



KOREA TESTING & RESEARCH INSTITUTE

Test Report issued under the
responsibility of:
Korea Testing & Research
Institute

TEST REPORT FCC Part 15 Subpart C § 15.247 FCC ID : YE4XSG2NA-DMX2	
Report Number.....:	FCC2014-0025
Date of issue	Sep 25, 2014.
Total number of pages	35 Pages
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Approved by (name + signature)	Lee, Sang-Ik  (RF Technical Manager)
Testing Laboratory.....:	Korea Testing & Research Institute (KTR)
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Applicant' s name.....:	Glosys Inc.
Address.....:	#510, Venture Valley B/D, 40 Omokcheon-Ro 152 Beon- Gil, Gwonseon-Gu, Suwon-Si, Gyeonggi-Do, Korea
Manufacturer' s name	Glosys Inc.
Address.....:	#510, Venture Valley B/D, 40 Omokcheon-Ro 152 Beon- Gil, Gwonseon-Gu, Suwon-Si, Gyeonggi-Do, Korea
Test specification:	
Standard	FCC Part 15 Subpart C § 15.247
Test procedure	KTR-QM-01, KTR-QM-02, KTR-QM-03
Test Report Form No.:	KTR-QI-Y013-F14
Test Report Form(s) Originator.....:	Korea Testing & Research Institute
Master TRF	Dated 2012-06
General remarks: The test results presented in this report relate only to the object tested. The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report. This report shall not be reproduced, except in full, without the written approval of the KTR's written approval. Testing Laboratory Homepage : www.ktr.or.kr	
Test item description	
Trade Mark	
Manufacturer	Glosys Inc.
Model/Type reference	XSG2NA-DMX2 / Car Infotainment System
Ratings	d.c. 12 V

Possible test case verdicts

- Test case does not apply to the test object.....:	N/A
- Test object does meet the requirement.....:	P (Pass)
- Test object does not meet the requirement.....:	F (Fail)

Testing

Date of receipt of test item.....:	2014. 08. 01.
Date(s) of performance of tests.....:	2014. 09. 01. ~ 2014. 09. 25.

Summary of testing**Applied Standards**

- FCC Part 15 Subpart C § 15.247
- FCC OET Public notice DA 00-705
- ANSI C63.4-2003

FCC Part 15 Subpart C § 15.247

Frequency Hopping Spread Spectrum System

Section in FCC Rule	Test Item	Result
§ 15.247(b)(1)	Peak Output power	P
§ 15.247(a)(1)	Hopping Channel Separation	P
§ 15.247(a)(1)(iii)	Number of Hopping Channel	P
§ 15.247(a)(1)(iii)	Time of Occupancy(Dwell Time)	P
§ 15.247(a)(1)	20 dB Bandwidth	P
§ 15.247(a)(1)(iii)	Time of occupancy(Dwell time)	P
§ 15.247(d)	Conducted Spurious Emission & Band-edge	P
§ 15.205(a) & § 15.209	Radiated Spurious Emission & Band Edge	P
§ 15.203(a) & § 15.247(b)	Antenna Requirement	P

Statement:

The measurement procedures described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2003) and the guidance provided in FCC OET Public notice DA 00-705 were used in the measurement of the DUT.

FCC Part 15 Subpart C § 15.247

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1.0 General Description

1.1 Laboratory & Applicant Information, Description of EUT

1.1.1 Laboratory & Applicant Information

〈Laboratory information〉

The 10 m semi-anechoic chamber and/or EMC facilities are used for these testing.

These facilities were accredited by KOLAS, KC, KCC of Korea, FCC of USA and VCCI of Japan

Address

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Registered No.

KOLAS : 011

KC : J

KCC & FCC : KR0030

VCCI Reg. No. : C-2363, R-2183

〈Applicant information〉

Address

Glosys Inc.

#510, Venture Valley B/D, 40 Omokcheon-Ro 152 Beon-Gil, Gwonseon-Gu, Suwon-Si, Gyeonggi-Do, Korea

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1.1.2 Description of EUT

Equipment under test	Car Infotainment System
Model name	XSG2NA-DMX2
Tx/Rx Operating frequency	2 402 MHz ~ 2 480 MHz
Modulation technique	FHSS(GFSK)
Number of channels	79
Antenna type	Chip antenna
Antenna gain	-4.54 dBi
Power source	DC 12 V

1.1.3 Test Frequency

	Low channel (Channel 00)	Middle channel (Channel 39)	High channel (Channel 78)
Frequency (MHz)	2 402	2 441	2 480

1.2 Information about the FHSS characteristics

1.2.1 Pseudorandom Frequency Hopping Sequence

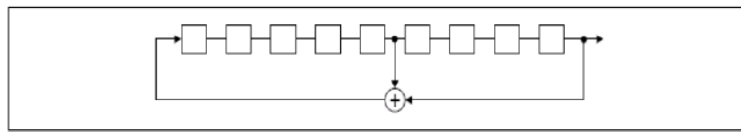
The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF channels.

The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master; the phase in the hopping sequence is determined by the Bluetooth clock of the master.

The channel is divided into time slots where each slot corresponds to an RF hop frequency. Consecutive hops correspond to different RF hop frequencies. The normal hop is 1 600 hops/s.

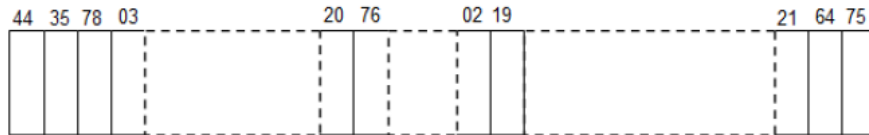
The Pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES; i.e. the shift register is initialized with nine ones.

- Number of shift register stages : 9
- Length of Pseudo-random sequence : $2^9 - 1 = 511$ bits
- Longest sequence of zeros : 8 (non-inverted signal)



Linear Feedback Shift Register for generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



1.2.2 Equal Hopping Frequency Use

All Bluetooth units participating in the piconet are time and hop-synchronized to the channel.

Example of a 79 hopping sequence in data mode:

40, 21, 44, 23, 42, 53, 46, 55, 48, 33, 53, 35, 50, 65, 54, 67, 56, 37, 60, 39, 58, 69, 62, 71, 64, 25, 68, 27, 66, 57, 70, 59, 72, 29, 76, 31, 74, 61, 78, 63, 01, 41, 05, 43, 03, 73, 07, 75, 09, 45, 13, 47, 11, 77, 15, 00, 64, 49, 66, 53, 68, 02, 70, 06, 01, 51, 03, 55, 05, 04

Each Frequency used equally on the average by each transmitter

1.2.3 System Receiver Input Bandwidth

Each channel bandwidth is 1 MHz.

The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

1.2.4 Equipment Description

15.247(a)(1) that rx input bandwidths shift frequencies in synchronization with the transmitted

15.247(g): In accordance with the Bluetooth Industry Standard, the system is designed to comply with all of the regulations in Section 15.247 when the transmitter is presented with a continuous data (or information)

15.247(h): In accordance with the Bluetooth Industry Standard, the system does not coordinate its channels selection/ hopping sequence with other frequency hopping system for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

2.0 Test results

2.1 Peak Output Power Measurement

Date of test	Sep 03. 2014.	
Laboratory Environment	Ambient temperature	22.9 °C
	Relative humidity	57.2 %
Test site	RF Test room	

■ Limit of Peak Output Power

§ 15.247(b), the maximum peak conducted output power of the intentional radiator shall not exceed the following :

- (1) For frequency hopping systems operating in the band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5 725 MHz ~ 5 850 MHz band : 1 Watts.

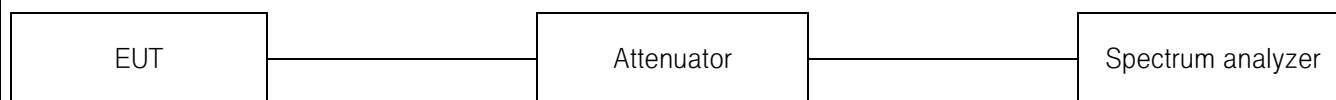
For all other frequency hopping systems in the 2 400 MHz ~ 2 483.5 MHz band : 0.125 Watts, the e.i.r.p shall not exceed 4 Watts.

■ Test procedure

The testing follows FCC Public DA 00-705 Measurement Guidelines.

- Place the EUT on the table, and then set it in the transmitting mode.
- The RF Output of EUT is connected to the spectrum analyzer through a RF cable and an attenuator.
The path loss is compensated to the results for each measurement.
- Set the spectrum analyzer as follows :
Center frequency: Low, middle and high channel
Span = Approximately 5 times the 20 dB bandwidth, centered on a hopping channel
RBW > the 20 dB bandwidth of the emission being measured
VBW ≥ RBW
Sweep = Auto
Detector function = peak
Trace =max hold
- Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission.
Record the result as the peak output power in the test report.

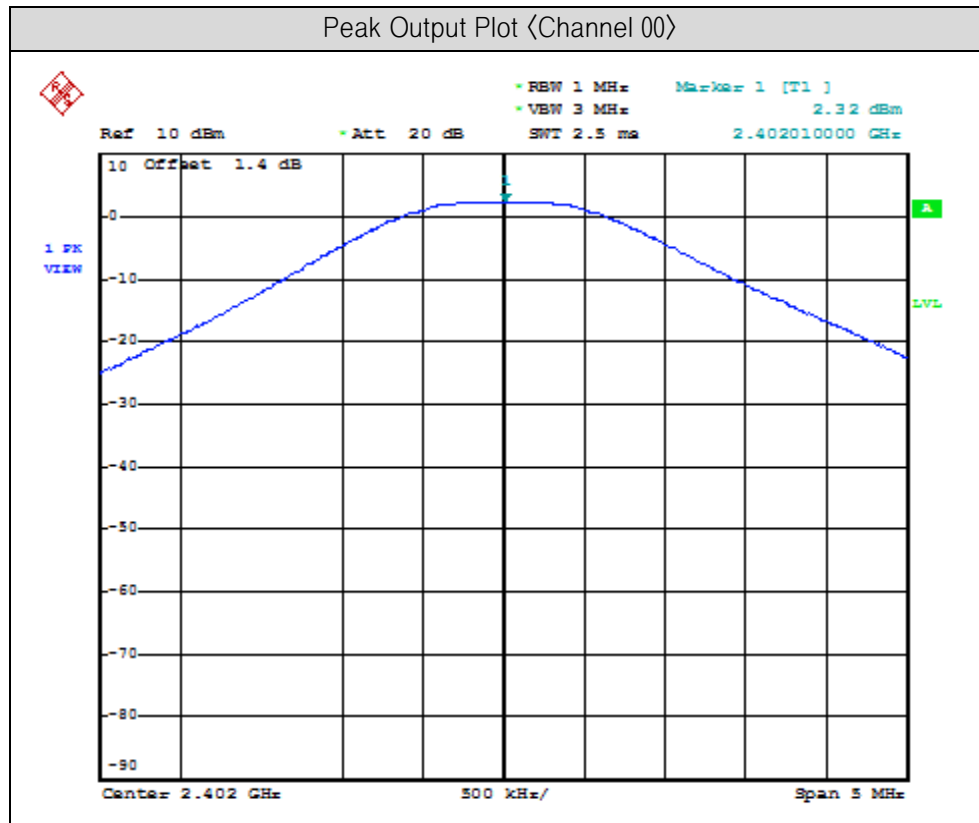
■ Test Setup



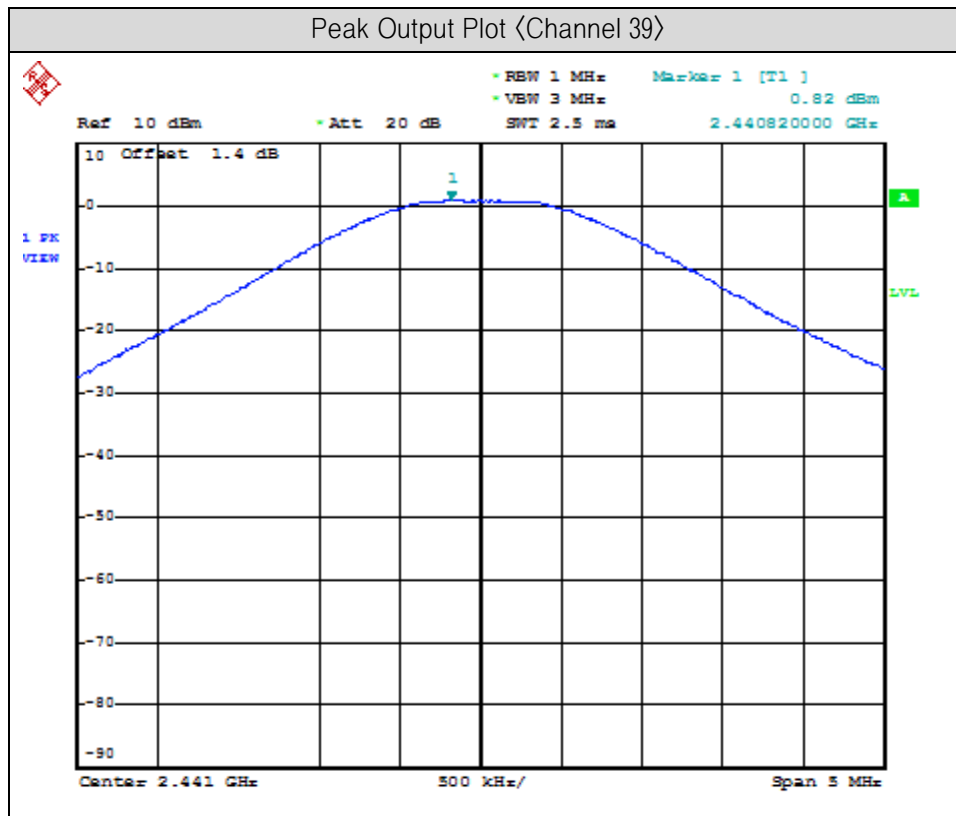
■ Test Result of Peak Output Power

Channel	Frequency(MHz)	Peak Output Power(dBm)	Limit(dBm)
00	2 402	2.32	30
39	2 441	0.82	30
78	2 480	-0.92	30

