

6. BANDWIDTH TEST

6.1. Limits

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

6.2. Test Procedure

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies Associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Test data:

Antenna 1

	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
802.11b	2412	10.11	>0.5	Pass
	2437	10.10	>0.5	Pass
	2462	10.10	>0.5	Pass
802.11g	2412	16.63	>0.5	Pass
	2437	16.62	>0.5	Pass
	2462	16.63	>0.5	Pass
802.11n (HT20)	2412	17.85	>0.5	Pass
	2437	17.85	>0.5	Pass
	2462	17.86	>0.5	Pass
802.11n (HT40)	2422	36.47	>0.5	Pass
	2437	36.48	>0.5	Pass
	2452	36.49	>0.5	Pass

Antenna 2

	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
802.11b	2412	9.60	>0.5	Pass
	2437	9.15	>0.5	Pass
	2462	10.07	>0.5	Pass
802.11g	2412	15.15	>0.5	Pass
	2437	15.15	>0.5	Pass
	2462	15.15	>0.5	Pass
802.11n (HT20)	2412	15.15	>0.5	Pass
	2437	15.15	>0.5	Pass
	2462	15.15	>0.5	Pass
802.11n (HT40)	2422	35.04	>0.5	Pass
	2437	35.05	>0.5	Pass
	2452	35.06	>0.5	Pass

Test plot as follows:

Antenna 1

802.11b 2412MHz



802.11g 2412MHz



802.11b 2437MHz



802.11g 2437MHz



802.11b 2462MHz



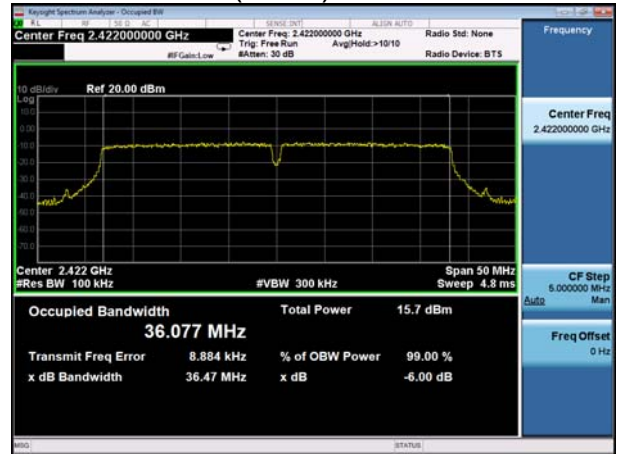
802.11g 2462MHz



802.11n (HT20) 2412MHz



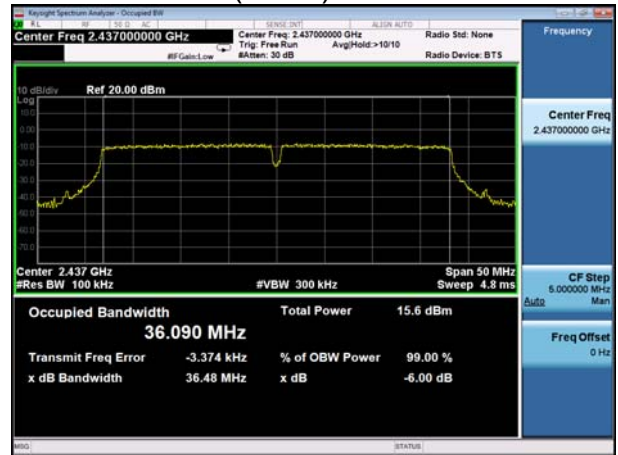
802.11n (HT40) 2422MHz



802.11n (HT20) 2437MHz



802.11n (HT40) 2437MHz



802.11n(HT20) 2462MHz



802.11n (HT40)2452MHz



Antenna 2

802.11b 2412MHz



802.11g 2412MHz



802.11b 2437MHz



802.11g 2437MHz



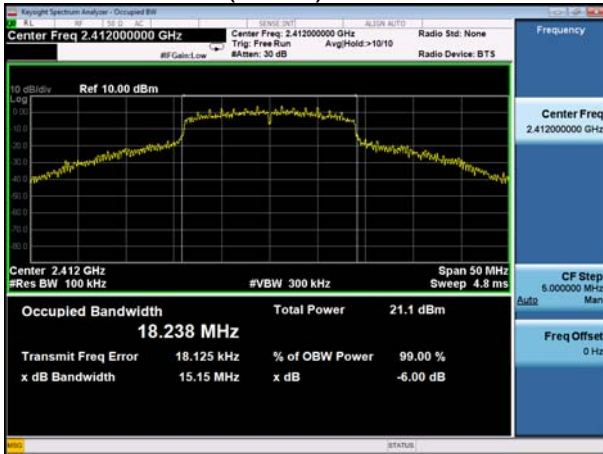
802.11b 2462MHz



802.11g 2462MHz



802.11n (HT20) 2412MHz



802.11n (HT40) 2422MHz



802.11n (HT20) 2437MHz



802.11n (HT40) 2437MHz



802.11n(HT20) 2462MHz



802.11n (HT40)2452MHz



7. OUTPUT POWER TEST

7.1. Limits

For systems using digital modulation in the 2400~2483.5MHz, The output power shall not exceed 1W (30dBm)

7.2. Test setup

1. The Transmitter output (antenna port) was connected to the power meter.
2. Turn on the EUT and power meter and then record the power value.
3. Repeat above procedures on all channels needed to be tested.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.



7.3. Test result

Test Channel	Frequency (MHz)	Maximum Conducted Output Power		Total power (dBm)	Limit (dBm)
		(dBm)			
		Ant 1	Ant 2		
TX 802.11b Mode					
CH01	2412	12.09	11.78	-	30.00
CH06	2437	12.13	11.91	-	30.00
CH11	2462	12.18	11.86	-	30.00
TX 802.11g Mode					
CH01	2412	10.35	10.29	-	30.00
CH06	2437	10.42	10.47	-	30.00
CH11	2462	10.39	10.38	-	30.00
TX 802.11n(20) Mode					
CH01	2412	9.37	9.12	12.26	29.96
CH06	2437	9.25	9.23	12.25	29.96
CH11	2462	9.38	9.41	12.41	29.96
TX 802.11n(40) Mode					
CH01	2422	8.29	8.37	11.34	29.96
CH06	2437	8.27	8.32	11.31	29.96
CH11	2452	8.35	8.28	11.33	29.96

Note:

1. In 802.11b and 802.11g mode, the ANT 1 and ANT 2 can't TX and RX at the same time;
2. 802.11n(20), 802.11n(40) mode the ANT A and ANT B can TX and RX at the same time;
3. Directional gain=GANT +10log(N)dbi =3.03+10log2=6.04dbi;
4. For power test the duty cycle is 100% in continuous transmitting mode;
5. TX means Transmit, RX means Receive.

8. DUTY CYCLE

8.1. Test Procedure

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set $RBW \geq OBW$ if possible; otherwise, set RBW to the largest available value. Set $VBW \geq RBW$. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are $> 50/T$ and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if $T \leq 16.7$ microseconds.)

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT was operating in controlled its channel.

Use the following spectrum analyzer settings:

Span = Zero Span

RBW = 8MHz

VBW = 50MHz

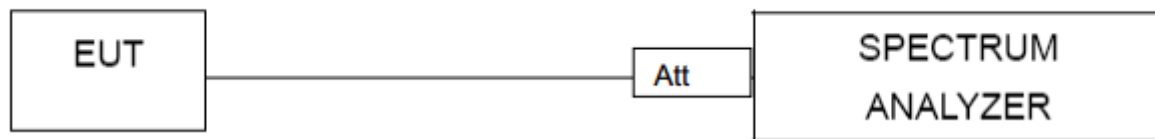
Number of points in Sweep > 100

Detector function = peak

Trace = Clear write Measure T_{total} and T_{on}

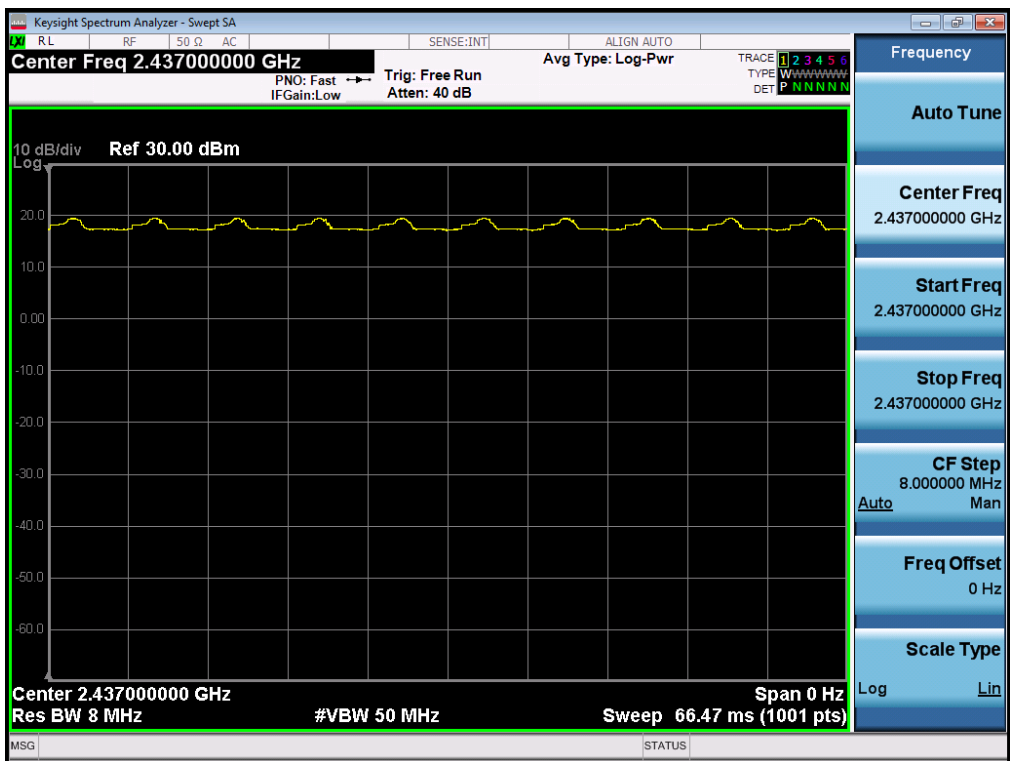
Calculate Duty Cycle = T_{on} / T_{total} and Duty Cycle Factor = $10 \cdot \log(1/\text{Duty Cycle})$

