



RADIO TEST REPORT

Test Report No. : 10938940H-A-R1

Applicant : Sony Corporation
Type of Equipment : Digital Wireless Transmitter
Model No. : DWT-B01NI
FCC ID : AK8DWTB01NI
Test regulation : FCC Part 74: 2015
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 must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. This report is a revised version of 10938940H-A. 10938940H-A is replaced with this report.

Date of test: August 25 to 31, 2015

Representative test engineer:

T. Shimada

Takumi Shimada
Engineer
Consumer Technology Division

Approved by:

T. Hatahara

Takahiro Hatahara
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/

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.: 10938940H-A

[illegible]

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, Emission Bandwidth and Frequency stability	12
APPENDIX 1: Data of Radio test	13
RF power output.....	13
Emission Bandwidth.....	14
Spurious emissions at antenna terminals	17
Field strength of spurious radiation.....	26
Frequency stability	29
APPENDIX 2: Test instruments	30
APPENDIX 3: Photographs of test setup	31
Radiated Spurious Emission.....	31
Worst Case Position (Horizontal: X-axis/ Vertical:Y-axis)	32

SECTION 1: Customer information

Company Name	:	Sony EMCS Corporation
Address	:	8-4, Shiomi Kisarazu-shi, Chiba, 292-0834 Japan
Telephone Number	:	+81-438-37-4704
Facsimile Number	:	+81-438-37-4705
Contact Person	:	Youhei Hisano

***Remarks**

Sony EMCS 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 Transmitter
Model No.	:	DWT-B01NI
Serial No.	:	Refer to 4.2 in this report.
Rating	:	DC 3.0V (2 x AA batteries)
Receipt Date of Sample	:	August 8, 2015
Country of Mass-production	:	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: DWT-B01NI (referred to as the EUT in this report) is a Digital Wireless Transmitter.

General Specification

Clock frequency(ies) in the system	:	X400	8MHz
		X202	12.288MHz
		X2000	16MHz
		X801 (TCXO)	19.2MHz
		IC600, 601, 700, 720, 721	1250 – 1500kHz
		IC702	1300kHz
		IC202	600 - 1000kHz
		IC606	250kHz
		VCO802 (VCO: change by a transmission frequency)	
		(14) 470.125-541.875MHz	

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 : 192kHz, Manufacturer defined
Channel spacing : 25kHz
Frequency of operation : (14) 470.125-541.875MHz
RF power : High: 50mW, Middle: 10mW, Low: 1mW
Antenna type : 1/4 Lambda Monopole antenna (whip type)
Antenna gain : 2.14dBi
Power Supply (radio part input) : DC 2.8V, DC 3.0V, DC 3.1V
AF Specification : 40Hz – 18000Hz, Maximum input: -24dBV (MIC level, ATT 0dB)
Operating temperature : 0 deg. C to 50 deg. C

Radio Specification (RF remote part)

Radio Type : Transceiver
Modulation type : DSSS
Frequency of Operation : 2405MHz to 2480MHz
Channel spacing : 5MHz
Method of frequency generation : Synthesizer
Power Supply (radio part input) : DC 2.8V
Antenna Type : Chip antenna
Antenna Gain : -1.0dBi 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: 2015, final revised on September 8, 2015

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

* The revision on September 8, 2015 does not affect the test specification applied to the EUT.

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 A1 Section 6.1			
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 A1 Section 6.6			
Emission Bandwidth (99% 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 A1 Section 6.2			
Spurious emissions at antenna terminals	FCC: Section 2.1051	FCC: Section 74.861 (e) (6)	See data.	Complied	Conducted
	IC: RSS-210 A1 Section 6.4	IC: RSS-210 A1 Section 6.4			
Field strength of spurious radiation	FCC: Section 2.1053	FCC: Section 74.861 (e) (6)	39.2dB 1410.38MHz, Vertical See IC report.	Complied	Radiated
	IC: RSS-Gen Section 6.13 RSS-210 A1 Section 6.4	IC: RSS-210 A1 Section 6.4			
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 A1 Section 6.3			

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, TIA/EIA 603-D (2010) is also referred.

Supplied Voltage Information

This test was performed with the New Battery (DC 3.0V) and the constant voltage was supplied to the EUT during the tests.

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

EMI

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

Spurious Emission (EUT height: 0.8m) (+dB)	
Measurement Distance 3m	
30MHz-300MHz	5.5dB
300MHz-1000MHz	4.1dB
1GHz-12.75GHz	4.8dB

Power meter (+dB)
Below 1GHz
0.7dB

Antenna terminal conducted emission (+dB)		
Below 1GHz	1GHz-3GHz	3GHz-18GHz
1.5dB	1.7dB	2.8dB

Occupied bandwidth (+%)
0.1

Radiated emission test (3m)

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. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999 Facsimile : +81 596 24 8124

	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.3 Preparation room
No.3 shielded room	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.4 Preparation room
No.4 shielded room	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9m	6.0 x 6.0m	-
No.6 shielded room	-	4.0 x 4.5 x 2.7m	4.0 x 4.5 m	-
No.6 measurement room	-	4.75 x 5.4 x 3.0m	4.75 x 4.15 m	-
No.7 shielded room	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	8.0 x 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	6.2 x 4.7 x 3.0m	4.8 x 4.6m	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m 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.

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

4.1 Operating Mode(s)

Mode	Remarks
Transmitting (Tx), Power setting: 1mW	Typ. 1mW
Transmitting (Tx), Power setting: 10mW	Typ. 10mW
Transmitting (Tx), Power setting: 50mW	Typ. 50mW
*Transmitting duty was 100% on all tests.	
*Power of the EUT was set by the software as follows; Power settings: Low (1mW), Middle (10mW), High (50mW) Software: 2.00B *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	470.125MHz (Low) 506.125MHz (Mid) 541.875MHz (High)	1mW, 10mW, 50mW	Digital modulation (PN9 data packet)	
Emission Bandwidth	470.125MHz (Low) 506.125MHz (Mid) 541.875MHz (High)	1mW, 50mW	Digital modulation (PN9 data packet)	
Spurious emissions at antenna terminals	470.125MHz (Low) 506.125MHz (Mid) 541.875MHz (High)	1mW, 50mW	Digital modulation (PN9 data packet)	
Field strength of spurious radiation	470.125MHz (Low) 506.125MHz (Mid) 541.875MHz (High)	1mW, 50mW	Digital modulation (PN9 data packet)	
Frequency stability	506.125MHz (Mid)	50mW	No modulation	*1)
*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.

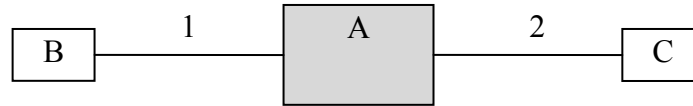
Ise EMC Lab.

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



* Cabling and setup(s) were 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 Transmitter	DWT-B01NI	81401	Sony EMCS Corporation	EUT
B	Lavalier Microphone	-	-	Sony EMCS Corporation	-
C	Keyboard	TK-FCP02G	1X000689	Elecom	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Microphone Cable	1.2	Shielded	Shielded	-
2	USB Cable	1.6	Shielded	Shielded	-

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 urethane platform of nominal size, 1.0m by 1.5m, raised 0.8m 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 3m.
The measuring antenna height was varied between 1 to 4m 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.
Spurious emissions were observed with enough time according to the test standard.
- 2) Exchanged the EUT to the Substitution Antenna, the measurement was set for the same height 0.8m as the EUT. The frequency below 1GHz of the Substitution Antenna was used the Half wave dipole Antenna, which was tuned the measured frequency in 1).
The frequency above 1GHz 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 4m 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	Below 1GHz	Above 1GHz
Instrument used	Test Receiver	Spectrum Analyzer
IF Bandwidth	RMS Average: 120kHz BW	RMS Average: RBW: 1MHz/VBW: 3MHz

- 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	: 30M-6GHz
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, Emission Bandwidth and Frequency stability

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: 50MHz BW)
Emission 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	9kHz -150kHz	200Hz	620Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz - 30MHz	10kHz	30kHz				
	30MHz – 1GHz	100kHz	300kHz				
	Above 1GHz	1MHz	3MHz				
Frequency stability	-	-	-	-	-	-	Spectrum Analyzer (Marker counter function was used)
*1) The measurement was performed with Peak and Max Hold. (Worst-case measurement)							

[Side band spectrum measurement (Emission mask)]

- Center frequency of the spectrum analyzer was set to the assigned transmitter frequency. Span was set to >500% of necessary bandwidth. Transmit the EUT, and the level of the RF power was set to a full scale reference level. This is the 0dB reference for the measurement.
- The EUT was modulated with PN9 digital audio packet.
- The resulting spectrum analyzer plot of the emission level was recorded.

