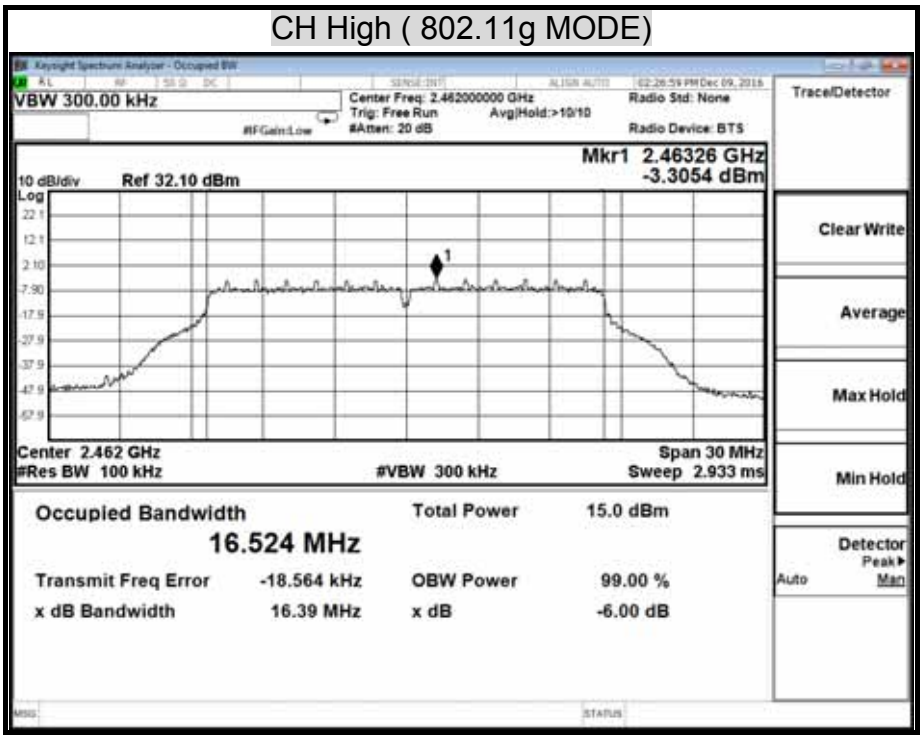
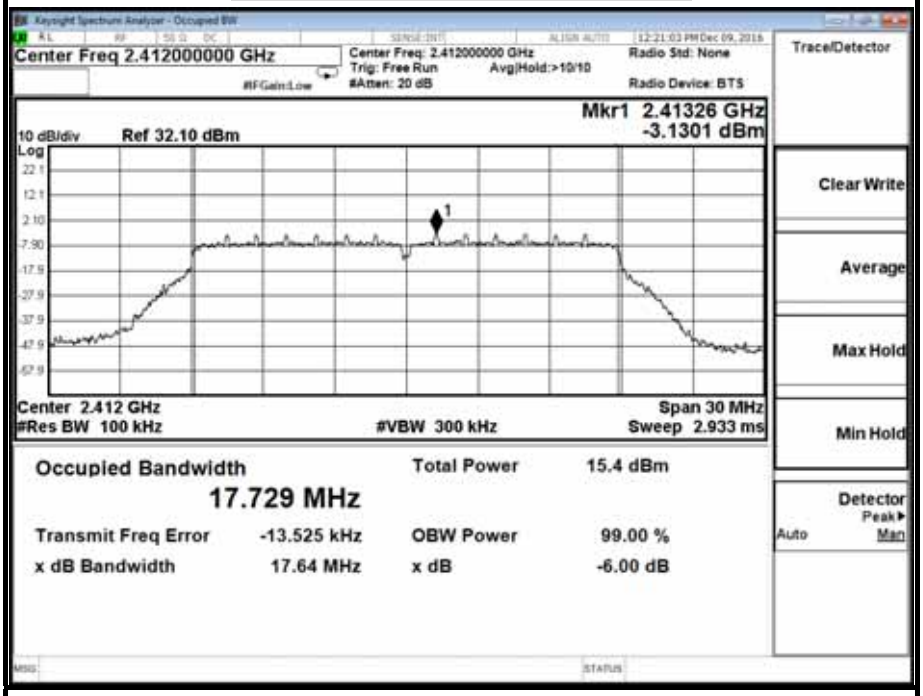
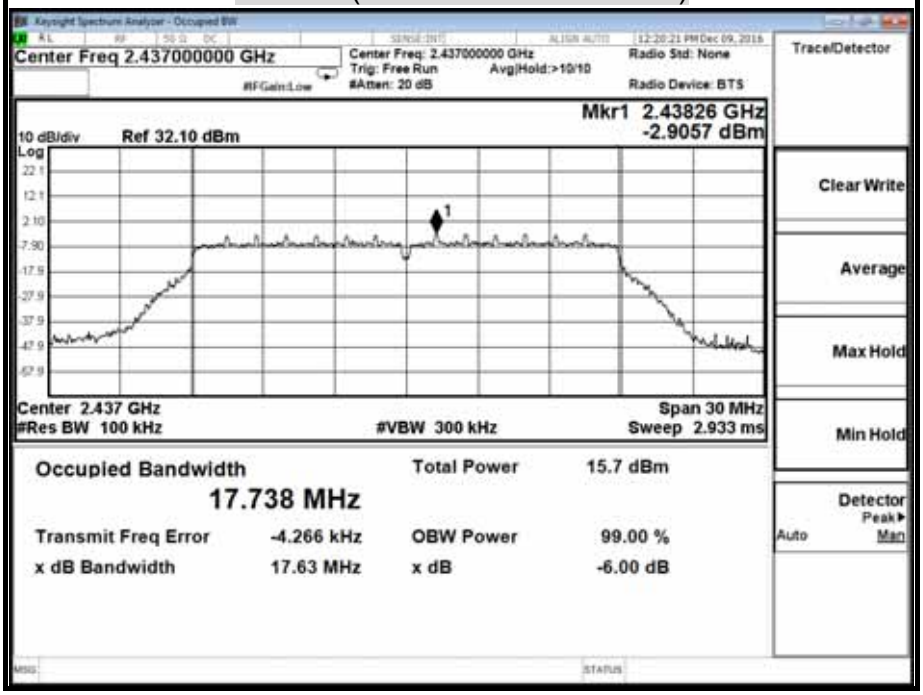


6dB BANDWIDTH (802.11n HT20 MODE)

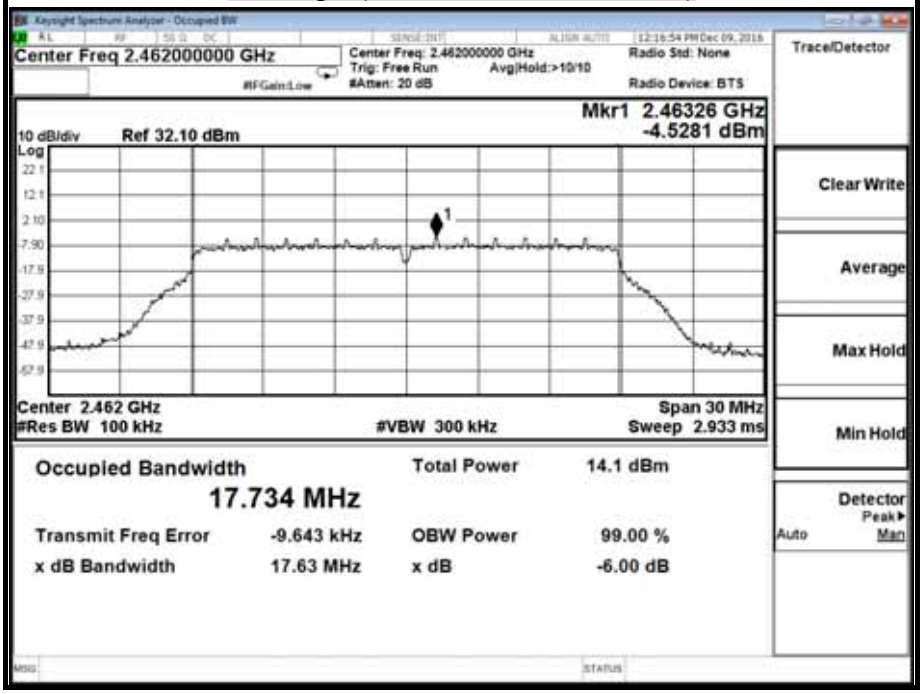
CH Low (802.11n HT20 MODE)



CH Mid (802.11n HT20 MODE)

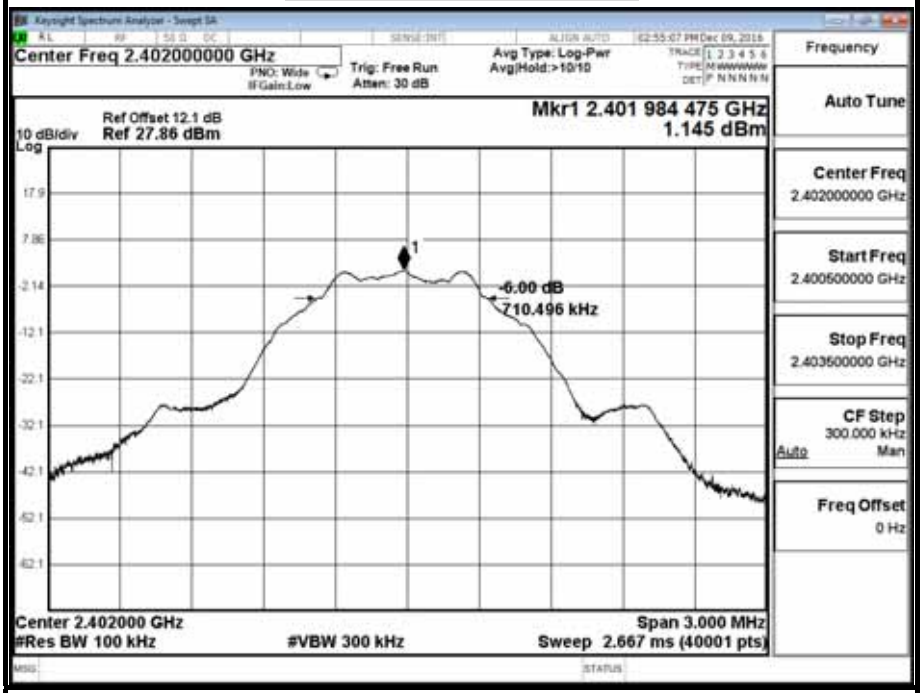


CH High (802.11n HT20 MODE)

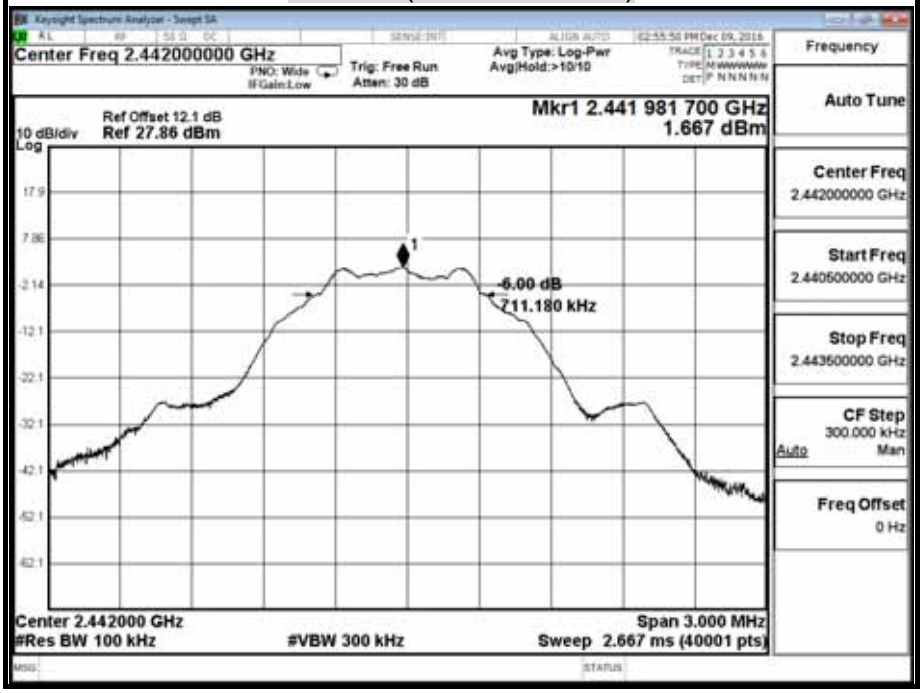


6dB BANDWIDTH (GFSK MODE)

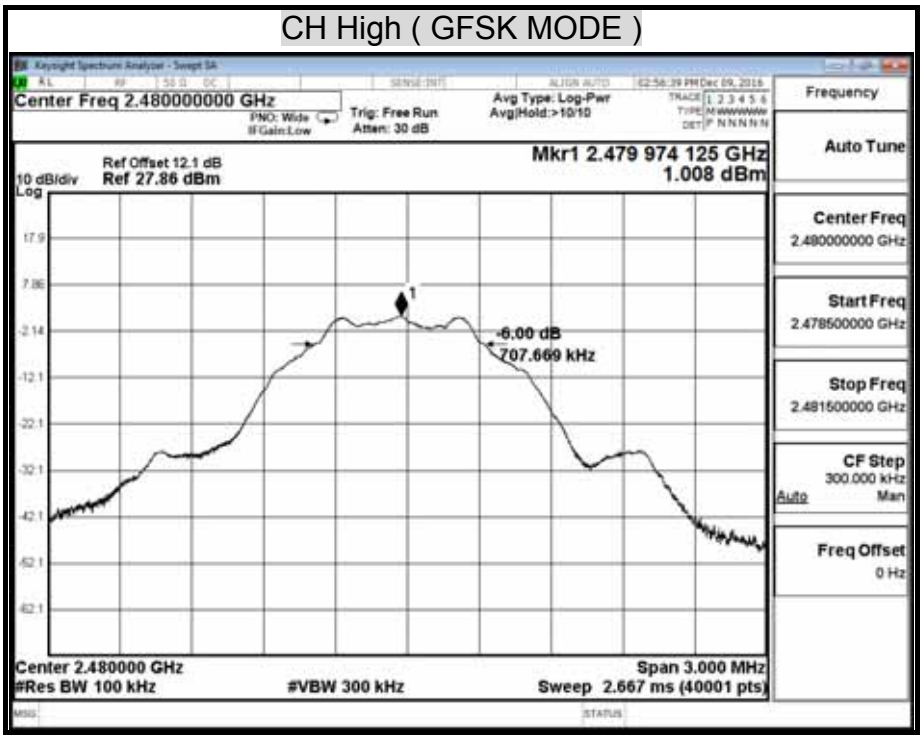
CH Low (GFSK MODE)



CH Mid (GFSK MODE)



CH High (GFSK MODE)



8.2 MAXIMUM PEAK OUTPUT POWER

LIMIT

§ 15.247(b) The maximum peak output power of the intentional radiator shall not exceed the following :

§ 15.247(b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands : 1 watt.

§ 15.247(b) (4) Except as shown in paragraphs (c) of this section , if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2), and (b)(3) of this section , as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

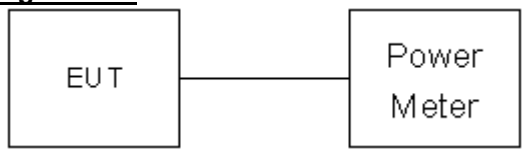
TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	04/29/2017
Power Meter	Anritsu	ML2487A	6K00003888	03/23/2017

TEST SETUP

For Peak Power

For Average Power



TEST PROCEDURE

The tests were performed in accordance with KDB 558074 5.2.1.2 and 5.2.2.1.

5.2.1.2 Measurement Procedure PK2:

1. Set the RBW = 1 MHz.
2. Set the VBW ≥ 3 RBW
3. Set the span ≥ 1.5 x DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select peak detector). If the instrument does not have a band power function,
9. Sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS bandwidth.

Average Power

Connect the EUT to power meter, set the center frequency of the power meter to the channel center frequency.

TEST RESULTS

No non-compliance noted

Model Name	HEADRUSH PEDALBOARD	Test By	Ted Huang
Temp & Humidity	24.3℃, 48%	Test Date	2016/12/08

IEEE 802.11b mode

Channel	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2412	11.61	30.00	-18.39
Middle	2437	11.43	30.00	-18.57
High	2462	11.28	30.00	-18.72

NOTE : 1. At finial test to get the worst-case emission at 1Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11g mode

Channel	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2412	16.38	30.00	-13.62
Middle	2437	16.24	30.00	-13.76
High	2462	16.14	30.00	-13.86

NOTE : 1.At finial test to get the worst-case emission at 6Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11n HT20 mode

Channel	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2412	16.13	30.00	-13.87
Middle	2437	16.27	30.00	-13.73
High	2462	15.06	30.00	-14.94

NOTE : 1. At finial test to get the worst-case emission at 6.5Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

Model Name	HEADRUSH PEDALBOARD	Test By	Ted Huang
Temp & Humidity	24.3℃, 48%	Test Date	2016/12/08

Bluetooth 4.0 (GFSK) mode

Channel	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2402	1.86	30.00	-28.14
Middle	2440	2.35	30.00	-27.65
High	2480	1.70	30.00	-28.30

NOTE : 1. At finial test to get the worst-case emission at 1Mbps.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.

Average Power Data

IEEE 802.11b mode

Channel	Channel Frequency (MHz)	Average Power (dBm)
Low	2412	8.38
Middle	2437	8.42
High	2462	8.49

IEEE 802.11g mode

Channel	Channel Frequency (MHz)	Average Power (dBm)
Low	2412	7.86
Middle	2437	7.87
High	2462	7.79

IEEE 802.11n HT20 mode

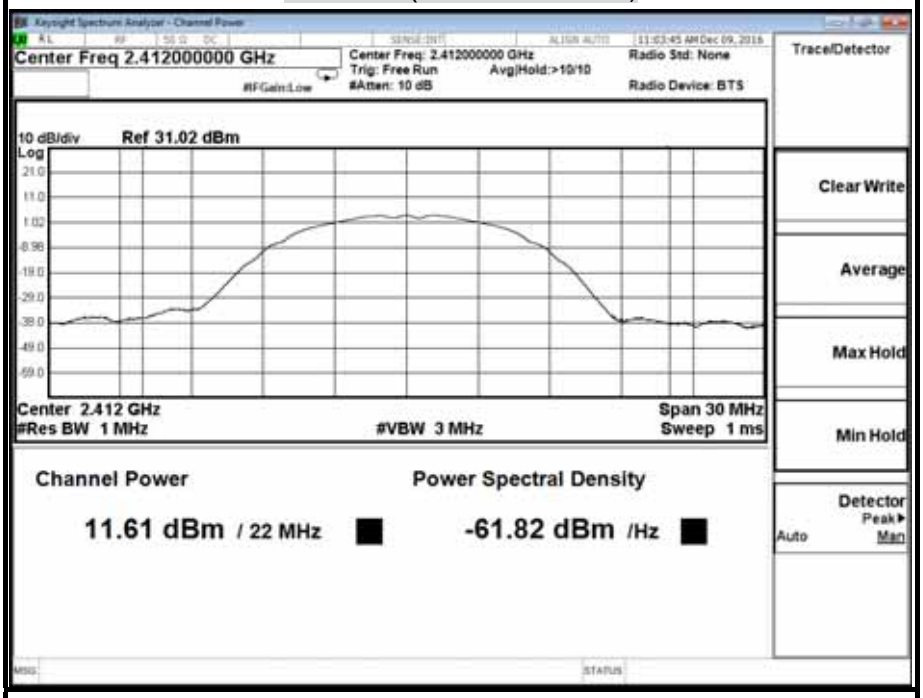
Channel	Channel Frequency (MHz)	Average Power (dBm)
		Chain 0
Low	2412	8.03
Middle	2437	7.91
High	2462	6.33

Bluetooth 4.0 (GFSK) mode

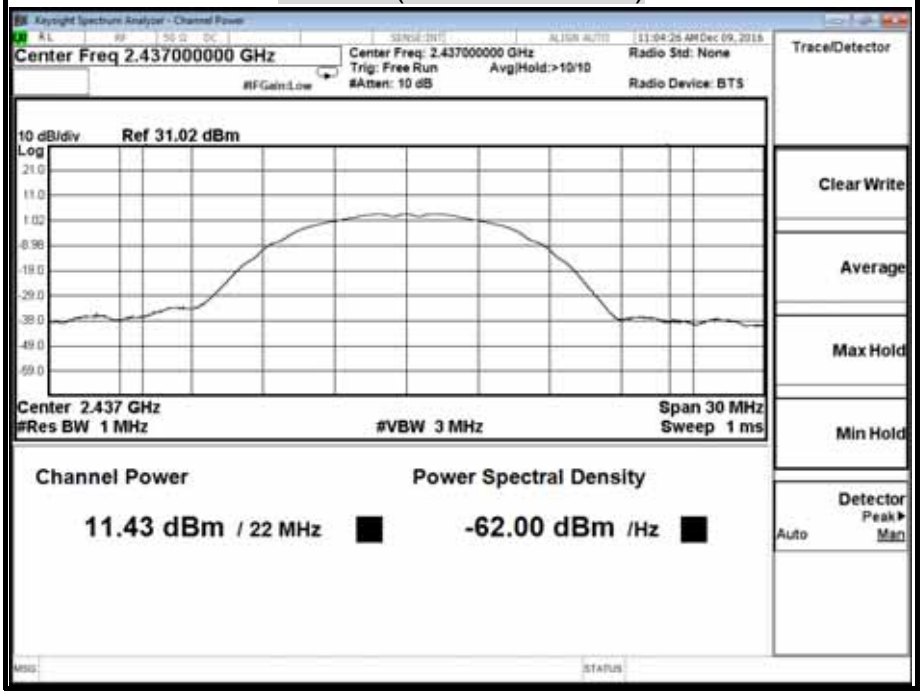
Channel	Channel Frequency (MHz)	Average Power (dBm)
		Chain 0
Low	2402	-0.60
Middle	2440	-0.05
High	2480	-0.75

MAXIMUM PEAK OUTPUT POWER (802.11b MODE)

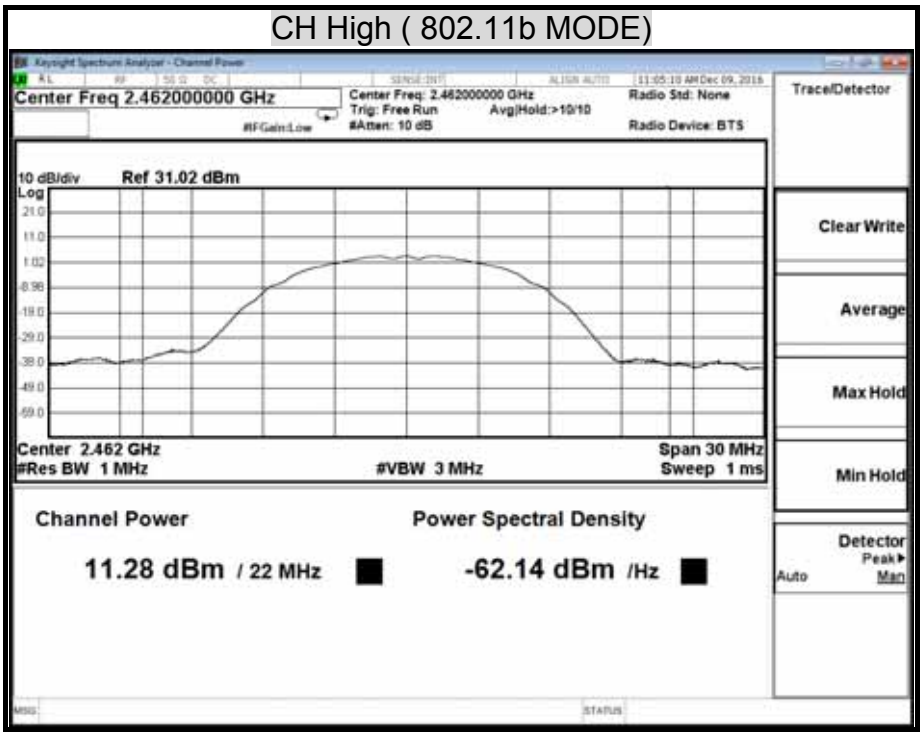
CH Low (802.11b MODE)



CH Mid (802.11b MODE)

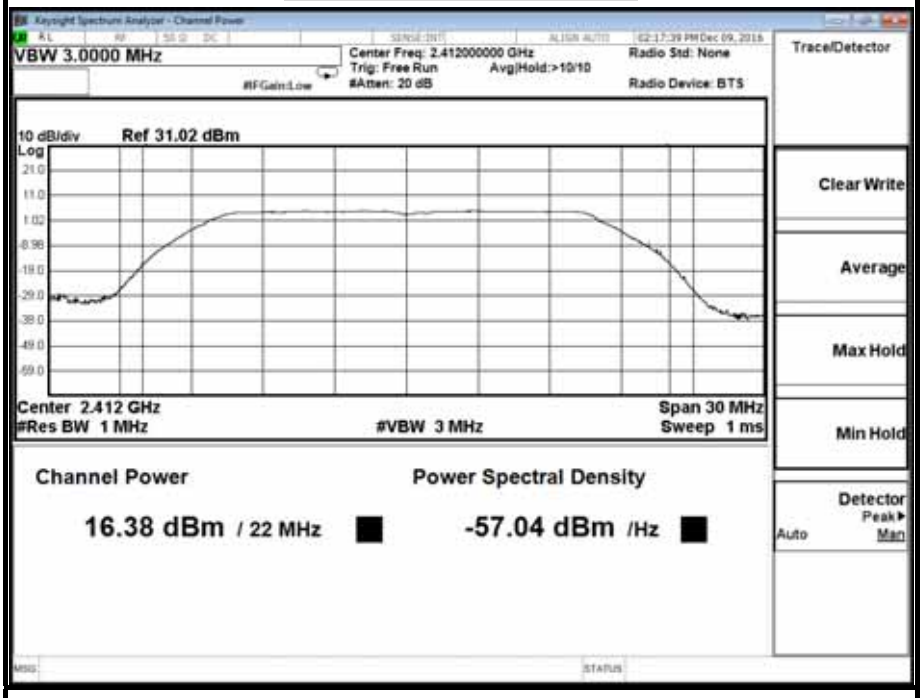


CH High (802.11b MODE)

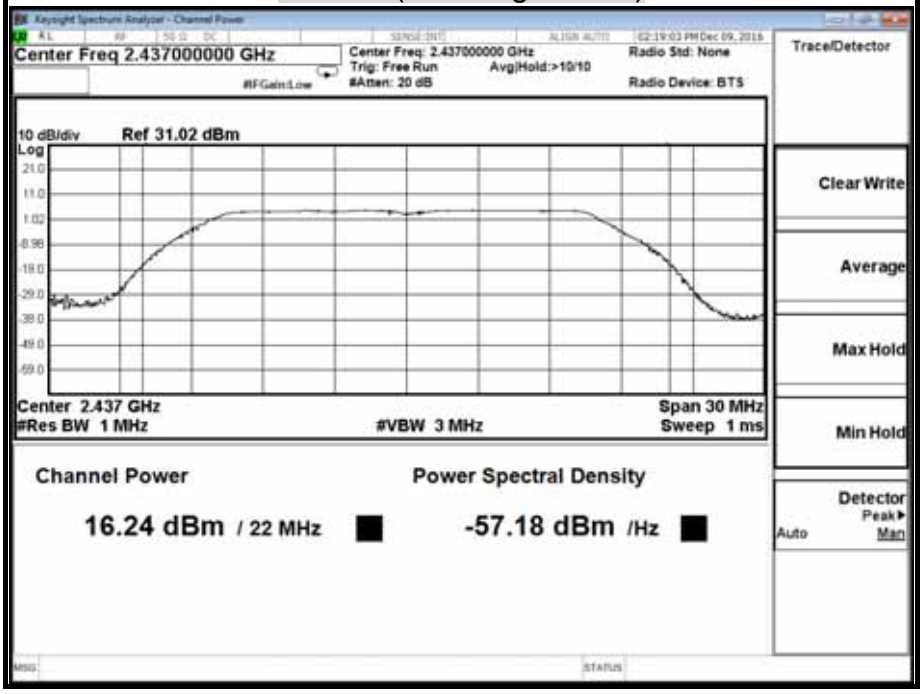


MAXIMUM PEAK OUTPUT POWER (802.11g MODE)

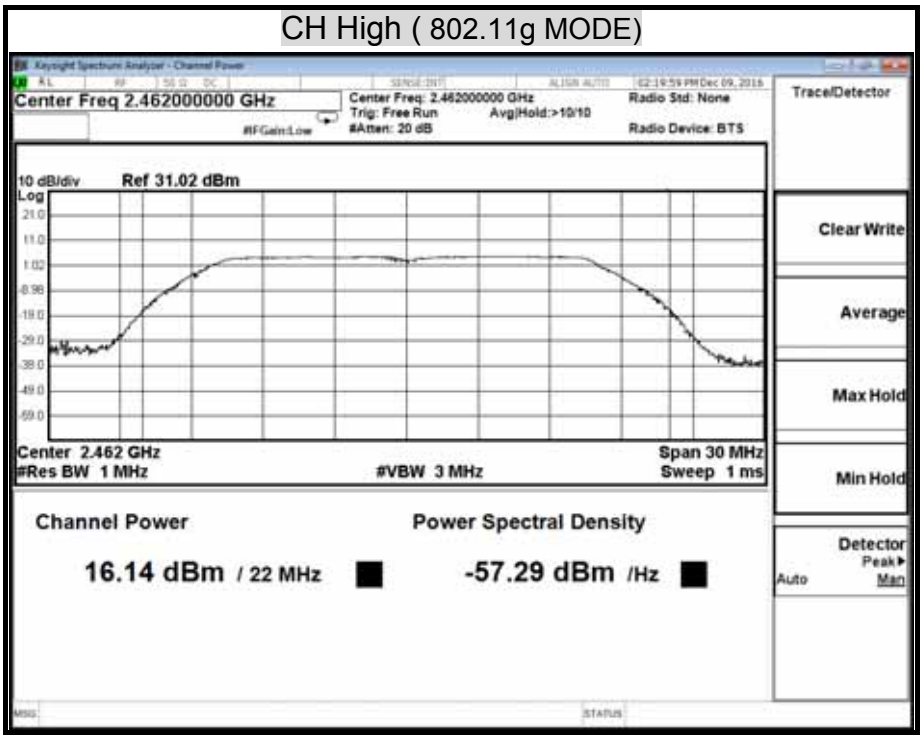
CH Low (802.11g MODE)



CH Mid (802.11g MODE)