8.2. Test Setup

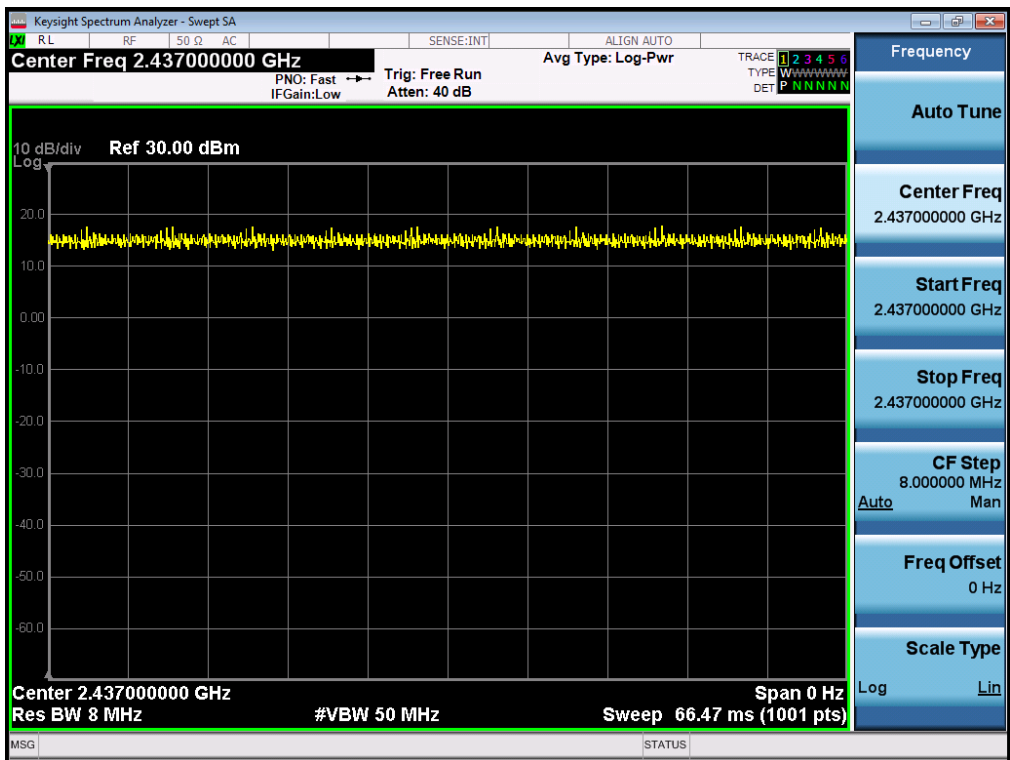


Antenna 1:

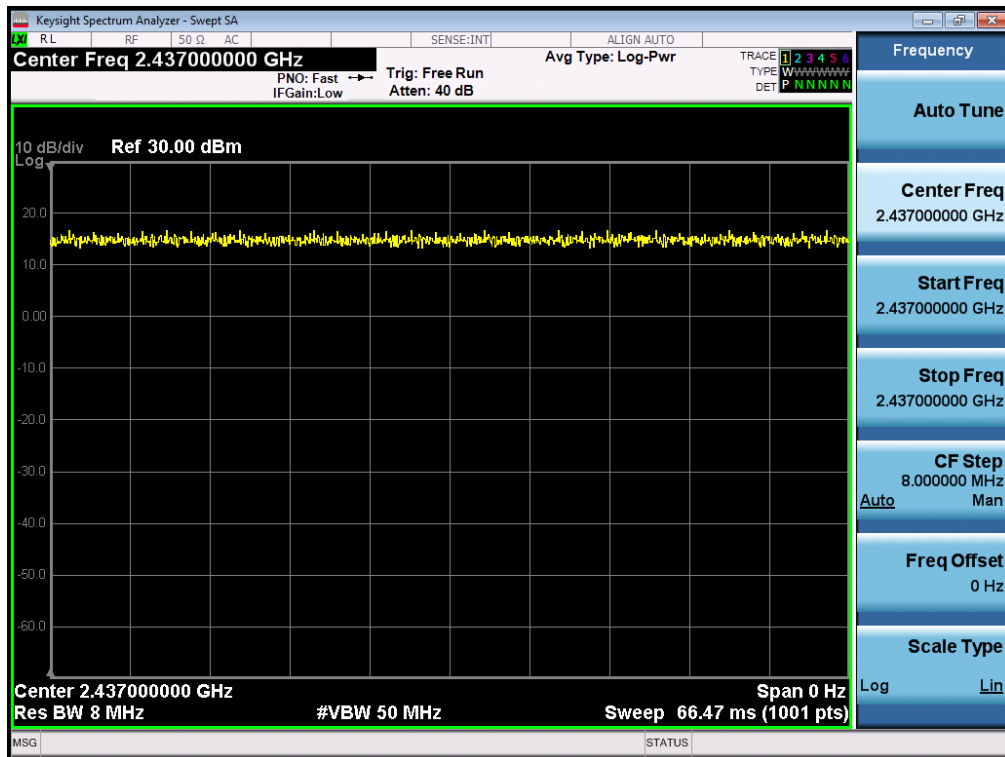
Test plot of Duty Cycle for 802.11b



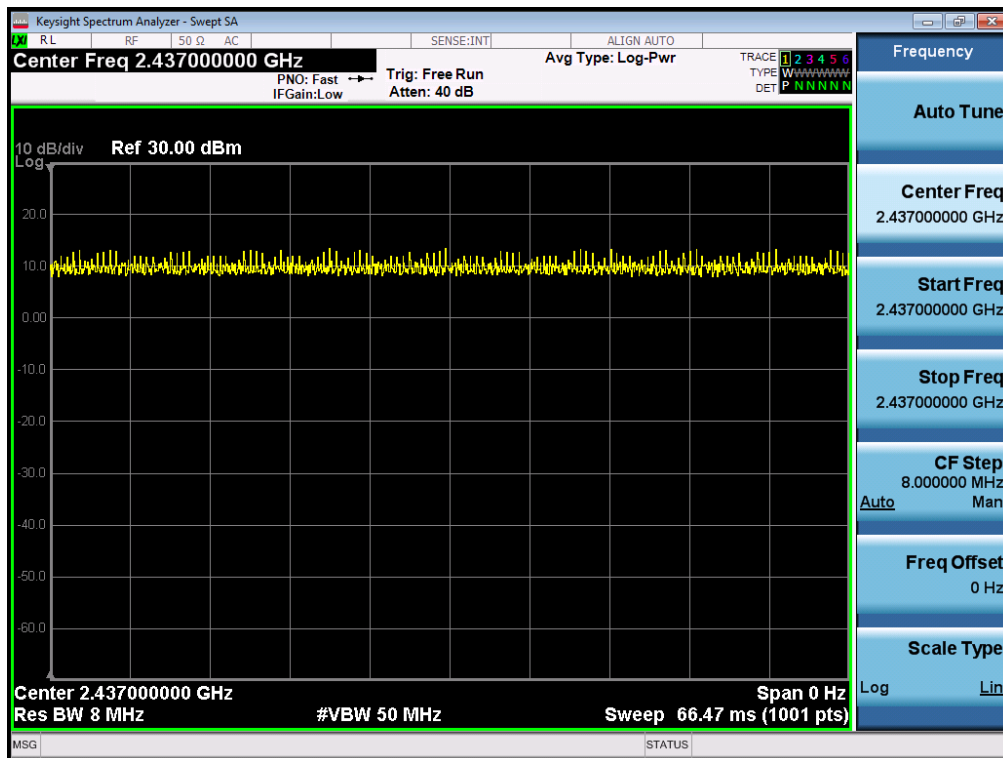
Test plot of Duty Cycle for 802.11g



Test plot of Duty Cycle for 802.11n(HT20)

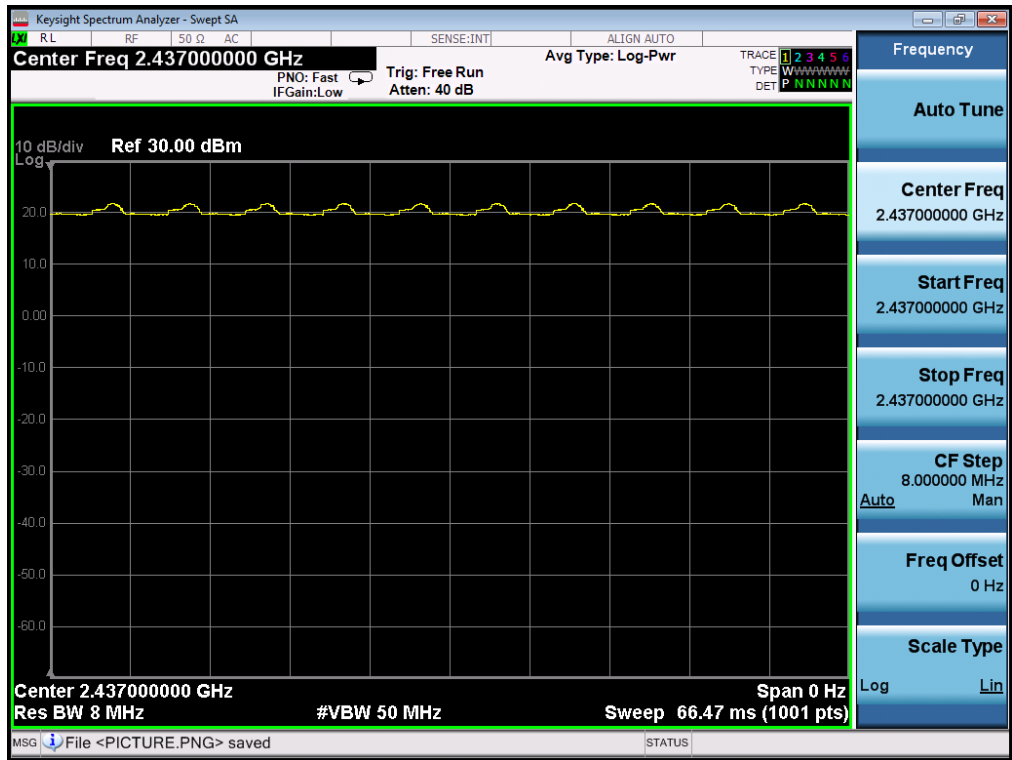


Test plot of Duty Cycle for 802.11n(HT40)

