



RADIO TEST REPORT

Test Report No. : 13554183S-A

Applicant : Sony Corporation, Japan and Sony Group Companies
Type of EUT : CONTROL BOX
Model Number of EUT : TMR-A9WT (Module: WM-BAC-AT-49)
FCC ID : AK8TMRA9WT
Test regulation : FCC Part 15 Subpart C: 2021
*WLAN / Bluetooth Low Energy part
Test Result : Complied (Refer to SECTION 3.2)

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
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6. This test report covers Radio technical requirements.
It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in SECTION 1.

Date of test: October 14 to November 28, 2020

Representative test engineer: 
Kazuya Noda
Leader
Consumer Technology Division

Approved by: 
Toyokazu Imamura
Leader
Consumer Technology Division



CERTIFICATE 1266.03

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

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REVISION HISTORY

Original Test Report No.: 13554183S-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13554183S-A	February 26, 2021	-	-

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	:	Sony Corporation, Japan and Sony Group Companies
Address	:	1-7-1 Konan Minato-ku, Tokyo, 108-0075 Japan
Contact Person	:	Kazuhiko Nagano

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	:	CONTROL BOX
Model Number	:	TMR-A9WT
Serial Number	:	Refer to SECTION 4.2
Rating	:	AC adapter Input: AC 100 V – 240 V, 50/60 Hz DC 12 V
Receipt Date	:	October 1, 2020
Country of Mass-production	:	Malaysia
Condition	:	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	:	No Modification by the test lab.

2.2 Product Description

Model: TMR-A9WT (referred to as the EUT in this report) is a CONTROL BOX.

Clock frequency of the EUT	:	48 MHz (MAX) (Module A: WM-BAC-AT-49) 48 MHz (MAX) (Module B: 1PJ)
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Radio Specification

<Module A: model No. WM-BAC-AT-49> (* The module covered by this report.)

	Bluetooth (BR/EDR) *1)	Bluetooth (Low Energy) *1)
Frequency of operation	2402 MHz - 2480 MHz	2402 MHz - 2480 MHz
Channel spacing	1 MHz	2 MHz
Modulation	FHSS: GFSK (*, EDR: GFSK+ /4-DQPSK, GFSK+ 8DPSK)	
Antenna type	Dipole antenna	
Antenna Gain	3.54 dBi	
Antenna	U.FL connector	
Connector type		

*1) The Bluetooth part antenna and the Module B antenna are common antenna. .

	IEEE802.11b	IEEE802.11g	IEEE802.11n (20 MHz band)	IEEE802.11n (40 MHz band)
Frequency of operation	2412 MHz - 2462 MHz	2412 MHz - 2462 MHz	2412 MHz - 2462 MHz 5180 MHz - 5240 MHz 5260 MHz - 5320 MHz 5500 MHz - 5720 MHz 5745 MHz - 5825 MHz	5190 MHz - 5230 MHz 5270 MHz - 5310 MHz 5510 MHz - 5710 MHz 5755 MHz - 5795 MHz
Channel spacing	5 MHz		2.4 GHz band 5 MHz 5 GHz band 20 MHz	5 GHz band 40 MHz
Modulation	DSSS: DBPSK, DQPSK, CCK	OFDM: BPSK, QPSK, 16QAM, 64QAM		
	IEEE802.11a	IEEE802.11ac (20 MHz band)	IEEE802.11ac (40 MHz band)	IEEE802.11ac (80 MHz band)
Frequency of operation	5180 MHz - 5240 MHz 5260 MHz - 5320 MHz 5500 MHz - 5720 MHz 5745 MHz - 5825 MHz	5180 MHz - 5240 MHz 5260 MHz - 5320 MHz 5500 MHz - 5720 MHz 5745 MHz - 5825 MHz	5190 MHz - 5230 MHz 5270 MHz - 5310 MHz 5510 MHz - 5710 MHz 5755 MHz - 5795 MHz	5210 MHz 5290 MHz 5530 MHz - 5610 MHz 5690 MHz 5775 MHz
Channel spacing	20 MHz		40 MHz	80 MHz
Modulation	OFDM BPSK, QPSK, 16QAM, 64QAM, 256QAM (*256QAM is only for IEEE802.11ac 80 MHz band)			
Antenna type	Dipole antenna			
Antenna Gain	ANT0 : 1.36 dBi (2.4 GHz), 3.71 dBi (U-NII-1), 2.60 dBi (U-NII-2A), 2.48 dBi (U-NII-2C), 3.09 dBi (U-NII-3) ANT1 : 1.90 dBi (2.4 GHz), 5.79 dBi (U-NII-1), 5.79 dBi (U-NII-2A), 5.12 dBi (U-NII-2C), 4.13 dBi (U-NII-3)			
Antenna	U.FL connector			
Connector type				

<Module B: Model No. 1PJ>

	IEEE802.11a	IEEE802.11n (20 MHz band)	IEEE802.11n (40 MHz band)
Frequency of operation	5180 MHz - 5240 MHz 5260 MHz - 5320 MHz 5500 MHz - 5700 MHz 5745 MHz - 5825 MHz	5180 MHz - 5240 MHz 5260 MHz - 5320 MHz 5500 MHz - 5700 MHz 5745 MHz - 5825 MHz	5190 MHz - 5230 MHz 5270 MHz - 5310 MHz 5510 MHz - 5670 MHz 5755 MHz - 5795 MHz
Channel spacing	20 MHz	20 MHz	40 MHz
Modulation	DSSS: DBPSK, DQPSK, CCK	OFDM: BPSK, QPSK, 16QAM, 64QAM	
Antenna type	Dipole antenna		
Antenna Gain	ANT : 4.64 dBi (U-NII-1), 4.48 dBi (U-NII-2A), 4.76 dBi (U-NII-2C), 4.76 dBi (U-NII-3)		
Antenna Connector type	U.FL connector		

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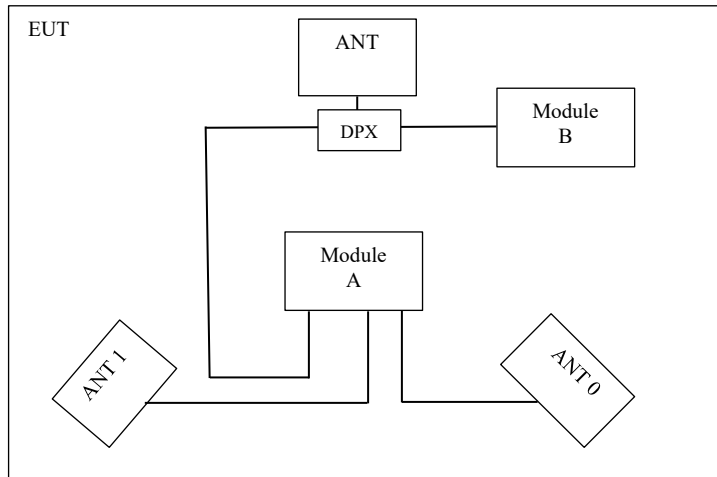
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Additional information of specification:



The EUT has Module A and Module B.

* DPX: Diplexer.

Combination of antennas used

	BT	BT LE	WLAN 2.4 GHz	WLAN 5 GHz
ANT	Module A	Module A	-	Module B
ANT 0	-	-	Module A	Module A
ANT 1	-	-	Module A	Module A

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
 FCC Part 15 final revised on January 12, 2021 and effective February 11, 2021
 * The revision does not affect the test result conducted before its effective date.

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

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	14.7 dB 11.70600 MHz, AV, N Tx BT LE 2M PHY 2402 MHz with Module A 11n-20 5320 MHz and Module B 11n-20 5580 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	0.2 dB 2390.000 MHz, AV, Hori. Tx 11n-20 2412 MHz with BT Hopping Off 2480 MHz and Module B 11n-20 5580 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 part regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % Occupied Bandwidth	ISED: RSS-Gen 6.7	ISED: -	N/A	- a)	Conducted
a) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth)					

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 1GHz	0.9 dB
Spurious emission (Conducted) 1 GHz-3 GHz	0.9 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.9 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.6 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.0 dB
Bandwidth Measurement	0.07 %
Duty cycle and Time Measurement	0.262 %
Temperature	0.95 deg.C.
Voltage	0.83 %

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3.5 Test Location

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A2LA Certificate Number: 1266.03

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

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
No.1 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.2 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.3 Shielded room	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
No.4 Shielded room	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
No.5 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.6 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.8 Shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

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 CDD (11b)	11 Mbps, PN9
IEEE 802.11g CDD (11g)	36 Mbps, PN9
IEEE 802.11n SDM 20 MHz BW (11n-20)	MCS 14, PN9
Bluetooth (BT) Low Energy (LE)	Uncoded 1 M-PHY , Maximum Packet Size , PRBS9
	Uncoded 2 M-PHY , Maximum Packet Size , PRBS9
*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: 12 dBm 11g: 13 dBm 11n-20: 12 dBm (2412 MHz), 13 dBm (2462 MHz), 14 dBm (2417-2457 MHz) BT LE: Fixed Software: WLAN (single transmission) AT-49 RF Test Ver 1.2 (Date: 2020.10.22, Storage location: Driven by connected PC) (simultaneous transmission) AT-49 RF Test Ver 1.4 (Date: 2020.11.20, Storage location: Driven by connected PC) LBEE5ZZ1PJ_331_RF_Test_v1.1 (Date: 2020.11.06, Storage location: Driven by connected PC) BT LE (single transmission) AT-49 BT Test Ver 1.1 (Date: 2020.10.14, Storage location: Driven by connected PC) (simultaneous transmission) AT-49 BT Test Ver 1.2 (Date: 2020.11.06, Storage location: Driven by connected PC) *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	

*The details of Operating mode(s)

Test Item	Operating Mode	Tested Antenna	Tested frequency
Conducted Emission Spurious Emission (below 1 GHz)	11n-20	ANT 0 + ANT 1 (Simultaneously)	2437 MHz
	BT LE 1 M-PHY BT LE 2 M-PHY	ANT	2402 MHz 2440 MHz 2480 MHz
	BT LE 2 M-PHY with Module A 11n-20 5320 MHz and Module B 11n-20 5580 MHz	ANT + ANT 0 +ANT 1 (Simultaneously)	2402 MHz
Spurious Emission (band edge)	11b 11g	ANT 0 + ANT 1 (Simultaneously)	2412 MHz 2462 MHz
	11n-20	ANT 0 + ANT 1 (Simultaneously)	2412 MHz 2417 MHz 2457 MHz 2462 MHz
	11n-20 with Module A 11n-20 5320 MHz and Module B 11n-20 5580 MHz	ANT 0 + ANT 1 (Simultaneously)	2412 MHz
	BT LE 1 M-PHY BT LE 2 M-PHY	ANT	2402 MHz 2480 MHz
	BT LE 1 M-PHY with Module A 11n-20 5320 MHz and Module B 11n-20 5580 MHz BT LE 2 M-PHY with Module A 11n-20 5320 MHz and Module B 11n-20 5580 MHz	ANT + ANT 0 +ANT 1 (Simultaneously)	2402 MHz 2480 MHz
Spurious Emission (above 1 GHz)	11b 11g	ANT 0 + ANT 1 (Simultaneously)	2412 MHz 2437 MHz 2462 MHz
	11n-20	ANT 0 + ANT 1 (Simultaneously)	2412 MHz 2437 MHz 2462 MHz
	11n-20 with Module A 11n-20 5320 MHz and Module B 11n-20 5580 MHz	ANT 0 + ANT 1 (Simultaneously)	2412 MHz
	BT LE 1 M-PHY BT LE 2 M-PHY	ANT	2402 MHz 2440 MHz 2480 MHz
	BT LE 2 M-PHY with Module A 11n-20 5320 MHz and Module B 11n-20 5580 MHz	ANT + ANT 0 +ANT 1 (Simultaneously)	2402 MHz
6 dB Bandwidth 99 % Occupied Bandwidth	11b 11g 11n-20	ANT 0	2412 MHz 2437 MHz 2462 MHz
	BT LE 1 M-PHY BT LE 2 M-PHY	ANT	2402 MHz 2440 MHz 2480 MHz
Maximum Peak Output Power Power Density	11b 11g 11n-20	ANT 0 + ANT 1 (Simultaneously)	2412 MHz 2437 MHz 2462 MHz
	BT LE 1 M-PHY BT LE 2 M-PHY	ANT	2402 MHz 2440 MHz 2480 MHz

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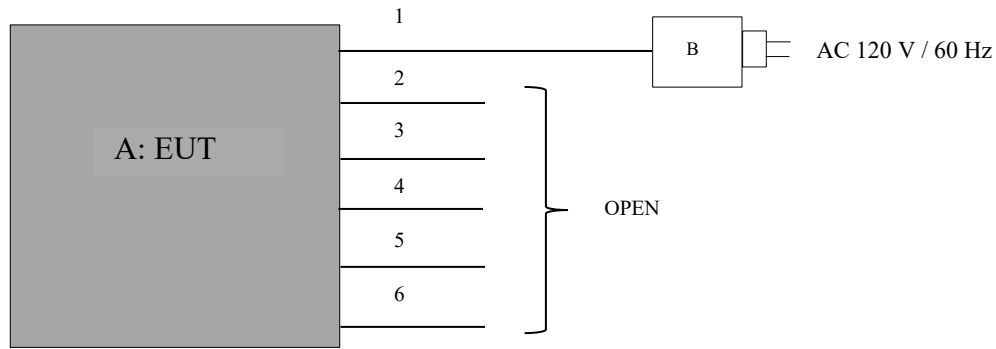
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4.2 Configuration and peripherals



Configuration and peripherals

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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	CONTROL BOX	TMR-A9WT	1 *1) 005 *2) 1000002 *3) 1000015 *4)	SONY	EUT *5)
B	AC Adaptor	AC-M1215UC	M2090660255	SONY	-

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

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

*3) Used for Radiated Emission test (single transmission)

*4) Used for Conducted Emission test and Radiated Emission test (simultaneous transmission)

*5) The EUT is mounted Module A(WM-BAC-AT-49) and Module B(1PJ) on its inside.

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC	1.5	Unshielded	Unshielded	-
2	USB	1.7	Shielded	Shielded	-
3	Audio	2.0	Shielded	Shielded	-
4	LAN	1.0	Unshielded	Unshielded	Cat.5e
5	HDMI	1.5	Shielded	Shielded	HDMI OUT
6	HDMI	1.8	Shielded	Shielded	HDMI IN

SECTION 5: Conducted Emission

Test Procedure and conditions

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

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane.

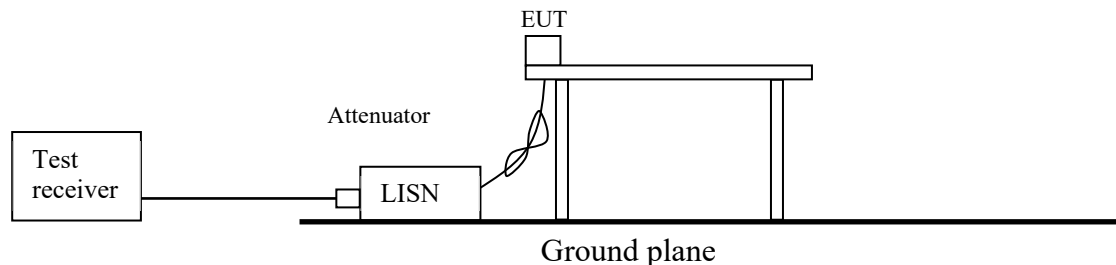
The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber. The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

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

Figure 1: Test Setup



SECTION 6: Radiated Spurious Emission

Test Procedure

It was measured based on "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, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

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

The height of the measuring antenna varied between 1 m and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.

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

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer.

The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

Test Antennas are used as below;

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

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

20 dBc was applied to the frequency over the limit of FCC 15.209 / Table 4 of RSS-Gen 8.9(ISED) and outside the restricted band of FCC 15.205 / 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	For WLAN <u>11.12.2.5.3</u> RBW: 1 MHz VBW: 1/T (T: burst length, refer to Burst rate confirmation sheet) Detector: Peak Trace: Max Hold For BT LE <u>11.12.2.5.2</u> 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.

UL Japan, Inc.

Shonan EMC Lab.

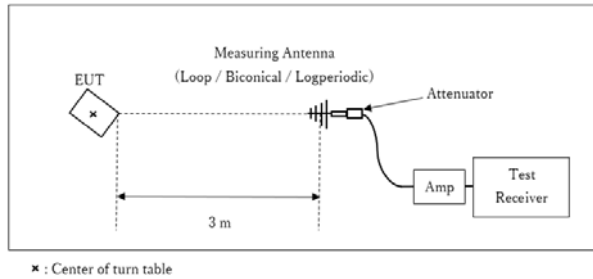
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

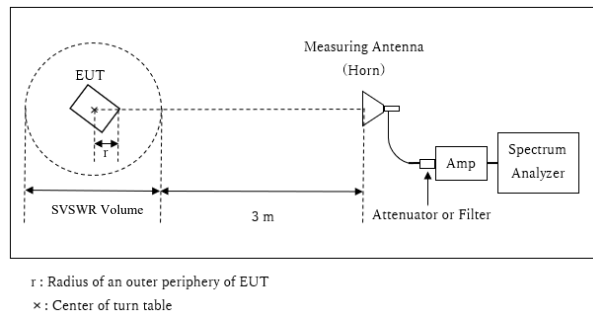
Figure 2: Test Setup

Below 1 GHz



Test Distance: 3 m

1 GHz - 10 GHz



Distance Factor: $20 \times \log (3.9 \text{ m} / 3.0 \text{ m}) = 2.28 \text{ dB}$

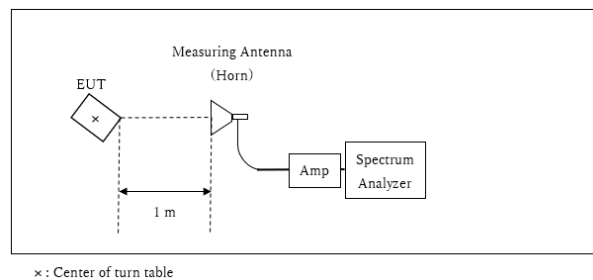
* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 3.9 \text{ m}$

SVSWR Volume : 2.0 m

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

$r = 0.1 \text{ m}$

10 GHz – 26.5 GHz



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

*Test Distance: 1 m

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

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

Measurement range : 30 MHz - 26.5 GHz

Test data : APPENDIX

Test result : Pass

SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6 dB Bandwidth	50 MHz, 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 *4) *5)	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".

*4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.

Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.

(9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz)

*5) The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohms. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to $45.5 - 51.5 = -6.0$ dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

The test results and limit are rounded off to two decimals place, so some differences might be observed.
The equipment and cables were not used for factor 0 dB of the data sheets.

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2020/11/28

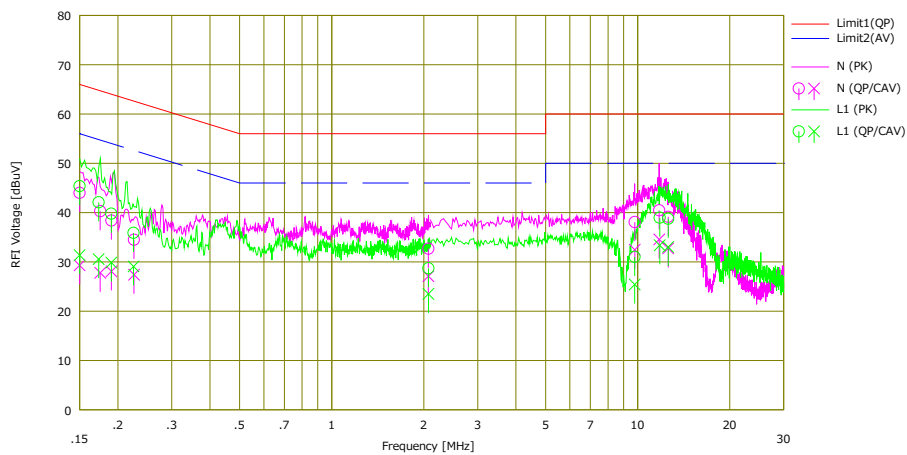
Mode : Tx 11n-20(SDM) 2437 MHz

Power : AC 120 V / 60 Hz
Temp./Humi. : 22 deg.C / 45 %RH

Remarks : -

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Kazuya Noda



No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		(QP) [dBuV]	(CAV) [dBuV]		(QP) [dBuV]	(CAV) [dBuV]	(QP) [dBuV]	(AV) [dBuV]	(QP) [dB]	(AV) [dB]		
1	0.15000	31.40	16.70	12.60	44.00	29.30	66.00	56.00	22.0	26.7	N	
2	0.17518	27.70	15.20	12.59	40.29	27.79	64.71	54.71	24.4	26.9	N	
3	0.19056	25.80	15.50	12.59	38.39	28.09	64.01	54.01	25.6	25.9	N	
4	0.22586	21.90	14.80	12.60	34.50	27.40	62.60	52.60	28.1	25.2	N	
5	2.06950	19.90	14.30	12.79	32.69	27.09	56.00	46.00	23.3	18.9	N	
6	9.77940	24.50	18.90	13.58	38.08	32.48	60.00	50.00	21.9	17.5	N	
7	11.76180	26.70	20.80	13.77	40.47	34.57	60.00	50.00	19.5	15.4	N	
8	12.58040	25.30	18.90	13.85	39.15	32.75	60.00	50.00	20.8	17.2	N	
9	0.15000	32.80	18.80	12.58	45.38	31.38	66.00	56.00	20.6	24.6	L1	
10	0.17320	29.50	18.00	12.58	42.08	30.58	64.81	54.81	22.7	24.2	L1	
11	0.19036	27.20	17.30	12.59	39.79	29.89	64.02	54.02	24.2	24.1	L1	
12	0.22506	23.30	16.50	12.59	35.89	29.09	62.63	52.63	26.7	23.5	L1	
13	2.07140	15.90	10.70	12.82	28.72	23.52	56.00	46.00	27.2	22.4	L1	
14	9.77244	17.60	12.00	13.43	31.03	25.43	60.00	50.00	28.9	24.5	L1	
15	11.80900	25.40	19.80	13.58	38.98	33.38	60.00	50.00	21.0	16.6	L1	
16	12.58440	25.10	19.40	13.64	38.74	33.04	60.00	50.00	21.2	16.9	L1	

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

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Conducted Emission

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2020/11/28

Mode : Tx BT LE 1M PHY 2402 MHz

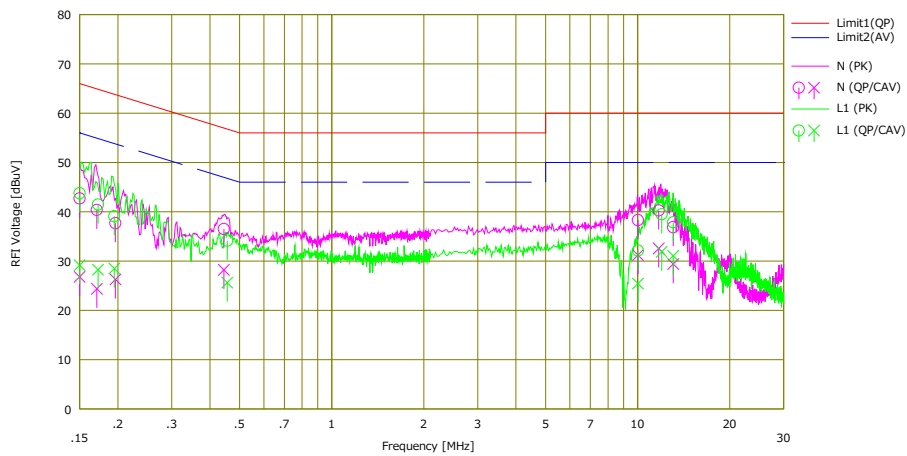
Power : AC 120 V / 60 Hz

Temp./Humi. : 22 deg.C / 45 %RH

Remarks : -

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Kazuya Noda



No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<CAV> [dBuV]		<QP> [dBuV]	<CAV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	30.10	14.20	12.60	42.70	26.80	66.00	56.00	23.3	29.2	N	
2	0.17067	27.80	11.80	12.59	40.39	24.39	64.93	54.93	24.5	30.5	N	
3	0.19633	25.10	13.70	12.59	37.69	26.29	63.76	53.76	26.0	27.4	N	
4	0.44430	23.90	15.60	12.62	36.52	28.22	56.98	46.98	20.4	18.7	N	
5	10.01920	24.70	17.60	13.61	38.31	31.21	60.00	50.00	21.6	18.7	N	
6	11.71760	26.50	18.80	13.77	40.27	32.57	60.00	50.00	19.7	17.4	N	
7	13.07140	23.00	15.50	13.89	36.89	29.39	60.00	50.00	23.1	20.6	N	
8	0.15000	31.20	16.60	12.58	43.78	29.18	66.00	56.00	22.2	26.8	L1	
9	0.17232	28.90	15.70	12.58	41.48	28.28	64.85	54.85	23.3	26.5	L1	
10	0.19472	26.50	15.90	12.59	39.09	28.49	63.83	53.83	24.7	25.3	L1	
11	0.45560	21.50	13.00	12.64	34.14	25.64	56.77	46.77	22.6	21.1	L1	
12	10.01900	18.70	12.00	13.45	32.15	25.45	60.00	50.00	27.8	24.5	L1	
13	11.97660	25.90	18.30	13.60	39.50	31.90	60.00	50.00	20.5	18.1	L1	
14	13.07070	24.20	17.40	13.67	37.87	31.07	60.00	50.00	22.1	18.9	L1	

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

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Shonan EMC Lab.

