CERTIFICATION TEST REPORT

FCC CFR47 Part 15 Subpart C

Test Report File No.	13-IST-0862	■ Basic	☐ Alternate
Date of Receipt	November 20, 2013	Begin of test date	November 26, 2013
Date of Issue	December 18, 2013	End of test date	December 15, 2013
Kind of Product	iLOG		
Model(s)	iLOG-Strain		
FCC ID	2ABHGILOG-STRAIN		
Applicant	Smart Control & Sensing		
Address	C-425,Migun Techno WorldⅡ, Yongsan-dong Yuseong-gu Daejeon, 305-500 Republic of Korea		
Manufacturer	Smart Control & Sensing		
Address	C-425,Migun Techno WorldⅡ, Yongsan-dong Yuseong-gu Daejeon, 305-500 Republic of Korea		

Test Result ■ **Positive** ☐ **Negative**

Tested By

B.O. KO.

Reviewed By

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 38 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.

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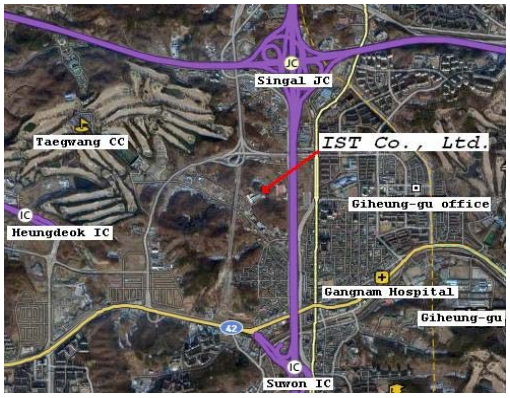
Note:

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

Battery	Lithium Ion battery (3.7 V, 300 mA) Charge voltage (Min 4.2 V/ 5 V /Max 7.5 V) Duration 5 Hours
Size	64 X 50 X 18 mm
Weight	65 g
Operating Temperature range	0 ~ 40 °C
Sampling rate	50 ~ 800 Hz
Internal flash	2 MB
Sensor	Resolution: 0.039 mV Input Range: 0 ~ 948 mV(Bipolar type) 1.22 ~ 3.78 V(voltage type) Export voltage: 5 V
RF	Bluetooth (CSR)

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
AC Conducted Emission	15.207	Compliant
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

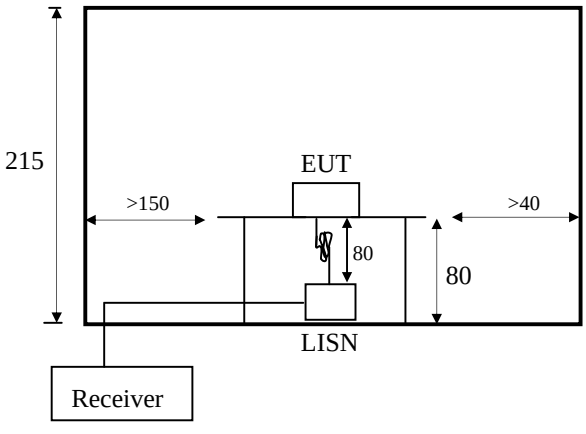
Descriptions of Test

Conducted Emissions:

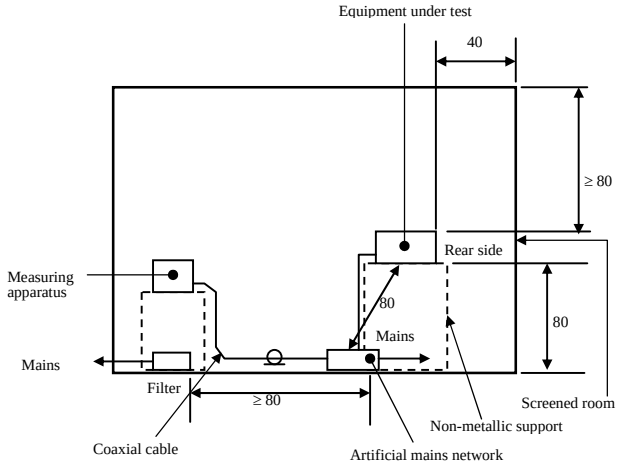
The measurement were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω/50 uH LISN as the input transducer to a Spectrum Analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 10 kHz or for "quasi-peak" & "Average" within a bandwidth of 9 KHz.

-Procedure of Test

The line-conducted facility is located inside a shielded room No.1. A 1 m X 1.5 m wooden table 80 cm height is placed 40 cm away from the vertical wall and 1.5 m away from the other wall of the shielded room. The R/S ESCI and Hyup-Rip KNW-407 LISN are bonded to bottom of the shielded room. The EUT is located on the wooden table with distance more than 80 cm from the LISN and powered from the EMCO LISN .The peripheral equipment is powered from the other LISN. Power to the LISNs are filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner ϕ 1.2 cm. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the EMCO LISN. All interconnecting cables more than 1m were shortened by non-inductive bundling to a 1m length. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating conditions. The RF output of the LISN was connected to the R/S receiver to determine the frequency producing the maximum emission from the EUT. The frequency producing the maximum level was reexamined using Quasi-Peak mode by manual measurement, after scanned by automatic Peak mode for frequency range from 0.15 to 30 MHz. The bandwidth of the receiver was set to 10 kHz. The EUT, peripheral equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission.



< Side View >



< Concept Drawing >

Limits

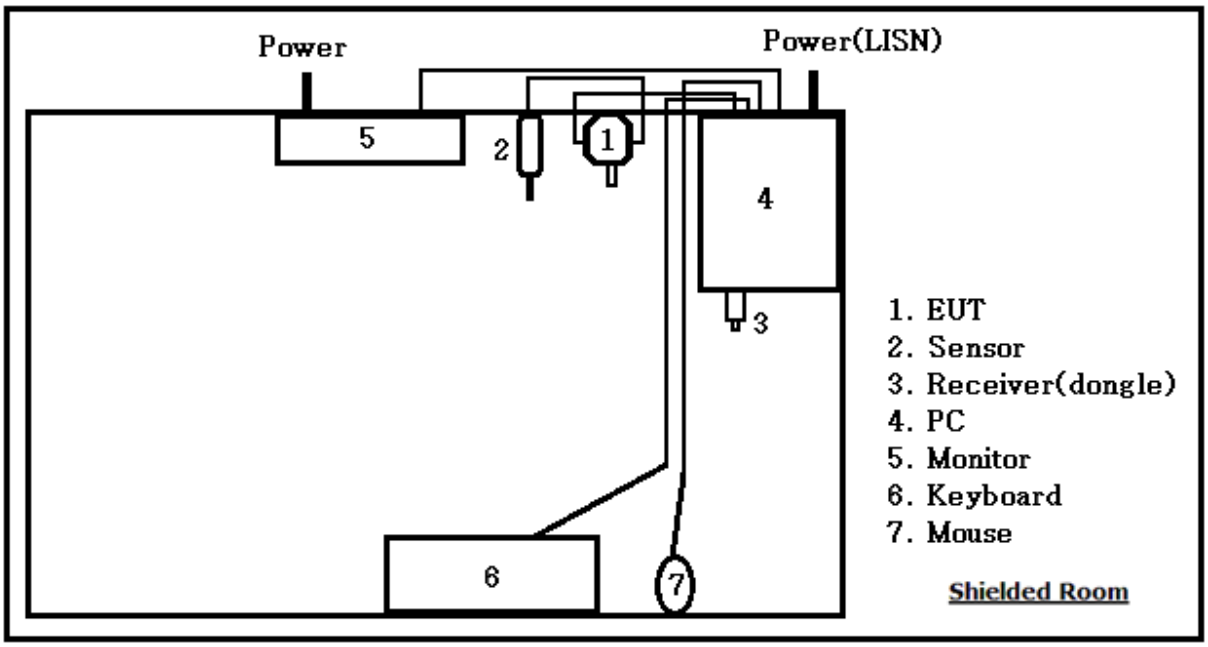
According to ∮15.207(a) except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network(LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Limits	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

* Decreases with the logarithm of the frequency.

Test specification.
According to FCC CFR Title 47 Part 15 Subpart C Section 15.207

Test Set-Up



Conducted Emissions

[Not Applicable]

◆ Test Equipment Used

Model Name	Description	Manufacturer	Due for Cal	Serial No.
ESCI	Test Receiver	Rohde & Schwarz	Jul. 16, 2014	100373
ESH2-Z5	LISN	Rohde & Schwarz	Oct. 08, 2014	842966/014
ESH3-Z2	Pulse Limiter	Rohde & Schwarz	May. 10, 2014	357.8810.52

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

◆ Configuration of the equipment under test :

Equipment	Type	Brand	Serial No.
EUT	iLOG-Strain	Smart Control & Sensing	000027
PC	DB400T2A	Samsung Electronics	J9QL98CCCA0002P
Monitor	1708FP1	Dell lnc.	7735431695P0C
Sensor	CDP-50	Tokyo Sokki Kenkyujo	518138
Receiver(dongle)	Parani-UD100	Sena Technologies, lnc.	S7APARANIUD100
Keyboard	SKG-3300UB	Samsung Electronics	TAKCB00378
Mouse	M-UV96	HP	E-C011-030-5046

Connecting Interface Cables :

Mouse cable (Unshielded) : 1.8 m
Keyboard cable (Unshielded) : 1.8 m
DC Power cable(EUT) (Unshielded) : 1 m
VGA cable(Monitor)(Unshielded) : 1.8 m
AC Power cable(Monitor)(Unshielded) : 1.5 m
AC Power cable(PC)(Unshielded) : 1.5 m
Sensor cable(Unshielded) : 1.3 m

