

Certification of Compliance

CFR 47 Part 15 Subpart C

Order No. : SB-1204042
Test Report No. : E12WD-077
Applicant : Samsung SDS Co.,Ltd.
Address of Applicant : 707-19, Youksam2-Dong, Kangnam-Gu, Seoul, Korea

Equipment Under Test (EUT)

Kind of Product : Electric Payment System
Model Name : SPS-700B
FCC ID : P4YSPS-700B
Buyer Model(s) : N/A

Standards : FCC Part 15 Subpart C (15.247 & 15.225):2010
ANSI C63.4:2009

Date of Receipt : 30 April, 2012
Date of Test : 01 ~ 09 May, 2012
Date of Issue : 11 May, 2012

Test Result : Positive Negative



Ji Hwan Kim / Testing By Engineer



Chang Woo, Kim / General Manager

In the configuration tested, the EUT complied with the standards specified above.

Remarks :

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

Contents

1. GENERAL INFORMATION	6
1.1 INFORMATION OF TEST LABORATORY	6
1.2 DESCRIPTION OF TEST	7
1.3 MEASUREMENT UNCERTAINTY CALCULATIONS	10
1.4 MANUFACTURER INFORMATION	11
1.5 GENERAL DESCRIPTION OF EUT	11
1.6 DETAILS OF EUT	11
1.7 DESCRIPTION OF SUPPORT UNITS	12
NOTE :	12
1.8 CABLE LIST	13
1.10 TEST SET-UP CONFIGURATION	14
1.11 TEST METHODOLOGY AND CONFIGURATION	14
1.12 STANDARDS APPLICABLE FOR TESTING	14
2. SUMMARY	15
3. EQUIPMENT UNDER TEST CONDITION A(WIFI OPERATION)	17
3.1 RADIATED EMISSION	17
3.1.1 TEST INSTRUMENTS	17
3.1.2 TEST AREA	17
3.1.3 OPERATION OF EUT	17
3.1.4 TEST DATE	17
3.1.5 RADIATED EMISSION LIMIT	18
3.1.5.1 RADIATED EMISSION RESULT(30 TO 1000 MHz)	19
3.1.5.2 FUNDAMENTAL & HARMONICS RADIATED EMISSION RESULT(1 TO 26 GHz)	25
3.3 PEAK POWER OUTPUT	49
3.3.1 TEST INSTRUMENTS	49
3.3.2 LIMIT	49
3.3.3 TEST CONFIGURATION	49
3.3.4 TEST PROCEDURE	49
3.3.5 PEAK POWER TEST RESULT	49
3.4 BAND EDGE	54
3.4.1 TEST INSTRUMENTS	54
3.4.2 LIMIT	54

3.4.3 TEST CONFIGURATION	55
3.4.4 TEST PROCEDURE	55
3.4.5 TEST RESULT METHOD OF BAND EDGE TEST RESULT OF RADIATED TEST	55
3.4.6 BAND EDGE TEST RESULT	56
3.5 6 DB BAND	64
3.5.1 TEST INSTRUMENTS	64
3.5.2 LIMIT	64
3.5.3 TEST CONFIGURATION	64
3.5.4 TEST PROCEDURE	64
3.5.5 6 DB BAND TEST RESULT	65
3.6 POWER DENSITY	69
3.6.1 TEST INSTRUMENTS	69
3.6.2 LIMIT	69
3.6.3 TEST CONFIGURATION	69
3.6.4 TEST PROCEDURE	69
3.6.5 POWER DENSITY TEST RESULT	69
4. EQUIPMENT UNDER TEST CONDITION B(BLUETOOTH OPERATION).....	74
4.1 RADIATED EMISSION	74
4.1.1 TEST INSTRUMENTS	74
4.1.2 TEST AREA	74
4.1.3 OPERATION OF EUT	74
4.1.4 TEST DATE	74
4.1.5 RADIATED EMISSION LIMIT	75
4.1.5.1 RADIATED EMISSION RESULT (30 TO 1000 MHz)	76
4.1.5.2 FUNDAMENTAL & HARMONICS RADIATED EMISSION RESULT(1 TO 26 GHz)	79
4.2 NUMBER OF HOPPING FQUENCY USED	91
4.2.1 TEST INSTRUMENTS	91
4.2.2 LIMIT	91
4.2.3 TEST CONFIGURATION	91
4.2.4 TEST PROCEDURE	91
4.2.5 NUMBER OF HOPPING FREQUENCY TEST RESULT	92
4.3 DWELL TIME ON EACH CHANNEL	93
4.3.1 TEST INSTRUMENTS	93
4.3.2 LIMIT	93

4.3.3 TEST CONFIGURATION	93
4.3.4 TEST PROCEDURE	93
4.3.5 DWELL TIME TEST RESULT	94
4.4 CHANNEL BANDWIDTH	98
4.4.1 TEST INSTRUMENTS	98
4.4.2 LIMIT	98
4.4.3 TEST CONFIGURATION	98
4.4.4 TEST PROCEDURE	98
4.4.5 CHANNEL BANDWIDTH TEST RESULT	99
4.5 HOPPING CHANNEL SEPARATION	101
4.5.1 TEST INSTRUMENTS	101
4.5.2 LIMIT	101
4.5.3 TEST CONFIGURATION	101
4.5.4 TEST PROCEDURE	101
4.5.5 HOPPING CHANNEL SEPARATION TEST RESULT	102
4.6 MAXIMUM PEAK OUTPUT POWER	104
4.6.1 TEST INSTRUMENTS	104
4.6.2 LIMIT	104
4.6.3 TEST CONFIGURATION	104
4.6.4 TEST PROCEDURE	104
4.6.5 MAXIMUM PEAK OUTPUT POWER TEST RESULT	105
4.7 BAND EDGE	107
4.7.1 TEST INSTRUMENTS	107
4.7.2 LIMIT	107
4.7.3 TEST CONFIGURATION	108
4.7.4 TEST PROCEDURE	108
4.7.5 TEST RESULT METHOD OF BAND EDGE TEST RESULT OF RADIATED TEST	108
4.7.6 BAND EDGE TEST RESULT	109
5. EQUIPMENT UNDER TEST CONDITION C(RFID(13.56 MHZ) OPERATION)	113
5.1 RADIATED EMISSION	113
5.1.1 TEST INSTRUMENTS	113
5.1.2 TEST AREA	113
5.1.3 OPERATION OF EUT	113
5.1.4 TEST DATE	113

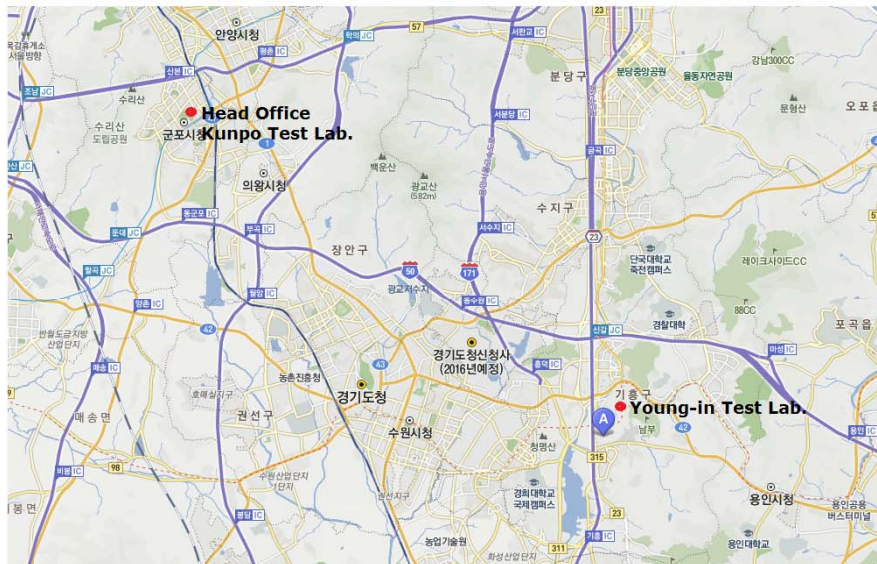
5.1.5 RADIATED EMISSION LIMIT	114
5.2 RADIATED FIELD EMISSION-15.225(A)	115
5.2.1 TEST INSTRUMENTS	115
5.2.2 FIELD STRENGTH CALCULATION	115
5.2.3 TEST RESULT – RADIATED FIELD EMISSION-15.225(A)	115
5.3 RADIATED ELECTRIC EMISSION-15.225(B) (C)	117
5.4 RADIATED FIELD EMISSION-15.109,15.209, 15.225(D)	119
5.5 FREQUENCY STABILITY-15.225(E)	121
5.5.1 TEST INSTRUMENTS	121
5.5.2 TEST RESULTS.....	121
6. EQUIPMENT UNDER TEST CONDITION D(WIFI+BLUETOOTH+RFID(13.56 MHZ) OPERATION)	122
6.1 RADIATED EMISSION	122
6.1.1 TEST INSTRUMENTS	122
6.1.2 TEST AREA	122
6.1.3 OPERATION OF EUT	122
6.1.4 TEST DATE	122
6.1.5 RADIATED EMISSION LIMIT	122
6.1.5 .1RADIATED EMISSION RESULT(0.009 TO 30 MHZ)	124
7.0 RF EXPOSURE	126
8.0 ANTENNA REQUIREMENT	129
APPENDIX A. THE PHOTO OF TEST SETUP	130
APPENDIX B. THE PHOTO OF EQUIPMENT UNDER TEST	132

1. General Information

1.1 Information of Test Laboratory.

FCC E-Filing : Registration Number:323115

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We , Standard Bank Co.,Ltd. are an independent EMC and RF and Safety consultancy that was established the whole facility in our laboratories. The test facility has been accredited by the following accreditation Bodies in compliance with ISO 17025:

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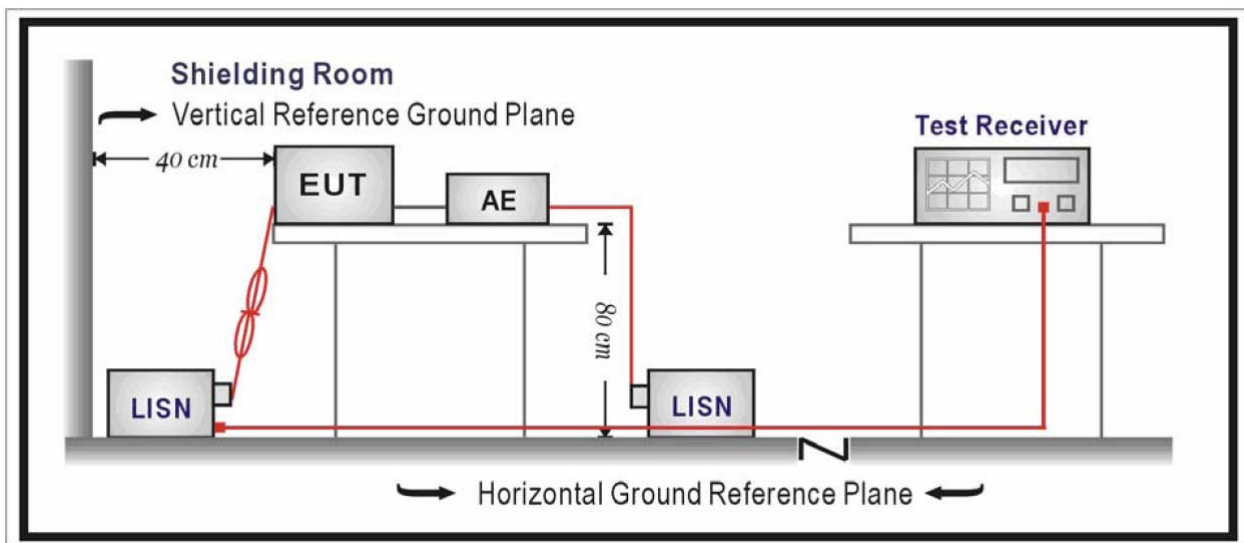
1.2 Description of Test

Conducted Emissions:

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination.(Please refers to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed on conducted measurement.

Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.



Limit Of Conducted Emission:

Test Specification

: According to FCC CFR Title 47 Part 15 Subpart C Section 15.207

FREQUENCY (MHz)	Limit	
	Quasi-peak	Average
0.15 to 0.5	66 to 56 *	56 to 46
0.5 to 5	56	46
5 to 30	60	50

*Decrease with the logarithm of the frequency

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 3m Full Chamber 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 120 kHz and above 1GHz is 1 MHz.)

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.

Limit Of Radiated Emission :

Test Specification

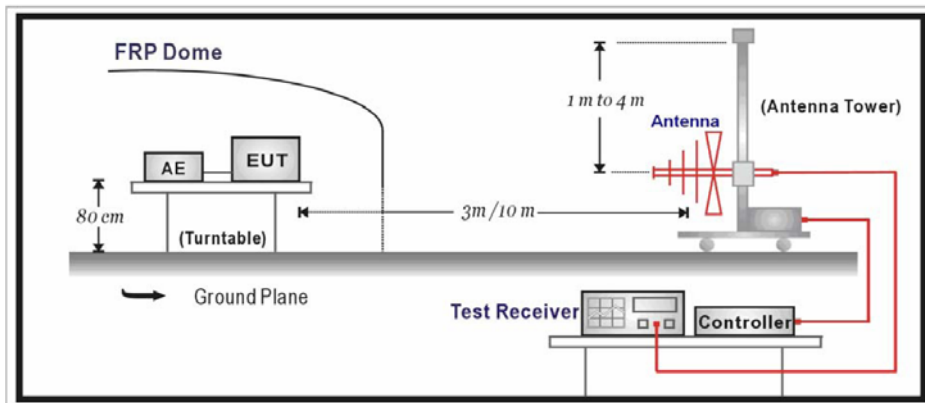
: According to FCC CFR Title 47 Part 15 Subpart C Section 15.209

Limits		
Frequency (MHz)	$\mu\text{V}/\text{meter}$	$\text{dB}\mu\text{V}/\text{meter}$
30-88	100	40.00
88-216	150	43.52
216-960	200	46.02
Above 960	500	53.98

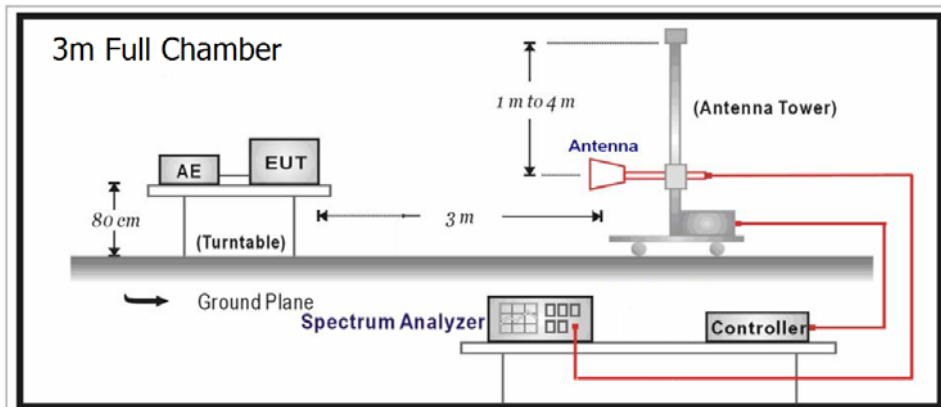
Remarks :

1. $RF\ Voltage(\text{dB}\mu\text{V}) = 20 \log RF\ Voltage(\mu\text{V})$
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring Instrument antenna and the closed point of any part of the device or System.

Below 1GHz Test Setup:



Above 1GHz Test Setup:



1.3 Measurement Uncertainty Calculations

Conducted Emissions

TYPE	Contribution	Probability Distribution	Uncertainty	Remark
B	LISN	normal(k=2)	±1.3	CAL.
	Impedance	normal(k=2)	±0.12	CAL.
	Voltage Division Factor	normal(k=2)	±0.2	NONCAL.
	cable	normal(k=2)	±0.2	NONCAL.
	Receiver	normal(k=1.64)	±0.0070	CAL.
	Input Impedance	normal(k=2)	±0.20 dB	
QP Sine-Wave Voltage Accuracy	normal(k=2)	±0.40 dB		
QP-Pulse Amplitude Sensibility	normal(k=2)	±0.57 dB		
QP-Pulse Frequency Response	normal(k=2)	±0.35 dB		
Random Noise	normal(k=2)	±0.35 dB		
Mismatch	U-Shaped	+0.7/-0.8		CISPR Theory
AMN to Receiver				
A	System Repeatability	Std deviation	±0.0721	
Combined Standard Uncertainty		normal	± 1.1155 [dB]	
Expanded Uncertainty U		normal(k=2)	± 2.23	95.45 %

Radiated Emission

TYPE	Contribution	Probability Distribution	Uncertainty 3/10m	Remark
B	Antenna factor	normal(k=2)	±0.5 dB	NPL NAMAS NAMAS
	frequency interpolation	rectangular	±0.1039 dB	
	height variation	rectangular	+1.5/-2.6 dB	
	directivity difference	rectangular	+0/-1.0 dB	
	phase center location	rectangular	±1.0 dB	
	Cable loss	normal(k=2)	±0.5 dB	
Receiver	normal(k=1.64)	±0.0070	±0.0070 ±0.20 dB ±0.40 dB ±0.57 dB ±0.35 dB	
Input Impedance	normal(k=2)	±0.20 dB		
QP Sine-Wave Voltage Accuracy	normal(k=2)	±0.40 dB		
QP-Pulse Amplitude Sensibility	normal(k=2)	±0.57 dB		
QP-Pulse Frequency Response	normal(k=2)	±0.35 dB		
Random Noise	normal(k=2)	±0.35 dB		
Mismatch : AMN – receiver	U-Shaped	+0.9/-1.0 dB		CISPR
	$\begin{cases} \Gamma_{\text{antenna}} = 0.33 \\ \Gamma_{\text{receiver}} = 0.33 \end{cases}$			
A	System repeatability	Std deviation	±0.1149 dB	
Combined standard Uncertainty		normal	±1.3193 [dB]	
Expanded Uncertainty U		normal(k=2)	± 2.63	95.45 %

1.4 Manufacturer Information

Manufacturer	:	Samsung SDS Co.,Ltd.
Address	:	707-19, Youksam2-Dong, Kangnam-Gu, Seoul, Korea

1.5 General Description of EUT

Name	:	Electric Payment System
Model No.	:	SPS-700B
Alt. Name	:	N/A
FCC ID	:	P4YSPS-700B
Serial No.	:	N/A

1.6 Details of EUT

Item		Specification
WLAN (IEEE 802. 11b/g)	Frequency Range	2412 ~ 2472 MHz
	Modulation Technique	DSSS
	Number of Channel	13
	Antenna/Gain	Dipole Antenna / 2 dBi
Bluetooth (2.1+EDR)	Frequency Range	2402 ~ 2480 MHz
	Modulation Technique	FHSS
	Number of Channel	79
	Antenna/Gain	Dipole Antenna / 2 dBi
RF Card	Frequency	13.5603 MHz
	Antenna	PCB printed Antenna
Operating Voltage	DC 12 V	

- Please refer to user's manual.

1.7 Description of Support Units

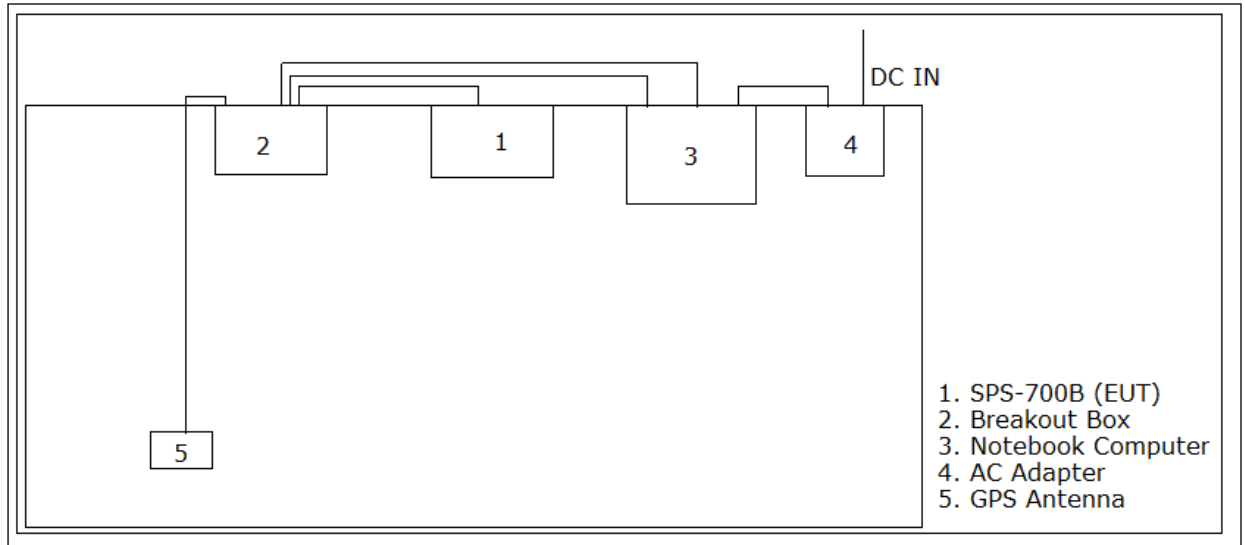
Product	Model No.	Serial No.	Manufacturer	Certification
Electric Payment System	SPS-700B	N/A	Samsung SDS Co.,Ltd.	EUT
Notebook	D400	N/A	Dell Inc.	-
AC Adapter	PA-1650-05D	05U092-34A-1BD6	Dongguang Lite Power	-
GPS Antenna	-	-	-	-

Note :

1.8 Cable List

Device Form		Device To		Cable Spec.	
Name	I/O Port	Name	I/O port	Length(m)	Shield
EUT	-	Breakout Box	PIM	3.0	Shielded
Breakout Box	LAN	Notebook Computer	LAN	3.0	Unshielded
	GPS	GPS Antenna	-	2.5	Shielded
	DC-IN	DC Power Supply	DC OUT	1.8	Unshielded
AC ADAPTER (Notebook Computer)	AC-IN	POWER	AC-POWER	1.5	Unshielded

1.10 Test Set-Up Configuration



1.11 Test Methodology And Configuration

RFID(13.56MHz), Wireless Lan, Bluetooth all device activating state.

1.12 Standards Applicable for Testing

Table of tests to be carried out under FCC Part 15 Subpart C

Test Standards	Status
FCC Part 15 Subpart C	A
Deviation from Standard	No Deviation

Note) N/A : Indicates that the test is not applicable
A : Indicates that the test is applicable

2. SUMMARY

Condition A : WIFI Mode(2412 ~ 2472 MHz)

Test Descriptions

- Conducted Emission	N/A
- The EUT uses the DC power	
- Radiated Emission	PASS
- Radiated Emission Result	
- Peak power output	PASS
- Test result	
- Band edge	PASS
- Test result	
- 6dB Band	PASS
- Test Result	
- Power Density	PASS
- Test Result	
- Antenna Requirement	PASS
- Test Result	

Condition B : Bluetooth Mode(2402 ~ 2480 MHz)

Test Descriptions

- Conducted Emission	N/A
- The EUT uses the DC power	
- Radiated Emission	PASS
- Radiated Emission Result	
- Number of Hopping Frequency Used	PASS
- Test result	
- Dwell Time on Each Channel	PASS
- Test result	
Channel Bandwidth	PASS
- Test result	
- Hopping Channel Separation	PASS
- Test result	
- Maximum Peak Output Power	PASS
- Test Result	
- Band Edge Measurement	PASS
- Test Result	
- Antenna Requirement	PASS
- Test Result	

**Condition C : RFID Mode(13.56MHz)
Test Descriptions**

- **Conducted Emission** **N/A**
 - **The EUT uses the DC power**
- **Radiated Emission-15.225(a)** **PASS**
 - **Radiated Emission Result**
- **Radiated Electric Field Emission-15.225(b)(c)** **PASS**
 - **Test result**
- **Radiated Electric Field Emission-15.209, 15.225(d)** **PASS**
 - **Test result**
- **Frequency stability-15.225(e)** **PASS**
 - **Test Result**

*Note : * The EUT power use Car's battery. Operating voltage is DC 12 V.*

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

**Condition D : WiFi+Bluetooth+RFID Mode(13.56MHz) operation
Test Descriptions**

- **Radiated Emission (0.009 to 30 MHz)** **PASS**
 - **Radiated Emission result**

3. Equipment Under Test Condition A(WiFi Operation)

3.1 Radiated Emission

3.1.1 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Next of Calibration
Horn Antenna	R&S	BBHA9120D233	0501	09. 10. 2013
Horn Antenna	R&S	BBHA9170	BBHA9170152	09. 16. 2013
Horn Antenna	SCHWARZBECK	BBHA9120D	BBHA9120D 839	12. 24. 2012
Horn Antenna	A.H System, Inc	SAS 571	500	03. 23. 2013
TRILOG Antenna	SCHWARZBECK	VULD 9160	3292	04. 28. 2013
Loop Antenna	6502	EMCO	00123879	12. 28. 2012
EMI Test Receiver	ROHDE&SCHWARZ	ESVS10	80241-015	01. 30. 2013
EMI Test Receiver	LIG NEX1	ER-265	L0811B009	04. 10. 2013
Spectrum Analyzer	ADVANTEST	R3273	130900034	12. 05. 2012
Spectrum Analyzer	LIG NEX1	NS-30	6052036	01. 30. 2013

Note : 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to RRL, 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)

3.1.2 Test Area

3m Full Chamber

3.1.3 Operation of EUT

Operating Environment

Temperature : 24.4 degree C
 Humidity : 46 %RH
 Atmospheric Pressure : 986 mBar

3.1.4 Test Date

May 02, 2012

3.1.5 Radiated Emission Limit

All emission from a digital device, including any network of conductors and apparatus connected thereto shall not exceed the level of field strength specified below:

FCC Part 15 Subpart C paragraph 15.249(a) Limit

Fundamental Frequency (MHz)	Field Strength of Fundamental (3m)		Field Strength of Harmonics (3m)		
	mV/m	dBuV/m	uV/m	dBuV/m	
2400-2483.5	50	94(Average) 114(Peak)	500	54(Average)	74(Peak)

- Note :
1. RF Field Strength (dBuV) = $20 \log \text{RF Voltage}(\mu\text{V})$
 2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
 3. The emission limit in this paragraph is based on measurement instrumentation employing an average detector

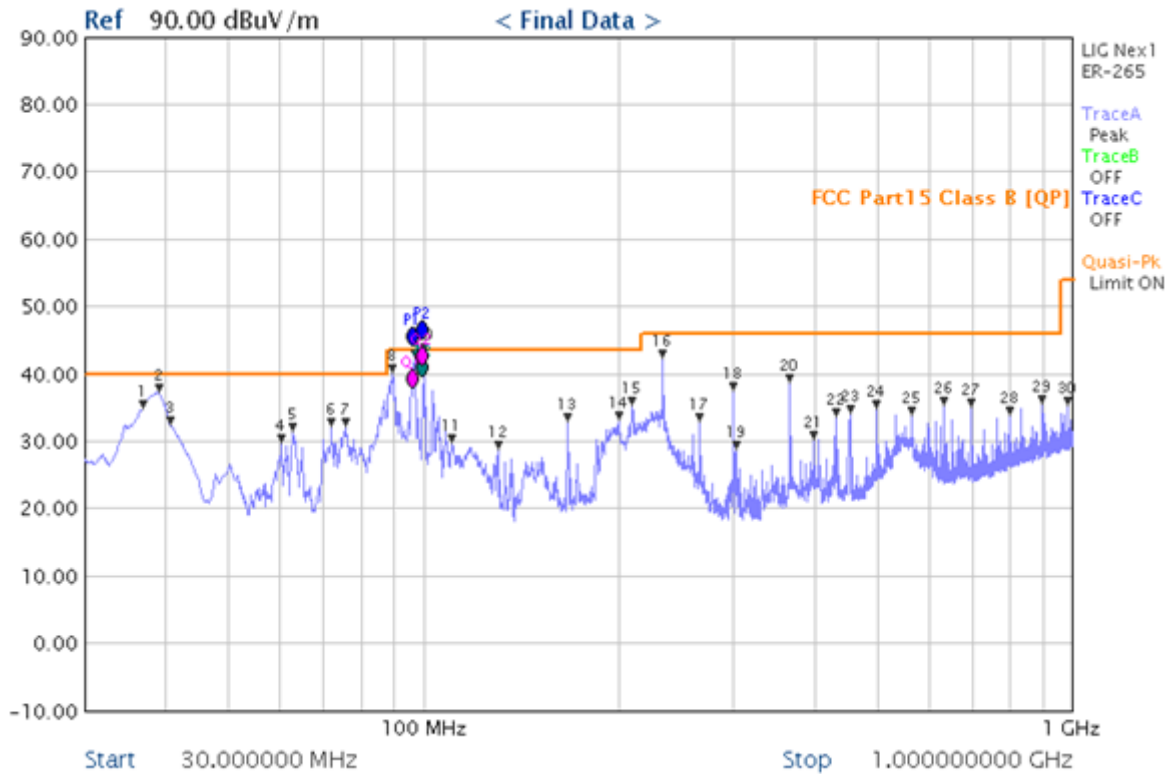
Frequencies in restricted band are complied to limit on Paragraph 15.209

Frequency Range (MHz)	Distance (m)	Field strength (dBuV/m)
0.009-0.490	3	$20 \log 2400/F \text{ (kHz)} + 80$
0.490-1.705	3	$20 \log 24000/F \text{ (kHz)} + 40$
1.705-30	3	$20 \log 30 + 40$
30-88	3	40.0
88-216	3	43.5
216-960	3	46.0
Above 960	3	54.0

- Note :
1. RF voltage (dBuV) = $20 \log \text{RF Voltage}(\mu\text{V})$
 2. In the Above Table, the tighter limit applies at the band edges.
 3. Distance refers to the distance in meters between the measuring instrument antenna and the EUT
 4. This device used to install a wall device. The location of EUT measurements has the Y-plane(Stand).
 5. All scanning using PK detector. And the final emission level was get using QP detector for frequency range from 30 – 1000 MHz. As to 1 - 26 GHz, the final emission level got using PK and AV detector.
 6. If measurement is made at 3m distance.

3.1.5.1 Radiated Emission Result(30 to 1000 MHz)

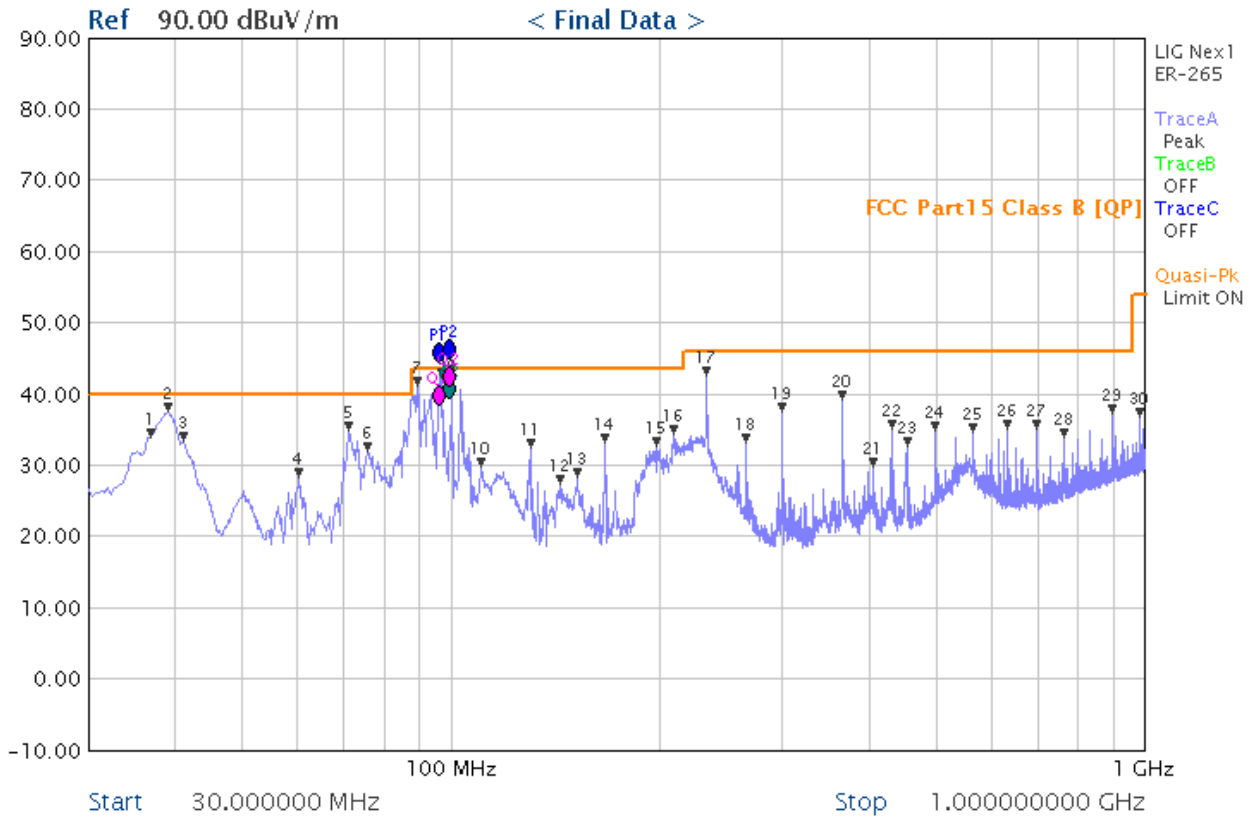
Test Mode	IEEE802.11b	Test Channel	1 CH (2412 MHz)
Test Result	PASS		



Frequency MHz	Reading dBuV/m	P (H, V)	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV/m	Total dBuV/m	Margin dB
39.12	23.57	V	12.02	1.30	0.00	40.00	36.89	3.11
89.45	30.98	H	7.59	1.90	0.00	43.50	40.48	3.03
96.67	29.57	H	8.76	1.97	0.00	43.50	40.30	3.20
99.98	28.40	H	9.35	1.90	0.00	43.50	39.65	3.85
233.09	28.58	V	11.01	3.16	0.00	46.00	42.75	3.25
299.53	20.59	H	13.31	3.50	0.00	46.00	37.40	8.60
365.85	20.78	V	14.78	3.96	0.00	46.00	39.52	6.48
879.92	6.26	V	23.25	6.22	0.00	46.00	35.73	10.27

Note : 1. Measurement level = reading level + correct factor

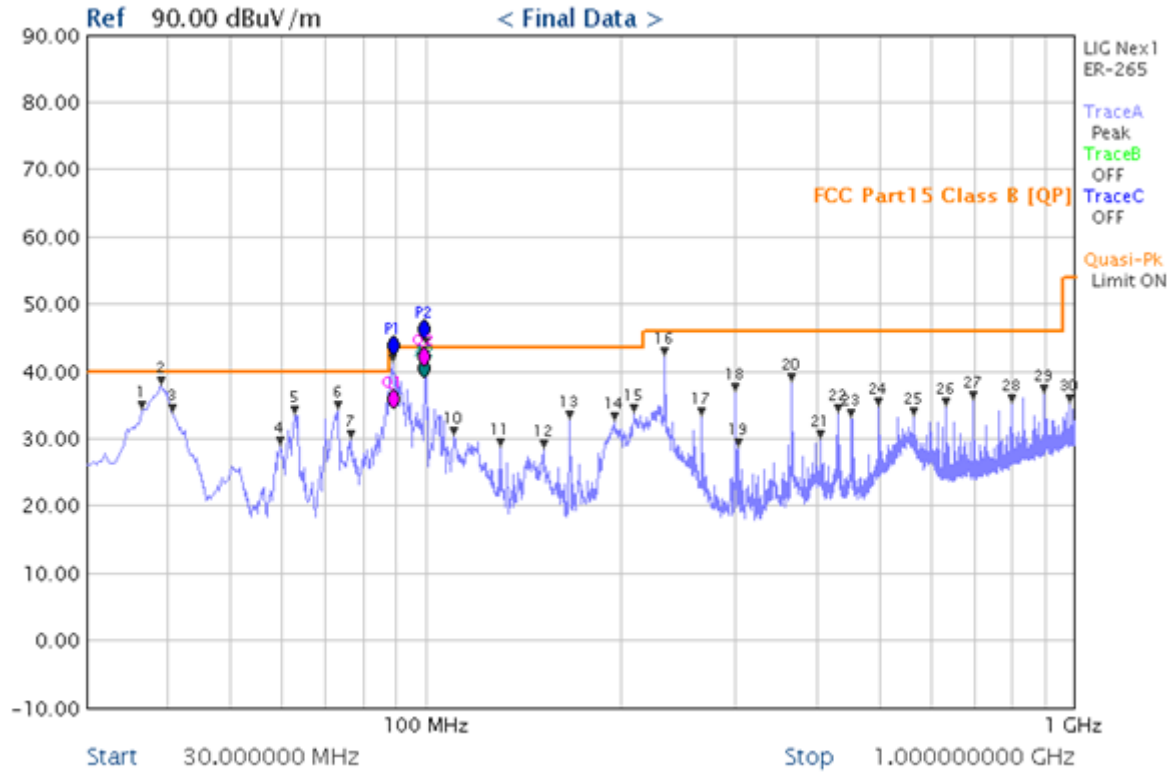
Test Mode	IEEE802.11b	Test Channel	7 CH (2442 MHz)
Test Result	PASS		