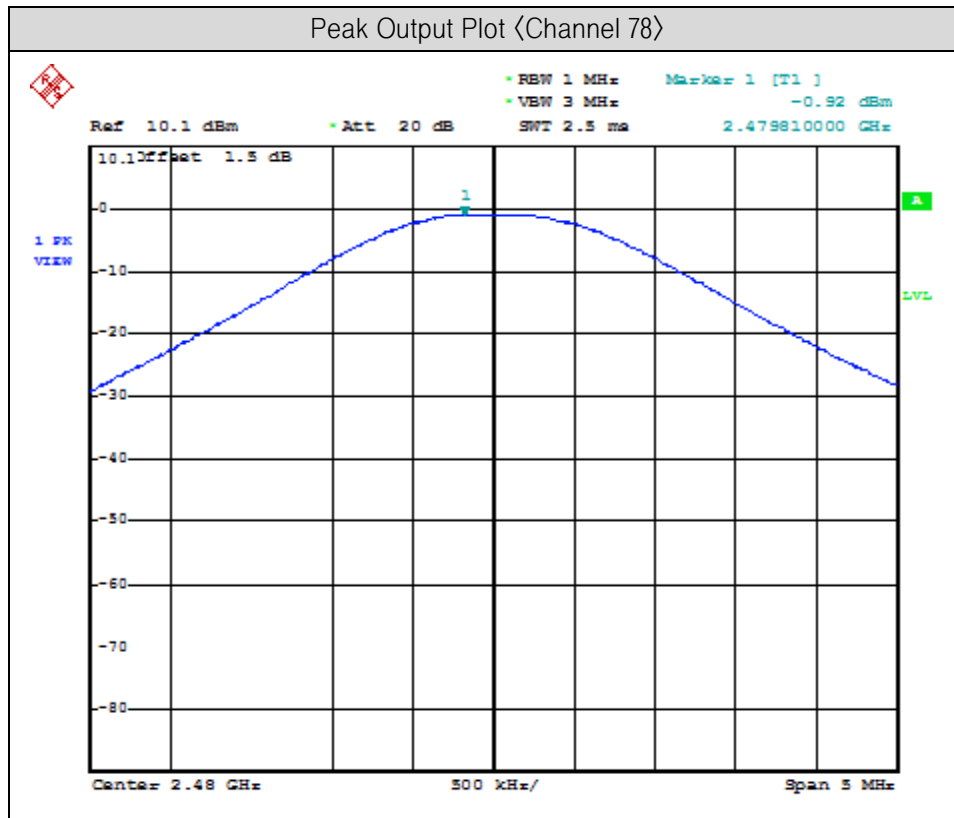
■ Test graph



<2 402 MHz>



<2 441 MHz>



<2 480 MHz>

2.2 Hopping Channel Separation Measurement

Date of test	Sep 03. 2014.	
Laboratory	Ambient temperature	22.9 °C
Environment	Relative humidity	57.2 %
Test site	RF Test room	

■ Limit of Hopping Channel Separation

§ 15.247(a)(1), Frequency hopping system operating in 2 400 MHz ~ 2 483.5 MHz . Band may have hopping channel carrier frequencies that are separated by 25 kHz or two-third of 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

■ Test procedure

The testing follows FCC Public DA 00-705 Measurement Guidelines.

1. Place the EUT on the table, and then set it in the transmitting mode.
2. The RF Output of EUT is connected to the spectrum analyzer through a RF cable and an attenuator.

The path loss is compensated to the results for each measurement.

3. Set the spectrum analyzer as follows :

Center frequency : Middle of hopping channel

Span = Wide enough to capture the peaks of two adjacent channels

RBW $\geq$ 1% of the span

VBW $\geq$ RBW

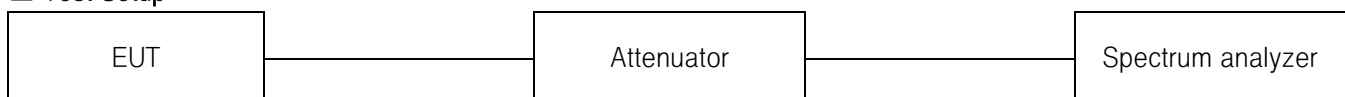
Sweep = Auto

Detector function = peak

Trace =max hold

4. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to determine the separation between the peaks of the adjacent channels. Record the result as the hopping channel separation in the test report

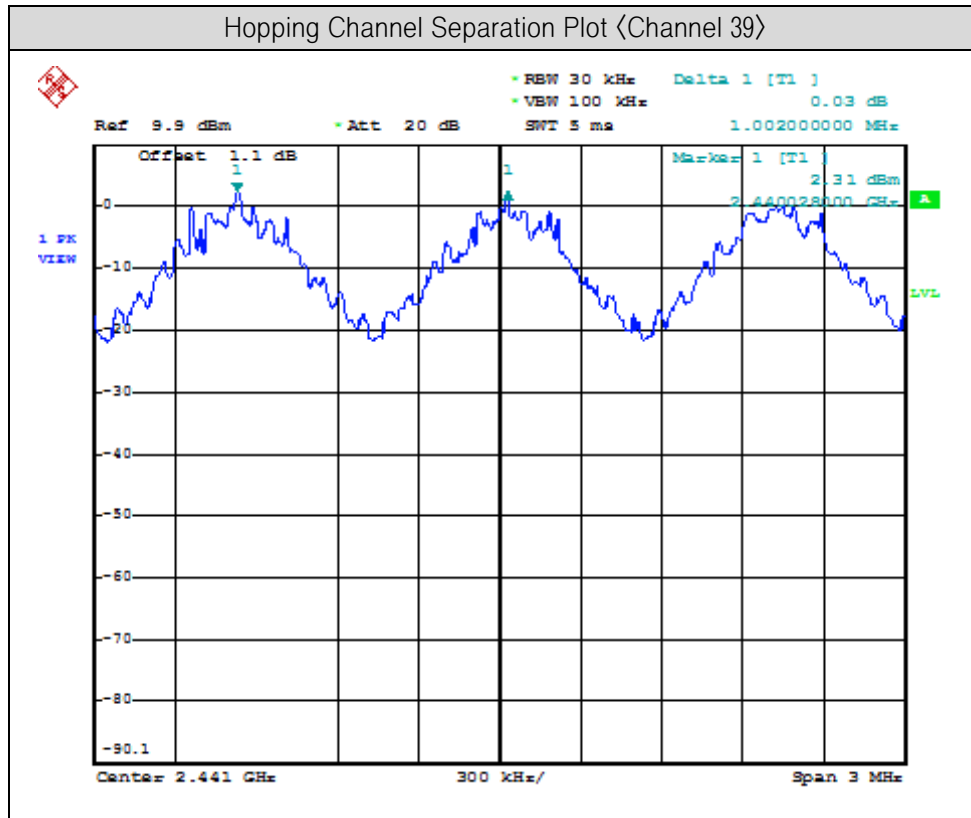
■ Test Setup



■ Test Result of Hopping Channel Separation

Channel	Frequency(MHz)	Adjacent Hopping Channel Separation(kHz)	Two-third of 20 dB bandwidth (kHz)	Minimum Bandwidth(kHz)
39	2 441	1 002	621	25

■ Test graph



<2 441 MHz>

2.3 Number of Hopping Channel Measurement

Date of test	Sep.03.2014	
Laboratory	Ambient temperature	22.9 °C
Environment	Relative humidity	57.2 %
Test site	RF Test room	

■ Limit of Number of Hopping Frequency

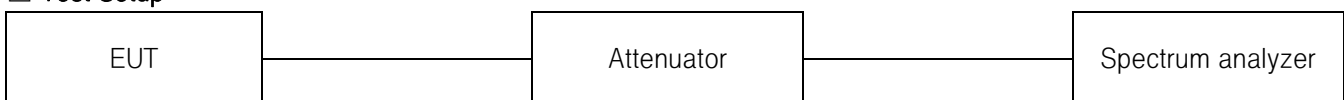
§ 15.247(a)(1)(iii), Frequency hopping systems in the 2 400 MHz ~ 2 483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

■ Test Procedure

The testing follows FCC Public DA 00-705 Measurement Guidelines.

1. Place the EUT on the table, and then set it in the transmitting mode.
2. The RF Output of EUT is connected to the spectrum analyzer through a RF cable and an attenuator.
The path loss is compensated to the results for each measurement.
3. The EUT must have its hopping function enabled.
4. Set the spectrum analyzer as follows :
Frequency : 2 400 MHz (Start) ~ 2 441.5 MHz (Stop), 2 441.5 MHz (Start) ~ 2 483.5 MHz (Stop)
Span = the frequency band of operation
RBW $\geq$ 1% of the span
VBW $\geq$ RBW
Sweep = Auto
Detector function = peak
Trace =max hold
5. Max hold and view.
6. Allow the trace to stabilize. Record the number of hopping channels in the test report.

