

RADIO TEST REPORT

(for Bluetooth Low Energy)

Project No. : JB-Z0563-B
Client : Sony Corporation
Client's Address : 1-7-1 Konan Minato-ku Tokyo, 108-0075 Japan
Product Name : Digital Media Player
Model No. : NW-ZX507
FCC ID : AK8NWZX500
Test Standard : 47 CFR Part 15 Subpart C
Sample Receipt Date : May 24, 2019
Test Date : May 24, 2019 to June 19, 2019
Original Report Date : July 5, 2019
Amend Report Date : July 31, 2019
Test Result : Complied

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- * This report replaces and supersedes all previous versions. Refer to Revision History on the following page.

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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.

Revision History

Revision	Date	Overview	Page
JB-Z0563 (Original)	July 5, 2019	-	-
JB-Z0563-A	July 26, 2019	Add procedures and measurement facility drawings for spurious.	P.7,13
JB-Z0563-B	July 31, 2019	Add description to procedures and measurement facility drawings for spurious emission.	P.7,13

1. General Information

1.1. Description of Equipment Under Test (EUT)

General Specification

Test Sample Condition	: ☐ Prototype	☒ Pre-production	☐ Mass-production
Product Name	: Digital Media Player		
Trade Name	: SONY		
Model No.	: NW-ZX507		
Serial No.	: 2, 3, 8, 16		
Power Rating of the EUT	: DC 3.7 V (Internal Battery) or DC 5 V (USB)		

Similar model(s) to be covered by this report

Model No. : None

Radio Specification

Function of the Equipment	: Transceiver
Operating Frequency	: 2402 - 2480 MHz
Modulation Type	: GFSK
Channel Spacing	: 2 MHz
Channel Bandwidth	: 1 MHz
Number of channels	: 40
Antenna Type	: Inverted-F Antenna
Antenna Connector Type	: None
Antenna Gain	: 2.4 dBi
Operating Temperature	: +5 to +35 deg.C

1.2. Summary of Test Result

Test Item	Test Method	Worst Margin	Results	Note
AC Power-line Conducted Emissions	Conducted	15.1 dB (QP) 0.150 MHz L1	Complied	-
6dB Bandwidth	Conducted	Refer to the test data	Complied	-
Maximum Peak Conducted Output Power	Conducted	22.81 dB	Complied	-
Power Spectral Density	Conducted	15.30 dB	Complied	-
Radiated Spurious Emissions	Radiated	7.6 dB (AV) 4959.571 MHz Horizontal	Complied	-
Conducted Spurious Emissions for Band Edge	Conducted	35.50 dB 2399.95 MHz	Complied	*1

Note

*1: Conducted Spurious Emissions measurement 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 Emissions measurement.

Other requirements

Part 15.31(e) Supply voltage requirement

: Complied (The voltage supplied from USB or battery are converted to regulated DC voltage by the built-in power circuit of the EUT.)

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
 Test Method : ANSI C63.10 - 2013
 KDB 558074 D01 15.247 Meas Guidance v05r02

Test Condition

AC Power-line Conducted Emissions

Dimensions of the EUT table : 0.8 m height, 1.5 m width and 1 m depth.

Radiated Spurious Emissions

Test Distance : ☒ 3 m ☐ 10m (9 kHz to 30 MHz)
☒ 3 m ☐ 10m (30 MHz to 1000 MHz)
☒ 3 m (1 GHz to 26.5 GHz)

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

Dimensions of validated test volume : 2 m diameter, 3 m top height, 0.5 m bottom height.

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

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. (150 kHz to 30 MHz, peak detector, RBW: 10 kHz)
8. On the worst condition of the EUT found in above, choose the six 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)

Antenna-port Conducted Measurements

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

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 were compensated the distance factor with follows:

$$9 \text{ kHz to } 490 \text{ kHz [Limit at 3 m]} = [\text{Limit at 300 m}] + 40\log(300[\text{m}] / 3[\text{m}])$$

$$490 \text{ kHz to } 30 \text{ MHz [Limit at 3 m]} = [\text{Limit at 30 m}] + 40\log(30[\text{m}] / 3[\text{m}])$$
5. Find the worst arrangement of the EUT according to follows;
 - Rotating the turntable and/ or scanning the antenna.
 - On every condition, exploring the highest emissions with the spectrum analyzer.
(9 kHz to 26.5 GHz, peak detector)
6. On the worst arrangement of the EUT found in above, choose the six highest harmonics or spurious emissions on the spectrum data.(*excluding carrier band edges)

The final measurements of all test operating modes carried out on these emissions as follows;

The test antenna and the turntable were performed with follows;

	9 kHz to 30 MHz	30 MHz to 1000 MHz	1 GHz to 26.5 GHz
Antenna	Loop Antenna	Bi-conical Antenna, Log-periodic Antenna	Horn Antenna
Antenna scanning range	1 m, Vertical, 360 degrees	1 m to 4 m, Horizontal and Vertical	1 m to 4 m *, Horizontal and Vertical
Turntable rotating range	360 degrees	360 degrees	360 degrees

*: When the measurement frequencies above 1 GHz, 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 to 90 kHz 110 kHz to 490 kHz	90 kHz to 110 kHz 490 kHz to 30 MHz	30 MHz to 1000 MHz	1 GHz to 26.5 GHz
Detector	Peak / Average	Quasi-peak	Quasi-peak	Peak / Average
RBW	200 Hz (6 dB) or 9 kHz (6 dB) *1	200 Hz (6 dB) or 9 kHz (6 dB) *1	120 kHz (6 dB)	1 MHz (6 dB)
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 to 150 kHz	150 kHz to 30 MHz	30 MHz to 26.5 GHz
Detector	Peak	Peak	Peak
RBW	300 Hz (6 dB) *	10 kHz (6 dB) *	100 kHz (6 dB)
Instrument	Spectrum analyzer	Spectrum analyzer	Spectrum analyzer

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

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

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

	2.4835 GHz to 2.4855 GHz
Detector	Peak
RBW	100 kHz (6 dB)
Instrument	Spectrum analyzer
Function	Channel Power (integration BW : 1 MHz)

9. Although these tests for below 30MHz 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 414788 D01.

Further these test for above 1GHz were performed test site complied with CISPR 16-1-4.

In the case of EUT size smaller than the validated test volume, the antenna position is adjusted such that the distance between the EUT and the antenna reference point is identical to the 3m used for the S-VSWR validation measurements. These method based on clause 7.3.1 of CISPR16-1-4 Edition 4, therefore correcting distance factor is not applied.

1.5. Test Location

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

A2LA Certificate No. : 3203.01
Cert. Validated Date : Oct. 31, 2019

AC Power-line Conducted Emissions

Shielded Room

☐ 4th Site ☒ EMC Site
Antenna-port Conducted Measurements

Shielded Room

☒ 4th Site SR1
Radiated Spurious Emissions

Semi-Anechoic chamber

☐ 4th Site ☒ EMC Site

1.6. Uncertainty

Test Item	Frequency	4th Site SR1
Maximum Conducted Output Power	1 GHz to 6 GHz	± 0.84 dB
Power Spectral Density, Conducted Spurious Emissions	below 6 GHz	± 1.25 dB

Test Item	Frequency	Distance	4th Site	EMC Site
AC Power-line Conducted Emissions	150 kHz to 30 MHz	-	± 3.34 dB	± 3.35 dB
Radiated Emissions	9 kHz to 30 MHz	3m	± 2.60 dB	± 3.13 dB
	30 MHz to 1000 MHz	3m	± 4.96 dB	± 5.26 dB
	1 GHz to 18 GHz	3m	± 5.22 dB	± 5.50 dB
	18 GHz to 26.5 GHz	3m	± 5.36 dB	± 5.63 dB

2. Test Specification

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. Operating Condition

The tests have been carried out the following conditions.

[Transmitting mode]

Test Items	Test Channels	Data Rate
AC Power-line Conducted Emissions *1	2402 MHz	1 Mbps
Radiated Spurious Emissions (below 1GHz) *1	2402 MHz	1 Mbps
6dB Bandwidth, Maximum Conducted Output Power, Power Spectral Density, Radiated Spurious Emissions (above 1GHz)	2402 MHz 2440 MHz 2480 MHz	1 Mbps
Conducted Spurious Emissions for Band Edge	2402 MHz	1 Mbps

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

Software Name : BT Test Tool
Software Version : 3

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 EUT System

AC Power-line Conducted Emissions

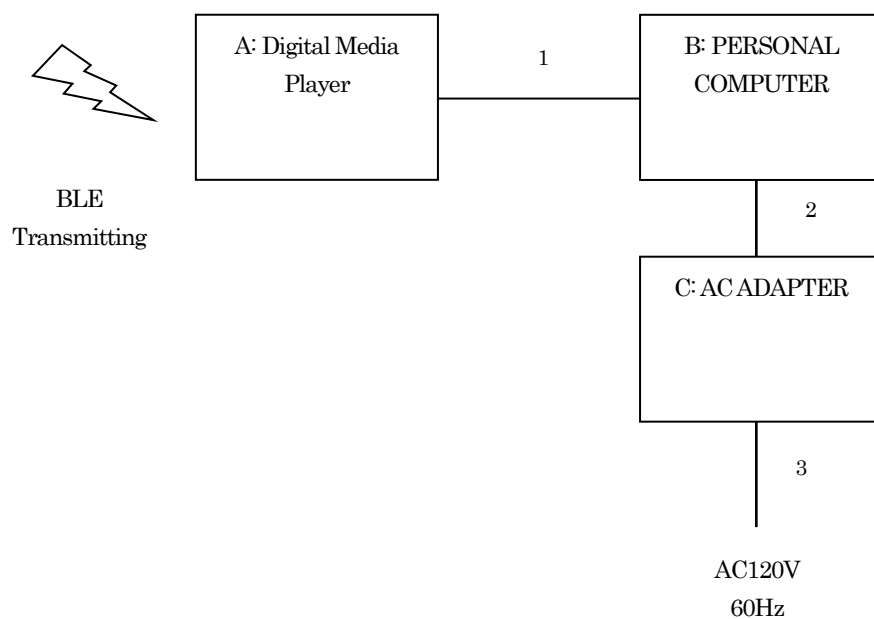
[EUT and Associated Equipment (AE)]

Symbol	EUT/ AE	Item	Manufacturer	Model No.	Serial No.
A	EUT	Digital Media Player	SONY	NW-ZX507	3
B	AE	PERSONAL COMPUTER	SONY	VJS131C11N	4120398
C	AE	AC ADAPTER	SONY	VJ8AC10V9	274969

[Type of Cable]

Symbol	Description	Identification (Manufacturer etc.)	Shielded Yes / No	Ferrite Core	Length (m)	Bundled
1	USB Cable	Kailai	Yes	No	0.5	No
2	DC Cable	-	No	No	1.8	Yes
3	AC Cable	-	No	No	1.5	Yes

[Connecting Diagram]



Antenna-port Conducted Measurements

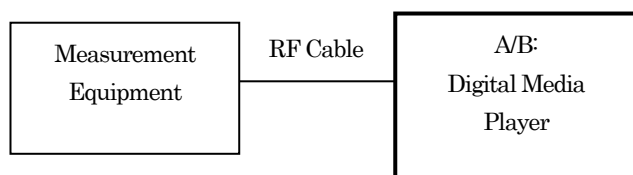
[EUT and Associated Equipment (AE)]

Symbol	EUT/ AE	Item	Manufacturer	Model No.	Serial No.
A	EUT	Digital Media Player	SONY	NW-ZX507	8 (for Maximum Conducted Output Power)
B	EUT	Digital Media Player	SONY	NW-ZX507	16 (for others)

[Type of Cable]

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

[Connecting Diagram]

**Radiated Spurious Emissions**

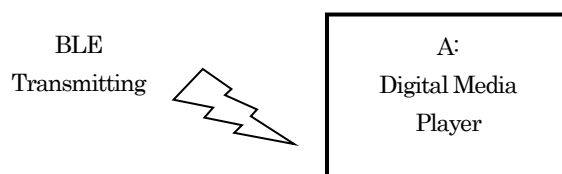
[EUT and Associated Equipment (AE)]

Symbol	EUT/ AE	Item	Manufacturer	Model No.	Serial No.
A	EUT	Digital Media Player	SONY	NW-ZX507	2

[Type of Cable]

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

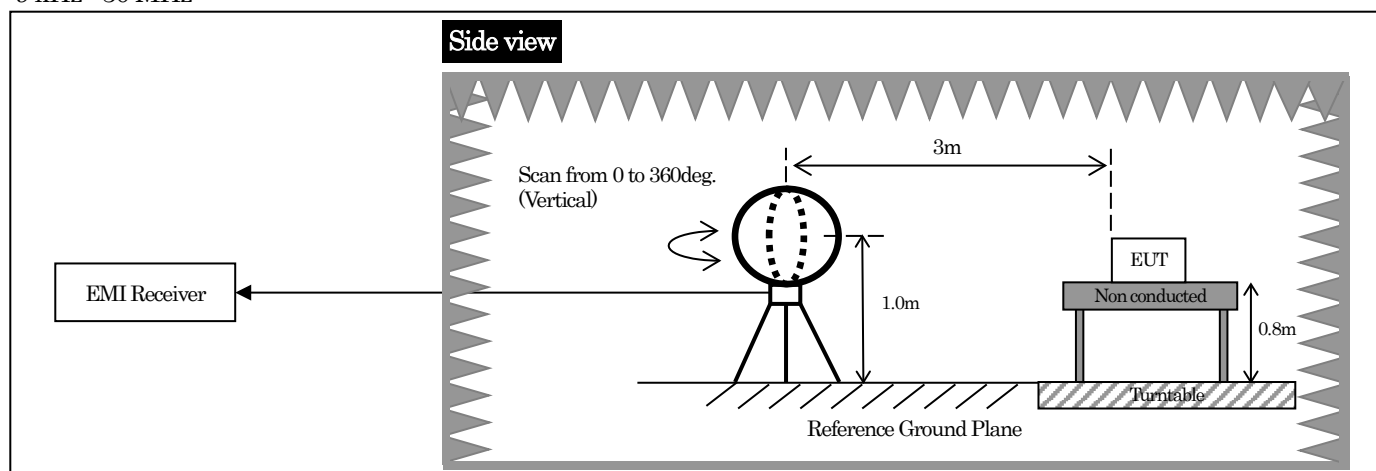
[Connecting Diagram]



