RADIO TEST REPORT

Test Report No. : 10686939H-C-R1

Applicant	:	**Sony Corporation**
Type of Equipment	:	**Digital Wireless Microphone**
Model No.	:	**DWM-02N**
FCC ID	:	**AK8DWM02N**
Test regulation	:	**FCC Part 74: 2014**
Test Result	:	**Complied**

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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 10686939H-C. 10686939H-C is replaced with this report.

Date of test: February 12 and 26, 2015

Representative test engineer:

Hironobu Ohnishi
Engineer
Consumer Technology Division

Approved by:

Takayuki Shimada
Engineer
Consumer Technology Division

NVLAP LAB CODE: 200572-0

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REVISION HISTORY

Original Test Report No.: 10686939H-C

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10686939H-C	March 16, 2015	-	-
1	10686939H-C-R1	September 30, 2015	P.4	Correction of clock frequency of IC602, 603, 604, 605, 607
1	10686939H-C-R1	September 30, 2015	P.5	Correction of channel spacing of Radio microphone part
1	10686939H-C-R1	September 30, 2015	P.9	Addition of explanatory for operating mode

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SECTION 1: Customer information

Company Name	:	Sony EMCS Corporation
Address	:	30 Ibarajima Ohya-cyo, Inazawa-shi, Aichi-ken, 492-8545 ,JAPAN
Telephone Number	:	+81-50-3807-4243
Facsimile Number	:	+81-50-3807-4306
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 Microphone
Model No.	:	DWM-02N
Serial No.	:	Refer to 4.2 in this report.
Rating	:	DC 3.0V (2 x AA batteries)
Receipt Date of Sample	:	February 11, 2015
Country of Manufacture	:	Japan
Condition of EUT	:	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

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

General Specification

Clock frequency(ies) in the system	:	X401	8MHz
		X202	12.288MHz
		X2001	16MHz
		X801 (TCXO)	19.2MHz
		IC602, 603, 604, 605, 607	1250 - 1500kHz
		IC606	1300kHz
		IC202	600 - 1000kHz
		IC500	250kHz
		X802 (VCO: change by a transmission frequency)	
			(14) 470.125-541.875MHz
			(30) 566.125-607.875MHz, 614.125-637.875MHz
			(42) 638.125-697.875MHz

Radio Specification (Radio microphone part)

Radio type	:	Transmitter
Modulation type	:	π/4 shift QPSK
Emission designator	:	192KG1D, 192KG1E
Necessary bandwidth	:	192kHz, Manufacturer defined
Channel spacing	:	25kHz
Frequency of operation	:	(14) 470.125-541.875MHz (30) 566.125-607.875MHz, 614.125-637.875MHz (42) 638.125-697.875MHz
RF power	:	High: 50mW, Middle: 10mW, Low: 1mW
Antenna type	:	1/4 Lambda Monopole antenna (helical type)
Antenna gain	:	2.14dBi
Power Supply (radio part input)	:	DC 2.8V, DC 3.0V, DC 5.0V
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	:	-3.0dBi max
Operating temperature	:	0 deg. C to 50 deg. C

*This test report applies for Radio microphone part.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 74: 2014, final revised on August 15, 2014 and effective September 15, 2014.

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

* The EUT complies with FCC Part 15 Subpart B: 2015, final revised on January 21, 2015.

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)	26.9dB 2093.63MHz, Horizontal	Complied	Radiated
	IC: RSS-Gen Section 6.13 RSS-210 A1 Section 6.4	IC: RSS-210 A1 Section 6.4	See IC report.		
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-C (2004) 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.

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.

3.5 Test Location

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	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

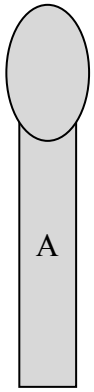
4.1 Operating Mode(s)

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; Software: Low (1mW), Middle (10mW), High (50mW) Software: 1.04 *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) 607.875MHz (Mid) 697.875MHz (High)	1mW, 10mW, 50mW	Digital modulation (PN9 data packet)	
Emission Bandwidth	470.125MHz (Low) 607.875MHz (Mid) 614.125MHz (Mid2) 697.875MHz (High)	1mW, 50mW	Digital modulation (PN9 data packet)	*1)
Spurious emissions at antenna terminals	470.125MHz (Low) 607.875MHz (Mid) 697.875MHz (High)	1mW, 50mW	Digital modulation (PN9 data packet)	
Field strength of spurious radiation	470.125MHz (Low) 607.875MHz (Mid) 697.875MHz (High)	1mW, 50mW	Digital modulation (PN9 data packet)	
Frequency stability	607.875MHz (Mid)	50mW	No modulation	*2)
*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) The tests were performed at both edges of allocated bands. (470-608MHz and 614-698MHz) *2) There is no difference in frequency generating method on each frequency. Therefore the test was performed on Mid channel as a representative.				

4.2 Configuration and peripherals



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

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Digital Wireless Microphone	DWM-02N	81412: Low channel, 83011: Mid/Mid2 channel, 84212: High channel	Sony EMCS Corporation	EUT

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-7GHz
Test data : APPENDIX
Test result : Pass

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	-	-	-	-	-	-	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

APPENDIX 1: Data of EMI test

RF power output
(Conducted)

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10686939H
Date	02/23/2015
Temperature/ Humidity	23 deg. C / 35% RH
Engineer	Hironobu Ohnishi
Mode	Tx

Power Setting	Channel	Freq. [MHz]	Reading Average [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result Average [dBm]	Result Average [mW]	Limit [mW]	Margin [dB]	Remarks
1mW	Low	470.125	-10.14	0.10	9.92	-0.12	0.973	250	24.10	
	Mid	607.875	-10.13	0.10	9.90	-0.13	0.971	250	24.11	
	Mid 2	614.125	-10.23	0.10	9.90	-0.23	0.948	250	24.21	*
	High	697.875	-10.14	0.10	9.88	-0.16	0.964	250	24.14	
10mW	Low	470.125	-1.86	0.10	9.92	8.16	6.55	250	15.82	
	Mid	607.875	-0.22	0.10	9.90	9.78	9.51	250	14.20	
	High	697.875	-0.31	0.10	9.88	9.67	9.27	250	14.31	
50mW	Low	470.125	6.05	0.10	9.92	16.07	40.5	250	7.91	
	Mid	607.875	6.76	0.10	9.90	16.76	47.4	250	7.22	
	Mid 2	614.125	6.97	0.10	9.90	16.97	49.8	250	7.01	*
	High	697.875	6.79	0.10	9.88	16.77	47.5	250	7.21	

Calculation formula:
Result = Reading + Cable Loss + Atten. Loss

* Reference data for the emission mask measurement.

Emission Bandwidth

Test place Ise EMC Lab. No.11 Measurement Room
Report No. 10686939H
Date 02/24/2015
Temperature/ Humidity 25 deg. C / 28% RH
Engineer Hironobu Ohnishi
Mode Tx

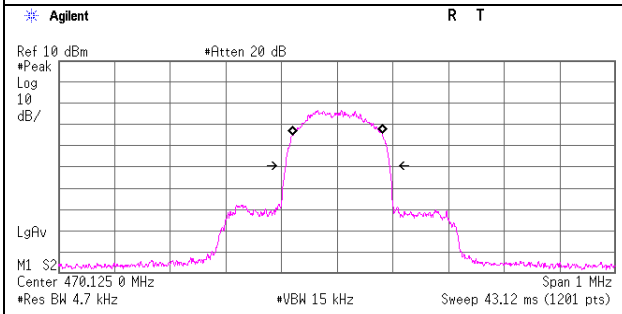
Power Setting	Channel	Freq. [MHz]	99% Occupied Bandwidth [kHz]	Limit [kHz]	Margin [kHz]
1mW	Low	470.125	161.6610	200	38.3390
	Mid	607.875	160.7423	200	39.2577
	Mid 2	614.125	160.5157	200	39.4843
	High	697.875	161.2715	200	38.7285
50mW	Low	470.125	160.3116	200	39.6884
	Mid	607.875	160.4660	200	39.5340
	Mid 2	614.125	161.0145	200	38.9855
	High	697.875	159.9430	200	40.0570

