

RADIO TEST REPORT

(for Bluetooth Low Energy)

Project No. : JB-Z0143-B

Client : Sony Corporation

Address : 1-7-1 Konan Minato-ku Tokyo, 108-0075 Japan

Type of Equipment : Digital Music Player

Model No. : NW-A35

Serial No. : 1, 4

FCC ID : AK8NWA30

IC : 409B-NWA30

Regulation Applied : 47 CFR Part 15 Subpart C / RSS-Gen Issue 4, RSS-247 Issue 1

Final Judgment : **Passed**

Sample Receipt : April 01, 2016

Testing : June 01, 2016 - June 24, 2016

Reported : July 11, 2016

Reported by :



Takanori Oho

Approved Signatory :



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Notice

- * These test results relate only to the items (combination equipment, test configuration, operation condition etc.) tested.
- * This report shall not be reproduced except in full, without written approval of the laboratory.
- * This report must not be used by the client to claim product endorsement by A2LA or any agency of the U.S. Government.
- * All test results are traceable to the national and / or international standards.

The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in Sony Global Manufacturing & Operations Corporation EMC/RF Test Laboratory.



TESTING CERT #3203.01

TABLE OF CONTENTS

1.	General Information.....	3
1.1.	Description of Equipment Under Test (EUT)	3
1.2.	Summary of Test Result	4
1.3.	Tested Methodology.....	5
1.4.	Measurement Procedures.....	5
1.5.	Test Facility	8
1.6.	Uncertainty.....	8
2.	System Test Configuration.....	9
2.1.	Validation.....	9
2.2.	Test Operating Conditions.....	9
2.3.	Special Accessories.....	9
2.4.	EUT Modifications.....	9
2.5.	Configuration of Tested System.....	10
3.	Test Data.....	13
3.1.	AC Power-line Conducted Emissions.....	13
3.2.	6dB Bandwidth	14
3.3.	99% Occupied Bandwidth.....	15
3.4.	Maximum Peak Conducted Output Power	16
3.5.	Power Spectral Density	17
3.6.	Radiated Spurious Emissions	18
3.7.	Conducted Spurious Emissions for Band Edge	44
4.	Method of Calculation	45
5.	List of Test Equipment.....	47
5.1.	AC Power-line Conducted Emissions.....	47
5.2.	Antenna-port Conducted Measurements	47
5.3.	Radiated Spurious Emissions	47
6.	Photographs of test setup.....	48
6.1.	Antenna-port Conducted Measurements Photo(s).....	48
6.2.	Antenna-port Conducted Measurements Photo(s).....	48
6.3.	Radiated Spurious Emissions Measurement Photo(s).....	49

Note

- 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.

1.2. Summary of Test Result

47 CFR Part 15 Subpart C § 15.247 [DTS] / RSS-Gen Issue 4, RSS-247 Issue 1

Test Item	Worst Margin	Test Frequency band	Results
AC Power-line Conducted Emissions	14.60 dB (QP) 0.150 MHz N	150 kHz - 30 MHz	Complied
6dB Bandwidth	Refer to the test data	Carrier	Complied
Maximum Peak Conducted Output Power	23.00 dB	Carrier	Complied
Power Spectral Density	16.88 dB	Carrier	Complied
Radiated Spurious Emissions	4.3 dB (AV) 7206.068 MHz Horizontal	9 kHz - 25 GHz (excluding carrier and band edge)	Complied
Conducted Spurious Emissions for Band Edge *1	34.55 dB 2399.96 MHz	Carrier band edge	Complied

*1: Conducted Spurious Emission was tested for the only frequencies in the non-restricted carrier band edges, since the spurious emissions in other non-restricted band were complied with Radiated Spurious Emission measurement.

Test Item	Worst Margin	Test Frequency band	Results
99% Occupied Bandwidth	Refer to the test data	Carrier	Complied

Other requirements

Part 15.31(e) Supply voltage requirement

: Complied (The EUT was tested with a new battery)

Part 15.203 / 212 Antenna requirement

: Complied (The EUT has an internal antenna which cannot be replaced by users)

1.3. Tested Methodology

Test Standard : 47 CFR Part15 Subpart C / RSS-Gen Issue 4, RSS-247 Issue 1
 Test Method : ANSI C63.10 - 2013
 KDB 558074 D01 DTS Meas. Guidance v03r05

Test Condition

Radiated Spurious Emissions

Test Distance : 3 m 10m (9kHz - 30 MHz)
 3 m 10m (30 - 1000 MHz)
 3 m (1 - 25 GHz)

Dimensions of the EUT table : 0.8m (below 1GHz) or 1.5m (above 1GHz) height, 2m width and 1m depth.

AC Power-line Conducted Emissions

Dimensions of the EUT table : 0.8m height, 2m width and 1m depth.

1.4. Measurement Procedures

We performed the measurements in accordance with NV3-06, available upon the request.

- No deviation
- Deviation from the above procedure

The summary of the above procedure is mentioned below

Antenna-port Conducted Measurement

1. Antenna-port of the EUT was connected to the power sensor (Maximum peak conducted output power) or spectrum analyzer. (other test items).
2. For each EUT operation mode, the Antenna-port Conducted Measurement were measured with spectrum analyzer.

Test Item	Detector	RBW
* Antenna-port Conducted Measurements		
6dB Bandwidth	Peak	100 kHz
Maximum Peak Conducted Output Power	Peak	-
Power Spectral Density	Peak	3 kHz
Conducted Spurious Emissions for Band Edge	Peak	100 kHz
99% Occupied Bandwidth	Peak	30 kHz

AC Power-line Conducted Emissions

1. The non-conductive table (EUT table) made of (FRP, wood, other non-conductive material) was placed 0.4 m from its rear to the vertical reference ground plane.
2. The EUT was placed on the center of tabletop and its rear was flush with the rear of the table, connected through a LISN to the input power mains.
3. The LISN was placed in 80 cm from the nearest part of the EUT chassis.
4. The excess length of the AC cable between the EUT and the LISN receptacle, or an adaptor or extension cable connected to and measured with LISN, was folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
5. The connection of the all other equipment to the second LISN was performed. The second LISN was terminated with a 50-ohm terminator.
6. Interconnecting cables that hang closer than 40 cm to the horizontal reference ground plane was folded back and forth forming a bundle 30 to 40 cm long, hanging approximately in the middle between the horizontal reference ground plane and the tabletop.
7. Find the worst mode and arrangement of the EUT according to the follows;
 - Connecting all peripherals and change the position of peripherals and cables.
 - Changing the all test operation modes of the EUT.
 - On every condition, exploring the highest emissions with the spectrum analyzer.
(150kHz - 30MHz, peak detector, RBW: 10 kHz)
8. On the worst condition of the EUT found in above, choose the 6 highest emissions on the spectrum data. The final measurements carried out on these emissions with EMI test receiver.
(quasi-peak and average detector, RBW: 9 kHz)

Radiated Spurious Emissions

1. The non-conductive table (EUT table) made of (FRP, Styrene Foam, other non-conductive material) was placed in the center of the turntable.
2. The EUT was placed on the center of the tabletop.
3. The test antenna was placed away from the EUT at test distance.
4. The limits compensated the distance factor with follows;

9 kHz - 490 kHz [Limit at 3m]	= [Limit at 300m] + 40log (300[m] / 3[m])
490 kHz - 30 MHz [Limit at 3m]	= [Limit at 30m] + 40log (30[m] / 3[m])
5. Find the worst arrangement of the EUT as follows;
 - Rotate the turntable and/or scanning the antenna.
 - On every condition, explore the highest emissions with the spectrum analyzer.
(9 kHz - 25 GHz, peak detector)

6. On the worst arrangement of the EUT found in above, choose the three highest harmonics or spurious emissions on the spectrum data.(*excluding carrier band edges)
 The final measurements are performed with all test operating modes for these emissions as follows;

The test antenna and the turntable were performed with follows;

	9kHz - 30MHz	30MHz - 1000MHz	above 1GHz
Antenna	Loop Antenna	Bi-conical Antenna, Log-periodic Antenna	Horn Antenna
Antenna scanning range	1m, Vertical, 360 degrees	1 - 4m, Horizontal and Vertical	1 - 4m *, Horizontal and Vertical
Turntable rotating range	360 degrees	360 degrees	360 degrees

*: When the measurement frequencies above 1GHz, final measurements are performed keeping the antenna in the "cone of radiation" from EUT area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.

Instruments settings were carried out with follows;

	9 kHz - 90 kHz 110 kHz - 490 kHz	90 kHz- 110 kHz 490 kHz - 30 MHz	30 MHz - 1000 MHz	above 1GHz
Detector	Peak / Average	Quasi-peak	Quasi-peak	Peak / Average
RBW	200 Hz (6dB) or 9 kHz (6dB) *1	200 Hz (6dB) or 9 kHz (6dB) *1	120 kHz (6dB)	1 MHz (3dB)
VBW	N/A	N/A	N/A	3 MHz (for peak) 10 kHz (for average) *2
Instrument	EMI test receiver	EMI test receiver	EMI test receiver	Spectrum analyzer

*1: When the measurement frequencies below 150 kHz, RBW: 200 Hz was used.

*2: VBW setting (for average) was higher than 1/T. (T is the minimum transmission duration)

7. If the final measurement result exceeded the limit in non-restricted band(excluding carrier band edges), the measurement is carried out additionally with follows;

Measurement points

- Fundamental Frequency
- Frequency that exceeded the limit in non-restricted band (excluding carrier band edges)

	9 kHz - 150 kHz	150 kHz - 30MHz	above 30MHz
Detector	Peak	Peak	Peak
RBW	3 dB RBW: 300 Hz *	3 dB RBW: 10 kHz *	3 dB RBW: 100 kHz
Instrument	Spectrum analyzer	Spectrum analyzer	Spectrum analyzer

*: Correction factor of RBW was compensated to a measurement result by the following formula.

$$C.F. \text{ of RBW [dB]} = 10 * \log (100\text{kHz} / \text{used RBW})$$

8. If the final average measurement result exceeded the limit in the authorized band edge, the integration method is carried out with follows;

	2483.5 - 2485.5MHz
Detector	Peak
RBW	3 dB RBW: 100 kHz
Instrument	Spectrum analyzer
Function	Channel Power (integration BW : 1MHz)

9. Although these tests were performed other than open field area test site, adequate comparison measurements were confirmed against 30 m open field area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.

1.5. Test Facility

Address of Test Facility

Test Facility Name : Sony Global Manufacturing & Operations Corporation
EMC/ RF Test Laboratory, Main Lab.
Address : Kisarazu Site 8-4 Shiomi Kisarazu-shi Chiba, 292-0834 Japan
Phone : +81 438 37 2750

AC Power-line Conducted Emissions

Shielded Room
 4th Site

Radiated Spurious Emission

Semi-Anechoic chamber
 4th Site

Antenna-port Conducted Measurements *

Shielded Room
 4th Site SR1

*Note: This item contains the following

- 6dB Bandwidth / 99% Occupied Bandwidth
- Maximum Peak Conducted Output Power
- Power Spectral Density
- Conducted Spurious Emissions for Band Edge

A2LA Accreditation for Test Facility

The above test facility has been fully reported to A2LA and accepted as follows:
Effective dates: 2015-09-15 through 2017-10-31

Canada Registered Test Site

IC Assigned Code : 409R-1

1.6. Uncertainty

Test Item	Frequency	4th Site SR1
Conducted Output Power	1 - 6GHz	± 0.84 dB
Power Spectral Density, Conducted Spurious Emissions	below 6GHz	± 0.89 dB

Test Item	Frequency	4th Site	
AC Power-line Conducted Emissions	150kHz - 30MHz	± 3.34 dB	
Radiated Emissions	below 30 MHz	3m	± 2.59 dB
	30 - 300 MHz	3m	± 4.18 dB
	300 - 1000 MHz	3m	± 4.04 dB
	1 - 6 GHz	3m	± 4.63 dB
	6 - 18 GHz	3m	± 5.31 dB
	18 - 26.5 GHz	3m	± 5.78 dB

2. System Test Configuration

2.1. Validation

The system was configured for testing in a typical (as a customer would normally use it).
The tests were conducted with the worst case modes as follows.

2.2. Test Operating Conditions

The tests have been carried out the following conditions.

Test Items	Operating Mode	Data Rate	Test Channels
AC Power-line Conducted Emissions	Bluetooth Low Energy	1 Mbps	2440 MHz *1
6dB Bandwidth, 99% Occupied Bandwidth, Maximum Peak Conducted Output Power, Power Spectral Density, Radiated Spurious Emissions	Bluetooth Low Energy	1 Mbps	2402 MHz, 2440 MHz, 2480 MHz
Conducted Spurious Emissions for Band Edge	Bluetooth Low Energy	1 Mbps	2402 MHz

Note:

*1: The test was performed with the representative mode that had been found as the worst emissions while exploratory testing.

The Software for Operating Mode

Name : Diagnosis
Version : 1.02.10

2.3. Special Accessories

Special accessories needed for connecting the EUT to achieve compliance:

Item	Manufacturer	Model No.	Serial No.	Remark
-	-	-	-	-

2.4. EUT Modifications

- No equipment modification to achieve compliance to the standard levels was done during the tests.
 Equipment was modified to achieve compliance to the standard level as below.

Responsible Party Signature

Typed/ Print Name :
Responsible Party :
Position :
Date :

2.5. Configuration of Tested System

Antenna-port Conducted Measurements

The equipment under test (EUT)

Symbol	Item	Manufacturer	Model No.	Serial No.
A	Digital Music Player	SONY	NW-A35	4

Support equipment for operation

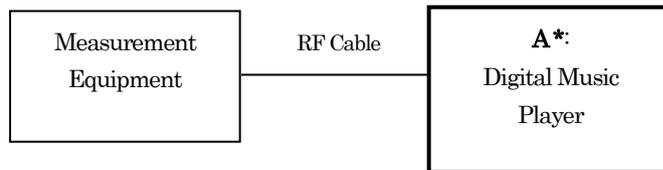
Symbol	Item	Manufacturer	Model No.	Serial No.
-	-	-	-	-

Type of cable

Symbol	Description	Identification (Manufacturer etc.)	Shielded YES / NO	Ferrite Core	Length (m)	Bundled
-	-	-	-	-	-	-

System configuration

*: EUT



Radiated Spurious Emissions

The equipment under test (EUT)

Symbol	Item	Manufacturer	Model No.	Serial No.
A	Digital Music Player	SONY	NW-A35	1

Support equipment for operation

Symbol	Item	Manufacturer	Model No.	Serial No.
-	-	-	-	-

Type of cable

Symbol	Description	Identification (Manufacturer etc.)	Shielded YES / NO	Ferrite Core	Length (m)	Bundled
-	-	-	-	-	-	-

System configuration

*: EUT

BLE
Transmitting



AC Power-line Conducted Emissions

The equipment under test (EUT)

Symbol	Item	Manufacturer	Model No.	Serial No.
A	Digital Music Player	SONY	NW-A35	1

