JQA File No. : KL80160049
Issue Date : May 24, 2016

TEST REPORT

Applicant	:	SHARP CORPORATION, Consumer Electronics Company, Communication Systems Division
Address	:	2-13-1, Iida Hachihonmatsu, Higashi-Hiroshima City, Hiroshima, 739-0192, Japan
Products	:	Smart Phone
Model No.	:	507SH
Serial No.	:	004401/11/576727/5 004401/11/576771/3
FCC ID	:	APYHRO00237
Test Standard	:	CFR 47 FCC Rules and Regulations Part 15
Test Results	:	**Passed**
Date of Test	:	April 19 ~ 25, 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

VLAC Lab Accreditation VLAC-001-2

- 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	**EMC**	: Electromagnetic Compatibility
AE	: Associated Equipment	**EMI**	: Electromagnetic Interference
N/A	: Not Applicable	**EMS**	: Electromagnetic Susceptibility
N/T	: Not Tested		

☑ - 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	:	SHARP CORPORATION, Consumer Electronics Company, Communication Systems Division 2-13-1, Iida Hachihonmatsu, Higashi-Hiroshima City, Hiroshima, 739-0192, Japan
2.	Products	:	Smart Phone
3.	Model No.	:	507SH
4.	Serial No.	:	004401/11/576727/5 004401/11/576771/3
5.	Product Type	:	Pre-production
6.	Date of Manufacture	:	March, 2016
7.	Power Rating	:	4.0VDC (Lithium-ion Battery UBATIA270AFN1 3010mAh)
8.	Grounding	:	None
9.	Transmitting Frequency	:	2402.0 MHz(00CH) – 2480.0MHz(78CH)
10.	Receiving Frequency	:	2402.0 MHz(00CH) – 2480.0MHz(78CH)
11.	Max. RF Output Power	:	12.26dBm(Measure Value)
12.	Antenna Type	:	Inverted-L Type Antenna (Integral)
13.	Antenna Gain	:	0 dBi
14.	Category	:	Spread Spectrum Transmitter(FHSS)
15.	EUT Authorization	:	Certification
16.	Received Date of EUT	:	April 19, 2016

17. Channel Plan

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:

Normal Mode:
Transmitting Frequency (in MHz) = 2402.0 + n
Receiving Frequency (in MHz) = 2402.0 + 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:

S. Kino

Shigeru Kinoshita
Assistant Manager
JQA KITA-KANSAI Testing Center
SAITO EMC Branch

Tested by:

Shigeru Osawa

Shigeru Osawa
Deputy 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.

FCC Public Notice DA 00-705, released March 30, 2000.

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

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	Smart Phone	Sharp	507SH	004401/11/576727/5 *1) 004401/11/576771/3 *2)	APYHRO00237
B	AC Adapter	Sharp	SHCEJ1	--	N/A
C	Earphone	Softbank	ZTCAA1	--	N/A
D	DTV Antenna	Sharp	--	--	N/A

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

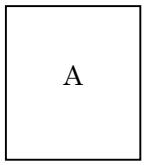
The auxiliary equipment used for testing :
None

Type of Cable:

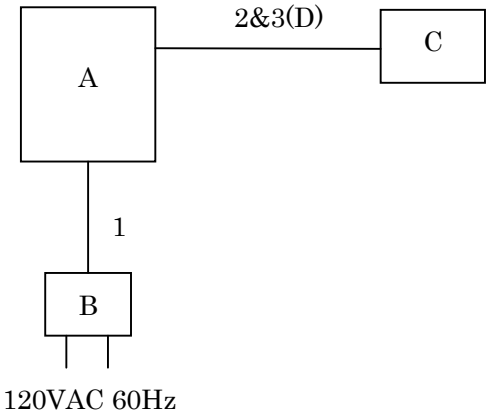
No.	Description	Identification (Manu. etc.)	Connector Shielded	Cable Shielded	Ferrite Core	Length (m)
1	USB conversion cable	--	--	NO	NO	1.5
2	Earphone Cable	--	--	NO	NO	0.5
3	DTV Antenna Cable	--	--	NO	NO	0.1

6.2 Test Arrangement (Drawings)

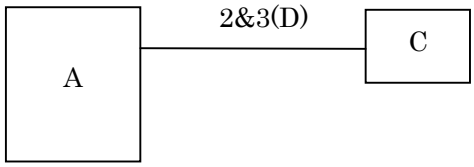
a) Single Unit



b) AC Adapter used



c) Earphone used



6.3 Operating Condition

Power Supply Voltage : 4.0 VDC (for Battery)
120 VAC, 60 Hz (For AC Adapter)

Transmitting/Receiving
Bluetooth 4.0 + EDR + LE
Transmitting frequency : 2402.0 MHz(0CH) – 2480.0 MHz(78CH)
Receiver frequency : 2402.0 MHz(0CH) – 2480.0 MHz(78CH)

The test were carried under 2 mode shown as follows:
1) BDR
2) EDR
In Spurious Emissions(Conducted) and Radiated Emissions, the worst case is BDR mode.

Modulation Type
1. DH1/ DH3/ DH5 Packet (Modulation Type : GFSK)
2. 2DH1/ 2DH3/ 2DH5 Packet (Modulation Type : pi/4-DQPSK)
3. 3DH1/ 3DH3/ 3DH5 Packet (Modulation Type : 8DPSK)

Other Clock Frequency
19.2MHz, 27MHz, 27.12MHz

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: 31_32_507SH_WLAN_BT Manual test mode operation_ver 2
- Software Version: Version 2
- Storage Location: Controller PC(supplied by applicant)

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)	Section 7.1	Passed	-
Minimum Hopping Channel	Section 15.247(a)(1)(iii)	Section 7.2	Passed	-
Occupied Bandwidth	Section 15.247(a)(1)	Section 7.3	Passed	-
Dwell Time	Section 15.247(a)(1)(iii)	Section 7.4	Passed	-
Peak Output Power (Conduction)	Section 15.247(b)(1)	Section 7.5	Passed	-
Peak Power Density (Conduction)	Section 15.247(e)	-	-	-
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	-

7.1 Channel Separation

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

7.1.1 Test Results

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

Channel Separation is 1.000 MHz
Channel Separation (Inquiry) is 2.000 MHz

Uncertainty of Measurement Results ± 0.9 %(2σ)

Remarks : _____

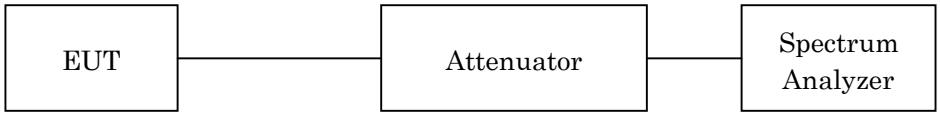
7.1.2 Test Instruments

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

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

7.1.3 Test Method and Test Setup (Diagrammatic illustration)

The test system is shown as follows:



The setting of the spectrum analyzer are shown as follows:

Res. Bandwidth	100 kHz
Video Bandwidth	300 kHz
Span	3 MHz / 5 MHz
Sweep Time	AUTO
Trace	Maxhold

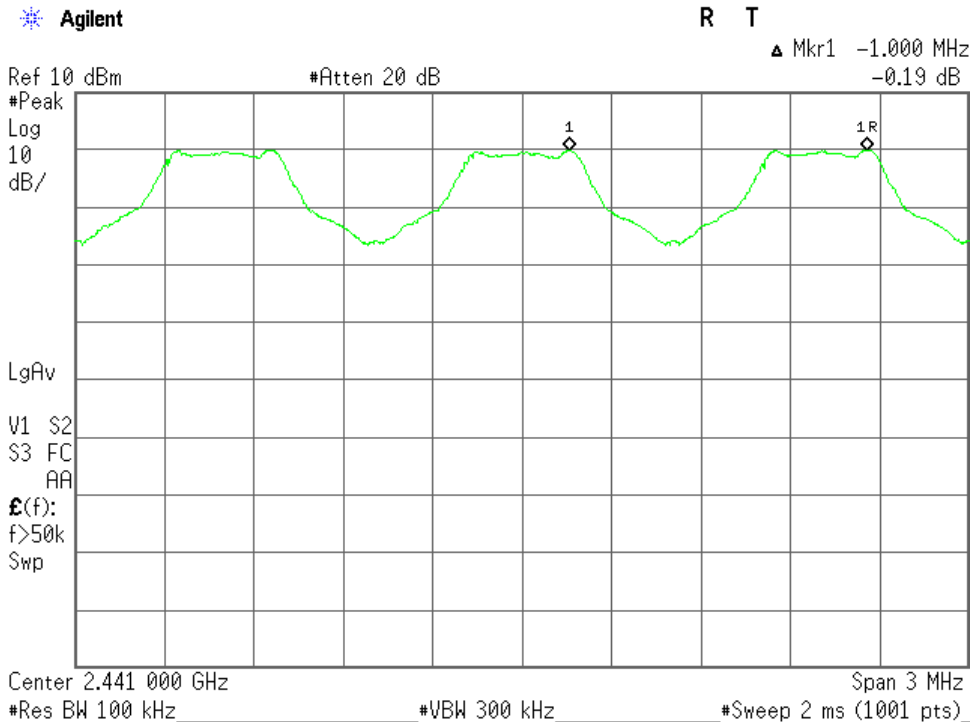
7.1.4 Test Data

Test Date :April 25, 2016
Temp.:23°C, Humi:52%

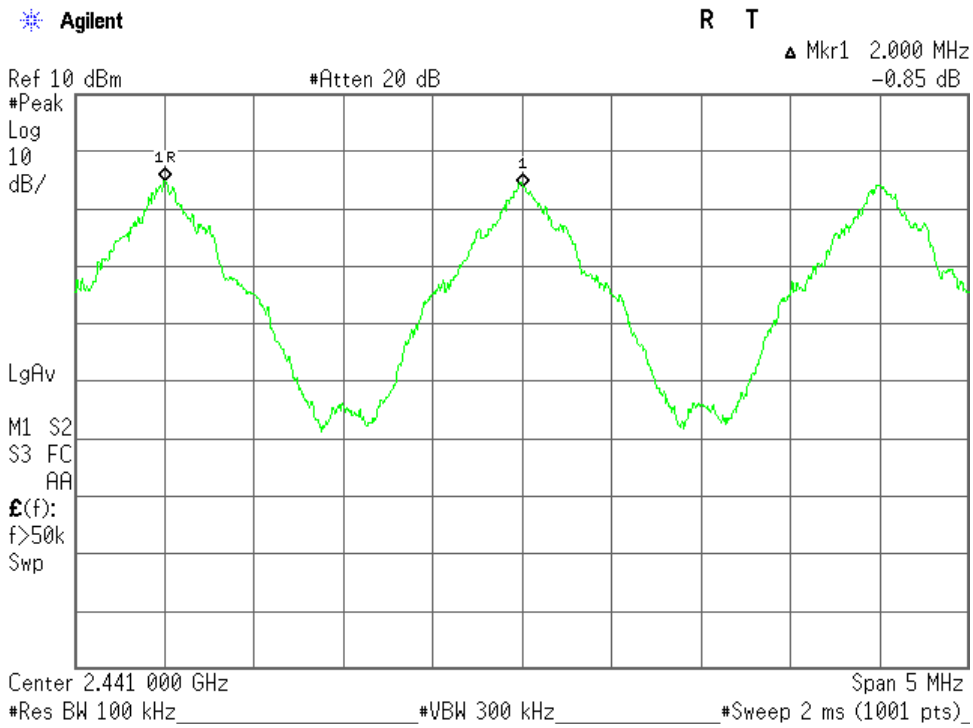
Mode of EUT	Channel Separation (MHz)	Limit* (MHz)
Hopping	1.000	0.855
Inquiry	2.000	0.551

Note: Two-thirds of the maximum 20 dB bandwidth of the hopping channel or 25 kHz (whichever is greater). Refer to the section 7.3.

Mode of EUT : Hopping



Mode of EUT : Inquiry



7.2 Minimum Hopping Channel

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

7.2.1 Test Results

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

Number of Channel is 79
Number of Channel (Inquiry) is 32
Number of Channel (AFH) is 20

Remarks : _____

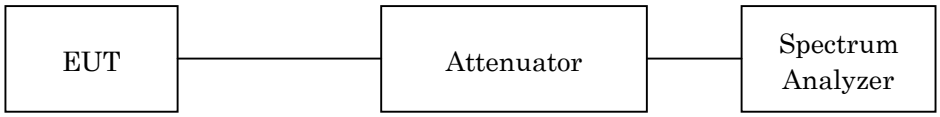
7.2.2 Test Instruments

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

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

7.2.3 Test Method and Test Setup (Diagrammatic illustration)

The test system is shown as follows:



The setting of the spectrum analyzer are shown as follows:

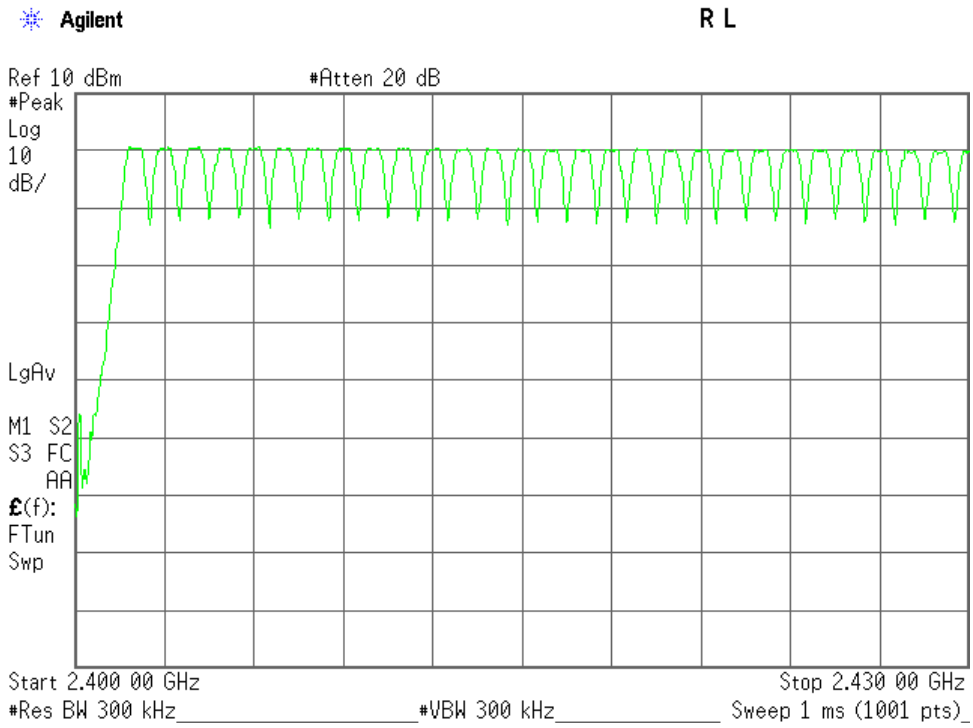
Res. Bandwidth	300 kHz
Video Bandwidth	300 kHz
Span	30 MHz
Sweep Time	AUTO
Trace	Maxhold

7.2.4 Test Data

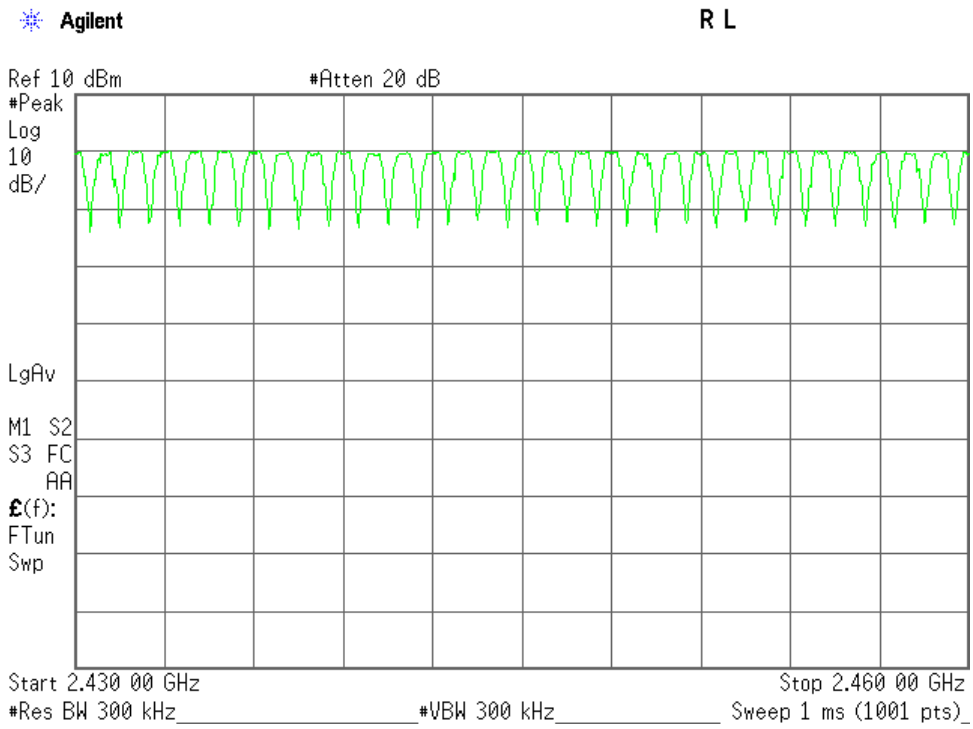
Test Date :April 25, 2016
Temp.:23°C, Humi:52%

Mode of EUT	Minimum Hopping Channel	Limit
Hopping	79	15
Inquiry	32	15
AFH(minimum)	20	15

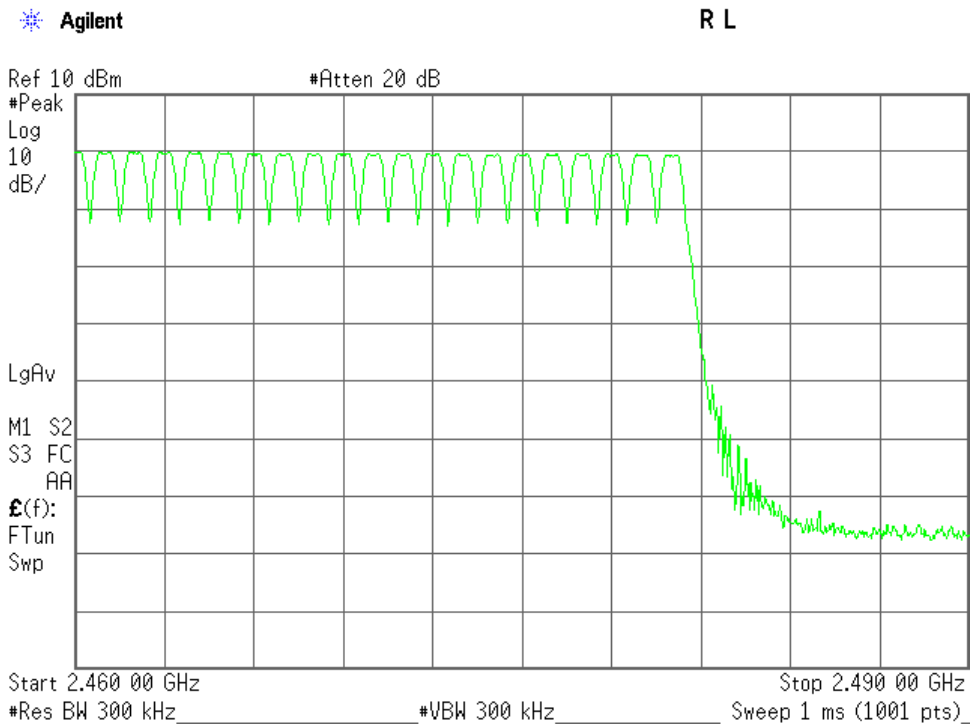
Mode of EUT : Hopping(1/3)