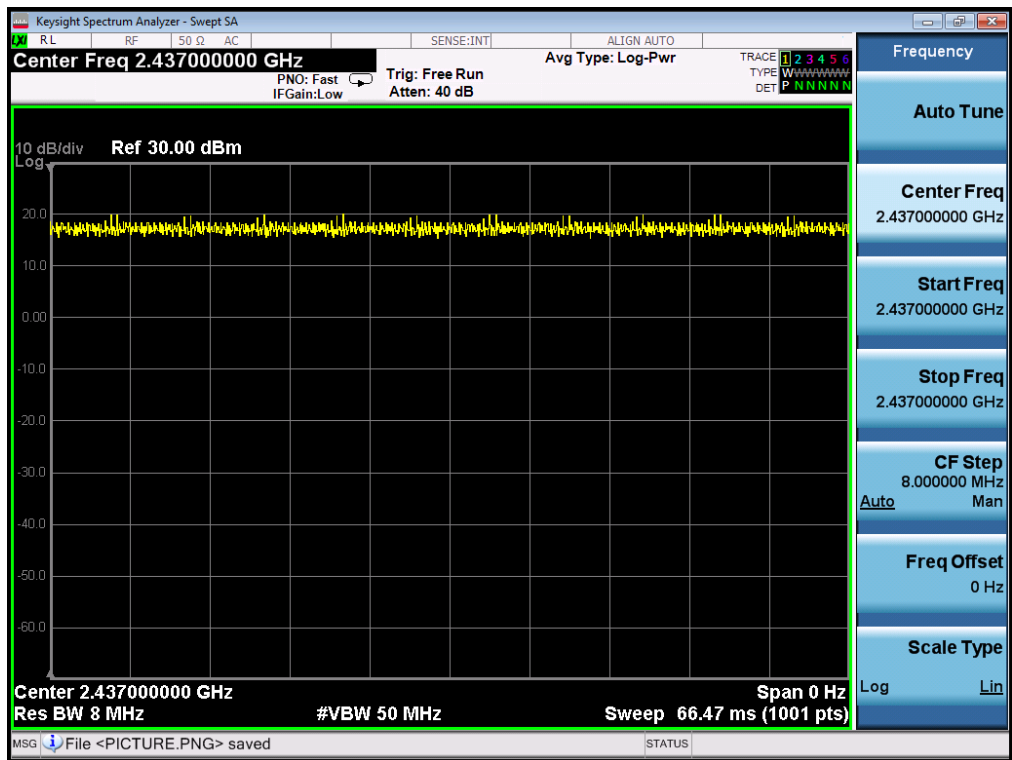


Antenna 2:

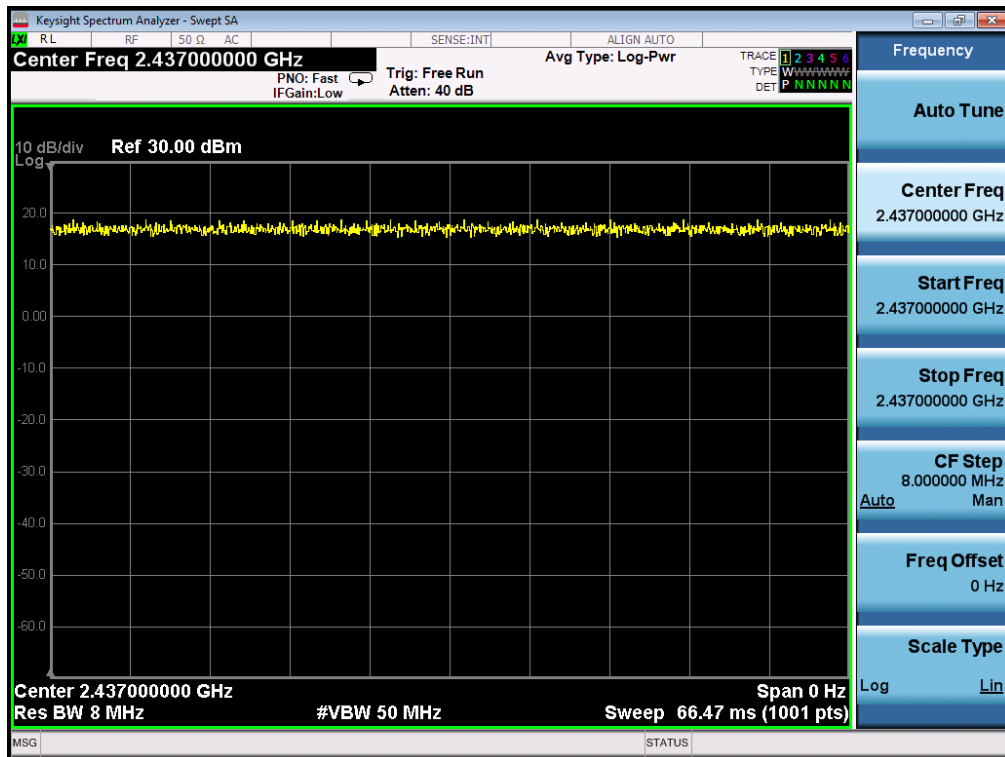
Test plot of Duty Cycle for 802.11b



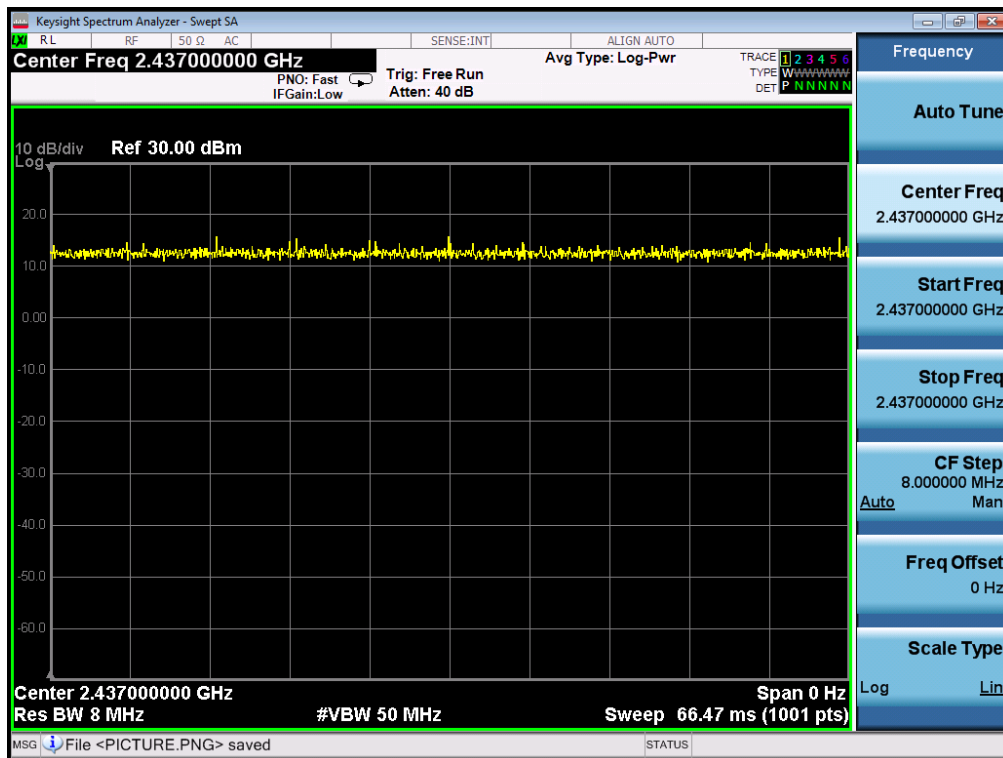
Test plot of Duty Cycle for 802.11g



Test plot of Duty Cycle for 802.11n(HT20)



Test plot of Duty Cycle for 802.11n(HT40)



9. POWER SPECTRAL DENSITY TEST

9.1. 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 3kHz band during any time interval of continuous transmission.

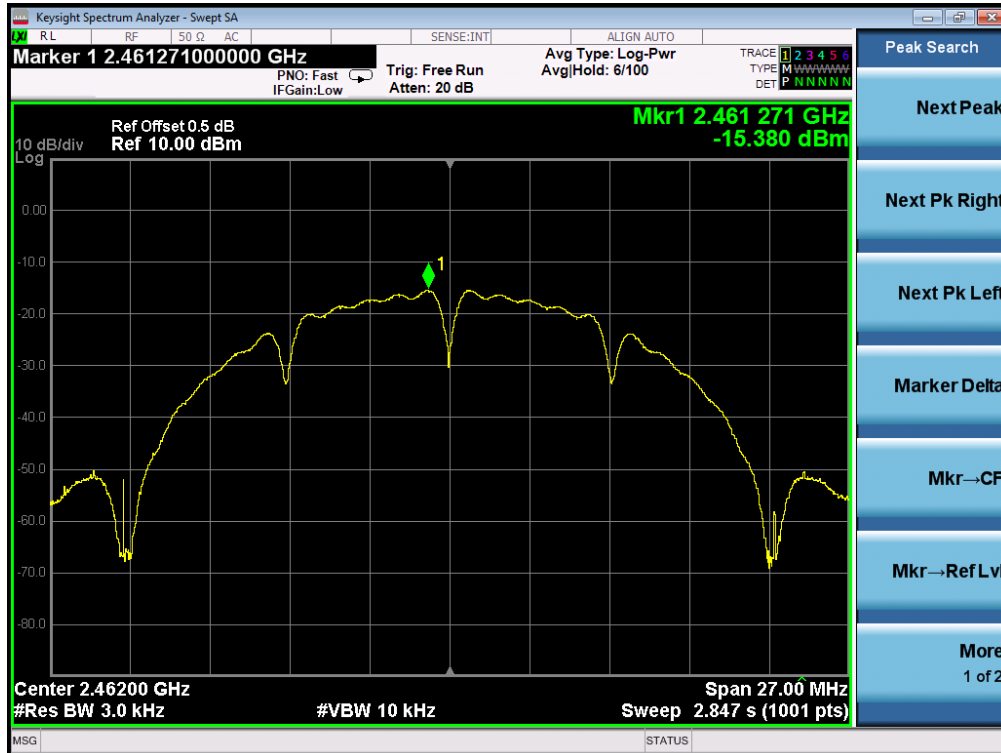
9.2. Test setup

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: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
4. Set the VBW $\geq 3 \text{ RBW}$.
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.

