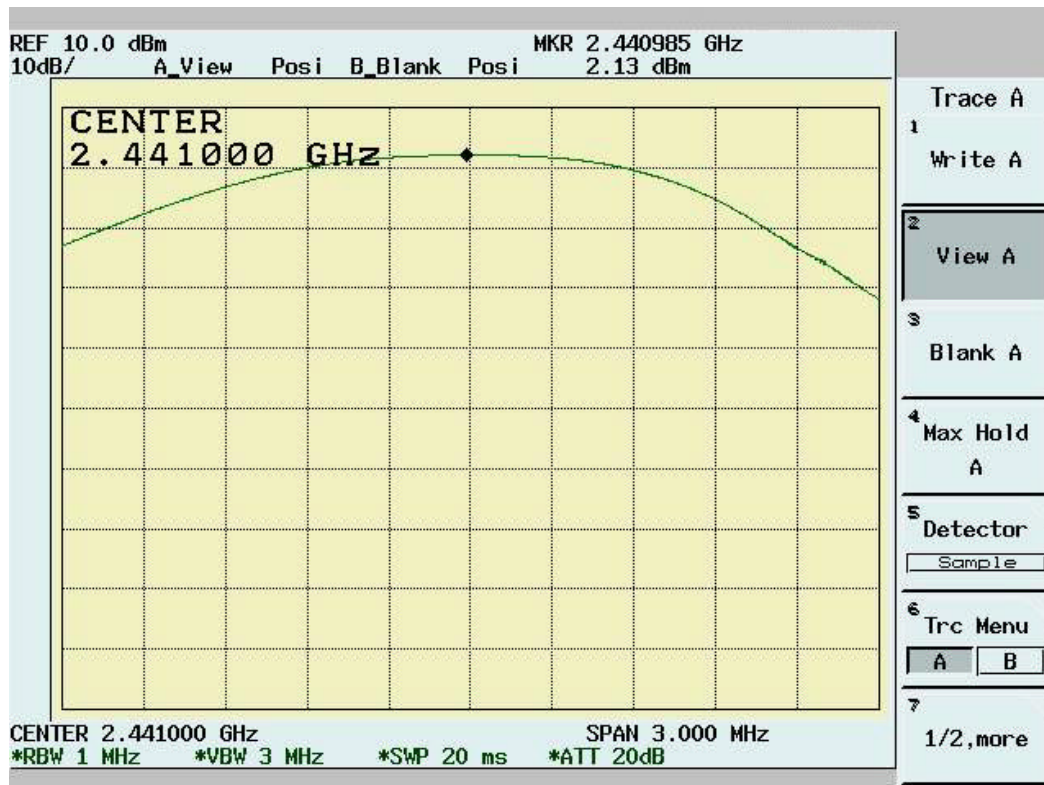




6.3 Radiated Emission Measurement

6.3.1 EUT Configuration

The equipment under test was set up on the 10 meter chamber with measurement distance of 3 meters. The EUT was placed on a non-conductive table 80cm above ground.

Any changes made to the configuration, or modifications made to the EUT, during testing are noted in the following test record.

6.3.2 Test Procedure

The system was set up as described above, with the EMI diagnostic software running. We found the maximum readings by varying the height of antenna and then rotating the turntable. Both polarization of antenna, horizontal and vertical, are measured.

30M to 1GHz: The highest emissions between 30 MHz to 1000 MHz were also analyzed in details by operating the spectrum analyzer and/or EMI receiver in quasi-peak mode to determine the precise amplitude of the emissions. While doing so, the interconnecting cables and major parts of the system were moved around, the antenna height was varied between one and four meters, its polarization was varied between vertical and horizontal, and the turntable was slowly rotated, to maximize the emission.

1GHz – 25GHz: The highest emissions were also analyzed in details by operating the spectrum analyzer and/or EMI receiver in peak mode to determine the precise amplitude of the emission. While doing so, the interconnecting cables and major parts of the system were moved around, the antenna height was varied between one and four meters, its polarization was varied between vertical and horizontal, and the turntable was slowly rotated, to maximize the emission. During test the EMI receiver and spectrum was setup according to *EMI Receiver/Spectrum Analyzer Configuration*.

For the test of 2nd to 10th harmonics frequencies, the equipment setup was also refer to *EMI Receiver/Spectrum Analyzer Configuration*. The frequencies were tested using Peak mode first, if the test data is higher than the emissions limit, an additional measurement using Average mode will be performed and the average reading will be compared to the limit and record in test report.

6.3.3 EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested)

Frequency Range Tested:	30MHz~1000MHz
Detector Function:	Quasi-Peak Mode
Resolution Bandwidth (RBW):	120KHz
Video Bandwidth (VBW)	1MHz

Frequency Range Tested:	1GHz – 25 GHz
Detector Function:	Peak Mode
Resolution Bandwidth (RBW):	1MHz
Video Bandwidth (VBW)	3MHz

Frequency Range Tested:	1GHz – 25 GHz
Detector Function:	Average Mode
Resolution Bandwidth (RBW):	1MHz
Video Bandwidth (VBW)	10 Hz

6.3.4 Test Data (30MHz – 1GHz):

30M – 1GHz Open Field Radiated Emissions (Horizontal) Channel 00, 39, 78

Operator: Jerry Chiou

Temperature(C): 25

Humidity(%): 63

Frequency	RxAmp.	AntFact	CableLoss	PreAmpGain	Corrct.Emi.	Limit	Margin	Ant.Pos.	TablePos.
MHz	(dBuV)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(deg)
67.83	14.84	6.21	1.50	0.00	22.55	40.00	-17.45	101.00	144.00
86.26	12.20	8.15	1.67	0.00	22.03	40.00	-17.97	101.00	170.00
95.96	13.46	9.91	1.79	0.00	25.17	43.50	-18.33	101.00	117.00
120.21	11.09	12.58	1.93	0.00	25.60	43.50	-17.90	101.00	144.00
143.49	14.30	10.85	2.23	0.00	27.39	43.50	-16.11	101.00	144.00
441.28	4.34	16.54	3.88	0.00	24.77	46.00	-21.23	101.00	63.00
453.89	5.04	16.75	3.98	0.00	25.77	46.00	-20.23	101.00	63.00
589.69	2.71	18.76	4.45	0.00	25.92	46.00	-20.08	101.00	117.00
792.42	1.39	19.88	5.04	0.00	26.31	46.00	-19.69	101.00	251.00