◆ Test Conditions

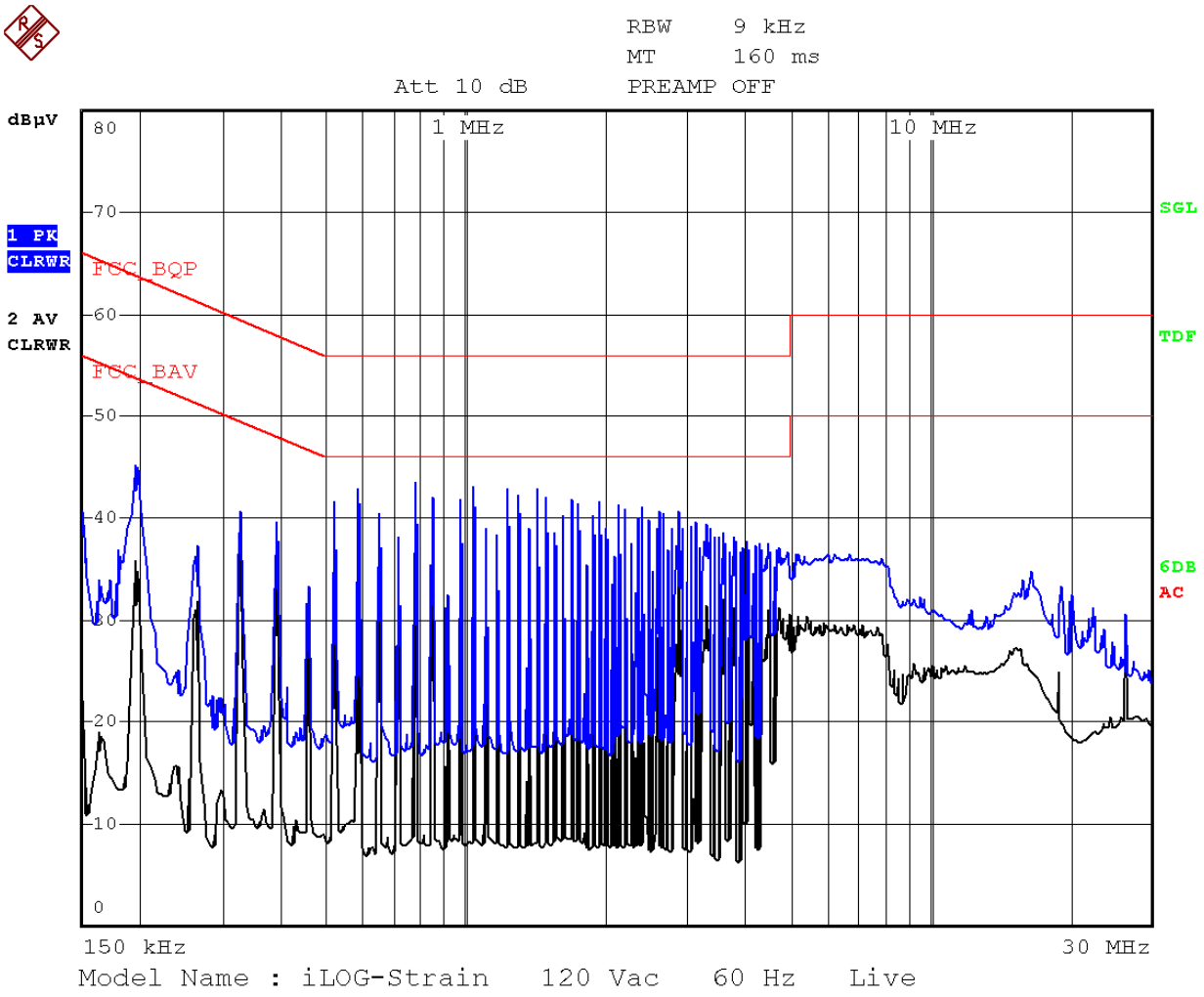
Temperature (20.8 ± 0.2) ℃
Humidity (52.3 ± 0.3) % R.H.
Atmosphere (1011) mbar

◆ Test Date December. 03, 2013

◆ Test Area Conducted Room #1

Conducted Emissions

Live Line

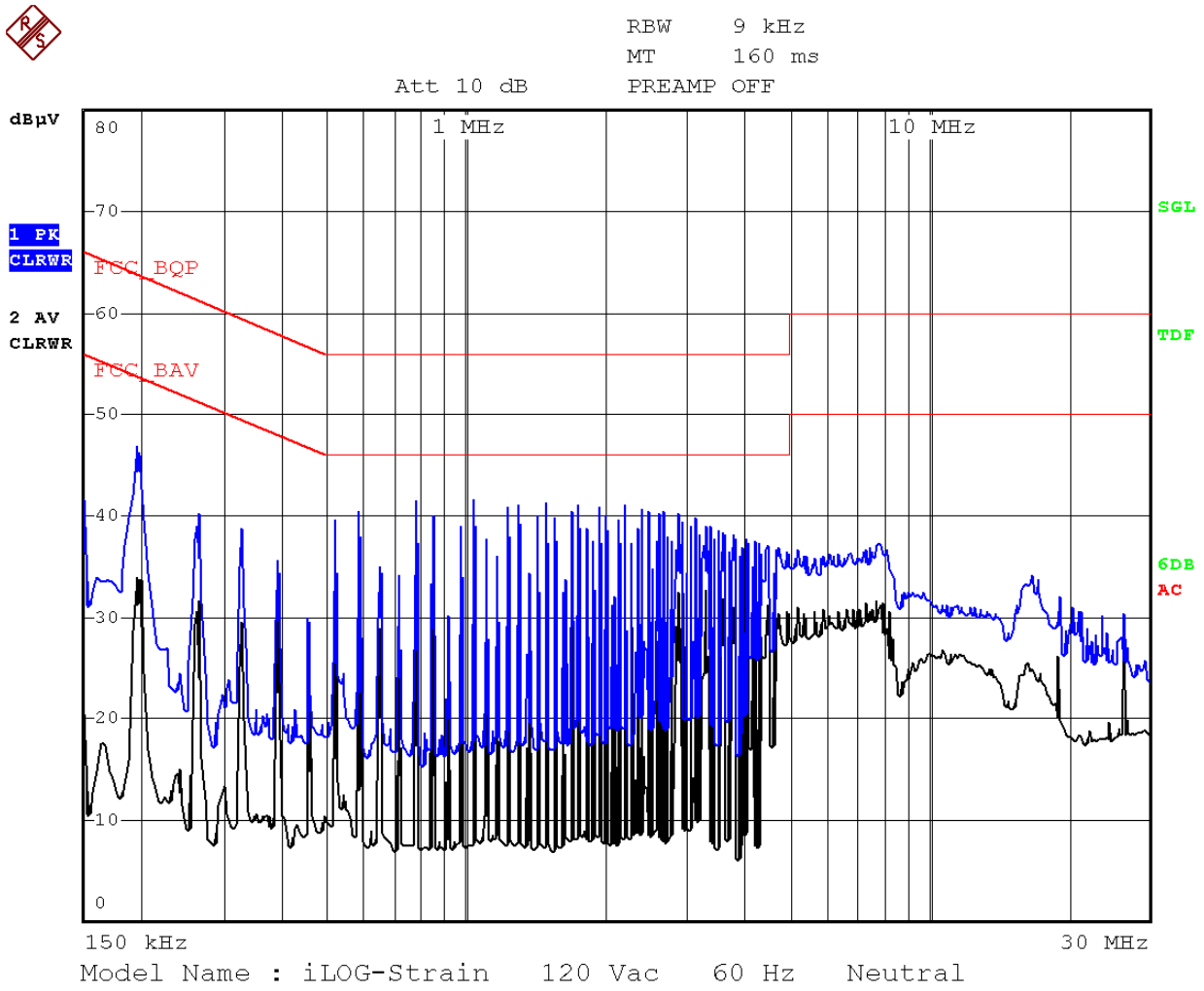


Freq. [MHz]	Measurement [dB µV]		Limit [dB µV]		Insertion Loss	Cable Loss	Result [dB µV]		Margin [dB]	
	Q-peak	Average	Q-peak	Average	[dB]	[dB]	Q-peak	Average	Q-peak	Average
0.194	44.01	35.34	63.86	53.86	0.12	0.02	44.15	35.48	19.71	18.38
0.326	39.24	36.41	59.55	49.55	0.13	0.03	39.40	36.57	20.15	12.98
0.390	39.27	35.52	58.06	48.06	0.13	0.05	39.45	35.70	18.62	12.37
0.586	42.21	38.44	56.00	46.00	0.14	0.04	42.39	38.62	13.61	7.38
0.782	42.83	38.81	56.00	46.00	0.15	0.06	43.04	39.02	12.96	6.98
1.042	42.64	38.12	56.00	46.00	0.16	0.05	42.85	38.33	13.15	7.67

Note :

Conducted Emissions

Neutral Line



Freq. [MHz]	Measurement [dB µV]		Limit [dB µV]		Insertion Loss	Cable Loss	Result [dB µV]		Margin [dB]	
	Q-peak	Average	Q-peak	Average	[dB]	[dB]	Q-peak	Average	Q-peak	Average
0.150	34.21	21.24	66.00	56.00	0.11	0.03	34.35	21.38	31.65	34.62
0.194	45.93	35.16	63.86	53.86	0.12	0.02	46.07	35.30	17.79	18.56
0.262	38.27	31.35	61.37	51.37	0.12	0.03	38.42	31.50	22.95	19.87
0.586	39.42	34.02	56.00	46.00	0.14	0.04	39.60	34.20	16.40	11.80
0.782	40.34	34.43	56.00	46.00	0.15	0.06	40.55	34.64	15.45	11.36
1.042	40.92	35.01	56.00	46.00	0.16	0.05	41.13	35.22	14.87	10.78

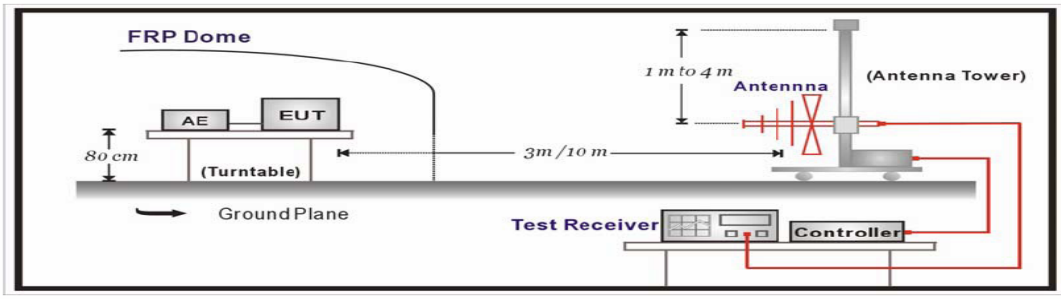
Note:

Descriptions of Test

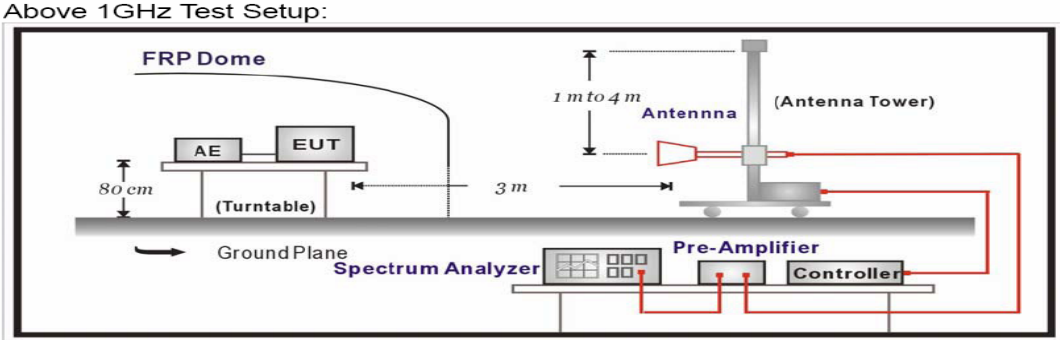
Radiated Emissions:

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.)

