RADIO TEST REPORT

Test Report No. : 12199538H-A-R1

Applicant	:	**Murata Manufacturing Co., Ltd.**
Type of Equipment	:	**Communication Module**
Model No.	:	**LBAA0ZZ1LL**
FCC ID	:	**VPYLB1LL**
Test regulation	:	**FCC Part 15 Subpart C: 2018**
Test Result	:	**Complied**

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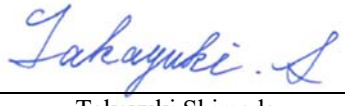
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, 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 12199538H-A. 12199538H-A is replaced with this report.

Date of test: March 6 to 11, 2018

Representative test engineer:

Takafumi Noguchi
Engineer
Consumer Technology Division

Approved by:



Takayuki Shimada
Leader
Consumer Technology Division

NVLAP TESTING
NVLAP LAB CODE: 200572-0

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REVISION HISTORY

Original Test Report No.: 12199538H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	12199538H-A	April 25, 2018	-	-
1	12199538H-A-R1	October 17, 2018	P 9, P 10	Correction of Configuration and peripherals in Clause 4.2
1	12199538H-A-R1	October 17, 2018	P 23, P 26, P 28	Addition of explanatory note *1)
1	12199538H-A-R1	October 17, 2018	P 37	Correction of Test Item of MLS-23 and MLS-24 in Appendix 2

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CONTENTS **PAGE**

SECTION 1: Customer information

Company Name	:	Murata Manufacturing Co., Ltd.
Address	:	1-10-1 Higashikotari, Nagaokakyo-shi, Kyoto 617-8555 Japan
Telephone Number	:	+81-75-955-6736
Facsimile Number	:	+81-75-955-6634
Contact Person	:	Motoo Hayashi

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

2.1 Identification of E.U.T.

Type of Equipment	:	Communication Module
Model No.	:	LBAA0ZZ1LL
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	Min. 2.0 V / Typ. 3.3 V / Max. 3.8 V
Receipt Date of Sample	:	March 5, 2018
Country of Mass-production	:	China, 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: LBAA0ZZ1LL (referred to as the EUT in this report) is a Communication Module.

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	902.5 MHz to 927.5 MHz
Modulation	:	GFSK
Antenna type	:	Monopole antenna
Antenna Gain	:	-2.7 dBi

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on March 12, 2018 and effective April 11, 2018

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928MHz,
2400-2483.5MHz, and 5725-5850MHz

* The revision on March 12, 2018, does not affect the test specification applied to the EUT.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	**FCC:** ANSI C63.10-2013 6. Standard test methods	**FCC:** Section 15.207	**QP** 13.7 dB, 11.34600 MHz, N **AV** 8.7 dB, 11.34600 MHz, N	Complied	-
	IC: RSS-Gen 8.8	**IC:** RSS-Gen 8.8			
6dB Bandwidth	**FCC:** KDB 558074 D01 DTS Meas Guidance v04	**FCC:** Section 15.247(a)(2)	See data.	Complied	Conducted
	IC: -	**IC:** RSS-247 5.2(a)			
Maximum Peak Output Power	**FCC:** KDB 558074 D01 DTS Meas Guidance v04	**FCC:** Section 15.247(b)(3)		Complied	Conducted
	IC: RSS-Gen 6.12	**IC:** RSS-247 5.4(d)			
Power Density	**FCC:** KDB 558074 D01 DTS Meas Guidance v04	**FCC:** Section 15.247(e)		Complied	Conducted
	IC: -	**IC:** RSS-247 5.2(b)			
Spurious Emission Restricted Band Edges	**FCC:** KDB 558074 D01 DTS Meas Guidance v04	**FCC:** Section15.247(d)	1.8 dB 902.00 MHz, PK, Vert.	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)
	IC: RSS-Gen 6.13	**IC:** RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10			

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
*1) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v04 12.2.7.

* In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred.

FCC Part 15.31 (e)
The RF Module has its own regulator.
The RF Module is constantly provided voltage through the regulator regardless of input voltage.
Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement
The antenna is not removable from the EUT.
Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.3

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % Occupied Bandwidth	**IC:** RSS-Gen 6.6	**IC:** -	N/A	-	Conducted

Other than above, 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.

Antenna Terminal test

Test Item		Uncertainty (+/-)
RF output power		1.3 dB
Antenna terminal conducted emission / Power dencity /		2.7 dB
Adjacent channnel power / Channnel power		
	Below 3GHz	1.9 dB
	3 GHz ot 6 GHz	2.1 dB

Conducted emission

using Item	Frequency range	Uncertainty (+/-)
AMN (LISN)	0.009 MHz to 0.15 MHz	3.8 dB
	0.15 MHz to 30 MHz	3.4 dB

Radiated emission

Measurement distance	Frequency range	Uncertainty (+/-)
3 m	9 kHz to 30 MHz	3.3 dB
10 m		3.2 dB
3 m	30 MHz to 200 MHz (Horizontal)	4.8 dB
	(Vertical)	5.0 dB
	200 MHz to 1000 MHz (Horizontal)	5.2 dB
	(Vertical)	6.3 dB
10 m	30 MHz to 200 MHz (Horizontal)	4.8 dB
	(Vertical)	4.9 dB
	200 MHz to 1000 MHz (Horizontal)	5.0 dB
	(Vertical)	5.0 dB
3 m	1 GHz to 6 GHz	5.0 dB
	6 GHz to 18 GHz	5.3 dB
1 m	10 GHz to 26.5 GHz	5.8 dB
	26.5 GHz to 40 GHz	5.8 dB
10 m	1 GHz to 18 GHz	5.2 dB

Conducted emission test

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

Radiated emission test

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

3.5 Test Location

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

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

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

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

4.1 Operating Mode(s)

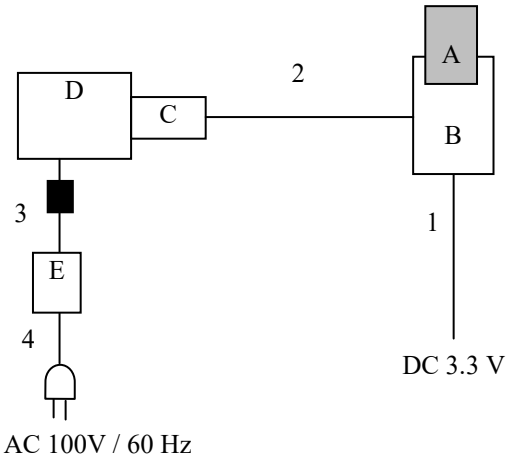
Mode	Remarks*
Transmitting (Tx)	-
*Power of the EUT was set by the software as follows; Power setting value: B Software: Murata SubGHz Tool 1.0.3 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	

*The details of Operating mode(s)

Test Item	Operating Mode	Tested antenna port	Tested frequency
Conducted Emission 6 dB Bandwidth Power Density 99 % Occupied Bandwidth Spurious Emission (Radiated /Conducted) Maximum Peak Output Power	Transmitting (Tx)	-	902.5 MHz 915.0 MHz 927.5 MHz

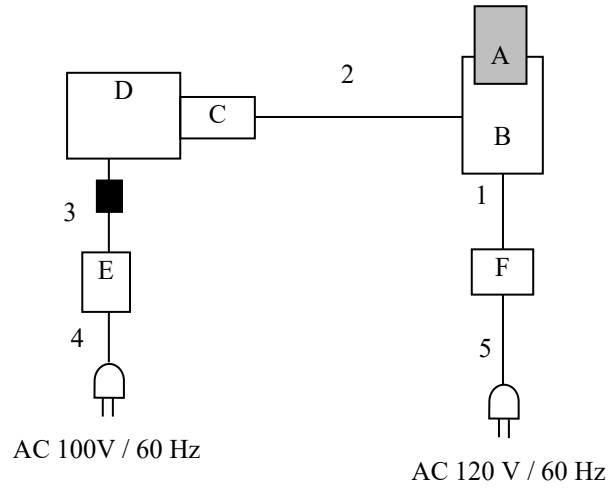
4.2 Configuration and peripherals

Except for Conducted Emission test



■ : Standard Ferrite Core

Conducted Emission test



■ : Standard Ferrite Core

* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Communication Module	LBAA0ZZ1LL	1 *1) , *4) 2 *2)	Murata Manufacturing Co., Ltd.	EUT
B	Jig Board	-	-	-	*3)
C	Jig Borad (USB)	-	-	-	-
D	Laptop PC	CF-N8HWCDPS	0BKSA08723	Panasonic	-
E	AC Adapter	CF-AA6372B	6372BM409X18054B	Panasonic	-
F	DC power supply	PMC35-2A	RM000298	KIKUSUI	*4)

*1) Used for Radiated Emission test
*2) Used for Antenna Terminal Conducted test
*3) The test was performed with the module that as normal assumed implementation conditions.
The use of a jig does not influence on the test result.
*4) Used for Conducted Emission test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	2.0 *1), *2) 0.2 *4)	Unshielded	Unshielded	-
2	Signal Cable	0.3	Unshielded	Unshielded	-
3	DC Cable	1.1	Unshielded	Unshielded	-
4	AC Cable	0.9	Unshielded	Unshielded	-
5	AC Cable	1.8	Unshielded	Unshielded	*4)

SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane.
The rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

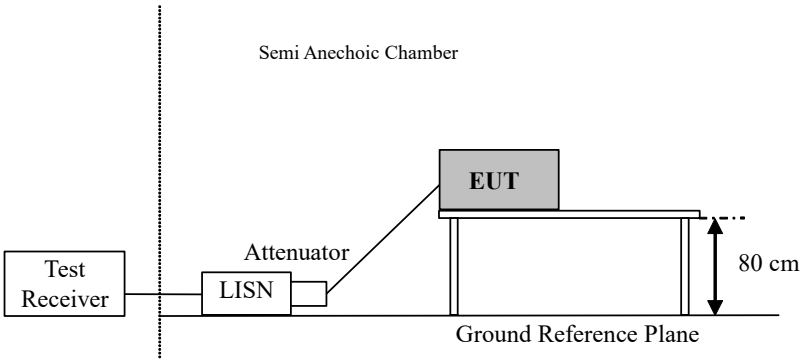
1) For the tests on EUT with other peripherals (as a whole system)
I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.
The EUT was connected to a LISN (AMN).
An overview sweep with peak detection has been performed.

