

4.5. Peak Power Spectral Density

a. Limit

1. For direct sequence systems, the peak 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.
2. The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

b. Test Procedure

1. Place the EUT on the table and set it in transmitting mode. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 10kHz, VBW = 30kHz, Span = 1.5xDTS BW
3. Record the max. reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

c. Test Equipment

Same as the equipment listed in 4.2.

d. Test Setup

See 4.1

e. Test Results

Pass

f. Test Data

Please refer to the following data.

g. Test Plot See the following pages

ANT A

Test mode: IEEE 802.11b

Channel	Frequency (MHz)	PPSD (dBm/3KHz)	Σ PPSD (dBm/3KHz)	Limit (dBm)	Result
Low	2412	-6.683	-	8.00	Pass
Mid	2437	-5.967	-		Pass
High	2462	-6.175	-		Pass

Test mode: IEEE 802.11g

Channel	Frequency (MHz)	PPSD (dBm)	Σ PPSD (dBm)	Limit (dBm)	Result
Low	2412	-14.353	-	8.00	Pass
Mid	2437	-10.986	-		Pass
High	2462	-11.913	-		Pass

Test mode: IEEE 802.11n (HT20)

Channel	Frequency (MHz)	PPSD (dBm/3KHz)	Σ PPSD (dBm/3KHz)	Limit (dBm)	Result
Low	2412	-12.424	-	8.00	Pass
Mid	2437	-11.256	-		Pass
High	2462	-12.903	-		Pass

Test mode: IEEE 802.11n (HT40)

Channel	Frequency (MHz)	PPSD (dBm/3KHz)	Σ PPSD (dBm/3KHz)	Limit (dBm)	Result
Low	2422	-17.489	-	8.00	Pass
Mid	2437	-15.708	-		Pass
High	2452	-17.712	-		Pass

ANT B

Test mode: IEEE 802.11b

Channel	Frequency (MHz)	PPSD (dBm/3KHz)	Σ PPSD (dBm/3KHz)	Limit (dBm)	Result
Low	2412	-5.604	-	8.00	Pass
Mid	2437	-8.279	-		Pass
High	2462	-6.445	-		Pass

Test mode: IEEE 802.11g

Channel	Frequency (MHz)	PPSD (dBm)	Σ PPSD (dBm)	Limit (dBm)	Result
Low	2412	-11.706	-	8.00	Pass
Mid	2437	-11.877	-		Pass
High	2462	-11.664	-		Pass

Test mode: IEEE 802.11n (HT20)

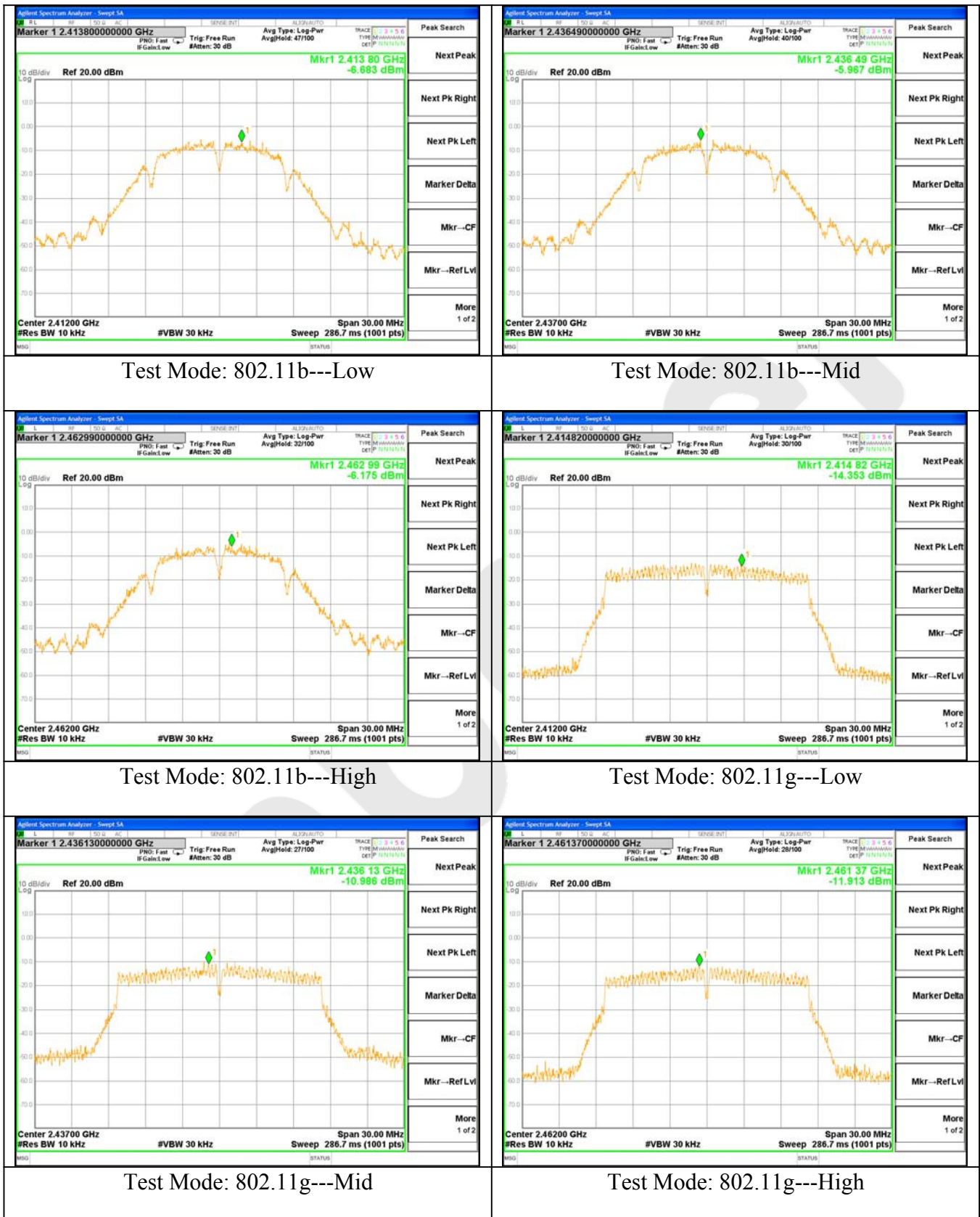
Channel	Frequency (MHz)	PPSD (dBm/3KHz)	Σ PPSD (dBm/3KHz)	Limit (dBm)	Result
Low	2412	-13.078	-	8.00	Pass
Mid	2437	-9.533	-		Pass
High	2462	-10.341	-		Pass

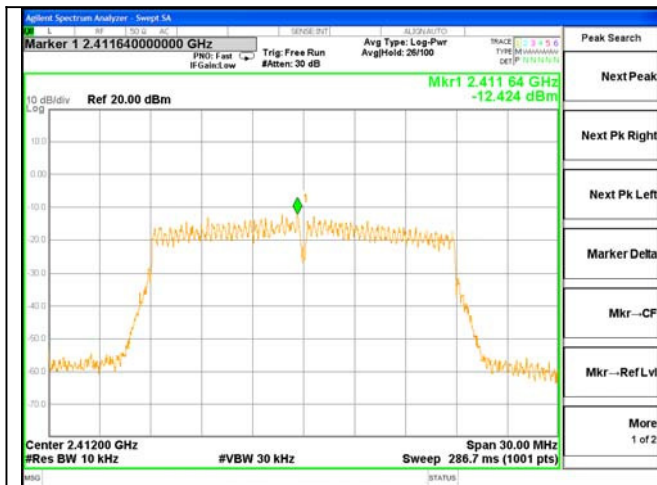
Test mode: IEEE 802.11n (HT40)

Channel	Frequency (MHz)	PPSD (dBm/3KHz)	Σ PPSD (dBm/3KHz)	Limit (dBm)	Result
Low	2422	-18.521	-	8.00	Pass
Mid	2437	-15.822	-		Pass
High	2452	-16.551	-		Pass

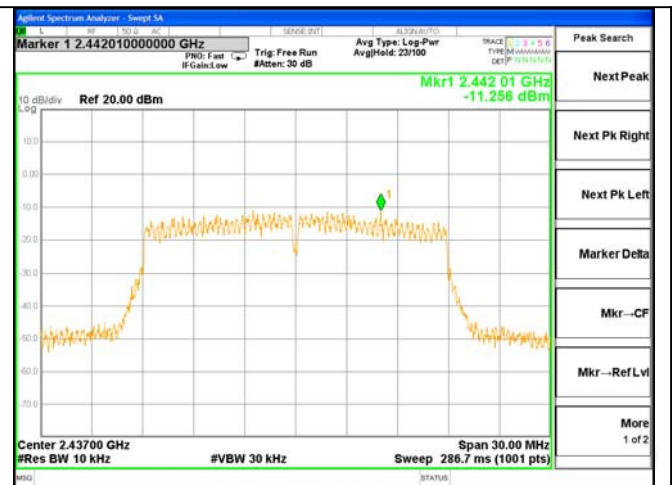
Channel	Channel Frequency (MHz)	ANT A PSD (dBm)	ANT B PSD (dBm)	Data Rate (Mbps)	MIMO PSD (dBm)	Limit (dBm)
802.11n (20M MIMO) mode						
Low	2412	-12.424	-13.078	MCS0	-9.731	8
Middle	2437	-11.256	-9.533	MCS0	-7.298	8
High	2462	-12.903	-10.341	MCS0	-8.425	8
802.11n (40M MIMO) mode						
Low	2422	-17.489	-18.521	MCS0	-14.962	8
Middle	2437	-15.708	-15.822	MCS0	-12.749	8
High	2452	-17.712	-16.551	MCS0	-14.089	8