Support equipment for operation

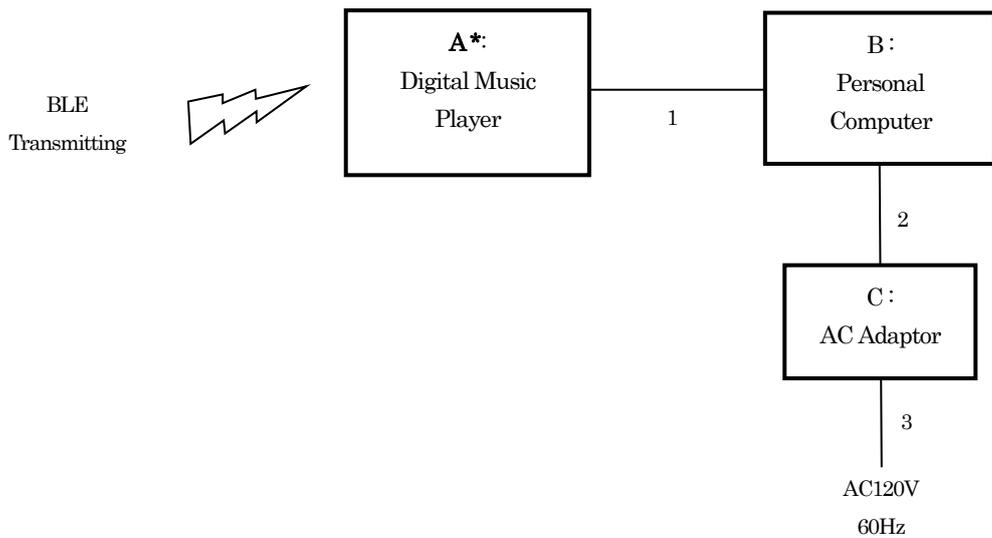
Symbol	Item	Manufacturer	Model No.	Serial No.
B	Personal Computer	HP	Elite Book 820	H10105155
C	AC Adaptor	HP	HSTNN-CA	WDVTPOCGC8X1LY

Type of cable

Symbol	Description	Identification (Manufacturer etc.)	Shielded YES / NO	Ferrite Core	Bundled	Length (m)
1	USB Cable	SONY	YES	NO	NO	1.0
2	DC Cable	-	NO	NO	YES	2.0
3	AC Cable	-	NO	NO	NO	1.0

System configuration

*: EUT



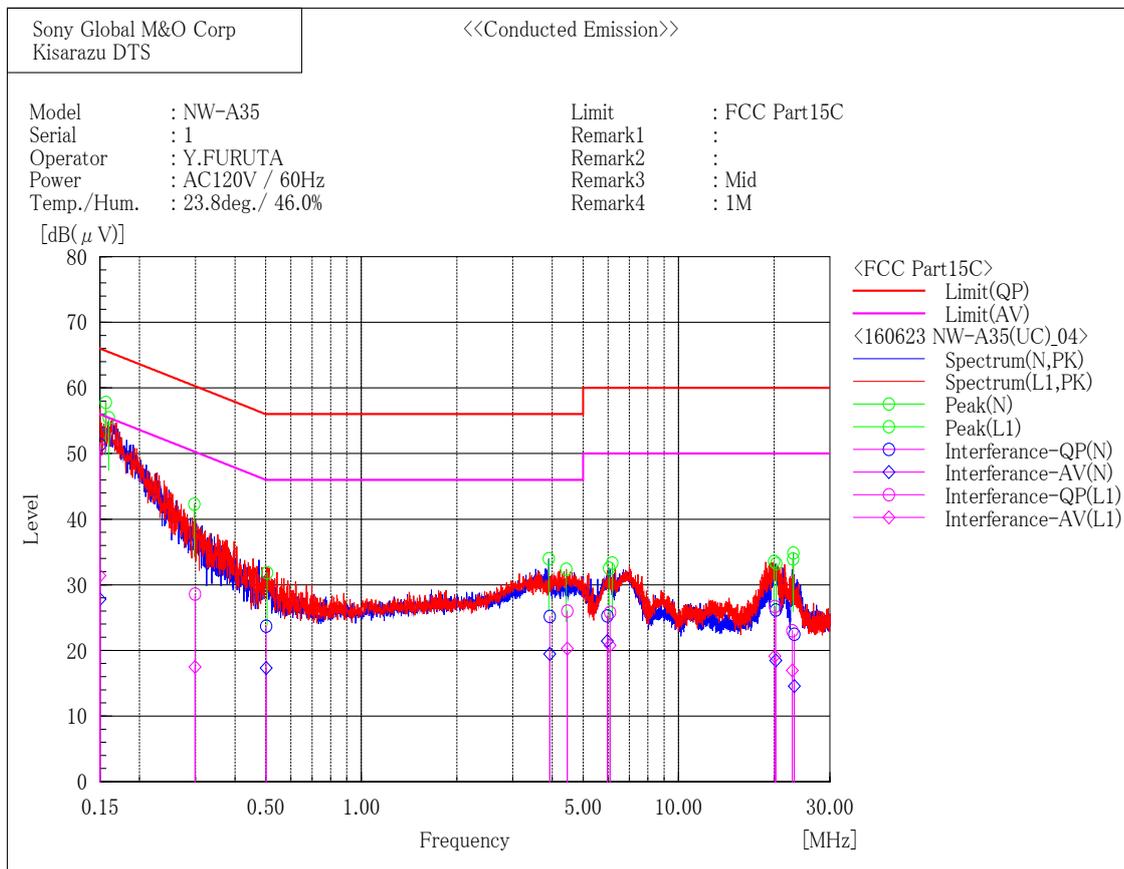
3. Test Data

3.1. AC Power-line Conducted Emissions

150kHz – 30MHz

1) Date of measurement : June 23, 2016

[Bluetooth Low Energy / 2440MHz]



Final Result

--- N Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c. f [dB]	Result QP [dB(μV)]	Result AV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin AV [dB]
1	0.150	35.4	11.8	16.0	51.4	27.8	66.0	56.0	14.6	28.2
2	0.501	7.5	1.1	16.2	23.7	17.3	56.0	46.0	32.3	28.7
3	3.929	9.2	3.4	16.0	25.2	19.4	56.0	46.0	30.8	26.6
4	5.963	9.2	5.4	16.0	25.2	21.4	60.0	50.0	34.8	28.6
5	20.255	9.6	2.0	16.5	26.1	18.5	60.0	50.0	33.9	31.5
6	23.173	5.8	-2.0	16.6	22.4	14.6	60.0	50.0	37.6	35.4

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c. f [dB]	Result QP [dB(μV)]	Result AV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin AV [dB]
1	0.150	34.7	15.4	16.0	50.7	31.4	66.0	56.0	15.3	24.6
2	0.299	12.7	1.6	15.9	28.6	17.5	60.3	50.3	31.7	32.8
3	4.462	10.0	4.3	16.0	26.0	20.3	56.0	46.0	30.0	25.7
4	6.079	9.7	4.7	16.1	25.8	20.8	60.0	50.0	34.2	29.2
5	20.109	10.3	2.7	16.4	26.7	19.1	60.0	50.0	33.3	30.9
6	22.824	6.5	0.5	16.5	23.0	17.0	60.0	50.0	37.0	33.0

3.2. 6dB Bandwidth

- 1) Ambient temperature : 21.5deg.C
- 2) Relative humidity : 50.0 %
- 3) Date of measurement : June 01, 2016
- 4) Measured by : M.KOUGA
- 5) Operating mode : Transmitting mode

Mode	Rate [Mbps]	Channel [MHz]	Result [MHz]	Limit [MHz]
BLE	1	2402	0.645	0.5
		2440	0.648	0.5
		2480	0.651	0.5

[Bluetooth Low Energy / 2402MHz]



[Bluetooth Low Energy / 2440MHz]



[Bluetooth Low Energy / 2480MHz]

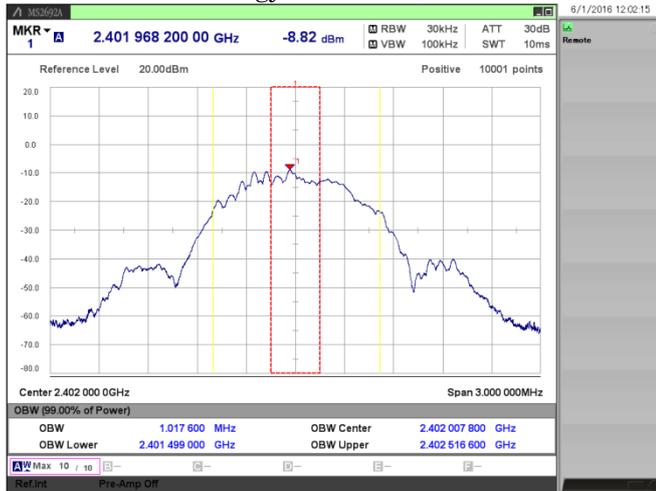


3.3. 99% Occupied Bandwidth

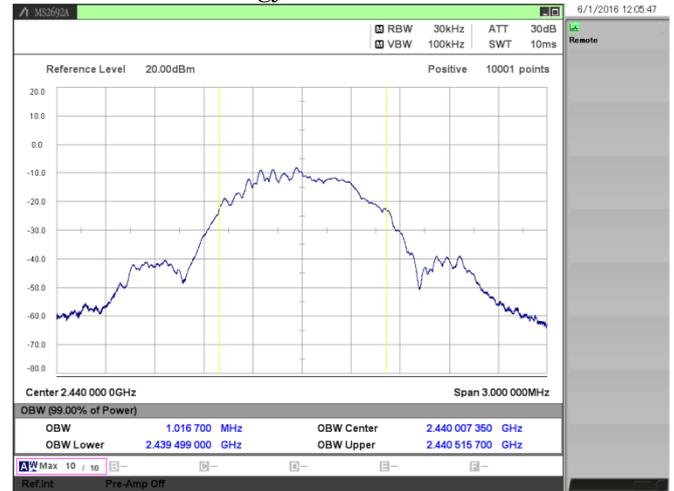
- 1) Ambient temperature : 21.5deg.C
- 2) Relative humidity : 50.0 %
- 3) Date of measurement : June 01, 2016
- 4) Measured by : M.KOUGA
- 5) Operating mode : Transmitting mode

Mode	Rate [Mbps]	Channel [MHz]	Result [MHz]	Limit [MHz]
BLE	1	2402	1.018	-
		2440	1.017	-
		2480	1.018	-

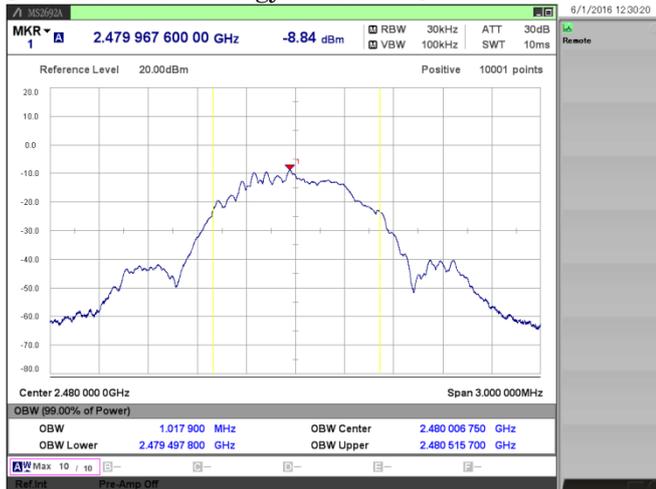
[Bluetooth Low Energy / 2402MHz]



[Bluetooth Low Energy / 2440MHz]



[Bluetooth Low Energy / 2480MHz]



3.4. Maximum Peak Conducted Output Power

- 1) Ambient temperature : 21.5deg.C
- 2) Relative humidity : 50.0 %
- 3) Date of measurement : June 01, 2016
- 4) Measured by : M.KOUGA
- 5) Operating mode : Transmitting mode

Maximum Peak Conducted Output Power

Mode	Rate [Mbps]	Channel [MHz]	Reading(PK) [dBm]	C.F. [dB]	Result(PK) [dBm]	Result(PK) [W]	Limit [dBm]	Margin [dB]
BLE	1	2402	-3.85	10.16	6.31	0.00428	30.0	23.69
		2440	-3.16	10.16	7.00	0.00501	30.0	23.00
		2480	-3.84	10.16	6.32	0.00429	30.0	23.68

Maximum Average Conducted Output Power (for SAR measurement)

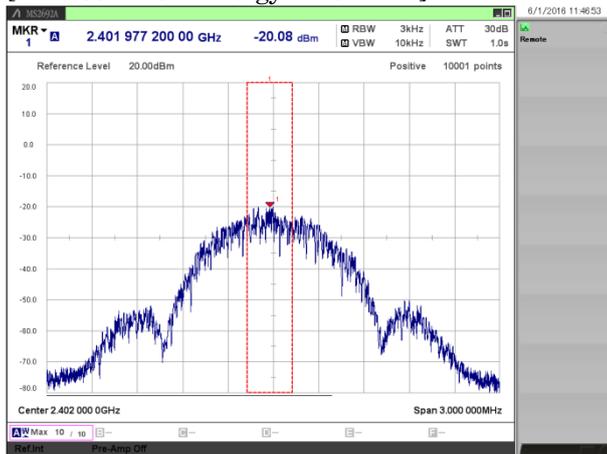
Mode	Rate [Mbps]	Channel [MHz]	Reading(AV) [dBm]	C.F. [dB]	Duty Factor [dB]	Result(AV) [dBm]	Result(AV) [W]
BLE	1	2402	-6.29	10.16	2.15	6.02	0.00400
		2440	-5.60	10.16	2.15	6.71	0.00469
		2480	-6.31	10.16	2.15	6.00	0.00398

3.5. Power Spectral Density

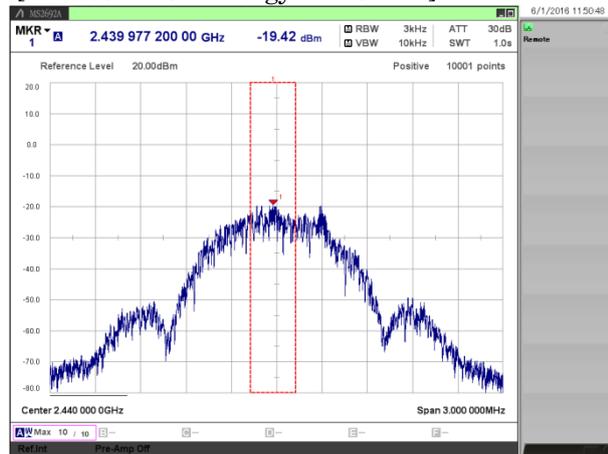
- 1) Ambient temperature : 21.5deg.C
- 2) Relative humidity : 50.0 %
- 3) Date of measurement : June 01, 2016
- 4) Measured by : M.KOUGA
- 5) Operating mode : Transmitting mode

Mode	Rate [Mbps]	Channel [MHz]	Reading(PK) [dBm]	C.F. [dB]	Result(PK) [dBm]	Limit [dBm]	Margin [dB]
BLE	1	2402	-20.08	10.54	-9.54	8.0	17.54
		2440	-19.42	10.54	-8.88	8.0	16.88
		2480	-20.02	10.54	-9.48	8.0	17.48

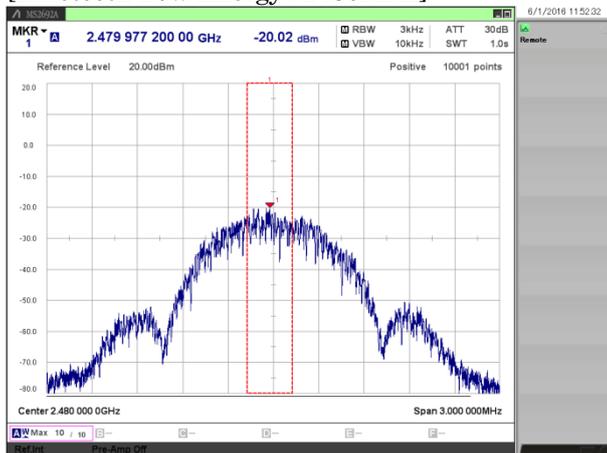
[Bluetooth Low Energy / 2402MHz]



