RADIO TEST REPORT

Test Report No. : 12529842H-A-R2

Applicant	:	**Murata Manufacturing Co., Ltd.**
Type of Equipment	:	**UHF RFID Reader/Writer**
Model No.	:	**LXRFZZUAAA-052**
FCC ID	:	**VPYLXRF052**
Test regulation	:	**FCC Part 15 Subpart C: 2018**
Test Result	:	**Complied (Refer to Section 3.2)**

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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 covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
7. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
8. The information provided from the customer for this report is identified in SECTION 1.
9. This report is a revised version of 12529842H-A-R1. 12529842H-A-R1 is replaced with this report.

Date of test: October 16 to 31, 2018

Representative test engineer:
Shuichi Ohyama
Engineer
Consumer Technology Division

Approved by:
Takayuki Shimada
Leader
Consumer Technology Division

NVLAP TESTING
NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
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http://japan.ul.com/resources/emc_accredited/

☐ The testing in which "Non-accreditation" is displayed is outside the accreditation scopes in UL Japan.
☒ There is no testing item of "Non-accreditation".

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REVISION HISTORY

Original Test Report No.: 12529842H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	12529842H-A	November 27, 2018	-	-
1	12529842H-A-R1	January 24, 2019	P 1	Addition of note No.8.
1	12529842H-A-R1	January 24, 2019	P.4	Addition of note in SECTION 1.
1	12529842H-A-R1	January 24, 2019	P.4	Addition of note for receipt date of sample in SECTION 2.1.
1	12529842H-A-R1	January 24, 2019	P.6	Addition of note in SECTION 3.2 and 3.3.
1	12529842H-A-R1	January 24, 2019	P 7	Addition of note in SECTION 3.4.
1	12529842H-A-R1	January 24, 2019	P 19	Correction of test data for limit of 20 dB bandwidth in APPENDIX1.
2	12529842H-A-R2	January 28, 2019	P 19	Correction of test data for limit of 20 dB bandwidth in APPENDIX1.

CONTENTS **PAGE**

SECTION 1: Customer information

Company Name	:	Murata Manufacturing Co., Ltd.
Address	:	10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-8555 Japan
Telephone Number	:	+81-75-955-7329
Facsimile Number	:	+81-75-955-7332
Contact Person	:	Yoichi Saito

The information provided from the customer is as follows;
- Applicant, Type of Equipment, Model No. on the cover and other relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (E.U.T.)
- SECTION 4: Operation of E.U.T. during testing

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

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

2.1 Identification of E.U.T.

Type of Equipment	:	UHF RFID Reader/Writer
Model No.	:	LXRFZZUAAA-052
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 5.0 V
Receipt Date of Sample (Information from test lab.)	:	October 16, 2018
Country of Mass-production	:	Japan
Condition of EUT	:	Production 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: LXRFZZUAAA-052 (referred to as the EUT in this report) is a UHF RFID Reader/Writer.

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation *	:	902.75 MHz to 927.25 MHz (US Wide) / 917.10 MHz to 926.90 MHz (US Narrow)
Modulation	:	DSB-ASK
Antenna type	:	Short Range Antenna (LXRFZZUCCA-036) Long Range Antenna (LXRFZZUCCA-034)
Antenna Gain	:	Short Range Antenna without cable: -16.0 dBi Long Range Antenna without cable: -1.6 dBi
Clock frequency	:	19.2 MHz

*The difference between US Wide and US Narrow is channel separation only. Therefore they are completely identical in RF characteristics.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C
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

* Also the EUT complies with FCC Part 15 Subpart B.

3.2 Procedures and results

Item	Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	**FCC:** ANSI C63.10-2013 6. Standard test methods	**FCC:** Section 15.207	**QP** 16.7 dB, 0.15000 MHz, N **AV** 18.2 dB, 10.51763 MHz, L	Complied a)	-
	IC: RSS-Gen 8.8	**IC:** RSS-Gen 8.8			
Carrier Frequency Separation	**FCC:** FCC Public Notice DA 00-705	**FCC:** Section15.247(a)(1)	See data.	Complied b)	Conducted
	IC: -	**IC:** RSS-247 5.1 (b)			
20dB Bandwidth	**FCC:** FCC Public Notice DA 00-705	**FCC:** Section15.247(a)(1)		Complied b)	Conducted
	IC: -	**IC:** RSS-247 5.1 (a)			
Number of Hopping Frequency	**FCC:** FCC Public Notice DA 00-705	**FCC:** Section15.247(a)(1)(iii)		Complied c)	Conducted
	IC: -	**IC:** RSS-247 5.1 (d)			
Dwell time	FCC: FCC Public Notice DA 00-705	**FCC:** Section15.247(a)(1)(iii)		Complied d)	Conducted
	IC: -	**IC:** RSS-247 5.1 (d)			
Maximum Peak Output Power	**FCC:** FCC Public Notice DA 00-705	**FCC:** Section15.247(b)(1)		Complied e)	Conducted
	IC: RSS-Gen 6.12	**IC:** RSS-247 5.4 (b)			
Spurious Emission & Band Edge Compliance	**FCC:** FCC Public Notice DA 00-705	**FCC:** Section15.247(d)	3.4 dB 1829.5 MHz, AV, Vertical	Complied f) / g)	Conducted/ 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).

a) Refer to APPENDIX 1 (data of Conducted Emission)
b) Refer to APPENDIX 1 (data of 20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation)
c) Refer to APPENDIX 1 (data of Number of Hopping Frequency)
d) Refer to APPENDIX 1 (data of Dwell time)
e) Refer to APPENDIX 1 (data of Maximum Peak Output Power)
f) Refer to APPENDIX 1 (data of Conducted Spurious Emission)
g) Refer to APPENDIX 1 (data of Radiated Spurious Emission)

Symbols:

Complied	The data of this test item has enough margin, more than the measurement uncertainty.
Complied#	The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

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

FCC Part 15.31 (e)
This EUT provides stable voltage constantly to RF Module regardless of input voltage.
Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement
The EUT has a unique coupling/antenna connector (RP-SMA).
Therefore the equipment complies with the requirement of 15.203.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	RSS-Gen 6.7	**IC:** -	N/A	Complied a)	Conducted
a) Refer to APPENDIX 1 (data of 20dB Bandwidth, 99%Occupied Bandwidth and Carrier Frequency Separation)					

Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

EMI

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

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

Antenna Terminal test

Test Item	Uncertainty (+/-)
20 dB Bandwidth / 99 % Occupied Bandwidth	0.96 %
Maximum Peak Output Power / Average Output Power	1.3 dB
Carrier Frequency Separation	0.42 %
Dwell time / Burst rate	0.10 %
Conducted Spurious Emission	2.7 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

3.5 Test Location

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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	3.1 x 5.0	-	-
No.9 measurement room	-	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

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

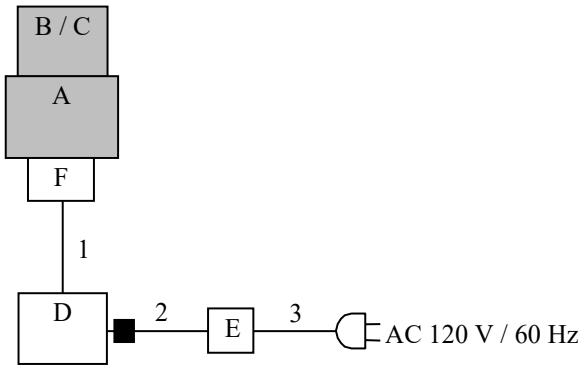
The mode(s) : 1. RFID Read / Write mode

Details of Operating Mode(s)

Test Item	Mode	Tested frequency	
		US Wide	US Narrow
Conducted Emission, Spurious Emission (Conducted/Radiated),	Tx (Hopping Off), Maximum power	902.75 MHz 914.75 MHz 927.25 MHz	-
20dB Bandwidth	Tx (Hopping Off), Maximum power	902.75 MHz 914.75 MHz 927.25 MHz	917.10 MHz 921.90 MHz 926.90 MHz
Maximum Peak Output Power	Tx (Hopping Off), Maximum / Minimum power	902.75 MHz 914.75 MHz 927.25 MHz	917.10 MHz 921.90 MHz 926.90 MHz
Number of Hopping Frequency, Carrier Frequency Separation	Tx (Hopping On), Maximum power	-	-
Dwell time	Tx (Hopping On), Maximum power	902.75 MHz 914.75 MHz 927.25 MHz	917.10 MHz 921.90 MHz 926.90 MHz
Band Edge Compliance (Conducted)	Tx (Hopping On / Hopping Off), Maximum power	-	-
99% Occupied Bandwidth	Tx (Hopping Off), Maximum power	902.75 MHz 914.75 MHz 927.25 MHz	917.10 MHz 921.90 MHz 926.90 MHz
	Tx (Hopping On), Maximum power	-	

*EUT has the power settings by the software as follows;
Power settings: 13 dBm (Minimum power) , 27 dBm (Maximum power)
Software: Continuous emission test: cw.exe
Hopping emission test: fh.exe
Communication operation test: fixed.exe
*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 carrier level and noise levels were confirmed with or without RF cable and the test was made at the worst case.

4.2 Configuration and peripherals



■ : 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	Remark
A	UHF RFID Reader/Writer	LXRFZZUAAA-052	B6Q7110021	Murata Manufacturing Co., Ltd.	EUT
B	Short Range Antenna	LXRFZZUCCA-036	236827	Murata Manufacturing Co., Ltd.	EUT *1)
C	Long Range Antenna	LXRFZZUCCA-034	270732	Murata Manufacturing Co., Ltd.	EUT *1)
D	Laptop PC	CF-NX1	2JKSA1424Q	Panasonic	-
E	AC Adaptor	CF-AA6412CM2	6412CM213817339C	Panasonic	-
F	Jig	-	-	Murata Manufacturing Co., Ltd.	-

*1) The test was performed with “without cable” which was the worst condition.

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	USB Cable	1.30	Shielded	Shielded	-
2	DC Cable	0.90	Unshielded	Unshielded	-
3	AC Cable	0.80	Unshielded	Unshielded	-

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 80 cm 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.

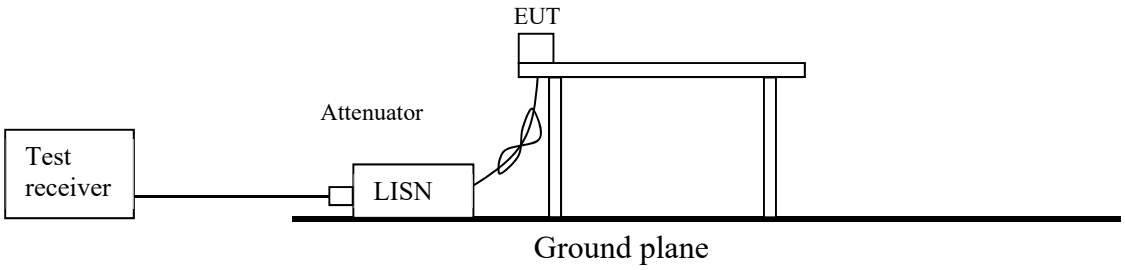
1) For the tests on EUT with other peripherals (as a whole system)
I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50 ohm connectors of the 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

[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.

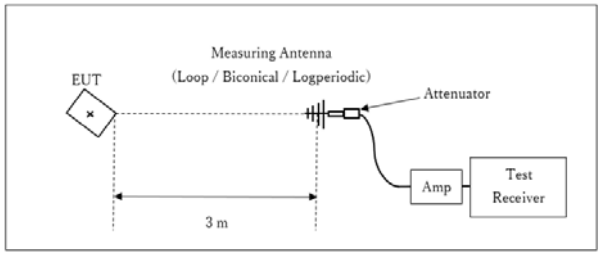
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (IC) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (IC).

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	RBW: 1 MHz VBW: 10 Hz *1)	RBW: 100 kHz VBW: 300 kHz

*1) Although DA 00-705 accepts VBW = 10 Hz for AV measurements, it was confirmed that superfluous smoothing was not performed.

Figure 2: Test Setup

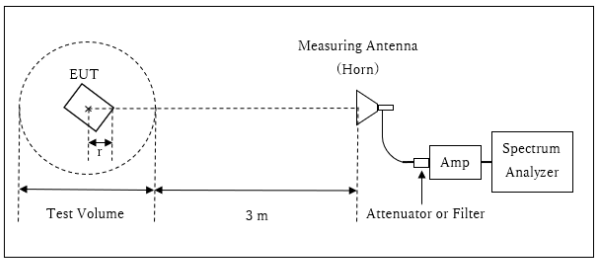
Below 1 GHz



× : 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
20dB Bandwidth	1 MHz	3 kHz	10 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: 50MHz BW)
Carrier Frequency Separation	3 MHz	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Number of Hopping Frequency	30 MHz	300 kHz	1 MHz	Auto	Peak	Max Hold	Spectrum Analyzer
Dwell Time	Zero Span	100 kHz, 1 MHz	300 kHz, 3 MHz	As necessary capture the entire dwell time per hopping channel	Peak	Clear Write	Spectrum Analyzer
Conducted Spurious Emission *3)	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				
	30 MHz to 25 GHz	100 kHz	300 kHz				
Conducted Spurious Emission Band Edge compliance	10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

*1) Peak hold was applied as Worst-case measurement.
*2) Reference data
*3) 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 not detected 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.
The equipment and cables were not used for factor 0 dB of the data sheets.

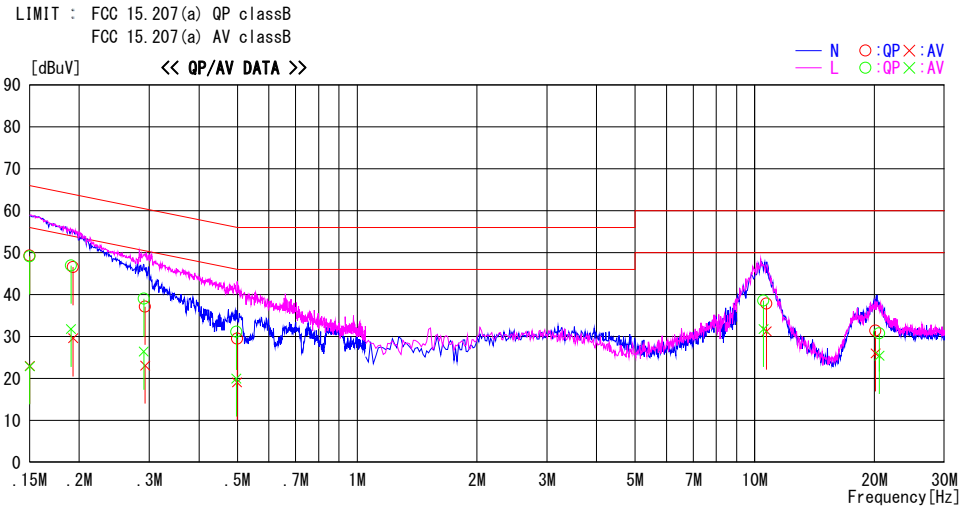
Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

Short Range Antenna without cable

Report No.	12529842H
Test place	Ise EMC Lab. No.1 Semi Anechoic Chamber
Date	October 31, 2018
Temperature / Humidity	22 deg. C / 37 % RH
Engineer	Shuichi Ohyama
Mode	Tx, Hopping Off 902.75 MHz



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	36.1	9.8	13.2	49.3	23.0	66.0	56.0	16.7	33.0	N	
0.19288	33.4	16.4	13.2	46.6	29.6	63.9	53.9	17.3	24.3	N	
0.29287	24.0	10.0	13.1	37.1	23.1	60.4	50.4	23.3	27.3	N	
0.49889	16.3	5.9	13.2	29.5	19.1	56.0	46.0	26.5	26.9	N	
10.71283	23.6	17.0	14.2	37.8	31.2	60.0	50.0	22.2	18.8	N	
20.12025	16.5	11.1	14.9	31.4	26.0	60.0	50.0	28.6	24.0	N	
0.15000	35.9	9.7	13.2	49.1	22.9	66.0	56.0	16.9	33.1	L	
0.19064	33.7	18.6	13.2	46.9	31.8	64.0	54.0	17.1	22.2	L	
0.29063	25.9	13.3	13.1	39.0	26.4	60.5	50.5	21.5	24.1	L	
0.49649	17.9	6.8	13.2	31.1	20.0	56.1	46.1	25.0	26.1	L	
10.51763	24.4	17.6	14.2	38.6	31.8	60.0	50.0	21.4	18.2	L	
20.58391	15.8	10.5	14.9	30.7	25.4	60.0	50.0	29.3	24.6	L	