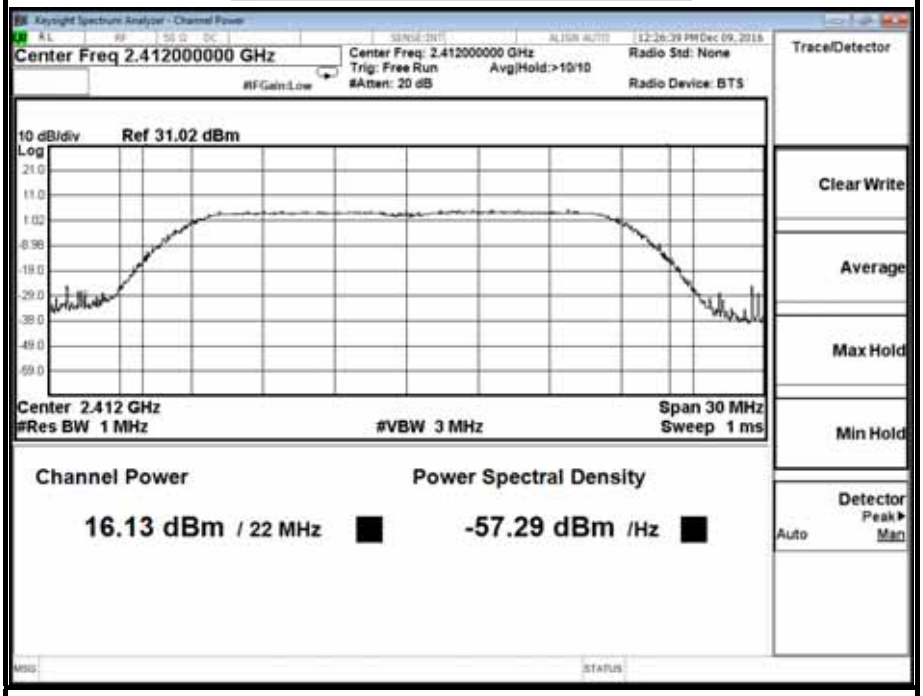


CH High (802.11g MODE)

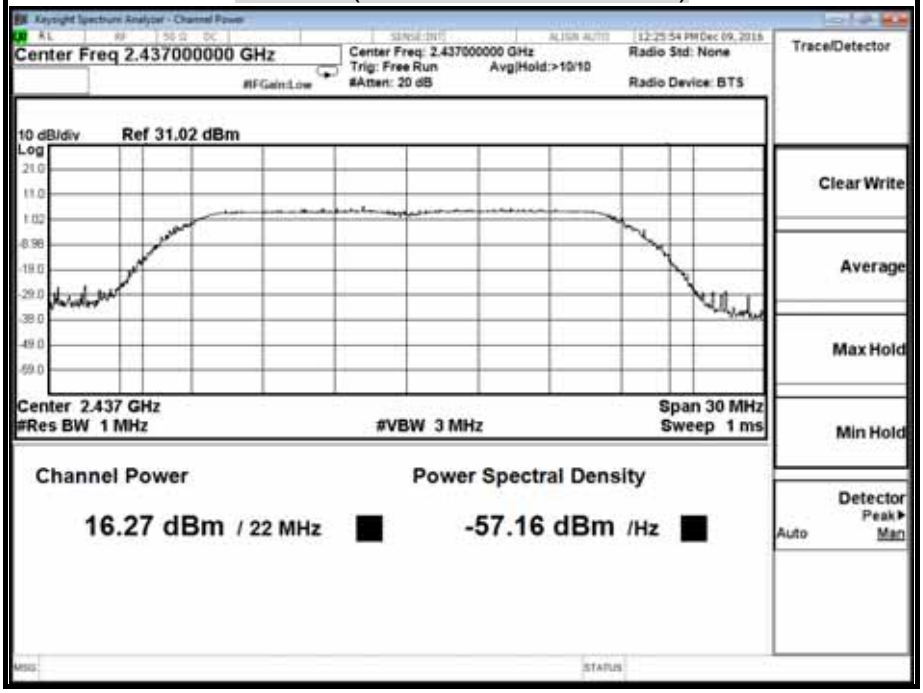


MAXIMUM PEAK OUTPUT POWER (802.11n HT20 MODE)

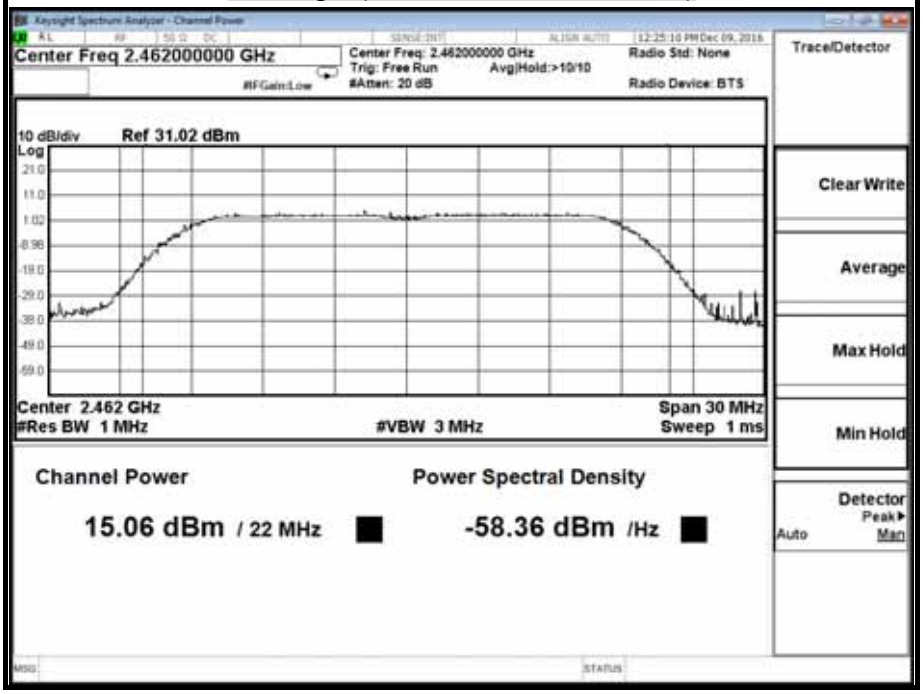
CH Low (802.11n HT20 MODE)



CH Mid (802.11n HT20 MODE)

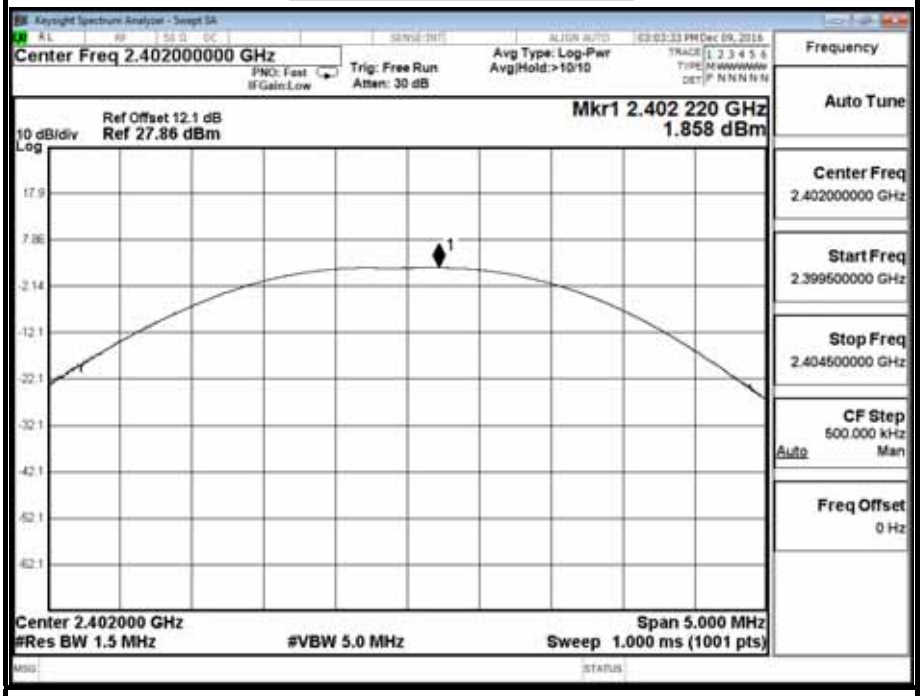


CH High (802.11n HT20 MODE)

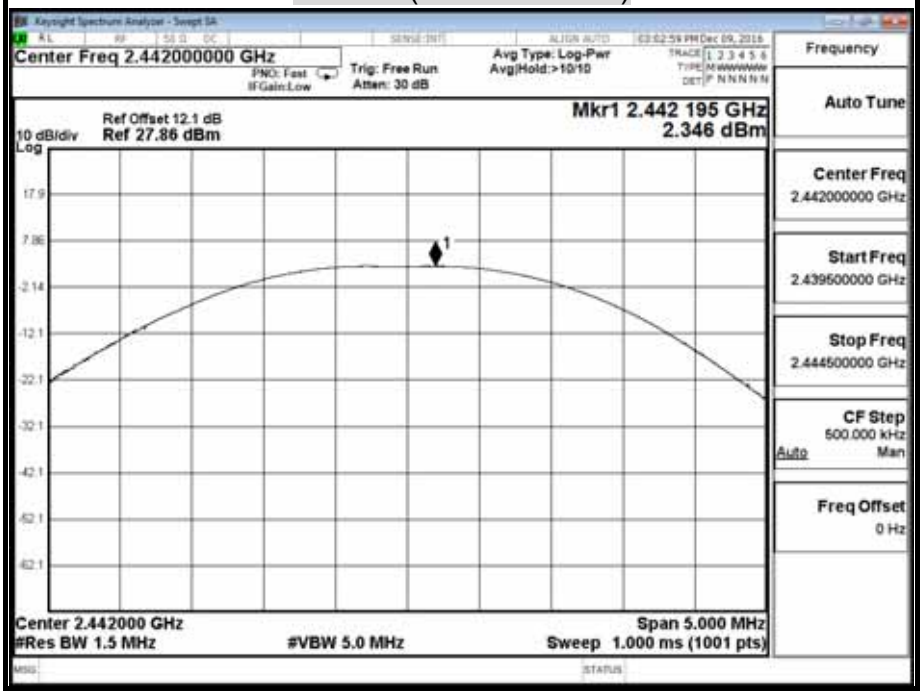


MAXIMUM PEAK OUTPUT POWER (GFSK MODE)

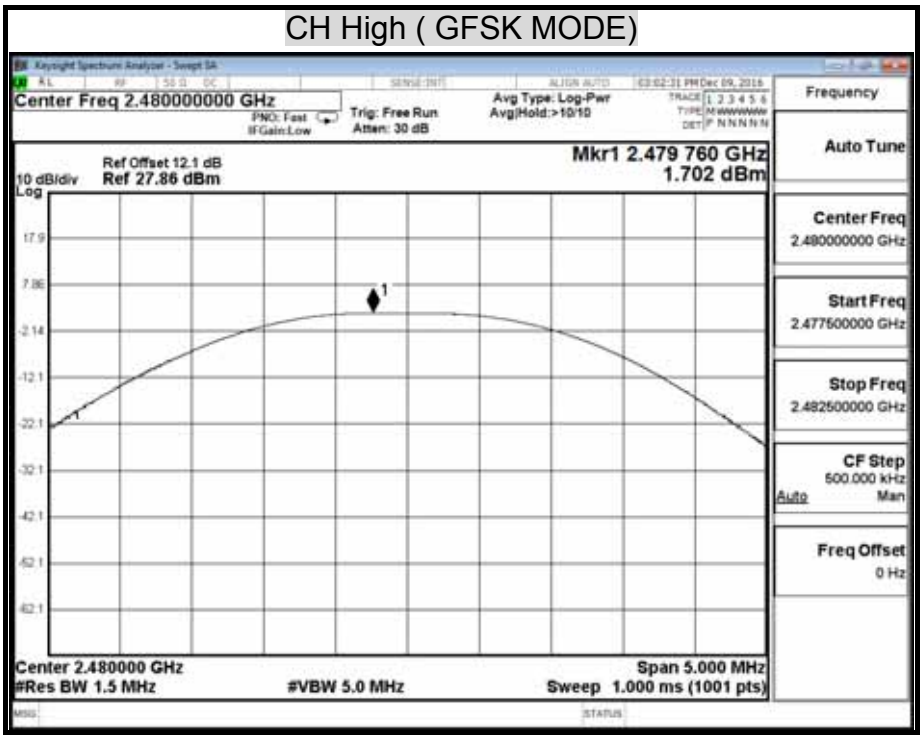
CH Low (GFSK MODE)



CH Mid (GFSK MODE)



CH High (GFSK MODE)



8.3 DUTY CYCLE

LIMIT

Nil (No dedicated limit specified in the Rules)

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	04/29/2017

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP

TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

TEST RESULTS

No non-compliance noted.

TEST DATA

WIFI

Model Name	HEADRUSH PEDALBOARD	Test By	Ted Huang
Temp & Humidity	24.3℃, 48%	Test Date	2016/12/08

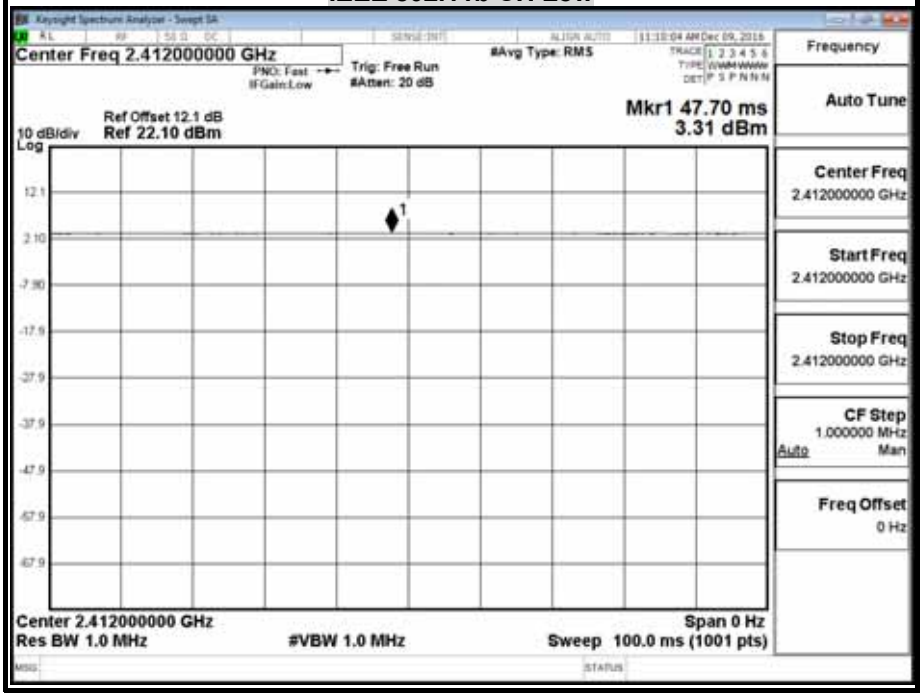
	us	Times	Ton	Total Ton time(ms)
Ton1	100000.000	1	100000	100
Ton2		0	0	
Ton3			0	
Tp				100

Ton	100		
Tp(Ton+Toff)	100		
Duty Cycle	1	100	%
10 * log (1/x) =	0		

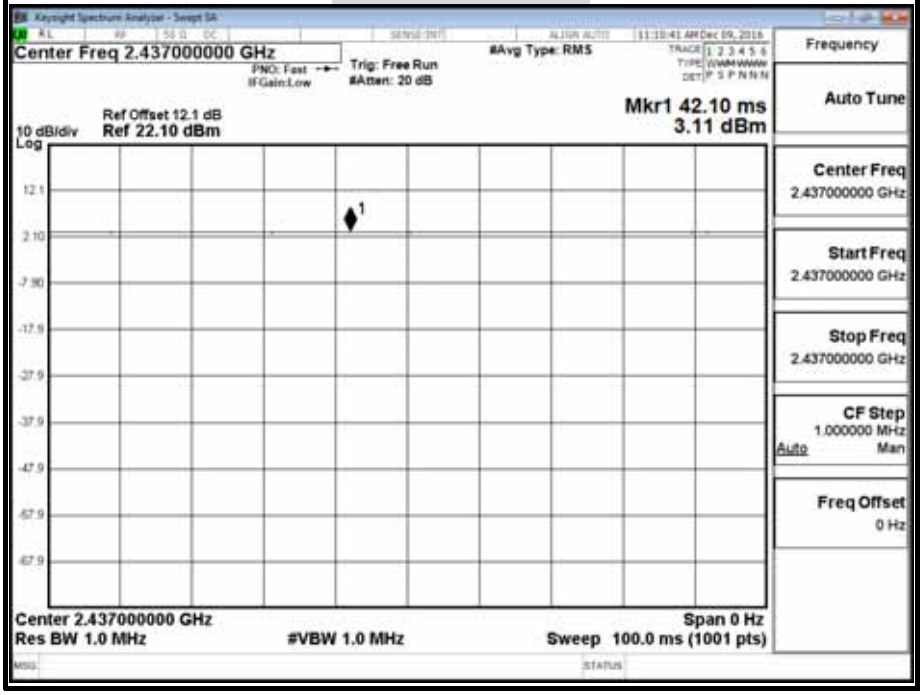
TEST PLOT

Plot

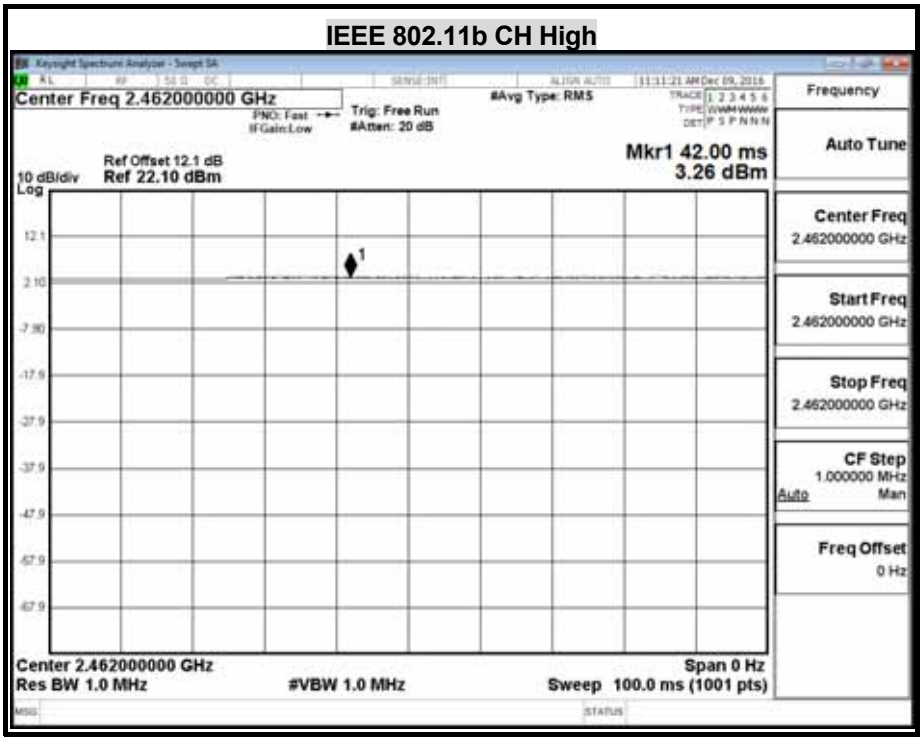
IEEE 802.11b CH Low



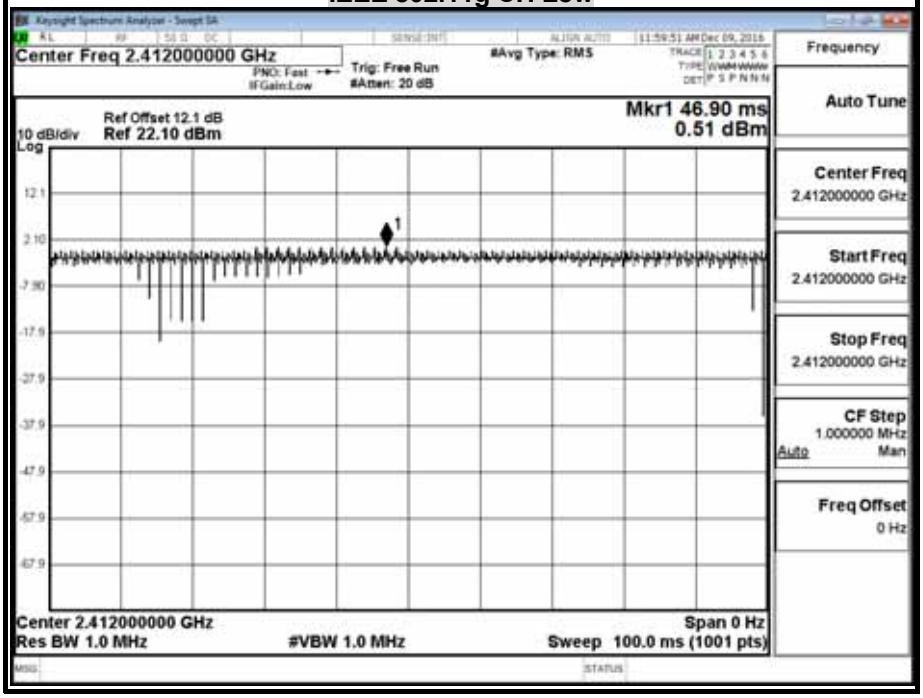
IEEE 802.11b CH Mid



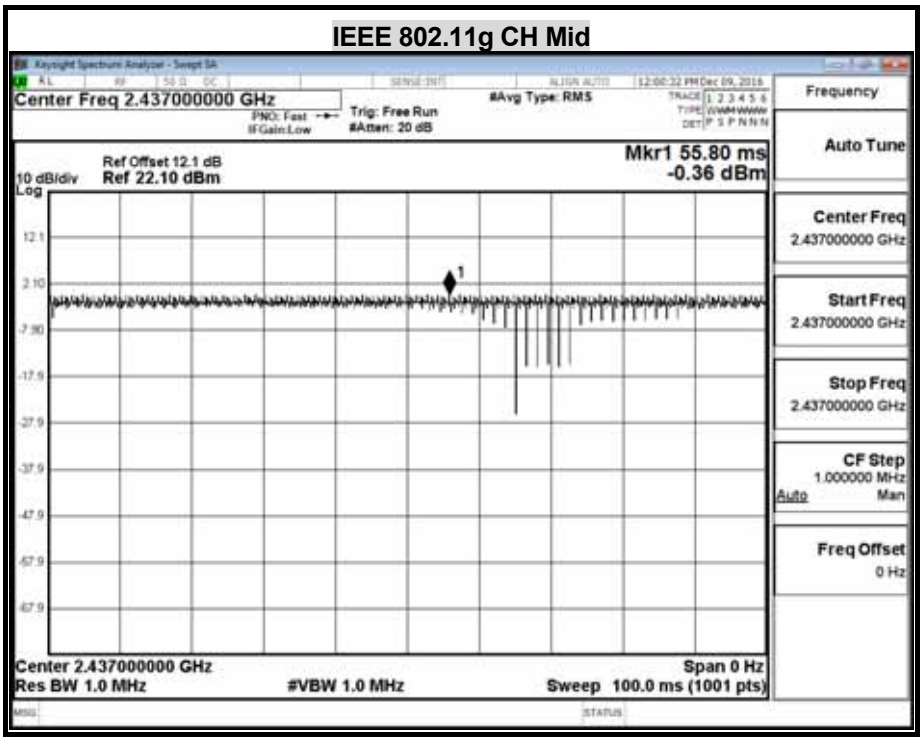
IEEE 802.11b CH High



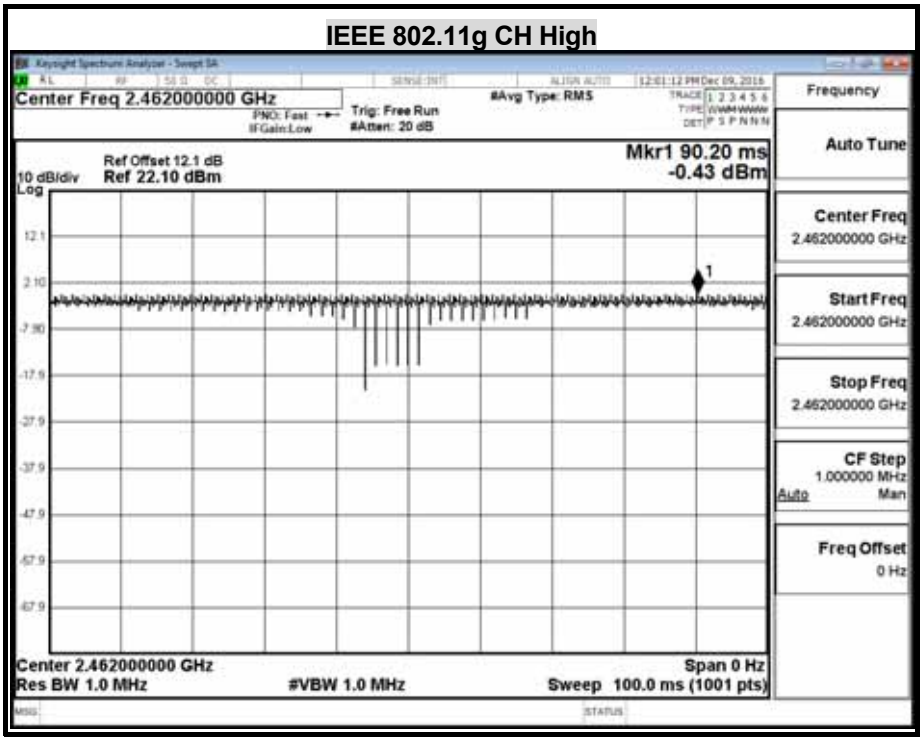
IEEE 802.11g CH Low



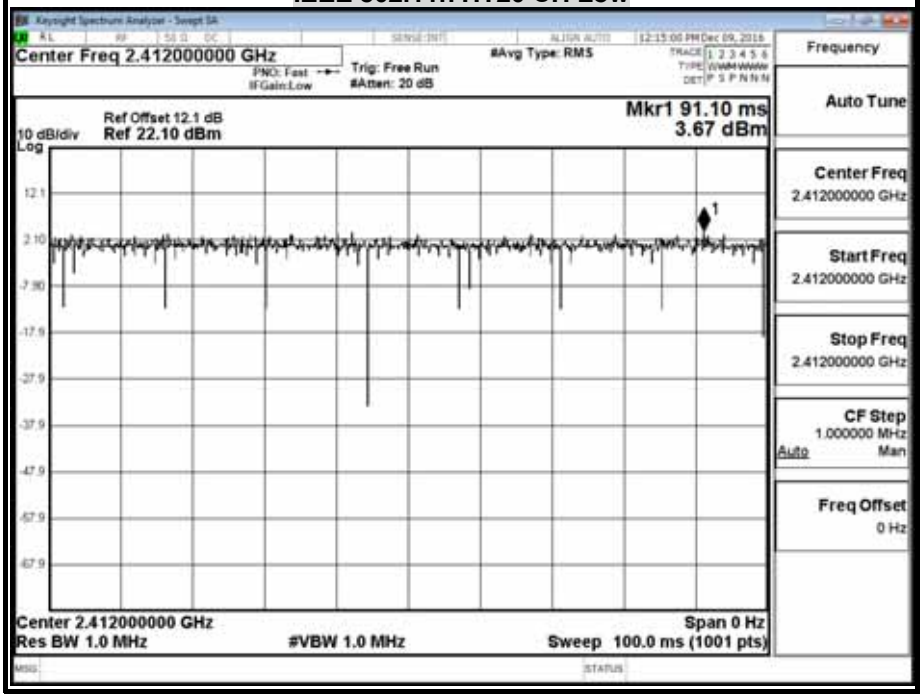
IEEE 802.11g CH Mid



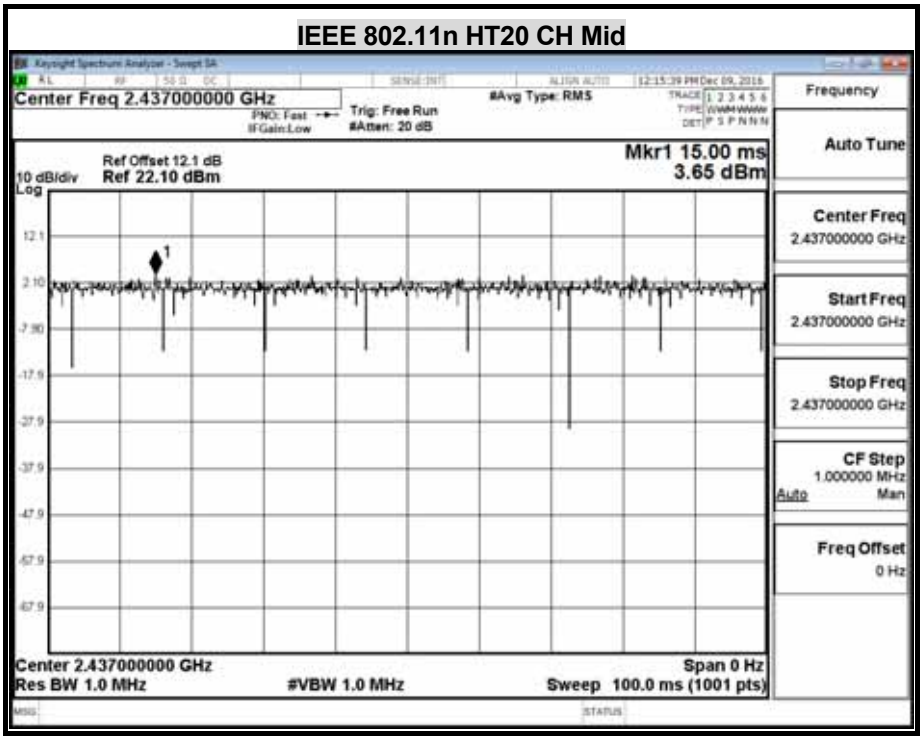
IEEE 802.11g CH High



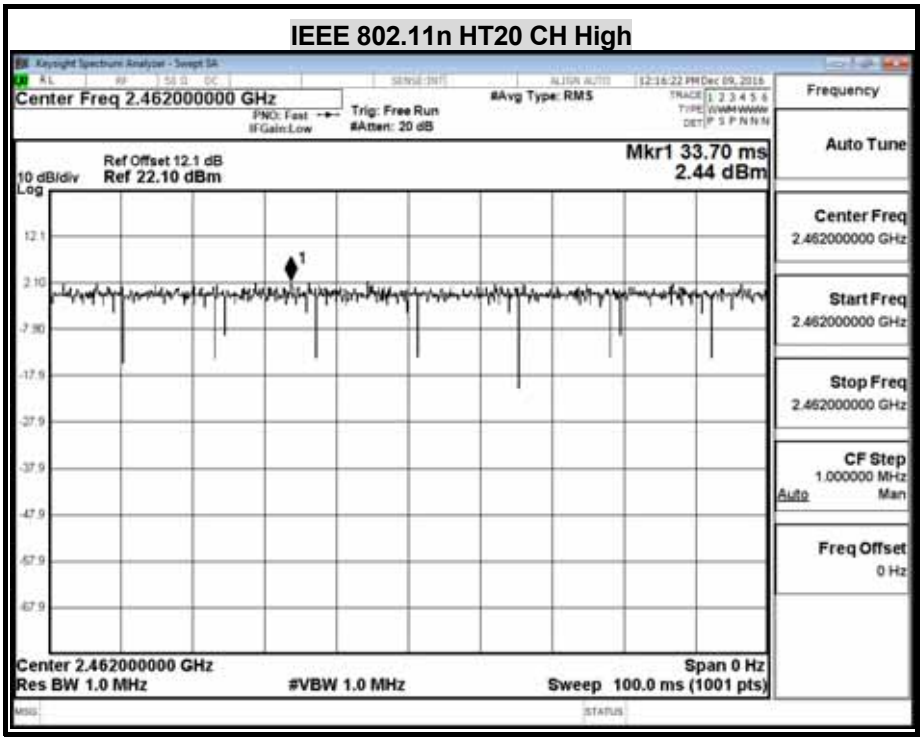
IEEE 802.11n HT20 CH Low



IEEE 802.11n HT20 CH Mid



IEEE 802.11n HT20 CH High



Bluetooth 4.0:

