



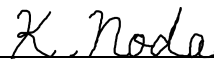
RADIO TEST REPORT

Test Report No. : 13295245S-A-R1

Applicant : Teraoka Seiko Co., Ltd.
Type of EUT : UHF RFID Reader
Model Number of EUT : CSH-17136
FCC ID : 2AF4P-CSH17136
Test regulation : FCC Part 15 Subpart C: 2020
Test Result : Complied (Refer to SECTION 3.2)

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
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6. This test report covers Radio technical requirements.
It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in SECTION 1.
10. This report is a revised version of 13295245S-A. 13295245S-A is replaced with this report.

Date of test: April 3 to 15, 2020

Representative test engineer: 
Kazuya Noda
Engineer
Consumer Technology Division

Approved by: 
Hikaru Shirasawa
Engineer
Consumer Technology Division



CERTIFICATE 1266.03

- ☐ 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.: 13295245S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13295245S-A	May 7, 2020	-	-
1	13295245S-A-R1	May 18, 2020	6	Correction of Specification in 3.2: 20dB Bandwidth: “FCC: Section15.247(a)(1) ISED: RSS-247 5.1 (a)” to “FCC: Section15.247(a)(1)(i) ISED: RSS-247 5.1 (c)” ----- Number of Hopping Frequency, Dwell time: “FCC: Section15.247(a)(1)(iii) ISED: RSS-247 5.1 (d)” to “FCC: Section15.247(a)(1)(i) ISED: RSS-247 5.1 (c)” ----- Maximum Peak Output Power: “FCC: Section15.247(a)(b)(1) ISED: RSS-247 5.4 (b)” to “FCC: Section15.247(a)(b)(2) ISED: RSS-247 5.4 (a)”
			14	Deletion of *4)
			18	Correction of 99% Occupied Bandwidth of Hopping On: “12.383” to “12383.3”
			23	Correction of Power setting: “24 fBm” to “24 dBm”

Reference: Abbreviations (Including words undescribed in this report)

A2LA	The American Association for Laboratory Accreditation	MCS	Modulation and Coding Scheme
AC	Alternating Current	MRA	Mutual Recognition Arrangement
AFH	Adaptive Frequency Hopping	N/A	Not Applicable
AM	Amplitude Modulation	NIST	National Institute of Standards and Technology
Amp, AMP	Amplifier	NS	No signal detect.
ANSI	American National Standards Institute	NSA	Normalized Site Attenuation
Ant, ANT	Antenna	NVLAP	National Voluntary Laboratory Accreditation Program
AP	Access Point	OBW	Occupied Band Width
ASK	Amplitude Shift Keying	OFDM	Orthogonal Frequency Division Multiplexing
Atten., ATT	Attenuator	P/M	Power meter
AV	Average	PCB	Printed Circuit Board
BPSK	Binary Phase-Shift Keying	PER	Packet Error Rate
BR	Bluetooth Basic Rate	PHY	Physical Layer
BT	Bluetooth	PK	Peak
BT LE	Bluetooth Low Energy	PN	Pseudo random Noise
BW	BandWidth	PRBS	Pseudo-Random Bit Sequence
Cal Int	Calibration Interval	PSD	Power Spectral Density
CCK	Complementary Code Keying	QAM	Quadrature Amplitude Modulation
Ch., CH	Channel	QP	Quasi-Peak
CISPR	Comite International Special des Perturbations Radioelectriques	QPSK	Quadri-Phase Shift Keying
CW	Continuous Wave	RBW	Resolution Band Width
DBPSK	Differential BPSK	RDS	Radio Data System
DC	Direct Current	RE	Radio Equipment
D-factor	Distance factor	RF	Radio Frequency
DFS	Dynamic Frequency Selection	RMS	Root Mean Square
DQPSK	Differential QPSK	RSS	Radio Standards Specifications
DSSS	Direct Sequence Spread Spectrum	Rx	Receiving
EDR	Enhanced Data Rate	SA, S/A	Spectrum Analyzer
EIRP, e.i.r.p.	Equivalent Isotropically Radiated Power	SG	Signal Generator
EMC	ElectroMagnetic Compatibility	SVSWR	Site-Voltage Standing Wave Ratio
EMI	ElectroMagnetic Interference	TR	Test Receiver
EN	European Norm	Tx	Transmitting
ERP, e.r.p.	Effective Radiated Power	VBW	Video BandWidth
EU	European Union	Vert.	Vertical
EUT	Equipment Under Test	WLAN	Wireless LAN
Fac.	Factor		
FCC	Federal Communications Commission		
FHSS	Frequency Hopping Spread Spectrum		
FM	Frequency Modulation		
Freq.	Frequency		
FSK	Frequency Shift Keying		
GFSK	Gaussian Frequency-Shift Keying		
GNSS	Global Navigation Satellite System		
GPS	Global Positioning System		
Hori.	Horizontal		
ICES	Interference-Causing Equipment Standard		
IEC	International Electrotechnical Commission		
IEEE	Institute of Electrical and Electronics Engineers		
IF	Intermediate Frequency		
ILAC	International Laboratory Accreditation Conference		
ISED	Innovation, Science and Economic Development Canada		
ISO	International Organization for Standardization		
JAB	Japan Accreditation Board		
LAN	Local Area Network		
LIMS	Laboratory Information Management System		

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SECTION 1: Customer information

Company Name	:	Teraoka Seiko Co., Ltd.
Address	:	13-12 Kugahara 5-chome Ohta-ku, Tokyo 146-8580 Japan
Telephone Number	:	+81-3-3752-5917
Facsimile Number	:	+81-3-3752-4109
Contact Person	:	Hideaki Haraguchi

The information provided from the customer is as follows;

- Applicant, Type of EUT, Model Number of EUT, FCC ID on the cover and other relevant pages
- Operating/Test Mode(s) (Mode(s)) on all the relevant pages
- SECTION 1: Customer information
- SECTION 2: Equipment under test (EUT)
- SECTION 4: Operation of EUT during testing

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

SECTION 2: Equipment under test (EUT)

2.1 Identification of EUT

Type of Equipment	:	UHF RFID Reader
Model No.	:	CSH-17136
Serial No.	:	Refer to SECTION 4.2
Rating	:	AC 100 V – 240 V, 50 Hz / 60 Hz
Receipt Date of Sample (Information from test lab.)	:	April 2, 2020
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: CSH-17136 (referred to as the EUT in this report) is a UHF RFID Reader.

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	915.125 MHz - 927.375 MHz
Modulation	:	PRASK
Antenna type	:	Patch
Antenna Gain	:	≤3 dBi
Clock frequency (Maximum)	:	32 MHz

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on April 1, 2020 and effective June 1, 2020 except 15.258

Title : FCC 47 CFR Part 15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz,
and 5725-5850 MHz

* The revision does not affect the test result conducted before its effective date.
Also the EUT complies with FCC Part 15 Subpart B.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods ----- ISED: RSS-Gen 8.8	FCC: Section 15.207 ----- ISED: RSS-Gen 8.8	7.2 dB 18.99069 MHz, L1, AV, Mode: 921.125 MHz, with Tag	Complied a)	-
Carrier Frequency Separation	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section15.247(a)(1) ----- ISED: RSS-247 5.1 (b)	See data.	Complied b)	Conducted
20dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section15.247(a)(1)(i) ----- ISED: RSS-247 5.1 (c)		Complied b)	Conducted
Number of Hopping Frequency	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section15.247(a)(1)(i) ----- ISED: RSS-247 5.1 (c)		Complied c)	Conducted
Dwell time	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section15.247(a)(1)(i) ----- ISED: RSS-247 5.1 (c)		Complied d)	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.12	FCC: Section15.247(a)(b)(2) ----- ISED: RSS-247 5.4 (a)		Complied e)	Conducted
Spurious Emission & Band Edge Compliance	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.13	FCC: Section15.247(d) ----- ISED: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	0.9 dB 7419.000 MHz, AV, Vertical Mode: Tx 927.375 MHz Output: 24 dBm, with Tag	Complied# f) / g)	Conducted/ Radiated (above 30 MHz) *1)

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.

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FCC Part 15.31 (e)

This EUT provides the stable voltage constantly to RF transmitter regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	ISED: RSS-Gen 6.7	ISED: -	N/A	- 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

There is no applicable rule of uncertainty in this applied standard. Therefore, the 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 $k=2$.

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Item	Frequency range	Uncertainty (+/-)			
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4,5,6,8 SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.6 dB	2.6 dB	2.5 dB	2.6 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.0 dB	3.0 dB	3.0 dB	-
	30 MHz-200 MHz	4.6 dB	4.6 dB	4.6 dB	-
	200 MHz-1 GHz	6.0 dB	6.0 dB	6.0 dB	-
	1 GHz-6 GHz	4.9 dB	4.9 dB	4.9 dB	-
	6 GHz-18 GHz	5.5 dB	5.5 dB	5.5 dB	-
	18 GHz-40 GHz	5.4 dB	5.4 dB	5.4 dB	-

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	0.98 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	1.75 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.89 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.12 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	1.06 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.24 dB
Spurious emission (Conducted) below 1GHz	0.9 dB
Spurious emission (Conducted) 1 GHz-3 GHz	0.9 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.9 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.6 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.0 dB
Bandwidth Measurement	0.07 %
Duty cycle and Time Measurement	0.262 %
Temperature	0.95 deg.C.
Voltage	0.83 %

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3.5 Test Location

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A2LA Certificate Number: 1266.03 (FCC Test Firm Registration Number: 626366, ISED Lab Company Number: 2973D)

Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber	8.1 x 5.1 x 3.55	8.1 x 5.1	-
No.1 Shielded room	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.2 Shielded room	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.3 Shielded room	6.3 x 4.7 x 2.7	6.3 x 4.7	-
No.4 Shielded room	4.4 x 4.7 x 2.7	4.4 x 4.7	-
No.5 Shielded room	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.6 Shielded room	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.8 shielded room	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	2.55 x 4.1 x 2.5	-	-

3.6 Test data, Test instruments, and Test set up

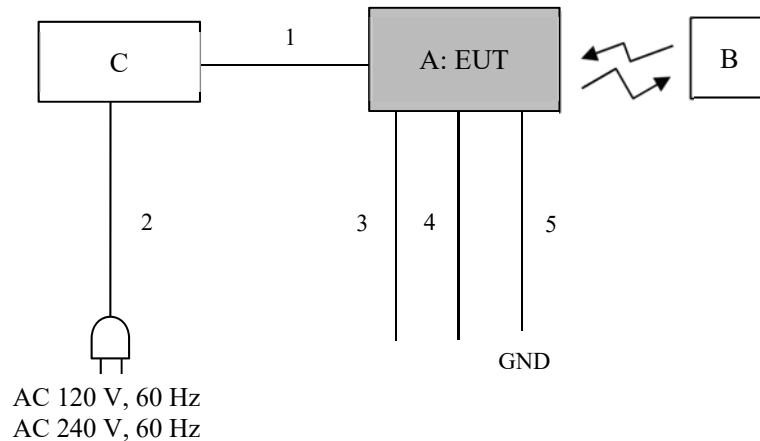
Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

Test Item	Mode	Tested frequency
Conducted Emission, Spurious Emission (Conducted/Radiated) Carrier Frequency Separation Maximum Peak Output Power	Tx (Hopping Off)	915.125 MHz, 921.125 MHz, 927.375 MHz
20dB Bandwidth 99% Occupied Bandwidth	Tx (Hopping On) Tx (Hopping Off)	915.125 MHz, 921.125 MHz, 927.375 MHz
Carrier Frequency Separation	Tx (Hopping On)	915.125 MHz, 921.125 MHz, 927.375 MHz
Number of Hopping Frequency Dwell time	Tx (Hopping On)	-
Band Edge Compliance (Conducted)	Tx (Hopping On) Tx (Hopping Off)	915.125 MHz, 927.375 MHz
*Power of the EUT was set by the software as follows; Power settings: 24 dBm / 0 dBm Software: LAN&COM Test Ver.1.70 (Date: 2019.11.13, Storage location: Driven by connected PC) The carrier level and noise levels were confirmed with and without Tag, and the test was made with the condition that has the maximum noise. *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.		

4.2 Configuration and peripherals



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.
As a result of comparing AC 120 V and AC 240 V at pre-check, conducted emission test was performed with AC 240 V of the worst voltage as representative.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	UHF RFID Reader	CSH-17136	WTU1901485	Teraoka Seiko Co., Ltd.	EUT
B	IC tag	UHFTAG-CSH	CS202004-01	Teraoka Seiko Co., Ltd.	-
C	AC Adapter	UI318-0530	J05-0351970	Welcat Inc.	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC	1.8	Unshielded	Unshielded	-
2	AC	2.0	Unshielded	Unshielded	-
3	LAN	1.0	Unshielded	Unshielded	-
4	Signal	1.2	Unshielded	Unshielded	-
5	FG	2.0	Unshielded	Unshielded	-

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity. 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.

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.

