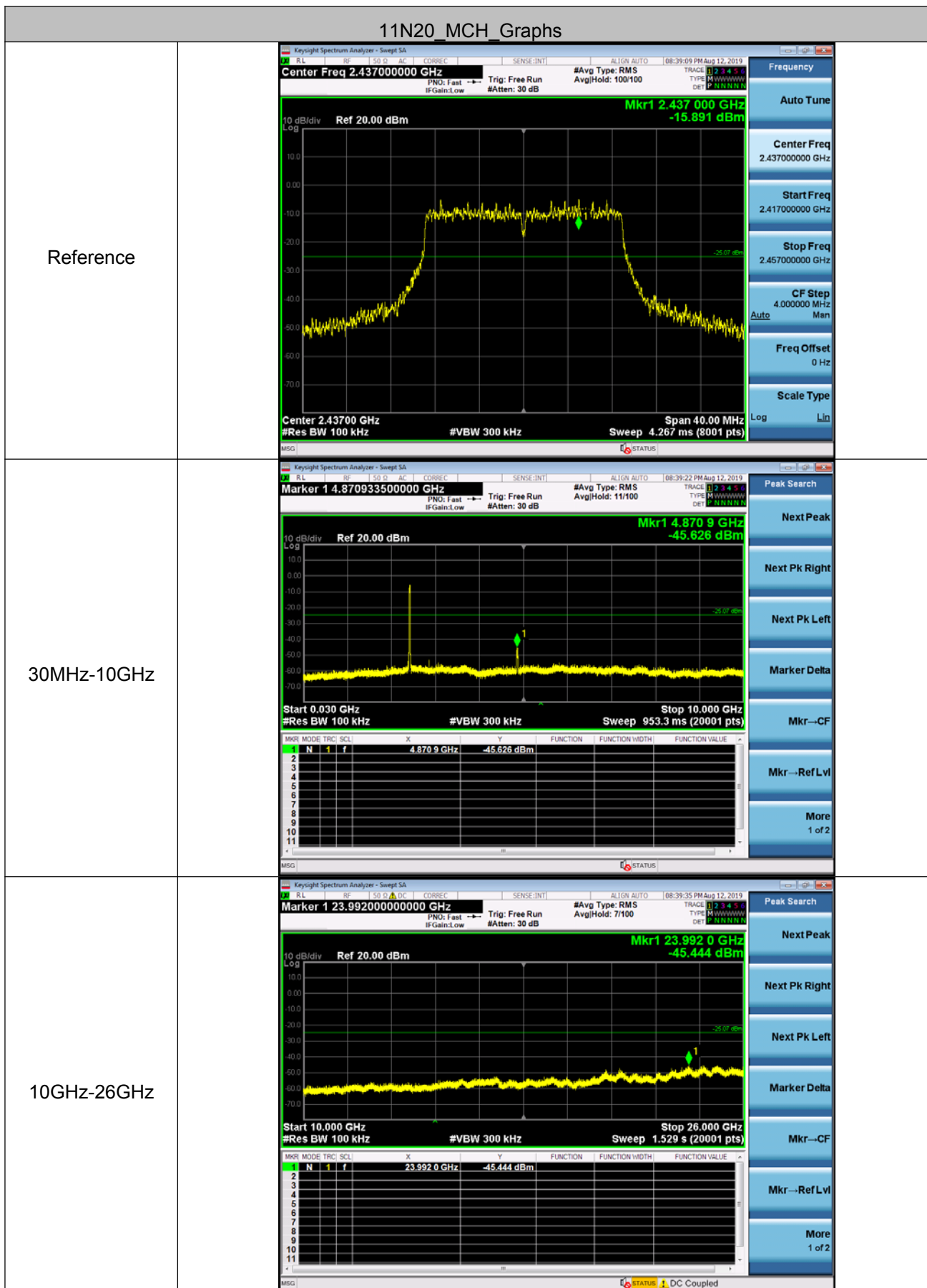
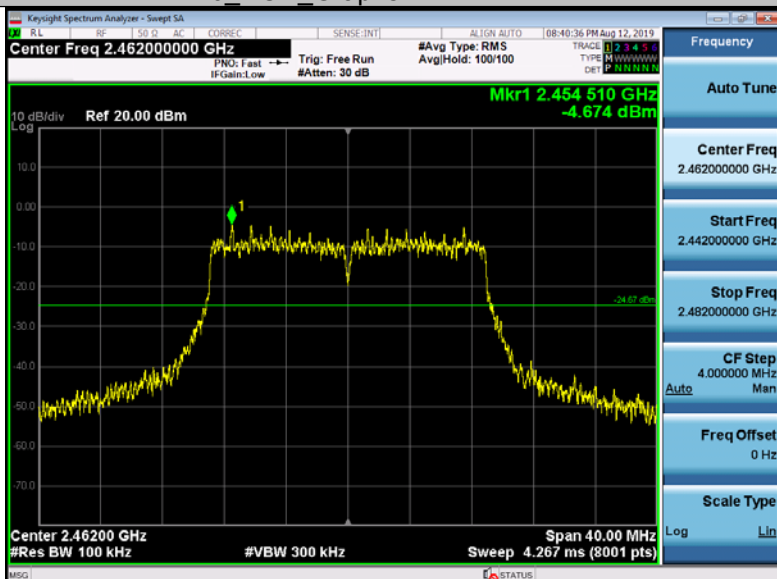