[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 Radio test

RF power output (Conducted)

Test place : Ise EMC Lab. No.6 Measurement Room
Report No. : 10938940H
Date : 08/31/2015
Temperature/ Humidity : 20 deg. C / 40% RH
Engineer : Takumi Shimada
Mode : Tx

Power Setting	Channel	Freq. [MHz]	Reading Average [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result Average		Limit [mW]	Margin [dB]	Remarks
						[dBm]	[mW]			
1mW	Low	470.125	-9.77	0.00	9.92	0.15	1.035	250	23.83	
	Mid	506.125	-10.06	0.00	9.92	-0.14	0.968	250	24.12	
	High	541.875	-10.26	0.00	9.91	-0.35	0.923	250	24.33	
10mW	Low	470.125	-1.74	0.00	9.92	8.18	6.58	250	15.80	
	Mid	506.125	-1.90	0.00	9.92	8.02	6.34	250	15.96	
	High	541.875	-2.05	0.00	9.91	7.86	6.11	250	16.12	
50mW	Low	470.125	5.40	0.00	9.92	15.32	34.0	250	8.66	
	Mid	506.125	5.34	0.00	9.92	15.26	33.6	250	8.72	
	High	541.875	5.22	0.00	9.91	15.13	32.6	250	8.85	

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.

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

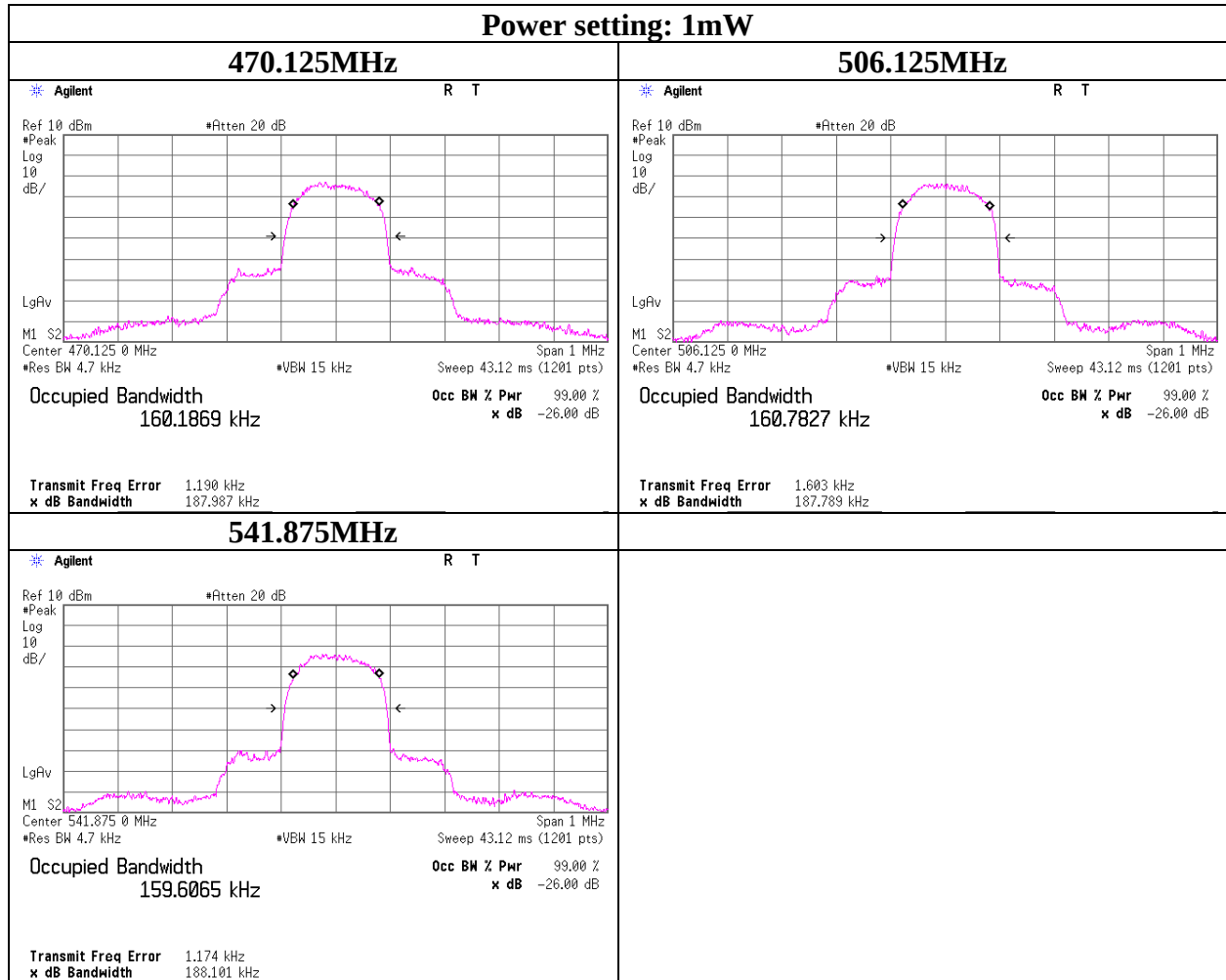
Emission Bandwidth

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 10938940H
Date 08/31/2015
Temperature/ Humidity 20 deg. C / 40% RH
Engineer Takumi Shimada
Mode Tx

Power Setting	Channel	Freq. [MHz]	99% Occupied Bandwidth [kHz]	Limit [kHz]	Margin [kHz]
1mW	Low	470.125	160.1869	200	39.8131
	Mid	506.125	160.7827	200	39.2173
	High	541.875	159.6065	200	40.3935
50mW	Low	470.125	160.4444	200	39.5556
	Mid	506.125	161.1554	200	38.8446
	High	541.875	160.4091	200	39.5909

Emission Bandwidth

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	10938940H
Date	08/31/2015
Temperature/ Humidity	20 deg. C / 40% RH
Engineer	Takumi Shimada
Mode	Tx



UL Japan, Inc.

Ise EMC Lab.