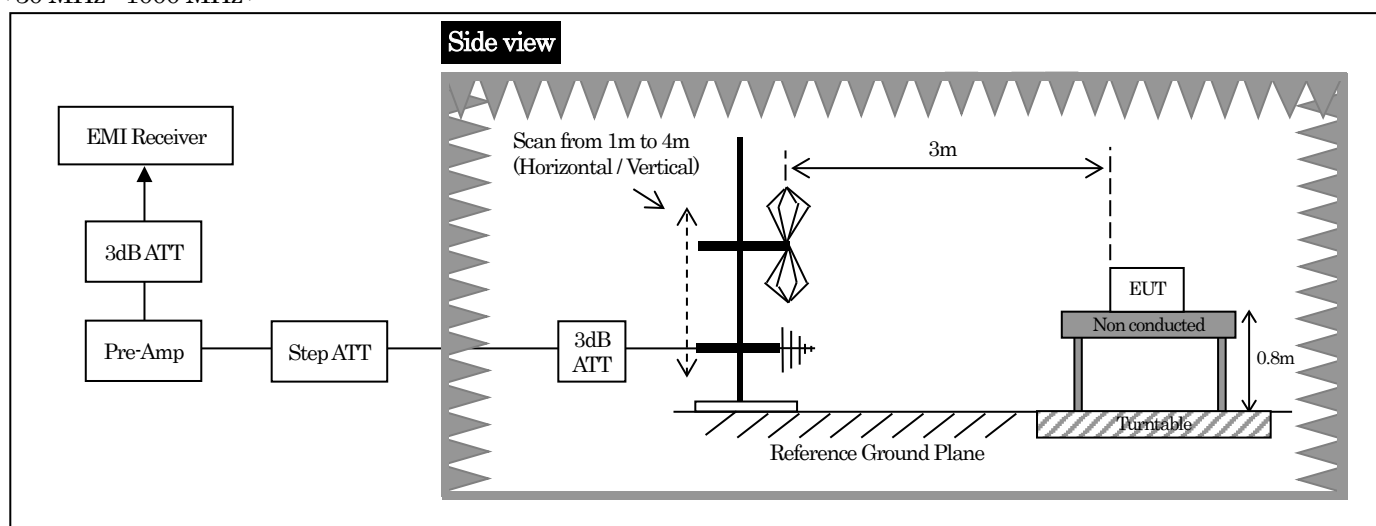
2.6. View of Measurement Facility

Radiated spurious emissions

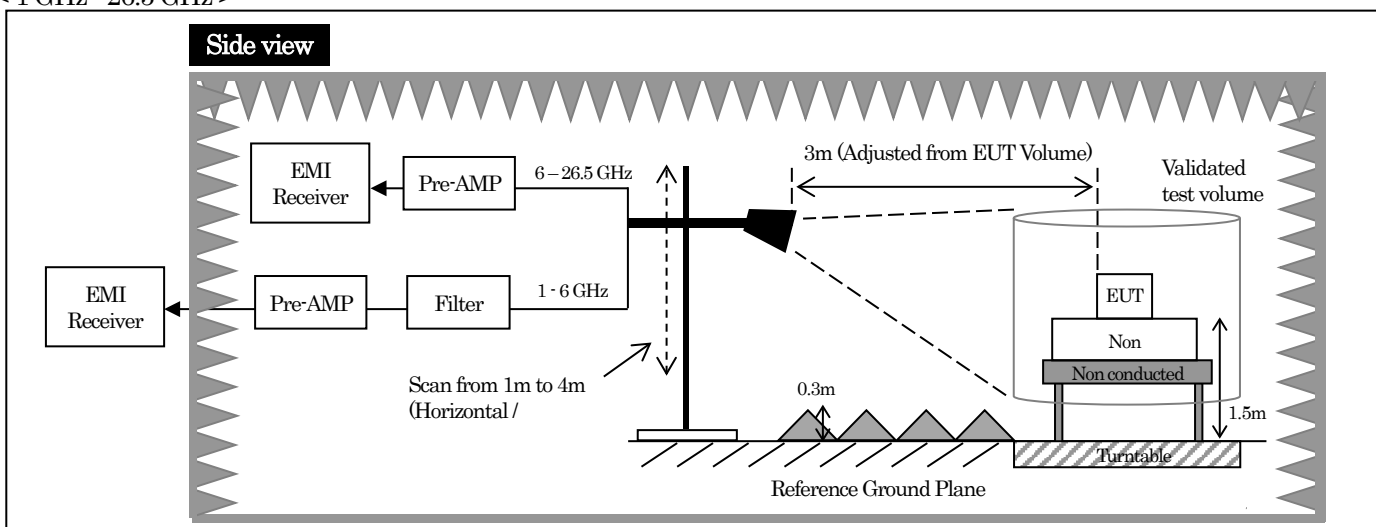
< 9 kHz - 30 MHz >



< 30 MHz - 1000 MHz >



< 1 GHz - 26.5 GHz >



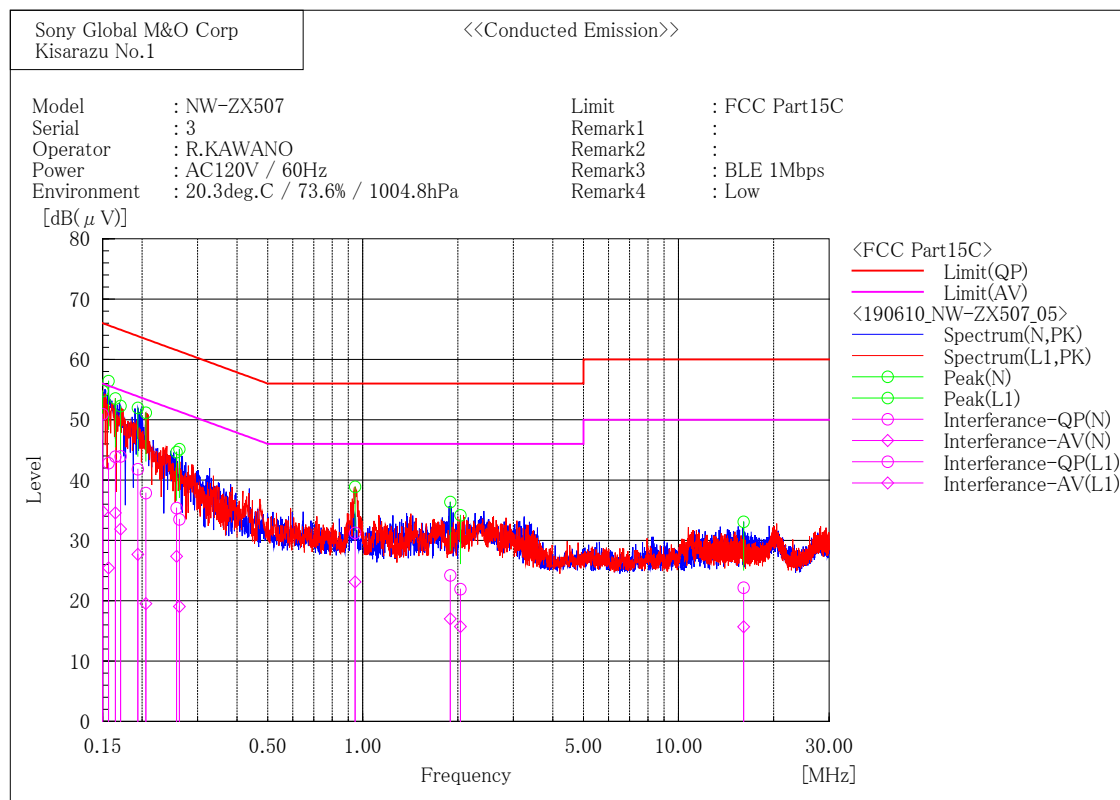
3. Test Data

3.1. AC Power-line Conducted Emissions

1) Date of measurement : June 10, 2019

The test data is mentioned as follows.

[1 Mbps / 2402 MHz]



Final Result

--- N Phase ---

No.	Frequency [MHz]	Reading QP [dB(μ V)]	Reading AV [dB(μ V)]	c. f [dB]	Result QP [dB(μ V)]	Result AV [dB(μ V)]	Limit QP [dB(μ V)]	Limit AV [dB(μ V)]	Margin QP [dB]	Margin AV [dB]
1	0.157	26.7	9.3	16.1	42.8	25.4	65.6	55.6	22.8	30.2
2	0.171	27.6	15.6	16.3	43.9	31.9	64.9	54.9	21.0	23.0
3	0.194	25.8	11.7	16.0	41.8	27.7	63.9	53.9	22.1	26.2
4	0.263	17.8	3.4	15.7	33.5	19.1	61.4	51.4	27.9	32.3
5	1.894	8.3	1.1	15.9	24.2	17.0	56.0	46.0	31.8	29.0
6	16.070	5.9	-0.6	16.3	22.2	15.7	60.0	50.0	37.8	34.3

--- L1 Phase ---

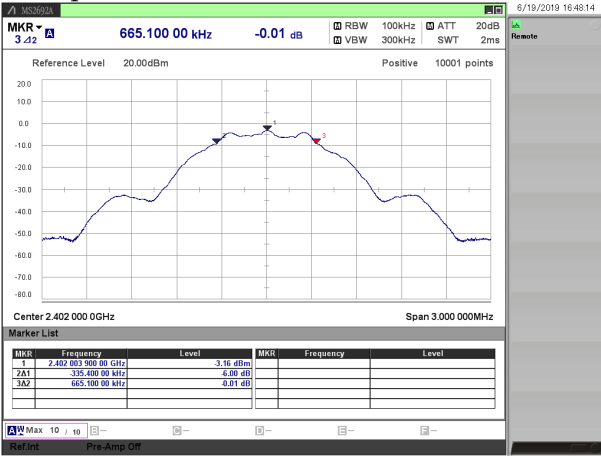
No.	Frequency [MHz]	Reading QP [dB(μ V)]	Reading AV [dB(μ V)]	c. f [dB]	Result QP [dB(μ V)]	Result AV [dB(μ V)]	Limit QP [dB(μ V)]	Limit AV [dB(μ V)]	Margin QP [dB]	Margin AV [dB]
1	0.150	35.0	18.9	15.9	50.9	34.8	66.0	56.0	15.1	21.2
2	0.165	27.7	18.4	16.2	43.9	34.6	65.2	55.2	21.3	20.6
3	0.206	21.9	3.6	15.9	37.8	19.5	63.4	53.4	25.6	33.9
4	0.257	19.7	11.7	15.7	35.4	27.4	61.5	51.5	26.1	24.1
5	0.946	15.3	7.1	16.0	31.3	23.1	56.0	46.0	24.7	22.9
6	2.040	6.0	-0.2	15.9	21.9	15.7	56.0	46.0	34.1	30.3

3.2. 6dB Bandwidth

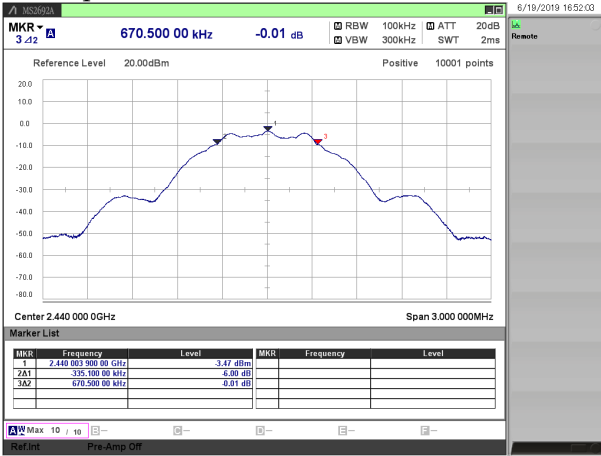
- 1) Ambient temperature
- : 21.5 deg.C
- 2) Relative humidity
- : 52.5 %
- 3) Date of measurement
- : June 19, 2019
- 4) Measured by
- : H.WAKI
- 5) Operating mode
- : Transmitting mode

Mode	Rate [Mbps]	Channel [MHz]	Result [MHz]	Limit [MHz]
BLE	1	2402	0.665	0.5
		2440	0.671	0.5
		2480	0.666	0.5

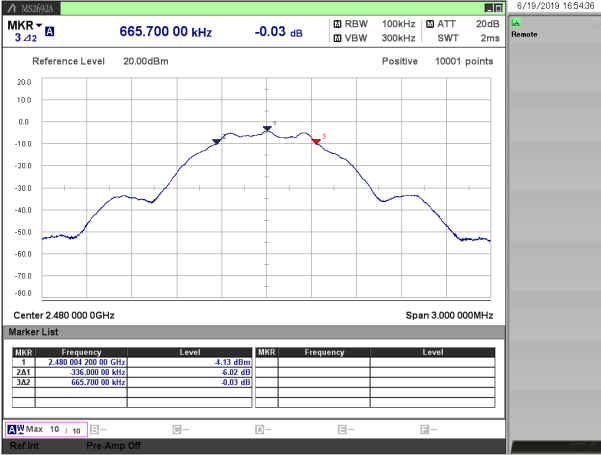
[1 Mbps / 2402 MHz]