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

Detector : QP and CISPR AV
Measurement range : 0.15 MHz - 30 MHz
Test data : APPENDIX
Test result : Pass

Figure 1: Test Setup



SECTION 6: Radiated Spurious Emission

Test Procedure

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "KDB 558074 D01 DTS Meas Guidance v04".

[For below 1 GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.
The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 and 4 m and EUT 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 with the Test Receiver, or the Spectrum Analyzer.
The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).
The test was made with the detector (RBW/VBW) in the following table.
When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

Frequency	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

In any 100 kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

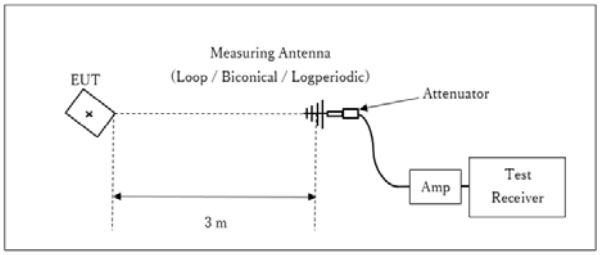
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	Average Power Method: RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces If duty cycle was less than 98%, a duty factor was added to the results.	RBW: 100 kHz VBW: 300kHz

*1) Average Power Measurement was performed based on 6. 0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v04".

Figure 2: Test Setup

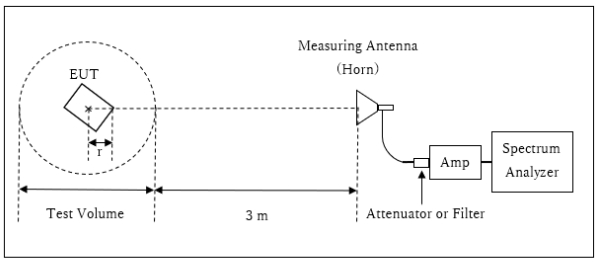
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz



r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: 20 x log (3.75 m / 3.0 m) = 1.94 dB
* Test Distance: (3 + Test Volume /2) - r = 3.75 m

Test Volume : 1.5 m
(Test Volume has been calibrated based on CISPR 16-1-4.)
r = 0.0 m

* The test was performed with r = 0.0 m since EUT is small and it was the rather conservative condition.

- 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 - 10 GHz
Test data : APPENDIX
Test result : Pass

SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6 dB Bandwidth	1 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6 dB Bandwidth	3 kHz	10 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	9.1 kHz	27 kHz				

*1) Peak hold was applied as Worst-case measurement.
*2) Reference data
*3) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v04".
*4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.
Then, wide-band noise near the limit was checked separately, however the noise was low enough as shown in the chart.
(9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 kHz).

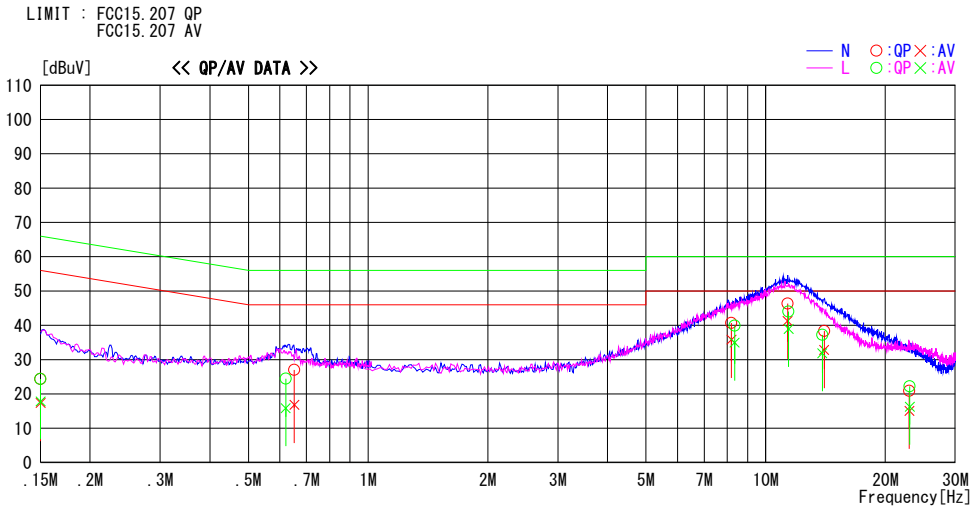
The test results and limit are rounded off to two decimals place, so some differences might be observed.

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

Report No.	12199538H
Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Date	March 11, 2018
Temperature / Humidity	15 deg. C / 26 % RH
Engineer	Yuta Moriya
Mode	Tx 927.5MHz



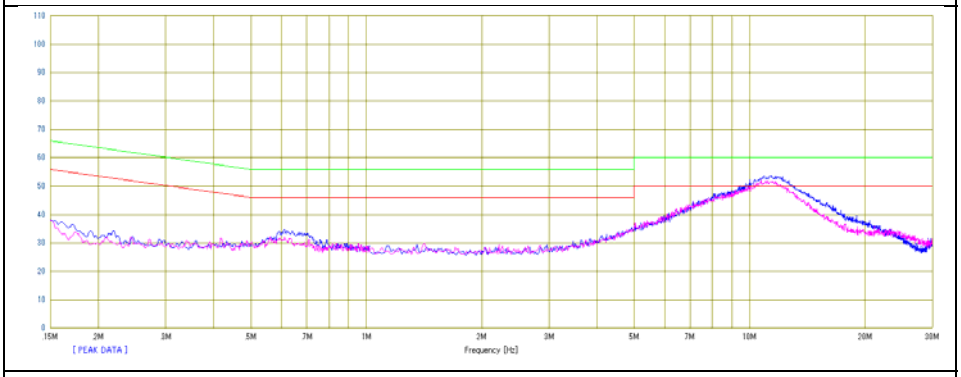
Frequency	Reading Level		Corr.	Results		Limit		Margin		Phase	Comment
	QP	AV	Factor	QP	AV	QP	AV	QP	AV		
[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
0.15000	11.2	4.2	13.2	24.4	17.4	66.0	56.0	41.6	38.6	N	
0.65260	13.7	3.5	13.3	27.0	16.8	56.0	46.0	29.0	29.2	N	
8.19400	26.7	21.8	14.0	40.7	35.8	60.0	50.0	19.3	14.2	N	
11.34600	32.0	27.0	14.3	46.3	41.3	60.0	50.0	13.7	8.7	N	
14.02520	23.9	18.4	14.4	38.3	32.8	60.0	50.0	21.7	17.2	N	
22.98680	6.0	0.2	14.9	20.9	15.1	60.0	50.0	39.1	34.9	N	
0.15000	11.2	4.7	13.2	24.4	17.9	66.0	56.0	41.6	38.1	L	
0.62100	11.3	2.7	13.2	24.5	15.9	56.0	46.0	31.5	30.1	L	
8.35000	25.8	20.9	14.1	39.9	35.0	60.0	50.0	20.1	15.0	L	
11.42034	29.7	24.7	14.3	44.0	39.0	60.0	50.0	16.0	11.0	L	
13.87620	22.8	17.5	14.4	37.2	31.9	60.0	50.0	22.8	18.1	L	
23.03160	7.3	1.4	14.9	22.2	16.3	60.0	50.0	37.8	33.7	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits.

