



RADIO TEST REPORT

Test Report No. : 11483725H-B

Applicant : Sony Corporation
Type of Equipment : Digital Wireless Transmitter
Model No. : DWT-P01N
FCC ID : AK8DWTP01N
Test regulation : FCC Part 74: 2014
Test Result : Complied

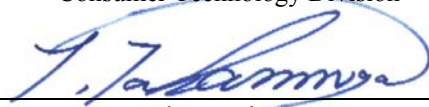
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6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)

Date of test: September 26 to October 18, 2016

Representative test engineer:


Koji Yamamoto
Engineer
Consumer Technology Division

Approved by:


Tsubasa Takayama
Engineer
Consumer Technology Division



NVLAP LAB CODE: 200572-0

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 11483725H-B

[illegible]

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SECTION 1: Customer information

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

***Remarks**

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

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

2.1 Identification of E.U.T.

Type of Equipment : Digital Wireless Transmitter
Model No. : DWT-P01N
Serial No. : Refer to 4.2 in this report.
Rating : DC 3.0 V, with two LR6 (AA) alkaline batteries
Receipt Date of Sample : September 1, 2016
Country of Manufacture : Japan
Condition of EUT : Engineering prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No Modification by the test lab

2.2 Product Description

Model: DWT-P01N (referred to as the EUT in this report) is a Digital Wireless Transmitter.

General Specification

Clock frequency(ies) in the system : X400 8 MHz
X202 12.288 MHz
X2000 16 MHz
X801 (TCXO) 19.2 MHz
IC600, 601, 700, 720, 721 1250 kHz - 1500 kHz
IC702 1300 kHz
IC202 600 kHz - 1000 kHz
IC606 250 kHz
IC607 100 kHz
X802 (VCO: change by a transmission frequency)
(14) 470.125 MHz -541.875 MHz
(30) 566.125 MHz -607.875 MHz, 614.125 MHz -637.875 MHz
(42) 638.125 MHz - 697.875 MHz

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Radio Specification (Radio microphone part)

Radio type	:	Transmitter
Modulation type	:	$\pi/4$ shift QPSK
Emission designator	:	192KG1D, 192KG1E
Necessary bandwidth	:	192 kHz, Manufacturer defined
Channel spacing	:	25 kHz
Frequency of operation	:	(14) 470.125 MHz - 541.875 MHz (30) 566.125 MHz - 607.875 MHz, 614.125 MHz - 637.875 MHz (42) 638.125 MHz - 697.875 MHz
RF power	:	High: 50 mW, Middle: 10 mW, Low: 1 mW
Antenna type	:	$\lambda/4$ Monopole integral antenna
Antenna gain	:	2.14 dBi
Power Supply (radio part input)	:	DC 2.8V, DC 3.0V, DC 3.1V, DC 5.0V
AF Specification	:	20 Hz – 22000 Hz, Maximum input: -22 dBu (MIC level, ATT 0 dB)
Operating temperature	:	0 deg. C to 50 deg. C

Radio Specification (RF remote part)

Radio Type	:	Transceiver
Modulation type	:	DSSS
Frequency of Operation	:	2405 MHz to 2475 MHz
Channel spacing	:	5MHz
Method of frequency generation	:	Synthesizer
Power Supply (radio part input)	:	DC 2.8 V
Antenna Type	:	Chip antenna
Antenna Gain	:	-3.0dBi max
Operating temperature	:	0 deg. C to 50 deg. C

*This test report applies for Radio microphone part.

**The RF remote module (Model number: RM-215) already certified as FCC ID: AK8RM215.

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 74: 2014

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

* The EUT complies with FCC Part 15 Subpart B.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
RF power output	FCC: Section 2.1046	FCC: Section 74.861 (e) (1)	See data.	Complied	Conducted
	IC: RSS-Gen Section 6.12 RSS-210 A1 Section 5.1	IC: RSS-210 G 3.1			
Modulation Characteristics	FCC: Section 2.1047	FCC: Section 74.861 (e) (3)	N/A	N/A *1)	-
	IC: RSS-210 A1 Section 5.3	IC: RSS-210 G 3.5			
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 G 3.2			
Spurious emissions at antenna terminals	FCC: Section 2.1051	FCC: Section 74.861 (e) (6)	See data.	Complied	Conducted
	EN 301 422-1 V 1.4.2	IC: RSS-210 G 3.4			
Field strength of spurious radiation	FCC: Section 2.1053	FCC: Section 74.861 (e) (6)	21.2dB 2093.63MHz, Horizontal See IC report.	Complied	Radiated
	EN 301 422-1 V 1.4.2	IC: RSS-210 G 3.4			
Emission mask	EN 301 422-1 V 1.4.2	FCC: Section 74.861 (e) (7) IC: RSS-210 G 3.4	See data.	Complied	Conducted
Frequency stability	FCC: Section 2.1055	FCC: Section 74.861 (e) (4)	See data.	Complied	Conducted
	IC: RSS-Gen Section 6.11	IC: RSS-210 G 3.3			

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

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

*1) Because the EUT has digital modulation.

* In case any questions arise about test procedure, 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.

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3.4 Uncertainty

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k = 2$.
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Substitution measurement (EUT height: 1.5 m, Distance: 3 m)	
Frequency range	Uncertainty (+/-)
25 MHz - 200 MHz	5.6 dB
200 MHz - 1000 MHz	4.1 dB
1 GHz - 12.75 GHz	4.6 dB

Antenna terminal test	Uncertainty (+/-)
RF output power	1.0 dB
Power Spectral Density and Unwanted Emissions	1.7 dB
Conducted Spurious Emission	2.7 dB

Radiated emission test (3m)

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

3.5 Test Location

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

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

Refer to APPENDIX.

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

4.1 Operating Mode(s)

Mode	Remarks
Transmitting (Tx), Power setting: 1mW	Typ. 1 mW
Transmitting (Tx), Power setting: 10mW	Typ. 10 mW
Transmitting (Tx), Power setting: 50mW	Typ. 50 mW
*Transmitting duty was 100% on all tests.	
*Power of the EUT was set by the software as follows; Software setting: Low (1 mW), Middle (10 mW), High (50 mW) Software version: 0.01 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product without 1mW, 10mW or 50mW settings.	

*The details of Operating mode(s)

Test Item	Tested frequency	Power setting	Modulation	Remarks
RF power output	470.125 MHz (Low) 607.875 MHz (Mid) 697.875 MHz (High)	1 mW, 10 mW, 50 mW	Digital modulation (PN9 data packet)	
Emission Bandwidth	470.125 MHz (Low) 607.875 MHz (Mid) 614.125 MHz (Mid2) 697.875 MHz (High)	1 mW, 50 mW	Digital modulation (PN9 data packet)	*1)
Spurious emissions at antenna terminals	470.125 MHz (Low) 607.875 MHz (Mid) 697.875 MHz (High)	1 mW, 50 mW	Digital modulation (PN9 data packet)	
Emission Mask	470.125 MHz (Low) 607.875 MHz (Mid) 614.125 MHz (Mid2) 697.875 MHz (High)	1 mW, 50 mW	Digital modulation (PN9 data packet)	*1)
Field strength of spurious radiation	470.125 MHz (Low) 607.875 MHz (Mid) 697.875 MHz (High)	1 mW, 50 mW	Digital modulation (PN9 data packet)	
Frequency stability	607.875 MHz (Mid)	50 mW	No modulation	*2)
*1) The tests were performed at both edges of allocated bands. (470-608 MHz and 614-698 MHz)				
*2) There is no difference in frequency generating method on each frequency. Therefore the test was performed on Mid channel as a representative.				

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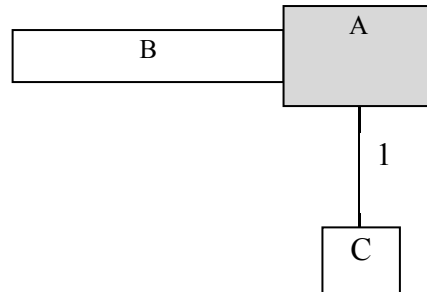
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4.2 Configuration and peripherals



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

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Digital Wireless Transmitter	DWT-P01N	14UC: Low channel, 30UC: Mid channel, 42UC: High channel	SONY	EUT
B	Dynamic Microphone	F-112	031	SONY	-
C	Keyboard	TK-FCP026	IX000689	ELECOM	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	1.8	Shielded	Shielded	-

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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 1 GHz	Above 1 GHz
Instrument used	Test Receiver	Spectrum Analyzer
IF Bandwidth	RMS Average: 120 kHz BW	RMS Average: RBW: 1 MHz/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 : 30 MHz-7 GHz
Test data : APPENDIX
Test result : Pass

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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: 50 MHz 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	9 kHz -150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz – 30 MHz	10 kHz	30 kHz				
	30 MHz – 1 GHz	100 kHz	300 kHz				
	Above 1 GHz	1 MHz	3 MHz				
Frequency stability	-	-	-	-	-	-	Frequency Counter

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

[Side band spectrum measurement (Emission mask)]

- 1) 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.
- 2) The EUT was modulated with PN9 digital audio packet.
- 3) 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

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APPENDIX 1: Data of EMI test

RF power output (Conducted)

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 11483725H
Date : 09/27/2016
Temperature/ Humidity : 23 deg. C / 50% RH
Engineer : Koji Yamamoto
Mode : Tx

Power Setting	Channel	Freq.	Reading Average	Cable Loss	Atten. Loss	Result Average		Limit	Margin	Remarks
		[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[mW]	[dB]	
1mW	Low	470.125	-9.68	0.10	9.91	0.33	1.079	250	23.65	
	Mid	607.875	-9.93	0.10	9.95	0.12	1.028	250	23.86	
	Mid 2	614.125	-10.00	0.10	9.95	0.05	1.012	250	23.93	*
	High	697.875	-9.64	0.10	9.90	0.36	1.086	250	23.62	
10mW	Low	470.125	-1.73	0.10	9.91	8.28	6.73	250	15.70	
	Mid	607.875	0.08	0.10	9.95	10.13	10.30	250	13.85	
	High	697.875	0.12	0.10	9.90	10.12	10.28	250	13.86	
50mW	Low	470.125	6.17	0.10	9.91	16.18	41.5	250	7.80	
	Mid	607.875	7.01	0.10	9.95	17.06	50.8	250	6.92	
	Mid 2	614.125	6.85	0.10	9.95	16.90	49.0	250	7.08	*
	High	697.875	6.95	0.10	9.90	16.95	49.5	250	7.03	

Calculation formula:

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

* Reference data for the emission mask measurement.

