



RADIO TEST REPORT

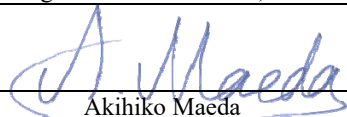
Test Report No. : 12890378H-B-R1

Applicant : Sony Corporation
Type of Equipment : UHF SYNTHESIZED WIRELESS MICROPHONE
Model No. : UTX-M40
FCC ID : AK8UTXM40
Test regulation : FCC Part 74: 2018
Test Result : Complied (Refer to SECTION 3.2)

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.
8. The information provided from the customer for this report is identified in SECTION 1.
9. This report is a revised version of 12890378H-B . 12890378H-B is replaced with this report.

Date of test: August 25 to November 8, 2019

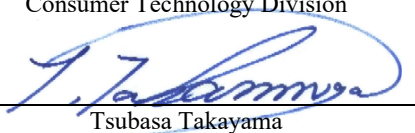
Representative test engineer:


Akihiko Maeda

Engineer

Consumer Technology Division

Approved by:


Tsubasa Takayama

Leader

Consumer Technology Division



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

Report Cover Page - 13-EM-F0429 Issue # 15.0

REVISION HISTORY

Original Test Report No.: 12890378H-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	12890378H-B	November 8, 2019	-	-
1	12890378H-B-R1	November 13, 2019	P 7	Correction of explanatory note *1) in Section 3.2 Addition of explanatory note *2) in Section 3.2

Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation	MCS	Modulation and Coding Scheme
AC	Alternating Current	MRA	Mutual Recognition Arrangement
AFH	Adaptive Frequency Hopping	N/A	Not Applicable
AM	Amplitude Modulation	NIST	National Institute of Standards and Technology
Amp, AMP	Amplifier	NS	No signal detect.
ANSI	American National Standards Institute	NSA	Normalized Site Attenuation
Ant, ANT	Antenna	NVLAP	National Voluntary Laboratory Accreditation Program
AP	Access Point	OBW	Occupied Band Width
ASK	Amplitude Shift Keying	OFDM	Orthogonal Frequency Division Multiplexing
Atten., ATT	Attenuator	P/M	Power meter
AV	Average	PCB	Printed Circuit Board
BPSK	Binary Phase-Shift Keying	PER	Packet Error Rate
BR	Bluetooth Basic Rate	PHY	Physical Layer
BT	Bluetooth	PK	Peak
BT LE	Bluetooth Low Energy	PN	Pseudo random Noise
BW	BandWidth	PRBS	Pseudo-Random Bit Sequence
Cal Int	Calibration Interval	PSD	Power Spectral Density
CCK	Complementary Code Keying	QAM	Quadrature Amplitude Modulation
Ch., CH	Channel	QP	Quasi-Peak
CISPR	Comite International Special des Perturbations Radioelectriques	QPSK	Quadri-Phase Shift Keying
CW	Continuous Wave	RBW	Resolution Band Width
DBPSK	Differential BPSK	RDS	Radio Data System
DC	Direct Current	RE	Radio Equipment
D-factor	Distance factor	RF	Radio Frequency
DFS	Dynamic Frequency Selection	RMS	Root Mean Square
DQPSK	Differential QPSK	RSS	Radio Standards Specifications
DSSS	Direct Sequence Spread Spectrum	Rx	Receiving
EDR	Enhanced Data Rate	SA, S/A	Spectrum Analyzer
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power	SG	Signal Generator
EMC	ElectroMagnetic Compatibility	SVSWR	Site-Voltage Standing Wave Ratio
EMI	ElectroMagnetic Interference	TR	Test Receiver
EN	European Norm	Tx	Transmitting
ERP, e.r.p.	Effective Radiated Power	VBW	Video BandWidth
EU	European Union	Vert.	Vertical
EUT	Equipment Under Test	WLAN	Wireless LAN
Fac.	Factor		
FCC	Federal Communications Commission		
FHSS	Frequency Hopping Spread Spectrum		
FM	Frequency Modulation		
Freq.	Frequency		
FSK	Frequency Shift Keying		
GFSK	Gaussian Frequency-Shift Keying		
GNSS	Global Navigation Satellite System		
GPS	Global Positioning System		
Hori.	Horizontal		
ICES	Interference-Causing Equipment Standard		
IEC	International Electrotechnical Commission		
IEEE	Institute of Electrical and Electronics Engineers		
IF	Intermediate Frequency		
ILAC	International Laboratory Accreditation Conference		
ISED	Innovation, Science and Economic Development Canada		
ISO	International Organization for Standardization		
JAB	Japan Accreditation Board		
LAN	Local Area Network		
LIMS	Laboratory Information Management System		

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.....	5
SECTION 2: Equipment under test (E.U.T.).....	5
SECTION 3: Test specification, procedures & results.....	7
SECTION 4: Operation of E.U.T. during testing.....	10
SECTION 5: Field strength of spurious radiation	13
SECTION 6: Modulation Characteristics	15
SECTION 7: Antenna terminal tests	16
SECTION 8: Necessary bandwidth	17
APPENDIX 1: Data of EMI test.....	18
RF Output Power	18
Modulation Characteristics	20
Occupied Bandwidth.....	26
Spurious emissions at antenna terminals.....	32
Necessary bandwidth	50
Field strength of spurious radiation.....	54
Frequency stability	62
APPENDIX 2: Test instruments	64
APPENDIX 3: Photographs of test setup	66
Radiated Spurious Emission	66
Worst Case Position	67

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.

The information provided from the customer is as follows;

- Applicant, Type of Equipment, Model No., FCC ID on the cover and other relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (E.U.T.)
- SECTION 4: Operation of E.U.T. during testing

* The laboratory is exempted from liability of any test results affected from the above information in SECTION 2 and 4.

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

2.1 Identification of E.U.T.

Type of Equipment	:	UHF SYNTHESIZED WIRELESS MICROPHONE
Model No.	:	UTX-M40
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3.0 V (Battery (2 x AA Batteries)) , DC 5.0 V (USB)
Receipt Date of Sample (Information from test lab.)	:	August 10, 2019
Country of Mass-production	:	Korea
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

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

2.2 Product Description

Model: UTX-M40 (referred to as the EUT in this report) is a UHF SYNTHESIZED WIRELESS MICROPHONE.

General Specification

Clock frequency(ies) in the system : DSP: 12 MHz (SPXO)

Radio Specification

[Radio microphone part] *1)

Radio type	:	Transmitter
Modulation type	:	Frequency modulation
Emission designator	:	116KF3E
Necessary bandwidth	:	116 kHz = 2M + 2D where M: Maximum modulation frequency = 18 kHz D: Peak deviation = 40 kHz
Channel spacing	:	125 kHz
Frequency of operation	:	UTX-M40 (UC14): 470.125 MHz - 541.875 MHz UTX-M40 (UC25): 536.125 MHz - 607.875 MHz UTX-M40 (U90) : 941.625 MHz - 951.875 MHz 953.000 MHz - 956.125 MHz 956.625 MHz - 959.625 MHz
Clock frequency(ies)	:	PLL: 26 MHz (TCXO)
RF power	:	High: 30 mW, Low: 5 mW
Antenna type	:	1/4 Lambda Monopole antenna (Helical type)
Antenna gain	:	2.14 dBi
Power Supply (radio part input)	:	DC 3.0 V, DC 5.3V
AF Specification	:	40 Hz - 18000 Hz, Maximum input: -24 dBV (MIC level, ATT 0 dB)

[NFC part]

Radio Type	:	Transceiver
Modulation type	:	ASK (amplitude-shift keying)
Frequency of Operation	:	13.56 MHz
Method of frequency generation	:	Crystal unit (SPXO)
Antenna Type	:	Loop Antenna
Antenna Gain	:	-68.8 dBi

*1) This test report applies to Radio microphone part.

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
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods	FCC: Section 15.207	N/A	N/A	*1)
	IC: RSS-Gen 8.8	IC: RSS-Gen 8.8			
RF power output	FCC: Section 2.1046	FCC: Section 74.861 (e) (1) / (d) (1)	See data.	Complied a)	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)	See data.	Complied b)	Conducted
	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 c)	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 d)	Conducted
		IC: RSS-210 G 3.4			
Necessary bandwidth	EN 300 422-1 V 1.4.2 Clause 8.3	FCC: Section 74.861 (e) (7) / (d) (4)	See data.	Complied e)	Conducted
		IC: RSS-210 G 3.4			
Field strength of spurious radiation	EN 300 422-1 V 1.4.2 Clause 8.4	KDB 206256 D1 Section III (e), (e) (2) IC: RSS-210 G 3.4	3.4 dB 3039.38 MHz, Horizontal	Complied# f)	Radiated
Frequency stability	FCC: Section 2.1055	FCC: Section 74.861 (e) (4)	See data.	Complied g)	Conducted *2)
	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) The test is not applicable since the EUT operates in RF mode only by battery and not by USB power supply.

*2) The test was performed only by battery since the EUT operates in RF mode only by battery and not by USB power supply.

- a) Refer to APPENDIX 1 (data of RF power output)
- b) Refer to APPENDIX 1 (data of Modulation Characteristics)
- c) Refer to APPENDIX 1 (data of Occupied Bandwidth)
- d) Refer to APPENDIX 1 (data of Spurious emissions at antenna terminals)
- e) Refer to APPENDIX 1 (data of Necessary bandwidth)
- f) Refer to APPENDIX 1 (data of Field strength of spurious radiation)
- g) Refer to APPENDIX 1 (data of Frequency stability)

Symbols:

Complied The data of this test item has enough margin, more than the measurement uncertainty.

Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

* In case any questions arise about test procedure, KDB 206256 D01 Wireless Microphones v02 and ANSI C63.26: 2015 are also referred.

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

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.

3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the results are derived depending on whether or not laboratory uncertainty is applied.

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

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.

*NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967 / ISED Lab Company Number: 2973C

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

Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

Test site	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	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	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	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	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.5 measurement room	6.4 x 6.4 x 3.0	6.4 x 6.4	-	-
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	3.1 x 5.0	-	-
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 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: 5 mW	Typ. 5 mW
Transmitting (Tx), Power setting: 30 mW	Typ. 30 mW
*Transmitting duty was 100 % on all tests.	
*Power of the EUT was set by the software as follows; Power settings: Low (5 mW), High (30 mW) Software: 0.107 *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 5 mW or 30 mW settings.	

*The details of Operating mode(s)

Test Item	Tested frequency		Power setting	Modulation	Remarks
Modulation Characteristics	539.000 MHz	(Mid)	5 mW, 30 mW	See data.	*1)
	950.625 MHz	(Mid)	5 mW, 30 mW		
RF power output	470.125 MHz	(Low)	5 mW, 30 mW	None (No modulation)	-
	539.000 MHz	(Mid)			
	607.875 MHz	(High)			
	941.625 MHz	(Low)	5 mW, 30 mW		
	950.625 MHz	(Mid1)			
	954.625 MHz	(Mid2)			
Occupied Bandwidth	539.625 MHz	(High)	5 mW, 30 mW	-21.5 dBV, 2500 Hz, Sine wave	*2)
	470.125 MHz	(Low)			
	539.000 MHz	(Mid)			
	607.875 MHz	(High)			
	941.625 MHz	(Low)	5 mW, 30 mW		
	950.625 MHz	(Mid)			
959.625 MHz	(High)				
Spurious emissions at antenna terminals	470.125 MHz	(Low)	5 mW, 30 mW	-21.5 dBV, 2500 Hz, Sine wave	*2)
	539.000 MHz	(Mid)			
	607.875 MHz	(High)			
	941.625 MHz	(Low)	5 mW, 30 mW		
	950.625 MHz	(Mid)			
	959.625 MHz	(High)			
Necessary bandwidth	470.125 MHz	(Low)	5 mW, 30 mW	See SECTION 9	-
	539.000 MHz	(Mid)			
	607.875 MHz	(High)			
	941.625 MHz	(Low)	5 mW, 30 mW _v		
	950.625 MHz	(Mid)			
	959.625 MHz	(High)			
Field strength of spurious radiation	470.125 MHz	(Low)	30 mW	None (No modulation)	-
	539.000 MHz	(Mid)			
	607.875 MHz	(High)			
	941.625 MHz	(Low)	30 mW		
	950.625 MHz	(Mid)			
	959.625 MHz	(High)			
Frequency stability	539.000 MHz	(Mid)	30 mW	None (No modulation)	*3)
	950.625 MHz	(Mid)	30 mW		

*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 audio part on each channel. Therefore the test was performed on Mid channel as a representative.
*2) When modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation.
*3) 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

A

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

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remark
A	UHF SYNTHESIZED WIRELESS MICROPHONE	UTX-M40	ES No.001 (UC14) *1) ES No.001 (UC25) *2) ES No.001 (UC90) *3)	Sony Corporation	EUT

*1) For tested frequency 470.125 MHz(Low), 539.000 MHz(Mid)

*2) For tested frequency 607.875 MHz(High)

*3) For tested frequency 941.625 MHz(Low), 950.625 MHz(Mid1), 954.625 MHz(Mid2), 959.625 MHz (High)

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.

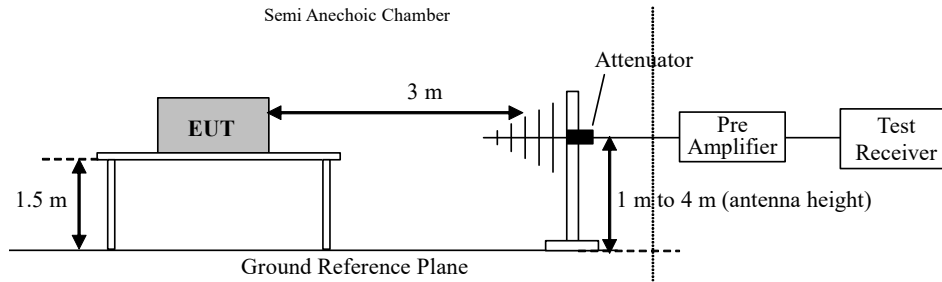
- 3) Effective radiated power was calculated by subtracting the cable loss and the attenuator loss connected between the Signal Generator and the Substitution Antenna from the Output power of the Signal Generator recorded in 2).
For the usage of the Antenna (Horn Antenna) except for the Half wave dipole 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

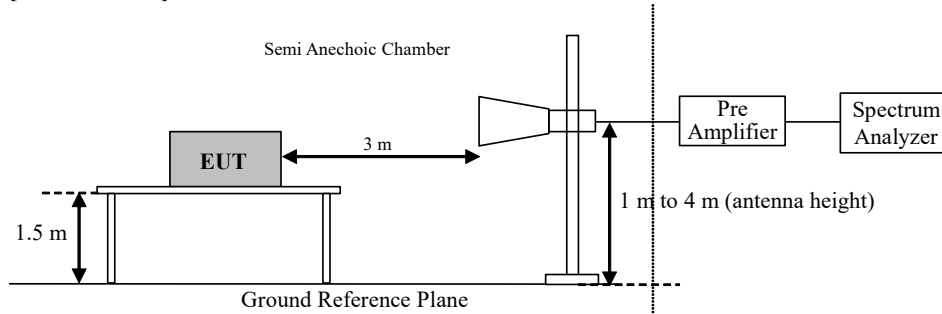
Frequency	25 MHz to 30 MHz	30 MHz to 1 GHz	Above 1 GHz
Instrument used	Spectrum Analyzer		
Detector	RMS Average		
IF Bandwidth	RBW: 10 kHz VBW: 30 kHz	RBW: 100 kHz VBW: 300 kHz	RBW: 1 MHz VBW: 3 MHz
Test Distance	3 m		

Figure 1: Test Setup

[25 MHz - 1 GHz]



[Above 1 GHz]



- 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 - 10 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: Modulation Characteristics

Deviation versus Audio input level and Audio Frequency

Test Procedure

The frequency deviations were measured when input level and frequency were varied.
It was measured with Spectrum analyzer and signal generator.

Audio input level	-80 dBV to -20 dBV, 5 dB step
Audio frequency	40 Hz, 100 Hz, 300 Hz, 500 Hz, 700 Hz, 1 kHz, 3 kHz, 5 kHz, 7 kHz, 10 kHz, 18 kHz

Audio Frequency Response

Test Procedure

The audio input level was measured when frequency deviation indicates 50% modulation which measured with Test receiver and Audio Analyzer.

Audio frequency	40 Hz, 70 Hz, 100 Hz, 300 Hz, 500 Hz, 700 Hz, 1 kHz, 3 kHz, 5 kHz, 7 kHz, 10 kHz, 15 kHz, 18 kHz
-----------------	---

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

Test data : APPENDIX
Test result : Pass

SECTION 7: 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
Spurious emissions at antenna terminals	9 kHz -150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer *2)
	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 since the modulation method was FM.
*2) In the frequency range below 30 MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.

[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

SECTION 8: Necessary bandwidth

Test procedure

In accordance with section 8.3 of ETSI EN 300 422-1, a weighted noise source through a weighting filter based on ITU-R Recommendation BS.559-2 was applied to the audio input of transmitter.

The transmitter RF output spectrums were measured at each channel using a receiving antenna and a spectrum analyzer with settings specified in the section 8.3.1 of ETSI EN 300 422-1. The input level of both white noise and filter to EUT was -12 dBV according to the following result.

	lim-8dB	lim	lim+12dB	Difference of Demodulation level lim-8dB and lim+12dB	White noise +Filter input level
EUT input level	-32.0 dBV	-24 dBV	-12.0 dBV		-12 dBV
Demodulation level	-27.5 dBV	-	-19.5 dBV	8.0 dB < 10 dB	
"lim" means "audio limiting threshold" declared by manufacturer.					

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 Output Power

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 3, 2019
Temperature/ Humidity 23 deg. C / 60 % RH
Engineer Ken Fujita
Mode Tx (470.125 MHz – 607.875 MHz)

Power Setting	Channel	Freq. [MHz]	Reading	Cable Loss [dB]	Atten. Loss [dB]	Result Average [Conducted]		Limit [Conducted] [mW]	Margin [dB]	Remarks
			Average [dBm]			[dBm]	[mW]			
5 mW	Low	470.125	-13.07	0.10	19.90	6.93	4.93	250	17.05	
	Mid	539.000	-12.76	0.10	19.90	7.24	5.30	250	16.74	
	High	607.875	-13.27	0.10	19.90	6.73	4.71	250	17.25	
30 mW	Low	470.125	-5.38	0.10	19.90	14.62	28.97	250	9.36	
	Mid	539.000	-4.98	0.10	19.90	15.02	31.77	250	8.96	
	High	607.875	-5.32	0.10	19.90	14.68	29.38	250	9.30	

Calculation formula:

$$\text{Result} = \text{Reading} + \text{Cable Loss} + \text{Atten. Loss}$$

Cable or Atten. was not used for factor 0.00dB of the above table.

