



RADIO TEST REPORT

Test Report No. : 13218114S-H-R1

Applicant : RICOH IMAGING COMPANY, LTD.
Type of EUT : DIGITAL CAMERA
Model Number of EUT : R03010
FCC ID : 2ACZS-R03010
Test regulation : FCC Part 15 Subpart C: 2020
Test Result : Complied (Refer to SECTION 3.2)

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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 13218114S-H. 13218114S-H is replaced with this report.

Date of test: June 1 to 12, 2020

Representative test engineer:

Kenichi Adachi

Engineer

Consumer Technology Division

Approved by:

Toyokazu Imamura

Leader

Consumer Technology Division



CERTIFICATE 1266.01

- ☐ 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.: 13218114S-H

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13218114S-H	July 17, 2020	-	-
1	13218114S-H-R1	July 21, 2020	P.48	Adjustment of data sheet size

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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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SECTION 1: Customer information

Company Name	:	RICOH IMAGING COMPANY, LTD.
Address	:	1-3-6 Nakamagome, Ohta-ku, Tokyo, 143-8555, Japan
Telephone Number	:	+81-50-3534-5213
Facsimile Number	:	+81-3-3775-8531
Contact Person	:	Kenji Daigo

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	:	DIGITAL CAMERA
Model Number	:	R03010
Serial Number	:	Refer to SECTION 4.2
Rating	:	DC 12 V, DC 7.2 V (Battery)
Receipt Date	:	May 25, 2020
Country of Mass-production	:	Philippines
Condition	:	Production model / Production prototype / 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: R03010 (referred to as the EUT in this report) is a DIGITAL CAMERA.

General specification

Clock	Oscillation Source	Frequency [MHz]
ASIC (Main Clock)	Crystal Unit	40
ASIC (Sub Clock)	RTC	0.032768
ASIC (Maximum Internal Clock)	-	2160
RTC	Crystal Unit	0.032768
CPU (Sub Clock)	Crystal Unit	0.032768
CPU (Maximum Internal Clock)	-	32
SRIC (Main Clock)	Crystal Unit	20
SRIC (Maximum Internal Clock)	-	200
DPU (Main Clock)	Crystal Unit	27
Audio Codec (Main Clock)	ASIC	24.576
WLAN/BLE Module (Main Clock)	ASIC	200
eMMC (Main Clock)	ASIC	187.5
SDRAM (Main Clock)	ASIC	930
Preprocessor (Main Clock)	Crystal Unit	72
Preprocessor (Sub Clock)	Clock Generator	100
Preprocessor (Maximum Internal Clock)	-	2500
Clock Generator	Crystal Unit	25
CMOS Image Sensor (Main Clock)	Crystal Unit	72
PLD (Main Clock)	-	133
PLD (Internal Clock)	-	0.025
		2
PLD (Maximum Internal Clock)	-	187.5
LCD (Main Clock)	PLD	187.5
SD (Main Clock)	ASIC	780
USB2.0	ASIC	240
USB3.1	ASIC	2500
HDMI	ASIC	1485

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Radio specification

WLAN

Radio Type	:	Transceiver
Frequency of Operation	:	2412 MHz - 2462 MHz
Modulation	:	DSSS, OFDM
Antenna type	:	$\lambda/2$ Dipole antenna
Antenna connector	:	MM5829-2700
Antenna Gain	:	2.23 dBi
Operating Temperature	:	-10 deg. C to +40 deg. C

Bluetooth Low Energy

Equipment Type	:	Transceiver
Frequency of Operation	:	2402 MHz – 2480 MHz
Type of Modulation	:	FHSS
Antenna Type	:	$\lambda/2$ Dipole antenna
Antenna connector	:	MM5829-2700
Antenna Gain	:	2.23 dBi
Operating Temperature	:	-10 deg. C to +40 deg. C

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	18.2 dB, 0.43304 MHz, N Mode: Tx BT LE, 2402 MHz	Complied a)	-
6 dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section 15.247(a)(2) ISED: RSS-247 5.2(a)	See data.	Complied b)	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.12	FCC: Section 15.247(b)(3) ISED: RSS-247 5.4(d)		Complied c)	Conducted
Power Density	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section 15.247(e) ISED: RSS-247 5.2(b)		Complied d)	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.13	FCC: Section 15.247(d) ISED: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	5.5 dB 600.001 MHz, QP, Hori. Mode: Tx 11n-20, 2437 MHz	Complied# e), f)	Conducted (below 30 MHz)/ 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) and KDB 558074 D01 15.247 Meas Guidance v05r02 8.5 and 8.6. a) Refer to APPENDIX 1 (data of Conducted Emission) b) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth) c) Refer to APPENDIX 1 (data of Maximum Peak Output Power) d) Refer to APPENDIX 1 (data of Power Density) e) Refer to APPENDIX 1 (data of Conducted Spurious Emission) f) 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 Module 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	Complied b)	Conducted

b) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)

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.

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	-
Radiated emission (Measurement distance: 1 m)	1 GHz-18 GHz	5.8 dB	5.8 dB	5.8 dB	-
	18 GHz-40 GHz	5.7 dB	5.7 dB	5.7 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 1 GHz	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 operating mode was determined as follows according to “Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009.

Mode	Remarks*
IEEE 802.11b (11b)	11 Mbps, PN9
IEEE 802.11g (11g)	6 Mbps, PN9
IEEE 802.11n 20 MHz BW (11n-20)	MCS 0, PN9
Bluetooth Low Energy (BT LE)	PRBS9
*Transmitting duty was refer to APPENDIX.	
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows;	
Power settings: 11b: 11.0 dBm	
11g: 10.0 dBm	
11n-20: 10.0 dBm	
BT LE: Fixed	
Software: R03010 Camera FW, Ver.025.0316 (β6.3)	
(Date: 2020.5.14, Storage location: EUT memory)	
Any conditions under the normal use do not exceed the condition of setting.	
In addition, end users cannot change the settings of the output power of the product.	

*The details of Operating mode(s)

Test Item	Operating Mode	Tested frequency
Conducted Emission	Tx, 11n-20	2437 MHz
	Tx, BT LE	2402 MHz
		2440 MHz
		2480 MHz
Spurious Emission	Tx, 11b	2412 MHz
6 dB Bandwidth	Tx, 11g	2437 MHz
Maximum Peak Output Power	Tx, 11n-20	2462 MHz
Power Density	Tx, BT LE	2402 MHz
99 % Occupied Bandwidth		2440 MHz
		2480 MHz

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	DIGITAL CAMERA	R03010	PP4-2 #91 *1) PP4-2 #196 *2) PP4-2 #129 *3) PP4-2 #155 *4)	RICOH IMAGING COMPANY, LTD.	EUT
B	Interchangeable Lens	smc PENTAX-DA 18-55mmF3.5-5.6AL WR	6588475	RICOH IMAGING COMPANY, LTD.	-
C	Rechargeable LI-ION BATTERY	D-LI90	201810	RICOH IMAGING COMPANY, LTD.	-
D	Battery Grip	D-BG8	P2-04	RICOH IMAGING COMPANY, LTD.	-
E	Rechargeable LI-ION BATTERY	D-LI90	201810	RICOH IMAGING COMPANY, LTD.	-
F	Flash	AF360FGZ II	1006720	RICOH IMAGING COMPANY, LTD.	-
G	Cable Switch	CS-205	-	RICOH IMAGING COMPANY, LTD.	-
H	MIC	ECM-DS30P	-	SONY	-
I	EarPhone	MDR-EX110SP	-	SONY	-
J	SD Card	SD-K08G	RIM-RF-SD12	TOSHIBA	8 GB
K	SD Card	TS32GSDC300S	-	Transcend	32 GB
L	AC Adapter	D-AC166	ESD-10	RICOH IMAGING COMPANY LTD.	-

*1) Used for Antenna Terminal conducted test (WLAN)

*2) Used for Antenna Terminal conducted test (BT LE)

*3) Used for Conducted Emission test and Radiated Emission test (WLAN)

*4) Used for Conducted Emission test and Radiated Emission test (BT LE)

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC	1.0	Unshielded	Unshielded	-
2	AC	1.8	Unshielded	Unshielded	-
3	HDMI	3.0	Shielded	Shielded	-
4	Ear Phone	0.65	Unshielded	Unshielded	-
5	Cable Swich	0.5	Shielded	Shielded	-

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm 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 80cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

2) For the tests on EUT itself (as a standalone equipment)

Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN / (AMN) to the input power source.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT via AC Adapter in a Shielded Room.

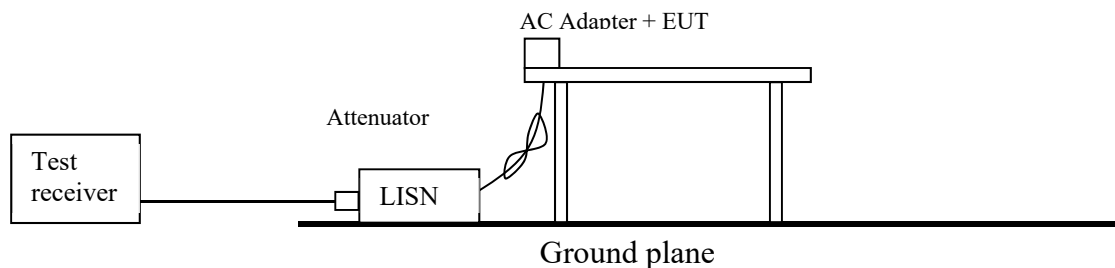
The EUT via AC Adapter was connected to a LISN (AMN).

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

It was measured based on "8.5 and 8.6 of KDB 558074 D01 15.247 Meas Guidance v05r02".

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 2.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

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

The height of the measuring antenna varied between 1 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.

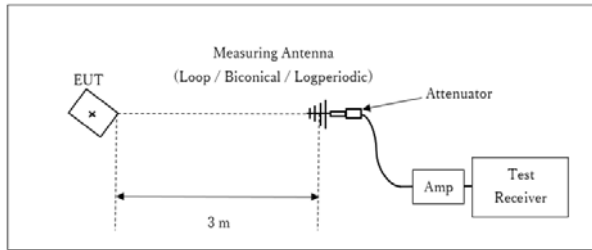
20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(ISED) and outside the restricted band of FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

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	11.12.2.5.2 RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (Linear voltage) Trace: 100 traces Duty factor was added to the results.	RBW: 100 kHz VBW: 300 kHz

*1) Average Power Measurement was performed based on ANSI C63.10-2013.

Figure 2: Test Setup

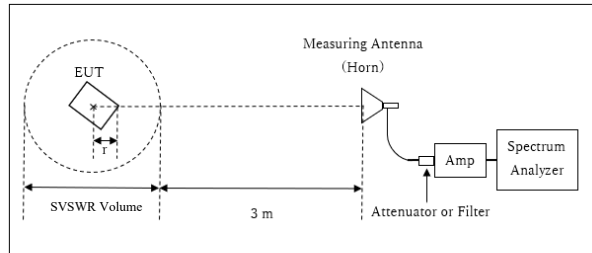
Below 1 GHz



× : Center of turn table

Test Distance: 3 m

1 GHz - 13 GHz



r : Radius of an outer periphery of EUT

× : Center of turn table

Distance Factor: $20 \times \log (3.79 \text{ m} / 3.0 \text{ m}) = 2.04 \text{ dB}$

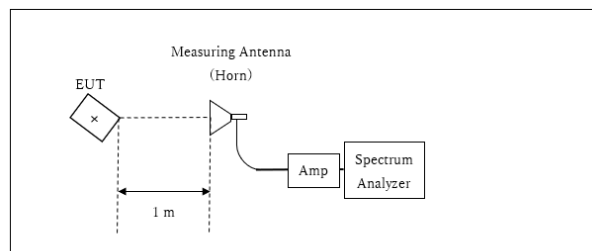
* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 3.79 \text{ m}$

SVSWR Volume : 2.0 m

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

$r = 0.21 \text{ m}$

13 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.

Combinations of the worst case (WLAN)

Frequency	Below 1 GHz	1 GHz - 2.8 GHz	2.8 GHz - 13 GHz	Above 13 GHz
Antenna polarization				
Horizontal	X	Y	X	X
Vertical	X	X	X	X

Combinations of the worst case (BT LE)

Frequency	Below 1 GHz	1 GHz - 2.8 GHz	2.8 GHz - 13 GHz	Above 13 GHz
Antenna polarization				
Horizontal	X	Z	X	X
Vertical	X	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

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SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6 dB Bandwidth	50 MHz or 10 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/Average *2)	-	Power Meter (Sensor: 160 MHz BW)
Peak Power Density	1.5 times the 6 dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *5) *6)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	10 kHz	30 kHz				

*1) Peak hold was applied as Worst-case measurement.
 *2) Reference data
 *3) Section 11.10.2 Method PKPSD (peak PSD) of "ANSI C63.10-2013".
 *5) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.
 Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.
 (9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz)
 *6) 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.3 Shielded Room
Date : 2020/06/05

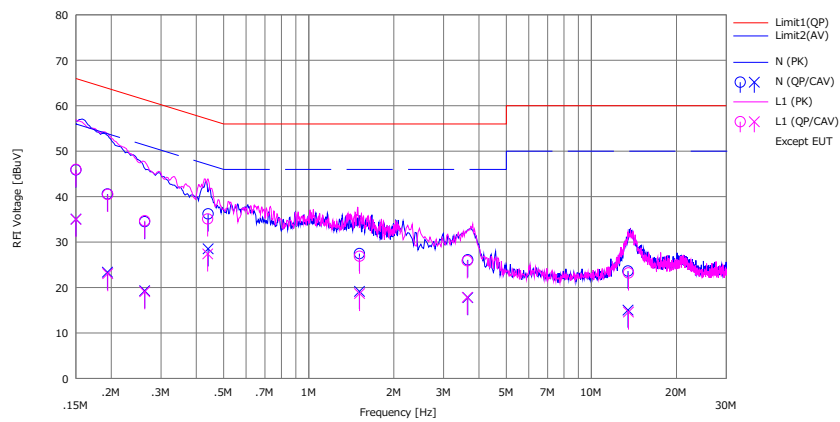
Mode : Tx, 11n-20, 2437 MHz

Power : AC 240 V / 60 Hz
Temp./Humi. : 26 deg.C / 48 %RH

Remarks : With AC Adapter

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Hiromasa Sato



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	33.40	22.60	12.48	45.88	35.08	66.00	56.00	20.1	20.9	N	
2	0.19401	28.10	10.90	12.48	40.58	23.38	63.86	53.86	23.2	30.4	N	
3	0.26264	22.00	6.80	12.49	34.49	19.29	61.35	51.35	26.8	32.0	N	
4	0.44044	23.70	16.00	12.50	36.20	28.50	57.05	47.05	20.8	18.5	N	
5	1.51109	14.90	6.60	12.56	27.46	19.16	56.00	46.00	28.5	26.8	N	
6	3.65410	13.40	5.10	12.68	26.08	17.78	56.00	46.00	29.9	28.2	N	
7	13.47416	10.50	1.90	13.12	23.62	15.02	60.00	50.00	36.3	34.9	N	
8	0.15000	33.50	22.50	12.48	45.98	34.98	66.00	56.00	20.0	21.0	L1	
9	0.19433	28.00	10.60	12.48	40.48	23.08	63.85	53.85	23.3	30.7	L1	
10	0.26278	22.20	6.60	12.48	34.68	19.08	61.34	51.34	26.6	32.2	L1	
11	0.43897	22.60	14.90	12.48	35.08	27.38	57.08	47.08	22.0	19.7	L1	
12	1.51283	14.30	6.10	12.58	26.88	18.68	56.00	46.00	29.1	27.3	L1	
13	3.63717	13.20	5.20	12.67	25.87	17.87	56.00	46.00	30.1	28.1	L1	
14	13.53505	10.21	1.60	13.00	23.21	14.60	60.00	50.00	36.7	35.4	L1	

Calculation: Result[dBuV] = Reading[dBuV] + C.Fac(LISN(AMN) + Cable + ATT)[dB]
LISN(AMN) : SLS-05