[1 Mbps / 2440 MHz]



[1 Mbps / 2480 MHz]



3.3. Maximum Peak Conducted Output Power

- 1) Ambient temperature : 23.1 deg.C
- 2) Relative humidity : 52.0 %
- 3) Date of measurement : May 24, 2019
- 4) Measured by : M.KOUGA
- 5) Operating mode : Transmitting mode

Maximum Peak Conducted Output Power

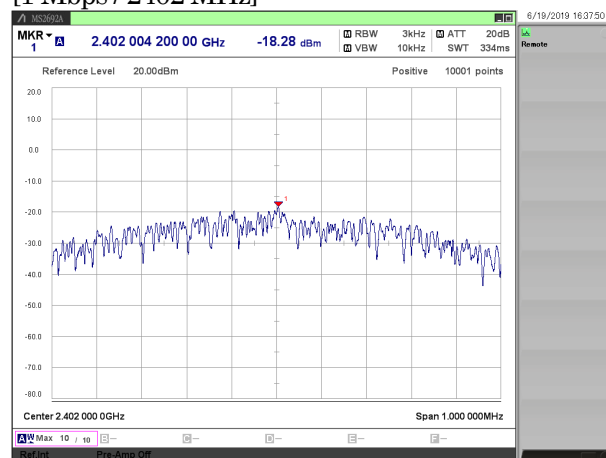
Mode	Rate [Mbps]	Channel [MHz]	Reading(PK) [dBm]	C.F. [dB]	Result(PK) [dBm]	Result(PK) [W]	Limit [dBm]	Margin [dB]
BLE	1	2402	-3.01	10.53	7.52	0.00565	30.0	22.48
		2440	-3.34	10.53	7.19	0.00524	30.0	22.81
		2480	-4.00	10.53	6.53	0.00450	30.0	23.47

3.4. Power Spectral Density

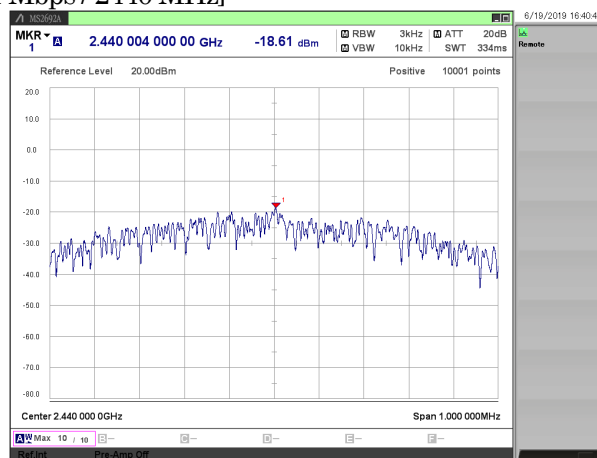
- | | |
|------------------------|---------------------|
| 1) Ambient temperature | : 21.5 deg.C |
| 2) Relative humidity | : 52.5 % |
| 3) Date of measurement | : June 19, 2019 |
| 4) Measured by | : H.WAKI |
| 5) Operating mode | : Transmitting mode |

Mode	Rate [Mbps]	Channel [MHz]	Reading(PK) [dBm]	C.F. [dB]	Result(PK) [dBm]	Limit [dBm]	Margin [dB]
BLE	1	2402	-18.28	10.98	-7.30	8.0	15.30
		2440	-18.61	10.98	-7.63	8.0	15.63
		2480	-19.29	10.98	-8.31	8.0	16.31

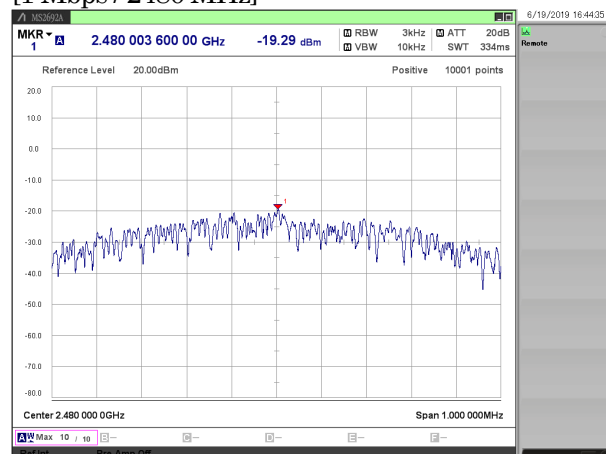
[1 Mbps / 2402 MHz]



[1 Mbps / 2440 MHz]



[1 Mbps / 2480 MHz]



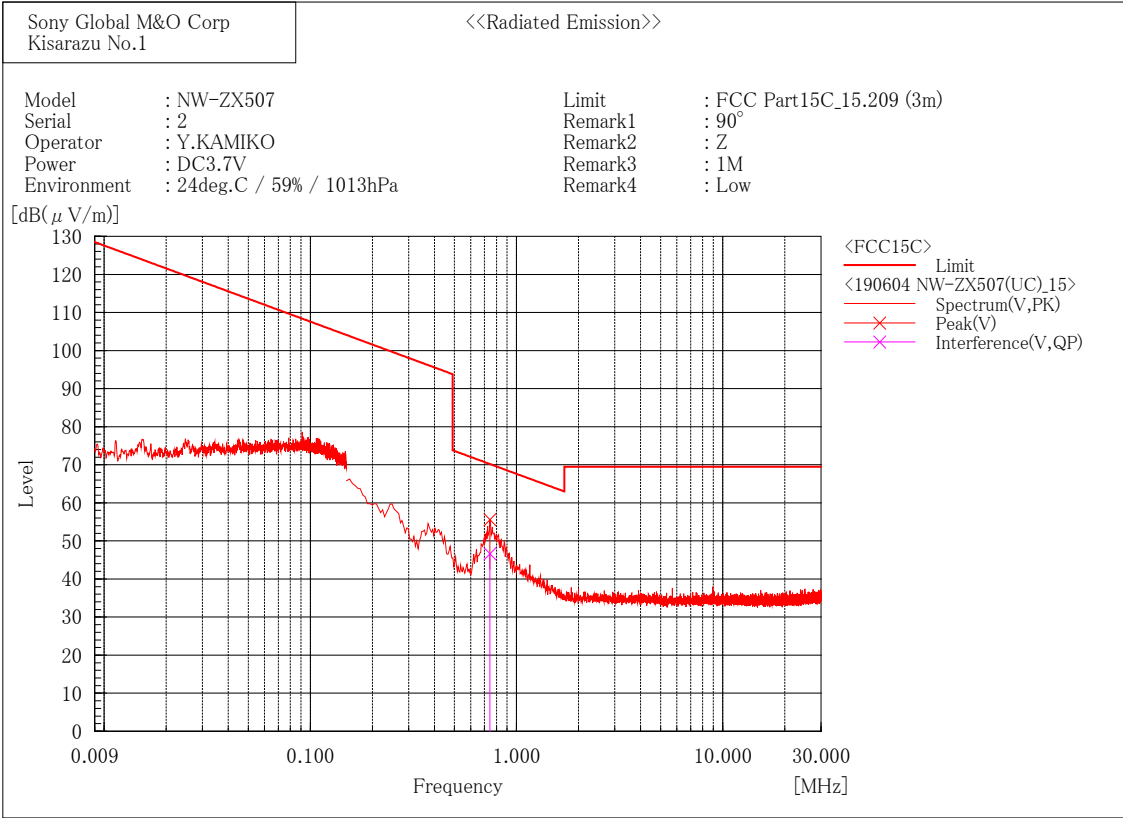
3.5. Radiated Spurious Emissions

1) Date of measurement

9 kHz to 30 MHz	: June 4 , 2019
30 MHz to 1000 MHz	: June 4 , 2019
1 GHz to 6 GHz	: May 31, 2019
6 GHz to 18 GHz	: May 31, 2019
18 GHz to 26.5 GHz	: June 3, 2019

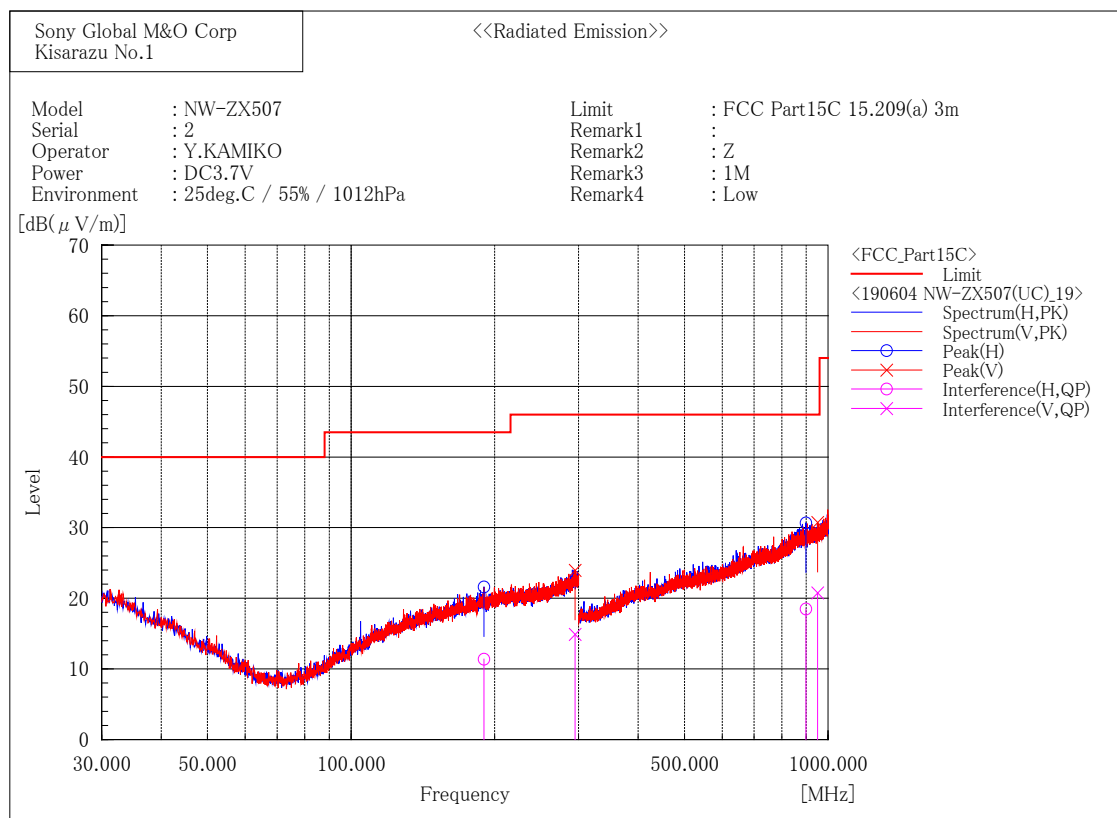
The test data is mentioned as follows.

9 kHz to 30 MHz
[1 Mbps / 2402 MHz]



30 MHz to 1000 MHz

[1 Mbps / 2402 MHz]



Final Result

--- Horizontal Polarization (QP)---

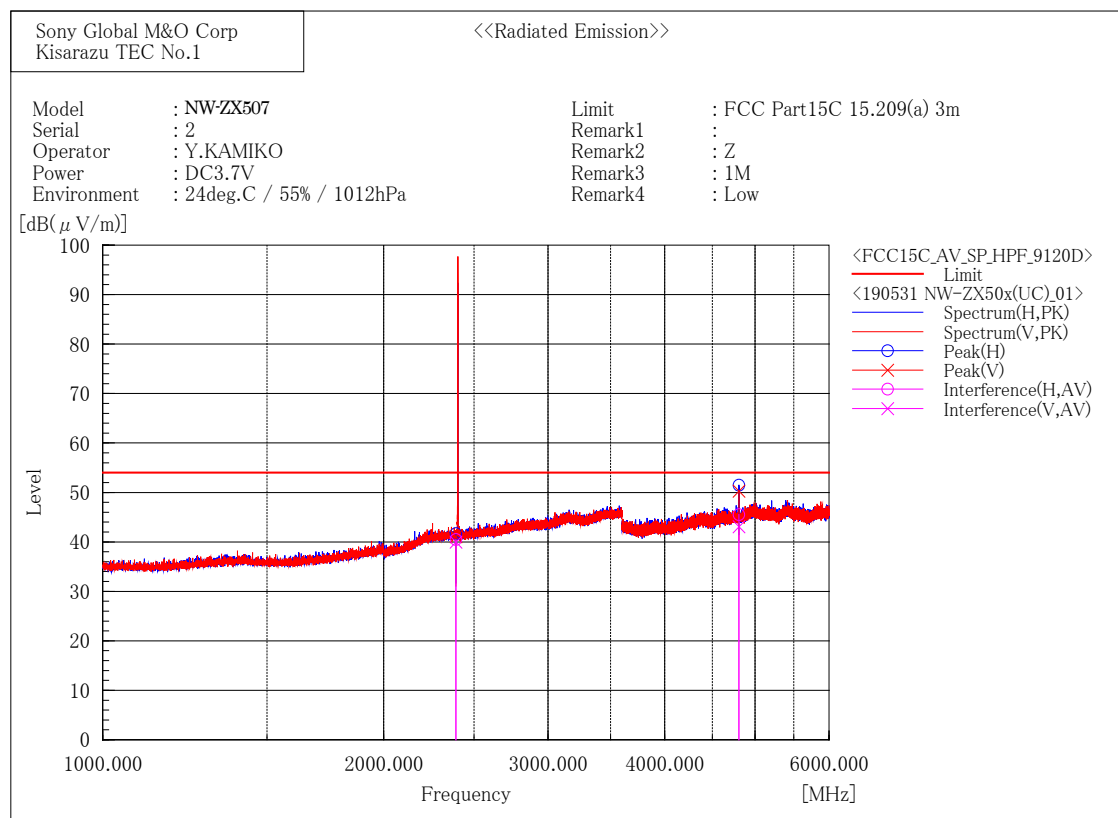
No.	Frequency [MHz]	Reading [dB(μ V)]	c. f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	189.840	19.2	-7.8	11.4	43.5	32.1	379.0	157.4
2	899.200	17.9	0.6	18.5	46.0	27.5	115.2	133.2