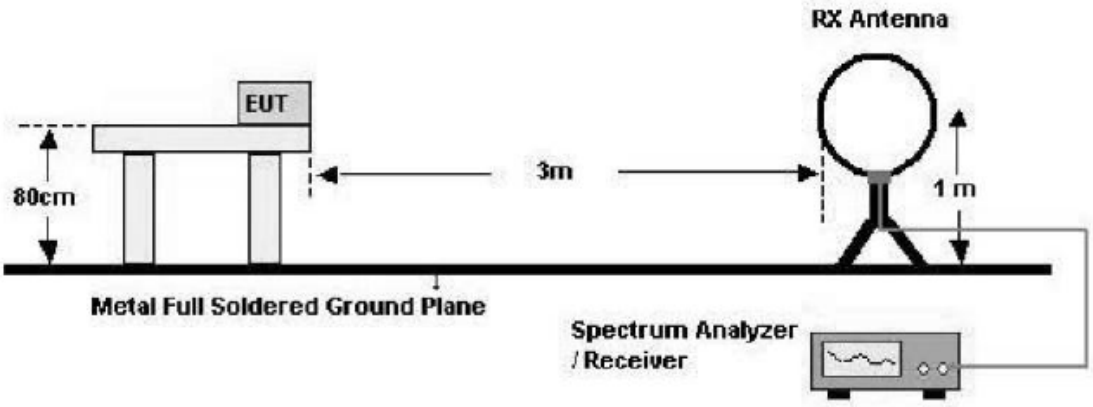
Under 1GHz Test Setup:



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)	μV/meter	dBμV/meter(3m)
0.009-0.490	2400/F(KHz) at 300 m	20log 2400/F(KHz)+80
0.490-1.705	24000/F(KHz)at 30m	20log 24000/F(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)=20log RF Voltage(uV)
2. dBuV/m = ERP(dBm)+106.92 dB + 20log(10m/3m) + 2.15dB(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	Due for Cal	Serial Number
ESCS30	EMI Receiver	Rohde & Schwarz	May 10, 2014	100171
SPECTRUM ANALYZER	R3273	ADVANTEST	Oct. 07, 2014	95090431
Loop Antenna	HFH2-Z2	Rohde & Schwarz	Oct. 26, 2014	8620771017
Log-bicon Antenna	VULB9161SE	Schwarz beck	Mar. 28, 2014	3047
HORN-Antenna	3115	EMCO	Oct. 25, 2015	9012-3602
PRE AMPLIFIER	8449B OPT H02	Rohde & Schwarz	Oct. 08, 2014	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:

Peak = Reading + 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

Frequency	Reading	P	Ant. Factor	Cable Loss	Limit	Total	Margin
MHz	dBuV	(H, V)	dB	dB	dBuV	dBuV	dB

Note : 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	P (H, V)	Ant. Factor dB	Cable Loss dB	Limit dBuV	Total dBuV	Margin dB
*42.612	18.90	V	12.04	1.11	40.00	32.05	-7.95
70.743	14.40	H	9.93	1.41	40.00	25.74	-14.26
78.505	16.20	H	8.33	1.48	40.00	26.01	-13.99
130.881	16.30	V	12.18	1.91	43.50	30.39	-13.11
176.475	14.90	H	11.82	2.20	43.50	28.92	-14.58
234.672	16.90	V	10.86	2.61	46.00	30.37	-15.63

3DH5

Frequency MHz	Reading dBuV	P (H, V)	Ant. Factor dB	Cable Loss dB	Limit dBuV	Total dBuV	Margin dB
31.941	15.90	H	11.39	0.95	40.00	28.24	-11.76
*42.615	18.30	V	12.04	1.11	40.00	31.45	-8.55
87.234	16.60	H	7.89	1.55	40.00	26.04	-13.96
103.722	15.10	V	9.66	1.73	43.50	26.49	-17.01
236.617	17.20	V	10.92	2.62	46.00	30.74	-15.26

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 :	iLOG-Strain	PROBE :	Above 1 GHz
MODE :	DH5	NOTE :	Low Ch

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
1.426	39.87	24.41	V	74.00	54.00	34.13	29.59
1.581	45.09	24.63	V	74.00	54.00	28.91	29.37
4.813	49.12	37.82	V	74.00	54.00	24.88	16.18
1.583	48.75	24.16	H	74.00	54.00	25.25	29.84
2.204	43.40	32.86	H	74.00	54.00	30.60	21.14
4.823	50.27	35.26	H	74.00	54.00	17.73	18.74
5.792	47.49	34.53	H	74.00	54.00	26.51	19.47

Restricted Band Edge Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
2.384	46.32	23.16	V	74.00	54.00	27.68	30.84
2.384	47.98	23.64	H	74.00	54.00	26.02	30.36

EUT :	iLOG-Strain	PROBE :	Above 1 GHz
MODE :	DH5	NOTE :	Middle Ch

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
1.612	40.67	31.37	V	74.00	54.00	33.33	22.63
4.936	49.68	37.58	V	74.00	54.00	24.32	16.42
5.235	43.89	28.54	V	74.00	54.00	30.11	25.46
7.068	52.17	37.69	V	74.00	54.00	21.83	16.31
1.614	45.75	34.33	H	74.00	54.00	29.25	19.67
4.931	52.24	38.68	H	74.00	54.00	21.76	15.32
5.225	44.62	29.57	H	74.00	54.00	29.38	24.43

EUT :	iLOG-Strain	PROBE :	Above 1 GHz
MODE :	DH5	NOTE :	High Ch

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
1.645	48.97	36.42	V	74.00	54.00	25.03	17.58
4.824	57.82	39.48	V	74.00	54.00	16.18	14.52
5.343	50.32	37.53	V	74.00	54.00	23.68	16.47
7.127	51.02	37.78	V	74.00	54.00	22.98	16.22
1.645	49.83	32.54	H	74.00	54.00	24.17	21.46
4.873	57.64	40.82	H	74.00	54.00	16.36	13.18
5.421	48.72	35.54	H	74.00	54.00	25.28	18.46

Restricted Band Edge Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
2.487	48.72	35.15	V	74.00	54.00	25.28	18.85
2.487	53.54	36.23	H	74.00	54.00	20.46	17.77

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

EUT :	iLOG-Strain	PROBE :	Above 1 GHz
MODE :	3DH5	NOTE :	Low Ch

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
1.233	38.74	22.63	V	74.00	54.00	35.26	31.37
1.679	47.32	27.94	V	74.00	54.00	26.68	26.06
4.735	52.42	34.45	V	74.00	54.00	21.58	19.55
1.677	49.31	26.25	H	74.00	54.00	24.69	27.75
2.245	41.27	29.76	H	74.00	54.00	32.73	24.24
4.737	55.36	37.34	H	74.00	54.00	18.64	16.66
5.813	47.32	32.26	H	74.00	54.00	26.68	21.74

Restricted Band Edge Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
2.387	50.73	31.43	V	74.00	54.00	23.27	22.57
2.385	51.81	30.82	H	74.00	54.00	22.19	23.18

EUT :	iLOG-Strain	PROBE :	Above 1 GHz
MODE :	3DH5	NOTE :	Middle Ch

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
1.681	41.52	30.41	V	74.00	54.00	32.48	23.59
4.834	51.34	33.57	V	74.00	54.00	22.66	20.43
5.318	40.87	28.46	V	74.00	54.00	33.13	25.54
6.992	48.73	34.28	H	74.00	54.00	25.27	19.72
1.678	40.48	29.68	H	74.00	54.00	33.52	24.32
4.812	49.52	32.97	H	74.00	54.00	24.48	21.03
5.315	42.92	31.98	H	74.00	54.00	31.08	22.02

EUT :	iLOG-Strain	PROBE :	Above 1 GHz
MODE :	3DH5	NOTE :	High Ch

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
1.667	48.04	36.41	V	74.00	54.00	25.96	17.59
4.975	57.65	39.74	V	74.00	54.00	16.35	14.26
5.635	49.62	37.22	V	74.00	54.00	24.38	16.78
8.228	50.27	36.87	H	74.00	54.00	23.73	17.13
1.659	48.25	35.61	H	74.00	54.00	25.75	18.39
4.988	52.83	38.74	H	74.00	54.00	21.17	15.26
5.624	46.32	35.23	H	74.00	54.00	27.68	18.77

Restricted Band Edge Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
2.485	47.68	39.42	H	74.00	54.00	26.32	14.58
2.485	51.54	43.34	V	74.00	54.00	22.46	10.66

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. 07, 2013
2	RF ROOM			

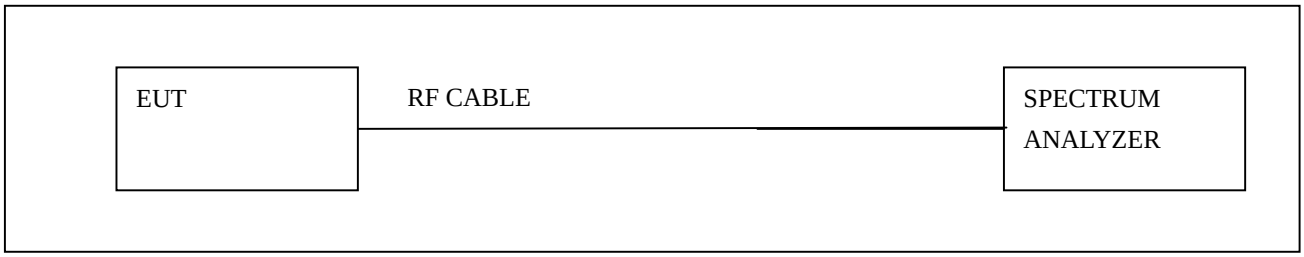
Note : All equipment upon which need to calibrated are with calibration period of 1 year.

◆ 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.

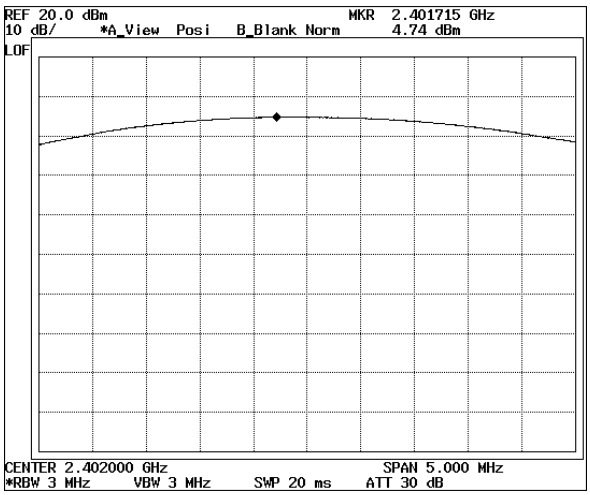
Peak Power Test result

Product	iLOG-Strain
Test Item	Peak Output Power
Test Mode	Tx / Channel 0, 39, 78
Test Site	RF Room
Measurement Method	Conducted