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Emission Bandwidth

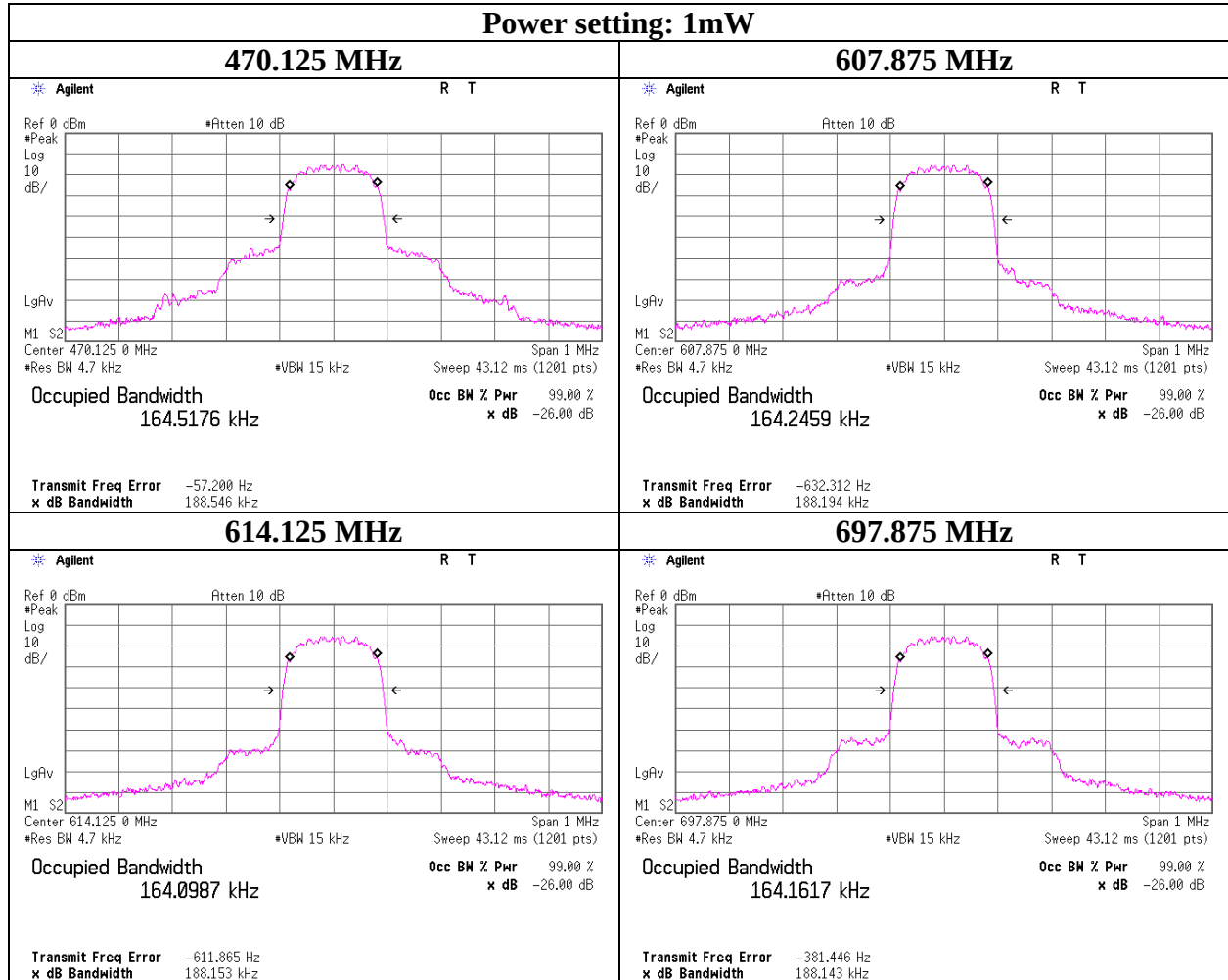
Test place
Report No.
Date
Temperature/ Humidity
Engineer
Mode

Ise EMC Lab. No.11 Measurement Room
11483725H
09/27/2016
23 deg. C / 52% RH
Koji Yamamoto
Tx

Power Setting	Channel	Freq. [MHz]	99% Occupied Bandwidth [kHz]	Limit [kHz]	Margin [kHz]
1mW	Low	470.125	164.5176	200	35.4824
	Mid	607.875	164.2459	200	35.7541
	Mid 2	614.125	164.0987	200	35.9013
	High	697.875	164.1617	200	35.8383
50mW	Low	470.125	164.7311	200	35.2689
	Mid	607.875	164.7670	200	35.2330
	Mid 2	614.125	164.7996	200	35.2004
	High	697.875	165.4063	200	34.5937

Emission Bandwidth

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 11483725H
Date : 09/27/2016
Temperature/ Humidity : 23 deg. C / 52% RH
Engineer : Koji Yamamoto
Mode : Tx



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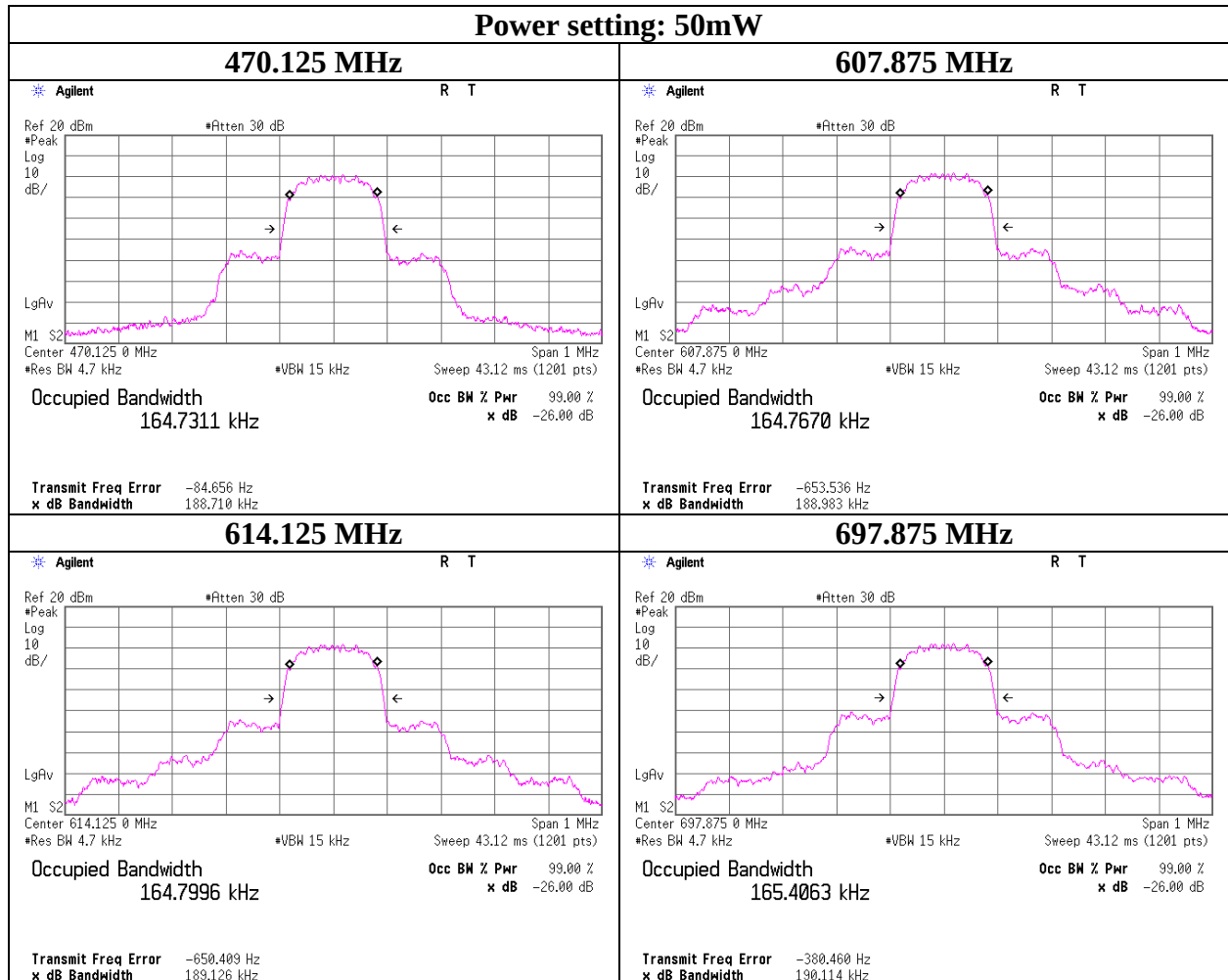
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Emission Bandwidth

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11483725H
Date	09/27/2016
Temperature/ Humidity	23 deg. C / 52% RH
Engineer	Koji Yamamoto
Mode	Tx



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Spurious emissions at antenna terminals

Test place Ise EMC Lab. No.11 Measurement Room
Report No. 11483725H
Date 09/28/2016
Temperature/ Humidity 23 deg. C / 55% RH
Engineer Koji Yamamoto
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	0.01041	-89.25	0.10	9.85	-79.30	-13	66.30
			0.2	-80.23	0.10	9.85	-70.28	-13	57.28
			940.2	-72.48	0.10	10.14	-62.24	-13	49.24
			3400	-59.77	0.10	10.03	-49.64	-13	36.64
	Mid	607.875	0.00947	-89.10	0.10	9.85	-79.15	-13	66.15
			0.598	-80.43	0.10	9.85	-70.48	-13	57.48
			3230	-59.77	0.10	10.01	-49.66	-13	36.66
			7208	-58.96	0.10	10.17	-48.69	-13	35.69
	High	697.875	0.01064	-88.81	0.10	9.85	-78.86	-13	65.86
			0.15	-80.35	0.10	9.85	-70.40	-13	57.40
			3060	-59.26	0.10	10.00	-49.16	-13	36.16
			8508	-58.88	0.10	10.12	-48.66	-13	35.66
50mW	Low	470.125	0.12803	-86.17	0.10	9.85	-76.22	-13	63.22
			0.15	-80.47	0.10	9.85	-70.52	-13	57.52
			940.2	-63.15	0.10	10.14	-52.91	-13	39.91
			3120	-59.54	0.10	10.00	-49.44	-13	36.44
	Mid	607.875	0.12803	-86.69	0.10	9.85	-76.74	-13	63.74
			0.15	-80.00	0.10	9.85	-70.05	-13	57.05
			599.9	-62.93	0.10	9.95	-52.88	-13	39.88
			3277	-59.40	0.10	10.02	-49.28	-13	36.28
			8217	-58.71	0.10	10.13	-48.48	-13	35.48
	High	697.875	0.01123	-88.41	0.10	9.85	-78.46	-13	65.46
			0.349	-79.71	0.10	9.85	-69.76	-13	56.76
			689.6	-64.00	0.10	9.90	-54.00	-13	41.00
			1397	-59.10	0.10	9.97	-49.03	-13	36.03
			7321	-58.57	0.10	10.17	-48.30	-13	35.30

Calculation formula:

Result = Reading + Cable Loss + Attenuator Loss

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

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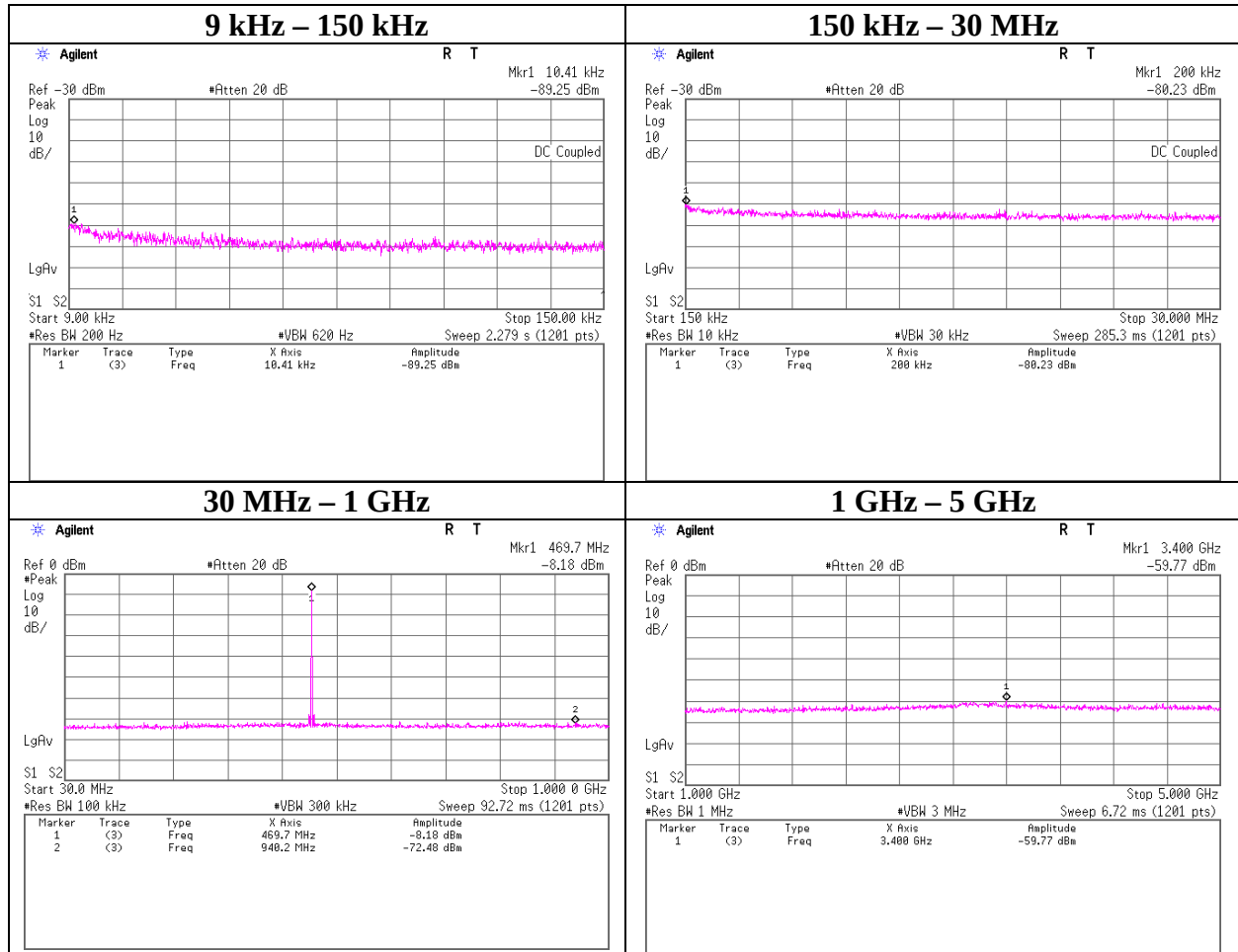
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emissions at antenna terminals