--- Vertical Polarization (QP)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c. f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	294.970	19.6	-4.7	14.9	46.0	31.1	195.6	273.7
2	951.233	19.4	1.4	20.8	46.0	25.2	209.7	246.5

1 GHz to 6 GHz

[1 Mbps / 2402 MHz]



Final Result

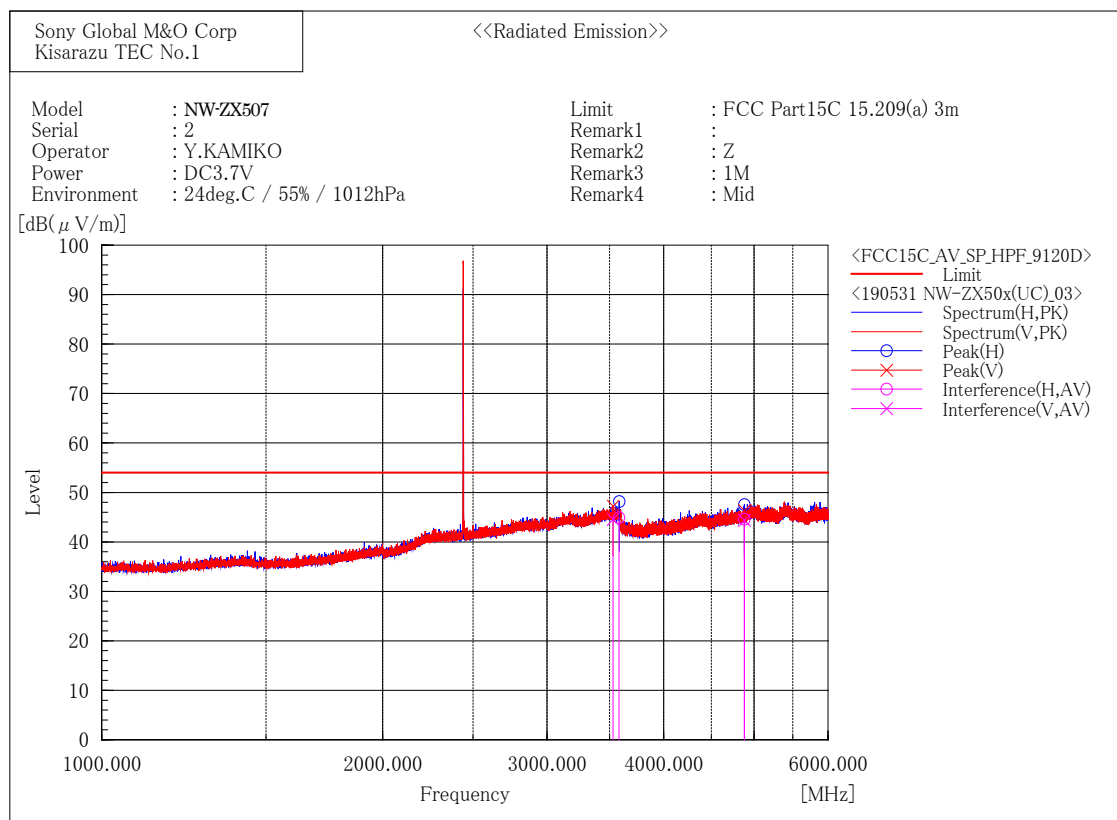
--- Horizontal Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c. f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	2390.000	37.8	2.7	40.5	54.0	13.5	388.0	44.0
2	4803.915	34.6	10.9	45.5	54.0	8.5	156.6	114.7

--- Vertical Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c. f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	2390.000	37.3	2.7	40.0	54.0	14.0	382.4	278.0
2	4803.923	32.2	10.9	43.1	54.0	10.9	278.0	316.6

[1 Mbps / 2440 MHz]



Final Result

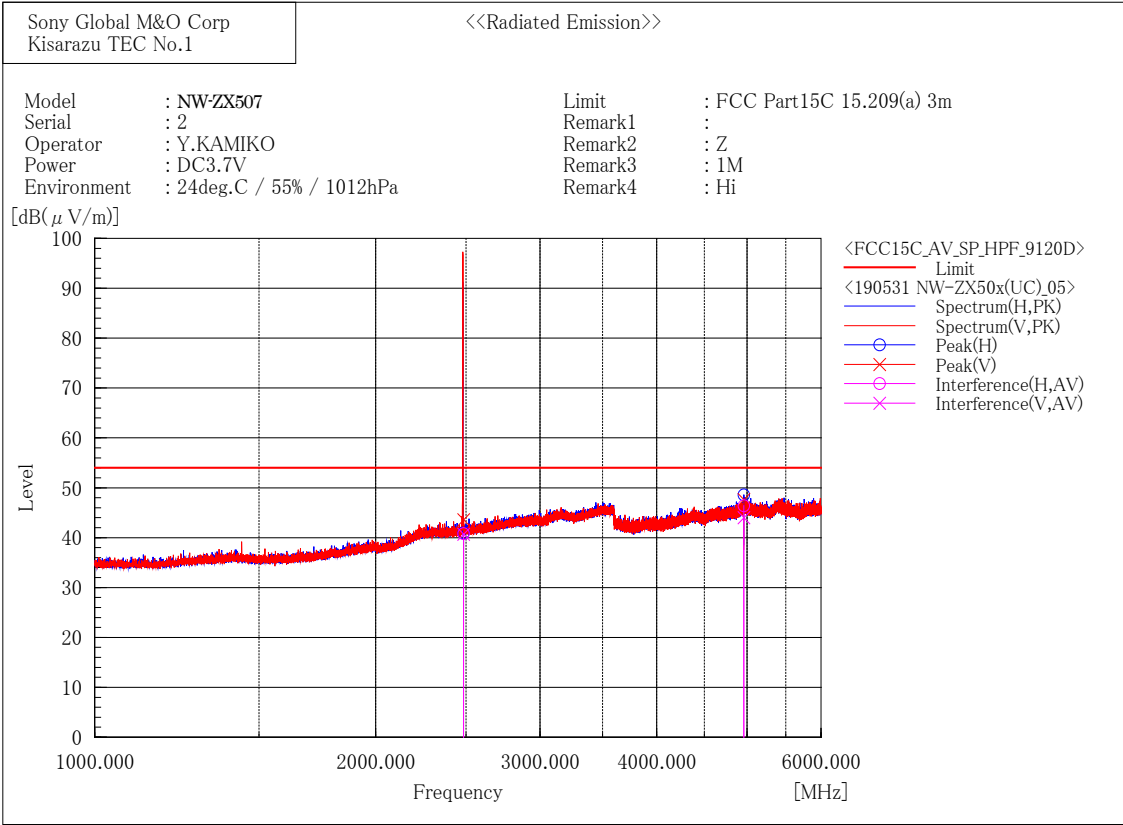
--- Horizontal Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c. f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	3582.581	37.6	7.3	44.9	54.0	9.1	374.0	197.7
2	4879.921	33.6	11.0	44.6	54.0	9.4	122.0	129.0

--- Vertical Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c. f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	3530.791	37.5	7.1	44.6	54.0	9.4	174.5	281.9
2	4880.044	33.4	11.0	44.4	54.0	9.6	149.0	312.6

[1 Mbps / 2480 MHz]



Final Result

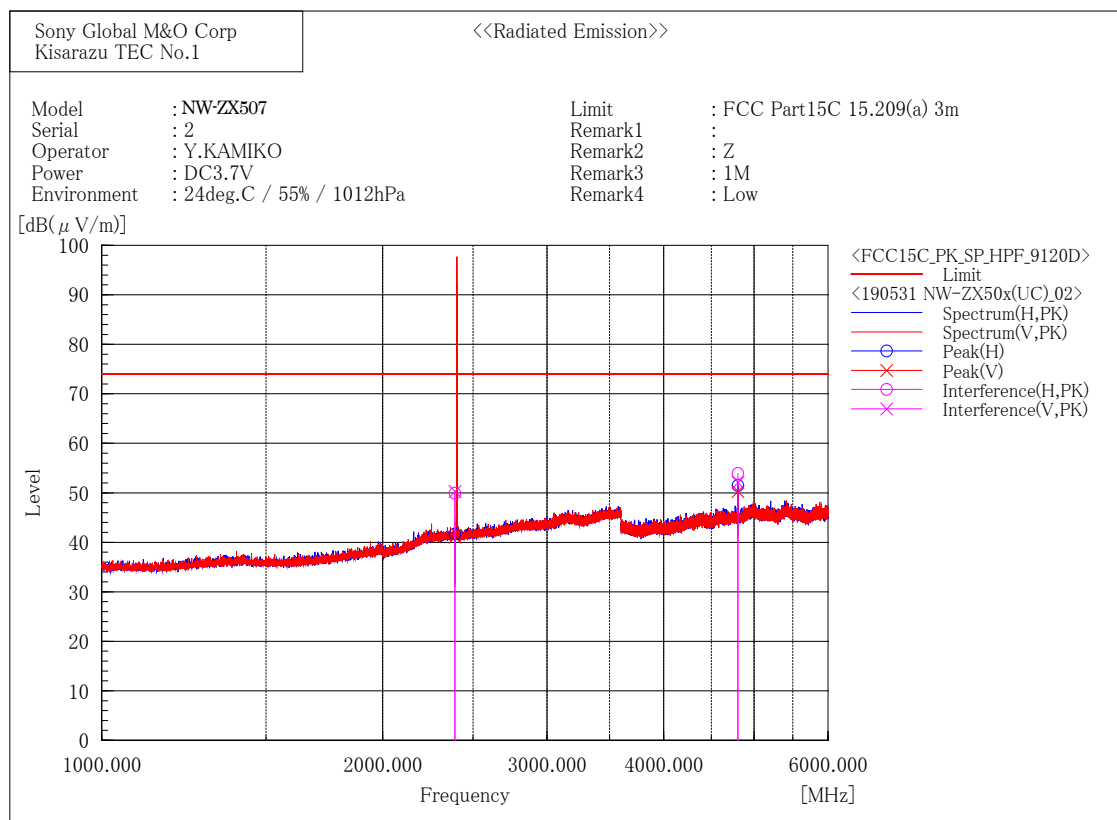
--- Horizontal Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c.f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	2483.500	37.7	3.1	40.8	54.0	13.2	330.9	52.9
2	4959.571	35.1	11.3	46.4	54.0	7.6	124.8	129.8

--- Vertical Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c.f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	2483.500	37.6	3.1	40.7	54.0	13.3	363.0	277.2
2	4959.673	32.7	11.3	44.0	54.0	10.0	144.7	293.5

[1 Mbps / 2402 MHz]



Final Result

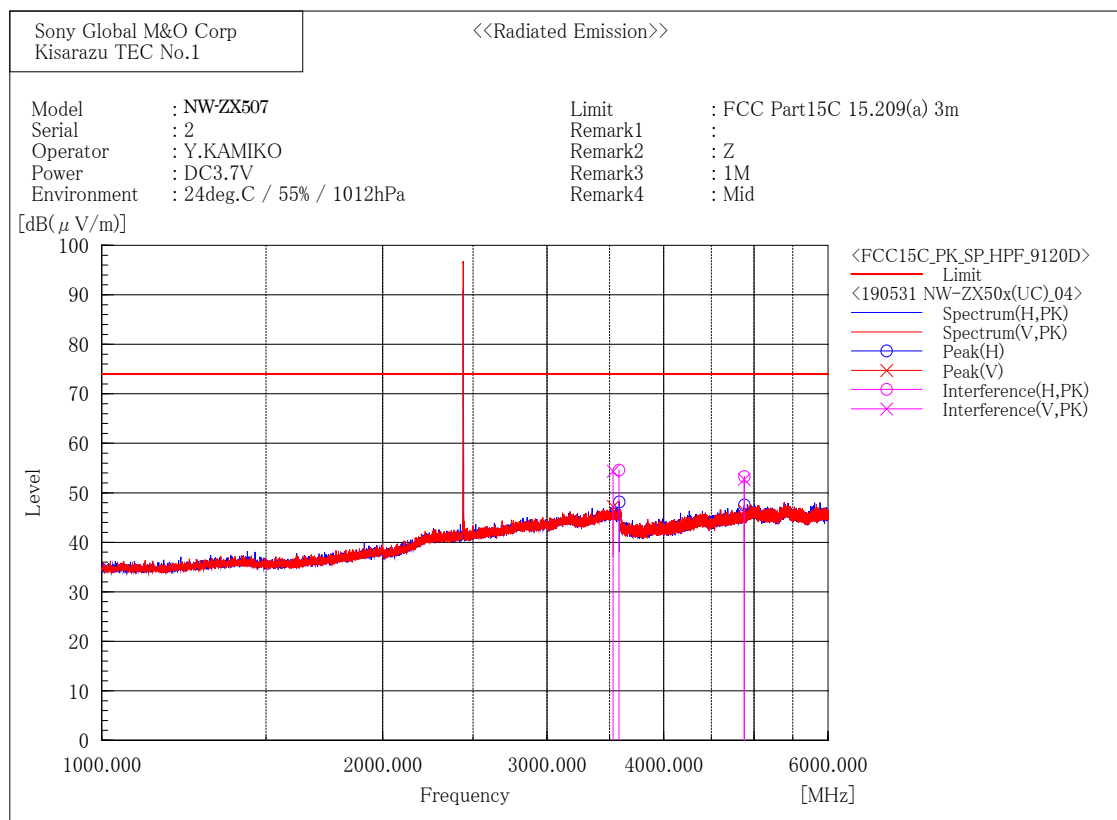
--- Horizontal Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c. f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	2390.000	47.2	2.7	49.9	74.0	24.1	388.0	44.0
2	4804.547	43.0	10.9	53.9	74.0	20.1	156.6	116.7