[Bluetooth Low Energy / 2440MHz]



[Bluetooth Low Energy / 2480MHz]



3.6. Radiated Spurious Emissions

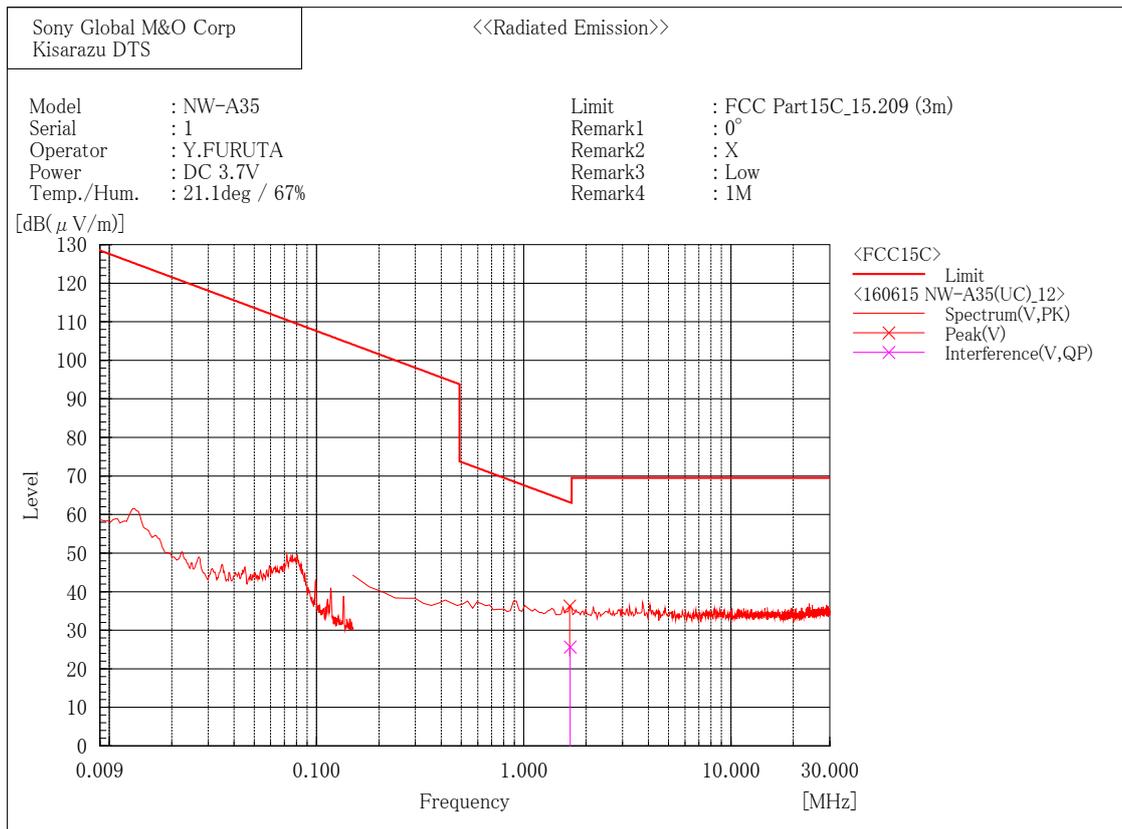
1) Date of measurement

9kHz - 30MHz : June 15, 2016 (all mode)
 30MHz - 1000MHz : June 07, 2016 (all mode)
 1GHz - 6GHz : June 13, 2016 (all mode)
 6GHz - 18GHz : June 13, 2016 (all mode)
 18GHz - 24.835GHz : June 14, 2016 (all mode)

June 13, 2016 (band edge plot data)

9 kHz - 30 MHz

[Bluetooth Low Energy (1 Mbps) / 2402MHz]

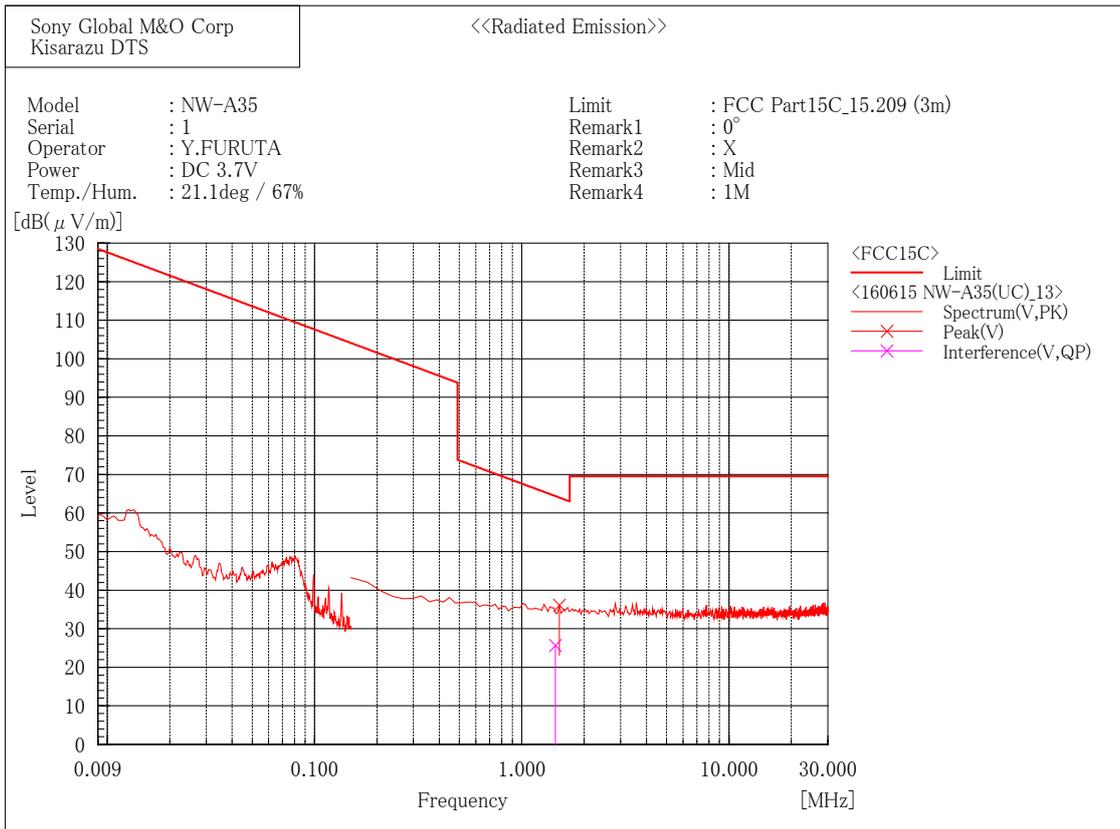


Final Result

--- Vertical Polarization (QP)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	1.676	5.8	19.9	25.7	63.1	37.4	100.0	294.0

[Bluetooth Low Energy (1 Mbps) / 2440MHz]

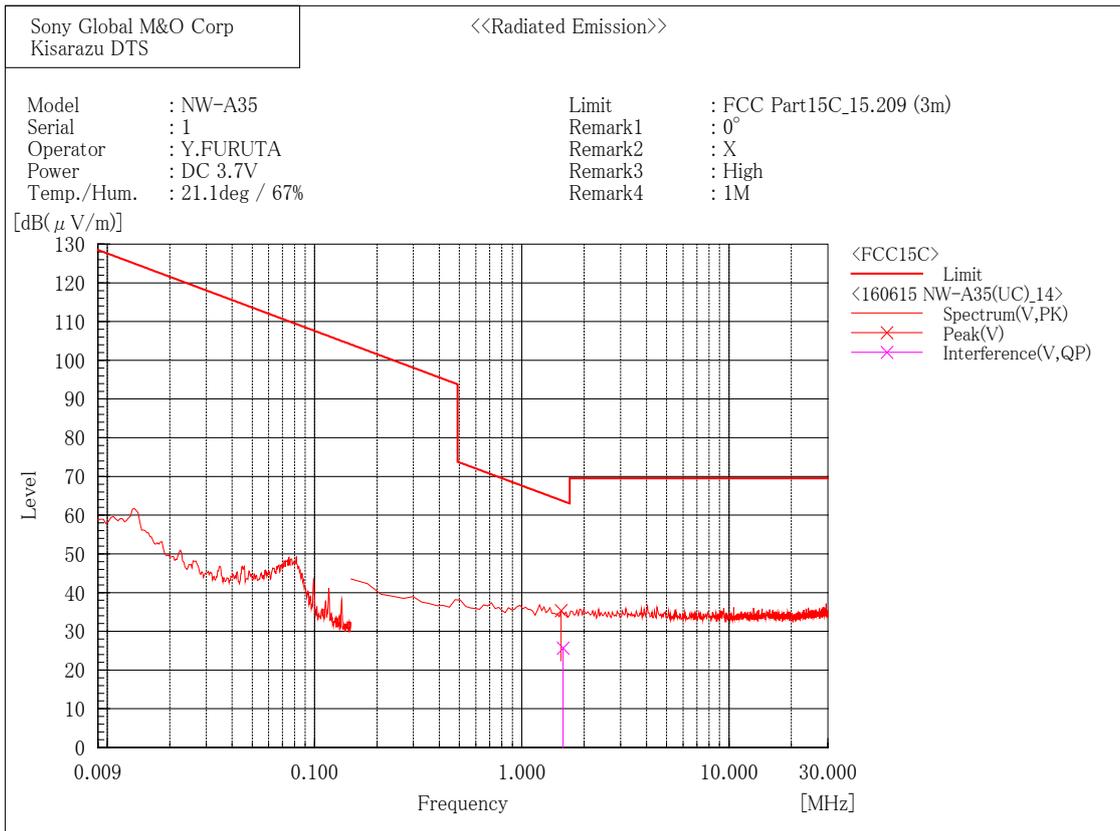


Final Result

--- Vertical Polarization (QP)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	1.451	5.9	19.8	25.7	64.4	38.7	100.0	80.0

[Bluetooth Low Energy (1 Mbps) / 2480MHz]

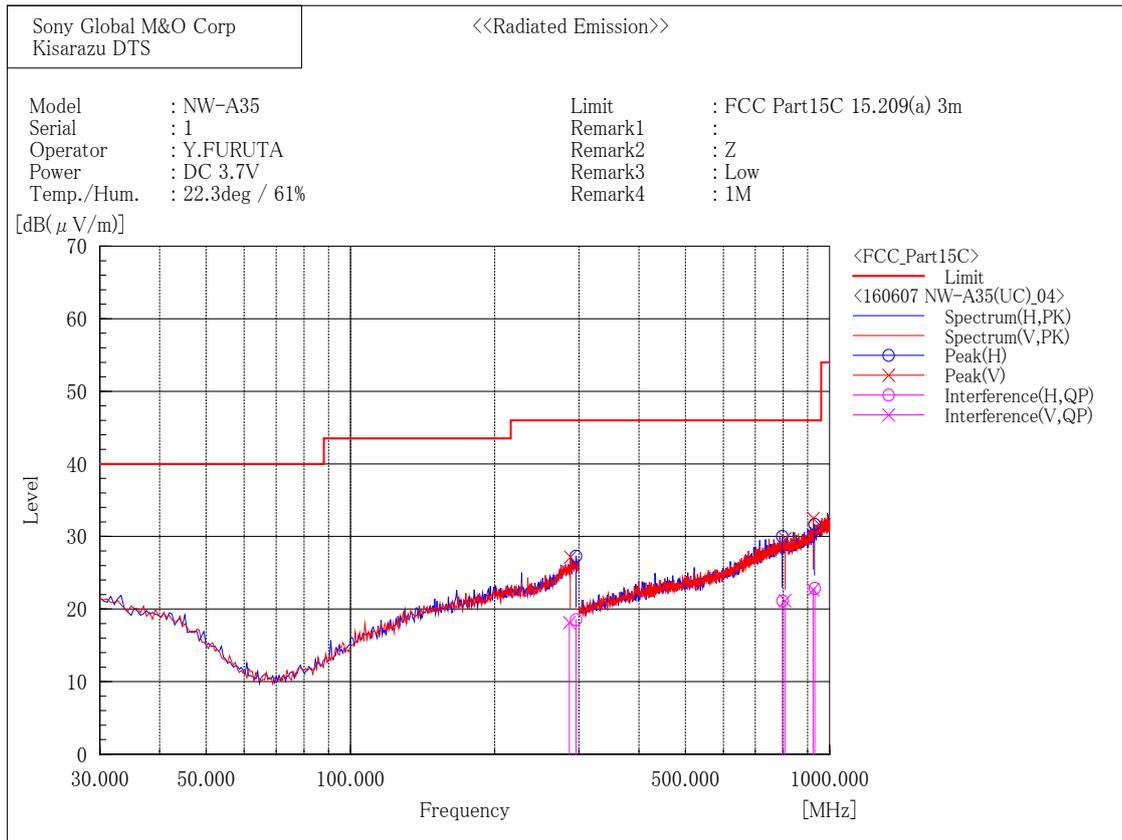


Final Result

--- Vertical Polarization (QP)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	1.580	5.8	19.9	25.7	63.7	38.0	100.0	20.8

30 MHz - 1000 MHz
 [Bluetooth Low Energy (1 Mbps) / 2402MHz]



Final Result

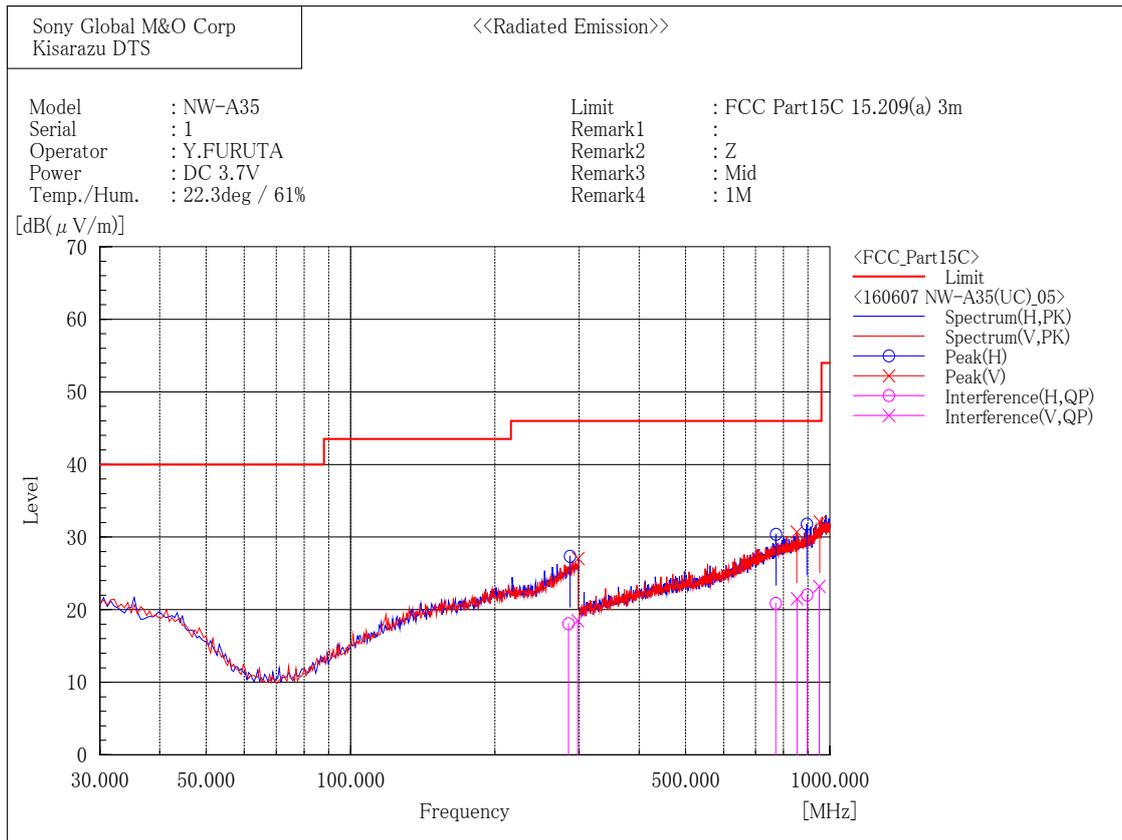
--- Horizontal Polarization (QP) ---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	295.634	24.5	-6.0	18.5	46.0	27.5	133.4	36.6
2	797.020	24.8	-3.7	21.1	46.0	24.9	112.6	345.4
3	930.820	24.5	-1.6	22.9	46.0	23.1	100.0	23.3

