



RADIO TEST REPORT

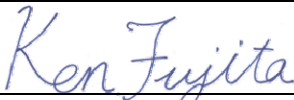
Test Report No. : 12244305H-A

Applicant : Sony Corporation
Type of Equipment : Digital Wireless Microphone
Model No. : DWM-02N
FCC ID : AK8DWM02N
Test regulation : FCC Part 74: 2018
Test Result : Complied

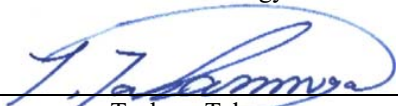
1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
7. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Date of test: March 28 to April 5, 2018

Representative test engineer:


Ken Fujita
Engineer
Consumer Technology Division

Approved by:


Tsubasa Takayama
Leader
Consumer Technology Division



NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
*As for the range of Accreditation in NVLAP, you may refer to the WEB address,
http://japan.ul.com/resources/emc_accredited/

- ☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

13-EM-F0429

REVISION HISTORY

Original Test Report No.: 12244305H-A

[illegible]

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

CONTENTS	PAGE
SECTION 1: Customer information.....	4
SECTION 2: Equipment under test (E.U.T.).....	4
SECTION 3: Test specification, procedures & results.....	6
SECTION 4: Operation of E.U.T. during testing.....	9
SECTION 5: Field strength of spurious radiation	11
SECTION 6: Antenna terminal tests	12
APPENDIX 1: Data of EMI test.....	13
RF power output.....	13
Occupied Bandwidth.....	14
Spurious emissions at antenna terminals.....	17
Emission Mask	26
Field strength of spurious radiation.....	32
Frequency stability	35
APPENDIX 2: Test instruments	36
APPENDIX 3: Photographs of test setup	37
Radiated Spurious Emission	37
Worst Case Position	38

SECTION 1: Customer information

Company Name	:	Sony Global Manufacturing & Operations Corporation
Address	:	8-4 Shiomi Kisarazu-shi, Chiba, 292-0834 Japan
Telephone Number	:	+81-438-37-4704
Contact Person	:	Youhei Hisano

***Remarks**

Sony Global Manufacturing & Operations Corporation (Subsidiary Company Name) is on behalf of the applicant: Sony Corporation.

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	Digital Wireless Microphone
Model No.	:	DWM-02N
Serial No.	:	Refer to 4.2 in this report.
Rating	:	DC 3.0 V (2 x AA batteries)
Receipt Date of Sample	:	March 26, 2018
Country of Manufacture	:	Japan
Condition of EUT	:	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model: DWM-02N (referred to as the EUT in this report) is a Digital Wireless Microphone.

General Specification

Clock frequency(ies) in the system	:	X401	8 MHz
		X202	12.288 MHz
		X2001	16 MHz
		X801 (TCXO)	19.2 MHz
		IC602, 603, 604, 605, 607	1250 kHz - 1500 kHz
		IC606	1300 kHz
		IC202	600 kHz - 1000 kHz
		IC500	250 kHz
		X802 (VCO: change by a transmission frequency)	
		(14)	470.125 MHz - 541.875 MHz
		(30)	566.125 MHz - 607.875 MHz

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radio Specification (Radio microphone part)

Radio type	:	Transmitter
Modulation type	:	$\pi/4$ shift QPSK
Emission designator	:	192KG1D, 192KG1E
Necessary bandwidth	:	192 kHz, Manufacturer defined
Channel spacing	:	25 kHz
Frequency of operation	:	470.125 MHz - 607.875 MHz (14) 470.125 MHz - 541.875 MHz (30) 566.125 MHz - 607.875 MHz
RF power	:	High: 50 mW, Middle: 10 mW, Low: 1 mW
Antenna type	:	1/4 Lambda Monopole antenna (helical type)
Antenna gain	:	2.14 dBi
AF Specification	:	40 Hz - 18000 Hz, Maximum input: -24 dBV (MIC level, ATT 0 dB)
Operating temperature	:	0 deg. C to 50 deg. C

Radio Specification (RF remote part)

Radio Type	:	Transceiver
Modulation type	:	DSSS
Frequency of Operation	:	2405 MHz - 2480 MHz
Channel spacing	:	5 MHz
Method of frequency generation	:	Synthesizer
Power Supply (radio part input)	:	DC 2.8 V
Antenna Type	:	Chip antenna
Antenna Gain	:	-3.0 dBi max
Operating temperature	:	0 deg. C to 50 deg. C

*This test report applies for Radio microphone part.

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 74: 2018

Title : FCC 47CFR Part74
EXPERIMENTAL RADIO, AUXILIARY, SPECIAL BROADCAST AND OTHER
PROGRAM DISTRIBUTIONAL SERVICES

* Also the EUT complies with FCC Part 15 Subpart B.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
RF power output	FCC: Section 2.1046	FCC: Section 74.861 (e) (1)	See data.	Complied	Conducted
	IC: RSS-Gen Section 6.12 RSS-210 A1 Section 5.1	IC: RSS-210 G 3.1			
Modulation Characteristics	FCC: Section 2.1047	FCC: Section 74.861 (e) (3)	N/A	N/A *1)	-
	IC: RSS-210 A1 Section 5.3	IC: RSS-210 G 3.5			
Occupied Bandwidth	FCC: Section 2.1049	FCC: Section 74.861 (e) (5)	See data.	Complied	Conducted
	IC: RSS-Gen Section 6.6	IC: RSS-210 G 3.2			
Spurious emissions at antenna terminals	EN 300 422-1 V 1.4.2 Clause 8.4	FCC: Section 74.861 (e) (6)	See data.	Complied	Conducted
		IC: RSS-210 G 3.4			
Field strength of spurious radiation	EN 300 422-1 V 1.4.2 Clause 8.4	FCC: Section 74.861 (e) (6)	21.1 dB 940.25 MHz, Horizontal	Complied	Radiated
		IC: RSS-210 G 3.4			
Emission mask	EN 300 422-1 V 1.4.2 Clause 8.3	FCC: Section 74.861 (e) (7)	See data.	Complied	Conducted
		IC: RSS-210 G 3.4			
Frequency stability	FCC: Section 2.1055	FCC: Section 74.861 (e) (4)	See data.	Complied	Conducted
	IC: RSS-Gen Section 6.11	IC: RSS-210 G 3.3			

Note: UL Japan, Inc.'s EMI Work Procedure No. 13-EM-W0420.

This EUT does not have receiving part. Therefore Receiver Spurious Emission test was not performed.

*1) Because the EUT has digital modulation.

* In case any questions arise about test procedure, KDB 206256 D01 Wireless Microphones v02 is also referred.

Supplied Voltage Information

The test was performed with the New Battery and the stable voltage was supplied to the EUT during the tests.

Antenna Information

The antenna is not removable from the EUT.

3.3 Addition to standard

No addition, exclusion nor deviation has been made from the standard.

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

3.4 Uncertainty

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k = 2$.

Ise EMC Lab.

Spurious Emission (EUT height: 1.5m)	dB
Mesurment Distance 3m	
•25 MHz - 200 MHz	5.6
•200 MHz - 1000 MHz	4.0
•1 GHz - 12.75 GHz	4.6

Antenna terminal test	Uncertainty (+/-)
RF output power	1.3 dB
Occupied bandwidth	
Span 1 MHz	0.96%
Emission mask	1.9 dB
Frequency stability	0.0154 ppm
Spurious emissions at antenna terminals	2.3 dB

Radiated emission test (3 m)

The data listed in this test report has enough margin, more than the site margin.

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124
NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.6 shielded room	-	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	-	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	-	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	-	3.1 x 5.0 x 2.7	N/A	-	-
No.9 measurement room	-	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 m x 2.0 m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Data of Radio, Test instruments, and Test set up

Refer to APPENDIX.

UL Japan, Inc. Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

SECTION 4: Operation of E.U.T. during testing

4.1 Operating Mode(s)

Mode	Remarks
Transmitting (Tx), Power setting: 1 mW	Typ. 1 mW
Transmitting (Tx), Power setting: 10 mW	Typ. 10 mW
Transmitting (Tx), Power setting: 50 mW	Typ. 50 mW
*Transmitting duty was 100% on all tests.	
*Power of the EUT was set by the software as follows; Software setting: Low (1 mW), Middle (10 mW), High (50 mW) Software version: 1.001 (14UC), 1.13 (30UC) *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product without 1mW, 10mW or 50mW settings.	

*The details of Operating mode(s)

Test Item	Tested frequency	Power setting	Modulation	Remarks
RF power output	470.125 MHz (Low) 539.000 MHz (Mid) 607.875 MHz (High)	1 mW, 10 mW, 50 mW	Digital modulation (PN9 data packet)	
Occupied bandwidth	470.125 MHz (Low) 539.000 MHz (Mid) 607.875 MHz (High)	1 mW, 50 mW	Digital modulation (PN9 data packet)	
Spurious emissions at antenna terminals	470.125 MHz (Low) 539.000 MHz (Mid) 607.875 MHz (High)	1 mW, 50 mW	Digital modulation (PN9 data packet)	
Emission Mask	470.125 MHz (Low) 539.000 MHz (Mid) 607.875 MHz (High)	1 mW, 50 mW	Digital modulation (PN9 data packet)	
Field strength of spurious radiation	470.125 MHz (Low) 539.000 MHz (Mid) 607.875 MHz (High)	50 mW	Digital modulation (PN9 data packet)	
Frequency stability	539.000 MHz (Mid)	50 mW	No modulation	*1)
*The isolator of RF filter circuit is consisted of passive component. It does not contain non-linear component. Therefore the test was performed on lowest, near middle and highest frequency that was chosen from available frequency band. *1) There is no difference in frequency generating method on each frequency. Therefore the test was performed on Mid channel as a representative.				

UL Japan, Inc.

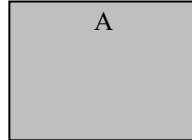
Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

4.2 Configuration and peripherals



* Setup was taken into consideration and test data was taken under worse case conditions.

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Digital Wireless Microphone	DWM-02N	14UC: Low / Mid Channel 30UC: High Channel	Sony Corporation	EUT

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

SECTION 5: Field strength of spurious radiation

Test Procedure

- 1) EUT was placed on a platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane. Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The Radiated Electric Field Strength has been measured in semi anechoic chamber at a distance of 3 m. The measuring antenna height was varied between 1 to 4 m and the turn table was rotated a full revolution in order to obtain the maximum value of the electric field strength. The measurements were performed for both vertical and horizontal antenna polarization.
- 2) Exchanged the EUT to the Substitution Antenna, the measurement was set for the same height 1.5 m as the EUT. The frequency below 1 GHz of the Substitution Antenna was used the Half wave dipole Antenna, which was tuned the measured frequency in 1). The frequency above 1 GHz of the Substitution Antenna was used Horn Antenna. The Substitution Antenna was connected to the Signal Generator, and the polarized electromagnetic radiation of the Substitution Antenna was matched with the one of the measuring Antenna, which was set with the Signal Generator to the measured frequency in 1). Then, we set with the Output power (CW) of the Signal Generator where the measuring electromagnetic field strength is equal to the measured value in 1) by means of varying the measuring antenna height between 1 to 4 m to obtain maximum receiving level. Its Output power of Signal Generator was recorded.
- 3) Effective radiated power was calculated by subtracting the cable loss and the attenuator loss connected between the Signal Generator and the Substitution Antenna from the Output power of the Signal Generator recorded in 2). For the usage of the Antenna (Horn Antenna) except for the Half wave dipole Antenna (2.15dBi) for the Substitution Antenna, the Effective radiated power was calculated by compensating the finite difference in the Antenna gain of the Half wave dipole Antenna, and Substitution Antenna.

