JQA File No. : KL80160139
Issue Date : June 27, 2016

TEST REPORT

Applicant	:	Hosiden Corporation
Address	:	4-33, Kitakyuhoji 1-Choda, Yao-City, Osaka 581-0071, Japan
Products	:	Bluetooth Low Energy Module
Model No.	:	HRM1062
Serial No.	:	16
		18
FCC ID	:	VIYHRM1062
Test Standard	:	CFR 47 FCC Rules and Regulations Part 15
Test Results	:	**Passed**
Date of Test	:	May 30 ~ June 10, 2016

Kousei Shibata
Manager
Japan Quality Assurance Organization
KITA-KANSAI Testing Center
SAITO EMC Branch
7-3-10, Saito-asagi, Ibaraki-shi, Osaka 567-0085, Japan

- The test results in this test report was made by using the measuring instruments which are traceable to national standards of measurement in accordance with ISO/IEC 17025.
- The applicable standard, testing condition and testing method which were used for the tests are based on the request of the applicant.
- The test results presented in this report relate only to the offered test sample.
- The contents of this test report cannot be used for the purposes, such as advertisement for consumers.
- This test report shall not be reproduced except in full without the written approval of JQA.
- VLAC does not approve, certify or warrant the product by this test report.

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DEFINITIONS FOR ABBREVIATION AND SYMBOLS USED IN THIS TEST REPORT

EUT : Equipment Under Test
AE : Associated Equipment
N/A : Not Applicable
N/T : Not Tested
EMC : Electromagnetic Compatibility
EMI : Electromagnetic Interference
EMS : Electromagnetic Susceptibility

☑ - indicates that the listed condition, standard or equipment is applicable for this report.
☐ - indicates that the listed condition, standard or equipment is not applicable for this report.

1 Description of the Equipment Under Test

1.	Manufacturer	:	Hosiden Corporation 4-33, Kitakyuhoji 1-Choda, Yao-City, Osaka 581-0071, Japan
2.	Products	:	Bluetooth Low Energy Module
3.	Model No.	:	HRM1062
4.	Serial No.	:	16
			18
5.	Product Type	:	Pre-production
6.	Date of Manufacture	:	April, 2016
7.	Power Rating	:	3.0VDC
8.	Grounding	:	None
9.	Transmitting Frequency	:	Bluetooth Low Energy: 2402.0 MHz(00CH) – 2480.0MHz(39CH)
10.	:	:	non-BLE 1Mbps: 2402.0 MHz(00CH) – 2480.0MHz(78CH)
		:	non-BLE 2Mbps: 2402.0 MHz(00CH) – 2480.0MHz(39CH)
11.	Receiving Frequency	:	Bluetooth Low Energy: 2402.0 MHz(00CH) – 2480.0MHz(39CH)
		:	non-BLE 1Mbps: 2402.0 MHz(00CH) – 2480.0MHz(78CH)
		:	non-BLE 2Mbps: 2402.0 MHz(00CH) – 2480.0MHz(39CH)
12.	Max. RF Output Power	:	3.67 dBm (Measure Value of Bluetooth Low Energy)
		:	3.64 dBm (Measure Value of non-BLE 1Mbps)
		:	3.66 dBm(Measure Value of non-BLE 2Mbps)
13.	Antenna Type	:	Printed Pattern Antenna (Integral)
14.	Antenna Gain	:	2.0 dBi
15.	Category	:	DTS
16.	EUT Authorization	:	Certification
17.	Received Date of EUT	:	May 30, 2016

18. Channel Plan

Bluetooth Low Energy and non-BLE 2Mbps Mode:
The carrier spacing is 2 MHz.
The carrier frequency is designated by the absolute frequency channel number (ARFCN).
The carrier frequency is expressed in the equation shown as follows:

Transmitting Frequency (in MHz) = 2402.0 + 2*n
Receiving Frequency (in MHz) = 2402.0 + 2*n
where, n : channel number ($0 \leq n \leq 39$)

non-BLE 1Mbps Mode:
The carrier spacing is 1 MHz.
The carrier frequency is designated by the absolute frequency channel number (ARFCN).
The carrier frequency is expressed in the equation shown as follows:

Transmitting Frequency (in MHz) = 2402.0 + 2*n
Receiving Frequency (in MHz) = 2402.0 + 2*n
where, n : channel number ($0 \leq n \leq 78$)

2 Summary of Test Results

Applied Standard : CFR 47 FCC Rules and Regulations Part 15
Subpart C - Intentional Radiators

The EUT described in clause 1 was tested according to the applied standard shown above.
Details of the test configuration is shown in clause 6.
The conclusion for the test items of which are required by the applied standard is indicated under the test result.

☑ - The test result was **passed** for the test requirements of the applied standard.

☐ - The test result was **failed** for the test requirements of the applied standard.

☐ - The test result was **not judged** the test requirements of the applied standard.

In the approval of test results,
- Determining compliance with the limits in this report was based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
- No deviations were employed from the applied standard.
- No modifications were conducted by JQA to achieve compliance to the limitations.

Reviewed by:

Shigeru Osawa
Deputy Manager
JQA KITA-KANSAI Testing Center
SAITO EMC Branch

Tested by:

Takeshi Choda
Assistant Manager
JQA KITA-KANSAI Testing Center
SAITO EMC Branch

3 Test Procedure

Test Requirements : §15.247, §15.207 and §15.209

Test Procedure : ANSI C63.10–2013
Testing unlicensed wireless devices.

KDB 558074 D01
DTS Meas Guidance v03r05: April 18, 2016.

KDB937606 (Publication Date: October 10, 2014)
Test Site Requirements for Part 15 and 18 Devices Operating Below 30MHz.

KDB 447498
RF exposure and equipment authorization requirements

4 Test Location

Japan Quality Assurance Organization (JQA)
KITA-KANSAI Testing Center
7-7, Ishimaru, 1-chome, Minoh-shi, Osaka, 562-0027, Japan
SAITO EMC Branch
7-3-10, Saito-asagi, Ibaraki-shi, Osaka 567-0085, Japan

5 Recognition of Test Laboratory

JQA KITA-KANSAI Testing Center SAITO EMC Branch is accredited under ISO/IEC 17025 by following accreditation bodies and the test facility is registered by the following bodies.

VLAC Accreditation No.	:	VLAC-001-2 (Expiry date : March 30, 2018)
VCCI Registration No.	:	A-0002 (Expiry date : March 30, 2018)
BSMI Registration No.	:	SL2-IS-E-6006, SL2-IN-E-6006, SL2-R1/R2-E-6006, SL2-A1-E-6006 (Expiry date : September 14, 2016)
IC Registration No.	:	2079E-3, 2079E-4 (Expiry date : July 16, 2017)

Accredited as conformity assessment body for Japan electrical appliances and material law by METI. (Expiry date : February 22, 2019)

6 Description of Test Setup

6.1 Test Configuration

The equipment under test (EUT) consists of :

	Item	Manufacturer	Model No.	Serial No.	FCC ID
A	Bluetooth Low Energy Module	Hosiden	HRM1062	16 *1) 18 *2)	VIYHRM1062

*1) Used for Antenna Conducted Emission.
*2) Used for AC Powerline Conducted Emission and Field Strength of Spurious Emission.

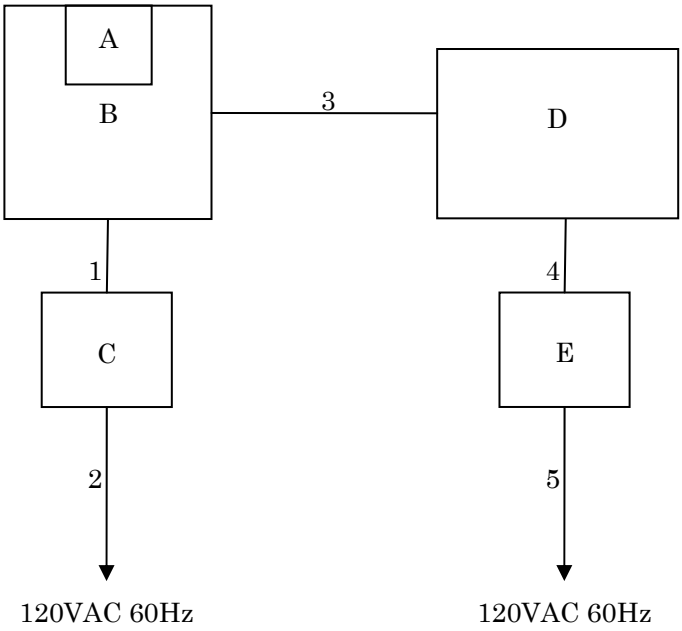
The auxiliary equipment used for testing :

	Item	Manufacturer	Model No.	Serial No.	FCC ID
B	Jig BoardBluetooth Low Energy Module	Hosiden	HRM1067	--	N/A
C	DC Power Source	KIKUSUI	PBZ40-10	QB001180	N/A
D	Note PC	lenovo	L530	--	DoC
E	AC Adaptor	lenovo	ADLX65NLT2A	--	DoC

Type of Cable:

No.	Description	Identification (Manu. etc.)	Connector Shielded	Cable Shielded	Ferrite Core	Length (m)
1	DC Cable	--	--	NO	NO	2.0
2	USB-Serial Cable	--	Yes	Yes	NO	2.0
3	AC Cable	--	--	NO	NO	0.5
4	DC Cable	--	--	Yes	NO	1.6
5	AC Cable	--	--	NO	NO	0.8

6.2 Test Arrangement (Drawings)



6.3 Operating Condition

Power Supply Voltage : 3.0 VDC (for Jig Board)
120 VAC, 60 Hz (For DC Power Supply)

Transmitting/Receiving

Bluetooth Low Energy and non-BLE 2Mbps Mode :
Transmitting frequency : 2402.0 MHz(0CH) – 2480.0 MHz(39CH)
Receiver frequency : 2402.0 MHz(0CH) – 2480.0 MHz(39CH)

non-BLE 1Mbps Mode :
Transmitting frequency : 2402.0 MHz(0CH) – 2480.0 MHz(78CH)
Receiver frequency : 2402.0 MHz(0CH) – 2480.0 MHz(78CH)

Modulation Type
1. Bluetooth Low Energy : GFSK
2. non-BLE 1Mbps : GFSK
3. non-BLE 2Mbps : GFSK

The tests were performed in the following worst condition.

Mode	Condition
Bluetooth Low Energy	1 Mbps
non-BLE 1Mbps	1 Mbps
non-BLE 2Mbps	2 Mbps

The EUT was rotated through three orthogonal axis (X, Y and Z axis) in radiated measurement.
The EUT with temporary antenna port was used in conducted measurement.

The test were carried out using the following test program supplied by applicant;
- Software Name: radio_test_SDK11v0r0_hosi_custom_for_HRM1062
- Software Version: Version 1.0
- Storage Location: Controller PC

7 Test Requirements

7.0 Summary of the Test Results

Test Item	FCC Specification	Reference of the Test Report	Results	Remarks
Antenna Requirement	Section 15.203	Section 1.12	Passed	-
Channel Separation	Section 15.247(a)(1)	-		-
Minimum Hopping Channel	Section 15.247(a)(1)(iii)	-	-	-
Occupied Bandwidth	Section 15.247(a)(2)	Section 7.3	Passed	-
Dwell Time	Section 15.247(a)(1)(iii)	-	-	-
Peak Output Power (Conduction)	Section 15.247(b)(3)	Section 7.5	Passed	-
Peak Power Density (Conduction)	Section 15.247(e)	Section 7.6	Passed	-
Spurious Emissions (Conduction)	Section 15.247(d)	Section 7.7	Passed	-
AC Powerline Conducted Emission	Section 15.207	Section 7.8	Passed	-
Radiated Emission	Section 15.247(d)	Section 7.9	Passed	-
SAR Test Exclusion	Section 15.247(i)	Section 7.10	Passed	-

7.1 Channel Separation

For the requirements, ☐ - Applicable [☐ - Tested. ☐ - Not tested by applicant request.]
☑ - Not Applicable

Remarks : _____

7.2 Minimum Hopping Channel

For the requirements, ☐ - Applicable [☐ - Tested. ☐ - Not tested by applicant request.]
☑ - Not Applicable

Remarks : _____

7.3 Occupied Bandwidth

For the requirements, ☑ - Applicable [☑ - Tested. ☐ - Not tested by applicant request.]
☐ - Not Applicable

7.3.1 Test Results

For the standard, ☑ - **Passed** ☐ - **Failed** ☐ - **Not judged**

The 99% Bandwidth of Bluetooth Low Energy is	1.0809	MHz	at	2480.0	MHz
The 99% Bandwidth of non-BLE 1Mbps is	0.989	MHz	at	2480.0	MHz
The 99% Bandwidth of non-BLE 2Mbps is	1.8759	MHz	at	2480.0	MHz
The -6dBc Bandwidth of Bluetooth Low Energy is	723.2	kHz	at	2440.0	MHz
The -6dBc Bandwidth of non-BLE 1Mbps is	507.7	kHz	at	2402.0	MHz
The -6dBc Bandwidth of non-BLE 2Mbps is	892.5	kHz	at	2440.0	MHz

Uncertainty of Measurement Results ± 0.9 %(2σ)

Remarks : _____

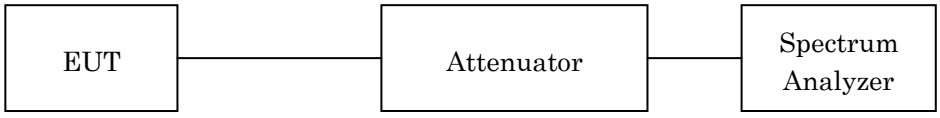
7.3.2 Test Instruments

Shielded Room S4				
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Cal. Due**
Spectrum Analyzer	E4446A	US44300388 (A-39)	Agilent	2016/08/11
RF Cable	SUCOFLEX102	14253/2 (C-52)	HUBER+SUHNER	2016/08/16
Attenuator	54A-10	W5675 (D-28)	Weinschel	2016/08/16

NOTE : The calibration interval of the above test instruments is 12 months.

7.3.3 Test Method and Test Setup (Diagrammatic illustration)

The test system is shown as follows:



The setting of the spectrum analyzer are shown as follows:

	BLE, non-BLE 1Mbps	non-BLE 2Mbps
Res. Bandwidth	100 kHz	100 kHz
Video Bandwidth	300 kHz	300 kHz
Span	3 MHz	6 MHz
Sweep Time	AUTO	AUTO
Trace	Maxhold	Maxhold

7.3.4 Test Data

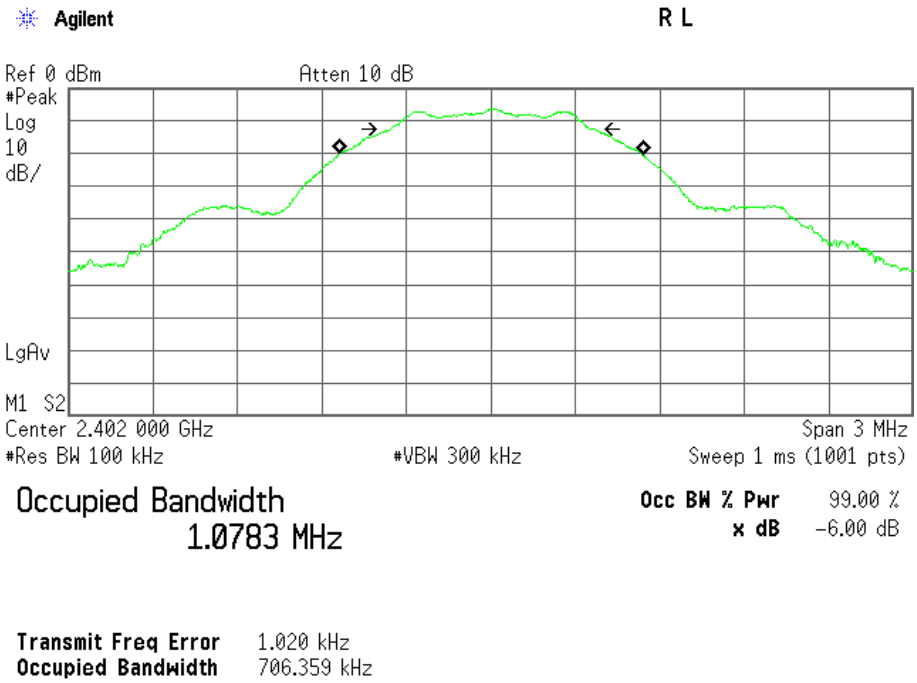
Test Date :May 30, 2016
Temp.:22°C, Humi:57%

The resolution bandwidth was set to 100 kHz, -6dBc display line was placed on the screen (or 99% bandwidth), the occupied bandwidth is the delta frequency between the two points where the display line intersects the signal trace.

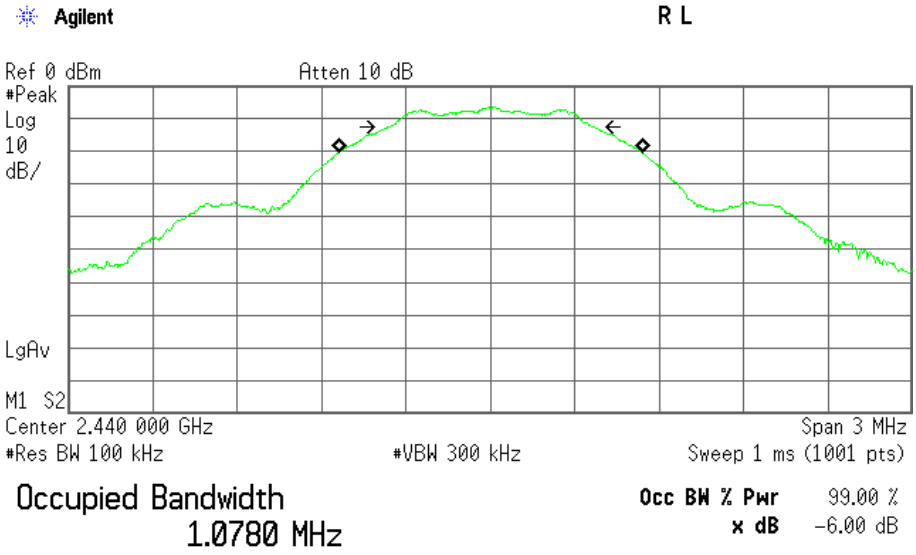
A) Bluetooth Low Energy

Channel	Frequency (MHz)	99% Bandwidth (MHz)	-6dBc Bandwidth (kHz)	Minimum -6dBc Bandwidth Limit (kHz)
00	2402.0	1.0783	706.4	500
19	2440.0	1.0780	723.2	500
39	2480.0	1.0809	700.7	500

Low Channel

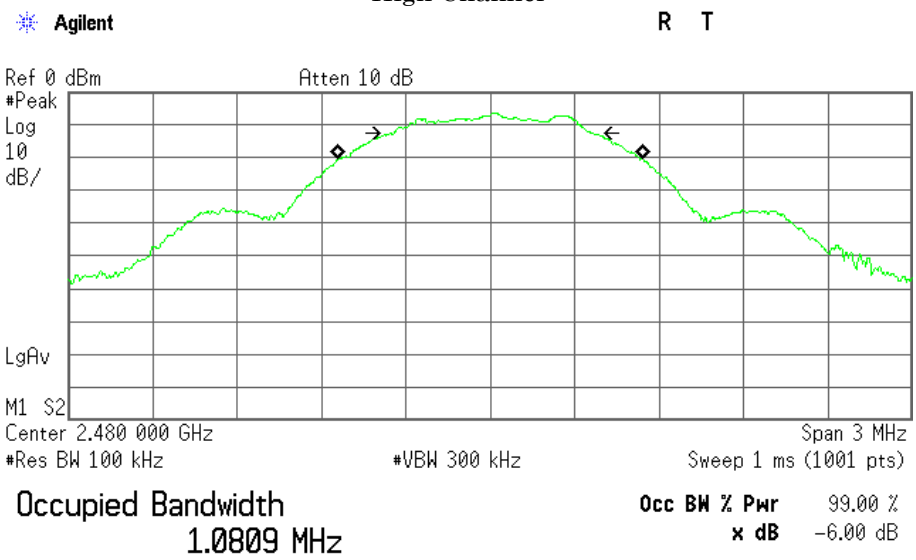


Middle Channel



Transmit Freq Error	1.274 kHz
Occupied Bandwidth	723.200 kHz

High Channel

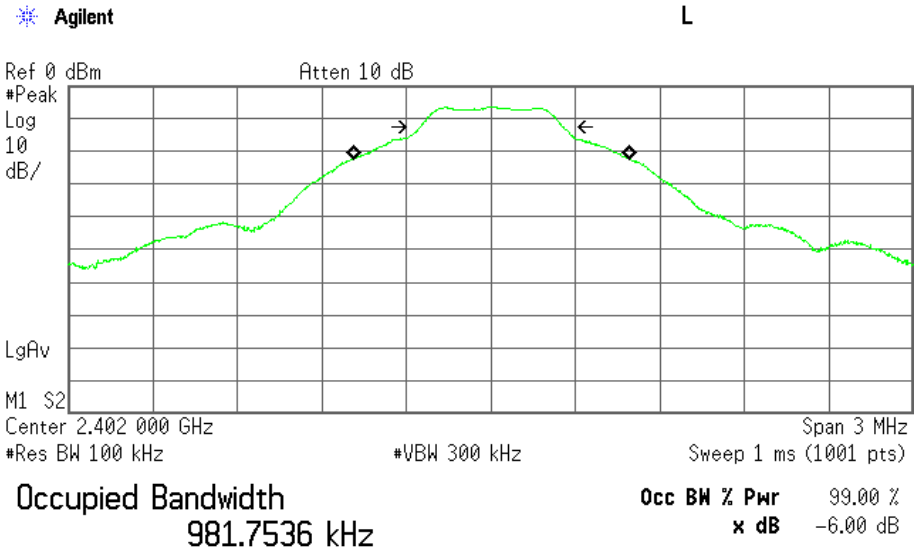


Transmit Freq Error	1.385 kHz
Occupied Bandwidth	700.669 kHz

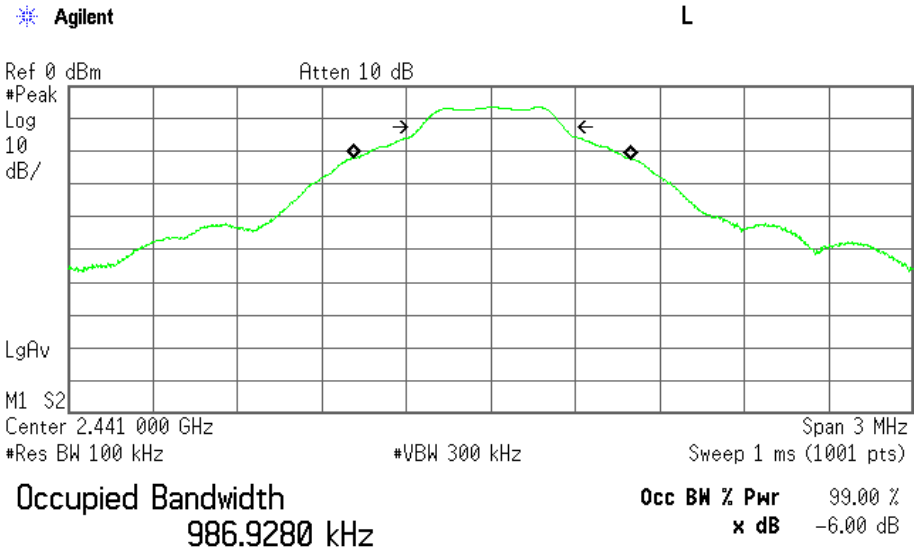
B) non-BLE 1Mbps

Channel	Frequency (MHz)	99% Bandwidth (MHz)	-6dBc Bandwidth (kHz)	Minimum -6dBc Bandwidth Limit (kHz)
00	2402.0	0.982	507.7	500
39	2441.0	0.987	504.5	500
78	2480.0	0.989	504.6	500

Low Channel

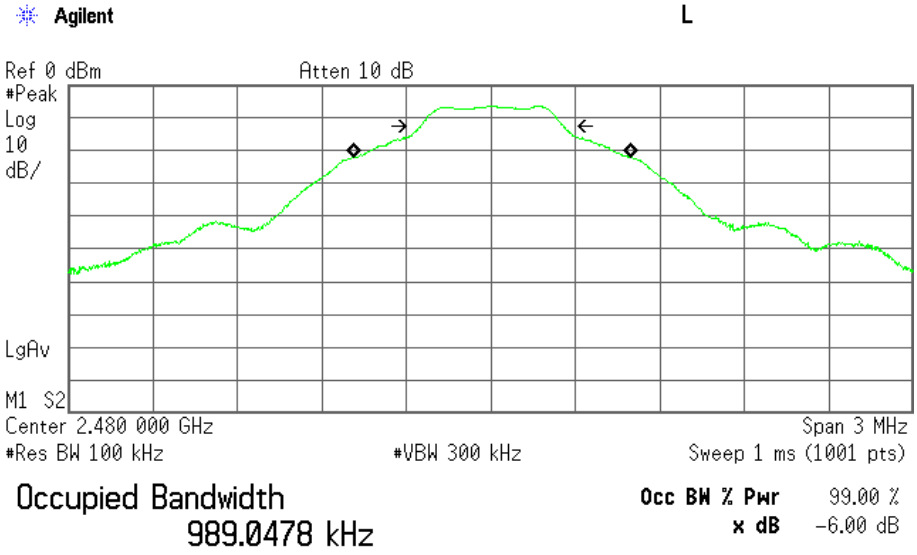


Middle Channel



Transmit Freq Error 4.040 kHz
Occupied Bandwidth 504.513 kHz

High Channel

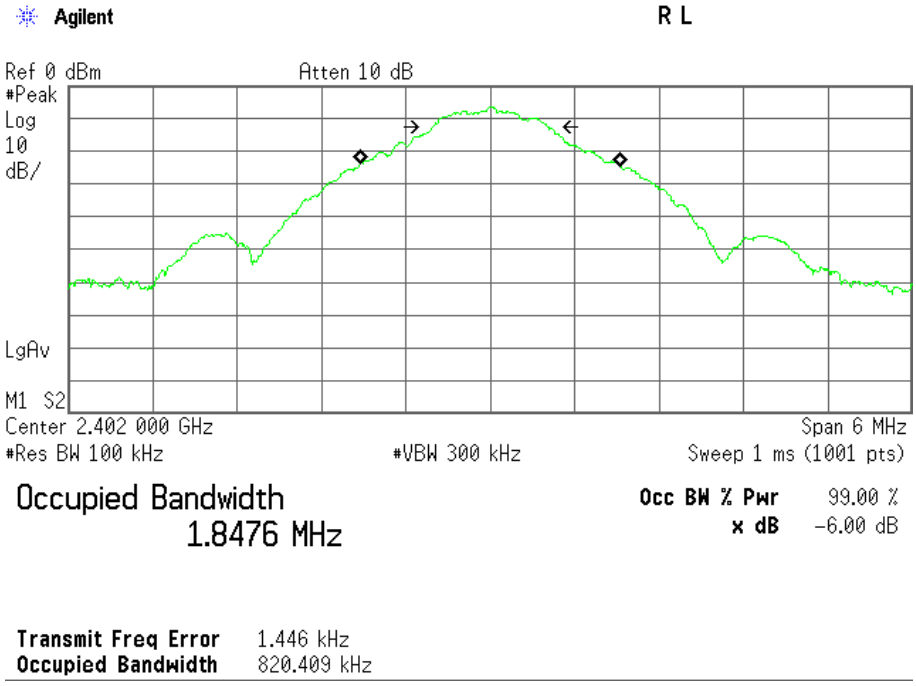


Transmit Freq Error 4.138 kHz
Occupied Bandwidth 504.633 kHz

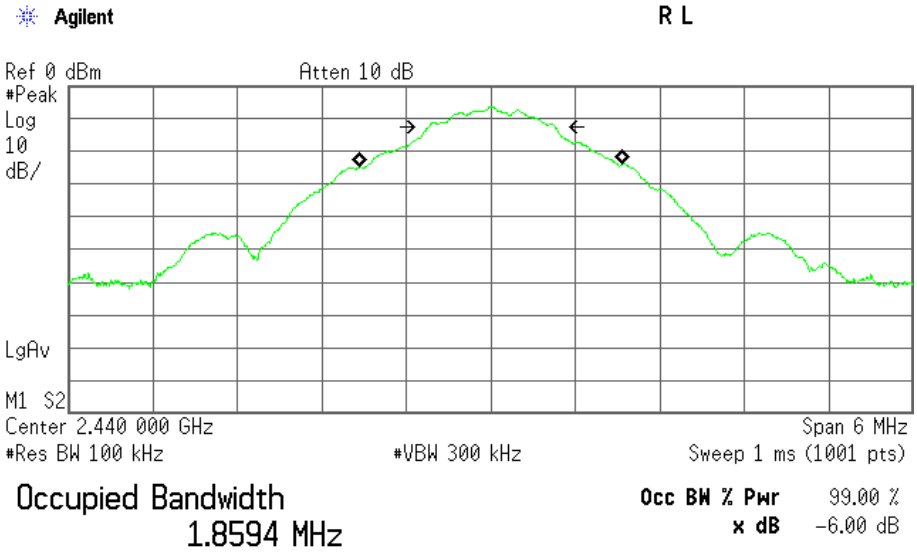
C) non-BLE 2Mbps

Channel	Frequency (MHz)	99% Bandwidth (MHz)	-6dBc Bandwidth (kHz)	Minimum -6dBc Bandwidth Limit (kHz)
00	2402.0	1.8476	820.4	500
19	2440.0	1.8594	892.5	500
39	2480.0	1.8759	810.2	500