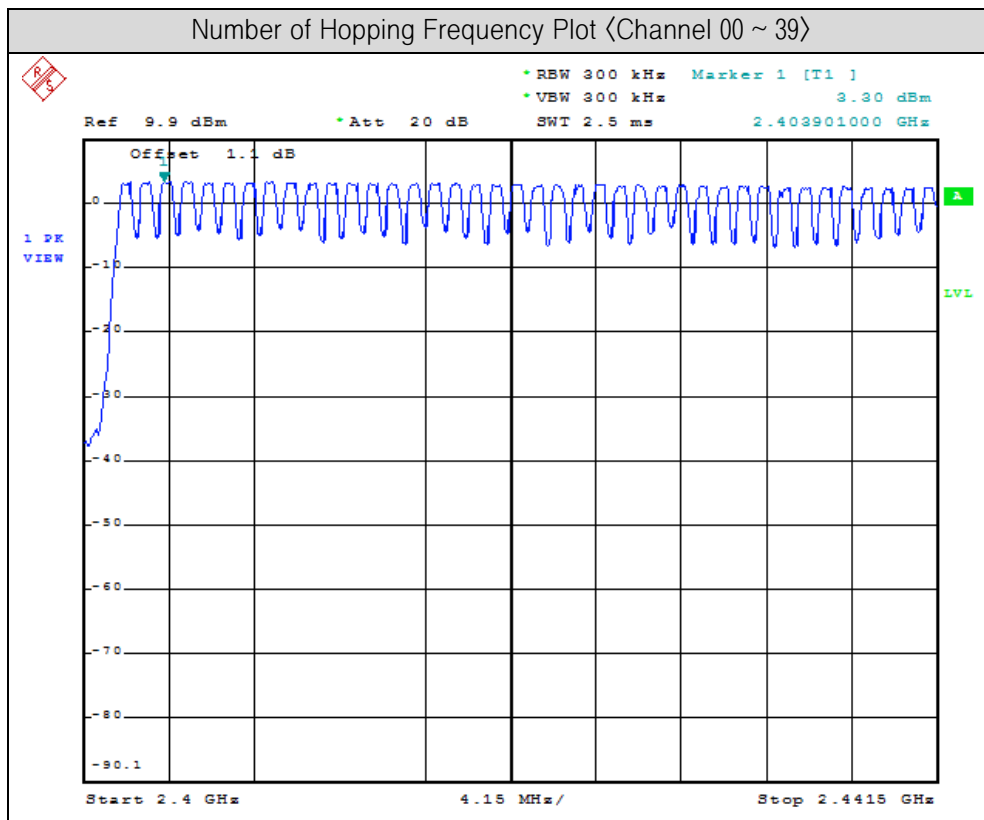
■ Test Setup



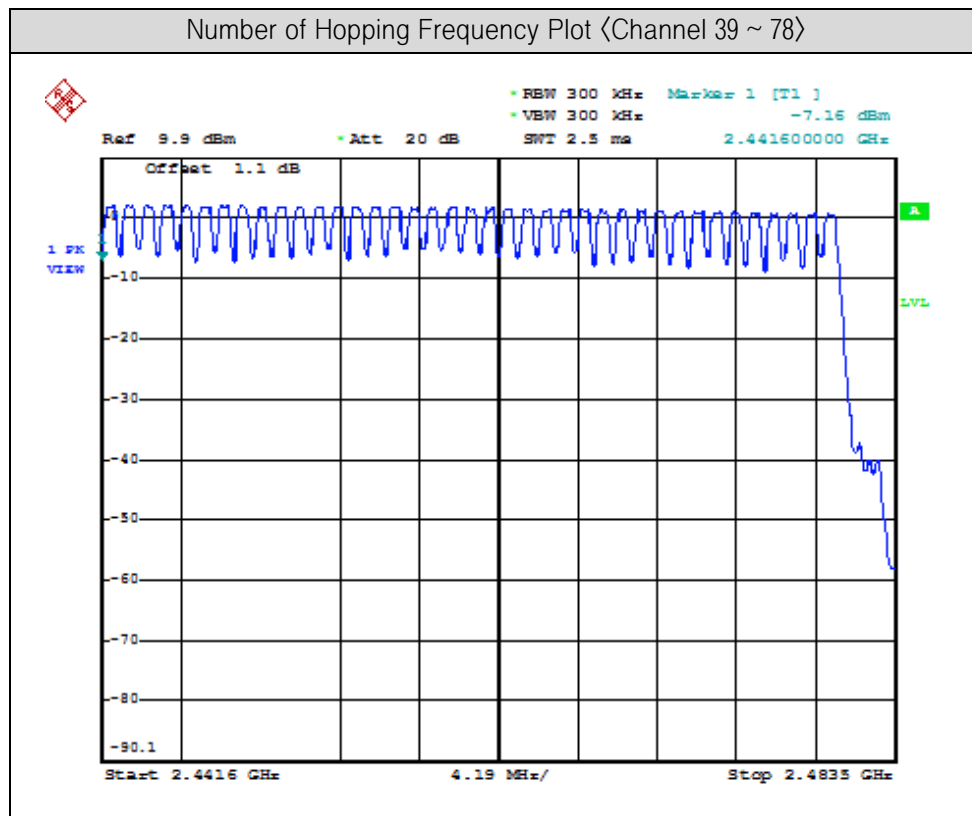
■ Test Result of Number of Hopping Frequency

Frequency(MHz)	Number of Hopping Frequency	Limit(Channels)
2 402 ~ 2 480	79	≥ 15

■ Test graph



<2 400 MHz ~ 2 441.5 MHz>



<2 441.5 MHz ~ 2 483.5 MHz>

2.4 Time of Occupancy(Dwell Time) Measurement

Date of test	Sep 03. 2014.	
Laboratory	Ambient temperature	22.9 °C
Environment	Relative humidity	57.2 %
Test site	RF Test room	

■ Limit of Time of Occupancy(Dwell Time)

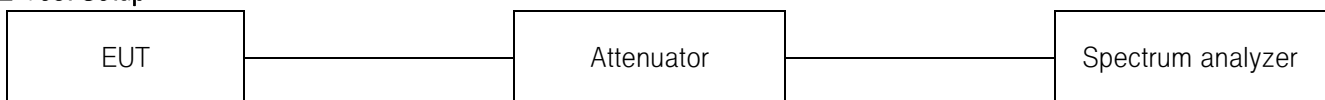
§ 15.247(a)(1)(iii), for frequency hopping system operating in the 2 400 MHz ~ 2 483.5 MHz band, the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of 31.6 seconds.

■ Test Procedure

The testing follows FCC Public DA 00-705 Measurement Guidelines.

- Place the EUT on the table, and then set it in the transmitting mode.
- The RF Output of EUT is connected to the spectrum analyzer through a RF cable and an attenuator.
The path loss is compensated to the results for each measurement.
- The EUT must have its hopping function enabled.
- Set the spectrum analyzer as follows :
Span = Zero span, centered on a hopping channel
RBW = 1 MHz
VBW ≥ RBW
Sweep = as necessary to capture the entire dwell time per hopping channel
Detector function = peak
Trace =max hold
- Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation.
 - The Bluetooth has 3 type of payload DH1, DH3, DH5. The hopping rate is insisted of 1 600 per second.

■ Test Setup



■ Test Result of Time of Occupancy(Dwell Time)

- Time of occupancy on the TX channel in 31.6 sec
= time domain slot length × (hop rate ÷ number of hop per channel) × 31.6

Packet type	Frequency (MHz)	Dwell time (ms)	Time of occupancy on the Tx channel in 31.6 sec (ms)	Limit for time of occupancy on the Tx channel in 31.6 sec (ms)
DH1	2 441	0.392	125.44	400
DH3	2 441	1.660	265.60	400
DH5	2 441	2.908	310.18	400

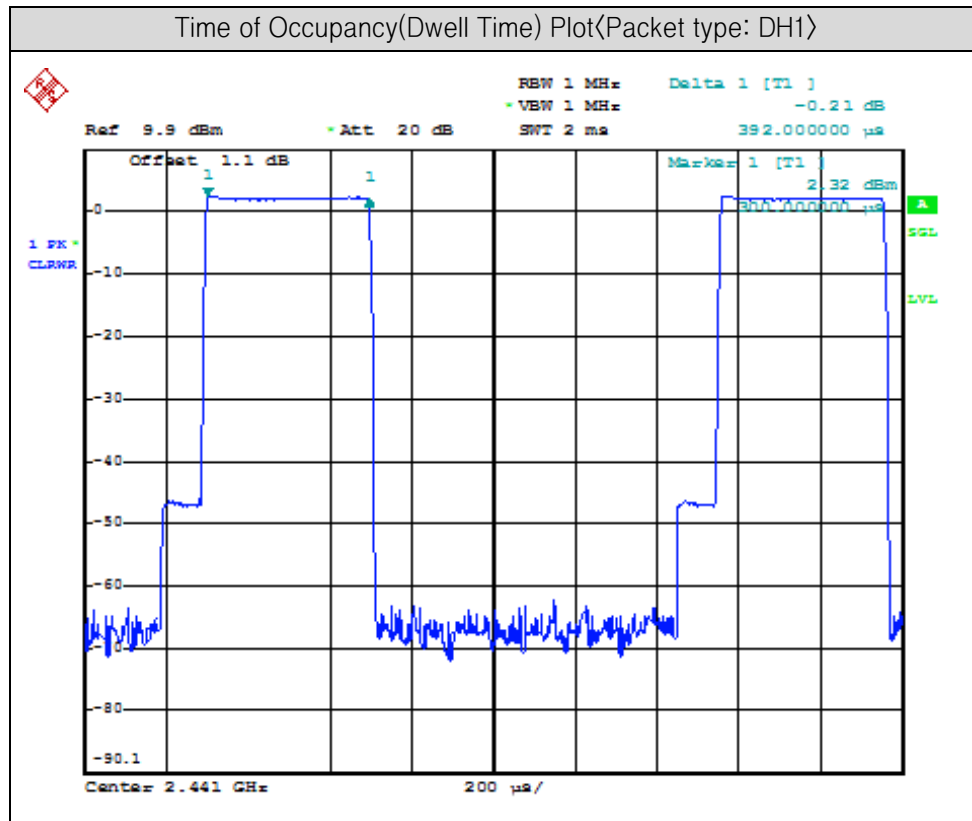
Note :

DH1: Dwell time (ms) × [(1 600 / 2) / 79] × 31.6(s) = 125.44 (ms)

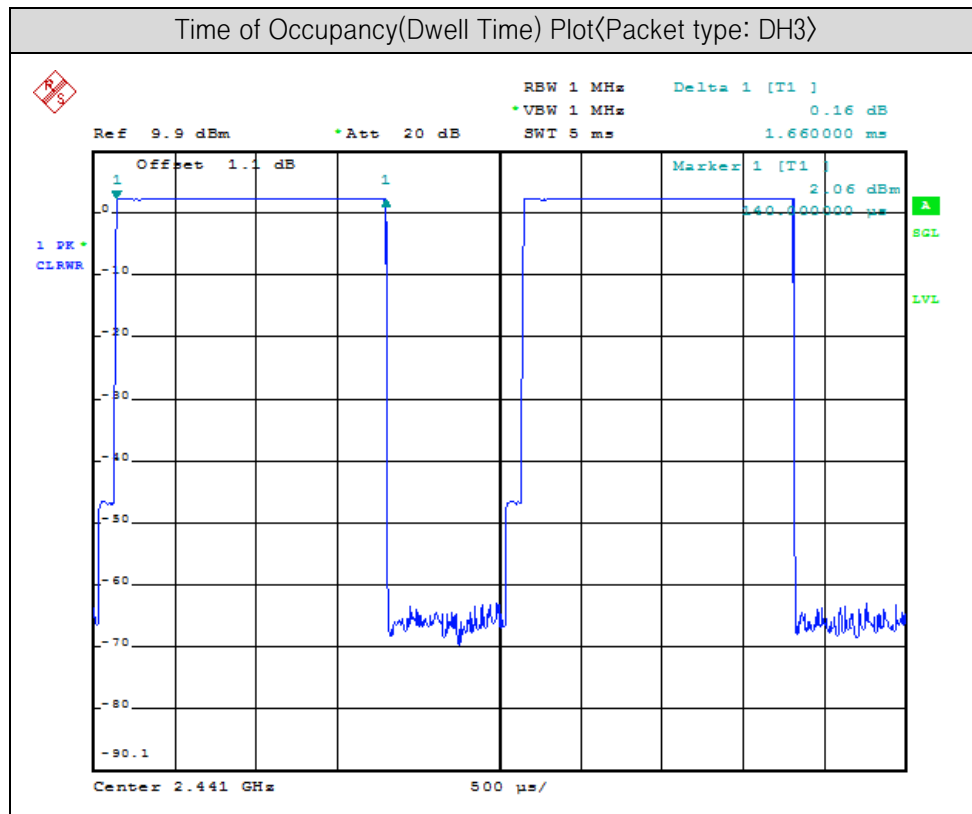
DH3: Dwell time (ms) × [(1 600 / 4) / 79] × 31.6(s) = 265.60 (ms)

DH5: Dwell time (ms) × [(1 600 / 6) / 79] × 31.6(s) = 310.18 (ms)