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 11483725H
Date : 09/28/2016
Temperature/ Humidity : 23 deg. C / 55% RH
Engineer : Koji Yamamoto
Mode : Tx 470.125MHz, 1mW



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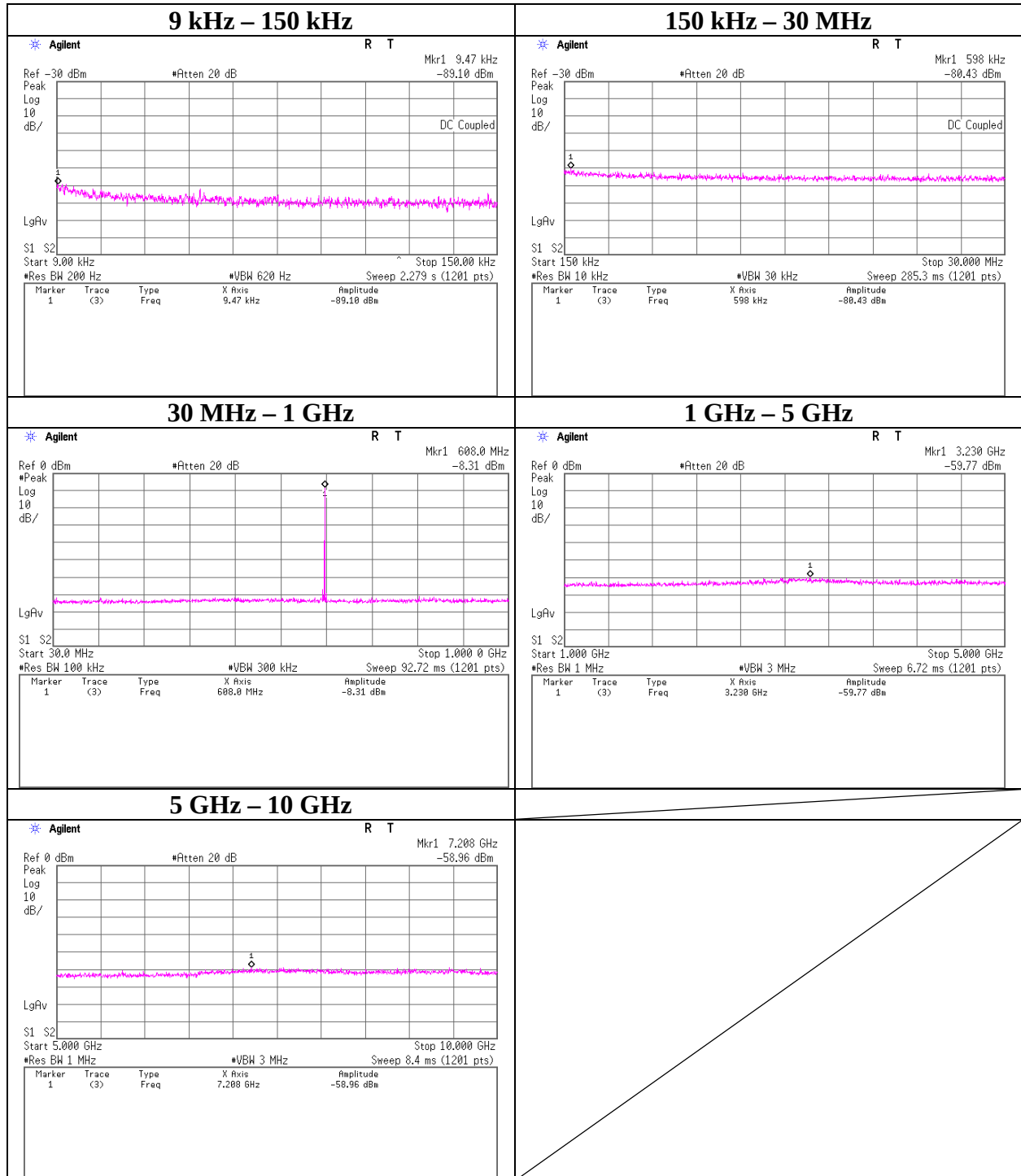
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Spurious emissions at antenna terminals

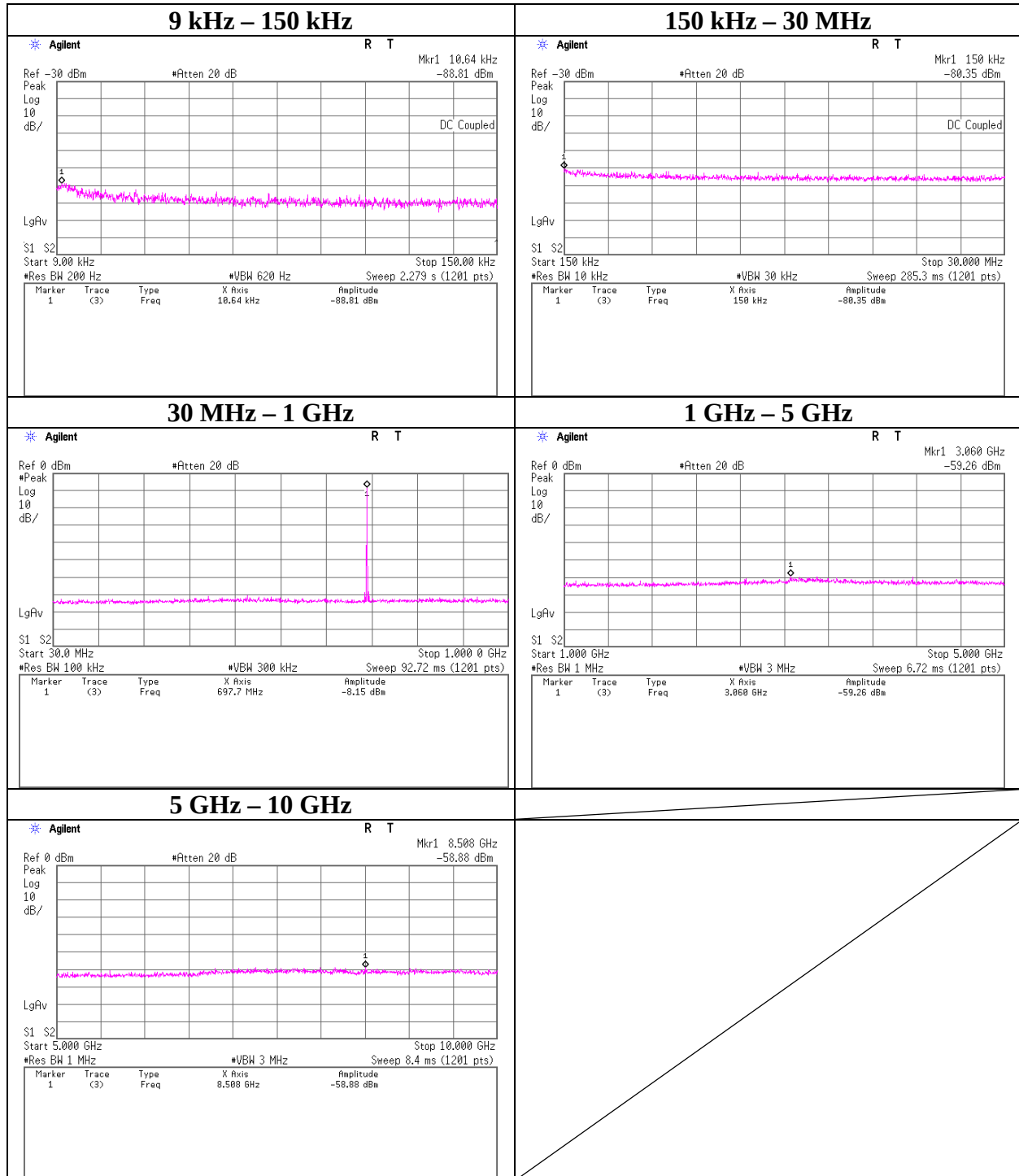
Test place
Report No.
Date
Temperature/ Humidity
Engineer
Mode

Ise EMC Lab. No.11 Measurement Room
11483725H
09/28/2016
23 deg. C / 55% RH
Koji Yamamoto
Tx 607.875 MHz, 1mW



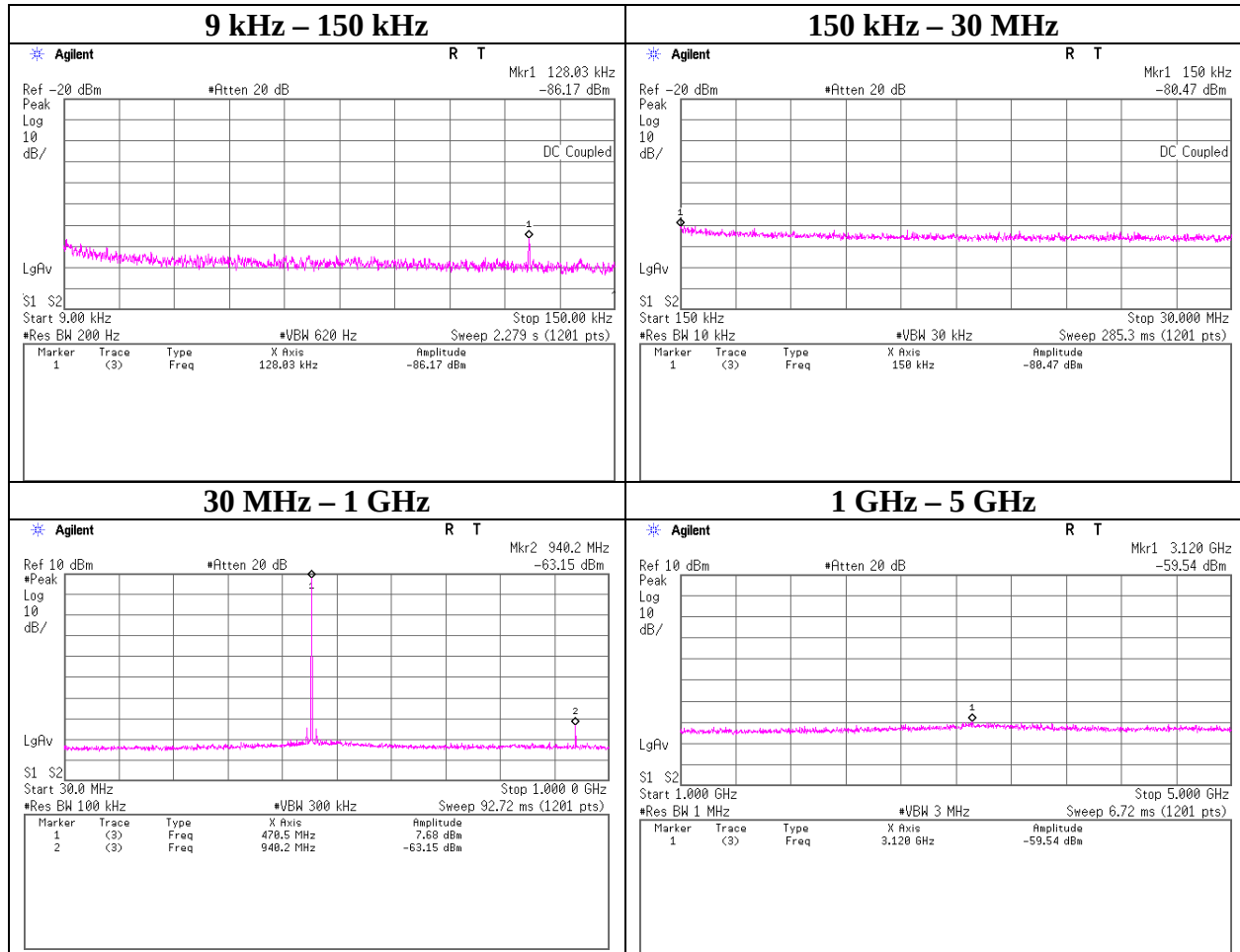
Spurious emissions at antenna terminals

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 11483725H
Date : 09/28/2016
Temperature/ Humidity : 23 deg. C / 55% RH
Engineer : Koji Yamamoto
Mode : Tx 697.875 MHz, 1mW



Spurious emissions at antenna terminals

Test place Ise EMC Lab. No.11 Measurement Room
Report No. 11483725H
Date 09/28/2016
Temperature/ Humidity 23 deg. C / 55% RH
Engineer Koji Yamamoto
Mode Tx 470.125 MHz, 50mW



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Ise EMC Lab.