RF Output Power

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 3, 2019 November 8, 2019
Temperature/ Humidity 23 deg. C / 60 % RH 21 deg. C / 50 % RH
Engineer Ken Fujita Ken Fujita
Mode Tx (941.625 MHz – 959.625 MHz)

Power Setting	Channel	Freq. [MHz]	Reading	Cable Loss [dB]	Atten. Loss [dB]	Result Average [Conducted]		Limit [Conducted] [mW]	Margin [dB]	Remarks
			Average [dBm]			[dBm]	[mW]			
5 mW	Low	941.625	-13.09	0.10	19.92	6.93	4.93	1000	23.07	
	Mid1	950.625	-13.10	0.10	19.92	6.92	4.92	1000	23.08	
	Mid2	954.625	-13.10	0.10	19.92	6.92	4.92	1000	23.08	
	High	959.625	-13.11	0.10	19.92	6.91	4.91	1000	23.09	
30 mW	Low	941.625	-5.25	0.10	19.92	14.77	29.99	1000	15.23	
	Mid1	950.625	-5.25	0.10	19.92	14.77	29.99	1000	15.23	
	Mid2	954.625	-5.26	0.10	19.92	14.76	29.92	1000	15.24	
	High	959.625	-5.26	0.10	19.92	14.76	29.92	1000	15.24	

Calculation formula:

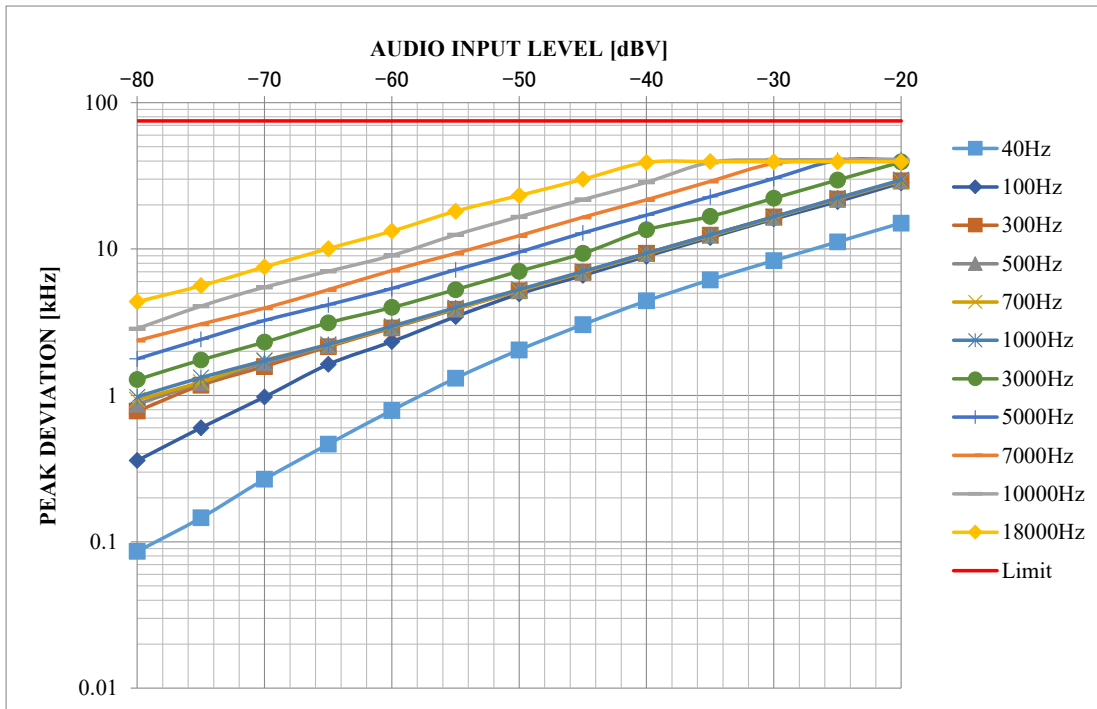
Result = Reading + Cable Loss + Atten. Loss

Modulation Characteristics

[Deviation versus Audio input level and Audio Frequency]

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 13, 2019
Temperature / Humidity 23 deg. C / 62 % RH
Engineer Yuichiro Yamazaki
Mode Tx 539.000 MHz, 5 mW

AF Level [dBV]	AF Frequency [Hz] / Peak Deviation [kHz]											Limit [kHz]
	40	100	300	500	700	1000	3000	5000	7000	10000	18000	
-80	0.086	0.360	0.782	0.873	0.933	0.978	1.283	1.781	2.372	2.861	4.375	75
-75	0.146	0.602	1.176	1.219	1.232	1.322	1.751	2.413	3.074	4.075	5.623	75
-70	0.268	0.979	1.580	1.670	1.732	1.723	2.314	3.252	3.953	5.493	7.564	75
-65	0.465	1.632	2.156	2.198	2.202	2.231	3.136	4.165	5.286	7.052	10.074	75
-60	0.791	2.336	2.891	2.930	2.937	2.973	3.992	5.378	7.146	9.046	13.264	75
-55	1.311	3.460	3.883	3.912	3.917	3.974	5.287	7.216	9.363	12.491	18.144	75
-50	2.046	4.946	5.198	5.213	5.193	5.293	7.070	9.532	12.368	16.601	23.243	75
-45	3.045	6.616	6.928	6.939	6.926	7.032	9.343	12.889	16.502	21.750	29.984	75
-40	4.425	8.942	9.340	9.358	9.234	9.359	13.536	17.043	21.754	28.580	39.032	75
-35	6.161	11.997	12.431	12.487	12.305	12.477	16.723	22.737	29.023	39.035	39.535	75
-30	8.325	16.060	16.591	16.496	16.407	16.623	22.264	30.333	38.502	40.636	39.466	75
-25	11.189	21.141	21.941	21.920	22.172	22.342	29.639	40.232	40.773	40.583	39.472	75
-20	15.043	28.351	29.301	29.256	29.280	29.743	39.383	40.873	40.673	40.686	39.422	75

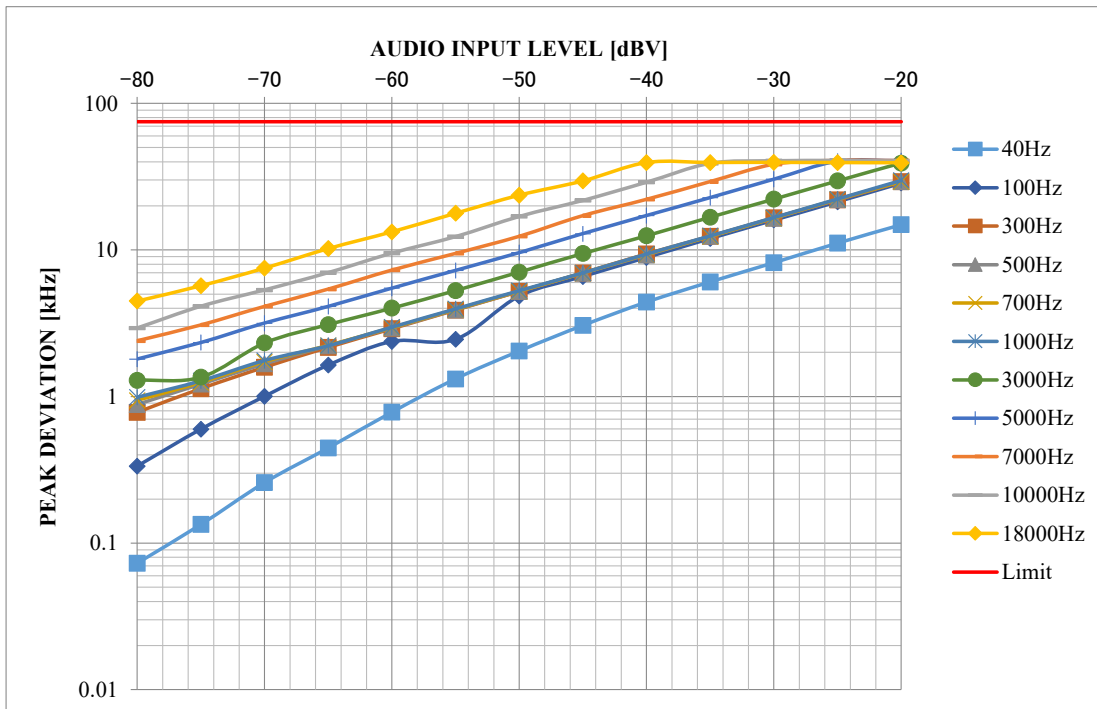


Modulation Characteristics

[Deviation versus Audio input level and Audio Frequency]

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 13, 2019
Temperature / Humidity 23 deg. C / 62 % RH
Engineer Yuichiro Yamazaki
Mode Tx 539.000 MHz, 30 mW

AF Level [dBV]	AF Frequency [Hz] / Peak Deviation [kHz]											Limit [kHz]
	40	100	300	500	700	1000	3000	5000	7000	10000	18000	
-80	0.073	0.335	0.780	0.884	0.941	0.989	1.293	1.802	2.401	2.932	4.482	75
-75	0.134	0.599	1.132	1.216	1.249	1.282	1.356	2.337	3.078	4.129	5.702	75
-70	0.259	1.003	1.586	1.673	1.728	1.765	2.321	3.169	4.123	5.336	7.521	75
-65	0.446	1.639	2.165	2.221	2.231	2.224	3.099	4.115	5.405	6.999	10.213	75
-60	0.783	2.375	2.901	2.935	2.949	2.980	4.012	5.492	7.299	9.512	13.289	75
-55	1.321	2.456	3.888	3.906	3.929	3.969	5.288	7.246	9.482	12.335	17.806	75
-50	2.045	4.852	5.204	5.217	5.229	5.287	7.069	9.592	12.415	16.932	23.653	75
-45	3.058	6.593	6.977	6.947	6.946	6.975	9.468	12.912	17.163	21.793	29.594	75
-40	4.414	8.891	9.398	9.246	9.320	9.399	12.512	17.159	22.156	28.989	39.429	75
-35	6.062	11.984	12.417	12.402	12.359	12.483	16.749	22.749	29.293	39.001	39.502	75
-30	8.193	15.993	16.602	16.437	16.489	16.659	22.229	30.349	38.453	40.574	39.553	75
-25	11.136	21.342	21.974	22.037	22.134	22.299	29.613	40.254	40.861	40.778	39.447	75
-20	14.869	28.592	29.204	29.285	29.302	29.843	39.179	40.634	40.712	40.412	39.329	75



UL Japan, Inc.
Ise EMC Lab.

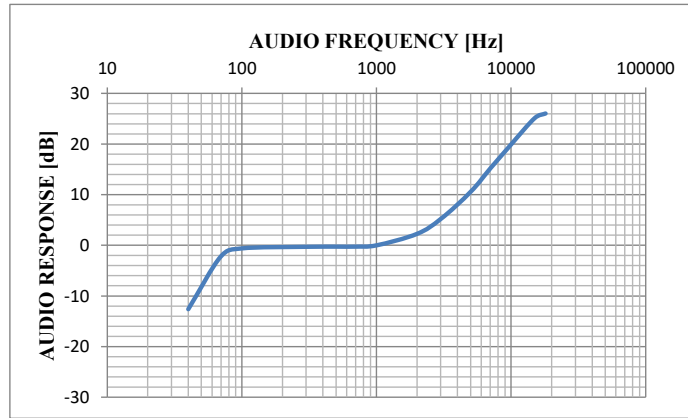
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

Modulation Characteristics [Audio Frequency Response]

Report No. 12890378H
Test place Ise EMC Lab. No.6 Shielded Room
Date September 13, 2019
Temperature / Humidity 23 deg. C / 58 % RH
Engineer Akihiko Maeda
Mode Tx 539.000 MHz

[Power Setting: High]

AF Frequency [Hz]	AF Level [mV]	AF Response [dB]
40	195.00	-12.60
70	58.76	-2.18
100	49.01	-0.61
300	47.23	-0.28
500	47.12	-0.26
700	46.97	-0.24
1000	45.71	0.00
2000	35.20	2.27
3000	25.10	5.21
5000	13.58	10.54
7000	7.98	15.16
10000	4.61	19.93
15000	2.53	25.14
18000	2.28	26.04

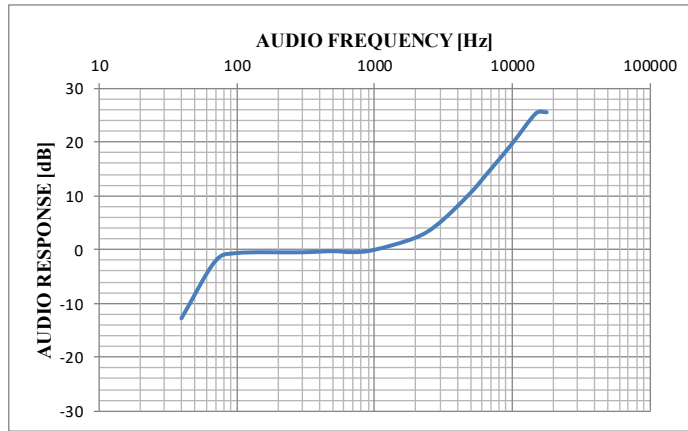


Calculation formula:

$$\text{AF Response} = 20 * \log(\text{AF Level of 1kHz} / \text{AF level})$$

[Power Setting: Low]

AF Frequency [Hz]	AF Level [mV]	AF Response [dB]
40	198.65	-12.73
70	59.02	-2.18
100	49.14	-0.59
300	48.34	-0.45
500	47.20	-0.24
700	48.21	-0.43
1000	45.90	0.00
2000	35.40	2.26
3000	25.65	5.05
5000	13.66	10.53
7000	8.28	14.88
10000	4.79	19.63
15000	2.48	25.35
18000	2.42	25.56



Calculation formula:

$$\text{AF Response} = 20 * \log(\text{AF Level of 1kHz} / \text{AF level})$$

UL Japan, Inc.
Ise EMC Lab.

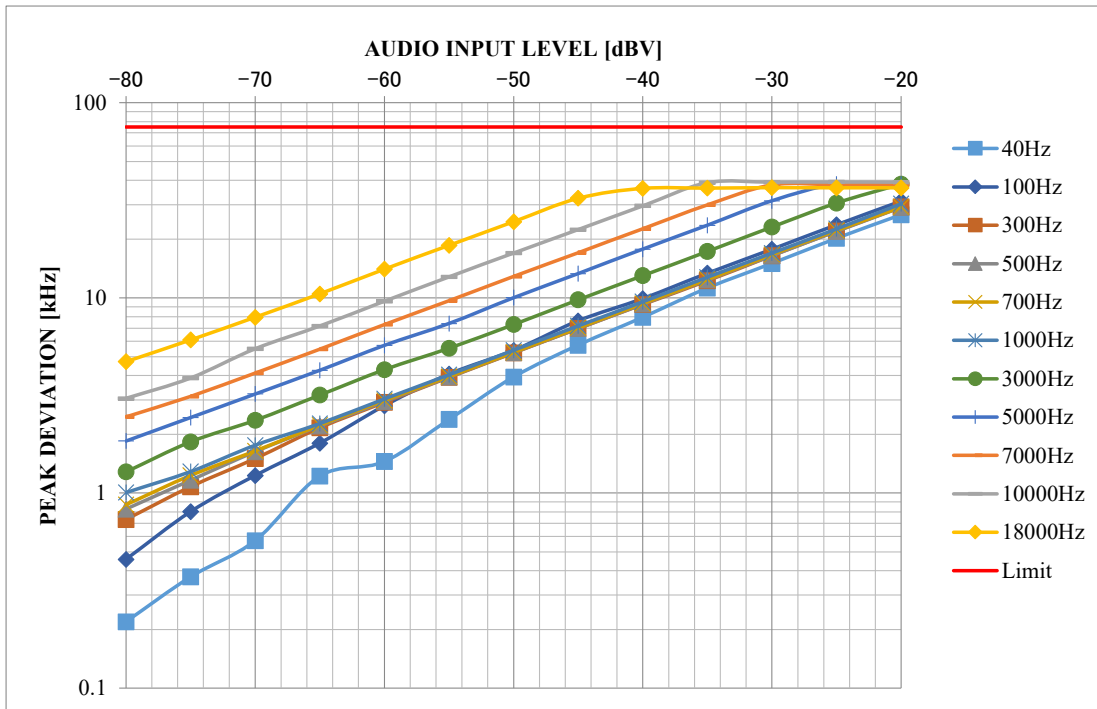
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

Modulation Characteristics

[Deviation versus Audio input level and Audio Frequency]

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 3, 2019 September 13, 2019
Temperature / Humidity 23 deg. C / 52 % RH 23 deg. C / 62 % RH
Engineer Yuta Moriya Yuichiro Yamazaki
Mode Tx 950.625 MHz, 5 mW

AF Level [dBV]	AF Frequency [Hz] / Peak Deviation [kHz]											Limit [kHz]
	40	100	300	500	700	1000	3000	5000	7000	10000	18000	
-80	0.219	0.457	0.732	0.827	0.872	1.007	1.284	1.850	2.459	3.053	4.710	75
-75	0.372	0.802	1.077	1.162	1.233	1.289	1.830	2.440	3.130	3.883	6.088	75
-70	0.570	1.230	1.501	1.629	1.645	1.760	2.360	3.216	4.121	5.483	7.955	75
-65	1.220	1.800	2.158	2.205	2.229	2.273	3.178	4.257	5.463	7.164	10.480	75
-60	1.450	2.800	2.914	2.940	2.984	3.036	4.288	5.709	7.306	9.603	14.031	75
-55	2.380	4.070	3.911	3.925	3.958	4.038	5.518	7.389	9.680	12.809	18.572	75
-50	3.930	5.380	5.221	5.238	5.264	5.398	7.302	10.023	12.889	16.957	24.556	75
-45	5.722	7.630	6.960	6.967	7.024	7.192	9.772	13.314	17.056	22.373	32.363	75
-40	7.951	9.920	9.245	9.282	9.365	9.570	12.992	17.775	22.647	29.608	36.389	75
-35	11.230	13.380	12.227	12.353	12.433	12.768	17.293	23.544	29.997	38.887	36.498	75
-30	15.000	17.760	16.445	16.466	16.676	16.986	23.079	31.397	37.984	39.150	36.684	75
-25	20.200	23.700	22.001	21.921	22.182	22.604	30.630	38.251	38.024	39.210	36.612	75
-20	26.660	31.360	29.206	29.101	29.220	30.384	38.335	38.254	37.998	39.169	36.622	75

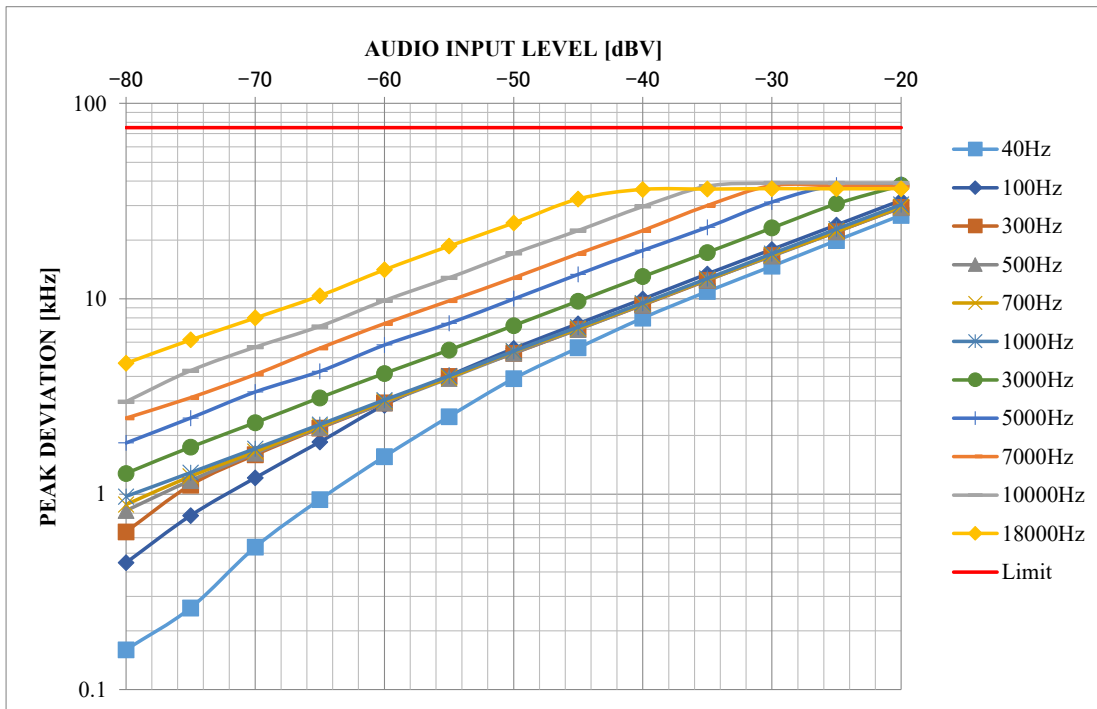


Modulation Characteristics

[Deviation versus Audio input level and Audio Frequency]

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 13, 2019
Temperature / Humidity 23 deg. C / 62 % RH
Engineer Yuichiro Yamazaki
Mode Tx 950.625 MHz, 30 mW

AF Level [dBV]	AF Frequency [Hz] / Peak Deviation [kHz]											Limit [kHz]
	40	100	300	500	700	1000	3000	5000	7000	10000	18000	
-80	0.160	0.446	0.642	0.825	0.886	0.973	1.277	1.833	2.451	2.975	4.682	75
-75	0.262	0.778	1.113	1.176	1.237	1.290	1.741	2.457	3.123	4.283	6.164	75
-70	0.536	1.213	1.591	1.623	1.655	1.711	2.321	3.341	4.104	5.658	7.984	75
-65	0.939	1.851	2.179	2.195	2.225	2.271	3.114	4.259	5.583	7.224	10.368	75
-60	1.558	2.856	2.936	2.938	2.988	3.035	4.154	5.811	7.463	9.791	14.084	75
-55	2.494	4.037	4.001	3.916	3.958	4.032	5.463	7.495	9.748	12.805	18.616	75
-50	3.902	5.560	5.258	5.276	5.371	5.397	7.298	10.001	12.789	17.092	24.444	75
-45	5.614	7.457	6.998	6.966	7.060	7.172	9.734	13.359	17.016	22.386	32.424	75
-40	7.972	9.971	9.301	9.336	9.417	9.517	13.001	17.730	22.367	29.682	36.297	75
-35	10.898	13.401	12.445	12.476	12.567	12.711	17.267	23.253	29.975	37.712	36.429	75
-30	14.687	17.868	16.637	16.526	16.737	17.012	23.062	31.316	37.907	39.151	36.638	75
-25	19.880	23.852	22.031	22.016	22.127	22.817	30.645	38.197	37.837	39.173	36.553	75
-20	26.774	31.890	29.299	29.269	29.668	30.367	38.099	38.346	37.539	39.162	36.643	75



UL Japan, Inc.
Ise EMC Lab.

