11. RADIATED EMISSION

11.1. 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 emission, 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 RBW and 3MHz VBW for peak reading. 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.

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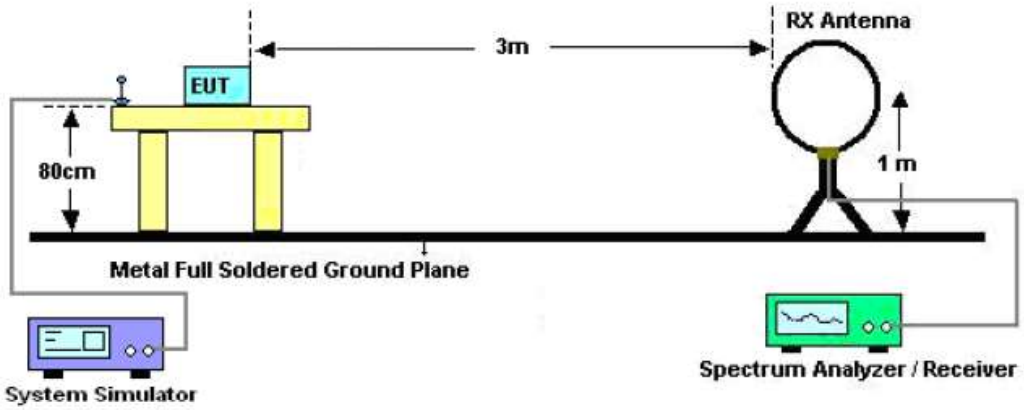
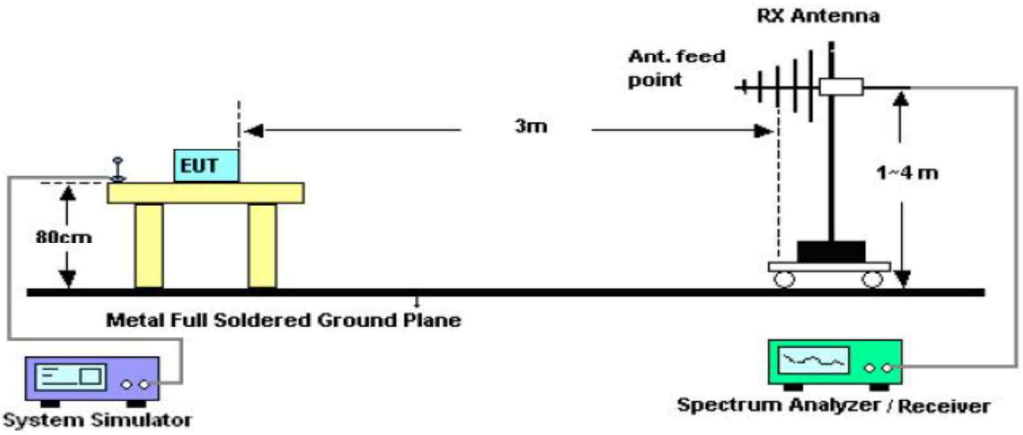
11.2. TEST SETUP

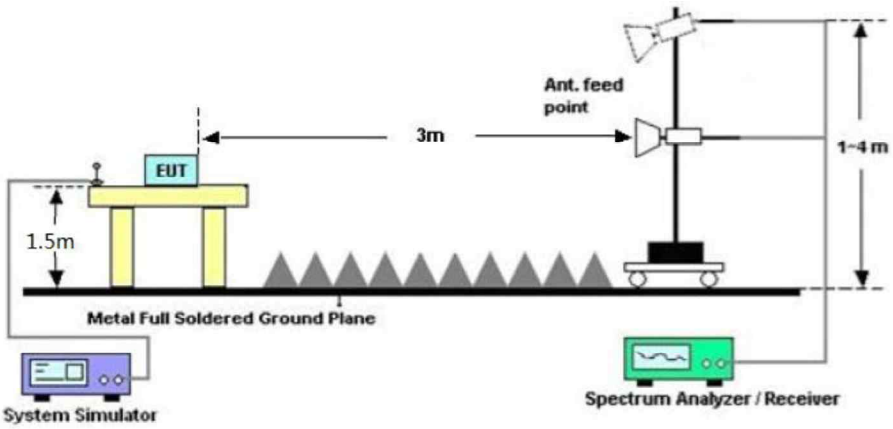
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



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11.3. LIMITS AND MEASUREMENT RESULT

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

Frequencies (MHz)	Field Strength (microvolts/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.