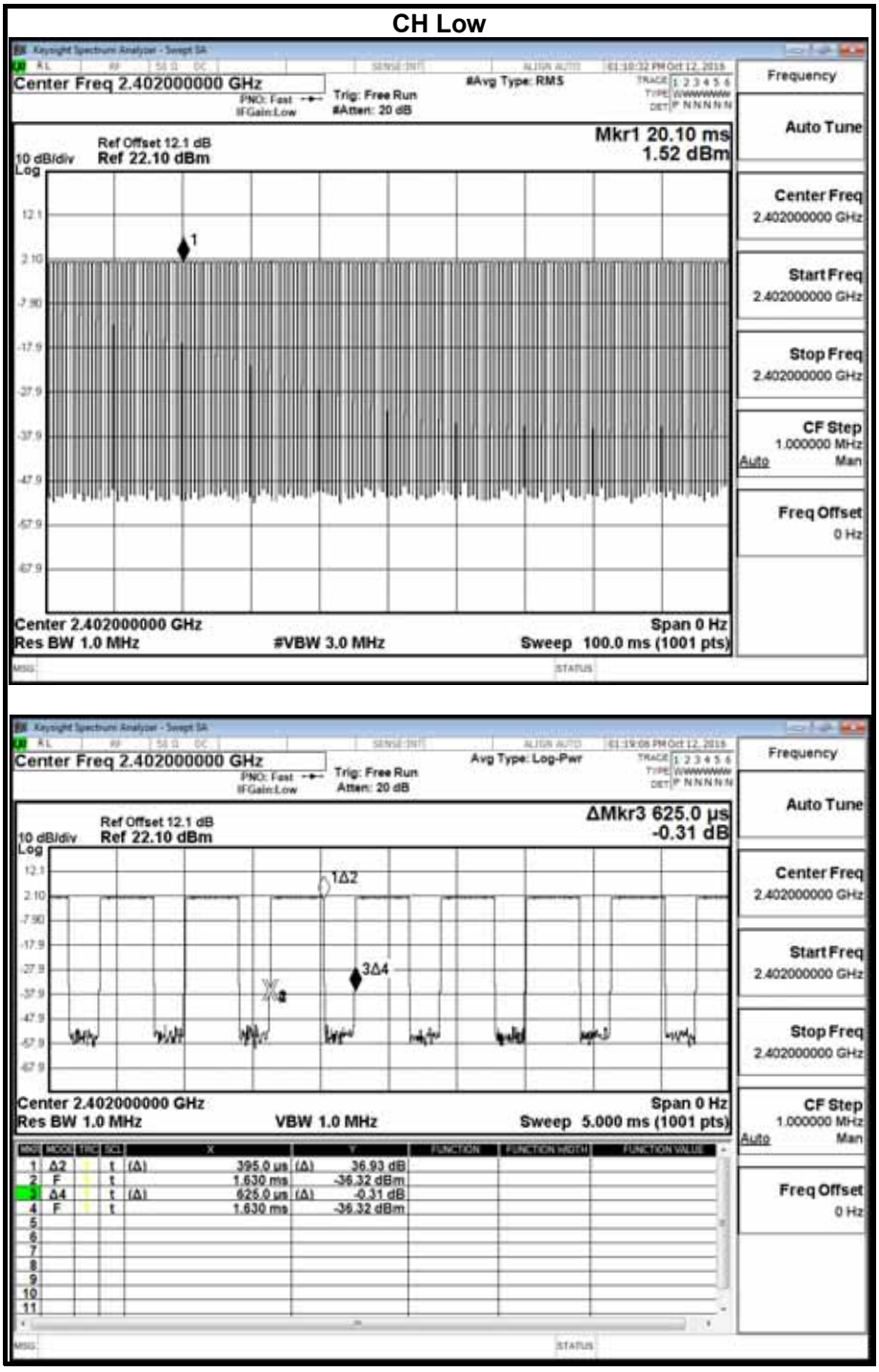
Model Name	HEADRUSH PEDALBOARD	Test By	Ted Huang
Temp & Humidity	24.3℃, 48%	Test Date	2016/12/08

	us	Times	Ton	Total Ton time(ms)
Ton1	395.000	1	395	
Ton2		0	0	
Ton3			0	0.395
Tp				0.625

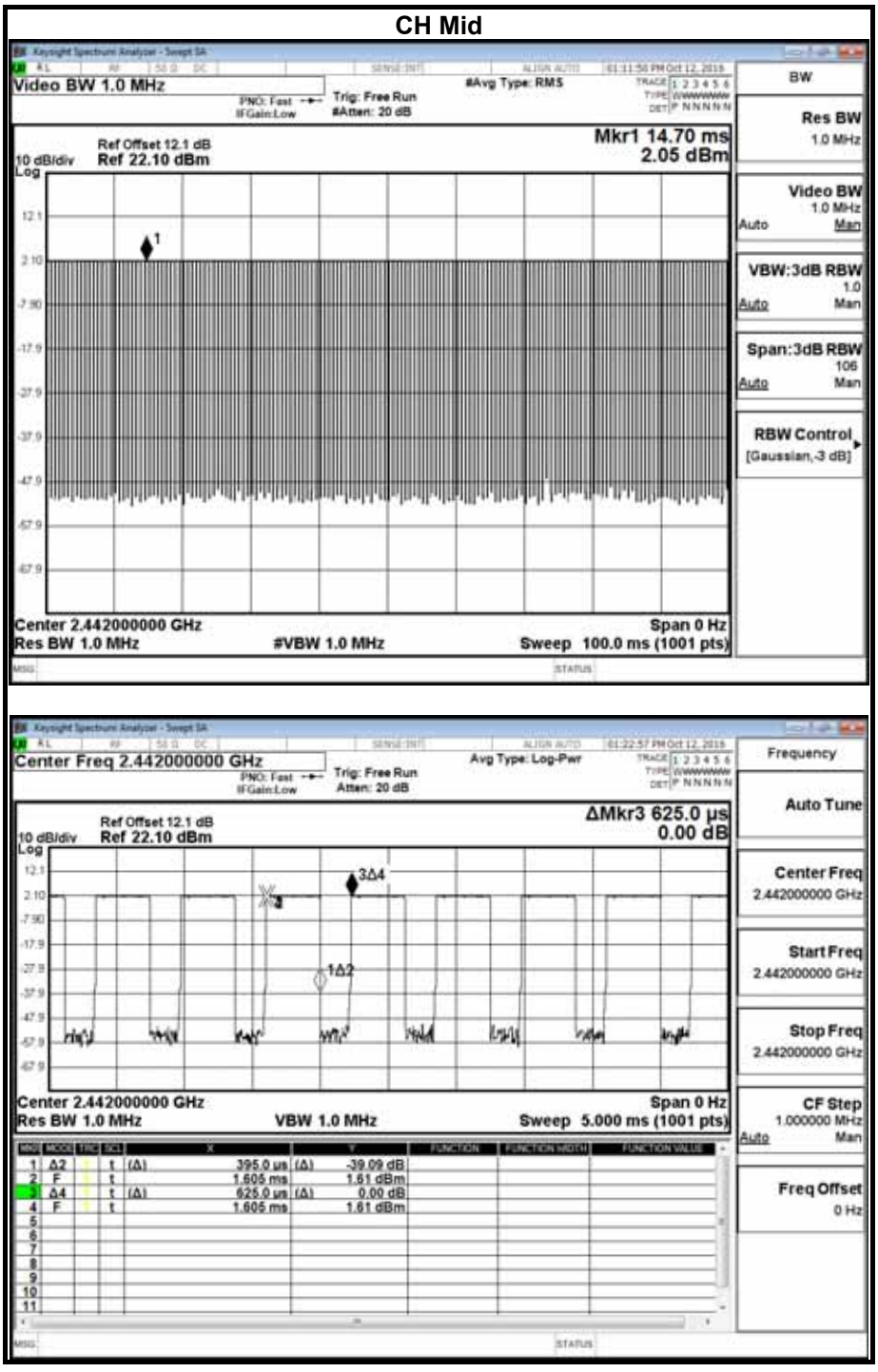
Ton	0.395
Tp(Ton+Toff)	0.625
Duty Cycle	0.632
10 * log (1/x) =	1.992829217

Plot

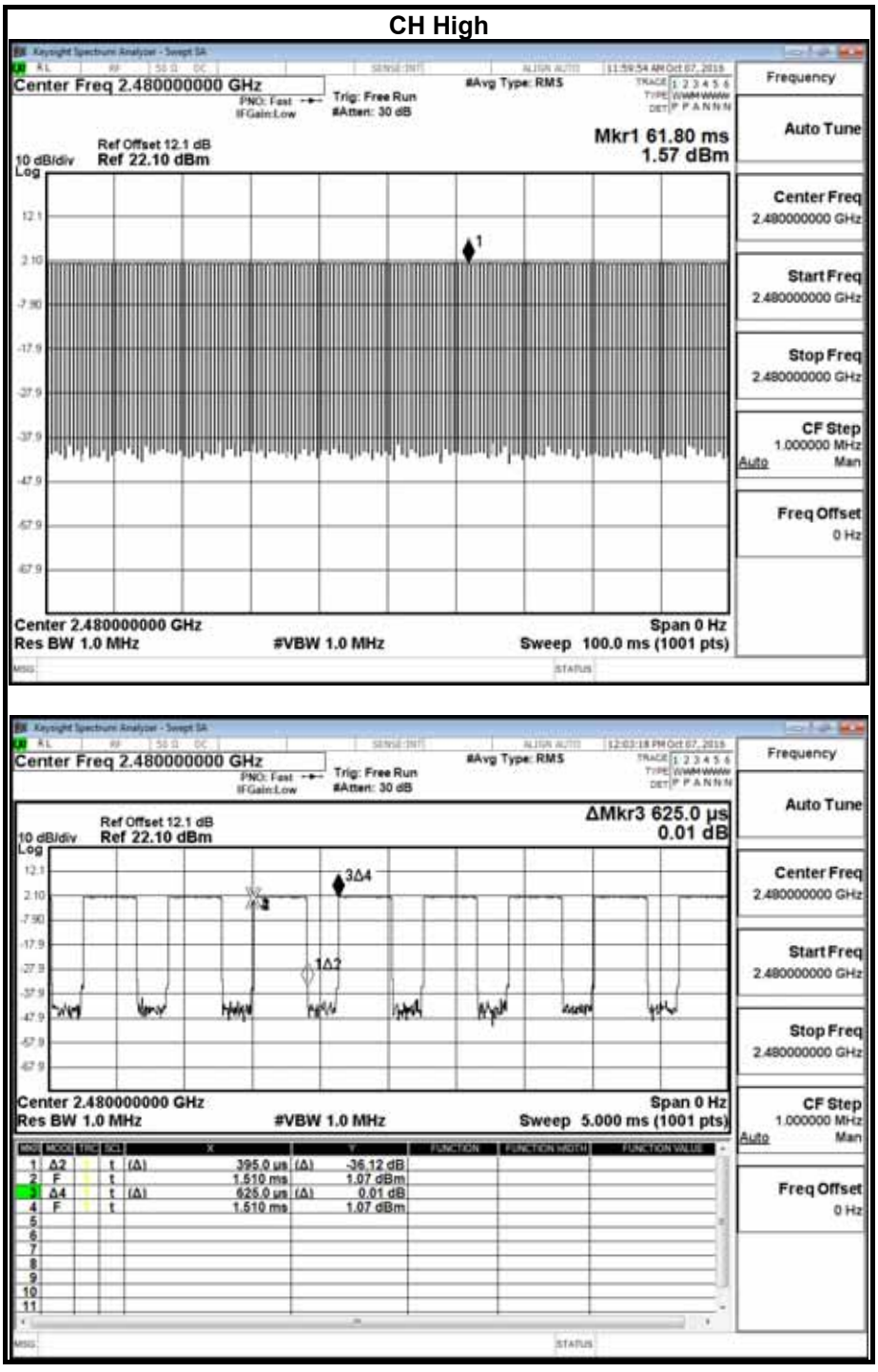
CH Low


Center Freq 2.402000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
#Avg Type: RMS
Ref Offset 12.1 dB
10 dB/div
Ref 22.10 dBm
Mkr1 20.10 ms
1.52 dBm
Center 2.402000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 100.0 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.402000000 GHz
Start Freq
2.402000000 GHz
Stop Freq
2.402000000 GHz
CF Step
1.000000 MHz
Auto
Man
Freq Offset
0 Hz
Center Freq 2.402000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Ref Offset 12.1 dB
10 dB/div
Ref 22.10 dBm
ΔMkr3 625.0 µs
-0.31 dB
Center 2.402000000 GHz
Res BW 1.0 MHz
VBW 1.0 MHz
Span 0 Hz
Sweep 5.000 ms (1001 pts)
1 Δ2 t (Δ) 395.0 µs (Δ) 36.93 dB
2 F t 1.630 ms -36.32 dBm
3 Δ4 t (Δ) 625.0 µs (Δ) -0.31 dB
4 F t 1.630 ms -36.32 dBm
Frequency
Auto Tune
Center Freq
2.402000000 GHz
Start Freq
2.402000000 GHz
Stop Freq
2.402000000 GHz
CF Step
1.000000 MHz
Auto
Man
Freq Offset
0 Hz

CH Mid


Video BW 1.0 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
#Avg Type: RMS
Ref Offset 12.1 dB
10 dB/div
Ref 22.10 dBm
Mkr1 14.70 ms
2.05 dBm
Center 2.442000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 100.0 ms (1001 pts)
BW
Res BW
1.0 MHz
Video BW
1.0 MHz
Auto
Man
VBW:3dB RBW
1.0
Auto
Man
Span:3dB RBW
106
Auto
Man
RBW Control
[Gaussian,-3 dB]
Center Freq 2.442000000 GHz
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
Ref Offset 12.1 dB
10 dB/div
Ref 22.10 dBm
ΔMkr3 625.0 µs
0.00 dB
Center 2.442000000 GHz
Res BW 1.0 MHz
VBW 1.0 MHz
Span 0 Hz
Sweep 5.000 ms (1001 pts)
1 Δ2 t (Δ) 395.0 µs (Δ) -39.09 dB
2 F t 1.605 ms 1.61 dBm
3 Δ4 t (Δ) 625.0 µs (Δ) 0.00 dB
4 F t 1.605 ms 1.61 dBm
Frequency
Auto Tune
Center Freq
2.442000000 GHz
Start Freq
2.442000000 GHz
Stop Freq
2.442000000 GHz
CF Step
1.000000 MHz
Auto
Man
Freq Offset
0 Hz

CH High


Center Freq 2.480000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
#Avg Type: RMS
Mkr1 61.80 ms
1.57 dBm
Ref Offset 12.1 dB
10 dB/div
Ref 22.10 dBm
Log
Center 2.480000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 100.0 ms (1001 pts)
Frequency
Auto Tune
Center Freq
2.480000000 GHz
Start Freq
2.480000000 GHz
Stop Freq
2.480000000 GHz
CF Step
1.000000 MHz
Auto
Man
Freq Offset
0 Hz
ΔMkr3 625.0 µs
0.01 dB
1 Δ2 t (Δ) 395.0 µs (Δ) -36.12 dB
2 F t 1.510 ms 1.07 dBm
3 Δ4 t (Δ) 625.0 µs (Δ) 0.01 dB
4 F t 1.510 ms 1.07 dBm

8.4 POWER SPECTRAL DENSITY

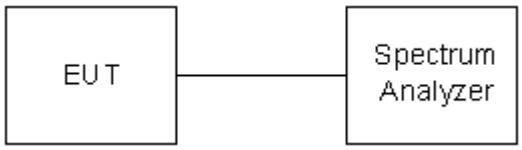
LIMIT

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

TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	04/29/2017

TEST SETUP



TEST PROCEDURE

The tests were performed in accordance with KDB 558074 5.3.1.

5.3.1 Measurement Procedure PKPSD:

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the *DTS bandwidth*.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST RESULTS

Model Name	HEADRUSH PEDALBOARD	Test By	Ted Huang
Temp & Humidity	24.3℃, 48%	Test Date	2016/12/08

IEEE 802.11b mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2412	0.42	8.00	-7.58	PASS
Middle	2437	0.59	8.00	-7.41	PASS
High	2462	0.61	8.00	-7.39	PASS

NOTE : 1. At finial test to get the worst-case emission at 1long Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11g mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2412	-3.28	8.00	-11.28	PASS
Middle	2437	-3.16	8.00	-11.16	PASS
High	2462	-3.31	8.00	-11.31	PASS

NOTE : 1. At finial test to get the worst-case emission at 6Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

IEEE 802.11n HT20 mode

Channel	Frequency (MHz)	PPSD Chain0 (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2412	-3.13	8.00	-11.13	PASS
Middle	2437	-2.91	8.00	-10.91	PASS
High	2462	-4.53	8.00	-12.53	PASS

NOTE : 1. At finial test to get the worst-case emission at 6.5Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

Model Name	HEADRUSH PEDALBOARD	Test By	Ted Huang
Temp & Humidity	24.3℃, 48%	Test Date	2016/12/08

Bluetooth 4.0 (GFSK) mode

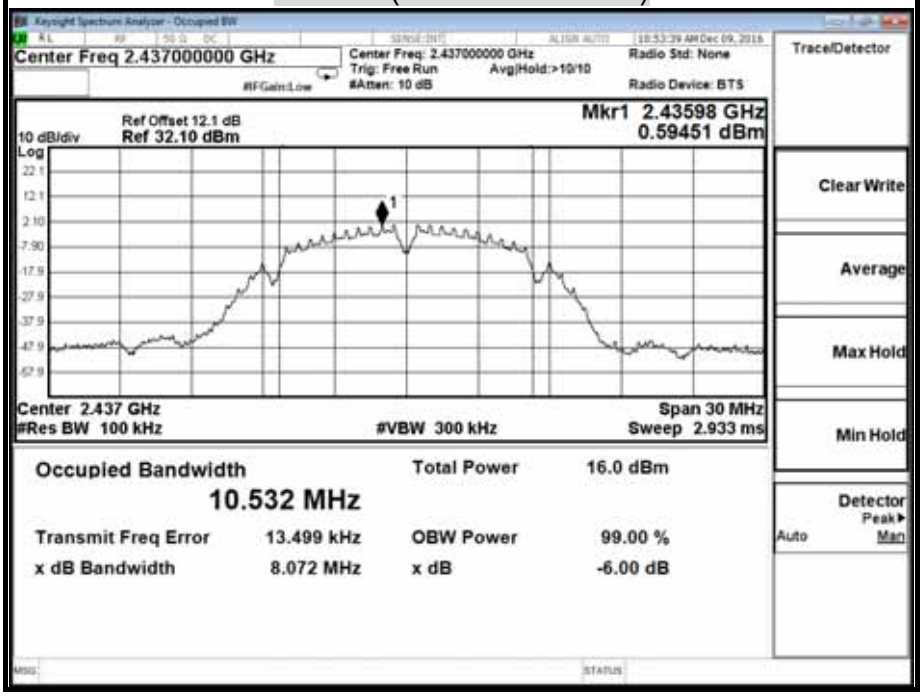
Channel	Frequency (MHz)	PPSD Chain0 (dBm)	Limit (dBm)	Margin (dB)	Pass / Fail
Low	2402	1.15	8.00	-6.86	PASS
Middle	2440	1.67	8.00	-6.33	PASS
High	2480	1.01	8.00	-6.99	PASS

NOTE : 1. At finial test to get the worst-case emission at 1Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.

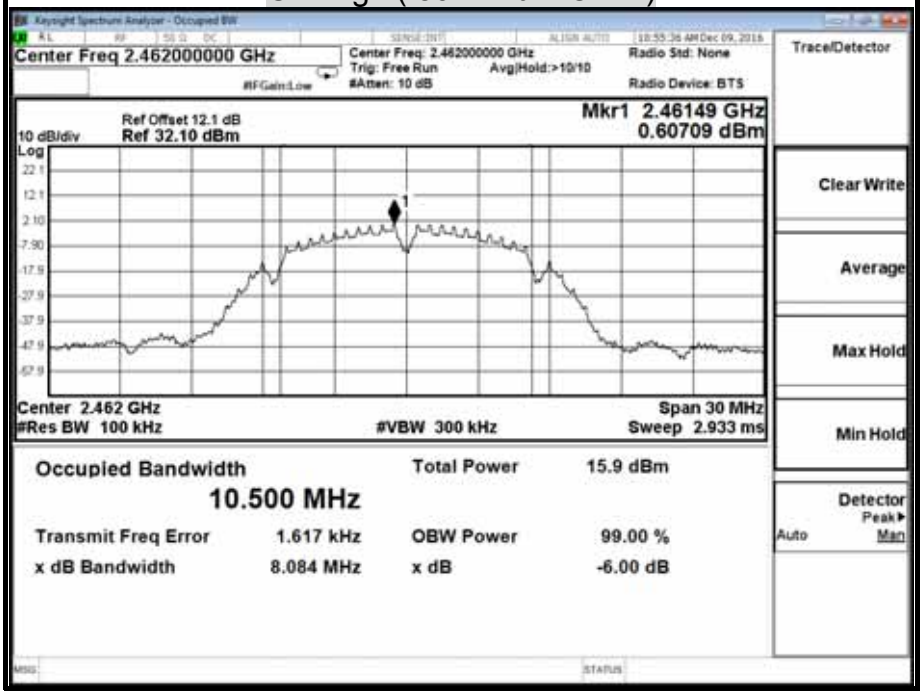
POWER SPECTRAL DENSITY (IEEE 802.11b MODE)

CH Low (802.11b MODE)

CH Mid (802.11b MODE)

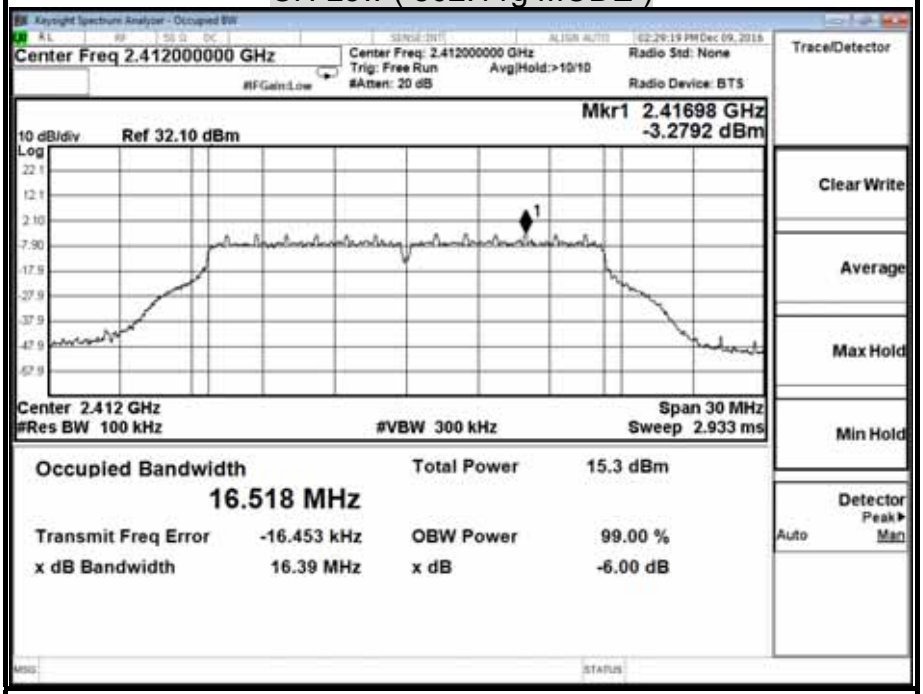


CH High (802.11b MODE)

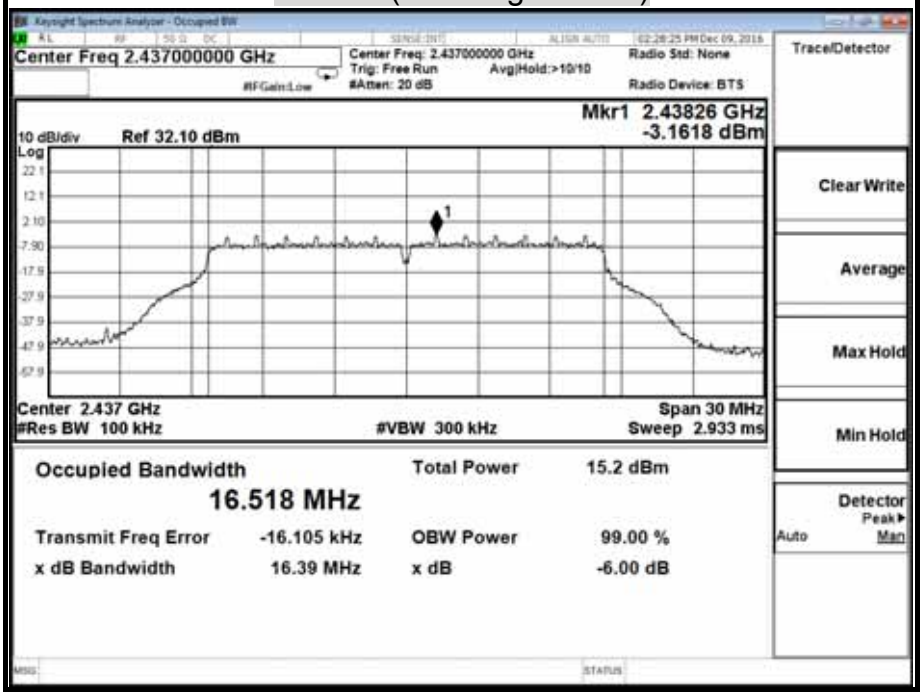


POWER SPECTRAL DENSITY (IEEE 802.11g MODE)

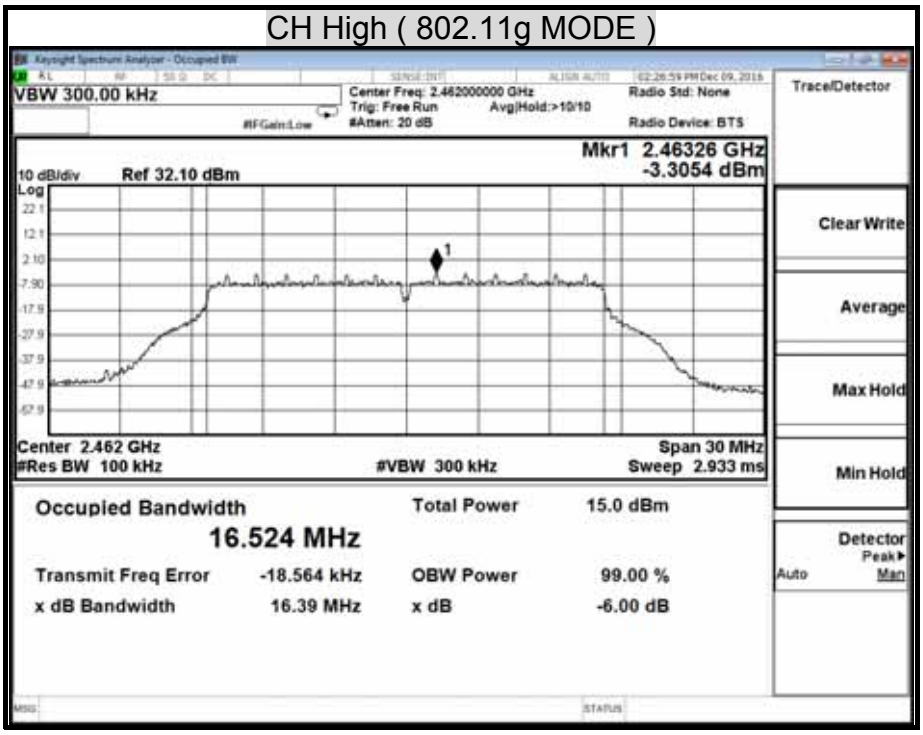
CH Low (802.11g MODE)



CH Mid (802.11g MODE)

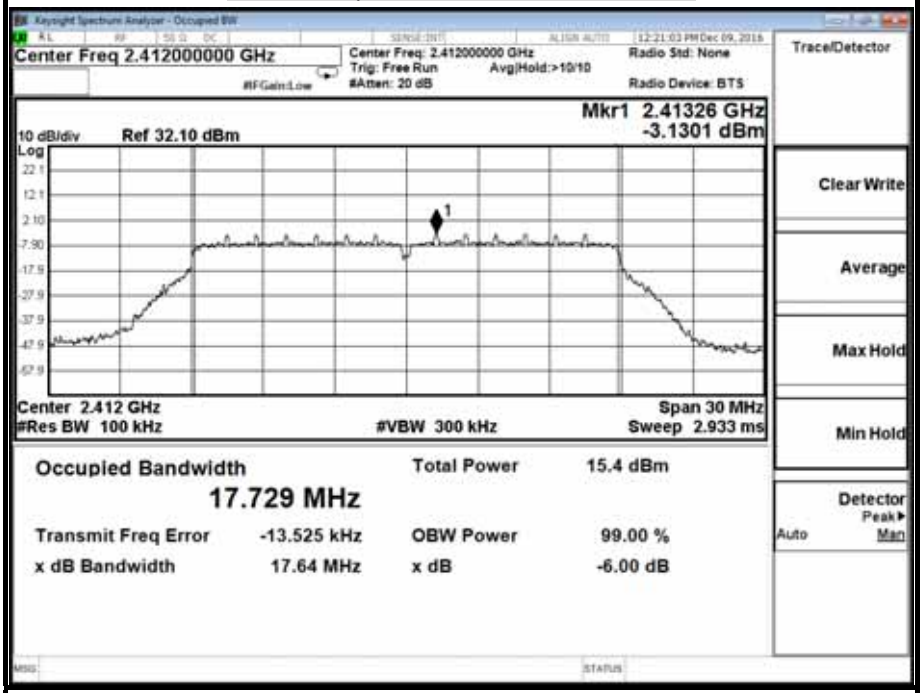


CH High (802.11g MODE)

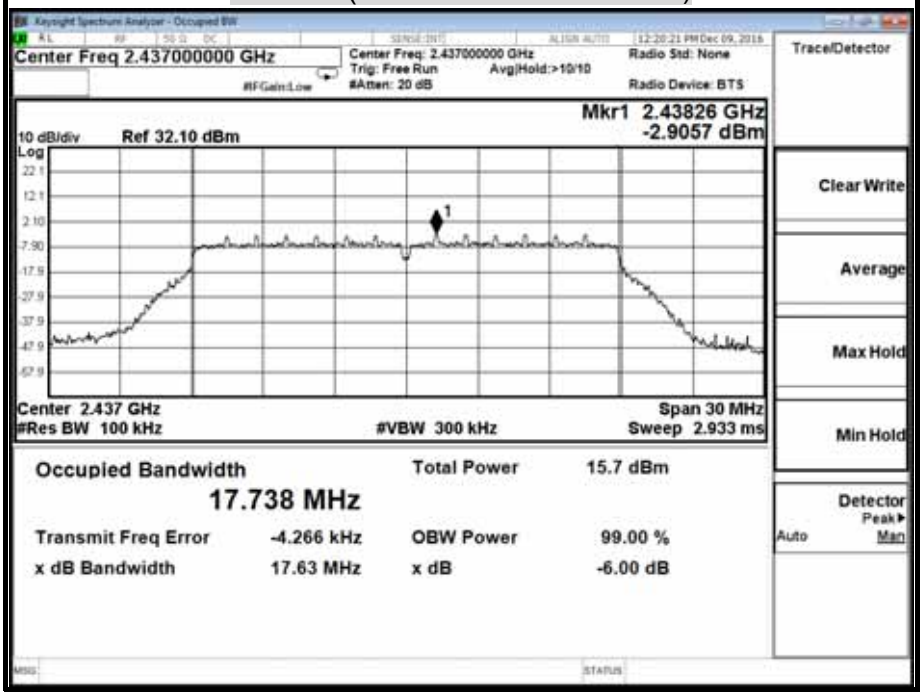


POWER SPECTRAL DENSITY (802.11n HT20 MODE)