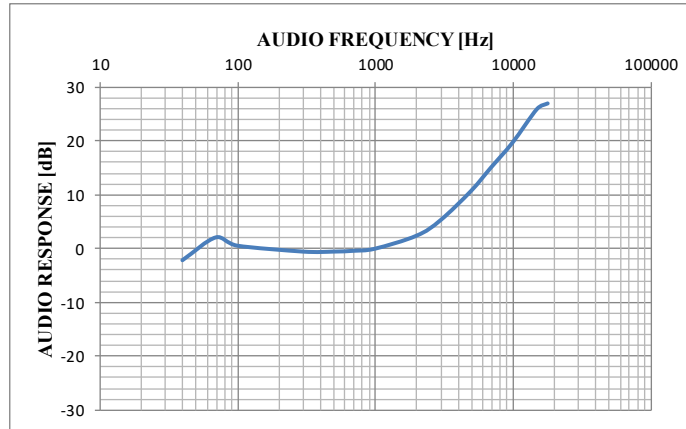
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999
Facsimile : +81 596 24 8124

Modulation Characteristics [Audio Frequency Response]

Report No. 12890378H
Test place Ise EMC Lab. No.6 Shielded Room
Date September 13, 2019
Temperature / Humidity 23 deg. C / 58 % RH
Engineer Akihiko Maeda
Mode Tx 950.625 MHz

[Power Setting: High]

AF Frequency [Hz]	AF Level [mV]	AF Response [dB]
40	56.21	-2.13
70	34.54	2.10
100	41.20	0.57
300	46.76	-0.53
500	46.83	-0.54
700	45.98	-0.38
1000	44.01	0.00
2000	33.44	2.39
3000	23.86	5.32
5000	12.79	10.73
7000	7.73	15.11
10000	4.56	19.69
15000	2.24	25.87
18000	1.98	26.94

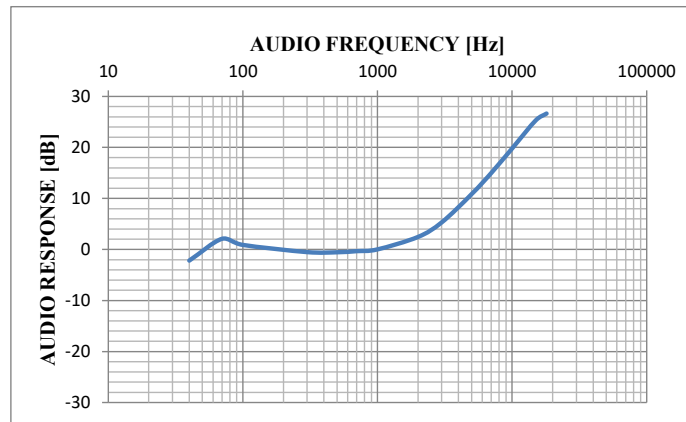


Calculation formula:

$$\text{AF Response} = 20 * \log(\text{AF Level of 1kHz} / \text{AF level})$$

[Power Setting: Low]

AF Frequency [Hz]	AF Level [mV]	AF Response [dB]
40	57.10	-2.18
70	35.04	2.06
100	40.12	0.88
300	47.13	-0.51
500	47.34	-0.55
700	46.17	-0.34
1000	44.42	0.00
2000	33.50	2.45
3000	24.10	5.31
5000	12.78	10.82
7000	7.92	14.98
10000	4.54	19.81
15000	2.41	25.31
18000	2.07	26.63



Calculation formula:

$$\text{AF Response} = 20 * \log(\text{AF Level of 1kHz} / \text{AF level})$$

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. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 10, 2019
Temperature/ Humidity 24 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx (470.125 MHz – 607.875 MHz)

Power Setting	Channel	Freq. [MHz]	99% Occupied Bandwidth [kHz]	Limit [kHz]	Margin [kHz]
5 mW	Low	470.125	85.9636	200	114.0364
	Mid	539.000	84.5415	200	115.4585
	High	607.875	83.9298	200	116.0702
30 mW	Low	470.125	85.8683	200	114.1317
	Mid	539.000	84.5670	200	115.4330
	High	607.875	84.0258	200	115.9742

Occupied Bandwidth

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 10, 2019
Temperature/ Humidity 24 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx (470.125 MHz – 607.875 MHz)

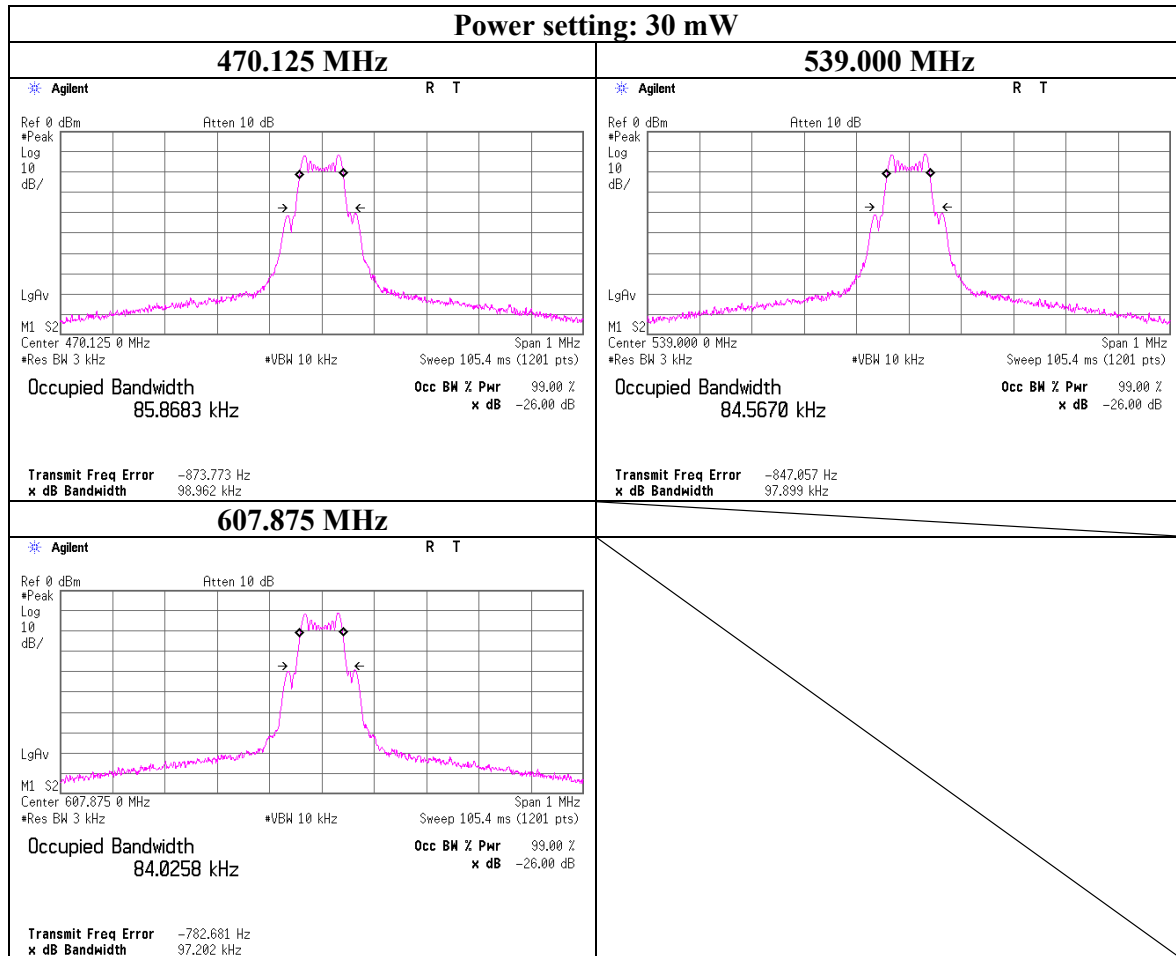


UL Japan, Inc.
Ise EMC Lab.

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

Occupied Bandwidth

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 10, 2019
Temperature/ Humidity 24 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx (470.125 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

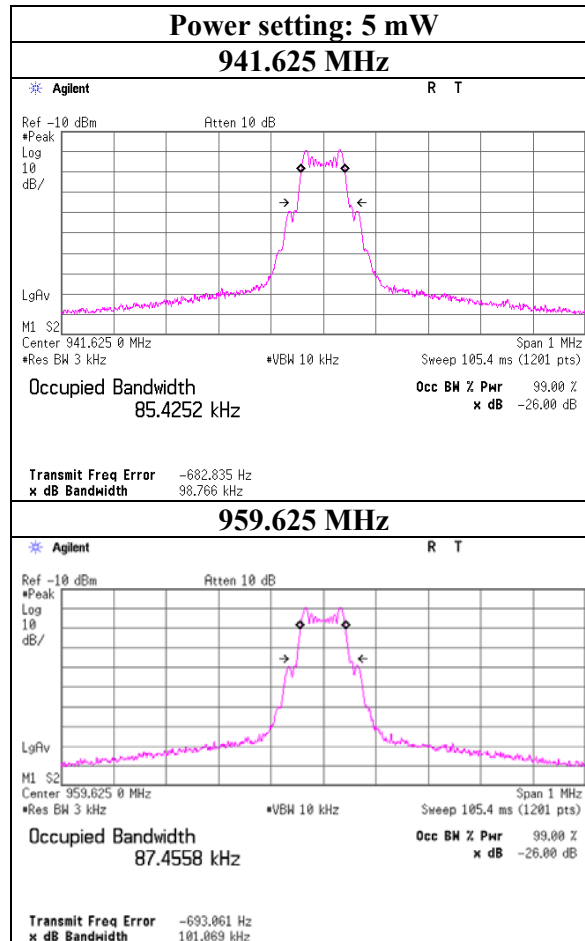
Occupied Bandwidth

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 10, 2019
Temperature/ Humidity 24 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx (941.625 MHz – 959.625 MHz)

Power Setting	Frequency [MHz]	Bandwidth [kHz]	Frequency Error [Hz]	Result [MHz]	Limit [MHz]
5 mW	941.625	85.4252	-682.835	941.5816	> 941.5
	959.625	87.4558	-693.061	959.6680	< 959.85
30 mW	941.625	85.3014	-705.580	941.5816	> 941.5
	959.625	87.4060	-701.423	959.6680	< 959.85

Occupied Bandwidth

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 10, 2019
Temperature/ Humidity 24 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx (941.625 MHz – 959.625 MHz)



UL Japan, Inc.
Ise EMC Lab.

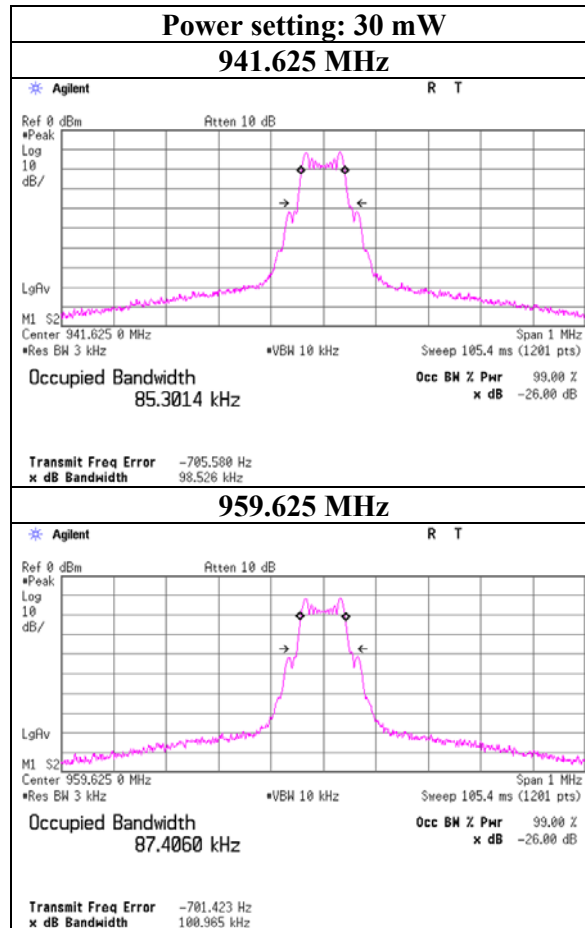
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Occupied Bandwidth

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 10, 2019
Temperature/ Humidity 24 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx (941.625 MHz – 959.625 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

Spurious emissions at antenna terminals

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 9, 2019
Temperature/ Humidity 25 deg. C / 35 % RH
Engineer Yuta Moriya
Mode Tx (470.125 MHz – 607.875 MHz)

Power Setting	Channel	Tested Freq. [MHz]	Reading		Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
			Freq. [MHz]	Level [dBm]					
5 mW	Low	470.125	0.01358	-100.09	0.10	19.86	-80.13	-13	67.13
			0.747	-90.34	0.11	19.86	-70.37	-13	57.37
			940.2	-75.88	0.39	19.92	-55.57	-13	42.57
			3267	-69.09	1.19	19.99	-47.91	-13	34.91
	Mid	539.000	0.00994	-100.62	0.10	19.86	-80.66	-13	67.66
			0.374	-89.92	0.10	19.86	-69.96	-13	56.96
			974.9	-81.29	0.40	19.92	-60.97	-13	47.97
			1078.75	-66.85	0.73	19.96	-46.16	-13	33.16
			3133.75	-68.82	1.17	19.99	-47.66	-13	34.66
	High	607.875	0.01041	-100.21	0.10	19.86	-80.25	-13	67.25
			0.25	-89.99	0.10	19.86	-70.03	-13	57.03
			529.6	-81.94	0.32	19.90	-61.72	-13	48.72
			3136	-69.02	1.17	19.99	-47.86	-13	34.86
30 mW	Low	470.125	0.01264	-101.54	0.10	19.86	-81.58	-13	68.58
			0.573	-90.69	0.20	19.86	-70.63	-13	57.63
			940.2	-73.89	0.39	19.92	-53.58	-13	40.58
			3067	-68.31	1.16	19.99	-47.16	-13	34.16
	Mid	539.000	0.0117	-101.12	0.10	19.86	-81.16	-13	68.16
			1.244	-90.65	0.11	19.86	-70.68	-13	57.68
			468.1	-81.96	0.30	19.90	-61.76	-13	48.76
			1078.75	-67.50	0.73	19.96	-46.81	-13	33.81
			3167.5	-68.95	1.18	19.99	-47.78	-13	34.78
	High	607.875	0.01018	-100.44	0.10	19.86	-80.48	-13	67.48
			0.225	-90.16	0.10	19.86	-70.20	-13	57.20
			405.9	-81.62	0.28	19.89	-61.45	-13	48.45
			1215	-69.18	0.77	19.96	-48.45	-13	35.45
			3104	-68.29	1.17	19.99	-47.13	-13	34.13

Calculation formula:

Result = Reading + Cable Loss + Attenuator Loss

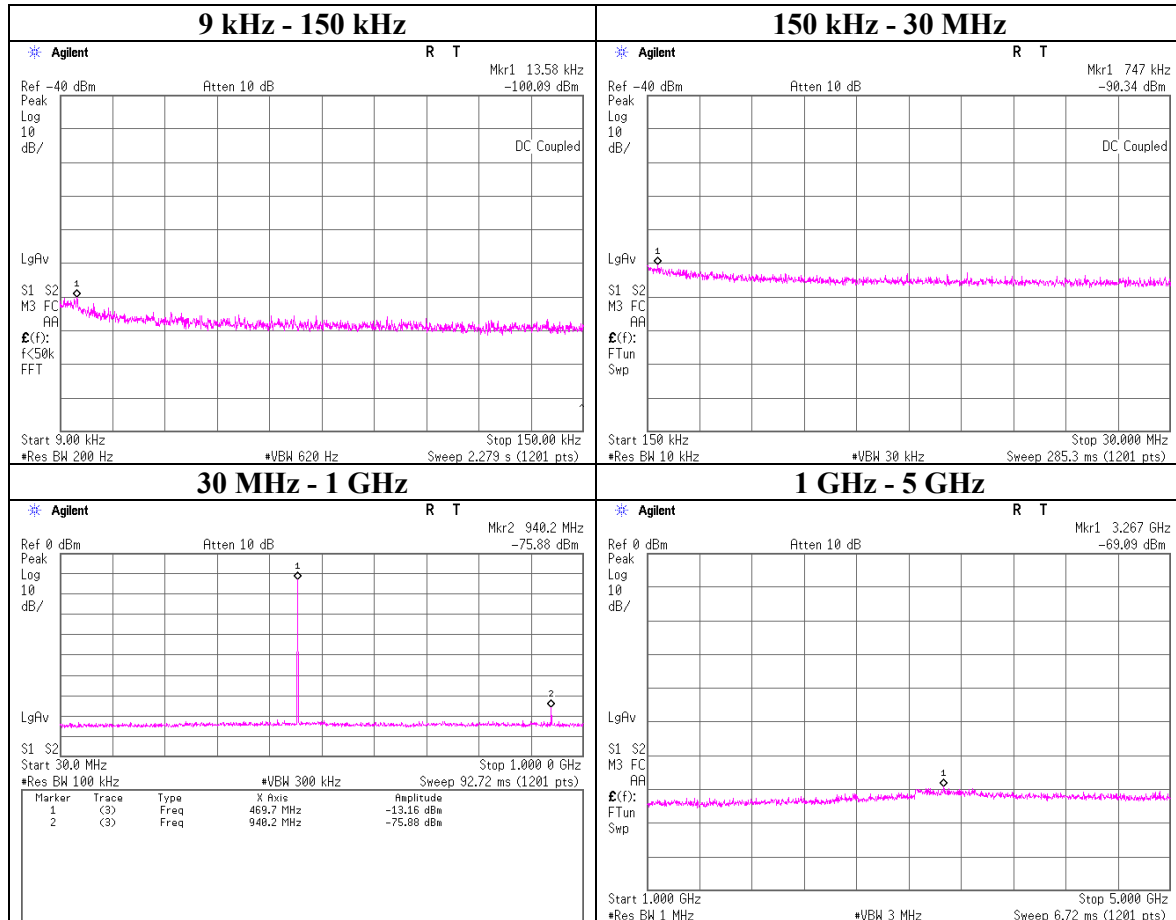
Limit = mean output power in dBm - (43+10log₁₀ (mean output power in watts)) dB = -13dBm

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. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 9, 2019
Temperature/ Humidity 25 deg. C / 35 % RH
Engineer Yuta Moriya
Mode Tx 470.125 MHz, 5 mW



UL Japan, Inc.

Ise EMC Lab.