--- Vertical Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c. f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	2390.000	47.6	2.7	50.3	74.0	23.7	382.4	280.0
2	4804.638	41.2	10.9	52.1	74.0	21.9	278.0	316.6

[1 Mbps / 2440 MHz]



Final Result

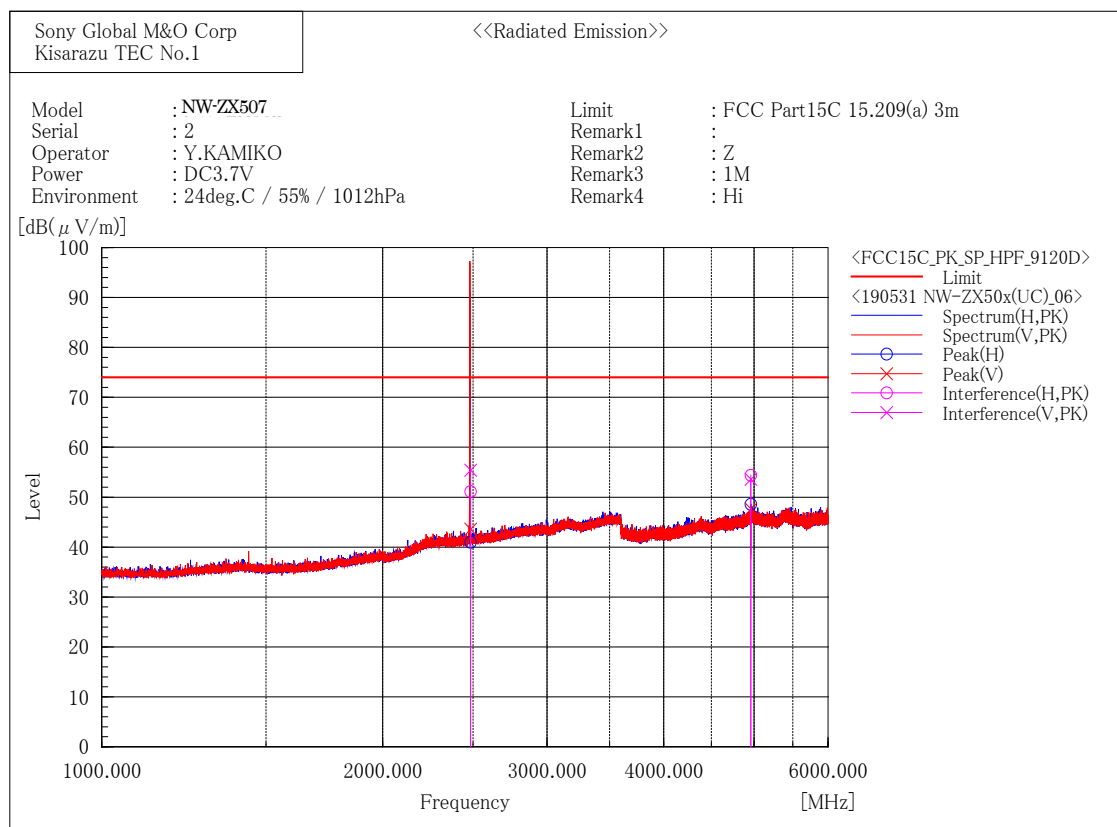
--- Horizontal Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c. f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	3582.528	47.3	7.3	54.6	74.0	19.4	374.0	197.7
2	4879.773	42.3	11.0	53.3	74.0	20.7	122.0	131.1

--- Vertical Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c. f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	3531.347	47.3	7.1	54.4	74.0	19.6	174.5	279.8
2	4879.168	41.7	11.0	52.7	74.0	21.3	149.0	310.6

[1 Mbps / 2480 MHz]



Final Result

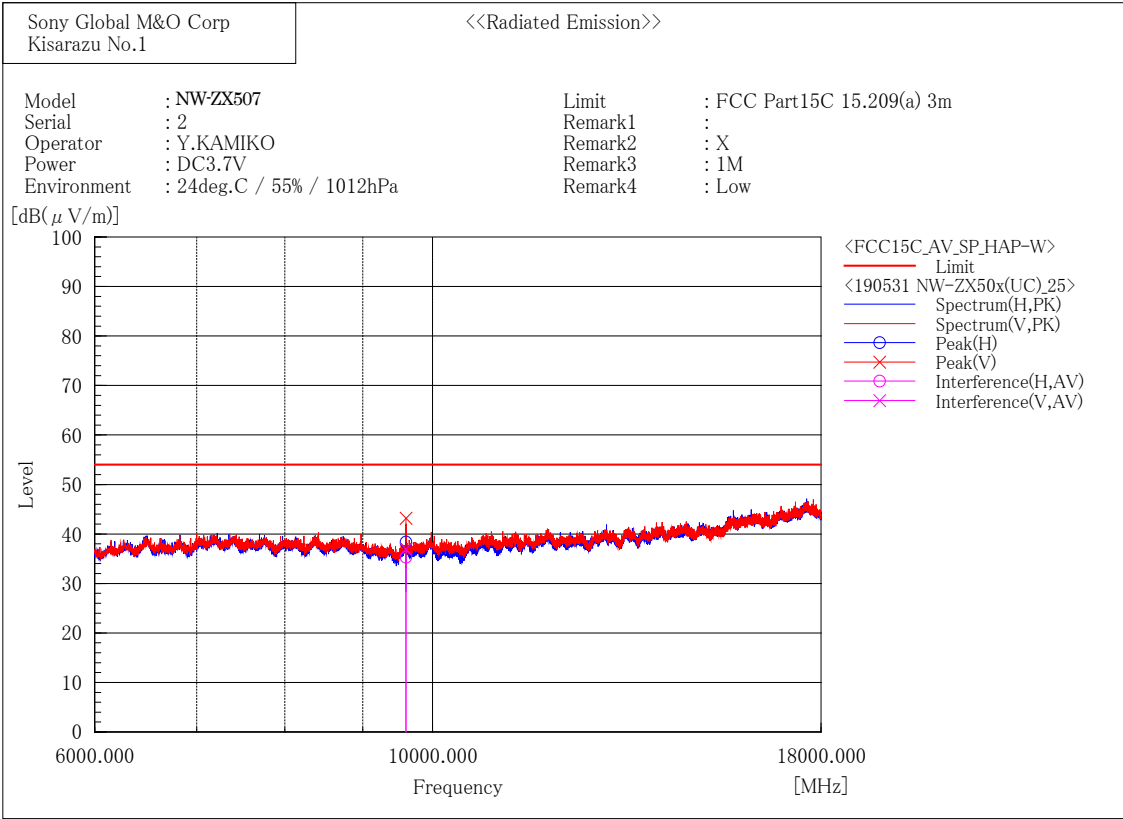
--- Horizontal Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c.f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	2483.500	48.0	3.1	51.1	74.0	22.9	330.9	54.9
2	4959.688	43.1	11.3	54.4	74.0	19.6	124.8	127.7

--- Vertical Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c.f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	2483.500	52.3	3.1	55.4	74.0	18.6	363.0	279.2
2	4960.458	42.3	11.3	53.6	74.0	20.4	144.7	291.6

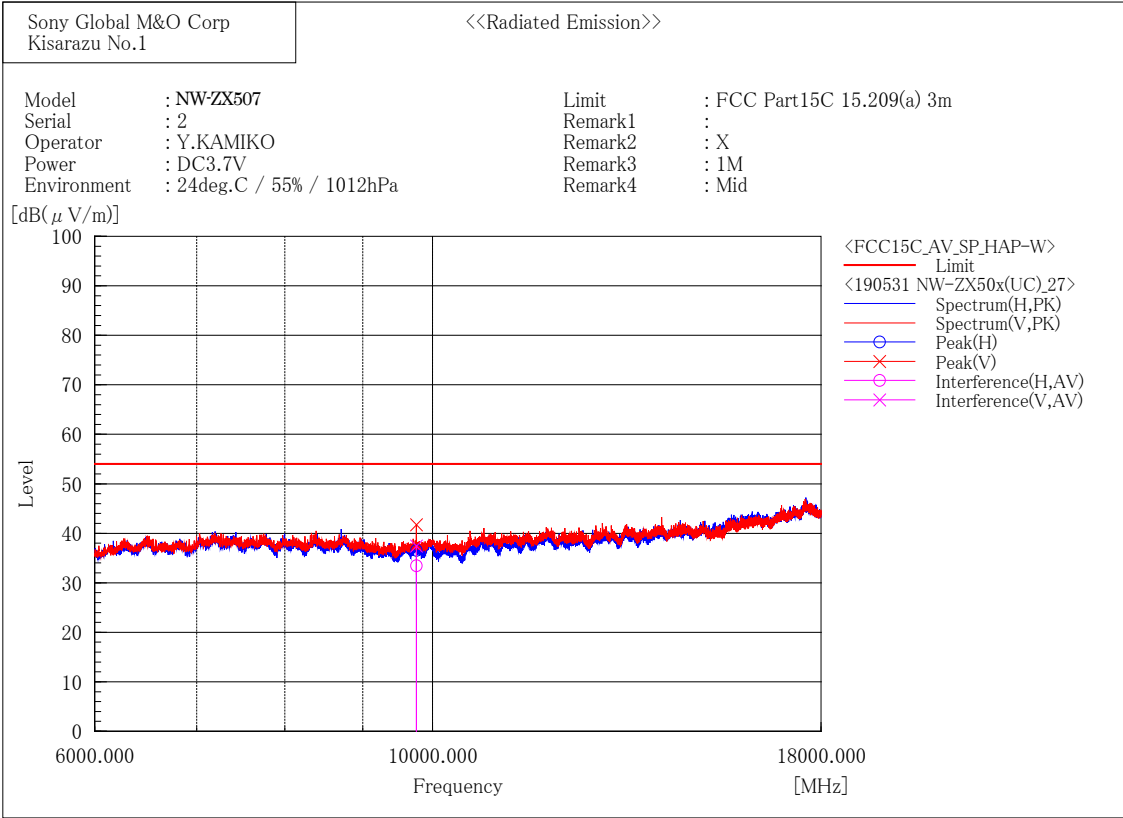
6 GHz to 18 GHz
[1 Mbps / 2402 MHz]



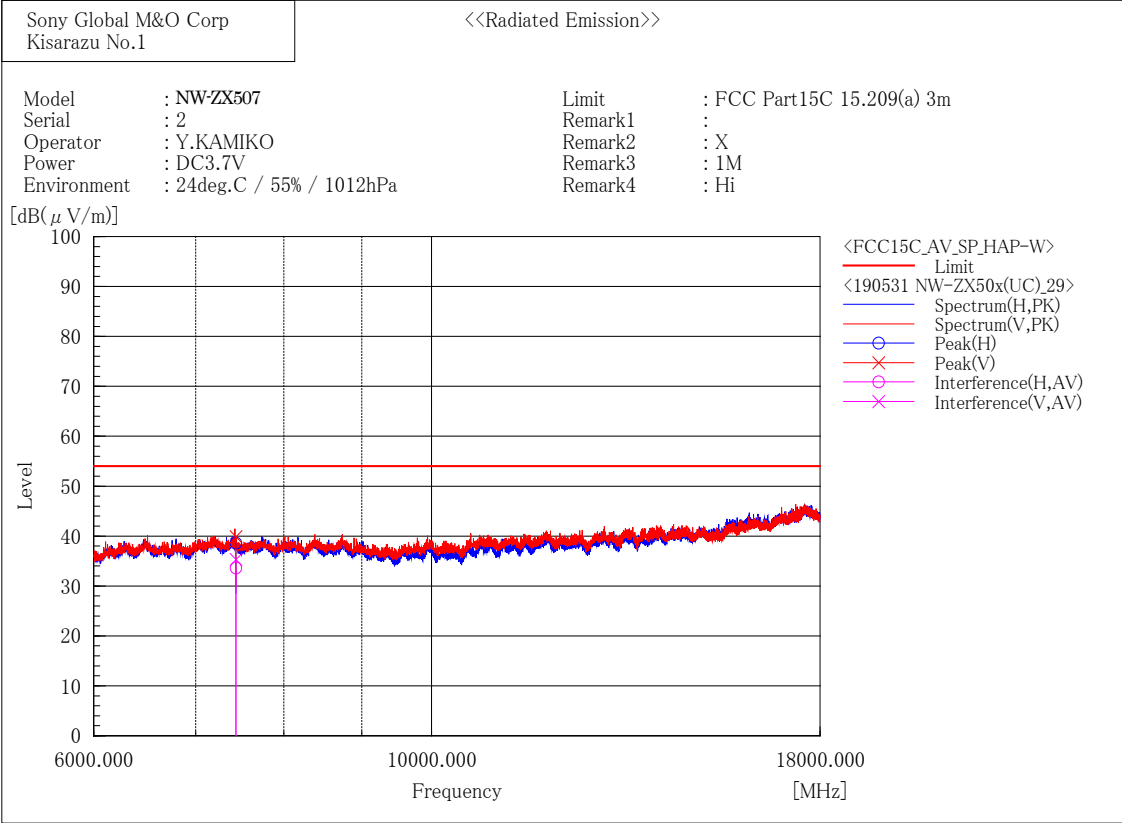
Final Result

--- Horizontal Polarization (AV)---								
No.	Frequency [MHz]	Reading [dB(μ V)]	c. f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	9608.004	41.3	-6.0	35.3	54.0	18.7	367.5	258.4
--- Vertical Polarization (AV)---								
No.	Frequency [MHz]	Reading [dB(μ V)]	c. f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	9607.964	42.9	-6.0	36.9	54.0	17.1	393.1	218.0