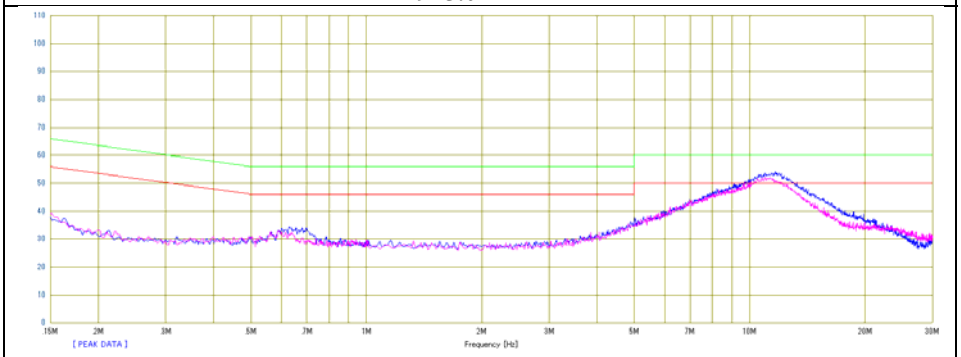
Conducted Emission

Report No.	12199538H
Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Date	March 11, 2018
Temperature / Humidity	15 deg. C / 26 % RH
Engineer	Yuta Moriya
Mode	Tx

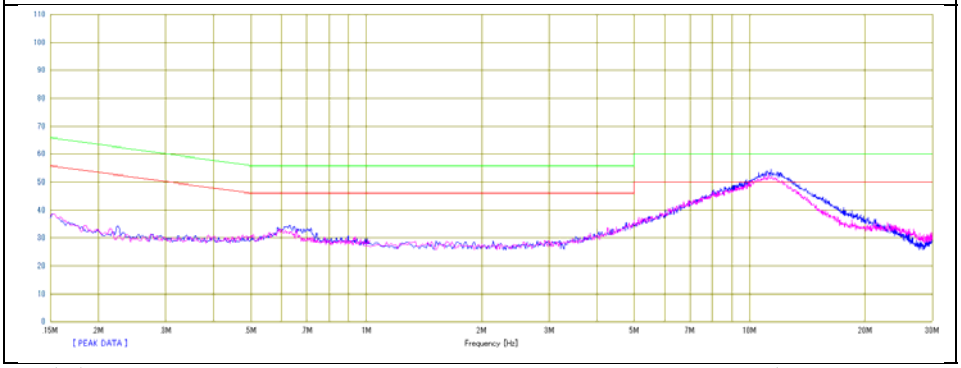
902.5 MHz



915.0 MHz



927.5 MHz



Y scale [dBuV] Chart N L

6 dB Bandwidth and 99 % Occupied Bandwidth

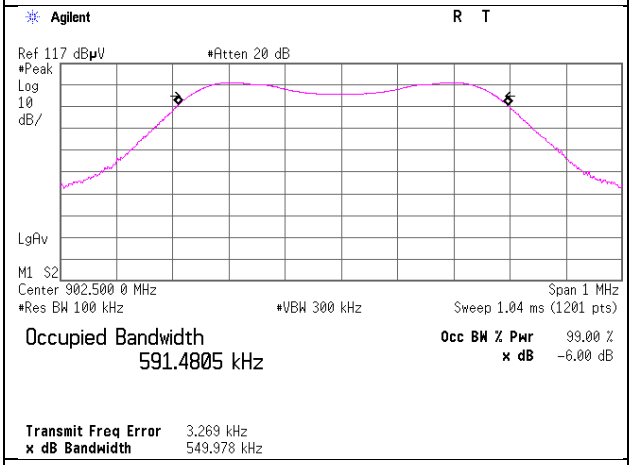
Report No.	12199538H
Test place	Ise EMC Lab. No.7 Measurement Room
Date	March 7, 2018
Temperature / Humidity	20 deg. C / 36 % RH
Engineer	Shuichi Ohyama
Mode	Tx

Frequency [MHz]	99 % Occupied Bandwidth [kHz]	6 dB Bandwidth [MHz]	Limit for 6 dB Bandwidth [MHz]
902.5	479.8622	0.550	> 0.5000
915.0	484.9489	0.550	> 0.5000
927.5	481.2266	0.549	> 0.5000

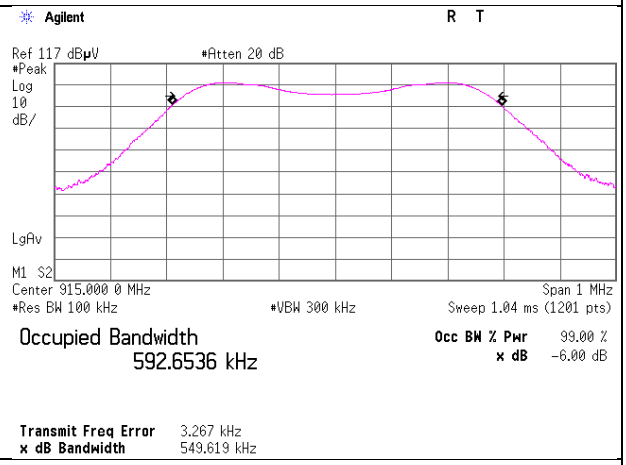
6 dB Bandwidth

Report No.	12199538H
Test place	Ise EMC Lab. No.7 Measurement Room
Date	March 7, 2018
Temperature / Humidity	20 deg. C / 36 % RH
Engineer	Shuichi Ohyama
Mode	Tx

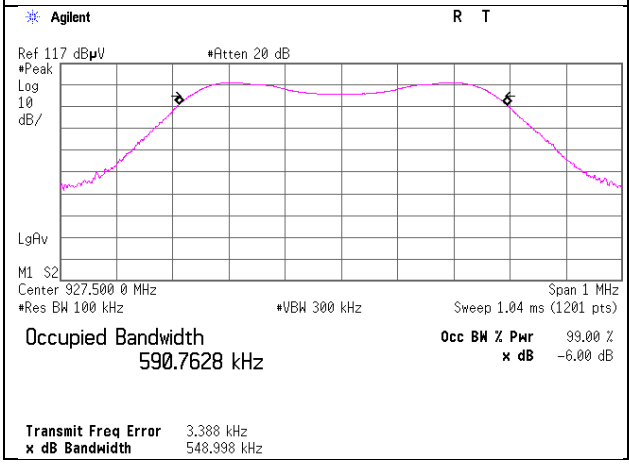
902.5 MHz

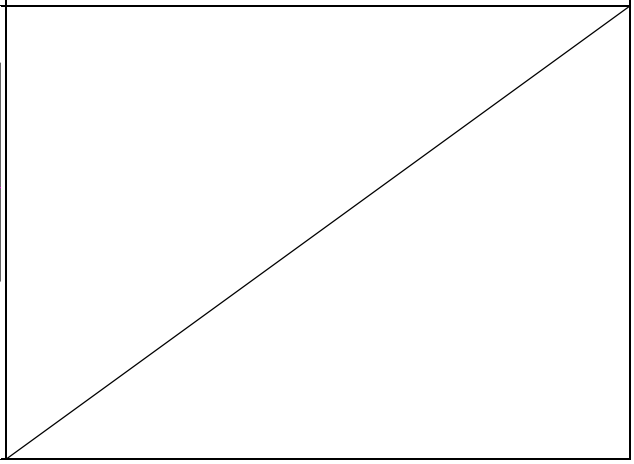


915.0 MHz



927.5 MHz



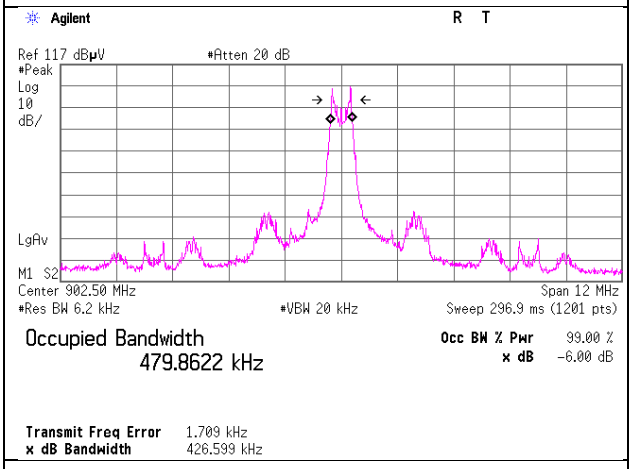


99 %Occupied Bandwidth

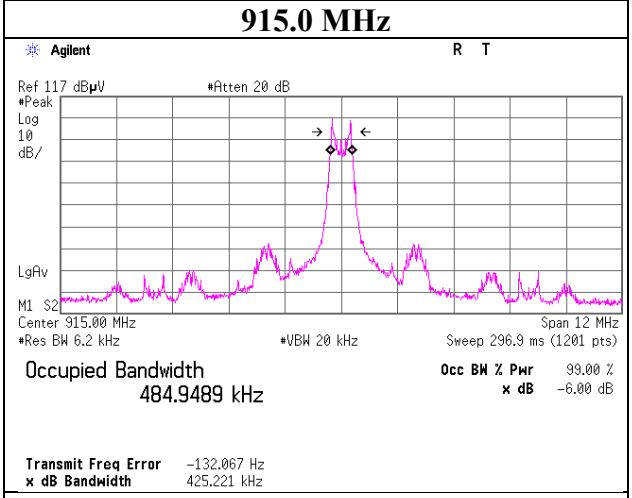
Report No.	12199538H
Test place	Ise EMC Lab. No.7 Measurement Room
Date	March 7, 2018
Temperature / Humidity	20 deg. C / 36 % RH
Engineer	Shuichi Ohyama
Mode	Tx

Tx

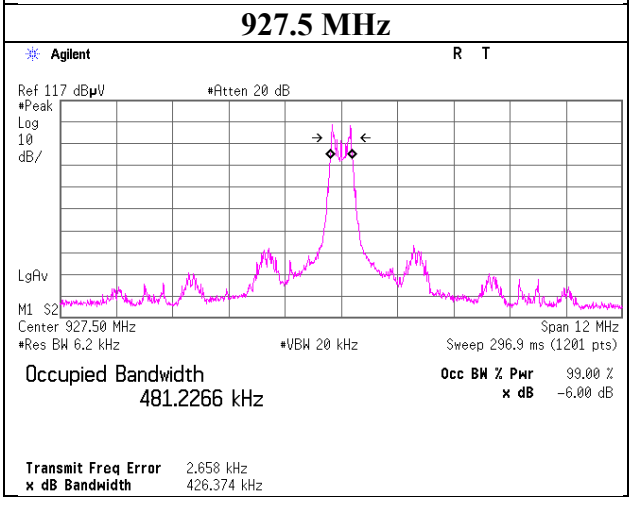
902.5 MHz



915.0 MHz



927.5 MHz



Maximum Peak Output Power

Report No.	12199538H
Test place	Ise EMC Lab. No.7 Measurement Room
Date	March 7, 2018
Temperature / Humidity	20 deg. C / 36 % RH
Engineer	Shuichi Ohyama
Mode	Tx

Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]
902.5	1.21	0.20	9.91	11.32	13.55	30.00	1000	18.68
915.0	1.23	0.20	9.91	11.34	13.61	30.00	1000	18.66
927.5	1.24	0.20	9.91	11.35	13.65	30.00	1000	18.65

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

*The equipment and cables were not used for factor 0 dB of the data sheets.