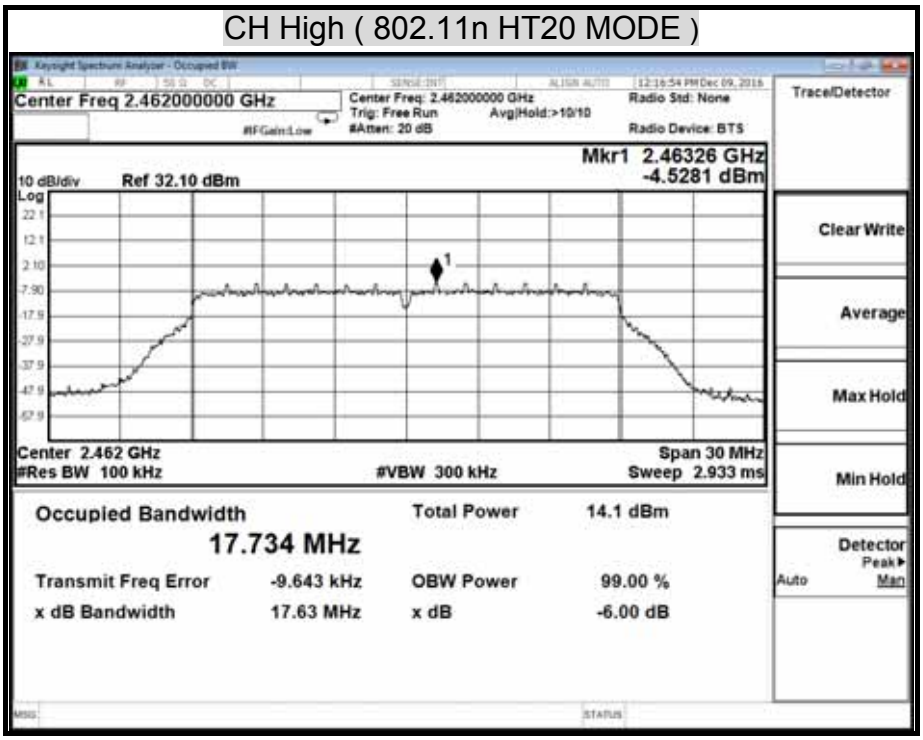
CH Low (802.11n HT20 MODE)



CH Mid (802.11n HT20 MODE)

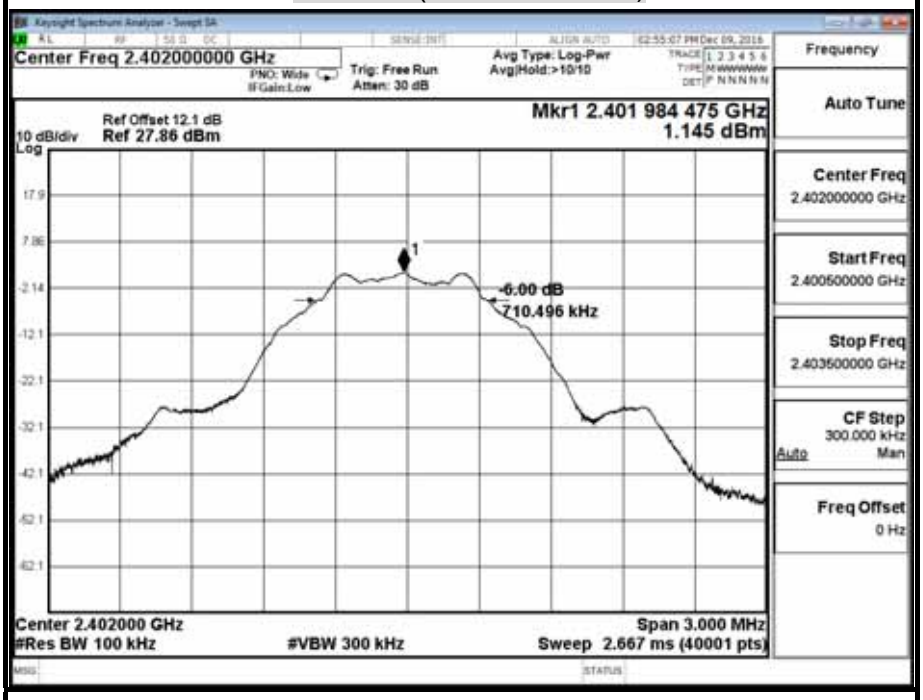


CH High (802.11n HT20 MODE)

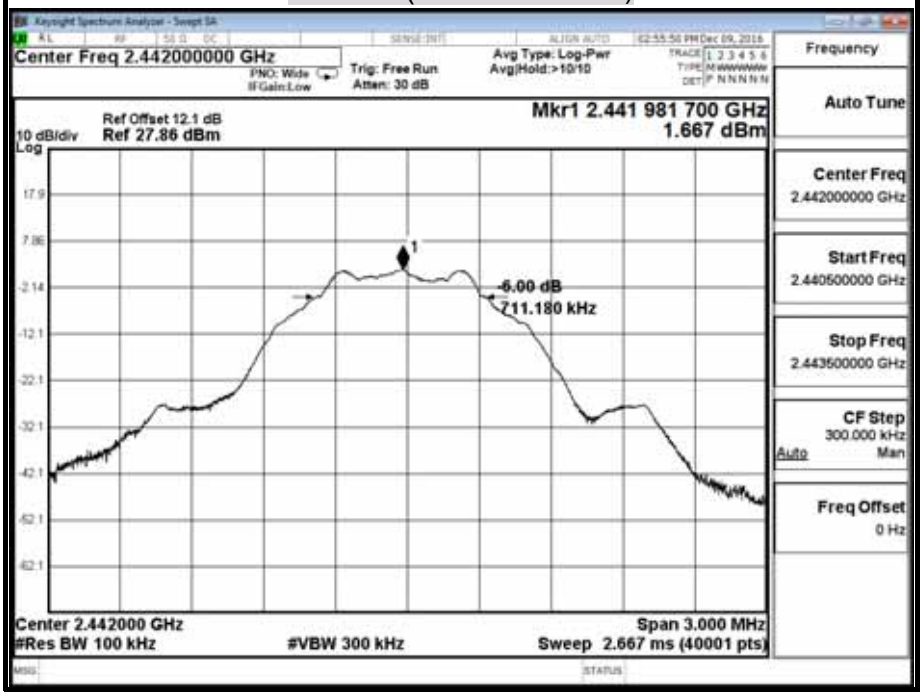


POWER SPECTRAL DENSITY (Bluetooth 4.0 (GFSK) MODE)

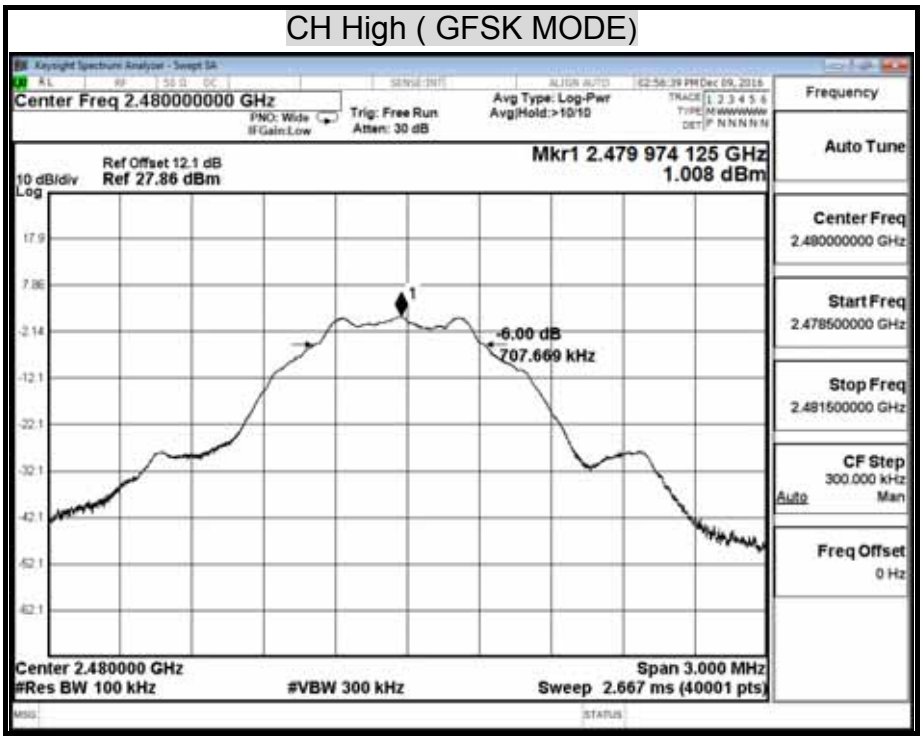
CH Low (GFSK MODE)



CH Mid (GFSK MODE)



CH High (GFSK MODE)



8.5 CONDUCTED SPURIOUS EMISSION

LIMITS

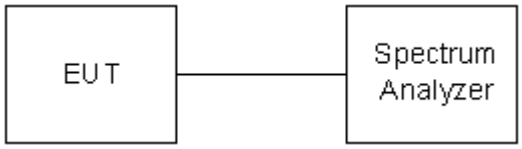
§ 15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the and that contains the highest level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

TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	04/29/2017

Remark: *Each piece of equipment is scheduled for calibration once a year.*

TEST SETUP



TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

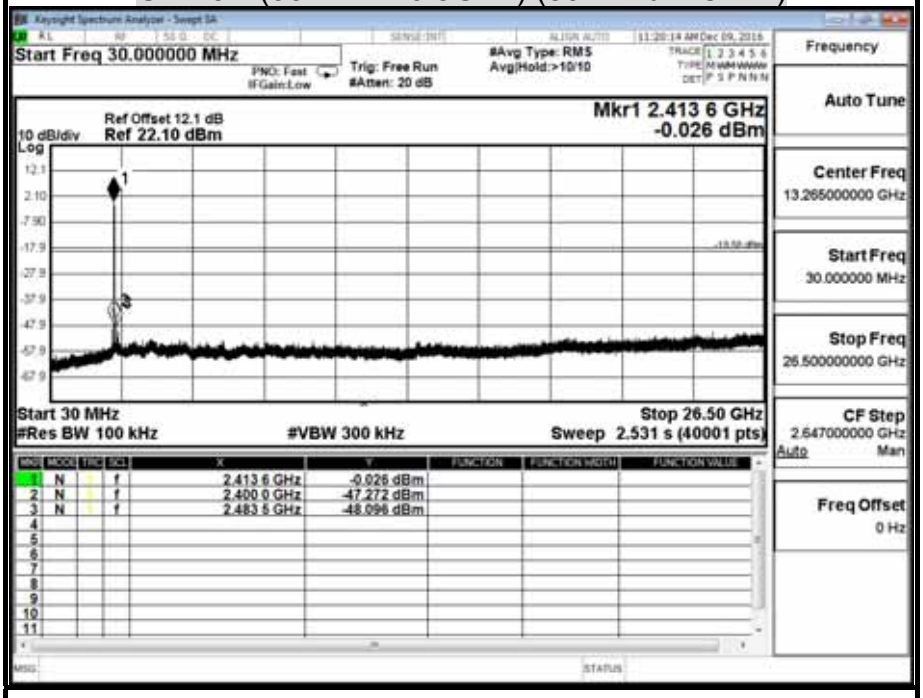
TEST RESULTS

OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

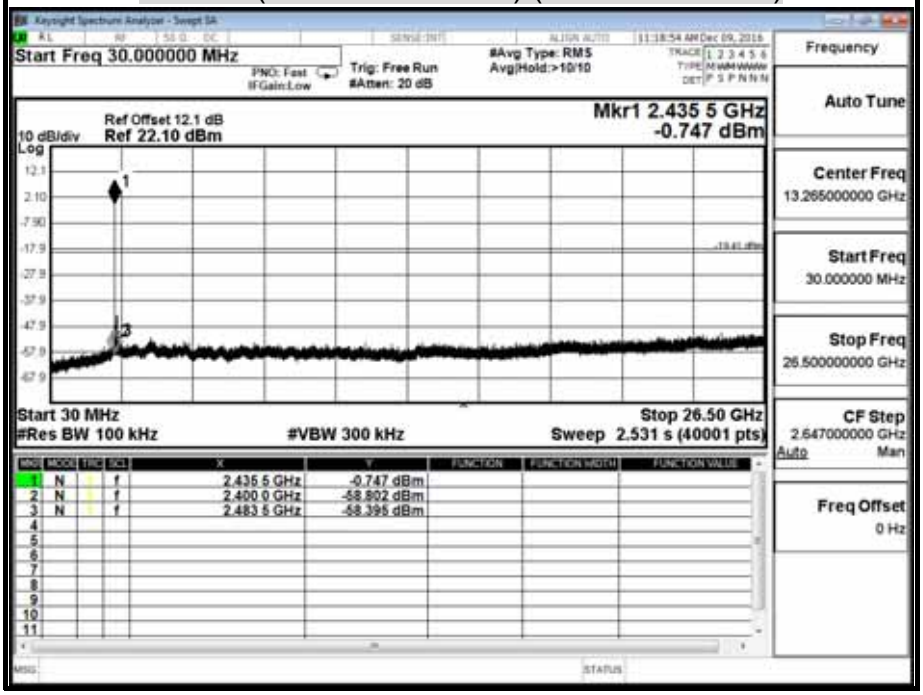
Model Name	HEADRUSH PEDALBOARD	Test By	Ted Huang
Temp & Humidity	24.3℃, 48%	Test Date	2016/12/08

(IEEE 802.11b MODE)

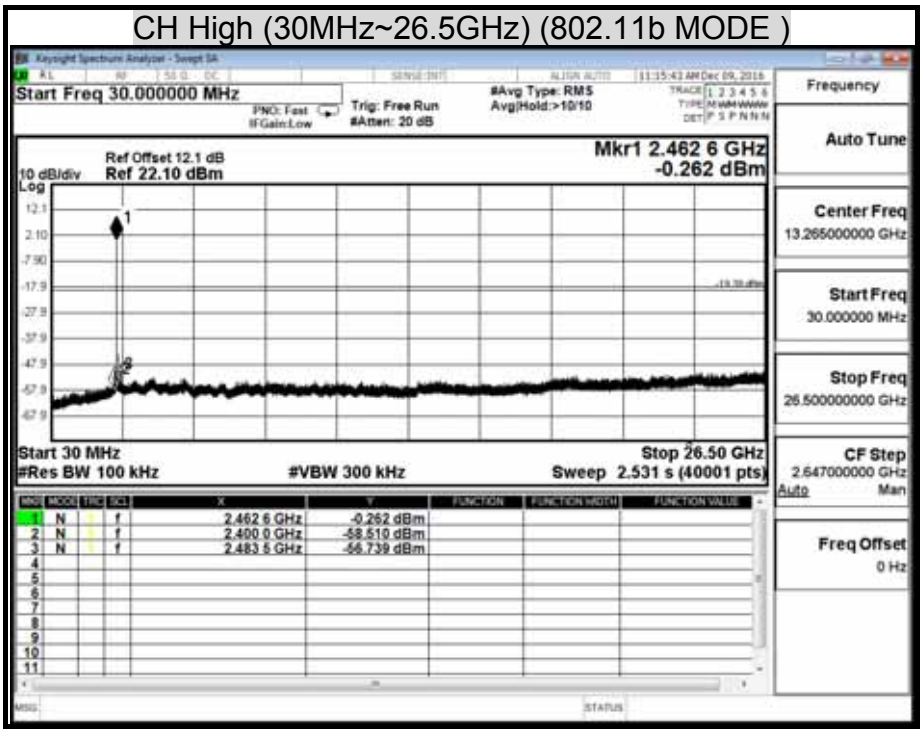
CH Low (30MHz~26.5GHz) (802.11b MODE)



CH Mid (30MHz~26.5GHz) (802.11b MODE)



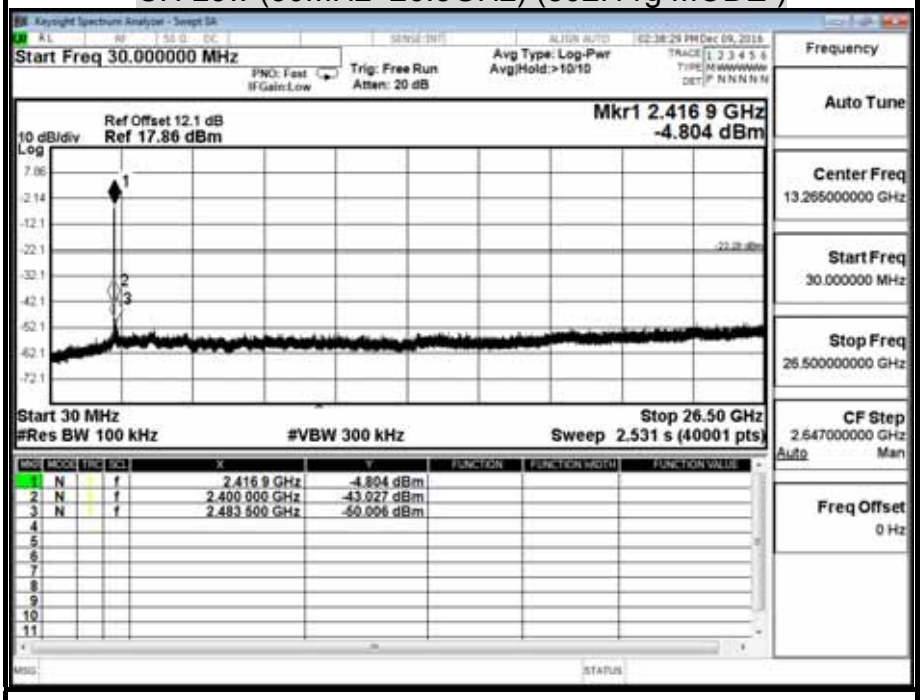
CH High (30MHz~26.5GHz) (802.11b MODE)



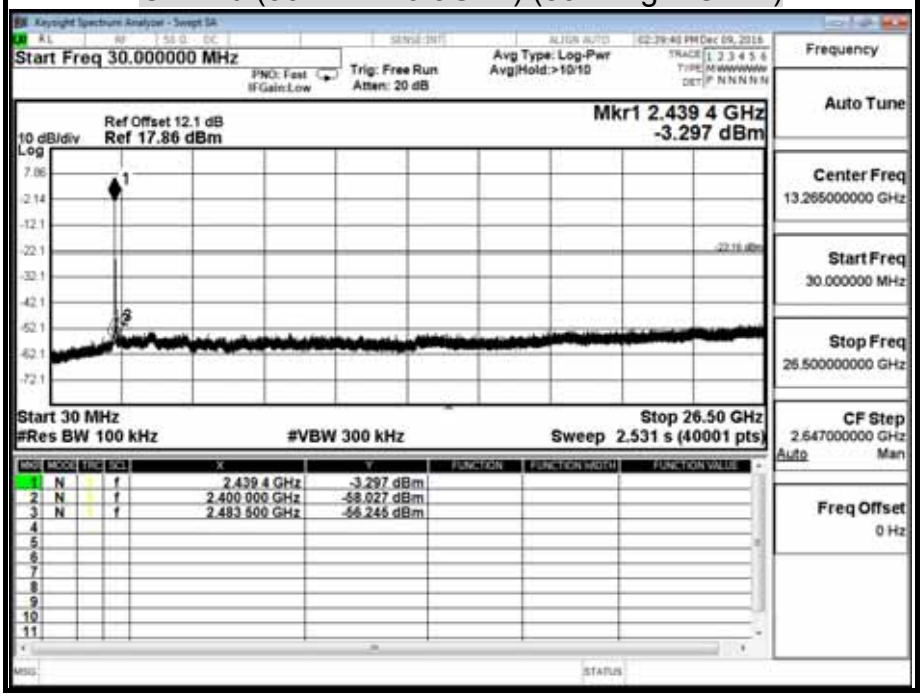
OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

(802.11g MODE)

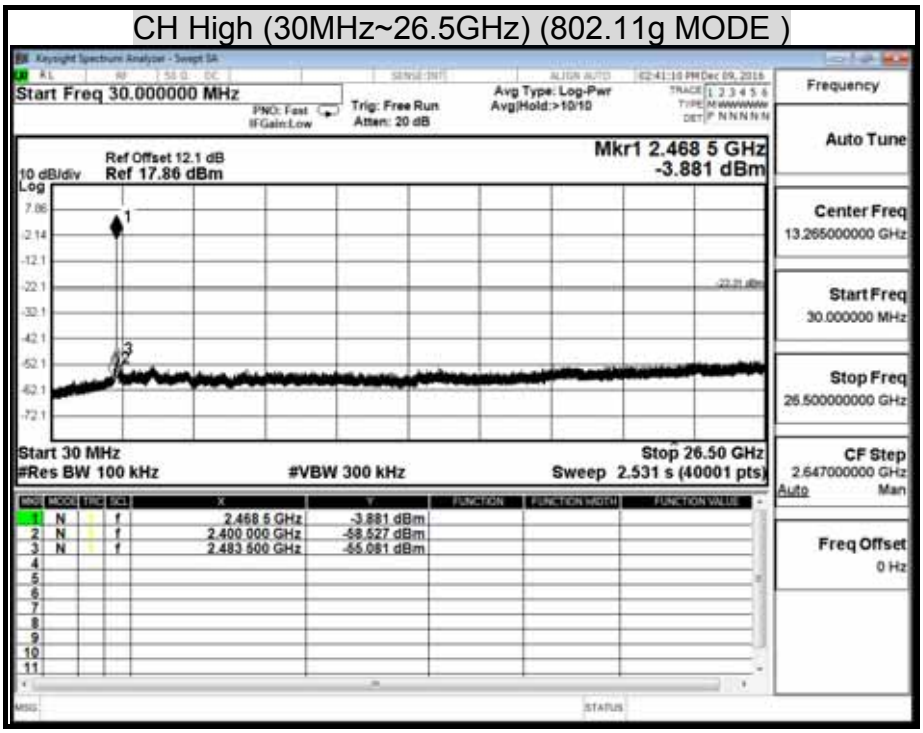
CH Low (30MHz~26.5GHz) (802.11g MODE)



CH Mid (30MHz~26.5GHz) (802.11g MODE)



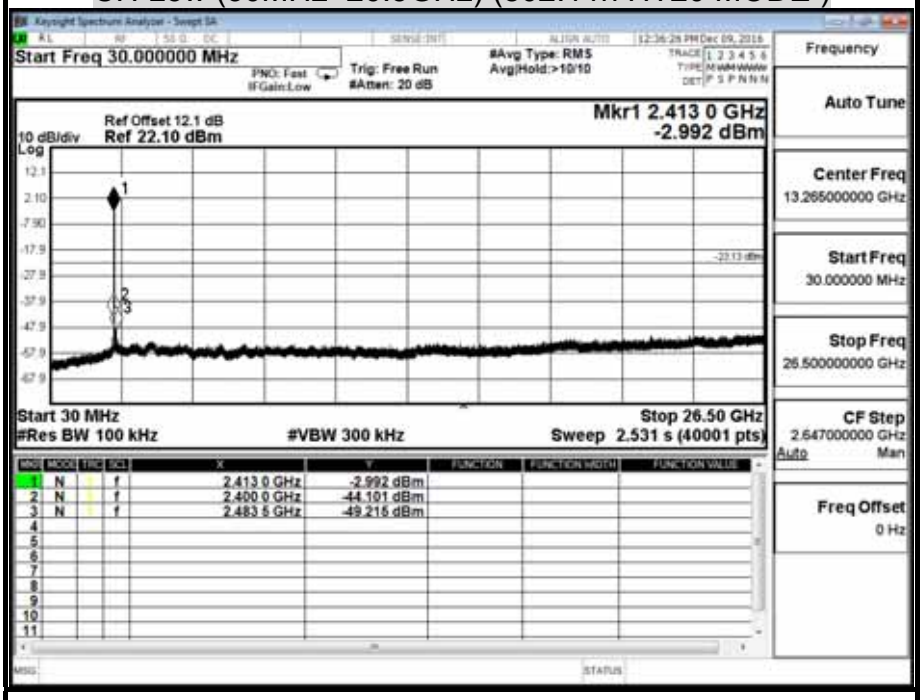
CH High (30MHz~26.5GHz) (802.11g MODE)



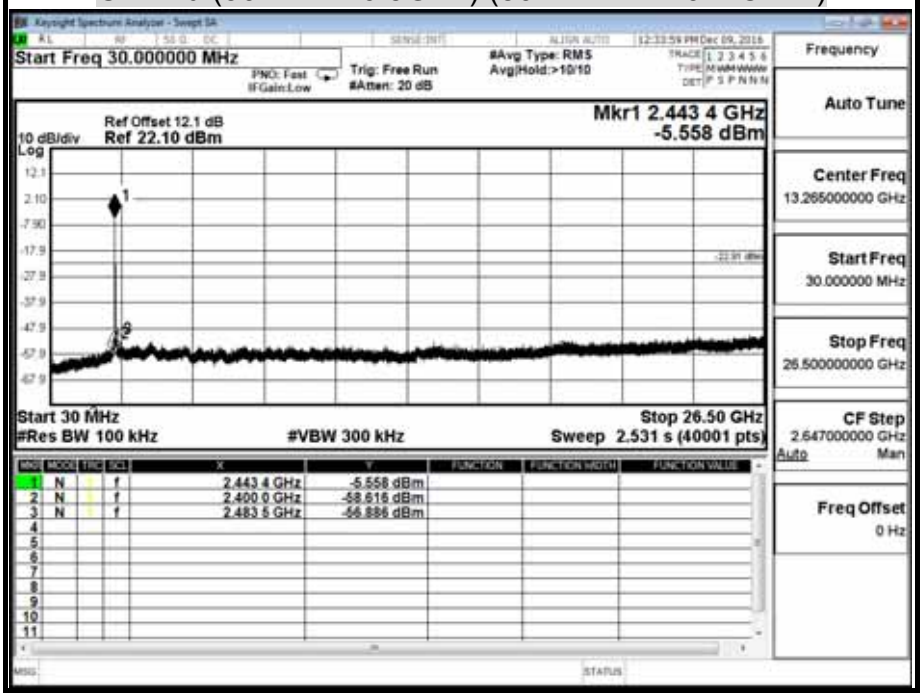
OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

(802.11n HT20 MODE)

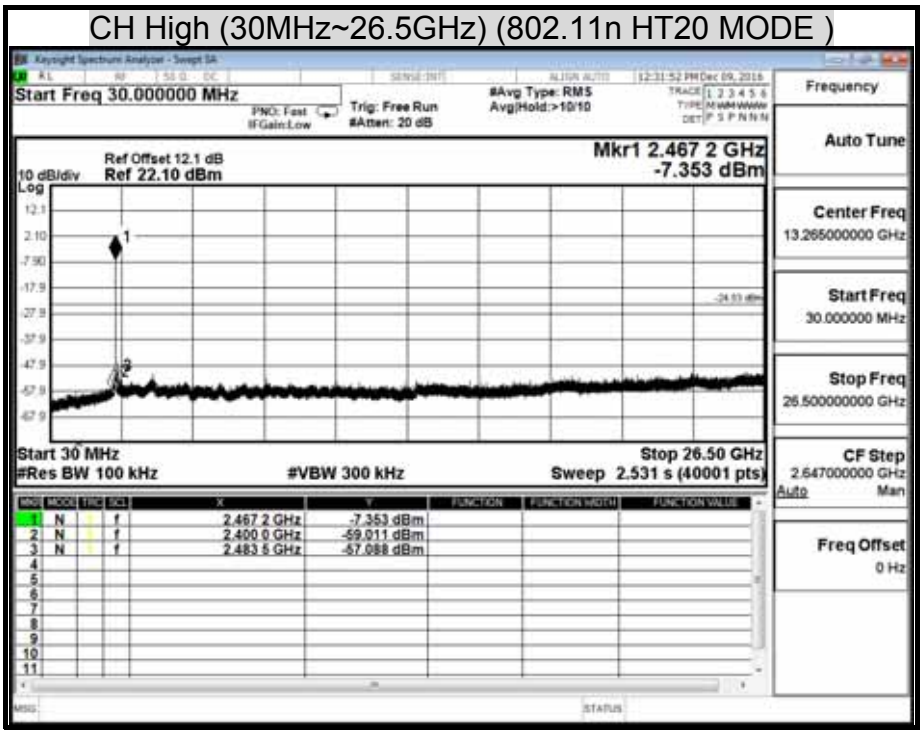
CH Low (30MHz~26.5GHz) (802.11n HT20 MODE)



CH Mid (30MHz~26.5GHz) (802.11n HT20 MODE)



CH High (30MHz~26.5GHz) (802.11n HT20 MODE)

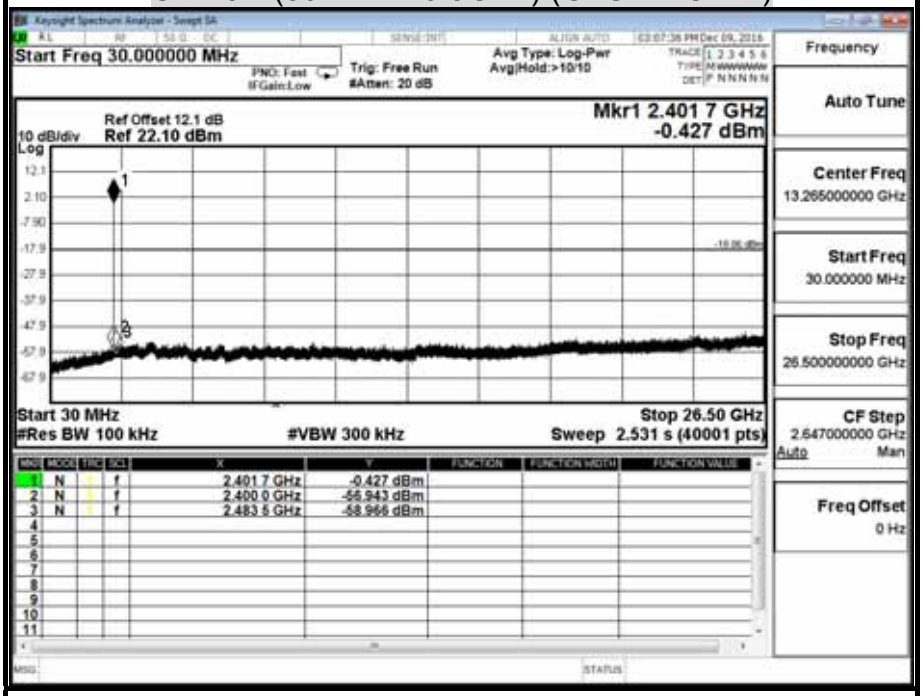


OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT

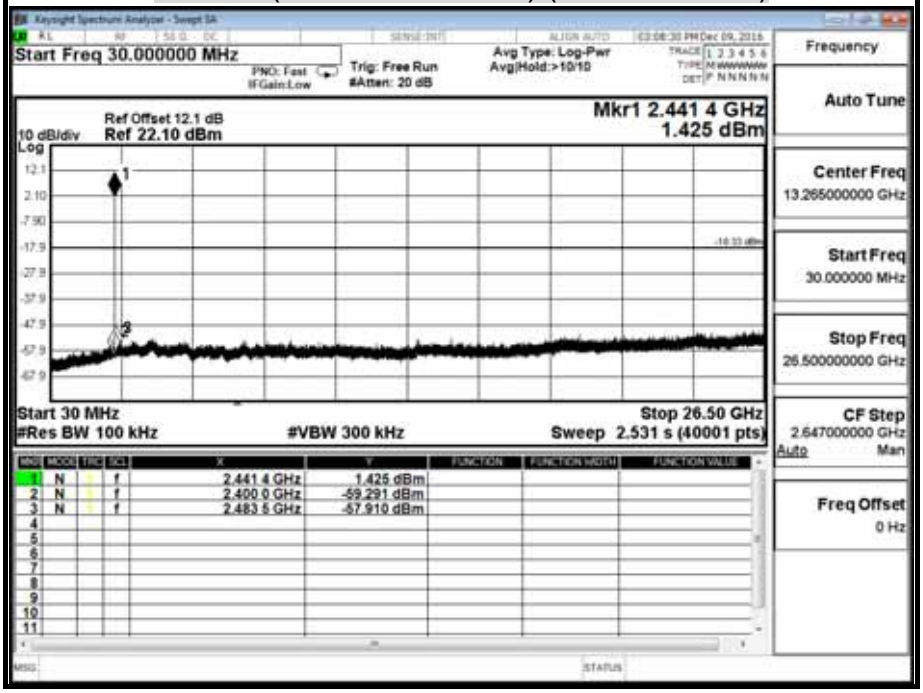
Model Name	HEADRUSH PEDALBOARD	Test By	Ted Huang
Temp & Humidity	24.3℃, 48%	Test Date	2016/12/08

