FCC RADIO TEST REPORT

FCC ID:QT4-WS4392
IC:22090-WS4392

Report Reference No. ..... :	16FAS10014 21
Date of issue ..... :	2016-10-25
FCC 2.948 No ..... :	923232
IC Registration Number ..... :	110033A-1
Testing Laboratory ..... :	ATT Product Service Co., Ltd.
Address ..... :	No. 3, ChangLianShan Industrial Park, ChangAn Town, DongGuan City, GuangDong, China.
Applicant's name……..:	Well Shin Technology Co.,Ltd.
Address……..:	No. 196, Xin Hu 3rd Road Nei Hu District Taipei City 114 Taiwan 523766 China.
Manufacturer……..:	Same as applicant
Address……:	Same as applicant

Test specification:

Test item description..... :	Portable SmartHub
Trade Mark..... :	N/A
Model/Type reference ..... :	WS-439-2
Ratings..... :	I/P: 100-240V,50/60Hz,0.2A U/P: USB 5V/1A Max

Responsible Engineer : Lake Hu

Approved by: Maoxing Wang

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TEST REPORT DECLARE

Applicant	:	Well Shin Technology Co.,Ltd.
Address	:	No. 196, Xin Hu 3rd Road Nei Hu District Taipei City 114 Taiwan 523766 China.
Equipment under Test	:	Portable SmartHub
Model No	:	WS-439-2
Trade Mark	:	N/A
Manufacturer	:	Well Shin Technology Co.,Ltd.
Address	:	No. 196, Xin Hu 3rd Road Nei Hu District Taipei City 114 Taiwan 523766 China.

Test Standard Used: FCC Rules and Regulations Part 15 Subpart C : 2015.
RSS-247 ISSUE 1 May 28,2015; RSS-GEN ISSUE 4 November 13, 2014

Test procedure used: ANSI C63.10:2013,558074 V03R05.

We Declare:
The equipment described above is tested by ATT Product Service Co., Ltd. and in the configuration tested the equipment complied with the standards specified above. The test results are contained in this test report and ATT Product Service Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After test and evaluation, our opinion is that the equipment provided for test compliance with the requirement of the above FCC standards.

Report No:	16FAS10014 21		
Date of Test:	2016-10-11--2016-10-24	**Date of Report**:	2016-10-25

Note: This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of ATT Product Service Co., Ltd.

1. Summary of test Standards and results

The EUT have been tested according to the applicable standards as referenced below.

Description of Test Item	Standard	Results
6dB Bandwidth And 99% Occupied Bandwidth	FCC Part 15.247 (a)(2) RSS 247:5.2.1	PASS
Peak Output Power	FCC Part 15.247(b)(3) RSS 247:5.4.4	PASS
Power Spectral Density	FCC Part 15.247(e) RSS 247:5.2.2	PASS
Spurious Emissions at Antenna Port	FCC Part 15.247(d) RSS 247:5.5	PASS
Spurious Emissions	FCC Part 15.205, 15.209, FCC Part 15.247(d) RSS 247:5.5	PASS
100 kHz Bandwidth of Frequency Band Edge	FCC Part 15.247(d) RSS 247:5.5	PASS
AC Line Conducted Emissions	FCC Part 15.207 (a) RSS 247:8.8	PASS
Antenna requirement	FCC Part 15: 15.203 RSS-Gen:8.3	PASS

2. GENERAL TEST INFORMATION

2.1. Accresitations

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

USA FCC Registration Number :923232
Canada INDUSTRY CANADA Registration Number 11033A

2.2. Description of EUT

EUT* Name	:	Portable SmartHub
Model Number	:	WS-439-2
Trade Mark	:	N/A
EUT function description	:	Please reference user manual of this device
Power supply	:	AC 120V/60Hz
Radio Specification	:	IEEE802.11b/g/n20/n40
Operation frequency	:	IEEE 802.11b: 2412MHz—2462MHz IEEE 802.11g: 2412MHz—2462MHz IEEE 802.11n20: HT20: 2412MHz—2462MHz IEEE 802.11n40: HT40: 2422MHz—2452MHz
Modulation	:	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n20: HT20: OFDM (64QAM, 16QAM, QPSK,BPSK) IEEE 802.11n40: HT40: OFDM (64QAM, 16QAM, QPSK,BPSK)
Antenna Type	:	PCB Antenna,maximum PK gain: 2 dBi
Date of Receipt	:	2016-10-11
Sample Type	:	Series production
HVIN	:	WS_RM08K_V3.5
FVIN	:	HLK_RM08M_V3.2

Note: EUT is the ab. of equipment under test.

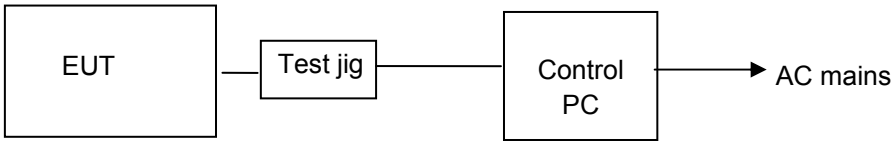
2.3. Accessories of EUT

Description of Accessories	Manufacturer	Model number or Type	Other
/	/	/	/

2.4. Assistant equipment used for test

Description of Assistant equipment	Manufacturer	Model number or Type	Other
Notebook	acer	Aspire E1-472G	FCC DoC

2.5. Block diagram of EUT configuration for test



EUT was connected to control to a special test jig provided by manufacturer which has a standard RSS-232 connector to connect to Notebook, and the Notebook will run a special test software "MP_v1.1.1" provided by manufacturer to control EUT work in test mode as blow table.

Tested mode, channel, and data rate information			
Mode	data rate (Mpbs) (see Note)	Channel	Frequency (MHz)
IEEE 802.11b	1	Low :CH1	2412
	1	Middle: CH6	2437
	1	High: CH11	2462
IEEE 802.11g	6	Low :CH1	2412
	6	Middle: CH6	2437
	6	High: CH11	2462
IEEE 802.11n HT20	MCS 0	Low :CH1	2412
	MCS 0	Middle: CH6	2437
	MCS 0	High: CH11	2462
IEEE 802.11n HT40	MCS 8	Low :CH3	2422
	MCS 8	Middle: CH6	2437
	MCS 8	High: CH9	2452
Note: According exploratory test, EUT will have maximum output power in those data rate, so those data rate were used for all test. (dutycycle>98%)			

2.6. Test environment conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature range:	21-25℃
Humidity range:	40-75%
Pressure range:	86-106kPa

2.7. Measurement uncertainty

Test Item	Uncertainty
Uncertainty for Conduction emission test	2.44dB
Uncertainty for Radiation Emission test (150KHz-30MHz)	3.21dB
Uncertainty for Radiation Emission test (30MHz-1GHz)	3.14 dB (Polarize: V)
	3.16 dB (Polarize: H)
Uncertainty for Radiation Emission test (1GHz to 25GHz)	2.08dB(Polarize: V)
	2.56dB (Polarize: H)
Uncertainty for radio frequency	1×10-9
Uncertainty for conducted RF Power	0.65dB

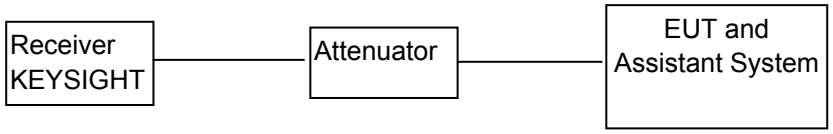
Note：This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

3. 6dB Bandwidth and 99% Occupied Bandwidth

3.1. Test equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until	Calibrated Date
1	Spectrum analyzer	KEYSIGHT	N9010A	MY55150427	2017/05/05	2016/05/06
2	Attenuator	Mini-Circuits	BW-S10W2	101109	2016/12/19	2015/12/20
3	RF Cable	Micable	C10-01-01-1	100309	2016/12/19	2015/12/20

3.2. Block diagram of test setup



3.3. Limits

For direct sequence systems, the minimum 6dB bandwidth shall be at least 500 KHz

3.4. Test Procedure

(1) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

(2) Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

(3) Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.

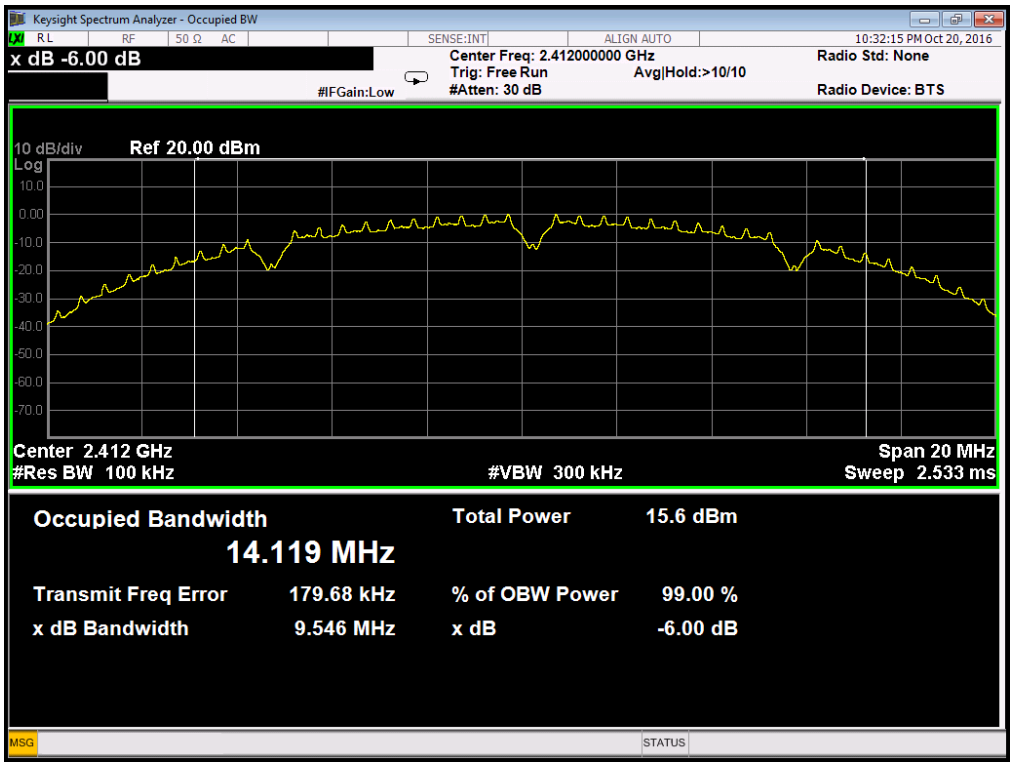
(4) Repeat above procedures until all frequencies measured were complete.

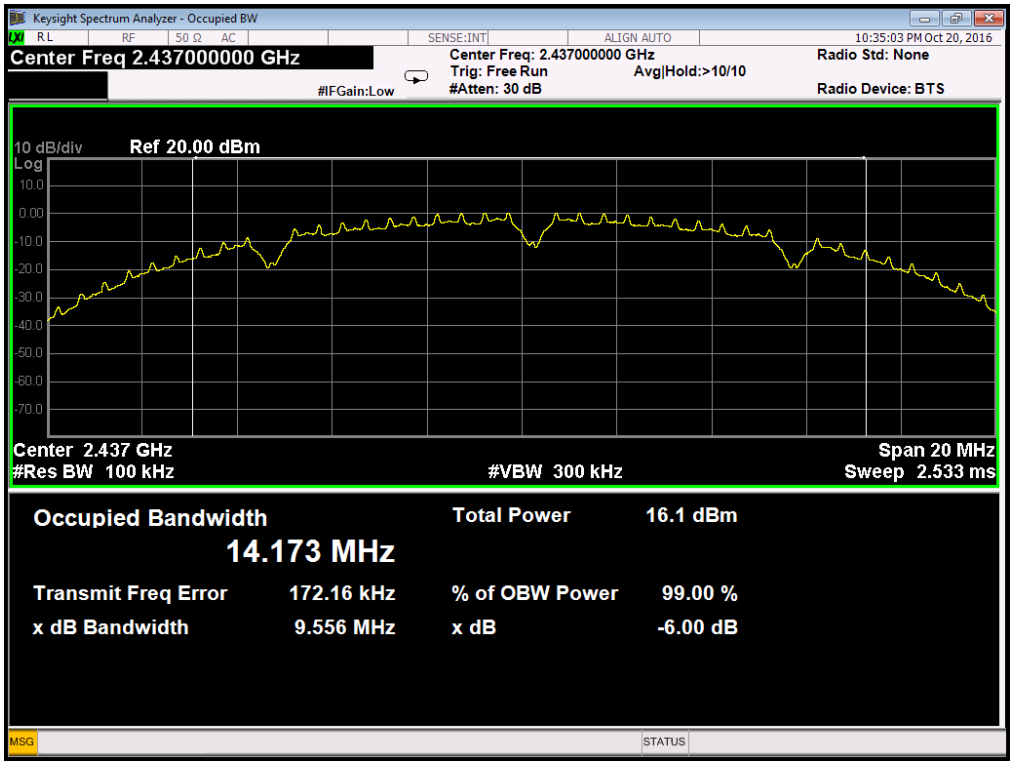
3.5. Test Result

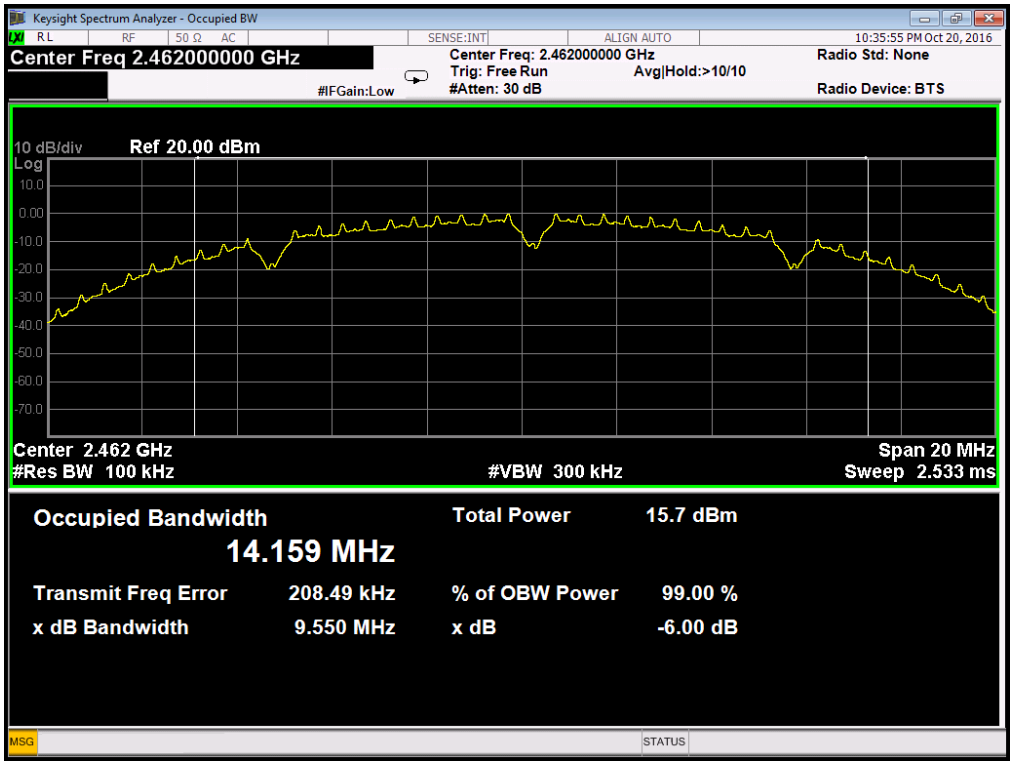
EUT Set Mode	CH or Frequency	6 dB bandwidth	99% dB bandwidth	Limt	Conclusion
		Result (MHz)	Result (MHz)	>500KHz	PASS
11b	CH1	9.546	14.119	>500KHz	PASS
	CH6	9.556	14.173	>500KHz	PASS
	CH11	9.550	14.159	>500KHz	PASS
11g	CH1	16.310	16.336	>500KHz	PASS
	CH6	16.070	16.345	>500KHz	PASS
	CH11	16.330	16.332	>500KHz	PASS
11n HT 20	CH1	17.320	17.508	>500KHz	PASS
	CH6	17.260	17.520	>500KHz	PASS
	CH11	17.560	17.514	>500KHz	PASS
11n HT 40	CH3	34.650	35.763	>500KHz	PASS
	CH6	35.930	35.820	>500KHz	PASS
	CH9	35.670	35.838	>500KHz	PASS