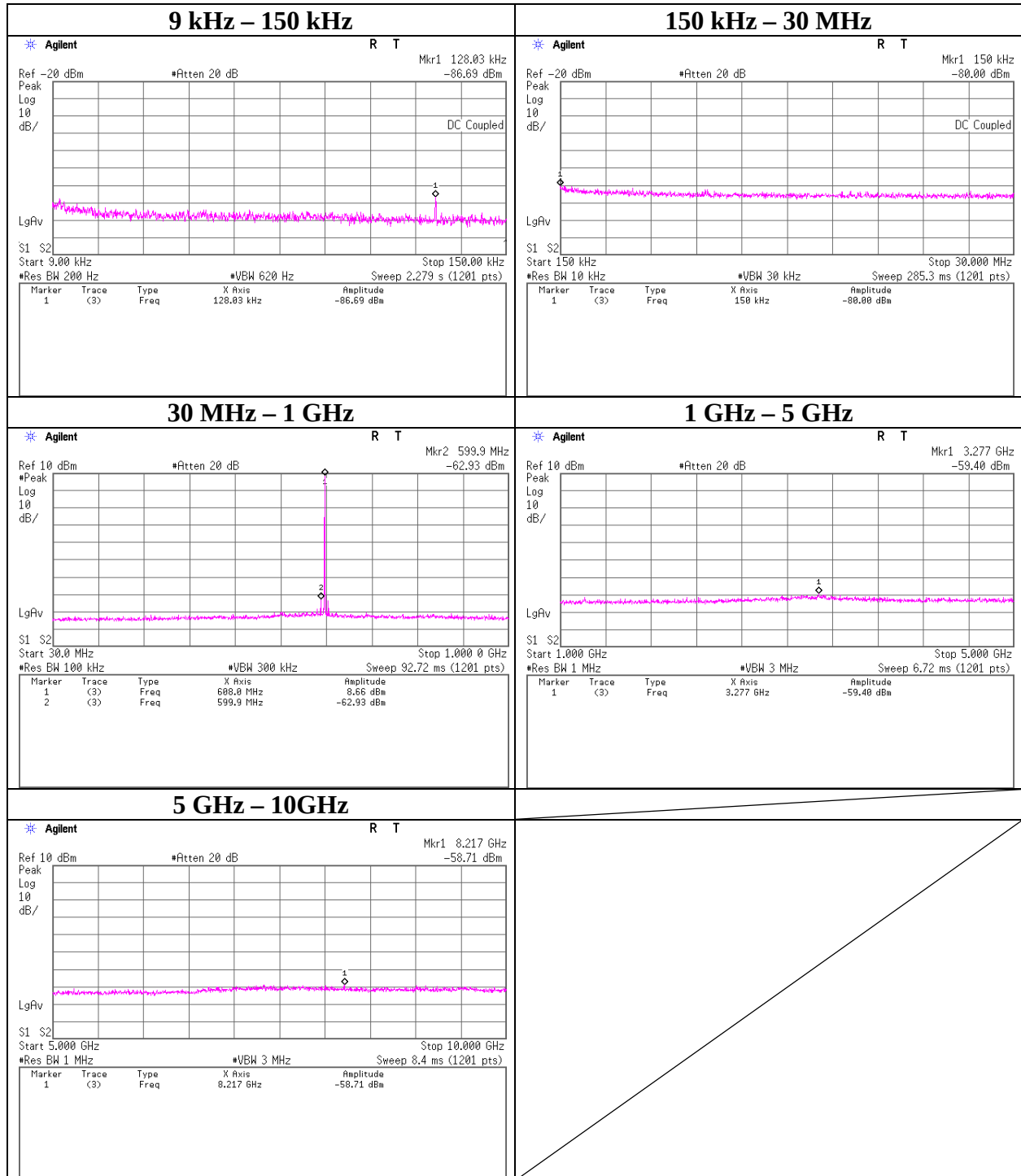
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

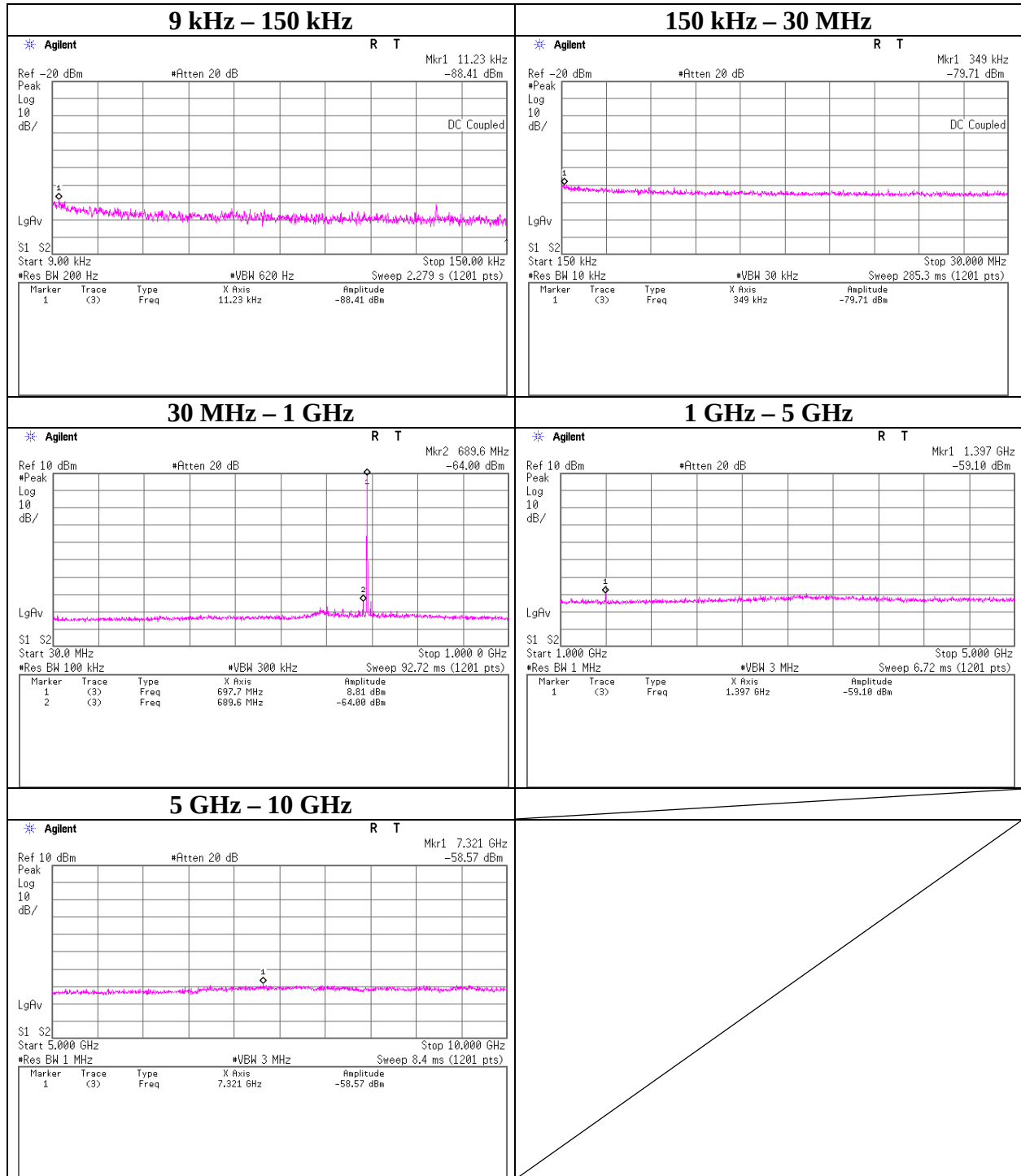
Spurious emissions at antenna terminals

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 11483725H
Date : 09/28/2016
Temperature/ Humidity : 23 deg. C / 55% RH
Engineer : Koji Yamamoto
Mode : Tx 607.875 MHz, 50mW



Spurious emissions at antenna terminals

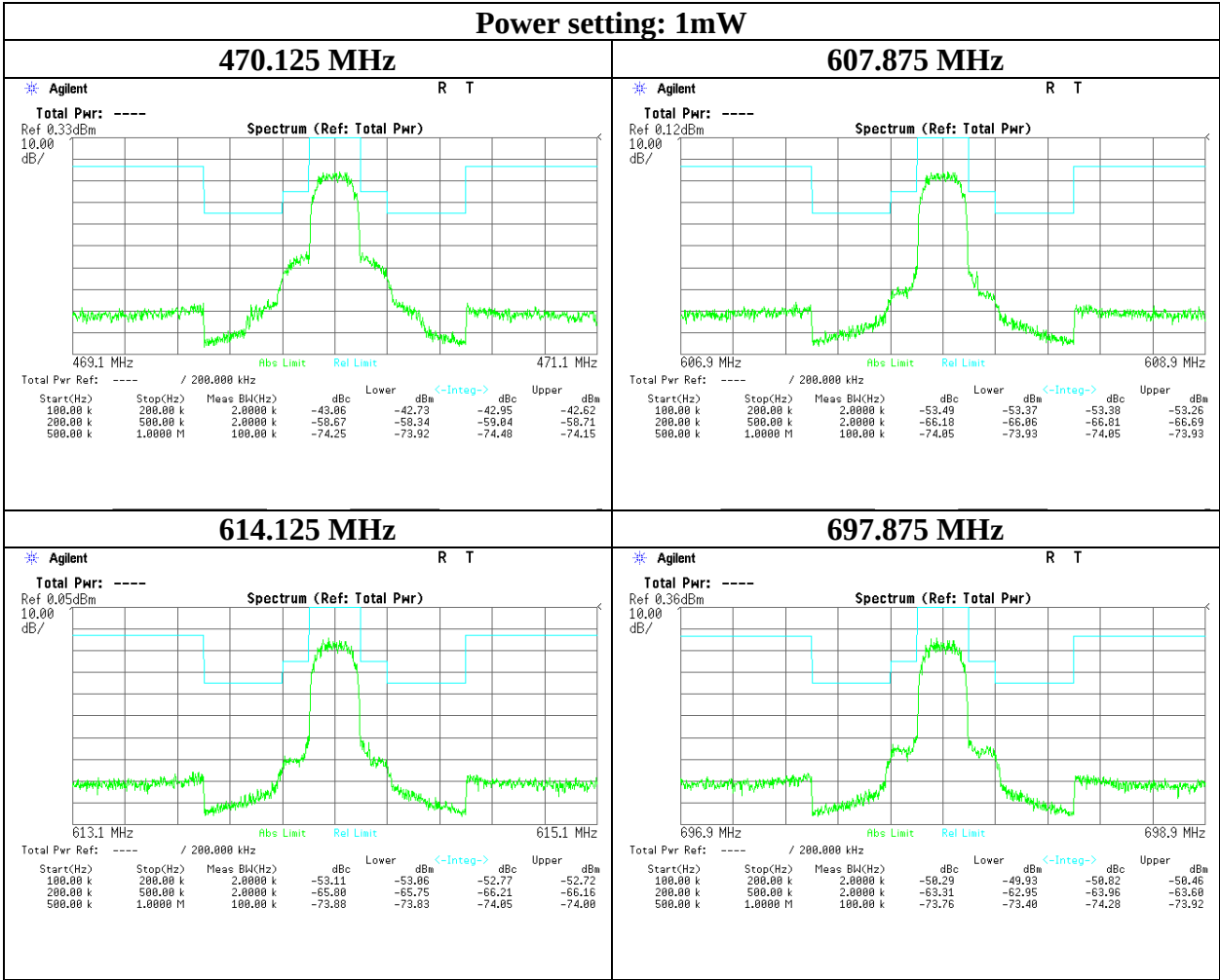
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11483725H
Date	09/28/2016
Temperature/ Humidity	23 deg. C / 55% RH
Engineer	Koji Yamamoto
Mode	Tx 697.875MHz, 50mW