30M – 1GHz Open Field Radiated Emissions (Vertical) Channel 00, 39, 78

Operator: Jerry Chiou

Temperature(C): 25

Humidity(%): 63

Frequency MHz	RxAmp. (dBuV)	AntFact (dB/m)	CableLoss (dB)	PreAmpGain (dB)	Corrct.Emi. (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.Pos. (cm)	TablePos. (deg)
56.19	16.84	7.10	1.31	0.00	25.25	40.00	-14.75	101.00	161.00
68.8	20.79	6.16	1.51	0.00	28.46	40.00	-11.54	101.00	349.00
95.96	23.88	9.91	1.79	0.00	35.59	43.50	-7.91	101.00	29.00
106.63	15.13	11.79	1.93	0.00	28.86	43.50	-14.64	101.00	188.00
123.12	11.64	12.35	1.98	0.00	25.98	43.50	-17.52	101.00	349.00
133.79	14.87	11.57	2.14	0.00	28.58	43.50	-14.92	101.00	349.00
139.61	17.59	11.22	2.16	0.00	30.97	43.50	-12.53	101.00	323.00
147.37	18.51	10.46	2.30	0.00	31.27	43.50	-12.23	101.00	323.00
851.59	0.25	20.31	5.02	0.00	25.58	46.00	-20.42	101.00	296.00
864.2	0.35	20.36	5.14	0.00	25.85	46.00	-20.15	101.00	161.00

NOTE:

- During the Pre-test, the EUT has been tested for Channel 00, 39, 78 transmit from Main and Aux antenna respectively to get all the critical emission frequencies. In the final test all the critical emission frequencies has been tested and the test data are listed above.

- Margin = Corrected Amplitude – Limit

Corrected Amplitude = Radiated Amplitude + Antenna Correction Factor + Cable Loss - Pre-Amplifier Gain

A margin of -8dB means that the emission is 8dB below the limit

All frequencies from 30MHz to 1GHz have been tested

Test Data (1GHz – 25 GHz) .

1GHz~ 25 GHz (Horizontal), Channel 00: 2402 MHz

Operator:JerryChiou

RBW:1MHz
Humidity(%):59
Temperature(C):25

Frequency	Rx_R.	Ant_F.	Cab_L.	PreAmpl	Emission	Limit	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
5484.52	31.88pk	35.38	4.75	27.53	44.48pk	54.00av	-9.52	100	139

1GHz~ 25 GHz (Vertical), Channel 00: 2402 MHz

Operator:JerryChiou

RBW:1MHz
Humidity(%):59
Temperature(C):25

Frequency	Rx_R.	Ant_F.	Cab_L.	PreAmpl	Emission	Limit	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
5484.52	33.84pk	35.38	4.75	27.53	46.45pk	54.00av	-7.55	100	139

Note:

- According to the standards used, Where limits are specified by agencies for both average and peak (or quasi-peak) detection , if the peak (or quasi-peak) measured value complies with the average limit , it is unnecessary to perform an average measurement.
- “ * ”: Fundamental Frequency
- “**”: Not in the restricted band, Limit level=Fundamental Emission-20dB
- “ pk”: peak mode
- “av”: average mode
- “---”: No meter reading data due to the emission level is smaller than spectrum noise level.
- The Spectrum noise level+Correction Factor < Limit - 6 dB
- Margin=Corrected Amplitude – Limit
- Corrected Amplitude=Radiated Amplitude+Antenna Correction Factor+Cable Loss-Pre-Amplifier Gain
- A margin of -8dB means that the emission is 8dB below the limit.

All frequencies from 1GHz to 25 GHz have been tested.

1GHz~ 25 GHz (Horizontal) , Channel 39 : 2441 MHz

Operator:JerryChiou

RBW:1MHz
Humidity(%):59
Temperature(C):25

Frequency	Rx_R.	Ant_F.	Cab_L.	PreAmpl	Emission	Limit	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
3407.59	36.48pk	30.86	3.36	25.79	44.92pk	54.00av	-9.08	103	252

1GHz~ 25 GHz (Vertical), Channel 39 : 2441 MHz

Operator:JerryChiou

RBW:1MHz
Humidity(%):59
Temperature(C):25

Frequency	Rx_R.	Ant_F.	Cab_L.	PreAmpl	Emission	Limit	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
8410.59	31.35pk	40.92	3.81	26.45	49.63pk	54.00av	-4.37	101	159

Note:

- According to the standards used:Where limits are specified by agencies for both average and peak (or quasi-peak) detection , if the peak (or quasi-peak) measured value complies with the average limit , it is unnecessary to perform an average measurement.
- “ * ”: Fundamental Frequency
- “**”: Not in the restricted band, Limit level=Fundamental Emission-20dB
- “pk”: peak mode
- “av”: average mode
- “---”: No meter reading data due to the emission level is smaller than spectrum noise level.
- The Spectrum noise level+Correction Factor < Limit - 6 dB
- Margin=Corrected Amplitude – Limit
- Corrected Amplitude=Radiated Amplitude+Antenna Correction Factor+Cable Loss-Pre-Amplifier Gain
- A margin of -8dB means that the emission is 8dB below the limit.

All frequencies from 1GHz to 25 GHz have been tested.