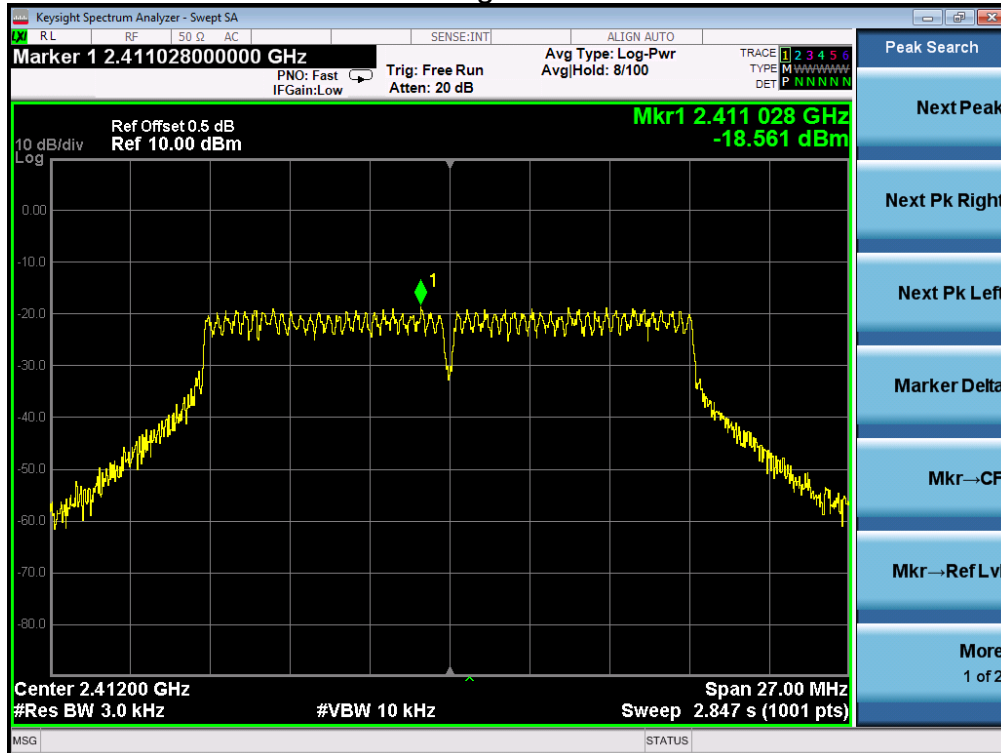
9.3. Test result

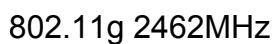
	Channel Frequency (MHz)	Power density (dBm/3kHz)		Total PSD	Limit (dBm/3kHz)	Result
		Ant 1	Ant 2			
802.11b	2412	-15.463	-13.235	-	8	Pass
	2437	-15.244	-13.063	-	8	Pass
	2462	-15.380	-13.301	-	8	Pass
802.11g	2412	-18.561	-16.055	-	8	Pass
	2437	-18.133	-15.956	-	8	Pass
	2462	-18.395	-15.962	-	8	Pass
802.11n (HT20)	2412	-18.165	-15.587	-13.68	7.96	Pass
	2437	-17.516	-15.570	-13.44	7.96	Pass
	2462	-17.544	-15.374	-13.32	7.96	Pass
802.11n (HT40)	2422	-20.927	-18.387	-16.46	7.96	Pass
	2437	-21.243	-19.380	-17.20	7.96	Pass
	2452	-21.135	-18.334	-16.50	7.96	Pass

802.11b 2462MHz

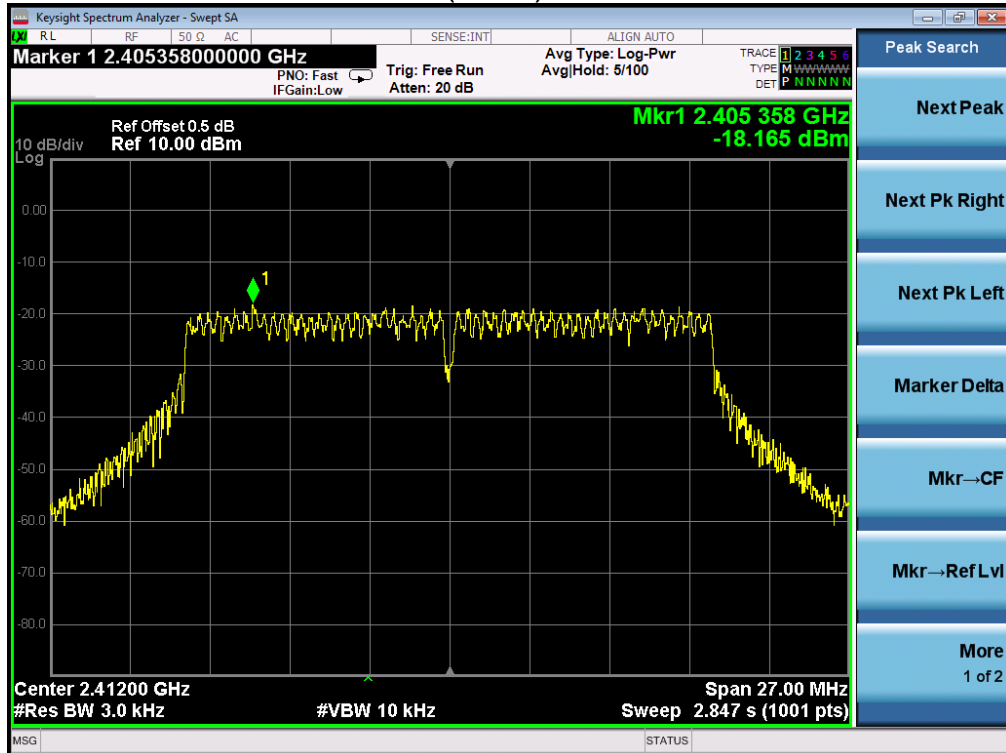


802.11g 2412MHz

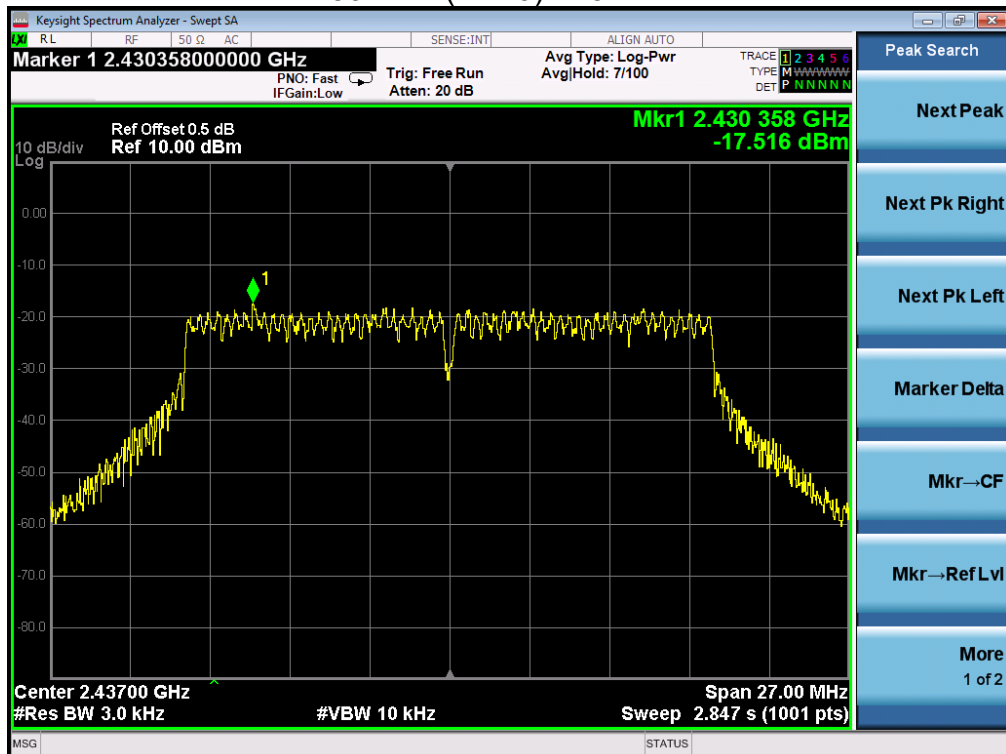




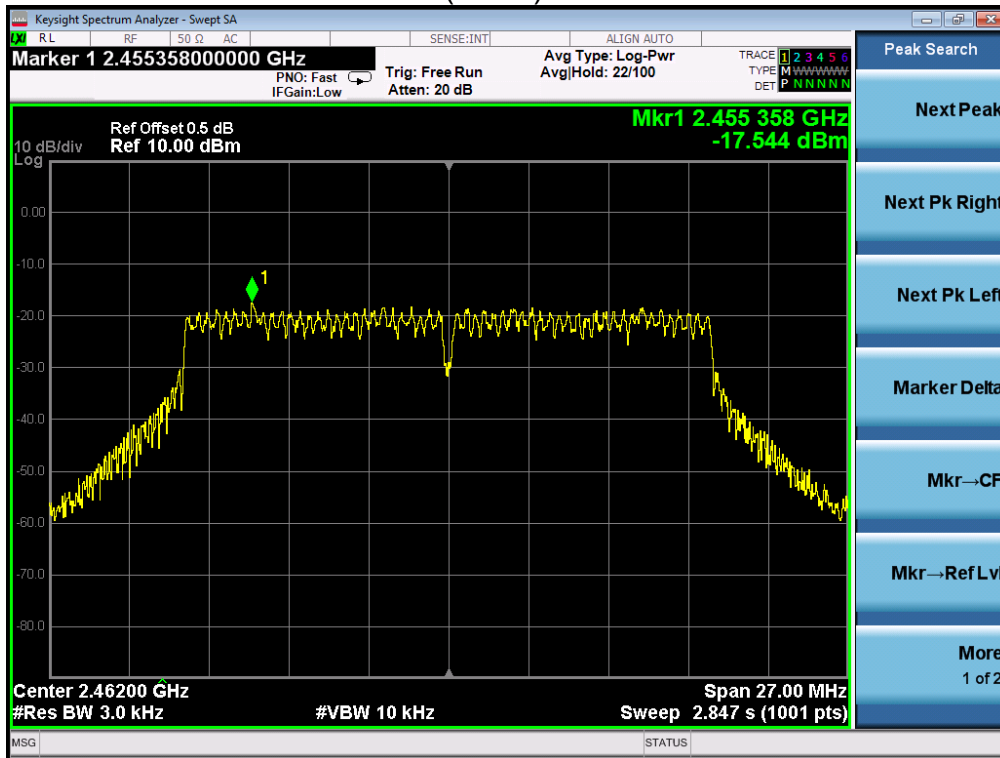
802.11n(HT20) 2412MHz



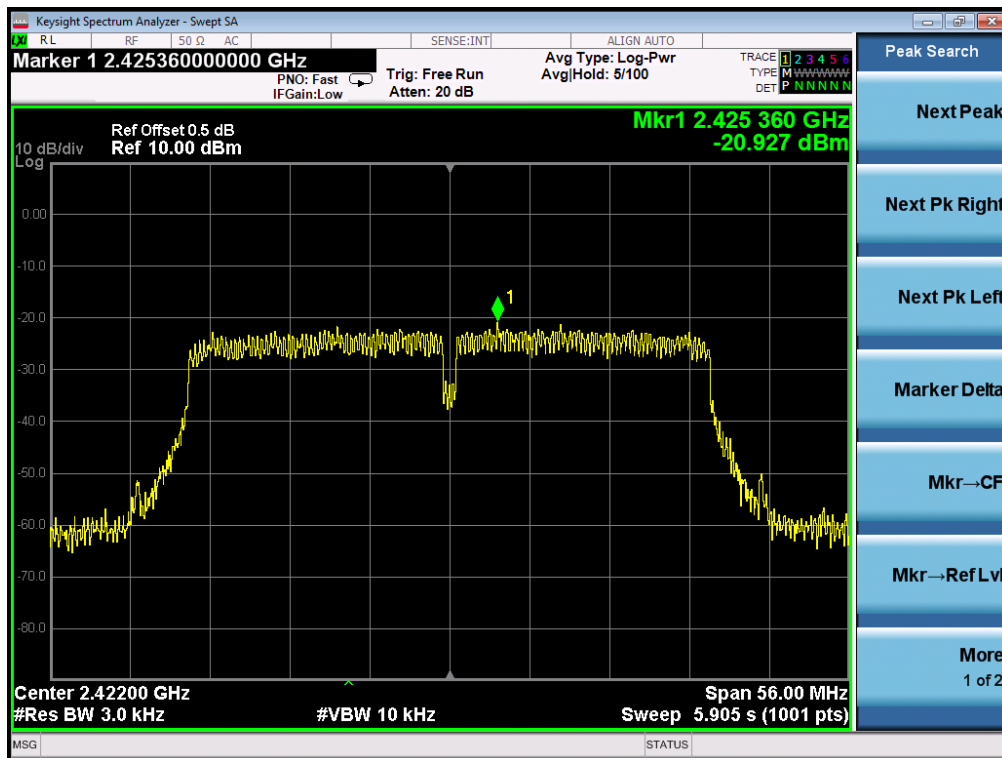
802.11n(HT20) 2437MHz



802.11n(HT20) 2462MHz



802.11n(HT40) 2422MHz



Antenna 2:

802.11b 2412MHz



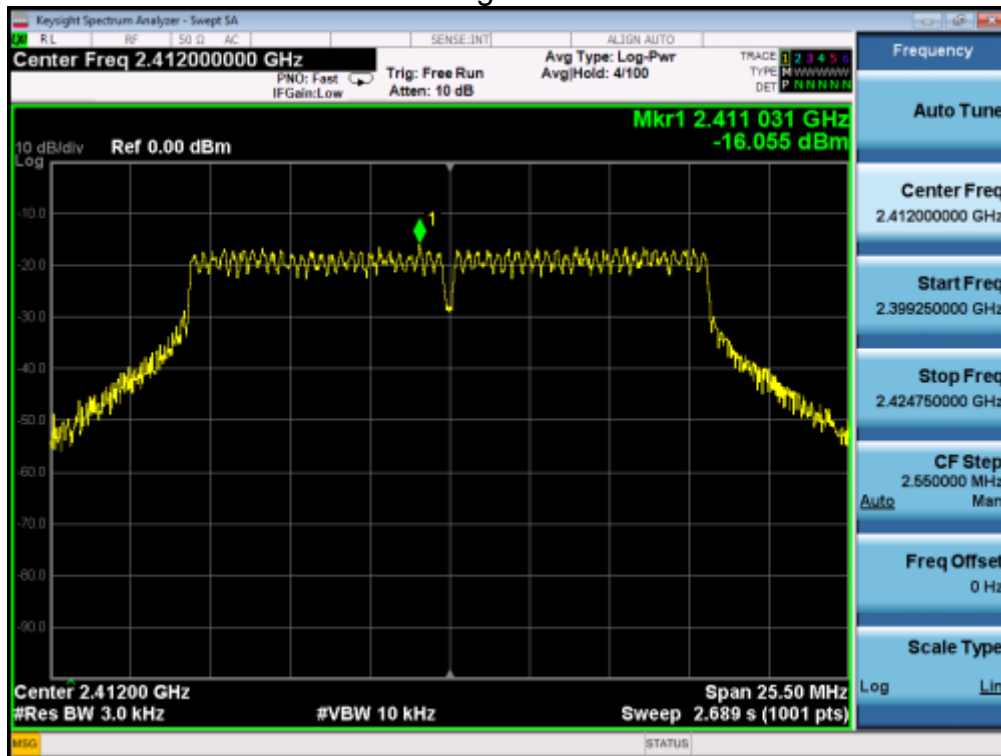
802.11b 2437MHz



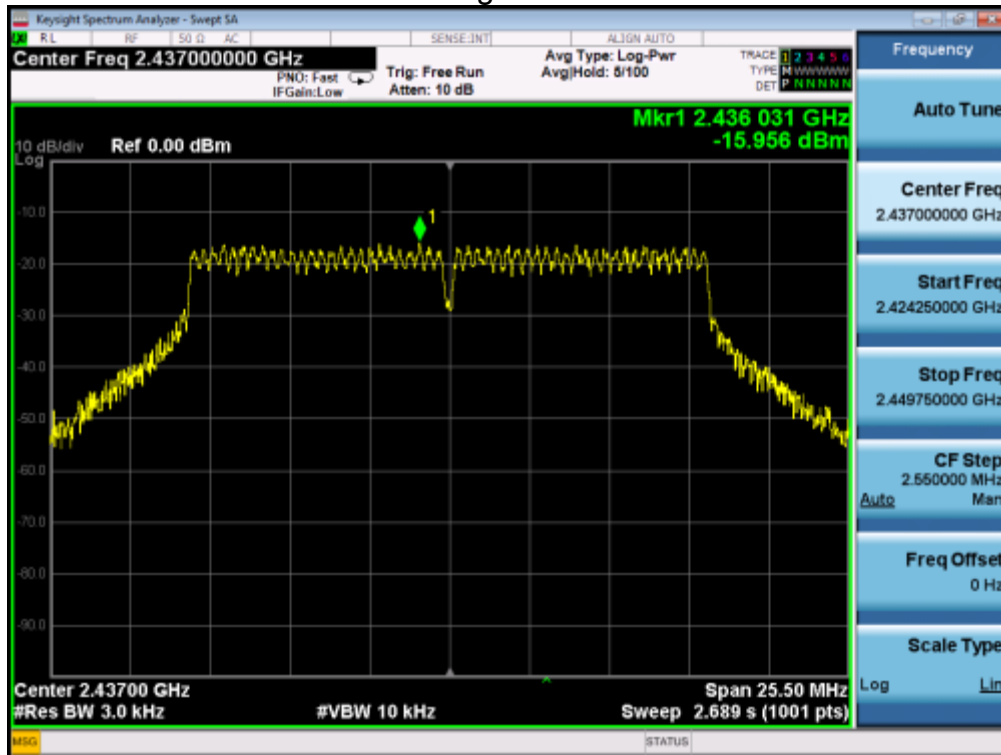
802.11b 2462MHz



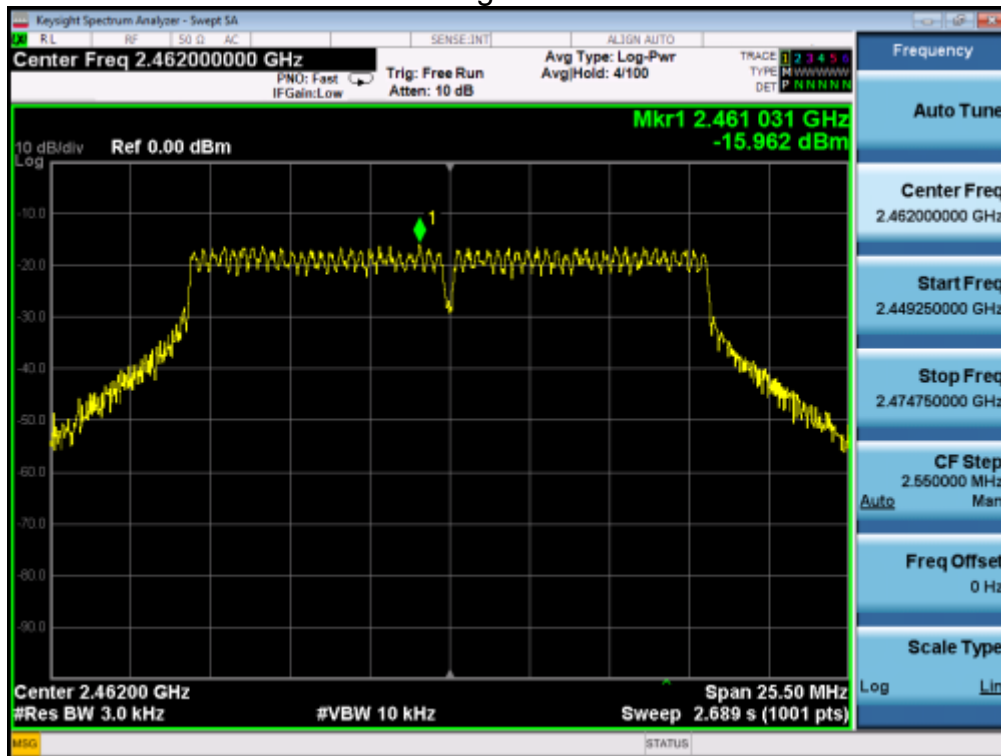
802.11g 2412MHz



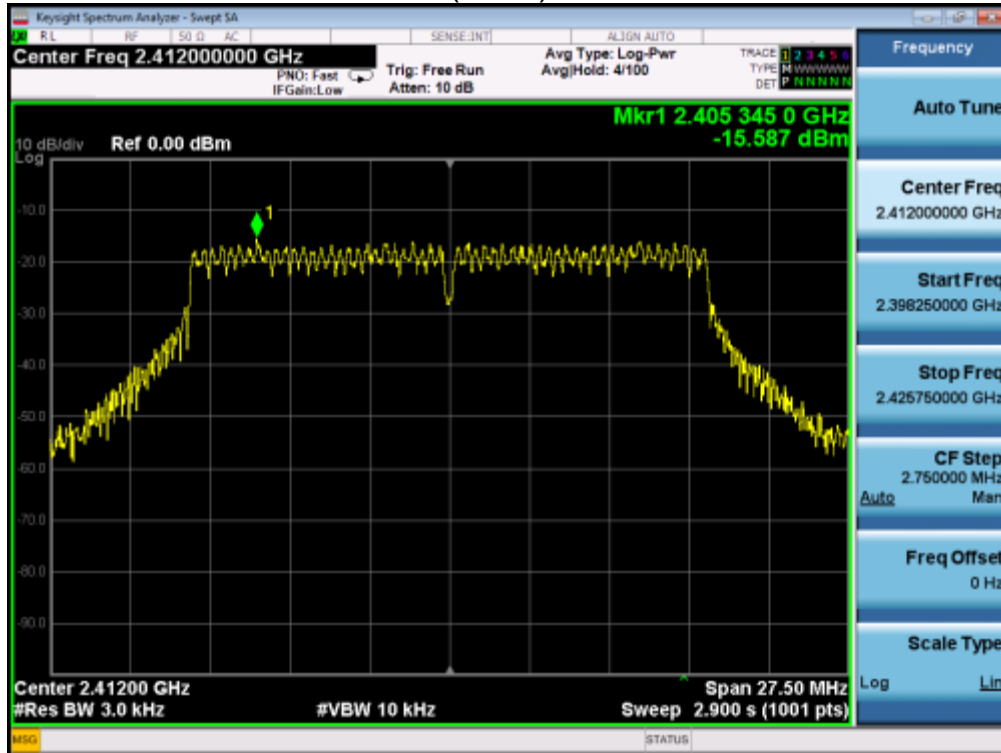
802.11g 2437MHz



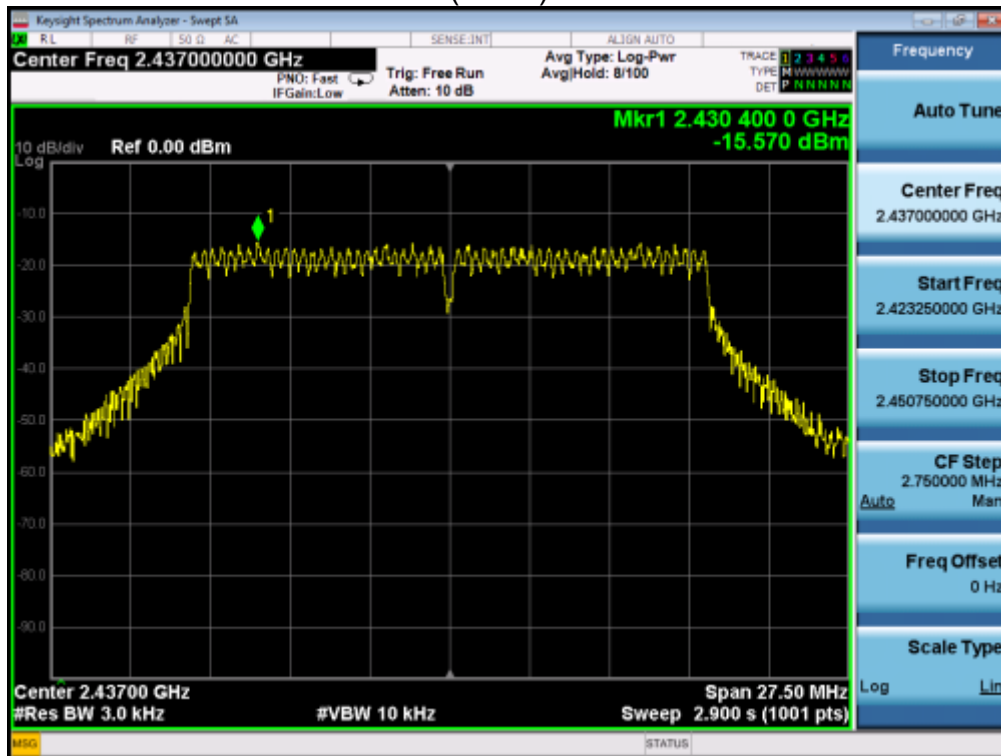
802.11g 2462MHz



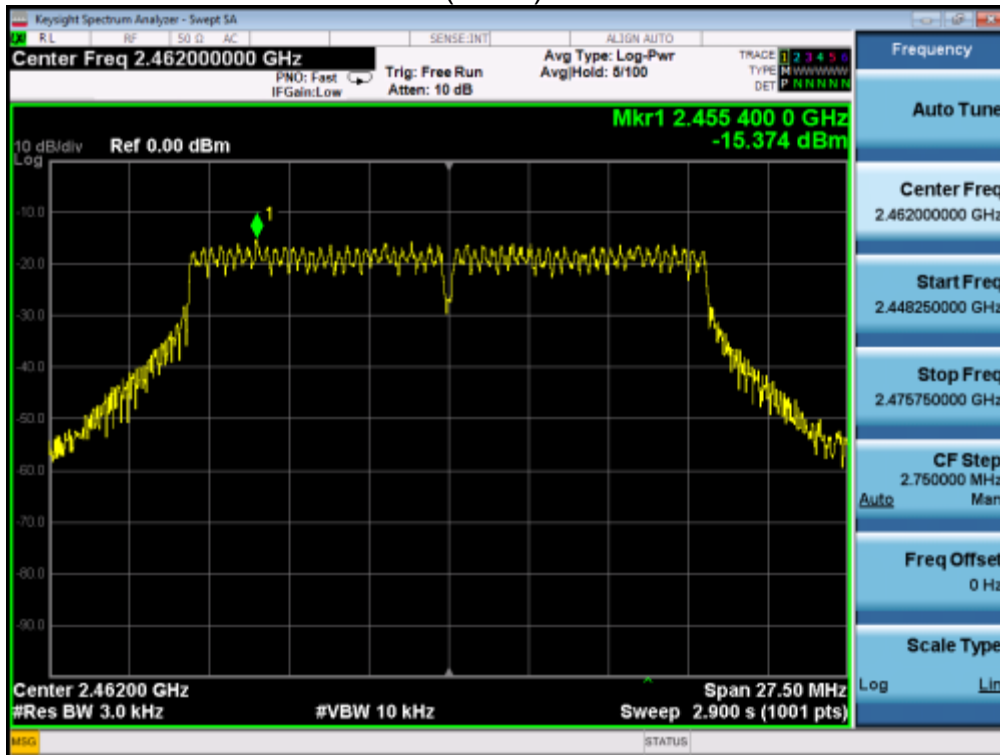
