FCC Test Report

for

Bluetooth BLE 4.0

Model Number	**:**	**X-NUCLEO-IDB04A1**
FCC ID	**:**	**S9NIDB04A1**
Report Number	**:**	**RF-D230-1501-214**
Date of Receipt	**:**	**March 30, 2015**
Date of Report	**:**	**April 27, 2015**

Prepared for

ST Microelectronics S.R.L.

Via C. Olivetti, 2, 20864 Agrate Brianza (MB), Italy

Prepared by

Central Research Technology Co.

EMC Test Laboratory

No.11, Lane41, Fushuen St., Jungshan Chiu, Taipei, Taiwan, 104, R.O.C.

NVLAP LAB CODE 200575-0

Verification of Compliance

Equipment under Test	**:** Bluetooth BLE 4.0
Model No.	**:** X-NUCLEO-IDB04A1
FCC ID	**:** S9NIDB04A1
Manufacturer	**:** ST Microelectronics S.R.L.
Applicant	**:** ST Microelectronics S.R.L.
Address	**:** Via C. Olivetti, 2, 20864 Agrate Brianza (MB), Italy
Applicable Standards	**:** 47 CFR part 15, Subpart C ANSI 63.10:2009
Date of Testing	**:** April 2~7, 2015
Deviation	**:** N/A
Condition of Test Sample	**:** Mass Production

We, **Central Research Technology Co**., hereby certify that one sample of the designated product was tested in our facility during the period mentioned above. The test records, data evaluation and Equipment Under Test (EUT) configurations shown in the present report are true and accurate representation of the measurements of the sample's RF characteristics under the conditions herein specified.

The test results show that the EUT as described in the present report is in compliance with the requirements set forth in the standards mentioned above and apply to the tested sample identified in the present report only. The test report shall not be reproduced, except in its entirety, without the written approval of Central Research Technology Co.

PREPARED BY : Cathy Chen , **DATE :** Apr. 27, 2015
(Cathy Chen/ Technical Manager)

APPROVED BY : J. Y. Shih , **DATE :** Apr. 27, 2015
(Tsun-Yu Shih/General Manager)

Contents

1 General Description

1.1 General Description of EUT

Equipment under Test	:	Bluetooth BLE 4.0
Model No.	:	X-NUCLEO-IDB04A1
Power in	:	5Vdc
Test Voltage	:	120Vac/60Hz to the connected NB
Manufacturer	:	ST Microelectronics S.R.L.
Channel Numbers	:	40
Frequency Range	:	2402~2480MHz
Function Modulation	:	GFSK
Modular Function	:	Bluetooth BLE 4.0
Antenna Spec	:	Antenna Gain : 0dBi
Function Description	:	

The EUT is used to transmit and receive data both. Please refer to the user's manual for the details.

Perform the functions of EUT continuously by executing the test program supplied by manufacturer.

Since the transmitter is considered a portable unit, it was pre-tested on the positioned in each of 3 axis. Therefor only the test data of the worse case - X axiz was used for Radiated test.

1.2 Applied standards

(1) Conduction Emission Requirement

For intentional device, according to §15.207(a) line conduction emission limit is as below table.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 - 5	56	46
5 - 30	60	50

* Decreases with the logarithm of the frequency.

(2) Radiated Emission Requirement

For intentional device, according to §15.209, the general requirement of field strength of radiated emissions from intentional radiator at a distance of 3 meters shall not exceed the below table.

Frequency (MHz)	Measurement Distance (m)	Field Strength (uV/m)	Field Strength (dBuV/m)
30 – 88	3	100	40.0
88 – 216	3	150	43.5
216 – 960	3	200	46.0
960 – 1610	3	500	54.0
above 1610	3	500	54.0

Note 1- The lower limit shall apply at the transition frequency.

(3) 6dB Bandwidth

According to 15.247(a)(2), Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

(4) Maximun Peak Output Power

According to 15.247(b)(3), For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

(5) 100kHz Bandedge

According to 15.247(d), 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).

(6) Power spectral density

According to 15.247(e),for digitally modulated systems,the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

(7) Restricted Band

Frequency (MHz)	Frequency (MHz)	Frequency (MHz)	Frequency (GHz)
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
[2]1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(2)
13.36 - 13.41			

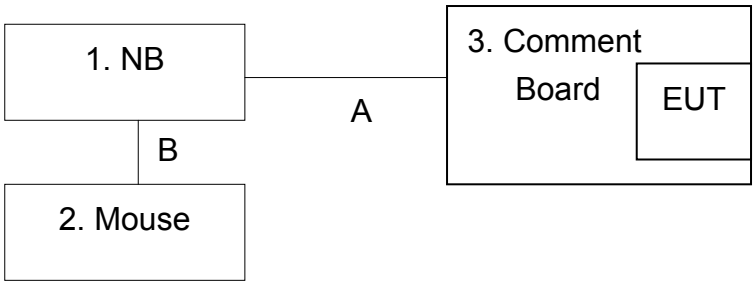
[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

1.3 The Support Units

No.	Unit	Model No.	Trade Name	Power Code	Supported by lab.
1.	NB	LATITUDE D400	DELL	N/A	✓
2.	Mouse	MO56UC	DELL	N/A	✓
3.	Comment Board	NUCLEO-L152RE	ST	N/A	

1.4 Layout of Setup



Connecting Cables :

No.	Cable	Length	Shielded	Core	Shielded Backshell	Supported by lab.	Note
A.	USB cable	1.1m	✓				
B	USB cable	1.8m	✓			✓	

1.5 Test Capability

Test Facility

The test facility used for evaluating the conformance of the EUT with each standard in the present report meets what required in CISPR16-1-4, CISPR16-2-3 and ANSI C63.10:2009.

Test Room	Type of Test Room	Descriptions
TR1	10m semi-anechoic chamber (23m×14m×9m)	Complying with the NSA requirements in documents CISPR 22 and ANSI C63.10:2009. For the radiated emission measurement.
TR11	3m semi-anechoic chamber (9m × 6m × 6m)	
TR13	Test Site	For the RF conducted emission measurement.
TR5	Shielding Room (8m×5m×4m)	For the conducted emission measurement.

Test Laboratory Competence Information

Central Research Technology Co. has been accredited / filed / authorized by the agencies listed in the following table.

Certificate	Nation	Agency	Code	Mark
Accreditation Certificate	USA	NVLAP	200575-0	ISO/IEC 17025
	R.O.C. (Taiwan)	TAF	0905	ISO/IEC 17025
	R.O.C. (Taiwan)	BSMI	SL2-IN-E-0033, SL2-IS-E-0033, SL2-R1/R2-E-0033, SL2-A1-E-0033 SL2-L1-E-0033	ISO/IEC 17025
Site Filing Document	USA	FCC	474046, TW1053	Test facility list & NSA/SVSWR Data
	Canada	IC	4699A-1,-3	Test facility list & NSA Data
	Japan	VCCI	R-1527,C-1609,T-1441, G-10, C-4400, G-614, T-1334	Test facility list & NSA/SVSWR Data
Authorization Certificate	Germany	TUV	UA50235497	ISO/IEC 17025
	Norway	Nemko	ELA212	ISO/IEC 17025

The copy of each certificate can be downloaded from our web site: www.crc-lab.com

1.6 Measurement Uncertainty

The assessed measurement uncertainty with a suitable coverage factor K to ensure 95% confidence level for the normal distribution are shown as below, the values are less than U_{cispr} in table 1 of CISPR 16-4-2.

Test Item	Measurement Uncertainty	
Radiated Emission: (30MHz~200MHz)	Horizontal 3.9dB；Vertical 4.2dB	
Radiated Emission: (200MHz~1GHz)	Horizontal 4.5dB；Vertical 5.7dB	
Radiated Emission: (1GHz~6GHz)	Horizontal 4.3dB；Vertical 4.5dB	
Radiated Emission: (6GHz~18GHz)	Horizontal 4.3dB；Vertical 4.4dB	
Line Conducted Emission	ESH2-Z5	3.3dB
	ENV 4200	3.1dB

2 Conducted Emission Measurement

Test Result : PASS

2.1 Applied Standard

For intentional device, according to §15.207(a) line conduction emission limit is as below table.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 - 5	56	46
5 - 30	60	50

* Decreases with the logarithm of the frequency.

Note:

For a device with a permanent antenna operating at or below 30 MHz, the FCC will accept measurements done with a suitable dummy load, in lieu of the permanent antenna under the following conditions: (1) perform the AC line conducted tests with the permanent antenna to determine compliance with the Section 15.207 limits outside the transmitter's fundamental emission band; (2) retest with a dummy load in lieu of the permanent antenna to determine compliance with the Section 15.207 limits within the transmitter's fundamental emission band.

2.2 Test Instruments

Test Site and Equipment	Manufacturer	Model No./ Serial No.	Last Calibration Date	Calibration Due Date
Test Receiver	R&S	ESCS 30/ 836858/021	Jan. 16, 2015	Jan. 16, 2016
LISN	R&S	ESH2-Z5/ 880669/039	March 25, 2015	March 25, 2016
2nd LISN	R&S	ENV4200/ 833209/010	April 2, 2015	April 2, 2016
50Ω terminator	R&S	N/A/ 001	Aug. 19, 2014	Aug. 19, 2015
RF Switch	R&S	RSU28/ 338965/002	Feb. 6, 2015	Aug. 6, 2015
RF Cable	N/A	N/A/ C0052 ~ 56	Feb. 6, 2015	Aug. 6, 2015
Dummy Load	N/A	50Ω 1/4W Resistance	NCR	NCR
Test Software	Audix	e3/ Ver. 5.2004-2-19k	NCR	NCR
TR5 shielded room	ETS LINDGREN	TR5/ 15353-F	NCR	NCR

Note:
1. The calibrations are traceable to NML/ROC.
2. NCR : No Calibration Required.

Instrument Setting

IF BW	Measurement Time	Detector	Trace	Comment
9kHz	1 second	Quasi-Peak / Average	Maxhold	

Climatic Condition

Ambient Temperature：26°C; Relative Humidity : 58%

2.3 Test Procedures

a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.

b. If the EUT is tabletop equipment, it was placed on a non-conducted table with a height of 0.8 meters above the reference ground plane and 0.4 meters from the conducting wall of the shielded room. Also if the EUT is floor-standing equipment, it was placed on a non-conducted support with a height of 12 millimeters above the reference ground plane.

c. Connect the EUT's power source to the appropriate power mains through the LISN.

d. All the other peripherals are connected to the 2nd LISN, if any.

e. The LISN was placed 0.8 meters from the EUT and at least 0.8 meters from other units and other metal planes.

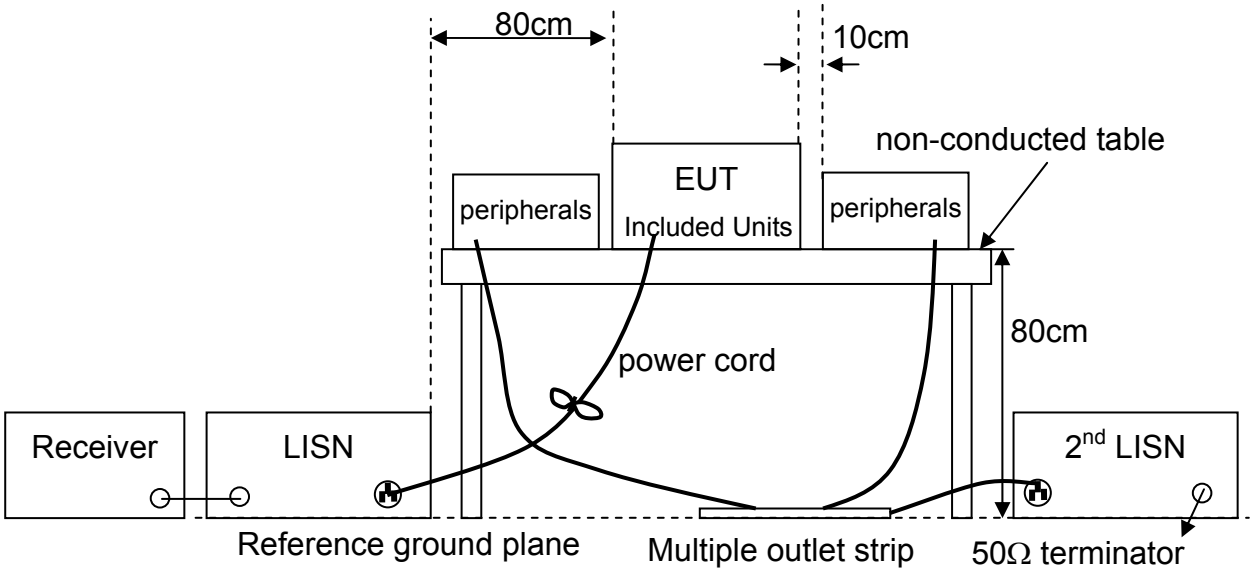
f. Measure the conducted emissions on each power line (Neutral Line and Line 1 – Hot side) of the EUT's power source by using the test receiver connected to the coupling RF output port of LISN.

g. Rapidly scan the signal from 150kHz to 30MHz by using the receiver through the Maximum-Peak detector to determine those frequencies associated with higher emission levels for each measured line.

h. Then measure the maximum level of conducted disturbance for each frequency found from step g. by using the receiver through the Quasi-Peak and Average detectors per CISPR 16-1.

i. Record the level for each frequency and compare with the required limit.