3.6. Original test data

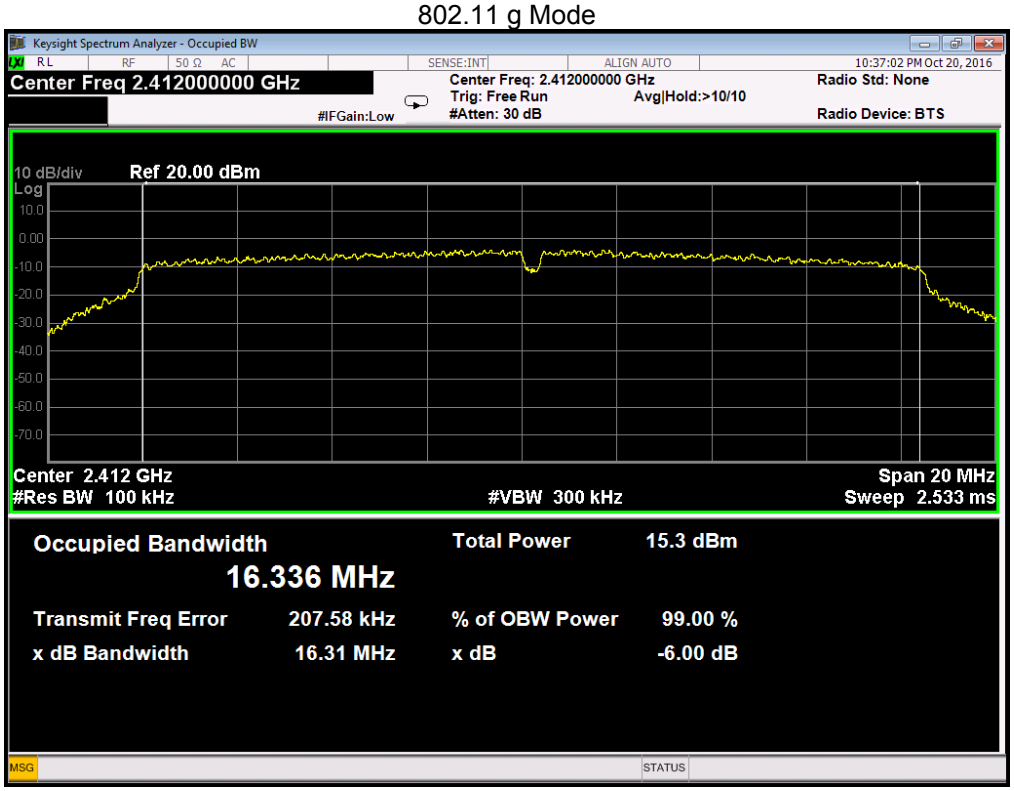
802.11 b Mode

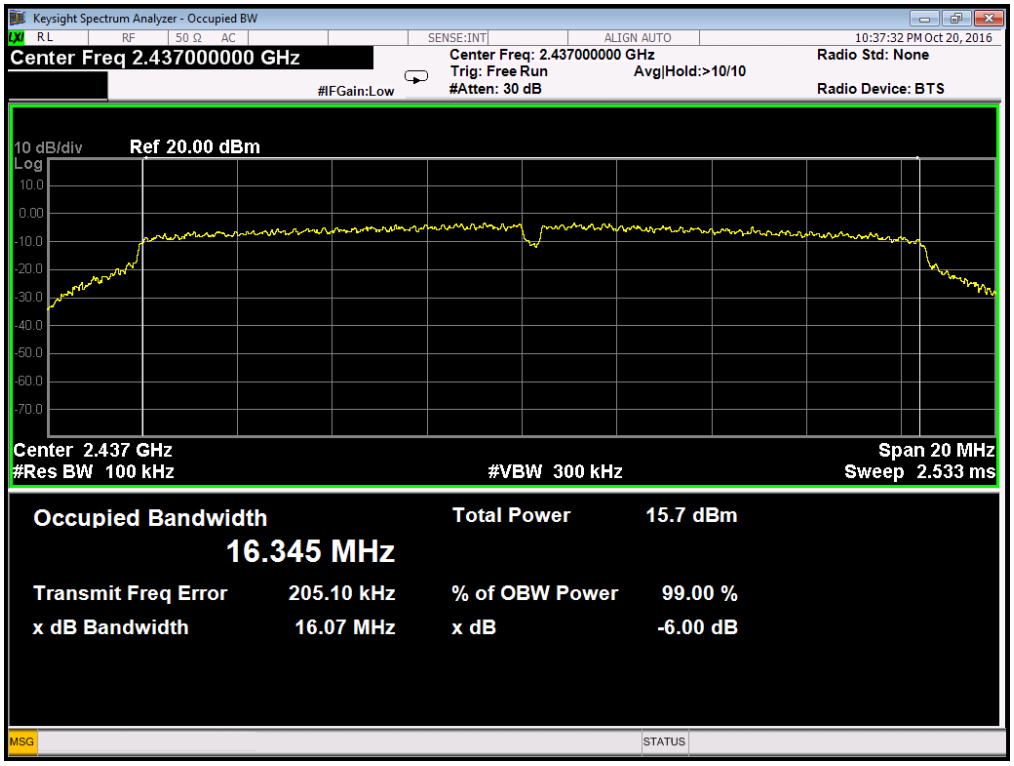


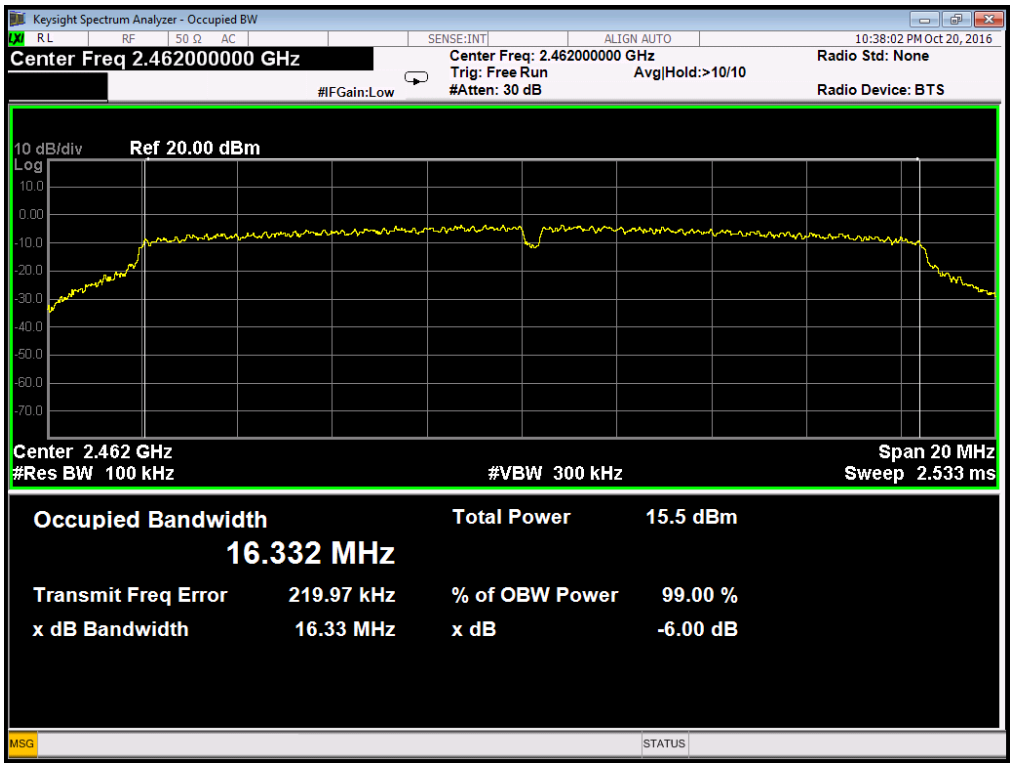



Keysight Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
10:35:55 PM Oct 20, 2016
Center Freq 2.462000000 GHz
Center Freq: 2.462000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.462 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 20 MHz
Sweep 2.533 ms
Occupied Bandwidth
14.159 MHz
Total Power
15.7 dBm
Transmit Freq Error
208.49 kHz
% of OBW Power
99.00 %
x dB Bandwidth
9.550 MHz
x dB
-6.00 dB
MSG
STATUS

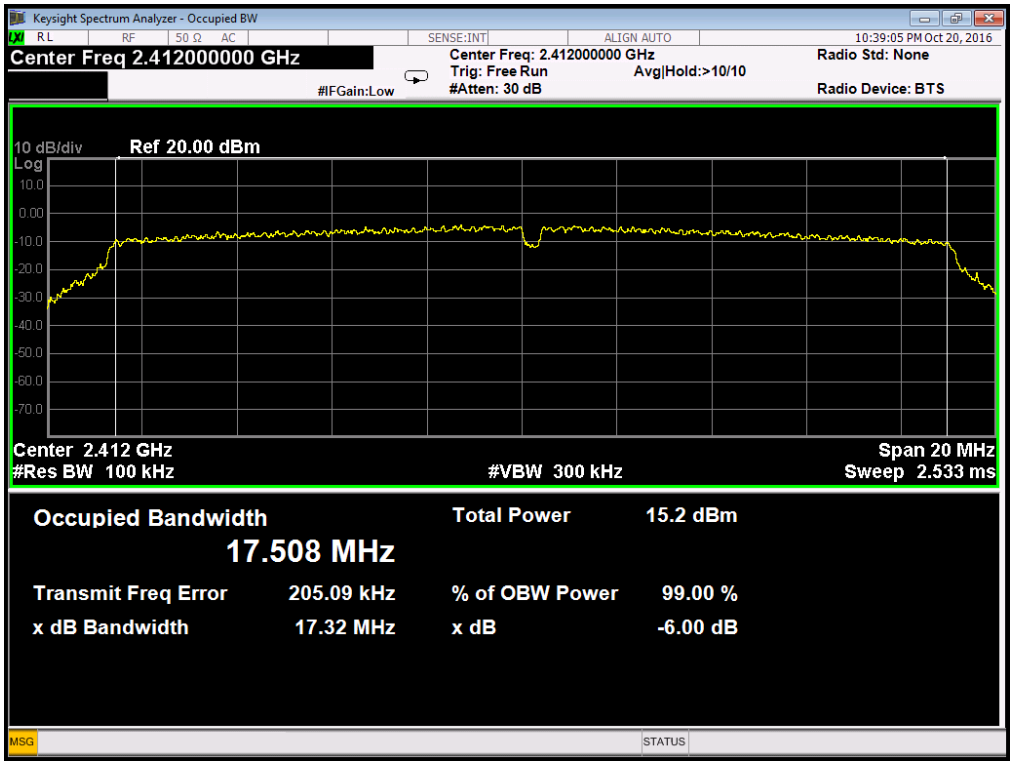
802.11 g Mode

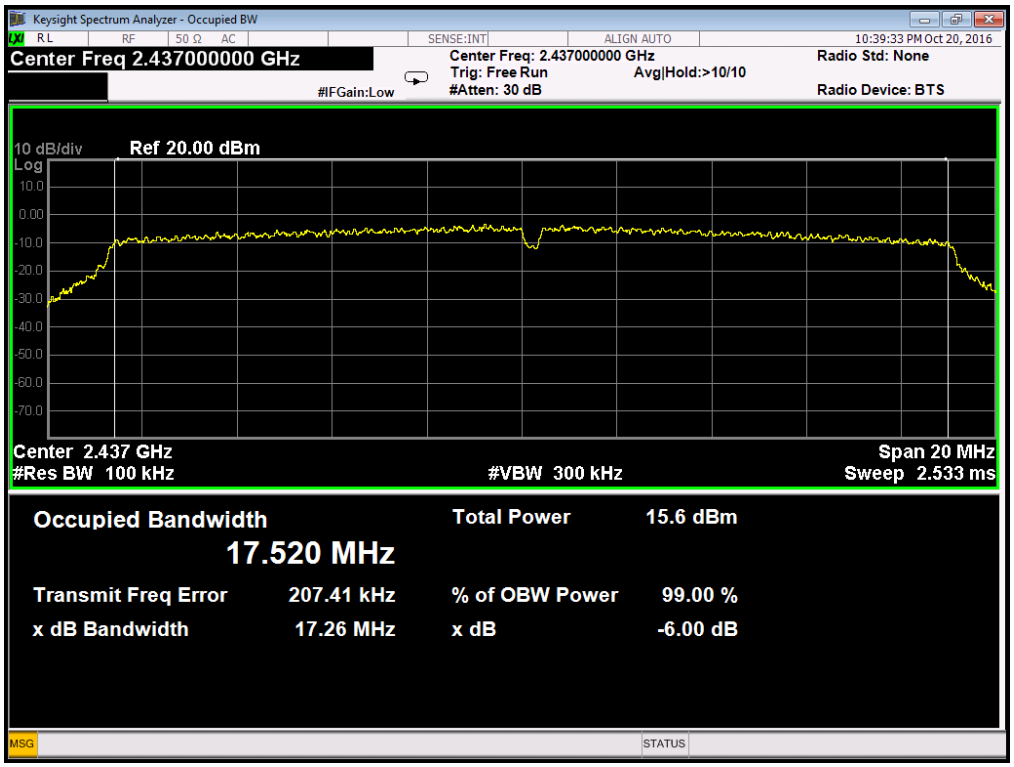

Keysight Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
10:37:02 PM Oct 20, 2016
Center Freq 2.412000000 GHz
Center Freq: 2.412000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.412 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 20 MHz
Sweep 2.533 ms
Occupied Bandwidth
16.336 MHz
Total Power
15.3 dBm
Transmit Freq Error
207.58 kHz
% of OBW Power
99.00 %
x dB Bandwidth
16.31 MHz
x dB
-6.00 dB
MSG
STATUS

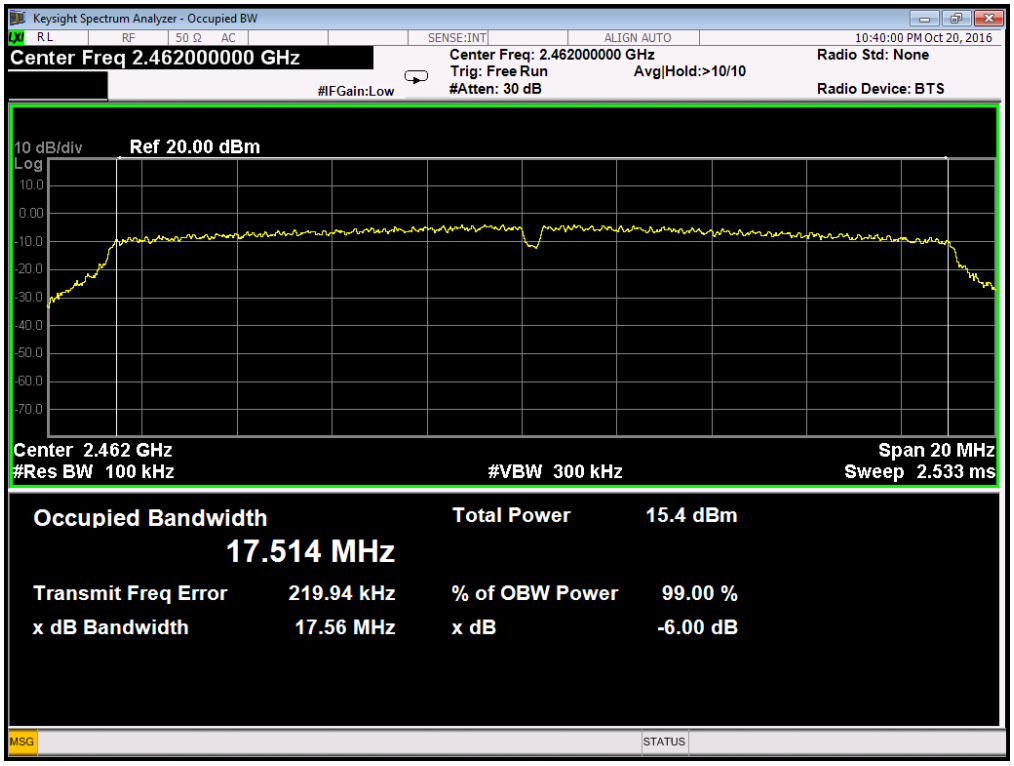

Keysight Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
10:37:32 PM Oct 20, 2016
Center Freq 2.437000000 GHz
Center Freq: 2.437000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.437 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 20 MHz
Sweep 2.533 ms
Occupied Bandwidth
16.345 MHz
Total Power
15.7 dBm
Transmit Freq Error
205.10 kHz
% of OBW Power
99.00 %
x dB Bandwidth
16.07 MHz
x dB
-6.00 dB
MSG
STATUS


Keysight Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
10:38:02 PM Oct 20, 2016
Center Freq 2.462000000 GHz
Center Freq: 2.462000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.462 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 20 MHz
Sweep 2.533 ms
Occupied Bandwidth
16.332 MHz
Total Power
15.5 dBm
Transmit Freq Error
219.97 kHz
% of OBW Power
99.00 %
x dB Bandwidth
16.33 MHz
x dB
-6.00 dB
MSG
STATUS

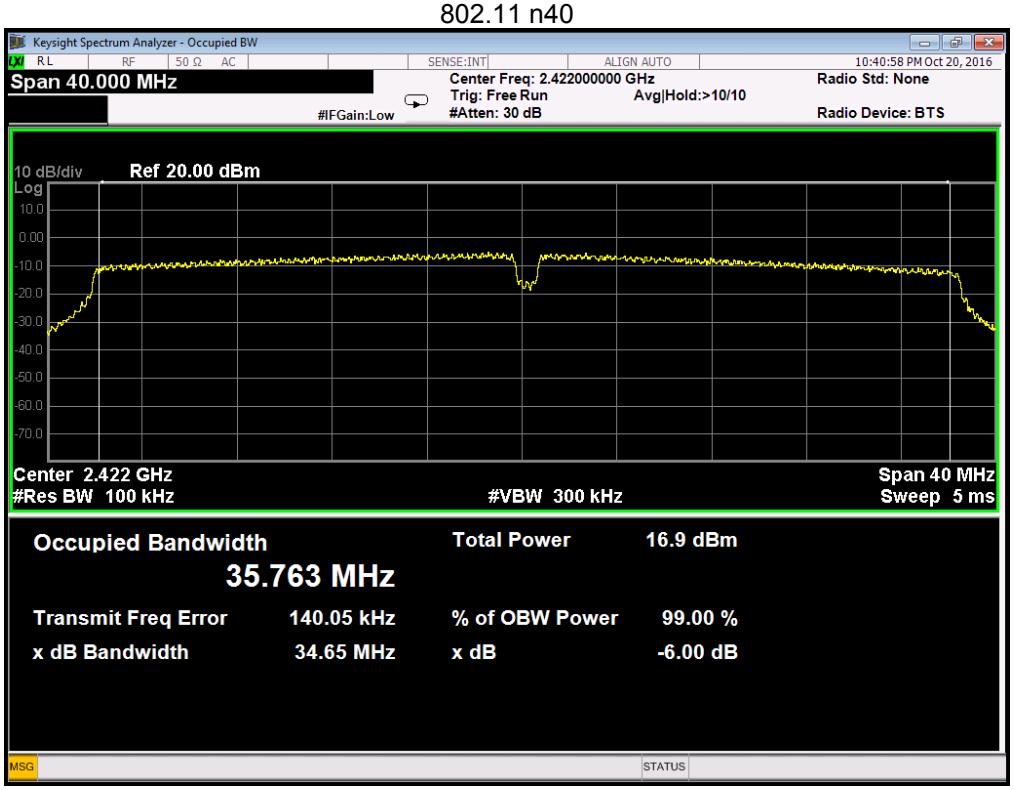
802.11 n20

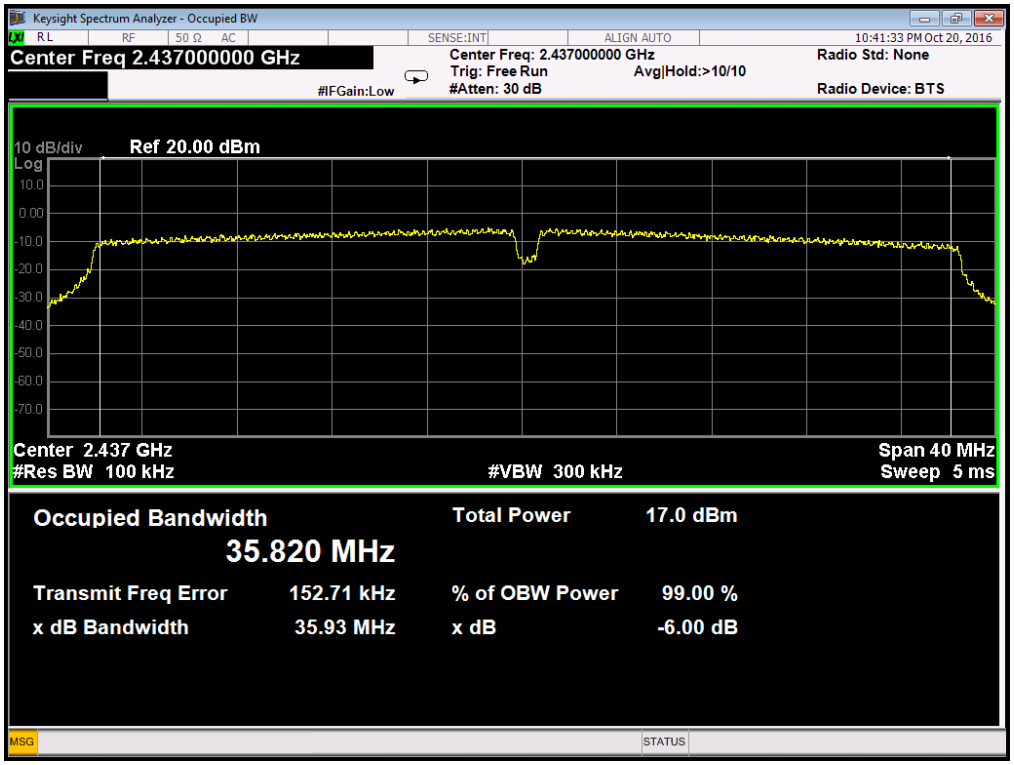

Keysight Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
10:39:05 PM Oct 20, 2016
Center Freq 2.412000000 GHz
Center Freq: 2.412000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.412 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 20 MHz
Sweep 2.533 ms
Occupied Bandwidth
17.508 MHz
Total Power
15.2 dBm
Transmit Freq Error
205.09 kHz
% of OBW Power
99.00 %
x dB Bandwidth
17.32 MHz
x dB
-6.00 dB
MSG
STATUS