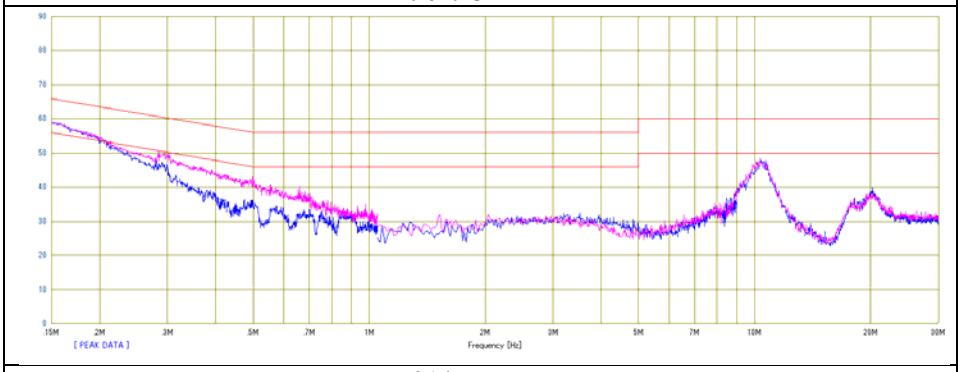
CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Conducted Emission

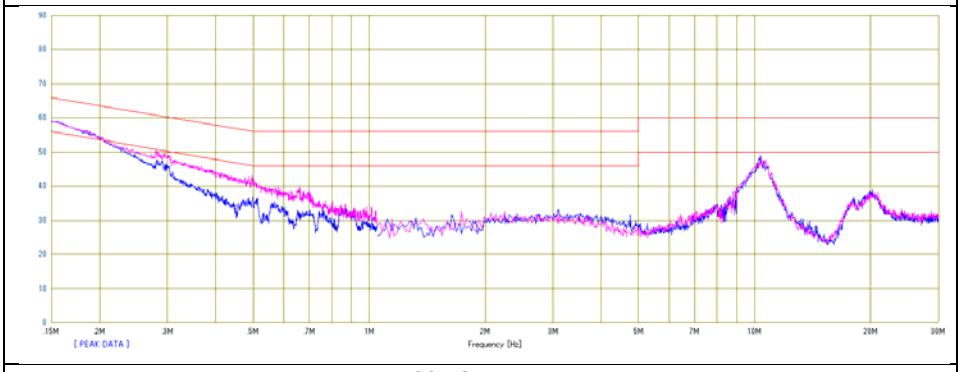
Short Range Antenna without cable

Report No.	12529842H
Test place	Ise EMC Lab. No.1 Semi Anechoic Chamber
Date	October 31, 2018
Temperature / Humidity	22 deg. C / 37 % RH
Engineer	Shuichi Ohyama
Mode	Tx, Hopping Off

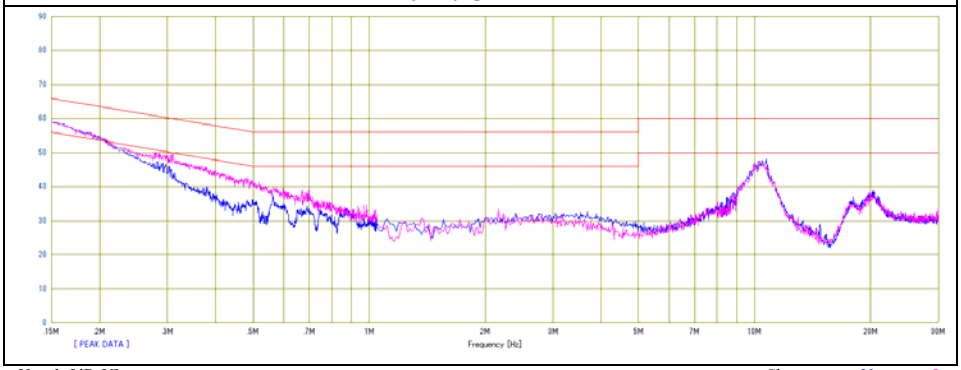
902.75 MHz



914.75 MHz



927.25 MHz

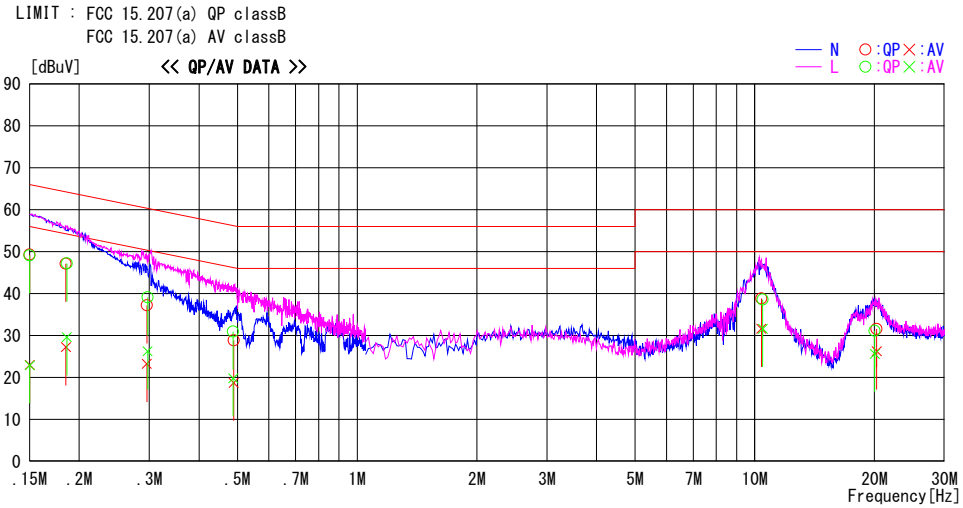


Y scale [dBuV] Chart — N — L

Conducted Emission

Long Range Antenna without cable

Report No.	12529842H
Test place	Ise EMC Lab. No.1 Semi Anechoic Chamber
Date	October 31, 2018
Temperature / Humidity	22 deg. C / 37 % RH
Engineer	Shuichi Ohyama
Mode	Tx, Hopping Off 902.75 MHz



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	36.1	9.8	13.2	49.3	23.0	66.0	56.0	16.7	33.0	N	
0.18504	33.9	14.0	13.2	47.1	27.2	64.3	54.3	17.2	27.1	N	
0.29584	24.1	10.1	13.1	37.2	23.2	60.4	50.4	23.2	27.2	N	
0.48928	15.6	5.5	13.2	28.8	18.7	56.2	46.2	27.4	27.5	N	
10.39383	24.6	17.4	14.2	38.8	31.6	60.0	50.0	21.2	18.4	N	
20.25782	16.7	11.3	14.9	31.6	26.2	60.0	50.0	28.4	23.8	N	
0.15000	35.9	9.7	13.2	49.1	22.9	66.0	56.0	16.9	33.1	L	
0.18597	34.0	16.4	13.2	47.2	29.6	64.2	54.2	17.0	24.6	L	
0.29716	26.0	13.1	13.1	39.1	26.2	60.3	50.3	21.2	24.1	L	
0.48768	17.7	6.6	13.2	30.9	19.8	56.2	46.2	25.3	26.4	L	
10.47351	24.4	17.4	14.2	38.6	31.6	60.0	50.0	21.4	18.4	L	
20.03844	16.2	10.7	14.9	31.1	25.6	60.0	50.0	28.9	24.4	L	

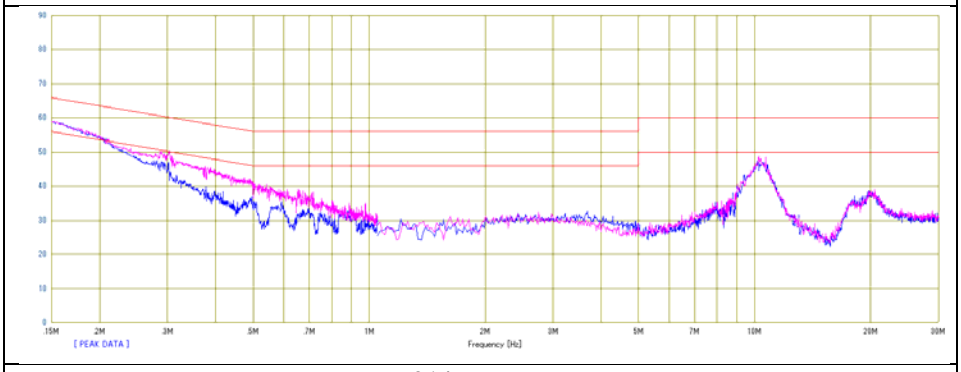
CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + C.F (LISN + CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Conducted Emission

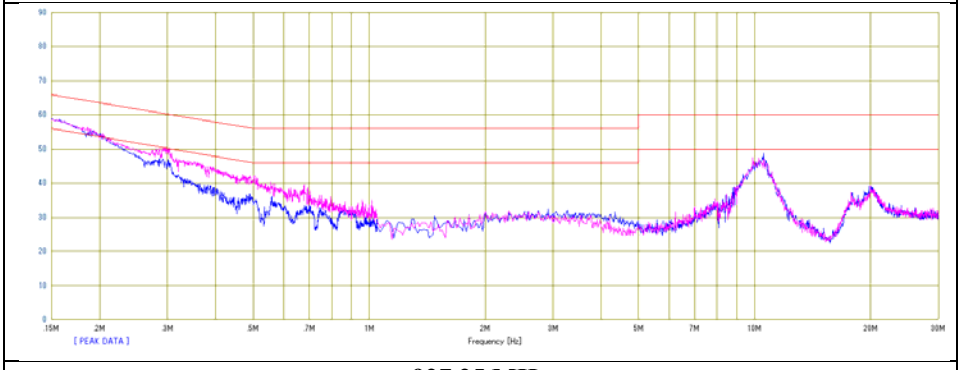
Long Range Antenna without cable

Report No.	12529842H
Test place	Ise EMC Lab. No.1 Semi Anechoic Chamber
Date	October 31, 2018
Temperature / Humidity	22 deg. C / 37 % RH
Engineer	Shuichi Ohyama
Mode	Tx, Hopping Off

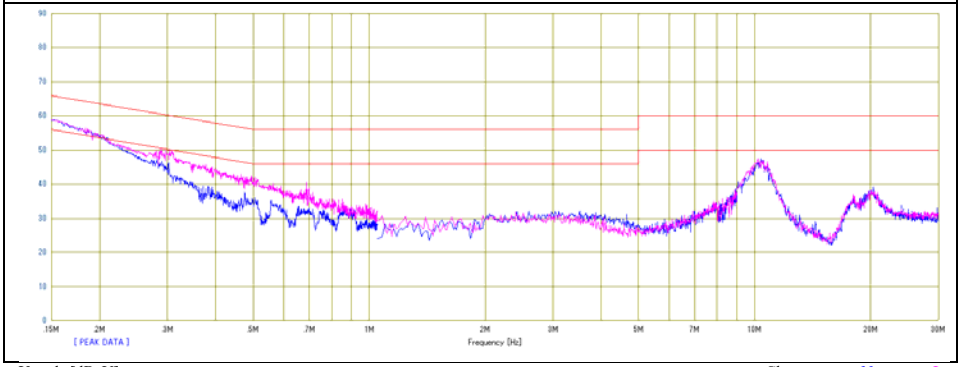
902.75 MHz



914.75 MHz



927.25 MHz



Y scale [dBuV] Chart — N — L

20 dB Bandwidth, 99 %Occupied Bandwidth and Carrier Frequency Separation

Report No.	12529842H	
Test place	Ise EMC Lab. No.6 Measurement Room	
Date	October 16, 2018	December 16, 2018
Temperature / Humidity	24 deg. C / 59 % RH	25 deg. C / 39 % RH
Engineer	Shuichi Ohyama	Takafumi Noguchi
Mode	Tx, Hopping Off / On	

US Wide

Freq. [MHz]	20dB Bandwidth [kHz]	Limit for 20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]	Carrier Frequency Separation [kHz]	Limit for Carrier Frequency separation [kHz]
902.75	84.084	<=500	132.6704	500.000	>= 84.084
914.75	83.529	<=500	127.3971	500.000	>= 83.529
927.25	81.702	<=500	123.3811	500.000	>= 81.702
Hopping On	-	-	24687.300	-	-

Limit for Carrier Frequency separation: 20dB Bandwidth or 25kHz (whichever is greater).

US Narrow

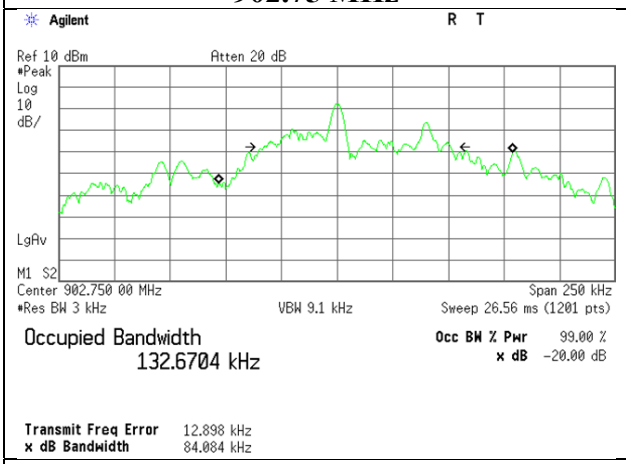
Freq. [MHz]	20dB Bandwidth [kHz]	Limit for 20dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]	Carrier Frequency Separation [kHz]	Limit for Carrier Frequency separation [kHz]
917.10	85.216	<=500	99.5010	200.000	>= 85.216
921.90	84.828	<=500	93.8672	200.000	>= 84.828
926.90	85.345	<=500	94.7437	200.000	>= 85.345
Hopping On	-	-	9862.900	-	-

Limit for Carrier Frequency separation: 20dB Bandwidth or 25kHz (whichever is greater).

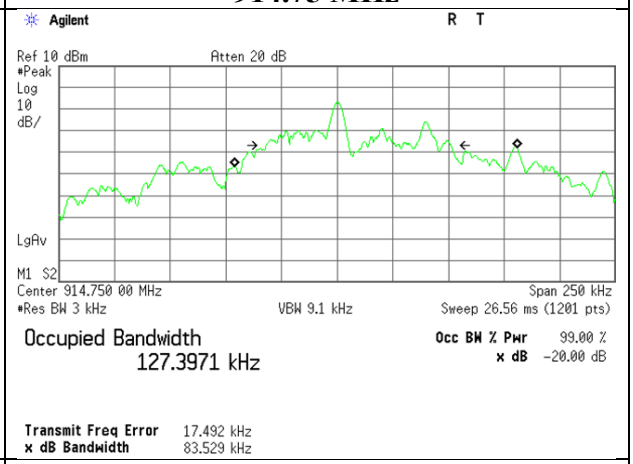
20 dB Bandwidth and 99 % Occupied Bandwidth

US Wide

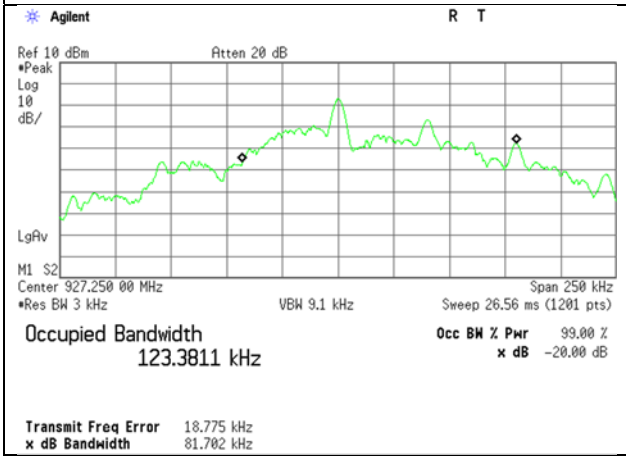
902.75 MHz



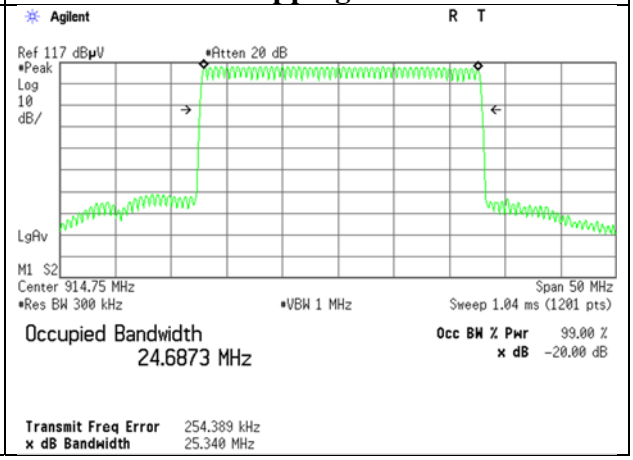
914.75 MHz



927.25 MHz



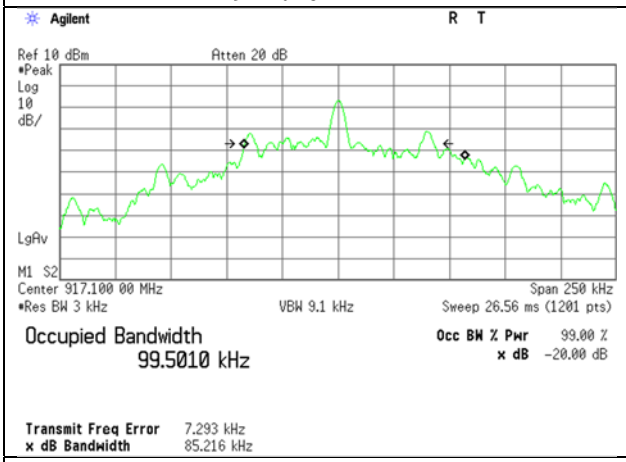
Hopping On



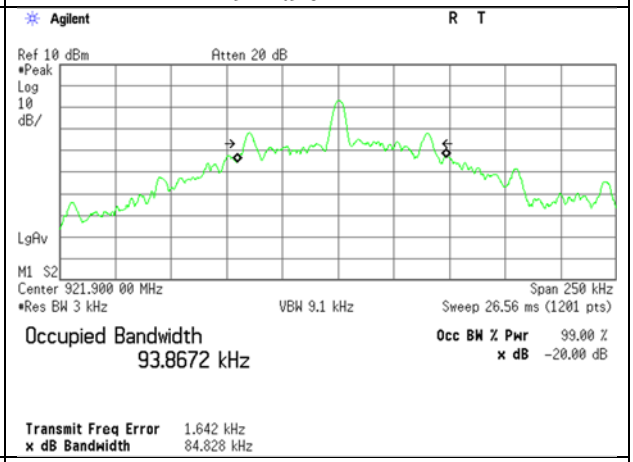
20 dB Bandwidth and 99 % Occupied Bandwidth