Low Channel

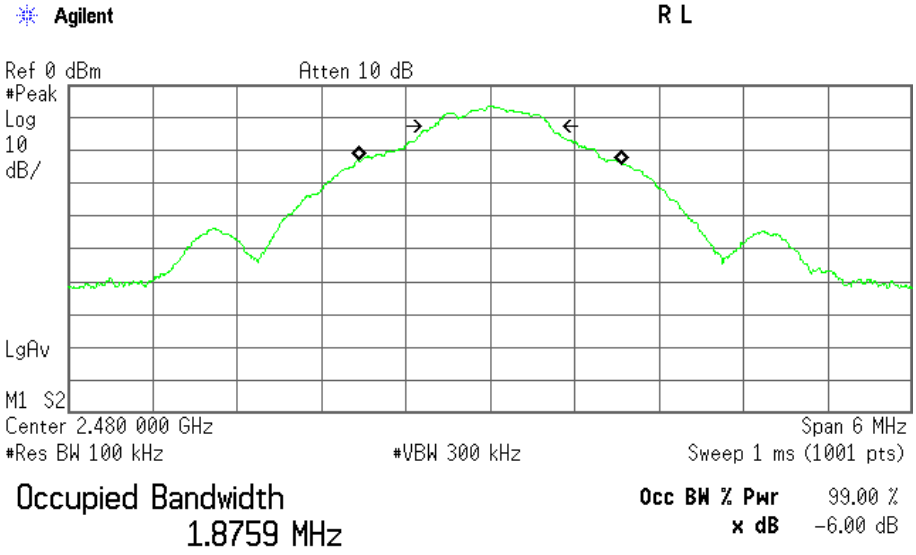


Middle Channel



Transmit Freq Error	-1.830 kHz
Occupied Bandwidth	892.489 kHz

High Channel



Transmit Freq Error	-431.725 Hz
Occupied Bandwidth	810.235 kHz

7.4 Dwell Time

For the requirements, ☐ - Applicable [☐ - Tested. ☐ - Not tested by applicant request.]
☑ - Not Applicable

Remarks : _____

7.5 Peak Output Power(Conduction)

For the requirements, ☑ - Applicable [☑ - Tested. ☐ - Not tested by applicant request.]
☐ - Not Applicable

7.5.1 Test Results

For the standard, ☑ - **Passed** ☐ - **Failed** ☐ - **Not judged**

Peak Output Power of BLE is	3.67	dBm	at	2480.0	MHz
Peak Output Power of non-BLE 1Mbps is	3.64	dBm	at	2480.0	MHz
Peak Output Power of non-BLE 2Mbps is	3.66	dBm	at	2480.0	MHz

Uncertainty of Measurement Results ± 0.9 dB(2σ)

Remarks : _____

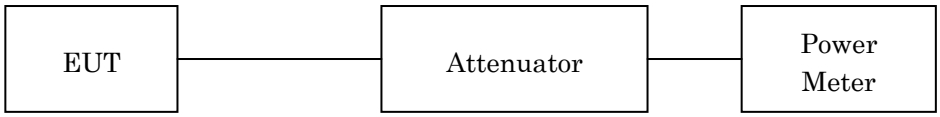
7.5.2 Test Instruments

Shielded Room S4				
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Cal. Due**
Power Meter	ML2495A	1423001 (B-16)	Anritsu	2016/07/16
Power Sensor	MA2411B	1339136 (B-18)	Anritsu	2016/07/16
RF Cable	SUCOFLEX102	14253/2 (C-52)	HUBER+SUHNER	2016/08/16
Attenuator	54A-10	W5675 (D-28)	Weinschel	2016/08/16

NOTE : The calibration interval of the above test instruments is 12 months.

7.5.3 Test Method and Test Setup (Diagrammatic illustration)

The Conducted RF Power Output was measured with a power meter, one attenuator and a short, low loss cable.



7.5.4 Test Data

1) Bluetooth Low Energy

Test Date: May 30, 2016
Temp.: 22 °C, Humi: 57 %

Transmitting Frequency		Correction Factor	Meter Reading	Conducted Peak Output Power		Limits	Margin
CH	[MHz]	[dB]	[dBm]	[dBm]	[mW]	[dBm]	[dB]
00	2402	10.07	-6.47	3.60	2.29	30.00	+26.40
19	2440	10.07	-6.43	3.64	2.31	30.00	+26.36
39	2480	10.07	-6.40	3.67	2.33	30.00	+26.33

Calculated result at 2480.000 MHz, as the worst point shown on underline:

	Correction Factor	=	10.07 dB
+)	Meter Reading	=	-6.40 dBm
	Result	=	3.67 dBm = 2.33 mW

Minimum Margin: 30.00 - 3.67 = 26.33 (dB)

NOTES
1. The correction factor shows the attenuation pad loss including the short, low loss cable or adapter.
2. Setting of measuring instrument(s) :

Detector Function	Video B.W.
Peak	Off

** Although the DC power suplly voltage was varied between 85% and 115% of the nominal rated voltage, the Peak Output Power did not change.

2) non-BLE 1Mbps

Test Date: May 30, 2016
Temp.: 22 °C, Humi: 57 %

Transmitting Frequency		Correction Factor	Meter Reading	Conducted Peak Output Power		Limits	Margin
CH	[MHz]	[dB]	[dBm]	[dBm]	[mW]	[dBm]	[dB]
00	2402	10.07	-6.48	3.59	2.29	30.00	+26.41
39	2441	10.07	-6.44	3.63	2.31	30.00	+26.37
78	2480	10.07	-6.43	3.64	2.31	30.00	+26.36

Calculated result at 2480.000 MHz, as the worst point shown on underline:

	Correction Factor	=	10.07 dB
+)	Meter Reading	=	-6.43 dBm
	Result	=	3.64 dBm = 2.31 mW

Minimum Margin: 30.00 - 3.64 = 26.36 (dB)

NOTES
1. The correction factor shows the attenuation pad loss including the short, low loss cable or adapter.
2. Setting of measuring instrument(s) :

Detector Function	Video B.W.
Peak	Off

** Although the DC power suplly voltage was varied between 85% and 115% of the nominal rated voltage, the Peak Output Power did not change.

3) non-BLE 2Mbps

Test Date: May 30, 2016
Temp.: 22 °C, Humi: 57 %

Transmitting Frequency		Correction Factor	Meter Reading	Conducted Peak Output Power		Limits	Margin
CH	[MHz]	[dB]	[dBm]	[dBm]	[mW]	[dBm]	[dB]
00	2402	10.07	-6.46	3.61	2.30	30.00	+26.39
19	2440	10.07	-6.44	3.63	2.31	30.00	+26.37
39	2480	10.07	-6.41	3.66	2.32	30.00	+26.34

Calculated result at 2480.000 MHz, as the worst point shown on underline:

	Correction Factor	=	10.07 dB
+)	Meter Reading	=	-6.41 dBm
	Result	=	3.66 dBm = 2.32 mW

Minimum Margin: 30.00 - 3.66 = 26.34 (dB)

NOTES
1. The correction factor shows the attenuation pad loss including the short, low loss cable or adapter.
2. Setting of measuring instrument(s) :

Detector Function	Video B.W.
Peak	Off

** Although the DC power suplly voltage was varied between 85% and 115% of the nominal rated voltage, the Peak Output Power did not change.

7.6 Peak Power Density(Conduction)

For the requirements, ☑ - Applicable [☑ - Tested. ☐ - Not tested by applicant request.]
☐ - Not Applicable

7.6.1 Test Results

For the standard, ☑ - **Passed** ☐ - **Failed** ☐ - **Not judged**

Peak Power Density of BLE is	2.03	dBm	at	2402.0	MHz
Peak Power Density of non-BLE 1Mbps is	2.28	dBm	at	2402.0	MHz
Peak Power Density of non-BLE 2Mbps is	1.13	dBm	at	2480.0	MHz

Uncertainty of Measurement Results ± 1.7 dB(2σ)

Remarks : _____

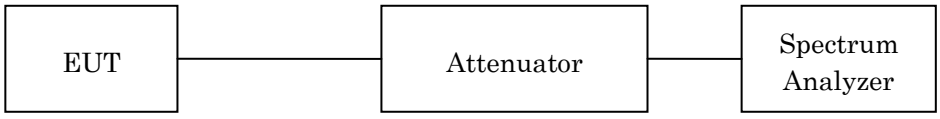
7.6.2 Test Instruments

Shielded Room S4				
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Cal. Due**
Spectrum Analyzer	E4446A	US44300388 (A-39)	Agilent	2016/08/11
RF Cable	SUCOFLEX102	14253/2 (C-52)	HUBER+SUHNER	2016/08/16
Attenuator	54A-10	W5675 (D-28)	Weinschel	2016/08/16

NOTE : The calibration interval of the above test instruments is 12 months.

7.6.3 Test Method and Test Setup (Diagrammatic illustration)

The test system is shown as follows:



7.6.4 Test Data

1) Bluetooth Low Energy

Test Date: May 30, 2016
Temp.: 22 °C, Humi: 57 %

Transmitting Frequency		Correction Factor	Meter Reading	Conducted Peak Power Density		Limits	Margin
CH	[MHz]	[dB]	[dBm]	[dBm]	[mW]	[dBm]	[dB]
00	2402	10.07	-8.04	2.03	1.59	8.00	+ 5.97
19	2440	10.07	-8.65	1.42	1.39	8.00	+ 6.58
39	2480	10.07	-8.66	1.41	1.38	8.00	+ 6.59

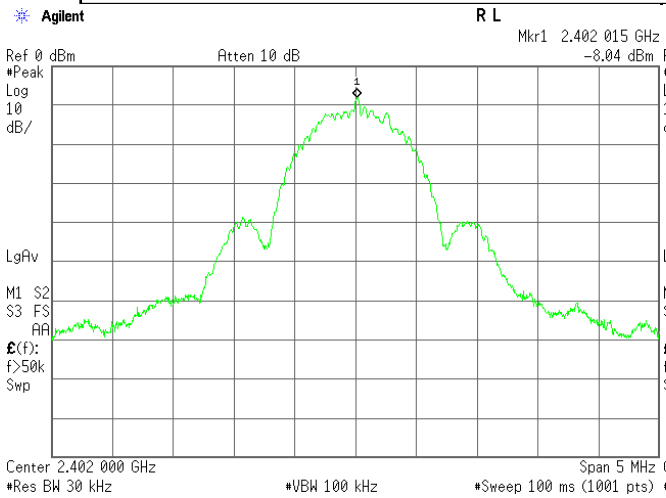
Calculated result at 2402.000 MHz, as the worst point shown on underline:

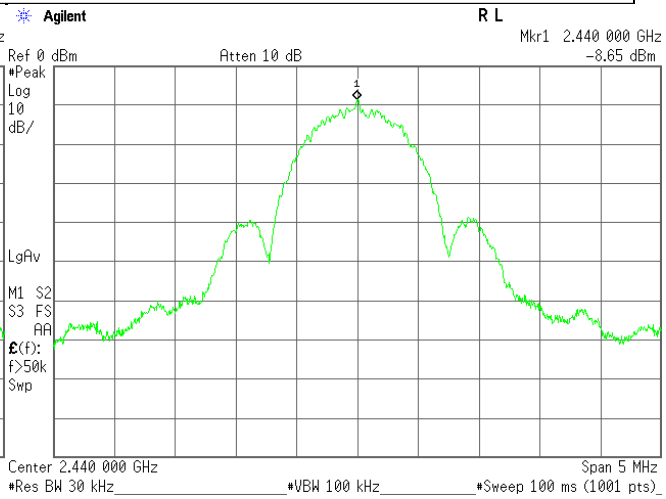
Correction Factor	=	10.07 dB	
+) Meter Reading	=	-8.04 dBm	
Result	=	2.03 dBm	= 1.59 mW

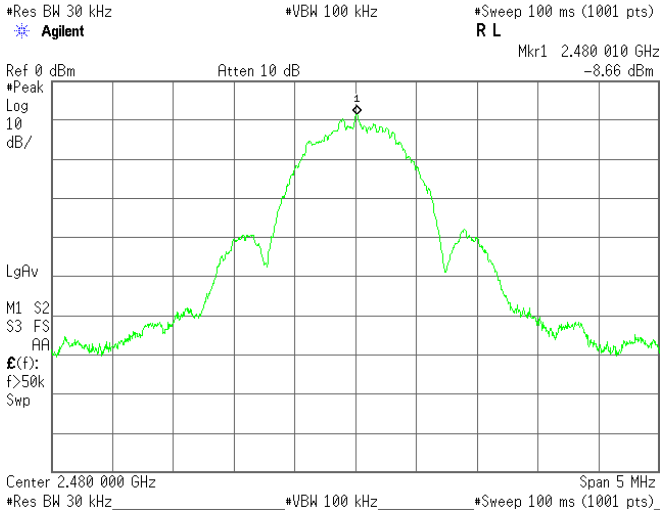
Minimum Margin: 8.00 - 2.03 = 5.97 (dB)

NOTES
1. The peak power density complied with the limit using 30 kHz resolution bandwidth of Spectrum Analyzer.
2. The correction factor shows the attenuation pad loss including the short, low loss cable or adapter.
3. Setting of measuring instrument(s) :

Detector Function	RES B.W.	Video B.W.
Peak	30kHz	100kHz







2) non-BLE 1Mbps

Test Date: May 30, 2016
Temp.: 22 °C, Humi: 57 %

Transmitting Frequency		Correction Factor	Meter Reading	Conducted Peak Power Density		Limits	Margin
CH	[MHz]	[dB]	[dBm]	[dBm]	[mW]	[dBm]	[dB]
00	2402	10.07	-7.79	2.28	1.69	8.00	+ 5.72
39	2441	10.07	-8.86	1.21	1.32	8.00	+ 6.79
78	2480	10.07	-8.18	1.89	1.54	8.00	+ 6.11

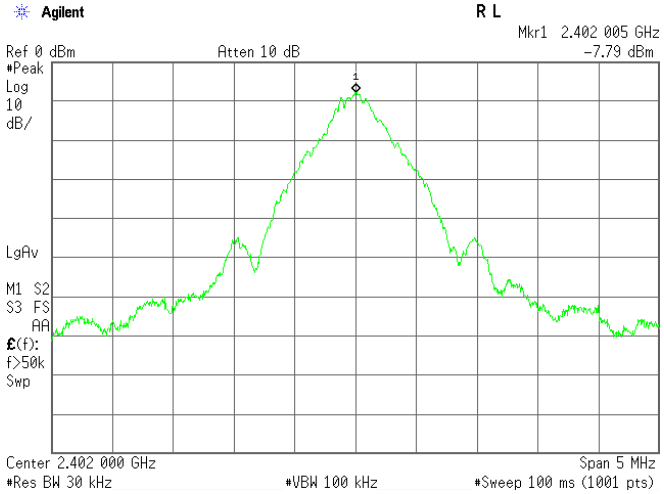
Calculated result at 2402.000 MHz, as the worst point shown on underline:

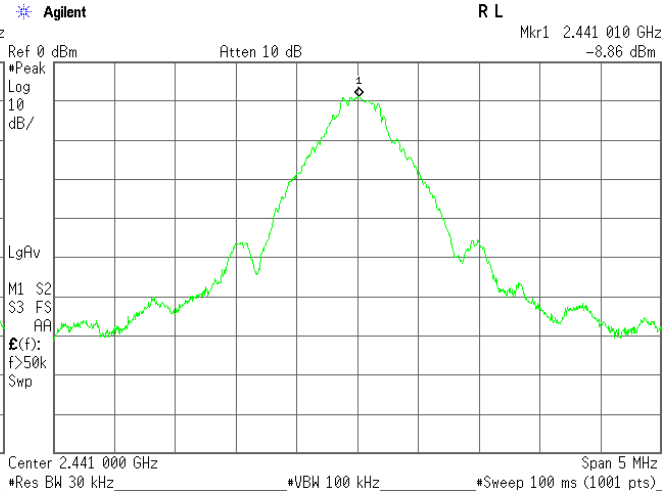
Correction Factor	=	10.07 dB
+) Meter Reading	=	-7.79 dBm
Result	=	2.28 dBm = 1.69 mW

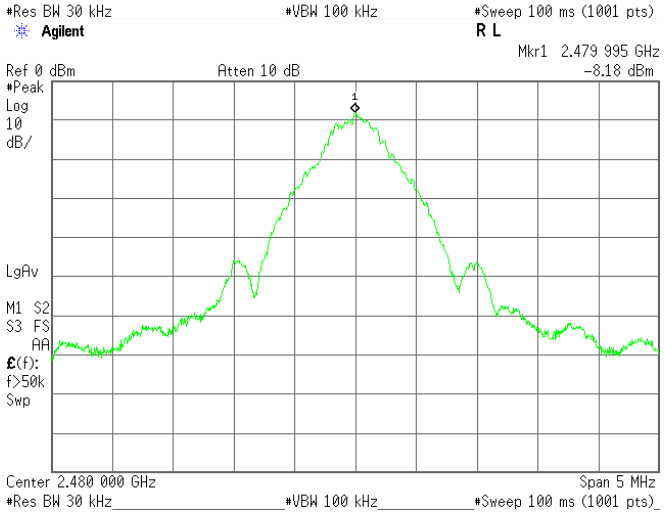
Minimum Margin: 8.00 - 2.28 = 5.72 (dB)

NOTES
1. The peak power density complied with the limit using 30 kHz resolution bandwidth of Spectrum Analyzer.
2. The correction factor shows the attenuation pad loss including the short, low loss cable or adapter.
3. Setting of measuring instrument(s) :

Detector Function	RES B.W.	Video B.W.
Peak	30kHz	100kHz







3) non-BLE 2Mbps

Test Date: May 30, 2016
Temp.: 22 °C, Humi: 57 %

Transmitting Frequency		Correction Factor	Meter Reading	Conducted Peak Power Density		Limits	Margin
CH	[MHz]	[dB]	[dBm]	[dBm]	[mW]	[dBm]	[dB]
00	2402	10.07	-9.82	0.25	1.06	8.00	+ 7.75
19	2440	10.07	-9.76	0.31	1.07	8.00	+ 7.69
39	2480	10.07	-8.94	1.13	1.30	8.00	+ 6.87

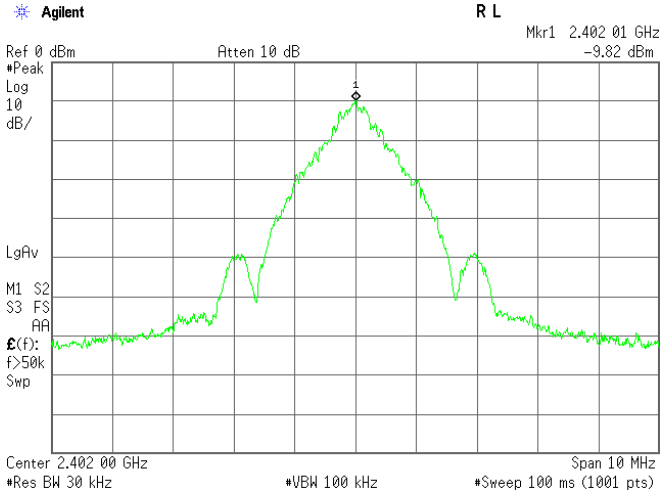
Calculated result at 2480.000 MHz, as the worst point shown on underline:

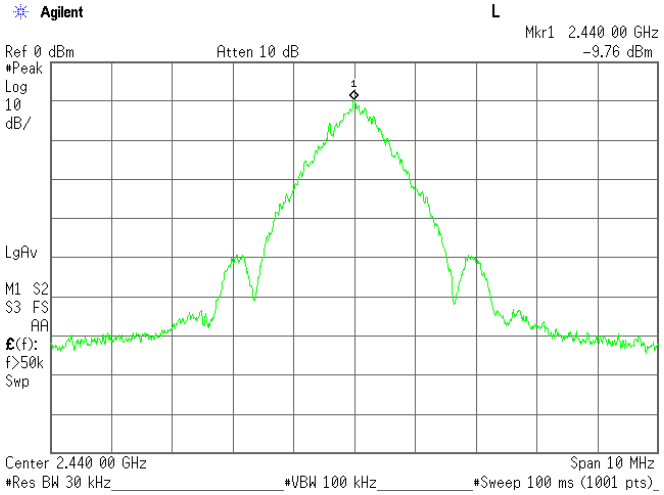
	Correction Factor	=	10.07 dB
+)	Meter Reading	=	-8.94 dBm
	Result	=	1.13 dBm = 1.30 mW

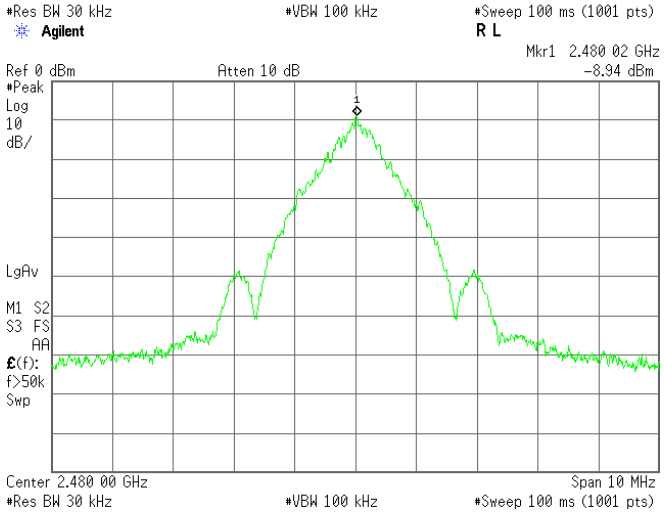
Minimum Margin: 8.00 - 1.13 = 6.87 (dB)

NOTES
1. The peak power density complied with the limit using 30 kHz resolution bandwidth of Spectrum Analyzer.
2. The correction factor shows the attenuation pad loss including the short, low loss cable or adapter.
3. Setting of measuring instrument(s) :

Detector Function	RES B.W.	Video B.W.
Peak	30kHz	100kHz







7.7 Spurious Emissions(Conduction)

For the requirements, ☑ - Applicable [☑ - Tested. ☐ - Not tested by applicant request.]
☐ - Not Applicable

7.7.1 Test Results

For the standard, ☑ - **Passed** ☐ - **Failed** ☐ - **Not judged**

Uncertainty of Measurement Results

9 kHz – 1 GHz	± 1.4	dB(2σ)
1 GHz – 18 GHz	± 1.7	dB(2σ)
18 GHz – 40 GHz	± 2.3	dB(2σ)

Remarks : _____

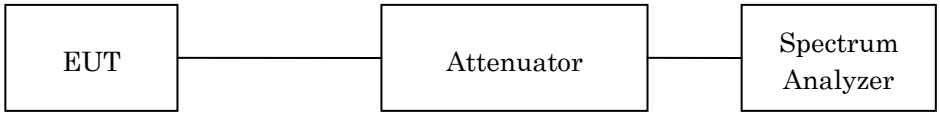
7.7.2 Test Instruments

Shielded Room S4				
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Cal. Due**
Spectrum Analyzer	E4446A	US44300388 (A-39)	Agilent	2016/08/11
RF Cable	SUCOFLEX102	14253/2 (C-52)	HUBER+SUHNER	2016/08/16
Attenuator	54A-10	W5675 (D-28)	Weinschel	2016/08/16

NOTE : The calibration interval of the above test instruments is 12 months.