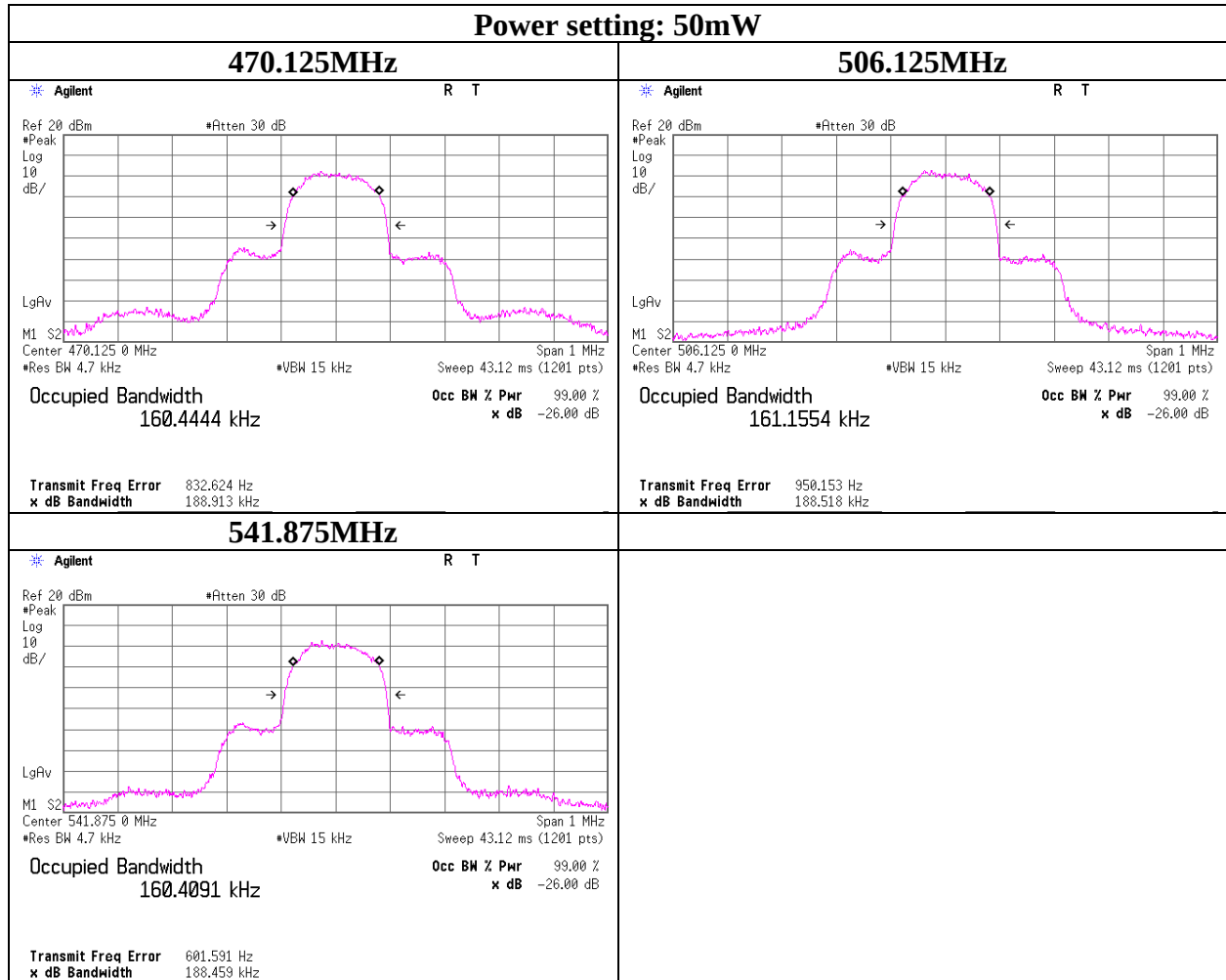
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Emission Bandwidth

Test place	Ise EMC Lab. No.6 Measurement Room
Report No.	10938940H
Date	08/31/2015
Temperature/ Humidity	20 deg. C / 40% RH
Engineer	Takumi Shimada
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

Spurious emissions at antenna terminals

Test place : Ise EMC Lab. No.6 Measurement Room
Report No. : 10938940H
Date : 08/31/2015
Temperature/ Humidity : 20 deg. C / 40% RH
Engineer : Takumi Shimada
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]					
1mW	Low	470.125	0.01264	-98.23	0.00	9.83	-88.40	-13	75.40
			0.2	-90.13	0.00	9.82	-80.31	-13	67.31
			940.2	-78.65	0.00	9.90	-68.75	-13	55.75
			3440	-69.70	0.00	10.05	-59.65	-13	46.65
	Mid	506.125	0.00959	-96.39	0.00	9.83	-86.56	-13	73.56
			0.175	-89.53	0.00	9.82	-79.71	-13	66.71
			3240	-69.99	0.00	10.04	-59.95	-13	46.95
			6738	-68.89	0.00	10.10	-58.79	-13	45.79
	High	541.875	0.00982	-98.14	0.00	9.83	-88.31	-13	75.31
			1.294	-89.86	0.00	9.82	-80.04	-13	67.04
			3083	-69.80	0.00	10.07	-59.73	-13	46.73
			8992	-69.17	0.00	10.18	-58.99	-13	45.99
50mW	Low	470.125	0.12803	-79.63	0.00	9.82	-69.81	-13	56.81
			0.15	-77.90	0.00	9.82	-68.08	-13	55.08
			0.9402	-65.23	0.00	9.82	-55.41	-13	42.41
			3517	-60.18	0.00	10.06	-50.12	-13	37.12
	Mid	506.125	0.12803	-80.22	0.00	9.82	-70.40	-13	57.40
			0.15	-78.93	0.00	9.82	-69.11	-13	56.11
			3173	-60.19	0.00	10.04	-50.15	-13	37.15
			6683	-58.63	0.00	10.10	-48.53	-13	35.53
	High	541.875	0.12803	-80.57	0.00	9.82	-70.75	-13	57.75
			0.15	-78.77	0.00	9.82	-68.95	-13	55.95
			1083	-59.43	0.00	10.01	-49.42	-13	36.42
			6804	-58.84	0.00	10.11	-48.73	-13	35.73

Calculation formula:

Result = Reading + Cable Loss + Attenuator Loss

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

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

UL Japan, Inc.

Ise EMC Lab.

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

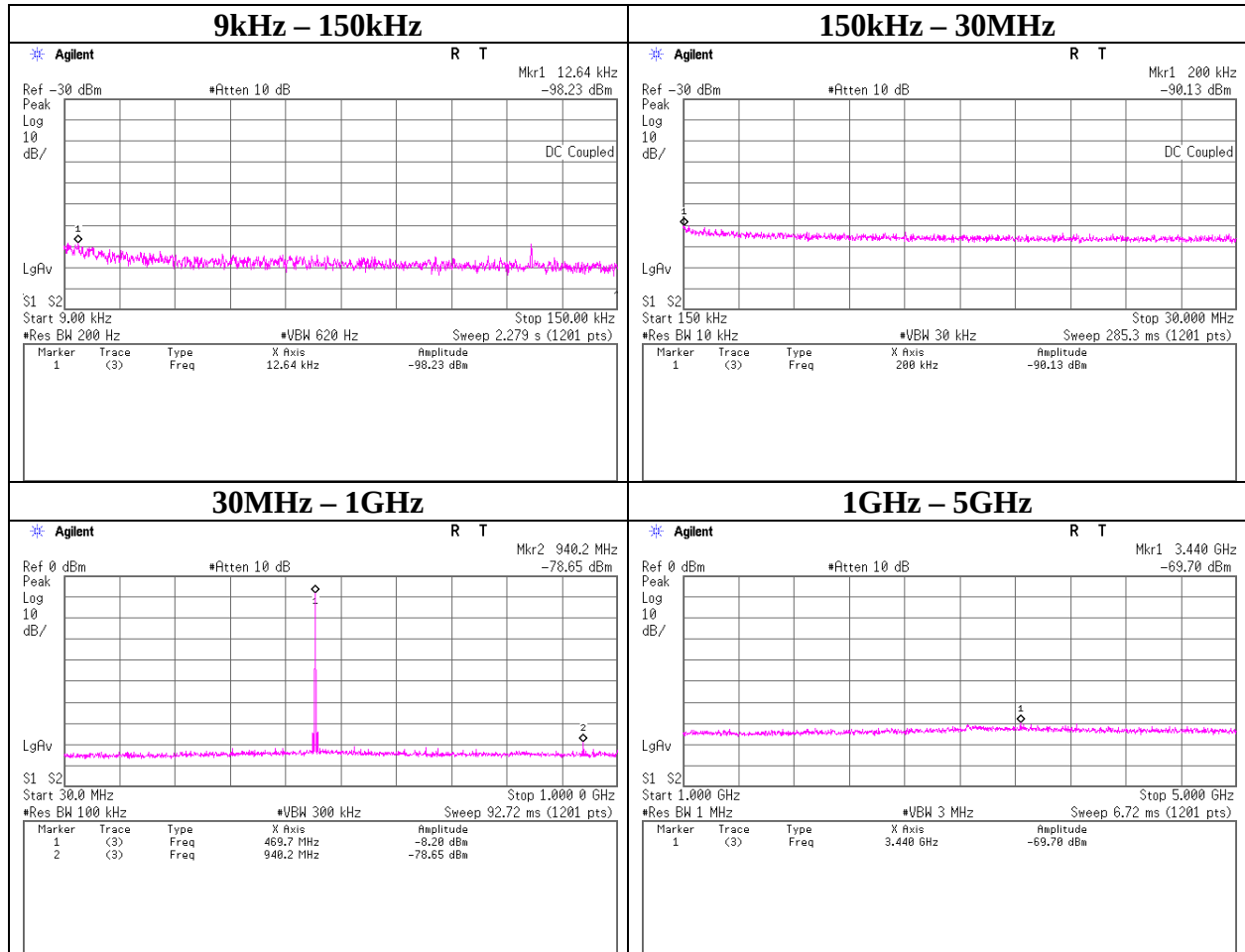
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emissions at antenna terminals