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2020/06/05

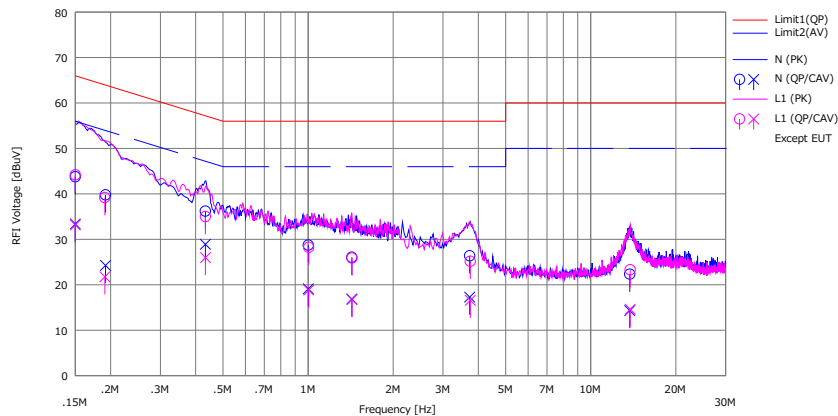
Mode : Tx, BT LE, 2402 MHz

Power : AC 240 V / 60 Hz
Temp./Humi. : 26 deg.C / 48 %RH

Remarks : with AC Adapter

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Hiromasa Sato

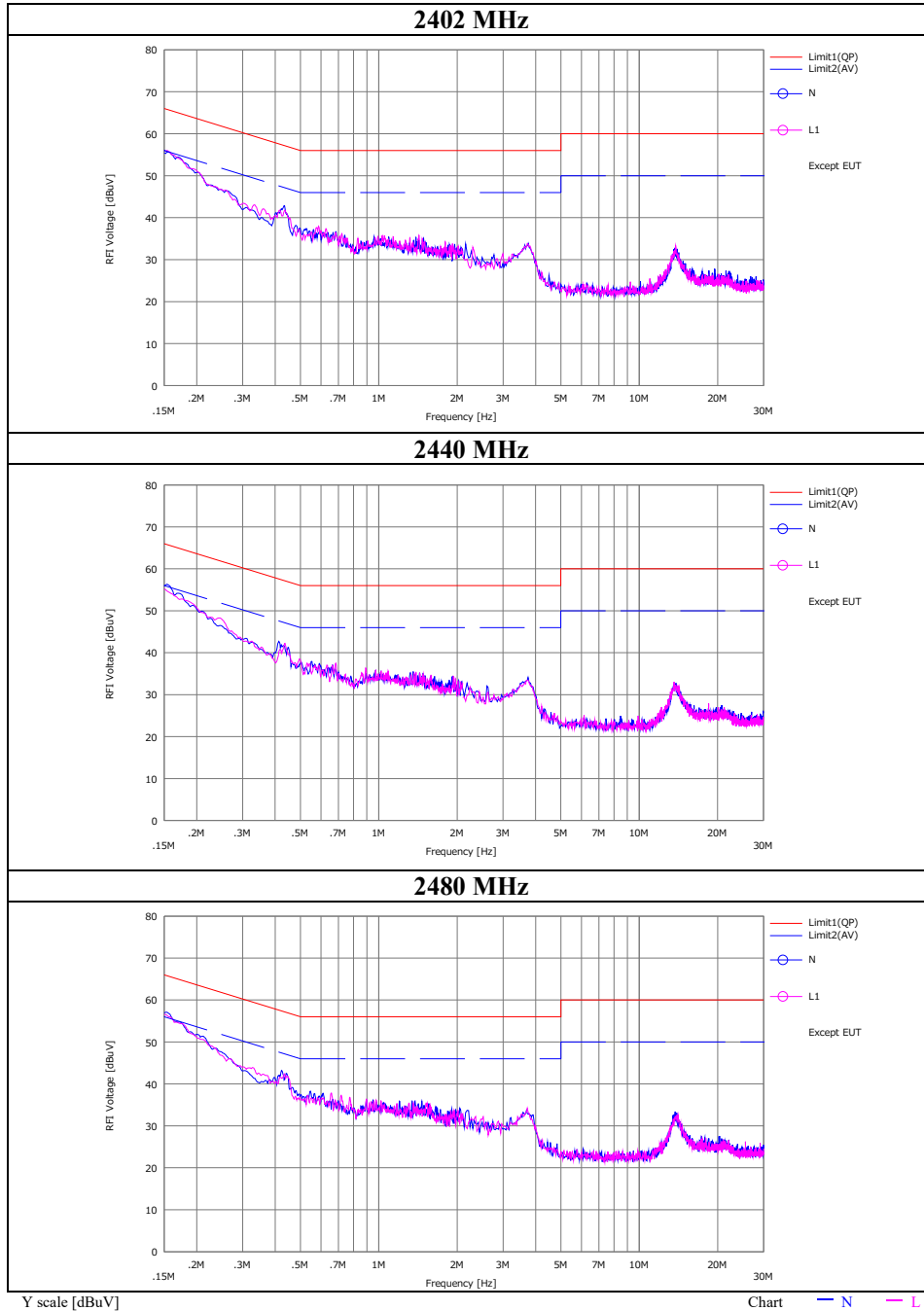


No.	Freq. [MHz]	Reading			C.Fac	Results		Limit		Margin		Phase	Comment
		(QP) [dBuV]	(CAV) [dBuV]	[dB]		(QP) [dBuV]	(CAV) [dBuV]	(QP) [dBuV]	(AV) [dBuV]	(QP) [dB]	(AV) [dB]		
1	0.15000	31.30	20.90	12.48		43.78	33.38	66.00	56.00	22.2	22.6	N	
2	0.19197	27.30	11.80	12.48		39.78	24.28	63.95	53.95	24.1	29.6	N	
3	0.43304	23.70	16.40	12.50		36.20	28.90	57.19	47.19	20.9	18.2	N	
4	1.00147	16.20	6.60	12.53		28.73	19.13	56.00	46.00	27.2	26.8	N	
5	1.42738	13.50	4.30	12.56		26.06	16.86	56.00	46.00	29.9	29.1	N	
6	3.73100	13.70	4.60	12.68		26.38	17.28	56.00	46.00	29.6	28.7	N	
7	13.74591	9.20	1.20	13.13		22.33	14.33	60.00	50.00	37.6	35.6	N	
8	0.15000	31.70	20.70	12.48		44.18	33.18	66.00	56.00	21.8	22.8	L1	
9	0.19088	26.70	9.30	12.48		39.18	21.78	64.00	54.00	24.8	32.2	L1	
10	0.43313	22.50	13.50	12.48		34.98	25.98	57.19	47.19	22.2	21.2	L1	
11	1.00522	15.70	6.30	12.53		28.23	18.83	56.00	46.00	27.7	27.1	L1	
12	1.42970	13.30	4.20	12.57		25.87	16.77	56.00	46.00	30.1	29.2	L1	
13	3.74882	12.50	3.90	12.67		25.17	16.57	56.00	46.00	30.8	29.4	L1	
14	13.79055	10.30	1.60	13.01		23.31	14.61	60.00	50.00	36.6	35.3	L1	

Calculation: Result[dBuV] = Reading[dBuV] + C.Fac(LISN(AMN) + Cable + ATT)[dB]
LISN(AMN) : SLS-05

Conducted Emission

Report No. 13218114S-H-R1
Test place Shonan EMC Lab. No.3 Semi Anechoic Chamber
Date June 4, 2020
Temperature / Humidity 26 deg. C / 48 % RH
Engineer Hiromasa Sato
Mode Tx BT LE

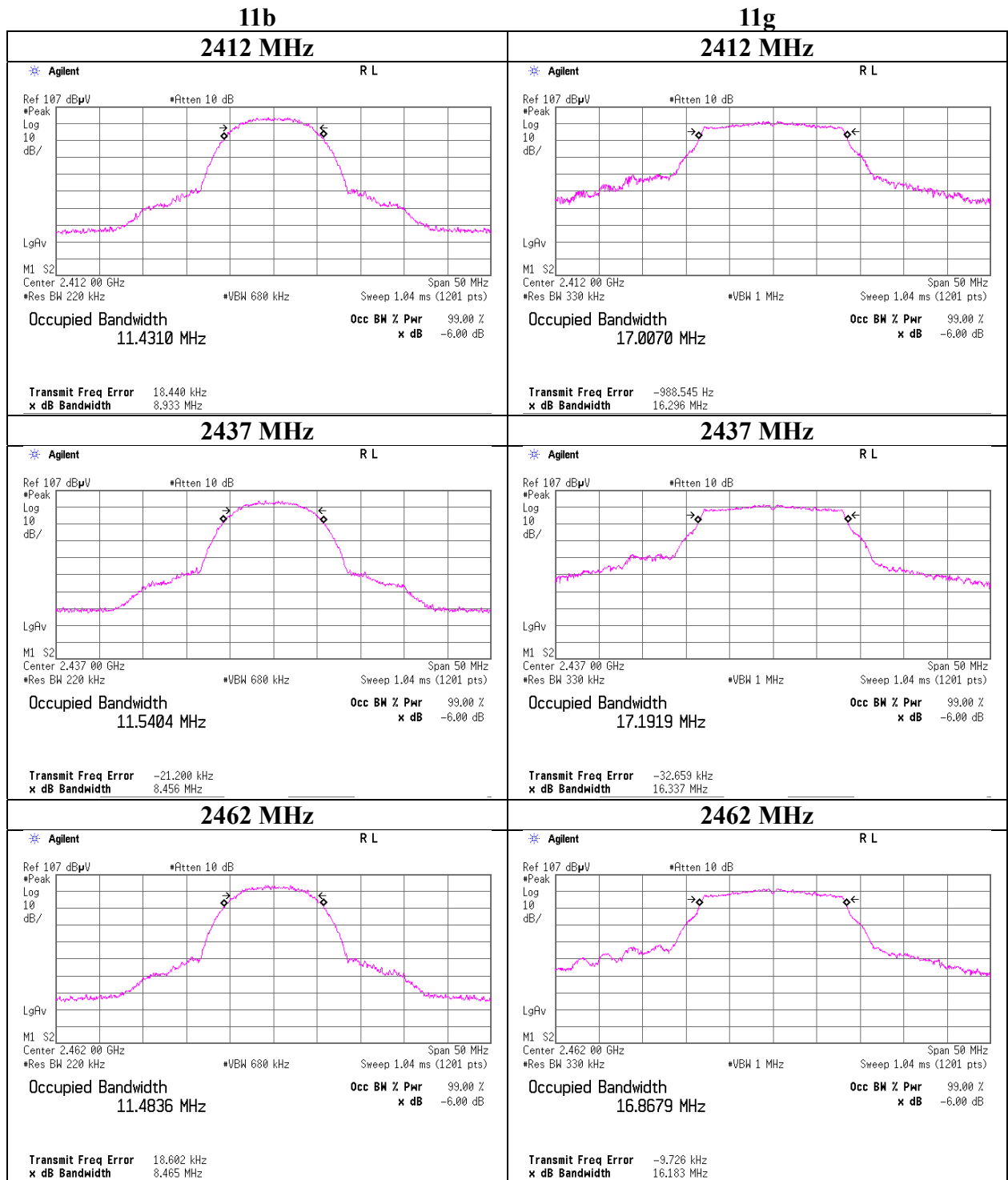


6 dB Bandwidth and 99 % Occupied Bandwidth

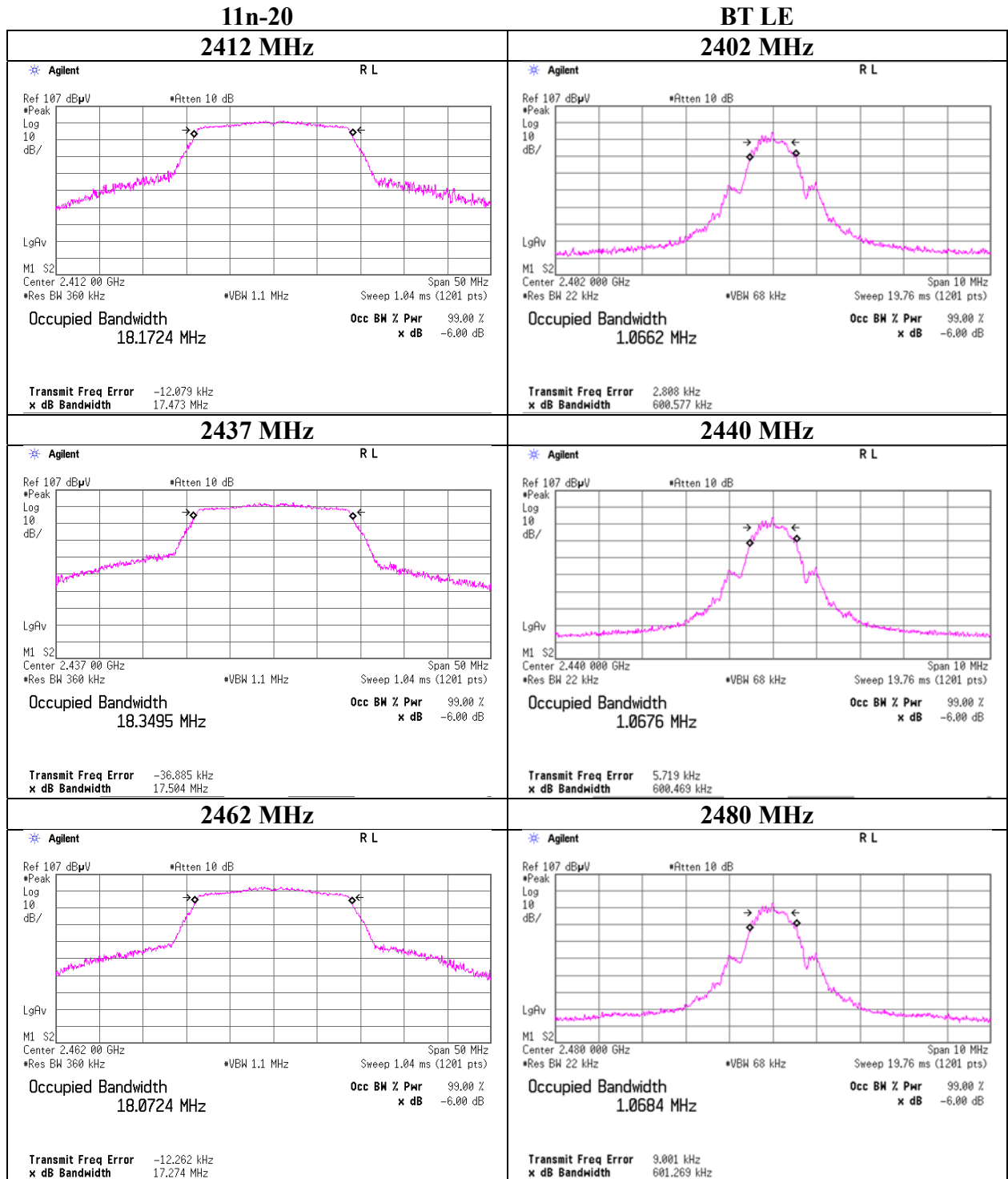
Report No.	13218114S-H-R1
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	June 4, 2020 June 12, 2020
Temperature / Humidity	24 deg. C / 51 % RH 24 deg. C / 56 % RH
Engineer	Kenichi Adachi Kenichi Adachi
Mode	Tx

Mode	Frequency [MHz]	99 % Occupied Bandwidth [kHz]	6 dB Bandwidth [MHz]	Limit for 6 dB Bandwidth [MHz]
11b	2412	11431.0	8.472	> 0.5000
	2437	11540.4	8.647	> 0.5000
	2462	11483.6	8.229	> 0.5000
11g	2412	17007.0	16.098	> 0.5000
	2437	17191.9	16.361	> 0.5000
	2462	16867.9	15.802	> 0.5000
11n-20	2412	18172.4	17.025	> 0.5000
	2437	18349.5	17.579	> 0.5000
	2462	18072.4	15.373	> 0.5000
BT LE	2402	1066.2	0.741	> 0.5000
	2440	1067.6	0.742	> 0.5000
	2480	1068.4	0.742	> 0.5000

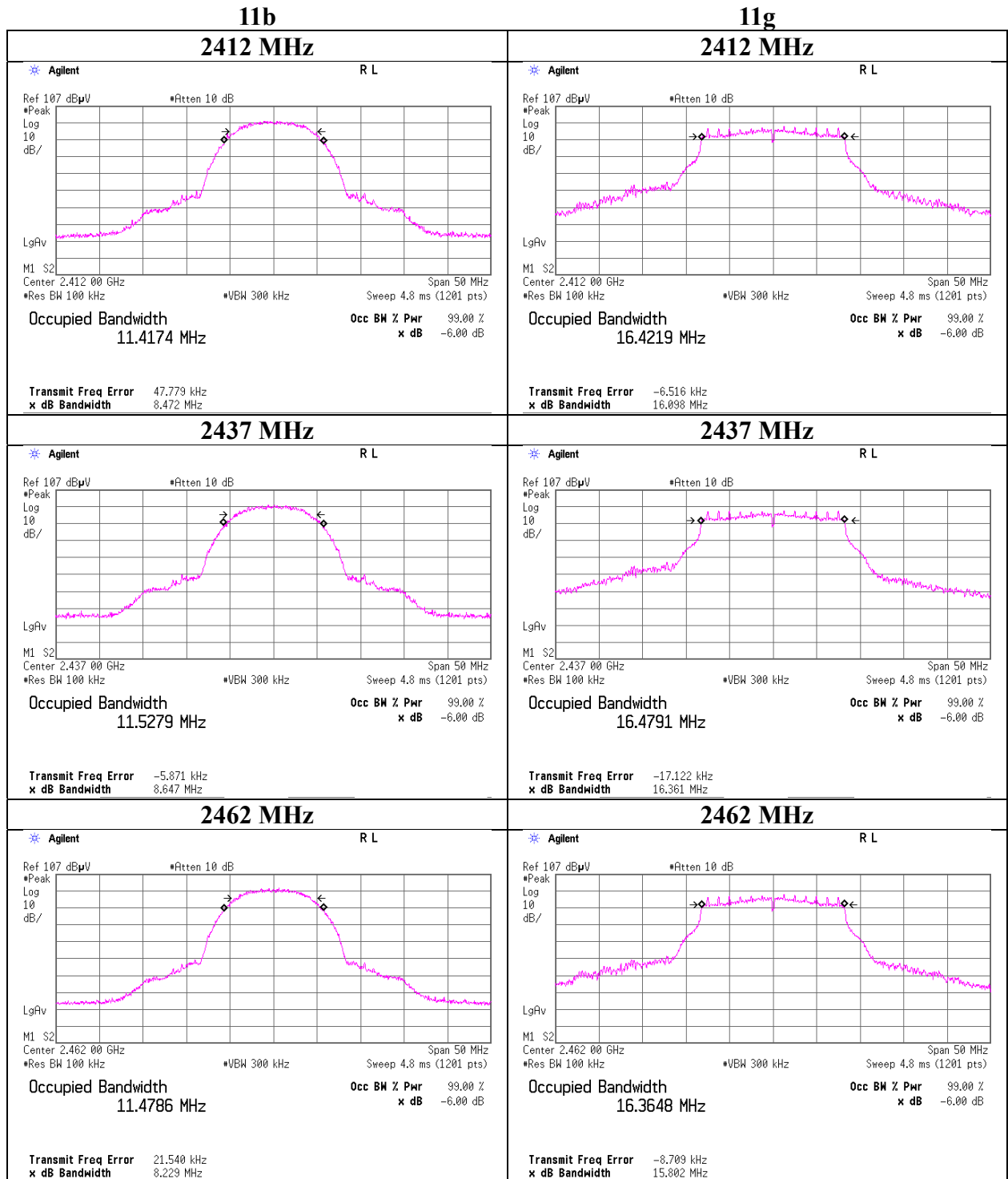
99 %Occupied Bandwidth



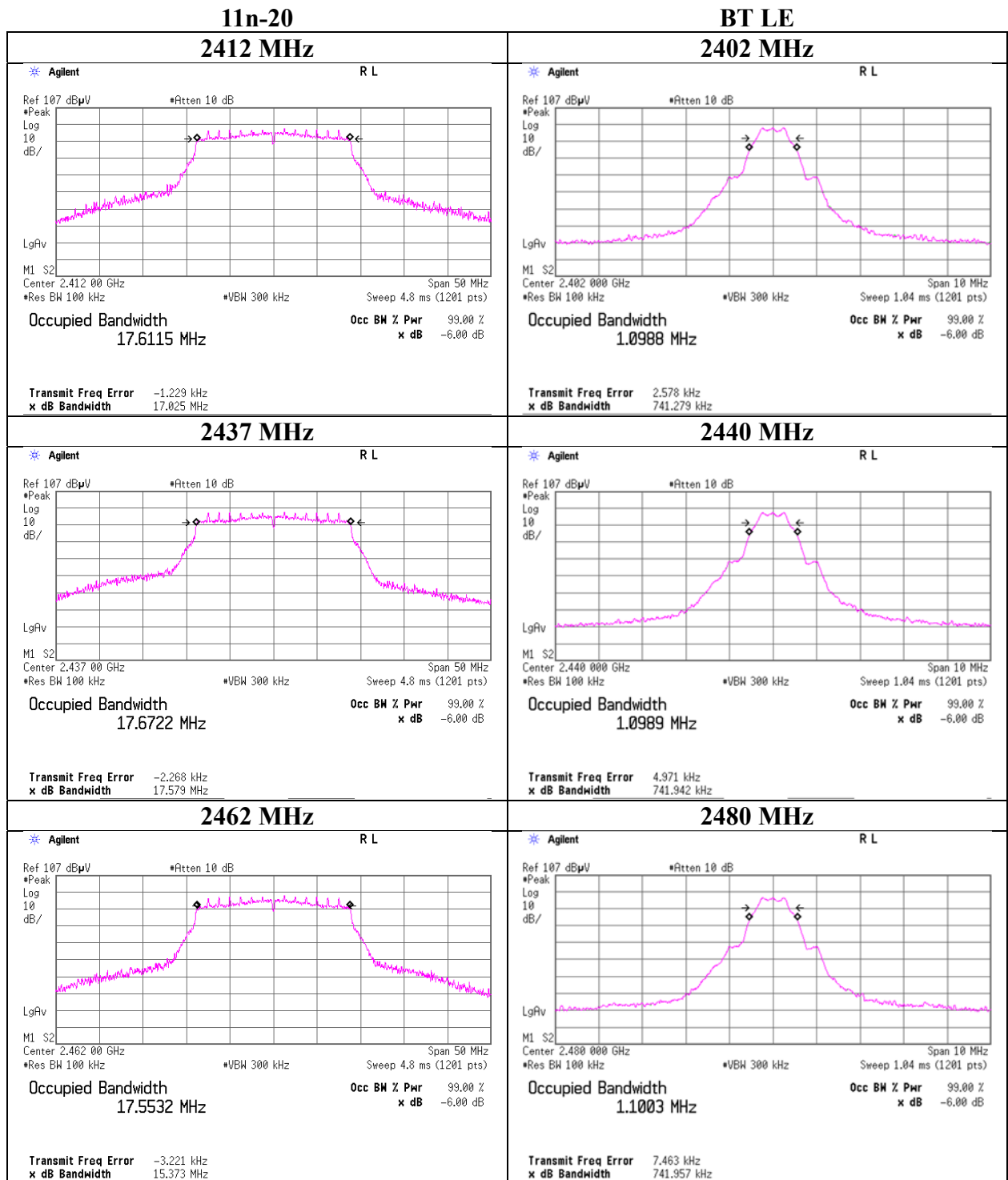
99 % Occupied Bandwidth



6 dB Bandwidth



6 dB Bandwidth



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Maximum Peak Output Power

Report No. 13218114S-H-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date June 1, 2020 June 2, 2020
Temperature / Humidity 26 deg. C / 41 % RH 26 deg. C / 49 % RH
Engineer Takahiro Kawakami Toshinori Yamada
Mode Tx 11b

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]		[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	3.02	1.96	9.87	14.85	30.55	30.00	1000	15.15	2.23	17.08	51.05	36.02	4000	18.94
2437	2.83	1.97	9.87	14.67	29.31	30.00	1000	15.33	2.23	16.90	48.98	36.02	4000	19.12
2462	3.12	1.97	9.87	14.96	31.33	30.00	1000	15.04	2.23	17.19	52.36	36.02	4000	18.83

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.

