9. MAXIMUM CONDUCTED OUTPUT POWER SPECTRAL DENSITY

9.1 MEASUREMENT PROCEDURE

(1). Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
(2). Set the EUT Work on the top, the middle and the bottom operation frequency individually.
(3). Set SPA Trace 1 Max hold, then View.

Note: The method of AVGPSD-1 in the ANSI C63.10 (2013) item 11.10 was used in this testing.

9.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

Refer To Section 8.2.

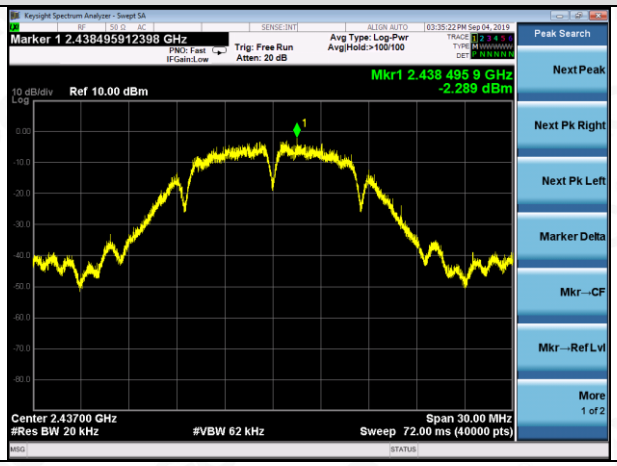
9.3 MEASUREMENT EQUIPMENT USED

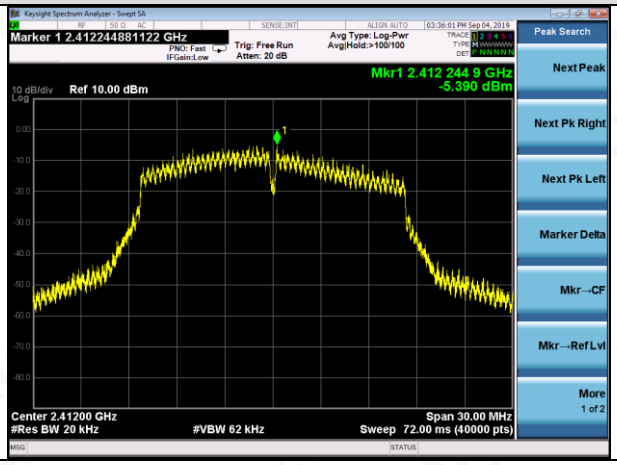
Refer To Section 6.

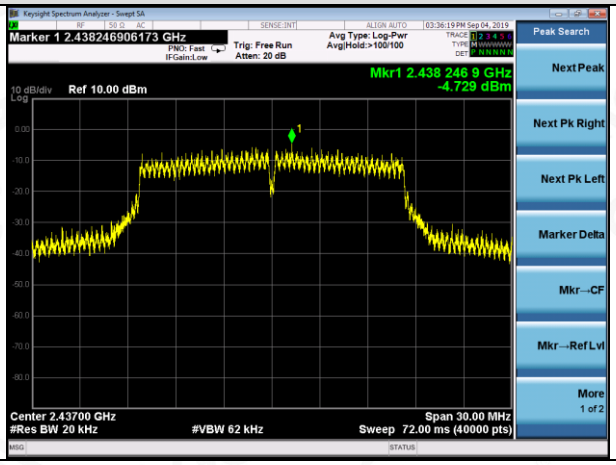
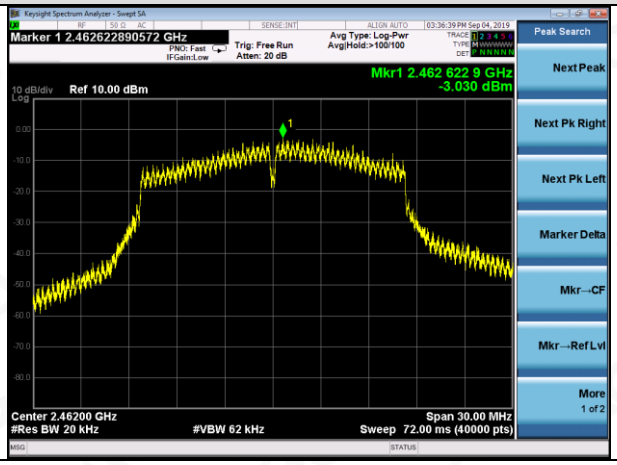
9.4 LIMITS AND MEASUREMENT RESULT