Frequency MHz	Reading dBuV/m	P (H, V)	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV/m	Total dBuV/m	Margin dB
39.12	23.57	V	12.02	1.30	0.00	40.00	36.89	3.11
89.45	30.99	H	7.59	1.90	0.00	43.50	40.48	3.02
96.67	29.27	H	8.76	1.97	0.00	43.50	40.00	3.50
99.98	28.32	H	9.35	1.90	0.00	43.50	39.57	3.93
233.09	28.54	V	11.01	3.16	0.00	46.00	42.71	3.29
299.53	20.53	H	13.31	3.50	0.00	46.00	37.34	8.66
365.85	20.81	V	14.78	3.96	0.00	46.00	39.55	6.45
879.92	8.26	V	23.25	6.22	0.00	46.00	37.73	8.27

Note : 1. Measurement level = reading level + correct factor

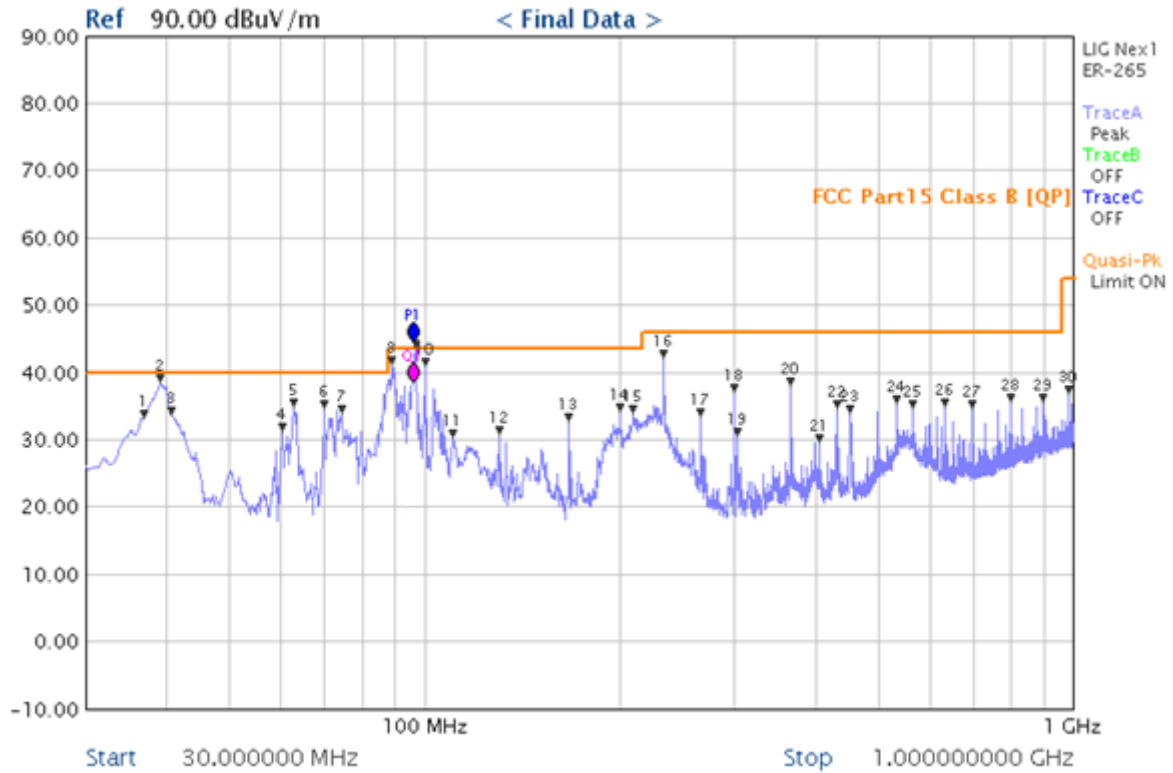
Test Mode	IEEE802.11b	Test Channel	13 CH (2472 MHz)
Test Result	PASS		



Frequency MHz	Reading dBuV/m	P (H, V)	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV/m	Total dBuV/m	Margin dB
39.12	23.41	V	12.02	1.30	0.00	40.00	36.73	3.27
88.86	30.23	H	7.62	1.90	0.00	43.50	39.75	3.75
99.99	28.84	H	9.35	1.90	0.00	43.50	40.09	3.41
233.09	28.48	V	11.01	3.16	0.00	46.00	42.65	3.35
365.85	20.42	V	14.78	3.96	0.00	46.00	39.16	6.84
798.21	7.28	H	22.47	5.90	0.00	46.00	35.65	10.35
897.92	6.80	V	23.42	6.29	0.00	46.00	36.51	9.49
983.07	7.42	H	24.05	6.66	0.00	54.00	38.13	15.87

Note : 1. Measurement level = reading level + correct factor

Test Mode	IEEE802.11g	Test Channel	1 CH (2412 MHz)
Test Result	PASS		

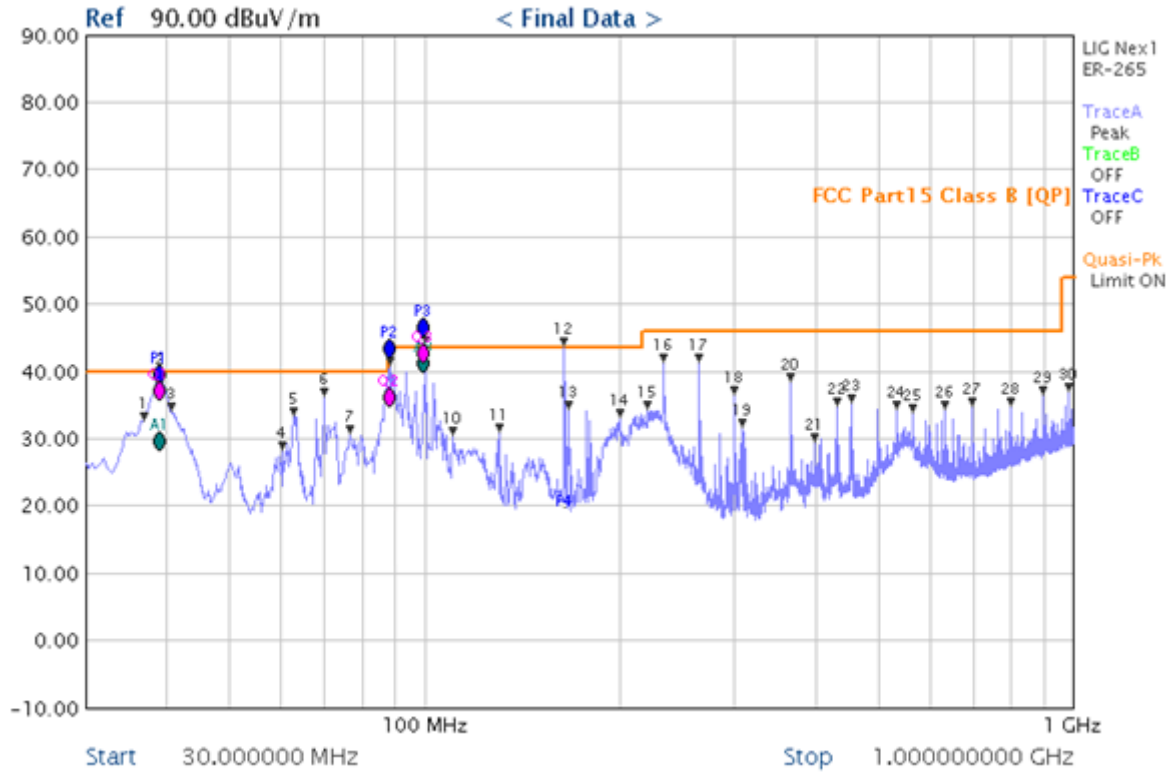


Frequency MHz	Reading dBuV/m	P (H, V)	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV/m	Total dBuV/m	Margin dB
39.12	23.57	V	12.02	1.30	0.00	40.00	36.89	3.11
88.86	30.48	H	7.62	1.90	0.00	43.50	40.00	3.50
96.67	29.01	H	8.76	1.97	0.00	43.50	39.74	3.76
99.99	28.67	H	9.35	1.90	0.00	43.50	39.92	3.58
233.09	26.42	V	11.01	3.16	0.00	46.00	40.59	5.41
299.53	19.28	H	13.31	3.50	0.00	46.00	36.09	9.91
365.85	18.80	V	14.78	3.96	0.00	46.00	37.54	8.46
983.07	6.67	H	24.05	6.66	0.00	54.00	37.38	16.62

Note : 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.

2. Measurement level = reading level + correct factor

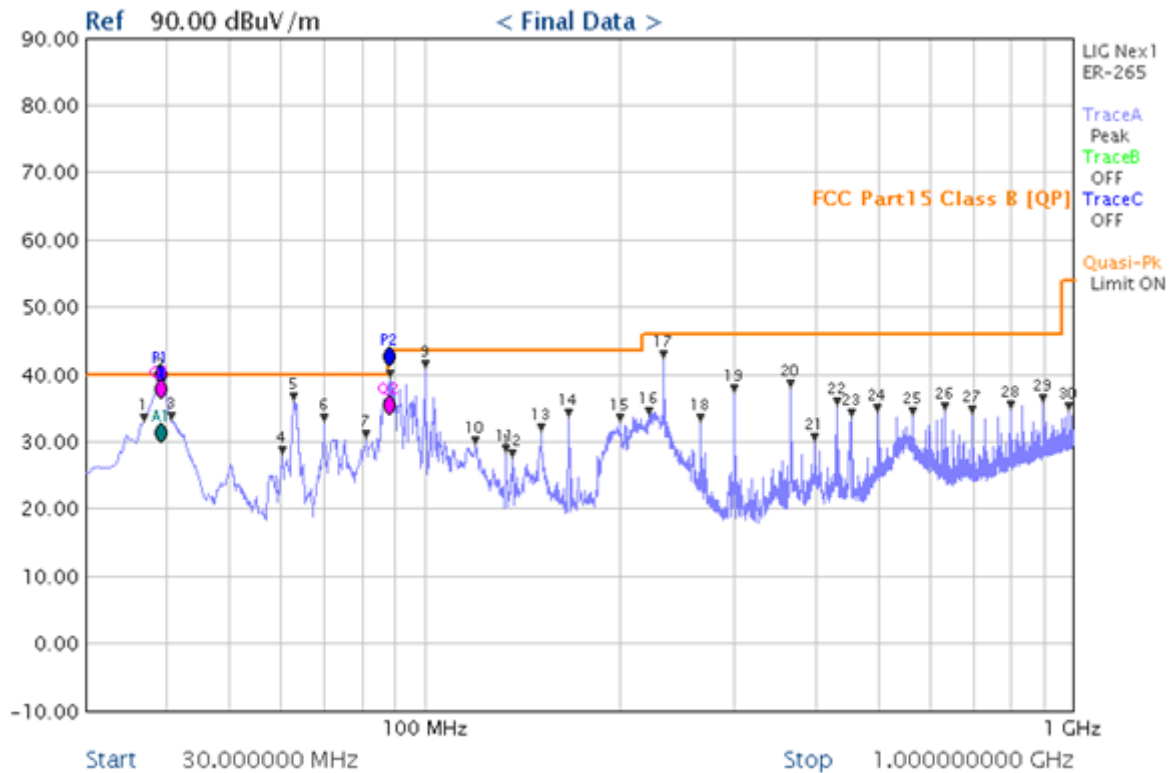
Test Mode	IEEE802.11g	Test Channel	7 CH (2442 MHz)
Test Result	PASS		



Frequency MHz	Reading dBuV/m	P (H, V)	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV/m	Total dBuV/m	Margin dB
39.12	23.64	V	12.02	1.30	0.00	40.00	36.96	3.04
88.86	30.59	H	7.62	1.90	0.00	43.50	40.11	3.39
99.99	29.04	H	9.35	1.90	0.00	43.50	40.29	3.21
164.05	24.67	V	12.91	2.54	0.00	43.50	40.12	3.38
233.09	26.42	V	11.01	3.16	0.00	46.00	40.59	5.41
264.24	26.40	V	12.18	3.36	0.00	46.00	41.94	4.06
299.53	19.62	H	13.31	3.50	0.00	46.00	36.43	9.57
365.85	18.37	H	14.78	3.96	0.00	46.00	37.11	8.89

Note : 1. Measurement level = reading level + correct factor

Test Mode	IEEE802.11g	Test Channel	13 CH (2472 MHz)
Test Result	PASS		

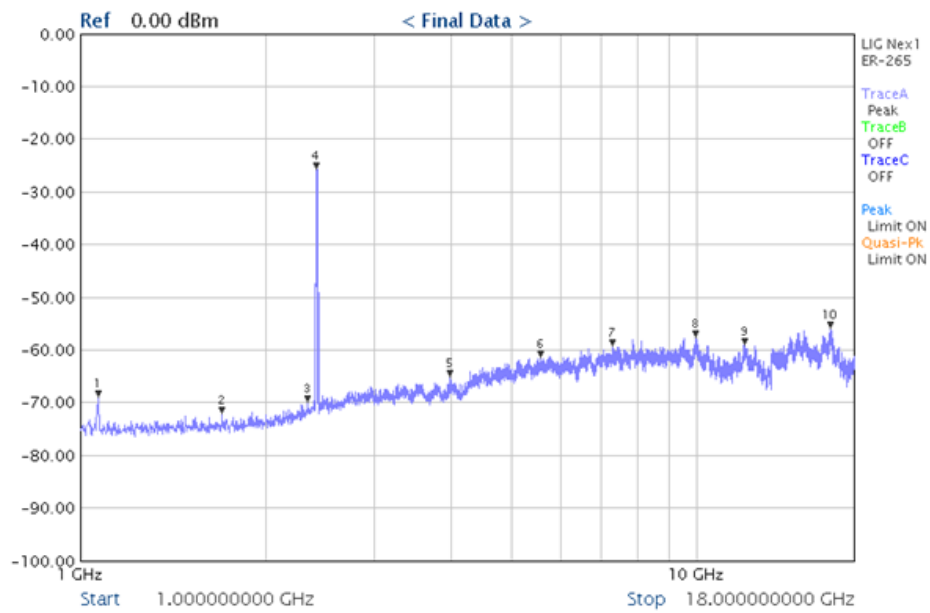
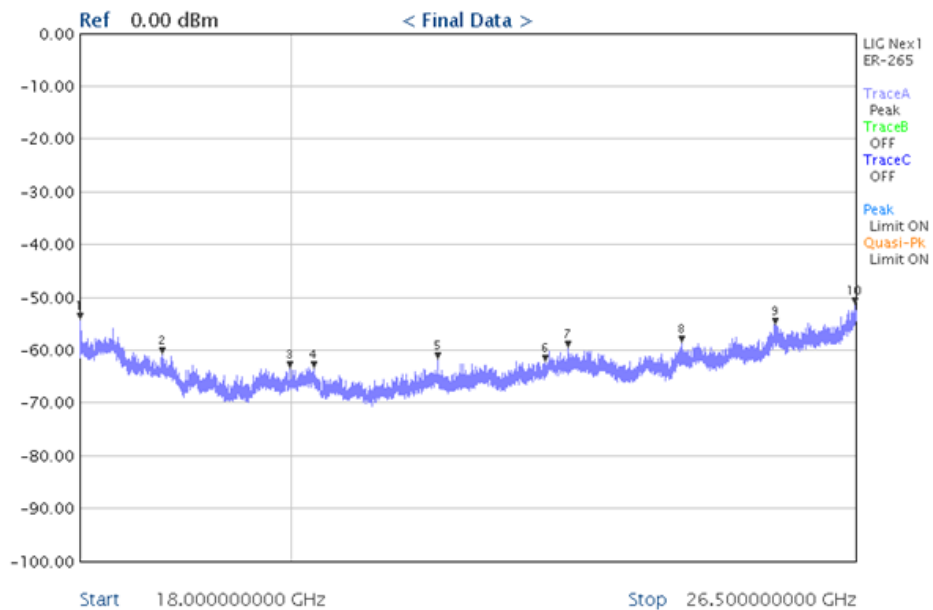


Frequency MHz	Reading dBuV/m	P (H, V)	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV/m	Total dBuV/m	Margin dB
39.12	23.66	V	12.02	1.30	0.00	40.00	36.98	3.02
62.68	22.94	V	11.56	1.65	0.00	40.00	36.15	3.85
88.15	29.37	H	7.65	1.90	0.00	43.50	38.92	4.58
99.99	28.57	H	9.35	1.90	0.00	43.50	39.82	3.68
233.09	28.33	V	11.01	3.16	0.00	46.00	42.50	3.50
299.53	20.31	H	13.31	3.50	0.00	46.00	37.12	8.88
365.85	18.91	V	14.78	3.96	0.00	46.00	37.65	8.35
897.92	5.77	V	23.42	6.29	0.00	46.00	35.48	10.52

Note : 1. Measurement level = reading level + correct factor

3.1.5.2 Fundamental & Harmonics Radiated Emission Result(1 to 26 GHz)

Test Mode	IEEE802.11b	Test Channel	1 CH (2412 MHz)
Test Item	Fundamental & Harmonics Radiated Emission Test Result	Polarization	Hor.
Test Result	PASS		

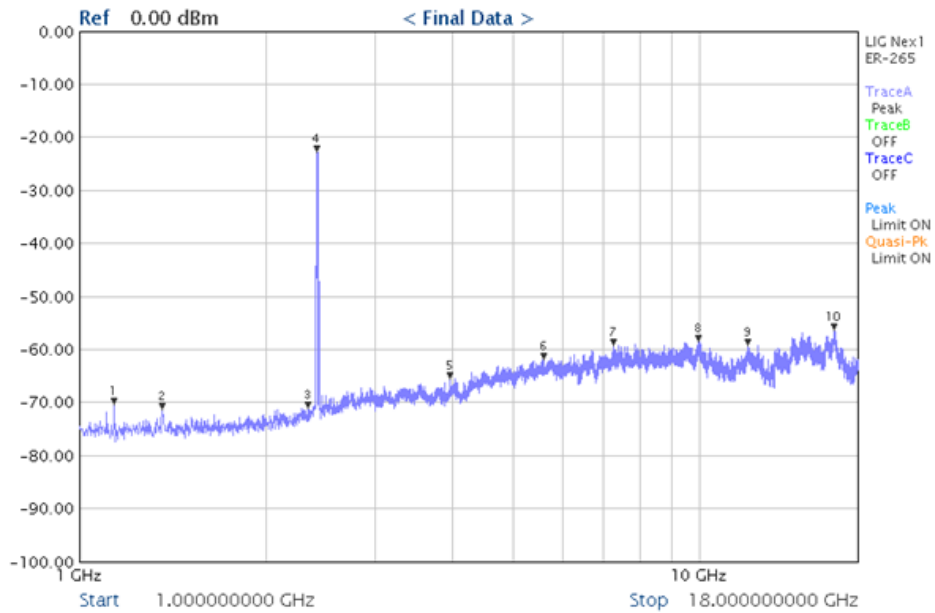

[1 to 18 GHz]

[18 to 26 GHz]

Frequency (MHz)	Emission PK/AV (dBuV/m)	Polarization	Limits PK/AV (dBuV/m)	Margin (dB)
2412	81.19(PK)	Hor.	114/94	32.81

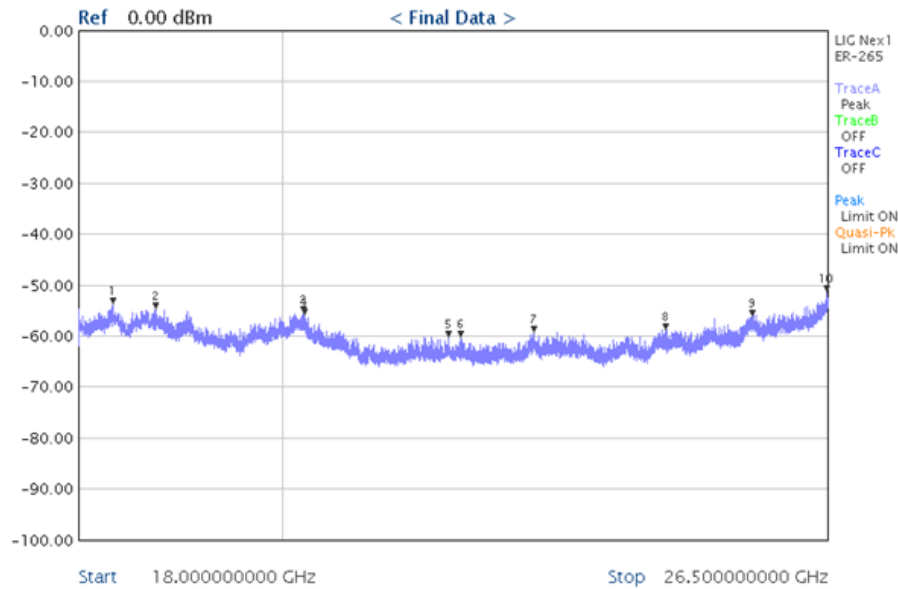
Note :

- 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.*
- 2. Measurement level = reading level + correct factor*

Test Mode	IEEE802.11b	Test Channel	1 CH (2412 MHz)
Test Item	Fundamental & Harmonics Radiated Emission Test Result	Polarization	Ver.
Test Result	PASS		



[1 to 18 GHz]

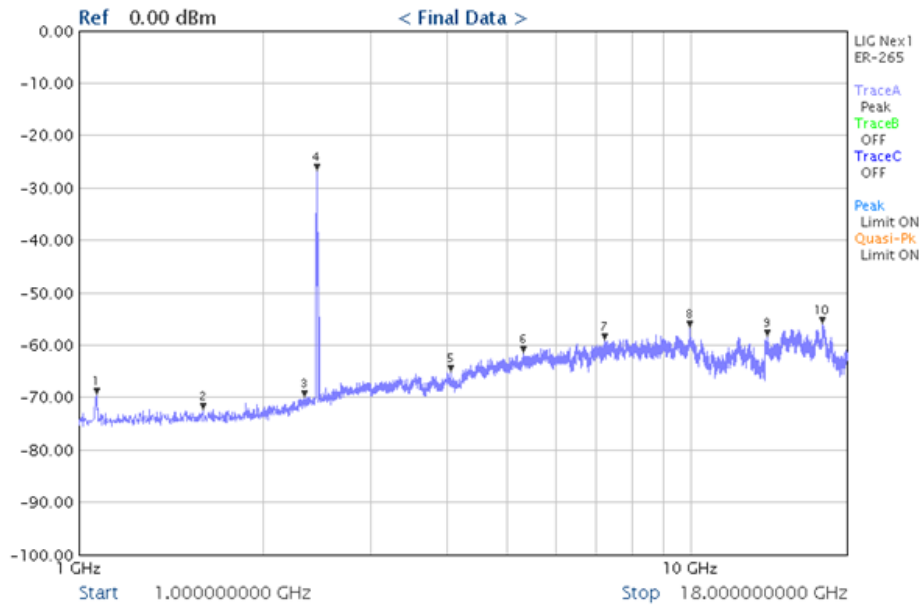


[18 to 26 GHz]

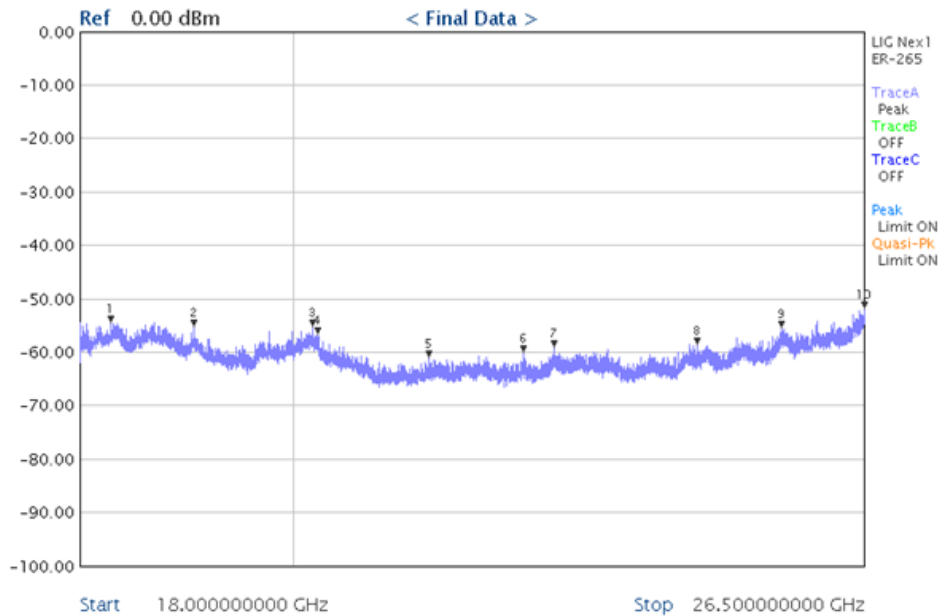
Frequency (MHz)	Emission PK/AV (dBuV/m)	Polarization	Limits PK/AV (dBuV/m)	Margin (dB)
2412	84.22(PK)	Ver.	114/94	29.78

*Note : 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.
2. Measurement level = reading level + correct factor*

Test Mode	IEEE802.11b	Test Channel	7 CH (2442 MHz)
Test Item	Fundamental & Harmonics Radiated Emission Test Result	Polarization	Hor.
Test Result	PASS		



[1 to 18 GHz]



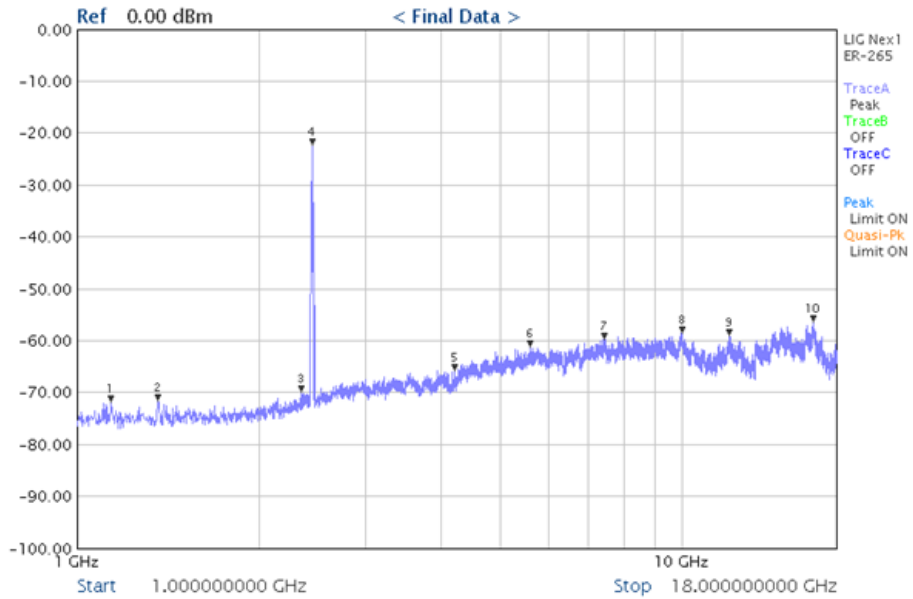
[18 to 26 GHz]

Frequency (MHz)	Emission PK/AV (dBuV/m)	Polarization	Limits PK/AV (dBuV/m)	Margin (dB)
2442	81.20(PK)	Hor.	114/94	32.80

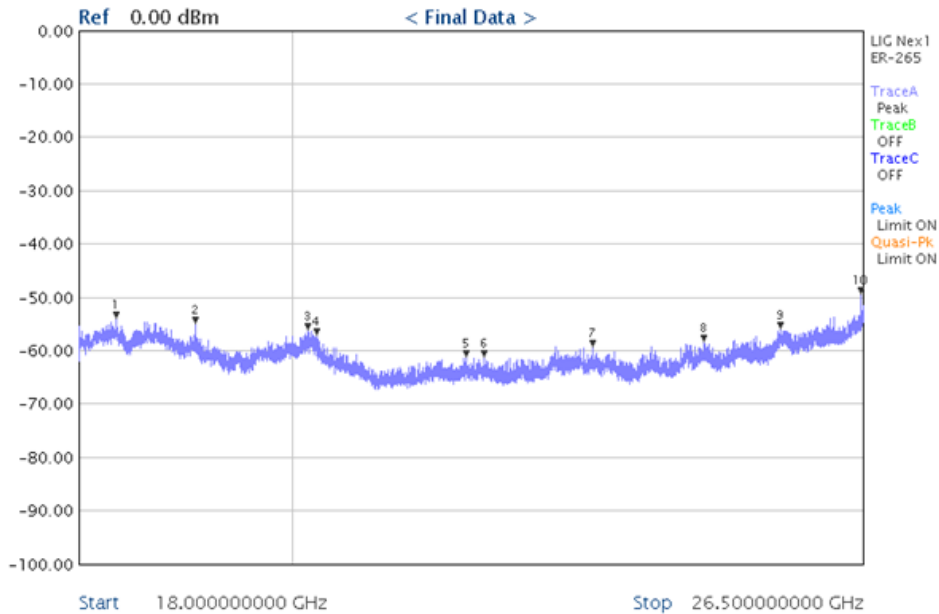
Note :

- 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.*
- 2. Measurement level = reading level + correct factor*

Test Mode	IEEE802.11b	Test Channel	7 CH (2442 MHz)
Test Item	Fundamental & Harmonics Radiated Emission Test Result	Polarization	Ver.
Test Result	PASS		



[1 to 18 GHz]

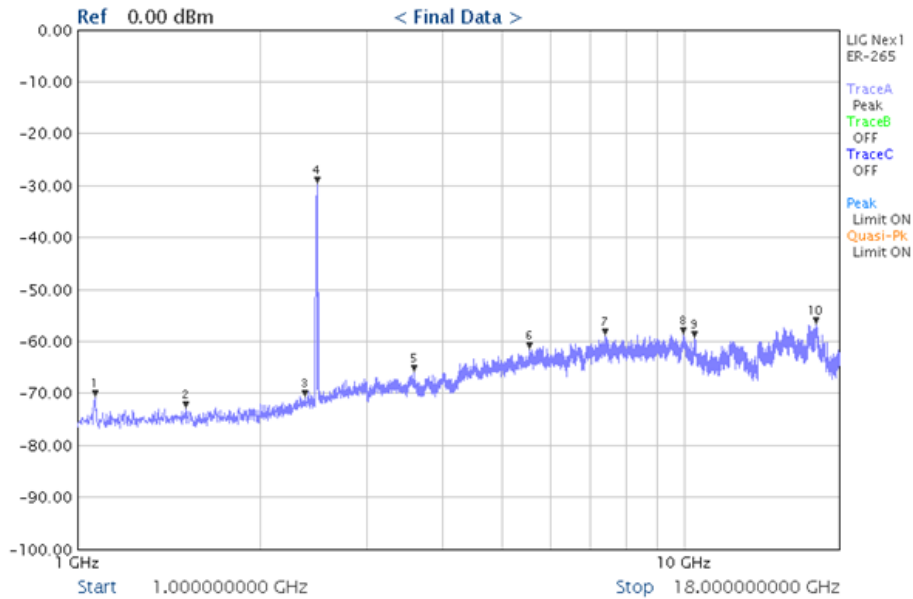


[18 to 26 GHz]

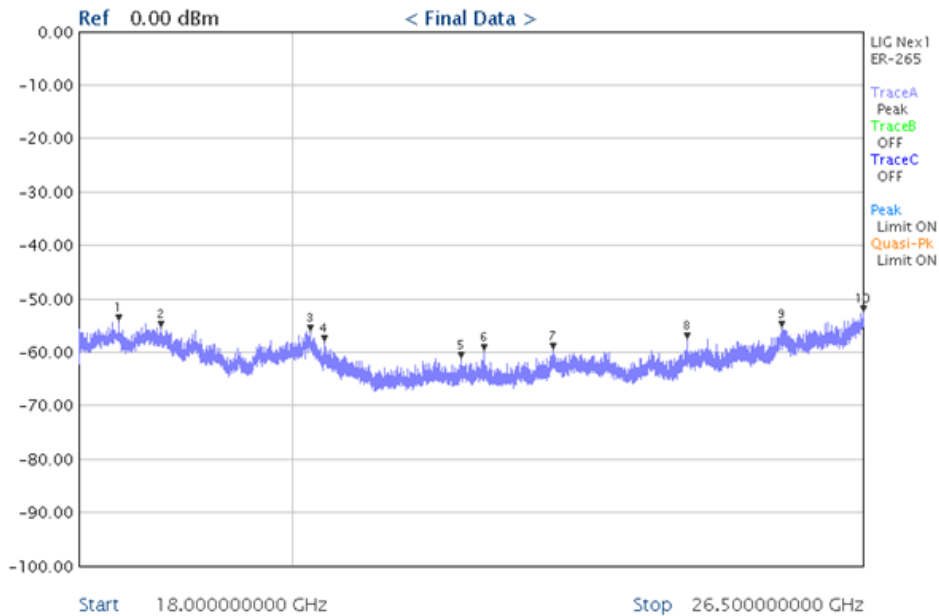
Frequency (MHz)	Emission PK/AV (dBuV/m)	Polarization	Limits PK/AV (dBuV/m)	Margin (dB)
2442	84.58(PK)	Ver.	114/94	29.42

*Note : 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.
2. Measurement level = reading level + correct factor*

Test Mode	IEEE802.11b	Test Channel	13 CH (2472 MHz)
Test Item	Fundamental & Harmonics Radiated Emission Test Result	Polarization	Hor.
Test Result	PASS		



[1 to 18 GHz]



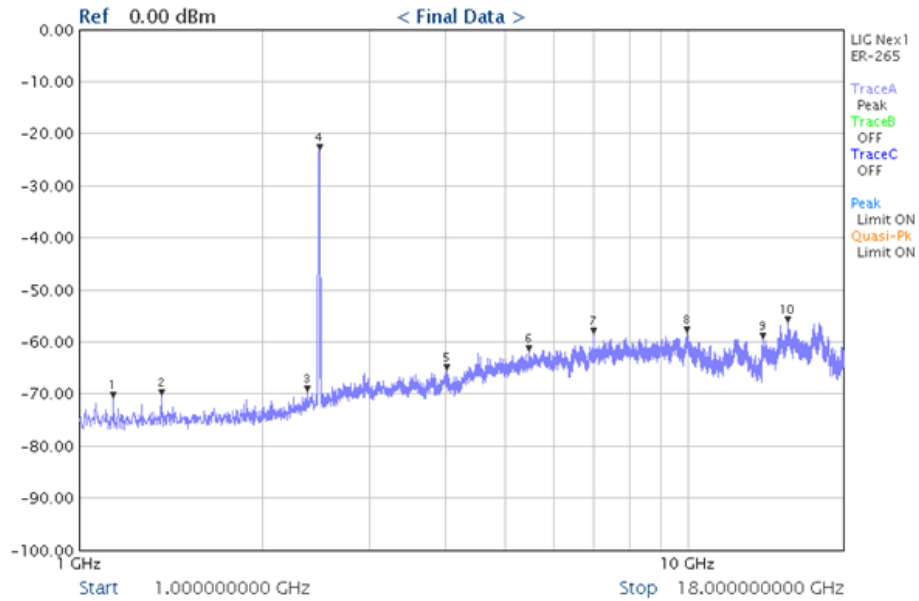
[18 to 26 GHz]

Frequency (MHz)	Emission PK/AV (dBuV/m)	Polarization	Limits PK/AV (dBuV/m)	Margin (dB)
2472	77.43(PK)	Hor.	114/94	36.57

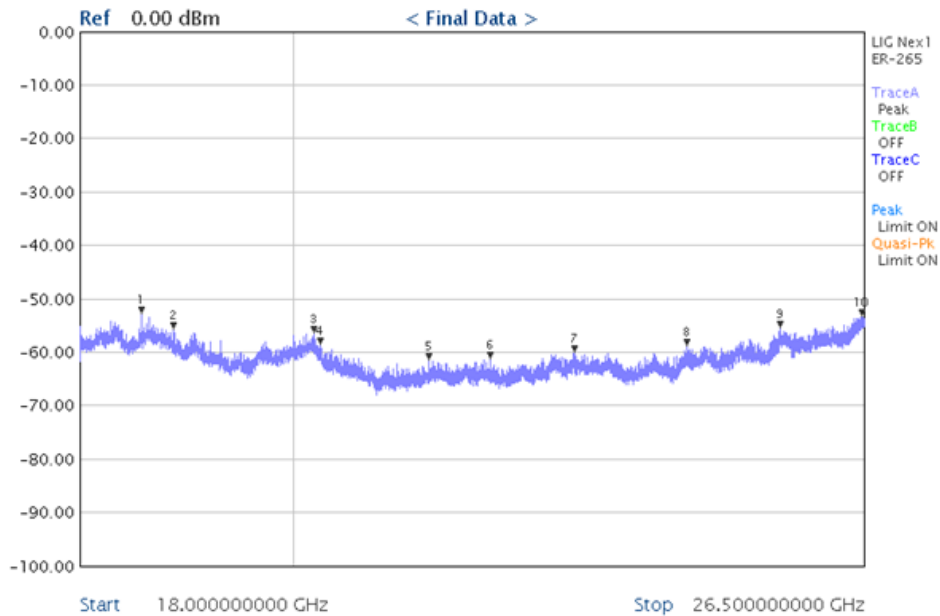
Note :

- 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.*
- 2. Measurement level = reading level + correct factor*

Test Mode	IEEE802.11b	Test Channel	13 CH (2472 MHz)
Test Item	Fundamental & Harmonics Radiated Emission Test Result	Polarization	Ver.
Test Result	PASS		



[1 to 18 GHz]