Test place
Report No.
Date
Temperature/ Humidity
Engineer
Mode

Ise EMC Lab. No.6 Measurement Room
10938940H
08/31/2015
20 deg. C / 40% RH
Takumi Shimada
Tx 470.125MHz, 1mW



UL Japan, Inc.

Ise EMC Lab.

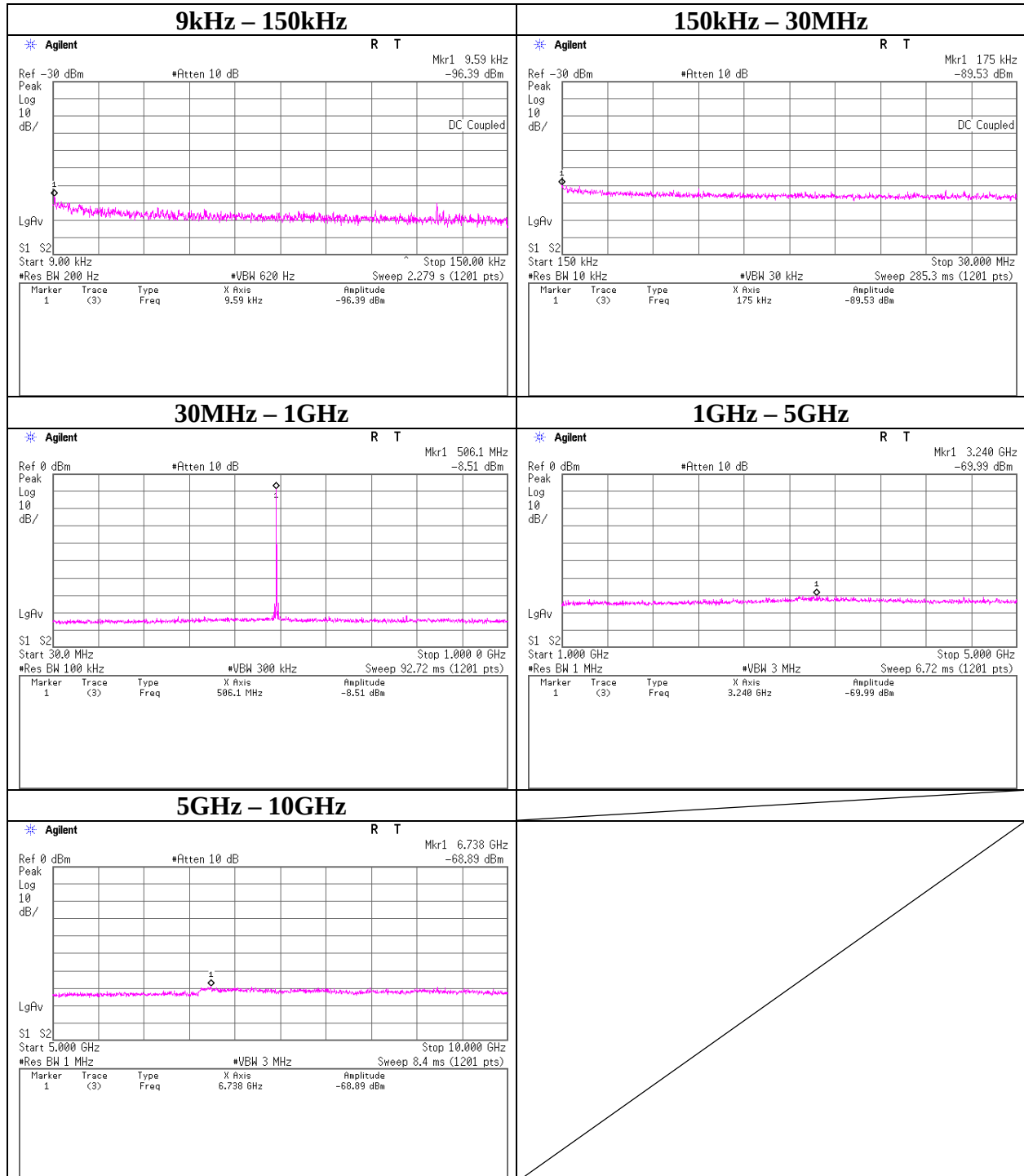
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