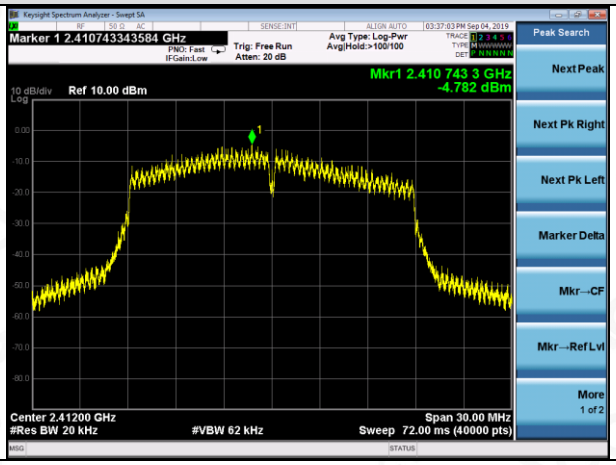
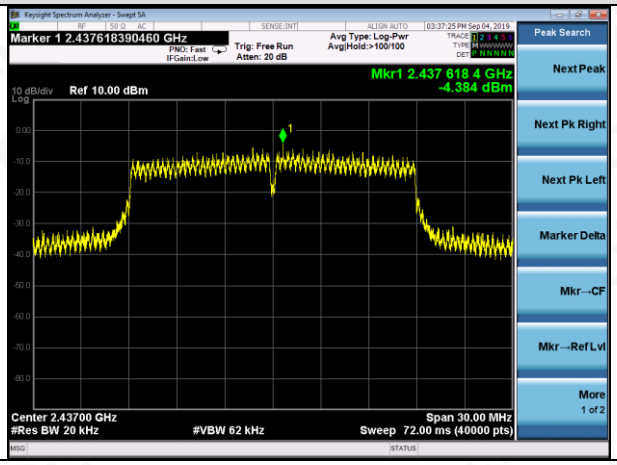
Mode	Channel	PSD [dBm/20kHz]	Limit[dBm/3kHz]	Verdict
11b	LCH	0.776	8	PASS
	MCH	-2.289	8	PASS
	HCH	1.333	8	PASS
11g	LCH	-5.390	8	PASS
	MCH	-4.729	8	PASS
	HCH	-3.030	8	PASS
11nHT20	LCH	-4.782	8	PASS
	MCH	-4.384	8	PASS
	HCH	-2.935	8	PASS