7.7.3 Test Method and Test Setup (Diagrammatic illustration)

The test system is shown as follows:



The setting of the spectrum analyzer are shown as follows:

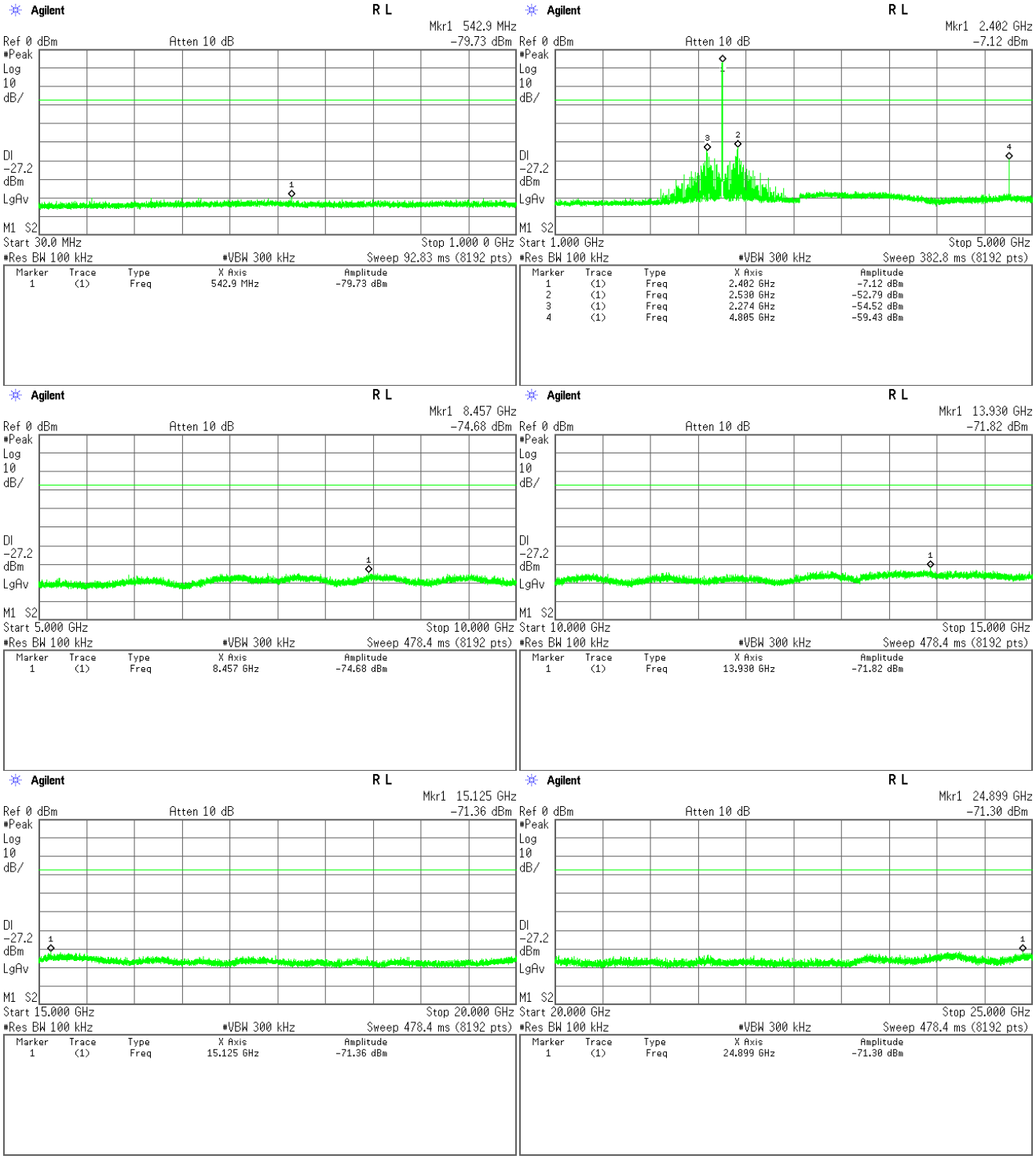
Frequency Range	30 MHz - 25 GHz	Band-Edge
Res. Bandwidth	100 kHz	100 kHz
Video Bandwidth	300 kHz	300 kHz
Sweep Time	AUTO	AUTO
Trace	Maxhold	Maxhold

7.7.4 Test Data

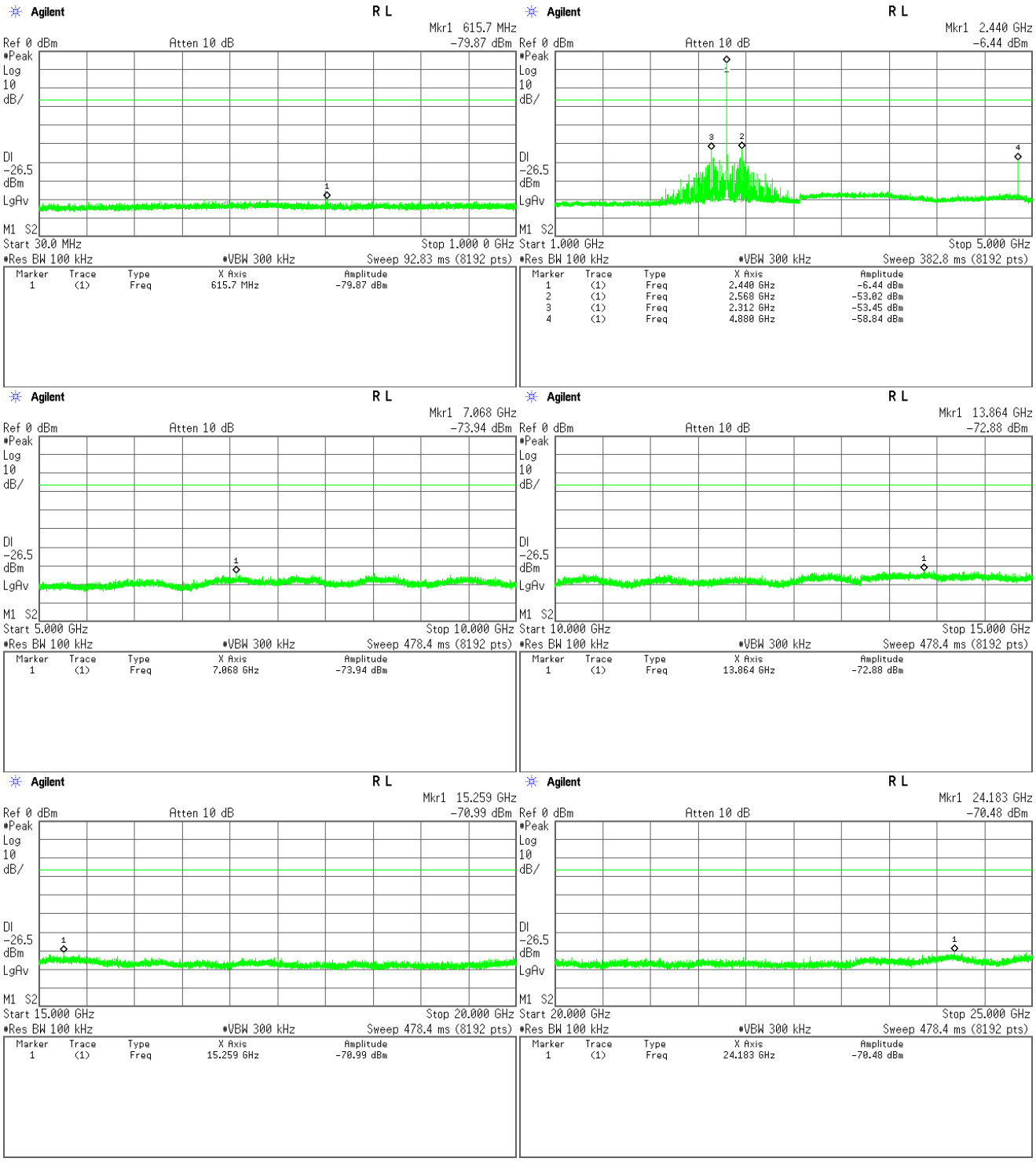
Test Date :May 30, 2016
Temp.:22°C, Humi:57%