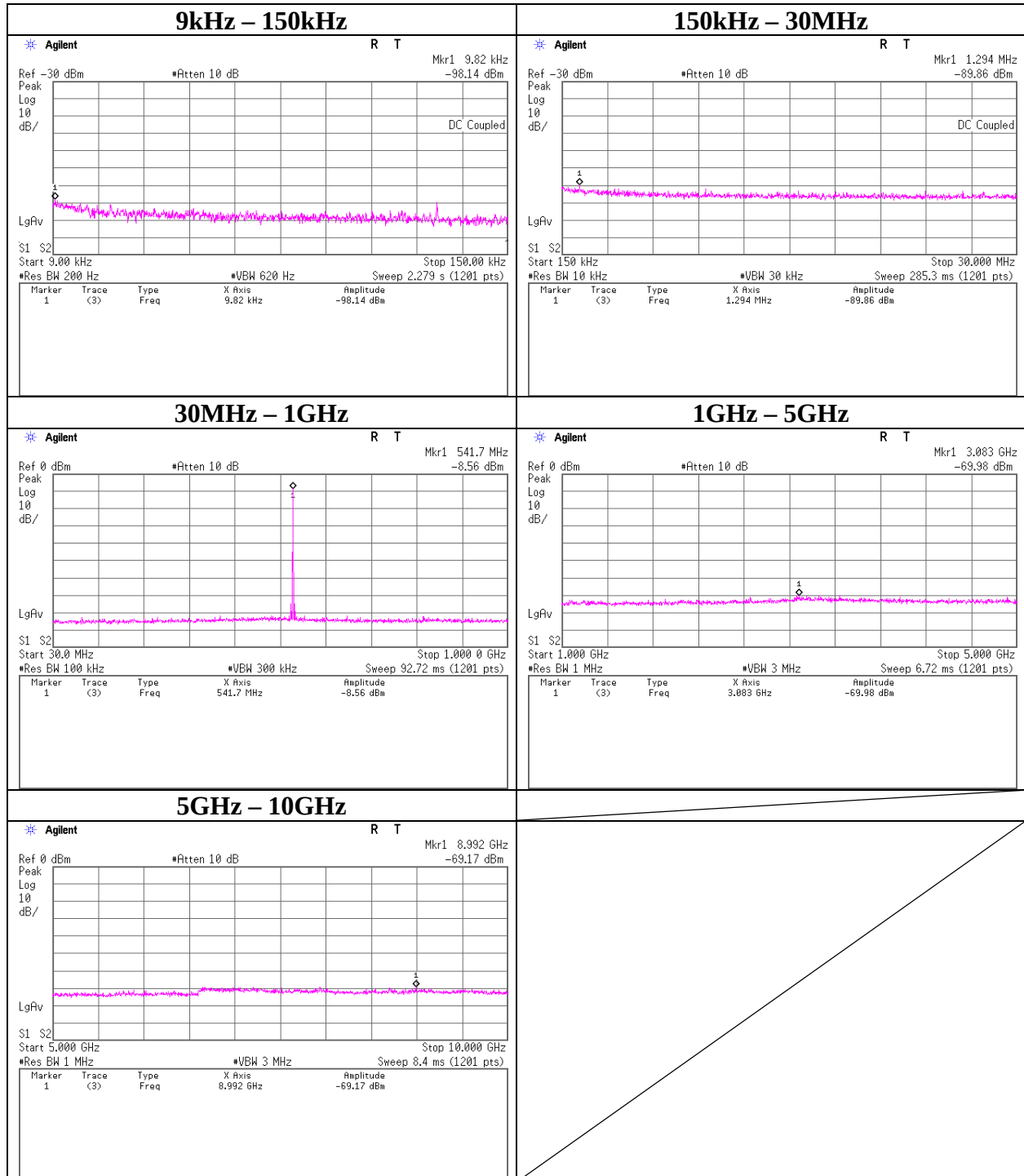
Spurious emissions at antenna terminals

Test place : Ise EMC Lab. No.6 Measurement Room
Report No. : 10938940H
Date : 08/31/2015
Temperature/ Humidity : 20 deg. C / 40% RH
Engineer : Takumi Shimada
Mode : Tx 506.125MHz, 1mW



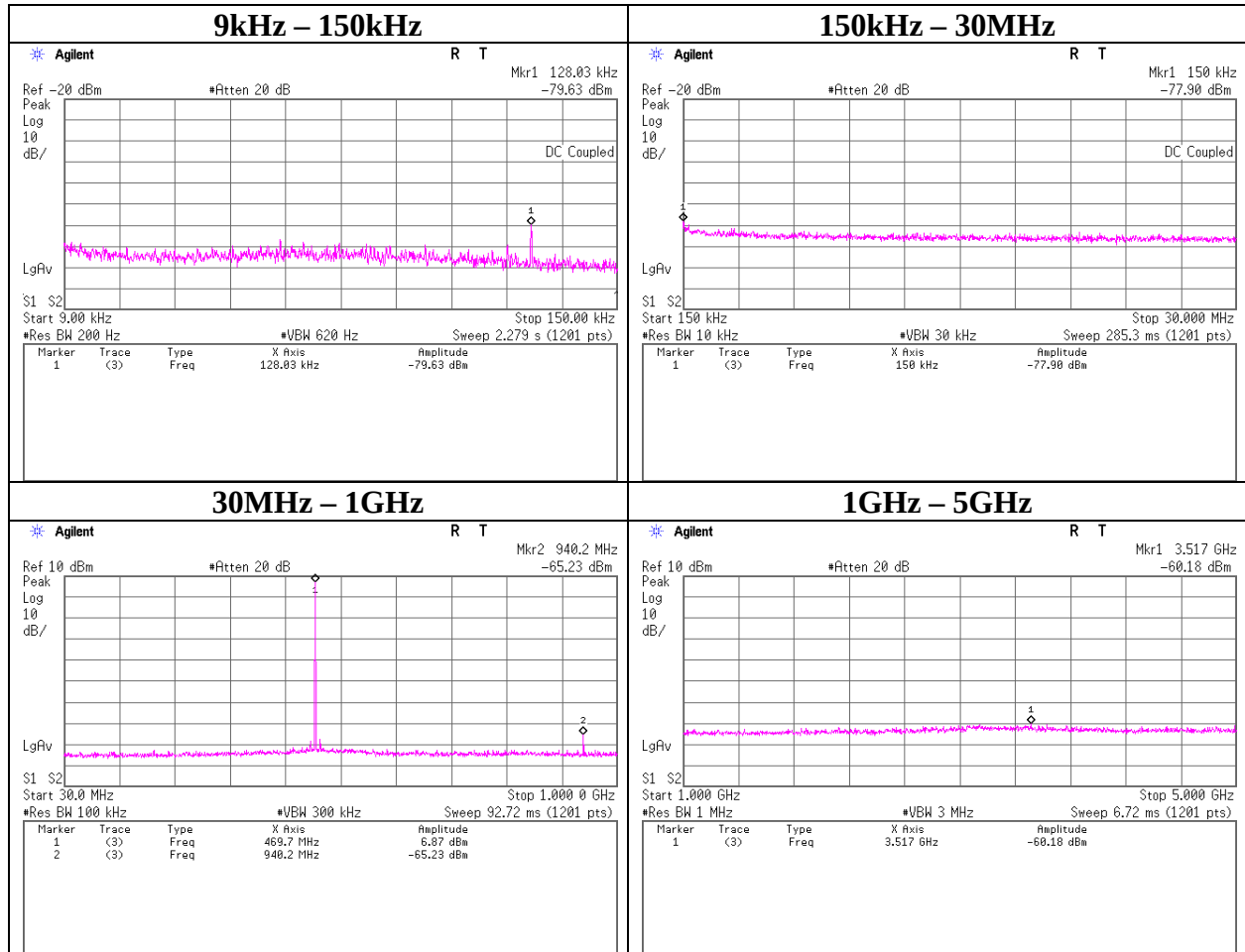
Spurious emissions at antenna terminals

Test place Ise EMC Lab. No.6 Measurement Room
Report No. 10938940H
Date 08/31/2015
Temperature/ Humidity 20 deg. C / 40% RH
Engineer Takumi Shimada
Mode Tx 541.875MHz, 1mW



Spurious emissions at antenna terminals

Test place : Ise EMC Lab. No.6 Measurement Room
Report No. : 10938940H
Date : 08/31/2015
Temperature/ Humidity : 20 deg. C / 40% RH
Engineer : Takumi Shimada
Mode : Tx 470.125MHz, 50mW



UL Japan, Inc.

Ise EMC Lab.