2437 MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	2.30	
2	2.67	
5.5	2.75	
11	2.83	*

*: Worst Rate

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

Maximum Peak Output Power

Report No. 13218114S-H-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date June 1, 2020 June 2, 2020
Temperature / Humidity 26 deg. C / 41 % RH 26 deg. C / 49 % RH
Engineer Takahiro Kawakami Toshinori Yamada
Mode Tx 11g

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]	[dBm]	[mW]	[dB]
2412	10.30	1.96	9.87	22.13	163.31	30.00	1000	7.87	2.23	24.36	272.90	36.02	4000	11.66
2437	9.99	1.97	9.87	21.83	152.41	30.00	1000	8.17	2.23	24.06	254.68	36.02	4000	11.96
2462	10.02	1.97	9.87	21.86	153.46	30.00	1000	8.14	2.23	24.09	256.45	36.02	4000	11.93

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.

2437 MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
6	9.99	*
9	9.87	
12	9.77	
18	9.46	
24	9.18	
36	9.04	
48	9.92	
54	9.98	

*: Worst Rate

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

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Maximum Peak Output Power

Report No. 13218114S-H-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date June 1, 2020 June 2, 2020
Temperature / Humidity 26 deg. C / 41 % RH 26 deg. C / 49 % RH
Engineer Takahiro Kawakami Toshinori Yamada
Mode Tx 11n-20

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]		[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	10.27	1.96	9.87	22.10	162.18	30.00	1000	7.90	2.23	24.33	271.02	36.02	4000	11.69
2437	10.65	1.97	9.87	22.49	177.42	30.00	1000	7.51	2.23	24.72	296.48	36.02	4000	11.30
2462	10.28	1.97	9.87	22.12	162.93	30.00	1000	7.88	2.23	24.35	272.27	36.02	4000	11.67

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.

2437 MHz

MCS	Reading	Remark
	[dBm]	
0	10.65	*
1	10.48	
2	10.21	
3	10.03	
4	10.35	
5	10.43	
6	9.96	
7	10.48	

*: Worst Rate

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

Maximum Peak Output Power

Report No. 13218114S-H-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date June 12, 2020
Temperature / Humidity 24 deg. C / 56 % RH
Engineer Kenichi Adachi
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin	Antenna Gain [dBi]	Result		Limit		Margin
				[dBm]	[mW]	[dBm]	[mW]	[dB]		[dBm]	[mW]	[dBm]	[mW]	
2402	-10.95	1.95	9.87	0.87	1.22	30.00	1000	29.13	2.23	3.10	2.04	36.02	4000	32.92
2440	-11.28	1.97	9.87	0.56	1.14	30.00	1000	29.44	2.23	2.79	1.90	36.02	4000	33.23
2480	-11.94	1.98	9.87	-0.09	0.98	30.00	1000	30.09	2.23	2.14	1.64	36.02	4000	33.88

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.

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Average Output Power
(Reference data for RF Exposure)

Report No. 13218114S-H-R1
Test place Shonan EMC Lab. No.5 Shielded Room No.1 Measurement Room
Date June 1, 2020 June 2, 2020 June 12, 2020
Temperature / Humidity 26 deg. C / 41 % RH 26 deg. C / 49 % RH 24 deg. C / 56 % RH
Engineer Takahiro Kawakami Toshinori Yamada Kenichi Adachi
Mode Tx

11b 1 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-0.83	1.96	9.87	11.00	12.59	0.05	11.05	12.74
2437	-0.82	1.97	9.87	11.02	12.65	0.05	11.07	12.79
2462	-0.98	1.97	9.87	10.86	12.19	0.05	10.91	12.33

11g 6 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-1.34	1.96	9.87	10.49	11.19	0.28	10.77	11.94
2437	-1.29	1.97	9.87	10.55	11.35	0.28	10.83	12.11
2462	-1.44	1.97	9.87	10.40	10.96	0.28	10.68	11.69

11n-20 MCS 0

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-2.05	1.96	9.87	9.78	9.51	0.30	10.08	10.19
2437	-1.49	1.97	9.87	10.35	10.84	0.30	10.65	11.61
2462	-1.75	1.97	9.87	10.09	10.21	0.30	10.39	10.94

BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-13.60	1.95	9.87	-1.78	0.66	1.95	0.17	1.04
2440	-13.96	1.97	9.87	-2.12	0.61	1.95	-0.17	0.96
2480	-14.71	1.98	9.87	-2.86	0.52	1.95	-0.91	0.81

Sample Calculation:

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

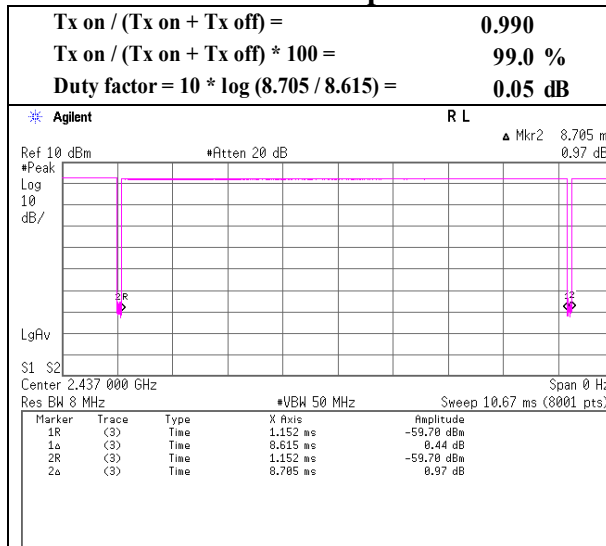
The average output power was measured with the lowest order modulation and lowest data rate configuration in each IEEE 802.11 mode based on KDB 248227 D01.

Duty Factor Calculation chart

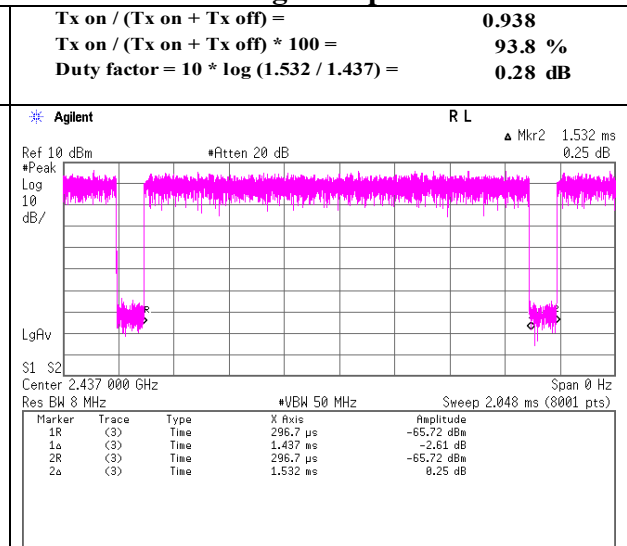
(for Average Output Power)

Report No.	13218114S-H-R1	
Test place	Shonan EMC Lab. No.5 Shielded Room	
Date	June 1, 2020	June 5, 2020
Temperature / Humidity	26 deg. C / 41 % RH	25 deg. C / 50 % RH
Engineer	Takahiro Kawakami	Kenichi Adachi
Mode	Tx	

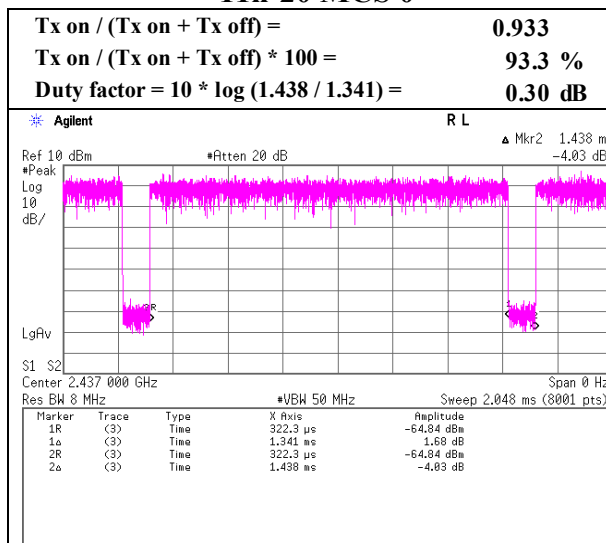
11b 1 Mbps



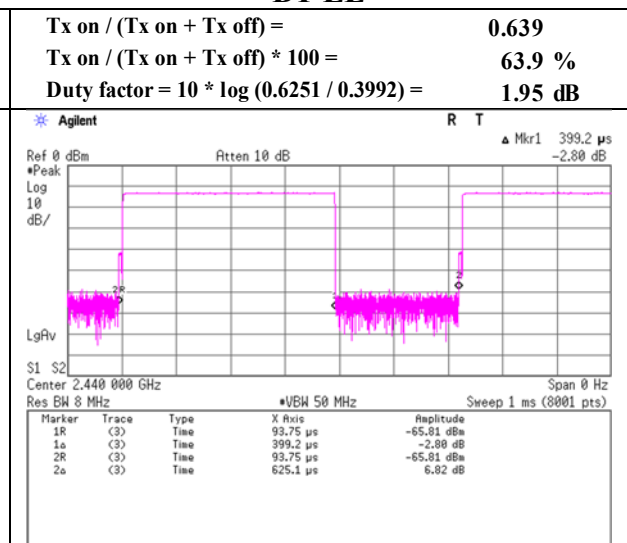
11g 6 Mbps



11n-20 MCS 0



BT LE



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

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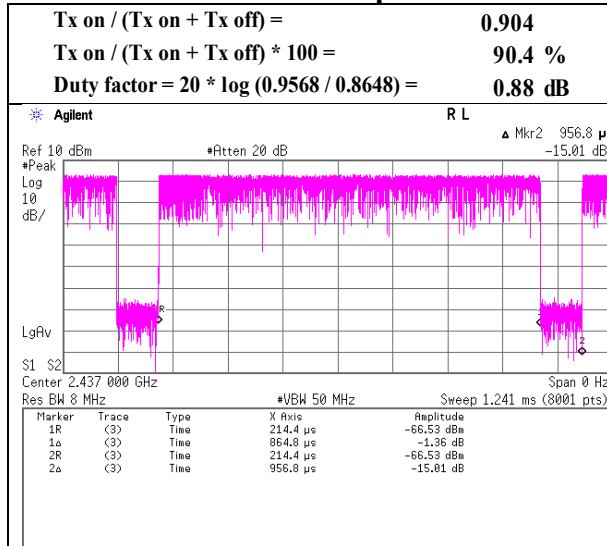
Facsimile : +81 463 50 6401

Duty Factor Calculation chart

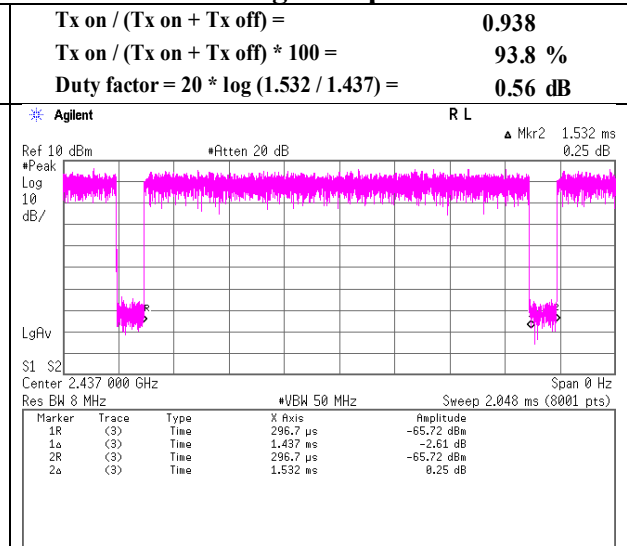
(for Radiated emission test)

Report No. 13218114S-H-R1
Test place Shonan EMC Lab. No.5 Shielded Room
Date June 1, 2020 June 5, 2020
Temperature / Humidity 26 deg. C / 41 % RH 25 deg. C / 50 % RH
Engineer Takahiro Kawakami Kenichi Adachi
Mode Tx

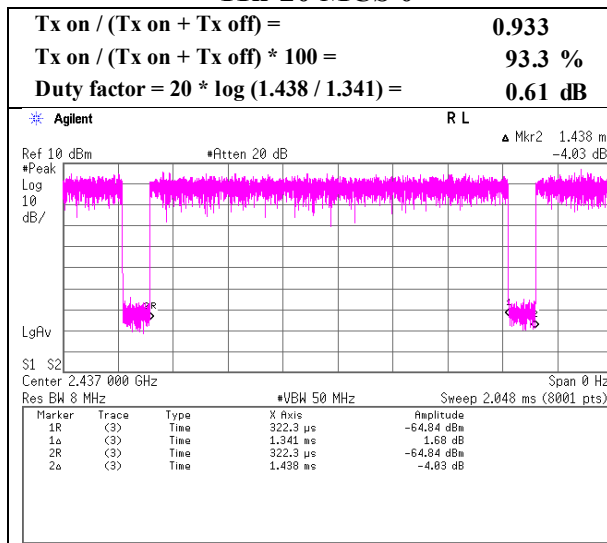
11b 11 Mbps



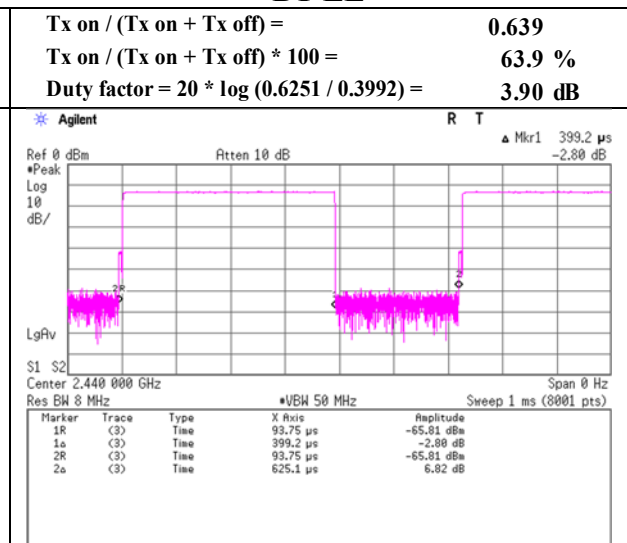
11g 6 Mbps



11n-20 MCS 0



BT LE



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

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Radiated Spurious Emission

Report No. 13218114S-H-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date June 3, 2020 June 3, 2020 June 4, 2020
Temperature / Humidity 21 deg. C / 64 % RH 23 deg. C / 59 % RH 23 deg. C / 63 % RH
Engineer Takahiro Kawakami Hiromasa Sato Takahiro Kawakami
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 26.5 GHz)
Mode Tx 11b, 2412 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.	2390.000	PK	48.86	28.33	14.08	41.66	2.04	51.65	73.90	22.2	100	2	
Hori.	4824.000	PK	46.67	31.64	6.59	42.93	2.04	44.01	73.90	29.8	150	0	Floor noise
Hori.	7236.000	PK	48.51	37.25	8.09	43.41	2.04	52.48	73.90	21.4	150	0	Floor noise
Hori.	9648.000	PK	47.71	38.97	9.25	43.10	2.04	54.87	73.90	19.0	150	0	Floor noise
Hori.	4824.000	AV	38.95	31.64	6.59	42.93	2.04	36.29	53.90	17.6	150	0	Floor noise
Hori.	7236.000	AV	39.35	37.25	8.09	43.41	2.04	43.32	53.90	10.5	150	0	Floor noise
Hori.	9648.000	AV	39.71	38.97	9.25	43.10	2.04	46.87	53.90	7.0	150	0	Floor noise
Vert.	2390.000	PK	47.69	28.33	14.08	41.66	2.04	50.48	73.90	23.4	137	317	
Vert.	4824.000	PK	46.24	31.64	6.59	42.93	2.04	43.58	73.90	30.3	150	0	Floor noise
Vert.	7236.000	PK	48.14	37.25	8.09	43.41	2.04	52.11	73.90	21.7	150	0	Floor noise
Vert.	9648.000	PK	47.82	38.97	9.25	43.10	2.04	54.98	73.90	18.9	150	0	Floor noise
Vert.	4824.000	AV	38.99	31.64	6.59	42.93	2.04	36.33	53.90	17.5	150	0	Floor noise
Vert.	7236.000	AV	39.40	37.25	8.09	43.41	2.04	43.37	53.90	10.5	150	0	Floor noise
Vert.	9648.000	AV	39.67	38.97	9.25	43.10	2.04	46.83	53.90	7.0	150	0	Floor noise