Emission Bandwidth

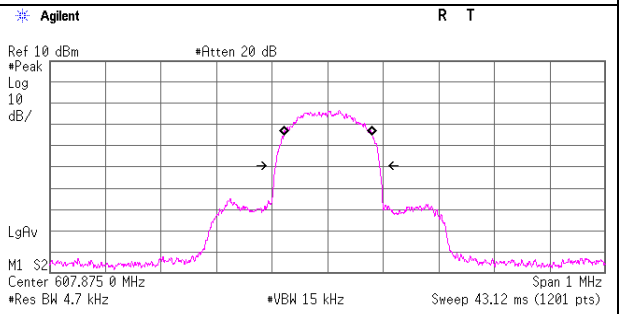
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10686939H
Date	02/24/2015
Temperature/ Humidity	25 deg. C / 28% RH
Engineer	Hironobu Ohnishi
Mode	Tx

Power setting: 1mW

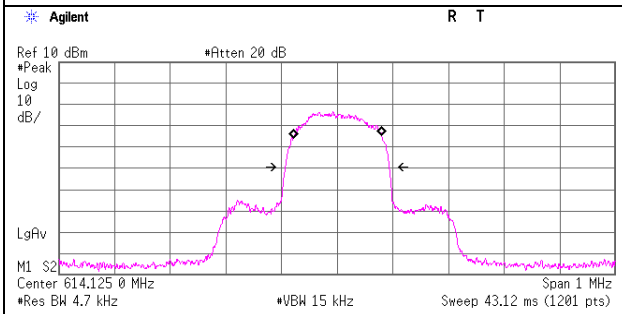
470.125MHz



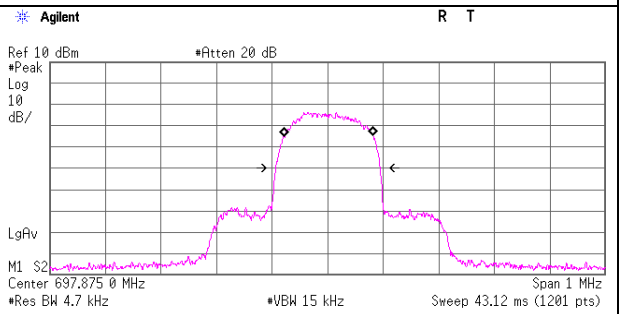
607.875MHz



614.125MHz



697.875MHz



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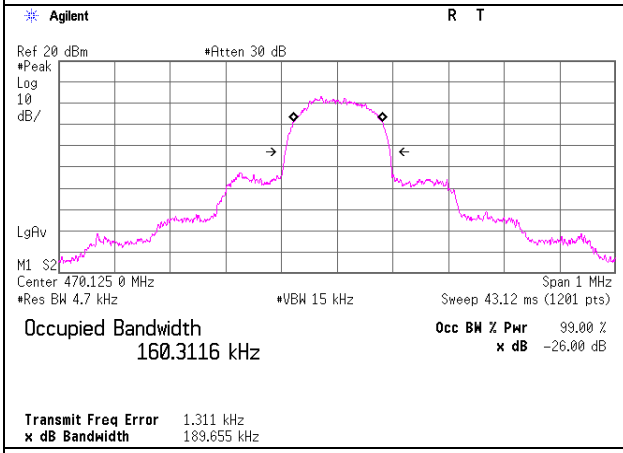
Emission Bandwidth

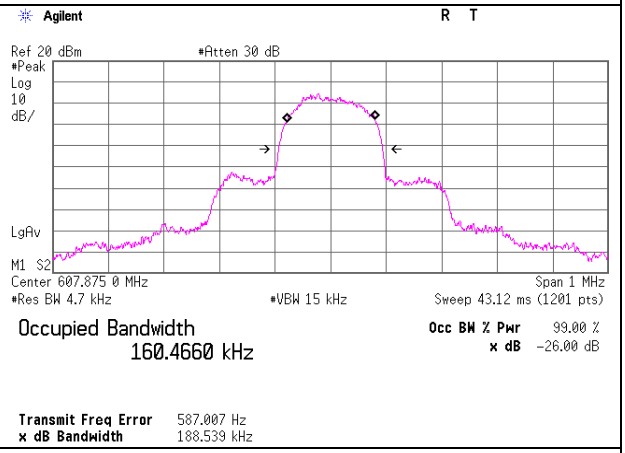
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10686939H
Date	02/24/2015
Temperature/ Humidity	25 deg. C / 28% RH
Engineer	Hironobu Ohnishi
Mode	Tx

Power setting: 50mW

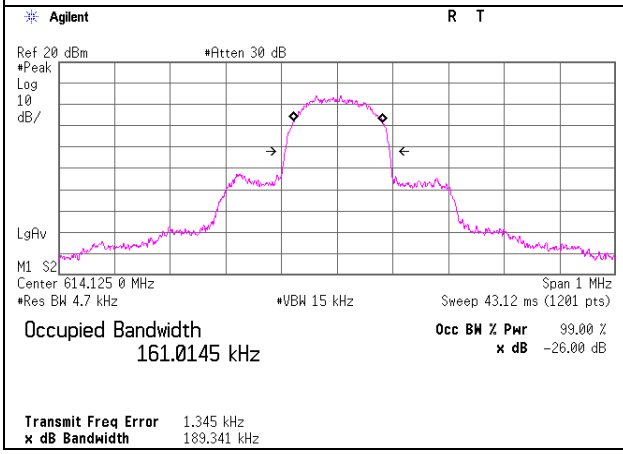
470.125MHz



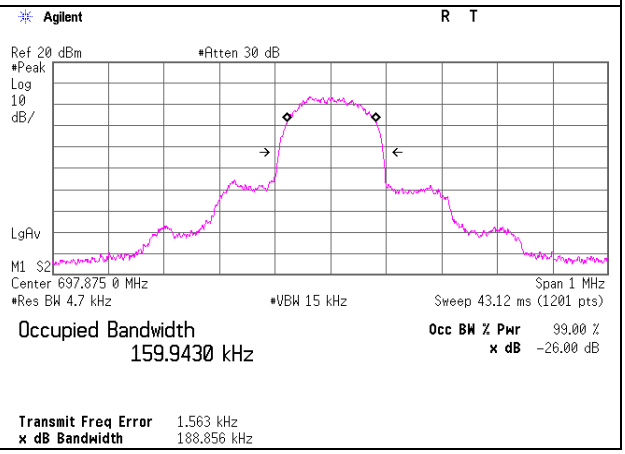
607.875MHz



614.125MHz



697.875MHz



Spurious emissions at antenna terminals

Test place Ise EMC Lab. No.11 Measurement Room
Report No. 10686939H
Date 02/24/2015
Temperature/ Humidity 25 deg. C / 28% RH
Engineer Hironobu Ohnishi
Mode Tx

Power Setting	Channel	Tested Freq. [MHz]	Reading Freq. [MHz]	Reading Level [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
1mW	Low	470.125	0.00947	-96.64	0.10	9.83	-86.71	-13	73.71
			0.648	-89.98	0.10	9.82	-80.06	-13	67.06
			940.2	-64.28	0.10	9.90	-54.28	-13	41.28
			3073	-69.95	0.10	10.04	-59.81	-13	46.81
	Mid	607.875	0.01206	-97.06	0.10	9.83	-87.13	-13	74.13
			0.15	-88.96	0.10	9.82	-79.04	-13	66.04
			3143	-69.99	0.10	10.04	-59.85	-13	46.85
			6862	-68.00	0.10	10.10	-57.80	-13	44.80
	High	697.875	0.0157	-96.63	0.10	9.83	-86.70	-13	73.70
			0.15	-87.46	0.10	9.82	-77.54	-13	64.54
			3127	-69.69	0.10	10.04	-59.55	-13	46.55
			7129	-67.07	0.10	10.11	-56.86	-13	43.86
50mW	Low	470.125	0.12803	-78.51	0.10	9.82	-68.59	-13	55.59
			0.15	-79.12	0.10	9.82	-69.20	-13	56.20
			940.2	-51.64	0.10	9.90	-41.64	-13	28.64
			3133	-59.53	0.10	10.04	-49.39	-13	36.39
	Mid	607.875	0.12803	-78.54	0.10	9.82	-68.62	-13	55.62
			0.15	-77.33	0.10	9.82	-67.41	-13	54.41
			1217	-58.74	0.10	10.00	-48.64	-13	35.64
			6821	-57.44	0.10	10.10	-47.24	-13	34.24
	High	697.875	0.12803	-79.70	0.10	9.82	-69.78	-13	56.78
			0.15	-75.98	0.10	9.82	-66.06	-13	53.06
			1397	-57.65	0.10	10.01	-47.54	-13	34.54
			2093	-56.81	0.10	10.02	-46.69	-13	33.69
			7033	-57.25	0.10	10.11	-47.04	-13	34.04