All comparison were carried out on same frequency and measurement factors.

Average Output Power
(Reference data for RF Exposure / SAR testing)

Report No.	12199538H
Test place	Ise EMC Lab. No.7 Measurement Room
Date	March 7, 2018
Temperature / Humidity	20 deg. C / 36 % RH
Engineer	Shuichi Ohyama
Mode	Tx

Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]
902.5	-9.72	0.20	9.91	0.39	1.09
915.0	-9.70	0.20	9.91	0.41	1.10
927.5	-9.69	0.20	9.91	0.42	1.10

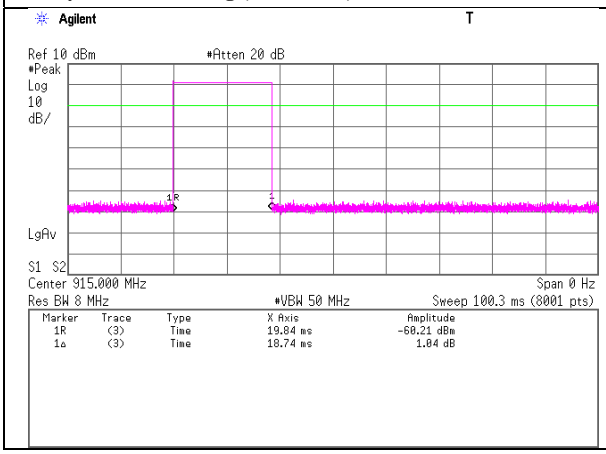
Sample Calculation:
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

*The equipment and cables were not used for factor 0 dB of the data sheets.

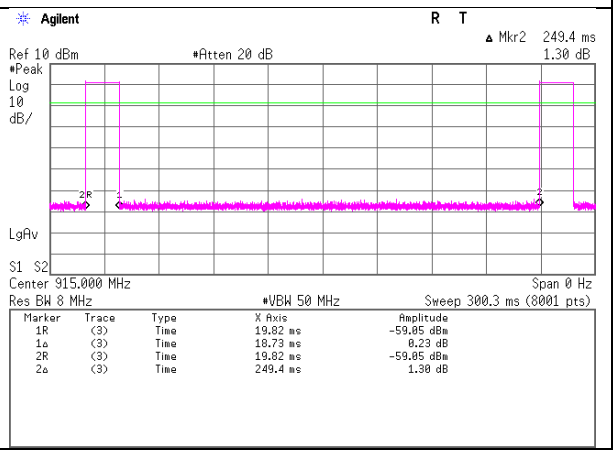
Burst rate confirmation

Report No.	12199538H
Test place	Ise EMC Lab. No.7 Measurement Room
Date	March 7, 2018
Temperature / Humidity	20 deg. C / 36 % RH
Engineer	Shuichi Ohyama
Mode	Tx

Tx on / (Tx on + Tx off) =	**0.187**
Tx on / (Tx on + Tx off) * 100 =	**18.7 %**
Duty factor = 20 * log (100 / 18.74) =	**14.54 dB**



Reference data



* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

Radiated Spurious Emission

Report No.	12199538H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.2
Date	March 6, 2018	March 9, 2018
Temperature / Humidity	23 deg. C / 38 % RH	22 deg. C / 32 % RH
Engineer	Takafumi Noguchi	Ryota Yamanaka
	(Below 1 GHz)	(Above 1 GHz)
Mode	Tx 902.5 MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	84.000	QP	38.0	7.4	8.0	32.2	-	21.2	40.0	18.8	
Hori	96.001	QP	37.8	9.4	8.1	32.2	-	23.1	43.5	20.4	
Hori	144.000	QP	42.9	14.6	8.7	32.1	-	34.1	43.5	9.4	
Hori	168.001	QP	40.1	15.9	8.9	32.1	-	32.8	43.5	10.7	
Hori	192.002	QP	35.2	16.4	9.1	32.1	-	28.6	43.5	14.9	
Hori	216.006	QP	38.9	11.3	9.3	32.1	-	27.4	46.0	18.6	
Hori	432.001	QP	36.2	16.2	10.9	32.0	-	31.3	46.0	14.7	
Hori	1805.000	PK	50.3	25.9	5.0	34.7	-	46.5	73.9	27.4	
Hori	2707.500	PK	61.3	27.9	5.3	34.4	-	60.1	73.9	13.8	
Hori	3610.000	PK	45.5	28.9	5.7	33.8	-	46.3	73.9	27.6	
Hori	4512.500	PK	47.1	30.6	6.1	33.6	-	50.2	73.9	23.7	
Hori	5415.000	PK	42.0	31.9	6.6	33.4	-	47.1	73.9	26.8	Floor noise
Hori	6317.500	PK	43.1	33.7	7.0	33.6	-	50.2	73.9	23.7	Floor noise
Hori	7220.000	PK	42.1	35.9	7.2	33.6	-	51.6	73.9	22.3	Floor noise
Hori	8122.500	PK	42.4	36.9	7.5	33.7	-	53.1	73.9	20.8	Floor noise
Hori	9025.000	PK	43.3	37.5	7.7	33.8	-	54.7	73.9	19.2	Floor noise
Hori	4512.500	AV	40.5	30.6	6.1	33.6	-	43.6	53.9	10.3	*1)
Hori	5415.000	AV	33.4	31.9	6.6	33.4	-	38.5	53.9	15.4	Floor noise
Hori	6317.500	AV	33.8	33.7	7.0	33.6	-	40.9	53.9	13.0	Floor noise
Hori	7220.000	AV	34.0	35.9	7.2	33.6	-	43.5	53.9	10.4	Floor noise
Hori	8122.500	AV	34.5	36.9	7.5	33.7	-	45.2	53.9	8.7	Floor noise
Hori	9025.000	AV	35.2	37.5	7.7	33.8	-	46.6	53.9	7.3	Floor noise
Vert	84.000	QP	47.2	7.4	8.0	32.2	-	30.4	40.0	9.6	
Vert	96.001	QP	48.2	9.4	8.1	32.2	-	33.5	43.5	10.0	
Vert	144.000	QP	36.0	14.6	8.7	32.1	-	27.2	43.5	16.3	
Vert	168.001	QP	34.9	15.9	8.9	32.1	-	27.6	43.5	15.9	
Vert	192.002	QP	32.4	16.4	9.1	32.1	-	25.8	43.5	17.7	
Vert	216.006	QP	32.6	11.3	9.3	32.1	-	21.1	46.0	24.9	
Vert	432.001	QP	32.0	16.2	10.9	32.0	-	27.1	46.0	18.9	
Vert	1805.000	PK	54.3	25.9	5.0	34.7	-	50.5	73.9	23.4	
Vert	2707.500	PK	60.3	27.9	5.3	34.4	-	59.1	73.9	14.8	
Vert	3610.000	PK	43.8	28.9	5.7	33.8	-	44.6	73.9	29.3	
Vert	4512.500	PK	47.3	30.6	6.1	33.6	-	50.4	73.9	23.5	
Vert	5415.000	PK	41.8	31.9	6.6	33.4	-	46.9	73.9	27.0	Floor noise
Vert	6317.500	PK	41.2	33.7	7.0	33.6	-	48.3	73.9	25.6	Floor noise
Vert	7220.000	PK	42.4	35.9	7.2	33.6	-	51.9	73.9	22.0	Floor noise
Vert	8122.500	PK	42.9	36.9	7.5	33.7	-	53.6	73.9	20.3	Floor noise
Vert	9025.000	PK	43.3	37.5	7.7	33.8	-	54.7	73.9	19.2	Floor noise
Vert	4512.500	AV	40.7	30.6	6.1	33.6	-	43.8	53.9	10.1	*1)
Vert	5415.000	AV	33.5	31.9	6.6	33.4	-	38.6	53.9	15.3	Floor noise
Vert	6317.500	AV	34.2	33.7	7.0	33.6	-	41.3	53.9	12.6	Floor noise
Vert	7220.000	AV	34.1	35.9	7.2	33.6	-	43.6	53.9	10.3	Floor noise
Vert	8122.500	AV	34.4	36.9	7.5	33.7	-	45.1	53.9	8.8	Floor noise
Vert	9025.000	AV	35.4	37.5	7.7	33.8	-	46.8	53.9	7.1	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz 20log (3.75 m / 3.0 m) = 1.94 dB

*1) Transmitting duty was 100 % in this frequency.