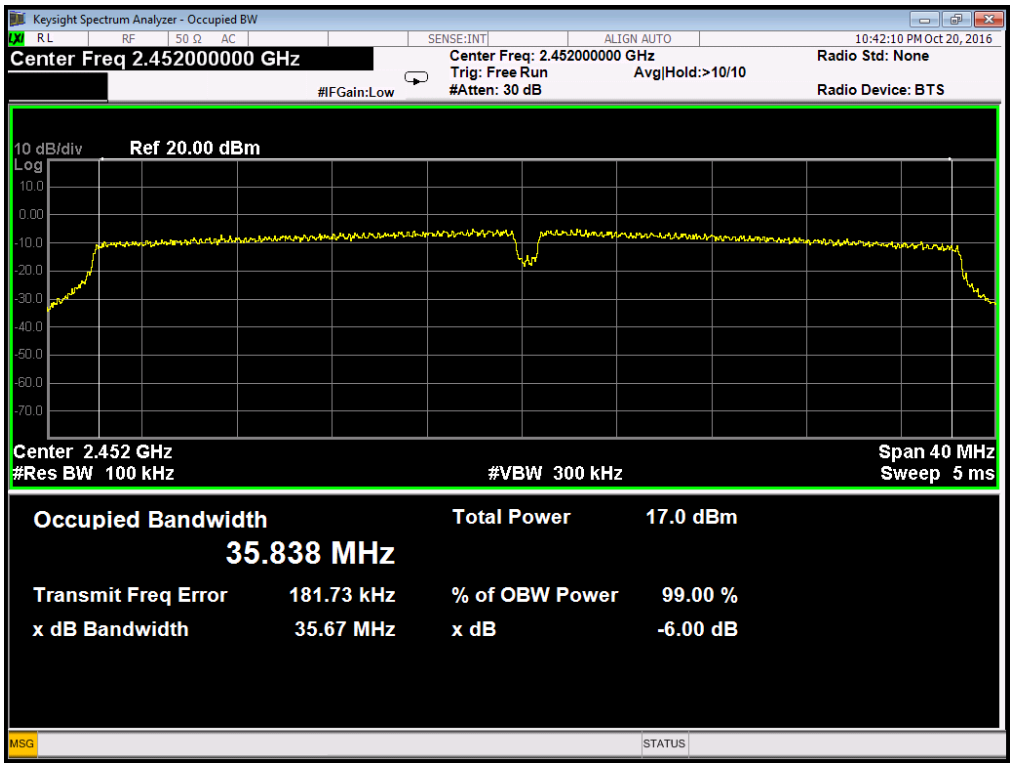

Keysight Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
10:39:33 PM Oct 20, 2016
Center Freq 2.437000000 GHz
Center Freq: 2.437000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.437 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 20 MHz
Sweep 2.533 ms
Occupied Bandwidth
17.520 MHz
Total Power
15.6 dBm
Transmit Freq Error
207.41 kHz
% of OBW Power
99.00 %
x dB Bandwidth
17.26 MHz
x dB
-6.00 dB
MSG
STATUS


Keysight Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
10:40:00 PM Oct 20, 2016
Center Freq 2.462000000 GHz
Center Freq: 2.462000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.462 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 20 MHz
Sweep 2.533 ms
Occupied Bandwidth
17.514 MHz
Total Power
15.4 dBm
Transmit Freq Error
219.94 kHz
% of OBW Power
99.00 %
x dB Bandwidth
17.56 MHz
x dB
-6.00 dB
MSG
STATUS

802.11 n40


Keysight Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
10:40:58 PM Oct 20, 2016
Span 40.000 MHz
Center Freq: 2.422000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.422 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 40 MHz
Sweep 5 ms
Occupied Bandwidth
35.763 MHz
Total Power
16.9 dBm
Transmit Freq Error
140.05 kHz
% of OBW Power
99.00 %
x dB Bandwidth
34.65 MHz
x dB
-6.00 dB
MSG
STATUS


Keysight Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
10:41:33 PM Oct 20, 2016
Center Freq 2.437000000 GHz
Center Freq: 2.437000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.437 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 40 MHz
Sweep 5 ms
Occupied Bandwidth
35.820 MHz
Total Power
17.0 dBm
Transmit Freq Error
152.71 kHz
% of OBW Power
99.00 %
x dB Bandwidth
35.93 MHz
x dB
-6.00 dB
MSG
STATUS

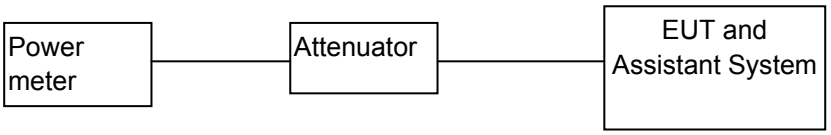

Keysight Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
10:42:10 PM Oct 20, 2016
Center Freq 2.452000000 GHz
Center Freq: 2.452000000 GHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.452 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 40 MHz
Sweep 5 ms
Occupied Bandwidth
35.838 MHz
Total Power
17.0 dBm
Transmit Freq Error
181.73 kHz
% of OBW Power
99.00 %
x dB Bandwidth
35.67 MHz
x dB
-6.00 dB
MSG
STATUS

4. Maximum Peak Output Power

4.1. Test equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until	Calibrated Date
1	Power meter	Agilent	E4417A	MY45100473	2016/12/19	2015/12/20
2	Wireband Power sensor	Agilent	E4427A	MY5100041	2016/12/19	2015/12/20

4.2. Block diagram of test setup



4.3. Limits

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz bands: 1 Watt. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.4. Test Procedure

1. Place the EUT on a bench and set it in transmitting mode. .
2. A wide band power meter with a matched thermocouple detector was used to directly measure the output power from the RF output port of the EUT in continuously transmitting mode.
3. The measurement shall be repeated at the lowest, the middle, and the highest channel of the stated frequency range.

4.5. TEST RESULT

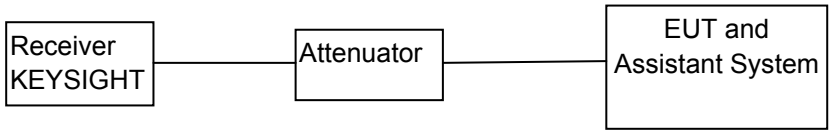
EUT Set Mode	Limit(Peak)	Conclusion	CH	Result(dBm)
				Peak
11b	30dBm	PASS	CH1	8.65
			CH6	8.71
			CH11	8.52
11g	30dBm	PASS	CH1	11.32
			CH6	11.15
			CH11	11.74
11n HT20	30dBm	PASS	CH1	10.96
			CH6	10.89
			CH11	10.91
11n HT40	30dBm	PASS	CH3	10.78
			CH6	10.86
			CH9	10.93

5. Power Spectral Density

5.1. Test equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until	Calibrated Date
1	Spectrum analyzer	KEYSIGHT	N9010A	MY55150427	2017/05/05	2016/05/06
2	Attenuator	Mini-Circuits	BW-S10W2	101109	2016/12/19	2015/12/20
3	RF Cable	Micable	C10-01-01-1	100309	2016/12/19	2015/12/20

5.2. Block diagram of test setup



5.3. Limits

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

5.4. TEST PROCEDURE

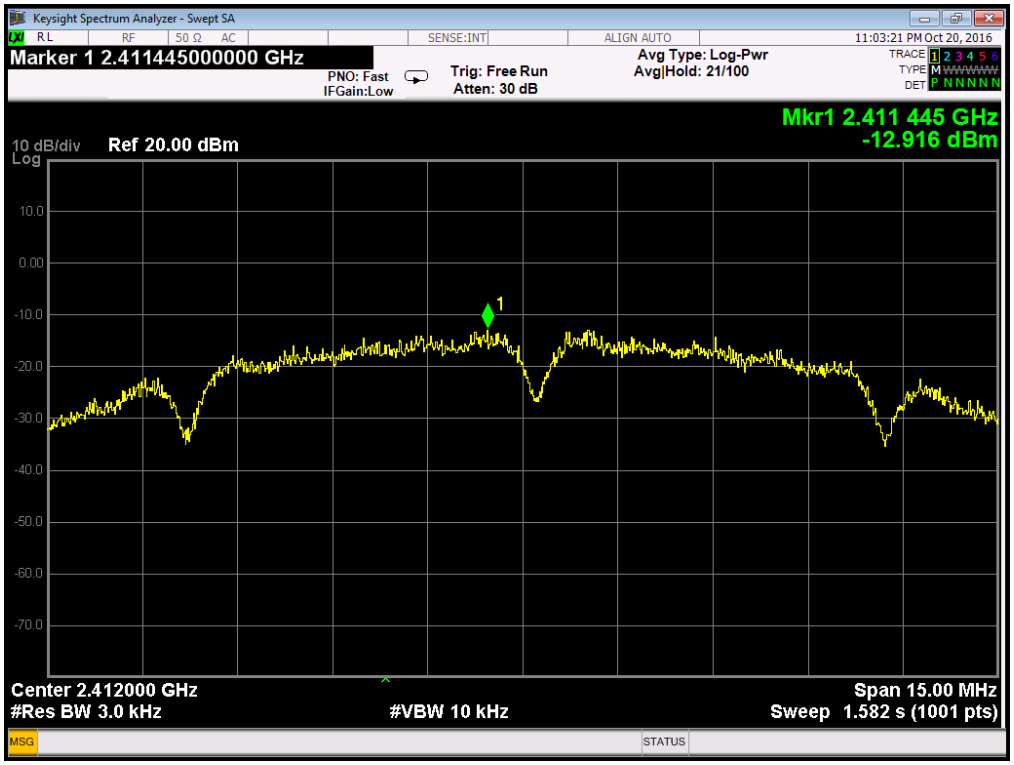
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generatorl.
2. Position the EUT was set without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range
3. According to KDB 558074 D01 DTS Meas Guidance v03, set the RBW = 3 kHz, VBW = 30 kHz, Set the span to 1.5 times the DTS channel bandwidth.
4. Use the peak marker function to determine the maximum power level in any 3 kHz band segment within the fundamental EBW

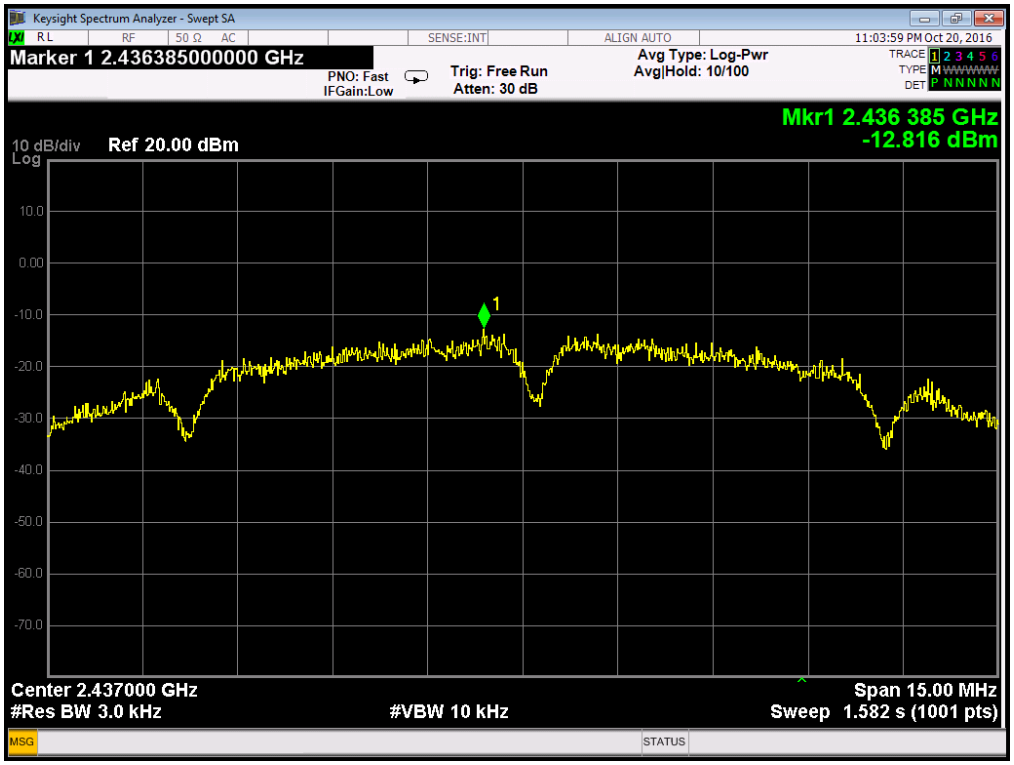
5.5. Test Result

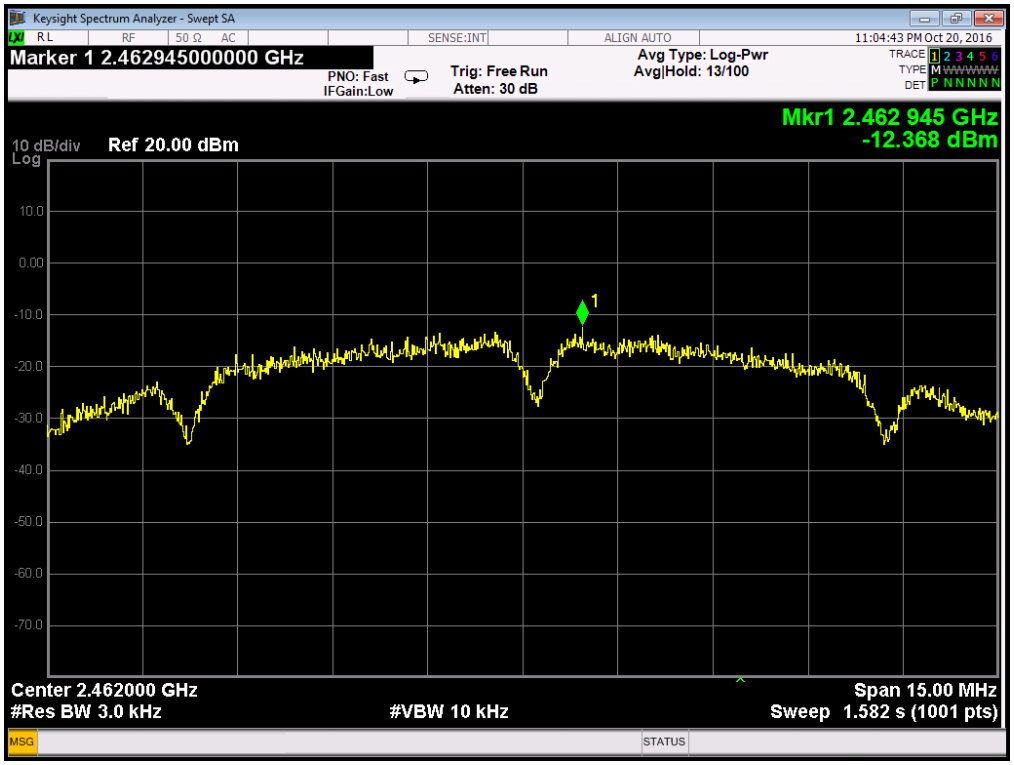
EUT Set Mode	CH or Frequency	Result	Limit: <dBm/3KHz	Conclusion
11b	CH1	-12.916	8	PASS
	CH6	-12.816	8	PASS
	CH11	-12.368	8	PASS
11g	CH1	-14.197	8	PASS
	CH6	-14.056	8	PASS
	CH11	-14.850	8	PASS
11n HT 20	CH1	-14.664	8	PASS
	CH6	-15.061	8	PASS
	CH11	-14.790	8	PASS
11n HT 40	CH3	-16.334	8	PASS
	CH6	-16.321	8	PASS
	CH9	-15.794	8	PASS