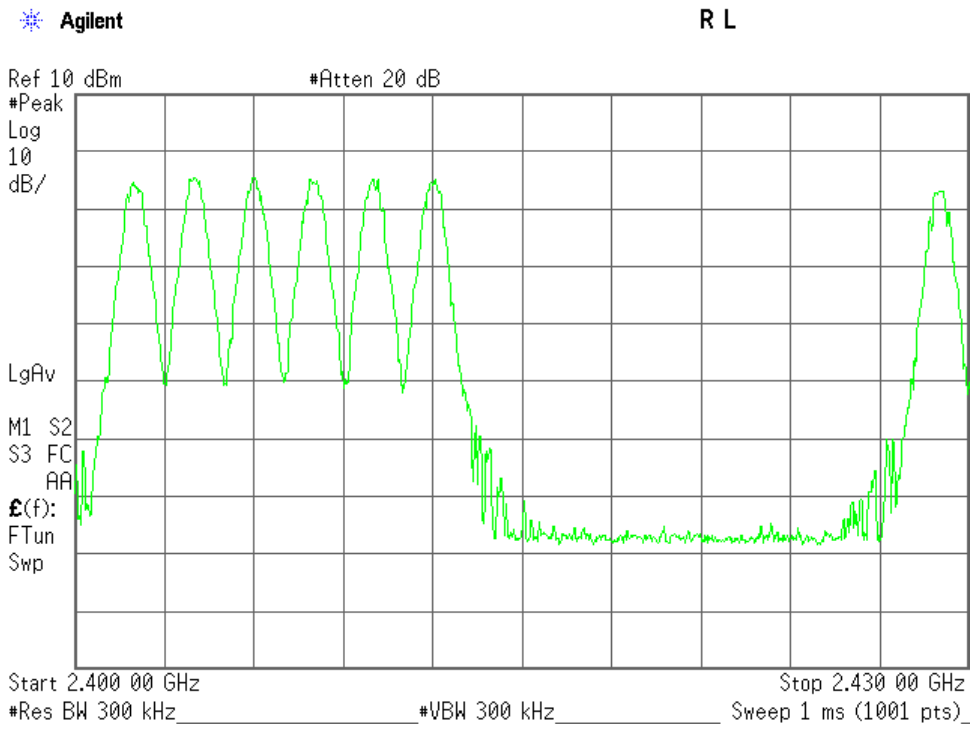
Mode of EUT : Hopping(2/3)



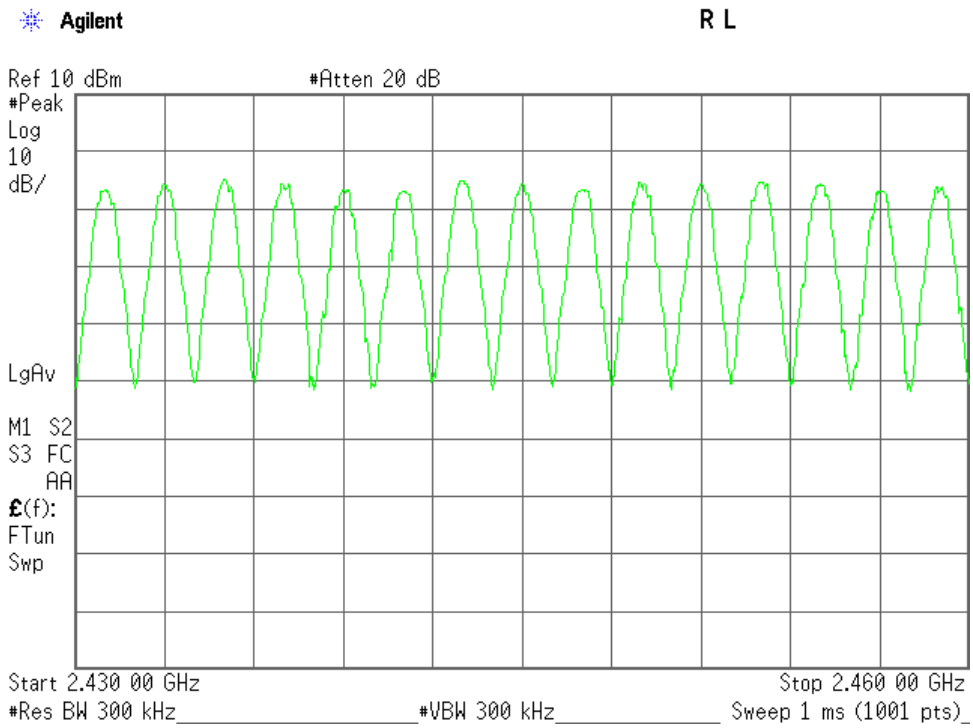
Mode of EUT : Hopping(3/3)



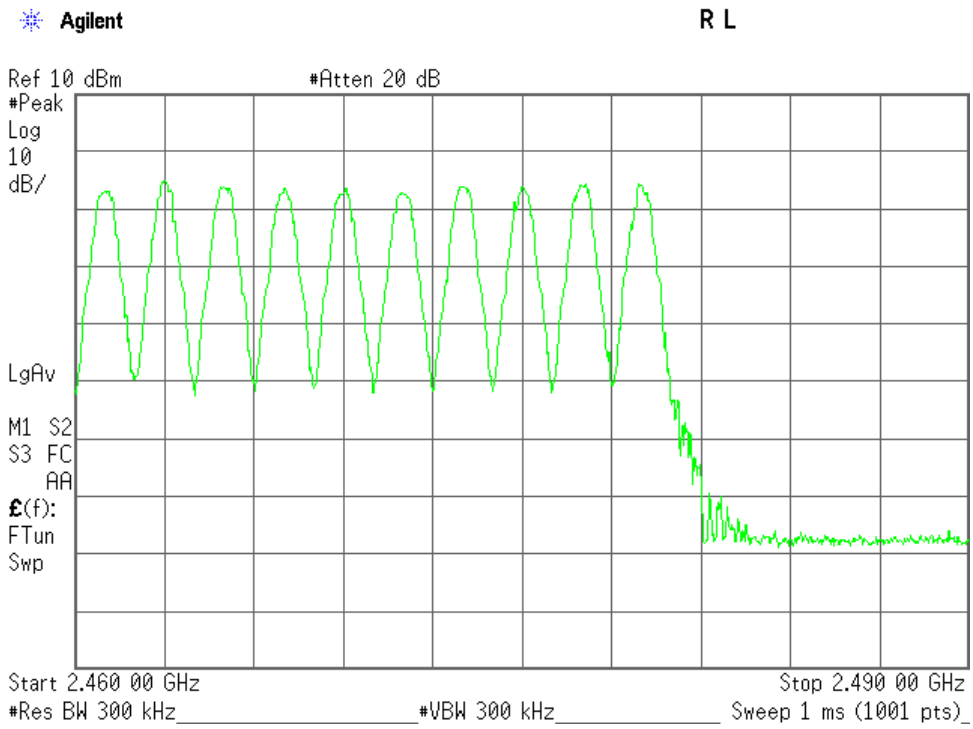
Mode of EUT : Inquiry(1/3)



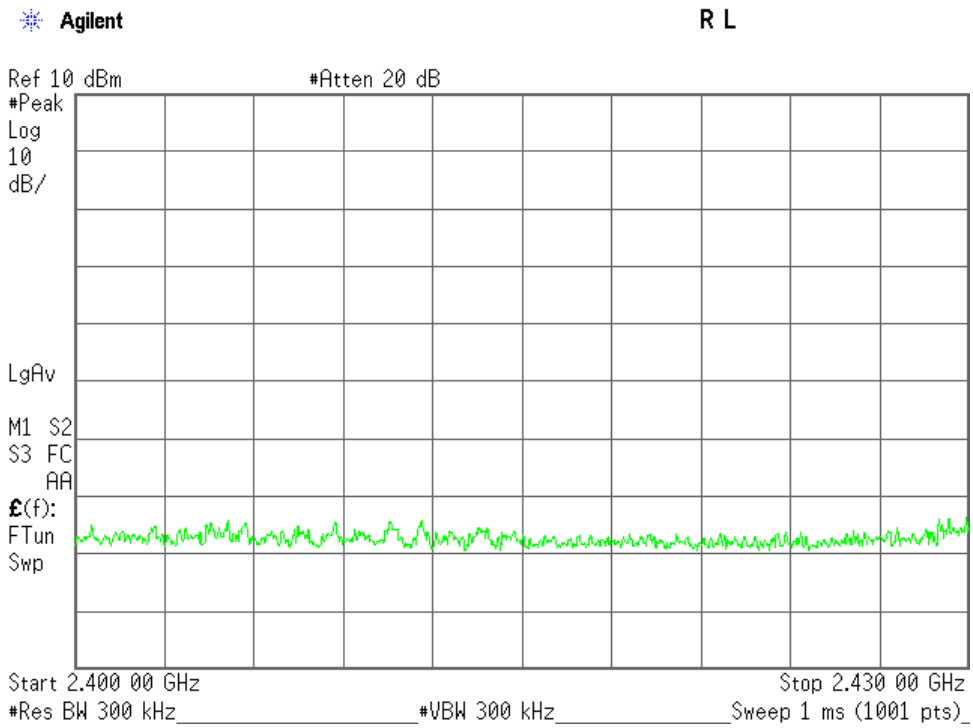
Mode of EUT : Inquiry(2/3)



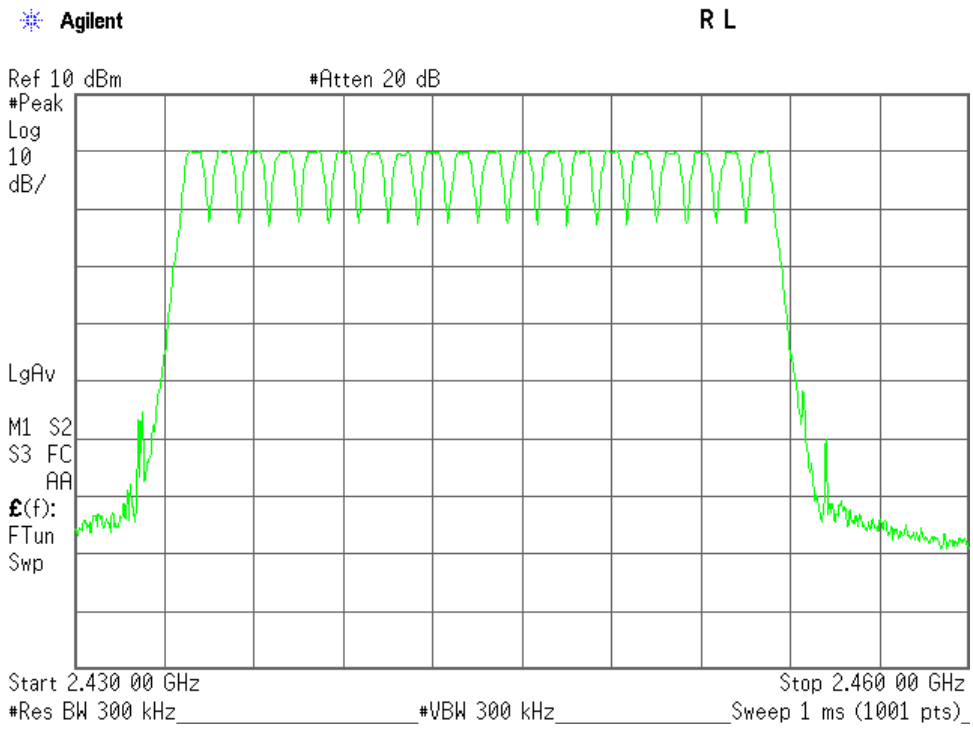
Mode of EUT : Inquiry(3/3)



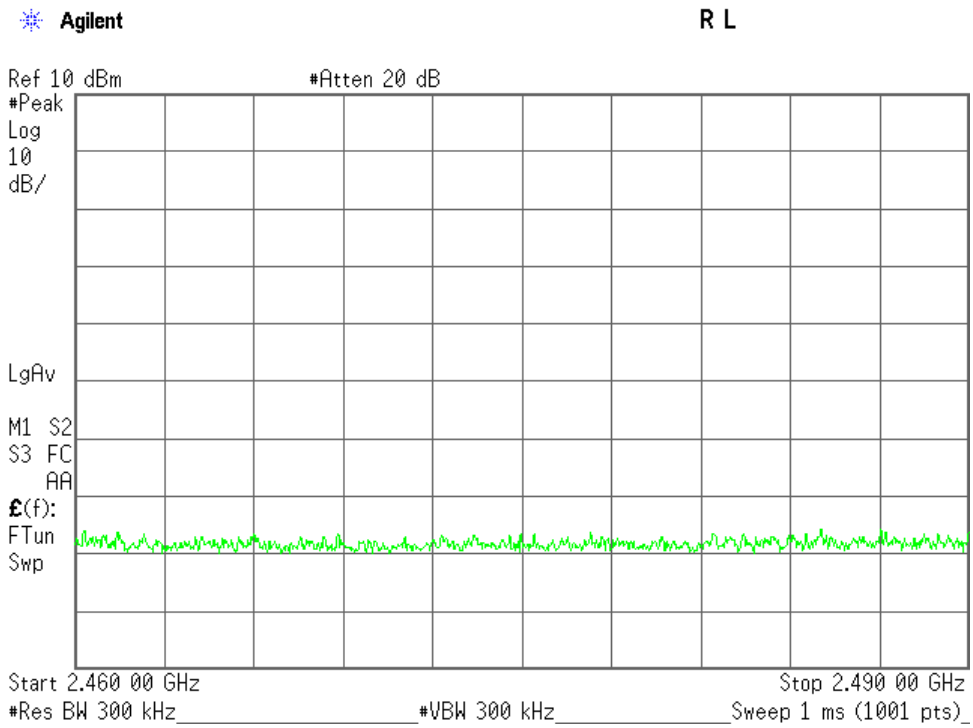
Mode of EUT : AFH(minimum)(1/3)



Mode of EUT : AFH(minimum) (2/3)



Mode of EUT : AFH(minimum) (3/3)



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 is 1174.9 kHz at 2402.0 MHz
The 20dB Bandwidth is 1283.0 kHz at 2441/ 2480 MHz

Uncertainty of Measurement Results ± 0.9 %(2σ)

Remarks : _____

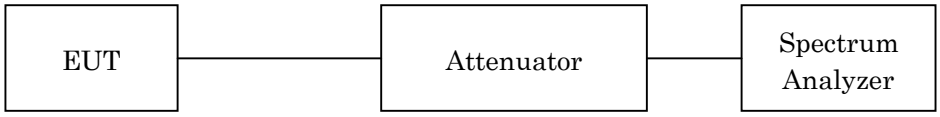
7.3.2 Test Instruments

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

Res. Bandwidth	30 kHz
Video Bandwidth	100 kHz
Span	2 MHz / 3 MHz
Sweep Time	AUTO
Trace	Maxhold

7.3.4 Test Data

Mode of EUT : BDR+EDR

Test Date :April 25, 2016
Temp.:23°C, Humi:52%

The resolution bandwidth was set to about 1% of emission bandwidth, -20dBc 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.

1)Packet Setting : DH5(Modulation type : GFSK)

Channel	Frequency (MHz)	99% Bandwidth (kHz)	-20dBc Bandwidth (kHz)	Two-thirds of the 20 dB bandwidth (kHz)
00	2402.0	905.7	975.0	650.0
39	2441.0	905.2	976.4	650.9
78	2480.0	913.7	992.4	661.6

2)Packet Setting : 2DH5(Modulation type : pi/4-DQPSK)

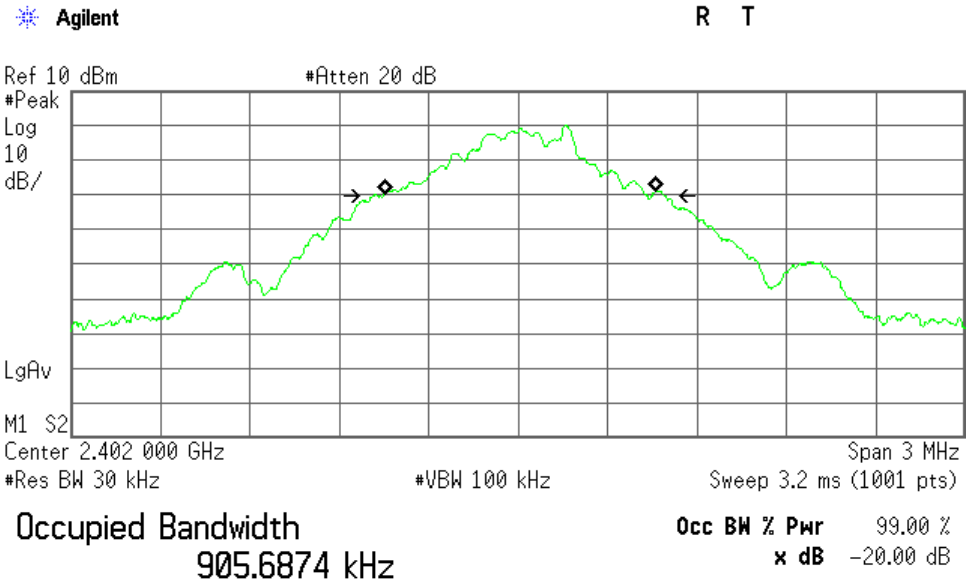
Channel	Frequency (MHz)	99% Bandwidth (kHz)	-20dBc Bandwidth (kHz)	Two-thirds of the 20 dB bandwidth (kHz)
00	2402.0	1174.9	1281.0	854.0
39	2441.0	1174.2	1283.0	855.3
78	2480.0	1172.4	1281.0	854.0

3)Packet Setting : 3DH5(Modulation type : 8DPSK)

Channel	Frequency (MHz)	99% Bandwidth (kHz)	-20dBc Bandwidth (kHz)	Two-thirds of the 20 dB bandwidth (kHz)
00	2402.0	1168.3	1280.0	853.3
39	2441.0	1170.4	1283.0	855.3
78	2480.0	1170.0	1283.0	855.3

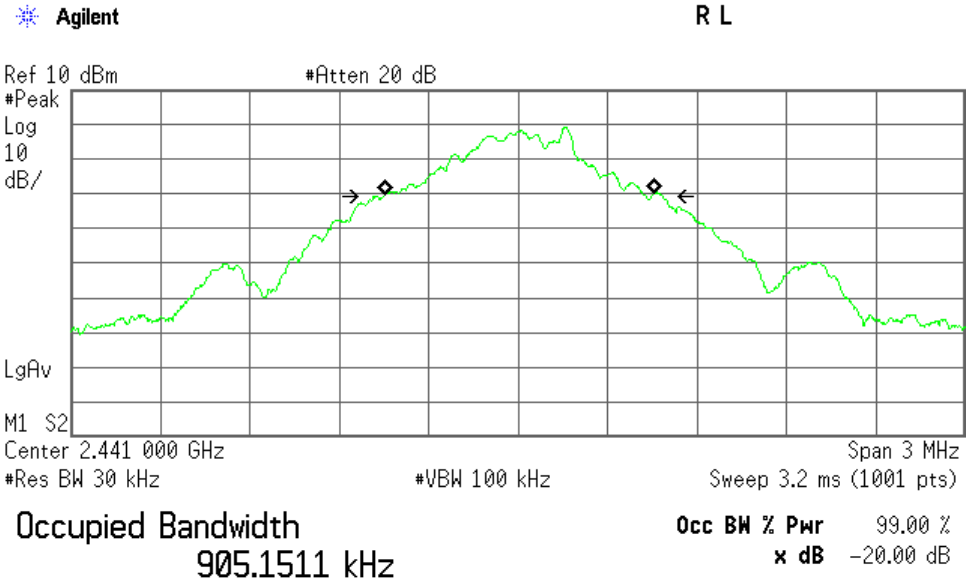
1)Packet Setting : DH5(Modulation type : GFSK)

