

<b>Operation Mode:</b>	TX / IEEE 802.11n HT40 MHz / CH Mid	Test Date:	September 29, 2014
Temperature:	24°C	Tested by:	Sun Guo
Humidity:	52% RH	Polarity:	Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1990.000	48.75	-8.32	40.43	74.00	-33.57	V	Peak
3250.000	47.76	-3.34	44.42	74.00	-29.58	V	Peak
4870.000	41.69	1.97	43.66	74.00	-30.34	V	Peak
5851.000	40.64	3.14	43.78	74.00	-30.22	V	Peak
6481.000	38.97	5.46	44.43	74.00	-29.57	V	Peak
7489.000	39.57	8.65	48.22	74.00	-25.78	V	Peak
1927.000	49.39	-8.42	40.97	74.00	-33.03	Н	Peak
3250.000	44.47	-3.34	41.13	74.00	-32.87	Н	Peak
4798.000	41.81	1.67	43.48	74.00	-30.52	Н	Peak
6409.000	40.98	5.15	46.13	74.00	-27.87	Н	Peak
7066.000	40.96	7.83	48.79	74.00	-25.21	Н	Peak
8236.000	39.46	9.52	48.98	74.00	-25.02	Н	Peak

#### REMARKS:

- 1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
- 2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
- 3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
- 4. Data of measurement within this frequency range shown "--- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
- 6. Margin (dB) = Remark result (dBuV/m) Average limit (dBuV/m).



Operation Mode: TX / IEEE 802.11n HT40 MHz / CH High Test Date: September 29, 2014

Temperature: 24°C

Tested by: Sun Guo

RH

Polarity: Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1999.000	49.07	-8.31	40.76	74.00	-33.24	V	Peak
3268.000	46.97	-3.31	43.66	74.00	-30.34	V	Peak
4996.000	41.21	2.49	43.70	74.00	-30.30	V	Peak
6067.000	39.96	3.68	43.64	74.00	-30.36	V	Peak
6931.000	39.90	7.40	47.30	74.00	-26.70	V	Peak
7633.000	40.94	8.93	49.87	74.00	-24.13	V	Peak
1729.000	48.04	-9.22	38.82	74.00	-35.18	Н	Peak
3268.000	44.12	-3.31	40.81	74.00	-33.19	Н	Peak
3862.000	42.75	-1.55	41.20	74.00	-32.80	Н	Peak
4942.000	40.43	2.27	42.70	74.00	-31.30	Н	Peak
6571.000	39.47	5.85	45.32	74.00	-28.68	Н	Peak
8326.000	39.96	9.47	49.43	74.00	-24.57	Н	Peak

#### REMARKS:

- 1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
- 2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
- 3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
- 4. Data of measurement within this frequency range shown "----" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
- 6. Margin (dB) = Remark result (dBuV/m) Average limit (dBuV/m).



## 7.3. 6dB BANDWIDTH MEASUREMENT

## 7.3.1. LIMITS

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

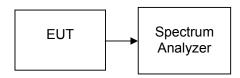
## 7.3.2. TEST INSTRUMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US44300399	03/09/2013	03/08/2014

## 7.3.3. TEST PROCEDURES (please refer to measurement standard)

- 8.1 Option 1:
  - a) Set RBW = 100 kHz.
  - b) Set the video bandwidth (VBW)  $\geq$  3 x RBW.
  - c) Detector = Peak.
  - d) Trace mode = max hold.
  - e) Sweep = auto couple.
  - f) Allow the trace to stabilize.
  - g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

## 7.3.4. TEST SETUP





## 7.3.5. TEST RESULTS

No non-compliance noted

#### <u>Test Data</u>

#### Test mode: IEEE 802.11b (Antenna 1)

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Test Result
Low	2412	8107		PASS
Mid	2437	8600	>500	PASS
High	2462	8112		PASS

#### Test mode: IEEE 802.11g (Antenna 1)

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Test Result
Low	2412	14446		PASS
Mid	2437	15064	>500	PASS
High	2462	15096		PASS

#### Test mode: IEEE 802.11n HT20 MHz (Antenna 1)

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Test Result
Low	2412	15108		PASS
Mid	2437	15085	>500	PASS
High	2462	15115		PASS

#### Test mode: IEEE 802.11n HT20 MHz (Antenna 2))

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Test Result
Low	2412	15090		PASS
Mid	2437	15125	>500	PASS
High	2462	15136		PASS



#### Test mode: IEEE 802.11n HT40 MHz (Antenna 1)

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Test Result
Low	2422	36835		PASS
Mid	2437	35788	>500	PASS
High	2452	35831		PASS

## Test mode: IEEE 802.11n HT40 MHz (Antenna 2)

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit (kHz)	Test Result
Low	2422	36434		PASS
Mid	2437	36417	>500	PASS
High	2452	36405		PASS



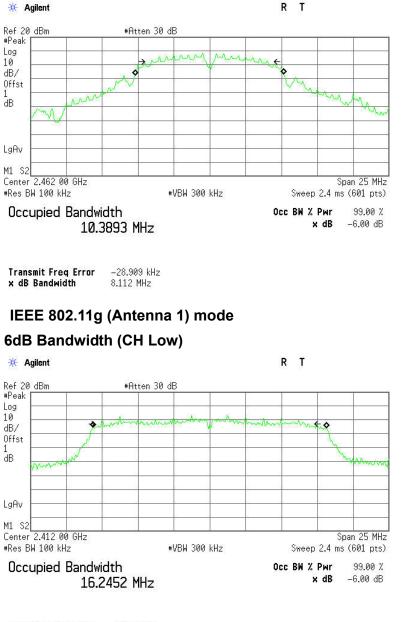
#### <u>Test Plot</u>

#### IEEE 802.11b (Antenna 1)mode 6dB Bandwidth (CH Low) 🔆 Agilent R T Ref 20 dBm #Atten 30 dB #Peak Log mont 10 dB/ Offst 1 dB LgAv M1 S2 Center 2.412 00 GHz Span 25 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 2.4 ms (601 pts) Occupied Bandwidth Occ BW % Pwr 99.00 % -6.00 dB 10.1873 MHz x dB **Transmit Freq Error** -48.503 kHz x dB Bandwidth 8.107 MHz 6dB Bandwidth (CH Mid) R T 🔆 Agilent Ref 20 dBm #Atten 30 dB #Peak Log MAA MAA 10 dB/ Offst 1 dB LgAv M1 S2 Center 2.437 00 GHz Span 25 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 2.4 ms (601 pts) Occupied Bandwidth Occ BW % Pwr 99.00 % **x dB** -6.00 dB 10.1810 MHz

Transmit Freq Error -36.973 kHz x dB Bandwidth 8.600 MHz



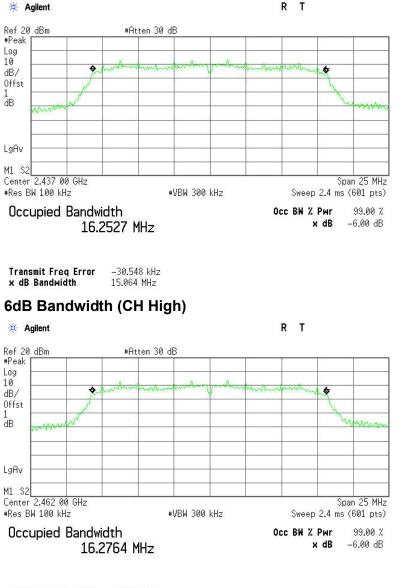
#### 6dB Bandwidth (CH High)



