

CERTIFICATION TEST REPORT

FCC CFR47 Part 15 Subpart C

Test Report File No.	13-IST-0511	<input checked="" type="checkbox"/> Basic	<input type="checkbox"/> Alternate
Date of Receipt	May 30, 2013	Begin of test date	June 03, 2013
Date of Issue	July 05, 2013	End of test date	June 07, 2013
Kind of Product	Serial to Bluetooth Converter		
Model(s)	WCS-232 Ver5.0		
FCC ID	PROWCS-232V50		
Applicant	SYSTEMBASE CO.,LTD.		
Address	16F, Daerung Post Tower-1, 212-8, Guro-dong, Seoul, Korea		
Manufacturer	SYSTEMBASE CO.,LTD.		
Address	16F, Daerung Post Tower-1, 212-8, Guro-dong, Seoul, Korea		

Test Result

Positive

Negative

Tested By

Reviewed By




B.O. KO.

S.J. CHO

Comment (s)

- Investigations requested : Measurement to the relevant clauses of FCC rules and regulations Part 15 Subpart C.
- The test report is consists of 32 pages.
- The test result only responds to the tested sample.
- It is not allowed to copy this report even partly without the allowance of IST Co., Ltd.
- This equipment as for has been shown to be capable of continued compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4
I assume full responsibility for accuracy and completeness of these data.



TABLE OF CONTENTS

Table of contents	2
Information of test laboratory, Product information	3
Measurement Uncertainty, Summary	4
Descriptions of Test	5
- Conducted Emission	-
* note : Conducted Emission refer EMC report.	
- Radiated Emission	7~12
- Radiated Emission, 9KHz to 30MHz(Magnetic Field Test)	7
- Peak power output	13~15
- Conducted Spurious Emission & Band edge	16~20
Frequency Separation &	
Occupied Bandwidth/20dB Bandwidth	21~27
- Number of hopping frequency	28~29
- Time of occupancy(Dwell time)	30~31
- Antenna requirements	32

Note:

INFORMATIONS OF TEST LABORATORY

EMC LABORATORY of IST Co., Ltd.
 400-19, Singal-dong, Giheung-gu, Yongin-si,
 Gyeonggi-Do, 446-599, Korea
 TEL: +82 31 326 6700 FAX: +82 31 326 6797

VCCI Registration No. : 1739
 FCC Registration No. : 400603
 KCC Registration No. : KR0018
 KOLAS Registration No. : KT118



PRODUCT INFORMATION

WCS-232

Serial Communication

Communication Interface	RS232
Communication Speed	Max. 230.4kbps
Communication Distance	Max. 15m
Connector	DB9 Female

Bluetooth Communication

Specification	Bluetooth Specification V2.1 + EDR class 1
Frequency	2402 ~ 2480 MHz
Wireless method	Frequency Hopping Spread Spectrum
Maximum Communication Distance	100m

Hard Ware

Power Supply	5V from USB port on the PC
Dimension	36.8(W) x 19.0(D) x 74.2(H)
Weight	35g

Test Mode :

Mode 1: Transmit (DH5)

Mode 2: Transmit (3DH5)

1. DH5 is for GFSK modulation, and 3DH5 is for 8DPSK
2. Regards to the frequency band operation; the highest that was included the lowest, middle and highest frequency of channel were selected to perform the test, and then shown on this report.

- Please refer to user's manual.

Measurement Uncertainty

Conducted Emissions	$U = 2.98$ [dB] (Confidence level approximately 95 %, $k = 2$)
Radiated Emissions (Antenna - Horizontal)	$U = 3.83$ [dB] (Confidence level approximately 95 %, $k = 2$)
Radiated Emissions (Antenna - Verical)	$U = 4.50$ [dB] (Confidence level approximately 95 %, $k = 2$)

SUMMARY

Bluetooth Mode(2402MHz ~2480MHz)

Applied Standard : FCC CRF Part 15 Subpart C

Description of Test	FCC Rule Parts	Results
Carrier Frequency Separation	15.247(a)(1)	Compliant
20 dB Bandwidth	15.247(a)(1)(ii) or (iii)	Compliant
Time of Occupancy	15.247(a)(1)(ii) or (iii)	Compliant
Number of Hopping Frequencies	15.247(a)(1)(ii) or (iii)	Compliant
Conducted Maximum Peak Output Power	15.247(b)(1)	Compliant
Spurious RF Conducted Emission	15.247(d)	Compliant
Spurious Radiated Emission	15.247(d), 15.209	Compliant
Receiver Spurious Emission		Compliant
Out-of- Band Emission	15.247(d)	Compliant
Occupied Bandwidth		Compliant

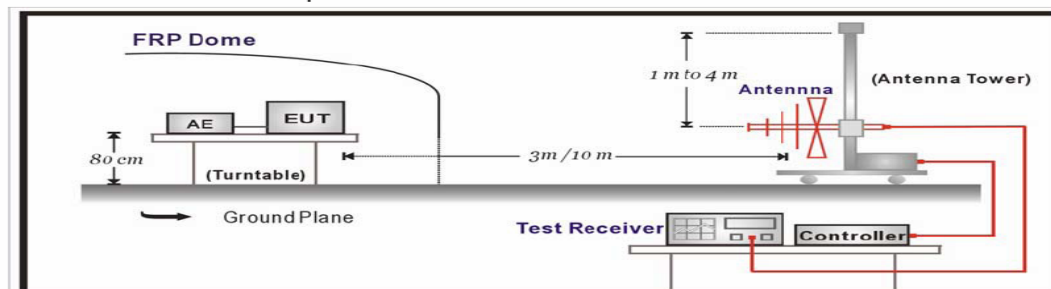
Descriptions of Test

Radiated Emissions:

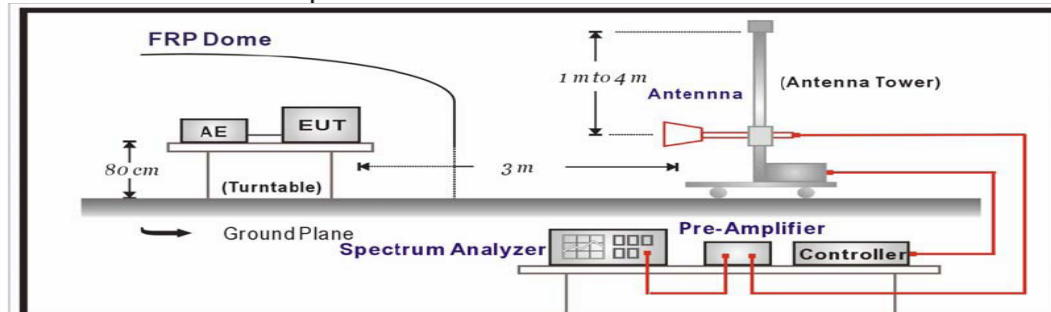
The measurement was performed over the frequency range of 30MHz to 1GHz using antenna as the input transducer to a Spectrum analyzer or a Field Intensity Meter. The measurement was made with the detector set for "quasi-peak" within a bandwidth of 120kHz. Procedure of Test

Preliminary measurements were made at 3 meter using bi-log antennas, and spectrum analyzer to determine the frequency producing the max. emission in anechoic chamber. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turn-table azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30MHz to 1000MHz using bi-log antenna. Above 1GHz, linearly polarized double ridge horn antennas were used. Final measurements were made at open site with 3-meters test distance using bi-log antenna or horn antenna. The OATS have been verified in regular for its normalized site attenuation. The test equipment was placed on a wooden table. Sufficient time for the EUT, peripheral equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined by manual. The detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 120kHz or 1MHz depending on the frequency of type of signal. The EUT, peripheral equipment and interconnecting cables were re-configured to the set-up producing the max. emission for the frequency and were placed on top of a 0.8-meter high nonmetallic 1 x 1.5 meter table. The EUT, peripheral equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by: varying the mode of operation to the EUT and/or peripheral equipment and changing the polarity of the antenna, whichever determined the worst-case emission. (The bandwidth below 1GHz setting on the field strength meter is 120KHz and above 1GHz is 1MHz.)

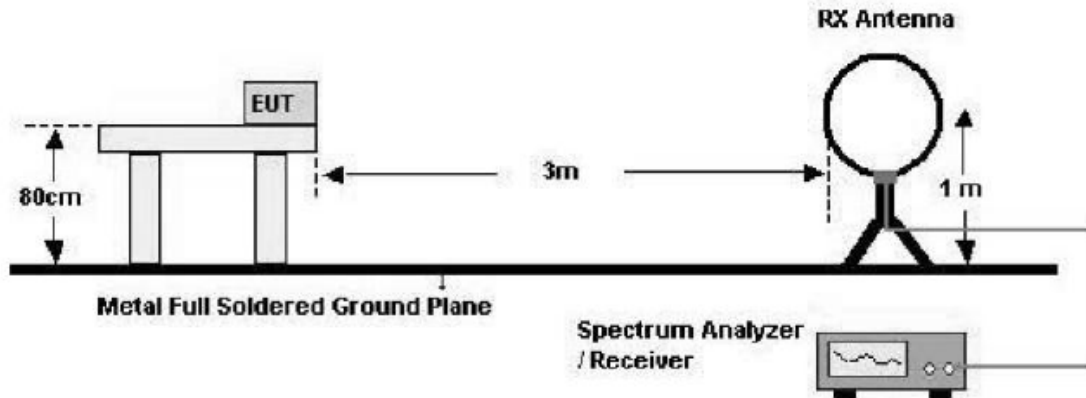
Under 1GHz Test Setup:



Above 1GHz Test Setup:



Below 30 MHz



Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, Shall be attenuated by at least 20dB below the level of the fundamental or to the General radiated emission limits in paragraph 15.209, whichever is the lesser attenuation:

FCC Part 15 Subpart C Section 15.209 Limits		
Frequency (MHz)	$\mu\text{V}/\text{meter}$	$\text{dB}\mu\text{V}/\text{meter} (3\text{m})$
0.009-0.490	$2400/F(\text{KHz})$ at 300 m	$20\log 2400/F(\text{KHz})+80$
0.490-1.705	$24000/F(\text{KHz})$ at 30m	$20\log 24000/F(\text{KHz})+40$
1.705-30	30 at 30 m	49.5
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Remarks :

1. RF Voltage (dBuV) = $20\log$ RF Voltage (uV)
2. $\text{dB}\mu\text{V}/\text{m} = \text{ERP}(\text{dBm}) + 106.92 \text{ dB} + 20\log(10\text{m}/3\text{m}) + 2.15\text{dB}$ (conversion Factor for E.I.R.P)
3. In the Above Table, the tighter limit applies at the band edges.
4. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

Test specification.