1GHz~ 25 GHz (Horizontal), Channel 78: 2480 MHz

Operator:JerryChiou

RBW:1MHz
Humidity(%):59
Temperature(C):25

Frequency	Rx_R.	Ant_F.	Cab_L.	PreAmpl	Emission	Limit	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
5716.28	30.73pk	35.66	4.58	27.40	43.56pk	54.00av	-10.44	100	206

1GHz~ 25 GHz (Vertical), Channel 78 : 2480 MHz

Operator:JerryChiou

RBW:1MHz
Humidity(%):59
Temperature(C):25

Frequency	Rx_R.	Ant_F.	Cab_L.	PreAmpl	Emission	Limit	Margin	A.Tower	T.Table
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	cm	deg
5716.28	33.15pk	35.66	4.58	27.40	45.99pk	54.00av	-8.01	100	206

Note:

- According to the standards used, Where limits are specified by agencies for both average and peak (or quasi-peak) detection , if the peak (or quasi-peak) measured value complies with the average limit , it is unnecessary to perform an average measurement.
- “ * ”: Fundamental Frequency
- “**”: Not in the restricted band, Limit level=Fundamental Emission-20dB
- “ pk”: peak mode
- “av”: average mode
- “---”: No meter reading data due to the emission level is smaller than spectrum noise level.
- The Spectrum noise level+Correction Factor < Limit - 6 dB
- Margin=Corrected Amplitude – Limit
- Corrected Amplitude=Radiated Amplitude+Antenna Correction Factor+Cable Loss-Pre-Amplifier Gain
- A margin of -8dB means that the emission is 8dB below the limit.

All frequencies from 1GHz to 25 GHz have been tested.

6.4 Band Edge Measurement

6.4.1 Test Procedure (Conducted)

1. The transmitter output of EUT was connected to the spectrum analyzer.
Equipment mode: Spectrum analyzer
Detector function: Peak mode
SPAN: 100MHz
RBW: 100KHz
VBW: 100KHz
Center frequency: 2.4GHz, 2.4835GHz.
2. Using Peak Search to read the peak power of Carrier frequencies after Maximum Hold function is completed
3. Find the next peak frequency outside the operation frequency band

6.4.2 Test Setup (Conducted)



6.4.3 Test Data:

Table: Band Edge measurement (Conducted)