2.4 Test Configurations



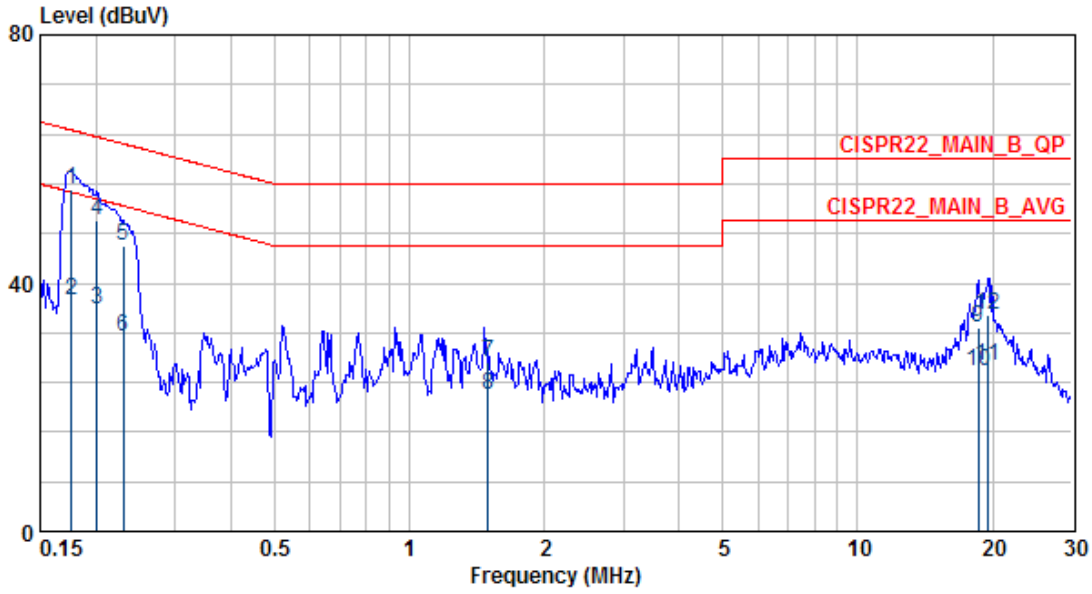
2.5 Test Results

Test Mode : **2402MHz, Continuous Transmitting**

Tester : DER-JAN KEN

Frequency Range : 150kHz~30MHz

Phase : **Line**



	Freq	Level	Factor	Read Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB		
1 @	0.176	55.09	0.14	54.95	64.68	-9.59	LINE	QP
2	0.176	37.29	0.14	37.15	54.68	-17.39	LINE	AVERAGE
3	0.201	35.73	0.14	35.59	53.58	-17.85	LINE	AVERAGE
4	0.201	49.98	0.14	49.84	63.58	-13.60	LINE	QP
5	0.230	46.11	0.14	45.97	62.44	-16.32	LINE	QP
6	0.230	31.49	0.14	31.35	52.44	-20.94	LINE	AVERAGE
7	1.498	27.21	0.24	26.97	56.00	-28.79	LINE	QP
8	1.498	22.09	0.24	21.85	46.00	-23.91	LINE	AVERAGE
9	18.622	32.77	1.08	31.69	60.00	-27.23	LINE	QP
10	18.622	25.89	1.08	24.81	50.00	-24.11	LINE	AVERAGE
11	19.532	26.68	1.11	25.57	50.00	-23.32	LINE	AVERAGE
12	19.532	34.93	1.11	33.82	60.00	-25.07	LINE	QP

Note:

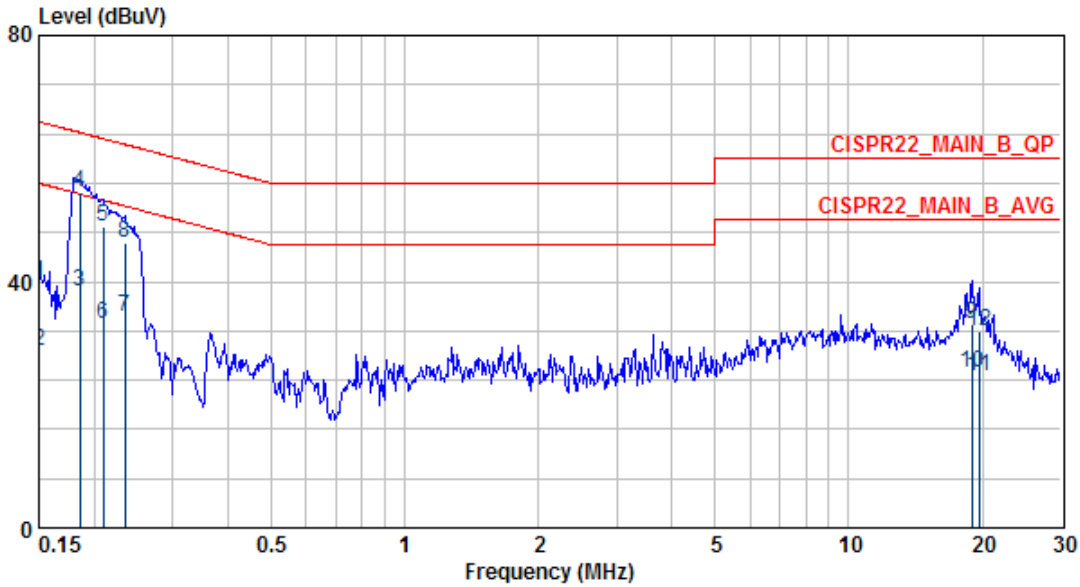
1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + insertion loss of LISN.
3. Q.P. is abbreviation of quasi-peak.

Test Mode **: 2402MHz, Continuous Transmitting**

Tester **:** DER-JAN KEN

Frequency Range **:** 150kHz~30MHz

Phase **: Neutral**



	Freq	Level	Factor	Read Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB		
1	0.150	39.94	0.16	39.78	66.00	-26.06	NEUTRAL	QP
2	0.150	28.64	0.16	28.48	56.00	-27.36	NEUTRAL	AVERAGE
3	0.185	38.49	0.16	38.33	54.24	-15.75	NEUTRAL	AVERAGE
4 @	0.185	54.52	0.16	54.36	64.24	-9.72	NEUTRAL	QP
5	0.209	48.79	0.16	48.63	63.23	-14.44	NEUTRAL	QP
6	0.209	33.14	0.16	32.98	53.23	-20.09	NEUTRAL	AVERAGE
7	0.234	34.29	0.16	34.13	52.30	-18.01	NEUTRAL	AVERAGE
8	0.234	46.17	0.16	46.01	62.30	-16.13	NEUTRAL	QP
9	18.920	32.99	1.10	31.89	60.00	-27.01	NEUTRAL	QP
10	18.920	25.27	1.10	24.17	50.00	-24.73	NEUTRAL	AVERAGE
11	19.635	24.71	1.13	23.58	50.00	-25.29	NEUTRAL	AVERAGE
12	19.635	31.80	1.13	30.67	60.00	-28.20	NEUTRAL	QP

Note:

1. Emission Level = reading value + correction factor.
2. Correction factor = cable loss + insertion loss of LISN.
3. Q.P. is abbreviation of quasi-peak.

3 6dB Bandwidth

Result: Pass

3.1 Applied standard

According to 15.247(a)(2), Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

3.2 Test Instruments

Test Site and Equipment	Manufacturer	Model No. /Serial No.	Last Calibration Date	Calibration Due Date
Spectrum Analyzer	Agilent	E4405B/ MY45106706	May 23, 2014	May 23, 2015
Test Site	N.A.	TR13	NCR	NCR

Note:

1. The calibrations are traceable to NML/ROC.
2. NCR:No Calibration Required.

Instrument Setting

RBW	VBW	Detector	Trace	Comment
100kHz	300kHz	Peak	Maxhold	

Climatic Condition

Ambient Temperature：25℃ Relative Humidity :60%

3.3 Measurement Procedure

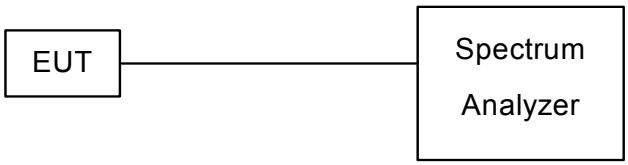
a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.

b. A software provided by client enabled the EUT to transmit data at low, middle and high channel frequencies individually.

c. Test procedures follow KDB 558074 D01 DTS Measurement Guidance v03r02 Section 8.0 option 1.

d. Measure the 6dB bandwidth and compare with the required limit.

3.4 Test configuration

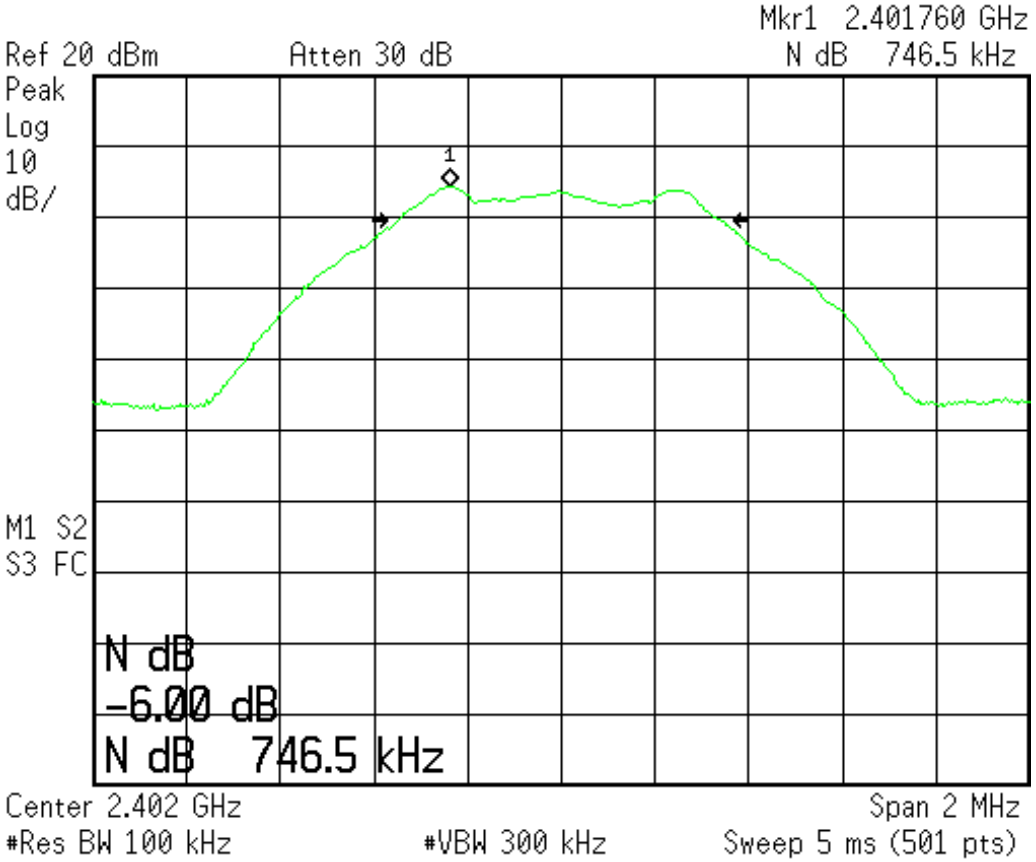


3.5 Test Data

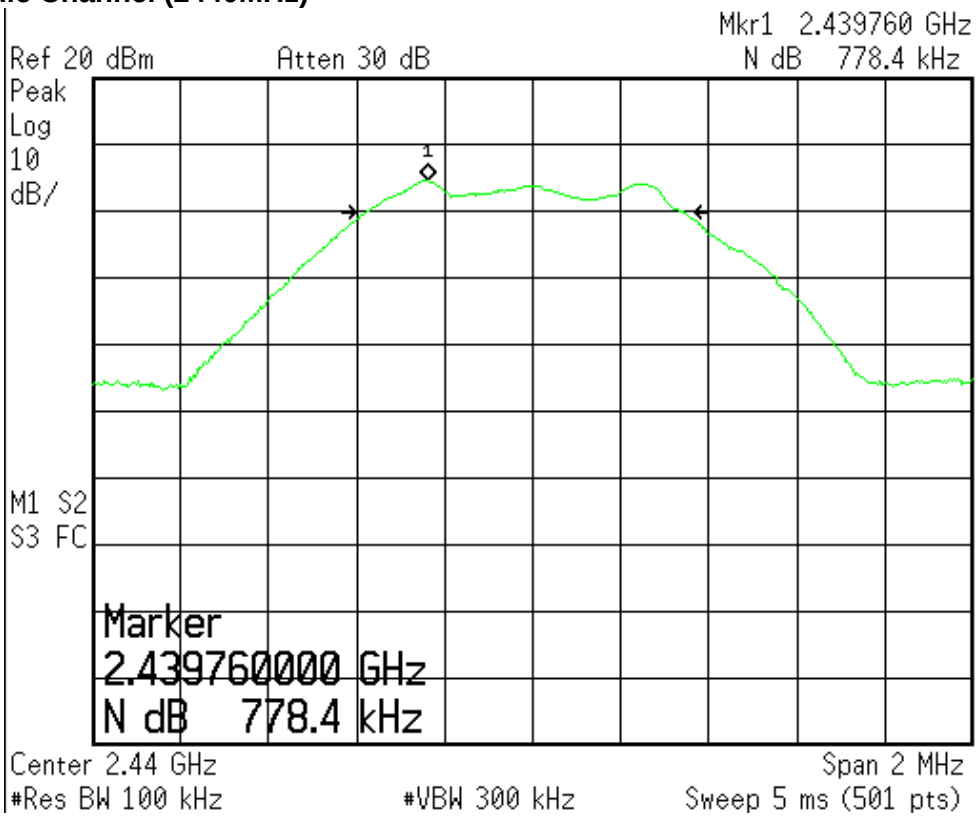
Test Mode : Continuous Transmitting **Tester :** Gary

Operating Frequency (MHz)	6 dB Bandwidth (kHz)	Limit (kHz)
2402	746.5	500
2440	778.4	500
2480	826.3	500

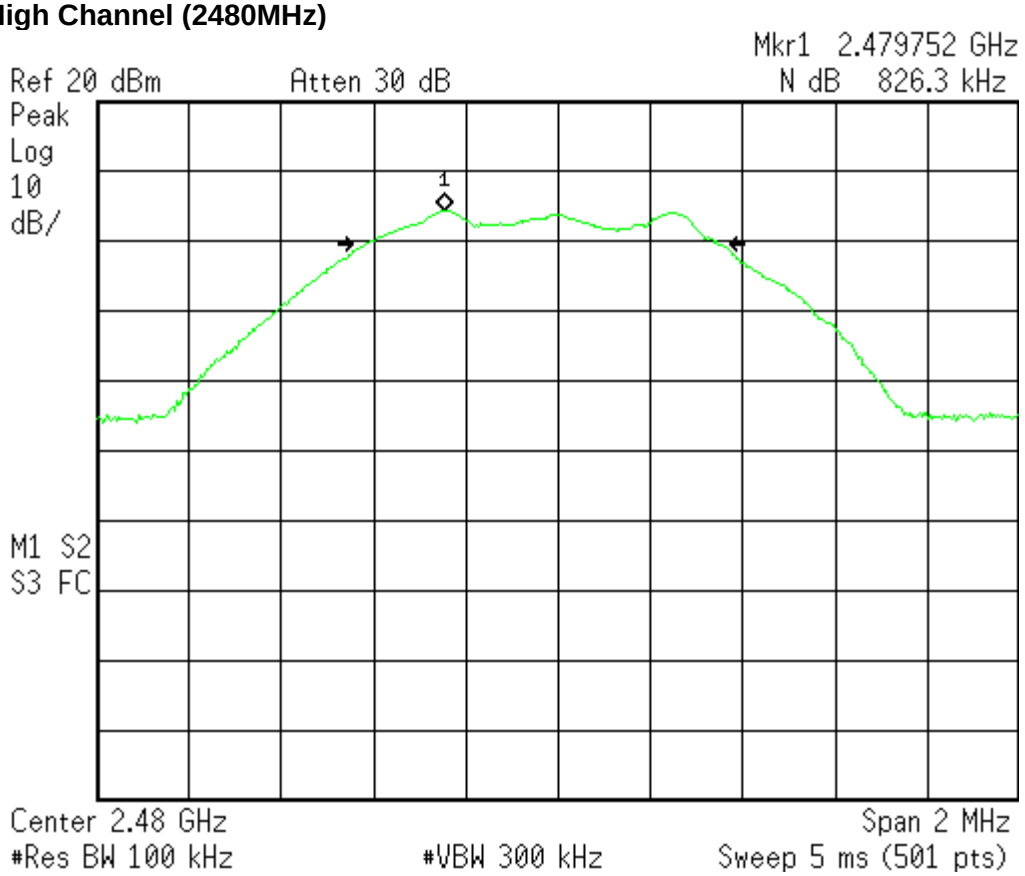
Low Channel (2402MHz)



Middle Channel (2440MHz)



High Channel (2480MHz)



4 Maximum Peak Output Power

Result: Pass

4.1 Applied standard

According to 15.247(b)(3), For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

4.2 Test Instruments

Test Site and Equipment	Manufacturer	Model No./ Serial No.	Last Calibration Date	Calibration Due Date
Spectrum Analyzer	Agilent	E4405B/ MY45106706	May 23, 2014	May 23, 2015
Test Site	N.A.	TR13	NCR	NCR

Note:

1.The calibrations are traceable to NML/ROC.