802.11n (HT20) 2412MHz



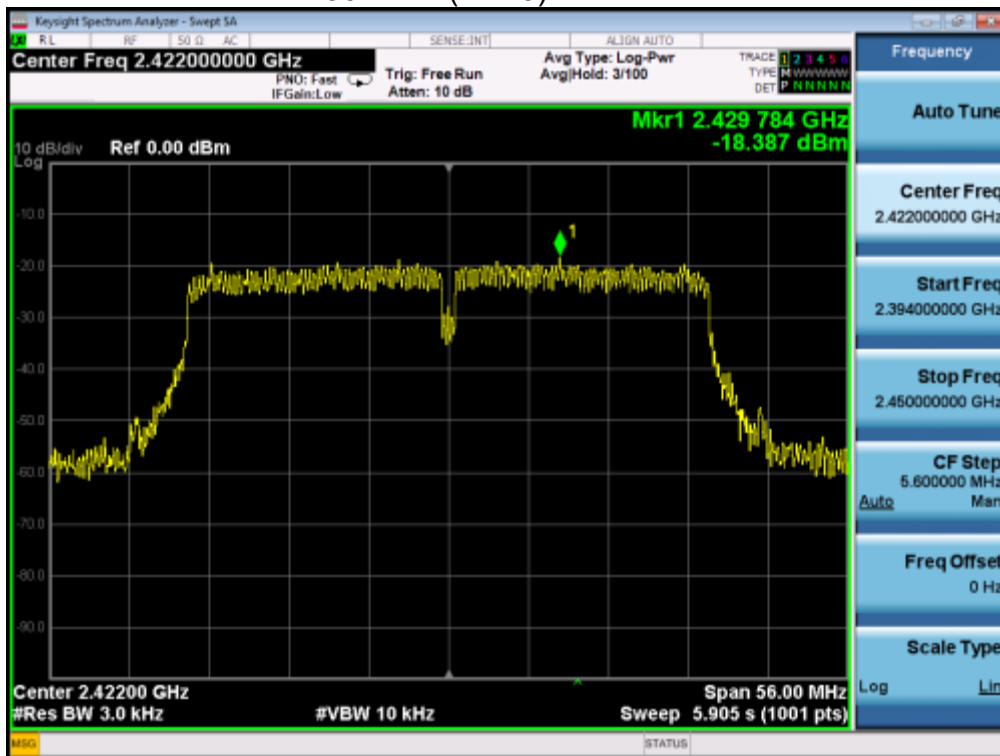
802.11n (HT20) 2437MHz



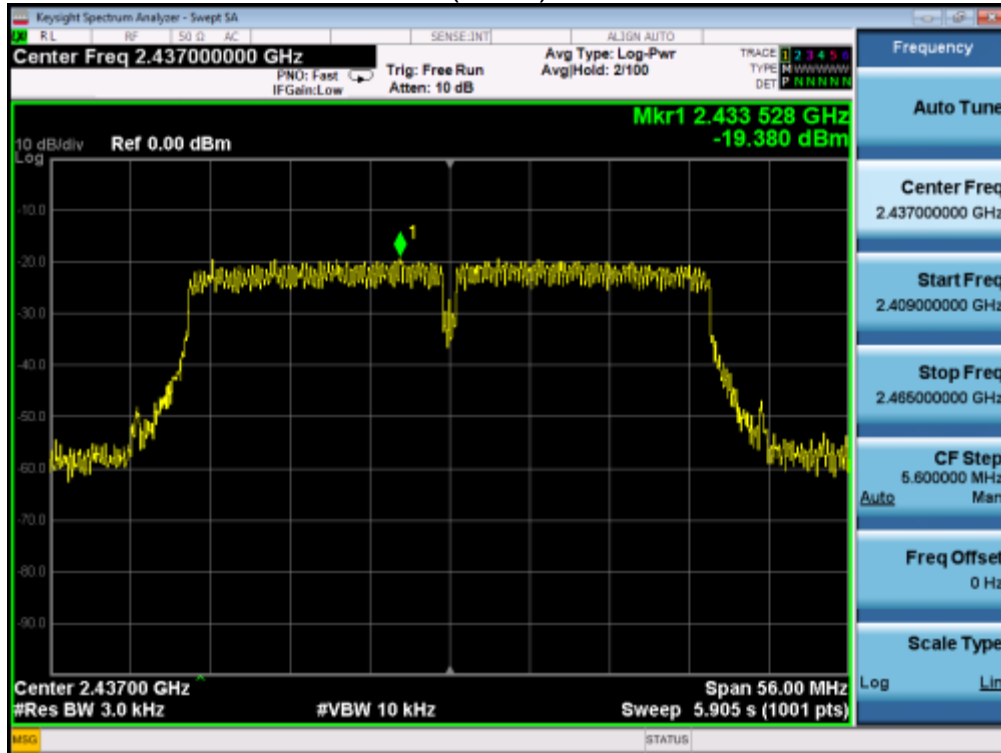
802.11n(HT20) 2462MHz



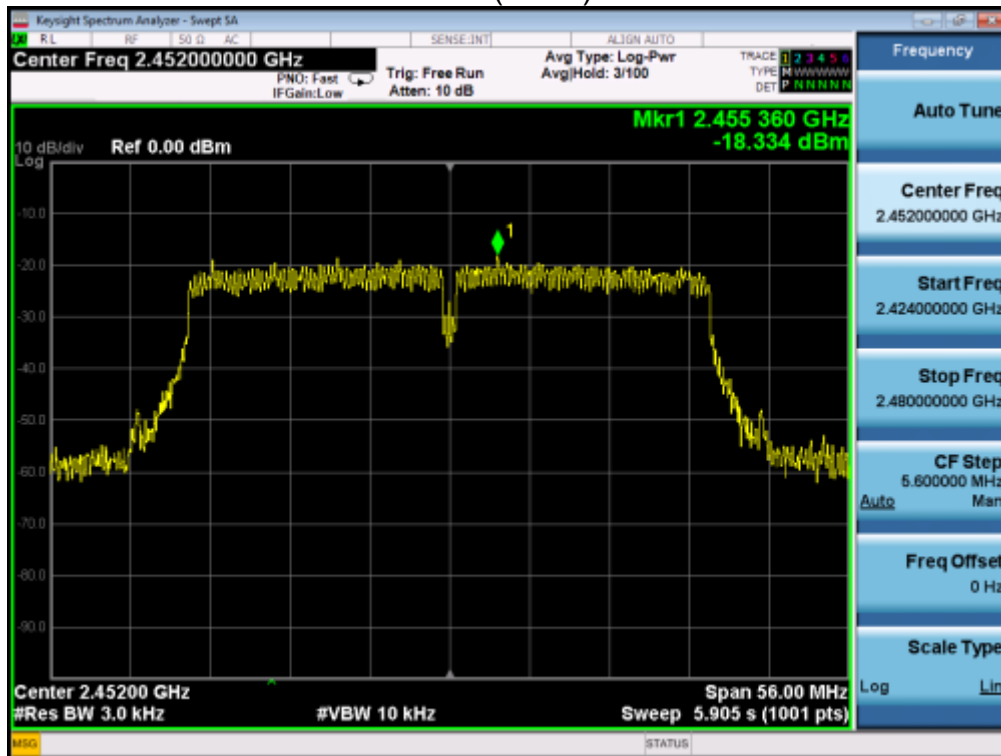
802.11n (HT40) 2422MHz



802.11n (HT40) 2437MHz



802.11n(HT40) 2452MHz



10. ANTENNA REQUIREMENTS

10.1. Limits

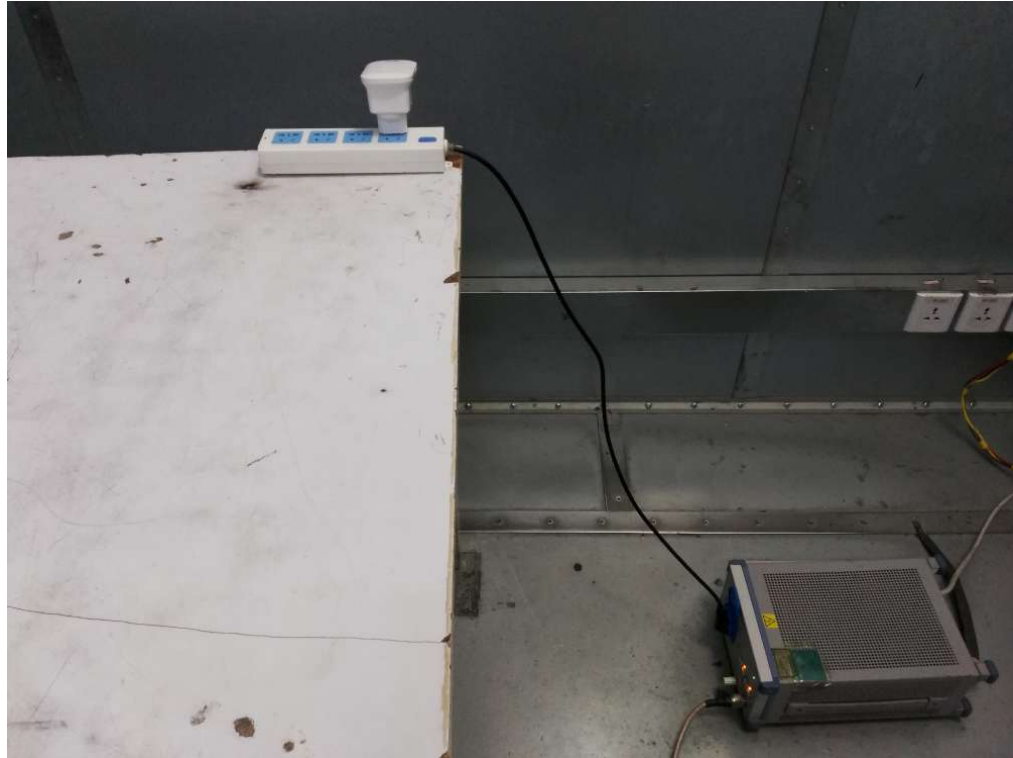