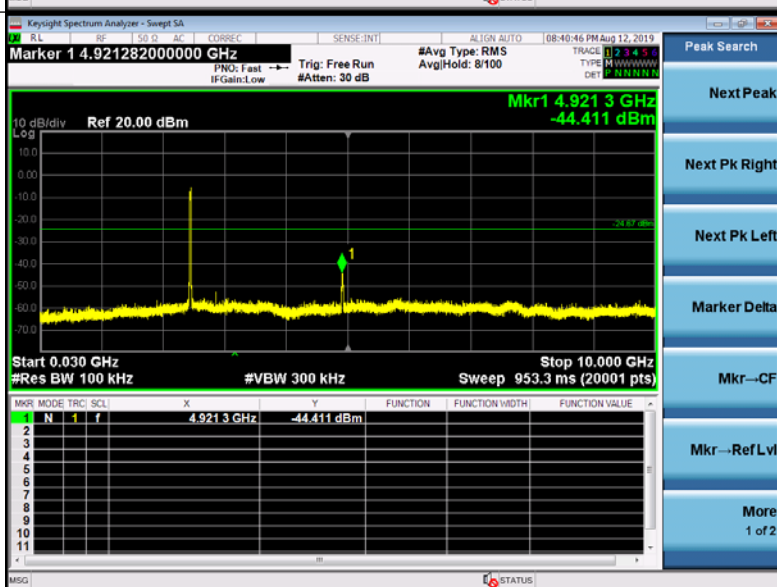


11N20_HCH_Graphs

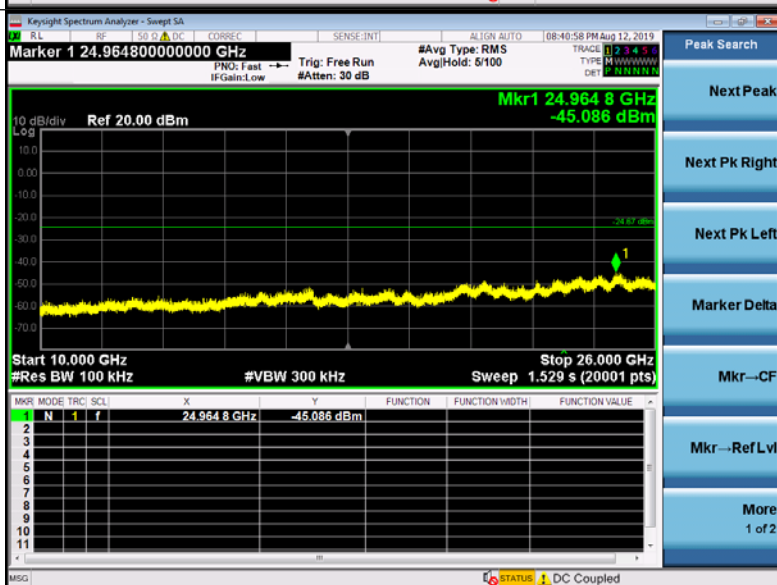
Reference



30MHz-10GHz



10GHz-26GHz



Remark:

Pretest 9kHz to 25GHz, find the highest point when testing, so only the worst data were shown in the test report. Per FCC Part 15.33 (a) and 15.31 (o) ,The amplitude of spurious emissions from intentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.

5.8 Radiated Spurious Emissions

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205				
Test Method:	ANSI C63.10 2013				
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	100 kHz	300kHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3
	Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.				

Test Setup:

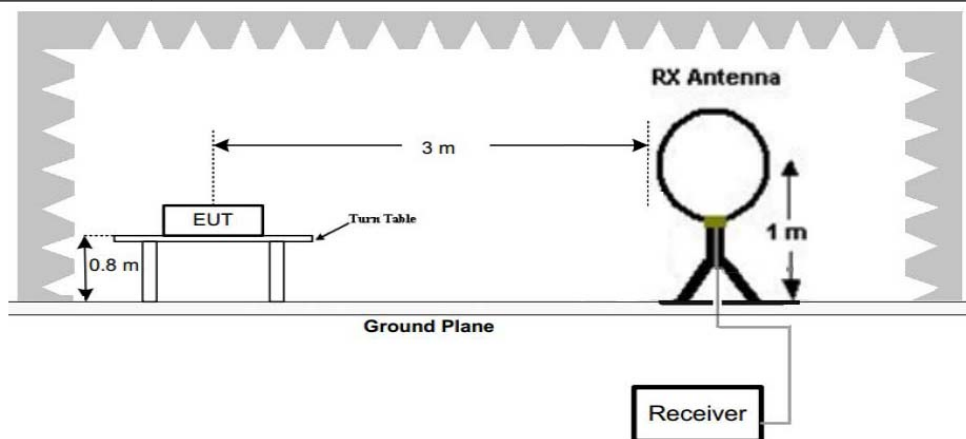


Figure 1. Below 30MHz

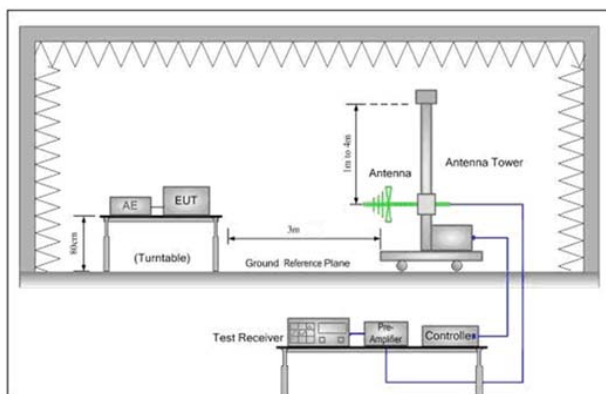


Figure 2. 30MHz to 1GHz

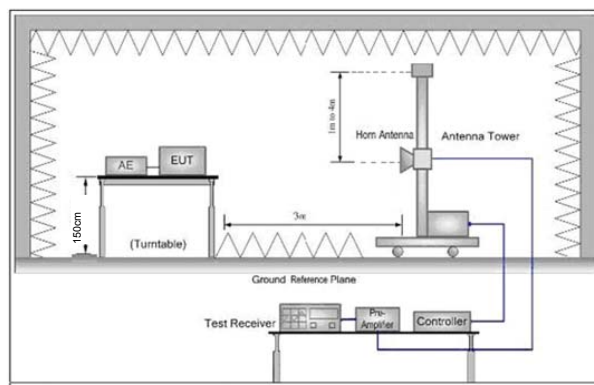


Figure 3. Above 1 GHz

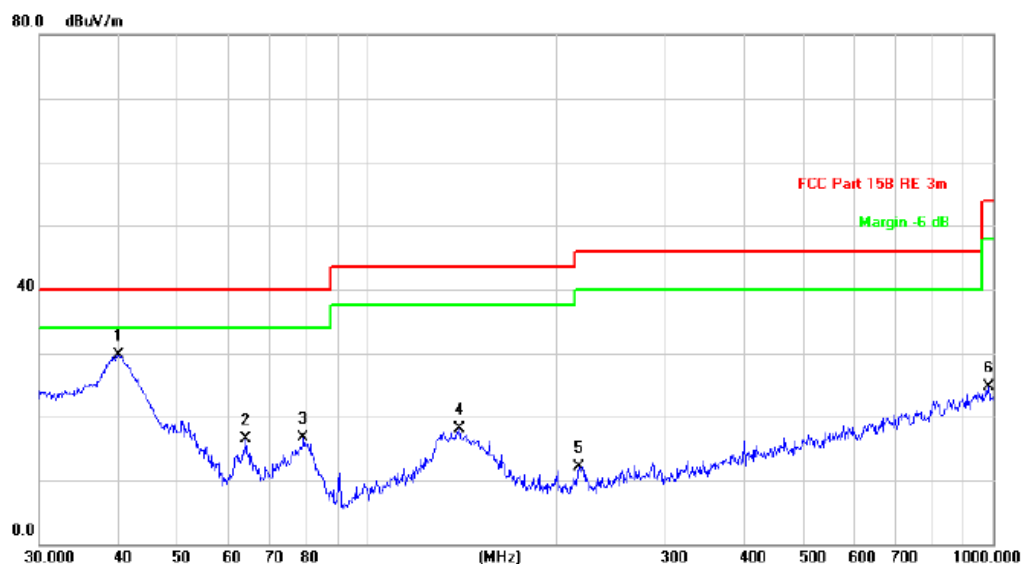
Test Procedure:

- a. 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
Note: For the radiated emission test above 1GHz:
Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

	d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. g. Test the EUT in the lowest channel, the middle channel, the Highest channel h. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates. Transmitting mode,
Final Test Mode:	Pretest the EUT at Transmitting mode, found the Transmitting mode which it is worse case, Through Pre-scan, find the 11Mbps of rate is the worst case of 802.11b; 54Mbps of rate is the worst case of 802.11g; 65Mbps of rate is the worst case of 802.11n(HT20); For below 1GHz, through Pre-scan, find the 11Mbps of rate of 802.11b at lowest channel is the worst case. Only the worst case is recorded in the report.
Test Results:	Pass

5.8.1 Radiated emission below 1GHz

30MHz~1GHz		
Test mode:	Transmitting	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree
1	*	40.1347	42.93	-13.15	29.78	40.00	-10.22	QP		
2		64.2074	35.37	-18.81	16.56	40.00	-23.44	QP		
3		79.2426	35.60	-18.90	16.70	40.00	-23.30	QP		
4		140.8351	31.00	-12.80	18.20	43.50	-25.30	QP		
5		218.3085	26.47	-14.41	12.06	46.00	-33.94	QP		
6		982.6200	24.02	0.62	24.64	54.00	-29.36	QP		

Remark:

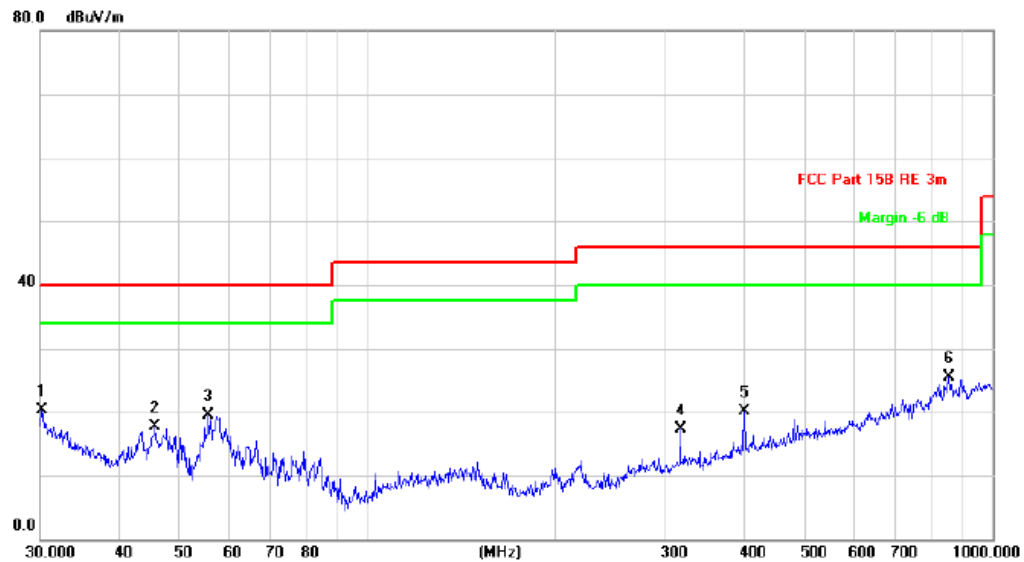
The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Factor= Antenna Factor + Cable Factor – Preamplifier Factor,

Level = Read Level + Factor,

Over Limit=Level-Limit Line.