(Bluetooth 4.0 (GFSK) MODE)

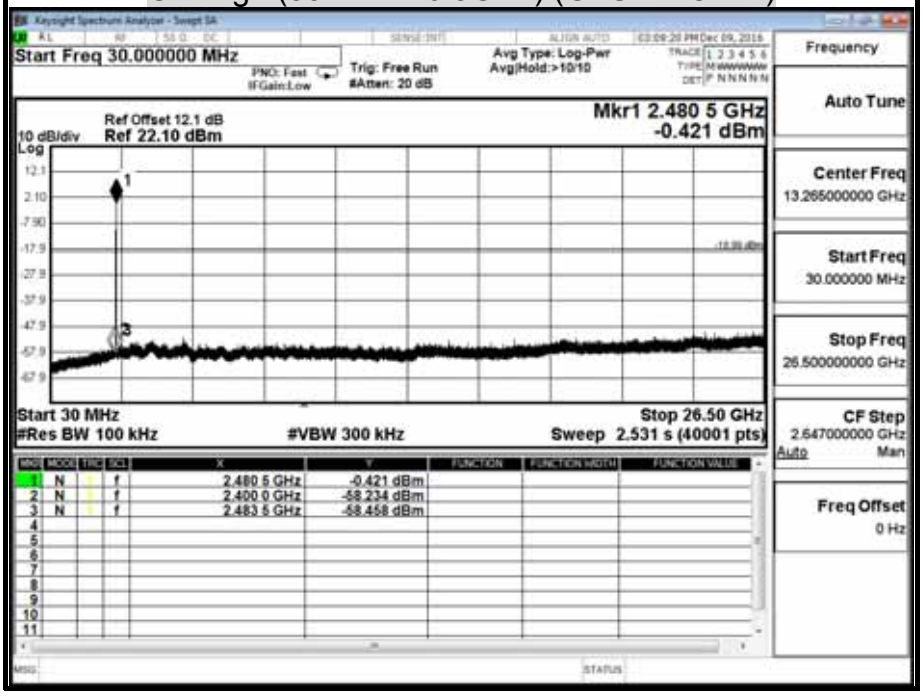
CH Low (30MHz~26.5GHz) (GFSK MODE)



CH Mid (30MHz~26.5GHz) (GFSK MODE)



CH High (30MHz~26.5GHz) (GFSK MODE)



8.6 RADIATED EMISSIONS

8.6.1 TRANSMITTER RADIATED SUPURIOUS EMSSIONS

LIMITS

§ 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 -1710	10.6 -12.7
6.26775 - 6.26825	108 -121.94	1718.8 - 1722.2	13.25 -13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 – 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 -16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3338	36.43 - 36.5
12.57675 - 12.57725	322 -335.4	3600 - 4400	([2])
13.36 - 13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

§ 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown is Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

§ 15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz, However, operation within these frequency bands is permitted under other sections of this Part, e-g, Sections 15.231 and 15.241.

§ 15.209 (b) In the emission table above, the tighter limit applies at the band edges.

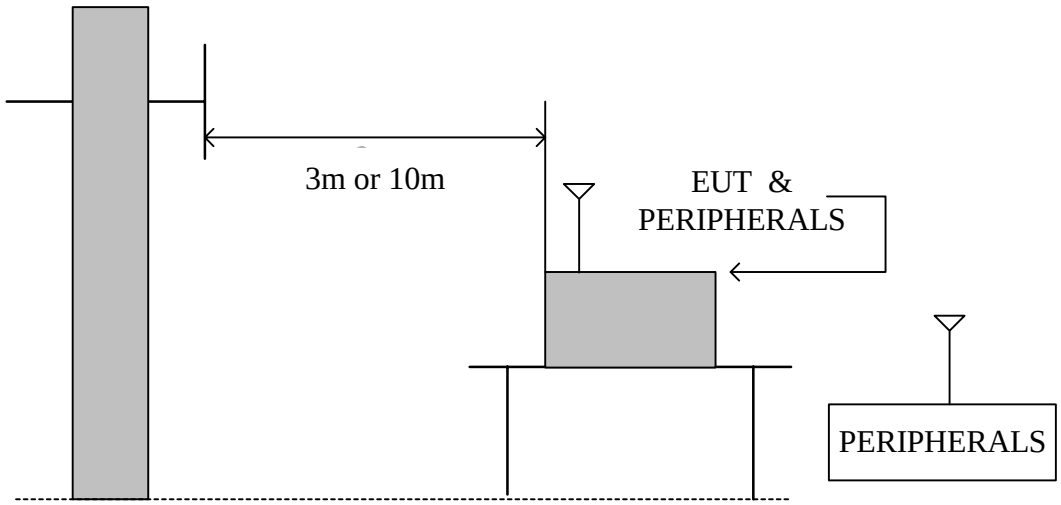
TEST EQUIPMENTS

The following test equipments are utilized in making the measurements contained in this report.

Chamber 966				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Amplifier	HP	8447F	2443A01671	01/14/2017
Bi-Log Antenna	Sunol	JB1	A070506-2	07/22/2017
Cable	HUBER+SUHNER	SUCOFLEX 104PEA	SN25737 /4PEA	12/04/2017
EMI Test Receiver	R&S	ESCS 30	100294	12/01/2017
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	04/29/2017
Horn Antenna	Com-Power	AH-118	071032	01/20/2017
Pre-Amplifier	EMCI	EMC012645	980098	01/17/2017
Software	Excel			

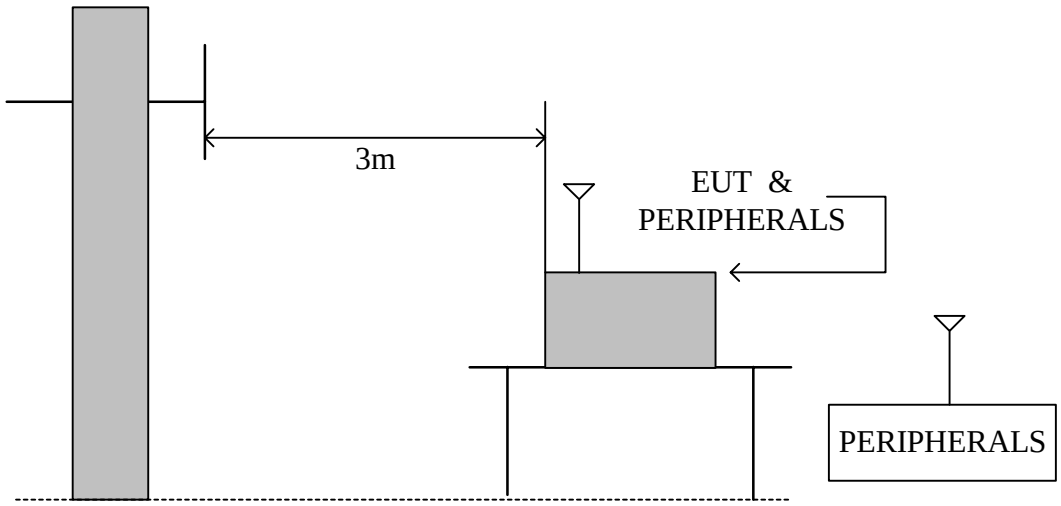
TEST SETUP

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 to 1GHz.



Antenna Elevation Variable

The diagram below shows the test setup that is utilized to make the measurements for emission above 1GHz.



Antenna Elevation Variable

TEST PROCEDURE

a. The EUT was placed on the top of a rotating table 0.8/1.5 meters above the ground at a 10 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.

b. White measuring the radiated emission below 1GHz, the EUT was set 3/10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. White measuring the radiated emission above 1GHz, the EUT was set 3 meters away from the interference-receiving antenna

c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarization of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. The tests were performed in accordance with 558074 D01 DTS Meas Guidance v03r03.

NOTE：

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.

2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1GHz.

3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1GHz.

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

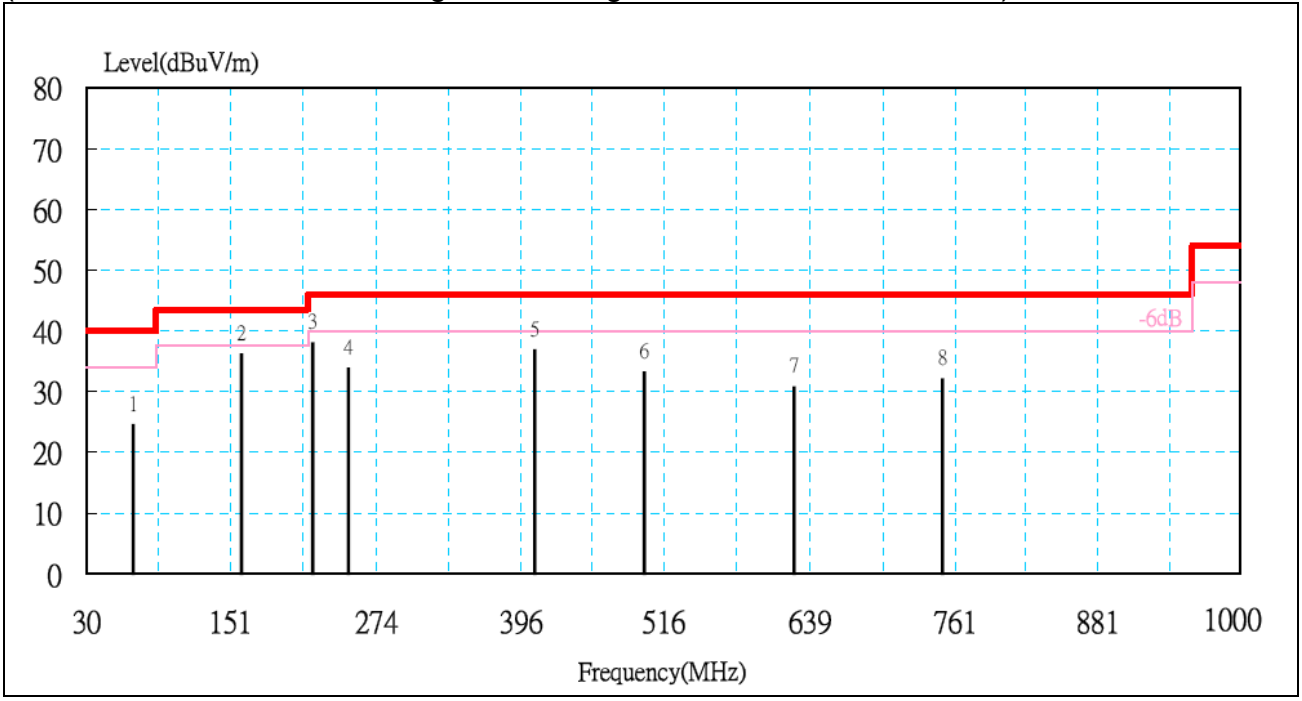
TEST RESULTS

No non-compliance noted.

8.6.2 WORST-CASE RADIATED EMISSION BELOW 1 GHz

Product Name	Guitar Processor	Test Date	2016/12/09
Model	HEADRUSH PEDALBOARD	Test By	Ted Huang
Test Mode	Normal Operation	TEMP& Humidity	24.5℃/52%

Horizontal
(The chart below shows the highest readings taken from the final data.)



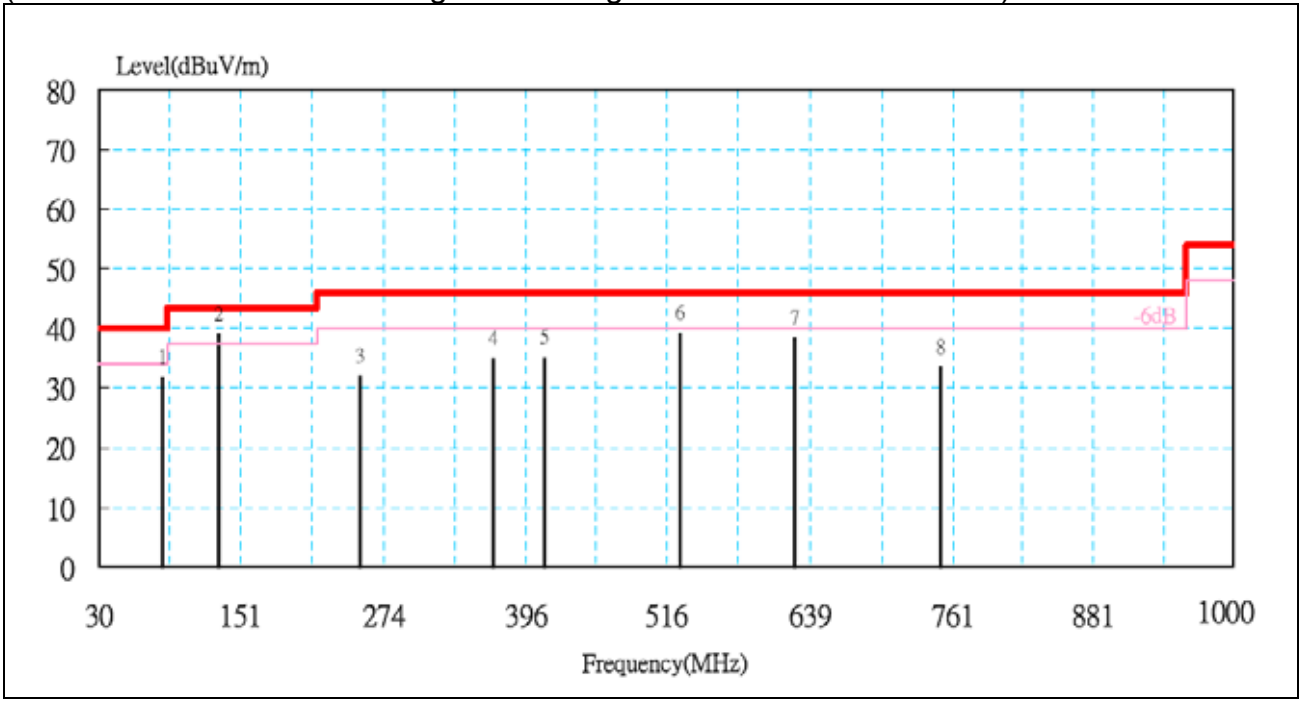
No.	Freq-Uency (MHz)	Meter Reading at 3 m Level (dBμV)	Antenna Factor (dB/m)	Cable Loss (dB)	Emission at 3 m Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Mode PK/QP
1	69.61	14.86	8.36	1.28	24.50	40.00	-15.50	QP
2	160.12	21.40	12.72	1.99	36.11	43.50	-7.39	QP
3	220.37	22.47	13.04	2.45	37.97	46.00	-8.03	QP
4	250.01	18.76	12.33	2.68	33.77	46.00	-12.23	QP
5	407.57	17.13	16.32	3.36	36.81	46.00	-9.19	QP
6	499.98	10.28	18.13	4.74	33.15	46.00	-12.85	QP
7	625.04	5.76	19.63	5.31	30.70	46.00	-15.30	QP
8	750.06	5.38	20.86	5.75	31.98	46.00	-14.02	QP

Note: 1. QP= Quasi-peak Reading.
2. The other emission levels were very low against the limit

Product Name	Guitar Processor	Test Date	2016/08/16
Model	HEADRUSH PEDALBOARD	Test By	Ted Huang
Test Mode	Normal Operation	TEMP& Humidity	26.4℃/52%

Vertical

(The chart below shows the highest readings taken from the final data.)



No.	Freq-Uency	Meter Reading at 3 m Level	Antenna Factor	Cable Loss	Emission at 3 m Level	Limits	Margin	Detector Mode
	(MHz)	(dBμV)	(dB/m)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	PK/QP
1	84.00	22.37	8.01	1.40	31.77	40.00	-8.23	QP
2	132.12	23.43	13.78	1.77	38.99	43.50	-4.51	QP
3	253.62	16.76	12.45	2.71	31.91	46.00	-14.09	QP
4	367.47	16.26	15.44	3.19	34.89	46.00	-11.11	QP
5	411.80	15.16	16.40	3.43	34.99	46.00	-11.01	QP
6	527.90	15.78	18.46	4.87	39.11	46.00	-6.89	QP
7	625.03	13.43	19.63	5.31	38.37	46.00	-7.63	QP
8	750.03	6.85	20.86	5.75	33.45	46.00	-12.55	QP

Note: 1. QP= Quasi-peak Reading.
2. The other emission levels were very low against the limit

8.6.3 TRANSMITTER RADIATED EMISSION ABOVE 1 GHz

Product Name	Guitar Processor	Test Date	2016/12/08
Model	HEADRUSH PEDALBOARD	Test By	Ted Huang
Test Mode	IEEE 802.11b TX (CH Low)	TEMP& Humidity	24.3℃, 48%

	TX / IEEE 802.11b mode / CH Low				Measurement Distance at 3m				Horizontal polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	1290.35	55.07	25.70	1.94	47.17	0.43	35.98	74.00	-38.02	P
	1290.35	46.38	25.70	1.94	47.17	0.43	27.29	54.00	-26.71	A
*	1607.20	58.32	27.40	2.18	46.97	0.57	41.50	74.00	-32.50	P
*	1607.20	49.06	27.40	2.18	46.97	0.57	32.24	54.00	-21.76	A
	1942.10	58.44	30.21	2.42	46.80	0.92	45.19	74.00	-28.81	P
	1942.10	49.68	30.21	2.42	46.80	0.92	36.43	54.00	-17.57	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

	TX / IEEE 802.11b mode / CH Low				Measurement Distance at 3m				Vertical polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
*	1172.79	55.76	25.26	1.84	47.25	0.42	36.03	74.00	-37.97	P
*	1172.79	46.37	25.26	1.84	47.25	0.42	26.64	54.00	-27.36	A
*	1605.62	63.58	27.39	2.18	46.97	0.57	46.75	74.00	-27.25	P
*	1605.62	53.77	27.39	2.18	46.97	0.57	36.94	54.00	-17.06	A
	1999.30	57.42	30.69	2.46	46.78	0.98	44.78	74.00	-29.22	P
	1999.30	48.63	30.69	2.46	46.78	0.98	35.99	54.00	-18.01	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

REMARK:

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
2. *Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz*
3. *The result basic equation calculation is as follow:*
   Level = Reading + AF + Cable – Preamp + Filter , Margin = Level-Limit
4. *The other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

Product Name	Guitar Processor	Test Date	2016/12/08
Model	HEADRUSH PEDALBOARD	Test By	Ted Huang
Test Mode	IEEE 802.11b TX (CH Middle)	TEMP& Humidity	24.3℃, 48%

	TX / IEEE 802.11b mode / CH Middle				Measurement Distance at 3m				Horizontal polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	1290.38	55.26	25.70	1.94	47.17	0.43	36.17	74.00	-37.83	P
	1290.38	46.45	25.70	1.94	47.17	0.43	27.36	54.00	-26.64	A
*	1607.16	58.68	27.40	2.18	46.97	0.57	41.86	74.00	-32.14	P
*	1607.16	49.37	27.40	2.18	46.97	0.57	32.55	54.00	-21.45	A
	1942.15	58.46	30.21	2.42	46.80	0.92	45.21	74.00	-28.79	P
	1942.15	49.52	30.21	2.42	46.80	0.92	36.27	54.00	-17.73	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

I

	TX / IEEE 802.11b mode / CH Middle				Measurement Distance at 3m				Vertical polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
*	1172.82	55.85	25.26	1.84	47.25	0.42	36.12	74.00	-37.88	P
*	1172.82	46.48	25.26	1.84	47.25	0.42	26.75	54.00	-27.25	A
*	1605.66	63.47	27.39	2.18	46.97	0.57	46.64	74.00	-27.36	P
*	1605.66	53.53	27.39	2.18	46.97	0.57	36.70	54.00	-17.30	A
	1999.35	57.86	30.69	2.46	46.78	0.98	45.23	74.00	-28.77	P
	1999.35	48.49	30.69	2.46	46.78	0.98	35.86	54.00	-18.14	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

REMARK:

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
2. *Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz*
3. *The result basic equation calculation is as follow:*
   Level = Reading + AF + Cable – Preamp + Filter , Margin = Level-Limit
4. *The other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

Product Name	Guitar Processor	Test Date	2016/12/08
Model	HEADRUSH PEDALBOARD	Test By	Ted Huang
Test Mode	IEEE 802.11b TX (CH High)	TEMP& Humidity	24.3℃, 48%

	TX / IEEE 802.11b mode / CH High				Measurement Distance at 3m				Horizontal polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	1290.42	55.62	25.70	1.94	47.17	0.43	36.53	74.00	-37.47	P
	1290.42	46.43	25.70	1.94	47.17	0.43	27.34	54.00	-26.66	A
*	1607.15	58.66	27.40	2.18	46.97	0.57	41.84	74.00	-32.16	P
*	1607.15	49.48	27.40	2.18	46.97	0.57	32.66	54.00	-21.34	A
	1942.08	58.53	30.21	2.42	46.80	0.92	45.28	74.00	-28.72	P
	1942.08	49.76	30.21	2.42	46.80	0.92	36.51	54.00	-17.49	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

	TX / IEEE 802.11b mode / CH High				Measurement Distance at 3m				Vertical polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
*	1172.86	56.34	25.26	1.84	47.25	0.42	36.61	74.00	-37.39	P
*	1172.86	46.88	25.26	1.84	47.25	0.42	27.15	54.00	-26.85	A
*	1605.66	63.42	27.39	2.18	46.97	0.57	46.59	74.00	-27.41	P
*	1605.66	53.56	27.39	2.18	46.97	0.57	36.73	54.00	-17.27	A
	1999.42	57.76	30.70	2.46	46.78	0.98	45.13	74.00	-28.87	P
	1999.42	48.82	30.70	2.46	46.78	0.98	36.19	54.00	-17.81	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

REMARK:

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
2. *Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz*
3. *The result basic equation calculation is as follow:*
   Level = Reading + AF + Cable – Preamp + Filter , Margin = Level-Limit
4. *The other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

Product Name	Guitar Processor	Test Date	2016/12/08
Model	HEADRUSH PEDALBOARD	Test By	Ted Huang
Test Mode	IEEE 802.11g TX (CH Low)	TEMP& Humidity	24.3℃, 48%

	TX / IEEE 802.11g mode / CH Low				Measurement Distance at 3m				Horizontal polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	1290.38	55.26	25.70	1.94	47.17	0.43	36.17	74.00	-37.83	P
	1290.38	46.42	25.70	1.94	47.17	0.43	27.33	54.00	-26.67	A
*	1607.18	58.62	27.40	2.18	46.97	0.57	41.80	74.00	-32.20	P
*	1607.18	49.25	27.40	2.18	46.97	0.57	32.43	54.00	-21.57	A
	1942.08	58.48	30.21	2.42	46.80	0.92	45.23	74.00	-28.77	P
	1942.08	49.76	30.21	2.42	46.80	0.92	36.51	54.00	-17.49	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

	TX / IEEE 802.11g mode / CH Low				Measurement Distance at 3m				Vertical polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
*	1172.83	55.75	25.26	1.84	47.25	0.42	36.02	74.00	-37.98	P
*	1172.83	46.62	25.26	1.84	47.25	0.42	26.89	54.00	-27.11	A
*	1605.65	63.58	27.39	2.18	46.97	0.57	46.75	74.00	-27.25	P
*	1605.65	53.78	27.39	2.18	46.97	0.57	36.95	54.00	-17.05	A
	1999.28	57.42	30.69	2.46	46.78	0.98	44.78	74.00	-29.22	P
	1999.28	48.72	30.69	2.46	46.78	0.98	36.08	54.00	-17.92	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

REMARK:

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
2. *Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz*
3. *The result basic equation calculation is as follow:*
   Level = Reading + AF + Cable – Preamp + Filter , Margin = Level-Limit
4. *The other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

Product Name	Guitar Processor	Test Date	2016/12/08
Model	HEADRUSH PEDALBOARD	Test By	Ted Huang
Test Mode	IEEE 802.11g TX (CH Middle)	TEMP& Humidity	24.3℃, 48%

	TX / IEEE 802.11g mode / CH Middle				Measurement Distance at 3m				Horizontal polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	1290.43	55.35	25.70	1.94	47.17	0.43	36.26	74.00	-37.74	P
	1290.43	46.48	25.70	1.94	47.17	0.43	27.39	54.00	-26.61	A
*	1607.24	58.77	27.40	2.18	46.97	0.57	41.95	74.00	-32.05	P
*	1607.24	49.48	27.40	2.18	46.97	0.57	32.66	54.00	-21.34	A
	1942.23	58.46	30.21	2.42	46.80	0.92	45.22	74.00	-28.78	P
	1942.23	49.76	30.21	2.42	46.80	0.92	36.52	54.00	-17.48	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

	TX / IEEE 802.11g mode / CH Middle				Measurement Distance at 3m				Vertical polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
*	1172.83	55.92	25.26	1.84	47.25	0.42	36.19	74.00	-37.81	P
*	1172.83	46.63	25.26	1.84	47.25	0.42	26.90	54.00	-27.10	A
*	1605.68	63.62	27.39	2.18	46.97	0.57	46.79	74.00	-27.21	P
*	1605.68	53.77	27.39	2.18	46.97	0.57	36.94	54.00	-17.06	A
	1999.37	57.76	30.69	2.46	46.78	0.98	45.13	74.00	-28.87	P
	1999.37	48.64	30.69	2.46	46.78	0.98	36.01	54.00	-17.99	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

REMARK:

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
2. *Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz*
3. *The result basic equation calculation is as follow:*
   Level = Reading + AF + Cable – Preamp + Filter , Margin = Level-Limit
4. *The other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

Product Name	Guitar Processor	Test Date	2016/12/08
Model	HEADRUSH PEDALBOARD	Test By	Ted Huang
Test Mode	IEEE 802.11g TX (CH High)	TEMP& Humidity	24.3℃, 48%

	TX / IEEE 802.11g mode / CH High				Measurement Distance at 3m				Horizontal polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	1290.36	55.52	25.70	1.94	47.17	0.43	36.43	74.00	-37.57	P
	1290.36	46.72	25.70	1.94	47.17	0.43	27.63	54.00	-26.37	A
*	1607.26	58.68	27.40	2.18	46.97	0.57	41.86	74.00	-32.14	P
*	1607.26	49.57	27.40	2.18	46.97	0.57	32.75	54.00	-21.25	A
	1942.16	58.65	30.21	2.42	46.80	0.92	45.41	74.00	-28.59	P
	1942.16	49.84	30.21	2.42	46.80	0.92	36.60	54.00	-17.40	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

	TX / IEEE 802.11g mode / CH High				Measurement Distance at 3m				Vertical polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
*	1172.88	56.48	25.26	1.84	47.25	0.42	36.75	74.00	-37.25	P
*	1172.88	47.24	25.26	1.84	47.25	0.42	27.51	54.00	-26.49	A
*	1605.69	63.56	27.39	2.18	46.97	0.57	46.73	74.00	-27.27	P
*	1605.69	53.68	27.39	2.18	46.97	0.57	36.85	54.00	-17.15	A
	1999.51	57.79	30.70	2.46	46.78	0.98	45.16	74.00	-28.84	P
	1999.51	48.96	30.70	2.46	46.78	0.98	36.33	54.00	-17.67	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

REMARK:

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
2. *Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz*
3. *The result basic equation calculation is as follow:*
   Level = Reading + AF + Cable – Preamp + Filter , Margin = Level-Limit
4. *The other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

Product Name	Guitar Processor	Test Date	2016/12/08
Model	HEADRUSH PEDALBOARD	Test By	Ted Huang
Test Mode	IEEE 802.11n HT20 TX (CH Low)	TEMP& Humidity	24.3℃, 48%

	TX / IEEE 802.11n HT20 mode / CH Low				Measurement Distance at 3m				Horizontal polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	1290.41	55.43	25.70	1.94	47.17	0.43	36.34	74.00	-37.66	P
	1290.41	46.75	25.70	1.94	47.17	0.43	27.66	54.00	-26.34	A
*	1607.26	58.56	27.40	2.18	46.97	0.57	41.74	74.00	-32.26	P
*	1607.26	49.28	27.40	2.18	46.97	0.57	32.46	54.00	-21.54	A
	1942.23	58.66	30.21	2.42	46.80	0.92	45.42	74.00	-28.58	P
	1942.23	49.76	30.21	2.42	46.80	0.92	36.52	54.00	-17.48	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

	TX / IEEE 802.11n HT20 mode / CH Low				Measurement Distance at 3m				Vertical polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
*	1172.67	55.82	25.26	1.84	47.25	0.42	36.09	74.00	-37.91	P
*	1172.67	46.42	25.26	1.84	47.25	0.42	26.69	54.00	-27.31	A
*	1605.58	63.63	27.39	2.18	46.97	0.57	46.80	74.00	-27.20	P
*	1605.58	53.57	27.39	2.18	46.97	0.57	36.74	54.00	-17.26	A
	1999.26	57.33	30.69	2.46	46.78	0.98	44.69	74.00	-29.31	P
	1999.26	48.62	30.69	2.46	46.78	0.98	35.98	54.00	-18.02	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

REMARK:

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
2. *Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz*
3. *The result basic equation calculation is as follow:*
   Level = Reading + AF + Cable – Preamp + Filter , Margin = Level-Limit
4. *The other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

Product Name	Guitar Processor	Test Date	2016/12/08
Model	HEADRUSH PEDALBOARD	Test By	Ted Huang
Test Mode	IEEE 802.11n HT20 TX (CH Middle)	TEMP& Humidity	24.3℃, 48%