11.4. TEST RESULT

Radiated emission below 30MHz

The amplitude of spurious emissions from 9kHz to 30MHz which are attenuated more than 20 dB below the permissible value need not be reported.

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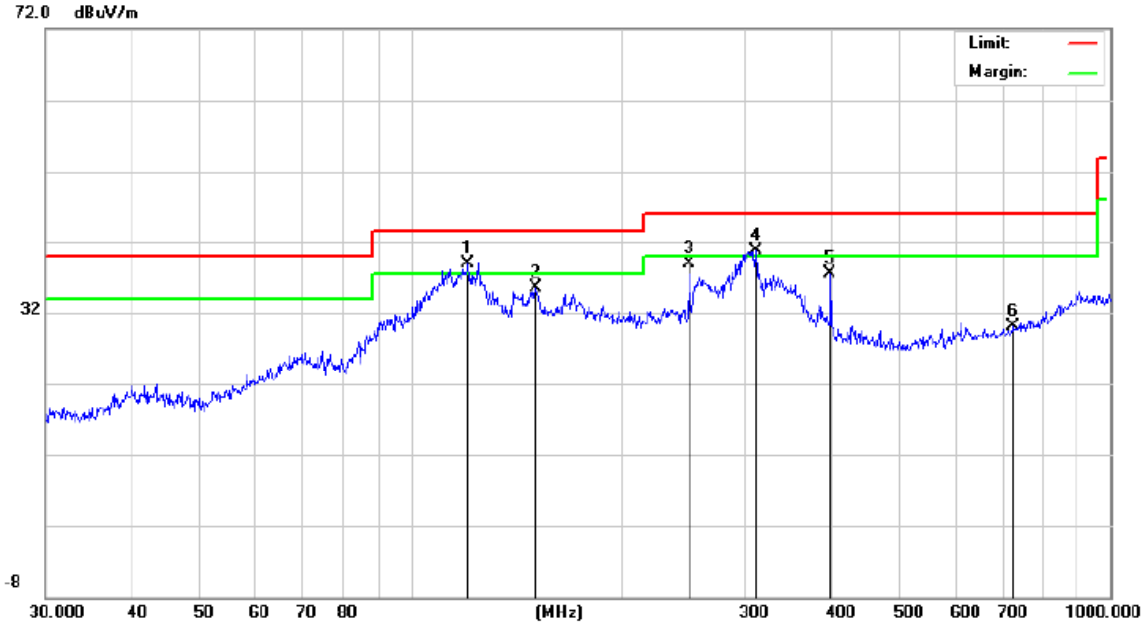
Radiated emission from 30MHz to 1000MHz

EUT	wifi module	Model Name	F89ESSM23
Temperature	25°C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11b with date rate 1 2437MHz	Antenna	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1	*	120.6991	19.85	18.96	38.81	43.50	-4.69	peak
2		151.0665	17.69	17.84	35.53	43.50	-7.97	peak
3		250.3012	21.49	17.48	38.97	46.00	-7.03	peak
4	!	311.0867	16.31	24.36	40.67	46.00	-5.33	peak
5		397.6334	13.90	23.70	37.60	46.00	-8.40	peak
6		726.8052	5.55	24.49	30.04	46.00	-15.96	peak