Calculation formula:

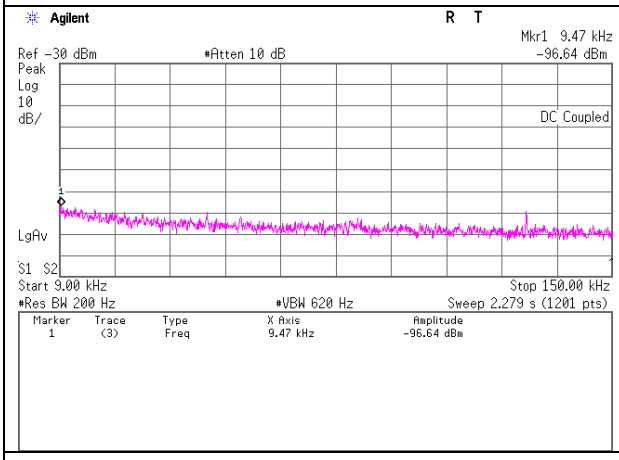
Result = Reading + Cable Loss + Attenuator Loss

Limit = mean output power in dBm - (43+10log$_{10}$ (mean output power in watts)) dB = -13dBm

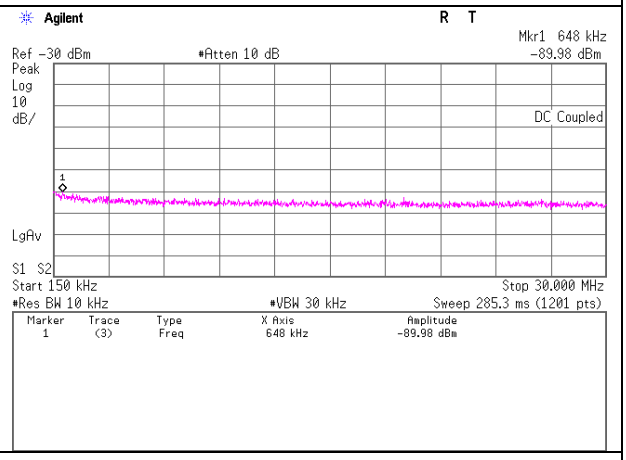
Spurious emissions at antenna terminals

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10686939H
Date	02/24/2015
Temperature/ Humidity	25 deg. C / 28% RH
Engineer	Hironobu Ohnishi
Mode	Tx 470.125MHz, 1mW

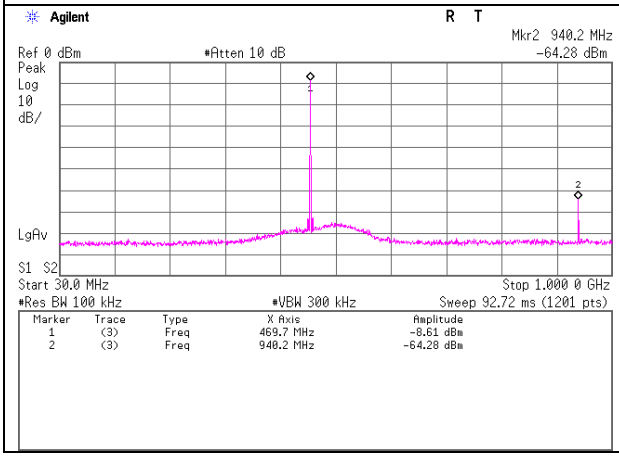
9kHz – 150kHz



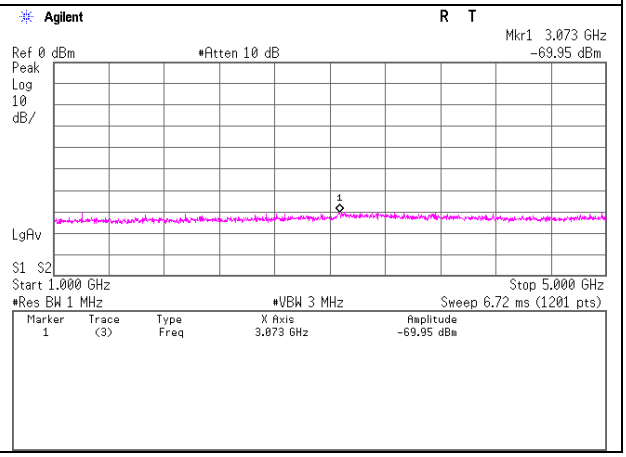
150kHz – 30MHz



30MHz – 1GHz



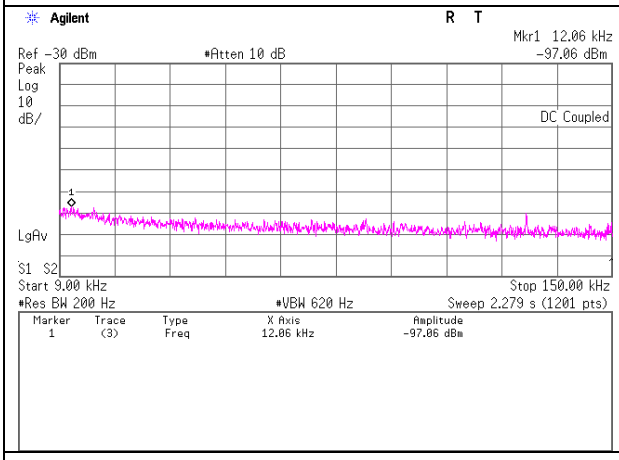
1GHz – 5GHz



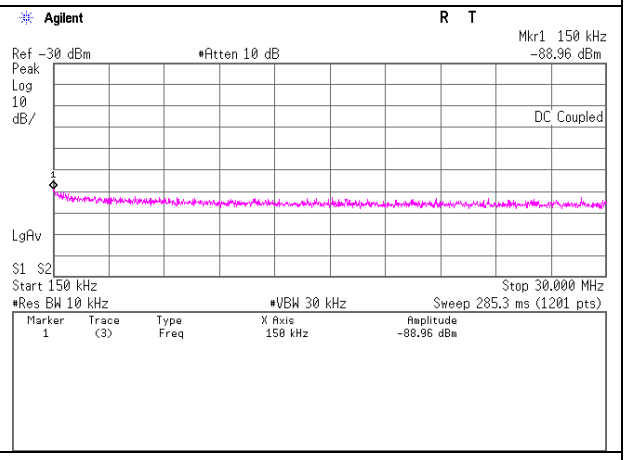
Spurious emissions at antenna terminals

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10686939H
Date	02/24/2015
Temperature/ Humidity	25 deg. C / 28% RH
Engineer	Hironobu Ohnishi
Mode	Tx 607.875MHz, 1mW