	TX / IEEE 802.11n HT20 mode / CH Middle				Measurement Distance at 3m				Horizontal polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	1290.41	55.33	25.70	1.94	47.17	0.43	36.24	74.00	-37.76	P
	1290.41	46.58	25.70	1.94	47.17	0.43	27.49	54.00	-26.51	A
*	1607.18	58.82	27.40	2.18	46.97	0.57	42.00	74.00	-32.00	P
*	1607.18	49.67	27.40	2.18	46.97	0.57	32.85	54.00	-21.15	A
	1942.09	58.59	30.21	2.42	46.80	0.92	45.34	74.00	-28.66	P
	1942.09	49.76	30.21	2.42	46.80	0.92	36.51	54.00	-17.49	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

	TX / IEEE 802.11n HT20 mode / CH Middle				Measurement Distance at 3m				Vertical polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
*	1172.76	56.24	25.26	1.84	47.25	0.42	36.51	74.00	-37.49	P
*	1172.76	46.57	25.26	1.84	47.25	0.42	26.84	54.00	-27.16	A
*	1605.63	63.63	27.39	2.18	46.97	0.57	46.80	74.00	-27.20	P
*	1605.63	53.75	27.39	2.18	46.97	0.57	36.92	54.00	-17.08	A
	1999.38	58.15	30.69	2.46	46.78	0.98	45.52	74.00	-28.48	P
	1999.38	48.67	30.69	2.46	46.78	0.98	36.04	54.00	-17.96	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

REMARK:

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
2. *Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz*
3. *The result basic equation calculation is as follow:*
   Level = Reading + AF + Cable – Preamp + Filter , Margin = Level-Limit
4. *The other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

Product Name	Guitar Processor	Test Date	2016/12/08
Model	HEADRUSH PEDALBOARD	Test By	Ted Huang
Test Mode	IEEE 802.11n HT20 TX (CH High)	TEMP& Humidity	24.3℃, 48%

	TX / IEEE 802.11n HT20 mode / CH High				Measurement Distance at 3m				Horizontal polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	1290.45	55.78	25.70	1.94	47.17	0.43	36.69	74.00	-37.31	P
	1290.45	46.52	25.70	1.94	47.17	0.43	27.43	54.00	-26.57	A
*	1607.26	58.66	27.40	2.18	46.97	0.57	41.84	74.00	-32.16	P
*	1607.26	49.65	27.40	2.18	46.97	0.57	32.83	54.00	-21.17	A
	1942.13	58.58	30.21	2.42	46.80	0.92	45.33	74.00	-28.67	P
	1942.13	49.82	30.21	2.42	46.80	0.92	36.57	54.00	-17.43	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

	TX / IEEE 802.11n HT20 mode / CH High				Measurement Distance at 3m				Vertical polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
*	1172.80	56.52	25.26	1.84	47.25	0.42	36.79	74.00	-37.21	P
*	1172.80	47.12	25.26	1.84	47.25	0.42	27.39	54.00	-26.61	A
*	1605.73	63.46	27.39	2.18	46.97	0.57	46.63	74.00	-27.37	P
*	1605.73	53.62	27.39	2.18	46.97	0.57	36.79	54.00	-17.21	A
	1999.56	57.82	30.70	2.46	46.78	0.98	45.19	74.00	-28.81	P
	1999.56	48.96	30.70	2.46	46.78	0.98	36.33	54.00	-17.67	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

REMARK:

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
2. *Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz*
3. *The result basic equation calculation is as follow:*
   Level = Reading + AF + Cable – Preamp + Filter , Margin = Level-Limit
4. *The other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

Product Name	Guitar Processor	Test Date	2016/12/08
Model	HEADRUSH PEDALBOARD	Test By	Ted Huang
Test Mode	Bluetooth 4.0 TX (CH Low)	TEMP& Humidity	24.3℃, 48%

	TX / Bluetooth 4.0 (GFSK) mode / CH Low				Measurement Distance at 3m				Horizontal polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	1290.42	55.74	25.70	1.94	47.17	0.43	36.65	74.00	-37.35	P
	1290.42	46.57	25.70	1.94	47.17	0.43	27.48	54.00	-26.52	A
*	1607.26	59.67	27.40	2.18	46.97	0.57	42.85	74.00	-31.15	P
*	1607.26	50.28	27.40	2.18	46.97	0.57	33.46	54.00	-20.54	A
*	4804.01	53.63	33.07	4.11	46.66	0.22	44.37	74.00	-29.63	P
*	4804.01	44.75	33.07	4.11	46.66	0.22	35.49	54.00	-18.51	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

	TX / Bluetooth 4.0 (GFSK) mode / CH Low				Measurement Distance at 3m				Vertical polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
*	1172.73	55.87	25.26	1.84	47.25	0.42	36.14	74.00	-37.86	P
*	1172.73	46.46	25.26	1.84	47.25	0.42	26.73	54.00	-27.27	A
*	1605.38	67.59	27.39	2.18	46.97	0.57	50.75	74.00	-23.25	P
*	1605.38	58.33	27.39	2.18	46.97	0.57	41.49	54.00	-12.51	A
*	4803.98	55.85	33.07	4.11	46.66	0.22	46.59	74.00	-27.41	P
*	4803.98	46.72	33.07	4.11	46.66	0.22	37.46	54.00	-16.54	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

REMARK:

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
2. *Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz*
3. *The result basic equation calculation is as follow:*
   Level = Reading + AF + Cable – Preamp + Filter , Margin = Level-Limit
4. *The other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

Product Name	Guitar Processor	Test Date	2016/12/08
Model	HEADRUSH PEDALBOARD	Test By	Ted Huang
Test Mode	Bluetooth 4.0 TX (CH Middle)	TEMP& Humidity	24.3℃, 48%

	TX / Bluetooth 4.0 (GFSK) mode / CH Middle				Measurement Distance at 3m				Horizontal polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	1290.38	55.63	25.70	1.94	47.17	0.43	36.54	74.00	-37.46	P
	1290.38	46.75	25.70	1.94	47.17	0.43	27.66	54.00	-26.34	A
*	1607.35	59.78	27.40	2.18	46.97	0.57	42.96	74.00	-31.04	P
*	1607.35	50.56	27.40	2.18	46.97	0.57	33.74	54.00	-20.26	A
*	4884.25	54.48	33.33	4.16	46.68	0.23	45.52	74.00	-28.48	P
*	4884.25	45.36	33.33	4.16	46.68	0.23	36.40	54.00	-17.60	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

	TX / Bluetooth 4.0 (GFSK) mode / CH Middle				Measurement Distance at 3m				Vertical polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
*	1172.76	55.68	25.26	1.84	47.25	0.42	35.95	74.00	-38.05	P
*	1172.76	46.62	25.26	1.84	47.25	0.42	26.89	54.00	-27.11	A
*	1605.43	67.62	27.39	2.18	46.97	0.57	50.78	74.00	-23.22	P
*	1605.43	58.45	27.39	2.18	46.97	0.57	41.61	54.00	-12.39	A
*	4884.13	56.43	33.33	4.16	46.68	0.23	47.47	74.00	-26.53	P
*	4884.13	47.58	33.33	4.16	46.68	0.23	38.62	54.00	-15.38	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

REMARK:

1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
2. *Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz*
3. *The result basic equation calculation is as follow:*
   Level = Reading + AF + Cable – Preamp + Filter , Margin = Level-Limit
4. *The other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

Product Name	Guitar Processor	Test Date	2016/12/08
Model	HEADRUSH PEDALBOARD	Test By	Ted Huang
Test Mode	Bluetooth 4.0 TX (CH High)	TEMP& Humidity	24.3℃, 48%

	TX / Bluetooth 4.0 (GFSK) mode / CH High				Measurement Distance at 3m				Horizontal polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
	1290.37	55.48	25.70	1.94	47.17	0.43	36.39	74.00	-37.61	P
	1290.37	46.57	25.70	1.94	47.17	0.43	27.48	54.00	-26.52	A
*	1607.45	59.76	27.40	2.18	46.97	0.57	42.95	74.00	-31.05	P
*	1607.45	49.92	27.40	2.18	46.97	0.57	33.11	54.00	-20.89	A
*	4959.43	53.82	33.57	4.21	46.70	0.24	45.14	74.00	-28.86	P
*	4959.43	44.08	33.57	4.21	46.70	0.24	35.40	54.00	-18.60	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

	TX / Bluetooth 4.0 (GFSK) mode / CH High				Measurement Distance at 3m				Vertical polarity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBμV)	(dB/m)	(dB)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(P/Q/A)
*	1172.65	55.82	25.26	1.84	47.25	0.42	36.09	74.00	-37.91	P
*	1172.65	46.28	25.26	1.84	47.25	0.42	26.55	54.00	-27.45	A
*	1605.47	65.37	27.39	2.18	46.97	0.57	48.53	74.00	-25.47	P
*	1605.47	55.87	27.39	2.18	46.97	0.57	39.03	54.00	-14.97	A
*	4960.23	53.86	33.57	4.21	46.70	0.24	45.18	74.00	-28.82	P
*	4960.23	44.28	33.57	4.21	46.70	0.24	35.60	54.00	-18.40	A
	N/A	------	------	------	------	------	------	------	------	P
	N/A	------	------	------	------	------	------	------	------	A

REMARK:

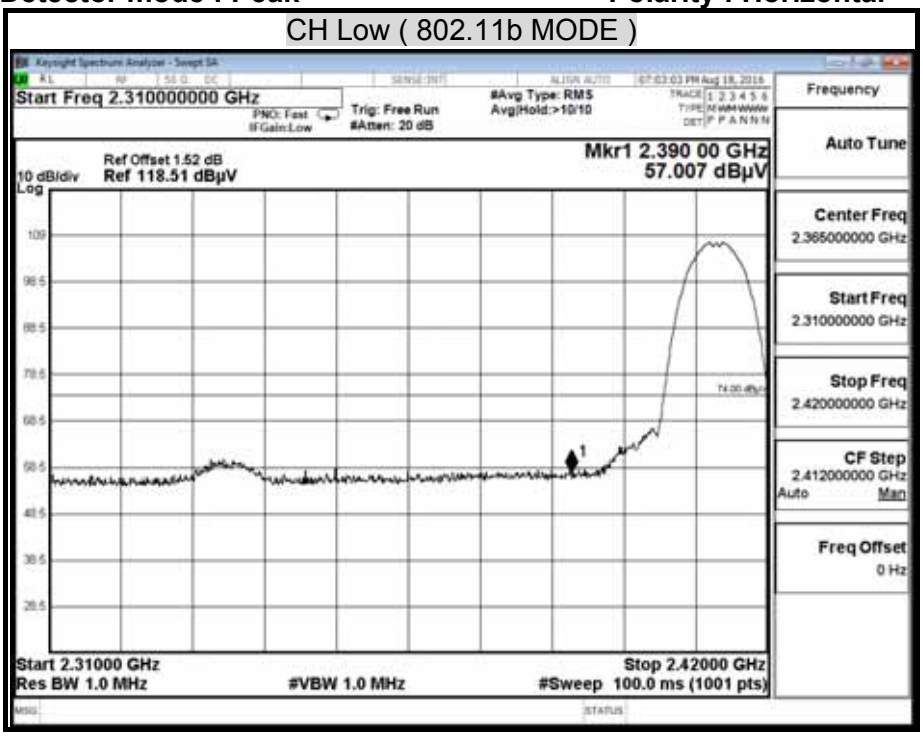
1. *AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss*
2. *Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz*
3. *The result basic equation calculation is as follow:*
   Level = Reading + AF + Cable – Preamp + Filter , Margin = Level-Limit
4. *The other emission levels were 20dB below the limit*
5. *The test limit distance is 3M limit.*

8.6.4 RESTRICTED BAND EDGES

Model Name	HEADRUSH PEDALBOARD	Test By	Ted Huang
Temp & Humidity	24.3℃, 48%	Test Date	2016/12/08

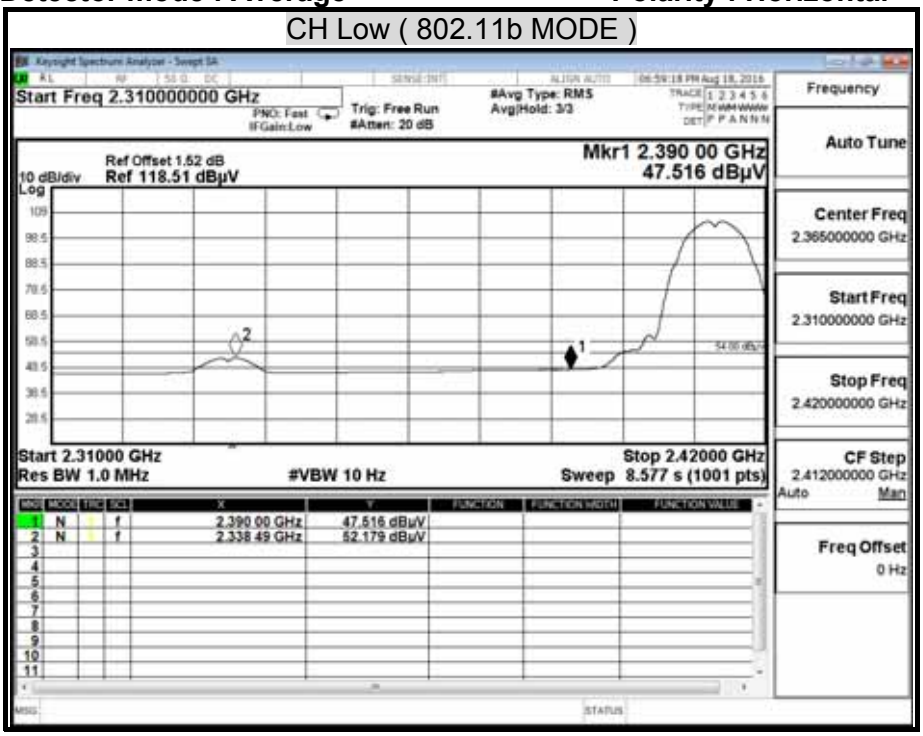
Detector mode : Peak **Polarity : Horizontal**

CH Low (802.11b MODE)



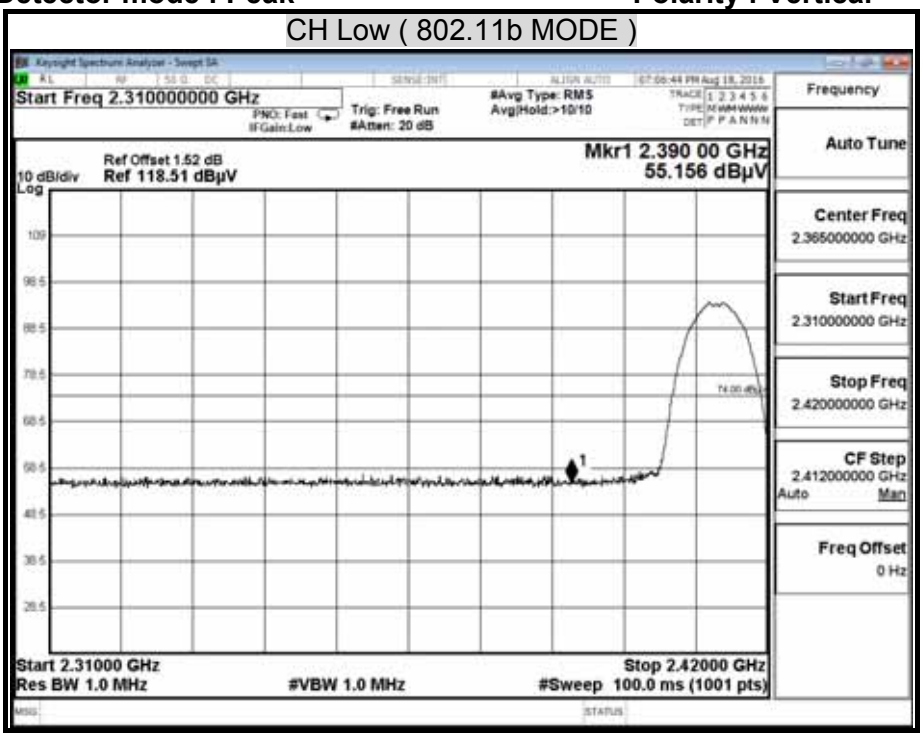
Detector mode : Average **Polarity : Horizontal**

CH Low (802.11b MODE)



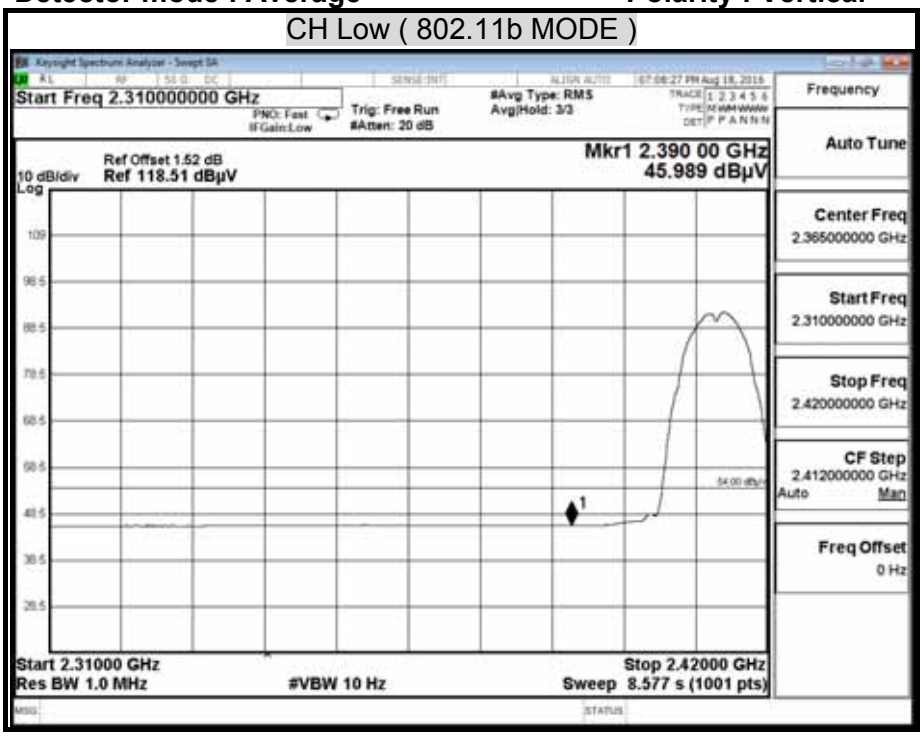
Detector mode : Peak **Polarity : Vertical**

CH Low (802.11b MODE)



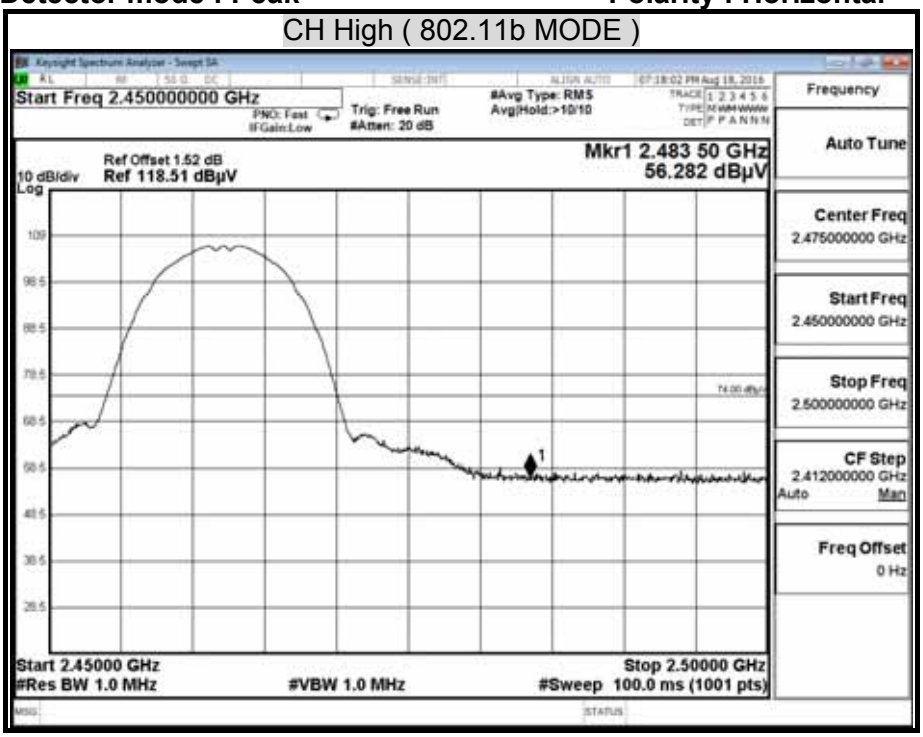
Detector mode : Average **Polarity : Vertical**

CH Low (802.11b MODE)



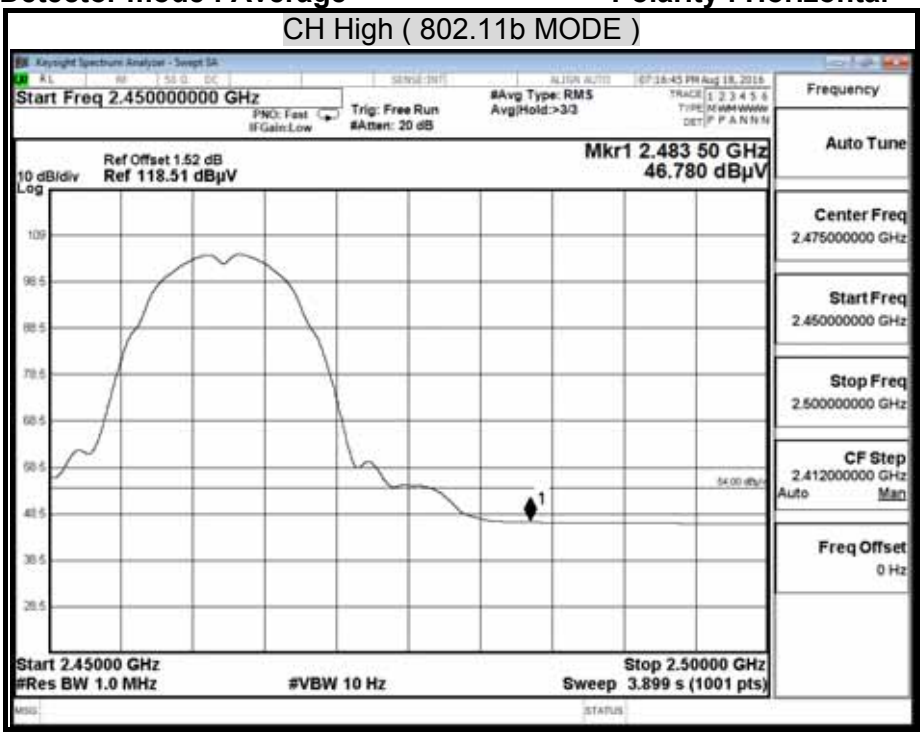
Detector mode : Peak **Polarity : Horizontal**

CH High (802.11b MODE)



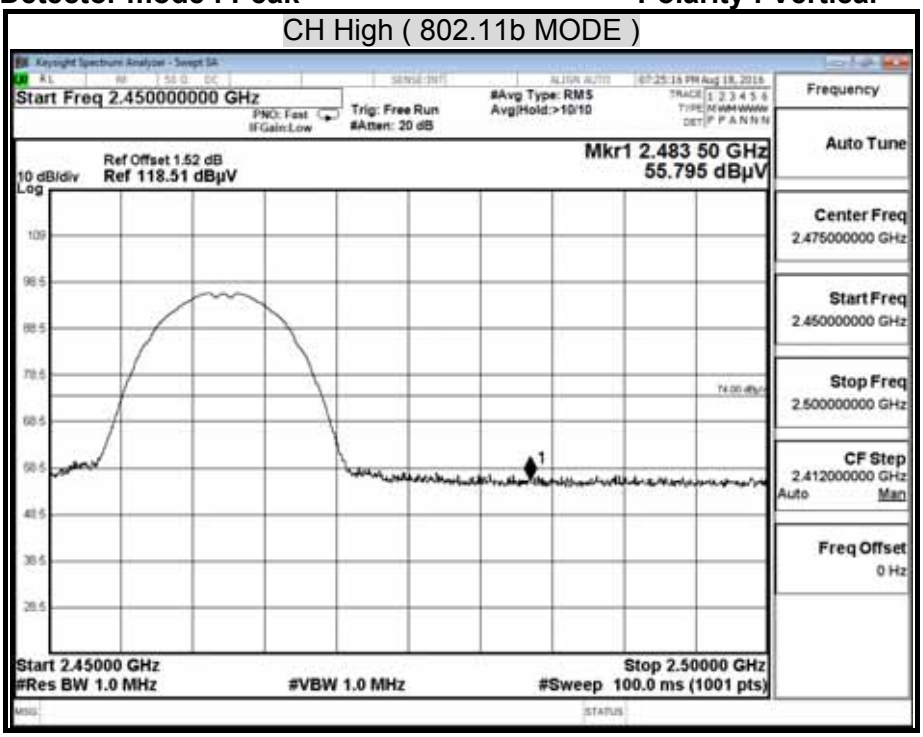
Detector mode : Average **Polarity : Horizontal**

CH High (802.11b MODE)



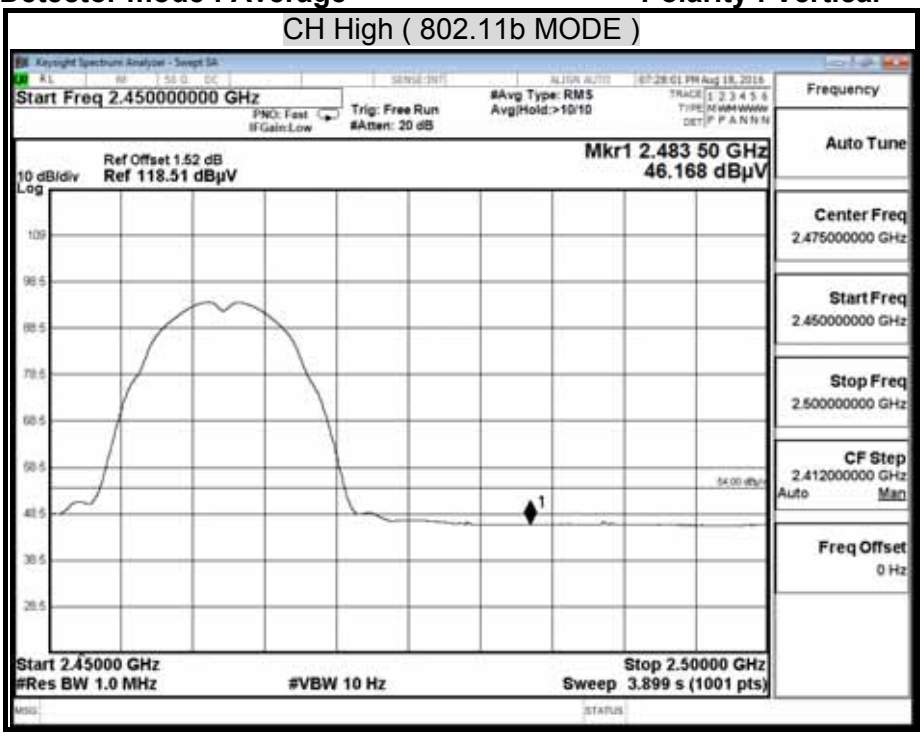
Detector mode : Peak **Polarity : Vertical**

CH High (802.11b MODE)



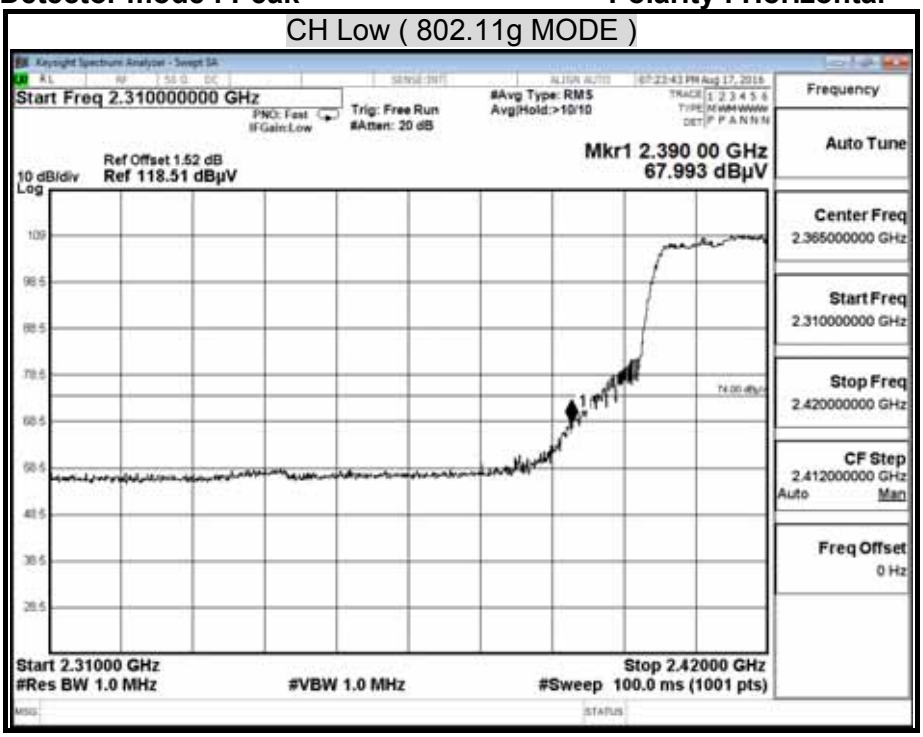
Detector mode : Average **Polarity : Vertical**

CH High (802.11b MODE)



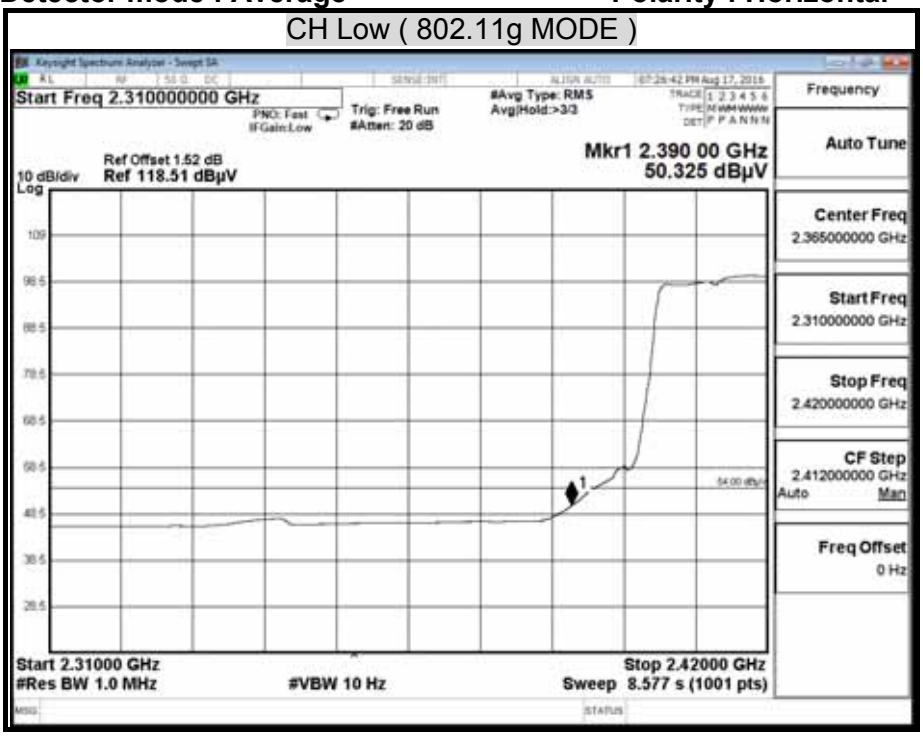
Detector mode : Peak **Polarity : Horizontal**