Radiated Spurious Emission

Report No.	12199538H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.2
Date	March 6, 2018	March 9, 2018
Temperature / Humidity	23 deg. C / 38 % RH	22 deg. C / 32 % RH
Engineer	Takafumi Noguchi (Below 1 GHz)	Ryota Yamanaka (Above 1 GHz)
Mode	Tx 902.5 MHz	

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	902.500	PK	106.4	21.9	13.5	31.0	110.8	-	-	Carrier
Hori	902.000	PK	84.5	21.9	13.5	31.0	88.9	90.8	1.9	
Vert	902.500	PK	103.0	21.9	13.5	31.0	107.4	-	-	Carrier
Vert	902.000	PK	81.2	21.9	13.5	31.0	85.6	87.4	1.8	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amprifier)

PK with Duty Factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	1805.000	PK	50.3	25.9	5.0	34.7	-14.5	32.0	53.9	21.9	*1)
Hori	2707.500	PK	61.3	27.9	5.3	34.4	-14.5	45.6	53.9	8.3	*1)
Hori	3610.000	PK	45.5	28.9	5.7	33.8	-14.5	31.8	53.9	22.1	*1)
Vert	1805.000	PK	54.3	25.9	5.0	34.7	-14.5	36.0	53.9	17.9	*1)
Vert	2707.500	PK	60.3	27.9	5.3	34.4	-14.5	44.6	53.9	9.3	*1)
Vert	3610.000	PK	43.8	28.9	5.7	33.8	-14.5	30.1	53.9	23.8	*1)

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz))
- Gain(Amprifier) + Duty factor (Refer to duty factor data sheet)

*1) Noise synchronized with duty of carrier frequency.

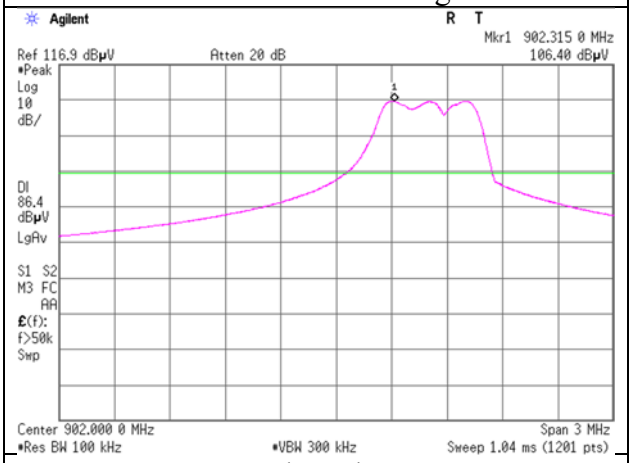
Distance factor: 1 GHz - 10 GHz 20log (3.75 m / 3.0 m) = 1.94 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12199538H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 6, 2018
Temperature / Humidity	23 deg. C / 38 % RH
Engineer	Takafumi Noguchi
	(Below 1 GHz)
Mode	Tx 902.5 MHz

Horizontal

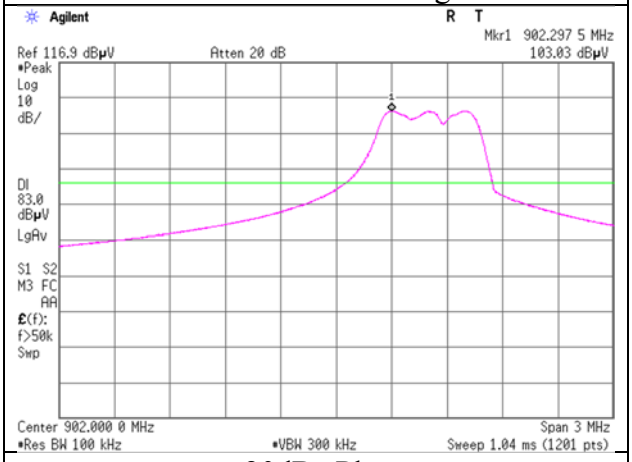
Authorized-band band-edge Plot



20dBc Plot

Vertical

Authorized-band band-edge Plot



20dBc Plot

* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No.	12199538H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.2
Date	March 6, 2018	March 10, 2018
Temperature / Humidity	23 deg. C / 38 % RH	20 deg. C / 27 % RH
Engineer	Takafumi Noguchi (Below 1 GHz)	Takumi Shimada (Above 1 GHz)
Mode	Tx 915.0 MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	84.000	QP	38.2	7.4	8.0	32.2	-	21.4	40.0	18.6	
Hori	96.001	QP	37.8	9.4	8.1	32.2	-	23.1	43.5	20.4	
Hori	144.000	QP	42.9	14.6	8.7	32.1	-	34.1	43.5	9.4	
Hori	168.001	QP	40.0	15.9	8.9	32.1	-	32.7	43.5	10.8	
Hori	192.002	QP	34.9	16.4	9.1	32.1	-	28.3	43.5	15.2	
Hori	216.006	QP	38.5	11.3	9.3	32.1	-	27.0	46.0	19.0	
Hori	432.001	QP	36.0	16.2	10.9	32.0	-	31.1	46.0	14.9	
Hori	1830.000	PK	46.8	25.9	5.1	34.7	-	43.1	73.9	30.8	
Hori	2745.000	PK	61.5	28.0	5.3	34.4	-	60.4	73.9	13.5	
Hori	3660.000	PK	44.3	29.1	5.7	33.8	-	45.3	73.9	28.6	
Hori	4575.000	PK	44.6	30.7	6.1	33.6	-	47.8	73.9	26.1	
Hori	5490.000	PK	40.9	31.9	6.6	33.4	-	46.0	73.9	27.9	Floor noise
Hori	6405.000	PK	41.5	34.0	7.0	33.6	-	48.9	73.9	25.0	Floor noise
Hori	7320.000	PK	42.8	36.1	7.3	33.6	-	52.6	73.9	21.3	Floor noise
Hori	8235.000	PK	42.6	36.7	7.4	33.7	-	53.0	73.9	20.9	Floor noise
Hori	9150.000	PK	43.1	37.7	7.8	33.8	-	54.8	73.9	19.1	Floor noise
Hori	4575.000	AV	38.2	30.7	6.1	33.6	-	41.4	53.9	12.5	*1)
Hori	5490.000	AV	33.9	31.9	6.6	33.4	-	39.0	53.9	14.9	Floor noise
Hori	6405.000	AV	33.3	34.0	7.0	33.6	-	40.7	53.9	13.2	Floor noise
Hori	7320.000	AV	34.2	36.1	7.3	33.6	-	44.0	53.9	9.9	Floor noise
Hori	8235.000	AV	34.6	36.7	7.4	33.7	-	45.0	53.9	8.9	Floor noise
Hori	9150.000	AV	34.7	37.7	7.8	33.8	-	46.4	53.9	7.5	Floor noise
Vert	84.000	QP	47.0	7.4	8.0	32.2	-	30.2	40.0	9.8	
Vert	96.001	QP	48.1	9.4	8.1	32.2	-	33.4	43.5	10.1	
Vert	144.000	QP	36.0	14.6	8.7	32.1	-	27.2	43.5	16.3	
Vert	168.001	QP	35.0	15.9	8.9	32.1	-	27.7	43.5	15.8	
Vert	192.002	QP	32.5	16.4	9.1	32.1	-	25.9	43.5	17.6	
Vert	216.006	QP	32.5	11.3	9.3	32.1	-	21.0	46.0	25.0	
Vert	432.001	QP	31.7	16.2	10.9	32.0	-	26.8	46.0	19.2	
Vert	1830.000	PK	59.2	25.9	5.1	34.7	-	55.5	73.9	18.4	
Vert	2745.000	PK	60.1	28.0	5.3	34.4	-	59.0	73.9	14.9	
Vert	3660.000	PK	43.0	29.1	5.7	33.8	-	44.0	73.9	29.9	
Vert	4575.000	PK	45.1	30.7	6.1	33.6	-	48.3	73.9	25.6	
Vert	5490.000	PK	40.3	31.9	6.6	33.4	-	45.4	73.9	28.5	Floor noise
Vert	6405.000	PK	42.1	34.0	7.0	33.6	-	49.5	73.9	24.4	Floor noise
Vert	7320.000	PK	43.0	36.1	7.3	33.6	-	52.8	73.9	21.1	Floor noise
Vert	8235.000	PK	42.2	36.7	7.4	33.7	-	52.6	73.9	21.3	Floor noise
Vert	9150.000	PK	43.2	37.7	7.8	33.8	-	54.9	73.9	19.0	Floor noise
Vert	4575.000	AV	40.0	30.7	6.1	33.6	-	43.2	53.9	10.7	*1)
Vert	5490.000	AV	33.5	31.9	6.6	33.4	-	38.6	53.9	15.3	Floor noise
Vert	6405.000	AV	33.0	34.0	7.0	33.6	-	40.4	53.9	13.5	Floor noise
Vert	7320.000	AV	33.9	36.1	7.3	33.6	-	43.7	53.9	10.2	Floor noise
Vert	8235.000	AV	34.3	36.7	7.4	33.7	-	44.7	53.9	9.2	Floor noise
Vert	9150.000	AV	34.0	37.7	7.8	33.8	-	45.7	53.9	8.2	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (3.75 m / 3.0 m) = 1.94 dB

*1) Transmitting duty was 100 % in this frequency.