5.6. Original test data

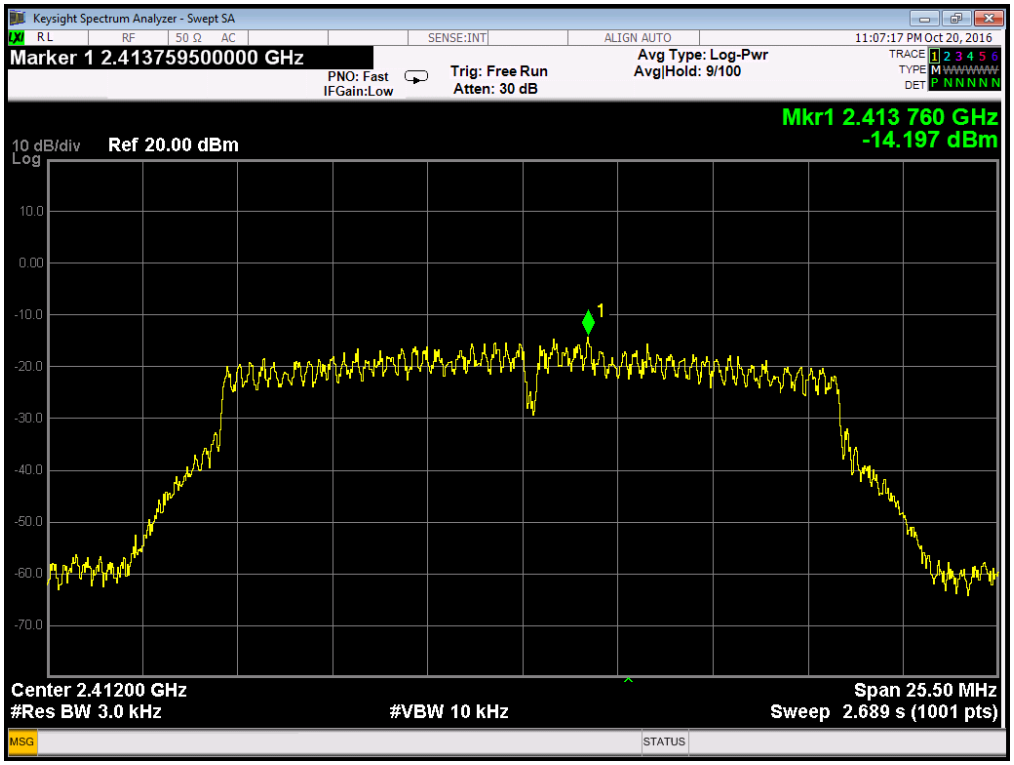
802.11 b Mode

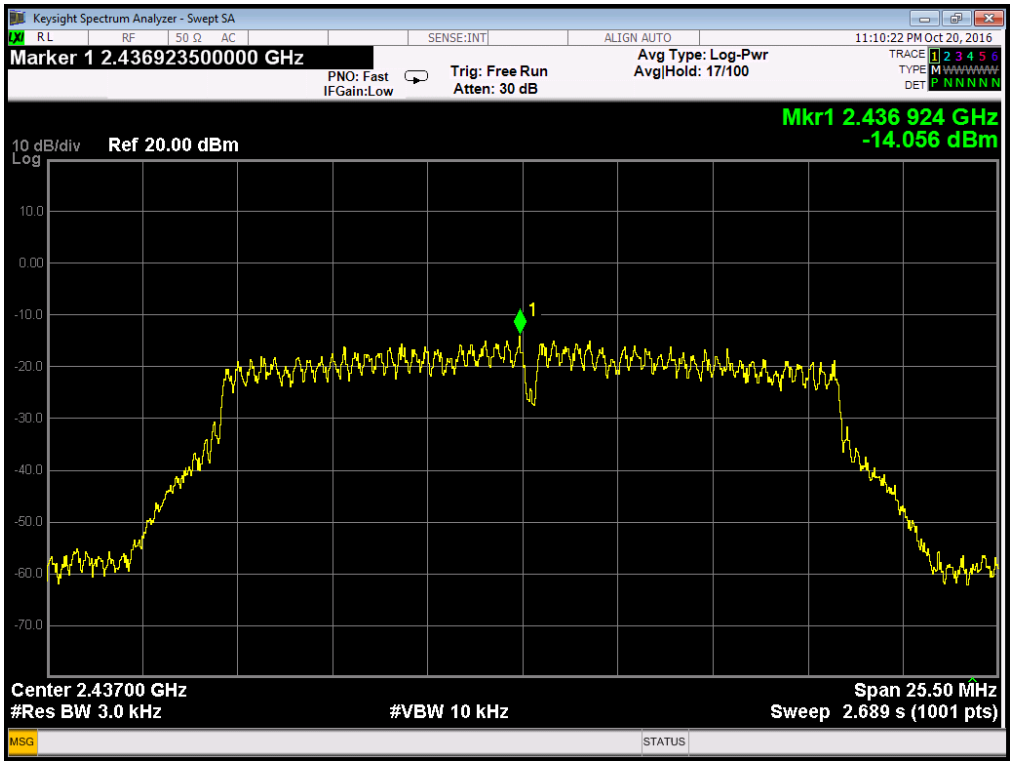


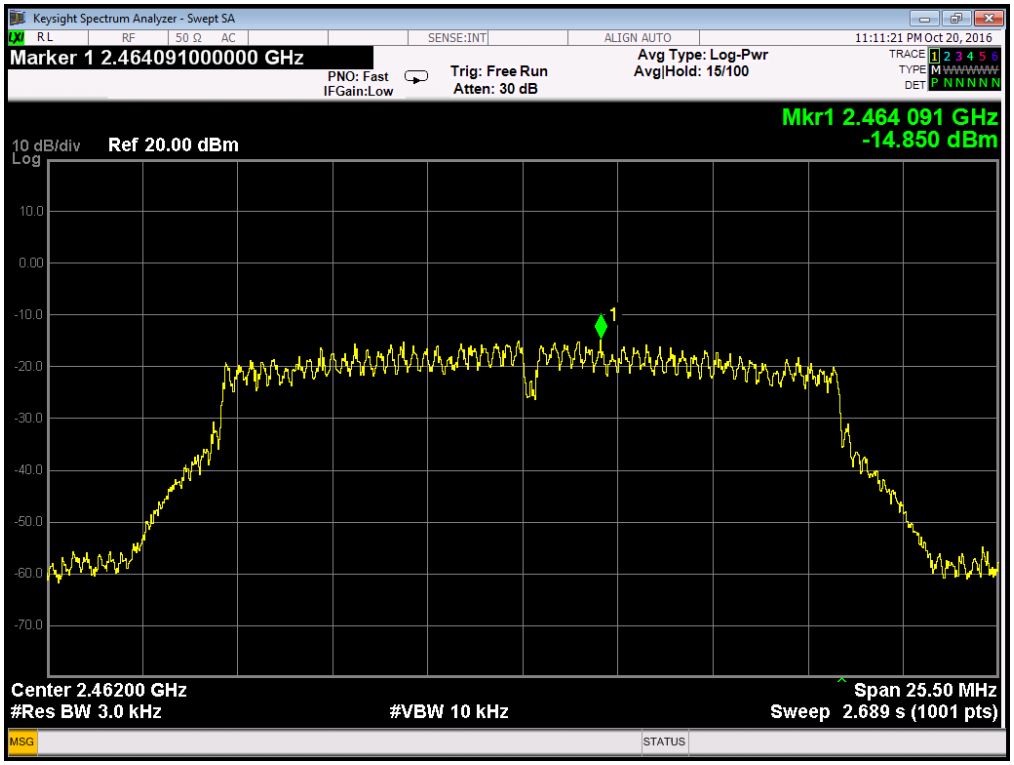



Keysight Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
11:04:43 PM Oct 20, 2016
Marker 1 2.462945000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 13/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Mkr1 2.462 945 GHz
-12.368 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.462000 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 15.00 MHz
Sweep 1.582 s (1001 pts)
MSG
STATUS

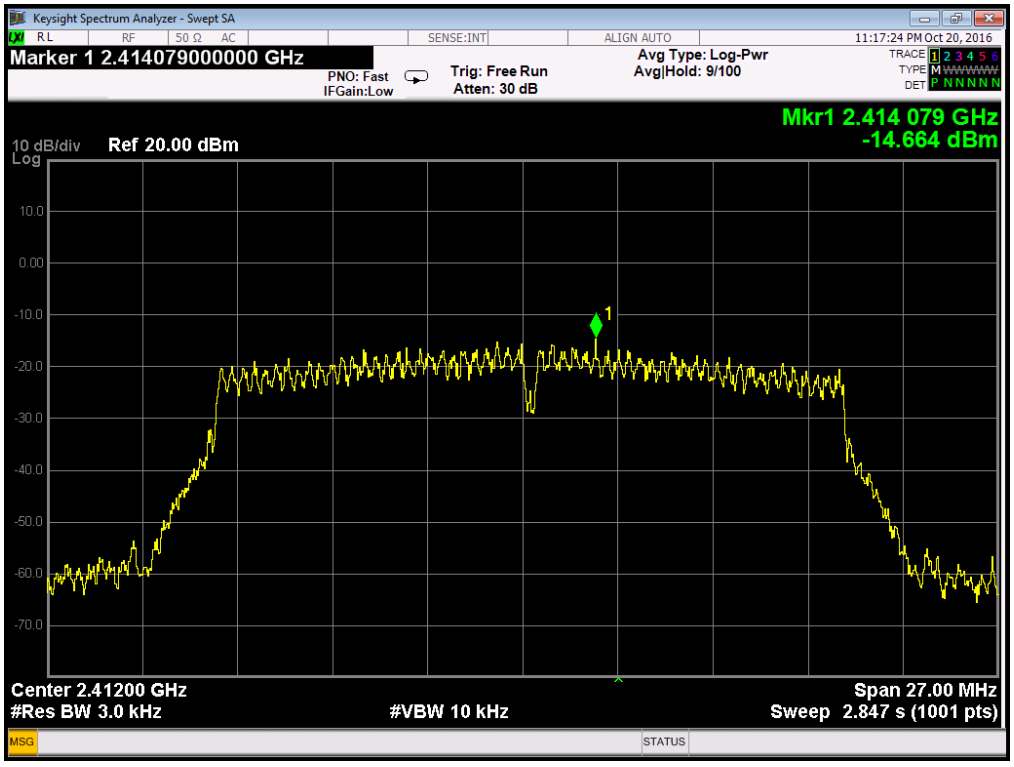
802.11 g Mode

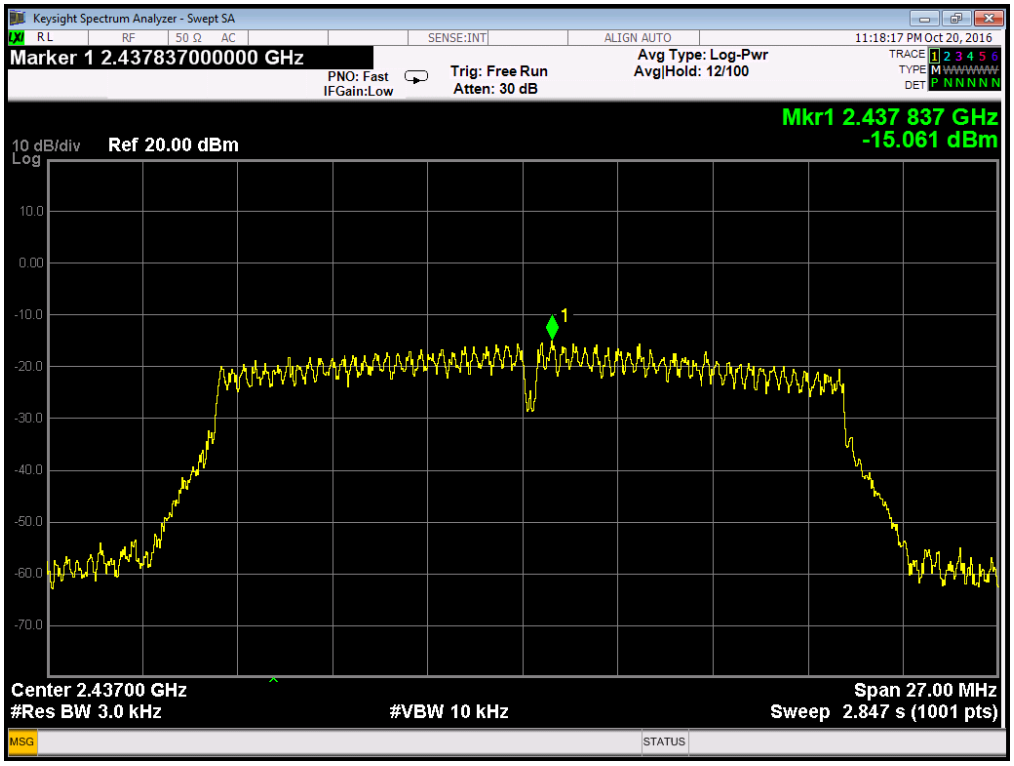

Keysight Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
11:07:17 PM Oct 20, 2016
Marker 1 2.413759500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 9/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Mkr1 2.413 760 GHz
-14.197 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.41200 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 25.50 MHz
Sweep 2.689 s (1001 pts)
MSG
STATUS

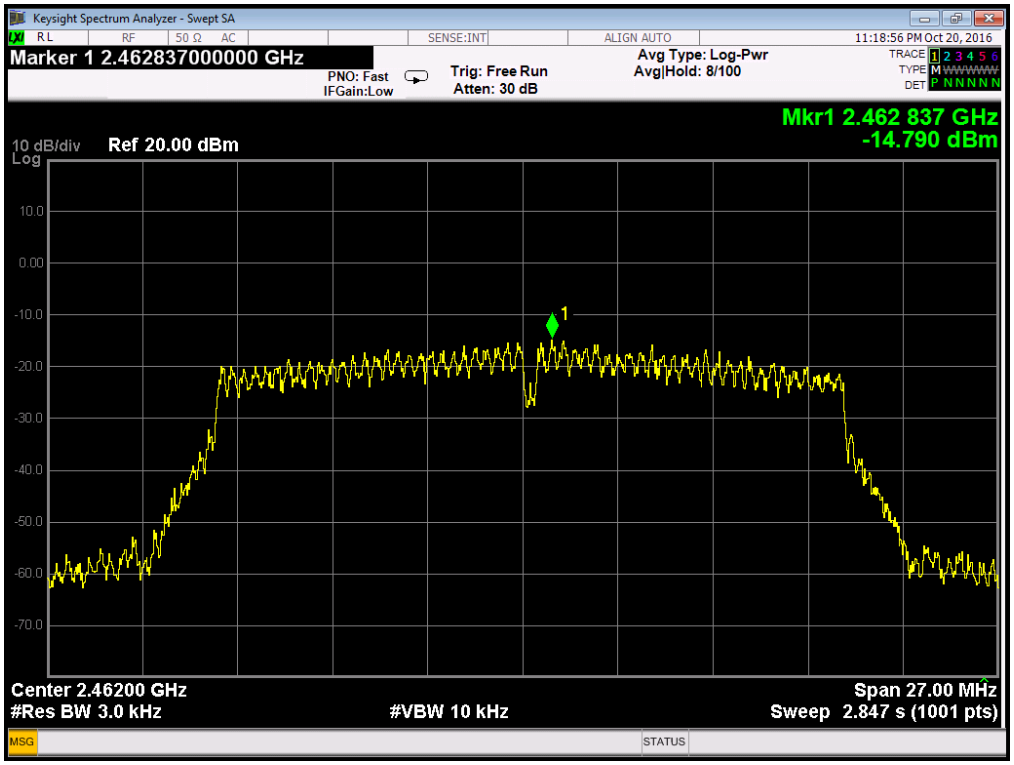

Keysight Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
11:10:22 PM Oct 20, 2016
Marker 1 2.436923500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 17/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Mkr1 2.436 924 GHz
-14.056 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
1
Center 2.43700 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 25.50 MHz
Sweep 2.689 s (1001 pts)
MSG
STATUS


Keysight Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
11:11:21 PM Oct 20, 2016
Marker 1 2.464091000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 15/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Mkr1 2.464 091 GHz
-14.850 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
1
Center 2.46200 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 25.50 MHz
Sweep 2.689 s (1001 pts)
MSG
STATUS

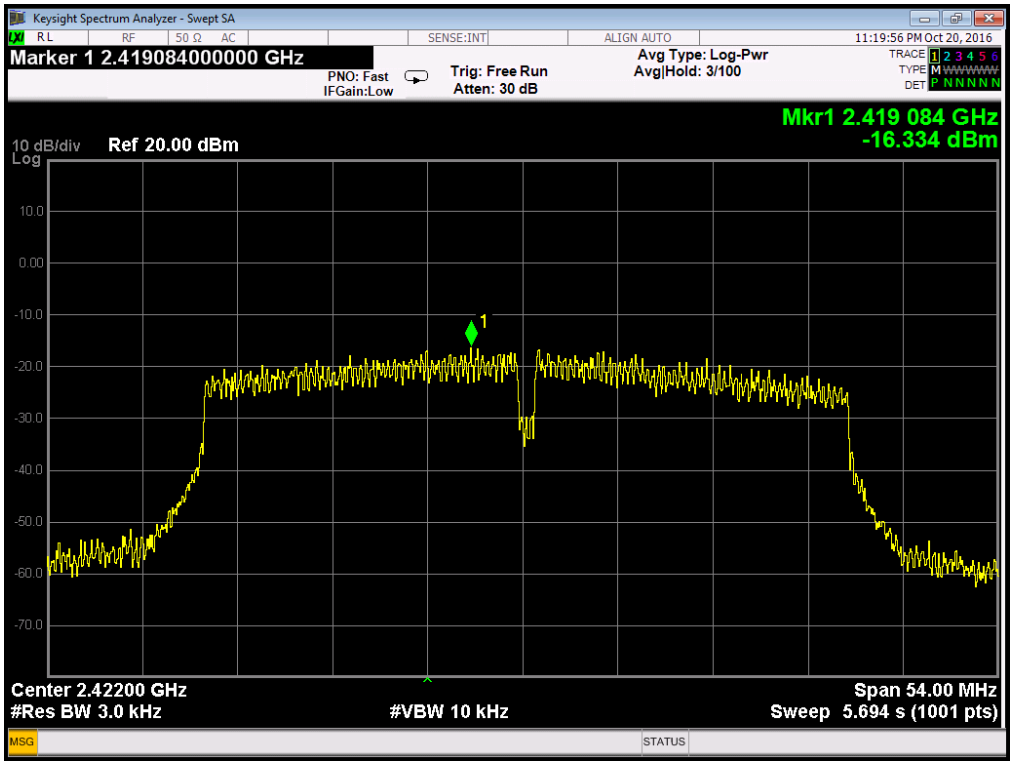
802.11 n20 Mode

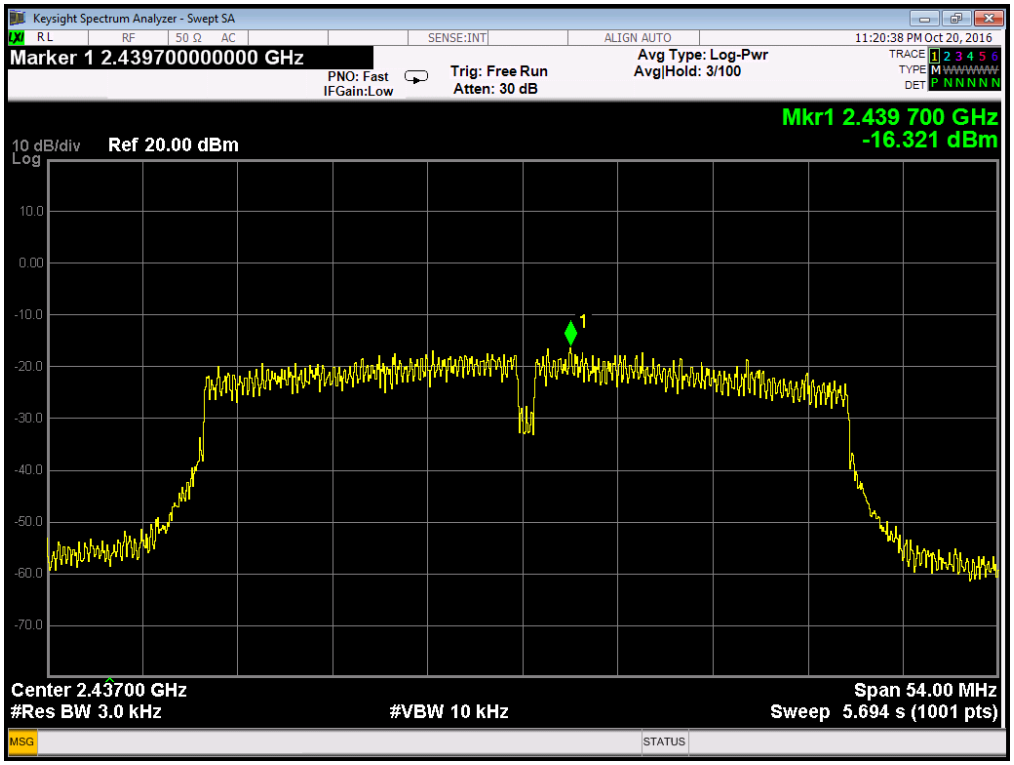


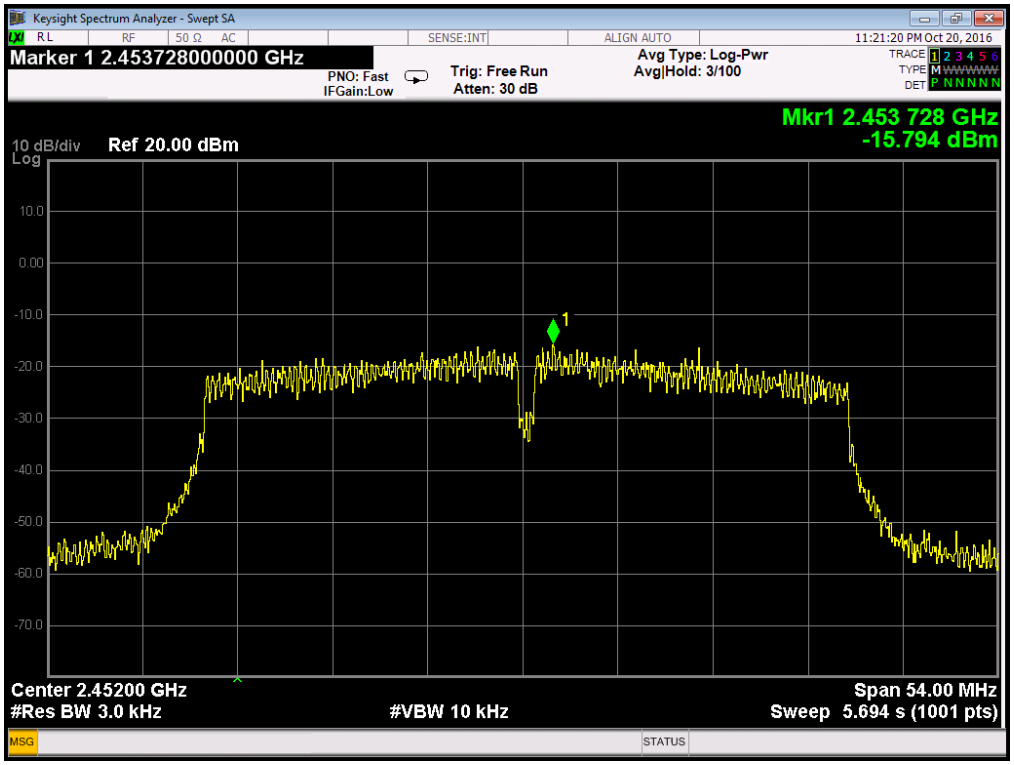




802.11 n40 Mode




Keysight Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
11:20:38 PM Oct 20, 2016
Marker 1 2.439700000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 3/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Mkr1 2.439 700 GHz
-16.321 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.43700 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 54.00 MHz
Sweep 5.694 s (1001 pts)
MSG
STATUS


