



RADIO TEST REPORT

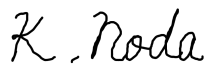
Test Report No. : 13915091S-A-R1

Applicant : Nintendo Co., Ltd.
Type of EUT : Game controller
Model Number of EUT : HAC-045
FCC ID : BKEHAC045
Test regulation : FCC Part 15 Subpart C: 2021
Test Result : Complied (Refer to SECTION 3)

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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 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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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 13915091S-A. 13915091S-A is replaced with this report.

Date of test: August 21 to 23, 2021

Representative test engineer: 
Shunsaku Yumi
Engineer

Approved by: 
Kazuya Noda
Leader



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.: 13915091S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13915091S-A	September 1, 2021	-	-
1	13915091S-A-R1	September 9, 2021	p.30, 33, 35, 38	Additional comment. "*1) Not out of band emission (Leakage power)" "*2) This spurious has same duty cycle as the carrier."
			p.32, 37	Additional comment. "*1) This spurious has same duty cycle as the carrier."

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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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CONTENTS	PAGE
SECTION 1: Customer information.....	5
SECTION 2: Equipment under test (EUT).....	5
SECTION 3: Test specification, procedures & results.....	6
SECTION 4: Operation of EUT during testing.....	9
SECTION 5: Conducted Emission.....	11
SECTION 6: Radiated Spurious Emission	12
SECTION 7: Antenna Terminal Conducted Tests.....	14
APPENDIX 1: Test data	15
Conducted Emission	15
20 dB Bandwidth, 99 % Occupied Bandwidth and Carrier Frequency Separation	19
Number of Hopping Frequency	23
Dwell time.....	25
Maximum Peak Output Power and Average power.....	28
Burst Rate Confirmation	29
Radiated Spurious Emission	30
Conducted Spurious Emission	41
Conducted Emission Band Edge compliance	47
APPENDIX 2: Test instruments	49
APPENDIX 3: Photographs of test setup.....	51
Conducted Emission	51
Radiated Spurious Emission	52
Pre-check of Worst Case Position.....	53
Antenna Terminal Conducted Tests.....	54

SECTION 1: Customer information

Company Name : Nintendo Co., Ltd.
Address : 11-1 Hokotate-cho, Kamitoba, Minami-ku, Kyoto 601-8501, Japan
Telephone Number : +81-75-662-9600
Facsimile Number : +81-75-662-9624
Contact Person : Kazuya Kuramoto

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) other than the Receipt Date
 - 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 : Game controller
Model Number : HAC-045
Serial Number : Refer to SECTION 4.2
Rating : DC 3.7 V (Battery),
DC 5 V (USB type C)
Receipt Date : July 13, 2021
Country of Mass-production : China
Condition : Engineering prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification : No Modification by the test lab.

2.2 Product Description

Model: HAC-045 (referred to as the EUT in this report) is a Game controller.

Radio Specification

Bluetooth (BDR / EDR function)

Radio Type : Transceiver
Frequency of Operation : 2402 MHz - 2480 MHz
Modulation : FHSS
Antenna type : $\lambda / 4$ Invert F antenna
Antenna Gain : 3.36 dBi
Clock frequency (Maxmum) : CPU: 96 MHz (XTAL: 24 MHz)

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on May 3, 2021 and effective July 2, 2021

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

* 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	31.2 dB, 0.15104 MHz, L1 QP, 3DH5 2441 MHz	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
20 dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ----- ISED: -	FCC: Section15.247(a)(1) ----- ISED: RSS-247 5.1 (a)		Complied b)	Conducted
Number of Hopping Frequency	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ----- ISED: -	FCC: Section15.247(a)(1)(iii) ----- ISED: RSS-247 5.1 (d)		Complied c)	Conducted
Dwell time	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ----- ISED: -	FCC: Section15.247(a)(1)(iii) ----- ISED: RSS-247 5.1 (d)		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)(1) ----- ISED: RSS-247 5.4 (b)		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		7.5 dB 2378.044 MHz, Vertical, AV, DH5 2402 MHz	Complied f) / g)

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 20 dB 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 the stable voltage constantly to RF Part 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 of Section 15.203.

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3.3 Addition to standard

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

b) Refer to APPENDIX 1 (data of 20 dB 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	2.6 dB	2.9 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.0 dB	2.7 dB	2.7 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	4.8 dB	4.8 dB	4.8 dB	-
	6 GHz-18 GHz	5.4 dB	5.4 dB	5.4 dB	-
	18 GHz-40 GHz	5.3 dB	5.3 dB	5.3 dB	-
Radiated emission (Measurement distance: 1 m)	1 GHz-18 GHz	5.7 dB	5.7 dB	5.7 dB	-
	18 GHz-40 GHz	5.6 dB	5.6 dB	5.6 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	1.4 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	1.6 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.89 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	1.2 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	0.91 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.2 dB
Spurious emission (Conducted) below 1GHz	0.87 dB
Spurious emission (Conducted) 1 GHz-3 GHz	0.96 dB
Spurious emission (Conducted) 3 GHz-18 GHz	3.0 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.6 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.2 dB
Bandwidth Measurement	0.012 %
Duty cycle and Time Measurement	0.27 %
Temperature_SCH-01	0.87 deg.C.
Humidity_SCH-01	4.3 %
Temperature_SCH-02	2.0 deg.C.
Humidity_SCH-02	6.6 %
Voltage	0.86 %

3.5 Test Location

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A2LA Certificate Number: 1266.03
(FCC test firm registration number: 626366, ISED lab company number: 2973D / CAB identifier: JP0001)

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	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)

Transmitting (Tx), Bluetooth (BT), Payload: PRBS9

Details of Operating Mode(s)

Test Item	Mode	Tested frequency
Conducted Emission, Spurious Emission (Conducted/Radiated)	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Carrier Frequency Separation	Tx (Hopping On) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
20 dB Bandwidth	Tx (Hopping Off) DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Number of Hopping Frequency	Tx (Hopping On) DH5, 3DH5	-
Dwell time	Tx (Hopping On), -DH1, DH3, DH5 -3DH1, 3DH3, 3DH5	-
Maximum Peak Output Power	Tx (Hopping Off) DH5, 2DH5, 3DH5	2402 MHz 2441 MHz 2480 MHz
Band Edge Compliance (Conducted)	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2480 MHz
99 % Occupied Bandwidth	Tx DH5, 3DH5 -Hopping On -Hopping Off	2402 MHz 2441 MHz 2480 MHz
<p>*As a result of preliminary test, the formal test was performed with the above modes, which had the maximum payload length (except Dwell time test) *2DH mode (2 Mb/s EDR: pi/4DQPSK) was excluded for other tests than power measurement by using 3DH mode (3 Mb/s EDR: 8DPSK) as a representative. * It is considered that the non-tested packet type (e.g. inquiry) can be omitted as it is complied with above all the test items based on Bluetooth Core specification.</p> <p>*EUT has the power settings by the software as follows; Power settings: Fixed Software: CyBlueTool Version 0.1.55.1 (Date: 2021.6.4, Storage location: Driven by connected PC)</p> <p>*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.</p>		

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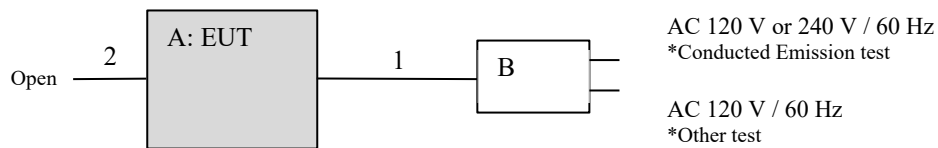
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4.2 Configuration and peripherals



* 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	Game controller	HAC-045	XXW01000002230 *1) XXW01000002162 *2)	Nintendo Co., Ltd.	EUT
B	AC Adapter	HAC-002	-	Nintendo Co., Ltd.	-

*1) Used for Antenna Terminal conducted test

*2) Used for Conducted Emission test and Radiated Emission test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB	1.50	Shielded	Shielded	-
2	Signal	0.13	Unshielded	Unshielded	*3)

*3) Cable for test operation during the development, not used for the product.

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.

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 hunged 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.

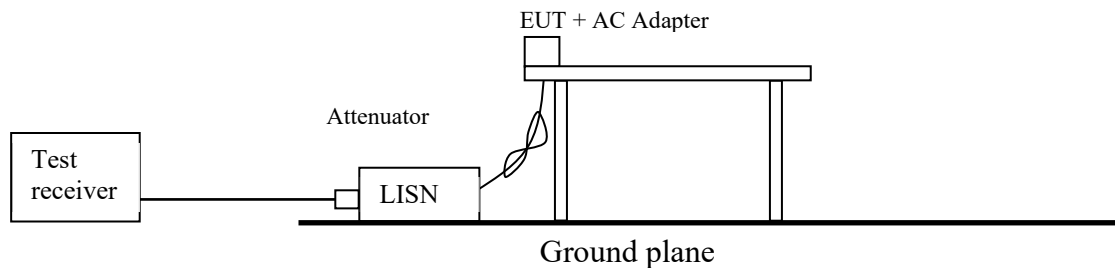
The EUT via AC Adapter was connected to a LISN (AMN).

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, 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.

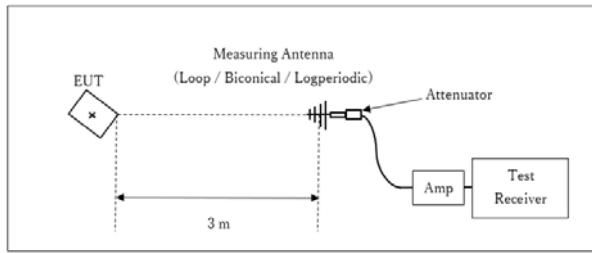
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9 (ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

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 (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

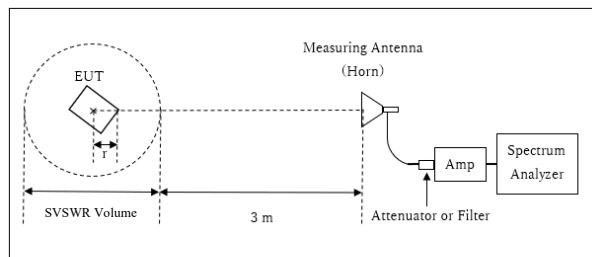
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz

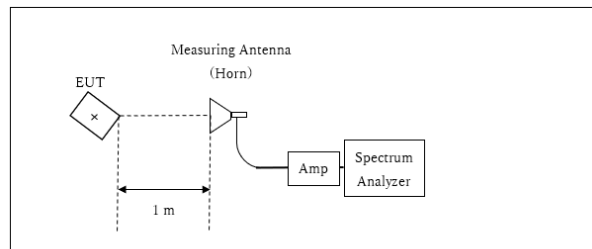


r : Radius of an outer periphery of EUT
× : Center of turn table

Distance Factor: $20 \times \log(3.92 \text{ m} / 3.0 \text{ m}) = 2.33 \text{ dB}$
* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 3.92 \text{ m}$

SVSWR Volume : 2.0 m
(SVSWR Volume has been calibrated based on CISPR 16-1-4.)
r = 0.08 m

10 GHz - 26.5 GHz



× : Center of turn table

Distance Factor: $20 \times \log(1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$
*Test Distance: 1 m

- 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.

Antenna polarization	Carrier	Spurious (30 MHz-1 GHz)	Spurious (1-2.8 GHz)	Spurious (2.8-10 GHz)	Spurious (10-18 GHz)	Spurious (18-26.5 GHz)
Horizontal	X	Y	X	X	X	X
Vertical	Z	Y	Z	X	X	X

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

Measurement range : 30 MHz - 26.5 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
20 dB Bandwidth	3 MHz	30 kHz	100 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 *1)	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Carrier Frequency Separation	3 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Number of Hopping Frequency	30 MHz	100 kHz	300 kHz	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) *4)	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 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) The measurement was performed with Max Hold since the duty cycle was not 100 %. Peak hold was applied as Worst-case measurement.
*2) Reference data
*3) In the frequency range below 30 MHz, 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 = 10 kHz)
*4) The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohms. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to $45.5 - 51.5 = -6.0$ dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

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

DATA OF CONDUCTED EMISSION TEST

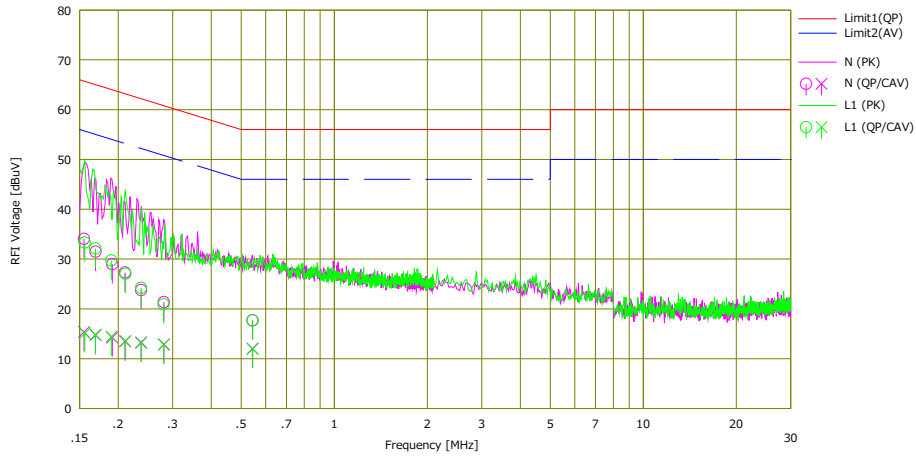
UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2021/08/23

Mode : Tx DH5 2441 MHz
Power : DC 5 V (AC 240 V/ 60 Hz)
Temp./Humi. : 22 deg.C / 53 %RH

Remarks : -

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Shunsaku Yumi

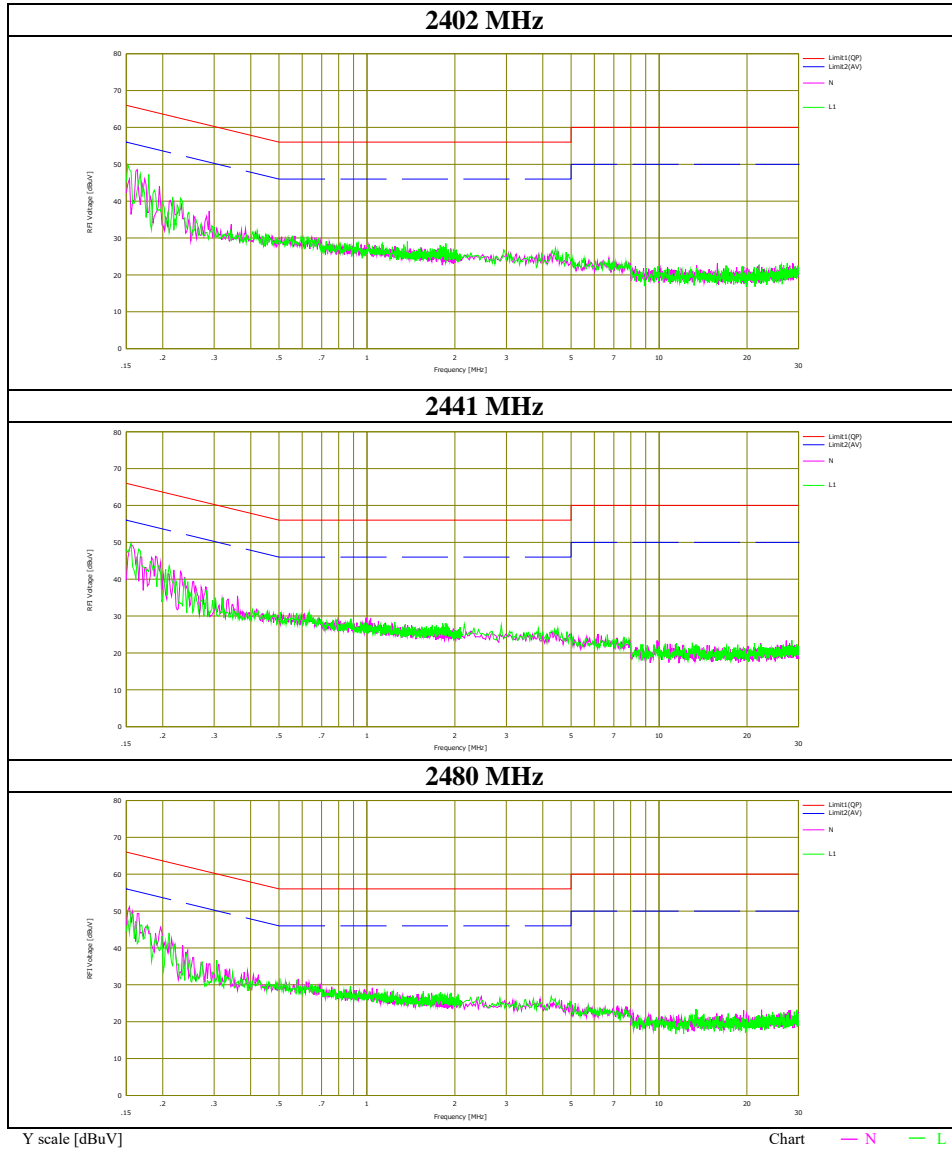


No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<CAV> [dBuV]		<QP> [dBuV]	<CAV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15491	21.50	2.80	12.56	34.06	15.36	65.73	55.73	31.6	40.3	N	
2	0.16891	18.90	2.20	12.56	31.46	14.76	65.01	55.01	33.5	40.2	N	
3	0.19135	16.40	1.70	12.57	28.97	14.27	63.98	53.98	35.0	39.7	N	
4	0.21026	14.70	0.90	12.58	27.28	13.48	63.20	53.20	35.9	39.7	N	
5	0.23721	11.20	0.70	12.57	23.77	13.27	62.19	52.19	38.4	38.9	N	
6	0.28080	8.80	0.30	12.57	21.37	12.87	60.79	50.79	39.4	37.9	N	
7	0.54348	5.10	-0.60	12.60	17.70	12.00	56.00	46.00	38.3	34.0	N	
8	0.15585	20.70	2.50	12.61	33.31	15.11	65.68	55.68	32.3	40.5	L1	
9	0.16867	19.50	2.20	12.62	32.12	14.82	65.03	55.03	32.9	40.2	L1	
10	0.18983	17.10	1.80	12.63	29.73	14.43	64.04	54.04	34.3	39.6	L1	
11	0.21115	14.40	0.90	12.64	27.04	13.54	63.16	53.16	36.1	39.6	L1	
12	0.23709	11.60	0.50	12.63	24.23	13.13	62.20	52.20	37.9	39.0	L1	
13	0.28041	8.30	0.20	12.61	20.91	12.81	60.80	50.80	39.8	37.9	L1	
14	0.54460	5.00	-0.70	12.68	17.68	11.98	56.00	46.00	38.3	34.0	L1	