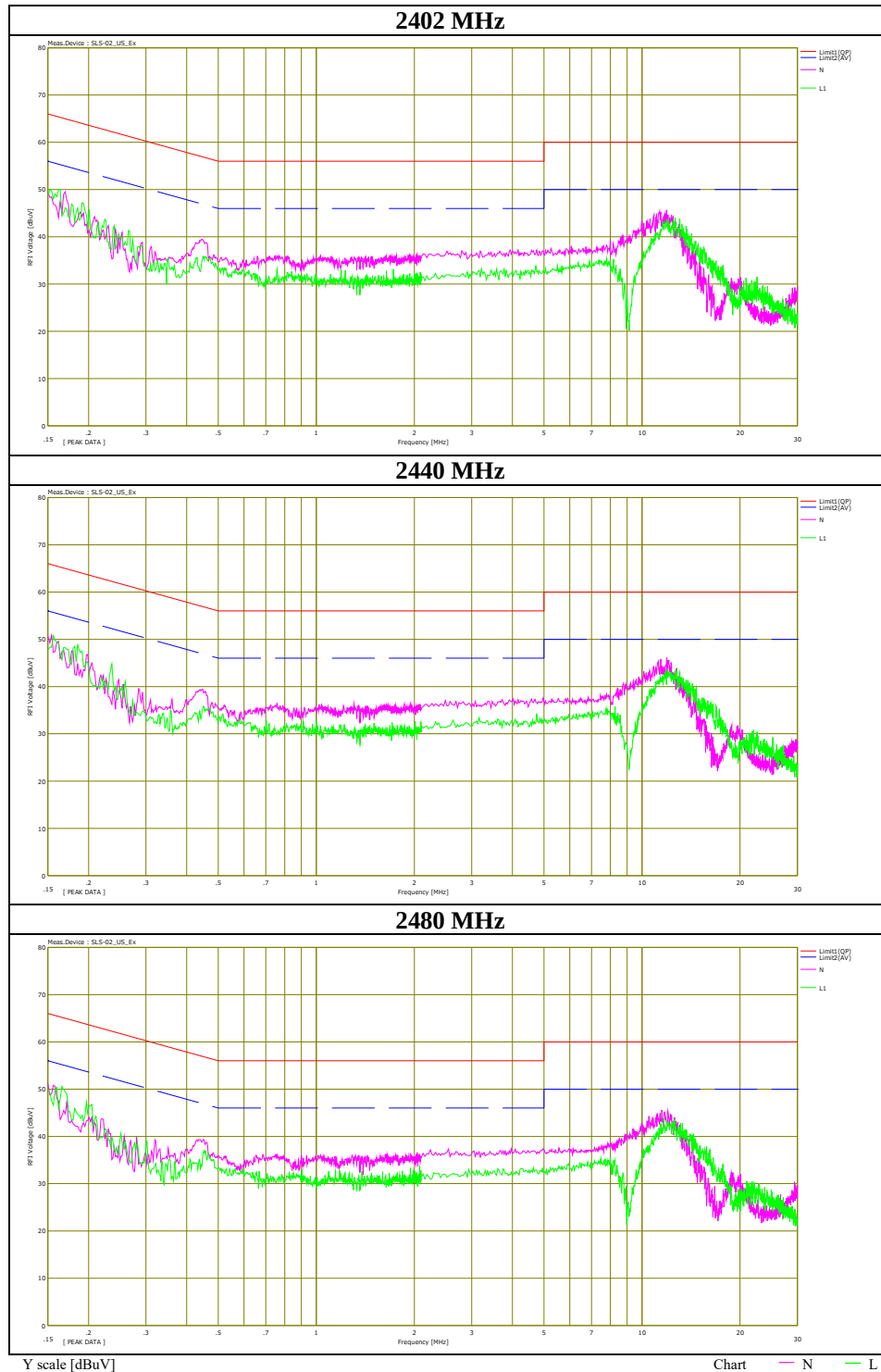
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

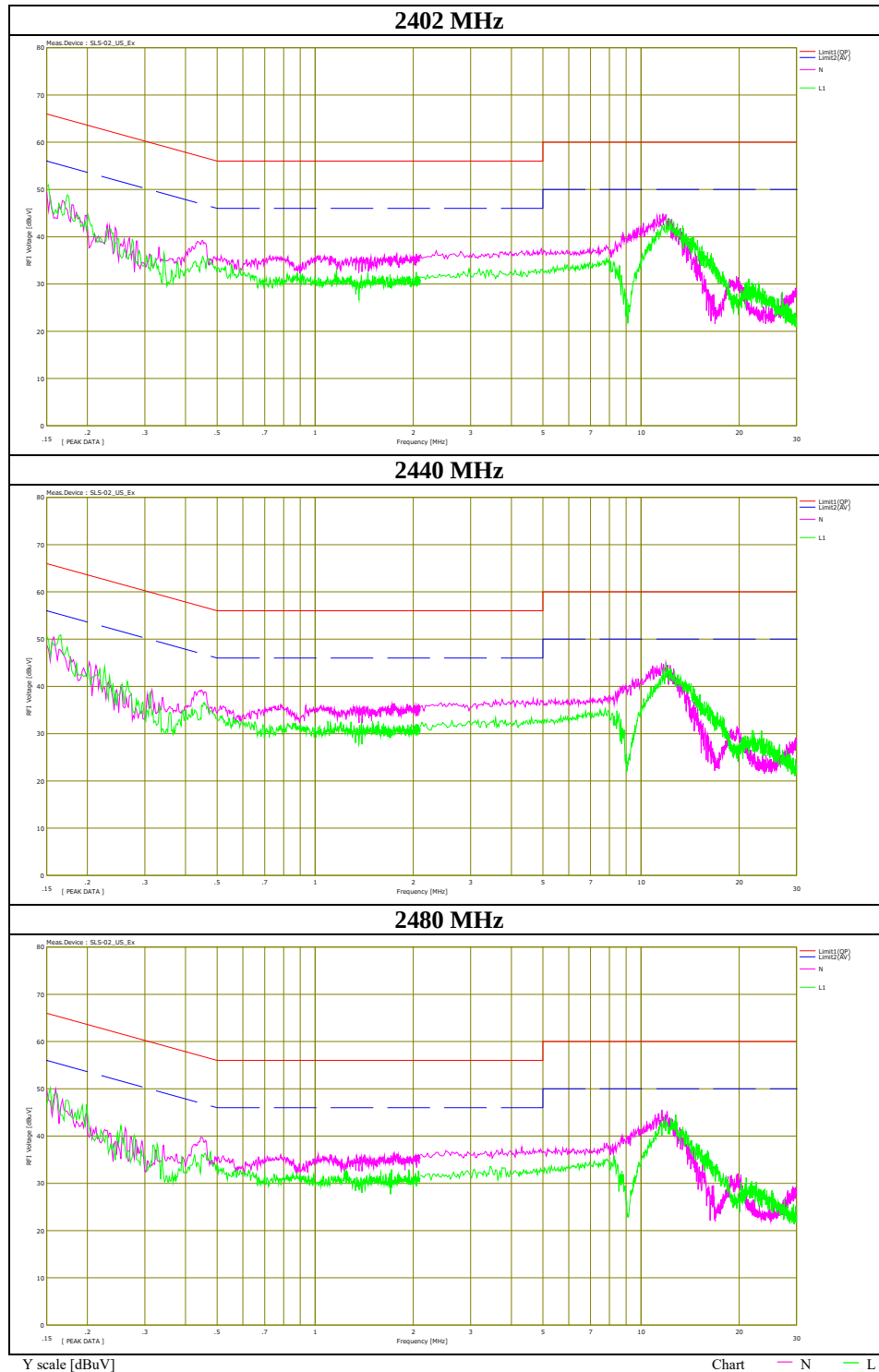
Conducted Emission

Report No. 13554183S-A
Test place Shonan EMC Lab. No.1 Shielded Room
Date November 28, 2020
Temperature / Humidity 22 deg. C / 45 % RH
Engineer Kazuya Noda
Mode Tx BT LE 1 M-PHY



Conducted Emission

Report No. 13554183S-A
Test place Shonan EMC Lab. No.1 Shielded Room
Date November 28, 2020
Temperature / Humidity 22 deg. C / 45 % RH
Engineer Kazuya Noda
Mode Tx BT LE 2 M-PHY



Conducted Emission

DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2020/11/28

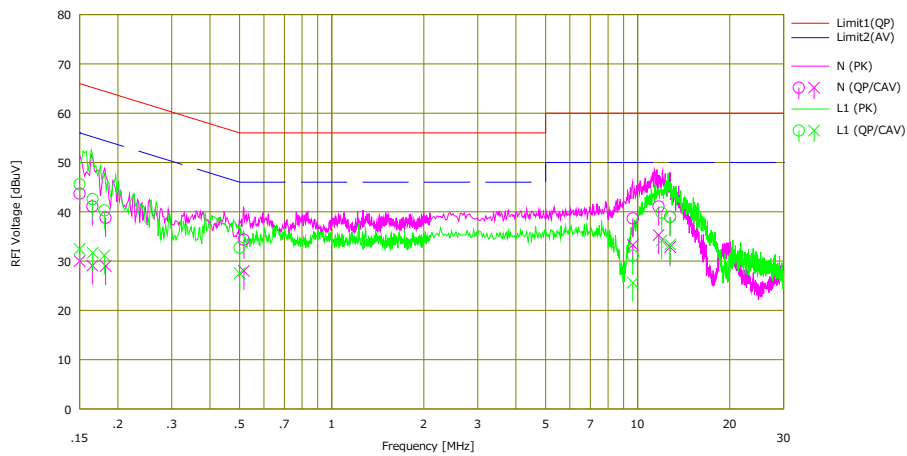
Mode : Tx BT LE 2M PHY 2402 MHz

Power : AC 120 V / 60 Hz
Temp./Humi. : 22 deg.C / 45 %RH

Remarks : with Module A 11n-20 5320 MHz and Module B 11n-20 5580 MHz

Limit : FCC_Part 15 Subpart C(15.207)

Engineer : Kazuya Noda



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	31.10	17.40	12.60	43.70	30.00	66.00	56.00	22.3	26.0	N	
2	0.16515	28.50	16.50	12.59	41.09	29.09	65.20	55.20	24.1	26.1	N	
3	0.18245	26.20	16.40	12.59	38.79	28.99	64.37	54.37	25.5	25.3	N	
4	0.51630	21.70	15.40	12.63	34.33	28.03	56.00	46.00	21.6	17.9	N	
5	9.63390	25.10	19.70	13.57	38.67	33.27	60.00	50.00	21.3	16.7	N	
6	11.70600	27.30	21.50	13.77	41.07	35.27	60.00	50.00	18.9	14.7	N	
7	12.76501	25.10	19.00	13.87	38.97	32.87	60.00	50.00	21.0	17.1	N	
8	0.15000	33.00	19.90	12.58	45.58	32.48	66.00	56.00	20.4	23.5	L1	
9	0.16548	30.00	19.10	12.58	42.58	31.68	65.18	55.18	22.6	23.5	L1	
10	0.18076	27.70	18.60	12.58	40.28	31.18	64.45	54.45	24.1	23.2	L1	
11	0.50030	20.10	14.90	12.65	32.75	27.55	56.00	46.00	23.2	18.4	L1	
12	9.63440	17.70	12.20	13.42	31.12	25.62	60.00	50.00	28.8	24.3	L1	
13	11.97800	26.20	20.60	13.60	39.80	34.20	60.00	50.00	20.2	15.8	L1	
14	12.77301	25.30	19.70	13.66	38.96	33.36	60.00	50.00	21.0	16.6	L1	

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

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Telephone : +81 463 50 6400

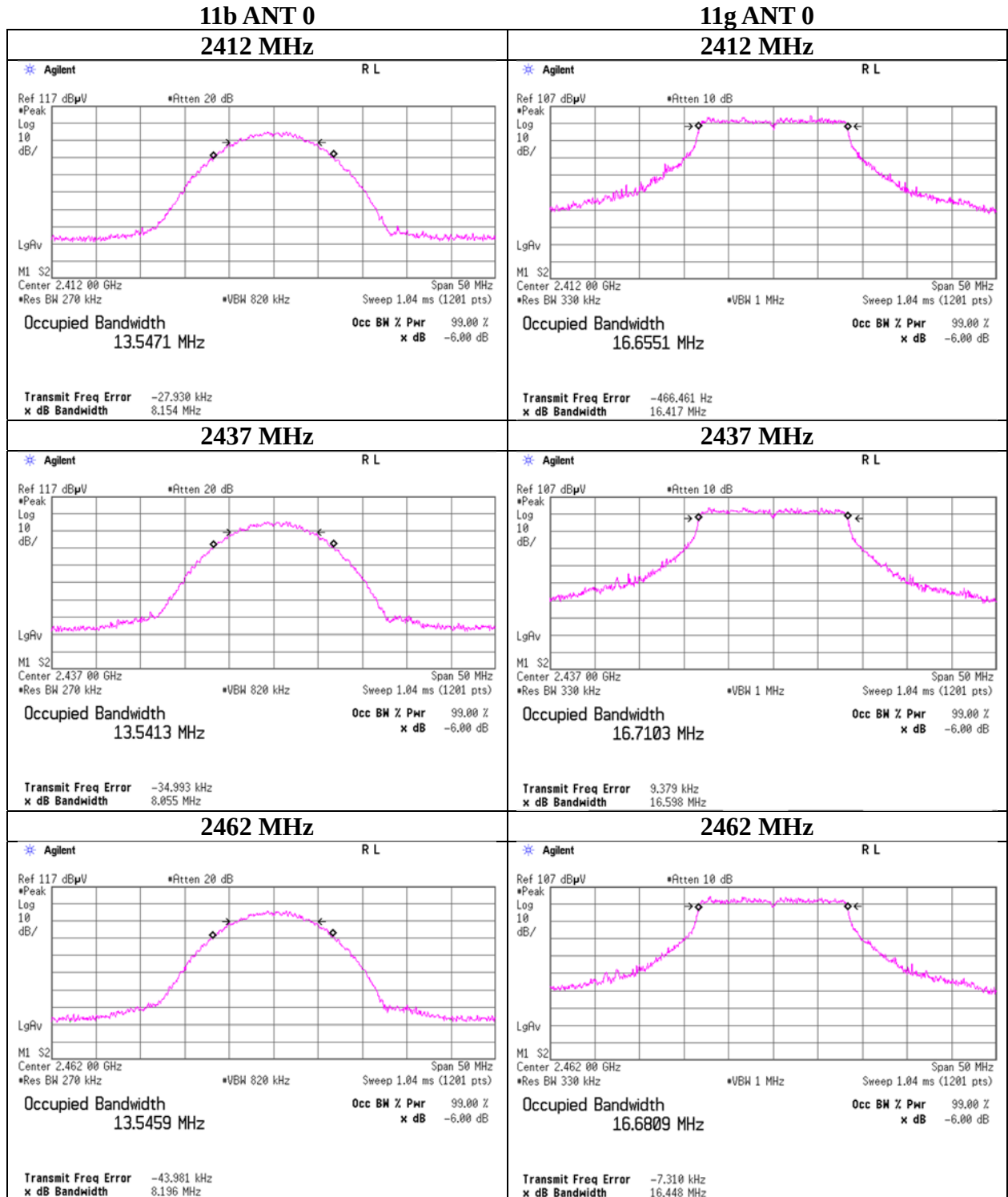
Facsimile : +81 463 50 6401

6 dB Bandwidth and 99 % Occupied Bandwidth

Report No.	13554183S-A	
Test place	Shonan EMC Lab. No.6 Shielded Room	
Date	October 14, 2020	November 7, 2020
Temperature / Humidity	27 deg. C / 45 % RH	23 deg. C / 40 % RH
Engineer	Kazuya Noda	Makoto Hosaka
Mode	Tx	

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
11b	2412	13547.1	9.024	> 0.5000
	2437	13541.3	9.024	> 0.5000
	2462	13545.9	8.731	> 0.5000
11g	2412	16655.1	16.527	> 0.5000
	2437	16710.3	16.501	> 0.5000
	2462	16680.9	16.529	> 0.5000
11n-20	2412	17933.6	17.760	> 0.5000
	2437	17907.1	17.767	> 0.5000
	2462	17956.7	17.765	> 0.5000
BT LE 1 M-PHY	2402	1033.4	0.710	> 0.5000
	2440	1032.1	0.702	> 0.5000
	2480	1033.0	0.710	> 0.5000
BT LE 2 M-PHY	2402	2022.1	1.184	> 0.5000
	2440	2022.2	1.180	> 0.5000
	2480	2021.2	1.184	> 0.5000

99 % Occupied Bandwidth



UL Japan, Inc.

Shonan EMC Lab.

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

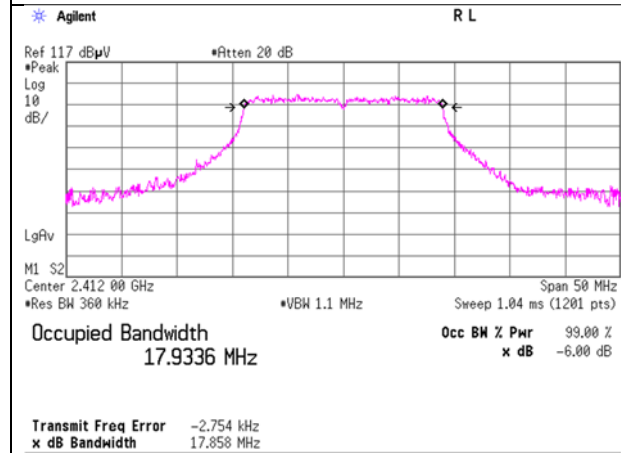
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

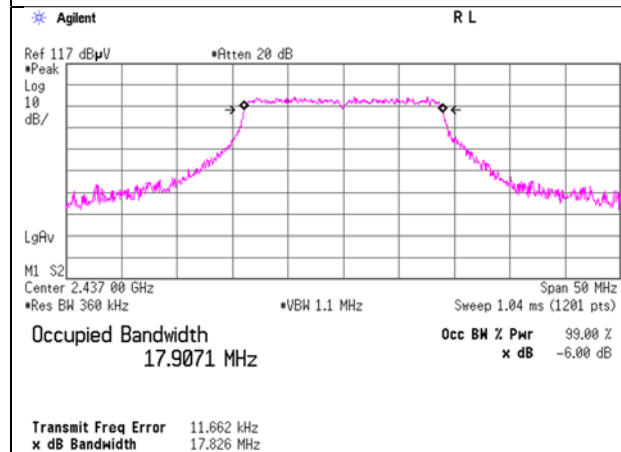
99 % Occupied Bandwidth

11n-20 ANT 0

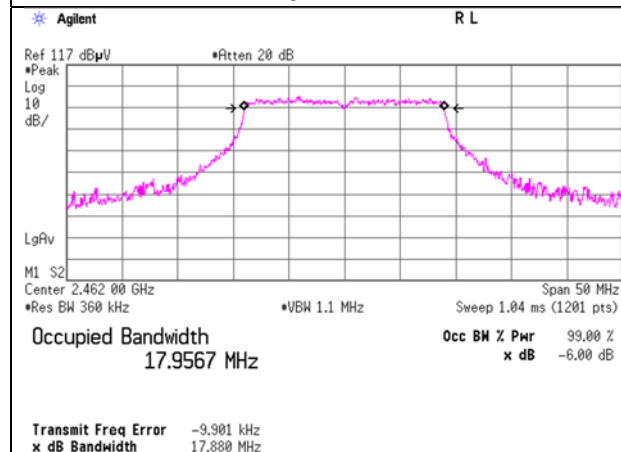
2412 MHz



2437 MHz



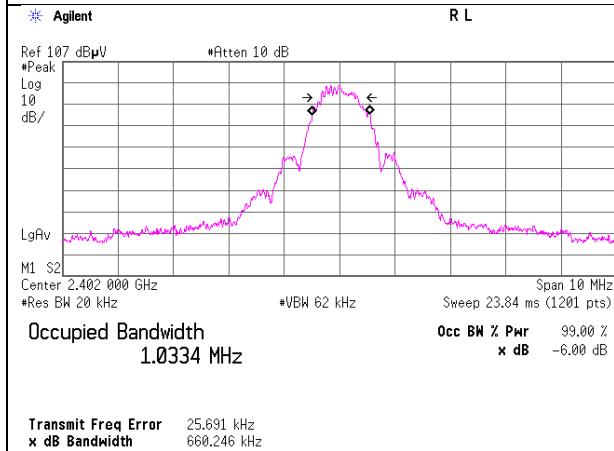
2462 MHz



99 % Occupied Bandwidth

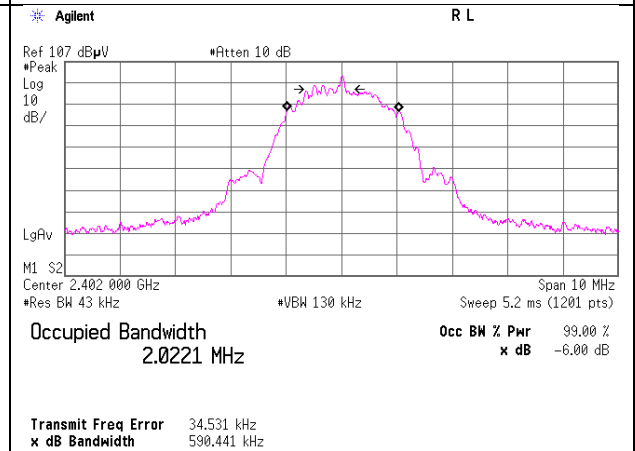
BT LE 1 M-PHY

2402 MHz

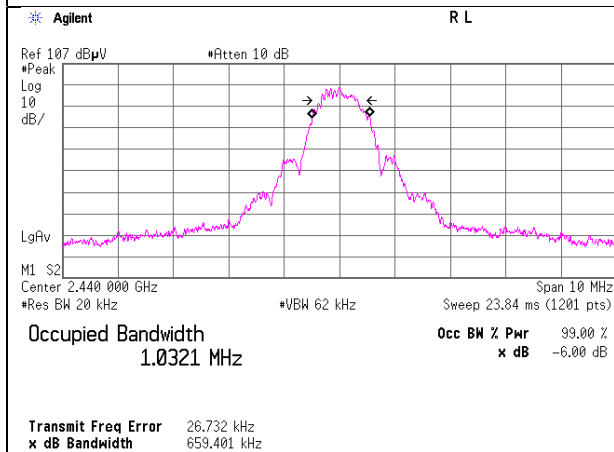


BT LE 2 M-PHY

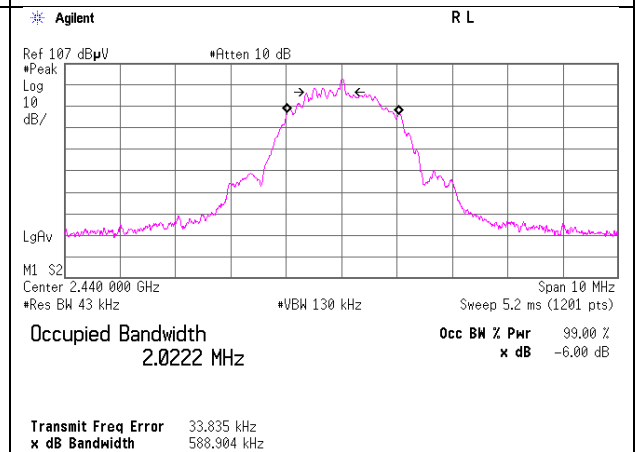
2402 MHz



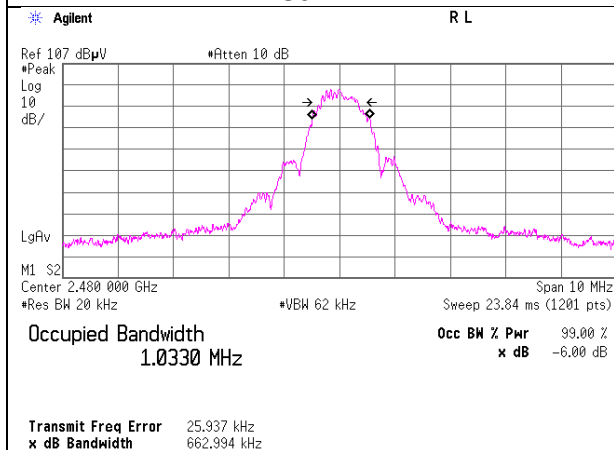
2440 MHz



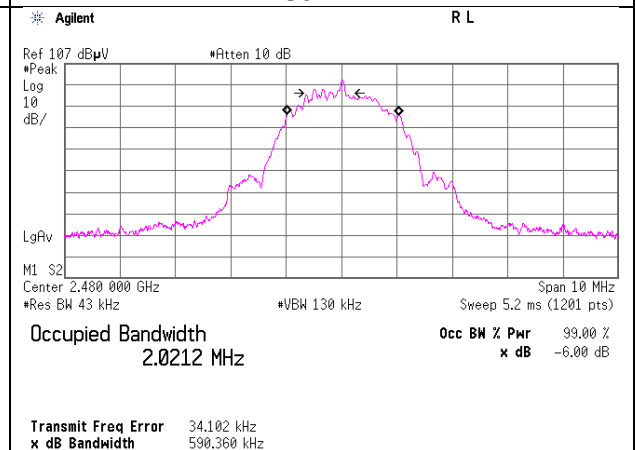
2440 MHz



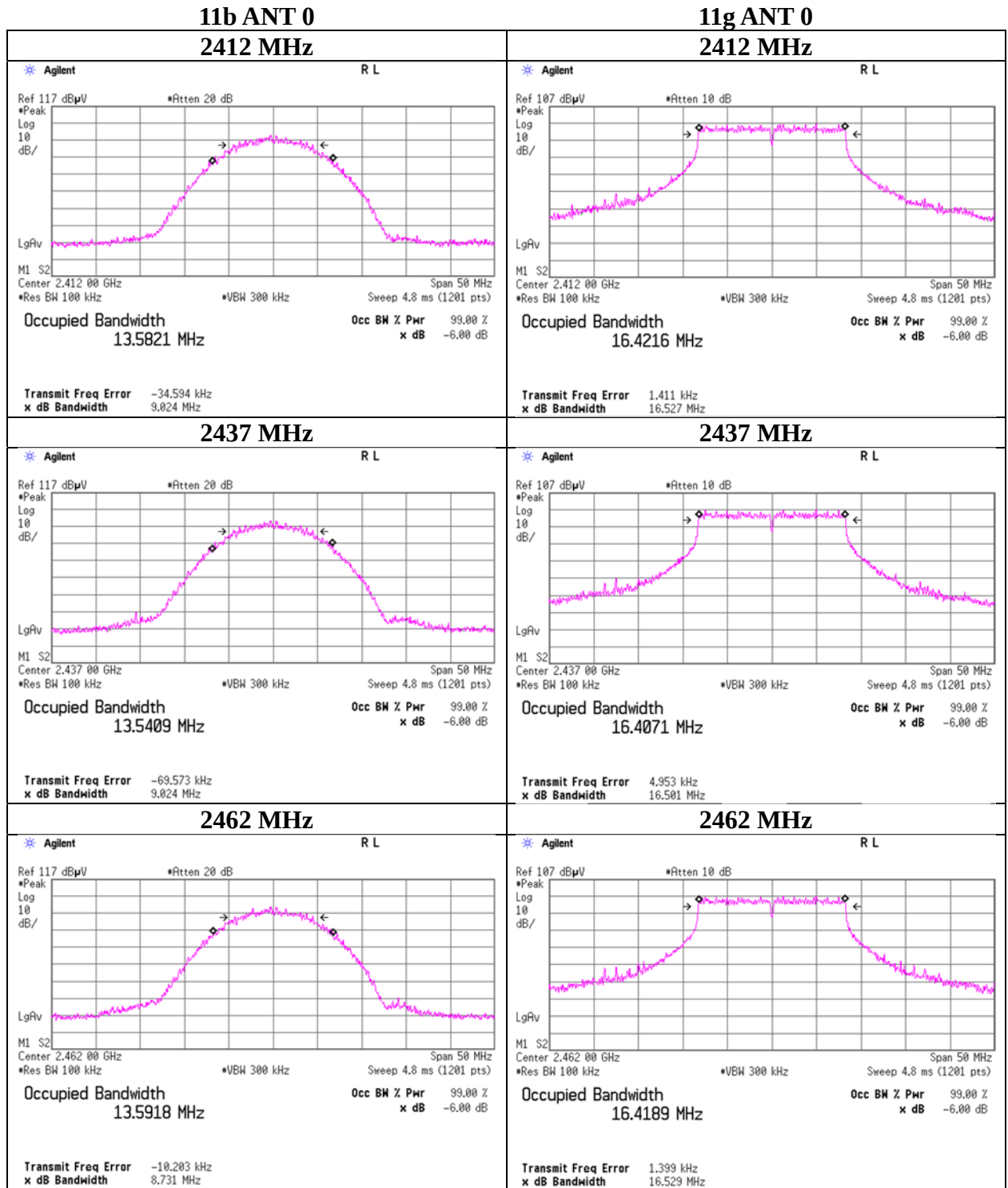
2480 MHz



2480 MHz



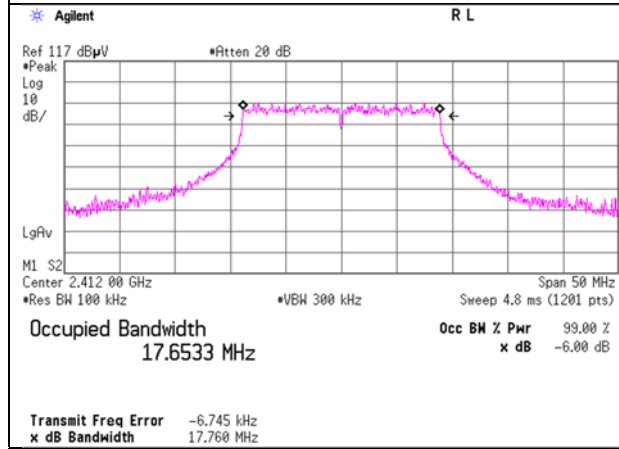
6 dB Bandwidth



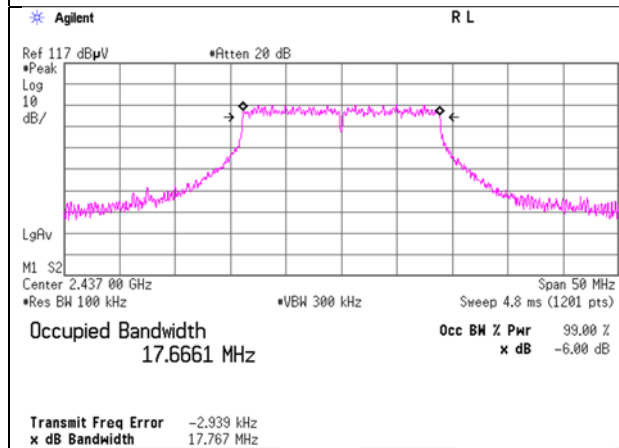
6 dB Bandwidth

11n-20 ANT 0

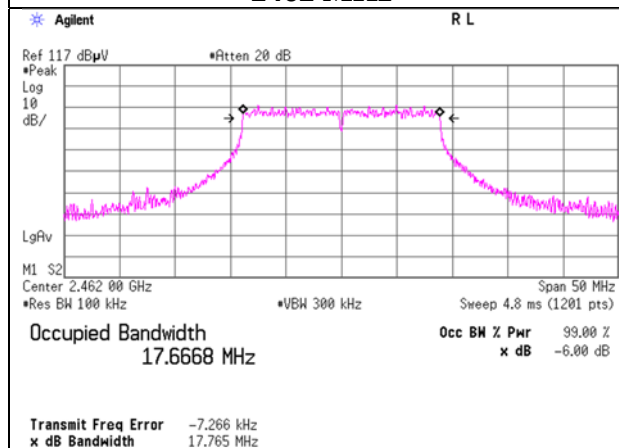
2412 MHz



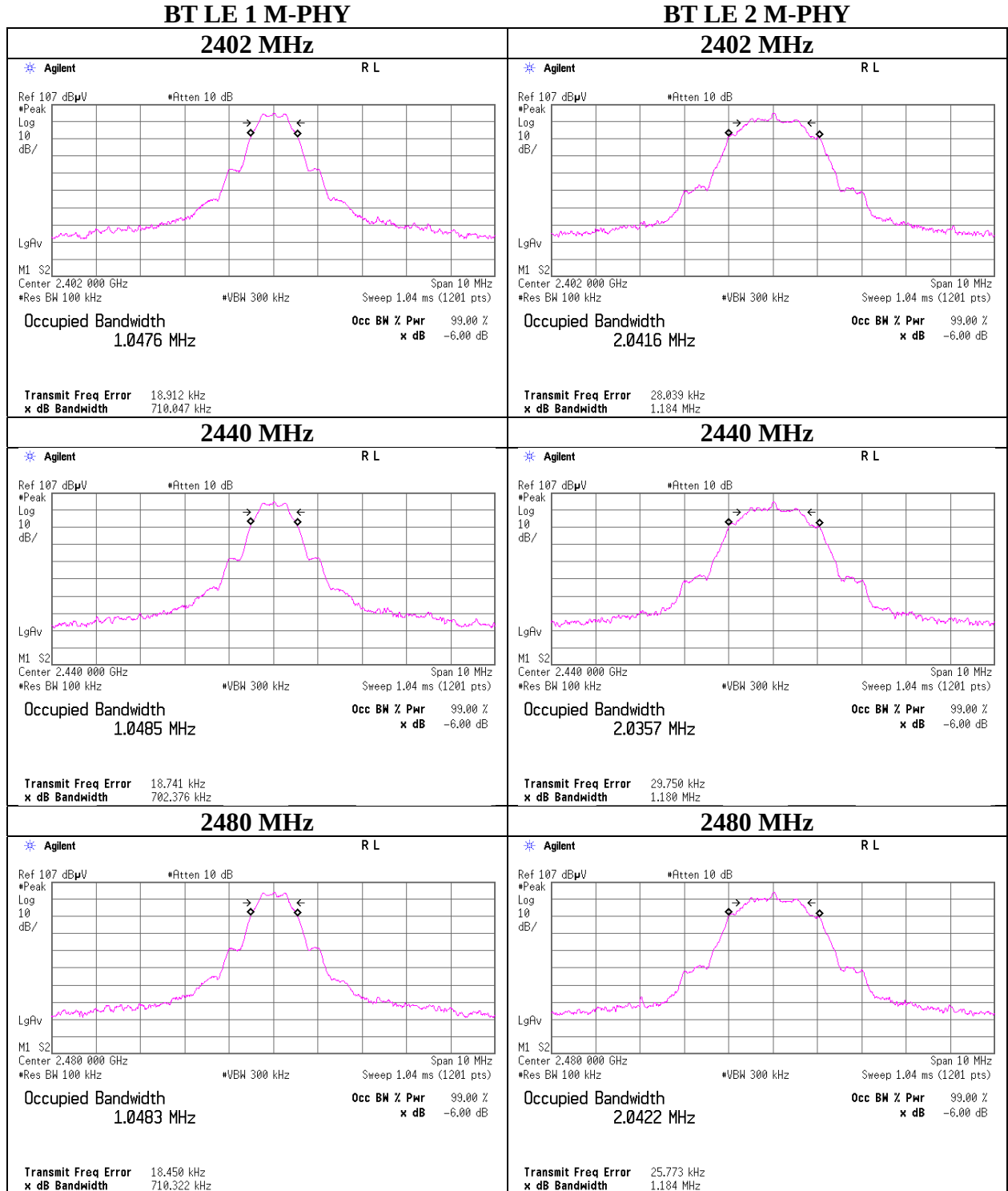
2437 MHz



2462 MHz



6 dB Bandwidth



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Shonan EMC Lab.