Transmit Freq Error -16.857 kHz x dB Bandwidth 14.446 MHz

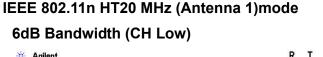


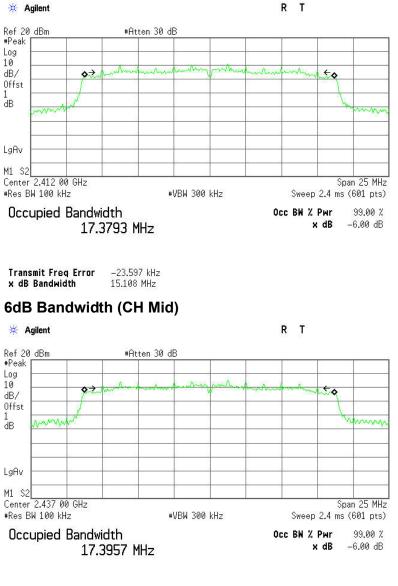
6dB Bandwidth (CH Mid)



Transmit Freq Error -23.279 kHz x dB Bandwidth 15.096 MHz



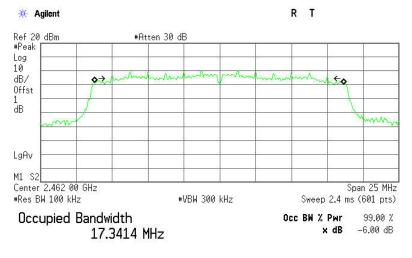




Transmit Freq Error -33.261 kHz x dB Bandwidth 15.085 MHz



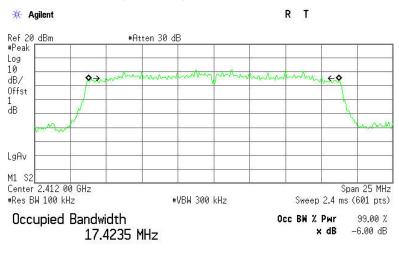
#### 6dB Bandwidth (CH High)



Transmit Freq Error -25.843 kHz x dB Bandwidth 15.115 MHz

#### IEEE 802.11n HT20 MHz (Antenna 2)mode

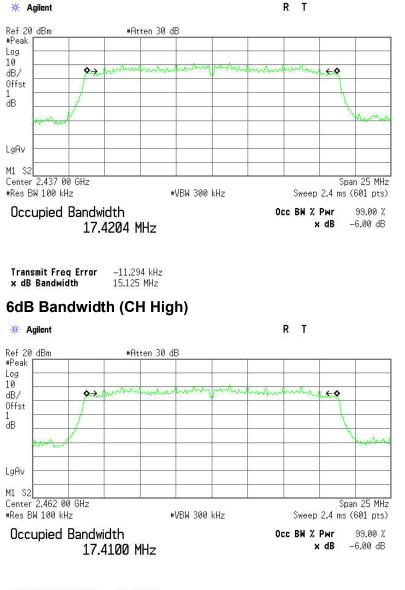
#### 6dB Bandwidth (CH Low)



Transmit Freq Error -10.073 kHz x dB Bandwidth 15.090 MHz

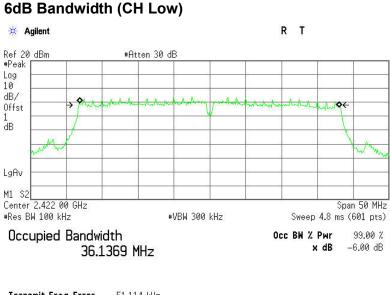


#### 6dB Bandwidth (CH Mid)



Transmit Freq Error -11.492 kHz x dB Bandwidth 15.136 MHz

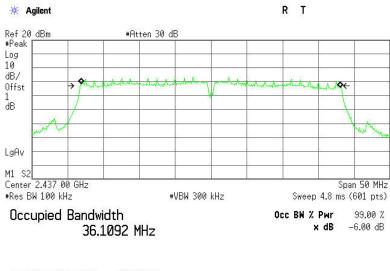




#### IEEE 802.11n HT40 MHz (Antenna 1) mode

Transmit Freq Error-51.114 kHzx dB Bandwidth35.835 MHz

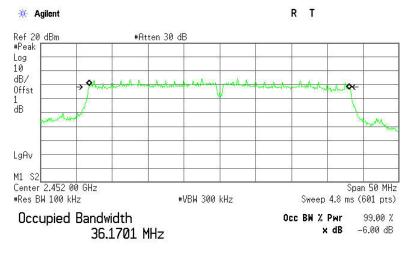




Transmit Freq Error -59.363 kHz x dB Bandwidth 35.788 MHz



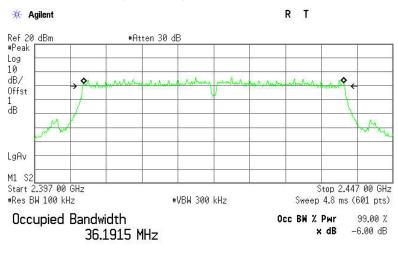
#### 6dB Bandwidth (CH High)



Transmit Freq Error -64.727 kHz x dB Bandwidth 35.831 MHz

#### IEEE 802.11n HT40 MHz (Antenna 2) mode

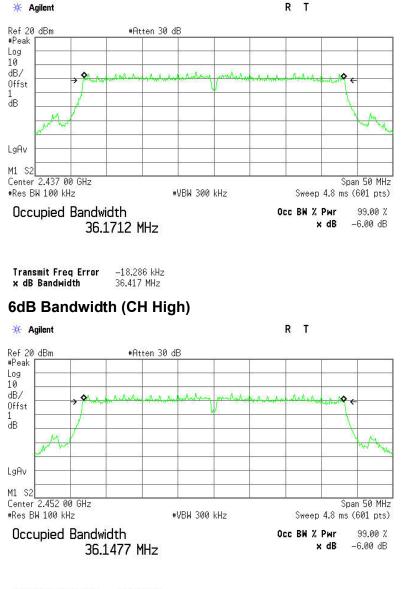
#### 6dB Bandwidth (CH Low)



Transmit Freq Error -9.158 kHz x dB Bandwidth 36.434 MHz



#### 6dB Bandwidth (CH Mid)



Transmit Freq Error-23.064 kHzx dB Bandwidth36.405 MHz



# 7.4. PEAK OUTPUT POWER

## 7.4.1. LIMITS

The maximum peak output power of the intentional radiator shall not exceed the following:

- 1. According to §15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
- 2. According to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, 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 in paragraphs (b)(1), (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.

#### 7.4.2. TEST INSTRUMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Calibration Due
Spectrum Analyzer	Agilent	E4446A	US44300399	03/09/2014	03/08/2015
Power Sensor	Anritsu	MA2411B	1126150	03/09/2014	03/08/2015
Power Meter	Anritsu	ML2495A	1204003	03/01/2014	03/01/2015

#### 7.4.3. TEST PROCEDURES (please refer to measurement standard)

#### 9.1.1 RBW ≥ DTS bandwidth

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the *DTS bandwidth*.