ANT A

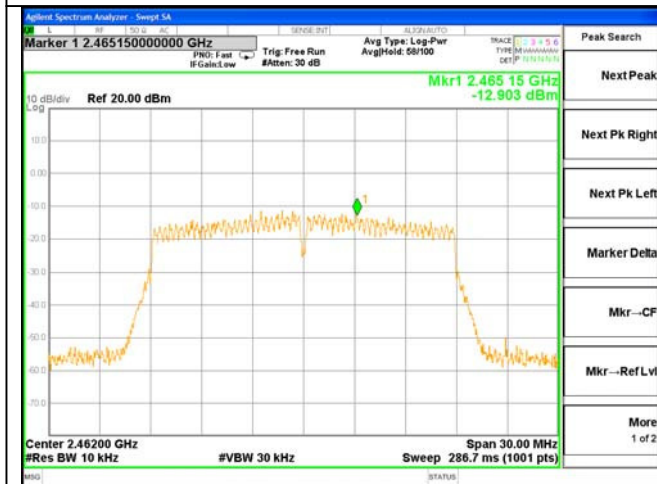




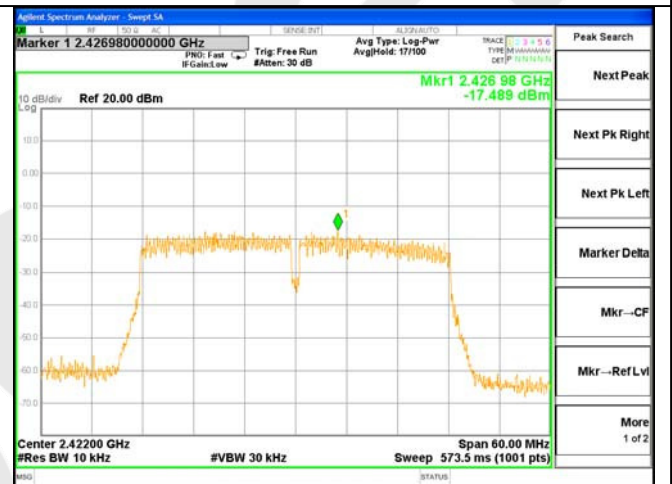
Test Mode: 802.11n20---Low



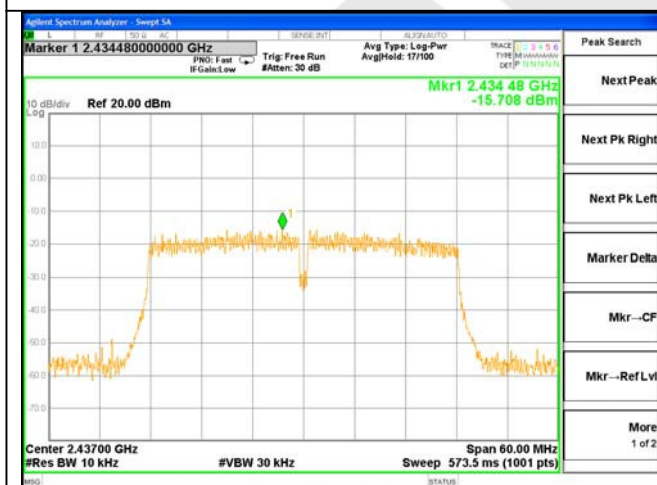
Test Mode: 802.11n20---Mid



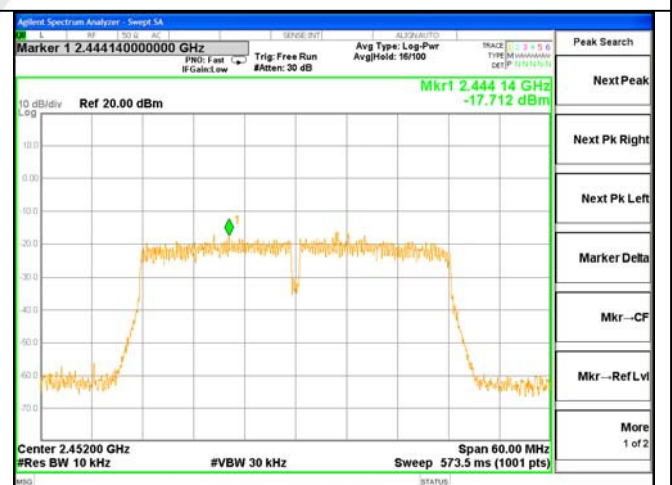
Test Mode: 802.11n20---High



Test Mode: 802.11n40---Low

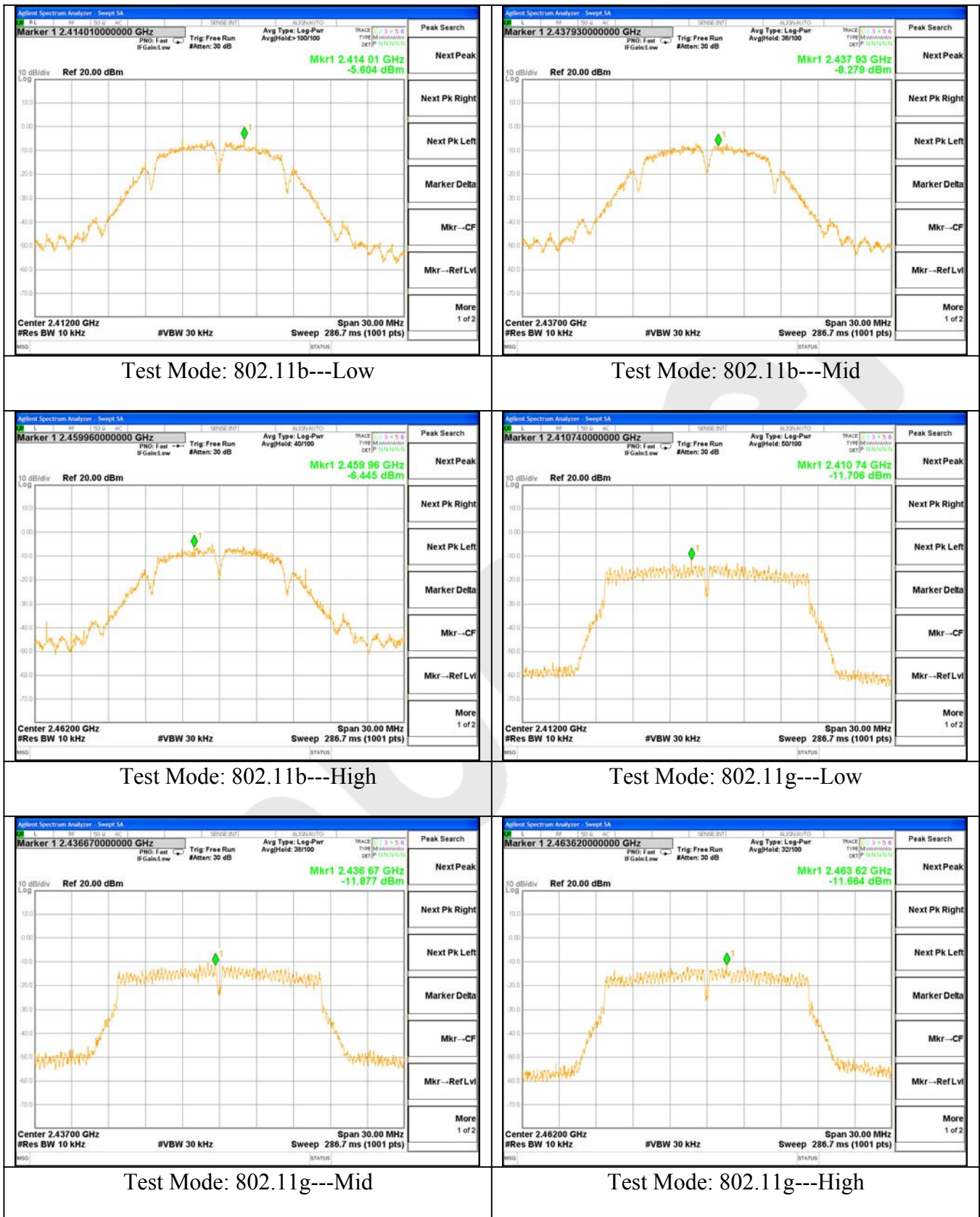


Test Mode: 802.11n40---Mid



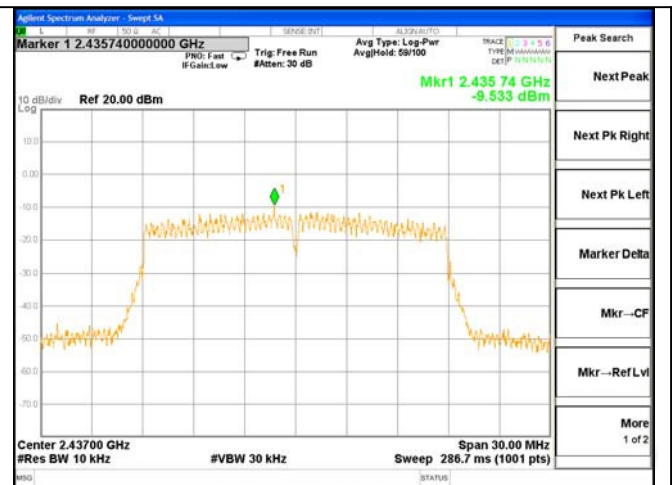
Test Mode: 802.11n40---High

ANT B

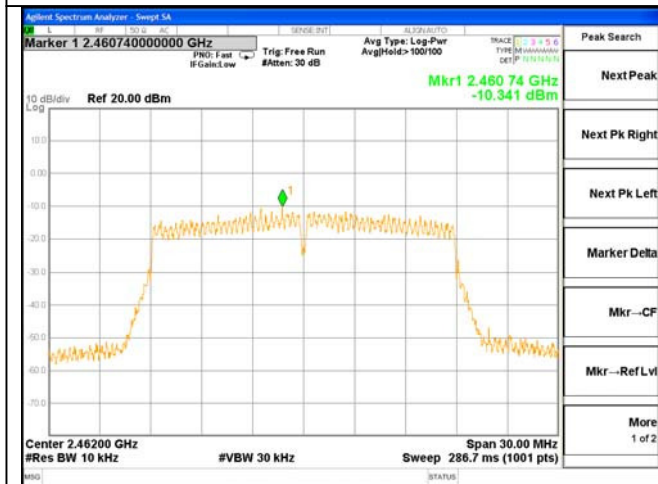




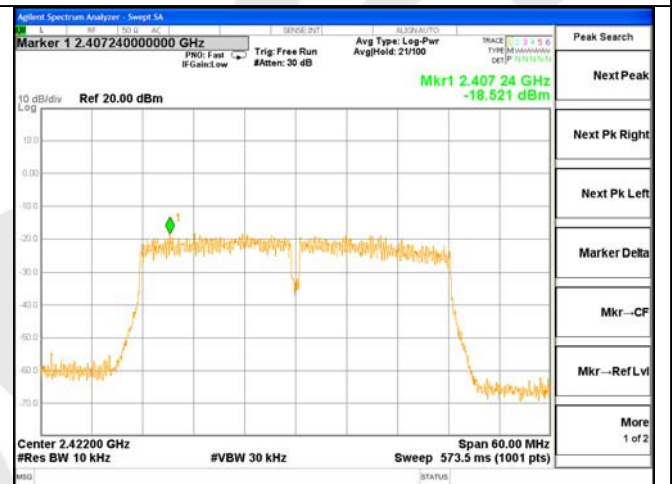
Test Mode: 802.11n20---Low



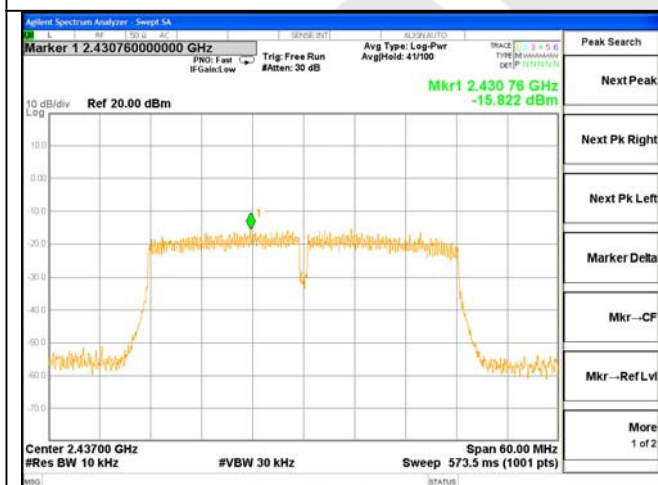
Test Mode: 802.11n20---Mid



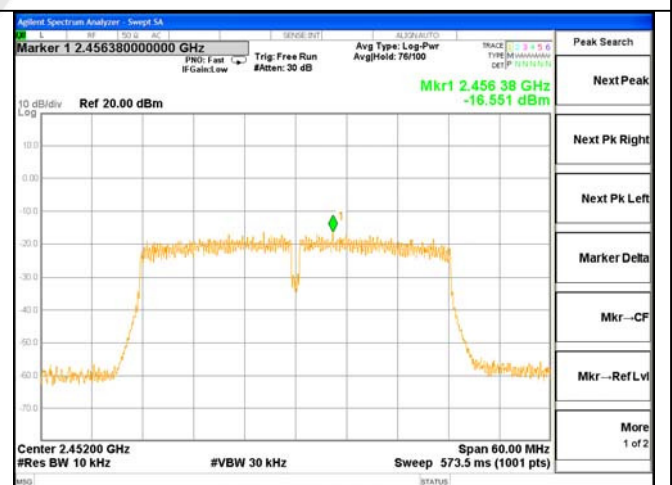
Test Mode: 802.11n20---High



Test Mode: 802.11n40---Low



Test Mode: 802.11n40---Mid



Test Mode: 802.11n40---High

4.6. Radiated Emissions

3.6.1.1. Test Limits (< 30 MHz)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30

3.6.1.2. Test Limits ($\geq$ 30 MHz)

FIELD STRENGTH of Fundamental: @3M	FIELD STRENGTH of Harmonics	S15.209 30 - 88 MHz	40 dBuV/m
902-928 MHz		88 - 216 MHz	43.5
2.4-2.4835 GHz		216 - 960 MHz	46
94 dBuV/m @3m	54 dBuV/m @3m	ABOVE 960 MHz	54dBuV/m

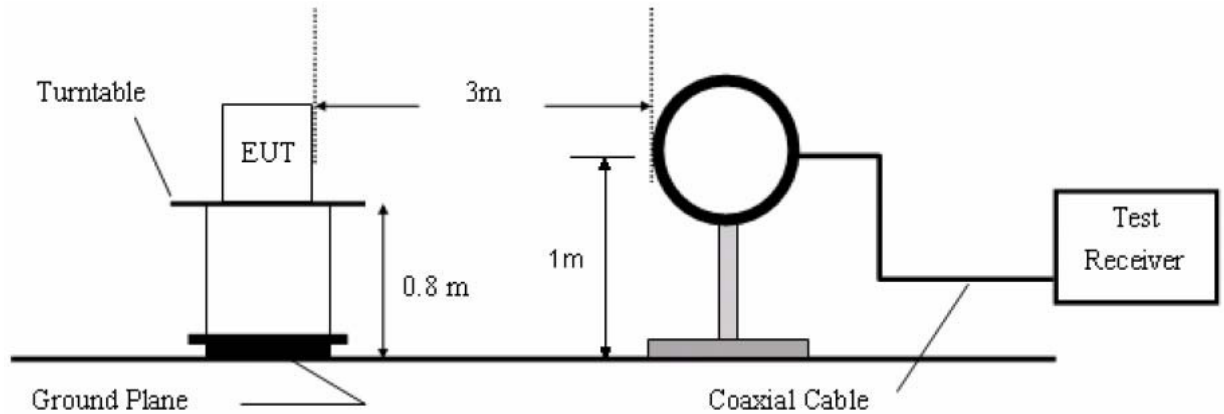
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the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

Test Equipment

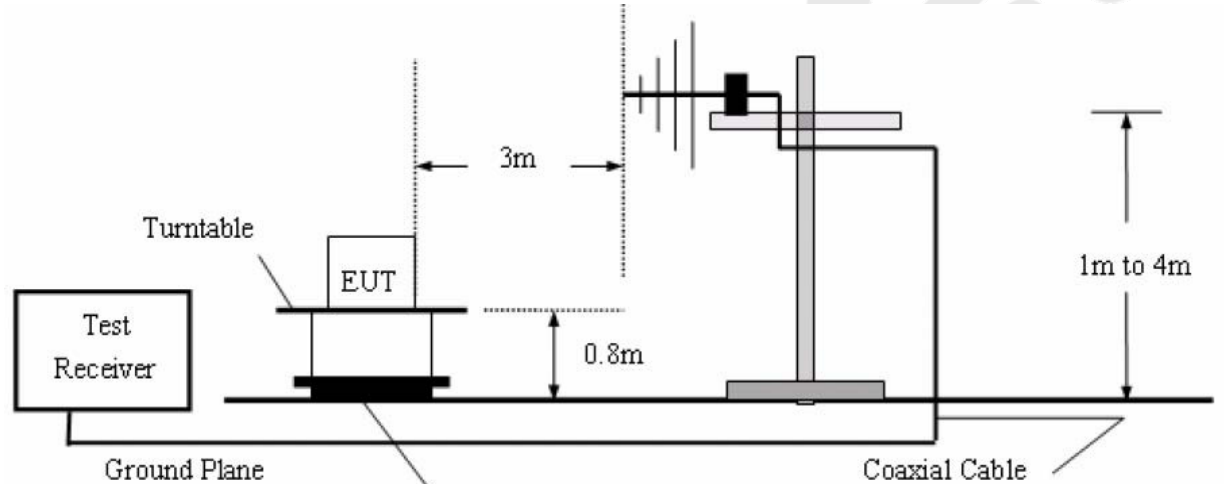
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	Spectrum Analysis	Agilent	E4407B	US39390582	Apr. 17, 2016	1 Year
2.	Preamplifier	Instruments corporation	EMC011830	980100	Apr. 17, 2016	1 Year
3.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Apr. 17, 2016	1 Year
4.	Double Ridged Horn Antenna	Instruments corporation	GTH-0118	351600	Apr. 20, 2016	1 Year
5.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Apr. 20, 2016	1 Year
6.	Pre-amplifier	SonOMA	310N	186860	Apr. 17, 2016	1 Year
7.	EMI Test Software EZ-EMC	SHURPLE	N/A	N/A	N/A	N/A
8.	Power Sensor	DAER	RPR3006W	15100041SN046	Jun 30, 2015	1 Year
9.	MXA Spectrum Analysis	Agilent	N9020A	MY51170037	Jun 30, 2015	1 Year
10.	MXG RF Vector Signal Generator	Agilent	N5182A	MY48180656	Jun 30, 2015	1 Year
11.	Signal Generator	Agilent	E4421B	MY41000743	Jun 30, 2015	1 Year
12.	DC Power supply	IV	IV-8080	YQSB0096	Jun 30, 2015	1 Year
13.	TEMP&HUMI PROGRAMMABLE CHAMBER	Bell Group	BE-THK-15 0M8	SE-0137	Mar 16, 2016	1 Year

4.6.2. Test Configuration:

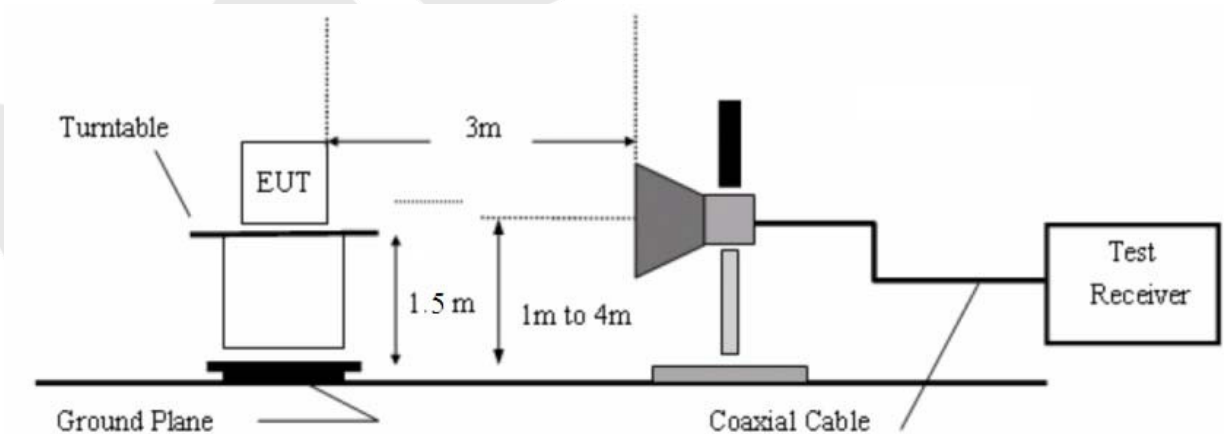
4.6.2.1. 9k to 30MHz emissions:



4.6.2.2. 30M to 1G emissions:



4.6.2.3. 1G to 40G emissions:



4.6.3. Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane.
For above 1GHz: The EUT is placed on a turntable, which is 1.5m above the ground plane.
The turn table can rotate 360 degrees to determine the position of the maximum emission level.
The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower.
The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna are set on test.