According to FCC CFR Title 47 Part 15 Subpart C Section 15.209.

Radiated Spurious Emission

[Applicable]

◆ Test Equipment Used

Name	Type	Manufacturer	Calibration. Date	Serial Number
ESCS30	EMI Receiver	Rohde & Schwarz	May 10, 2013	100171
SPECTRUM ANALYZER	R3273	ADVANTEST	Oct. 10, 2012	95090431
Loop Antenna	HFH2-Z2	Rohde & Schwarz	Oct. 26, 2012	8620771017
Log-bicon Antenna	VULB9160	Schwarz beck	Mar. 28, 2012	3047
HORN-Antenna	3115	EMCO	Nov. 21, 2011	9012-3602
HORN-Antenna	HF906	Rohde & Schwarz	Nov. 21, 2011	100530
PRE AMPLIFIER	8449B OPT H02	Rohde & Schwarz	Oct. 09, 2012	3008A0530

Note : 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to RRA, KRISS, KTL and HCT.

2. The calibration interval of horn ant. and loop ant. is 24 months

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. For the limit is employed average value, therefore the peak value can be transferred to average value by subtracting the duty factor. The basic equation with a sample calculation is as follows:

$$\text{Peak} = \text{Reading} + \text{Corrected Factor}$$

Where Corr. Factor = Antenna Factor + Cable Factor - Amplifier Gain (if any)

Radiated Emissions Test, 9 kHz to 30 MHz(Magnetic Field Test)

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions at a distance of 3 meters according to Section 15.31(f) (2) .
2. The EUT was placed on the top of the 0.8-meter height, 1 x 1.5 meter non-metallic table.
3. Emissions from the EUT are maximized by adjusting the orientation of the Loop antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions if applicable.
4. To obtain the final measurement data, each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector with specified bandwidth.
5. The result was 20dB lower than the limit line 15.31(o) was not reported.

Radiated Emission Result
Under 1GHz

[Applicable]

DH5

Frequency MHz	Reading dBuV/m	P (H, V)	Ant. Factor dBuV/m	Cable Loss dB	Limit dBuV/m	Total dBuV/m	Margin dB
60.071	6.50	H	11.56	1.34	40.00	19.40	-20.60
160.952	7.40	V	13.23	2.13	43.50	22.76	-20.74
*216.245	13.80	H	10.31	2.52	46.00	26.63	-19.37
231.764	11.90	V	10.77	2.60	46.00	25.27	-20.73

3DH5

Frequency MHz	Reading dBuV/m	P (H, V)	Ant. Factor dBuV/m	Cable Loss dB	Limit dBuV/m	Total dBuV/m	Margin dB
56.198	5.30	V	11.81	1.29	40.00	18.40	-21.60
154.165	8.70	V	13.10	2.08	43.50	23.88	-19.62
*215.273	12.40	H	10.28	2.52	43.50	25.20	-18.30
232.732	7.60	V	10.80	2.60	46.00	21.00	-25.00

Note :

1. Remark "*" means that the data is the worst emission level.
2. All reading levels are Quasi-peak value.
3. Measurement level = reading level + correct factor

Above 1Ghz

EUT :	WCS-232 Ver5.0	PROBE :	Above 1 GHz
MODE :	DH5	NOTE :	Low Ch

Test Data

Frequency GHz	Reading dBuV/m		P	Limit dBuV/m		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
1.213	40.79	23.41	V	74.00	54.00	33.21	30.59
1.582	49.02	28.82	V	74.00	54.00	24.98	25.18
4.821	43.09	25.63	V	74.00	54.00	30.91	28.37
1.584	48.88	24.06	H	74.00	54.00	25.12	29.94
2.204	41.30	31.98	H	74.00	54.00	32.70	22.02
4.823	45.07	29.26	H	74.00	54.00	28.93	24.74
5.792	46.48	32.53	H	74.00	54.00	27.52	21.47

Restricted Band Edge Test Data

Frequency GHz	Reading dBuV/m		P	Limit dBuV/m		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
2.383	45.32	29.16	V	74.00	54.00	28.68	24.84
2.384	47.98	33.64	H	74.00	54.00	26.02	20.36

EUT :	WCS-232 Ver5.0	PROBE :	Above 1 GHz
MODE :	DH5	NOTE :	Middle Ch

Test Data

Frequency GHz	Reading dBuV/m		P	Limit dBuV/m		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
1.605	51.68	36.58	V	74.00	54.00	22.32	17.42
4.921	41.87	30.24	V	74.00	54.00	32.13	23.76
5.137	43.19	28.54	V	74.00	54.00	30.81	25.46
7.068	51.27	35.69	V	74.00	54.00	22.73	18.31
1.604	49.62	34.32	H	74.00	54.00	24.38	19.68
4.912	42.34	29.58	H	74.00	54.00	31.66	24.42
5.223	43.72	28.58	H	74.00	54.00	30.28	25.42

EUT :	WCS-232 Ver5.0	PROBE :	Above 1 GHz
MODE :	DH5	NOTE :	High Ch

Test Data

Frequency GHz	Reading dBuV/m		P	Limit dBuV/m		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
	1.645	57.82		39.38	V	74.00	54.00
4.934	48.99	36.32	V	74.00	54.00	25.01	17.68
5.353	50.41	37.62	V	74.00	54.00	23.59	16.38
7.132	51.02	37.78	V	74.00	54.00	22.98	16.22
1.645	49.84	32.65	H	74.00	54.00	24.16	21.35
4.981	47.64	35.22	H	74.00	54.00	26.36	18.78
5.432	48.72	35.54	H	74.00	54.00	25.28	18.46

Restricted Band Edge Test Data

Frequency GHz	Reading dBuV/m		P	Limit dBuV/m		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
	2.485	46.75		34.46	V	74.00	54.00
2.485	51.52	37.35	H	74.00	54.00	22.48	16.65

Note : Reading(dBuv) : Measurement Level + Ant Factor + Cable Loss - Amp Gain

EUT :	WCS-232 Ver5.0	PROBE :	Above 1 GHz
MODE :	3DH5	NOTE :	Low Ch

Test Data

Frequency GHz	Reading dBuV/m		P	Limit dBuV/m		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
	1.224	38.64		21.61	V	74.00	54.00
1.578	47.51	28.93	V	74.00	54.00	26.49	25.07
4.838	41.42	23.52	V	74.00	54.00	32.58	30.48
1.577	48.34	27.15	H	74.00	54.00	25.66	26.85
2.263	40.17	29.89	H	74.00	54.00	33.83	24.11
4.837	46.24	27.25	H	74.00	54.00	27.76	26.75
5.803	45.43	31.27	H	74.00	54.00	28.57	22.73

Restricted Band Edge Test Data

Frequency GHz	Reading dBuV/m		P	Limit dBuV/m		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
	2.386	49.84		30.23	V	74.00	54.00
2.384	50.82	29.84	H	74.00	54.00	23.18	24.16

EUT :	WCS-232 Ver5.0	PROBE :	Above 1 GHz
MODE :	3DH5	NOTE :	Middle Ch

Test Data

Frequency GHz	Reading dBuV/m		P	Limit dBuV/m		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
	1.612	50.56		32.49	V	74.00	54.00
4.881	40.62	29.42	V	74.00	54.00	33.38	24.58
5.236	41.57	27.97	V	74.00	54.00	32.43	26.03
6.988	49.53	34.78	H	74.00	54.00	24.47	19.22
1.62	48.51	32.17	H	74.00	54.00	25.49	21.83
4.892	39.48	27.69	H	74.00	54.00	34.52	26.31
5.115	41.92	29.98	H	74.00	54.00	32.08	24.02
1.612	50.56	32.49	H	74.00	54.00	23.44	21.51

EUT :	WCS-232 Ver5.0	PROBE :	Above 1 GHz
MODE :	3DH5	NOTE :	High Ch

Test Data

Frequency GHz	Reading dBuV/m		P	Limit dBuV/m		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
	1.667	58.61		40.72	V	74.00	54.00
4.973	47.05	35.43	V	74.00	54.00	26.95	18.57
5.628	49.52	38.22	V	74.00	54.00	24.48	15.78
7.209	50.37	36.97	H	74.00	54.00	23.63	17.03
1.654	52.73	37.94	H	74.00	54.00	21.27	16.06
4.985	47.25	35.49	H	74.00	54.00	26.75	18.51
5.645	44.32	33.24	H	74.00	54.00	29.68	20.76

Restricted Band Edge Test Data

Frequency GHz	Reading dBuV/m		P	Limit dBuV/m		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
	2.485	45.69		38.43	H	74.00	54.00
2.485	51.34	43.79	V	74.00	54.00	22.66	10.21

Note : Reading(dBuv) : Measurement Level + Ant Factor + Cable Loss - Amp Gain

Peak Power Output

◆ Test Equipment

The following test equipment are used during the test:

Item	Equipment	Manufacturer	Model no/Serial No.	Last Cal.
1	Spectrum Analyzer	ADVANTEST	R3273 / 95090431	Oct. 10, 2012
2	RF ROOM			

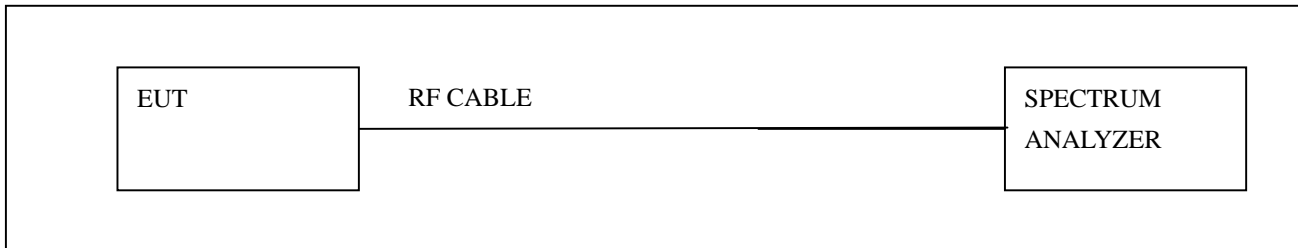
Note : All equipment upon which need to calibrated are with calibration period of 1 year.