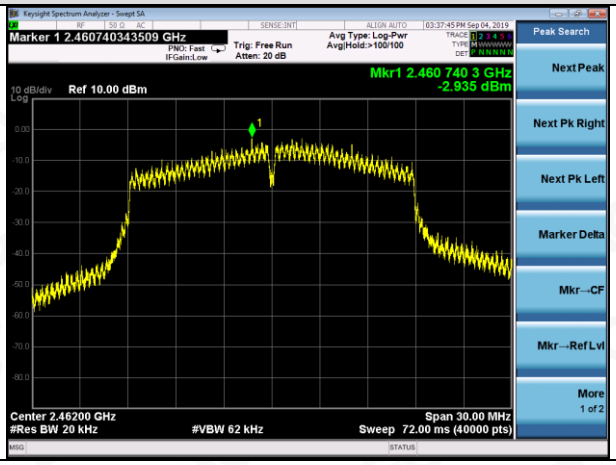
Test Graph

11b-LCH	11b-MCH
	

11b-HCH	11g-LCH
	

11g-MCH	11g-HCH
	

11nHT20-LCH	11nHT20-MCH
	

11nHT20-HCH	
	

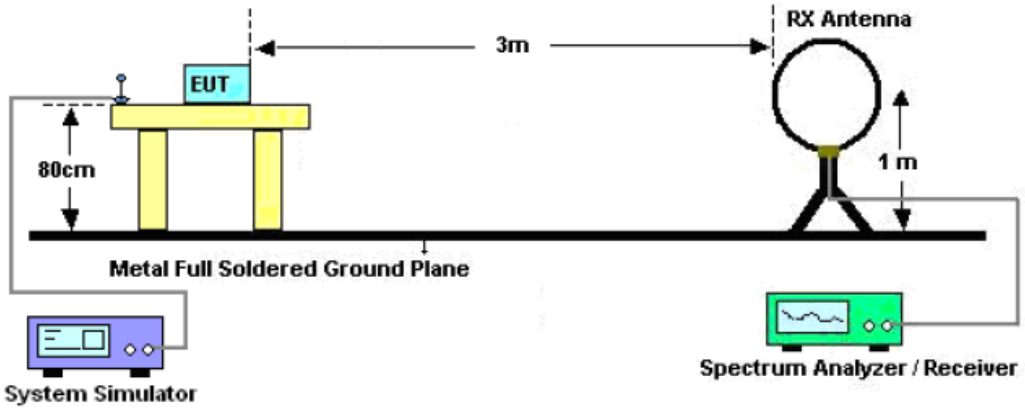
10. RADIATED EMISSION

10.1. MEASUREMENT PROCEDURE

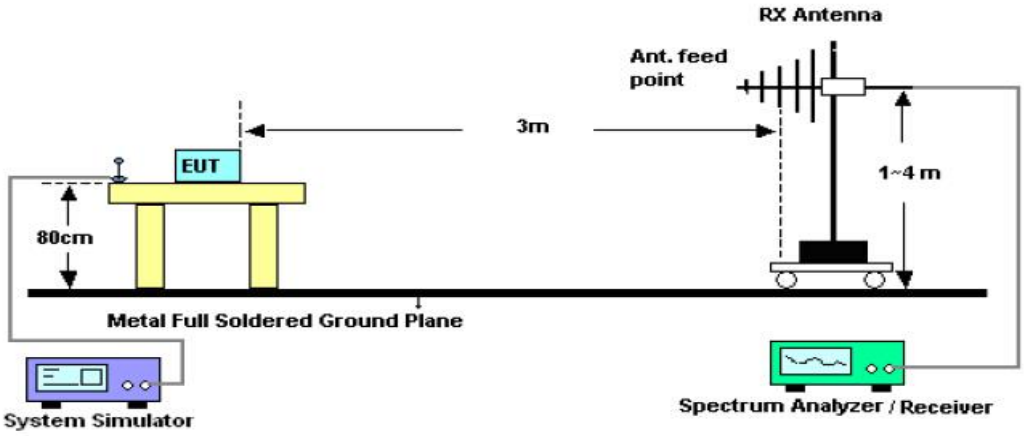
1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer. 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.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

10.2. TEST SETUP

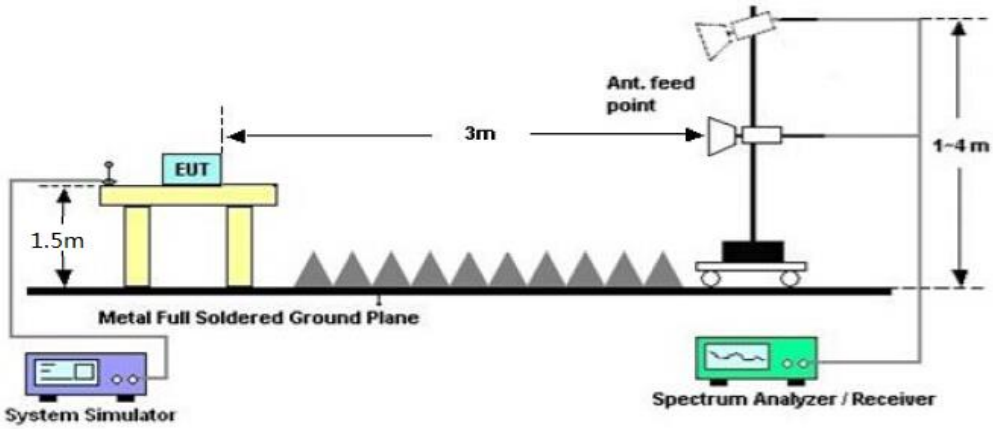
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