Measurements are made on 9KHz to 30MHz and 30MHz to 26GHz range with the transmitter set to the lowest, middle, and highest channels.

All readings from 30MHz to 1GHz are quasi-peak values with a resolution bandwidth of 120kHz. All reading are above 1GHz, peak & average values with a resolution bandwidth of 1MHz.

The EUT is tested in 9*6*6 Chamber. The device is evaluated in xyz orientation.

The test results are listed in Section 3.6.4.

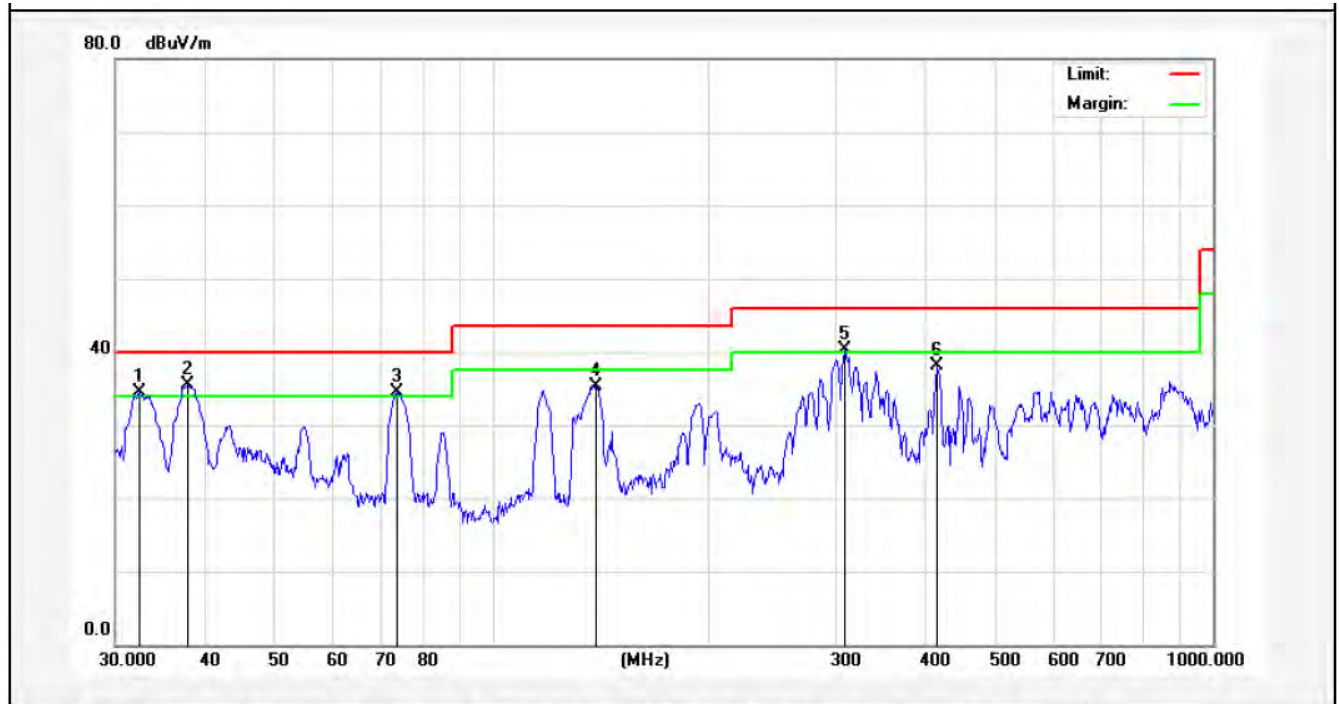
4.6.4. Test Results

The EUT was tested on (Charging, On) modes, only the worst data of (Charging) is attached in the following pages.

Only the worst case (x orientation).

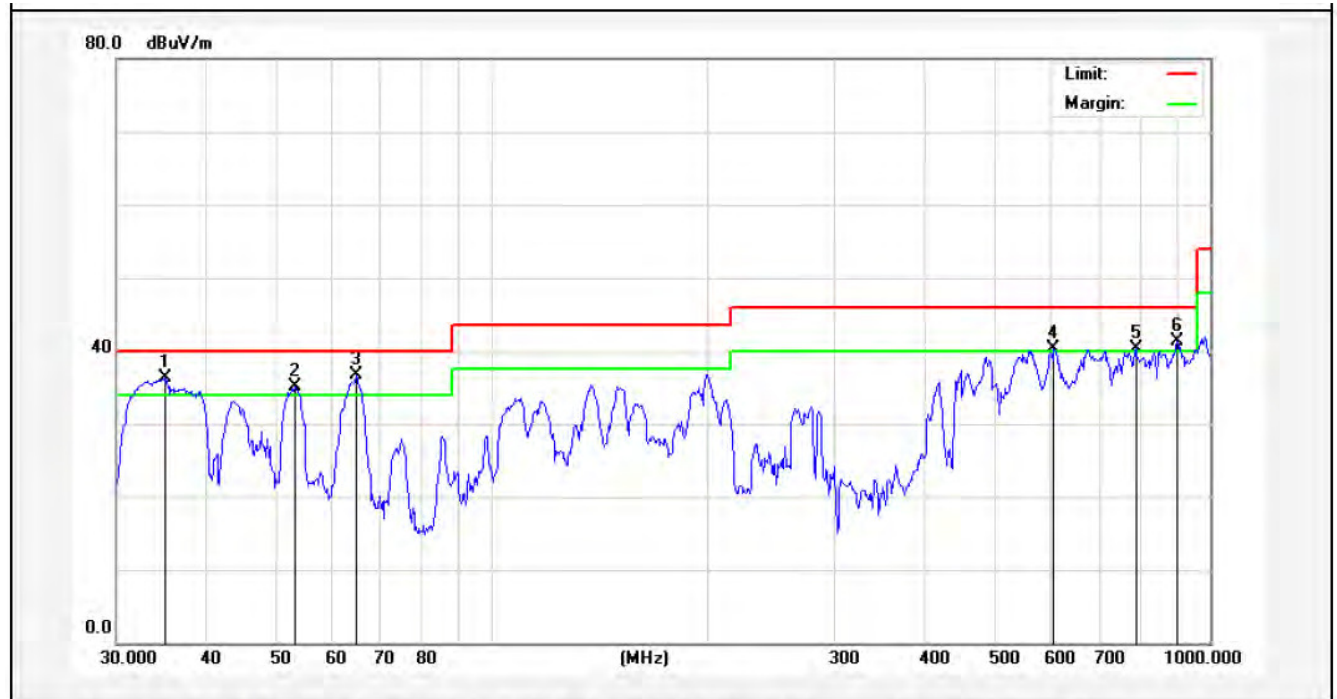
The test results of above 18000MHz are attenuated more than 20dB below the permissible limits, so the results don't record in the report.

Job No.:	011605879I	Plarization:	Horizontal
Standard:	(RE)FCC PART15 C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test	Temp.(C)/Hum. (%RH):	24.3(C)/55% RH
Test Mode:	Charging	Distance:	3m



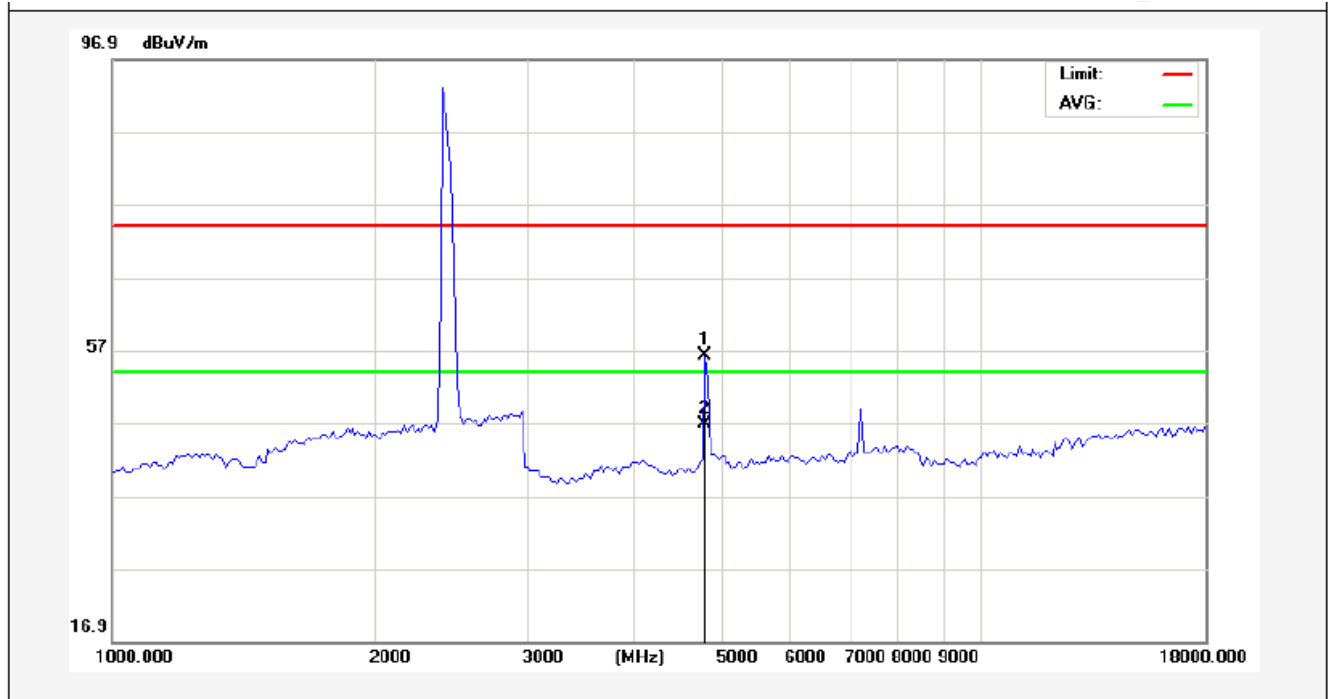
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	32.4059	50.16	-15.67	34.49	40.00	-5.51	QP	300	0	
2	37.8121	47.62	-12.09	35.53	40.00	-4.47	QP	300	360	
3	73.8756	54.78	-20.37	34.41	40.00	-5.59	QP	300	0	
4	139.3611	58.77	-23.44	35.33	43.50	-8.17	peak			
5	307.8312	56.98	-16.73	40.25	46.00	-5.75	QP	300	360	
6	413.2706	50.58	-12.55	38.03	46.00	-7.97	peak			

Job No.:	011605879I	Plarization:	Vertical
Standard:	(RE)FCC PART15 C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test	Temp.(C)/Hum.(%RH):	24.3(C)/55% RH
Test Mode:	Charging	Distance:	3m



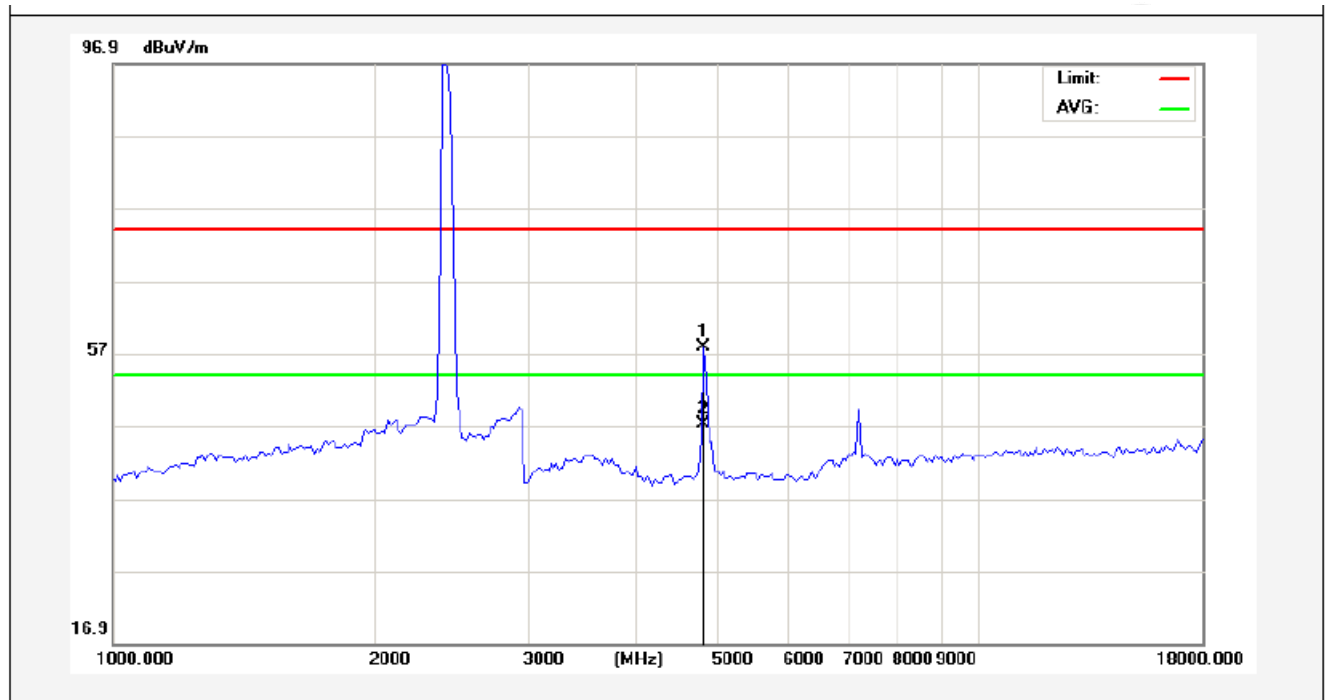
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	35.0048	50.57	-14.29	36.28	40.00	-3.72	QP	100	0	
2	53.1313	49.81	-14.79	35.02	40.00	-4.98	QP	100	360	
3	64.6594	53.94	-17.33	36.61	40.00	-3.39	QP	100	0	
4	605.6592	49.49	-9.20	40.29	46.00	-5.71	QP	100	360	
5	787.8513	46.27	-5.92	40.35	46.00	-5.65	QP	100	0	
6	900.1472	45.14	-3.76	41.38	46.00	-4.62	QP	100	360	