Low Channel



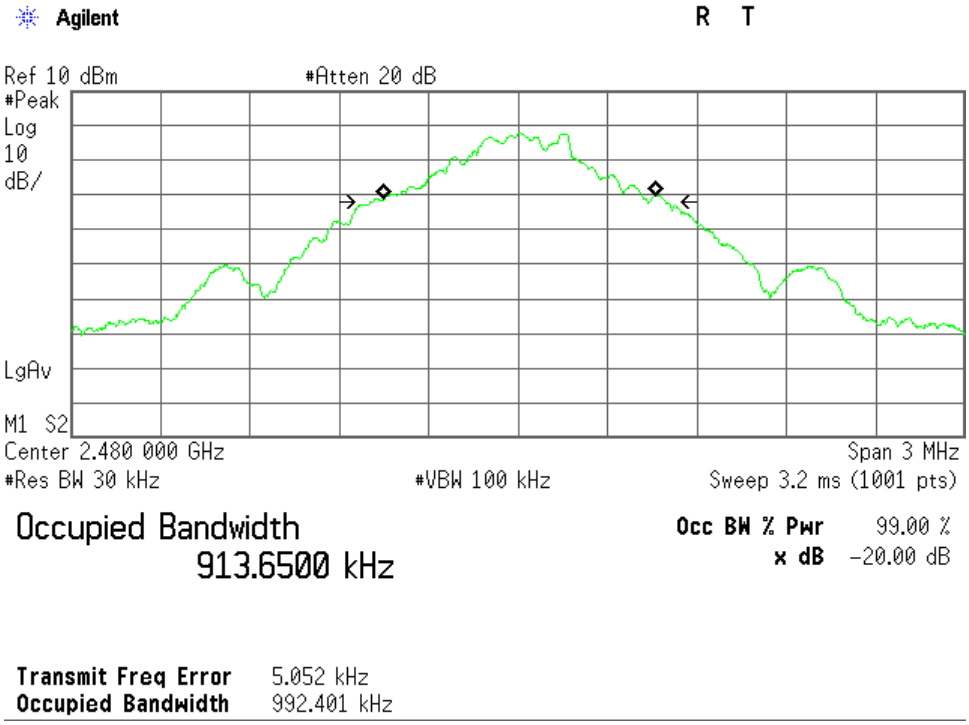
Transmit Freq Error 7.032 kHz
Occupied Bandwidth 975.022 kHz

Middle Channel



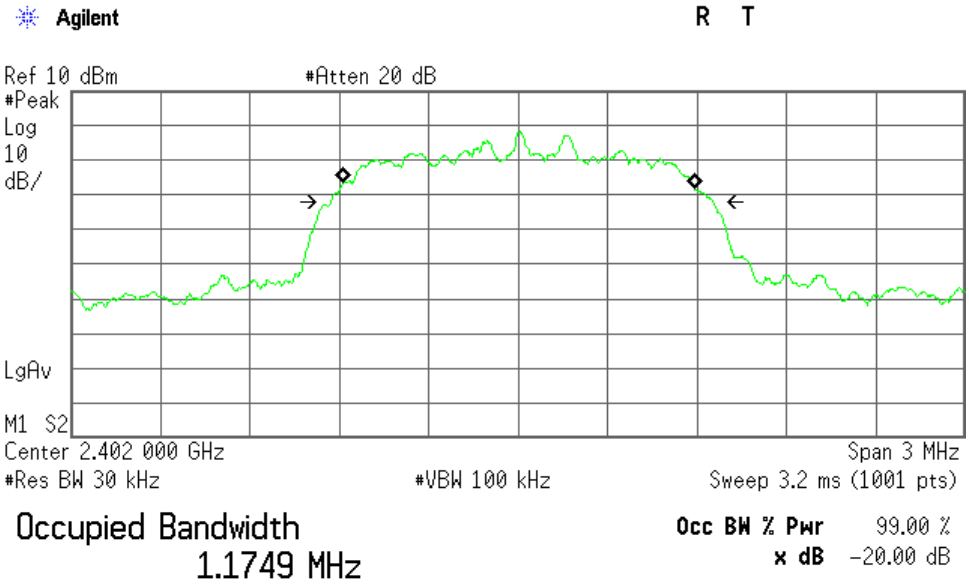
Transmit Freq Error 4.608 kHz
Occupied Bandwidth 976.417 kHz

High Channel



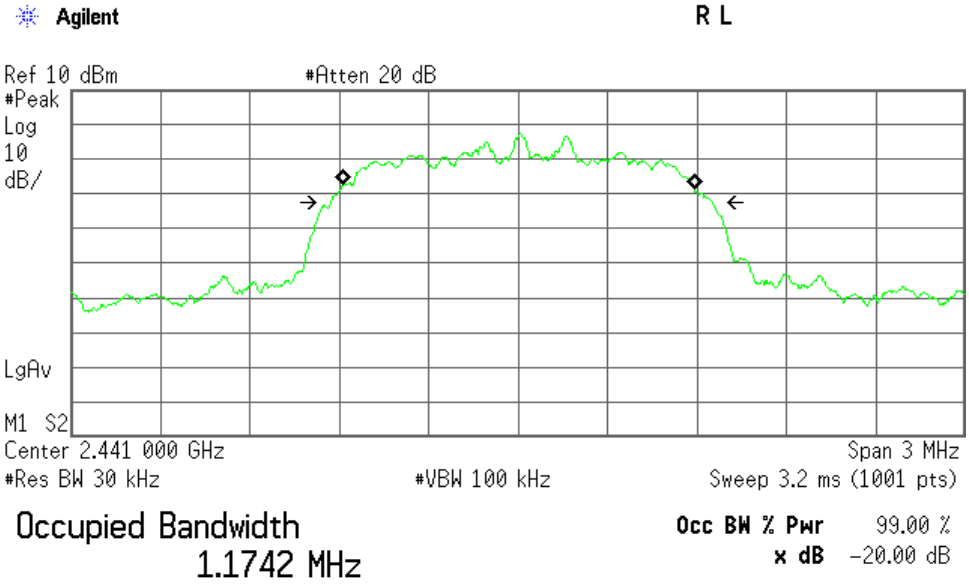
2)Packet Setting : 2DH5(Modulation type : pi/4-DQPSK)

Low Channel



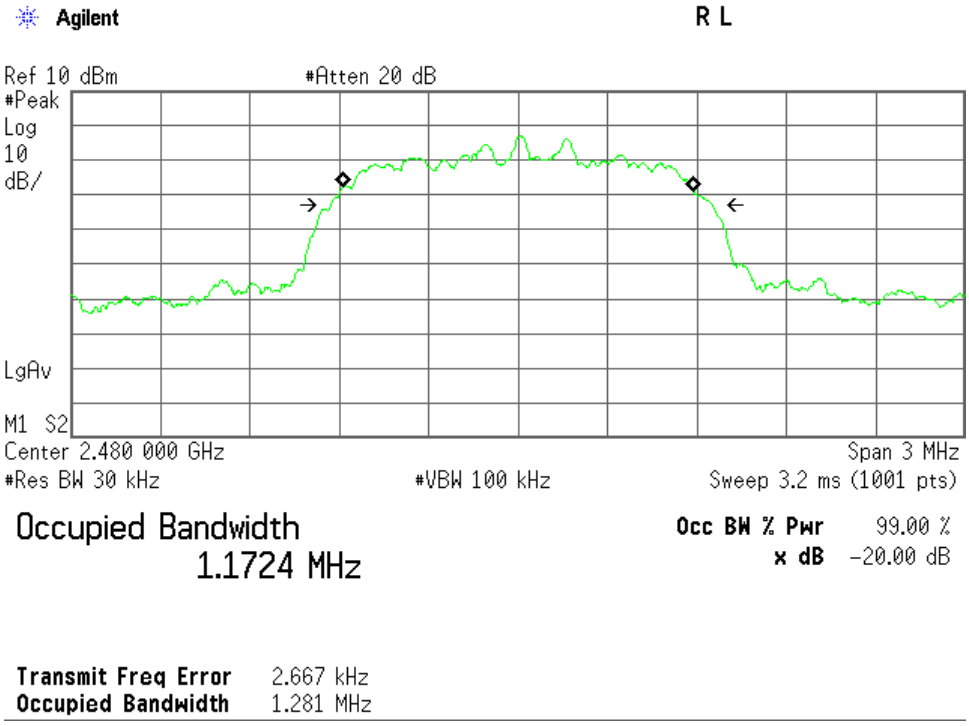
Transmit Freq Error	3.821 kHz
Occupied Bandwidth	1.281 MHz

Middle Channel



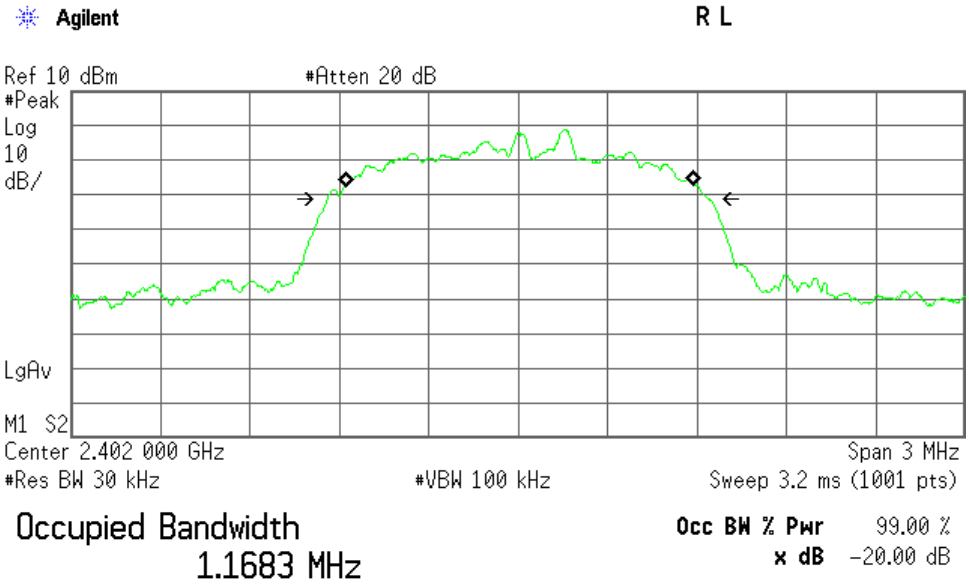
Transmit Freq Error	2.885 kHz
Occupied Bandwidth	1.283 MHz

High Channel



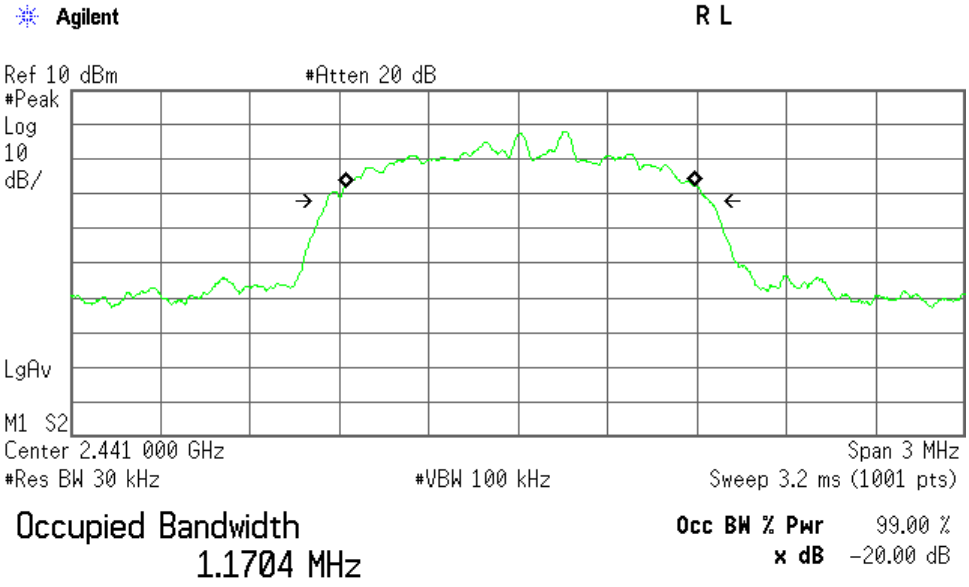
3)Packet Setting : 3 DH5(Modulation type : 8DPSK)

Low Channel



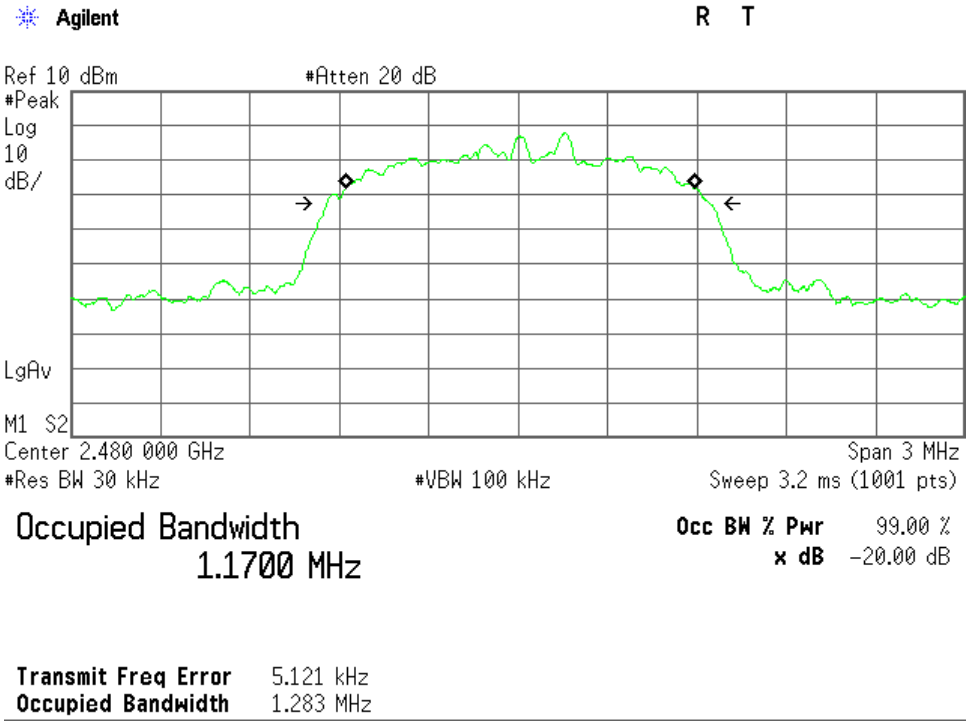
Transmit Freq Error	4.500 kHz
Occupied Bandwidth	1.280 MHz

Middle Channel



Transmit Freq Error	5.087 kHz
Occupied Bandwidth	1.283 MHz

High Channel



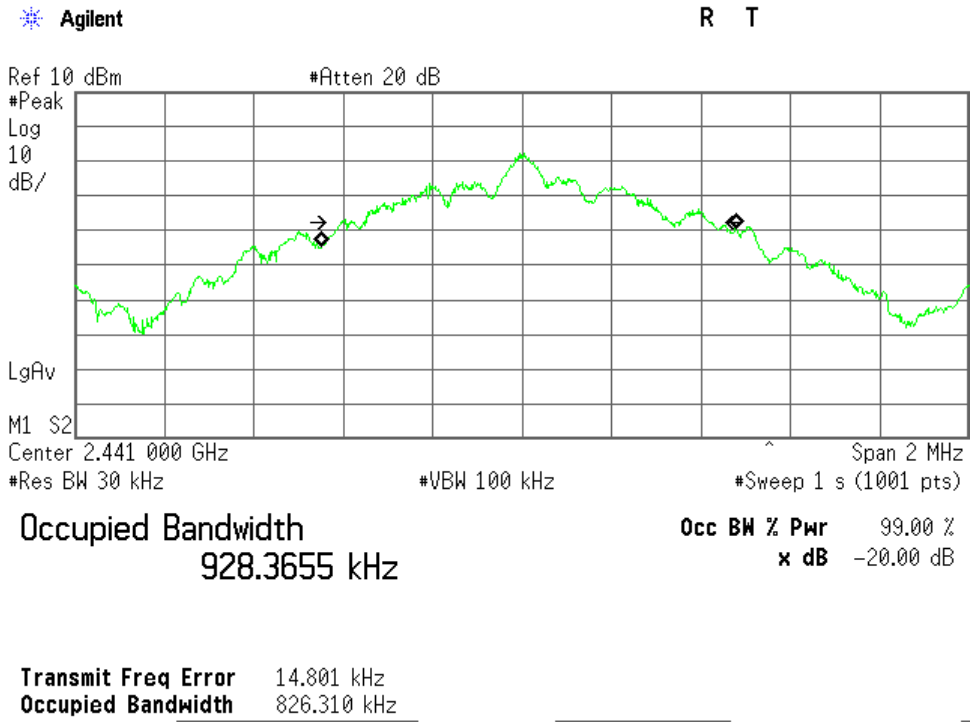
Mode of EUT : Inquiry

Test Date :April 25, 2016
Temp.:23°C, Humi:52%

The resolution bandwidth was set to about 1% of emission bandwidth, -20dBc 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.