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Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Maximum Peak Output Power

Report No. 13554183S-A
Test place Shonan EMC Lab. No5 Shielded Room
Date November 7, 2020
Temperature / Humidity 23 deg. C / 40 % RH
Engineer Makoto Hosaka
Mode Tx 11b

ANT 0 + ANT 1

Freq. [MHz]	Conducted Power					e.i.r.p.				
	Result		Limit		Margin [dB]	Result		Limit		Margin [dB]
	[dBm]	[mW]	[dBm]	[mW]		[dBm]	[mW]	[dBm]	[mW]	
2412	17.61	57.68	30.00	1000	12.39	22.25	168.06	36.02	4000	13.77
2437	17.64	58.14	30.00	1000	12.36	22.29	169.40	36.02	4000	13.73
2462	17.89	61.50	30.00	1000	12.11	22.53	179.18	36.02	4000	13.49

Sample Calculation:

Result = ANT 0 Result + ANT 1 Result

e.i.r.p. Result = ANT 0 Result (e.i.r.p.) + ANT 1 Result (e.i.r.p.)

ANT 0

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Directional Gain [dBi]	Result (e.i.r.p.)	
				[dBm]	[mW]		[dBm]	[mW]
2412	3.37	0.97	9.63	13.97	24.95	4.64	18.61	72.69
2437	3.74	0.97	9.63	14.34	27.16	4.64	18.98	79.15
2462	4.12	0.96	9.63	14.71	29.58	4.64	19.35	86.19

ANT 1

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Directional Gain [dBi]	Result (e.i.r.p.)	
				[dBm]	[mW]		[dBm]	[mW]
2412	4.36	0.98	9.81	15.15	32.73	4.64	19.79	95.38
2437	4.12	0.97	9.82	14.91	30.97	4.64	19.55	90.25
2462	4.27	0.97	9.80	15.04	31.92	4.64	19.68	92.99

Sample Calculation:

Result = Reading + Cable Loss + Attenuator Loss

Result(e.i.r.p.) = Result + Directional Gain

$$\text{Directional Gain} = 10 \log \frac{\sum_{j=1}^{N_{ss}} (\sum_{k=1}^{N_{ANT}} g_{j,k})^2}{N_{ANT}}$$

Nss = the number of independent spatial streams of data = 1

N ANT = the total number of antennas = 2

$$g_{j,k} = 10^{G_k/20}$$

G_k is the gain in dBi of the k th antenna.

Refer to SECTION 2 for Antenna gain.

Worst Rate Check (2437 MHz)

Rate	ANT 0					ANT 1					Total Result Power		Remark
	Reading	Cable Loss	Atten. Loss	Result		Reading	Cable Loss	Atten. Loss	Result				
				[dBm]	[mW]				[dBm]	[mW]			
	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[dB]	[dB]	[dBm]	[mW]			
1	3.57	0.97	9.63	14.17	26.12	3.96	0.97	9.82	14.75	29.85	17.48	55.98	-
2	3.67	0.97	9.63	14.27	26.73	4.04	0.97	9.82	14.83	30.41	17.57	57.14	-
5.5	3.70	0.97	9.63	14.30	26.92	4.08	0.97	9.82	14.87	30.69	17.60	57.61	-
11	3.74	0.97	9.63	14.34	27.16	4.12	0.97	9.82	14.91	30.97	17.64	58.14	*

*Worst Rate

Sample Calculation:

Each port Result = Reading + Cable Loss + Attenuator Loss

Total Result = Loss Result + Loss Result

Maximum Peak Output Power

Report No. 13554183S-A
Test place Shonan EMC Lab. No.5 Shielded Room
Date October 18, 2020
Temperature / Humidity 23 deg. C / 42 % RH
Engineer Yosuke Murakami
Mode Tx 11g

ANT 0 + ANT 1

Freq.	Conducted Power					e.i.r.p.				
	Result		Limit		Margin	Result		Limit		Margin
	[dBm]	[mW]	[dBm]	[mW]		[dBm]	[mW]	[dBm]	[mW]	
2412	25.96	394.47	30.00	1000	4.04	30.60	1149.39	36.02	4000	5.42
2437	26.31	427.09	30.00	1000	3.69	30.95	1244.43	36.02	4000	5.07
2462	26.06	403.47	30.00	1000	3.94	30.70	1175.59	36.02	4000	5.32

Sample Calculation:

Result = ANT 0 Result + ANT 1 Result

e.i.r.p. Result = ANT 0 Result (e.i.r.p.) + ANT 1 Result (e.i.r.p.)

ANT 0

Freq.	Reading	Cable Loss	Atten. Loss	Result		Directional Gain	Result (e.i.r.p.)	
				[dBm]	[mW]		[dBm]	[mW]
2412	11.81	0.97	9.63	22.41	174.18	4.64	27.05	507.52
2437	12.32	0.97	9.63	22.92	195.88	4.64	27.56	570.75
2462	12.30	0.96	9.63	22.89	194.54	4.64	27.53	566.83

ANT 1

Freq.	Reading	Cable Loss	Atten. Loss	Result		Directional Gain	Result (e.i.r.p.)	
				[dBm]	[mW]		[dBm]	[mW]
2412	12.64	0.98	9.81	23.43	220.29	4.64	28.07	641.87
2437	12.85	0.97	9.82	23.64	231.21	4.64	28.28	673.67
2462	12.43	0.97	9.80	23.20	208.93	4.64	27.84	608.76

Sample Calculation:

Result = Reading + Cable Loss + Attenuator Loss

Result(e.i.r.p.) = Result + Directional Gain

Directional Gain = $10 \log \frac{\sum_{j=1}^{N_{ss}} (\sum_{k=1}^{N_{ANT}} g_{jk})^2}{N_{ANT}}$

Nss = the number of independent spatial streams of data = 1

N ANT = the total number of antennas = 2

$g_{j,k} = 10^{G_k/20}$

G_k is the gain in dBi of the k th antenna.

Refer to SECTION 2 for Antenna gain

Worst Rate Check of Conducted Power (2437 MHz)

Rate	ANT 0					ANT 1					Total Result Power		Remark
	Reading	Cable Loss [dB]	Atten. Loss [dB]	Result		Reading	Cable Loss [dB]	Atten. Loss [dB]	Result				
				[dBm]	[mW]				[dBm]	[mW]	[dBm]	[mW]	
6	6.43	0.97	9.63	17.03	50.47	6.88	0.97	9.82	17.67	58.48	20.37	108.95	-
9	6.42	0.97	9.63	17.02	50.35	6.86	0.97	9.82	17.65	58.21	20.36	108.56	-
12	6.45	0.97	9.63	17.05	50.70	6.82	0.97	9.82	17.61	57.68	20.35	108.38	-
18	8.97	0.97	9.63	19.57	90.57	9.10	0.97	9.82	19.89	97.50	22.74	188.07	-
24	8.89	0.97	9.63	19.49	88.92	9.39	0.97	9.82	20.18	104.23	22.86	193.15	-
36	12.32	0.97	9.63	22.92	195.88	12.85	0.97	9.82	23.64	231.21	26.31	427.09	*
48	12.24	0.97	9.63	22.84	192.31	12.57	0.97	9.82	23.36	216.77	26.12	409.08	-
54	12.18	0.97	9.63	22.78	189.67	12.60	0.97	9.82	23.39	218.27	26.11	407.94	-

*Worst Rate

Sample Calculation:

Each port Result = Reading + Cable Loss + Attenuator Loss

Total Result = Loss Result + Loss Result

Maximum Peak Output Power

Report No.	13554183S-A
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	October 22, 2020 November 13, 2020
Temperature / Humidity	23 deg. C / 57 % RH 21 deg. C / 49 % RH
Engineer	Yosuke Murakami Yusuke Tanikawara
Mode	Tx 11n-20

ANT 0 + ANT 1

Freq. [MHz]	Conducted Power					e.i.r.p.				
	Result		Limit		Margin [dB]	Result		Limit		Margin [dB]
	[dBm]	[mW]	[dBm]	[mW]		[dBm]	[mW]	[dBm]	[mW]	
2412	26.29	425.72	30.00	1000	3.71	27.96	625.01	36.02	4000	8.06
2437	26.94	494.04	30.00	1000	3.06	28.61	726.28	36.02	4000	7.41
2462	26.70	467.91	30.00	1000	3.30	28.35	684.64	36.02	4000	7.67

Sample Calculation:

Result = ANT 0 Result + ANT 1 Result

e.i.r.p. Result = ANT 0 Result (e.i.r.p.) + ANT 1 Result (e.i.r.p.)

ANT 0

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Antenna Gain [dBi]	Result (e.i.r.p.)	
				[dBm]	[mW]		[dBm]	[mW]
2412	12.18	0.97	9.63	22.78	189.67	1.36	24.14	259.42
2437	12.72	0.97	9.63	23.32	214.78	1.36	24.68	293.76
2462	12.86	0.96	9.63	23.45	221.31	1.36	24.81	302.69

ANT 1

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Antenna Gain [dBi]	Result (e.i.r.p.)	
				[dBm]	[mW]		[dBm]	[mW]
2412	12.94	0.98	9.81	23.73	236.05	1.90	25.63	365.59
2437	13.67	0.97	9.82	24.46	279.25	1.90	26.36	432.51
2462	13.15	0.97	9.80	23.92	246.60	1.90	25.82	381.94

Sample Calculation:

Result = Reading + Cable Loss + Attenuator Loss

Result(e.i.r.p.) = Result + Antenna Gain

Worst Rate Check (2437 MHz)

MCS Number	ANT 0					ANT 1					Total Result Power		Remark
	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result				
				[dBm]	[mW]				[dBm]	[mW]			
8	7.08	0.97	9.63	17.68	58.61	7.44	0.97	9.82	18.23	66.53	20.97	125.14	-
9	7.01	0.97	9.63	17.61	57.68	7.34	0.97	9.82	18.13	65.01	20.89	122.69	-
10	9.43	0.97	9.63	20.03	100.69	9.75	0.97	9.82	20.54	113.24	23.30	213.93	-
11	9.40	0.97	9.63	20.00	100.00	9.73	0.97	9.82	20.52	112.72	23.28	212.72	-
12	12.40	0.97	9.63	23.00	199.53	12.66	0.97	9.82	23.45	221.31	26.24	420.84	-
13	12.25	0.97	9.63	22.85	192.75	12.65	0.97	9.82	23.44	220.80	26.17	413.55	-
14	12.72	0.97	9.63	23.32	214.78	13.67	0.97	9.82	24.46	279.25	26.94	494.04	*
15	12.16	0.97	9.63	22.76	188.80	12.81	0.97	9.82	23.60	229.09	26.21	417.89	-

*Worst Rate

Sample Calculation:

Each port Result = Reading + Cable Loss + Attenuator Loss

Total Result = Loss Result + Loss Result

Maximum Peak Output Power

Report No. 13554183S-A
Test place Shonan EMC Lab. No.6 Shielded Room
Date October 14, 2020
Temperature / Humidity 27 deg. C / 45 % RH
Engineer Kazuya Noda
Mode Tx BT LE

BT LE 1 M-PHY				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2402	-4.98	0.99	9.81	5.82	3.82	30.00	1000	24.18	3.54	9.36	8.63	36.02	4000	26.66
2440	-5.35	0.98	9.82	5.45	3.51	30.00	1000	24.55	3.54	8.99	7.93	36.02	4000	27.03
2480	-5.93	0.97	9.82	4.86	3.06	30.00	1000	25.14	3.54	8.40	6.92	36.02	4000	27.62

BT LE 2 M-PHY				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2402	-4.60	0.99	9.81	6.20	4.17	30.00	1000	23.80	3.54	9.74	9.42	36.02	4000	26.28
2440	-4.88	0.98	9.82	5.92	3.91	30.00	1000	24.08	3.54	9.46	8.83	36.02	4000	26.56
2480	-5.56	0.97	9.82	5.23	3.33	30.00	1000	24.77	3.54	8.77	7.53	36.02	4000	27.25

Sample Calculation:

Result = Reading + Cable Loss + Attenuator Loss

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

Average Output Power (Reference data for RF Exposure)

Report No. 13554183S-A
Test place Shonan EMC Lab. No.5 Shielded Room
Date October 18, 2020 October 22, 2020 November 7, 2020 November 13, 2020
Temperature / Humidity 23 deg. C / 42 % RH 23 deg. C / 57 % RH 23 deg. C / 40 % RH 21 deg. C / 49 % RH
Engineer Yosuke Murakami Yosuke Murakami Makoto Hosaka Yusuke Tanikawara
Mode Tx

11b		2 Mbps											
ANT 0						ANT 1						Total Power	
Frequency	Reading (Average)	Cable Loss	Atten. Loss	Result (Peak)		Reading (Average)	Cable Loss	Atten. Loss	Result (Average)		Result (Average)		
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	
2412	0.96	0.97	9.63	11.56	14.32	1.86	0.98	9.81	12.65	18.41	15.15	32.73	
2437	1.28	0.97	9.63	11.88	15.42	1.69	0.97	9.82	12.48	17.70	15.20	33.12	
2462	1.64	0.96	9.63	12.23	16.71	1.69	0.97	9.80	12.46	17.62	15.36	34.33	

11g		18 Mbps										
		ANT 0				ANT 1				Total Power		
Frequency	Reading (Average)	Cable Loss	Atten. Loss	Result (Peak)		Reading (Average)	Cable Loss	Atten. Loss	Result (Average)		Result (Average)	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]
2412	1.97	0.97	9.63	12.57	18.07	2.94	0.98	9.81	13.73	23.60	16.20	41.68
2437	2.32	0.97	9.63	12.92	19.59	2.64	0.97	9.82	13.43	22.03	16.19	41.62
2462	2.57	0.96	9.63	13.16	20.70	2.70	0.97	9.80	13.47	22.23	16.33	42.93

11n-20		MCS 10											
		ANT 0					ANT 1					Total Power	
Frequency	Reading (Average)	Cable Loss	Atten. Loss	Result (Peak)		Reading (Average)	Cable Loss	Atten. Loss	Result (Average)		Result (Average)		
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	
2412	1.02	0.97	9.63	11.62	14.52	2.00	0.98	9.81	12.79	19.01	15.25	33.53	
2437	2.78	0.97	9.63	13.38	21.78	3.17	0.97	9.82	13.96	24.89	16.69	46.67	
2462	2.29	0.96	9.63	12.88	19.41	2.44	0.97	9.80	13.21	20.94	16.06	40.35	

Sample Calculation:

Result [dBm] = Reading + Cable Loss + Attenuator Loss

Result [mW] = $10^{\text{Result [dBm]} / 10}$

Total Result [mW] = ANT 0 Result [mW] + ANT 1 Result [mW]

Total Result [dBm] = $10 \times \log(\text{Total Result [mW]})$

(*1) Power was measured with using the gate function of power meter.

It means that the intervals during which the transmitter is off or is transmitting at reduced power level is not included in the average.

Therefore, there is no need to add duty cycle correction to the result.

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

Average Output Power (Reference data for RF Exposure)

Report No. 13554183S-A
Test place Shonan EMC Lab. No.5 Shielded Room
Date October 18, 2020
Temperature / Humidity 23 deg. C / 42 % RH
Engineer Yosuke Murakami
Mode Tx

11b, 2437 MHz

Rate [Mbps]	Conducted power			Result [dBm]	Remarks
	Antenna ANT 0 [mW]	ANT 1 [mW]	Sum [mW]		
1	15.14	17.18	32.31	15.09	-
2	15.42	17.70	33.12	15.20	*
5.5	15.38	17.26	32.64	15.14	-
11	15.56	17.46	33.02	15.19	-

ANT 0						ANT 1			
Rate	Duty Factor *1)	Reading	Cable Loss	Atten. Loss	Result Cond. Power	Reading	Cable Loss	Atten. Loss	Result Cond. Power
[Mbps]	[dB]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]	[dB]	[dBm]
1	0.00	1.20	0.97	9.63	11.80	1.56	0.97	9.82	12.35
2	0.00	1.28	0.97	9.63	11.88	1.69	0.97	9.82	12.48
5.5	0.00	1.27	0.97	9.63	11.87	1.58	0.97	9.82	12.37
11	0.00	1.32	0.97	9.63	11.92	1.63	0.97	9.82	12.42

Sample Calculation:

Conducted Power Result = Reading + Cable Loss + Atten. Loss

* Worst Rate

2437 MHz

Rate [Mbps]	Conducted power			Result [dBm]	Remarks
	Antenna ANT 0 [mW]	ANT 1 [mW]	Sum [mW]		
6	16.63	19.23	35.87	15.55	-
9	16.60	19.19	35.78	15.54	-
12	16.41	18.58	34.98	15.44	-
18	19.59	22.03	41.62	16.19	*
24	18.75	21.78	40.53	16.08	-
36	18.41	20.42	38.83	15.89	-
48	18.20	20.37	38.57	15.86	-
54	18.37	20.32	38.69	15.88	-

ANT 0					ANT 1				
Rate	Duty Factor *1)	Reading	Cable Loss	Atten. Loss	Result Cond. Power	Reading	Cable Loss	Atten. Loss	Result Cond. Power
[Mbps]	[dB]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]	[dB]	[dBm]
6	0.00	1.61	0.97	9.63	12.21	2.05	0.97	9.82	12.84
9	0.00	1.60	0.97	9.63	12.20	2.04	0.97	9.82	12.83
12	0.00	1.55	0.97	9.63	12.15	1.90	0.97	9.82	12.69
18	0.00	2.32	0.97	9.63	12.92	2.64	0.97	9.82	13.43
24	0.00	2.13	0.97	9.63	12.73	2.59	0.97	9.82	13.38
36	0.00	2.05	0.97	9.63	12.65	2.31	0.97	9.82	13.10
48	0.00	2.00	0.97	9.63	12.60	2.30	0.97	9.82	13.09
54	0.00	2.04	0.97	9.63	12.64	2.29	0.97	9.82	13.08

Sample Calculation:

Conducted Power Result = Reading + Cable Loss + Atten. Loss

* Worst Rate

*1) Power was measured with using the gate function of power meter.

It means that the intervals during which the transmitter is off or is transmitting at reduced power level is not included in the average.
Therefore, there is no need to add duty cycle correction to the result.

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Average Output Power (Reference data for RF Exposure)

Report No.	13554183S-A
Test place	Shonan EMC Lab. No.5 Shielded Room
Date	October 18, 2020
Temperature / Humidity	23 deg. C / 42 % RH
Engineer	Yosuke Murakami
Mode	Tx

11n-20, 2437 Mz

Rate	Conducted power			Result	Remarks
	Antenna				
[MCS]	ANT 0 [mW]	ANT 1 [mW]	Sum [mW]	[dBm]	
8	18.79	21.23	40.03	16.02	-
9	17.78	20.32	38.11	15.81	-
10	21.78	24.89	46.67	16.69	*
11	21.48	24.10	45.58	16.59	-
12	21.53	23.93	45.46	16.58	-
13	20.89	23.66	44.55	16.49	-
14	21.18	23.82	45.01	16.53	-
15	21.04	23.71	44.75	16.51	-

Rate	Duty Factor *1)	ANT 0				ANT 1			
		Reading	Cable Loss	Atten. Loss	Result Cond. Power	Reading	Cable Loss	Atten. Loss	Result Cond. Power
[MCS]	[dB]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]	[dB]	[dBm]
8	0.00	2.14	0.97	9.63	12.74	2.48	0.97	9.82	13.27
9	0.00	1.90	0.97	9.63	12.50	2.29	0.97	9.82	13.08
10	0.00	2.78	0.97	9.63	13.38	3.17	0.97	9.82	13.96
11	0.00	2.72	0.97	9.63	13.32	3.03	0.97	9.82	13.82
12	0.00	2.73	0.97	9.63	13.33	3.00	0.97	9.82	13.79
13	0.00	2.60	0.97	9.63	13.20	2.95	0.97	9.82	13.74
14	0.00	2.66	0.97	9.63	13.26	2.98	0.97	9.82	13.77
15	0.00	2.63	0.97	9.63	13.23	2.96	0.97	9.82	13.75

Sample Calculation:

Conducted Power Result = Reading + Cable Loss + Atten. Loss

* Worst Rate

*1) Power was measured with using the gate function of power meter.

It was means that the intervals during which the transmitter is off or is transmitting at reduced power level is not included in the average. Therefore, there is no need to add duty cycle correction to the result.