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN):SLS-02

Conducted Emission

Report No.	13915091S-A-R1
Test place	Shonan EMC Lab. No.1 Shielded room
Date	August 23, 2021
Temperature / Humidity	22 deg. C / 53 % RH
Engineer	Shunsaku Yumi
Mode	Tx, Hopping Off, DH5



Conducted Emission

DATA OF CONDUCTED EMISSION TEST

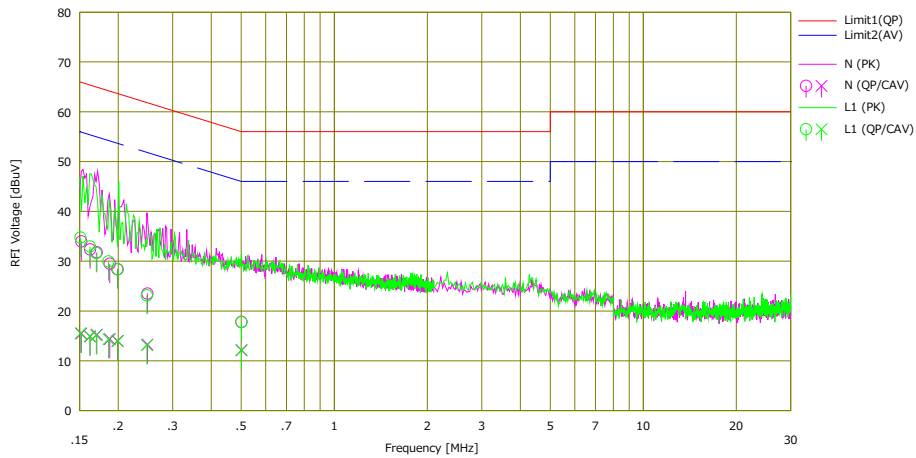
UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2021/08/23

Mode : Tx 3DH5 2441 MHz
Power : DC 5 V (AC 240 V/ 60 Hz)
Temp./Humi. : 22 deg.C / 53 %RH

Remarks : -

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Shunsaku Yumi

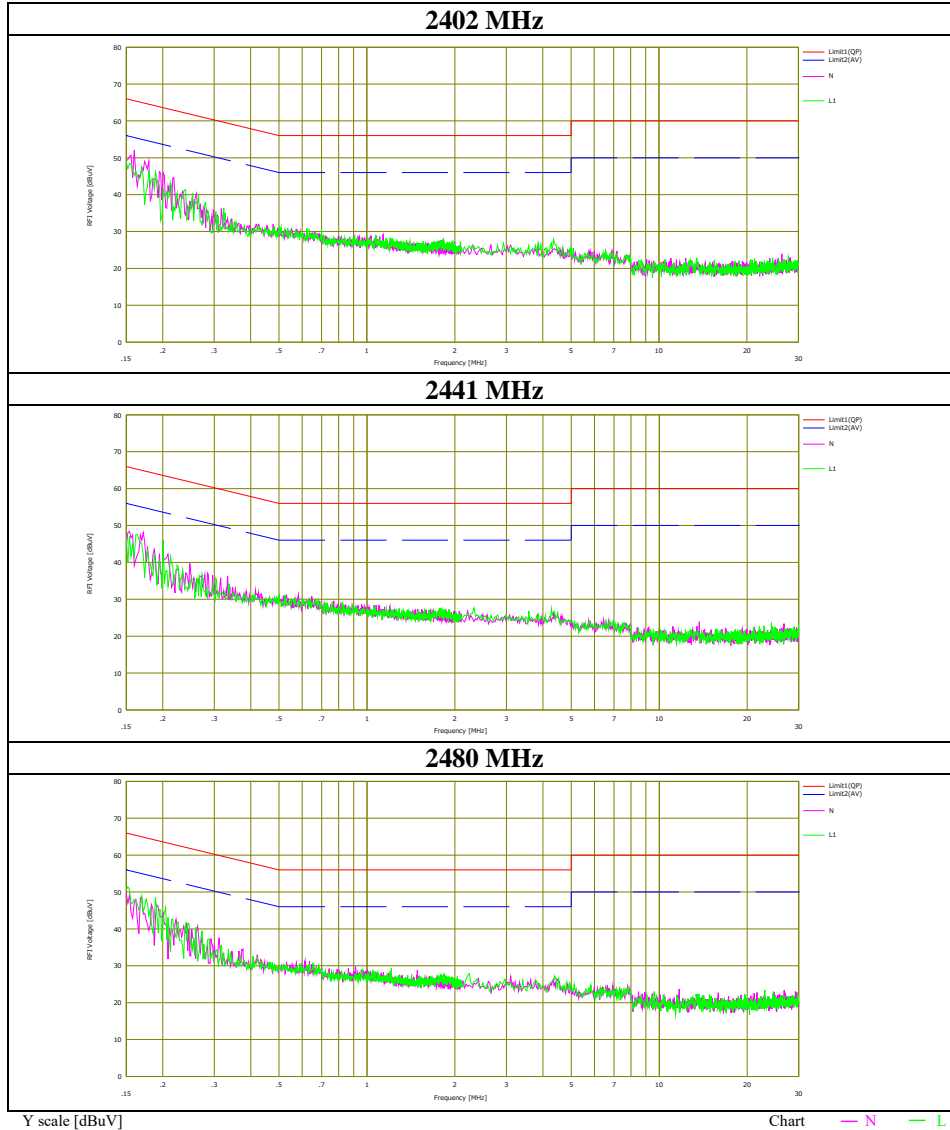


No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		(QP) [dBuV]	(CAV) [dBuV]		(QP) [dBuV]	(CAV) [dBuV]	(QP) [dBuV]	(AV) [dBuV]	(QP) [dB]	(AV) [dB]		
1	0.15192	21.40	2.90	12.56	33.96	15.46	65.89	55.89	31.9	40.4	N	
2	0.16217	19.80	2.30	12.56	32.36	14.86	65.35	55.35	32.9	40.4	N	
3	0.17051	19.20	2.70	12.56	31.76	15.26	64.94	54.94	33.1	39.6	N	
4	0.18765	16.90	1.80	12.57	29.47	14.37	64.14	54.14	34.6	39.7	N	
5	0.19871	15.80	1.40	12.58	28.38	13.98	63.66	53.66	35.2	39.6	N	
6	0.24856	10.90	0.70	12.57	23.47	13.27	61.81	51.81	38.3	38.5	N	
7	0.50092	5.20	-0.50	12.59	17.79	12.09	56.00	46.00	38.2	33.9	N	
8	0.15104	22.10	2.90	12.61	34.71	15.51	65.94	55.94	31.2	40.4	L1	
9	0.16194	20.30	2.30	12.62	32.92	14.92	65.36	55.36	32.4	40.4	L1	
10	0.16979	19.00	2.50	12.62	31.62	15.12	64.97	54.97	33.3	39.8	L1	
11	0.18598	17.30	1.70	12.63	29.93	14.33	64.21	54.21	34.2	39.8	L1	
12	0.19944	15.70	1.30	12.65	28.35	13.95	63.63	53.63	35.2	39.6	L1	
13	0.24752	10.50	0.50	12.62	23.12	13.12	61.84	51.84	38.7	38.7	L1	
14	0.50124	5.10	-0.50	12.67	17.77	12.17	56.00	46.00	38.2	33.8	L1	

Calculation: Result[dBuV]=Reading[dBuV]+C.Fac(LISN(AMN)+Cable+ATT)[dB]
LISN(AMN):SLS-02

Conducted Emission

Report No.	13915091S-A-R1
Test place	Shonan EMC Lab. No.1 Shielded room
Date	August 23, 2021
Temperature / Humidity	22 deg. C / 53 % RH
Engineer	Shunsaku Yumi
Mode	Tx, Hopping Off, 3DH5



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

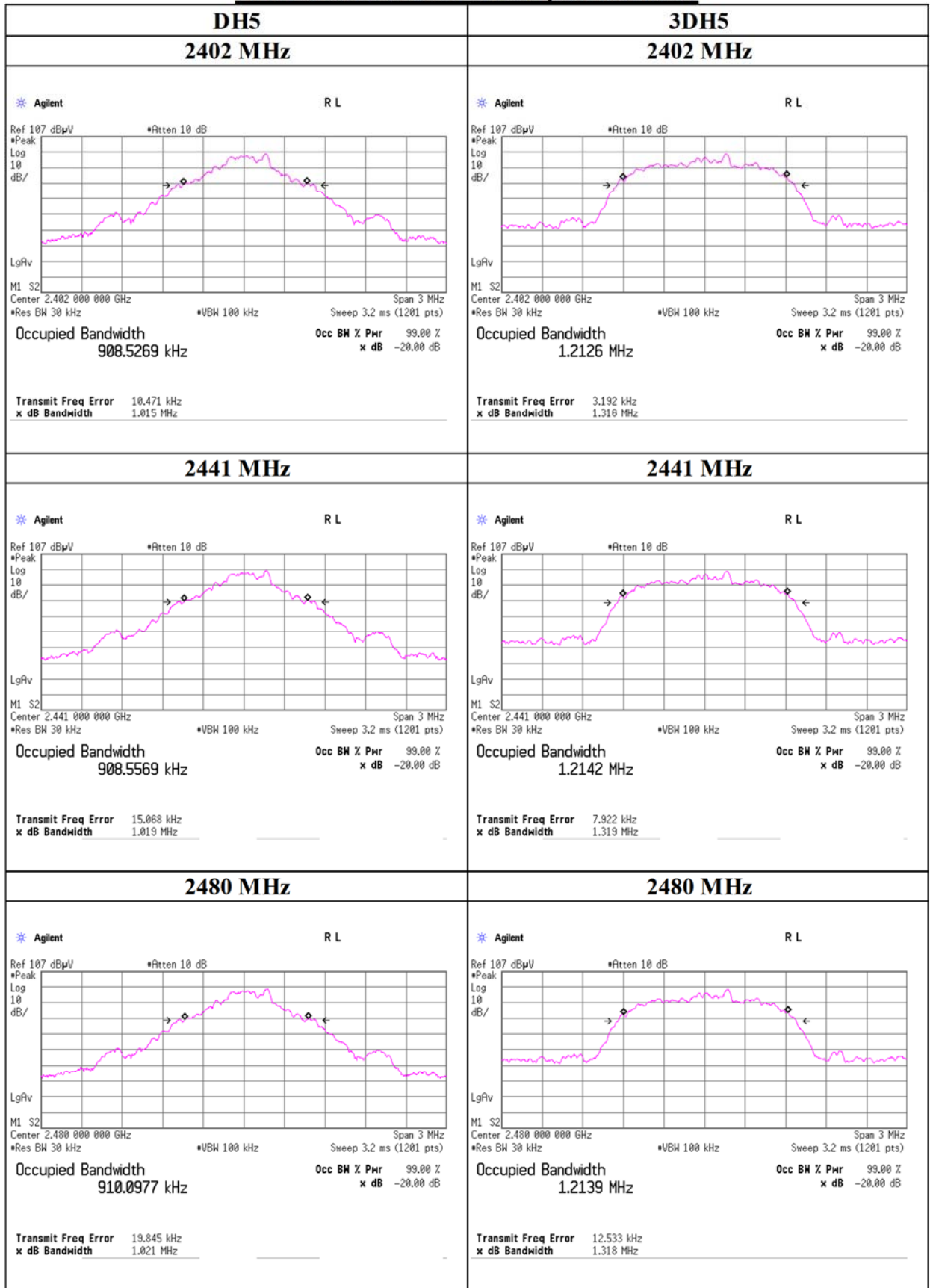
Report No. 13915091S-A-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date August 21, 2021
Temperature / Humidity 25 deg. C / 43 % RH
Engineer Kenichi Adachi
Mode Tx, Hopping Off, Tx, Hopping On

Mode	Freq. [MHz]	20 dB Bandwidth [MHz]	99 % Occupied Bandwidth [kHz]	Carrier Frequency Separation [MHz]	Limit for Carrier Frequency separation [MHz]
DH5	2402.0	1.015	908.5	1.000	≥ 0.677
DH5	2441.0	1.019	908.6	1.000	≥ 0.679
DH5	2480.0	1.021	910.1	1.000	≥ 0.681
DH5	Hopping On	-	78602.3	-	-
3DH5	2402.0	1.316	1212.6	1.000	≥ 0.877
3DH5	2441.0	1.319	1214.2	1.000	≥ 0.879
3DH5	2480.0	1.318	1213.9	1.000	≥ 0.879
3DH5	Hopping On	-	78742.8	-	-

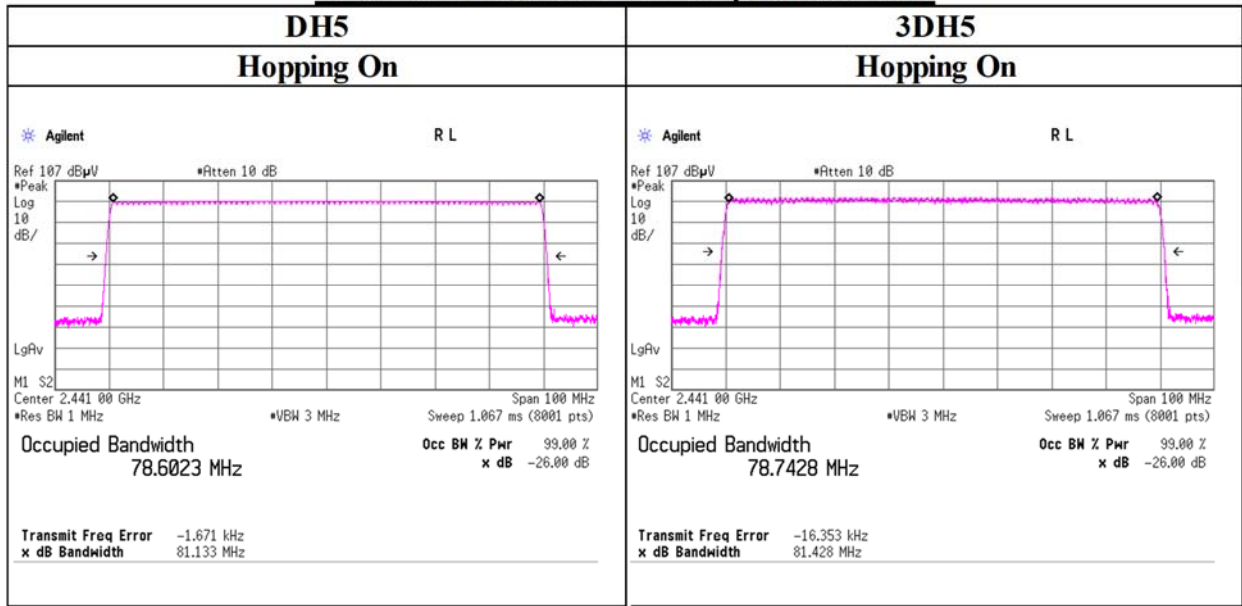
Limit: Two-thirds of 20 dB Bandwidth or 25 kHz (whichever is greater).

No limit applies to 20 dB Bandwidth.

20 dB Bandwidth & 99 % Occupied Bandwidth



20 dB Bandwidth & 99 % Occupied Bandwidth



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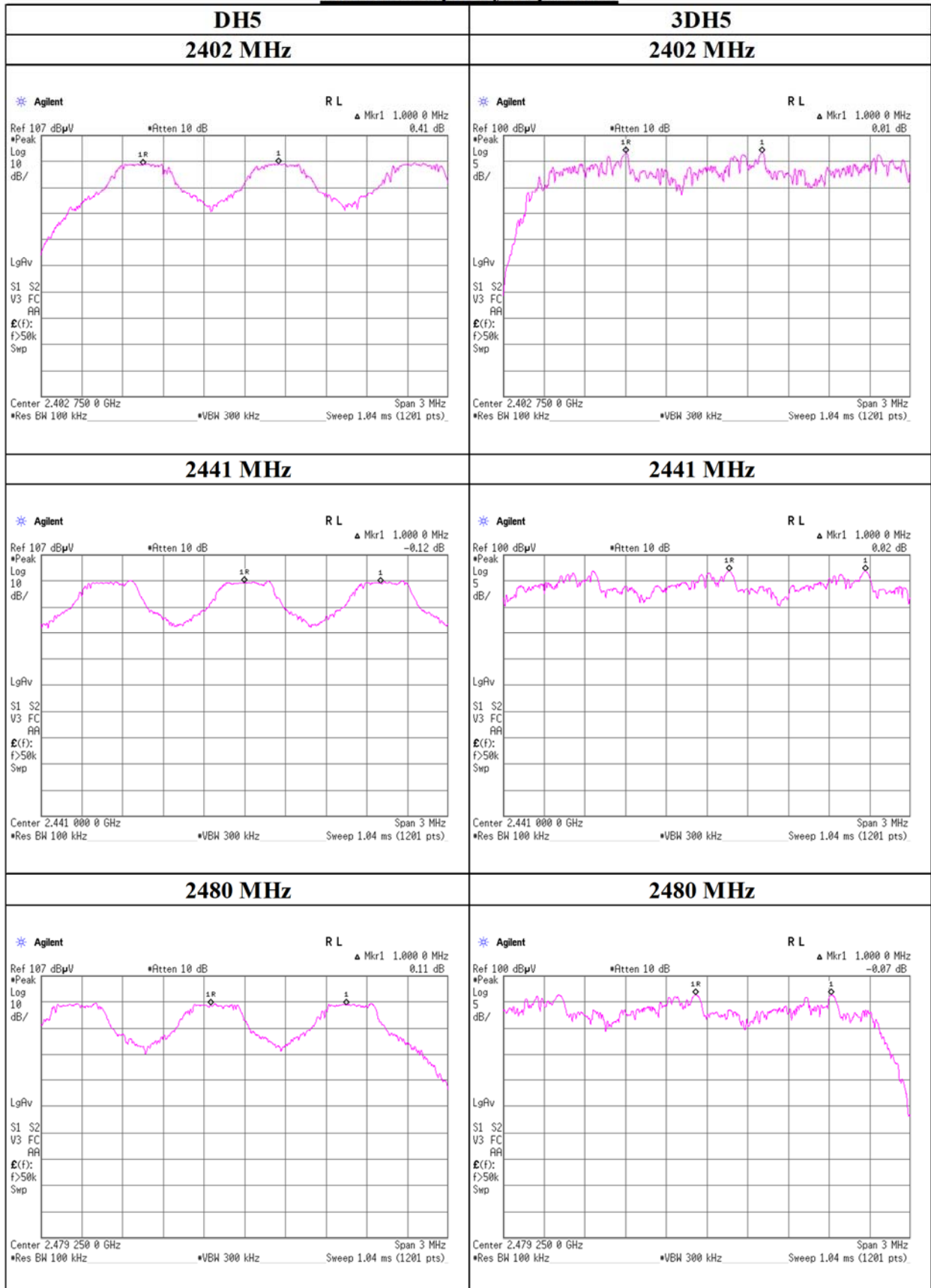
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Carrier Frequency Separation