1) Bluetooth Low Energy

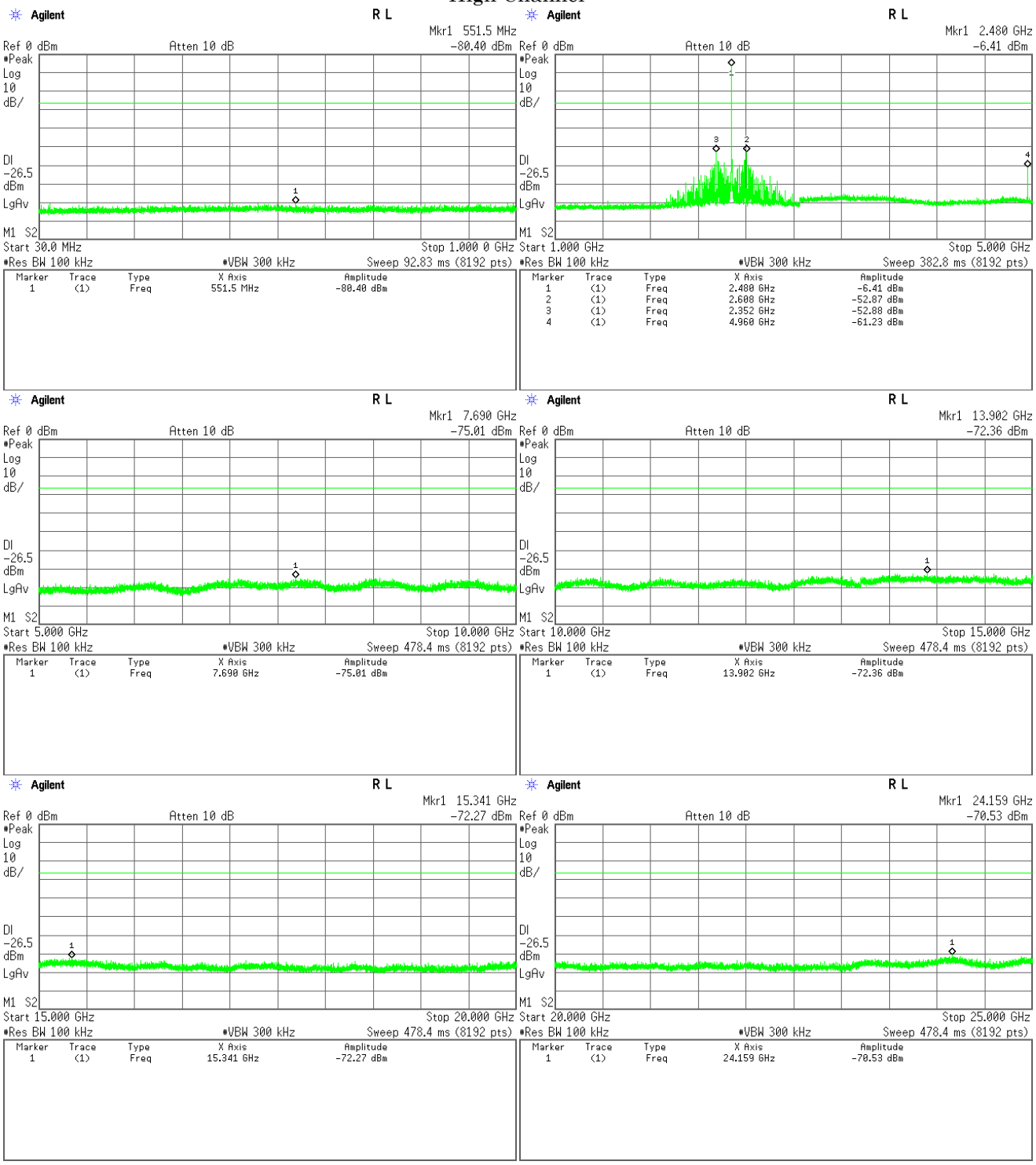
Low Channel



Middle Channel

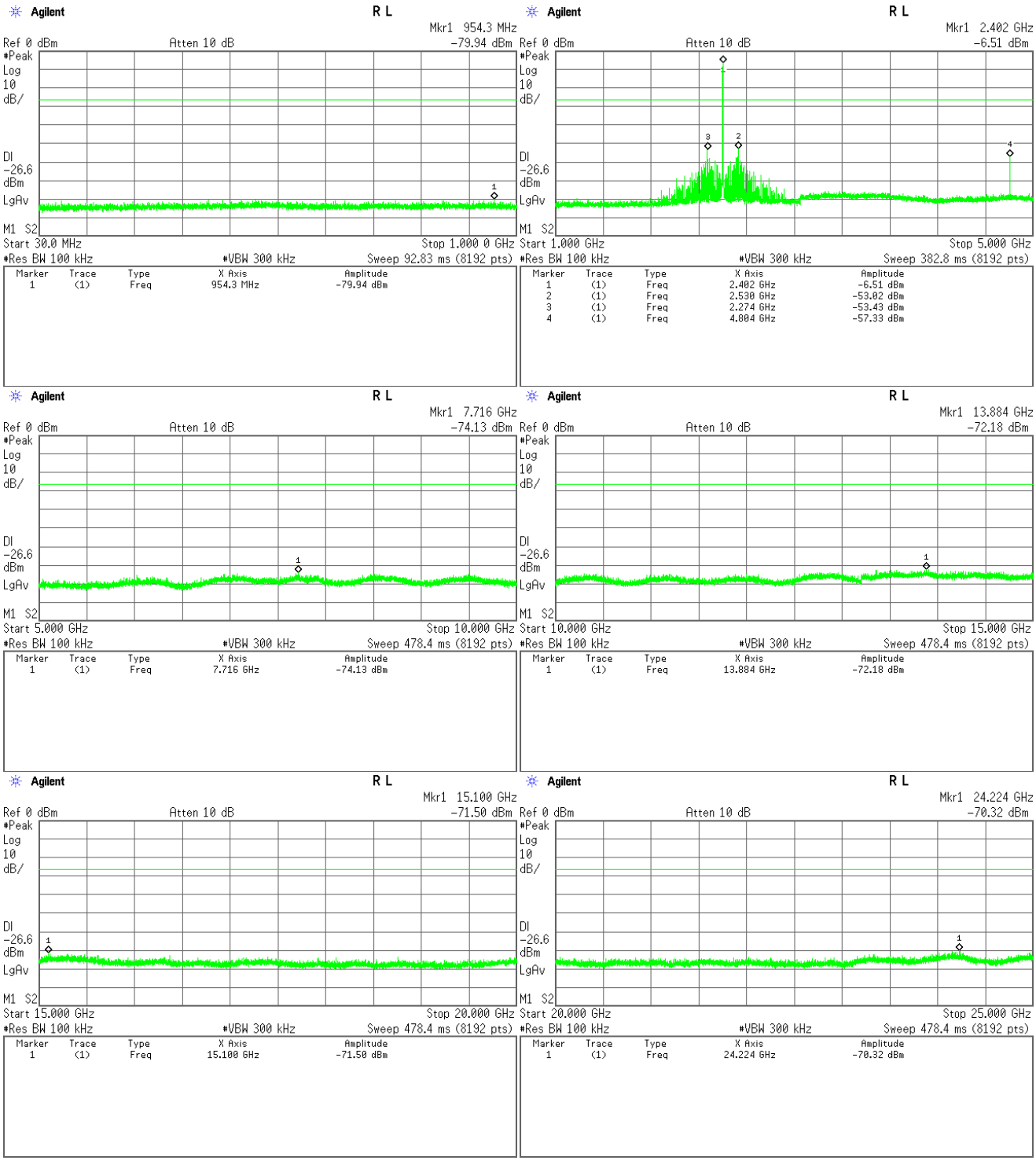


High Channel

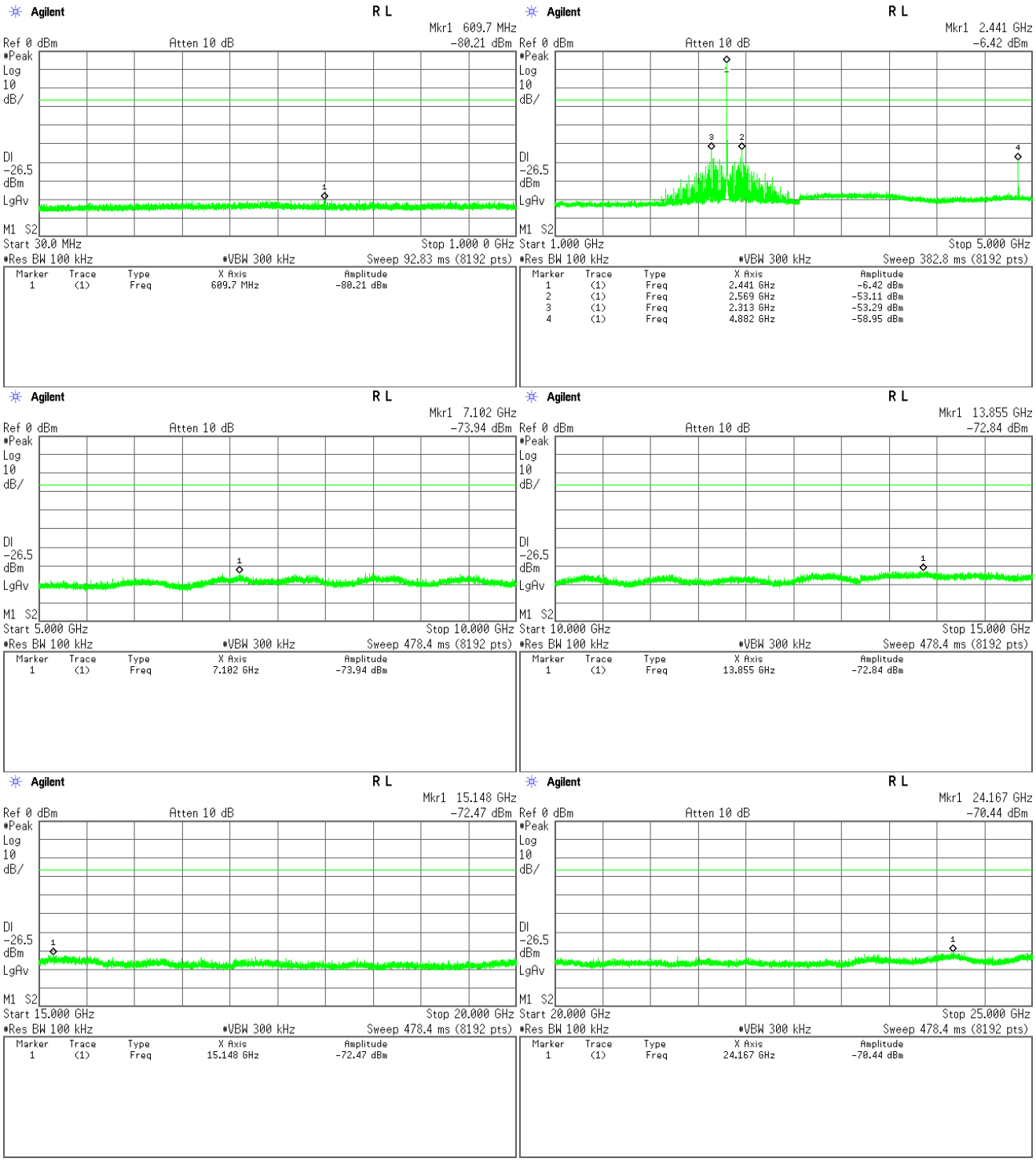


2) non-BLE 1Mbps

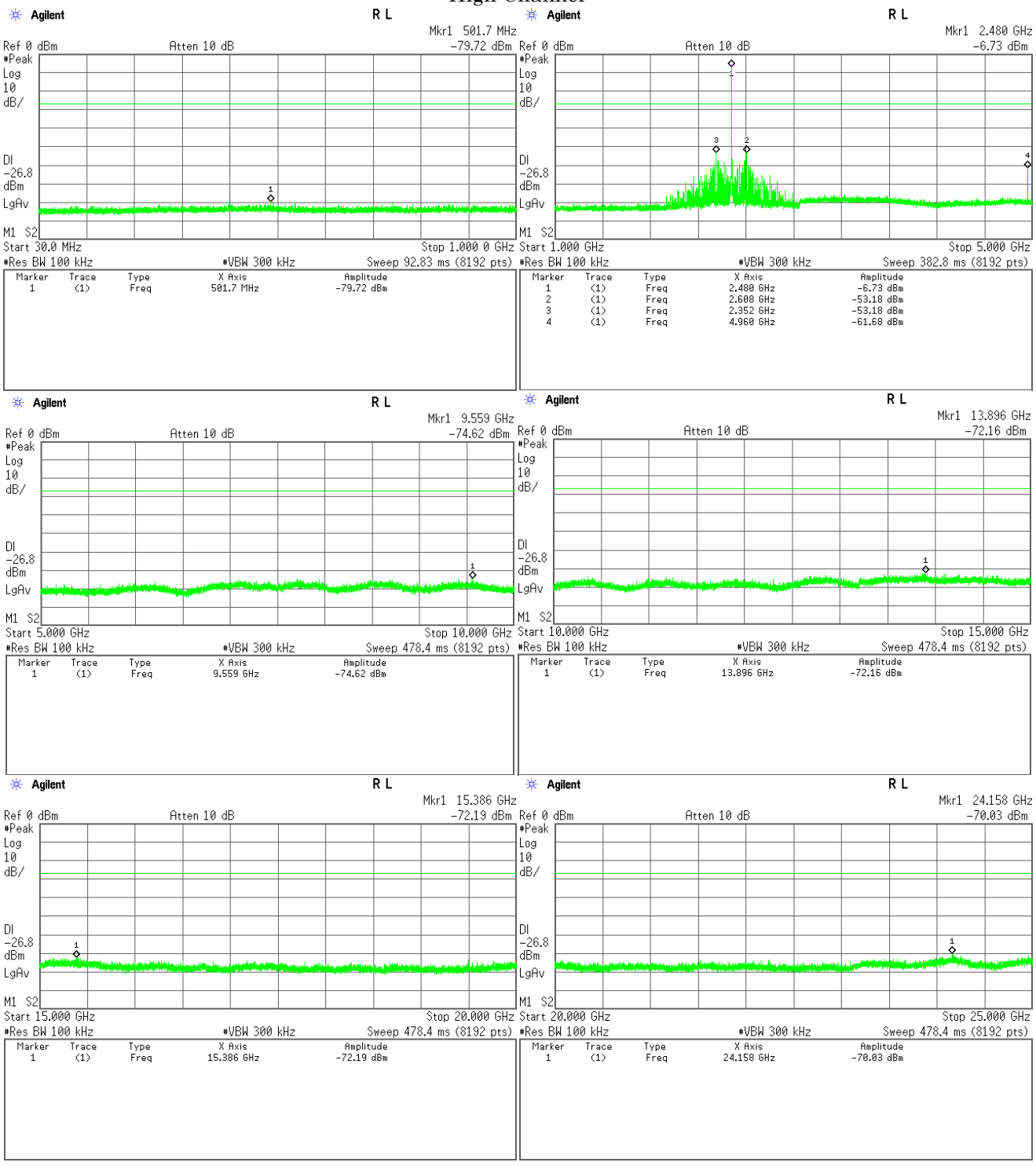
Low Channel



Middle channel

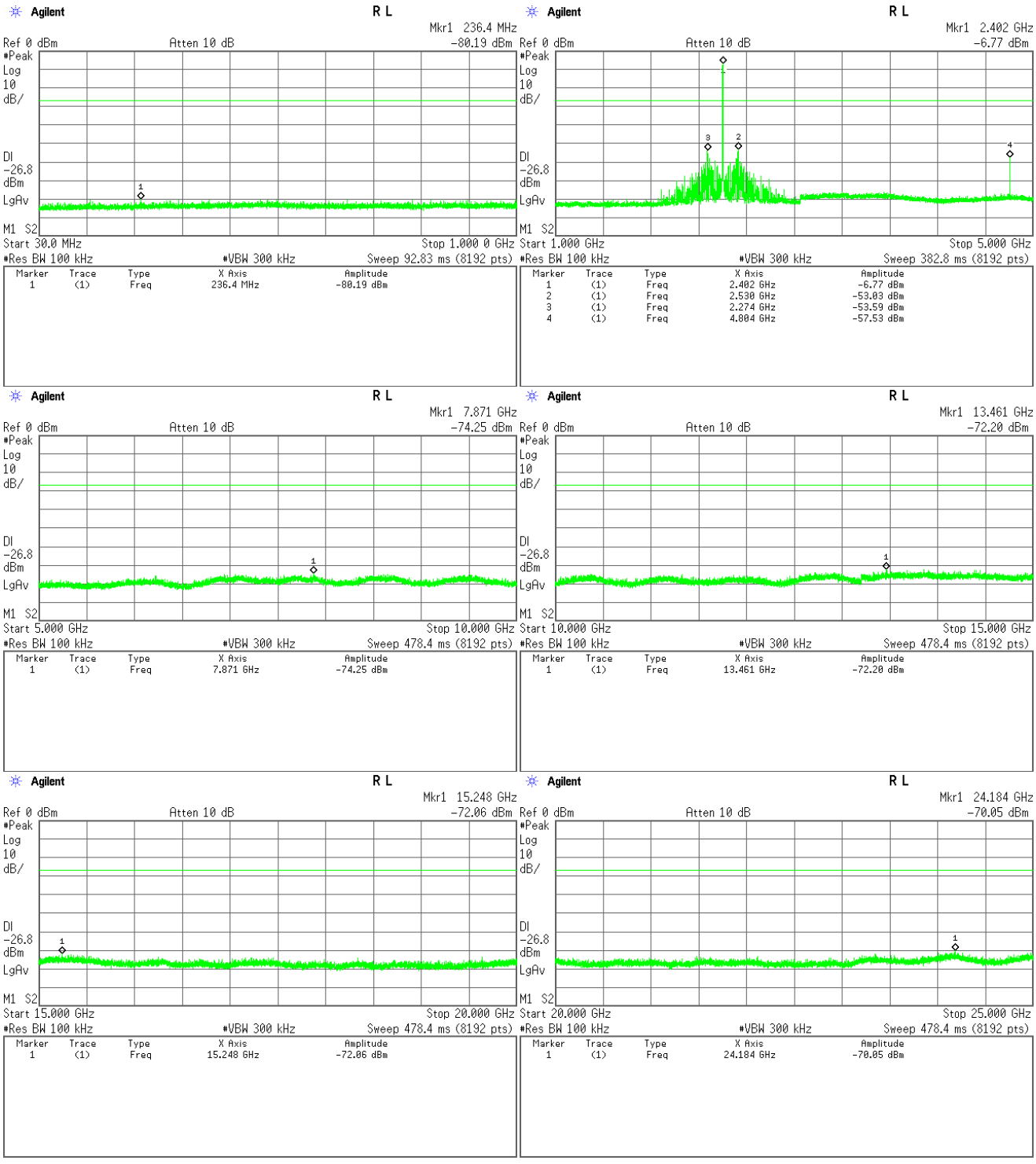


High Channel

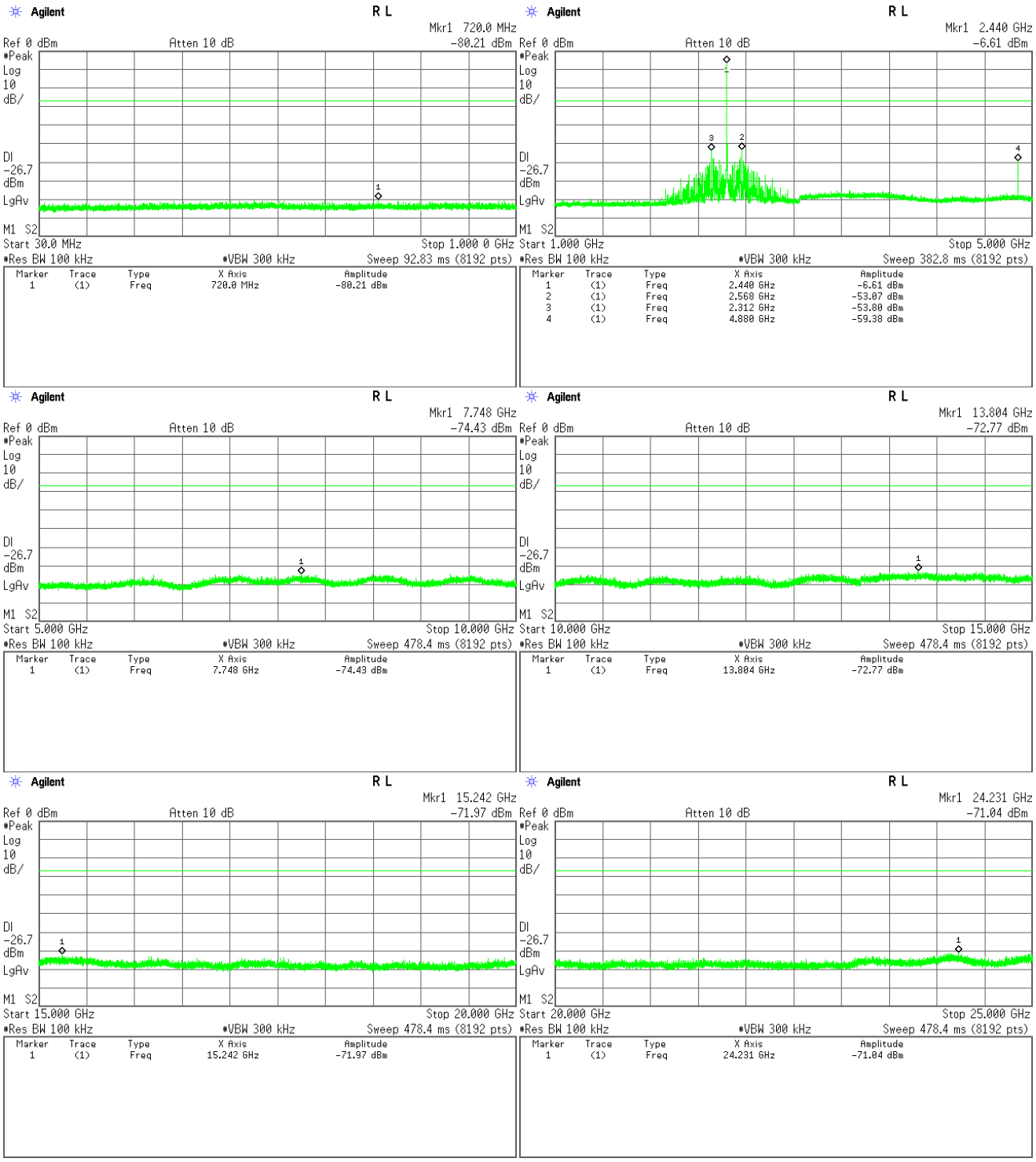


3) non-BLE 2Mbps

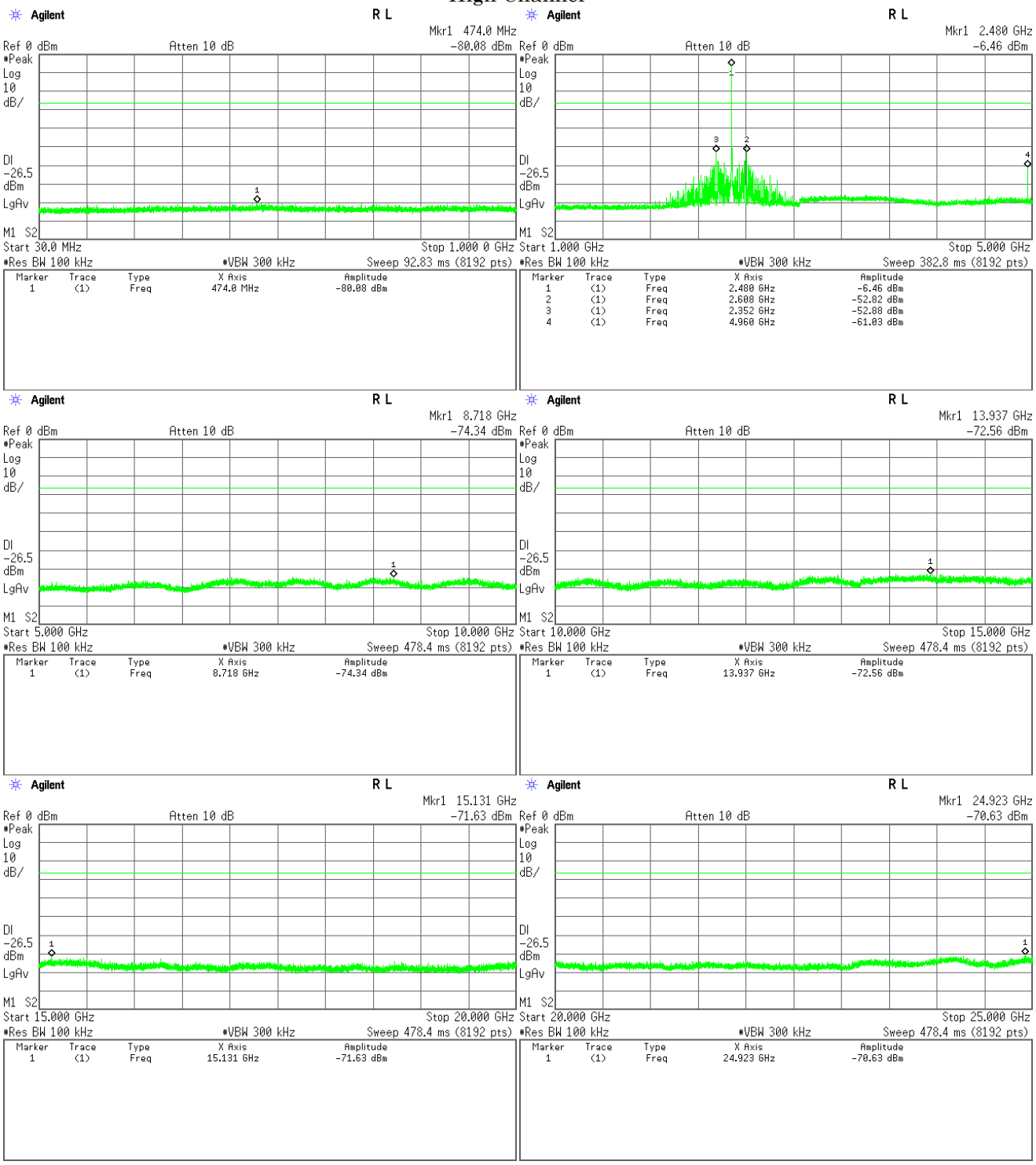
Low Channel



Middle Channel



High Channel

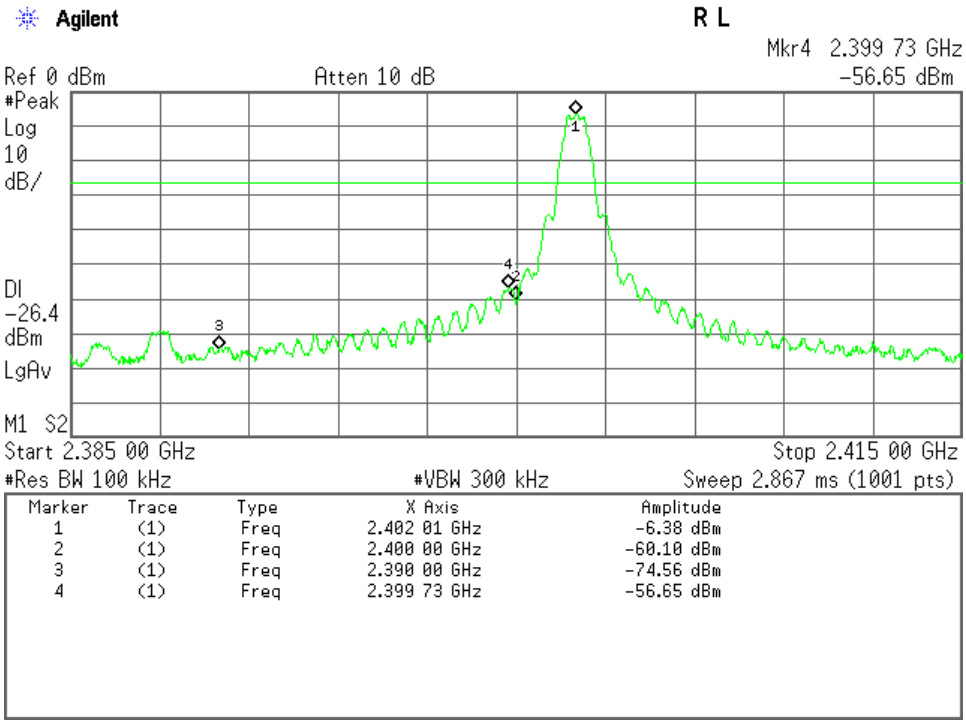


Band-Edge Emission

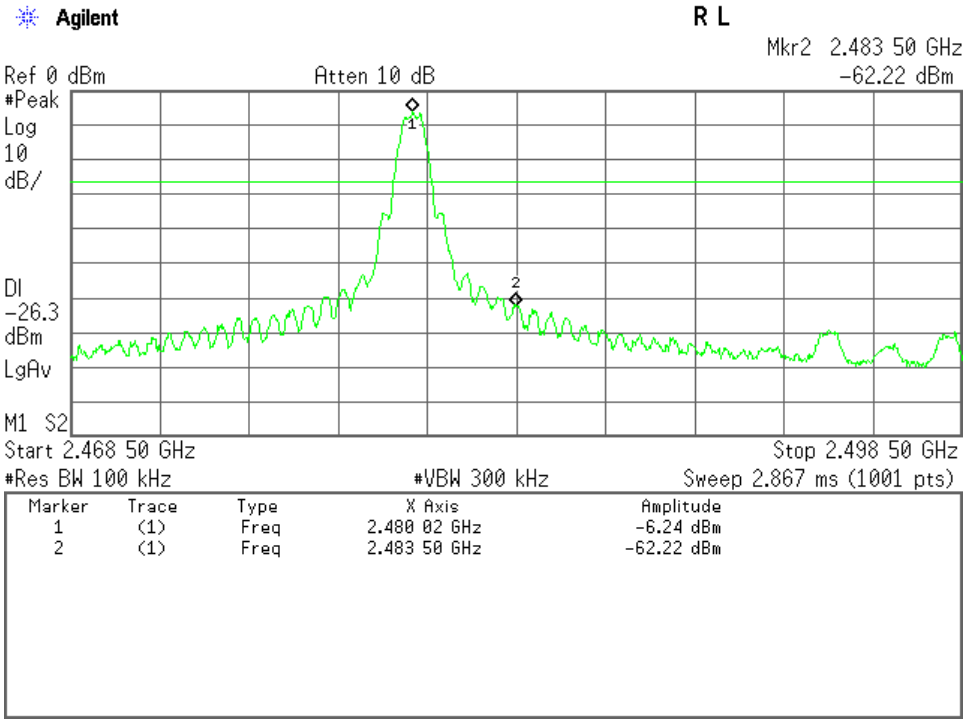
Test Date :May 30, 2016
Temp.:22°C, Humi:57%

1) Bluetooth Low Energy

Low Channel

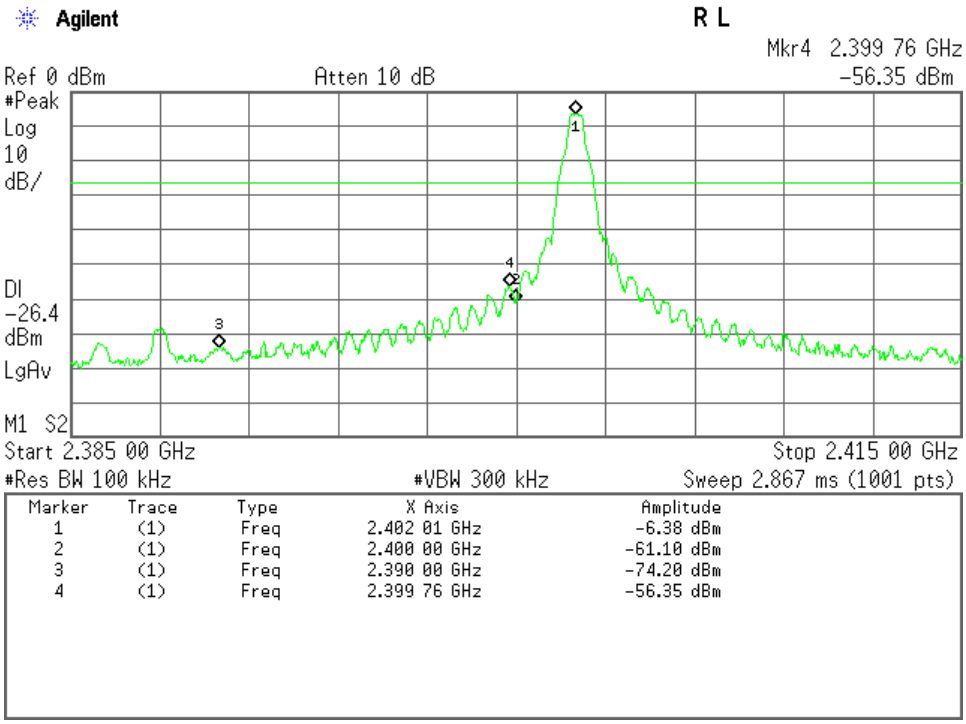


High Channel

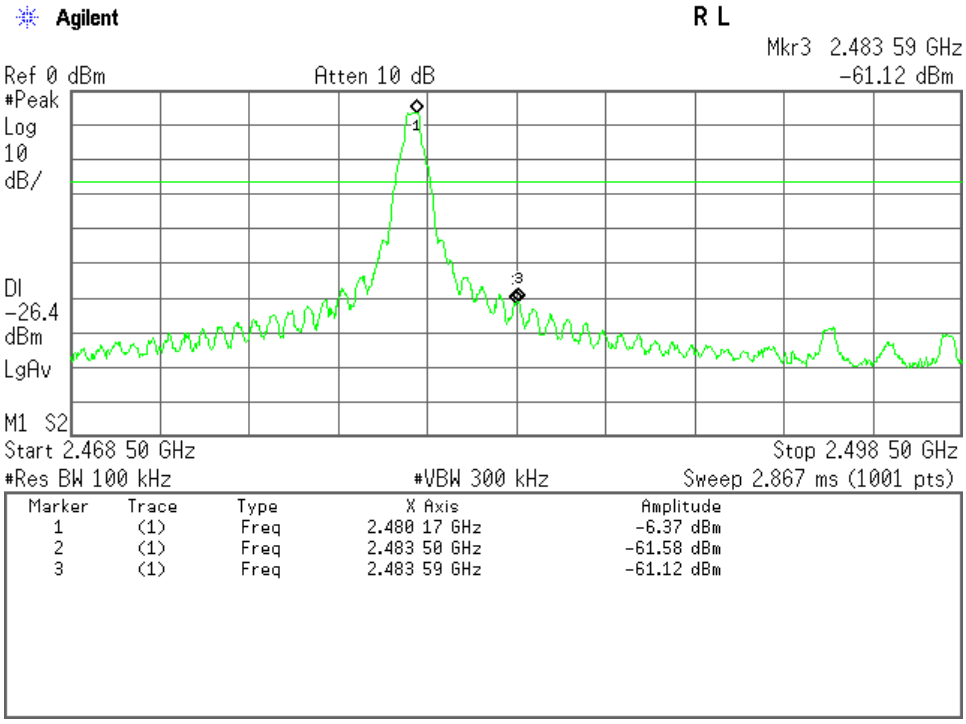


2) non-BLE 1Mbps

Low Channel

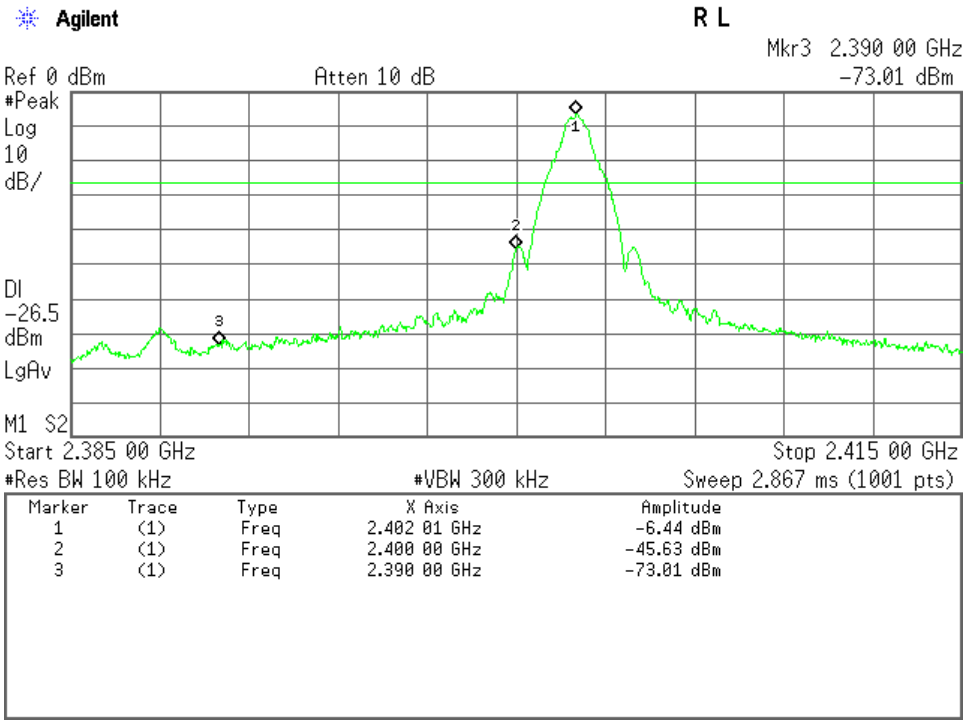


High Channel

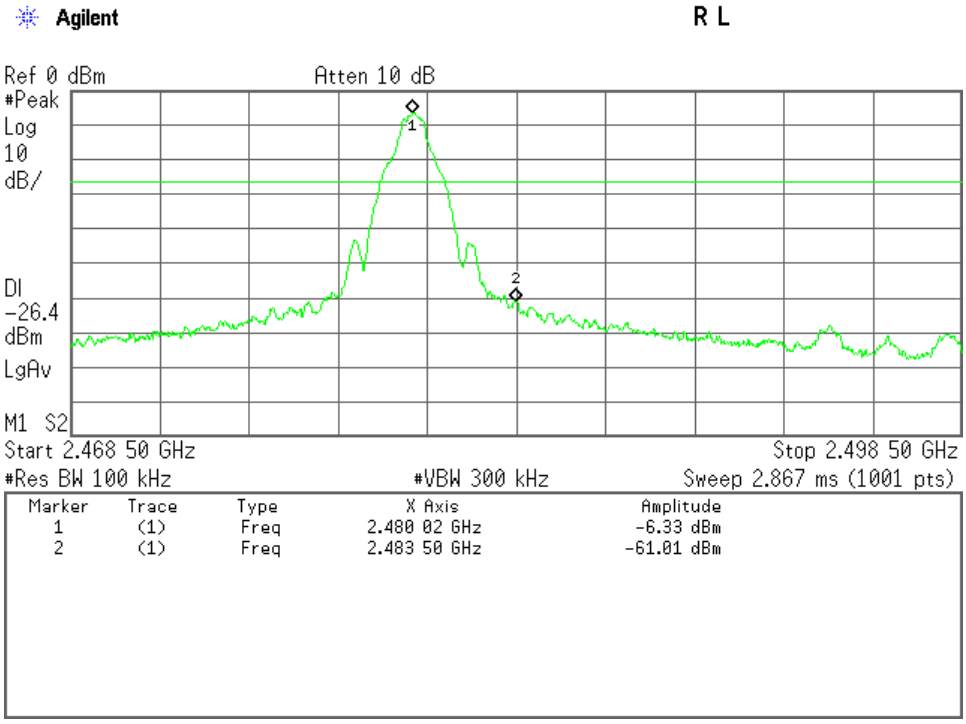


3) non-BLE 2Mbps

Low Channel



High Channel



7.8 AC Powerline Conducted Emission

For the requirements, ☑ - Applicable [☑ - Tested. ☐ - Not tested by applicant request.]
☐ - Not Applicable

7.8.1 Test Results

For the standard, ☑ - **Passed** ☐ - **Failed** ☐ - **Not judged**

Min. Limit Margin (Average) 8.3 dB at 0.438 MHz

Uncertainty of Measurement Results ± 2.6 dB(2σ)

Remarks :

7.8.2 Test Instruments

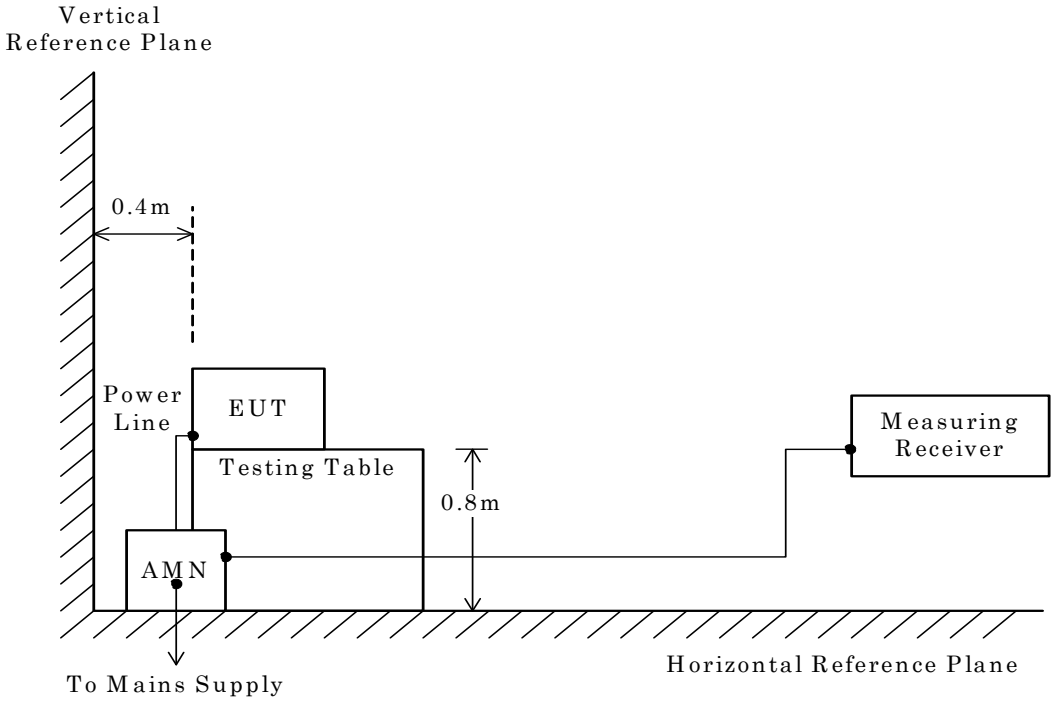
Measurement Room M2				
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Cal. Due**
Test Receiver	ESU 26	100170 (A-6)	Rohde & Schwarz	2017/04/27
AMN (main)	KNW-242	8-431-14 (D-7)	Kyoritsu	2016/10/28
AMN (sub)	ESH3-Z5	893045/007 (D-12)	Rohde & Schwarz	2016/08/27
RF Cable	RG223/U	--- (H-35)	HUBER+SUHNER	2017/05/30

NOTE : The calibration interval of the above test instruments is 12 months.

7.8.3 Test Method and Test Setup (Diagrammatic illustration)

The preliminary tests were performed using the scan mode of test receiver or spectrum analyzer to observe the emissions characteristics of the EUT.
The EUT configuration, cable configuration and mode of operation were determined for producing the maximum level of emissions.
This configurations was used for final tests.

– Side View –



NOTE
AMN : Artificial Mains Network

7.8.4 Test Data

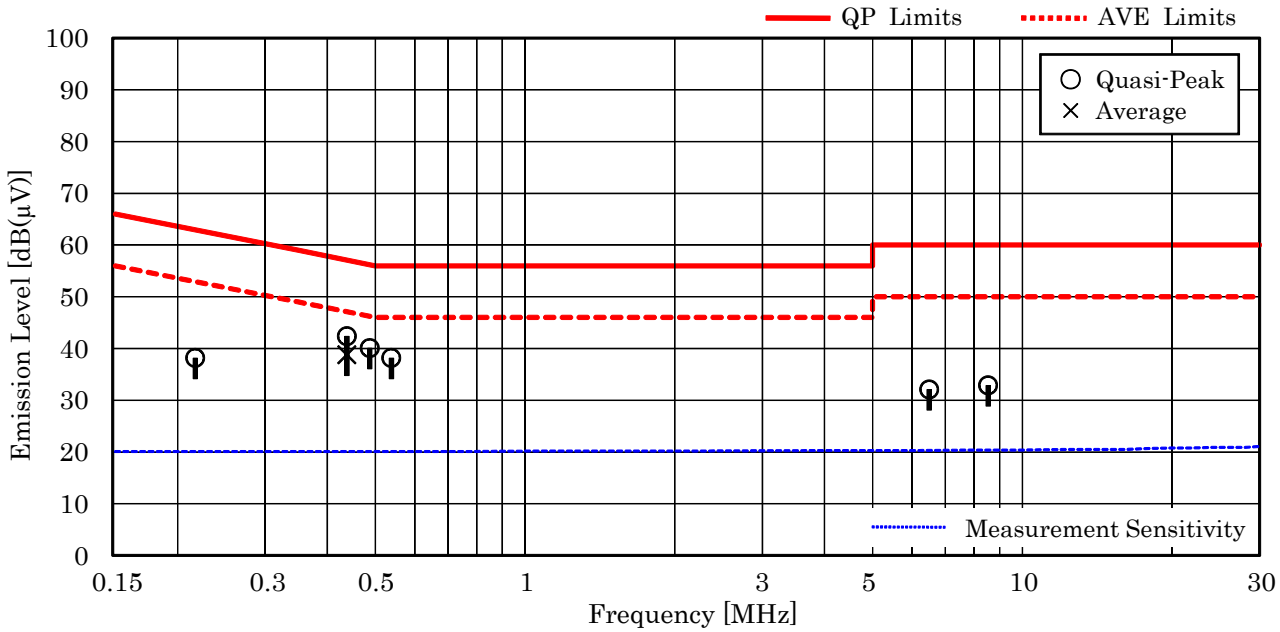
Mode of EUT : All modes have been investigated and the worst case mode for channel (39ch: 2480MHz / non-BLE 2Mbps, Bluetooth Low Energy and non-BLE 1Mbps) has been listed.

Test voltage : 120VAC 60Hz

Test Date: June 10, 2016
Temp.: 23 °C, Humi.: 49 %

Measured phase : L1

Frequency [MHz]	Corr. Factor [dB]	Meter Readings [dB(μV)] QP	AVE	Limits [dB(μV)] QP	AVE	Results [dB(μV)] QP	AVE	Margin [dB] QP	AVE	Remarks
0.217	10.1	28.1	--	62.9	52.9	38.2	--	+24.7	--	-
0.438	10.1	32.3	28.7	57.1	47.1	42.4	38.8	+14.7	+ 8.3	-
0.487	10.1	30.0	--	56.2	46.2	40.1	--	+16.1	--	-
0.538	10.1	28.1	--	56.0	46.0	38.2	--	+17.8	--	-
6.496	10.3	21.8	--	60.0	50.0	32.1	--	+27.9	--	-
8.533	10.4	22.5	--	60.0	50.0	32.9	--	+27.1	--	-



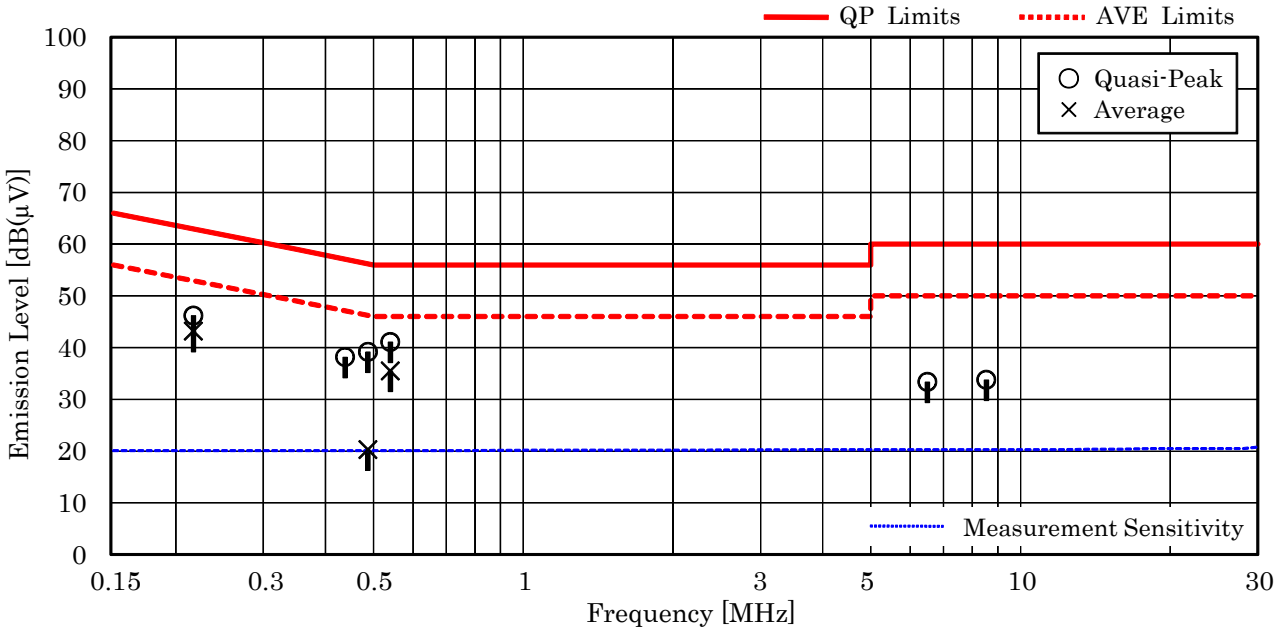
NOTES
1. The spectrum was checked from 150 kHz to 30 MHz.
2. The correction factor includes the AMN insertion loss and the cable loss.
3. The symbol of "<" means "or less".
4. The symbol of ">" means "more than".
5. The symbol of "--" means "not applicable".
6. Calculated result at 0.438 MHz, as the worst point shown on underline:
   Correction Factor + Meter Reading (AVE) = 10.1 + 28.7 = 38.8 dB(μV)
7. QP : Quasi-Peak Detector / AVE : Average Detector
8. Test receiver setting(s) : CISPR QP 9 kHz / Average 9 kHz

Test voltage : 120VAC 60Hz

Test Date: June 10, 2016
Temp.: 23 °C, Humi.: 49 %

Measured phase : L2

Frequency [MHz]	Corr. Factor [dB]	Meter Readings [dB(μV)] QP	AVE	Limits [dB(μV)] QP	AVE	Results [dB(μV)] QP	AVE	Margin [dB] QP	AVE	Remarks
0.217	10.1	36.1	33.1	62.9	52.9	46.2	43.2	+16.7	+ 9.7	-
0.438	10.1	28.1	--	57.1	47.1	38.2	--	+18.9	--	-
0.487	10.1	29.1	10.2	56.2	46.2	39.2	20.3	+17.0	+25.9	-
0.540	10.1	31.0	25.4	56.0	46.0	41.1	35.5	+14.9	+10.5	-
6.496	10.3	23.1	--	60.0	50.0	33.4	--	+26.6	--	-
8.533	10.3	23.5	--	60.0	50.0	33.8	--	+26.2	--	-



NOTES
1. The spectrum was checked from 150 kHz to 30 MHz.
2. The correction factor includes the AMN insertion loss and the cable loss.
3. The symbol of "<" means "or less".
4. The symbol of ">" means "more than".
5. The symbol of "--" means "not applicable".
6. Calculated result at 0.217 MHz, as the worst point shown on underline:
   Correction Factor + Meter Reading (AVE) = 10.1 + 33.1 = 43.2 dB(μV)
7. QP : Quasi-Peak Detector / AVE : Average Detector
8. Test receiver setting(s) : CISPR QP 9 kHz / Average 9 kHz

7.9 Radiated Emission

For the requirements, ☑ - Applicable [☑ - Tested. ☐ - Not tested by applicant request.]
☐ - Not Applicable

7.9.1 Test Results

For the standard, ☑ - **Passed** ☐ - **Failed** ☐ - **Not judged**

Min. Limit Margin (Quasi-Peak) 4.4 dB at 195.58 MHz

Uncertainty of Measurement Results

9 kHz – 30 MHz	± 3.0	dB(2σ)
30 MHz – 300 MHz	± 3.8	dB(2σ)
300 MHz – 1000 MHz	± 4.8	dB(2σ)
1 GHz – 6 GHz	± 4.7	dB(2σ)
6 GHz – 18 GHz	± 4.6	dB(2σ)
18 GHz – 40 GHz	± 5.5	dB(2σ)

Remarks : Y axis position.