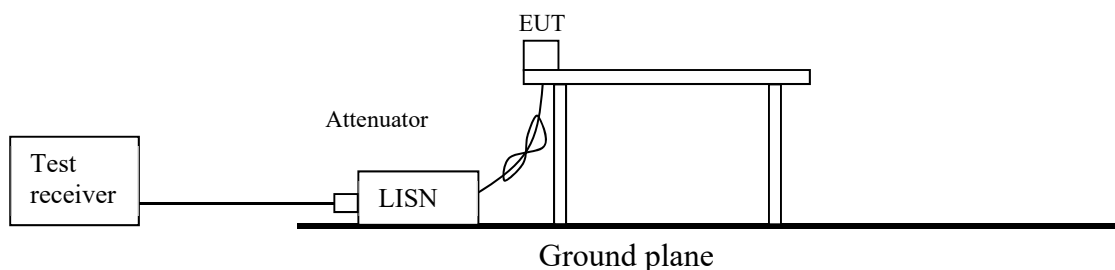
The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT via AC adapter in a shielded room. The EUT was connected to a LISN (AMN).

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 platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The table is made of expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity. 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 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 m and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

Test antenna was aimed at the EUT for receiving the maximum signal and always kept within the illumination area of the 3 dB beamwidth of the antenna.

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.

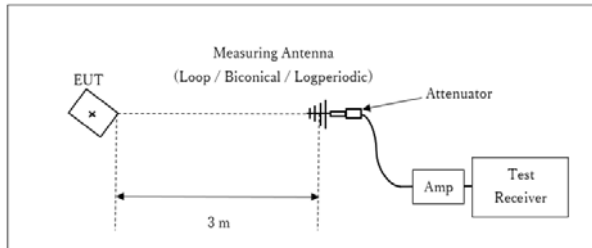
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

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	RBW: 1 MHz VBW: 1/T (10 Hz) (T: burst length, refer to Burst rate confirmation sheet) Detector: Peak	RBW: 100 kHz VBW: 300 kHz

*1) Average Power Measurement was performed based on KDB 558074 D01 15.247 Meas Guidance v05r02.

Figure 2: Test Setup

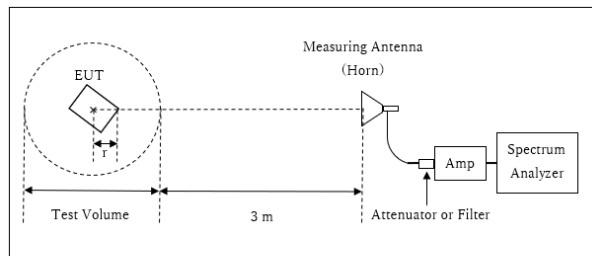
Below 1 GHz



x : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz



r : Radius of an outer periphery of EUT

x : Center of turn table

Distance Factor: $20 \times \log (3.93 \text{ m} / 3.0 \text{ m}) = 2.35 \text{ dB}$

* Test Distance: $(3 + \text{Test Volume} / 2) - r = 3.93 \text{ m}$

Test Volume : 2.0 m

(Test Volume has been calibrated based on CISPR 16-1-4.)

$r = 0.07\text{m}$

The test was made on EUT at the normal use position.

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	300 kHz	1 kHz	3 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: 160 MHz BW)
Carrier Frequency Separation	800 kHz	30 kHz	91 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Number of Hopping Frequency	914.5 MHz to 921.3 MHz	30 kHz	91 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
	921.3 MHz to 928 MHz						
Dwell Time	Zero Span	100 kHz	300 kHz	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	10 kHz	30 kHz				
	30 MHz to 10 GHz	100 kHz	300 kHz				
Conducted Spurious Emission Band Edge compliance	900 MHz to 920 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
	925 MHz to 932 MHz						
*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.							

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

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APPENDIX 1: Test data

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
Date : 2020/04/07

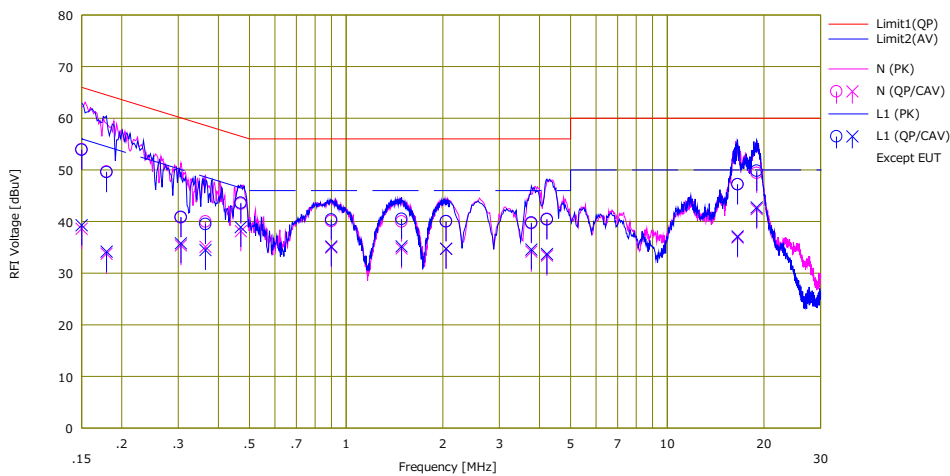
Mode : Transmitting 921.125 MHz

Power : AC 240 V / 60 Hz
Temp./Humi. : 24 deg.C / 34 %RH

Remarks : with Tag

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Takahiro Kawakami



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		[QP] [dBuV]	[CAV] [dBuV]		[QP] [dBuV]	[CAV] [dBuV]	[QP] [dBuV]	[AV] [dBuV]	[QP] [dB]	[AV] [dB]		
1	0.15000	41.50	26.10	12.49	53.99	38.59	66.00	56.00	12.0	17.4	N	
2	0.17938	37.20	21.30	12.46	49.66	33.76	64.51	54.51	14.8	20.7	N	
3	0.30561	28.30	22.90	12.48	40.78	35.38	60.09	50.09	19.3	14.7	N	
4	0.36469	27.50	22.60	12.49	39.99	35.09	58.62	48.62	18.6	13.5	N	
5	0.47010	30.90	25.60	12.52	43.42	38.12	56.51	46.51	13.0	8.3	N	
6	0.89895	27.50	22.40	12.57	40.07	34.97	56.00	46.00	15.9	11.0	N	
7	1.48797	27.40	22.20	12.59	39.99	34.79	56.00	46.00	16.0	11.2	N	
8	2.04729	27.40	22.10	12.62	40.02	34.72	56.00	46.00	15.9	11.2	N	
9	3.77354	26.90	21.40	12.76	39.66	34.16	56.00	46.00	16.3	11.8	N	
10	4.22032	27.70	20.60	12.79	40.49	33.39	56.00	46.00	15.5	12.6	N	
11	16.55429	33.80	23.50	13.40	47.20	36.90	60.00	50.00	12.8	13.1	N	
12	18.98963	35.90	28.90	13.51	49.41	42.41	60.00	50.00	10.5	7.5	N	
13	0.15000	41.40	26.80	12.49	53.89	39.29	66.00	56.00	12.1	16.7	L1	
14	0.17947	37.10	21.70	12.46	49.56	34.16	64.51	54.51	14.9	20.3	L1	
15	0.30566	28.40	23.30	12.48	40.88	35.78	60.09	50.09	19.2	14.3	L1	
16	0.36468	27.00	22.00	12.49	39.49	34.49	58.62	48.62	19.1	14.1	L1	
17	0.46951	31.10	26.40	12.52	43.62	38.92	56.52	46.52	12.9	7.6	L1	
18	0.89869	27.80	22.60	12.57	40.37	35.17	56.00	46.00	15.6	10.8	L1	
19	1.48785	27.90	22.60	12.59	40.49	35.19	56.00	46.00	15.5	10.8	L1	
20	2.04709	27.40	22.10	12.62	40.02	34.72	56.00	46.00	15.9	11.2	L1	
21	3.77422	27.00	21.80	12.76	39.76	34.56	56.00	46.00	16.2	11.4	L1	
22	4.21988	27.60	20.90	12.79	40.39	33.69	56.00	46.00	15.6	12.3	L1	
23	16.55411	33.80	23.70	13.40	47.20	37.10	60.00	50.00	12.8	12.9	L1	
24	18.99069	36.30	29.20	13.51	49.81	42.71	60.00	50.00	10.1	7.2	L1	

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN): SLS-03

UL Japan, Inc.

Shonan EMC Lab.

1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Conducted Emission

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
Date : 2020/04/07

Mode : Transmitting 915.125 MHz

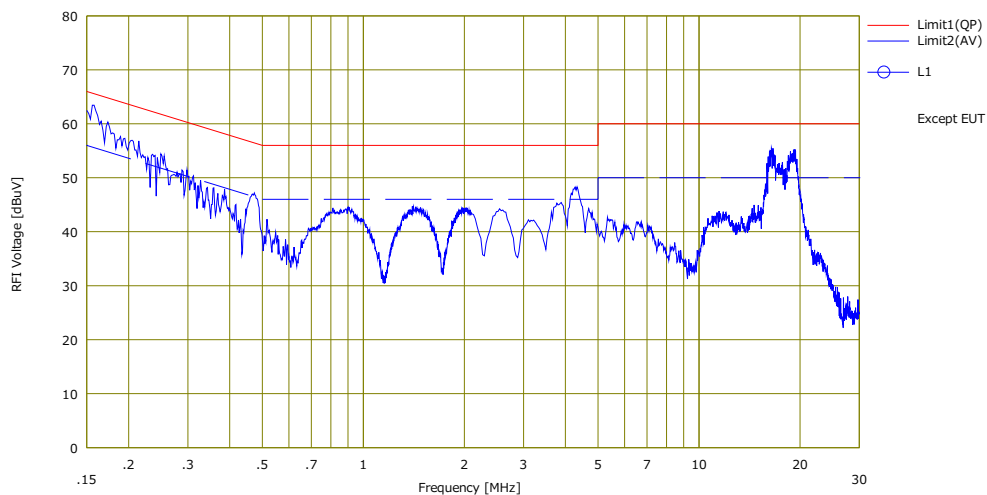
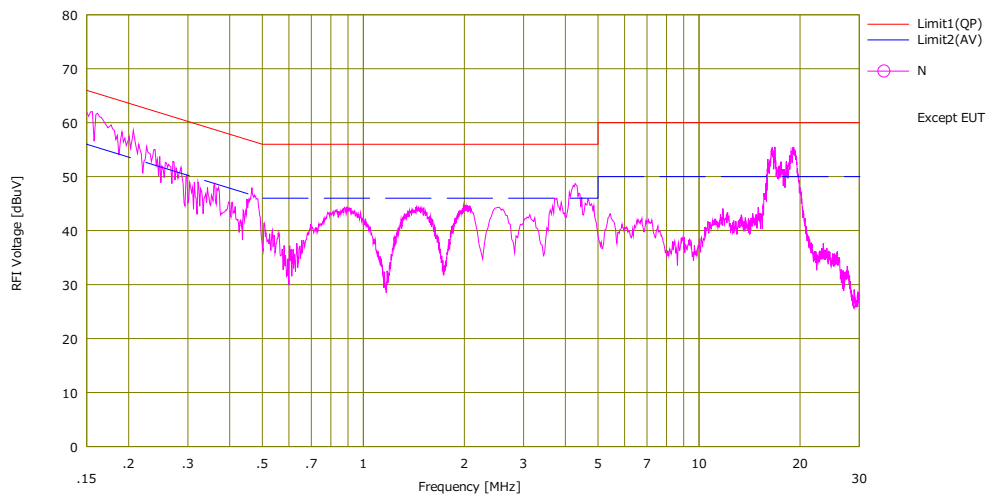
Power : AC 240 V / 60 Hz

Temp./Humi. : 24 deg.C / 34 %RH

Remarks : with Tag

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Takahiro Kawakami



Calculation: Result[dBuV] = Reading[dBuV] + C.Fac(LISN(AMN) + Cable + ATT)[dB]
LISN(AMN): SLS-03

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Conducted Emission

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.5 Shielded Room
Date : 2020/04/07

Mode : Transmitting 927.375 MHz

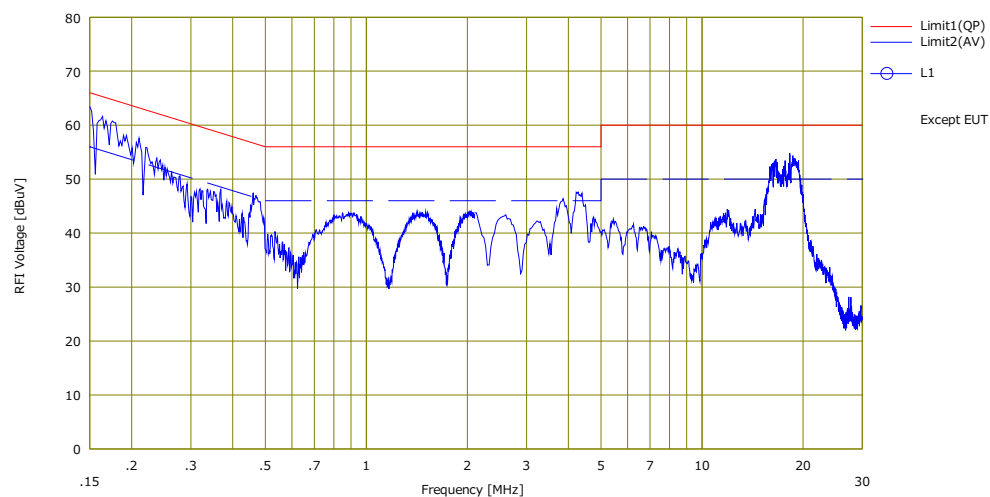
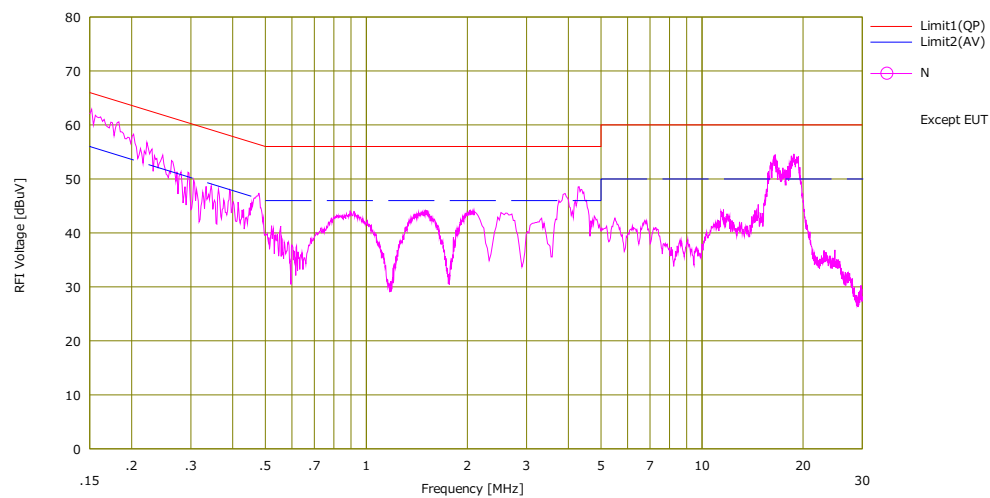
Power : AC 240 V / 60 Hz