◆ Limits

The maximum peak output power of the intentional radiator shall not exceed the following :

1. According to § 15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz : 1Watt.
2. According to § 15.247(b)(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, is 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

◆ Test Setup



◆ Test Procedure

The transmitter output is connected to the Spectrum analyzer. The Spectrum analyzer is set to the peak power detection.

Peak Power Test result

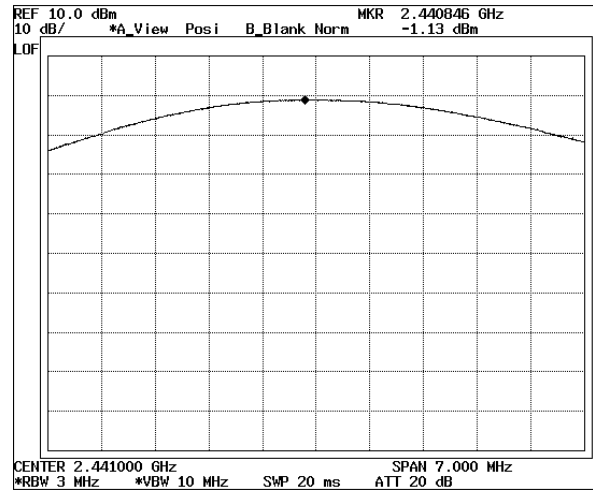
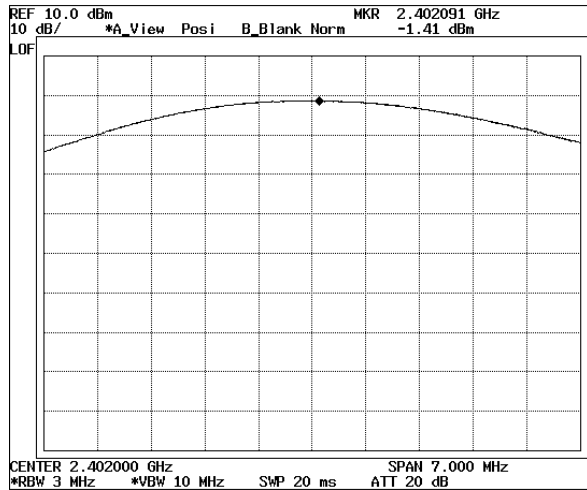
Product	WCS-232 Ver5.0
Test Item	Peak Power Output
Test Mode	Tx / Channel 0, 39, 78
Test Site	RF Room
Measurement Method	Conducted

DH5

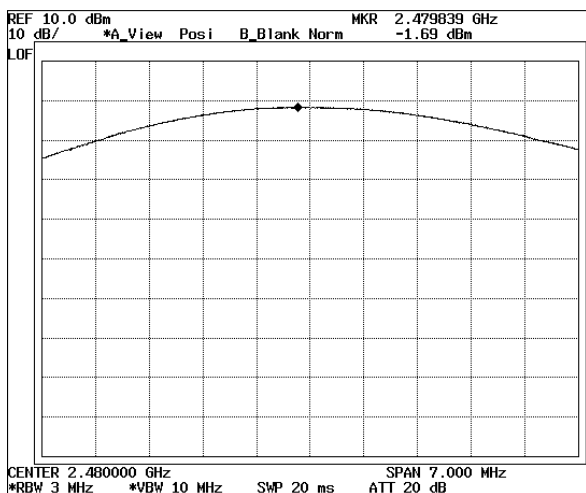
Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
0	2402	-1.41	1Watt=30dBm	Pass
39	2441	-1.13	1Watt=30dBm	Pass
78	2480	-1.69	1Watt=30dBm	Pass

Channel 0

Channel 39



Channel 78



Peak Power Test result

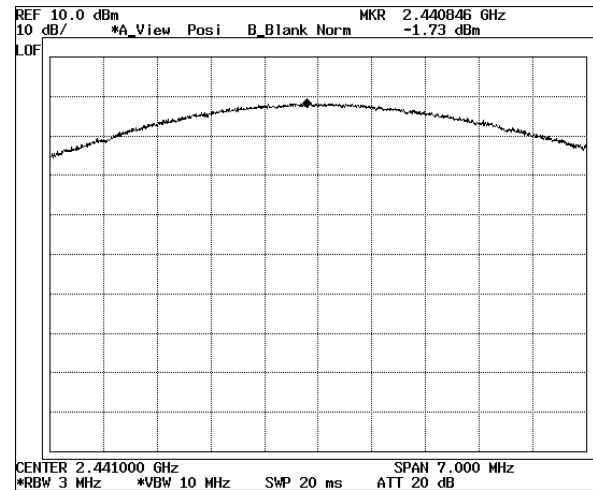
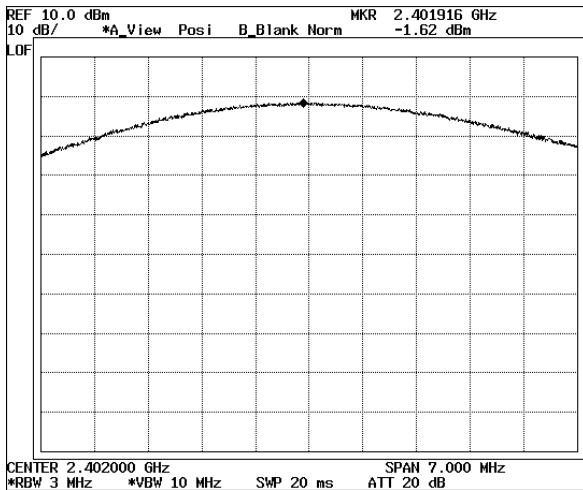
Product	WCS-232 Ver5.0
Test Item	Peak Power Output
Test Mode	Tx / Channel 0, 39, 78
Test Site	RF Room
Measurement Method	Conducted

3DH5

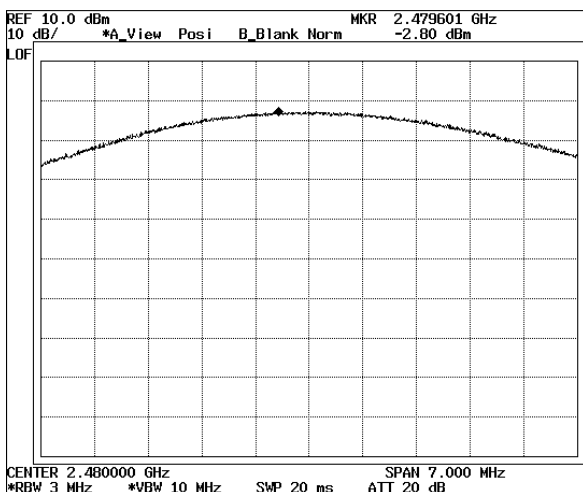
Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
0	2402	-1.62	1Watt=30dBm	Pass
39	2441	-1.73	1Watt=30dBm	Pass
78	2480	-2.80	1Watt=30dBm	Pass

Channel 0

Channel 39



Channel 78



Note : Measurement level = reading level + correct factor

Conducted Spurious Emissions &

Band Edge

◆ **TEST Equipment**

The following test equipment are used during the test:

Item	Equipment	Manufacturer	Model no/Serial No.	Last Cal.
1	Spectrum Analyzer	ADVANTEST	R3273 / 95090431	Oct. 10, 2012
2	RF ROOM			

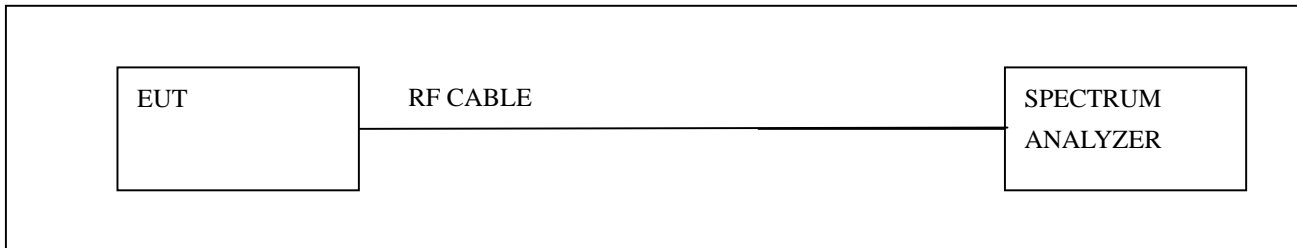
Note : All equipment upon which need to calibrated are with calibration period of 1 year.

◆ **Limits**

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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 emission 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)(see Section 15.205(c)).

◆ **Test Setup**



◆ **Test Procedure**

The transmitter output is connected to the Spectrum analyzer.