Frequency	25 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

Frequency	25 MHz to 30 MHz	30 MHz to 1 GHz	Above 1 GHz
Instrument used	Spectrum Analyzer		
Detector	RMS Average		
IF Bandwidth	RBW: 10 kHz VBW: 30 kHz	RBW: 100 kHz VBW: 300 kHz	RBW: 1 MHz VBW: 3 MHz
Test Distance	3 m		

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Measurement range	: 25 MHz-7 GHz
Test data	: APPENDIX
Test result	: Pass

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

SECTION 6: Antenna terminal tests

Test Procedure

The tests were made with below setting connected to the antenna port.

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
RF power output	-	-	-	Auto	Average	-	Power Meter (Sensor: 50 MHz BW)
Occupied Bandwidth	Enough width to display emission skirts	1 to 5% of Occupied bandwidth	Three times of RBW	Auto	Peak *1)	Max Hold *1)	Spectrum Analyzer
Conducted Spurious Emission	9 kHz -150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz - 30 MHz	10 kHz	30 kHz				
	30 MHz - 1 GHz	100 kHz	300 kHz				
	Above 1 GHz	1 MHz	3 MHz				
Frequency stability	-	-	-	-	-	-	Frequency Counter

*1) The measurement was performed with Peak and Max Hold. (Worst-case measurement)

[Side band spectrum measurement (Emission mask)]

The EUT was modulated with PN9 audio data packet.

The spectrum mask was measured in accordance with section 8.3.2 of EN 300 422-1.

The measurements were made under normal condition.

[Frequency stability]

The power supply set to 100 % nominal setting, raise EUT operating temperature to 50 deg. C.

Record the frequency of the EUT.

Repeat measurements at each 10 deg. C decrement to -30 deg. C.

EUT power supply was varied between 85 % and 115 % of nominal and the frequency of the EUT was recorded when temperature is 20 deg. C. The additional test was performed at battery end point voltage.

The test results and limit are rounded off to two decimals place, so some differences might be observed.

Test data : APPENDIX

Test result : Pass

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

APPENDIX 1: Data of EMI test

RF power output

Report No. 12244305H
Test place Ise EMC Lab. No.7 Shielded Room
Date April 1, 2018
Temperature/ Humidity 23 deg. C / 39 % RH
Engineer Ken Fujita
Mode Tx

Power Setting	Channel	Freq. [MHz]	Reading Average [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result Average [Conducted] [dBm] [mW]		Limit [Conducted] [mW]	Margin [dB]	Remarks
1 mW	Low	470.125	-9.91	0.30	9.89	0.28	1.067	250	23.70	
	Mid	539.000	-9.87	0.32	9.89	0.34	1.081	250	23.64	
	High	607.875	-9.91	0.33	9.90	0.32	1.076	250	23.66	
10 mW	Low	470.125	-1.73	0.30	9.89	8.46	7.01	250	15.52	
	Mid	539.000	-1.46	0.32	9.89	8.75	7.50	250	15.23	
	High	607.875	-0.66	0.33	9.90	9.57	9.06	250	14.41	
50 mW	Low	470.125	6.33	0.30	9.89	16.52	44.9	250	7.46	
	Mid	539.000	6.42	0.32	9.89	16.63	46.0	250	7.35	
	High	607.875	6.26	0.33	9.90	16.49	44.6	250	7.49	

Calculation formula:

Result = Reading + Cable Loss + Atten. Loss

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Occupied Bandwidth

Report No. 12244305H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 4, 2018
Temperature/ Humidity 23 deg. C / 42 % RH
Engineer Yuta Moriya
Mode Tx

Power Setting	Channel	Freq. [MHz]	99% Occupied Bandwidth [kHz]	Limit [kHz]	Margin [kHz]
1 mW	Low	470.125	160.3151	200	39.6849
	Mid	539.000	163.2962	200	36.7038
	High	607.875	163.2684	200	36.7316
50 mW	Low	470.125	164.4078	200	35.5922
	Mid	539.000	164.2534	200	35.7466
	High	607.875	163.8241	200	36.1759

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Occupied Bandwidth

Report No.

Test place

Date

Temperature/ Humidity

Engineer

Mode

12244305H

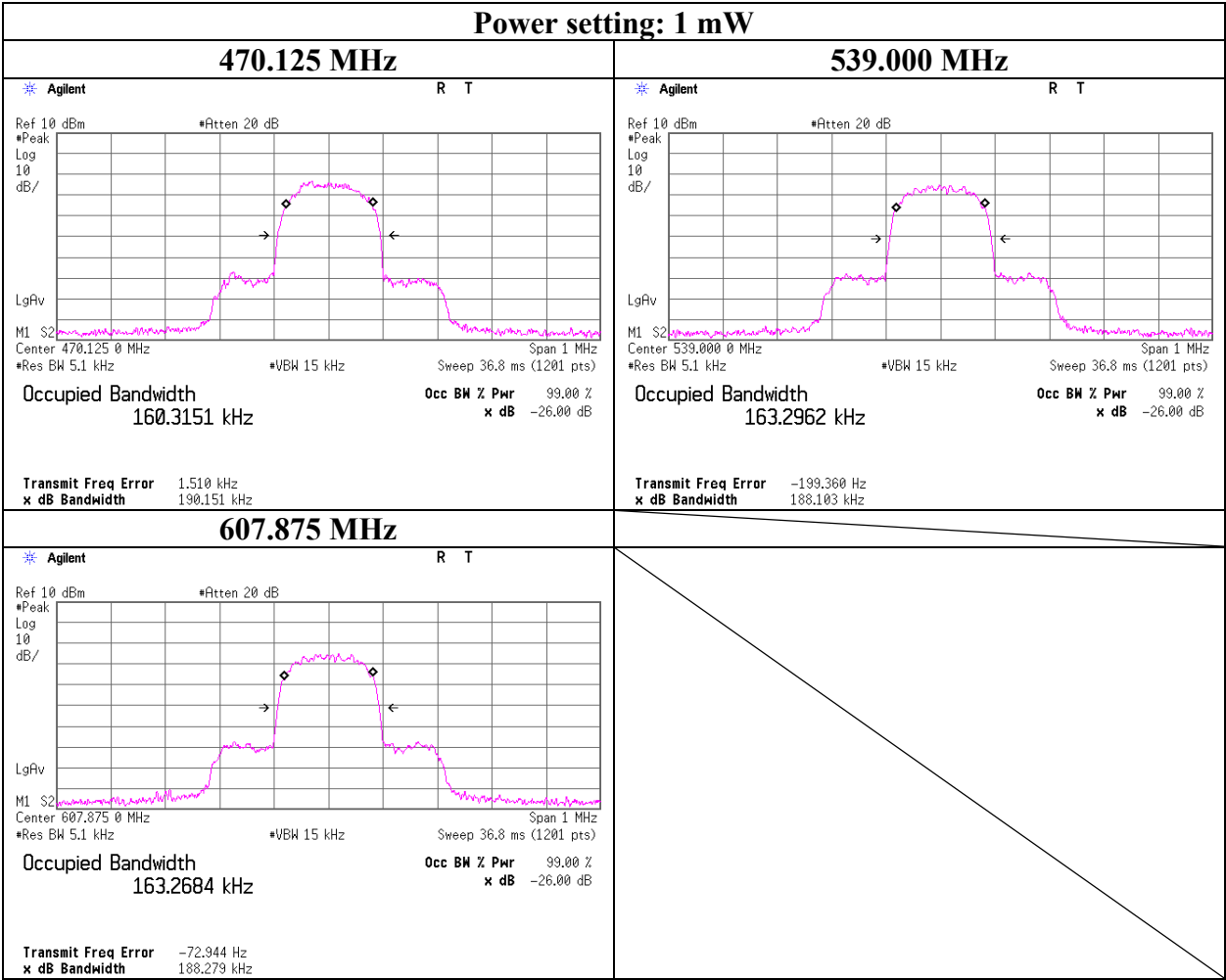
Ise EMC Lab. No.6 Measurement Room

April 4, 2018

23 deg. C / 42 % RH

Yuta Moriya

Tx



Occupied Bandwidth

Report No.

Test place

Date

Temperature/ Humidity

Engineer

Mode

12244305H

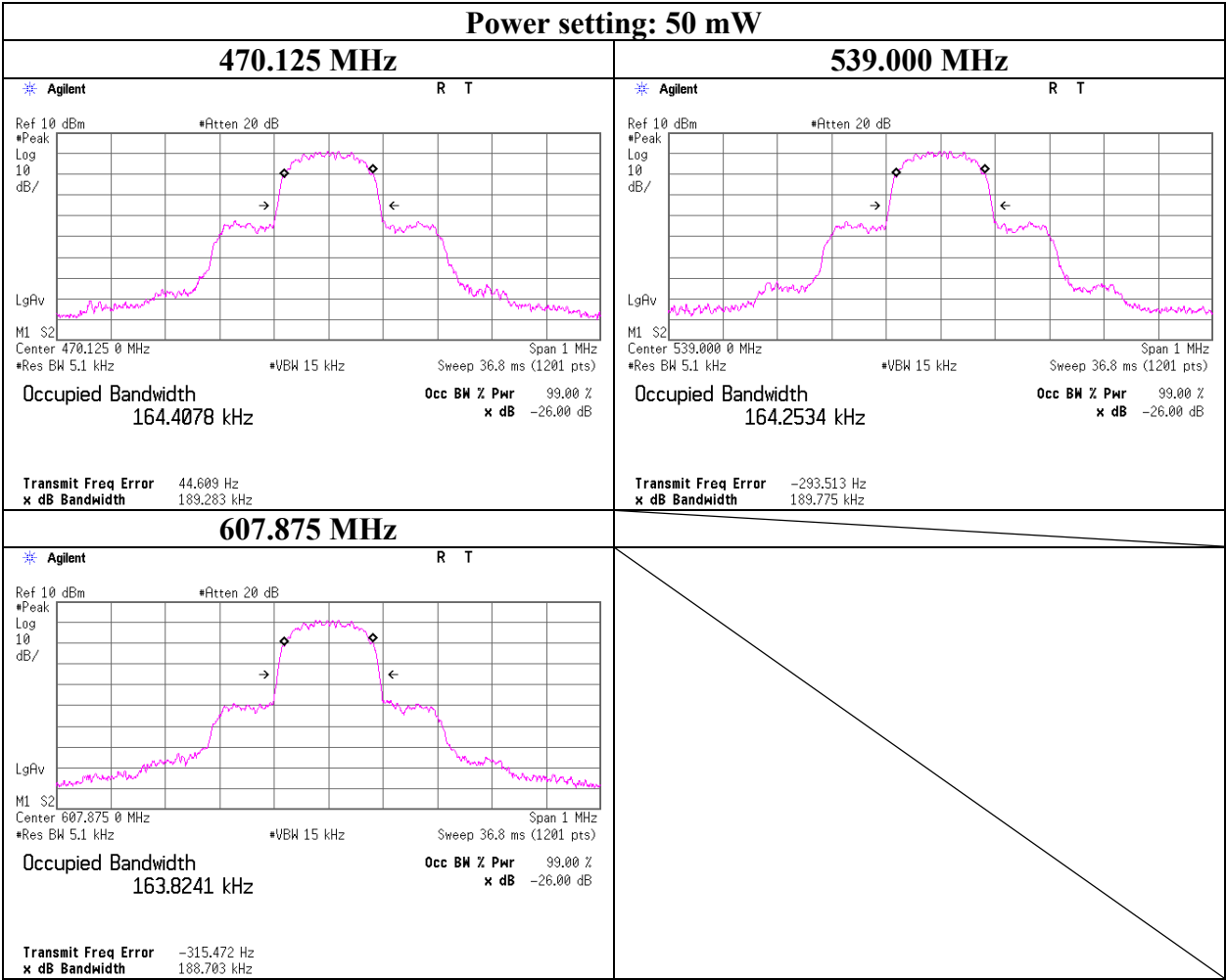
Ise EMC Lab. No.6 Measurement Room

April 4, 2018

23 deg. C / 42 % RH

Yuta Moriya

Tx



Spurious emissions at antenna terminals

Report No. 12244305H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 4, 2018
Temperature/ Humidity 23 deg. C / 42 % RH
Engineer Yuta Moriya
Mode Tx