7.9.2 Test Instruments

Anechoic Chamber A2				
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Cal. Due**
Test Receiver	ESU 26	100170 (A-6)	Rohde & Schwarz	2017/04/27
AMN (main)	HFH2-Z2	872096/25 (C-2)	Rohde & Schwarz	2016/07/26
AMN (sub)	RG213/U	--- (H-28)	HUBER+SUHNER	2016/07/26
Pre-Amplifier	310N	304573 (A-17)	SONOMA	2017/04/03
Biconical Antenna	VHA9103/BBA9106	1184 (C-43)	Schwarzbeck	2017/05/18
Log-periodic Antenna	UHALP9108-A1	0419 (C-28)	Schwarzbeck	2017/05/18
RF Cable	S 10162 B-11 etc.	--- (H-4)	HUBER+SUHNER	2017/04/03
Site Attenuation	--	--- (H-15)	----	N/A
Pre-Amplifier	TPA0118-36	1010 (A-37)	TOYO	2017/05/17
Horn Antenna	91888-2	562 (C-41-1)	EATON	2016/06/16
Horn Antenna	91889-2	568 (C-41-2)	EATON	2016/06/16
Horn Antenna	3160-04	9903-1053 (C-55)	EMCO	2016/06/29
Horn Antenna	3160-05	9902-1061 (C-56)	EMCO	2016/06/29
Horn Antenna	3160-06	9712-1045 (C-57)	EMCO	2016/06/29
Horn Antenna	3160-07	9902-1113 (C-58)	EMCO	2016/06/29
Horn Antenna	3160-08	9904-1099 (C-59)	EMCO	2016/06/29
Horn Antenna	3160-09	9808-1117 (C-48)	EMCO	2016/06/28
Attenuator	54A-10	W5713 (D-29)	Weinschel	2016/08/16
Attenuator	2-10	BA6214 (D-79)	Weinschel	2016/11/19
RF Cable	SUCOFLEX104	267479/4 (C-66)	HUBER+SUHNER	2017/01/06
RF Cable	SUCOFLEX104	267414/4 (C-67)	HUBER+SUHNER	2017/01/06
RF Cable	SUCOFLEX102EA	3041/2EA (C-69)	HUBER+SUHNER	2017/01/06
Band Rejection Filter	BRM50701	029 (D-93)	MICRO-TRONICS	2017/02/17
SVSWR	--	--- (H-19)	----	N/A
Double-Ridge Guide Horn Antenna	3117	00126730 (C-73)	ETS LINDGREN	2016/11/18
Pre-Amplifier	WJ-6611-513	0289 (A-23)	Watkins Johnson	2017/01/06
Pre-Amplifier	WJ-6882-824	0048 (A-21)	Watkins Johnson	2017/01/06
Pre-Amplifier	DBL-0618N515	001 9830 (A-33)	DBS Microwave	2017/01/06

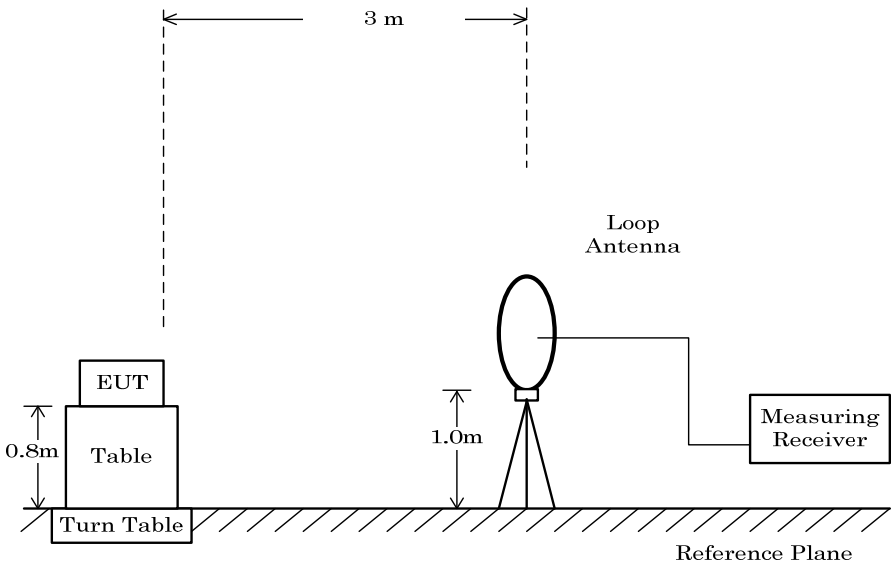
NOTE : The calibration interval of the above test instruments is 12 months.

7.9.3 Test Method and Test Setup (Diagrammatic illustration)

7.9.3.1 Radiated Emission 9 kHz – 30 MHz

The preliminary tests were performed at the measurement distance that specified for compliance to determine the emission characteristics of the EUT.
The EUT configuration(in X, Y and Z axis), cable configuration and mode of operation were determined for producing the maximum level of emissions.
The measurement were performed about three antenna orientations (parallel, perpendicular, and ground-parallel).
According to KDB 937606, a used anechoic chamber were equivalent to those on an open fields site based on comparison measurements.
This configurations was used for the final tests.

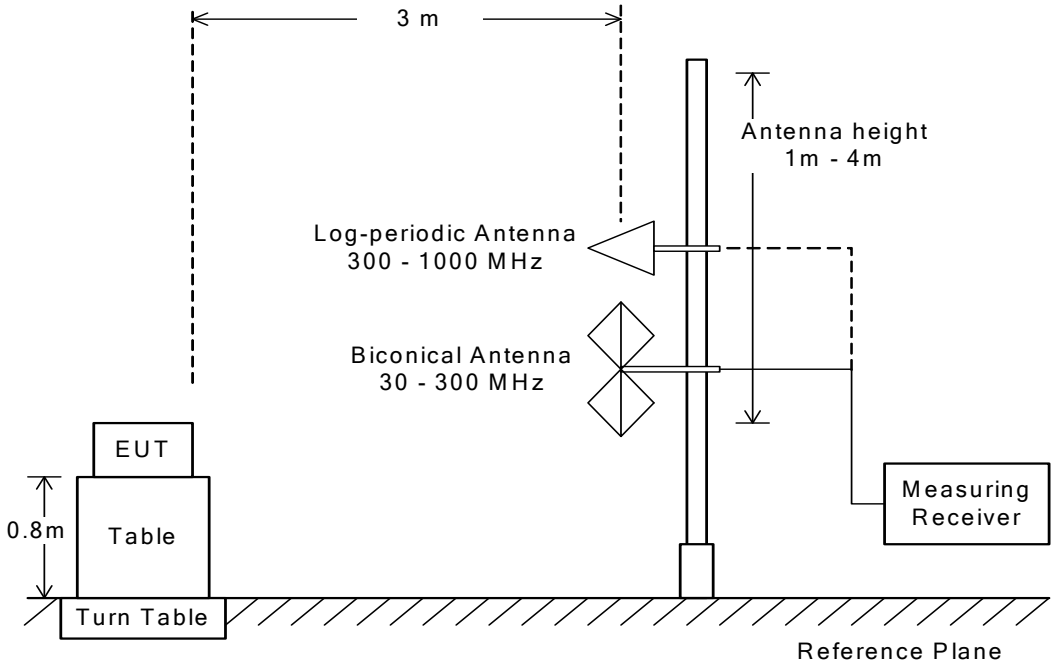
– Side View –



7.9.3.2 Radiated Emission 30 MHz – 1000 MHz

The preliminary tests were performed at the measurement distance that specified for compliance to determine the emission characteristics of the EUT.
The EUT configuration(in X, Y and Z axis), cable configuration and mode of operation were determined for producing the maximum level of emissions.
This configurations was used for the final tests.

– Side View –



7.9.3.3 Radiated Emission above 1 GHz

The preliminary tests were performed at the measurement distance that specified for compliance to determine the emission characteristics of the EUT.
The EUT configuration(in X, Y and Z axis), cable configuration and mode of operation were determined for producing the maximum level of emissions.
This configurations was used for the final tests.

The setting of the measuring instruments are shown as follows:

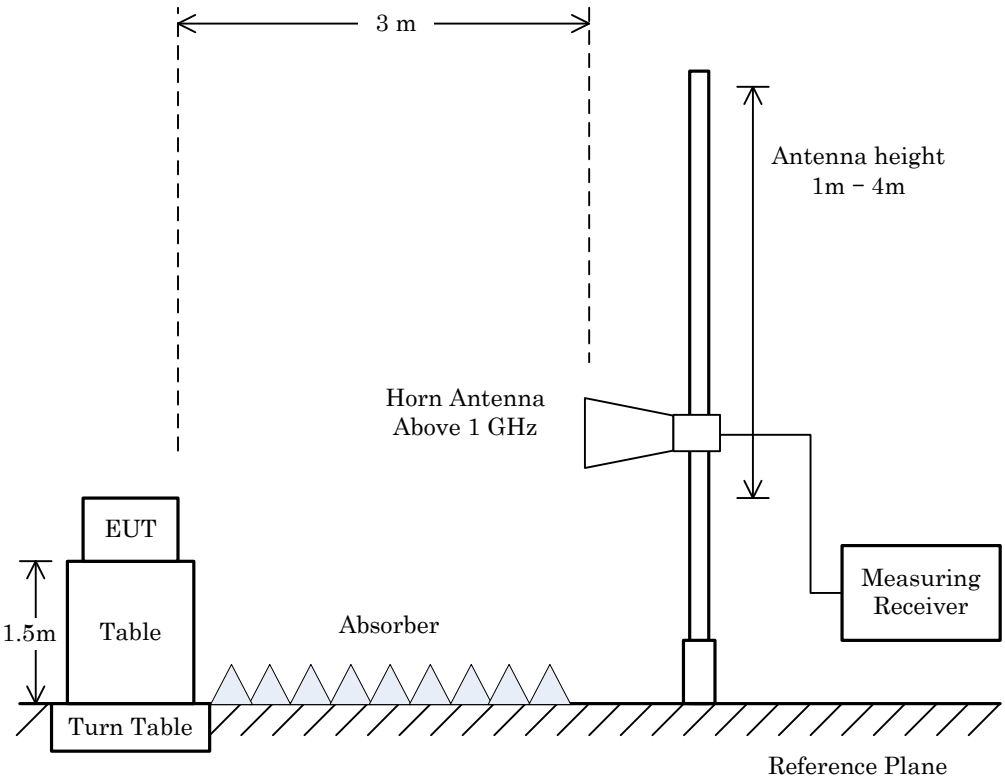
Type	Peak	Average
Detector Function	Peak	Peak
Res. Bandwidth	1 MHz	1 MHz
Video Bandwidth	3 MHz	≥ 1/T *1)
Video Filtering	Linear Voltage	Linear Voltage
Sweep Time	AUTO	AUTO
Trace	Max Hold	Max Hold

Note: 1. T: Minimum transmission duration

Average (VBW) Setting:

Mode	Interval (msec)	Cycle (msec)	Duty cycle (%)	Burst on period(T) (msec)	Min. VBW(1/T) (kHz)	VBW Setting (kHz)
BLE	0.11	2.22	94.9%	2.11	0.47	0.50
non-BLE (1Mbps)	0.11	2.22	94.9%	2.11	0.47	0.50
non-BLE (2Mbps)	0.11	1.18	90.3%	1.07	0.94	1.00

– Side View –



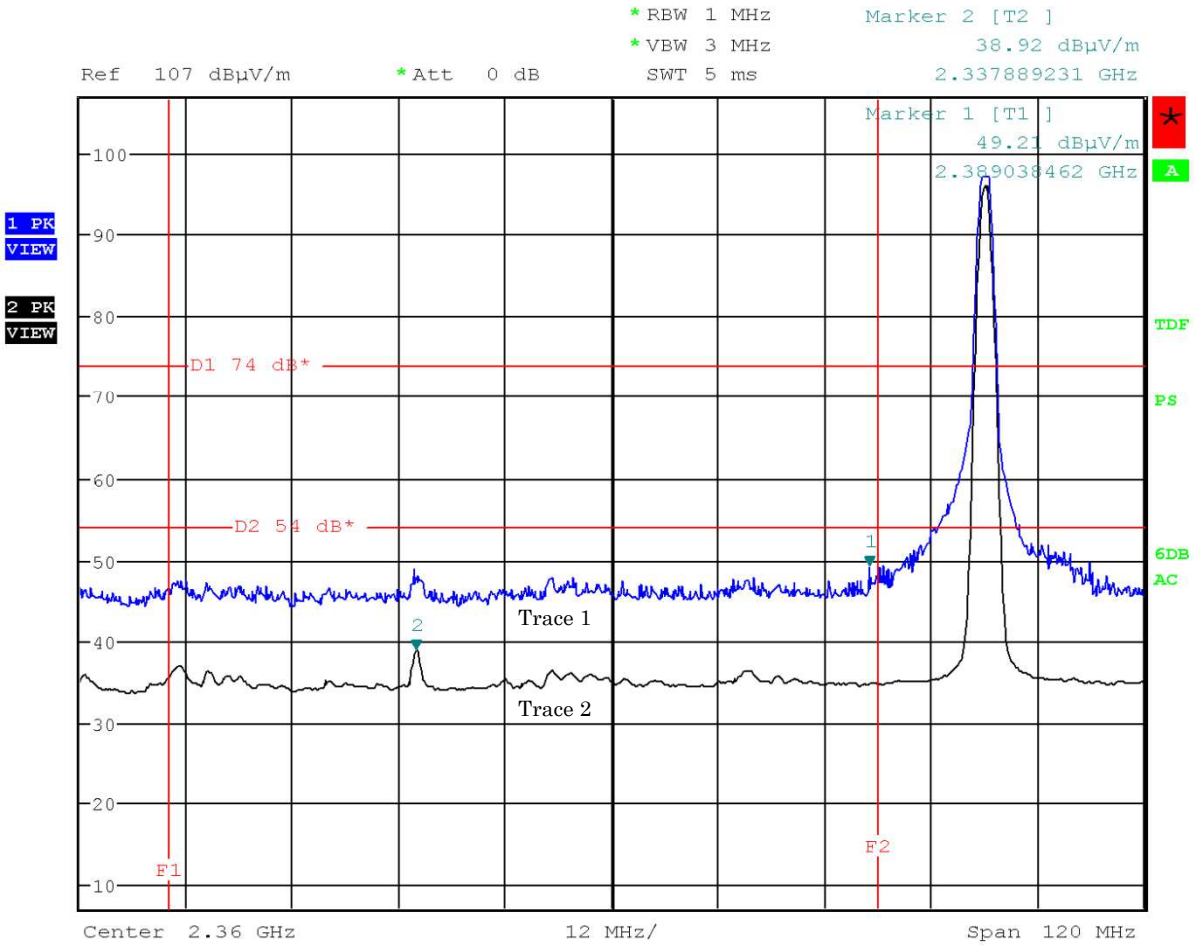
NOTE
When the EUT is manipulated through three different orientations, the scan height upper range for the measurement antenna is limited to 2.5 m or 0.5 m above the top of the EUT.

7.9.4 Test Data

7.9.4.1 Band-edge Compliance

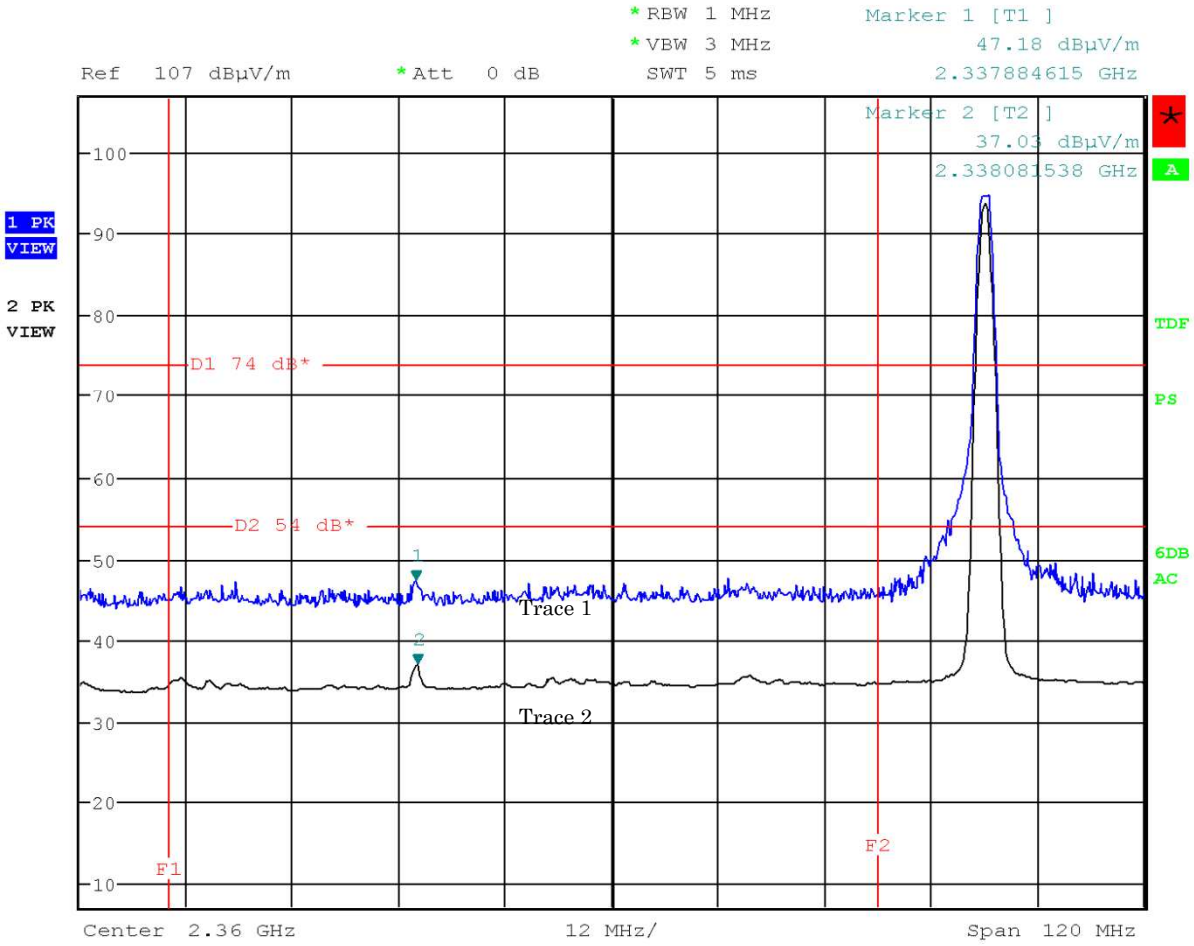
Test Date :June 8, 2016
Temp.:21°C, Humi:56%

Mode of EUT : 0ch: 2402 MHz, (Bluetooth Low Energy)
Antenna Polarization : Horizontal



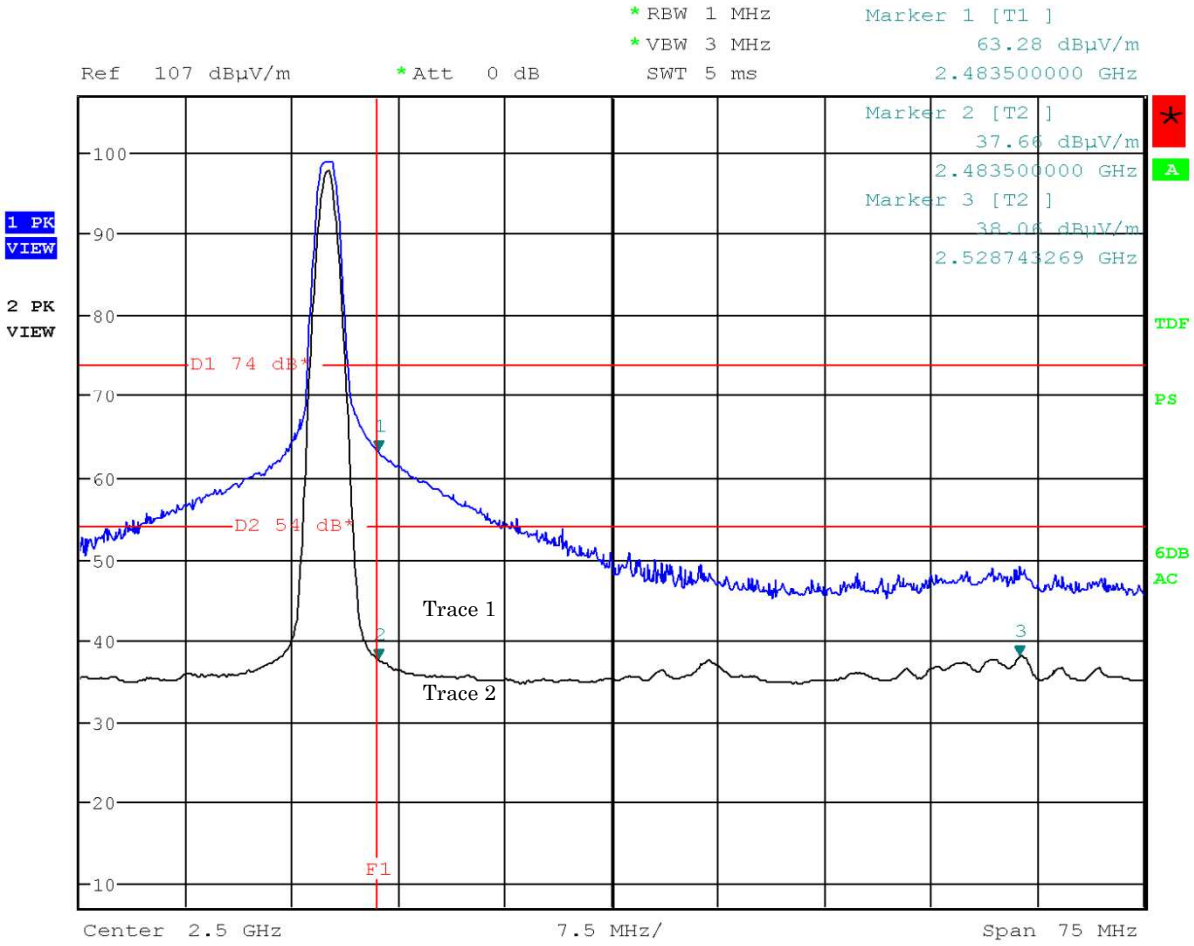
Note: The trace 1 is Peak . The trace 2 is Average.

Mode of EUT : 0ch: 2402 MHz, (Bluetooth Low Energy)
Antenna Polarization : Vertical



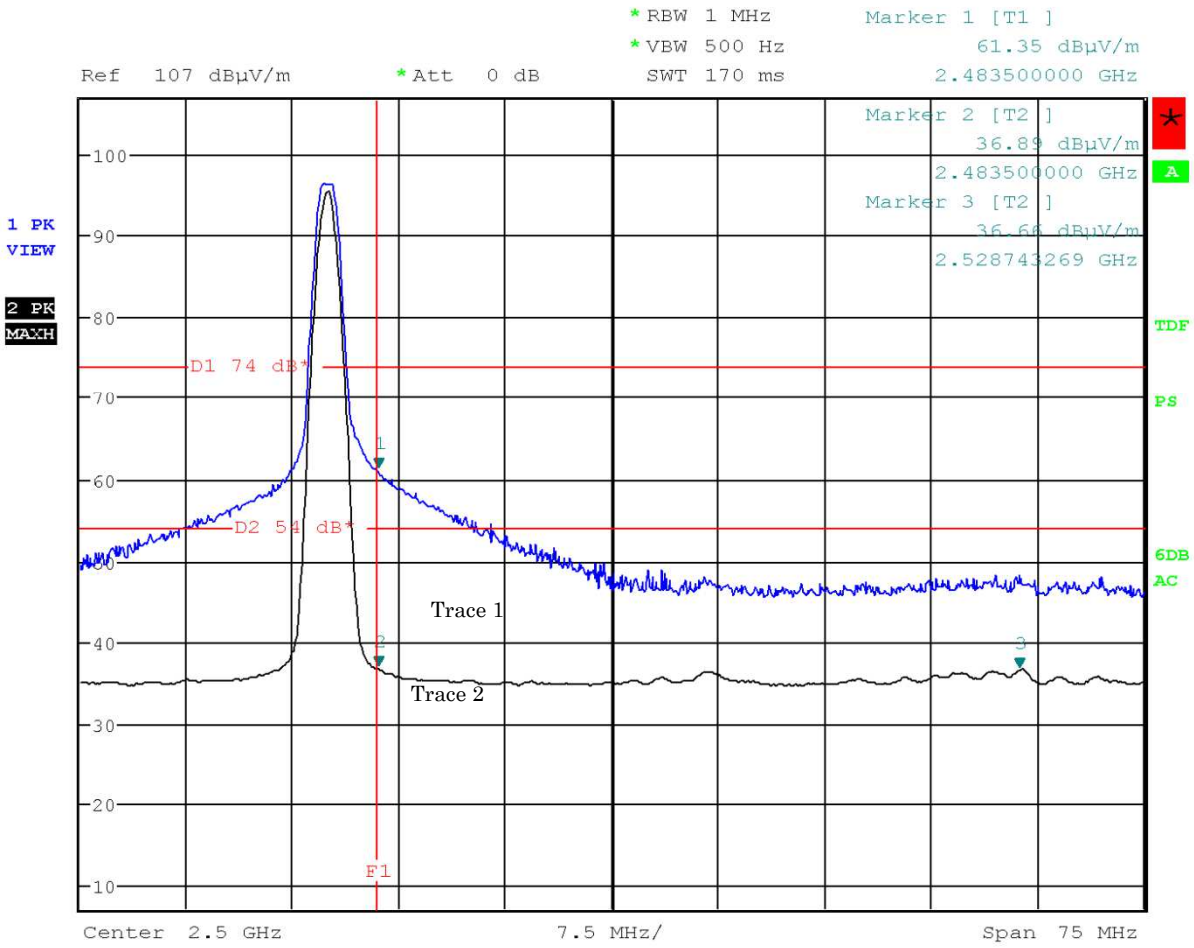
Note: The trace 1 is Peak . The trace 2 is Average.