Spurious emissions at antenna terminals

Test place
Report No.
Date
Temperature/ Humidity
Engineer
Mode

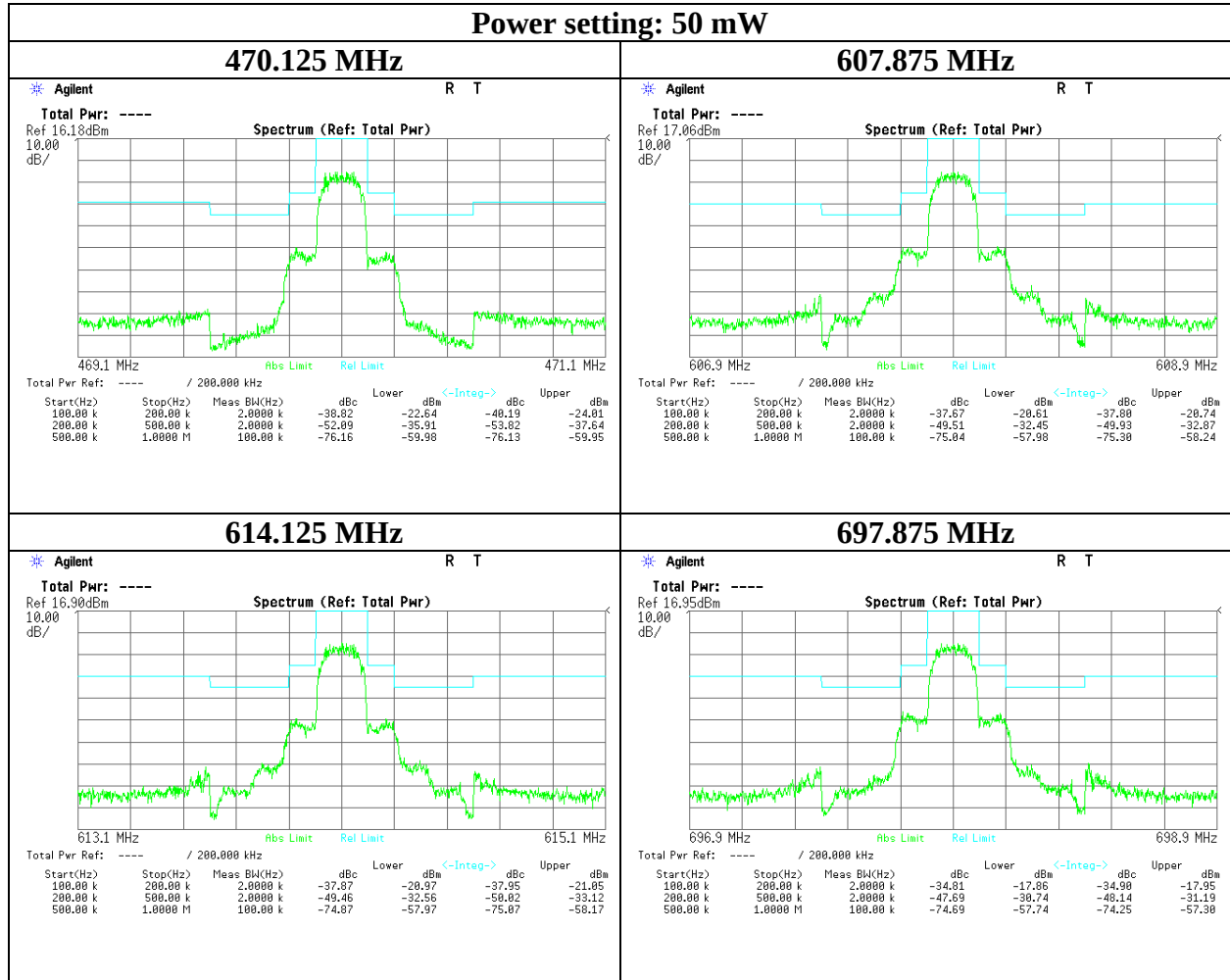
Ise EMC Lab. No.11 Measurement Room
11483725H
09/28/2016
23 deg. C / 55% RH
Koji Yamamoto
Tx



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

Spurious emissions at antenna terminals

Test place : Ise EMC Lab. No.11 Measurement Room
Report No. : 11483725H
Date : 09/28/2016
Temperature/ Humidity : 23 deg. C / 55% RH
Engineer : Koji Yamamoto
Mode : Tx



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

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Emission Mask

Test place

Report No.

Date

Temperature/ Humidity

Engineer

Mode

Ise EMC Lab. No.11 measurement room

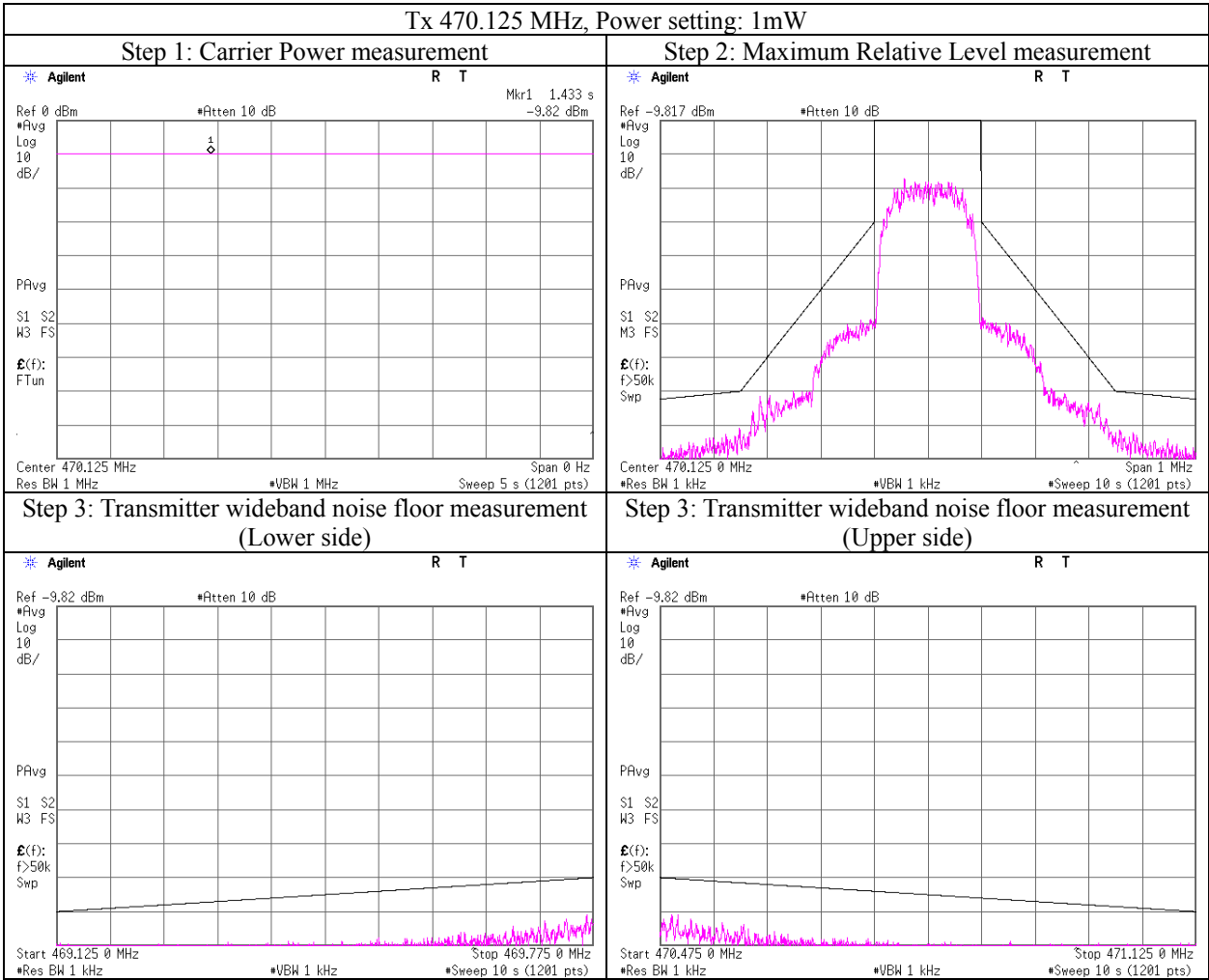
11483725H

10/18/2016

23deg. C / 53 % RH

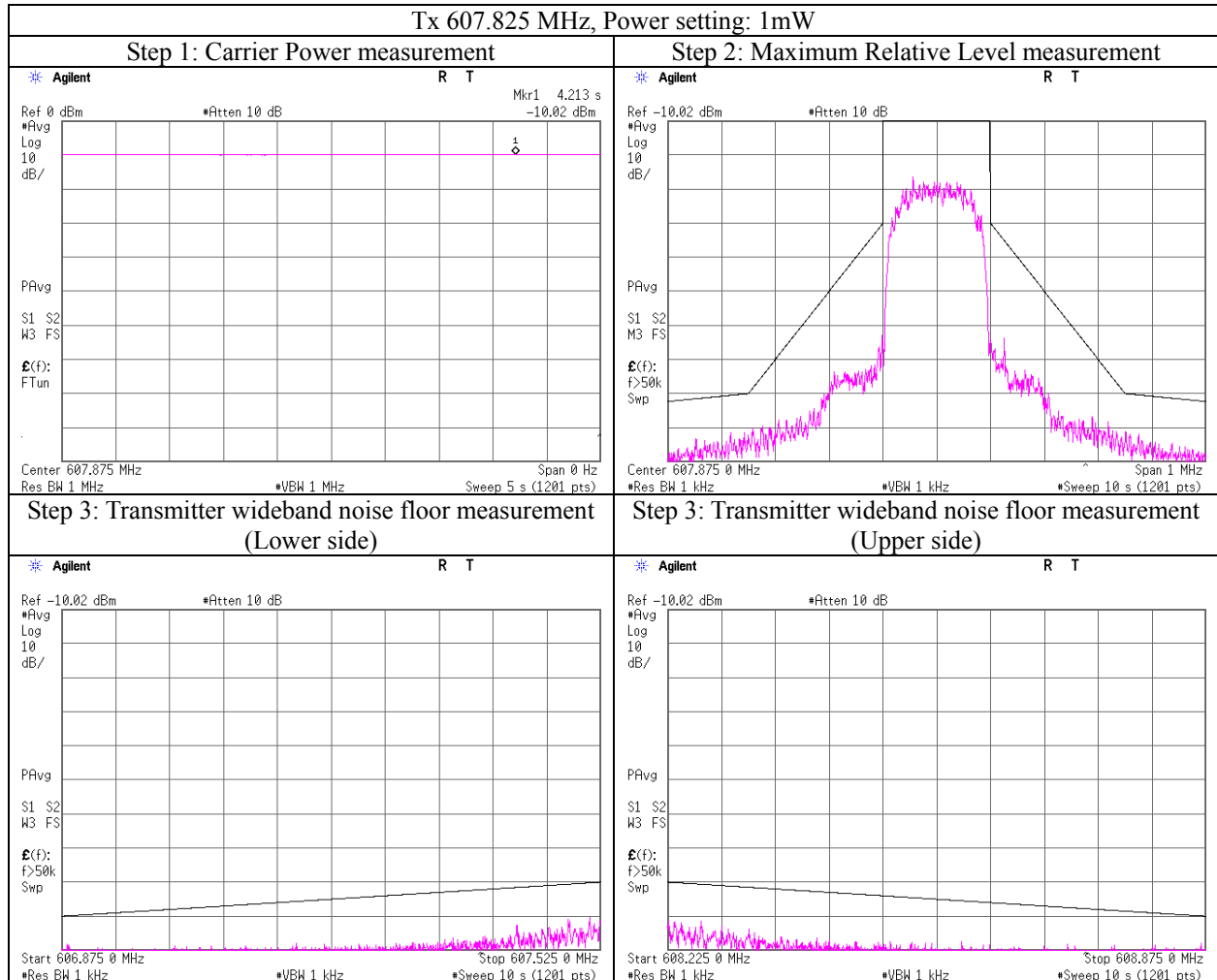
Koji Yamamoto

Tx



Emission Mask

Test place Ise EMC Lab. No.11 measurement room
Report No. 11483725H
Date 10/18/2016
Temperature/ Humidity 23deg. C / 53 % RH
Engineer Koji Yamamoto
Mode Tx



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Ise EMC Lab.