- a) Set the RBW  $\geq$  DTS bandwidth.
- b) Set VBW  $\geq$  3 RBW.
- c) Set span  $\ge$  3 x RBW
- d) Sweep time = auto couple.
- e) Detector = peak.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use peak marker function to determine the peak amplitude level.



## 9.1.2 Integrated band power method

This procedure may be used when the maximum available RBW of the measurement instrument is less than the *DTS bandwidth*.

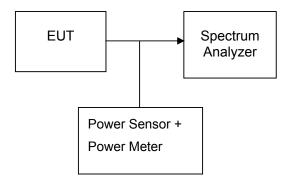
- a) Set the RBW = 1 MHz.
- b) Set the VBW ≥ 3 RBW
- c) Set the span  $\geq$  1.5 x DTS bandwidth.
- d) Detector = peak.
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.

h) 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, sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS bandwidth.

## 9.1.3 PKPM1 Peak power meter method

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

## 7.4.4. TEST SETUP





## 7.4.5. TEST RESULTS

No non-compliance noted

<u>Test Data</u>

Test mode: IEEE 802.11b (Antenna 1)

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Remark	Result
Low	2412	19.38	0.08670			PASS
Mid	2437	20.27	0.10641	1	peak	PASS
High	2462	18.94	0.07834			PASS
Low	2412	15.44	0.03499			PASS
Mid	2437	16.43	0.04395	1	AVG	PASS
High	2462	15.02	0.03177			PASS

#### Test mode: IEEE 802.11g (Antenna 1)

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Remark	Result
Low	2412	23.23	0.21038			PASS
Mid	2437	23.57	0.22751	1	peak	PASS
High	2462	21.95	0.15668			PASS
Low	2412	12.93	0.01963			PASS
Mid	2437	15.28	0.03373	1	AVG	PASS
High	2462	11.55	0.01429			PASS

#### Test mode: IEEE 802.11n HT20 MHz (Combine with Antenna 1 and Antenna 2)

Channel	nel Frequency (dBm)		Output Power Total(dBm)	Limit (W)	Remark	Result		
	(10112)	Chain 1	Chain 2 (W)		(••)			
Low	2412	21.33	20.72	24.05	0.25386			PASS
Mid	2437	23.17	22.51	25.86	0.38573	1	peak	PASS
High	2462	20.89	20.32	23.62	0.23039			PASS
Low	2412	10.72	10.07	13.42	0.02197			PASS
Mid	2437	13.96	13.38	16.69	0.04667	1	AVG	PASS
High	2462	10.53	9.85	13.21	0.02096			PASS

#### Test mode: IEEE 802.11n HT40 MHz (Combine with Antenna 1 and Antenna 2)

Channel	Frequency (MHz)	I (0Bm) I '		Output Power Total(dBm)	Output Power	Power (W)		Result
	(11172)	Chain 1	Chain 2	(W)		(**)		
Low	2422	18.71	18.95	21.84	0.15283			PASS
Mid	2437	21.17	21.08	24.14	0.25915	1	peak	PASS
High	2452	18.03	18.16	21.11	0.12900			PASS
Low	2422	7.54	7.72	10.64	0.01159			PASS
Mid	2437	11.65	11.33	14.50	0.02820	1	AVG	PASS
High	2452	7.79	7.57	10.69	0.01173			PASS

Note : Combine Power Calculation :

Total Power(dBm) =log (10 <sup>(chain 0 power/10)</sup>+10 <sup>(chain 1 power/10)</sup>)\*10

# 7.5. BAND EDGES MEASUREMENT

## 7.5.1. LIMITS

According to §15.247(d), in any 100 kHz 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 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. 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 Section 15.205(c)).

	Radiated Emission Test Site 966(2)												
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration								
PSA Series Spectrum Analyzer	Agilent	E4446A	US44300399	03/01/2014	03/01/2015								
Spectrum Analyzer	Agilent	N9010A	MY52221469	10/25/2014	10/24/2015								
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100783	03/09/2014	03/08/2015								
Amplifier	MITEQ	AM-1604-3000	1123808	03/18/2015	03/18/2015								
High Noise Amplifier	Agilent	8449B	3008A01838	03/18/2015	03/18/2015								
Board-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170-497	07/10/2014	07/09/2015								
Bilog Antenna	SCHAFFNER	CBL6143	5082	03/01/2014	03/01/2015								
Horn Antenna	SCHWARZBECK	BBHA9120	D286	03/01/2014	03/01/2015								
Loop Antenna	Α, R, Α	PLA-1030/B	1029	09/27/2014	09/26/2015								
Turn Table	N/A	N/A	N/A	N.C.R	N.C.R								
Controller	Sunol Sciences	SC104V	022310-1	N.C.R	N.C.R								
Controller	СТ	N/A	N/A	N.C.R	N.C.R								
Temp. / Humidity Meter	Anymetre	JR913	N/A	02/28/2014	02/28/2015								
Antenna Tower	SUNOL	TLT2	N/A	N.C.R	N.C.R								
Test S/W	FARAD		LZ-RF / CCS	S-SZ-3A2									

## 7.5.2. TEST INSTRUMENTS

**NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The FCC Site Registration number is 101879.

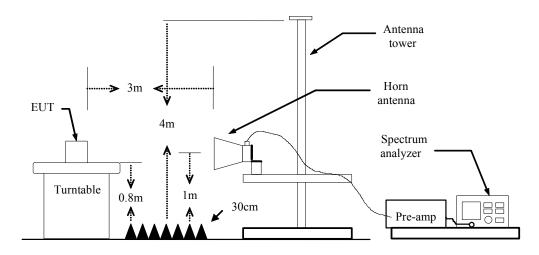
3. N.C.R = No Calibration Required.



7.5.3. TEST PROCEDURES (please refer to measurement standard)

- 1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
- 2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
- 4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
  - (a) PEAK: RBW=1MHz / VBW=3MHz / Sweep=AUTO
  - (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
- 5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are

## 7.5.4. TEST SETUP





7.5.5. TEST RESULTS

Test Plot

IEEE 802.11b (Antenna 1)mode

Band Edges (CH Low)