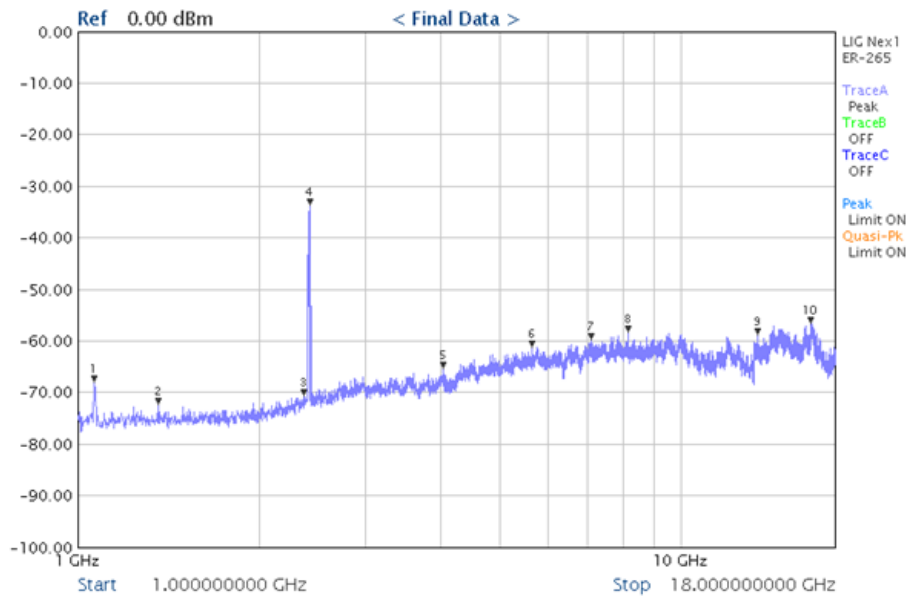


[18 to 26 GHz]

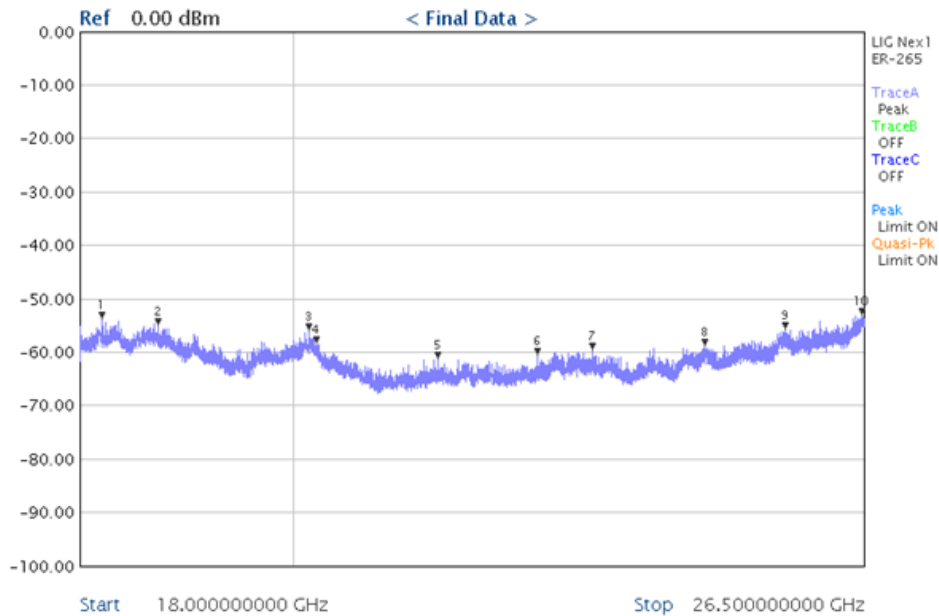
Frequency (MHz)	Emission PK/AV (dBuV/m)	Polarization	Limits PK/AV (dBuV/m)	Margin (dB)
2472	83.73(PK)	Ver.	114/94	30.27

Note : 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.
2. Measurement level = reading level + correct factor

Test Mode	IEEE802.11g	Test Channel	1 CH (2412 MHz)
Test Item	Fundamental & Harmonics Radiated Emission Test Result	Polarization	Hor.
Test Result	PASS		



[1 to 18 GHz]

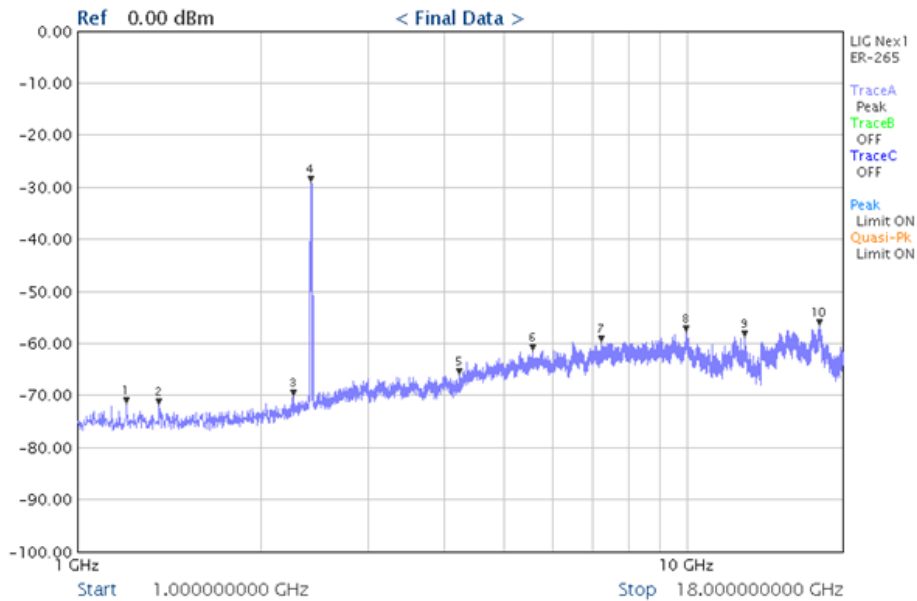


[18 to 26 GHz]

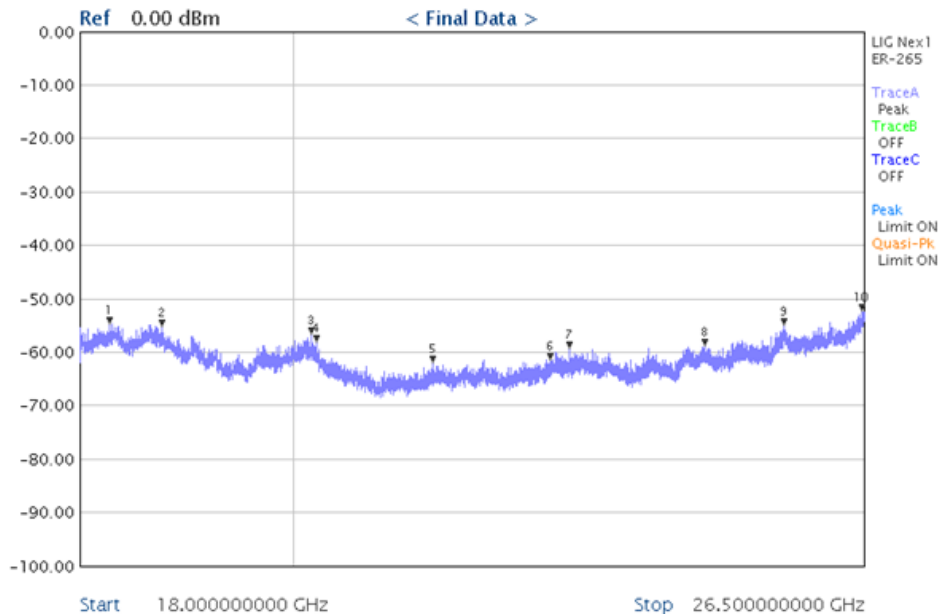
Frequency (MHz)	Emission PK/AV (dBuV/m)	Polarization	Limits PK/AV (dBuV/m)	Margin (dB)
2412	73.35(PK)	Hor.	114/94	40.65

*Note : 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.
2. Measurement level = reading level + correct factor*

Test Mode	IEEE802.11g	Test Channel	1 CH (2412 MHz)
Test Item	Fundamental & Harmonics Radiated Emission Test Result	Polarization	Ver.
Test Result	PASS		



[1 to 18 GHz]

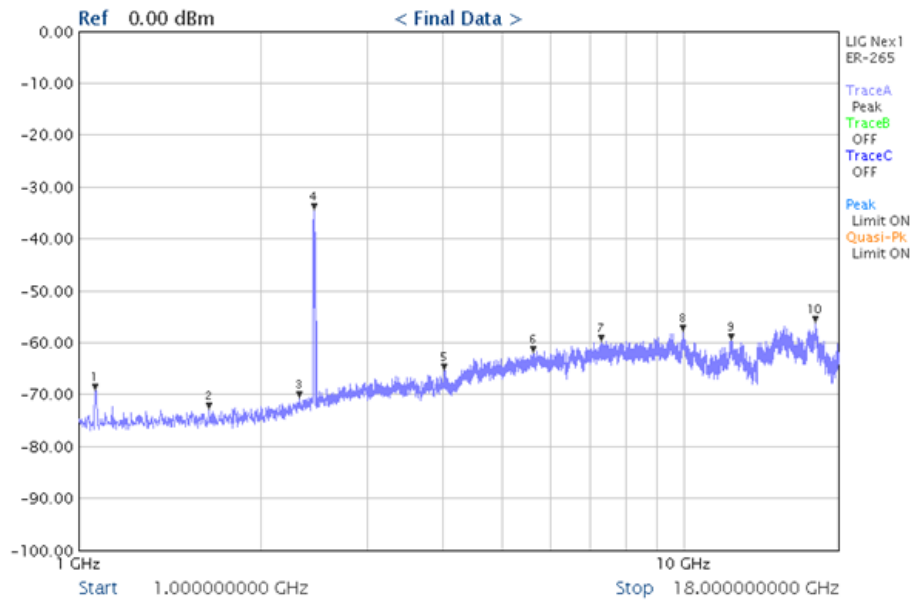


[18 to 26 GHz]

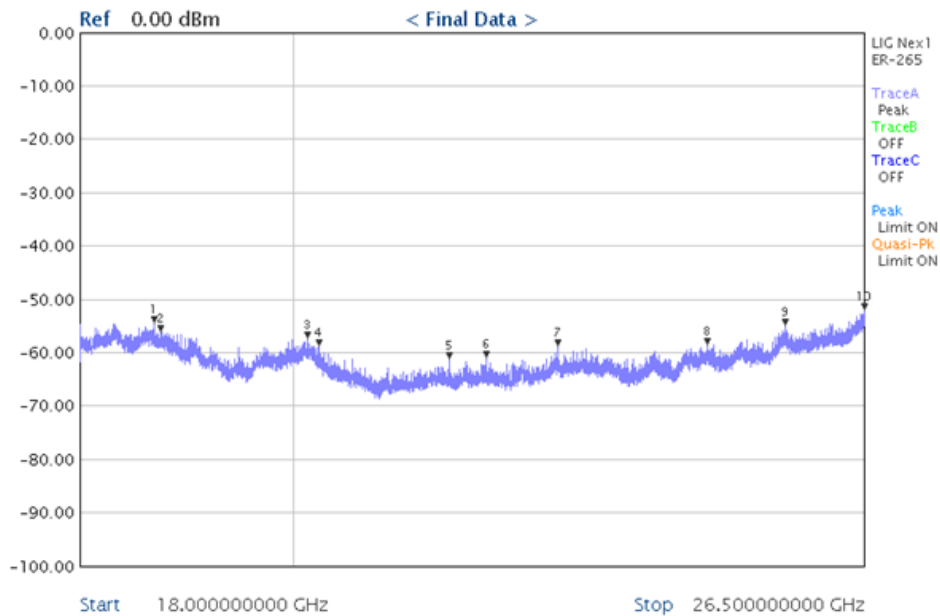
Frequency (MHz)	Emission PK/AV (dBuV/m)	Polarization	Limits PK/AV (dBuV/m)	Margin (dB)
2412	77.83(PK)	Ver.	114/94	36.17

*Note : 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.
2. Measurement level = reading level + correct factor*

Test Mode	IEEE802.11g	Test Channel	7 CH (2442 MHz)
Test Item	Fundamental & Harmonics Radiated Emission Test Result	Polarization	Hor.
Test Result	PASS		



[1 to 18 GHz]

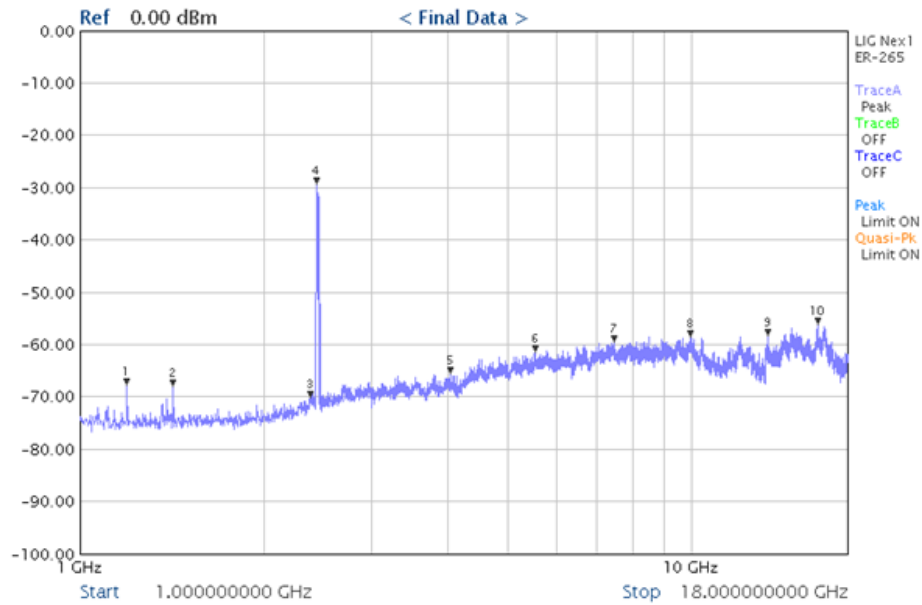


[18 to 26 GHz]

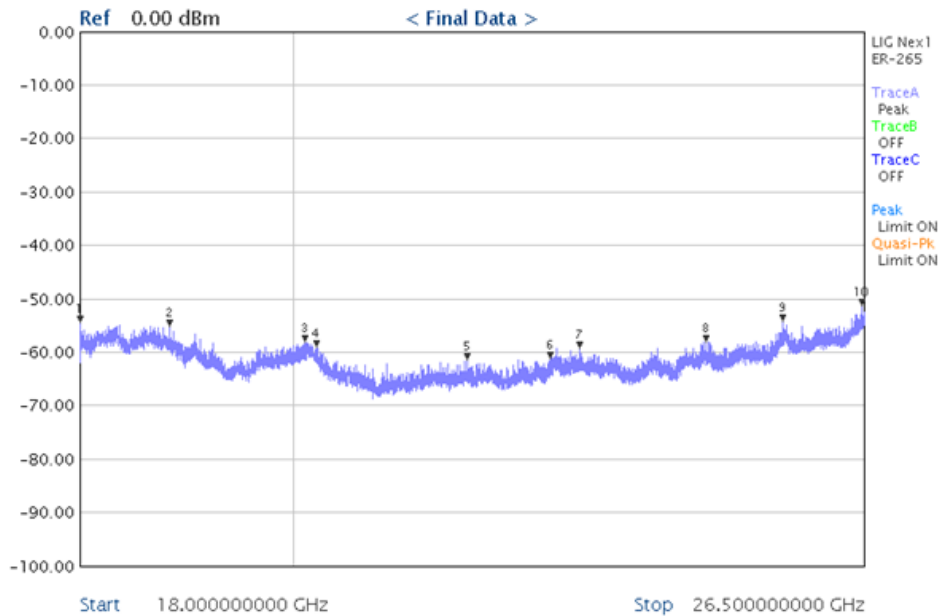
Frequency (MHz)	Emission PK/AV (dBuV/m)	Polarization	Limits PK/AV (dBuV/m)	Margin (dB)
2442	72.50(PK)	Hor.	114/94	41.50

*Note : 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.
2. Measurement level = reading level + correct factor*

Test Mode	IEEE802.11g	Test Channel	7 CH (2442 MHz)
Test Item	Fundamental & Harmonics Radiated Emission Test Result	Polarization	Ver.
Test Result	PASS		



[1 to 18 GHz]

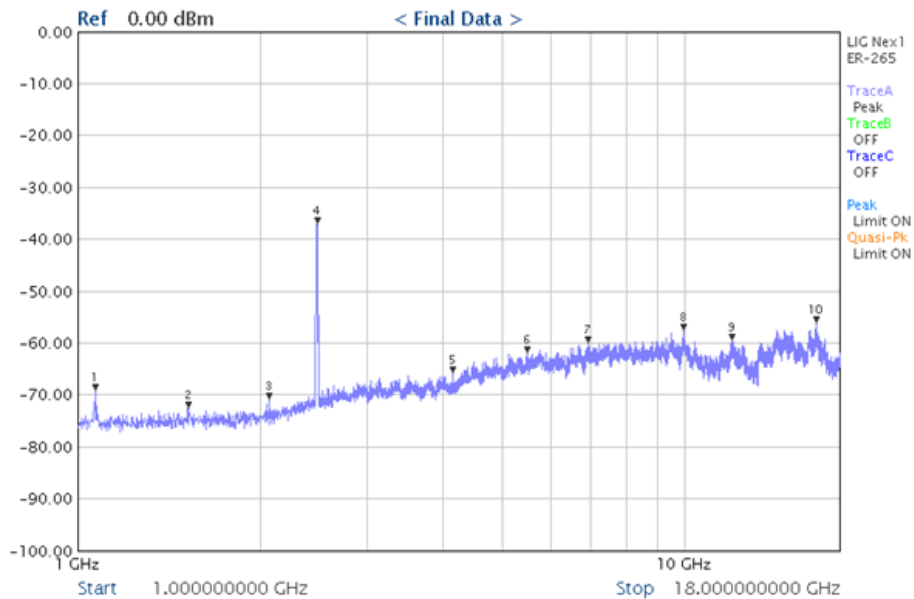


[18 to 26 GHz]

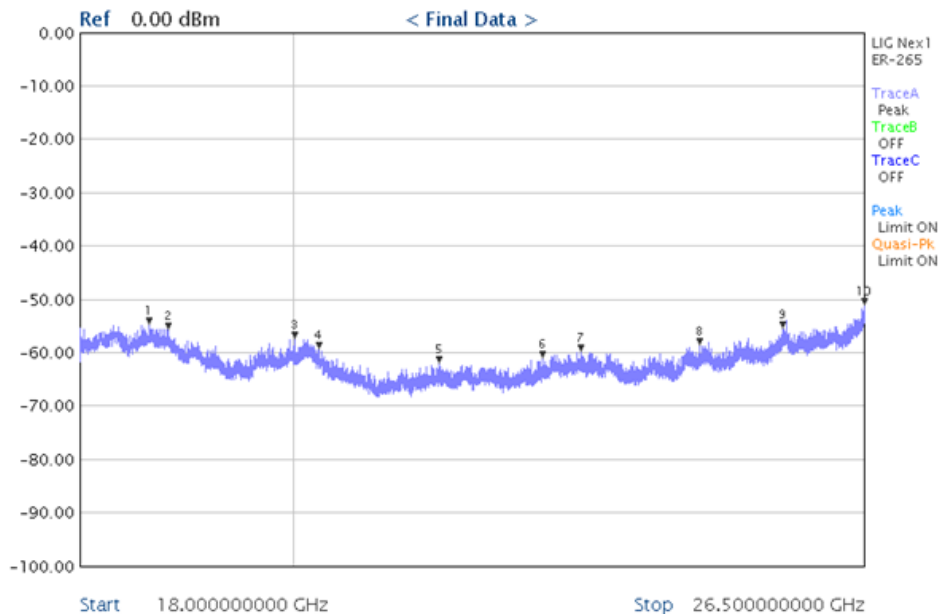
Frequency (MHz)	Emission PK/AV (dBuV/m)	Polarization	Limits PK/AV (dBuV/m)	Margin (dB)
2442	77.70(PK)	Ver.	114/94	36.30

*Note : 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.
2. Measurement level = reading level + correct factor*

Test Mode	IEEE802.11g	Test Channel	13 CH (2472 MHz)
Test Item	Fundamental & Harmonics Radiated Emission Test Result	Polarization	Hor.
Test Result	PASS		



[1 to 18 GHz]

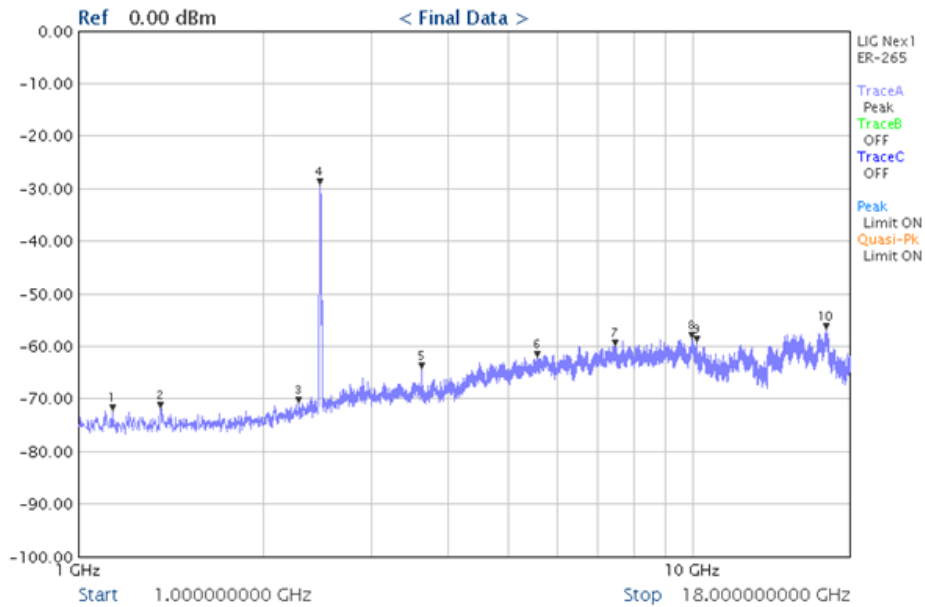


[18 to 26 GHz]

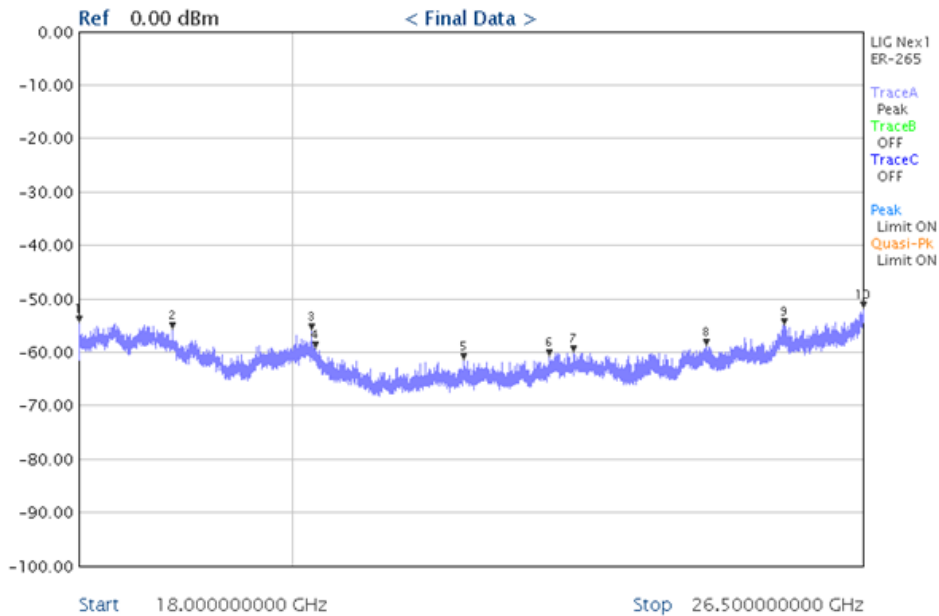
Frequency (MHz)	Emission PK/AV (dBuV/m)	Polarization	Limits PK/AV (dBuV/m)	Margin (dB)
2472	69.94(PK)	Hor.	114/94	44.06

*Note : 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.
2. Measurement level = reading level + correct factor*

Test Mode	IEEE802.11g	Test Channel	13 CH (2472 MHz)
Test Item	Fundamental & Harmonics Radiated Emission Test Result	Polarization	Ver.
Test Result	PASS		



[1 to 18 GHz]



[18 to 26 GHz]

Frequency (MHz)	Emission PK/AV (dBuV/m)	Polarization	Limits PK/AV (dBuV/m)	Margin (dB)
2472	77.65(PK)	Ver.	114/94	36.35

*Note : 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.
2. Measurement level = reading level + correct factor*

3.3 Peak Power Output

3.3.1 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Next of Calibration
Spectrum Analyzer	ADVANTEST	R3273	130900034	12. 05. 2012
RF Test Room	-	-	-	-

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

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

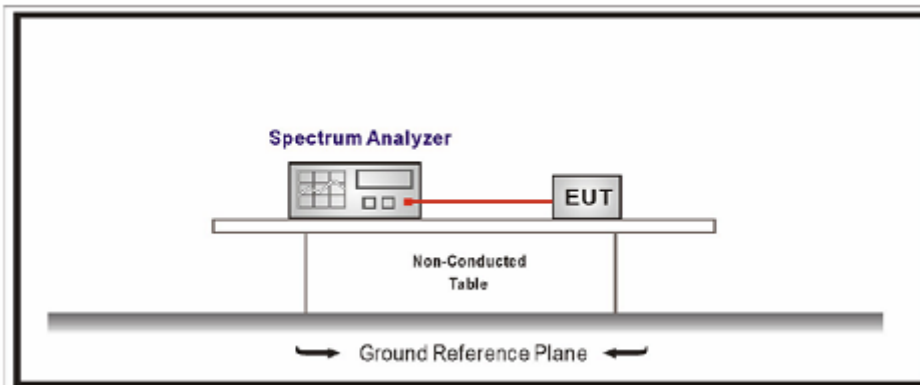
3.3.2 Limit

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

3.3.3 Test Configuration

RF Conducted Measurement:



3.3.4 Test Procedure

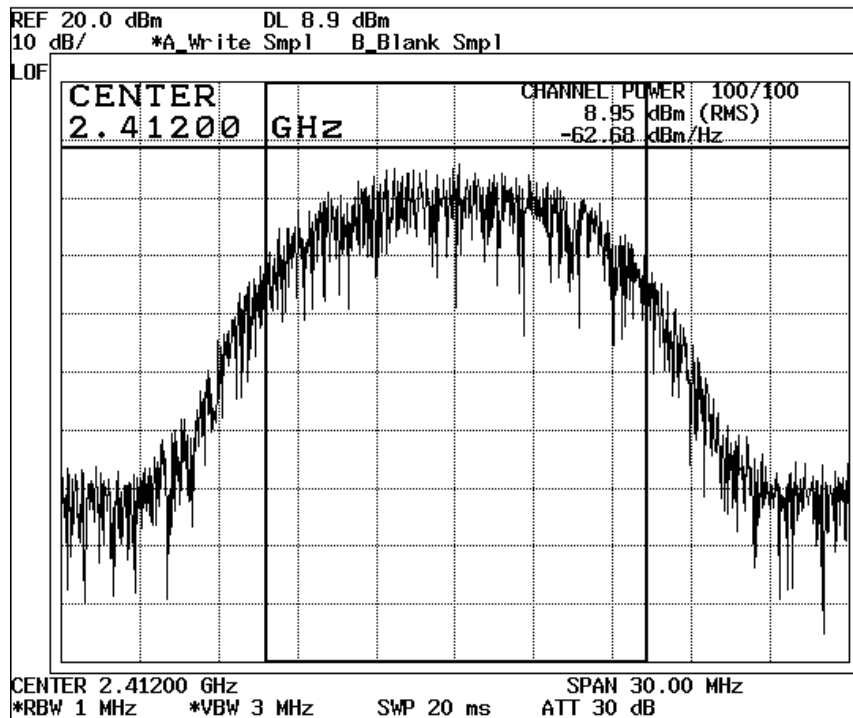
The transmitter output is connected to the Spectrum analyzer. The Spectrum analyzer is set to the peak power detection.

3.3.5 Peak Power Test Result

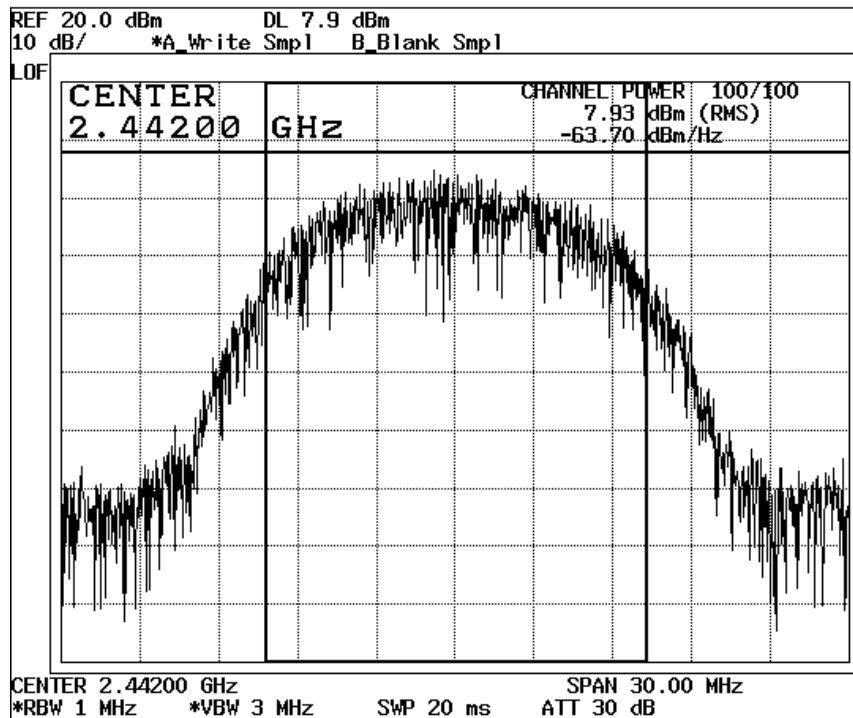
Test Item	Peak Power Output
Test Mode	802.11b
Test Site	RF Room
Measurement Method	Conducted

Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
1	2412	8.95	1Watt=30dBm	Pass
7	2442	7.93	1Watt=30dBm	Pass
13	2472	7.31	1Watt=30dBm	Pass

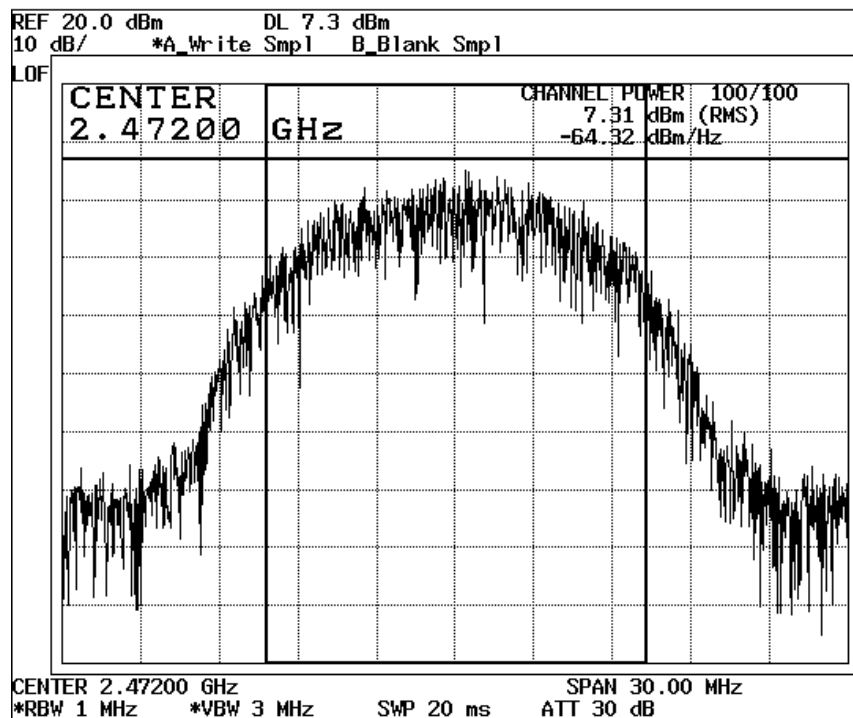
Channel 1.



Channel 7.



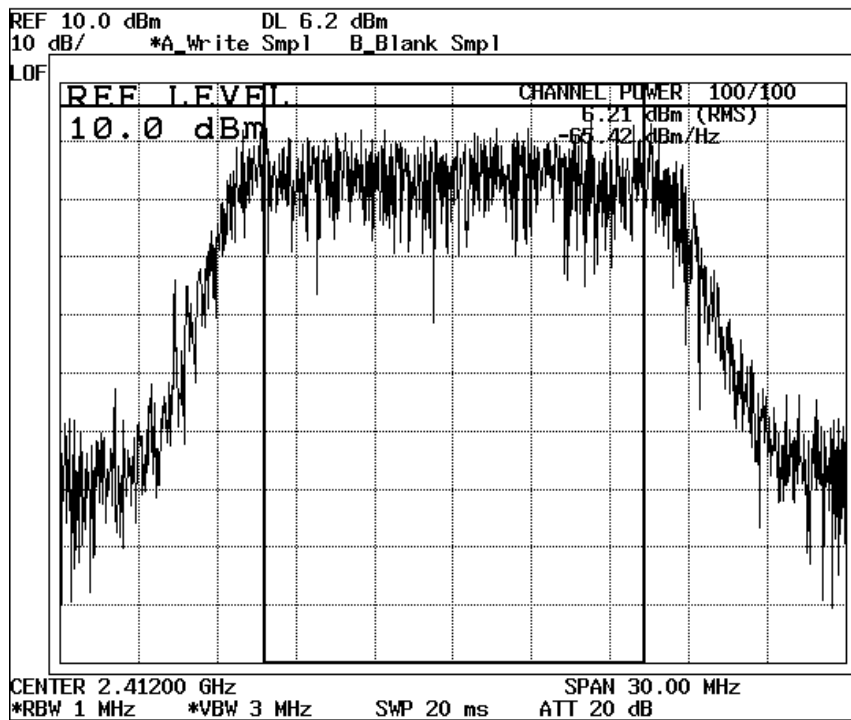
Channel 13.



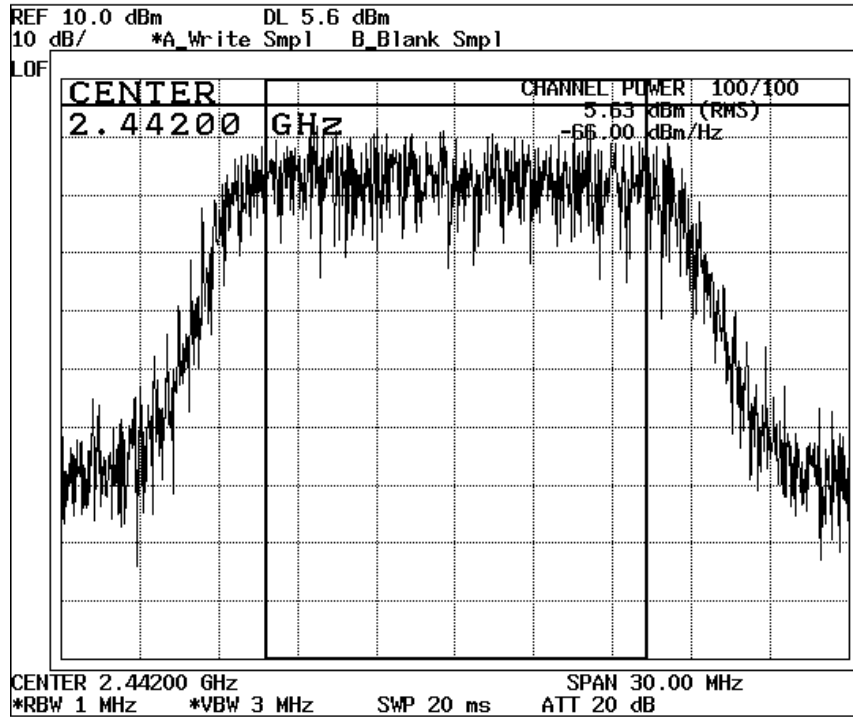
Test Item	Peak Power Output
Test Mode	802.11g
Test Site	RF Room
Measurement Method	Conducted

Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
1	2412	6.21	1Watt=30dBm	Pass
7	2442	5.63	1Watt=30dBm	Pass
13	2472	5.01	1Watt=30dBm	Pass

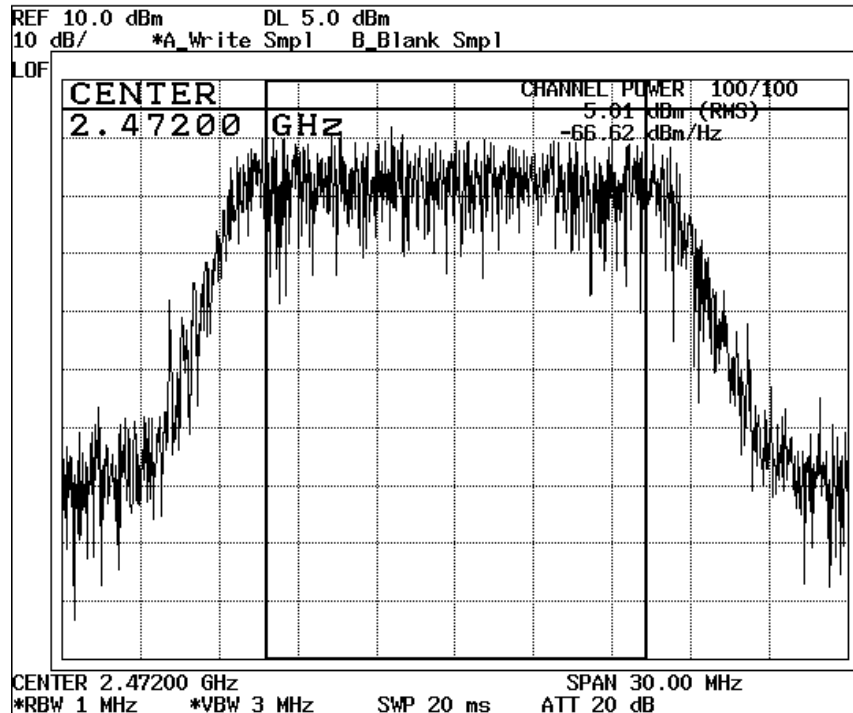
Channel 1.