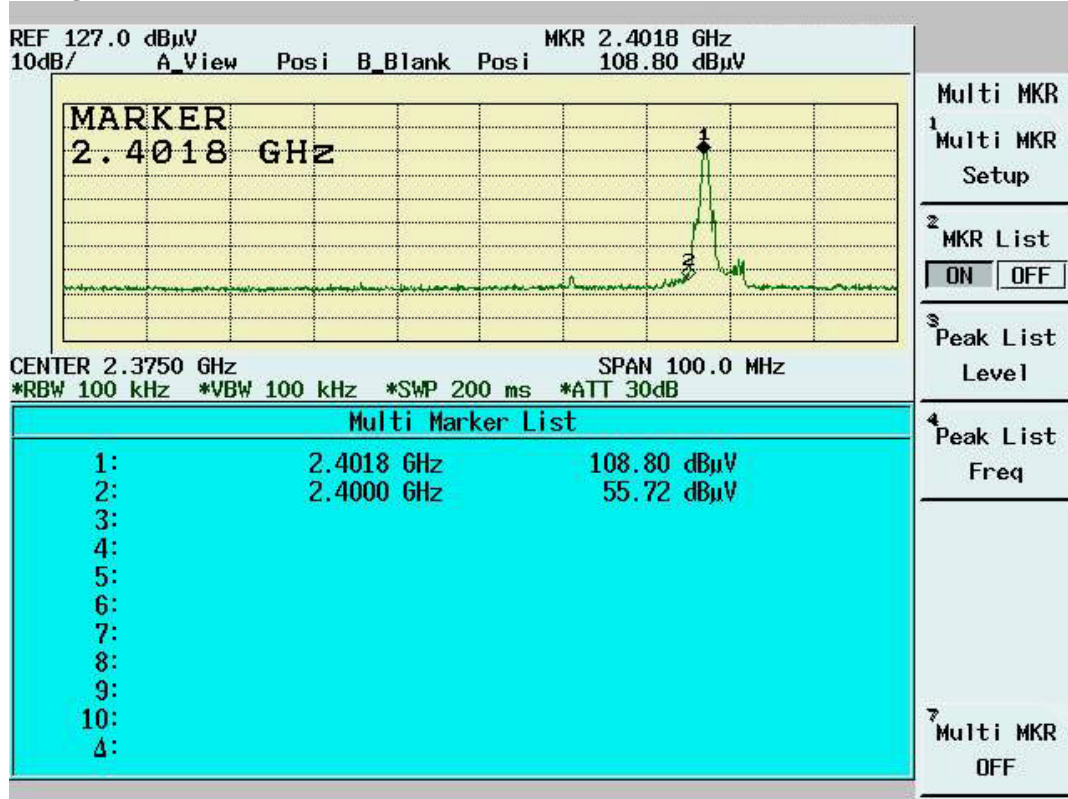
Temperature ():25

Test Engineer:Jerry Chiou

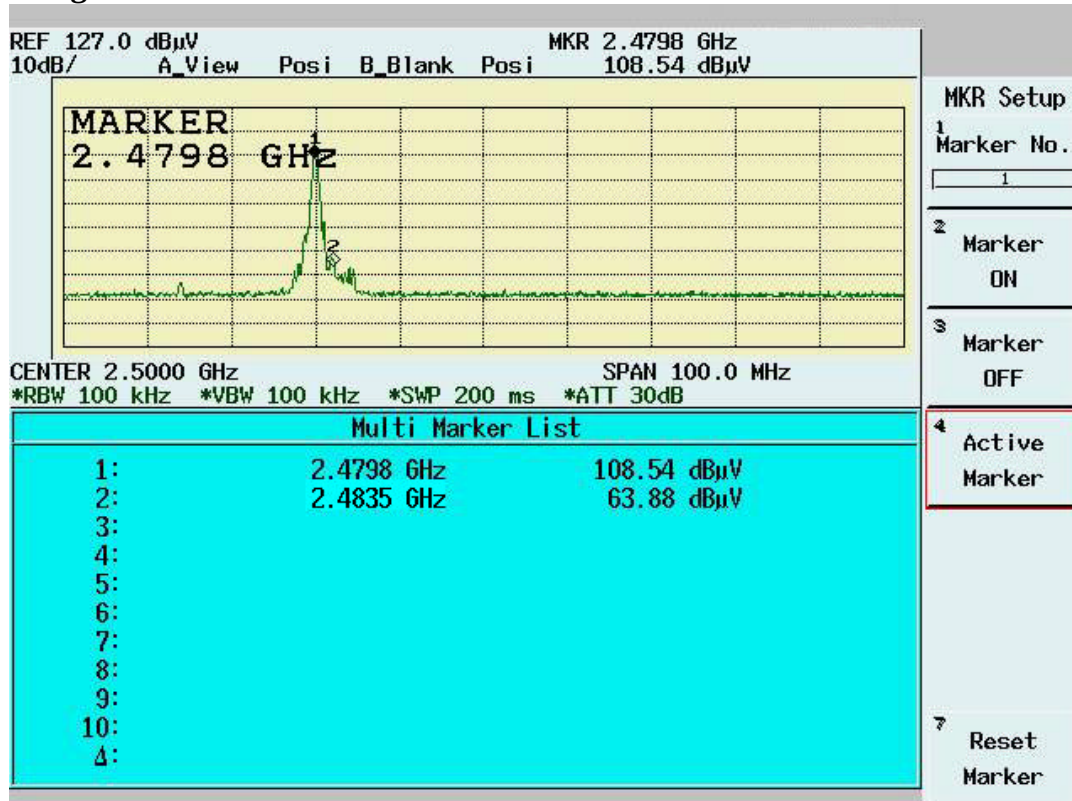
Humidity (%):55

Channel	Frequency (MHz)	Spectrum Reading (dBuV)	Carrier - Outsideband Limit: >20dB (dB)	Pass/Fail
00	2401.8	108.8	---	---
Outside band	2400.0	55.7	53.1	Pass
78	2479.8	108.5	---	---
Outside band	2483.5	63.9	44.7	Pass

Band Edge Conducted Measurement



Band Edge Conducted Measurement



6.4.4 Test Procedure (Radiated)

1. Antenna and Turntable test procedure same as Radiated Emission Measurement.
Equipment mode: Spectrum analyzer
Detector function: Peak mode
SPAN: 100MHz
RBW: 1MHz
VBW: 3MHz
Center frequency: 2.375GHz, 2.500GHz.
2. Using Peak Search to read the peak power of Carrier frequencies after Maximum Hold function is completed.
3. Find the next peak frequency outside the operation frequency band
4. For peak frequency emission level measurement in Restricted Band ,
Change RBW: 1MHz
VBW: 10Hz
Span: 100MHz.
5. Get the spectrum reading after Maximum Hold function is completed.

6.4.5 Test Setup (Radiated)

Same as *Radiated Emission Measurement*

6.4.6 Test Data

Table Band Edge measurement (Radiated)