Mode of EUT : 39ch: 2480 MHz, (Bluetooth Low Energy)
Antenna Polarization : Horizontal



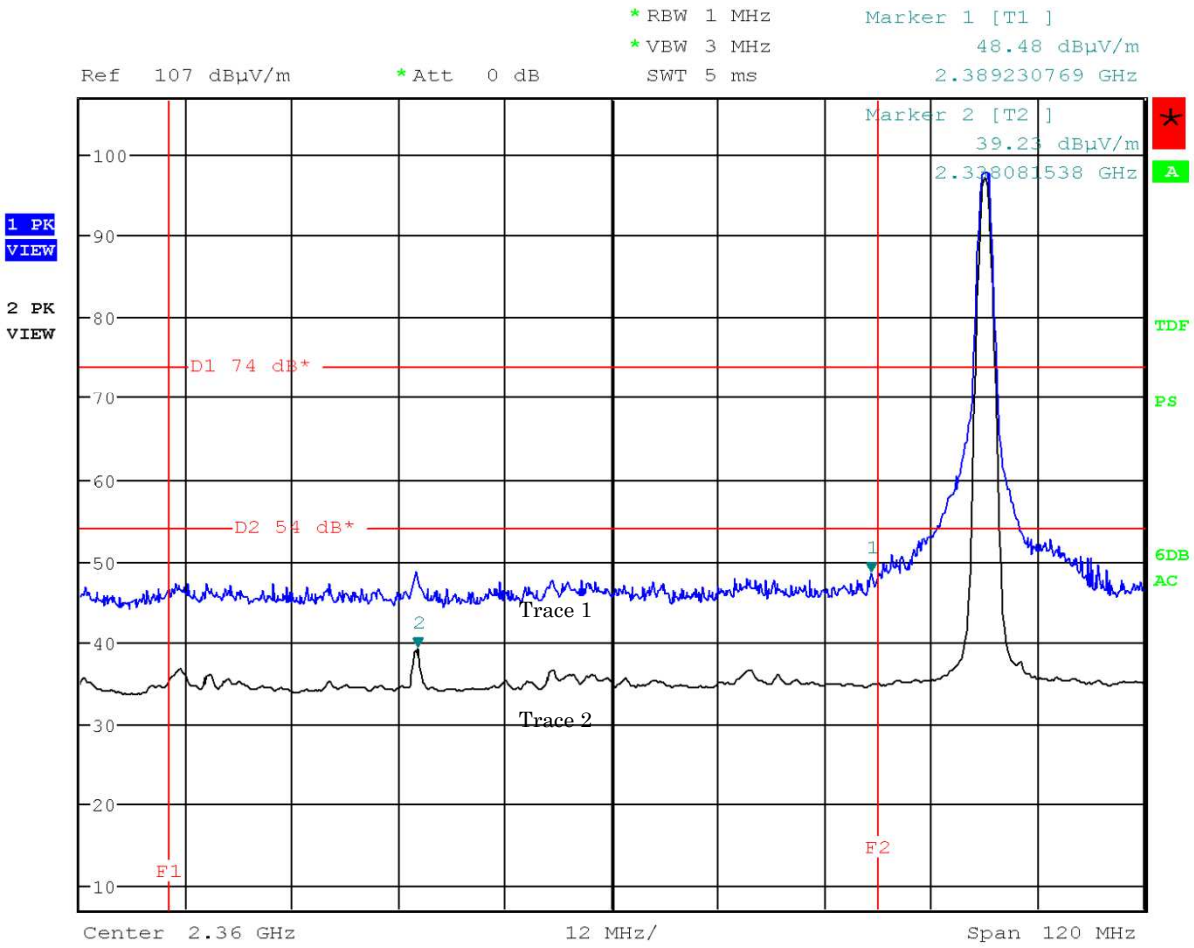
Note: The trace 1 is Peak . The trace 2 is Average.

Mode of EUT : 39ch: 2480 MHz, (Bluetooth Low Energy)
Antenna Polarization : Vertical



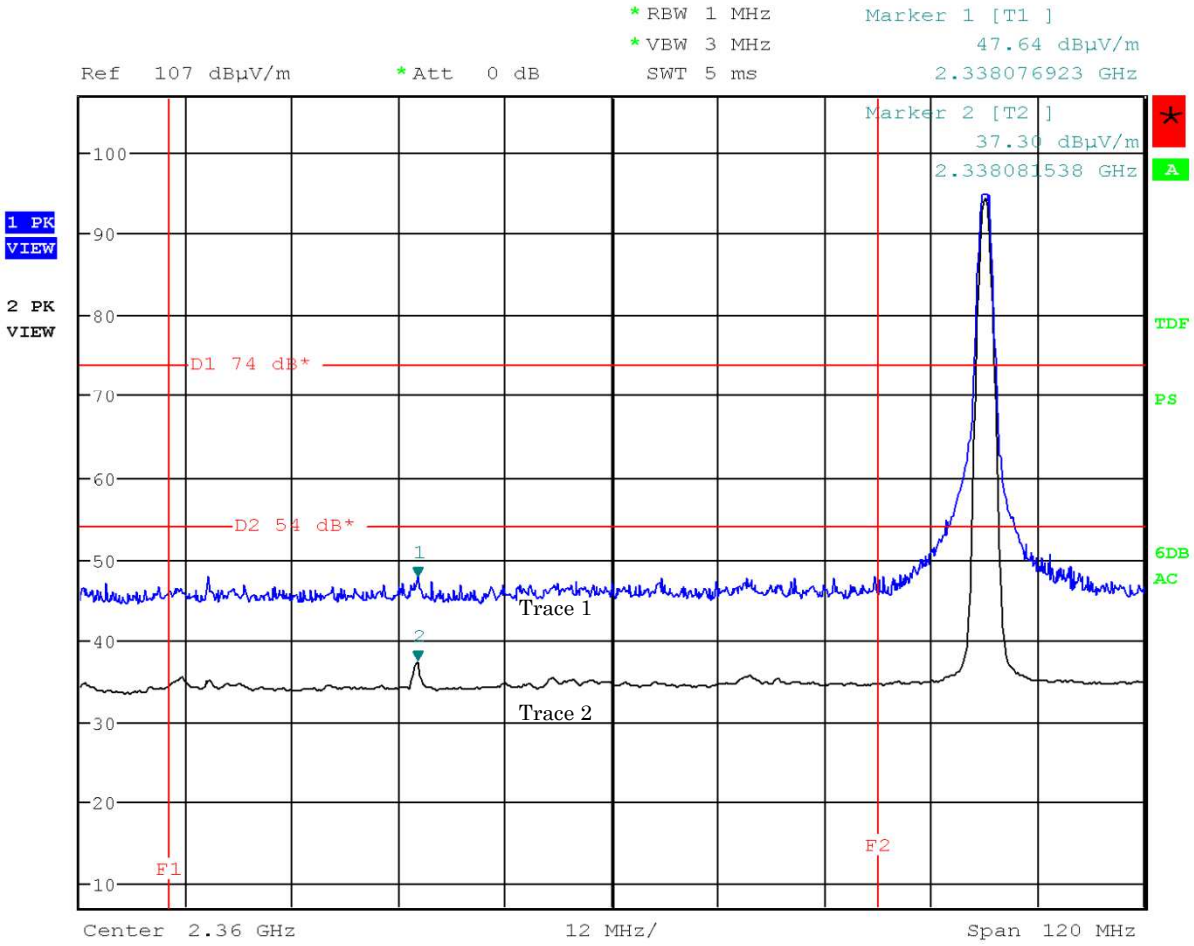
Note: The trace 1 is Peak . The trace 2 is Average.

Mode of EUT : 0ch: 2402 MHz, (non-BLE 1Mbps)
Antenna Polarization : Horizontal



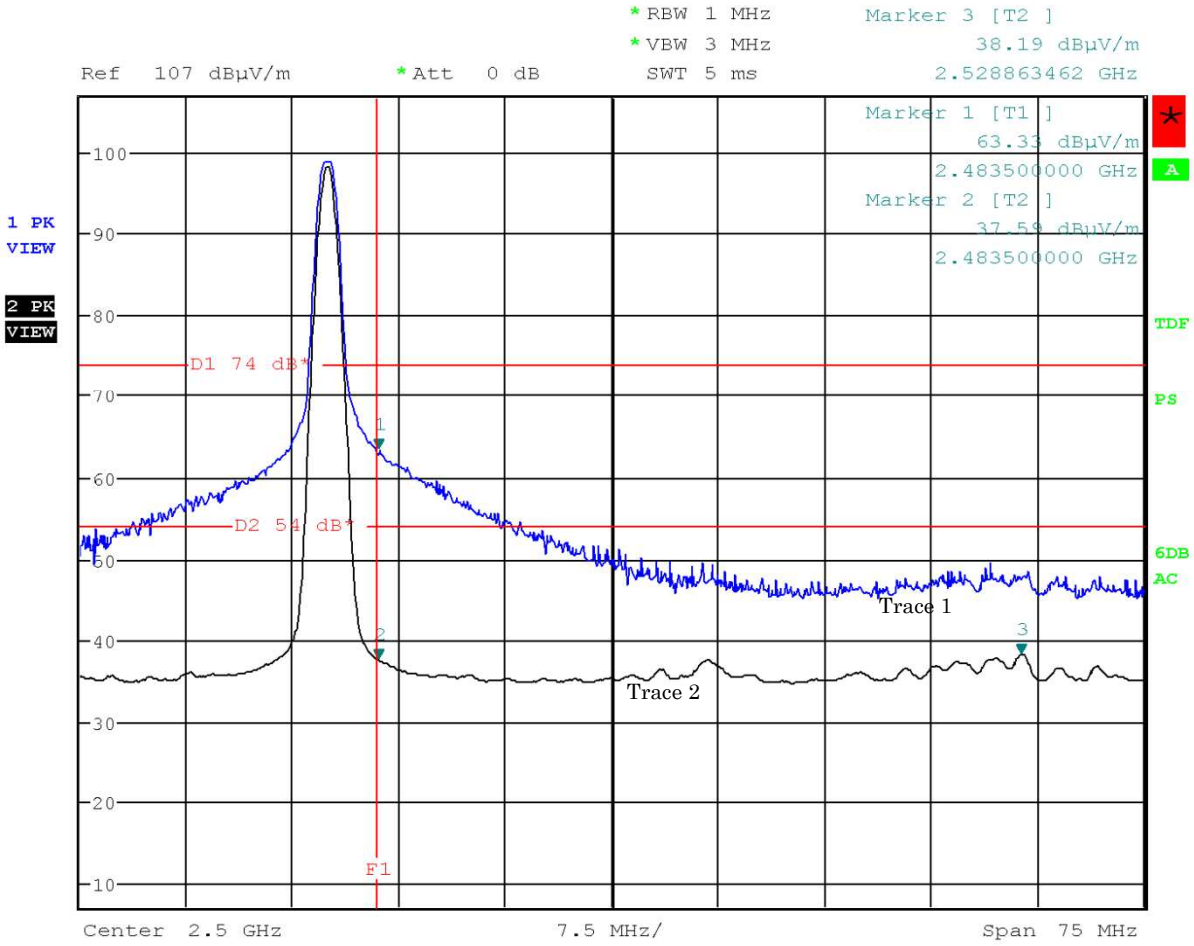
Note: The trace 1 is Peak . The trace 2 is Average.

Mode of EUT : 0ch: 2402 MHz, (non-BLE 1Mbps)
Antenna Polarization : Vertical



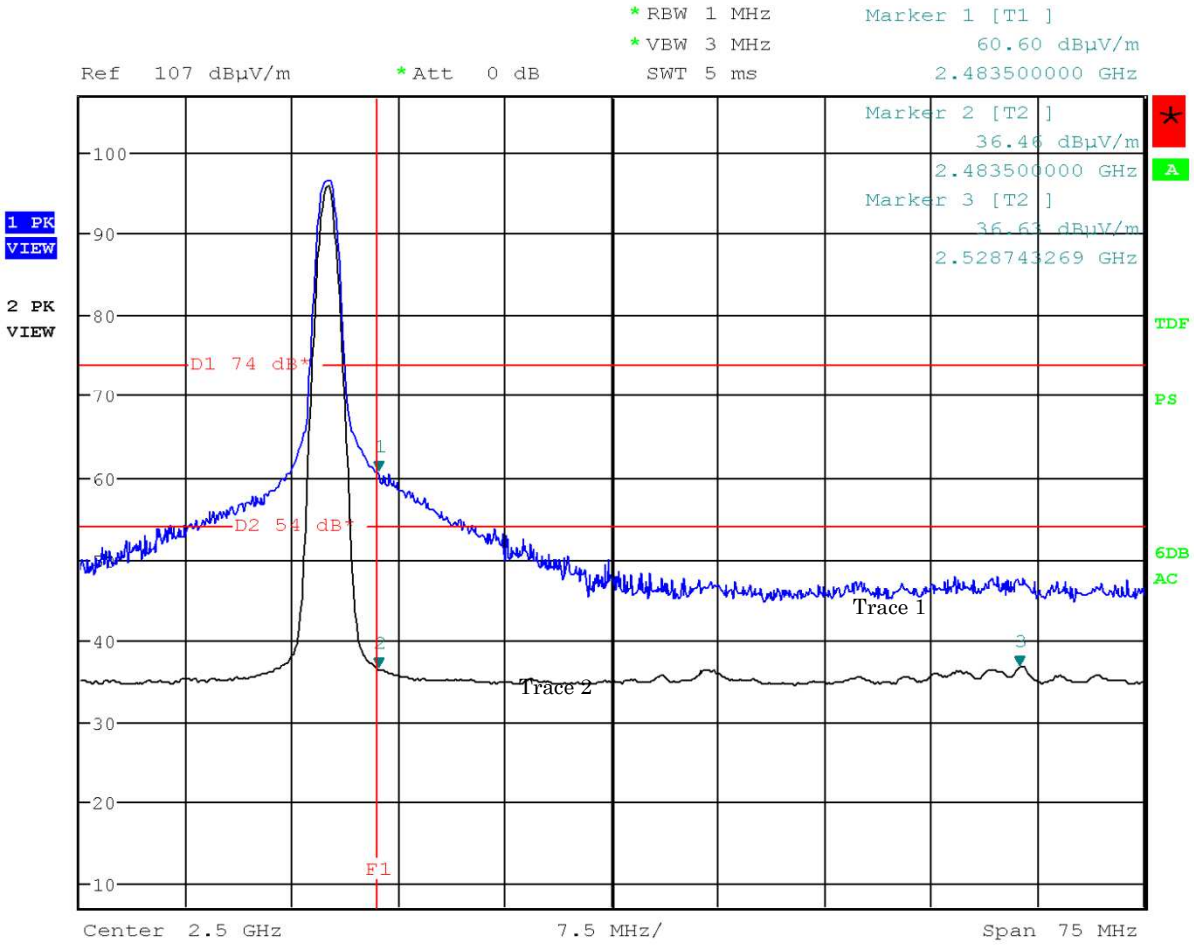
Note: The trace 1 is Peak . The trace 2 is Average.

Mode of EUT : 79ch: 2480 MHz, (non-BLE 1Mbps)
Antenna Polarization : Horizontal



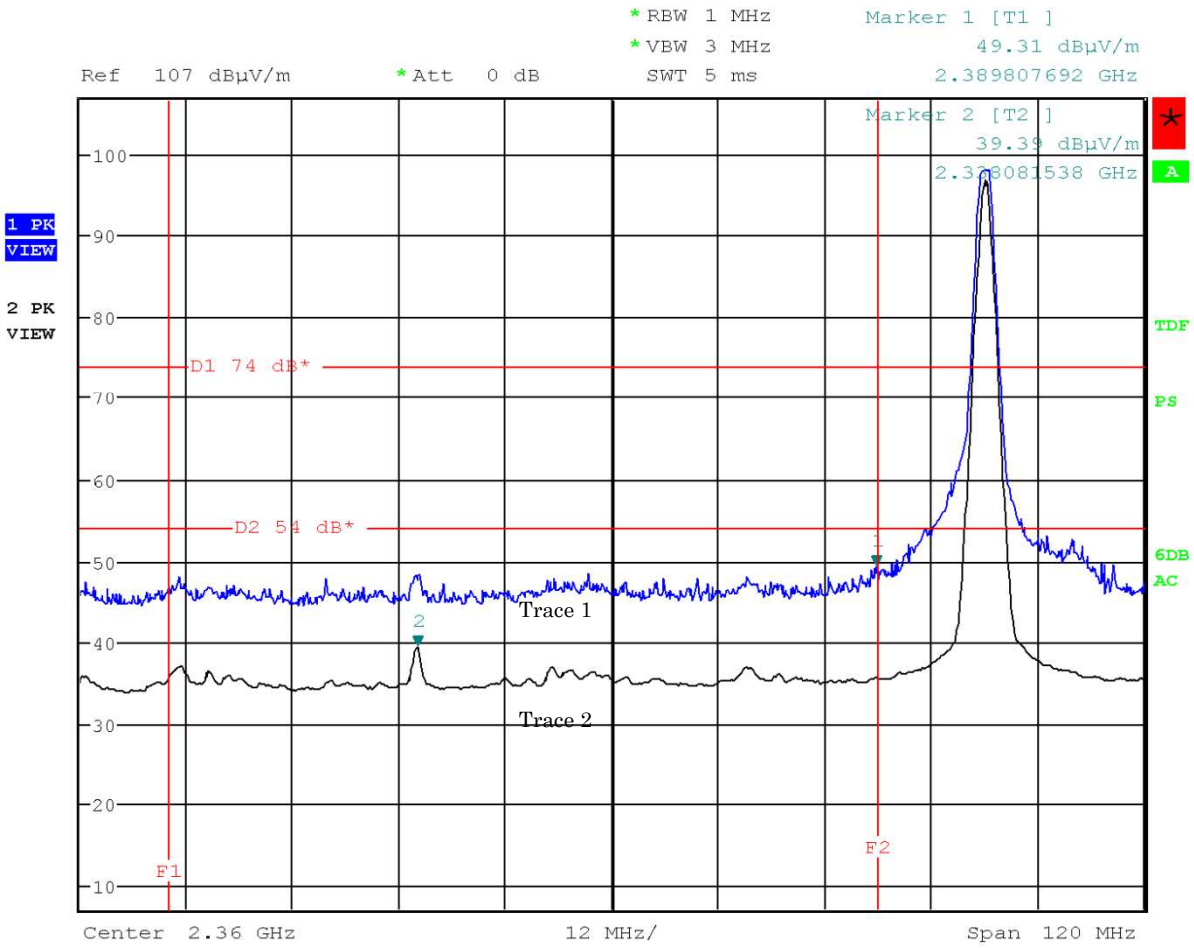
Note: The trace 1 is Peak . The trace 2 is Average.

Mode of EUT : 79ch: 2480 MHz, (non-BLE 1Mbps)
Antenna Polarization : Vertical



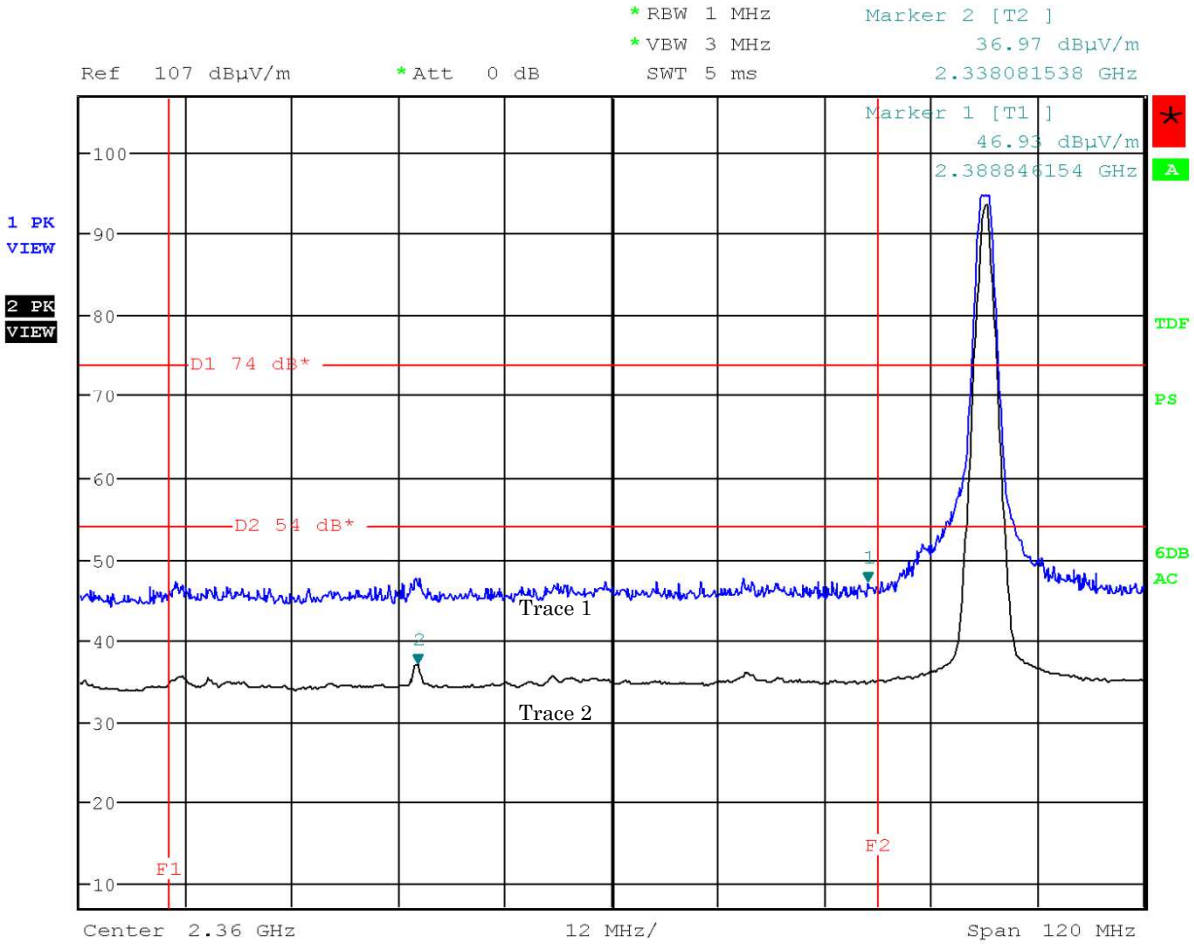
Note: The trace 1 is Peak . The trace 2 is Average.

Mode of EUT : 0ch: 2402 MHz, (non-BLE 2Mbps)
Antenna Polarization : Horizontal



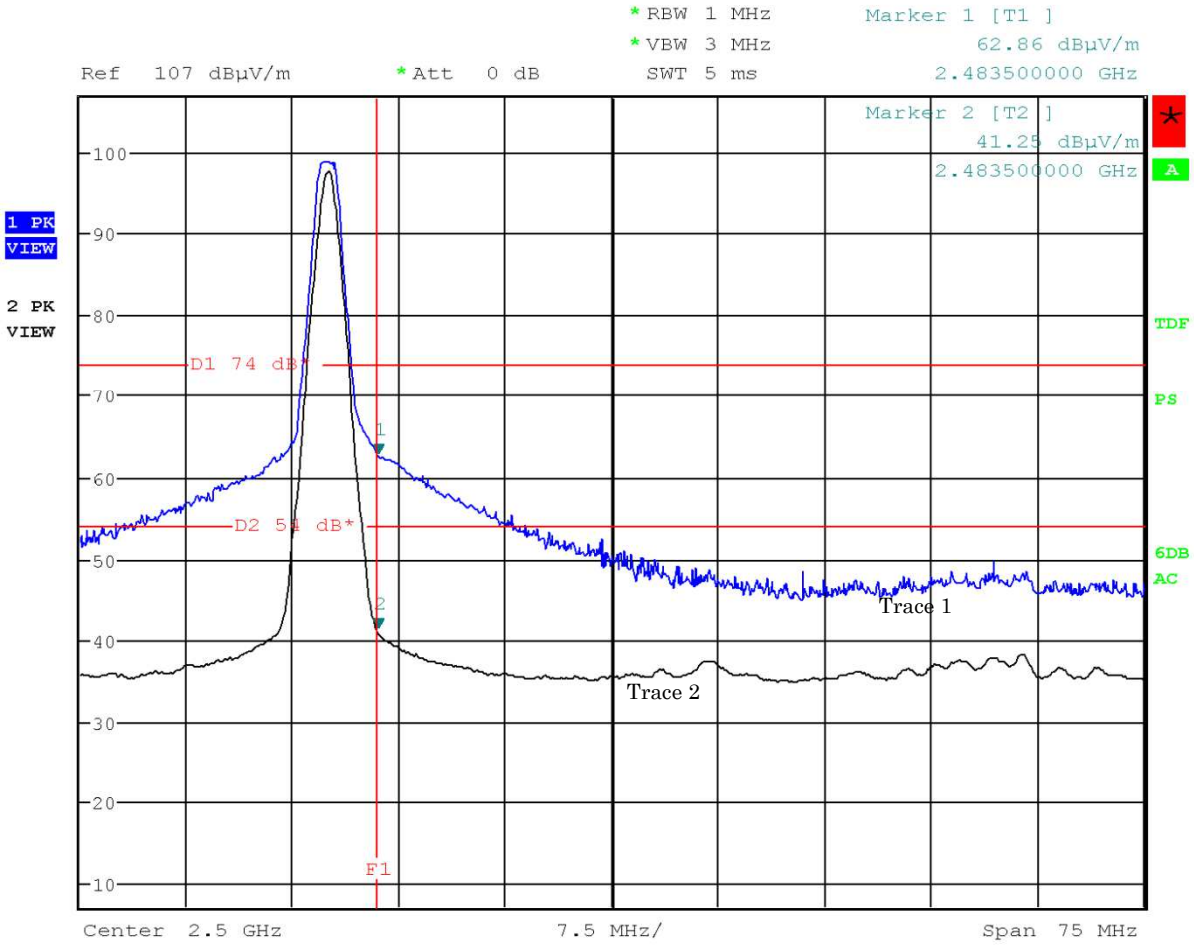
Note: The trace 1 is Peak . The trace 2 is Average.