2.NCR : No Calibration Required.

Instrument Setting

RBW	VBW	Detector	Trace	Comment
30kHz	100kHz	Peak	Maxhold	

Climatic Condition

Ambient Temperature：25℃ Relative Humidity :60%

4.3 Measurement Procedure

a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.

b. The software provided by client enabled the EUT to transmit data at lowest, middle and highest channel frequencies individually.

c. Test procedures follow KDB 558074 D01 DTS Measurement Guidance v03r02 section 9.2.2.2.

d. Measurement the maximum peak output and compare with the required limit.

4.4 Test configuration

4.5 Test Data

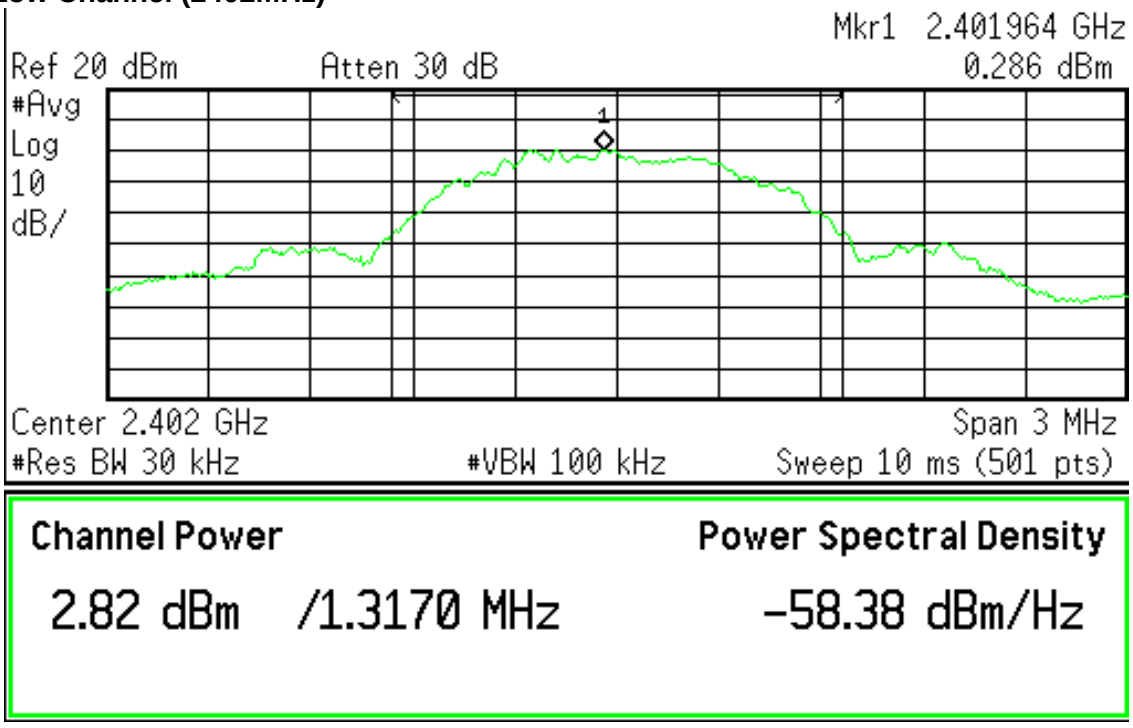
Test Mode : Continuous Transmitting **Tester :** Gary

Operating Frequency (MHz)	Reading Data (dBm)	Correction Factor (dB)	Emission (dBm)	Limit (dBm)	Margin (dB)
2402	2.82	0.5	3.32	30	26.68
2440	3.03	0.5	3.53	30	26.47
2480	2.87	0.5	3.37	30	26.63

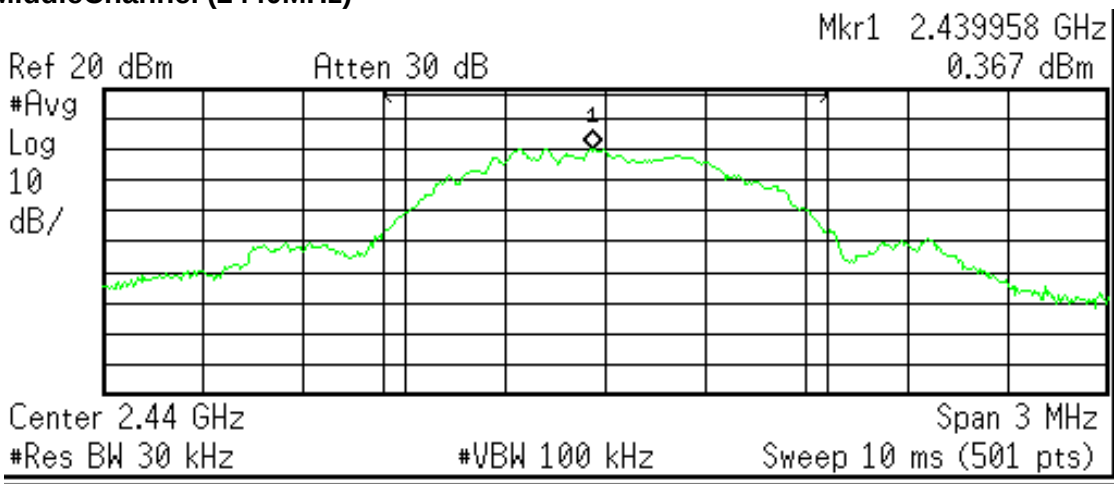
Note:

1. Correction Factor (dB) = Cable Loss + Attenuator
2. Emission (dBm) = Reading Data + Correction Factor
3. Margin (dB) = Limit – Emission

Low Channel (2402MHz)

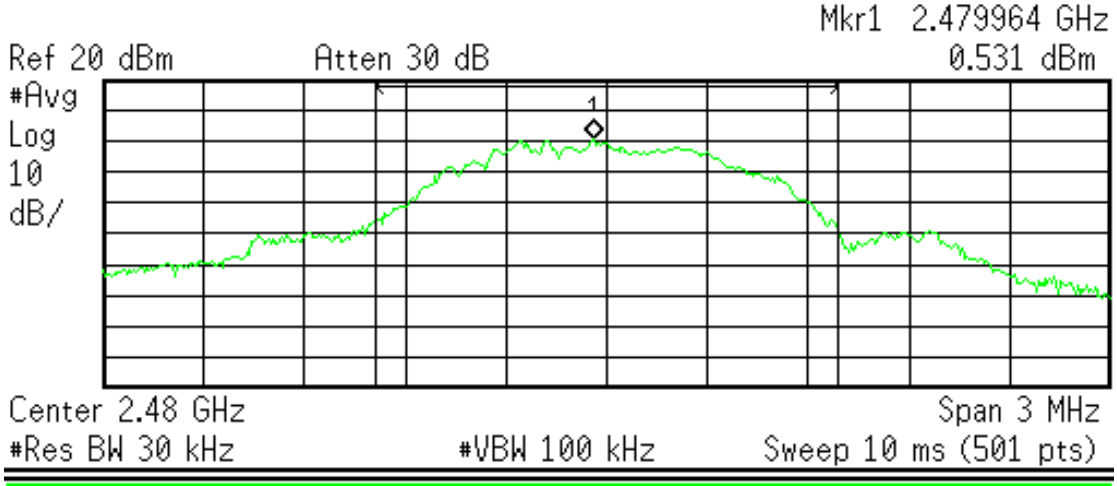


MiddleChannel (2440MHz)



Channel Power	Power Spectral Density
3.03 dBm /1.3170 MHz	-58.17 dBm/Hz

High Channel (2480MHz)



Channel Power	Power Spectral Density
2.87 dBm /1.3770 MHz	-58.52 dBm/Hz

5 Peak Power Spectral Density

Result: Pass

5.1 Applied standard

According to 15.247(e),for digitally modulated systems,the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

5.2 Test Instruments

Test Site and Equipment	Manufacturer	Model No. /Serial No.	Last Calibration Date	Calibration Due Date
Spectrum Analyzer	Agilent	E4405B/ MY45106706	May 23, 2014	May 23, 2015
Test Site	N.A.	TR13	NCR	NCR

Note:

1. The calibrations are traceable to NML/ROC.
2. NCR:No Calibration Required.

Instrument Setting

RBW	VBW	Detector	Trace	Comment
30kHz	100kHz	Peak	Maxhold	

Climatic Condition

Ambient Temperature：25℃ Relative Humidity :60%

5.3 Measurement Procedure

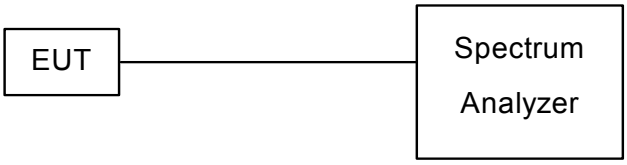
a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.

b. A software provided by client enabled the EUT to transmit data at low, middle and high channel frequencies individually.

c. Test procedures follow KDB 558074 D01 DTS Measurement Guidance v03r02 section 10.3.

d. Measure the peak power spectrum density and compare with the required limit.

5.4 Test configuration



5.5 Test Data

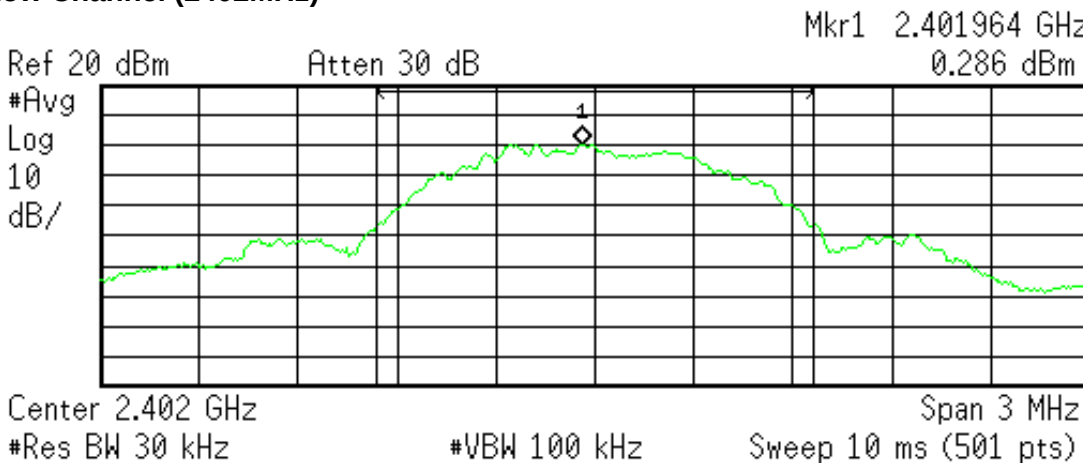
Test Mode : Continuous Transmitting **Tester** : Gary

Operating Frequency (MHz)	Reading Data (dBm)	Correction Factor (dB)	Emission (dBm)	Limit (dBm)	Margin (dBm)
2402	0.286	0.5	0.786	8	7.214
2440	0.367	0.5	0.867	8	7.133
2480	0.531	0.5	1.031	8	6.969

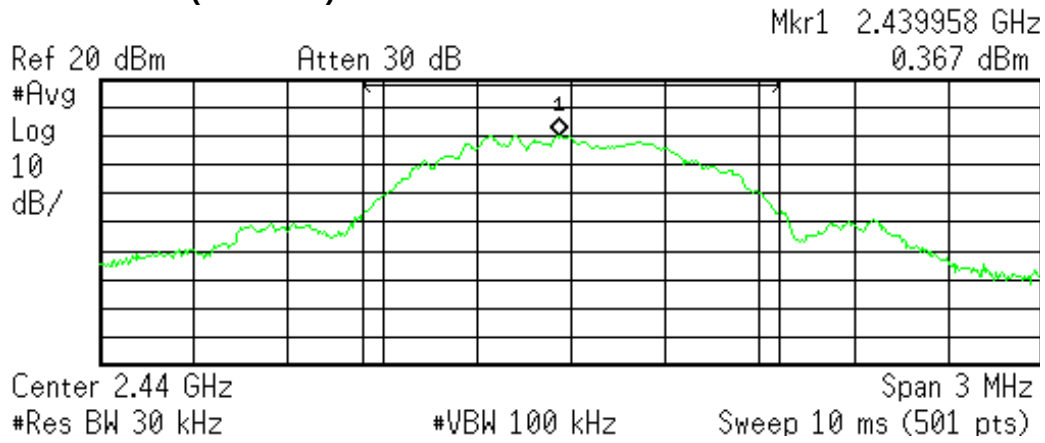
Note:

1. Correction Factor (dB) = Cable Loss + Attenuator
2. Emission (dBm) = Reading Data + Correction Factor
3. Margin (dB) = Limit – Emission

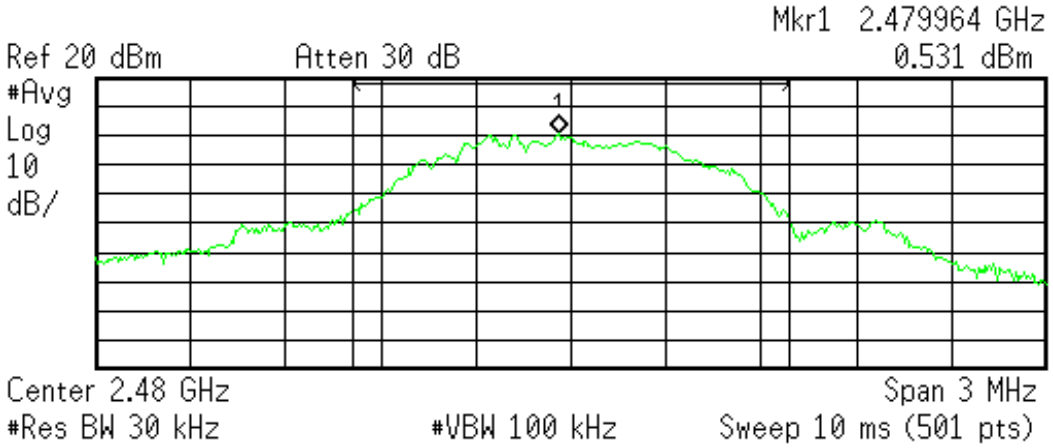
Low Channel (2402MHz)



Middle Channel (2440MHz)



High Channel (2480MHz)



6 RF Antenna Conducted spurious

Result: Pass

6.1 Applied standard

According to 15.247(c),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).