Job No.:	011605879I	Plarization:	Horizontal
Standard:	(RE)FCC PART15 C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test	Temp.(C)/Hum.(%RH):	24.3(C)/55 % RH
Note:	ANT A 802.11b(2412MHz)	Distance:	3m



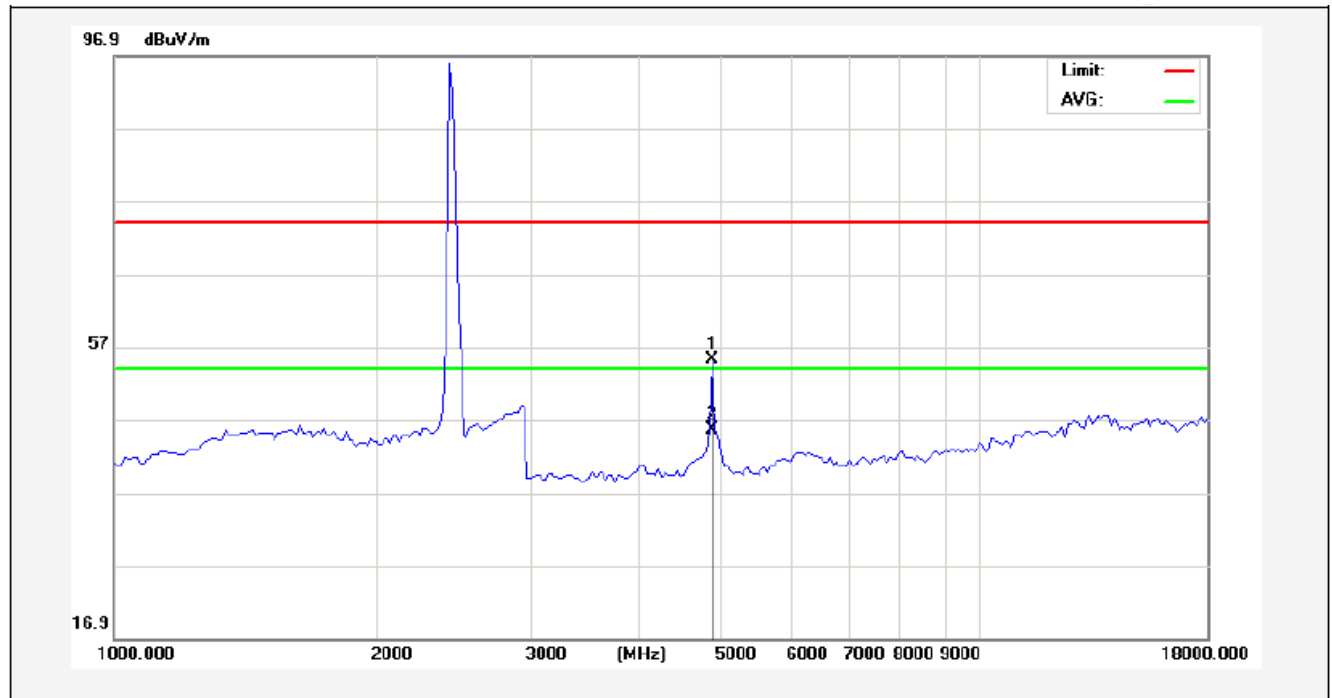
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4825.000	52.79	3.34	56.13	74.00	-17.87	peak			
2	4825.000	43.50	3.34	46.84	54.00	-7.16	AVG			

Job No.:	011605879I	Plarization:	Vertical
Standard:	(RE)FCC PART15 C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test	Temp.(C)/Hum.(%RH):	24.3(C)/55 %RH
Note:	ANT A 802.11b(2412MHz)	Distance:	3m



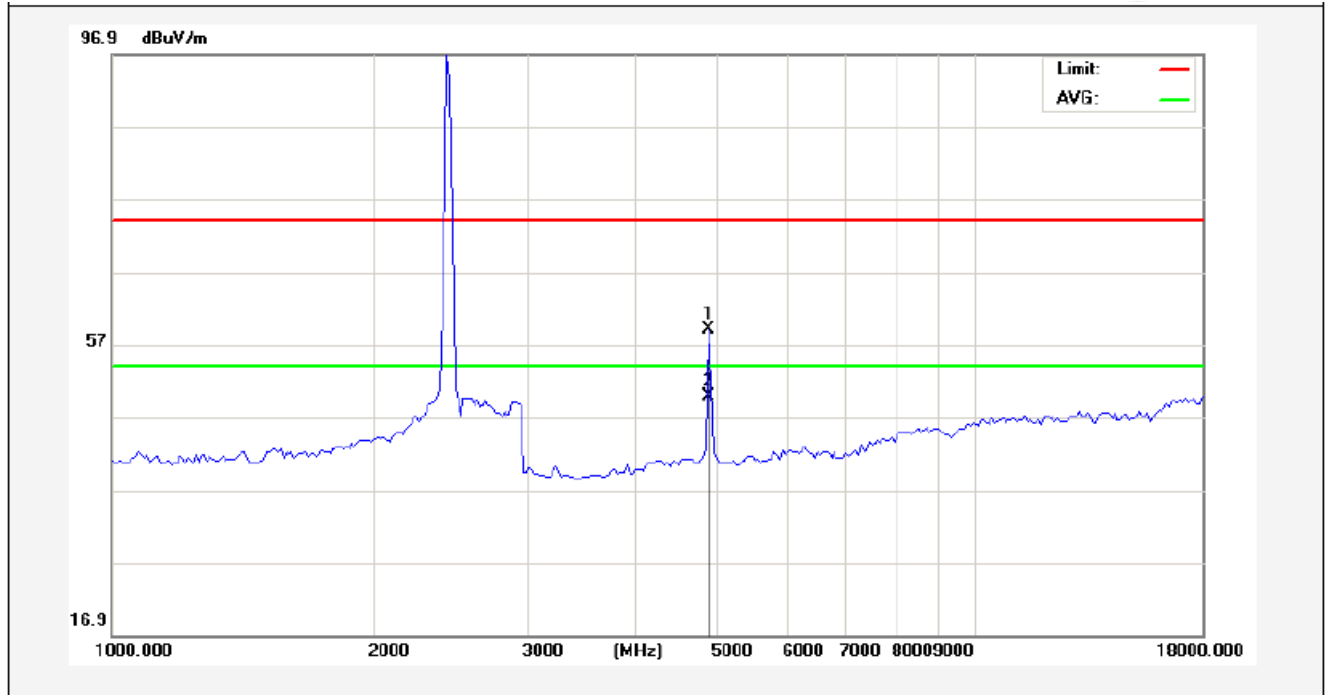
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4825.000	54.54	3.34	57.88	74.00	-16.12	peak			
2	4825.000	43.86	3.34	47.20	54.00	-6.80	AVG			

Job No.:	011605879I	Plarization:	Horizontal
Standard:	(RE)FCC PART15 C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test	Temp.(C)/Hum.(%RH):	24.3(C)/55% RH
Note:	ANT A 802.11b(2437MHz)	Distance:	3m



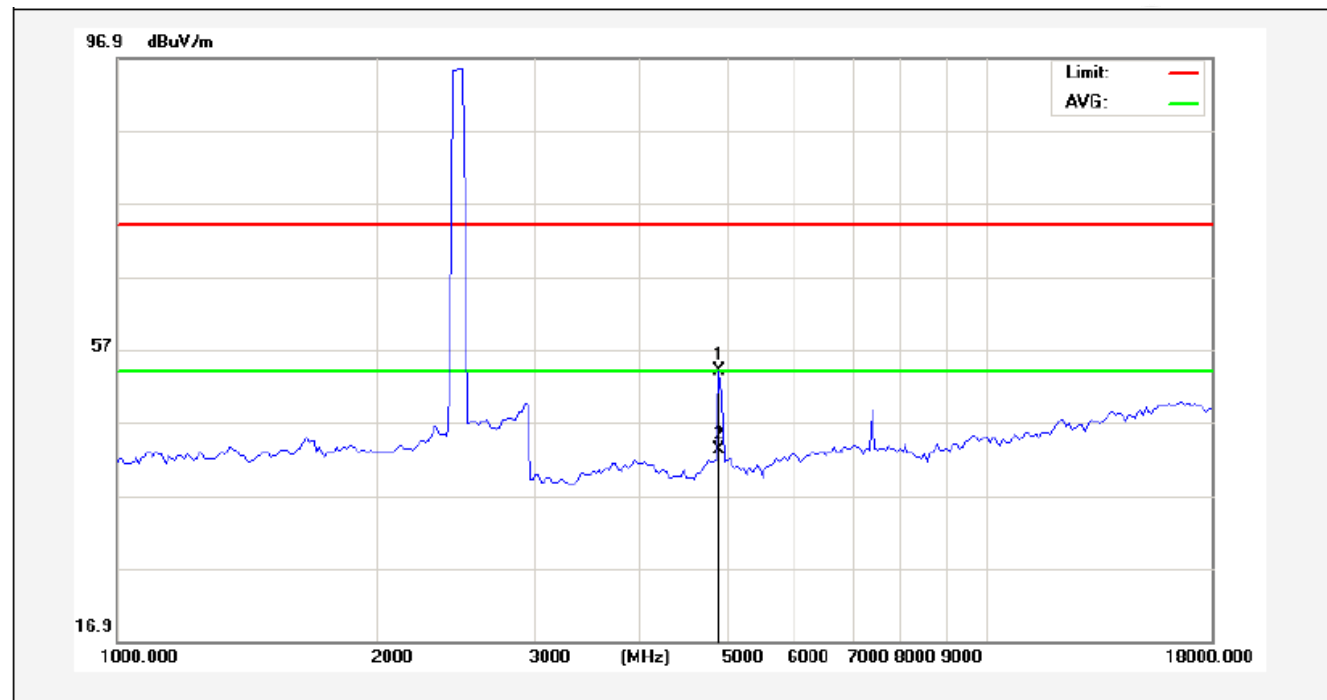
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4867.500	51.70	3.41	55.11	74.00	-18.89	peak			
2	4867.500	42.17	3.41	45.58	54.00	-8.42	AVG			

Job No.:	011605879I	Plarization:	Vertical
Standard:	(RE)FCC PART15 C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test	Temp.(C)/Hum.(%RH):	24.3(C)/55 % RH
Note:	ANT A 802.11b(2437MHz)	Distance:	3m



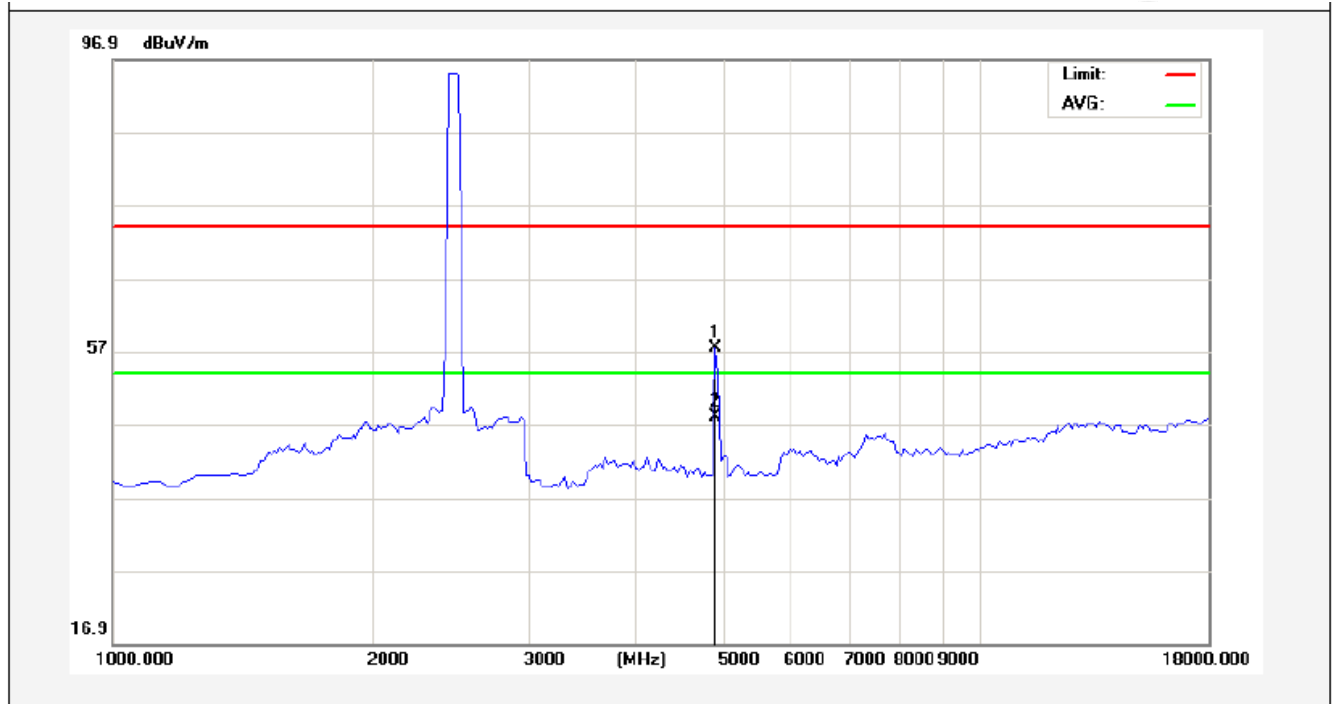
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4867.500	55.63	3.41	59.04	74.00	-14.96	peak			
2	4867.500	46.33	3.41	49.74	54.00	-4.26	AVG			

Job No.:	011605879I	Plarization:	Horizontal
Standard:	(RE)FCC PART15 C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test	Temp.(C)/Hum.(%RH):	24.3(C)/55% RH
Note:	ANT A 802.11b(2462MHz)	Distance:	3m