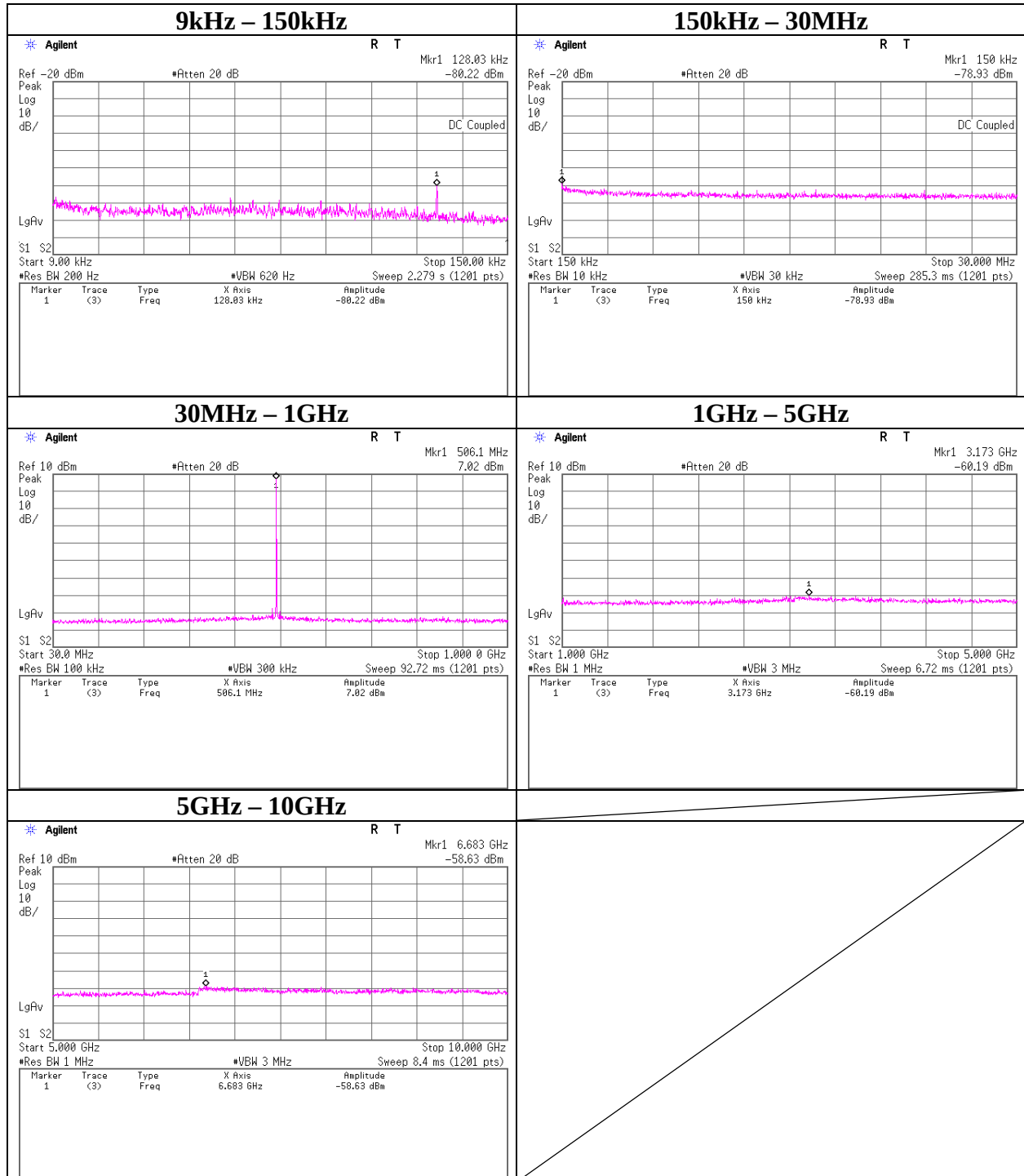
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

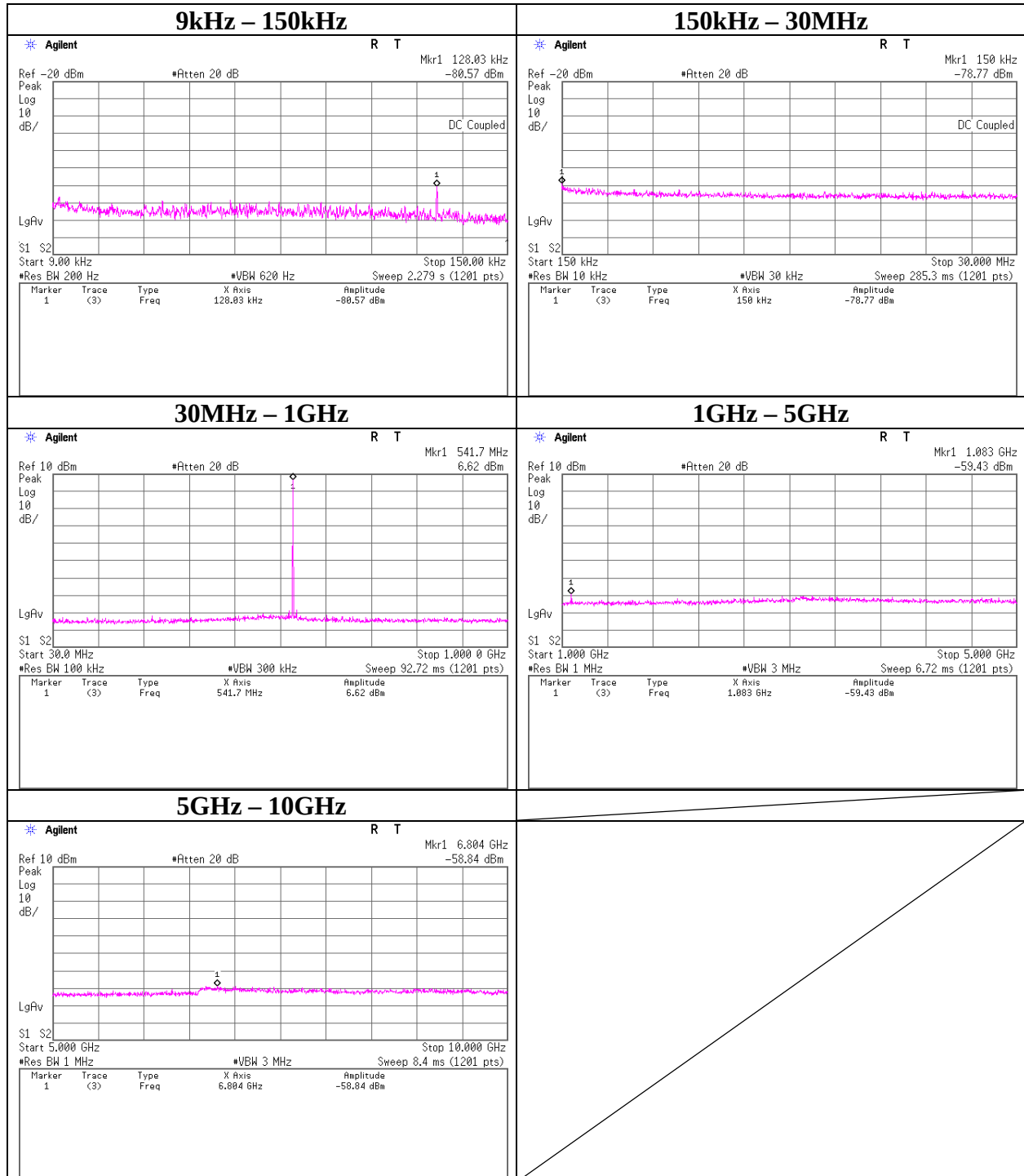
Spurious emissions at antenna terminals

Test place : Ise EMC Lab. No.6 Measurement Room
Report No. : 10938940H
Date : 08/31/2015
Temperature/ Humidity : 20 deg. C / 40% RH
Engineer : Takumi Shimada
Mode : Tx 506.125MHz, 50mW



Spurious emissions at antenna terminals

Test place : Ise EMC Lab. No.6 Measurement Room
Report No. : 10938940H
Date : 08/31/2015
Temperature/ Humidity : 20 deg. C / 40% RH
Engineer : Takumi Shimada
Mode : Tx 541.875MHz, 50mW



Spurious emissions at antenna terminals

Test place

Report No.