Power Setting	Channel	Tested Freq. [MHz]	Reading		Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
			Freq. [MHz]	Level [dBm]					
1 mW	Low	470.125	0.01464	-90.28	0.10	9.83	-80.35	-13	67.35
			0.299	-80.84	0.10	9.83	-70.91	-13	57.91
			940.2	-65.33	0.40	9.91	-55.02	-13	42.02
			3177	-58.65	1.16	10.05	-47.44	-13	34.44
	Mid	539.000	0.01229	-92.01	0.10	9.83	-82.08	-13	69.08
			0.15	-79.46	0.10	9.83	-69.53	-13	56.53
			3283	-59.20	1.18	10.05	-47.97	-13	34.97
			7500	-56.93	1.67	10.04	-45.22	-13	32.22
	High	607.875	0.01511	-91.61	0.10	9.83	-81.68	-13	68.68
			1.046	-80.22	0.11	9.84	-70.27	-13	57.27
			3283	-58.94	1.18	10.05	-47.71	-13	34.71
			7038	-56.90	1.60	10.04	-45.26	-13	32.26
50 mW	Low	470.125	0.12803	-80.33	0.10	9.83	-70.40	-13	57.40
			0.15	-79.31	0.10	9.83	-69.38	-13	56.38
			940.2	-57.14	0.40	9.91	-46.83	-13	33.83
			3217	-58.75	1.17	10.05	-47.53	-13	34.53
	Mid	539.000	0.12803	-82.11	0.10	9.83	-72.18	-13	59.18
			0.15	-77.67	0.10	9.83	-67.74	-13	54.74
			1077	-58.17	0.72	10.02	-47.43	-13	34.43
			7075	-55.07	1.60	10.04	-43.43	-13	30.43
	High	607.875	0.12803	-81.63	0.10	9.83	-71.70	-13	58.70
			0.15	-79.44	0.10	9.83	-69.51	-13	56.51
			3127	-58.28	1.16	10.05	-47.07	-13	34.07
			7054	-56.15	1.60	10.04	-44.51	-13	31.51

Calculation formula:

Result = Reading + Cable Loss + Attenuator Loss

Limit = mean output power in dBm - (43+10log₁₀ (mean output power in watts)) dB = -13dBm

UL Japan, Inc.

Ise EMC Lab.

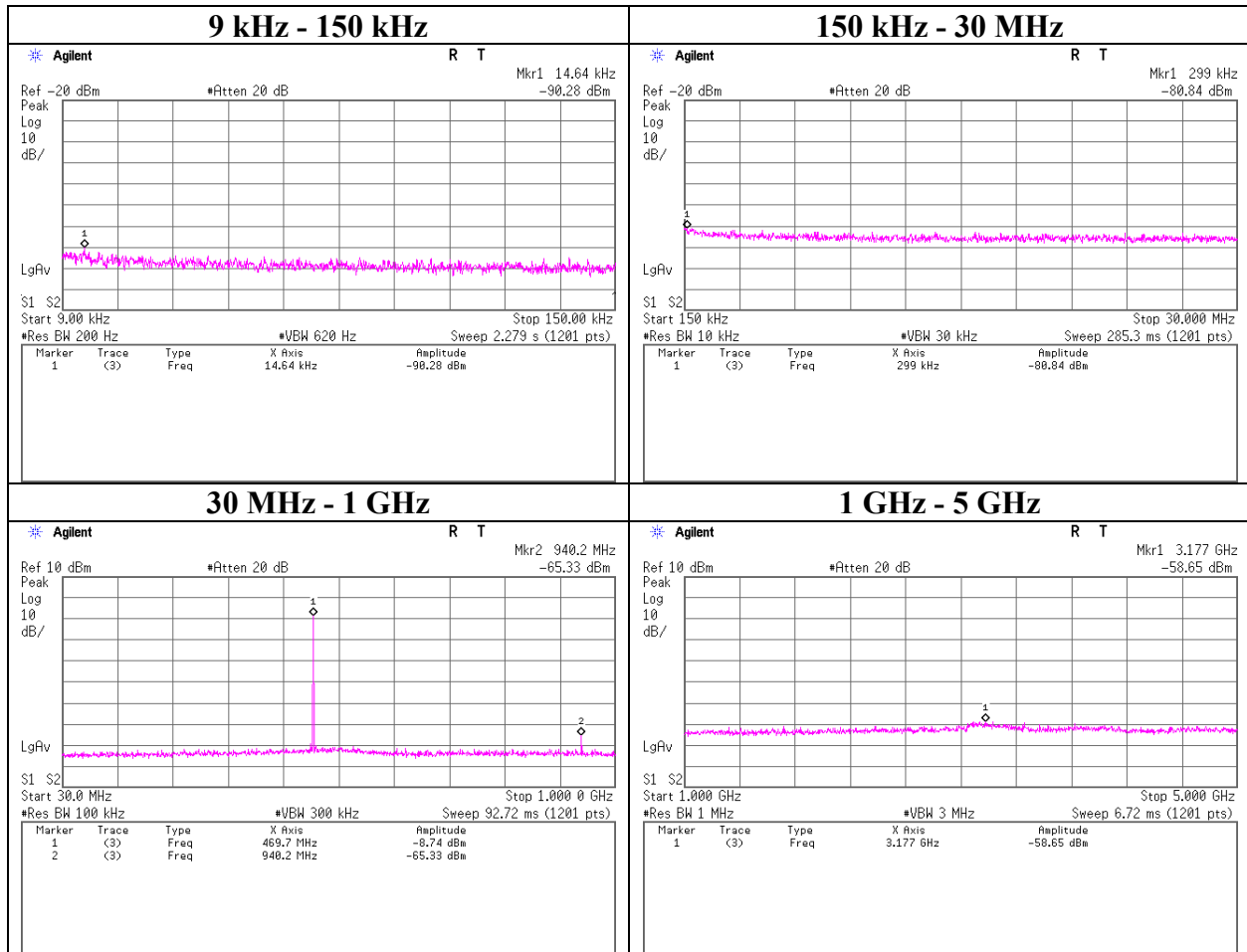
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emissions at antenna terminals

Report No. 12244305H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 4, 2018
Temperature/ Humidity 23 deg. C / 42 % RH
Engineer Yuta Moriya
Mode Tx 470.125 MHz, 1 mW



UL Japan, Inc.

Ise EMC Lab.

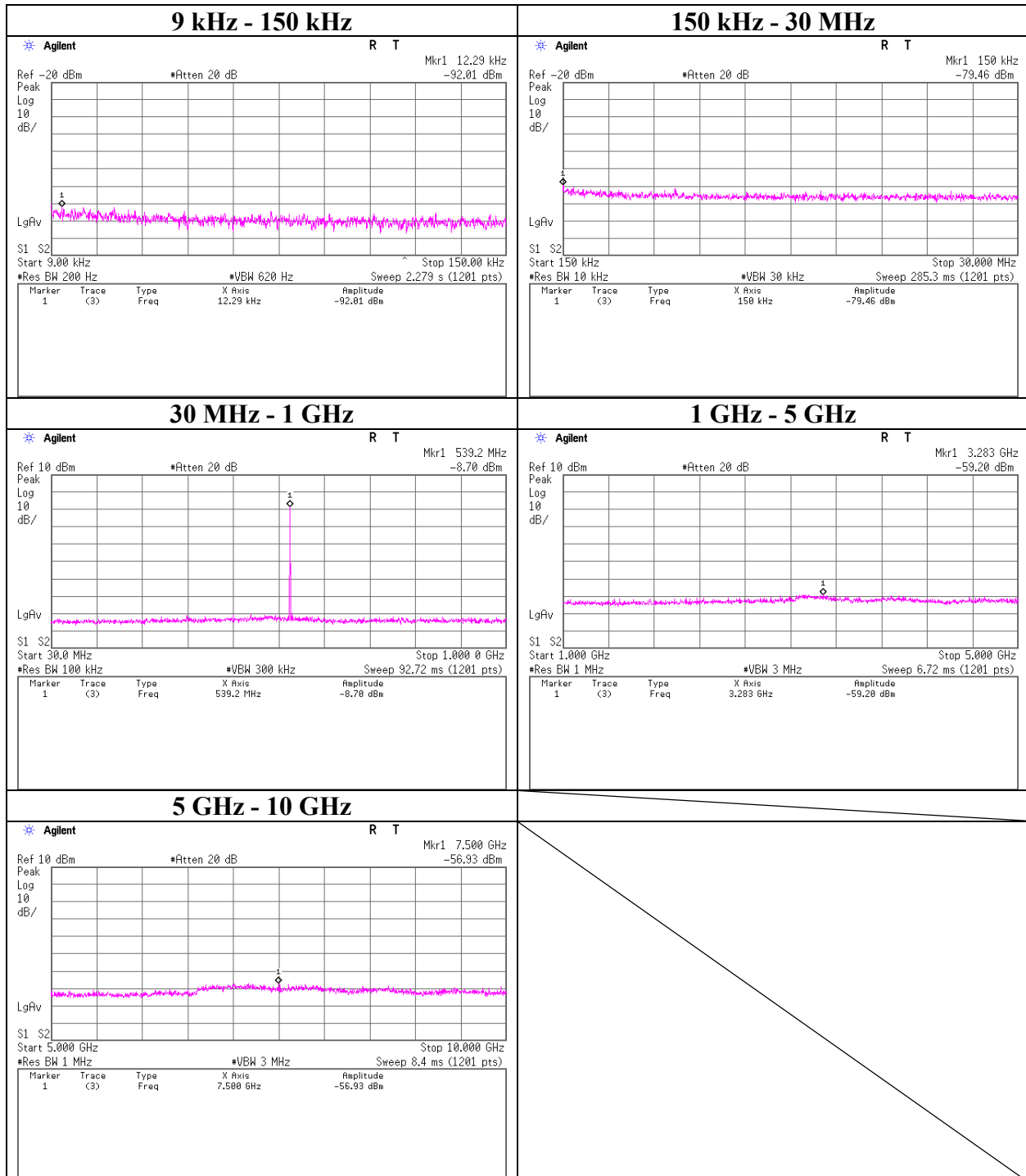
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