RESULT: PASS

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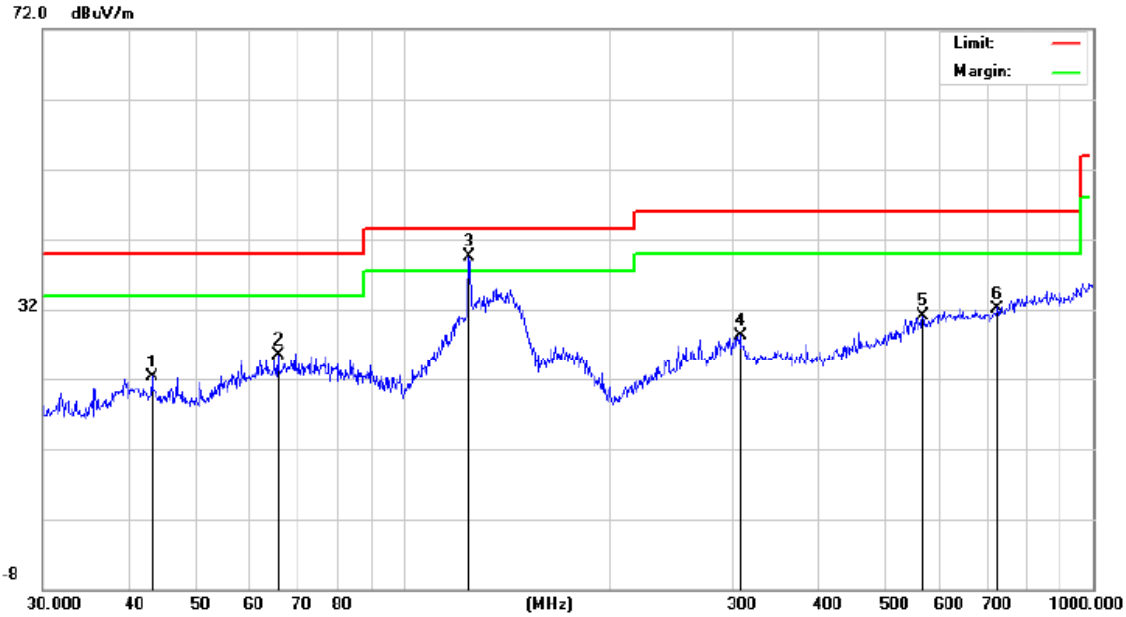
EUT	wifi module	Model Name	F89ESSM23
Temperature	25°C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11b with date rate 1 2437MHz	Antenna	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		43.2017	6.85	15.54	22.39	40.00	-17.61	peak
2		65.8031	7.57	18.01	25.58	40.00	-14.42	peak
3	*	124.5690	20.51	19.03	39.54	43.50	-3.96	peak
4		307.8313	7.95	20.43	28.38	46.00	-17.62	peak
5		566.6223	6.22	24.96	31.18	46.00	-14.82	peak
6		726.8052	5.44	26.76	32.20	46.00	-13.80	peak

RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-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 middle channel is the worst case and recorded in the report.

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Radiated emission above 1GHz

EUT	wifi module	**Model Name**	F89ESSM23
Temperature	25°C	**Relative Humidity**	58%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with date rate 1 2412MHz	**Antenna**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4824.000	56.38	0.08	56.46	74	-17.54	peak
4824.000	47.51	0.08	47.59	54	-6.41	AVG
7236.000	50.24	2.21	52.45	74	-21.55	peak
7236.000	41.58	2.21	43.79	54	-10.21	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	wifi module	**Model Name**	F89ESSM23
Temperature	25°C	**Relative Humidity**	58%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with date rate 1 2412MHz	**Antenna**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4824.000	55.97	0.08	56.05	74	-17.95	peak
4824.000	46.37	0.08	46.45	54	-7.55	AVG
7236.000	51.08	2.21	53.29	74	-20.71	peak
7236.000	40.71	2.21	42.92	54	-11.08	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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EUT	wifi module	Model Name	F89ESSM23
Temperature	25°C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11b with date rate 1 2437MHz	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4874.000	56.37	0.14	56.51	74	-17.49	peak
4874.000	47.51	0.14	47.65	54	-6.35	AVG
7311.000	51.06	2.36	53.42	74	-20.58	peak
7311.000	40.37	2.36	42.73	54	-11.27	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	wifi module	Model Name	F89ESSM23
Temperature	25°C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11b with date rate 1 2437MHz	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4874.000	56.38	0.14	56.52	74	-17.48	peak
4874.000	46.28	0.14	46.42	54	-7.58	AVG
7311.000	50.27	2.36	52.63	74	-21.37	peak
7311.000	40.19	2.36	42.55	54	-11.45	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

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EUT	wifi module	Model Name	F89ESSM23
Temperature	25°C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11b with date rate 1 2462MHz	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4924.000	55.29	0.22	55.51	74	-18.49	peak
4924.000	45.87	0.22	46.09	54	-7.91	AVG
7386.000	49.62	2.64	52.26	74	-21.74	peak
7386.000	40.27	2.64	42.91	54	-11.09	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	wifi module	Model Name	F89ESSM23
Temperature	25°C	Relative Humidity	58%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11b with date rate 1 2462MHz	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4924.000	56.38	0.22	56.6	74	-17.4	peak
4924.000	46.28	0.22	46.5	54	-7.5	AVG
7386.000	51.27	2.64	53.91	74	-20.09	peak
7386.000	42.16	2.64	44.8	54	-9.2	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

RESULT: PASS

Note:

The amplitude of other spurious emissions from 1G to 25 GHz which are attenuated more than 20 dB below the permissible value need not be reported.

Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

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

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

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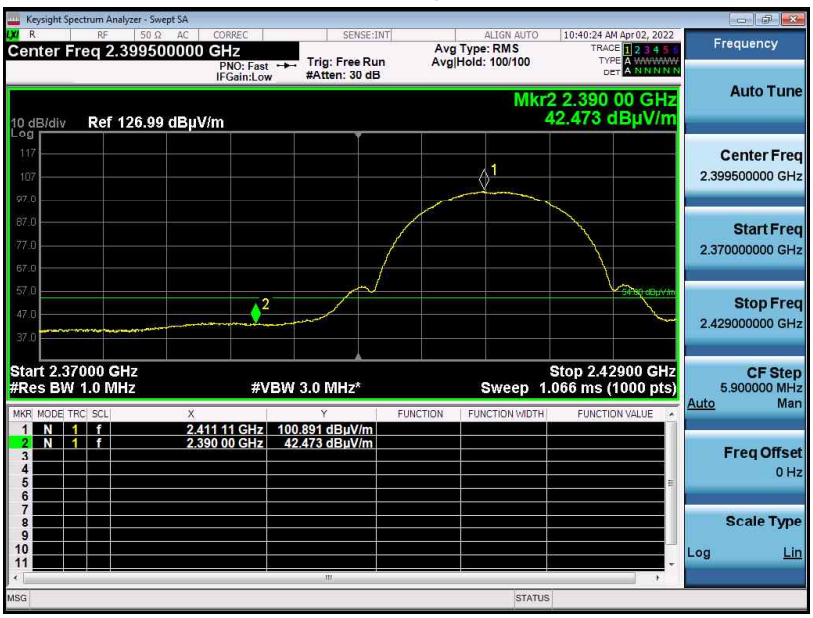
Test result for band edge emission at restricted bands

EUT	wifi module	Model Name	F89ESSM23
Temperature	25°C	Relative Humidity	60%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11b with data rate 1 2412MHz	Antenna	Horizontal

Test Graph for Peak Measurement

Test Graph for Average Measurement



RESULT: PASS

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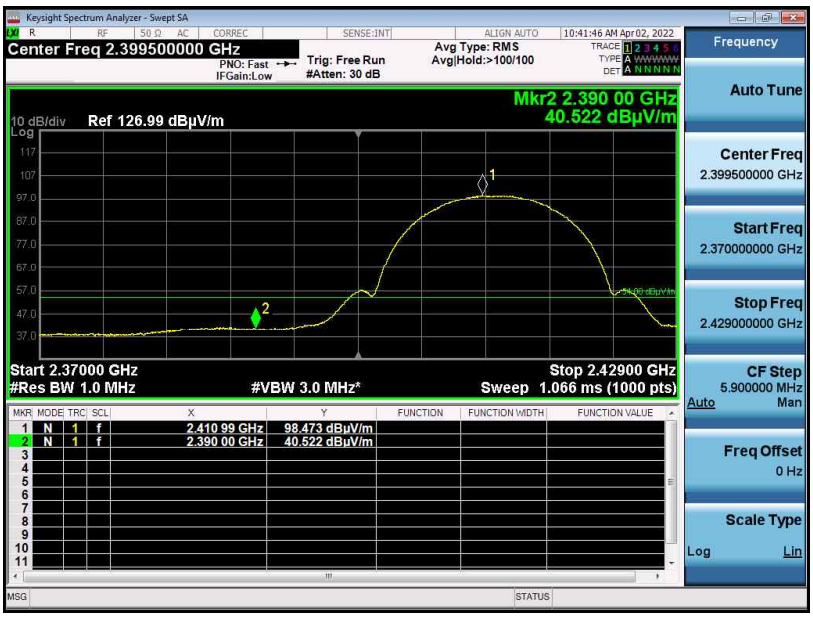
EUT	wifi module	Model Name	F89ESSM23
Temperature	25°C	Relative Humidity	60%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11b with data rate 1 2412MHz	Antenna	Vertical