[1 Mbps / 2440 MHz]



[1 Mbps / 2480 MHz]



Final Result

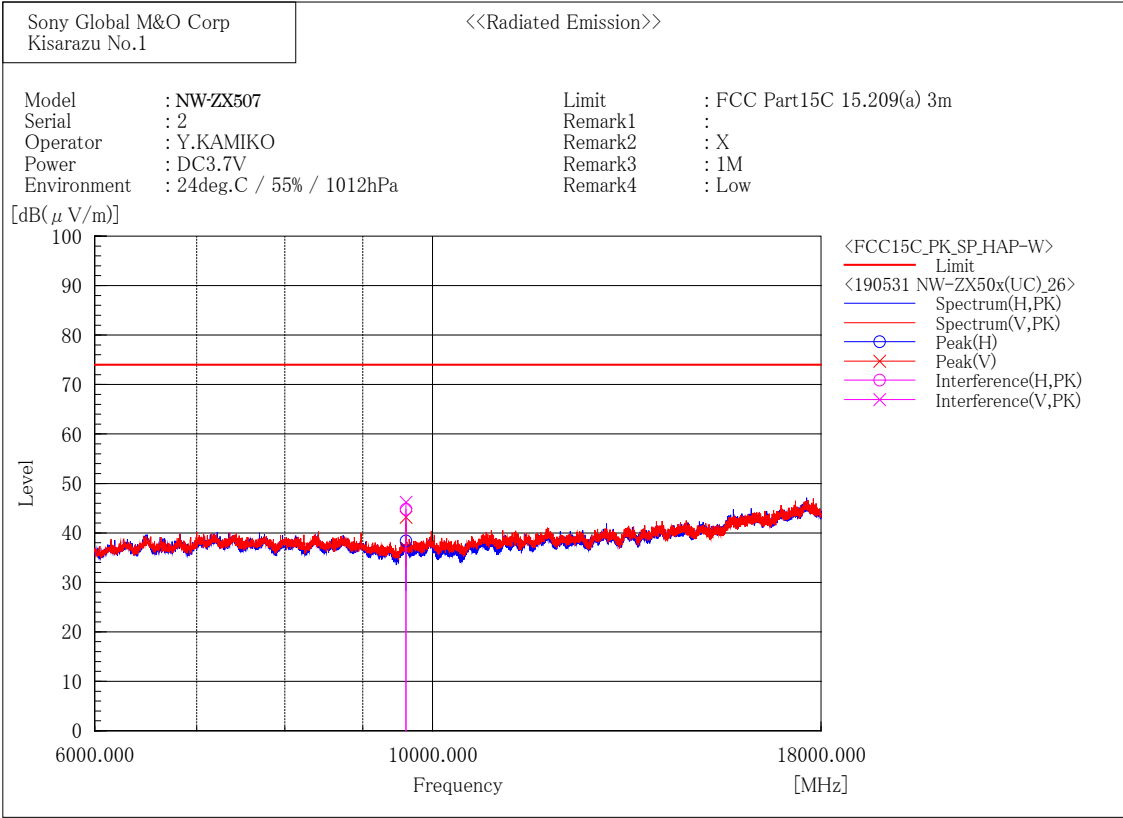
--- Horizontal Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c.f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	7439.519	41.5	-7.9	33.6	54.0	20.4	303.8	258.8

--- Vertical Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c.f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	7439.861	43.2	-7.9	35.3	54.0	18.7	100.0	64.0

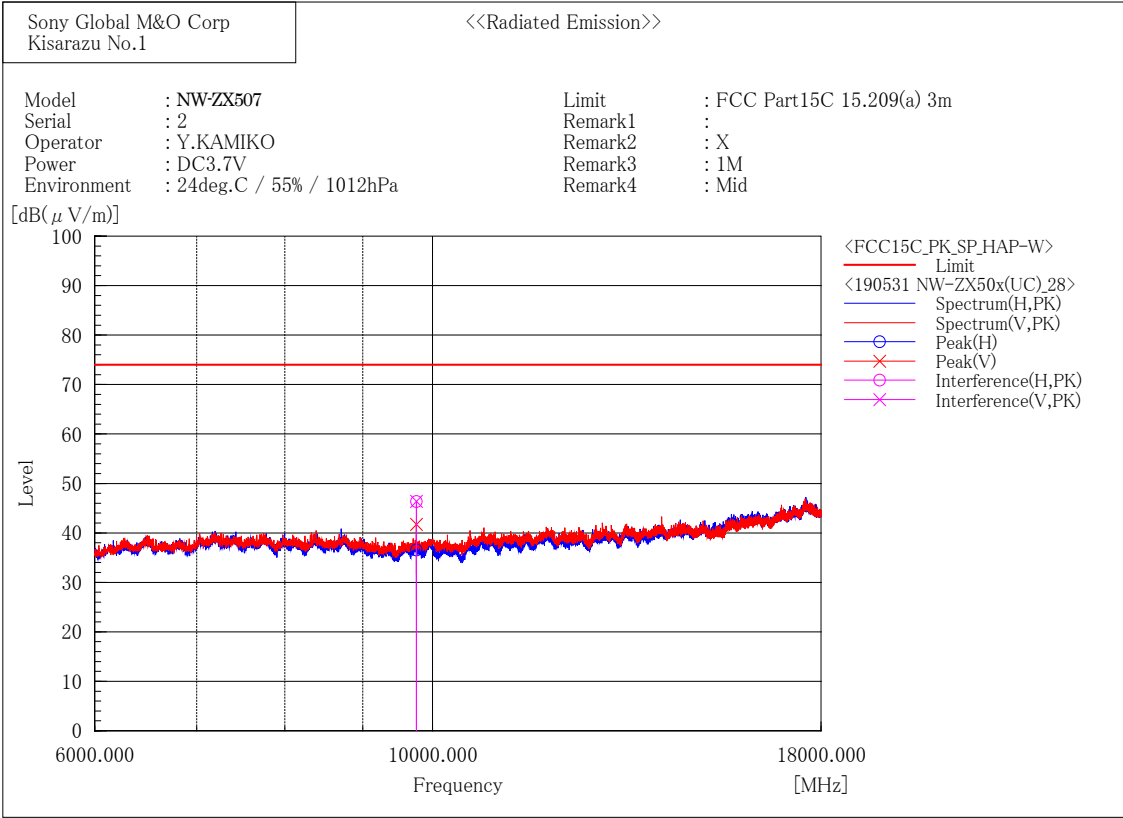
[1 Mbps / 2402 MHz]



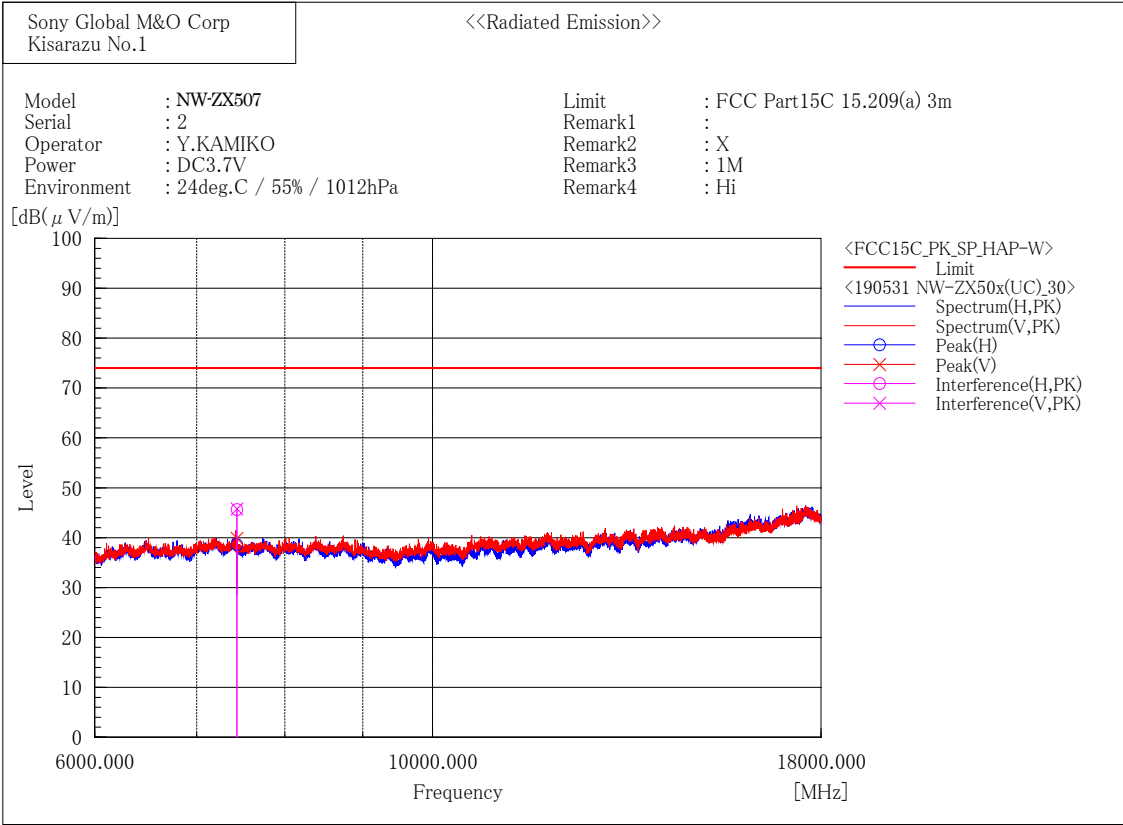
Final Result

--- Horizontal Polarization (PK)---								
No.	Frequency	Reading	c. f	Result	Limit	Margin	Height	Angle
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[cm]	[°]
1	9609.125	50.8	-6.0	44.8	74.0	29.2	367.5	258.4
--- Vertical Polarization (PK)---								
No.	Frequency	Reading	c. f	Result	Limit	Margin	Height	Angle
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[cm]	[°]
1	9607.627	52.2	-6.0	46.2	74.0	27.8	393.1	219.9

[1 Mbps / 2440 MHz]



[1 Mbps / 2480 MHz]



Final Result

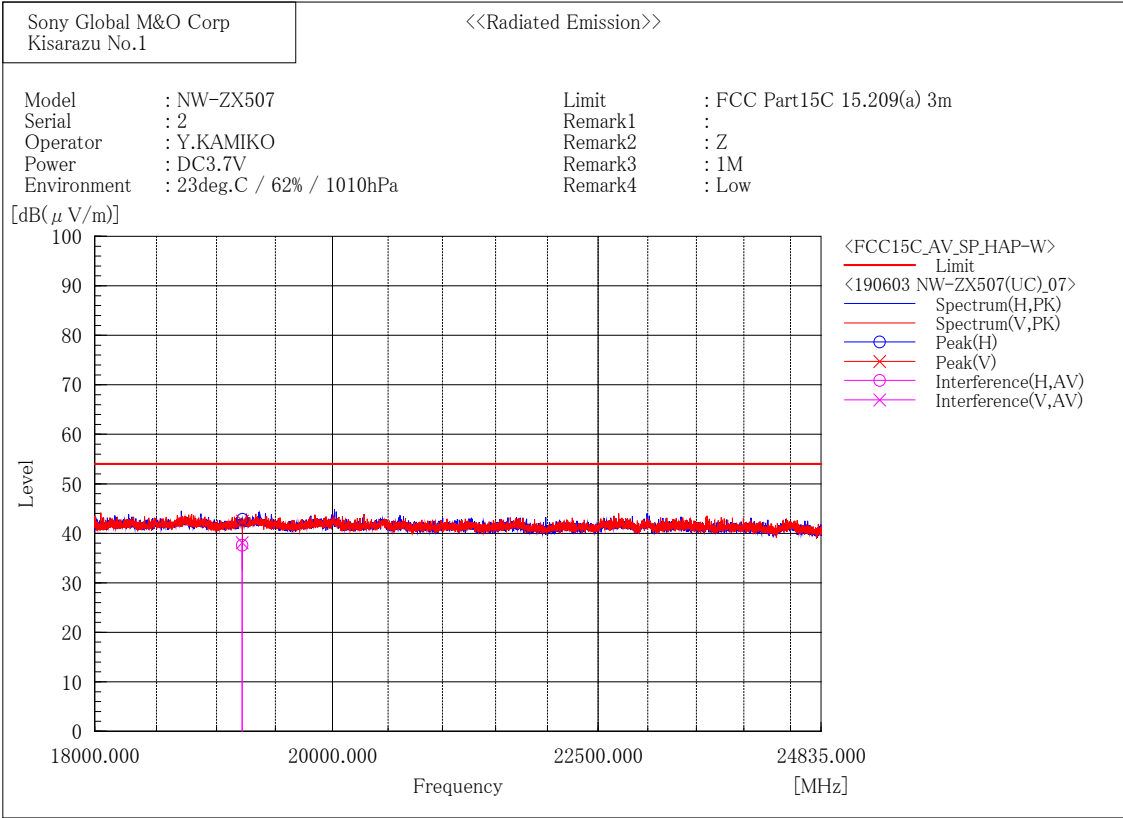
--- Horizontal Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c.f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	7439.442	53.5	-7.9	45.6	74.0	28.4	303.8	260.8