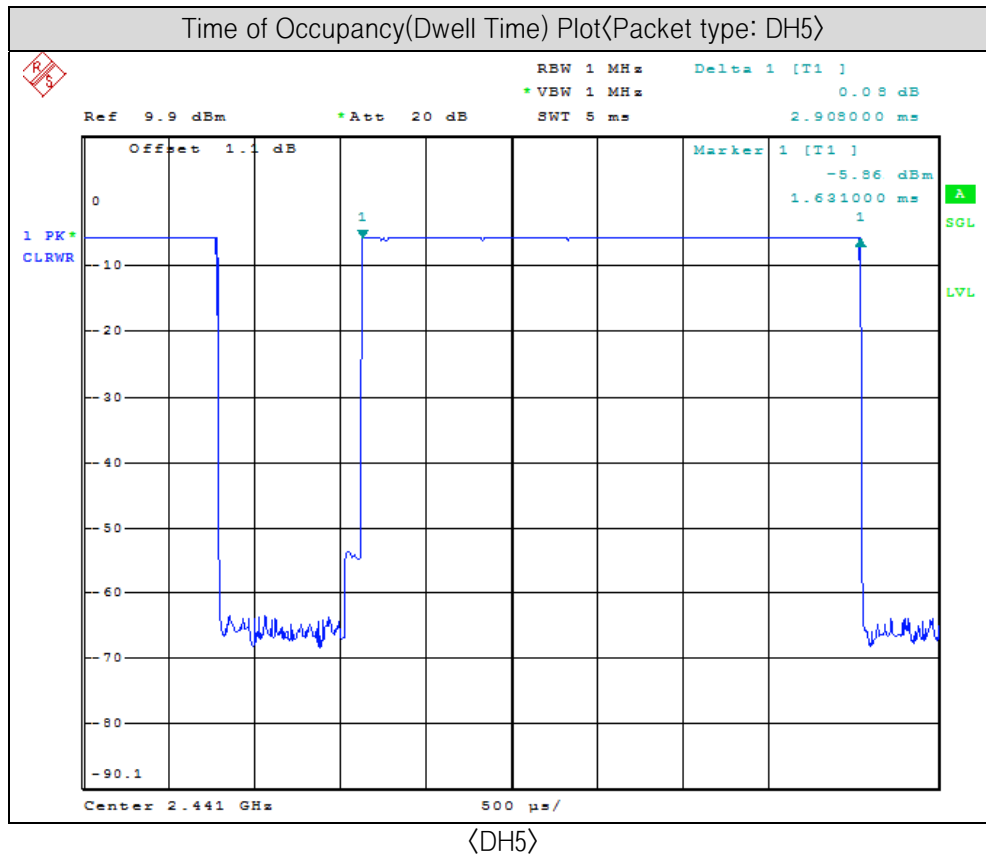
■ Test graph



<DH1>



<DH3>



2.5 20 dB Bandwidth Measurement

Date of test	Sep 03, 2014.	
Laboratory	Ambient temperature	22.9 °C
Environment	Relative humidity	57.2 %
Test site	RF Test room	

■ Limit of 20 dB Bandwidth

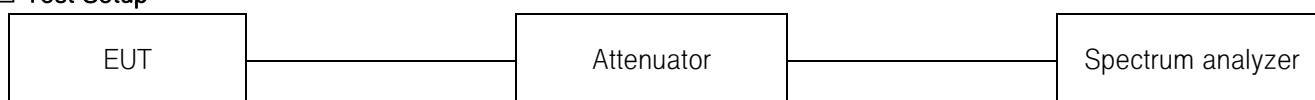
N/A

■ Test Procedure

The testing follows FCC Public DA 00-705 Measurement Guidelines.

1. Place the EUT on the table, and then set it in the transmitting mode.
2. The RF Output of EUT is connected to the spectrum analyzer through a RF cable and an attenuator.
The path loss is compensated to the results for each measurement.
3. The EUT must have its hopping function enabled.
4. Set the spectrum analyzer as follows :
Center frequency: Low, middle and high channel
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
RBW $\geq$ 1% of the 20 dB Bandwidth
VBW $\geq$ RBW
Sweep = Auto
Detector function = peak
Trace =max hold
5. The marker-to-peak function is to set the mark to the peak of the emission. Allow the trace to stabilize. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point 20 dB bandwidth of the emission.
6. Record the 20 dB bandwidth of the emission in the test report.

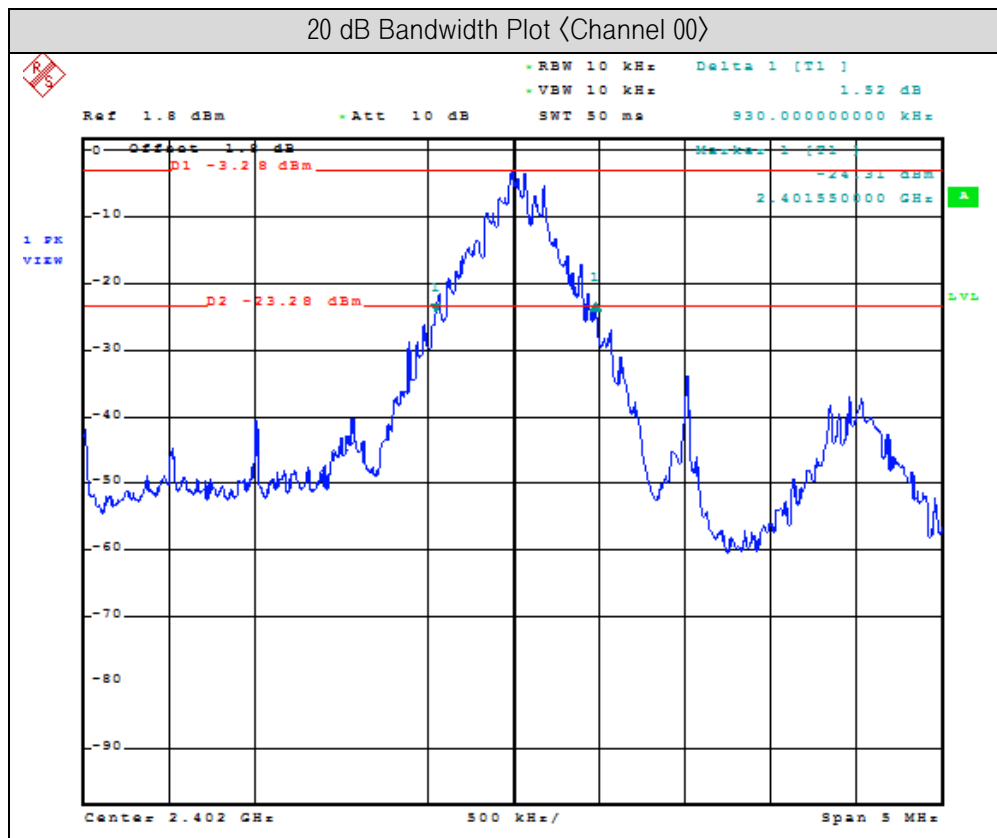
■ Test Setup



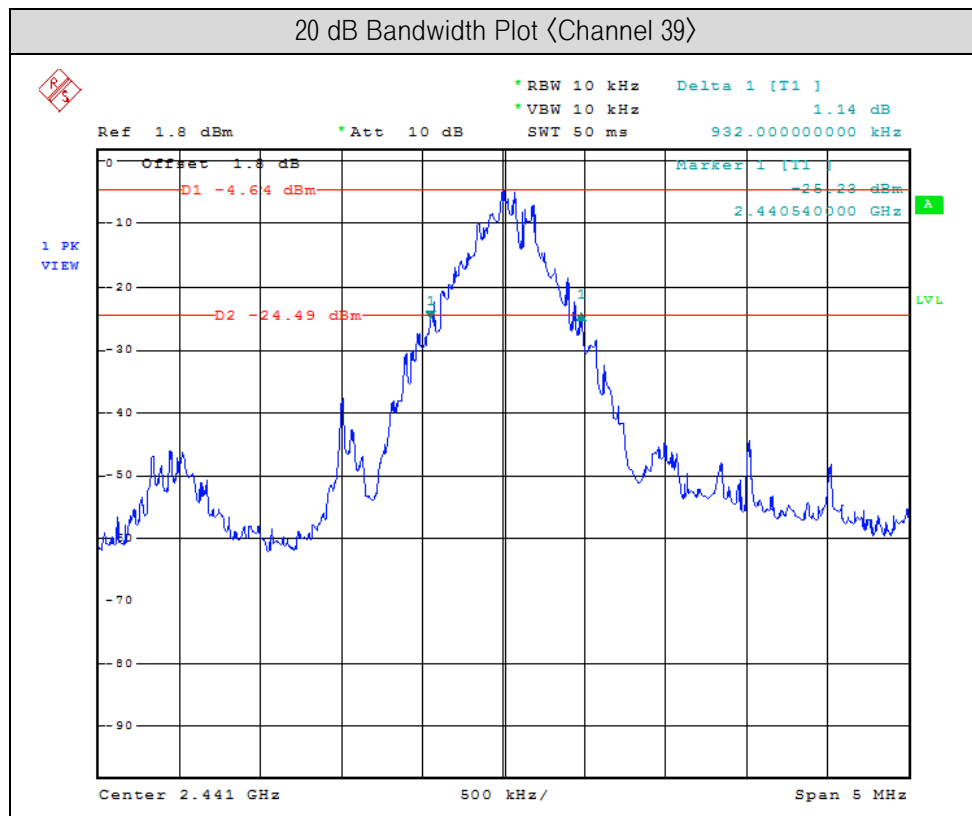
■ Test Result of 20 dB Bandwidth

Channel	Frequency(MHz)	20 dB Bandwidth(MHz)
00	2 402	0.930
39	2 441	0.932
78	2 480	0.890

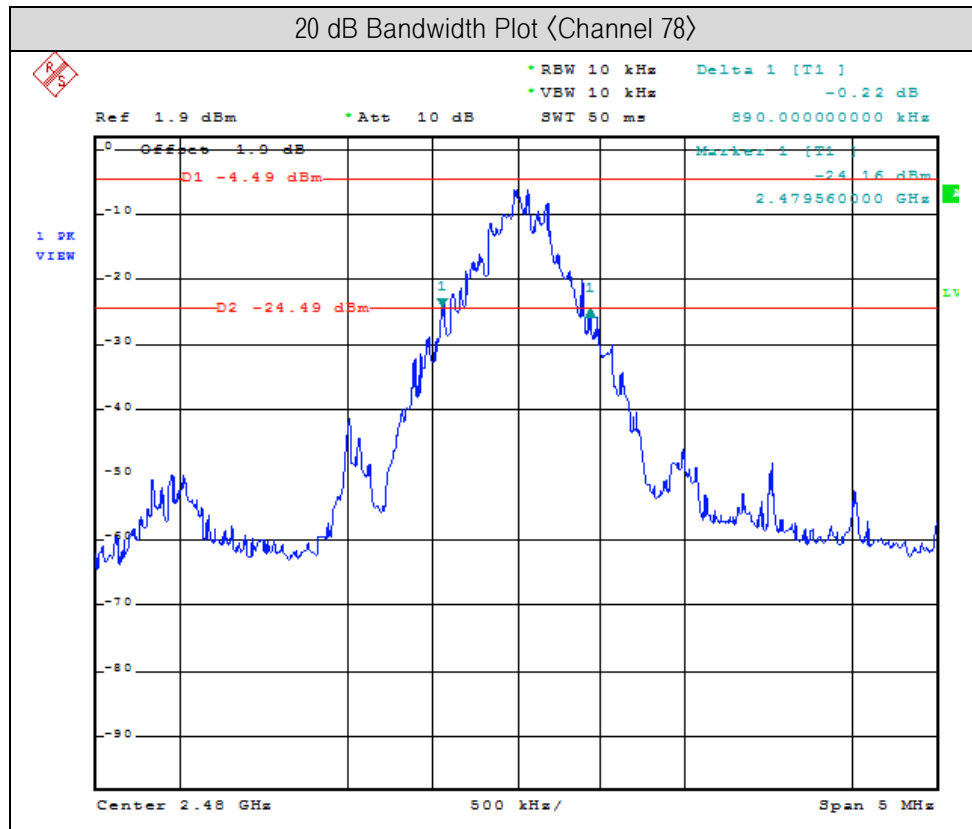
■ Test graph



<2 402 MHz>



<2 441 MHz>



<2 480 MHz>

2.6 Conducted Spurious Emission & Band-edge Measurement

Date of test	Sep 03. 2014.	
Laboratory	Ambient temperature	22.9 °C
Environment	Relative humidity	57.2 %
Test site	RF Test room	

■ Limit of Conducted Spurious Emission & Band-edge Measurement

§ 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph(b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in section § 15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section § 15.205(a), must also comply the radiated emission limits specified in section § 15.209(a) (see section § 15.205(c))

■ Test Procedure for Band-edge Compliance of RF Conducted Emissions

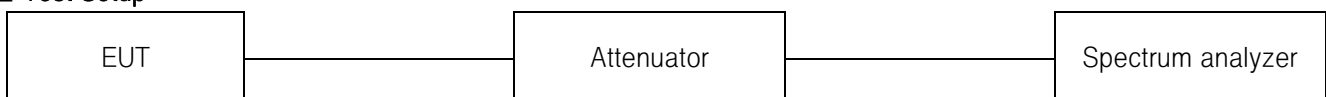
The testing follows FCC Public DA 00-705 Measurement Guidelines.

- Place the EUT on the table, and then set it in the transmitting mode.
- The RF Output of EUT is connected to the spectrum analyzer through a RF cable and an attenuator.
The path loss is compensated to the results for each measurement.
- Set the spectrum analyzer as follows :
Center frequency: Low, middle and high channel
Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
RBW = 100 kHz
VBW ≥ RBW
Sweep = Auto
Detector function = peak
Trace =max hold
 - All harmonics and spurious must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.
- Record the result in the test report.