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

Distance factor : 1 GHz - 13 GHz : 20log(3.79 m / 3.0 m) = 2.04 dB

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

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	38.52	28.33	14.08	41.66	0.88	2.04	42.19	53.90	11.7	*1)
Vert.	2390.000	AV	38.27	28.33	14.08	41.66	0.88	2.04	41.94	53.90	11.9	*1)

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

Distance factor : 1 GHz - 13 GHz : 20log(3.79 m / 3.0 m) = 2.04 dB

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

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

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.	2412.000	PK	98.00	28.29	14.09	41.67	2.04	100.75	-	-	Carrier
Hori.	2400.000	PK	46.22	28.31	14.08	41.67	2.04	48.98	80.75	31.7	
Vert.	2412.000	PK	98.74	28.29	14.09	41.67	2.04	101.49	-	-	Carrier
Vert.	2400.000	PK	46.44	28.31	14.08	41.67	2.04	49.20	81.49	32.2	

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

Distance factor : 1 GHz - 13 GHz : 20log(3.79 m / 3.0 m) = 2.04 dB

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

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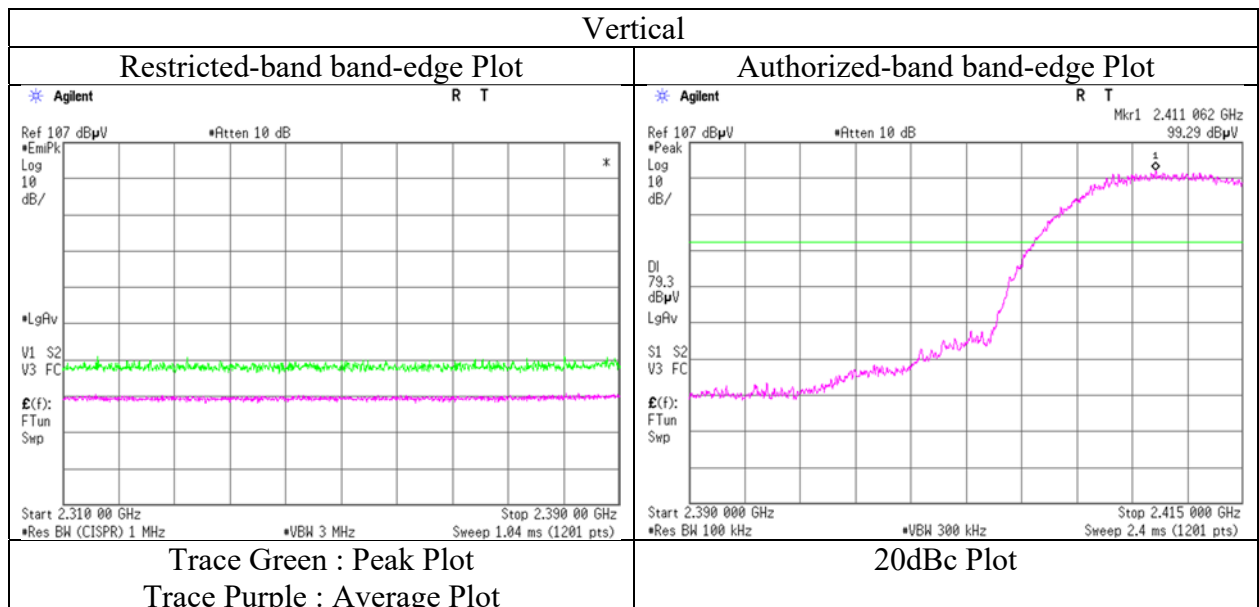
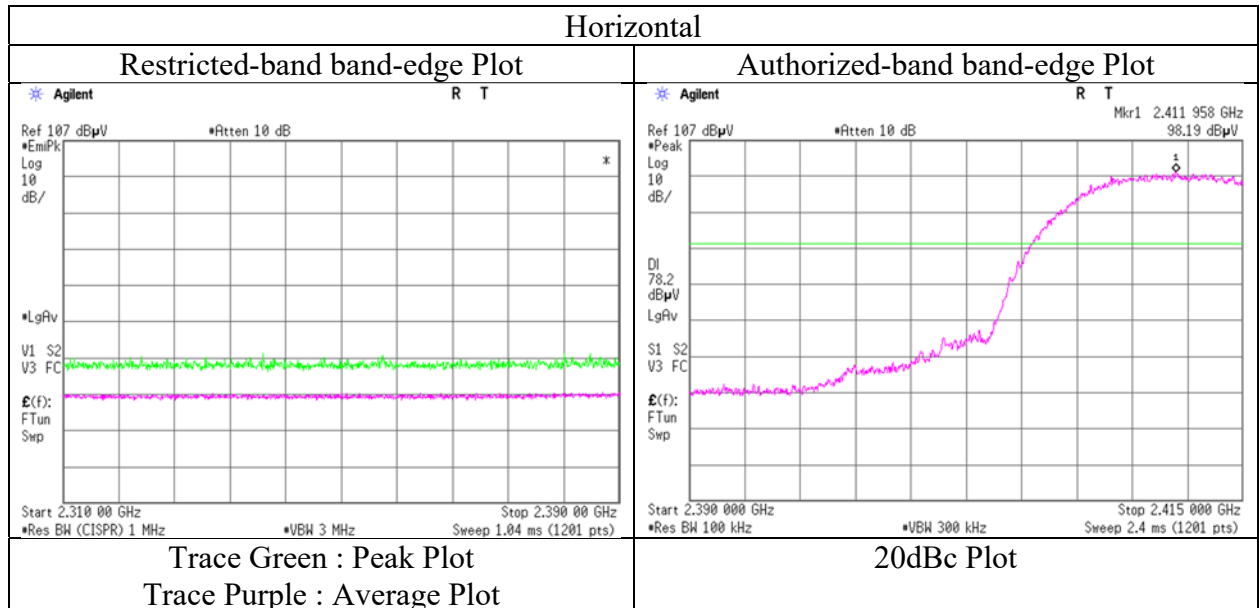
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13218114S-H-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3		
Date	June 3, 2020	June 3, 2020	June 4, 2020
Temperature / Humidity	21 deg. C / 64 % RH	23 deg. C / 59 % RH	23 deg. C / 63 % RH
Engineer	Takahiro Kawakami	Hiromasa Sato	Takahiro Kawakami
	(1 GHz – 2.8 GHz)	(2.8 GHz – 13 GHz)	(13 GHz – 26.5 GHz)
Mode	Tx 11b, 2412 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.

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Shonan EMC Lab.

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

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Radiated Spurious Emission

Report No. 13218114S-H-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date June 3, 2020 June 3, 2020 June 4, 2020
Temperature / Humidity 21 deg. C / 64 % RH 23 deg. C / 59 % RH 23 deg. C / 63 % RH
Engineer Takahiro Kawakami Hiromasa Sato Takahiro Kawakami
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 26.5 GHz)
Mode Tx 11b, 2437 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.	4874.000	PK	47.52	31.70	6.62	42.93	2.04	44.95	73.90	28.9	150	0	Floor noise
Hori.	7311.000	PK	48.40	37.36	8.13	43.48	2.04	52.45	73.90	21.4	150	0	Floor noise
Hori.	9748.000	PK	48.69	39.31	9.30	42.98	2.04	56.36	73.90	17.5	150	0	Floor noise
Hori.	4874.000	AV	38.95	31.70	6.62	42.93	2.04	36.38	53.90	17.5	150	0	Floor noise
Hori.	7311.000	AV	38.97	37.36	8.13	43.48	2.04	43.02	53.90	10.8	150	0	Floor noise
Hori.	9748.000	AV	39.64	39.31	9.30	42.98	2.04	47.31	53.90	6.5	150	0	Floor noise
Vert.	4874.000	PK	47.35	31.70	6.62	42.93	2.04	44.78	73.90	29.1	150	0	Floor noise
Vert.	7311.000	PK	48.59	37.36	8.13	43.48	2.04	52.64	73.90	21.2	150	0	Floor noise
Vert.	9748.000	PK	48.37	39.31	9.30	42.98	2.04	56.04	73.90	17.8	150	0	Floor noise
Vert.	4874.000	AV	38.76	31.70	6.62	42.93	2.04	36.19	53.90	17.7	150	0	Floor noise
Vert.	7311.000	AV	38.97	37.36	8.13	43.48	2.04	43.02	53.90	10.8	150	0	Floor noise
Vert.	9748.000	AV	39.60	39.31	9.30	42.98	2.04	47.27	53.90	6.6	150	0	Floor noise

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.79\text{ m} / 3.0\text{ m}) = 2.04\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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Radiated Spurious Emission

Report No. 13218114S-H-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date June 3, 2020 June 3, 2020 June 4, 2020
Temperature / Humidity 21 deg. C / 64 % RH 23 deg. C / 59 % RH 23 deg. C / 63 % RH
Engineer Takahiro Kawakami Hiromasa Sato Takahiro Kawakami
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 26.5 GHz)
Mode Tx 11b, 2462 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.	2483.500	PK	47.93	28.24	14.17	41.69	2.04	50.69	73.90	23.2	100	353	
Hori.	4924.000	PK	47.22	31.82	6.64	42.94	2.03	44.77	73.90	29.1	150	0	Floor noise
Hori.	7386.000	PK	48.66	37.49	8.18	43.55	2.03	52.81	73.90	21.0	150	0	Floor noise
Hori.	9848.000	PK	48.01	39.33	9.36	42.87	2.03	55.86	73.90	18.0	150	0	Floor noise
Hori.	4924.000	AV	38.80	31.82	6.64	42.94	2.03	36.35	53.90	17.5	150	0	Floor noise
Hori.	7386.000	AV	39.07	37.49	8.18	43.55	2.03	43.22	53.90	10.6	150	0	Floor noise
Hori.	9848.000	AV	39.20	39.33	9.36	42.87	2.03	47.05	53.90	6.8	150	0	Floor noise
Vert.	2483.500	PK	48.41	28.24	14.17	41.69	2.04	51.17	73.90	22.7	132	331	
Vert.	4924.000	PK	47.88	31.82	6.64	42.94	2.03	45.43	73.90	28.4	150	0	Floor noise
Vert.	7386.000	PK	48.55	37.49	8.18	43.55	2.03	52.70	73.90	21.2	150	0	Floor noise
Vert.	9848.000	PK	48.04	39.33	9.36	42.87	2.03	55.89	73.90	18.0	150	0	Floor noise
Vert.	4924.000	AV	38.79	31.82	6.64	42.94	2.03	36.34	53.90	17.5	150	0	Floor noise
Vert.	7386.000	AV	39.10	37.49	8.18	43.55	2.03	43.25	53.90	10.6	150	0	Floor noise
Vert.	9848.000	AV	39.28	39.33	9.36	42.87	2.03	47.13	53.90	6.7	150	0	Floor noise

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.79\text{ m} / 3.0\text{ m}) = 2.04\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	38.68	28.24	14.17	41.69	0.88	2.04	42.32	53.9	11.5	*1)
Vert.	2483.500	AV	38.64	28.24	14.17	41.69	0.88	2.04	42.28	53.9	11.6	*1)

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.79\text{ m} / 3.0\text{ m}) = 2.04\text{ dB}$

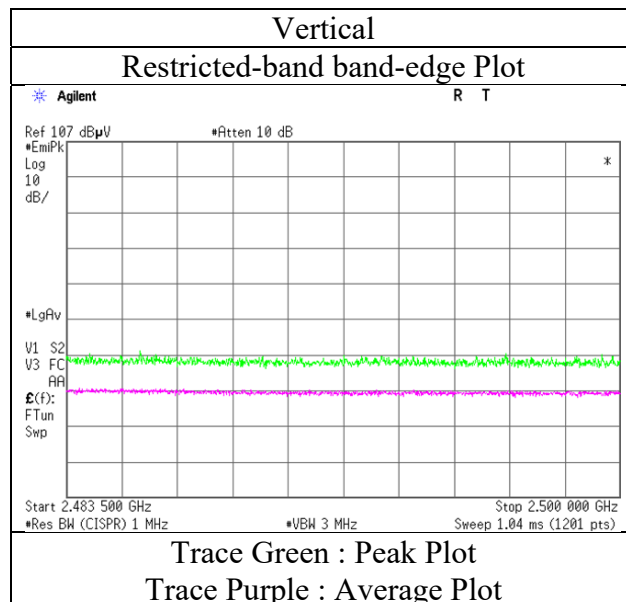
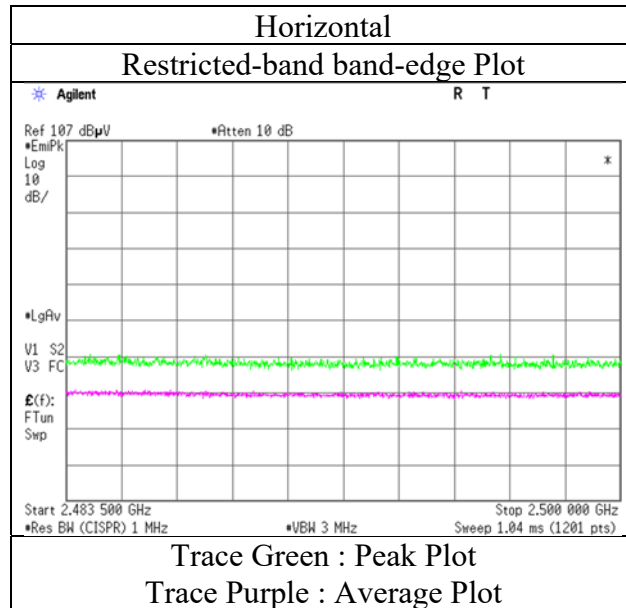
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13218114S-H-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3		
Date	June 3, 2020	June 3, 2020	June 4, 2020
Temperature / Humidity	21 deg. C / 64 % RH	23 deg. C / 59 % RH	23 deg. C / 63 % RH
Engineer	Takahiro Kawakami	Hiromasa Sato	Takahiro Kawakami
	(1 GHz – 2.8 GHz)	(2.8 GHz – 13 GHz)	(13 GHz – 26.5 GHz)
Mode	Tx 11b, 2462 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. 13218114S-H-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date June 3, 2020 June 3, 2020 June 4, 2020
Temperature / Humidity 21 deg. C / 64 % RH 23 deg. C / 59 % RH 23 deg. C / 63 % RH
Engineer Takahiro Kawakami Hiromasa Sato Takahiro Kawakami
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 26.5 GHz)
Mode Tx 11g, 2412 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.	2390.000	PK	60.64	28.33	14.08	41.66	2.04	63.43	73.90	10.4	110	7	
Hori.	4824.000	PK	47.92	31.64	6.59	42.93	2.04	45.26	73.90	28.6	150	0	Floor noise
Hori.	7236.000	PK	48.54	37.25	8.09	43.41	2.04	52.51	73.90	21.3	150	0	Floor noise
Hori.	9648.000	PK	48.47	38.97	9.25	43.10	2.04	55.63	73.90	18.2	150	0	Floor noise
Hori.	4824.000	AV	39.06	31.64	6.59	42.93	2.04	36.40	53.90	17.5	150	0	Floor noise
Hori.	7236.000	AV	39.13	37.25	8.09	43.41	2.04	43.10	53.90	10.8	150	0	Floor noise
Hori.	9648.000	AV	39.42	38.97	9.25	43.10	2.04	46.58	53.90	7.3	150	0	Floor noise
Vert.	2390.000	PK	61.17	28.33	14.08	41.66	2.04	63.96	73.90	9.9	116	331	
Vert.	4824.000	PK	47.64	31.64	6.59	42.93	2.04	44.98	73.90	28.9	150	0	Floor noise
Vert.	7236.000	PK	48.13	37.25	8.09	43.41	2.04	52.10	73.90	21.8	150	0	Floor noise
Vert.	9648.000	PK	48.40	38.97	9.25	43.10	2.04	55.56	73.90	18.3	150	0	Floor noise
Vert.	4824.000	AV	39.11	31.64	6.59	42.93	2.04	36.45	53.90	17.4	150	0	Floor noise
Vert.	7236.000	AV	39.47	37.25	8.09	43.41	2.04	43.44	53.90	10.4	150	0	Floor noise
Vert.	9648.000	AV	39.52	38.97	9.25	43.10	2.04	46.68	53.90	7.2	150	0	Floor noise

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

Distance factor : 1 GHz - 13 GHz : 20log (3.79 m / 3.0 m) = 2.04 dB

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

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	42.99	28.33	14.08	41.66	0.56	2.04	46.34	53.9	7.5	*1)
Vert.	2390.000	AV	43.33	28.33	14.08	41.66	0.56	2.04	46.68	53.9	7.2	*1)

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

Distance factor : 1 GHz - 13 GHz : 20log (3.79 m / 3.0 m) = 2.04 dB

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

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

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.	2412.000	PK	93.77	28.29	14.09	41.67	2.04	96.52	-	-	Carrier
Hori.	2400.000	PK	54.78	28.31	14.08	41.67	2.04	57.54	76.52	18.9	
Vert.	2412.000	PK	94.71	28.29	14.09	41.67	2.04	97.46	-	-	Carrier
Vert.	2400.000	PK	54.97	28.31	14.08	41.67	2.04	57.73	77.46	19.7	

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

Distance factor : 1 GHz - 13 GHz : 20log (3.79 m / 3.0 m) = 2.04 dB

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

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Shonan EMC Lab.