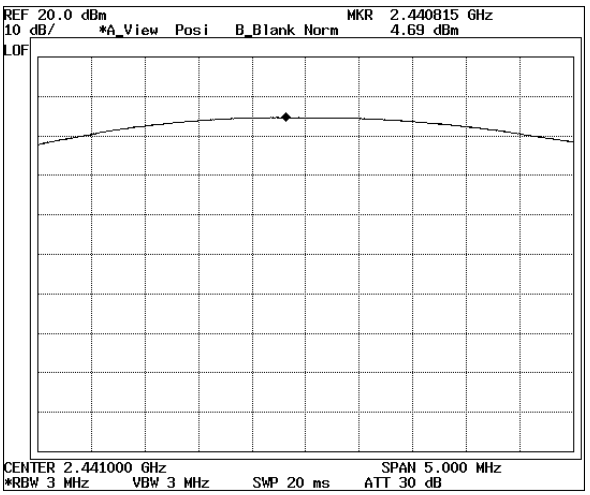
DH5

Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
0	2402	4.74	1Watt=30dBm	Pass
39	2441	4.69	1Watt=30dBm	Pass
78	2480	4.61	1Watt=30dBm	Pass

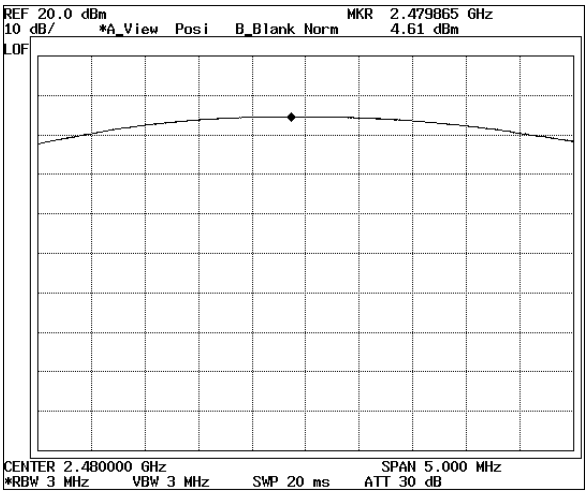
Channel 0



Channel 39



Channel 78



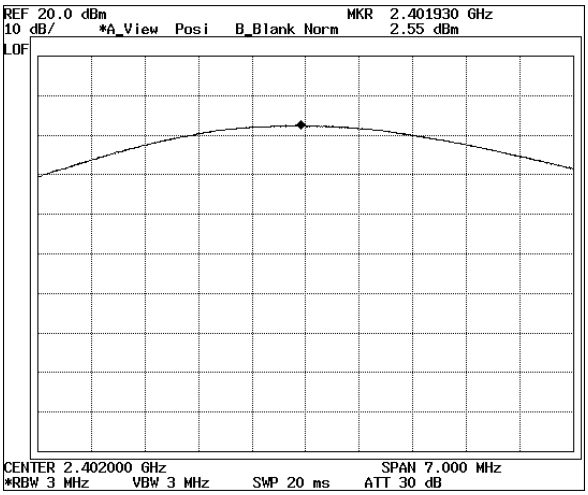
Peak Power Test result

Product	iLOG-Strain
Test Item	Peak Output Power
Test Mode	Tx / Channel 0, 39, 78
Test Site	RF Room
Measurement Method	Conducted

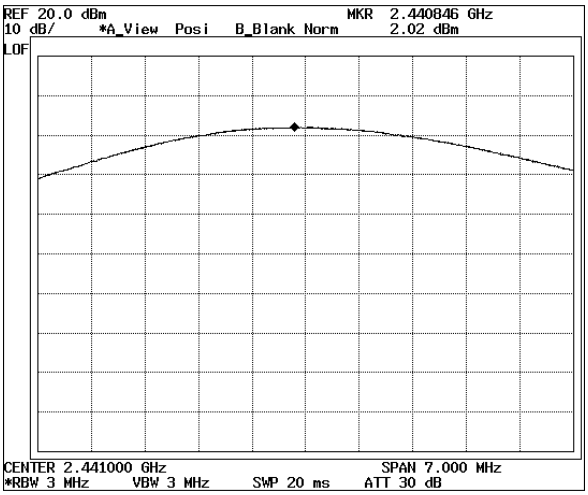
3DH5

Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
0	2402	2.55	1Watt=30dBm	Pass
39	2441	2.02	1Watt=30dBm	Pass
78	2480	1.41	1Watt=30dBm	Pass

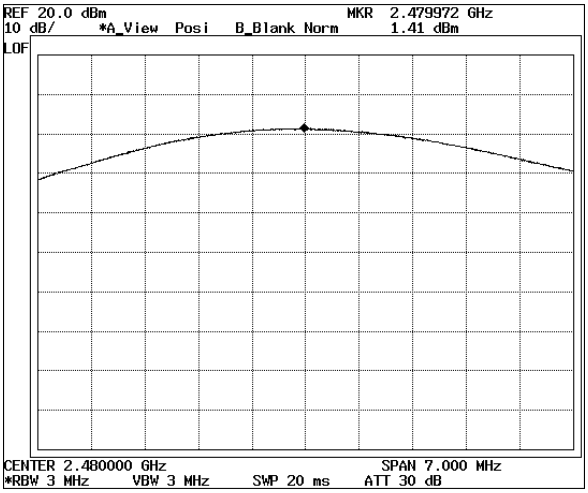
Channel 0



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. 07, 2013
2	RF ROOM			

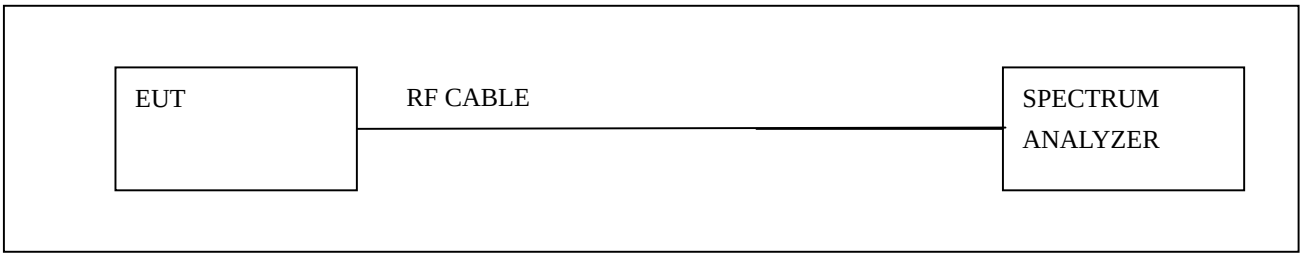
Note : All equipment upon which need to calibrated are with calibration period of 1 year.

◆ 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.

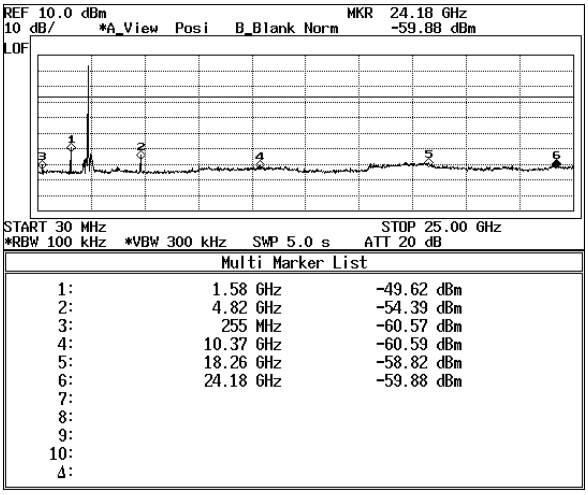
According to FCC CFR Title 47 Part 15 Subpart C Section 15.247

Conducted Spurious Emission Test result

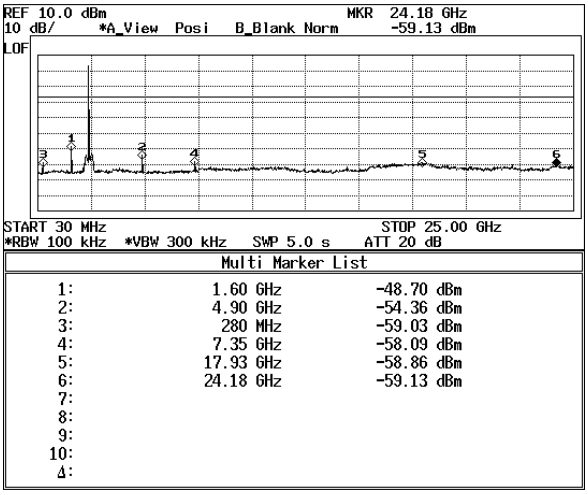
Product	iLOG-Strain
Test Item	Conducted Spurious Emission
Test Mode	Tx / Channel 0, 39, 78, Hopping
Test Site	RF Room
Measurement Method	Conducted

DH5

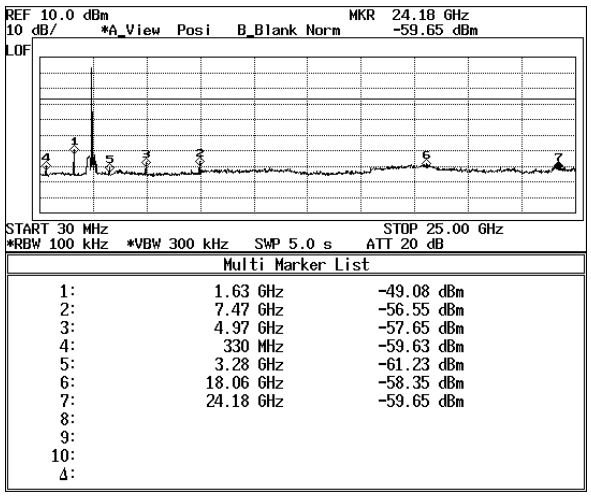
Channel 0 (2402 MHz)



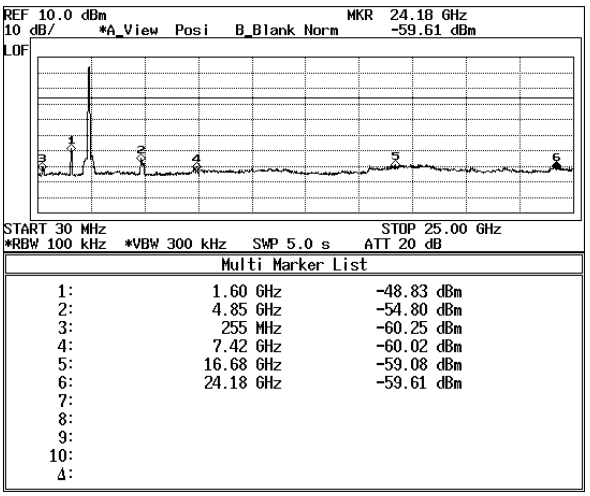
Channel 39 (2441 MHz)



Channel 78 (2480 MHz)