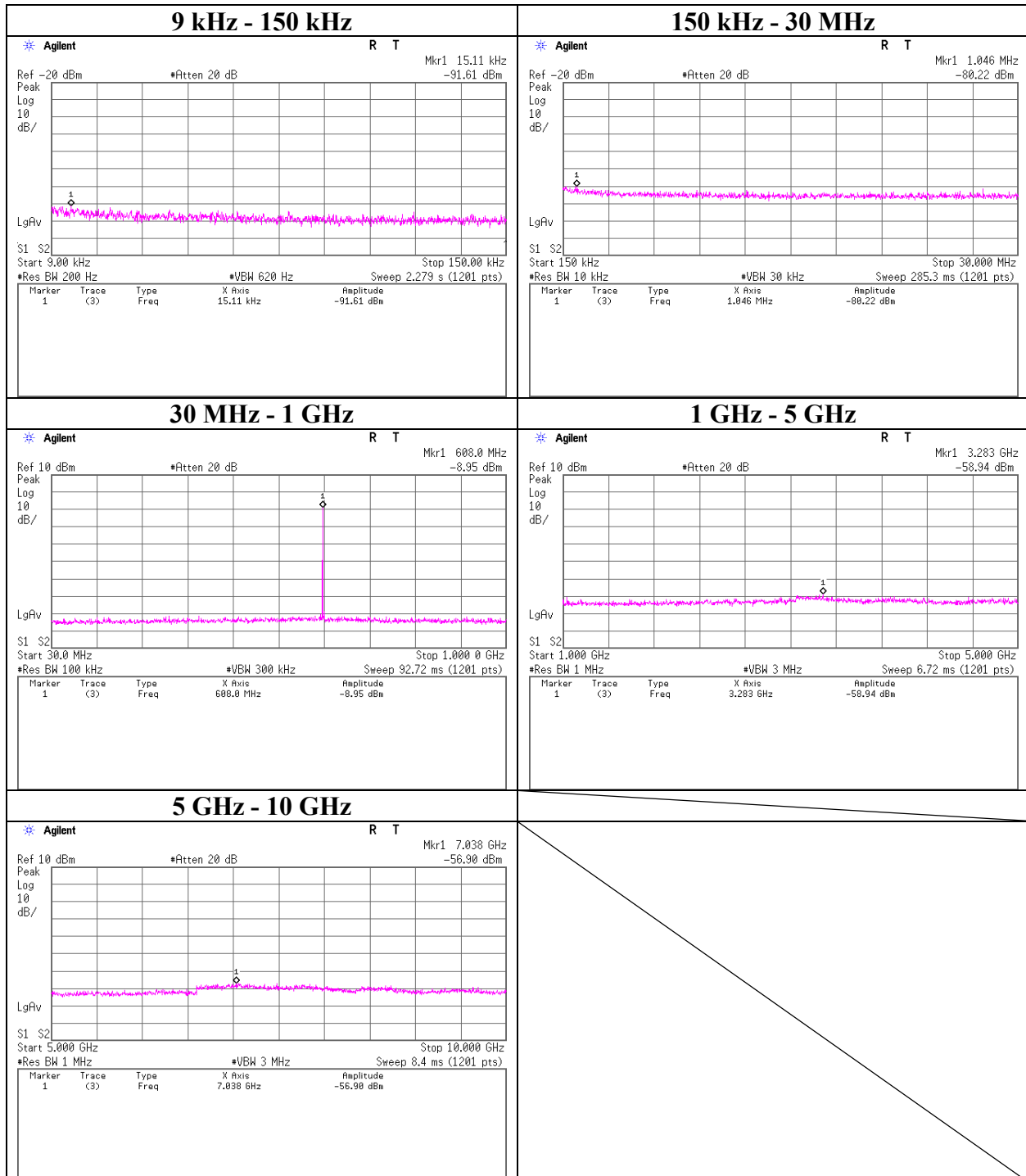
Spurious emissions at antenna terminals

Report No. 12244305H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 4, 2018
Temperature/ Humidity 23 deg. C / 42 % RH
Engineer Yuta Moriya
Mode Tx 539.000 MHz, 1 mW



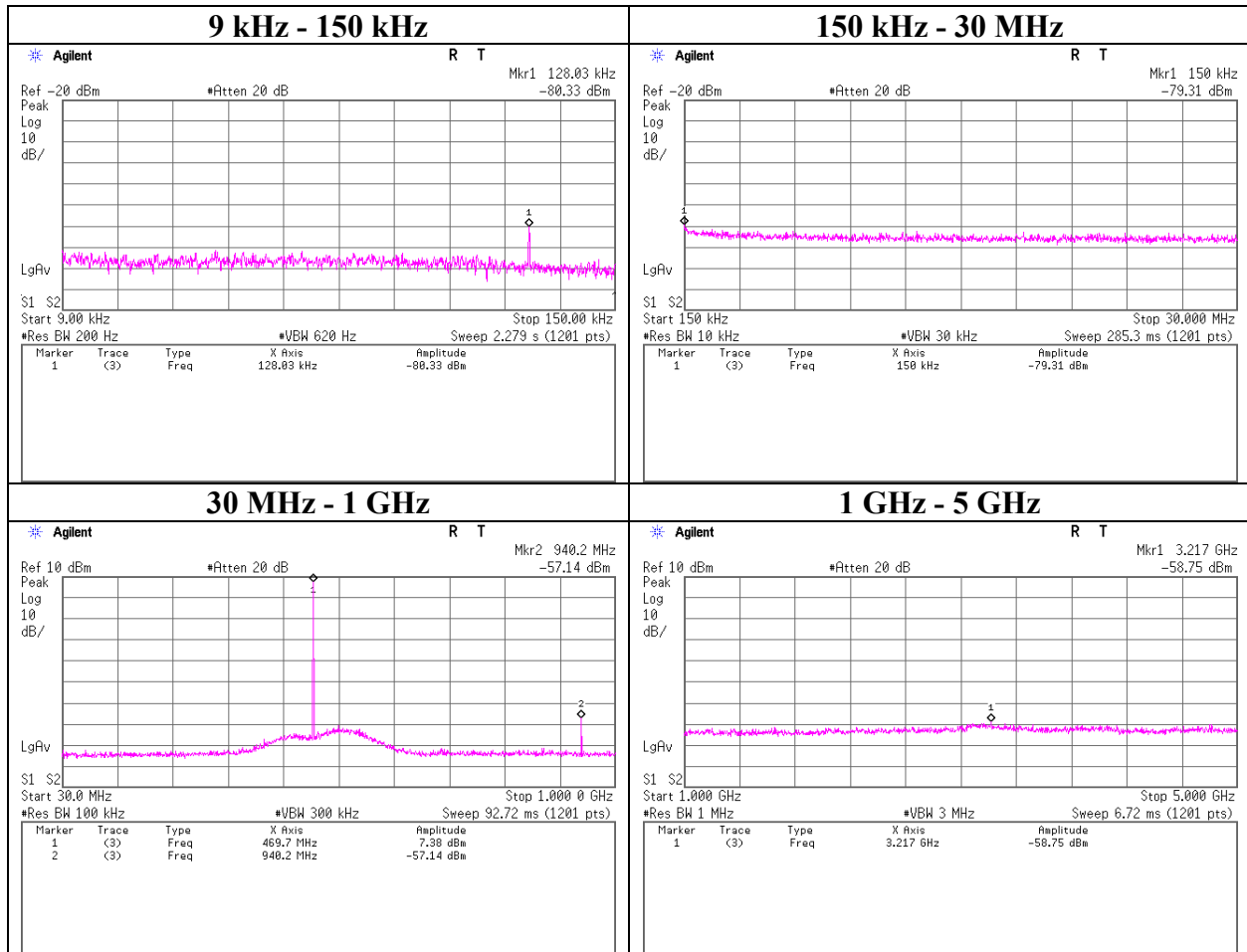
Spurious emissions at antenna terminals

Report No. 12244305H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 4, 2018
Temperature/ Humidity 23 deg. C / 42 % RH
Engineer Yuta Moriya
Mode Tx 607.875 MHz, 1 mW



Spurious emissions at antenna terminals

Report No. 12244305H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 4, 2018
Temperature/ Humidity 23 deg. C / 42 % RH
Engineer Yuta Moriya
Mode Tx 470.125 MHz, 50 mW



UL Japan, Inc.

Ise EMC Lab.

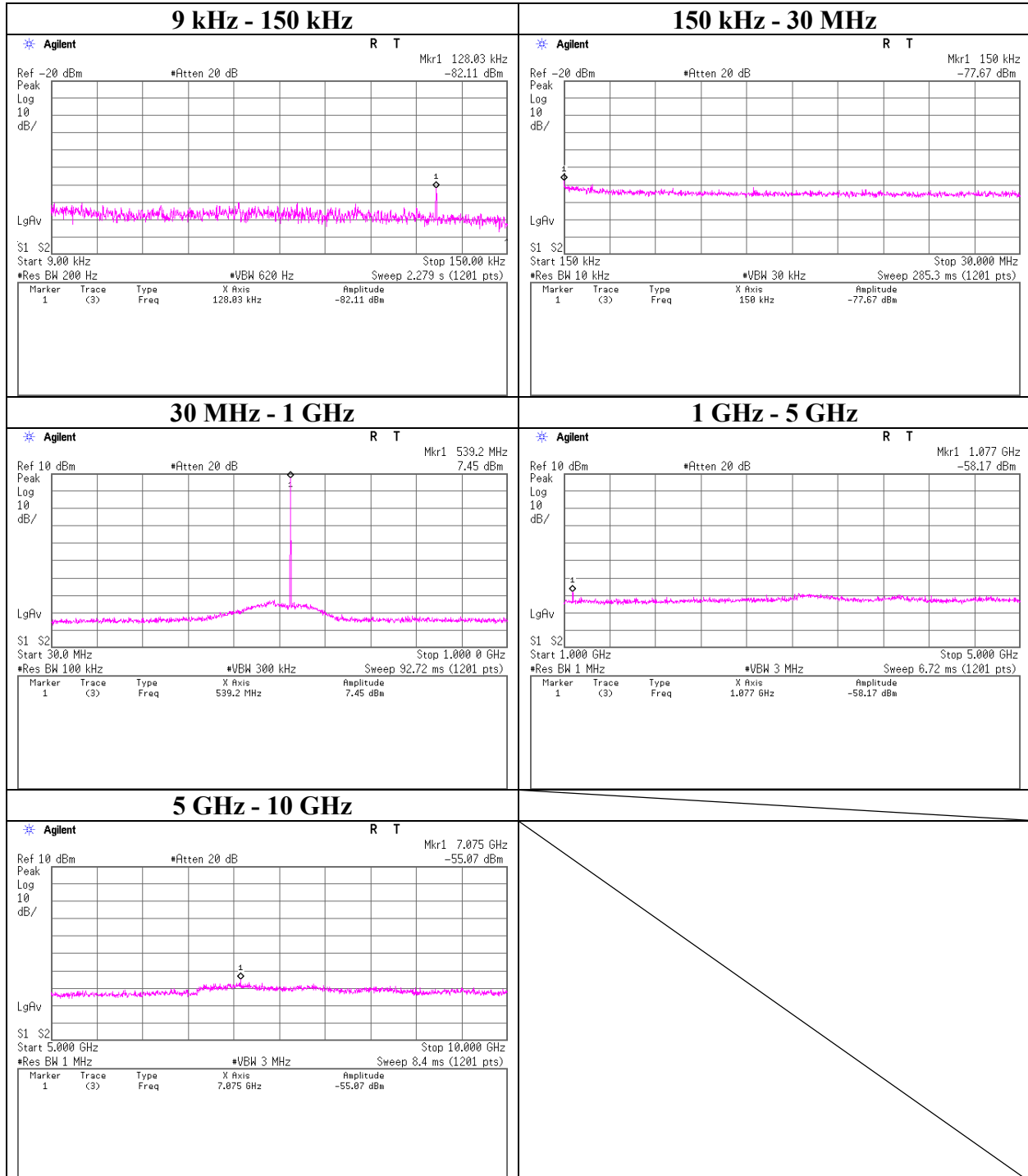
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