Channel 7.



Channel 13.



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3.4 Band Edge

3.4.1 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Next of Calibration
Horn Antenna	R&S	BBHA9120D233	0501	09. 10. 2013
Horn Antenna	R&S	BBHA9170	BBHA9170152	09. 16. 2013
Horn Antenna	SCHWARZBECK	BBHA9120D	BBHA9120D 839	12. 24. 2012
Horn Antenna	A.H System, Inc	SAS 571	500	03. 23. 2013
TRILOG Antenna	SCHWARZBECK	VULD 9160	3292	04. 28. 2013
Loop Antenna	6502	EMCO	00123879	12. 28. 2012
EMI Test Receiver	ROHDE&SCHWARZ	ESVS10	80241-015	01. 30. 2013
EMI Test Receiver	LIG NEX1	ER-265	L0811B009	04. 10. 2013
Spectrum Analyzer	ADVANTEST	R3273	130900034	12. 05. 2012
Spectrum Analyzer	LIG NEX1	NS-30	6052036	01. 30. 2013

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

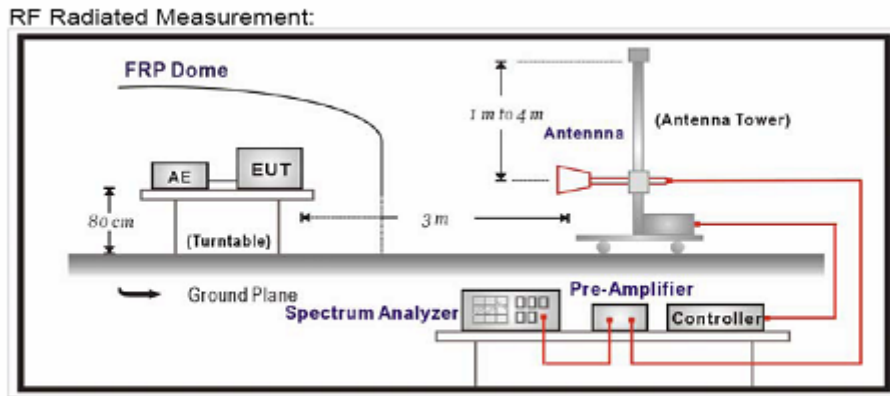
2. The calibration interval of horn ant. and loop ant. is 24 months

3.4.2 Limit

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)).

3.4.3 Test Configuration



3.4.4 Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters. The antenna can move up and down between 1 meter and 4 meters to fine out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.4:2003 on radiated measurement.

The bandwidth below 1 GHz setting on the field strength meter is 120 kHz, above 1GHz are 1MHz.

3.4.5 Test Result Method of Band Edge Test Result of Radiated Test.

Emission Level(dBuV/m) = Reading Level + Correct Factor.

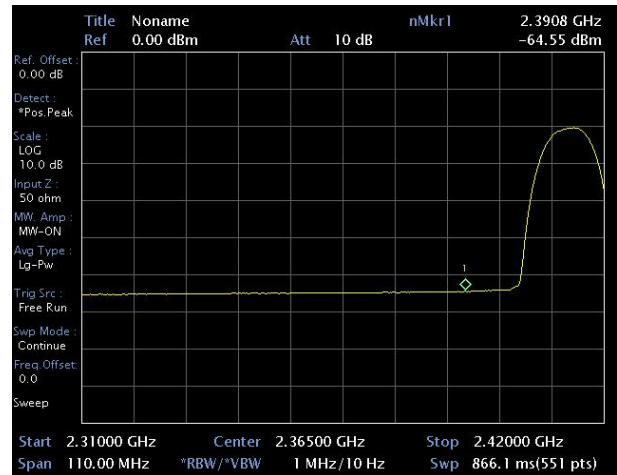
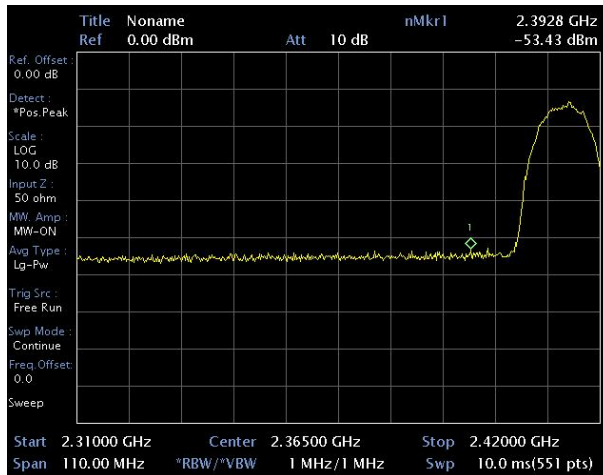
Test Frequency (MHz)	Correct Factor (dB)	
	Antenna Factor (dB)	Cable loss (dB)
2390	27.02	4.13
2483.5	27.33	4.20

Note : Correct Factor = AF + CL

AF – Antenna Factor , CL-Cable Loss

3.4.6 Band Edge Test Result

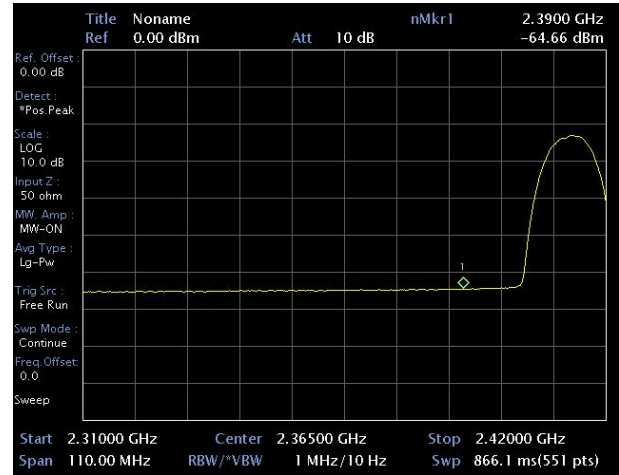
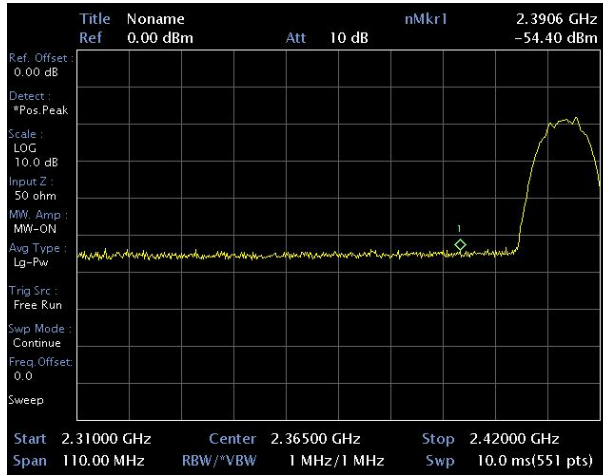
Detect mode	Peak / Average Mode	Test Site	3m Full Chamber
Note	IEEE802.11b- CH1 (2412 MHz)		
Ant. Pol.	Vertical		



Frequency (MHz)	Reading PK/AV (dBuV/m)	Factor(dB) CL+AF	Limits PK/AV (dBuV/m)	Result PK/AV (dBuV/m)	Margin PK/AV (dB)
2390	22.41/11.29	31.15	74/54	53.56/42.44	20.44/11.56

Note : Emission Level(dBuV/m) = Reading Level + Correct Factor

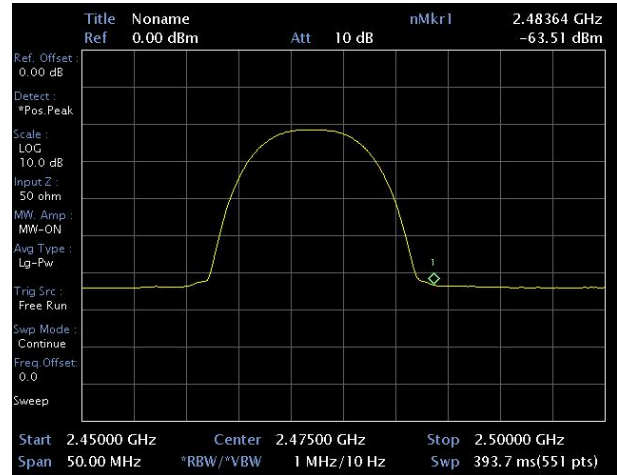
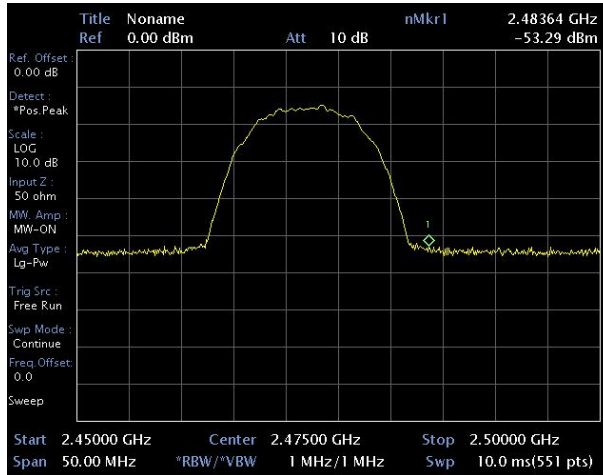
Detect mode	Peak / Average Mode	Test Site	3m Full Chamber
Note	IEEE802.11b- CH1 (2412 MHz)		
Ant. Pol.	Horizontal		



Frequency (MHz)	Reading PK/AV (dBuV/m)	Factor(dB) CL+AF	Limits PK/AV (dBuV/m)	Result PK/AV (dBuV/m)	Margin PK/AV (dB)
2390	21.44/11.18	31.15	74/54	52.59/42.33	21.41/11.67

Note : Emission Level(dBuV/m) = Reading Level + Correct Factor

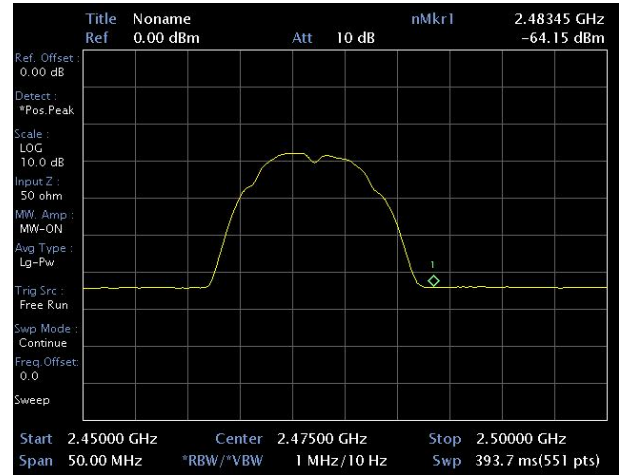
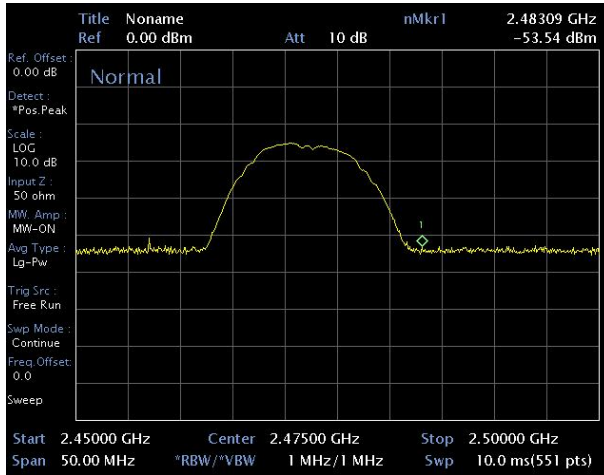
Detect mode	Peak / Average Mode	Test Site	3m Full Chamber
Note	IEEE802.11b- CH13 (2472 MHz)		
Ant. Pol.	Vertical		



Frequency (MHz)	Reading PK/AV (dBuV/m)	Factor(dB) CL+AF	Limits PK/AV (dBuV/m)	Result PK/AV (dBuV/m)	Margin PK/AV (dB)
2483.5	22.17/11.95	31.53	74/54	53.70/43.48	20.30/10.52

Note : Emission Level(dBuV/m) = Reading Level + Correct Factor

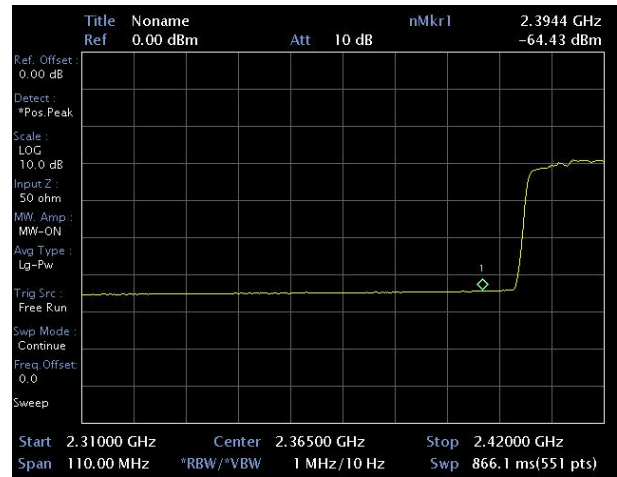
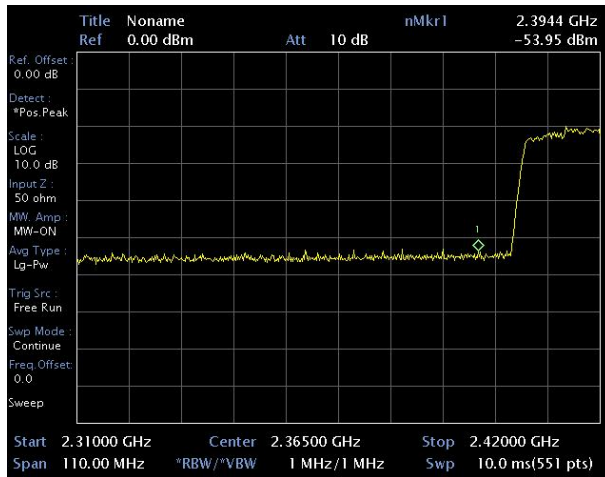
Detect mode	Peak / Average Mode	Test Site	3m Full Chamber
Note	IEEE802.11b- CH13 (2472 MHz)		
Ant. Pol.	Horizontal		



Frequency (MHz)	Reading PK/AV (dBuV/m)	Factor(dB) CL+AF	Limits PK/AV (dBuV/m)	Result PK/AV (dBuV/m)	Margin PK/AV (dB)
2483.5	21.92/11.31	31.53	74/54	53.45/42.84	20.55/11.16

Note : Emission Level(dBuV/m) = Reading Level + Correct Factor

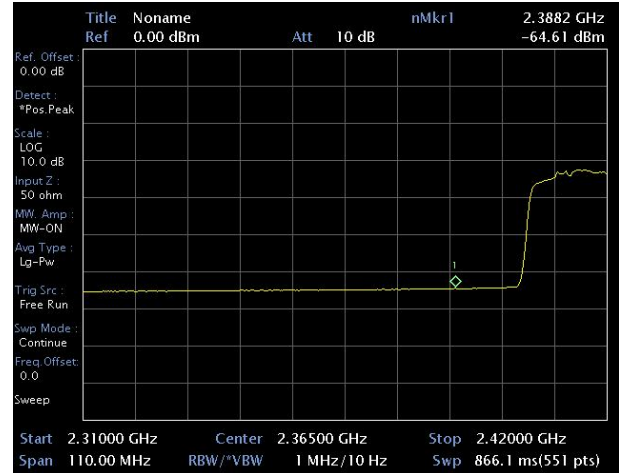
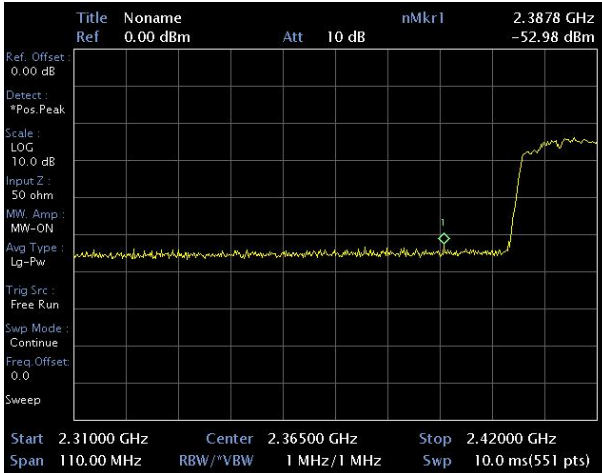
Detect mode	Peak / Average Mode	Test Site	3m Full Chamber
Note	IEEE802.11g- CH1 (2412 MHz)		
Ant. Pol.	Vertical		



Frequency (MHz)	Reading PK/AV (dBuV/m)	Factor(dB) CL+AF	Limits PK/AV (dBuV/m)	Result PK/AV (dBuV/m)	Margin PK/AV (dB)
2390	21.89/11.41	31.15	74/54	53.04/42.56	20.96/11.44

Note : Emission Level(dBuV/m) = Reading Level + Correct Factor

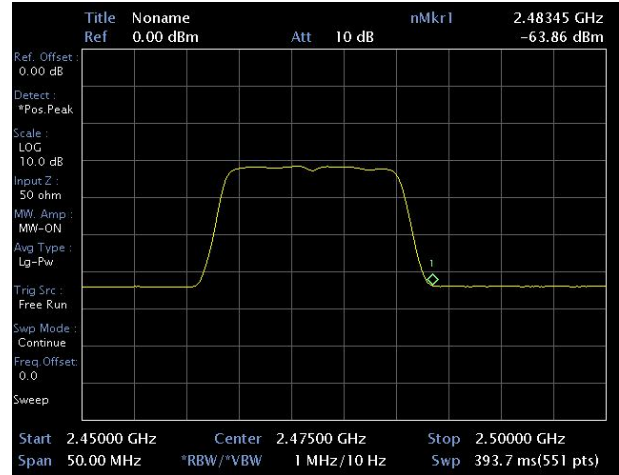
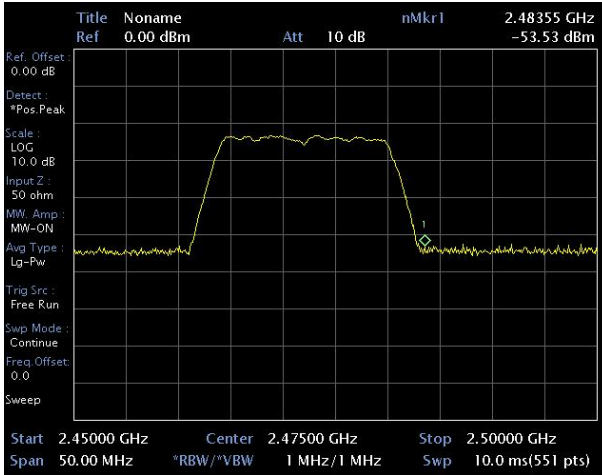
Detect mode	Peak / Average Mode	Test Site	3m Full Chamber
Note	IEEE802.11g- CH1 (2412 MHz)		
Ant. Pol.	Horizontal		



Frequency (MHz)	Reading PK/AV (dBuV/m)	Factor(dB) CL+AF	Limits PK/AV (dBuV/m)	Result PK/AV (dBuV/m)	Margin PK/AV (dB)
2390	22.86/11.23	31.15	74/54	54.01/42.38	19.99/11.62

Note : Emission Level(dBuV/m) = Reading Level + Correct Factor

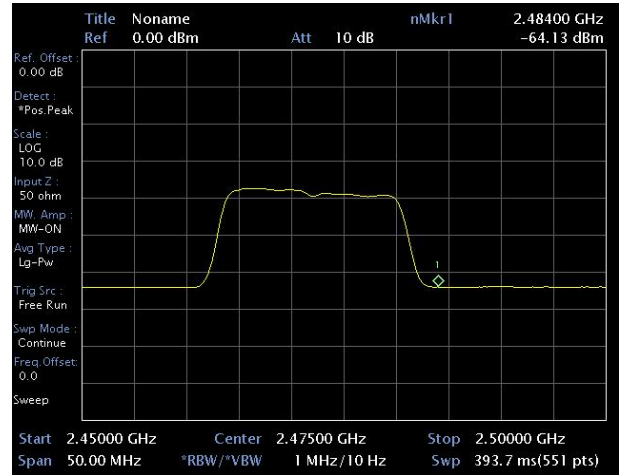
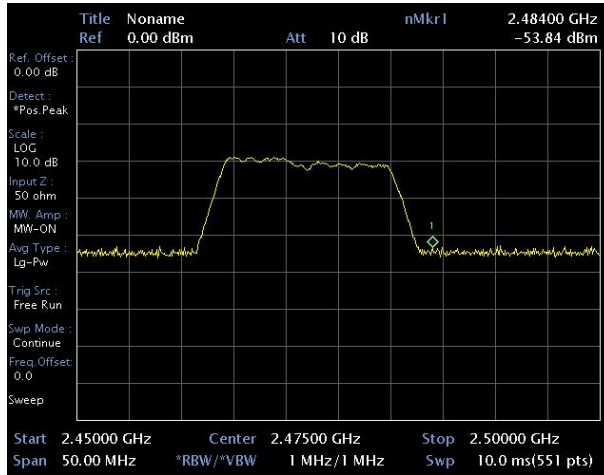
Detect mode	Peak / Average Mode	Test Site	3m Full Chamber
Note	IEEE802.11g- CH13 (2472 MHz)		
Ant. Pol.	Vertical		



Frequency (MHz)	Reading PK/AV (dBuV/m)	Factor(dB) CL+AF	Limits PK/AV (dBuV/m)	Result PK/AV (dBuV/m)	Margin PK/AV (dB)
2483.5	21.93/11.60	31.53	74/54	53.46/43.13	20.54/10.87

Note : Emission Level(dBuV/m) = Reading Level + Correct Factor

Detect mode	Peak / Average Mode	Test Site	3m Full Chamber
Note	IEEE802.11g- CH13 (2472 MHz)		
Ant. Pol.	Horizontal		



Frequency (MHz)	Reading PK/AV (dBuV/m)	Factor(dB) CL+AF	Limits PK/AV (dBuV/m)	Result PK/AV (dBuV/m)	Margin PK/AV (dB)
2483.5	21.62/11.33	31.53	74/54	53.15/42.86	20.85/11.14

Note : Emission Level(dBuV/m) = Reading Level + Correct Factor

3.5 6 dB Band

3.5.1 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Next of Calibration
Spectrum Analyzer	ADVANTEST	R3273	130900034	12. 05. 2012
RF Test Room	-	-	-	-

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

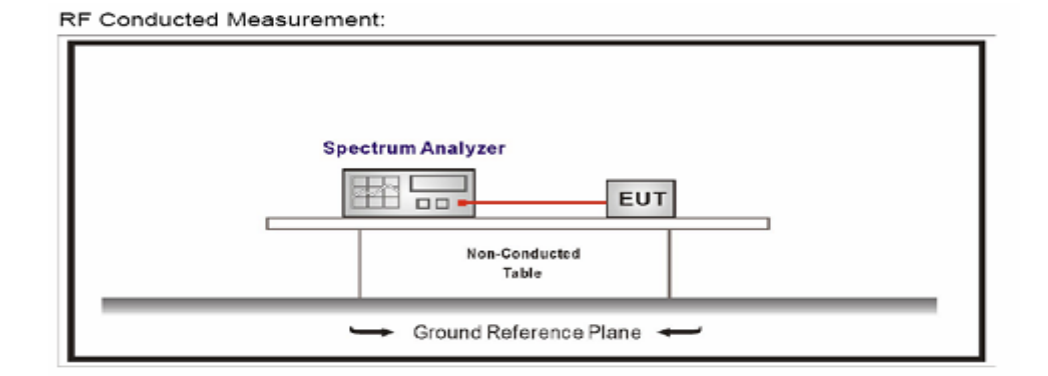
2. The calibration interval of horn ant. and loop ant. is 24 months

3.5.2 Limit

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions :

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

3.5.3 Test Configuration



3.5.4 Test Procedure

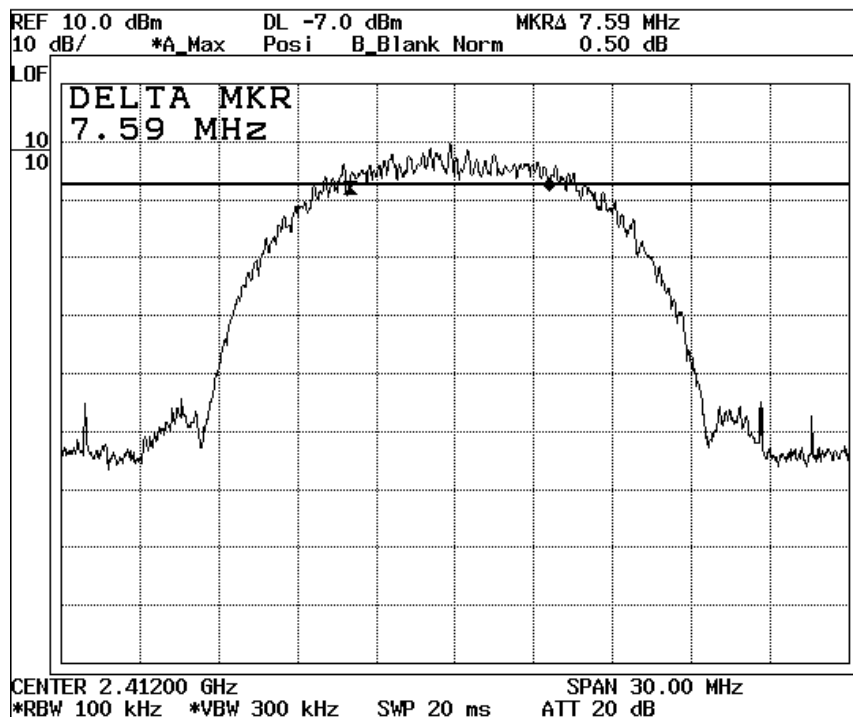
The transmitter output is connected to the Spectrum analyzer. The Spectrum analyzer is set to the 6dB Band.

3.5.5 6 dB Band Test Result

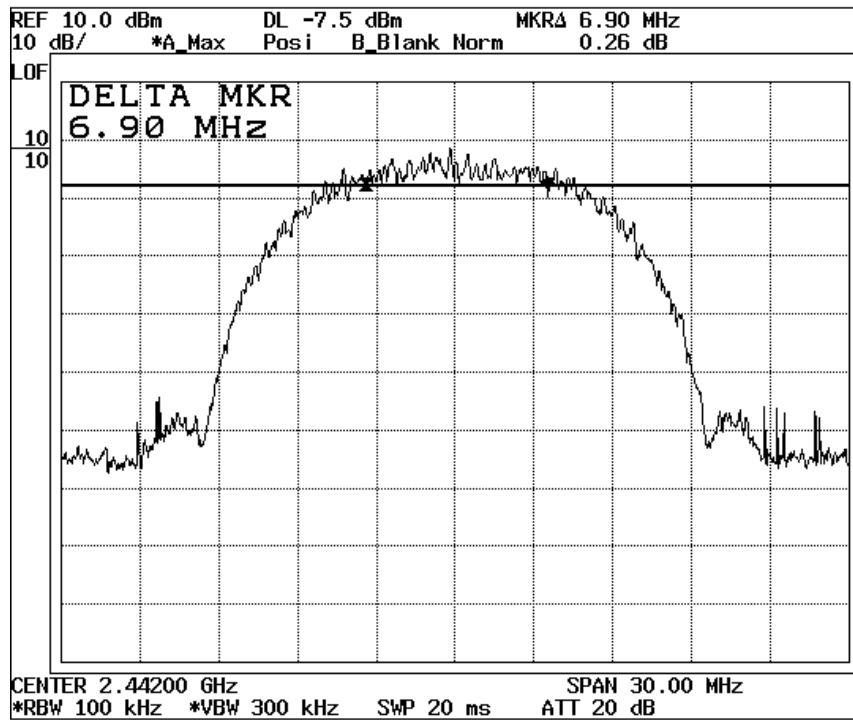
Test Item	6 dB Band
Test Mode	802.11b
Test Site	RF Room
Measurement Method	Conducted

Channel No.	Frequency (MHz)	Measure (kHz)	Limit (kHz)	Result
1	2412	7590	>500	Pass
7	2442	6900	>500	Pass
13	2472	6900	>500	Pass

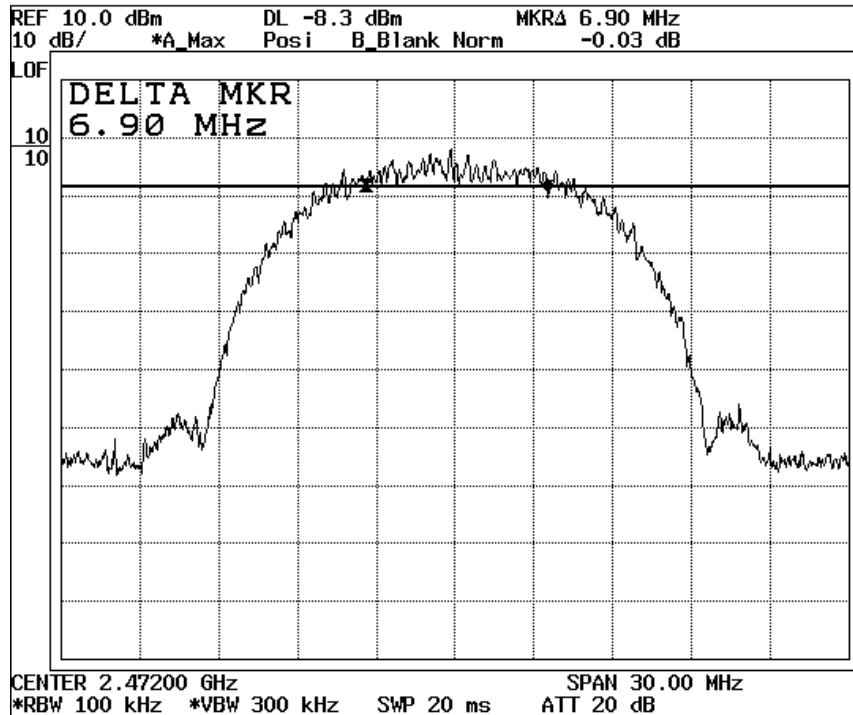
Channel 1.



Channel 7.



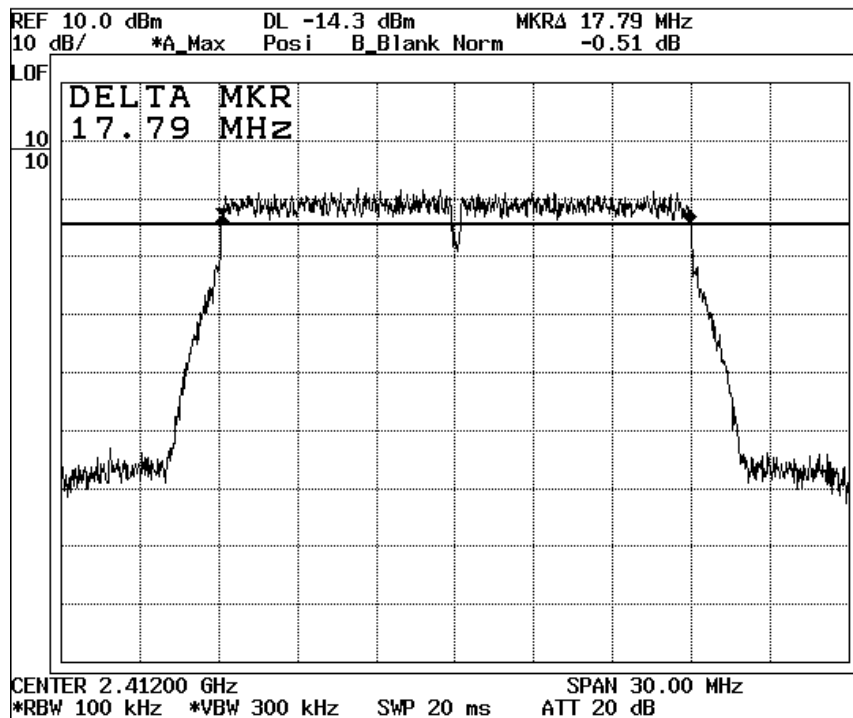
Channel 13.



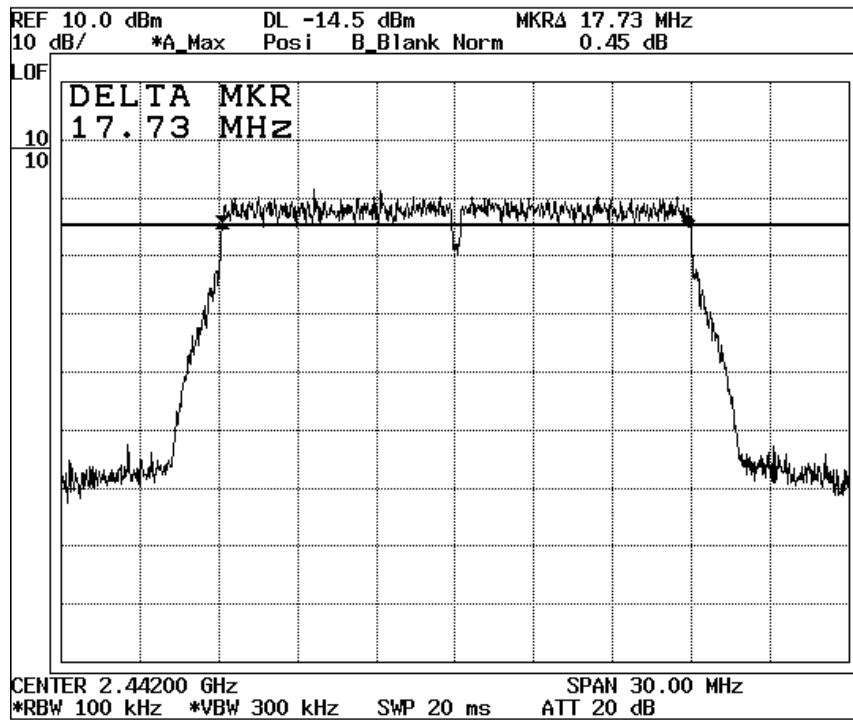
Test Item	6 dB Band
Test Mode	802.11g
Test Site	RF Room
Measurement Method	Conducted

Channel No.	Frequency (MHz)	Measure (kHz)	Limit (kHz)	Result
1	2412	17790	>500	Pass
7	2442	17730	>500	Pass
13	2472	17880	>500	Pass

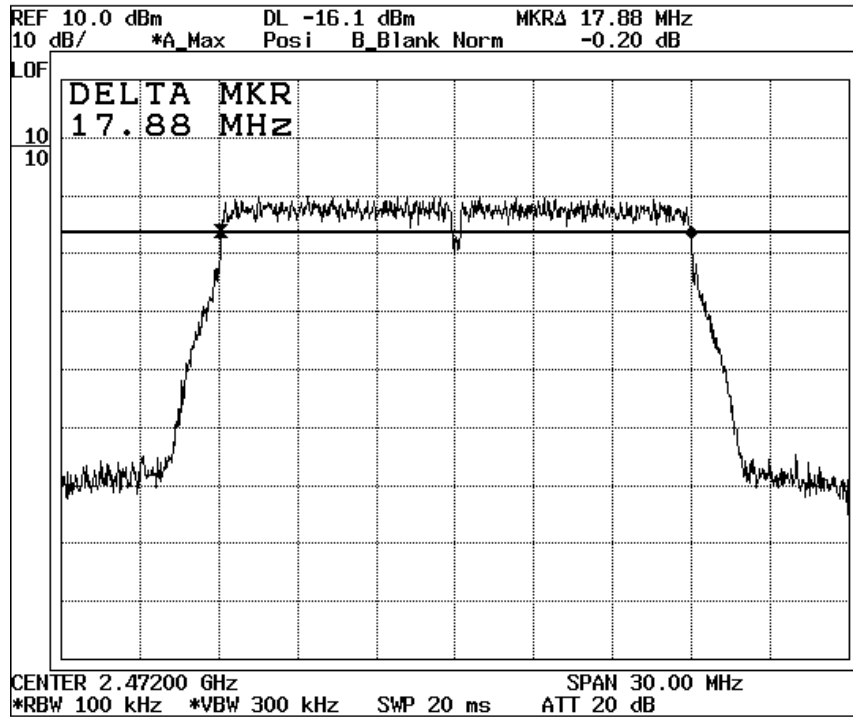
Channel 1.



Channel 7.