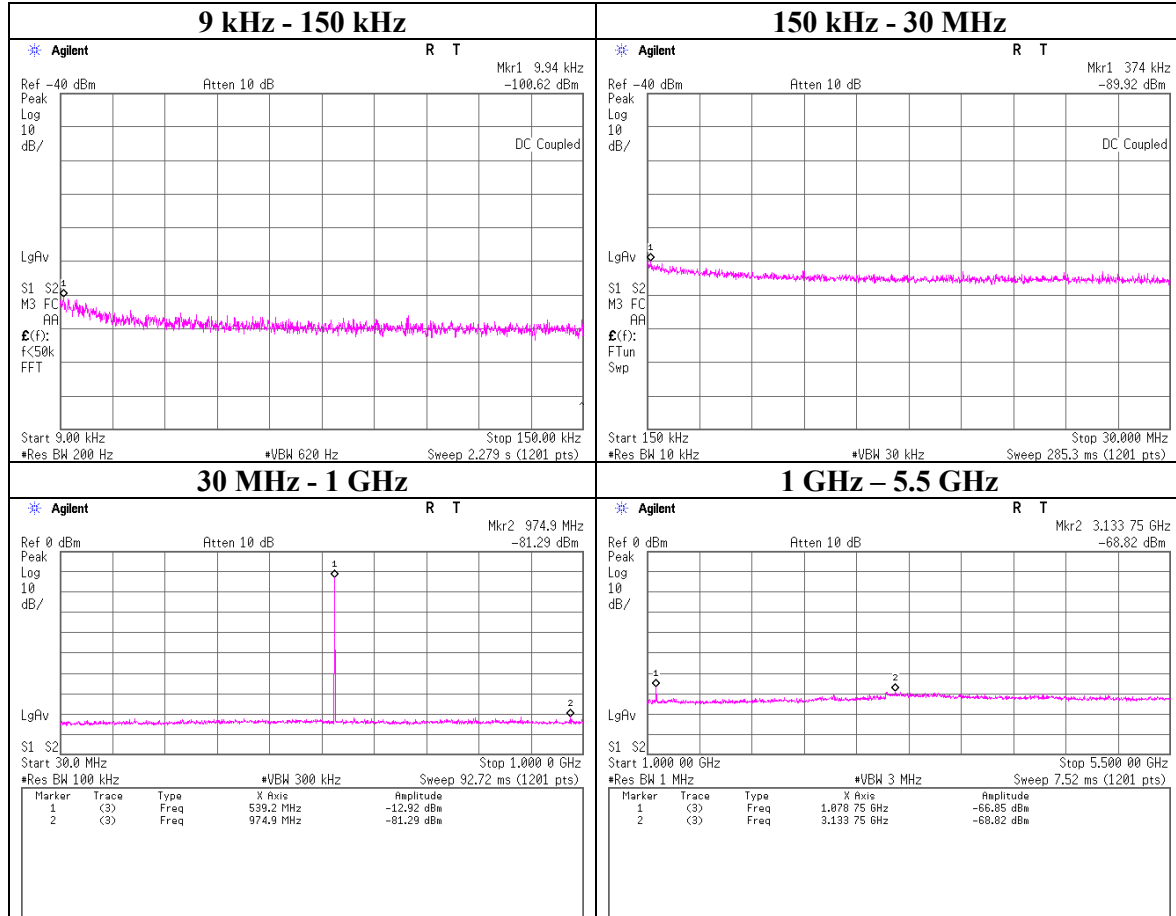
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emissions at antenna terminals

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 9, 2019
Temperature/ Humidity 25 deg. C / 35 % RH
Engineer Yuta Moriya
Mode Tx 539.000 MHz, 5 mW



UL Japan, Inc.

Ise EMC Lab.

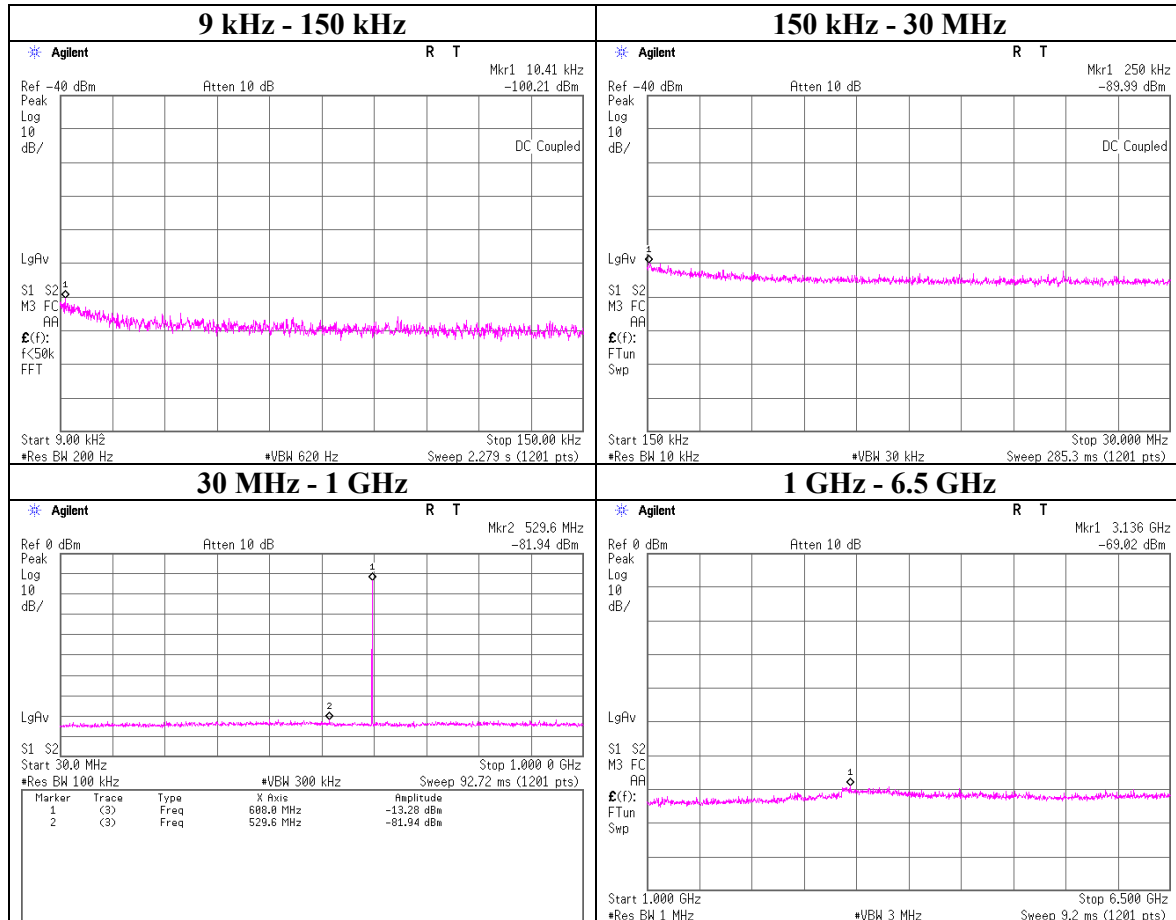
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emissions at antenna terminals

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 9, 2019
Temperature/ Humidity 25 deg. C / 35 % RH
Engineer Yuta Moriya
Mode Tx 607.875 MHz, 5 mW



UL Japan, Inc.

Ise EMC Lab.

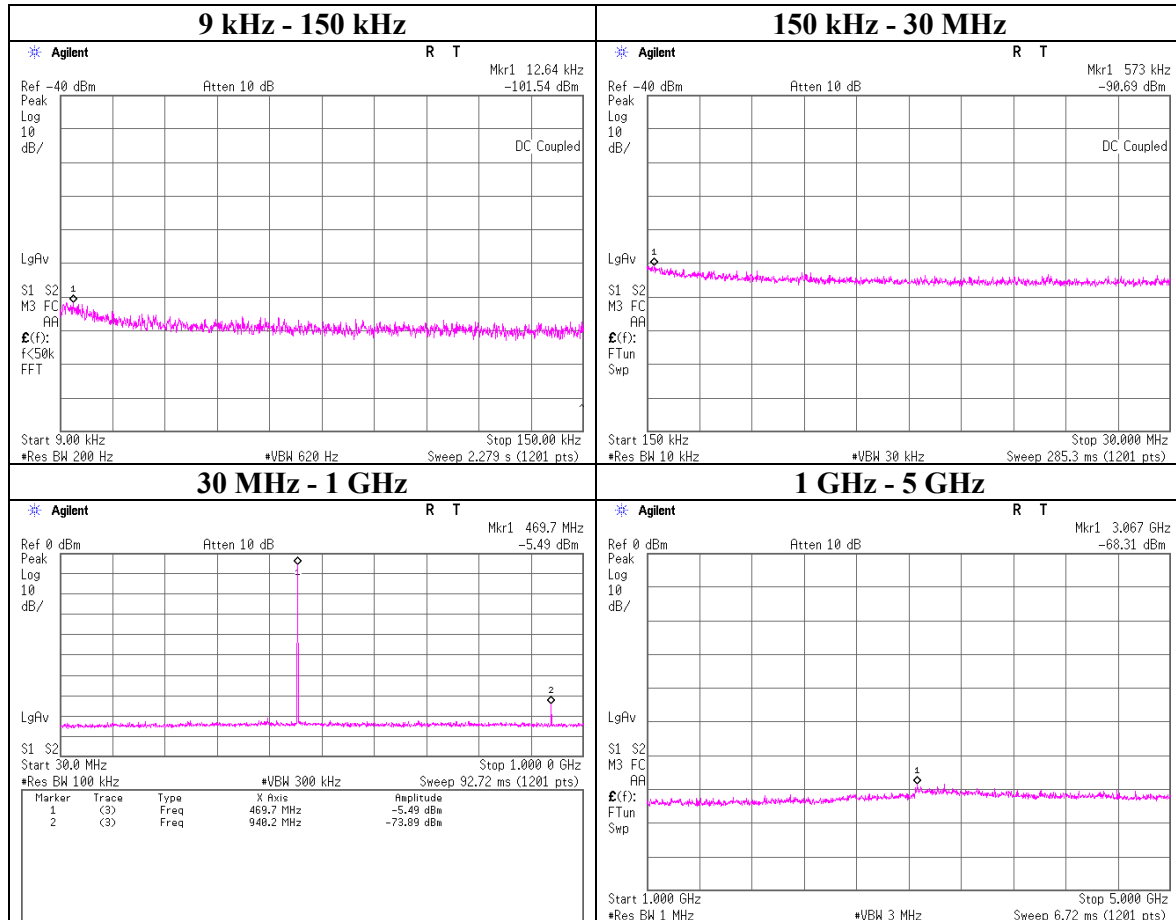
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emissions at antenna terminals

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 9, 2019
Temperature/ Humidity 25 deg. C / 35 % RH
Engineer Yuta Moriya
Mode Tx 470.125 MHz, 30 mW



UL Japan, Inc.

Ise EMC Lab.

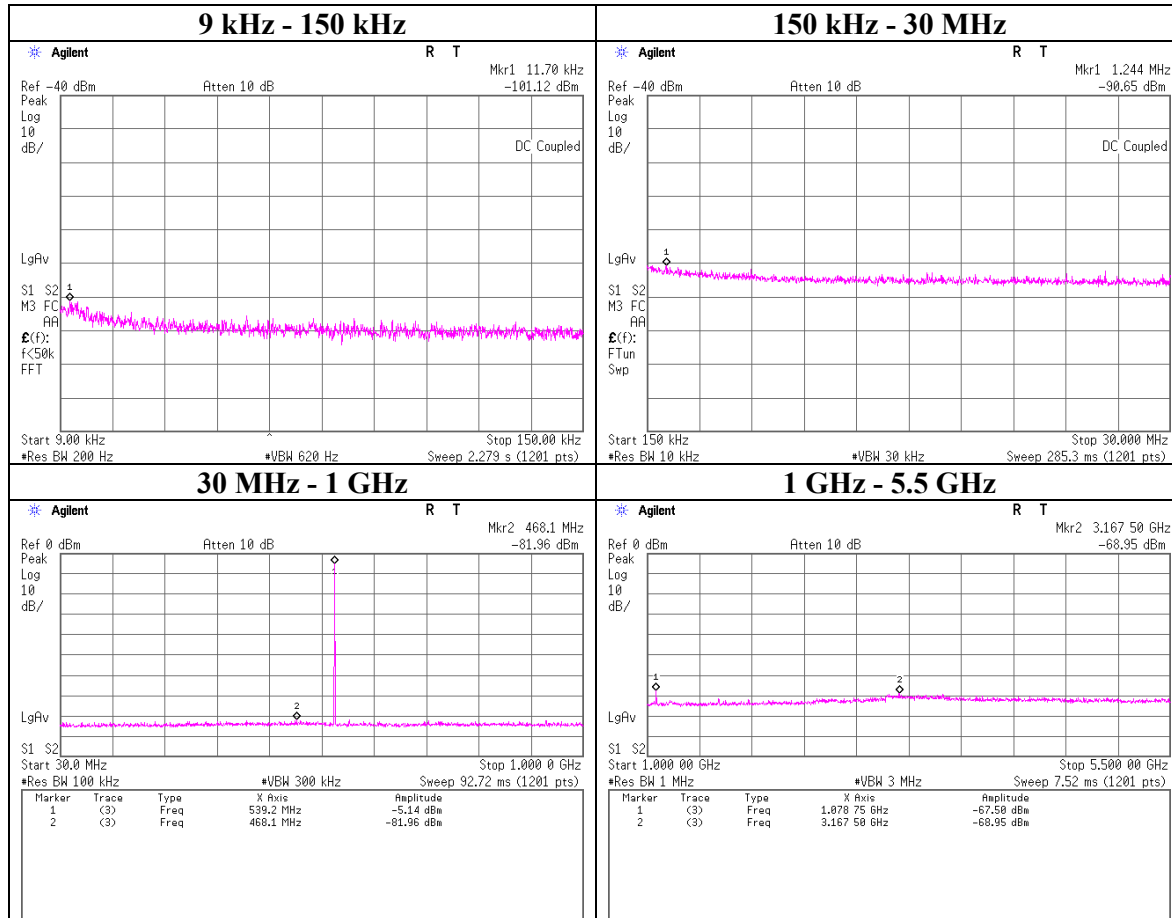
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emissions at antenna terminals

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 9, 2019
Temperature/ Humidity 25 deg. C / 35 % RH
Engineer Yuta Moriya
Mode Tx 539.000 MHz, 30 mW



UL Japan, Inc.

Ise EMC Lab.

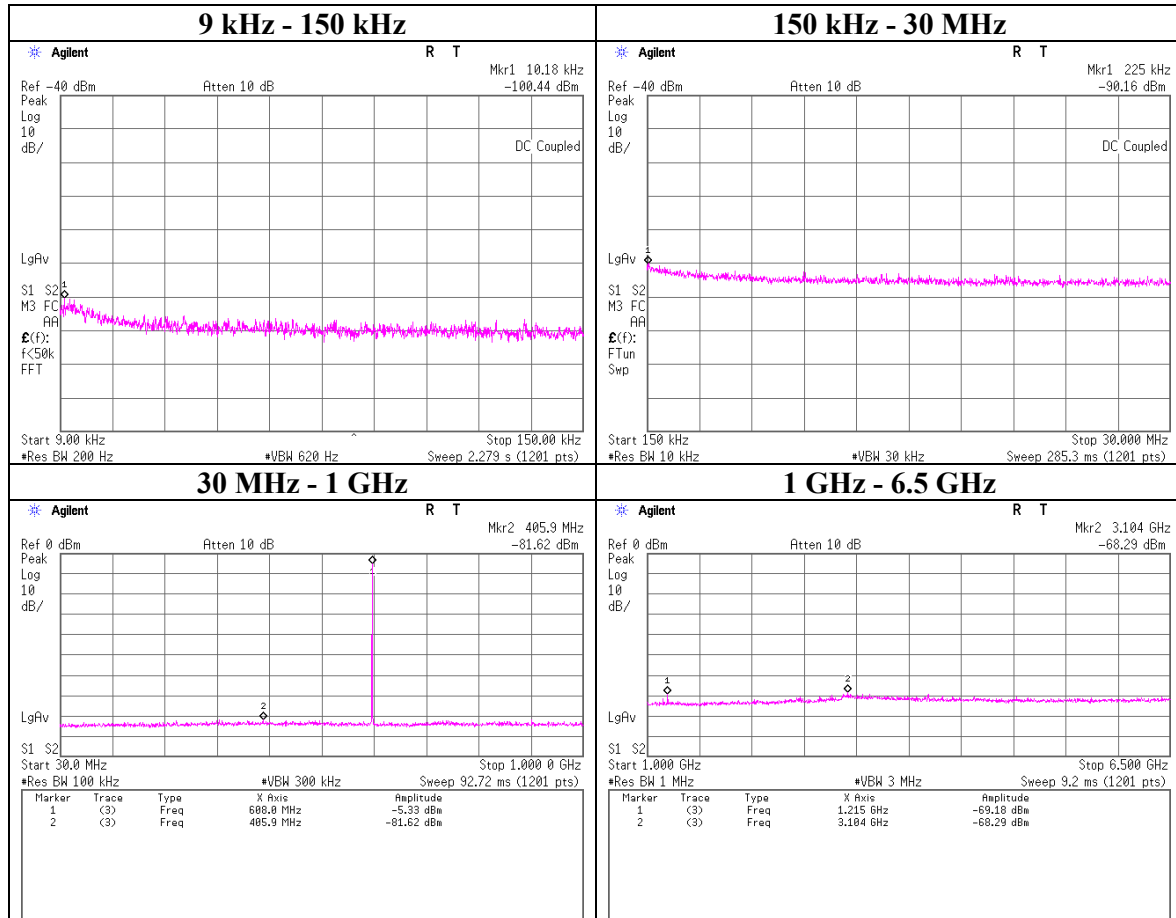
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emissions at antenna terminals

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 9, 2019
Temperature/ Humidity 25 deg. C / 35 % RH
Engineer Yuta Moriya
Mode Tx 607.875 MHz, 30 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. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 10, 2019
Temperature/ Humidity 24 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx (941.625 MHz – 959.625 MHz)

Power Setting	Channel	Tested Freq. [MHz]	Reading		Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
			Freq. [MHz]	Level [dBm]					
5 mW	Low	941.625	0.013	-100.93	0.10	19.86	-80.97	-13	67.97
			0.175	-90.47	0.10	19.86	-70.51	-13	57.51
			521.5	-82.09	0.31	19.90	-61.88	-13	48.88
			3057	-69.03	1.16	19.99	-47.88	-13	34.88
			6954	-67.32	1.65	19.90	-45.77	-13	32.77
	Mid	950.625	0.01206	-100.92	0.10	19.86	-80.96	-13	67.96
			0.648	-89.08	0.11	19.86	-69.11	-13	56.11
			469.7	-81.84	0.30	19.90	-61.64	-13	48.64
			3570	-69.33	1.25	19.99	-48.09	-13	35.09
			7300	-67.08	1.71	19.93	-45.44	-13	32.44
	High	959.625	0.0144	-100.28	0.10	19.86	-80.32	-13	67.32
			0.225	-90.60	0.10	19.86	-70.64	-13	57.64
			413.2	-81.27	0.29	19.89	-61.09	-13	48.09
			3420	-69.46	1.22	19.99	-48.25	-13	35.25
			6779	-67.97	1.63	19.91	-46.43	-13	33.43
30 mW	Low	941.625	0.01488	-99.77	0.10	19.86	-79.81	-13	66.81
			0.225	-89.28	0.10	19.86	-69.32	-13	56.32
			503.7	-81.66	0.31	19.90	-61.45	-13	48.45
			3150	-68.96	1.17	19.99	-47.80	-13	34.80
			7483	-67.65	1.75	19.94	-45.96	-13	32.96
	Mid	950.625	0.01158	-100.20	0.10	19.86	-80.24	-13	67.24
			0.473	-90.01	0.10	19.86	-70.05	-13	57.05
			451.1	-81.67	0.30	19.90	-61.47	-13	48.47
			3110	-68.52	1.17	19.99	-47.36	-13	34.36
			7496	-67.61	1.75	19.95	-45.91	-13	32.91
	High	959.625	0.01123	-100.70	0.10	19.86	-80.74	-13	67.74
			0.648	-90.36	0.11	19.86	-70.39	-13	57.39
			276.5	-82.10	0.25	19.89	-61.96	-13	48.96
			3503	-69.29	1.24	19.99	-48.06	-13	35.06
			7546	-67.70	1.76	19.95	-45.99	-13	32.99