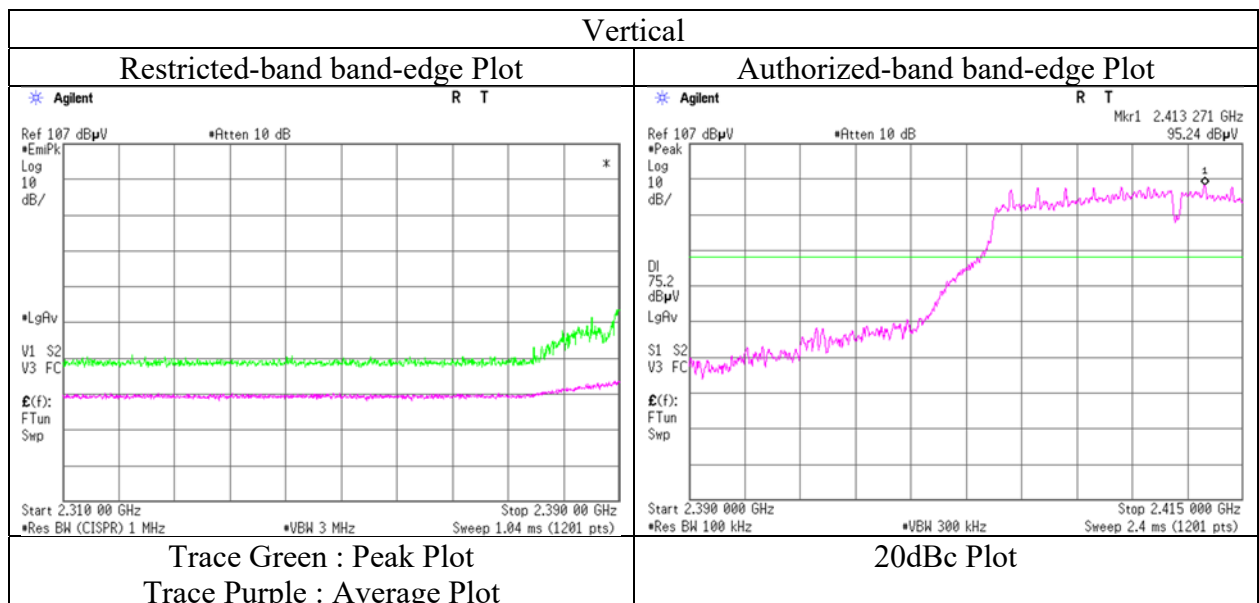
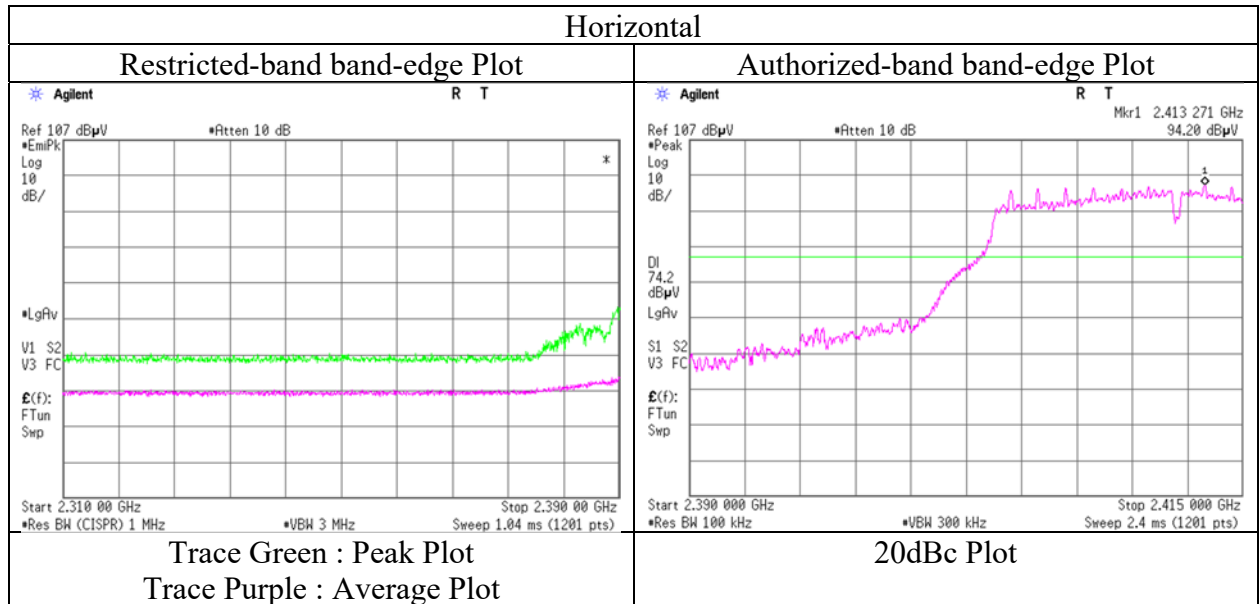
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13218114S-H-R1	June 3, 2020	June 4, 2020
Test place	Shonan EMC Lab.	23 deg. C / 59 % RH	23 deg. C / 63 % RH
Semi Anechoic Chamber	No.3	Hiromasa Sato	Takahiro Kawakami
Date	June 3, 2020	(2.8 GHz – 13 GHz)	(13 GHz – 26.5 GHz)
Temperature / Humidity	21 deg. C / 64 % RH		
Engineer	Takahiro Kawakami		
Mode	Tx 11g, 2412 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. 13218114S-H-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date June 3, 2020 June 3, 2020 June 4, 2020
Temperature / Humidity 21 deg. C / 64 % RH 23 deg. C / 59 % RH 23 deg. C / 63 % RH
Engineer Takahiro Kawakami Hiromasa Sato Takahiro Kawakami
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 26.5 GHz)
Mode Tx 11g, 2437 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.	4874.000	PK	47.08	31.70	6.62	42.93	2.04	44.51	73.90	29.3	150	0	Floor noise
Hori.	7311.000	PK	48.54	37.36	8.13	43.48	2.04	52.59	73.90	21.3	150	0	Floor noise
Hori.	9748.000	PK	48.13	39.31	9.30	42.98	2.04	55.80	73.90	18.1	150	0	Floor noise
Hori.	4874.000	AV	39.01	31.70	6.62	42.93	2.04	36.44	53.90	17.4	150	0	Floor noise
Hori.	7311.000	AV	39.19	37.36	8.13	43.48	2.04	43.24	53.90	10.6	150	0	Floor noise
Hori.	9748.000	AV	39.37	39.31	9.30	42.98	2.04	47.04	53.90	6.8	150	0	Floor noise
Vert.	4874.000	PK	47.69	31.70	6.62	42.93	2.04	45.12	73.90	28.7	150	0	Floor noise
Vert.	7311.000	PK	48.47	37.36	8.13	43.48	2.04	52.52	73.90	21.3	150	0	Floor noise
Vert.	9748.000	PK	48.11	39.31	9.30	42.98	2.04	55.78	73.90	18.1	150	0	Floor noise
Vert.	4874.000	AV	39.14	31.70	6.62	42.93	2.04	36.57	53.90	17.3	150	0	Floor noise
Vert.	7311.000	AV	39.45	37.36	8.13	43.48	2.04	43.50	53.90	10.4	150	0	Floor noise
Vert.	9748.000	AV	39.48	39.31	9.30	42.98	2.04	47.15	53.90	6.7	150	0	Floor noise

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.79\text{ m} / 3.0\text{ m}) = 2.04\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

UL Japan, Inc.

Shonan EMC Lab.

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

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Radiated Spurious Emission

Report No. 13218114S-H-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date June 3, 2020 June 3, 2020 June 4, 2020
Temperature / Humidity 21 deg. C / 64 % RH 23 deg. C / 59 % RH 23 deg. C / 63 % RH
Engineer Takahiro Kawakami Hiromasa Sato Takahiro Kawakami
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 26.5 GHz)
Mode Tx 11g, 2462 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.	4924.000	PK	47.27	31.82	6.64	42.94	2.04	44.83	73.90	29.0	150		0 Floor noise
Hori.	7386.000	PK	48.50	37.49	8.18	43.55	2.04	52.66	73.90	21.2	150		0 Floor noise
Hori.	9848.000	PK	48.26	39.33	9.36	42.87	2.04	56.12	73.90	17.7	150		0 Floor noise
Hori.	2483.500	PK	56.55	28.24	14.17	41.69	2.04	59.31	73.90	14.5	100		3
Hori.	4924.000	AV	39.13	31.82	6.64	42.94	2.04	36.69	53.90	17.2	150		0 Floor noise
Hori.	7386.000	AV	39.24	37.49	8.18	43.55	2.04	43.40	53.90	10.5	150		0 Floor noise
Hori.	9848.000	AV	39.39	39.33	9.36	42.87	2.04	47.25	53.90	6.6	150		0 Floor noise
Vert.	2483.500	PK	58.03	28.24	14.17	41.69	2.04	60.79	73.90	13.1	110	345	
Vert.	4924.000	PK	47.77	31.82	6.64	42.94	2.04	45.33	73.90	28.5	150		0 Floor noise
Vert.	7386.000	PK	48.51	37.49	8.18	43.55	2.04	52.67	73.90	21.2	150		0 Floor noise
Vert.	9848.000	PK	48.24	39.33	9.36	42.87	2.04	56.10	73.90	17.8	150		0 Floor noise
Vert.	4924.000	AV	39.10	31.82	6.64	42.94	2.04	36.66	53.90	17.2	150		0 Floor noise
Vert.	7386.000	AV	39.47	37.49	8.18	43.55	2.04	43.63	53.90	10.2	150		0 Floor noise
Vert.	9848.000	AV	39.44	39.33	9.36	42.87	2.04	47.30	53.90	6.6	150		0 Floor noise

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.79\text{ m} / 3.0\text{ m}) = 2.04\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	41.13	28.24	14.17	41.69	0.56	2.04	44.45	53.9	9.4	*1)
Vert.	2483.500	AV	41.14	28.24	14.17	41.69	0.56	2.04	44.46	53.9	9.4	*1)

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.79\text{ m} / 3.0\text{ m}) = 2.04\text{ dB}$

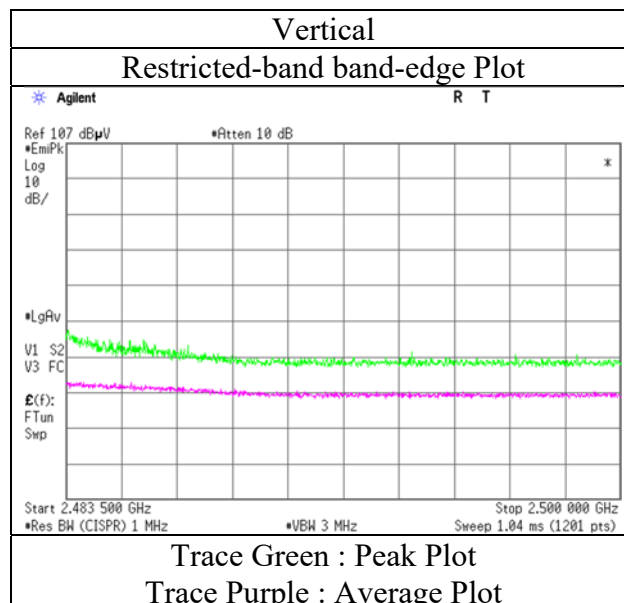
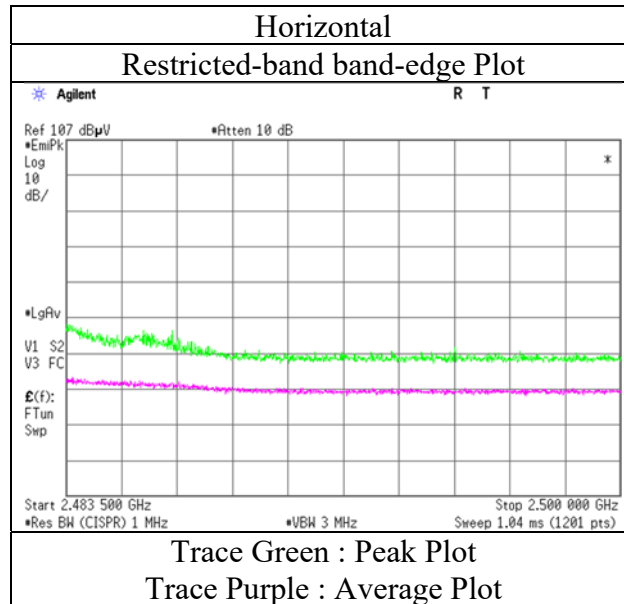
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13218114S-H-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3		
Date	June 3, 2020	June 3, 2020	June 4, 2020
Temperature / Humidity	21 deg. C / 64 % RH	23 deg. C / 59 % RH	23 deg. C / 63 % RH
Engineer	Takahiro Kawakami	Hiromasa Sato	Takahiro Kawakami
	(1 GHz – 2.8 GHz)	(2.8 GHz – 13 GHz)	(13 GHz – 26.5 GHz)
Mode	Tx 11g, 2462 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.

UL Japan, Inc.

Shonan EMC Lab.

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Radiated Spurious Emission

Report No. 13218114S-H-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date June 3, 2020 June 4, 2020
Temperature / Humidity 23 deg. C / 59 % RH 23 deg. C / 63 % RH
Engineer Hiromasa Sato Takahiro Kawakami
(1 GHz – 13 GHz) (13 GHz – 26.5 GHz)
Mode Tx 11n-20, 2412 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.	2390.000	PK	58.46	28.33	14.08	41.66	2.04	61.25	73.90	12.6	141	10	
Hori.	4824.000	PK	47.20	31.64	6.59	42.93	2.04	44.54	73.90	29.3	150	0	Floor noise
Hori.	7236.000	PK	48.35	37.25	8.09	43.41	2.04	52.32	73.90	21.5	150	0	Floor noise
Hori.	9648.000	PK	48.24	38.97	9.25	43.10	2.04	55.40	73.90	18.5	150	0	Floor noise
Hori.	4824.000	AV	39.12	31.64	6.59	42.93	2.04	36.46	53.90	17.4	150	0	Floor noise
Hori.	7236.000	AV	39.28	37.25	8.09	43.41	2.04	43.25	53.90	10.6	150	0	Floor noise
Hori.	9648.000	AV	39.41	38.97	9.25	43.10	2.04	46.57	53.90	7.3	150	0	Floor noise
Vert.	2390.000	PK	59.18	28.33	14.08	41.66	2.04	61.97	73.90	11.9	149	350	
Vert.	4824.000	PK	47.55	31.64	6.59	42.93	2.04	44.89	73.90	29.0	150	0	Floor noise
Vert.	7236.000	PK	48.39	37.25	8.09	43.41	2.04	52.36	73.90	21.5	150	0	Floor noise
Vert.	9648.000	PK	48.25	38.97	9.25	43.10	2.04	55.41	73.90	18.4	150	0	Floor noise
Vert.	4824.000	AV	39.08	31.64	6.59	42.93	2.04	36.42	53.90	17.4	150	0	Floor noise
Vert.	7236.000	AV	39.49	37.25	8.09	43.41	2.04	43.46	53.90	10.4	150	0	Floor noise
Vert.	9648.000	AV	39.40	38.97	9.25	43.10	2.04	46.56	53.90	7.3	150	0	Floor noise

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.79\text{ m} / 3.0\text{ m}) = 2.04\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	41.17	28.33	14.08	41.66	0.61	2.04	44.57	53.9	9.3	*1)
Vert.	2390.000	AV	41.23	28.33	14.08	41.66	0.61	2.04	44.63	53.9	9.2	*1)

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.79\text{ m} / 3.0\text{ m}) = 2.04\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

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.	2412.000	PK	92.43	28.29	14.09	41.67	2.04	95.18	-	-	Carrier
Hori.	2400.000	PK	54.70	28.31	14.08	41.67	2.04	57.46	75.18	17.7	
Vert.	2412.000	PK	92.77	28.29	14.09	41.67	2.04	95.52	-	-	Carrier
Vert.	2400.000	PK	56.04	28.31	14.08	41.67	2.04	58.80	75.52	16.7	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.79\text{ m} / 3.0\text{ m}) = 2.04\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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Shonan EMC Lab.

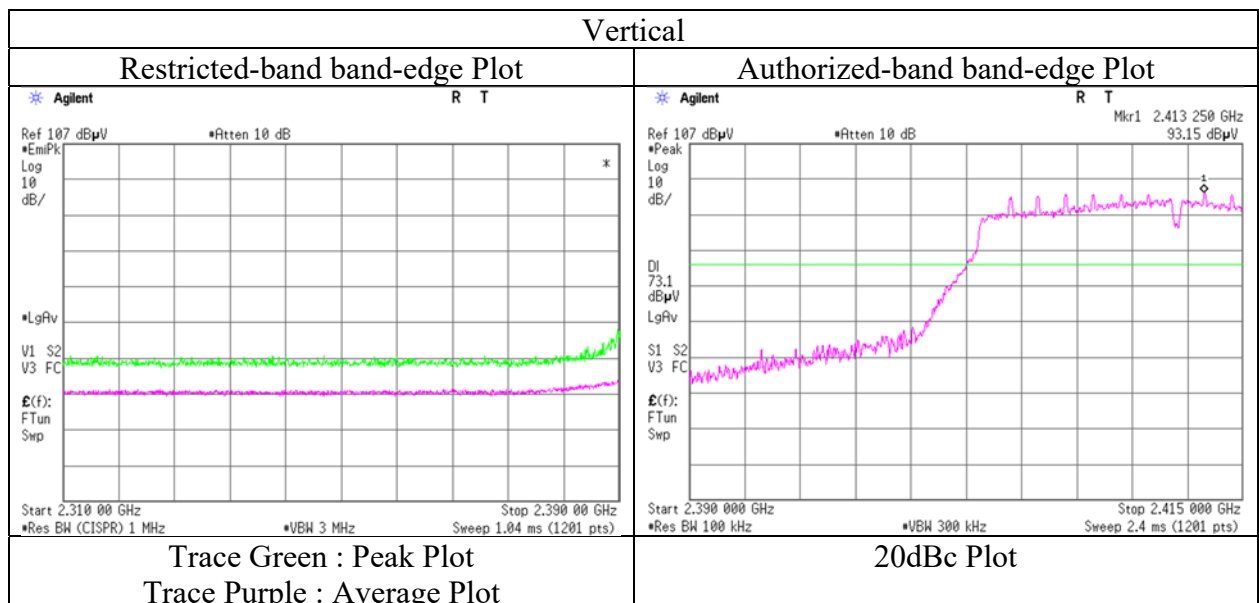
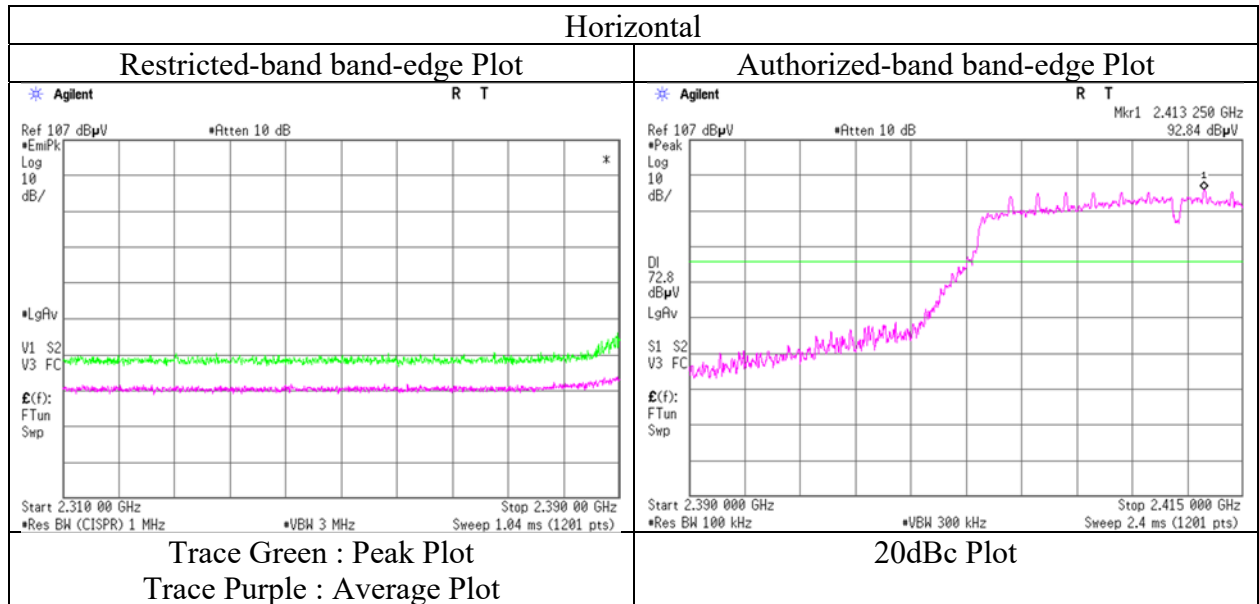
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13218114S-H-R1	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	
Date	June 3, 2020	June 4, 2020
Temperature / Humidity	23 deg. C / 59 % RH	23 deg. C / 63 % RH
Engineer	Hiromasa Sato	Takahiro Kawakami
	(1 GHz – 13 GHz)	(13 GHz – 26.5 GHz)
Mode	Tx 11n-20, 2412 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. 13218114S-H-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date June 4, 2020 June 3, 2020 June 4, 2020
Temperature / Humidity 26 deg. C / 57 % RH 23 deg. C / 59 % RH 23 deg. C / 63 % RH
Engineer Hiromasa Sato Hiromasa Sato Takahiro Kawakami
(30 MHz – 1 GHz) (1 GHz – 13 GHz) (13 GHz – 26.5 GHz)
Mode Tx 11n-20, 2437 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.	200.000	QP	42.93	16.56	7.98	32.04	0.00	35.43	43.50	8.0	155	281	
Hori.	224.998	QP	35.64	11.26	8.12	32.01	0.00	23.01	46.00	22.9	188	231	
Hori.	375.001	QP	38.43	15.11	8.89	31.93	0.00	30.50	46.00	15.5	100	60	
Hori.	400.001	QP	36.54	15.74	9.00	31.93	0.00	29.35	46.00	16.6	100	58	
Hori.	600.001	QP	43.27	19.30	9.80	31.94	0.00	40.43	46.00	5.5	180	24	
Hori.	999.997	QP	33.15	22.39	11.16	30.11	0.00	36.59	53.90	17.3	100	50	
Hori.	4874.000	PK	47.11	31.70	6.62	42.93	2.04	44.54	73.90	29.3	150	0	Floor noise
Hori.	7311.000	PK	48.49	37.36	8.13	43.48	2.04	52.54	73.90	21.3	150	0	Floor noise
Hori.	9748.000	PK	48.20	39.31	9.30	42.98	2.04	55.87	73.90	18.0	150	0	Floor noise
Hori.	4874.000	AV	39.10	31.70	6.62	42.93	2.04	36.53	53.90	17.3	150	0	Floor noise
Hori.	7311.000	AV	39.37	37.36	8.13	43.48	2.04	43.42	53.90	10.4	150	0	Floor noise
Hori.	9748.000	AV	39.44	39.31	9.30	42.98	2.04	47.11	53.90	6.7	150	0	Floor noise
Vert.	43.909	QP	37.83	13.38	6.71	32.17	0.00	25.75	40.00	14.2	100	144	
Vert.	71.999	QP	38.28	6.45	6.93	32.15	0.00	19.51	40.00	20.4	100	318	
Vert.	134.767	QP	30.26	14.15	7.47	32.10	0.00	19.78	43.50	23.7	100	192	
Vert.	200.000	QP	33.92	16.56	7.98	32.04	0.00	26.42	43.50	17.0	100	270	
Vert.	600.001	QP	41.20	19.30	9.80	31.94	0.00	38.36	46.00	7.6	155	359	
Vert.	999.986	QP	32.84	22.39	11.16	30.11	0.00	36.28	53.90	17.6	104	292	
Vert.	4874.000	PK	47.34	31.70	6.62	42.93	2.04	44.77	73.90	29.1	150	0	Floor noise
Vert.	7311.000	PK	48.50	37.36	8.13	43.48	2.04	52.55	73.90	21.3	150	0	Floor noise
Vert.	9748.000	PK	48.39	39.31	9.30	42.98	2.04	56.06	73.90	17.8	150	0	Floor noise
Vert.	4874.000	AV	39.16	31.70	6.62	42.93	2.04	36.59	53.90	17.3	150	0	Floor noise
Vert.	7311.000	AV	39.44	37.36	8.13	43.48	2.04	43.49	53.90	10.4	150	0	Floor noise
Vert.	9748.000	AV	39.46	39.31	9.30	42.98	2.04	47.13	53.90	6.7	150	0	Floor noise