6.2 Test Instruments

Test Site and Equipment	Manufacturer	Model No./ Serial No.	Last Calibration Date	Calibration Due Date
Spectrum Analyzer	Agilent	E4405B/ MY45106706	May 23, 2014	May 23, 2015
Test Site	N.A.	TR13	NCR	NCR

Note:

1.The calibrations are traceable to NML/ROC.

2.NCR : No Calibration Required.

Instrument Setting

RBW	VBW	Detector	Trace	Comment
100kHz	300kHz	Peak	Maxhold	

Climatic Condition

Ambient Temperature：25℃ Relative Humidity :60%

6.3 Measurement Procedure

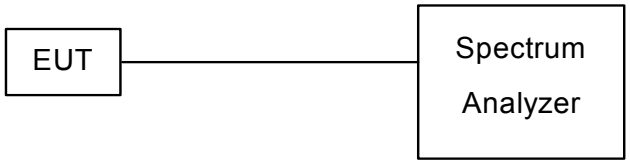
a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.

b. The software provided by client enabled the EUT to transmit data at low, middle and high channel frequencies individually.

c. Test procedures follow KDB 558074 D01 DTS Measurement Guidance v03r02 section 11.

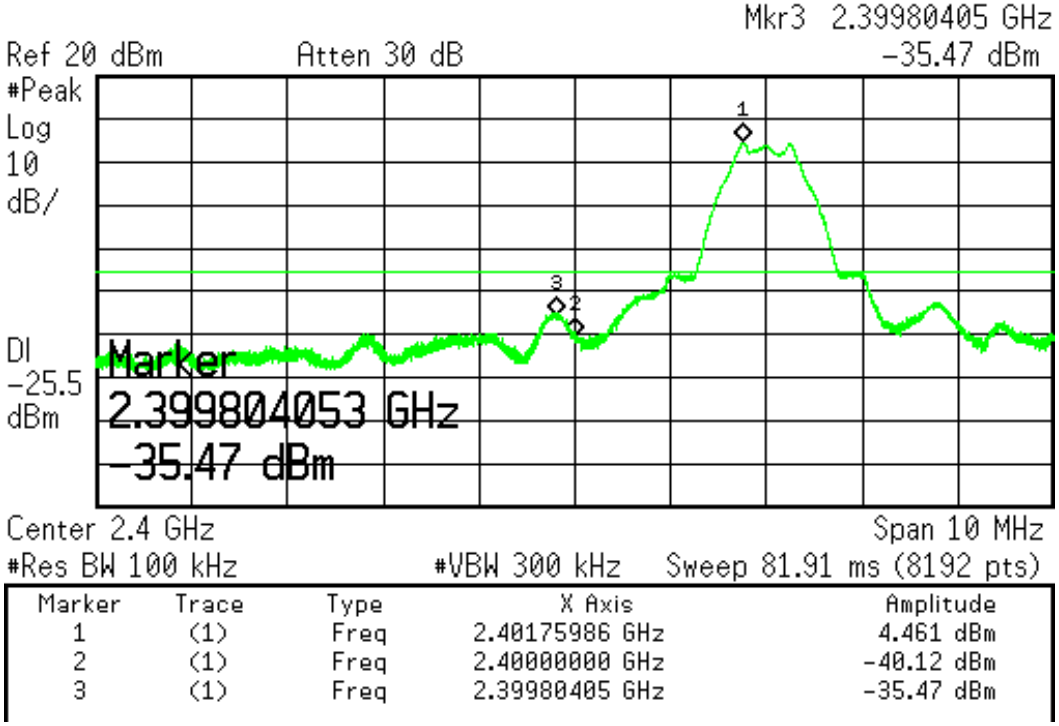
d. Measurement the conducted spurious and compare with the required limit.

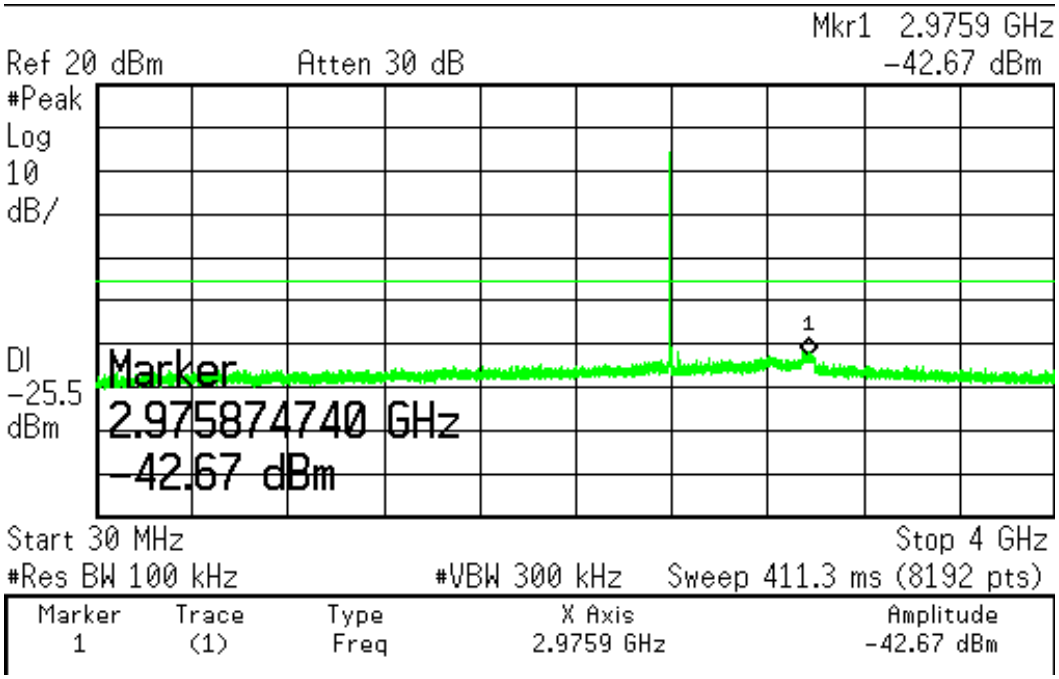
6.4 Test configuration

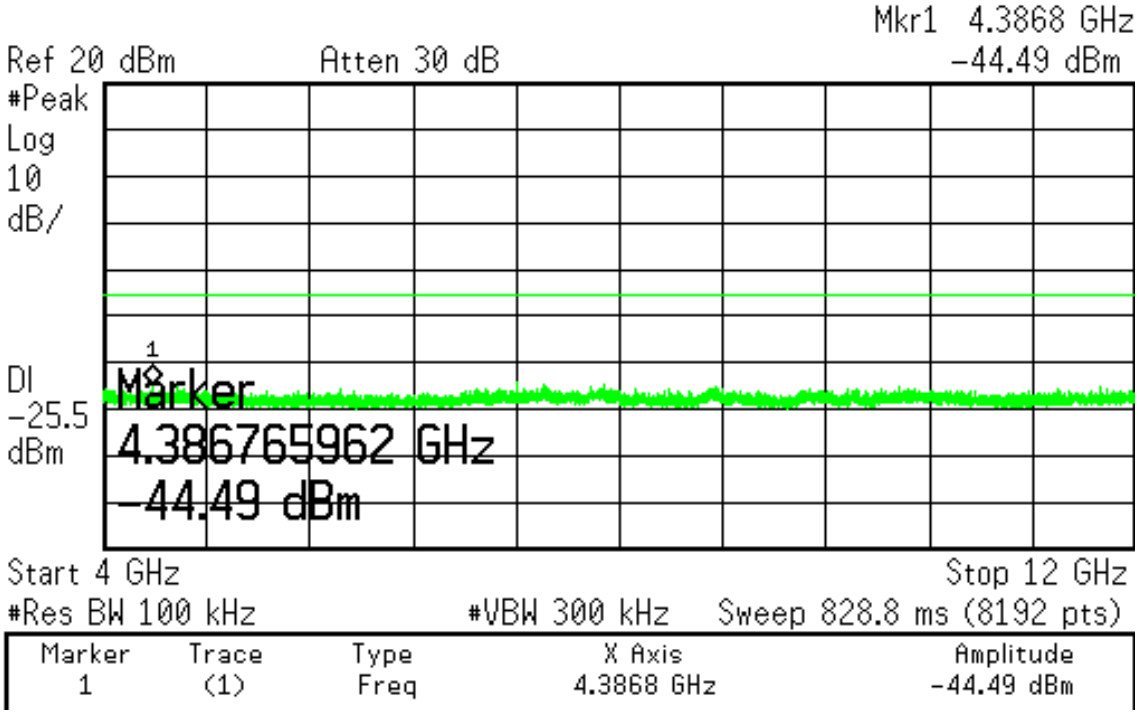


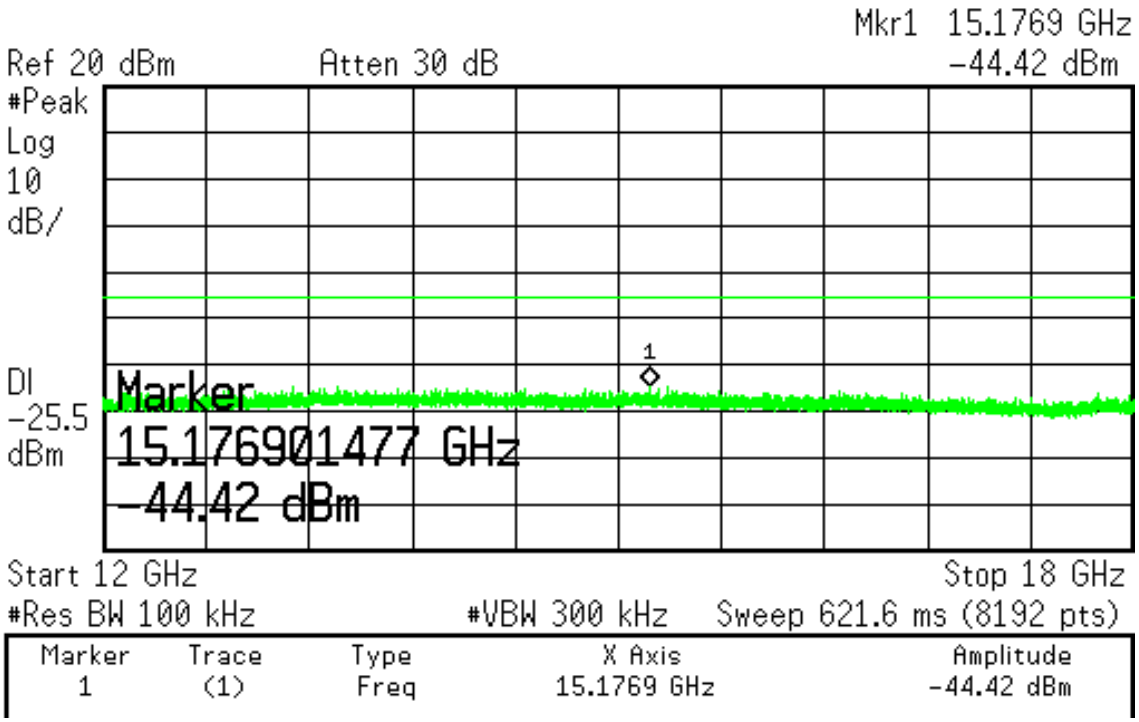
6.5 Test Data

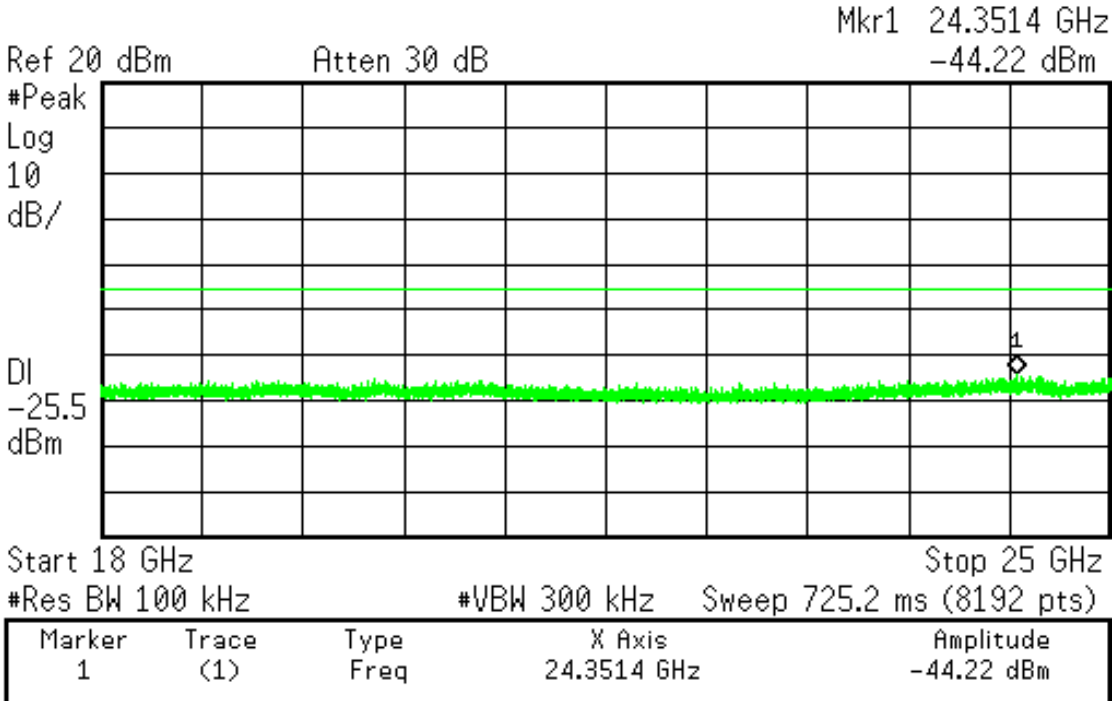
Test Mode	**: Continuous Transmitting**	**Tester**	**:**	Gary
Test Frequency: Low Channel (2402MHz)		**Frequency Rang**	**:**	30MHz~25GHz