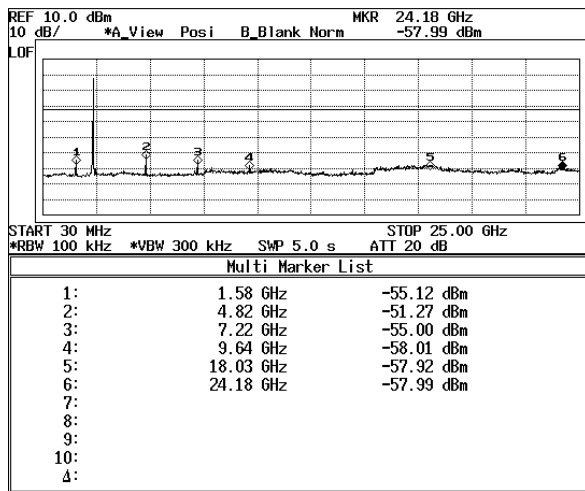
According to FCC CFR Title 47 Part 15 Subpart C Section 15.247

Conducted Spurious Emission Test result

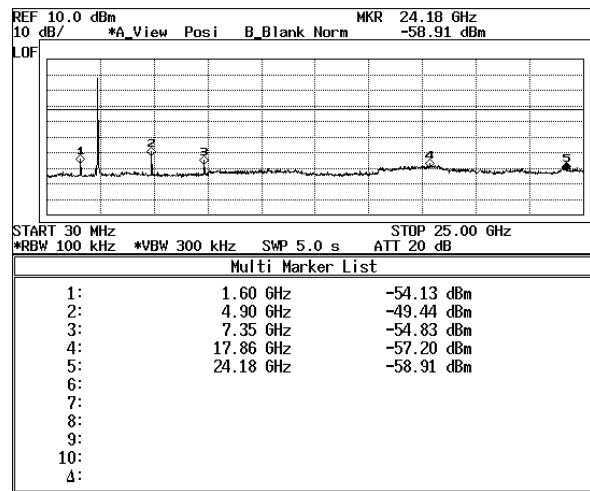
Product	WCS-232 Ver5.0
Test Item	Conducted Spurious Emission
Test Mode	Tx / Channel 0, 39, 78, Hopping
Test Site	RF Room
Measurement Method	Conducted

DH5

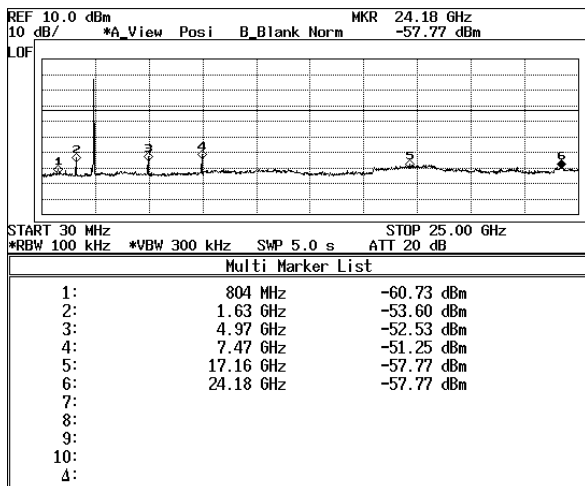
Channel 0 (2402 MHz)



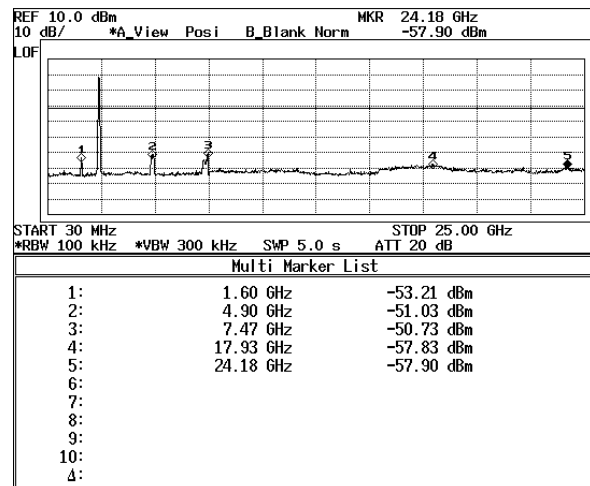
Channel 39 (2441 MHz)



Channel 78 (2480 MHz)



Hopping mode

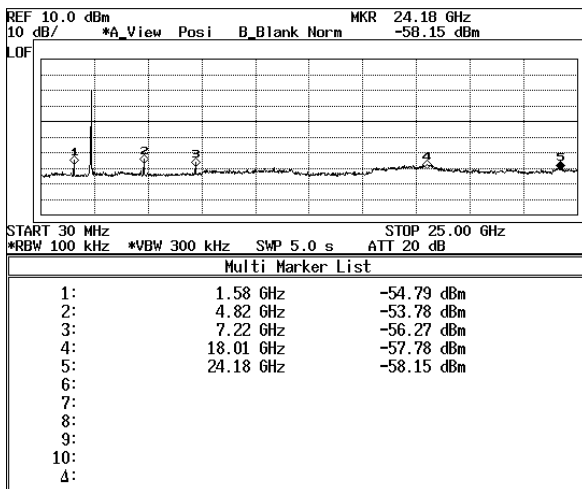


Conducted Spurious Emission Test result

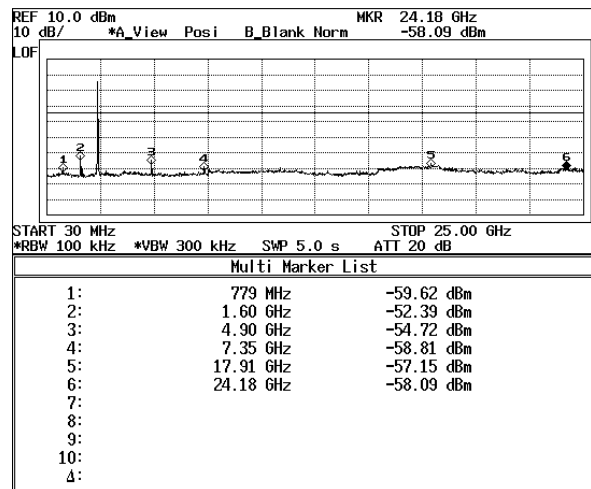
Product	WCS-232 Ver5.0
Test Item	Conducted Spurious Emission
Test Mode	Tx / Channel 0, 39, 78, Hopping
Test Site	RF Room
Measurement Method	Conducted

3DH5

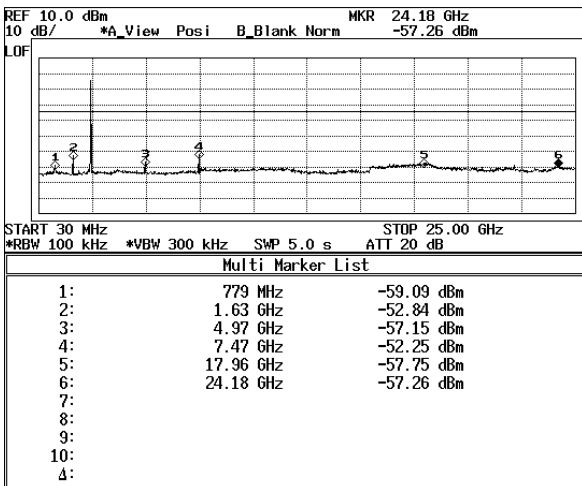
Channel 0 (2402 MHz)



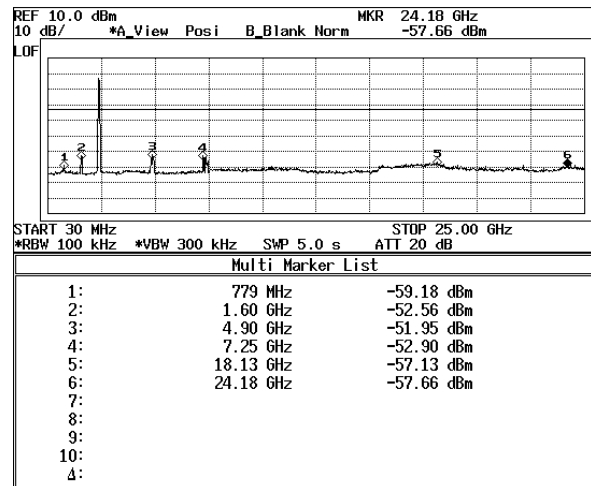
Channel 39 (2441 MHz)



Channel 78 (2480 MHz)



Hopping mode



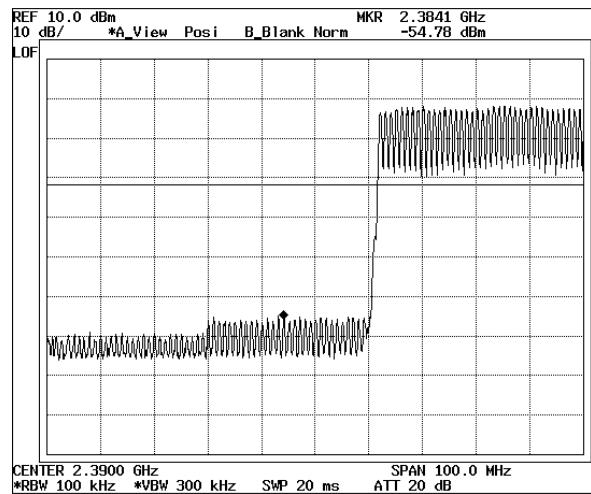
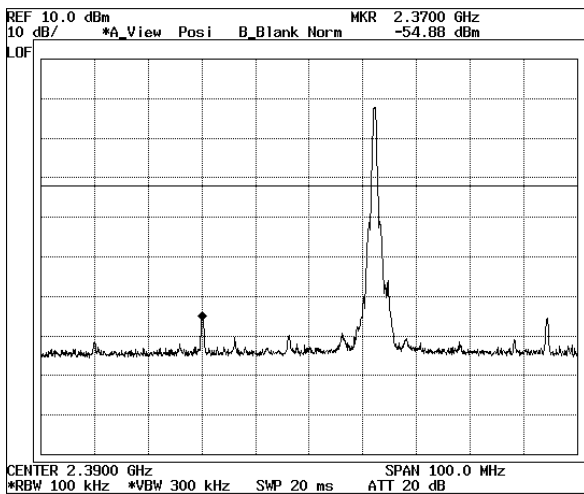
Band Edge Test result

Product	WCS-232 Ver5.0
Test Item	Band Edge
Test Mode	Tx / Channel 0, 39, 78, Hopping
Test Site	RF Room
Measurement Method	Conducted