Test Graph for Peak Measurement

Test Graph for Average Measurement



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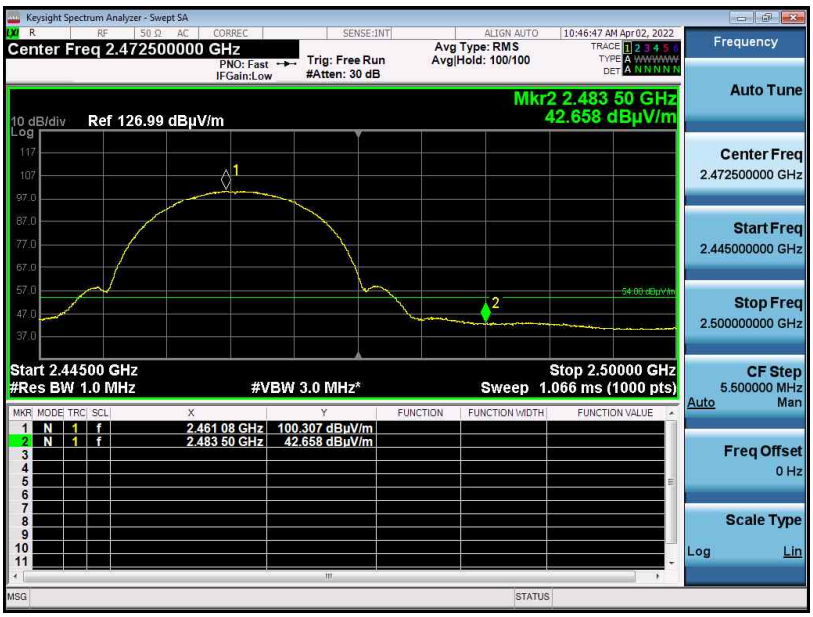
EUT	wifi module	Model Name	F89ESSM23
Temperature	25°C	Relative Humidity	60%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11b with data rate 1 2462MHz	Antenna	Horizontal

Test Graph for Peak Measurement

Test Graph for Average Measurement



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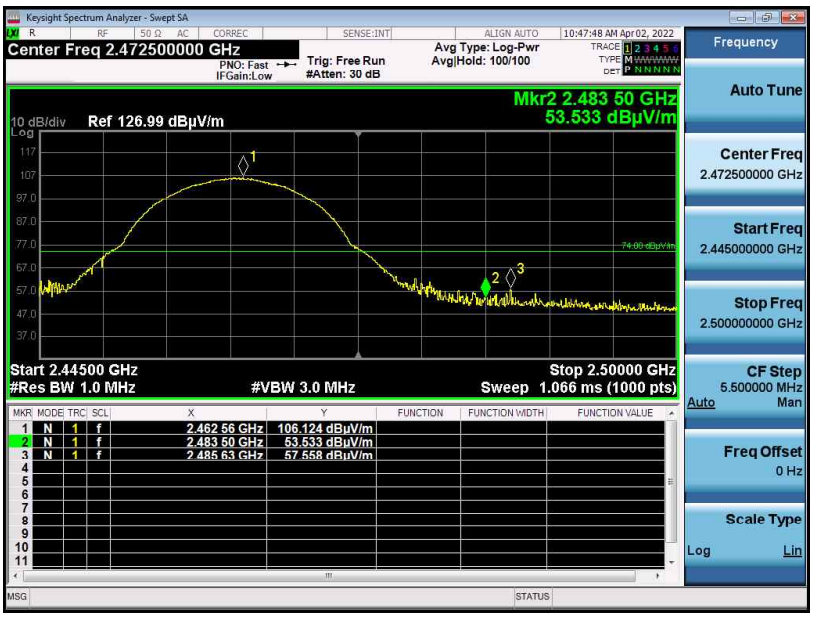
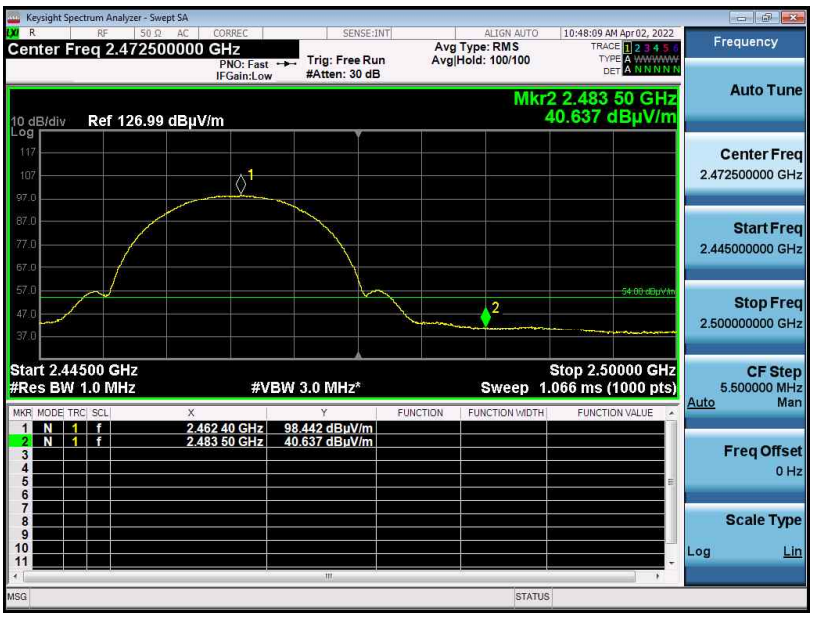
EUT	wifi module	Model Name	F89ESSM23
Temperature	25°C	Relative Humidity	60%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11b with data rate 1 2462MHz	Antenna	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement



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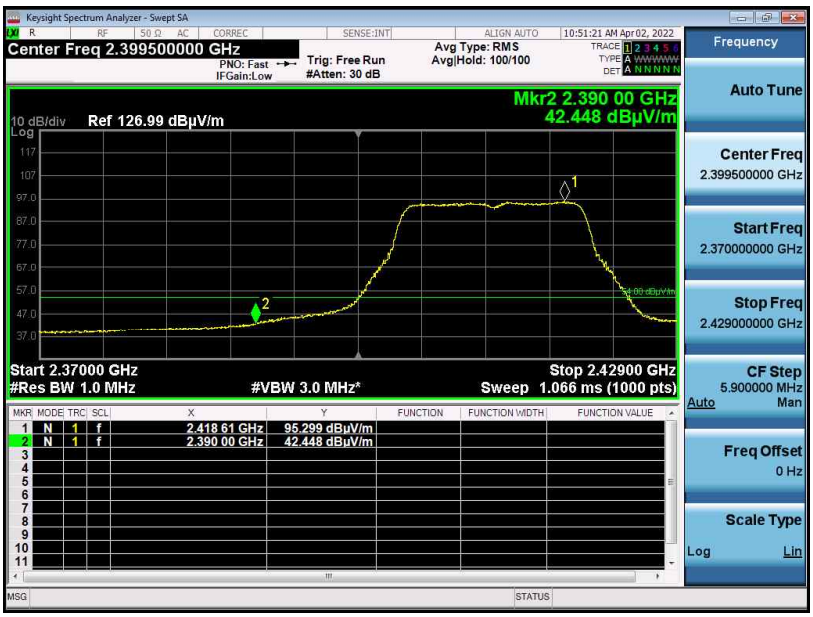
EUT	wifi module	Model Name	F89ESSM23
Temperature	25°C	Relative Humidity	60%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11g with data rate 6 2412MHz	Antenna	Horizontal