Average Output Power **(Reference data for RF Exposure)**

Report No. 13554183S-A
Test place Shonan EMC Lab. No.6 Shielded Room
Date October 14, 2020
Temperature / Humidity 27 deg. C / 45 % RH
Engineer Kazuya Noda
Mode Tx

BT LE 1 M-PHY

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	-7.46	0.99	9.81	3.34	2.16	1.79	5.13	3.26
2440	-7.74	0.98	9.82	3.06	2.02	1.79	4.85	3.05
2480	-8.47	0.97	9.82	2.32	1.71	1.79	4.11	2.57

BT LE 2 M-PHY

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	-10.10	0.99	9.81	0.70	1.17	4.34	5.04	3.19
2440	-10.36	0.98	9.82	0.44	1.11	4.34	4.78	3.00
2480	-11.04	0.97	9.82	-0.25	0.94	4.34	4.09	2.56

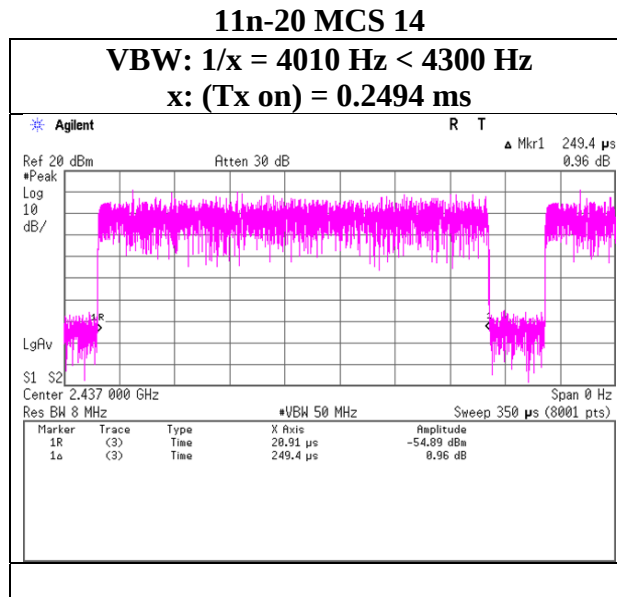
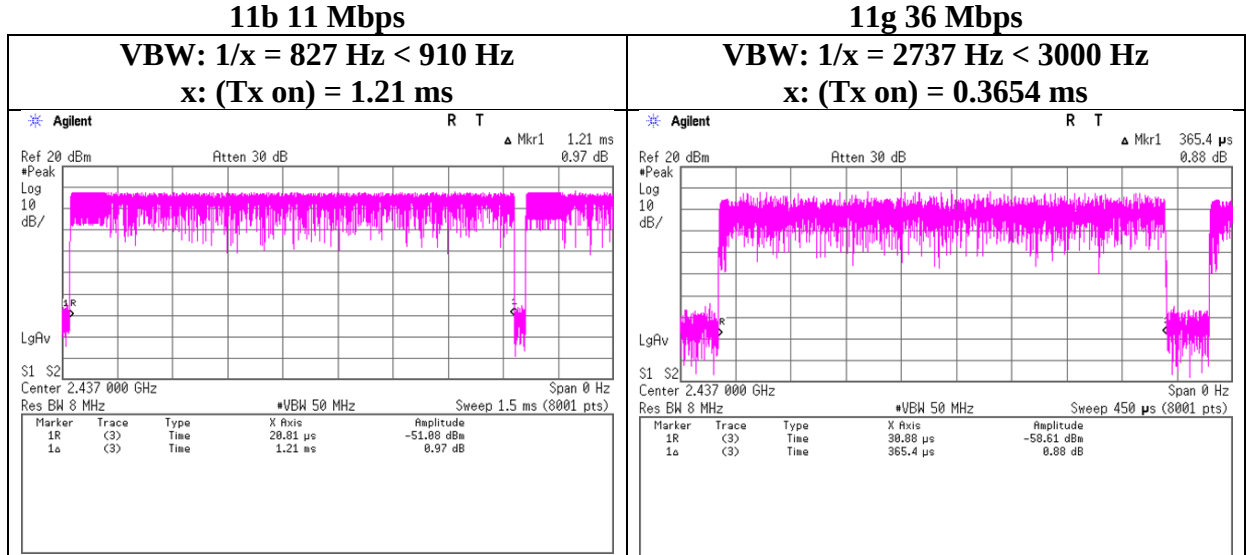
Sample Calculation:

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

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

Burst rate confirmation

Report No.	13554183S-A		
Test place	Shonan EMC Lab. No.5 Shielded Room		
Date	October 18, 2020	October 22, 2020	November 7, 2020
Temperature / Humidity	23 deg. C / 42 % RH	23 deg. C / 57 % RH	23 deg. C / 40 % RH
Engineer	Yosuke Murakami	Yosuke Murakami	Makoto Hosaka
Mode	Tx		



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

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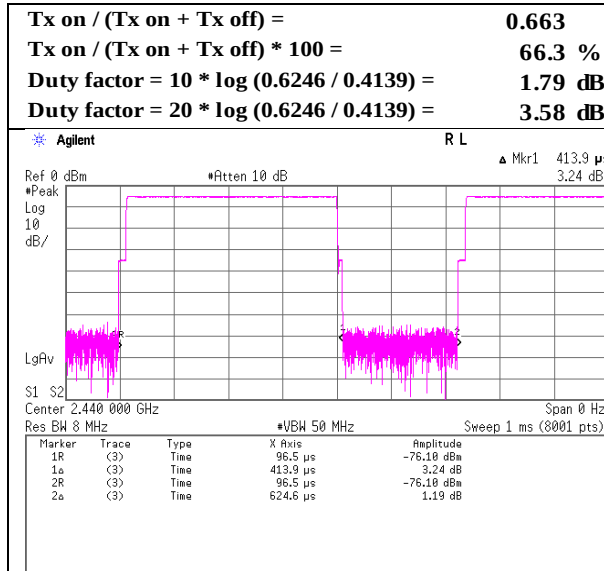
Telephone : +81 463 50 6400

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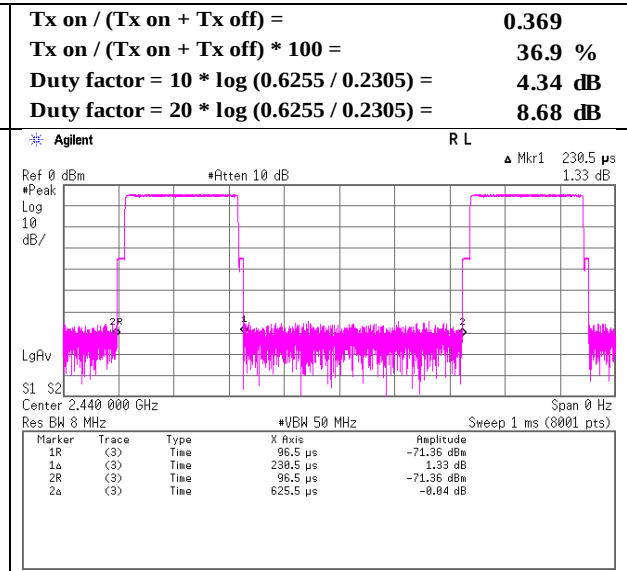
Burst rate confirmation

Report No.	13554183S-A
Test place	Shonan EMC Lab. No.6 Shielded Room
Date	October 14, 2020
Temperature / Humidity	27 deg. C / 45 % RH
Engineer	Kazuya Noda
Mode	Tx

BT LE 1 M-PHY



BT LE 2 M-PHY



* 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. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date November 8, 2020 November 14, 2020 November 15, 2020
Temperature / Humidity 22 deg. C / 56 % RH 21 deg. C / 46 % RH 21 deg. C / 44 % RH
Engineer Toshinori Yamada Yusuke Tanikawara Takahiro Suzuki
(1 GHz – 2.8 GHz) (2.8 GHz - 10 GHz) (10 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.	2315.850	PK	45.31	28.06	14.42	39.53	2.28	50.54	73.9	23.3	375	102	-
Hori.	2390.000	PK	47.85	27.93	14.49	39.55	2.28	53.00	73.9	20.9	375	102	-
Hori.	4824.000	PK	47.07	31.49	7.04	39.73	2.28	48.15	73.9	25.7	225	262	-
Hori.	7236.000	PK	45.12	36.92	8.68	39.52	2.28	53.48	73.9	20.4	150	0	-
Hori.	9648.000	PK	45.54	38.33	10.21	39.61	2.28	56.75	73.9	17.1	150	0	-
Hori.	2315.850	AV	35.20	28.06	14.42	39.53	2.28	40.43	53.9	13.4	375	102	VBW:910 Hz
Hori.	2390.000	AV	36.26	27.93	14.49	39.55	2.28	41.41	53.9	12.4	375	102	VBW:910 Hz
Hori.	4824.000	AV	41.02	31.49	7.04	39.73	2.28	42.10	53.9	11.8	225	262	VBW:910 Hz
Hori.	7236.000	AV	33.78	36.92	8.68	39.52	2.28	42.14	53.9	11.7	150	0	Floor noise
Hori.	9648.000	AV	34.42	38.33	10.21	39.61	2.28	45.63	53.9	8.2	150	0	Floor noise
Vert.	2315.850	PK	45.96	28.06	14.42	39.53	2.28	51.19	73.9	22.7	372	349	-
Vert.	2390.000	PK	47.04	27.93	14.49	39.55	2.28	52.19	73.9	21.7	372	349	-
Vert.	4824.000	PK	47.05	31.49	7.04	39.73	2.28	48.13	73.9	25.7	141	294	-
Vert.	7236.000	PK	45.83	36.92	8.68	39.52	2.28	54.19	73.9	19.7	150	0	-
Vert.	9648.000	PK	45.96	38.33	10.21	39.61	2.28	57.17	73.9	16.7	150	0	-
Vert.	2315.850	AV	35.02	28.06	14.42	39.53	2.28	40.25	53.9	13.6	372	349	VBW:910 Hz
Vert.	2390.000	AV	34.74	27.93	14.49	39.55	2.28	39.89	53.9	14.0	372	349	VBW:910 Hz
Vert.	4824.000	AV	38.86	31.49	7.04	39.73	2.28	39.94	53.9	13.9	141	294	VBW:910 Hz
Vert.	7236.000	AV	33.77	36.92	8.68	39.52	2.28	42.13	53.9	11.7	150	0	Floor noise
Vert.	9648.000	AV	34.05	38.33	10.21	39.61	2.28	45.26	53.9	8.6	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : 20log (3.90 m / 3.0 m) = 2.28 dB

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

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	100.32	27.90	14.51	39.56	2.28	105.45	-	-	Carrier
Hori.	2400.000	PK	49.13	27.92	14.50	39.56	2.28	54.27	85.4	31.1	-
Vert.	2412.000	PK	98.25	27.90	14.51	39.56	2.28	103.38	-	-	Carrier
Vert.	2400.000	PK	42.69	27.92	14.50	39.56	2.28	47.83	83.3	35.4	-

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

Distance factor : 1 GHz - 10 GHz : 20log (3.90 m / 3.0 m) = 2.28 dB

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

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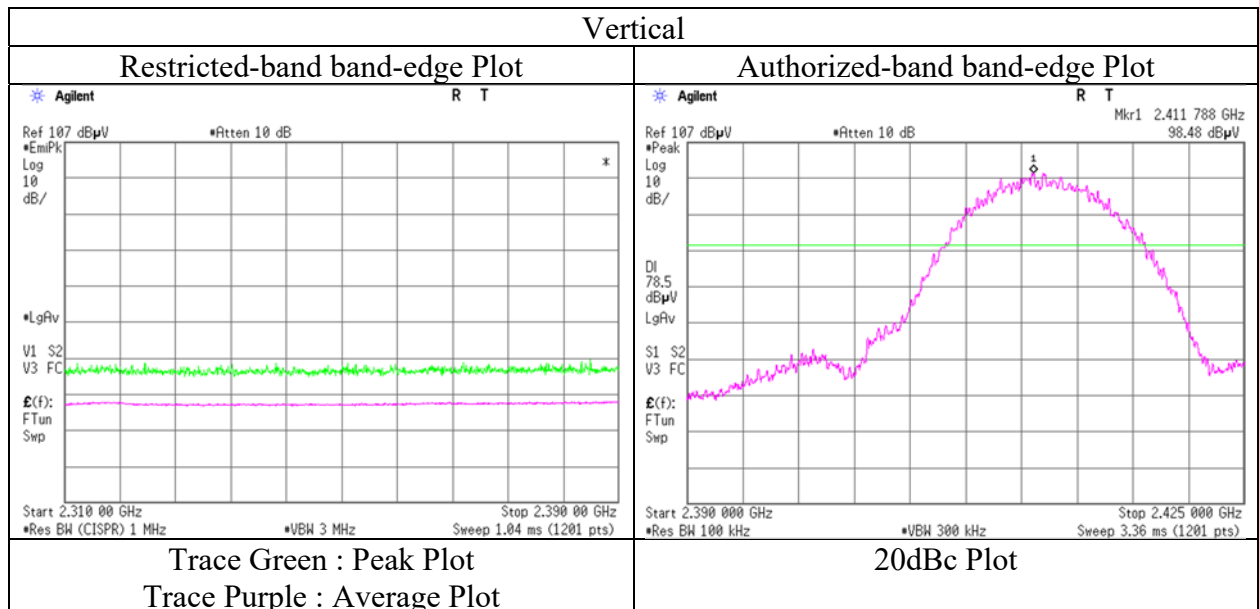
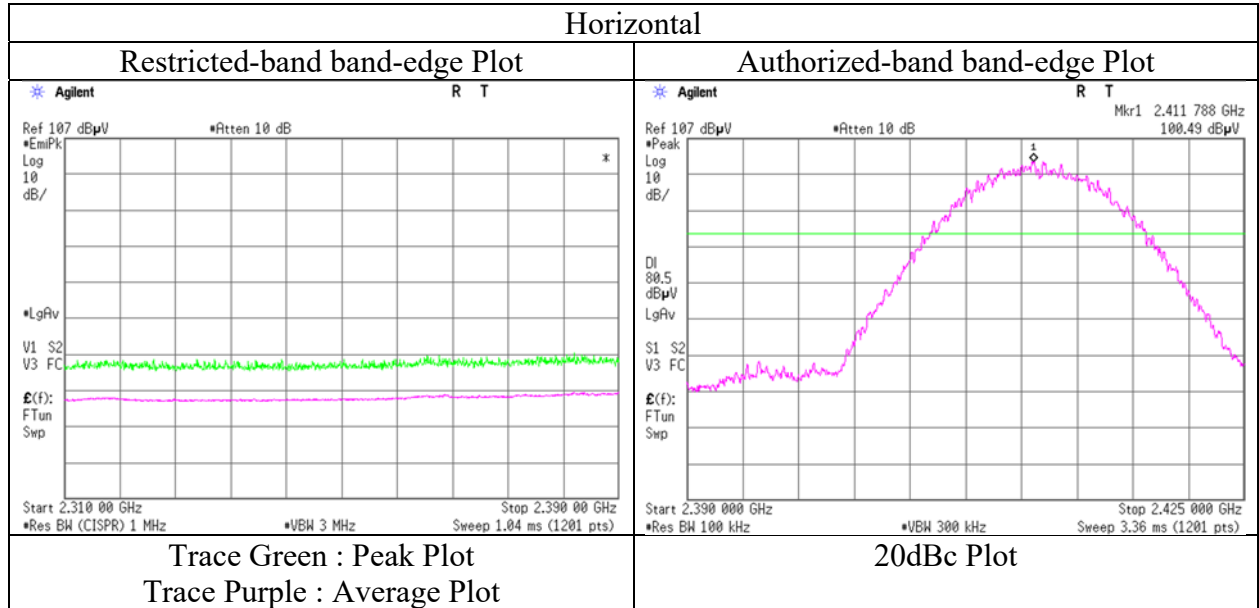
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13554183S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	November 8, 2020
Temperature / Humidity	22 deg. C / 56 % RH
Engineer	Toshinori Yamada
	(1 GHz – 2.8 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.

UL Japan, Inc.

Shonan EMC Lab.

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Radiated Spurious Emission

Report No. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date November 13, 2020 November 14, 2020 November 15, 2020
Temperature / Humidity 21 deg. C / 37 % RH 21 deg. C / 46 % RH 21 deg. C / 44 % RH
Engineer Yasumasa Owaki Yusuke Tanikawara Takahiro Suzuki
(1 GHz – 2.8 GHz) (2.8 GHz - 10 GHz) (10 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	48.40	31.51	7.08	39.72	2.28	49.55	73.9	24.3	340	86	-
Hori.	7311.000	PK	45.02	36.93	8.72	39.56	2.28	53.39	73.9	20.5	150	0	-
Hori.	9748.000	PK	46.69	38.60	10.21	39.49	2.28	58.29	73.9	15.6	150	0	-
Hori.	4874.000	AV	42.68	31.51	7.08	39.72	2.28	43.83	53.9	10.0	340	86	VBW:910 Hz
Hori.	7311.000	AV	33.69	36.93	8.72	39.56	2.28	42.06	53.9	11.8	150	0	Floor noise
Hori.	9748.000	AV	34.65	38.60	10.21	39.49	2.28	46.25	53.9	7.6	150	0	Floor noise
Vert.	4874.000	PK	46.86	31.51	7.08	39.72	2.28	48.01	73.9	25.8	147	289	-
Vert.	7311.000	PK	45.51	36.93	8.72	39.56	2.28	53.88	73.9	20.0	150	0	-
Vert.	9748.000	PK	46.92	38.60	10.21	39.49	2.28	58.52	73.9	15.3	150	0	-
Vert.	4874.000	AV	38.67	31.51	7.08	39.72	2.28	39.82	53.9	14.0	147	289	VBW:910 Hz
Vert.	7311.000	AV	33.84	36.93	8.72	39.56	2.28	42.21	53.9	11.6	150	0	Floor noise
Vert.	9748.000	AV	34.79	38.60	10.21	39.49	2.28	46.39	53.9	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 - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

10 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. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date November 8, 2020 November 14, 2020 November 15, 2020
Temperature / Humidity 22 deg. C / 56 % RH 21 deg. C / 46 % RH 21 deg. C / 44 % RH
Engineer Toshinori Yamada Yusuke Tanikawara Takahiro Suzuki
(1 GHz – 2.8 GHz) (2.8 GHz - 10 GHz) (10 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	47.99	27.84	14.59	39.58	2.28	53.12	73.9	20.7	355	107	-
Hori.	2487.212	PK	45.50	27.83	14.59	39.59	2.28	50.61	73.9	23.2	355	107	-
Hori.	4924.000	PK	47.57	31.57	7.11	39.71	2.28	48.82	73.9	25.0	336	264	-
Hori.	7386.000	PK	45.60	37.00	8.76	39.60	2.28	54.04	73.9	19.8	150	0	-
Hori.	9848.000	PK	45.28	38.71	10.22	39.37	2.28	57.12	73.9	16.7	150	0	-
Hori.	2483.500	AV	35.81	27.84	14.59	39.58	2.28	40.94	53.9	12.9	355	107	VBW:910 Hz
Hori.	2487.212	AV	36.10	27.83	14.59	39.59	2.28	41.21	53.9	12.6	355	107	VBW:910 Hz
Hori.	4924.000	AV	39.83	31.57	7.11	39.71	2.28	41.08	53.9	12.8	336	264	VBW:910 Hz
Hori.	7386.000	AV	33.70	37.00	8.76	39.60	2.28	42.14	53.9	11.7	150	0	Floor noise
Hori.	9848.000	AV	34.21	38.71	10.22	39.37	2.28	46.05	53.9	7.8	150	0	Floor noise
Vert.	2483.500	PK	46.68	27.84	14.59	39.58	2.28	51.81	73.9	22.0	398	353	-
Vert.	4924.000	PK	46.88	31.57	7.11	39.71	2.28	48.13	73.9	25.7	148	295	-
Vert.	7386.000	PK	45.78	37.00	8.76	39.60	2.28	54.22	73.9	19.6	150	0	-
Vert.	9848.000	PK	45.68	38.71	10.22	39.37	2.28	57.52	73.9	16.3	150	0	-
Vert.	2483.500	AV	34.53	27.84	14.59	39.58	2.28	39.66	53.9	14.2	398	353	VBW:910 Hz
Vert.	4924.000	AV	39.81	31.57	7.11	39.71	2.28	41.06	53.9	12.8	148	295	VBW:910 Hz
Vert.	7386.000	AV	33.81	37.00	8.76	39.60	2.28	42.25	53.9	11.6	150	0	Floor noise
Vert.	9848.000	AV	34.68	38.71	10.22	39.37	2.28	46.52	53.9	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 - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$
10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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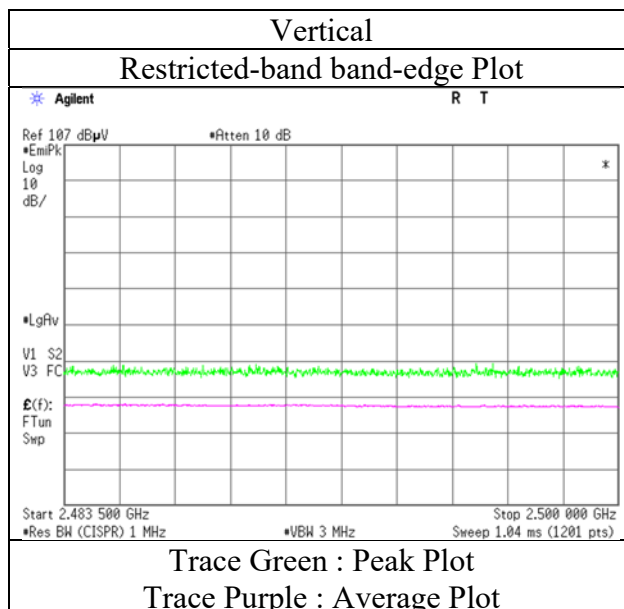
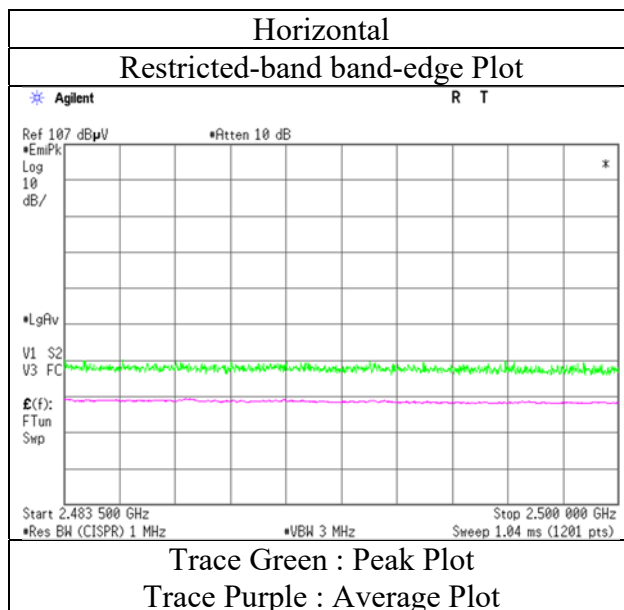
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13554183S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	November 8, 2020
Temperature / Humidity	22 deg. C / 56 % RH
Engineer	Toshinori Yamada (1 GHz – 2.8 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. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date November 8, 2020 November 14, 2020 November 15, 2020
Temperature / Humidity 22 deg. C / 56 % RH 21 deg. C / 46 % RH 21 deg. C / 44 % RH
Engineer Toshinori Yamada Yusuke Tanikawara Takahiro Suzuki
(1 GHz – 2.8 GHz) (2.8 GHz - 10 GHz) (10 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	60.72	27.93	14.49	39.55	2.28	65.87	73.9	8.0	379	102	-
Hori.	4824.000	PK	47.40	31.49	7.04	39.73	2.28	48.48	73.9	25.4	349	261	-
Hori.	7236.000	PK	45.89	36.92	8.68	39.52	2.28	54.25	73.9	19.6	150	0	-
Hori.	9648.000	PK	46.14	38.33	10.21	39.61	2.28	57.35	73.9	16.5	150	0	-
Hori.	2390.000	AV	46.15	27.93	14.49	39.55	2.28	51.30	53.9	2.6	379	102	VBW:3 kHz
Hori.	4824.000	AV	37.45	31.49	7.04	39.73	2.28	38.53	53.9	15.3	349	261	VBW:3 kHz
Hori.	7236.000	AV	34.58	36.92	8.68	39.52	2.28	42.94	53.9	10.9	150	0	Floor noise
Hori.	9648.000	AV	35.06	38.33	10.21	39.61	2.28	46.27	53.9	7.6	150	0	Floor noise
Vert.	2388.600	PK	58.33	27.93	14.49	39.55	2.28	63.48	73.9	10.4	377	357	-
Vert.	2390.000	PK	56.59	27.93	14.49	39.55	2.28	61.74	73.9	12.1	377	357	-
Vert.	4824.000	PK	46.05	31.49	7.04	39.73	2.28	47.13	73.9	26.7	168	295	-
Vert.	7236.000	PK	45.30	36.92	8.68	39.52	2.28	53.66	73.9	20.2	150	0	-
Vert.	9648.000	PK	46.65	38.33	10.21	39.61	2.28	57.86	73.9	16.0	150	0	-
Vert.	2388.600	AV	41.60	27.93	14.49	39.55	2.28	46.75	53.9	7.1	377	357	VBW:3 kHz
Vert.	2390.000	AV	41.44	27.93	14.49	39.55	2.28	46.59	53.9	7.3	377	357	VBW:3 kHz
Vert.	4824.000	AV	35.85	31.49	7.04	39.73	2.28	36.93	53.9	16.9	168	295	VBW:3 kHz
Vert.	7236.000	AV	34.61	36.92	8.68	39.52	2.28	42.97	53.9	10.9	150	0	Floor noise
Vert.	9648.000	AV	34.98	38.33	10.21	39.61	2.28	46.19	53.9	7.7	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

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	96.23	27.90	14.51	39.56	2.28	101.36	-	-	Carrier
Hori.	2400.000	PK	59.18	27.92	14.50	39.56	2.28	64.32	81.3	16.9	-
Vert.	2412.000	PK	93.23	27.90	14.51	39.56	2.28	98.36	-	-	Carrier
Vert.	2400.000	PK	58.30	27.92	14.50	39.56	2.28	63.44	78.3	14.8	-

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

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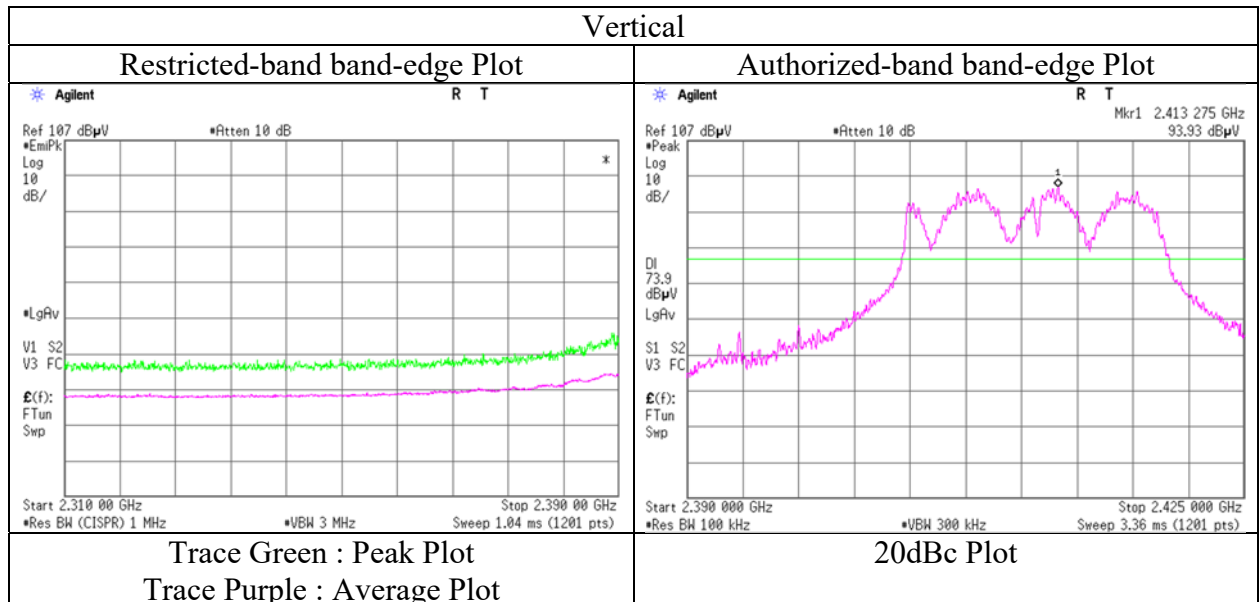
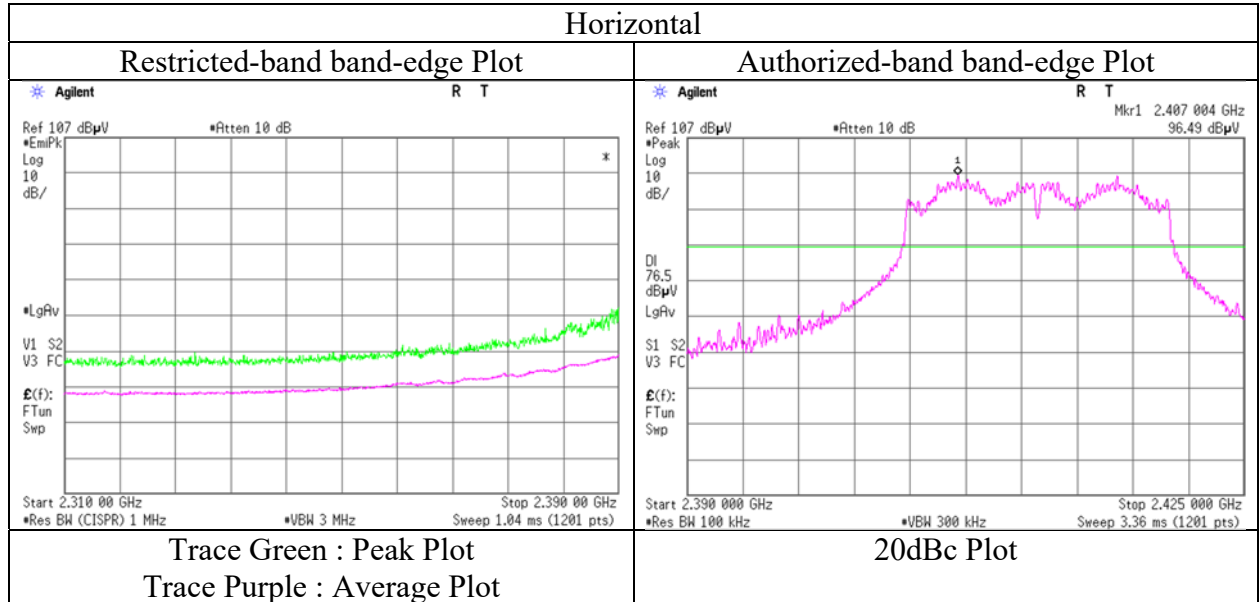
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13554183S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	November 8, 2020
Temperature / Humidity	22 deg. C / 56 % RH
Engineer	Toshinori Yamada
	(1 GHz – 2.8 GHz)
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. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date November 13, 2020 November 14, 2020 November 15, 2020
Temperature / Humidity 21 deg. C / 37 % RH 21 deg. C / 46 % RH 21 deg. C / 44 % RH
Engineer Yasumasa Owaki Yusuke Tanikawara Takahiro Suzuki
(1 GHz – 2.8 GHz) (2.8 GHz - 10 GHz) (10 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	46.67	31.51	7.08	39.72	2.28	47.82	73.9	26.0	301	252	-
Hori.	7311.000	PK	45.36	36.93	8.72	39.56	2.28	53.73	73.9	20.1	150	0	-
Hori.	9748.000	PK	46.92	38.60	10.21	39.49	2.28	58.52	73.9	15.3	150	0	-
Hori.	4874.000	AV	36.75	31.51	7.08	39.72	2.28	37.90	53.9	16.0	301	252	VBW:3 kHz
Hori.	7311.000	AV	34.47	36.93	8.72	39.56	2.28	42.84	53.9	11.0	150	0	Floor noise
Hori.	9748.000	AV	35.70	38.60	10.21	39.49	2.28	47.30	53.9	6.6	150	0	Floor noise
Vert.	4874.000	PK	46.30	31.51	7.08	39.72	2.28	47.45	73.9	26.4	141	288	-
Vert.	7311.000	PK	45.98	36.93	8.72	39.56	2.28	54.35	73.9	19.5	150	0	-
Vert.	9748.000	PK	46.78	38.60	10.21	39.49	2.28	58.38	73.9	15.5	150	0	-
Vert.	4874.000	AV	36.19	31.51	7.08	39.72	2.28	37.34	53.9	16.5	141	288	VBW:3 kHz
Vert.	7311.000	AV	34.76	36.93	8.72	39.56	2.28	43.13	53.9	10.7	150	0	Floor noise
Vert.	9748.000	AV	35.69	38.60	10.21	39.49	2.28	47.29	53.9	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 - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

UL Japan, Inc.