--- Vertical Polarization (QP) ---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	286.126	24.4	-6.3	18.1	46.0	27.9	375.9	293.2
2	806.720	24.8	-3.6	21.2	46.0	24.8	223.9	190.6
3	923.420	24.5	-1.8	22.7	46.0	23.3	343.7	313.9

[Bluetooth Low Energy (1 Mbps) / 2440MHz]



Final Result

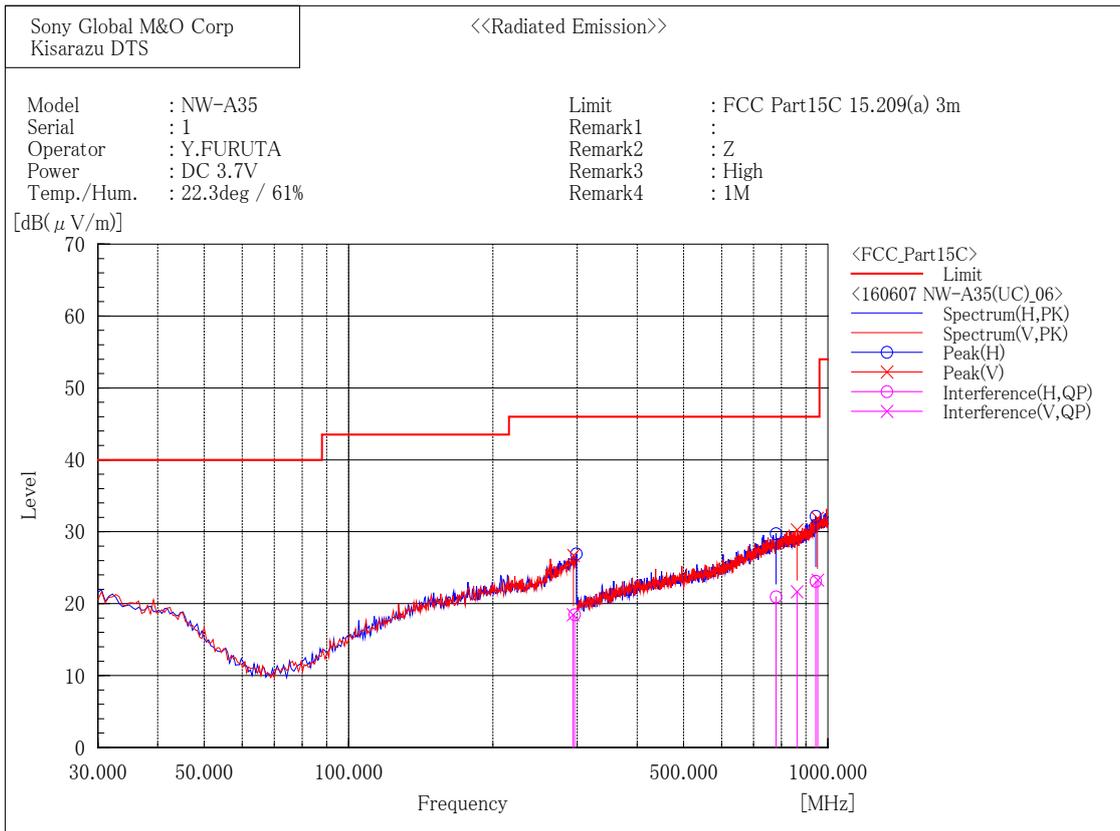
--- Horizontal Polarization (QP) ---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	285.013	24.5	-6.4	18.1	46.0	27.9	288.8	341.1
2	771.260	24.9	-4.0	20.9	46.0	25.1	263.0	293.9
3	896.420	24.5	-2.5	22.0	46.0	24.0	235.7	74.1

--- Vertical Polarization (QP) ---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	297.673	24.5	-6.0	18.5	46.0	27.5	340.6	318.7
2	854.500	24.6	-3.1	21.5	46.0	24.5	149.0	259.7
3	950.360	24.3	-1.1	23.2	46.0	22.8	348.3	34.0

[Bluetooth Low Energy (1 Mbps) / 2480MHz]



Final Result

--- Horizontal Polarization (QP)---

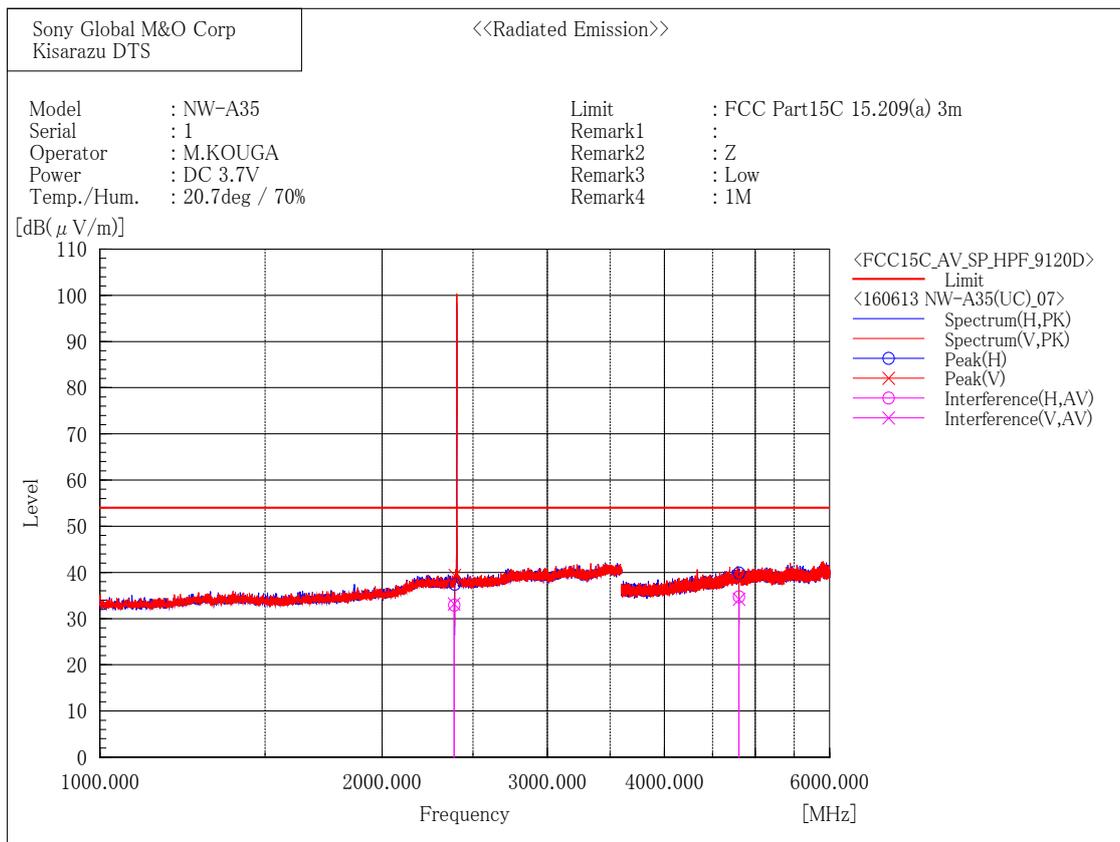
No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	296.237	24.4	-6.0	18.4	46.0	27.6	286.1	27.3
2	779.860	24.9	-3.9	21.0	46.0	25.0	198.6	254.7
3	943.760	24.3	-1.2	23.1	46.0	22.9	236.3	163.3

--- Vertical Polarization (QP)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	293.758	24.4	-6.0	18.4	46.0	27.6	100.0	132.6
2	862.400	24.7	-3.0	21.7	46.0	24.3	220.4	162.4
3	952.920	24.3	-1.0	23.3	46.0	22.7	398.1	144.2

1GHz - 6 GHz

[Bluetooth Low Energy (1 Mbps) / 2402MHz]



Final Result

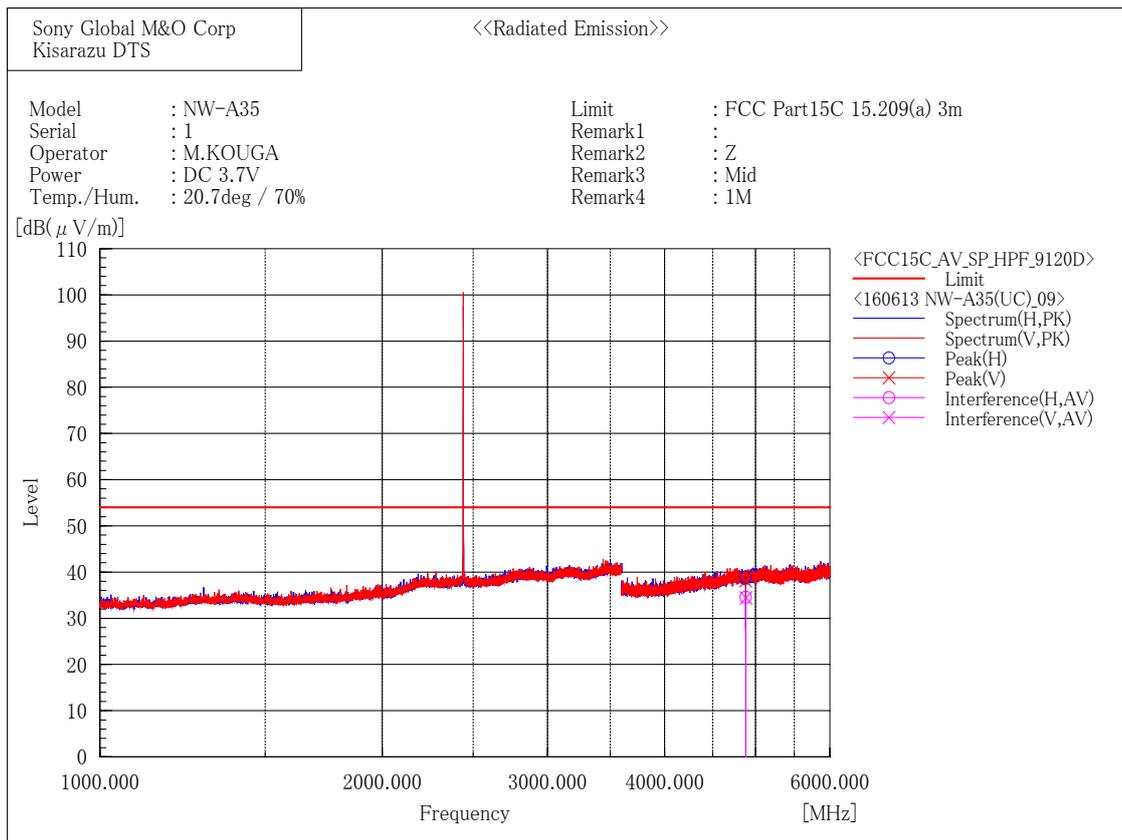
--- Horizontal Polarization (AV) ---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	2387.097	34.3	-1.4	32.9	54.0	21.1	239.7	51.5
2	4804.103	31.6	3.1	34.7	54.0	19.3	151.2	100.7

--- Vertical Polarization (AV) ---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	2386.068	34.6	-1.4	33.2	54.0	20.8	202.0	146.1
2	4803.654	31.1	3.1	34.2	54.0	19.8	134.2	299.9

[Bluetooth Low Energy (1 Mbps) / 2440MHz]



Final Result

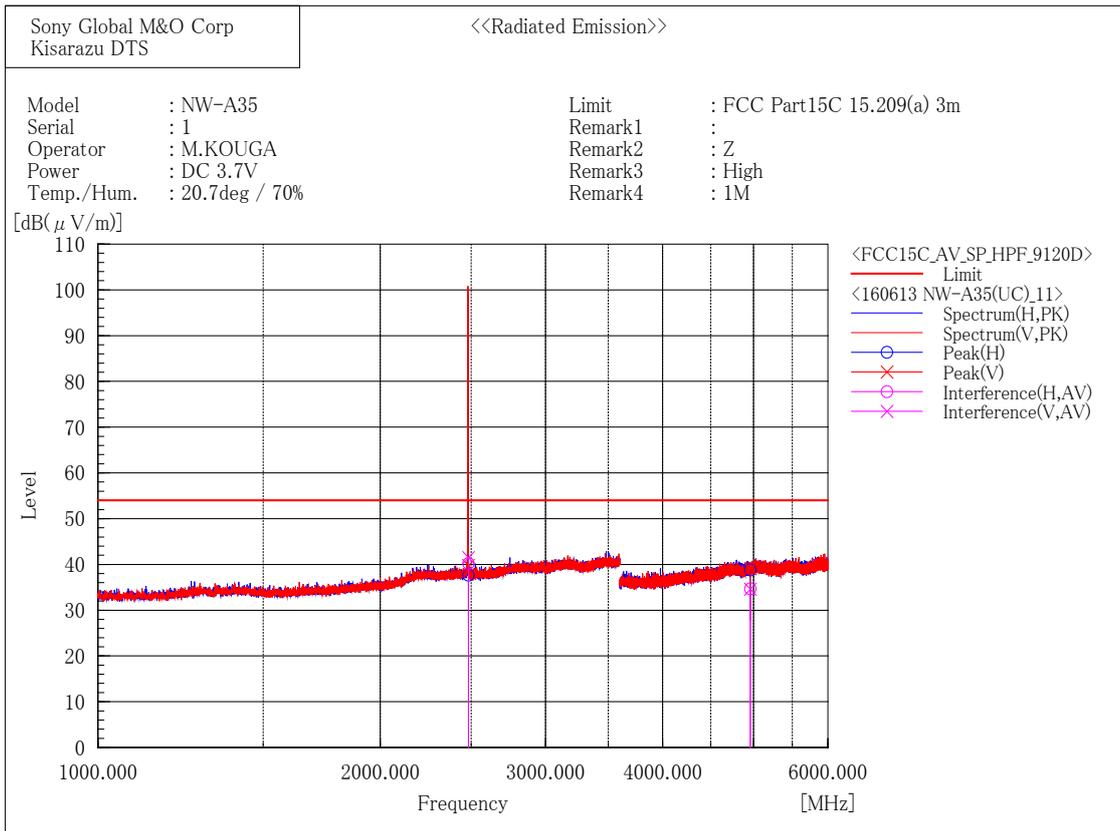
--- Horizontal Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	4880.235	31.7	2.9	34.6	54.0	19.4	222.3	95.4

--- Vertical Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	4881.187	31.5	2.9	34.4	54.0	19.6	203.9	177.1

[Bluetooth Low Energy (1 Mbps) / 2480MHz]