Frequency (MHz)	99% Bandwidth (kHz)	-20dBc Bandwidth (kHz)	Two-thirds of the 20 dB bandwidth (kHz)
2441.0	928.4	826.3	550.9

Middle Channel



7.4 Dwell Time

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

7.4.1 Test Results

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

Dwell Time is 307.8 msec
Dwell Time (Inquiry) is 63.7 msec
Dwell Time (AFH) is 307.8 msec

Uncertainty of Measurement Results ± 0.6 %(2σ)

Remarks : _____

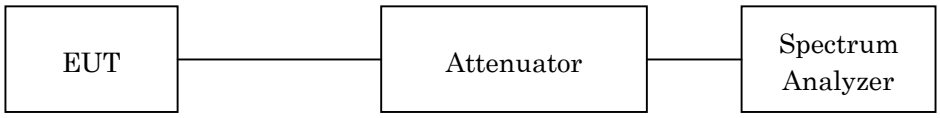
7.4.2 Test Instruments

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

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

7.4.3 Test Method and Test Setup (Diagrammatic illustration)

The test system is shown as follows:



The setting of the spectrum analyzer are shown as follows:

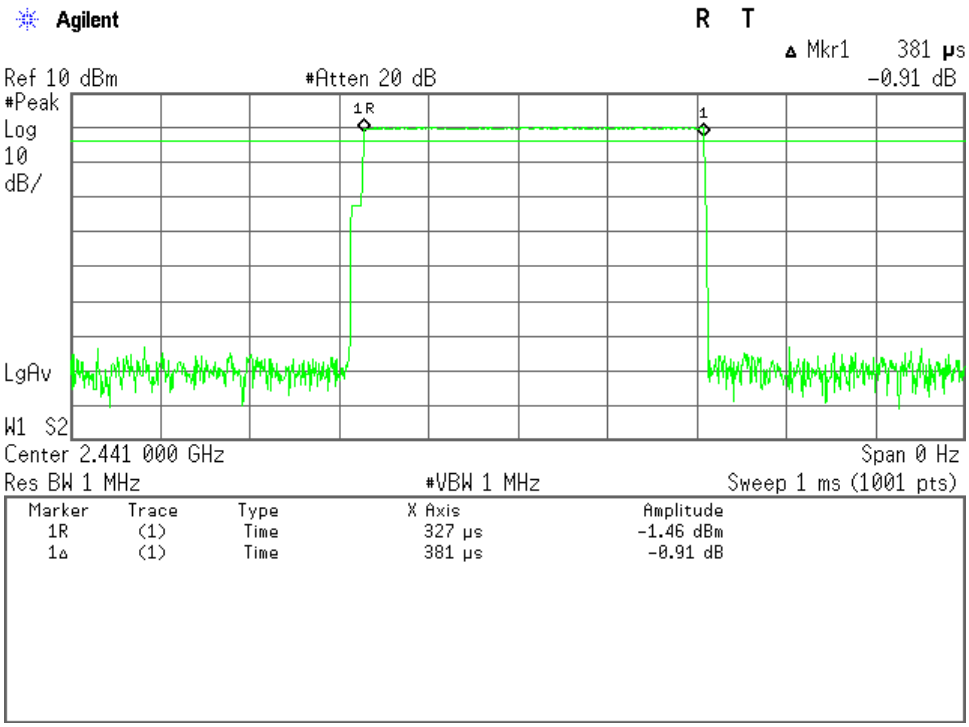
Res. Bandwidth	1 MHz
Video Bandwidth	1 MHz
Span	Zero Span

7.4.4 Test Data

Test Date :April 25, 2016
Temp.:23°C, Humi:52%

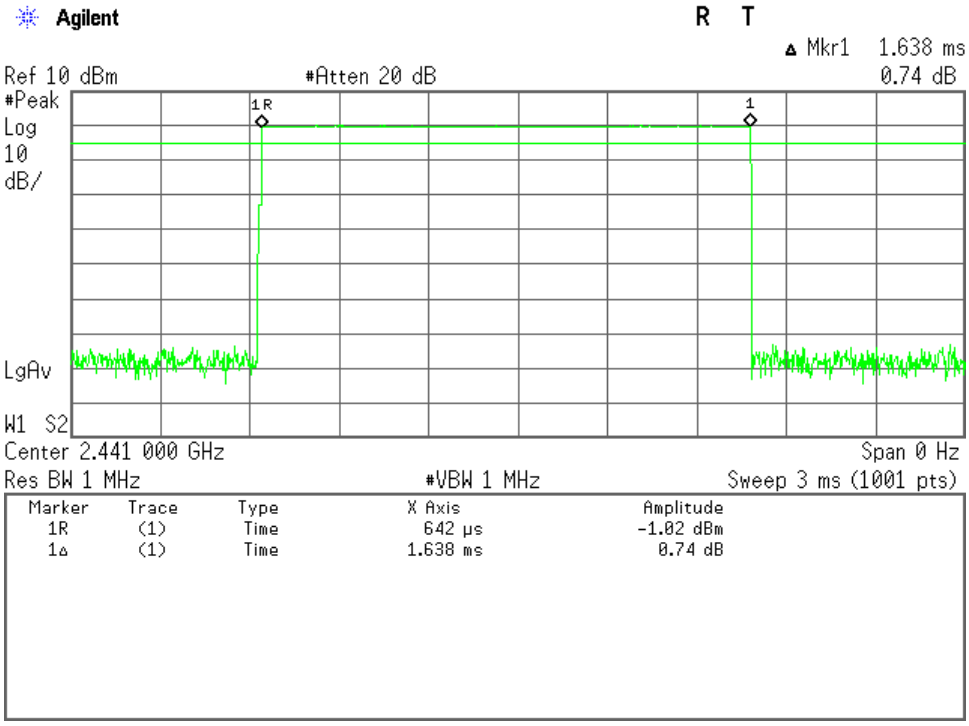
Mode of EUT	Dwell Time (msec)	Limit (msec)
DH1	121.9	400
DH3	262.1	400
DH5	307.8	400
Inquiry	63.7	400

DH1(Modulation type : GFSK)



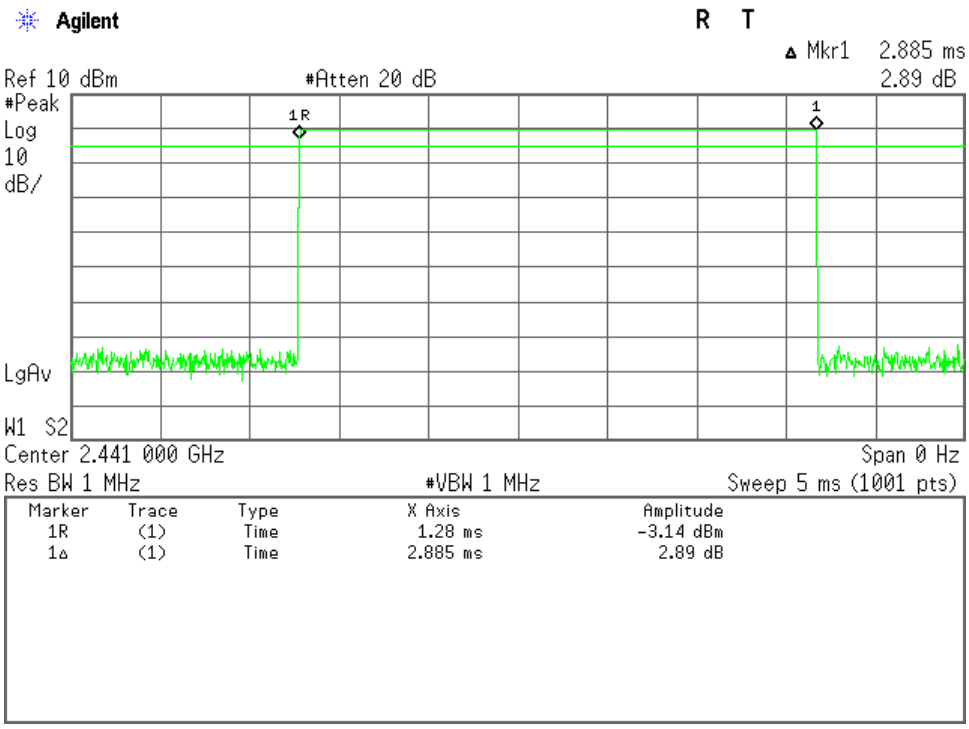
Note : The system makes worst case 1600 hops per second or 1 time slot has a length of 625 µs with 79 channels. A DH1 Packet need 1 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case 800 hops per second with 79 channels. So the system has each channel 10.1266 times per second and so for 31.6 seconds the system have 320.0 times of appearance.
Each tx-time per appearance is 0.381 ms.
Dwell time = 320.0 * 0.381 = 121.9 ms

DH3(Modulation type : GFSK)



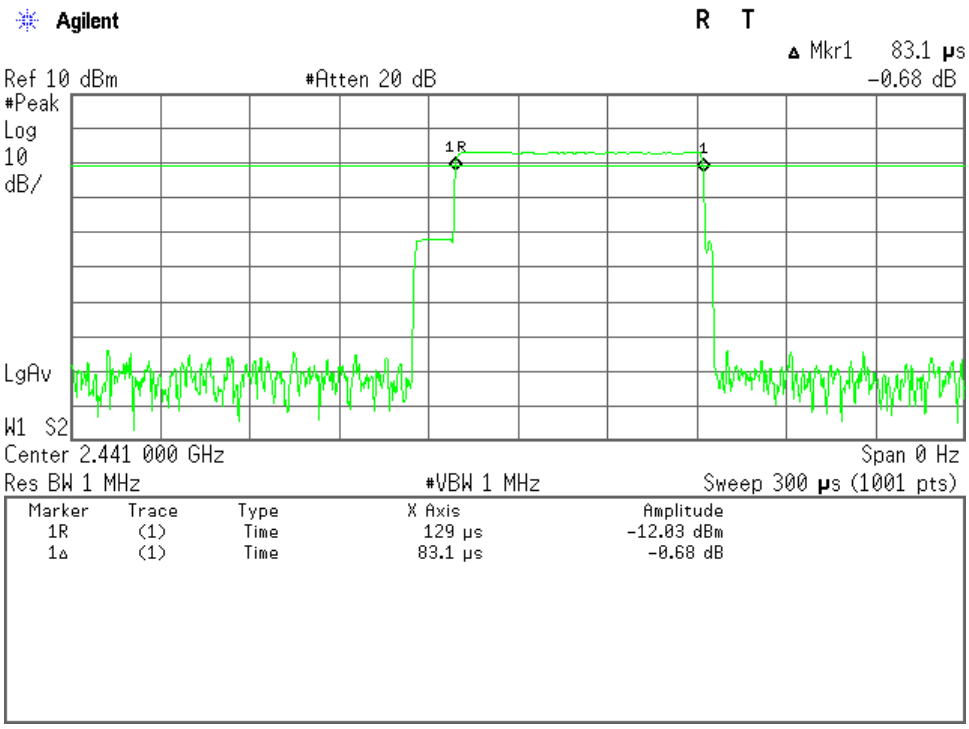
Note : A DH3 Packet need 3 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case 400 hops per second with 79 channels. So the system have each channel 5.063 times per second and so for 31.6 seconds the system have 160.0 times of appearance.
Each tx-time per appearance is 1.638 ms.
Dwell time = 160.0 * 1.638 = 262.1 ms

DH5(Modulation type : GFSK)



Note : A DH5 Packet need 5 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case 266.667 hops per second with 79 channels. So the system have each channel 3.3755 times per second and so for 31.6 seconds the system have 106.7 times of appearance.
Each tx-time per appearance is 2.885 ms.
Dwell time = 106.7 * 2.885 = 307.8 ms

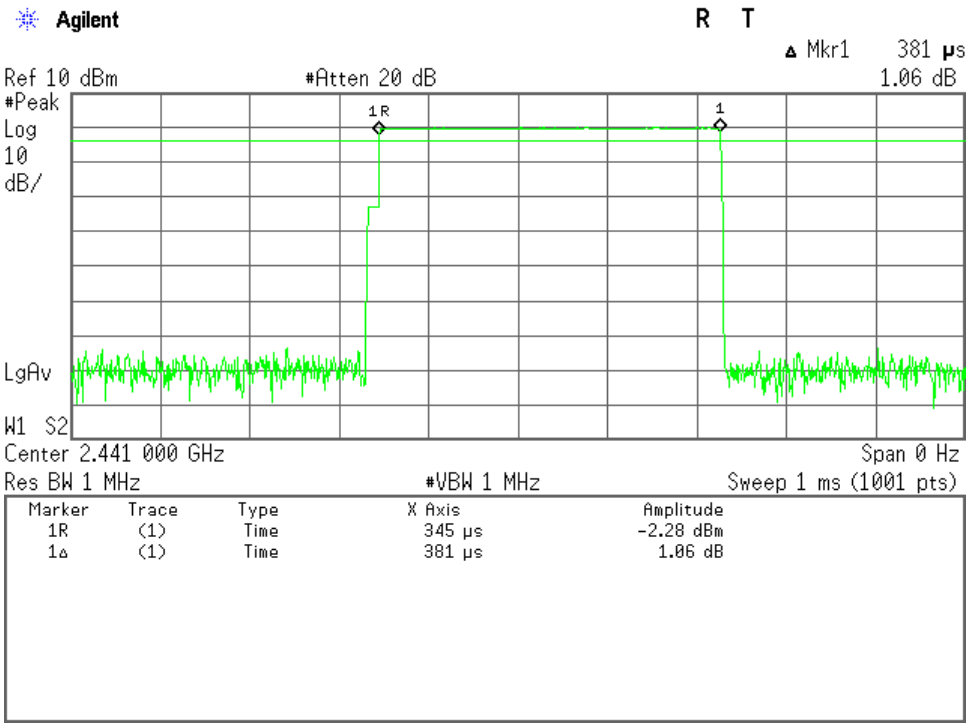
Inquiry



Note : The system have 32 hopping channel in Inquiry mode.
The time period = 32 * 0.4 = 12.8 seconds
In maximum case the Bluetooth system have three blocks of 2560 ms in 12.8 s period. One block has 256 burst at each hopping channel.
Each tx-time per appearance is 0.083 ms.
Dwell time = 0.083 * 256 * 3 = 63.7 ms

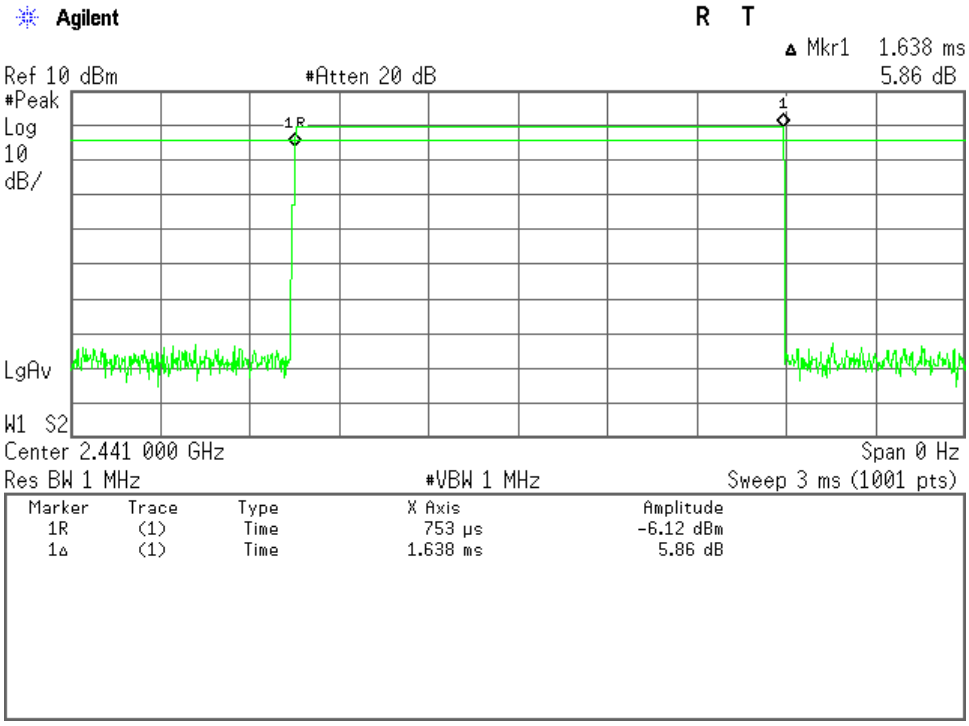
Mode of EUT	Dwell Time (msec)	Limit (msec)
DH1(AFH)	121.9	400
DH3(AFH)	262.1	400
DH5(AFH)	307.8	400

DH1(AFH mode, Modulation type : GFSK)



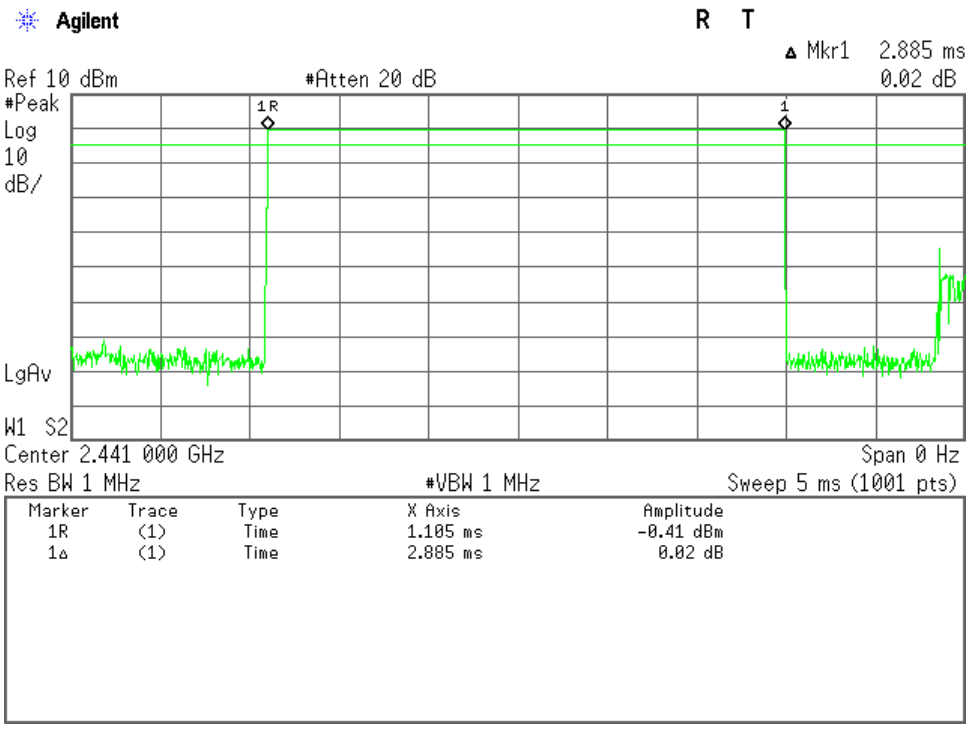
Note : The system makes worst case 1600 hops per second or 1 time slot has a length of 625 µs with 79 channels. A DH1 Packet need 1 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case 800 hops per second with 20 channels. So the system has each channel 40 times per second and so for 8 seconds the system have 320.0 times of appearance.
Each tx-time per appearance is 0.381 ms.
Dwell time = 320.0 * 0.381 = 121.9 ms

DH3(AFH mode, Modulation type : GFSK)



Note : A DH3 Packet need 3 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case 400 hops per second with 20 channels. So the system have each channel 20 times per second and so for 8 seconds the system have 160.0 times of appearance.
Each tx-time per appearance is 1.638 ms.
Dwell time = 160.0 * 1.638 = 262.1 ms

DH5(AFH mode, Modulation type : GFSK)



Note : A DH5 Packet need 5 time slot for transmitting and 1 time slot for receiving. Then the system makes worst case 266.667 hops per second with 20 channels. So the system have each channel 13.33335 times per second and so for 8 seconds the system have 106.7 times of appearance.
Each tx-time per appearance is 2.885 ms.
Dwell time = 106.7 * 2.885 = 307.8 ms

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 is 12.26 dBm at 2402.0 MHz

Uncertainty of Measurement Results ± 0.9 dB(2σ)

Remarks : _____

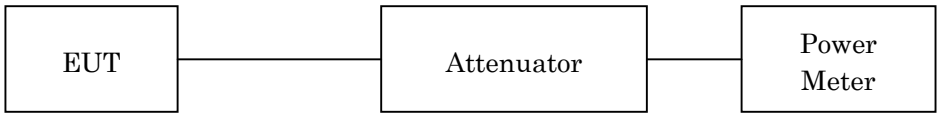
7.5.2 Test Instruments

Shielded Room S4				
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Cal. Due**
Power Meter	N1911A	GB45100291 (B-63)	Agilent	2016/07/16
Power Sensor	N1921A	US44510470 (B-64)	Agilent	2016/07/16
Attenuator	54A-10	W5675 (D-28)	Weinschel	2016/08/16
RF Cable	SUCOFLEX102	14253/2 (C-52)	HUBER+SUHNER	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)DH5(Modulation type : GFSK)