Test mode:	Transmitting	Horizontal
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No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	cm	degree
1	*	30.2111	23.97	-3.68	20.29	40.00	-19.71	QP	
2		45.8553	33.55	-15.76	17.79	40.00	-22.21	QP	
3		55.8047	38.31	-18.89	19.42	40.00	-20.58	QP	
4		316.5890	28.04	-10.65	17.39	46.00	-28.61	QP	
5		400.4319	28.76	-8.57	20.19	46.00	-25.81	QP	
6		851.0353	25.75	-0.23	25.52	46.00	-20.48	QP	

Remark:

The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Factor= Antenna Factor + Cable Factor – Preamplifier Factor,

Level = Read Level + Factor,

Over Limit=Level-Limit Line.

5.8.2 Transmitter emission above 1GHz

Test mode:		802.11b(11Mbps)		Test channel:		Lowest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
4824.000	52.16	-4.26	47.90	74	-26.10	PK	H
4824.000	51.91	-4.26	47.65	74	-26.35	AV	H
7236.000	50.83	1.18	52.01	74	-21.99	PK	H
7236.000	47.39	1.18	48.57	74	-25.43	AV	H
4824.000	52.73	-4.26	48.47	74	-25.53	PK	V
4824.000	51.60	-4.26	47.34	74	-26.66	AV	V
7236.000	51.60	1.18	52.78	74	-21.22	PK	V
7236.000	48.16	1.18	49.34	74	-24.66	AV	V

Test mode:		802.11b(11Mbps)		Test channel:		Middle	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
4874.000	52.96	-4.12	48.84	74	-25.16	PK	H
4874.000	50.72	-4.12	46.60	74	-27.40	AV	H
7311.000	51.04	1.46	52.50	74	-21.50	PK	H
7311.000	49.00	1.46	50.46	74	-23.54	AV	H
4874.000	52.82	-4.12	48.70	74	-25.30	PK	V
4874.000	50.40	-4.12	46.28	74	-27.72	AV	V
7311.000	51.08	1.46	52.54	74	-21.46	PK	V
7311.000	49.20	1.46	50.66	74	-23.34	AV	V

Test mode:		802.11b(11Mbps)		Test channel:		Highest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
4924.000	52.68	-4.03	48.65	74	-25.35	PK	H
4924.000	51.48	-4.03	47.45	74	-26.55	AV	H
7386.000	51.61	1.66	53.27	74	-20.73	PK	H
7386.000	49.35	1.66	51.01	74	-22.99	AV	H
4924.000	52.66	-4.03	48.63	74	-25.37	PK	V
4924.000	51.50	-4.03	47.47	74	-26.53	AV	V
7386.000	50.93	1.66	52.59	74	-21.41	PK	V
7386.000	48.07	1.66	49.73	74	-24.27	AV	V

Remark:

- 1) The 1Mbps of rate of 802.11b is the worst case.
- 2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor
- 3) Scan from 9kHz to 25GHz,The disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

5.9 Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205		
Test Method:	ANSI C63.10 2013		
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)		
Limit:	Frequency	Limit (dBuV/m @3m)	Remark
	30MHz-88MHz	40.0	Quasi-peak Value
	88MHz-216MHz	43.5	Quasi-peak Value
	216MHz-960MHz	46.0	Quasi-peak Value
	960MHz-1GHz	54.0	Quasi-peak Value
	Above 1GHz	54.0	Average Value
		74.0	Peak Value
Test Setup:			

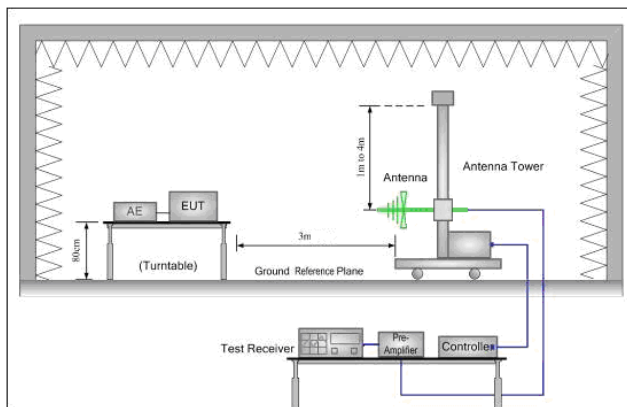


Figure 1. 30MHz to 1GHz

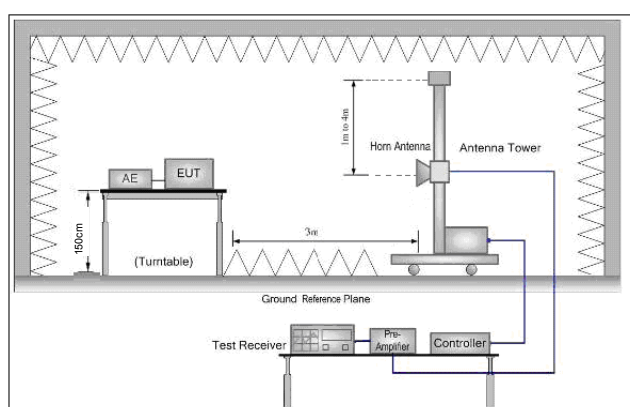


Figure 2. Above 1 GHz

Test Procedure:

- 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
 - 2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- Note: For the radiated emission test above 1GHz:
- Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
 - The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

	d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. f. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel g. Test the EUT in the lowest channel , the Highest channel h. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Transmitting with all kind of modulations, data rates. Transmitting mode.
Final Test Mode:	Pretest the EUT at Transmitting mode, found the Transmitting mode which it is worse case Through Pre-scan, find the 11Mbps of rate is the worst case of 802.11b; 54Mbps of rate is the worst case of 802.11g ; 65Mbps of rate is the worst case of 802.11n(HT20) ; Only the worst case is recorded in the report.
Test Results:	Pass

Test data:

Worse case mode:		802.11b(11Mbps)		Test channel:		Lowest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
2390.000	62.46	-9.2	53.26	74	-20.74	PK	H
2390.000	47.30	-9.2	38.10	54	-15.90	AV	H
2400.000	59.17	-9.39	49.78	74	-24.22	PK	H
2400.000	41.82	-9.39	32.43	54	-21.57	AV	H
2390.000	61.78	-9.2	52.58	74	-21.42	PK	V
2390.000	47.68	-9.2	38.48	54	-15.52	AV	V
2400.000	59.44	-9.39	50.05	74	-23.95	PK	V
2400.000	42.36	-9.39	32.97	54	-21.03	AV	V

Worse case mode:		802.11b(11Mbps)		Test channel:		Highest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
2483.500	61.97	-9.29	52.68	74	-21.32	PK	H
2483.500	46.39	-9.29	37.10	54	-16.90	AV	H
2483.500	59.23	-9.29	49.94	74	-24.06	PK	V
2483.500	42.47	-9.29	33.18	54	-20.82	AV	V

Worse case mode:		802.11g(54Mbps)		Test channel:		Lowest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
2390.000	62.55	-9.2	53.35	74	-20.65	PK	H
2390.000	46.51	-9.2	37.31	54	-16.69	AV	H
2400.000	60.70	-9.39	51.31	74	-22.69	PK	H
2400.000	42.86	-9.39	33.47	54	-20.53	AV	H
2390.000	60.99	-9.2	51.79	74	-22.21	PK	V
2390.000	47.43	-9.2	38.23	54	-15.77	AV	V
2400.000	59.83	-9.39	50.44	74	-23.56	PK	V
2400.000	41.37	-9.39	31.98	54	-22.02	AV	V

Worse case mode:		802.11g(54Mbps)		Test channel:		Highest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
2483.500	59.31	-9.29	50.02	74	-23.98	PK	H
2483.500	46.52	-9.29	37.23	54	-16.77	AV	H
2483.500	60.86	-9.29	51.57	74	-22.43	PK	V
2483.500	42.90	-9.29	33.61	54	-20.39	AV	V

Worse case mode:		802.11n(HT20) (65Mbps)		Test channel:		Lowest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
2390.000	63.58	-9.29	54.29	74	-19.71	PK	H
2390.000	46.35	-9.29	37.06	54	-16.94	AV	H
2400.000	60.89	-9.29	51.60	74	-22.40	PK	H
2400.000	41.52	-9.29	32.23	54	-21.77	AV	H
2390.000	63.64	-9.29	54.35	74	-19.65	PK	V
2390.000	47.51	-9.29	38.22	54	-15.78	AV	V
2400.000	60.49	-9.29	51.20	74	-22.80	PK	V
2400.000	41.23	-9.29	31.94	54	-22.06	AV	V

Worse case mode:		802.11n(HT20) (65Mbps)		Test channel:		Highest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)		H/V
2483.500	62.22	-9.29	52.93	74	-21.07	PK	H
2483.500	47.77	-9.29	38.48	54	-15.52	AV	H
2483.500	59.89	-9.29	50.60	74	-23.40	PK	V
2483.500	42.81	-9.29	33.52	54	-20.48	AV	V

Note:

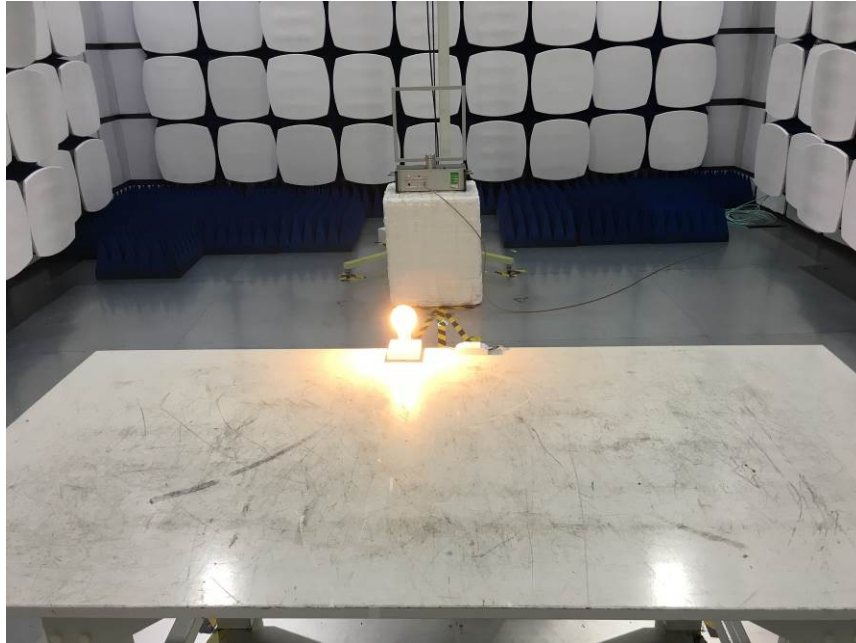
The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