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional 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.

10.2. Result

The antennas used for this product is PIFA 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 3.03 dBi.

11. PHOTOGRAPHS OF TEST SET-UP

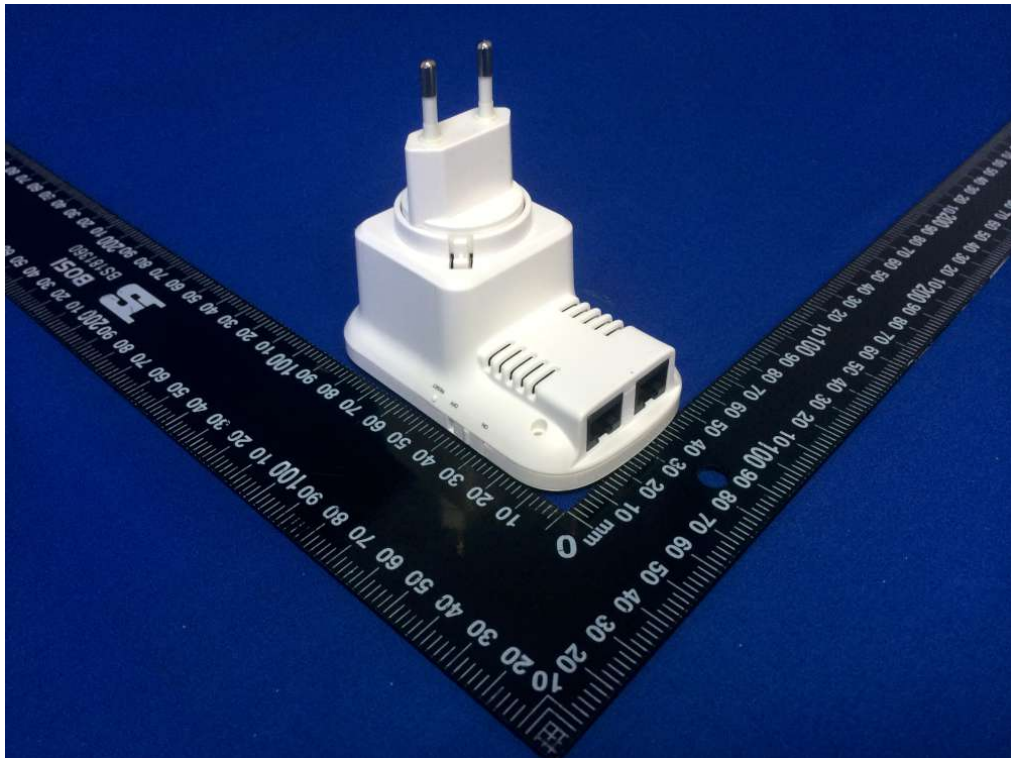
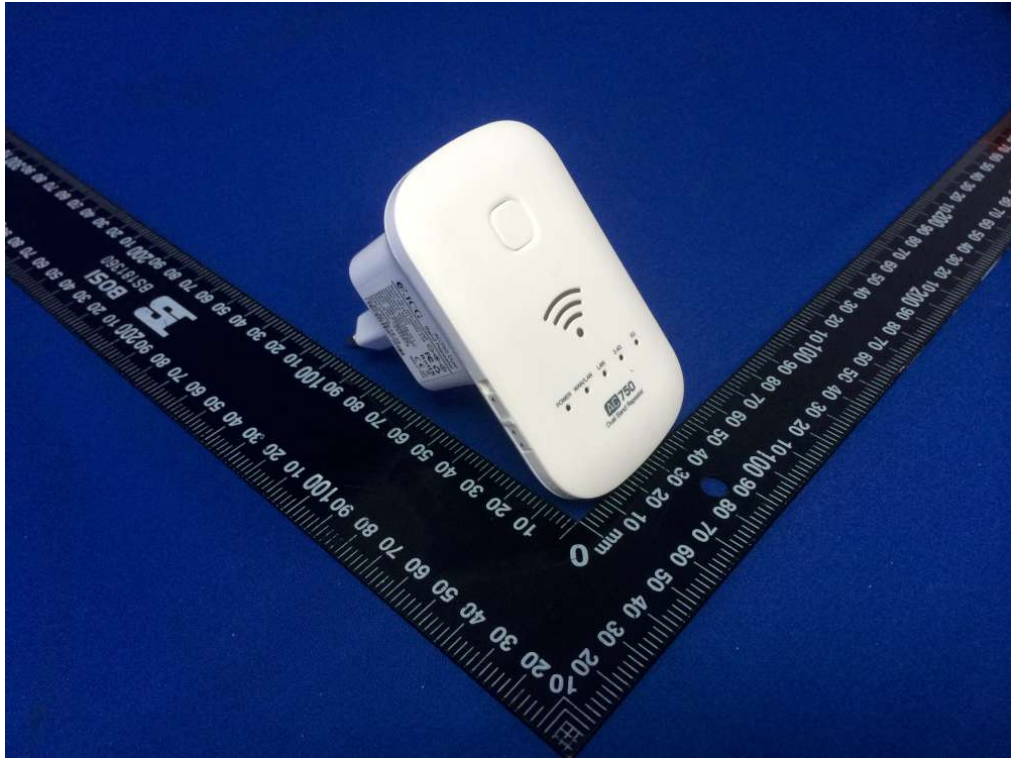
Conducted Emission