Shonan EMC Lab.

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Radiated Spurious Emission

Report No. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date November 8, 2020 November 14, 2020 November 15, 2020
Temperature / Humidity 22 deg. C / 56 % RH 21 deg. C / 46 % RH 21 deg. C / 44 % RH
Engineer Toshinori Yamada Yusuke Tanikawara Takahiro Suzuki
(1 GHz – 2.8 GHz) (2.8 GHz - 10 GHz) (10 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.	2483.500	PK	56.64	27.84	14.59	39.58	2.28	61.77	73.9	12.1	394	121	-
Hori.	4924.000	PK	46.60	31.57	7.11	39.71	2.28	47.85	73.9	26.0	381	257	-
Hori.	7386.000	PK	45.58	37.00	8.76	39.60	2.28	54.02	73.9	19.8	150	0	-
Hori.	9848.000	PK	45.25	38.71	10.22	39.37	2.28	57.09	73.9	16.8	150	0	-
Hori.	2483.500	AV	44.02	27.84	14.59	39.58	2.28	49.15	53.9	4.7	394	121	VBW:3 kHz
Hori.	4924.000	AV	36.91	31.57	7.11	39.71	2.28	38.16	53.9	15.7	381	257	VBW:3 kHz
Hori.	7386.000	AV	34.34	37.00	8.76	39.60	2.28	42.78	53.9	11.1	150	0	Floor noise
Hori.	9848.000	AV	35.07	38.71	10.22	39.37	2.28	46.91	53.9	6.9	150	0	Floor noise
Vert.	2483.500	PK	54.70	27.84	14.59	39.58	2.28	59.83	73.9	14.0	360	3	-
Vert.	4924.000	PK	45.99	31.57	7.11	39.71	2.28	47.24	73.9	26.6	213	297	-
Vert.	7386.000	PK	45.70	37.00	8.76	39.60	2.28	54.14	73.9	19.7	150	0	-
Vert.	9848.000	PK	46.29	38.71	10.22	39.37	2.28	58.13	73.9	15.7	150	0	-
Vert.	2483.500	AV	40.65	27.84	14.59	39.58	2.28	45.78	53.9	8.1	360	3	VBW:3 kHz
Vert.	4924.000	AV	36.20	31.57	7.11	39.71	2.28	37.45	53.9	16.4	213	297	VBW:3 kHz
Vert.	7386.000	AV	34.00	37.00	8.76	39.60	2.28	42.44	53.9	11.4	150	0	Floor noise
Vert.	9848.000	AV	34.89	38.71	10.22	39.37	2.28	46.73	53.9	7.1	150	0	Floor noise

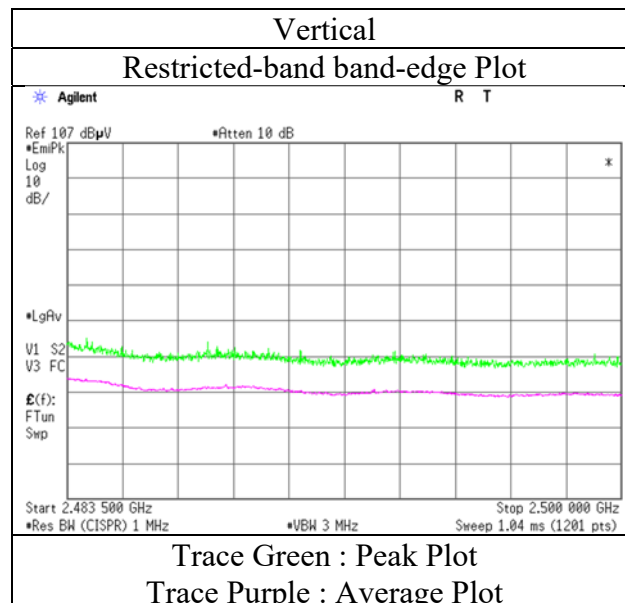
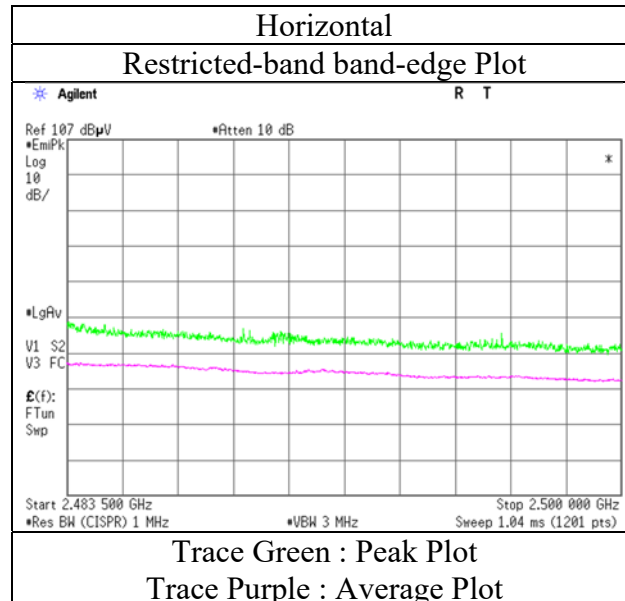
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13554183S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	November 8, 2020
Temperature / Humidity	22 deg. C / 56 % RH
Engineer	Toshinori Yamada
	(1 GHz – 2.8 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.

Radiated Spurious Emission

Report No. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date November 13, 2020 November 14, 2020 November 15, 2020
Temperature / Humidity 21 deg. C / 37 % RH 21 deg. C / 46 % RH 21 deg. C / 44 % RH
Engineer Yasumasa Owaki Yusuke Tanikawara Takahiro Suzuki
(1 GHz – 2.8 GHz) (2.8 GHz - 10 GHz) (10 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	63.97	27.93	14.50	39.55	2.28	69.13	73.9	4.7	380	107	-
Hori.	4824.000	PK	46.24	31.49	7.04	39.73	2.28	47.32	73.9	26.5	397	263	-
Hori.	7236.000	PK	45.30	36.92	8.68	39.52	2.28	53.66	73.9	20.2	150	0	-
Hori.	9648.000	PK	46.27	38.33	10.21	39.61	2.28	57.48	73.9	16.4	150	0	-
Hori.	2390.000	AV	48.30	27.93	14.50	39.55	2.28	53.46	53.9	0.4	380	107	VBW:4.3 kHz
Hori.	4824.000	AV	37.42	31.49	7.04	39.73	2.28	38.50	53.9	15.4	397	263	VBW:4.3 kHz
Hori.	7236.000	AV	35.14	36.92	8.68	39.52	2.28	43.50	53.9	10.4	150	0	Floor noise
Hori.	9648.000	AV	35.63	38.33	10.21	39.61	2.28	46.84	53.9	7.0	150	0	Floor noise
Vert.	2390.000	PK	58.43	27.93	14.50	39.55	2.28	63.59	73.9	10.3	179	328	-
Vert.	4824.000	PK	45.81	31.49	7.04	39.73	2.28	46.89	73.9	27.0	346	314	-
Vert.	7236.000	PK	45.34	36.92	8.68	39.52	2.28	53.70	73.9	20.2	150	0	-
Vert.	9648.000	PK	45.78	38.33	10.21	39.61	2.28	56.99	73.9	16.9	150	0	-
Vert.	2390.000	AV	42.64	27.93	14.50	39.55	2.28	47.80	53.9	6.1	179	328	VBW:4.3 kHz
Vert.	4824.000	AV	36.83	31.49	7.04	39.73	2.28	37.91	53.9	15.9	346	314	VBW:4.3 kHz
Vert.	7236.000	AV	35.10	36.92	8.68	39.52	2.28	43.46	53.9	10.4	150	0	Floor noise
Vert.	9648.000	AV	35.61	38.33	10.21	39.61	2.28	46.82	53.9	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 - 10 GHz : 20log(3.90 m / 3.0 m) = 2.28 dB

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

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	95.48	27.90	14.52	39.56	2.28	100.62	-	-	Carrier
Hori.	2400.000	PK	59.48	27.92	14.51	39.56	2.28	64.63	80.6	15.9	-
Vert.	2412.000	PK	90.60	27.90	14.52	39.56	2.28	95.74	-	-	Carrier
Vert.	2400.000	PK	59.64	27.92	14.51	39.56	2.28	64.79	75.7	10.9	-

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

Distance factor : 1 GHz - 10 GHz : 20log(3.90 m / 3.0 m) = 2.28 dB

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

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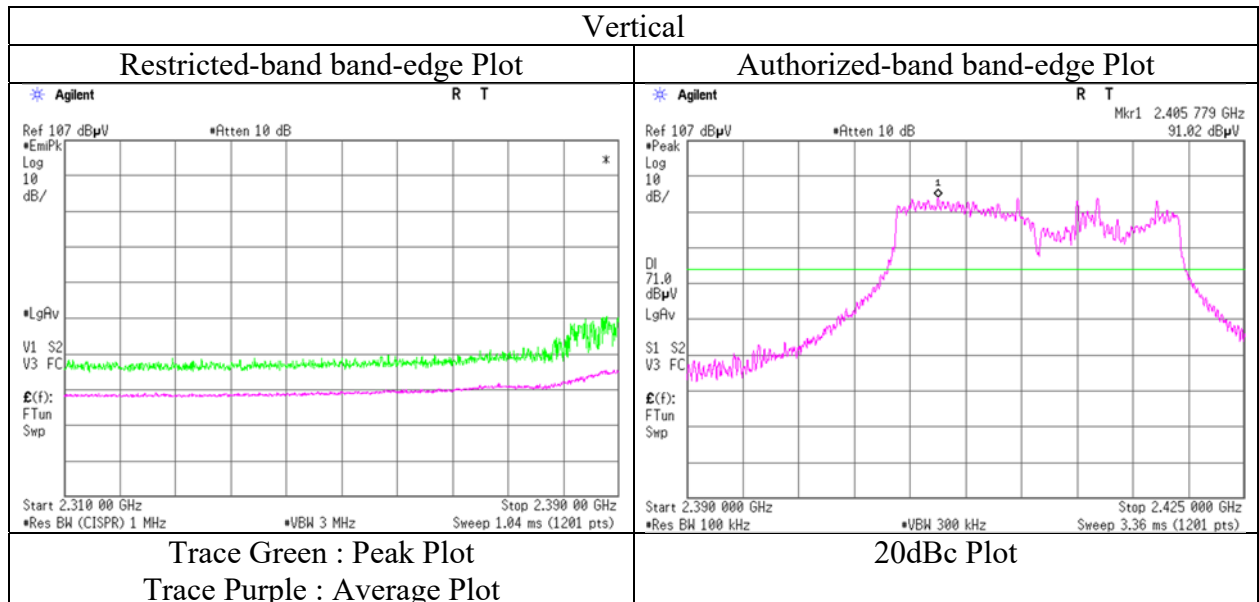
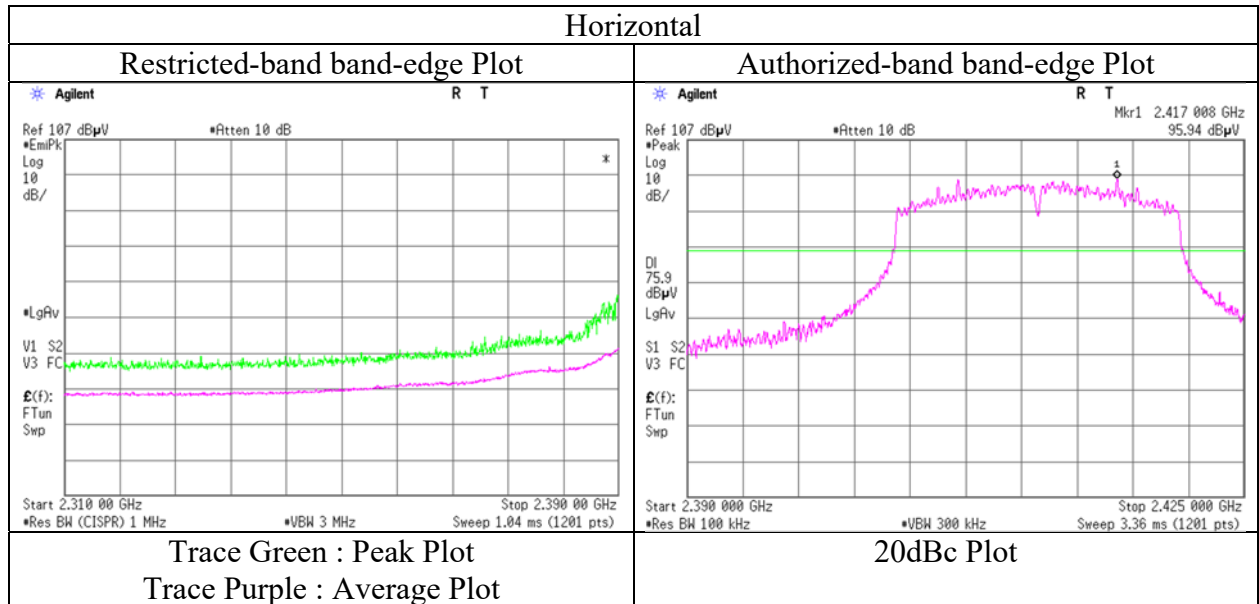
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13554183S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	November 13, 2020
Temperature / Humidity	21 deg. C / 37 % RH
Engineer	Yasumasa Owaki
	(1 GHz – 2.8 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. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date November 13, 2020
Temperature / Humidity 21 deg. C / 37 % RH
Engineer Yasumasa Owaki
(1 GHz – 2.8 GHz)
Mode Tx 11n-20 2417 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.	2380.666	PK	61.44	27.95	14.49	39.55	2.28	66.61	73.9	7.2	381	108	-
Hori.	2390.000	PK	61.87	27.93	14.50	39.55	2.28	67.03	73.9	6.8	381	108	-
Hori.	2380.666	AV	42.97	27.95	14.49	39.55	2.28	48.14	53.9	5.7	381	108	VBW:4.3 kHz
Hori.	2390.000	AV	45.66	27.93	14.50	39.55	2.28	50.82	53.9	3.0	381	108	VBW:4.3 kHz
Vert.	2390.000	PK	56.18	27.93	14.50	39.55	2.28	61.34	73.9	12.5	236	340	-
Vert.	2390.000	AV	40.56	27.93	14.50	39.55	2.28	45.72	53.9	8.1	236	340	VBW:4.3 kHz

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

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.	2417.000	PK	96.44	27.89	14.52	39.56	2.28	101.57	-	-	Carrier
Hori.	2400.000	PK	57.68	27.92	14.51	39.56	2.28	62.83	81.5	18.6	-
Vert.	2417.000	PK	92.83	27.89	14.52	39.56	2.28	97.96	-	-	Carrier
Vert.	2400.000	PK	52.01	27.92	14.51	39.56	2.28	57.16	77.9	20.7	-

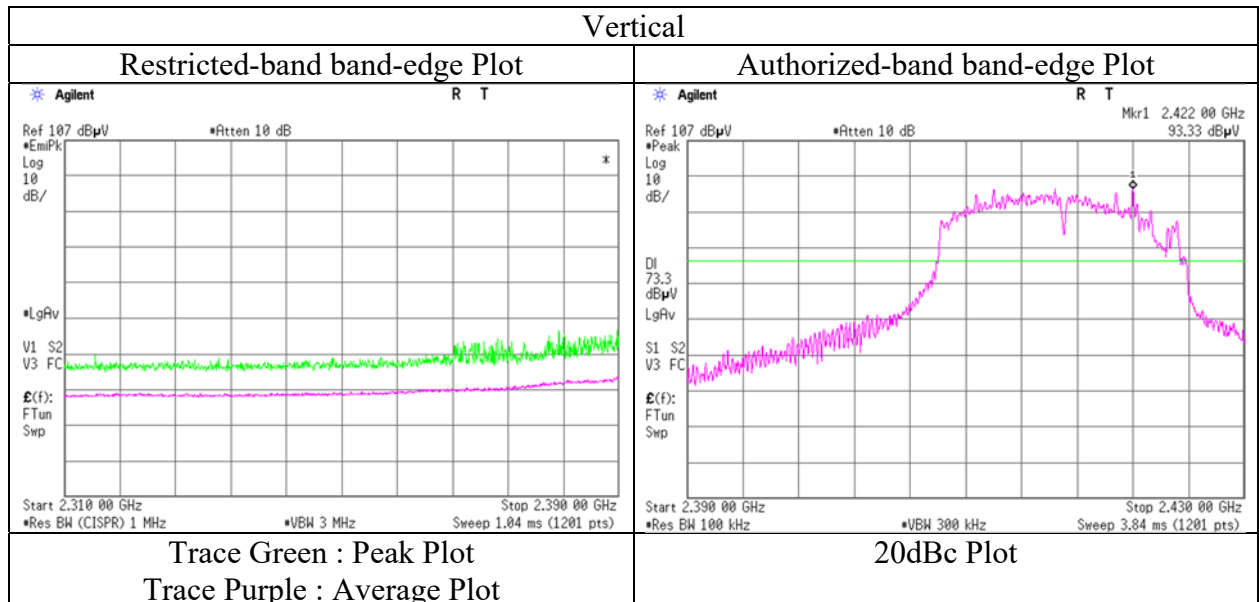
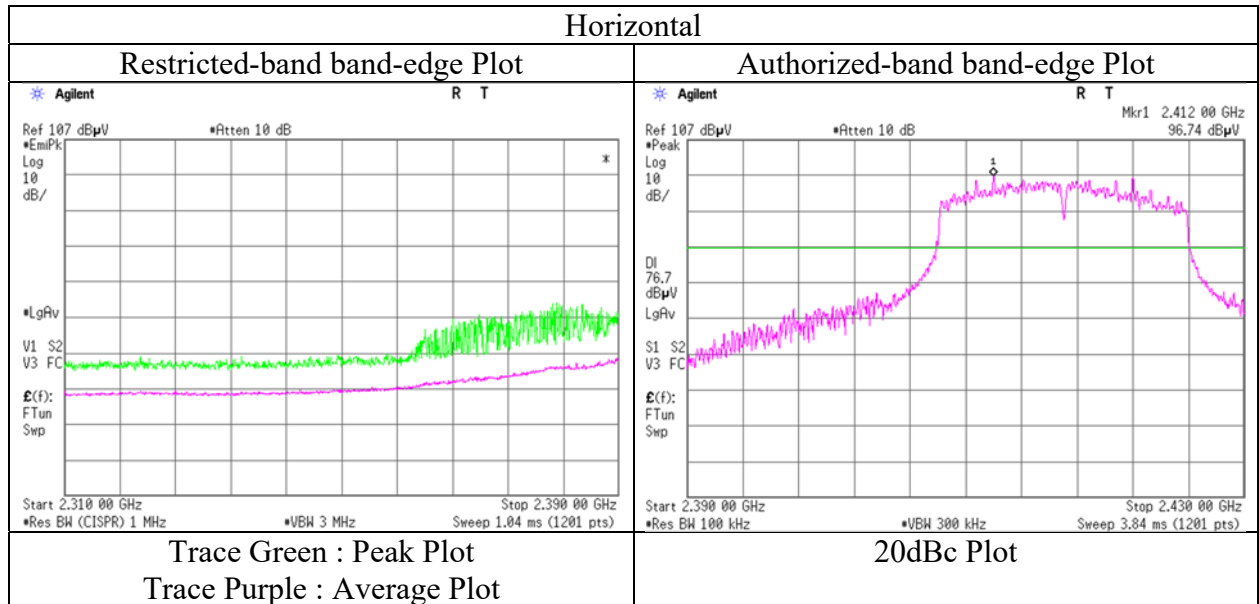
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13554183S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	November 13, 2020
Temperature / Humidity	21 deg. C / 37 % RH
Engineer	Yasumasa Owaki
	(1 GHz – 2.8 GHz)
Mode	Tx 11n-20 2417 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. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber 1
Date November 15, 2020 November 13, 2020 November 14, 2020 November 15, 2020
Temperature / Humidity 21 deg. C / 44 % RH 21 deg. C / 37 % RH 21 deg. C / 46 % RH 21 deg. C / 44 % RH
Engineer Takahiro Suzuki Yasumasa Owaki Yusuke Tanikawara Takahiro Suzuki
(30 MHz – 1000 MHz) (1 GHz – 2.8 GHz) (2.8 GHz - 10 GHz) (10 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.	712.698	QP	33.66	20.00	8.82	32.13	0.00	30.35	46.0	15.6	142	188	-
Hori.	811.006	QP	36.82	20.82	9.24	31.96	0.00	34.92	46.0	11.0	129	124	-
Hori.	840.005	QP	36.80	21.27	9.38	31.79	0.00	35.66	46.0	10.3	119	304	-
Hori.	909.308	QP	34.84	22.07	9.67	31.42	0.00	35.16	46.0	10.8	100	15	-
Hori.	933.886	QP	35.13	21.98	9.76	31.24	0.00	35.63	46.0	10.3	100	6	-
Hori.	958.465	QP	39.35	22.16	9.85	31.03	0.00	40.33	46.0	5.6	100	10	-
Hori.	4874.000	PK	47.13	31.51	7.08	39.72	2.28	48.28	73.9	25.6	389	260	-
Hori.	7311.000	PK	45.43	36.93	8.72	39.56	2.28	53.80	73.9	20.1	150	0	-
Hori.	9748.000	PK	46.00	38.60	10.21	39.49	2.28	57.60	73.9	16.3	150	0	-
Hori.	4874.000	AV	37.56	31.51	7.08	39.72	2.28	38.71	53.9	15.1	389	260	VBW:4.3 kHz
Hori.	7311.000	AV	35.31	36.93	8.72	39.56	2.28	43.68	53.9	10.2	150	0	Floor noise
Hori.	9748.000	AV	35.84	38.60	10.21	39.49	2.28	47.44	53.9	6.4	150	0	Floor noise
Vert.	47.399	QP	43.84	12.12	7.44	31.83	0.00	31.57	40.0	8.4	100	4	-
Vert.	67.866	QP	39.87	6.82	7.40	31.83	0.00	22.26	40.0	17.7	100	102	-
Vert.	136.475	QP	35.17	14.30	8.52	31.79	0.00	26.20	43.5	17.3	100	10	-
Vert.	192.858	QP	32.71	16.44	8.98	31.78	0.00	26.35	43.5	17.1	100	187	-
Vert.	4874.000	PK	46.26	31.51	7.08	39.72	2.28	47.41	73.9	26.4	171	290	-
Vert.	7311.000	PK	45.16	36.93	8.72	39.56	2.28	53.53	73.9	20.3	150	0	-
Vert.	9748.000	PK	45.70	38.60	10.21	39.49	2.28	57.30	73.9	16.6	150	0	-
Vert.	4874.000	AV	36.50	31.51	7.08	39.72	2.28	37.65	53.9	16.2	171	290	VBW:4.3 kHz
Vert.	7311.000	AV	35.02	36.93	8.72	39.56	2.28	43.39	53.9	10.5	150	0	Floor noise
Vert.	9748.000	AV	36.10	38.60	10.21	39.49	2.28	47.70	53.9	6.2	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

10 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. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1
Date November 13, 2020
Temperature / Humidity 21 deg. C / 37 % RH
Engineer Yasumasa Owaki
(1 GHz – 2.8 GHz)
Mode Tx 11n-20 2457 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	60.15	27.84	14.60	39.58	2.28	65.29	73.9	8.6	361	97	-
Hori.	2483.500	AV	43.60	27.84	14.60	39.58	2.28	48.74	53.9	5.1	361	97	VBW:4.3 kHz
Vert.	2483.500	PK	52.61	27.84	14.60	39.58	2.28	57.75	73.9	16.1	209	331	-
Vert.	2486.525	PK	53.22	27.83	14.60	39.59	2.28	58.34	73.9	15.5	209	331	-
Vert.	2483.500	AV	38.18	27.84	14.60	39.58	2.28	43.32	53.9	10.5	209	331	VBW:4.3 kHz
Vert.	2486.525	AV	38.13	27.83	14.60	39.59	2.28	43.25	53.9	10.6	209	331	VBW:4.3 kHz

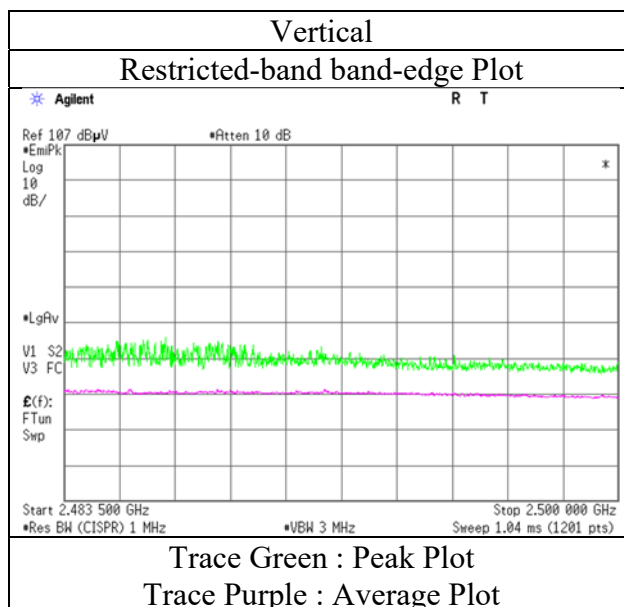
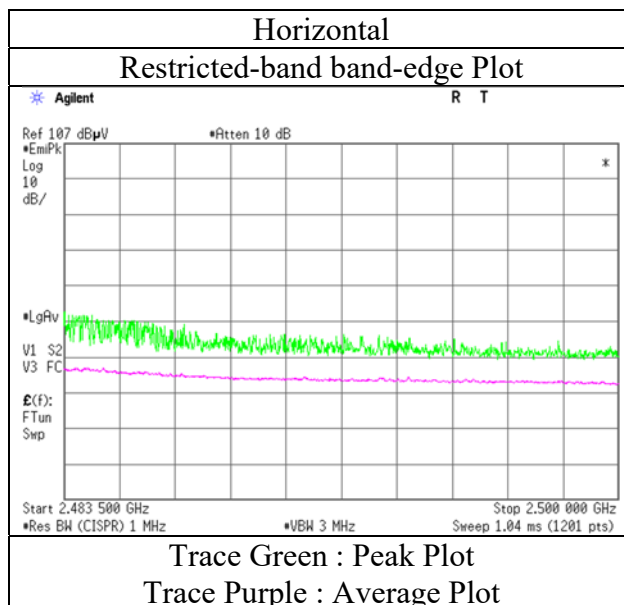
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13554183S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	November 13, 2020
Temperature / Humidity	21 deg. C / 37 % RH
Engineer	Yasumasa Owaki (1 GHz – 2.8 GHz)
Mode	Tx 11n-20 2457 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. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber 1
Date November 13, 2020 November 14, 2020 November 15, 2020
Temperature / Humidity 21 deg. C / 37 % RH 21 deg. C / 46 % RH 21 deg. C / 44 % RH
Engineer Yasumasa Owaki Yusuke Tanikawara Takahiro Suzuki
(1 GHz – 2.8 GHz) (2.8 GHz - 10 GHz) (10 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	63.68	27.84	14.60	39.58	2.28	68.82	73.9	5.0	354	105	-
Hori.	4924.000	PK	45.85	31.57	7.11	39.71	2.28	47.10	73.9	26.8	381	257	-
Hori.	7386.000	PK	45.04	37.00	8.76	39.60	2.28	53.48	73.9	20.4	150	0	-
Hori.	9848.000	PK	45.28	38.71	10.22	39.37	2.28	57.12	73.9	16.7	150	0	-
Hori.	2483.500	AV	47.19	27.84	14.60	39.58	2.28	52.33	53.9	1.5	354	105	VBW:4.3 kHz
Hori.	4924.000	AV	37.36	31.57	7.11	39.71	2.28	38.61	53.9	15.2	381	257	VBW:4.3 kHz
Hori.	7386.000	AV	34.98	37.00	8.76	39.60	2.28	43.42	53.9	10.4	150	0	Floor noise
Hori.	9848.000	AV	35.59	38.71	10.22	39.37	2.28	47.43	53.9	6.4	150	0	Floor noise
Vert.	2483.500	PK	54.37	27.84	14.60	39.58	2.28	59.51	73.9	14.3	204	333	-
Vert.	2485.617	PK	53.87	27.83	14.60	39.59	2.28	58.99	73.9	14.9	204	333	-
Vert.	4924.000	PK	45.76	31.57	7.11	39.71	2.28	47.01	73.9	26.8	297	300	-
Vert.	7386.000	PK	45.87	37.00	8.76	39.60	2.28	54.31	73.9	19.5	150	0	-
Vert.	9848.000	PK	46.09	38.71	10.22	39.37	2.28	57.93	73.9	15.9	150	0	-
Vert.	2483.500	AV	40.22	27.84	14.60	39.58	2.28	45.36	53.9	8.5	204	333	VBW:4.3 kHz
Vert.	2485.617	AV	38.89	27.83	14.60	39.59	2.28	44.01	53.9	9.8	204	333	VBW:4.3 kHz
Vert.	4924.000	AV	36.65	31.57	7.11	39.71	2.28	37.90	53.9	16.0	297	300	VBW:4.3 kHz
Vert.	7386.000	AV	35.09	37.00	8.76	39.60	2.28	43.53	53.9	10.3	150	0	Floor noise
Vert.	9848.000	AV	35.36	38.71	10.22	39.37	2.28	47.20	53.9	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 - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

UL Japan, Inc.