Keysight Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
11:21:20 PM Oct 20, 2016
Marker 1 2.453728000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 3/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Mkr1 2.453 728 GHz
-15.794 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.45200 GHz
#Res BW 3.0 kHz
#VBW 10 kHz
Span 54.00 MHz
Sweep 5.694 s (1001 pts)
MSG
STATUS

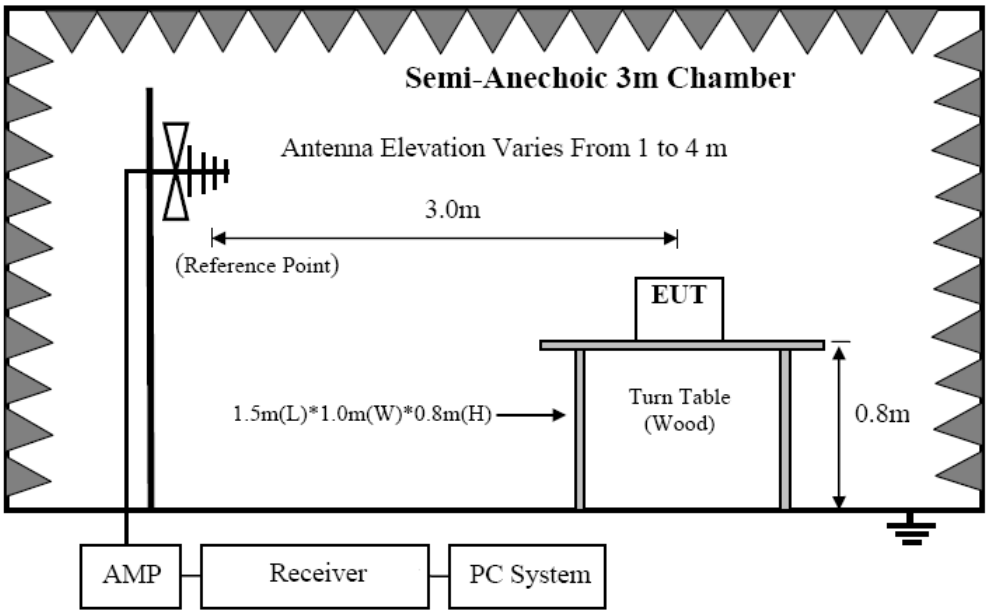
6. Spurious Emissions

6.1. Test equipment

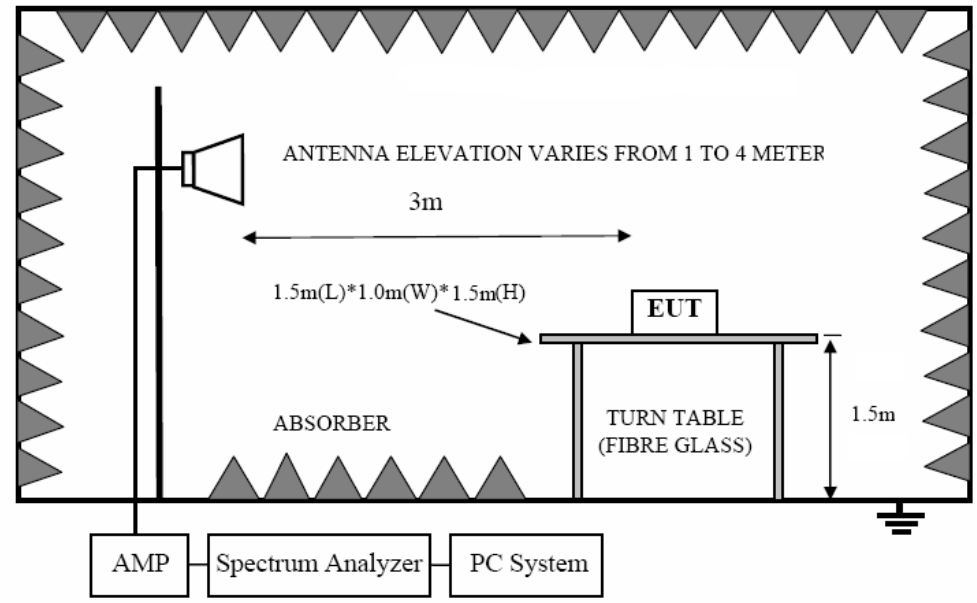
Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until	Calibrated Date
1	EMI Test Receiver	R&S	ESCI	101307	2016/12/19	2015/12/20
2	Spectrum analyzer	Agilent	E4407B	US40240708	2017/07/08	2016/07/09
3	Loop antenna	Chase	HLA6120	20129	2016/12/19	2015/12/20
4	Trilog Broadband Antenna	Schwarzbeck	VULB9163	9163-462	2016/12/19	2015/12/20
5	Double Ridged Horn Antenna	Schwarzbeck	BBHA9120D	9120D 1065	2016/12/19	2015/12/20
6	Pre-Amplifier	R&S	SCU-01	10049	2016/12/19	2015/12/20
7	Pre-Amplifier	A.H.	PAM0-0118	360	2016/12/19	2015/12/20
8	Pre-Amplifier	HP	8449B	3274A06298	2016/12/19	2015/12/20
9	RF Cable	R&S	R01	10403	2016/12/19	2015/12/20
10	RF Cable	R&S	R02	10512	2016/12/19	2015/12/20
11	Horn Antenna	Schwarzbeck	BBHA 9170	9170 1248	2016/12/19	2015/12/20

6.2. Block diagram of test setup

In 3m Anechoic Chamber Test Setup Diagram for below 1GHz



In 3m Anechoic Chamber Test Setup Diagram for frequency above 1GHz



Note: For harmonic emissions test a appropriate high pass filter was inserted in the input port of AMP.

6.3. Limit

6.3.1 FCC 15.205 Restricted frequency band

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	2690 - 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 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])

6.3.2 FCC 15.209 Limit

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		μV/m	dB(μV)/m
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

6.3.3 Limit for this EUT

The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10:2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

6.4. TEST PROCEDURE

(1) EUT was placed on a non-metallic table, 80 cm above the ground plane inside a semi-anechoic chamber.

(2) Setup EUT and assistant system according clause 2.4 and 8.2

(3) Test antenna was located 3m from the EUT on an adjustable mast. Below pre-scan procedure was first performed in order to find prominent radiated emissions.

(a) Change work frequency or channel of device if practicable.

(b) Change modulation type of device if practicable.

(c) Change power supply range from 85% to 115% of the rated supply voltage

(d) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions

(4) Spectrum frequency from 9MHz to 25GHz (tenth harmonic of fundamental frequency) was investigated, and no any obvious emission were detected from 9KHz to 30MHz and 18GHz to 25GHz, so below final test was performed with frequency range from 30MHz to 18GHz.

(5) For final emissions measurements at each frequency of interest, the EUT were rotated and the antenna

height was varied between 1m and 4m in order to maximize the emission. Measurements in both horizontal and vertical polarities were made and the data was recorded. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.10 2013 on Radiated Emission test.

(6) For emissions from 30MHz to 1GHz, Quasi-Peak values were measured with EMI Receiver and the bandwidth of Receiver is 120 KHz.

(7)For emissions above 1GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1MHz, VBW is set at 3MHz for Peak measure, Detector is at PK; RBW is set at 1MHz, VBW is set at 3MHz for Average measure, Detector is at RMS..

6.5. Test result

Below 30M

EUT:	Portable SmartHub	Model No.:	WS-439-2
Temperature:	24℃	Relative Humidity:	55%
Distance:	3m	Test Power:	AC 120V/60Hz
Polarization:	/	Test Result:	Pass
Test Mode:	Keeping TX mode	Test By:	Lake

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	P
--	--	--	--	P

Note:

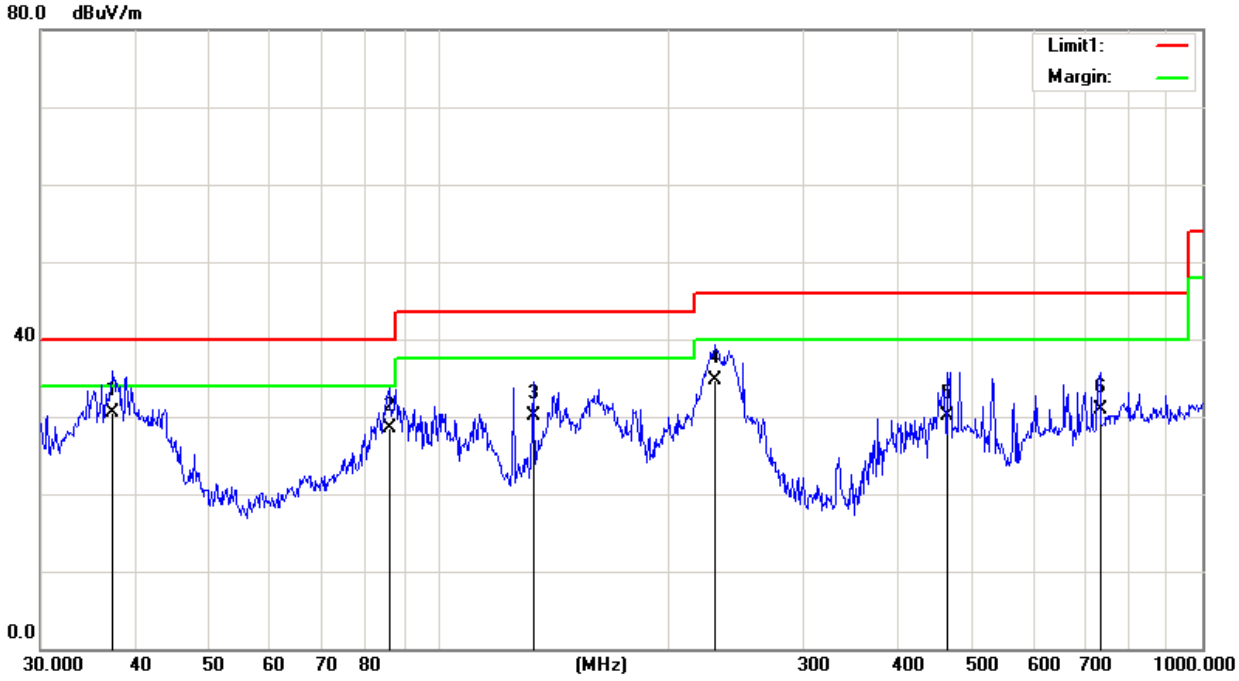
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =20 log (specific distance/test distance)(dB);

Limit line = specific limits(dBuv) + distance extrapolation factor

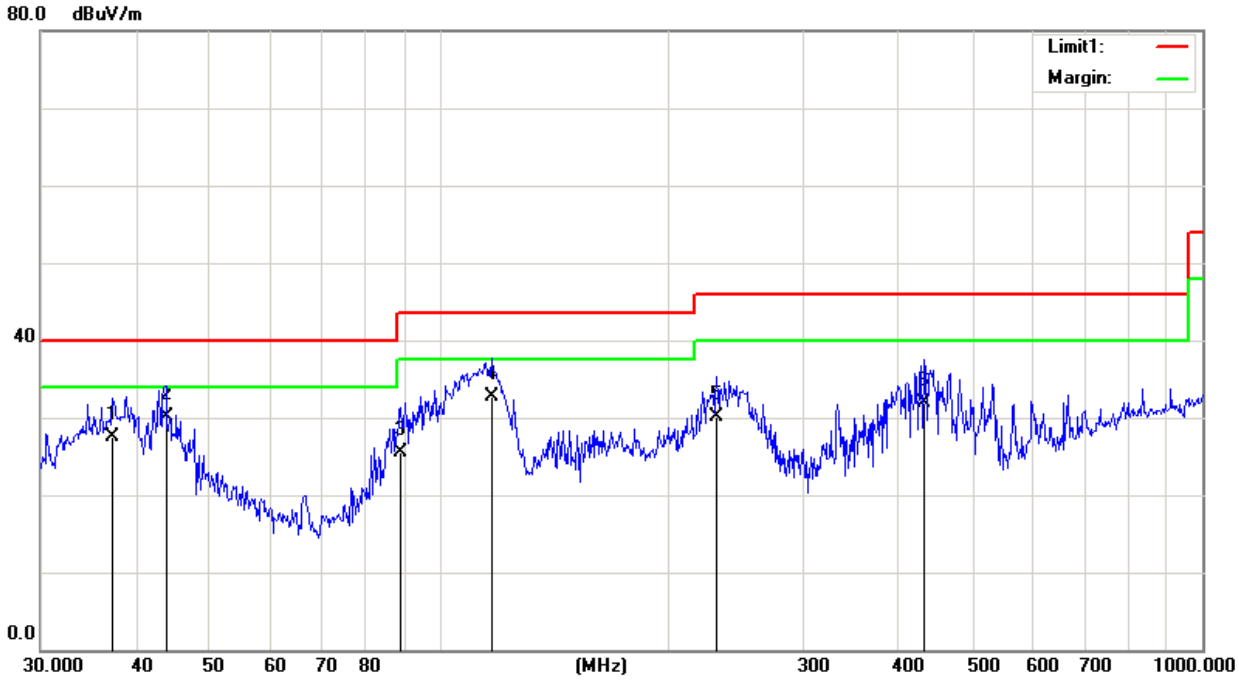
Between 30M – 1000 MHz

EUT:	Portable SmartHub	**Model No.:**	WS-439-2
Temperature:	24	**Relative Humidity:**	55%
Distance:	3m	**Test Power:**	AC 120V/60Hz
Polarization:	Vertical	**Test Result:**	Pass
Standard:	(RE)FCC PART 15 class C 3m	**Test By:**	Lake
Test Mode:	Keeping TX Mdoe		



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	37.2854	43.08	-12.52	30.56	40.00	-9.44	QP
2	85.8983	42.63	-14.14	28.49	40.00	-11.51	QP
3	132.6850	41.39	-11.33	30.06	43.50	-13.44	QP
4	229.2931	42.18	-7.43	34.75	46.00	-11.25	QP
5	463.9696	33.42	-3.30	30.12	46.00	-15.88	QP
6	734.4913	29.70	1.17	30.87	46.00	-15.13	QP

EUT:	Portable SmartHub	Model No.:	WS-439-2
Temperature:	24	Relative Humidity:	55%
Distance:	3m	Test Power:	AC 120V/60Hz
Polarization:	Horizontal	Test Result:	Pass
Standard:	(RE)FCC PART 15 class C 3m	Test By:	Lake
Test Mode:	Keeping TX Mdoe		



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	37.2854	39.45	-11.90	27.55	40.00	-12.45	QP
2	43.8119	43.79	-13.60	30.19	40.00	-9.81	QP
3	88.9637	44.06	-18.65	25.41	43.50	-18.09	QP
4	116.9495	47.29	-14.64	32.65	43.50	-10.85	QP
5	230.9068	40.19	-10.18	30.01	46.00	-15.99	QP
6	432.5457	34.46	-2.64	31.82	46.00	-14.18	QP

Between 1000M – 25000 MHz

Test Site	:	3m Chamber			
EUT	:	Portable SmartHub	**Tested By**	:	Lake
Power Supply	:	AC 120V/60Hz	**Model Number**	:	WS-439-2
Condition	:	Temp:24.5'C,Humi:55%, Press:100.1kPa	**Test Mode**	:	Tx mode
Memo	:	802.11b (worst case)	**Antenna/Distance**	:	VULB 9163 /3m

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	FCC 15.247	
(MHz)	Reading (dBμV)	PK/QP/AV	Polar (H/V)	Factor (dB)	(dB)	(dB)	(dBμV/m)	Limit (dBμV/m)	Margin (dB)
Low Channel (2412)									
4824	60.78	PK	H	32.3	5.91	31.78	67.21	74	-6.79
4824	44.22	AV	H	32.3	5.91	31.78	50.65	54	-3.35
4824	52.36	PK	V	32.3	5.91	31.78	58.79	74	-15.21
4824	39.57	AV	V	32.3	5.91	31.78	46	54	-8.00
7236	37.33	PK	H	36.3	6.34	30.97	49	74	-25.00
7236	26.06	AV	H	36.3	6.34	30.97	37.73	54	-16.27
7236	36.14	PK	V	36.3	6.34	30.97	47.81	74	-26.19
7236	24.52	AV	V	36.3	6.34	30.97	36.19	54	-17.81
9648	31.32	PK	H	37.9	8.01	30.86	46.37	74	-27.63
9648	19.44	AV	H	37.9	8.01	30.86	34.49	54	-19.51
9648	30.71	PK	V	37.9	8.01	30.86	45.76	74	-28.24
9648	19.28	AV	V	37.9	8.01	30.86	34.33	54	-19.67
Middle Channel(2437)									
4874	59.28	PK	H	32.6	6.15	31.78	66.25	74	-7.75
4874	43.14	AV	H	32.6	6.15	31.78	50.11	54	-3.89
4874	51.93	PK	V	32.6	6.15	31.78	58.9	74	-15.10
4874	39.11	AV	V	32.6	6.15	31.78	46.08	54	-7.92
7311	35.47	PK	H	36.7	6.22	30.97	47.42	74	-26.58
7311	25.08	AV	H	36.7	6.22	30.97	37.03	54	-16.97
7311	34.12	PK	V	36.7	6.22	30.97	46.07	74	-27.93
7311	23.69	AV	V	36.7	6.22	30.97	35.64	54	-18.36
9748	32.33	PK	H	38.2	8.11	30.86	47.78	74	-26.22
9748	20.17	AV	H	38.2	8.11	30.86	35.62	54	-18.38
9748	30.52	PK	V	38.2	8.11	30.86	45.97	74	-28.03
9748	21.56	AV	V	38.2	8.11	30.86	37.01	54	-16.99