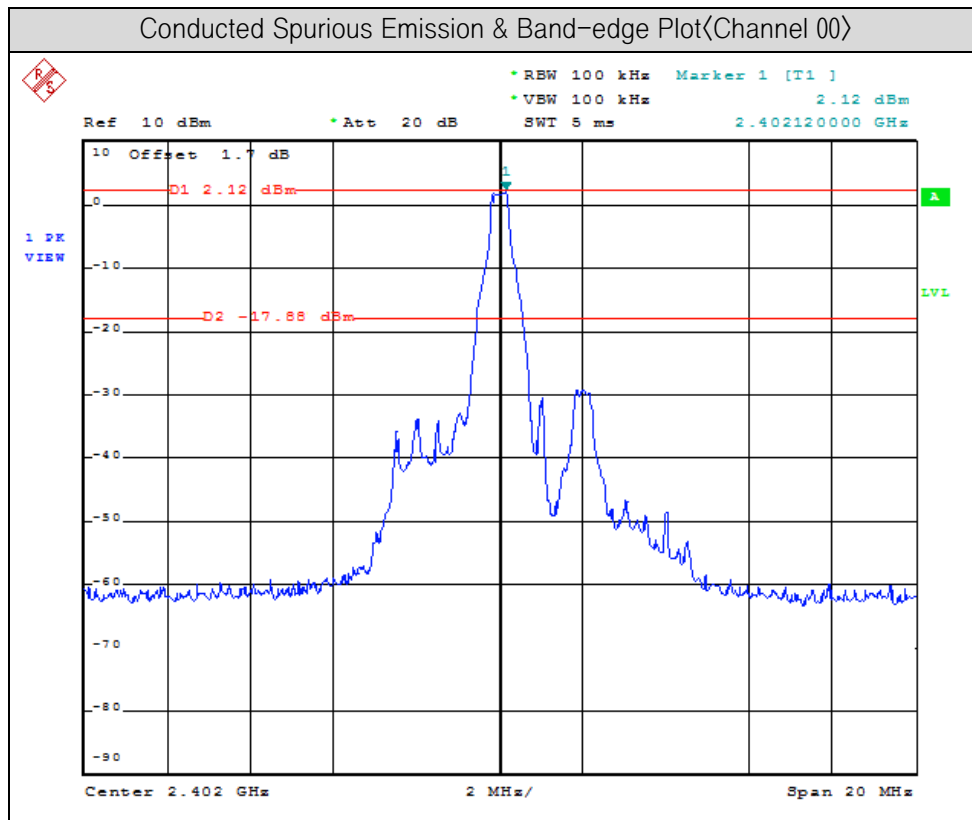
■ Test Procedure for Spurious RF Conducted Emissions

- The RF Output of EUT is connected to the spectrum analyzer through a RF cable and an attenuator.
The path loss is compensated to the results for each measurement.
- Set the spectrum analyzer as follows :
RBW = 100 kHz
VBW ≥ RBW
Sweep = Auto
Detector function = peak
Trace = max hold

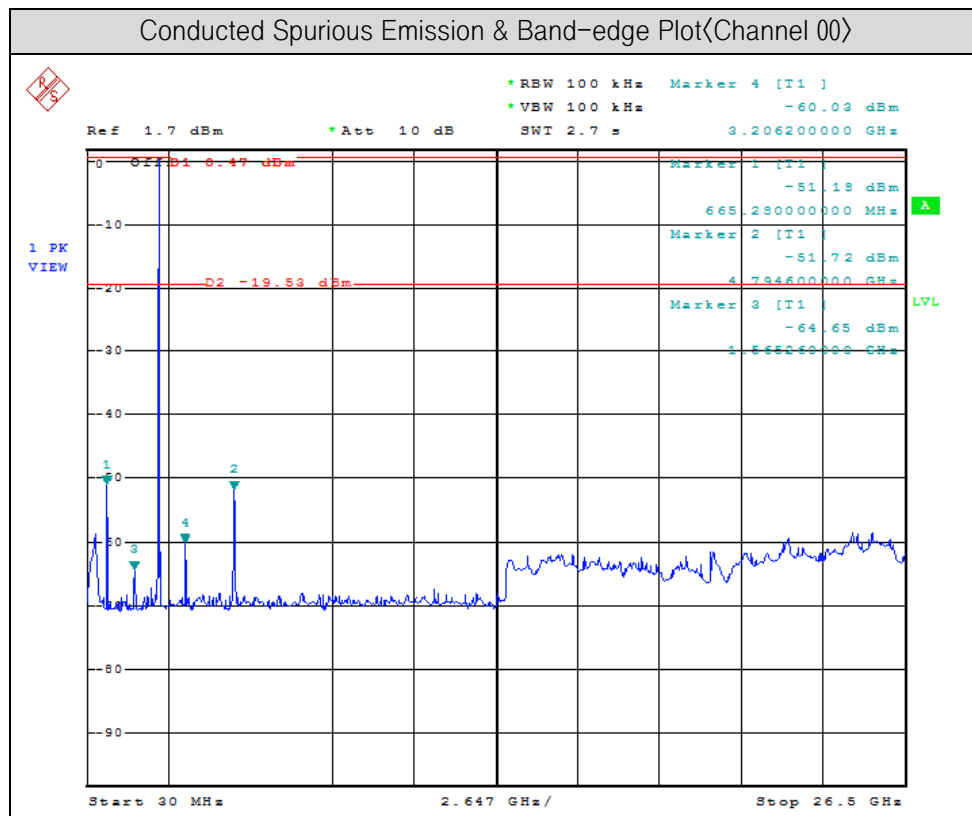
■ Test Setup



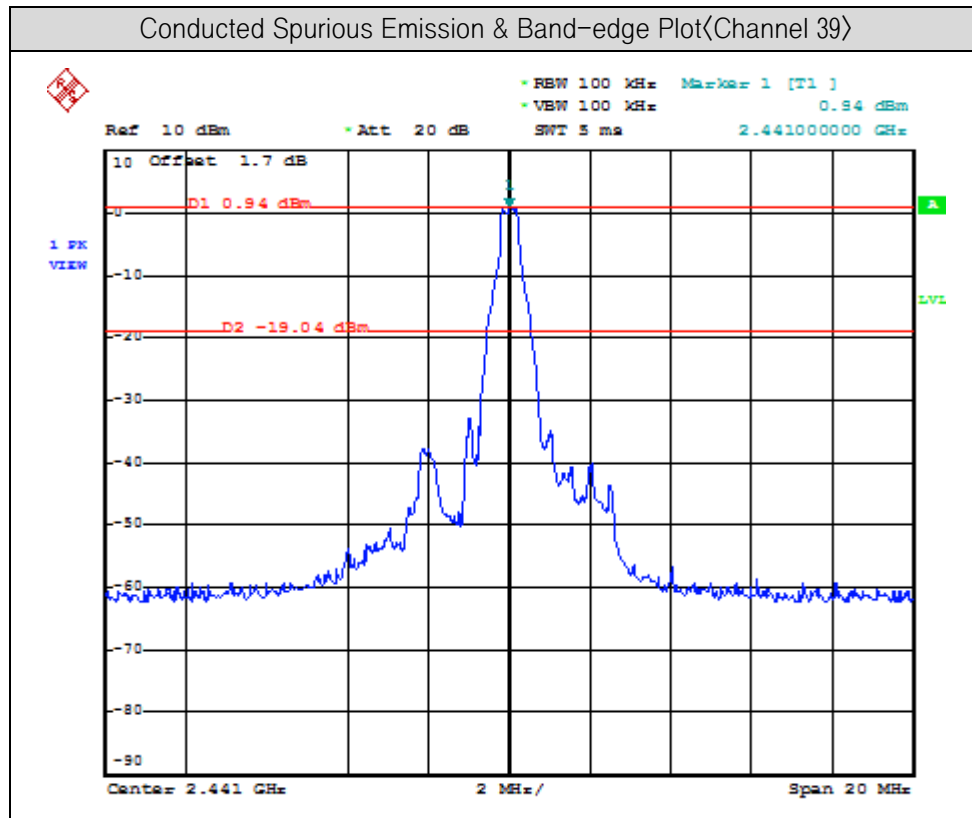
■ Test Result & Graph of Conducted Spurious Emission & Band-edge