6 Photographs - EUT Test Setup

6.1 Radiated Emission

Below 30MHz



30MHz~1GHz



Above 1GHz

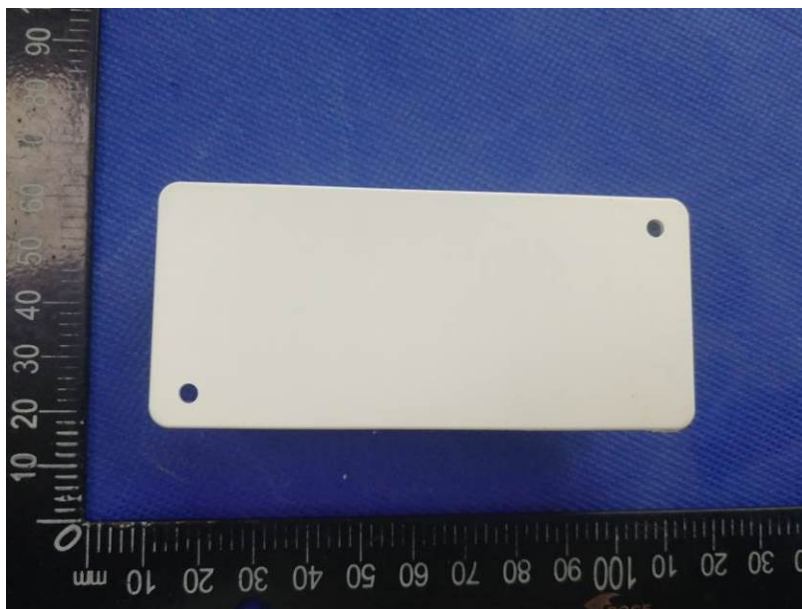


6.2 Conducted Emission

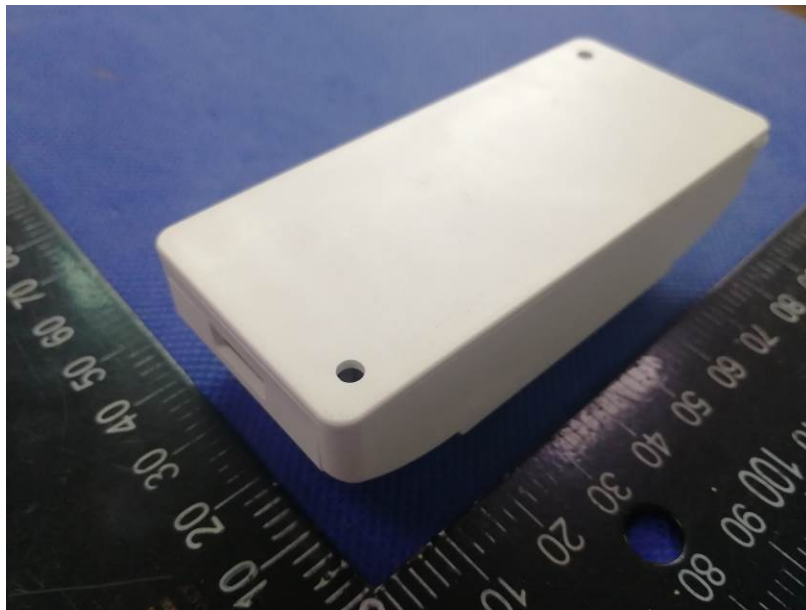
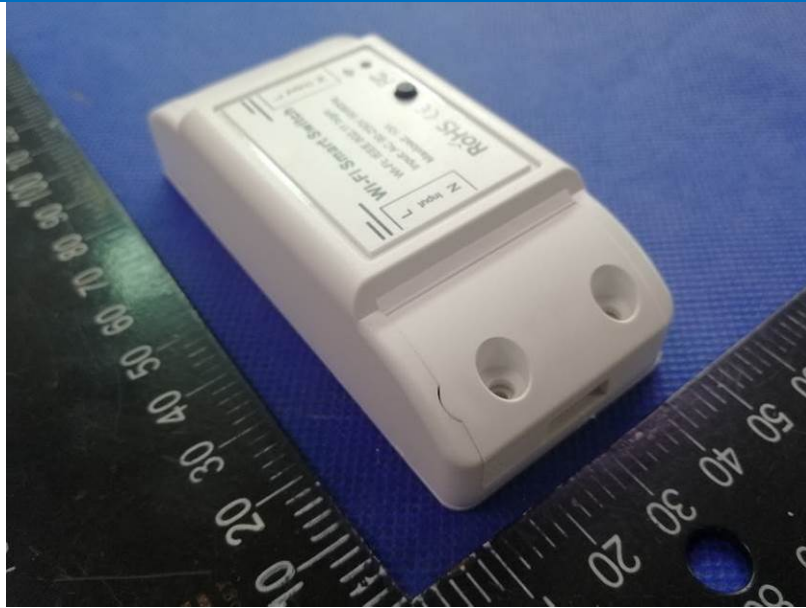