High Channel(2462)									
4924	58.11	PK	H	32.8	6.17	31.78	65.3	74	-8.70
4924	42.09	AV	H	32.8	6.17	31.78	49.28	54	-4.72
4924	51.54	PK	V	32.8	6.17	31.78	58.73	74	-15.27
4924	39.38	AV	V	32.8	6.17	31.78	46.57	54	-7.43
7386	35.36	PK	H	36.8	6.26	30.97	47.45	74	-26.55
7386	26.24	AV	H	36.8	6.26	30.97	38.33	54	-15.67
7386	37.17	PK	V	36.8	6.26	30.97	49.26	74	-24.74
7386	25.89	AV	V	36.8	6.26	30.97	37.98	54	-16.02
9848	30.04	PK	H	38.4	8.17	30.86	45.75	74	-28.25
9848	20.45	AV	H	38.4	8.17	30.86	36.16	54	-17.84
9848	29.26	PK	V	38.4	8.17	30.86	44.97	74	-29.03
9848	19.59	AV	V	38.4	8.17	30.86	35.3	54	-18.70

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss
2: All modes have been tested ,only worse case 802.11b is reported

Radiated band edge:

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	FCC 15.247	
(MHz)	Reading (dBμV)	PK/QP/AV	Polar (H/V)	Factor (dB)	(dB)	(dB)	(dBμV/m)	Limit (dBμV/m)	Margin (dB)
Lowest Channel (802.11B)									
2390	22.47	PK	H	28.4	3.57	0	54.44	74	-19.56
2390	9.32	AV	H	28.4	3.57	0	41.29	54	-12.71
2390	23.51	PK	V	28.4	3.57	0	55.48	74	-18.52
2390	9.45	AV	V	28.4	3.57	0	41.42	54	-12.58
Highest Channel (802.11B)									
2483.5	21.52	PK	H	28.7	3.62	0	53.84	74	-20.16
2483.5	9.45	AV	H	28.7	3.62	0	41.77	54	-12.23
2483.5	23.41	PK	V	28.7	3.62	0	55.73	74	-18.27
2483.5	9.52	AV	V	28.7	3.62	0	41.84	54	-12.16
Lowest Channel (802.11G)									
2390	22.98	PK	H	28.4	3.57	0	54.95	74	-19.05
2390	9.69	AV	H	28.4	3.57	0	41.66	54	-12.34
2390	22.74	PK	V	28.4	3.57	0	54.71	74	-19.29
2390	9.57	AV	V	28.4	3.57	0	41.54	54	-12.46
Highest Channel (802.11G)									
2483.5	25.52	PK	H	28.7	3.62	0	57.84	74	-16.16
2483.5	9.61	AV	H	28.7	3.62	0	41.93	54	-12.07
2483.5	24.14	PK	V	28.7	3.62	0	56.46	74	-17.54
2483.5	9.43	AV	V	28.7	3.62	0	41.75	54	-12.25

Frequency	Receiver		Rx Antenna		Cable loss	Amplifier Gain	Corrected Amplitude	FCC 15.247	
(MHz)	Reading (dBμV)	PK/QP/AV	Polar (H/V)	Factor (dB)	(dB)	(dB)	(dBμV/m)	Limit (dBμV/m)	Margin (dB)
Lowest Channel (802.11N HT20)									
2390	23.36	PK	H	28.4	3.57	0	55.33	74	-18.67
2390	11.57	AV	H	28.4	3.57	0	43.54	54	-10.46
2390	22.45	PK	V	28.4	3.57	0	54.42	74	-19.58
2390	10.63	AV	V	28.4	3.57	0	42.6	54	-11.4
Highest Channel (802.11N HT20)									
2483.5	25.33	PK	H	28.7	3.62	0	57.65	74	-16.35
2483.5	11.22	AV	H	28.7	3.62	0	43.54	54	-10.46
2483.5	24.37	PK	V	28.7	3.62	0	56.69	74	-17.31
2483.5	10.26	AV	V	28.7	3.62	0	42.58	54	-11.42
Lowest Channel (802.11N HT40)									
2390	24.58	PK	H	28.4	3.57	0	56.55	74	-17.45
2390	12.79	AV	H	28.4	3.57	0	44.76	54	-9.24
2390	23.33	PK	V	28.4	3.57	0	55.3	74	-18.7
2390	11.25	AV	V	28.4	3.57	0	43.22	54	-10.78
Highest Channel (802.11N HT40)									
2483.5	26.05	PK	H	28.7	3.62	0	58.37	74	-15.63
2483.5	12.43	AV	H	28.7	3.62	0	44.75	54	-9.25
2483.5	25.06	PK	V	28.7	3.62	0	57.38	74	-16.62
2483.5	11.29	AV	V	28.7	3.62	0	43.61	54	-10.39

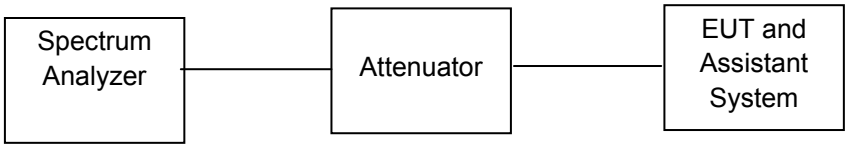
Note: 1. Result Level = Read Level + Antenna Factor + Cable Loss- Amplifier Gain

7. 100 kHz Bandwidth of Frequency Band Edge

7.1. Test equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until	Calibrated Date
1	Spectrum analyzer	KEYSIGHT	N9010A	MY55150427	2017/05/05	2016/05/06
2	Attenuator	Mini-Circuits	BW-S10W2	101109	2016/12/19	2015/12/20
3	RF Cable	Micable	C10-01-01-1	100309	2016/12/19	2015/12/20

7.2. Block diagram of test setup



7.3. Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. 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)).

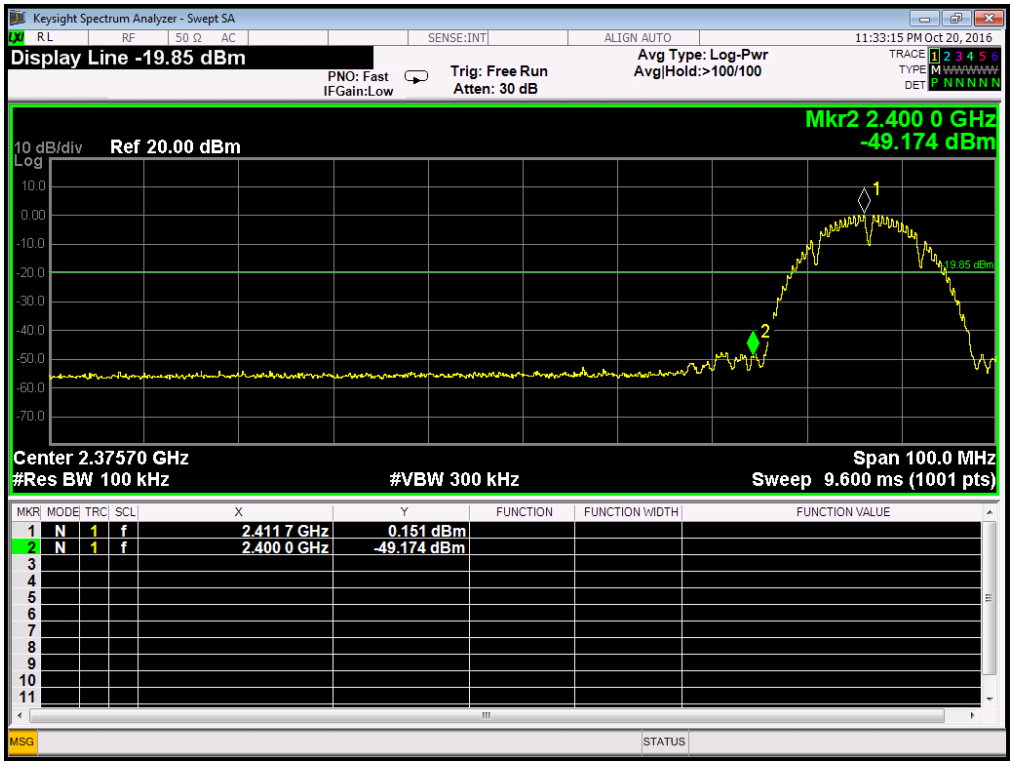
7.4. Test Procedure

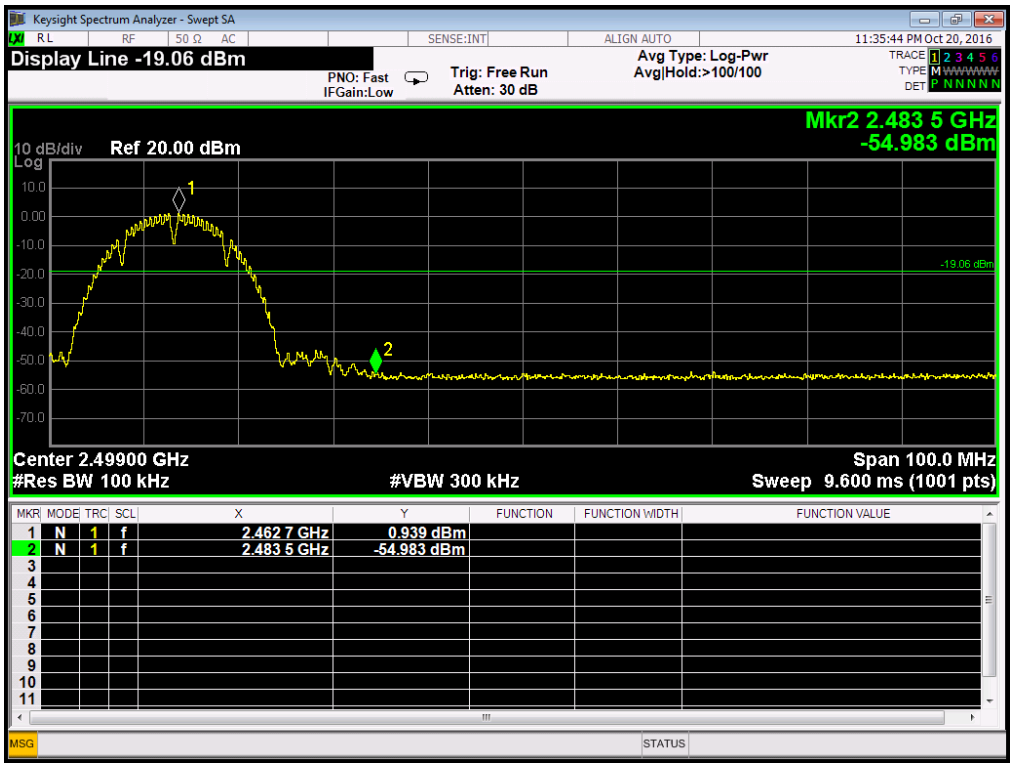
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

7.5. Test result

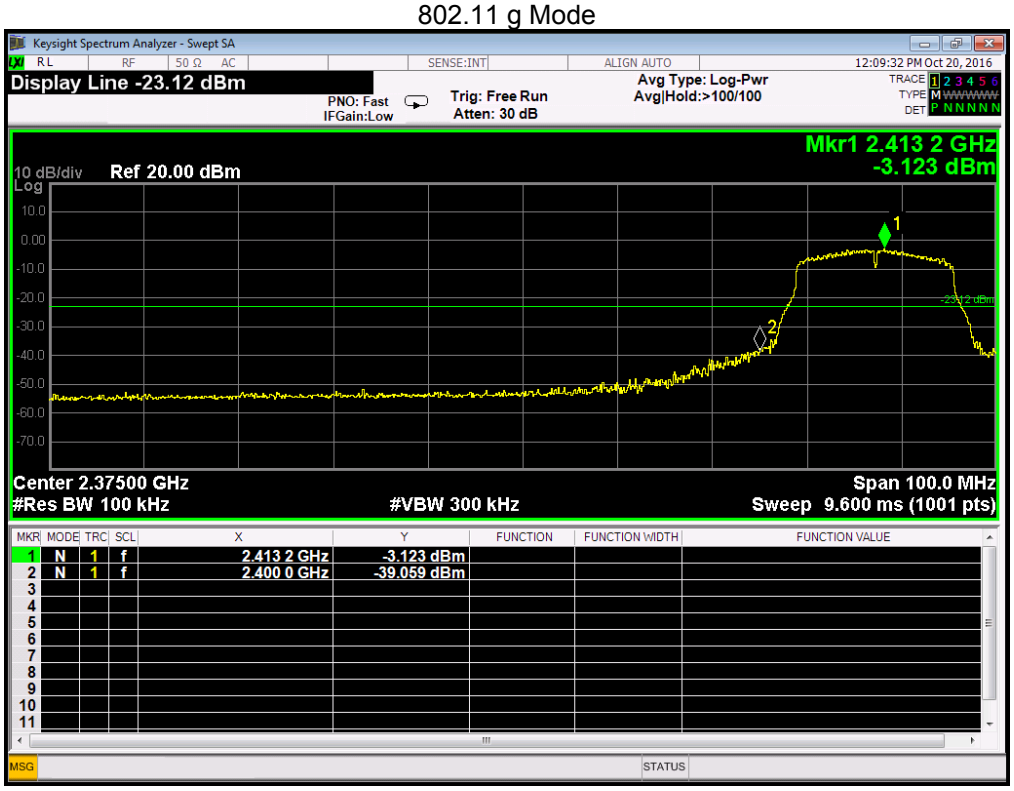
Frequency Band	Delta Peak to band emission (dBc)	＞Limit (dBc)	Result
802.11 b Mode			
2400	49.325	20	Pass
2483.5	55.922	20	Pass
802.11 g Mode			
2400	35.936	20	Pass
2483.5	44.335	20	Pass
802.11 n20 Mode			
2400	31.552	20	Pass
2483.5	43.014	20	Pass
802.11 n40 Mode			
2400	33.464	20	Pass
2483.5	36.908	20	Pass

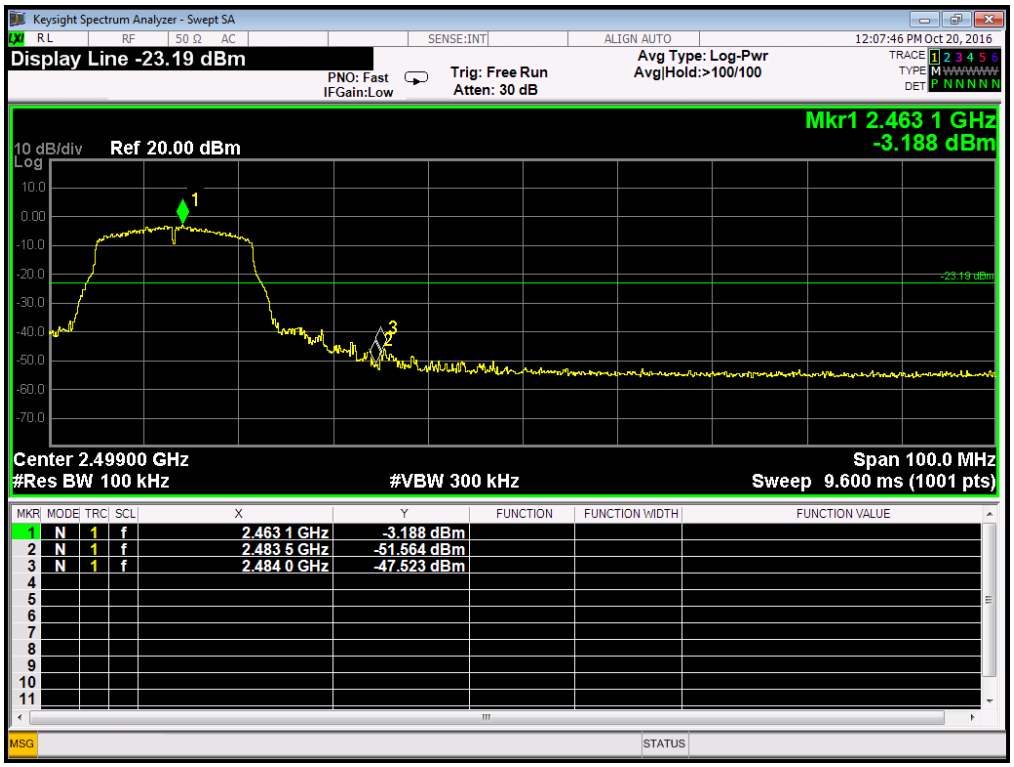
802.11 b Mode


Keysight Spectrum Analyzer - Swept SA
Display Line -19.85 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:33:15 PM Oct 20, 2016
Mkr2 2.400 0 GHz
-49.174 dBm
10 dB/div
Log
Ref 20.00 dBm
-19.85 dBm
Center 2.37570 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 100.0 MHz
Sweep 9.600 ms (1001 pts)
1 N 1 f 2.411 7 GHz 0.151 dBm
2 N 1 f 2.400 0 GHz -49.174 dBm

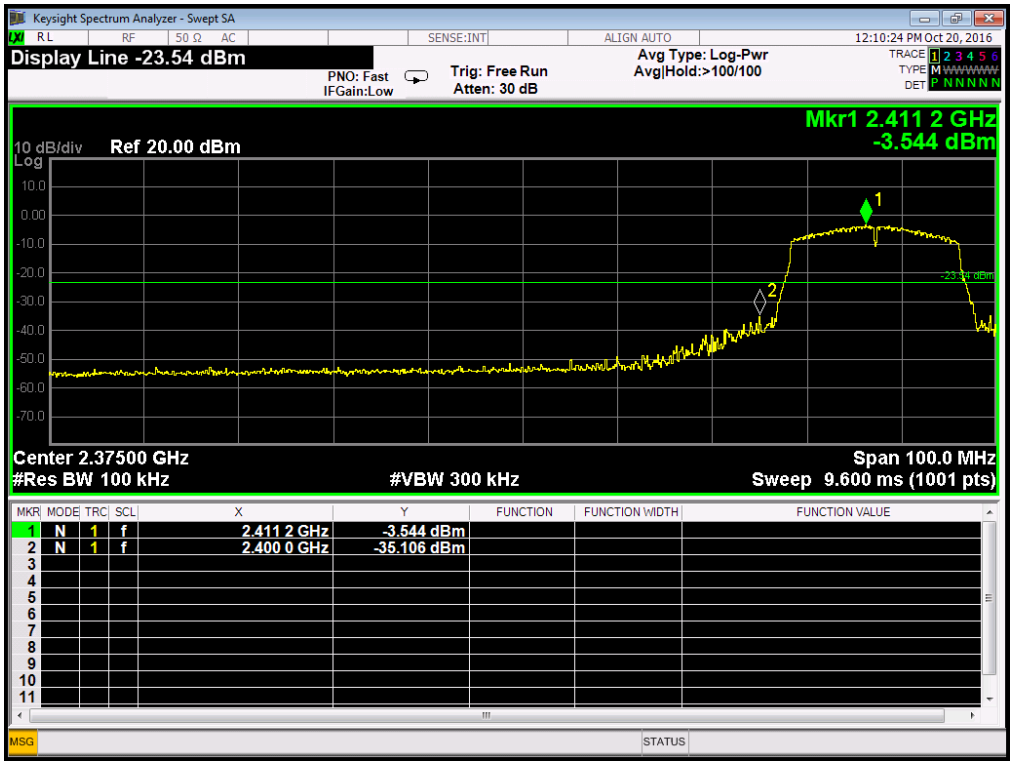

Keysight Spectrum Analyzer - Swept SA
Display Line -19.06 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
11:35:44 PM Oct 20, 2016
Mkr2 2.483 5 GHz
-54.983 dBm
10 dB/div
Log
Ref 20.00 dBm
-19.06 dBm
Center 2.49900 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 100.0 MHz
Sweep 9.600 ms (1001 pts)
1 N 1 f 2.462 7 GHz 0.939 dBm
2 N 1 f 2.483 5 GHz -54.983 dBm