Test Engineer: Jerry Chiou

Temperature (): 25

Data Rate

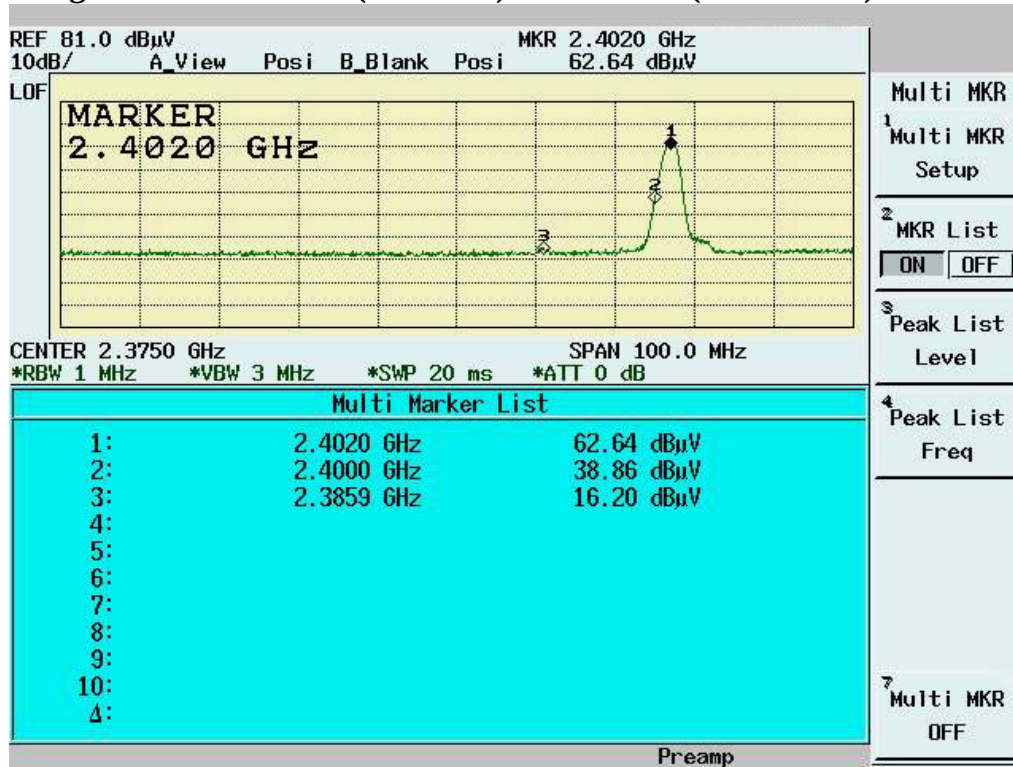
Humidity (%): 60

Description	Frequency (MHz)	Spectrum Reading (dBuV)	Correction Factor (dB/m)	Emission Level (dBuV/m)	dBc (Limit: > 20dBc)	Limit (dBuV/m)	Equip. Setup VBW	Pass or Fail
Channel_00 (average mode)	2401.90	26.05	35.48	61.53	---	---	10Hz	---
Channel_00 (peak mode)	2402.00	62.64	35.48	98.12	---	---	3MHz	---
Outside band (peak mode)	2400.00	38.86	35.48	74.34	23.78	---	3MHz	Pass
Channel_78 (average mode)	2479.90	25.27	35.51	60.78	---	---	10Hz	---
Channel_78 (peak mode)	2480.00	60.57	35.51	96.08	---	---	3MHz	---
Outside band (peak mode)	2484.10	18.60	35.51	54.11	41.97	---	3MHz	Pass
Channel_00 Restricted band (peak mode)	2385.90	16.20	35.47	51.67	---	74	3MHz	Pass
Restricted band (average mode)	2386.00	5.60	35.47	41.07	---	54	10Hz	Pass
Channel_78 Restricted band (peak mode)	2484.10	18.60	35.51	54.11	---	74	3MHz	Pass
Restricted band (average mode)	2483.50	6.62	35.51	42.13	---	54	10Hz	Pass

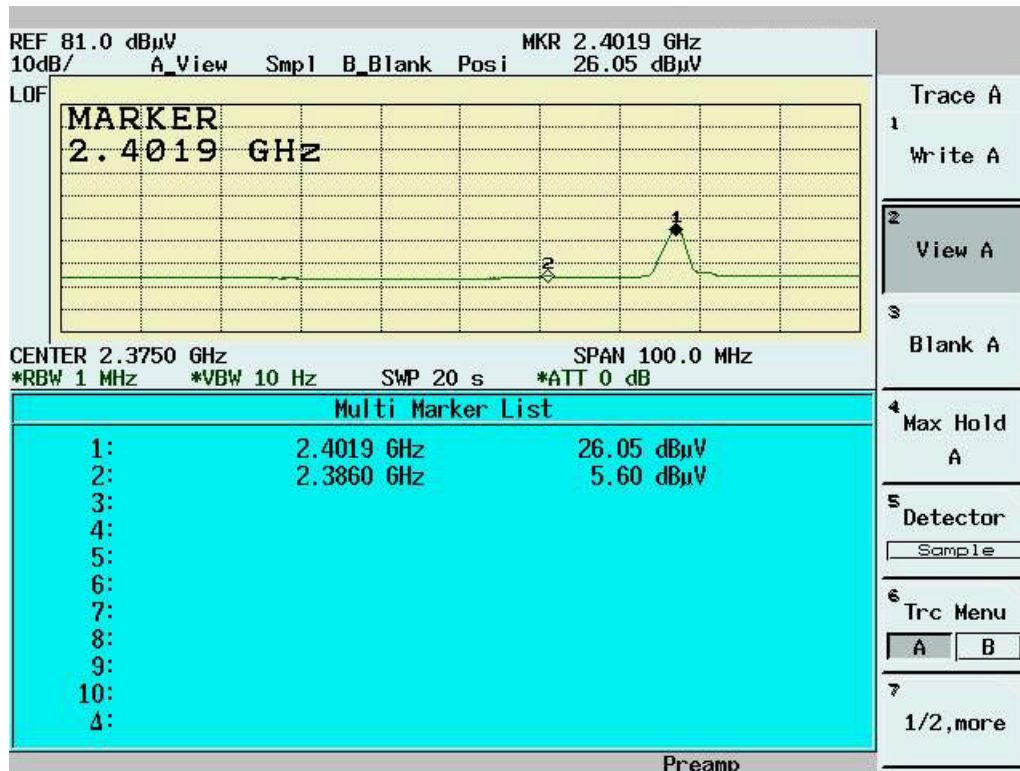
Note:

- The Spectrum plot of emission level measurement in Restricted band is attached.
- Emission Level=Spectrum Reading+Correction Factor
- Correction Factor=Antenna Factor+cable loss–amplifier gain
- Both Horizontal and Vertical polarizaion have been tested and the worst data is listed above.

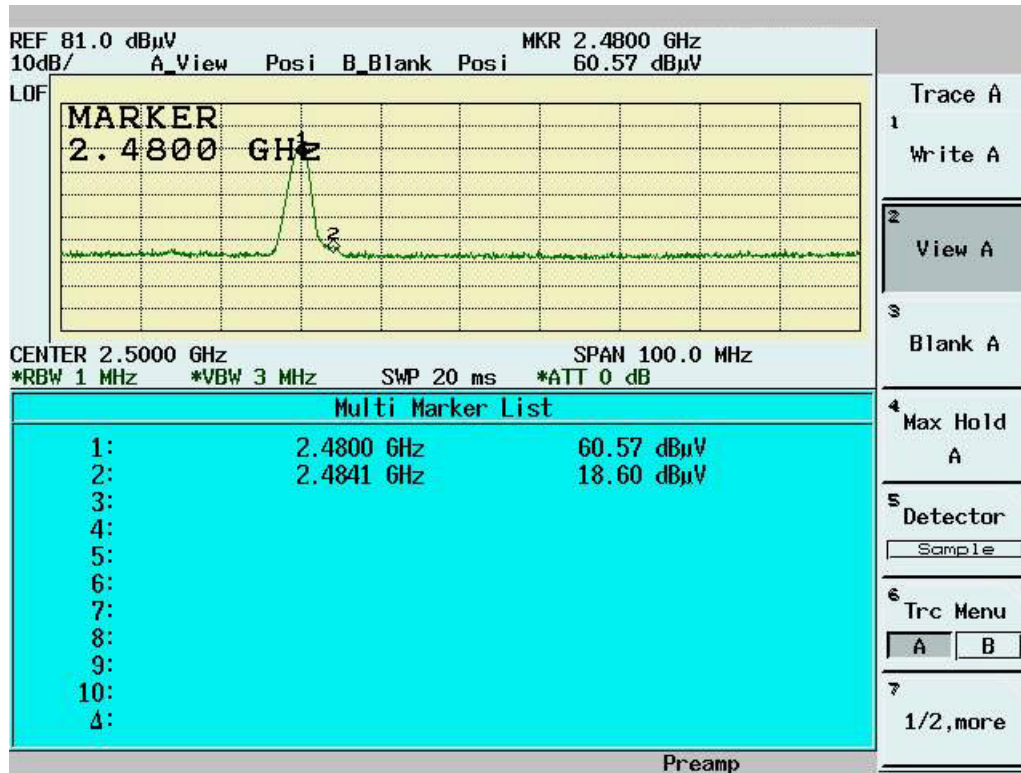
Band Edge Restricted Band (Radiated)-Peak Mode (Channel 00)