Test Date: April 19, 2016
Temp.: 23 °C, Humi: 37 %

Transmitting Frequency		Correction Factor	Meter Reading	Conducted Peak Output Power		Limits	Margin
CH	[MHz]	[dB]	[dBm]	[dBm]	[mW]	[dBm]	[dB]
00	2402	10.39	0.62	11.01	12.62	20.97	+ 9.96
39	2441	10.42	-0.15	10.27	10.64	20.97	+10.70
78	2480	10.43	-0.65	9.78	9.51	20.97	+11.19

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

	Correction Factor	=	10.39 dB
+)	Meter Reading	=	0.62 dBm
	Result	=	11.01 dBm = 12.62 mW

Minimum Margin: 20.97 - 11.01 = 9.96 (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

2) 2DH5(Modulation type : pi/4-DQPSK)

Test Date: April 19, 2016
Temp.: 23 °C, Humi: 37 %

Transmitting Frequency		Correction Factor	Meter Reading	Conducted Peak Output Power		Limits	Margin
CH	[MHz]	[dB]	[dBm]	[dBm]	[mW]	[dBm]	[dB]
00	2402	10.39	1.51	11.90	15.49	20.97	+ 9.07
39	2441	10.42	0.72	11.14	13.00	20.97	+ 9.83
78	2480	10.43	0.30	10.73	11.83	20.97	+10.24

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

	Correction Factor	=	10.39 dB
+)	Meter Reading	=	1.51 dBm
	Result	=	11.90 dBm = 15.49 mW

Minimum Margin: 20.97 - 11.90 = 9.07 (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

3) 3DH5(Modulation type : 8DPSK)

Test Date: April 19, 2016
Temp.: 23 °C, Humi: 37 %

Transmitting Frequency		Correction Factor	Meter Reading	Conducted Peak Output Power		Limits	Margin
CH	[MHz]	[dB]	[dBm]	[dBm]	[mW]	[dBm]	[dB]
00	2402	10.39	1.87	12.26	16.83	20.97	+ 8.71
39	2441	10.42	1.07	11.49	14.09	20.97	+ 9.48
78	2480	10.43	0.70	11.13	12.97	20.97	+ 9.84

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

	Correction Factor	=	10.39 dB
+)	Meter Reading	=	1.87 dBm
	Result	=	12.26 dBm = 16.83 mW

Minimum Margin: 20.97 - 12.26 = 8.71 (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

7.6 Peak Power Density(Conduction)

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

Remarks : _____

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 : _____

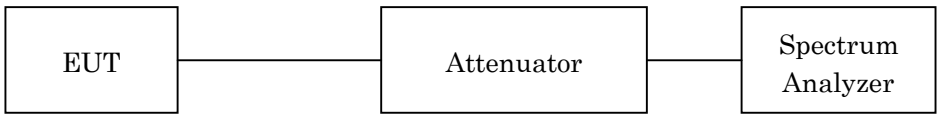
7.7.2 Test Instruments

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

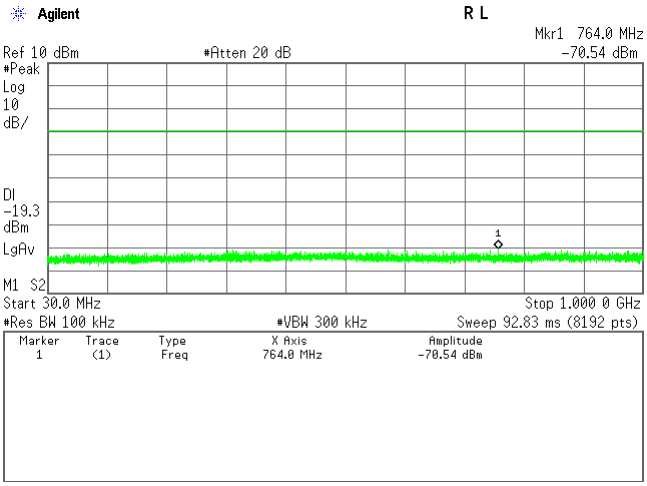
Frequency Range	30 MHz - 25 GHz	Band-Edge
Res. Bandwidth	100 kHz	100 kHz
Video Bandwidth	300 kHz	300 kHz
Sweep Time	AUTO	AUTO
Trace	Maxhold	Maxhold

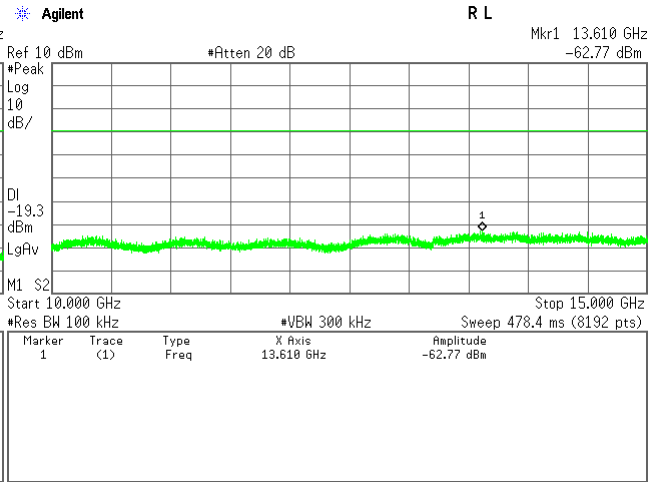
7.7.4 Test Data

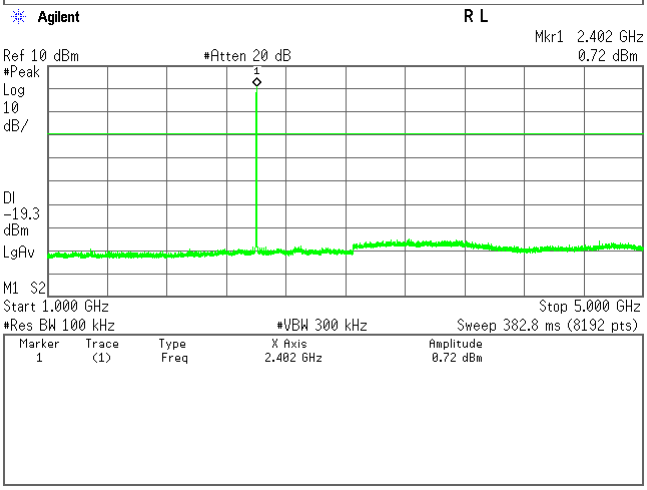
Test Date :April 25, 2016
Temp.:23°C, Humi:52%

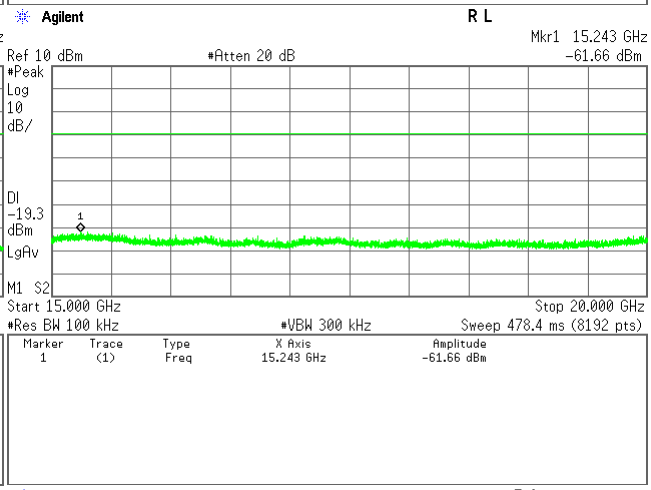
Mode of EUT : BDR (worst case)