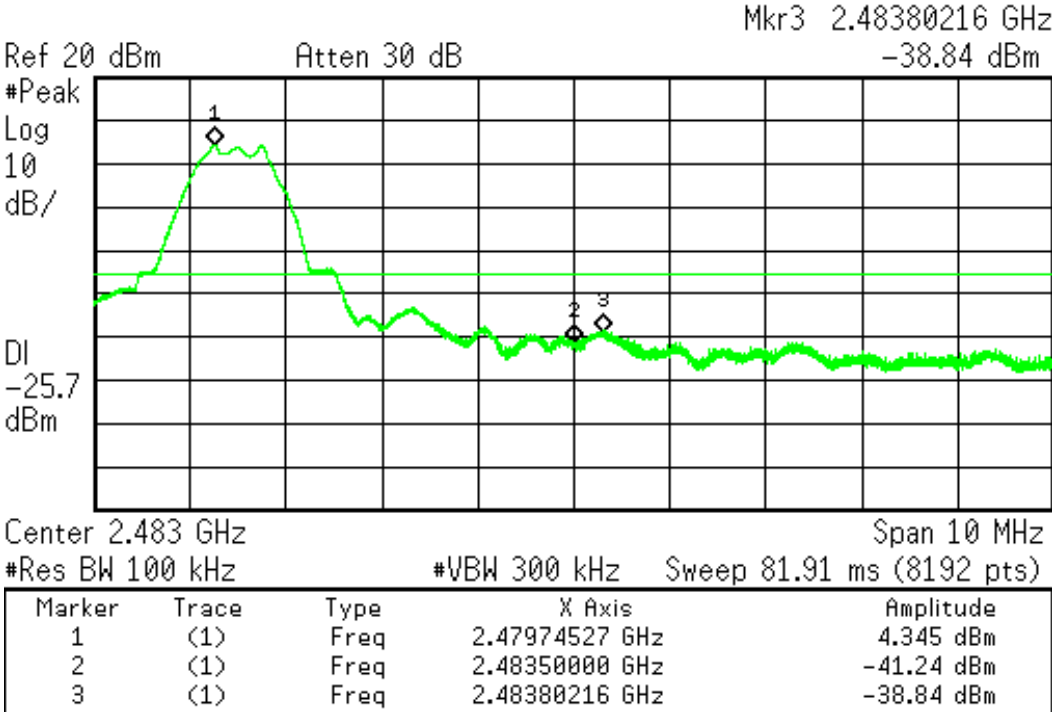

Mkr1 4.3868 GHz
Ref 20 dBm
Atten 30 dB
-44.49 dBm
#Peak
Log
10
dB/
1
Marker
4.386765962 GHz
-44.49 dBm
Dl
-25.5
dBm
Start 4 GHz
Stop 12 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 828.8 ms (8192 pts)
Marker 1 Trace (1) Type Freq X Axis 4.3868 GHz Amplitude -44.49 dBm


Mkr1 15.1769 GHz
Ref 20 dBm
Atten 30 dB
-44.42 dBm
#Peak
Log
10
dB/
1
Marker
15.176901477 GHz
-44.42 dBm
Dl
-25.5
dBm
Start 12 GHz
Stop 18 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 621.6 ms (8192 pts)
Marker 1 Trace (1) Type Freq X Axis 15.1769 GHz Amplitude -44.42 dBm

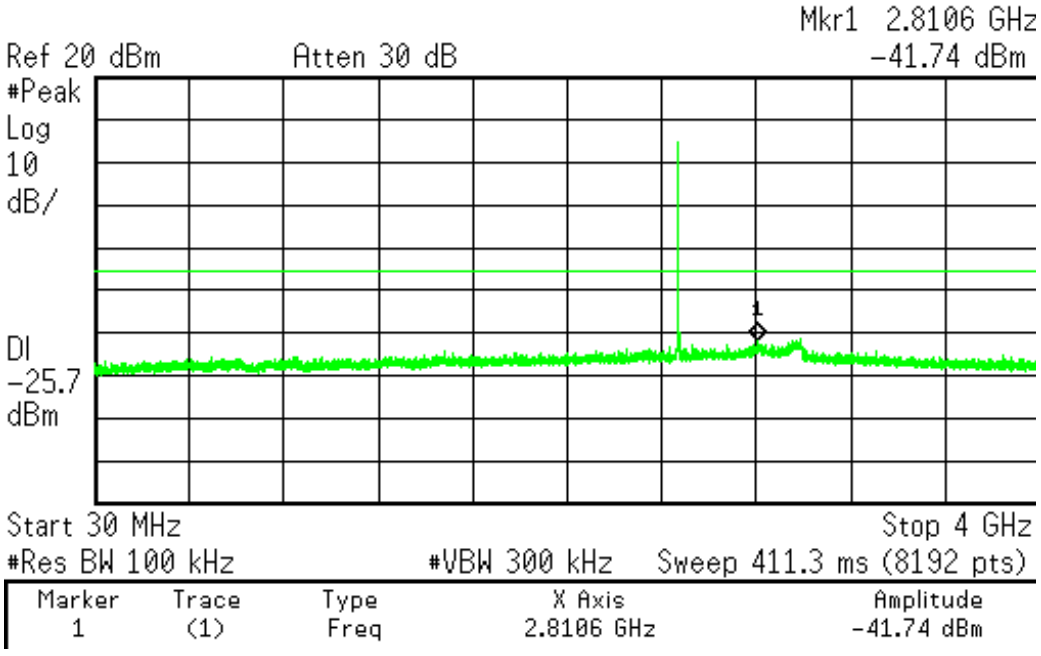

Mkr1 24.3514 GHz
Ref 20 dBm
Atten 30 dB
-44.22 dBm
#Peak
Log
10
dB/
DI
-25.5
dBm
1
Start 18 GHz
Stop 25 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 725.2 ms (8192 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 24.3514 GHz -44.22 dBm

Test Mode : Continuous Transmitting **Tester : Gary**

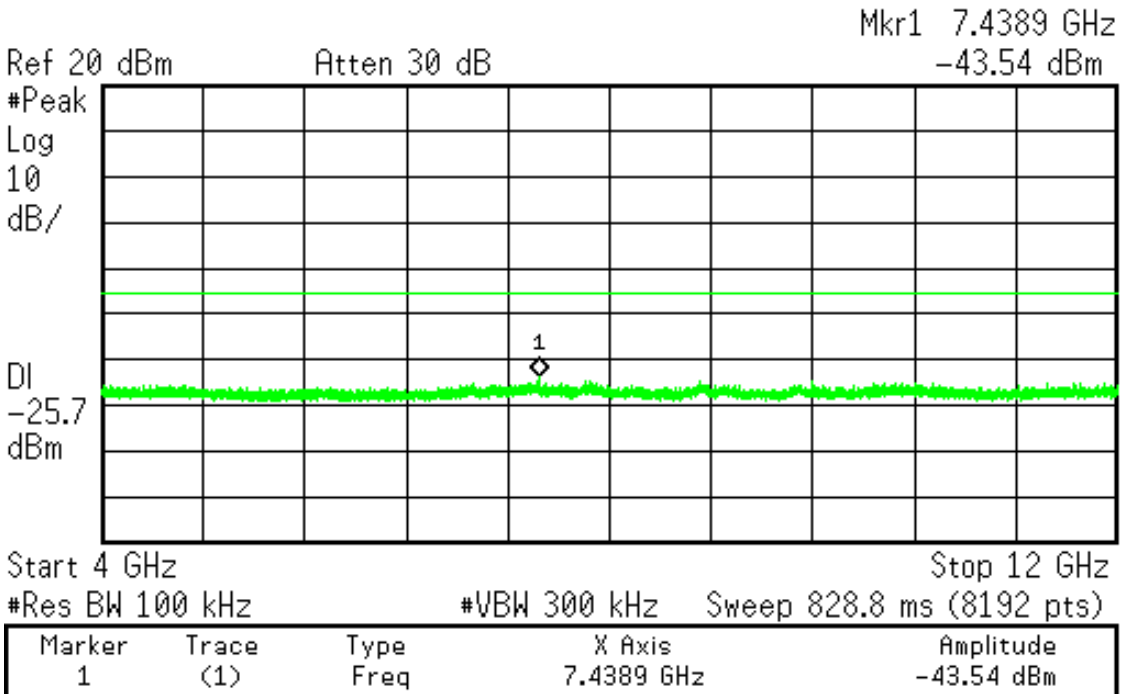
Test Frequency: High Channel (2480MHz) **Frequency Rang : 30MHz~25GHz**

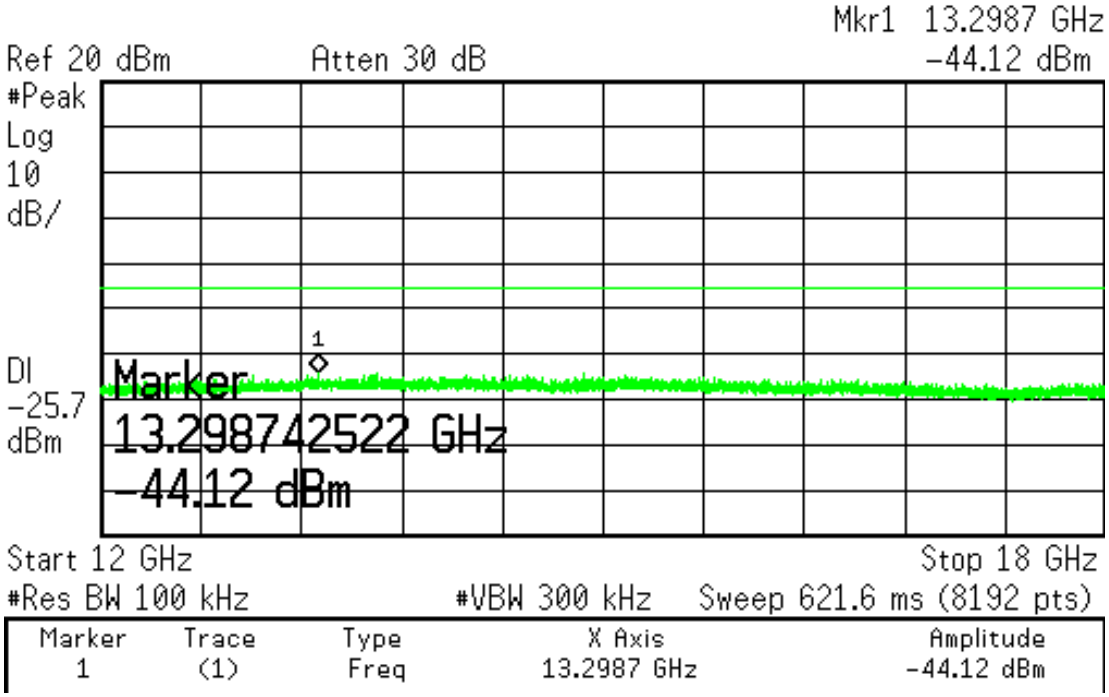


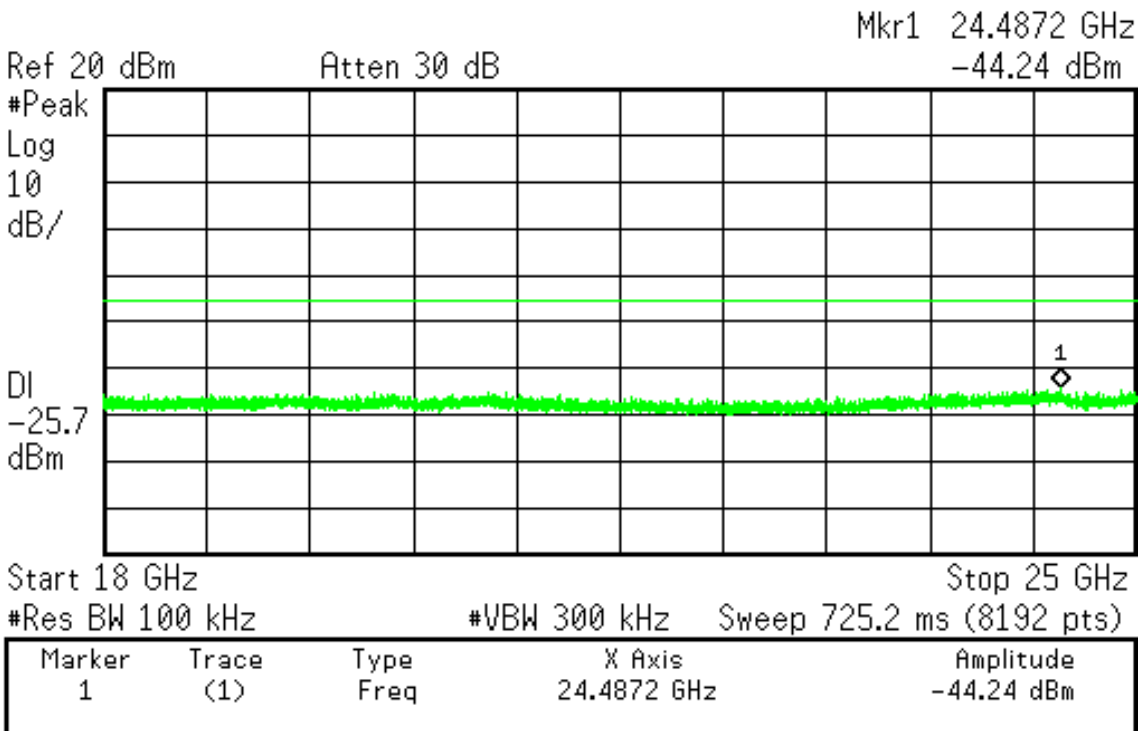
Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.47974527 GHz	4.345 dBm
2	(1)	Freq	2.48350000 GHz	-41.24 dBm
3	(1)	Freq	2.48380216 GHz	-38.84 dBm



Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.8106 GHz	-41.74 dBm


Mkr1 7.4389 GHz
-43.54 dBm
Ref 20 dBm
Atten 30 dB
#Peak
Log
10
dB/
DI
-25.7
dBm
1
Start 4 GHz
Stop 12 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 828.8 ms (8192 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 7.4389 GHz -43.54 dBm


Mkr1 13.2987 GHz
-44.12 dBm
Ref 20 dBm
Atten 30 dB
#Peak
Log
10
dB/
DI
-25.7
dBm
1
Marker
13.298742522 GHz
-44.12 dBm
Start 12 GHz
Stop 18 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 621.6 ms (8192 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 13.2987 GHz -44.12 dBm


Mkr1 24.4872 GHz
-44.24 dBm
Ref 20 dBm
Atten 30 dB
#Peak
Log
10
dB/
Dl
-25.7
dBm
1
Start 18 GHz
Stop 25 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 725.2 ms (8192 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 24.4872 GHz -44.24 dBm

7 Band Edge

Result: Pass

7.1 Applied standard

According to 15.247(c), 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).

7.2 Test Instruments

Test Site and Equipment	Manufacturer	Model No./ Serial No.	Last Calibration Date	Calibration Due Date
Spectrum Analyzer	Agilent	FSP40/ 100031	July 25, 2014	July 25, 2015
Antenna	EMCO	3117/ 00082847	Nov. 21, 2014	Nov. 21, 2015
PRE-AMPLIFIER	MITEQ	TTA1800-30-HG-N-M	Dec. 1, 2014	Dec. 1, 2015
Semi - anechoic Chamber	ETS. LINDGREN	TR1/ 17627-B	April 12, 2014	April 12, 2015

Note:

1.The calibrations are traceable to NML/ROC.

2.NCR : No Calibration Required.