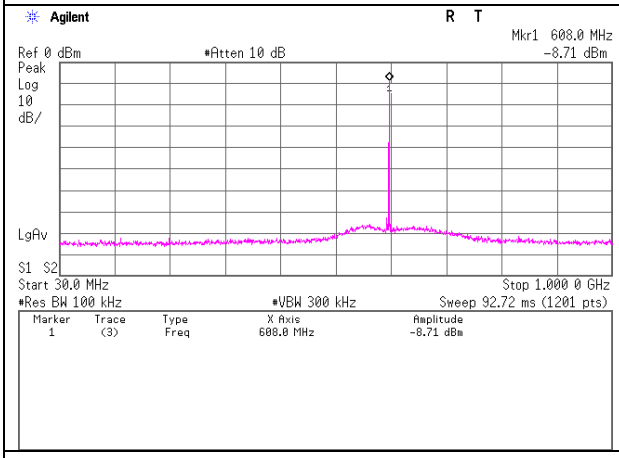
9kHz – 150kHz



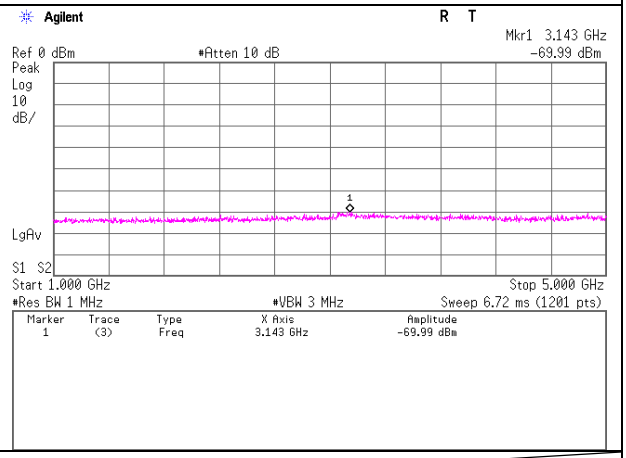
150kHz – 30MHz



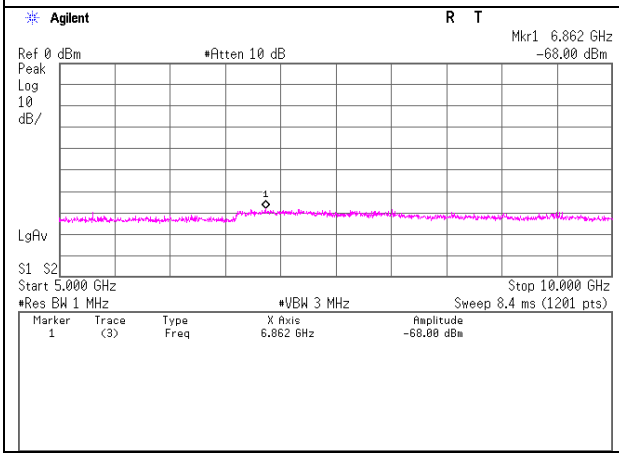
30MHz – 1GHz



1GHz – 5GHz



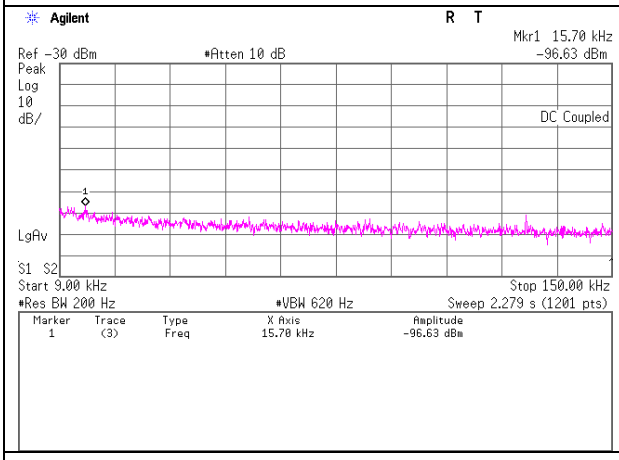
5GHz – 10GHz



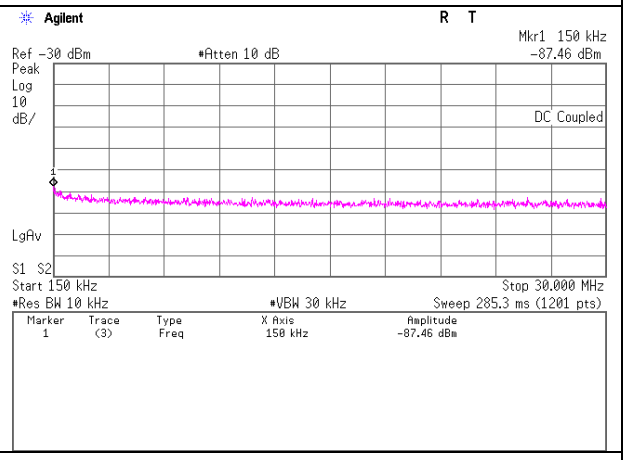
Spurious emissions at antenna terminals

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10686939H
Date	02/24/2015
Temperature/ Humidity	25 deg. C / 28% RH
Engineer	Hironobu Ohnishi
Mode	Tx 697.875MHz, 1mW