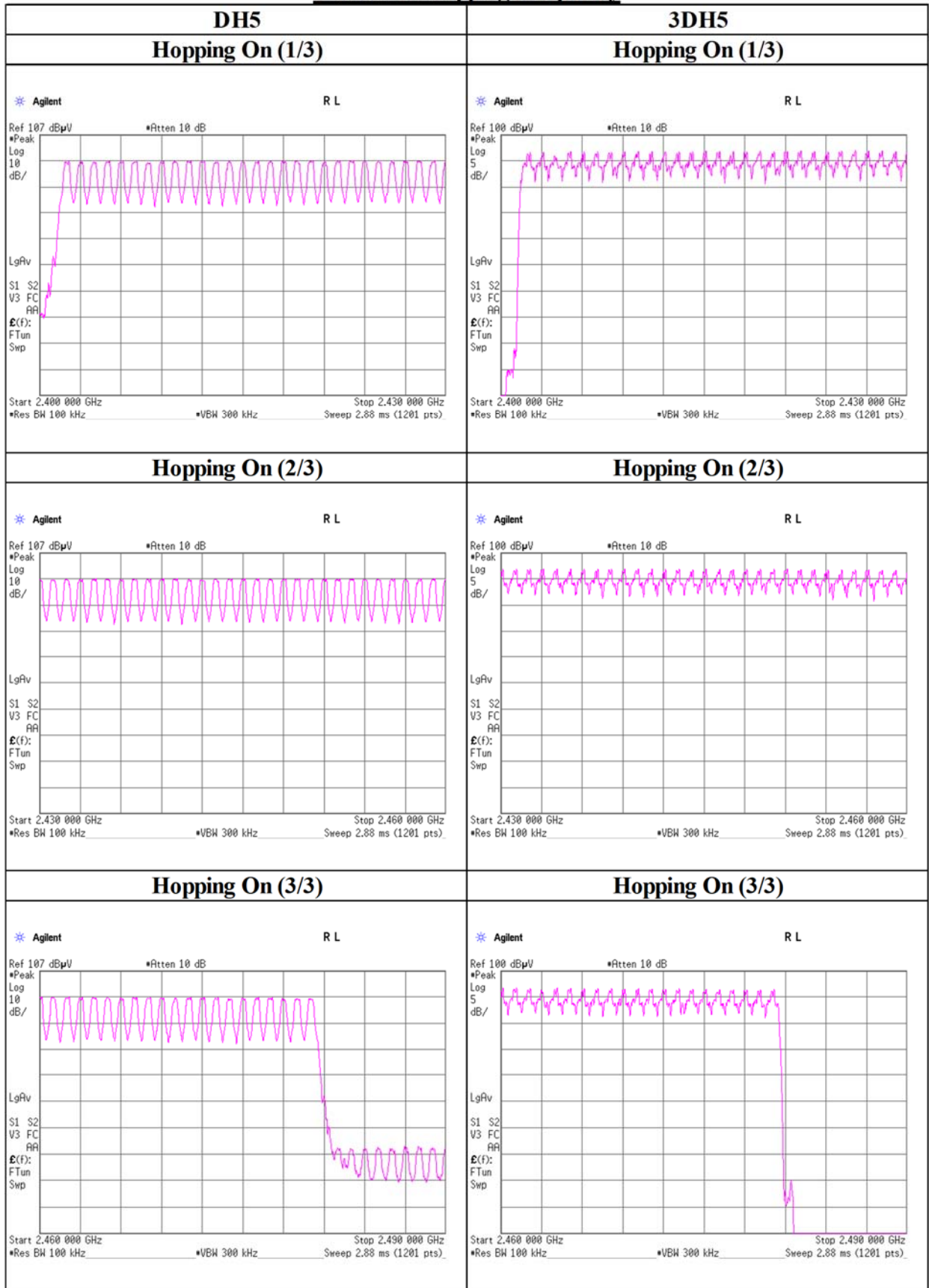
Number of Hopping Frequency

Report No. 13915091S-A-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date August 21, 2021
Temperature / Humidity 25 deg. C / 43 % RH
Engineer Kenichi Adachi
Mode Tx, Hopping On

Mode	Number of channel [channels]	Limit [channels]
DH5	79	≥ 15
3DH5	79	≥ 15

Test was not performed at AFH mode whose number of hopping channel is 20 channels because this Bluetooth radio is in compliance of Bluetooth Specification.

Number of Hopping Frequency



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Dwell time

Report No. 13915091S-A-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date August 21, 2021
Temperature / Humidity 25 deg. C / 43 % RH
Engineer Kenichi Adachi
Mode Tx, Hopping On

Mode	Number of transmission in a 31.6 (79 Hopping x 0.4)				Length of transmission [ms]	Result [ms]	Limit [ms]	
DH1	51.4 times	/	5 s x	31.6 s =	325 times	0.421	137	400
DH3	27.2 times	/	5 s x	31.6 s =	172 times	1.678	289	400
DH5	19.6 times	/	5 s x	31.6 s =	124 times	2.927	363	400
3DH1	50.2 times	/	5 s x	31.6 s =	318 times	0.428	136	400
3DH3	27.2 times	/	5 s x	31.6 s =	172 times	1.679	289	400
3DH5	19.4 times	/	5 s x	31.6 s =	123 times	2.930	360	400

Sample Calculation

Result = Number of transmission x Length of transmission

*Average data of 5 tests.(except Inquiry)

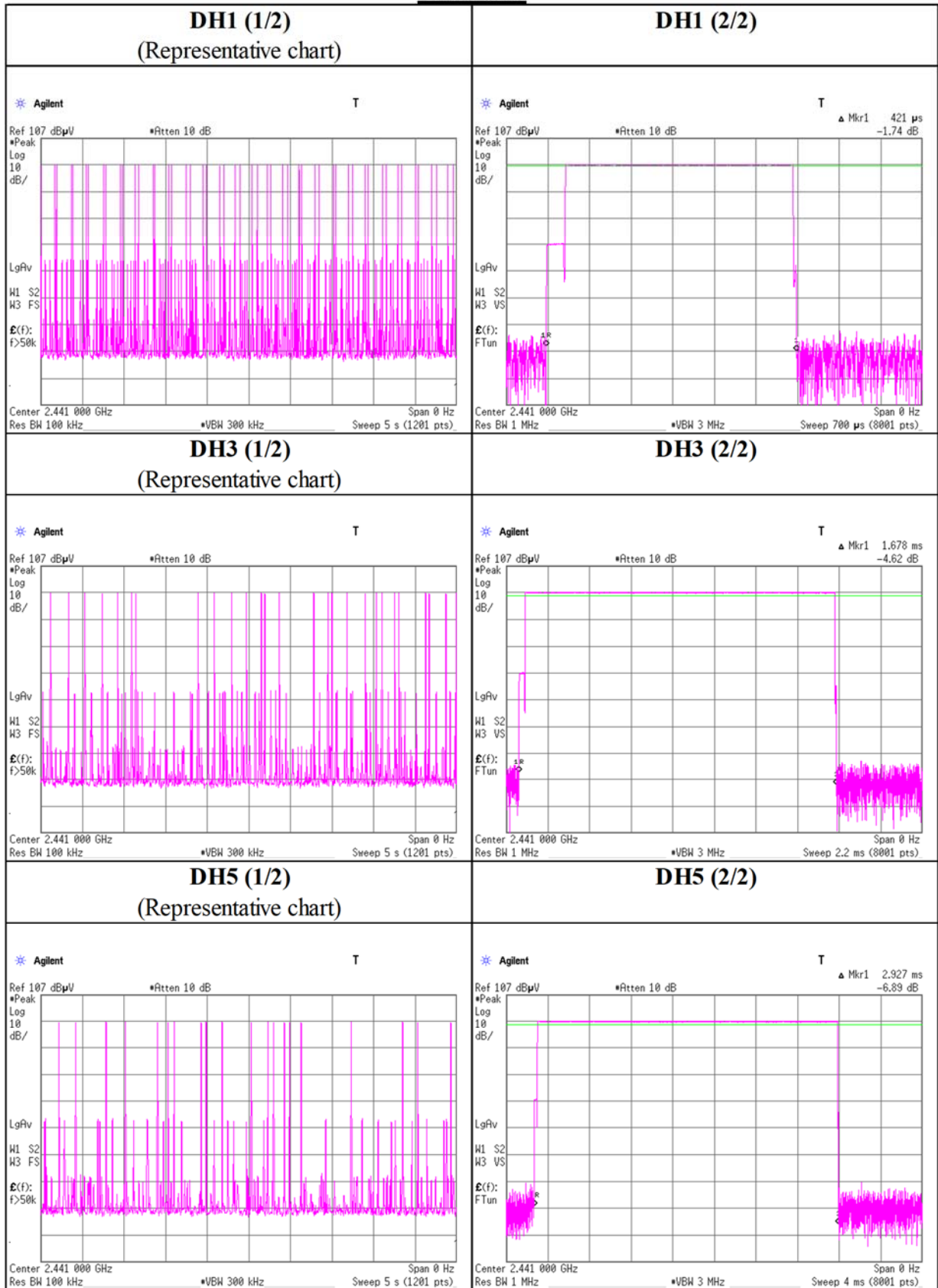
Mode	Sampling [times]					Average [times]
	1	2	3	4	5	
DH1	51	51	53	52	50	51.4
DH3	27	28	24	28	29	27.2
DH5	20	18	20	20	20	19.6
3DH1	50	49	49	52	51	50.2
3DH3	26	26	28	27	29	27.2
3DH5	20	19	22	18	18	19.4

Sample Calculation

Average = Summation (Sampling 1 to 5) / 5

This device complies with the Bluetooth protocol for FHSS operation, employing a pseudo random channel selection and hopping rate to ensure that the occupancy time in $N \times 0.4$ s, where N is the number of channels being used in the hopping sequence ($20 \leq N \leq 79$), is always less than 0.4 s regardless of packet size. This is confirmed in the test report for $N = 79$.

Dwell time



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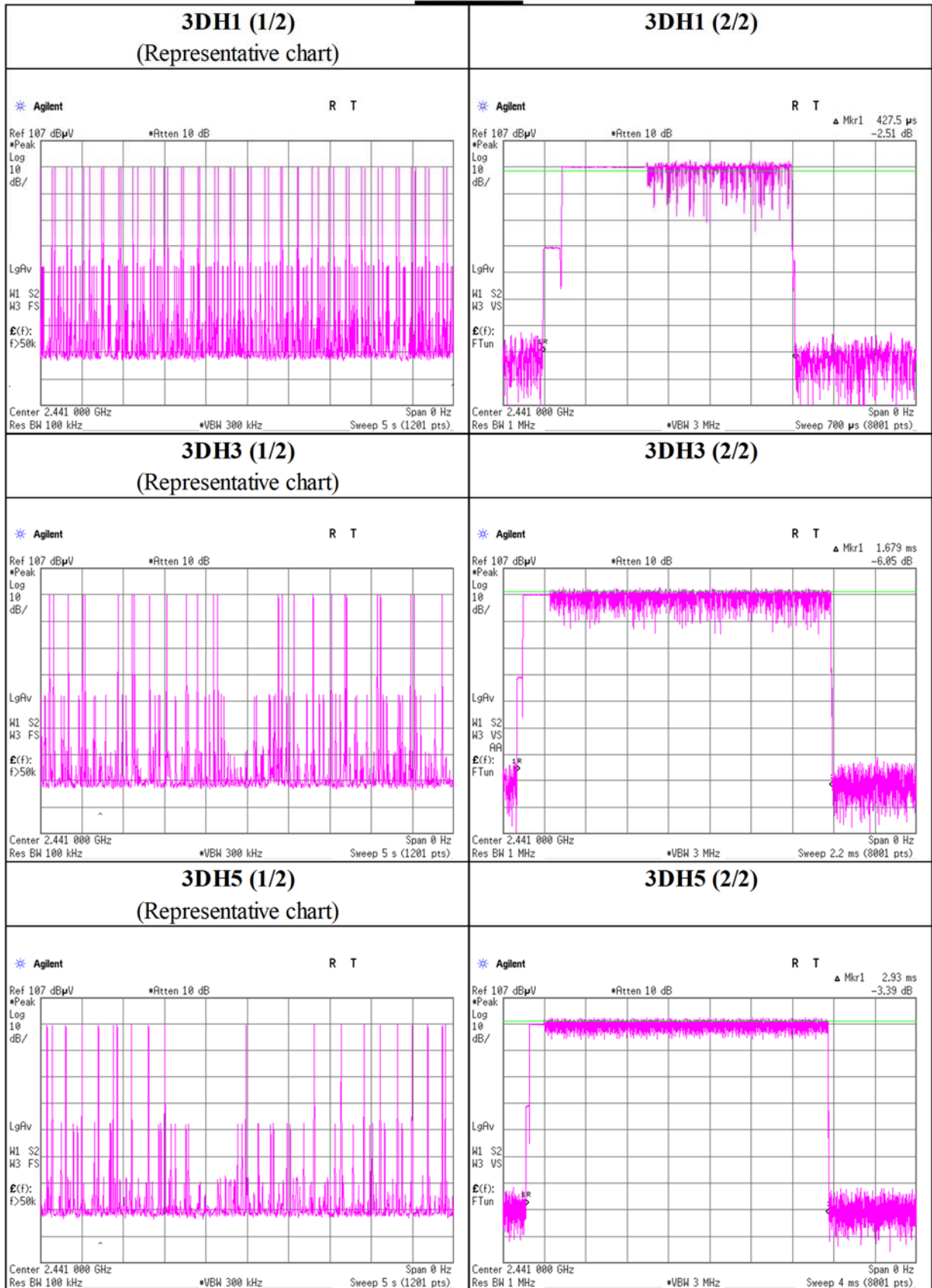
Shonan EMC Lab.

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Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Dwell time



Maximum Peak Output Power and Average power

Report No. 13915091S-A-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date August 21, 2021
Temperature / Humidity 25 deg. C / 43 % RH
Engineer Kenichi Adachi
Mode Tx, Hopping Off

Maximum peak output power

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Conducted Power					e.i.r.p. for RSS-247					
					Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
					[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
DH5	2402	-9.84	1.75	9.92	1.83	1.52	30.00	1000	28.17	3.36	5.19	3.30	36.02	4000	30.83
DH5	2441	-9.52	1.76	9.92	2.16	1.64	30.00	1000	27.84	3.36	5.52	3.56	36.02	4000	30.50
DH5	2480	-9.91	1.76	9.92	1.77	1.50	30.00	1000	28.23	3.36	5.13	3.26	36.02	4000	30.89
2DH5	2402	-7.39	1.75	9.92	4.28	2.68	30.00	1000	25.72	3.36	7.64	5.81	36.02	4000	28.38
2DH5	2441	-7.23	1.76	9.92	4.45	2.79	30.00	1000	25.55	3.36	7.81	6.04	36.02	4000	28.21
2DH5	2480	-7.92	1.76	9.92	3.76	2.38	30.00	1000	26.24	3.36	7.12	5.15	36.02	4000	28.90
3DH5	2402	-7.22	1.75	9.92	4.45	2.79	30.00	1000	25.55	3.36	7.81	6.04	36.02	4000	28.21
3DH5	2441	-7.08	1.76	9.92	4.60	2.88	30.00	1000	25.40	3.36	7.96	6.25	36.02	4000	28.06
3DH5	2480	-7.57	1.76	9.92	4.11	2.58	30.00	1000	25.89	3.36	7.47	5.58	36.02	4000	28.55

Sample Calculation:

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

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

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

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

Test was not performed at AFH mode, because the decrease of number of channel (min: 20 ch) at AFH mode does not influence on the output power and bandwidth of the EUT.
As this device had AFH mode and frequency separation could not meet the requirement of over 20 dB BW without 2/3 relaxation, 125 mW power limit was applied to it.