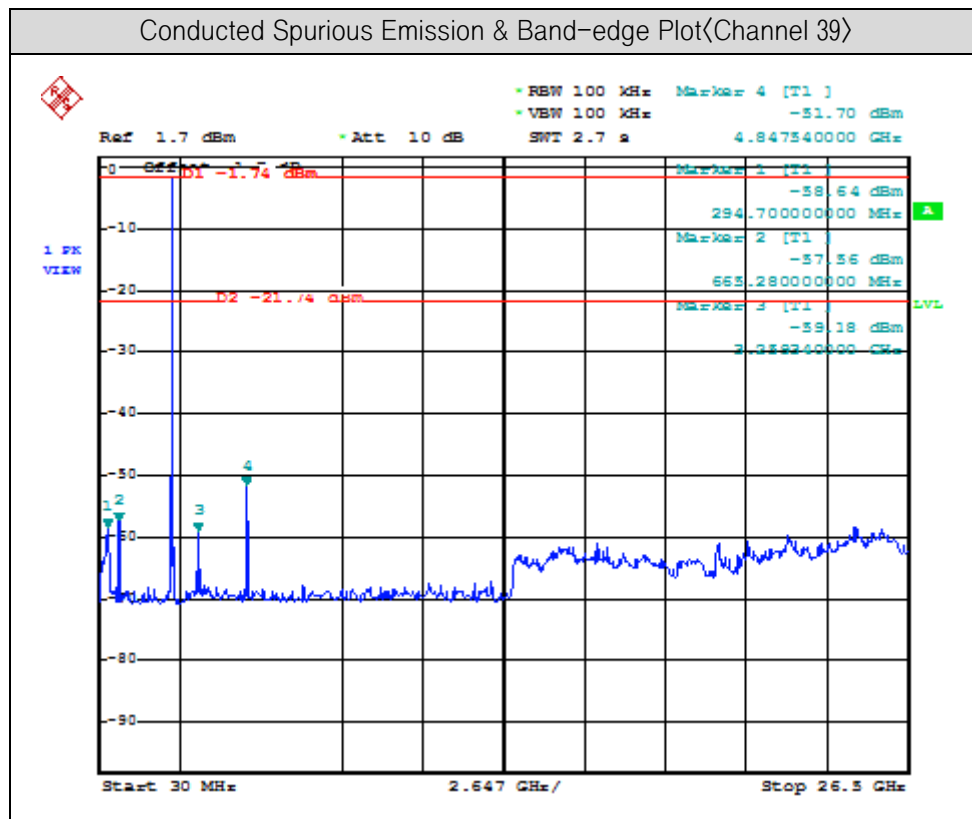
<2 402 MHz>



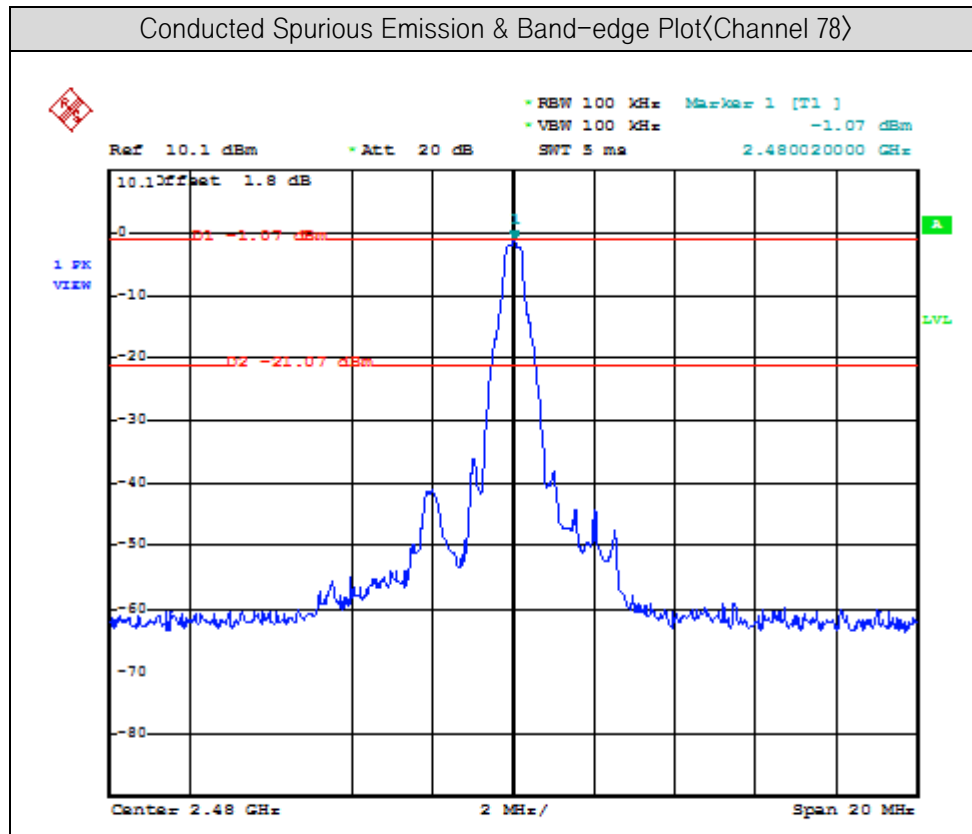
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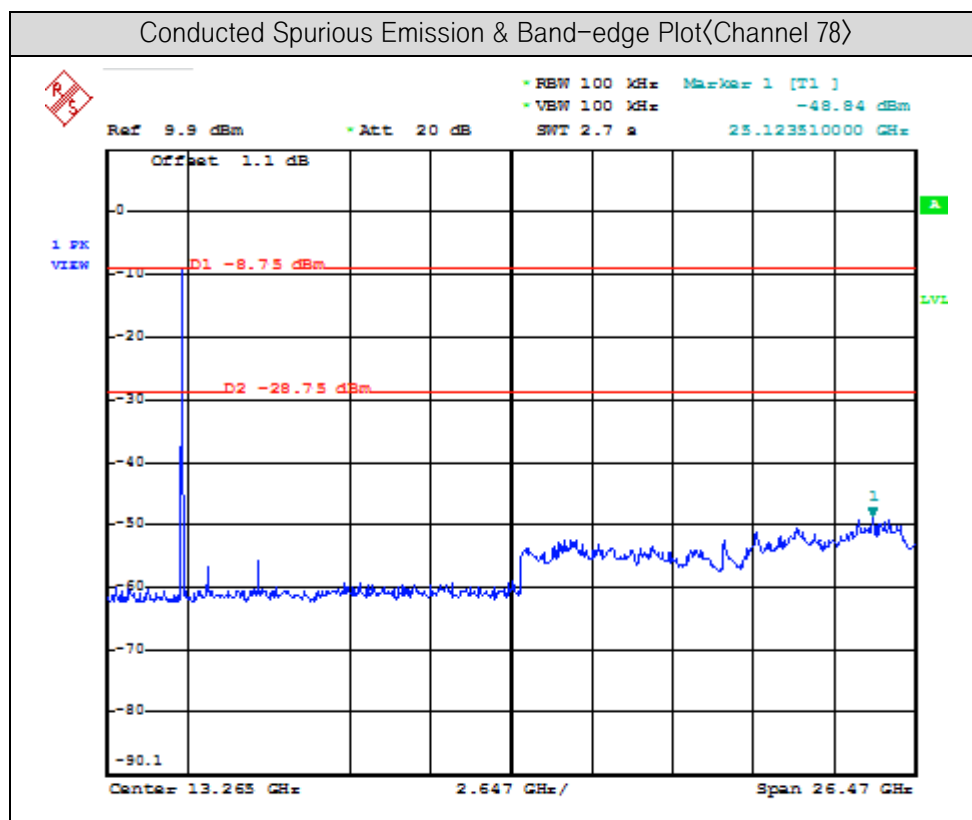
<2 441 MHz>



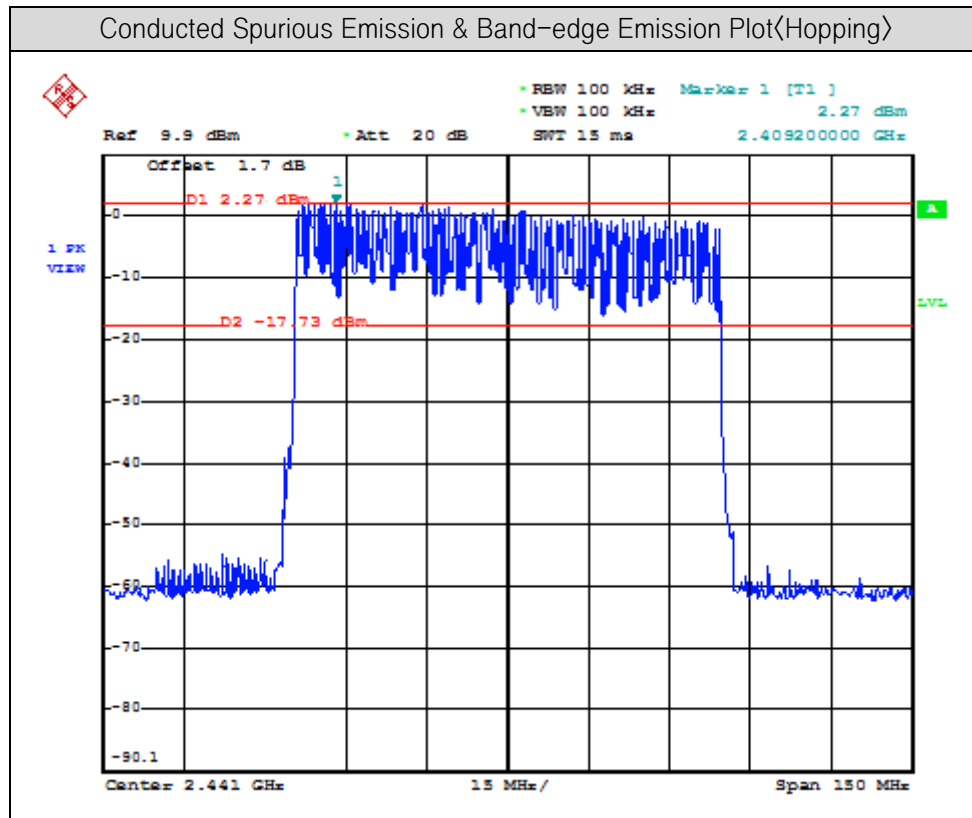
<2 441 MHz>



<2 480 MHz>



<2 480 MHz>



2.7 Radiated Spurious Emission & Band Edge Measurement

Date of test	Sep 22, 2014.	
Laboratory Environment	Ambient temperature	20.6 °C
	Relative humidity	54.7 %
Test site	10 m Radiated Chamber	

■ Limit of Radiated Spurious Emission & Band-edge Measurement

§ 15.209(a), for an intentional radiator devices, the general required of field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values :

Frequency (MHz)	Distance (m)	Radiated (uV/m)
0.009 ~ 0.490	300	2400 / F(kHz)
0.490 ~ 1.705	30	24000 / F(kHz)
1.705 ~ 30.0	30	30
30 ~ 88	3	100**
88 ~ 216	3	150**
216 ~ 960	3	200**
Above 960	3	500

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 MHz ~ 72 MHz, 76 MHz ~ 88 MHz, 174 MHz ~ 216 MHz or 470 MHz ~ 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections § 15.231 and § 15.241.

■ Test Procedure

The testing follows the guidelines in Spurious Radiated Emissions of FCC Public DA 00-705 Measurement Guidelines and the guidelines in ANSI C63.4-2003

1. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1GHz, the EUT was set 3 meter away from the interference receiving antenna.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emissions, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak value of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average methods as specified and then reported in a data sheet.

NOTE :

All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

[9 kHz to 30 MHz]

Set the spectrum analyzer as follows :

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 200 Hz for Quasi-peak detection (QP) at frequency below 9 kHz~ 150 kHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 9 kHz for Quasi-peak detection (QP) at frequency below 150 kHz~ 30 MHz.

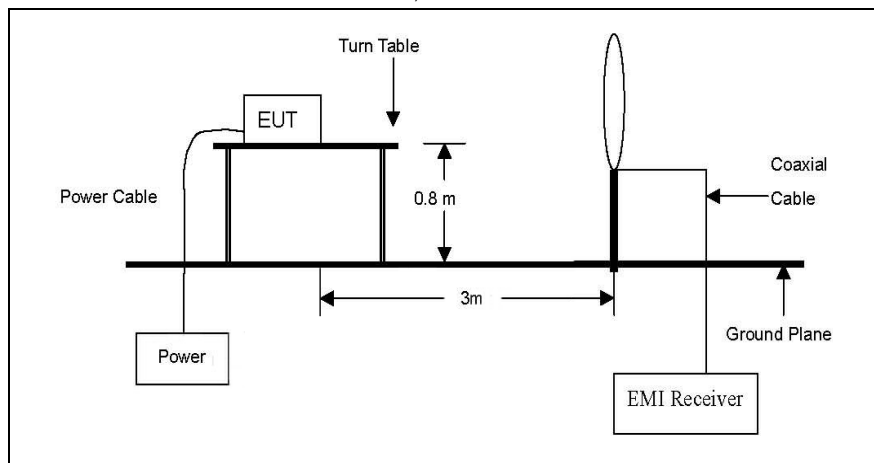
[30 MHz to 1 GHz and 1 GHz to 24 GHz]

Set the spectrum analyzer as follows :

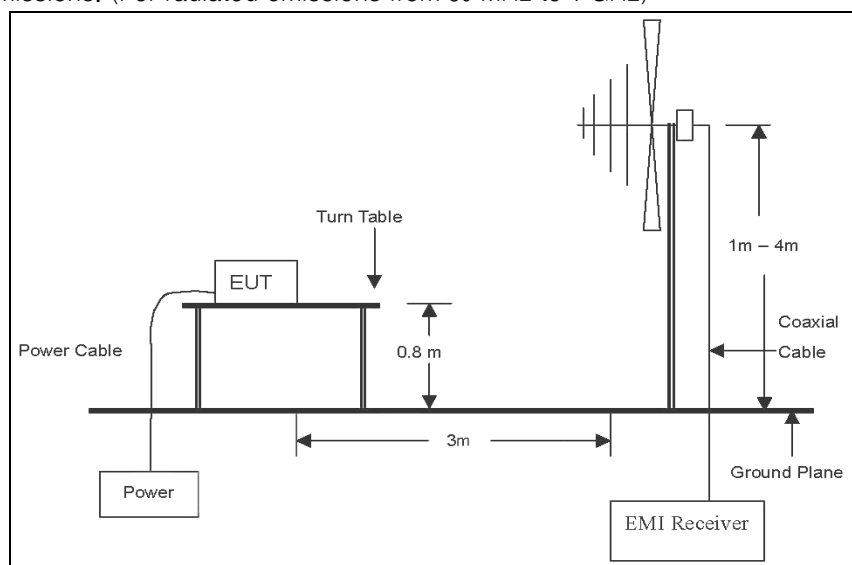
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer 120 kHz for Peak detection (PK) or Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1 GHz.

■ Test Setup

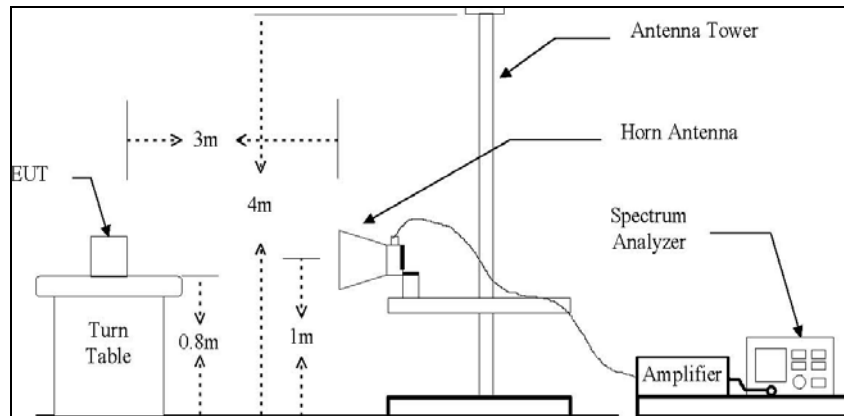
- The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions.(For radiated emissions below 30 MHz)



- The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions. (For radiated emissions from 30 MHz to 1 GHz)



- The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 24 GHz emissions.



■ Test Result of Radiated Spurious Emission & Band Edge

The frequency spectrum from 9 kHz to 30 MHz was investigated.