Radiated Spurious Emission

Report No.	12199538H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.2
Date	March 6, 2018	March 10, 2018
Temperature / Humidity	23 deg. C / 38 % RH	20 deg. C / 27 % RH
Engineer	Takafumi Noguchi	Takumi Shimada
	(Below 1 GHz)	(Above 1 GHz)
Mode	Tx 915.0 MHz	

PK with Duty Factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	1830.000	PK	46.8	25.9	5.1	34.7	-14.5	28.6	53.9	25.3	*1)
Hori	2745.000	PK	61.5	28.0	5.3	34.4	-14.5	45.9	53.9	8.0	*1)
Hori	3660.000	PK	44.3	29.1	5.7	33.8	-14.5	30.8	53.9	23.1	*1)
Vert	1830.000	PK	59.2	25.9	5.1	34.7	-14.5	41.0	53.9	12.9	*1)
Vert	2745.000	PK	60.1	28.0	5.3	34.4	-14.5	44.5	53.9	9.4	*1)
Vert	3660.000	PK	43.0	29.1	5.7	33.8	-14.5	29.5	53.9	24.4	*1)

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz))
- Gain(Amprifier) + Duty factor (Refer to duty factor data sheet)

*1) Noise synchronized with duty of carrier frequency.

Distance factor: 1 GHz - 10 GHz 20log (3.75 m / 3.0 m) = 1.94 dB

Radiated Spurious Emission

Report No.	12199538H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.2
Date	March 6, 2018	March 10, 2018
Temperature / Humidity	23 deg. C / 38 % RH	20 deg. C / 27 % RH
Engineer	Takafumi Noguchi (Below 1 GHz)	Takumi Shimada (Above 1 GHz)
Mode	Tx 927.5 MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	84.000	QP	37.6	7.4	8.0	32.2	-	20.8	40.0	19.2	
Hori	96.001	QP	37.8	9.4	8.1	32.2	-	23.1	43.5	20.4	
Hori	144.000	QP	43.0	14.6	8.7	32.1	-	34.2	43.5	9.3	
Hori	168.001	QP	40.1	15.9	8.9	32.1	-	32.8	43.5	10.7	
Hori	192.002	QP	35.3	16.4	9.1	32.1	-	28.7	43.5	14.8	
Hori	216.006	QP	38.9	11.3	9.3	32.1	-	27.4	46.0	18.6	
Hori	432.001	QP	36.1	16.2	10.9	32.0	-	31.2	46.0	14.8	
Hori	1855.000	PK	50.3	25.9	5.1	34.7	-	46.6	73.9	27.3	
Hori	2782.500	PK	58.8	28.1	5.2	34.4	-	57.7	73.9	16.2	
Hori	3710.000	PK	43.5	29.2	5.7	33.7	-	44.7	73.9	29.2	
Hori	4637.500	PK	44.6	30.9	6.1	33.7	-	47.9	73.9	26.0	
Hori	5565.000	PK	40.6	32.0	6.7	33.4	-	45.9	73.9	28.0	Floor noise
Hori	6492.500	PK	41.8	34.4	7.0	33.6	-	49.6	73.9	24.3	Floor noise
Hori	7420.000	PK	42.7	36.3	7.3	33.6	-	52.7	73.9	21.2	Floor noise
Hori	8347.500	PK	44.1	36.6	7.5	33.7	-	54.5	73.9	19.4	Floor noise
Hori	9275.000	PK	43.9	38.0	7.8	33.8	-	55.9	73.9	18.0	Floor noise
Hori	4637.500	AV	34.9	30.9	6.1	33.7	-	38.2	53.9	15.7	*1)
Hori	5565.000	AV	33.2	32.0	6.7	33.4	-	38.5	53.9	15.4	Floor noise
Hori	6492.500	AV	33.3	34.4	7.0	33.6	-	41.1	53.9	12.8	Floor noise
Hori	7420.000	AV	34.2	36.3	7.3	33.6	-	44.2	53.9	9.7	Floor noise
Hori	8347.500	AV	35.4	36.6	7.5	33.7	-	45.8	53.9	8.1	Floor noise
Hori	9275.000	AV	34.6	38.0	7.8	33.8	-	46.6	53.9	7.3	Floor noise
Vert	84.000	QP	47.1	7.4	8.0	32.2	-	30.3	40.0	9.7	
Vert	96.001	QP	48.2	9.4	8.1	32.2	-	33.5	43.5	10.0	
Vert	144.000	QP	36.1	14.6	8.7	32.1	-	27.3	43.5	16.2	
Vert	168.001	QP	35.0	15.9	8.9	32.1	-	27.7	43.5	15.8	
Vert	192.002	QP	32.3	16.4	9.1	32.1	-	25.7	43.5	17.8	
Vert	216.006	QP	32.4	11.3	9.3	32.1	-	20.9	46.0	25.1	
Vert	432.001	QP	32.0	16.2	10.9	32.0	-	27.1	46.0	18.9	
Vert	1855.000	PK	59.6	25.9	5.1	34.7	-	55.9	73.9	18.0	
Vert	2782.500	PK	61.1	28.1	5.2	34.4	-	60.0	73.9	13.9	
Vert	3710.000	PK	44.4	29.2	5.7	33.7	-	45.6	73.9	28.3	
Vert	4637.500	PK	45.1	30.9	6.1	33.7	-	48.4	73.9	25.5	
Vert	5565.000	PK	42.5	32.0	6.7	33.4	-	47.8	73.9	26.1	Floor noise
Vert	6492.500	PK	41.6	34.4	7.0	33.6	-	49.4	73.9	24.5	Floor noise
Vert	7420.000	PK	43.4	36.3	7.3	33.6	-	53.4	73.9	20.5	Floor noise
Vert	8347.500	PK	43.4	36.6	7.5	33.7	-	53.8	73.9	20.1	Floor noise
Vert	9275.000	PK	43.1	38.0	7.8	33.8	-	55.1	73.9	18.8	Floor noise
Vert	4637.500	AV	40.3	30.9	6.1	33.7	-	43.6	53.9	10.3	*1)
Vert	5565.000	AV	33.1	32.0	6.7	33.4	-	38.4	53.9	15.5	Floor noise
Vert	6492.500	AV	33.2	34.4	7.0	33.6	-	41.0	53.9	12.9	Floor noise
Vert	7420.000	AV	34.1	36.3	7.3	33.6	-	44.1	53.9	9.8	Floor noise
Vert	8347.500	AV	35.1	36.6	7.5	33.7	-	45.5	53.9	8.4	Floor noise
Vert	9275.000	AV	34.6	38.0	7.8	33.8	-	46.6	53.9	7.3	Floor noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (3.75 m / 3.0 m) = 1.94 dB

*1) Transmitting duty was 100 % in this frequency.

Radiated Spurious Emission

Report No.	12199538H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.2
Date	March 6, 2018	March 10, 2018
Temperature / Humidity	23 deg. C / 38 % RH	20 deg. C / 27 % RH
Engineer	Takafumi Noguchi (Below 1 GHz)	Takumi Shimada (Above 1 GHz)
Mode	Tx 927.5 MHz	

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	927.500	PK	106.0	22.0	13.6	30.8	110.8	-	-	Carrier
Hori	928.000	PK	79.3	22.0	13.6	30.8	84.1	90.8	6.7	
Vert	927.500	PK	102.8	22.0	13.6	30.8	107.6	-	-	Carrier
Vert	928.000	PK	76.1	22.0	13.6	30.8	80.9	87.6	6.7	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amprifier)

PK with Duty Factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	1855.000	PK	50.3	25.9	5.1	34.7	-14.5	32.1	53.9	21.8	*1)
Hori	2782.500	PK	58.8	28.1	5.2	34.4	-14.5	43.2	53.9	10.7	*1)
Hori	3710.000	PK	43.5	29.2	5.7	33.7	-14.5	30.2	53.9	23.7	*1)
Vert	1855.000	PK	59.6	25.9	5.1	34.7	-14.5	41.4	53.9	12.5	*1)
Vert	2782.500	PK	61.1	28.1	5.2	34.4	-14.5	45.5	53.9	8.4	*1)
Vert	3710.000	PK	44.4	29.2	5.7	33.7	-14.5	31.1	53.9	22.8	*1)

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz))
- Gain(Amprifier) + Duty factor (Refer to duty factor data sheet)

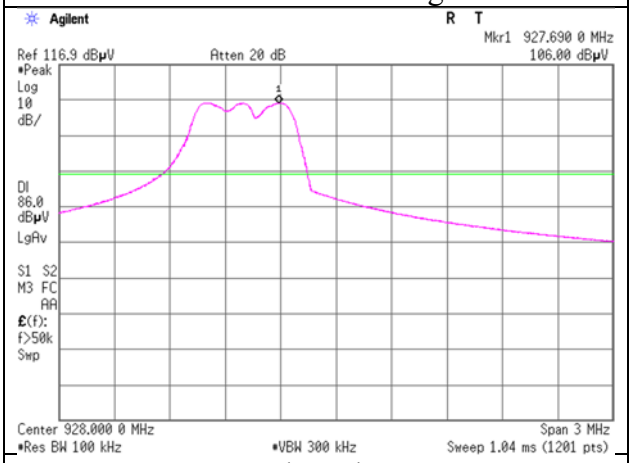
*1) Noise synchronized with duty of carrier frequency.