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.79\text{ m} / 3.0\text{ m}) = 2.04\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Radiated Spurious Emission

Report No. 13218114S-H-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date June 3, 2020 June 4, 2020
Temperature / Humidity 23 deg. C / 59 % RH 23 deg. C / 63 % RH
Engineer Hiromasa Sato Takahiro Kawakami
(1 GHz – 13 GHz) (13 GHz – 26.5 GHz)
Mode Tx 11n-20, 2462 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.	2483.500	PK	60.84	28.24	14.17	41.69	2.04	63.60	73.90	10.3	121	15	
Hori.	4924.000	PK	47.21	31.82	6.64	42.94	2.04	44.77	73.90	29.1	100	0	Floor noise
Hori.	7386.000	PK	48.37	37.49	8.18	43.55	2.04	52.53	73.90	21.3	100	0	Floor noise
Hori.	9848.000	PK	48.31	39.33	9.36	42.87	2.04	56.17	73.90	17.7	100	0	Floor noise
Hori.	4924.000	AV	39.08	31.82	6.64	42.94	2.04	36.64	53.90	17.2	100	0	Floor noise
Hori.	7386.000	AV	39.47	37.49	8.18	43.55	2.04	43.63	53.90	10.2	100	0	Floor noise
Hori.	9848.000	AV	39.41	39.33	9.36	42.87	2.04	47.27	53.90	6.6	100	0	Floor noise
Vert.	2483.500	PK	61.17	28.24	14.17	41.69	2.04	63.93	73.90	9.9	129	288	
Vert.	4924.000	PK	47.29	31.82	6.64	42.94	2.04	44.85	73.90	29.0	100	0	Floor noise
Vert.	7386.000	PK	48.44	37.49	8.18	43.55	2.04	52.60	73.90	21.3	100	0	Floor noise
Vert.	9848.000	PK	48.36	39.33	9.36	42.87	2.04	56.22	73.90	17.6	100	0	Floor noise
Vert.	4924.000	AV	39.17	31.82	6.64	42.94	2.04	36.73	53.90	17.1	100	0	Floor noise
Vert.	7386.000	AV	39.49	37.49	8.18	43.55	2.04	43.65	53.90	10.2	100	0	Floor noise
Vert.	9848.000	AV	39.28	39.33	9.36	42.87	2.04	47.14	53.90	6.7	100	0	Floor noise

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.79\text{ m} / 3.0\text{ m}) = 2.04\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	42.27	28.24	14.17	41.69	0.61	2.04	45.64	53.9	8.2	*1)
Vert.	2483.500	AV	42.80	28.24	14.17	41.69	0.61	2.04	46.17	53.9	7.7	*1)

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.79\text{ m} / 3.0\text{ m}) = 2.04\text{ dB}$

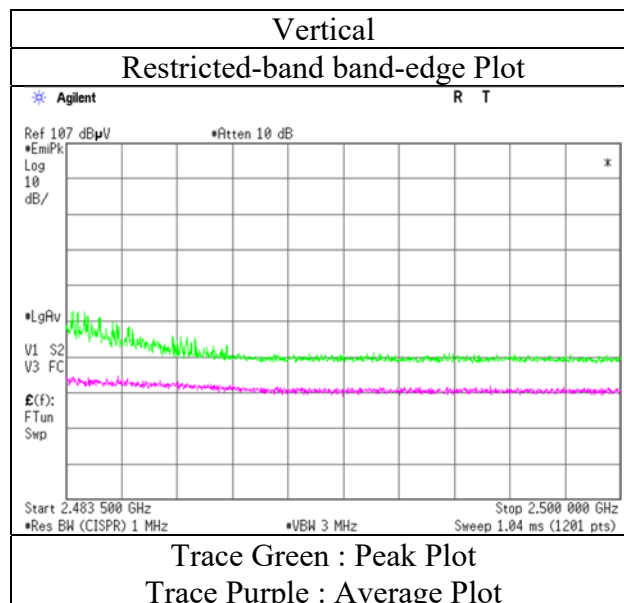
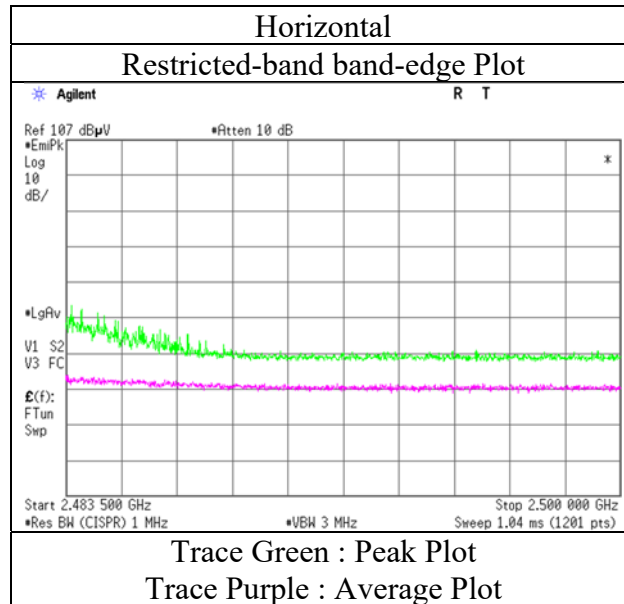
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13218114S-H-R1	
Test place	Shonan EMC Lab.	
Semi Anechoic Chamber	No.3	
Date	June 3, 2020	June 4, 2020
Temperature / Humidity	23 deg. C / 59 % RH	23 deg. C / 63 % RH
Engineer	Hiromasa Sato	Takahiro Kawakami
	(1 GHz – 13 GHz)	(13 GHz – 26.5 GHz)
Mode	Tx 11n-20, 2462 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.

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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Radiated Spurious Emission

Report No. 13218114S-H-R1
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date June 4, 2020
Temperature / Humidity 26 deg. C / 57 % RH
Engineer Hiromasa Sato
(30 MHz – 1 GHz)
Mode Tx BT LE, 2402 MHz

No.3
June 6, 2020
23 deg. C / 69 % RH
Takahiro Kawakami
(1 GHz – 2.8 GHz)

No.3
June 4, 2020
23 deg. C / 63 % RH
Takahiro Kawakami
(2.8 GHz – 26.5 GHz)

(* 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.	65.269	QP	30.04	7.19	6.48	32.15	0.00	11.56	40.00	28.4	150	292	
Hori.	96.099	QP	33.52	9.39	7.42	32.14	0.00	18.19	43.50	25.3	253	244	
Hori.	216.000	QP	33.57	11.22	8.07	32.02	0.00	20.84	43.50	22.6	157	95	
Hori.	375.001	QP	38.21	15.11	8.89	31.93	0.00	30.28	46.00	15.7	100	55	
Hori.	540.001	QP	40.98	17.69	9.58	31.99	0.00	36.26	46.00	9.7	193	51	
Hori.	2390.000	PK	47.78	28.33	14.08	41.66	2.04	50.57	73.90	23.3	373	270	
Hori.	4804.000	PK	48.61	31.62	6.58	42.92	2.04	45.93	73.90	27.9	150	0	Floor noise
Hori.	7206.000	PK	48.02	37.23	8.08	43.39	2.04	51.98	73.90	21.9	150	0	Floor noise
Hori.	9608.000	PK	48.29	38.84	9.21	43.14	2.04	55.24	73.90	18.6	150	0	Floor noise
Hori.	4804.000	AV	38.97	31.62	6.58	42.92	2.04	36.29	53.90	17.6	150	0	Floor noise
Hori.	7206.000	AV	38.33	37.23	8.08	43.39	2.04	42.29	53.90	11.6	150	0	Floor noise
Hori.	9608.000	AV	38.17	38.84	9.21	43.14	2.04	45.12	53.90	8.7	150	0	Floor noise
Vert.	46.067	QP	39.90	12.58	6.74	32.16	0.00	27.06	40.00	12.9	100	192	
Vert.	71.999	QP	39.42	6.45	6.93	32.15	0.00	20.65	40.00	19.3	104	23	
Vert.	137.782	QP	31.16	14.31	7.53	32.09	0.00	20.91	43.50	22.5	100	152	
Vert.	325.001	QP	32.76	14.33	8.66	31.95	0.00	23.80	46.00	22.2	100	222	
Vert.	624.995	QP	34.06	19.46	9.88	31.94	0.00	31.46	46.00	14.5	131	2	
Vert.	2390.000	PK	47.24	28.33	14.08	41.66	2.04	50.03	73.90	23.8	149	270	
Vert.	4804.000	PK	47.56	31.62	6.58	42.92	2.04	44.88	73.90	29.0	150	0	Floor noise
Vert.	7206.000	PK	48.31	37.23	8.08	43.39	2.04	52.27	73.90	21.6	150	0	Floor noise
Vert.	9608.000	PK	47.83	38.84	9.21	43.14	2.04	54.78	73.90	19.1	150	0	Floor noise
Vert.	4804.000	AV	38.97	31.62	6.58	42.92	2.04	36.29	53.90	17.6	150	0	Floor noise
Vert.	7206.000	AV	38.31	37.23	8.08	43.39	2.04	42.27	53.90	11.6	150	0	Floor noise
Vert.	9608.000	AV	38.19	38.84	9.21	43.14	2.04	45.14	53.90	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 - 13 GHz : $20\log(3.79 \text{ m} / 3.0 \text{ m}) = 2.04 \text{ dB}$

13 GHz - 40 GHz : $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	37.43	28.33	14.08	41.66	3.90	2.04	44.12	53.9	9.7	*1)
Vert.	2390.000	AV	38.10	28.33	14.08	41.66	3.90	2.04	44.79	53.9	9.1	*1)

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.79 \text{ m} / 3.0 \text{ m}) = 2.04 \text{ dB}$

13 GHz - 40 GHz : $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

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	93.24	28.31	14.09	41.67	2.04	96.01	-	-	Carrier
Hori.	2400.000	PK	39.25	28.31	14.08	41.67	2.04	42.01	76.01	34.0	
Vert.	2402.000	PK	92.98	28.31	14.09	41.67	2.04	95.75	-	-	Carrier
Vert.	2400.000	PK	39.53	28.31	14.08	41.67	2.04	42.29	75.75	33.4	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.79 \text{ m} / 3.0 \text{ m}) = 2.04 \text{ dB}$

13 GHz - 40 GHz : $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.54 \text{ dB}$

UL Japan, Inc.

Shonan EMC Lab.

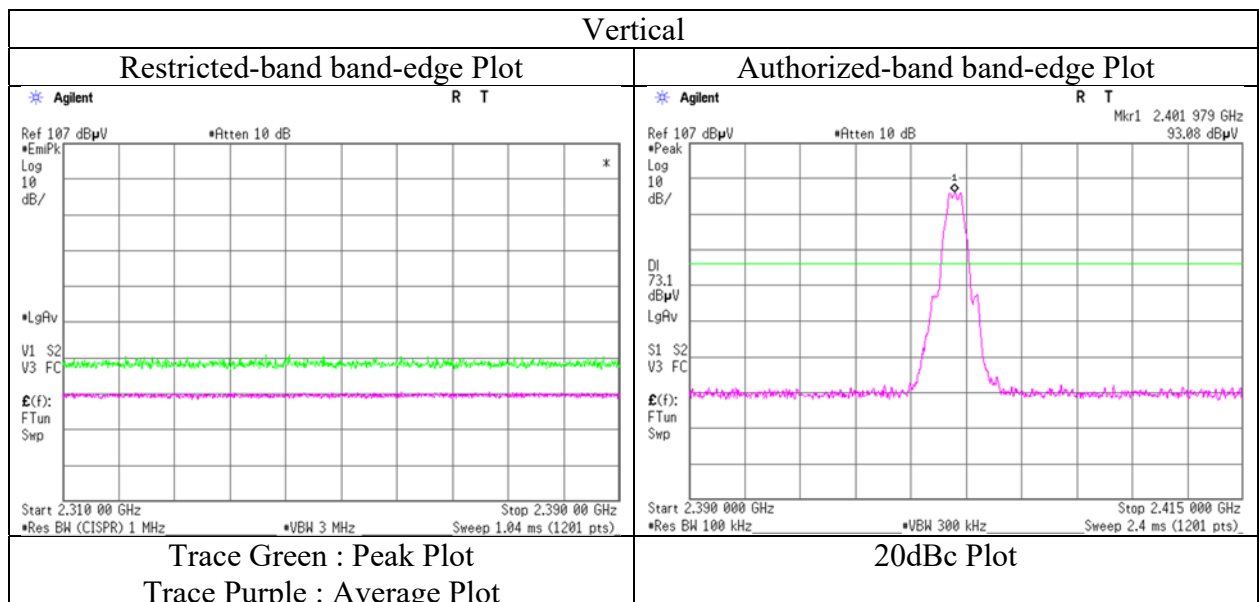
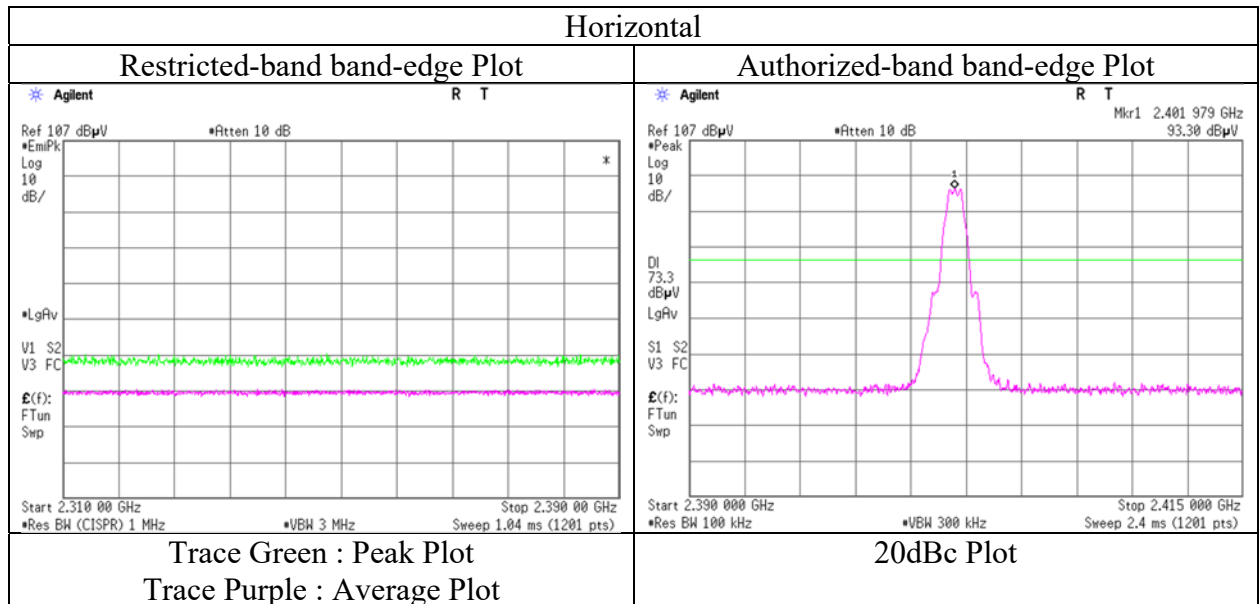
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13218114S-H-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	June 6, 2020
Temperature / Humidity	23 deg. C / 69 % RH
Engineer	Takahiro Kawakami
	(1 GHz – 2.8 GHz)
Mode	Tx BT LE, 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.