Calculation formula:

$$\text{Result} = \text{Reading} + \text{Cable Loss} + \text{Attenuator Loss}$$

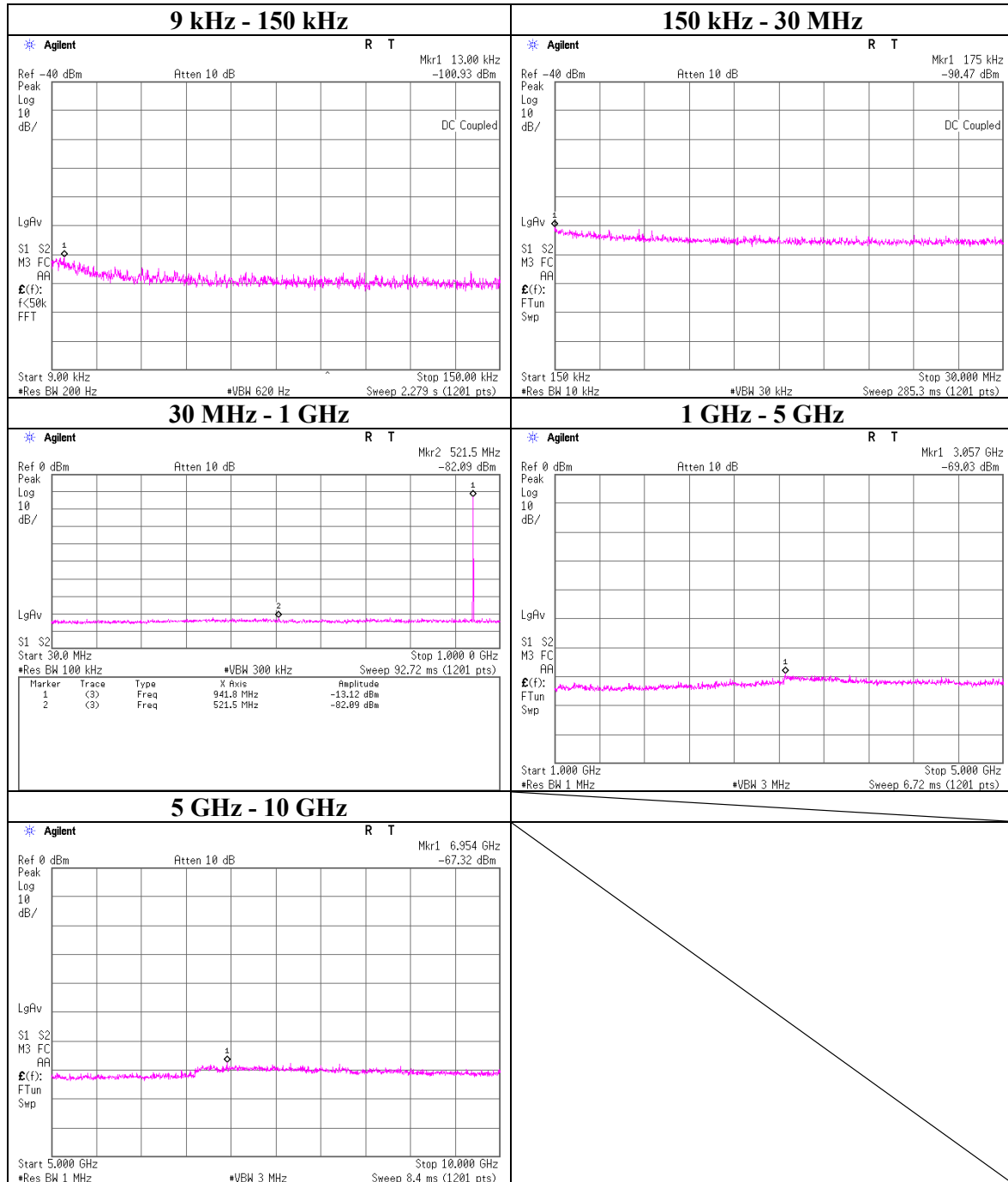
$$\text{Limit} = \text{mean output power in dBm} - (43 + 10 \log_{10} (\text{mean output power in watts})) \text{ dB} = -13 \text{ dBm}$$

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. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 10, 2019
Temperature/ Humidity 24 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx 941.625 MHz, 5 mW



UL Japan, Inc.

Ise EMC Lab.

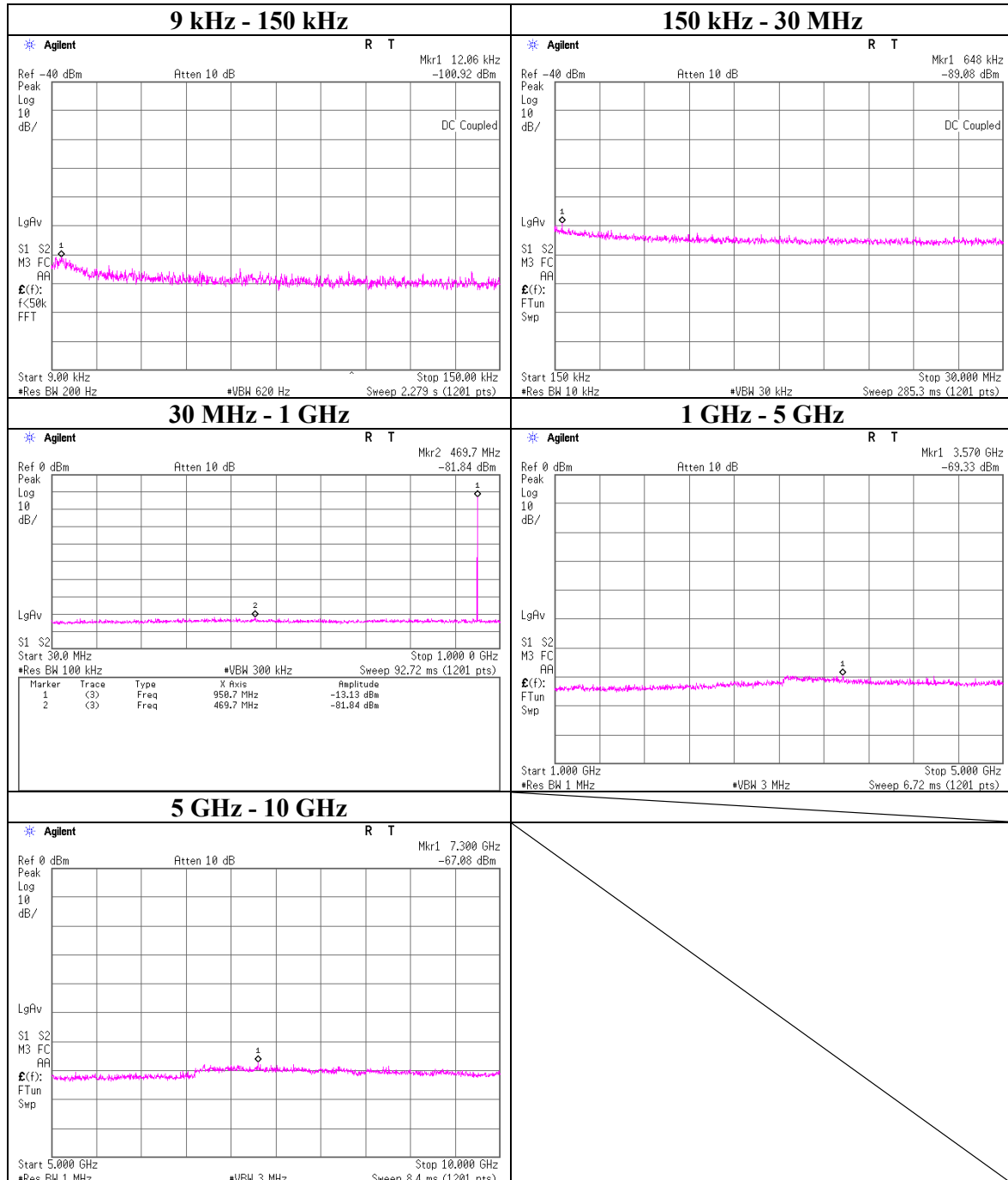
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emissions at antenna terminals

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 10, 2019
Temperature/ Humidity 24 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx 950.625 MHz, 5 mW



UL Japan, Inc.

Ise EMC Lab.

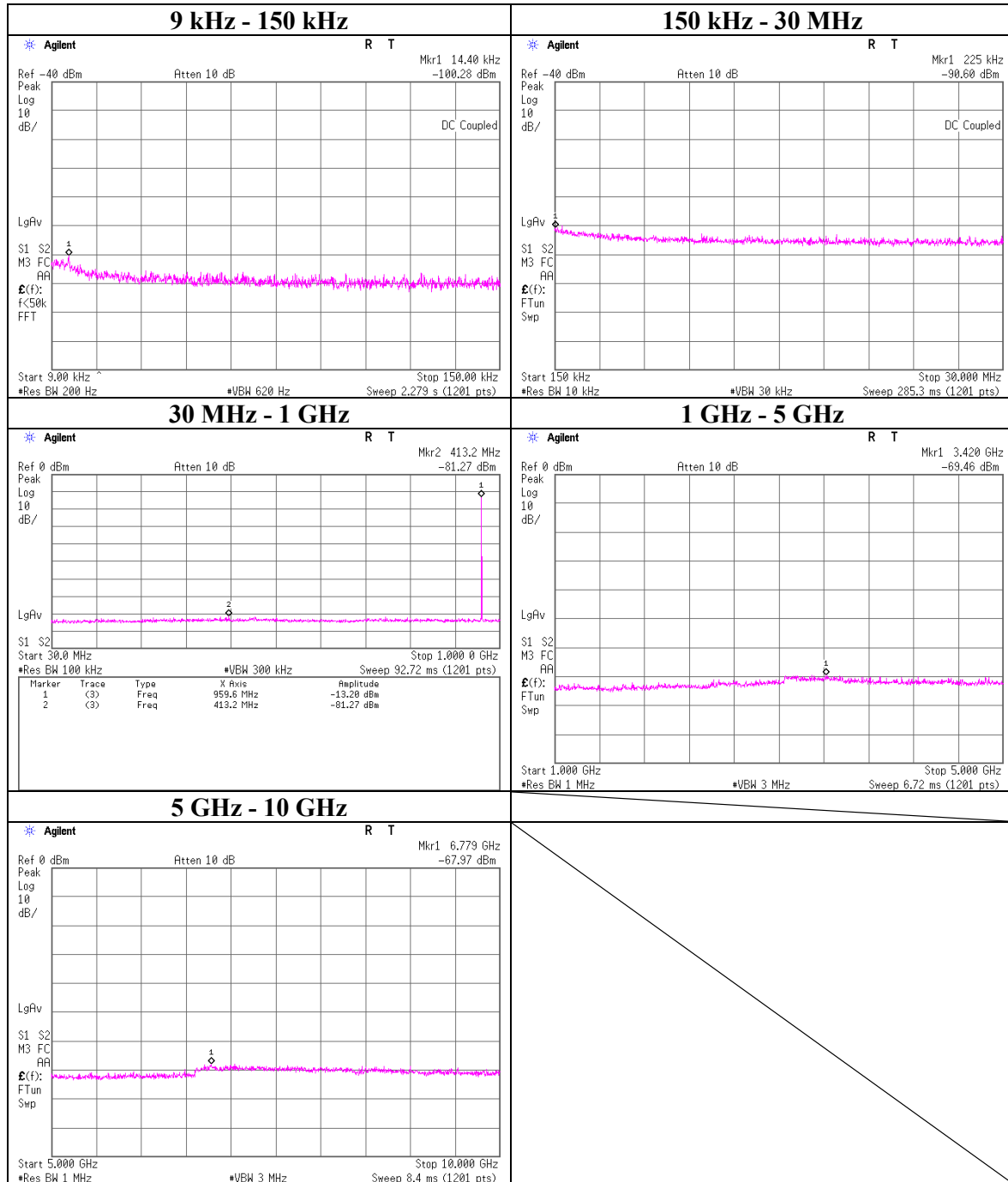
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emissions at antenna terminals

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 10, 2019
Temperature/ Humidity 24 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx 959.625 MHz, 5 mW



UL Japan, Inc.

Ise EMC Lab.

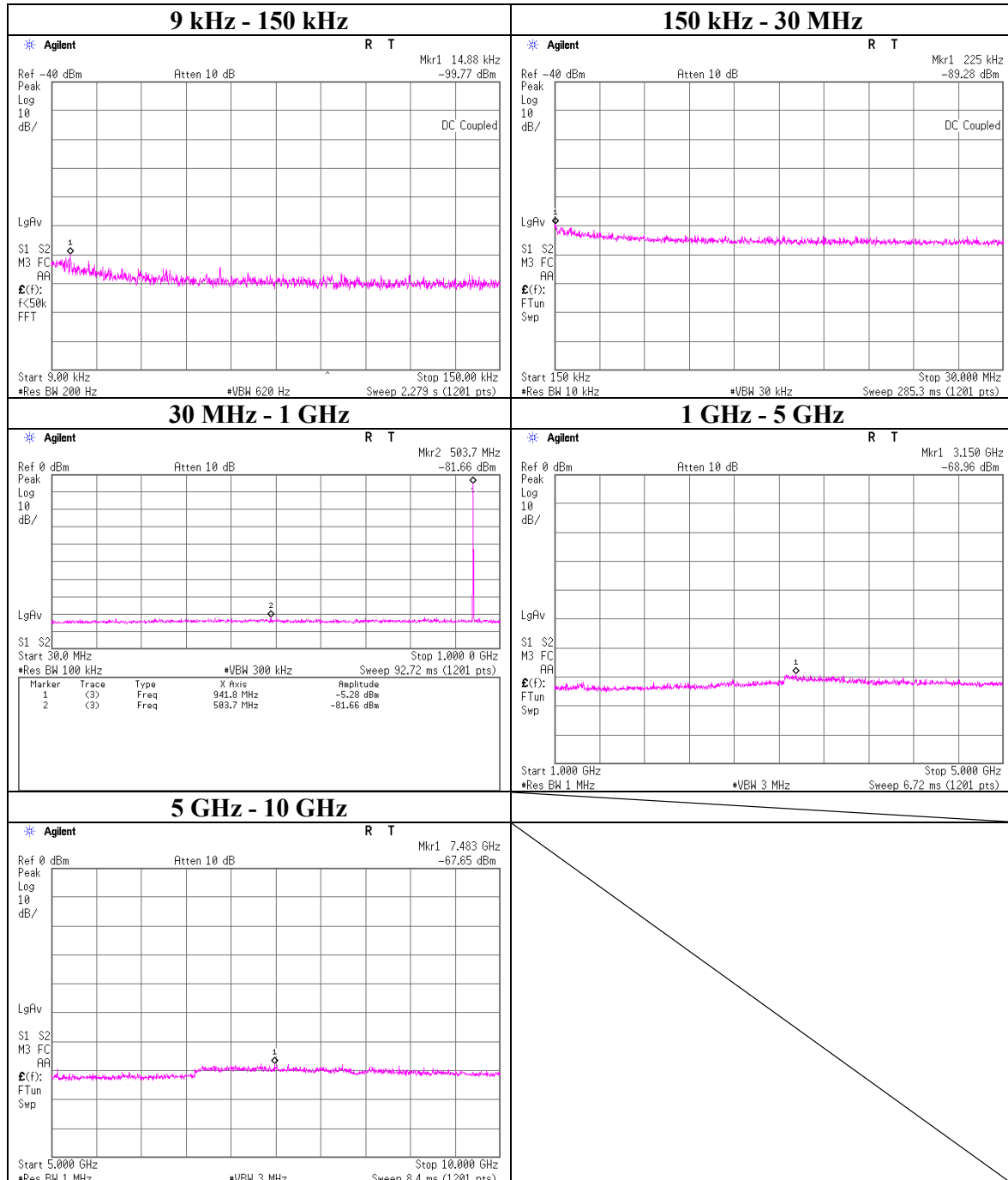
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

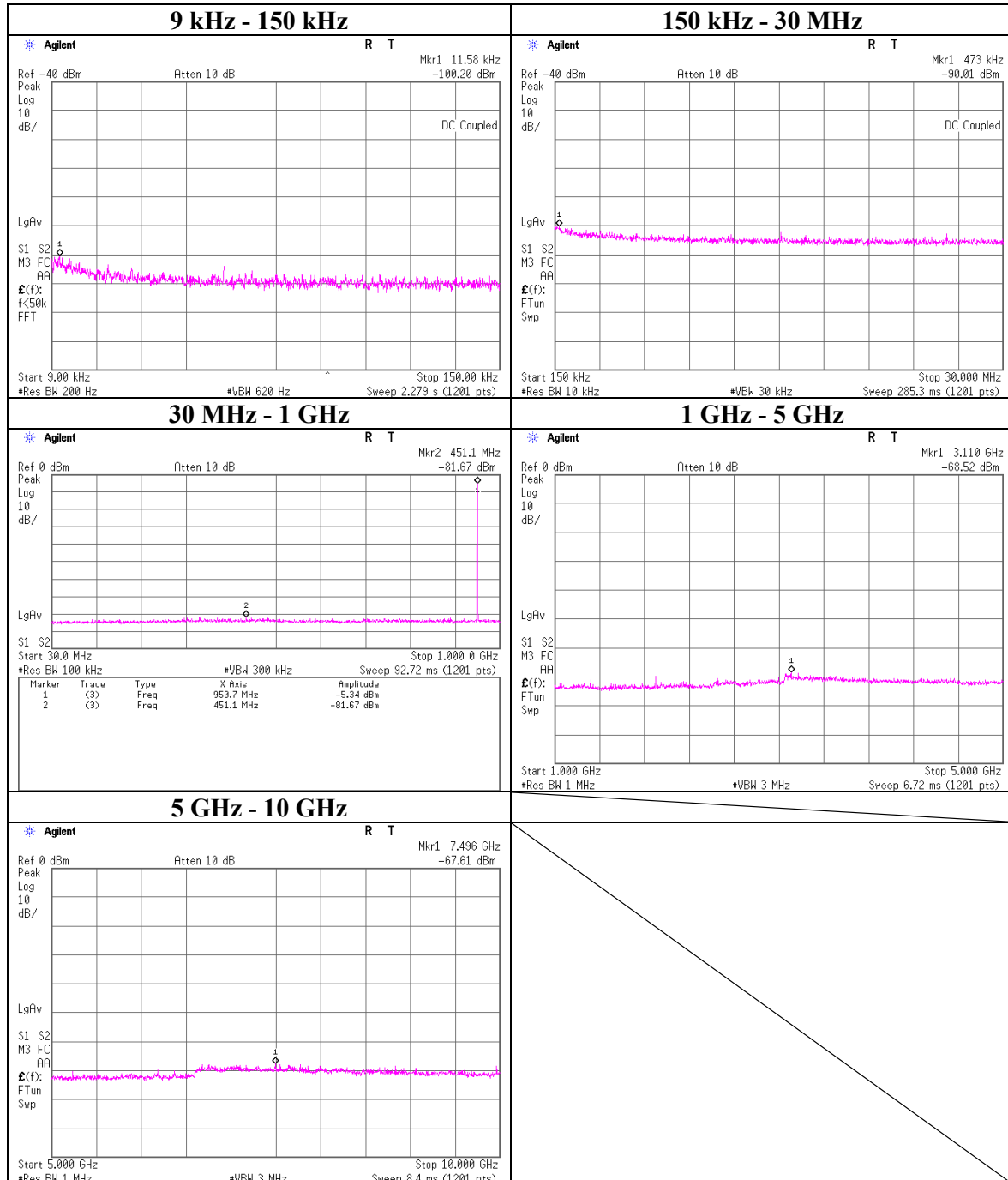
Spurious emissions at antenna terminals

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 10, 2019
Temperature/ Humidity 24 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx 941.625 MHz, 30 mW