7 Photographs - EUT Constructional Details

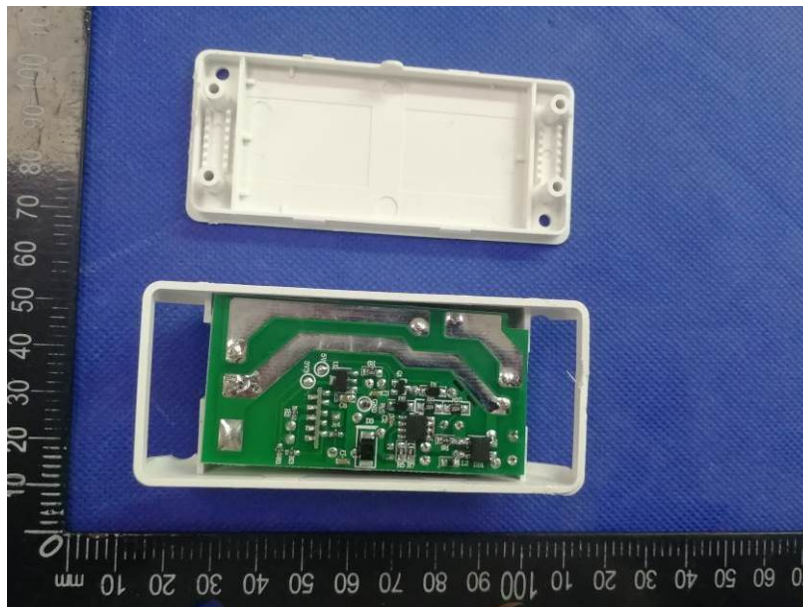
External photos

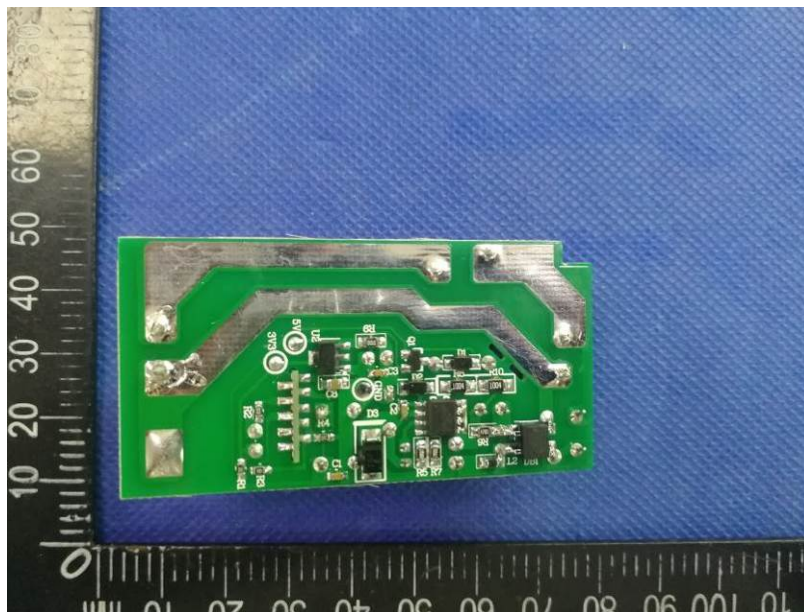
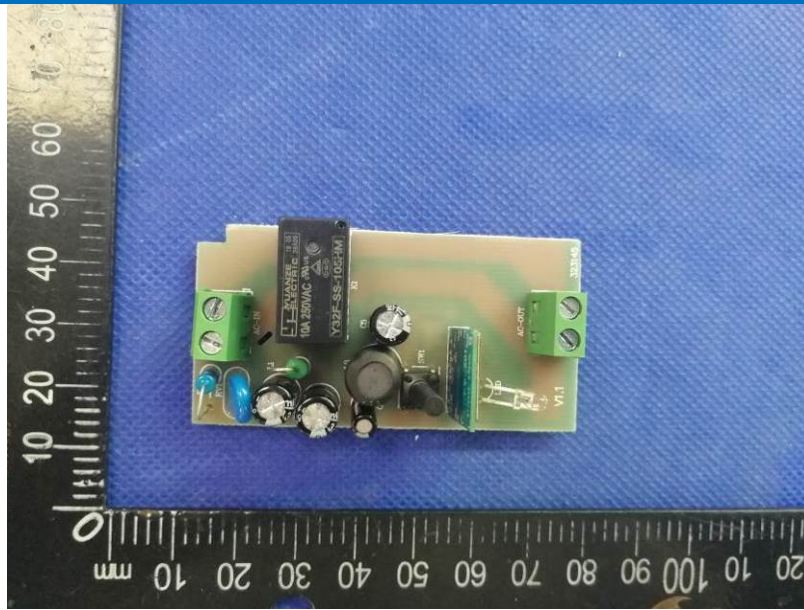