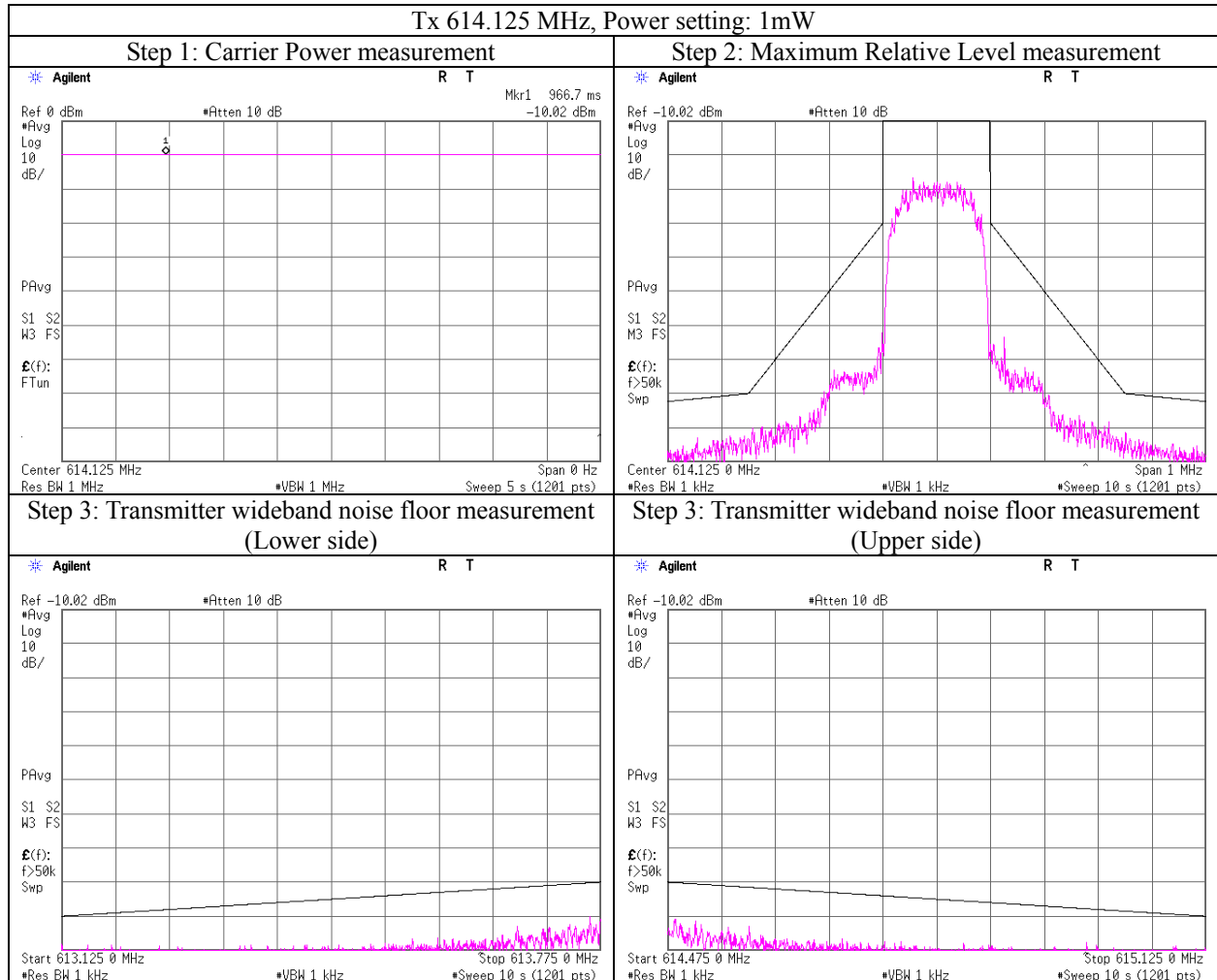
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Facsimile : +81 596 24 8124

Emission Mask

Test place Ise EMC Lab. No.11 measurement room
Report No. 11483725H
Date 10/18/2016
Temperature/ Humidity 23deg. C / 53 % RH
Engineer Koji Yamamoto
Mode Tx



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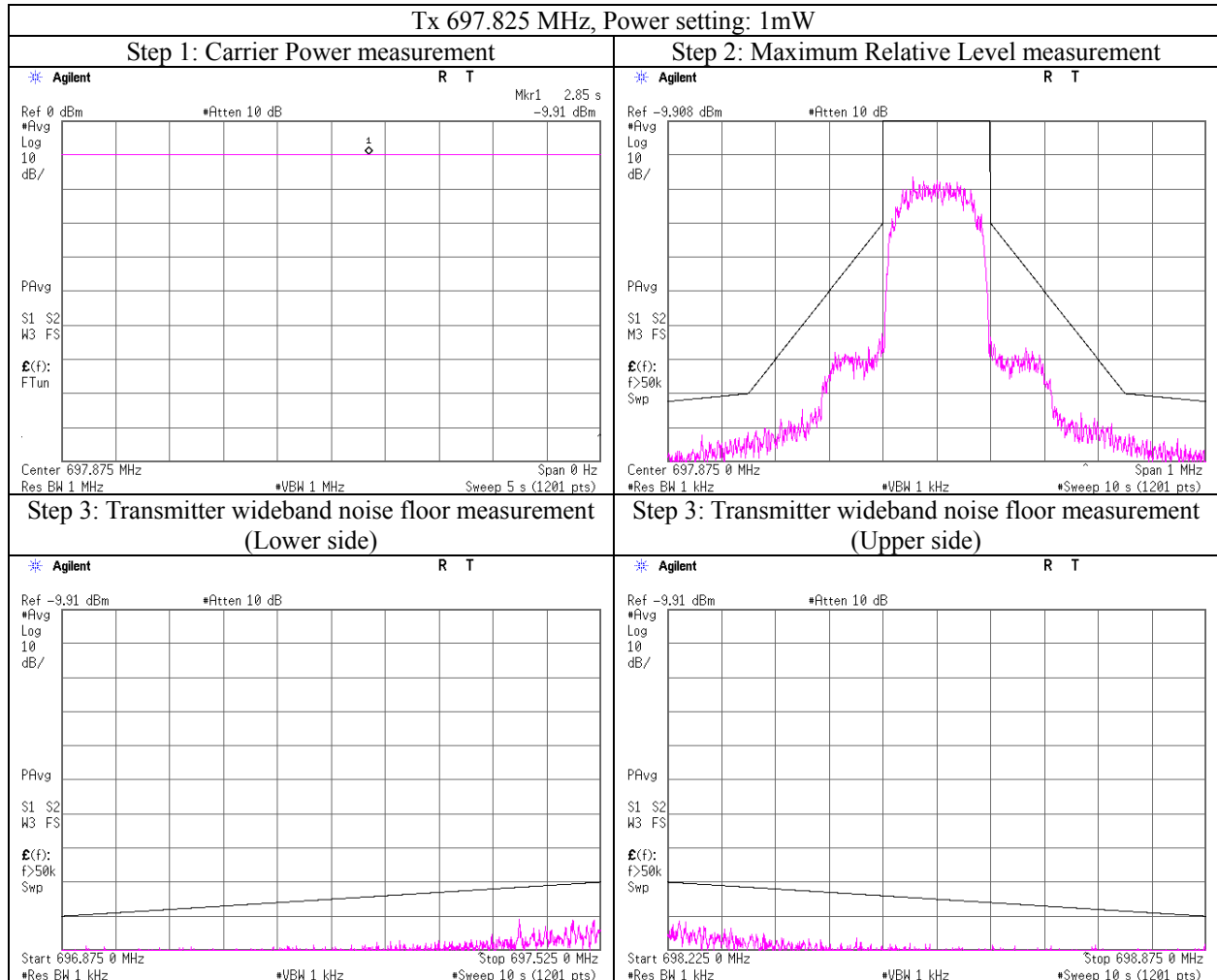
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Telephone : +81 596 24 8999

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Emission Mask

Test place	Ise EMC Lab. No.11 measurement room
Report No.	11483725H
Date	10/18/2016
Temperature/ Humidity	23deg. C / 53 % RH
Engineer	Koji Yamamoto
Mode	Tx



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Emission Mask

Test place

Report No.