Average power (Reference data for RF Exposure)

Mode	Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
					[dBm]	[mW]		[dBm]	[mW]
					DH5	2402	-11.24	1.75	9.92
DH5	2441	-10.91	1.76	9.92	0.77	1.19	1.08	1.85	1.53
DH5	2480	-11.31	1.76	9.92	0.37	1.09	1.08	1.45	1.40
2DH5	2402	-11.06	1.75	9.92	0.61	1.15	1.07	1.68	1.47
2DH5	2441	-10.84	1.76	9.92	0.84	1.21	1.07	1.91	1.55
2DH5	2480	-11.53	1.76	9.92	0.15	1.04	1.07	1.22	1.33
3DH5	2402	-11.06	1.75	9.92	0.61	1.15	1.07	1.68	1.47
3DH5	2441	-10.84	1.76	9.92	0.84	1.21	1.07	1.91	1.55
3DH5	2480	-11.36	1.76	9.92	0.32	1.08	1.07	1.39	1.38

Sample Calculation:

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

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

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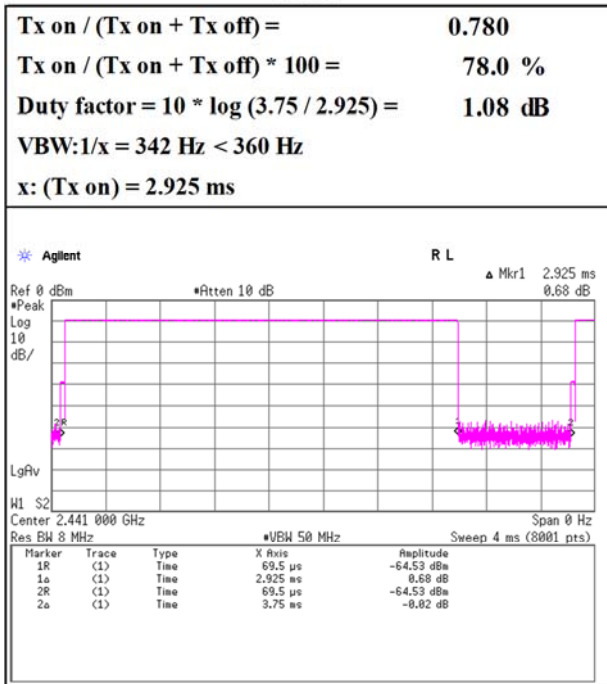
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

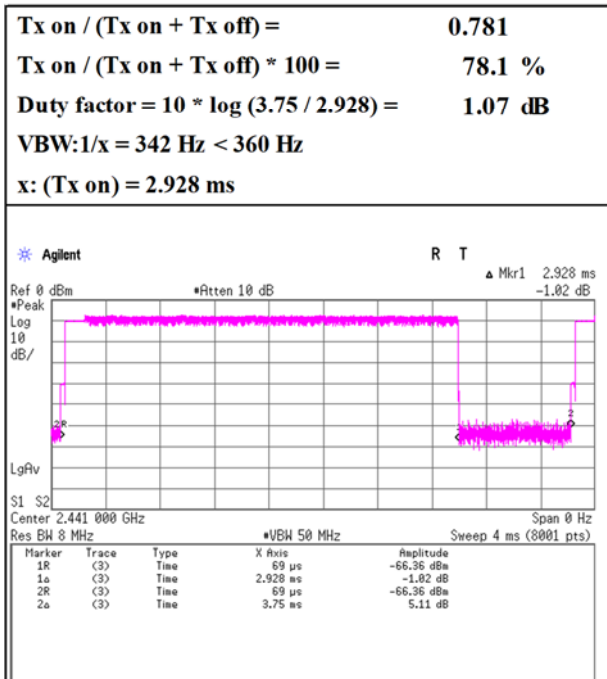
Burst Rate Confirmation

Report No. 13915091S-A-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date August 21, 2021
Temperature / Humidity 25 deg. C / 43 % RH
Engineer Kenichi Adachi
Mode Tx, Hopping Off

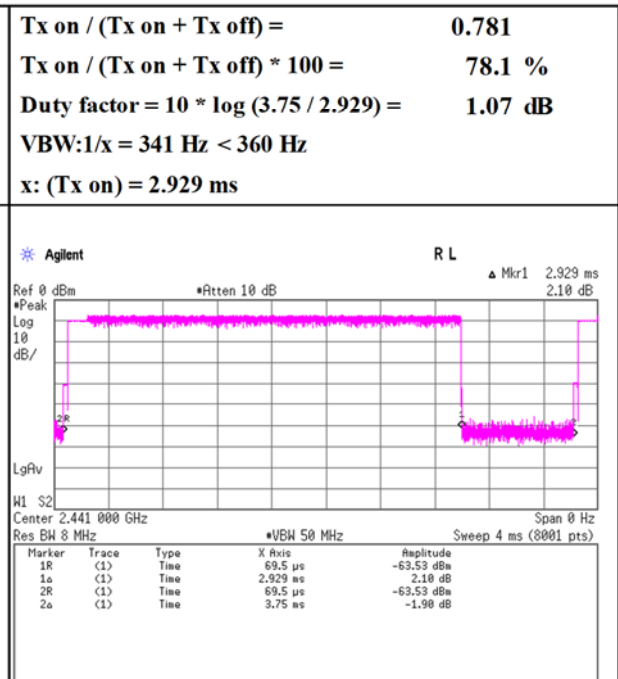
DH5



2DH5



3DH5



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Radiated Spurious Emission

Report No. 13915091S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1 No.1
Date August 23, 2021 August 22, 2021
Temperature / Humidity 24 deg.C, 64 %RH 22 deg.C, 57 %RH
Engineer Takahiro Kawakami Yusuke Tanikawara
(30 MHz -1 GHz, (1 GHz -18 GHz)
18 GHz -26.5 GHz)
Mode Tx, Hopping Off, DH5 2402 MHz

(* 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.	377.774	QP	24.53	15.18	7.09	31.80	0.00	15.00	46.0	31.0	100	77	-
Hori.	1441.241	PK	47.19	25.01	13.75	39.16	2.33	49.12	73.9	24.7	140	285	-
Hori.	2354.081	PK	45.72	27.82	14.79	39.60	2.33	51.06	73.9	22.8	148	257	-
Hori.	2378.045	PK	48.70	27.76	14.82	39.61	2.33	54.00	73.9	19.9	148	257	-
Hori.	2390.000	PK	45.35	27.73	14.83	39.61	2.33	50.63	73.9	23.2	148	257	-
Hori.	4804.000	PK	45.50	31.22	7.58	39.69	2.33	46.94	73.9	26.9	150	0	Floor noise
Hori.	7206.000	PK	44.87	36.56	9.34	39.49	2.33	53.61	73.9	20.2	150	0	Floor noise
Hori.	9608.000	PK	46.11	38.15	10.92	39.68	2.33	57.83	73.9	16.0	150	0	Floor noise
Hori.	1441.241	AV	38.93	25.01	13.75	39.16	2.33	40.86	53.9	13.0	140	285	*2), VBW:360 Hz
Hori.	2354.081	AV	35.85	27.82	14.79	39.60	2.33	41.19	53.9	12.7	148	257	*2), VBW:360 Hz
Hori.	2378.045	AV	40.91	27.76	14.82	39.61	2.33	46.21	53.9	7.6	148	257	*2), VBW:360 Hz
Hori.	2390.000	AV	33.64	27.73	14.83	39.61	2.33	38.92	53.9	14.9	148	257	*1), VBW:360 Hz
Hori.	4804.000	AV	33.62	31.22	7.58	39.69	2.33	35.06	53.9	18.8	150	0	Floor noise
Hori.	7206.000	AV	33.52	36.56	9.34	39.49	2.33	42.26	53.9	11.6	150	0	Floor noise
Hori.	9608.000	AV	34.12	38.15	10.92	39.68	2.33	45.84	53.9	8.0	150	0	Floor noise
Vert.	52.582	QP	35.87	10.35	7.46	31.81	0.00	21.87	40.0	18.1	100	232	-
Vert.	59.886	QP	37.27	8.22	7.27	31.81	0.00	20.95	40.0	19.0	100	353	-
Vert.	62.344	QP	37.38	7.72	7.24	31.81	0.00	20.53	40.0	19.4	100	358	-
Vert.	64.987	QP	35.51	7.21	7.21	31.81	0.00	18.12	40.0	21.8	100	26	-
Vert.	68.028	QP	33.89	6.77	7.42	31.81	0.00	16.27	40.0	23.7	100	25	-
Vert.	70.745	QP	34.89	6.47	7.60	31.81	0.00	17.15	40.0	22.8	100	359	-
Vert.	73.436	QP	34.85	6.29	7.85	31.81	0.00	17.18	40.0	22.8	100	12	-
Vert.	1441.231	PK	47.27	25.01	13.75	39.16	2.33	49.20	73.9	24.7	169	291	-
Vert.	2354.081	PK	46.27	27.82	14.79	39.60	2.33	51.61	73.9	22.2	209	245	-
Vert.	2378.044	PK	48.61	27.76	14.82	39.61	2.33	53.91	73.9	19.9	209	245	-
Vert.	2390.000	PK	45.37	27.73	14.83	39.61	2.33	50.65	73.9	23.2	209	245	-
Vert.	4804.000	PK	45.17	31.22	7.58	39.69	2.33	46.61	73.9	27.2	150	0	Floor noise
Vert.	7206.000	PK	44.96	36.56	9.34	39.49	2.33	53.70	73.9	20.2	150	0	Floor noise
Vert.	9608.000	PK	46.26	38.15	10.92	39.68	2.33	57.98	73.9	15.9	150	0	Floor noise
Vert.	1441.231	AV	40.18	25.01	13.75	39.16	2.33	42.11	53.9	11.7	169	291	*2), VBW:360 Hz
Vert.	2354.081	AV	36.29	27.82	14.79	39.60	2.33	41.63	53.9	12.2	209	245	*2), VBW:360 Hz
Vert.	2378.044	AV	41.04	27.76	14.82	39.61	2.33	46.34	53.9	7.5	209	245	*2), VBW:360 Hz
Vert.	2390.000	AV	33.65	27.73	14.83	39.61	2.33	38.93	53.9	14.9	209	245	*1), VBW:360 Hz
Vert.	4804.000	AV	33.68	31.22	7.58	39.69	2.33	35.12	53.9	18.7	150	0	Floor noise
Vert.	7206.000	AV	33.55	36.56	9.34	39.49	2.33	42.29	53.9	11.6	150	0	Floor noise
Vert.	9608.000	AV	34.34	38.15	10.92	39.68	2.33	46.06	53.9	7.8	150	0	Floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.92 m / 3.0 m) = 2.33 dB

10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

*These results have sufficient margin without taking account Duty cycle correction factor.

*1) Not out of band emission.(Leakage power)

*2) This spurious has same duty cycle as the carrier.

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.	2402.000	PK	95.56	27.71	14.85	39.62	2.33	100.83	-	-	Carrier
Hori.	2400.000	PK	40.25	27.71	14.84	39.62	2.33	45.51	80.8	35.2	-
Vert.	2402.000	PK	95.52	27.71	14.85	39.62	2.33	100.79	-	-	Carrier
Vert.	2400.000	PK	40.02	27.71	14.84	39.62	2.33	45.28	80.7	35.4	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.92 m / 3.0 m) = 2.33 dB

10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

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Shonan EMC Lab.

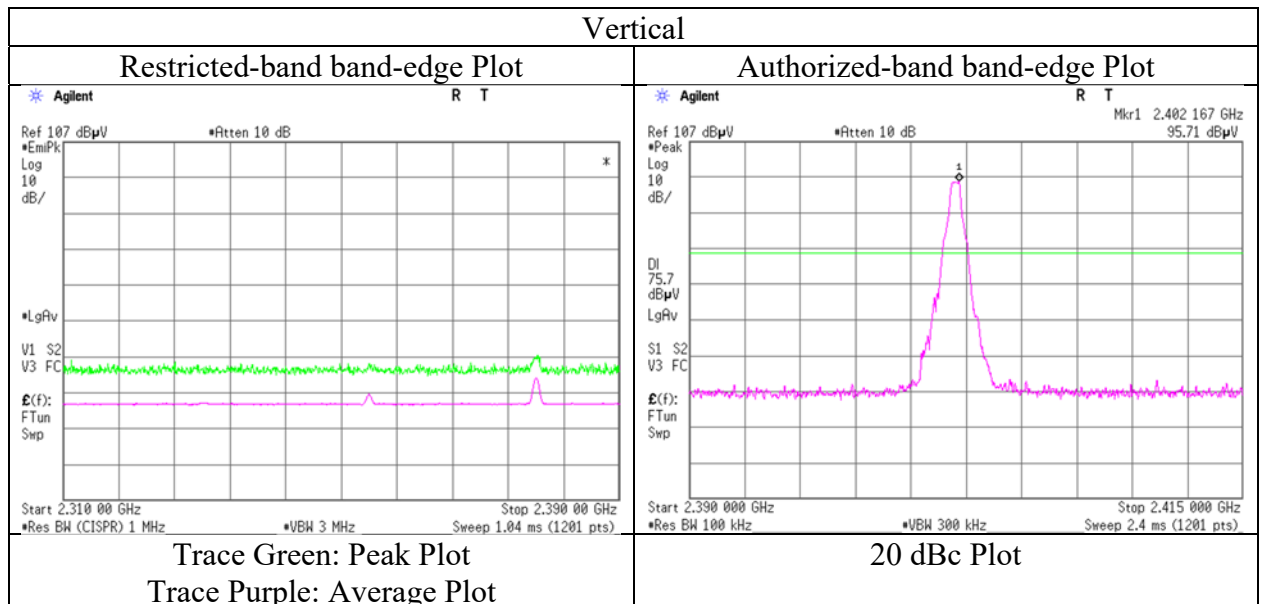
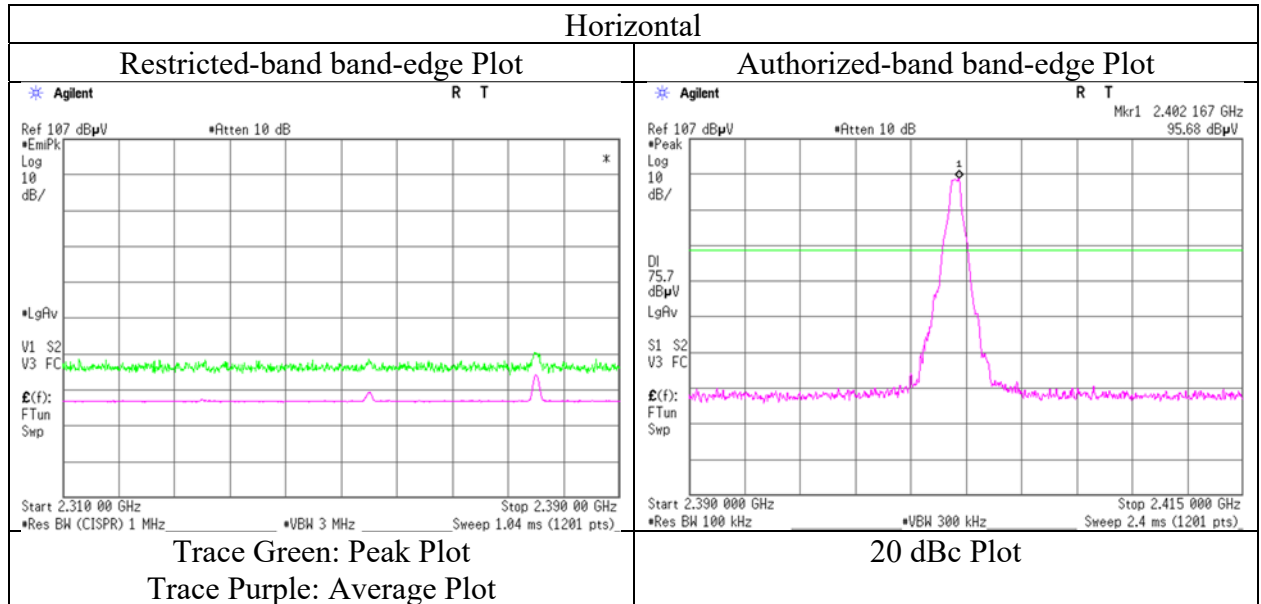
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

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Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13915091S-A-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	August 22, 2021
Temperature / Humidity	22 deg.C, 57 %RH
Engineer	Yusuke Tanikawara
Mode	Tx, Hopping Off, DH5 2402 MHz



* 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. 13915091S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1 No.1
Date August 23, 2021 August 22, 2021
Temperature / Humidity 24 deg.C, 64 %RH 22 deg.C, 57 %RH
Engineer Takahiro Kawakami Yusuke Tanikawara
(30 MHz -1 GHz, (1 GHz -18 GHz)
18 GHz -26.5 GHz)
Mode Tx, Hopping Off, DH5 2441 MHz

(* 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.	362.714	QP	26.36	15.11	6.99	31.79	0.00	16.67	46.0	29.3	100	44	-
Hori.	1464.630	PK	46.94	24.93	13.77	39.15	2.33	48.82	73.9	25.0	136	285	-
Hori.	2489.048	PK	45.97	27.60	14.94	39.65	2.33	51.19	73.9	22.7	207	265	-
Hori.	4882.000	PK	45.06	31.25	7.63	39.70	2.33	46.57	73.9	27.3	150	0	Floor noise
Hori.	7323.000	PK	43.44	36.69	9.42	39.46	2.33	52.42	73.9	21.4	150	0	Floor noise
Hori.	9764.000	PK	43.85	38.63	10.94	39.60	2.33	56.15	73.9	17.7	150	0	Floor noise
Hori.	1464.630	AV	38.77	24.93	13.77	39.15	2.33	40.65	53.9	13.2	136	285	*1), VBW:360 Hz
Hori.	2489.048	AV	34.56	27.60	14.94	39.65	2.33	39.78	53.9	14.1	207	265	*1), VBW:360 Hz
Hori.	4882.000	AV	33.48	31.25	7.63	39.70	2.33	34.99	53.9	18.9	150	0	Floor noise
Hori.	7323.000	AV	32.49	36.69	9.42	39.46	2.33	41.47	53.9	12.4	150	0	Floor noise
Hori.	9764.000	AV	32.82	38.63	10.94	39.60	2.33	45.12	53.9	8.7	150	0	Floor noise
Vert.	52.550	QP	35.01	10.36	7.45	31.81	0.00	21.01	40.0	18.9	100	322	-
Vert.	60.017	QP	36.75	8.19	7.27	31.81	0.00	20.40	40.0	19.6	100	0	-
Vert.	62.468	QP	38.63	7.70	7.24	31.81	0.00	21.76	40.0	18.2	100	359	-
Vert.	64.922	QP	36.50	7.23	7.21	31.81	0.00	19.13	40.0	20.8	100	351	-
Vert.	68.053	QP	34.46	6.76	7.42	31.81	0.00	16.83	40.0	23.1	100	345	-
Vert.	70.873	QP	35.21	6.45	7.61	31.81	0.00	17.46	40.0	22.5	100	8	-
Vert.	73.198	QP	35.18	6.29	7.83	31.81	0.00	17.49	40.0	22.5	100	1	-
Vert.	1464.631	PK	47.87	24.93	13.77	39.15	2.33	49.75	73.9	24.1	132	286	-
Vert.	2488.802	PK	45.72	27.60	14.94	39.65	2.33	50.94	73.9	22.9	144	218	-
Vert.	4882.000	PK	44.92	31.25	7.63	39.70	2.33	46.43	73.9	27.4	150	0	Floor noise
Vert.	7323.000	PK	43.56	36.69	9.42	39.46	2.33	52.54	73.9	21.3	150	0	Floor noise
Vert.	9764.000	PK	43.70	38.63	10.94	39.60	2.33	56.00	73.9	17.9	150	0	Floor noise
Vert.	1464.631	AV	40.57	24.93	13.77	39.15	2.33	42.45	53.9	11.4	132	286	*1), VBW:360 Hz
Vert.	2488.802	AV	34.78	27.60	14.94	39.65	2.33	40.00	53.9	13.9	144	218	*1), VBW:360 Hz
Vert.	4882.000	AV	33.46	31.25	7.63	39.70	2.33	34.97	53.9	18.9	150	0	Floor noise
Vert.	7323.000	AV	32.39	36.69	9.42	39.46	2.33	41.37	53.9	12.5	150	0	Floor noise
Vert.	9764.000	AV	32.84	38.63	10.94	39.60	2.33	45.14	53.9	8.7	150	0	Floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.92 m / 3.0 m) = 2.33 dB

10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

*These results have sufficient margin without taking account Duty cycle correction factor.