Shonan EMC Lab.

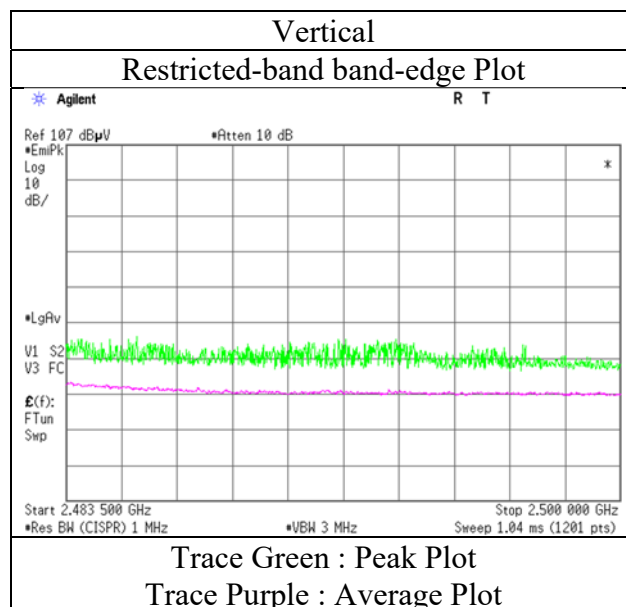
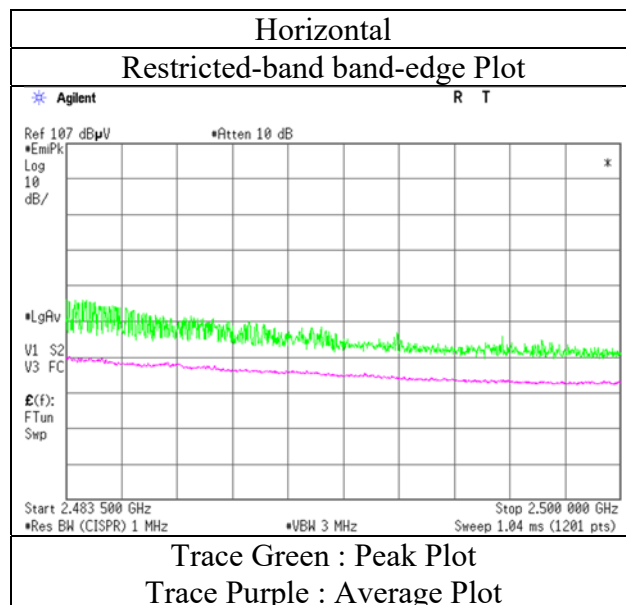
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

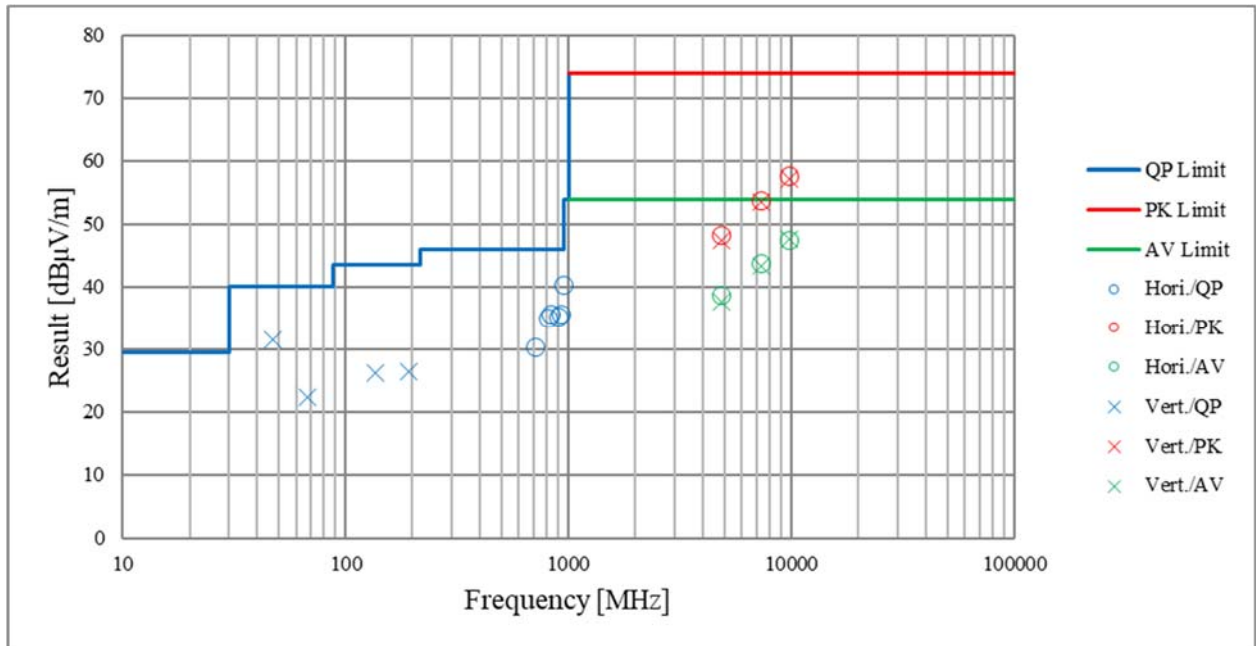
Report No.	13554183S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.1
Date	November 13, 2020
Temperature / Humidity	21 deg. C / 37 % RH
Engineer	Yasumasa Owaki (1 GHz – 2.8 GHz)
Mode	Tx 11n-20 2462 MHz



* 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.

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	13554183S-A			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	1			
Date	November 15, 2020	November 13, 2020	November 14, 2020	November 15, 2020
Temperature / Humidity	21 deg. C / 44 % RH	21 deg. C / 37 % RH	21 deg. C / 46 % RH	21 deg. C / 44 % RH
Engineer	Takahiro Suzuki	Yasumasa Owaki	Yusuke Tanikawara	Takahiro Suzuki
	(30 MHz – 1000 MHz)	(1 GHz – 2.8 GHz)	(2.8 GHz - 10 GHz)	(10 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

Report No. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber 1 1 1 1 1
Date Oct 30, 2020 Oct 19, 2020 Oct 20, 2020 Oct 21, 2020 Oct 29, 2020
Temperature / Humidity 21 deg.C, 47 %RH 22 deg.C, 54 %RH 23 deg.C, 52 %RH 21 deg.C, 47 %RH 22 deg.C, 50 %RH
Engineer Takahiro Suzuki Takahiro Suzuki Takahiro Suzuki Yosuke Murakami Toshinori Yamada
(30 MHz -1 GHz) (1 GHz -2.8 GHz) (2.8 GHz -10 GHz) (10 GHz -18 GHz) (18 GHz -26.5 GHz)
Mode Tx BT LE 1 M-PHY 2402 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	189.543	QP	27.85	16.41	8.96	31.78	0.00	21.44	43.5	22.0	163	303	-
Hori.	212.082	QP	33.67	11.19	5.90	31.77	0.00	18.99	43.5	24.5	149	35	-
Hori.	2390.000	PK	46.80	27.93	14.49	39.55	2.28	51.95	73.9	21.9	144	10	-
Hori.	4804.000	PK	47.83	31.47	7.03	39.73	2.28	48.88	73.9	25.0	146	3	-
Hori.	7206.000	PK	47.04	36.90	8.67	39.51	2.28	55.38	73.9	18.5	100	0	-
Hori.	9608.000	PK	46.24	38.23	10.20	39.66	2.28	57.29	73.9	16.6	100	0	-
Hori.	7206.000	AV	34.53	36.90	8.67	39.51	2.28	42.87	53.9	11.0	100	0	Floor noise
Hori.	9608.000	AV	33.91	38.23	10.20	39.66	2.28	44.96	53.9	8.9	100	0	Floor noise
Vert.	36.641	QP	34.89	16.10	7.19	31.83	0.00	26.35	40.0	13.6	100	138	-
Vert.	45.456	QP	43.09	12.85	7.40	31.83	0.00	31.51	40.0	8.4	100	201	-
Vert.	63.120	QP	42.75	7.59	7.24	31.83	0.00	25.75	40.0	14.2	100	201	-
Vert.	111.848	QP	41.74	12.17	8.16	31.81	0.00	30.26	43.5	13.2	100	159	-
Vert.	130.852	QP	33.52	13.99	8.39	31.80	0.00	24.10	43.5	19.4	100	0	-
Vert.	173.517	QP	33.18	15.76	8.95	31.78	0.00	26.11	43.5	17.3	100	256	-
Vert.	188.822	QP	32.57	16.38	8.96	31.78	0.00	26.13	43.5	17.3	100	103	-
Vert.	2390.000	PK	45.84	27.93	14.49	39.55	2.28	50.99	73.9	22.9	147	205	-
Vert.	4804.000	PK	47.11	31.47	7.03	39.73	2.28	48.16	73.9	25.7	147	201	-
Vert.	7206.000	PK	47.28	36.90	8.67	39.51	2.28	55.62	73.9	18.2	150	0	-
Vert.	9608.000	PK	46.22	38.23	10.20	39.66	2.28	57.27	73.9	16.6	150	0	-
Vert.	7206.000	AV	34.51	36.90	8.67	39.51	2.28	42.85	53.9	11.0	150	0	Floor noise
Vert.	9608.000	AV	34.08	38.23	10.20	39.66	2.28	45.13	53.9	8.7	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

10 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	34.83	27.93	14.49	39.55	3.58	2.28	43.56	53.9	10.3	*1)
Hori.	4804.000	AV	35.98	31.47	7.03	39.73	3.58	2.28	40.61	53.9	13.2	-
Vert.	2390.000	AV	34.89	27.93	14.49	39.55	3.58	2.28	43.62	53.9	10.2	*1)
Vert.	4804.000	AV	34.78	31.47	7.03	39.73	3.58	2.28	39.41	53.9	14.4	-

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

Duty factor refer to "Burst rate confirmation" 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	98.75	27.92	14.50	39.56	2.28	103.89	-	-	Carrier
Hori.	2400.000	PK	42.09	27.92	14.50	39.56	2.28	47.23	83.8	36.5	-
Vert.	2402.000	PK	86.51	27.92	14.50	39.56	2.28	91.65	-	-	Carrier
Vert.	2400.000	PK	35.76	27.92	14.50	39.56	2.28	40.90	71.6	30.7	-

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

UL Japan, Inc.

Shonan EMC Lab.

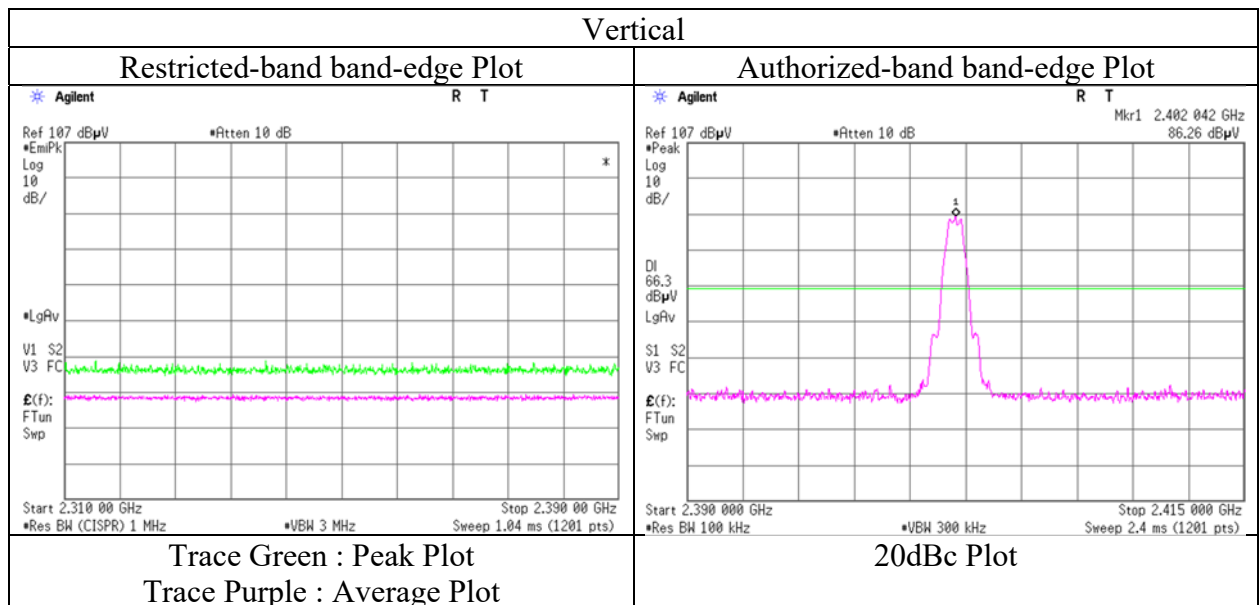
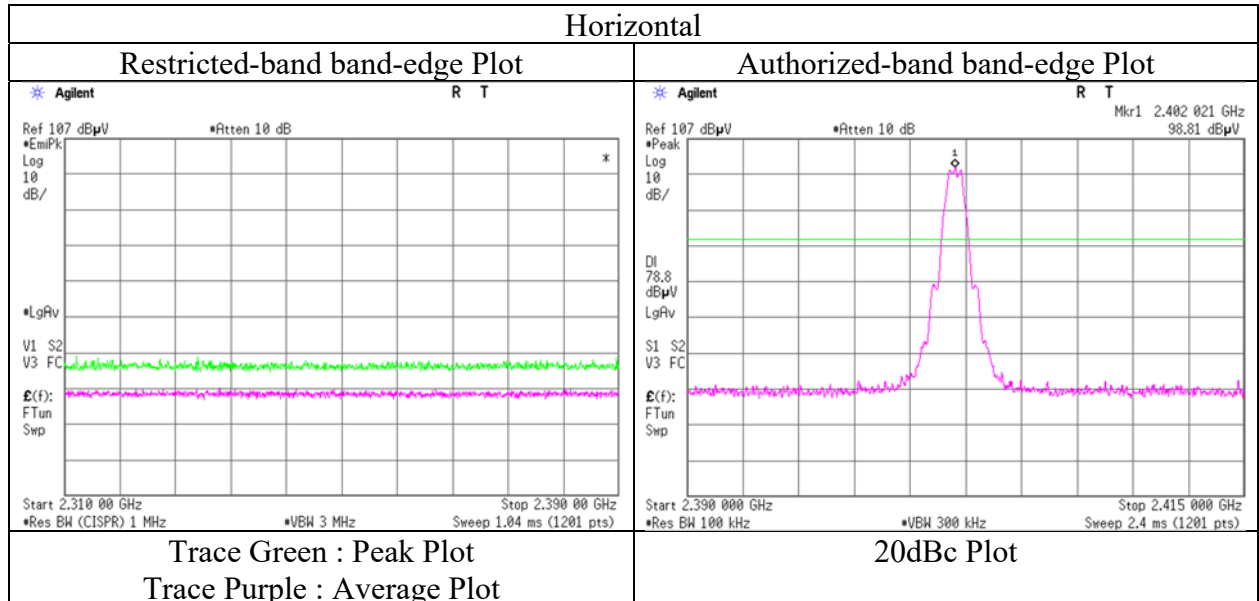
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13554183S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	1
Date	Oct 19, 2020
Temperature / Humidity	22 deg.C, 54 %RH
Engineer	Takahiro Suzuki
	(1 GHz -2.8 GHz)
Mode	Tx BT LE 1 M-PHY 2402 MHz



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

Radiated Spurious Emission

Report No. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber 1 1 1 1 1
Date Oct 30, 2020 Oct 19, 2020 Oct 20, 2020 Oct 21, 2020 Oct 29, 2020
Temperature / Humidity 21 deg.C, 47 %RH 22 deg.C, 54 %RH 23 deg.C, 52 %RH 21 deg.C, 47 %RH 22 deg.C, 50 %RH
Engineer Takahiro Suzuki Takahiro Suzuki Takahiro Suzuki Yosuke Murakami Toshinori Yamada
(30 MHz -1 GHz) (1 GHz -2.8 GHz) (2.8 GHz -10 GHz) (10 GHz -18 GHz) (18 GHz -26.5 GHz)
Mode Tx BT LE 1 M-PHY 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.	192.576	QP	27.95	16.42	8.98	31.78	0.00	21.57	43.5	21.9	177	306	-
Hori.	212.728	QP	34.01	11.18	5.91	31.77	0.00	19.33	43.5	24.1	147	39	-
Hori.	4880.000	PK	46.95	31.51	7.07	39.72	2.28	48.09	73.9	25.8	145	3	-
Hori.	7320.000	PK	46.21	36.94	8.73	39.56	2.28	54.60	73.9	19.3	150	0	-
Hori.	9760.000	PK	47.27	38.62	10.22	39.47	2.28	58.92	73.9	14.9	150	0	-
Hori.	7320.000	AV	34.83	36.94	8.73	39.56	2.28	43.22	53.9	10.6	150	0	Floor noise
Hori.	9760.000	AV	34.71	38.62	10.22	39.47	2.28	46.36	53.9	7.5	150	0	Floor noise
Vert.	37.096	QP	34.42	15.92	7.20	31.83	0.00	25.71	40.0	14.2	100	358	-
Vert.	46.197	QP	43.89	12.57	7.42	31.83	0.00	32.05	40.0	7.9	100	167	-
Vert.	63.683	QP	41.37	7.48	7.23	31.83	0.00	24.25	40.0	15.7	100	223	-
Vert.	113.477	QP	40.53	12.35	8.16	31.81	0.00	29.23	43.5	14.2	100	63	-
Vert.	131.839	QP	34.25	14.03	8.41	31.79	0.00	24.90	43.5	18.6	100	321	-
Vert.	171.717	QP	32.38	15.75	8.95	31.78	0.00	25.30	43.5	18.2	100	167	-
Vert.	188.129	QP	32.74	16.33	8.96	31.78	0.00	26.25	43.5	17.2	100	195	-
Vert.	4880.000	PK	47.04	31.51	7.07	39.72	2.28	48.18	73.9	25.7	348	102	-
Vert.	7320.000	PK	46.09	36.94	8.73	39.56	2.28	54.48	73.9	19.4	150	0	-
Vert.	9760.000	PK	47.21	38.62	10.22	39.47	2.28	58.86	73.9	15.0	150	0	-
Vert.	7320.000	AV	34.00	36.94	8.73	39.56	2.28	42.39	53.9	11.5	150	0	Floor noise
Vert.	9760.000	AV	33.44	38.62	10.22	39.47	2.28	45.09	53.9	8.8	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

10 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.	4880.000	AV	35.46	31.51	7.07	39.72	3.58	2.28	40.18	53.9	13.7	-
Vert.	4880.000	AV	34.86	31.51	7.07	39.72	3.58	2.28	39.58	53.9	14.3	-

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

Duty factor refer to "Burst rate confirmation" sheet.

Radiated Spurious Emission

Report No. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber 1 1 1 1 1
Date Oct 30, 2020 Oct 19, 2020 Oct 20, 2020 Oct 21, 2020 Oct 29, 2020
Temperature / Humidity 21 deg.C, 47 %RH 22 deg.C, 54 %RH 23 deg.C, 52 %RH 21 deg.C, 47 %RH 22 deg.C, 50 %RH
Engineer Takahiro Suzuki Takahiro Suzuki Takahiro Suzuki Yosuke Murakami Toshinori Yamada
(30 MHz -1 GHz) (1 GHz -2.8 GHz) (2.8 GHz -10 GHz) (10 GHz -18 GHz) (18 GHz -26.5 GHz)
Mode Tx BT LE 1 M-PHY 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.	189.887	QP	28.18	16.43	8.96	31.78	0.00	21.79	43.5	21.7	170	306	-
Hori.	211.002	QP	34.56	11.20	5.90	31.77	0.00	19.89	43.5	23.6	151	35	-
Hori.	2483.500	PK	48.86	27.84	14.59	39.58	2.28	53.99	73.9	19.9	134	0	-
Hori.	4960.000	PK	47.18	31.69	7.14	39.71	2.28	48.58	73.9	25.3	136	0	-
Hori.	7440.000	PK	47.23	37.02	8.80	39.62	2.28	55.71	73.9	18.1	150	0	-
Hori.	9920.000	PK	46.86	38.66	10.23	39.28	2.28	58.75	73.9	15.1	150	0	-
Hori.	7440.000	AV	34.73	37.02	8.80	39.62	2.28	43.21	53.9	10.6	150	0	Floor noise
Hori.	9920.000	AV	33.52	38.66	10.23	39.28	2.28	45.41	53.9	8.4	150	0	Floor noise
Vert.	36.385	QP	35.27	16.20	7.19	31.83	0.00	26.83	40.0	13.1	100	208	-
Vert.	45.420	QP	43.79	12.86	7.40	31.83	0.00	32.22	40.0	7.7	100	6	-
Vert.	62.588	QP	42.38	7.68	7.24	31.83	0.00	25.47	40.0	14.5	100	299	-
Vert.	108.263	QP	39.02	11.62	8.18	31.81	0.00	27.01	43.5	16.4	100	278	-
Vert.	134.793	QP	34.36	14.23	8.48	31.79	0.00	25.28	43.5	18.2	100	351	-
Vert.	172.248	QP	32.55	15.77	8.95	31.78	0.00	25.49	43.5	18.0	100	229	-
Vert.	184.070	QP	31.43	16.18	8.95	31.78	0.00	24.78	43.5	18.7	100	166	-
Vert.	2483.500	PK	46.14	27.84	14.59	39.58	2.28	51.27	73.9	22.6	370	51	-
Vert.	4960.000	PK	47.12	31.69	7.14	39.71	2.28	48.52	73.9	25.3	348	47	-
Vert.	7440.000	PK	46.28	37.02	8.80	39.62	2.28	54.76	73.9	19.1	150	0	-
Vert.	9920.000	PK	45.63	38.66	10.23	39.28	2.28	57.52	73.9	16.3	150	0	-
Vert.	7440.000	AV	34.19	37.02	8.80	39.62	2.28	42.67	53.9	11.2	150	0	Floor noise
Vert.	9920.000	AV	34.35	38.66	10.23	39.28	2.28	46.24	53.9	7.6	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : 20log (3.90 m / 3.0 m) = 2.28 dB

10 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.	2483.500	AV	35.84	27.84	14.59	39.58	3.58	2.28	44.55	53.9	9.3	*1)
Hori.	4960.000	AV	36.00	31.69	7.14	39.71	3.58	2.28	40.98	53.9	12.9	-
Vert.	2483.500	AV	35.36	27.84	14.59	39.58	3.58	2.28	44.07	53.9	9.8	*1)
Vert.	4960.000	AV	36.31	31.69	7.14	39.71	3.58	2.28	41.29	53.9	12.6	-

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

Distance factor : 1 GHz - 10 GHz : 20log (3.90 m / 3.0 m) = 2.28 dB

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

Duty factor refer to "Burst rate confirmation" sheet.

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

UL Japan, Inc.

Shonan EMC Lab.

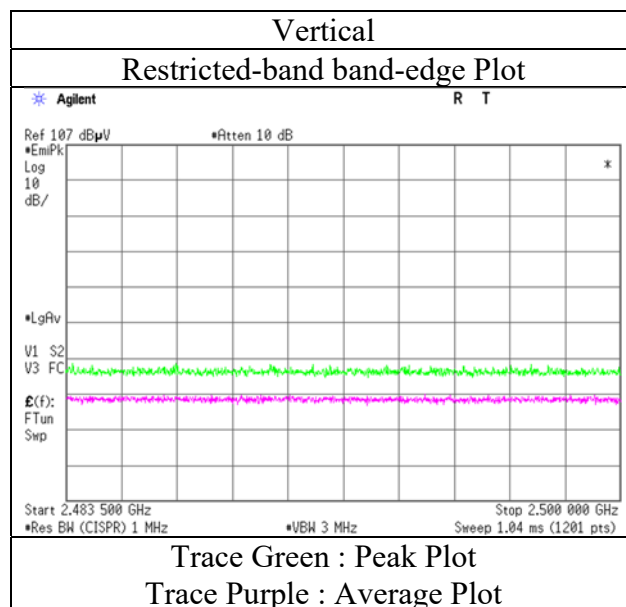
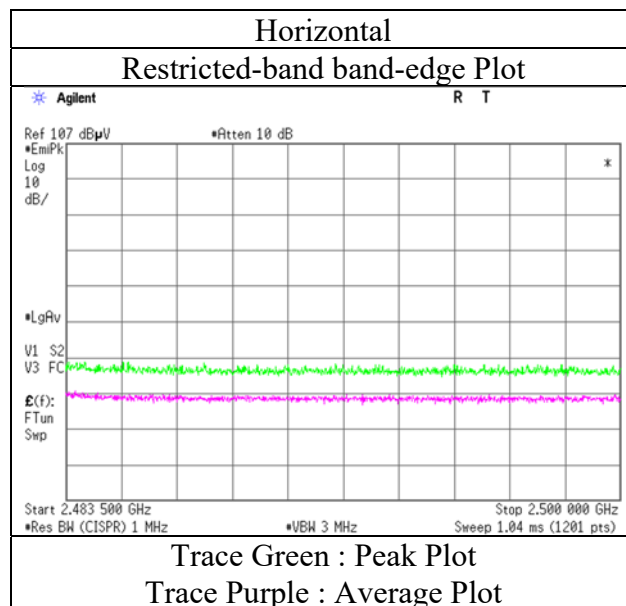
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13554183S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	1
Date	Oct 19, 2020
Temperature / Humidity	22 deg.C, 54 %RH
Engineer	Takahiro Suzuki (1 GHz -2.8 GHz)
Mode	Tx BT LE 1 M-PHY 2480 MHz



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

Radiated Spurious Emission

Report No. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber 1 1 1 1 1
Date Oct 30, 2020 Oct 19, 2020 Oct 20, 2020 Oct 21, 2020 Oct 29, 2020
Temperature / Humidity 21 deg.C, 47 %RH 22 deg.C, 54 %RH 23 deg.C, 52 %RH 21 deg.C, 47 %RH 22 deg.C, 50 %RH
Engineer Takahiro Suzuki Takahiro Suzuki Takahiro Suzuki Yosuke Murakami Toshinori Yamada
(30 MHz -1 GHz) (1 GHz -2.8 GHz) (2.8 GHz -10 GHz) (10 GHz -18 GHz) (18 GHz -26.5 GHz)
Mode Tx BT LE 2 M-PHY 2402 MHz

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

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	193.666	QP	27.83	16.50	8.99	31.78	0.00	21.54	43.5	21.9	170	290	-
Hori.	211.976	QP	33.98	11.19	5.90	31.77	0.00	19.30	43.5	24.2	163	47	-
Hori.	2390.000	PK	46.21	27.93	14.49	39.55	2.28	51.36	73.9	22.5	147	10	-
Hori.	4804.000	PK	48.74	31.47	7.03	39.73	2.28	49.79	73.9	24.1	144	7	-
Hori.	7206.000	PK	46.28	36.90	8.67	39.51	2.28	54.62	73.9	19.2	150	0	-
Hori.	9608.000	PK	46.23	38.23	10.20	39.66	2.28	57.28	73.9	16.6	150	0	-
Hori.	7206.000	AV	34.33	36.90	8.67	39.51	2.28	42.67	53.9	11.2	150	0	Floor noise
Hori.	9608.000	AV	33.78	38.23	10.20	39.66	2.28	44.83	53.9	9.0	150	0	Floor noise
Vert.	36.218	QP	34.08	16.27	7.19	31.83	0.00	25.71	40.0	14.2	100	168	-
Vert.	46.167	QP	43.53	12.58	7.41	31.83	0.00	31.69	40.0	8.3	100	359	-
Vert.	64.306	QP	40.85	7.36	7.22	31.83	0.00	23.60	40.0	16.4	100	251	-
Vert.	115.710	QP	39.47	12.68	8.16	31.81	0.00	28.50	43.5	15.0	100	50	-
Vert.	133.293	QP	33.82	14.15	8.45	31.79	0.00	24.63	43.5	18.8	100	359	-
Vert.	172.694	QP	32.99	15.77	8.95	31.78	0.00	25.93	43.5	17.5	100	210	-
Vert.	186.133	QP	32.24	16.26	8.95	31.78	0.00	25.67	43.5	17.8	100	210	-
Vert.	2390.000	PK	46.32	27.93	14.49	39.55	2.28	51.47	73.9	22.4	106	204	-
Vert.	4804.000	PK	47.86	31.47	7.03	39.73	2.28	48.91	73.9	24.9	110	201	-
Vert.	7206.000	PK	46.37	36.90	8.67	39.51	2.28	54.71	73.9	19.1	150	0	-
Vert.	9608.000	PK	46.38	38.23	10.20	39.66	2.28	57.43	73.9	16.4	150	0	-
Vert.	7206.000	AV	34.58	36.90	8.67	39.51	2.28	42.92	53.9	10.9	150	0	Floor noise
Vert.	9608.000	AV	33.82	38.23	10.20	39.66	2.28	44.87	53.9	9.0	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : 20log(3.90 m / 3.0 m) = 2.28 dB

10 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	34.96	27.93	14.49	39.55	8.68	2.28	48.79	53.9	5.1	*1)
Hori.	4804.000	AV	35.12	31.47	7.03	39.73	8.68	2.28	44.85	53.9	9.0	-
Vert.	2390.000	AV	34.76	27.93	14.49	39.55	8.68	2.28	48.59	53.9	5.3	*1)
Vert.	4804.000	AV	35.16	31.47	7.03	39.73	8.68	2.28	44.89	53.9	9.0	-

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

Distance factor : 1 GHz - 10 GHz : 20log(3.90 m / 3.0 m) = 2.28 dB

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

Duty factor refer to "Burst rate confirmation" 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	98.67	27.92	14.50	39.56	2.28	103.81	-	-	Carrier
Hori.	2400.000	PK	51.96	27.92	14.50	39.56	2.28	57.10	83.8	26.7	-
Vert.	2402.000	PK	86.52	27.92	14.50	39.56	2.28	91.66	-	-	Carrier
Vert.	2400.000	PK	41.65	27.92	14.50	39.56	2.28	46.79	71.6	24.8	-

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

Distance factor : 1 GHz - 10 GHz : 20log(3.90 m / 3.0 m) = 2.28 dB

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

UL Japan, Inc.