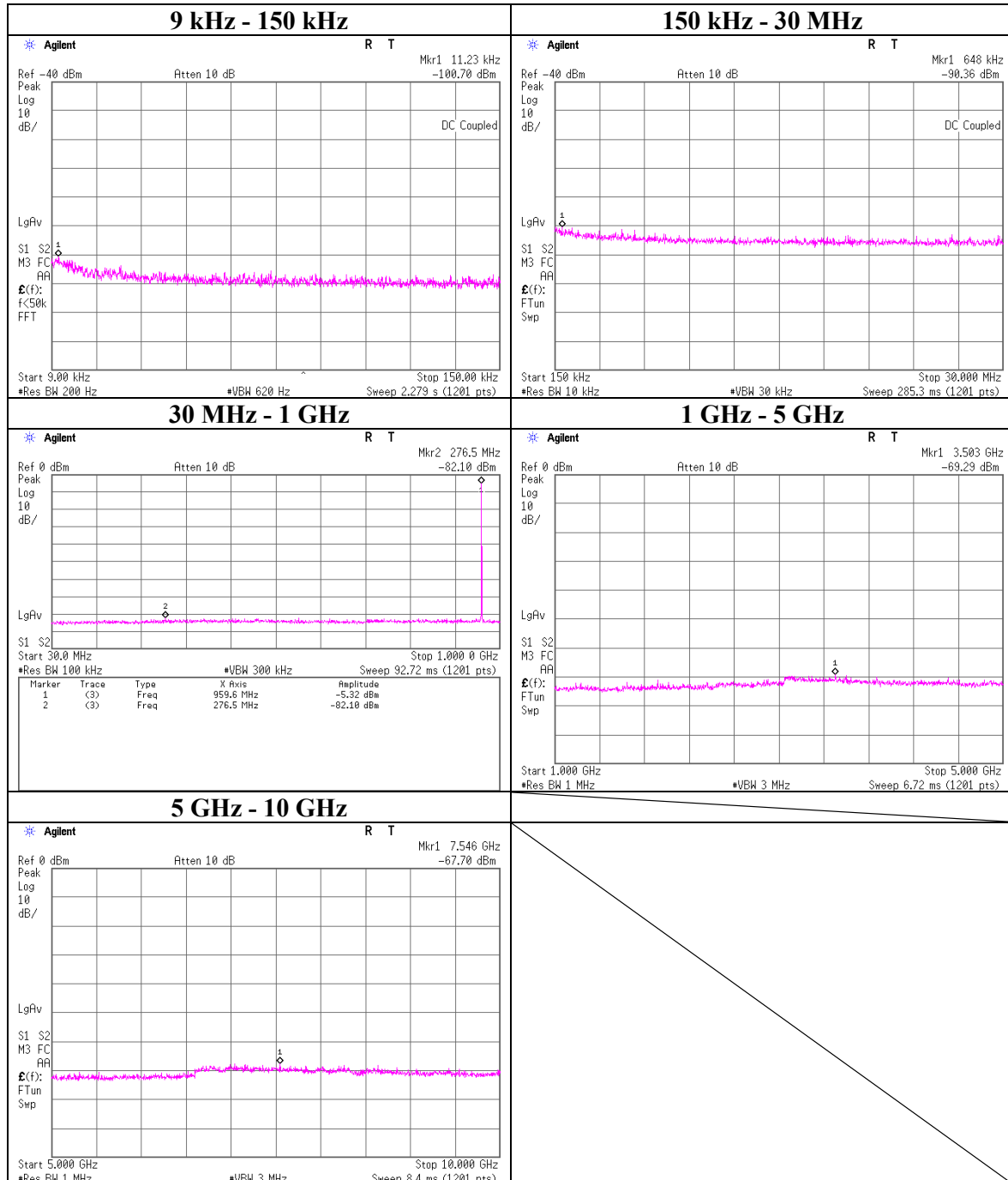
Spurious emissions at antenna terminals

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 10, 2019
Temperature/ Humidity 24 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx 950.625 MHz, 30 mW



Spurious emissions at antenna terminals

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 10, 2019
Temperature/ Humidity 24 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx 959.625 MHz, 30 mW



UL Japan, Inc.

Ise EMC Lab.

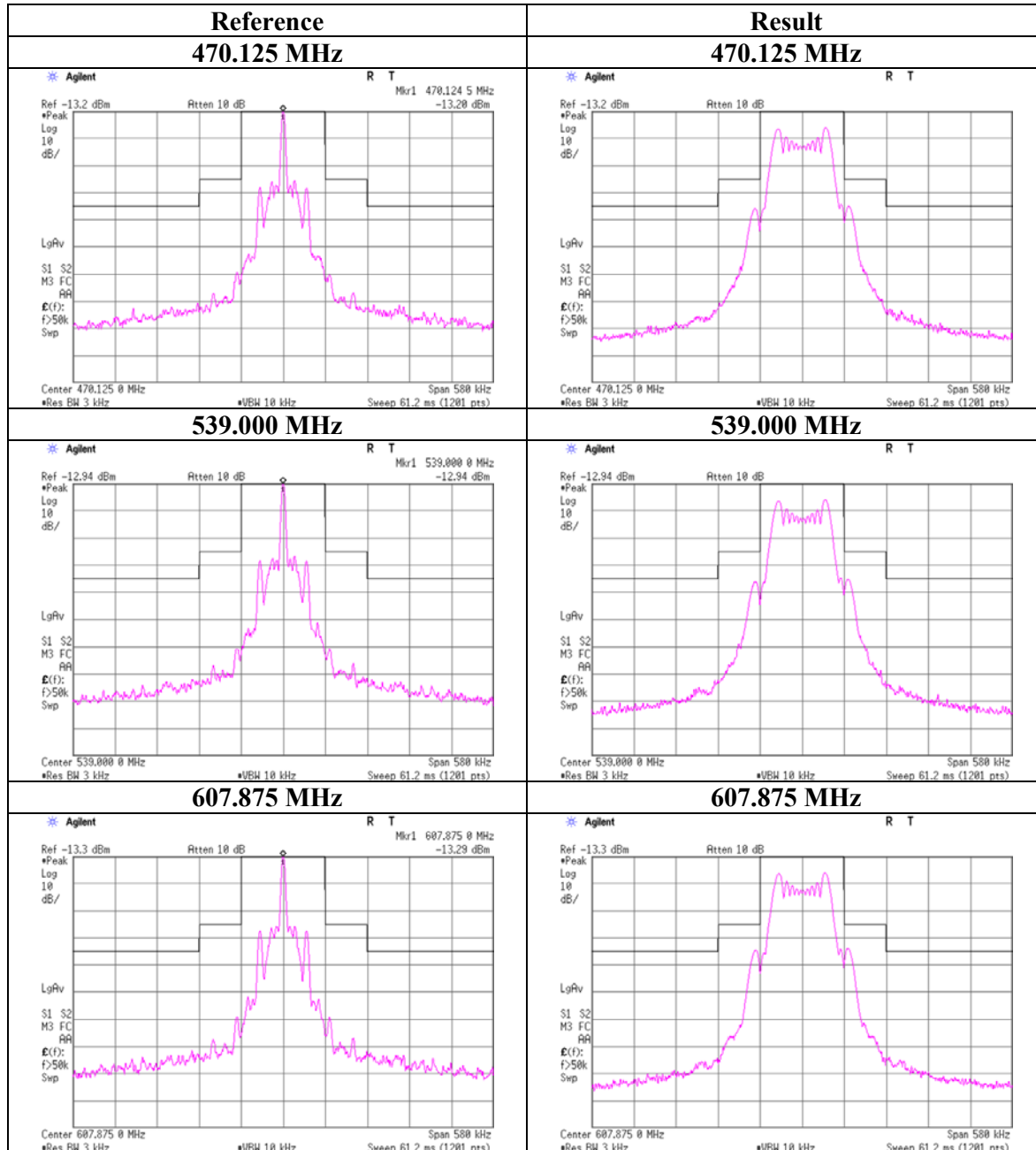
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emissions at antenna terminals
[Side band spectrum measurement]

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 10, 2019
Temperature/ Humidity 24 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx (470.125 MHz – 607.875 MHz), 5 mW

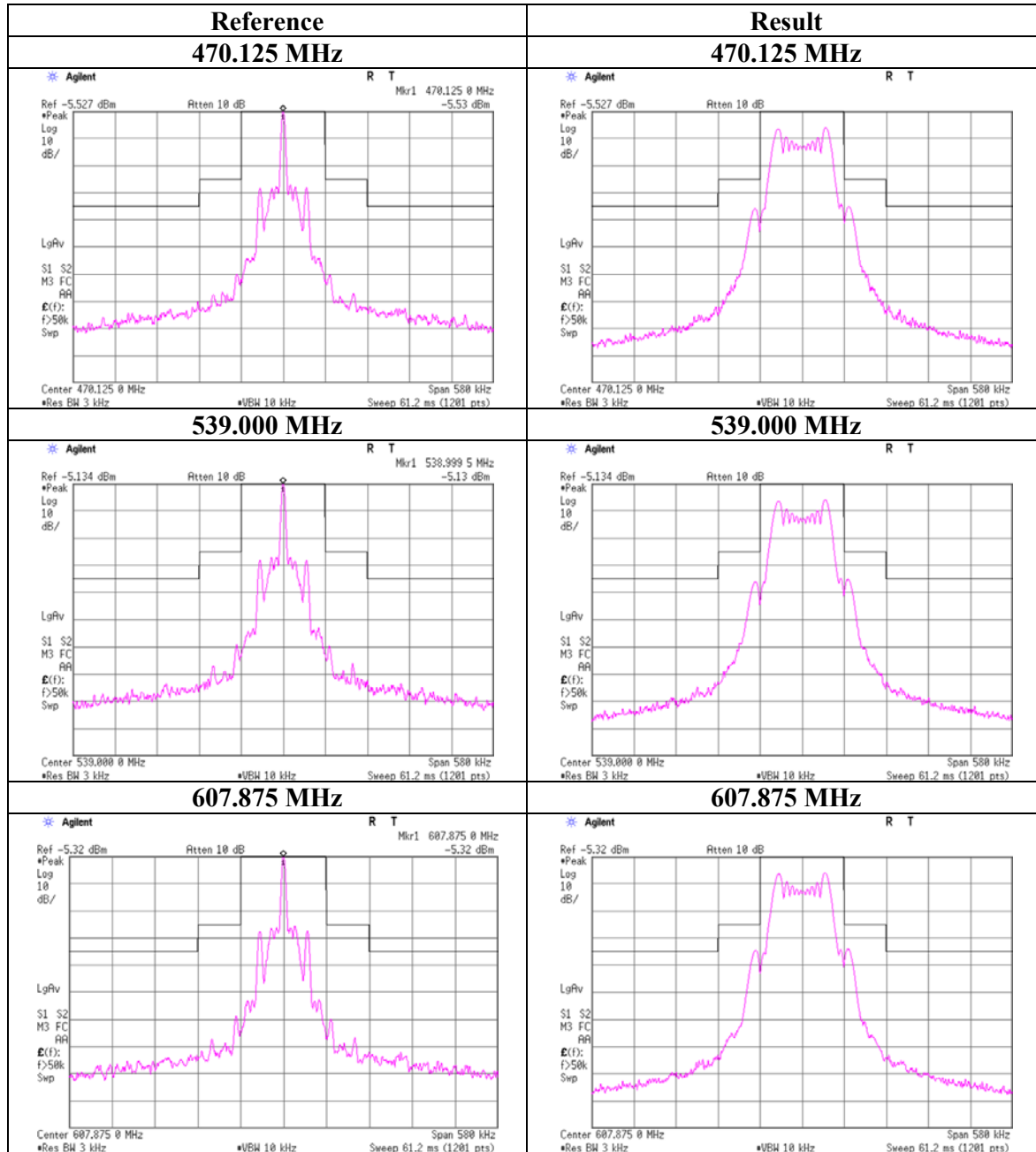


UL Japan, Inc.
Ise EMC Lab.

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

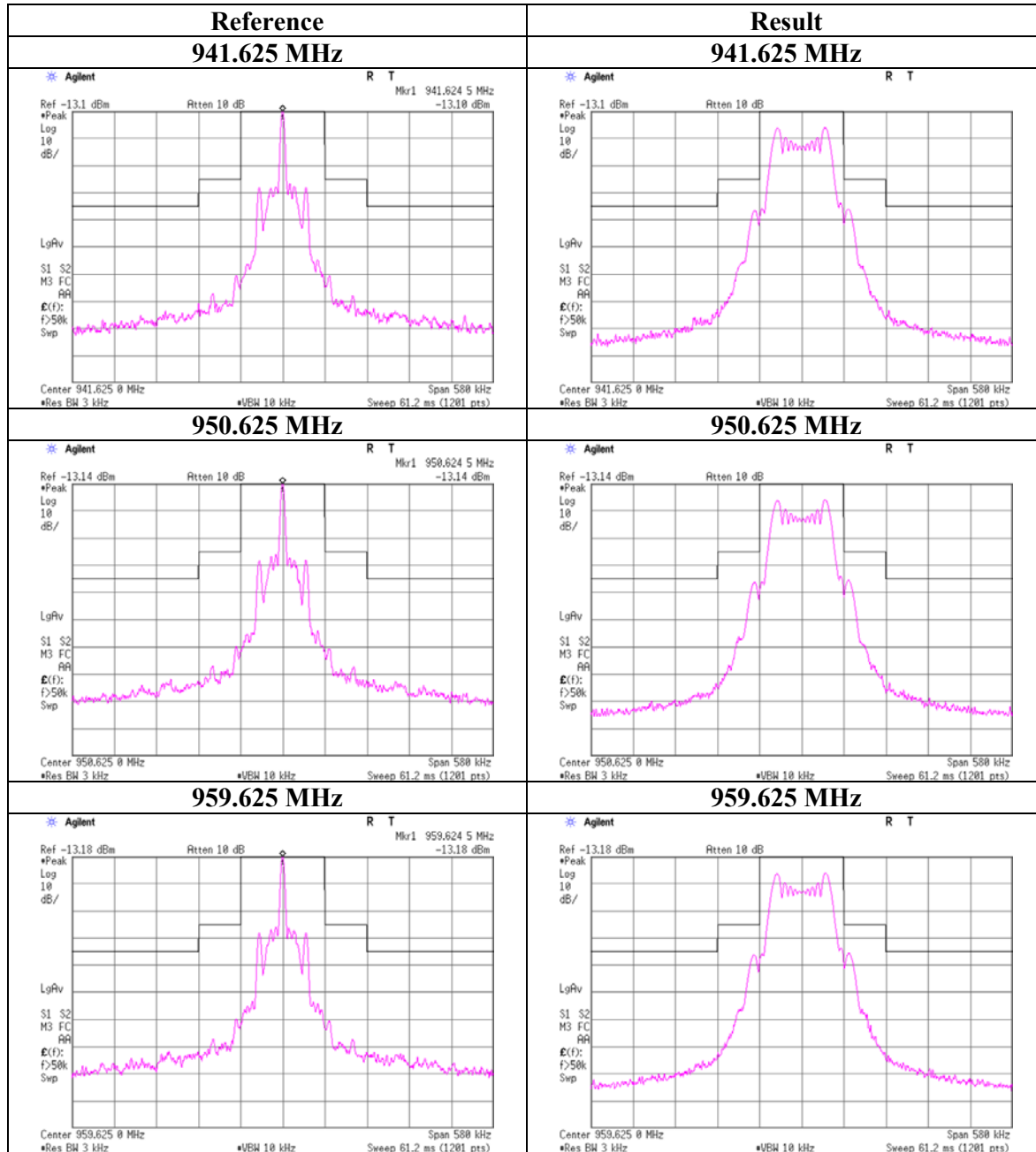
Spurious emissions at antenna terminals
[Side band spectrum measurement]

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 10, 2019
Temperature/ Humidity 24 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx (470.125 MHz – 607.875 MHz), 30 mW



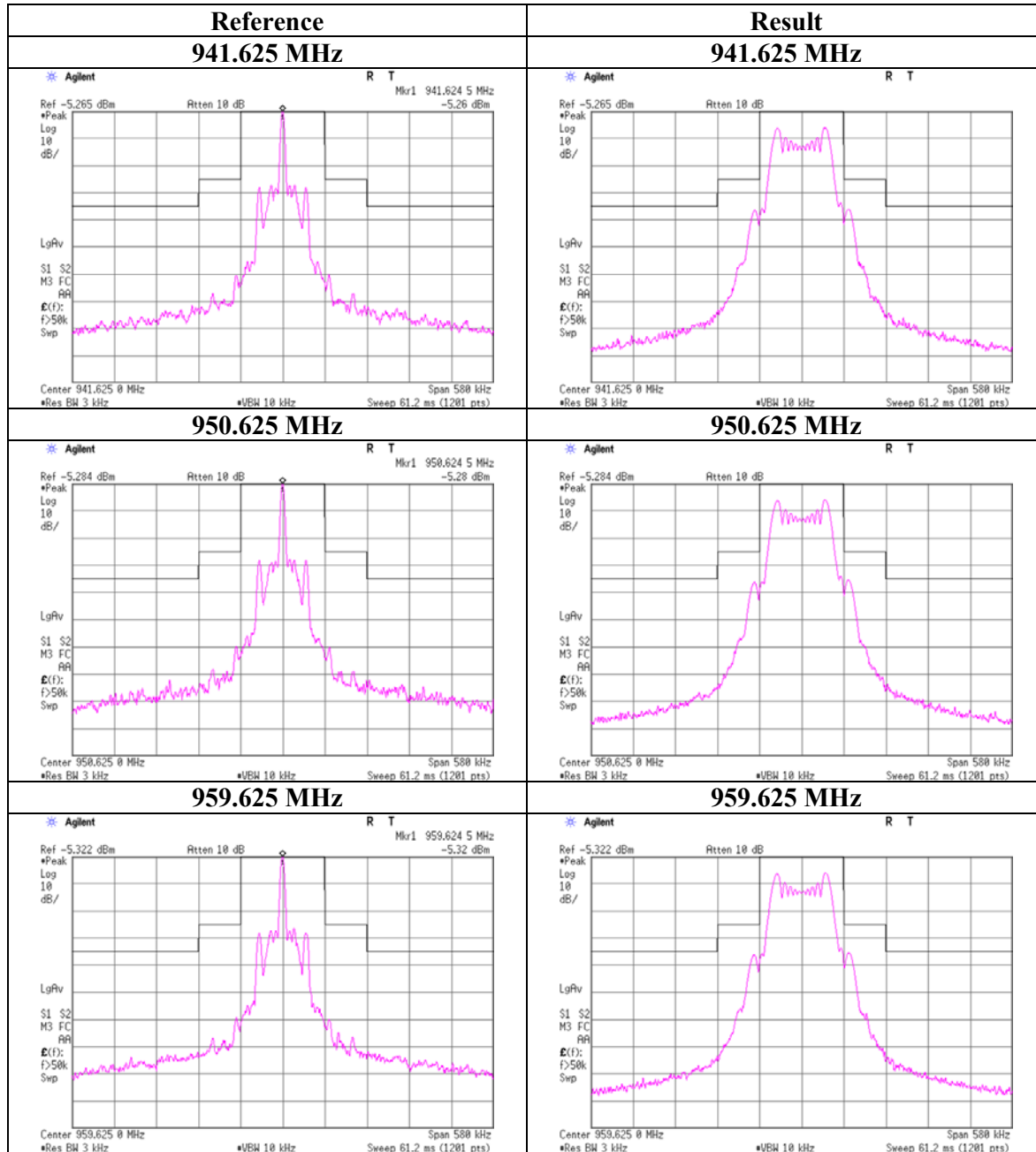
Spurious emissions at antenna terminals
[Side band spectrum measurement]

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 10, 2019
Temperature/ Humidity 24 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx (941.625 MHz – 959.625 MHz), 5 mW