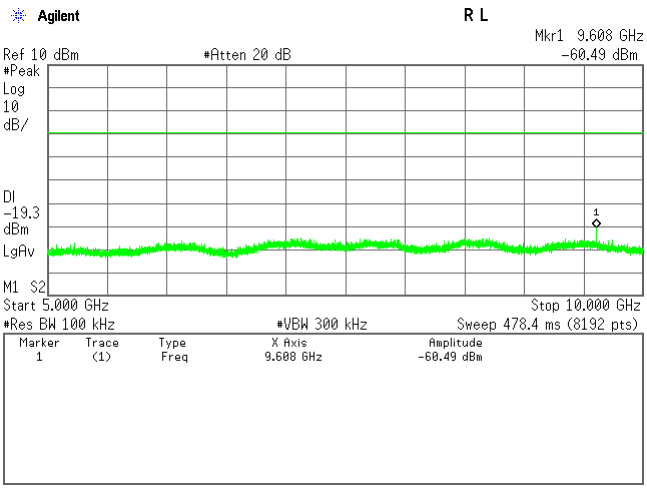
Low Channel

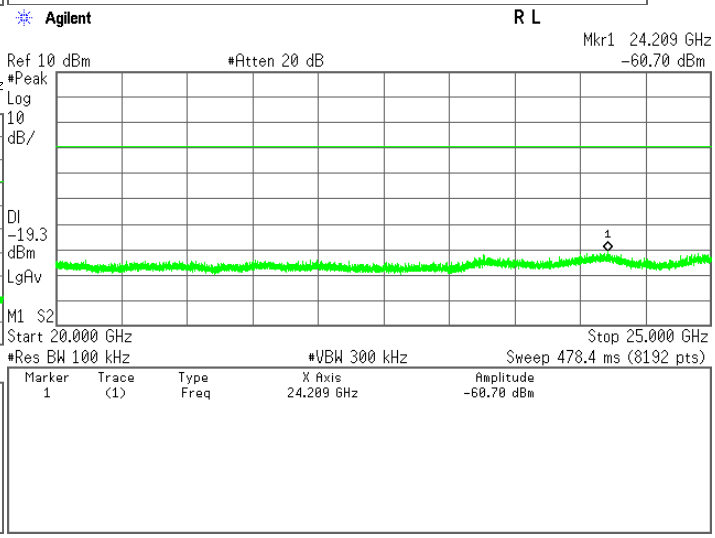




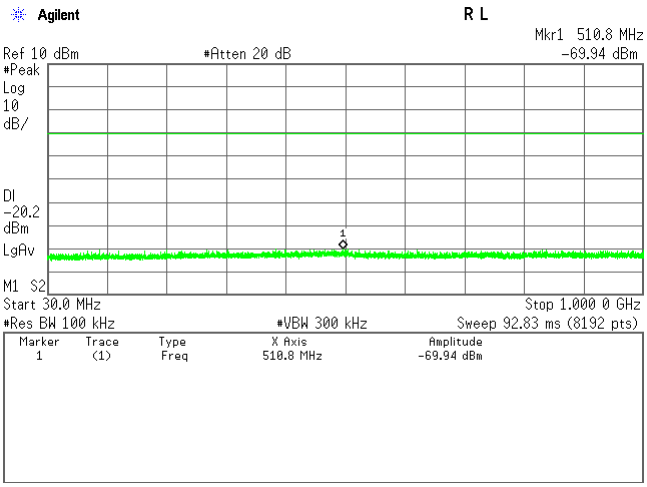


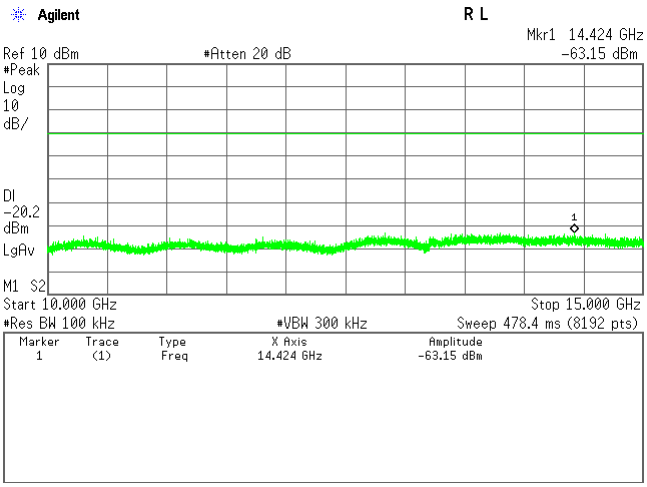


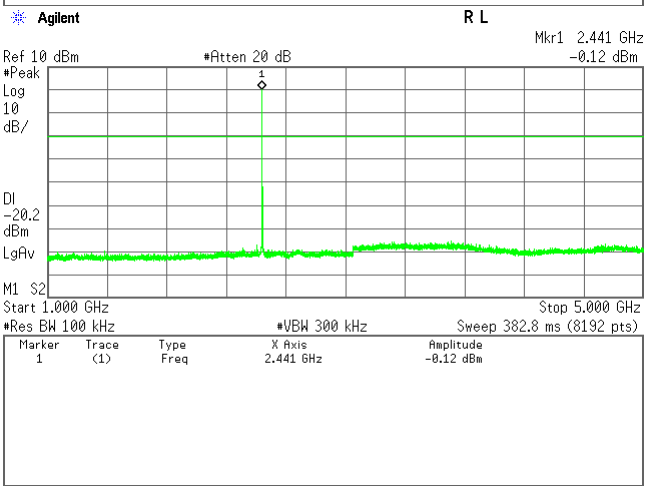


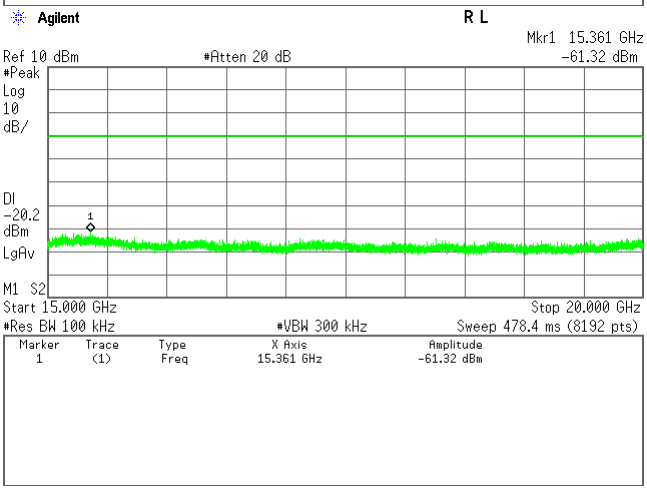


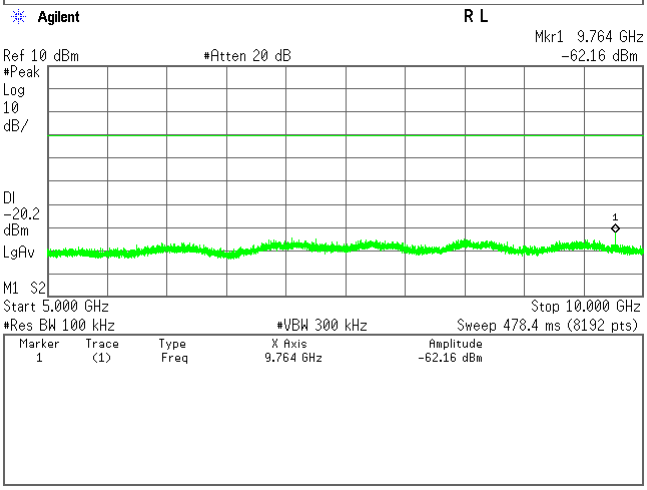
Middle Channel

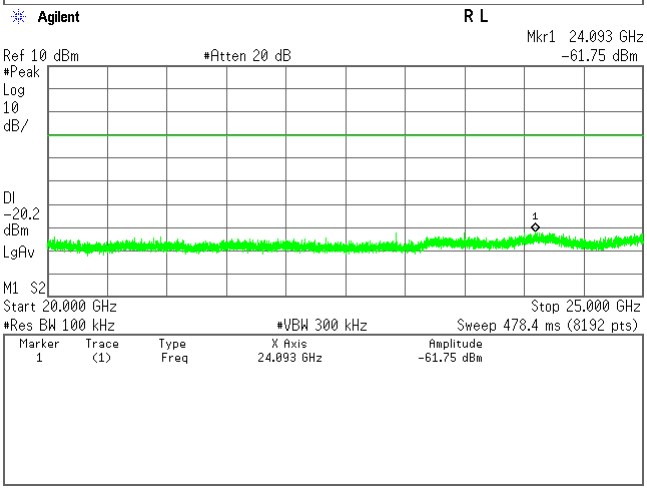




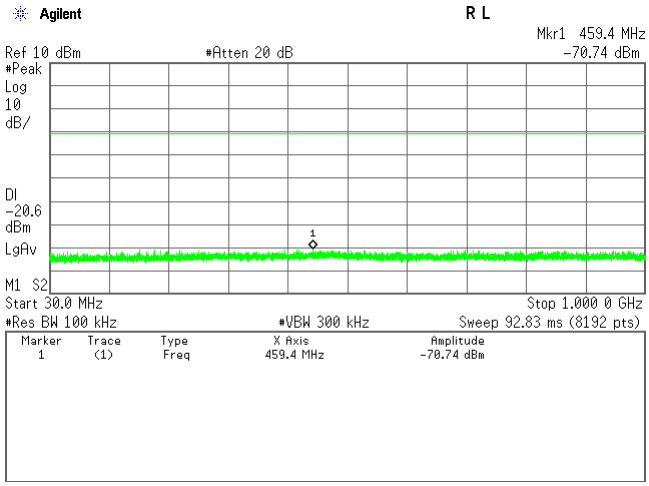


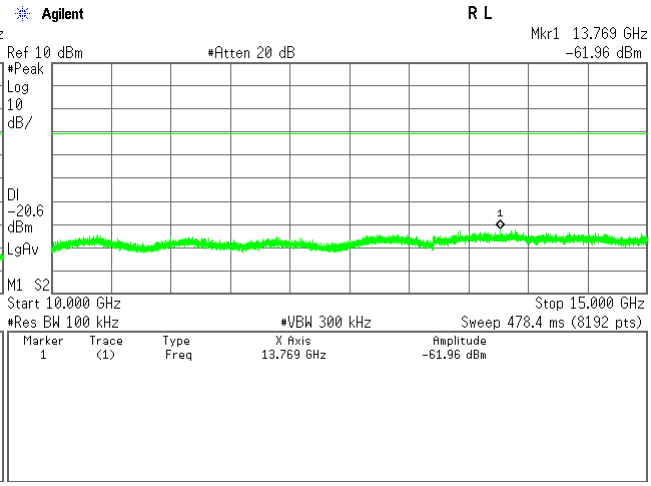


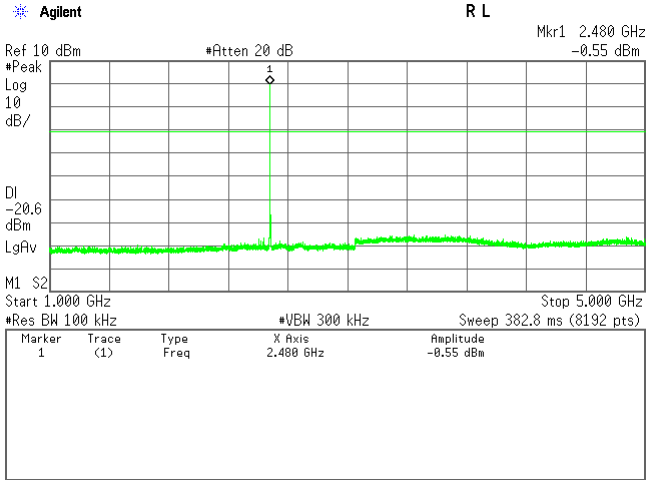


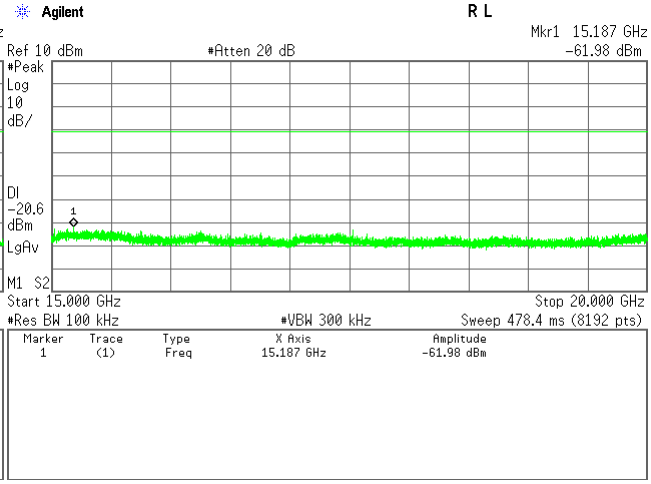


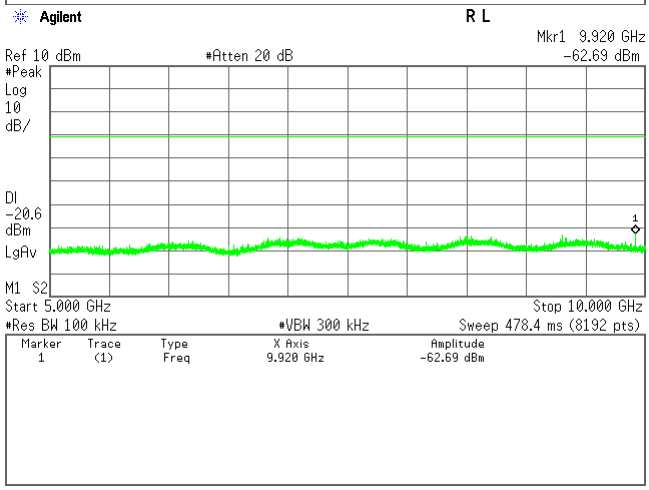
High Channel

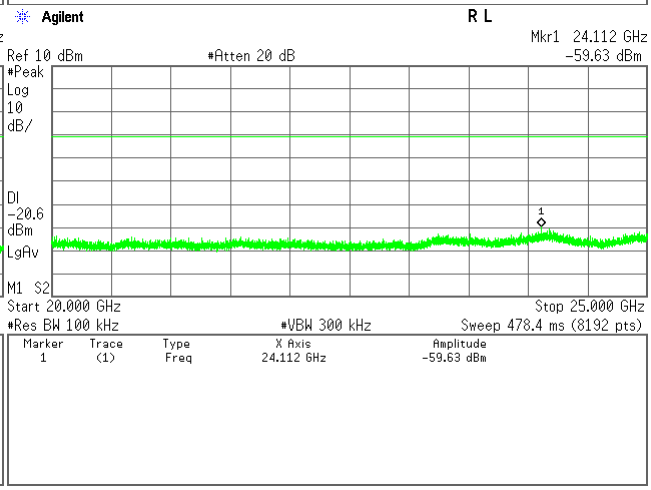






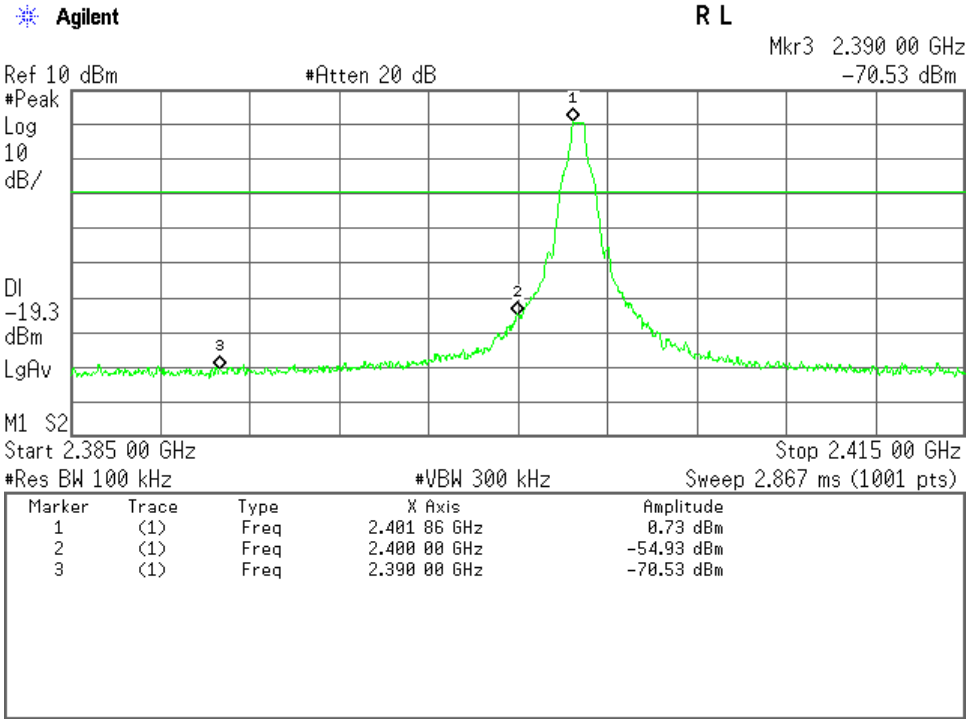




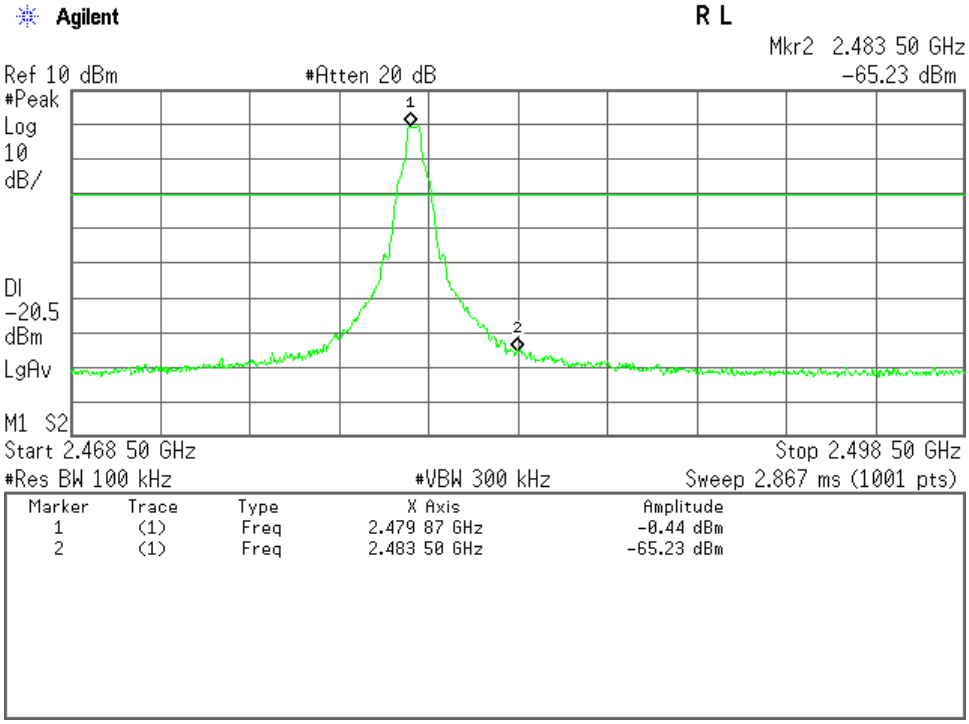


Band-Edge Emission

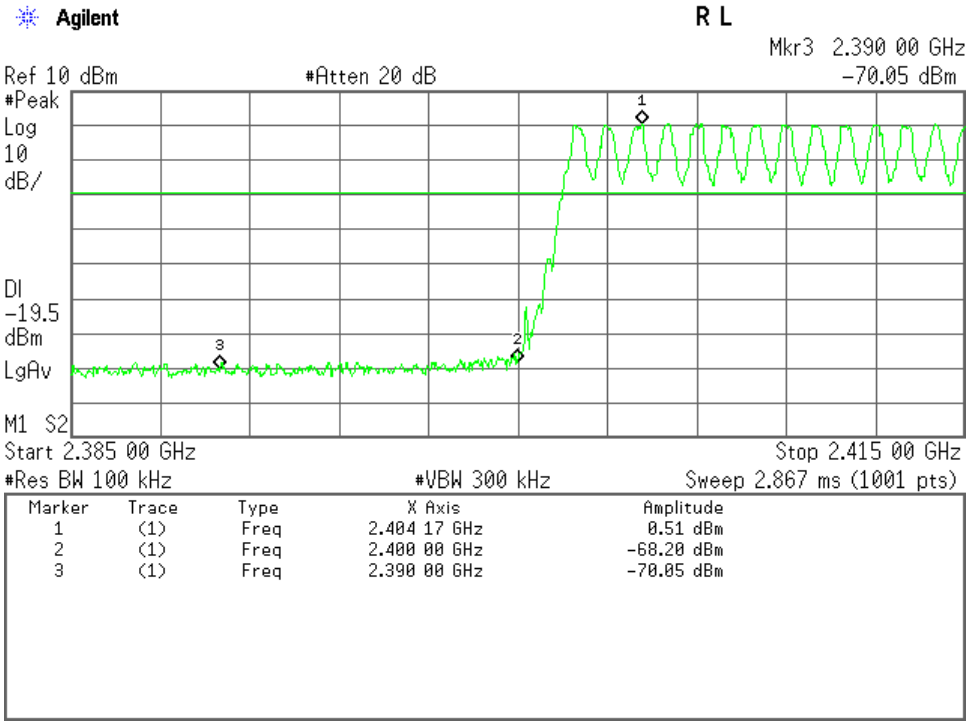
Low Channel(Hopping off), Band-Edge Emission



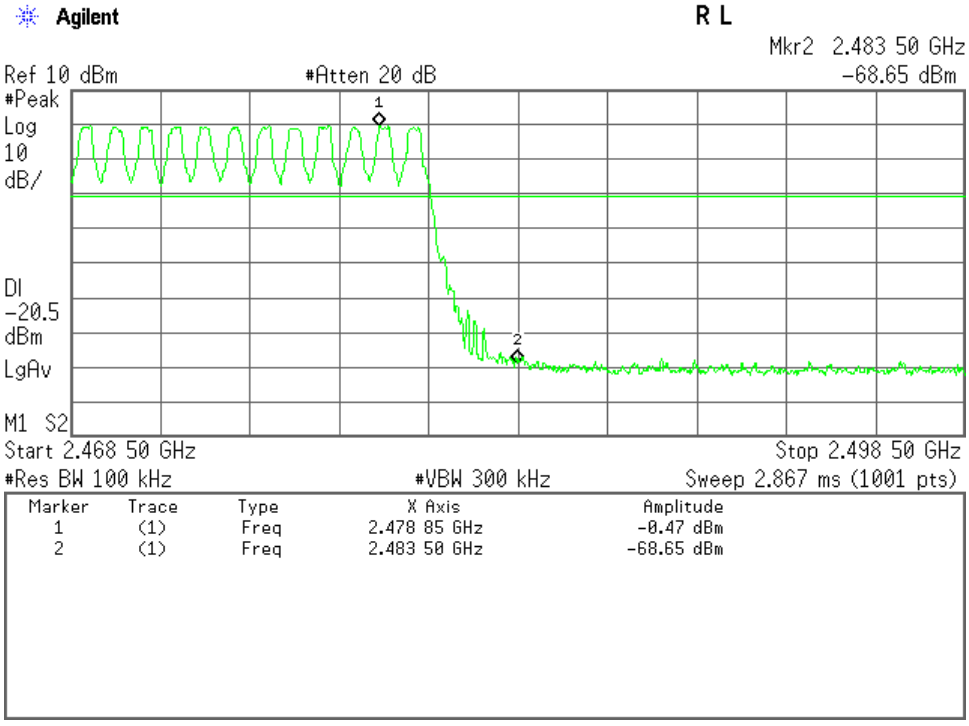
High Channel(Hopping off), Band-Edge Emission



Low Channel(Hopping on), Band-Edge Emission



High Channel(Hopping on), Band-Edge Emission



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 (Quasi-Peak) 9.7 dB at 2.468 MHz

Uncertainty of Measurement Results ± 2.6 dB(2σ)

Remarks : _____

7.8.2 Test Instruments

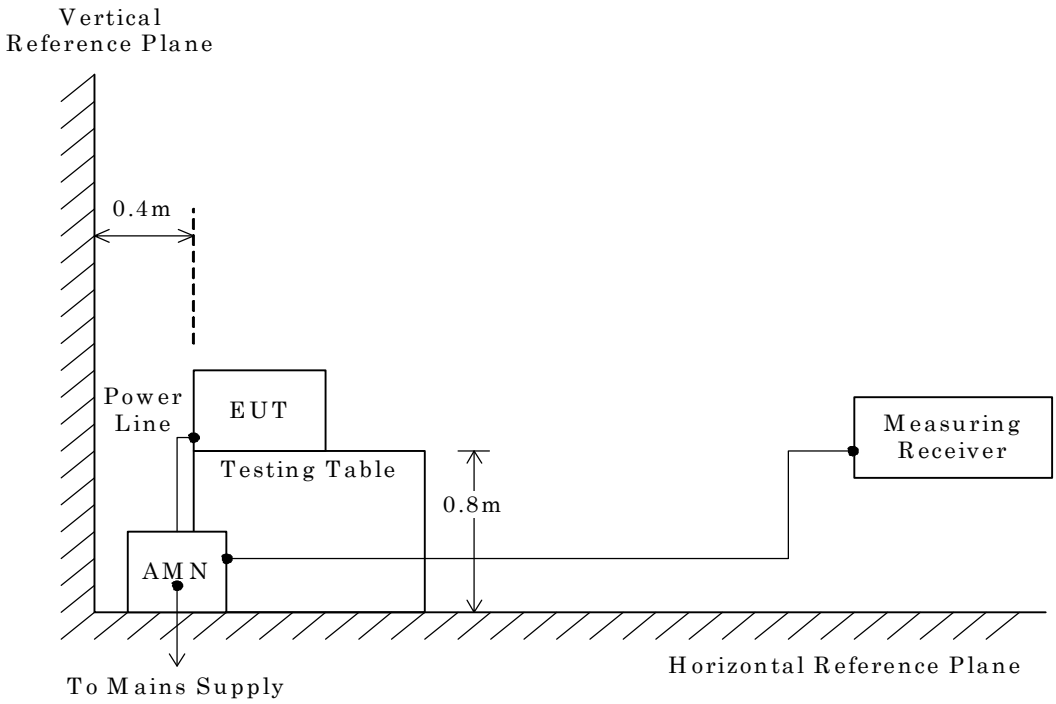
Measurement Room M2				
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Cal. Due**
Test Receiver	ESU 26	100170 (A-6)	Rohde & Schwarz	2016/04/25
AMN (main)	KNW-407FR	8-2019-1 (D-103)	Kyoritsu	2016/10/15
RF Cable	RG223/U	--- (H-35)	HUBER+SUHNER	2016/06/04

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

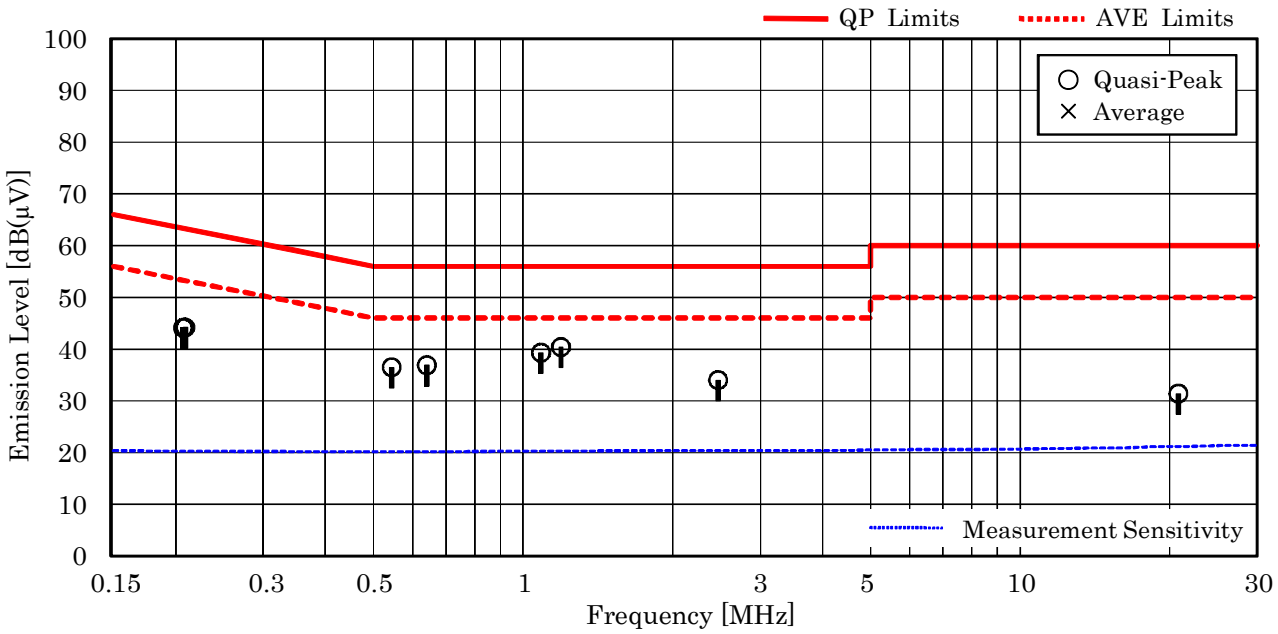
Mode of EUT : All modes have been investigated and the worst case mode for channel (39ch: 2441MHz) has been listed.