DH5

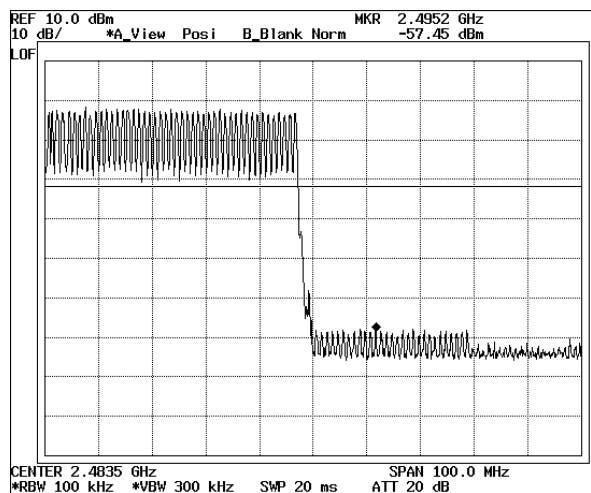
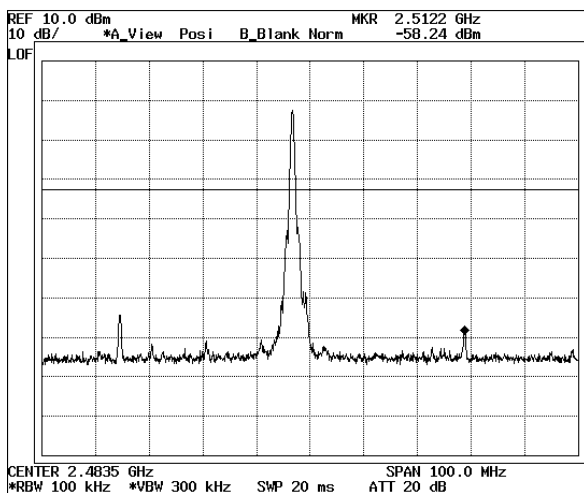
Channel : 0 CH(2402 MHz)

Hopping mode



Channel : 78 CH(2480 MHz)

Hopping mode



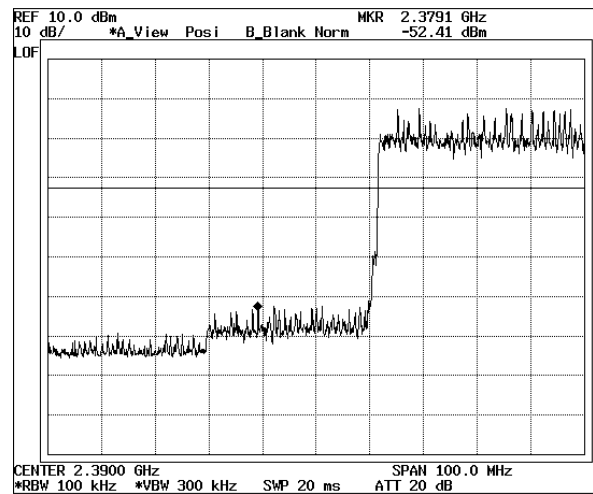
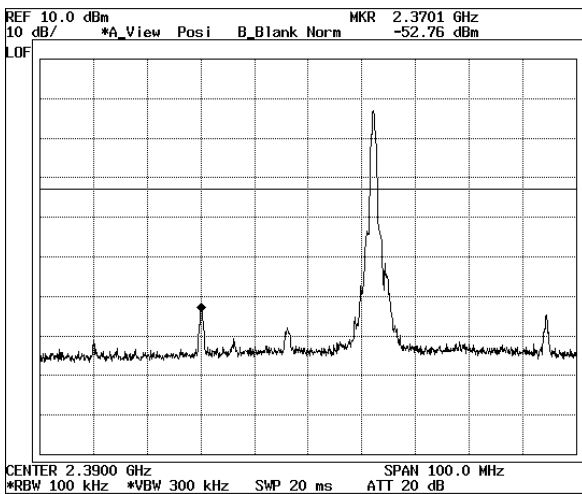
Band Edge Test result

Product	WCS-232 Ver5.0
Test Item	Band Edge
Test Mode	Tx / Channel 0, 39, 78, Hopping
Test Site	RF Room
Measurement Method	Conducted

3DH5

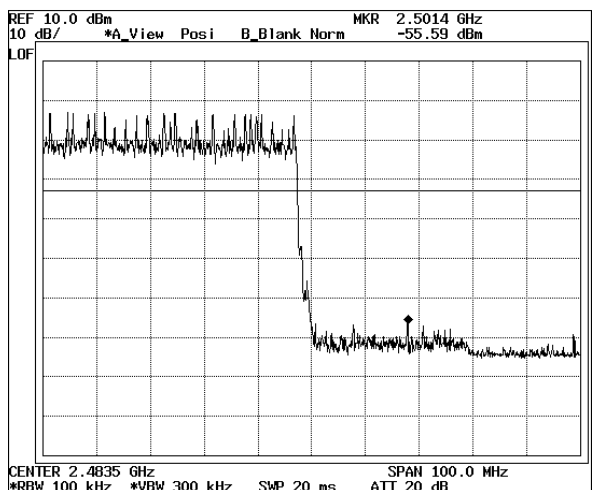
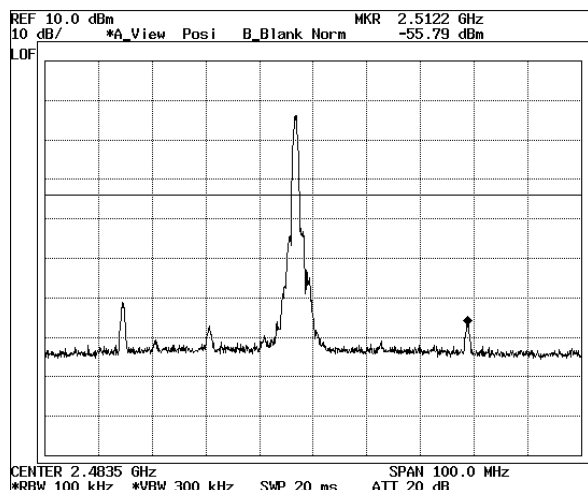
Channel : 0 CH(2402 MHz)

Hopping mode



Channel : 78 CH(2480 MHz)

Hopping mode



Frequency Separation &

20dB Bandwidth/Occupied Bandwidth

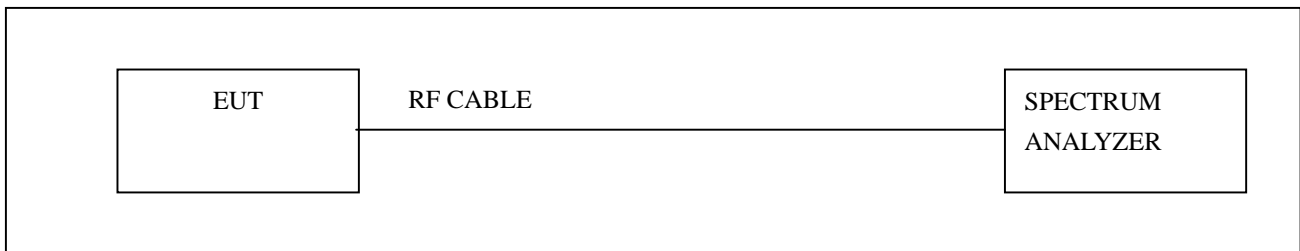
◆ Test Equipment

The following test equipment are used during the test:

Item	Equipment	Manufacturer	Model no/Serial No.	Last Cal.
1	Spectrum Analyzer	ADVANTEST	R3273 / 95090431	Oct.10, 2012
2	RF ROOM			

Note : All equipment upon which need to calibrated are with calibration period of 1 year.

◆ Test Setup



◆ Limits

According to 15.247(a)(1), Frequency hopping systems operation in the 2400-2483.5 MHz band may have hopping carrier frequencies that are separated by 25 KHz or two-third of 20 dB band width of hopping channel, is greater.

◆ Test Procedure

The transmitter output is connected to the Spectrum analyzer.

According to FCC CFR Title 47 Part 15 Subpart C Section 15.247

20dB BandWidth Test result

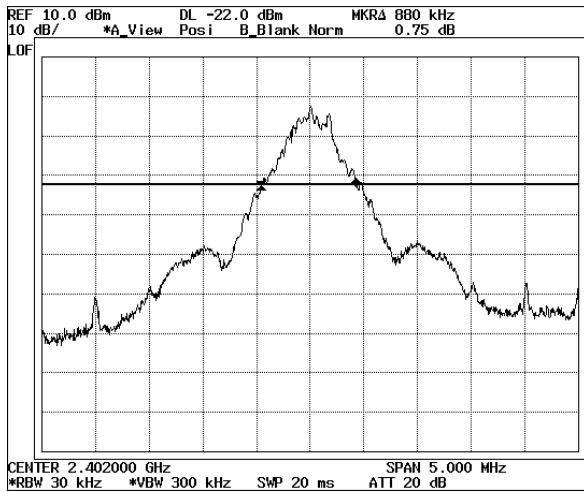
Product	WCS-232 Ver5.0
Test Item	20dB BandWidth
Test Mode	Tx / Channel 0, 39, 78
Test Site	RF Room
Measurement Method	Conducted