*1) This spurious has same duty cycle as the carrier.

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.	2441.000	PK	96.67	27.64	14.89	39.63	2.33	101.90	-	-	Carrier
Hori.	2393.022	PK	37.78	27.72	14.84	39.61	2.33	43.06	81.9	38.8	-
Vert.	2441.000	PK	95.79	27.64	14.89	39.63	2.33	101.02	-	-	Carrier
Vert.	2392.334	PK	37.93	27.73	14.83	39.61	2.33	43.21	81.0	37.7	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.92 m / 3.0 m) = 2.33 dB

10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

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Shonan EMC Lab.

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Radiated Spurious Emission

Report No. 13915091S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1 No.1
Date August 23, 2021 August 22, 2021
Temperature / Humidity 24 deg.C, 64 %RH 22 deg.C, 57 %RH
Engineer Takahiro Kawakami Yusuke Tanikawara
(30 MHz -1 GHz, (1 GHz -18 GHz)
18 GHz -26.5 GHz)
Mode Tx, Hopping Off, DH5 2480 MHz

(* 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.	366.711	QP	26.83	15.11	7.02	31.79	0.00	17.17	46.0	28.8	100	35	-
Hori.	1488.052	PK	46.90	24.86	13.81	39.14	2.33	48.76	73.9	25.1	134	278	-
Hori.	2483.500	PK	46.02	27.61	14.94	39.64	2.33	51.26	73.9	22.6	196	246	-
Hori.	4960.000	PK	44.49	31.43	7.70	39.72	2.33	46.23	73.9	27.6	150	0	Floor noise
Hori.	7440.000	PK	44.67	36.84	9.50	39.42	2.33	53.92	73.9	19.9	150	0	Floor noise
Hori.	9920.000	PK	42.93	38.71	10.96	39.52	2.33	55.41	73.9	18.4	150	0	Floor noise
Hori.	1488.052	AV	39.37	24.86	13.81	39.14	2.33	41.23	53.9	12.6	134	278	*2), VBW:360 Hz
Hori.	2483.500	AV	34.51	27.61	14.94	39.64	2.33	39.75	53.9	14.1	196	246	*1), VBW:360 Hz
Hori.	4960.000	AV	33.12	31.43	7.70	39.72	2.33	34.86	53.9	19.0	150	0	Floor noise
Hori.	7440.000	AV	32.45	36.84	9.50	39.42	2.33	41.70	53.9	12.2	150	0	Floor noise
Hori.	9920.000	AV	31.81	38.71	10.96	39.52	2.33	44.29	53.9	9.6	150	0	Floor noise
Vert.	52.539	QP	34.82	10.36	7.45	31.81	0.00	20.82	40.0	19.1	100	249	-
Vert.	59.999	QP	36.81	8.19	7.27	31.81	0.00	20.46	40.0	19.5	100	0	-
Vert.	62.417	QP	38.70	7.70	7.24	31.81	0.00	21.83	40.0	18.1	100	32	-
Vert.	64.818	QP	36.40	7.25	7.21	31.81	0.00	19.05	40.0	20.9	100	8	-
Vert.	68.108	QP	34.80	6.76	7.42	31.81	0.00	17.17	40.0	22.8	100	356	-
Vert.	71.014	QP	35.05	6.44	7.63	31.81	0.00	17.31	40.0	22.6	100	1	-
Vert.	73.267	QP	35.19	6.29	7.83	31.81	0.00	17.50	40.0	22.5	100	16	-
Vert.	1488.056	PK	47.32	24.86	13.81	39.14	2.33	49.18	73.9	24.7	133	274	-
Vert.	2483.500	PK	46.59	27.61	14.94	39.64	2.33	51.83	73.9	22.0	144	224	-
Vert.	4960.000	PK	44.64	31.43	7.70	39.72	2.33	46.38	73.9	27.5	150	0	Floor noise
Vert.	7440.000	PK	44.26	36.84	9.50	39.42	2.33	53.51	73.9	20.3	150	0	Floor noise
Vert.	9920.000	PK	42.99	38.71	10.96	39.52	2.33	55.47	73.9	18.4	150	0	Floor noise
Vert.	1488.056	AV	39.63	24.86	13.81	39.14	2.33	41.49	53.9	12.4	133	274	*2), VBW:360 Hz
Vert.	2483.500	AV	34.65	27.61	14.94	39.64	2.33	39.89	53.9	14.0	144	224	*1), VBW:360 Hz
Vert.	4960.000	AV	33.28	31.43	7.70	39.72	2.33	35.02	53.9	18.8	150	0	Floor noise
Vert.	7440.000	AV	32.54	36.84	9.50	39.42	2.33	41.79	53.9	12.1	150	0	Floor noise
Vert.	9920.000	AV	31.84	38.71	10.96	39.52	2.33	44.32	53.9	9.5	150	0	Floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.92 m / 3.0 m) = 2.33 dB

10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

*These results have sufficient margin without taking account Duty cycle correction factor.

*1) Not out of band emission.(Leakage power)

*2) This spurious has same duty cycle as the carrier.

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.	2480.000	PK	95.56	27.61	14.93	39.64	2.33	100.79	-	-	Carrier
Hori.	2504.051	PK	41.23	27.58	14.95	39.65	2.33	46.44	80.7	34.2	-
Hori.	2528.032	PK	39.96	27.58	14.97	39.64	2.33	45.20	80.7	35.5	-
Vert.	2480.000	PK	95.75	27.61	14.93	39.64	2.33	100.98	-	-	Carrier
Vert.	2504.053	PK	41.60	27.58	14.95	39.65	2.33	46.81	80.9	34.0	-
Vert.	2528.054	PK	39.30	27.58	14.97	39.64	2.33	44.54	80.9	36.3	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.92 m / 3.0 m) = 2.33 dB

10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

UL Japan, Inc.

Shonan EMC Lab.

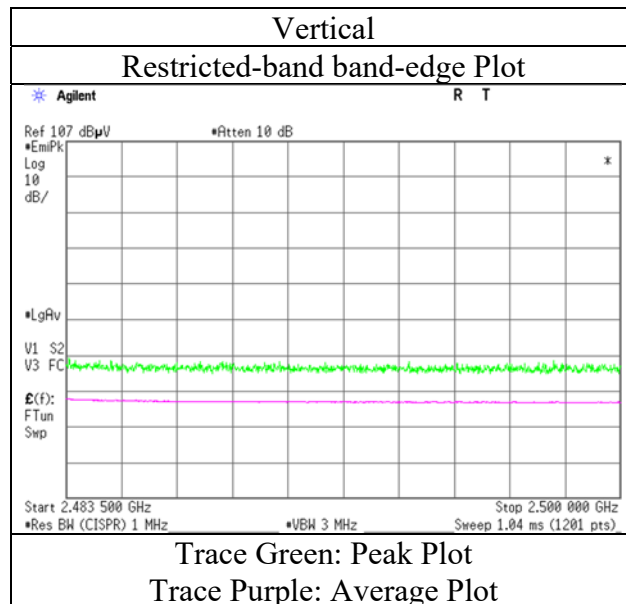
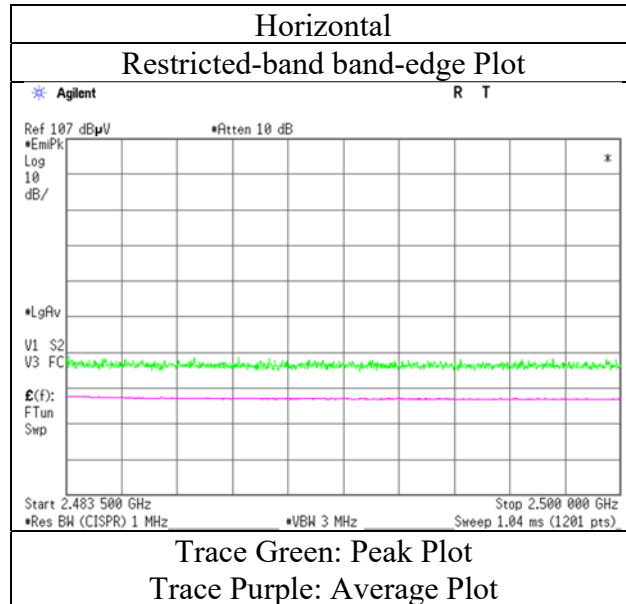
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13915091S-A-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	August 22, 2021
Temperature / Humidity	22 deg.C, 57 %RH
Engineer	Yusuke Tanikawara
Mode	Tx, Hopping Off, DH5 2480 MHz



* 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. 13915091S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1 No.1
Date August 23, 2021 August 22, 2021
Temperature / Humidity 24 deg.C, 64 %RH 22 deg.C, 57 %RH
Engineer Takahiro Kawakami Yusuke Tanikawara
(30 MHz -1 GHz, (1 GHz -18 GHz)
18 GHz -26.5 GHz)
Mode Tx, Hopping Off, 3DH5 2402 MHz

(* 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.	363.896	QP	26.19	15.10	7.00	31.79	0.00	16.50	46.0	29.5	100	36	-
Hori.	1441.246	PK	46.78	25.01	13.75	39.16	2.33	48.71	73.9	25.1	108	290	-
Hori.	2354.096	PK	46.84	27.82	14.79	39.60	2.33	52.18	73.9	21.7	241	257	-
Hori.	2378.050	PK	48.02	27.76	14.82	39.61	2.33	53.32	73.9	20.5	241	257	-
Hori.	2390.000	PK	45.70	27.73	14.83	39.61	2.33	50.98	73.9	22.9	241	257	-
Hori.	4804.000	PK	45.24	31.22	7.58	39.69	2.33	46.68	73.9	27.2	150	0	Floor noise
Hori.	7206.000	PK	45.52	36.56	9.34	39.49	2.33	54.26	73.9	19.6	150	0	Floor noise
Hori.	9608.000	PK	45.40	38.15	10.92	39.68	2.33	57.12	73.9	16.7	150	0	Floor noise
Hori.	1441.246	AV	38.06	25.01	13.75	39.16	2.33	39.99	53.9	13.9	108	290	*2), VBW:360 Hz
Hori.	2354.096	AV	36.04	27.82	14.79	39.60	2.33	41.38	53.9	12.5	241	257	*2), VBW:360 Hz
Hori.	2378.050	AV	39.78	27.76	14.82	39.61	2.33	45.08	53.9	8.8	241	257	*2), VBW:360 Hz
Hori.	2390.000	AV	33.76	27.73	14.83	39.61	2.33	39.04	53.9	14.8	241	257	*1), VBW:360 Hz
Hori.	4804.000	AV	33.56	31.22	7.58	39.69	2.33	35.00	53.9	18.9	150	0	Floor noise
Hori.	7206.000	AV	33.50	36.56	9.34	39.49	2.33	42.24	53.9	11.6	150	0	Floor noise
Hori.	9608.000	AV	34.32	38.15	10.92	39.68	2.33	46.04	53.9	7.8	150	0	Floor noise
Vert.	52.482	QP	35.10	10.38	7.45	31.81	0.00	21.12	40.0	18.8	100	259	-
Vert.	59.937	QP	36.75	8.21	7.27	31.81	0.00	20.42	40.0	19.5	100	312	-
Vert.	62.330	QP	38.31	7.72	7.24	31.81	0.00	21.46	40.0	18.5	100	358	-
Vert.	64.815	QP	35.92	7.25	7.21	31.81	0.00	18.57	40.0	21.4	100	0	-
Vert.	68.158	QP	34.62	6.75	7.42	31.81	0.00	16.98	40.0	23.0	100	351	-
Vert.	70.904	QP	34.89	6.45	7.61	31.81	0.00	17.14	40.0	22.8	100	312	-
Vert.	73.266	QP	35.08	6.29	7.83	31.81	0.00	17.39	40.0	22.6	100	358	-
Vert.	1441.235	PK	47.68	25.01	13.75	39.16	2.33	49.61	73.9	24.2	138	287	-
Vert.	2354.079	PK	46.94	27.82	14.79	39.60	2.33	52.28	73.9	21.6	152	214	-
Vert.	2378.055	PK	47.80	27.76	14.82	39.61	2.33	53.10	73.9	20.8	152	214	-
Vert.	2390.000	PK	44.77	27.73	14.83	39.61	2.33	50.05	73.9	23.8	152	214	-
Vert.	4804.000	PK	45.62	31.22	7.58	39.69	2.33	47.06	73.9	26.8	150	0	Floor noise
Vert.	7206.000	PK	45.10	36.56	9.34	39.49	2.33	53.84	73.9	20.0	150	0	Floor noise
Vert.	9608.000	PK	45.65	38.15	10.92	39.68	2.33	57.37	73.9	16.5	150	0	Floor noise
Vert.	1441.235	AV	39.54	25.01	13.75	39.16	2.33	41.47	53.9	12.4	138	287	*2), VBW:360 Hz
Vert.	2354.079	AV	36.18	27.82	14.79	39.60	2.33	41.52	53.9	12.3	152	214	*2), VBW:360 Hz
Vert.	2378.055	AV	39.56	27.76	14.82	39.61	2.33	44.86	53.9	9.0	152	214	*2), VBW:360 Hz
Vert.	2390.000	AV	33.61	27.73	14.83	39.61	2.33	38.89	53.9	15.0	152	214	*1), VBW:360 Hz
Vert.	4804.000	AV	33.64	31.22	7.58	39.69	2.33	35.08	53.9	18.8	150	0	Floor noise
Vert.	7206.000	AV	33.42	36.56	9.34	39.49	2.33	42.16	53.9	11.7	150	0	Floor noise
Vert.	9608.000	AV	34.29	38.15	10.92	39.68	2.33	46.01	53.9	7.8	150	0	Floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.92 m / 3.0 m) = 2.33 dB

10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

*These results have sufficient margin without taking account Duty cycle correction factor.

*1) Not out of band emission.(Leakage power)

*2) This spurious has same duty cycle as the carrier.

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.	2402.000	PK	95.76	27.71	14.85	39.62	2.33	101.03	-	-	Carrier
Hori.	2400.000	PK	38.89	27.71	14.84	39.62	2.33	44.15	81.0	36.8	-
Vert.	2402.000	PK	95.37	27.71	14.85	39.62	2.33	100.64	-	-	Carrier
Vert.	2400.000	PK	39.23	27.71	14.84	39.62	2.33	44.49	80.6	36.1	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.92 m / 3.0 m) = 2.33 dB

10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

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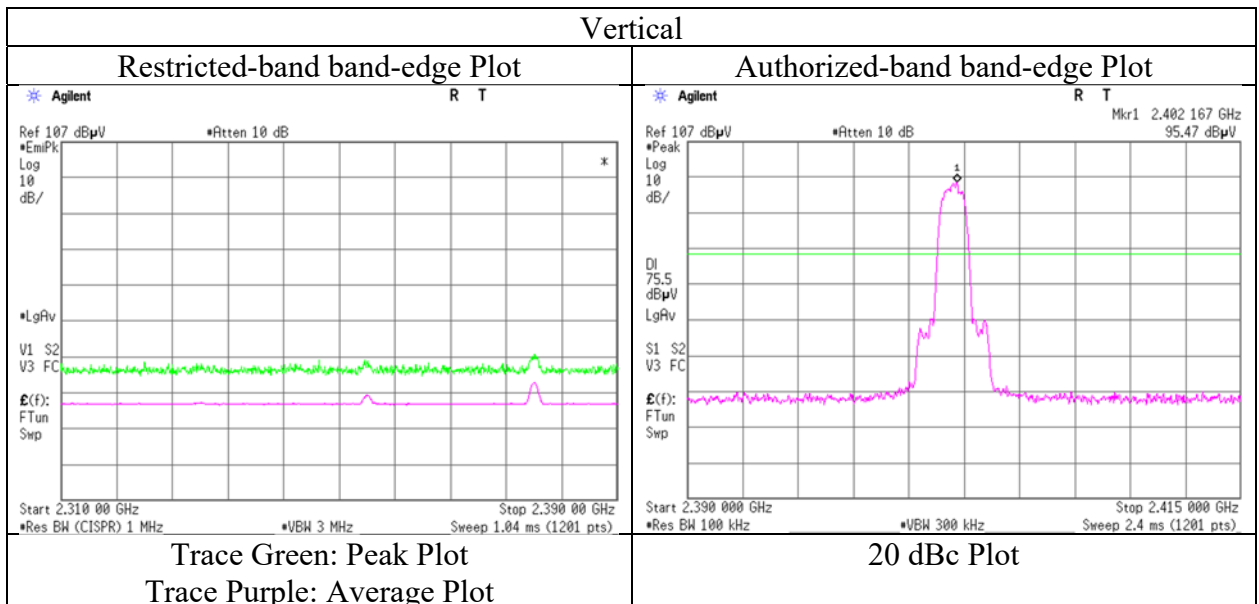
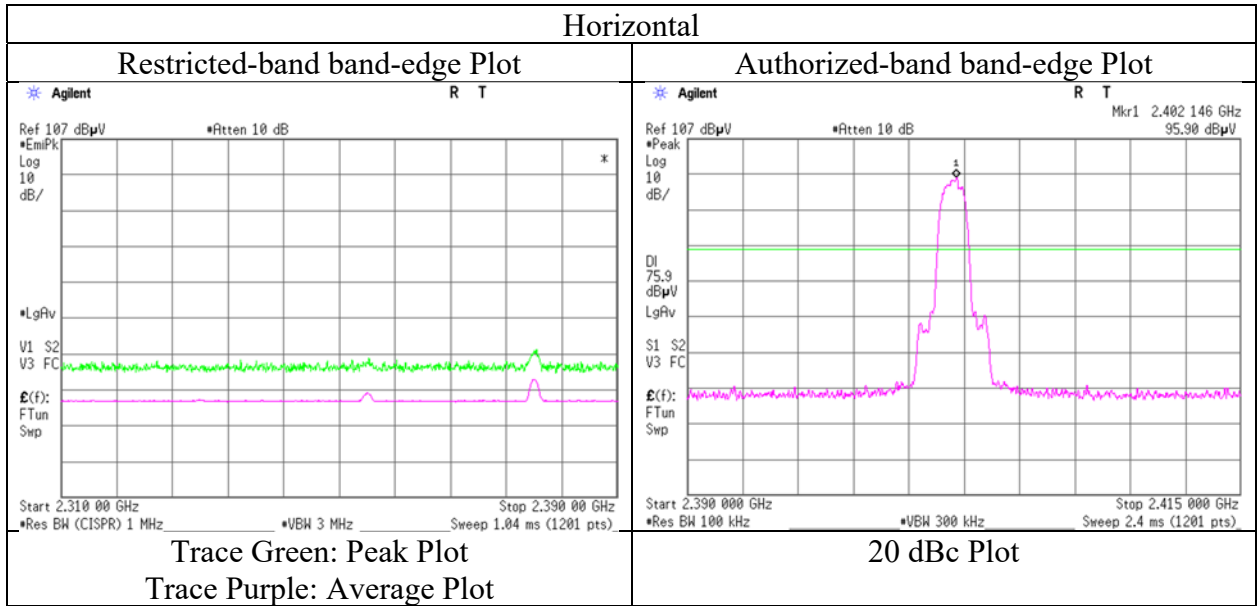
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Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	13915091S-A-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	August 22, 2021
Temperature / Humidity	22 deg.C, 57 %RH
Engineer	Yusuke Tanikawara
Mode	Tx, Hopping Off, 3DH5 2402 MHz