Mode of EUT : 0ch: 2402 MHz, (non-BLE 2Mbps)
Antenna Polarization : Vertical



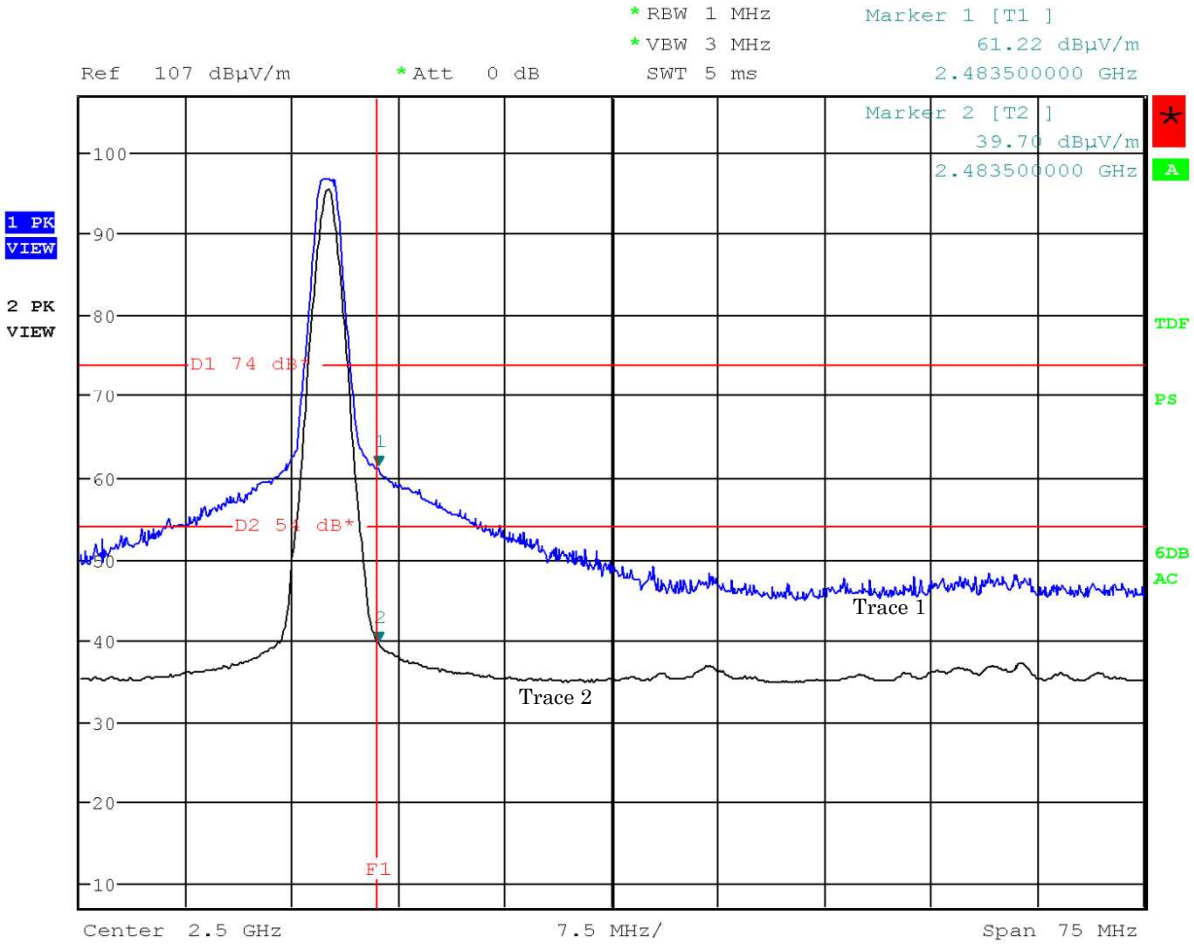
Note: The trace 1 is Peak . The trace 2 is Average.

Mode of EUT : 39ch: 2480 MHz, (non-BLE 2Mbps)
Antenna Polarization : Horizontal



Note: The trace 1 is Peak . The trace 2 is Average.

Mode of EUT : 39ch: 2480 MHz, (non-BLE 2Mbps)
Antenna Polarization : Vertical



Note: The trace 1 is Peak . The trace 2 is Average.

7.9.4.2 Other Spurious Emission (9kHz – 30MHz)

Test Date :June 9, 2016
Temp.:23°C, Humi:49%

Mode of EUT : Bluetooth LE / non-BLE 1Mbps / non-BLE 2Mbps
Results : No spurious emissions in the range 20dB below the limit.

7.9.4.3 Other Spurious Emission (30MHz – 1000MHz)

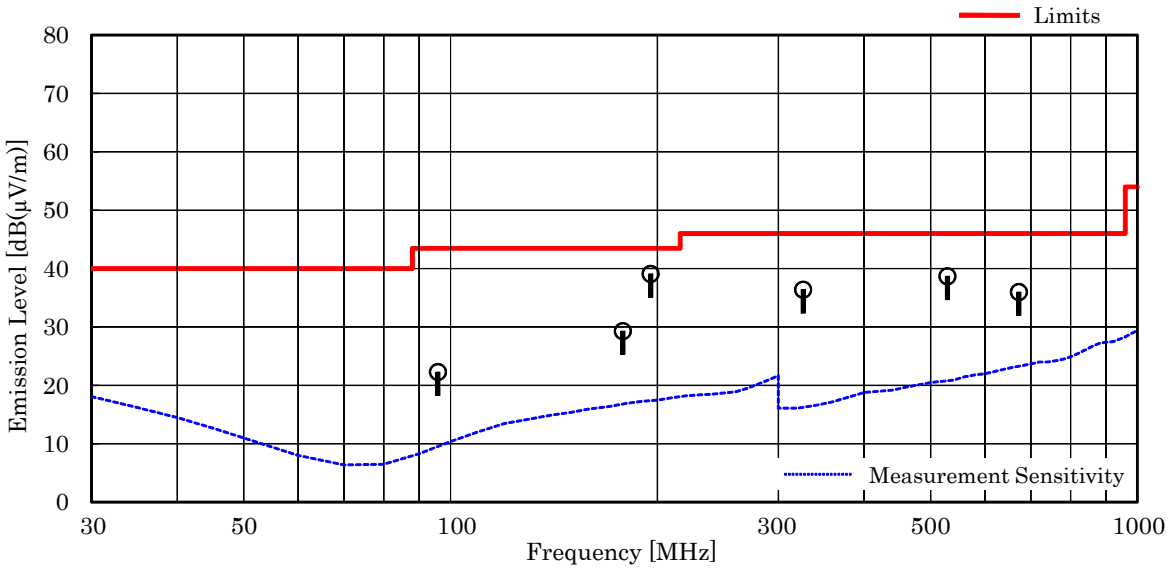
Mode of EUT : All modes have been investigated and the worst case mode for channel (39ch: 2480MHz / non-BLE 2Mbps, Bluetooth Low Energy and non-BLE 1Mbps) has been listed.

Test voltage : 120VAC 60Hz

Test Date: June 9, 2016
Temp.: 23 °C, Humi: 49 %

Antenna pole : Horizontal

Frequency [MHz]	Antenna Factor [dB(1/m)]	Corr. Factor [dB]	Meter Readings [dB(μV)]	Limits [dB(μV/m)]	Results [dB(μV/m)]	Margin [dB]	Remarks
95.88	9.4	-26.8	39.7	43.5	22.3	+21.2	-
178.19	15.8	-26.0	39.5	43.5	29.3	+14.2	-
195.58	16.3	-25.9	48.7	43.5	39.1	+ 4.4	-
326.10	14.3	-25.0	47.1	46.0	36.4	+ 9.6	-
528.98	17.9	-24.1	44.9	46.0	38.7	+ 7.3	-
672.14	19.9	-23.6	39.7	46.0	36.0	+10.0	-



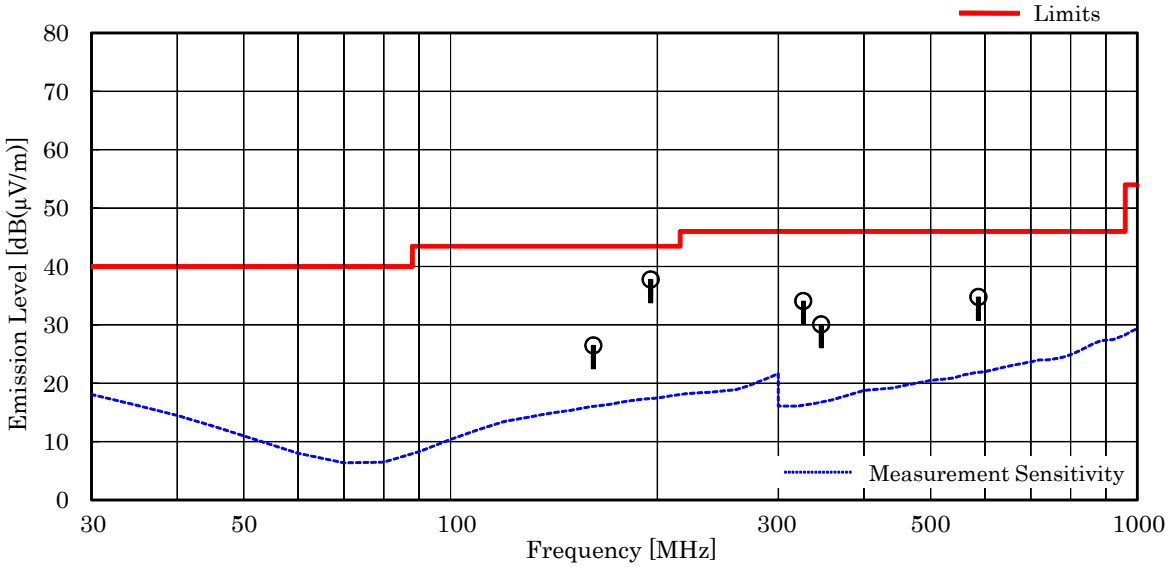
NOTES
1. Test Distance : 3 m
2. The spectrum was checked from 30 MHz to 1000 MHz.
3. The correction factor is composed of cable loss, pad attenuation and/or amplifier gain.
4. The symbol of "<" means "or less".
5. The symbol of ">" means "more than".
6. Calculated result at 195.58 MHz, as the worst point shown on underline:
   Antenna Factor + Correction Factor + Meter Reading = 16.3 + (-25.9) + 48.7 = 39.1 dB(μV/m)
   Antenna Height : 165 cm, Turntable Angle : 108 °
7. Test receiver setting(s) : CISPR QP 120 kHz [QP : Quasi-Peak]

Test voltage : 120VAC 60Hz

Test Date: June 9, 2016
Temp.: 23 °C, Humi: 49 %

Antenna pole : Vertical

Frequency [MHz]	Antenna Factor [dB(1/m)]	Corr. Factor [dB]	Meter Readings [dB(μV)]	Limits [dB(μV/m)]	Results [dB(μV/m)]	Margin [dB]	Remarks
161.44	15.3	-26.2	37.4	43.5	26.5	+17.0	-
195.61	16.3	-25.9	47.4	43.5	37.8	+ 5.7	-
326.25	14.3	-25.0	44.8	46.0	34.1	+11.9	-
346.42	14.6	-24.9	40.4	46.0	30.1	+15.9	-
586.91	18.9	-24.0	39.9	46.0	34.8	+11.2	-
835.59	21.6	-22.7	< 27.0	46.0	< 25.9	> +20.1	-



NOTES
1. Test Distance : 3 m
2. The spectrum was checked from 30 MHz to 1000 MHz.
3. The correction factor is composed of cable loss, pad attenuation and/or amplifier gain.
4. The symbol of "<" means "or less".
5. The symbol of ">" means "more than".
6. Calculated result at 195.61 MHz, as the worst point shown on underline:
   Antenna Factor + Correction Factor + Meter Reading = 16.3 + (-25.9) + 47.4 = 37.8 dB(μV/m)
   Antenna Height : 100 cm, Turntable Angle : 206 °
7. Test receiver setting(s) : CISPR QP 120 kHz [QP : Quasi-Peak]

7.9.4.4 Other Spurious Emission (Above 1000MHz)

Mode of EUT : Bluetooth Low Energy

Test Date: June 8, 2016
Temp.: 21 °C, Humi: 56 %

Frequency	Antenna Factor	Corr. Factor	Meter Readings [dB(μV)] Horizontal		Vertical		Limits [dB(μV/m)]		Results [dB(μV/m)]		Margin	Remarks
[MHz]	[dB(1/m)]	[dB]	PK	AVE	PK	AVE	PK	AVE	PK	AVE	[dB]	
Test condition : Tx Low Ch												
2274.0	21.3	0.8	27.7	20.6	28.0	21.1	74.0	54.0	50.1	43.2	+10.8	
2530.0	21.3	0.9	30.1	22.8	29.1	22.2	74.0	54.0	52.3	45.0	+ 9.0	
4804.0	34.4	-31.4	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 51.0	< 41.0	> +13.0	
12010.0	38.9	-35.0	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 51.9	< 41.9	> +12.1	
19216.0	40.5	-42.8	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.7	< 37.7	> +16.3	
Test condition : TX Middle Ch												
2312.0	21.4	0.8	28.4	21.5	28.6	21.8	74.0	54.0	50.8	44.0	+10.0	
2568.0	21.2	0.9	29.6	21.8	29.0	20.6	74.0	54.0	51.7	43.9	+10.1	
4880.0	34.4	-31.2	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 51.2	< 41.2	> +12.8	
7320.0	35.8	-31.0	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 52.8	< 42.8	> +11.2	
12200.0	39.0	-35.3	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 51.7	< 41.7	> +12.3	
19520.0	40.4	-42.7	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.7	< 37.7	> +16.3	
Test condition : TX High Ch												
2352.0	21.6	0.8	29.8	23.6	29.9	23.8	74.0	54.0	52.3	46.2	+ 7.8	
2608.0	21.1	0.9	28.9	21.9	27.8	19.1	74.0	54.0	50.9	43.9	+10.1	
4960.0	34.3	-31.3	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 51.0	< 41.0	> +13.0	
7440.0	35.8	-31.0	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 52.8	< 42.8	> +11.2	
12400.0	39.0	-35.8	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 51.2	< 41.2	> +12.8	
19840.0	40.4	-42.8	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.6	< 37.6	> +16.4	
22320.0	40.6	-43.2	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.4	< 37.4	> +16.6	

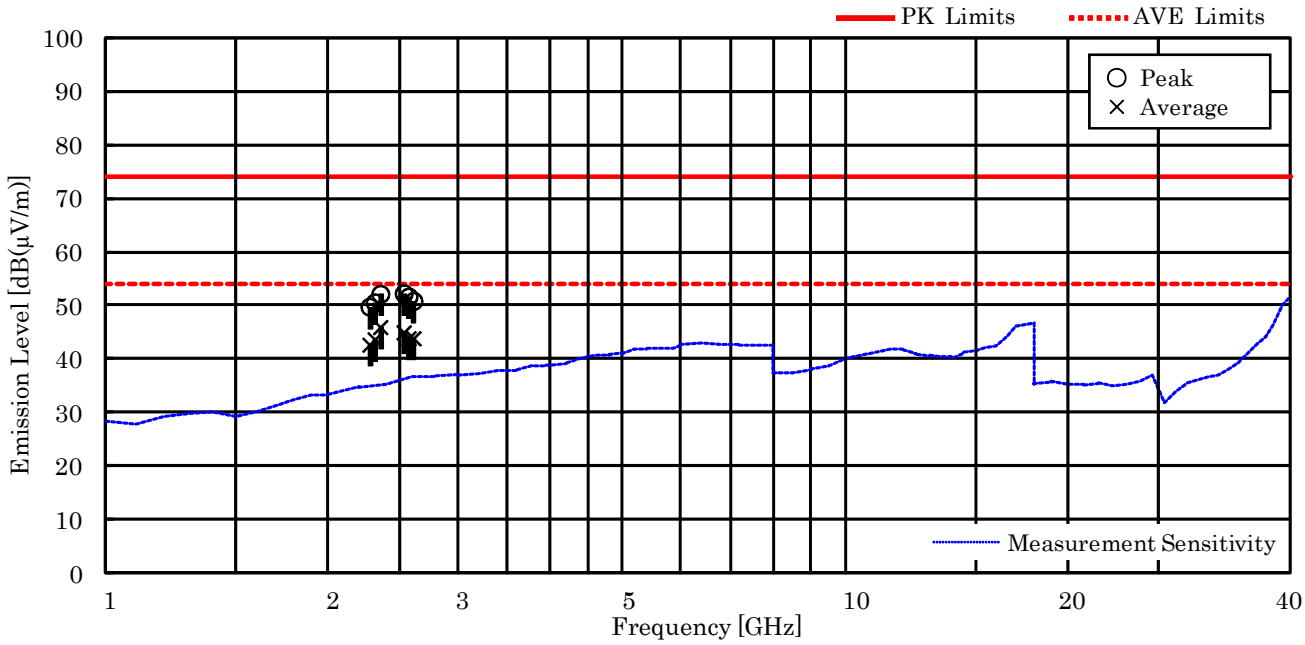
Calculated result at 2352.0 MHz, as the worst point shown on underline:

	Antenna Factor	=	21.6 dB(1/m)
	Corr. Factor	=	0.8 dB
+)	Meter Reading	=	23.8 dB(μV)
	Result	=	46.2 dB(μV/m)

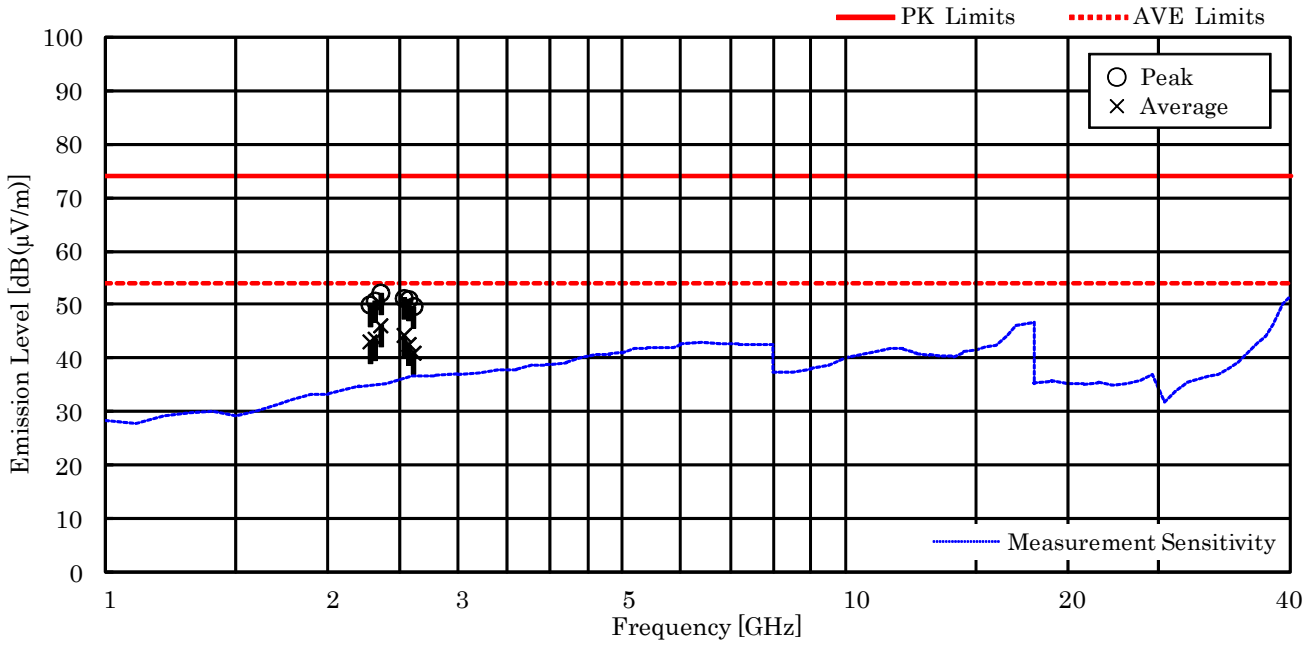
Minimum Margin: 54.0 - 46.2 = 7.8 (dB)

NOTES
1. Test Distance : 3 m
2. The spectrum was checked from 1 GHz to 25 GHz (10th harmonic of the highest fundamental frequency).
3. The correction factor is shown as follows:
   Corr. Factor [dB] = Cable Loss + 20dB Pad Att. - Pre-Amp. Gain [dB] (1.0 - 7.6GHz)
   Corr. Factor [dB] = Cable Loss + 10dB Pad Att. - Pre-Amp. Gain [dB] (7.6 - 18.0GHz)
   Corr. Factor [dB] = Cable Loss - Pre-Amp. Gain [dB] (over 18 GHz)
4. The symbol of "<" means "or less".
5. The symbol of ">" means "more than".
6. PK : Peak / AVE : Average

Mode of EUT : Bluetooth Low Energy
TX Low/Middle/High ch (Horizontal)



TX Low/Middle/High ch (Vertical)



Mode of EUT : non-BLE 1Mbps

Test Date: June 8, 2016
Temp.: 21 °C, Humi: 56 %

Frequency [MHz]	Antenna Factor [dB(1/m)]	Corr. Factor [dB]	Meter Readings [dB(μV)] Horizontal PK	Horizontal AVE	Vertical PK	Vertical AVE	Limits [dB(μV/m)] PK	Limits AVE	Results [dB(μV/m)] PK	Results AVE	Margin [dB]	Remarks
Test condition : Tx Low Ch												
2274.0	21.3	0.8	27.8	21.0	27.7	21.5	74.0	54.0	49.9	43.6	+10.4	
2530.0	21.3	0.9	30.2	23.3	29.3	22.4	74.0	54.0	52.4	45.5	+ 8.5	
4804.0	34.4	-31.4	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 51.0	< 41.0	> +13.0	
12010.0	38.9	-34.8	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 52.1	< 42.1	> +11.9	
19216.0	40.5	-42.8	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.7	< 37.7	> +16.3	
Test condition : TX Middle Ch												
2313.0	21.4	0.8	29.0	21.9	28.2	22.0	74.0	54.0	51.2	44.2	+ 9.8	
2569.0	21.2	0.9	29.9	22.3	28.0	20.8	74.0	54.0	52.0	44.4	+ 9.6	
4882.0	34.4	-31.2	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 51.2	< 41.2	> +12.8	
7323.0	35.7	-30.9	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 52.8	< 42.8	> +11.2	
12205.0	39.0	-35.1	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 51.9	< 41.9	> +12.1	
19528.0	40.4	-42.7	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.7	< 37.7	> +16.3	
Test condition : TX High Ch												
2352.0	21.6	0.8	29.7	24.1	29.6	24.1	74.0	54.0	52.1	46.5	+ 7.5	
2608.0	21.1	0.9	29.6	22.3	28.3	19.5	74.0	54.0	51.6	44.3	+ 9.7	
4960.0	34.3	-31.2	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 51.1	< 41.1	> +12.9	
7440.0	35.8	-30.9	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 52.9	< 42.9	> +11.1	
12400.0	39.0	-35.6	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 51.4	< 41.4	> +12.6	
19840.0	40.4	-42.8	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.6	< 37.6	> +16.4	
22320.0	40.6	-43.2	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.4	< 37.4	> +16.6	

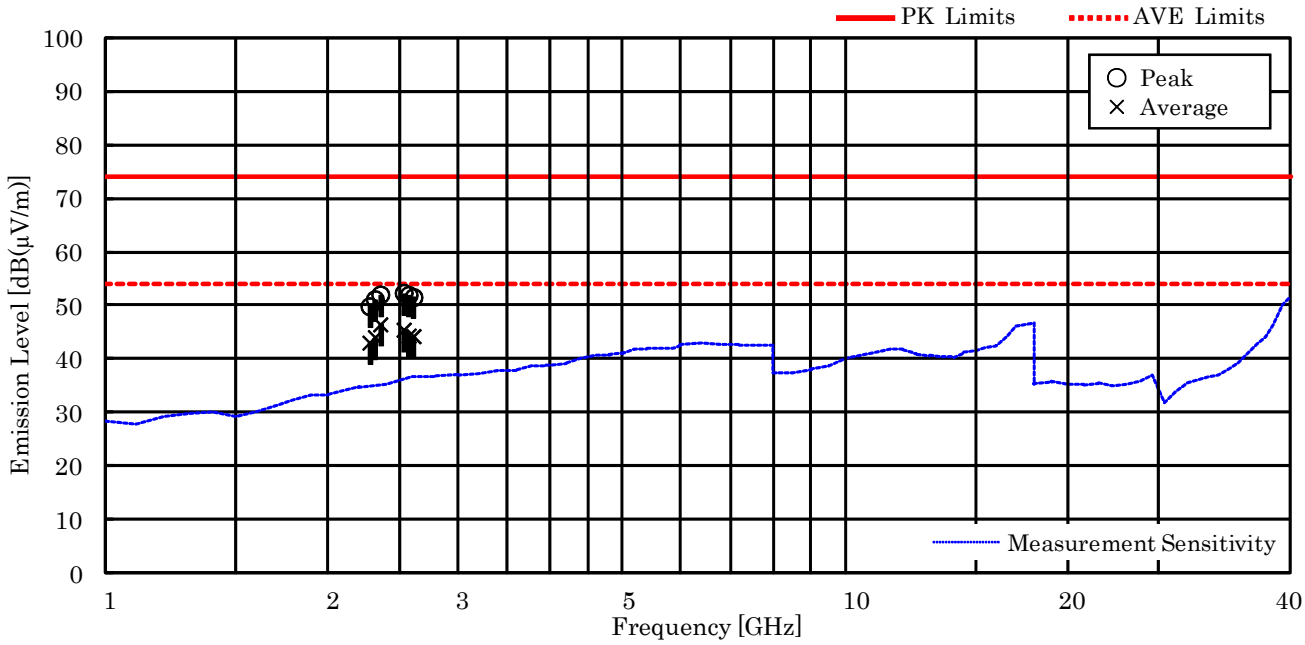
Calculated result at 2352.0 MHz, as the worst point shown on underline:

	Antenna Factor	=	21.6 dB(1/m)
	Corr. Factor	=	0.8 dB
+)	Meter Reading	=	24.1 dB(μV)
	Result	=	46.5 dB(μV/m)

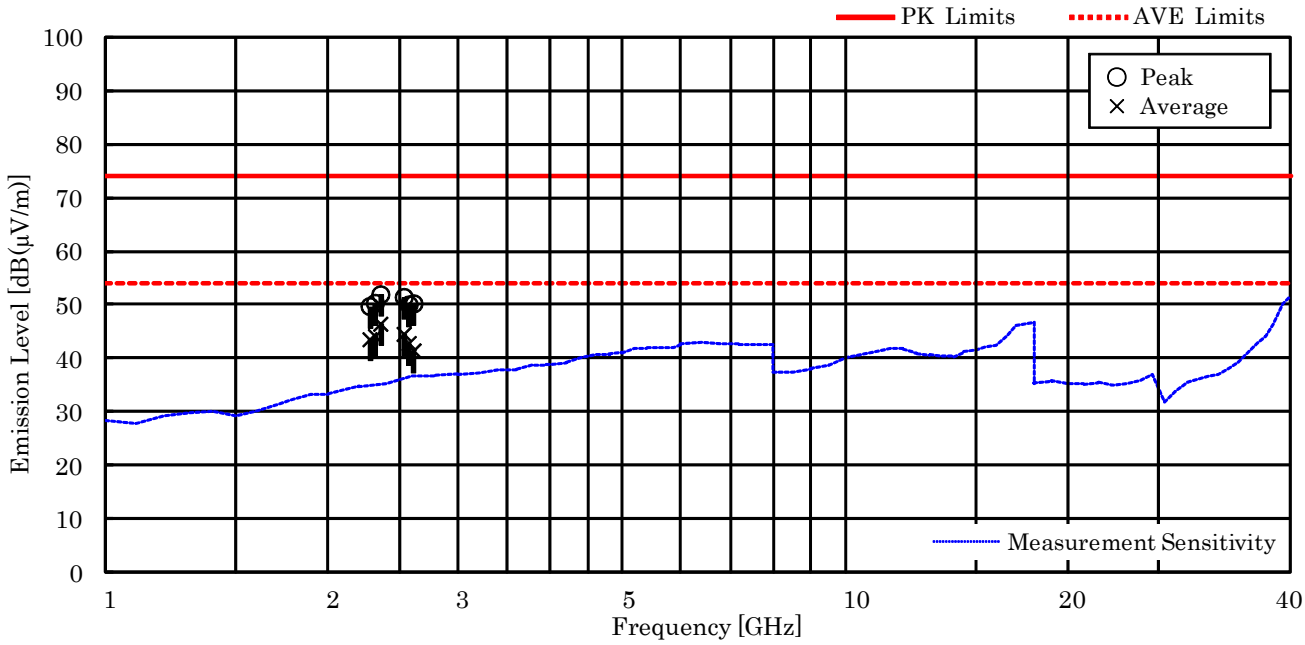
Minimum Margin: 54.0 - 46.5 = 7.5 (dB)