Final Result

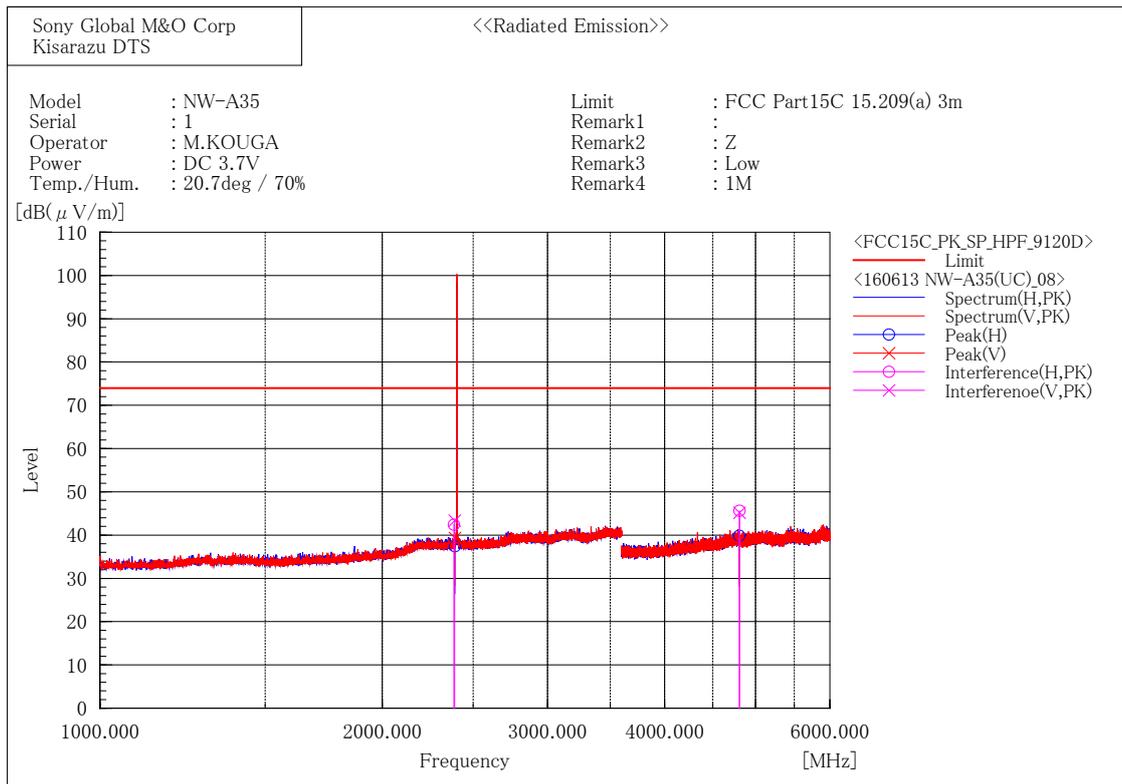
--- Horizontal Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	2483.501	41.5	-1.3	40.2	54.0	13.8	181.8	113.1
2	4959.924	31.6	3.1	34.7	54.0	19.3	168.3	218.4

--- Vertical Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	2483.504	42.8	-1.3	41.5	54.0	12.5	238.1	214.9
2	4960.241	31.5	3.1	34.6	54.0	19.4	202.6	172.1

[Bluetooth Low Energy (1 Mbps) / 2402MHz]



Final Result

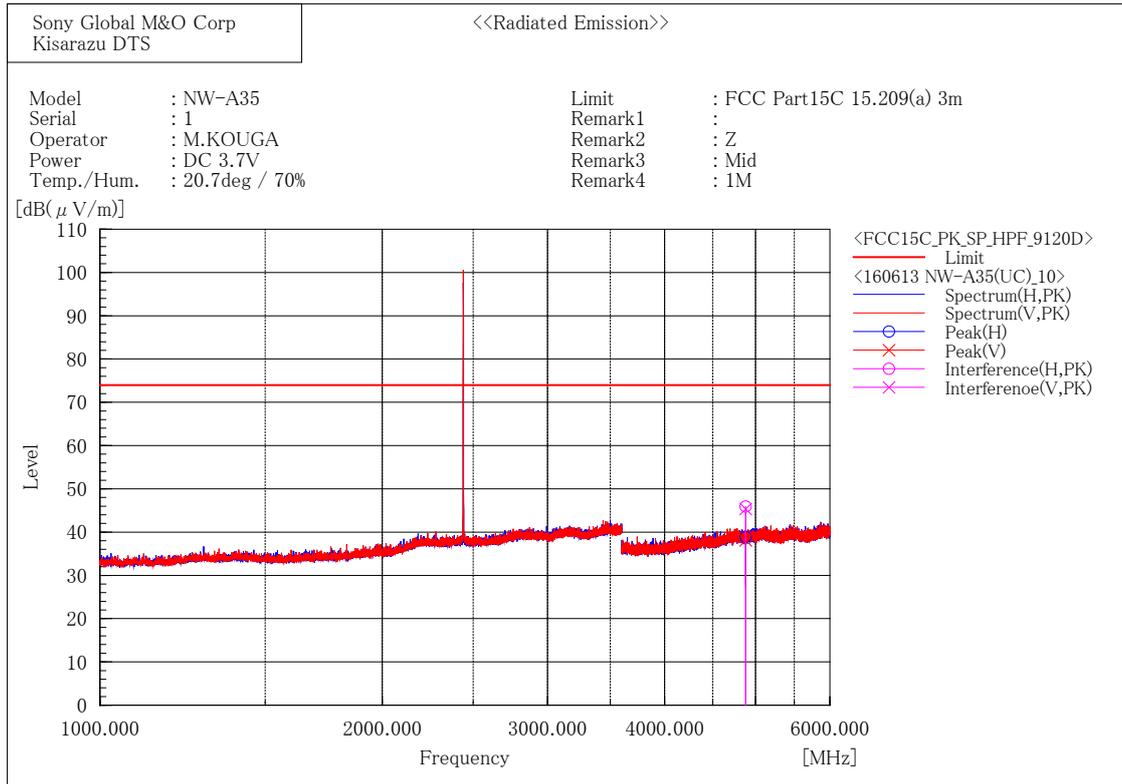
--- Horizontal Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	2384.279	43.8	-1.4	42.4	74.0	31.6	239.7	50.1
2	4805.417	42.6	3.1	45.7	74.0	28.3	150.0	101.1

--- Vertical Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	2388.567	44.8	-1.4	43.4	74.0	30.6	202.0	146.2
2	4804.486	42.1	3.1	45.2	74.0	28.8	134.0	300.1

[Bluetooth Low Energy (1 Mbps) / 2440MHz]



Final Result

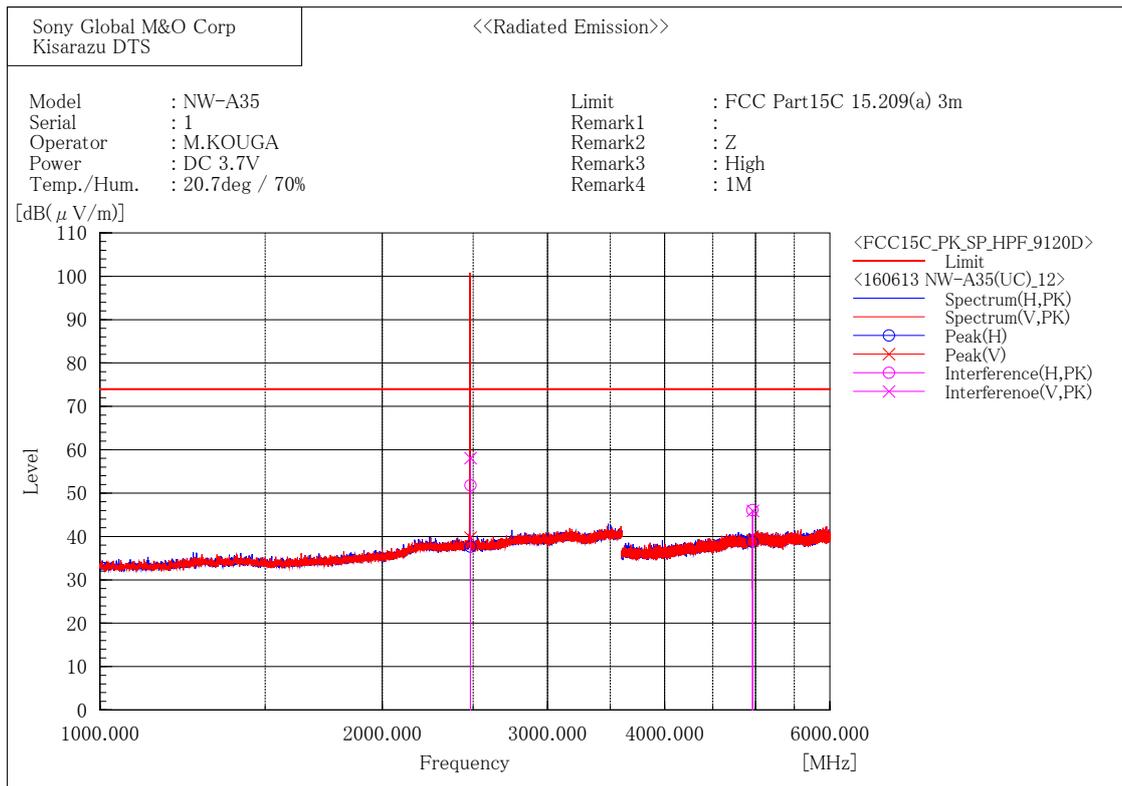
--- Horizontal Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	4880.324	43.0	2.9	45.9	74.0	28.1	222.3	95.4

--- Vertical Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	4880.612	42.4	2.9	45.3	74.0	28.7	195.1	164.1

[Bluetooth Low Energy (1 Mbps) / 2480MHz]



Final Result

--- Horizontal Polarization (PK)---

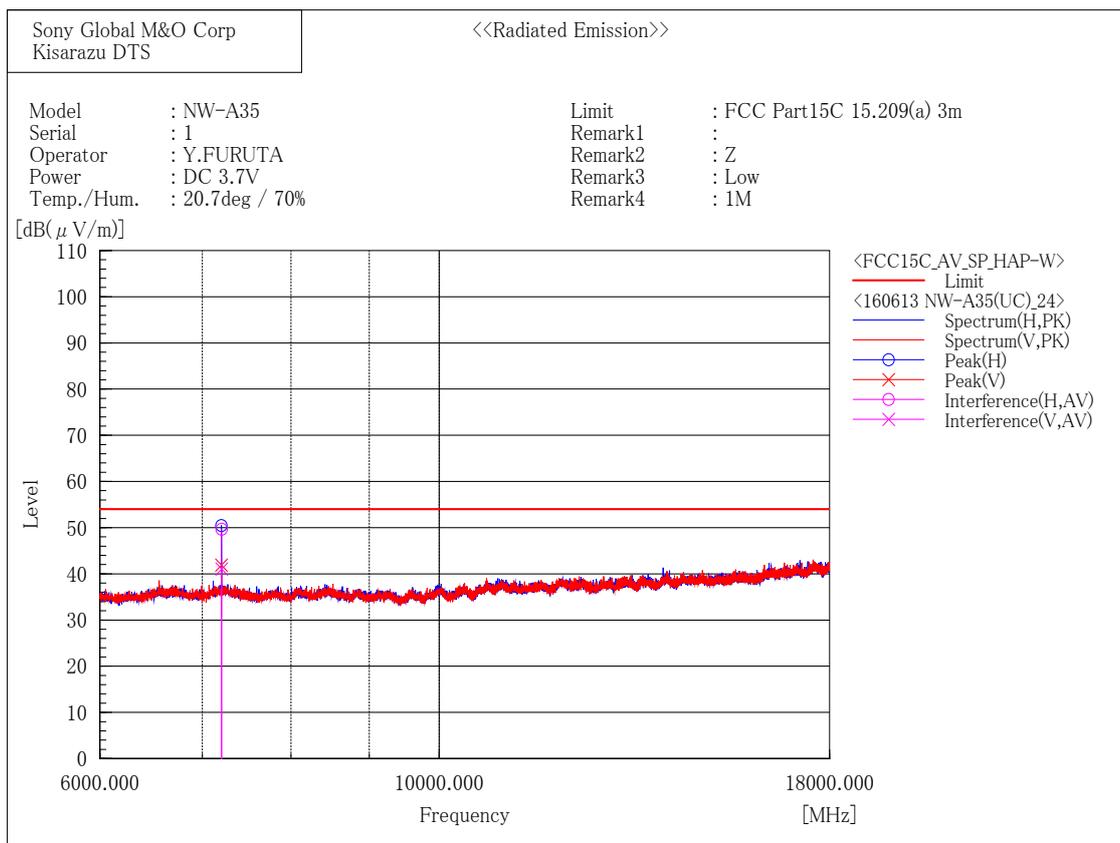
No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	2483.503	53.1	-1.3	51.8	74.0	22.2	181.8	113.2
2	4960.383	43.0	3.1	46.1	74.0	27.9	168.3	218.5

--- Vertical Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	2483.514	59.4	-1.3	58.1	74.0	15.9	238.1	215.0
2	4965.537	42.8	3.1	45.9	74.0	28.1	202.6	172.2

6 GHz - 18 GHz

[Bluetooth Low Energy (1 Mbps) / 2402MHz]



Final Result

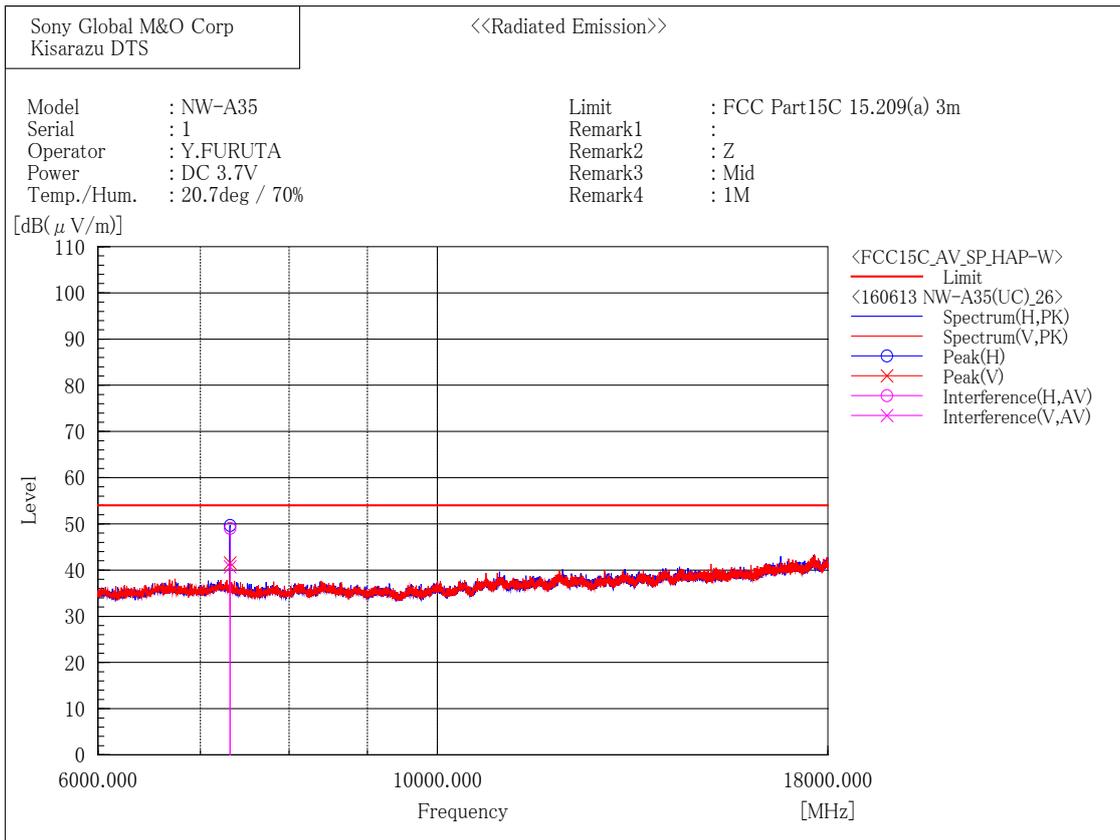
--- Horizontal Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	7206.068	57.8	-8.1	49.7	54.0	4.3	109.0	336.1