10.3. LIMITS AND MEASUREMENT RESULT

15.209(a) Limit in the below table has to be followed

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Note: All modes were tested For restricted band radiated emission,
the test records reported below are the worst result compared to other modes.

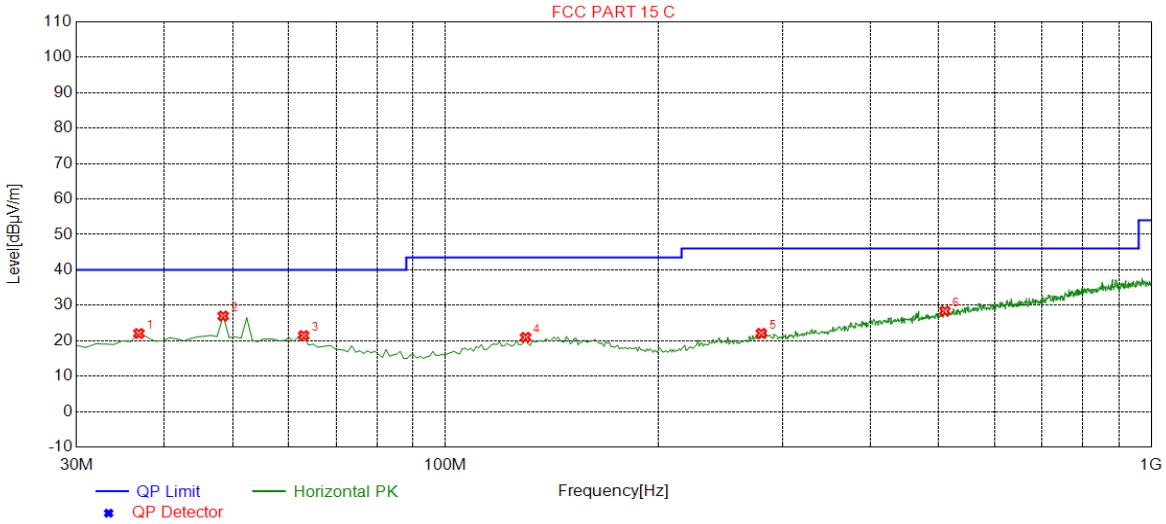
10.4. TEST RESULT

RADIATED EMISSION BELOW 30MHZ

No emission found between lowest internal used/generated frequencies to 30MHz.

RADIATED EMISSION BELOW 1GHZ

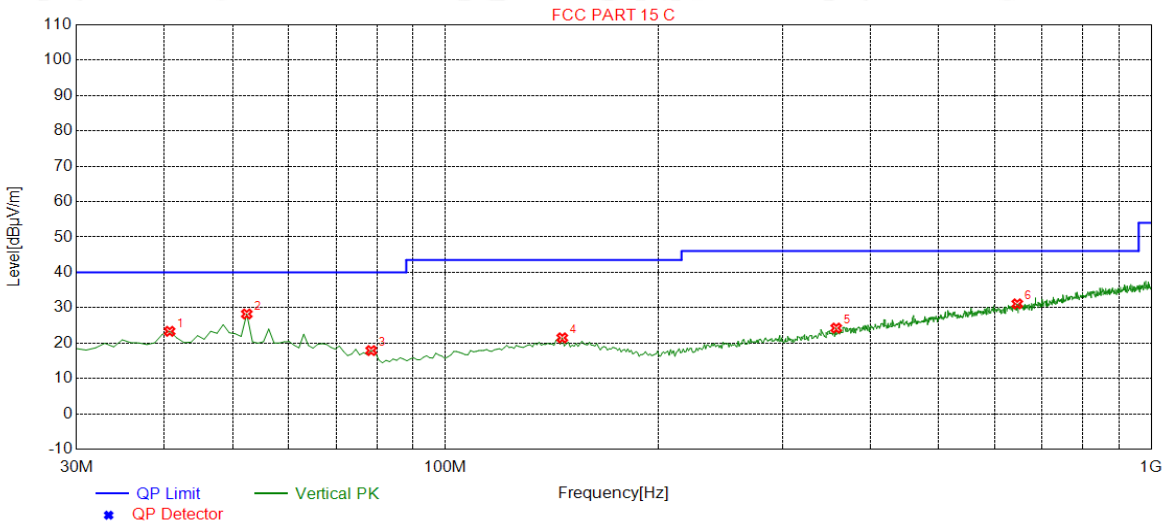
RADIATED EMISSION TEST- (30MHZ-1GHZ) -HORIZONTAL