Date

Temperature/ Humidity

Engineer

Mode

Ise EMC Lab. No.11 measurement room

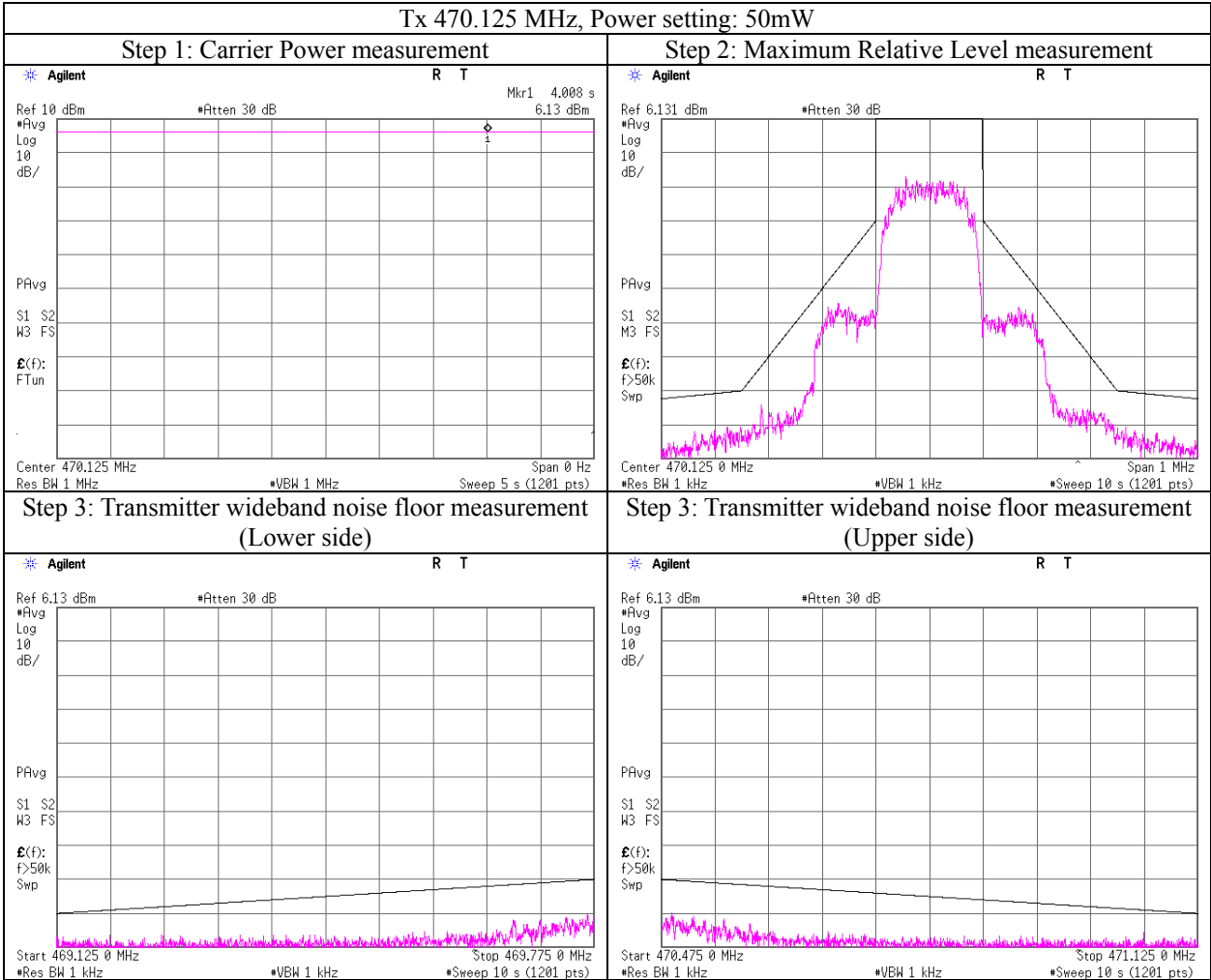
11483725H

10/18/2016

23deg. C / 53 % RH

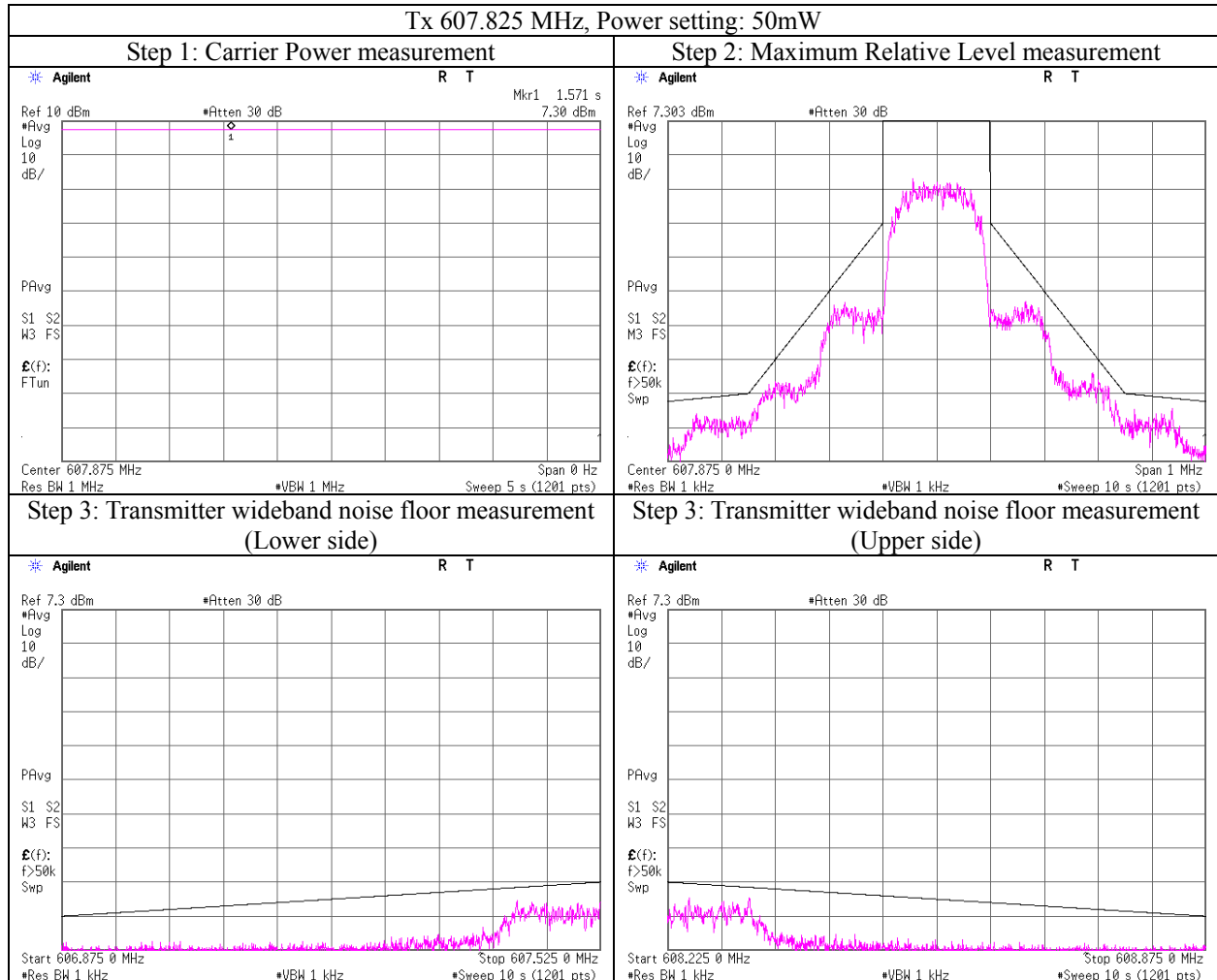
Koji Yamamoto

Tx



Emission Mask

Test place Ise EMC Lab. No.11 measurement room
Report No. 11483725H
Date 10/18/2016
Temperature/ Humidity 23deg. C / 53 % RH
Engineer Koji Yamamoto
Mode Tx



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Ise EMC Lab.

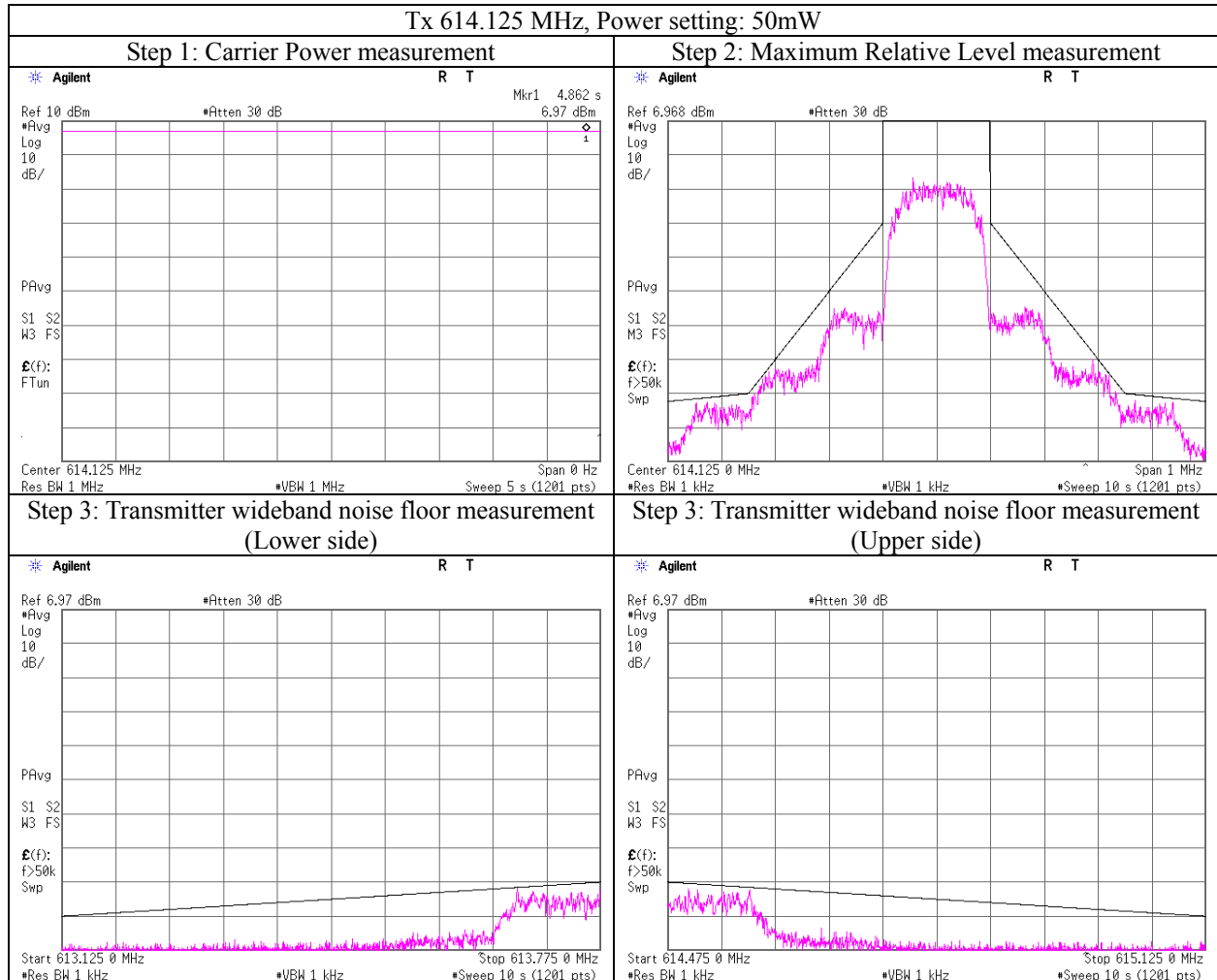
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Emission Mask

Test place : Ise EMC Lab. No.11 measurement room
Report No. : 11483725H
Date : 10/18/2016
Temperature/ Humidity : 23deg. C / 53 % RH
Engineer : Koji Yamamoto
Mode : Tx



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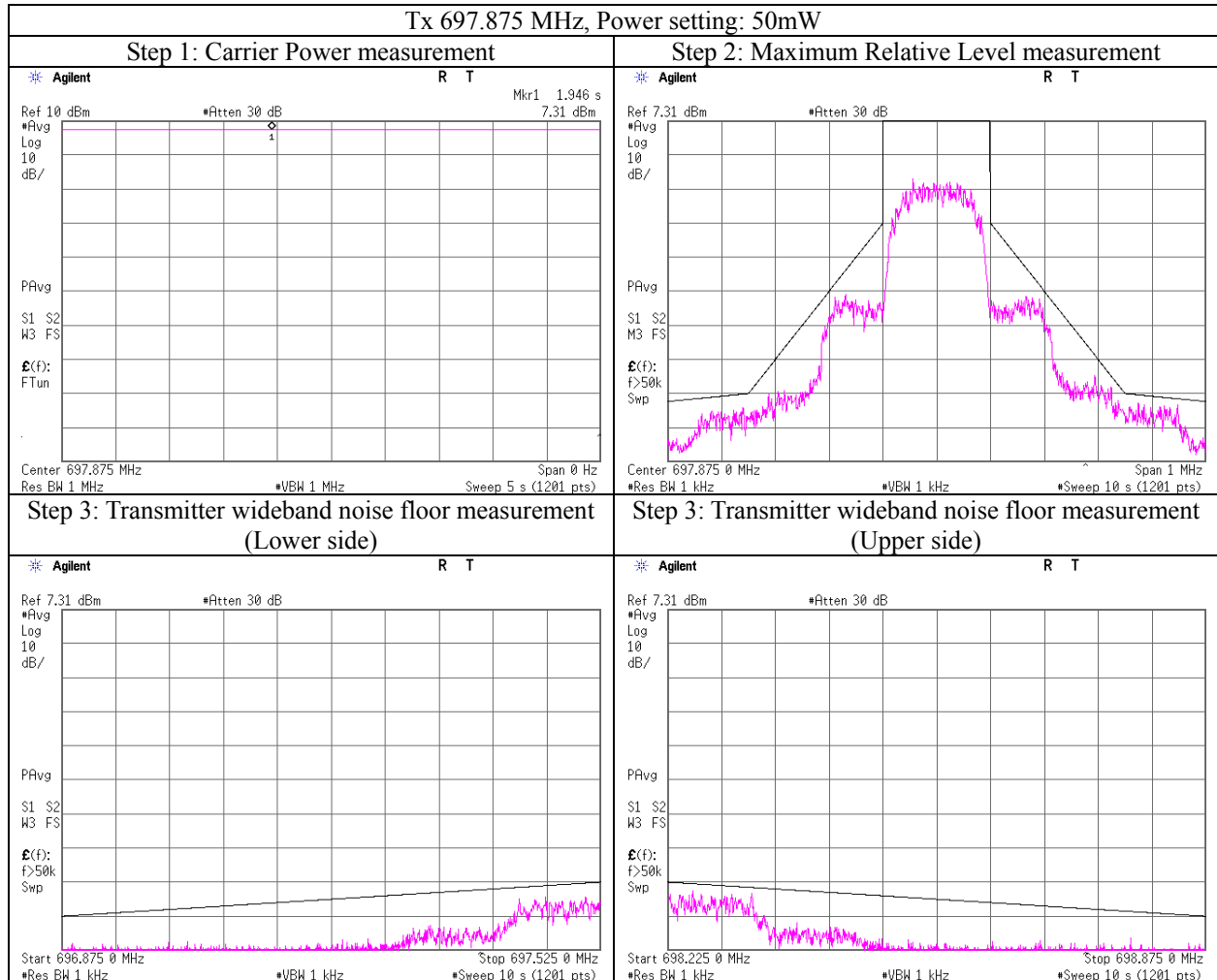
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Emission Mask