--- Vertical Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	7206.042	49.1	-8.1	41.0	54.0	13.0	134.0	260.6

[Bluetooth Low Energy (1 Mbps) / 2440MHz]



Final Result

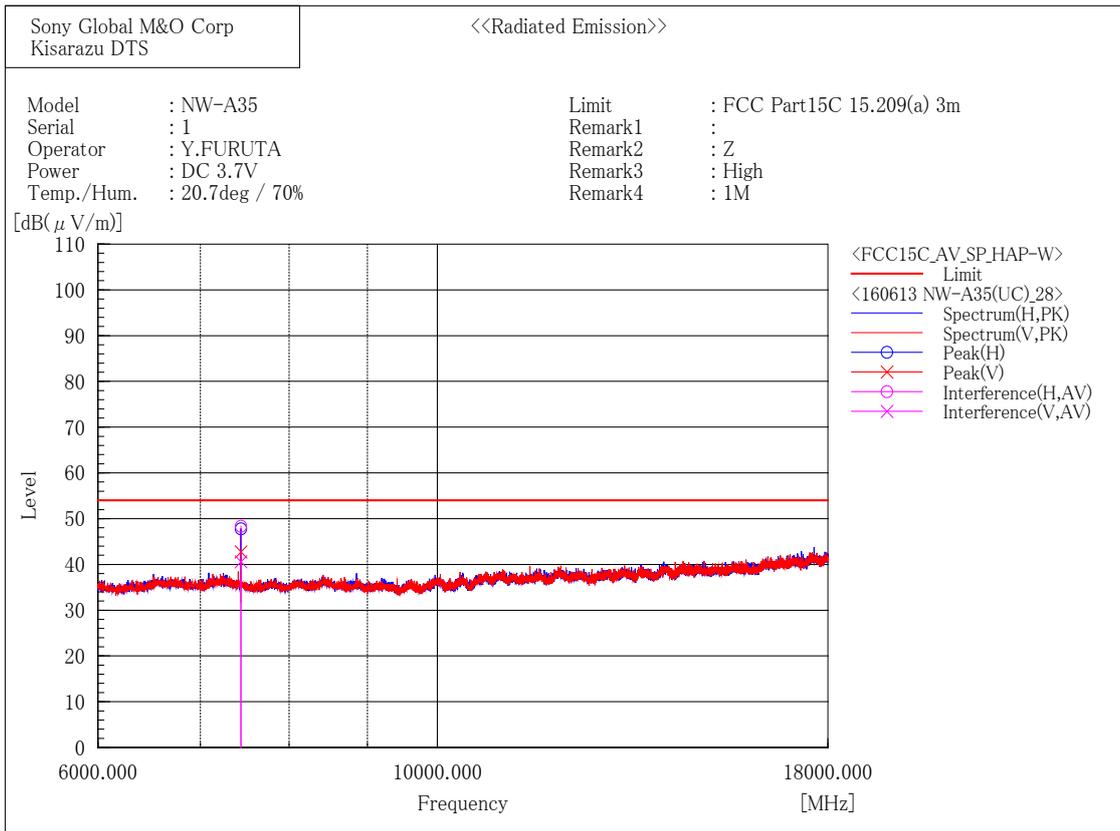
--- Horizontal Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	7320.032	57.3	-8.3	49.0	54.0	5.0	100.0	308.1

--- Vertical Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	7320.064	49.0	-8.3	40.7	54.0	13.3	123.7	266.6

[Bluetooth Low Energy (1 Mbps) / 2480MHz]



Final Result

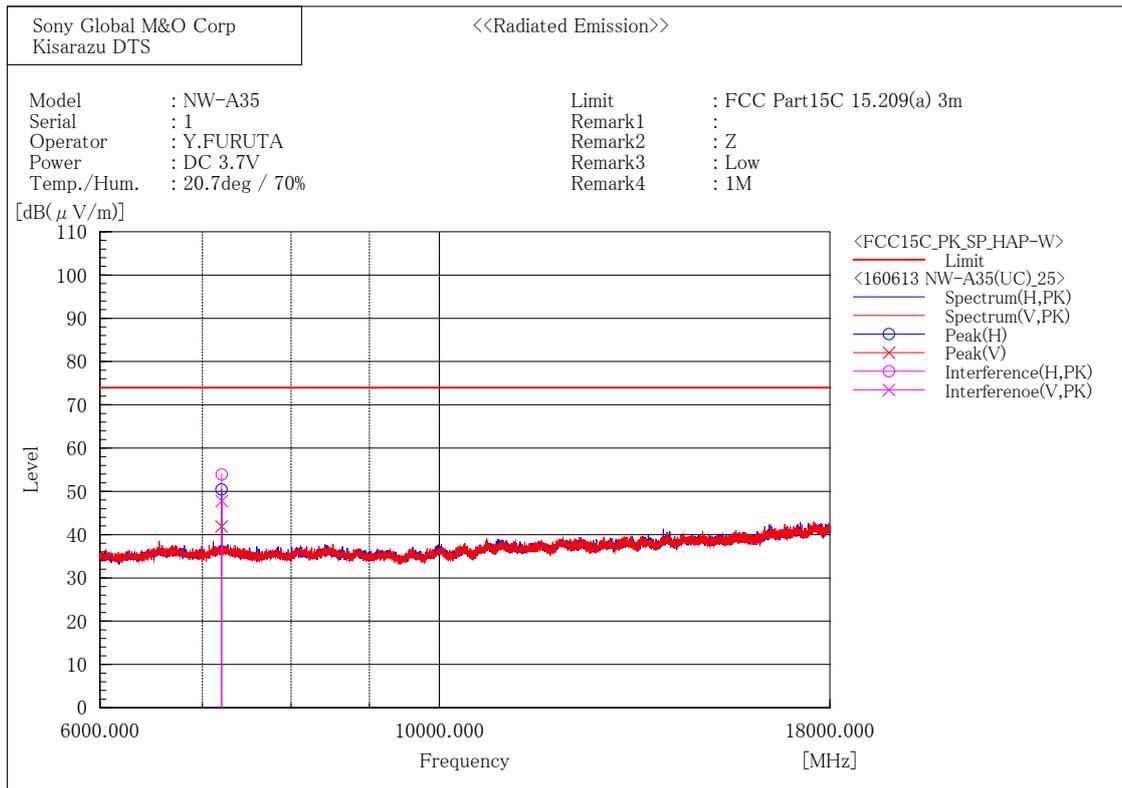
--- Horizontal Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	7440.145	57.1	-8.7	48.4	54.0	5.6	100.0	333.3

--- Vertical Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	7440.025	49.3	-8.7	40.6	54.0	13.4	117.3	269.1

[Bluetooth Low Energy (1 Mbps) / 2402MHz]



Final Result

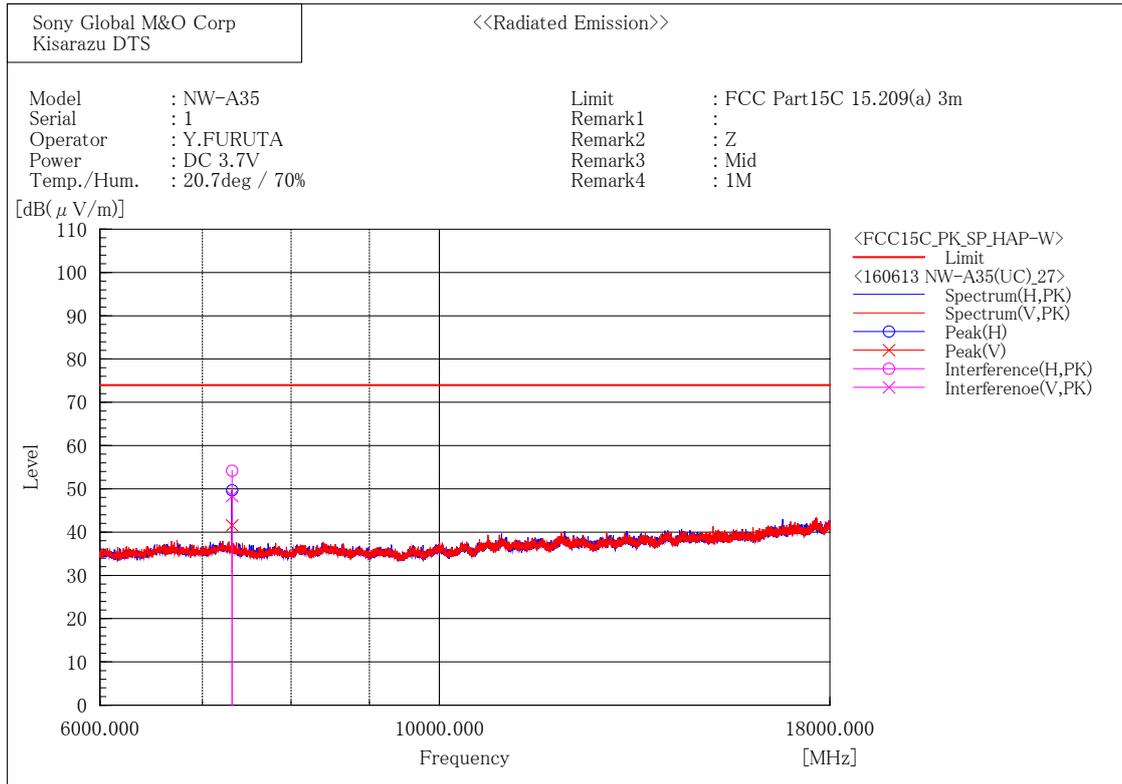
--- Horizontal Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	7206.070	62.0	-8.1	53.9	74.0	20.1	109.0	335.1

--- Vertical Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	7206.091	55.9	-8.1	47.8	74.0	26.2	130.0	266.3

[Bluetooth Low Energy (1 Mbps) / 2440MHz]



Final Result

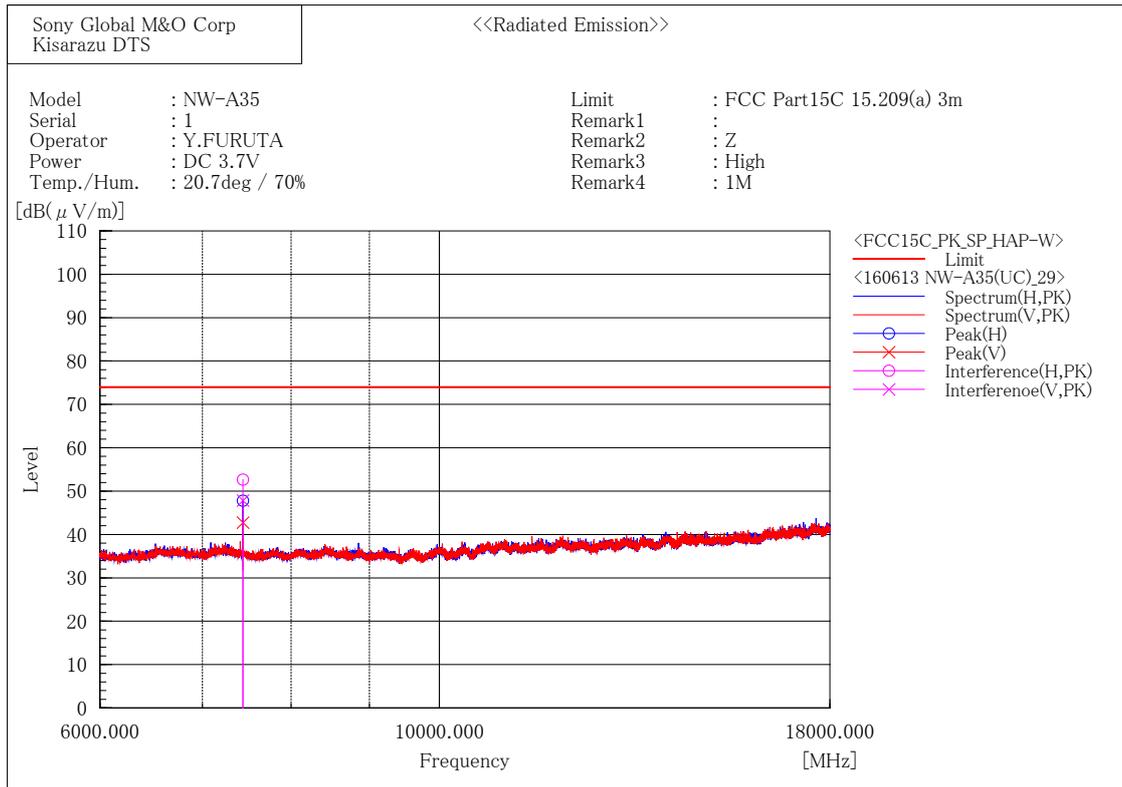
--- Horizontal Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	7319.928	62.5	-8.3	54.2	74.0	19.8	103.7	302.5

--- Vertical Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	7319.898	56.6	-8.3	48.3	74.0	25.7	119.0	261.4

[Bluetooth Low Energy (1 Mbps) / 2480MHz]



Final Result

--- Horizontal Polarization (PK)---

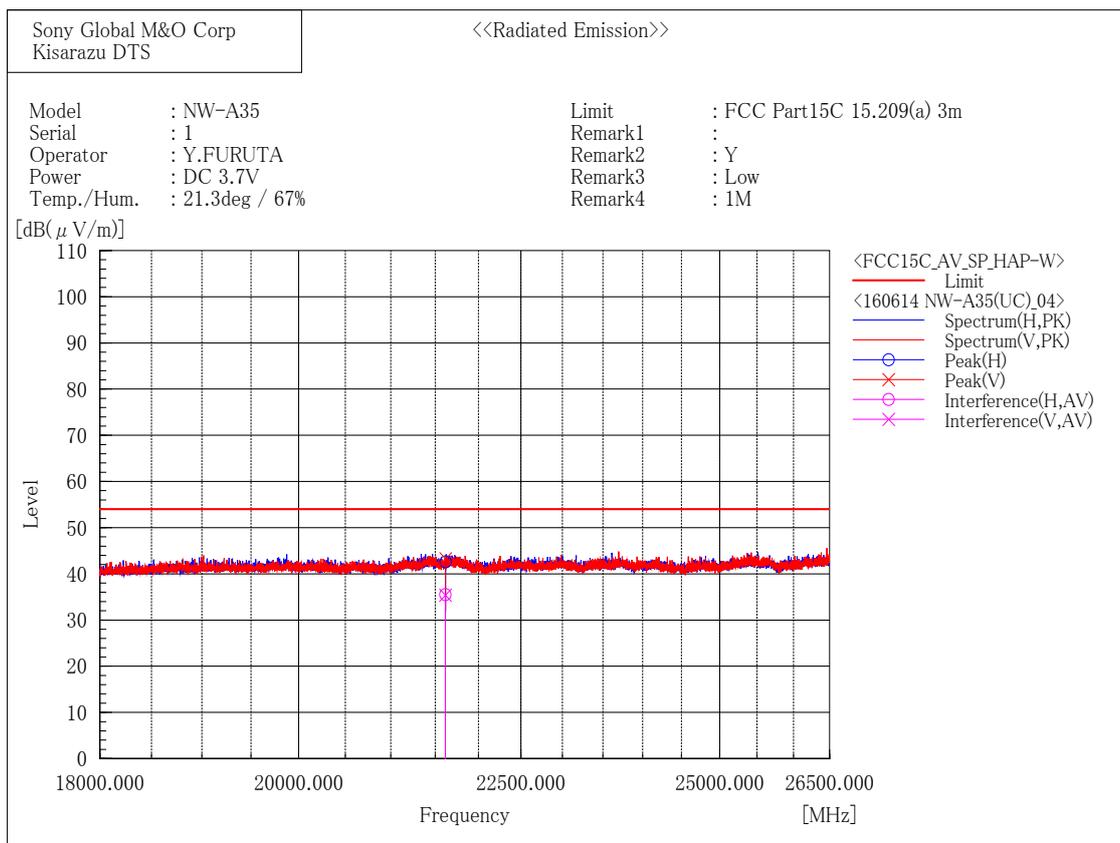
No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	7439.913	61.4	-8.7	52.7	74.0	21.3	100.0	338.3