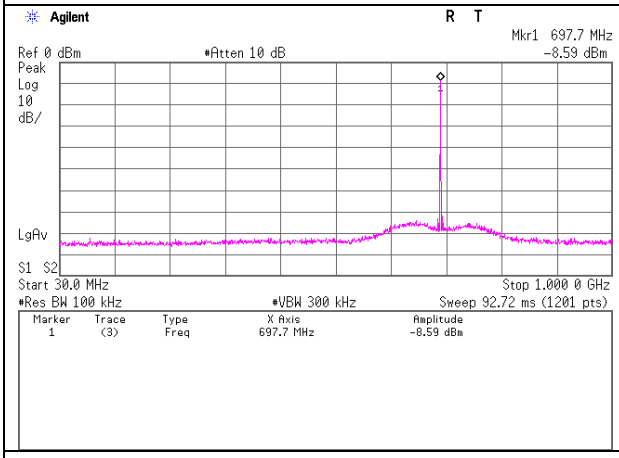
9kHz – 150kHz



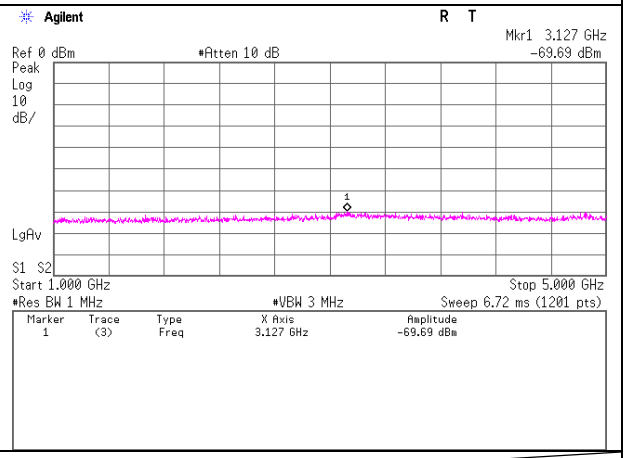
150kHz – 30MHz



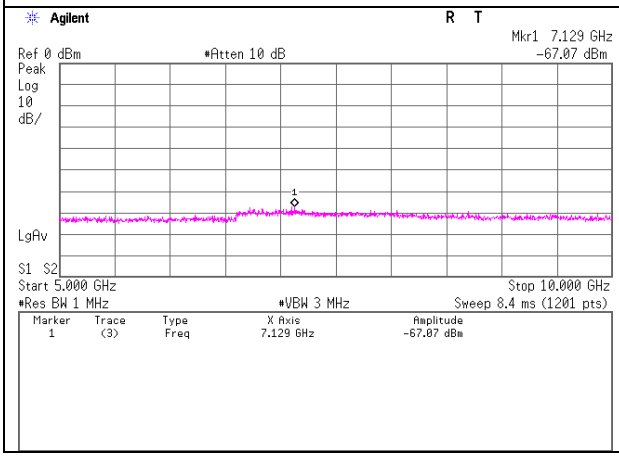
30MHz – 1GHz



1GHz – 5GHz



5GHz – 10GHz



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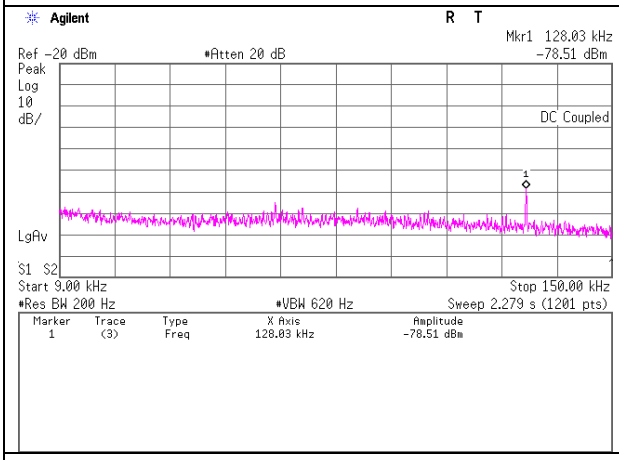
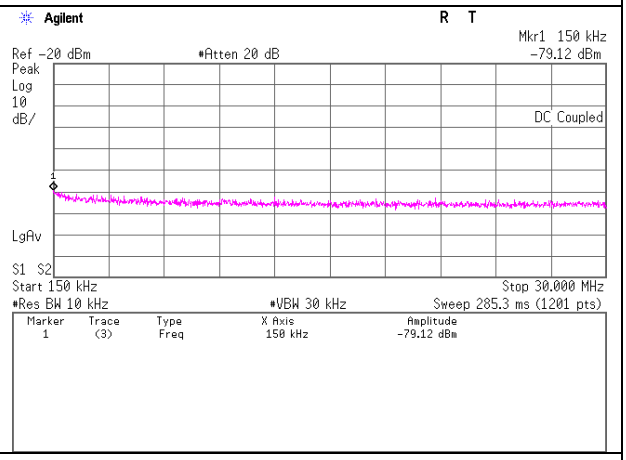
Spurious emissions at antenna terminals

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10686939H
Date	02/24/2015
Temperature/ Humidity	25 deg. C / 28% RH
Engineer	Hironobu Ohnishi
Mode	Tx 470.125MHz, 50mW

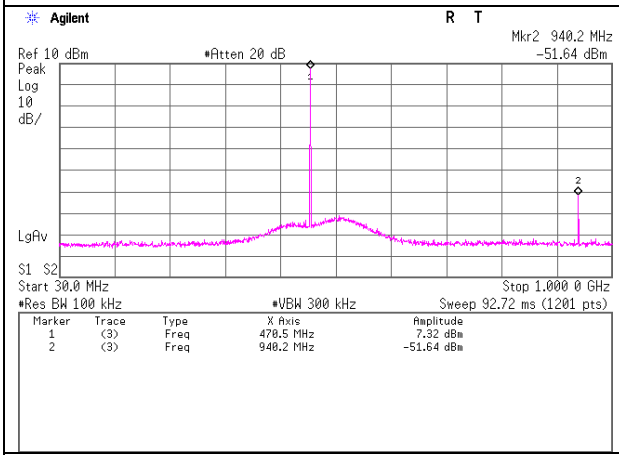
9kHz – 150kHz



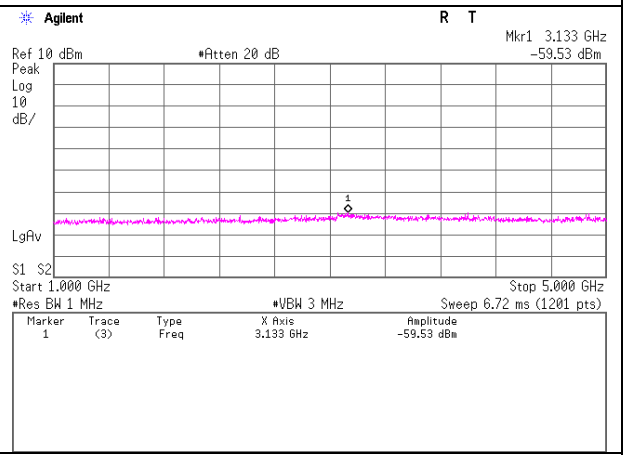
150kHz – 30MHz



30MHz – 1GHz



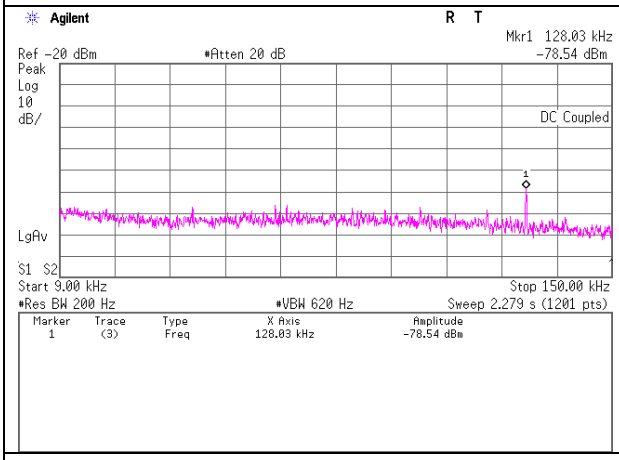
1GHz – 5GHz



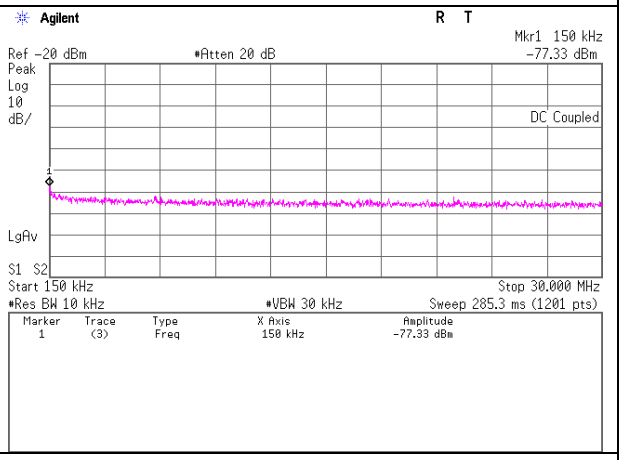
Spurious emissions at antenna terminals

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10686939H
Date	02/24/2015
Temperature/ Humidity	25 deg. C / 28% RH
Engineer	Hironobu Ohnishi
Mode	Tx 607.875MHz, 50mW