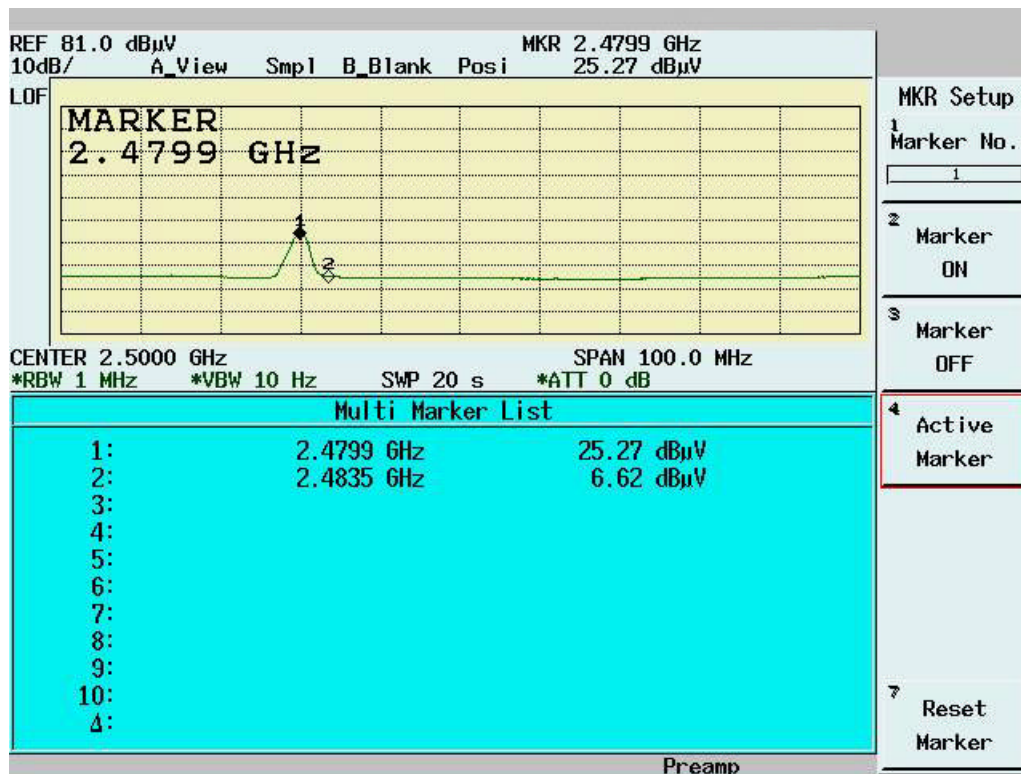
Band Edge Restricted Band (Radiated)-Average Mode (Channel 00)



Band Edge Restricted Band (Radiated)-Peak Mode (Channel 78)



Band Edge Restricted Band (Radiated)-Average Mode (Channel 78)



6.5 Bandwidth & Hopping Channel Separation

6.5.1 Standard Applicable

According to §15.247(a)(1), frequency hopping system shall have, hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies.

6.5.2 Test Procedure

■ Bandwidth Test Procedure

The Transmitter output of EUT was connected to the spectrum analyzer. The 20 dB bandwidth of the fundamental frequency was measured. The setting of spectrum analyzer is as follows

Equipment mode	Spectrum analyzer
Detector function	Peak mode
RBW	30KHz
VBW	100KHz

■ Hopping Channel Separation Test Procedure

1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable.
Equipment mode: Spectrum analyzer
RBW: 100KHz
VBW: 300KHz
SPAN:3MHz
2. By using the Max-Hold function record the separation of two adjacent channels.
3. Measure the frequency difference of these two adjacent channels by spectrum analyzer Marker function.
4. Repeat above procedures until all frequencies measured were complete.

6.5.3 Test Setup



6.5.4 Test Data

20dB Bandwidth

Temperature ():25

Test Engineer:Jerry Chiou

Humidity (%):55

Channel	Frequency (MHz)	20dB Bandwidth (KHz)	Limit (KHz)	Pass/Fail
00	2402	852	1000	Pass
39	2441	852	1000	Pass
78	2480	852	1000	Pass