--- Vertical Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	7439.879	56.5	-8.7	47.8	74.0	26.2	121.5	260.1

18 GHz – 24.835 GHz

[Bluetooth Low Energy (1 Mbps) / 2402MHz]



Final Result

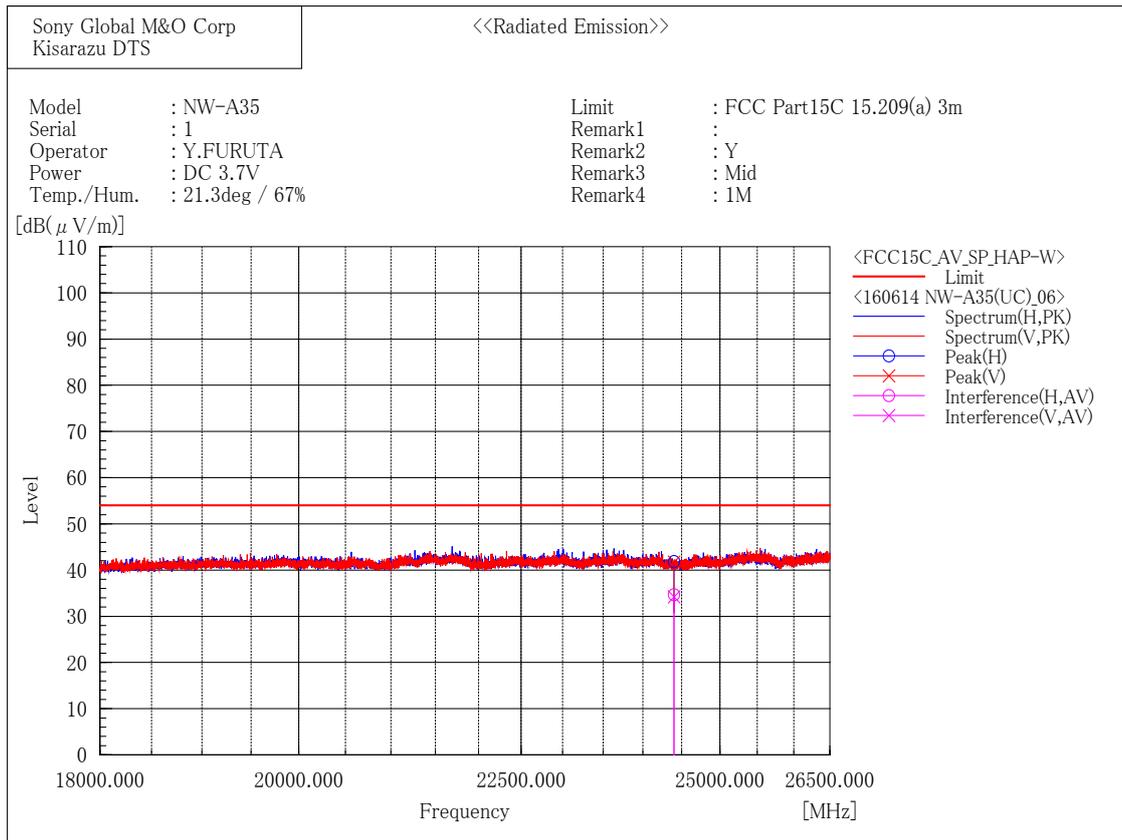
--- Horizontal Polarization (AV) ---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	21617.080	36.3	-0.8	35.5	54.0	18.5	417.6	31.9

--- Vertical Polarization (AV) ---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	21617.060	36.2	-0.8	35.4	54.0	18.6	175.1	126.8

[Bluetooth Low Energy (1 Mbps) / 2440MHz]



Final Result

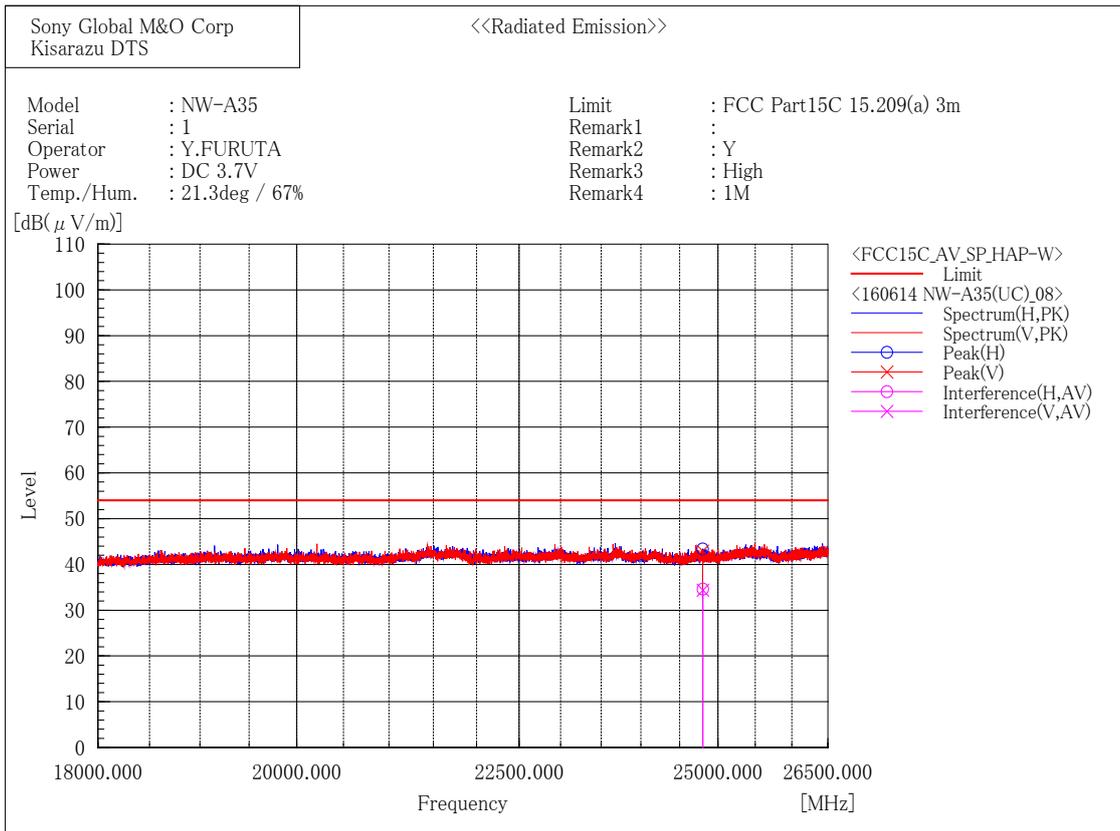
--- Horizontal Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	24399.102	36.8	-2.2	34.6	54.0	19.4	114.3	273.3

--- Vertical Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	24399.998	36.4	-2.2	34.2	54.0	19.8	299.8	43.4

[Bluetooth Low Energy (1 Mbps) / 2480MHz]



Final Result

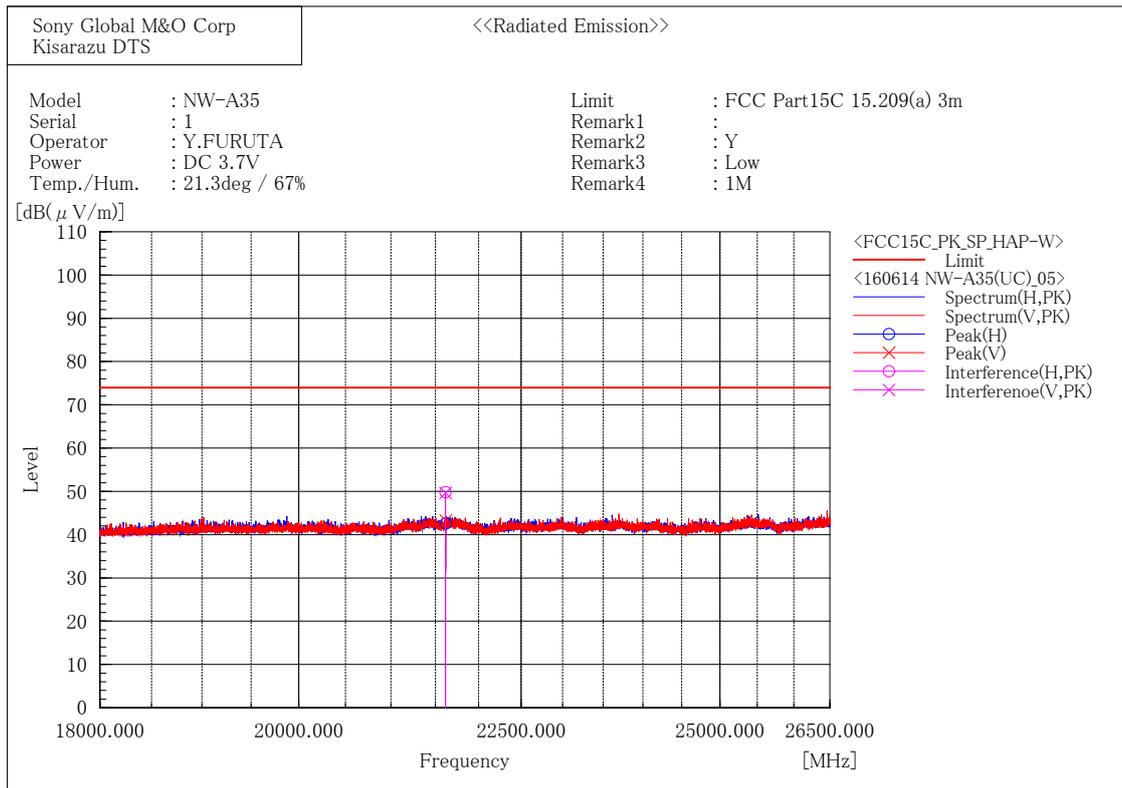
--- Horizontal Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	24800.978	36.7	-2.1	34.6	54.0	19.4	120.1	343.7

--- Vertical Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	24800.960	36.5	-2.1	34.4	54.0	19.6	111.0	21.3

[Bluetooth Low Energy (1 Mbps) / 2402MHz]



Final Result

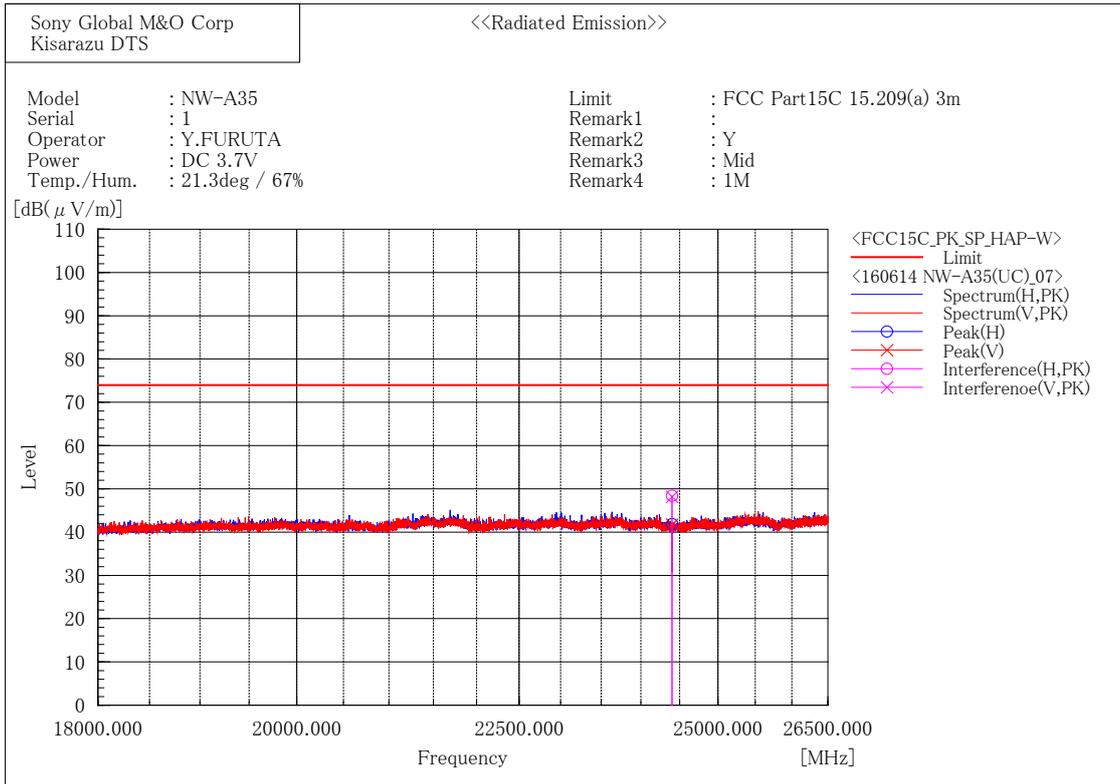
--- Horizontal Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	21617.532	50.6	-0.8	49.8	74.0	24.2	417.6	31.9

--- Vertical Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	21618.124	50.4	-0.8	49.6	74.0	24.4	176.4	119.8

[Bluetooth Low Energy (1 Mbps) / 2440MHz]