Test voltage : 120VAC 60Hz

Test Date: April 21, 2016
Temp.: 20 °C, Humi.: 55 %

Measured phase : L1

Frequency [MHz]	Corr. Factor [dB]	Meter Readings [dB(μV)] QP	Meter Readings [dB(μV)] AVE	Limits [dB(μV)] QP	Limits [dB(μV)] AVE	Results [dB(μV)] QP	Results [dB(μV)] AVE	Margin [dB] QP	Margin [dB] AVE	Remarks
0.207	10.3	33.8	--	63.3	53.3	44.1	--	+19.2	--	-
0.209	10.3	33.9	--	63.2	53.2	44.2	--	+19.0	--	-
0.544	10.2	26.3	--	56.0	46.0	36.5	--	+19.5	--	-
0.640	10.2	26.7	--	56.0	46.0	36.9	--	+19.1	--	-
1.087	10.3	29.0	--	56.0	46.0	39.3	--	+16.7	--	-
1.192	10.3	30.1	--	56.0	46.0	40.4	--	+15.6	--	-
2.468	10.4	23.6	--	56.0	46.0	34.0	--	+22.0	--	-
20.823	11.2	20.2	--	60.0	50.0	31.4	--	+28.6	--	-



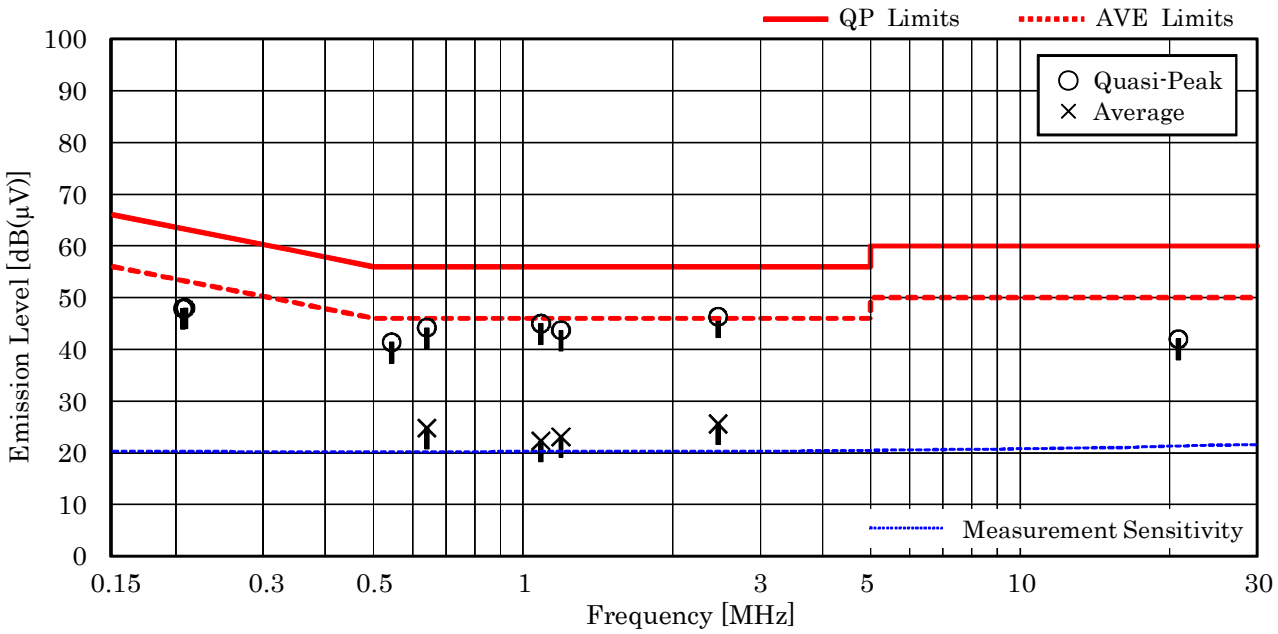
NOTES
1. The spectrum was checked from 150 kHz to 30 MHz.
2. The correction factor includes the AMN insertion loss and the cable loss.
3. The symbol of "<" means "or less".
4. The symbol of ">" means "more than".
5. The symbol of "--" means "not applicable".
6. Calculated result at 1.192 MHz, as the worst point shown on underline:
   Correction Factor + Meter Reading (QP) = 10.3 + 30.1 = 40.4 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: April 21, 2016
Temp.: 20 °C, Humi.: 55 %

Measured phase : L2

Frequency [MHz]	Corr. Factor [dB]	Meter Readings [dB(μV)] QP	Meter Readings [dB(μV)] AVE	Limits [dB(μV)] QP	Limits [dB(μV)] AVE	Results [dB(μV)] QP	Results [dB(μV)] AVE	Margin [dB] QP	Margin [dB] AVE	Remarks
0.207	10.2	37.7	--	63.3	53.3	47.9	--	+15.4	--	-
0.209	10.2	37.8	--	63.2	53.2	48.0	--	+15.2	--	-
0.544	10.2	31.2	--	56.0	46.0	41.4	--	+14.6	--	-
0.640	10.2	34.0	14.6	56.0	46.0	44.2	24.8	+11.8	+21.2	-
1.087	10.3	34.7	12.0	56.0	46.0	45.0	22.3	+11.0	+23.7	-
1.192	10.3	33.4	12.8	56.0	46.0	43.7	23.1	+12.3	+22.9	-
2.468	10.4	35.9	15.2	56.0	46.0	46.3	25.6	+ 9.7	+20.4	-
20.823	11.4	30.6	--	60.0	50.0	42.0	--	+18.0	--	-



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 2.468 MHz, as the worst point shown on underline:
   Correction Factor + Meter Reading (QP) = 10.4 + 35.9 = 46.3 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 (Average) > 12.4 dB at 7323.0 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 :

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	2016/04/25
Loop Antenna	HFH2-Z2	872096/25 (C-2)	Rohde & Schwarz	2016/07/26
RF Cable	RG213/U	--- (H-28)	HUBER+SUHNER	2016/07/26
Pre-Amplifier	310N	304573 (A-17)	SONOMA	2017/04/03
Biconical Antenna	VHA9103/BBA9106	2355 (C-30)	Schwarzbeck	2016/05/24
Log-periodic Antenna	UHALP9108-A1	0694 (C-31)	Schwarzbeck	2016/05/24
RF Cable	S 10162 B-11 etc.	--- (H-4)	HUBER+SUHNER	2017/04/03
Site Attenuation	--	--- (H-15)	----	2017/01/03
Pre-Amplifier	TPA0118-36	1010 (A-37)	TOYO	2016/05/11
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)	----	2017/03/03

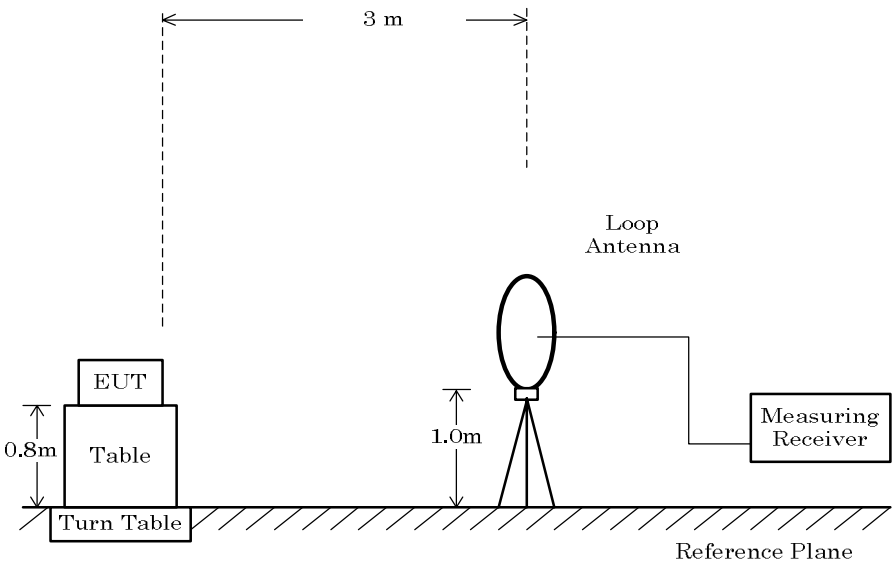
NOTE : The calibration interval of the above test instruments is 12 months.

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.

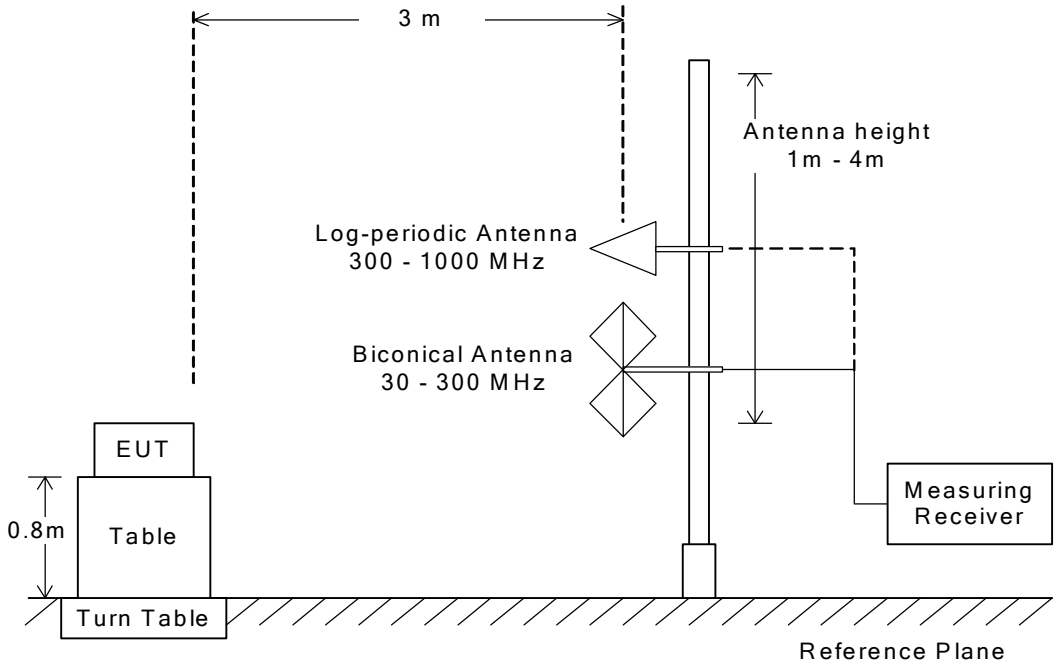
– Side View –



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:

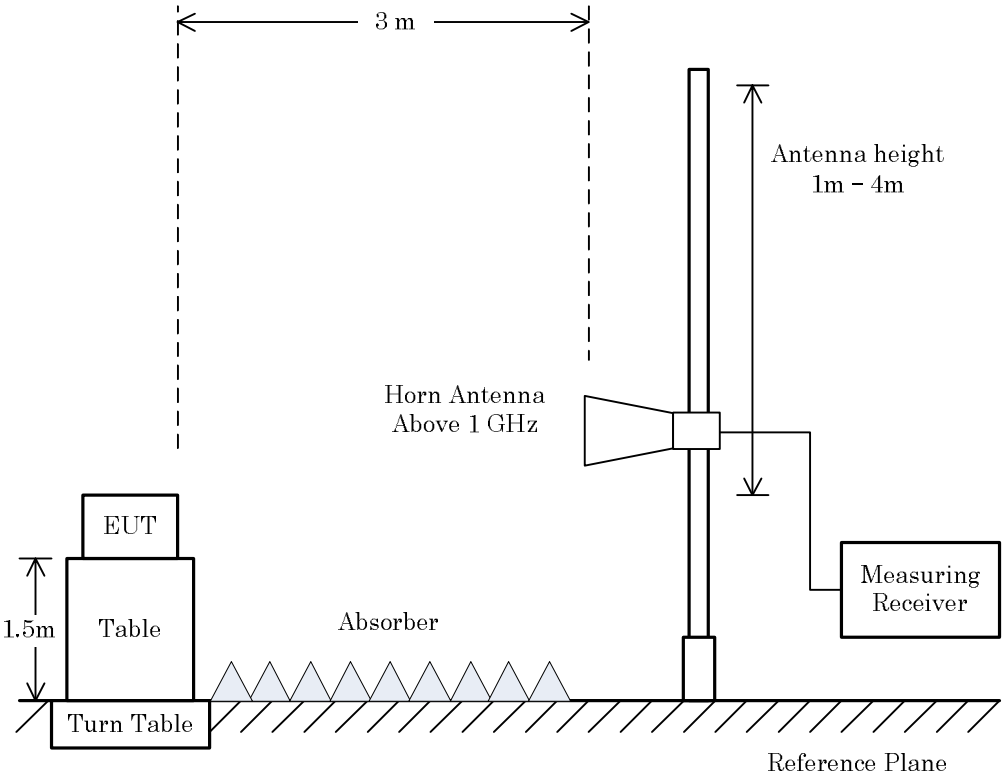
Type	Peak	Average
Detector Function	Peak	Peak
Res. Bandwidth	1 MHz	1 MHz
Video Bandwidth	3 MHz	≥ 1/T *1)
Video Filtering	Linear Voltage	Linear Voltage
Sweep Time	AUTO	AUTO
Trace	Max Hold	Max Hold

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)
BDR(DH5)	0.86	3.75	77.1%	2.89	0.35	0.50

– Side View –



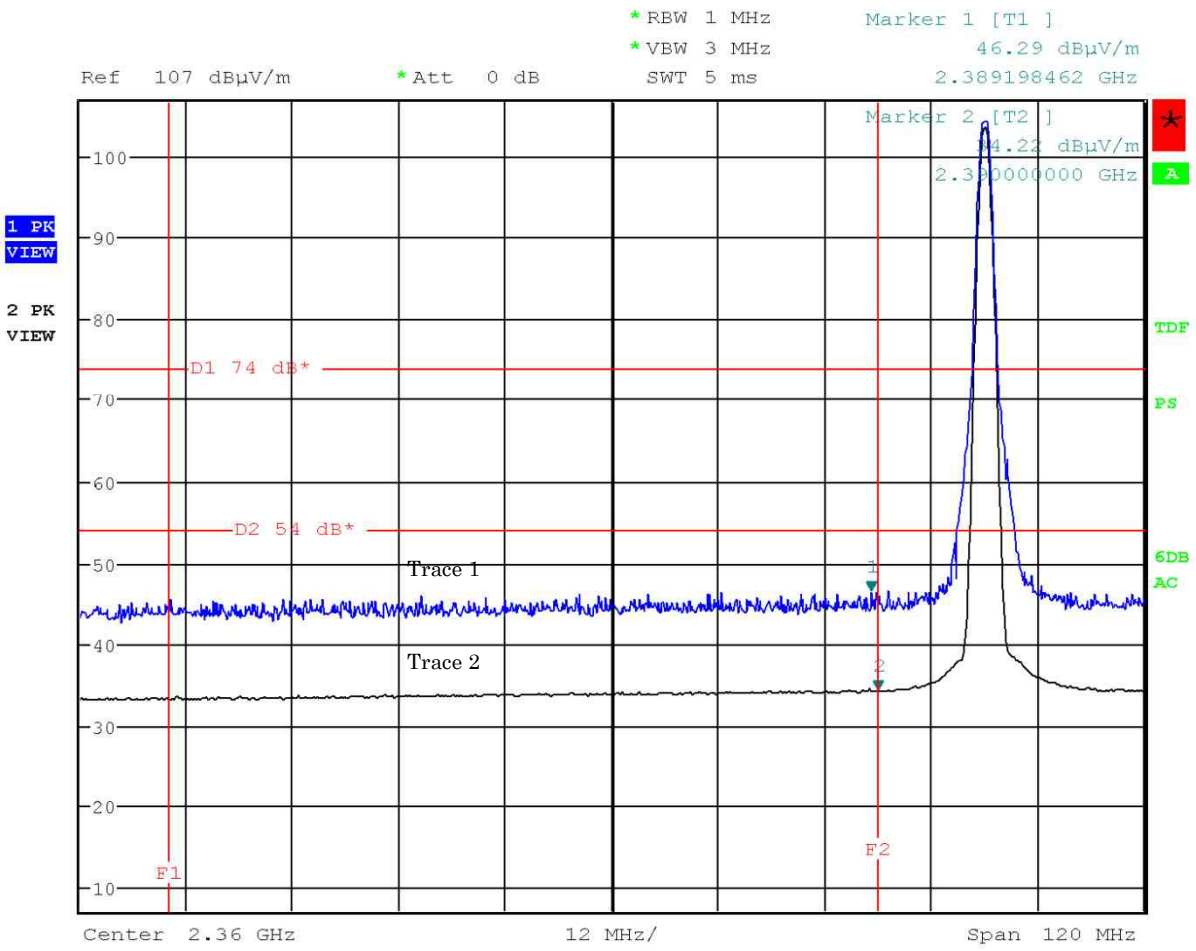
NOTE
When the EUT is manipulated through three different orientations, the scan height upper range for the measurement antenna is limited to 2.5 m or 0.5 m above the top of the EUT.

7.9.4 Test Data

7.9.4.1 Band-edge Compliance

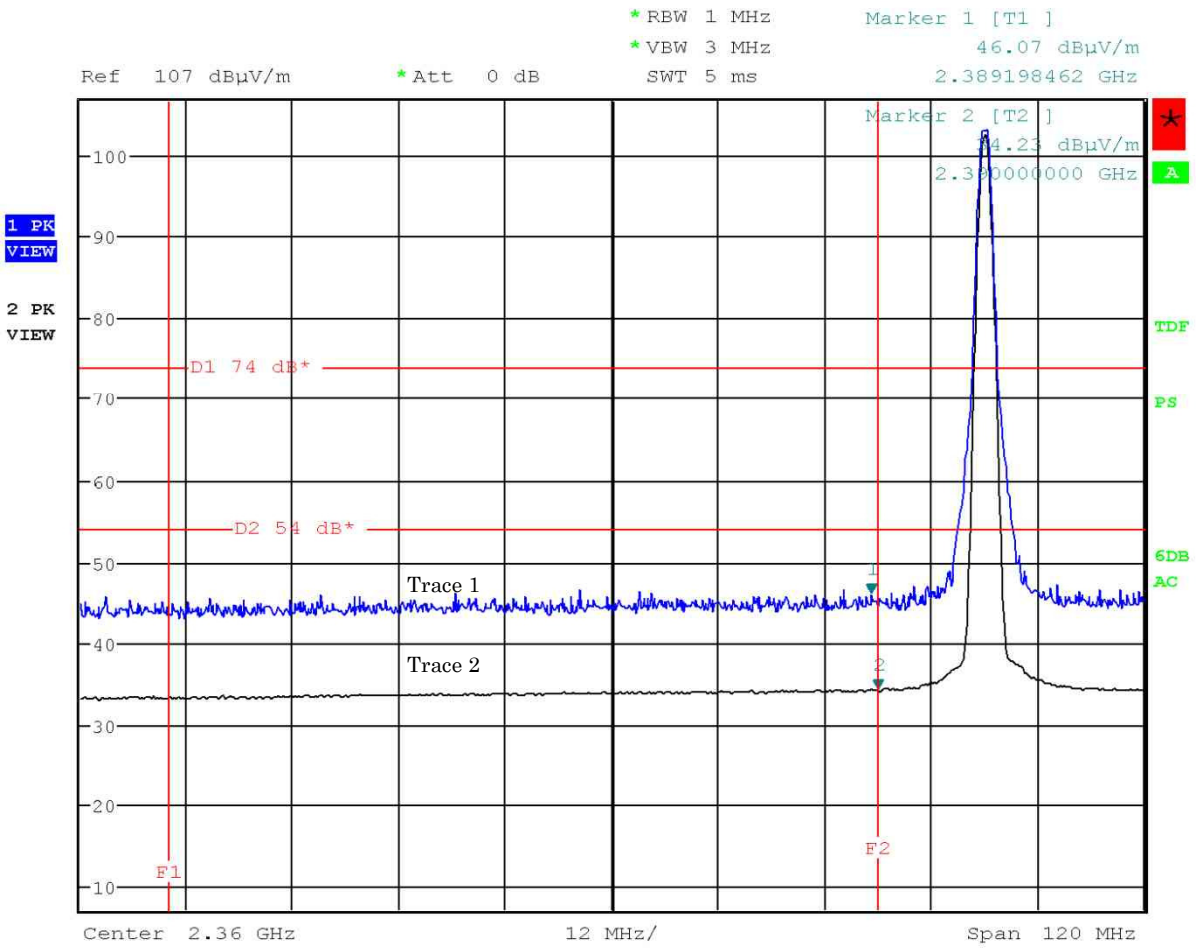
Test Date :April 20, 2016
Temp.:20°C, Humi:39%

Mode of EUT : BDR, Hopping off (0ch: 2402 MHz) (worst case)
Antenna Polarization : Horizontal