US Narrow

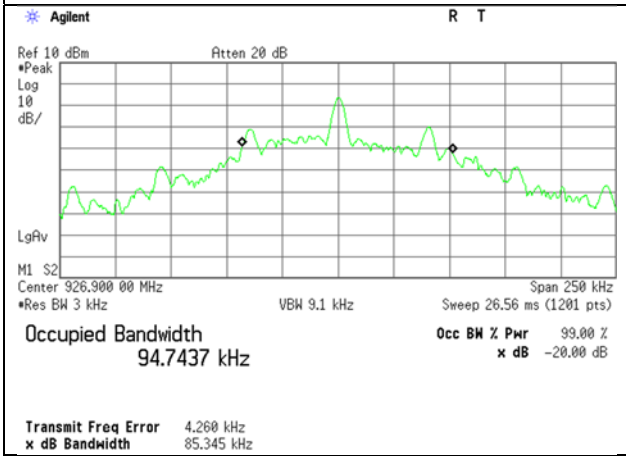
917.10 MHz



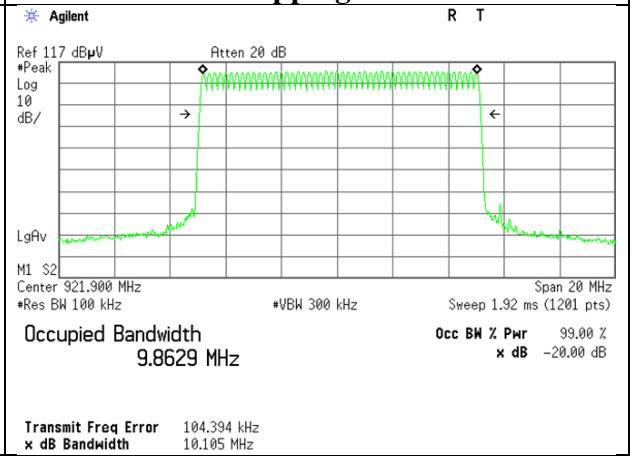
921.90 MHz



926.90 MHz



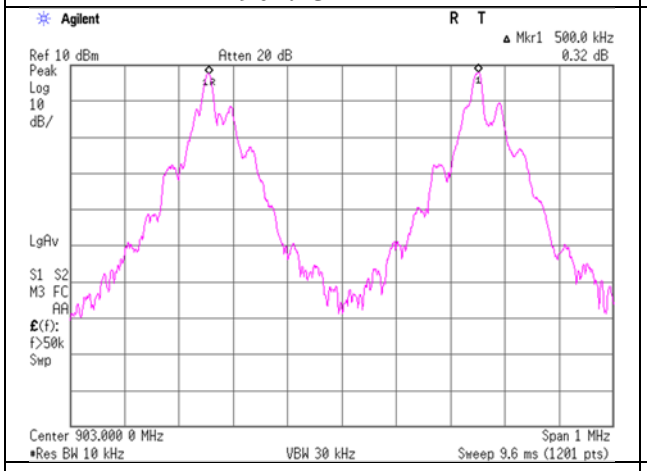
Hopping On



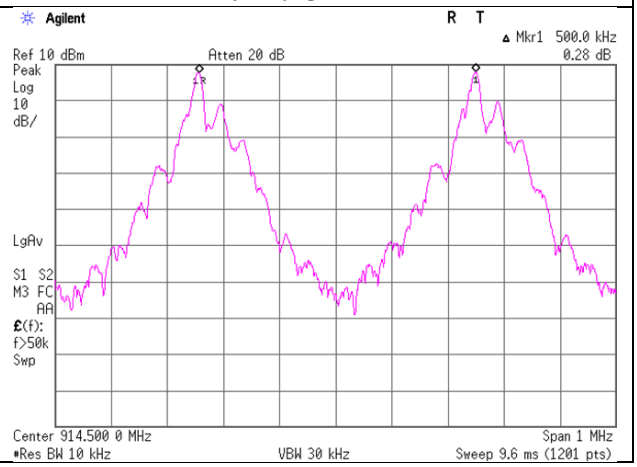
Carrier Frequency Separation

US Wide

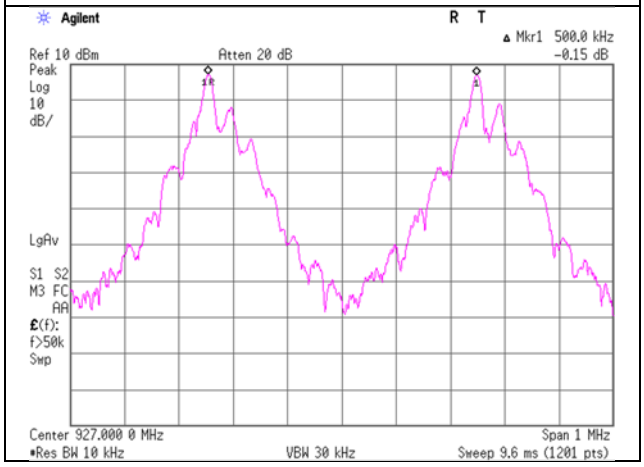
902.75 MHz



914.75 MHz



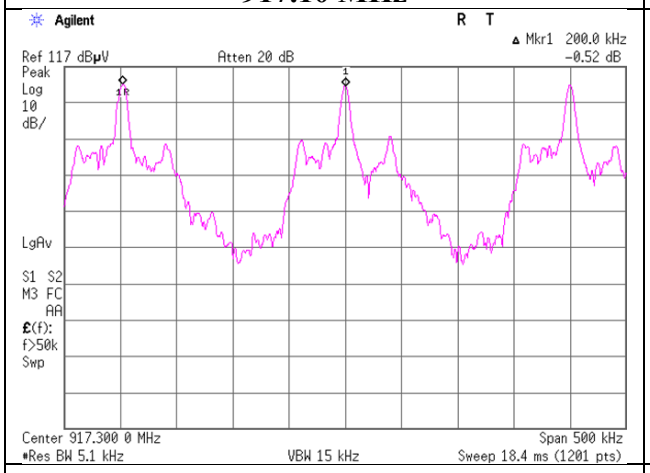
927.25 MHz



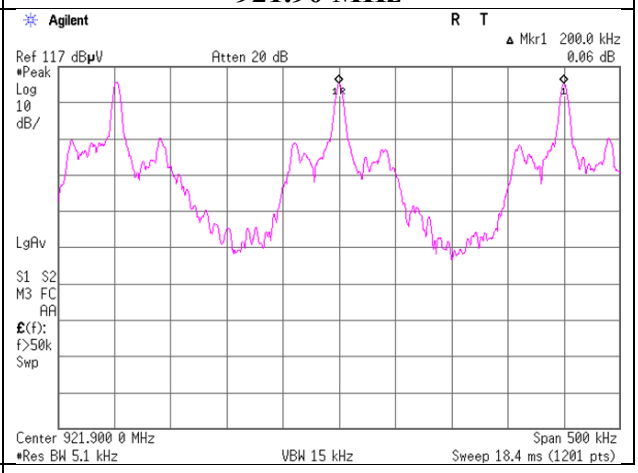
Carrier Frequency Separation

US Narrow

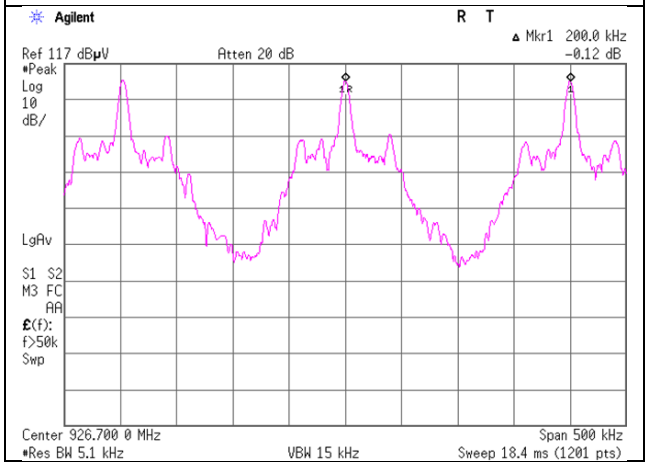
917.10 MHz



921.90 MHz



926.90 MHz



Number of Hopping Frequency

Report No.	12529842H	
Test place	Ise EMC Lab. No.6 Measurement Room	
Date	October 16, 2018	December 16, 2018
Temperature / Humidity	24 deg. C / 59 % RH	25 deg. C / 39 % RH
Engineer	Shuichi Ohyama	Takafumi Noguchi
Mode	Tx, Hopping On	

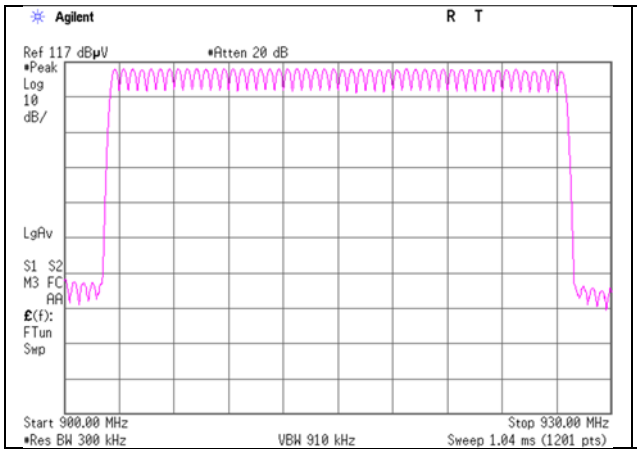
US Wide

Number of channel [channels]	Limit [channels]
50	>= 50

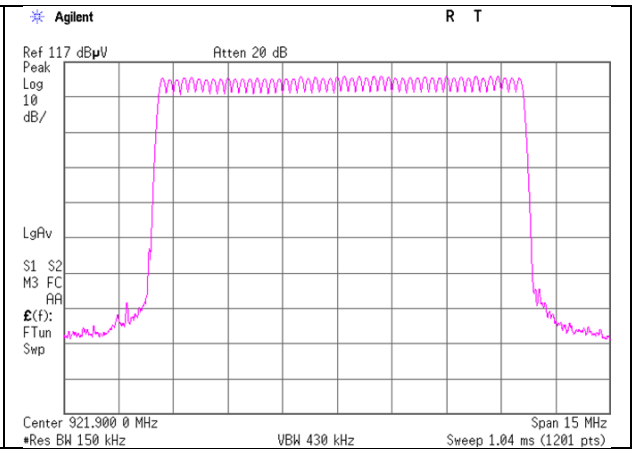
US Narrow

Number of channel [channels]	Limit [channels]
50	>= 50

US Wide



US Narrow



Dwell time

Report No.	12529842H	
Test place	Ise EMC Lab. No.6 Measurement Room	
Date	October 16, 2018	December 16, 2018
Temperature / Humidity	24 deg. C / 59 % RH	25 deg. C / 39 % RH
Engineer	Shuichi Ohyama	Takafumi Noguchi
Mode	Tx, Hopping On	

US Wide

Frequency [MHz]	Number of transmission in 20 sec period	Length of transmission [msec]	Result [msec]	Limit [msec]
902.75	1	391.7	391.7	400
914.75	1	385.4	385.4	400
927.25	1	391.7	391.7	400

Sample Calculation
Result = Number of transmission x Length of transmission

US Narrow

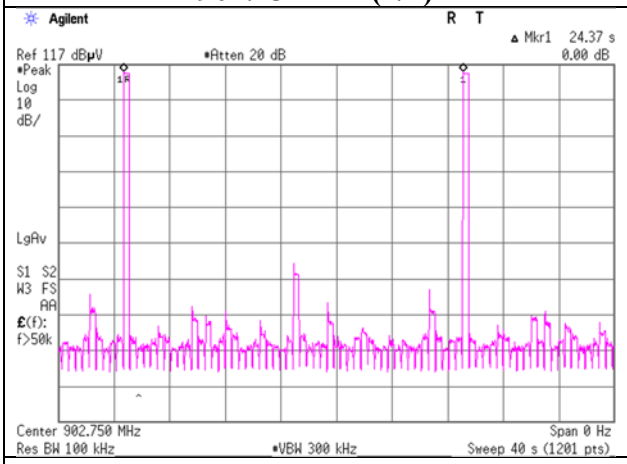
Frequency [MHz]	Number of transmission in 20 sec period	Length of transmission [msec]	Result [msec]	Limit [msec]
902.75	1	391.7	391.7	400
914.75	1	391.7	391.7	400
927.25	1	391.7	391.7	400

Sample Calculation
Result = Number of transmission x Length of transmission

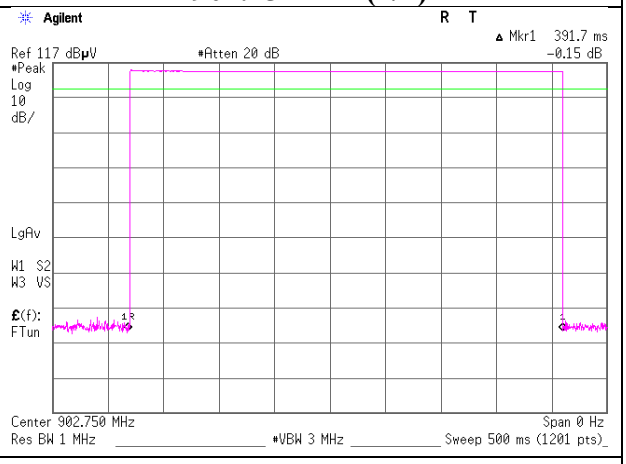
Dwell time

US Wide

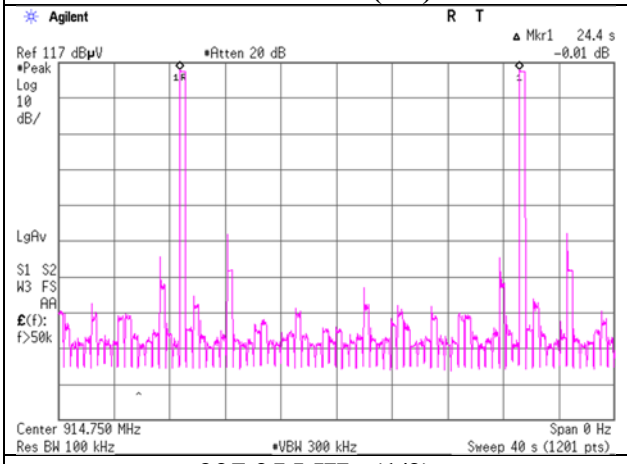
902.75 MHz (1/2)



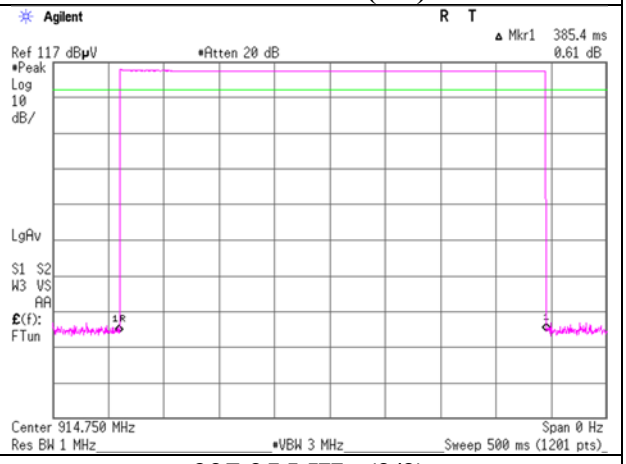
902.75 MHz (2/2)