Temp./Humi. : 24 deg.C / 34 %RH

Remarks : with Tag

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Takahiro Kawakami



Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN):SLS-03

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

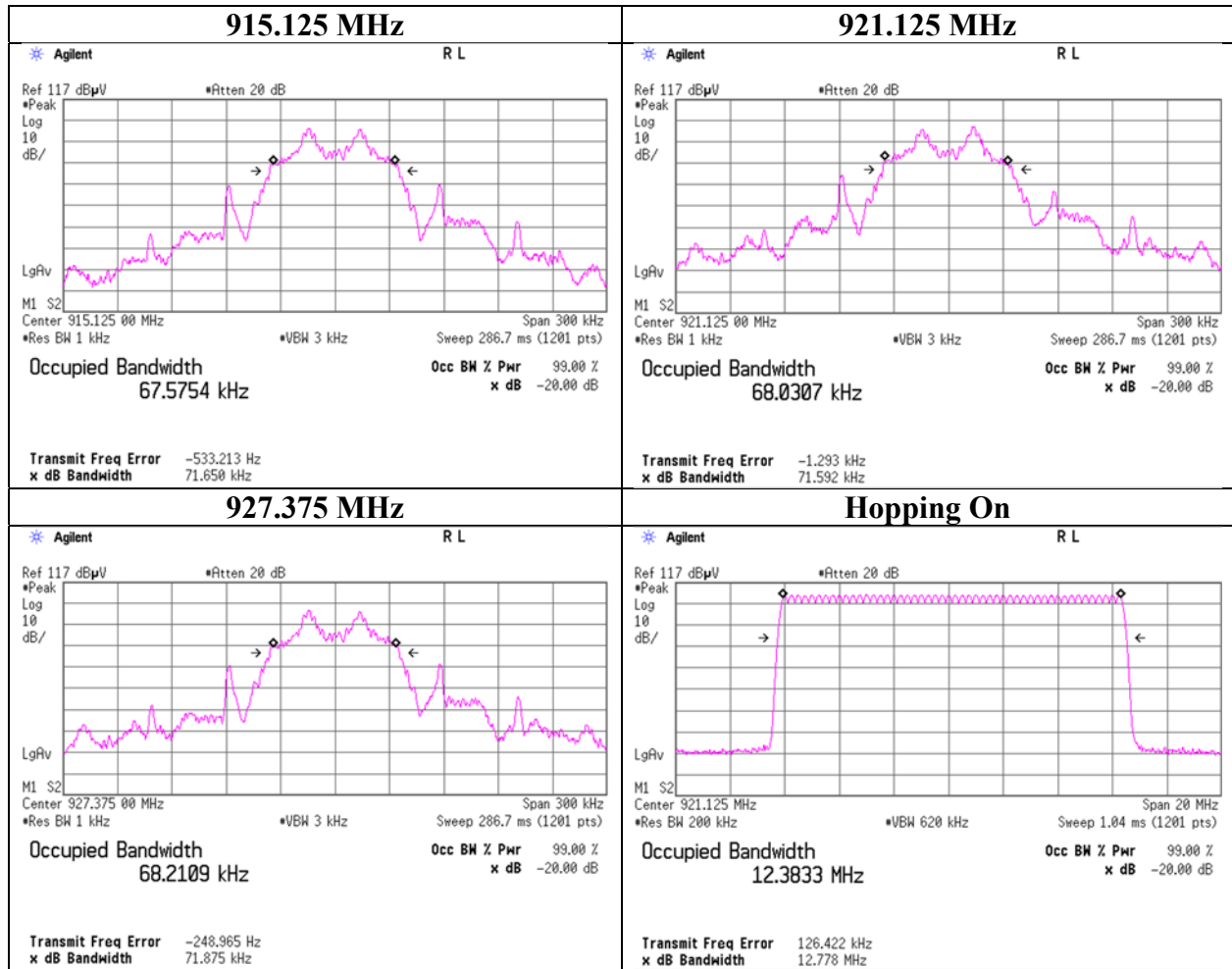
Report No. 13295245S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date April 3, 2020
Temperature / Humidity 26 deg. C / 47 % RH
Engineer Kazuya Noda
Mode Tx, Hopping Off, Tx, Hopping On

Freq. [MHz]	20dB Bandwidth [MHz]	99% Occupied Bandwidth [kHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
915.125	0.071650	67.5754	0.250	≥ 0.071650
921.125	0.071592	68.0307	0.250	≥ 0.071592
927.375	0.071875	68.2109	0.250	≥ 0.071875
Hopping On	12.778	12383.3	-	-

Limit: 20dB Bandwidth or 25kHz (whichever is greater).

20 dB Bandwidth limit is 250 kHz or less than. (for 902 MHz to 928 MHz)

20dB Bandwidth and 99% Occupied Bandwidth



UL Japan, Inc.

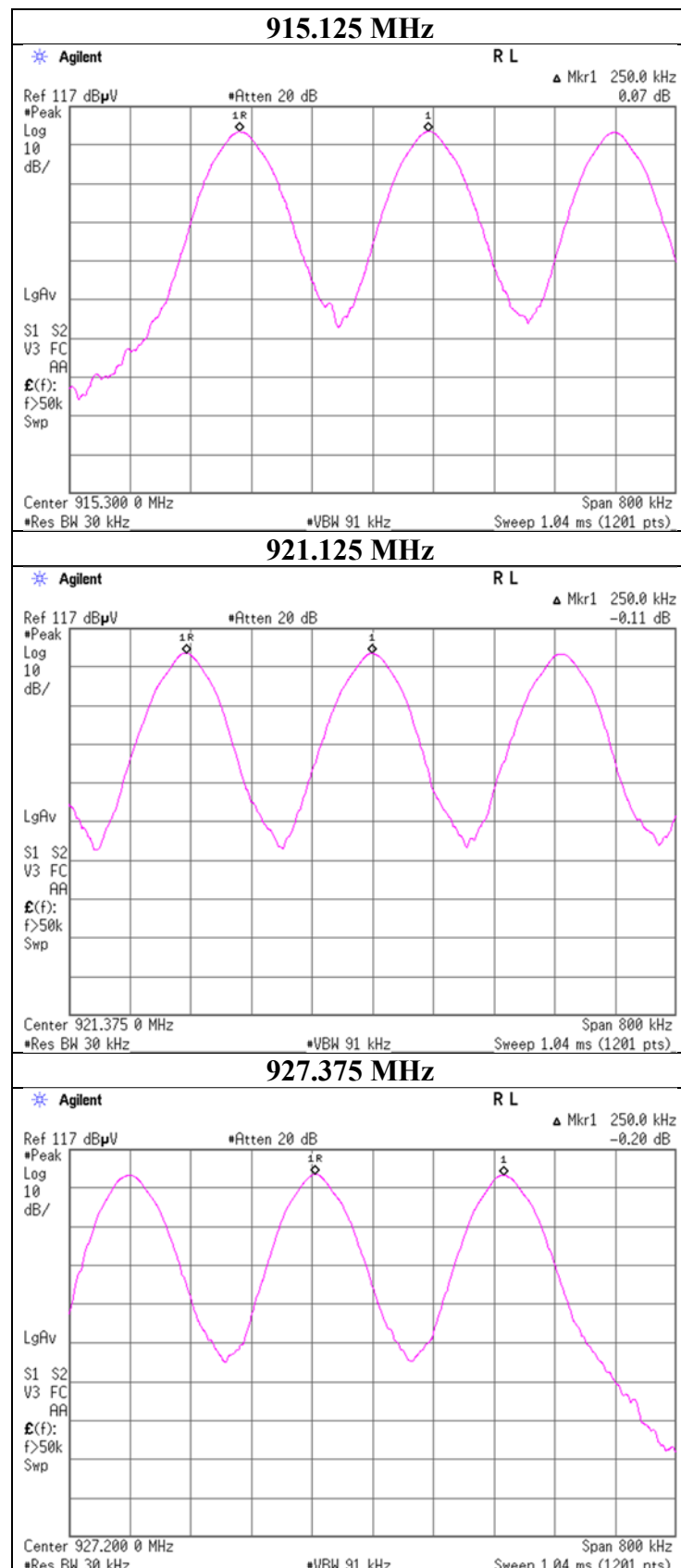
Shonan EMC Lab.

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Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

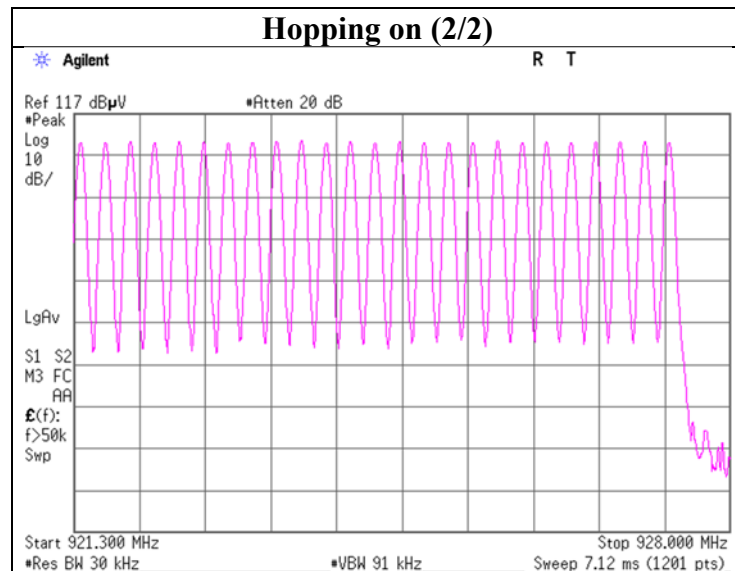
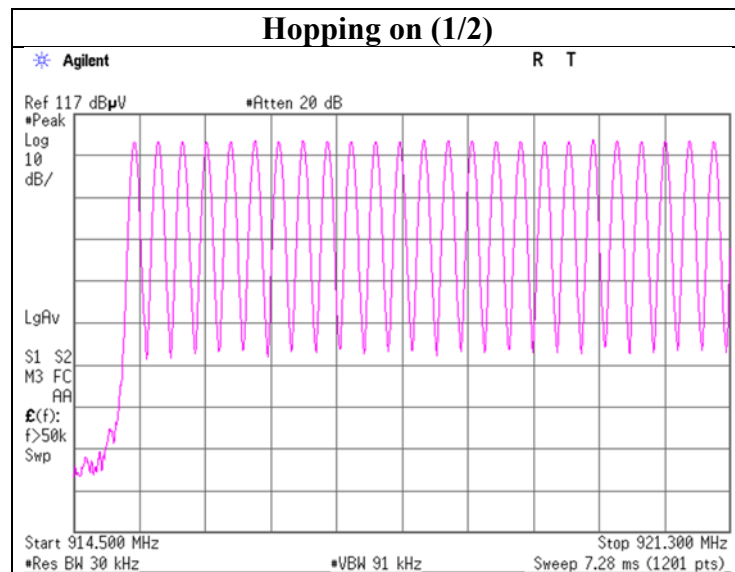
Carrier Frequency Separation



Number of Hopping Frequency

Report No.	13295245S-A-R1
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	April 3, 2020
Temperature / Humidity	26 deg. C / 47 % RH
Engineer	Kazuya Noda
Mode	Tx, Hopping On