Shonan EMC Lab.

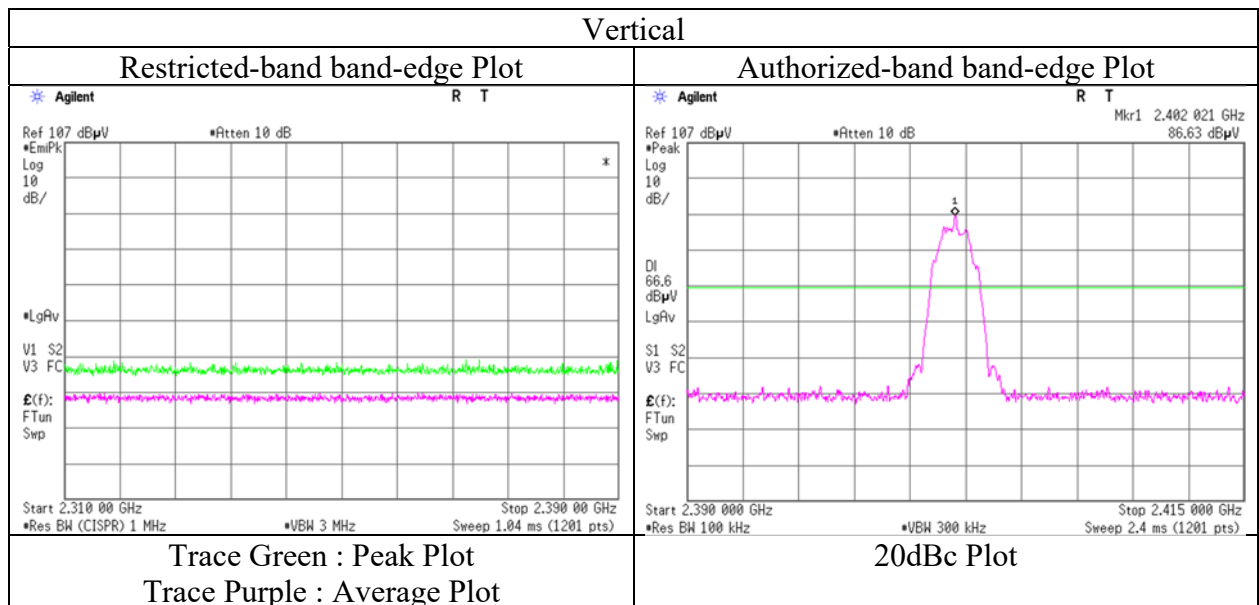
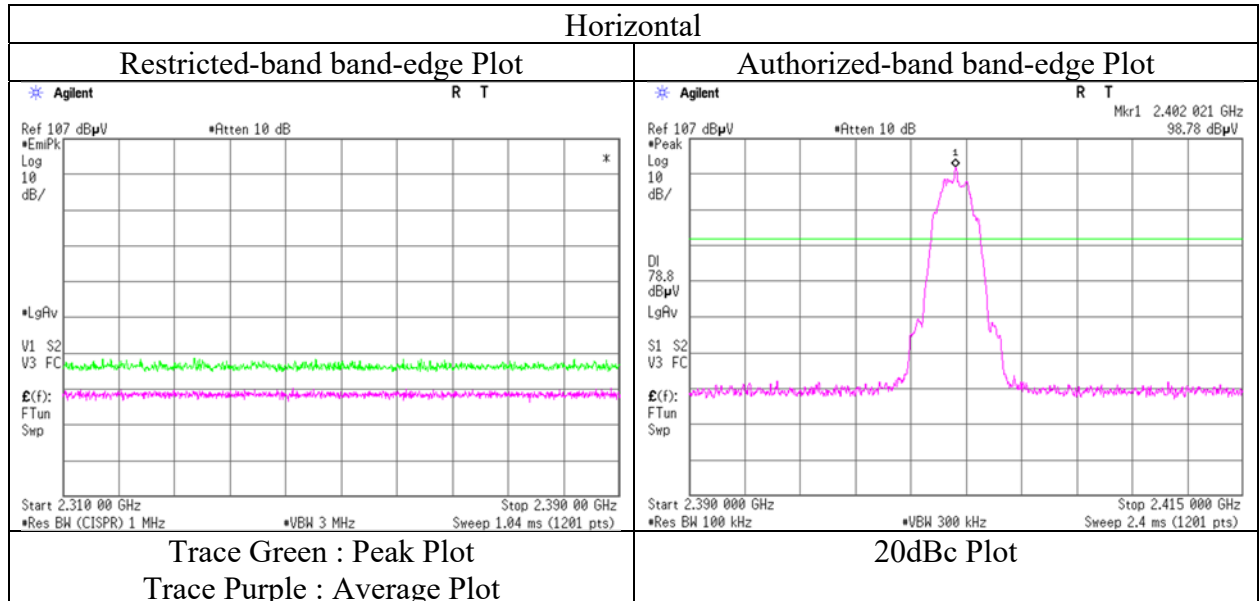
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13554183S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	1
Date	Oct 19, 2020
Temperature / Humidity	22 deg.C, 54 %RH
Engineer	Takahiro Suzuki
	(1 GHz -2.8 GHz)
Mode	Tx BT LE 2 M-PHY 2402 MHz



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

Radiated Spurious Emission

Report No. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber 1 1 1 1 1
Date Nov 02, 2020 Oct 19, 2020 Oct 20, 2020 Oct 21, 2020 Oct 29, 2020
Temperature / Humidity 20 deg.C, 44 %RH 22 deg.C, 54 %RH 23 deg.C, 52 %RH 21 deg.C, 47 %RH 22 deg.C, 50 %RH
Engineer Yasumasa Owaki Takahiro Suzuki Takahiro Suzuki Yosuke Murakami Toshinori Yamada
(30 MHz -1 GHz) (1 GHz -2.8 GHz) (2.8 GHz -10 GHz) (10 GHz -18 GHz) (18 GHz -26.5 GHz)
Mode Tx BT LE 2 M-PHY 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.	4880.000	PK	47.79	31.51	7.07	39.72	2.28	48.93	73.9	24.9	146	4	-
Hori.	7320.000	PK	46.58	36.94	8.73	39.56	2.28	54.97	73.9	18.9	150	0	-
Hori.	9760.000	PK	46.18	38.62	10.22	39.47	2.28	57.83	73.9	16.0	150	0	-
Hori.	7320.000	AV	34.83	36.94	8.73	39.56	2.28	43.22	53.9	10.6	150	0	Floor noise
Hori.	9760.000	AV	34.39	38.62	10.22	39.47	2.28	46.04	53.9	7.8	150	0	Floor noise
Vert.	31.085	QP	27.50	18.26	7.06	31.83	0.00	20.99	40.0	19.0	100	209	-
Vert.	38.961	QP	35.10	15.23	7.24	31.83	0.00	25.74	40.0	14.2	100	276	-
Vert.	45.113	QP	44.90	12.98	7.40	31.83	0.00	33.45	40.0	6.5	100	304	-
Vert.	54.304	QP	35.80	9.74	7.44	31.83	0.00	21.15	40.0	18.8	100	191	-
Vert.	114.783	QP	36.00	12.55	8.15	31.81	0.00	24.89	43.5	18.6	100	221	-
Vert.	123.609	QP	34.90	13.47	8.26	31.80	0.00	24.83	43.5	18.6	100	160	-
Vert.	128.386	QP	33.80	13.84	8.35	31.80	0.00	24.19	43.5	19.3	100	112	-
Vert.	176.599	QP	30.80	15.97	8.94	31.78	0.00	23.93	43.5	19.5	100	199	-
Vert.	188.759	QP	32.00	16.37	8.96	31.78	0.00	25.55	43.5	17.9	100	229	-
Vert.	193.022	QP	31.10	16.45	8.98	31.78	0.00	24.75	43.5	18.7	100	216	-
Vert.	4880.000	PK	47.03	31.51	7.07	39.72	2.28	48.17	73.9	25.7	370	67	-
Vert.	7320.000	PK	46.31	36.94	8.73	39.56	2.28	54.70	73.9	19.2	150	0	-
Vert.	9760.000	PK	46.13	38.62	10.22	39.47	2.28	57.78	73.9	16.1	150	0	-
Vert.	7320.000	AV	34.61	36.94	8.73	39.56	2.28	43.00	53.9	10.9	150	0	Floor noise
Vert.	9760.000	AV	34.72	38.62	10.22	39.47	2.28	46.37	53.9	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 - 10 GHz : 20log (3.90 m / 3.0 m) = 2.28 dB

10 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.	4880.000	AV	34.85	31.51	7.07	39.72	8.68	2.28	44.67	53.9	9.2	-
Vert.	4880.000	AV	34.93	31.51	7.07	39.72	8.68	2.28	44.75	53.9	9.1	-

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

Distance factor : 1 GHz - 10 GHz : 20log (3.90 m / 3.0 m) = 2.28 dB

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

Duty factor refer to "Burst rate confirmation" sheet.

Radiated Spurious Emission

Report No.	13554183S-A				
Test place	Shonan EMC Lab.				
Semi Anechoic Chamber	1	1	1	1	1
Date	Nov 02, 2020	Oct 19, 2020	Oct 20, 2020	Oct 21, 2020	Oct 29, 2020
Temperature / Humidity	20 deg.C, 44 %RH	22 deg.C, 54 %RH	23 deg.C, 52 %RH	21 deg.C, 47 %RH	22 deg.C, 50 %RH
Engineer	Yasumasa Owaki	Takahiro Suzuki	Takahiro Suzuki	Yosuke Murakami	Toshinori Yamada
	(30 MHz -1 GHz)	(1 GHz -2.8 GHz)	(2.8 GHz -10 GHz)	(10 GHz -18 GHz)	(18 GHz -26.5 GHz)
Mode	Tx BT LE 2 M-PHY 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.	2483.500	PK	49.55	27.84	14.59	39.58	2.28	54.68	73.9	19.2	145	3	-
Hori.	4960.000	PK	47.18	31.69	7.14	39.71	2.28	48.58	73.9	25.3	147	6	-
Hori.	7440.000	PK	46.51	37.02	8.80	39.62	2.28	54.99	73.9	18.9	150	0	-
Hori.	9920.000	PK	45.98	38.66	10.23	39.28	2.28	57.87	73.9	16.0	150	0	-
Hori.	7440.000	AV	34.61	37.02	8.80	39.62	2.28	43.09	53.9	10.8	150	0	Floor noise
Hori.	9920.000	AV	34.38	38.66	10.23	39.28	2.28	46.27	53.9	7.6	150	0	Floor noise
Vert.	30.725	QP	27.70	18.38	7.05	31.83	0.00	21.30	40.0	18.7	100	210	-
Vert.	39.701	QP	35.10	14.97	7.26	31.83	0.00	25.50	40.0	14.5	100	141	-
Vert.	41.568	QP	38.60	14.28	7.31	31.83	0.00	28.36	40.0	11.6	100	78	-
Vert.	45.686	QP	45.10	12.76	7.41	31.83	0.00	33.44	40.0	6.5	100	250	-
Vert.	52.045	QP	39.70	10.49	7.46	31.83	0.00	25.82	40.0	14.1	100	61	-
Vert.	109.450	QP	40.70	11.82	8.17	31.81	0.00	28.88	43.5	14.6	100	176	-
Vert.	135.706	QP	33.70	14.27	8.50	31.79	0.00	24.68	43.5	18.8	100	153	-
Vert.	174.368	QP	31.20	15.78	8.95	31.78	0.00	24.15	43.5	19.3	100	354	-
Vert.	184.852	QP	31.40	16.21	8.95	31.78	0.00	24.78	43.5	18.7	100	226	-
Vert.	189.135	QP	31.80	16.40	8.97	31.78	0.00	25.39	43.5	18.1	100	230	-
Vert.	2483.500	PK	46.64	27.84	14.59	39.58	2.28	51.77	73.9	22.1	374	98	-
Vert.	4960.000	PK	47.76	31.69	7.14	39.71	2.28	49.16	73.9	24.7	370	95	-
Vert.	7440.000	PK	47.03	37.02	8.80	39.62	2.28	55.51	73.9	18.3	150	0	-
Vert.	9920.000	PK	46.70	38.66	10.23	39.28	2.28	58.59	73.9	15.3	150	0	-
Vert.	7440.000	AV	34.62	37.02	8.80	39.62	2.28	43.10	53.9	10.8	150	0	Floor noise
Vert.	9920.000	AV	34.28	38.66	10.23	39.28	2.28	46.17	53.9	7.7	150	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

10 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	34.87	27.84	14.59	39.58	8.68	2.28	48.68	53.9	5.2	*1)
Hori.	4960.000	AV	34.99	31.69	7.14	39.71	8.68	2.28	45.07	53.9	8.8	-
Vert.	2483.500	AV	34.52	27.84	14.59	39.58	8.68	2.28	48.33	53.9	5.5	*1)
Vert.	4960.000	AV	35.12	31.69	7.14	39.71	8.68	2.28	45.20	53.9	8.7	-

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

Duty factor refer to "Burst rate confirmation" sheet.

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

UL Japan, Inc.

Shonan EMC Lab.

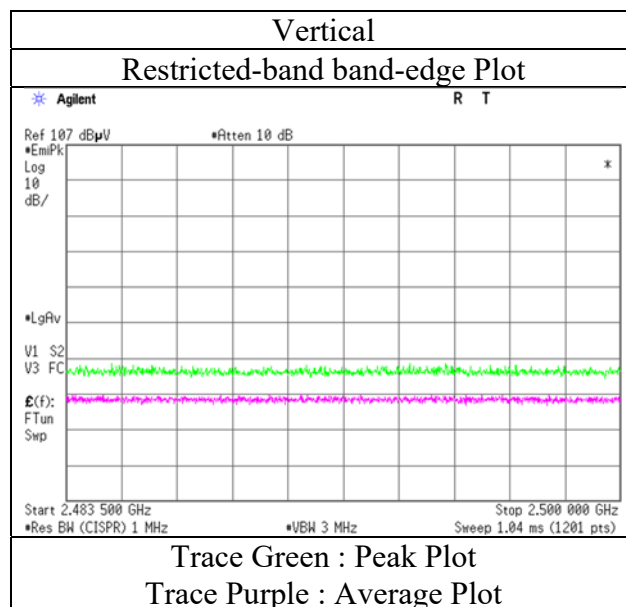
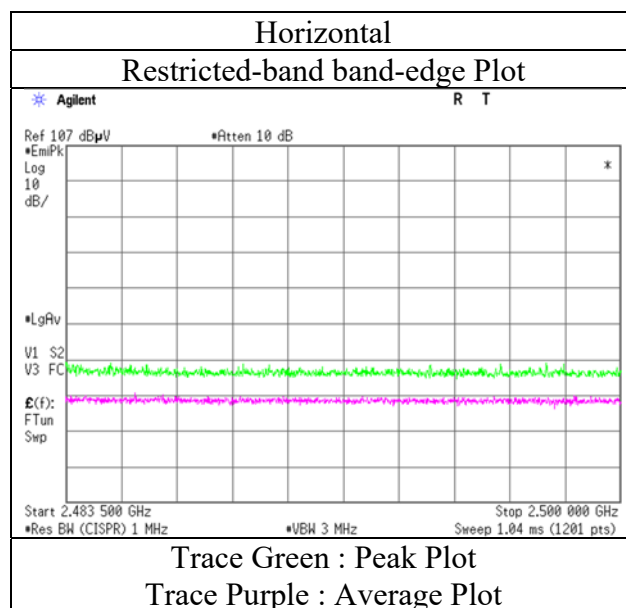
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

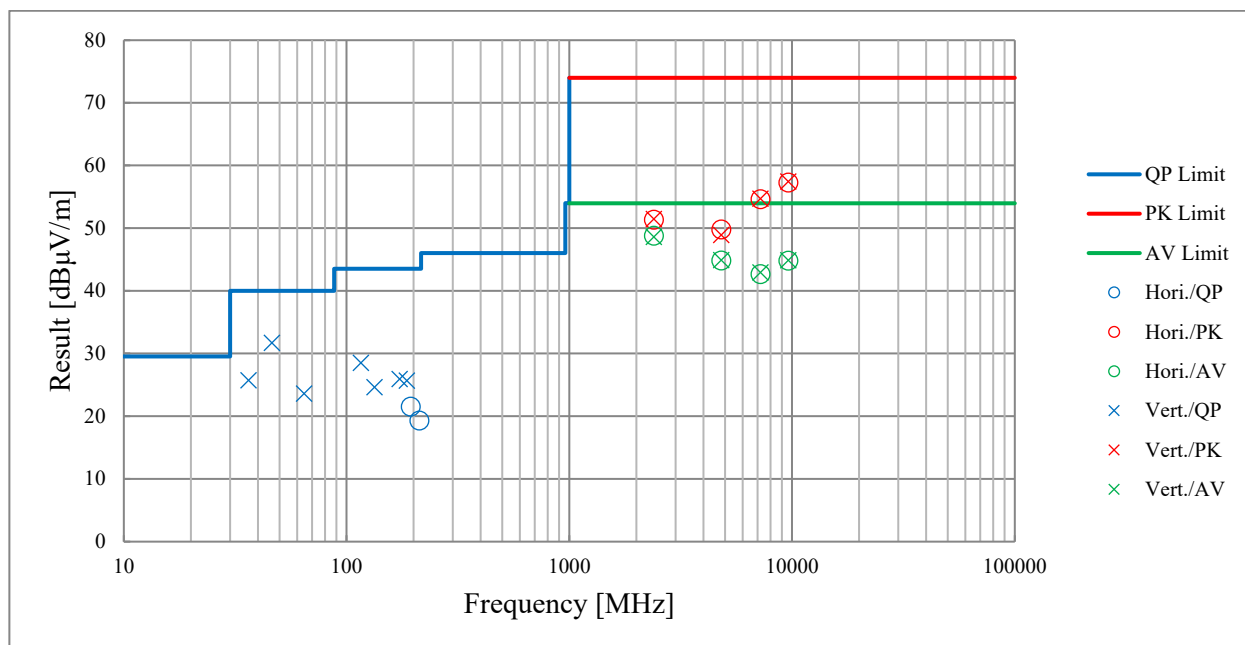
Report No. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber 1
Date Oct 19, 2020
Temperature / Humidity 22 deg.C, 54 %RH
Engineer Takahiro Suzuki
(1 GHz -2.8 GHz)
Mode Tx BT LE 2 M-PHY 2480 MHz



* 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.	13554183S-A				
Test place	Shonan EMC Lab.				
Semi Anechoic Chamber	1	1	1	1	1
Date	Oct 30, 2020	Oct 19, 2020	Oct 20, 2020	Oct 21, 2020	Oct 29, 2020
Temperature / Humidity	21 deg.C, 47 %RH	22 deg.C, 54 %RH	23 deg.C, 52 %RH	21 deg.C, 47 %RH	22 deg.C, 50 %RH
Engineer	Takahiro Suzuki	Takahiro Suzuki	Takahiro Suzuki	Yosuke Murakami	Toshinori Yamada
	(30 MHz -1 GHz)	(1 GHz -2.8 GHz)	(2.8 GHz -10 GHz)	(10 GHz -18 GHz)	(18 GHz -26.5 GHz)
Mode	Tx BT LE 2 M-PHY 2402 MHz				



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

Radiated Spurious Emission

Report No. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date November 30, 2020
Temperature / Humidity 22 deg. C / 43 % RH
Engineer Toshinori Yamada
(1 GHz – 2.8 GHz)
Mode Tx 11n-20 2412 MHz with Module A BT Hopping Off 2480 MHz and Module B 11n-20 5580 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	66.35	28.41	14.23	41.66	2.28	69.61	73.9	4.2	385	86	-
Hori.	2390.000	AV	50.41	28.41	14.23	41.66	2.28	53.67	53.9	0.2	385	86	VBW:4.3 kHz
Vert.	2390.000	PK	62.82	28.41	14.23	41.66	2.28	66.08	73.9	7.8	257	338	-
Vert.	2390.000	AV	46.06	28.41	14.23	41.66	2.28	49.32	53.9	4.5	257	338	VBW:4.3 kHz

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

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	98.02	28.37	14.24	41.67	2.28	101.24	-	-	Carrier
Hori.	2400.000	PK	62.56	28.38	14.23	41.67	2.28	65.78	81.2	15.4	-
Vert.	2412.000	PK	94.63	28.37	14.24	41.67	2.28	97.85	-	-	Carrier
Vert.	2400.000	PK	62.49	28.38	14.23	41.67	2.28	65.71	77.8	12.0	-

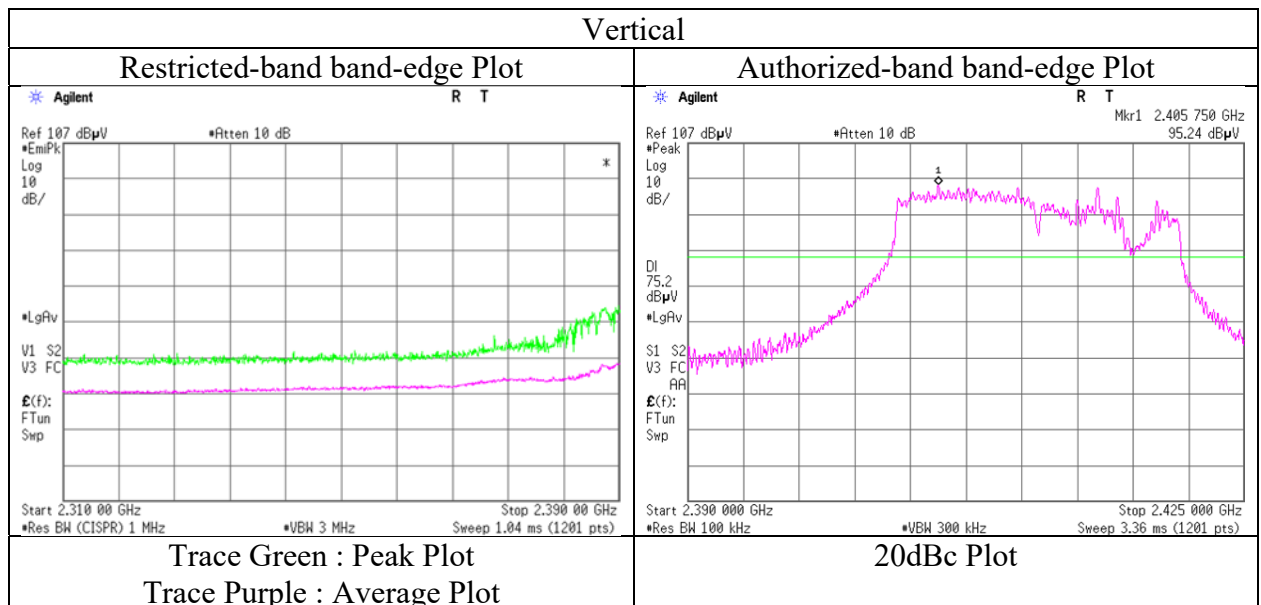
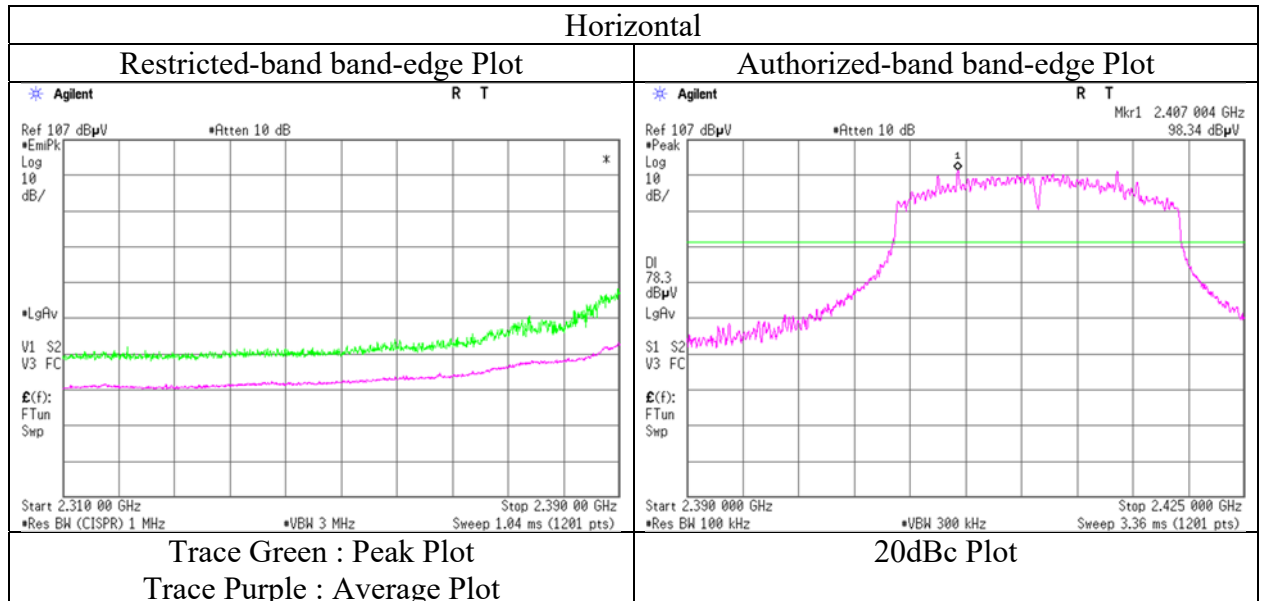
Result = Reading + Ant. Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13554183S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	November 30, 2020
Temperature / Humidity	22 deg. C / 43 % RH
Engineer	Toshinori Yamada
	(1 GHz – 2.8 GHz)
Mode	Tx 11n-20 2412 MHz with Module A BT Hopping Off 2480 MHz and Module B 11n-20 5580 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. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date November 30, 2020
Temperature / Humidity 22 deg. C / 43 % RH
Engineer Toshinori Yamada
(1 GHz – 2.8 GHz)
Mode Tx 11n-20 2412 MHz with Module A BT LE 2M-PHY 2480 MHz and Module B 11n-20 5580 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	65.88	28.41	14.23	41.66	2.28	69.14	73.9	4.7	386	100	-
Hori.	2390.000	AV	49.86	28.41	14.23	41.66	2.28	53.12	53.9	0.7	386	100	VBW:4.3 kHz
Vert.	2390.000	PK	61.75	28.41	14.23	41.66	2.28	65.01	73.9	8.8	270	335	-
Vert.	2390.000	AV	45.31	28.41	14.23	41.66	2.28	48.57	53.9	5.3	270	335	VBW:4.3 kHz