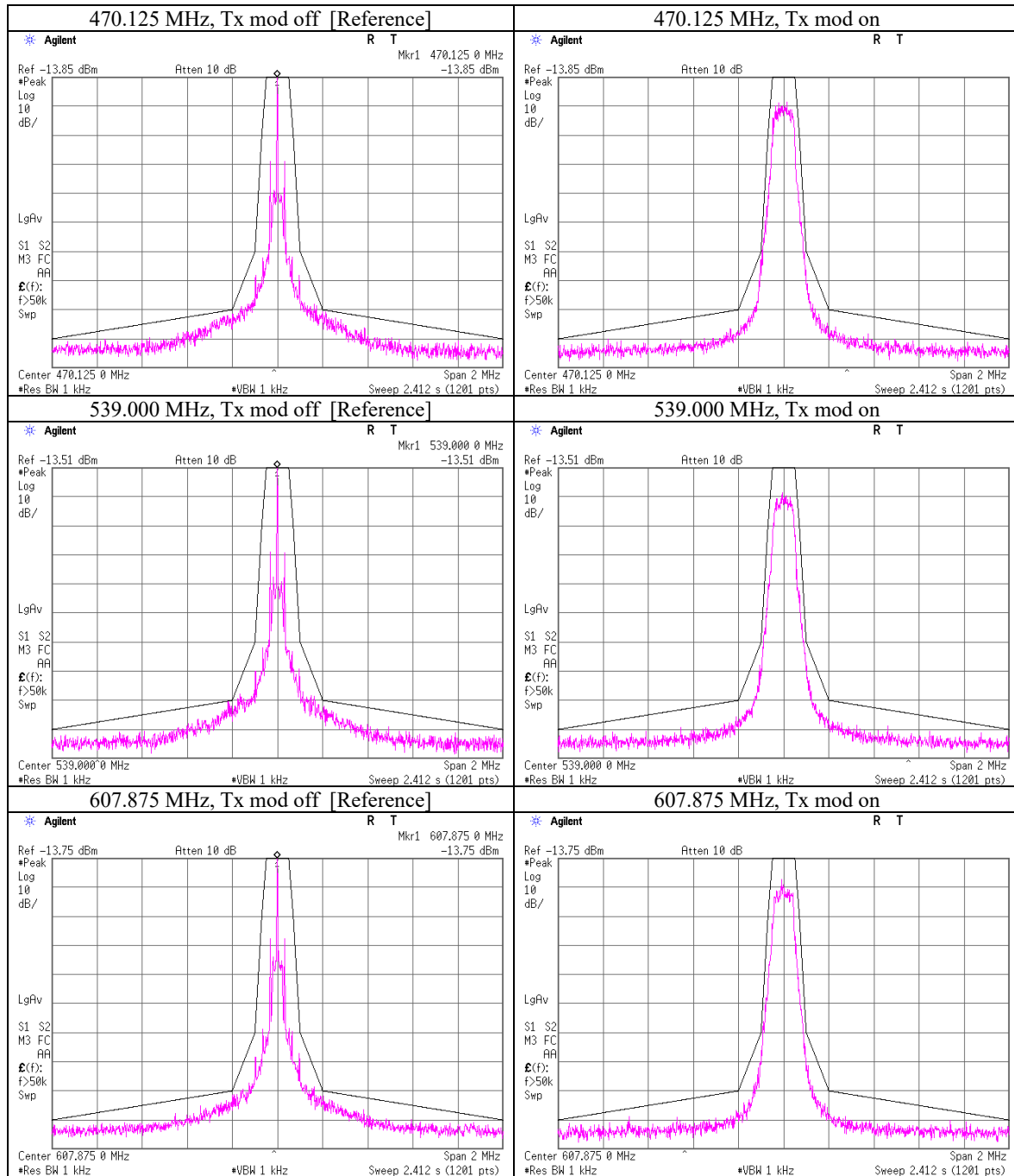
Spurious emissions at antenna terminals
[Side band spectrum measurement]

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 10, 2019
Temperature/ Humidity 24 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx (941.625 MHz – 959.625 MHz), 30 mW



Necessary bandwidth

Report No.	12890378H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	September 10, 2019
Temperature/ Humidity	24 deg. C / 49 % RH
Engineer	Akihiko Maeda
Mode	Tx (470.125 MHz – 607.875 MHz), 5 mW



UL Japan, Inc.

Ise EMC Lab.

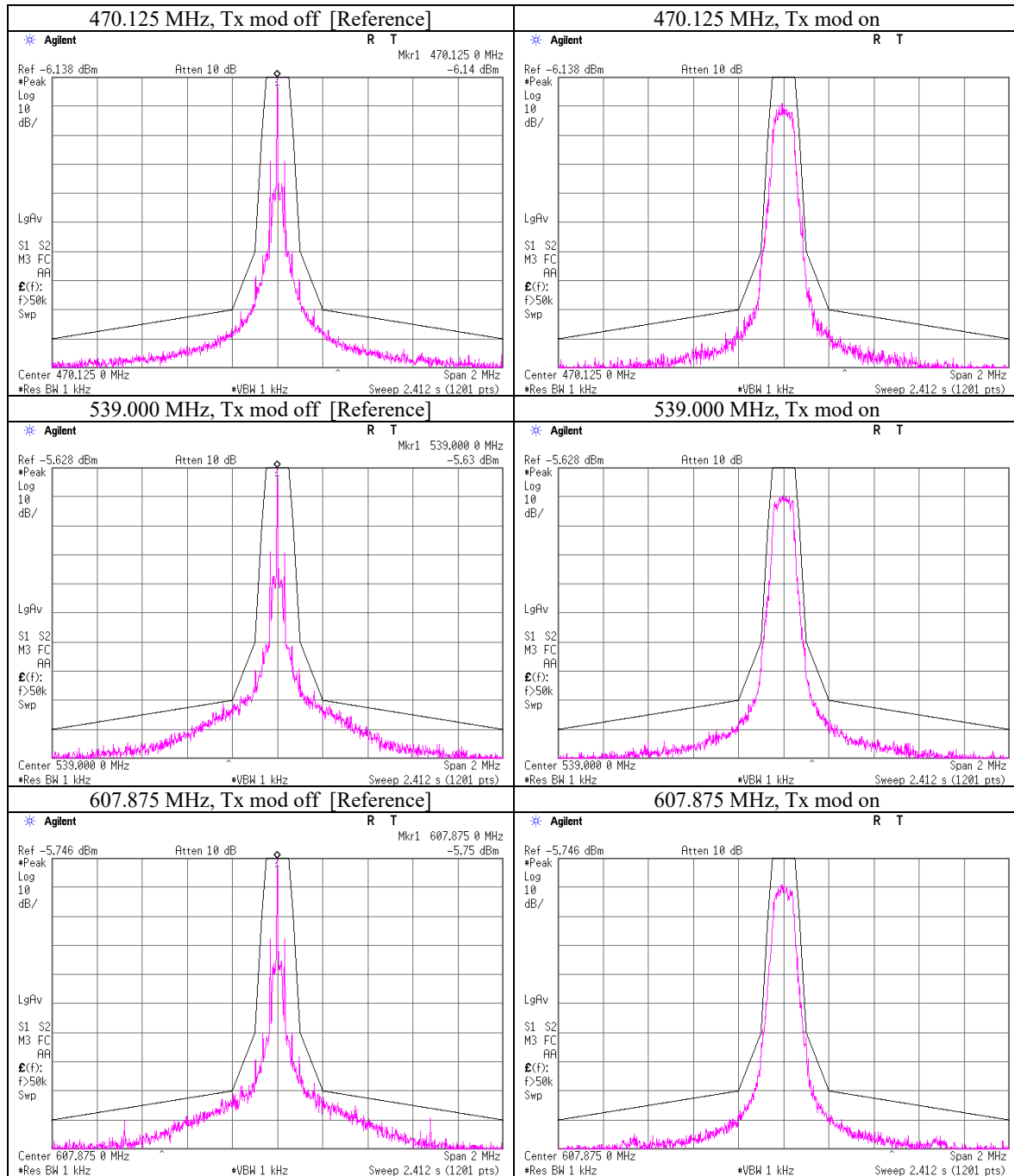
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Necessary bandwidth

Report No.	12890378H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	September 10, 2019
Temperature/ Humidity	24 deg. C / 49 % RH
Engineer	Akihiko Maeda
Mode	Tx (470.125 MHz – 607.875 MHz), 30 mW



UL Japan, Inc.

Ise EMC Lab.

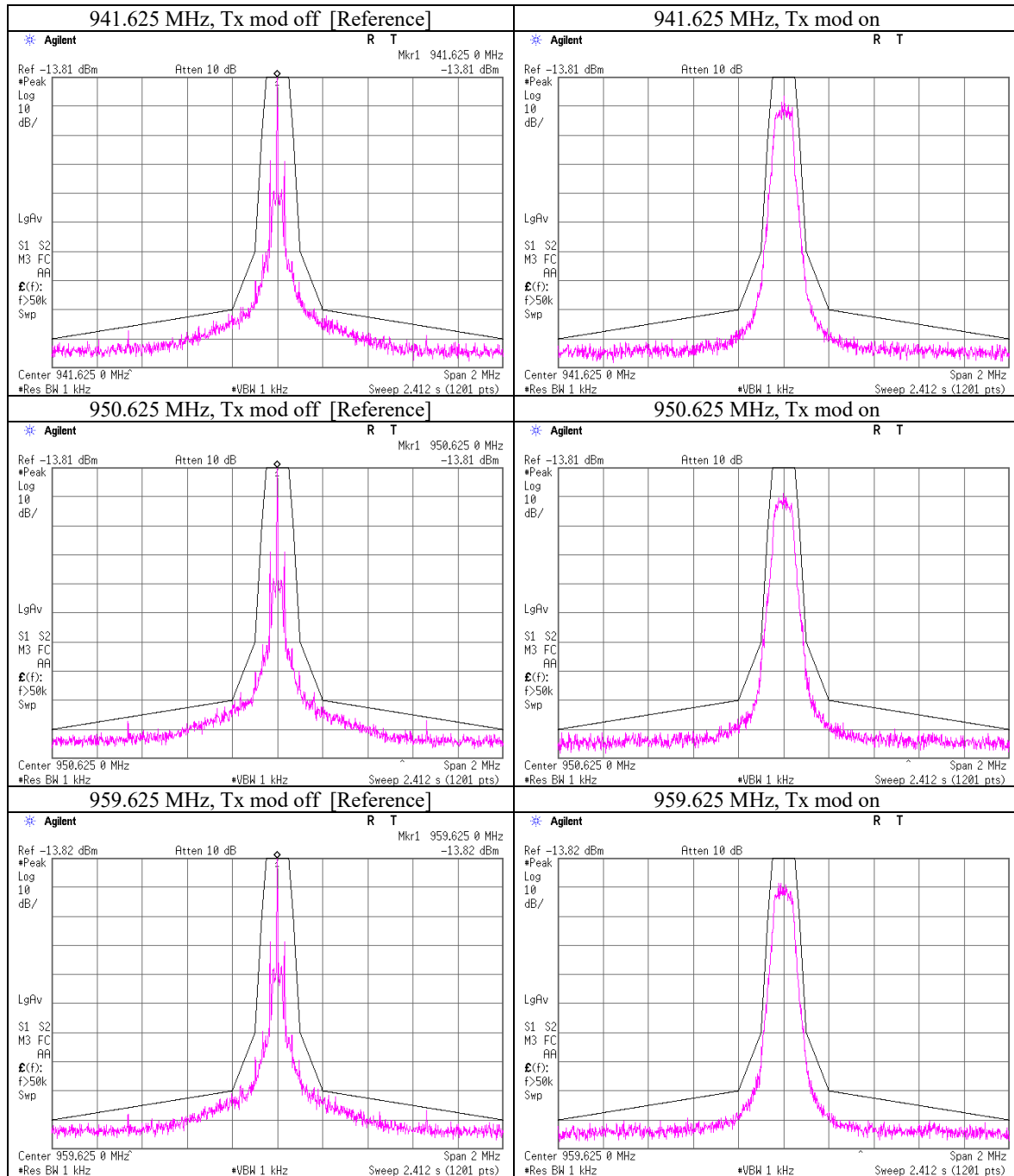
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Necessary bandwidth

Report No.	12890378H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	September 10, 2019
Temperature/ Humidity	24 deg. C / 49 % RH
Engineer	Akihiko Maeda
Mode	Tx (941.625 MHz – 959.625 MHz), 5 mW



UL Japan, Inc.

Ise EMC Lab.

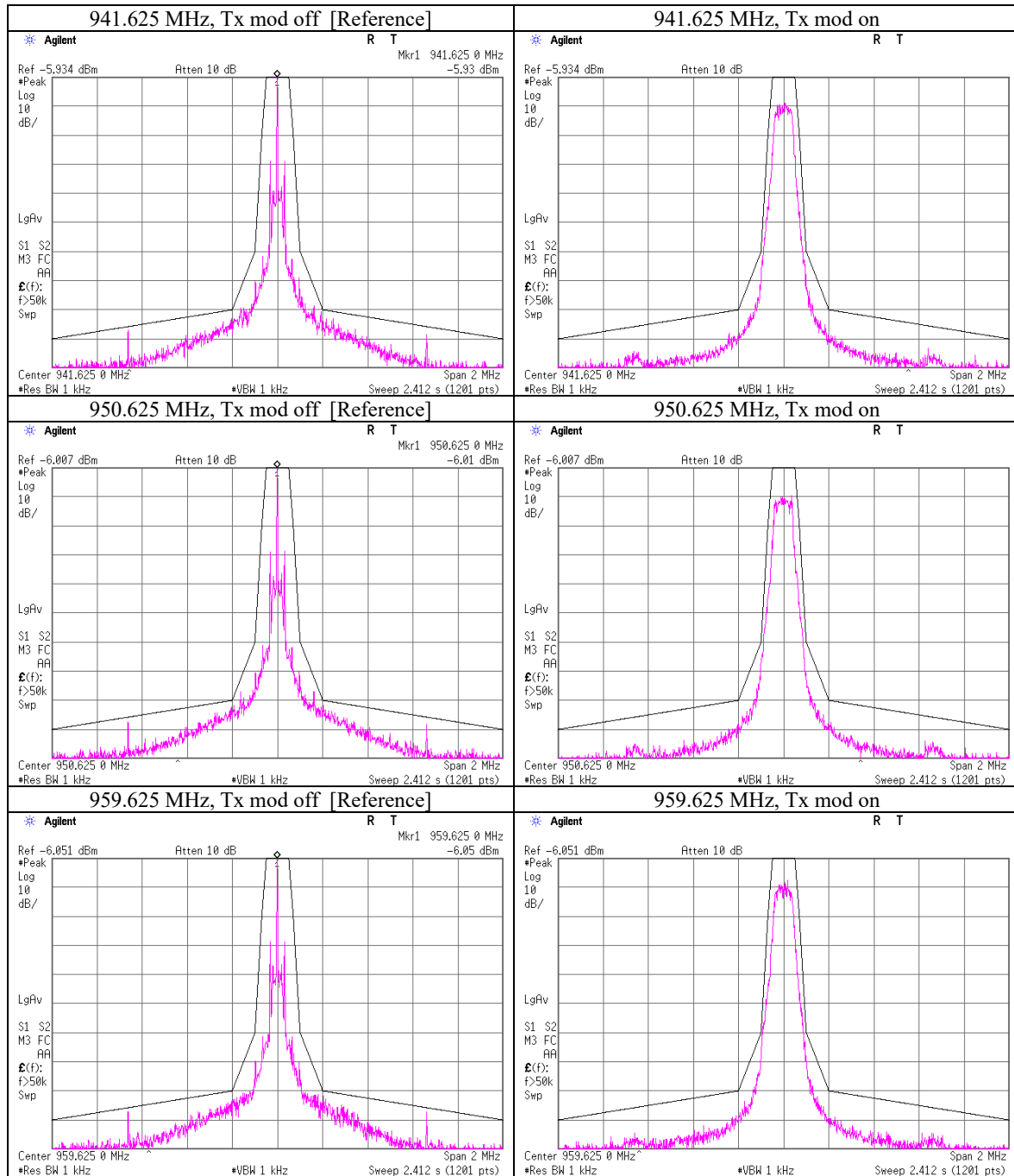
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Necessary bandwidth

Report No.	12890378H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	September 10, 2019
Temperature/ Humidity	24 deg. C / 49 % RH
Engineer	Akihiko Maeda
Mode	Tx (941.625 MHz – 959.625 MHz), 30 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

Field strength of spurious radiation

Report No. 12890378H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date August 25, 2019 August 25, 2019
Temperature / Humidity 22 deg. C / 53 % RH 22 deg. C / 58 % RH
Engineer Akihiko Maeda Koji Yamamoto
(Above 1 GHz) (Below 1 GHz)
Mode Tx 470.125 MHz

Frequency	Rx SA/TR		Tx SG		Tx	Tx	Result		Limit	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]		Cable Loss [dB]	Ant. Gain [dBi]	(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	36.9	32.4	-47.6	-50.6	5.3	-8.2	-63.2	-66.2	-36.0	27.2	30.2	170	60	100	0	
1410.38	59.3	55.6	-45.2	-49.7	3.2	7.5	-43.0	-47.5	-30.0	13.0	17.5	138	315	276	0	
1880.50	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
2350.63	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
2820.75	48.8	44.6	-52.3	-57.1	4.5	10.4	-48.5	-53.3	-30.0	18.5	23.3	105	26	233	6	
3290.88	52.2	51.5	-49.9	-50.9	4.9	11.6	-45.3	-46.3	-30.0	15.3	16.3	123	25	200	7	
3761.00	43.9	42.5	-57.0	-59.6	5.2	12.3	-52.1	-54.7	-30.0	22.1	24.7	124	150	140	187	
4231.13	44.3	45.4	-54.7	-54.3	5.6	12.3	-50.1	-49.7	-30.0	20.1	19.7	155	181	141	180	
4701.25	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

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

Rx-ANTENNA : Biconical Antenna(25 MHz - 200 MHz), Logperiodic Antenna(200 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

Tx-ANTENNA : 120 MHz tuned Dipole Antenna(30 MHz - 120 MHz), Dipole Antenna(120 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

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)

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

Field strength of spurious radiation

Report No.	12890378H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	August 25, 2019	August 25, 2019
Temperature / Humidity	22 deg. C / 53 % RH	22 deg. C / 58 % RH
Engineer	Akihiko Maeda	Koji Yamamoto
	(Above 1 GHz)	(Below 1 GHz)
Mode	Tx 539.000 MHz	

Frequency	Rx SA/TR		Tx SG		Tx	Tx	Result		Limit	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]		Cable Loss [dB]	Ant. Gain [dBi]	(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					
[MHz]					[dB]	[dBi]			[dBm]							
1078.00	50.9	46.9	-54.1	-60.5	2.8	5.6	-53.4	-59.8	-30.0	23.4	29.8	112	54	301	3	
1617.00	50.5	47.6	-55.4	-59.0	3.4	8.8	-52.2	-55.8	-30.0	22.2	25.8	144	38	263	5	
2156.00	47.9	42.6	-54.7	-59.4	3.9	10.8	-50.0	-54.7	-30.0	20.0	24.7	107	35	254	2	
2695.00	42.8	40.6	-60.2	-62.3	4.4	10.2	-56.5	-58.6	-30.0	26.5	28.6	109	130	203	7	
3234.00	49.8	47.0	-51.9	-55.3	4.9	11.9	-47.0	-50.4	-30.0	17.0	20.4	135	166	236	6	
3773.00	42.3	39.3	-58.9	-63.6	5.3	12.3	-54.0	-58.7	-30.0	24.0	28.7	138	30	243	6	
4312.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
4851.00	42.9	43.7	-54.2	-53.8	6.0	12.3	-50.1	-49.7	-30.0	20.1	19.7	141	177	153	181	
5390.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

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

Rx-ANTENNA : Biconical Antenna(25 MHz - 200 MHz), Logperiodic Antenna(200 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

Tx-ANTENNA : 120 MHz tuned Dipole Antenna(30 MHz - 120 MHz), Dipole Antenna(120 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

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.