UL Japan, Inc.

Shonan EMC Lab.

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

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Radiated Spurious Emission

Report No.	13218114S-H-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	June 4, 2020	June 6, 2020	June 4, 2020
Temperature / Humidity	26 deg. C / 57 % RH	23 deg. C / 69 % RH	23 deg. C / 63 % RH
Engineer	Hiromasa Sato (30 MHz – 1 GHz)	Takahiro Kawakami (1 GHz – 2.8 GHz)	Takahiro Kawakami (2.8 GHz – 26.5 GHz)
Mode	Tx BT LE, 2440 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.	65.241	QP	30.77	7.20	6.48	32.15	0.00	12.30	40.00	27.7	188	103	
Hori.	94.335	QP	32.44	9.04	7.46	32.14	0.00	16.80	43.50	26.7	242	241	
Hori.	216.000	QP	33.67	11.22	8.07	32.02	0.00	20.94	43.50	22.5	151	86	
Hori.	375.000	QP	38.01	15.11	8.89	31.93	0.00	30.08	46.00	15.9	100	56	
Hori.	540.001	QP	40.70	17.69	9.58	31.99	0.00	35.98	46.00	10.0	193	49	
Hori.	4880.000	PK	48.46	31.71	6.62	42.93	2.04	45.90	73.90	28.0	150	0	Floor noise
Hori.	7320.000	PK	48.15	37.38	8.14	43.49	2.04	52.22	73.90	21.6	150	0	Floor noise
Hori.	9760.000	PK	47.75	39.33	9.31	42.97	2.04	55.46	73.90	18.4	150	0	Floor noise
Hori.	4880.000	AV	38.71	31.71	6.62	42.93	2.04	36.15	53.90	17.7	150	0	Floor noise
Hori.	7320.000	AV	38.94	37.38	8.14	43.49	2.04	43.01	53.90	10.8	150	0	Floor noise
Hori.	9760.000	AV	38.90	39.33	9.31	42.97	2.04	46.61	53.90	7.2	150	0	Floor noise
Vert.	46.947	QP	39.25	12.27	6.75	32.16	0.00	26.11	40.00	13.8	100	185	
Vert.	72.000	QP	39.16	6.45	6.93	32.15	0.00	20.39	40.00	19.6	101	27	
Vert.	135.565	QP	31.66	14.20	7.48	32.10	0.00	21.24	43.50	22.2	100	158	
Vert.	337.556	QP	30.87	14.74	8.73	31.94	0.00	22.40	46.00	23.6	146	359	
Vert.	647.995	QP	34.26	19.24	9.96	31.95	0.00	31.51	46.00	14.4	131	6	
Vert.	4880.000	PK	48.02	31.71	6.62	42.93	2.04	45.46	73.90	28.4	150	0	Floor noise
Vert.	7320.000	PK	48.15	37.38	8.14	43.49	2.04	52.22	73.90	21.6	150	0	Floor noise
Vert.	9760.000	PK	48.32	39.33	9.31	42.97	2.04	56.03	73.90	17.8	150	0	Floor noise
Vert.	4880.000	AV	38.54	31.71	6.62	42.93	2.04	35.98	53.90	17.9	150	0	Floor noise
Vert.	7320.000	AV	39.01	37.38	8.14	43.49	2.04	43.08	53.90	10.8	150	0	Floor noise
Vert.	9760.000	AV	39.10	39.33	9.31	42.97	2.04	46.81	53.90	7.0	150	0	Floor noise

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.79\text{ m} / 3.0\text{ m}) = 2.04\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Radiated Spurious Emission

Report No.	13218114S-H-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	June 4, 2020	June 6, 2020	June 4, 2020
Temperature / Humidity	26 deg. C / 57 % RH	23 deg. C / 69 % RH	23 deg. C / 63 % RH
Engineer	Hiromasa Sato (30 MHz – 1 GHz)	Takahiro Kawakami (1 GHz – 2.8 GHz)	Takahiro Kawakami (2.8 GHz – 26.5 GHz)
Mode	Tx BT LE, 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.	65.221	QP	30.18	7.20	6.48	32.15	0.00	11.71	40.00	28.2	148	203	
Hori.	93.452	QP	33.47	8.87	7.47	32.14	0.00	17.67	43.50	25.8	254	237	
Hori.	216.001	QP	33.61	11.22	8.07	32.02	0.00	20.88	46.00	25.1	157	81	
Hori.	375.001	QP	37.88	15.11	8.89	31.93	0.00	29.95	46.00	16.0	100	65	
Hori.	540.001	QP	40.89	17.69	9.58	31.99	0.00	36.17	46.00	9.8	178	52	
Hori.	2483.500	PK	47.84	28.24	14.17	41.69	2.04	50.60	73.90	23.3	384	279	
Hori.	4960.000	PK	47.99	31.96	6.67	42.94	2.04	45.72	73.90	28.1	150	0	Floor noise
Hori.	7440.000	PK	48.16	37.56	8.21	43.60	2.04	52.37	73.90	21.5	150	0	Floor noise
Hori.	9920.000	PK	47.22	39.18	9.42	42.78	2.04	55.08	73.90	18.8	150	0	Floor noise
Hori.	4960.000	AV	38.63	31.96	6.67	42.94	2.04	36.36	53.90	17.5	150	0	Floor noise
Hori.	7440.000	AV	38.94	37.56	8.21	43.60	2.04	43.15	53.90	10.7	150	0	Floor noise
Hori.	9920.000	AV	38.72	39.18	9.42	42.78	2.04	46.58	53.90	7.3	150	0	Floor noise
Vert.	46.354	QP	41.56	12.48	6.75	32.16	0.00	28.63	40.00	11.3	100	196	
Vert.	71.999	QP	38.99	6.45	6.93	32.15	0.00	20.22	40.00	19.7	115	35	
Vert.	135.443	QP	31.36	14.19	7.48	32.10	0.00	20.93	43.50	22.5	100	163	
Vert.	337.399	QP	31.03	14.73	8.72	31.94	0.00	22.54	46.00	23.4	153	18	
Vert.	647.995	QP	33.48	19.24	9.96	31.95	0.00	30.73	46.00	15.2	114	6	
Vert.	2483.500	PK	48.13	28.24	14.17	41.69	2.04	50.89	73.90	23.0	291	309	
Vert.	4960.000	PK	47.99	31.96	6.67	42.94	2.04	45.72	73.90	28.1	150	0	Floor noise
Vert.	7440.000	PK	48.16	37.56	8.21	43.60	2.04	52.37	73.90	21.5	150	0	Floor noise
Vert.	9920.000	PK	48.03	39.18	9.42	42.78	2.04	55.89	73.90	18.0	150	0	Floor noise
Vert.	4960.000	AV	38.89	31.96	6.67	42.94	2.04	36.62	53.90	17.2	150	0	Floor noise
Vert.	7440.000	AV	38.81	37.56	8.21	43.60	2.04	43.02	53.90	10.8	150	0	Floor noise
Vert.	9920.000	AV	38.47	39.18	9.42	42.78	2.04	46.33	53.90	7.5	150	0	Floor noise

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.79\text{ m} / 3.0\text{ m}) = 2.04\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	38.12	28.24	14.17	41.69	3.90	2.04	44.78	53.9	9.1	*1)
Vert.	2483.500	AV	38.31	28.24	14.17	41.69	3.90	2.04	44.97	53.9	8.9	*1)

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.79\text{ m} / 3.0\text{ m}) = 2.04\text{ dB}$

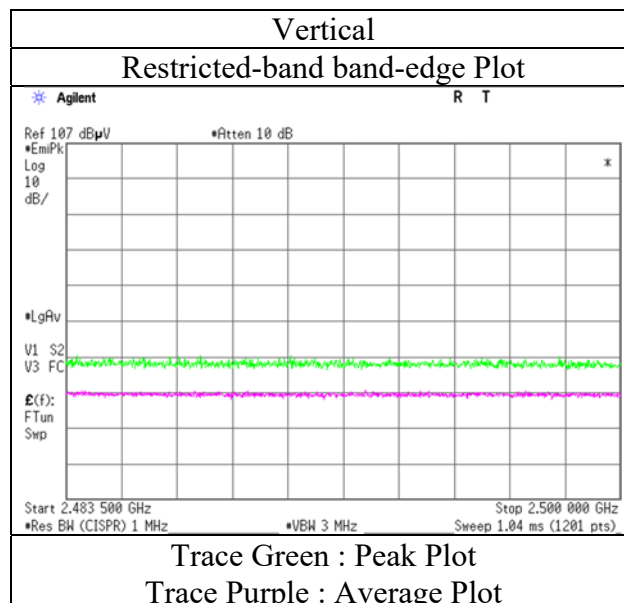
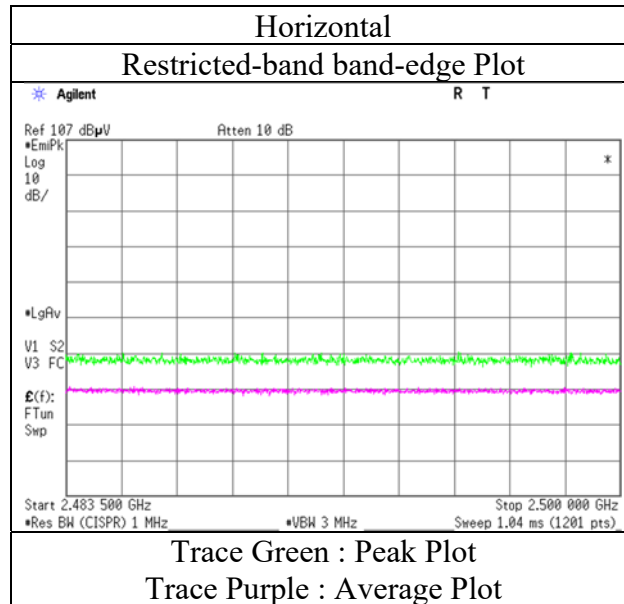
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13218114S-H-R1
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	June 6, 2020
Temperature / Humidity	23 deg. C / 69 % RH
Engineer	Takahiro Kawakami
	(1 GHz – 2.8 GHz)
Mode	Tx BT LE, 2480 MHz

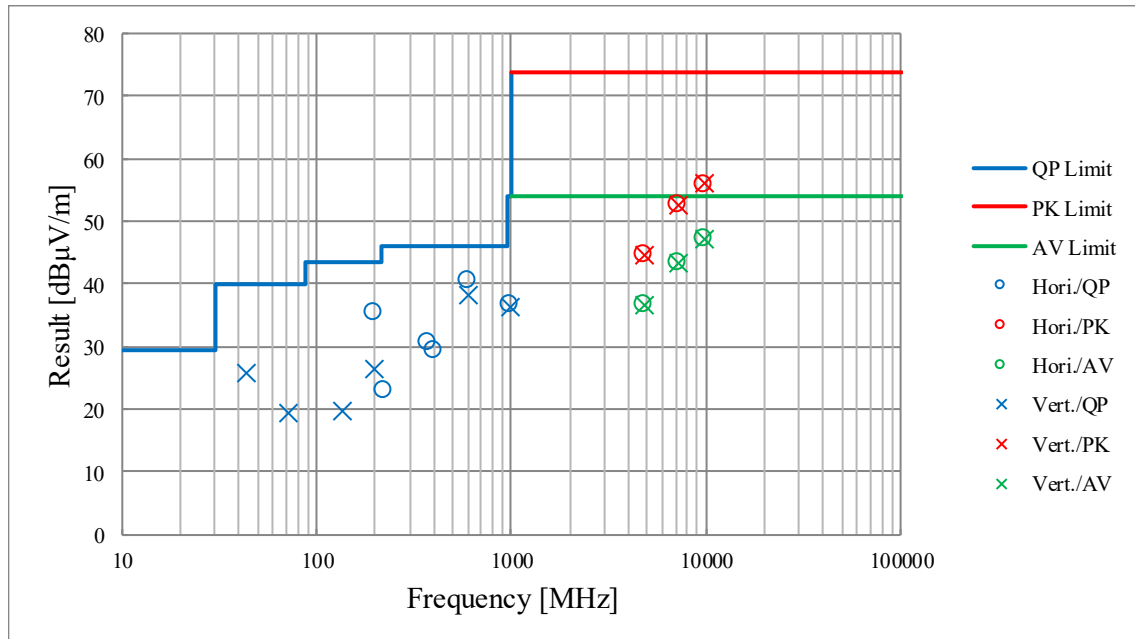


* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.

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

Radiated Spurious Emission
(Plot data, Worst case)

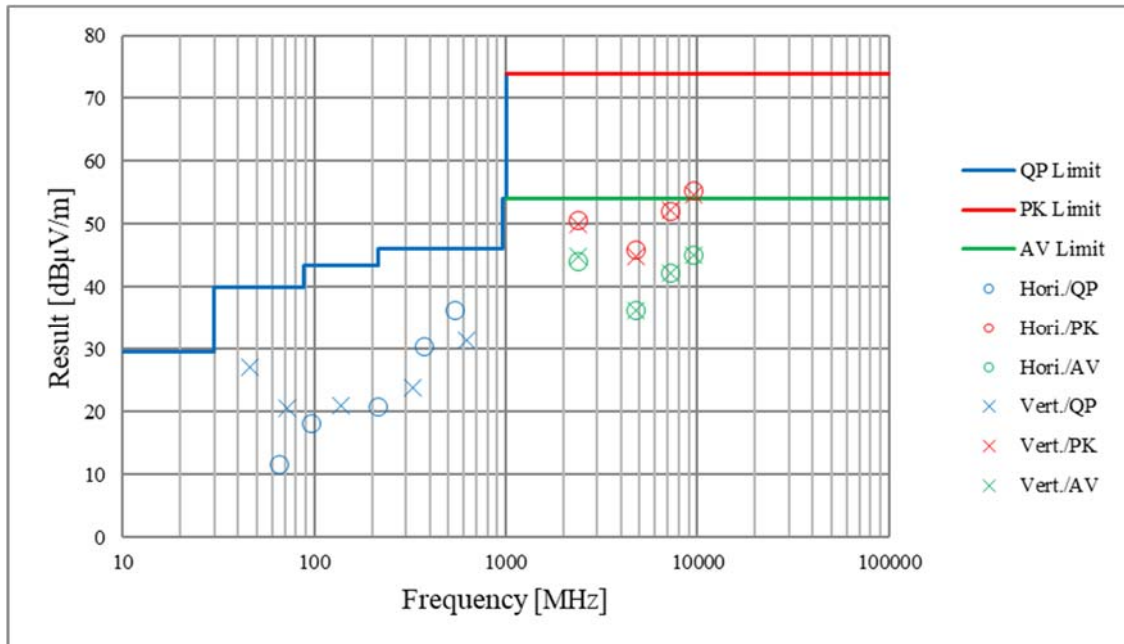
Report No.	13218114S-H-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3		
Date	June 4, 2020	June 3, 2020	June 4, 2020
Temperature / Humidity	26 deg. C / 57 % RH	23 deg. C / 59 % RH	23 deg. C / 63 % RH
Engineer	Hiromasa Sato	Hiromasa Sato	Takahiro Kawakami
	(30 MHz – 1 GHz)	(1 GHz – 13 GHz)	(13 GHz – 26.5 GHz)
Mode	Tx 11n-20, 2437 MHz		



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

Radiated Spurious Emission
(Plot data, Worst case)

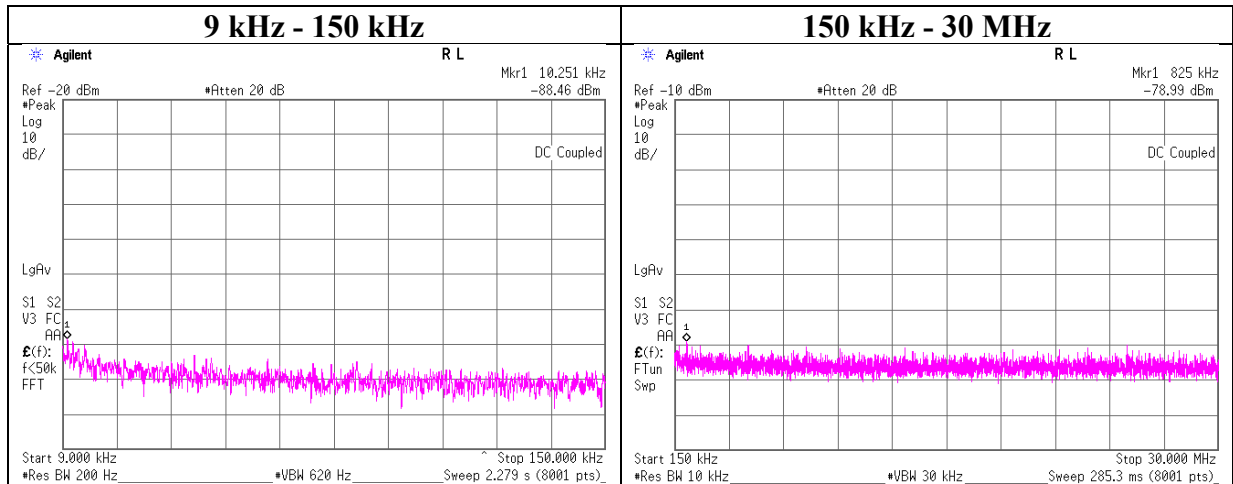
Report No.	13218114S-H-R1		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.3	No.3	No.3
Date	June 4, 2020	June 6, 2020	June 4, 2020
Temperature / Humidity	26 deg. C / 57 % RH	23 deg. C / 69 % RH	23 deg. C / 63 % RH
Engineer	Hiromasa Sato (30 MHz – 1 GHz)	Takahiro Kawakami (1 GHz – 2.8 GHz)	Takahiro Kawakami (2.8 GHz – 26.5 GHz)
Mode	Tx BT LE, 2402 MHz		



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

Conducted Spurious Emission

Report No. 13218114S-H-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date June 4, 2020
Temperature / Humidity 24 deg. C / 51 % RH
Engineer Kenichi Adachi
Mode Tx 11n-20, 2437 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
10.25	-88.5	0.59	9.8	2.2	1	-75.8	300	6.0	-14.6	47.3	61.9	
825	-79.0	0.61	9.8	2.2	1	-66.3	30	6.0	14.9	29.2	14.3	