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	36.7900	22.04	14.16	40.00	17.96	150	121	Horizontal
2	48.4300	26.98	14.71	40.00	13.02	150	192	Horizontal
3	62.9800	21.47	13.42	40.00	18.53	150	1	Horizontal
4	129.9100	20.96	14.14	43.50	22.54	150	9	Horizontal
5	280.2600	22.10	16.29	46.00	23.90	150	320	Horizontal
6	510.1500	28.38	22.38	46.00	17.62	100	36	Horizontal

RESULT: PASS

RADIATED EMISSION TEST- (30MHZ-1GHZ) -VERTICAL



NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	40.6700	23.33	14.91	40.00	16.67	100	231	Vertical
2	52.3100	28.23	14.49	40.00	11.77	100	311	Vertical
3	78.5000	17.89	10.46	40.00	22.11	100	1	Vertical
4	146.4000	21.48	14.88	43.50	22.02	100	255	Vertical
5	357.8600	24.25	18.13	46.00	21.75	100	235	Vertical
6	645.9500	31.10	25.07	46.00	14.90	100	287	Vertical

RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss, Margin= Result -Limit.

2. The “Factor” value can be calculated automatically by software of measurement system.

3. All test modes had been pre-tested. The 802.11b at low channel is the worst case and recorded in the report.

RADIATED EMISSION ABOVE 1GHZ

Frequency (MHz)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type	Comment
TX 11b 2412MHz					
4824	48.39	74	-25.61	Pk	Horizontal
4824	35.27	54	-18.73	AV	Horizontal
7236	51.37	74	-22.63	pk	Horizontal
7236	34.03	54	-19.97	AV	Horizontal
4824	51.29	74	-22.71	Pk	Vertical
4824	34.13	54	-19.87	AV	Vertical
7236	49.74	74	-24.26	Pk	Vertical
7236	37.96	54	-16.04	AV	Vertical
TX 11b 2437MHz					
4874	49.11	74	-24.89	Pk	Horizontal
4874	31.04	54	-22.96	AV	Horizontal
7311	47.94	74	-26.06	Pk	Horizontal
7311	34.42	54	-19.58	AV	Horizontal
4874	50.19	74	-23.81	Pk	Vertical
4874	39.75	54	-14.25	AV	Vertical
7311	47.29	74	-26.71	Pk	Vertical
7311	36.93	54	-17.07	AV	Vertical
TX 11b 2462MHz					
4924	49.71	74	-24.29	Pk	Horizontal
4924	33.51	54	-20.49	AV	Horizontal
7386	49.46	74	-24.54	Pk	Horizontal
7386	37.64	54	-16.36	AV	Horizontal
4924	51.47	74	-22.53	Pk	Vertical
4924	37.85	54	-16.15	AV	Vertical
7386	47.47	74	-26.53	Pk	Vertical
7386	35.68	54	-18.32	AV	Vertical

RESULT: PASS

Note:

1. Margin = Emission Level - Limit

2.1GHz-25GHz(All test modes had been pre-tested. The 802.11b mode is the worst case and recorded in the report. No recording in the test report at least have 20dB margin).