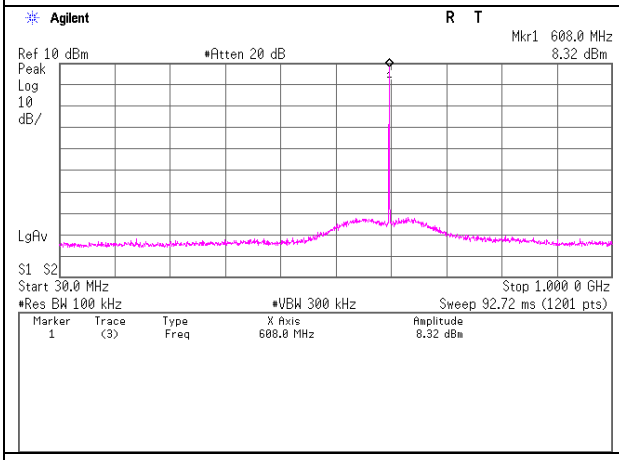
9kHz – 150kHz



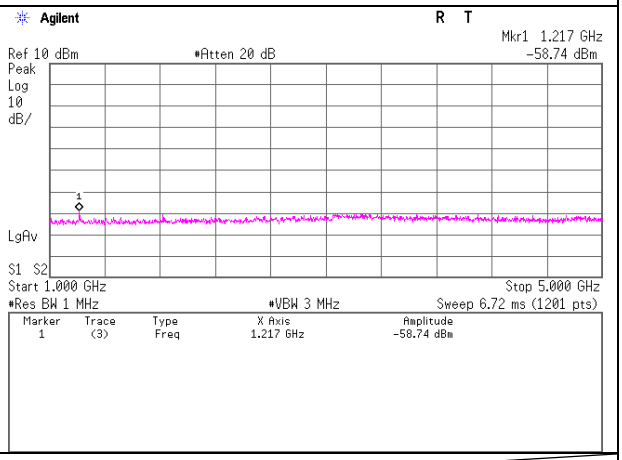
150kHz – 30MHz



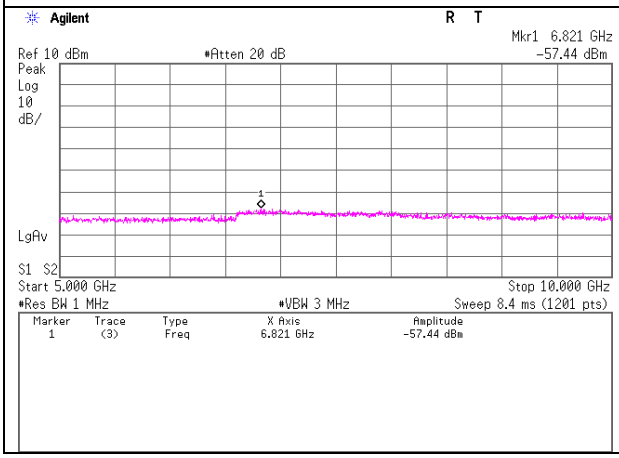
30MHz – 1GHz



1GHz – 5GHz



5GHz – 10GHz



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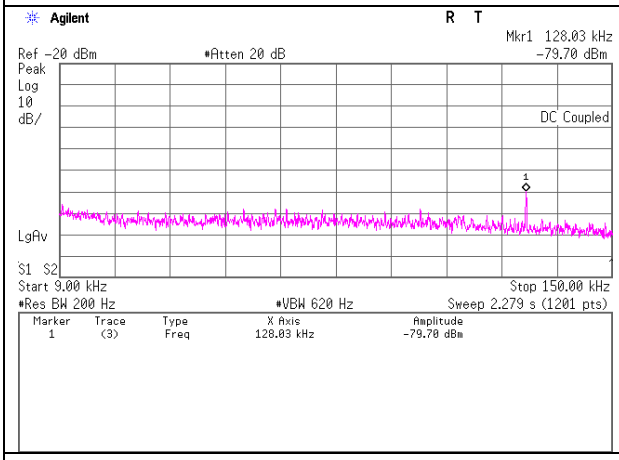
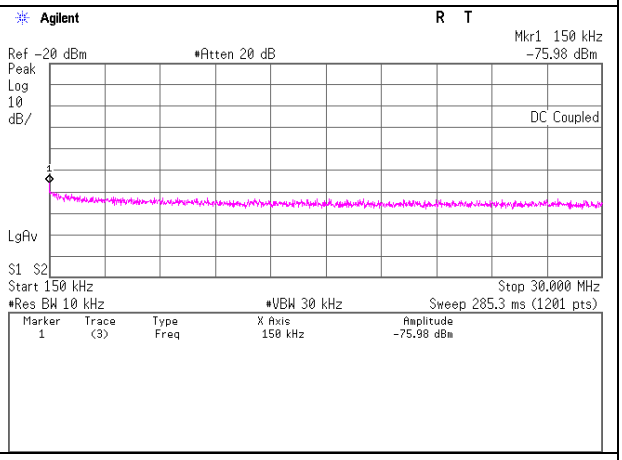
Spurious emissions at antenna terminals

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10686939H
Date	02/24/2015
Temperature/ Humidity	25 deg. C / 28% RH
Engineer	Hironobu Ohnishi
Mode	Tx 697.875MHz, 50mW

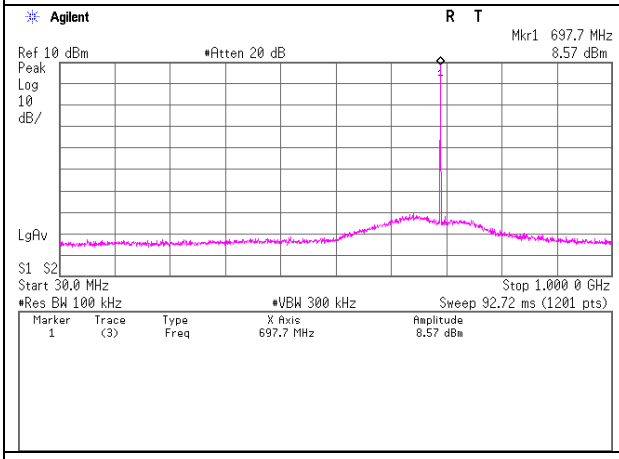
9kHz – 150kHz



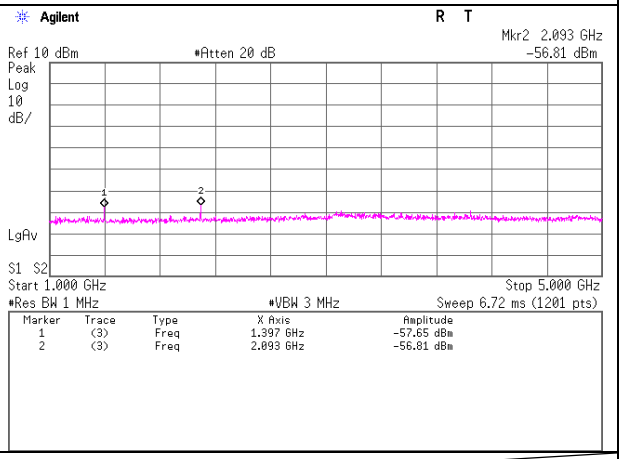
150kHz – 30MHz



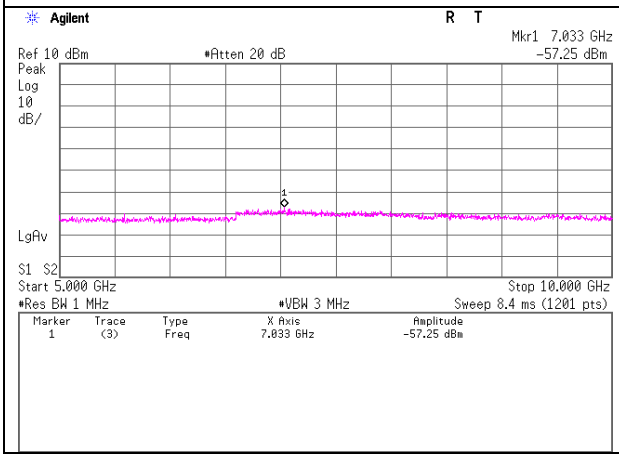
30MHz – 1GHz



1GHz – 5GHz



5GHz – 10GHz



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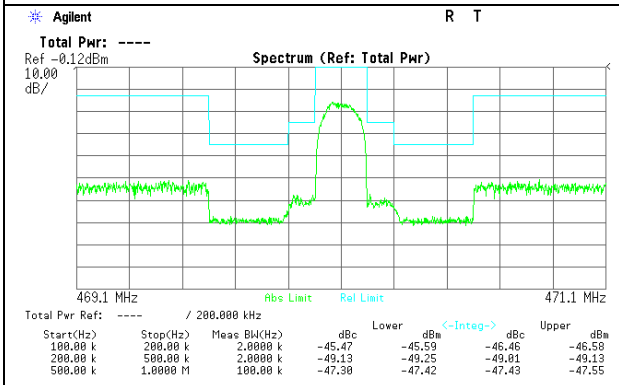
Spurious emissions at antenna terminals

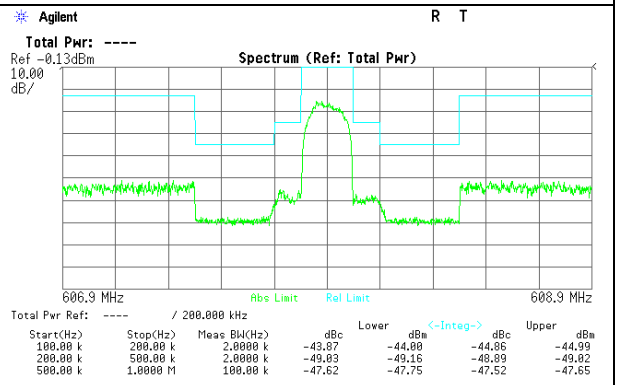
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10686939H
Date	02/24/2015
Temperature/ Humidity	25 deg. C / 28% RH
Engineer	Hironobu Ohnishi
Mode	Tx