* 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. 13915091S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1 No.1
Date August 23, 2021 August 22, 2021
Temperature / Humidity 24 deg.C, 64 %RH 22 deg.C, 57 %RH
Engineer Takahiro Kawakami Yusuke Tanikawara
(30 MHz -1 GHz, (1 GHz -18 GHz)
18 GHz -26.5 GHz)
Mode Tx, Hopping Off, 3DH5 2441 MHz

(* 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.	365.707	QP	25.11	15.11	7.01	31.79	0.00	15.44	46.0	30.5	100	43	-
Hori.	1464.635	PK	46.67	24.93	13.77	39.15	2.33	48.55	73.9	25.3	134	281	-
Hori.	2489.055	PK	46.88	27.60	14.94	39.65	2.33	52.10	73.9	21.8	139	258	-
Hori.	4882.000	PK	44.76	31.25	7.63	39.70	2.33	46.27	73.9	27.6	150	0	Floor noise
Hori.	7323.000	PK	43.67	36.69	9.42	39.46	2.33	52.65	73.9	21.2	150	0	Floor noise
Hori.	9764.000	PK	43.71	38.63	10.94	39.60	2.33	56.01	73.9	17.8	150	0	Floor noise
Hori.	1464.635	AV	37.46	24.93	13.77	39.15	2.33	39.34	53.9	14.5	134	281	*1), VBW:360 Hz
Hori.	2489.055	AV	37.07	27.60	14.94	39.65	2.33	42.29	53.9	11.6	139	258	*1), VBW:360 Hz
Hori.	4882.000	AV	33.42	31.25	7.63	39.70	2.33	34.93	53.9	18.9	150	0	Floor noise
Hori.	7323.000	AV	32.48	36.69	9.42	39.46	2.33	41.46	53.9	12.4	150	0	Floor noise
Hori.	9764.000	AV	32.73	38.63	10.94	39.60	2.33	45.03	53.9	8.8	150	0	Floor noise
Vert.	52.514	QP	35.98	10.37	7.45	31.81	0.00	21.99	40.0	18.0	100	274	-
Vert.	59.865	QP	37.26	8.23	7.27	31.81	0.00	20.95	40.0	19.0	100	0	-
Vert.	62.390	QP	38.10	7.71	7.24	31.81	0.00	21.24	40.0	18.7	100	353	-
Vert.	65.019	QP	35.65	7.21	7.22	31.81	0.00	18.27	40.0	21.7	100	2	-
Vert.	68.053	QP	33.91	6.76	7.42	31.81	0.00	16.28	40.0	23.7	100	347	-
Vert.	70.769	QP	34.95	6.46	7.60	31.81	0.00	17.20	40.0	22.8	100	19	-
Vert.	73.385	QP	34.72	6.29	7.84	31.81	0.00	17.04	40.0	22.9	100	325	-
Vert.	1464.631	PK	47.36	24.93	13.77	39.15	2.33	49.24	73.9	24.6	134	279	-
Vert.	2489.056	PK	47.02	27.60	14.94	39.65	2.33	52.24	73.9	21.6	135	217	-
Vert.	4882.000	PK	44.62	31.25	7.63	39.70	2.33	46.13	73.9	27.7	150	0	Floor noise
Vert.	7323.000	PK	43.47	36.69	9.42	39.46	2.33	52.45	73.9	21.4	150	0	Floor noise
Vert.	9764.000	PK	44.23	38.63	10.94	39.60	2.33	56.53	73.9	17.3	150	0	Floor noise
Vert.	1464.631	AV	38.42	24.93	13.77	39.15	2.33	40.30	53.9	13.6	134	279	*1), VBW:360 Hz
Vert.	2489.056	AV	37.57	27.60	14.94	39.65	2.33	42.79	53.9	11.1	135	217	*1), VBW:360 Hz
Vert.	4882.000	AV	33.36	31.25	7.63	39.70	2.33	34.87	53.9	19.0	150	0	Floor noise
Vert.	7323.000	AV	32.42	36.69	9.42	39.46	2.33	41.40	53.9	12.5	150	0	Floor noise
Vert.	9764.000	AV	32.75	38.63	10.94	39.60	2.33	45.05	53.9	8.8	150	0	Floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.92 m / 3.0 m) = 2.33 dB

10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

*These results have sufficient margin without taking account Duty cycle correction factor.

*1) This spurious has same duty cycle as the carrier.

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.	2441.000	PK	95.44	27.64	14.89	39.63	2.33	100.67	-	-	Carrier
Hori.	2393.034	PK	37.29	27.72	14.84	39.61	2.33	42.57	80.6	38.0	-
Vert.	2441.000	PK	95.90	27.64	14.89	39.63	2.33	101.13	-	-	Carrier
Vert.	2393.034	PK	38.11	27.72	14.84	39.61	2.33	43.39	81.1	37.7	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.92 m / 3.0 m) = 2.33 dB

10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

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Radiated Spurious Emission

Report No. 13915091S-A-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1 No.1
Date August 23, 2021 August 22, 2021
Temperature / Humidity 24 deg.C, 64 %RH 22 deg.C, 57 %RH
Engineer Takahiro Kawakami Yusuke Tanikawara
(30 MHz -1 GHz, (1 GHz -18 GHz)
18 GHz -26.5 GHz)
Mode Tx, Hopping Off, 3DH5 2480 MHz

(* 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.	366.833	QP	24.67	15.11	7.02	31.79	0.00	15.01	46.0	30.9	100	37	-
Hori.	1488.054	PK	46.83	24.86	13.81	39.14	2.33	48.69	73.9	25.2	132	273	-
Hori.	2483.500	PK	45.54	27.61	14.94	39.64	2.33	50.78	73.9	23.1	192	250	-
Hori.	4960.000	PK	44.50	31.43	7.70	39.72	2.33	46.24	73.9	27.6	150	0	Floor noise
Hori.	7440.000	PK	44.43	36.84	9.50	39.42	2.33	53.68	73.9	20.2	150	0	Floor noise
Hori.	9920.000	PK	42.70	38.71	10.96	39.52	2.33	55.18	73.9	18.7	150	0	Floor noise
Hori.	1488.054	AV	37.34	24.86	13.81	39.14	2.33	39.20	53.9	14.7	132	273	*2), VBW:360 Hz
Hori.	2483.500	AV	34.47	27.61	14.94	39.64	2.33	39.71	53.9	14.1	192	250	*1), VBW:360 Hz
Hori.	4960.000	AV	33.18	31.43	7.70	39.72	2.33	34.92	53.9	18.9	150	0	Floor noise
Hori.	7440.000	AV	32.42	36.84	9.50	39.42	2.33	41.67	53.9	12.2	150	0	Floor noise
Hori.	9920.000	AV	31.86	38.71	10.96	39.52	2.33	44.34	53.9	9.5	150	0	Floor noise
Vert.	52.468	QP	35.87	10.39	7.45	31.81	0.00	21.90	40.0	18.1	100	281	-
Vert.	59.915	QP	37.28	8.21	7.26	31.81	0.00	20.94	40.0	19.0	100	26	-
Vert.	62.418	QP	38.43	7.70	7.24	31.81	0.00	21.56	40.0	18.4	100	5	-
Vert.	64.880	QP	36.05	7.23	7.21	31.81	0.00	18.68	40.0	21.3	100	359	-
Vert.	67.898	QP	34.45	6.78	7.40	31.81	0.00	16.82	40.0	23.1	100	4	-
Vert.	70.893	QP	34.78	6.45	7.61	31.81	0.00	17.03	40.0	22.9	100	11	-
Vert.	73.356	QP	34.75	6.29	7.84	31.81	0.00	17.07	40.0	22.9	100	7	-
Vert.	1488.065	PK	46.74	24.86	13.81	39.14	2.33	48.60	73.9	25.3	130	270	-
Vert.	2483.500	PK	46.04	27.61	14.94	39.64	2.33	51.28	73.9	22.6	144	224	-
Vert.	4960.000	PK	44.62	31.43	7.70	39.72	2.33	46.36	73.9	27.5	150	0	Floor noise
Vert.	7440.000	PK	43.94	36.84	9.50	39.42	2.33	53.19	73.9	20.7	150	0	Floor noise
Vert.	9920.000	PK	43.43	38.71	10.96	39.52	2.33	55.91	73.9	17.9	150	0	Floor noise
Vert.	1488.065	AV	37.78	24.86	13.81	39.14	2.33	39.64	53.9	14.2	130	270	*2), VBW:360 Hz
Vert.	2483.500	AV	34.75	27.61	14.94	39.64	2.33	39.99	53.9	13.9	144	224	*1), VBW:360 Hz
Vert.	4960.000	AV	33.31	31.43	7.70	39.72	2.33	35.05	53.9	18.8	150	0	Floor noise
Vert.	7440.000	AV	32.51	36.84	9.50	39.42	2.33	41.76	53.9	12.1	150	0	Floor noise
Vert.	9920.000	AV	31.87	38.71	10.96	39.52	2.33	44.35	53.9	9.5	150	0	Floor noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.92 m / 3.0 m) = 2.33 dB

10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

*These results have sufficient margin without taking account Duty cycle correction factor.

*1) Not out of band emission.(Leakage power)

*2) This spurious has same duty cycle as the carrier.

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.	2480.000	PK	94.78	27.61	14.93	39.64	2.33	100.01	-	-	Carrier
Hori.	2504.059	PK	40.12	27.58	14.95	39.65	2.33	45.33	80.0	34.6	-
Hori.	2528.039	PK	39.01	27.58	14.97	39.64	2.33	44.25	80.0	35.7	-
Vert.	2480.000	PK	95.04	27.61	14.93	39.64	2.33	100.27	-	-	Carrier
Vert.	2504.037	PK	40.55	27.58	14.95	39.65	2.33	45.76	80.2	34.4	-
Vert.	2528.056	PK	37.87	27.58	14.97	39.64	2.33	43.11	80.2	37.0	-

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : 20log(3.92 m / 3.0 m) = 2.33 dB

10 GHz - 40 GHz : 20log(1.0 m / 3.0 m) = -9.54 dB

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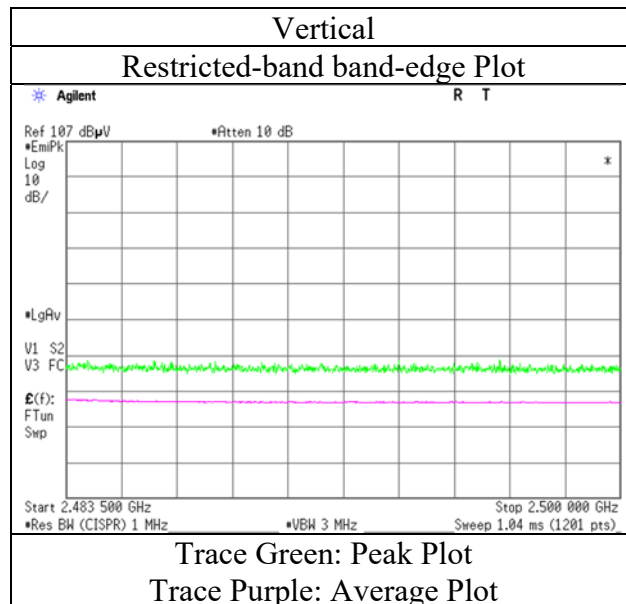
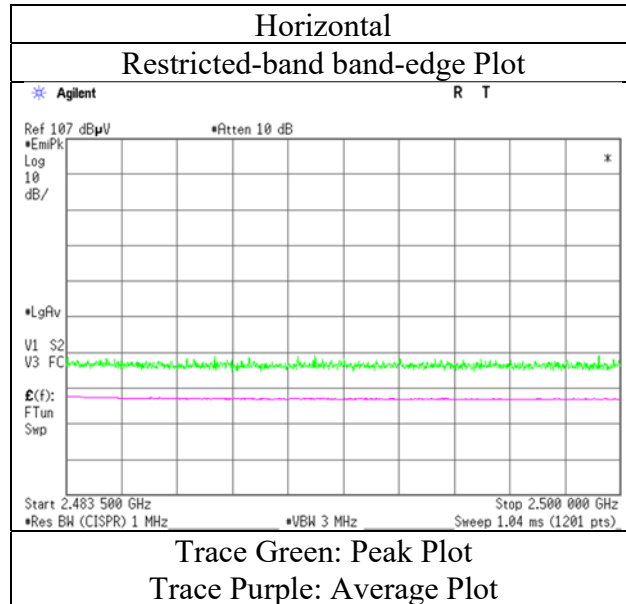
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Radiated Spurious Emission
(Reference Plot for band-edge)

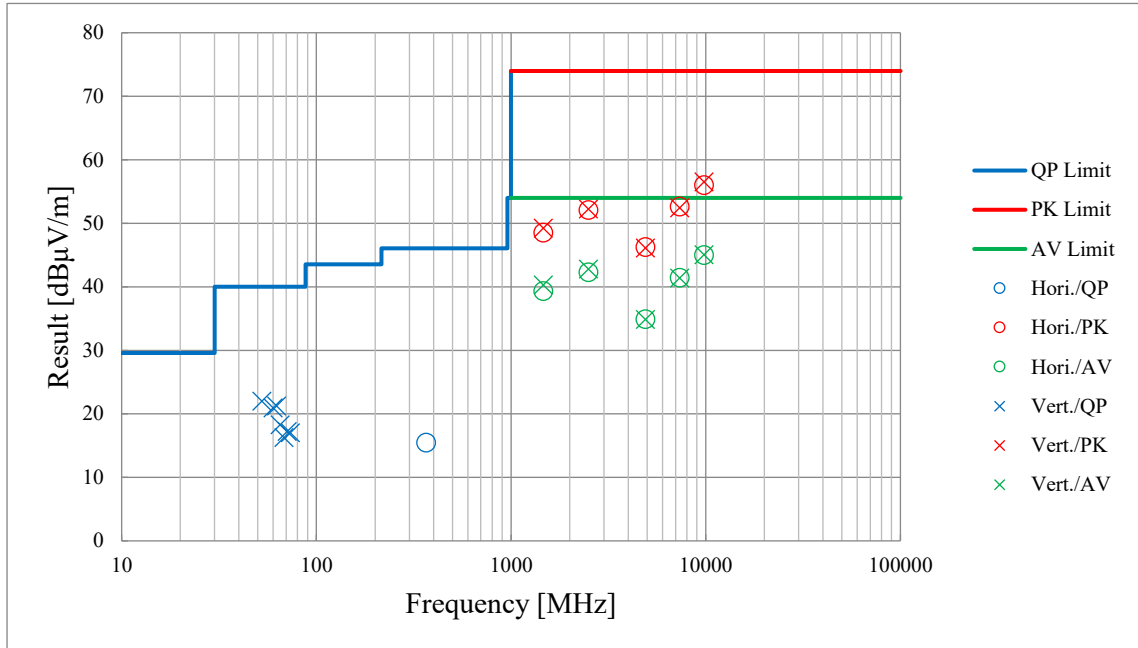
Report No.	13915091S-A-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	August 22, 2021
Temperature / Humidity	22 deg.C, 57 %RH
Engineer	Yusuke Tanikawara
Mode	Tx, Hopping Off, 3DH5 2480 MHz



* 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.	13915091S-A-R1	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.1	No.1
Date	August 23, 2021	August 22, 2021
Temperature / Humidity	24 deg.C, 64 %RH	22 deg.C, 57 %RH
Engineer	Takahiro Kawakami (30 MHz -1 GHz, 18 GHz -26.5 GHz)	Yusuke Tanikawara (1 GHz -18 GHz)
Mode	Tx, Hopping Off, 3DH5 2441 MHz	

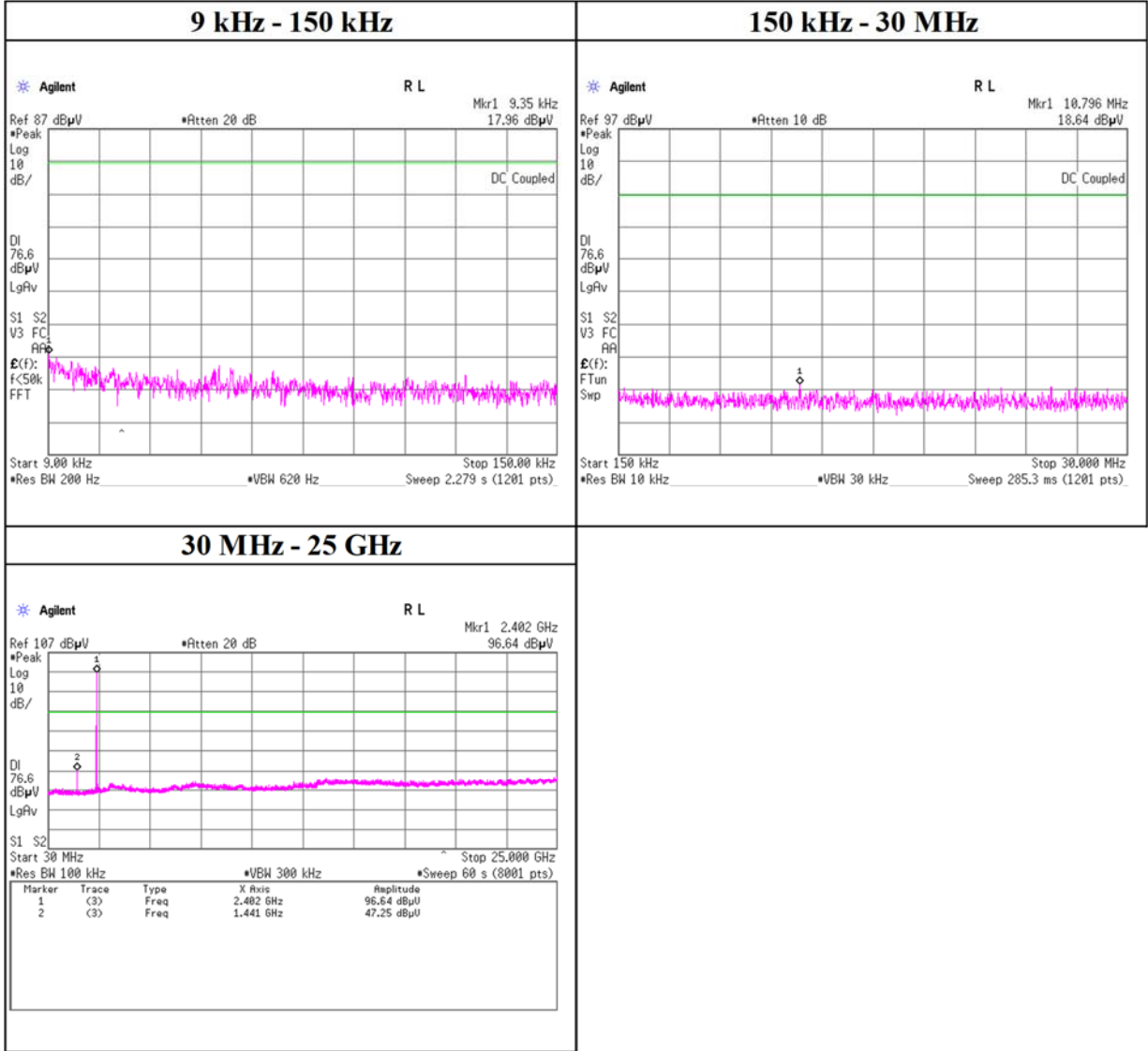


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

Conducted Spurious Emission

Report No. 13915091S-A-R1
 Test place Shonan EMC Lab. No.1 Measurement Room
 Date August 21, 2021
 Temperature / Humidity 25 deg. C / 43 % RH
 Engineer Kenichi Adachi
 Mode Tx, Hopping Off, DH5, 2402 MHz

2402 MHz



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Shonan EMC Lab.