CH Low (802.11g MODE)



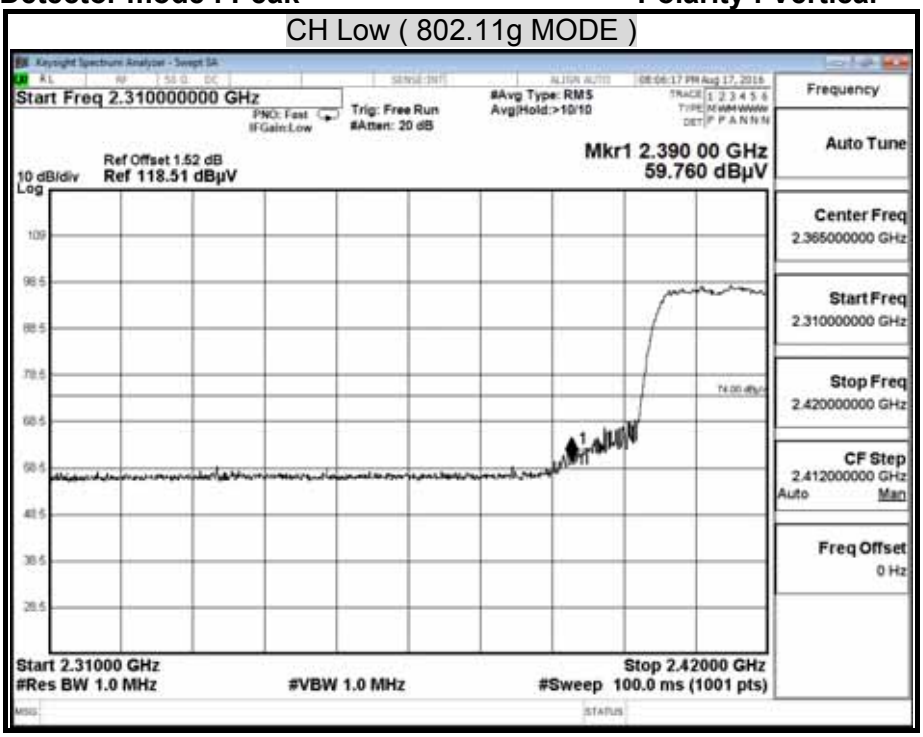
Detector mode : Average **Polarity : Horizontal**

CH Low (802.11g MODE)



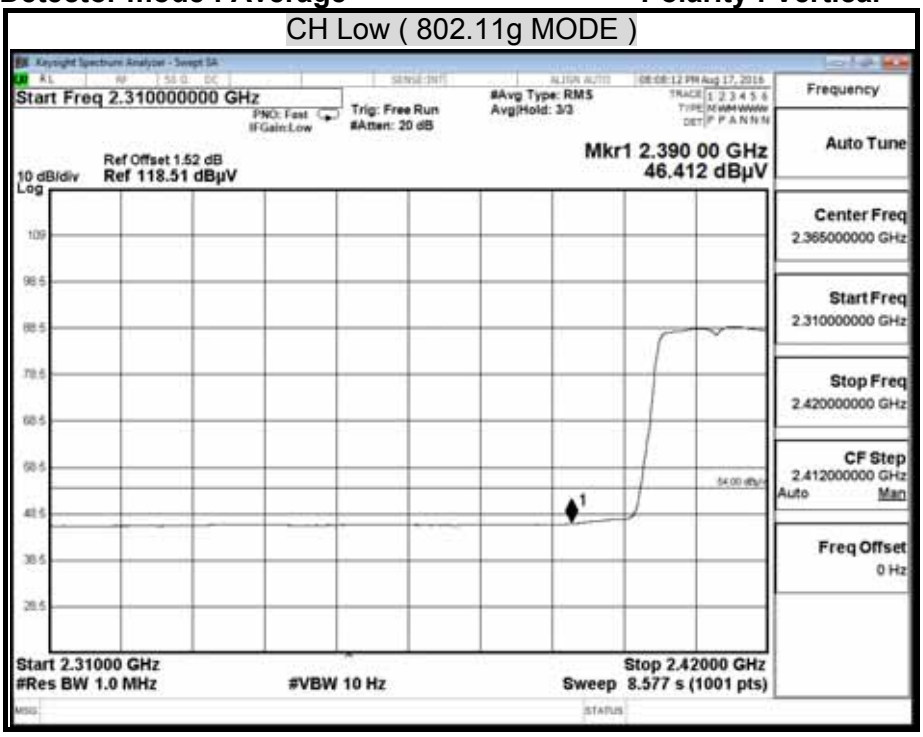
Detector mode : Peak **Polarity : Vertical**

CH Low (802.11g MODE)



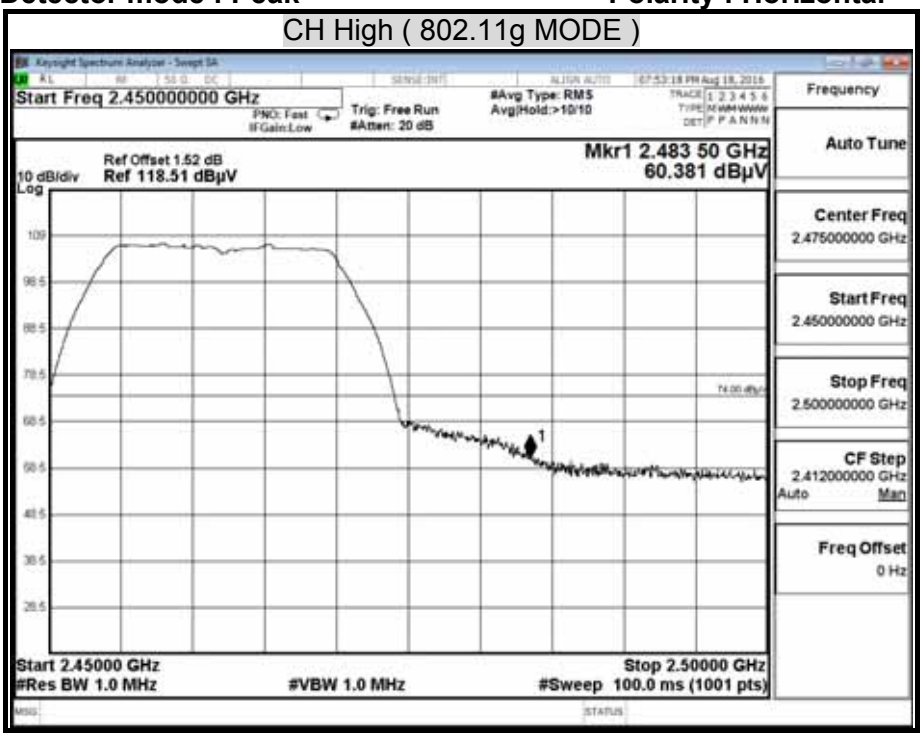
Detector mode : Average **Polarity : Vertical**

CH Low (802.11g MODE)



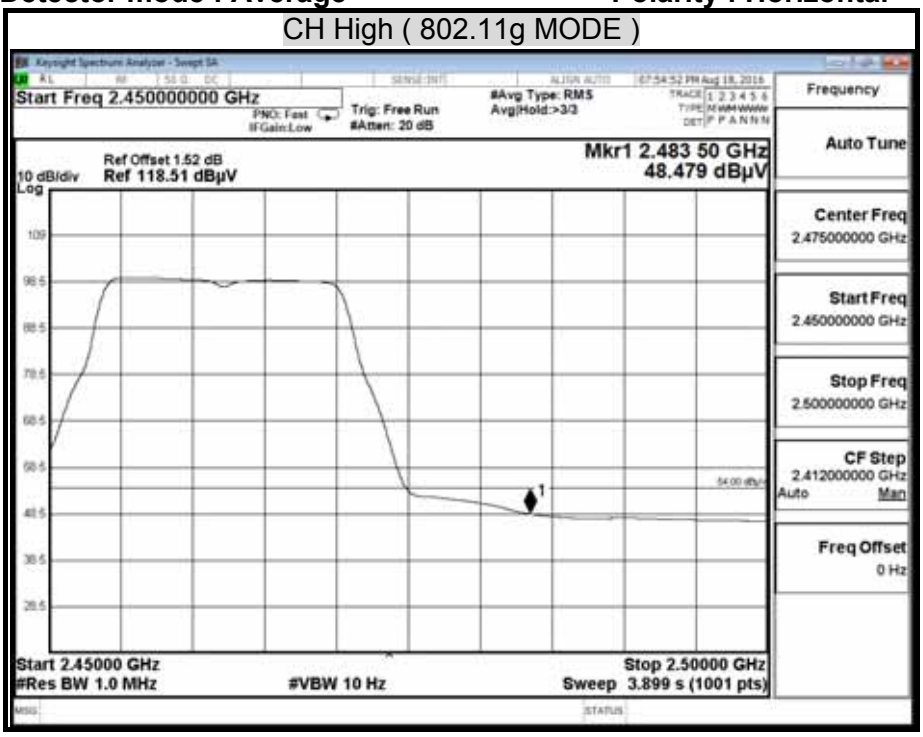
Detector mode : Peak **Polarity : Horizontal**

CH High (802.11g MODE)



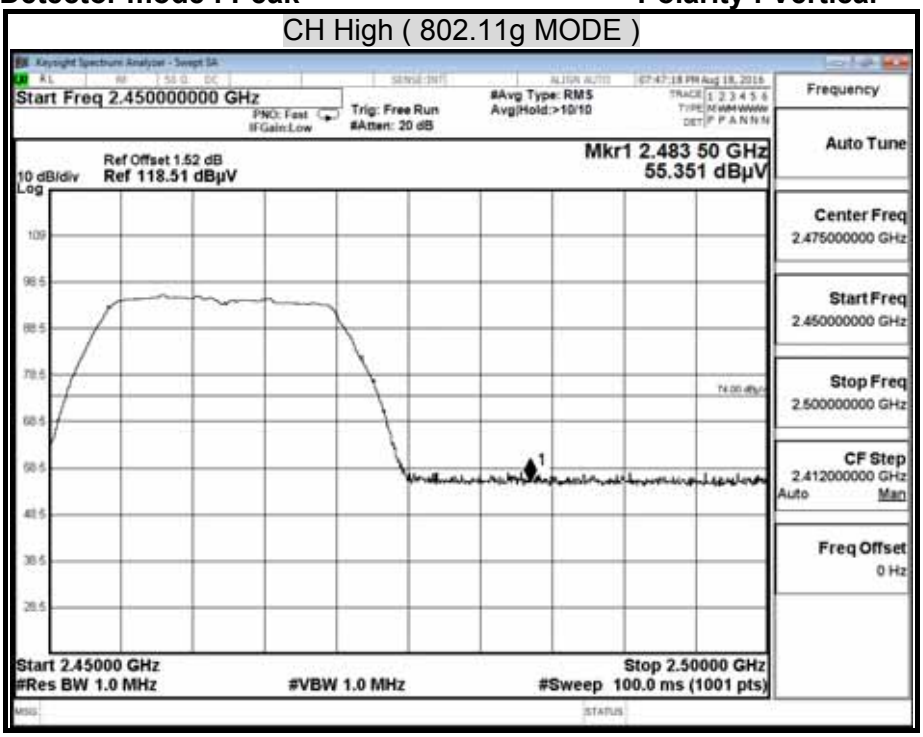
Detector mode : Average **Polarity : Horizontal**

CH High (802.11g MODE)



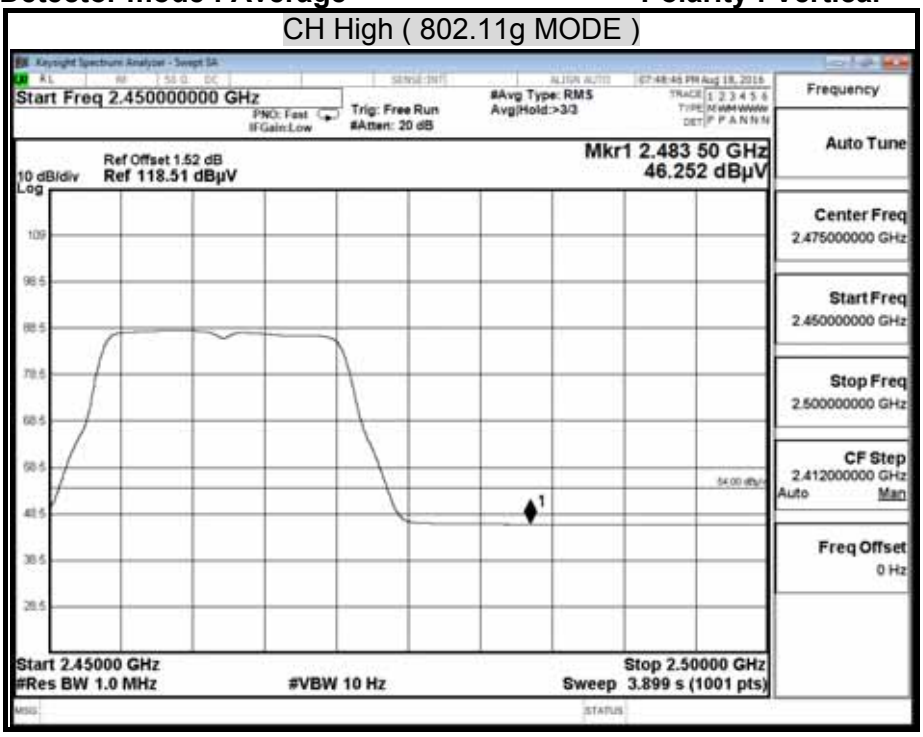
Detector mode : Peak **Polarity : Vertical**

CH High (802.11g MODE)



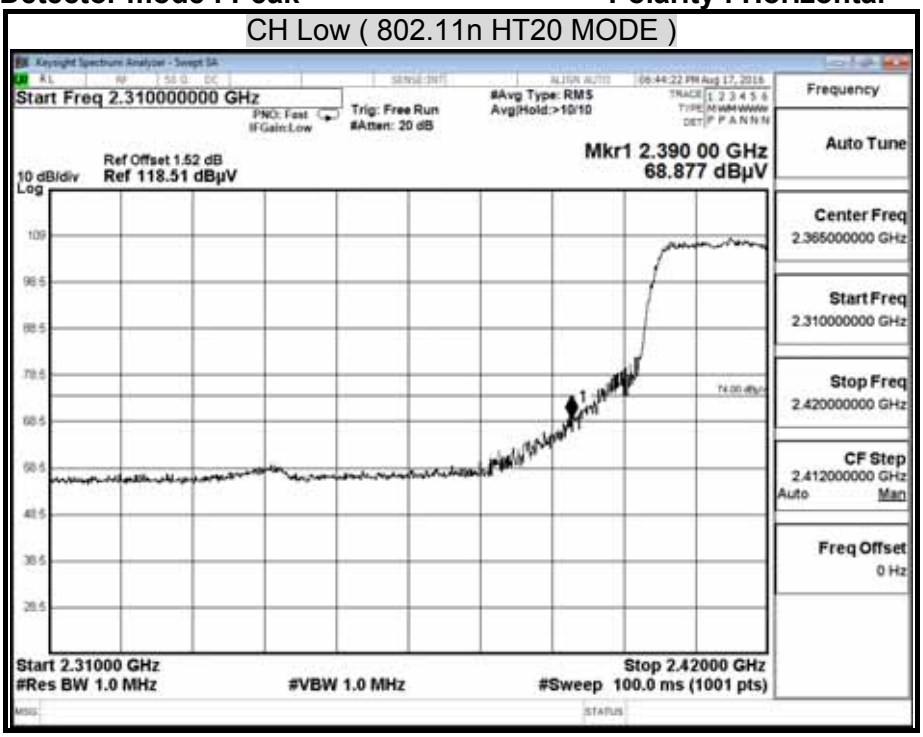
Detector mode : Average **Polarity : Vertical**

CH High (802.11g MODE)



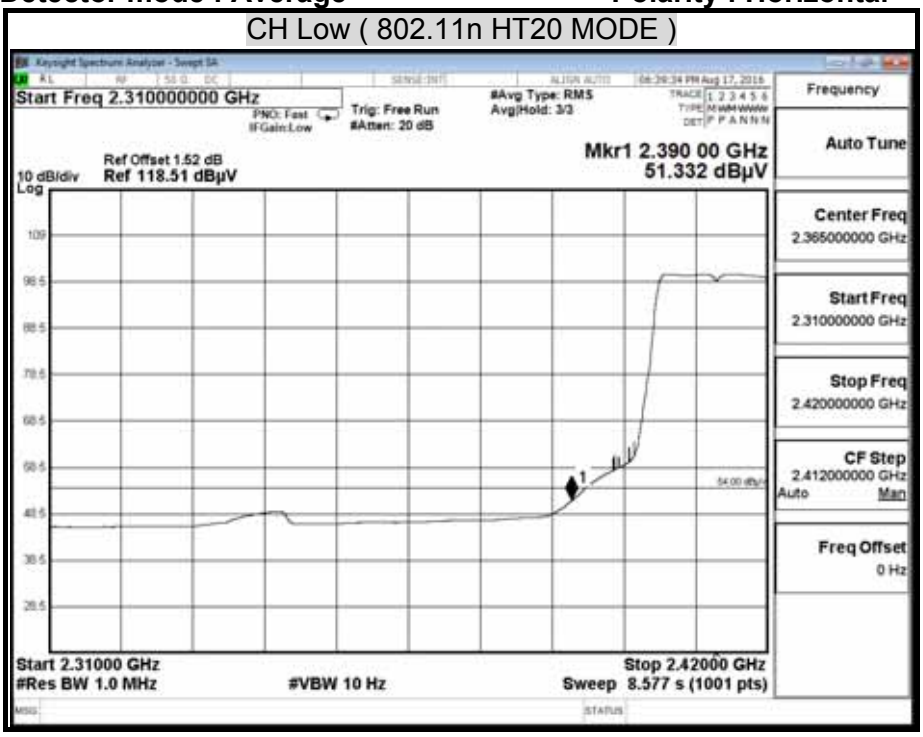
Detector mode : Peak **Polarity : Horizontal**

CH Low (802.11n HT20 MODE)



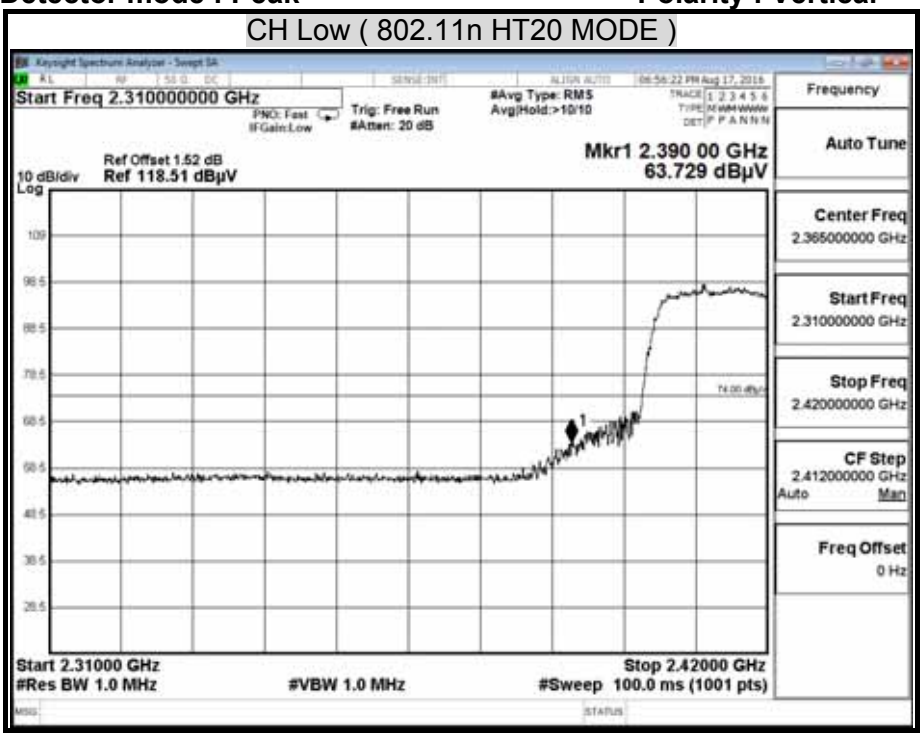
Detector mode : Average **Polarity : Horizontal**

CH Low (802.11n HT20 MODE)



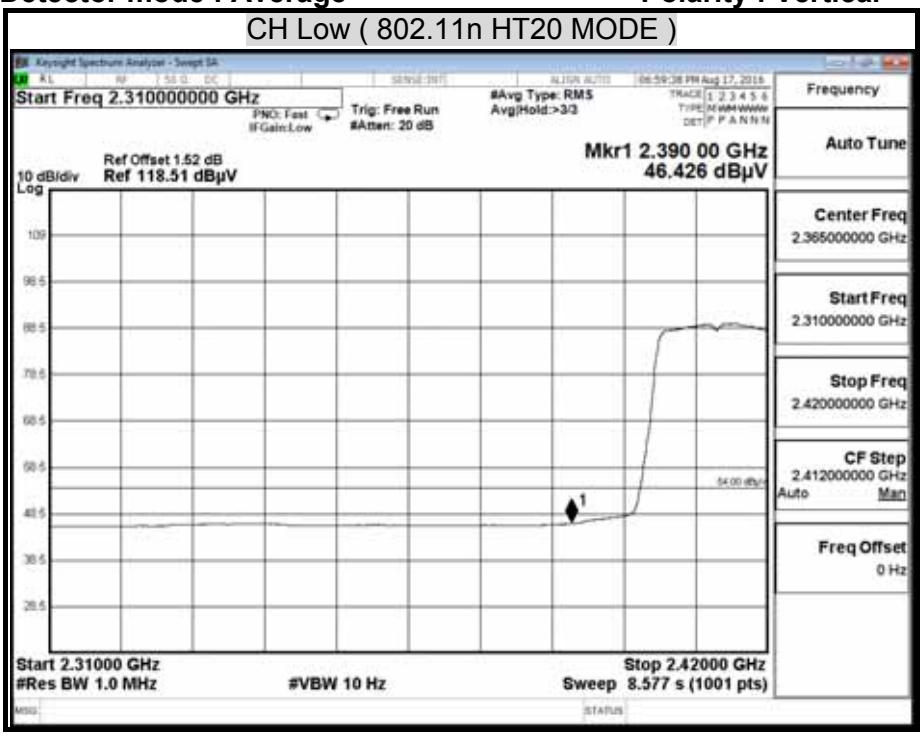
Detector mode : Peak **Polarity : Vertical**

CH Low (802.11n HT20 MODE)



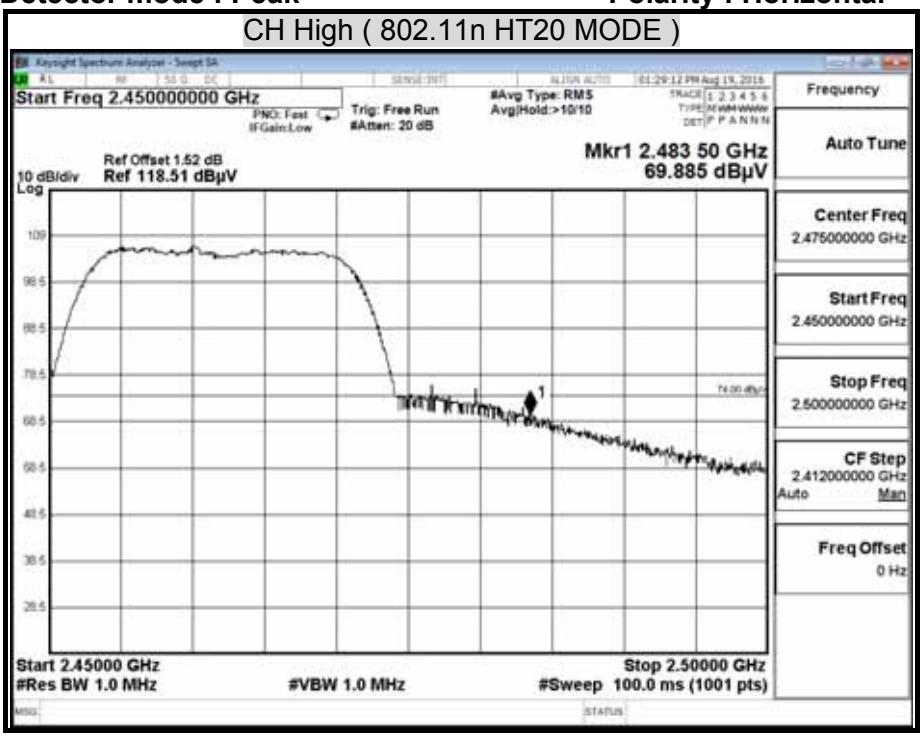
Detector mode : Average **Polarity : Vertical**

CH Low (802.11n HT20 MODE)



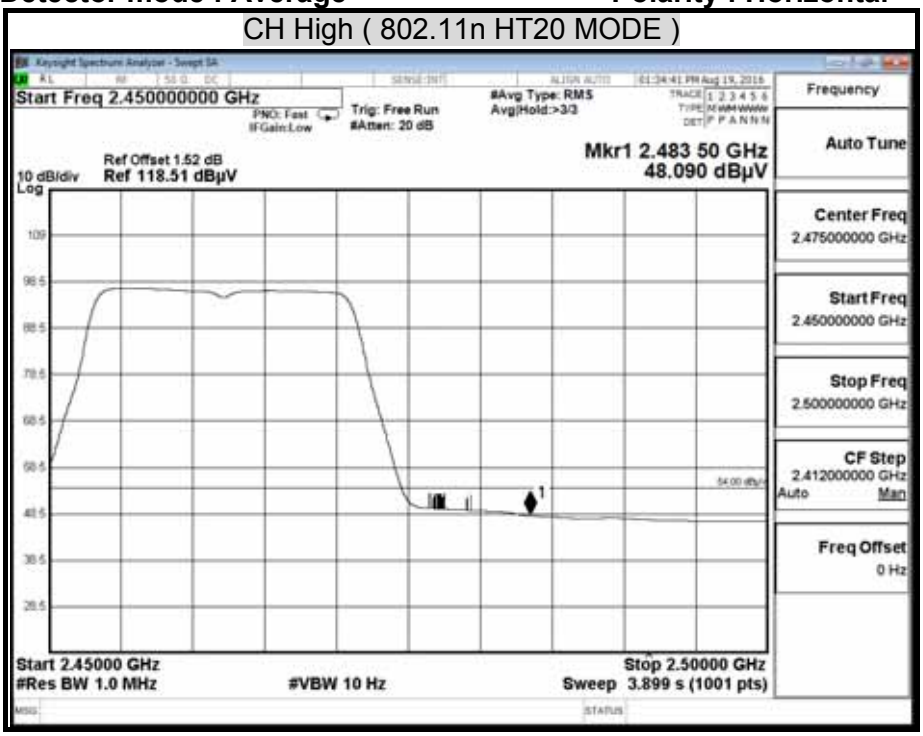
Detector mode : Peak **Polarity : Horizontal**

CH High (802.11n HT20 MODE)



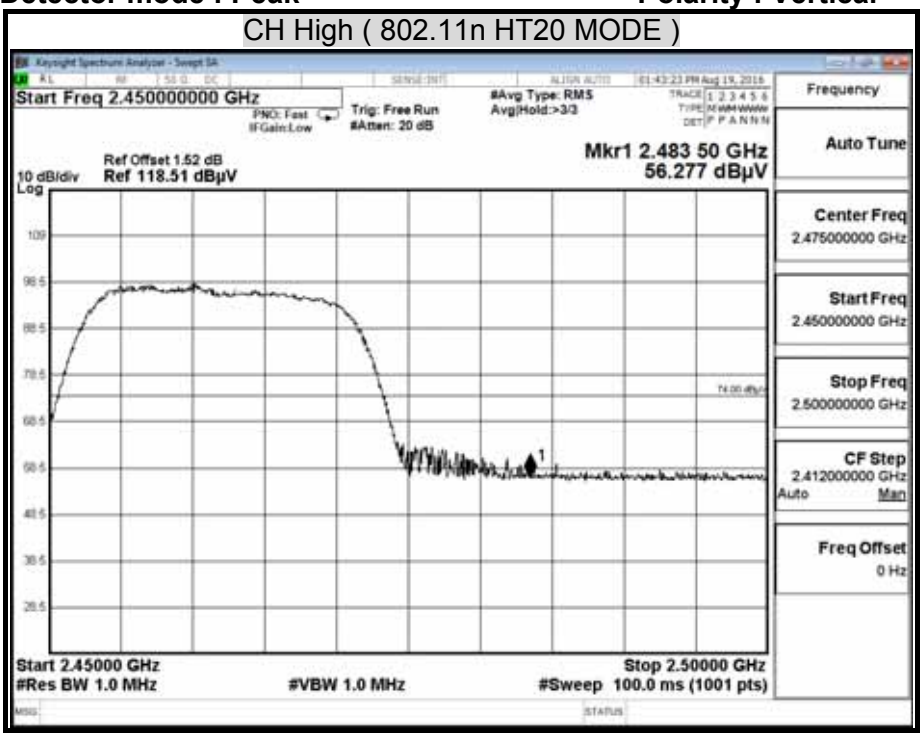
Detector mode : Average **Polarity : Horizontal**

CH High (802.11n HT20 MODE)



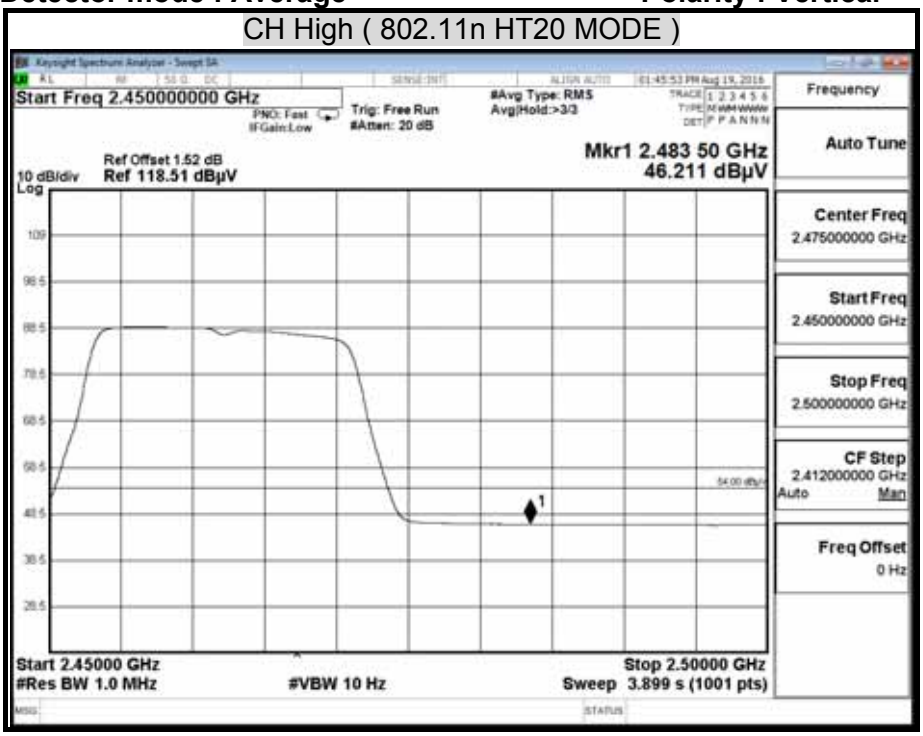
Detector mode : Peak **Polarity : Vertical**