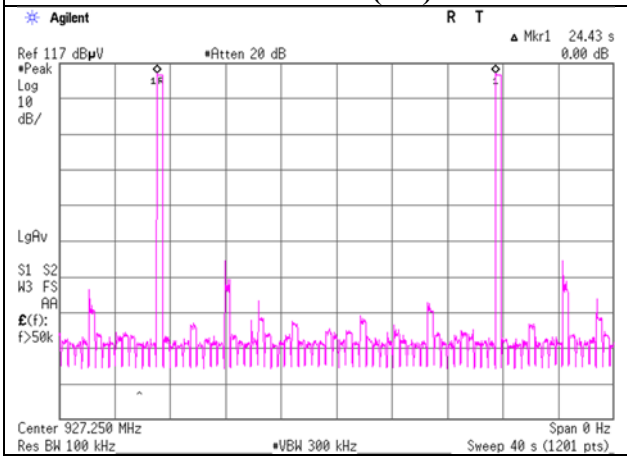
914.75 MHz (1/2)



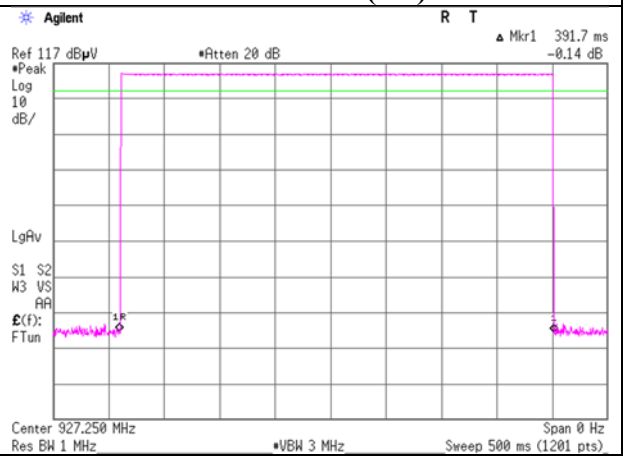
914.75 MHz (2/2)



927.25 MHz (1/2)



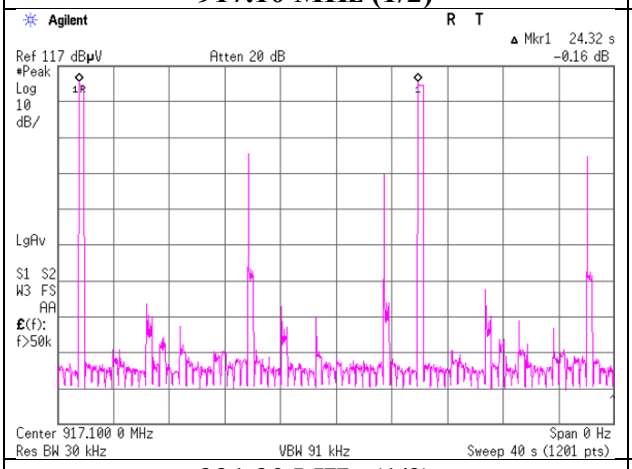
927.25 MHz (2/2)



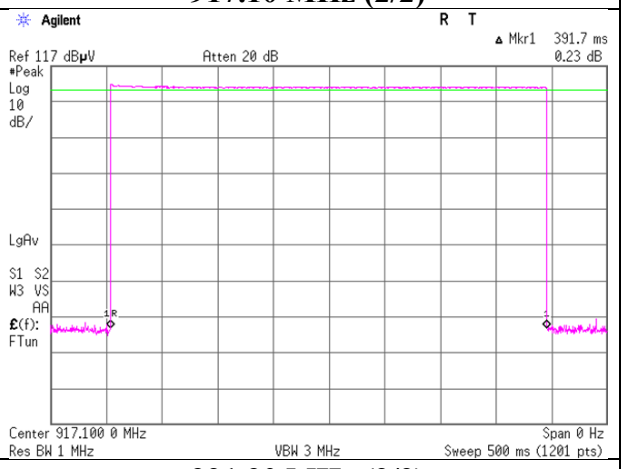
Dwell time

US Narrow

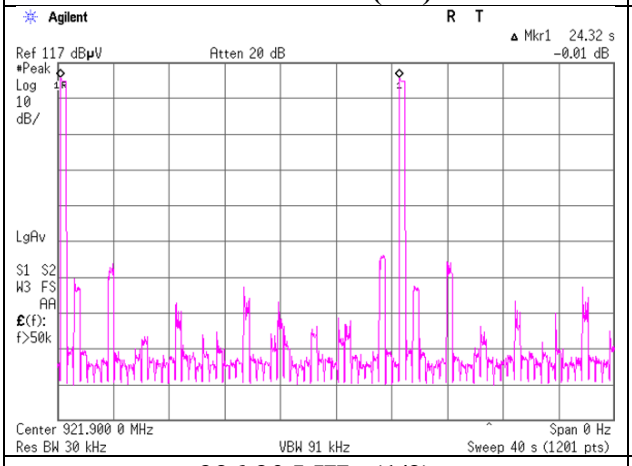
917.10 MHz (1/2)



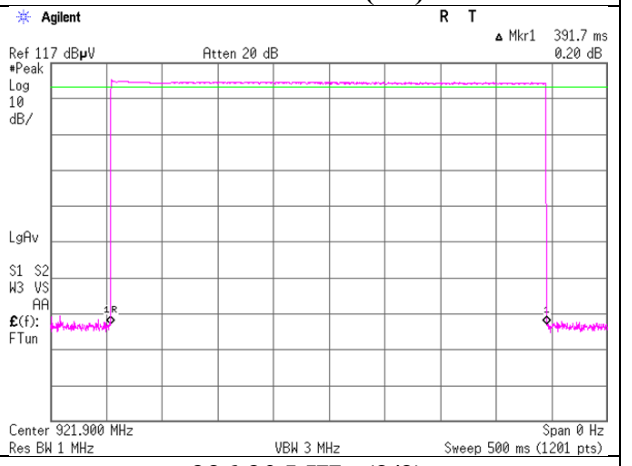
917.10 MHz (2/2)



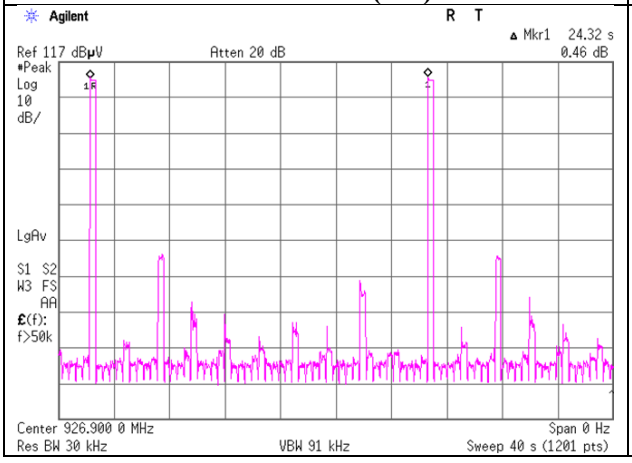
921.90 MHz (1/2)



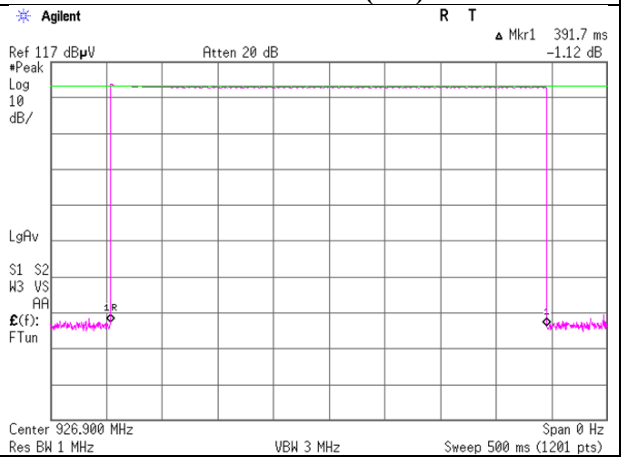
921.90 MHz (2/2)



926.90 MHz (1/2)



926.90 MHz (2/2)



Maximum Peak Output Power

Report No.	12529842H	
Test place	Ise EMC Lab. No.6 Measurement Room	
Date	October 16, 2018	December 16, 2018
Temperature / Humidity	24 deg. C / 59 % RH	25 deg. C / 39 % RH
Engineer	Shuichi Ohyama	Takafumi Noguchi
Mode	Tx, Hopping Off	

US Wide

Maximum Power Setting				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
902.75	7.81	0.00	19.90	27.71	590.20	30.00	1000	2.29	-1.60	26.11	408.32	36.02	4000	9.91
914.75	7.53	0.00	19.90	27.43	553.35	30.00	1000	2.57	-1.60	25.83	382.82	36.02	4000	10.19
927.25	7.04	0.00	19.90	26.94	494.31	30.00	1000	3.06	-1.60	25.34	341.98	36.02	4000	10.68

Sample Calculation:
Result = Reading + Cable Loss + Attenuator Loss
e.i.r.p. Result = Conducted Power Result + Antenna Gain

Minimum Power Setting				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
902.75	-6.20	0.00	19.90	13.70	23.44	30.00	1000	16.30	-1.60	12.10	16.22	36.02	4000	23.92
914.75	-6.46	0.00	19.90	13.44	22.08	30.00	1000	16.56	-1.60	11.84	15.28	36.02	4000	24.18
927.25	-7.05	0.00	19.90	12.85	19.28	30.00	1000	17.15	-1.60	11.25	13.34	36.02	4000	24.77

Sample Calculation:
Result = Reading + Cable Loss + Attenuator Loss
e.i.r.p. Result = Conducted Power Result + Antenna Gain

US Narrow

Maximum Power Setting				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
917.10	7.57	0.00	19.90	27.47	558.47	30.00	1000	2.53	-1.60	25.87	386.37	36.02	4000	10.15
921.90	7.67	0.00	19.90	27.57	571.48	30.00	1000	2.43	-1.60	25.97	395.37	36.02	4000	10.05
926.90	7.77	0.00	19.90	27.67	584.79	30.00	1000	2.33	-1.60	26.07	404.58	36.02	4000	9.95

Sample Calculation:
Result = Reading + Cable Loss + Attenuator Loss
e.i.r.p. Result = Conducted Power Result + Antenna Gain

Minimum Power Setting				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
917.10	-6.85	0.00	19.90	13.05	20.18	30.00	1000	16.95	-1.60	11.45	13.96	36.02	4000	24.57
921.90	-6.49	0.00	19.90	13.41	21.93	30.00	1000	16.59	-1.60	11.81	15.17	36.02	4000	24.21
926.90	-6.39	0.00	19.90	13.51	22.44	30.00	1000	16.49	-1.60	11.91	15.52	36.02	4000	24.11

Sample Calculation:
Result = Reading + Cable Loss + Attenuator Loss
e.i.r.p. Result = Conducted Power Result + Antenna Gain

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

Report No.	12529842H	
Test place	Ise EMC Lab. No.6 Measurement Room	
Date	October 16, 2018	December 16, 2018
Temperature / Humidity	24 deg. C / 59 % RH	25 deg. C / 39 % RH
Engineer	Shuichi Ohyama	Takafumi Noguchi
Mode	Tx, Hopping Off	

US Wide

Maximum Power Setting

Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)		Duty factor	Result (Burst power average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
902.75	5.64	0.00	19.90	25.54	358.10	0.96	26.50	446.68
914.75	5.36	0.00	19.90	25.26	335.74	0.96	26.22	418.79
927.25	4.82	0.00	19.90	24.72	296.48	0.96	25.68	369.83

Sample Calculation:
Result (Time average) = Reading + Cable Loss + Attenuator Loss
Result (Burst power average) = Time average + Duty factor

Minimum Power Setting

Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)		Duty factor	Result (Burst power average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
902.75	-8.31	0.00	19.90	11.59	14.42	0.96	12.55	17.99
914.75	-8.53	0.00	19.90	11.37	13.71	0.96	12.33	17.10
927.25	-9.05	0.00	19.90	10.85	12.16	0.96	11.81	15.17

Sample Calculation:
Result (Time average) = Reading + Cable Loss + Attenuator Loss
Result (Burst power average) = Time average + Duty factor

US Narrow

Maximum Power Setting

Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)		Duty factor	Result (Burst power average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
917.10	5.39	0.00	19.90	25.29	338.06	0.96	26.25	421.70
921.90	5.55	0.00	19.90	25.45	350.75	0.96	26.41	437.52
926.90	5.61	0.00	19.90	25.51	355.63	0.96	26.47	443.61

Sample Calculation:
Result (Time average) = Reading + Cable Loss + Attenuator Loss
Result (Burst power average) = Time average + Duty factor

Minimum Power Setting

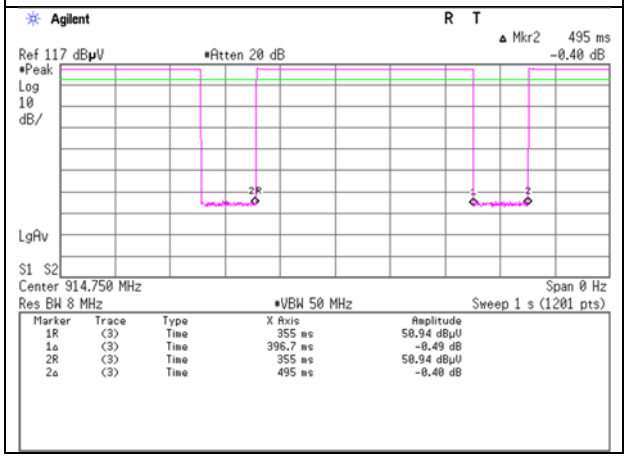
Freq.	Reading	Cable Loss	Atten. Loss	Result (Time average)		Duty factor	Result (Burst power average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dB]	[dBm]	[mW]
917.10	-8.94	0.00	19.90	10.96	12.47	0.96	11.92	15.56
921.90	-8.48	0.00	19.90	11.42	13.87	0.96	12.38	17.30
926.90	-8.38	0.00	19.90	11.52	14.19	0.96	12.48	17.70

Sample Calculation:
Result (Time average) = Reading + Cable Loss + Attenuator Loss
Result (Burst power average) = Time average + Duty factor

Burst Rate Confirmation

Report No.	12529842H	
Test place	Ise EMC Lab. No.6 Measurement Room	
Date	October 16, 2018	October 16, 2018
Temperature / Humidity	24 deg. C / 59 % RH	24 deg. C / 59 % RH
Engineer	Shuichi Ohyama	Shuichi Ohyama
Mode	Tx, Hopping Off	

Tx on / (Tx on + Tx off) =	**0.801**
Tx on / (Tx on + Tx off) * 100 =	**80.1 %**
Duty factor = 10 * log (495 / 396.7) =	**0.96 dB**