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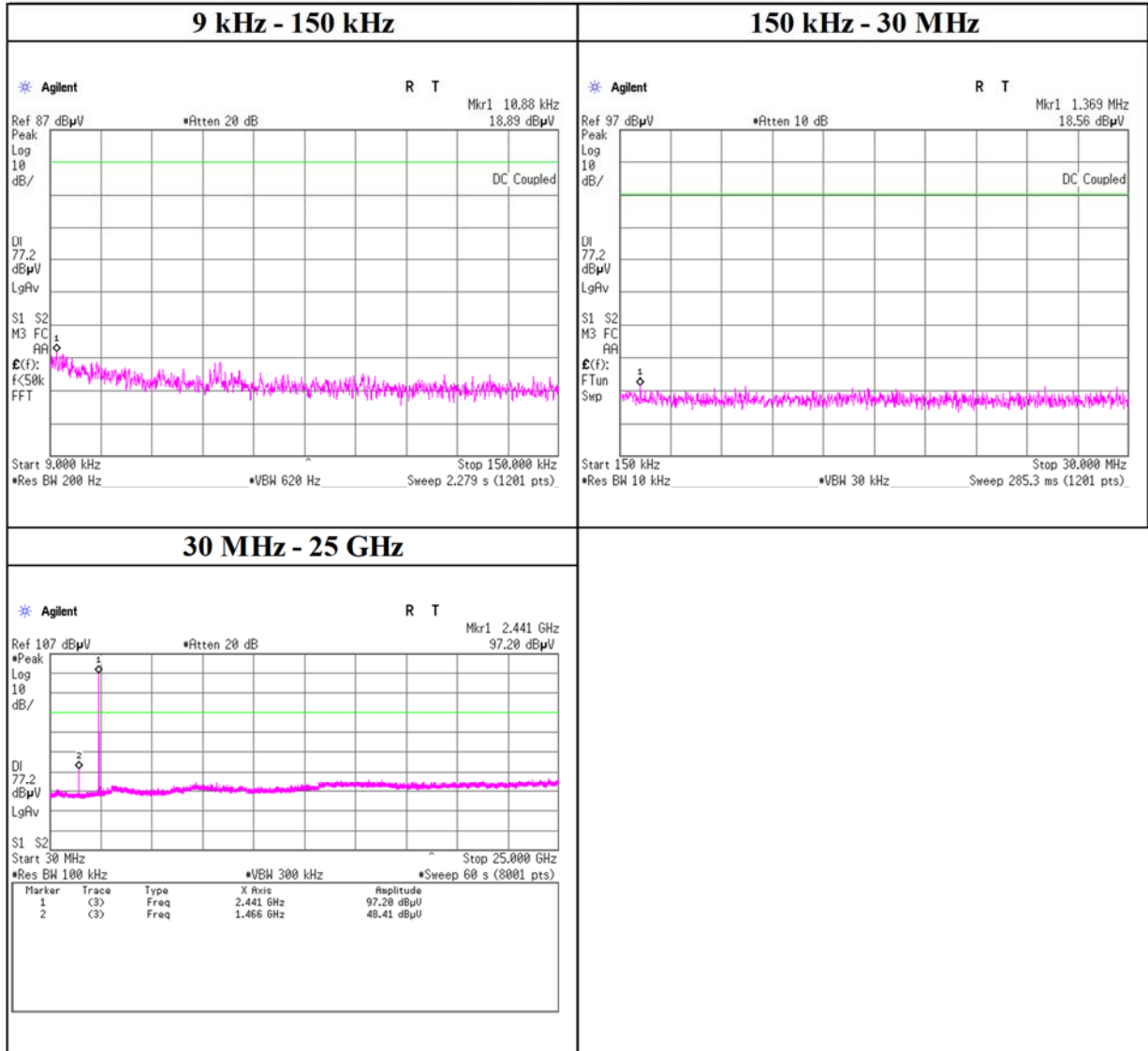
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Conducted Spurious Emission

Report No. 13915091S-A-R1
 Test place Shonan EMC Lab. No.1 Measurement Room
 Date August 21, 2021
 Temperature / Humidity 25 deg. C / 43 % RH
 Engineer Kenichi Adachi
 Mode Tx, Hopping Off, DH5, 2441 MHz

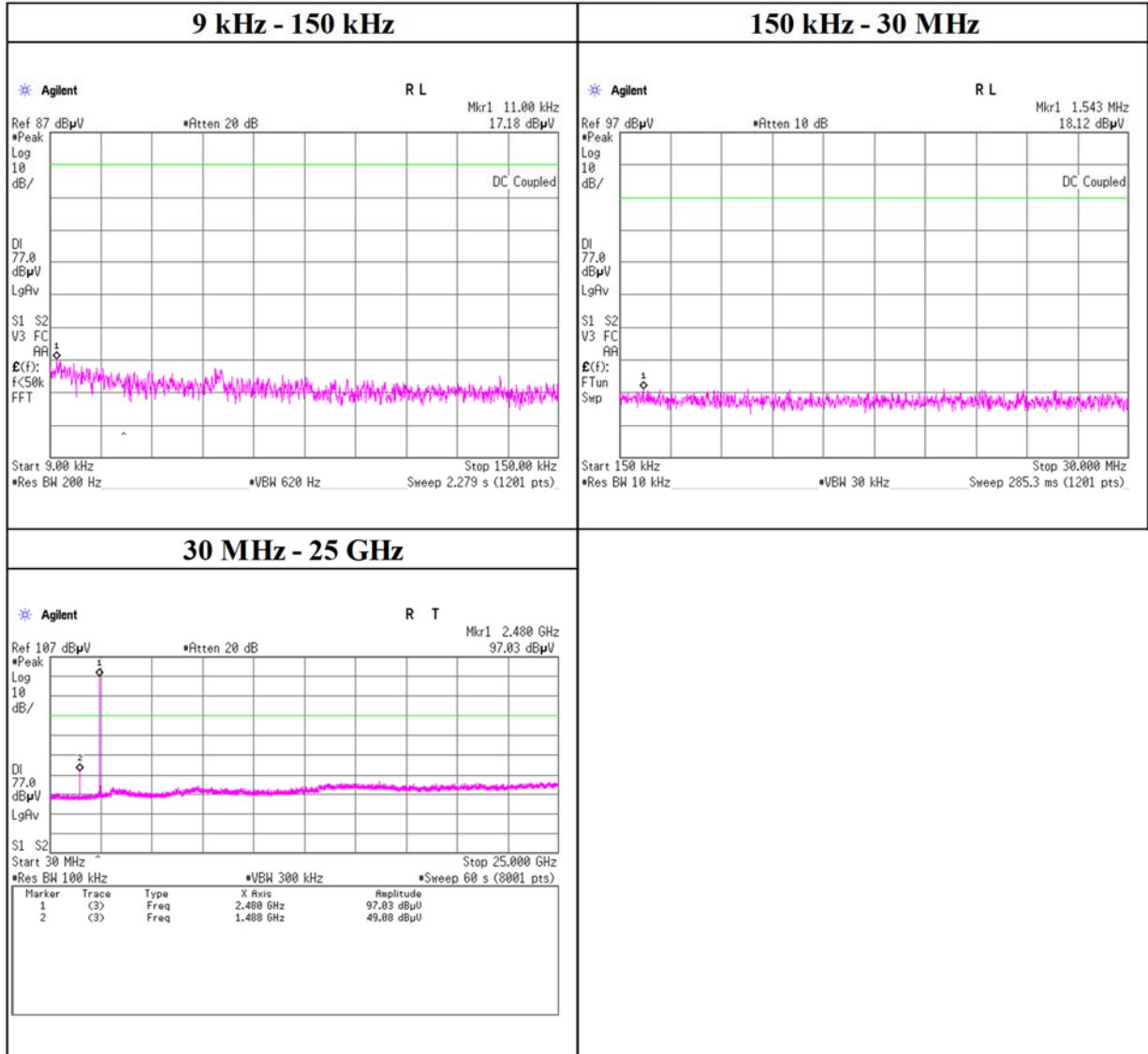
2441 MHz



Conducted Spurious Emission

Report No. 13915091S-A-R1
 Test place Shonan EMC Lab. No.1 Measurement Room
 Date August 21, 2021
 Temperature / Humidity 25 deg. C / 43 % RH
 Engineer Kenichi Adachi
 Mode Tx, Hopping Off, DH5, 2480 MHz

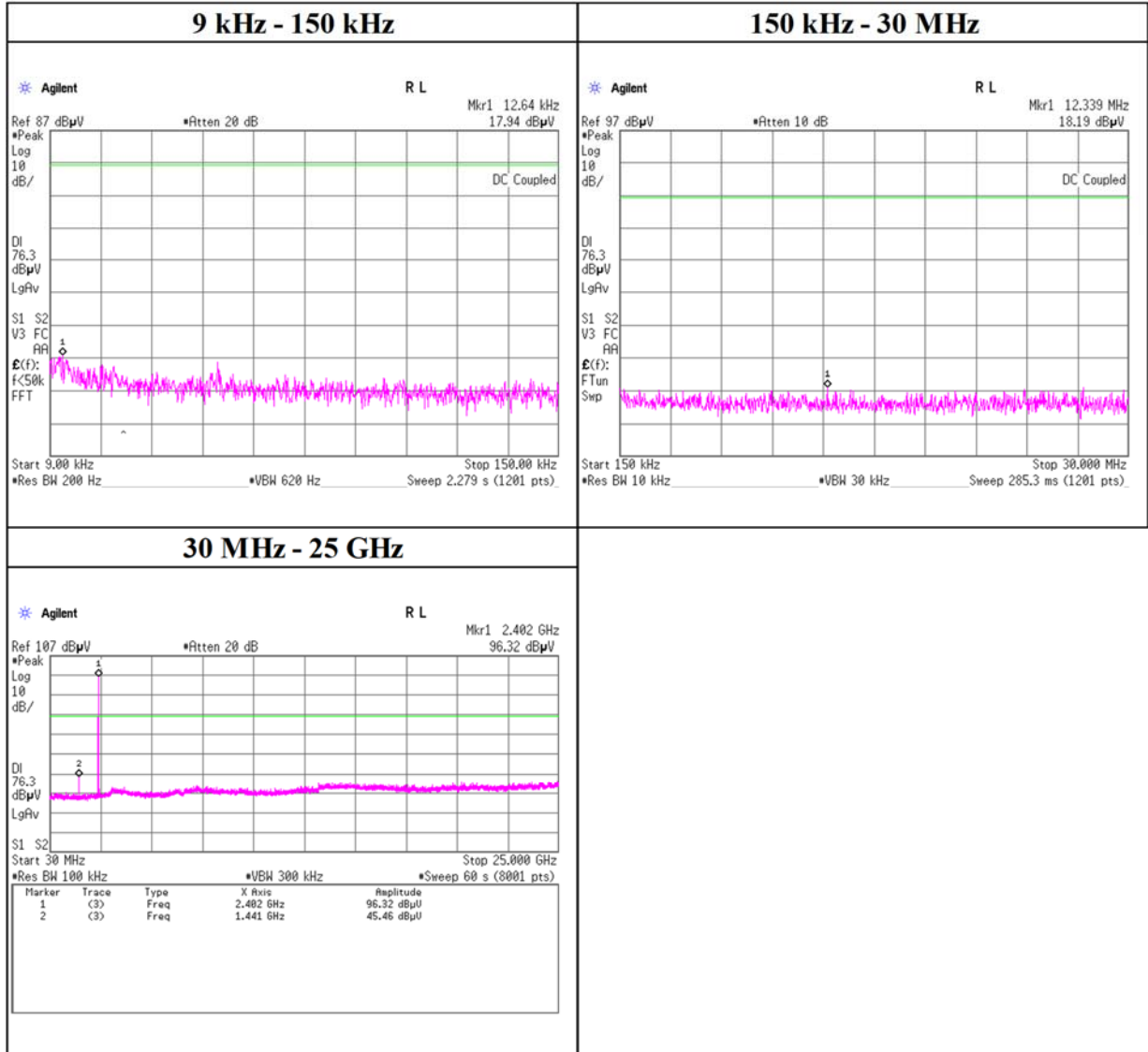
2480 MHz



Conducted Spurious Emission

Report No. 13915091S-A-R1
 Test place Shonan EMC Lab. No.1 Measurement Room
 Date August 21, 2021
 Temperature / Humidity 25 deg. C / 43 % RH
 Engineer Kenichi Adachi
 Mode Tx, Hopping Off, 3DH5, 2402 MHz

2402 MHz



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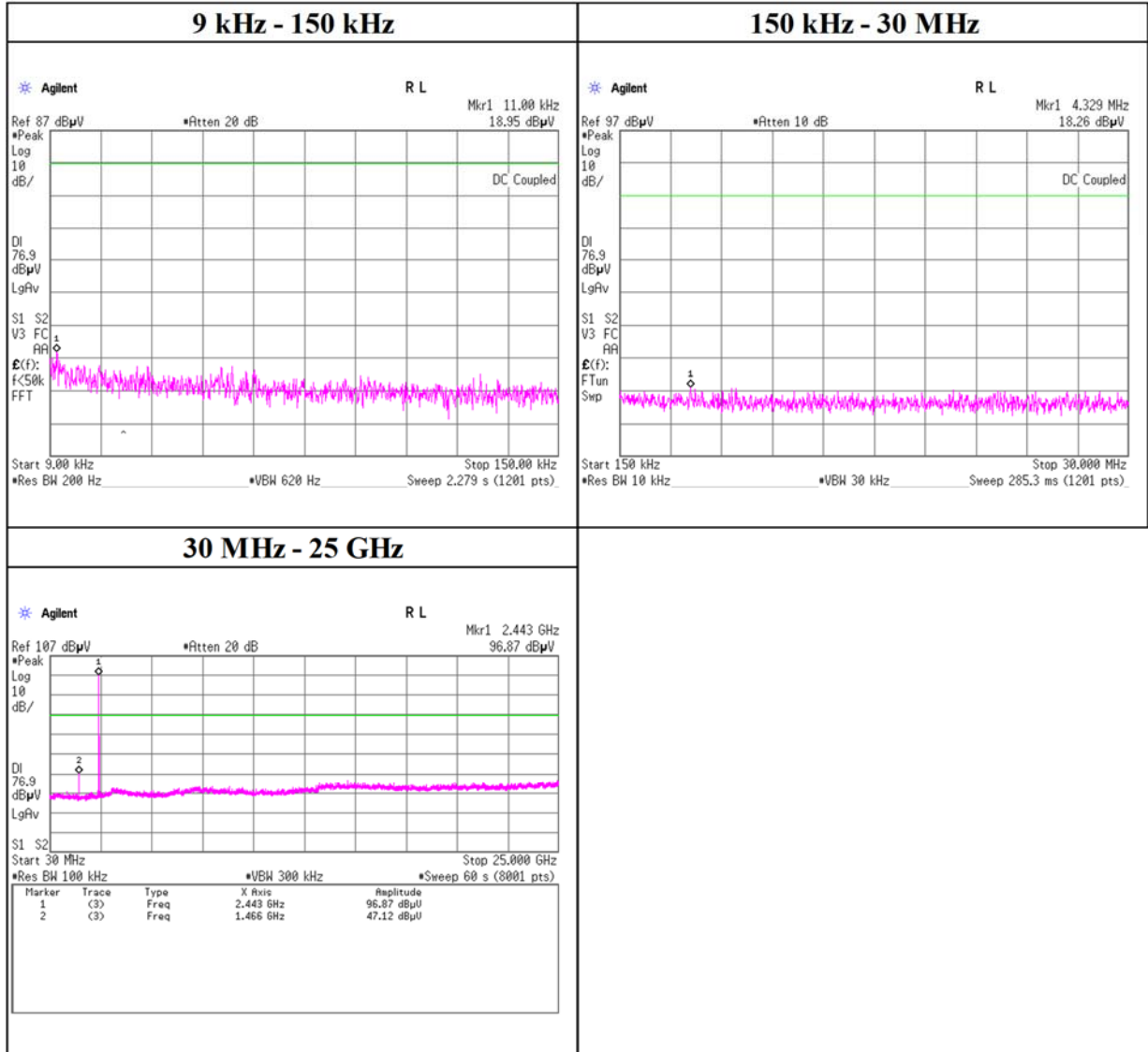
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Conducted Spurious Emission

Report No. 13915091S-A-R1
 Test place Shonan EMC Lab. No.1 Measurement Room
 Date August 21, 2021
 Temperature / Humidity 25 deg. C / 43 % RH
 Engineer Kenichi Adachi
 Mode Tx, Hopping Off, 3DH5, 2441 MHz

2441 MHz



UL Japan, Inc.