Instrument Setting

RBW	VBW	Detector	Trace	Comment
1MHz	3MHz	Peak	Maxhold	Peak
1MHz	10Hz	Peak	Maxhold	Average

Climatic Condition

Ambient Temperature：26℃ Relative Humidity : 54%

7.3 Measurement Procedure

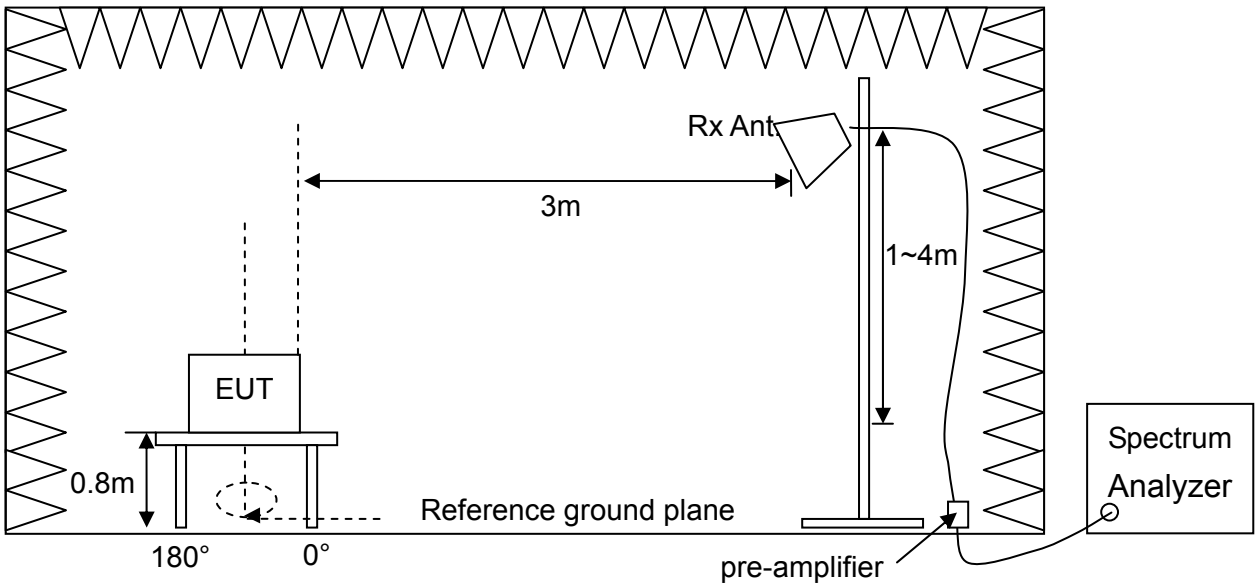
a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.

b. The software provided by client enabled the EUT to transmit data at lowest and highest channel frequencies individually.

c. Test procedures follow KDB 558074 D01 DTS Measurement Guidance v03r02 section 12.

d. Measurement the band edge and compare with the required limit.

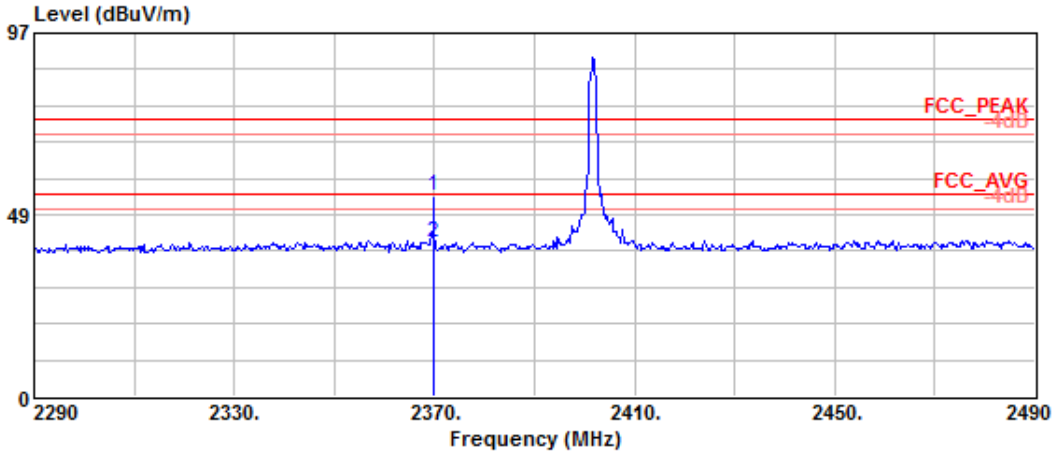
7.4 Test configuration



7.5 Test Data

Test Mode : Continuous Transmitting **Tester : Gary**

Test Frequency: Low Channel (2402MHz)



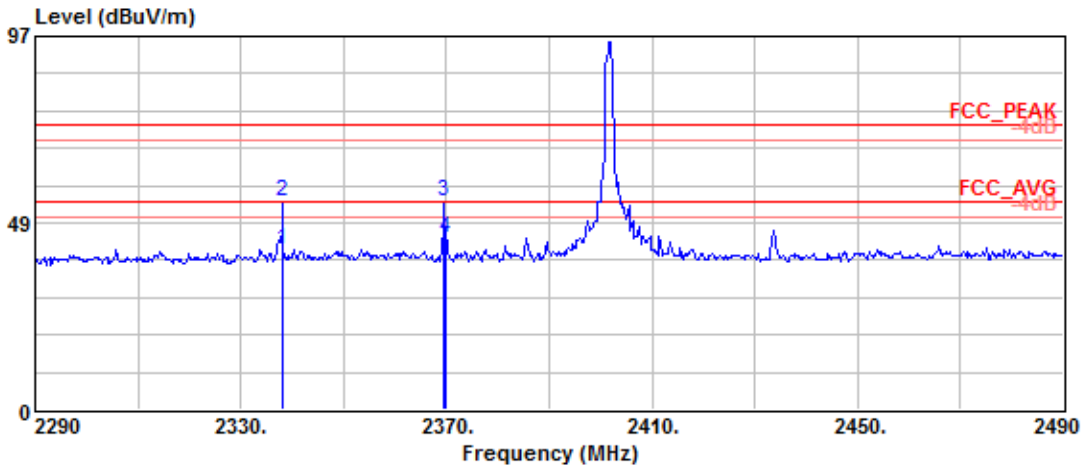
	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Ant Pos	Table Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	2369.800	53.65	18.45	35.20	74.00	-20.35	190	156	HORIZONTAL	Peak
2	2369.971	41.11	5.91	35.20	54.00	-12.89	176	159	HORIZONTAL	Average

Note:

1. Correction Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Pre-amplifier
2. Emission (dBuV/m) = Reading Data + Correction Factor

Test Mode : Continuous Transmitting **Tester : Gary**

Test Frequency: Low Channel (2402MHz)

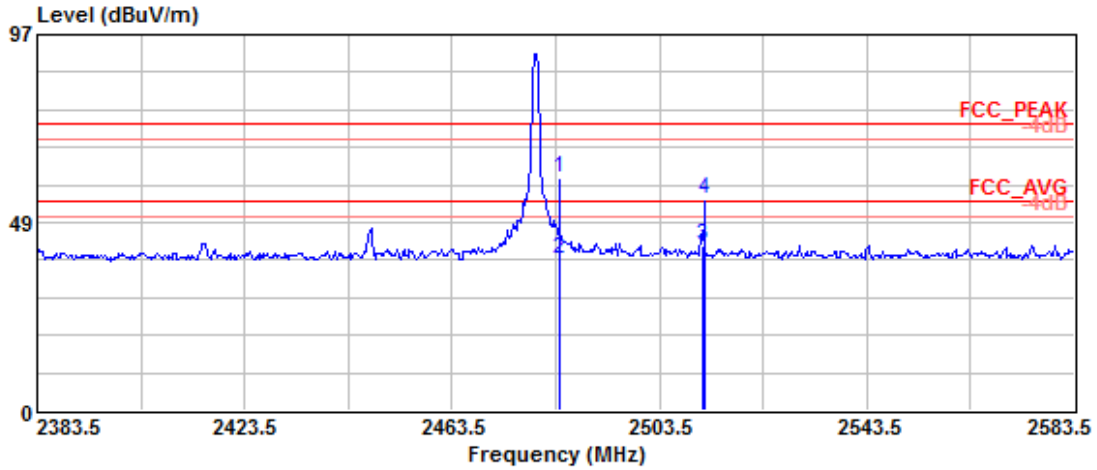


	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Ant Pos	Table Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	2337.986	41.55	6.43	35.12	54.00	-12.45	131	185	VERTICAL	Average
2	2338.156	54.03	18.91	35.12	74.00	-19.97	125	190	VERTICAL	Peak
3	2369.473	53.80	18.60	35.20	74.00	-20.20	238	198	VERTICAL	Peak
4 @	2369.943	44.45	9.25	35.20	54.00	-9.55	238	198	VERTICAL	Average

Note:

1. Correction Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Pre-amplifier
2. Emission (dBuV/m) = Reading Data + Correction Factor

Test Mode : Continuous Transmitting **Tester : Gary**
Test Frequency: High Channel (2480MHz)

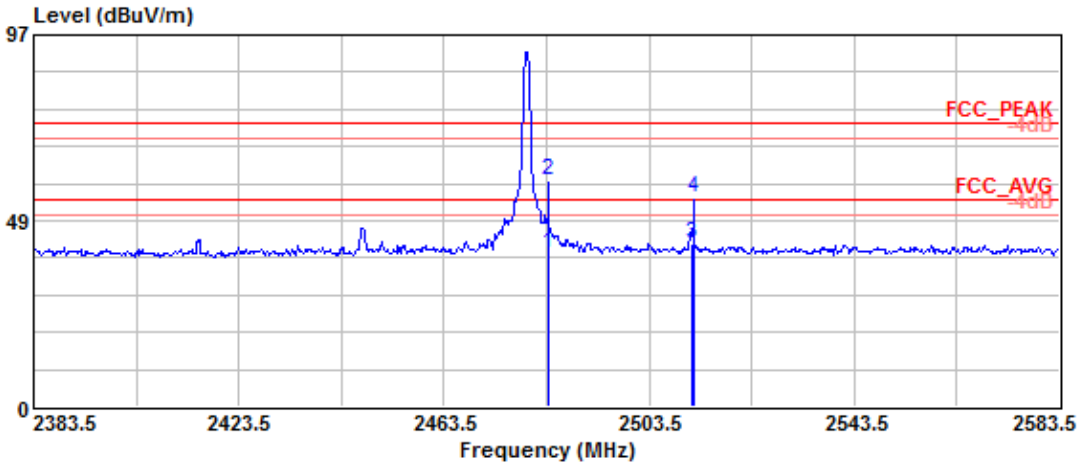


	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Ant Pos	Table Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	2484.358	60.00	24.53	35.47	74.00	-14.00	305	60	HORIZONTAL	Peak
2	2484.358	38.95	3.48	35.47	54.00	-15.05	298	52	HORIZONTAL	Average
3	2512.021	42.67	7.16	35.51	54.00	-11.33	302	53	HORIZONTAL	Average
4	2512.071	54.57	19.06	35.51	74.00	-19.43	302	54	HORIZONTAL	Peak

Note:

1. Correction Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Pre-amplifier
2. Emission (dBuV/m) = Reading Data + Correction Factor

Test Mode : Continuous Transmitting **Tester : Gary**
Test Frequency: Channel 11 (2480MHz)



	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Ant Pos	Table Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	2483.779	39.84	4.37	35.47	54.00	-14.16	193	181	VERTICAL	Average
2	2483.807	58.88	23.41	35.47	74.00	-15.12	231	167	VERTICAL	Peak
3	2511.980	42.58	7.07	35.51	54.00	-11.42	216	168	VERTICAL	Average
4	2512.124	54.45	18.94	35.51	74.00	-19.55	190	167	VERTICAL	Peak

Note:

1. Correction Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Pre-amplifier
2. Emission (dBuV/m) = Reading Data + Correction Factor

8 Radiated Emission

Result: Pass

8.1 Applied standard

According to 15.247(c), 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).

8.2 Test Instruments

☑ For Measurement below 1000MHz

Test Site and Equipment	Manufacturer	Model No./ Serial No.	Last Calibration Date	Calibration Due Date
EMI Test Receiver	R&S	ESCI/ 100019	June 12, 2014	June 12, 2015
Spectrum Analyzer	Agilent	E4407B/ MY45106795	May 29, 2014	May 29, 2015
Bi-Log Antenna	EMCO	3142C/ 52088	May 14, 2014	May 14, 2015
Pre-Amplifier	Mini-circuit	ZKL-2/ 004	Feb. 10, 2015	Aug. 10, 2015
RF Cable	N/A	N/A/ C0080	Feb. 10, 2015	Aug. 10, 2015
TR11 Semi - anechoic Chamber	ETS. LINDGREN	TR11/ 906-A	May 2, 2014	May 2, 2015

Note:

1. The calibrations are traceable to NML/ROC.
2. NCR : No Calibration Required.
3. The calibration date of the semi-anechoic chamber listed above is the date of NSA measurement.

☑ For Measurement above 1000MHz

Test Site and Equipment	Manufacturer	Model No./ Serial No.	Last Calibration Date	Calibration Due Date
Horn Antenna	EMCO	3117/ 0082847	Nov. 21, 2014	Nov. 21, 2015
Bore-sight Antenna Mast	Sunol	TLT2/ 051110-5	NCR	NCR
Pre-Amplifier	MITEQ	TTA1800-30-HG-N-M/ 1904295	Dec. 1, 2014	Dec. 1, 2015
EMI TEST RECEIVER	R&S	ESI 26/ 837491/015	July 9, 2014	July 9, 2015
RF Cable	Suhner	Sucoflex 104/ C0093	March 10, 2015	March 10, 2016
Test Software	Audix	e3/ Ver. 4.3.714.e	NCR	NCR
TR1 Fully -anechoic Chamber	ETS. LINDGREN	TR1/ 17627-B	March 14, 2015	March 14, 2016

Note:

1. The calibrations are traceable to NML/ROC.
2. NCR : No Calibration Required.
3. The calibration date of the chamber TR1 listed above is the date of site VSWR measurement.