Field strength of spurious radiation

Report No.	12890378H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	
Date	August 25, 2019	August 25, 2019	
Temperature / Humidity	22 deg. C / 53 % RH	22 deg. C / 58 % RH	
Engineer	Akihiko Maeda	Koji Yamamoto	
	(Above 1 GHz)	(Below 1 GHz)	
Mode	Tx 607.875 MHz		

Frequency	Rx SA/TR		Tx SG		Tx	Tx	Result		Limit	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]		Cable Loss [dB]	Ant. Gain [dBi]	(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	
1215.75	47.9	44.1	-58.1	-63.3	3.0	6.3	-56.9	-62.1	-30.0	26.9	32.1	132	44	303	0	
1823.63	50.5	47.2	-54.8	-59.2	3.6	9.7	-50.9	-55.3	-30.0	20.9	25.3	126	37	286	3	
2431.50	53.9	48.5	-49.4	-54.2	4.2	10.5	-45.3	-50.1	-30.0	15.3	20.1	107	33	264	2	
3039.38	63.2	62.0	-37.6	-39.7	4.7	11.1	-33.4	-35.5	-30.0	3.4	5.5	110	20	241	5	
3647.25	48.5	47.6	-51.9	-53.5	5.2	12.2	-47.0	-48.6	-30.0	17.0	18.6	120	59	183	158	
4255.13	41.4	42.7	-58.0	-57.6	5.6	12.3	-53.5	-53.1	-30.0	23.5	23.1	135	178	123	166	
4863.00	45.1	45.3	-51.6	-51.6	6.0	12.3	-47.5	-47.5	-30.0	17.5	17.5	156	161	129	186	
5470.88	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
6078.75	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

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

Rx-ANTENNA : Biconical Antenna(25 MHz - 200 MHz), Logperiodic Antenna(200 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

Tx-ANTENNA : 120 MHz tuned Dipole Antenna(30 MHz - 120 MHz), Dipole Antenna(120 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

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.	12890378H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	August 25, 2019	August 25, 2019
Temperature / Humidity	22 deg. C / 53 % RH	22 deg. C / 58 % RH
Engineer	Akihiko Maeda	Koji Yamamoto
	(Above 1 GHz)	(Below 1 GHz)
Mode	Tx 941.625 MHz	

Frequency	Rx SA/TR		Tx SG		Tx	Tx	Result		Limit	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]		Cable Loss [dB]	Ant. Gain [dBi]	(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					
1883.25	53.0	49.2	-51.7	-56.3	3.7	10.1	-47.5	-52.1	-30.0	17.5	22.1	102	34	273	4	
2824.88	61.4	57.2	-39.7	-44.1	4.5	10.4	-36.0	-40.4	-30.0	6.0	10.4	118	31	250	5	
3766.50	56.1	52.8	-44.2	-48.4	5.3	12.3	-39.3	-43.5	-30.0	9.3	13.5	138	29	228	27	
4708.13	44.1	40.7	-53.7	-57.9	5.9	11.9	-49.9	-54.1	-30.0	19.9	24.1	164	160	108	195	
5649.75	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-
6591.38	46.2	46.4	-46.5	-46.2	7.1	12.2	-43.6	-43.3	-30.0	13.6	13.3	116	162	182	164	
7533.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-
8474.63	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-
9416.25	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	-

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

Rx-ANTENNA : Biconical Antenna(25 MHz - 200 MHz), Logperiodic Antenna(200 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

Tx-ANTENNA : 120 MHz tuned Dipole Antenna(30 MHz - 120 MHz), Dipole Antenna(120 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

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.	12890378H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	August 25, 2019	August 25, 2019
Temperature / Humidity	22 deg. C / 53 % RH	22 deg. C / 58 % RH
Engineer	Akihiko Maeda	Koji Yamamoto
	(Above 1 GHz)	(Below 1 GHz)
Mode	Tx 950.625 MHz	

Frequency [MHz]	Rx SA/TR Reading [dBuV]		Tx SG Reading [dBm]		Cable Loss [dB]	Tx Ant. Gain [dBi]	Result (ERP) [dBm]		Limit (ERP) [dBm]	Margin [dB]		Horizontal Rx Ant. Height [cm]		Vertical Rx Ant. Height [cm]		Remarks
	HOR	VER	HOR	VER			HOR	VER		HOR	VER	HOR	VER	Turn Table [deg.]	Turn Table [deg.]	
1901.25	57.7	55.3	-47.0	-50.2	3.7	10.1	-42.8	-46.0	-30.0	12.8	16.0	100	34	272	0	
2851.88	59.2	55.8	-41.7	-46.0	4.5	10.1	-38.3	-42.6	-30.0	8.3	12.6	131	27	228	12	
3802.50	53.2	50.1	-46.4	-50.6	5.3	12.2	-41.6	-45.8	-30.0	11.6	15.8	148	29	242	353	
4753.13	46.2	46.1	-50.5	-51.3	6.0	12.1	-46.5	-47.3	-30.0	16.5	17.3	144	172	157	186	
5703.75	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
6654.38	46.2	46.8	-46.0	-46.1	7.2	12.0	-43.4	-43.5	-30.0	13.4	13.5	119	163	222	167	
7605.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
8555.63	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
9506.25	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

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

Rx-ANTENNA : Biconical Antenna(25 MHz - 200 MHz), Logperiodic Antenna(200 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

Tx-ANTENNA : 120 MHz tuned Dipole Antenna(30 MHz - 120 MHz), Dipole Antenna(120 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

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)

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

Field strength of spurious radiation

Report No.	12890378H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	August 25, 2019	August 25, 2019
Temperature / Humidity	22 deg. C / 53 % RH	22 deg. C / 58 % RH
Engineer	Akihiko Maeda	Koji Yamamoto
	(Above 1 GHz)	(Below 1 GHz)
Mode	Tx 959.625 MHz	

Frequency [MHz]	Rx SA/TR		Tx SG		Tx	Tx	Result		Limit	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]		Cable Loss [dB]	Ant. Gain [dBi]	(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					
1919.25	61.0	54.5	-44.1	-51.4	3.7	9.8	-40.2	-47.5	-30.0	10.2	17.5	136	42	181	0	
2878.88	58.0	54.8	-42.5	-46.5	4.6	10.6	-38.6	-42.6	-30.0	8.6	12.6	104	28	225	13	
3838.50	49.0	49.4	-50.8	-51.4	5.3	12.2	-46.1	-46.7	-30.0	16.1	16.7	124	35	100	33	
4798.13	46.8	47.4	-49.4	-49.2	6.0	11.9	-45.6	-45.4	-30.0	15.6	15.4	168	169	155	188	
5757.75	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
6717.38	47.6	48.7	-43.5	-43.6	7.2	12.0	-40.8	-40.9	-30.0	10.8	10.9	107	151	170	166	
7677.00	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
8636.63	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	
9596.25	NS	NS	-	-	-	-	-	-	-30.0	-	-	-	-	-	-	

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

Rx-ANTENNA : Biconical Antenna(25 MHz - 200 MHz), Logperiodic Antenna(200 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

Tx-ANTENNA : 120 MHz tuned Dipole Antenna(30 MHz - 120 MHz), Dipole Antenna(120 MHz - 1000 MHz), Horn Antenna(1 GHz - the tenth harmonic)

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

NS : No signal detect.

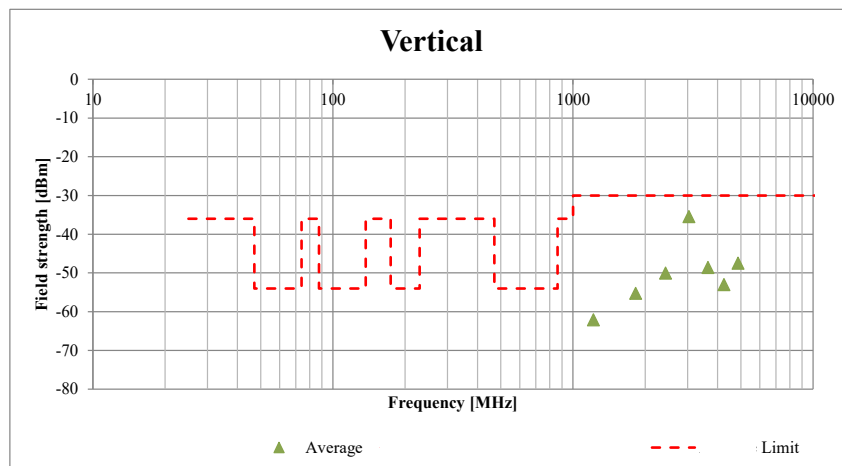
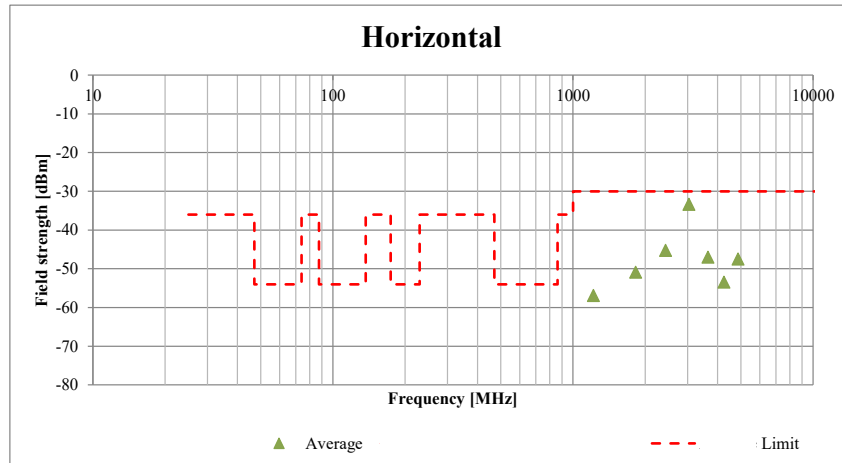
Detector : 25 MHz to 30 MHz: Spectrum Analyzer RMS Average (RBW: 10 kHz / VBW: 30 kHz)

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.

Field strength of spurious radiation
(Plot data, Worst case)

Report No.	12890378H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	August 25, 2019	August 25, 2019
Temperature / Humidity	22 deg. C / 53 % RH	22 deg. C / 58 % RH
Engineer	Akihiko Maeda (Above 1 GHz)	Koji Yamamoto (Below 1 GHz)
Mode	Tx 607.875 MHz	



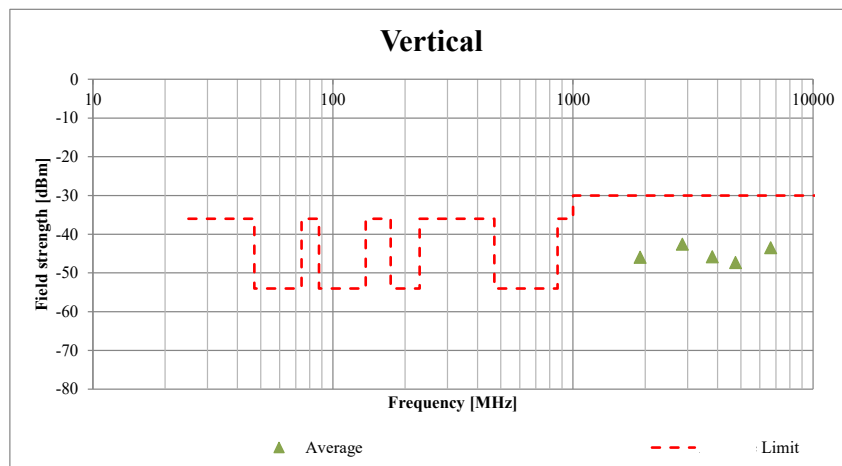
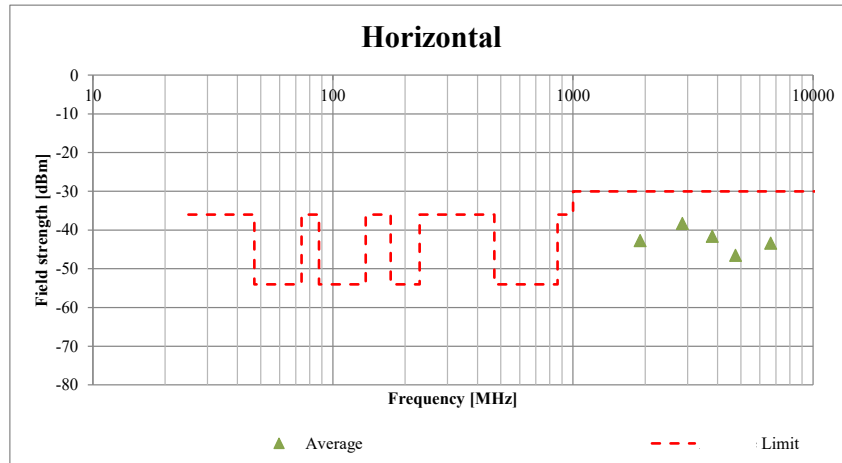
*These plots data contains sufficient number to show the trend of characteristic features for EUT.

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

Field strength of spurious radiation
(Plot data, Worst case)

Report No.	12890378H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	August 25, 2019	August 25, 2019
Temperature / Humidity	22 deg. C / 53 % RH	22 deg. C / 58 % RH
Engineer	Akihiko Maeda (Above 1 GHz)	Koji Yamamoto (Below 1 GHz)
Mode	Tx 950.625 MHz	



*These plots data contains sufficient number to show the trend of characteristic features for 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

Frequency stability

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 3, 2019 September 4, 2019
Temperature / Humidity 23 deg. C / 60 % RH 23 deg. C / 52 % RH
Engineer Ken Fujita Takumi Shimada
Mode Tx 539.000 MHz

Varying Temperature

Test condition Temp. [deg. C]	Voltage [V]	Tested frequency [MHz]	Measured frequency [MHz]	Frequency error [MHz]	Result [%]	Limit [+/- %]	Remarks
50	3.00	539.000	538.999779	-0.000221	-0.00004	0.005	
40	3.00	539.000	538.999752	-0.000248	-0.00005	0.005	
30	3.00	539.000	538.999735	-0.000265	-0.00005	0.005	
20	3.00	539.000	538.999745	-0.000255	-0.00005	0.005	
10	3.00	539.000	538.999740	-0.000260	-0.00005	0.005	
0	3.00	539.000	538.999701	-0.000299	-0.00006	0.005	
-10	3.00	539.000	538.999717	-0.000283	-0.00005	0.005	
-20	3.00	539.000	538.999711	-0.000289	-0.00005	0.005	
-30	3.00	539.000	538.999712	-0.000288	-0.00005	0.005	

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

Varying Supply Voltage

Test condition Temp. [deg. C]	Voltage [V]	Tested frequency [MHz]	Measured frequency [MHz]	Frequency error [MHz]	Result [%]	Limit [+/- %]	Remarks
20	3.00	539.000	538.999710	-0.000290	-0.00005	0.005	Battery Power
20	2.15	539.000	538.999737	-0.000263	-0.00005	0.005	Battery End Point

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

Frequency stability

Report No. 12890378H
Test place Ise EMC Lab. No.6 Measurement Room
Date September 3, 2019 September 4, 2019
Temperature / Humidity 23 deg. C / 60 % RH 23 deg. C / 52 % RH
Engineer Ken Fujita Takumi Shimada
Mode Tx 950.625 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	950.625	950.624361	-0.000639	-0.00007	-	
40	3.00	950.625	950.624369	-0.000631	-0.00007	-	
30	3.00	950.625	950.624377	-0.000623	-0.00007	-	
20	3.00	950.625	950.624438	-0.000562	-0.00006	-	
10	3.00	950.625	950.624397	-0.000603	-0.00006	-	
0	3.00	950.625	950.624340	-0.000660	-0.00007	-	
-10	3.00	950.625	950.624336	-0.000664	-0.00007	-	
-20	3.00	950.625	950.624440	-0.000560	-0.00006	-	
-30	3.00	950.625	950.624412	-0.000588	-0.00006	-	

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	950.625	950.624380	-0.000620	-0.00007	-	Battery Power
20	2.19	950.625	950.624385	-0.000615	-0.00006	-	Battery End Point

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

APPENDIX 2: Test instruments

Test Instruments

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
RE	141397	Coaxial Cable	UL Japan	-	-	06/18/2019	06/30/2020	12
RE	178648	EMI measurement program	TSJ	TEPTO-DV	-	-	-	-
RE	141412	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	06/17/2019	06/30/2020	12
RE	141896	Signal Generator	Rohde & Schwarz	SMR40	100137	06/04/2019	06/30/2020	12
RE	141297	High Pass Filter (1.1-10GHz)	TOKYO KEIKI	TF219CD1	1001	01/10/2019	01/31/2020	12
RE	141198	Biconical Antenna	Schwarzbeck	VHA9103+BBA9106	2513	08/23/2019	08/31/2020	12
RE	141264	Logperiodic Antenna (200-1000MHz)	Schwarzbeck	VUSLP9111B	9111B-189	08/23/2019	08/31/2020	12
RE	141369	Band Pass Filter	M-City	BPF0950-01	UL0002	02/06/2019	02/29/2020	12
RE	141581	MicroWave System Amplifier	AGILENT	83017A	650	10/04/2018	10/31/2019	12
RE	141514	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	1611	05/16/2019	05/31/2020	12
RE	141409	Microwave Cable (1-30GHz)	Huber+Suhner	SF103/11PC3.5-31/11PC3.5-31/8.0m	54308/3	01/10/2019	01/31/2020	12
RE	141967	Signal Generator	Rohde & Schwarz	SMT02	51400043	08/01/2019	08/31/2020	12
RE	142227	Measure	KOMELON	KMC-36	-	-	-	-
RE	141899	Spectrum Analyzer	AGILENT	E4448A	MY46180655	08/07/2019	08/31/2020	12
RE	141508	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	05/16/2019	05/31/2020	12
RE	141331	Attenuator(6dB)	TME	UFA-01	-	02/05/2019	02/29/2020	12
RE	141545	DIGITAL HiTESTER	HIOKI	3805	51201148	01/29/2019	01/31/2020	12
RE	141562	Thermo-Hygrometer	CUSTOM	CTH-201	0010	01/11/2019	01/31/2020	12
RE	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	06/28/2018	06/30/2020	24
RE	141583	Pre Amplifier	SONOMA INSTRUMENT	310	260833	02/08/2019	02/29/2020	12
RE	141454	Dipole Antenna	Schwarzbeck	UHAP	991	10/23/2018	10/31/2019	12
RE	141220	Coaxial Cable	UL Japan	-	-	07/05/2019	07/31/2020	12
AT	141809	Power Meter	ANRITSU	ML2495A	825002	05/16/2019	05/31/2020	12
AT	141561	Thermo-Hygrometer	CUSTOM	CTH-201	1401	01/11/2019	01/31/2020	12
AT	141171	Attenuator(20dB)_DC-1GHz N	Weinschel Corp	MODEL 1	BG0143	12/17/2018	12/31/2019	12
AT	141498	Microwave Counter	ADVANTEST	R5373	120100309	06/22/2019	06/30/2020	12
AT	141830	Power sensor	ANRITSU	MA2411B	738285	05/16/2019	05/31/2020	12
AT	141221	Coaxial Cable	Suhner	NRG180	-	08/09/2019	08/31/2020	12
AT	141884	Spectrum Analyzer	AGILENT	E4448A	MY44020357	03/13/2019	03/31/2020	12
AT	141500	Function Generator	AGILENT	33612A	MY53400159	01/11/2019	01/31/2020	12
AT	141430	Temperature and Humidity Chamber	TABAI ESPEC	PL-1KT	14007630	04/09/2019	04/30/2020	12
AT	141395	Coaxial Cable	UL Japan	-	-	11/13/2018	11/30/2019	12
AT	141901	Spectrum Analyzer	AGILENT	E4440A	MY48250080	10/04/2018	10/31/2019	12
AT	89845	Audio Analyzer	AUDIO PRECISION	APx525	APX2-270709	11/26/2018	11/30/2019	12
AT	142607	Video Amplifier	UNITEK ELECTROBICS INC.	UTK-200	505001	-	-	-
AT	142606	ITU-R BS, 559-2 Colored Noise Filter	UL Japan	-	-	-	-	-
AT	141174	Attenuator(20dB)(above1G Hz)	HIROSE ELECTRIC CO.,LTD.	AT-120	901247	01/10/2019	01/31/2020	12
AT	141904	Spectrum Analyzer	KEYSIGHT	N9030A	US51350215	09/25/2018	09/30/2019	12
AT	141224	Microwave Cable	Junkosha	MWX221	1409S496	03/05/2019	03/31/2020	12
AT	141897	Signal Generator	KEYSIGHT	N5182B	MY56200024	11/16/2018	11/30/2019	12

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

***Hyphens for Last Calibration Date, Calibration Due Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.**

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**