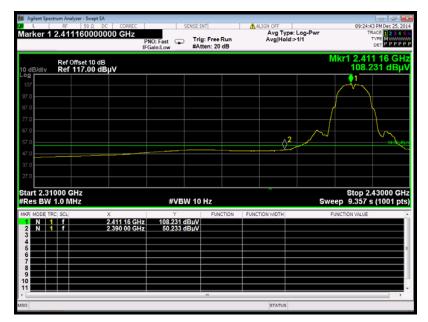
**Detector mode: Peak** 

**Polarity: Vertical** 

Cog   Interview of the second seco	Agilent Spectrum	Analyzer - Swept SA ∛F   50 Ω D0 121200000	00 GHz	NO: Fast Gain:Low ##	ig: Free Run tten: 20 dB	ALIGN OFF Avg Type Avg Hold:	: Log-Pwr >1/1	09:23:07 PM Dec TRACE 2 TVPE M DET P P	25, 201
Log   107   108 <th>10 dB/div R</th> <th>ef Offset 10 dB ef 117.00 dB</th> <th>βµV</th> <th></th> <th></th> <th></th> <th>М</th> <th>kr1 2.412 12 112.857 d</th> <th></th>	10 dB/div R	ef Offset 10 dB ef 117.00 dB	βµV				М	kr1 2.412 12 112.857 d	
KRR   BOODE TRCI SCL   X   Y   FUNCTION   FUNCTION WIDTH   FUNCTION VALUE     1   N   1   f   2.2412 12 GHz   112.857 dBuV   FUNCTION WIDTH   FUNCTION VALUE     2   N   1   f   2.399 00 GHz   62.023 dBuV   FUNCTION WIDTH   FUNCTION VALUE     6   -   -   -   -   -   -   -     9   -   -   -   -   -   -   -   -	107 97.0 87.0 77.0 67.0 67.0 47.0 37.0 27.0								~
1   N   1   f   2.412.12 GHz   112.857 dBuV     2   N   1   f   2.390 00 GHz   62.023 dBuV     3   -   -   -   -   -     4   -   -   -   -   -     6   -   -   -   -   -     7   -   -   -   -   -     8   -   -   -   -   -				#VBW 3.	0 MHz		Sweep	Stop 2.43000 1.000 ms (100	I GH
	1   N   1   1     2   N   1   1     3   4   5   5     6   7   8   9     9   9   10   10		2.412 12 GHz	112.857 dBuV		FUNCTION WIDTH	FU	NCTION VALUE	

Detector mode: Average

**Polarity: Vertical** 



No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2390.0000	55.42	-6.60	62.02	74.00	-11.98	Peak	Vertical
2	2390.0000	43.63	-6.60	50.23	54.00	-3.77	Average	Vertical

FCC ID: MSQ-RTN12D1

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Aglient Spectrum Analyzer - Swept SA
Aug Type: Log-Pwr Aryg Ty

Detector mode: Peak

## **Polarity: Horizontal**

Detector mode: Average

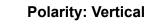
**Polarity: Horizontal** 

Agilent Spectrum Analyzer - Swept				
L RF 50 ຊ larker 1 2.41128000	0000 GHz PNO: Fast IFGain:Low	SENSE:INT Trig: Free Run #Atten: 20 dB	ALIGN OFF Avg Type: Log-Pwr Avg Hold: 7/100	10:39:46 PM Dec 25, 201 TRACE 1 2 3 4 5 TYPE MWWWW DET P P P P P
Ref Offset 10 0 dB/div Ref 117.00	dB dBµV		I	/kr1 2.411 28 GHz 97.414 dBµ\
37.0			^2	
tart 2.31000 GHz Res BW 1.0 MHz	#	VBW 10 Hz	Swe	Stop 2.43000 GH ep 9.357 s (1001 pts
KR MODE TRC SCL 1 N 1 f 2 N 1 f 3 4 5	X 2.411 28 GHz 97.4 2.390 00 GHz 43.7	FUNCTION 14 dBµV 44 dBµV	FUNCTION WIDTH F	UNCTION VALUE
9 9 1				

No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2390.0000	49.21	-6.60	55.81	74.00	-18.19	Peak	Horizontal
2	2390.0000	37.14	-6.60	43.74	54.00	-10.26	Average	Horizontal



## Band Edges (CH High) Detector mode: Peak





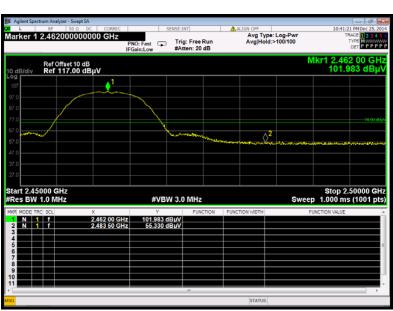
Detector mode: Average

## **Polarity: Vertical**

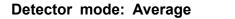


No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2483.5000	52.50	-6.24	58.74	74.00	-15.26	Peak	Vertical
2	2483.5000	40.68	-6.24	46.92	54.00	-7.08	Average	Vertical





**Polarity: Horizontal Detector mode: Peak** 



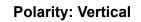
## **Polarity: Horizontal**

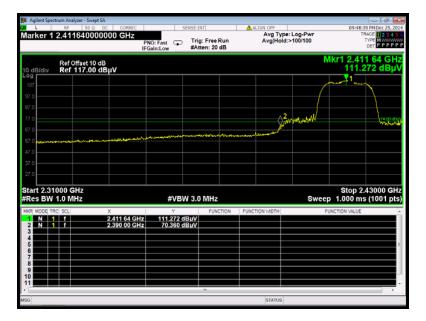


No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2483.5000	49.09	-6.24	55.33	74.00	-18.67	Peak	Horizontal
2	2483.5000	37.36	-6.24	43.60	54.00	-10.40	Average	Horizontal



# IEEE 802.11g (Antenna 1)mode Band Edges (CH Low) Detector mode: Peak





Detector mode: Average

#### **Polarity: Vertical**

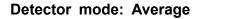


No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2390.0000	63.76	-6.60	70.36	74.00	-3.64	Peak	Vertical
2	2390.0000	46.38	-6.60	52.98	54.00	-1.02	Average	Vertical



Agilent Spectrum Analyzer - Swept SA					- 0 B
arker 1 2.412000000000 GHz	PNO: Fast C T IFGain:Low	rig: Free Run Atten: 20 dB	ALIGN OFF Avg Type: Lo Avg Hold:>10	g-Pwr 0/100	10:37:05 PM Dec 25, 20 TRACE 2 3 4 TYPE MWWW DET PPPP
Ref Offset 10 dB				Mkr1	2.412 00 GH 101.541 dBµ
07					1
7.0					hand
7.0					74.00 d
7.0			Alvier Alvier	-1/West	harmer -
7.0					
7.0					
tart 2.31000 GHz Res BW 1.0 MHz	#VBW 3	.0 MHz			top 2.43000 GH 00 ms (1001 pt
KR MODE TRC SCL X	Y	FUNCTION	FUNCTION WDTH	FUNCTION	VALUE
1 N 1 f 2.412 00 GH 2 N 1 f 2.390 00 GH 3	iz 101.541 dBµ iz 57.830 dBµ	v v			
4 5 6					
7 8 8 9 8 8					

Detector mode: Peak Polarity: Horizontal



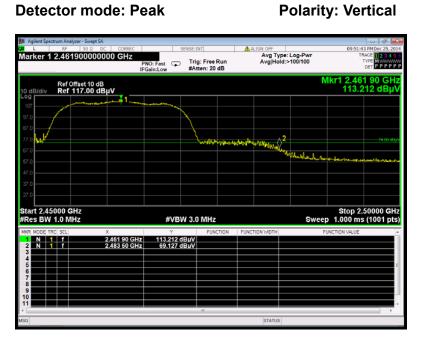
## **Polarity: Horizontal**

	RF	lyzer - Swept SA 50 Ω C	C CORREC		SENS	E:INT		ALIGN O	Ŧ			10:3	7:39 PM Dec 25, 20
arker 1	2.41	160000	000 GHz	PNO: Fast FGain:Low	<b>•</b>	Trig: Free R Atten: 20 d	un B	Av	g Type:   Hold:	Log-Pwr 1/100			TRACE 1 2 3 4 1 TYPE MWWWW DET PPPP
dB/div	Ref ( Ref	offset 10 dE 117.00 dI	³ BµV								M	kr1 2.4 88	11 16 GH .335 dBµ
07													
7.0													
7.0											$\left( \right)$		
7.0									. 2				54.00 40
7.0					_				aggregation 2				
7.0													
art 2.31 Res BW				#	VBW 1	10 Hz	Ŷ				Swee	Stop p 9.357	2.43000 GH ' s (1001 pt
R MODE TR	RC SCL		× 2.411 16 GHz		Y 335 dBµ	FUNCT	ION	FUNCTION W	тн		FUI	NCTION VALU	E
1 N 1	1		2.390 00 GHz	45.	330 dBµ	Ň							
2 N 1													