--- Vertical Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c.f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	7439.781	53.7	-7.9	45.8	74.0	28.2	100.0	64.0

18 GHz to 26.5 GHz
[1 Mbps / 2402 MHz]

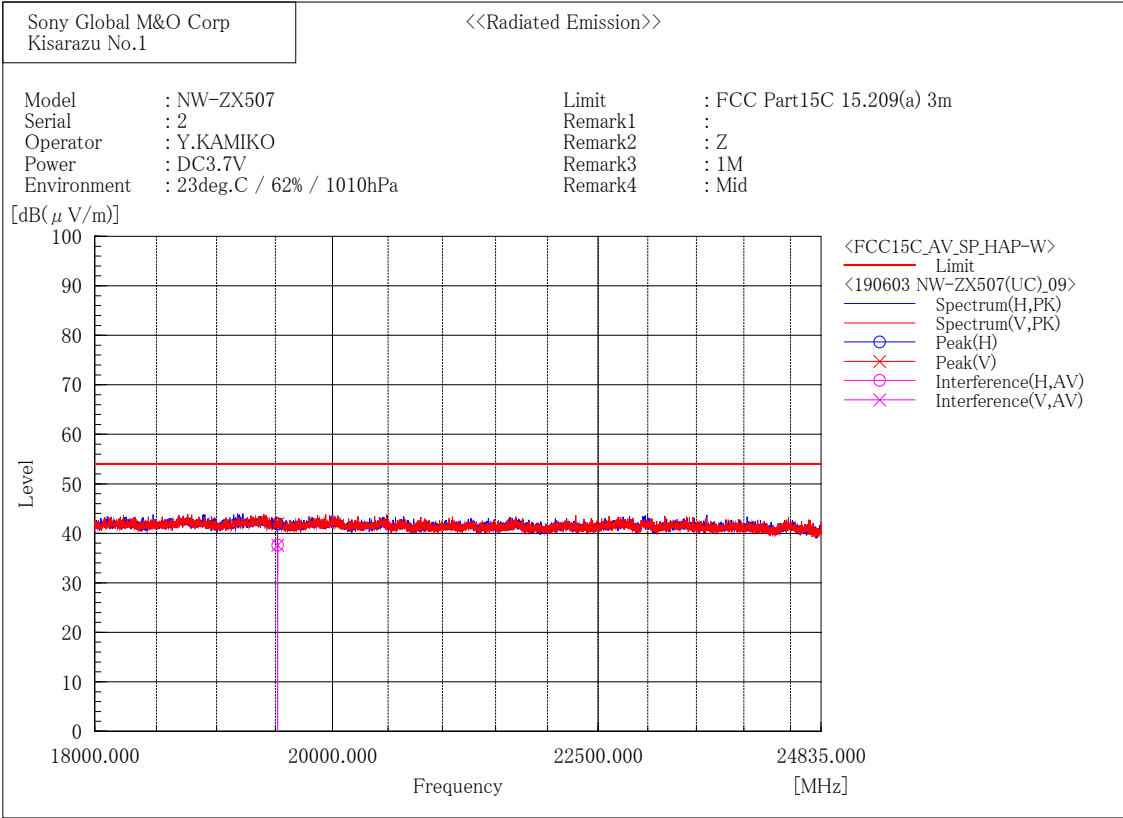


Final Result

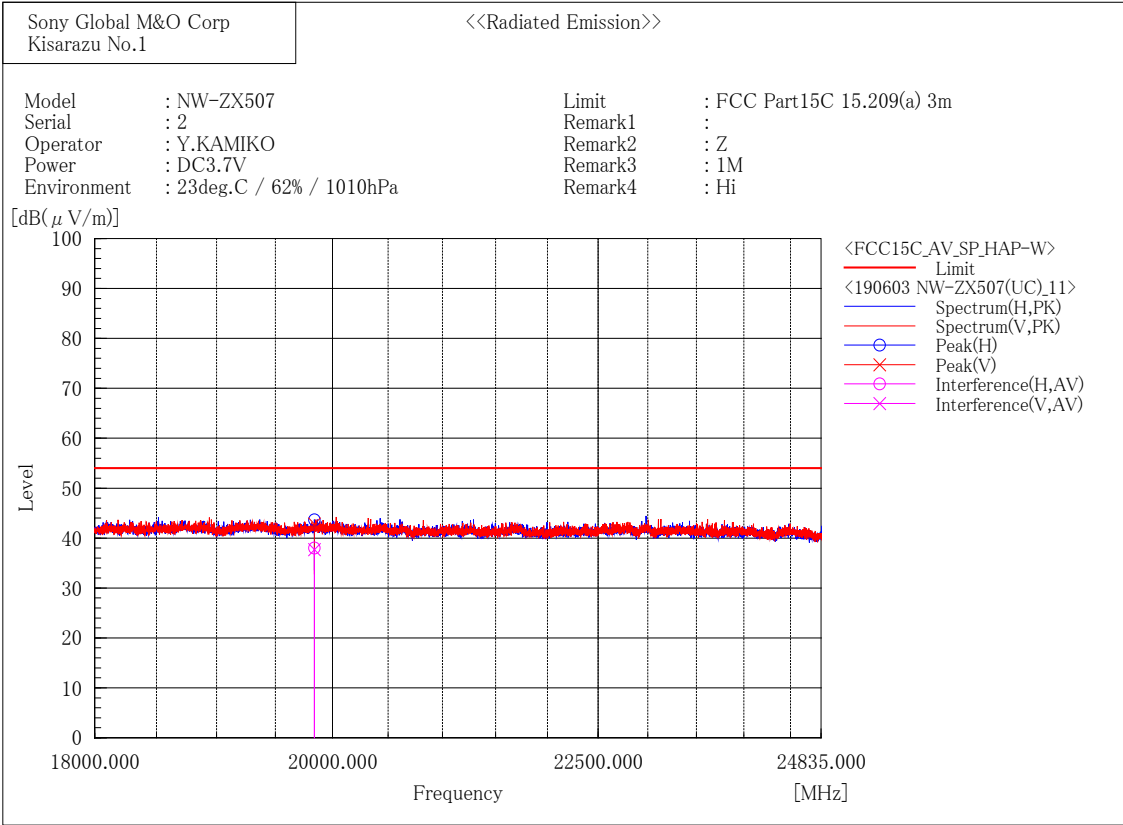
--- Horizontal Polarization (AV)---								
No.	Frequency	Reading	c.f	Result	Limit	Margin	Height	Angle
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[cm]	[°]
1	19216.000	38.4	-0.8	37.6	54.0	16.4	203.1	171.2

--- Vertical Polarization (AV)---								
No.	Frequency	Reading	c.f	Result	Limit	Margin	Height	Angle
	[MHz]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[cm]	[°]
1	19216.000	38.9	-0.8	38.1	54.0	15.9	186.5	314.3

[1 Mbps / 2440 MHz]



[1 Mbps / 2480 MHz]



Final Result

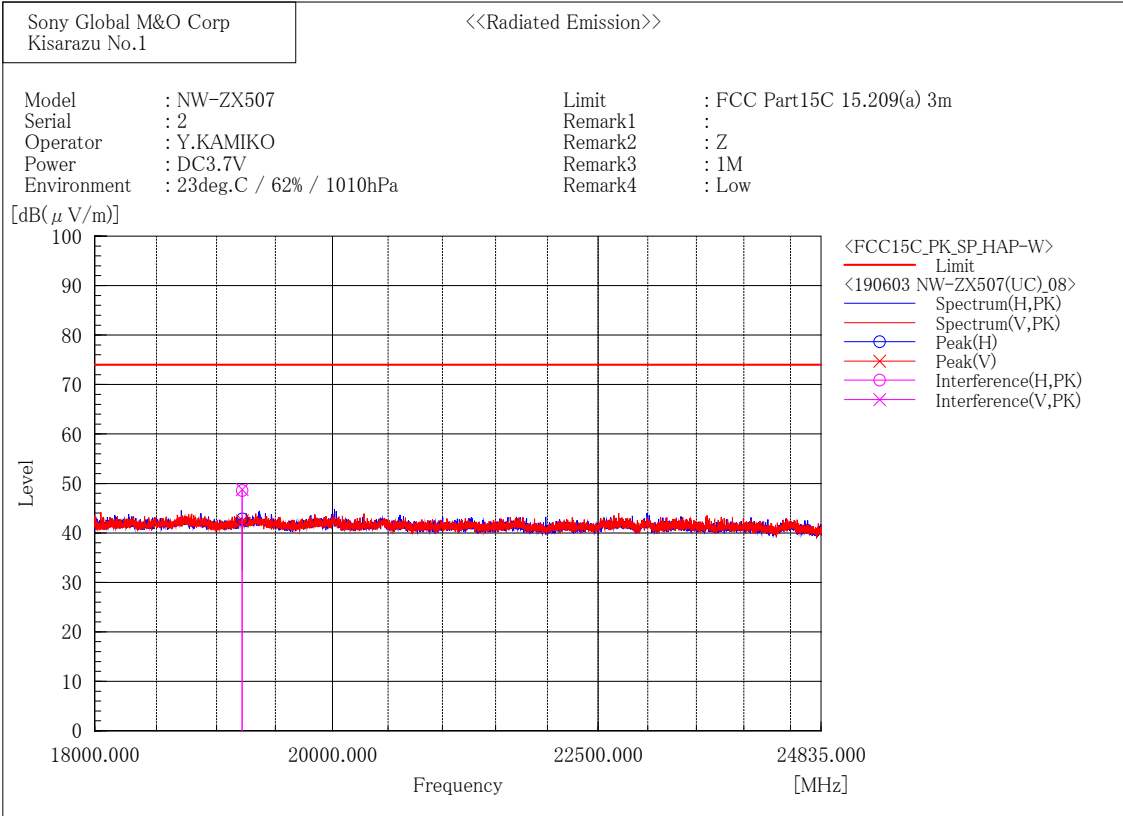
--- Horizontal Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c. f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	19840.000	38.9	-0.9	38.0	54.0	16.0	414.0	273.7

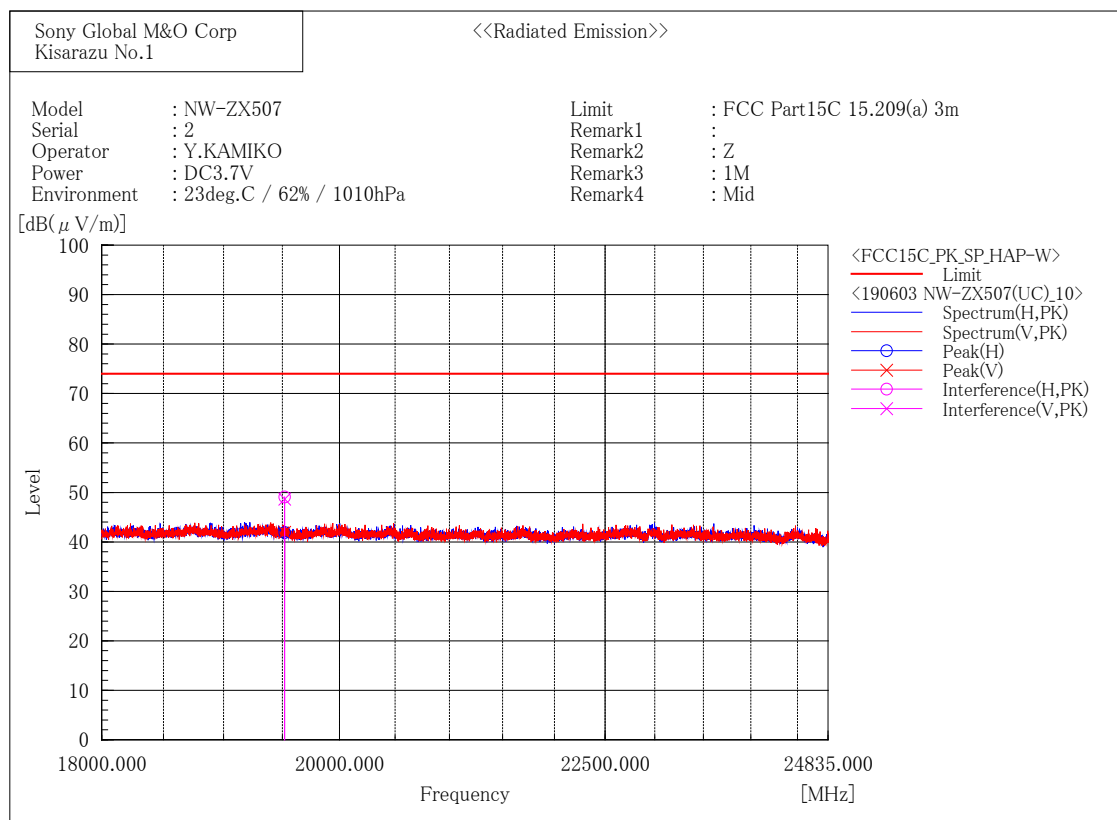
--- Vertical Polarization (AV)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c. f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	19840.000	38.6	-0.9	37.7	54.0	16.3	100.0	242.9

[1 Mbps / 2402 MHz]



[1 Mbps / 2440 MHz]