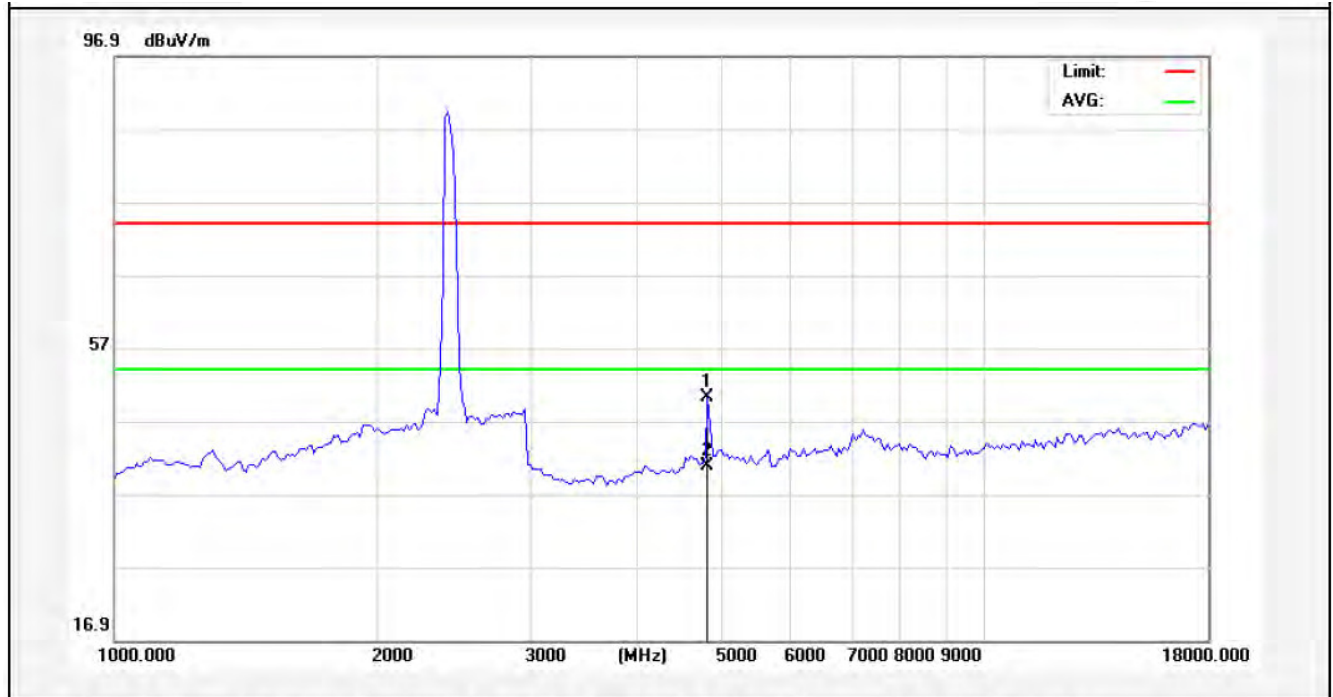
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4910.000	50.50	3.49	53.99	74.00	-20.01	peak			
2	4910.000	39.75	3.49	43.24	54.00	-10.76	AVG			

Job No.:	011605879I	Plarization:	Vertical
Standard:	(RE)FCC PART15 C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test	Temp.(C)/Hum.(%RH):	24.3(C)/55% RH
Note:	ANT A 802.11b(2462MHz)	Distance:	3m



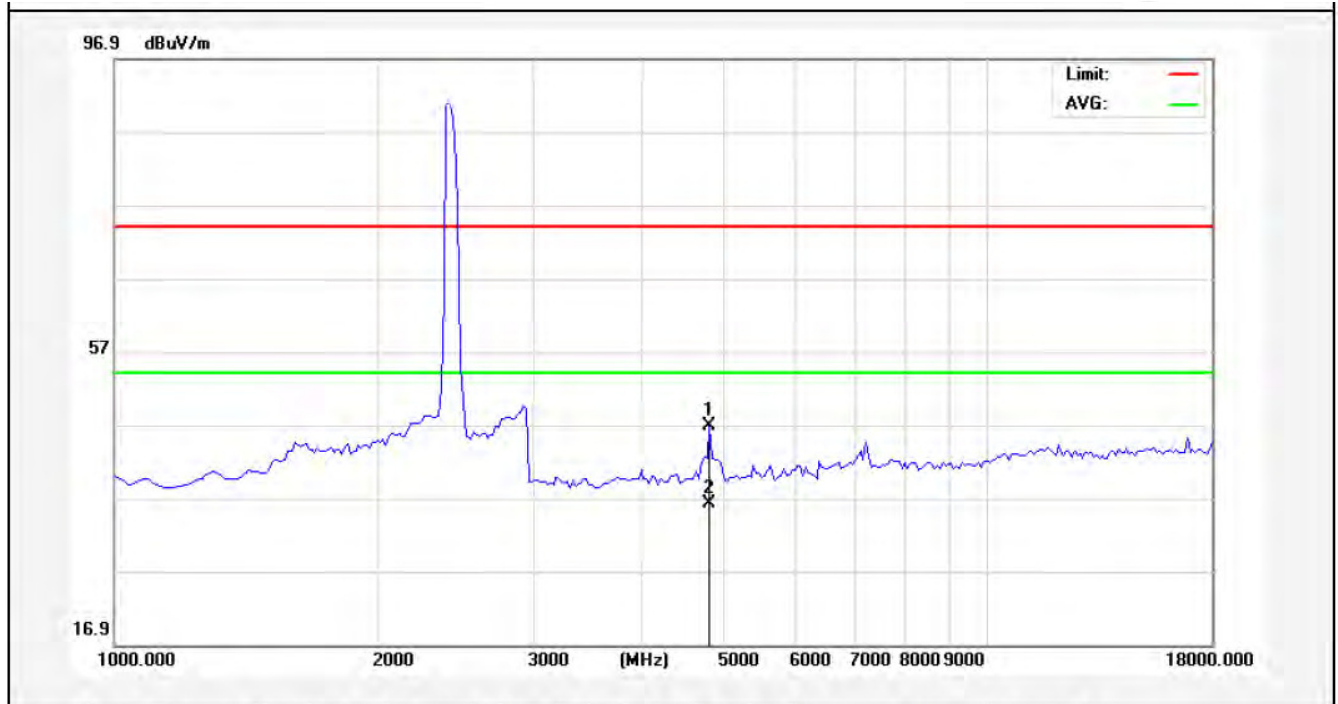
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4910.000	54.00	3.49	57.49	74.00	-16.51	peak			
2	4910.000	44.47	3.49	47.96	54.00	-6.04	AVG			

Job No.:	011605879I	Plarization:	Horizontal
Standard:	(RE)FCC PART15 C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test	Temp.(C)/Hum.(%RH):	24.3(C)/55 % RH
Note:	ANT B 802.11b(2412MHz)	Distance:	3m



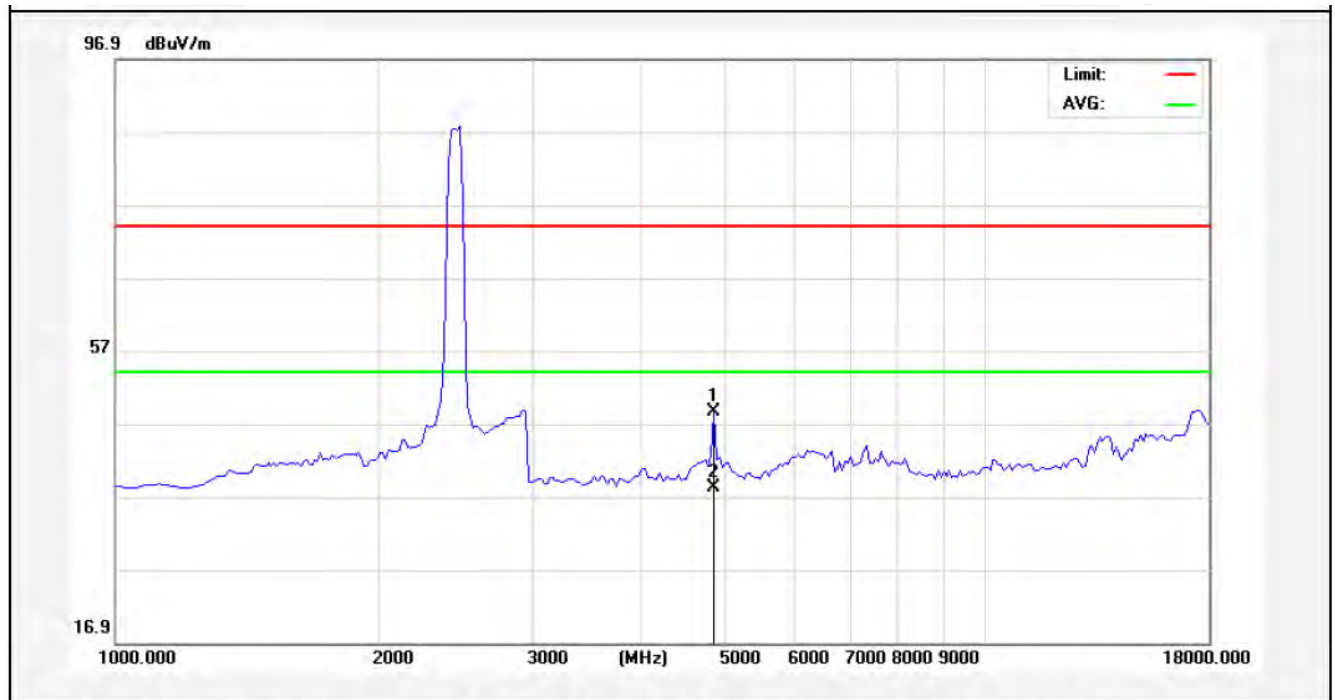
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4825.000	46.79	3.34	50.13	74.00	-23.87	peak			
2	4825.000	37.43	3.34	40.77	54.00	-13.23	AVG			

Job No.:	011605879I	Plarization:	Vertical
Standard:	(RE)FCC PART15 C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test	Temp.(C)/Hum.(%RH):	24.3(C)/55 %RH
Note:	ANT B 802.11b(2412MHz)	Distance:	3m



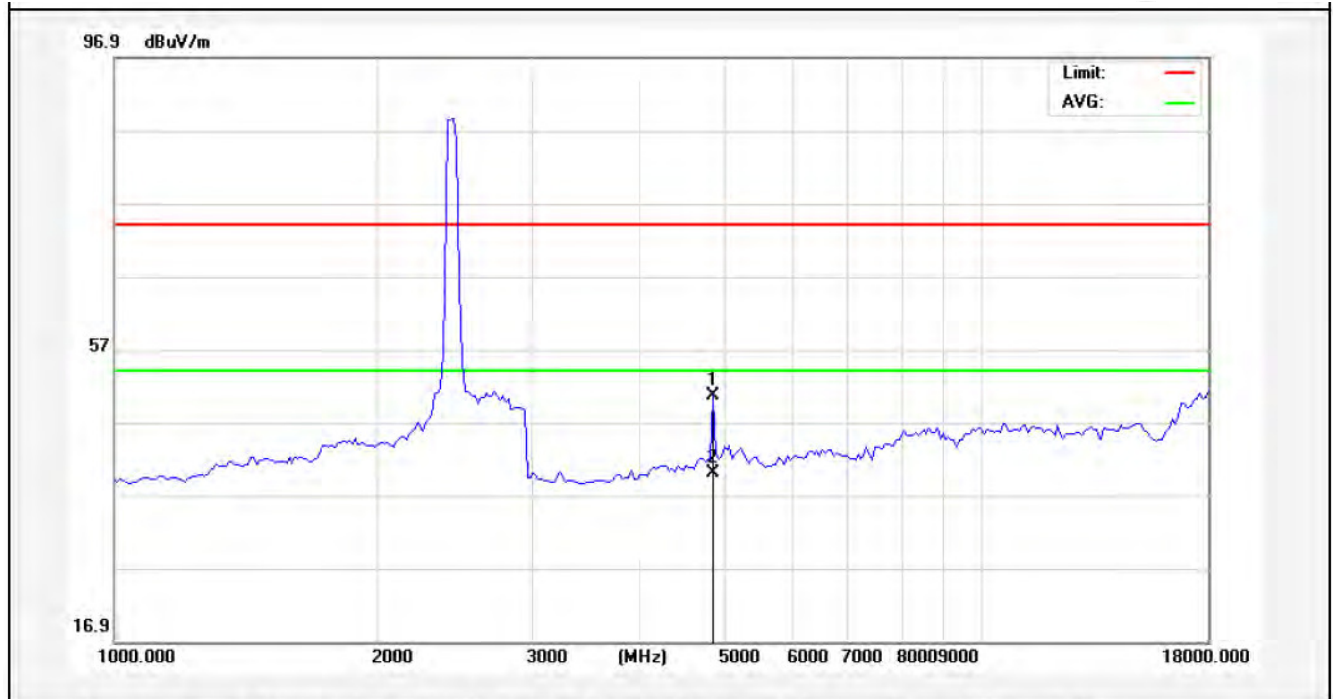
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4825.000	43.54	3.34	46.88	74.00	-27.12	peak			
2	4825.000	32.85	3.34	36.19	54.00	-17.81	AVG			

Job No.:	011605879I	Plarization:	Horizontal
Standard:	(RE)FCC PART15 C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test	Temp.(C)/Hum.(%RH):	24.3(C)/55% RH
Note:	ANT B 802.11b(2437MHz)	Distance:	3m



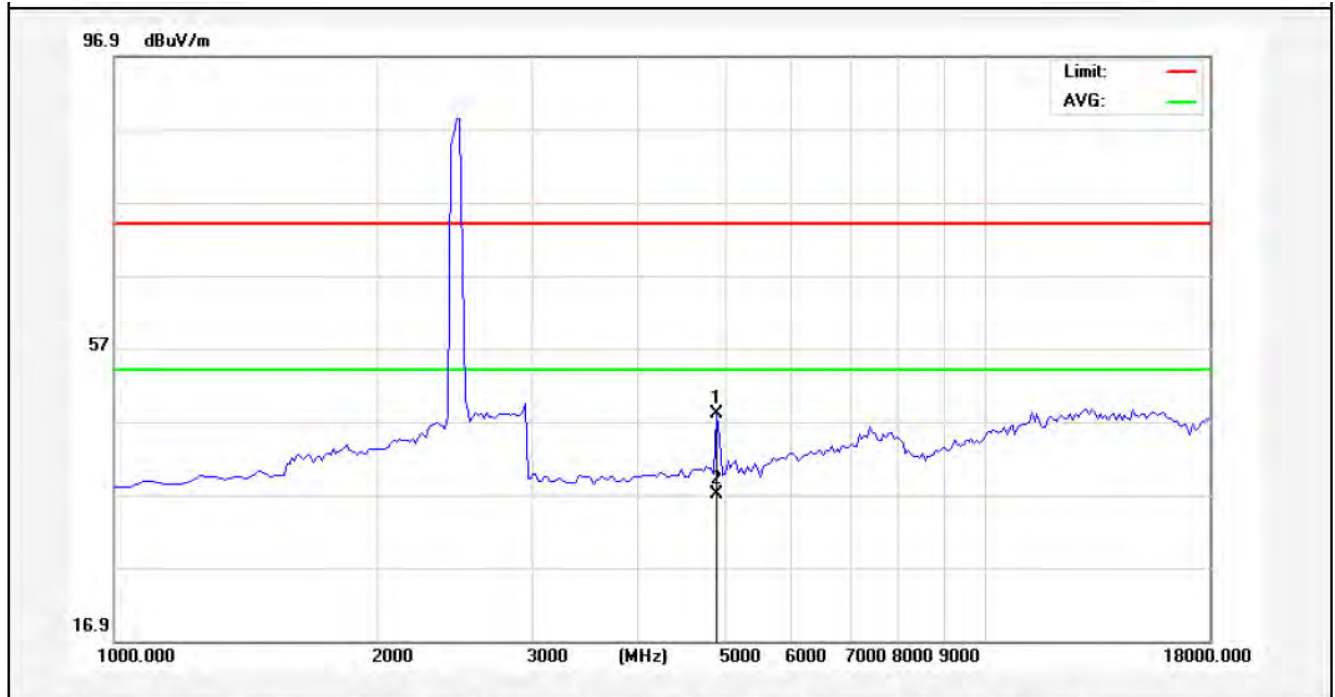
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4867.500	45.20	3.41	48.61	74.00	-25.39	peak			
2	4867.500	34.76	3.41	38.17	54.00	-15.83	AVG			