No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2390.0000	51.23	-6.60	57.83	74.00	-16.17	Peak	Horizontal
2	2390.0000	38.73	-6.60	45.33	54.00	-8.67	Average	Horizontal



## Band Edges (CH High) Detector mode: Peak



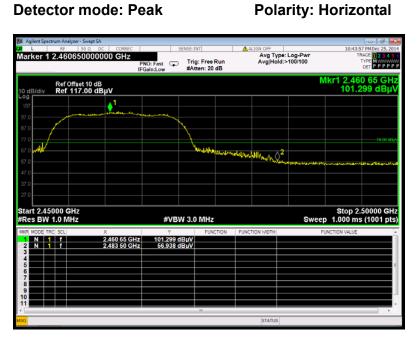
Detector mode: Average

## Polarity: Vertical

Agrient Spec	trum Analy RF	zer - Swept SA 50 Ω DC	CORREC		SENSE:II	NT.	ALIGN OFF		00-5	0:17 PM Dec 25, 20
arker 1		1500000	00 GHz	NO: Fast ( Gain:Low	Trig	: Free Run ten: 20 dB	Avg	Type: Log-Pwr Iold: 4/100	09.5	TRACE 1 2 3 4 TYPE M
dB/div	Ref 01 Ref 1	fset 10 dB 17.00 dB	μV						Mkr1 2.4 99	61 15 GH .562 dBµ
07			<b>●</b> <sup>1</sup>							
7.0	$\bigwedge$									
7.0 7.0										
										54.00 dD
.0										
art 2.45	000 GI	Hz							Stop	2.50000 GH
tes BW				#\	/BW 10	Hz		SI	weep 3.899	s (1001 pt
R MODE TR	RC SCL	)	( 2.461 15 GHz	Y	52 dBµV	FUNCTION	FUNCTION WIDT	н	FUNCTION VALU	E
	f		2.483 50 GHz	50.5	39 dBµV					
						m				

No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2483.5000	62.89	-6.24	69.13	74.00	-4.87	Peak	Vertical
2	2483.5000	44.30	-6.24	50.54	54.00	-3.46	Average	Vertical





Detector mode: Average

## **Polarity: Horizontal**

Agilent Spectrum Analyzer - Swe		SENSE:I	Log L	ALIGN OFF		10.10.3	1 PM Dec 25, 201
arker 1 2.4611000	00000 GHz	D: East 🕞 Trig	: Free Run ten: 20 dB		e: Log-Pwr d: 9/100	T	TYPE MWWWW DET PPPP
Ref Offset 10 dB/div Ref 117.00	0 dB 0 dBµV				N	lkr1 2.46 89.9	1 10 GH: 83 dBµ\
7.0	1						
7.0							
7.0				◊	2		54.00 dDµ
7.0							
tart 2.45000 GHz Res BW 1.0 MHz		#VBW 10	Hz		Swe	Stop 2. ep 3.899 s	50000 GH: (1001 pts
R MODE TRC SCL	X 2.461 10 GHz 2.483 50 GHz	Ү 89.983 dBµV 44.643 dBµV	FUNCTION	FUNCTION WIDTH	FL	UNCTION VALUE	
5 6 7 8							
9 11 1 11 1 11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			m				
				STATUS			

No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2483.5000	50.70	-6.24	56.94	74.00	-17.06	Peak	Horizontal
2	2483.5000	38.40	-6.24	44.64	54.00	-9.36	Average	Horizontal

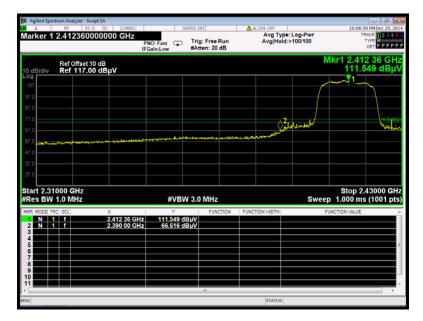


## IEEE 802.11n HT20 MHz (Combine with Antenna 1 and Antenna 2) mode

Band Edges (CH Low)

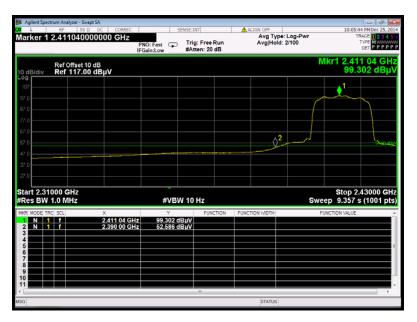
**Detector mode: Peak** 

**Polarity: Vertical** 



Detector mode: Average

#### **Polarity: Vertical**



No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2390.0000	59.92	-6.60	66.52	74.00	-7.48	Peak	Vertical
2	2390.0000	45.99	-6.60	52.59	54.00	-1.41	Average	Vertical



 Agilest Spectrum Analyzer - Sweet SA
 Autor OPE
 Description
 <thDescripant</th>
 Description
 <thDe

Detector mode: Peak

## **Polarity: Horizontal**

Detector mode: Average

**Polarity: Horizontal** 

Agilent Spec	trum Analyzer - S						
larker 1			PNO: Fast 🗭 FGain:Low	Trig: Free Run #Atten: 20 dB	ALIGN OFF Avg Type: Log Avg Hold: 2/10	-Pwr )	10:30:52 PM Dec 25, 20: TRACE 1 2 3 4 5 TYPE M
0 dB/div	Ref Offset Ref 117.	10 dB 00 dBµV				Mkr1	2.411 28 GH 86.841 dBµ
107 17.0							
7.0						~	
7.0							
7.0					$\Diamond^2$		54.00 40
7.0							
tart 2.31	000 GHz 1.0 MHz		#VB\	N 10 Hz		Sweep	Stop 2.43000 GH 9.357 s (1001 pts
KR MODE TR		× 2.411 28 GHz	Y 86.841 d	FUNCTION	FUNCTION WDTH	FUNCTIO	IN VALUE
2 N 1	1	2.390 00 GHz					
5							
8							
1							•
					STATUS		

No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2390.0000	49.10	-6.60	55.70	74.00	-18.30	Peak	Horizontal
2	2390.0000	37.66	-6.60	44.26	54.00	-9.74	Average	Horizontal