Final Result

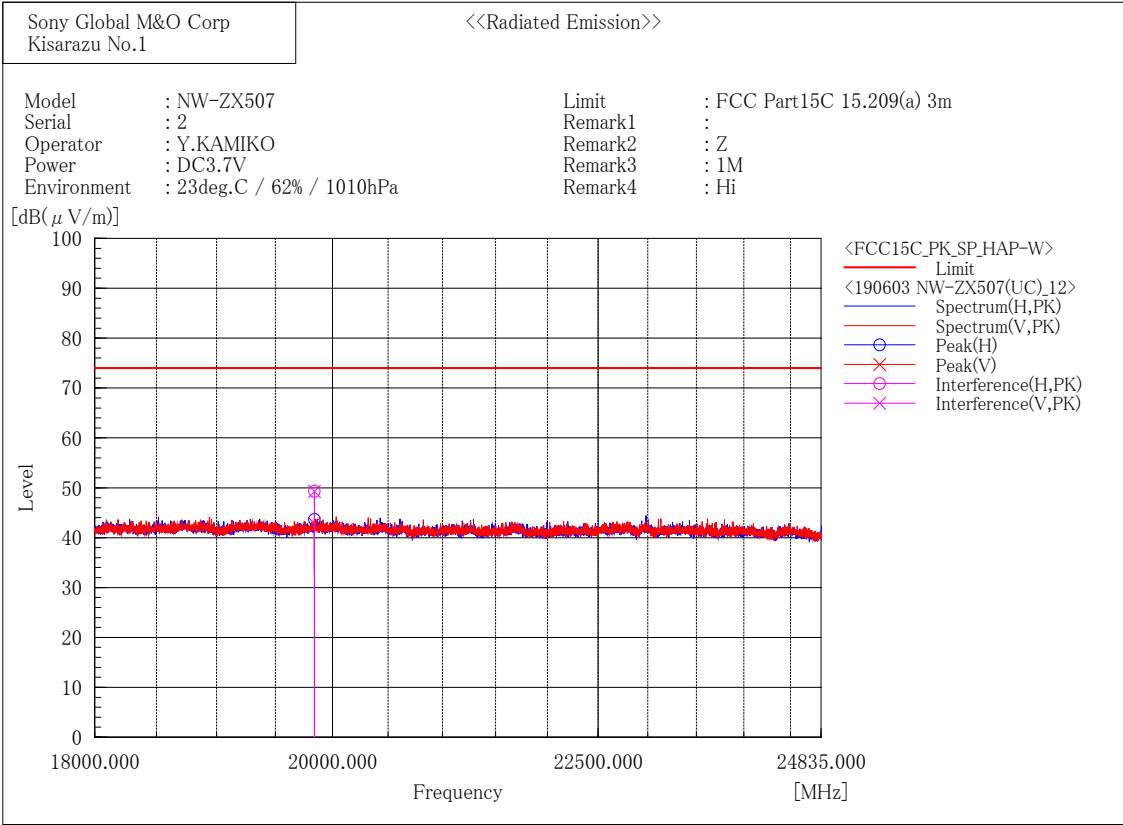
--- Horizontal Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c.f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	19520.000	49.9	-0.8	49.1	74.0	24.9	170.3	155.5

--- Vertical Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c.f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	19520.000	49.5	-0.8	48.7	74.0	25.3	122.6	10.1

[1 Mbps / 2480 MHz]



Final Result

--- Horizontal Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c.f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	19840.000	50.2	-0.9	49.3	74.0	24.7	414.0	273.7

--- Vertical Polarization (PK)---

No.	Frequency [MHz]	Reading [dB(μ V)]	c.f [dB(1/m)]	Result [dB(μ V/m)]	Limit [dB(μ V/m)]	Margin [dB]	Height [cm]	Angle [°]
1	19840.000	50.2	-0.9	49.3	74.0	24.7	100.0	244.9

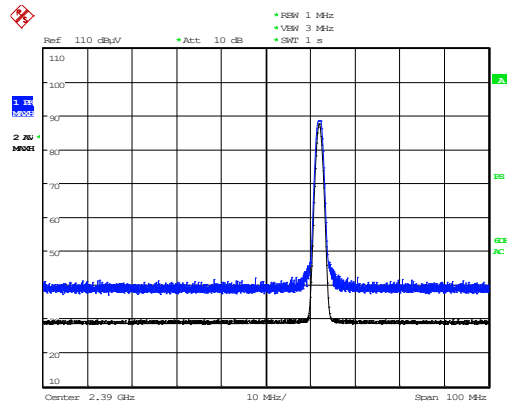
2.4 GHz Restricted-Band Edge (Plot data)

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 2390 MHz and above 2483.5 MHz)

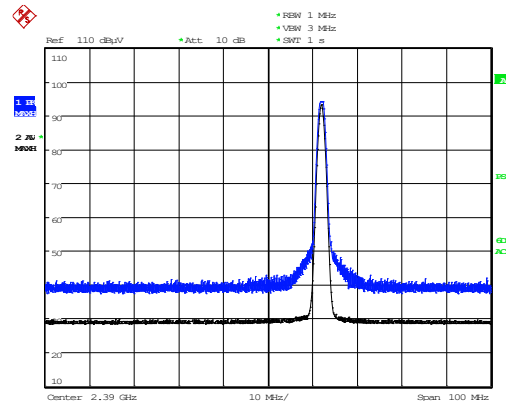
The result of the final radiated spurious emissions measurement refers in previous pages.

[1 Mbps / 2402 MHz]

Horizontal

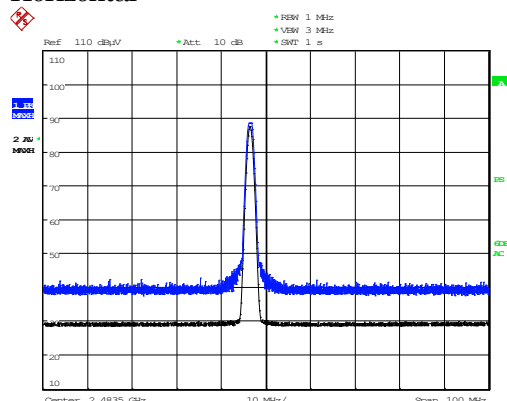


Vertical

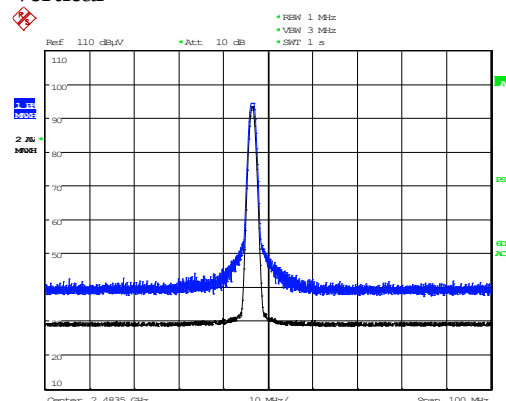


[1 Mbps / 2480 MHz]

Horizontal



Vertical

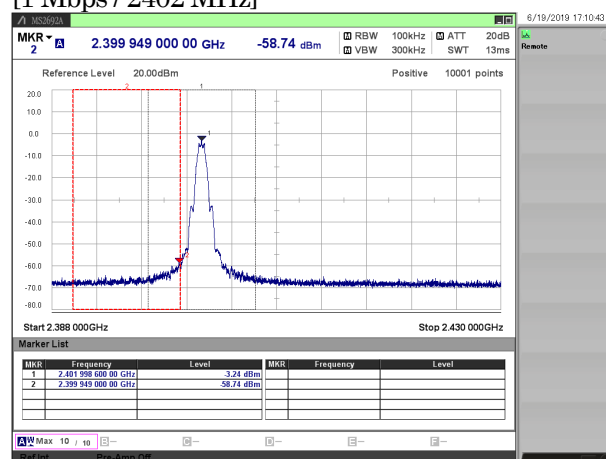


3.6. Conducted Spurious Emissions for Band Edge

- 1) Ambient temperature : 21.5 deg.C
- 2) Relative humidity : 52.5 %
- 3) Date of measurement : June 19, 2019
- 4) Measured by : H.WAKI
- 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	2402.00	-3.24	10.98	7.74	-	-
			2399.95	-58.74	10.98	-47.76	-12.3	35.50

[1 Mbps / 2402 MHz]



4. Method of Calculation

4.1. AC Power-line Conducted Emissions

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

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

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

4.2. Maximum Peak Conducted Output Power

Method of calculation : Software
Software Name : SW-0316
Software Version : Ver.2

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

Test Result (AV) [dBm] = Meter Reading [dBm] + C.F. [dB] + Duty Factor [dB]

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

4.3. Power Spectral Density

Method of calculation : Software
Software Name : SW-0316
Software Version : Ver.2

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

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

4.4. Radiated Spurious Emissions

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

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

Note (a) Meter Reading : Reading of the EMI test receiver or the 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 Emissions for Band Edge

Method of calculation : Software
Software Name : SW-0316
Software Version : Ver.2

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

Note (a) Meter Reading : Reading of the spectrum analyzer.
(b) C.F. : System Cable 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

	Ctrl#	Equipment	Model No.	Serial No.	Manufacturer	Cal.Interval	Last Cal.
x	CS0015	EMC-CE Cable System 1	-	-	-	12 months	18.11.04
x	M0663	6dB Attenuator	6806.01A	-	HUBER+SUHNER	12 months	18.11.04
x	M0569	HIGH FREQUENCY FUSE	MP612A	-	Anritsu	12 months	18.11.04
x	M0130	RF Selector	NS4902SR	109001	Toyo Corporation	12 months	18.11.04
x	M0605	LISN/AMN	ENV216	101305	Rohde & Schwarz	12 months	18.10.01
x	M5062	Scientific Ambient Monitor	0560 6220	39515563/802	testo	12 months	18.07.17
x	M0515	EMI Receiver	ESCI	100606	Rohde & Schwarz	12 months	18.10.01
x	M5080	Temperature Meter	608-H2	41476135	testo	12 months	18.10.18

5.2. Antenna-port Conducted Measurements

	Ctrl#	Equipment	Model No.	Serial No.	Manufacturer	Cal.Interval	Last Cal.
-	W0140	Spectrum Analyzer	FSU26	200717	Rohde & Schwarz	12 months	18.09.01
x	W0100	Spectrum Analyzer	MS2692A	6201338954	Anritsu	12 months	19.05.19
x	W0101	Signal Analyzer	MS2692A	6201338955	Anritsu	12 months	19.05.19
x	W0110	10dB Attenuator	6610-SK-50-1	0002	Huber + Suhner	12 months	18.09.01
x	W0006	Power Meter	N1911A	MY50000295	Agilent Technologies	12 months	18.10.06
x	W0007	Power Sensor	N1922A	MY50180022	Agilent Technologies	12 months	18.10.06
x	W0029	10dB Attenuator	8493C	76549	Agilent Technologies	12 months	18.09.01
-	WC0002	RF Cable	SUCOFLEX 102	34124/2	HUBER + SUHNER	12 months	18.09.01
-	WC0003	RF Cable	SUCOFLEX 102	34127/2	HUBER + SUHNER	12 months	18.09.01
x	WC0004	RF Cable	SUCOFLEX 102	34288/2	HUBER + SUHNER	12 months	18.09.01
-	WC0005	RF Cable	SUCOFLEX 102	34287/2	HUBER + SUHNER	12 months	18.09.01
-	WC0006	RF Cable	SUCOFLEX 102	34289/2	HUBER + SUHNER	12 months	18.09.01
-	WC0007	RF Cable	SUCOFLEX 102	34286/2	HUBER + SUHNER	12 months	18.09.01
x	M0720	Thermometer	TH-321	140036	AS ONE	12 months	18.07.20

5.3. Radiated Spurious Emissions

	Ctrl#	Equipment	Model No.	Serial No.	Manufacturer	Cal.Interval	Last Cal.
x	M0486	EMI Receiver	ESU40	100050	Rohde & Schwarz	12 months	18.10.01
x	M0686	EMI Receiver	N9038A	MY52260113	Agilent Technologies	12 months	18.11.13
x	A0073	Loop Antenna	HFH2-Z2	100171	Rohde & Schwarz	12 months	18.12.10
x	A0089	Biconical Antenna	BBA9106	VHA91032835	Schwarzbeck	12 months	18.12.03
x	A0088	Log periodic Antenna	UHALP9108A1	0649	Schwarzbeck	12 months	18.12.03
x	A0064	Horn Antenna	BBHA9120D	746	Schwarzbeck	12 months	18.11.04
x	A0078	Horn Antenna	HAP06-18W	00000070	Toyo Corporation	12 months	18.11.04
x	A0058	Horn Antenna	HAP18-26W	00000016	Toyo Corporation	12 months	18.12.01
x	CS0017	N-RE Cable System 1	-	-	-	12 months	18.11.04
x	CS0018	N-RE Cable System 2	-	-	-	12 months	18.11.04
x	CS0045	N-3m EMF Cable System	-	-	-	12 months	18.11.04
x	CS0074/0075	N-RE Cable SYSTEM 4	-	-	-	12 months	18.11.04
x	M0126	Step Attenuator	8494H	3837M01144	Agilent Technologies	12 months	18.11.04
x	M0752	Pre Amplifier	310N	320621	SONOMA INSTRUMENT	12 months	18.11.04
x	M0128	3dB Attenuator	8491A	53541	Agilent Technologies	12 months	18.11.04
x	M0609	3dB Attenuator	8491B	MY39265960	Agilent Technologies	12 months	18.11.04
x	M0737	GHz Filter Box	FB-G1	001	Sony EMCS	12 months	18.11.04
x	M5079	Temperature Meter	608-H2	41475953	testo	12 months	18.10.18
x	M5062	Scientific Ambient Monitor	0560 6220	39515563/802	testo	12 months	18.07.17

About calibration interval

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