Job No.:	011605879I	Plarization:	Vertical
Standard:	(RE)FCC PART15 C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test	Temp.(C)/Hum.(%RH):	24.3(C)/55% RH
Note:	ANT B 802.11b(2437MHz)	Distance:	3m



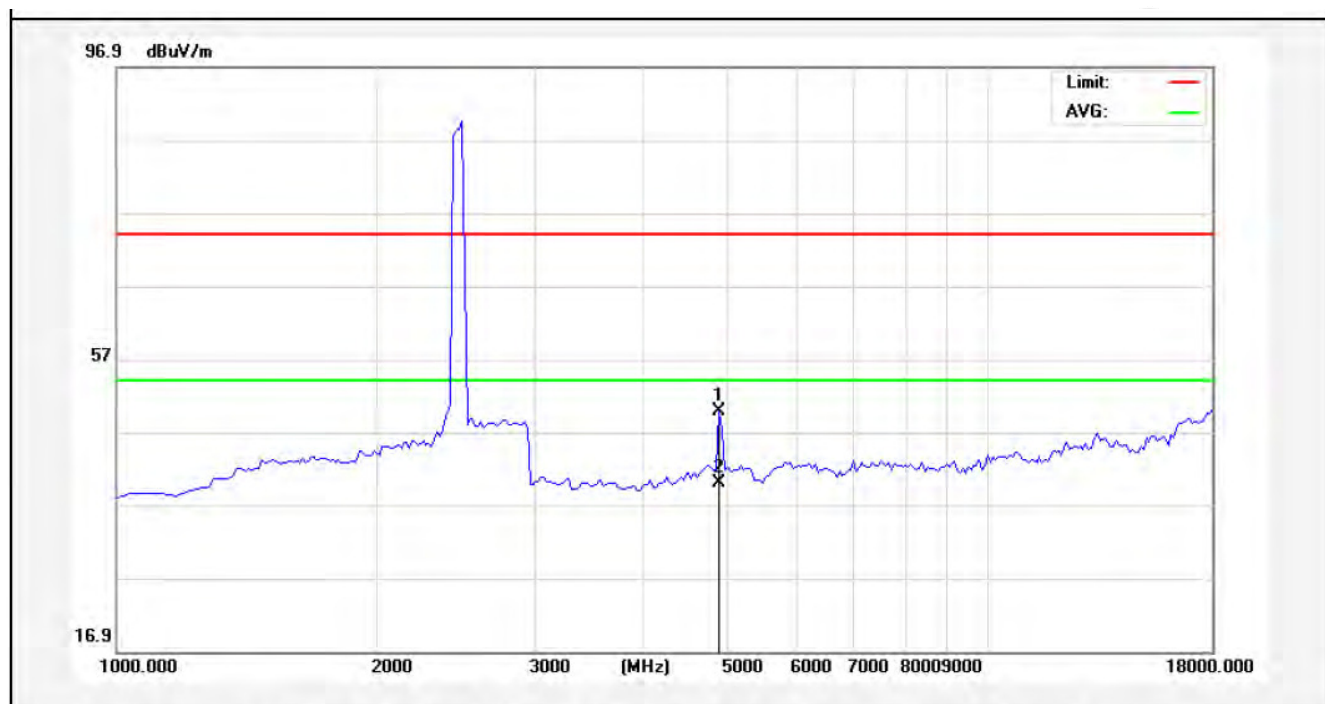
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4867.500	47.13	3.41	50.54	74.00	-23.46	peak			
2	4867.500	36.59	3.41	40.00	54.00	-14.00	AVG			

Job No.:	011605879I	Plarization:	Horizontal
Standard:	(RE)FCC PART15 C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test	Temp.(C)/Hum.(%RH):	24.3(C)/55% RH
Note:	ANT B 802.11b(2462MHz)	Distance:	3m



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4910.000	44.50	3.49	47.99	74.00	-26.01	peak			
2	4910.000	33.61	3.49	37.10	54.00	-16.90	AVG			

Job No.:	011605879I	Plarization:	Vertical
Standard:	(RE)FCC PART15 C _3m	Power Source:	AC 120V, 60Hz for adapter
Test item:	Radiation Test	Temp.(C)/Hum.(%RH):	24.3(C)/55% RH
Note:	ANT B 802.11b(2462MHz)	Distance:	3m



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/)	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	4910.000	46.33	3.49	49.82	74.00	-24.18	peak			
2	4910.000	36.50	3.49	39.99	54.00	-14.01	AVG			

5. ANTENNA APPLICATION

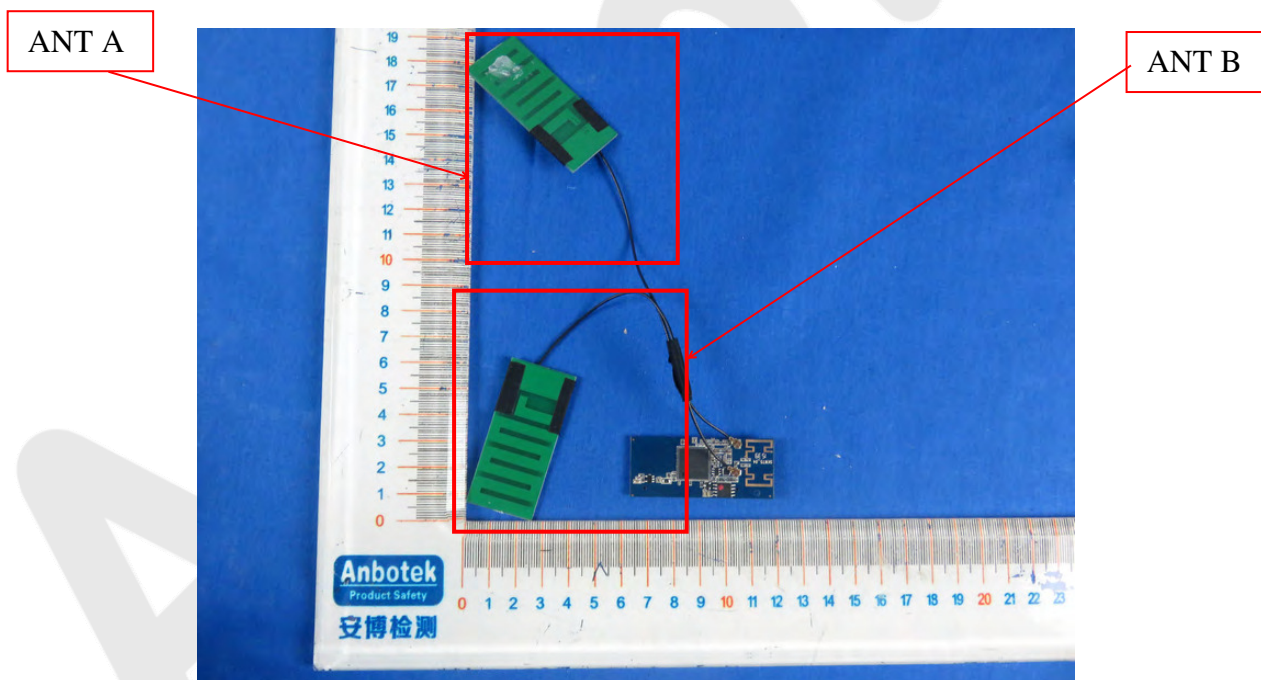
5.1. Antenna requirement

The EUT'S antenna is met the requirement of FCC part 15C section 15.203.

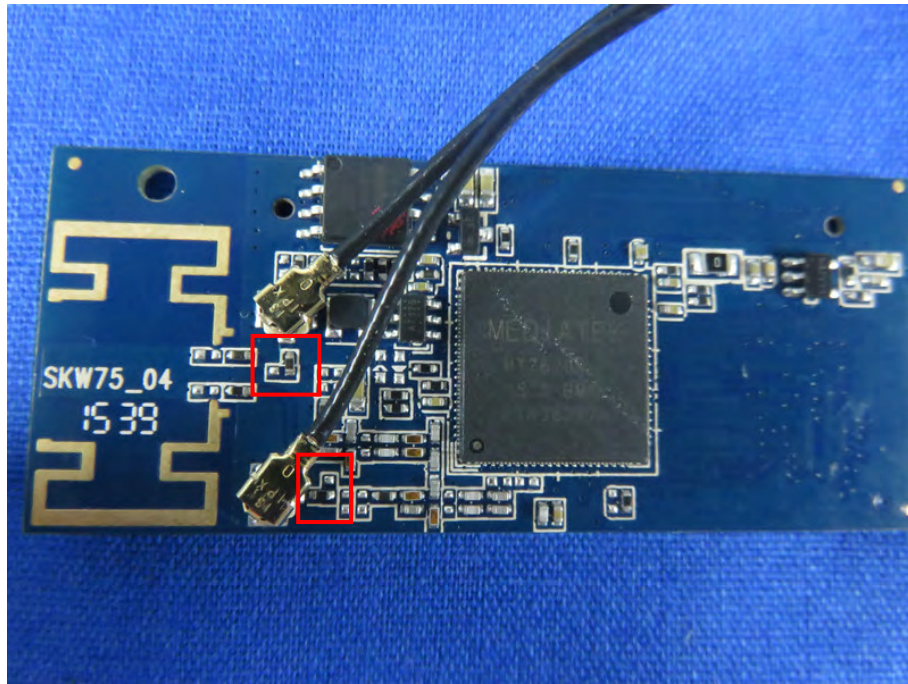
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

4.2. Result

The EUT's antenna used a integrated antenna which is permanently attached, The antenna's gain is 2dBi and meets the requirement.



Note: This is a switching circuit. Now, the line is switched to the external antenna. The PCB antenna is not use.



6. PHOTOGRAPH

6.1. Photo of Conducted Emission Measurement



6.2. Photo of Radiation Emission Test



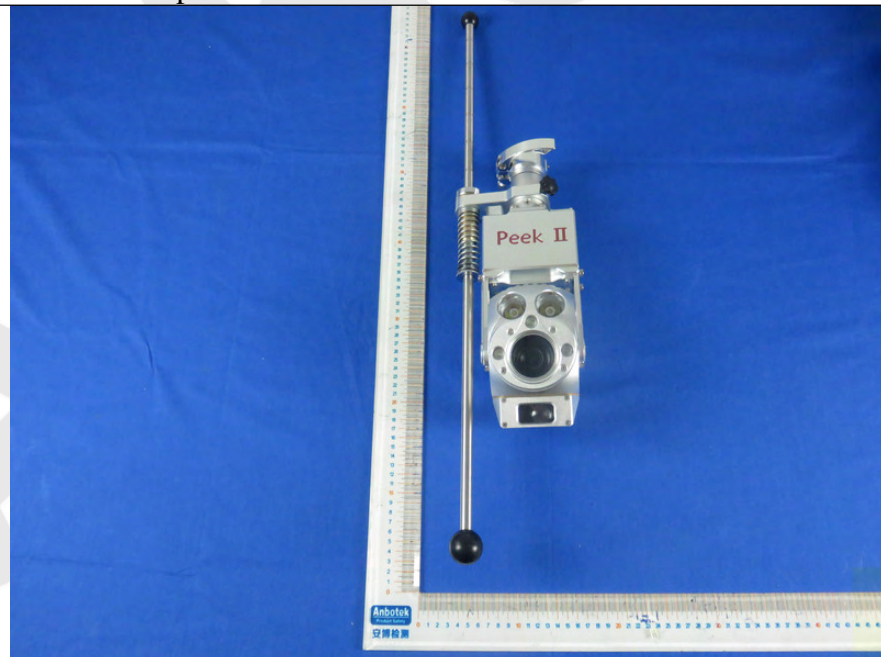


APPENDIX I (EXTERNAL PHOTOS)