Channel 13.



3.6 Power Density

3.6.1 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Next of Calibration
Spectrum Analyzer	ADVANTEST	R3273	130900034	12. 05. 2012
RF Test Room	-	-	-	-

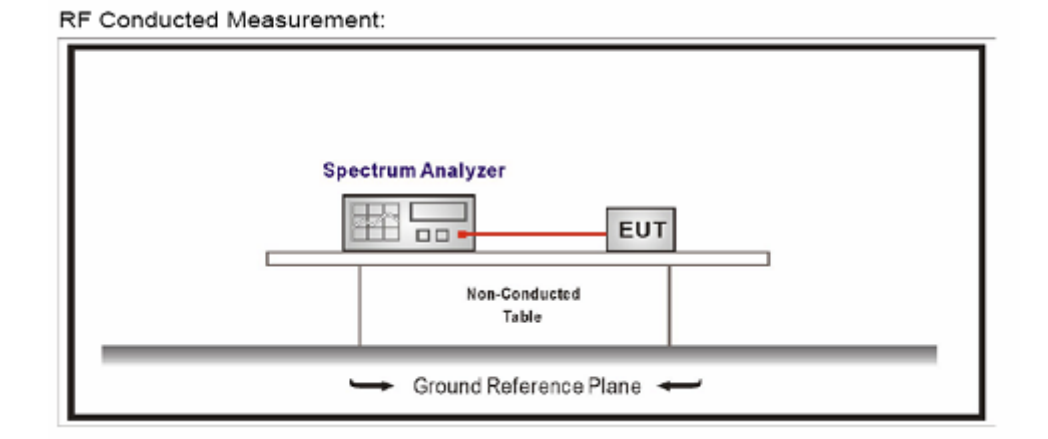
Note : 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to RRL, KRISS, KTL and HCT.

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

3.6.2 Limit

Section 15.247 (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (v) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

3.6.3 Test Configuration



3.6.4 Test Procedure

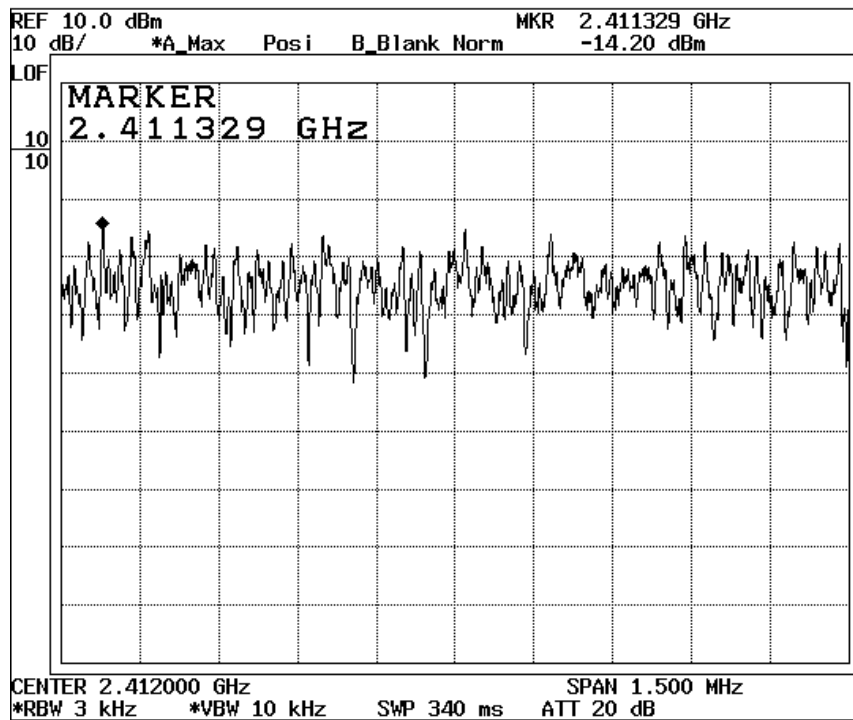
The transmitter output is connected to the Spectrum analyzer. The Spectrum analyzer is set to the Power Density.

3.6.5 Power Density Test Result

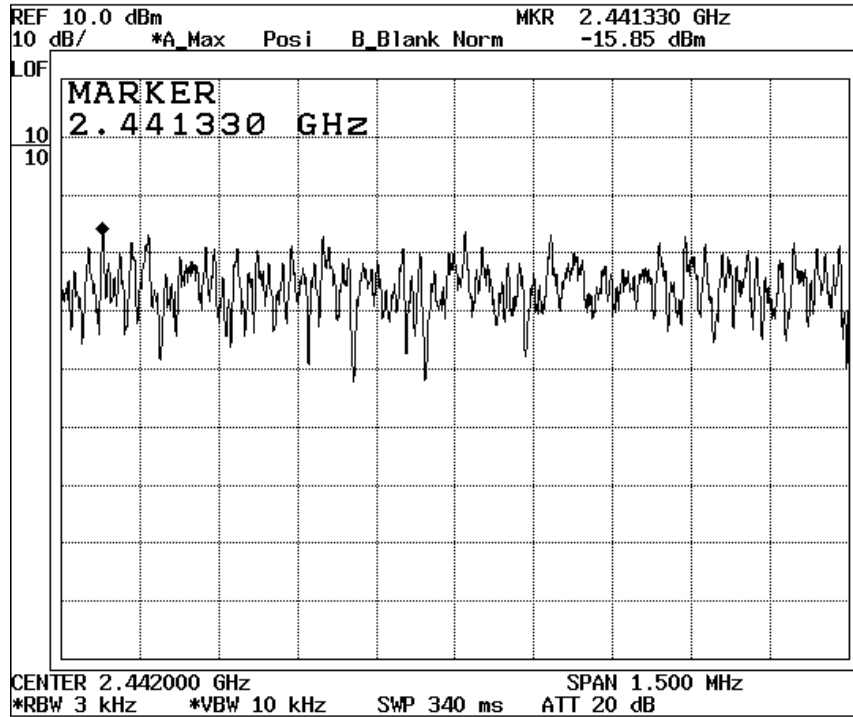
Test Item	Power Density
Test Mode	802.11b
Test Site	RF Room
Measurement Method	Conducted

Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
1	2412	-14.20	< 8	Pass
7	2442	-15.85	< 8	Pass
13	2472	-16.39	< 8	Pass

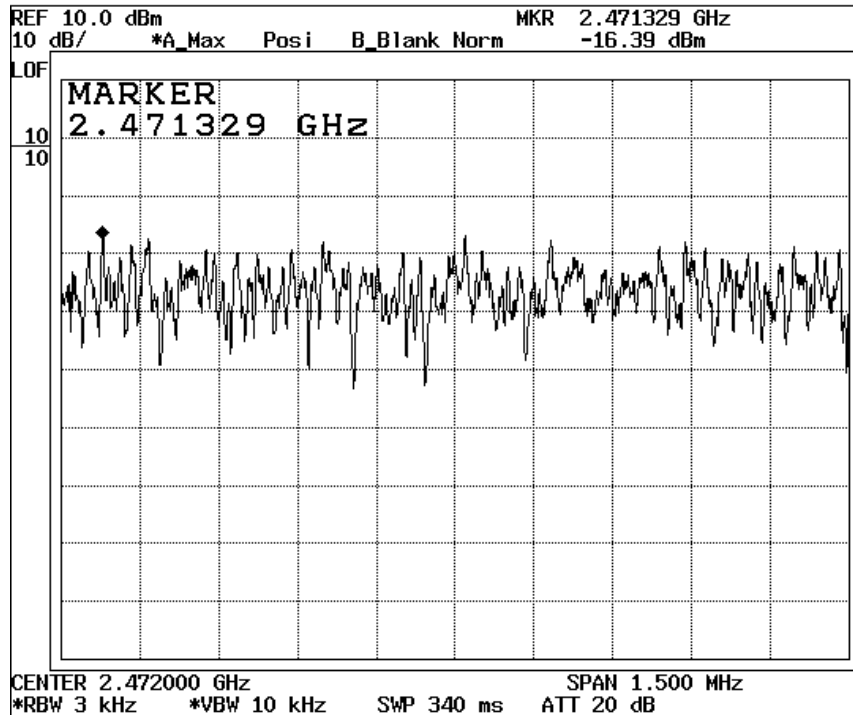
Channel 1.



Channel 7.



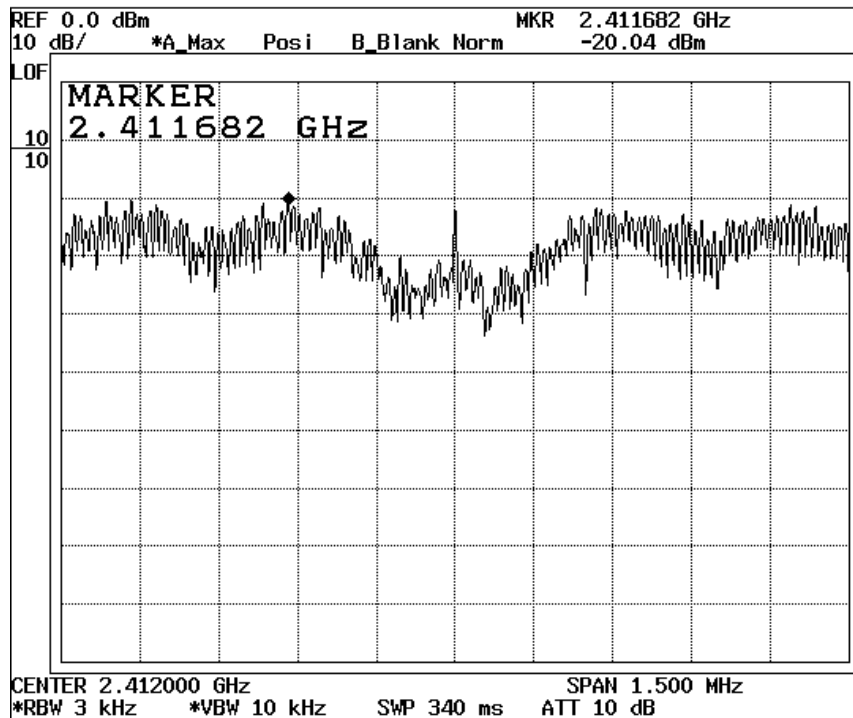
Channel 13.



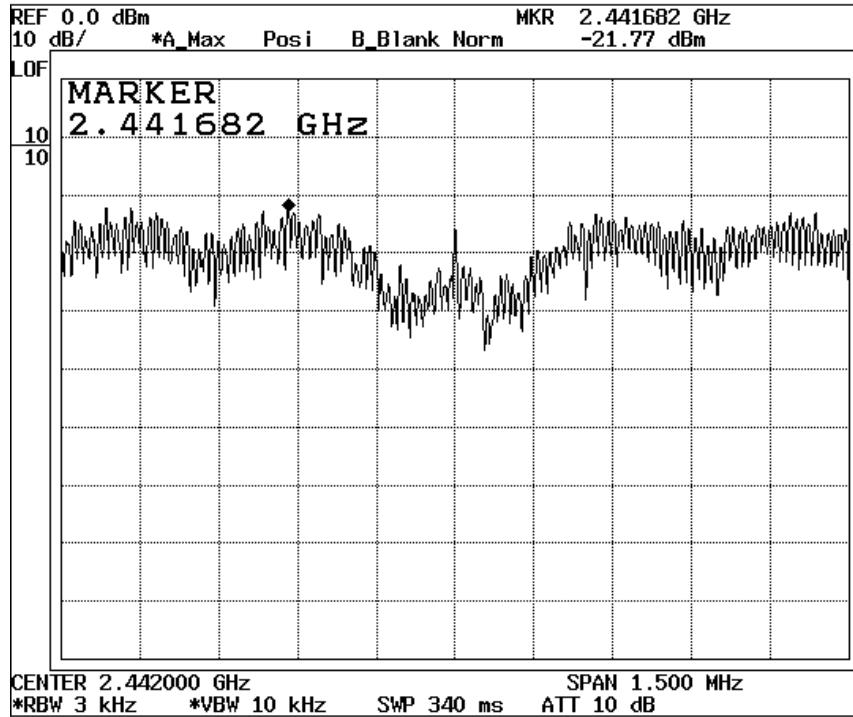
Test Item	Power Density
Test Mode	802.11g
Test Site	RF Room
Measurement Method	Conducted

Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
1	2412	-20.04	< 8	Pass
7	2442	-21.77	< 8	Pass
13	2472	-20.92	< 8	Pass

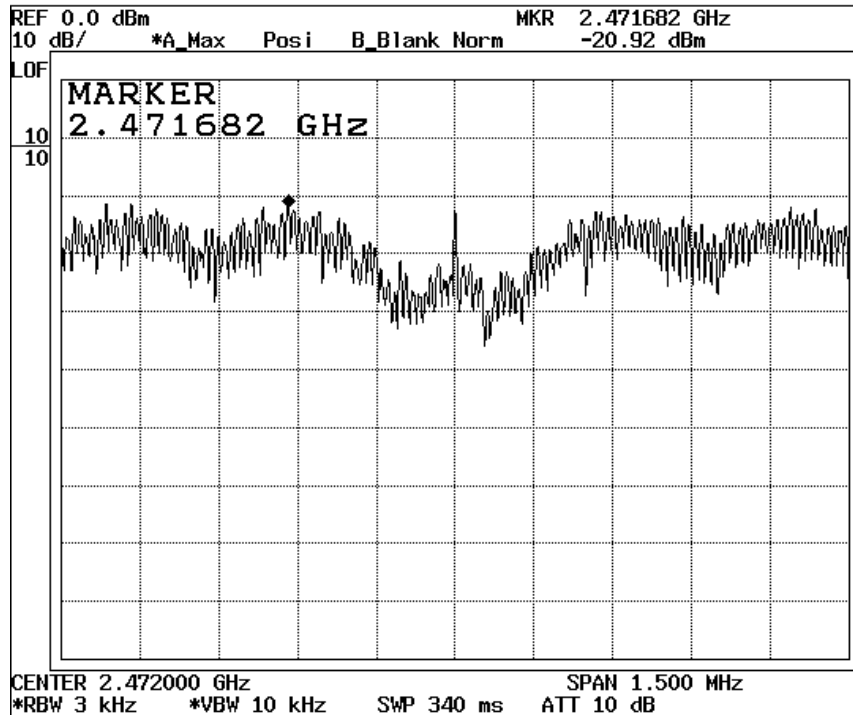
Channel 1.



Channel 7.



Channel 13.



4. Equipment Under Test Condition B(Bluetooth Operation)

4.1 Radiated Emission

4.1.1 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Next of Calibration
Horn Antenna	R&S	BBHA9120D233	0501	09. 10. 2013
Horn Antenna	R&S	BBHA9170	BBHA9170152	09. 16. 2013
Horn Antenna	SCHWARZBECK	BBHA9120D	BBHA9120D 839	12. 24. 2012
Horn Antenna	A.H System, Inc	SAS 571	500	03. 23. 2013
TRILOG Antenna	SCHWARZBECK	VULD 9160	3292	04. 28. 2013
Loop Antenna	6502	EMCO	00123879	12. 28. 2012
EMI Test Receiver	ROHDE&SCHWARZ	ESVS10	80241-015	01. 30. 2013
EMI Test Receiver	LIG NEX1	ER-265	L0811B009	04. 10. 2013
Spectrum Analyzer	ADVANTEST	R3273	130900034	12. 05. 2012
Spectrum Analyzer	LIG NEX1	NS-30	6052036	01. 30. 2013

Note : 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to RRL, 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)

4.1.2 Test Area

3m Full Chamber

4.1.3 Operation of EUT

Operating Environment

Temperature : 24.4 degree C
 Humidity : 46 %RH
 Atmospheric Pressure : 986 mBar

4.1.4 Test Date

May 04, 2012

4.1.5 Radiated Emission Limit

All emission form a digital device, including any network of conductors and apparatus connected thereto shall not exceed the level of field strength specified below:

FCC Part 15 Subpart C paragraph 15.249(a) Limit

Fundamental Frequency (MHz)	Field Strength of Fundamental (3m)		Field Strength of Harmonics (3m)		
	mV/m	dBuV/m	uV/m	dBuV/m	
2400-2483.5	50	94(Average) 114(Peak)	500	54(Average)	74(Peak)

- Note :
1. RF Field Strength (dBuV) = 20log RF Voltage(uV)
 2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
 3. The emission limit in this paragraph is based on measurement instrumentation employing an average detector

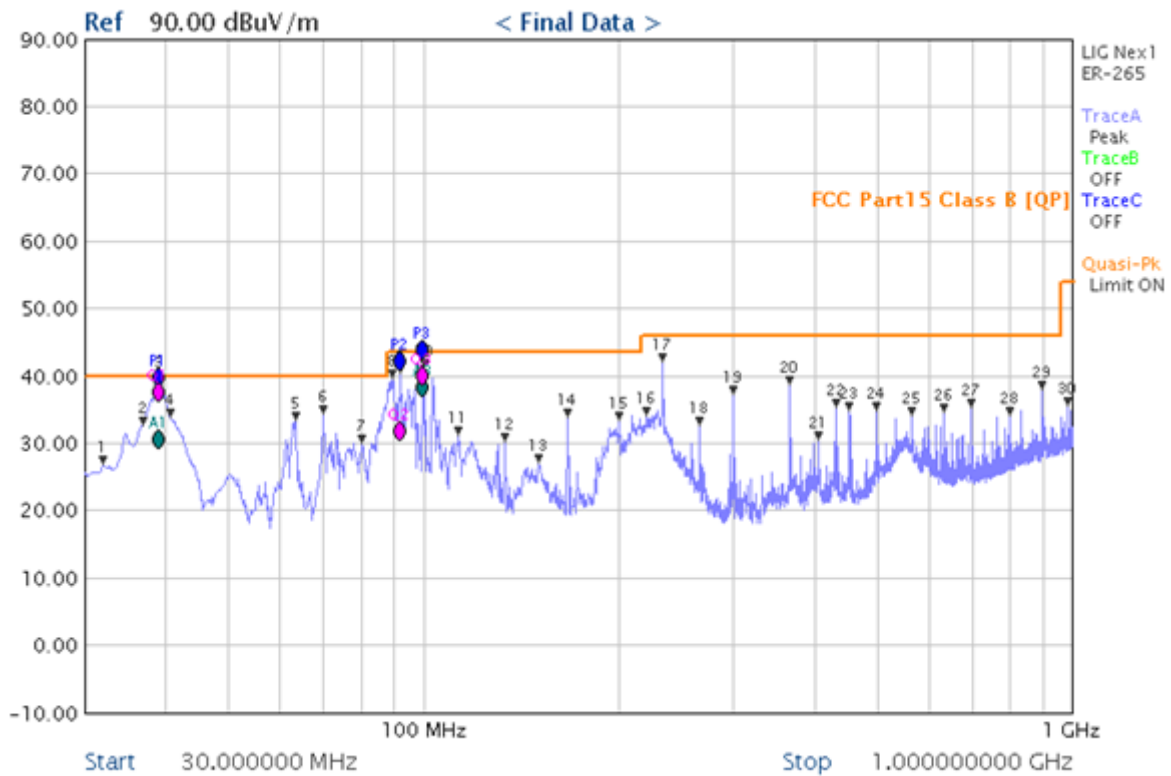
Frequencies in restricted band are complied to limit on Paragraph 15.209

Frequency Range (MHz)	Distance (m)	Field strength (dBuV/m)
0.009-0.490	3	20log 2400/F (kHz) + 80
0.490-1.705	3	20log 24000/F (kHz) + 40
1.705-30	3	20log 30 + 40
30-88	3	40.0
88-216	3	43.5
216-960	3	46.0
Above 960	3	54.0

- Note :
1. RF voltage (dBuV) = 20 log RF Voltage (uV)
 2. In the Above Table, the tighter limit applies at the band edges.
 3. Distance refers to the distance in meters between the measuring instrument antenna and the EUT
 4. This device used to install a wall device. The location of EUT measurements has the Y-plane(Stand).
 5. All scanning using PK detector. And the final emission level was get using QP detector for frequency range from 30 – 1000 MHz. As to 1 - 26 GHz, the final emission level got using PK and AV detector.
 6. If measurement is made at 3m distance.

4.1.5.1 Radiated Emission Result (30 to 1000 MHz)

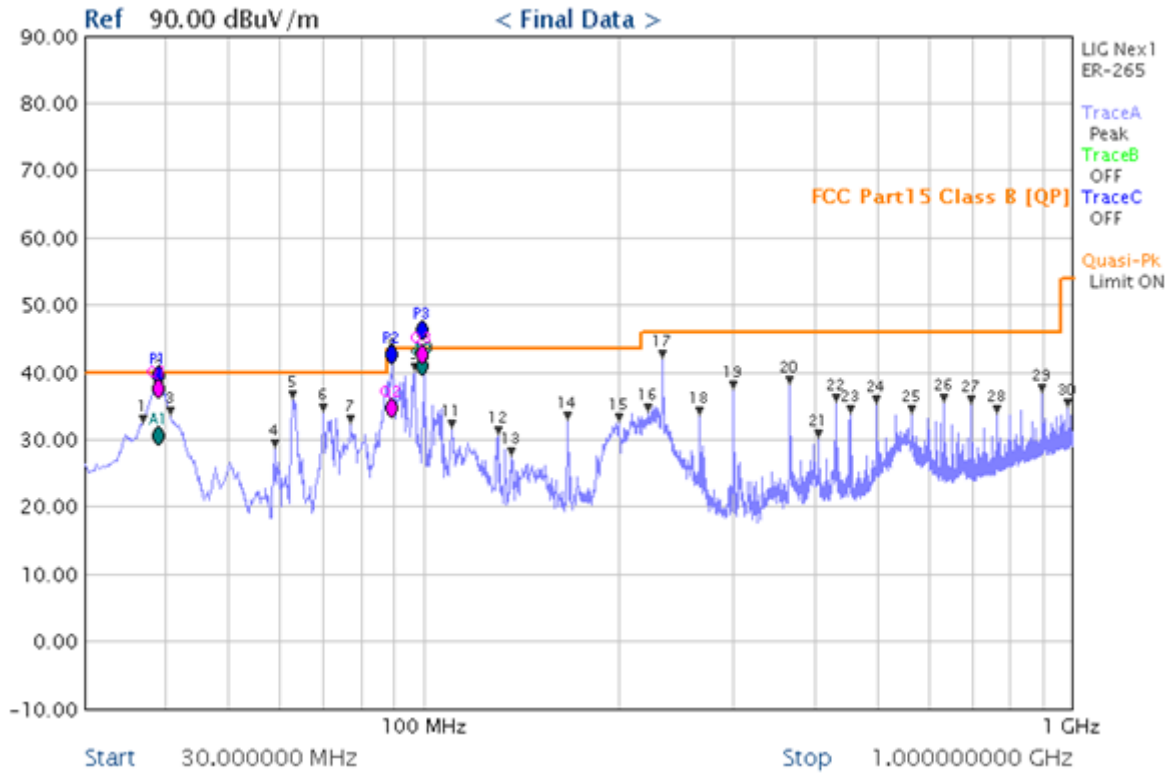
Test Mode	Bluetooth	Test Channel	0 CH (2402 MHz)
Test Result	PASS		



Frequency MHz	Reading dBuV/m	P (H, V)	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV/m	Total dBuV/m	Margin dB
39.12	23.60	V	12.02	1.30	0.00	40.00	36.92	3.08
89.45	29.67	V	7.59	1.90	0.00	43.50	39.16	4.34
92.05	30.24	V	7.94	1.94	0.00	43.50	40.12	3.38
99.99	29.17	H	9.35	1.90	0.00	43.50	40.42	3.08
233.09	28.09	V	11.01	3.16	0.00	46.00	42.26	3.74
299.53	20.35	H	13.31	3.50	0.00	46.00	37.16	8.84
365.85	19.73	H	14.78	3.96	0.00	46.00	38.47	7.53
897.92	8.03	V	23.42	6.29	0.00	46.00	37.74	8.26

Note : 1. Measurement level = reading level + correct factor

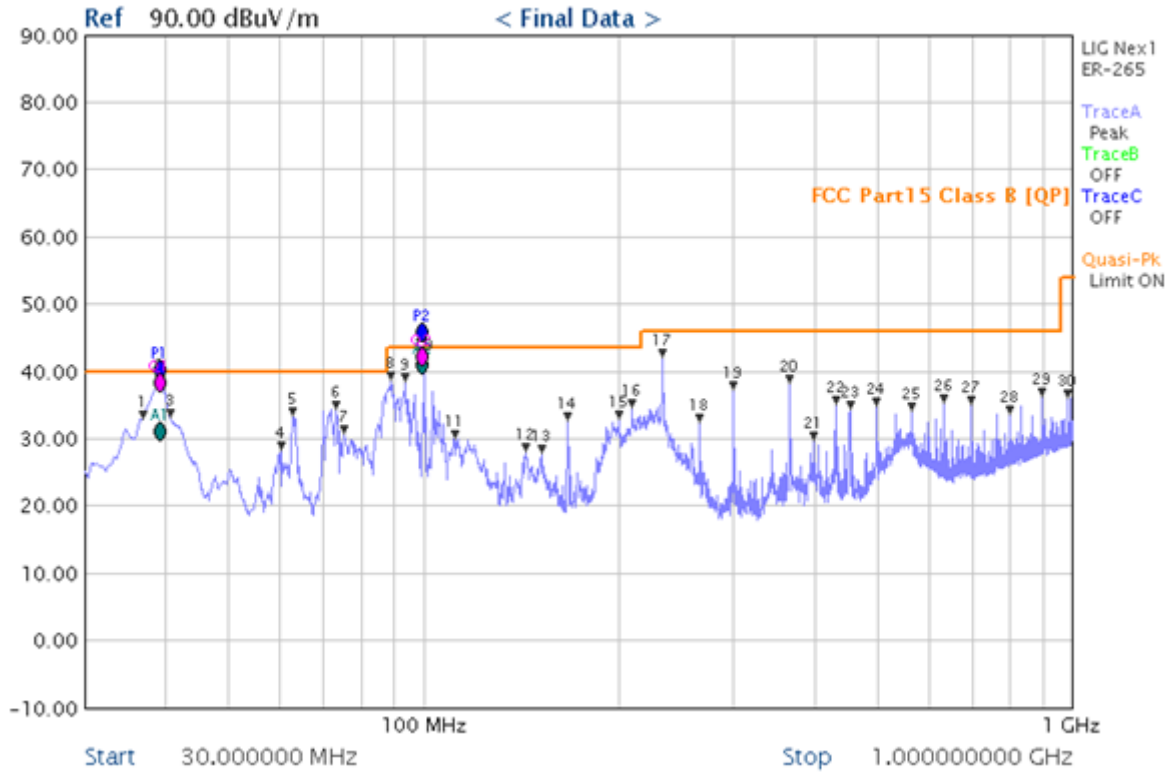
Test Mode	Bluetooth	Test Channel	39 CH (2441 MHz)
Test Result	PASS		



Frequency MHz	Reading dBuV/m	P (H, V)	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV/m	Total dBuV/m	Margin dB
39.12	22.98	V	12.02	1.30	0.00	40.00	36.30	3.70
89.45	29.54	H	7.59	1.90	0.00	43.50	39.03	4.47
96.67	30.14	H	8.76	1.97	0.00	43.50	40.87	2.63
99.99	29.15	H	9.35	1.90	0.00	43.50	40.40	3.10
233.09	27.87	V	11.01	3.16	0.00	46.00	42.04	3.96
299.53	20.38	H	13.31	3.50	0.00	46.00	37.19	8.81
365.85	19.54	V	14.78	3.96	0.00	46.00	38.28	7.72
897.92	7.87	V	23.42	6.29	0.00	46.00	37.58	8.42

Note : 1. Measurement level = reading level + correct factor

Test Mode	Bluetooth	Test Channel	78 CH (2480 MHz)
Test Result	PASS		

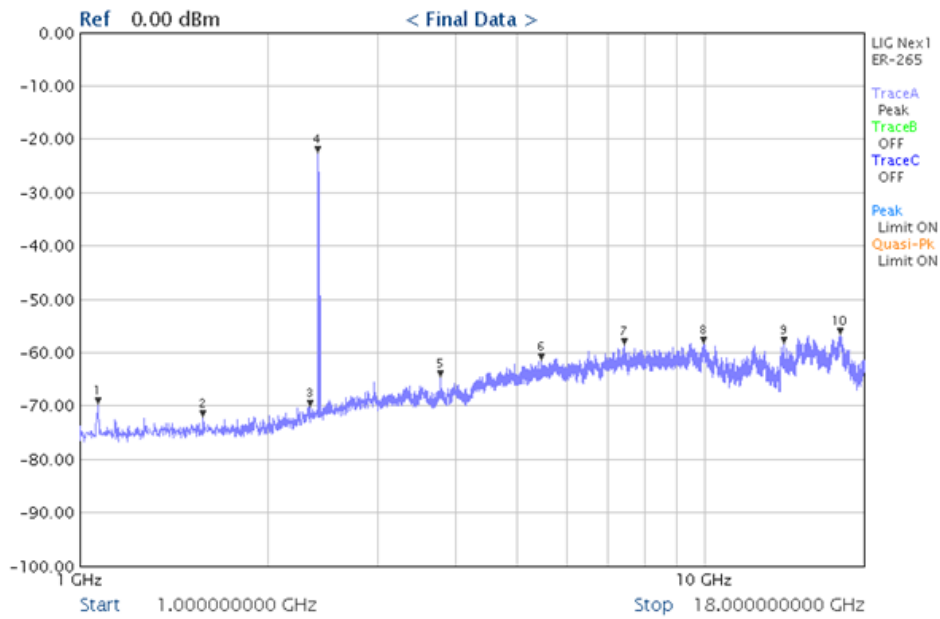
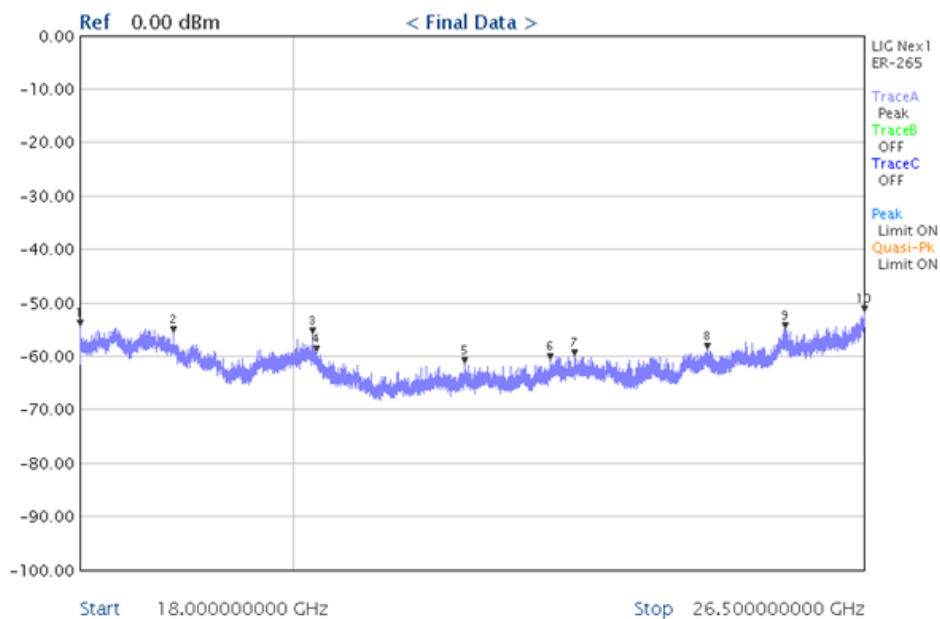


Frequency MHz	Reading dBuV/m	P (H, V)	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV/m	Total dBuV/m	Margin dB
39.12	23.04	V	12.02	1.30	0.00	40.00	36.36	3.64
88.86	28.66	H	7.62	1.90	0.00	43.50	38.18	5.32
93.36	28.44	H	8.17	1.97	0.00	43.50	38.58	4.92
99.99	29.18	H	9.35	1.90	0.00	43.50	40.43	3.07
233.09	27.89	V	11.01	3.16	0.00	46.00	42.06	3.94
299.53	20.31	H	13.31	3.50	0.00	46.00	37.12	8.88
365.85	17.07	V	14.78	3.96	0.00	46.00	35.81	10.19
897.92	6.23	V	23.42	6.29	0.00	46.00	35.94	10.06

Note : 1. Measurement level = reading level + correct factor

4.1.5.2 Fundamental & Harmonics Radiated Emission Result(1 to 26 GHz)

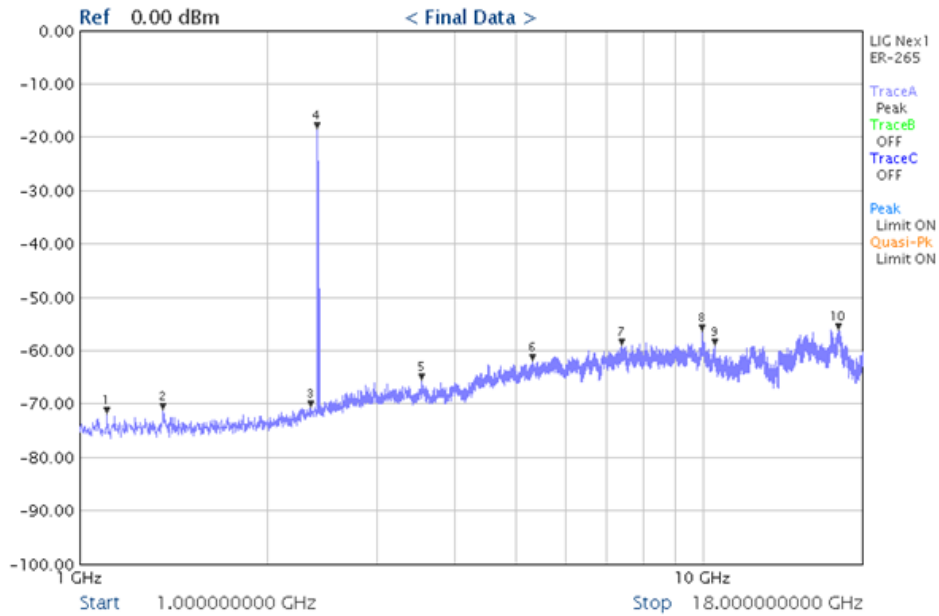
Test Mode	Bluetooth	Test Channel	0 CH (2402 MHz)
Test Item	Fundamental & Harmonics Radiated Emission Test Result	Polarization	Hor.
Test Result	PASS		


[1 to 18 GHz]

[18 to 26 GHz]

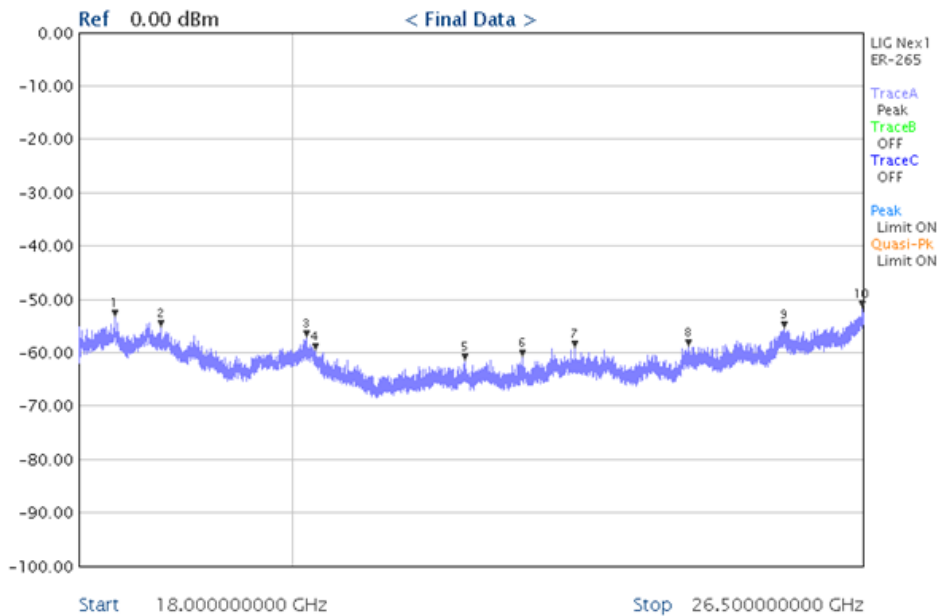
Frequency (MHz)	Emission PK/AV (dBuV/m)	Polarization	Limits PK/AV (dBuV/m)	Margin (dB)
2402	84.46(PK)	Hor.	114/94	29.54

*Note : 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.
2. Measurement level = reading level + correct factor*

Test Mode	Bluetooth	Test Channel	0 CH (2402 MHz)
Test Item	Fundamental & Harmonics Radiated Emission Test Result	Polarization	Ver.
Test Result	PASS		



[1 to 18 GHz]