Number of channel [channels]	Limit [channels]
50	≥ 50



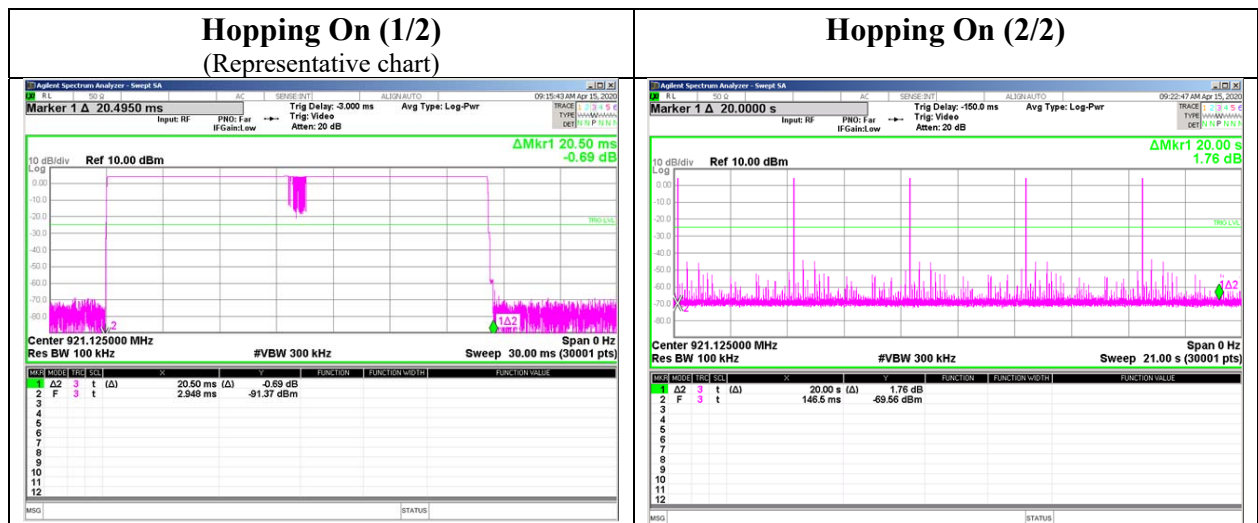
Dwell time

Report No. 13295245S-A-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date April 15, 2020
Temperature / Humidity 23 deg. C / 33 % RH
Engineer Kazuya Noda
Mode Tx, Hopping On

Number of transmission in a 20 second period	Length of transmission [msec]	Result [msec]	Limit [msec]
5.0 times / 20 sec. x 20.0 sec. = 5 times	20.500	103	400

Sample Calculation

Result = Number of transmission x Length of transmission



Maximum Peak Output Power

Report No. 13295245S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date April 3, 2020
Temperature / Humidity 26 deg. C / 47 % RH
Engineer Kazuya Noda
Mode Tx, Hopping Off

Power setting	Freq.	Reading	Cable Loss	Atten. Loss	Conducted Power					e.i.r.p. for RSS-247					
					Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
					[dBm]	[mW]	[dBm]	[mW]			[dB]	[dBi]	[dBm]	[mW]	
24 dBm	915.125	3.80	0.65	19.86	24.31	269.77	30.00	1000	5.69	3.00	27.31	538.27	36.02	4000	8.71
	921.125	3.92	0.65	19.86	24.43	277.33	30.00	1000	5.57	3.00	27.43	553.35	36.02	4000	8.59
	927.375	3.81	0.66	19.86	24.33	271.02	30.00	1000	5.67	3.00	27.33	540.75	36.02	4000	8.69
0 dBm	915.125	-8.33	0.65	9.87	2.19	1.66	30.00	1000	27.81	3.00	5.19	3.30	36.02	4000	30.83
	921.125	-8.11	0.65	9.87	2.41	1.74	30.00	1000	27.59	3.00	5.41	3.48	36.02	4000	30.61
	927.375	-6.56	0.66	9.87	3.97	2.49	30.00	1000	26.03	3.00	6.97	4.98	36.02	4000	29.05

Sample Calculation:

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

e.i.r.p. Result = Conducted Power Result + Antenna Gain

Average Output Power (Reference data for RF Exposure)

Report No. 13295245S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date April 3, 2020
Temperature / Humidity 26 deg. C / 47 % RH
Engineer Kazuya Noda
Mode Tx, Hopping Off

Power setting	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
					[dBm]	[mW]		[dBm]	[mW]
24 dBm	915.125	1.76	0.65	19.86	22.27	168.66	0.00	22.27	168.66
	921.125	1.85	0.65	19.86	22.36	172.19	0.00	22.36	172.19
	927.375	1.78	0.66	19.86	22.30	169.82	0.00	22.30	169.82
0 dBm	915.125	-10.87	0.65	9.87	-0.35	0.92	0.00	-0.35	0.92
	921.125	-10.61	0.65	9.87	-0.09	0.98	0.00	-0.09	0.98
	927.375	-11.04	0.66	9.87	-0.51	0.89	0.00	-0.51	0.89

Sample Calculation:

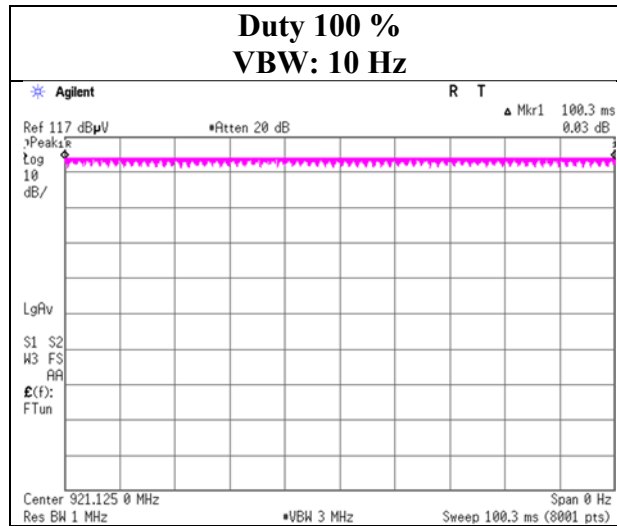
Result (Time average) = Reading + Cable Loss + Attenuator Loss

Result (Burst power average) = Time average + Duty factor

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

Burst Rate Confirmation

Report No. 13295245S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date April 3, 2020
Temperature / Humidity 26 deg. C / 47 % RH
Engineer Kazuya Noda
Mode Tx, Hopping Off



UL Japan, Inc.

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Radiated Spurious Emission

Report No. 13295245S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.2
Date April 3, 2020 April 4, 2020
Temperature / Humidity 21 deg. C / 41 % RH 22 deg. C / 46 % RH
Engineer Makoto Hosaka Toshinori Yamada
(30 MHz -1 GHz) (1 GHz -10 GHz)
Mode Transmitting 915.125 MHz, Output: 24 dBm, with Tag

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	199.997	QP	35.90	16.75	18.88	31.76	0.00	39.77	43.5	3.7	160	42	
Hori.	375.000	QP	38.90	14.95	17.23	31.63	0.00	39.45	46.0	6.5	100	96	
Hori.	383.999	QP	34.40	15.08	17.28	31.63	0.00	35.13	46.0	10.8	100	319	
Hori.	625.005	QP	33.90	19.25	18.47	31.61	0.00	40.01	46.0	5.9	100	162	
Hori.	875.011	QP	32.60	21.59	19.59	30.97	0.00	42.81	46.0	3.1	100	112	
Hori.	1830.430	PK	55.53	25.81	4.36	38.95	2.35	49.10	73.9	24.8	317	89	
Hori.	2745.645	PK	49.39	28.45	4.87	38.52	2.35	46.54	73.9	27.3	173	271	
Hori.	3660.860	PK	54.37	29.63	5.55	38.16	2.35	53.74	73.9	20.1	220	112	
Hori.	4576.075	PK	50.47	31.21	6.17	38.54	2.35	51.66	73.9	22.2	191	188	
Hori.	5491.290	PK	46.73	32.27	6.86	38.82	2.35	49.39	73.9	24.5	166	22	
Hori.	7321.720	PK	50.12	37.42	7.86	39.33	2.35	58.42	73.9	15.4	193	220	
Hori.	9152.150	PK	47.55	38.40	9.00	39.81	2.35	57.49	73.9	16.4	196	113	
Hori.	1830.430	AV	49.81	25.81	4.36	38.95	2.35	43.38	53.9	10.5	317	89	
Hori.	2745.645	AV	41.41	28.45	4.87	38.52	2.35	38.56	53.9	15.3	173	271	
Hori.	3660.860	AV	50.20	29.63	5.55	38.16	2.35	49.57	53.9	4.3	220	112	
Hori.	4576.075	AV	42.40	31.21	6.17	38.54	2.35	43.59	53.9	10.3	191	188	
Hori.	5491.290	AV	38.13	32.27	6.86	38.82	2.35	40.79	53.9	13.1	166	22	
Hori.	7321.720	AV	42.24	37.42	7.86	39.33	2.35	50.54	53.9	3.3	193	220	
Hori.	9152.150	AV	35.26	38.40	9.00	39.81	2.35	45.20	53.9	8.7	196	113	
Vert.	47.661	QP	36.50	11.93	17.05	31.89	0.00	33.59	40.0	6.4	100	167	
Vert.	106.655	QP	34.20	11.18	17.83	31.85	0.00	31.36	43.5	12.1	100	112	
Vert.	199.997	QP	35.50	16.75	18.88	31.76	0.00	39.37	43.5	4.1	100	123	
Vert.	625.000	QP	36.20	19.25	18.47	31.61	0.00	42.31	46.0	3.6	100	174	
Vert.	875.011	QP	31.10	21.59	19.59	30.97	0.00	41.31	46.0	4.6	100	298	
Vert.	1700.023	PK	50.32	25.43	4.38	38.96	2.35	43.52	73.9	30.3	255	96	
Vert.	1830.430	PK	55.29	25.81	4.36	38.95	2.35	48.86	73.9	25.0	400	177	
Vert.	2745.645	PK	47.33	28.45	4.87	38.52	2.35	44.48	73.9	29.4	141	342	
Vert.	3660.860	PK	52.45	29.63	5.55	38.16	2.35	51.82	73.9	22.0	169	215	
Vert.	4576.075	PK	49.37	31.21	6.17	38.54	2.35	50.56	73.9	23.3	168	112	
Vert.	5491.290	PK	47.43	32.27	6.86	38.82	2.35	50.09	73.9	23.8	180	68	
Vert.	6406.505	PK	45.52	34.44	7.49	39.01	2.35	50.79	73.9	23.1	150	215	
Vert.	7321.720	PK	50.84	37.42	7.86	39.33	2.35	59.14	73.9	14.7	131	315	
Vert.	8236.935	PK	48.25	37.47	8.27	39.48	2.35	56.86	73.9	17.0	173	205	
Vert.	9152.150	PK	47.16	38.40	9.00	39.81	2.35	57.10	73.9	16.8	148	205	
Vert.	1700.023	AV	44.89	25.43	4.38	38.96	2.35	38.09	53.9	15.8	255	96	
Vert.	1830.430	AV	49.70	25.81	4.36	38.95	2.35	43.27	53.9	10.6	400	177	
Vert.	2745.645	AV	36.81	28.45	4.87	38.52	2.35	33.96	53.9	19.9	141	342	
Vert.	3660.860	AV	47.31	29.63	5.55	38.16	2.35	46.68	53.9	7.2	169	215	
Vert.	4576.075	AV	40.51	31.21	6.17	38.54	2.35	41.70	53.9	12.2	168	112	
Vert.	5491.290	AV	39.08	32.27	6.86	38.82	2.35	41.74	53.9	12.1	180	68	
Vert.	6406.505	AV	33.99	34.44	7.49	39.01	2.35	39.26	53.9	14.6	150	215	
Vert.	7321.720	AV	42.53	37.42	7.86	39.33	2.35	50.83	53.9	3.0	131	315	
Vert.	8236.935	AV	37.29	37.47	8.27	39.48	2.35	45.90	53.9	8.0	173	205	
Vert.	9152.150	AV	36.67	38.40	9.00	39.81	2.35	46.61	53.9	7.2	148	205	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB

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

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	915.125	PK	103.46	21.61	19.76	30.76	0.00	114.07	-	-	Carrier
Hori.	902.000	PK	30.89	21.50	19.71	30.85	0.00	41.25	94.07	52.8	
Vert.	915.125	PK	105.81	21.61	19.76	30.76	0.00	116.42	-	-	Carrier
Vert.	902.000	PK	30.31	21.50	19.71	30.85	0.00	40.67	96.42	55.7	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log (3.93 m / 3.0 m) = 2.35 dB

UL Japan, Inc.

Shonan EMC Lab.