Date

Temperature/ Humidity

Engineer

Mode

Ise EMC Lab. No.6 Measurement Room

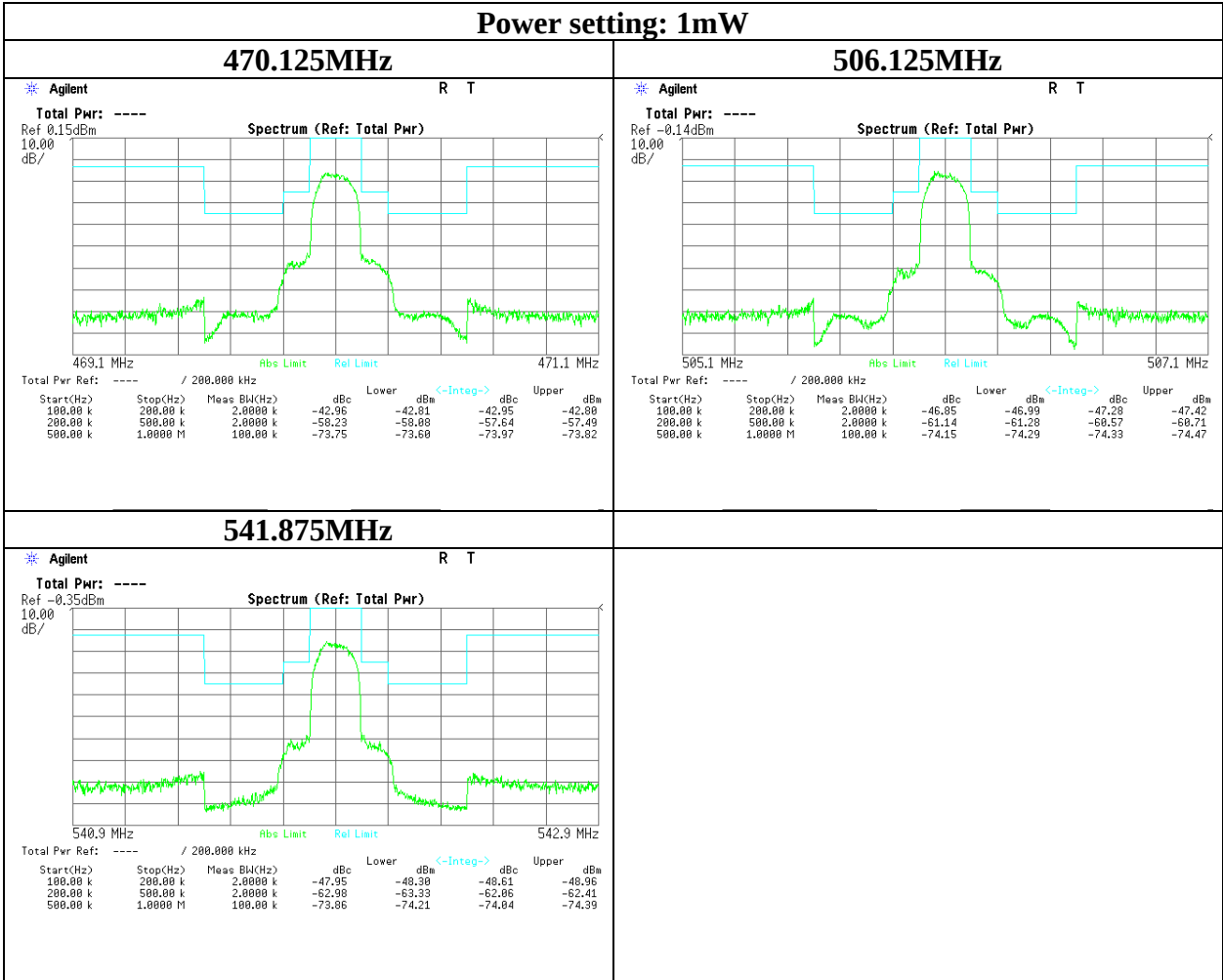
10938940H

08/31/2015

20 deg. C / 40% RH

Takumi Shimada

Tx



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

Spurious emissions at antenna terminals

Test place

Report No.

Date

Temperature/ Humidity

Engineer

Mode

Ise EMC Lab. No.6 Measurement Room

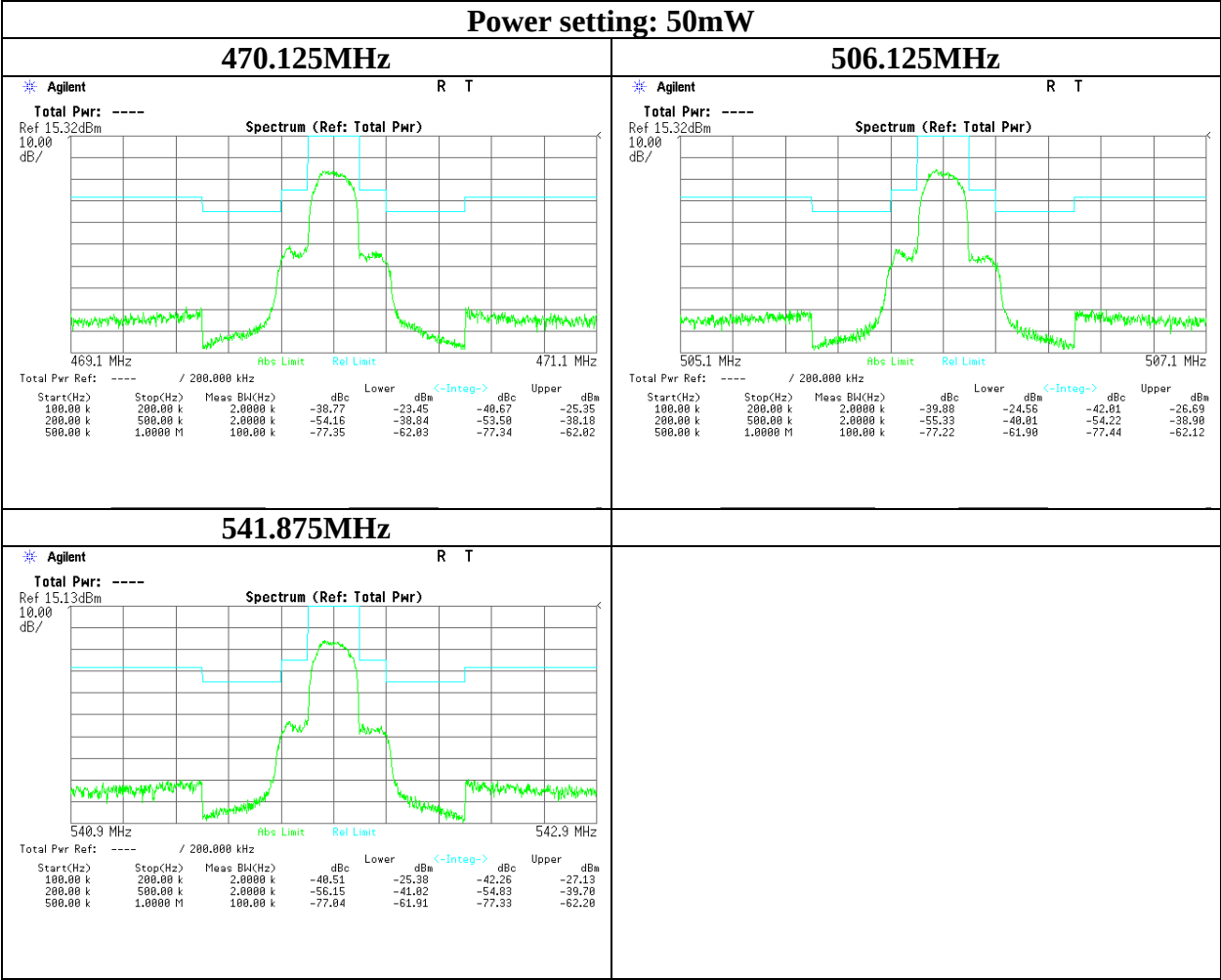
10938940H

08/31/2015

20 deg. C / 40% RH

Takumi Shimada

Tx



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

Field strength of spurious radiation

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. : 10938940H
Date : 08/25/2015 08/26/2015
Temperature/ Humidity : 23 deg. C / 52% RH 23 deg. C / 57% RH
Engineer : Yuta Moriya Takumi Shimada
(Below 1GHz) (Above 1GHz)
Mode : Tx 470.125MHz

[Power setting: 1mW]

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]					Rx Ant.	Turn	Rx Ant.	Turn	
	[MHz]	HOR	VER	HOR				VER	[dB]		[dBi]	[dB]	HOR	VER	[dB]	HOR	
940.25	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
1410.38	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
1880.50	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
2350.63	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
2820.75	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
3290.88	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
3761.00	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
4231.13	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
4701.25	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-

[Power setting: 50mW]

Frequency	Rx SA/TR		Tx SG		Tx	Tx	Tx Ant.	Result		Limit	Margin		Horizontal		Vertical		Remarks
	Reading		Reading		Cable Loss	Ant. Gain	Atten. Loss	(ERP)			(ERP)	[dB]	Rx Ant. Height	Turn Table	Rx Ant. Height	Turn Table	
	[dBuV]		[dBm]					[dBm]									
[MHz]	HOR	VER	HOR	VER	[dB]	[dBi]	[dB]	HOR	VER	[dBm]			[dB]	[cm]	[deg.]	[cm]	[deg.]
940.25	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
1410.38	50.0	50.3	-57.8	-54.3	3.1	7.4	0.0	-55.7	-52.2	-13.0	42.7	39.2	100	56	100	70	
1880.50	39.4	40.1	-70.5	-65.8	3.6	9.9	0.0	-66.3	-61.6	-13.0	53.3	48.6	100	322	100	122	
2350.63	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
2820.75	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
3290.88	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
3761.00	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
4231.13	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
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(30M-300MHz), Logperiodic Antenna(300M-1000MHz), Horn Antenna(1G-12.75GHz)

Tx-ANTENNA : 120MHz tuned Dipole Antenna(30M-120MHz), Dipole Antenna(120M-1000MHz), Horn Antenna(1G-12.75GHz)

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

NS : No signal detect.