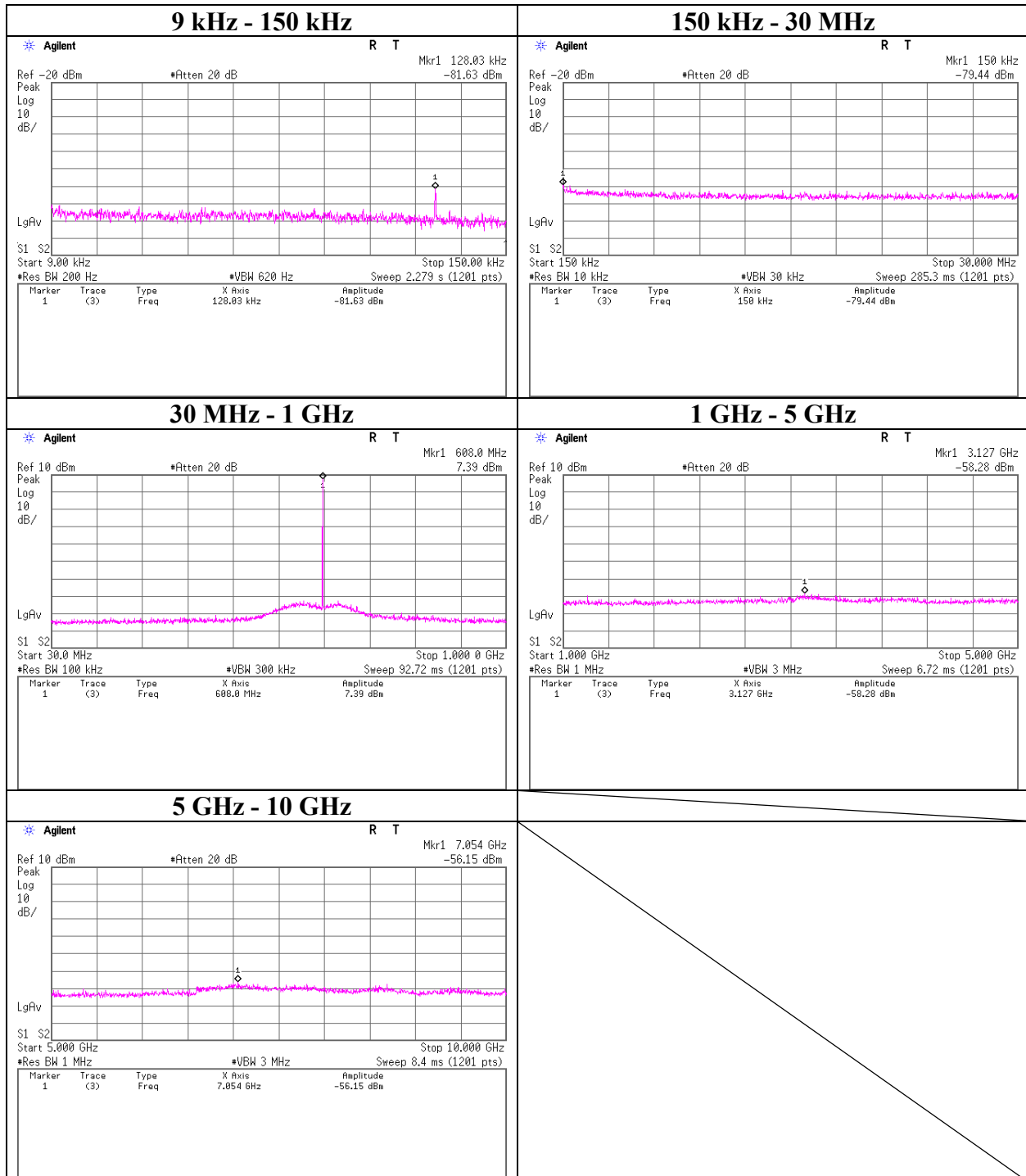
Spurious emissions at antenna terminals

Report No. 12244305H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 4, 2018
Temperature/ Humidity 23 deg. C / 42 % RH
Engineer Yuta Moriya
Mode Tx 539.000 MHz, 50 mW



Spurious emissions at antenna terminals

Report No. 12244305H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 4, 2018
Temperature/ Humidity 23 deg. C / 42 % RH
Engineer Yuta Moriya
Mode Tx 607.875 MHz, 50 mW



Spurious emissions at antenna terminals

[Side band spectrum measurement]

Report No. 12444305H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 5, 2018
Temperature/ Humidity 23 deg. C / 41 % RH
Engineer Masafumi Niwa
Mode Tx

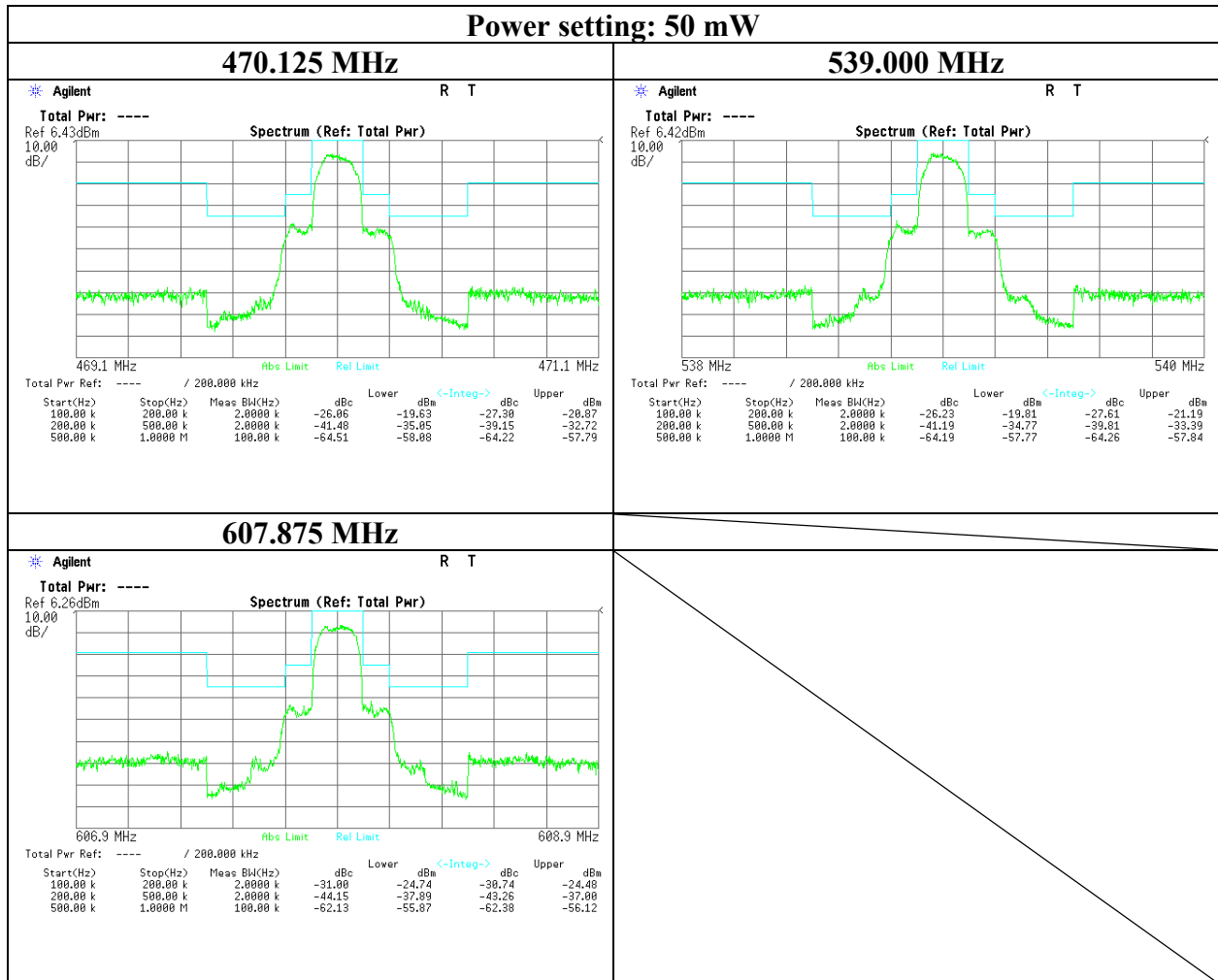


0dB reference level was set to each RF power output result.

Spurious emissions at antenna terminals

[Side band spectrum measurement]

Report No. 12444305H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 5, 2018
Temperature/ Humidity 23 deg. C / 41 % RH
Engineer Masafumi Niwa
Mode Tx



0dB reference level was set to each RF power output result.