Instrument Setting

RBW	VBW	Detector	Trace	Comment
120kHz	N/A	Quasi-Peak	Maxhold	Below 1GHz
1MHz	3MHz	Peak	Maxhold	Above 1GHz, Peak
1MHz	10Hz	Peak	Maxhold	Above 1GHz, Average

Climatic Condition

Ambient Temperature：20℃ Relative Humidity :23%

8.3 Measurement Procedure

a. The EUT was set up per the test configuration figured in the next section of this chapter to simulate the typical usage per the user's manual.

b. A software provided by client enabled the EUT to transmit and receive data at operating frequency.(if necessary)

c. If the EUT is tabletop equipment, it should be placed on a wooden table with a height of 0.8 meters above the reference ground plane in the semi-anechoic chamber. If the EUT is floor-standing equipment, it should be placed on a non-conducted support with a height of 12 millimeters above the reference ground plane in the semi-anechoic chamber.

d. The EUT is set 3m away from the interference receiving antenna.

e. Rapidly sweep the signal in the test frequency range by using the spectrum through the Maximum-peak detector.

f. Rotate the EUT from 0° to 360° and position the receiving antenna at heights from 1 to 4 meters above the reference ground plane continuously to determine at least six frequencies associated with higher emission levels and record them.

g. Then measure each frequency found from step f. by using the spectrum with rotating the EUT and positioning the receiving antenna height to determine the maximum level.

h. For measurement of frequency below 1000MHz, set the receiver detector to be Quasi-Peak per CISPR 16-1 to find out the maximum level occurred.

i. For measurement of frequency above 1000MHz, set the spectrum detector to be Peak or Average to find out the maximum level occurred, if any.

j. Record frequency, azimuth angle of the turntable, height, and polarization of the receiving antenna and compare the maximum level with the required limit.

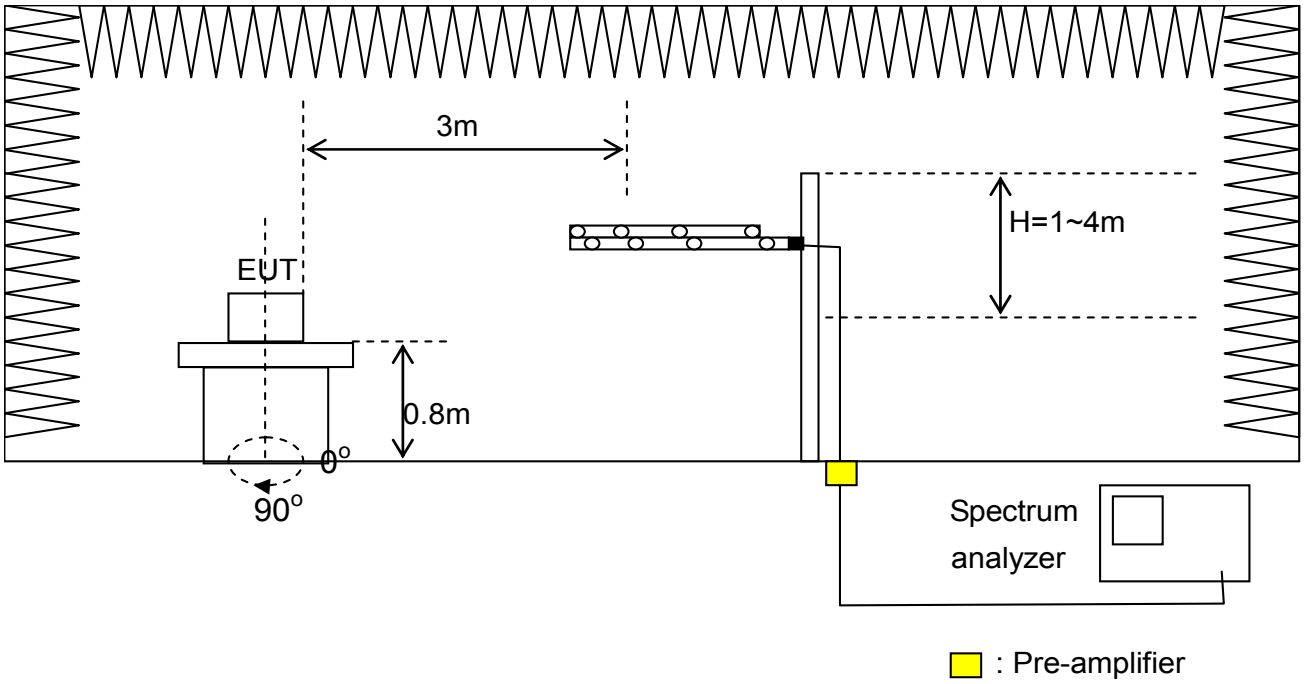
k. Change the receiving antenna to another polarization to measure radiated emission by following step e. to j. again.

l. If the peak emission level below 1000MHz measured from step f. is 4dB lower than the limit specified, then the emission values presented will be the peak value only. Otherwise, accurate Q.P. value will be measured and presented.

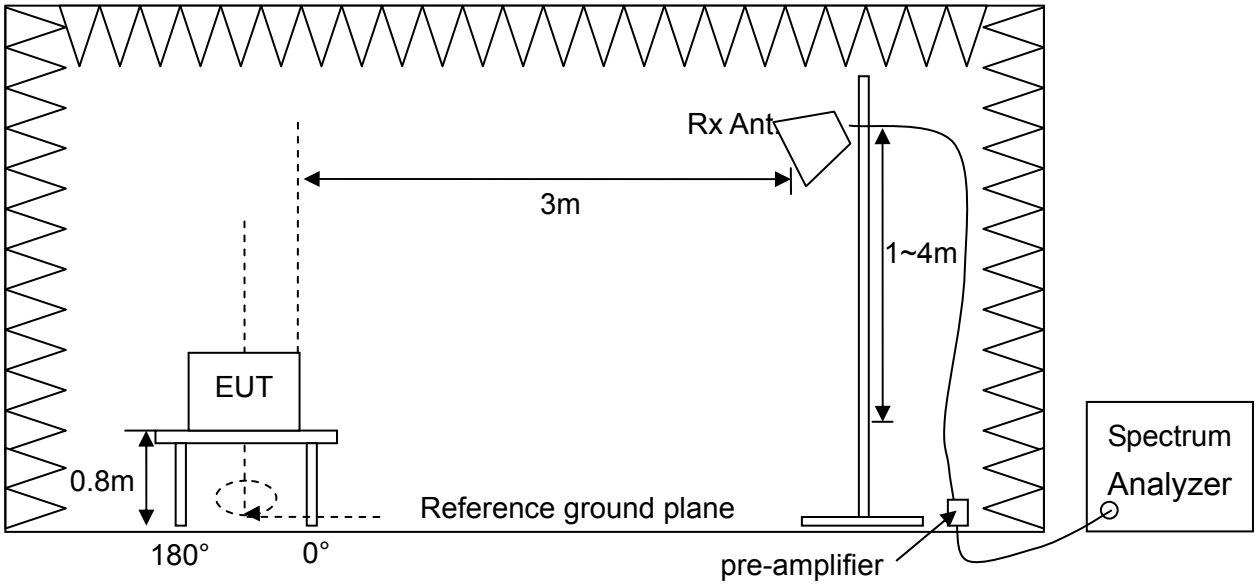
m. If the peak emission level above 1000MHz measured from step f. is 20dB lower than the limit specified, then the emission values presented will be the peak value only. Otherwise, accurate A.V. value will be measured and presented.

8.4 Test configuration

Below 1GHz



Above 1GHz



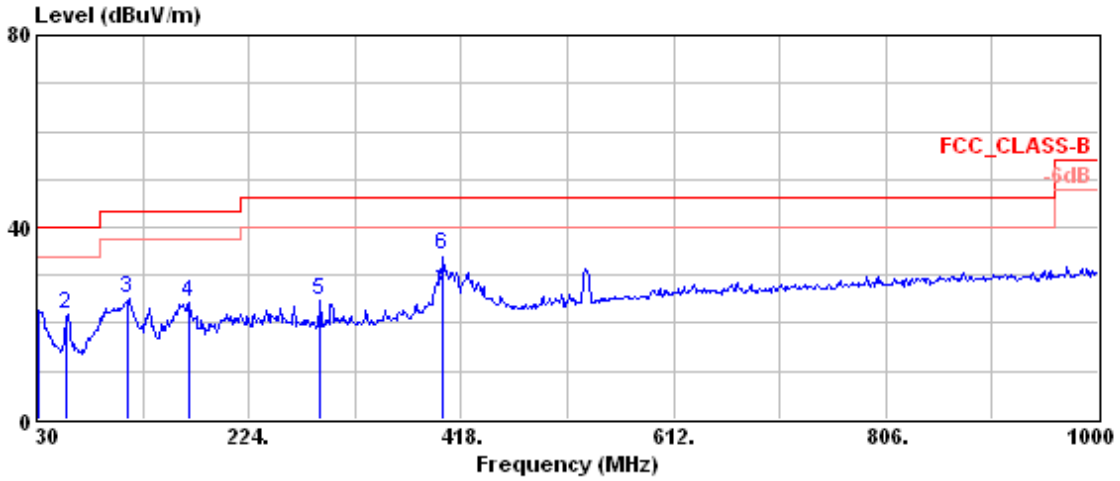
8.5 Test Data

Radiated Emission Measurement below 1000MHz

Test Mode : **2402MHz, Continuous Transmitting**

Test Distance : 3m **Tester** : Gary

Polarization : Horizontal **Frequency Range** : 30MHz~1000MHz



	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Ant Pos	Table Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	31.080	22.59	31.67	-9.08	40.00	-17.41	---	---	HORIZONTAL	Peak
2	57.540	21.91	40.82	-18.91	40.00	-18.09	---	---	HORIZONTAL	Peak
3	113.700	25.20	44.31	-19.11	43.50	-18.30	---	---	HORIZONTAL	Peak
4	168.510	24.48	41.13	-16.65	43.50	-19.02	---	---	HORIZONTAL	Peak
5	288.390	24.89	37.54	-12.65	46.00	-21.11	---	---	HORIZONTAL	Peak
6	401.030	34.08	42.81	-8.73	46.00	-11.92	216	173	HORIZONTAL	Peak
7	401.030	26.20	34.93	-8.73	46.00	-19.80	216	173	HORIZONTAL	QP

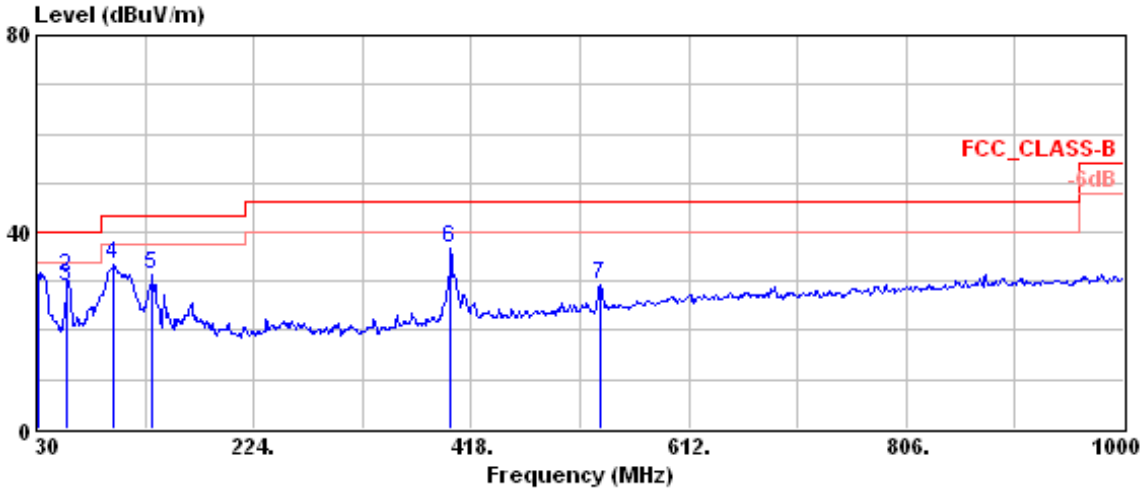
Note：

1. Correction Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Preamplifier
2. Emission Level (dBuV/m) = Reading Data + Correction Factor

Test Mode : **2402MHz, Continuous Transmitting**

Test Distance : 3m **Tester** : Gary

Polarization : Vertical **Frequency Range** : 30MHz~1000MHz



	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Ant Pos	Table Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1 @	32.430	31.75	41.58	-9.83	40.00	-8.25	---	---	VERTICAL	Peak
2	57.986	31.13	50.10	-18.97	40.00	-8.87	106	314	VERTICAL	Peak
3	57.986	28.84	47.81	-18.97	40.00	-11.16	106	314	VERTICAL	QP
4	98.850	33.33	51.83	-18.50	43.50	-10.17	---	---	VERTICAL	Peak
5	133.410	31.43	50.40	-18.97	43.50	-12.07	---	---	VERTICAL	Peak
6	399.400	36.54	45.31	-8.77	46.00	-9.46	---	---	VERTICAL	Peak
7	533.100	29.38	35.40	-6.02	46.00	-16.62	---	---	VERTICAL	Peak

Note：

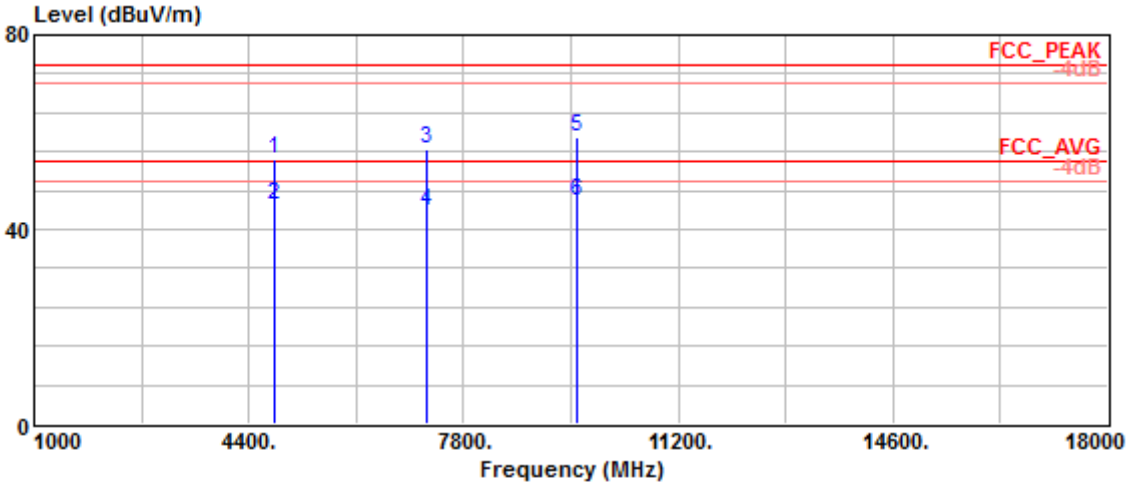
1. Correction Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Preamplifier
2. Emission Level (dBuV/m) = Reading Data + Correction Factor

Radiated Emission Measurement above 1000MHz

Test Model **: 2402MHz, Continuous Transmitting**

Test Distance **:** 3m **Tester** **:** Gary

Antenna Polarization **:** Horizontal **Frequency Range :**1GHz~25GHz



	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Ant Pos	Table Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	4803.549	54.27	67.24	-12.97	74.00	-19.73	274	284	HORIZONTAL	Peak
2	4803.843	44.76	57.73	-12.97	54.00	-9.24	263	264	HORIZONTAL	Average
3	7205.184	56.63	66.74	-10.11	74.00	-17.37	323	127	HORIZONTAL	Peak
4	7205.935	43.82	53.93	-10.11	54.00	-10.18	323	128	HORIZONTAL	Average
5	9606.810	58.87	66.21	-7.34	74.00	-15.13	257	83	HORIZONTAL	Peak
6	9607.338	45.67	53.01	-7.34	54.00	-8.33	211	77	HORIZONTAL	Average

Note:

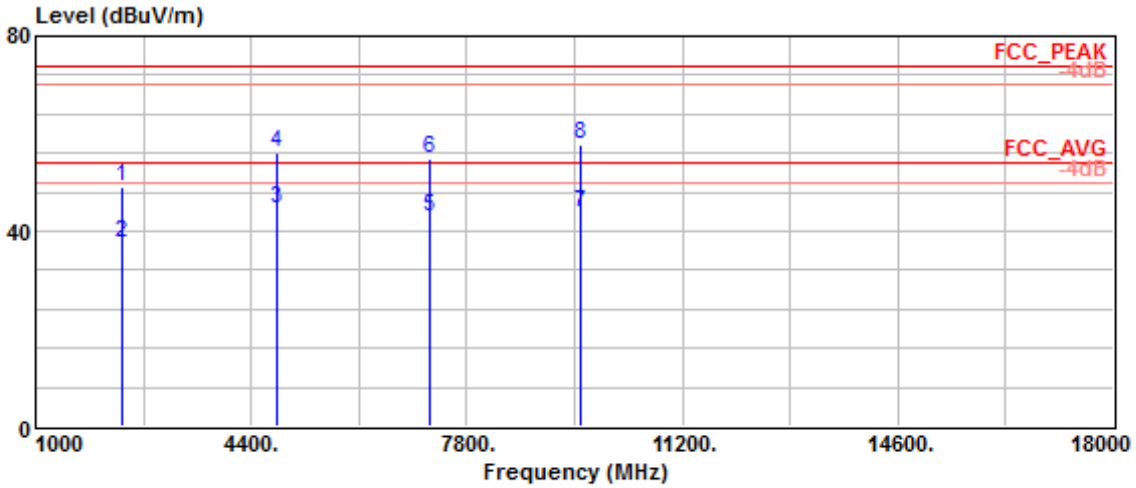
1. Emission Level (dBuV/m) = Reading Value + Correction Factor.
2. Correction Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Preamplifier.
3. PK. and AV. are abbreviation of peak and average respectively.