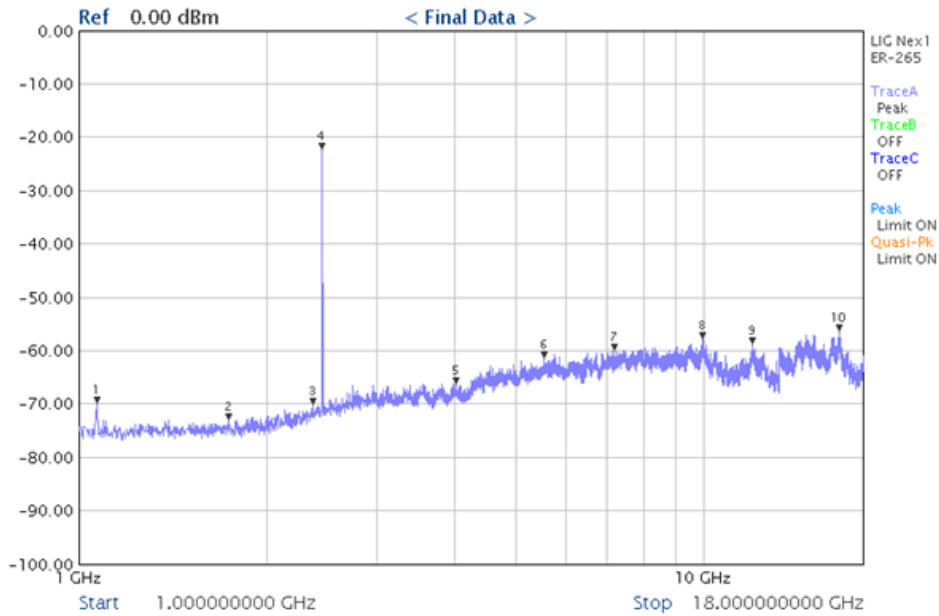


[18 to 26 GHz]

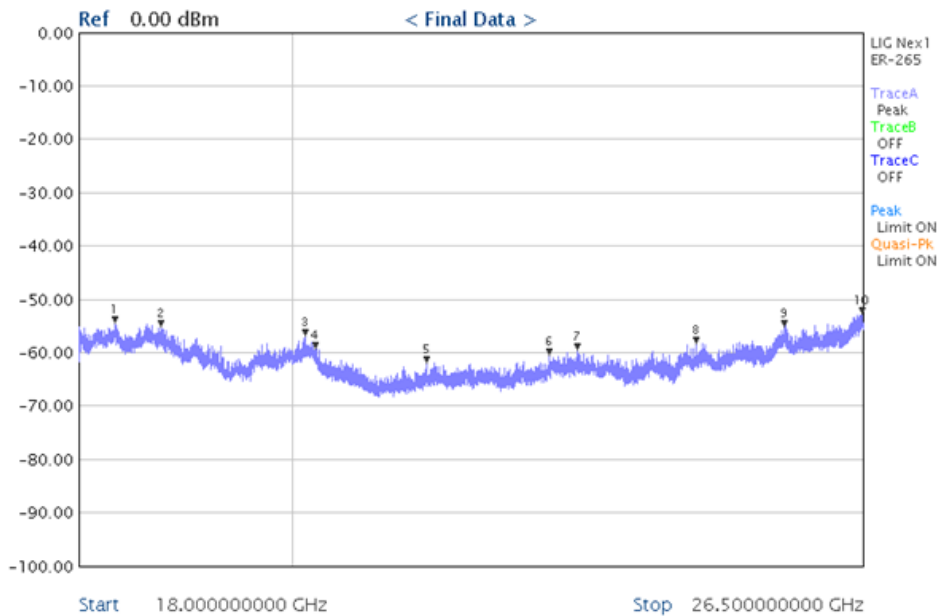
Frequency (MHz)	Emission PK/AV (dBuV/m)	Polarization	Limits PK/AV (dBuV/m)	Margin (dB)
2402	88.62(PK)	Hor.	114/94	25.38

*Note : 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.
2. Measurement level = reading level + correct factor*

Test Mode	Bluetooth	Test Channel	39 CH (2441 MHz)
Test Item	Fundamental & Harmonics Radiated Emission Test Result	Polarization	Hor.
Test Result	PASS		



[1 to 18 GHz]



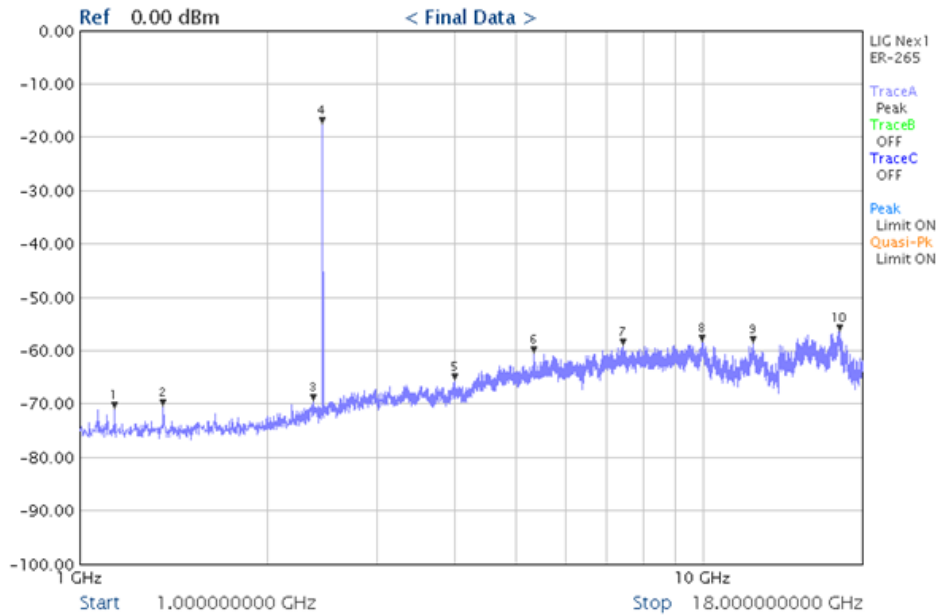
[18 to 26 GHz]

Frequency (MHz)	Emission PK/AV (dBuV/m)	Polarization	Limits PK/AV (dBuV/m)	Margin (dB)
2441	84.54(PK)	Hor.	114/94	29.46

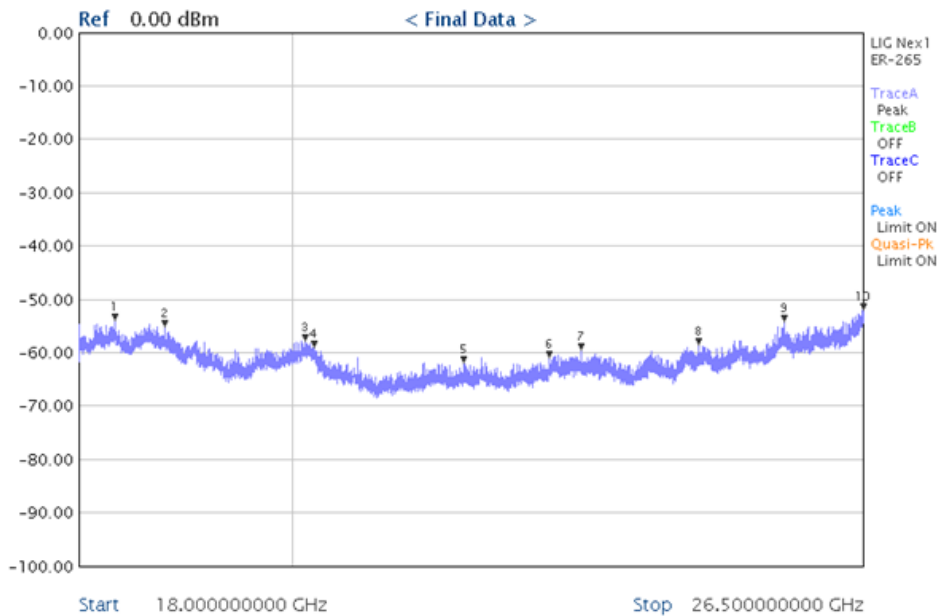
Note :

- 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.*
- 2. Measurement level = reading level + correct factor*

Test Mode	Bluetooth	Test Channel	39CH (2441 MHz)
Test Item	Fundamental & Harmonics Radiated Emission Test Result	Polarization	Ver
Test Result	PASS		



[1 to 18 GHz]

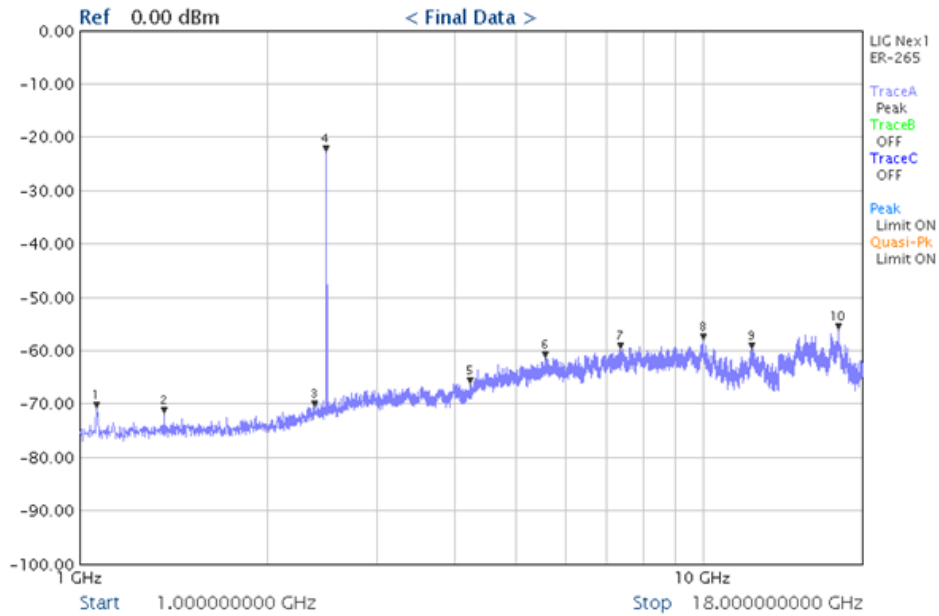


[18 to 26 GHz]

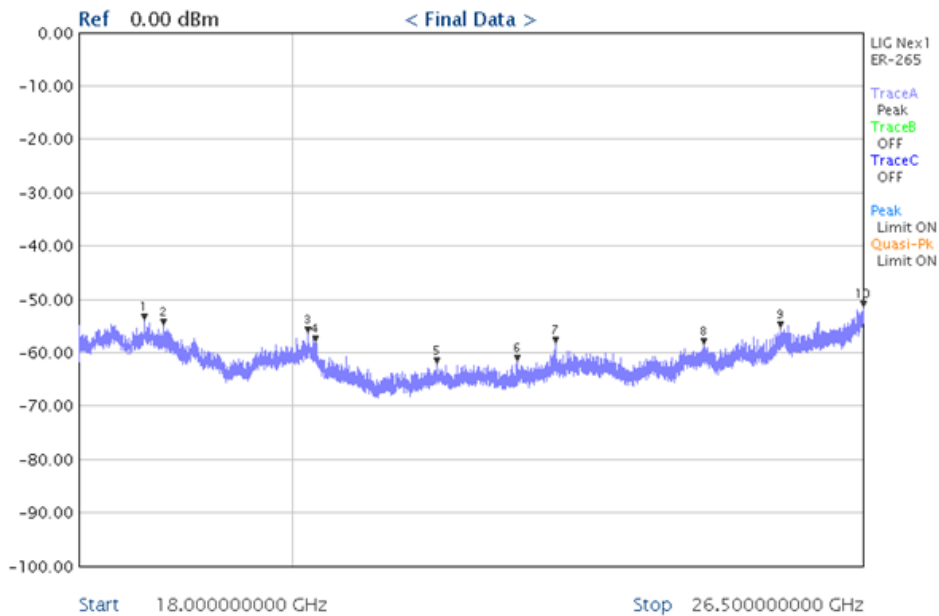
Frequency (MHz)	Emission PK/AV (dBuV/m)	Polarization	Limits PK/AV (dBuV/m)	Margin (dB)
2441	89.44(PK)	Hor.	114/94	24.46

*Note : 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.
2. Measurement level = reading level + correct factor*

Test Mode	Bluetooth	Test Channel	78CH (2480 MHz)
Test Item	Fundamental & Harmonics Radiated Emission Test Result	Polarization	Hor.
Test Result	PASS		



[1 to 18 GHz]

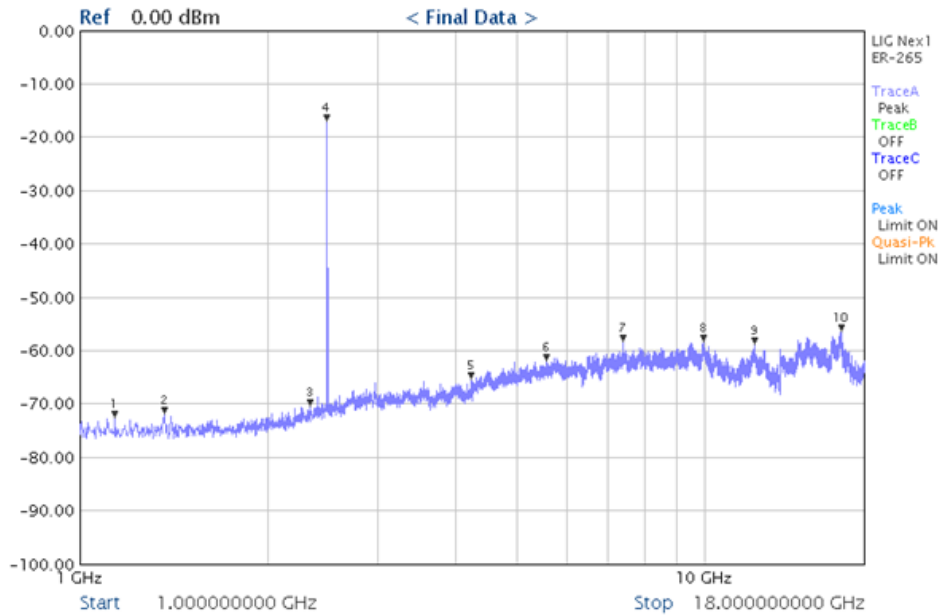


[18 to 26 GHz]

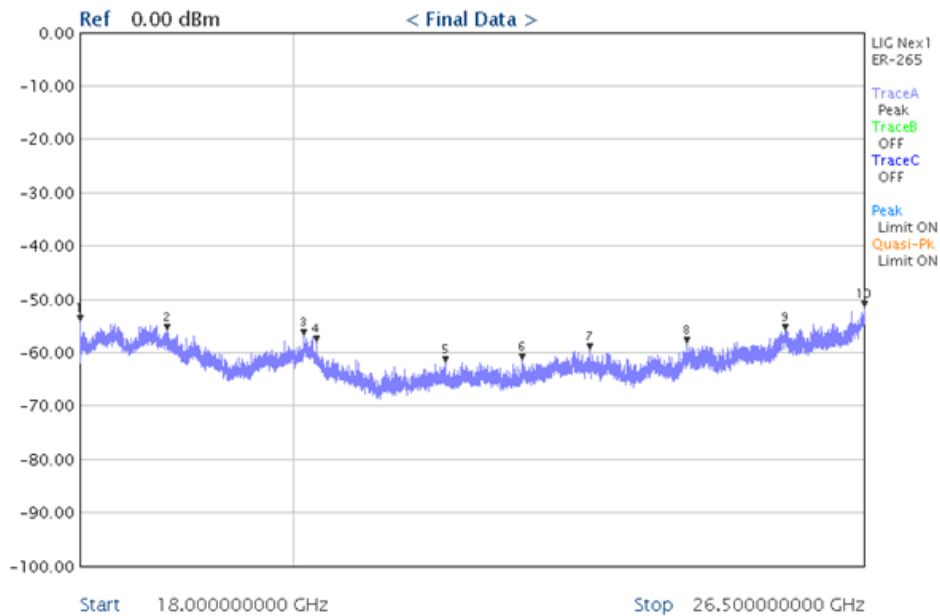
Frequency (MHz)	Emission PK/AV (dBuV/m)	Polarization	Limits PK/AV (dBuV/m)	Margin (dB)
2480	84.22(PK)	Hor.	114/94	29.78

*Note : 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.
2. Measurement level = reading level + correct factor*

Test Mode	Bluetooth	Test Channel	78CH (2480 MHz)
Test Item	Fundamental & Harmonics Radiated Emission Test Result	Polarization	Ver.
Test Result	PASS		



[1 to 18 GHz]



[18 to 26 GHz]

Frequency (MHz)	Emission PK/AV (dBuV/m)	Polarization	Limits PK/AV (dBuV/m)	Margin (dB)
2480	89.96(PK)	Hor.	114/94	24.04

Note : 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.
2. Measurement level = reading level + correct factor

4.2 Number of Hopping Frequency Used

4.2.1 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Next of Calibration
Spectrum Analyzer	ADVANTEST	R3273	130900034	12. 05. 2012
RF Test Room	-	-	-	-

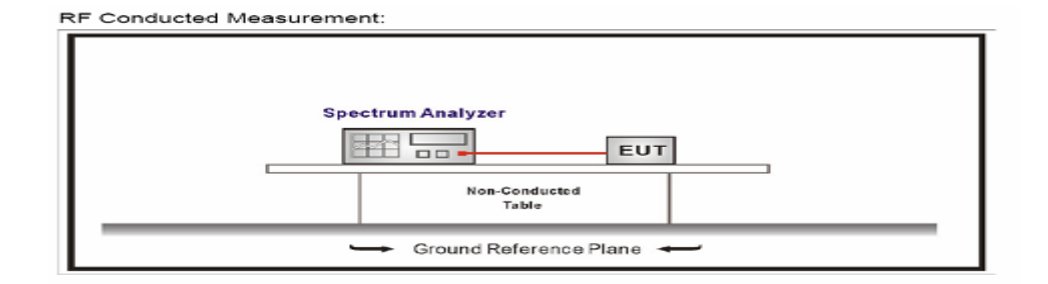
Note : 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to RRL, KRISS, KTL and HCT.

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

4.2.2 Limit

At least 15 channels frequencies, and should be equally spaced.

4.2.3 Test Configuration



4.2.4 Test Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Turn off the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operating in its linear range.
3. Set the SA on MaxHold Mode, and keep the EUT hopping mode. Record all the signals from each channel until each one has been recorded.
4. Set the SA on View Mode and plot the result on the SA screen.
5. Repeat the above procedures until all frequencies measured were complete.

4.3 Dwell Time On Each Channel

4.3.1 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Next of Calibration
Spectrum Analyzer	ADVANTEST	R3273	130900034	12. 05. 2012
RF Test Room	-	-	-	-

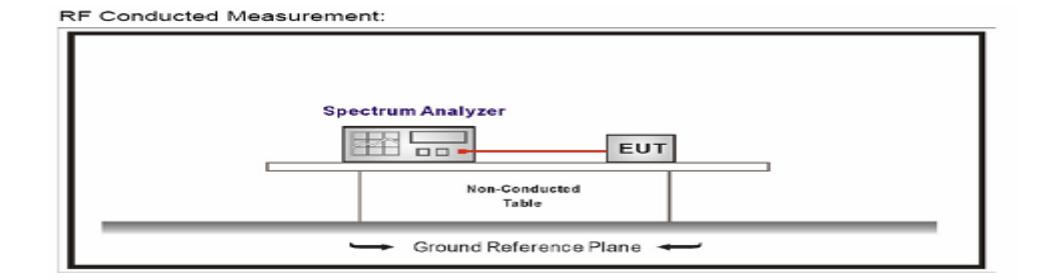
Note : 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to RRL, KRISS, KTL and HCT.

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

4.3.2 Limit

The average time of occupancy on any channel shall not be greater the 0.4 seconds within a period fo 04. Seconds multiplied by the number of hopping channels employed.

4.3.3 Test Configuration



4.3.4 Test Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal
2. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. The set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency to be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Measure the time duration of one transmission in the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all different time-slot modes have been completed.

4.3.5 Dwell Time Test Result

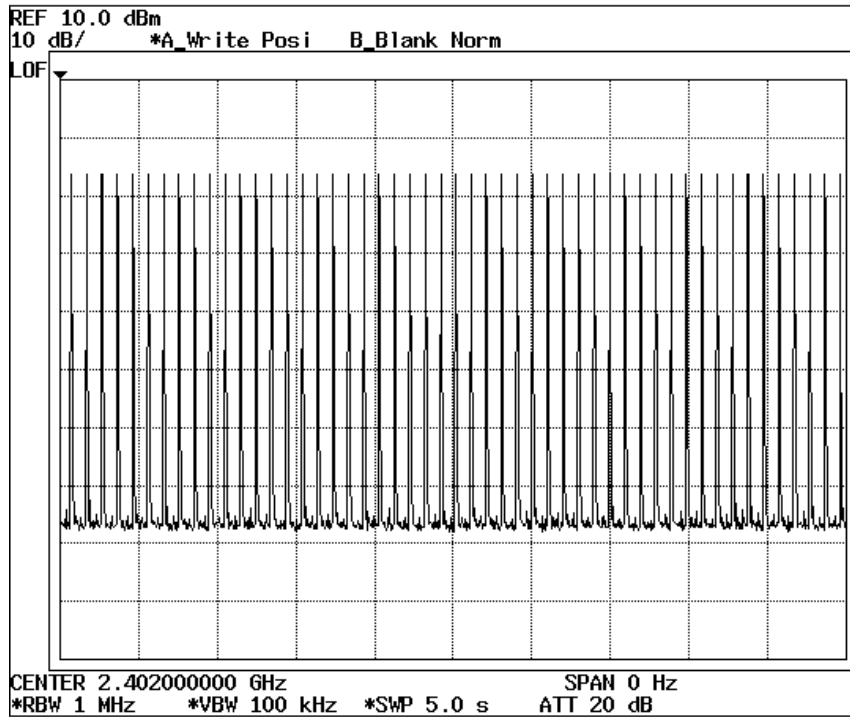
Test Mode	Bluetooth	Test Site	RF Test Room
Test Result	PASS		

Mode	Number of transmission in a 31.6 (79 Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	51 (times / 5 sec)*6.32 = 322.32times	0.560	180.50	400
DH3	26 (times / 5 sec)*6.32 = 164.32times	1.800	295.78	400
DH5	17 (times / 5 sec)*6.32 = 107.44times	3.045	327.15	400

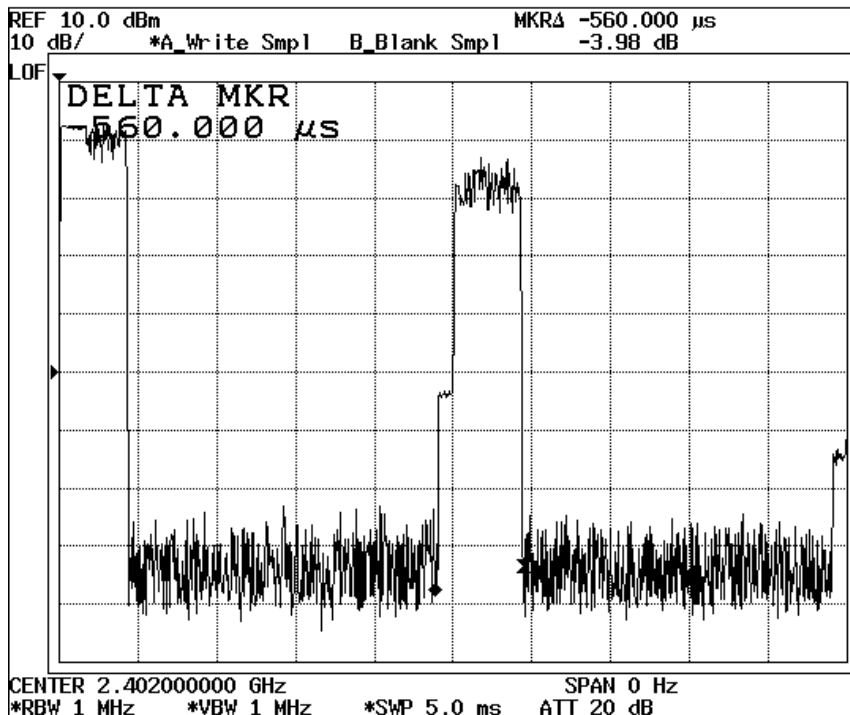
Note) 1. Test plots of the transmitting time slot are shown on next 3 pages.

2. Dwell Time = 79(Channels) x 0.4(s) x average hopping channel x package transfer time

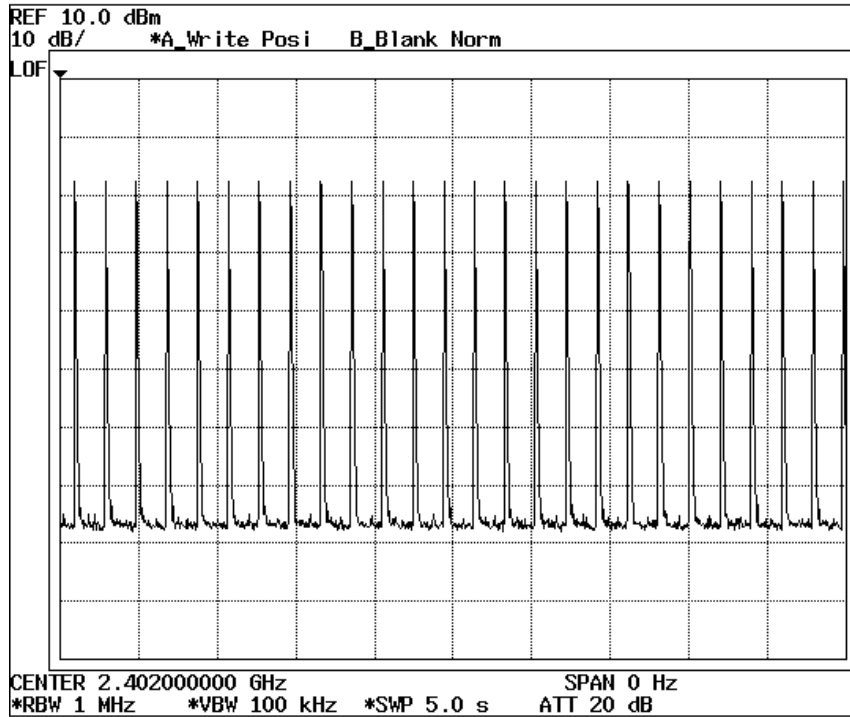
8-DQPSK-DH1



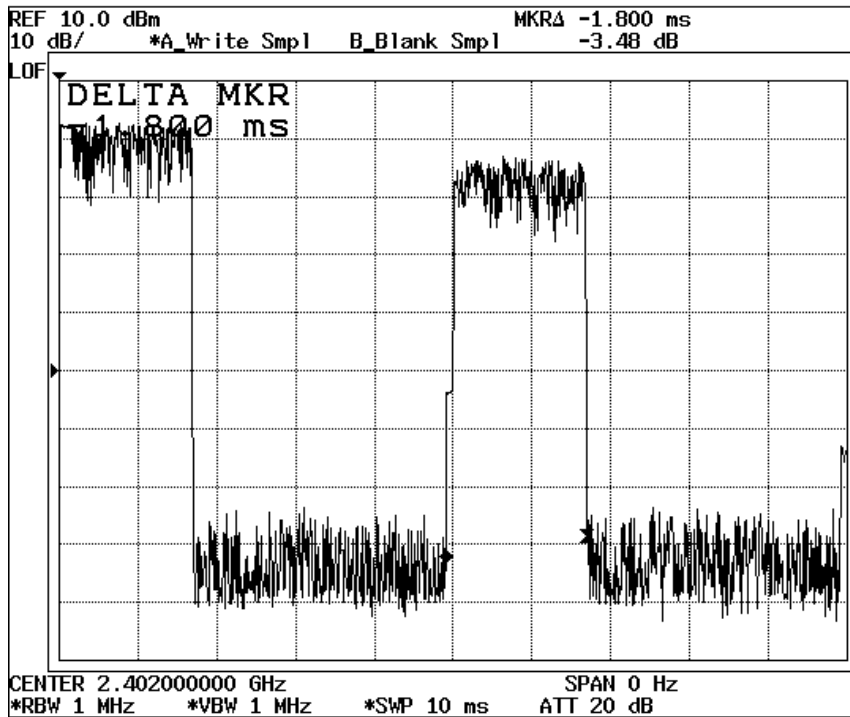
8-DQPSK Dwell Time



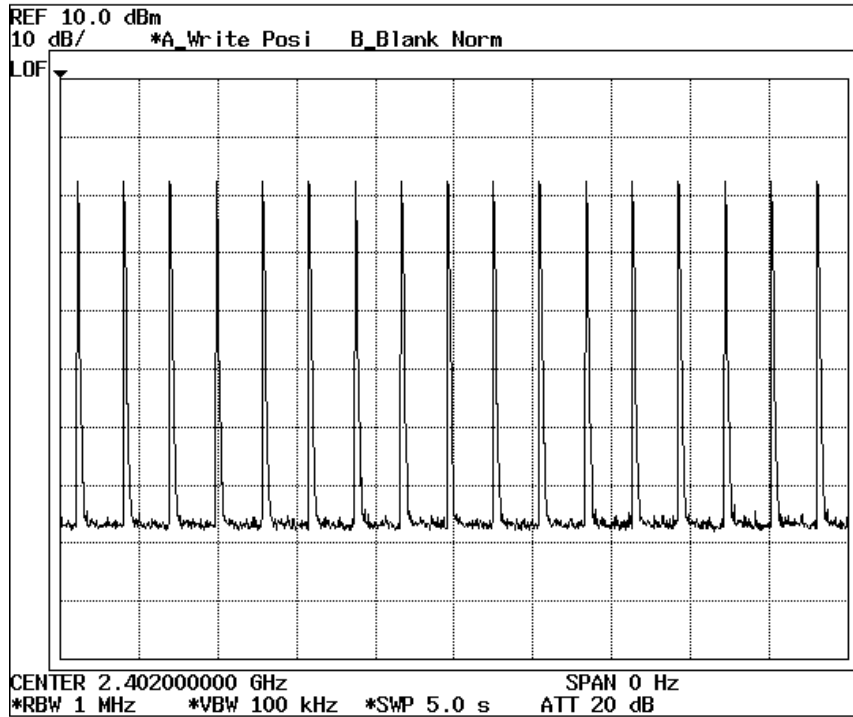
8-DQPSK-DH3



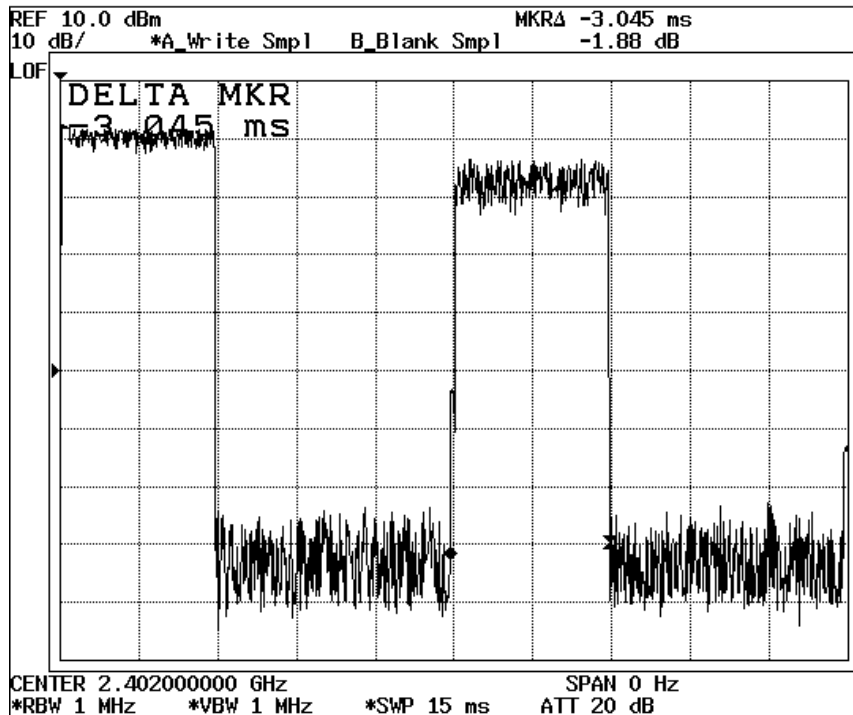
8-DQPSK-Dwell Time



8-DQPSK-DH5



8-DQPSK-Dwell Time



4.4 Channel Bandwidth

4.4.1 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Next of Calibration
Spectrum Analyzer	ADVANTEST	R3273	130900034	12. 05. 2012
RF Test Room	-	-	-	-

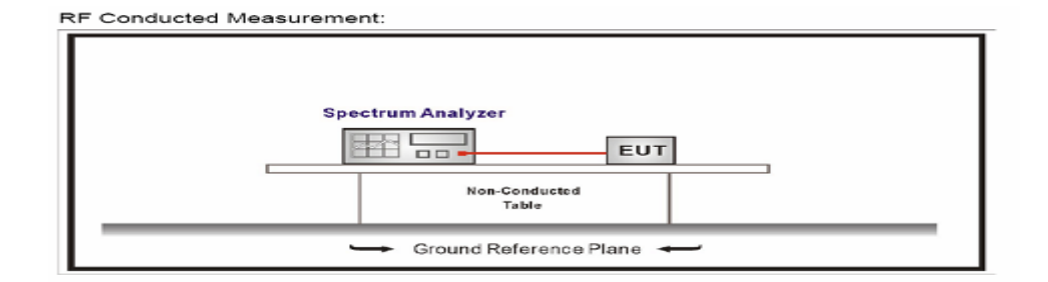
Note : 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to RRL, KRISS, KTL and HCT.

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

4.4.2 Limit

For frequency hopping system operating in the 2400-2483.5 MHz, if the 20 dB bandwidth of hopping channel is greater than 25 kHz, tow-thirds 20 dB bandwidth of hopping channel shell be a minimum limit for the hopping channel separation.