Emission Mask

Report No.12444305H

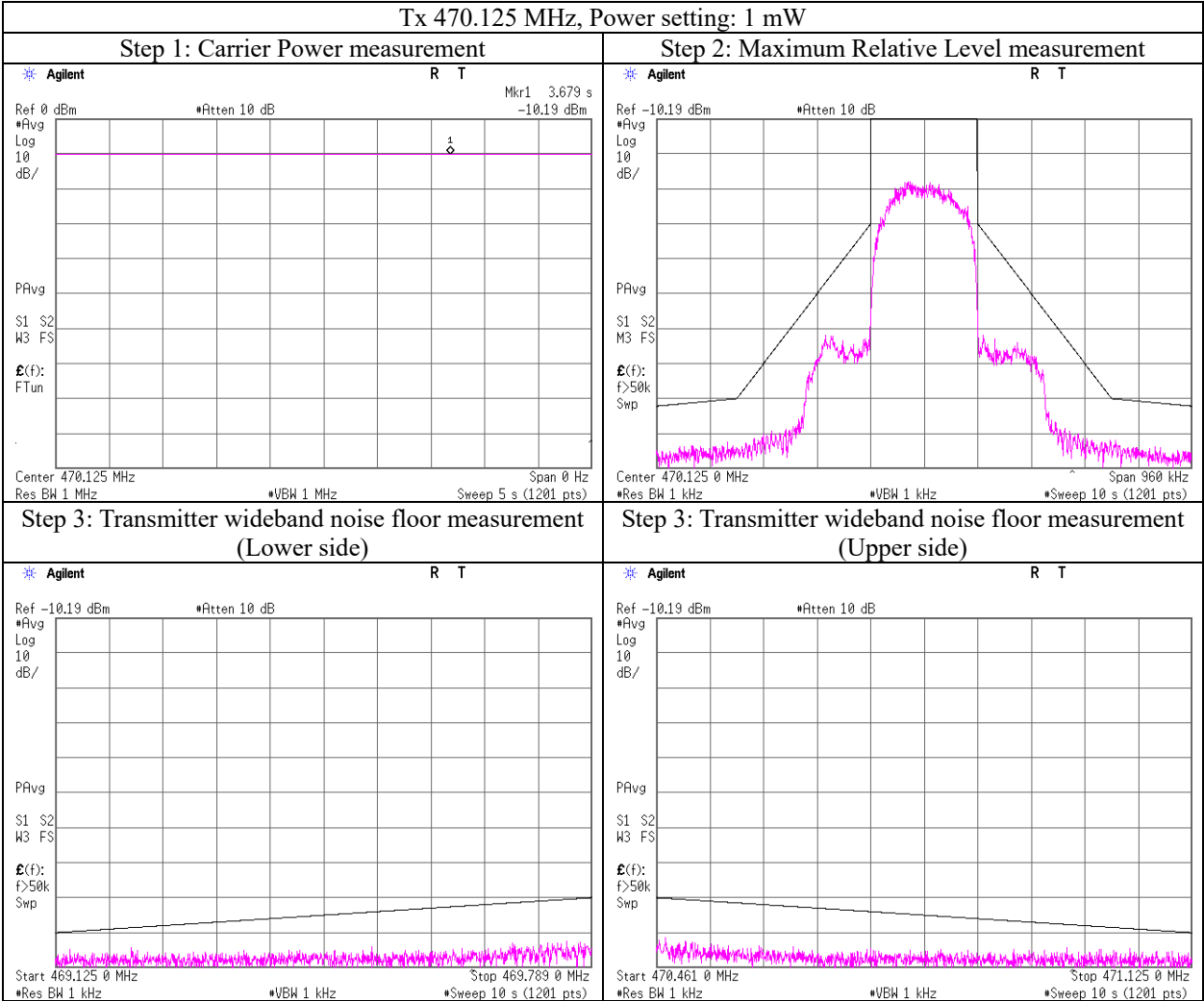
Test placeIse EMC Lab. No.6 Measurement Room

DateApril 5, 2018

Temperature/ Humidity23 deg. C / 41 % RH

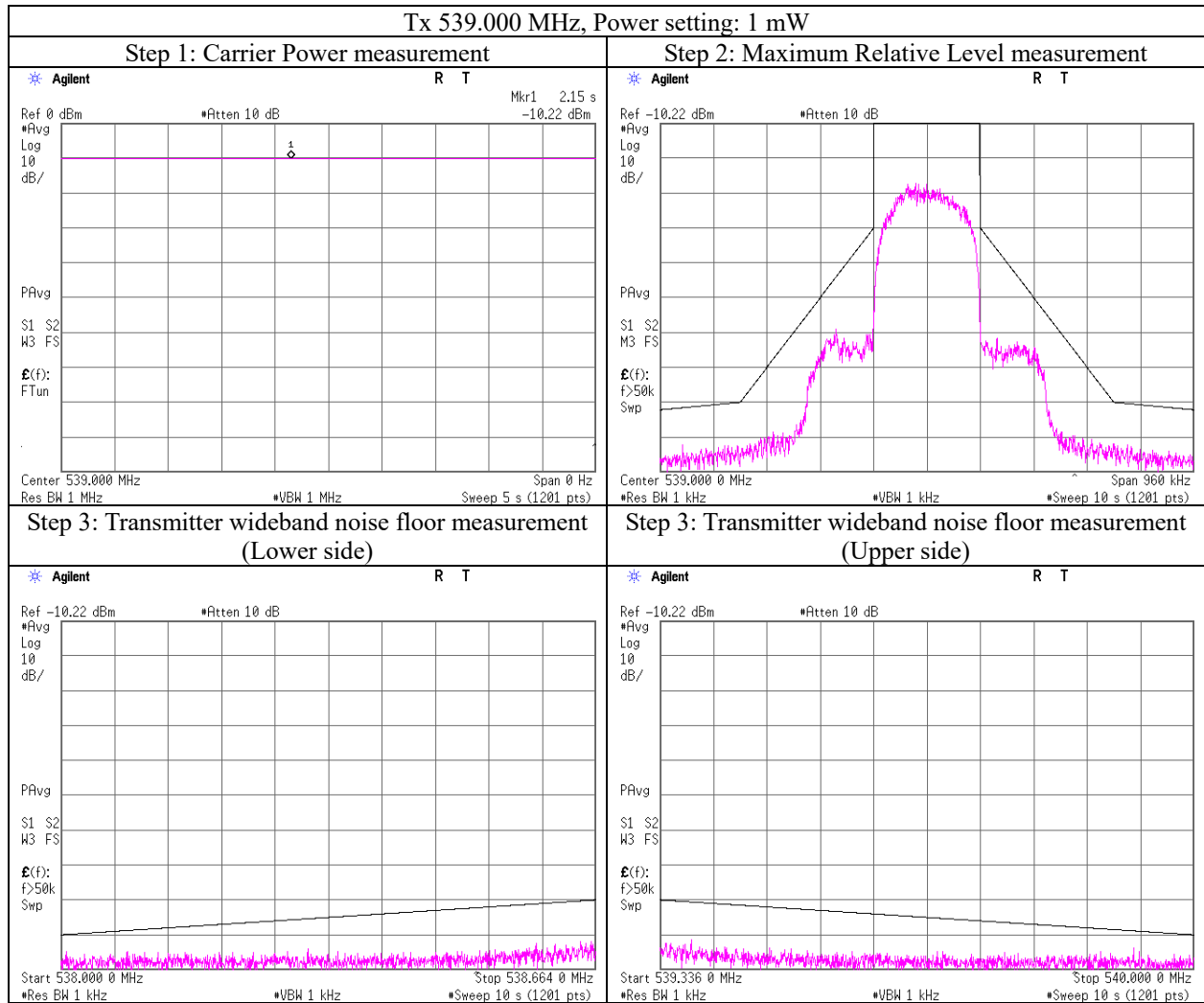
EngineerMasafumi Niwa

ModeTx



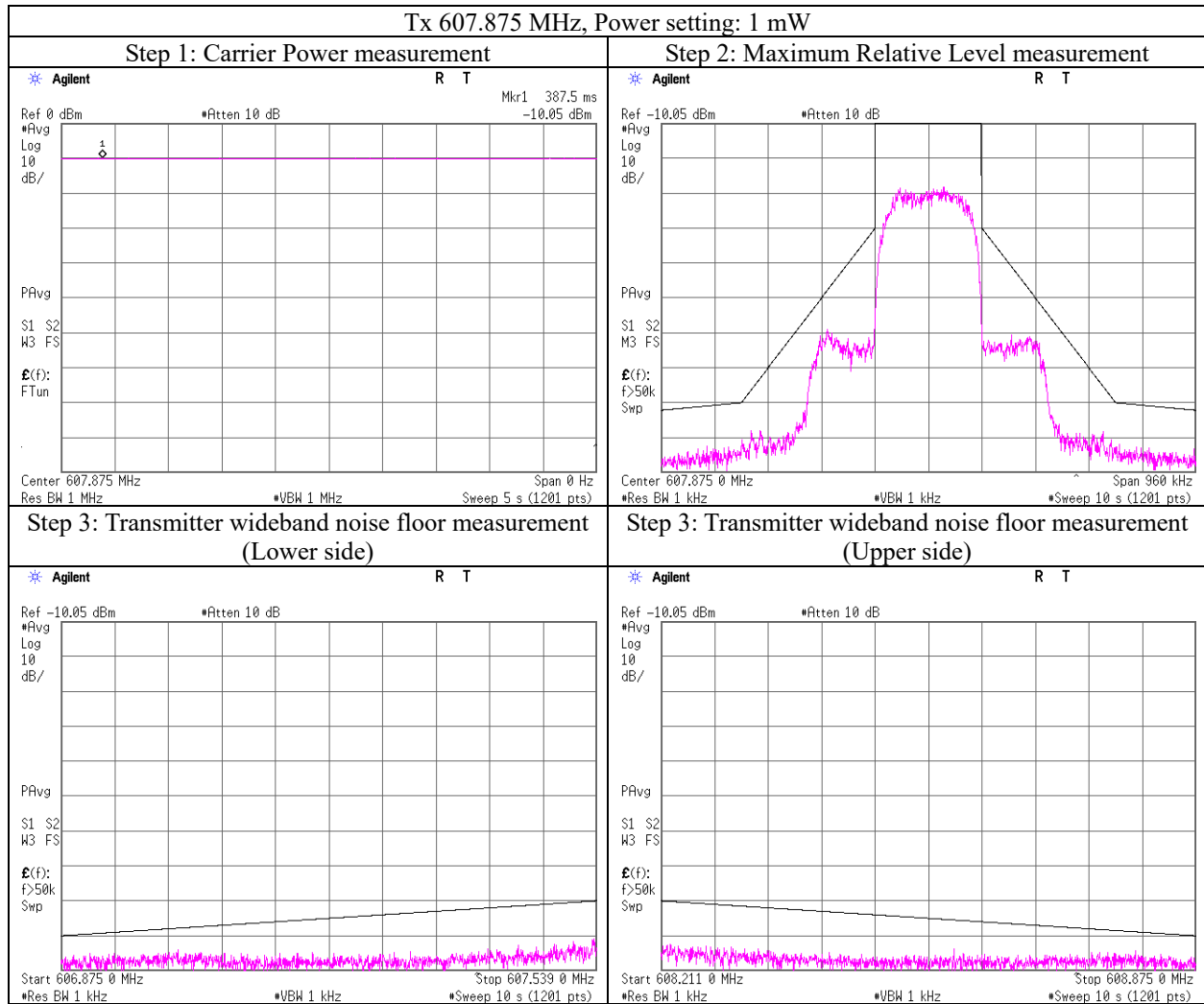
Emission Mask

Report No.	12444305H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	April 5, 2018
Temperature/ Humidity	23 deg. C / 41 % RH
Engineer	Masafumi Niwa
Mode	Tx



Emission Mask

Report No.	12444305H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	April 5, 2018
Temperature/ Humidity	23 deg. C / 41 % RH
Engineer	Masafumi Niwa
Mode	Tx



UL Japan, Inc.

Ise EMC Lab.