# Band Edges (CH High)

Detector mode: Peak

# Agient Spectrum Analyzer - Swept SA Agient Spectrum Analyzer - Swept SA Marker 1 2.4.4629500000000 GHz SENSE:INT Aution OPF Job 1037 Moc 23, 2014 Marker 1 2.4.4629500000000 GHz PNO: Fast Trig: Free Run Aug Type: Log-Pwr Aug Type: Log-Pwr Marker 1 2.4.4629500000000 GHz PNO: Fast Trig: Free Run Aug Type: Log-Pwr Trig: Trig: Free Run 10 dBdraiv Ref Offset 10 dB Mkr1 2.462 95 GHz 112.376 dBµV 112.376 dBµV 10 dBdraiv Ref Offset 10 dB Start 2.45000 GHz Start 2.45000 GHz Stort 2.50000 GHz 57 0 Stort 2.45000 GHz WWW 3.0 MHz Stort 2.50000 GHz Stort 2.50000 GHz 10 dBdraiv U 2.462 95 GHz 112.376 dBµV Stort 2.50000 GHz 10 dBraiv WWW 3.0 MHz Stort 2.50000 GHz Stort 2.50000 GHz 11 d 2.462 95 GHz 112.376 dBµV Stort 2.462 95 GHz 112.376 dBµV 10 d III d 2.462 95 GHz Stort 2.37 dBNV Stort 2.50000 GHz Stort 2.462 95 GHz Stort 2.37 dBNV 10 d III d 2.462 95 GHz III d Sto

## Detector mode: Average

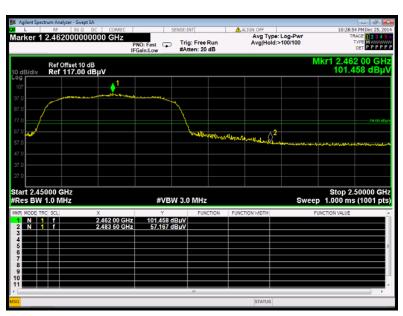
## **Polarity: Vertical**

**Polarity: Vertical** 

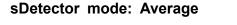
Agilent Spectrum Analyzer - Swept SA L RF 50 Ω DC CORREC	SENSE:INT	ALIGN OFF	10:01:41 PM Dec 25, 20
arker 1 2.461050000000 GHz	PNO: Fast Trig: Free Run IFGain:Low #Atten: 20 dB	Avg Type: Log-Pwr Avg Hold: 3/100	TRACE 12345 TYPE MWWWW DET PPPP
Ref Offset 10 dB 0 dB/div Ref 117.00 dBµV		MI	kr1 2.461 05 GH 100.001 dBµ
167 7.0			
7.0			
7.0			
7.0		\$2	54.00 dDy
7.0			
art 2.45000 GHź Res BW 1.0 MHz	#VBW 10 Hz	Swee	Stop 2.50000 GH p 3.899 s (1001 pts
R MODE TRC SCL X 1 N 1 f 2,461 05 G	Y FUNCTION	FUNCTION WIDTH FUN	CTION VALUE
2 N 1 f 2.483 50 G	Hz 51.096 dBuV		
6 7			
9 0			

No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2483.5000	59.18	-6.24	65.42	74.00	-8.58	Peak	Vertical
2	2483.5000	44.86	-6.24	51.10	54.00	-2.90	Average	Vertical





Detector mode: Peak Polarity: Horizontal



## **Polarity: Horizontal**

gilent Spectrum Analyzer - Sw L RF 50 S		SENSE:17	I TV	ALIGN OFF		10:29:30 PM Dec 25, 2
rker 1 2.4611500	PN		: Free Run ten: 20 dB	Avg Type: L Avg Hold: 4/		TRACE 2 3 4 TYPE MWWW DET PPP
Ref Offset 1 B/div Ref 117.0	0 dB 0 dBuV				Mk	r1 2.461 15 GH 89.204 dBµ
,	1					
		$\rightarrow$				
° =/====						54.00 d
rt 2.45000 GHz s BW 1.0 MHz		#VBW 10	Hz		Sweep	Stop 2.50000 GI 3.899 s (1001 p
MODE TRC SCL	х	Y	FUNCTION	FUNCTION WIDTH		TION VALUE
N 1 1 N 1 f	2.461 15 GHz 2.483 50 GHz	89.204 dBµV 44.565 dBµV				
	2.400 00 0112	11.000 0001				
						,

No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2483.5000	50.93	-6.24	57.17	74.00	-16.83	Peak	Horizontal
2	2483.5000	38.33	-6.24	44.57	54.00	-9.44	Average	Horizontal



## IEEE 802.11n HT40 MHz (Combine with Antenna 1 and Antenna 2) mode

Band Edges (CH Low)

**Detector mode: Peak** 

**Polarity: Vertical** 



Detector mode: Average

#### **Polarity: Vertical**



No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2390.0000	58.11	-6.60	64.71	74.00	-9.29	Peak	Vertical
2	2390.0000	46.02	-6.60	52.62	54.00	-1.38	Average	Vertical





## **Polarity: Horizontal**



**Detector mode: Average** 

**Polarity: Horizontal** 

and some first	RF 50 Ω	DC CORREC	SENSE	INT	ALIGN OFF		10:33:08 PM Dec 25, 20
arker 1	2.42046000	PN		rig: Free Run Atten: 20 dB		Type: Log-Pwr Iold: 1/100	TRACE 1234 TYPE MWWWW DET PPPP
) dB/div	Ref Offset 10 d Ref 117.00 d	lB IBμV				Mk	r1 2.420 46 GH 80.697 dBµ
og 107							
7.0							
7.0						<b>1</b>	
7.0						r	
7.0							C4 00 40
7.0					$^2 \wedge$	}	
7.0							
7.0							
tart 2.31			#VBW 1	0 Hz		Sweep	Stop 2.45000 GH 0 10.92 s (1001 pt
tart 2.310 Res BW	1.0 MHz	X 2 420 45 CHz	Y	FUNCTION	FUNCTION WIDT		Stop 2.45000 GH 0 10.92 s (1001 pt: CTION VALUE
tart 2.310 Res BW R MODE TRO N 1 2 N 1	1.0 MHz	× 2.420 46 GHz 2.390 00 GHz		FUNCTION	FUNCTION WIDT		o 10.92 s (1001 pt
tart 2.310 Res BW	1.0 MHz	2.420 46 GHz	۲ 80,697 dBu\	FUNCTION	FUNCTION WIDT		o 10.92 s (1001 pt
tart 2.310 Res BW ( R MODE TRO N 1 2 N 1 3 4 5 5 6	1.0 MHz	2.420 46 GHz	۲ 80,697 dBu\	FUNCTION	FUNCTION WIDT		o 10.92 s (1001 pt
tart 2.310 Res BW	1.0 MHz	2.420 46 GHz	۲ 80,697 dBu\	FUNCTION	, FUNCTION WIDT		o 10.92 s (1001 pt
tart 2.31( Res BW MDE TR MDE TR N 1 3 4 5 6 7 7 8	1.0 MHz	2.420 46 GHz	۲ 80,697 dBu\	FUNCTION	FUNCTION WIDT		o 10.92 s (1001 pt

No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2390.0000	49.44	-6.60	56.04	74.00	-17.96	Peak	Horizontal
2	2390.0000	37.68	-6.60	44.28	54.00	-9.72	Average	Horizontal