Radiated emissions		Ant.	Correction factors			Total	Limit	
Frequency (MHz)	Reading (dBuV)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	F_d (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
Below 30	Not detected	–	–	–	–	–	–	–

※ Remark

- All spurious emission at channels are almost the same below 30 MHz, so that high channel was chosen at representative in final test.
- Actual = Reading + Ant. factor + Cable loss + F_d
- $F_d = 20\log(D_m / D_s)$

Where:

- F_d = Distance factor in dB
 D_m = Measurement distance in meters
 D_s = Specification distance in meters

The frequency spectrum from 30 MHz to 1 000 MHz was investigated.

Radiated emissions		Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dBuV)	Pol.	Ant. factor (dB/m)	Cable loss (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
32.40	20.09	V	14.39	0.86	35.34	40.00	4.66
547.40	17.51	V	19.94	2.69	40.14	46.00	5.86
664.80	14.40	V	21.76	2.30	38.47	46.00	7.53
747.70	13.18	V	22.81	2.46	38.45	46.00	7.55
812.60	9.91	V	23.63	1.70	35.24	46.00	10.76
827.10	11.15	H	23.79	1.70	36.64	46.00	9.36
945.30	11.23	H	25.03	1.81	38.07	54.00	15.93
985.80	14.84	V	25.45	1.94	42.23	54.00	11.77

※ Remark

- All spurious emission at channels are almost the same below 1 GHz, so that middle channel was chosen at representative in final test.
- Actual = Reading + Ant. factor + Amp + CL (Cable loss)
- Detector mode: Quasi peak

4. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.

The frequency spectrum from 1 GHz to 25 GHz was investigated.

〈Channel 00〉								
Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 343.3	49.89	Peak	V	27.74	-35.01	42.62	74.00	31.38
2 350.1	37.93	Average	V	27.77	-34.97	30.72	54.00	23.28
2 350.1	47.49	Peak	H	27.77	-34.97	40.28	74.00	33.72
2 350.1	37.93	Average	H	27.18	-34.97	30.72	54.00	23.28
2 377.9	46.48	Peak	V	27.82	-34.90	39.39	74.00	34.61
2 377.9	36.40	Average	V	27.82	-34.90	29.31	54.00	24.69
2 377.9	46.48	Peak	H	27.82	-34.90	39.39	74.00	34.61
2 377.9	36.40	Average	H	27.82	-34.90	29.31	54.00	24.69
2 399.7	49.98	Peak	V	27.87	-34.85	43.01	74.00	30.99
2 399.7	40.14	Average	V	27.87	-34.85	33.17	54.00	20.83
2 399.7	51.51	Peak	H	27.87	-34.85	44.51	74.00	29.46
2 399.7	40.14	Average	H	27.87	-34.85	33.17	54.00	20.83
4 802.0	51.80	Peak	V	32.88	-29.40	54.74	74.00	19.26
4 802.0	40.54	Average	V	32.88	-29.40	43.48	54.00	10.52
4 802.0	50.80	Peak	H	32.88	-29.40	53.74	74.00	20.26
4 802.0	37.74	Average	H	32.88	-29.40	40.68	54.00	13.32

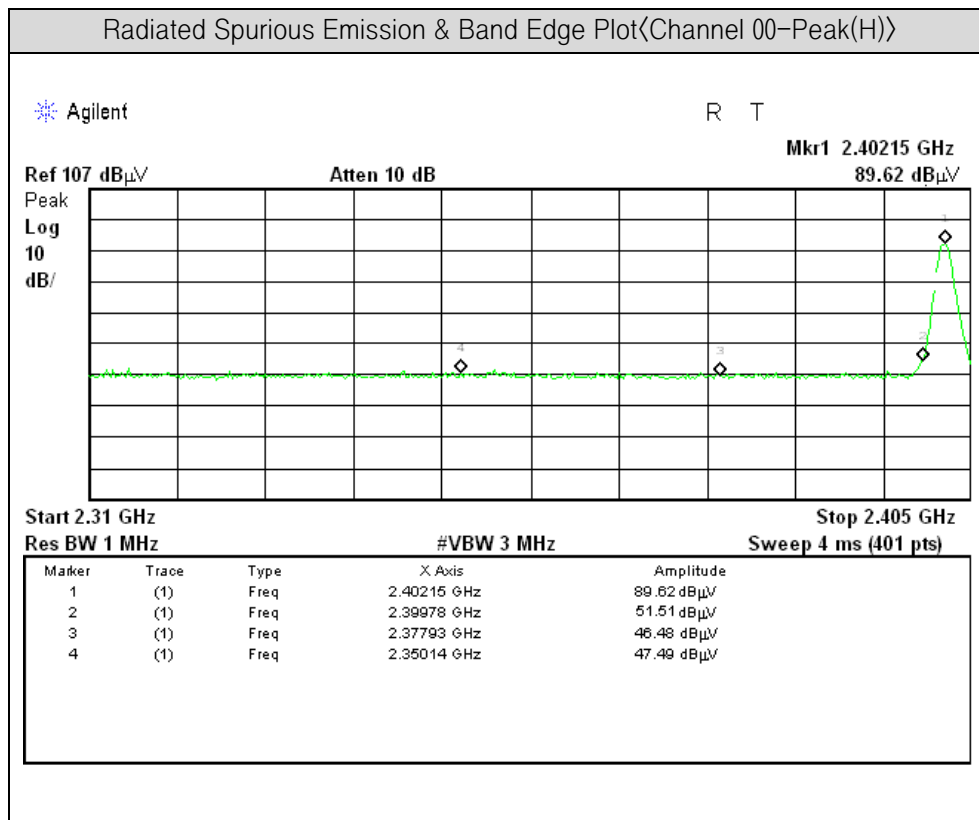
Mode〈Channel 39〉								
Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4 884.0	51.75	Peak	H	32.84	-29.96	54.63	74.00	19.37
4 884.0	48.88	Peak	V	32.84	-29.96	51.76	74.00	22.24
4 884.0	38.30	Average	H	32.84	-29.96	41.18	54.00	12.82
4 884.0	38.81	Average	V	32.84	-29.96	41.69	54.00	12.31

Mode<Channel 78>								
Radiated emissions			Ant.	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detector mode	Pol.	Ant. factor (dB/m)	Amp + CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 489.5	46.25	Peak	V	28.12	-34.56	39.82	74.00	34.18
2 489.5	36.82	Average	V	28.12	-34.56	30.39	74.00	23.61
2 489.5	47.25	Peak	H	28.12	-34.56	40.82	54.00	33.18
2 489.5	37.00	Average	H	28.12	-34.56	30.57	54.00	23.44
2 492.3	44.89	Peak	V	28.15	-34.52	38.52	74.00	35.48
2 492.3	36.88	Average	V	28.15	-34.52	30.51	74.00	23.49
2 492.3	46.31	Peak	H	28.15	-34.52	39.94	54.00	34.06
2 492.3	36.93	Average	H	28.15	-34.52	30.56	54.00	23.44
4 960.0	49.34	Peak	V	32.81	-29.98	52.17	74.00	21.83
4 960.0	38.64	Average	V	32.81	-29.98	41.47	74.00	12.53
4 960.0	49.96	Peak	H	32.81	-29.98	52.79	54.00	21.21
4 960.0	37.87	Average	H	32.81	-29.98	40.70	54.00	13.30

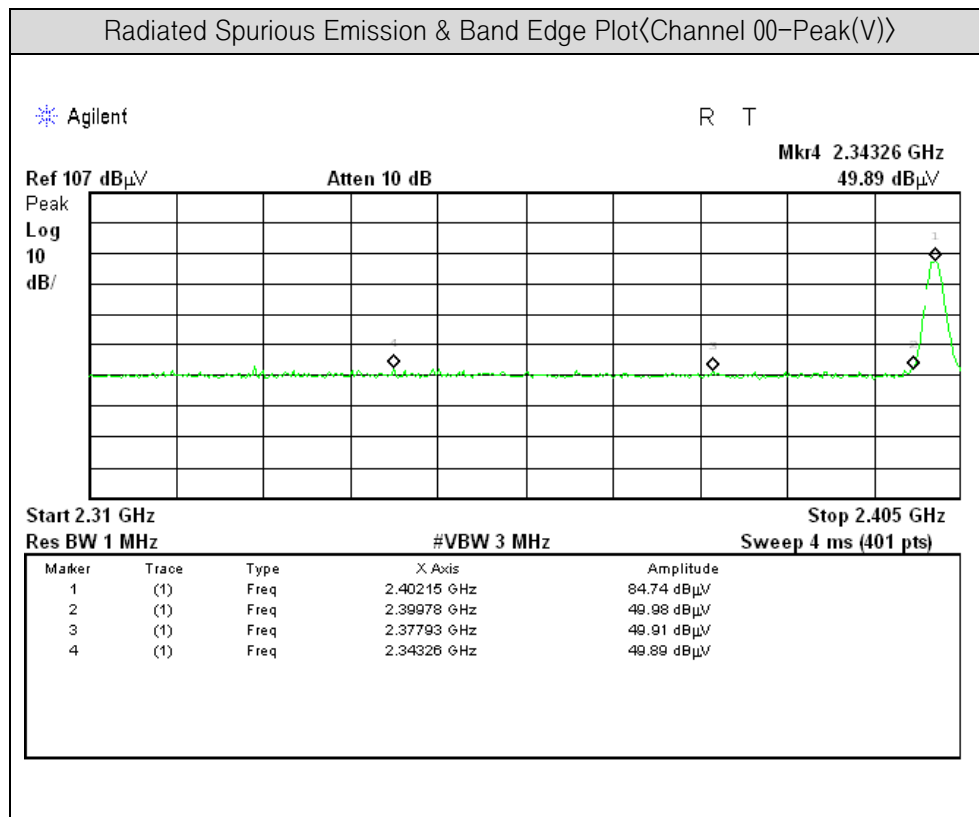
※ Remark

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit.
4. Actual = Reading + Ant. factor + Amp + CL (Cable loss)
5. To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes.