Hopping Channel Separation

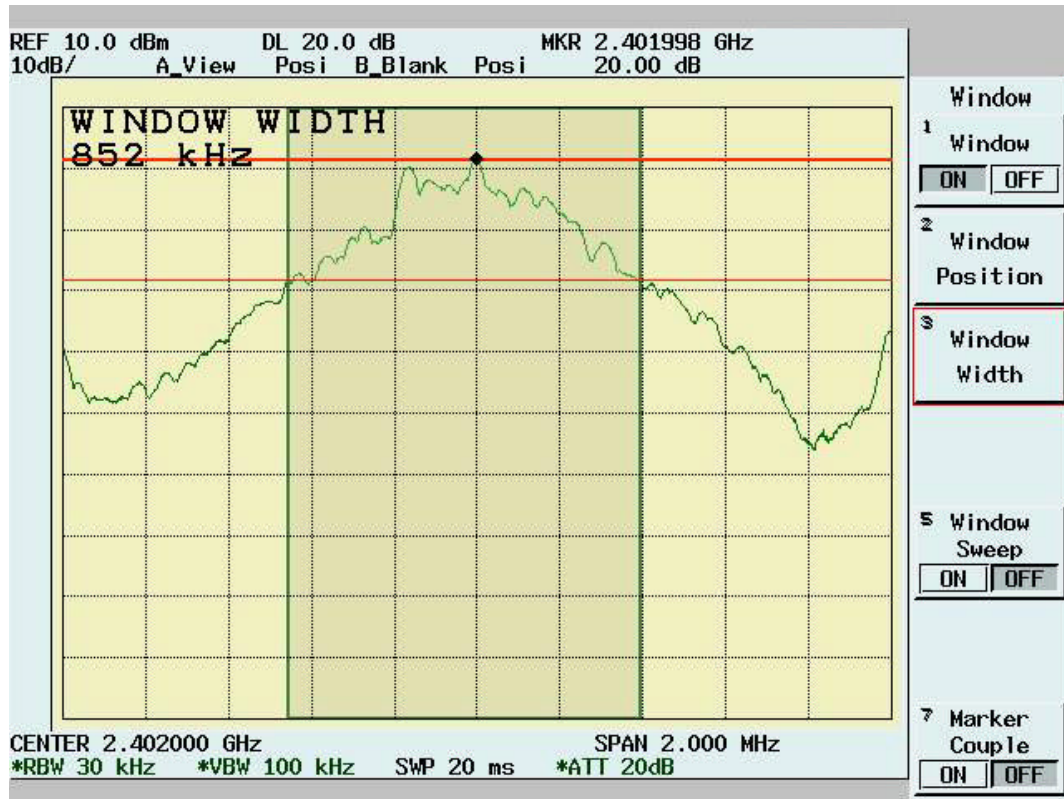
Temperature ():25

Test Engineer:Jerry Chiou

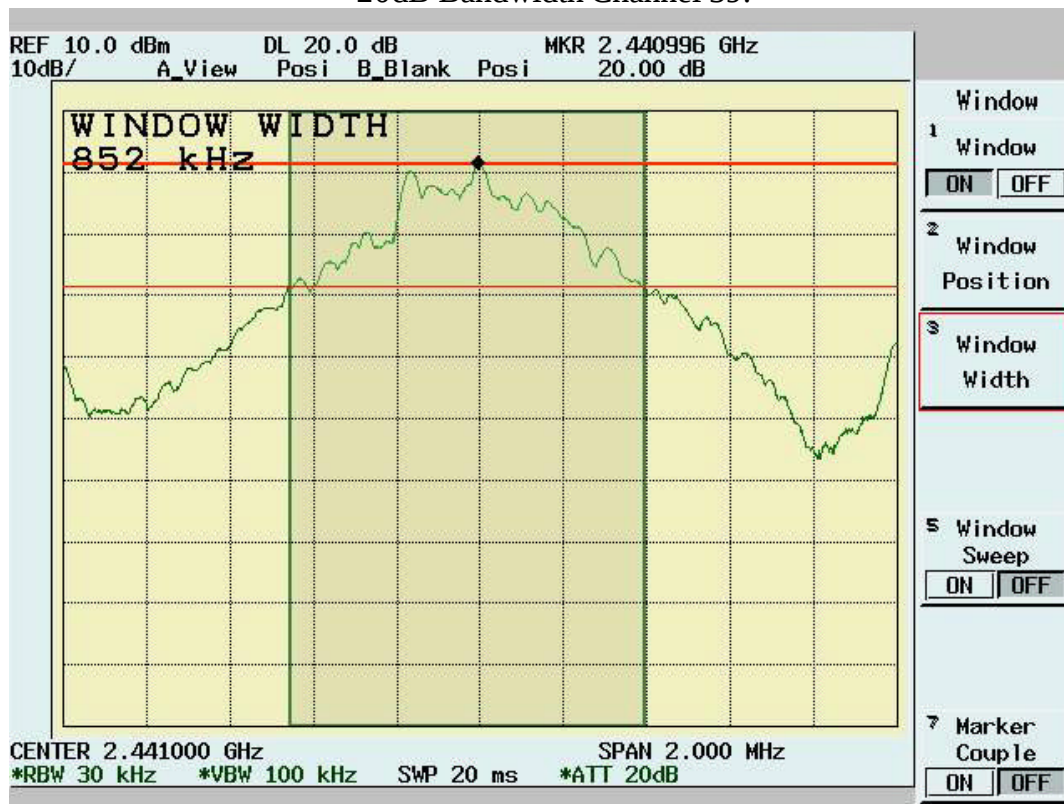
Humidity (%):55

Channel	Frequency (MHz)	Separation (KHz)	Limit (KHz)	Pass/Fail
00	2402	999	852	Pass
39	2441	999	852	Pass
78	2480	999	852	Pass