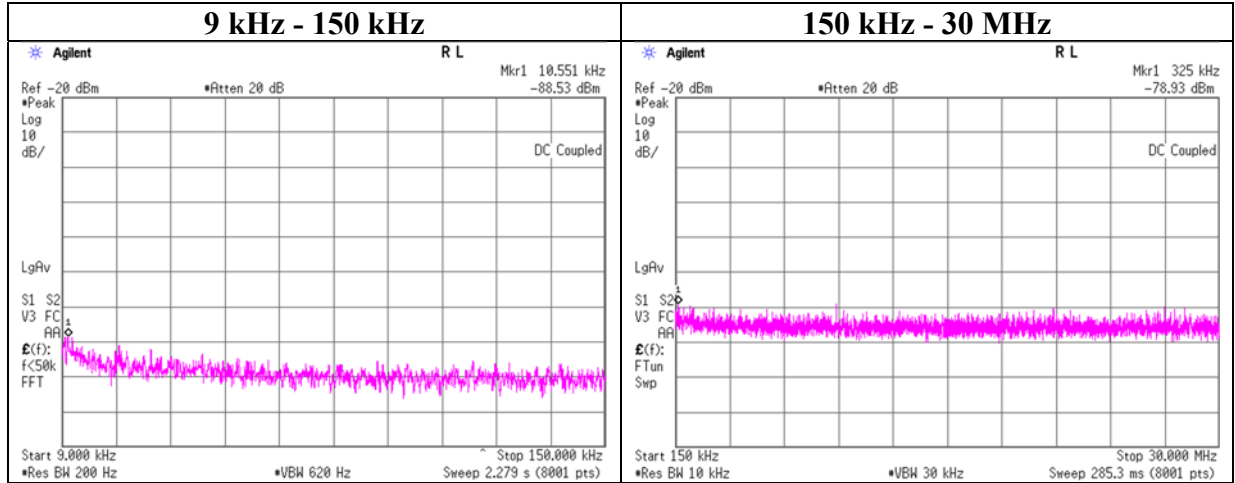
$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log(\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$

$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$

N: Number of output

Conducted Spurious Emission

Report No. 13218114S-H-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date June 8, 2020
Temperature / Humidity 24 deg. C / 47 % RH
Engineer Kenichi Adachi
Mode Tx BT LE, 2402 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
10.55	-88.5	0.59	9.8	2.2	1	-75.9	300	6.0	-14.6	47.1	61.7	
325	-78.9	0.61	9.8	2.2	1	-66.3	300	6.0	-5.0	17.3	22.3	

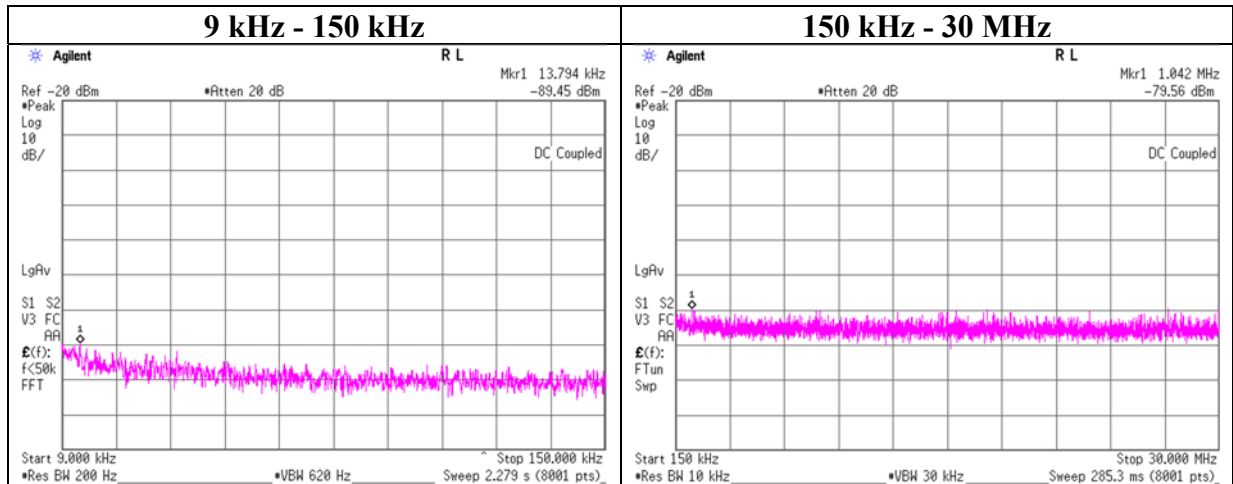
$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log(\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$

$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$

N: Number of output

Conducted Spurious Emission

Report No. 13218114S-H-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date June 8, 2020
Temperature / Humidity 24 deg. C / 47 % RH
Engineer Kenichi Adachi
Mode Tx BT LE, 2440 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
13.79	-89.5	0.59	9.8	2.2	1	-76.8	300	6.0	-15.6	44.8	60.4	
1042	-79.6	0.61	9.8	2.2	1	-66.9	30	6.0	14.3	27.2	12.9	

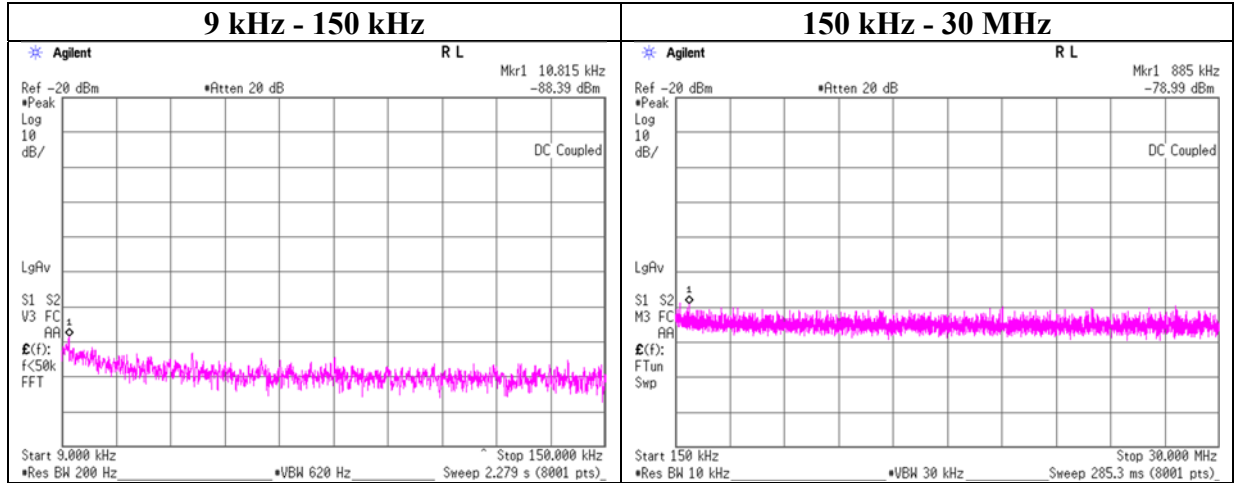
$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log(\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$

$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$

N: Number of output

Conducted Spurious Emission

Report No. 13218114S-H-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date June 8, 2020
Temperature / Humidity 24 deg. C / 47 % RH
Engineer Kenichi Adachi
Mode Tx BT LE, 2480 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
10.82	-88.4	0.59	9.8	2.2	1	-75.8	300	6.0	-14.5	46.9	61.4	
885	-79.0	0.61	9.8	2.2	1	-66.3	30	6.0	14.9	28.6	13.7	

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

$EIRP[dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

N: Number of output

Power Density

Report No. 13218114S-H-R1
Test place Shonan EMC Lab. No.1 Measurement Room
Date June 4, 2020 June 12, 2020
Temperature / Humidity 24 deg. C / 51 % RH 24 deg. C / 56 % RH
Engineer Kenichi Adachi Kenichi Adachi
Mode Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412	-22.39	1.96	9.87	-10.56	8.00	18.56
2437	-23.25	1.97	9.87	-11.41	8.00	19.41
2462	-22.04	1.97	9.87	-10.20	8.00	18.20

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412	-25.01	1.96	9.87	-13.18	8.00	21.18
2437	-25.06	1.97	9.87	-13.22	8.00	21.22
2462	-24.93	1.97	9.87	-13.09	8.00	21.09

11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412	-25.59	1.96	9.87	-13.76	8.00	21.76
2437	-24.08	1.97	9.87	-12.24	8.00	20.24
2462	-24.74	1.97	9.87	-12.90	8.00	20.90

BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402	-25.72	1.95	9.87	-13.90	8.00	21.90
2440	-26.11	1.97	9.87	-14.27	8.00	22.27
2480	-27.02	1.98	9.87	-15.17	8.00	23.17

Sample Calculation:

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

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

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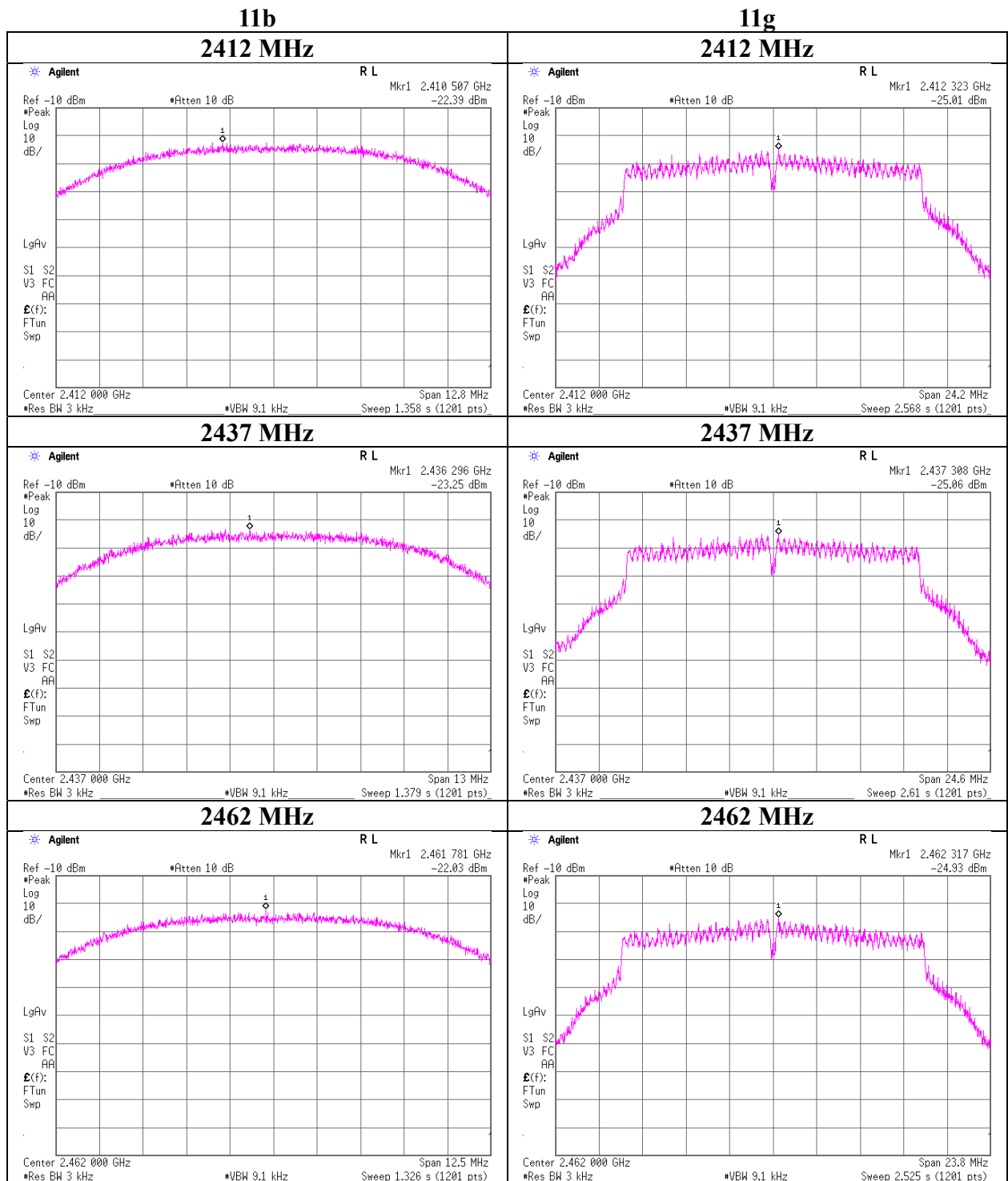
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Power Density



UL Japan, Inc.

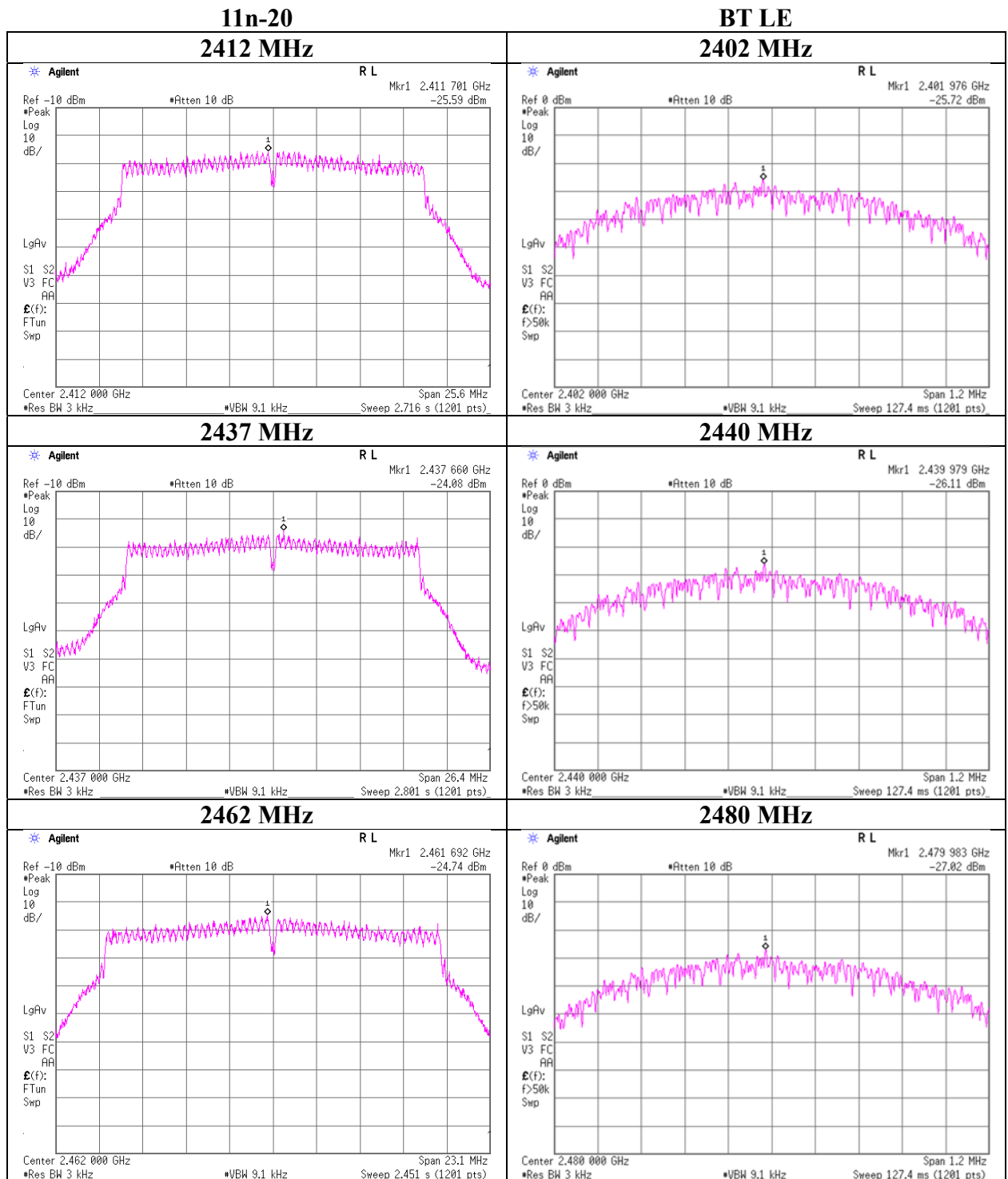
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APPENDIX 2: Test instruments

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	2020/04/09	12
AT	SAT10-13	151610	Attenuator	Weinschel Corp.	54A-10	81626	2020/03/02	12
AT	SCC-G14	145175	Coaxial Cable	Suhner	SUCOFLEX 102	31600/2	2019/12/12	12
AT	SOS-13	146321	Humidity Indicator	CUSTOM	CTH-202	Q.C.17	2019/12/19	12
AT	SOS-27	191845	Humidity Indicator	CUSTOM	CTH-201	-	2019/12/12	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-09	150461	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46186392	2020/02/10	12
AT	SSA-02	145800	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY48250106	2020/04/16	12
RE	COTS-SEMI-5	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,ME,PE)	-	-	-
RE	KJM-02	146432	Measure	TAJIMA	GL19-55	-	-	-
RE	SAEC-03(NSA)	145565	Semi-Anechoic Chamber	TDK	SAEC-03(NSA)	3	2020/04/12	12
RE	SAEC-03(SVSWR)	145566	Semi-Anechoic Chamber	TDK	SAEC-03(SVSWR)	3	2020/05/11	12
RE	SAF-03	145126	Pre Amplifier	SONOMA	310N	290213	2020/02/19	12
RE	SAF-06	145005	Pre Amplifier	Toyo Corporation	TPA0118-36	1440491	2020/02/20	12
RE	SAF-08	145007	Pre Amplifier	Toyo Corporation	HAP18-26W	19	2020/03/03	12
RE	SAT10-06	145137	Attenuator	Keysight Technologies Inc	8493C-010	74865	2019/11/06	12
RE	SAT6-13	167094	Attenuator	JFW	50HF-006N	-	2020/02/21	12
RE	SBA-03	145023	Biconical Antenna	Schwarzbeck Mess - Elektronik	BBA9106	91032666	2020/05/17	12

Test equipment (2/2)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	SCC-C1/C2/C3/C4/C5/C10/SRSE-03	145171	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-271(RF Selector)	2020/04/12	12
RE	SCC-G15	145176	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	2020/03/04	12
RE	SCC-G43	156380	Coaxial Cable	HUBER+SUNER	SUCOFLEX_104_E	SN MY 13406/4E	2020/06/04	12
RE	SCC-G57	179540	Coaxial Cable	Huber+Suhner	SUCOFLEX 102	802815/2	2020/05/12	12
RE	SCC-G58	183047	Coaxial Cable	HUBER+SUNER	SUCOFLEX 104	800287/4A	2020/06/04	12
RE	SFL-02	145301	Highpass Filter	MICRO-TRONICS	HPM50111	51	2019/11/06	12
RE	SHA-03	145501	Horn Antenna	Schwarzbeck Mess - Elektronik	BBHA9120D	9120D-739	2019/06/26	12
RE	SHA-04	145512	Horn Antenna	ETS LINDGREN	3160-09	00094868	2019/06/26	12
RE	SLA-07	145529	Logperiodic Antenna	Schwarzbeck Mess - Elektronik	VUSLP9111B	196	2020/05/17	12
RE	SOS-23	191840	Humidity Indicator	CUSTOM	CTH-201	-	2019/12/12	12
RE	SSA-03	145801	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY48250152	2019/08/08	12
RE	STR-08	150463	Test Receiver	Rohde & Schwarz	ESW44	101581	2019/11/22	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

UL Japan, Inc.

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