Hopping mode

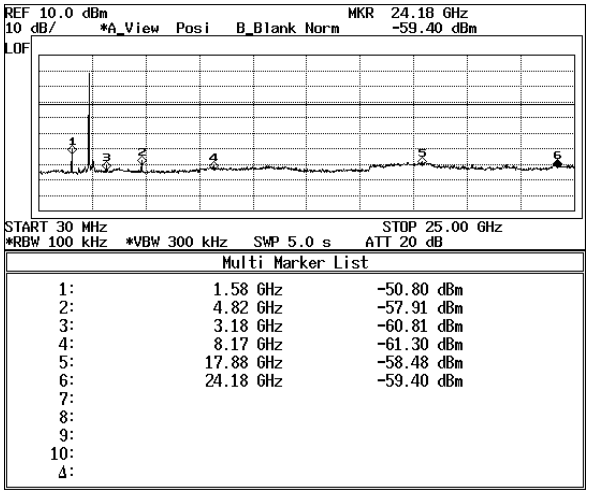


Conducted Spurious Emission Test result

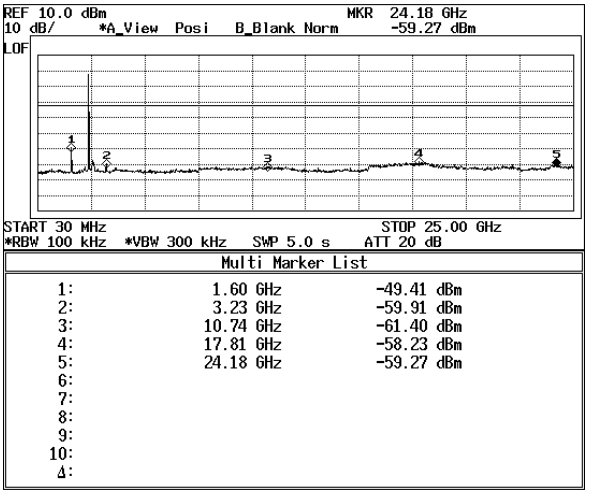
Product	iLOG-Strain
Test Item	Conducted Spurious Emission
Test Mode	Tx / Channel 0, 39, 78, Hopping
Test Site	RF Room
Measurement Method	Conducted

3DH5

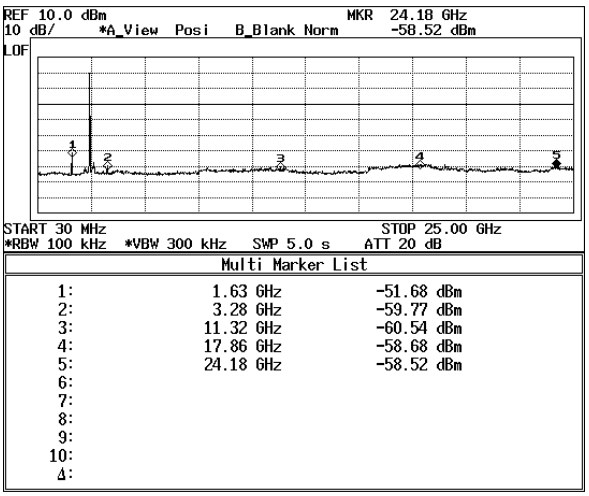
Channel 0 (2402 MHz)



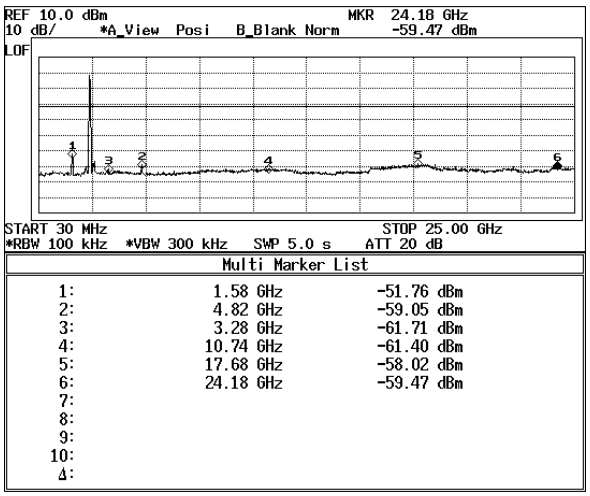
Channel 39 (2441 MHz)



Channel 78 (2480 MHz)



Hopping mode



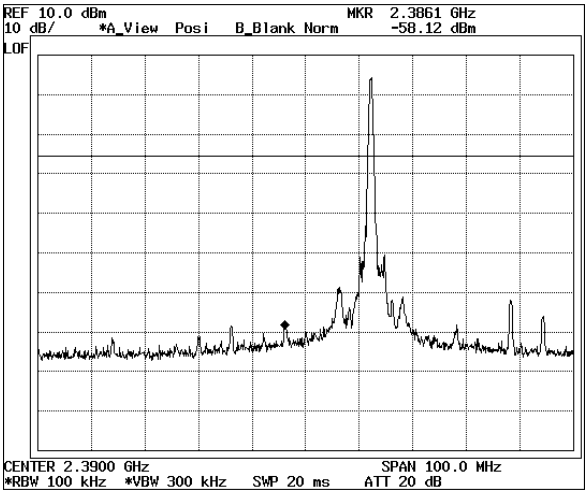
Band Edge Test result

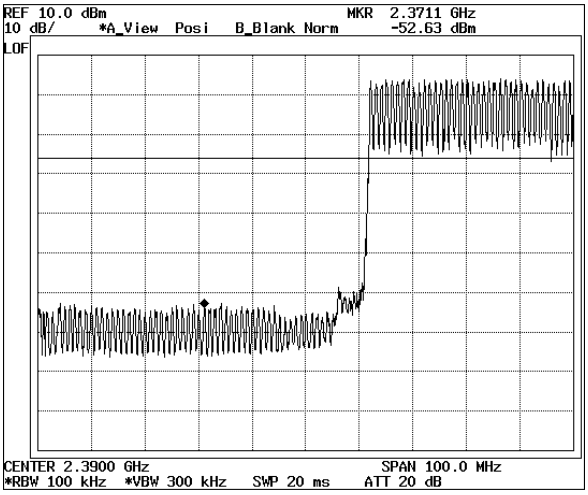
Product	iLOG-Strain
Test Item	Band Edge
Test Mode	Tx / Channel 0, 39, 78, Hopping
Test Site	RF Room
Measurement Method	Conducted

DH5

Channel : 0 CH(2402 MHz)

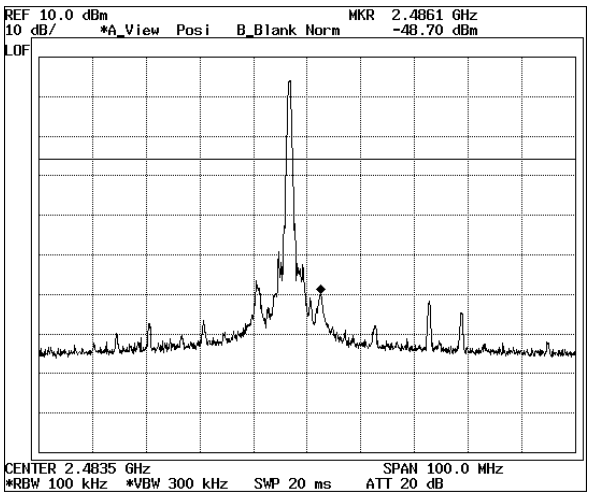
Hopping mode

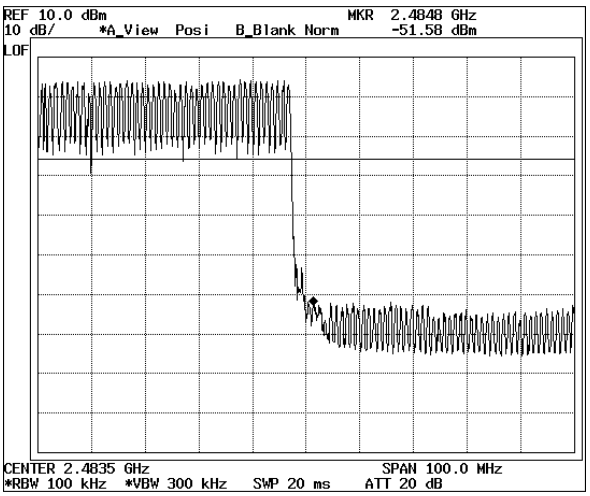




Channel : 78 CH(2480 MHz)

Hopping mode





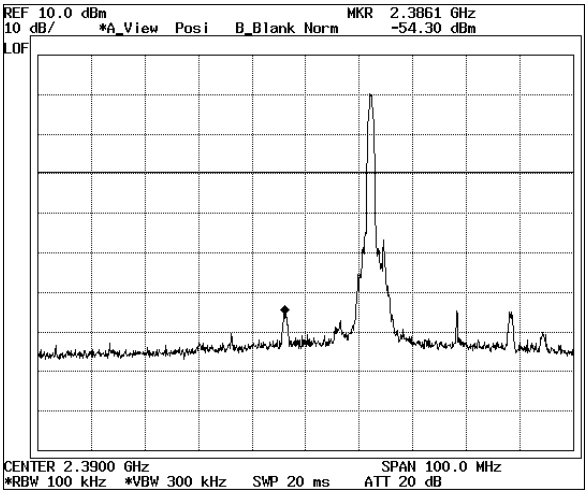
Band Edge Test result

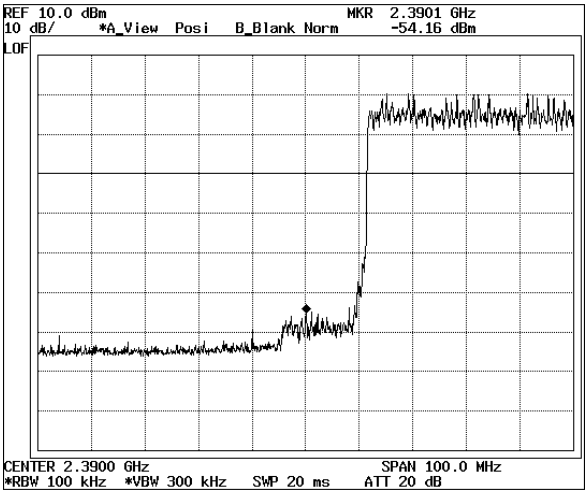
Product	iLOG-Strain
Test Item	Band Edge
Test Mode	Tx / Channel 0, 39, 78, Hopping
Test Site	RF Room
Measurement Method	Conducted

3DH5

Channel : 0 CH(2402 MHz)

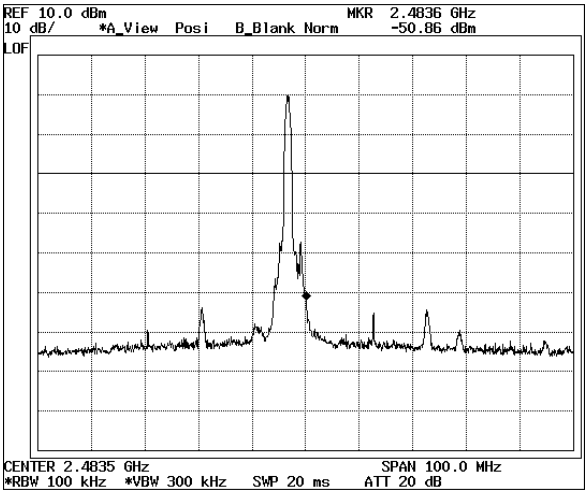
Hopping mode

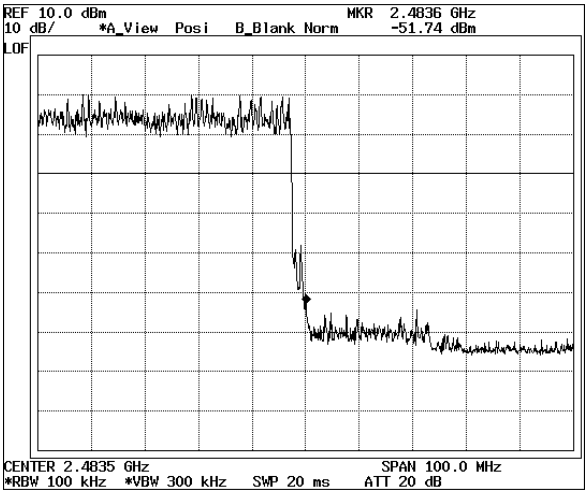




Channel : 78 CH(2480 MHz)