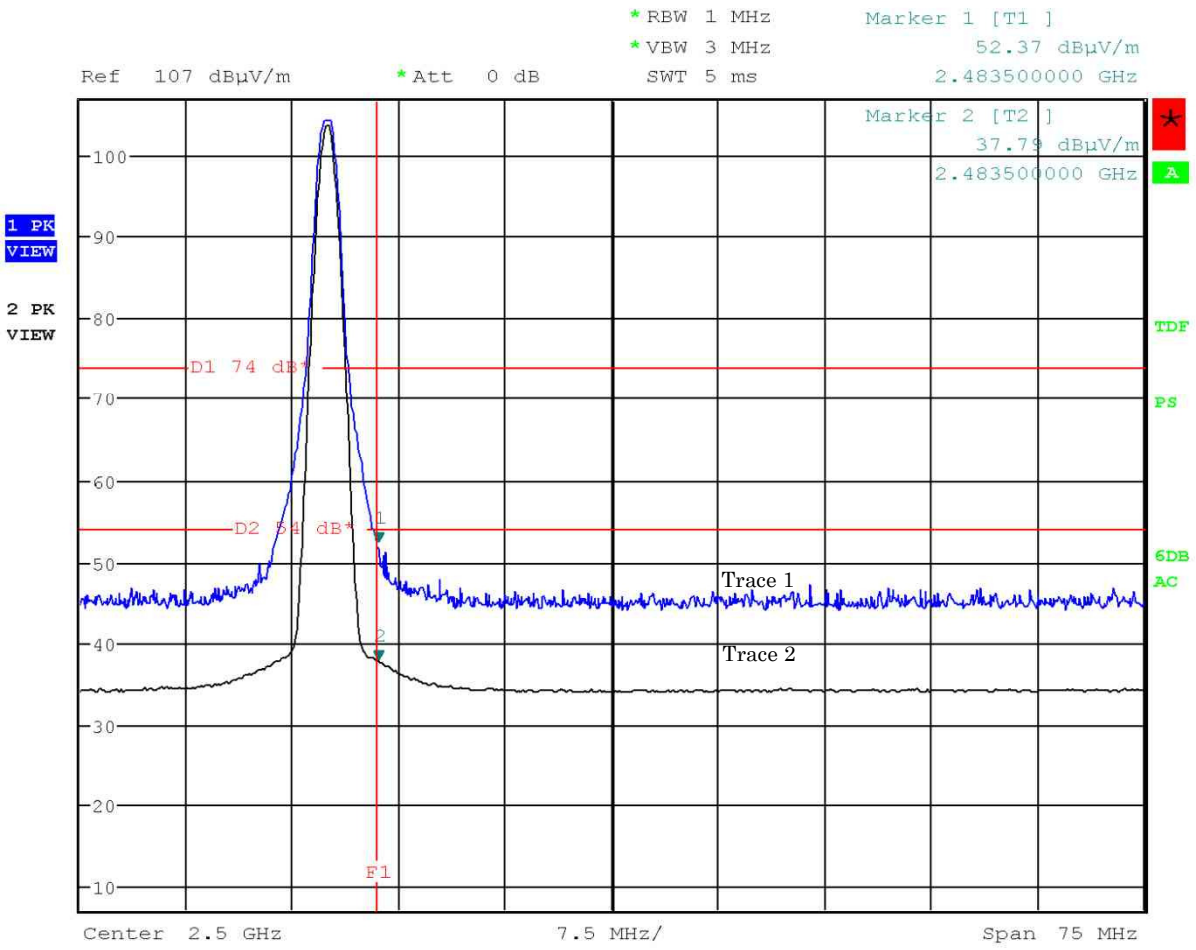
Note: The trace 1 is Peak . The trace 2 is Average.

Mode of EUT : BDR, Hopping off (0ch: 2402 MHz) (worst case)
Antenna Polarization : Vertical



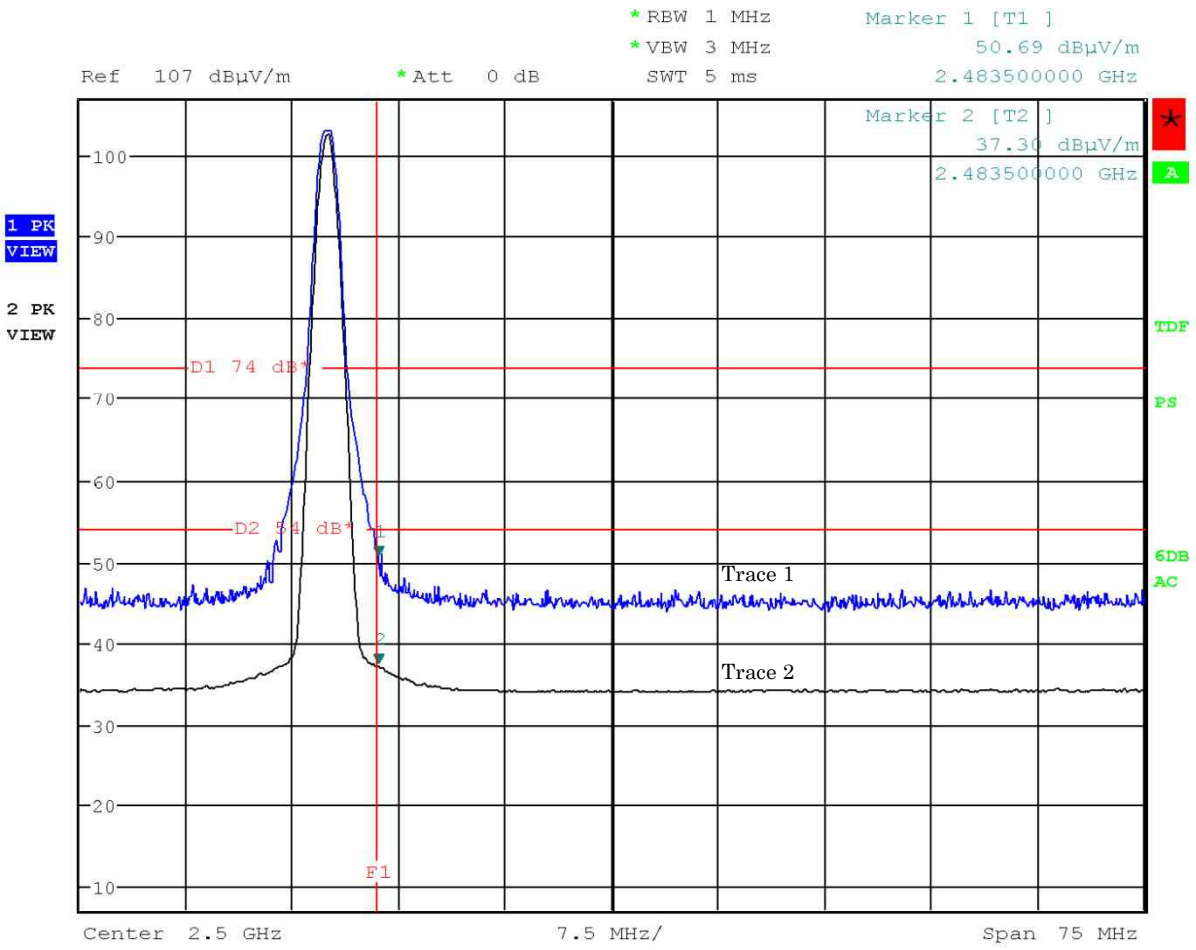
Note: The trace 1 is Peak . The trace 2 is Average.

Mode of EUT : BDR, Hopping off (78ch: 2480 MHz) (worst case)
Antenna Polarization : Horizontal



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

Mode of EUT : BDR, Hopping off (78ch: 2480 MHz) (worst case)
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 :April 20, 2016
Temp.:20°C, Humi:39%

Mode of EUT : All modes have been investigated and the worst case mode has been listed.
Results : No spurious emissions in the range 20dB below the limit.

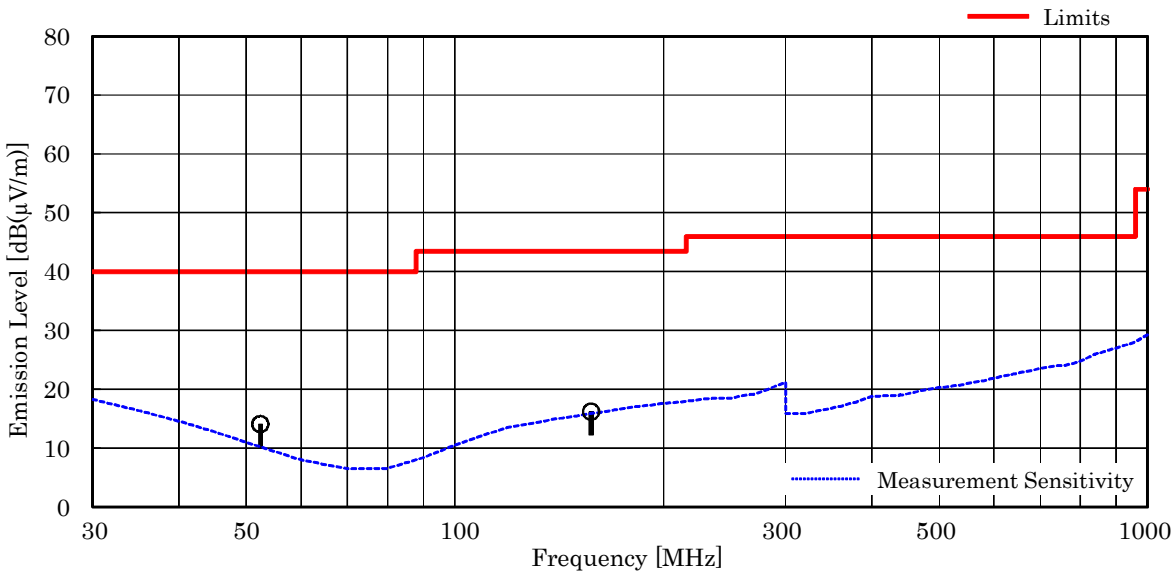
7.9.4.3 Other Spurious Emission (30MHz – 1000MHz)

Mode of EUT : All modes have been investigated and the worst case mode has been listed.

Test Date: April 21, 2016
Temp.: 20 °C, Humi: 55 %

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
30.78	18.5	-27.5	< 27.0	40.0	< 18.0	> +22.0	-
33.17	17.5	-27.5	< 27.0	40.0	< 17.0	> +23.0	-
52.41	10.3	-27.2	31.0	40.0	14.1	+25.9	-
95.85	9.3	-26.7	< 27.0	43.5	< 9.6	> +33.9	-
157.24	15.0	-26.1	27.3	43.5	16.2	+27.3	-

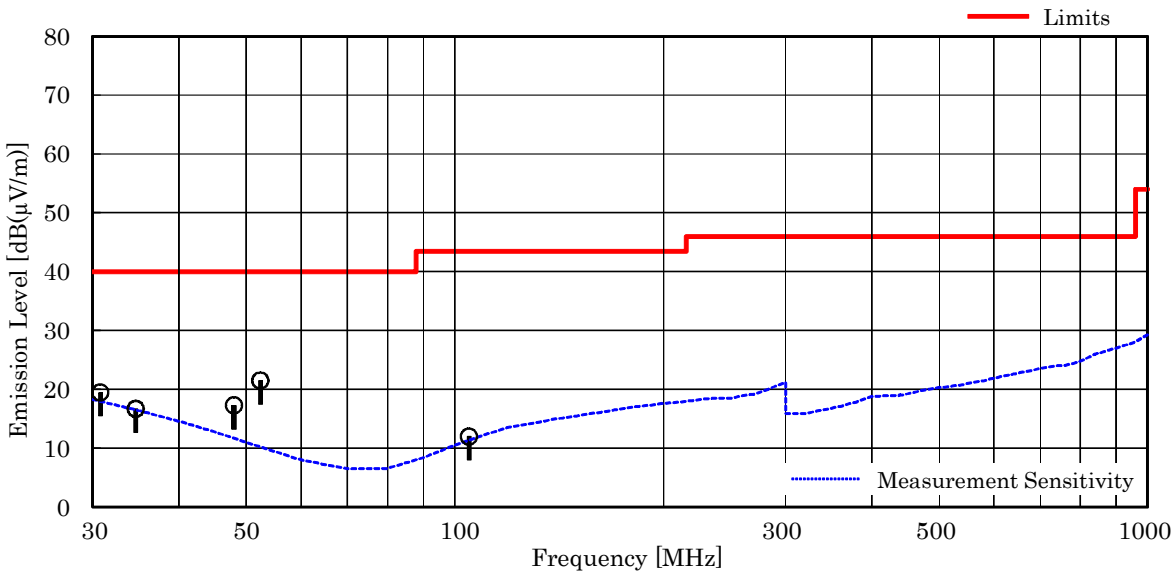


NOTES
1. Test Distance : 3 m
2. The spectrum was checked from 30 MHz to 1000 MHz.
3. The correction factor is composed of cable loss, pad attenuation and/or amplifier gain.
4. The symbol of "<" means "or less".
5. The symbol of ">" means "more than".
6. Calculated result at 30.78 MHz, as the worst point shown on underline:
   Antenna Factor + Coorection Factor + Meter Reading = 18.5 + (-27.5) + <27.0 = <18.0 dB(μV/m)
   Antenna Height : 330 cm, Turntable Angle : 286 °
7. Test receiver setting(s) : CISPR QP 120 kHz [QP : Quasi-Peak]

Test Date: April 21, 2016
Temp.: 20 °C, Humi: 55 %

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
30.78	18.5	-27.5	28.5	40.0	19.5	+20.5	-
34.63	16.9	-27.4	27.2	40.0	16.7	+23.3	-
39.67	15.1	-27.4	< 27.0	40.0	< 14.7	> +25.3	-
48.00	11.9	-27.2	32.6	40.0	17.3	+22.7	-
52.41	10.3	-27.2	38.4	40.0	21.5	+18.5	-
104.82	10.9	-26.6	27.7	43.5	12.0	+31.5	-



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 52.41 MHz, as the worst point shown on underline:
   Antenna Factor + Coorection Factor + Meter Reading = 10.3 + (-27.2) + 38.4 = 21.5 dB(μV/m)
   Antenna Height : 100 cm, Turntable Angle : 177 °
7. Test receiver setting(s) : CISPR QP 120 kHz [QP : Quasi-Peak]

7.9.4.4 Other Spurious Emission (Above 1000MHz)

Mode of EUT : BDR (worst case)

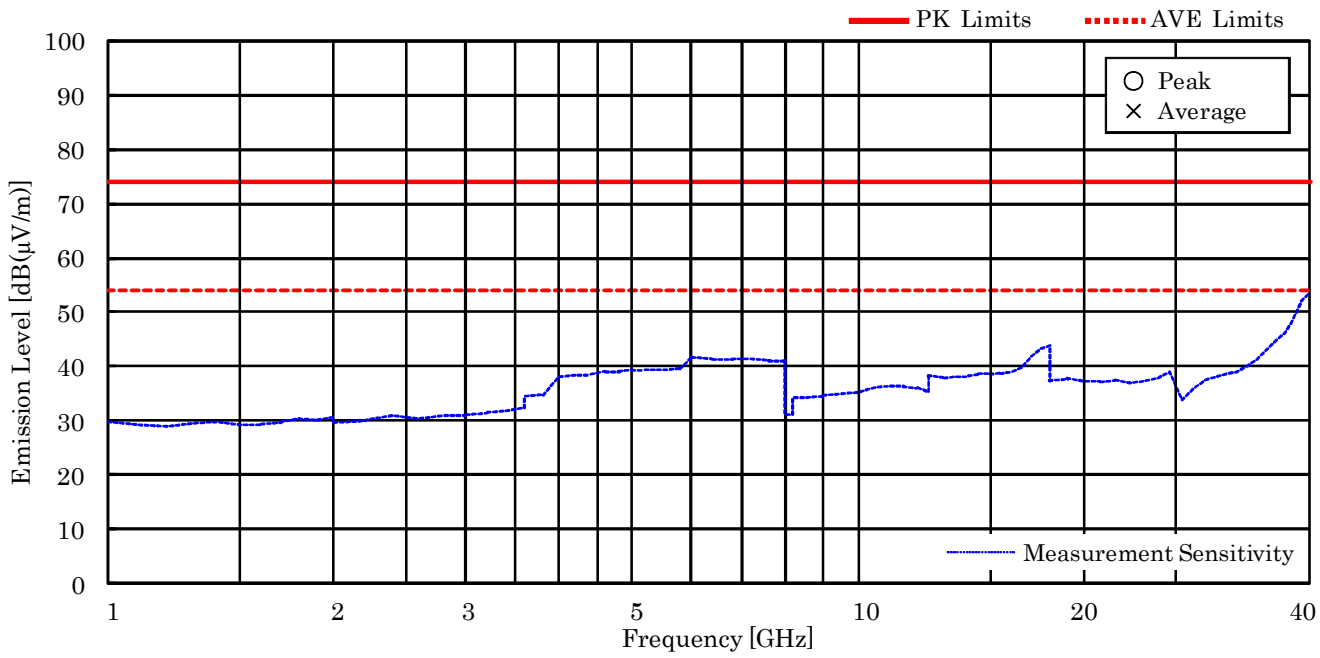
Test Date: April 20, 2016
Temp.: 20 °C, Humi: 39 %

Frequency [MHz]	Antenna Factor [dB(1/m)]	Corr. Factor [dB]	D.C.F. [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													
4804.0	27.3	-15.9	0.0	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 49.4	< 39.4	> +14.6	
12010.0	33.6	-25.6	0.0	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 46.0	< 36.0	> +18.0	
19216.0	40.5	-42.8	0.0	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.7	< 37.7	> +16.3	
Test condition : TX Middle Ch													
4882.0	27.3	-15.8	0.0	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 49.5	< 39.5	> +14.5	
7323.0	29.9	-16.3	0.0	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 51.6	< 41.6	> +12.4	
12205.0	33.5	-26.0	0.0	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 45.5	< 35.5	> +18.5	
19528.0	40.4	-42.7	0.0	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.7	< 37.7	> +16.3	
Test condition : TX High Ch													
4960.0	27.3	-15.8	0.0	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 49.5	< 39.5	> +14.5	
7440.0	29.8	-16.4	0.0	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 51.4	< 41.4	> +12.6	
12400.0	33.6	-26.4	0.0	< 38.0	< 28.0	< 38.0	< 28.0	74.0	54.0	< 45.2	< 35.2	> +18.8	
19840.0	40.4	-42.8	0.0	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.6	< 37.6	> +16.4	
22320.0	40.6	-43.2	0.0	< 50.0	< 40.0	< 50.0	< 40.0	74.0	54.0	< 47.4	< 37.4	> +16.6	

Calculated result at 7323.0 MHz, as the worst point shown on underline:

	Antenna Factor	=	29.9 dB(1/m)
	Corr. Factor	=	-16.3 dB
	D.C.F.(For AVE only)	=	0.0 dB
+)	Meter Reading	=	<28.0 dB(μV)
	Result	=	<41.6 dB(μV/m)

Minimum Margin: 54.0 - <41.6 = >12.4 (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
7. D.C.F. Calculation. (D.C.F. ; Duty Cycle Correction Factor)
   - Time to cycle through all channels = t = T [ms] x 20 (AFH minimum hopping channels), where T = burst on duration
   - 100 ms / t = h --> Round up to next highest integer, to account for worst case, H
   - The Worst Case Dwell Time [ms] = T x H
   - D.C.F. [dB] = 20 x log(The Worst Case Dwell Time / 100 [ms])

TX Low/Middle/High ch (Horizontal/Vertical)