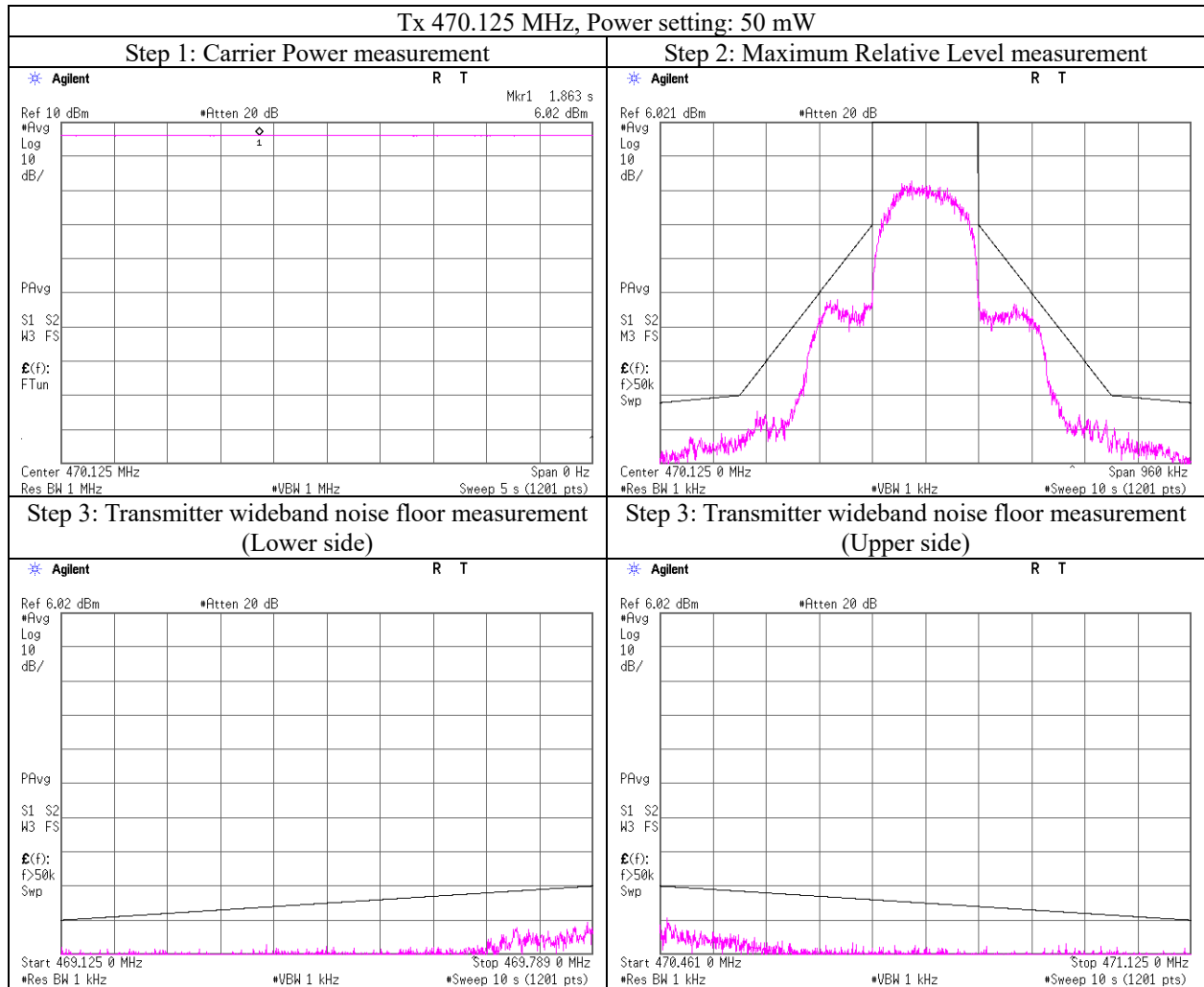
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Emission Mask

Report No.	12444305H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	April 5, 2018
Temperature/ Humidity	23 deg. C / 41 % RH
Engineer	Masafumi Niwa
Mode	Tx



UL Japan, Inc.

Ise EMC Lab.

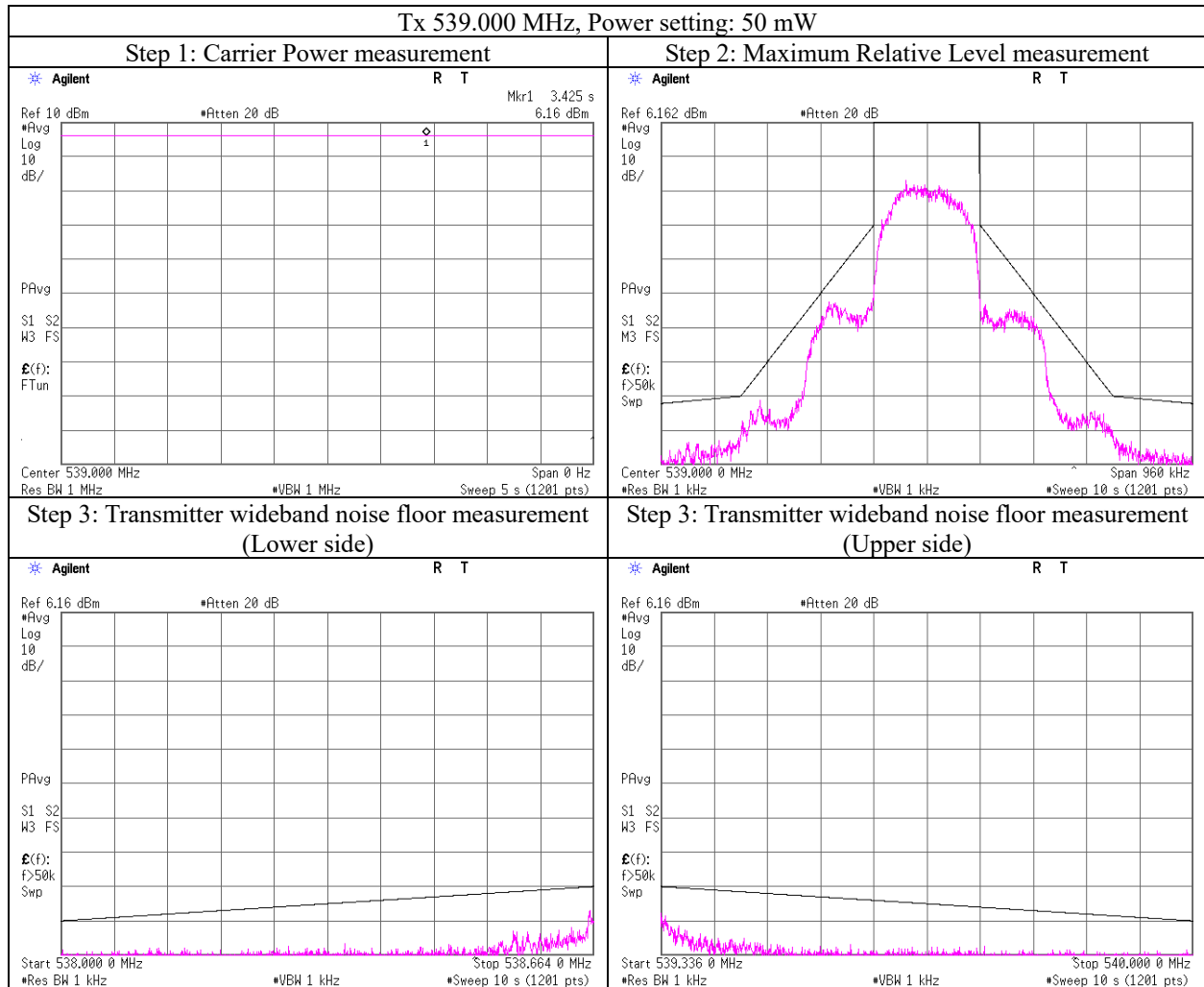
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Emission Mask

Report No.	12444305H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	April 5, 2018
Temperature/ Humidity	23 deg. C / 41 % RH
Engineer	Masafumi Niwa
Mode	Tx



UL Japan, Inc.

Ise EMC Lab.

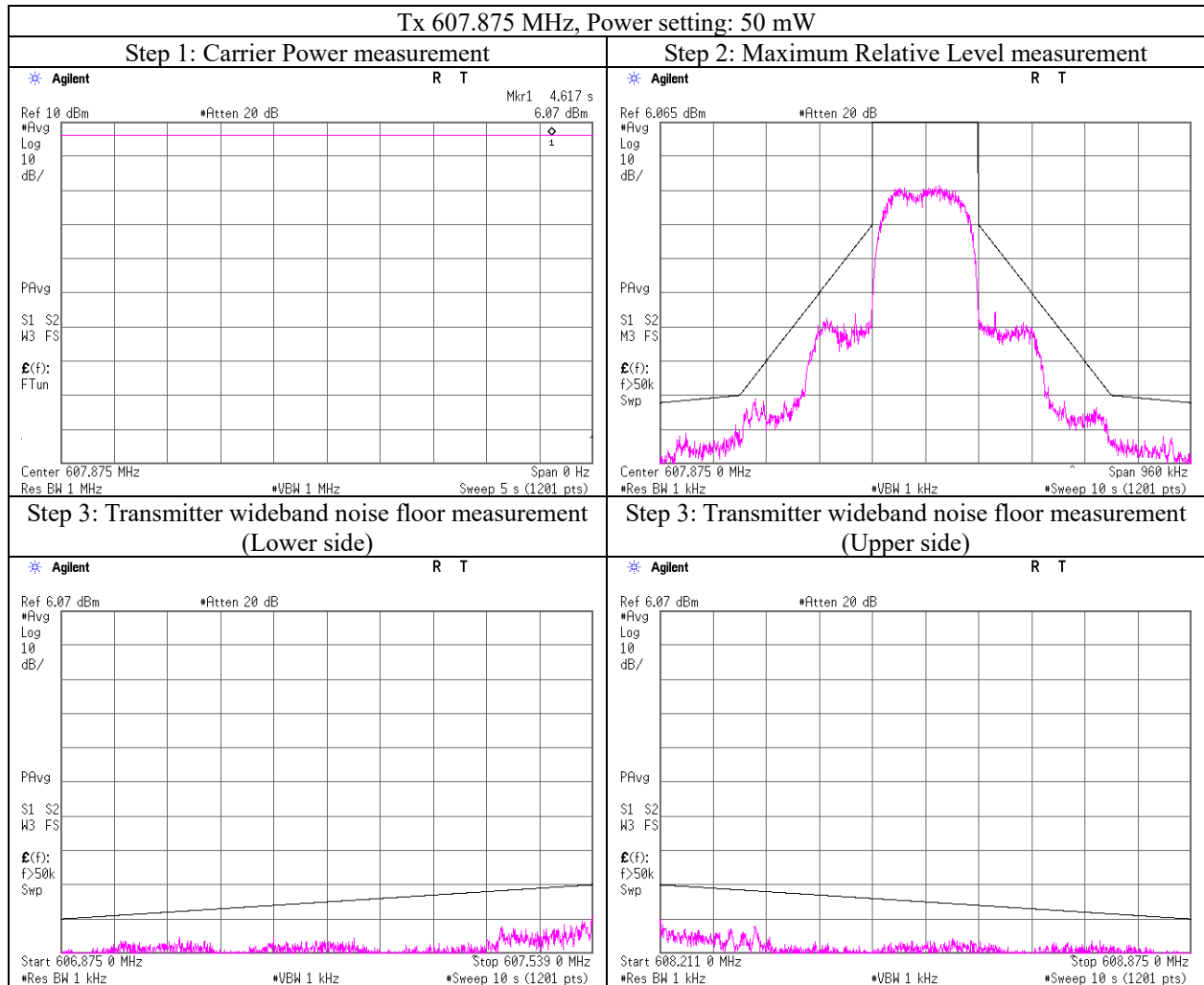
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Emission Mask