# Band Edges (CH High)

etector mode: Pe	eak			Polarity	y: Vertica
Agilent Spectrum Analyzer - Swept SA     L   RF   S0 Ω   DC   CORREC     arker 1 2,450300000000 GHz		NT g: Free Run tten: 20 dB	ALIGN OFF Avg Type: Avg Hold:>		10:11:39 PM Dec 25, 20 TRACE 1 2 3 4 5 TYPE DET P P P P
Ref Offset 10 dB dB/div Ref 117.00 dBµV				Mkr1	2.450 30 GH 107.317 dBµ
<b>og</b> 107 07.0	1 				
7.0			have	() <sup>2</sup>	74.00 40,
7.0				nen verten werden der	and and a stand of the second
7.0					
tart 2.43000 GHz Res BW 1.0 MHz	#VBW 3.0	) MHz			Stop 2.50000 GH 000 ms (1001 pt
KR   MODE   TRC   SCL   X     1   N   1   f   2.450 30 GH     2   N   1   f   2.483 50 GH		FUNCTION	FUNCTION WIDTH	FUNCTION	DN VALUE
3 4 5 6					
7 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9					
			STATUS		

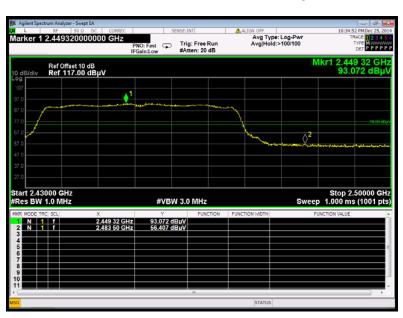
**Detector mode: Average** 

**Polarity: Vertical** 



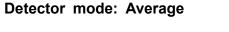
No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2483.5000	57.06	-6.24	63.30	74.00	-10.70	Peak	Vertical
2	2483.5000	45.74	-6.24	51.98	54.00	-2.02	Average	Vertical





#### Detector mode: Peak Pol

#### **Polarity: Horizontal**



## **Polarity: Horizontal**

Agilent Spectrum Analyzer - Swept SA					
arker 1 2.453870000000	PNO: Fast C T	rig: Free Run Atten: 20 dB	ALIGN OFF Avg Type: Log- Avg Hold: 2/100	-Pwr	34:24 PM Dec 25, 201 TRACE 1 2 3 4 5 TYPE MWWWW DET P P P P P
Ref Offset 10 dB	IFGaln:Low #	Atten: 20 dB		Mkr1 2.	453 87 GH
dB/div Ref 117.00 dBµV	/			8	1.898 dBµ\
07					
7.0	<u> </u>				
7.0					
7.0					
7.0					54.00 dB
7.0			$\sim$		
7.0					
7.0					
tart 2.43000 GHz Res BW 1.0 MHz	#VBW 1	0 Hz		Stop Sweep 5.45	o 2.50000 GH 58 s (1001 pts
R MODE TRC SCL X	Y	FUNCTION	FUNCTION WDTH	FUNCTION VAL	JUE
2 N 1 f 2.4	53 87 GHz 81.898 dBu 83 50 GHz 43.577 dBu	v v			
7 B					
0					

No.	Frequency (MHz)	Reading (dBuV)	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Antenna Pole
1	2483.5000	50.17	-6.24	56.41	74.00	-17.59	Peak	Horizontal
2	2483.5000	37.34	-6.24	43.58	54.00	-10.42	Average	Horizontal



# 7.6. PEAK POWER SPECTRAL DENSITY MEASUREMENT

## 7.6.1. LIMITS

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

According to §15.247(f), the digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

#### 7.6.2. TEST INSTRUMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Calibration Due
Spectrum Analyzer	ROHDE&SCHWARZ	FSU	200409	09/23/2013	09/22/2014

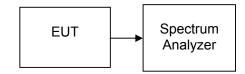
#### 7.6.3. TEST PROCEDURES (please refer to measurement standard)

§15.247(e)specifies a conducted power spectral density (PSD) limit of 8 dBm in any 3 kHz band segment within the fundamental EBW during any time interval of continuous transmission. The same method as used to determine the conducted output power shall be used to determine the power spectral density (i.e.,if peak-detected fundamental power was measured then use the peak PSD procedure and if average fundamental power was measured then use the average PSD procedure).

## 10.2 Method PKPSD (peak PSD)

- 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  $\leq$  RBW  $\leq$  100 kHz.
- 4. Set the VBW  $\geq$  3 x 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.

## 7.6.4. TEST SETUP





## 7.6.5. TEST RESULTS

No non-compliance noted

#### <u>Test Data</u>

#### Test mode: IEEE 802.11b (Antenna 1)

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Test Result
Low	2412	-5.39		PASS
Mid	2437	-3.97	8	PASS
High	2462	-6.89		PASS

## Test mode: IEEE 802.11g (Antenna 1)

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Test Result
Low	2412	-10.38		PASS
Mid	2437	-8.43	8	PASS
High	2462	-11.63		PASS

## Test mode: IEEE 802.11n HT20 MHz (Combine with Antenna 1 and Antenna 2)

Channel	Frequency (MHz)	PPSD (dBm)		PPSD Total (dBm)	Limit (W)	Result
		Antenna 1	Antenna 2	(ubiii)	(•••)	
Low	2412	-12.94	-12.71	-9.81		PASS
Mid	2437	-8.30	-8.91	-5.58	8	PASS
High	2462	-13.57	-13.11	-10.32		PASS

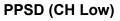
#### Test mode: IEEE 802.11n HT40 MHz (Combine with Antenna 1 and Antenna 2)

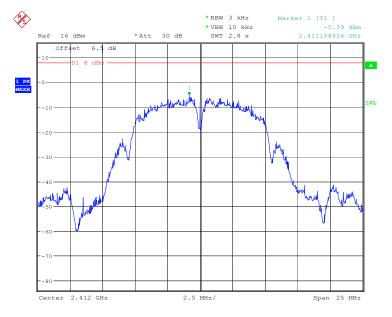
Channel	Frequency (MHz)	PPSD (dBm)		PPSD Total	Limit	Result
		Antenna 1	Antenna 2	(dBm)	(W)	Rooun
Low	2422	-17.82	-20.13	-15.81		PASS
Mid	2437	-13.47	-12.03	-9.68	8	PASS
High	2452	-19.39	-20.63	-16.96		PASS



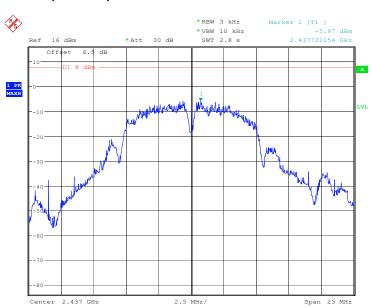
#### <u>Test Plot</u>

IEEE 802.11b (Antenna 1)mode





Date: 28.SEP.2013 09:22:00

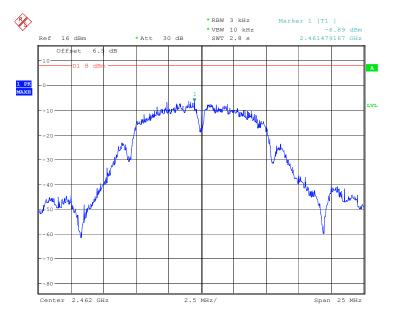


PPSD (CH Mid)

Date: 28.SEP.2013 09:23:48

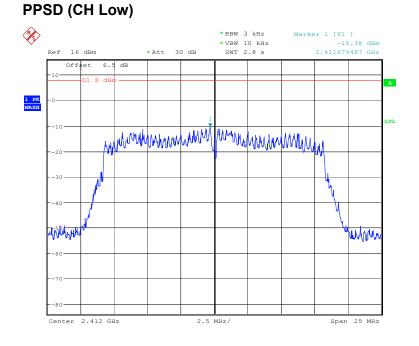


PPSD (CH High)