CH High (802.11n HT20 MODE)



Detector mode : Average **Polarity : Vertical**

CH High (802.11n HT20 MODE)

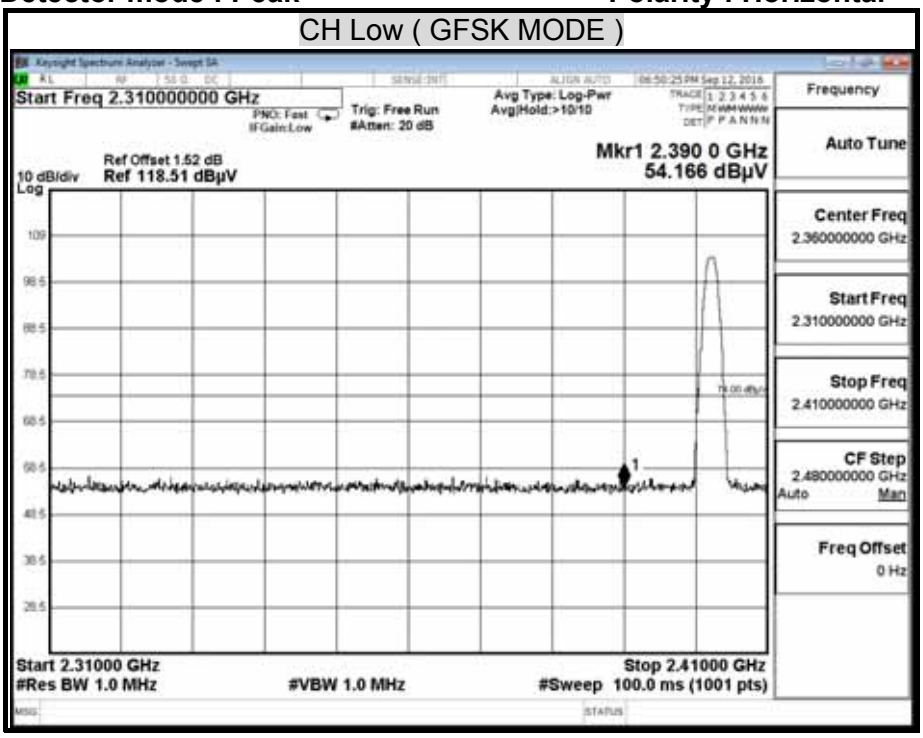


Bluetooth 4.0

Model Name	HEADRUSH PEDALBOARD	Test By	Ted Huang
Temp & Humidity	24.3℃, 48%	Test Date	2016/12/08

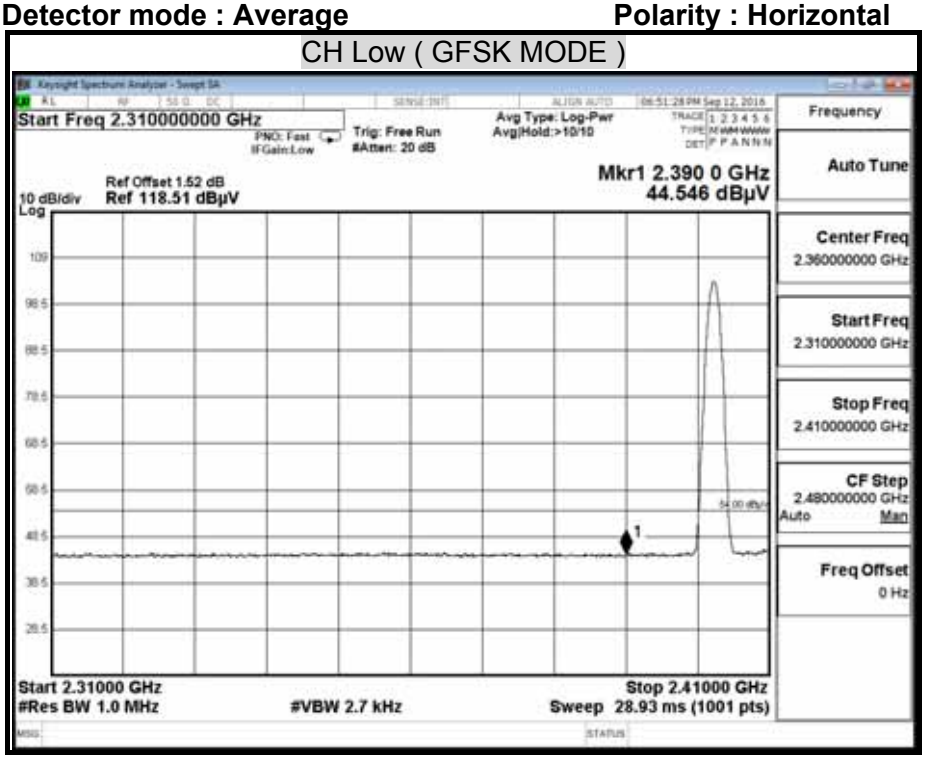
Detector mode : Peak **Polarity : Horizontal**

CH Low (GFSK MODE)



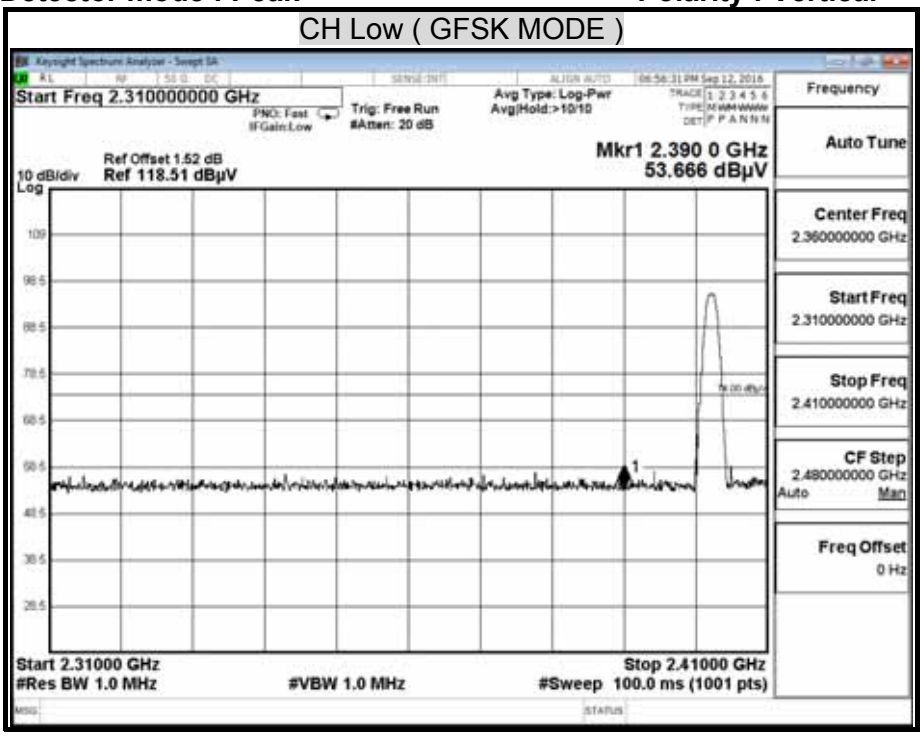
Detector mode : Average **Polarity : Horizontal**

CH Low (GFSK MODE)



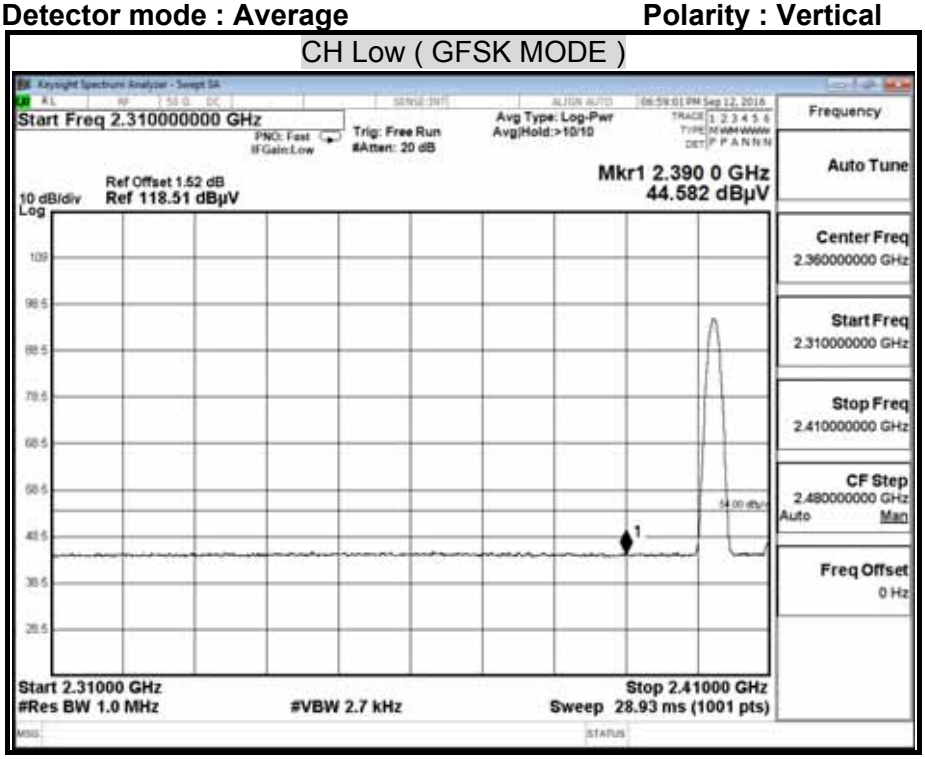
Detector mode : Peak **Polarity : Vertical**

CH Low (GFSK MODE)



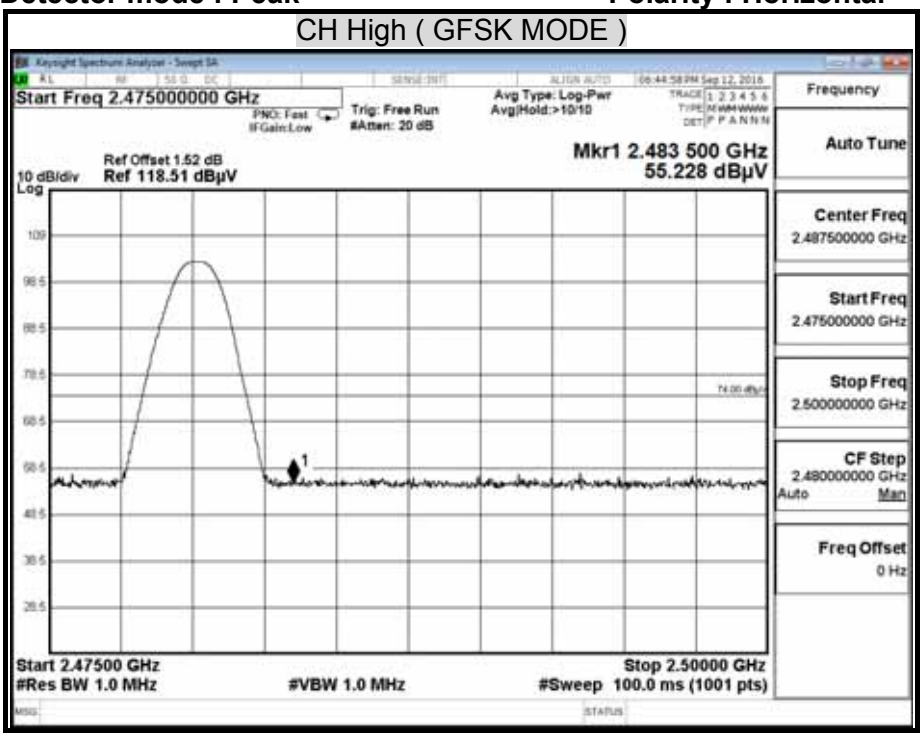
Detector mode : Average **Polarity : Vertical**

CH Low (GFSK MODE)



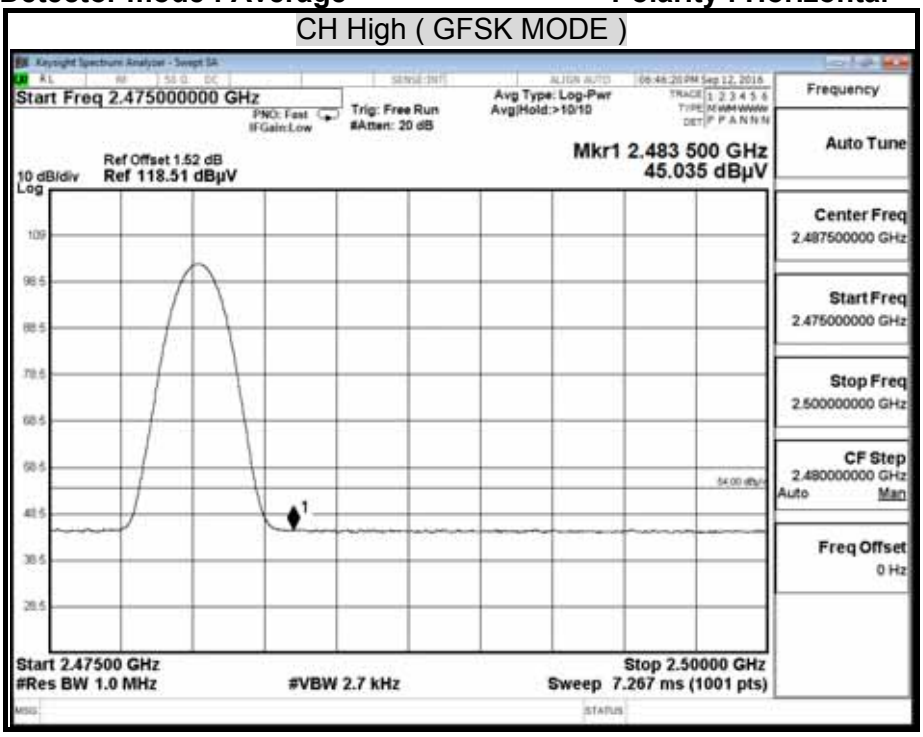
Detector mode : Peak **Polarity : Horizontal**

CH High (GFSK MODE)



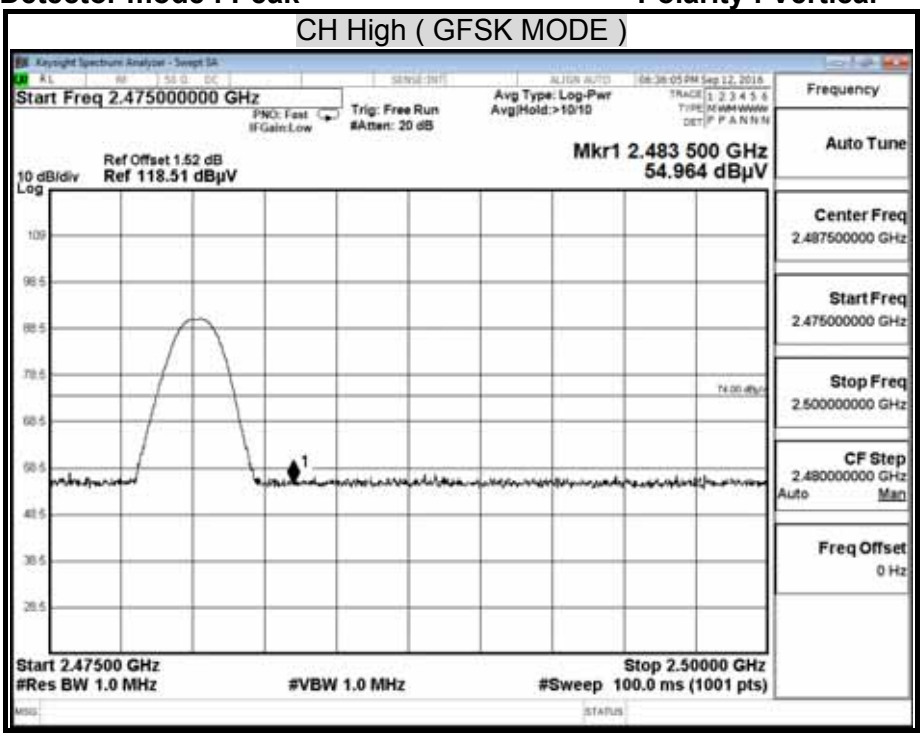
Detector mode : Average **Polarity : Horizontal**

CH High (GFSK MODE)



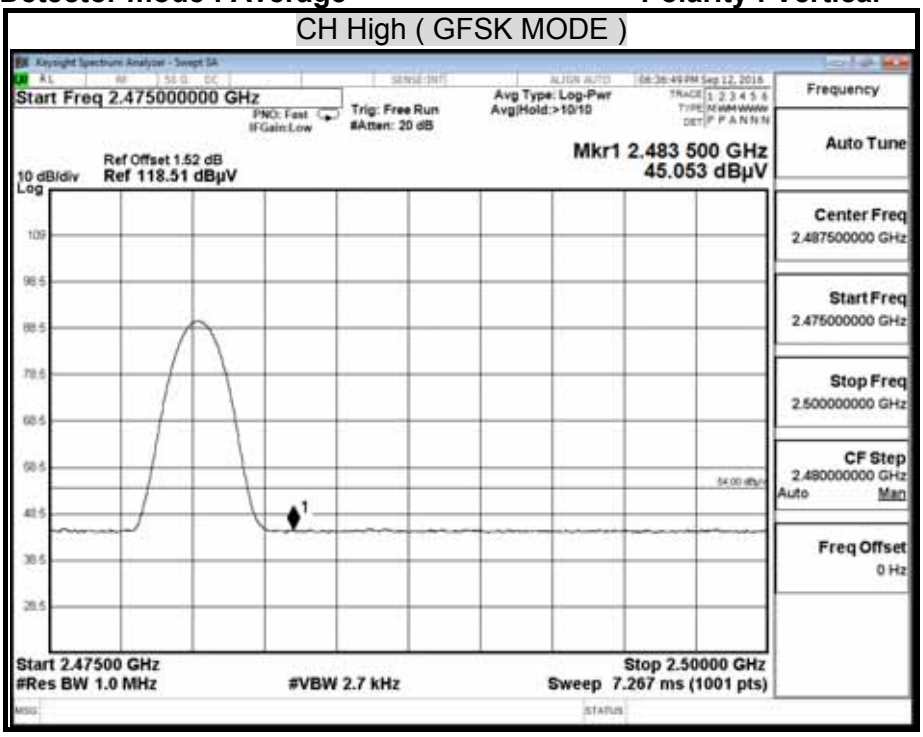
Detector mode : Peak **Polarity : Vertical**

CH High (GFSK MODE)



Detector mode : Average **Polarity : Vertical**

CH High (GFSK MODE)



8.7 POWERLINE CONDUCTED EMISSIONS

LIMITS

§ 15.207 (a) Except as shown in paragraph (b) and (c) this section, for an intentional radiator that 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 the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

The lower limit applies at the boundary between the frequency ranges.

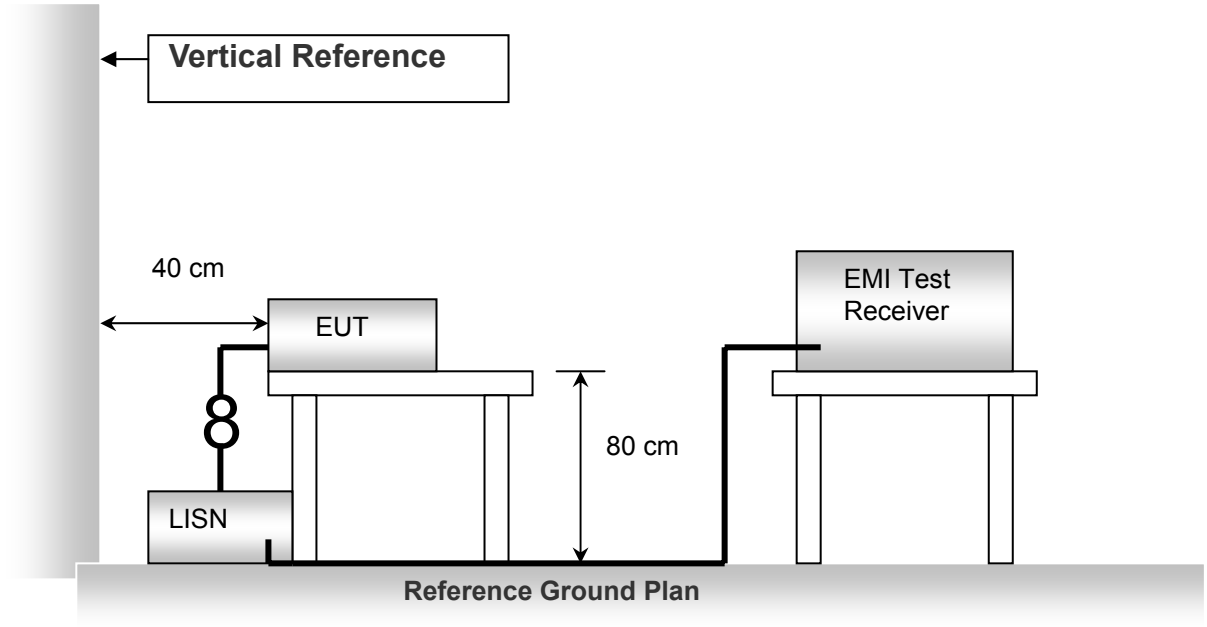
Frequency of Emission (MHz)	Conducted limit (dBμv)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56	56 to 46
0.5 - 5	56	46
5 - 30	60	50

TEST EQUIPMENTS

The following test equipments are used during the conducted power line tests：

Conducted Emission room #1				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
BNC Coaxial Cable	CCS	BNC50	11	12/04/2017
EMI Test Receiver	R&S	ESCS 30	100348	12/11/2017
LISN	SCHWARZBECK	NNLK8130	8130124	11/07/2017
LISN	FCC	FCC-LISN-50-32-2	08009	05/03/2017
Pulse Limiter	R&S	ESH3-Z2	100116	12/04/2017
Software	e-3 (5.04211j)			

TEST SETUP



TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80cm above the horizontal ground plane. The EUT IS CONFIGURED IN ACCORDANCE WITH ANSI C63.10.

The resolution bandwidth is set to 9 kHz for both quasi-peak detection and average detection measurements.

Line conducted data is recorded for both NEUTRAL and LINE.

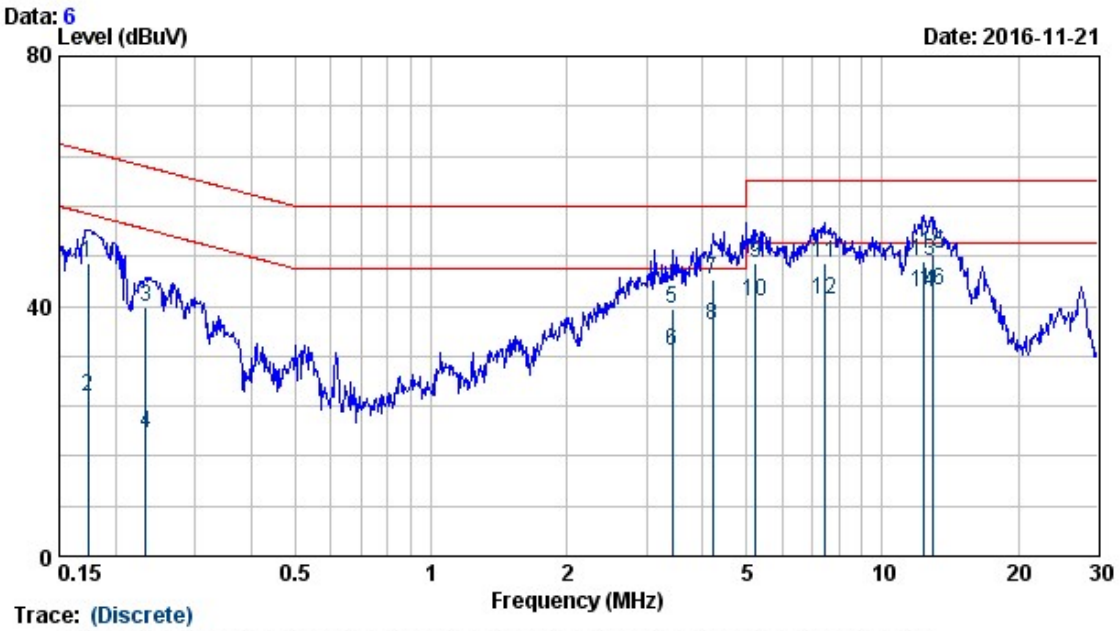
TEST RESULTS

No non-compliance noted.

Model No.	HEADRUSH PEDALBOARD	Test Mode	Normal Operation
Environmental Conditions	25℃, 51% RH	Resolution Bandwidth	9 kHz
Tested by	Event Cheng		

Line

(The chart below shows the highest readings taken from the final data.)



Trace: (Discrete)

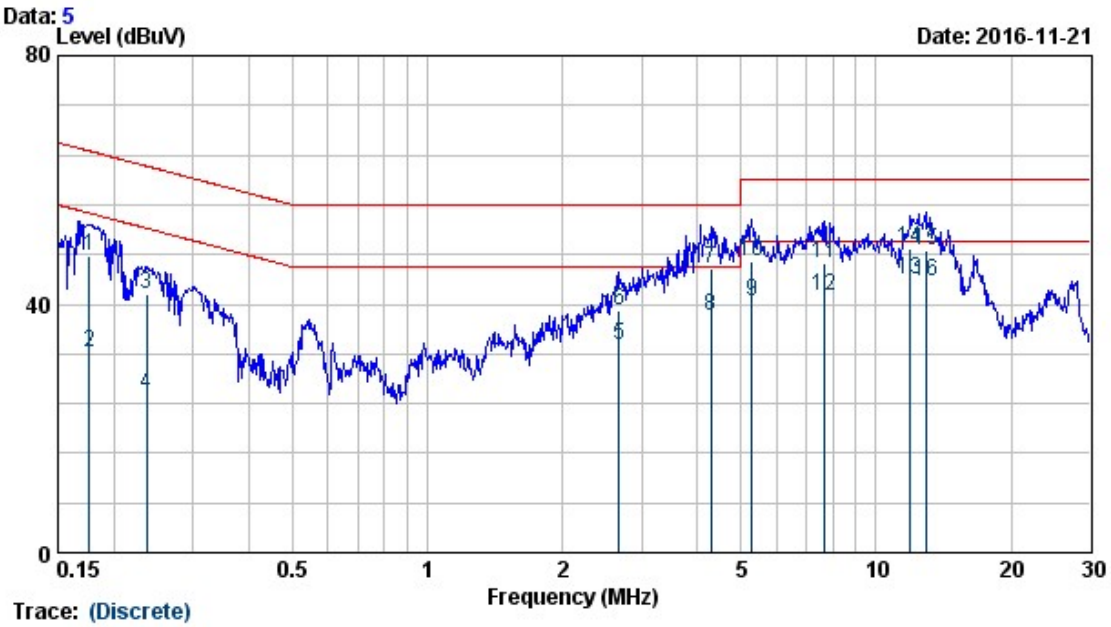
Freq. MHz	LISN Factor dB	Cable Loss dB	Meter Reading dBuV	Measured Level dBuV	Limits dBuV	Over Limits dBuV	Detector
0.17	9.64	0.10	37.11	46.85	64.77	-17.92	QP
0.17	9.64	0.10	15.76	25.50	54.77	-29.27	AVERAGE
0.23	9.66	0.10	29.99	39.75	62.35	-22.59	QP
0.23	9.66	0.10	9.73	19.49	52.35	-32.85	AVERAGE
3.42	9.77	0.10	29.67	39.54	56.00	-16.46	QP
3.42	9.77	0.10	23.07	32.94	46.00	-13.06	AVERAGE
4.20	9.78	0.12	34.45	44.35	56.00	-11.65	QP
4.20	9.78	0.12	27.11	37.01	46.00	-8.99	AVERAGE
5.25	9.83	0.20	36.76	46.79	60.00	-13.21	QP
5.25	9.83	0.20	30.63	40.66	50.00	-9.34	AVERAGE
7.45	9.92	0.20	36.70	46.82	60.00	-13.18	QP
7.45	9.92	0.20	30.88	41.00	50.00	-9.00	AVERAGE
12.32	10.08	0.20	36.94	47.22	60.00	-12.78	QP
12.32	10.08	0.20	31.95	42.23	50.00	-7.77	AVERAGE
12.92	10.11	0.20	38.14	48.45	60.00	-11.55	QP
12.92	10.11	0.20	32.31	42.62	50.00	-7.38	AVERAGE

NOTE:

1. Measured Level (dBuV) = LISN Factor (dB) + Cable Loss (dB)+ Meter Reading (dBuV)
2. Over Limit (dBuV) = Measured Level (dBuV) – Limits (dBuV)

Model No.	HEADRUSH PEDALBOARD	Test Mode	Normal Operation
Environmental Conditions	25℃, 51% RH	Resolution Bandwidth	9 kHz
Tested by	Event Cheng		

Neutral
(The chart below shows the highest readings taken from the final data.)



Trace: (Discrete)

Freq. MHz	LISN Factor dB	Cable Loss dB	Meter Reading dBuV	Measured Level dBuV	Limits dBuV	Over Limits dBuV	Detector
0.18	9.66	0.10	37.87	47.63	64.68	-17.05	QP
0.18	9.66	0.10	22.52	32.28	54.68	-22.40	AVERAGE
0.24	9.68	0.10	31.75	41.53	62.22	-20.68	QP
0.24	9.68	0.10	15.69	25.47	52.22	-26.74	AVERAGE
2.68	9.77	0.10	23.47	33.34	46.00	-12.66	AVERAGE
2.68	9.77	0.10	28.99	38.86	56.00	-17.14	QP
4.29	9.75	0.13	35.77	45.65	56.00	-10.35	QP
4.29	9.75	0.13	28.11	37.99	46.00	-8.01	AVERAGE
5.28	9.81	0.20	30.43	40.44	50.00	-9.56	AVERAGE
5.28	9.81	0.20	36.89	46.90	60.00	-13.10	QP
7.65	9.93	0.20	36.38	46.51	60.00	-13.49	QP
7.65	9.93	0.20	31.19	41.32	50.00	-8.68	AVERAGE
11.93	10.09	0.20	33.79	44.08	50.00	-5.92	AVERAGE
11.93	10.09	0.20	38.68	48.97	60.00	-11.03	QP
12.92	10.13	0.20	38.46	48.79	60.00	-11.21	QP
12.92	10.13	0.20	33.19	43.52	50.00	-6.48	AVERAGE

NOTE:
1. Measured Level (dBuV) = LISN Factor (dB) + Cable Loss (dB)+ Meter Reading (dBuV)
2. Over Limit (dBuV) = Measured Level (dBuV) – Limits (dBuV)

9. ANTENNA REQUIREMENT

9.1 STANDARD APPLICABLE

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

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

9.2 ANTENNA CONNECTED CONSTRUCTION

Type: PCB Antenna
Model: WLA-EM-1508-0008-B
Manufacturer: BRITO
Gain: 4.6 dBi