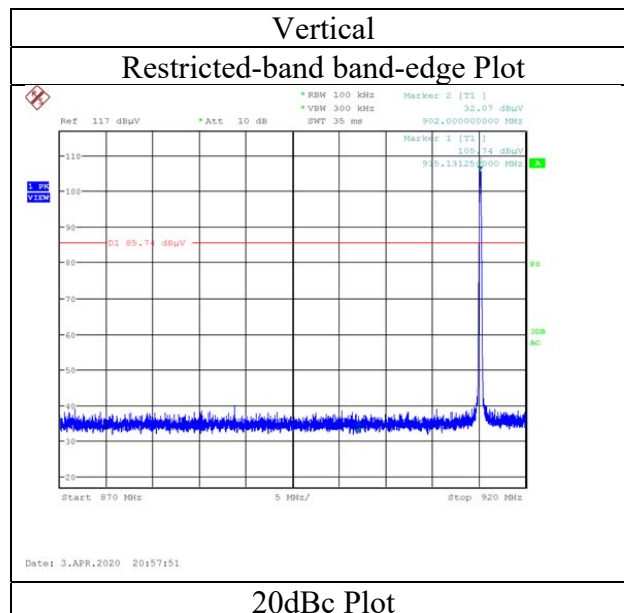
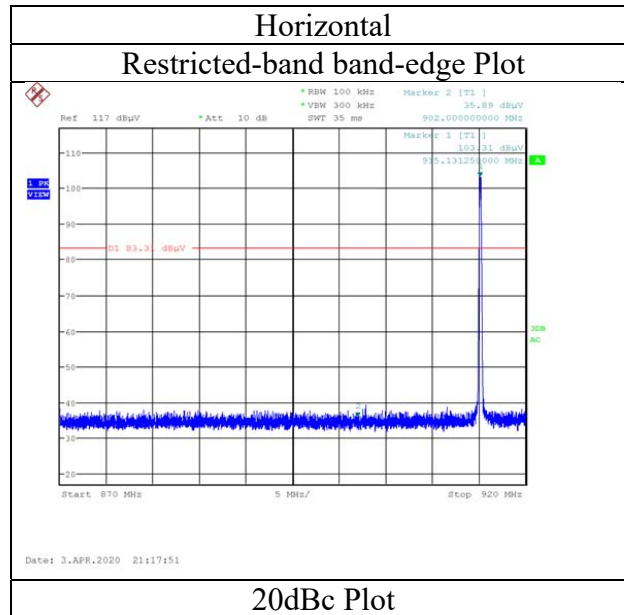
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission **(Reference Plot for band-edge)**

Report No.	13295245S-A-R1	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.2	No.2
Date	April 3, 2020	April 4, 2020
Temperature / Humidity	21 deg. C / 41 % RH	22 deg. C / 46 % RH
Engineer	Makoto Hosaka	Toshinori Yamada
	(30 MHz -1 GHz)	(1 GHz -10 GHz)
Mode	Transmitting 915.125 MHz, Output: 24 dBm, with Tag	



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No. 13295245S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.2 No.2
Date April 3, 2020 April 4, 2020
Temperature / Humidity 21 deg. C / 41 % RH 22 deg. C / 46 % RH
Engineer Makoto Hosaka Toshinori Yamada
(30 MHz -1 GHz) (1 GHz -10 GHz)
Mode Transmitting 921.125 MHz, Output: 24 dBm, with Tag

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	199.996	QP	35.90	16.75	18.88	31.76	0.00	39.77	43.5	3.7	158	48	
Hori.	375.004	QP	38.80	14.95	17.23	31.63	0.00	39.35	46.0	6.6	100	111	
Hori.	384.005	QP	34.40	15.08	17.28	31.63	0.00	35.13	46.0	10.8	100	306	
Hori.	625.002	QP	34.30	19.25	18.47	31.61	0.00	40.41	46.0	5.5	164	171	
Hori.	750.004	QP	32.80	19.85	19.03	31.43	0.00	40.25	46.0	5.7	137	295	
Hori.	875.006	QP	30.90	21.59	19.59	30.97	0.00	41.11	46.0	4.8	309	109	
Hori.	1842.250	PK	51.42	25.87	4.36	38.95	2.35	45.05	73.9	28.8	333	267	
Hori.	2763.375	PK	49.93	28.51	4.87	38.51	2.35	47.15	73.9	26.7	384	335	
Hori.	3684.500	PK	54.18	29.69	5.56	38.16	2.35	53.62	73.9	20.2	395	331	
Hori.	4605.625	PK	50.67	31.32	6.18	38.54	2.35	51.98	73.9	21.9	147	119	
Hori.	5526.750	PK	49.03	32.29	6.87	38.83	2.35	51.71	73.9	22.1	327	16	
Hori.	7369.000	PK	48.64	37.48	7.87	39.40	2.35	56.94	73.9	16.9	152	215	
Hori.	9211.250	PK	47.24	38.56	9.02	39.81	2.35	57.36	73.9	16.5	146	128	
Hori.	1842.250	AV	44.23	25.87	4.36	38.95	2.35	37.86	53.9	16.0	333	267	
Hori.	2763.375	AV	41.66	28.51	4.87	38.51	2.35	38.88	53.9	15.0	384	335	
Hori.	3684.500	AV	50.21	29.69	5.56	38.16	2.35	49.65	53.9	4.2	395	331	
Hori.	4605.625	AV	41.93	31.32	6.18	38.54	2.35	43.24	53.9	10.6	147	119	
Hori.	5526.750	AV	39.87	32.29	6.87	38.83	2.35	42.55	53.9	11.3	327	16	
Hori.	7369.000	AV	40.21	37.48	7.87	39.40	2.35	48.51	53.9	5.3	152	215	
Hori.	9211.250	AV	35.00	38.56	9.02	39.81	2.35	45.12	53.9	8.7	146	128	
Vert.	47.107	QP	38.10	12.15	17.05	31.89	0.00	35.41	40.0	4.5	100	165	
Vert.	108.242	QP	35.10	11.46	17.83	31.85	0.00	32.54	43.5	10.9	100	354	
Vert.	199.996	QP	34.90	16.75	18.88	31.76	0.00	38.77	43.5	4.7	100	112	
Vert.	375.007	QP	38.10	14.95	17.23	31.63	0.00	38.65	46.0	7.3	159	257	
Vert.	384.003	QP	34.20	15.08	17.28	31.63	0.00	34.93	46.0	11.0	160	263	
Vert.	625.000	QP	34.80	19.25	18.47	31.61	0.00	40.91	46.0	5.0	100	228	
Vert.	875.007	QP	30.40	21.59	19.59	30.97	0.00	40.61	46.0	5.3	100	299	
Vert.	1700.021	PK	49.83	25.43	4.38	38.96	2.35	43.03	73.9	30.8	256	99	
Vert.	1842.250	PK	49.60	25.87	4.36	38.95	2.35	43.23	73.9	30.6	251	184	
Vert.	2763.375	PK	47.27	28.51	4.87	38.51	2.35	44.49	73.9	29.4	187	138	
Vert.	3684.500	PK	54.00	29.69	5.56	38.16	2.35	53.44	73.9	20.4	384	359	
Vert.	4605.625	PK	50.61	31.32	6.18	38.54	2.35	51.92	73.9	21.9	202	109	
Vert.	5526.750	PK	47.19	32.29	6.87	38.83	2.35	49.87	73.9	24.0	151	169	
Vert.	6447.875	PK	45.29	34.61	7.53	39.00	2.35	50.78	73.9	23.1	100	359	
Vert.	7369.000	PK	49.82	37.48	7.87	39.40	2.35	58.12	73.9	15.7	104	49	
Vert.	8290.125	PK	47.04	37.31	8.32	39.51	2.35	55.51	73.9	18.3	133	56	
Vert.	9211.250	PK	46.86	38.56	9.02	39.81	2.35	56.98	73.9	16.9	158	226	
Vert.	1700.021	AV	44.97	25.43	4.38	38.96	2.35	38.17	53.9	15.7	256	99	
Vert.	1842.250	AV	42.32	25.87	4.36	38.95	2.35	35.95	53.9	17.9	251	184	
Vert.	2763.375	AV	35.77	28.51	4.87	38.51	2.35	32.99	53.9	20.9	187	138	
Vert.	3684.500	AV	49.51	29.69	5.56	38.16	2.35	48.95	53.9	4.9	384	359	
Vert.	4605.625	AV	41.33	31.32	6.18	38.54	2.35	42.64	53.9	11.2	202	109	
Vert.	5526.750	AV	38.80	32.29	6.87	38.83	2.35	41.48	53.9	12.4	151	169	
Vert.	6447.875	AV	33.66	34.61	7.53	39.00	2.35	39.15	53.9	14.7	100	359	
Vert.	7369.000	AV	42.50	37.48	7.87	39.40	2.35	50.80	53.9	3.1	104	49	
Vert.	8290.125	AV	35.12	37.31	8.32	39.51	2.35	43.59	53.9	10.3	133	56	
Vert.	9211.250	AV	35.64	38.56	9.02	39.81	2.35	45.76	53.9	8.1	158	226	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)) - Gain(Amplifier) + Distance factor
Distance factor : 1 GHz - 10 GHz : $20\log(3.93\text{ m} / 3.0\text{ m}) = 2.35\text{ dB}$

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

UL Japan, Inc.

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Radiated Spurious Emission

Report No. 13295245S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.2
Date April 3, 2020 April 4, 2020
Temperature / Humidity 21 deg. C / 41 % RH 22 deg. C / 46 % RH
Engineer Makoto Hosaka Toshinori Yamada
(30 MHz -1 GHz) (1 GHz -10 GHz)
Mode Transmitting 927.375 MHz, Output: 24 dBm, with Tag

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	199.999	QP	35.90	16.75	18.88	31.76	0.00	39.77	43.5	3.7	170	225	
Hori.	375.000	QP	32.00	14.95	17.23	31.63	0.00	32.55	46.0	13.4	100	116	
Hori.	384.000	QP	30.60	15.08	17.28	31.63	0.00	31.33	46.0	14.6	100	132	
Hori.	625.003	QP	34.10	19.25	18.47	31.61	0.00	40.21	46.0	5.7	100	112	
Hori.	750.010	QP	33.70	19.85	19.03	31.43	0.00	41.15	46.0	4.8	197	74	
Hori.	875.011	QP	33.70	21.59	19.59	30.97	0.00	43.91	46.0	2.0	172	314	
Hori.	1854.750	PK	51.49	25.89	4.35	38.94	2.35	45.14	73.9	28.7	327	86	
Hori.	2782.125	PK	47.50	28.58	4.88	38.50	2.35	44.81	73.9	29.0	216	333	
Hori.	3709.500	PK	50.03	29.76	5.59	38.16	2.35	49.57	73.9	24.3	143	332	
Hori.	4636.875	PK	46.11	31.41	6.21	38.54	2.35	47.54	73.9	26.3	258	56	
Hori.	5564.250	PK	47.01	32.30	6.91	38.86	2.35	49.71	73.9	24.1	311	20	
Hori.	7419.000	PK	48.04	37.57	7.90	39.48	2.35	56.38	73.9	17.5	399	162	
Hori.	9273.750	PK	46.80	38.70	9.07	39.82	2.35	57.10	73.9	16.8	226	224	
Hori.	1854.750	AV	45.89	25.89	4.35	38.94	2.35	39.54	53.9	14.3	327	86	
Hori.	2782.125	AV	37.84	28.58	4.88	38.50	2.35	35.15	53.9	18.7	216	333	
Hori.	3709.500	AV	43.55	29.76	5.59	38.16	2.35	43.09	53.9	10.8	143	332	
Hori.	4636.875	AV	36.06	31.41	6.21	38.54	2.35	37.49	53.9	16.4	258	56	
Hori.	5564.250	AV	39.71	32.30	6.91	38.86	2.35	42.41	53.9	11.4	311	20	
Hori.	7419.000	AV	41.33	37.57	7.90	39.48	2.35	49.67	53.9	4.2	399	162	
Hori.	9273.750	AV	35.48	38.70	9.07	39.82	2.35	45.78	53.9	8.1	226	224	
Vert.	47.106	QP	37.30	12.15	17.05	31.89	0.00	34.61	40.0	5.3	100	190	
Vert.	107.859	QP	35.80	11.40	17.83	31.85	0.00	33.18	43.5	10.3	100	2	
Vert.	199.998	QP	35.60	16.75	18.88	31.76	0.00	39.47	43.5	4.0	100	151	
Vert.	375.007	QP	36.50	14.95	17.23	31.63	0.00	37.05	46.0	8.9	172	230	
Vert.	384.009	QP	36.10	15.08	17.28	31.63	0.00	36.83	46.0	9.1	144	251	
Vert.	625.002	QP	34.50	19.25	18.47	31.61	0.00	40.61	46.0	5.3	100	233	
Vert.	750.007	QP	30.60	19.85	19.03	31.43	0.00	38.05	46.0	7.9	100	42	
Vert.	875.005	QP	32.40	21.59	19.59	30.97	0.00	42.61	46.0	3.3	100	77	
Vert.	1700.025	PK	50.80	25.43	4.38	38.96	2.35	44.00	73.9	29.9	257	97	
Vert.	1854.750	PK	49.79	25.89	4.35	38.94	2.35	43.44	73.9	30.4	243	170	
Vert.	2782.125	PK	45.98	28.58	4.88	38.50	2.35	43.29	73.9	30.6	147	216	
Vert.	3709.500	PK	51.53	29.76	5.59	38.16	2.35	51.07	73.9	22.8	395	234	
Vert.	4636.875	PK	48.28	31.41	6.21	38.54	2.35	49.71	73.9	24.1	374	354	
Vert.	5564.250	PK	47.42	32.30	6.91	38.86	2.35	50.12	73.9	23.7	201	65	
Vert.	6491.625	PK	45.12	34.77	7.55	38.99	2.35	50.80	73.9	23.1	146	6	
Vert.	7419.000	PK	50.59	37.57	7.90	39.48	2.35	58.93	73.9	14.9	106	15	
Vert.	9273.750	PK	46.43	38.70	9.07	39.82	2.35	56.73	73.9	17.1	257	160	
Vert.	1700.025	AV	45.34	25.43	4.38	38.96	2.35	38.54	53.9	15.3	257	97	
Vert.	1854.750	AV	44.77	25.89	4.35	38.94	2.35	38.42	53.9	15.4	243	170	
Vert.	2782.125	AV	35.65	28.58	4.88	38.50	2.35	32.96	53.9	20.9	147	216	
Vert.	3709.500	AV	47.45	29.76	5.59	38.16	2.35	46.99	53.9	6.9	395	234	
Vert.	4636.875	AV	38.34	31.41	6.21	38.54	2.35	39.77	53.9	14.1	374	354	
Vert.	5564.250	AV	40.55	32.30	6.91	38.86	2.35	43.25	53.9	10.6	201	65	
Vert.	6491.625	AV	33.24	34.77	7.55	38.99	2.35	38.92	53.9	14.9	146	6	
Vert.	7419.000	AV	44.63	37.57	7.90	39.48	2.35	52.97	53.9	0.9	106	15	
Vert.	9273.750	AV	36.70	38.70	9.07	39.82	2.35	47.00	53.9	6.9	257	160	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.93 m / 3.0 m) = 2.35 dB