Date: 28.SEP.2013 09:23:06

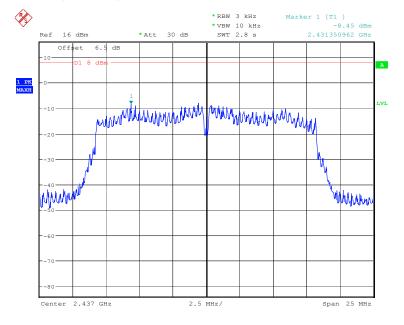
# IEEE 802.11g (Antenna 1)mode



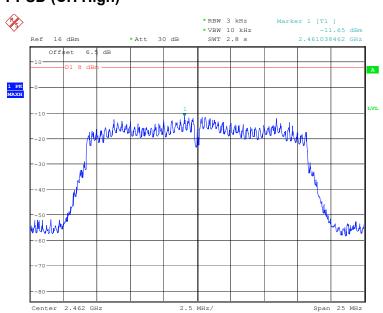
Date: 28.SEP.2013 09:19:18



PPSD (CH Mid)



Date: 28.SEP.2013 09:20:50

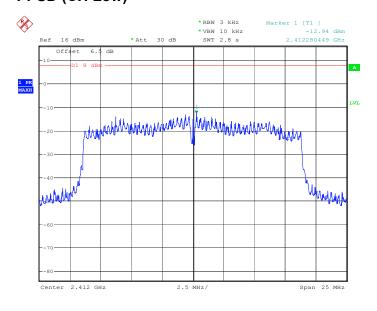


PPSD (CH High)

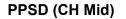
Date: 28.SEP.2013 09:20:05

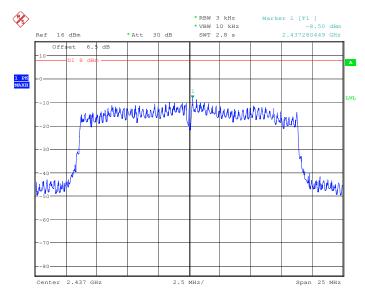


IEEE 802.11n HT20 MHz( Antenna 1)mode PPSD (CH Low)



Date: 28.SEP.2013 09:36:40

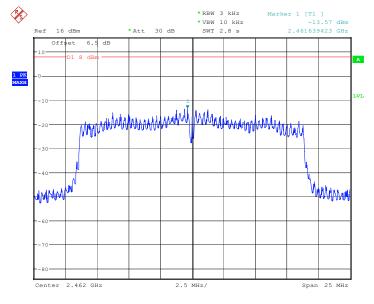




Date: 28.SEP.2013 09:25:18

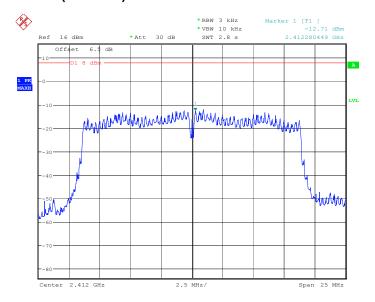


**PPSD (CH High)** 



Date: 28.SEP.2013 09:27:19

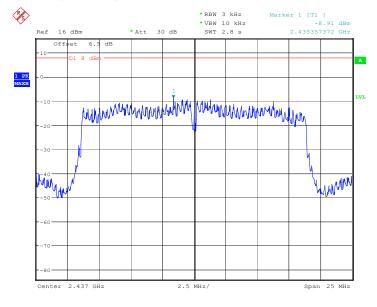
# IEEE 802.11n HT20 MHz(Antenna 2)mode PPSD (CH Low)



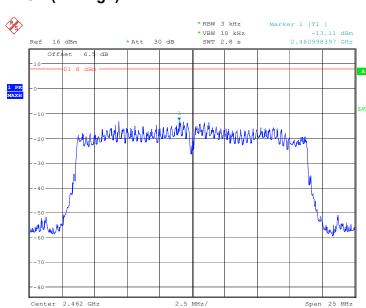
Date: 28.SEP.2013 09:42:01

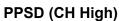


PPSD (CH Mid)



Date: 28.SEP.2013 09:44:06

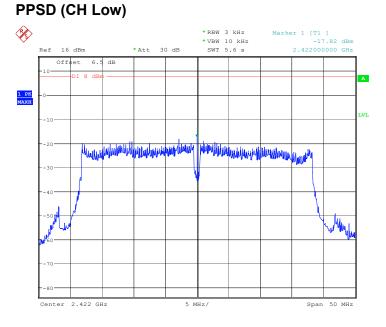




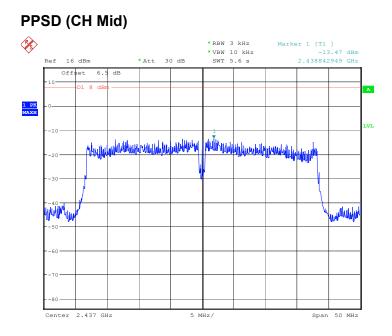
Date: 28.SEP.2013 09:42:56







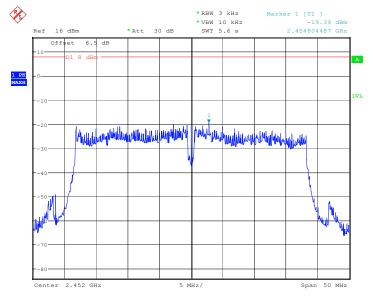
Date: 28.SEP.2013 09:34:08



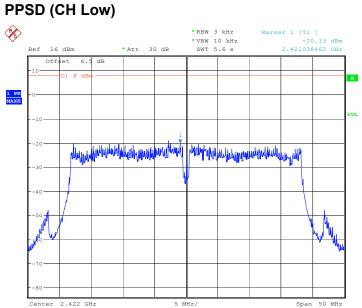
Date: 28.SEP.2013 09:31:57



**PPSD (CH High)** 



Date: 28.SEP.2013 09:34:52

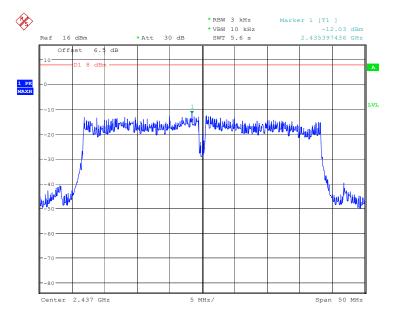


IEEE 802.11n HT40 MHz (Antenna 2)mode

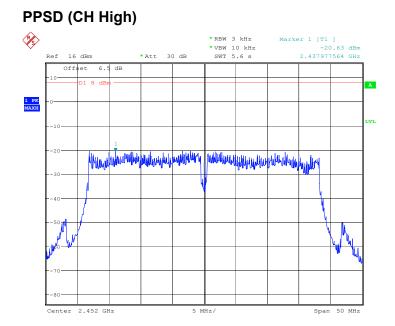
Date: 28.SEP.2013 09:47:32



PPSD (CH Mid)



Date: 28.SEP.2013 09:46:05



Date: 28.SEP.2013 09:48:07