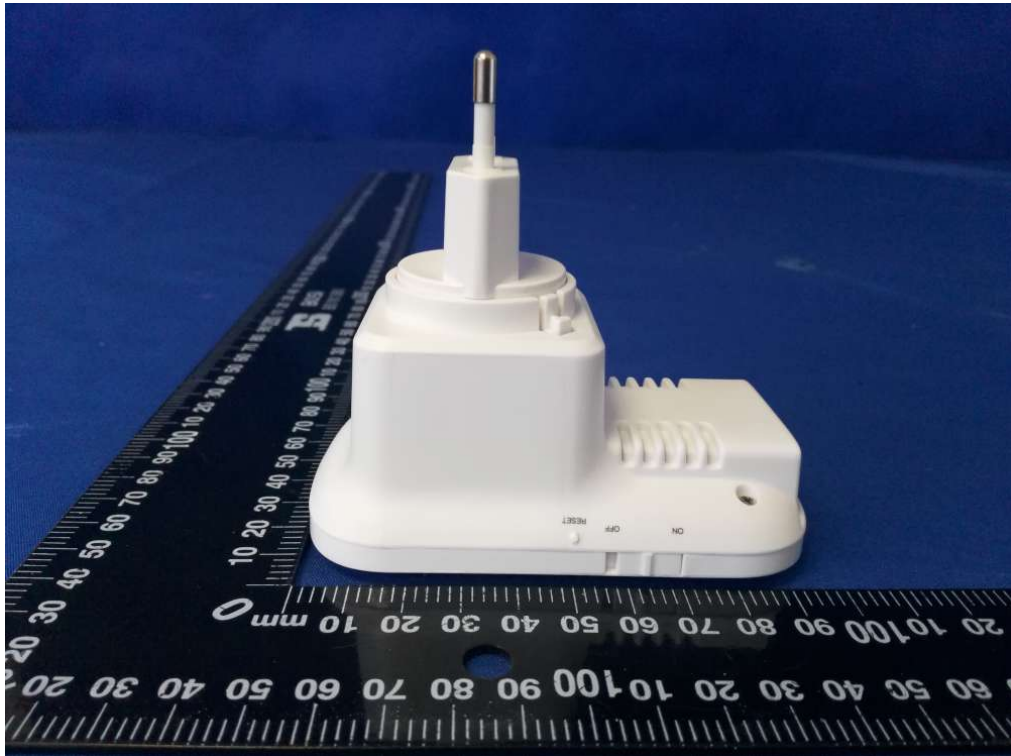
Radiated Emission Test



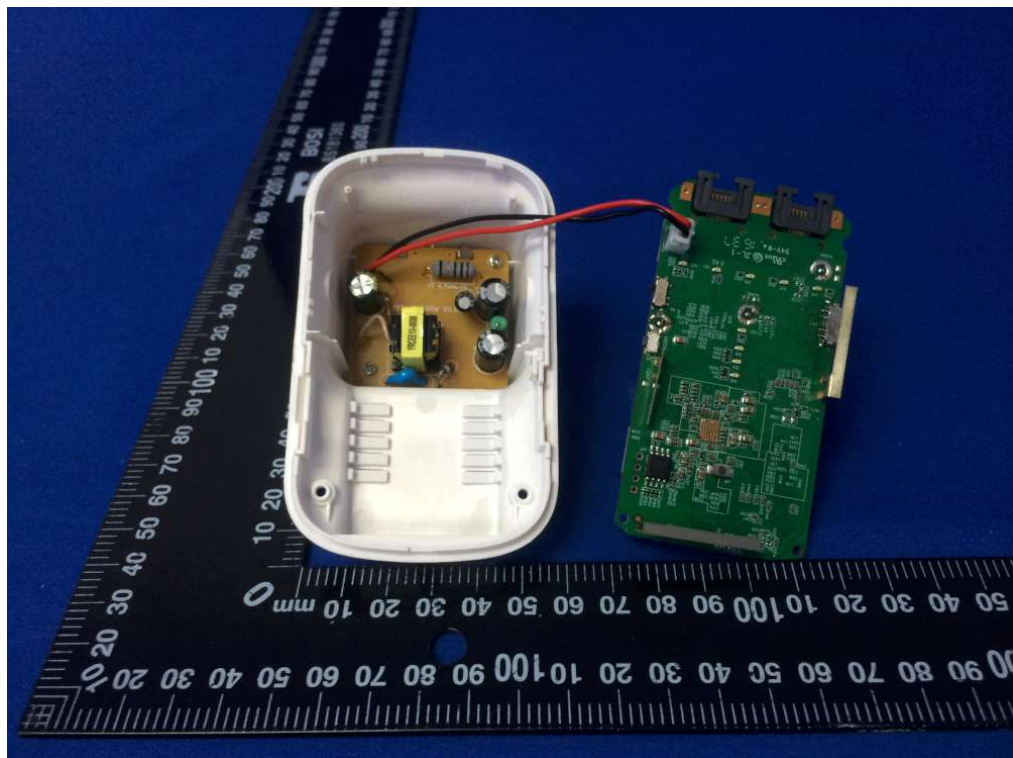
12. PHOTOGRAPHS OF THE EUT

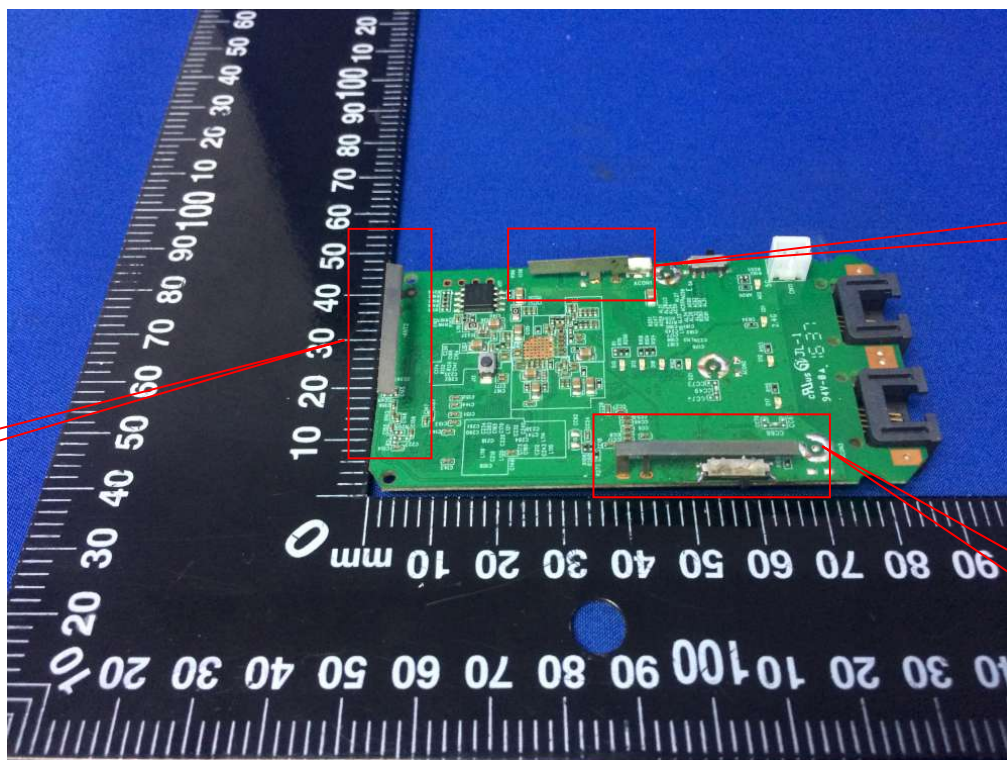








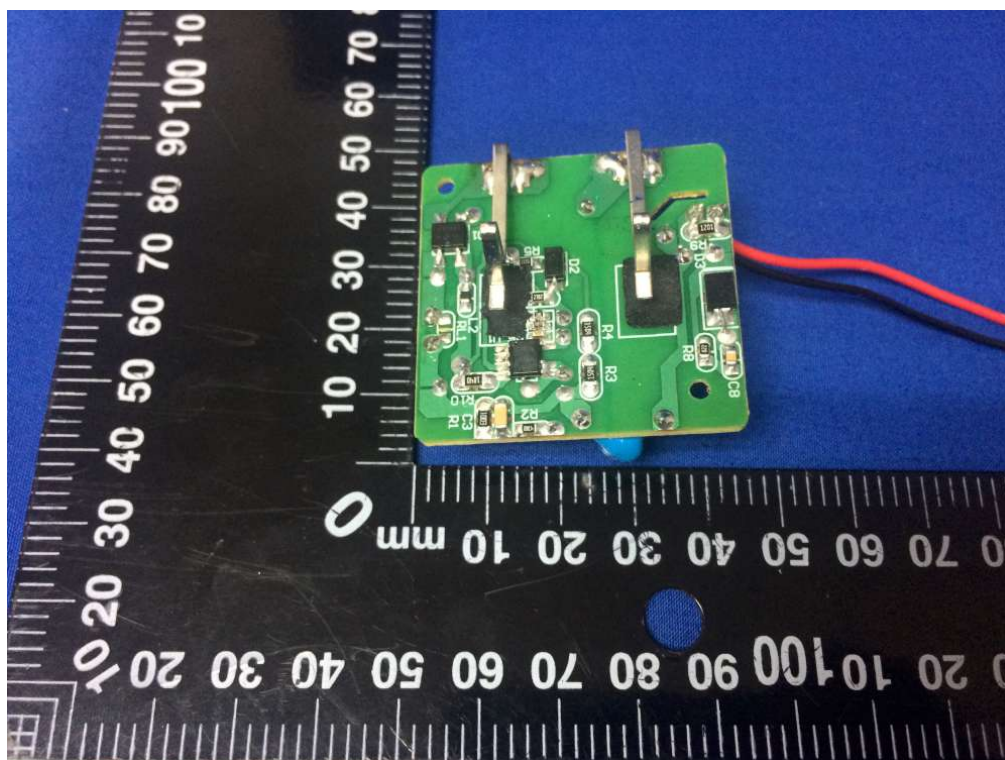
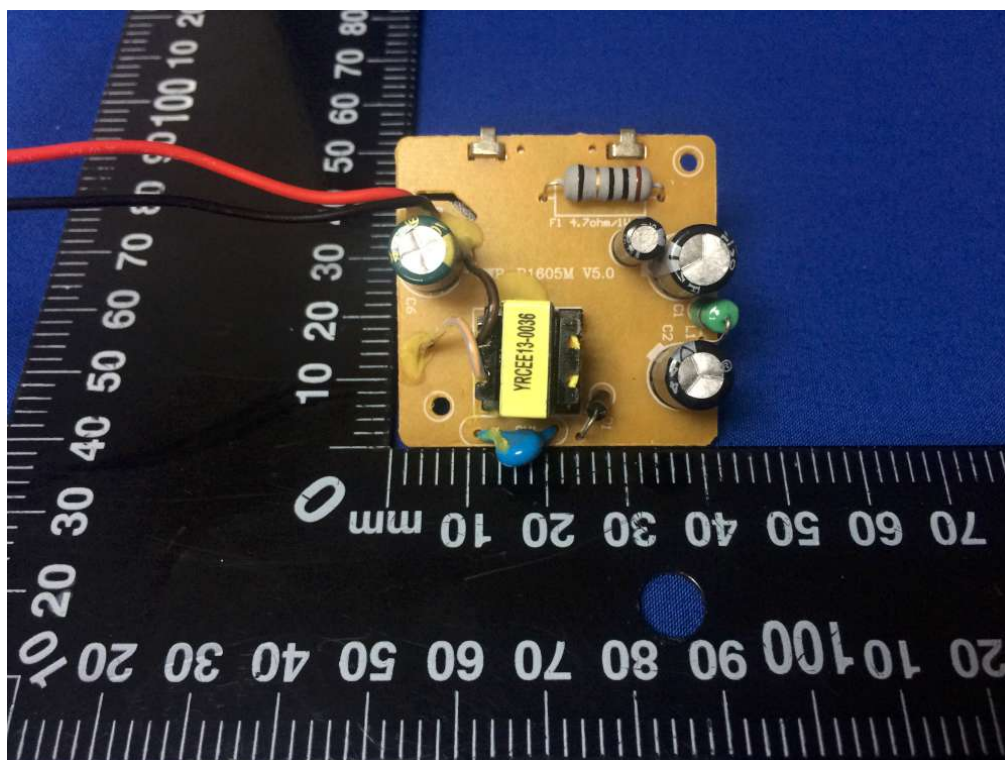




2.4G ANT 1

5G Antenna

2.4G ANT 2



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