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

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	927.375	PK	104.69	21.69	19.81	30.67	0.00	115.52	-	-	Carrier
Hori.	928.000	PK	38.60	21.69	19.82	30.66	0.00	49.45	95.52	46.0	
Vert.	927.375	PK	107.05	21.69	19.81	30.67	0.00	117.88	-	-	Carrier
Vert.	928.000	PK	39.54	21.69	19.82	30.66	0.00	50.39	97.88	47.4	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.93 m / 3.0 m) = 2.35 dB

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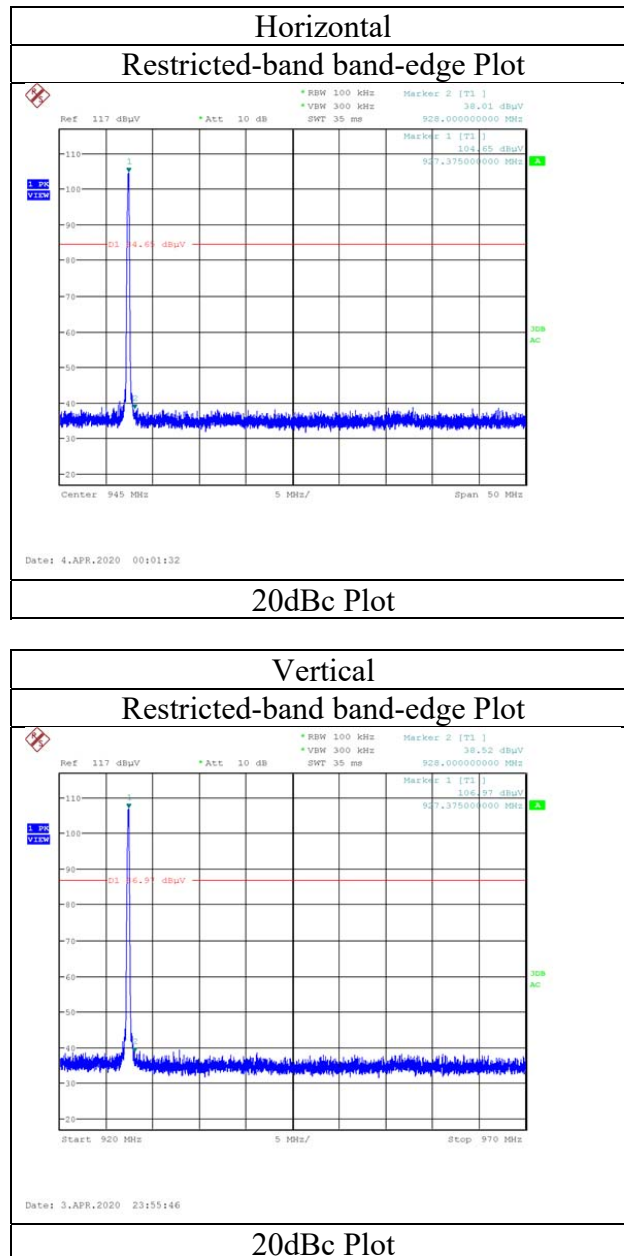
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Radiated Spurious Emission **(Reference Plot for band-edge)**

Report No. 13295245S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.2
Date April 3, 2020
Temperature / Humidity 21 deg. C / 41 % RH
Engineer Makoto Hosaka
(30 MHz -1 GHz)
Mode Transmitting 927.375 MHz, Output: 24 dBm, with Tag



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No.	13295245S-A-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.2
Date	April 3, 2020
Temperature / Humidity	21 deg. C / 41 % RH
Engineer	Makoto Hosaka
	(30 MHz -1 GHz)
Mode	Transmitting 915.125 MHz, Output: 0 dBm, with Tag

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	915.125	PK	80.92	21.61	19.76	30.76	0.00	91.53	-	-	Carrier
Hori.	902.000	PK	31.12	21.50	19.71	30.85	0.00	41.48	71.53	30.0	
Vert.	915.125	PK	84.04	21.61	19.76	30.76	0.00	94.65	-	-	Carrier
Vert.	902.000	PK	29.57	21.50	19.71	30.85	0.00	39.93	74.65	34.7	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(3.93\text{ m} / 3.0\text{ m}) = 2.35\text{ dB}$

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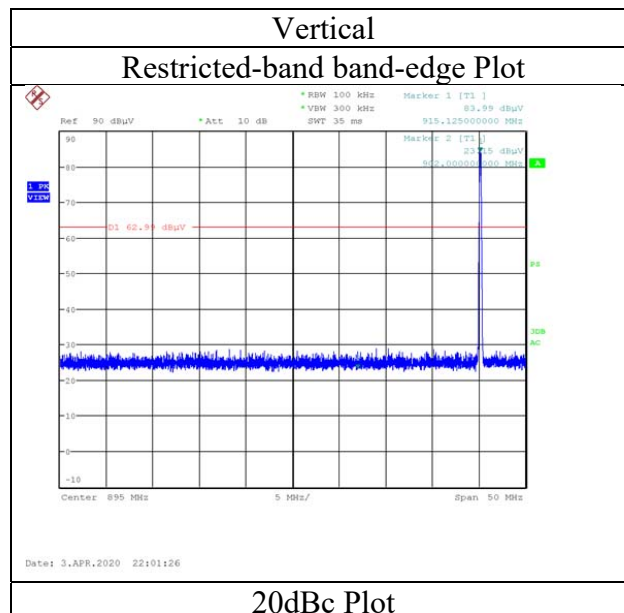
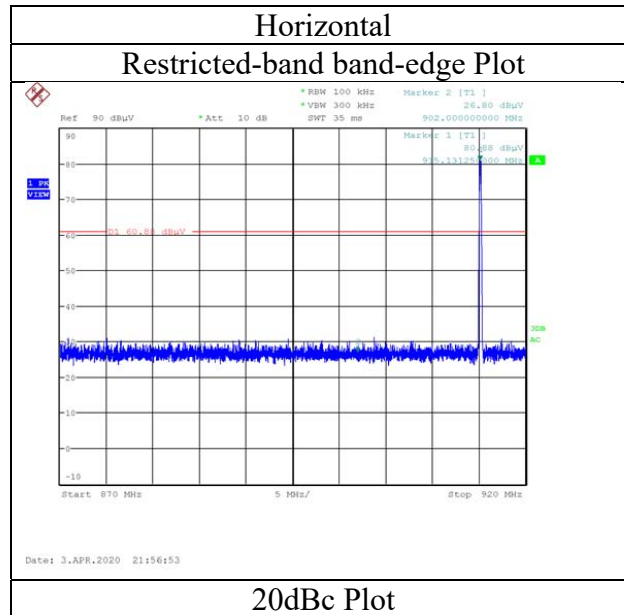
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Radiated Spurious Emission
(Reference Plot for band-edge)

Report No. 13295245S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.2
Date April 3, 2020
Temperature / Humidity 21 deg. C / 41 % RH
Engineer Makoto Hosaka
(30 MHz -1 GHz)
Mode Transmitting 915.125 MHz, Output: 0 dBm, with Tag



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission

Report No. 13295245S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.2
Date April 3, 2020
Temperature / Humidity 21 deg. C / 41 % RH
Engineer Makoto Hosaka
(30 MHz -1 GHz)
Mode Transmitting 927.375 MHz, Output: 0 dBm, with Tag

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

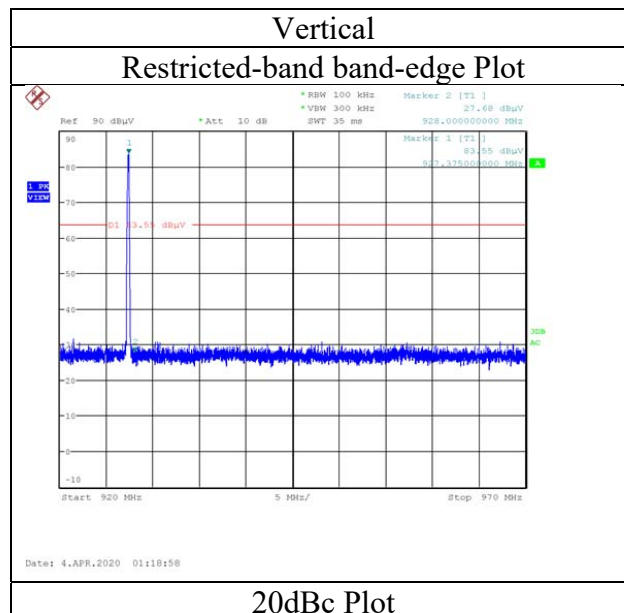
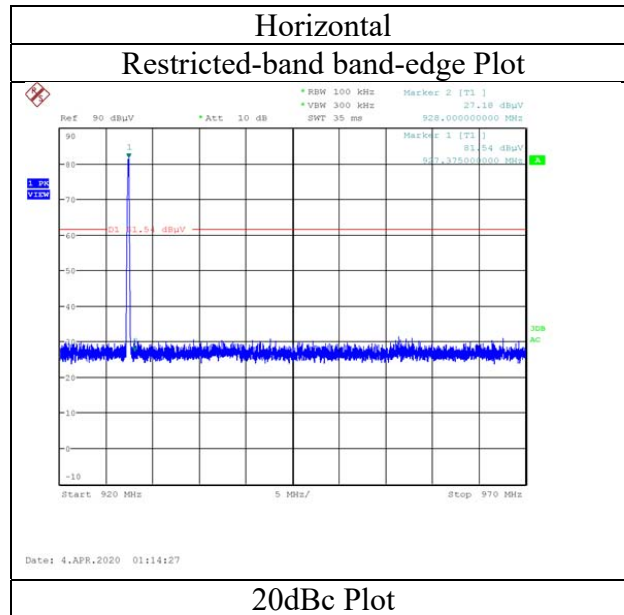
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	927.375	PK	81.59	21.69	19.81	30.67	0.00	92.42	-	-	Carrier
Hori.	928.000	PK	30.66	21.69	19.82	30.66	0.00	41.51	72.42	30.9	
Vert.	927.375	PK	83.58	21.69	19.81	30.67	0.00	94.41	-	-	Carrier
Vert.	928.000	PK	30.78	21.69	19.82	30.66	0.00	41.63	74.41	32.7	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(3.93\text{ m} / 3.0\text{ m}) = 2.35\text{ dB}$

Radiated Spurious Emission
(Reference Plot for band-edge)

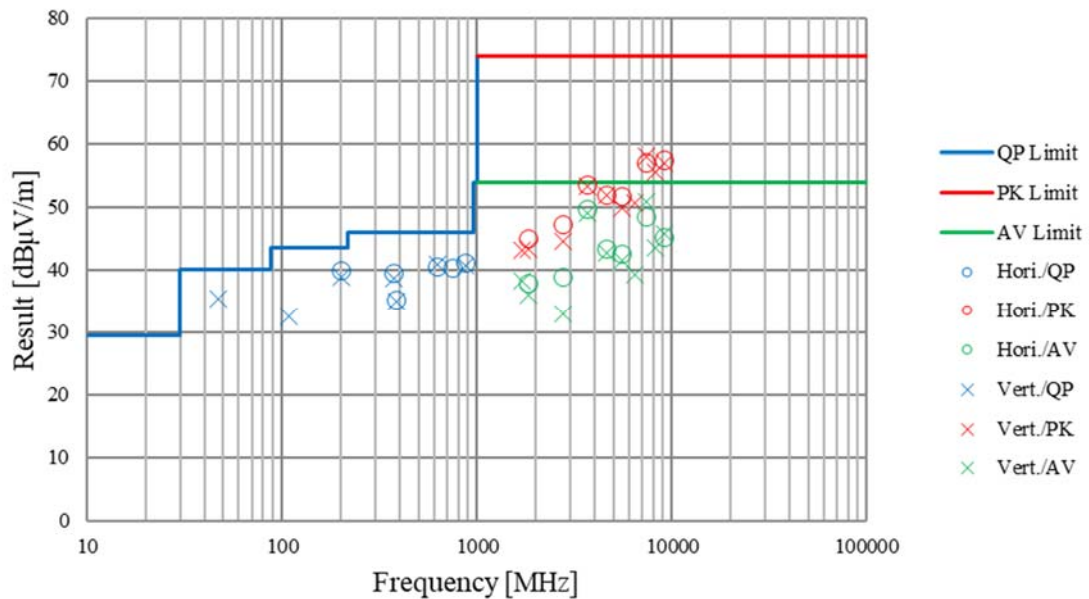
Report No. 13295245S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.2
Date April 3, 2020
Temperature / Humidity 21 deg. C / 41 % RH
Engineer Makoto Hosaka
(30 MHz -1 GHz)
Mode Transmitting 927.375 MHz, Output: 0 dBm, with Tag



* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission **(Plot data, Worst case)**

Report No.	13295245S-A-R1	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.2	No.2
Date	April 3, 2020	April 4, 2020
Temperature / Humidity	21 deg. C / 41 % RH	22 deg. C / 46 % RH
Engineer	Makoto Hosaka	Toshinori Yamada
	(30 MHz -1 GHz)	(1 GHz -10 GHz)
Mode	Transmitting 921.125 MHz, Output: 24 dBm, with Tag	

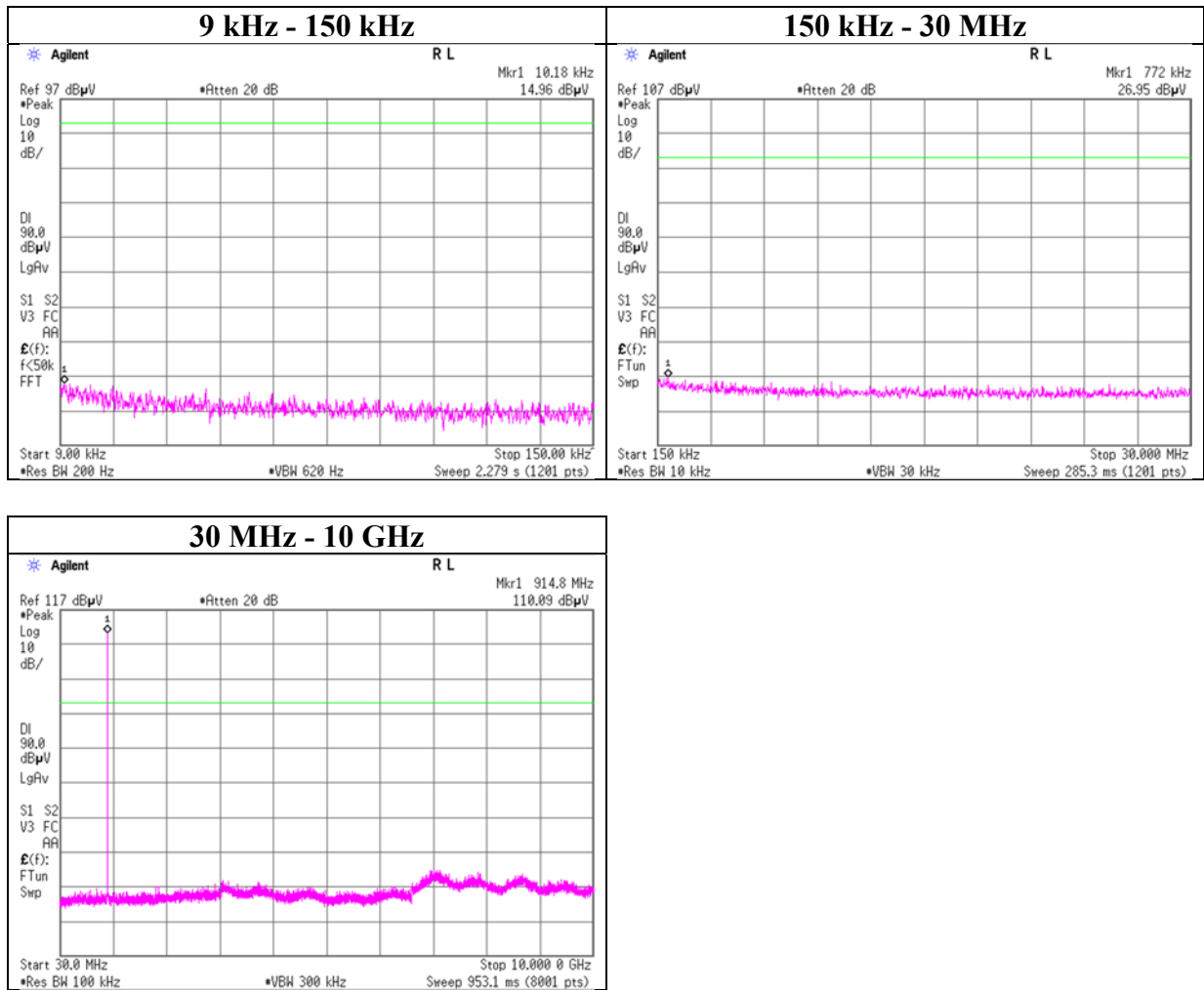


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

Report No. 13295245S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date April 3, 2020
Temperature / Humidity 26 deg. C / 47 % RH
Engineer Kazuya Noda
Mode Tx, Hopping Off

915.125 MHz



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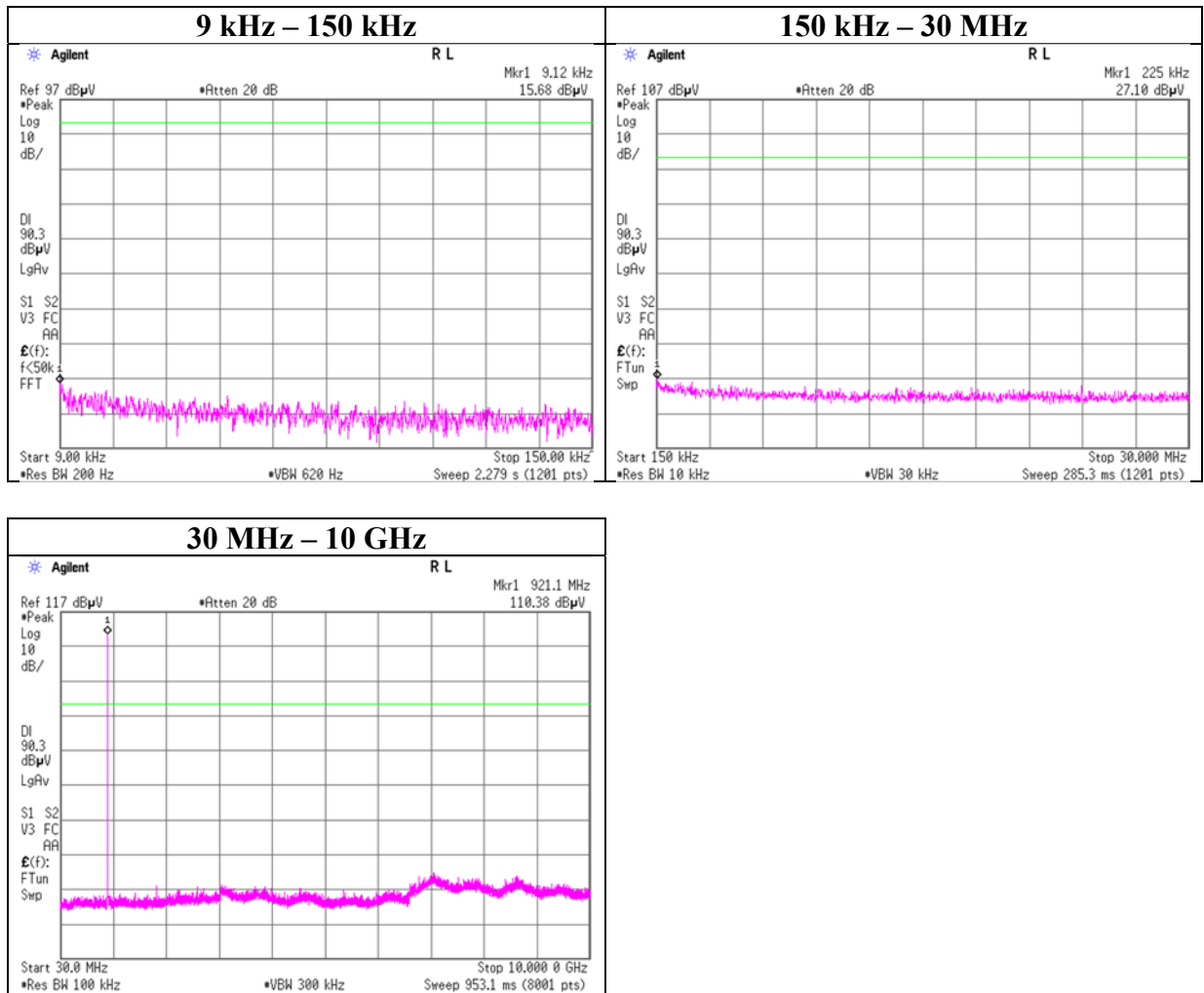
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Facsimile : +81 463 50 6401

Conducted Spurious Emission

Report No. 13295245S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date April 3, 2020
Temperature / Humidity 26 deg. C / 47 % RH
Engineer Kazuya Noda
Mode Tx, Hopping Off

921.125 MHz



UL Japan, Inc.

Shonan EMC Lab.

1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

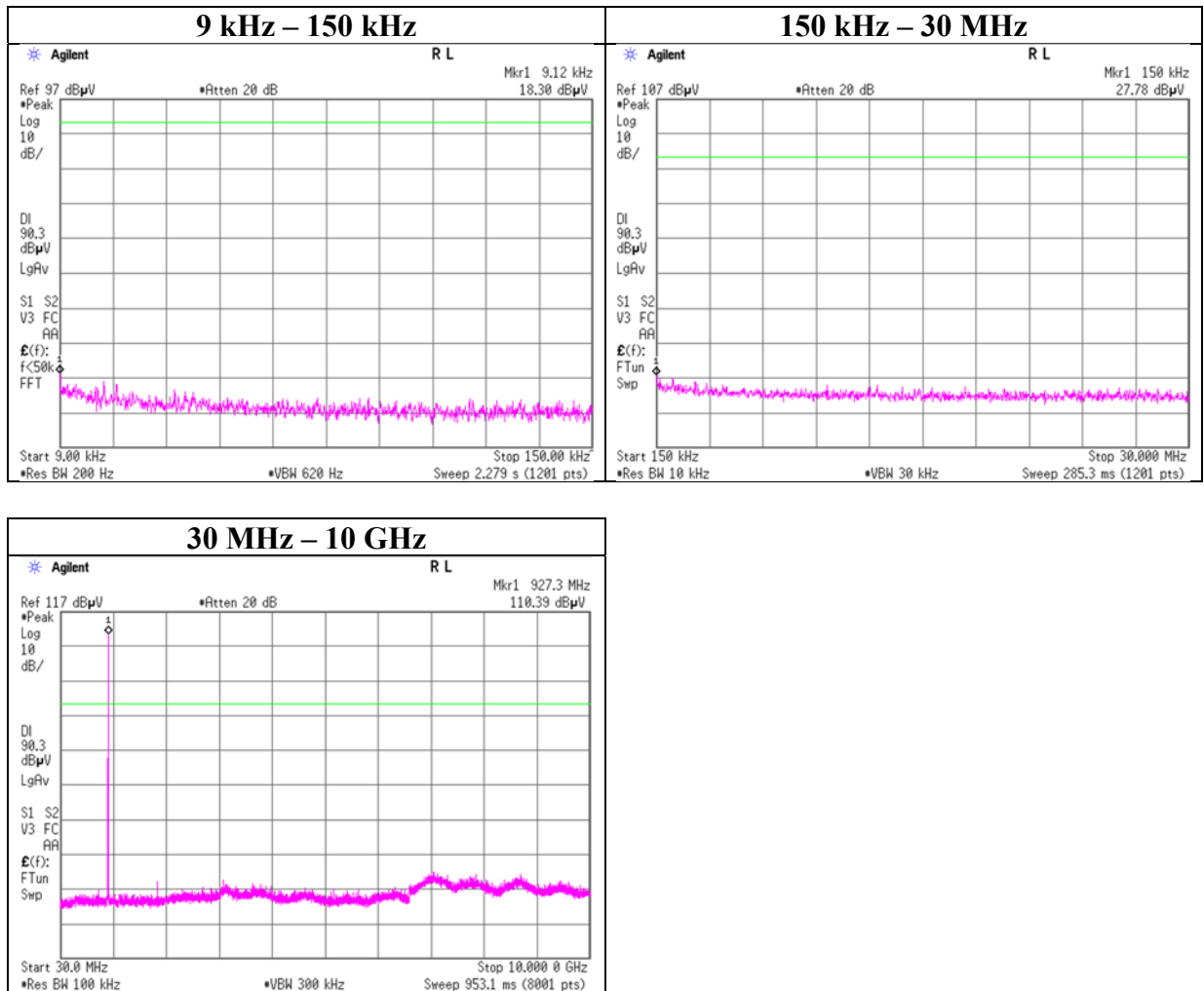
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Conducted Spurious Emission

Report No. 13295245S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date April 3, 2020
Temperature / Humidity 26 deg. C / 47 % RH
Engineer Kazuya Noda
Mode Tx, Hopping Off

927.375 MHz



UL Japan, Inc.

Shonan EMC Lab.