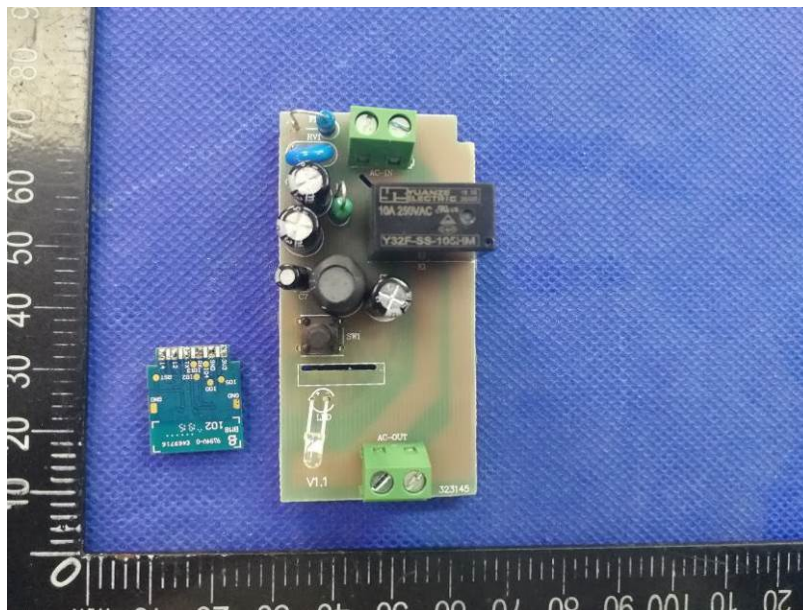
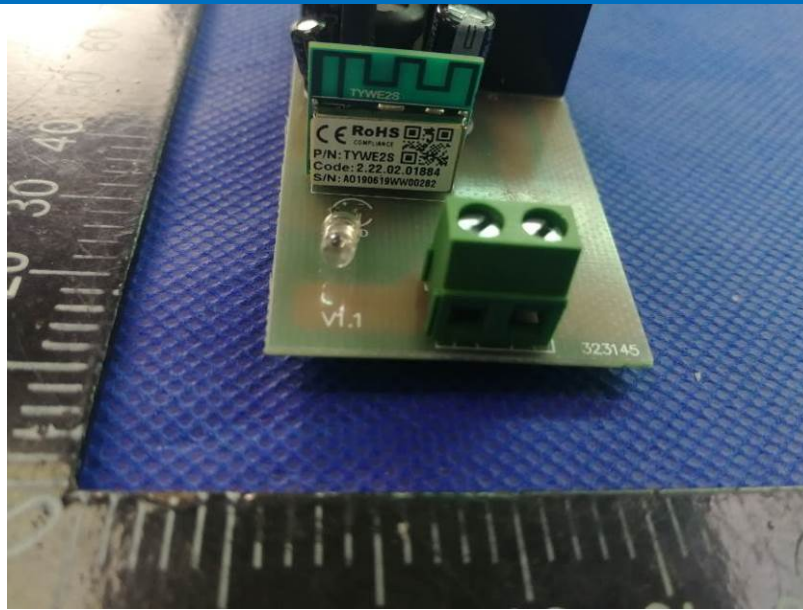


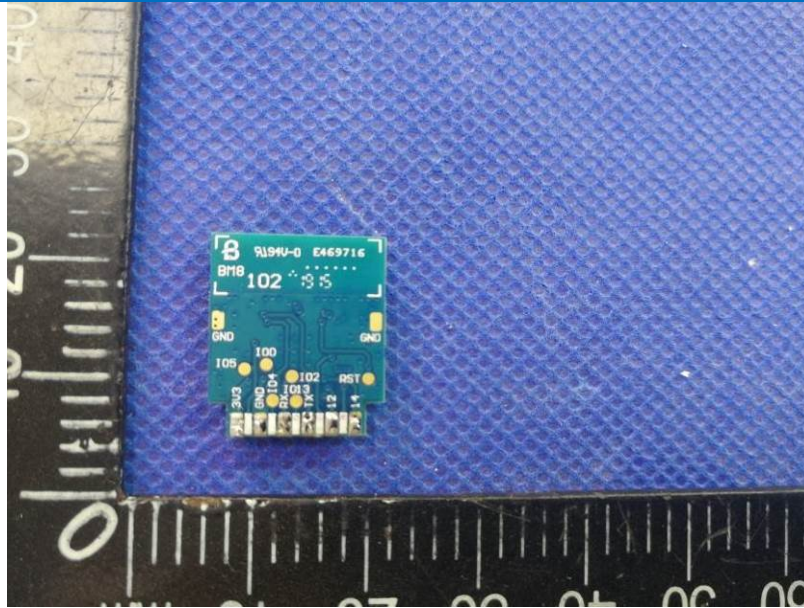


Internal photos

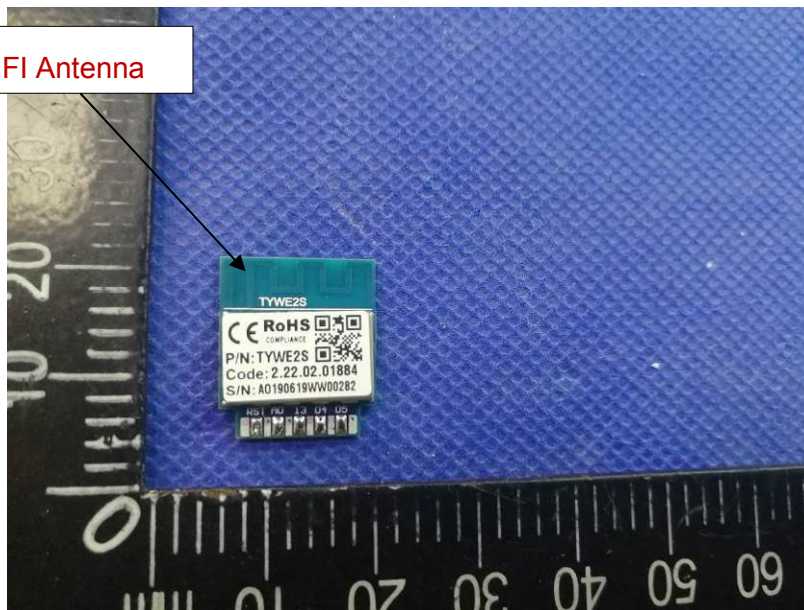








WIFI Antenna



THE END