NOTES
1. Test Distance : 3 m
2. The spectrum was checked from 1 GHz to 25 GHz (10th harmonic of the highest fundamental frequency).
3. The correction factor is shown as follows:
   Corr. Factor [dB] = Cable Loss + 20dB Pad Att. - Pre-Amp. Gain [dB] (1.0 - 7.6GHz)
   Corr. Factor [dB] = Cable Loss + 10dB Pad Att. - Pre-Amp. Gain [dB] (7.6 - 18.0GHz)
   Corr. Factor [dB] = Cable Loss - Pre-Amp. Gain [dB] (over 18 GHz)
4. The symbol of "<" means "or less".
5. The symbol of ">" means "more than".
6. PK : Peak / AVE : Average

Mode of EUT : non-BLE 1Mbps
TX Low/Middle/High ch (Horizontal)



TX Low/Middle/High ch (Vertical)



Mode of EUT : non-BLE 2Mbps

Test Date: June 8, 2016
Temp.: 21 °C, Humi: 56 %

Frequency [MHz]	Antenna Factor [dB(1/m)]	Corr. Factor [dB]	Meter Readings [dB(μV)] Horizontal PK	Horizontal AVE	Vertical PK	Vertical AVE	Limits [dB(μV/m)] PK	Limits AVE	Results [dB(μV/m)] PK	Results AVE	Margin [dB]	Remarks
Test condition : Tx Low Ch												
2274.0	21.3	0.8	28.5	20.5	28.1	21.0	74.0	54.0	50.6	43.1	+10.9	
2530.0	21.3	0.9	29.5	22.9	29.2	22.0	74.0	54.0	51.7	45.1	+ 8.9	
4804.0	34.4	-31.4	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 51.0	< 41.0	> +13.0	
12010.0	38.9	-34.8	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 52.1	< 42.1	> +11.9	
19216.0	40.5	-42.8	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.7	< 37.7	> +16.3	
Test condition : TX Middle Ch												
2312.0	21.4	0.8	28.1	21.6	28.4	21.6	74.0	54.0	50.6	43.8	+10.2	
2568.0	21.2	0.9	29.4	22.0	28.8	20.5	74.0	54.0	51.5	44.1	+ 9.9	
4880.0	34.4	-31.3	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 51.1	< 41.1	> +12.9	
7320.0	35.8	-30.9	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 52.9	< 42.9	> +11.1	
12200.0	39.0	-35.1	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 51.9	< 41.9	> +12.1	
19520.0	40.4	-42.7	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.7	< 37.7	> +16.3	
Test condition : TX High Ch												
2352.0	21.6	0.8	30.0	23.6	29.8	23.6	74.0	54.0	52.4	46.0	+ 8.0	
2608.0	21.1	0.9	28.8	21.9	28.3	19.2	74.0	54.0	50.8	43.9	+10.1	
4960.0	34.3	-31.2	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 51.1	< 41.1	> +12.9	
7440.0	35.8	-30.9	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 52.9	< 42.9	> +11.1	
12400.0	39.0	-36.0	< 48.0	< 38.0	< 48.0	< 38.0	74.0	54.0	< 51.0	< 41.0	> +13.0	
19840.0	40.4	-42.8	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.6	< 37.6	> +16.4	
22320.0	40.6	-43.2	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.4	< 37.4	> +16.6	

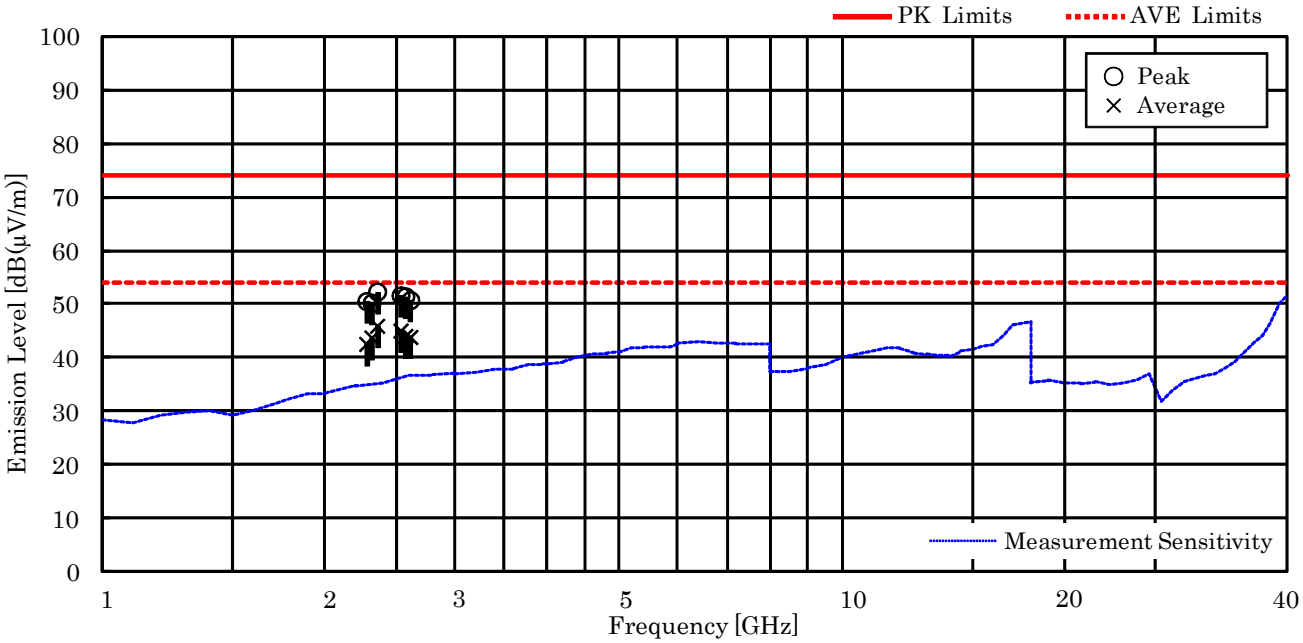
Calculated result at 2352.0 MHz, as the worst point shown on underline:

	Antenna Factor	=	21.6 dB(1/m)
	Corr. Factor	=	0.8 dB
+)	Meter Reading	=	23.6 dB(μV)
	Result	=	46.0 dB(μV/m)

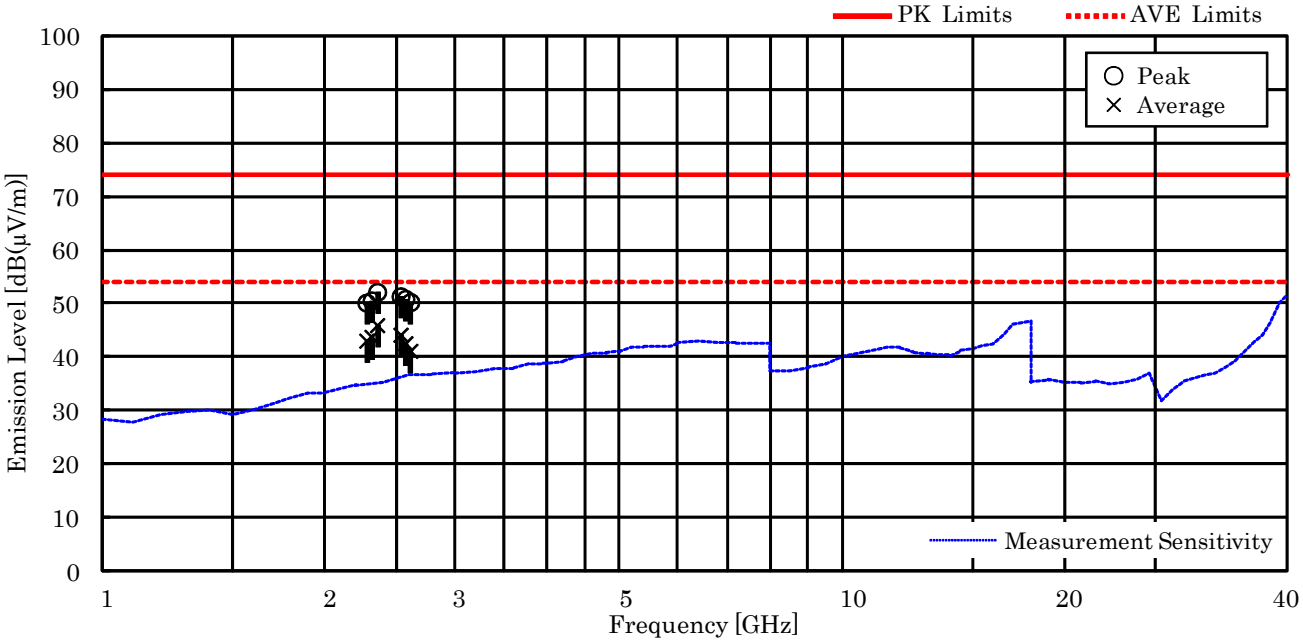
Minimum Margin: 54.0 - 46.0 = 8.0 (dB)

NOTES
1. Test Distance : 3 m
2. The spectrum was checked from 1 GHz to 25 GHz (10th harmonic of the highest fundamental frequency).
3. The correction factor is shown as follows:
   Corr. Factor [dB] = Cable Loss + 20dB Pad Att. - Pre-Amp. Gain [dB] (1.0 - 7.6GHz)
   Corr. Factor [dB] = Cable Loss + 10dB Pad Att. - Pre-Amp. Gain [dB] (7.6 - 18.0GHz)
   Corr. Factor [dB] = Cable Loss - Pre-Amp. Gain [dB] (over 18 GHz)
4. The symbol of "<" means "or less".
5. The symbol of ">" means "more than".
6. PK : Peak / AVE : Average

Mode of EUT : non-BLE 2Mbps
TX Low/Middle/High ch (Horizontal)



TX Low/Middle/High ch (Vertical)



7.10 SAR Test Exclusion

7.10.1 Maximum Output Power (Average)

Band	Mode	Data Rate	Ch#	Frequency (MHz)	Average Power (dBm)	
					Measured	Spec. Max.
2.4 GHz (DTS)	BLE	1 Mbps	0	2402	3.39	4.0
			19	2440	3.44	
			39	2480	3.39	
	non-BLE	1 Mbps	0	2402	3.39	4.0
			39	2441	3.44	
			78	2480	3.40	
		2 Mbps	0	2402	3.38	4.0
			19	2440	3.42	
			39	2480	3.38	

Note(s):
Power measurement is required for the transmission mode configuration with the highest maximum output power specified for production units. (BLE GFSK and non-BLE 1Mpbs/2Mbps GFSK configurations are considered separately.)

- When the same highest maximum output power specification applies to multiple transmission modes, the largest channel bandwidth configuration with the lowest order modulation and lowest data rate is measured.
- When the same highest maximum output power is specified for multiple largest channel bandwidth configurations with the same lowest order modulation or lowest order modulation and lowest data rate, power measurement is required for all equivalent 802.15 configurations with the same maximum output power.

7.10.2 Standalone SAR Test Exclusion Considerations (KDB 447498 D01)

The 1 g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by;
[(*max. power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)] · [√f $_{(GHz)}$] ≤ 3.0, where

- f $_{(GHz)}$ is the RF channel transmit frequency in GHz.
- Power and distance are rounded to the nearest mW and mm before calculation.
- The result is rounded to one decimal place for comparison.
- When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied.

SAR exclusion calculations for antenna ≤ 50 mm from the user

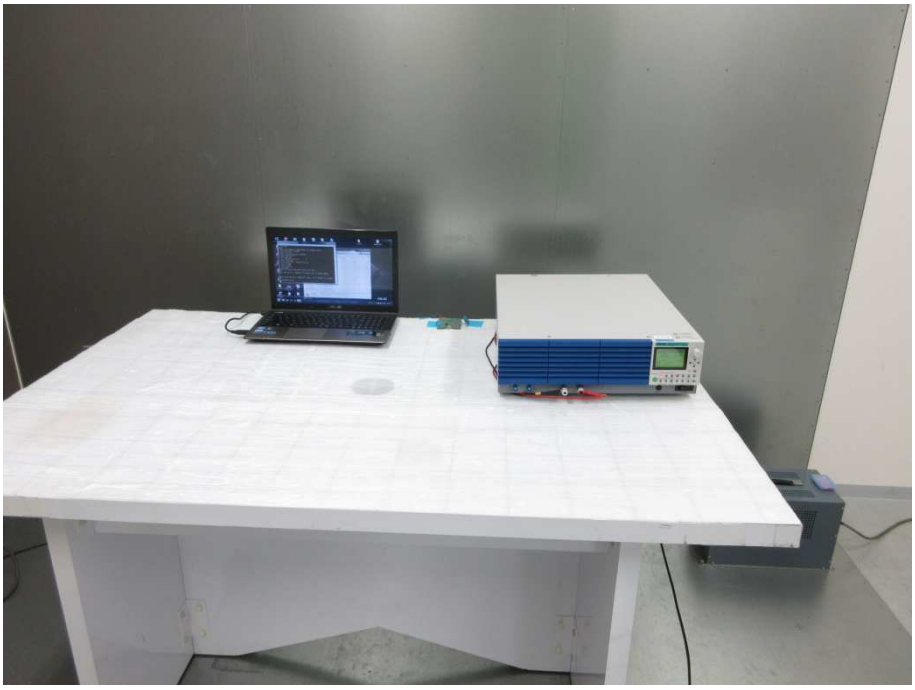
Band	Freq. (MHz)	Max. Power		Distance (mm)	Threshold	Test Exclusion
		(dBm)	(mW)			
BLE	2440	4.0	2.5	< 5	0.9	YES

The minimum user separation distance was assumed to be 0 mm for the purpose of the SAR exclusion calculations.

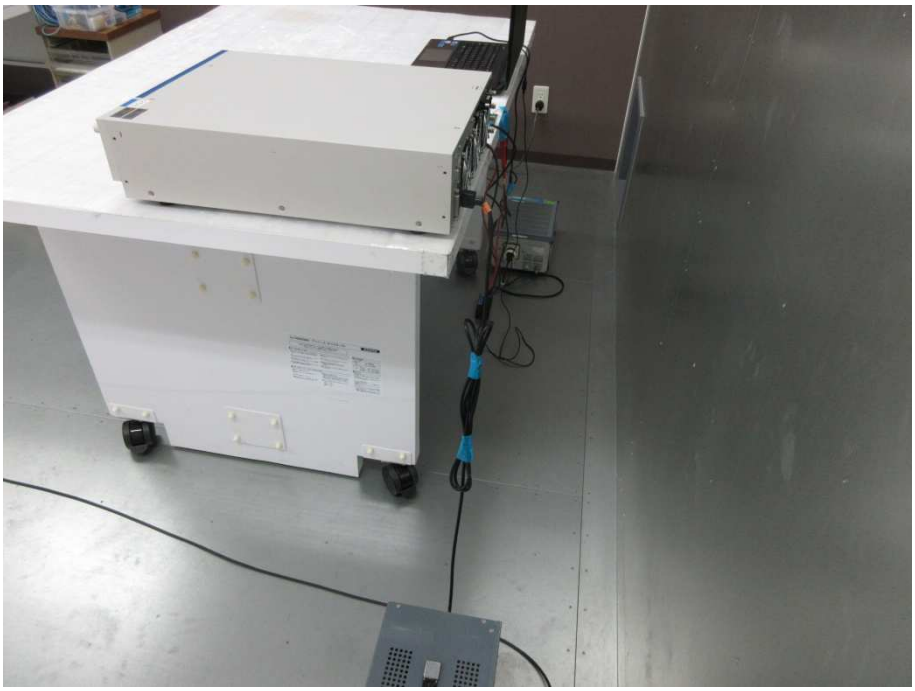
Conclusion:
The device qualifies for the Standalone SAR test exclusion because the computed value is < 3.

7.11 Test Setup (Photographs)

7.11.1 AC Powerline Conducted Emission



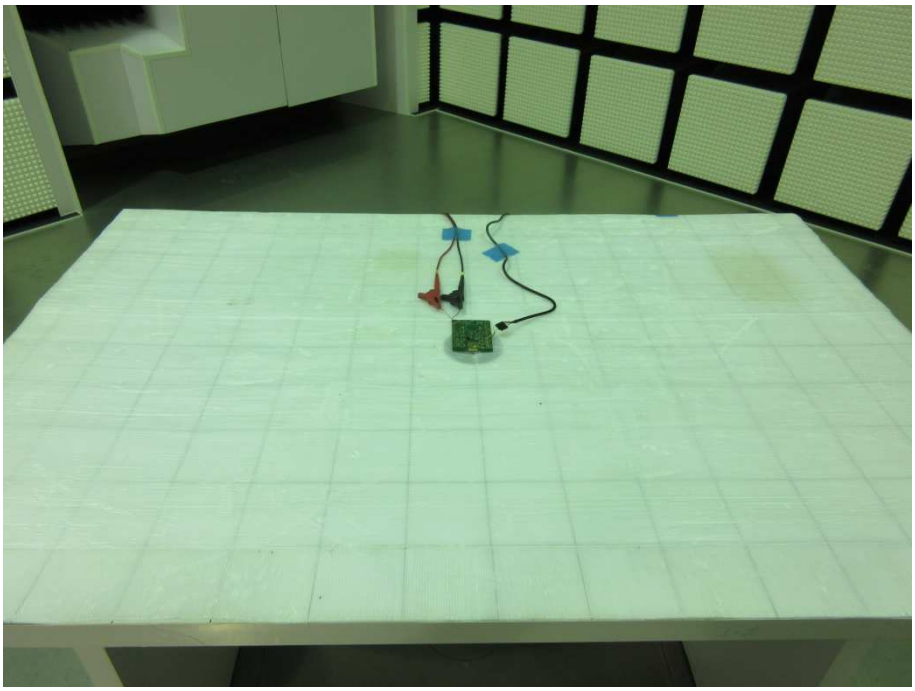
– Front View –



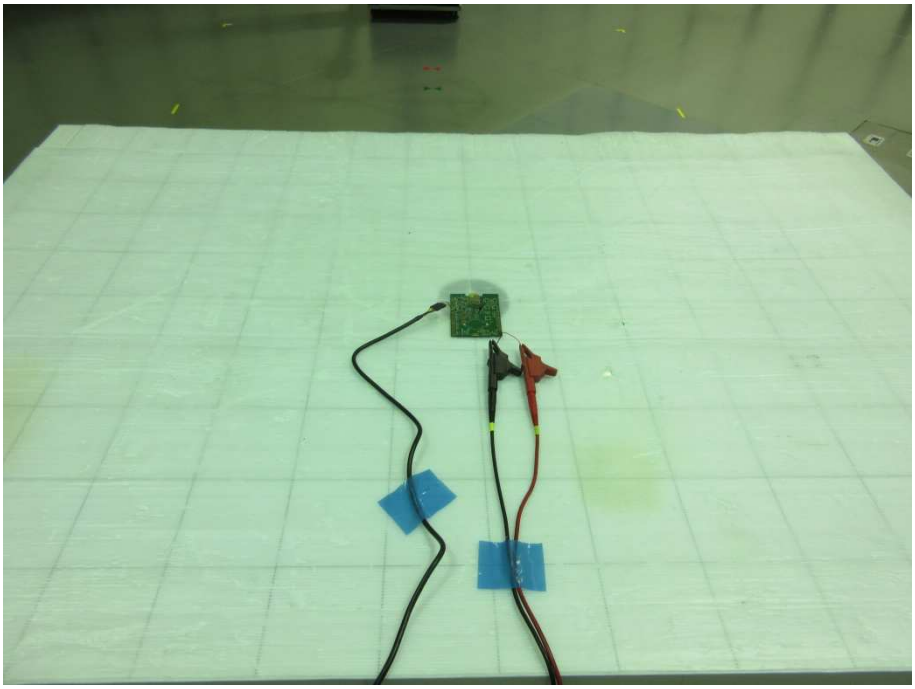
– Side View –

Photograph present configuration with maximum emission

7.11.2 Radiated Emission(9kHz – 1000MHz)

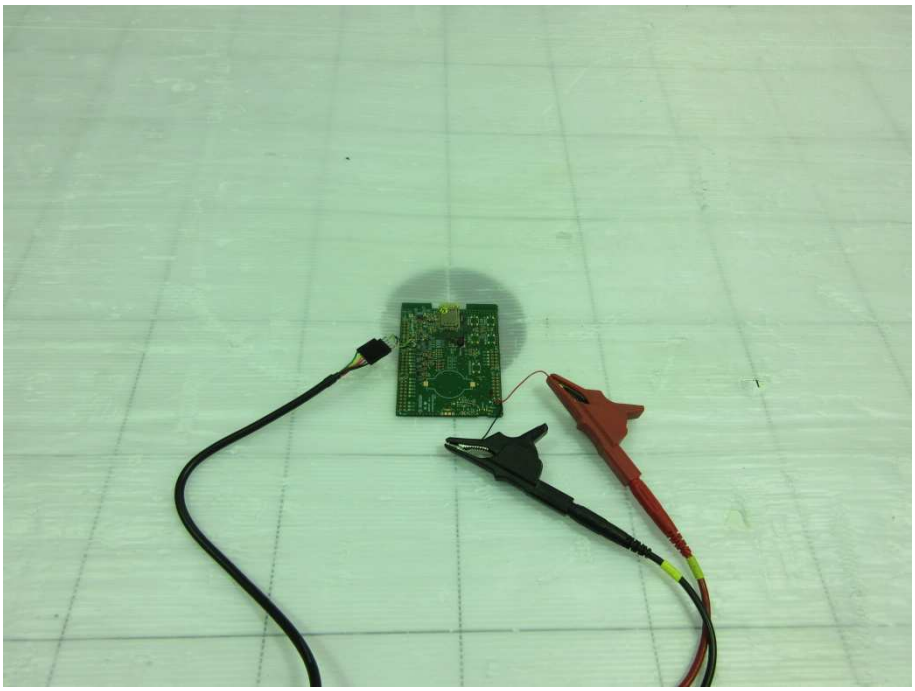


– Front View–

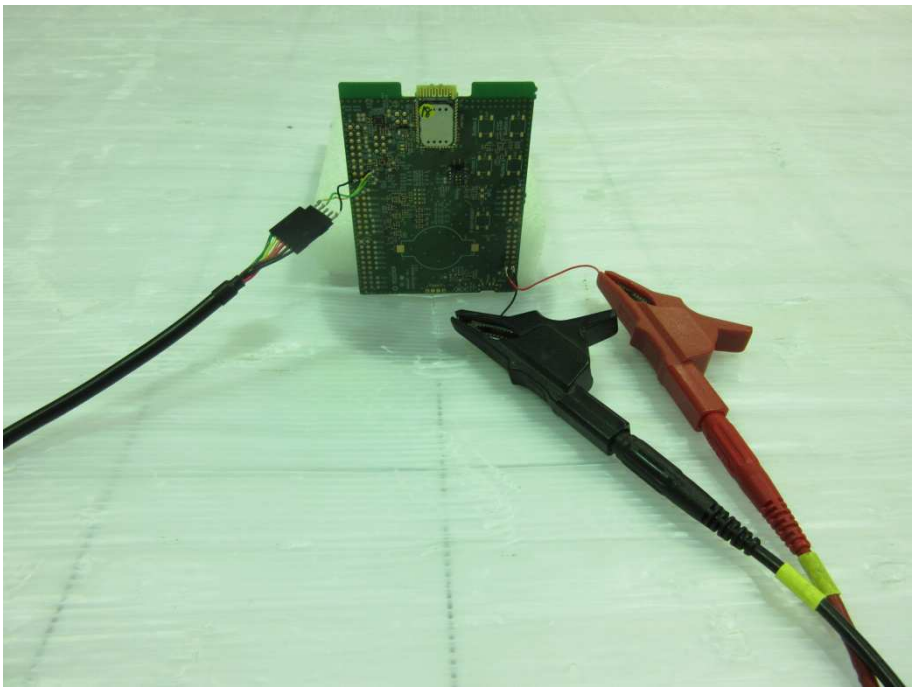


– Rear View –

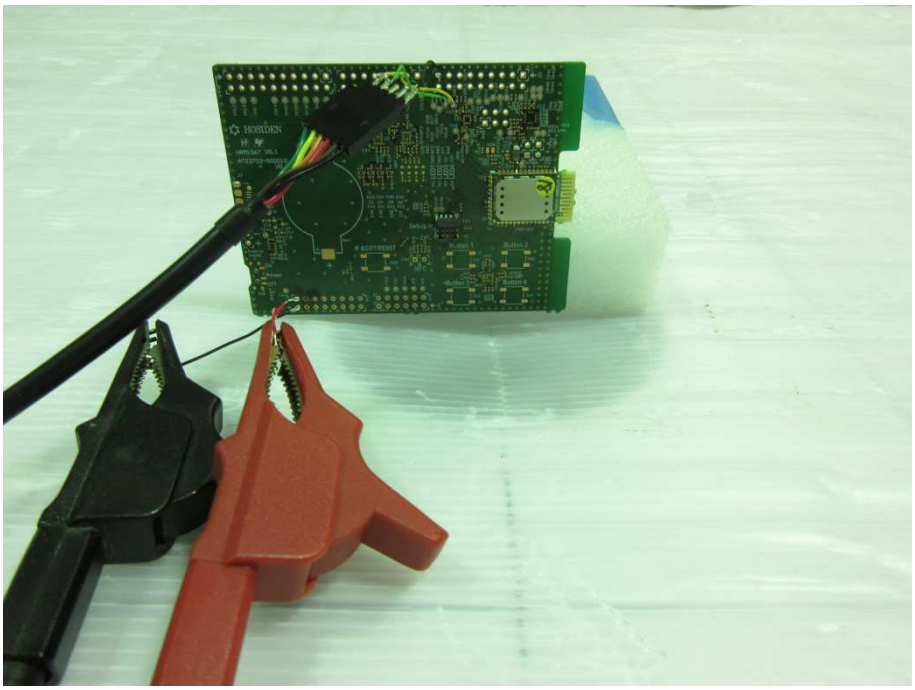
Photograph present configuration with maximum emission



–X axis–



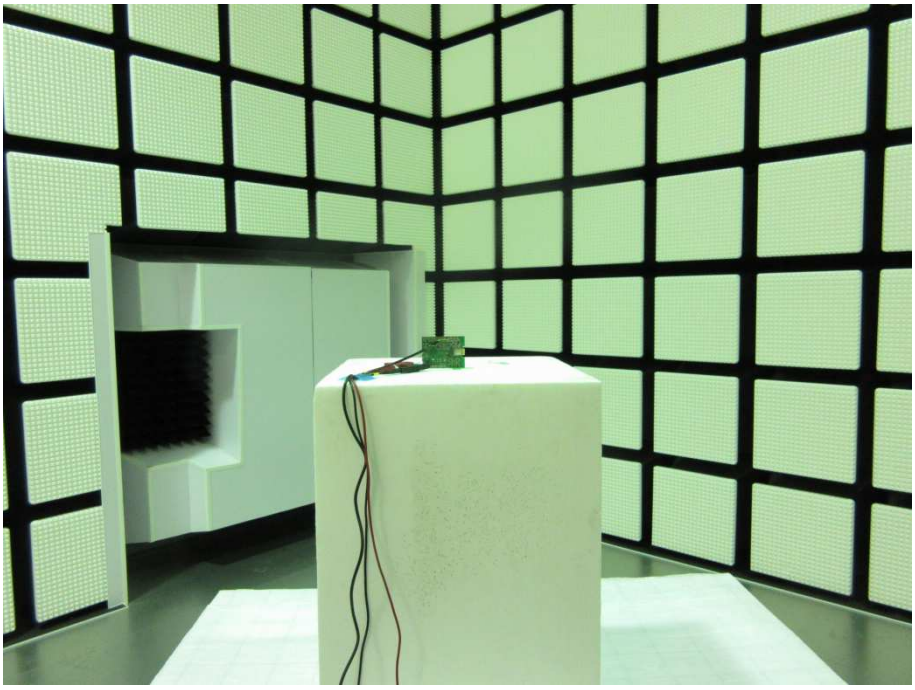
–Y axis–



– Z axis –

7.11.3 Radiated Emission(Above 1GHz)

–Front View–



–Rear View–

Photograph present configuration with maximum emission