Report No. 12444305H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 5, 2018
Temperature/ Humidity 23 deg. C / 41 % RH
Engineer Masafumi Niwa
Mode Tx



UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Field strength of spurious radiation

Report No. 12244305H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date March 28, 2018
Temperature / Humidity 21 deg. C / 35 % RH
Engineer Masafumi Niwa
Mode Tx 470.125 MHz

[Power setting: 50 mW]

Frequency [MHz]	Rx SA/TR		Tx SG		Tx	Tx	Tx Ant.	Result		Limit	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]		Cable Loss [dB]	Ant. Gain [dBi]	Atten. Loss [dB]	(ERP) [dBm]		(ERP) [dBm]	[dB]		Rx Ant. Height [cm]	Turn Table [deg.]	Rx Ant. Height [cm]	Turn Table [deg.]	
	HOR	VER	HOR	VER				HOR	VER		HOR	VER					
940.25	40.6	37.2	-41.8	-44.2	5.2	2.2	10.1	-57.1	-59.5	-36.0	21.1	23.5	128	126	242	227	
1410.38	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
1880.50	54.3	52.1	-55.8	-58.8	3.6	10.0	0.0	-51.5	-54.5	-30.0	21.5	24.5	128	221	158	299	
2350.63	48.8	NS	-63.7	-	4.0	10.8	0.0	-59.1	-	-30.0	29.1	-	100	213	-	-	
2820.75	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
3290.88	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
3761.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
4231.13	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
4701.25	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	

Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss -2.15

Rx-ANTENNA : Biconical Antenna (25 M - 200 MHz), Logperiodic Antenna (200 M - 1000 MHz), Horn Antenna (1 G - 7 GHz)

Tx-ANTENNA : 120 MHz tuned Dipole Antenna (25 M - 120 MHz), Dipole Antenna (120 M - 1000 MHz), Horn Antenna (1 G - 7 GHz)

Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

NS : No signal detect.

Detector : 25 MHz to 30 MHz: Spectrum Analyzer RMS Average (RBW: 10 kHz / VBW: 30 kHz)
30 MHz to 1 GHz: Spectrum Analyzer RMS Average (RBW: 100 kHz / VBW: 300 kHz)
Above 1 GHz: Spectrum Analyzer RMS Average (RBW: 1 MHz / VBW: 3 MHz)
*Emissions were investigated up to the 10th harmonic of the fundamental.

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Field strength of spurious radiation

Report No. 12244305H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date March 28, 2018
Temperature / Humidity 21 deg. C / 35 % RH
Engineer Masafumi Niwa
Mode Tx 539.000 MHz

[Power setting: 50 mW]

Frequency	Rx SA/TR		Tx SG		Tx	Tx	Tx Ant.	Result		Limit	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]		Cable Loss	Ant. Gain	Atten. Loss	(ERP) [dBm]		(ERP) [dBm]			Rx Ant.	Turn	Rx Ant.	Turn	
	[MHz]	HOR	VER	HOR	VER	[dB]	[dBi]	[dB]	HOR	VER	[dB]	HOR	VER	Height [cm]	Table [deg.]	Height [cm]	
1078.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-
1617.00	54.1	51.7	-57.5	-61.0	3.3	8.2	0.0	-54.8	-58.3	-30.0	24.8	28.3	124	219	136	90	
2156.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-
2695.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-
3234.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-
3773.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-
4312.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-
4851.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-
5390.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-

Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss -2.15

Rx-ANTENNA : Biconical Antenna (25 M - 200 MHz), Logperiodic Antenna (200 M - 1000 MHz), Horn Antenna (1 G - 7 GHz)

Tx-ANTENNA : 120 MHz tuned Dipole Antenna (25 M - 120 MHz), Dipole Antenna (120 M - 1000 MHz), Horn Antenna (1 G - 7 GHz)

Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

NS : No signal detect.

Detector : 25 MHz to 30 MHz: Spectrum Analyzer RMS Average (RBW: 10 kHz / VBW: 30 kHz)
30 MHz to 1 GHz: Spectrum Analyzer RMS Average (RBW: 100 kHz / VBW: 300 kHz)
Above 1 GHz: Spectrum Analyzer RMS Average (RBW: 1 MHz / VBW: 3 MHz)

*Emissions were investigated up to the 10th harmonic of the fundamental.

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Field strength of spurious radiation

Report No. 12244305H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date March 28, 2018
Temperature / Humidity 21 deg. C / 35 % RH
Engineer Masafumi Niwa
Mode Tx 607.875 MHz

[Power setting: 50 mW]

Frequency	Rx SA/TR		Tx SG		Tx	Tx	Tx Ant.	Result		Limit	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]		Cable Loss [dB]	Ant. Gain [dBi]	Atten. Loss [dB]	(ERP) [dBm]		(ERP) [dBm]	[dB]		Rx Ant. Height [cm]	Turn Table [deg.]	Rx Ant. Height [cm]	Turn Table [deg.]	
	HOR	VER	HOR	VER				HOR	VER								
1215.75	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
1823.63	54.9	52.2	-55.2	-60.2	3.5	9.6	0.0	-51.2	-56.2	-30.0	21.2	26.2	121	67	163	291	
2431.50	NS	48.9	-	-62.5	4.1	10.8	0.0	-	-57.9	-30.0	-	27.9	-	-	117	0	
3039.38	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
3647.25	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
4255.13	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
4863.00	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
5470.88	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
6078.75	NS	NS	-	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

Calculation Result = SG Reading - Tx Cable Loss + Tx Antenna Gain - Tx Antenna Attenuator Loss -2.15

Rx-ANTENNA : Biconical Antenna (25 M - 200 MHz), Logperiodic Antenna (200 M - 1000 MHz), Horn Antenna (1 G - 7 GHz)

Tx-ANTENNA : 12 0MHz tuned Dipole Antenna (25 M - 120 MHz), Dipole Antenna (120 M - 1000 MHz), Horn Antenna (1 G - 7 GHz)

Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

NS : No signal detect.

Detector : 25 MHz to 30 MHz: Spectrum Analyzer RMS Average (RBW: 10 kHz / VBW: 30 kHz)
30 MHz to 1 GHz: Spectrum Analyzer RMS Average (RBW: 100 kHz / VBW: 300 kHz)
Above 1 GHz: Spectrum Analyzer RMS Average (RBW: 1 MHz / VBW: 3 MHz)

*Emissions were investigated up to the 10th harmonic of the fundamental.

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Frequency stability

Test place : Ise EMC Lab. No.6 measurement room
Report No. : 12244305H
Date : April 4, 2018
Temperature/ Humidity : 22 deg. C / 35 % RH
Engineer : Koji Yamamoto
Mode : Tx 539.000 MHz

Varying Temperature

Test condition		Tested frequency [MHz]	Measured frequency [MHz]	Frequency error [MHz]	Result [%]	Limit [+/- %]	Remarks
Temp. [deg. C]	Voltage [V]						
50	3.00	539.000	538.999835	-0.000165	-0.00003	0.005	
40	3.00	539.000	538.999862	-0.000138	-0.00003	0.005	
30	3.00	539.000	538.999889	-0.000111	-0.00002	0.005	
20	3.00	539.000	538.999889	-0.000111	-0.00002	0.005	
10	3.00	539.000	538.999906	-0.000094	-0.00002	0.005	
0	3.00	539.000	538.999937	-0.000063	-0.00001	0.005	
-10	3.00	539.000	538.999878	-0.000122	-0.00002	0.005	
-20	3.00	539.000	538.999723	-0.000277	-0.00005	0.005	
-30	3.00	539.000	538.999758	-0.000242	-0.00004	0.005	

Calculation formula: Frequency error = Measured frequency - Tested frequency
Result [%] = Frequency error / Tested frequency * 100

Varying Supply Voltage

Test condition		Tested frequency [MHz]	Measured frequency [MHz]	Frequency error [MHz]	Result [%]	Limit [+/- %]	Remarks
Temp. [deg. C]	Voltage [V]						
20	3.00	539.000	538.999889	-0.000111	-0.00002	0.005	Nominal
20	2.55	539.000	538.999885	-0.000115	-0.00002	0.005	
20	3.45	539.000	538.999896	-0.000104	-0.00002	0.005	
20	2.26	539.000	538.999874	-0.000126	-0.00002	0.005	Battery End Point

Calculation formula: Frequency error = Measured frequency - Tested frequency
Result [%] = Frequency error / Tested frequency * 100

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2017/08/31 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2017/12/21 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	RE	2017/11/14 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2017/11/23 * 12
MLA-21	Logperiodic Antenna (200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-190	RE	2017/12/10 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2018/02/23 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2017/11/14 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2017/09/27 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	RE	2017/08/07 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2018/02/26 * 12
MCC-216	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 1608S087(5 m)	RE	2017/08/04 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2018/01/23 * 12
MSG-16	Signal Generator	Rohde & Schwarz	SMR40	100137	RE	2017/06/27 * 12
MCC-130	Microwave Cable (1-30GHz)	HUBER+SUHNER	SF103/11PC3.5-31/11PC3.5-31/8.0m	54308/3	RE	2018/01/16 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2017/05/22 * 12
MHF-27	High Pass Filter (1.1-10GHz)	TOKYO KEIKI	TF219CD1	1001	RE	2018/01/18 * 12
MBF-07	Band Pass Filter	M-City	BPF0940-01	UL0010	RE	2018/02/28 * 12
YTSSG03	Signal Generator	Rohde & Schwarz	SMT02	51400043	RE	2017/08/23 * 12
MCC-125	Coaxial Cable	UL Japan	-	-	RE	2017/07/13 * 12
MDA-03	Dipole Antenna	Schwarzbeck	UHAP	991	RE	2017/10/14 * 12
MOS-29	Thermo-Hygrometer	Custom	CTH-201	2901	AT	2018/01/24 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	AT	2018/01/09 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	AT	2017/08/22 * 12
MPM-09	Power Meter	Anritsu	ML2495A	6K00003348	AT	2017/10/13 * 12
MPSE-12	Power sensor	Anritsu	MA2411B	011598	AT	2017/10/13 * 12
MCC-38	Coaxial Cable	UL Japan	-	-	AT	2017/12/15 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2017/11/14 * 12
MCC-170	Microwave Cable	Junkosha	MWX221	1409S493	AT	2018/03/12 * 12
MAT-22	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2018/03/12 * 12
MCH-07	Temperature Chamber	ESPEC CORP.	SU-241	92013843	AT	2017/07/18 * 12
MFC-01	Microwave Counter	Advantest	R5373	120100309	AT	2017/06/21 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	AT	2018/01/24 * 12

The expiration date of the calibration is the end of the expired month.

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test Item: RE: Radiated Emission test
AT: Antenna Terminal Conducted test

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124