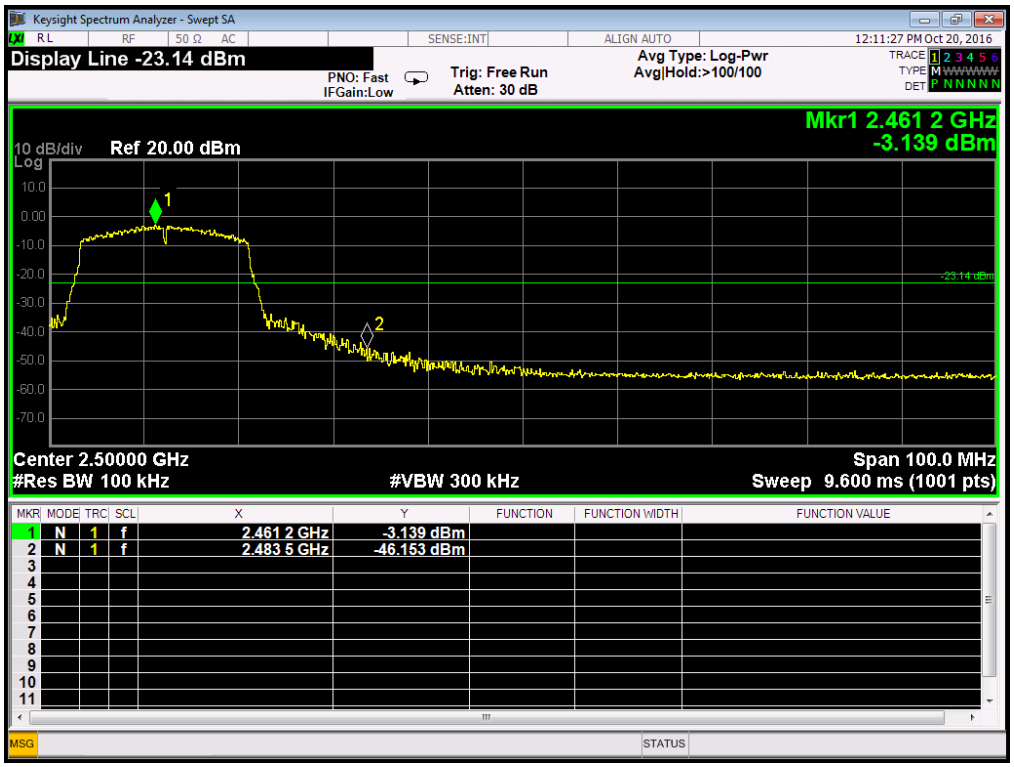
802.11 g Mode


Keysight Spectrum Analyzer - Swept SA
Display Line -23.12 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:09:32 PM Oct 20, 2016
Mkr1 2.413 2 GHz
-3.123 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.37500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 100.0 MHz
Sweep 9.600 ms (1001 pts)
1 N 1 f 2.413 2 GHz -3.123 dBm
2 N 1 f 2.400 0 GHz -39.059 dBm

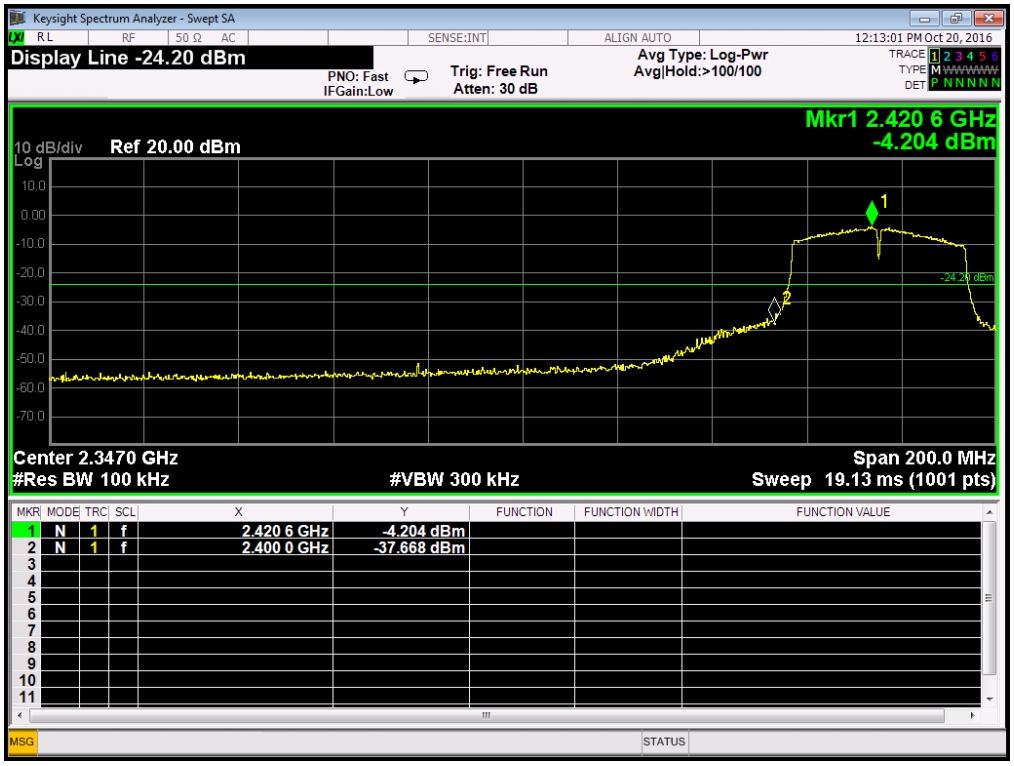

Keysight Spectrum Analyzer - Swept SA
Display Line -23.19 dBm
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:07:46 PM Oct 20, 2016
Mkr1 2.463 1 GHz
-3.188 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.49900 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 100.0 MHz
Sweep 9.600 ms (1001 pts)
1 N 1 f 2.463 1 GHz -3.188 dBm
2 N 1 f 2.483 5 GHz -51.564 dBm
3 N 1 f 2.484 0 GHz -47.523 dBm

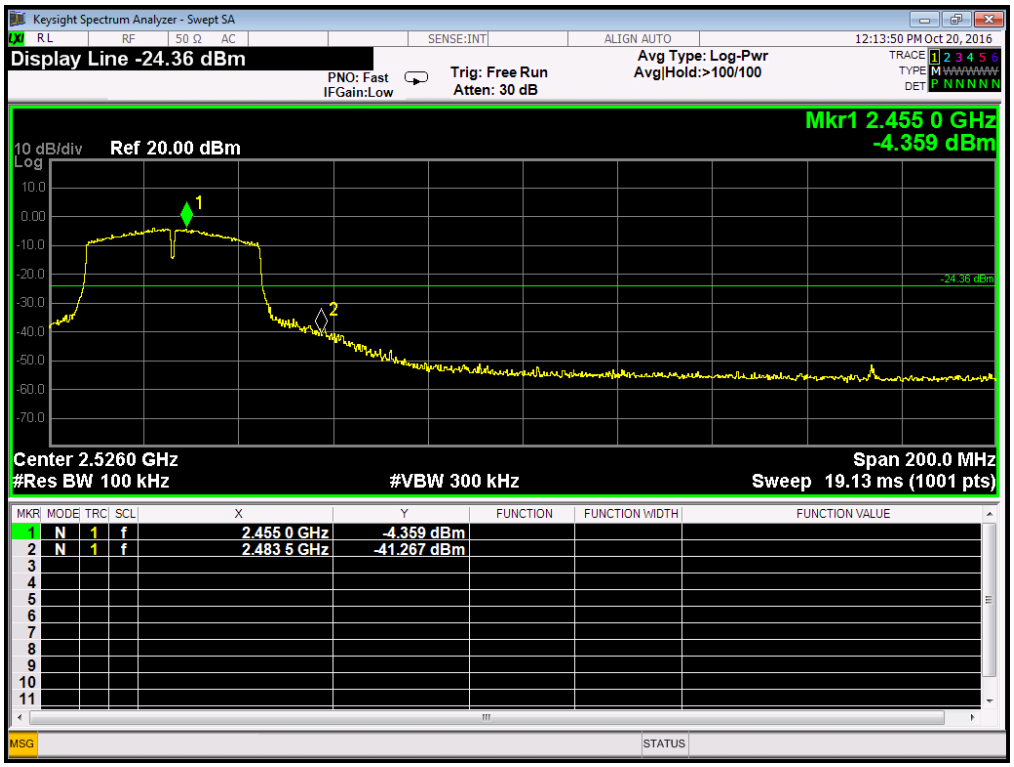
802.11 n20 Mode





802.11 n40 Mode



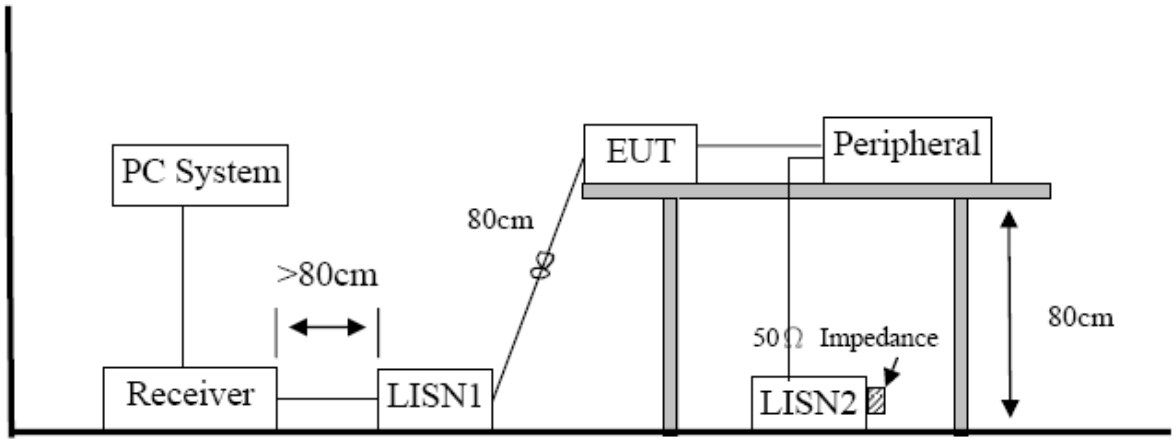


8. Power Line Conducted Emission

8.1. Test equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until	Calibrated Date
1	Test Receiver	R&S	ESCI	101308	2016/12/25	2015/12/26
2	LISN 1	AFJ	LS16	16011103219	2016/12/25	2015/12/26
3	LISN 2	R&S	ESH2-Z5	100309	2016/12/25	2015/12/26
4	Pulse Limiter	MTS-systemtechnik	MTS-IMP-136	261115-010-0024	2016/12/25	2015/12/26

8.2. Block diagram of test setup



8.3. Power Line Conducted Emission Limits(Class B)

Frequency	Quasi-Peak Level dB(μV)	Average Level dB(μV)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Note 1: * Decreasing linearly with logarithm of frequency.

Note 2: The lower limit shall apply at the transition frequencies.

8.4. Test Procedure

The EUT and Support equipment, if needed, were put placed on a non-metallic table, 80cm above the ground plane.

Configuration EUT to simulate typical usage as described in clause 2.4 and test equipment as described in clause 10.2 of this report.

All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4.

All support equipment power received from a second LISN.

Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.

The Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.

During the above scans, the emissions were maximized by cable manipulation.

The test mode(s) described in clause 2.4 were scanned during the preliminary test.

After the preliminary scan, we found the test mode producing the highest emission level.

The EUT configuration and worse cable configuration of the above highest emission levels were recorded for reference of the final test.

EUT and support equipment were set up on the test bench as per the configuration with highest emission level in the preliminary test.

A scan was taken on both power lines, Neutral and Line, recording at least the six highest emissions.

Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit.

The test data of the worst-case condition(s) was recorded.

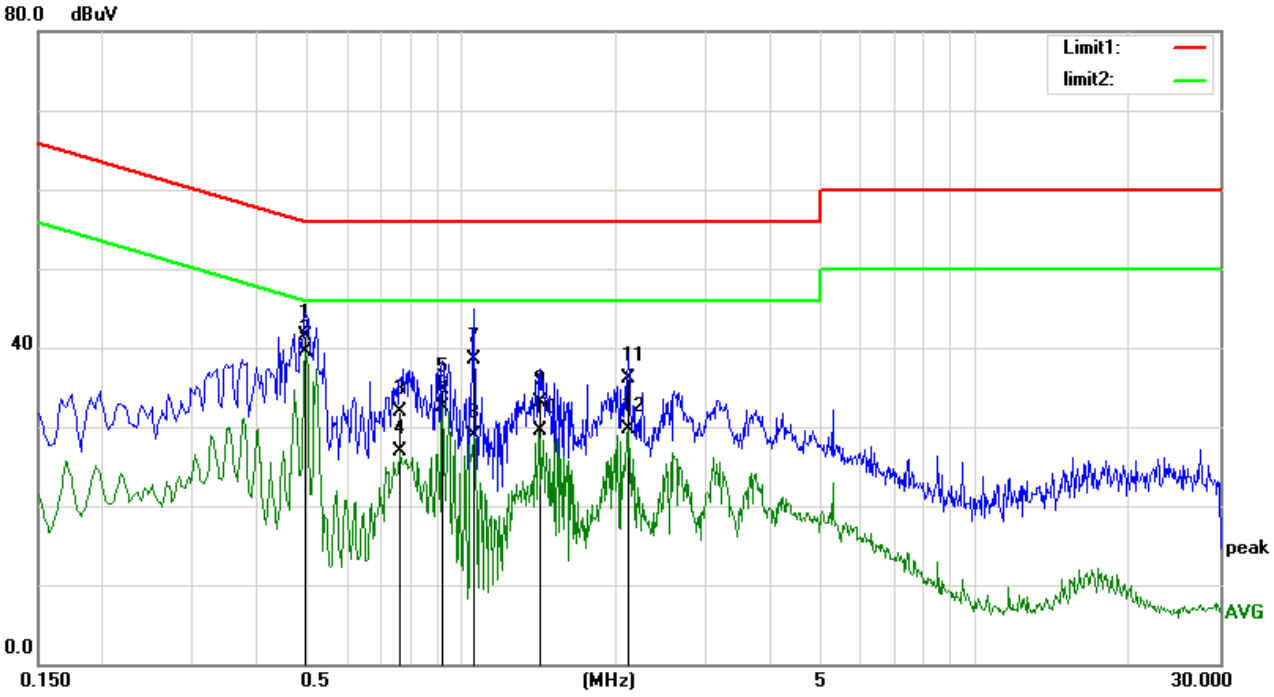
The bandwidth of test receiver is set at 9 KHz.

8.5. Test Result

pass. (See below detailed test result)

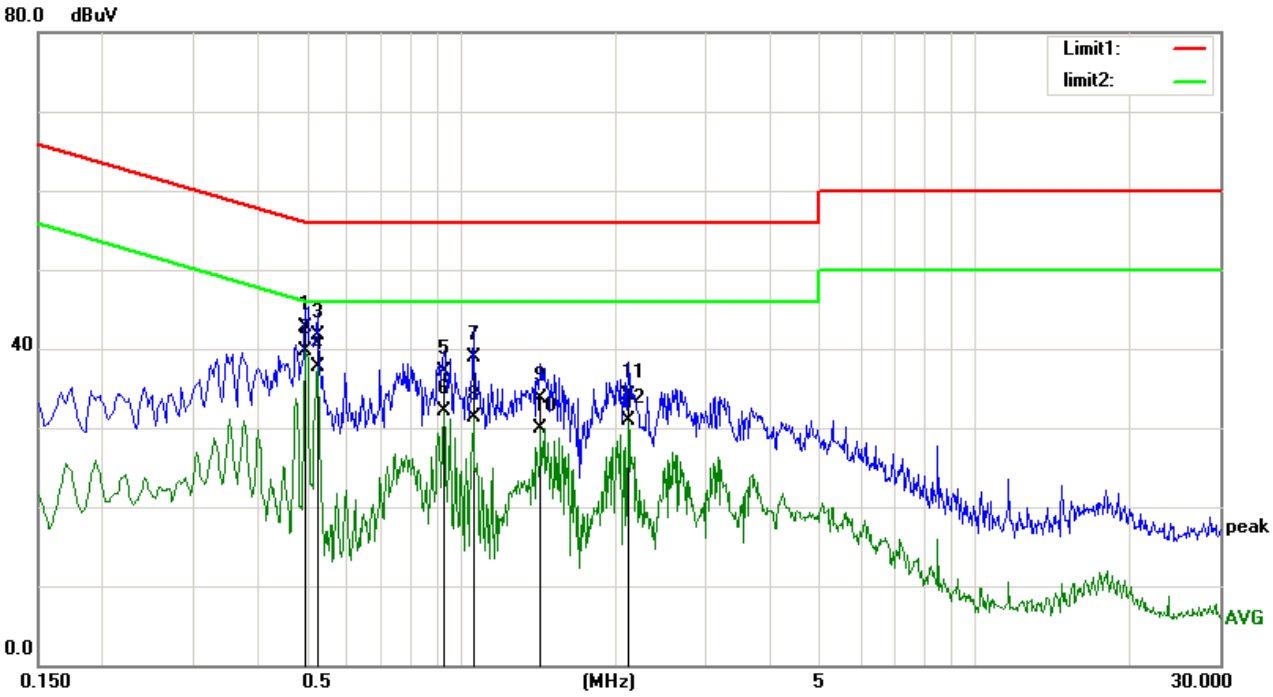
Note1: All emissions not reported below are too low against the prescribed limits.
Note2: "-----" means average detection; "-----" mans peak detection