Radiated Spurious Emission

Short Range Antenna without cable

Report No.	12529842H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.2	No.2
Date	October 22, 2018	October 23, 2018
Temperature / Humidity	22 deg. C / 44 % RH	22 deg. C / 49 % RH
Engineer	Takumi Shimada	Shuichi Ohyama
	(30 MHz -1000 MHz)	(1 GHz - 10 GHz)
Mode	Tx, Hopping Off 902.75 MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	32.267	QP	29.4	17.5	6.8	30.5	23.2	40.0	16.8	
Hori	72.006	QP	28.9	6.2	7.2	30.4	11.9	40.0	28.1	
Hori	99.624	QP	31.8	10.1	7.5	30.3	19.1	43.5	24.4	
Hori	150.744	QP	32.2	14.8	7.8	30.0	24.8	43.5	18.7	
Hori	451.360	QP	32.2	16.5	9.5	29.9	28.3	46.0	17.7	
Hori	753.765	QP	28.7	20.0	10.8	28.9	30.6	46.0	15.4	
Hori	1805.500	PK	56.7	25.5	5.1	34.7	52.6	73.9	21.3	
Hori	2708.250	PK	45.6	28.3	5.4	34.4	44.9	73.9	29.0	
Hori	3611.000	PK	44.8	29.5	5.7	33.8	46.2	73.9	27.7	
Hori	4513.750	PK	42.8	30.7	6.0	33.6	45.9	73.9	28.0	Floor noise
Hori	5416.500	PK	42.1	31.6	6.5	33.4	46.8	73.9	27.1	Floor noise
Hori	6319.250	PK	42.8	33.1	6.8	33.6	49.1	73.9	24.8	Floor noise
Hori	7222.000	PK	43.2	35.6	7.2	33.6	52.4	73.9	21.5	Floor noise
Hori	8124.750	PK	42.3	36.3	7.5	33.7	52.4	73.9	21.5	Floor noise
Hori	9027.500	PK	42.6	37.2	7.7	33.8	53.7	73.9	20.2	Floor noise
Hori	1805.500	AV	53.2	25.5	5.1	34.7	49.1	53.9	4.8	
Hori	2708.250	AV	33.9	28.3	5.4	34.4	33.2	53.9	20.7	
Hori	3611.000	AV	36.1	29.5	5.7	33.8	37.5	53.9	16.4	
Hori	4513.750	AV	29.6	30.7	6.0	33.6	32.7	53.9	21.2	Floor noise
Hori	5416.500	AV	29.2	31.6	6.5	33.4	33.9	53.9	20.0	Floor noise
Hori	6319.250	AV	29.4	33.1	6.8	33.6	35.7	53.9	18.2	Floor noise
Hori	7222.000	AV	29.8	35.6	7.2	33.6	39.0	53.9	14.9	Floor noise
Hori	8124.750	AV	29.1	36.3	7.5	33.7	39.2	53.9	14.7	Floor noise
Hori	9027.500	AV	29.9	37.2	7.7	33.8	41.0	53.9	12.9	Floor noise
Vert	32.860	QP	32.2	17.3	6.8	30.5	25.8	40.0	14.2	
Vert	72.006	QP	38.3	6.2	7.2	30.4	21.3	40.0	18.7	
Vert	99.922	QP	37.7	10.1	7.5	30.3	25.0	43.5	18.5	
Vert	150.744	QP	34.7	14.8	7.8	30.0	27.3	43.5	16.2	
Vert	451.706	QP	33.9	16.5	9.5	29.9	30.0	46.0	16.0	
Vert	753.765	QP	26.2	20.0	10.8	28.9	28.1	46.0	17.9	
Vert	1805.500	PK	55.9	25.5	5.1	34.7	51.8	73.9	22.1	
Vert	2708.250	PK	46.4	28.3	5.4	34.4	45.7	73.9	28.2	
Vert	3611.000	PK	48.8	29.5	5.7	33.8	50.2	73.9	23.7	
Vert	4513.750	PK	41.8	30.7	6.0	33.6	44.9	73.9	29.0	Floor noise
Vert	5416.500	PK	43.7	31.6	6.5	33.4	48.4	73.9	25.5	Floor noise
Vert	6319.250	PK	42.8	33.1	6.8	33.6	49.1	73.9	24.8	Floor noise
Vert	7222.000	PK	43.0	35.6	7.2	33.6	52.2	73.9	21.7	Floor noise
Vert	8124.750	PK	42.4	36.3	7.5	33.7	52.5	73.9	21.4	Floor noise
Vert	9027.500	PK	43.2	37.2	7.7	33.8	54.3	73.9	19.6	Floor noise
Vert	1805.500	AV	52.3	25.5	5.1	34.7	48.2	53.9	5.7	
Vert	2708.250	AV	35.0	28.3	5.4	34.4	34.3	53.9	19.6	
Vert	3611.000	AV	43.7	29.5	5.7	33.8	45.1	53.9	8.8	
Vert	4513.750	AV	31.0	30.7	6.0	33.6	34.1	53.9	19.8	Floor noise
Vert	5416.500	AV	29.4	31.6	6.5	33.4	34.1	53.9	19.8	Floor noise
Vert	6319.250	AV	30.6	33.1	6.8	33.6	36.9	53.9	17.0	Floor noise
Vert	7222.000	AV	30.3	35.6	7.2	33.6	39.5	53.9	14.4	Floor noise
Vert	8124.750	AV	31.1	36.3	7.5	33.7	41.2	53.9	12.7	Floor noise
Vert	9027.500	AV	30.4	37.2	7.7	33.8	41.5	53.9	12.4	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

***These results have sufficient margin without taking account Dwell time factor.**

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	902.750	PK	78.8	21.8	11.3	0.0	111.9	-	-	Carrier
Hori	902.000	PK	25.2	21.8	11.3	0.0	58.3	91.9	33.6	
Vert	902.750	PK	77.6	21.8	11.3	0.0	110.7	-	-	Carrier
Vert	902.000	PK	24.7	21.8	11.3	0.0	57.8	90.7	32.9	

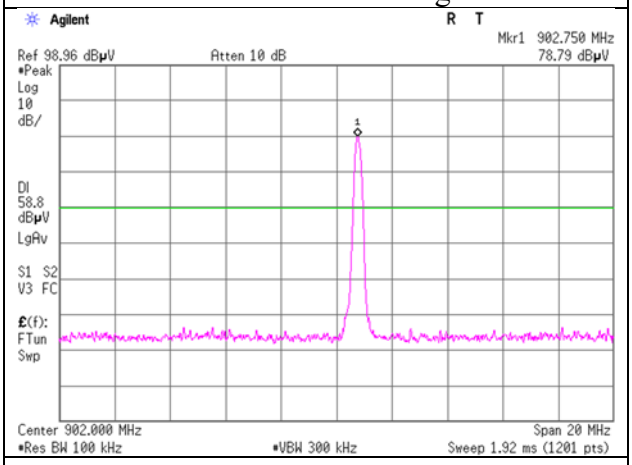
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amprifier)

Radiated Spurious Emission
(Reference Plot for band-edge)
Short Range Antenna without cable

Report No.	12529842H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	October 22, 2018
Temperature / Humidity	22 deg. C / 44 % RH
Engineer	Takumi Shimada (30 MHz -1000 MHz)
Mode	Tx, Hopping Off 902.75 MHz

Horizontal

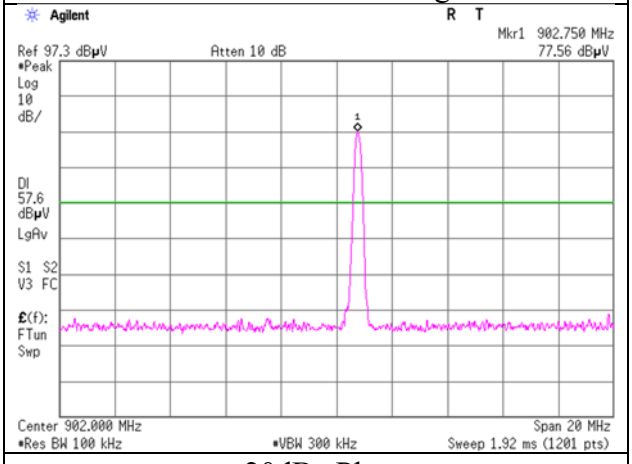
Authorized-band band-edge Plot



20dBc Plot

Vertical

Authorized-band band-edge Plot



20dBc Plot

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

Radiated Spurious Emission

Short Range Antenna without cable

Report No.	12529842H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.2	No.2
Date	October 22, 2018	October 23, 2018
Temperature / Humidity	22 deg. C / 44 % RH	22 deg. C / 49 % RH
Engineer	Takumi Shimada	Shuichi Ohyama
	(30 MHz -1000 MHz)	(1 GHz - 10 GHz)
Mode	Tx, Hopping Off 914.75 MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	32.351	QP	29.6	17.5	6.8	30.5	23.4	40.0	16.6	
Hori	72.003	QP	29.1	6.2	7.2	30.4	12.1	40.0	27.9	
Hori	99.646	QP	32.0	10.1	7.5	30.3	19.3	43.5	24.2	
Hori	150.742	QP	32.4	14.8	7.8	30.0	25.0	43.5	18.5	
Hori	451.648	QP	32.4	16.5	9.5	29.9	28.5	46.0	17.5	
Hori	753.762	QP	28.6	20.0	10.8	28.9	30.5	46.0	15.5	
Hori	1829.500	PK	57.1	25.5	5.1	34.7	53.0	73.9	20.9	
Hori	2744.250	PK	44.1	28.4	5.4	34.4	43.5	73.9	30.4	
Hori	3659.000	PK	48.2	29.6	5.7	33.8	49.7	73.9	24.2	
Hori	4573.750	PK	42.6	30.7	6.1	33.6	45.8	73.9	28.1	Floor noise
Hori	5488.500	PK	41.5	31.5	6.5	33.4	46.1	73.9	27.8	Floor noise
Hori	6403.250	PK	42.9	33.4	6.9	33.6	49.6	73.9	24.3	Floor noise
Hori	7318.000	PK	43.0	35.9	7.2	33.6	52.5	73.9	21.4	Floor noise
Hori	8232.750	PK	41.9	36.1	7.5	33.7	51.8	73.9	22.1	Floor noise
Hori	9147.500	PK	43.2	37.7	7.7	33.8	54.8	73.9	19.1	Floor noise
Hori	1829.500	AV	53.5	25.5	5.1	34.7	49.4	53.9	4.5	
Hori	2744.250	AV	33.1	28.4	5.4	34.4	32.5	53.9	21.4	
Hori	3659.000	AV	44.1	29.6	5.7	33.8	45.6	53.9	8.3	
Hori	4573.750	AV	29.7	30.7	6.1	33.6	32.9	53.9	21.0	Floor noise
Hori	5488.500	AV	28.7	31.5	6.5	33.4	33.3	53.9	20.6	Floor noise
Hori	6403.250	AV	29.1	33.4	6.9	33.6	35.8	53.9	18.1	Floor noise
Hori	7318.000	AV	29.7	35.9	7.2	33.6	39.2	53.9	14.7	Floor noise
Hori	8232.750	AV	29.0	36.1	7.5	33.7	38.9	53.9	15.0	Floor noise
Hori	9147.500	AV	30.4	37.7	7.7	33.8	42.0	53.9	11.9	Floor noise
Vert	32.537	QP	32.1	17.4	6.8	30.5	25.8	40.0	14.2	
Vert	72.004	QP	38.1	6.2	7.2	30.4	21.1	40.0	18.9	
Vert	99.915	QP	37.4	10.1	7.5	30.3	24.7	43.5	18.8	
Vert	150.742	QP	34.6	14.8	7.8	30.0	27.2	43.5	16.3	
Vert	451.565	QP	34.1	16.5	9.5	29.9	30.2	46.0	15.8	
Vert	753.762	QP	26.7	20.0	10.8	28.9	28.6	46.0	17.4	
Vert	1829.500	PK	53.4	25.5	5.1	34.7	49.3	73.9	24.6	
Vert	2744.250	PK	45.6	28.4	5.4	34.4	45.0	73.9	28.9	
Vert	3659.000	PK	49.6	29.6	5.7	33.8	51.1	73.9	22.8	
Vert	4573.750	PK	43.0	30.7	6.1	33.6	46.2	73.9	27.7	Floor noise
Vert	5488.500	PK	41.8	31.5	6.5	33.4	46.4	73.9	27.5	Floor noise
Vert	6403.250	PK	43.0	33.4	6.9	33.6	49.7	73.9	24.2	Floor noise
Vert	7318.000	PK	42.5	35.9	7.2	33.6	52.0	73.9	21.9	Floor noise
Vert	8232.750	PK	42.0	36.1	7.5	33.7	51.9	73.9	22.0	Floor noise
Vert	9147.500	PK	43.6	37.7	7.7	33.8	55.2	73.9	18.7	Floor noise
Vert	1829.500	AV	49.3	25.5	5.1	34.7	45.2	53.9	8.7	
Vert	2744.250	AV	34.4	28.4	5.4	34.4	33.8	53.9	20.1	
Vert	3659.000	AV	45.5	29.6	5.7	33.8	47.0	53.9	6.9	
Vert	4573.750	AV	30.1	30.7	6.1	33.6	33.3	53.9	20.6	Floor noise
Vert	5488.500	AV	28.8	31.5	6.5	33.4	33.4	53.9	20.5	Floor noise
Vert	6403.250	AV	31.8	33.4	6.9	33.6	38.5	53.9	15.4	Floor noise
Vert	7318.000	AV	29.7	35.9	7.2	33.6	39.2	53.9	14.7	Floor noise
Vert	8232.750	AV	30.8	36.1	7.5	33.7	40.7	53.9	13.2	Floor noise
Vert	9147.500	AV	30.9	37.7	7.7	33.8	42.5	53.9	11.4	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

Radiated Spurious Emission

Short Range Antenna without cable

Report No.	12529842H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.2	No.2
Date	October 22, 2018	October 23, 2018
Temperature / Humidity	22 deg. C / 44 % RH	22 deg. C / 49 % RH
Engineer	Takumi Shimada	Shuichi Ohyama
	(30 MHz -1000 MHz)	(1 GHz - 10 GHz)
Mode	Tx, Hopping Off 927.25 MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	32.657	QP	29.3	17.3	6.8	30.5	22.9	40.0	17.1	
Hori	72.166	QP	29.3	6.2	7.2	30.4	12.3	40.0	27.7	
Hori	99.675	QP	31.8	10.1	7.5	30.3	19.1	43.5	24.4	
Hori	150.746	QP	32.4	14.8	7.8	30.0	25.0	43.5	18.5	
Hori	451.638	QP	32.6	16.5	9.5	29.9	28.7	46.0	17.3	
Hori	753.764	QP	28.7	20.0	10.8	28.9	30.6	46.0	15.4	
Hori	1854.500	PK	54.0	25.4	5.1	34.7	49.8	73.9	24.1	
Hori	2781.750	PK	45.4	28.4	5.3	34.4	44.7	73.9	29.2	
Hori	3709.000	PK	47.2	29.7	5.7	33.7	48.9	73.9	25.0	
Hori	4636.250	PK	42.7	30.8	6.1	33.7	45.9	73.9	28.0	Floor noise
Hori	5563.500	PK	42.5	31.4	6.6	33.4	47.1	73.9	26.8	Floor noise
Hori	6490.750	PK	41.4	33.7	6.9	33.6	48.4	73.9	25.5	Floor noise
Hori	7418.000	PK	42.2	36.1	7.3	33.6	52.0	73.9	21.9	Floor noise
Hori	8345.250	PK	43.4	35.7	7.5	33.7	52.9	73.9	21.0	Floor noise
Hori	9272.500	PK	44.3	38.1	7.7	33.8	56.3	73.9	17.6	Floor noise
Hori	1854.500	AV	50.2	25.4	5.1	34.7	46.0	53.9	7.9	
Hori	2781.750	AV	33.2	28.4	5.3	34.4	32.5	53.9	21.4	
Hori	3709.000	AV	44.2	29.7	5.7	33.7	45.9	53.9	8.0	
Hori	4636.250	AV	29.5	30.8	6.1	33.7	32.7	53.9	21.2	Floor noise
Hori	5563.500	AV	28.6	31.4	6.6	33.4	33.2	53.9	20.7	Floor noise
Hori	6490.750	AV	28.9	33.7	6.9	33.6	35.9	53.9	18.0	Floor noise
Hori	7418.000	AV	29.2	36.1	7.3	33.6	39.0	53.9	14.9	Floor noise
Hori	8345.250	AV	29.9	35.7	7.5	33.7	39.4	53.9	14.5	Floor noise
Hori	9272.500	AV	31.4	38.1	7.7	33.8	43.4	53.9	10.5	Floor noise
Vert	32.836	QP	32.2	17.3	6.8	30.5	25.8	40.0	14.2	
Vert	72.127	QP	38.4	6.2	7.2	30.4	21.4	40.0	18.6	
Vert	99.923	QP	37.1	10.1	7.5	30.3	24.4	43.5	19.1	
Vert	150.746	QP	34.4	14.8	7.8	30.0	27.0	43.5	16.5	
Vert	451.612	QP	34.3	16.5	9.5	29.9	30.4	46.0	15.6	
Vert	753.764	QP	26.5	20.0	10.8	28.9	28.4	46.0	17.6	
Vert	1854.500	PK	51.4	25.4	5.1	34.7	47.2	73.9	26.7	
Vert	2781.750	PK	43.9	28.4	5.3	34.4	43.2	73.9	30.7	
Vert	3709.000	PK	48.3	29.7	5.7	33.7	50.0	73.9	23.9	
Vert	4636.250	PK	42.3	30.8	6.1	33.7	45.5	73.9	28.4	Floor noise
Vert	5563.500	PK	41.8	31.4	6.6	33.4	46.4	73.9	27.5	Floor noise
Vert	6490.750	PK	41.9	33.7	6.9	33.6	48.9	73.9	25.0	Floor noise
Vert	7418.000	PK	42.4	36.1	7.3	33.6	52.2	73.9	21.7	Floor noise
Vert	8345.250	PK	44.5	35.7	7.5	33.7	54.0	73.9	19.9	Floor noise
Vert	9272.500	PK	44.8	38.1	7.7	33.8	56.8	73.9	17.1	Floor noise
Vert	1854.500	AV	45.3	25.4	5.1	34.7	41.1	53.9	12.8	
Vert	2781.750	AV	33.4	28.4	5.3	34.4	32.7	53.9	21.2	
Vert	3709.000	AV	43.5	29.7	5.7	33.7	45.2	53.9	8.7	
Vert	4636.250	AV	29.9	30.8	6.1	33.7	33.1	53.9	20.8	Floor noise
Vert	5563.500	AV	28.6	31.4	6.6	33.4	33.2	53.9	20.7	Floor noise
Vert	6490.750	AV	29.9	33.7	6.9	33.6	36.9	53.9	17.0	Floor noise
Vert	7418.000	AV	30.1	36.1	7.3	33.6	39.9	53.9	14.0	Floor noise
Vert	8345.250	AV	31.8	35.7	7.5	33.7	41.3	53.9	12.6	Floor noise
Vert	9272.500	AV	31.6	38.1	7.7	33.8	43.6	53.9	10.3	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