1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

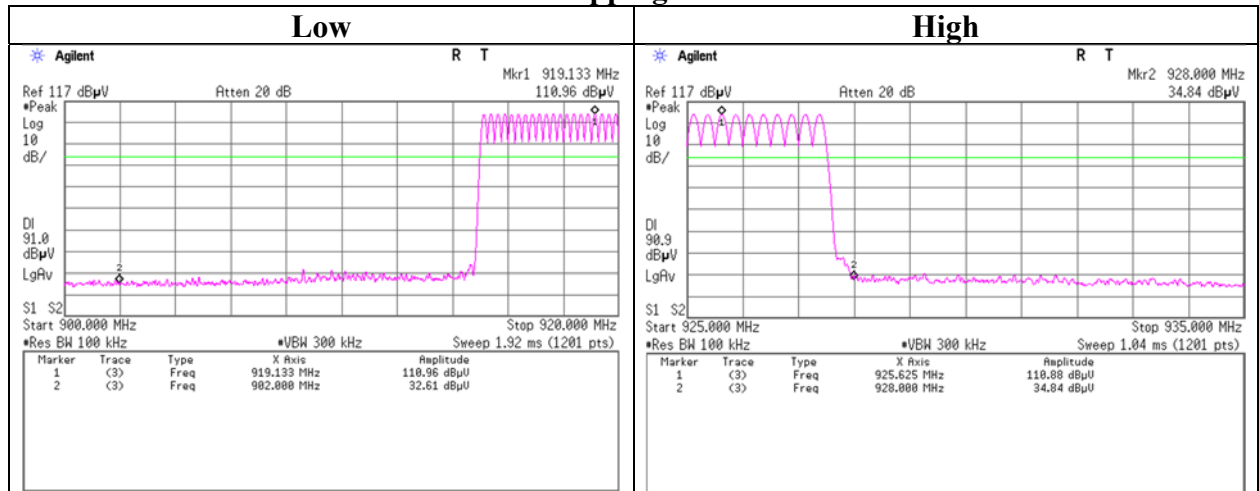
Telephone : +81 463 50 6400

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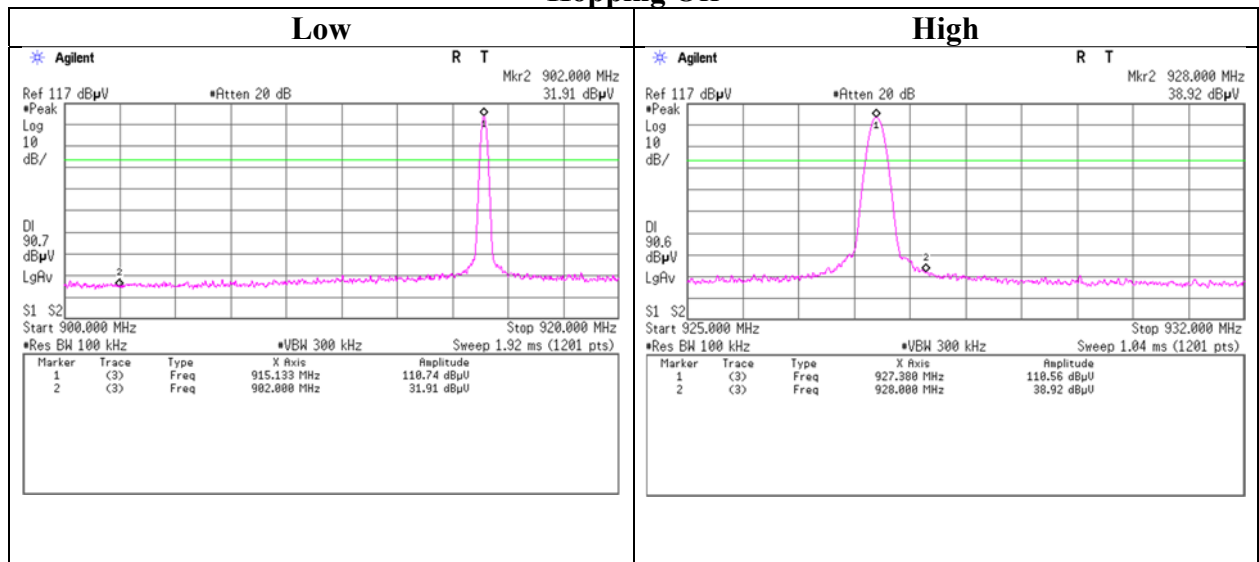
Conducted Emission Band Edge compliance

Report No. 13295245S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date April 3, 2020
Temperature / Humidity 26 deg. C / 47 % RH
Engineer Kazuya Noda
Mode Tx
Power setting 24 dBm

Hopping On



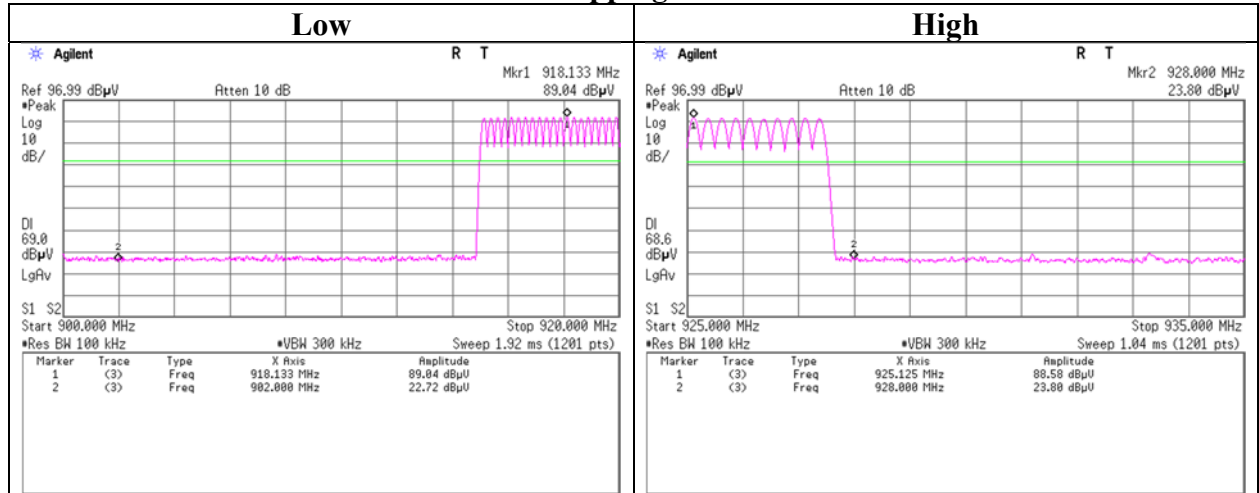
Hopping Off



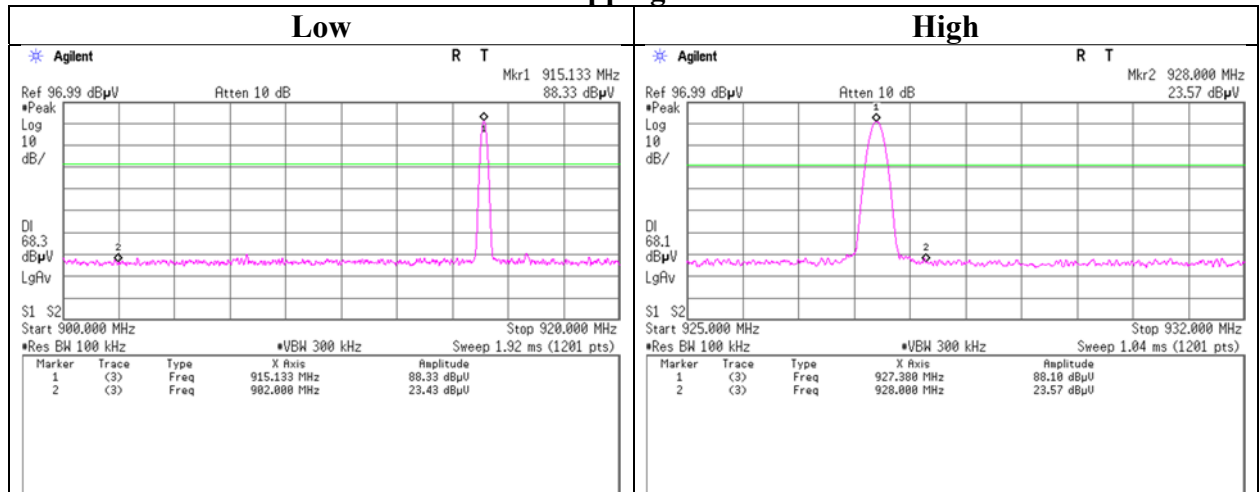
Conducted Emission Band Edge compliance

Report No. 13295245S-A-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date April 3, 2020
Temperature / Humidity 26 deg. C / 47 % RH
Engineer Kazuya Noda
Mode Tx
Power setting 0 dBm

Hopping On



Hopping Off



APPENDIX 2: Test instruments

Test Instruments (1/2)

Test Name	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Interval (Month)
AT	SAT10-13	151610	Attenuator	Weinschel Corp.	54A-10	81626	2020/03/02	12
AT	SAT20-06	145146	Attenuator	Weinschel Corp.	54A-20	31506	2020/04/01	12
AT	SCC-G64	196945	Coaxial Cable	HUBER+SUNER	SUCOFLEX 102	803414/2	2020/03/10	12
AT	SCC-H16	155706	Microwave cable	RS Pro	R-132G7210 100CO	-	2019/06/17	12
AT	SOS-13	146321	Humidity Indicator	CUSTOM	CTH-202	Q.C.17	2019/12/19	12
AT	SPM-13	169910	Power Meter	Keysight Technologies Inc	8990B	MY51000448	2020/01/28	12
AT	SPSS-06	169911	Power sensor	Keysight Technologies Inc	N1923A	MY57270004	2020/01/28	12
AT	SRENT-15	160899	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46185516	2020/01/15	12
AT	SSA-01	146223	Spectrum Analyzer	Keysight Technologies Inc	N9010A-526	MY48031482	2020/03/18	12
AT,CE	SOS-27	191845	Humidity Indicator	CUSTOM	CTH-201	-	2019/12/12	12
CE	KAT3-12	144896	Attenuator	JFW IND. INC.	50HF-003N	-	2019/07/18	12
CE	KTS-07	145111	Digital Tester	SANWA	PC500	7019232	2019/10/01	12
CE	SCC-05	145033	Coaxial Cable	Fujikura,HP,Mini-Circuits,Fujikura	5D2W	-	2019/04/19	12
CE	SLS-03	145540	LISN	Rohde & Schwarz	ENV216	100513	2020/02/19	12
CE	SLS-04	145541	LISN	Rohde & Schwarz	ENV216	100514	2020/02/19	12
CE	STM-03	146188	Terminator	TME	CT-01 BP	-	2019/12/05	12
CE	STR-06	146208	Test Receiver	Rohde & Schwarz	ESCI	101259	2020/04/01	12

Test Instruments (2/2)

Test Name	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Interval (Month)
RE	COTS-SEMI-5	170932	EMI Software	TSJ	TEPTO-DV3(RE,CE,ME, PE)	-	-	-
RE	SAEC-02 (NSA)	145563	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	2020/03/20	12
RE	SAEC-02 (SVSWR)	145598	Semi-Anechoic Chamber	TDK	SAEC-02(SVSWR)	2	2019/05/09	12
RE	SAF-02	145004	Pre Amplifier	SONOMA	310N	290212	2020/02/19	12
RE	SAF-05	145128	Pre Amplifier	Toyo Corporation	TPA0118-36	1440490	2019/07/12	12
RE	SAT10-17	167093	Attenuator	JFW	50HF-010N	-	2020/02/21	12
RE	SAT20-01	145142	Attenuator(above 1GHz)	Keysight Technologies Inc	8493C-020	74889	2019/11/06	12
RE	SAT3-11	150921	Attenuator	JFW	50HF-003N	-	2020/01/30	12
RE	SAT6-14	167095	Attenuator	JFW	50HF-006N	-	2020/02/21	12
RE	SBA-02	145022	Biconical Antenna	Schwarzbeck Mess - Elektronik	BBA9106	91032665	2019/04/01	12
RE	SCC-B1/B3/B5/B7/B8/B13/SRSE-02	144975	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	2019/04/19	12
RE	SCC-B2/B4/B6/B7/B8/B13/SRSE-02	144976	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	2019/04/19	12
RE	SCC-G40	166491	Coaxial Cable	Junkosha	MWX221-01000NFSNMS/B	1612S005	2020/01/08	12
RE	SCC-G50	178573	Coaxial Cable	HUBER+SUNER	SUCOFLEX_104E	MY13407/4E	2020/03/09	12
RE	SCC-G51	178572	Coaxial Cable	HUBER+SUNER	SUCOFLEX 104	800288 /4A	2020/03/09	12
RE	SFL-22	168802	Highpass Filter	MICRO-TRONICS	HPM50114	G035	2020/04/02	12
RE	SHA-02	145384	Horn Antenna	Schwarzbeck Mess - Elektronik	BBHA9120D	9120D-726	2019/06/26	12
RE	SJM-09	145336	Measure	PROMART	SEN1935	-	-	-
RE	SLA-06	145528	Logperiodic Antenna	Schwarzbeck Mess - Elektronik	VUSLP9111B	195	2019/04/01	12
RE	SOS-21	191838	Humidity Indicator	CUSTOM	CTH-201	-	2019/12/12	12
RE	STR-07	146209	Test Receiver	Rohde & Schwarz	ESU26	100484	2019/09/13	12
RE	STS-01	145792	Digital Hitester	Hioki	3805-50	80997812	2019/10/01	12
RE	STS-03	146210	Digital Hitester	Hioki	3805-50	80997823	2019/10/01	12

*Hyphens for Last Calibration 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.

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

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

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

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