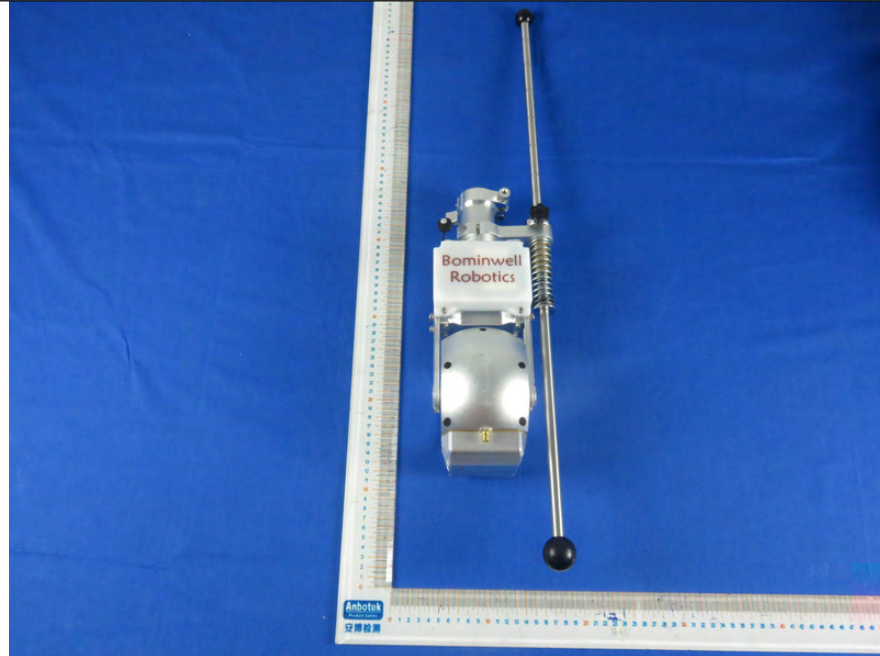
1. Figure
The EUT-Overall View



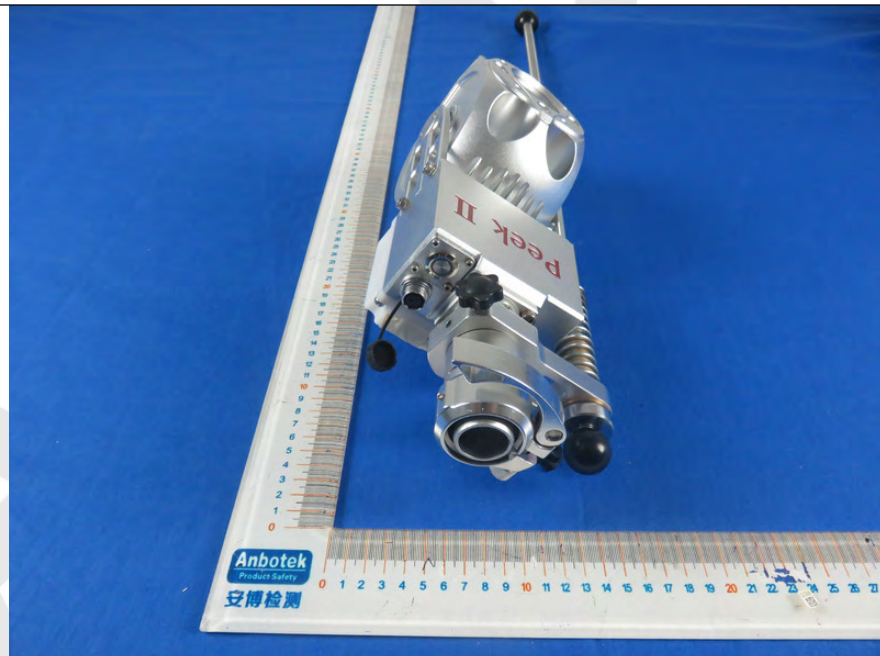
2. Figure
The EUT-Top View



3. Figure
The EUT-Bottom View



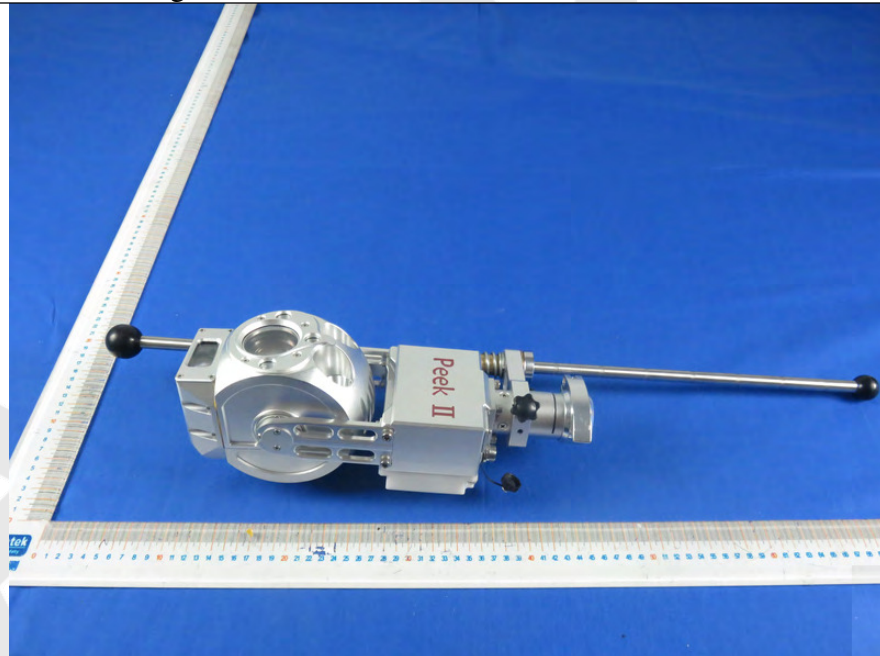
4. Figure
The EUT-Front View



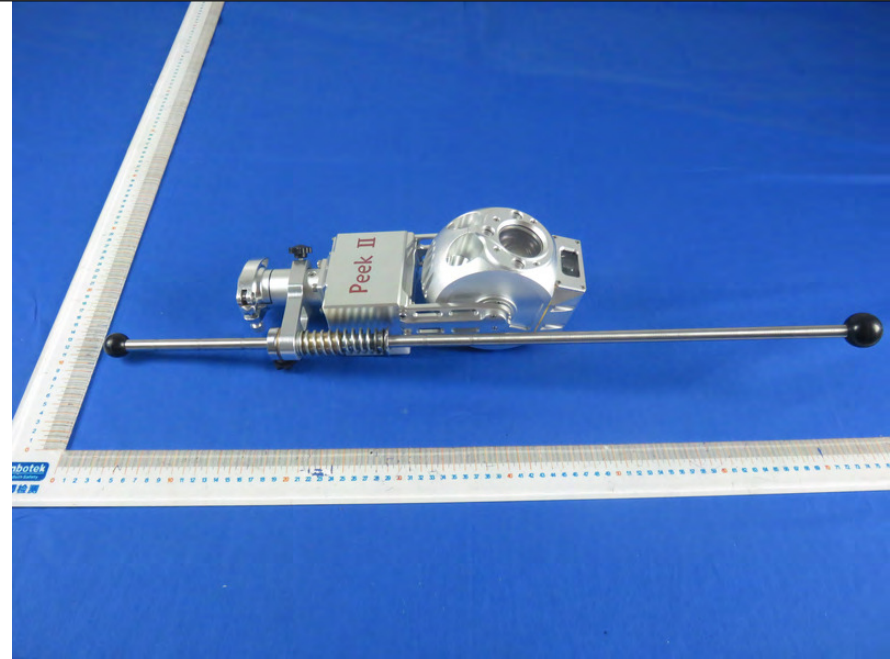
5. Figure
The EUT-Back View



6. Figure
The EUT-Right View

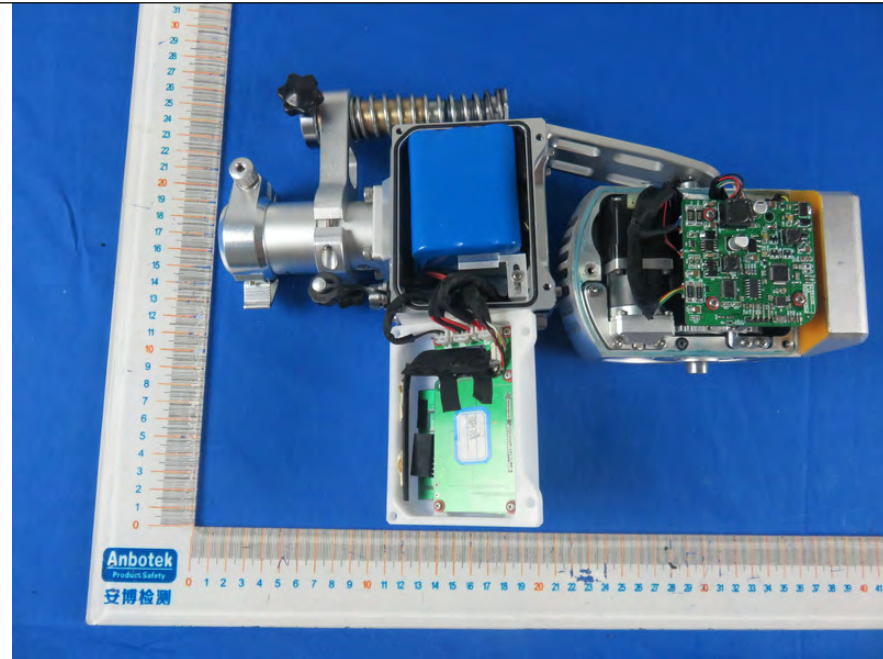


7. Figure
The EUT-Left View



APPENDIX II (INTERNAL PHOTOS)