Final Result

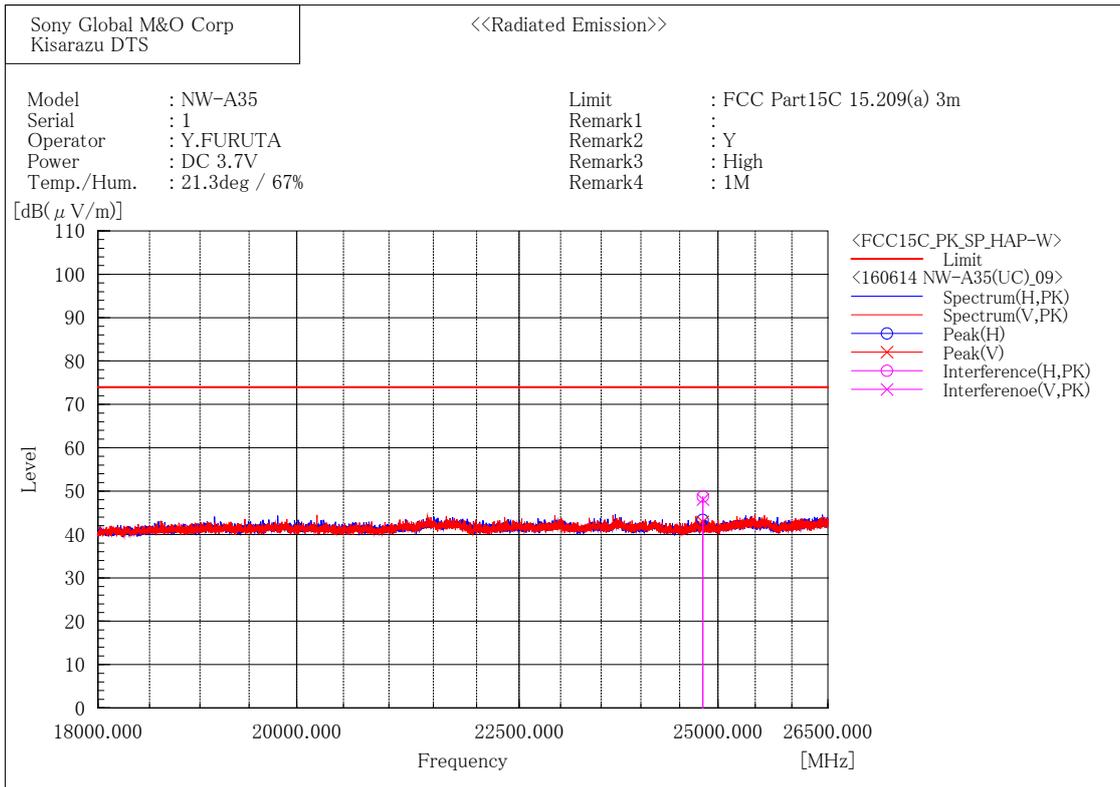
--- Horizontal Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	24399.922	50.6	-2.2	48.4	74.0	25.6	114.3	273.2

--- Vertical Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	24399.218	50.4	-2.2	48.2	74.0	25.8	304.8	35.8

[Bluetooth Low Energy (1 Mbps) / 2480MHz]



Final Result

--- Horizontal Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	24800.422	50.9	-2.1	48.8	74.0	25.2	120.1	343.7

--- Vertical Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μV)]	c. f [dB(1/m)]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]	Height [cm]	Angle [°]
1	24800.448	50.2	-2.1	48.1	74.0	25.9	112.0	21.2

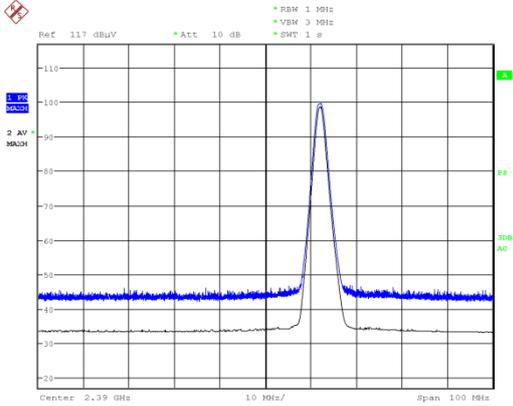
2.4GHz Restricted-Band Edge (Plot data)

These plot data show peak (trace blue) and average (trace black) spectrum for worst case emissions in the restricted-band edges. (Restricted band edges: below 2390MHz and above 2483.5MHz)

The result of the final radiated emissions measurement refers in previous pages.

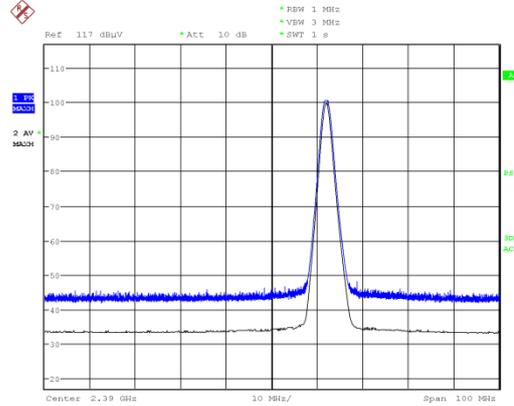
[Bluetooth Low Energy / 2402MHz]

Horizontal



Date: 13.JUN.2016 15:43:22

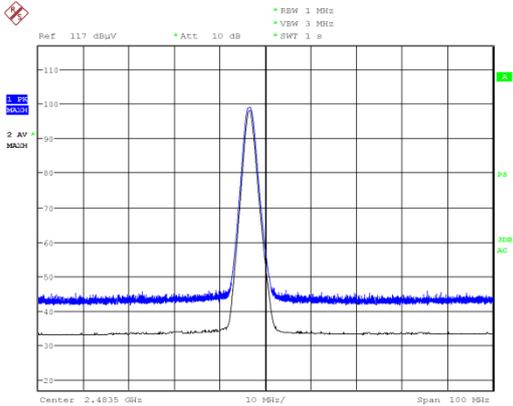
Vertical



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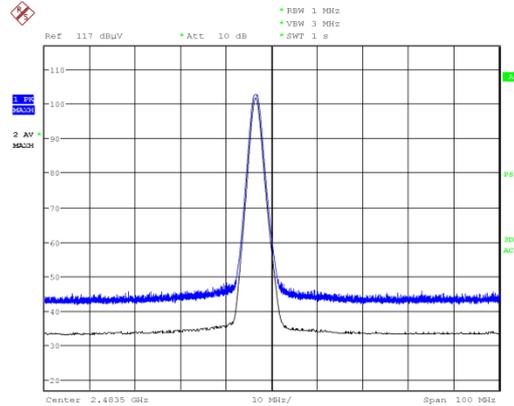
[Bluetooth Low Energy / 2480MHz]

Horizontal



Date: 13.JUN.2016 16:54:45

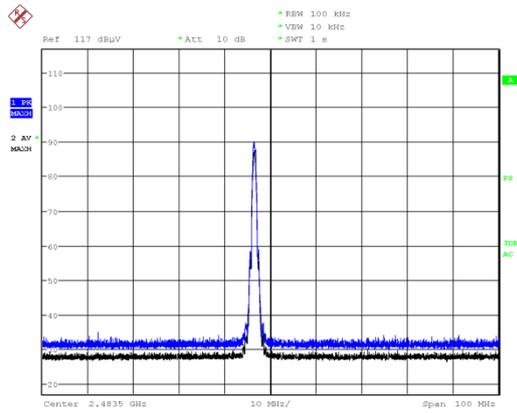
Vertical



Date: 13.JUN.2016 17:05:15

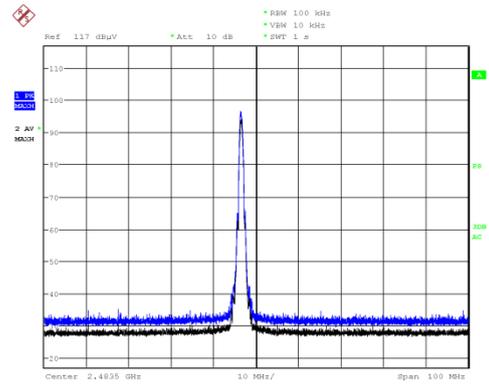
[Bluetooth Low Energy / 2480MHz]

Horizontal



Date: 13.JUN.2016 18:29:18

Vertical



Date: 13.JUN.2016 18:29:53

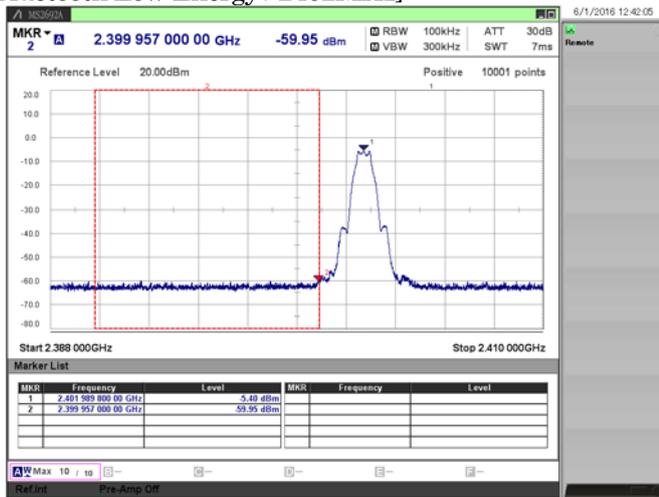
* Plot data in case of RBW: 100kHz (for integration method)

3.7. Conducted Spurious Emissions for Band Edge

- 1) Ambient temperature : 21.5deg.C
- 2) Relative humidity : 50.0 %
- 3) Date of measurement : June 01, 2016
- 4) Measured by : M.KOUGA
- 5) Operating mode : Transmitting mode

Mode	Rate [Mbps]	Channel [MHz]	Frequency [MHz]	Reading(PK) [dBm]	C.F. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
BLE	1	2402	2401.99	-5.40	10.54	-	-	
			2399.96	-59.95	10.54	-49.41	-14.9	34.55

[Bluetooth Low Energy / 2402MHz]



4. Method of Calculation

4.1. AC Power-line Conducted Emissions Measurement

Method of calculation : Software
 The Software for Calculation Name : EP5/ CE
 Version : Ver5.0.0

$$\text{Test Result [dBuV]} = \text{Meter Reading [dBuV]} + \text{C.F. [dB]}$$

Notes :

- (a) Meter Reading : Reading of the EMI test receiver or spectrum analyzer.
- (b) C.F. : System Loss + Correction Factor of LISN.

4.2. Maximum Peak Conducted Output Power Measurement

Method of calculation : Software
 The Software for Calculation Name : SW-316
 Version : Ver.1.0

$$\text{Test Result (PK) [dBm]} = \text{Meter Reading [dBm]} + \text{C.F. [dB]}$$

$$\text{Test Result (AV) [dBm]} = \text{Meter Reading [dBm]} + \text{C.F. [dB]} + \text{Duty Factor [dB]}$$

Notes :

- (a) Meter Reading : Reading of the power meter.
- (b) C.F. : Attenuator Loss + EUT Cable Loss
- (c) Duty Factor : $10\log \{(\text{Tx ON Time} + \text{Tx OFF Time}) / (\text{Tx ON Time})\}$

4.3. Power Density Measurement

Method of calculation : Software
 The Software for Calculation Name : SW-316
 Version : Ver.1.0

$$\text{Test Result [dBm]} = \text{Meter Reading [dBm]} + \text{C.F. [dB]}$$

Notes :

- (a) Meter Reading : Reading of the spectrum analyzer.
- (b) C.F. : System Cable Loss + Attenuator Loss + EUT Cable Loss

4.4. Radiated Spurious Emission Measurement

Method of calculation : Software
 The Software for Calculation Name : V-Scan
 Version : Ver. 4.0.30

Test Result [dBuV/m] = Meter Reading [dBuV] + C.F. [dB/m]

Notes :

- (a) Meter Reading : Reading of the EMI test receiver or spectrum analyzer.
 (b) C.F. : Antenna Factor (including Balun Loss) + System GainLoss
 : Antenna Factor (including Balun Loss) + System GainLoss + 20 log (3 m/ 10 m)

4.5. Conducted Spurious Emission for Band Edge Measurement

Method of calculation : Software
 The Software for Calculation Name : SW-316
 Version : Ver.1.0

Test Result [dBm] = Meter Reading [dBm] + C.F. [dB]

Notes :

- (a) Meter Reading : Reading of the spectrum analyzer.
 (b) C.F. : System Cable Loss + Attenuator Loss + EUT Cable Loss

5. List of Test Equipment

All test results are traceable to the national and/or international standards.

5.1. AC Power-line Conducted Emissions

4th Site Shielded Room

	Ctrl.#	Equipment	Model No.	Serial No.	Manufacturer	Cal.Int.	Last Cal.
x	-	Shield Room	-	-	TDK	-	-
x	M515	EMI Receiver	ESCI	100606	Rohde & Schwarz	12	15.07.07
-	M109	EMI Receiver	ESI7	100051	Rohde & Schwarz	12	16.03.15
x	CS043	4th Site CE Cable SYSTEM	-	-	EMC/RF Test Lab.	12	15.10.28
x	M664	6dB Attenuator	6806.01A	N/A	HUBER+SUHNER AG	12	15.10.28
x	M619	HIGH FREQUENCY FUSE	MP612A	N/A	Anritsu	12	15.10.28
-	M026	LISN	KNW-407	8-541-1	Kyoritsu	12	15.12.10
-	M420	LISN	ESH3-Z5	829996/008	Rohde & Schwarz	12	16.01.09
x	M514	LISN (for EUT)	ENV216	100424	Rohde & Schwarz	12	16.05.25
-	M152	50 ohm Terminator	CT-01	N/A	TME	12	15.10.28
-	M158	50 ohm Terminator	T1302	N/A	Stack	12	16.01.27
x	M690	Thermometer	AD-5640A	201304	A&D	12	15.11.15

5.2. Antenna-port Conducted Measurements

4th Site Shielded Room 1

	Ctrl.#	Equipment	Model No.	Serial No.	Manufacturer	Cal.Int.	Last Cal.
x	-	Shield Room	B83117-B2432-T161	P26428	Albatross Project	-	-
x	W100	Spectrum Analyzer	MS2692A	6201338954	Anritsu	12	16.04.15
x	W006	Power Meter	N1911A	MY50000295	Keysight Technologies	12	15.09.28
x	W007	Power Sensor	N1922A	MY50180022	Keysight Technologies	12	15.09.28
x	W029	10dB Attenuator	8493C	76549	Keysight Technologies	12	15.09.24
x	WC05	RF Cable	SUCOFLEX 102	34287	HUBER + SUHNER	12	15.10.16
x	M719	Thermometer	TH-321	140053	AS ONE	12	16.04.27

5.3. Radiated Spurious Emissions

4th Site 10m Semi-Anechoic Chamber

	Ctrl.#	Equipment	Model No.	Serial No.	Manufacturer	Cal.Int.	Last Cal.
x	M506	EMC Chamber	None	-	TDK	12	15.08.03
x	M575	EMI Receiver	ESCI	100161	Rohde & Schwarz	12	15.11.09
x	M504	EMI Receiver	ESU40	100086	Rohde & Schwarz	12	15.11.25
x	A073	Loop Antenna	HFH2-Z2	100171	Rohde & Schwarz	12	15.10.12
x	A043	Bi-conical Antenna	BBA9106	V5(91032598)	Schwarzbeck	12	15.08.04
x	A046	Log-periodic Antenna	UHALP9108A1	0830	Schwarzbeck	12	15.08.06
x	A056	Horn Antenna	BBHA9120D	670	Schwarzbeck	12	16.01.27
x	A057	Horn Antenna	HAP06-18W	00000037	TOYO Corporation	12	15.08.04
x	A058	Horn Antenna	HAP18-26W	00000016	TOYO Corporation	12	16.01.26
-	CS037	Fourth Site RE Cable SYS1	-	-	EMC/RF Test Lab.	12	15.10.28
x	CS039	Fourth Site RE Cable SYS3	-	-	EMC/RF Test Lab.	12	15.10.28
x	CS054	Fourth Site EMF Cable SYS	-	-	EMC/RF Test Lab.	12	15.10.28
x	CS064/065	Fourth Site RE Cable SYS8	-	-	EMC/RF Test Lab.	12	15.10.28
x	M510	RF Selector	NS4900	0802-226	TOYO Corporation	12	15.10.28
x	M620	RF Pre-Amp	8447D	2944A10720	Keysight Technologies	12	15.10.28
x	M706	3dB Attenuator	8491A	MY39267782	Keysight Technologies	12	15.10.28
x	M831	GHz Filter Box	FB-G1	002	Sony Global M&O	12	15.10.28
x	M689	Thermometer	AD-5640A	201303	A&D	12	15.11.05

About calibration interval

Valid until the end of the month listed in "Cal. Int." column.