20dB Bandwidth

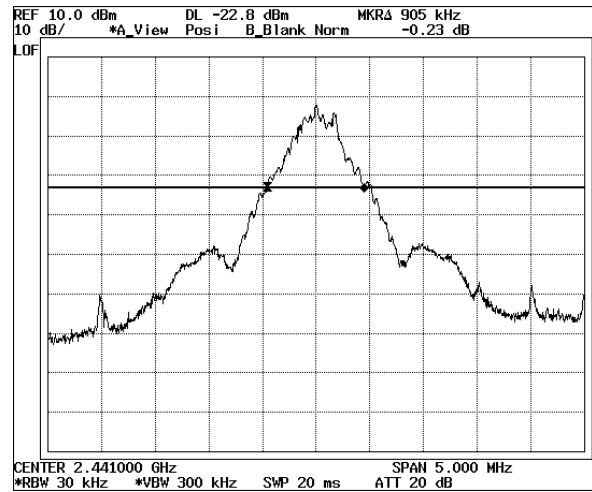
DH5

Channel	20dB Band width (KHz)	Result
Low CH	880	Pass
Middle CH	905	
High CH	905	

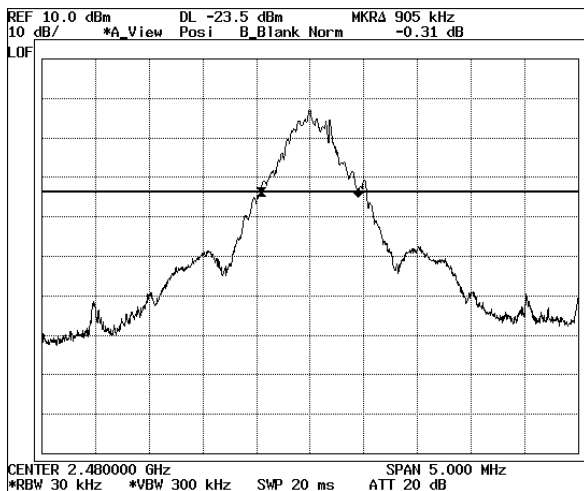
Low Channel



Mid Channel



High Channel



20dB BandWidth Test result

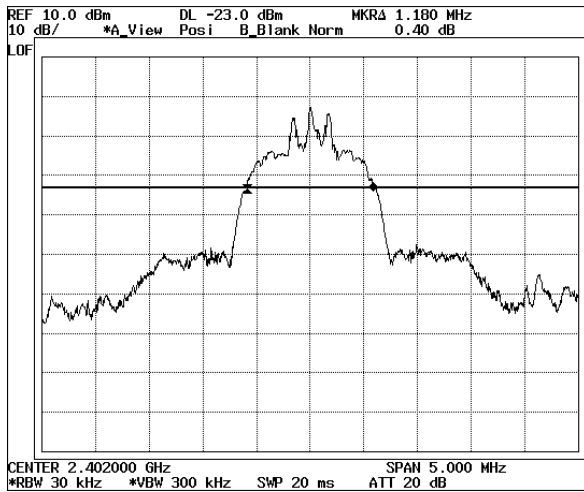
Product	WCS-232 Ver5.0
Test Item	20dB BandWidth
Test Mode	Tx / Channel 0, 39, 78
Test Site	RF Room
Measurement Method	Conducted

20dB Bandwidth

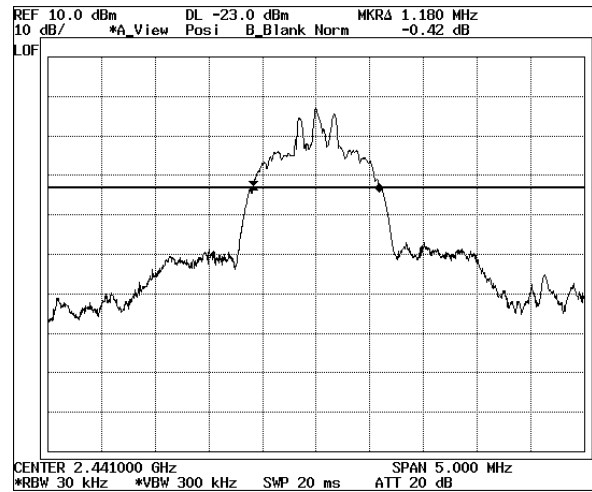
3DH5

Channel	20dB Band width (KHz)	Result
Low CH	1180	Pass
Middle CH	1180	
High CH	1180	

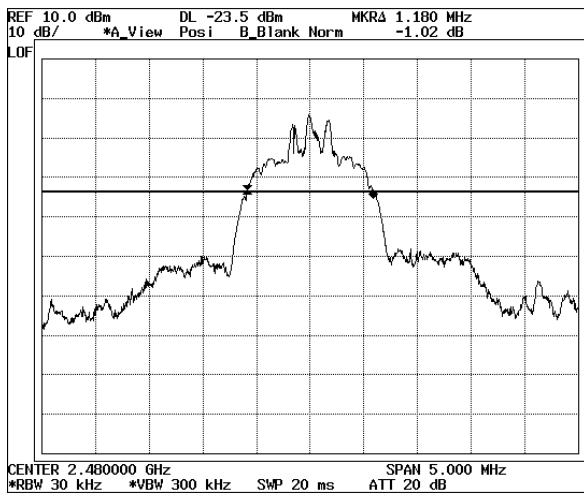
Low Channel



Mid Channel



High Channel



Channel Separation Test result

Product	WCS-232 Ver5.0
Test Item	Channel Separation
Test Mode	Transmit
Test Site	RF Room
Measurement Method	Conducted

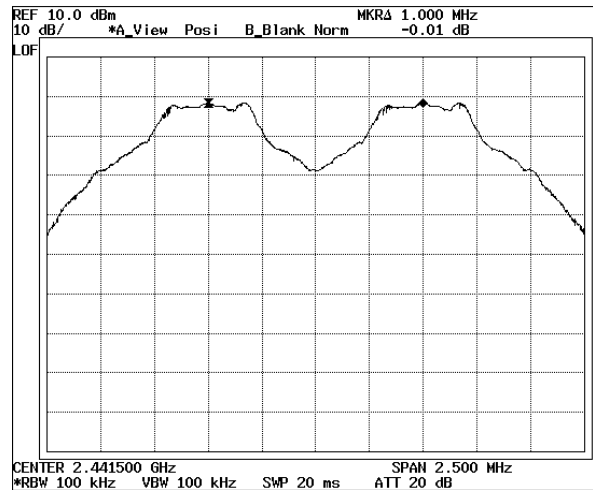
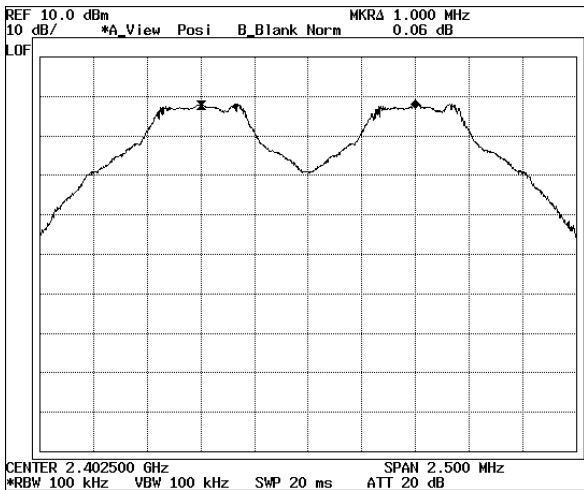
Channel Separation

DH5

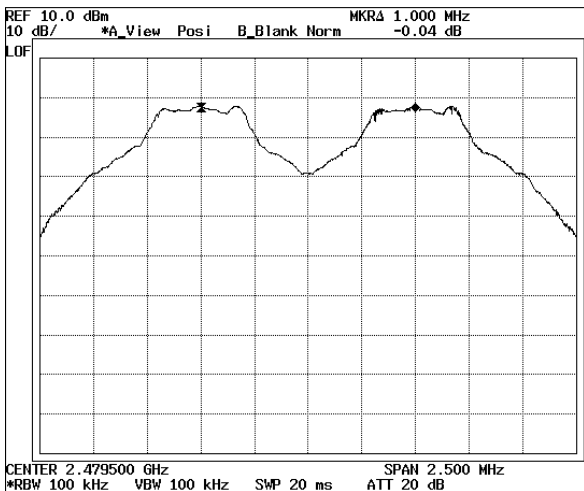
Channel	Channel Separation (KHz)	20dB bandwidth (KHz)	Limit (KHz)	Result
Low CH	1000	880	>25 or >2/3 of the 20dB BW	Pass
Middle CH	1000	905		
High CH	1000	905		

Low Channel

Mid Channel



High Channel



Channel Separation Test result

Product	WCS-232 Ver5.0
Test Item	Channel Separation
Test Mode	Transmit
Test Site	RF Room
Measurement Method	Conducted

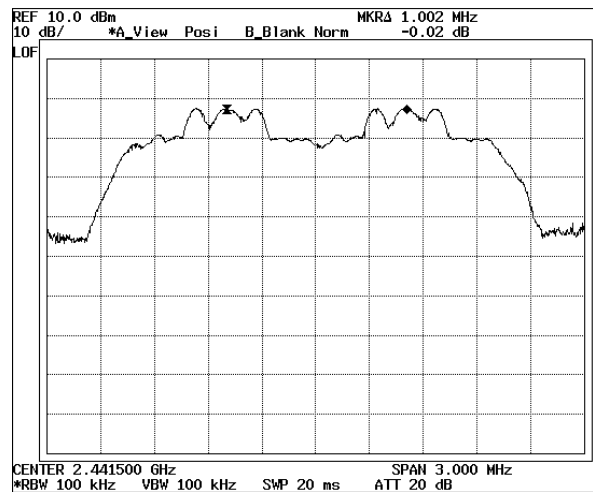
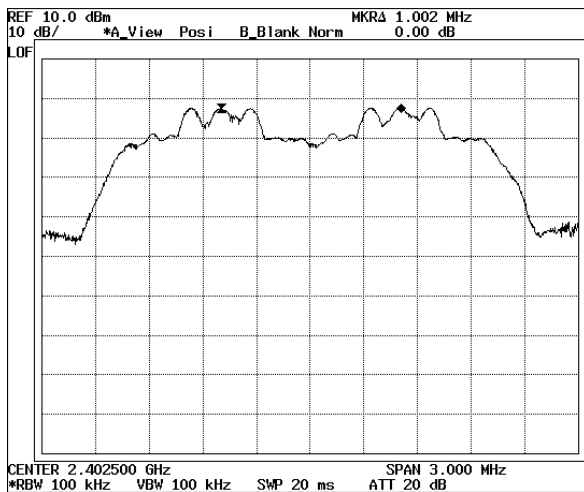
Channel Separation