1. Figure
The EUT-Inside View



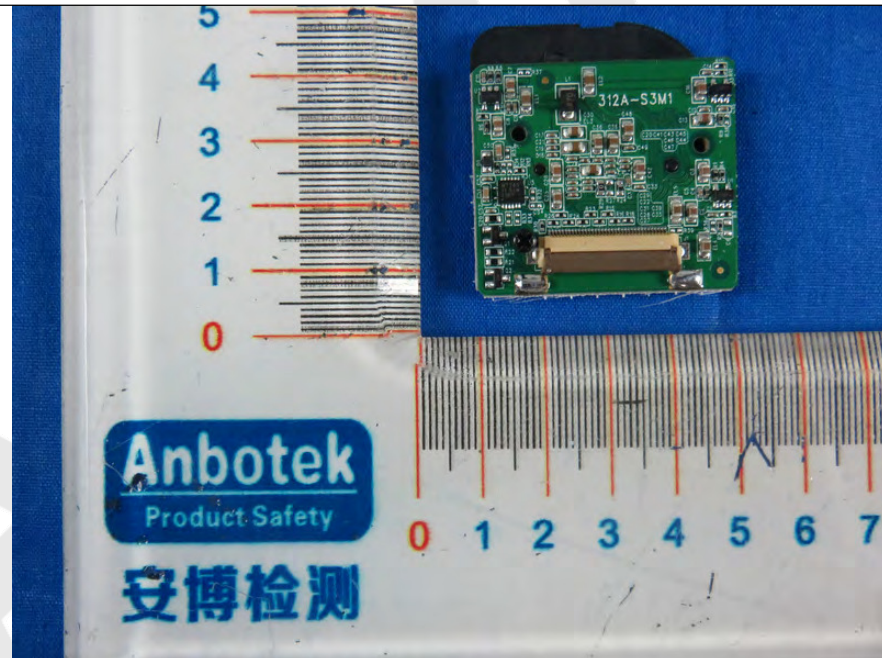
2. Figure
PCB of the EUT-Front View



3. Figure
PCB of the EUT-Back View



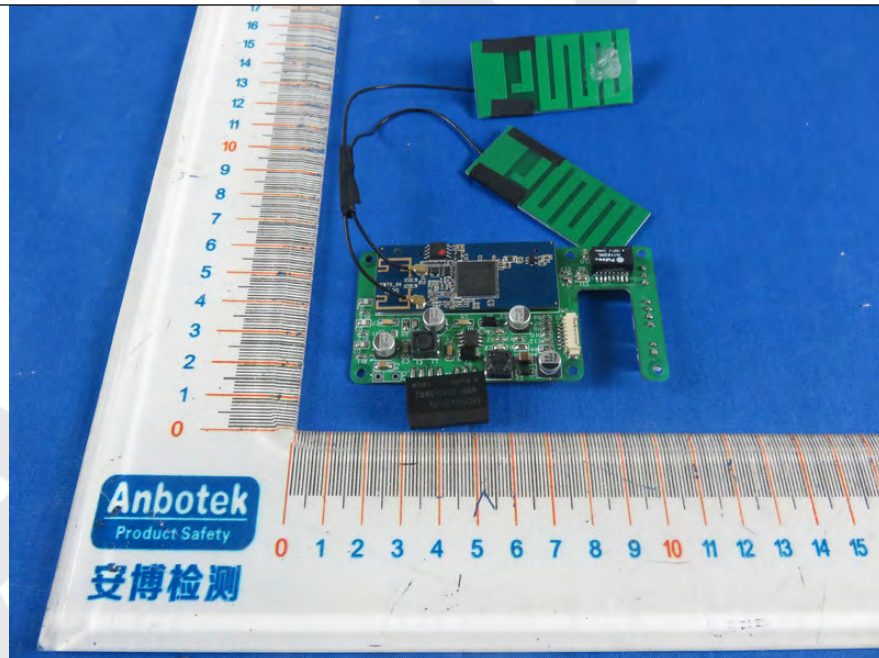
4. Figure
PCB of the EUT-Front View



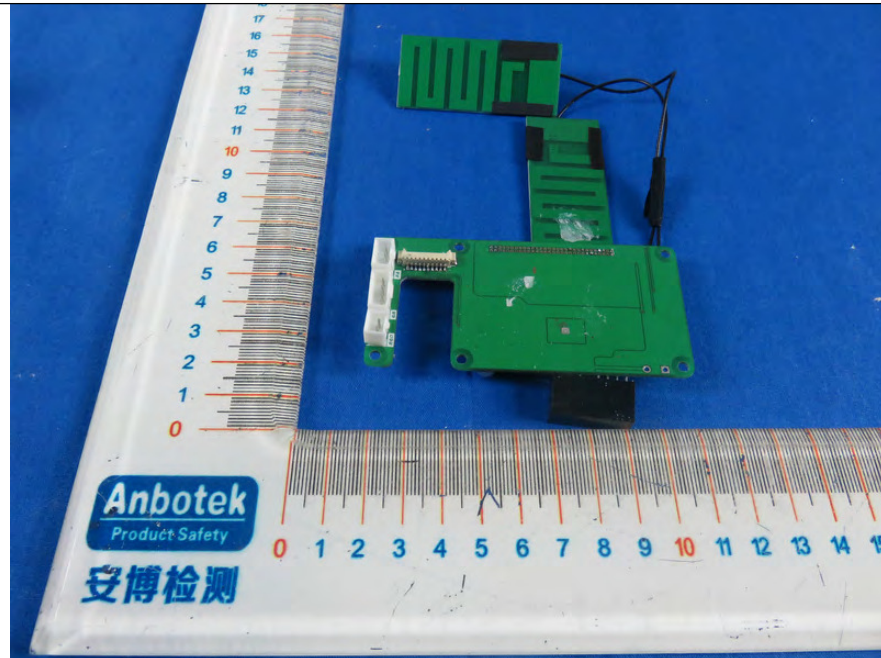
5. Figure
PCB of the EUT-Back View



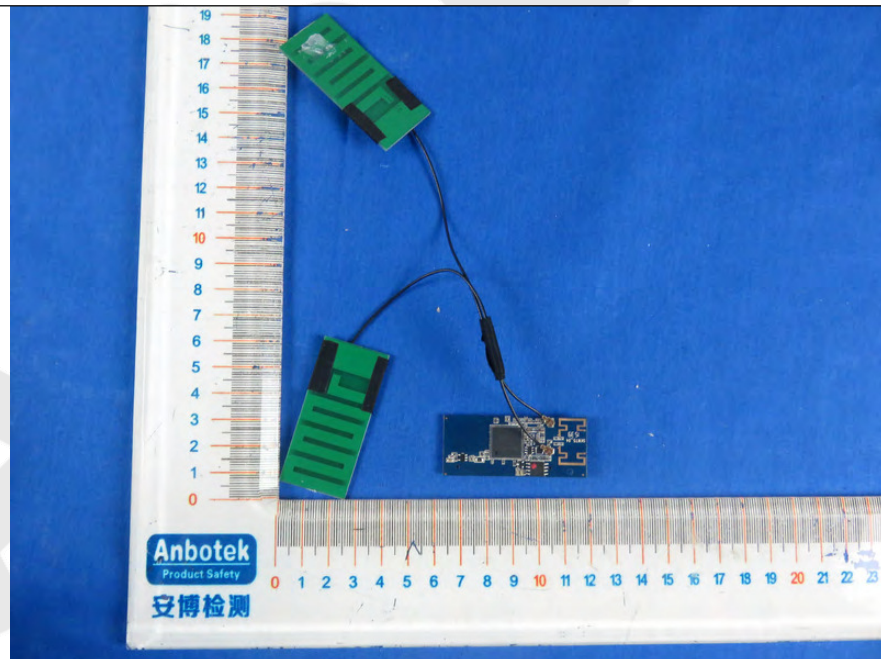
6. Figure
PCB of the EUT-Front View



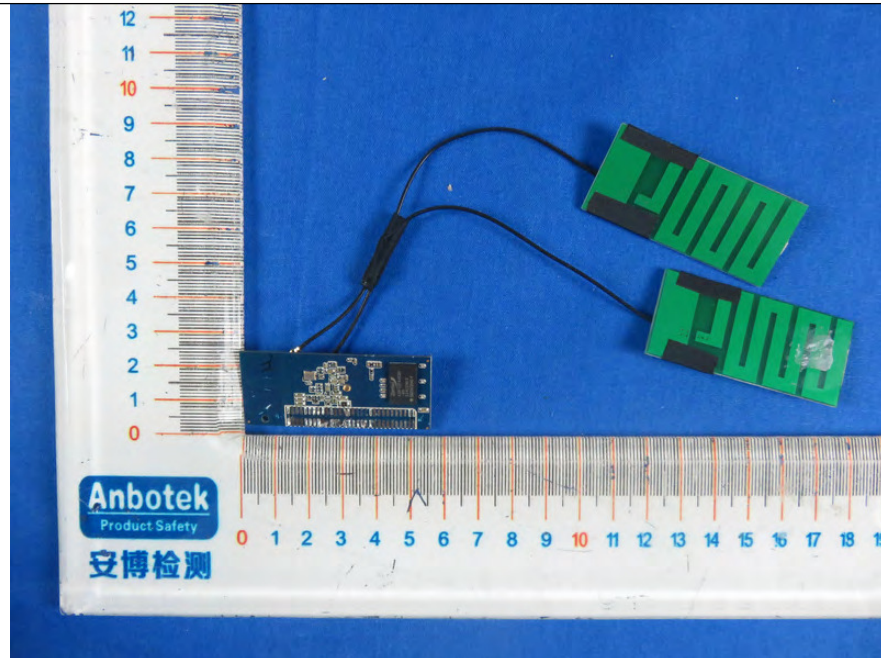
7. Figure
PCB of the EUT-Back View



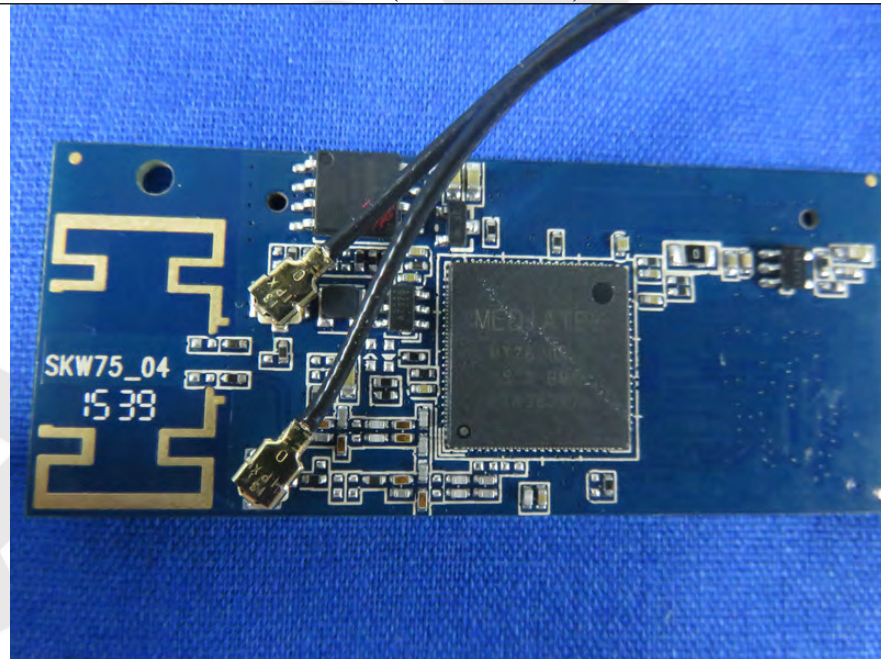
8. Figure
PCB of the EUT-Front View



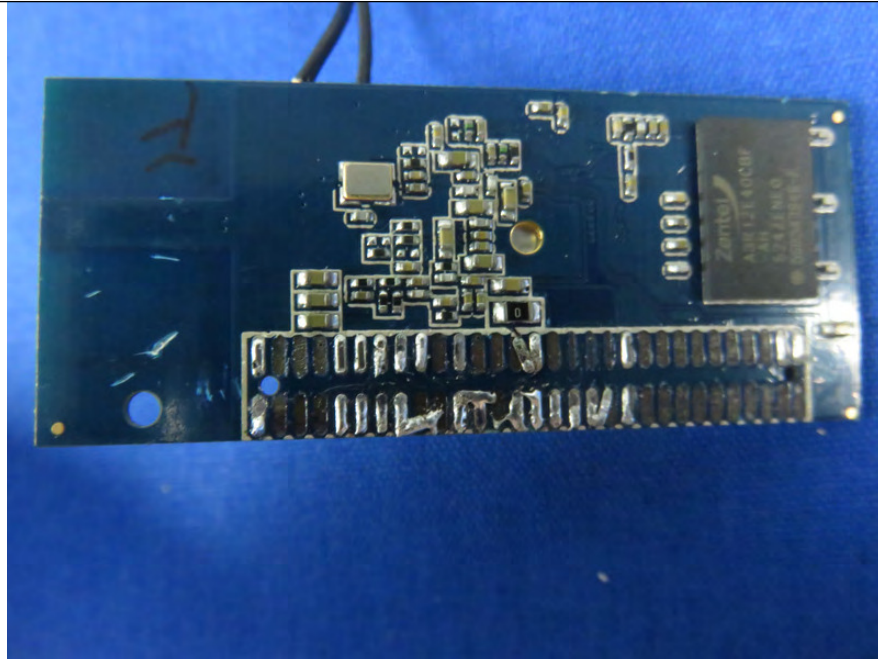
9. Figure
PCB of the EUT-Back View



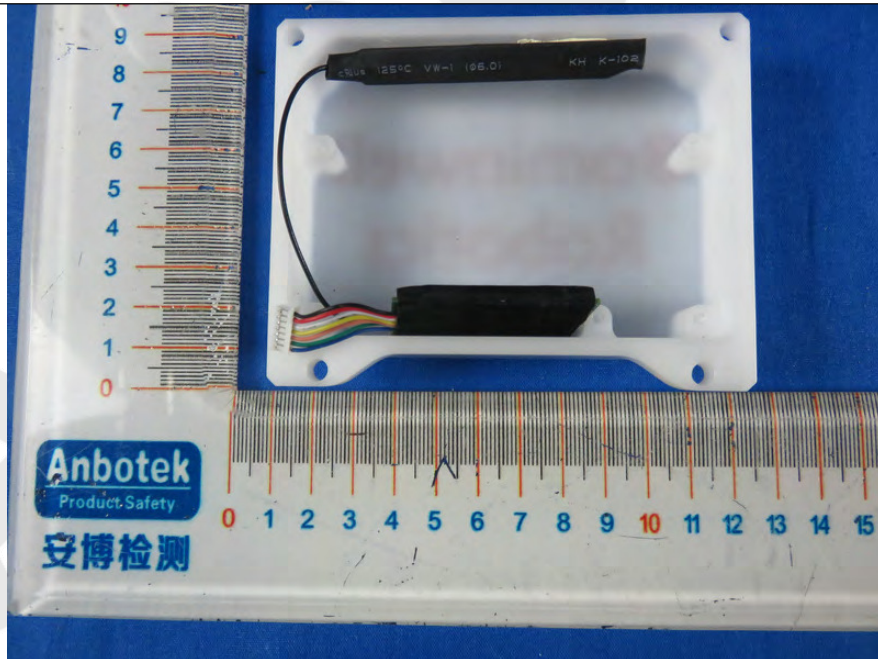
10. Figure
PCB of the EUT-Front View (WiFi Module)



11. Figure
PCB of the EUT-Back View (WiFi Module)



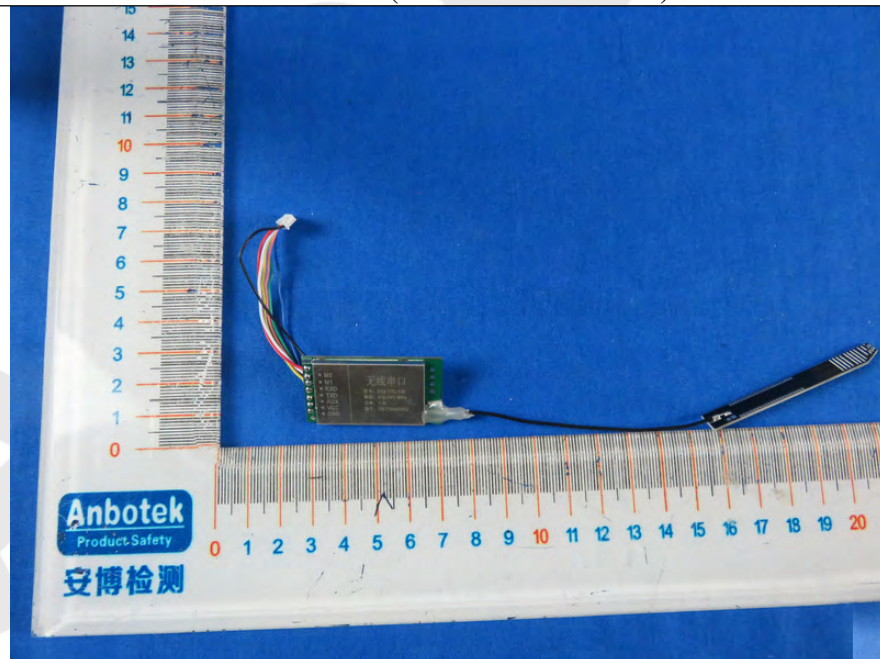
12. Figure
The EUT-Inside View



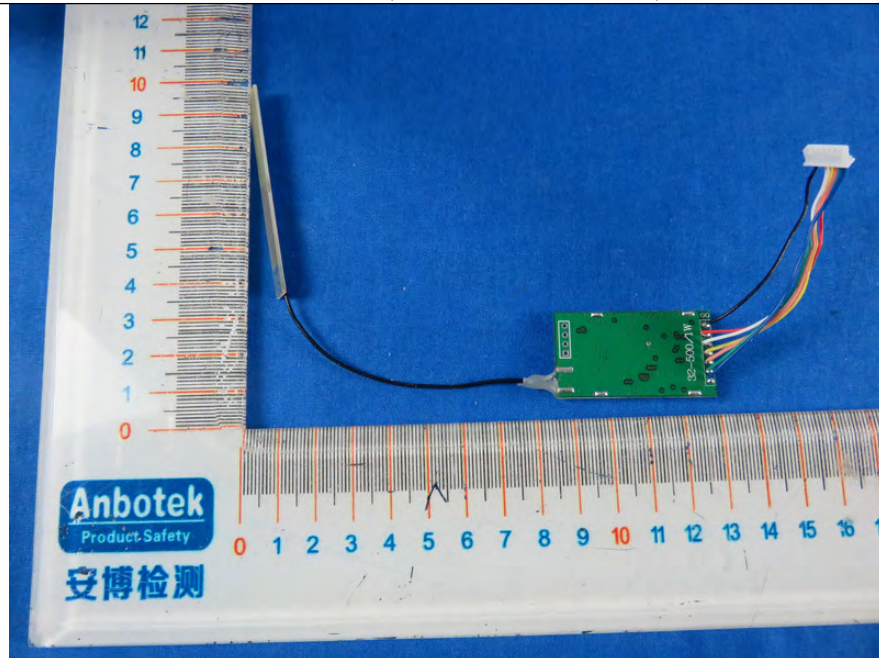
13. Figure
The EUT-Inside View



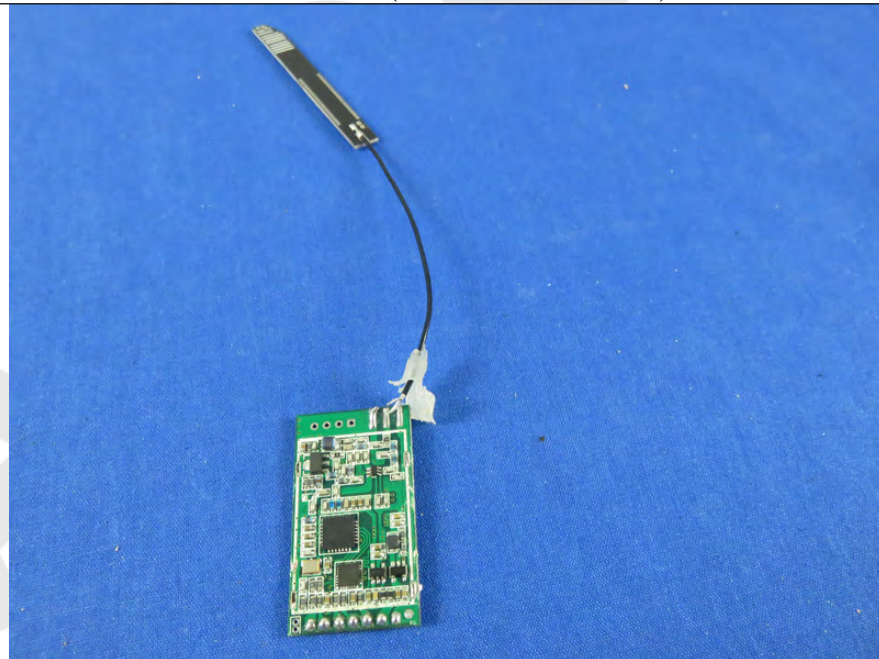
14. Figure
PCB of the EUT-Front View (433.92MHz Module)



15. Figure
PCB of the EUT-Back View (433.92MHz Module)



16. Figure
PCB of the EUT-Front View (433.92MHz Module)



17. Figure
PCB of the EUT-Back View (433.92MHz Module)