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12199538H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.3
Date	March 6, 2018
Temperature / Humidity	23 deg. C / 38 % RH
Engineer	Takafumi Noguchi (Below 1 GHz)
Mode	Tx 927.5 MHz

Horizontal

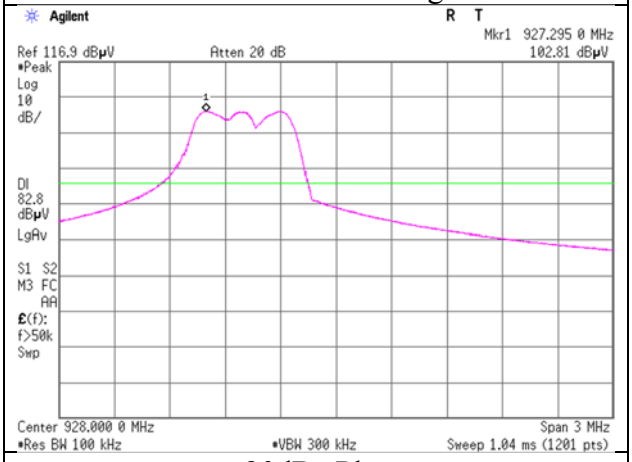
Restricted-band band-edge Plot



20dBc Plot

Vertical

Restricted-band band-edge Plot

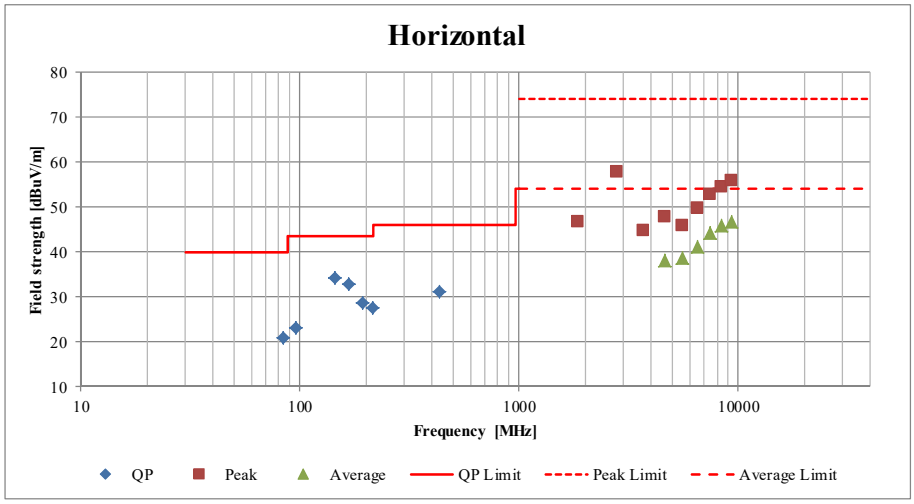


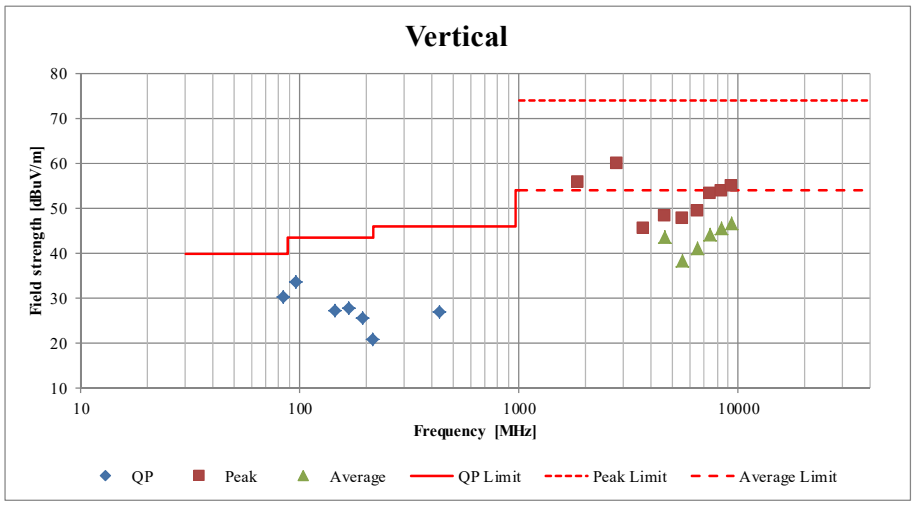
20dBc Plot

* Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	12199538H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.2
Date	March 6, 2018	March 10, 2018
Temperature / Humidity	23 deg. C / 38 % RH	20 deg. C / 27 % RH
Engineer	Takafumi Noguchi (Below 1 GHz)	Takumi Shimada (Above 1 GHz)
Mode	Tx 927.5 MHz	



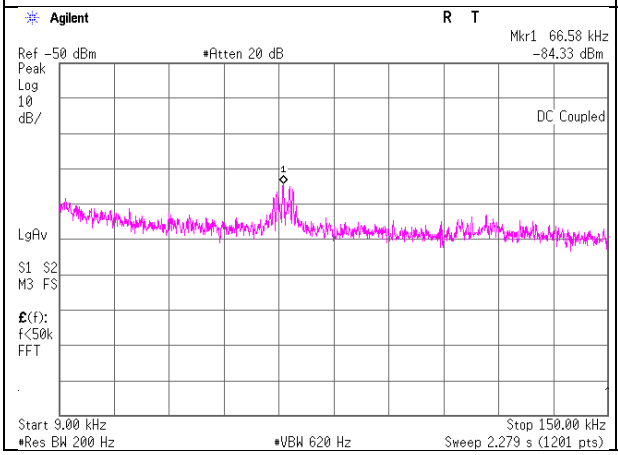


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

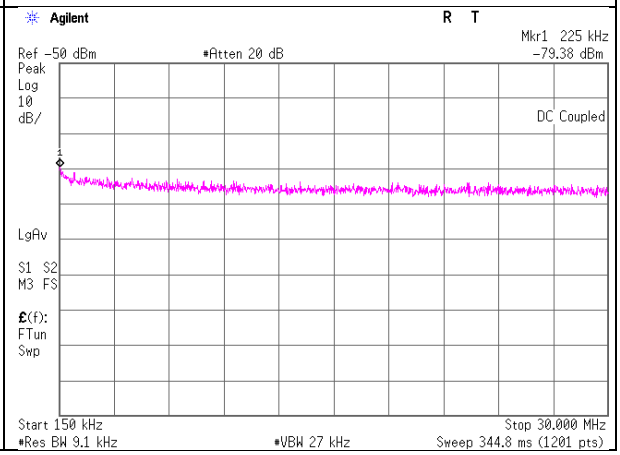
Conducted Spurious Emission

Report No.	12199538H
Test place	Ise EMC Lab. No.7 Measurement Room
Date	March 7, 2018
Temperature / Humidity	20 deg. C / 36 % RH
Engineer	Shuichi Ohyama
Mode	902.5 MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
66.58	-84.3	0.27	9.9	2.0	1	-72.2	300	6.0	-11.0	31.1	42.1	
225.00	-79.4	0.33	9.9	2.0	1	-67.2	300	6.0	-5.9	20.5	26.4	

E [dBuV/m] = EIRP [dBm] - 20 log (Distance [m]) + Ground bounce [dB] + 104.8 [dBuV/m]

EIRP = Reading + Cable Loss (including the cable(s) customer supplied) + Attenator Loss + Antenna Gain + 10 * log (N)

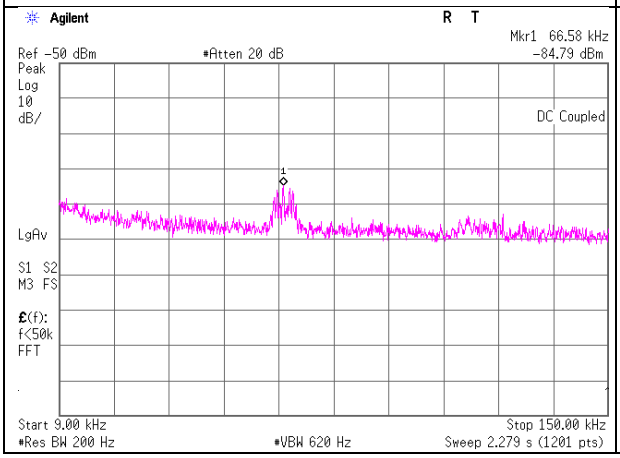
N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

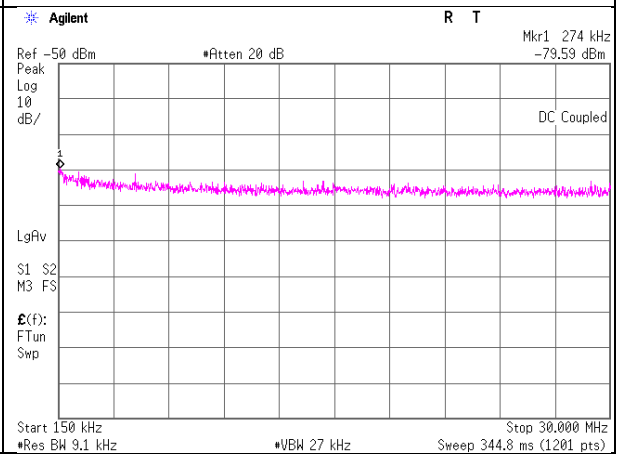
Conducted Spurious Emission

Report No.	12199538H
Test place	Ise EMC Lab. No.7 Measurement Room
Date	March 7, 2018
Temperature / Humidity	20 deg. C / 36 % RH
Engineer	Shuichi Ohyama
Mode	915.0 MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator Loss [dB]	Antenna Gain * [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
66.58	-84.8	0.27	9.9	2.0	1	-72.7	300	6.0	-11.4	31.1	42.5	
274.00	-79.6	0.35	9.9	2.0	1	-67.4	300	6.0	-6.1	18.8	24.9	