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	927.250	PK	79.3	21.7	11.4	0.0	112.4	-	-	Carrier
Hori	928.000	PK	26.0	21.7	11.4	0.0	59.1	92.4	33.3	
Vert	927.250	PK	77.0	21.7	11.4	0.0	110.1	-	-	Carrier
Vert	928.000	PK	24.8	21.7	11.4	0.0	57.9	90.1	32.2	

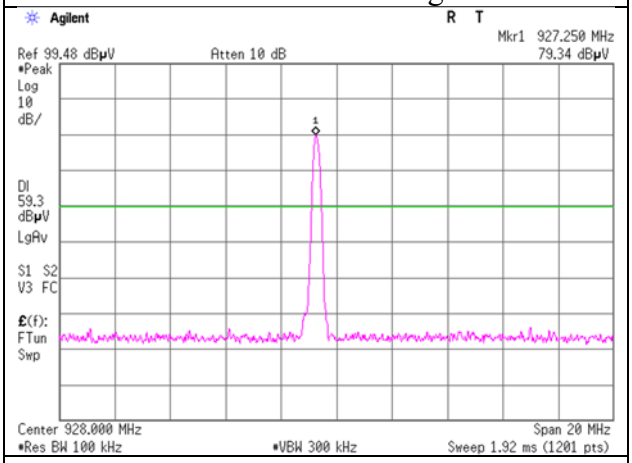
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amprifier)

Radiated Spurious Emission
(Reference Plot for band-edge)
Short Range Antenna without cable

Report No.	12529842H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	October 22, 2018
Temperature / Humidity	22 deg. C / 44 % RH
Engineer	Takumi Shimada (30 MHz -1000 MHz)
Mode	Tx, Hopping Off 927.25 MHz

Horizontal

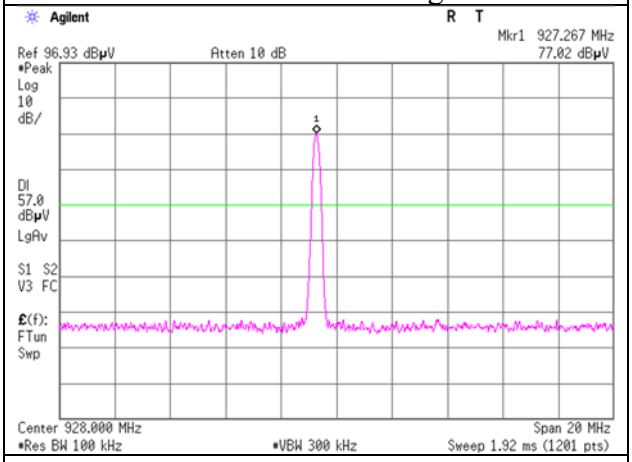
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

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

Radiated Spurious Emission

Long Range Antenna without cable

Report No.	12529842H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.2	No.2
Date	October 22, 2018	October 23, 2018
Temperature / Humidity	22 deg. C / 44 % RH	22 deg. C / 49 % RH
Engineer	Takumi Shimada	Shuichi Ohyama
	(30 MHz -1000 MHz)	(1 GHz - 10 GHz)
Mode	Tx, Hopping Off 902.75 MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	32.267	QP	25.6	17.5	6.8	30.5	19.4	40.0	20.6	
Hori	53.517	QP	24.8	9.8	7.0	30.4	11.2	40.0	28.8	
Hori	99.896	QP	32.0	10.1	7.5	30.3	19.3	43.5	24.2	
Hori	179.318	QP	26.1	16.0	8.0	29.8	20.3	43.5	23.2	
Hori	452.000	QP	33.4	16.5	9.5	29.9	29.5	46.0	16.5	
Hori	754.391	QP	28.9	20.0	10.8	28.9	30.8	46.0	15.2	
Hori	1805.500	PK	62.7	25.5	5.1	34.7	58.6	73.9	15.3	
Hori	2708.250	PK	50.3	28.3	5.4	34.4	49.6	73.9	24.3	
Hori	3611.000	PK	52.1	29.5	5.7	33.8	53.5	73.9	20.4	
Hori	4513.750	PK	43.8	30.7	6.0	33.6	46.9	73.9	27.0	Floor noise
Hori	5416.500	PK	41.6	31.6	6.5	33.4	46.3	73.9	27.6	Floor noise
Hori	6319.250	PK	43.1	33.1	6.8	33.6	49.4	73.9	24.5	Floor noise
Hori	7222.000	PK	42.6	35.6	7.2	33.6	51.8	73.9	22.1	Floor noise
Hori	8124.750	PK	42.4	36.3	7.5	33.7	52.5	73.9	21.4	Floor noise
Hori	9027.500	PK	43.0	37.2	7.7	33.8	54.1	73.9	19.8	Floor noise
Hori	1805.500	AV	53.4	25.5	5.1	34.7	49.3	53.9	4.6	
Hori	2708.250	AV	36.8	28.3	5.4	34.4	36.1	53.9	17.8	
Hori	3611.000	AV	49.0	29.5	5.7	33.8	50.4	53.9	3.5	
Hori	4513.750	AV	31.6	30.7	6.0	33.6	34.7	53.9	19.2	Floor noise
Hori	5416.500	AV	29.2	31.6	6.5	33.4	33.9	53.9	20.0	Floor noise
Hori	6319.250	AV	30.4	33.1	6.8	33.6	36.7	53.9	17.2	Floor noise
Hori	7222.000	AV	30.4	35.6	7.2	33.6	39.6	53.9	14.3	Floor noise
Hori	8124.750	AV	29.1	36.3	7.5	33.7	39.2	53.9	14.7	Floor noise
Hori	9027.500	AV	30.3	37.2	7.7	33.8	41.4	53.9	12.5	Floor noise
Vert	32.267	QP	26.9	17.5	6.8	30.5	20.7	40.0	19.3	
Vert	54.083	QP	34.5	9.6	7.0	30.4	20.7	40.0	19.3	
Vert	99.928	QP	38.1	10.1	7.5	30.3	25.4	43.5	18.1	
Vert	179.318	QP	31.6	16.0	8.0	29.8	25.8	43.5	17.7	
Vert	452.000	QP	33.9	16.5	9.5	29.9	30.0	46.0	16.0	
Vert	754.595	QP	25.1	20.0	10.8	28.9	27.0	46.0	19.0	
Vert	1805.500	PK	60.3	25.5	5.1	34.7	56.2	73.9	17.7	
Vert	2708.250	PK	45.8	28.3	5.4	34.4	45.1	73.9	28.8	
Vert	3611.000	PK	50.6	29.5	5.7	33.8	52.0	73.9	21.9	
Vert	4513.750	PK	42.8	30.7	6.0	33.6	45.9	73.9	28.0	Floor noise
Vert	5416.500	PK	41.7	31.6	6.5	33.4	46.4	73.9	27.5	Floor noise
Vert	6319.250	PK	42.5	33.1	6.8	33.6	48.8	73.9	25.1	Floor noise
Vert	7222.000	PK	43.6	35.6	7.2	33.6	52.8	73.9	21.1	Floor noise
Vert	8124.750	PK	42.0	36.3	7.5	33.7	52.1	73.9	21.8	Floor noise
Vert	9027.500	PK	42.9	37.2	7.7	33.8	54.0	73.9	19.9	Floor noise
Vert	1805.500	AV	51.2	25.5	5.1	34.7	47.1	53.9	6.8	
Vert	2708.250	AV	34.4	28.3	5.4	34.4	33.7	53.9	20.2	
Vert	3611.000	AV	46.5	29.5	5.7	33.8	47.9	53.9	6.0	
Vert	4513.750	AV	31.3	30.7	6.0	33.6	34.4	53.9	19.5	Floor noise
Vert	5416.500	AV	29.2	31.6	6.5	33.4	33.9	53.9	20.0	Floor noise
Vert	6319.250	AV	29.5	33.1	6.8	33.6	35.8	53.9	18.1	Floor noise
Vert	7222.000	AV	29.8	35.6	7.2	33.6	39.0	53.9	14.9	Floor noise
Vert	8124.750	AV	29.2	36.3	7.5	33.7	39.3	53.9	14.6	Floor noise
Vert	9027.500	AV	29.9	37.2	7.7	33.8	41.0	53.9	12.9	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

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	902.750	PK	88.3	21.8	11.3	0.0	121.4	-	-	Carrier
Hori	902.000	PK	28.7	21.8	11.3	0.0	61.8	101.4	39.6	
Vert	902.750	PK	88.0	21.8	11.3	0.0	121.1	-	-	Carrier
Vert	902.000	PK	29.6	21.8	11.3	0.0	62.7	101.1	38.4	

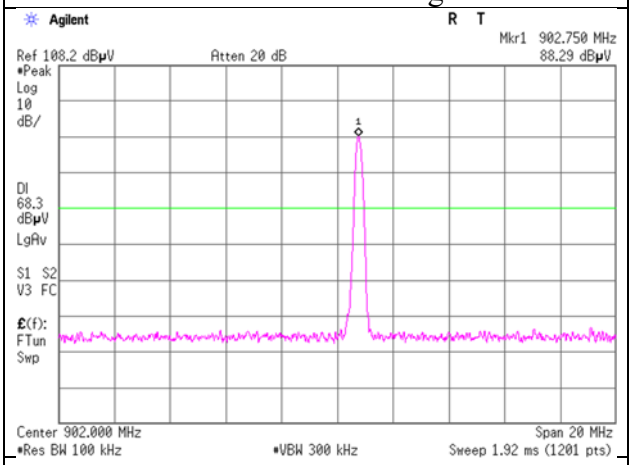
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amprifier)

Radiated Spurious Emission
(Reference Plot for band-edge)
Long Range Antenna without cable

Report No.	12529842H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	October 22, 2018
Temperature / Humidity	22 deg. C / 44 % RH
Engineer	Takumi Shimada
	(30 MHz -1000 MHz)
Mode	Tx, Hopping Off 902.75 MHz

Horizontal

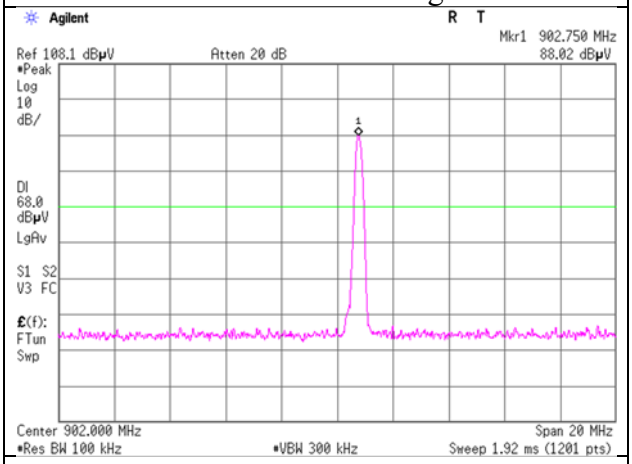
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

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

Radiated Spurious Emission

Long Range Antenna without cable

Report No.	12529842H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.2	No.2
Date	October 22, 2018	October 23, 2018
Temperature / Humidity	22 deg. C / 44 % RH	22 deg. C / 49 % RH
Engineer	Takumi Shimada	Shuichi Ohyama
	(30 MHz -1000 MHz)	(1 GHz - 10 GHz)
Mode	Tx, Hopping Off 914.75 MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	32.157	QP	25.8	17.5	6.8	30.5	19.6	40.0	20.4	
Hori	53.968	QP	24.7	9.6	7.0	30.4	10.9	40.0	29.1	
Hori	99.915	QP	32.3	10.1	7.5	30.3	19.6	43.5	23.9	
Hori	179.327	QP	26.4	16.0	8.0	29.8	20.6	43.5	22.9	
Hori	452.000	QP	33.7	16.5	9.5	29.9	29.8	46.0	16.2	
Hori	754.442	QP	28.7	20.0	10.8	28.9	30.6	46.0	15.4	
Hori	1829.500	PK	62.4	25.5	5.1	34.7	58.3	73.9	15.6	
Hori	2744.250	PK	49.3	28.4	5.4	34.4	48.7	73.9	25.2	
Hori	3659.000	PK	51.6	29.6	5.7	33.8	53.1	73.9	20.8	
Hori	4573.750	PK	43.4	30.7	6.1	33.6	46.6	73.9	27.3	Floor noise
Hori	5488.500	PK	41.8	31.5	6.5	33.4	46.4	73.9	27.5	Floor noise
Hori	6403.250	PK	43.1	33.4	6.9	33.6	49.8	73.9	24.1	Floor noise
Hori	7318.000	PK	43.3	35.9	7.2	33.6	52.8	73.9	21.1	Floor noise
Hori	8232.750	PK	42.7	36.1	7.5	33.7	52.6	73.9	21.3	Floor noise
Hori	9147.500	PK	43.5	37.7	7.7	33.8	55.1	73.9	18.8	Floor noise
Hori	1829.500	AV	52.7	25.5	5.1	34.7	48.6	53.9	5.3	
Hori	2744.250	AV	39.6	28.4	5.4	34.4	39.0	53.9	14.9	
Hori	3659.000	AV	48.8	29.6	5.7	33.8	50.3	53.9	3.6	
Hori	4573.750	AV	30.4	30.7	6.1	33.6	33.6	53.9	20.3	Floor noise
Hori	5488.500	AV	28.8	31.5	6.5	33.4	33.4	53.9	20.5	Floor noise
Hori	6403.250	AV	29.6	33.4	6.9	33.6	36.3	53.9	17.6	Floor noise
Hori	7318.000	AV	29.7	35.9	7.2	33.6	39.2	53.9	14.7	Floor noise
Hori	8232.750	AV	30.4	36.1	7.5	33.7	40.3	53.9	13.6	Floor noise
Hori	9147.500	AV	30.2	37.7	7.7	33.8	41.8	53.9	12.1	Floor noise
Vert	32.232	QP	26.7	17.5	6.8	30.5	20.5	40.0	19.5	
Vert	54.011	QP	34.2	9.6	7.0	30.4	20.4	40.0	19.6	
Vert	99.926	QP	38.1	10.1	7.5	30.3	25.4	43.5	18.1	
Vert	179.323	QP	32.1	16.0	8.0	29.8	26.3	43.5	17.2	
Vert	452.000	QP	34.0	16.5	9.5	29.9	30.1	46.0	15.9	
Vert	754.496	QP	25.2	20.0	10.8	28.9	27.1	46.0	18.9	
Vert	1829.500	PK	62.9	25.5	5.1	34.7	58.8	73.9	15.1	
Vert	2744.250	PK	47.4	28.4	5.4	34.4	46.8	73.9	27.1	
Vert	3659.000	PK	50.5	29.6	5.7	33.8	52.0	73.9	21.9	
Vert	4573.750	PK	43.5	30.7	6.1	33.6	46.7	73.9	27.2	Floor noise
Vert	5488.500	PK	41.7	31.5	6.5	33.4	46.3	73.9	27.6	Floor noise
Vert	6403.250	PK	42.2	33.4	6.9	33.6	48.9	73.9	25.0	Floor noise
Vert	7318.000	PK	42.9	35.9	7.2	33.6	52.4	73.9	21.5	Floor noise
Vert	8232.750	PK	42.2	36.1	7.5	33.7	52.1	73.9	21.8	Floor noise
Vert	9147.500	PK	44.2	37.7	7.7	33.8	55.8	73.9	18.1	Floor noise
Vert	1829.500	AV	54.6	25.5	5.1	34.7	50.5	53.9	3.4	
Vert	2744.250	AV	37.0	28.4	5.4	34.4	36.4	53.9	17.5	
Vert	3659.000	AV	46.5	29.6	5.7	33.8	48.0	53.9	5.9	
Vert	4573.750	AV	30.9	30.7	6.1	33.6	34.1	53.9	19.8	Floor noise
Vert	5488.500	AV	28.8	31.5	6.5	33.4	33.4	53.9	20.5	Floor noise
Vert	6403.250	AV	29.2	33.4	6.9	33.6	35.9	53.9	18.0	Floor noise
Vert	7318.000	AV	29.6	35.9	7.2	33.6	39.1	53.9	14.8	Floor noise
Vert	8232.750	AV	29.0	36.1	7.5	33.7	38.9	53.9	15.0	Floor noise
Vert	9147.500	AV	30.4	37.7	7.7	33.8	42.0	53.9	11.9	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