Shonan EMC Lab.

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

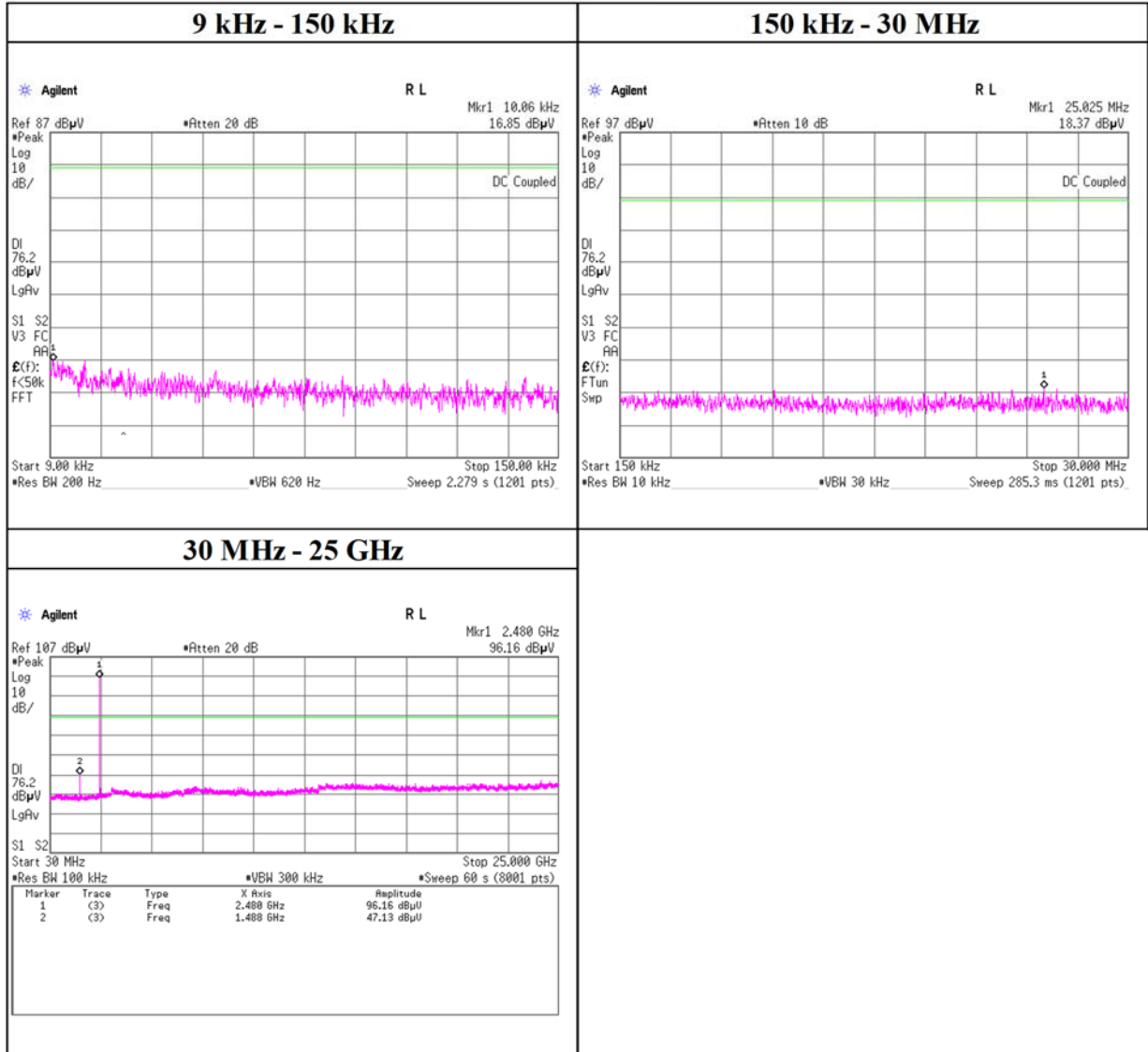
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Conducted Spurious Emission

Report No. 13915091S-A-R1
 Test place Shonan EMC Lab. No.1 Measurement Room
 Date August 21, 2021
 Temperature / Humidity 25 deg. C / 43 % RH
 Engineer Kenichi Adachi
 Mode Tx, Hopping Off, 3DH5, 2480 MHz

2480 MHz



UL Japan, Inc.

Shonan EMC Lab.

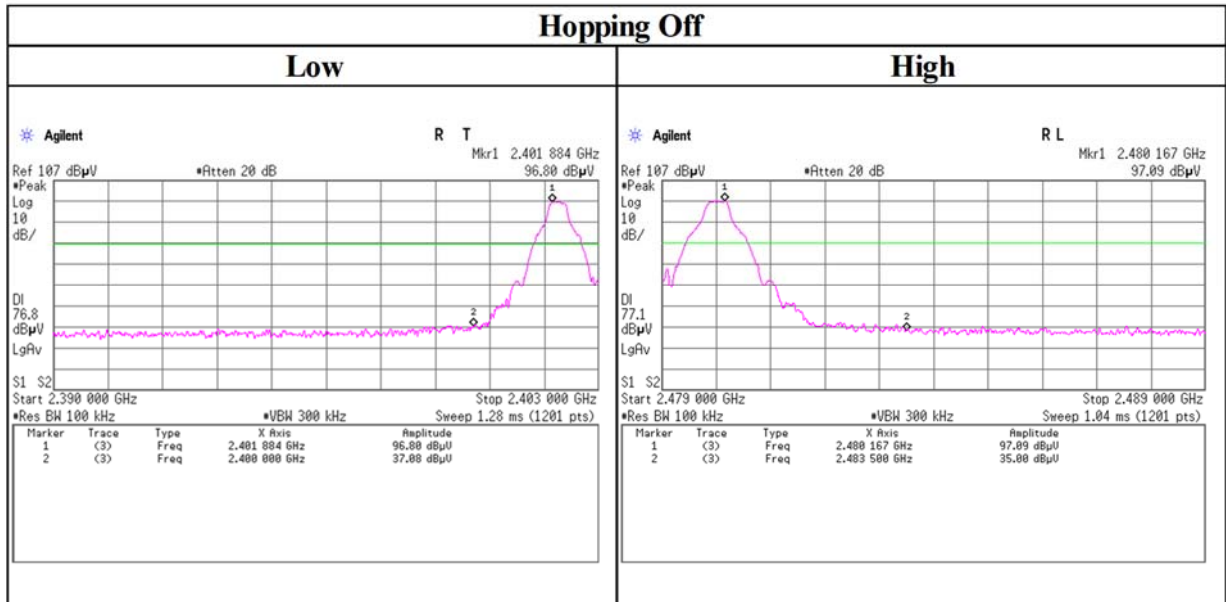
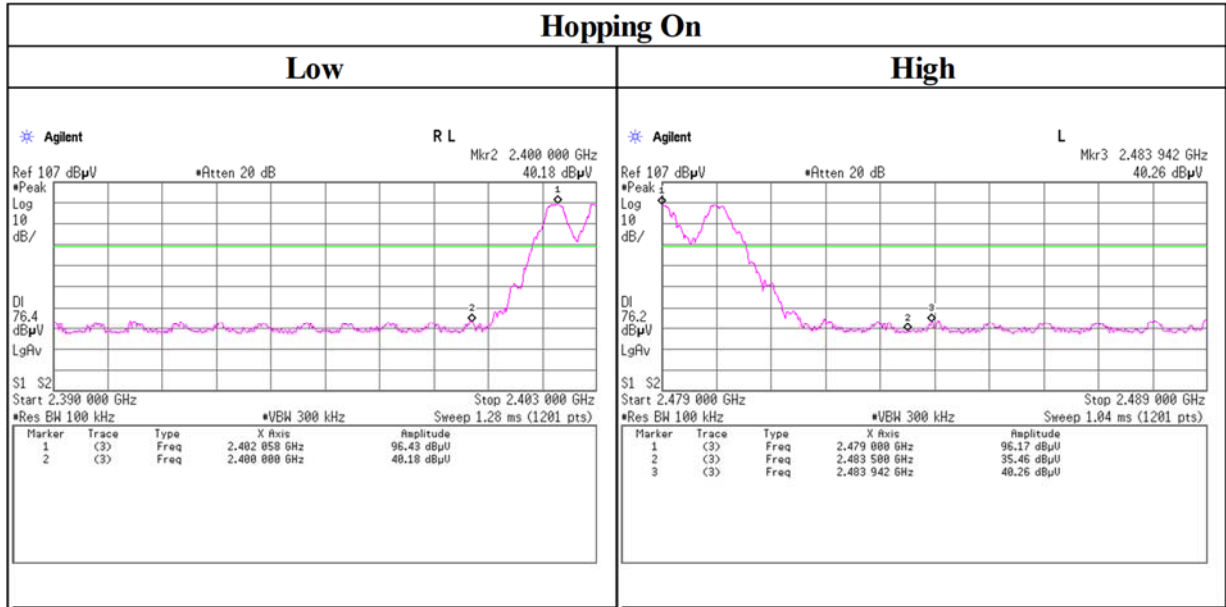
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

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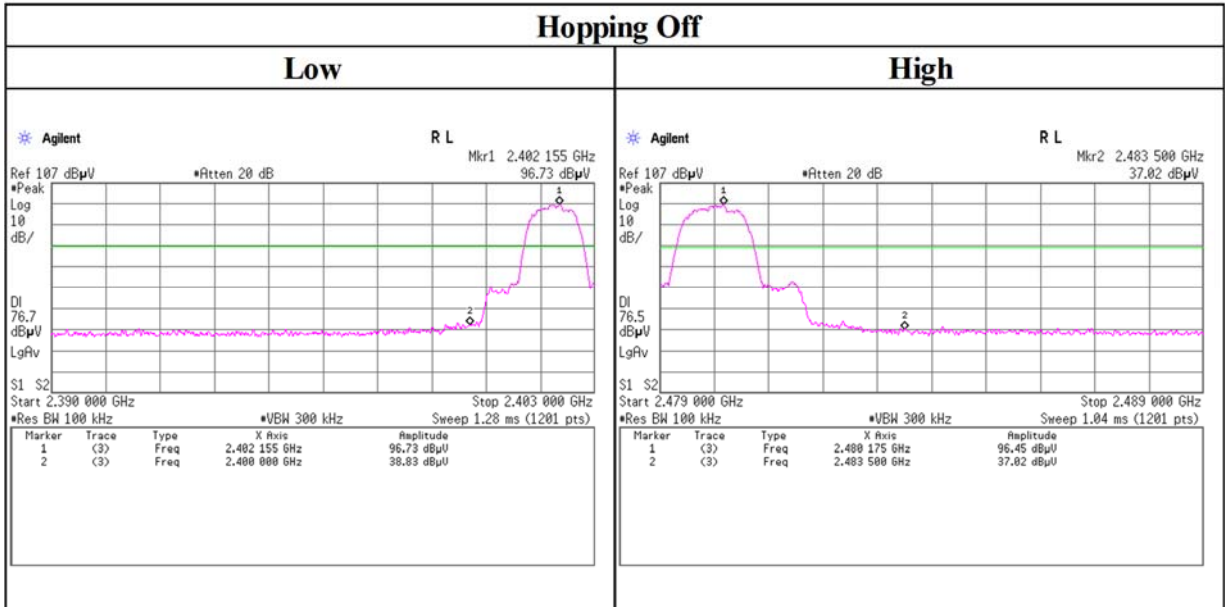
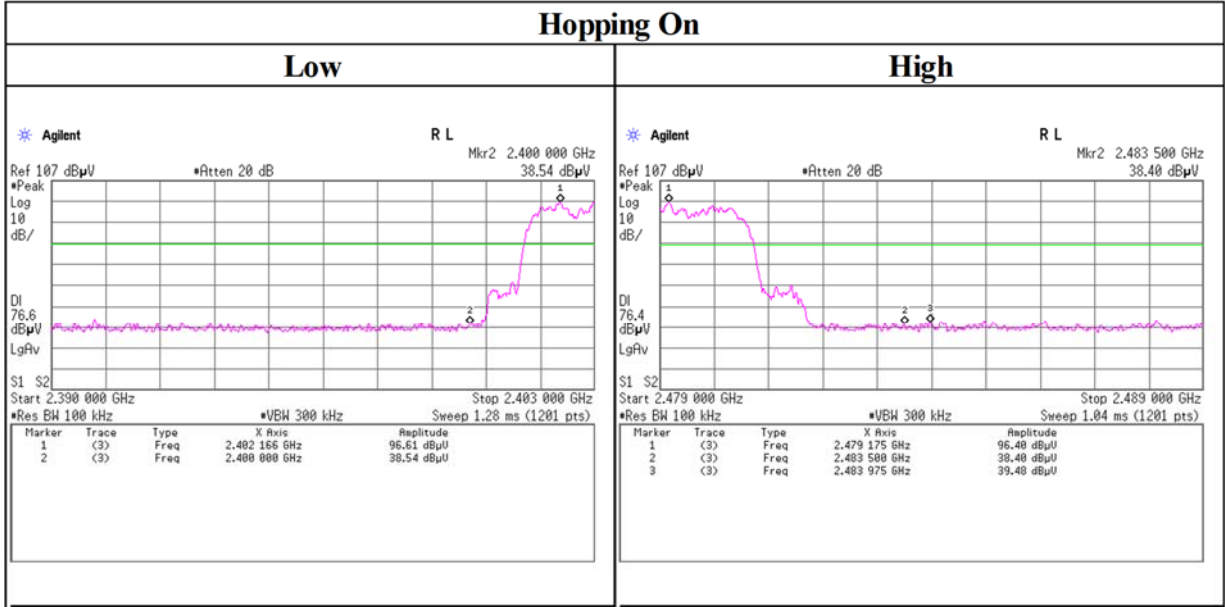
Conducted Emission Band Edge compliance

Report No. 13915091S-A-R1
 Test place Shonan EMC Lab. No.1 Measurement Room
 Date August 21, 2021
 Temperature / Humidity 25 deg. C / 43 % RH
 Engineer Kenichi Adachi
 Mode Tx, DH5



Conducted Emission Band Edge compliance

Report No. 13915091S-A-R1
 Test place Shonan EMC Lab. No.1 Measurement Room
 Date August 21, 2021
 Temperature / Humidity 25 deg. C / 43 % RH
 Engineer Kenichi Adachi
 Mode Tx, 3DH5



APPENDIX 2: Test instruments

Test equipment (1/2)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	KTS-08	145095	Digital Tester	SANWA	PC500	7019224	2021/04/26	12
AT	SAT10-12	151609	Attenuator	Weinschel Corp.	54A-10	81601	2021/03/01	12
AT	SCC-G64	196945	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	803414/2	2021/03/01	12
AT	SOS-28	191846	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2021/08/02	12
AT	SPM-06	146267	Power Meter	Anritsu Corporation	ML2495A	850009	2021/05/25	12
AT	SPSS-03	146309	Power sensor	Anritsu Corporation	MA2411B	917063	2021/05/25	12
AT	SRENT-09	150461	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46186392	2021/02/22	12
CE	SAT3-13	150923	Attenuator	JFW	50HF-003N	-	2021/01/26	12
CE	SCC-A12/A13/SRSE-01	144966	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-269(RF Selector)	2021/04/12	12
CE	SLS-02	145539	LISN	Rohde & Schwarz	ENV216	100512	2021/02/24	12
CE	SOS-16	167990	Humidity Indicator	CUSTOM. Inc	CTH-202	708Q08R	2020/10/01	12
CE,RE	COTS-SEMI-5	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,ME,PE)	-	-	-
CE,RE	KJM-09	145929	Measure	KOMELON	KMC-36	-	-	-
CE,RE	STR-01	145790	Test Receiver	Rohde & Schwarz	ESU40	100093	2021/04/27	12
CE,RE	STS-01	145792	Digital Hitester	HIOKI E.E. CORPORATION	3805-50	80997812	2020/10/19	12
RE	KAT6-04	144899	Attenuator	Inmet	18N-6dB	-	2020/12/10	12
RE	SAEC-01(NSA)	145597	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	2021/04/30	12
RE	SAEC-01(SVSWR)	145561	Semi-Anechoic Chamber	TDK	SAEC-01(SVSWR)	1	2021/05/09	12
RE	SAF-01	145003	Pre Amplifier	SONOMA	310N	290211	2021/02/10	12
RE	SAF-04	145127	Pre Amplifier	Toyo Corporation	TPA0118-36	2072554	2021/05/17	12
RE	SAF-08	145007	Pre Amplifier	Toyo Corporation	HAP18-26W	19	2021/03/01	12
RE	SAT10-06	145137	Attenuator	Keysight Technologies Inc	8493C-010	74865	2020/10/05	12
RE	SAT3-09	144959	Attenuator	JFW	50HF-003N	-	2020/08/18	12
RE	SBA-01	145161	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	BBA9106	91032664	2021/04/10	12
RE	SCC-A1/A3/A5/A7/A8/A13/SRSE-01	144967	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	2021/04/13	12
RE	SCC-A2/A4/A6/A7/A8/A13/SRSE-01	144968	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	2021/04/12	12
RE	SCC-G05	145039	Coaxial Cable	Junkosha	J12J102207-00	APR-30-15-037	2021/01/26	12
RE	SCC-G15	145176	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	2021/03/01	12
RE	SCC-G41	151617	Coaxial Cable	Junkosha	MWX221-01000NFSNMS/B	1612S006	2021/01/19	12
RE	SCC-G57	179540	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	802815/2	2021/05/18	12
RE	SCC-G62	196985	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	803650/2	2021/03/01	12
RE	SCC-G68	200008	Coaxial Cable	Huber+Suhner	SUCOFLEX 104	575616/4	2021/07/06	12
RE	SFL-02	145301	Highpass Filter	MICRO-TRONICS	HPM50111	51	2020/10/05	12
RE	SHA-01	145383	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	9120D-725	2021/05/20	12

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Test equipment (2/2)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	SHA-04	145512	Horn Antenna	ETS-Lindgren	3160-09	00094868	2021/06/14	12
RE	SHA-08	194683	Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA 9120 C	694	2021/03/03	12
RE	SLA-05	145527	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	193	2021/04/10	12
RE	SOS-20	191837	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2021/08/02	12
RE	SSA-02	145800	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY48250106	2021/04/13	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