Hopping mode





Frequency Separation &

20dB Bandwidth/Occupied Bandwidth

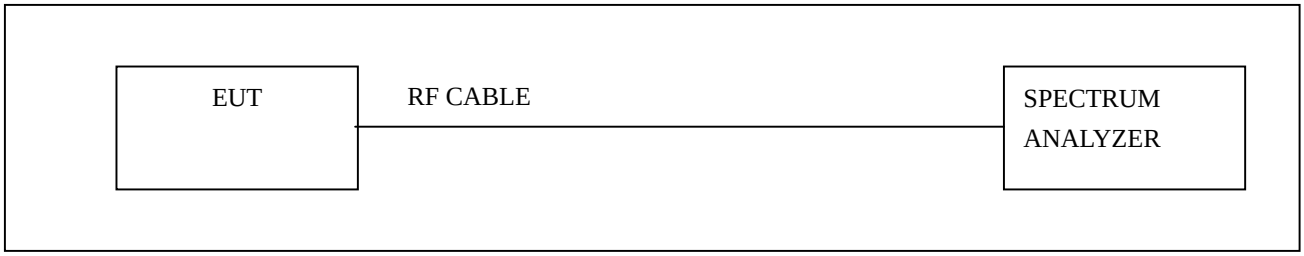
◆Test Equipment

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.07, 2013
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

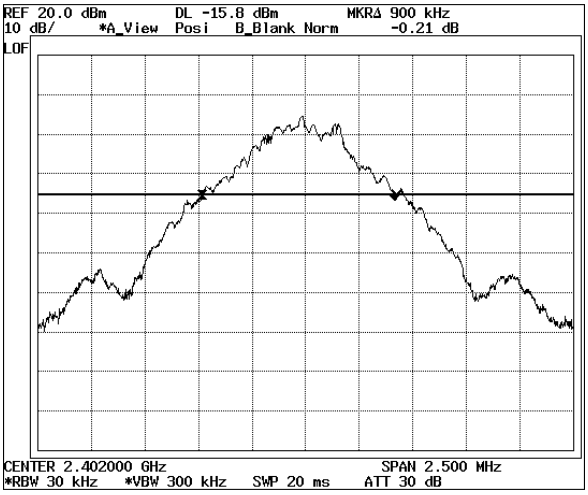
Product	ILOG-Strain
Test Item	20dB BandWidth
Test Mode	Tx / Channel 0, 39, 78
Test Site	RF Room
Measurement Method	Conducted

20dB Bandwidth

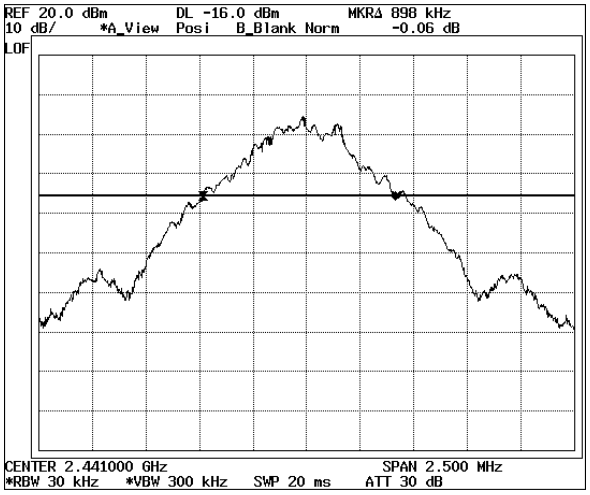
DH5

Channel	20dB Band width (KHz)	Result
Low CH	900	Pass
Middle CH	898	
High CH	898	

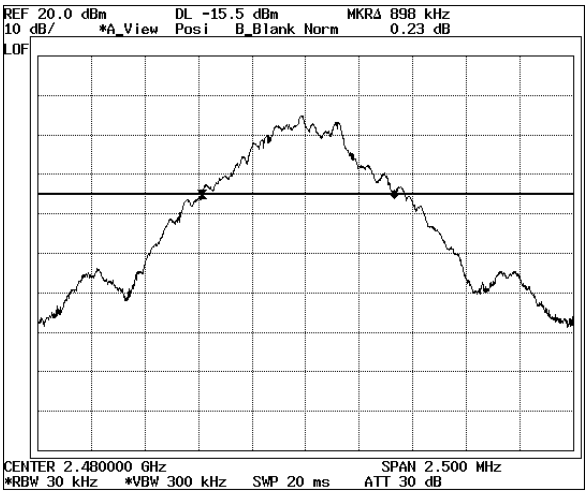
Low Channel



Mid Channel



High Channel



20dB BandWidth Test result

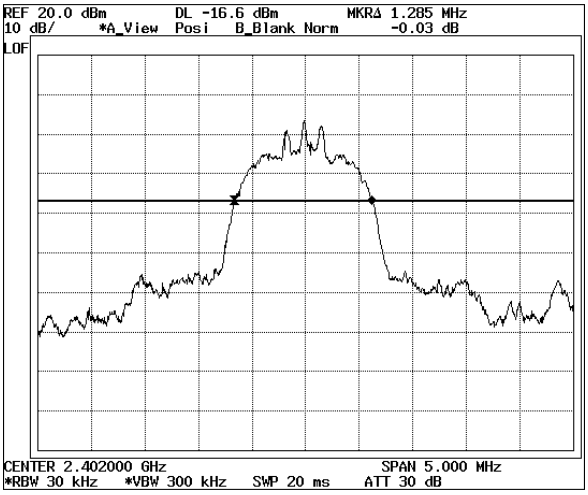
Product	iLOG-Strain
Test Item	20dB BandWidth
Test Mode	Tx / Channel 0, 39, 78
Test Site	RF Room
Measurement Method	Conducted

20dB Bandwidth

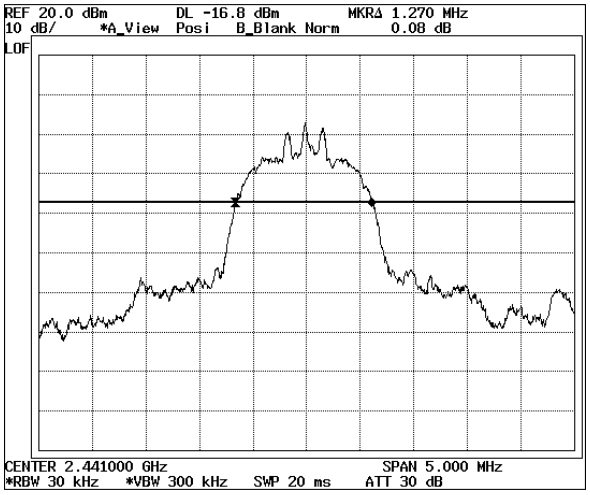
3DH5

Channel	20dB Band width (KHz)	Result
Low CH	1285	Pass
Middle CH	1270	
High CH	1270	

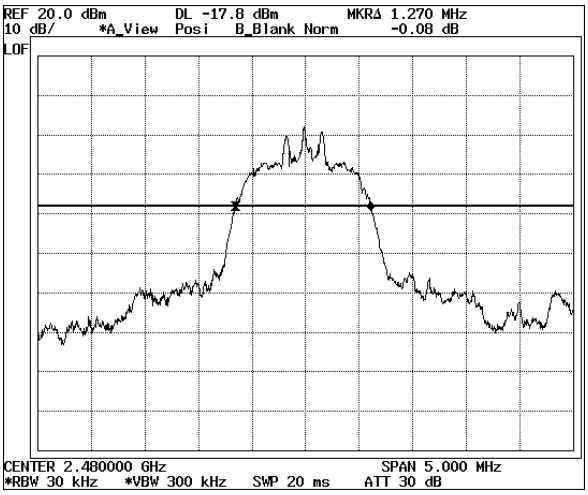
Low Channel



Mid Channel



High Channel



Channel Separation Test result

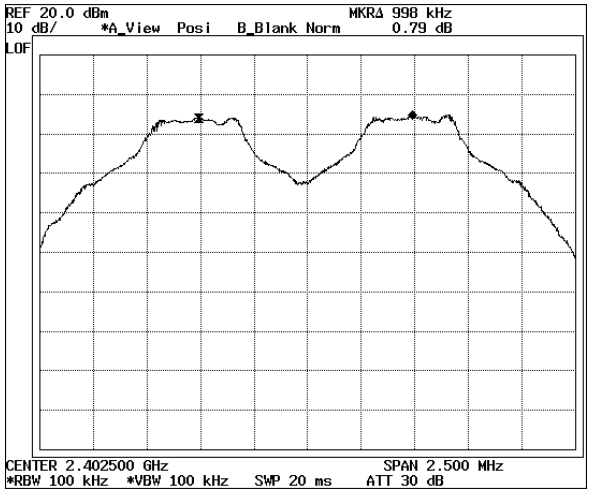
Product	iLOG-Strain
Test Item	Channel Separation
Test Mode	Tx / Channel 0, 39, 78
Test Site	RF Room
Measurement Method	Conducted

Channel Separation

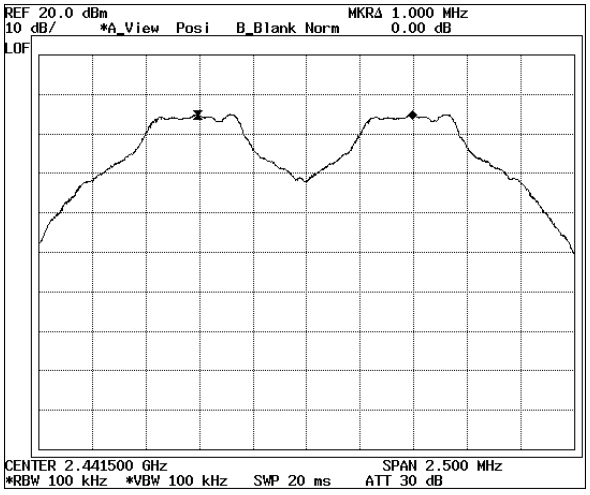
DH5

Channel	Channel Separation (KHz)	20dB bandwidth (KHz)	Limit (KHz)	Result
Low CH	998	900	>25 or >2/3 of the 20dB BW	Pass
Middle CH	1000	898		
High CH	1000	898		