11. BAND EDGE EMISSION

11.1. MEASUREMENT PROCEDURE

1)Radiated restricted band edge measurements

The radiated restricted band edge measurements are measured with an EMI test receiver connected to the receive antenna while the EUT is transmitting

2)Conducted Emissions at the bang edge

a)The transmitter output was connected to the spectrum analyzer

b)Set RBW=1MHz,VBW=3MHz

c)Suitable frequency span including 100kHz bandwidth from band edge

11.2. TEST SET-UP

Radiated same as 11.2

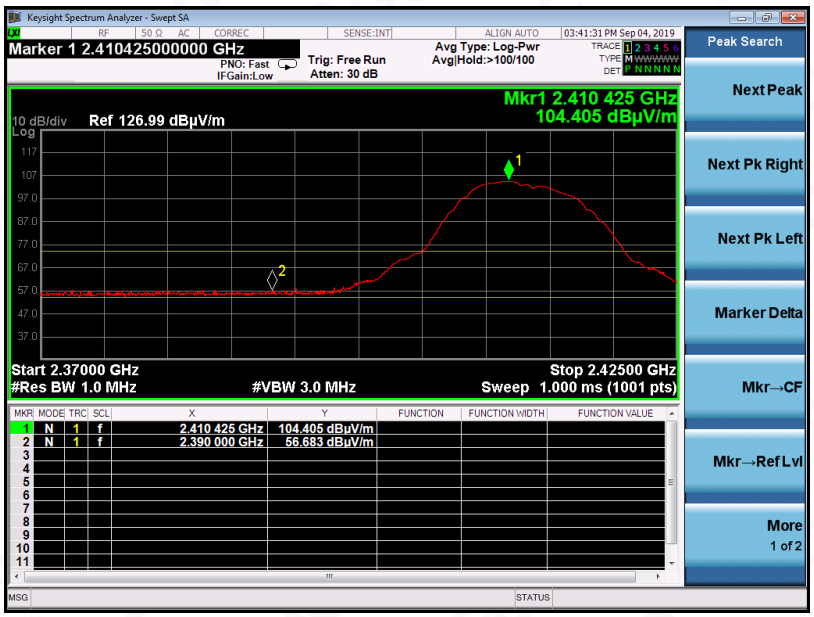
Note:

1. Factor=Antenna Factor + Cable loss - Amplifier gain. Field Strength=Factor + Reading level
2. The factor had been edited in the “Input Correction” of the Spectrum Analyzer. So the Amplitude of test plots is equal to Reading level plus the Factor in dB. Use the A dB(μV) to represent the Amplitude. Use the F dB(μV/m) to represent the Field Strength. So A=F.

11.3. TEST RESULT

EUT	Pallet Tracker	**Model Name**	Ultra Long
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with data rate 1 2412MHZ	**Antenna**	Horizontal

PK



AV

RESULT: PASS

EUT	Pallet Tracker	**Model Name**	Ultra Long
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with data rate 1 2412MHZ	**Antenna**	Vertical

PK

AV

RESULT: PASS

EUT	Pallet Tracker	**Model Name**	Ultra Long
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with data rate 1 2462MHZ	**Antenna**	Horizontal

PK

AV

RESULT: PASS

EUT	Pallet Tracker	**Model Name**	Ultra Long
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with data rate 1 2462MHZ	**Antenna**	Vertical

PK

AV

RESULT: PASS

EUT	Pallet Tracker	**Model Name**	Ultra Long
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11g with data rate 6 2412MHZ	**Antenna**	Horizontal

PK

AV

RESULT: PASS

EUT	Pallet Tracker	**Model Name**	Ultra Long
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11g with data rate 6 2412MHZ	**Antenna**	Vertical

PK

AV

RESULT: PASS

EUT	Pallet Tracker	**Model Name**	Ultra Long
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11g with data rate 6 2462MHZ	**Antenna**	Horizontal