E [dBuV/m] = EIRP [dBm] - 20 log (Distance [m]) + Ground bounce [dB] + 104.8 [dBuV/m]

EIRP = Reading + Cable Loss (including the cable(s) customer supplied) + Attenator Loss + Antenna Gain + 10 * log (N)

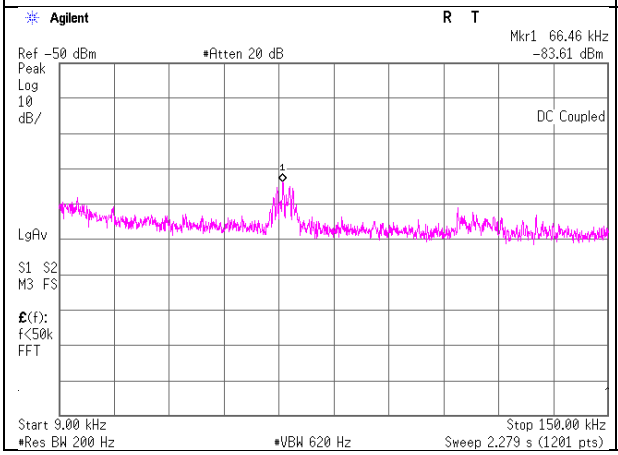
N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

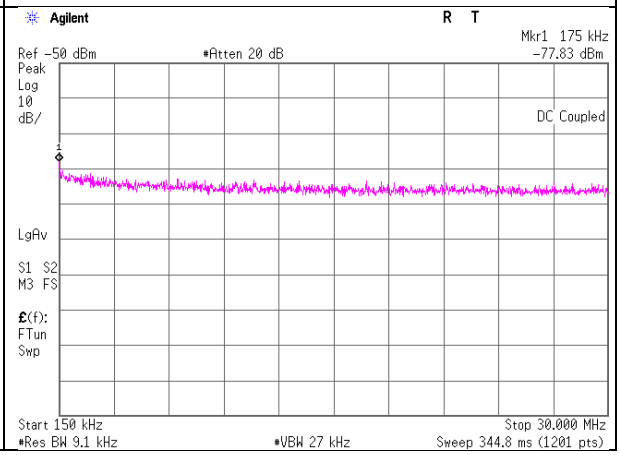
Conducted Spurious Emission

Report No.	12199538H
Test place	Ise EMC Lab. No.7 Measurement Room
Date	March 7, 2018
Temperature / Humidity	20 deg. C / 36 % RH
Engineer	Shuichi Ohyama
Mode	927.5MHz

9 kHz - 150 kHz



150 kHz - 30 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenator Loss [dB]	Antenna Gain * [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
66.46	-83.6	0.27	9.9	2.0	1	-71.5	300	6.0	-10.2	31.1	41.3	
175.00	-77.8	0.32	9.9	2.0	1	-65.7	300	6.0	-4.4	22.7	27.1	

E [dBuV/m] = EIRP [dBm] - 20 log (Distance [m]) + Ground bounce [dB] + 104.8 [dBuV/m]

EIRP = Reading + Cable Loss (including the cable(s) customer supplied) + Attenator Loss + Antenna Gain + 10 * log (N)

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

Power Density

Report No.	12199538H
Test place	Ise EMC Lab. No.7 Measurement Room
Date	March 7, 2018
Temperature / Humidity	20 deg. C / 36 % RH
Engineer	Shuichi Ohyama
Mode	Tx

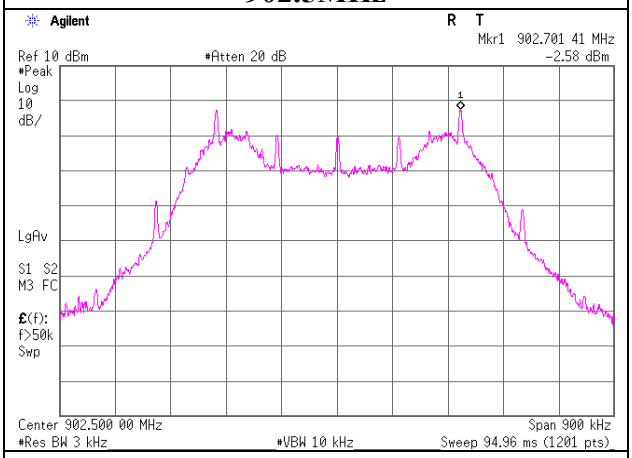
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
902.50	-2.58	0.50	9.91	7.83	8.00	0.17
915.00	-2.50	0.50	9.91	7.91	8.00	0.09
927.50	-2.60	0.50	9.91	7.81	8.00	0.19

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

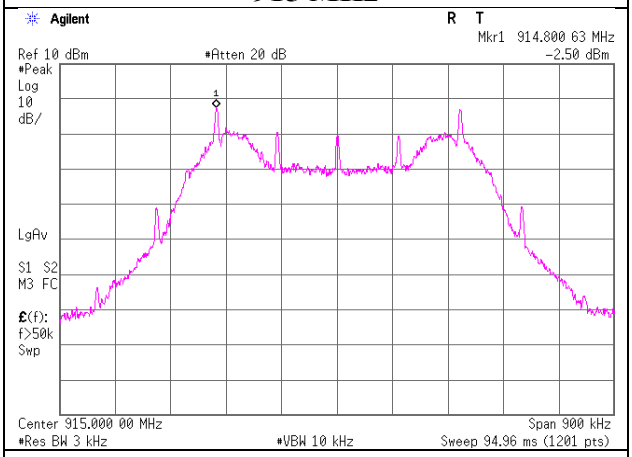
Power Density

Tx

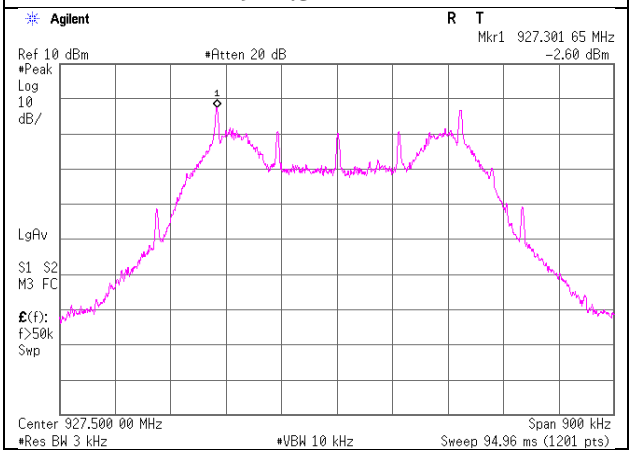
902.5MHz



915 MHz



927.5 MHz



APPENDIX 2: Test instruments

Test Instruments

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	2017/10/31 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2018/01/24 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-03	Spectrum Analyzer	Agilent	E4448A	MY44020357	RE	2017/11/07 * 12
MTR-08	Test Receiver	Rohde & Schwarz	ESCI	100767	RE	2017/08/22 * 12
MBA-03	Biconical Antenna	Schwarzbeck	BBA9106	1915	RE	2017/10/02 * 12
MLA-22	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-191	RE	2018/01/30 * 12
MCC-51	Coaxial cable	UL Japan	-	-	RE	2017/07/12 * 12
MAT-98	Attenuator	KEYSIGHT	8491A	MY52462349	RE	2017/12/14 * 12
MPA-13	Pre Amplifier	SONOMA INSTRUMENT	310	260834	RE	2017/03/27 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	RE	2018/01/09 * 12
MSA-16	Spectrum Analyzer	Agilent	E4440A	MY46186390	AT	2017/09/20 * 12
MAT-10	Attenuator(10dB)	Weinschel Corp	2	BL1173	AT	2017/11/14 * 12
MCC-38	Coaxial Cable	UL Japan	-	-	AT	2017/12/15 * 12
MPM-09	Power Meter	Anritsu	ML2495A	6K00003348	AT	2017/10/13 * 12
MPSE-12	Power sensor	Anritsu	MA2411B	011598	AT	2017/10/13 * 12
MOS-34	Thermo-Hygrometer	Custom	CTH-201	3401	AT	2018/01/24 * 12
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE/CE	2017/08/31 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE/CE	2017/12/21 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE/CE	-
MRENT-130	Spectrum Analyzer	Agilent	E4440A	MY46187750	RE	2017/11/17 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2018/02/26 * 12
MCC-216	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 1608S087(5 m)	RE	2017/08/04 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2018/01/23 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	RE/CE	2017/08/07 * 12
MHF-27	High Pass Filter(1.1-10GHz)	TOKYO KEIKI	TF219CD1	1001	RE	2018/01/18 * 12
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	CE	2017/11/14 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	CE	2017/08/21 * 12
MLS-23	LISN(AMN)	Schwarzbeck	NSLK8127	8127-729	CE(EUT)	2017/07/24 * 12
MLS-24	LISN(AMN)	Schwarzbeck	NSLK8127	8127-730	CE(AE)	2017/07/20 * 12
MTA-31	Terminator	TME	CT-01	-	CE	2017/12/11 * 12
MCC-13	Coaxial Cable	Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	CE	2018/02/23 * 12
MAT-65	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	CE	2017/12/19 * 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: **CE: Conducted Emission test**
RE: Radiated Emission test
AT: Antenna Terminal Conducted test