EUT:	Portable SmartHub	**Model No.:**	WS-439-2
Temperature:	24	**Relative Humidity:**	55%
Distance:	3m	**Test Power:**	DC 120V/60Hz
Polarization:	L1	**Test Result:**	Pass
Standard:	FCC PART 15 class C	**Test By:**	Lake
Test Mode:	Keeping TX Mdoe		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.4979	31.34	10.18	41.52	56.03	-14.51	QP
2	0.4979	29.23	10.18	39.41	46.03	-6.62	AVG
3	0.7620	21.86	10.10	31.96	56.00	-24.04	QP
4	0.7620	16.76	10.10	26.86	46.00	-19.14	AVG
5	0.9220	24.65	10.10	34.75	56.00	-21.25	QP
6	0.9220	22.32	10.10	32.42	46.00	-13.58	AVG
7	1.0580	28.46	10.10	38.56	56.00	-17.44	QP
8	1.0580	18.71	10.10	28.81	46.00	-17.19	AVG
9	1.4179	22.95	10.10	33.05	56.00	-22.95	QP
10	1.4179	19.43	10.10	29.53	46.00	-16.47	AVG
11	2.1139	26.01	10.11	36.12	56.00	-19.88	QP
12	2.1139	19.67	10.11	29.78	46.00	-16.22	AVG

EUT:	Portable SmartHub	Model No.:	WS-439-2
Temperature:	24	Relative Humidity:	55%
Distance:	3m	Test Power:	DC 120V/60Hz
Polarization:	N	Test Result:	Pass
Standard:	FCC PART 15 class C	Test By:	Lake
Test Mode:	Keeping TX Mdoe		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.4979	32.47	10.18	42.65	56.03	-13.38	QP
2	0.4979	29.49	10.18	39.67	46.03	-6.36	AVG
3	0.5260	31.62	10.17	41.79	56.00	-14.21	QP
4	0.5260	27.46	10.17	37.63	46.00	-8.37	AVG
5	0.9260	27.03	10.10	37.13	56.00	-18.87	QP
6	0.9260	22.07	10.10	32.17	46.00	-13.83	AVG
7	1.0580	28.72	10.10	38.82	56.00	-17.18	QP
8	1.0580	21.12	10.10	31.22	46.00	-14.78	AVG
9	1.4259	23.66	10.10	33.76	56.00	-22.24	QP
10	1.4259	19.87	10.10	29.97	46.00	-16.03	AVG
11	2.1179	23.99	10.11	34.10	56.00	-21.90	QP
12	2.1179	20.76	10.11	30.87	46.00	-15.13	AVG

9. Conducted Spurious Emissions

9.1. Test Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until	Calibrated Date
1	Spectrum analyzer	KEYSIGHT	N9010A	MY55150427	2017/05/05	2016/05/06
2	Attenuator	Mini-Circuits	BW-S10W2	101109	2016/12/19	2015/12/20
3	RF Cable	Micable	C10-01-01-1	100309	2016/12/19	2015/12/20

9.2. Limit

In any 100kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

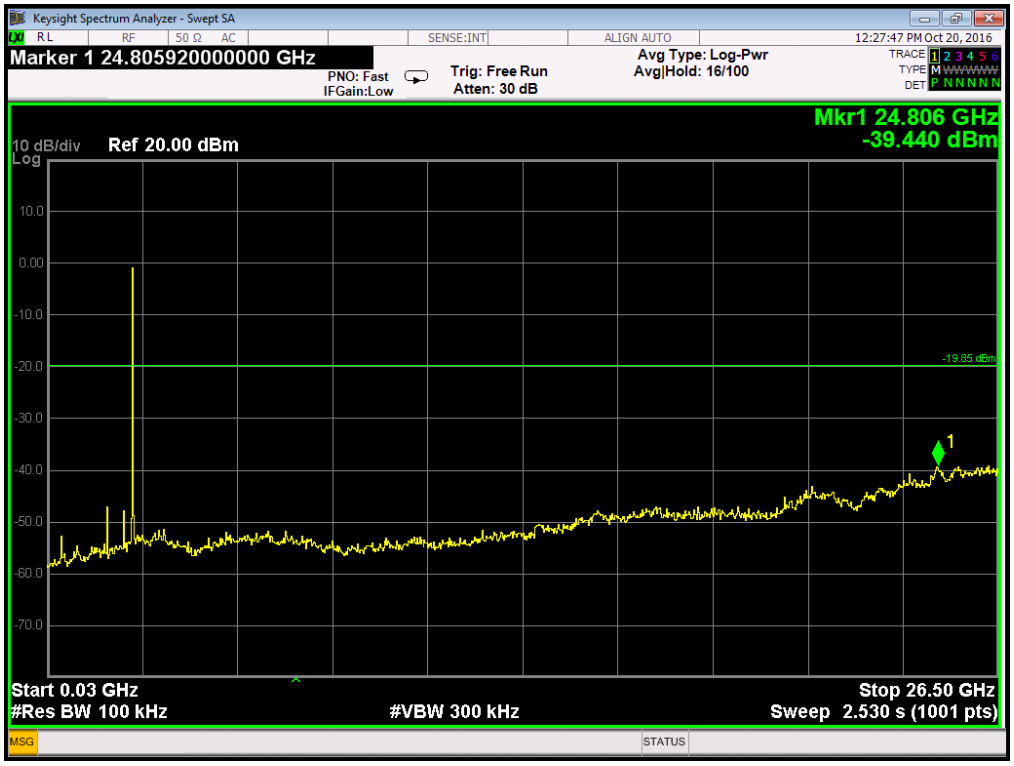
9.3. Test Procedure

The transmitter output was connected to a spectrum analyzer, The resolution bandwidth is set to 100 kHz, The video bandwidth is set to 300 kHz and measure all the emissions detected.

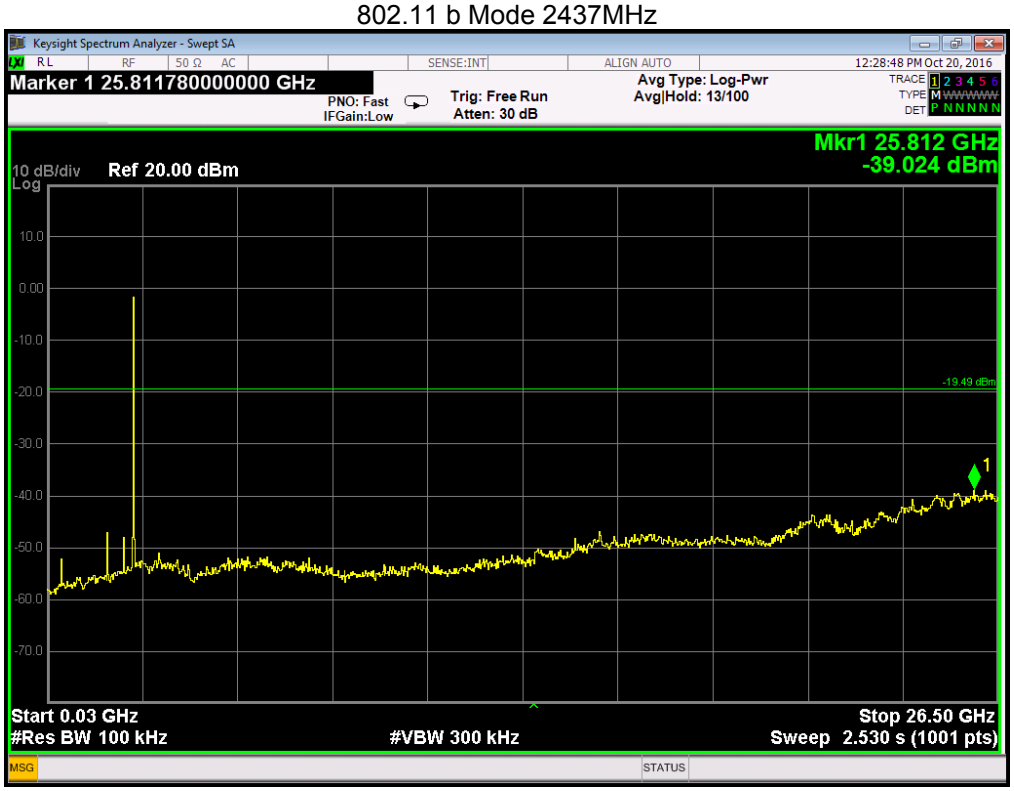
9.4. Test result

PASS (**See below detailed test result**.)

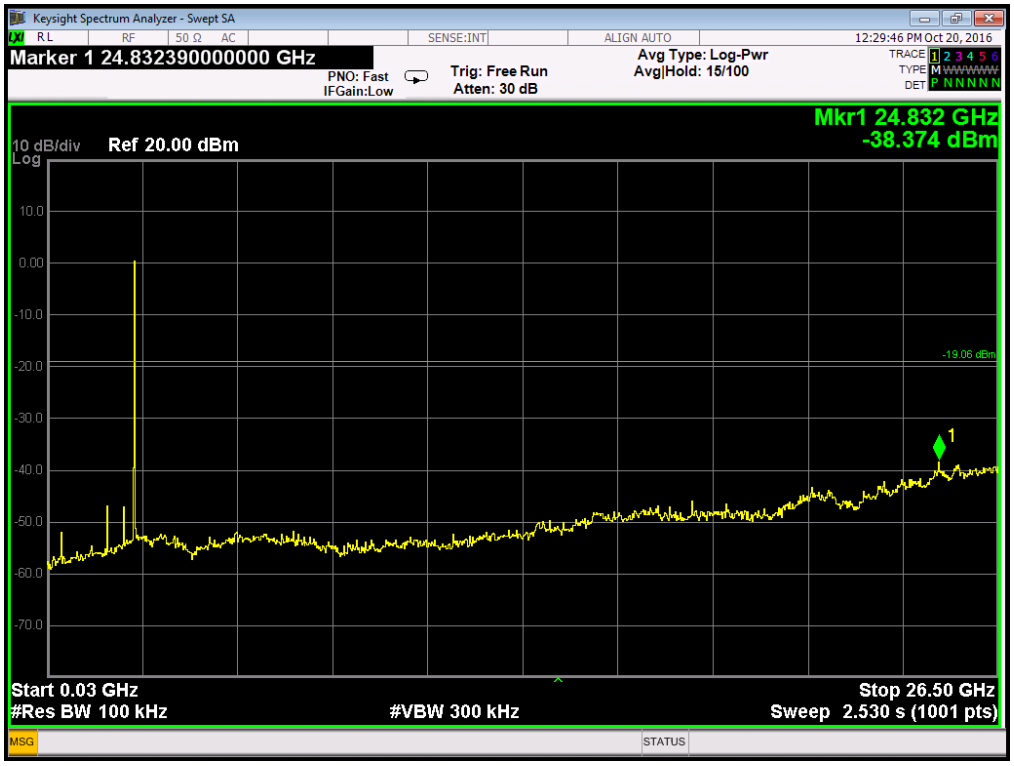
802.11 b Mode 2412MHz



802.11 b Mode 2437MHz

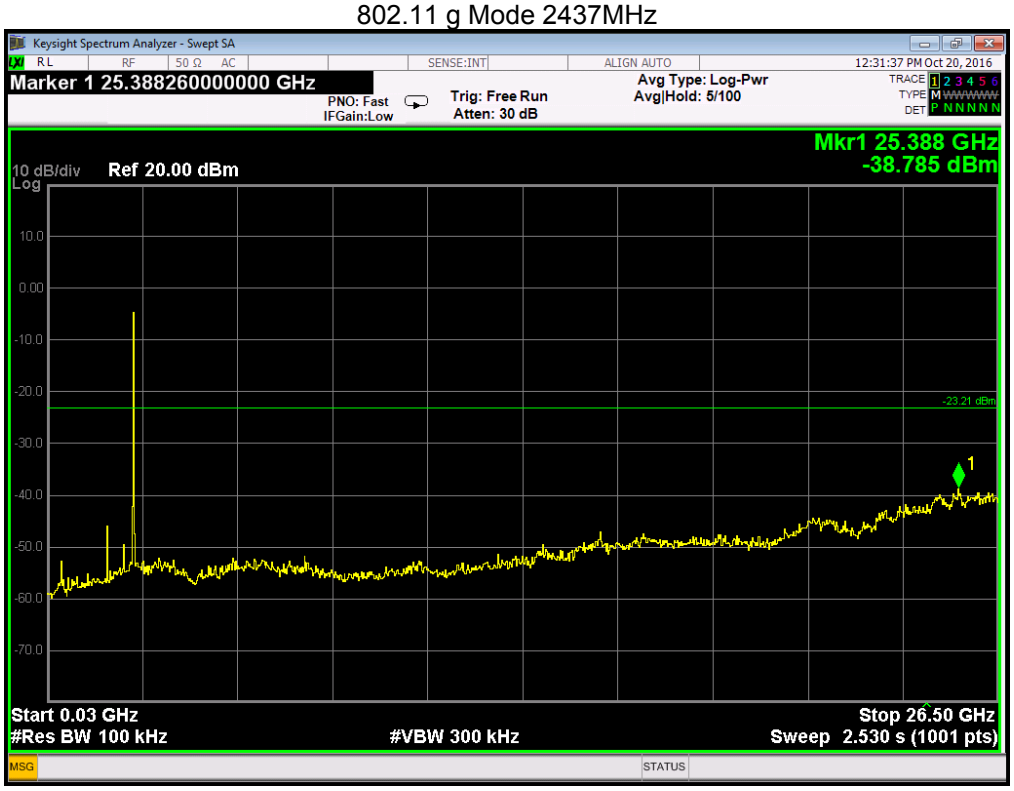


802.11 b Mode 2462MHz

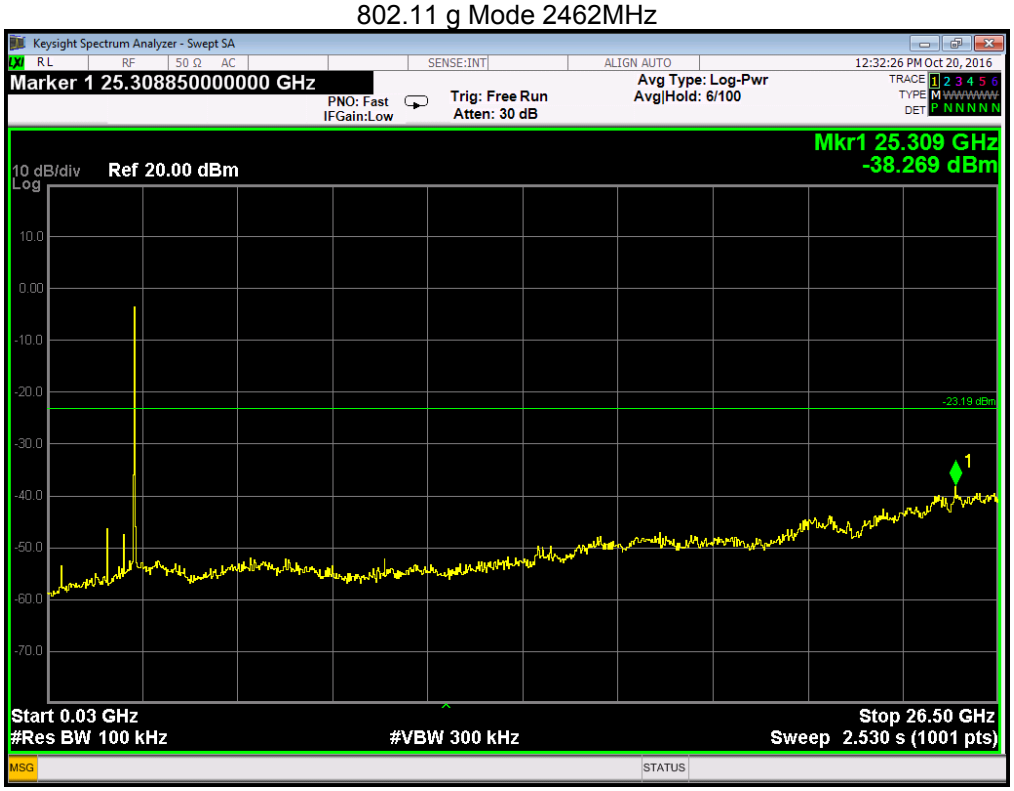


802.11 g Mode 2412MHz

802.11 g Mode 2437MHz



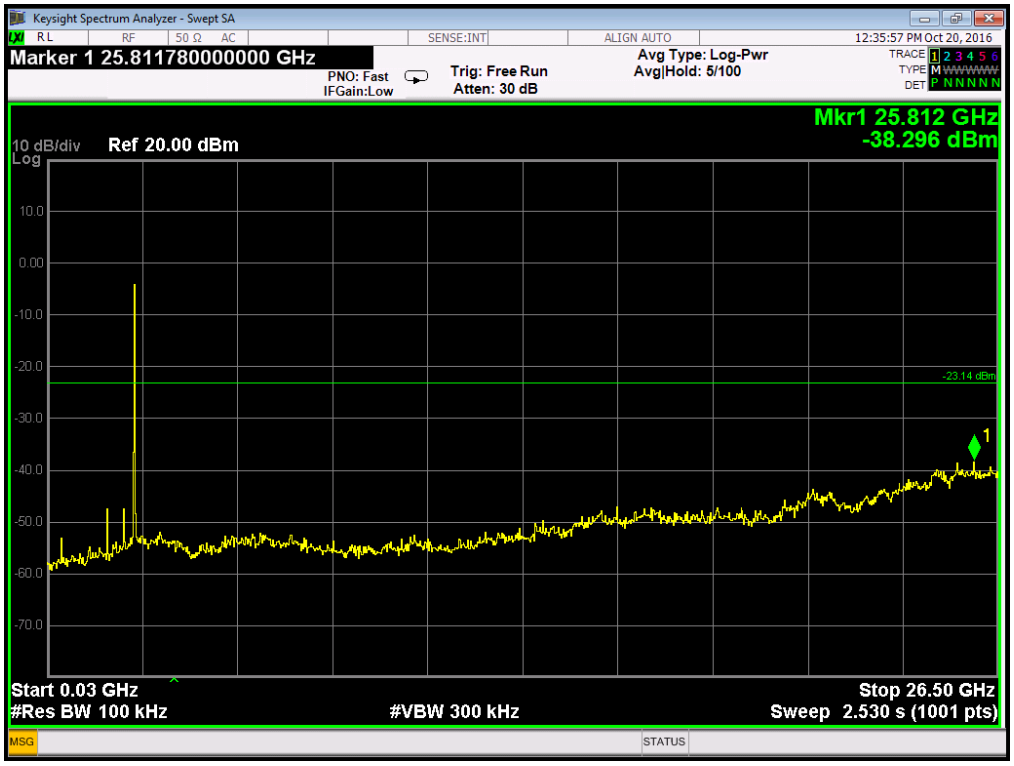
802.11 g Mode 2462MHz



802.11 n20 Mode 2412MHz

802.11 n20 Mode 2437MHz

802.11 n20 Mode 2462MHz



802.11 n40 Mode 2422MHz

802.11 n40 Mode 2437MHz

802.11 n40 Mode 2452MHz

9. Antenna Requirements

9.1. Limit

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. Result

The antennas used for this product are built-in undetachable dipole antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 2 dBi. The EUT has an internal antenna, the directional gain of antenna is 2 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Therefore the EUT is considered sufficient to comply with the provision.

END OF REPORT