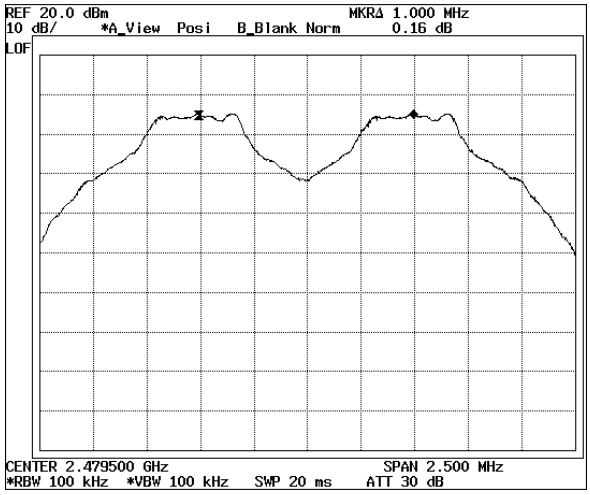
Low Channel



Mid Channel



High Channel



Channel Separation Test result

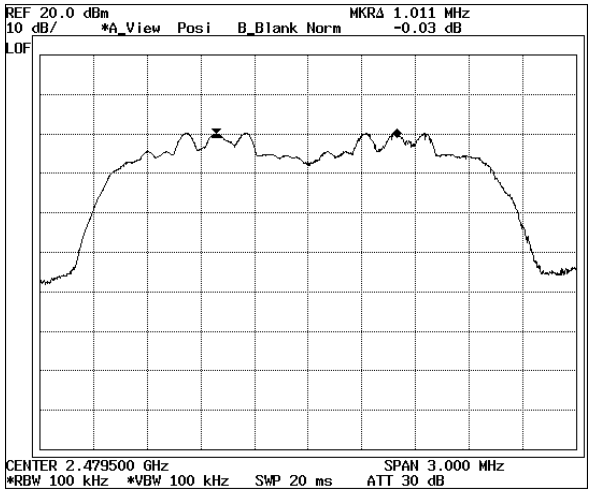
Product	iLOG-Strain
Test Item	Channel Separation
Test Mode	Tx / Channel 0, 39, 78
Test Site	RF Room
Measurement Method	Conducted

Channel Separation

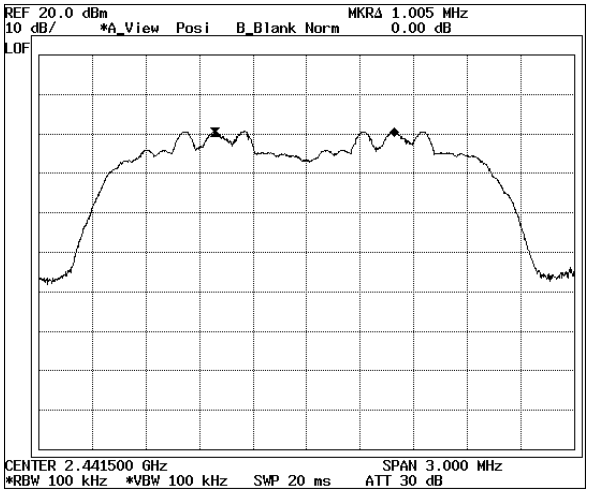
3DH5

Channel	Channel Separation (KHz)	20dB bandwidth (KHz)	Limit (KHz)	Result
Low CH	1011	1285	>25 or >2/3 of the 20dB BW	Pass
Middle CH	1005	1270		
High CH	1002	1270		

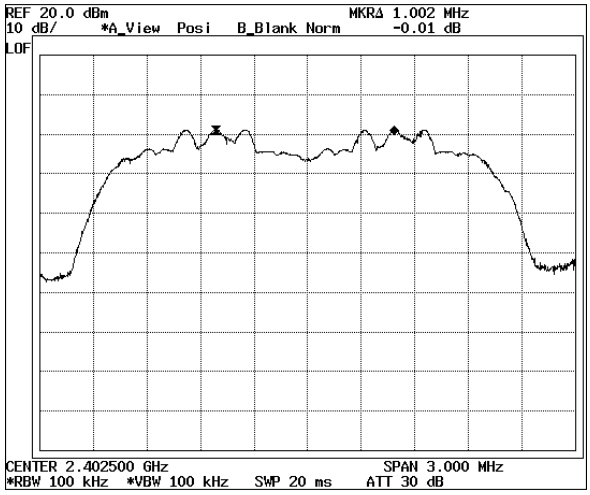
Low Channel



Mid Channel



High Channel



Occupied BandWidth Test result

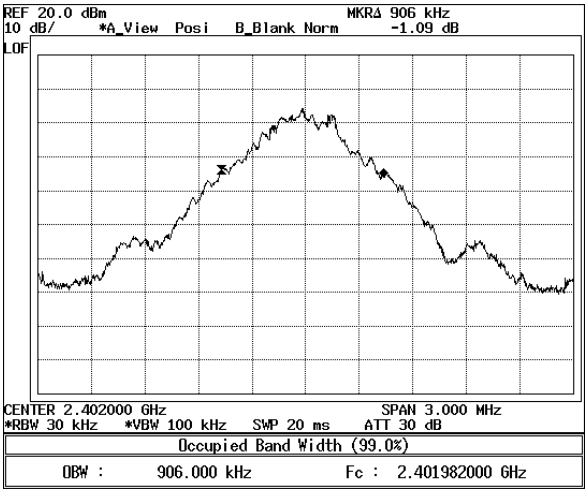
Product	iLOG-Strain
Test Item	Occupied Bandwidth
Test Mode	Tx / Channel 0, 39, 78
Test Site	RF Room
Measurement Method	Conducted

Occupied Bandwidth(99%)

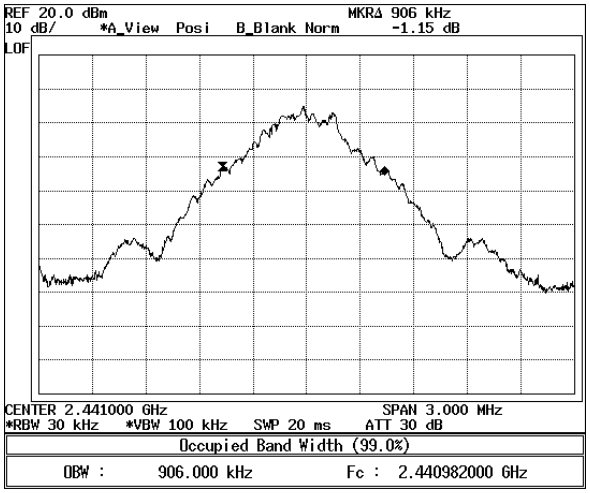
DH5

Channel	99% BW(KHz)	Result
Low CH	906	Pass
Middle CH	906	
High CH	909	

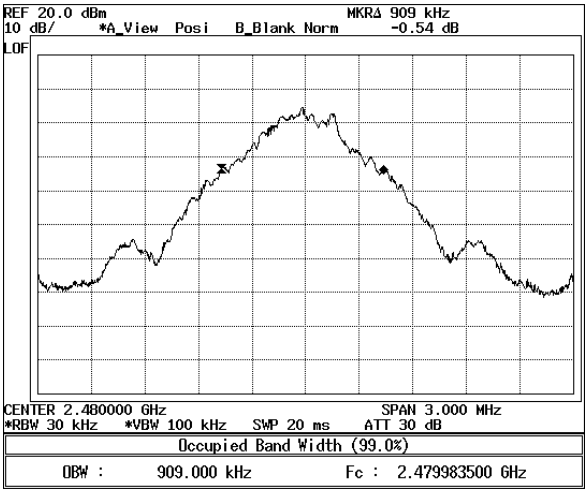
Low Channel



Mid Channel



High Channel



Occupied BandWidth Test result

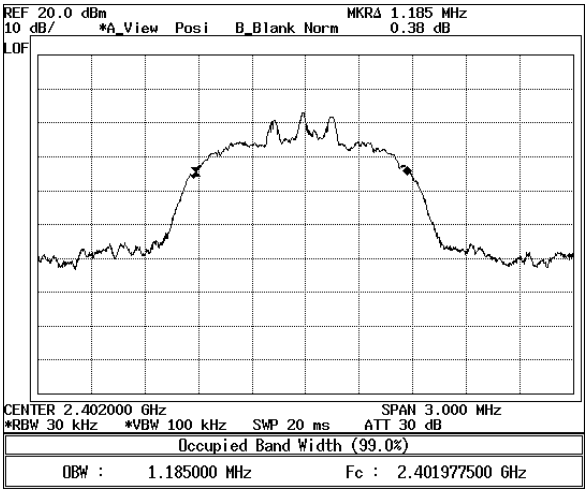
Product	iLOG-Strain
Test Item	Occupied Bandwidth
Test Mode	Tx / Channel 0, 39, 78
Test Site	RF Room
Measurement Method	Conducted

Occupied Bandwidth(99%)

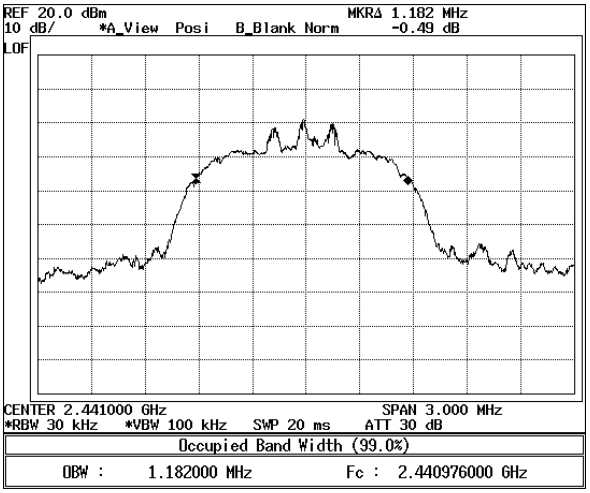
3DH5

Channel	99% BW(KHz)	Result
Low CH	1185	Pass
Middle CH	1182	
High CH	1179	

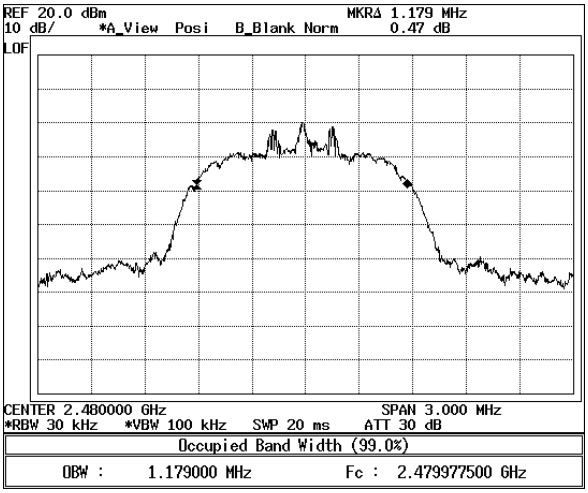
Low Channel



Mid Channel



High Channel



Number of Hopping Frequency

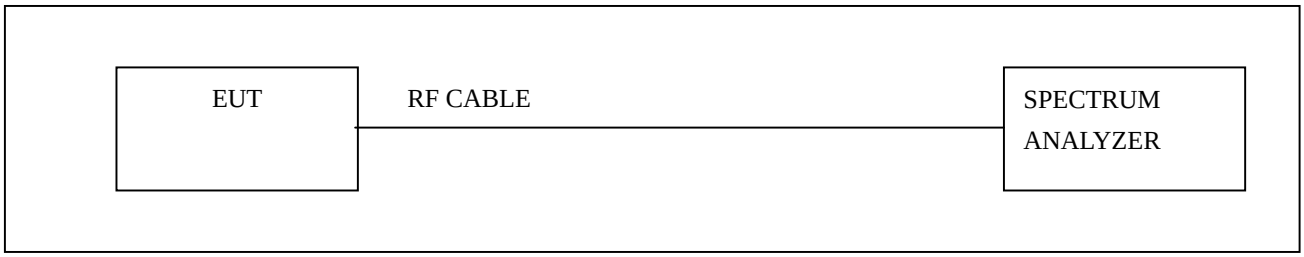
◆Test Equipment

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.07, 2013
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.