Test Graph for Peak Measurement

Test Graph for Average Measurement



RESULT: PASS

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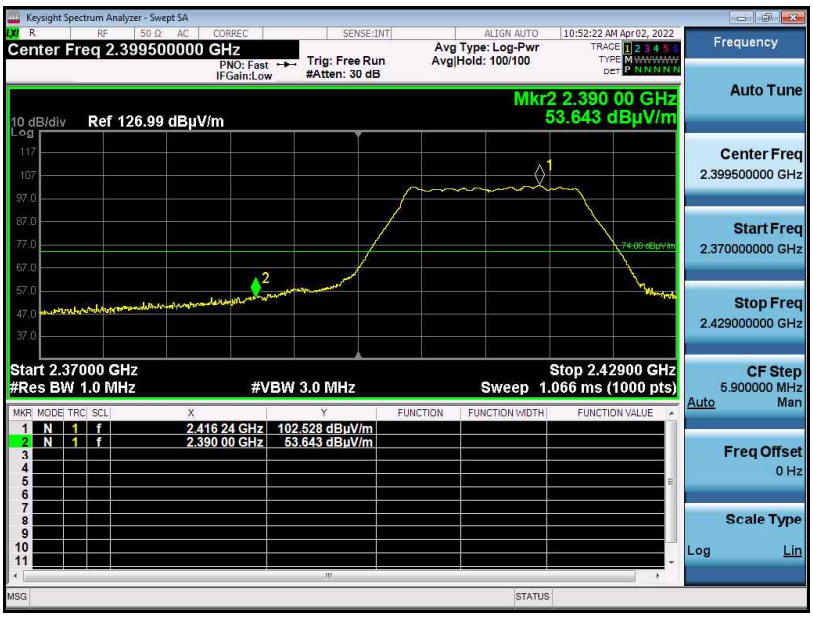
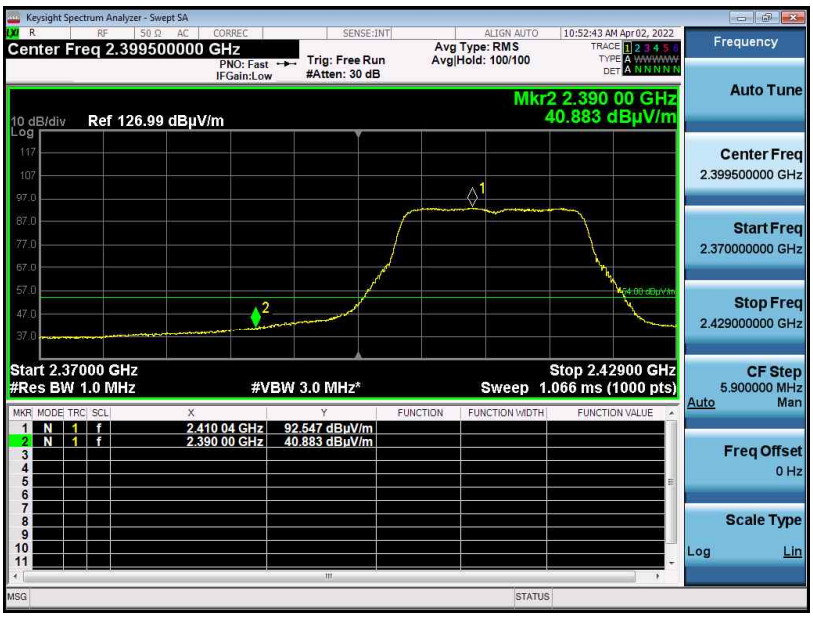
Temperature	25°C	Relative Humidity	60%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11g with data rate 6 2412MHz	Antenna	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement



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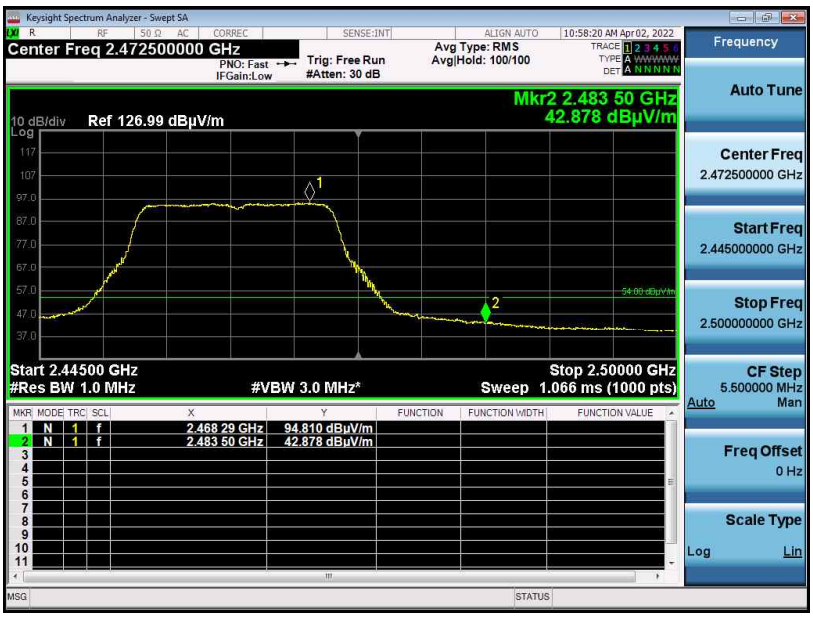
EUT	wifi module	Model Name	F89ESSM23
Temperature	25°C	Relative Humidity	60%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11g with data rate 6 2462MHz	Antenna	Horizontal

Test Graph for Peak Measurement

Test Graph for Average Measurement



RESULT: PASS

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