Detector : Below 1GHz: Test receiver RMS (BW: 120kHz)

Above 1GHz: Spectrum analyzer RMS Average (RBW: 1MHz, VBW: 3MHz)

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

Field strength of spurious radiation

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. 10938940H
Date 08/25/2015 08/26/2015
Temperature/ Humidity 23 deg. C / 52% RH 23 deg. C / 57% RH
Engineer Yuta Moriya Takumi Shimada
(Below 1GHz) (Above 1GHz)
Mode Tx 506.125MHz

[Power setting: 1mW]

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					
1012.25	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
1518.38	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
2024.50	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
2530.63	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
3036.75	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
3542.88	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
4049.00	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
4555.13	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
5061.25	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	

[Power setting: 50mW]

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					
1012.25	38.9	41.0	-66.7	-67.7	2.6	6.1	0.0	-65.4	-66.4	-13.0	52.4	53.4	100	0	100	134	
1518.38	51.0	53.2	-57.4	-55.7	3.2	7.8	0.0	-55.0	-53.3	-13.0	42.0	40.3	100	359	100	80	
2024.50	38.5	37.2	-72.0	-76.2	3.7	10.6	0.0	-67.3	-71.5	-13.0	54.3	58.5	100	180	100	0	
2530.63	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
3036.75	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
3542.88	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
4049.00	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
4555.13	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
5061.25	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	

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

Rx-ANTENNA : Biconical Antenna(30M-300MHz), Logperiodic Antenna(300M-1000MHz), Horn Antenna(1G-12.75GHz)

Tx-ANTENNA : 120MHz tuned Dipole Antenna(30M-120MHz), Dipole Antenna(120M-1000MHz), Horn Antenna(1G-12.75GHz)

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

NS : No signal detect.

Detector : Below 1GHz: Test receiver RMS (BW: 120kHz)

Above 1GHz: Spectrum analyzer RMS Average (RBW: 1MHz, VBW: 3MHz)

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

Field strength of spurious radiation

Test place Ise EMC Lab. No.4 Semi Anechoic Chamber
Report No. 10938940H
Date 08/25/2015 08/26/2015
Temperature/ Humidity 23 deg. C / 52% RH 23 deg. C / 57% RH
Engineer Yuta Moriya Takumi Shimada
(Below 1GHz) (Above 1GHz)
Mode Tx 541.875MHz

[Power setting: 1mW]

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					
1083.75	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
1625.63	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
2167.50	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
2709.38	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
3251.25	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
3793.13	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
4335.00	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
4876.88	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
5418.75	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	

[Power setting: 50mW]

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					
1083.75	42.6	45.9	-61.3	-63.9	2.7	6.3	0.0	-59.8	-62.4	-13.0	46.8	49.4	100	42	100	83	
1625.63	49.8	44.7	-62.2	-60.8	3.3	8.5	0.0	-59.2	-57.8	-13.0	46.2	44.8	100	204	100	0	
2167.50	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
2709.38	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
3251.25	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
3793.13	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
4335.00	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
4876.88	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
5418.75	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	

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

Rx-ANTENNA : Biconical Antenna(30M-300MHz), Logperiodic Antenna(300M-1000MHz), Horn Antenna(1G-12.75GHz)

Tx-ANTENNA : 120MHz tuned Dipole Antenna(30M-120MHz), Dipole Antenna(120M-1000MHz), Horn Antenna(1G-12.75GHz)

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

NS : No signal detect.

Detector : Below 1GHz: Test receiver RMS (BW: 120kHz)

Above 1GHz: Spectrum analyzer RMS Average (RBW: 1MHz, VBW: 3MHz)

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

Frequency stability

Test place : Ise EMC Lab. No.6 Measurement Room
Report No. : 10938940H
Date : 08/31/2015
Temperature/ Humidity : 20 deg. C / 40% RH
Engineer : Takumi Shimada
Mode : Tx 506.125MHz

Tested frequency:	506.125 MHz
-------------------	-------------

Test condition		Measured frequency	Result	Limit	Remarks
Temp. [deg. C]	Voltage [V]	[MHz]	[ppm]	(+/- 0.005%) [+/- ppm]	
50	3	506.124385	-1.21	50	
40	3	506.124508	-0.97	50	
30	3	506.124681	-0.63	50	
20	3	506.124712	-0.57	50	
10	3	506.124872	-0.25	50	
0	3	506.124767	-0.46	50	
-10	3	506.124531	-0.93	50	
-20	3	506.124386	-1.21	50	
-30	3	506.124765	-0.47	50	
20	2.55	506.124711	-0.57	50	85% of nominal voltage
20	3.45	506.124708	-0.58	50	115% of nominal voltage
20	2.14	506.124715	-0.56	50	Battery end point voltage

Calculation formula:

$$\text{Result} = (\text{Measured frequency} - \text{Tested frequency}) / \text{Tested frequency} * 10^6$$

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	2015/07/01 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2015/01/13 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-13	Spectrum Analyzer	Agilent	E4440A	MY46185823	RE	2015/06/02 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2015/06/08 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2014/10/18 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2014/10/18 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2015/02/06 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2014/11/11 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2014/09/26 * 12
MCC-64	Coaxial Cable	UL Japan	-	-	RE	2015/03/06 * 12
MBF-06	Band Pass Filter	M-City	BPF0950-01	UL0002	RE	2015/03/20 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2015/02/05 * 12
MCC-166	Microwave Cable	Junkosha	MWX221	1303S120(1m) / 1311S167(5m)	RE	2014/09/24 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2015/01/28 * 12
MHF-27	High Pass Filter(1.1-10GHz)	TOKYO KEIKI	TF219CD1	1001	RE	2015/01/23 * 12
MHA-05	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	253	RE	2015/05/18 * 12
MCC-130	Microwave Cable(1-30GHz)	HUBER+SUHNER	SF103/11PC3.5-31/11PC3.5-31/8.0m	54308/3	RE	2015/01/07 * 12
KSG-05	Signal Generator	Rohde & Schwarz	SMR40	100137	RE	2015/07/02 * 12
MRENT-122	Spectrum Analyzer	KEYSIGHT	E4440A	MY46187096	AT	2015/06/01 * 12
MPM-08	Power Meter	Anritsu	ML2495A	6K00003338	AT	2014/10/16 * 12
MPSE-11	Power sensor	Anritsu	MA2411B	011737	AT	2014/10/15 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2014/11/19 * 12
MAT-25	Attenuator(10dB)(above 1GHz)	Agilent	8493C	71642	AT	2015/06/18 * 12
MOS-14	Thermo-Hygrometer	Custom	CTH-201	1401	AT	2015/01/13 * 12
MCH-04	Temperature and Humidity Chamber	Tabai Espec	PL-2KP	14015723	AT	2015/08/02 * 12
MMM-12	DIGITAL HiTESTER	Hioki	3805	060500120	AT	2015/02/05 * 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, 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