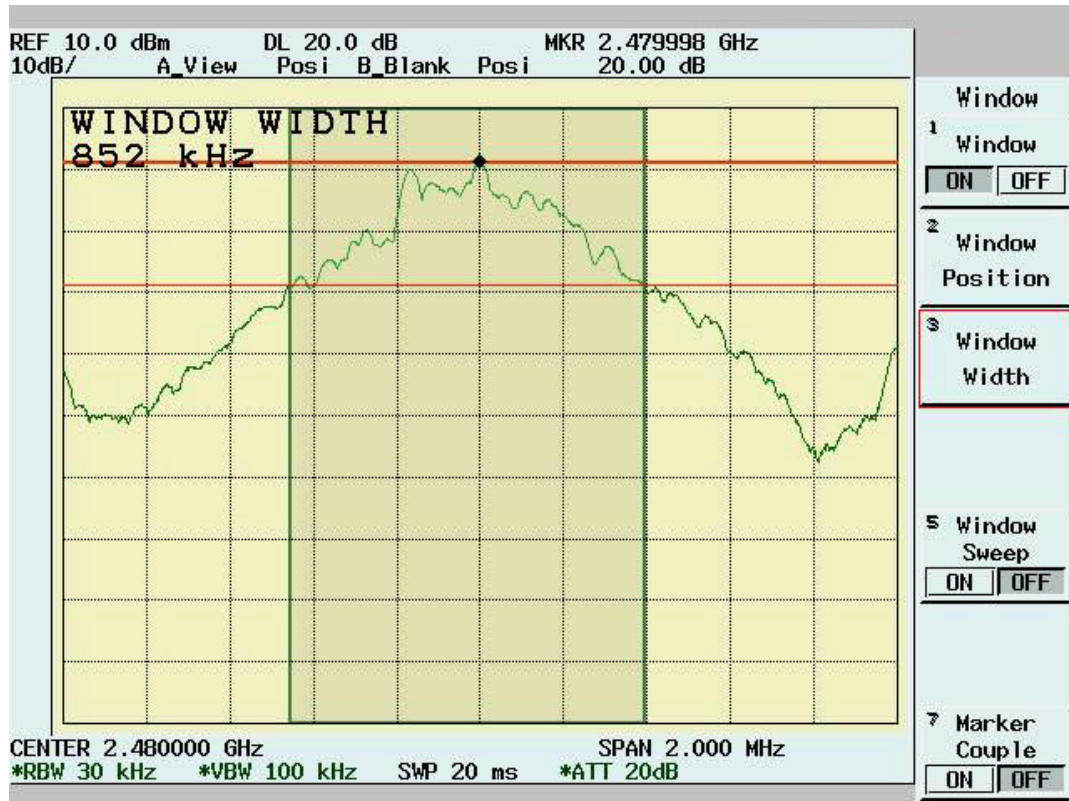
20dB Bandwidth Channel 00:



20dB Bandwidth Channel 39:



20dB Bandwidth Channel 78:



Hopping Channel Separation Channel 00



Hopping Channel Separation Channel 39



Hopping Channel Separation Channel 78

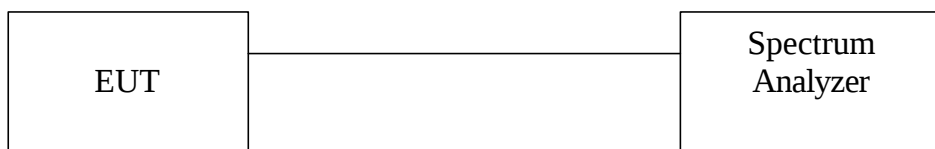


6.6 Number of Hopping Frequency Used

6.6.1 Test Procedure

1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable.
Equipment mode: Spectrum analyzer
RBW: 300KHz
VBW: 1MHz
2. Set the spectrum analyzer on Max-Hold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
3. Repeat above procedures until all frequencies measured were complete.

6.6.2 Test Setup

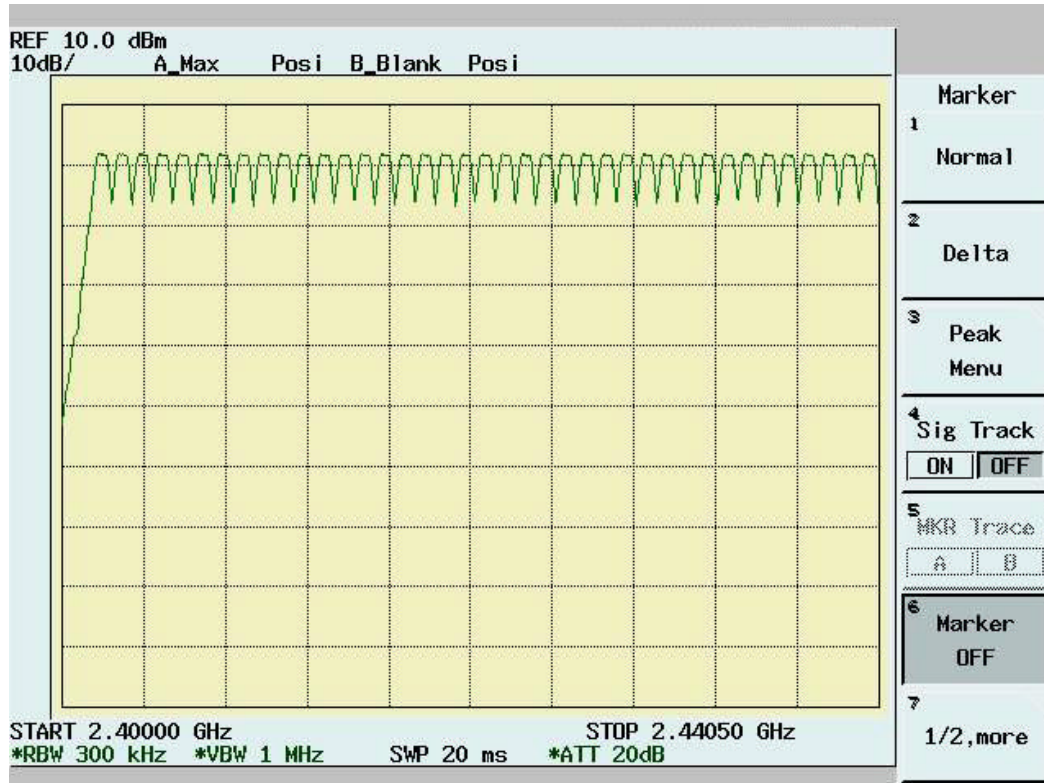


6.6.3 Test Data

Number of Hopping Frequency Used

Test result	Limit (KHz)	Pass/Fail
79	>75	Pass

2400~2405MHz



2405~2482MHz