Radiated Spurious Emission

Long Range Antenna without cable

Report No.	12529842H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.2	No.2
Date	October 22, 2018	October 23, 2018
Temperature / Humidity	22 deg. C / 44 % RH	22 deg. C / 49 % RH
Engineer	Takumi Shimada	Shuichi Ohyama
	(30 MHz -1000 MHz)	(1 GHz - 10 GHz)
Mode	Tx, Hopping Off 927.25 MHz	

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	32.251	QP	25.4	17.5	6.8	30.5	19.2	40.0	20.8	
Hori	54.034	QP	24.7	9.6	7.0	30.4	10.9	40.0	29.1	
Hori	99.896	QP	32.1	10.1	7.5	30.3	19.4	43.5	24.1	
Hori	179.322	QP	26.5	16.0	8.0	29.8	20.7	43.5	22.8	
Hori	452.000	QP	33.9	16.5	9.5	29.9	30.0	46.0	16.0	
Hori	754.478	QP	28.4	20.0	10.8	28.9	30.3	46.0	15.7	
Hori	1854.500	PK	62.5	25.4	5.1	34.7	58.3	73.9	15.6	
Hori	2781.750	PK	47.4	28.4	5.3	34.4	46.7	73.9	27.2	
Hori	3709.000	PK	49.6	29.7	5.7	33.7	51.3	73.9	22.6	
Hori	4636.250	PK	42.4	30.8	6.1	33.7	45.6	73.9	28.3	Floor noise
Hori	5563.500	PK	41.9	31.4	6.6	33.4	46.5	73.9	27.4	Floor noise
Hori	6490.750	PK	43.2	33.7	6.9	33.6	50.2	73.9	23.7	Floor noise
Hori	7418.000	PK	42.1	36.1	7.3	33.6	51.9	73.9	22.0	Floor noise
Hori	8345.250	PK	42.8	35.7	7.5	33.7	52.3	73.9	21.6	Floor noise
Hori	9272.500	PK	44.5	38.1	7.7	33.8	56.5	73.9	17.4	Floor noise
Hori	1854.500	AV	54.1	25.4	5.1	34.7	49.9	53.9	4.0	
Hori	2781.750	AV	35.6	28.4	5.3	34.4	34.9	53.9	19.0	
Hori	3709.000	AV	45.6	29.7	5.7	33.7	47.3	53.9	6.6	
Hori	4636.250	AV	29.5	30.8	6.1	33.7	32.7	53.9	21.2	Floor noise
Hori	5563.500	AV	28.6	31.4	6.6	33.4	33.2	53.9	20.7	Floor noise
Hori	6490.750	AV	30.7	33.7	6.9	33.6	37.7	53.9	16.2	Floor noise
Hori	7418.000	AV	29.2	36.1	7.3	33.6	39.0	53.9	14.9	Floor noise
Hori	8345.250	AV	30.5	35.7	7.5	33.7	40.0	53.9	13.9	Floor noise
Hori	9272.500	AV	31.4	38.1	7.7	33.8	43.4	53.9	10.5	Floor noise
Vert	32.195	QP	26.9	17.5	6.8	30.5	20.7	40.0	19.3	
Vert	54.009	QP	34.3	9.6	7.0	30.4	20.5	40.0	19.5	
Vert	99.921	QP	38.4	10.1	7.5	30.3	25.7	43.5	17.8	
Vert	179.317	QP	32.0	16.0	8.0	29.8	26.2	43.5	17.3	
Vert	452.000	QP	34.1	16.5	9.5	29.9	30.2	46.0	15.8	
Vert	754.452	QP	25.1	20.0	10.8	28.9	27.0	46.0	19.0	
Vert	1854.500	PK	62.8	25.4	5.1	34.7	58.6	73.9	15.3	
Vert	2781.750	PK	50.5	28.4	5.3	34.4	49.8	73.9	24.1	
Vert	3709.000	PK	50.6	29.7	5.7	33.7	52.3	73.9	21.6	
Vert	4636.250	PK	42.5	30.8	6.1	33.7	45.7	73.9	28.2	Floor noise
Vert	5563.500	PK	41.6	31.4	6.6	33.4	46.2	73.9	27.7	Floor noise
Vert	6490.750	PK	42.7	33.7	6.9	33.6	49.7	73.9	24.2	Floor noise
Vert	7418.000	PK	42.9	36.1	7.3	33.6	52.7	73.9	21.2	Floor noise
Vert	8345.250	PK	42.9	35.7	7.5	33.7	52.4	73.9	21.5	Floor noise
Vert	9272.500	PK	44.8	38.1	7.7	33.8	56.8	73.9	17.1	Floor noise
Vert	1854.500	AV	54.1	25.4	5.1	34.7	49.9	53.9	4.0	
Vert	2781.750	AV	38.4	28.4	5.3	34.4	37.7	53.9	16.2	
Vert	3709.000	AV	46.9	29.7	5.7	33.7	48.6	53.9	5.3	
Vert	4636.250	AV	29.6	30.8	6.1	33.7	32.8	53.9	21.1	Floor noise
Vert	5563.500	AV	28.5	31.4	6.6	33.4	33.1	53.9	20.8	Floor noise
Vert	6490.750	AV	28.8	33.7	6.9	33.6	35.8	53.9	18.1	Floor noise
Vert	7418.000	AV	29.3	36.1	7.3	33.6	39.1	53.9	14.8	Floor noise
Vert	8345.250	AV	30.0	35.7	7.5	33.7	39.5	53.9	14.4	Floor noise
Vert	9272.500	AV	31.4	38.1	7.7	33.8	43.4	53.9	10.5	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

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	927.250	PK	90.4	21.7	11.4	0.0	123.5	-	-	Carrier
Hori	928.000	PK	29.8	21.7	11.4	0.0	62.9	103.5	40.6	
Vert	927.250	PK	91.4	21.7	11.4	0.0	124.5	-	-	Carrier
Vert	928.000	PK	30.8	21.7	11.4	0.0	63.9	104.5	40.6	

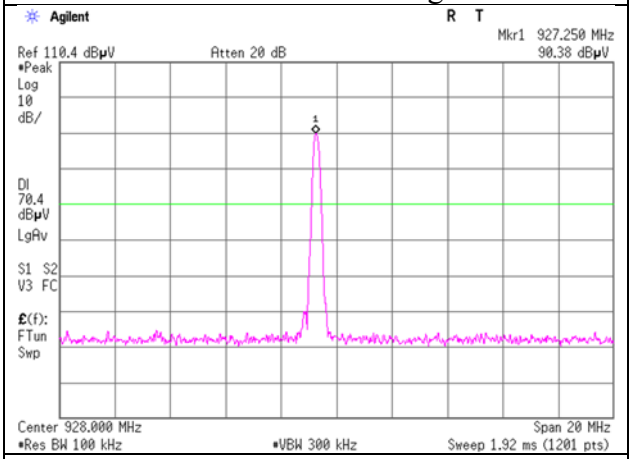
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amprifier)

Radiated Spurious Emission
(Reference Plot for band-edge)
Long Range Antenna without cable

Report No.	12529842H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	October 22, 2018
Temperature / Humidity	22 deg. C / 44 % RH
Engineer	Takumi Shimada
	(30 MHz -1000 MHz)
Mode	Tx, Hopping Off 927.25 MHz

Horizontal

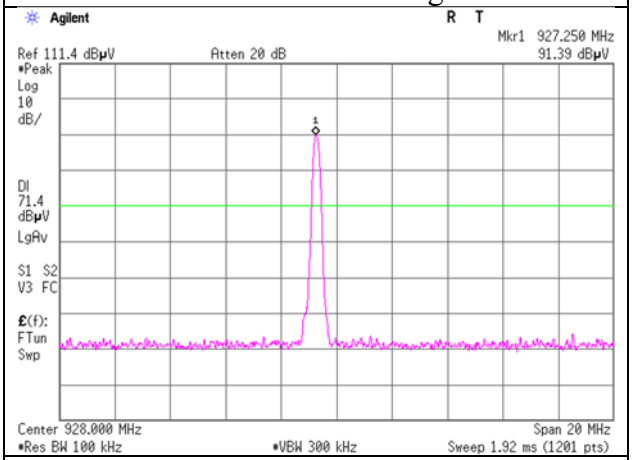
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

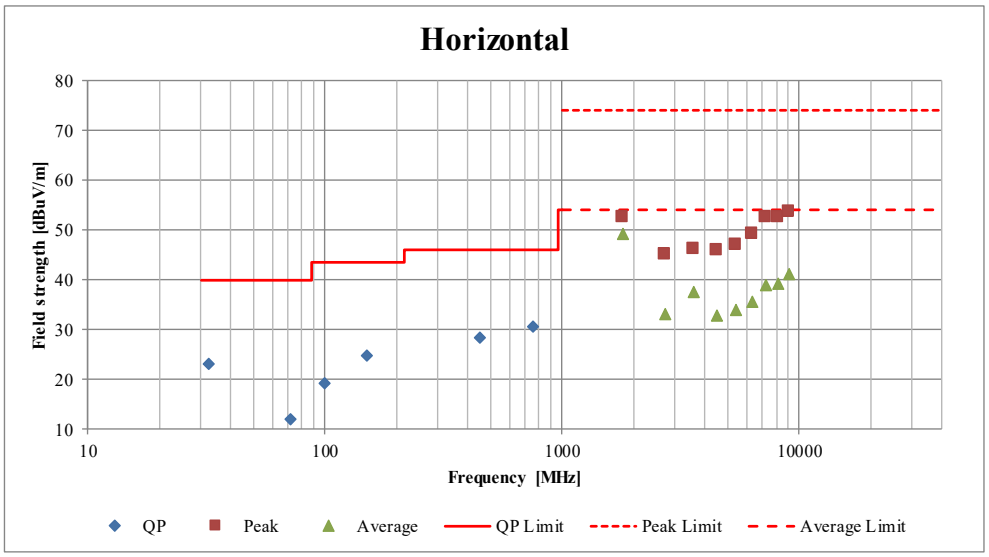


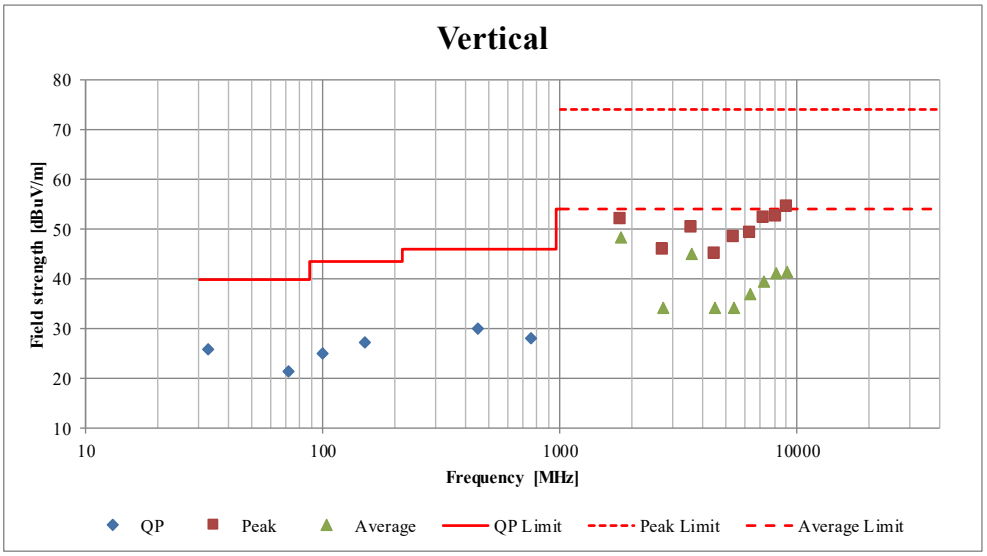
Trace Green : Peak Plot
Trace Purple : Average Plot

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

Radiated Spurious Emission
(Plot data, Worst case)
Short Range Antenna without cable

Report No.	12529842H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.2	No.2
Date	October 22, 2018	October 23, 2018
Temperature / Humidity	22 deg. C / 44 % RH	22 deg. C / 49 % RH
Engineer	Takumi Shimada	Shuichi Ohyama
	(30 MHz -1000 MHz)	(1 GHz - 10 GHz)
Mode	Tx, Hopping Off 902.75 MHz	

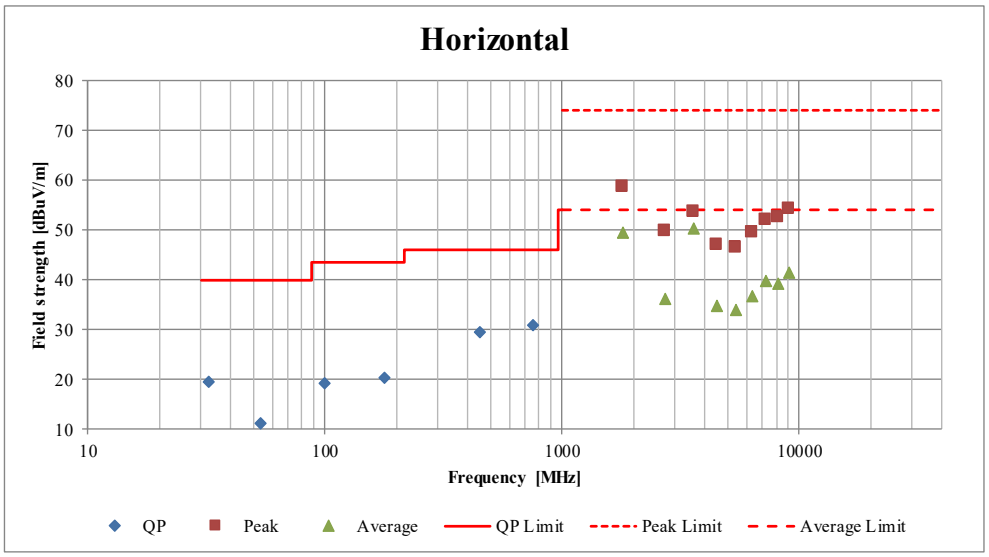


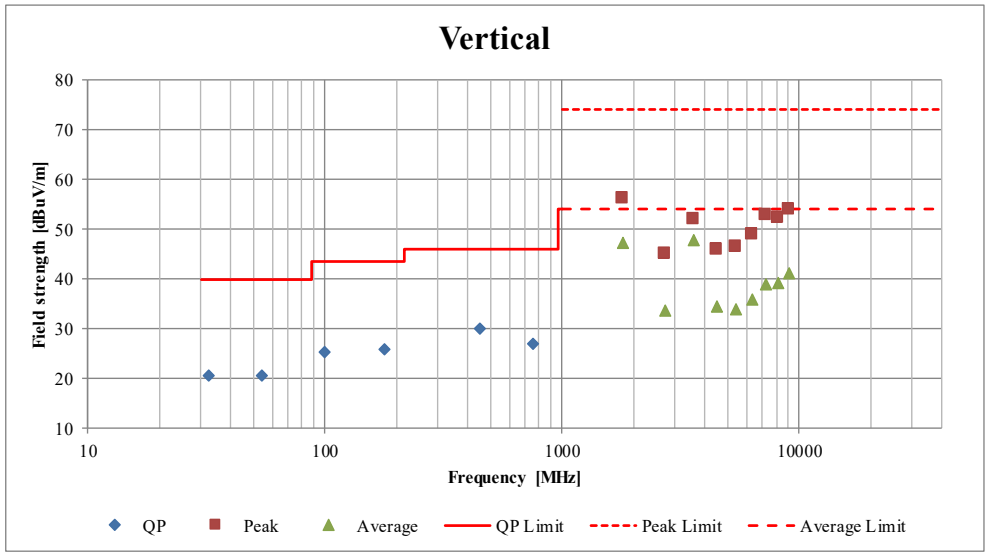


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Radiated Spurious Emission
(Plot data, Worst case)
Long Range Antenna without cable

Report No.	12529842H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.2	No.2
Date	October 22, 2018	October 23, 2018
Temperature / Humidity	22 deg. C / 44 % RH	22 deg. C / 49 % RH
Engineer	Takumi Shimada	Shuichi Ohyama
	(30 MHz -1000 MHz)	(1 GHz - 10 GHz)
Mode	Tx, Hopping Off 902.75 MHz	