No signal can be detected from 18GHz to 25GHz, so the graphs are omitted above 18GHz.

Test Model : **2402MHz, Continuous Transmitting**

Test Distance : 3m **Tester** : Gary

Antenna Polarization : Vertical **Frequency Range** :1GHz~25GHz



	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Ant Pos	Table Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	2369.555	49.14	63.95	-14.81	74.00	-24.86	122	195	VERTICAL	Peak
2	2370.083	37.45	52.26	-14.81	54.00	-16.55	120	155	VERTICAL	Average
3	4803.970	44.57	57.54	-12.97	54.00	-9.43	117	192	VERTICAL	Average
4	4804.088	56.23	69.20	-12.97	74.00	-17.77	100	191	VERTICAL	Peak
5	7205.934	42.79	52.90	-10.11	54.00	-11.21	210	101	VERTICAL	Average
6	7206.579	54.65	64.76	-10.11	74.00	-19.35	210	154	VERTICAL	Peak
7	9607.254	43.54	50.88	-7.34	54.00	-10.46	372	211	VERTICAL	Average
8	9608.770	57.57	64.91	-7.34	74.00	-16.43	396	228	VERTICAL	Peak

Note:

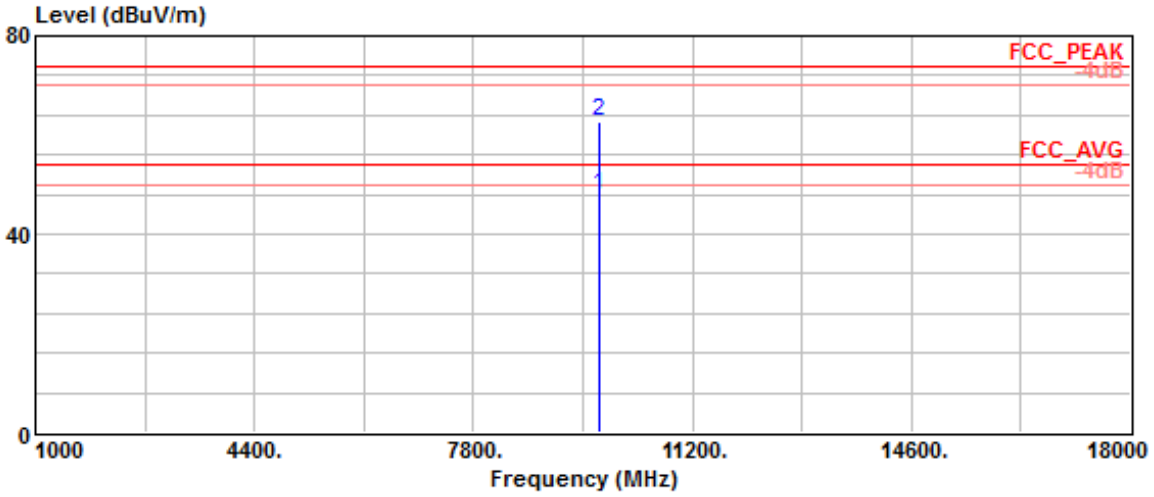
1. Level (dBuV/m) = Read level + Factor.
2. Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Preamplifier.
3. Over Limit (dB) = Level – Limit line
4. PK. and AV. are abbreviation of peak and average respectively.

No signal can be detected from 18GHz to 25GHz, so the graphs are omitted above 18GHz.

Test Model **: 2440MHz, Continuous Transmitting**

Test Distance **:** 3m **Tester** **:** Gary

Antenna Polarization **:** Horizontal **Frequency Range :**1GHz~25GHz



	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Ant Pos	Table Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1 @	9759.740	48.02	54.89	-6.87	54.00	-5.98	208	69	HORIZONTAL	Average
2	9761.067	62.75	69.60	-6.85	74.00	-11.25	208	67	HORIZONTAL	Peak

Note:

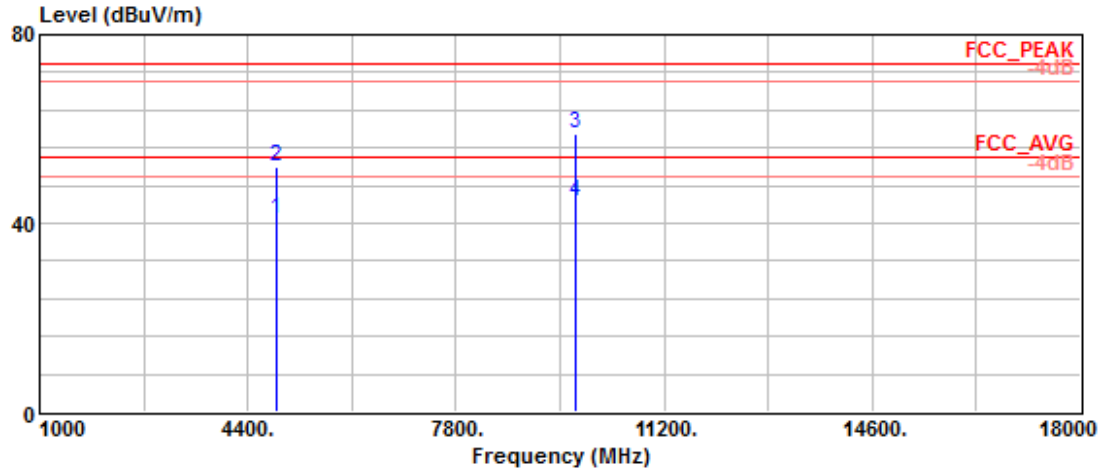
1. Level (dBuV/m) = Read level + Factor.
2. Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Preamplifier.
3. Over Limit (dB) = Level – Limit line
4. PK. and AV. are abbreviation of peak and average respectively.

No signal can be detected from 18GHz to 25GHz, so the graphs are omitted above 18GHz.

Test Model **: 2440MHz, Continuous Transmitting**

Test Distance **:** 3m **Tester** **:** Gary

Antenna Polarization **:** Vertical **Frequency Range :**1GHz~25GHz



	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Ant Pos	Table Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	4879.864	40.71	53.69	-12.98	54.00	-13.29	104	179	VERTICAL	Average
2	4880.627	51.75	64.73	-12.98	74.00	-22.25	123	182	VERTICAL	Peak
3	9758.949	58.86	65.73	-6.87	74.00	-15.14	386	228	VERTICAL	Peak
4	9759.349	44.61	51.48	-6.87	54.00	-9.39	387	226	VERTICAL	Average

Note:

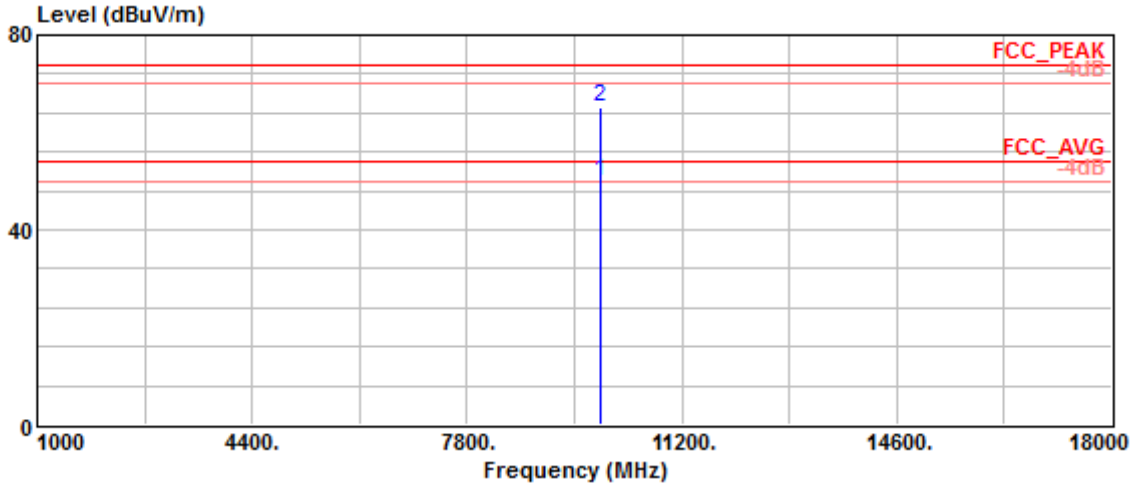
1. Level (dBuV/m) = Read level + Factor.
2. Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Preamplifier.
3. Over Limit (dB) = Level – Limit line
4. PK. and AV. are abbreviation of peak and average respectively.

No signal can be detected from 18GHz to 25GHz, so the graphs are omitted above 18GHz.

Test Model **: 2480MHz, Continuous Transmitting**

Test Distance **:** 3m **Tester** **:** Gary

Antenna Polarization **:** Horizontal **Frequency Range :**1GHz~25GHz



	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Ant Pos	Table Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1 @	9919.734	49.92	56.33	-6.41	54.00	-4.08	206	62	HORIZONTAL	Average
2	9920.838	65.18	71.59	-6.41	74.00	-8.82	330	64	HORIZONTAL	Peak

Note:

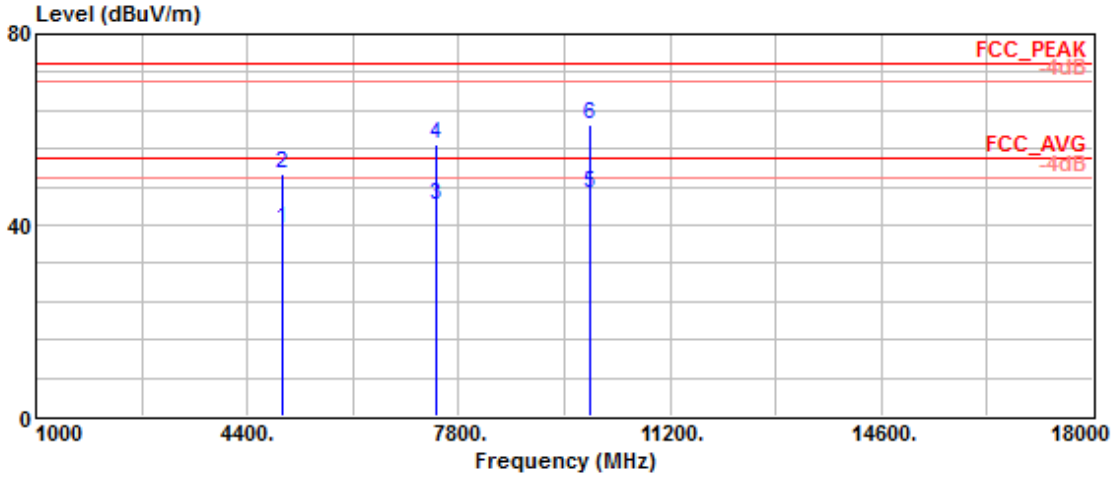
1. Level (dBuV/m) = Read level + Factor.
2. Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Preamplifier.
3. Over Limit (dB) = Level – Limit line
4. PK. and AV. are abbreviation of peak and average respectively.

No signal can be detected from 18GHz to 25GHz, so the graphs are omitted above 18GHz.

Test Model : **2480MHz, Continuous Transmitting**

Test Distance : 3m **Tester** : Gary

Antenna Polarization : Vertical **Frequency Range** :1GHz~25GHz



	Freq	Level	Read Level	Factor	Limit Line	Over Limit	Ant Pos	Table Pos	Pol/Phase	Remark
	MHz	dBuV/m	dBuV	dB/m	dBuV/m	dB	cm	deg		
1	4959.927	39.26	52.25	-12.99	54.00	-14.74	129	170	VERTICAL	Average
2	4960.455	50.73	63.72	-12.99	74.00	-23.27	127	183	VERTICAL	Peak
3	7439.913	43.93	53.78	-9.85	54.00	-10.07	255	160	VERTICAL	Average
4	7440.688	57.01	66.86	-9.85	74.00	-16.99	228	160	VERTICAL	Peak
5 @	9919.464	46.42	52.83	-6.41	54.00	-7.58	245	200	VERTICAL	Average
6	9920.920	61.15	67.56	-6.41	74.00	-12.85	243	198	VERTICAL	Peak

Note:

1. Level (dBuV/m) = Read level + Factor.
2. Factor (dB/m) = Cable Loss + Antenna Factor – Gain of Preamplifier.
3. Over Limit (dB) = Level – Limit line
4. PK. and AV. are abbreviation of peak and average respectively.

No signal can be detected from 18GHz to 25GHz, so the graphs are omitted above 18GHz.

9 Antenna Requirement

9.1 Applied standard

According to 15.247(4), The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi

9.2 Antenna Information

This antenna is permanently attached aand its relative information as follow:

Brand	Model	Frequency Range (MHz)	Gain (dBi)	Comment
ST Microelectronics S.R.L.	AN3359	2400MHz~2483.5MHz	0	

9.3 Result

Gain of the antenna is less than 6dBi.