3DH5

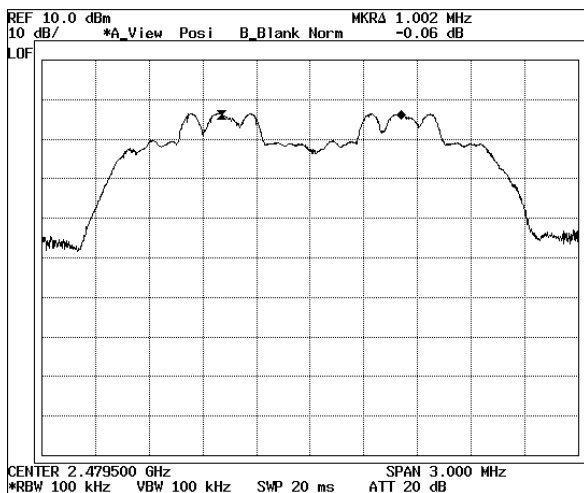
Channel	Channel Separation (KHz)	20dB bandwidth (KHz)	Limit (KHz)	Result
Low CH	1002	1180	>25 or >2/3 of the 20dB BW	Pass
Middle CH	1002	1180		
High CH	1002	1180		

Low Channel

Mid Channel



High Channel



Occupied BandWidth Test result

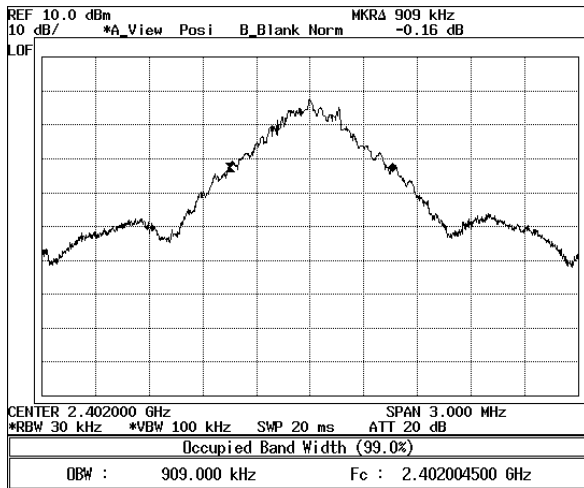
Product	WCS-232 Ver5.0
Test Item	Occupied Bandwidth
Test Mode	Transmit
Test Site	RF Room
Measurement Method	Conducted

Occupied Bandwidth(99%)

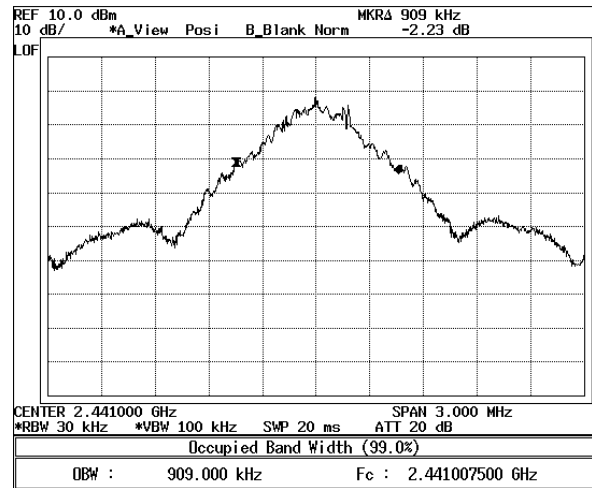
DH5

Channel	99% BW(KHz)	Result
Low CH	909	Pass
Middle CH	909	
High CH	918	

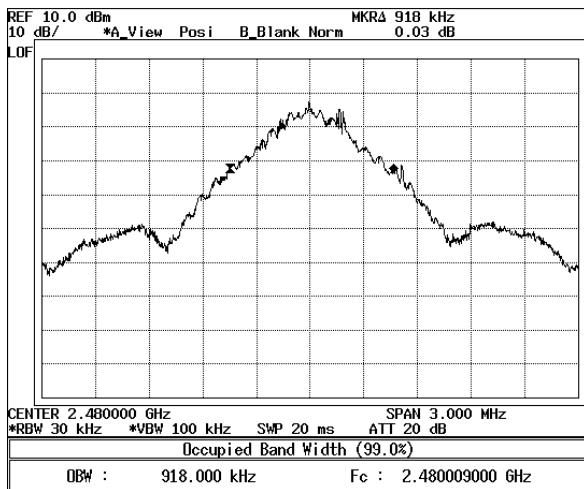
Low Channel



Mid Channel



High Channel



Occupied BandWidth Test result

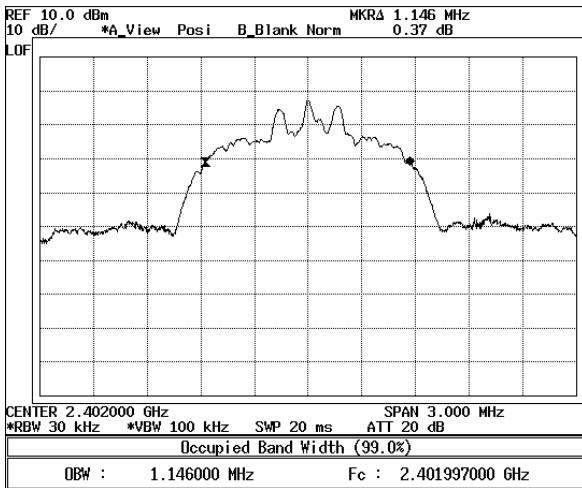
Product	WCS-232 Ver5.0
Test Item	Occupied Bandwidth
Test Mode	Transmit
Test Site	RF Room
Measurement Method	Conducted

Occupied Bandwidth(99%)

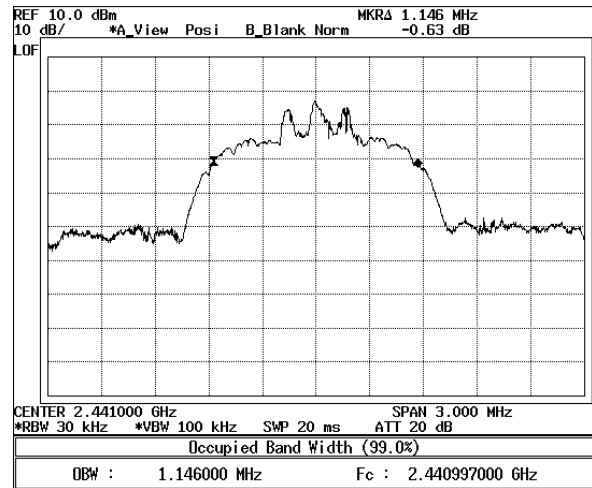
3DH5

Channel	99% BW(KHz)	Result
Low CH	1146	Pass
Middle CH	1146	
High CH	1143	

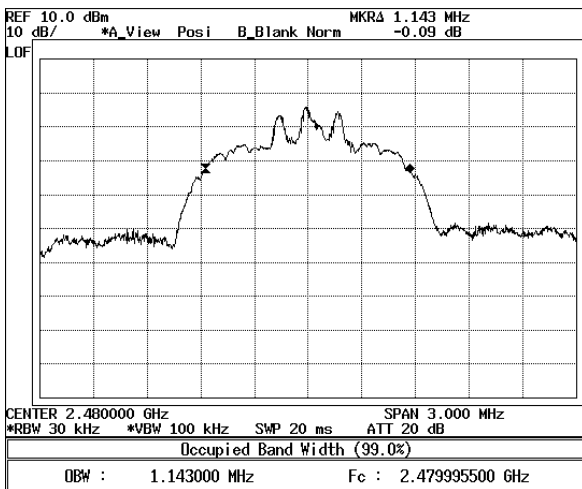
Low Channel



Mid Channel



High Channel



Number of Hopping Frequency

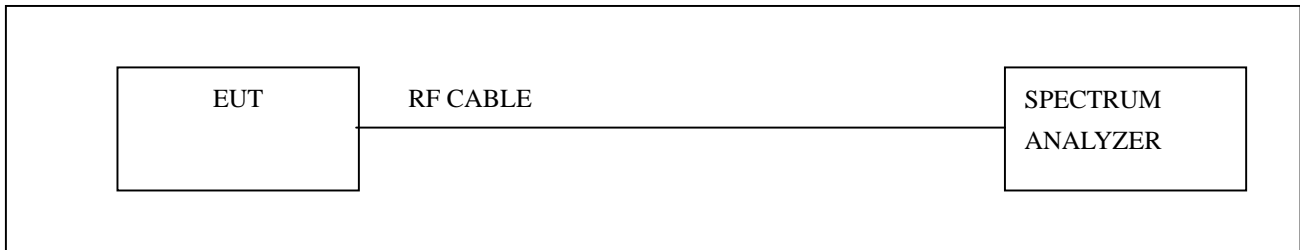
◆ Test Equipment

The following test equipment are used during the test:

Item	Equipment	Manufacturer	Model no/Serial No.	Last Cal.
1	Spectrum Analyzer	ADVANTEST	R3273 / 95090431	Oct.10, 2012
2	RF ROOM			

Note : All equipment upon which need to calibrated are with calibration period of 1 year.

◆ Test Setup



◆ Limits

According to 15.247(a)(1)(ii), Frequency hopping systems operation in the 2400-2483.5 MHz bands shall use at least 15 hopping frequencies.

◆ Test Procedure

The transmitter output is connected to the Spectrum analyzer.