Test place	Ise EMC Lab. No.11 measurement room
Report No.	11483725H
Date	10/18/2016
Temperature/ Humidity	23deg. C / 53 % RH
Engineer	Koji Yamamoto
Mode	Tx



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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Field strength of spurious radiation

Report No. 11483725H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date September 26, 2016 September 29, 2016
Temperature / Humidity 22 deg. C / 58 % RH 22 deg. C / 58 % RH
Engineer Hiroyuki Furutaka Yuta Moriya
(Above 1 GHz) (Below 1 GHz)
Mode Tx 470.125 MHz

[Power setting: 1 mW]

Frequency	Rx SA/TR		Tx SG		Tx	Tx	Tx Ant.	Result		Limit	Margin		Horizontal		Vertical		Remarks	
	Reading [dBuV]		Reading [dBm]		Cable Loss	Ant. Gain	Atten. Loss	(ERP) [dBm]		(ERP) [dBm]			Rx Ant.	Turn	Rx Ant.	Turn		
	[MHz]	HOR	VER	HOR	VER	[dB]	[dBi]	[dB]	HOR	VER		[dB]	HOR	VER	Height [cm]	Table [deg.]		Height [cm]
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	-	-	-	-	-	-	-	-

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

Rx-ANTENNA : Biconical Antenna(30M-200MHz), Logperiodic Antenna(200M-1000MHz), Horn Antenna(1G-7GHz)

Tx-ANTENNA : 120MHz tuned Dipole Antenna(30M-120MHz), Dipole Antenna(120M-1000MHz), Horn Antenna(1G-7GHz)

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 (RW: 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

[Power setting: 50 mW]

Frequency	Rx SA/TR		Tx SG		Tx	Tx	Tx Ant.	Result		Limit	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]		Cable Loss [dB]	Ant. Gain [dBi]	Atten. Loss [dB]	(ERP) [dBm]		(ERP) [dBm]	[dB]		Rx Ant. Height [cm]	Turn Table [deg.]	Rx Ant. Height [cm]	Turn Table [deg.]	
	[MHz]	HOR	VER	HOR				VER	HOR								
940.25	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
1410.38	48.3	45.3	-61.9	-68.8	3.2	8.0	0.0	-59.3	-66.2	-13.0	46.3	53.2	105	102	114	154	
1880.50	43.6	45.1	-70.4	-67.4	3.7	10.6	0.0	-65.7	-62.7	-13.0	52.7	49.7	100	234	100	63	
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-200MHz), Logperiodic Antenna(200M-1000MHz), Horn Antenna(1G-7GHz)

Tx-ANTENNA : 120MHz tuned Dipole Antenna(30M-120MHz), Dipole Antenna(120M-1000MHz), Horn Antenna(1G-7GHz)

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 (RW: 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

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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Field strength of spurious radiation

Report No. 11483725H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date September 26, 2016 September 29, 2016
Temperature / Humidity 22 deg. C / 58 % RH 22 deg. C / 58 % RH
Engineer Hiroyuki Furutaka Yuta Moriya
(Above 1GHz) (Below 1GHz)
Mode Tx 607.875MHz

[Power setting: 1mW]

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)			Rx Ant.	Turn Table	Rx Ant.	Turn Table	
	[dBuV]		[dBm]					[dBm]									
[MHz]	HOR	VER	HOR	VER	[dB]	[dBi]	[dB]	HOR	VER	[dBm]	[dB]	HOR	VER	Height [cm]	Table [deg.]	Height [cm]	Table [deg.]
1215.75	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
1823.63	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
2431.50	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
3039.38	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
3647.25	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
4255.13	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
4863.00	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
5470.88	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	-
6078.75	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-200MHz), Logperiodic Antenna(200M-1000MHz), Horn Antenna(1G-7GHz)

Tx-ANTENNA : 120MHz tuned Dipole Antenna(30M-120MHz), Dipole Antenna(120M-1000MHz), Horn Antenna(1G-7GHz)

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 (RW: 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 = -13dBn

[Power setting: 50mW]

Frequency	Rx SA/TR		Tx SG		Tx	Tx	Tx Ant.	Result		Limit	Margin		Horizontal		Vertical		Remarks
	Reading [dBuV]		Reading [dBm]		Cable Loss	Ant. Gain [dBi]	Atten. Loss [dB]	(ERP) [dBm]		(ERP) [dBm]			Rx Ant.	Turn	Rx Ant.	Turn	
	[MHz]	HOR	VER	HOR	VER	[dB]	[dBi]	[dB]	HOR	VER	[dBm]	[dB]	VER	Height [cm]	Table [deg.]	Height [cm]	
1215.75	51.3	50.3	-57.4	-59.1	3.0	6.9	0.0	-55.6	-57.3	-13.0	42.6	44.3	122	319	173	355	
1823.63	51.5	48.9	-56.9	-61.1	3.6	10.3	0.0	-52.4	-56.6	-13.0	39.4	43.6	111	40	214	33	
2431.50	50.2	50.0	-57.5	-56.9	4.2	11.1	0.0	-52.8	-52.2	-13.0	39.8	39.2	111	35	100	334	
3039.38	42.9	42.8	-67.0	-67.5	4.7	11.4	0.0	-62.4	-62.9	-13.0	49.4	49.9	108	29	106	7	
3647.25	49.8	49.6	-53.9	-54.3	5.3	12.3	0.0	-49.1	-49.5	-13.0	36.1	36.5	100	27	105	359	
4255.13	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
4863.00	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
5470.88	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
6078.75	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-200MHz), Logperiodic Antenna(200M-1000MHz), Horn Antenna(1G-7GHz)

Tx-ANTENNA : 120MHz tuned Dipole Antenna(30M-120MHz), Dipole Antenna(120M-1000MHz), Horn Antenna(1G-7GHz)

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 (RW: 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 = -13dBn

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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Field strength of spurious radiation

Report No. 11483725H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.3
Date September 26, 2016
Temperature / Humidity 22 deg. C / 58 % RH
Engineer Hiroyuki Furutaka
(Above 1GHz)
Mode Tx 697.875MHz

[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]		(ERP) [dBm]			Rx Ant. Height [cm]	Turn Table [deg.]	Rx Ant. Height [cm]	Turn Table [deg.]	
	HOR	VER	HOR	VER				HOR	VER								
1395.75	47.6	45.0	-62.4	-67.0	3.2	7.9	0.0	-59.8	-64.4	-13.0	46.8	51.4	100	308	155	194	
2093.63	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
2791.50	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
3489.38	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
4187.25	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
4885.13	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
5583.00	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
6280.88	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
6978.75	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-200MHz), Logperiodic Antenna(200M-1000MHz), Horn Antenna(1G-7GHz)

Tx-ANTENNA : 120MHz tuned Dipole Antenna(30M-120MHz), Dipole Antenna(120M-1000MHz), Horn Antenna(1G-7GHz)

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 (RW: 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 = -13dBn

[Power setting: 50mW]

Frequency	Rx SA/TR		Tx SG		Tx	Tx	Tx Ant.	Result		Limit	Margin		Horizontal		Vertical		Remarks	
	Reading [dBuV]		Reading [dBm]		Cable Loss	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.]
	[MHz]	HOR	VER	HOR				VER	HOR			VER						
1395.75	64.2	58.1	-42.1	-48.8	3.2	7.9	0.0	-39.5	-46.2	-13.0	26.5	33.2	112	270	160	193		
2093.63	65.7	61.4	-39.3	-43.0	3.9	11.1	0.0	-34.2	-37.9	-13.0	21.2	24.9	100	52	100	76		
2791.50	51.7	43.5	-49.8	-65.6	4.5	11.2	0.0	-45.2	-61.0	-13.0	32.2	48.0	100	332	100	327		
3489.38	43.8	45.6	-64.2	-60.0	5.2	12.3	0.0	-59.2	-55.0	-13.0	46.2	42.0	108	37	106	170		
4187.25	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-		
4885.13	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-		
5583.00	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-		
6280.88	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-		
6978.75	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-200MHz), Logperiodic Antenna(200M-1000MHz), Horn Antenna(1G-7GHz)

Tx-ANTENNA : 120MHz tuned Dipole Antenna(30M-120MHz), Dipole Antenna(120M-1000MHz), Horn Antenna(1G-7GHz)

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 (RW: 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 = -13dBn

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Frequency stability

Test place Ise EMC Lab. No.11 Measurement Room
Report No. 11483725H
Date 09/27/2016
Temperature/ Humidity 22 deg. C / 51% RH
Engineer Koji Yamamoto
Mode Tx 607.875MHz

Tested frequency:	607.875 MHz
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Test condition		Measured frequency	Result	Limit	Remarks
Temp. [deg. C]	Voltage [V]	[MHz]	[ppm]	(+/- 0.005%) [+/- ppm]	
50	3	607.874451	-0.90	50	
40	3	607.874579	-0.69	50	
30	3	607.874665	-0.55	50	
20	3	607.874669	-0.54	50	
10	3	607.874717	-0.47	50	
0	3	607.874751	-0.41	50	
-10	3	607.874601	-0.66	50	
-20	3	607.874750	-0.41	50	
-30	3	607.874511	-0.80	50	
20	2.55	607.874668	-0.55	50	85% of nominal voltage
20	3.45	607.874667	-0.55	50	115% of nominal voltage
20	2.28	607.874668	-0.55	50	Battery end point voltage

Calculation formula:

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

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APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2015/10/01 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2016/01/21 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2016/08/17 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2016/02/29 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2016/05/29 * 12
MCC-167	Microwave Cable	Junkosha	MWX221	1404S374(1m) / 1405S074(5m)	RE	2016/05/20 * 12
MCC-130	Microwave Cable(1-30GHz)	HUBER+SUHNER	SF103/11PC3.5-31/11PC3.5-31/8.0m	54308/3	RE	2016/01/19 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2016/03/24 * 12
MHF-27	High Pass Filter(1.1-10GHz)	TOKYO KEIKI	TF219CD1	1001	RE	2016/01/19 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	RE	2016/01/13 * 12
MSG-16	Signal Generator	Rohde & Schwarz	SMR40	100137	RE	2016/06/29 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2015/12/08 * 12
MMM-17	DIGITAL HiTESTER	Hioki	3805	070900530	AT	2016/01/13 * 12
MRENT-126	Spectrum Analyzer	KEYSIGHT	E4440A	MY46185516	AT	2016/07/01 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2015/11/10 * 12
MPM-13	Power Meter	Anritsu	ML2495A	0824014	AT	2015/11/11 * 12
MPSE-18	Power sensor	Anritsu	MA2411B	0738174	AT	2015/11/11 * 12
MFC-01	Microwave Counter	Advantest	R5373	120100309	AT	2016/06/01 * 12
MLPA-07	Loop Antenna	UL Japan	-	-	AT	Pre Check
MAT-91	Attenuator	Weinschel Associates	WA56-10	56100307	AT	2016/06/09 * 12
MAEC-01	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	RE	2016/09/02 * 12
MOS-27	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	RE	2016/01/21 * 12
MJM-25	Measure	KOMELON	KMC-36	-	RE	-
MTR-09	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	RE	2016/06/25 * 12
KBA-05	Biconical Antenna	Schwarzbeck	BBA9106	2513	RE	2015/11/02 * 12
MLA-20	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-189	RE	2016/01/30 * 12
MAT-08	Attenuator(6dB)	Weinschel Corp	2	BK7971	RE	2015/11/10 * 12
MCC-02	Coaxial Cable	Suhner/storm/Agilent/T SJ	-	-	RE	2016/09/09 * 12
MPA-19	Pre Amplifier	MITEQ	MLA-10K01-B01-35	1237616	RE	2016/02/25 * 12
MMM-03	Digital Tester	Fluke	FLUKE 26-3	78030621	RE	2016/08/23 * 12
MCC-64	Coaxial Cable	UL Japan	-	-	RE	2016/03/10 * 12
MBF-06	Band Pass Filter	M-City	BPF0950-01	UL0002	RE	2016/03/15 * 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

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