4.4.3 Test Configuration



4.4.4 Test Procedure

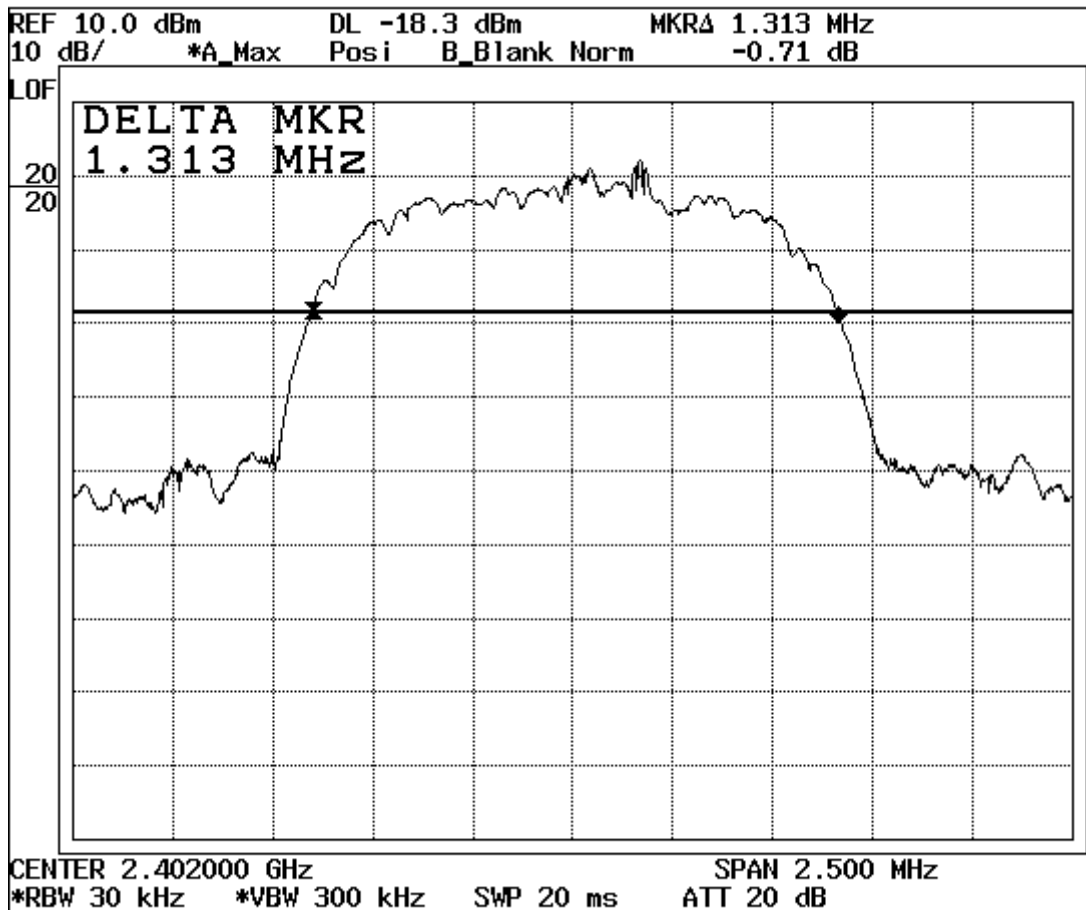
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that wre attenuated 20 dB from the reference level. Record the the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

4.4.5 Channel Bandwidth Test Result

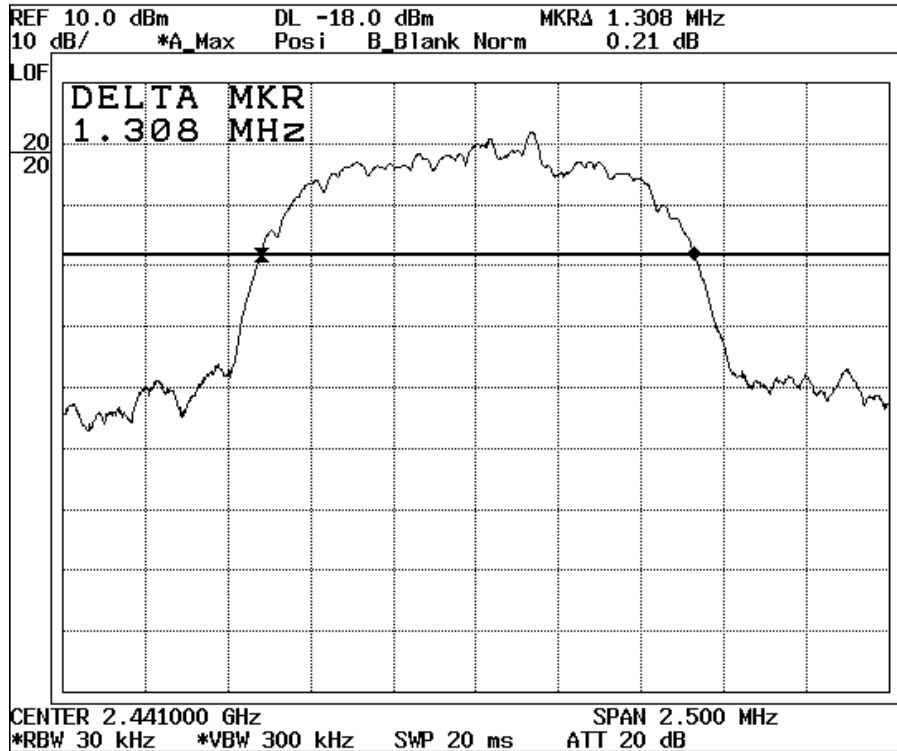
Test Mode	Bluetooth	Test Site	RF Test Room
Test Result	PASS		

CHANNEL	CHANNEL FREQUENCY (MHz)	20 dB bandwidth (MHz)
0	2402	1.313
39	2441	1.308
78	2480	1.313

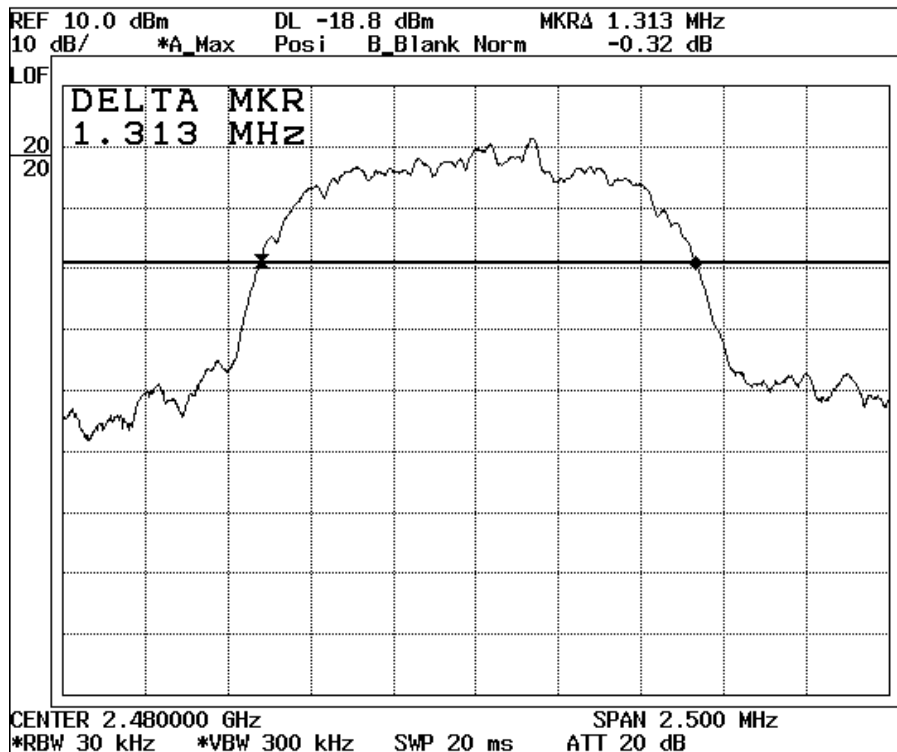
CH 0 (2402)



CH 39 (2441)



CH 78 (2480)



4.5 Hopping Channel Separation

4.5.1 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Next of Calibration
Spectrum Analyzer	Advantest	R3273	121100554	Jun. 15, 2010
RF Test Room	-	-	-	-

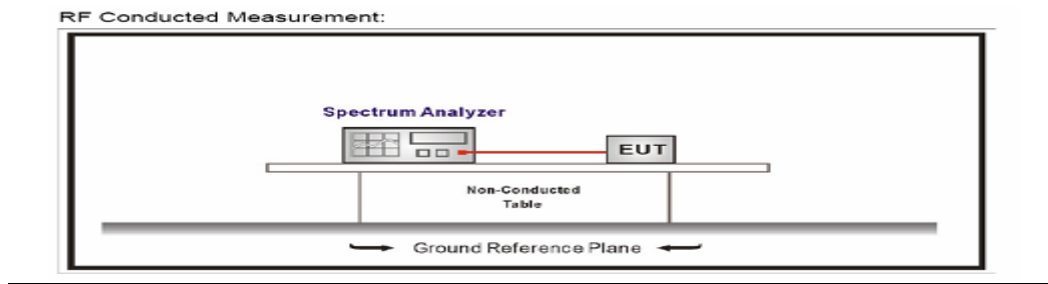
Note : 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to RRL, KRISS, KTL and HCT.

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

4.5.2 Limit

At least 25 kHz or two-third of 20 dB hopping Channel bandwidth (whichever is greater).

4.5.3 Test Configuration



4.5.4 Test Procedure

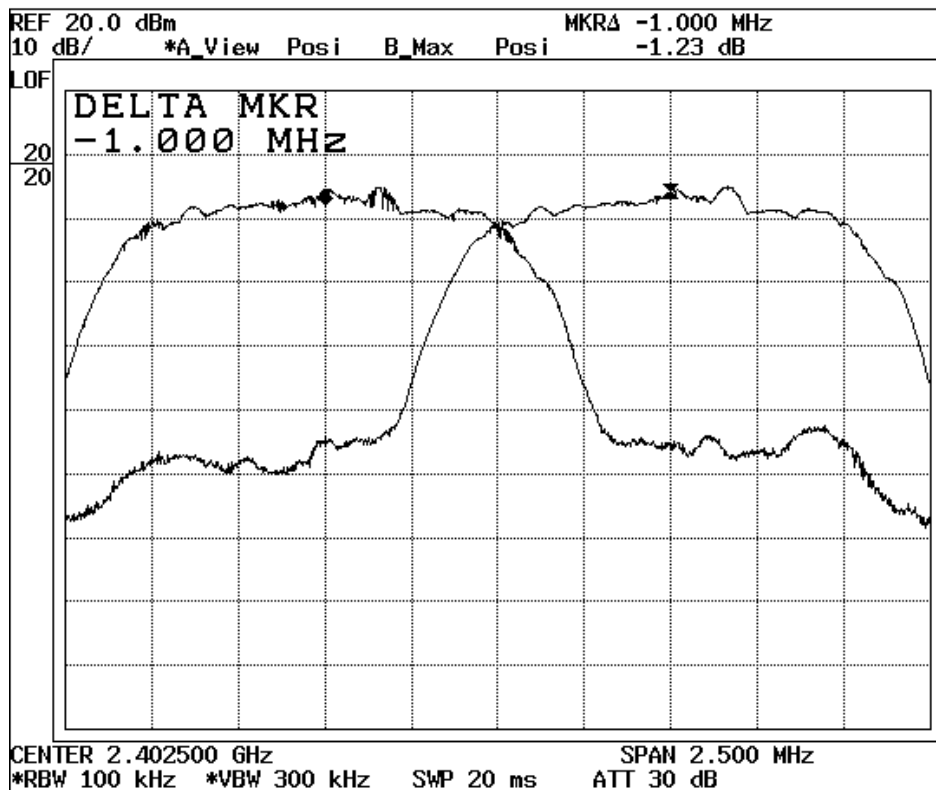
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the Maxhold function record the separation of two adjacent channels.
4. Measure the frequency difference of these two adjacent channels by SA mark function. And then plot the result on SA screen.

4.5.5 Hopping Channel Separation Test Result

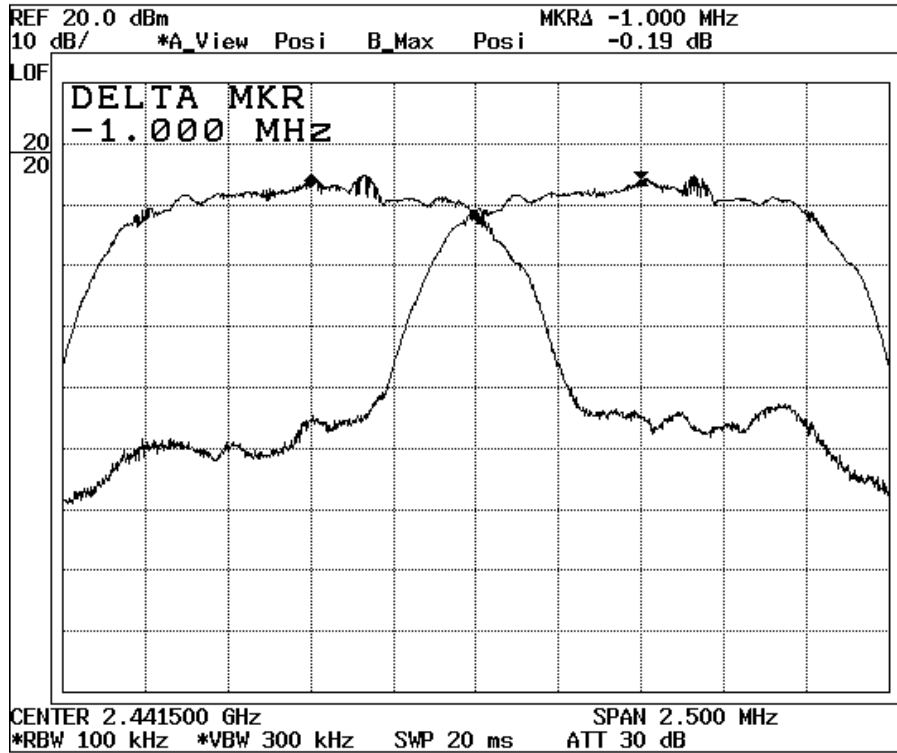
Test Mode	Bluetooth	Test Site	RF Test Room
Test Result	PASS		

CHANNEL	FREQUENCY (MHz)	ADJACENT CHANNEL SEPARATION (MHz)	RESULT
0	2402	1.00	PASS
39	2441	1.00	PASS
78	2480	1.00	PASS

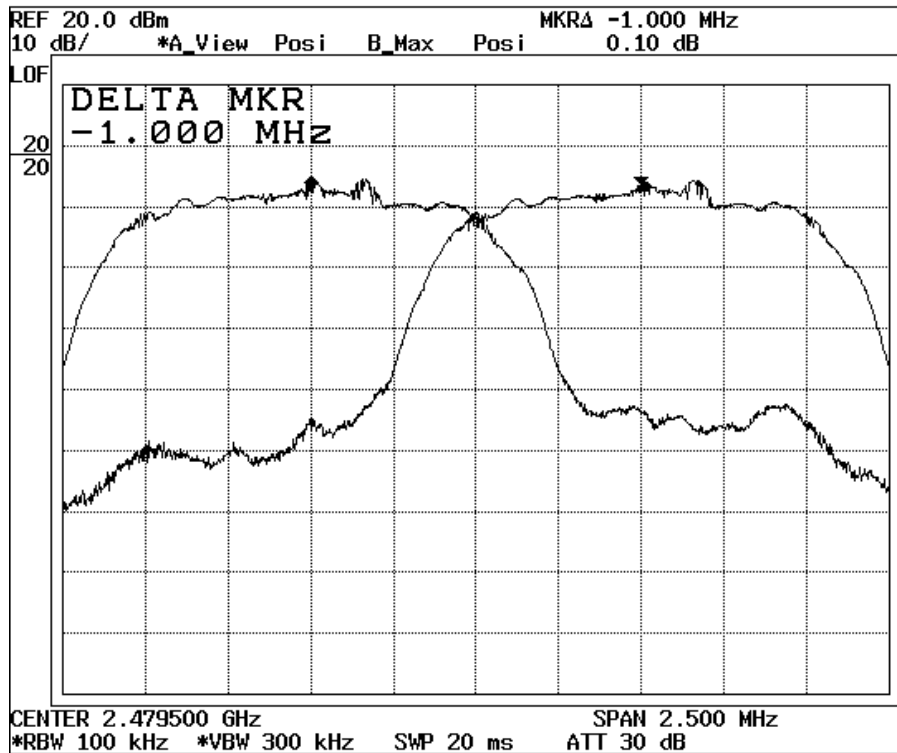
CH 0 (2402 MHz)



CH 39 (2441 MHz)



CH 78 (2480 MHz)



4.6 Maximum Peak Output Power

4.6.1 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Next of Calibration
Spectrum Analyzer	Advantest	R3273	121100554	Jun. 15, 2010
RF Test Room	-	-	-	-

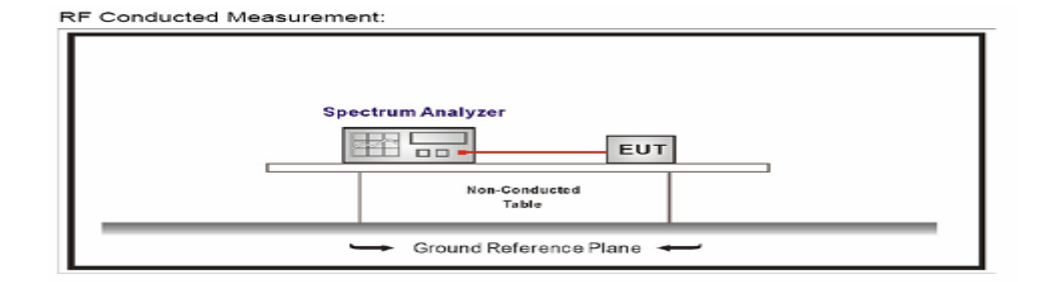
Note : 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to RRL, KRISS, KTL and HCT.

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

4.6.2 Limit

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

4.6.3 Test Configuration



4.6.4 Test Procedure

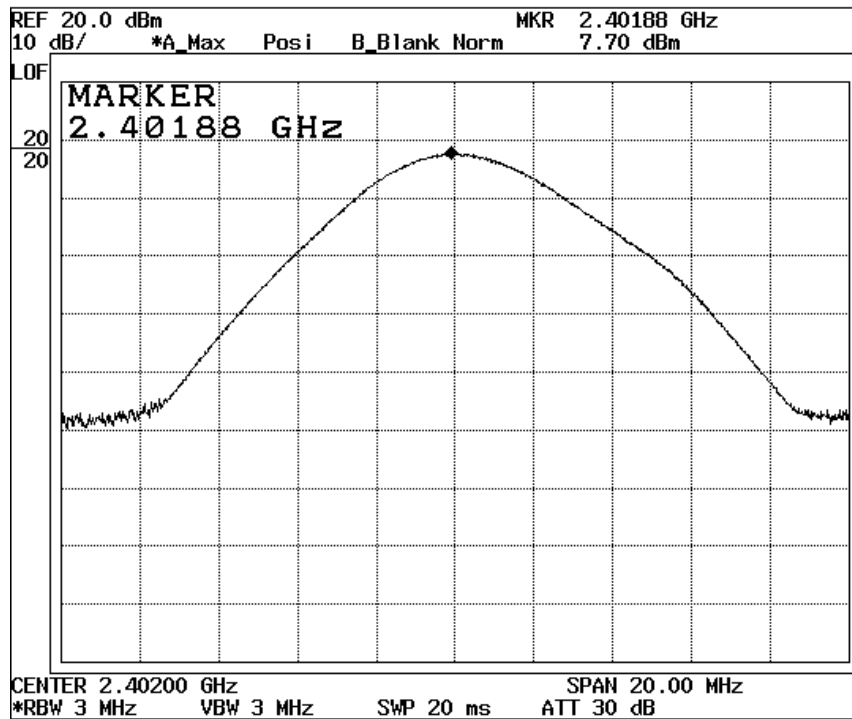
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operation range. Set a reference level on the measuring instrument equal to the highest peak value.
3. The center frequency of the spectrum analyzer is set to the fundamental frequency and using 1 MHz RBW and 1 MHz VBW.
4. Measure the captured power within the band and recording the plot.
5. Repeat above procedures until all frequencies required were complete.

4.6.5 Maximum Peak Output Power Test Result

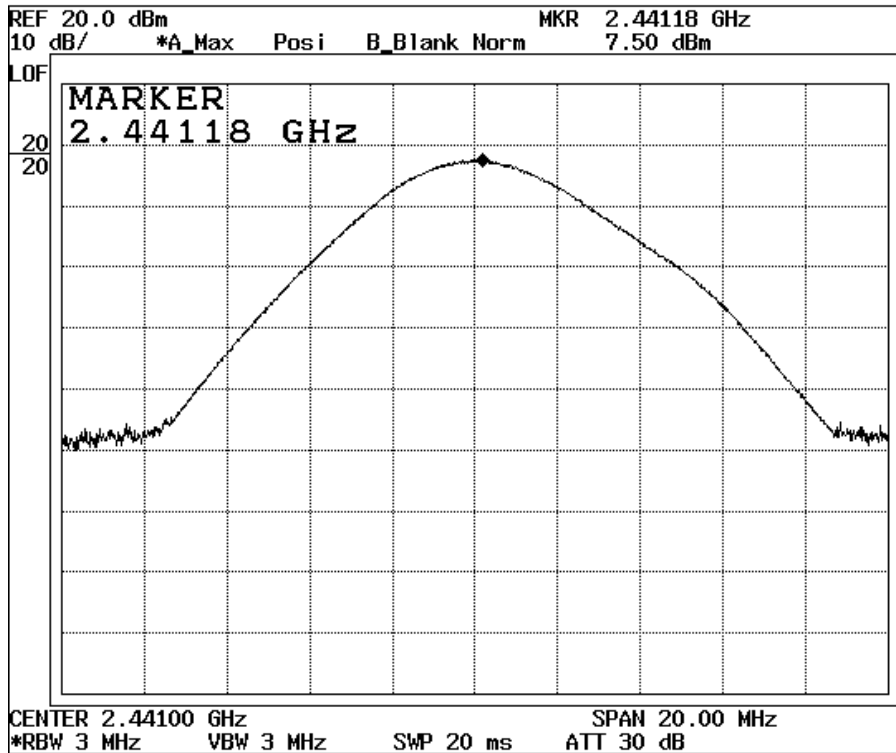
Test Mode	Bluetooth	Test Site	RF Test Room
Test Result	PASS		

Channel No.	Frequency (MHz)	Measue Leve (dBm)	Limit (dBm)	Result
0	2402	7.70	1Watt = 30 dBm	PASS
39	2441	7.50	1Watt = 30 dBm	PASS
78	2480	7.18	1Watt = 30 dBm	PASS

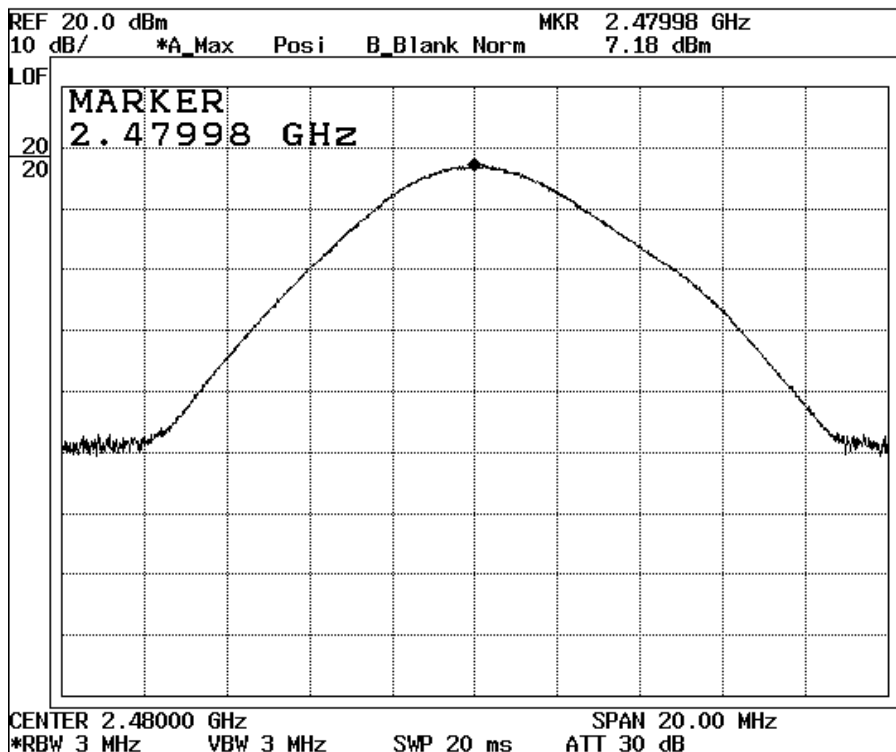
CH 0 (2402 MHz)



CH 39 (2441 MHz)



CH 78 (2480 MHz)



4.7 Band Edge

4.7.1 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Next of Calibration
Horn Antenna	R&S	BBHA9120D233	0501	09. 10. 2013
Horn Antenna	R&S	BBHA9170	BBHA9170152	09. 16. 2013
Horn Antenna	SCHWARZBECK	BBHA9120D	BBHA9120D 839	12. 24. 2012
Horn Antenna	A.H System, Inc	SAS 571	500	03. 23. 2013
TRILOG Antenna	SCHWARZBECK	VULD 9160	3292	04. 28. 2013
Loop Antenna	6502	EMCO	00123879	12. 28. 2012
EMI Test Receiver	ROHDE&SCHWARZ	ESVS10	80241-015	01. 30. 2013
EMI Test Receiver	LIG NEX1	ER-265	L0811B009	04. 10. 2013
Spectrum Analyzer	ADVANTEST	R3273	130900034	12. 05. 2012
Spectrum Analyzer	LIG NEX1	NS-30	6052036	01. 30. 2013

- Note :*
- 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to RRL, KRISS, KTL and HCT.*
 - 2. The calibration interval of horn ant. and loop ant. is 24 months*

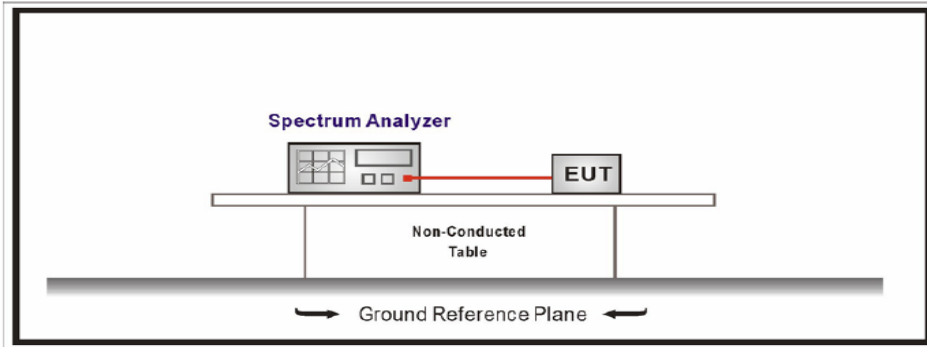
4.7.2 Limit

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.

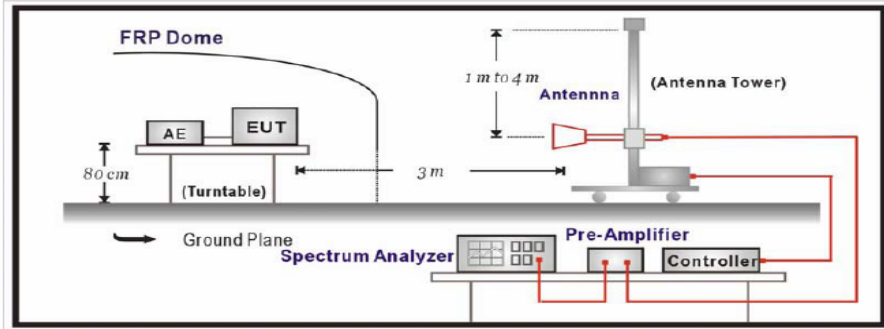
Attenuation below the general limits specified in section 15.209(a) is not required. In addition, radiated emission which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a)(see Section 15.205(c)).

4.7.3 Test Configuration

RF Conducted Measurement:



RF Radiated Measurement:



4.7.4 Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters. The antenna can move up and down between 1 meter and 4 meters to fine out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.4:2003 on radiated measurement.

The bandwidth below 1 GHz setting on the field strength meter is 100 kHz, above 1GHz are 1MHz.

4.7.5 Test Result Method of Band Edge Test Result of Radiated Test.

Emission Level(dBuV/m) = Reading Level + Correct Factor.

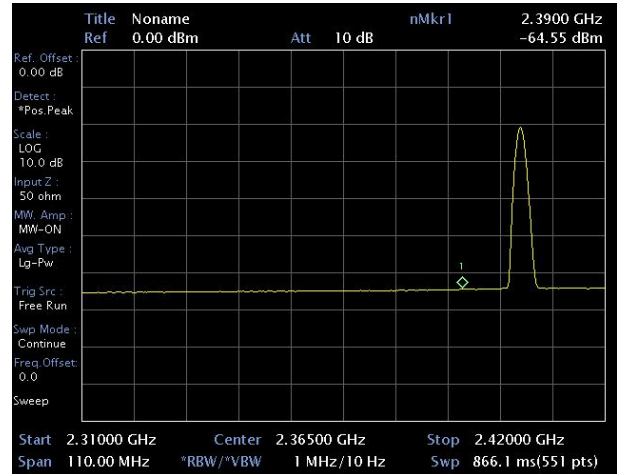
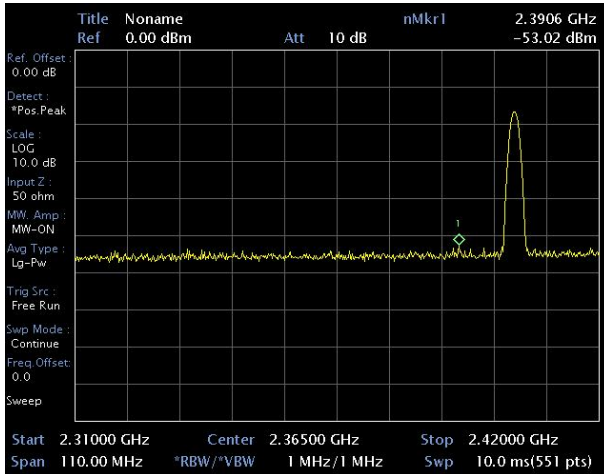
Test Frequency (MHz)	Correct Factor (dB)	
	Antenna Factor (dB)	Cable loss (dB)
2390	27.02	4.13
2483.5	27.33	4.20

Note : Correct Factor = AF + CL

AF – Antenna Factor , CL-Cable Loss

4.7.6 Band Edge Test Result

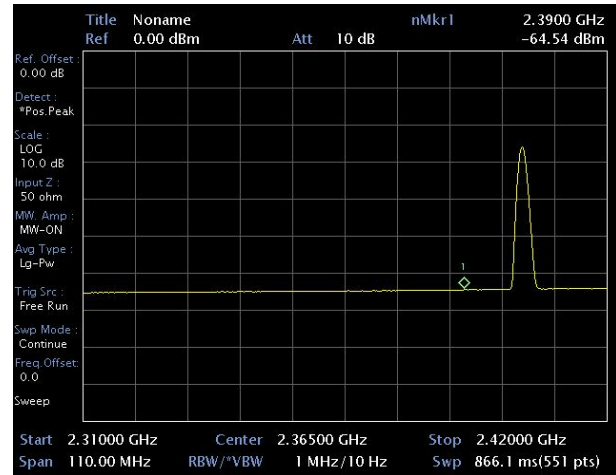
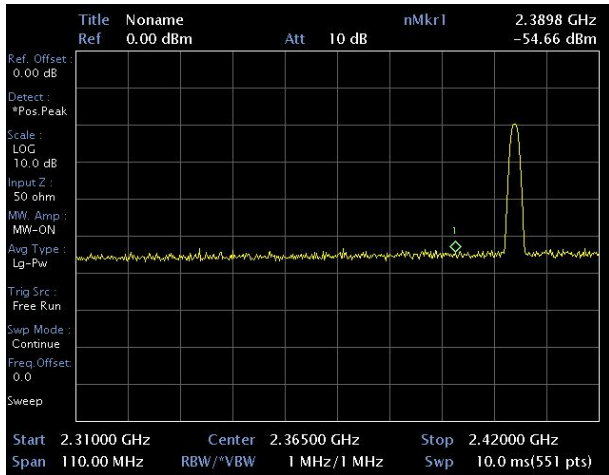
Detect mode	Peak / Average Mode	Test Site	3m Full Chamber
Test mode	8-DQPSK	Test Channel	0 CH (2402 MHz)
Ant. Polarization	Vertical	Polarization	Y-Plane



Frequency (MHz)	Reading PK/AV (dBuV/m)	Factor(dB) CL+AF	Limits PK/AV (dBuV/m)	Result PK/AV (dBuV/m)	Margin PK/AV (dB)
2390	22.82/11.29	31.15	74/54	53.97/42.44	20.03/11.56

Note : Emission Level(dBuV/m) = Reading Level + Correct Factor

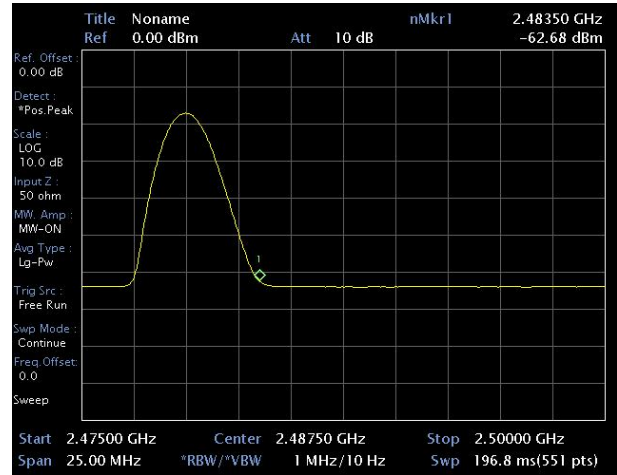
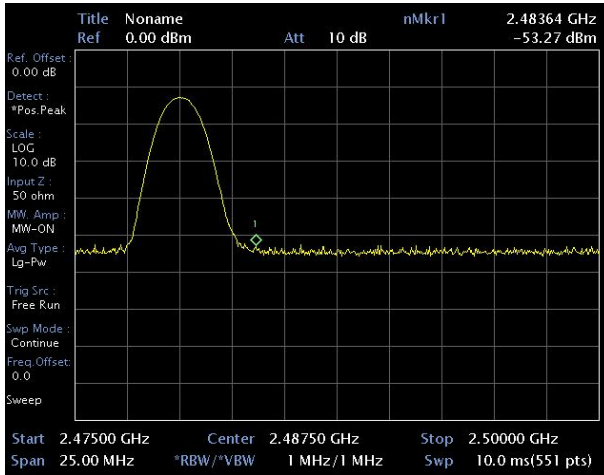
Detect mode	Peak / Average Mode	Test Site	3m Full Chamber
Test mode	8-DQPSK	Test Channel	0 CH (2402 MHz)
Ant. Polarization	Horizontal	Polarization	Y-Plane



Frequency (MHz)	Reading PK/AV (dBuV/m)	Factor(dB) CL+AF	Limits PK/AV (dBuV/m)	Result PK/AV (dBuV/m)	Margin PK/AV (dB)
2390	21.18/11.30	27.38	74/54	52.33/42.45	21.67/11.55

Note : Emission Level(dBuV/m) = Reading Level + Correct Factor

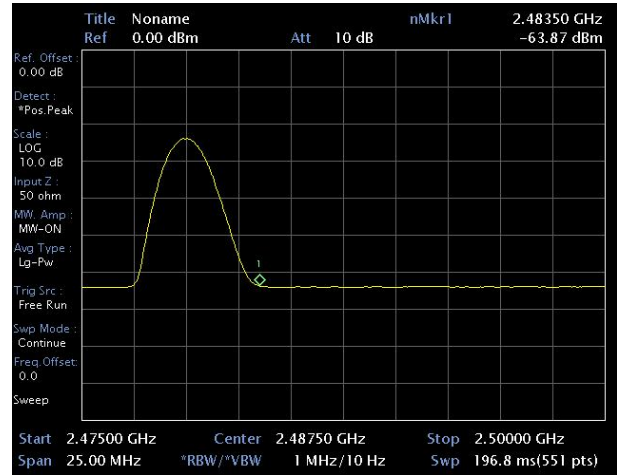
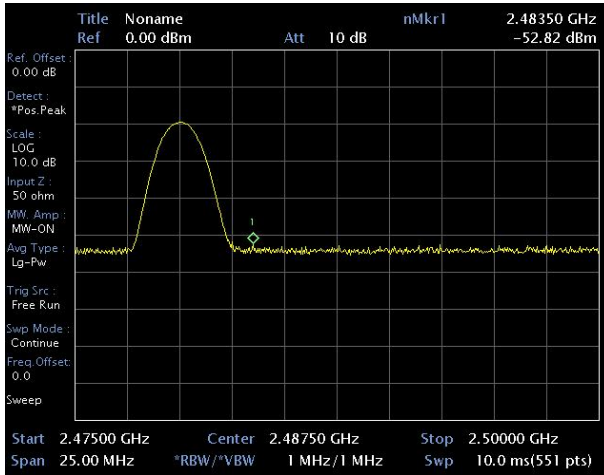
Detect mode	Peak / Average Mode	Test Site	3m Full Chamber
Test mode	8-DQPSK	Test Channel	78 CH (2480 MHz)
Ant. Polarization	Vertical	Polarization	Y-Plane



Frequency (MHz)	Reading PK/AV (dBuV/m)	Factor(dB) CL+AF	Limits PK/AV (dBuV/m)	Result PK/AV (dBuV/m)	Margin PK/AV (dB)
2483.5	22.19/12.78	31.53	74/54	53.72/44.31	20.28/9.69

Note : Emission Level(dBuV/m) = Reading Level + Correct Factor

Detect mode	Peak / Average Mode	Test Site	3m Full Chamber
Test mode	8-DQPSK	Test Channel	78 CH (2480 MHz)
Ant. Polarization	Horizontal	Polarization	Y-Plane



Frequency (MHz)	Reading PK/AV (dBuV/m)	Factor(dB) CL+AF	Limits PK/AV (dBuV/m)	Result PK/AV (dBuV/m)	Margin PK/AV (dB)
2483.5	22.64/11.59	31.53	74/54	54.17/43.12	19.83/10.88

Note : Emission Level(dBuV/m) = Reading Level + Correct Factor

5. Equipment Under Test Condition C(RFID(13.56 MHz) Operation)

5.1 Radiated Emission

5.1.1 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Next of Calibration
Horn Antenna	R&S	BBHA9120D233	0501	09. 10. 2013
Horn Antenna	R&S	BBHA9170	BBHA9170152	09. 16. 2013
Horn Antenna	SCHWARZBECK	BBHA9120D	BBHA9120D 839	12. 24. 2012
Horn Antenna	A.H System, Inc	SAS 571	500	03. 23. 2013
TRILOG Antenna	SCHWARZBECK	VULD 9160	3292	04. 28. 2013
Loop Antenna	6502	EMCO	00123879	12. 28. 2012
EMI Test Receiver	ROHDE&SCHWARZ	ESVS10	80241-015	01. 30. 2013
EMI Test Receiver	LIG NEX1	ER-265	L0811B009	04. 10. 2013
Spectrum Analyzer	ADVANTEST	R3273	130900034	12. 05. 2012
Spectrum Analyzer	LIG NEX1	NS-30	6052036	01. 30. 2013

Note : 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to RRL, 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)

5.1.2 Test Area

3m Full Chamber

5.1.3 Operation of EUT

Operating Environment

Temperature : 24.4 degree C
 Humidity : 46 %RH
 Atmospheric Pressure : 986 mBar

5.1.4 Test Date

May 6, 2012

5.1.5 Radiated Emission Limit

All emission from a digital device, including any network of conductors and apparatus connected thereto shall not exceed the level of field strength specified below:

FCC Part 15 Subpart C paragraph 15.249(a) Limit

Fundamental Frequency (MHz)	Field Strength of Fundamental (3m)		Field Strength of Harmonics (3m)		
	mV/m	dBuV/m	uV/m	dBuV/m	
2400-2483.5	50	94(Average) 114(Peak)	500	54(Average)	74(Peak)

Note : 1. RF Field Strength (dBuV) = 20log RF Voltage(uV)

2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
3. The emission limit in this paragraph is based on measurement instrumentation employing an average detector

Frequencies in restricted band are complied to limit on Paragraph 15.209

Frequency Range (MHz)	Distance (m)	Field strength (dBuV/m)
0.009-0.490	3	20log 2400/F (kHz) + 80
0.490-1.705	3	20log 24000/F (kHz) + 40
1.705-30	3	20log 30 + 40
30-88	3	40.0
88-216	3	43.5
216-960	3	46.0
Above 960	3	54.0

Note : 1. RF voltage (dBuV) = 20 log RF Voltage (uV)

2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the EUT
4. This device used to install a wall device. The location of EUT measurements has the Y-plane(Stand).
5. All scanning using PK detector. And the final emission level was get using QP detector for frequency range from 30 – 1000 MHz. As to 1 - 26 GHz, the final emission level got using PK and AV detector.
6. If measurement is made at 3m distance.