PK

AV

RESULT: PASS

EUT	Pallet Tracker	Model Name	Ultra Long
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11g with data rate 6 2462MHZ	Antenna	Vertical

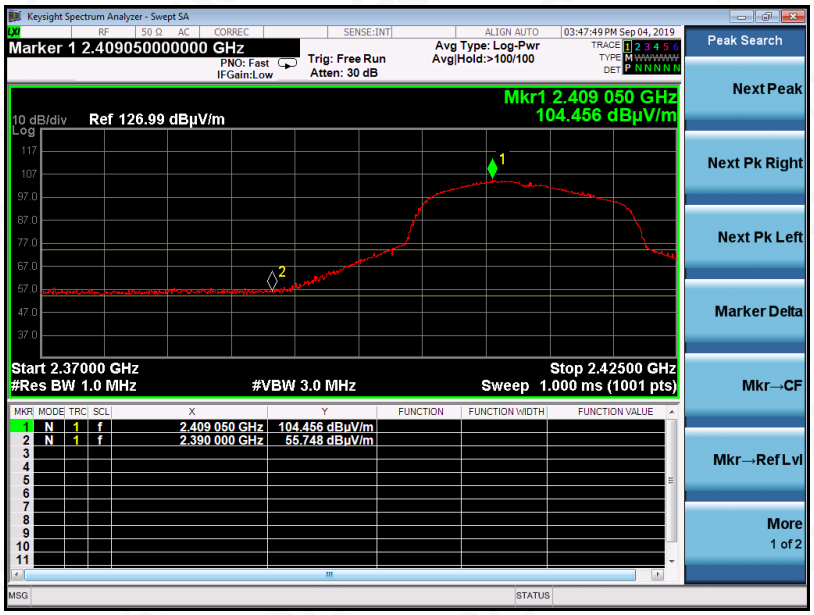
PK

AV

RESULT: PASS

EUT	Pallet Tracker	**Model Name**	Ultra Long
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11n 20 with data rate 6.5 2412MHZ	**Antenna**	Horizontal

PK



AV

RESULT: PASS

EUT	Pallet Tracker	**Model Name**	Ultra Long
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11n 20 with data rate 6.5 2412MHZ	**Antenna**	Vertical

PK

AV

RESULT: PASS

EUT	Pallet Tracker	Model Name	Ultra Long
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11n 20 with data rate 6.5 2462MHZ	Antenna	Horizontal

PK

AV

RESULT: PASS

EUT	Pallet Tracker	Model Name	Ultra Long
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11n 20 with data rate 6.5 2462MHZ	Antenna	Vertical