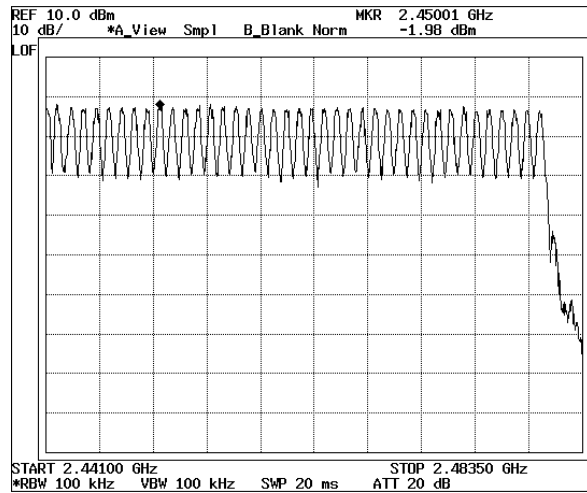
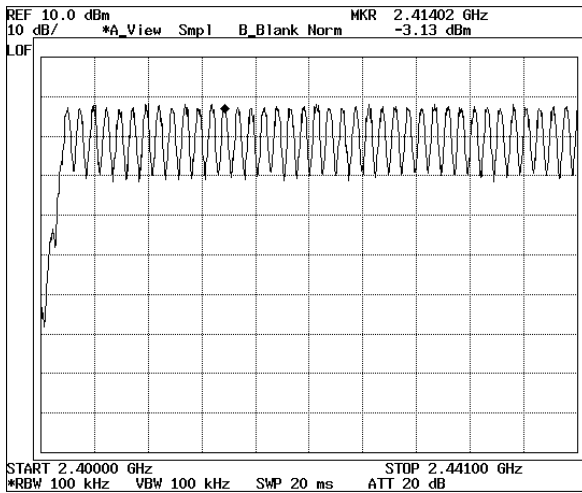
According to FCC CFR Title 47 Part 15 Subpart C Section 15.247

Number of Hopping Frequency Test result

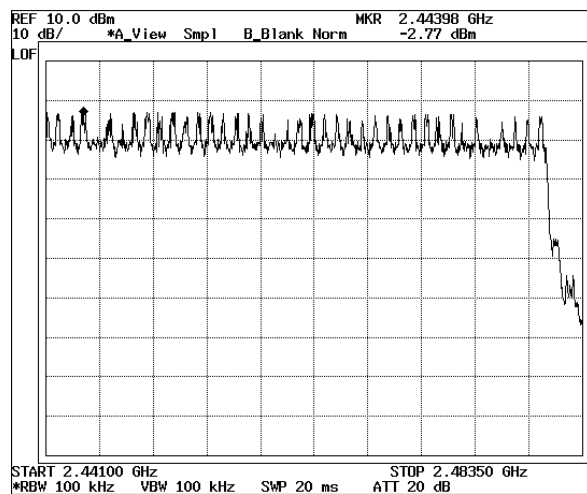
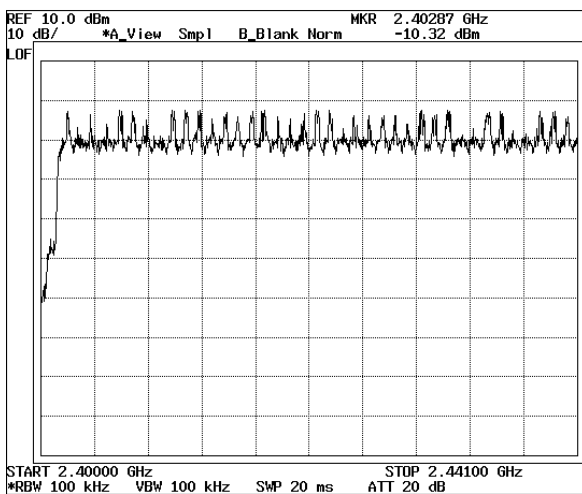
Product	WCS-232 Ver5.0
Test Item	Number of Hopping Frequency
Test Mode	Transmit
Test Site	RF Room
Measurement Method	Conducted

Channel (No. of channel)	Limit (No. of channel)	Result
79	>15	Pass

DH5



3DH5



Time of Occupancy(Dwell Time)

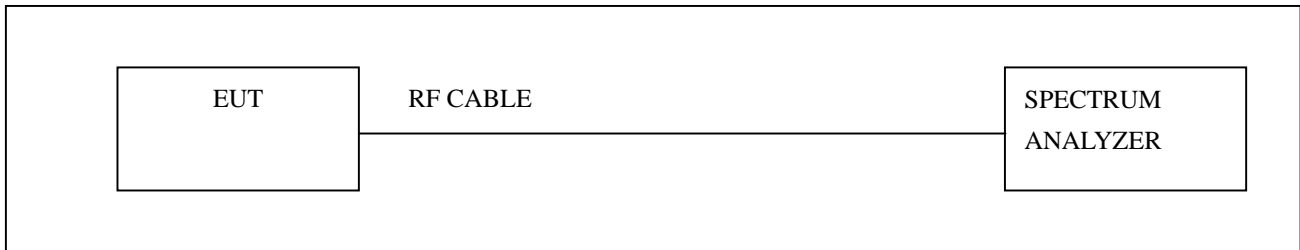
◆ Test Equipment

The following test equipment are used during the test:

Item	Equipment	Manufacturer	Model no/Serial No.	Last Cal.
1	Spectrum Analyzer	ADVANTEST	R3273 / 95090431	Oct. 10, 2012
2	RF ROOM			

Note : All equipment upon which need to calibrated are with calibration period of 1 year.

◆ Test Setup



◆ Limits

According to 15.247(a)(1)(iii), Frequency hopping systems operating in the 2400-2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4s within a period 0.4s multiplied by the number of hopping channels employed.

◆ Test Procedure

The transmitter output is connected to the Spectrum analyzer.

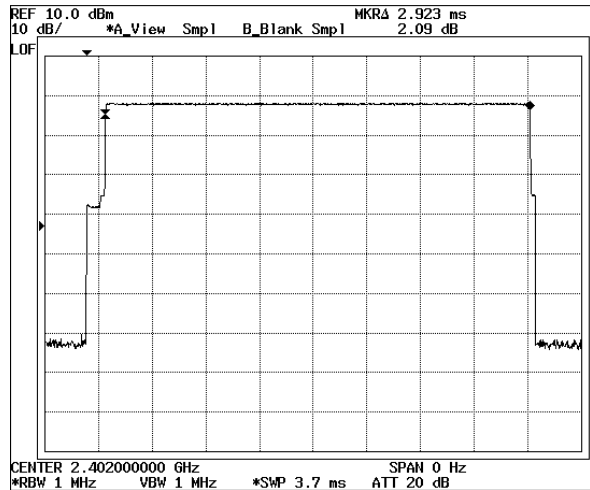
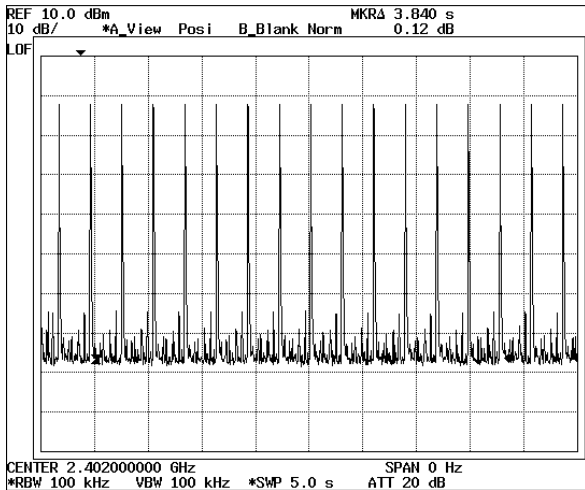
According to FCC CFR Title 47 Part 15 Subpart C Section 15.247

Dwell time Test result

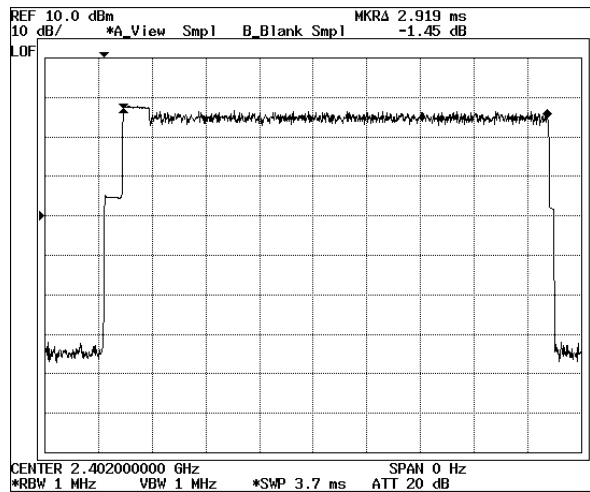
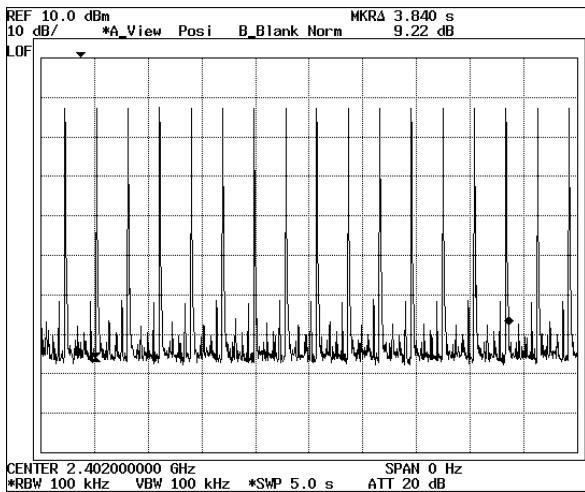
Test Item	Dwell Time
Test Mode	Transmit
Test Site	RF Room
Measurement Method	Conducted

Mode	Number of transmission in a 31.6	Length of transmission time(ms)	Result (ms)	Limit (ms)	Result
DH5	17(times/5s) *6.32 = 107.44times	2.923	314.047	400	Pass
3DH5	17(times/5s) *6.32 = 107.44times	2.919	313.617		Pass

DH5



3DH5



Note : High, Low and mid channels have same length of transmission time.

Antenna requirements

According to FCC 47 CFR 15.203

“an intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached or an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section”

- * the antenna of this EUT is a unique(SMA Female).
- * the EUT complies with the requirement of 15.203