5.2 Radiated Field emission-15.225(a)

5.2.1 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Next of Calibration
Horn Antenna	R&S	BBHA9120D233	0501	09. 10. 2013
Horn Antenna	R&S	BBHA9170	BBHA9170152	09. 16. 2013
Horn Antenna	SCHWARZBECK	BBHA9120D	BBHA9120D 839	12. 24. 2012
Horn Antenna	A.H System, Inc	SAS 571	500	03. 23. 2013
TRILOG Antenna	SCHWARZBECK	VULD 9160	3292	04. 28. 2013
Loop Antenna	6502	EMCO	00123879	12. 28. 2012
EMI Test Receiver	ROHDE&SCHWARZ	ESVS10	80241-015	01. 30. 2013
EMI Test Receiver	LIG NEX1	ER-265	L0811B009	04. 10. 2013
Spectrum Analyzer	ADVANTEST	R3273	130900034	12. 05. 2012
Spectrum Analyzer	LIG NEX1	NS-30	6052036	01. 30. 2013

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

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

5.2.2 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)

5.2.3 Test Result – Radiated Field Emission-15.225(a)

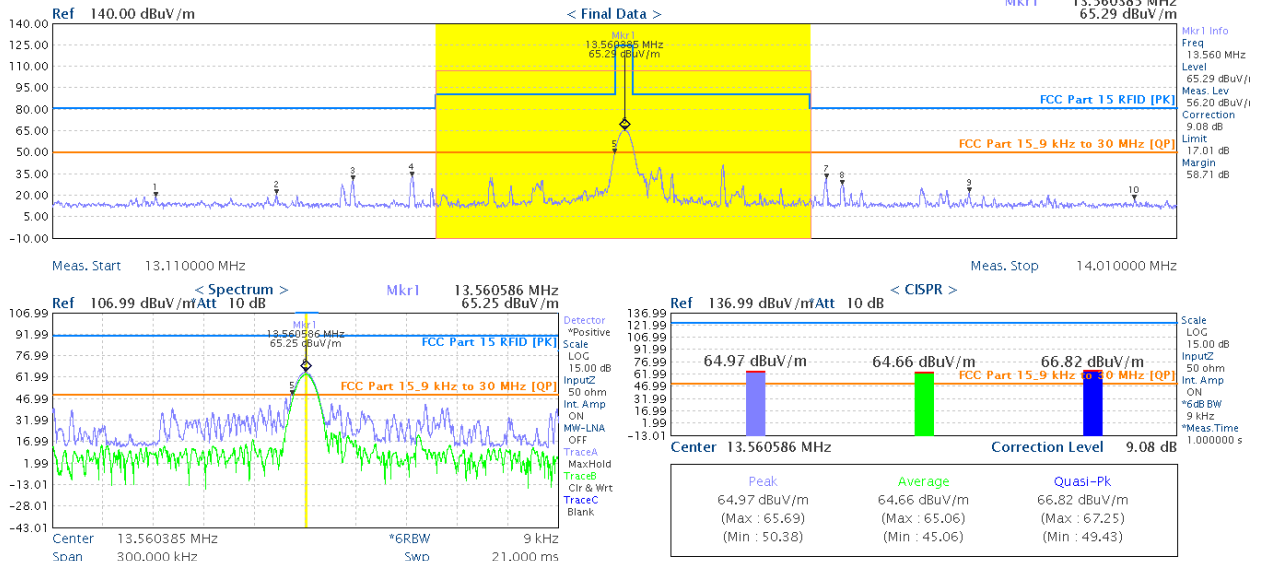
Frequency(MHz)	Field Strength of Fundamental uV/m	Field Strength of Fundamental dBuV/m(30m)	Field Strength of Fundamental dBuV/m(3m)
13.553 – 13.567	15,848	83.9	123.9

[Applicable]

Freq. [MHz]	Reading [dBuV/m]	Antenna Factor [dB/m]	Cable Loss [dB]	Polar. [H/V]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
13.5595	45.77	18.70	0.82	H	65.29	123.9	58.61
13.5595	49.22	18.70	0.82	V	68.74	123.9	55.16

Sweep Measurement Mode

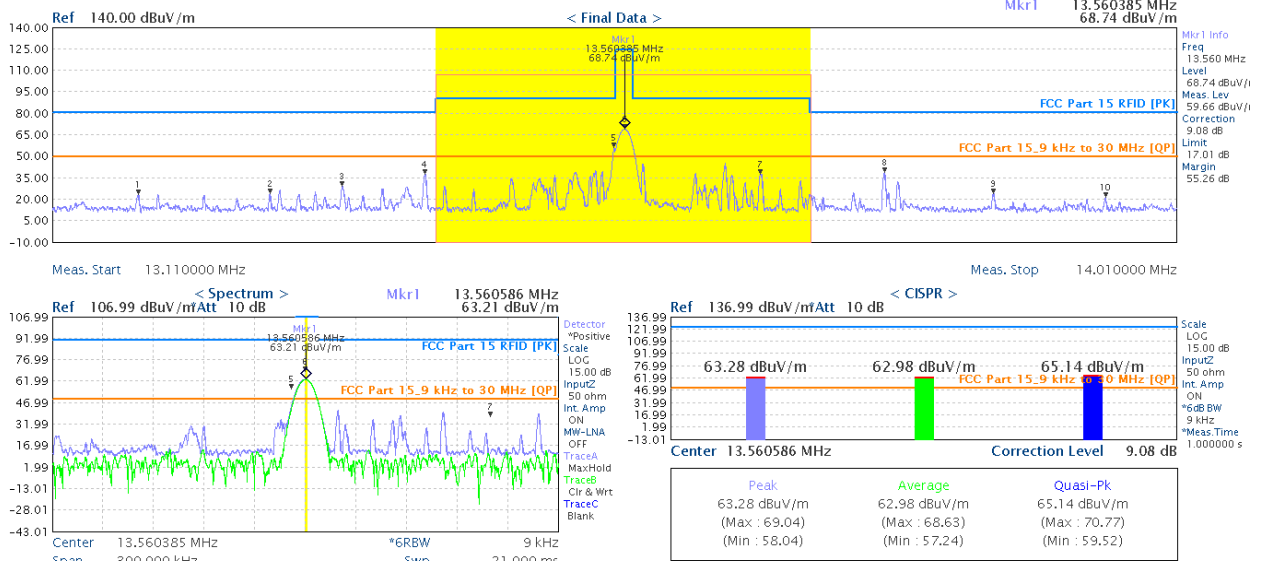
Running..



[HOR.]

Sweep Measurement Mode

Running..



[VER.]

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5.3 Radiated Electric Emission-15.225(b) (c)

Frequency (MHz)	Field Strength of Fundamental uV/m	Field Strength of Fundamental dBuV/m(30m)	Field Strength of Fundamental dBuV/m(3m)
13.110 – 13.410	106	40.5	80.5
13.410 – 13.553	334	50.4	90.4
13.567 – 13.710	334	50.4	90.4
13.710 – 14.010	106	40.5	80.5

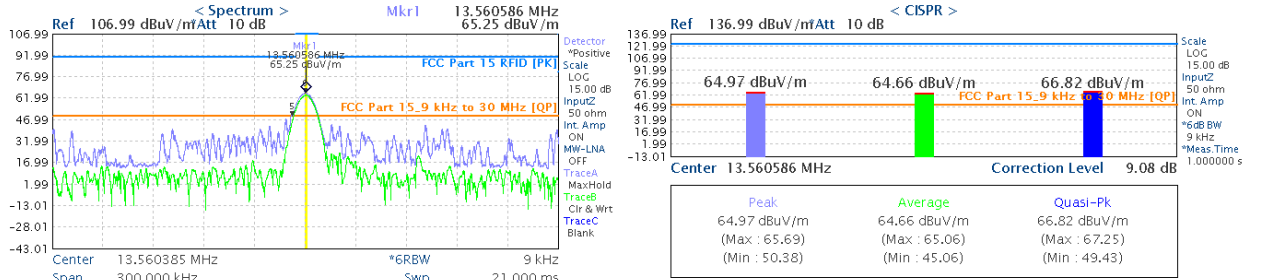
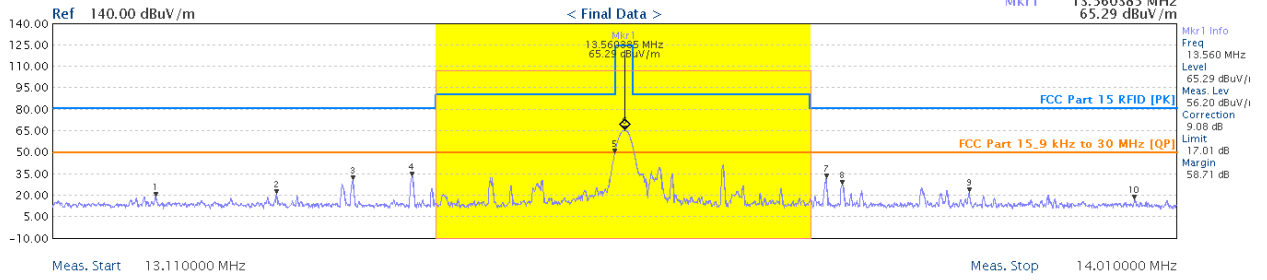
[Applicable]

Freq. [MHz]	Reading [dBuV/m]	Height [m]	Antenna Factor [dB/m]	Cable Loss [dB]	Polar. [H/V]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
-	-	-	-	-	-	-	-	-

Note : Other emission don't exceed the level 20dB below the applicable limit.

Sweep Measurement Mode

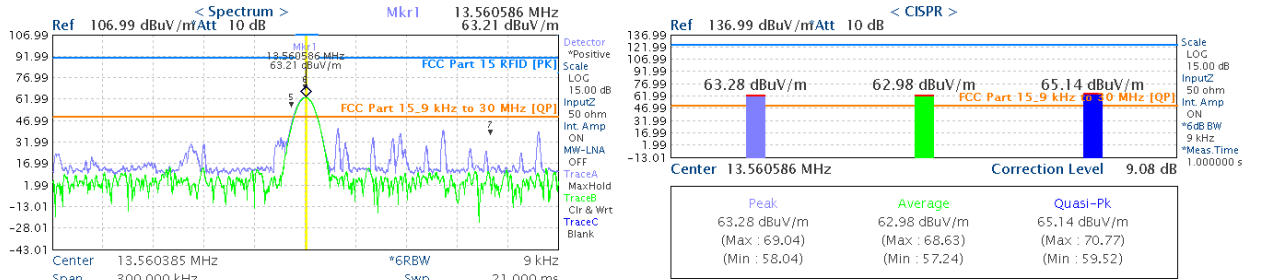
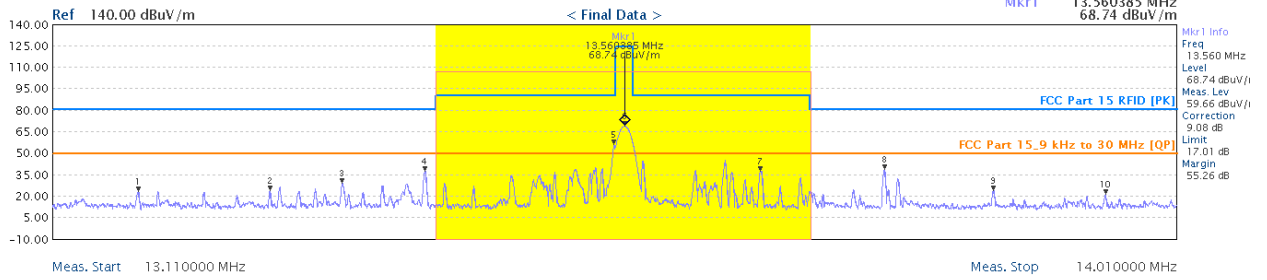
Running..



[HOR.]

Sweep Measurement Mode

Running..



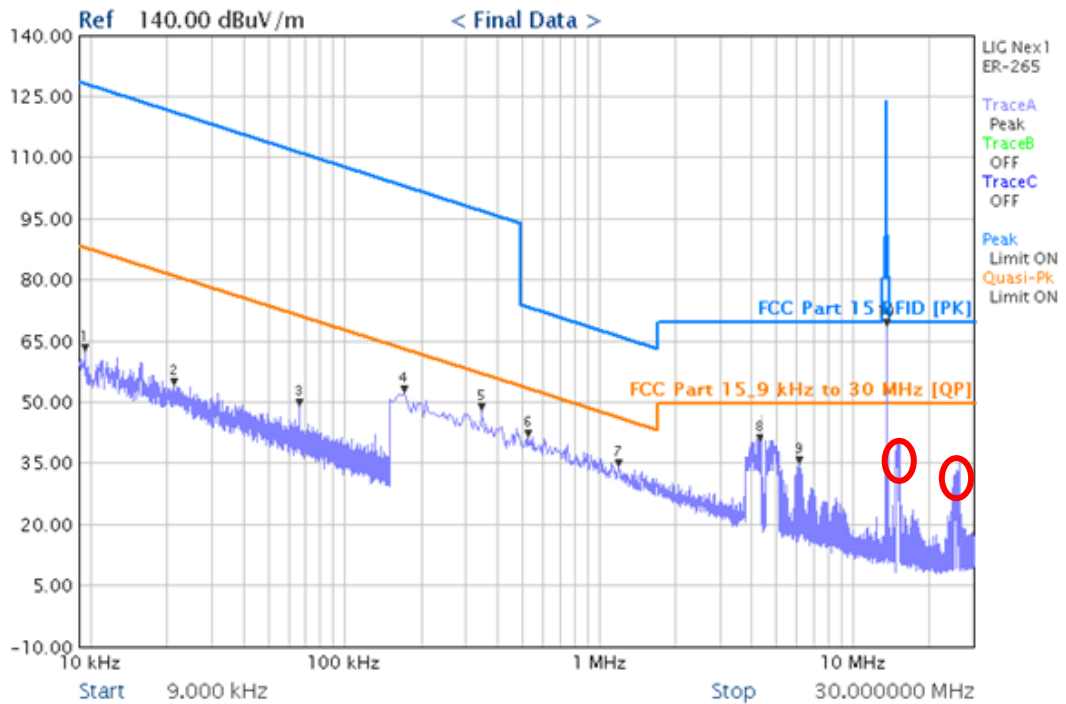
[VER.]

5.4 Radiated Field Emission-15.109,15.209, 15.225(d)

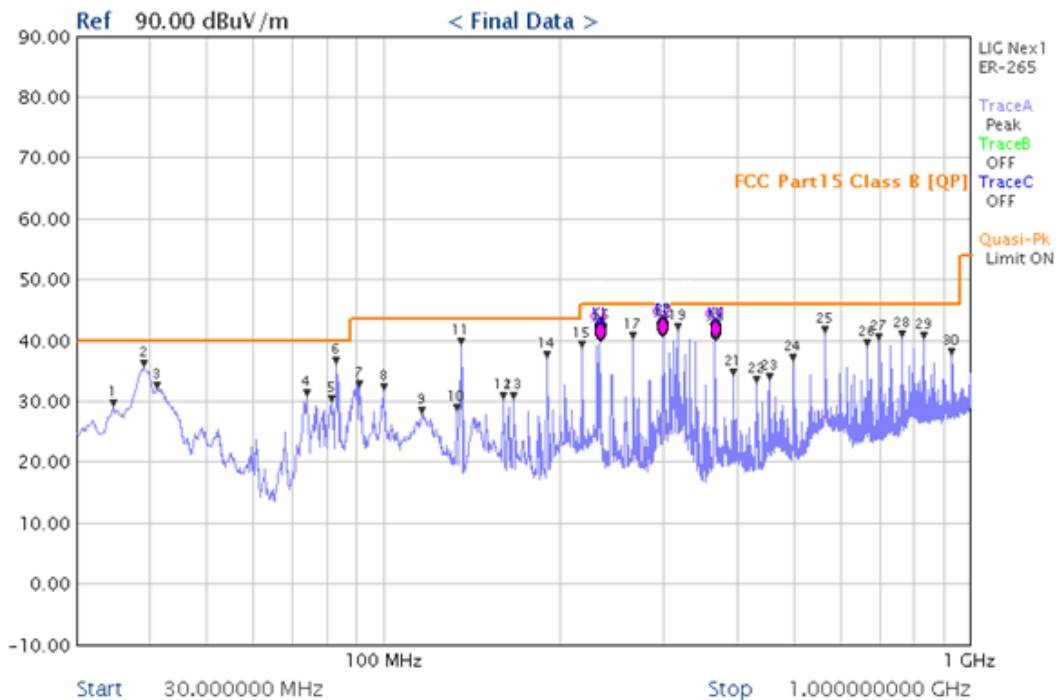
Frequency (MHz)	Field Strength of Fundamental uV/m	Field Strength of Fundamental dBuV/m(3m)
1.705 – 30.0	30 (at 30m)	49.5
30 – 88	100 (at 3m)	40
88 – 216	150 (at 3m)	43.5
216 - 960	200 (at 3m)	46
Above 960	500 (at 3m)	54

Frequency MHz	Reading dBuV/m	P (H, V)	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV/m	Total dBuV/m	Margin dB
39.12	22.44	V	12.02	1.30	0.0	40.00	35.76	4.24
82.93	26.87	H	7.89	1.86	0.0	40.00	36.62	3.38
135.87	24.15	H	12.51	2.36	0.0	43.50	39.02	4.48
190.11	23.02	V	10.60	2.80	0.0	43.50	36.42	7.08
217.46	25.60	V	10.36	3.04	0.0	46.00	39.00	7.00
233.09	28.26	H	11.01	3.16	0.0	46.00	42.43	3.57
266.25	25.11	H	12.24	3.37	0.0	46.00	40.72	5.28
299.53	22.82	H	13.31	3.50	0.0	46.00	39.63	6.37
316.46	21.56	H	13.68	3.63	0.0	46.00	38.87	7.13
365.85	21.44	V	14.78	3.96	0.0	46.00	40.18	5.82
565.74	16.06	H	18.96	4.96	0.0	46.00	39.98	6.02
765.05	12.29	H	21.90	5.83	0.0	46.00	40.02	5.98
831.48	11.09	H	22.80	6.03	0.0	46.00	39.92	6.08

[Below 30 MHz]



[30 to 1000 MHz]



Note : Remark “O” means that the data is Compat chamber ambient.

5.5 Frequency Stability-15.225(e)

5.5.1 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Next of Calibration
Spectrum Analyzer	ADVANTEST	R3273	130900034	12. 05. 2012
TEM&HUMID CHAMBER	한영넥스	TH500	N/A	12. 05. 2012

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

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

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery

5.5.2 Test Results.

Table 1 : Frequency Tolerance									
Reference Frequency : 13.5603 MHz, Limit : within ± 1356.03 Hz									
Environment Temperature [°C]	Power Supplied [Vdc]	Carrier Frequency Measured with Time Elapsed							
		SRARTUP		2 minutes		5 minutes		10 minutes	
		[Hz]	Err[Hz]	[Hz]	Err[Hz]	[Hz]	Err[Hz]	[Hz]	Err[Hz]
+50	12	13560407	107	13560371	71	13560375	75	13560380	80
+40	12	13560383	83	13560374	74	13560372	72	13560369	69
+30	12	13560394	94	13560386	86	13560387	87	13560381	81
+20	12	13560419	119	13560409	109	13560401	101	13560393	93
+10	12	13560404	104	13560420	120	13560418	118	13560411	111
0	12	13560415	115	13560386	86	13560395	95	13560414	114
-10	12	13560409	109	13560407	107	13560383	83	13560385	85
-20	12	13560321	21	13560352	52	13560382	82	13560373	73

Table 2 : Frequency Tolerance								
Reference Frequency : 13.5595 MHz, Limit : within ± 1355.95 Hz								
Power Supplied[Vdc]	Carrier Frequency Measured with Time Elapsed							
	SRARTUP		2 minutes		5 minutes		10 minutes	
	[Hz]	Err[Hz]	[Hz]	Err[Hz]	[Hz]	Err[Hz]	[Hz]	Err[Hz]
85 %	13560386	86	13560386	86	13560381	81	13560380	80
100 %	13560385	85	13560386	86	13560381	81	13560380	80
115 %	13560385	85	13560385	85	13560381	81	13560380	80

Err[Hz] = Measured carrier frequency (MHz) – Reference Frequency (13.5603 MHz)

6. Equipment Under Test Condition D(WiFi+Bluetooth+RFID(13.56 MHz) Operation)

6.1 Radiated Emission

6.1.1 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Next of Calibration
Horn Antenna	R&S	BBHA9120D233	0501	09. 10. 2013
Horn Antenna	R&S	BBHA9170	BBHA9170152	09. 16. 2013
Horn Antenna	SCHWARZBECK	BBHA9120D	BBHA9120D 839	12. 24. 2012
Horn Antenna	A.H System, Inc	SAS 571	500	03. 23. 2013
TRILOG Antenna	SCHWARZBECK	VULD 9160	3292	04. 28. 2013
Loop Antenna	6502	EMCO	00123879	12. 28. 2012
EMI Test Receiver	ROHDE&SCHWARZ	ESVS10	80241-015	01. 30. 2013
EMI Test Receiver	LIG NEX1	ER-265	L0811B009	04. 10. 2013
Spectrum Analyzer	ADVANTEST	R3273	130900034	12. 05. 2012
Spectrum Analyzer	LIG NEX1	NS-30	6052036	01. 30. 2013

Note : 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to RRL, 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)

6.1.2 Test Area

3m Full Chamber

6.1.3 Operation of EUT

Operating Environment

Temperature : 24.4 degree C
 Humidity : 46 %RH
 Atmospheric Pressure : 986 mBar

6.1.4 Test Date

May 06, 2012

6.1.5 Radiated Emission Limit

All emission from a digital device, including any network of conductors and apparatus connected thereto shall not exceed the level of field strength specified below:

FCC Part 15 Subpart C paragraph 15.249(a) Limit

Fundamental Frequency (MHz)	Field Strength of Fundamental (3m)			Field Strength of Harmonics (3m)		
	mV/m	dBuV/m		uV/m	dBuV/m	
2400-2483.5	50	94(Average)	114(Peak)	500	54(Average)	74(Peak)

Note : 1. RF Field Strength (dBuV) = 20log RF Voltage(uV)

2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

3. The emission limit in this paragraph is based on measurement instrumentation employing an average detector

Frequencies in restricted band are complied to limit on Paragraph 15.209

Frequency Range (MHz)	Distance (m)	Field strength (dBuV/m)
0.009-0.490	3	20log 2400/F (kHz) + 80
0.490-1.705	3	20log 24000/F (kHz) + 40
1.705-30	3	20log 30 + 40
30-88	3	40.0
88-216	3	43.5
216-960	3	46.0
Above 960	3	54.0

Note : 1. RF voltage (dBuV) = 20 log RF Voltage (uV)

2. In the Above Table, the tighter limit applies at the band edges.

3. Distance refers to the distance in meters between the measuring instrument antenna and the EUT

4. This device used to install a wall device. The location of EUT measurements has the Y-plane(Stand).

5. All scanning using PK detector. And the final emission level was get using QP detector for frequency range from 30 – 1000 MHz. As to 1G-26G, the final emission level got using PK and AV detector.

6. If measurement is made at 3m distance.

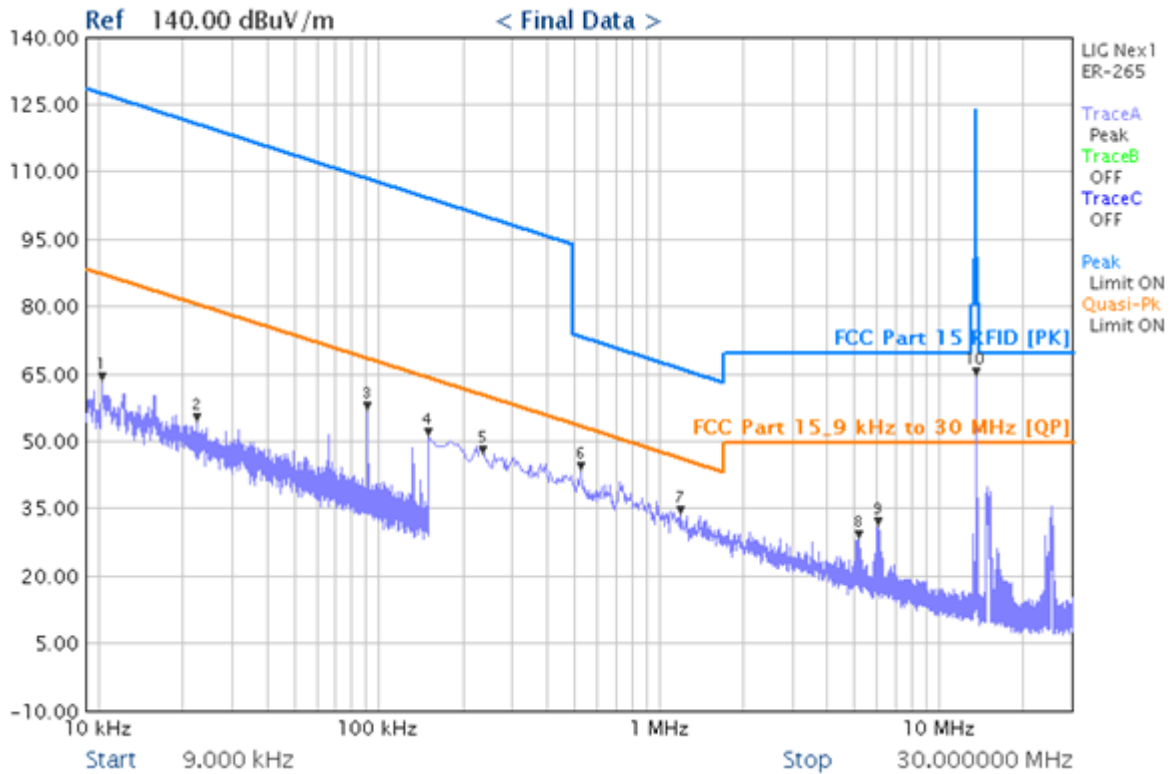
6.1.5 .1 Radiated Emission Result(0.009 to 30 MHz)

Radiated Emission from 0.009 – 30 MHz

EUT set Condition : Normal operating Mode

Antenna Polarity : Hor.

Results : Pass



Frequency MHz	Reading dBuV/m	P (H, V)	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV/m	Total dBuV/m	Margin dB
-	-	-	-	-	-	-	-	-

Note : 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.

2. Measurement level = reading level + correct factor

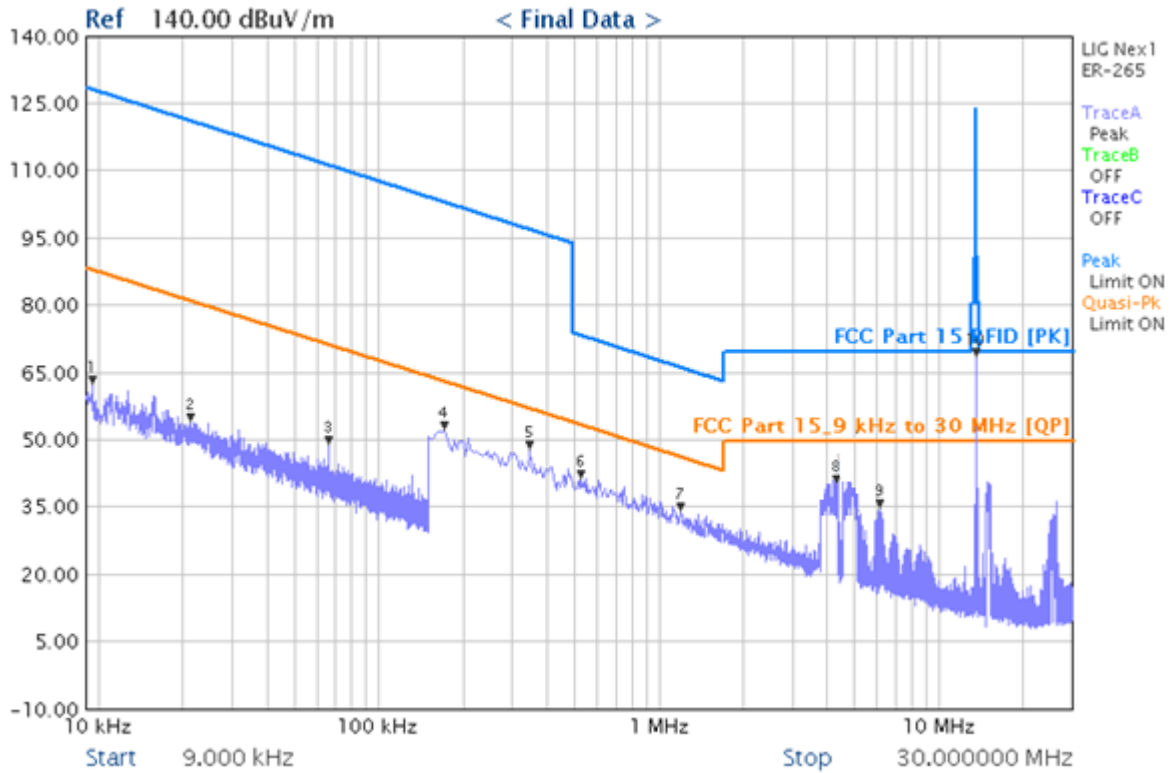
3. This device used to install a wall device. The location of EUT measurements has the Y-Plane.

Radiated Emission from 0.009 – 30 MHz

EUT set Condition : Normal operating Mode

Antenna Polarity : Ver.

Results : Pass



Frequency	Reading	P	Ant. Factor	Cable Loss	AMP GAIN	Limit	Total	Margin
MHz	dBuV/m	(H, V)	dB	dB	dB	dBuV/m	dBuV/m	dB
-	-	-	-	-	-	-	-	-

Note : 1. Other emissions don't exceed the level of 20 dB below the applicable Limit.

2. Measurement level = reading level + correct factor

3. This device used to install a wall device. The location of EUT measurements has the Y-Plane.

7.0 RF Exposure

7.1 Test Instruments

Description	Manufacturer	Model No.	Serial No.	Next of Calibration
Spectrum Analyzer	Advantest	R3273	121100554	Jun. 15, 2010
RF Test Room	-	-	-	-

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

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

7.2 Limit

According to §15.247(b)(4) and §1.1307(b)(1), Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1093 RF exposure is calculated.

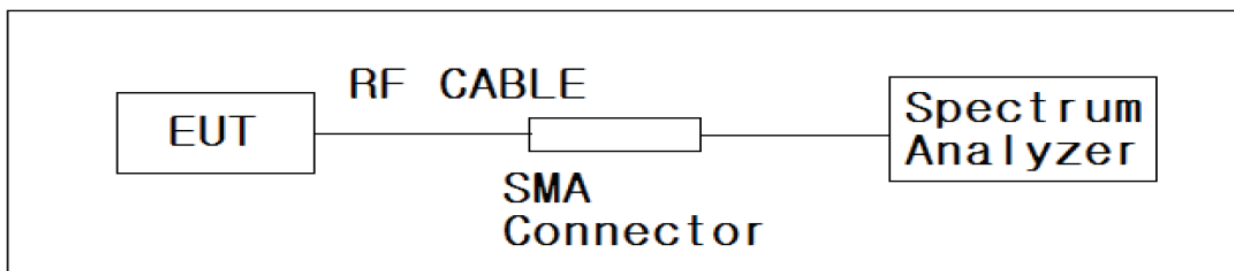
Limits for Maximum permissive Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3 – 1.34	614	1.63	*(100)	30
1.34 – 30	824/f	2.19/f	*(180/f ²)	30
30 – 300	27.5	0.073	0.2	30
300 – 1500	/	/	f/1500	30
1500 - 15000	/	/	1.0	30

f = frequency in MHz

*= Plane-wave equipment power density

7.3 Test Configuration



7.4 Test Result
7.4.1 WiFi Result

EUT	SPS-700B
Frequency Range	2412 ~ 2472 MHz
Device category	Portable (<20 cm separation)
Exposure classification	General population/Uncontrolled exposure (S = 1mW/cm ²)
Max. output power	8.95 dBm (7.85 mW)
Antenna gain(Max.)	2.00 dBi (numeric gain : 1.585)
Evaluation applied	MPE evaluation

Note :

1. The Maximum output power is 8.95 dBm (7.85 mW) at 2412 MHz
(with 1.585 numeric antenna gain)
2. For mobile or fixed location transmitters, no SAR consideration applied.
The minimum separation generally be used is at least 20cm, even if the calculations indicate that the MPE distance would be lesser.

$$S = PG/4\pi R^2$$

* S = Power density

* P = Power input to antenna

* G = power gain of the antenna in the direction of interest relative to an isotropic radiator

* R = Distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal (dBm)	:	8.95
Maximum peak output power at antenna input terminal (mW)	:	7.85
Antenna Gain (typical)(dBi)	:	2.00
Maximum antenna gain (numeric)	:	1.585
Prediction distance (cm)	:	20
Predication frequency (MHz)	:	2412
MPE limit for uncontrolled exposure at prediction frequency (mW/cm ²)	:	1
Power density at predication frequency (mW/cm ²)	:	0.002477

Note : The power density at 20 cm does not exceed the 1mW/cm² limit. Therefore, the exposure condition is compliant with FCC rules.

7.4.1 Bluetooth Result

EUT	SPS-700B
Frequency Range	2402 ~ 2480 MHz
Device category	Portable (<20 cm separation)
Exposure classification	General population/Uncontrolled exposure (S = 1mW/cm ²)
Max. output power	7.70 dBm (5.889 mW)
Antenna gain(Max.)	2.00 dBi (numeric gain : 1.585)
Evaluation applied	MPE evaluation
Note : 1. The Maximum output power is 7.70 dBm (5.889 mW) at 2402 MHz (with 1.585 numeric antenna gain) 2. For mobile or fixed location transmitters, no SAR consideration applied. The minimum separation generally be used is at least 20cm, even if the calculations indicate that the MPE distance would be lesser.	

$$S = PG/4\pi R^2$$

* S = Power density

* P = Power input to antenna

* G = power gain of the antenna in the direction of interest relative to an isotropic radiator

* R = Distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal (dBm)	: 7.70
Maximum peak output power at antenna input terminal (mW)	: 5.889
Antenna Gain (typical)(dBi)	: 2.00
Maximum antenna gain (numeric)	: 1.585
Prediction distance (cm)	: 20
Predication frequency (MHz)	: 2402
MPE limit for uncontrolled exposure at prediction frequency (mW/cm ²)	: 1
Power density at predication frequency (mW/cm ²)	: 0.00186

Note : The power density at 20 cm does not exceed the 1mW/cm² limit. Therefore, the exposure condition is compliant with FCC rules.

8.0 ANTENNA REQUIREMENT

8.1 RFID Antenna

8.1.1 Applicable Standard

According to § 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.

8.1.2 Antenna Construction

The antenna is permanently mounted on PCB, no consideration of replacement.

8.1.3 Test Result : Pass

8.2 WIFI & BluetoothAntenna

8.2.1 Applicable Standard

According to § 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.

8.2.2 Antenna Construction

The antenna is located inside the case, no consideration of replacement

Helical antenna SMA connector of the RF board through the device is fixed and the Maximum gain of the antennas is 2.0 dBi.

8.2.3 Test Result : Pass

Appendix A. The Photo of Test Setup

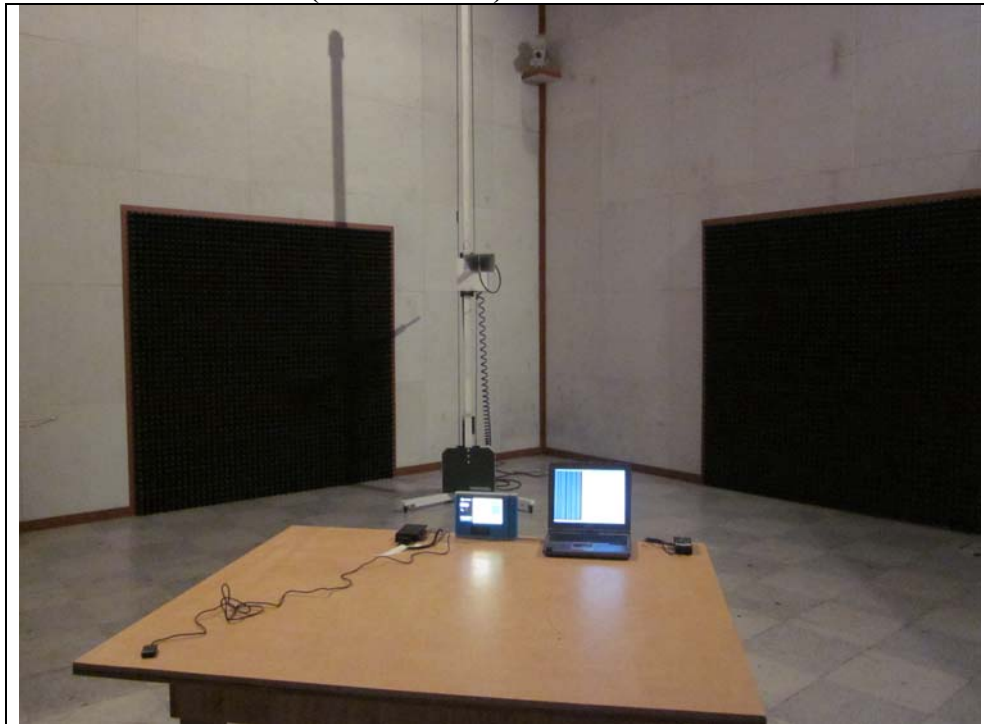
- View of Radiated Emission (9 kHz to 30 MHz)



- View of Radiated Emission (30 MHz to 1GHz)



● **View of Radiated Emission (Above 1GHz)**



Appendix B. The Photo of Equipment Under Test

Front View of EUT



Rear View of EUT



Inside View of EUT