Power setting: 1mW

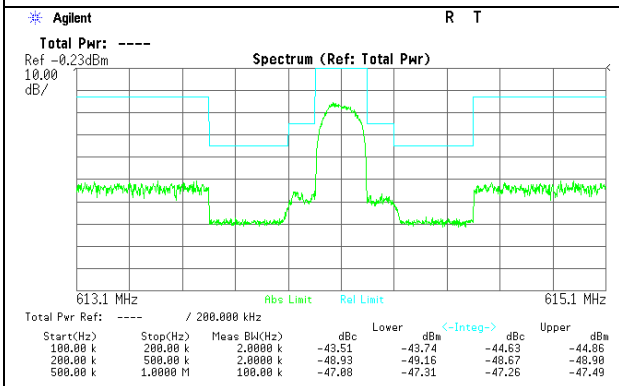
470.125MHz



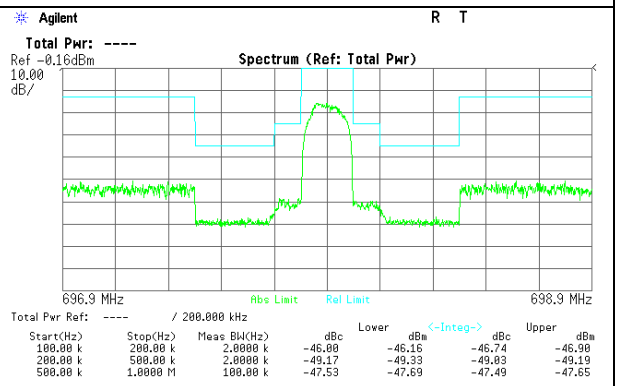
607.875MHz



614.125MHz



697.875MHz



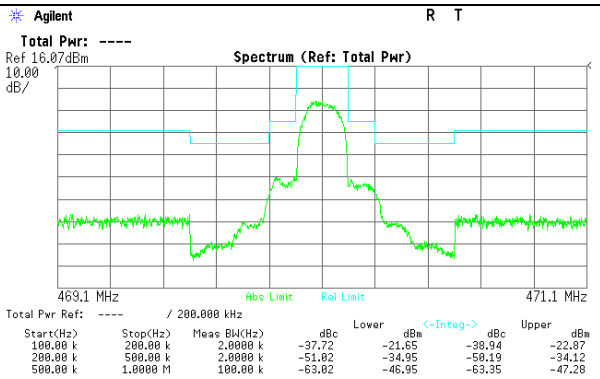
0dB reference level was set to each RF power output result.

Spurious emissions at antenna terminals

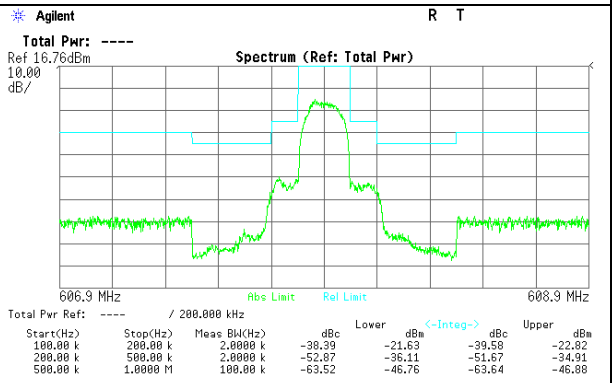
Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10686939H
Date	02/24/2015
Temperature/ Humidity	25 deg. C / 28% RH
Engineer	Hironobu Ohnishi
Mode	Tx

Power setting: 50mW

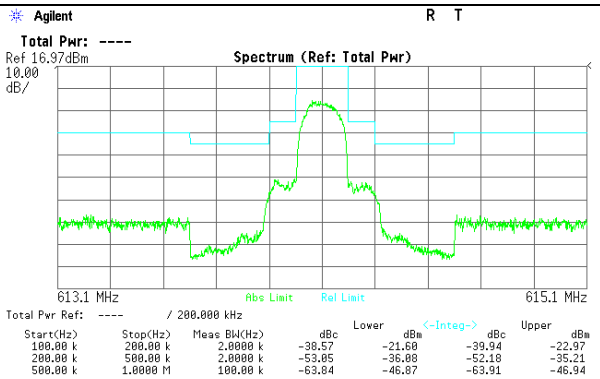
470.125MHz



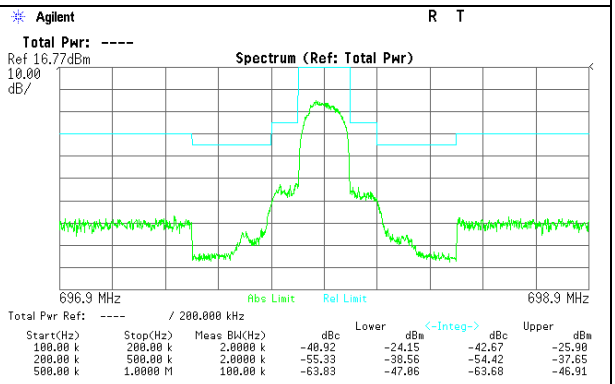
607.875MHz



614.125MHz



697.875MHz



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

Field strength of spurious radiation

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber	
Report No.	10686939H	
Date	02/12/2015	02/14/2015
Temperature/ Humidity	23 deg. C / 33% RH	21 deg. C / 37% RH
Engineer	Satofumi Matsuyama (Below 1GHz)	Kazuya Yoshioka (Above 1GHz)
Mode	Tx 470.125MHz	

[Power setting: 1mW]

Frequency	Rx SA/TR Reading [dBuV]		Tx SG Reading [dBm]		Tx Cable Loss	Tx Ant. Gain	Tx Ant. Atten. Loss	Result (ERP) [dBm]		Limit (ERP) [dBm]	Margin [dB]		Horizontal		Vertical		Remarks
													Rx Ant. Height	Turn Table	Rx Ant. Height	Turn Table	
[MHz]	HOR	VER	HOR	VER	[dB]	[dBi]	[dB]	HOR	VER		HOR	VER	[cm]	[deg.]	[cm]	[deg.]	
940.25	34.2	30.4	-52.9	-54.9	5.2	2.2	10.1	-68.2	-70.2	-13.0	55.2	57.2	100	122	164	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 Reading [dBuV]		Tx SG Reading [dBm]		Tx Cable Loss	Tx Ant. Gain	Tx Ant. Atten. Loss	Result (ERP) [dBm]		Limit (ERP) [dBm]	Margin [dB]		Horizontal		Vertical		Remarks
													Rx Ant. Height	Turn Table	Rx Ant. Height	Turn Table	
[MHz]	HOR	VER	HOR	VER	[dB]	[dBi]	[dB]	HOR	VER		HOR	VER	[cm]	[deg.]	[cm]	[deg.]	
940.25	47.9	41.6	-39.2	-43.7	5.2	2.2	10.1	-54.5	-59.0	-13.0	41.5	46.0	100	126	161	211	
1410.38	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
1880.50	39.9	38.9	-67.5	-70.9	3.6	9.6	0.0	-63.6	-67.0	-13.0	50.6	54.0	116	144	100	195	
2350.63	38.6	36.0	-68.6	-71.5	4.0	10.5	0.0	-64.2	-67.1	-13.0	51.2	54.1	120	139	100	311	
2820.75	36.1	NS	-70.1	-	4.4	10.5	0.0	-66.2	-	-13.0	53.2	-	-	-	-	-	
3290.88	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
3761.00	34.5	NS	-73.0	-	5.2	12.3	0.0	-68.1	-	-13.0	55.1	-	-	-	-	-	
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

Field strength of spurious radiation

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber	
Report No.	10686939H	
Date	02/12/2015	02/14/2015
Temperature/ Humidity	23 deg. C / 33% RH	21 deg. C / 37% RH
Engineer	Satofumi Matsuyama (Below 1GHz)	Kazuya Yoshioka (Above 1GHz)
Mode	Tx 607.875MHz	

[Power setting: 1mW]