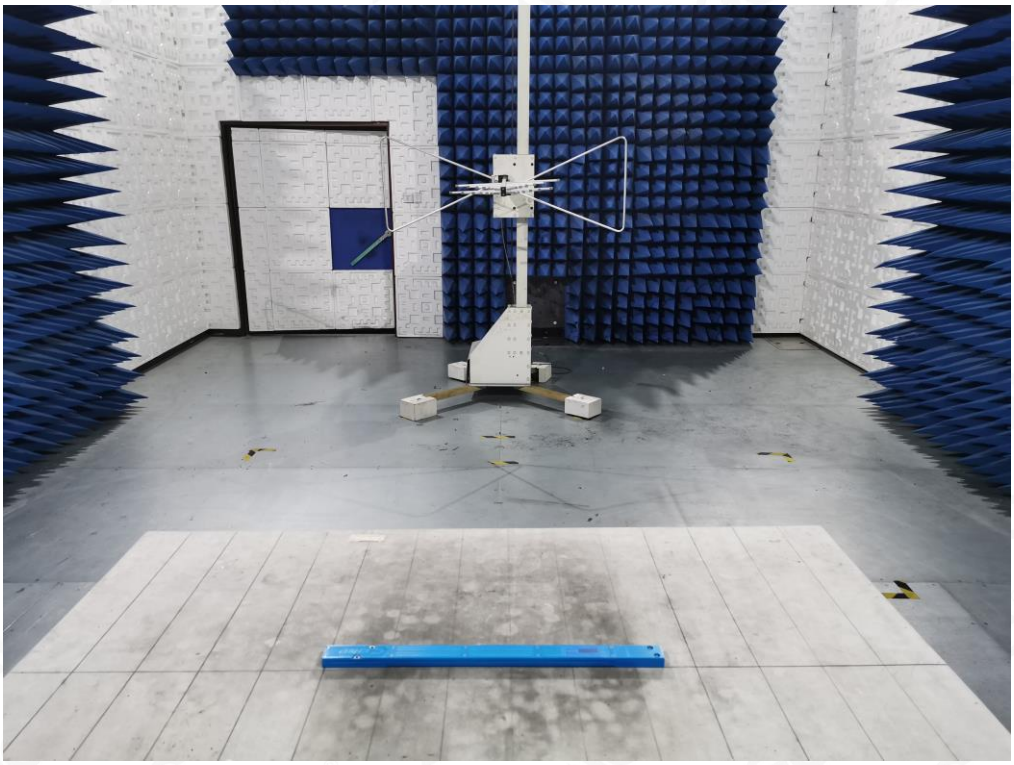
PK

AV

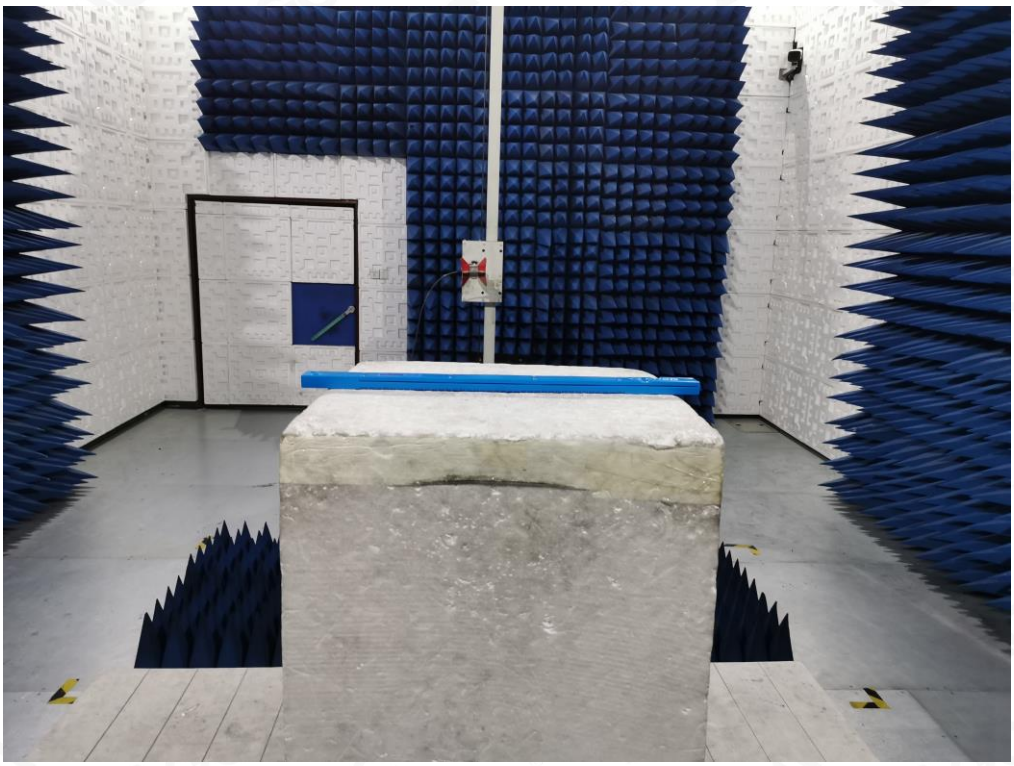
RESULT: PASS

APPENDIX A: PHOTOGRAPHS OF TEST SETUP

RADIATED EMISSION TEST SETUP



RADIATED EMISSION ABOVE 1G TEST SETUP



----END OF REPORT----