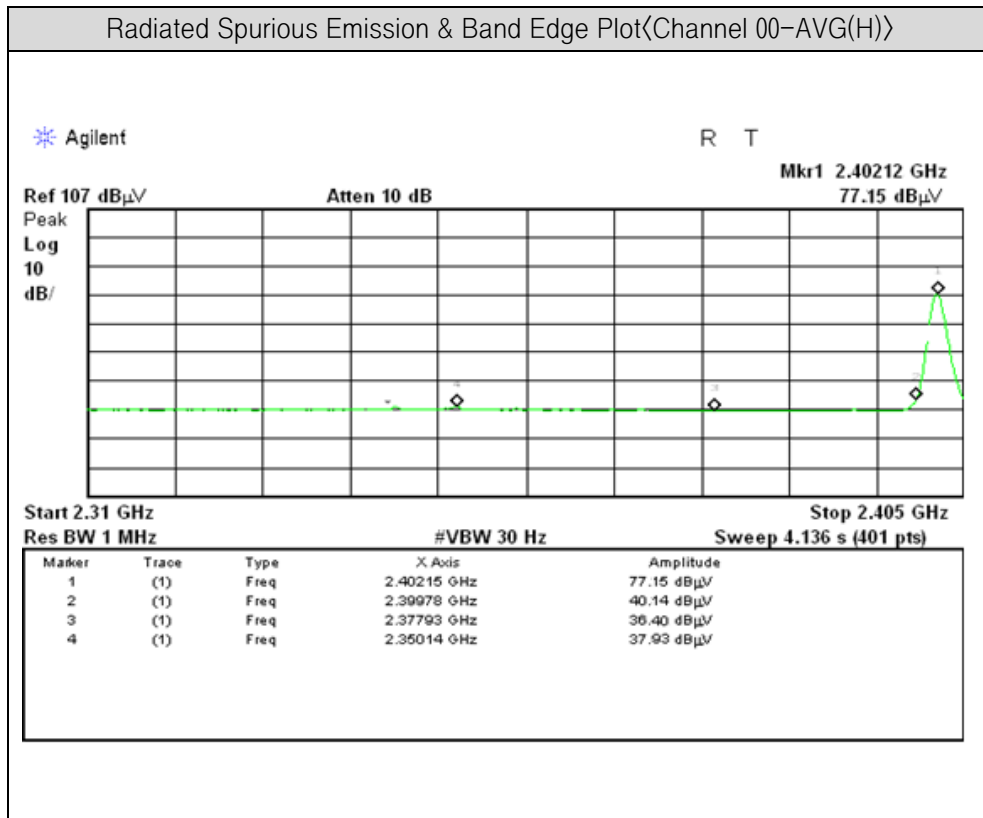
■ Test Graph



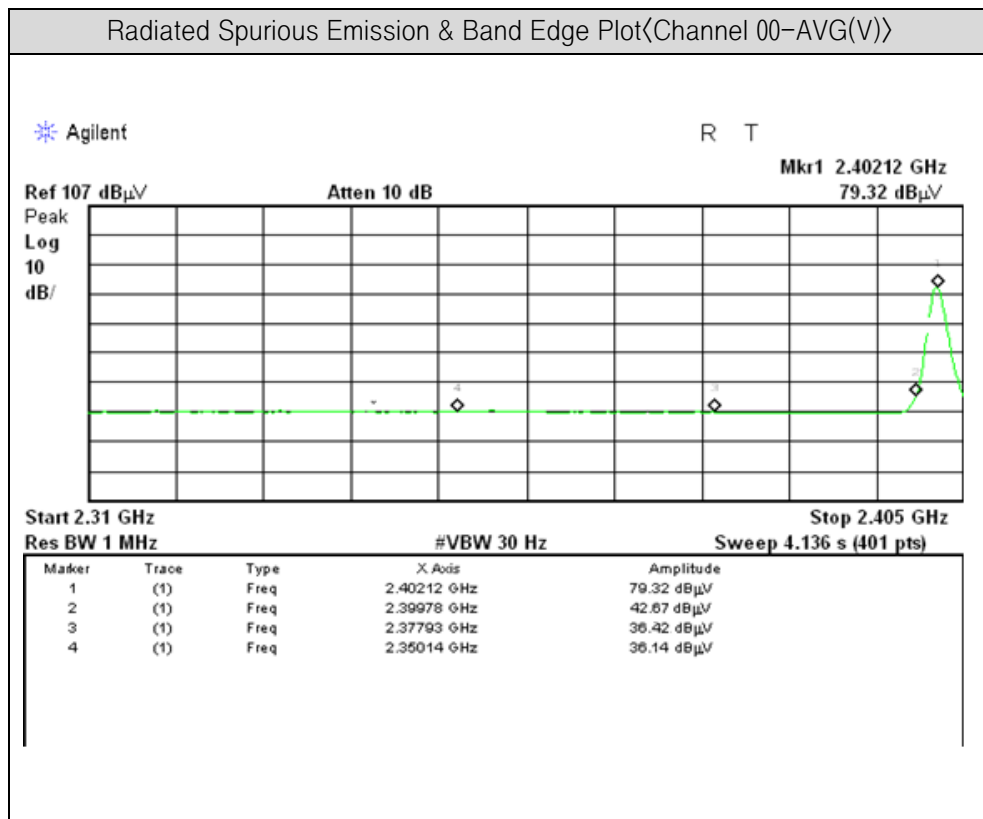
<2 402 MHz>



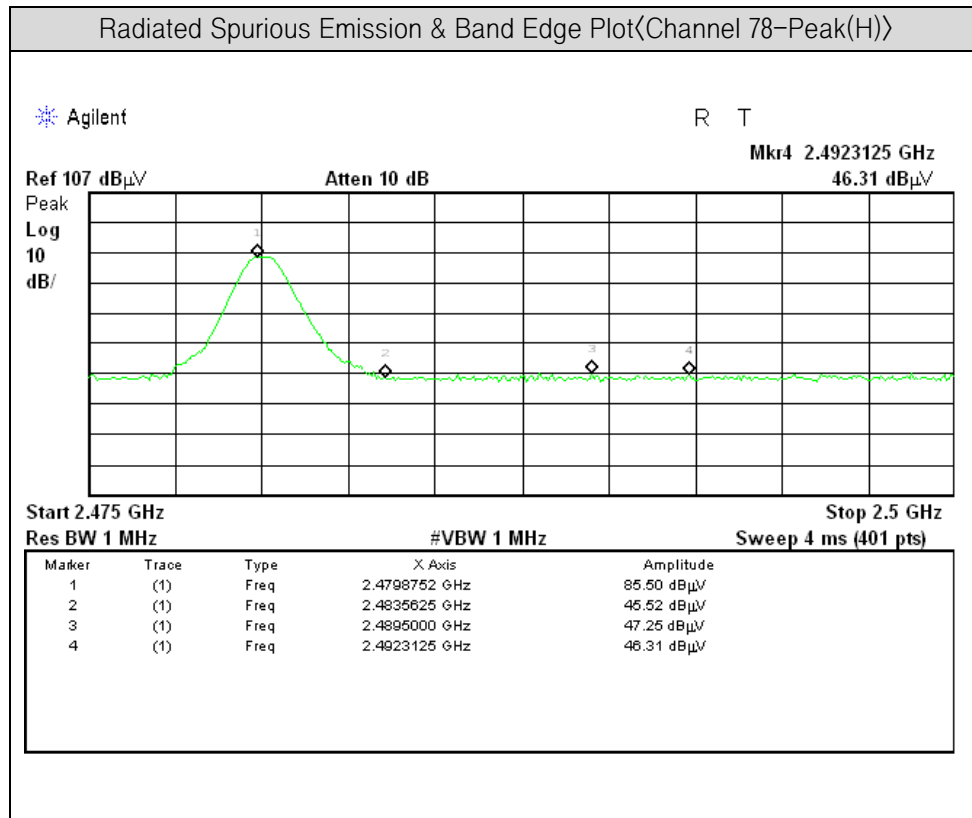
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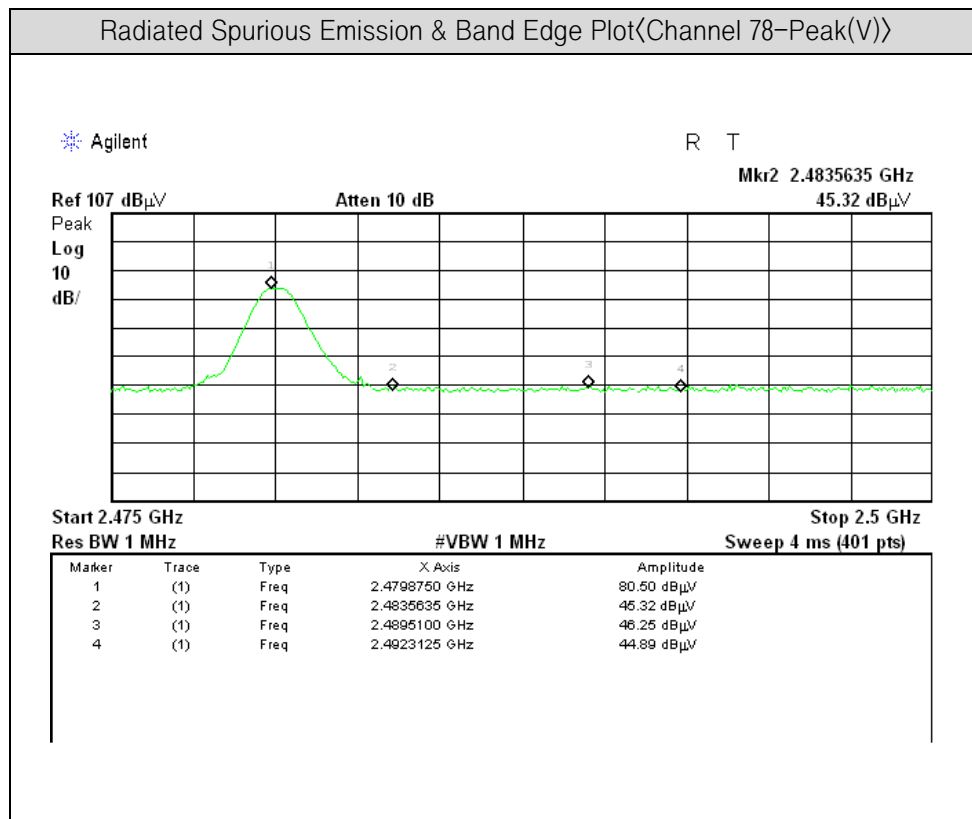
<2 402 MHz>



<2 402 MHz>



<2 480 MHz>



<2 480 MHz>

Radiated Spurious Emission & Band Edge Plot<Channel 78-AVG(H)>

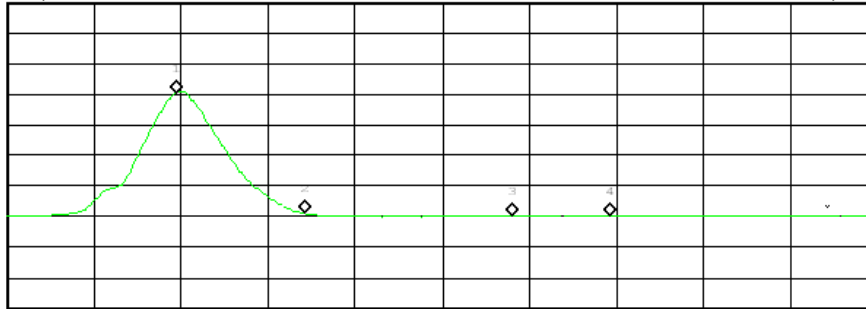
Agilent

R T

Mkr4 2.4923122 GHz

36.92 dB μ VRef 107 dB μ V

Atten 10 dB

Peak
Log
10
dB/

Start 2.475 GHz

Stop 2.5 GHz

Res BW 1 MHz

#VBW 30 Hz

Sweep 1.088 s (401 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.4798752 GHz	78.20 dB μ V
2	(1)	Freq	2.4835627 GHz	37.97 dB μ V
3	(1)	Freq	2.4895000 GHz	37.00 dB μ V
4	(1)	Freq	2.4923120 GHz	36.93 dB μ V

<2 480 MHz>

Radiated Spurious Emission & Band Edge Plot<Channel 78-AVG(V)>

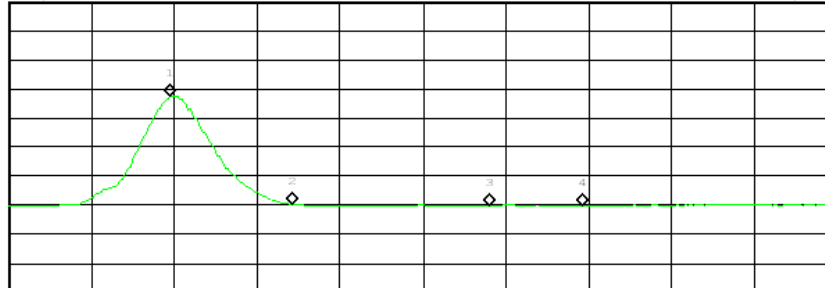
Agilent

R T

Mkr2 2.4835628 GHz

37.12 dB μ VRef 107 dB μ V

Atten 10 dB

Peak
Log
10
dB/

Start 2.475 GHz

Stop 2.5 GHz

Res BW 1 MHz

#VBW 30 Hz

Sweep 1.088 s (401 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.4798747 GHz	74.34 dB μ V
2	(1)	Freq	2.4835628 GHz	38.01 dB μ V
3	(1)	Freq	2.4895120 GHz	36.82 dB μ V
4	(1)	Freq	2.4923123 GHz	36.88 dB μ V

<2 480 MHz>

2.8 Antenna Requirement

■ Standard Applicable

For intentional device, according to FCC 47 CFR Section § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section § 15.247(b) if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by amount in dB that gain of the antenna exceeds 6dBi.

■ Antenna Connected Construction

Antenna used in this EUT is integral type (PCB antenna) with gain of -4.54 dBi.

3.0 Used Test Equipment

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSP	837866/034	2014.08.08	2015.08.08
Spectrum Analyzer	Agilent	E7402A	US40240261	2014.03.13	2015.03.13
EMC Analyzer	Agilent	7405A	US39430154	2013.10.11	2014.10.11
Signal Generator	R&S	SMR40	100122	2014.01.17	2015.01.17
DC Power Supply	Agilent	6673A	MY41000334	2013.10.11	2014.10.11
Loop Antenna	R&S	HFH2-Z2	825841/008	2013.03.19	2015.03.19
Broad Band Antenna	Schwarzbeck	VULB9168	484	2013.07.19	2015.07.19
Horn Antenna	EMCO	3115	9811-5606	2013.09.05	2015.09.05
Antenna Mast	HD	MA240	-	-	-
Turn Table	HD	DT430S	-	-	-
Preamplifier	Testek	TK-PA18	120006	2014.06.05	2015.06.05
Highpass Filter	WAINWRIGHT	WHNX3.5/26.5 G-6SS	13	2014.06.18	2015.06.18
Laptop	Samsung Electronics	NT-RV520	HSGK91MCA00190D	-	-

4.0 Test Setup