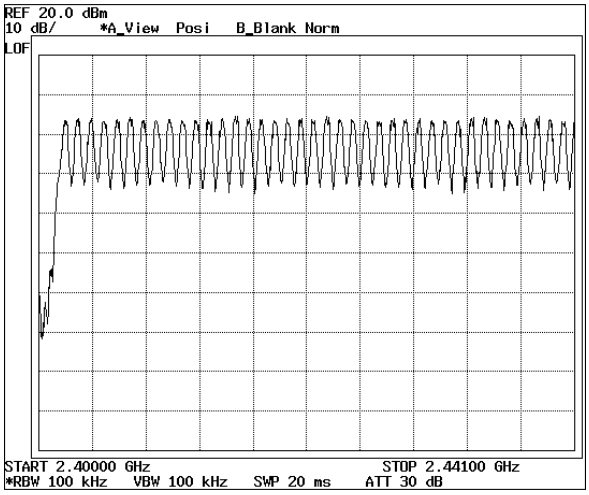
According to FCC CFR Title 47 Part 15 Subpart C Section 15.247

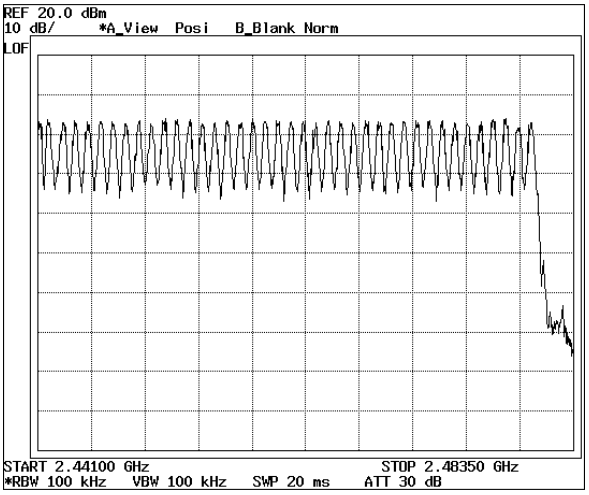
Number of Hopping Frequency Test result

Product	iLOG-Strain
Test Item	Number of Hopping Frequency
Test Mode	Transmit
Test Site	RF Room
Measurement Method	Conducted

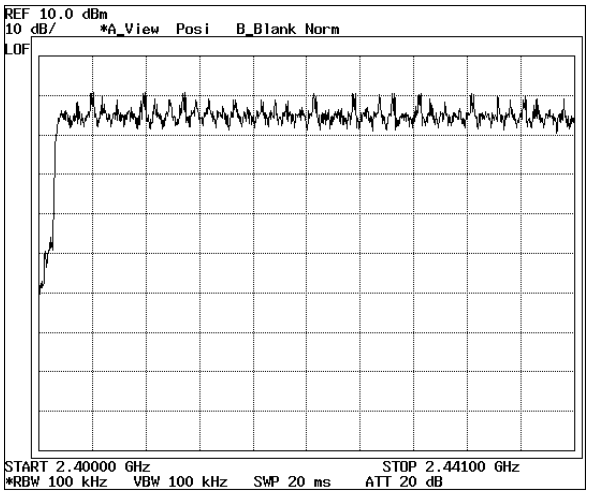
Channel (No. of channel)	Limit (No. of channel)	Result
79	>15	Pass

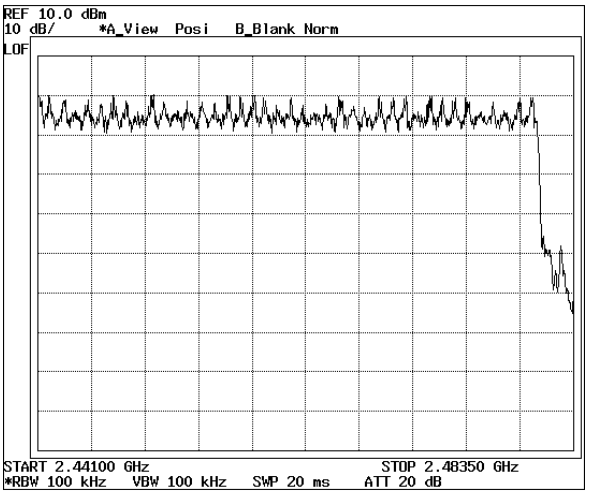
DH5





3DH5





Time of Occupancy(Dwell Time)

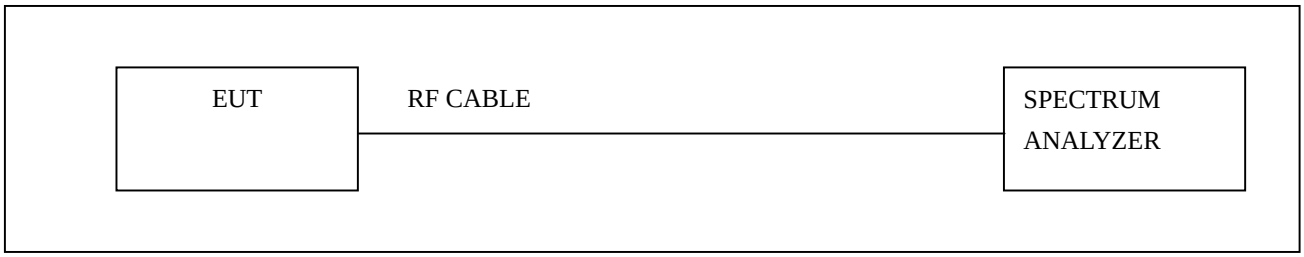
◆Test Equipment

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. 07, 2013
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.

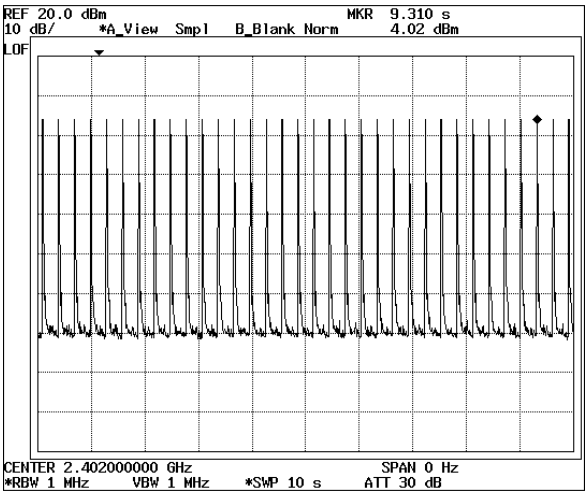
According to FCC CFR Title 47 Part 15 Subpart C Section 15.247

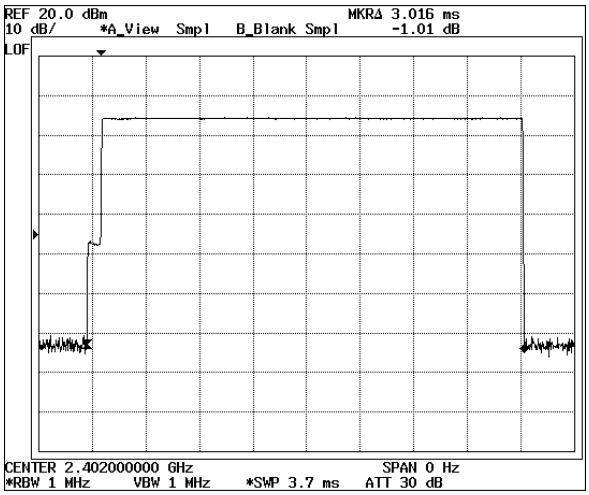
Dwell time Test result

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

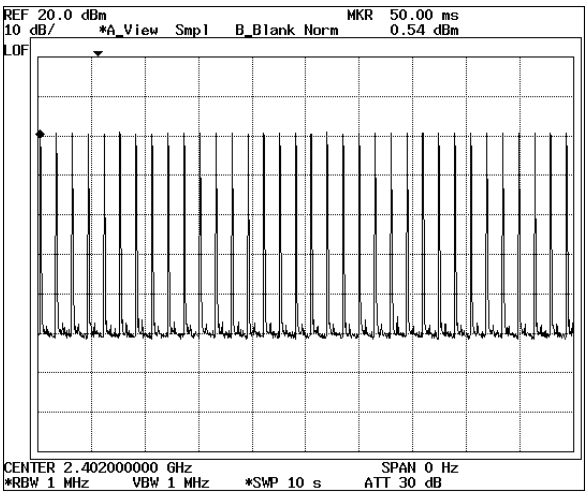
Mode	Number of transmission in a 31.6	Length of transmission time(ms)	Result (ms)	Limit (ms)	Result
DH5	34(times/5s) *3.16 = 107.44times	3.016	324.04	400	Pass
3DH5	34(times/5s) *3.16 = 107.44times	3.038	326.40		Pass

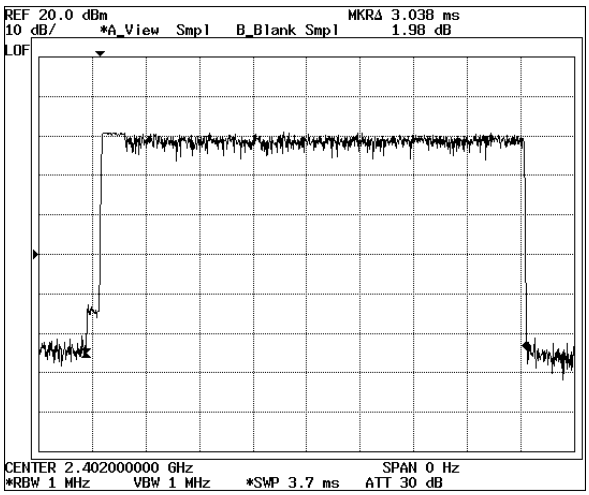
DH5





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(Reverse Polarity SMA Male Plug)

* the EUT complies with the requirement of 15.203