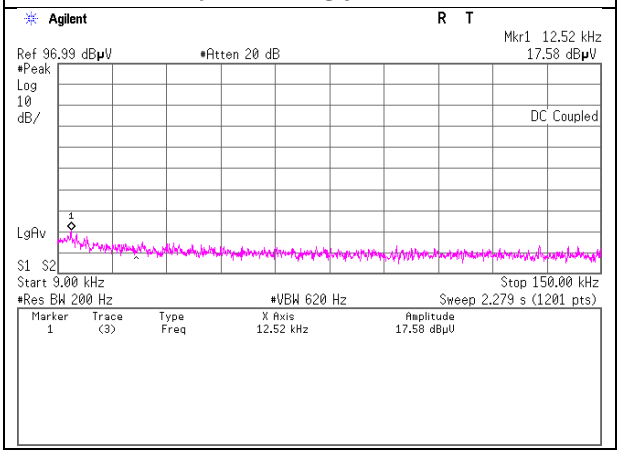
*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

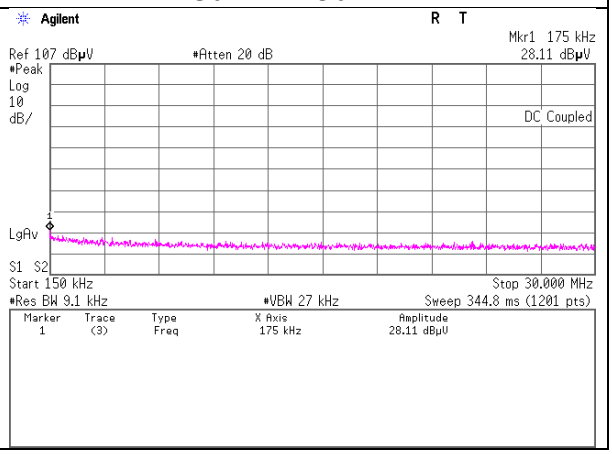
Report No.	12529842H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	October 16, 2018
Temperature / Humidity	24 deg. C / 59 % RH
Engineer	Shuichi Ohyama
Mode	Tx, Hopping Off 902.75 MHz

902.75 MHz

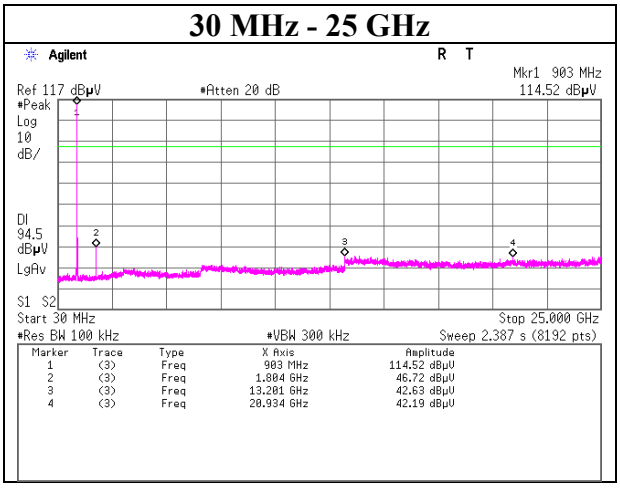
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

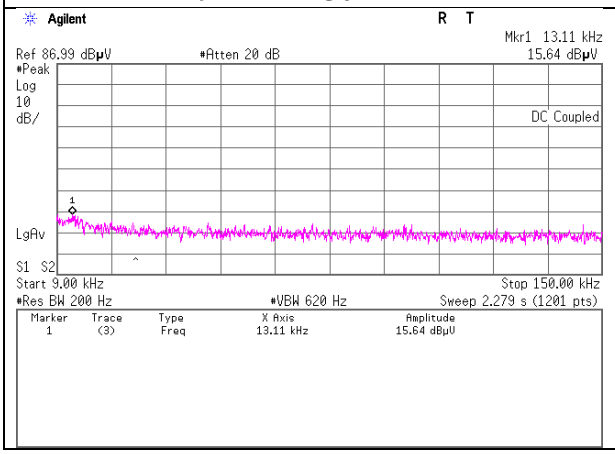


Conducted Spurious Emission

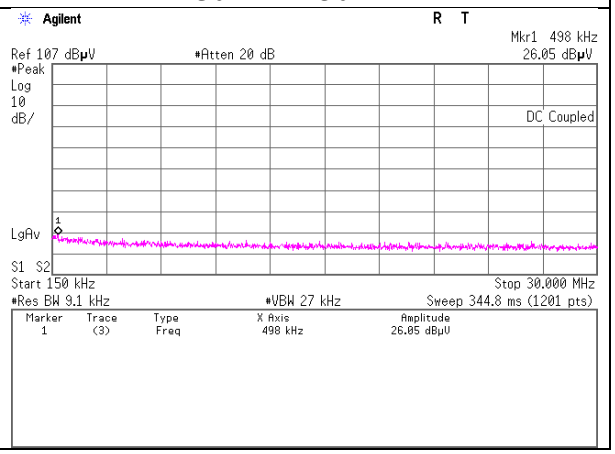
Report No.	12529842H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	October 16, 2018
Temperature / Humidity	24 deg. C / 59 % RH
Engineer	Shuichi Ohyama
Mode	Tx, Hopping Off 914.75 MHz

914.75 MHz

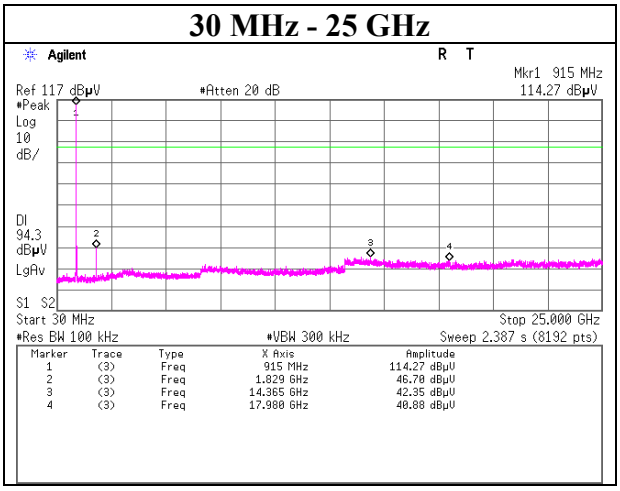
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

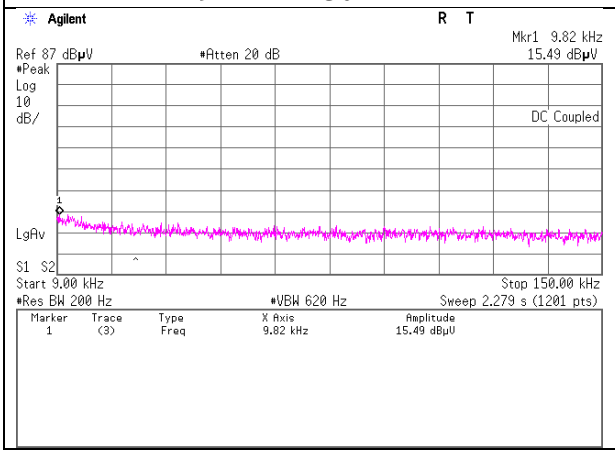


Conducted Spurious Emission

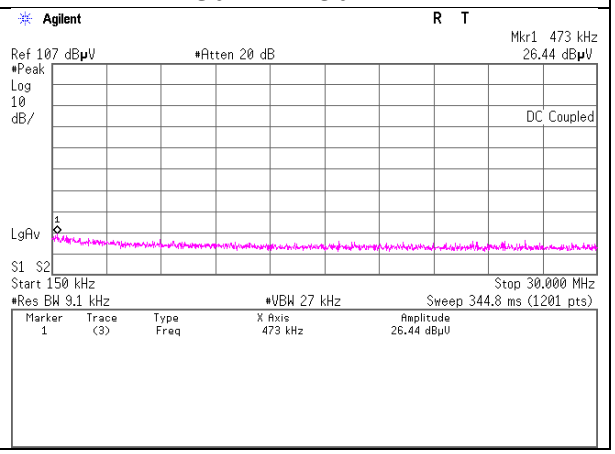
Report No.	12529842H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	October 16, 2018
Temperature / Humidity	24 deg. C / 59 % RH
Engineer	Shuichi Ohyama
Mode	Tx, Hopping Off 927.25 MHz

927.25 MHz

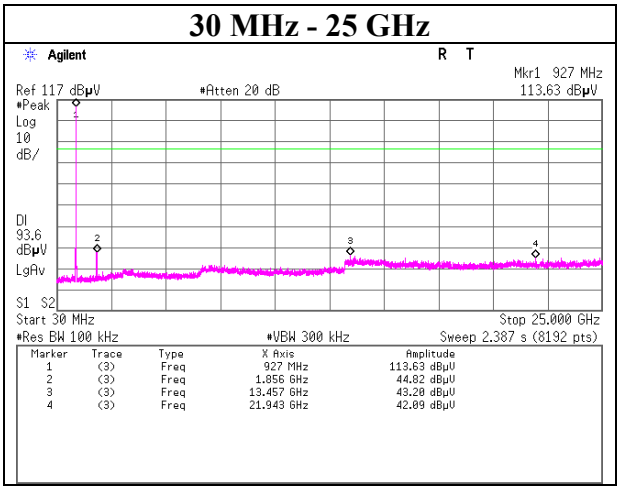
9 kHz - 150 kHz



150 kHz - 30 MHz



30 MHz - 25 GHz

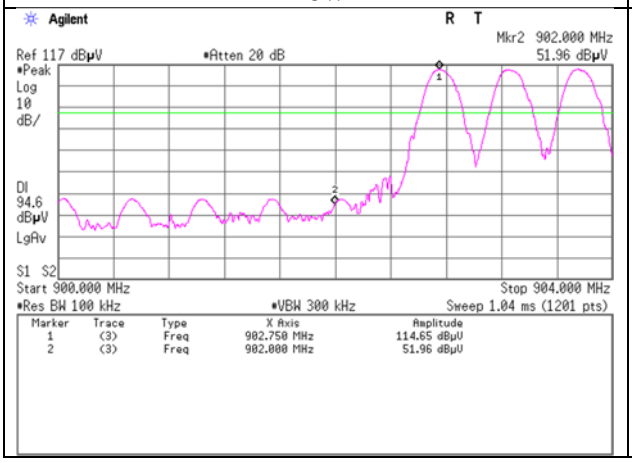


Conducted Emission Band Edge compliance

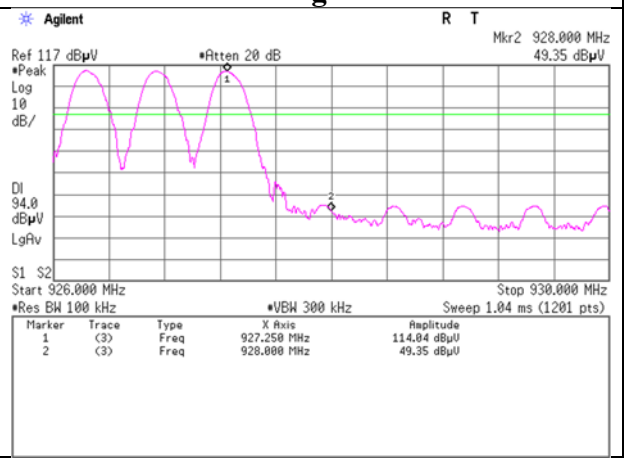
Report No.	12529842H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	October 16, 2018
Temperature / Humidity	24 deg. C / 59 % RH
Engineer	Shuichi Ohyama
Mode	Tx Hopping On / Off

Hopping On

Low

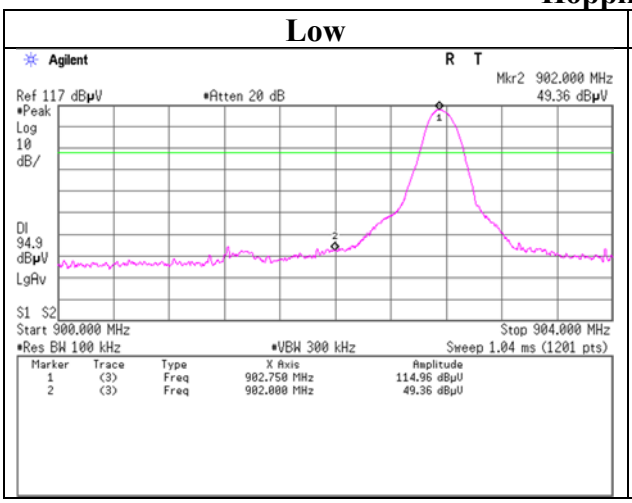


High

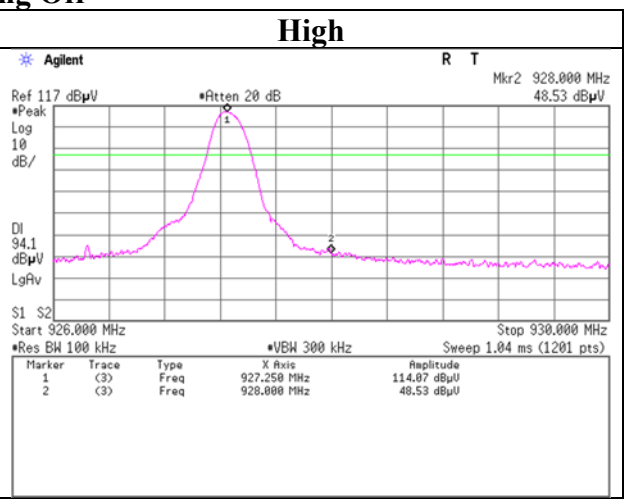


Hopping Off

Low



High



APPENDIX 2: Test instruments

Test Instruments

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
AT	141561	Thermo-Hygrometer	CUSTOM	CTH-201	1401	01/24/2018	01/31/2019	12
AT	141901	Spectrum Analyzer	AGILENT	E4440A	MY48250080	10/04/2018	10/31/2019	12
AT	141805	Power Meter	ANRITSU	ML2495A	6K00003338	10/16/2018	10/31/2019	12
AT	141840	Power sensor	ANRITSU	MA2411B	11737	10/16/2018	10/31/2019	12
AT	141171	Attenuator(20dB)_ DC-1GHz_N	Weinschel Corp	MODEL 1	BG0143	12/14/2017	12/31/2018	12
RE	141265	Logperiodic Antenna (200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-190	05/31/2018	05/31/2019	12
RE	141578	Pre Amplifier	AGILENT	8447D	2944A10845	09/19/2018	09/30/2019	12
RE	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	06/29/2018	06/30/2020	24
RE	141942	Test Receiver	Rohde & Schwarz	ESCI	100300	08/08/2018	08/31/2019	12
RE	141556	Thermo-Hygrometer	CUSTOM	CTH-201	0003	12/21/2017	12/31/2018	12
RE,CE	141152	EMI measurement program	TSJ	TEPTO-DV	-	-	-	-
RE	142228	Measure	KOMELON	KMC-36	-	-	-	-
RE	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	08/21/2018	08/31/2019	12
RE	141203	Attenuator(6dB)	Weinschel Corp	2	BK7970	11/05/2018	11/30/2019	12
RE	141427	Biconical Antenna	Schwarzbeck	VHA9103B	8031	05/31/2018	05/31/2019	12
RE	141317	Coaxial Cable	Fujikura/Agilent	-	-	02/23/2018	02/28/2019	12
RE	141297	High Pass Filter (1.1-10GHz)	TOKYO KEIKI	TF219CD1	1001	01/18/2018	01/31/2019	12
RE	141512	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	06/06/2018	06/30/2019	12
RE	141392	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 1608S087(5 m)	08/08/2018	08/31/2019	12
RE	141579	Pre Amplifier	AGILENT	8449B	3008A02142	01/23/2018	01/31/2019	12
RE	141884	Spectrum Analyzer	AGILENT	E4448A	MY44020357	11/02/2018	11/30/2019	12
RE	142006	AC2_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-06902	04/01/2018	04/30/2019	12
CE	141566	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	01/24/2018	01/31/2019	12
CE	141998	AC1_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	06/18/2018	06/30/2020	24
CE	142226	Measure	KOMELON	KMC-36	-	-	-	-
CE	141950	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	06/15/2018	06/30/2019	12
CE	141530	Digital Tester	Fluke Corporation	FLUKE 26-3	78030621	08/21/2018	08/31/2019	12
CE	141215	Coaxial Cable	Fujikura/Suhner/TSJ	5D-2W/3D-2W/RG400u/RFM-E421(SW)	-/01068 (Switcher)	06/04/2018	06/30/2019	12
CE	141247	Attenuator(13dB)	JFW Industries, Inc.	50FP-013H2 N	-	12/19/2017	12/31/2018	12
CE	141537	LISN(AMN)	Schwarzbeck	NSLK8127	8127-731	07/12/2018	07/31/2019	12

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

The expiration date of the calibration is the end of the expired month.
All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

Test item: CE: Conducted Emission test
RE: Radiated Emission test
AT: Antenna Terminal Conducted test