Frequency	Rx SA/TR Reading [dBuV]		Tx SG Reading [dBm]		Tx Cable Loss	Tx Ant. Gain	Tx Ant. Atten. Loss	Result (ERP) [dBm]		Limit (ERP) [dBm]	Margin [dB]		Horizontal		Vertical		Remarks
													Rx Ant. Height	Turn Table	Rx Ant. Height	Turn Table	
[MHz]	HOR	VER	HOR	VER	[dB]	[dBi]	[dB]	HOR	VER		HOR	VER	[cm]	[deg.]	[cm]	[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	33.8	34.2	-66.9	-67.7	6.0	12.5	0.0	-62.6	-63.4	-13.0	49.6	50.4	100	58	100	0	
5470.88	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
6078.75	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	

[Power setting: 50mW]

Frequency	Rx SA/TR Reading [dBuV]		Tx SG Reading [dBm]		Tx Cable Loss	Tx Ant. Gain	Tx Ant. Atten. Loss	Result (ERP) [dBm]		Limit (ERP) [dBm]	Margin [dB]		Horizontal		Vertical		Remarks
													Rx Ant. Height	Turn Table	Rx Ant. Height	Turn Table	
[MHz]	HOR	VER	HOR	VER	[dB]	[dBi]	[dB]	HOR	VER		HOR	VER	[cm]	[deg.]	[cm]	[deg.]	
1215.75	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
1823.63	47.0	46.8	-59.5	-62.2	3.5	9.3	0.0	-55.8	-58.5	-13.0	42.8	45.5	126	140	100	189	
2431.50	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
3039.38	38.3	38.6	-65.5	-66.4	4.6	10.6	0.0	-61.7	-62.6	-13.0	48.7	49.6	114	158	100	5	
3647.25	37.6	35.2	-64.9	-67.9	5.1	12.4	0.0	-59.8	-62.8	-13.0	46.8	49.8	100	149	100	0	
4255.13	34.7	34.7	-69.6	-73.0	5.5	12.2	0.0	-65.1	-68.5	-13.0	52.1	55.5	100	152	100	0	
4863.00	35.4	35.4	-65.3	-66.5	6.0	12.5	0.0	-61.0	-62.2	-13.0	48.0	49.2	100	57	100	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-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

Field strength of spurious radiation

Test place	Ise EMC Lab. No.4 Semi Anechoic Chamber	
Report No.	10686939H	
Date	02/12/2015	02/14/2015
Temperature/ Humidity	23 deg. C / 33% RH	21 deg. C / 37% RH
Engineer	Satofumi Matsuyama (Below 1GHz)	Kazuya Yoshioka (Above 1GHz)
Mode	Tx 697.875MHz	

[Power setting: 1mW]

Frequency	Rx SA/TR Reading [dBuV]		Tx SG Reading [dBm]		Tx Cable Loss	Tx Ant. Gain	Tx Ant. Atten. Loss	Result (ERP) [dBm]		Limit (ERP) [dBm]	Margin [dB]		Horizontal		Vertical		Remarks
													Rx Ant. Height	Turn Table	Rx Ant. Height	Turn Table	
[MHz]	HOR	VER	HOR	VER	[dB]	[dBi]	[dB]	HOR	VER		HOR	VER	[cm]	[deg.]	[cm]	[deg.]	
1395.75	NS	NS	-	-	-	-	-	-	-	-13.0	-	-	-	-	-	-	
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	-	-	-	-	-	-	

[Power setting: 50mW]

Frequency	Rx SA/TR Reading [dBuV]		Tx SG Reading [dBm]		Tx Cable Loss	Tx Ant. Gain	Tx Ant. Atten. Loss	Result (ERP) [dBm]		Limit (ERP) [dBm]	Margin [dB]		Horizontal		Vertical		Remarks
													Rx Ant. Height	Turn Table	Rx Ant. Height	Turn Table	
[MHz]	HOR	VER	HOR	VER	[dB]	[dBi]	[dB]	HOR	VER		HOR	VER	[cm]	[deg.]	[cm]	[deg.]	
1395.75	38.5	36.9	-69.5	-73.7	3.1	7.4	0.0	-67.4	-71.6	-13.0	54.4	58.6	107	128	149	190	
2093.63	60.7	57.9	-44.2	-46.7	3.8	10.2	0.0	-39.9	-42.4	-13.0	26.9	29.4	100	215	166	177	
2791.50	42.0	40.8	-62.2	-62.1	4.4	10.5	0.0	-58.2	-58.1	-13.0	45.2	45.1	100	217	104	0	
3489.38	44.5	40.0	-58.8	-63.5	5.0	12.5	0.0	-53.5	-58.2	-13.0	40.5	45.2	100	202	132	160	
4187.25	38.5	38.8	-63.5	-62.2	5.5	12.2	0.0	-59.0	-57.7	-13.0	46.0	44.7	100	206	100	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-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

Frequency stability

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	10686939H
Date	02/26/2015
Temperature/ Humidity	24 deg. C / 32% RH
Engineer	Hironobu Ohnishi
Mode	Tx 607.875MHz

Tested frequency:	607.875 MHz

Test condition		Measured	Result	Limit	Remarks
Temp. [deg. C]	Voltage [V]	frequency [MHz]	[ppm]	(+/- 0.005%) [+/- ppm]	
50	3	607.874585	-0.68	50	
40	3	607.874705	-0.49	50	
30	3	607.874869	-0.22	50	
20	3	607.874995	-0.01	50	
10	3	607.875039	0.06	50	
0	3	607.874936	-0.11	50	
-10	3	607.874778	-0.37	50	
-20	3	607.874803	-0.32	50	
-30	3	607.875198	0.33	50	
20	2.55	607.874995	-0.01	50	85% of nominal voltage
20	3.45	607.874996	-0.01	50	115% of nominal voltage
20	2.05	607.874995	-0.01	50	Battery end point voltage

Calculation formula:

Result = (Measured frequency - Tested frequency) / Tested frequency * 10^6

APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2014/02/28 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE	2015/01/13 * 12
MJM-23	Measure	ASKUL	-	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MTR-01	Test Receiver	Rohde & Schwarz	ESI40	100084	RE	2014/11/10 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2014/11/22 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2014/11/22 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2014/06/02 * 12
MAT-68	Attenuator	Anritsu	MP721B	6200961025	RE	2014/11/11 * 12
MPA-19	Pre Amplifier	MITEQ	MLA-10K01-B01-35	1237616	RE	2015/02/03 * 12
MBF-06	Band Pass Filter	M-City	BPF0950-01	UL0002	RE	2014/04/14 * 12
MCC-38	Coaxial Cable	UL Japan	-	-	RE	2014/12/02 * 12
YTSSG03	Signal Generator	Rohde & Schwarz	SMT02	51400043	RE	2014/08/18 * 12
MCC-126	Coaxial Cable	UL Japan	-	-	RE	2014/07/14 * 12
MDA-03	Dipole Antenna	Schwarzbeck	UHAP	991	RE	2014/10/06 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2014/08/12 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	RE	2014/06/11 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	MY39500780	RE	2014/03/11 * 12
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	RE	2014/06/11 * 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	2014/07/23 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2014/05/26 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2015/02/26 * 12
MHF-27	High Pass Filter(1.1-10GHz)	TOKYO KEIKI	TF219CD1	1001	RE	2015/01/23 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	AT	2014/12/22 * 12
MSA-15	Spectrum Analyzer	Agilent	E4440A	MY46187105	AT	2014/11/11 * 12
MPM-12	Power Meter	Anritsu	ML2495A	0825002	AT	2014/06/16 * 12
MPSE-17	Power sensor	Anritsu	MA2411B	0738285	AT	2014/06/16 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2014/11/19 * 12
MAT-25	Attenuator(10dB)(above 1GHz)	Agilent	8493C	71642	AT	2014/06/12 * 12
MCH-06	Temperature and Humidity Chamber	Tabai Espec	PL-1KT	14007630	AT	2014/04/23 * 12
MMM-17	DIGIITAL HiTESTER	Hioki	3805	070900530	AT	2015/01/16 * 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