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

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	97.65	28.37	14.24	41.67	2.28	100.87	-	-	Carrier
Hori.	2400.000	PK	63.00	28.38	14.23	41.67	2.28	66.22	80.8	14.5	-
Vert.	2412.000	PK	94.79	28.37	14.24	41.67	2.28	98.01	-	-	Carrier
Vert.	2400.000	PK	63.36	28.38	14.23	41.67	2.28	66.58	78.0	11.4	-

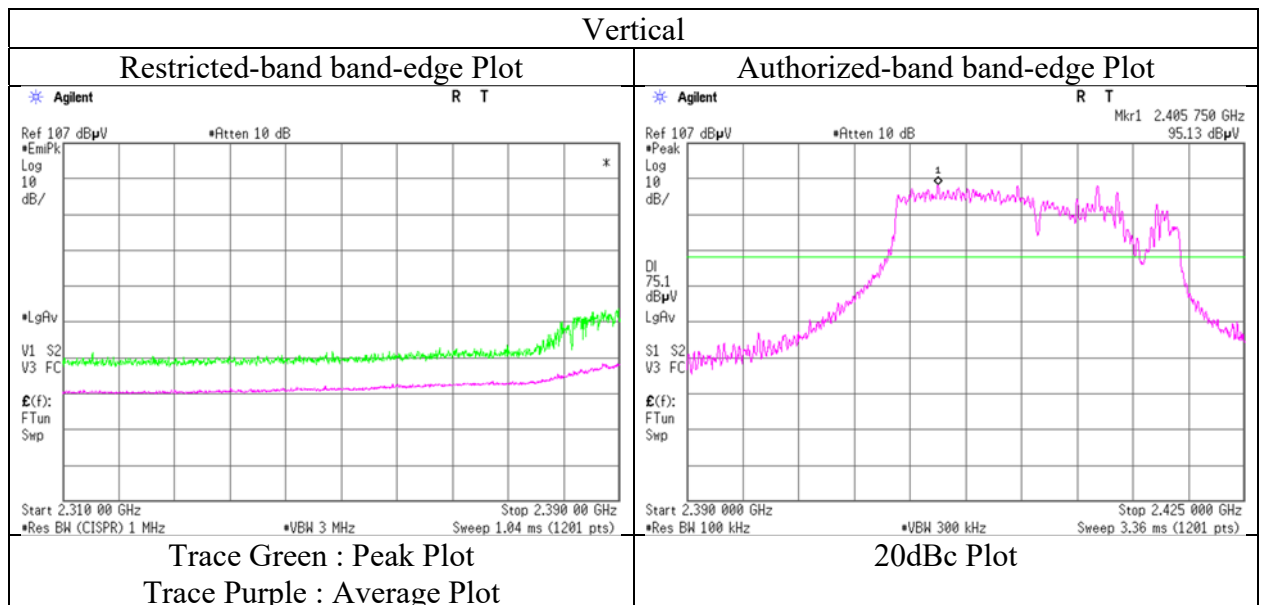
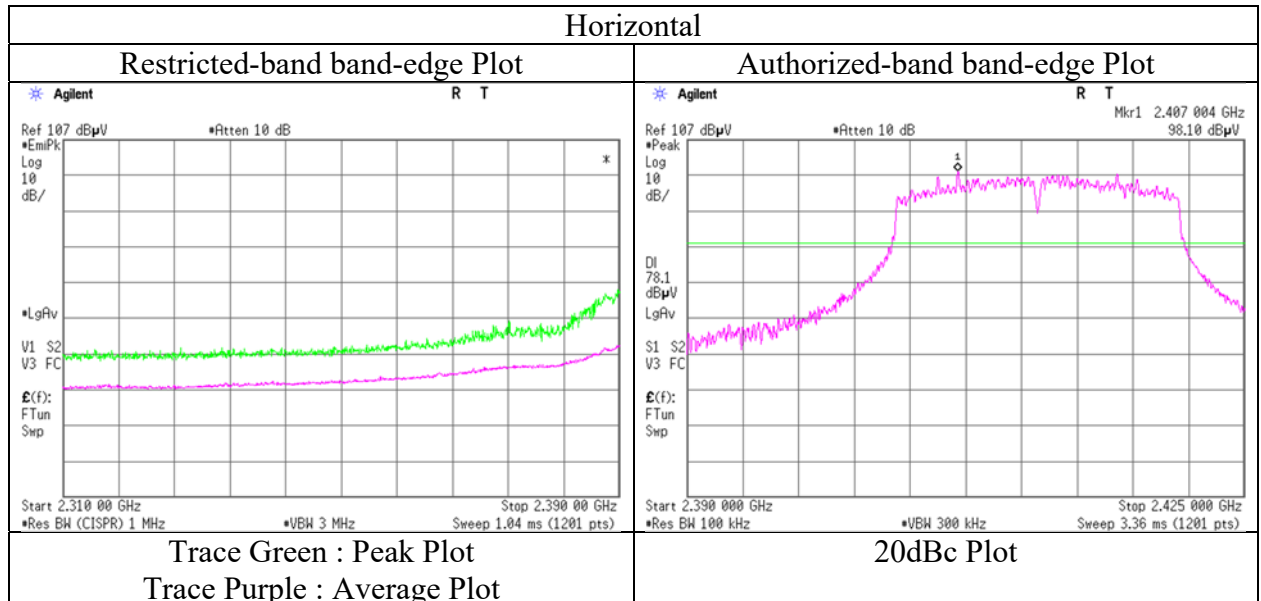
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13554183S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	November 30, 2020
Temperature / Humidity	22 deg. C / 43 % RH
Engineer	Toshinori Yamada
	(1 GHz – 2.8 GHz)
Mode	Tx 11n-20 2412 MHz with Module A BT LE 2M-PHY 2480 MHz and Module B 11n-20 5580 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. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber 1
Date November 24, 2020
Temperature / Humidity 21 deg.C, 41 %RH
Engineer Yosuke Murakami
(1 GHz -2.8 GHz)
Mode Tx BT LE 1 M-PHY 2402 MHz with Module A 11n-20 5320 MHz and Module B 11n-20 5580 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	45.54	27.93	14.50	39.55	2.28	50.70	73.9	23.2	151	10	-
Vert.	2390.000	PK	45.09	27.93	14.50	39.55	2.28	50.25	73.9	23.6	108	141	-

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

10 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	34.23	27.93	14.50	39.55	3.58	2.28	42.97	53.9	10.9	*1)
Vert.	2390.000	AV	34.47	27.93	14.50	39.55	3.58	2.28	43.21	53.9	10.6	*1)

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

Duty factor refer to "Burst rate confirmation" 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	98.73	27.92	14.51	39.56	2.28	103.88	-	-	Carrier
Hori.	2400.000	PK	40.54	27.92	14.51	39.56	2.28	45.69	83.8	38.1	-
Vert.	2402.000	PK	90.01	27.92	14.51	39.56	2.28	95.16	-	-	Carrier
Vert.	2400.000	PK	36.59	27.92	14.51	39.56	2.28	41.74	75.1	33.3	-

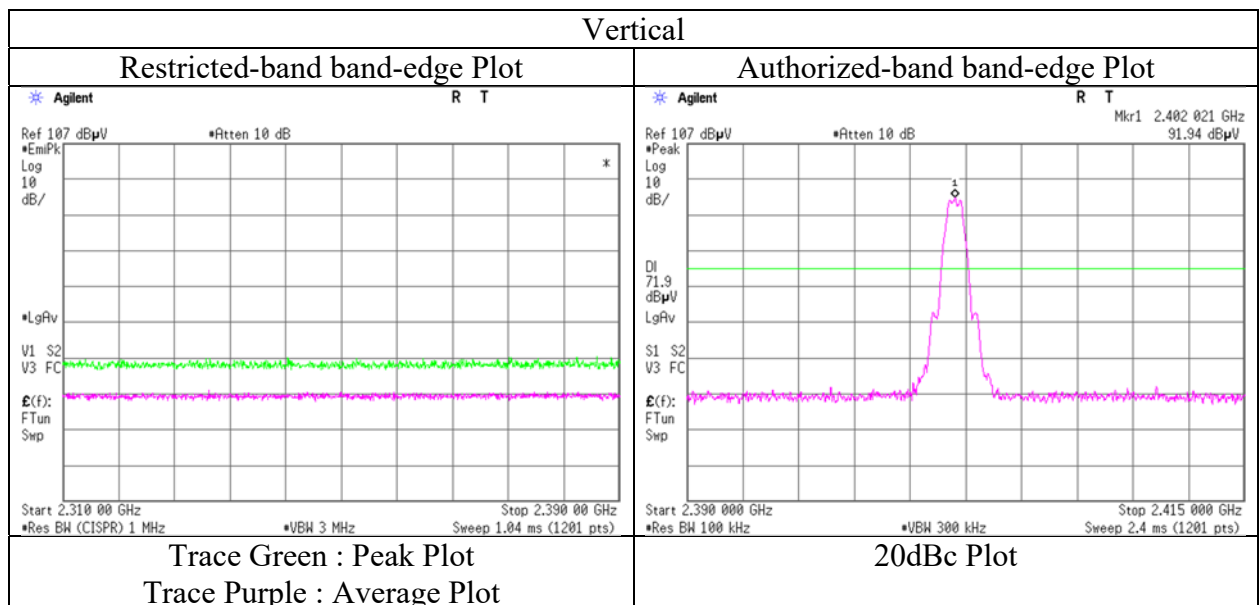
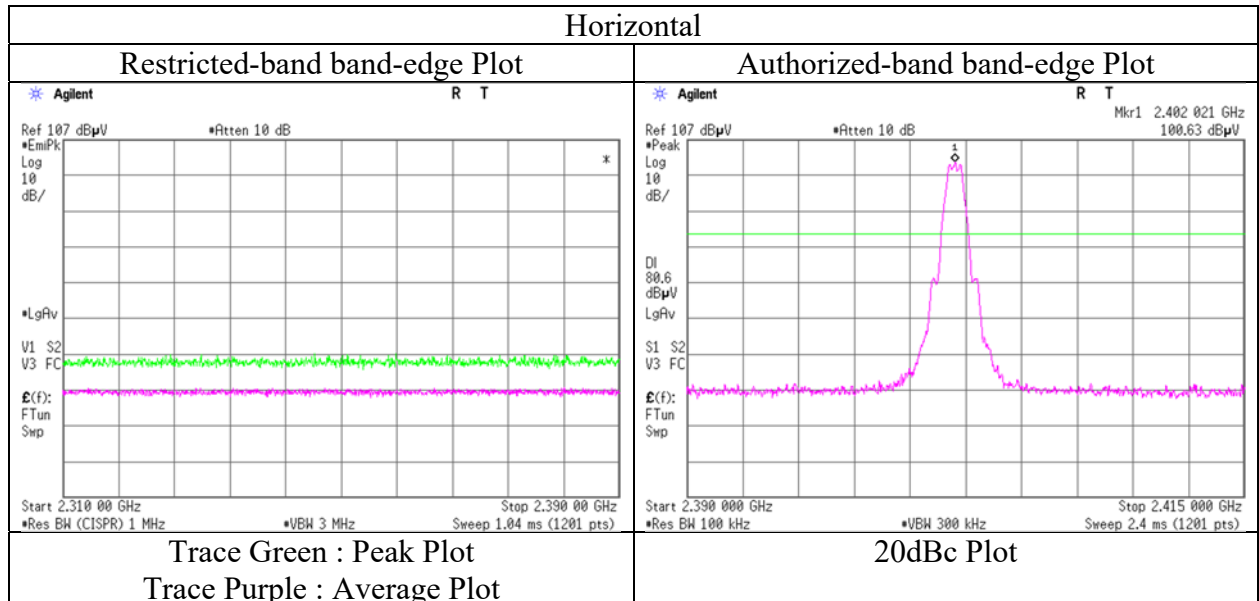
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

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

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13554183S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	1
Date	November 24, 2020
Temperature / Humidity	21 deg.C, 41 %RH
Engineer	Yosuke Murakami
	(1 GHz -2.8 GHz)
Mode	Tx BT LE 1 M-PHY 2402 MHz with Module A 11n-20 5320 MHz and Module B 11n-20 5580 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. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date November 23, 2020
Temperature / Humidity 22 deg.C, 45 %RH
Engineer Yasumasa Owaki
(1 GHz -2.8 GHz)
Mode Tx BT LE 1 M-PHY 2480 MHz with Module A 11n-20 5320 MHz and Module B 11n-20 5580 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	50.72	28.28	14.31	41.69	2.28	53.90	73.9	20.0	130	7	-
Vert.	2483.500	PK	48.13	28.28	14.31	41.69	2.28	51.31	73.9	22.5	336	57	-

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

10 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	39.10	28.28	14.31	41.69	3.58	2.28	45.86	53.9	8.0	*1)
Vert.	2483.500	AV	38.07	28.28	14.31	41.69	3.58	2.28	44.83	53.9	9.0	*1)

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

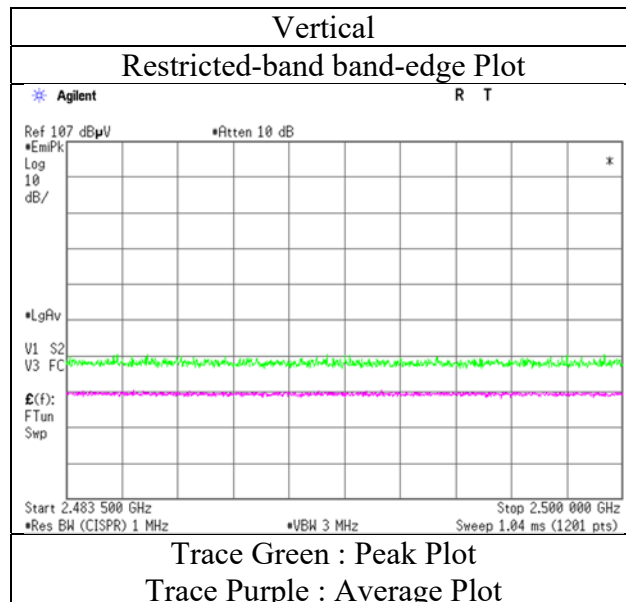
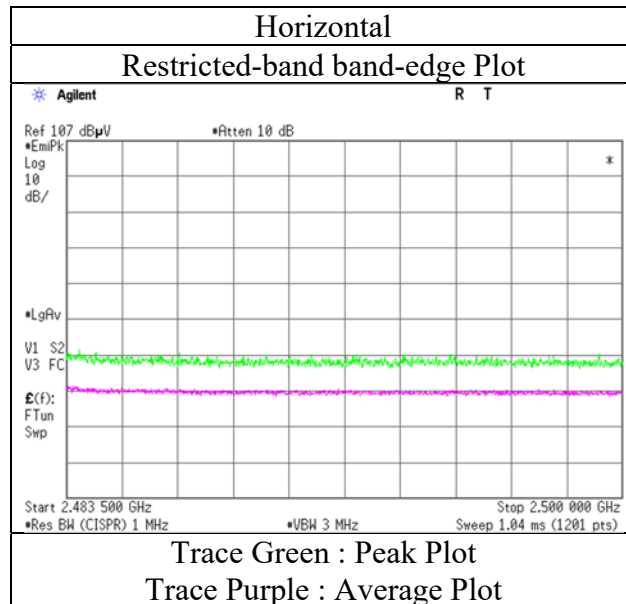
10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Duty factor refer to "Burst rate confirmation" sheet.

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

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

Report No. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date November 23, 2020
Temperature / Humidity 22 deg.C, 45 %RH
Engineer Yasumasa Owaki
(1 GHz -2.8 GHz)
Mode Tx BT LE 1 M-PHY 2480 MHz with Module A 11n-20 5320 MHz and Module B 11n-20 5580 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.	13554183S-A			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	1	1	3	1
Date	November 27, 2020	November 24, 2020	November 23, 2020	November 26, 2020
Temperature / Humidity	20 deg.C, 46 %RH	21 deg.C, 41 %RH	22 deg.C, 45 %RH	21 deg.C, 48 %RH
Engineer	Yosuke Murakami	Yosuke Murakami	Yasumasa Owaki	Yosuke Murakami
	(30 MHz -1 GHz)	(1 GHz -2.8 GHz)	(2.8 GHz -10 GHz)	(10 GHz -26.5 GHz)
Mode	Tx BT LE 2 M-PHY 2402 MHz with Module A 11n-20 5320 MHz and Module B 11n-20 5580 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.	688.128	QP	36.42	19.66	8.70	32.16	0.00	32.62	46.0	13.3	136	44	-
Hori.	712.702	QP	37.95	20.00	8.82	32.13	0.00	34.64	46.0	11.3	124	179	-
Hori.	811.005	QP	34.81	20.82	9.24	31.96	0.00	32.91	46.0	13.0	104	299	-
Hori.	860.156	QP	34.09	21.71	9.47	31.68	0.00	33.59	46.0	12.4	100	15	-
Hori.	884.734	QP	31.00	21.97	9.58	31.56	0.00	30.99	46.0	15.0	100	13	-
Hori.	909.398	QP	37.01	22.07	9.67	31.42	0.00	37.33	46.0	8.6	100	8	-
Hori.	2390.000	PK	45.59	27.93	14.50	39.55	2.28	50.75	73.9	23.1	148	10	-
Hori.	4804.000	PK	51.08	31.60	6.68	42.92	2.28	48.72	73.9	25.1	289	269	-
Hori.	7206.000	PK	48.90	37.60	8.16	43.39	2.28	53.55	73.9	20.3	100	0	-
Hori.	9608.000	PK	48.70	38.92	9.33	43.14	2.28	56.09	73.9	17.8	100	0	-
Hori.	7206.000	AV	39.43	37.60	8.16	43.39	2.28	44.08	53.9	9.8	100	0	Floor noise
Hori.	9608.000	AV	38.76	38.92	9.33	43.14	2.28	46.15	53.9	7.7	100	0	Floor noise
Vert.	43.848	QP	39.52	13.45	7.37	31.83	0.00	28.51	40.0	11.4	100	7	-
Vert.	50.066	QP	45.09	11.15	7.47	31.83	0.00	31.88	40.0	8.1	100	182	-
Vert.	87.773	QP	43.51	7.79	8.40	31.82	0.00	27.88	40.0	12.1	100	0	-
Vert.	151.983	QP	34.49	14.96	8.85	31.78	0.00	26.52	43.5	16.9	100	240	-
Vert.	909.311	QP	32.58	22.07	9.67	31.42	0.00	32.90	46.0	13.1	117	181	-
Vert.	2390.000	PK	45.42	27.93	14.50	39.55	2.28	50.58	73.9	23.3	107	140	-
Vert.	4804.000	PK	50.23	31.60	6.68	42.92	2.28	47.87	73.9	26.0	187	278	-
Vert.	7206.000	PK	48.46	37.60	8.16	43.39	2.28	53.11	73.9	20.7	100	0	-
Vert.	9608.000	PK	49.30	38.92	9.33	43.14	2.28	56.69	73.9	17.2	100	0	-
Vert.	7206.000	AV	39.29	37.60	8.16	43.39	2.28	43.94	53.9	9.9	100	0	Floor noise
Vert.	9608.000	AV	38.88	38.92	9.33	43.14	2.28	46.27	53.9	7.6	100	0	Floor noise

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

Distance factor : 1 GHz - 10 GHz : 20log(3.90 m / 3.0 m) = 2.28 dB

10 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	36.15	27.93	14.50	39.55	8.68	2.28	49.99	53.9	3.9	*1)
Hori.	4804.000	AV	40.25	31.60	6.68	42.92	8.68	2.28	46.57	53.9	7.3	-
Vert.	2390.000	AV	36.03	27.93	14.50	39.55	8.68	2.28	49.87	53.9	4.0	*1)
Vert.	4804.000	AV	39.37	31.60	6.68	42.92	8.68	2.28	45.69	53.9	8.2	-

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

Distance factor : 1 GHz - 10 GHz : 20log(3.90 m / 3.0 m) = 2.28 dB

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

Duty factor refer to "Burst rate confirmation" 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	98.92	27.92	14.51	39.56	2.28	104.07	-	-	Carrier
Hori.	2400.000	PK	52.01	27.92	14.51	39.56	2.28	57.16	84.0	26.8	-
Vert.	2402.000	PK	89.80	27.92	14.51	39.56	2.28	94.95	-	-	Carrier
Vert.	2400.000	PK	44.94	27.92	14.51	39.56	2.28	50.09	74.9	24.8	-

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

Distance factor : 1 GHz - 10 GHz : 20log(3.90 m / 3.0 m) = 2.28 dB

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

UL Japan, Inc.

Shonan EMC Lab.

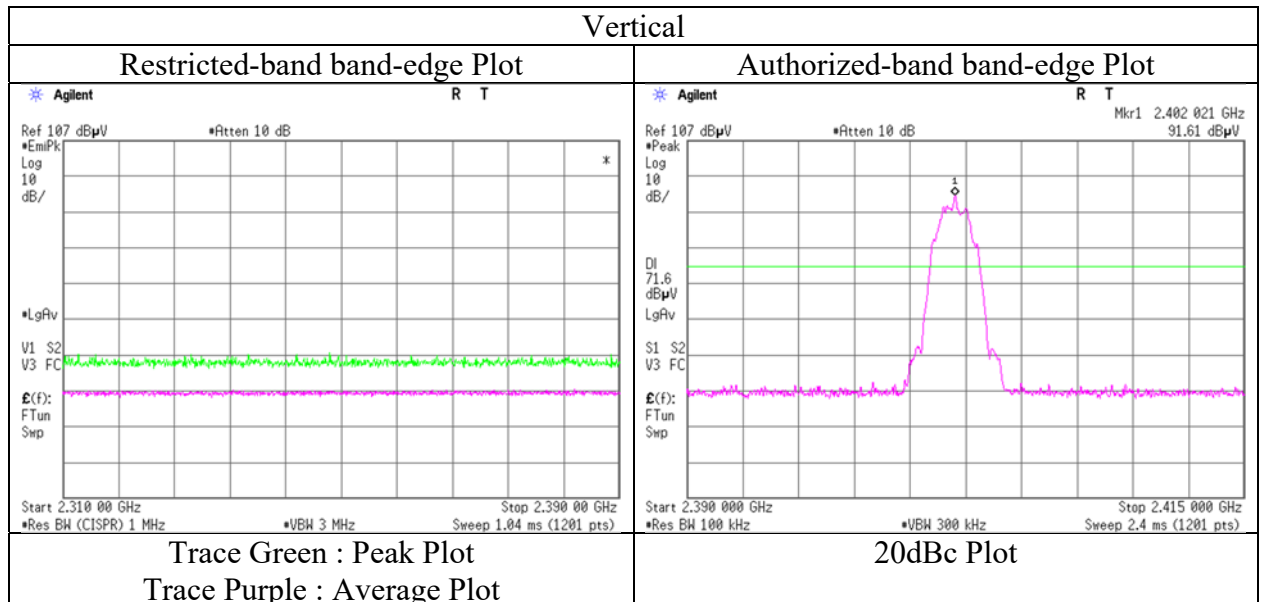
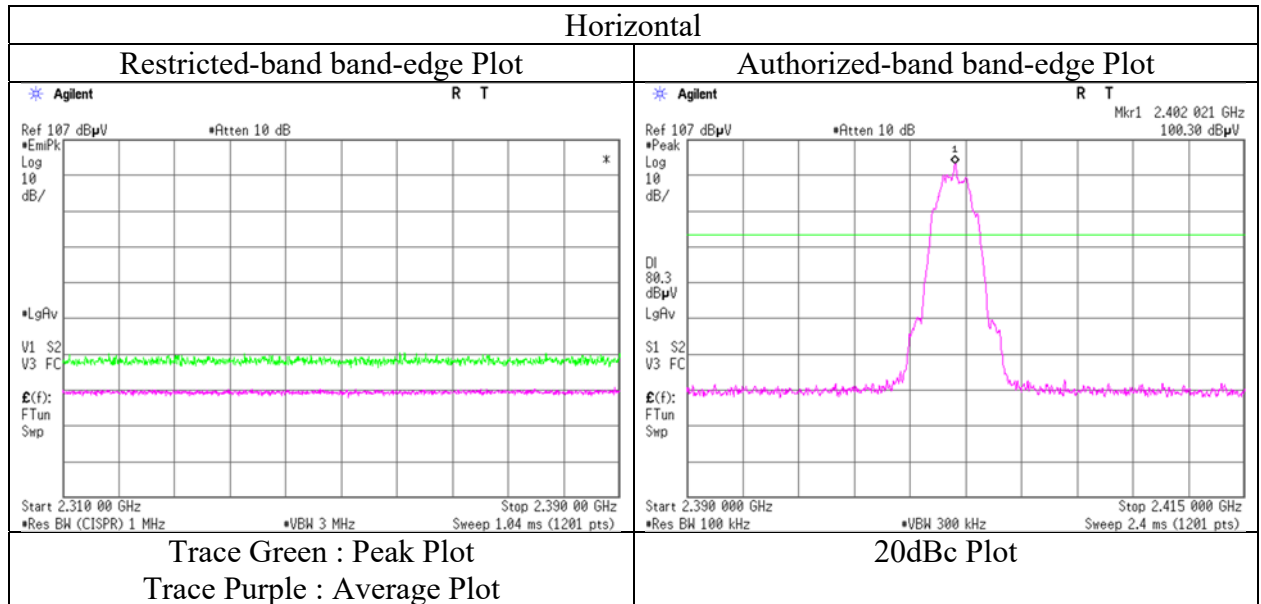
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13554183S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	1
Date	November 24, 2020
Temperature / Humidity	21 deg.C, 41 %RH
Engineer	Yosuke Murakami (1 GHz -2.8 GHz)
Mode	Tx BT LE 2 M-PHY 2402 MHz with Module A 11n-20 5320 MHz and Module B 11n-20 5580 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. 13554183S-A
Test place Shonan EMC Lab.
Semi Anechoic Chamber 3
Date November 23, 2020
Temperature / Humidity 22 deg.C, 45 %RH
Engineer Yasumasa Owaki
(1 GHz -2.8 GHz)
Mode Tx BT LE 2 M-PHY 2480 MHz with Module A 11n-20 5320 MHz and Module B 11n-20 5580 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	51.91	28.28	14.31	41.69	2.28	55.09	73.9	18.8	132	12	-
Vert.	2483.500	PK	48.86	28.28	14.31	41.69	2.28	52.04	73.9	21.8	373	53	-

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

10 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	37.05	28.28	14.31	41.69	8.68	2.28	48.91	53.9	4.9	*1)
Vert.	2483.500	AV	37.93	28.28	14.31	41.69	8.68	2.28	49.79	53.9	4.1	*1)

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

Distance factor : 1 GHz - 10 GHz : $20\log(3.90\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$

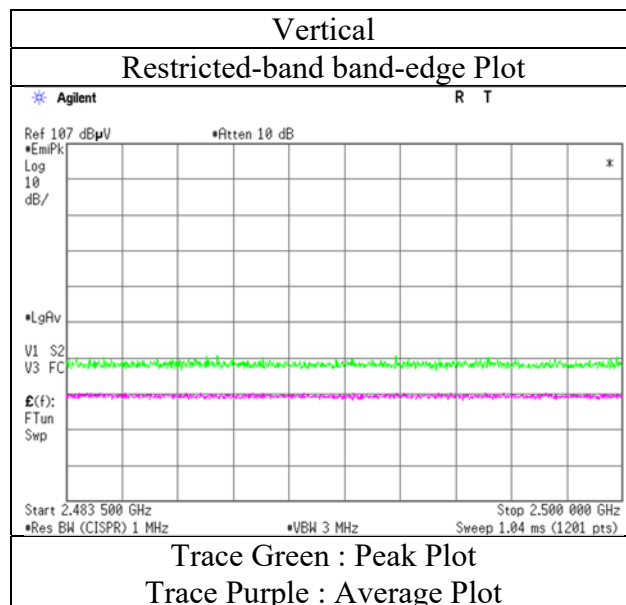
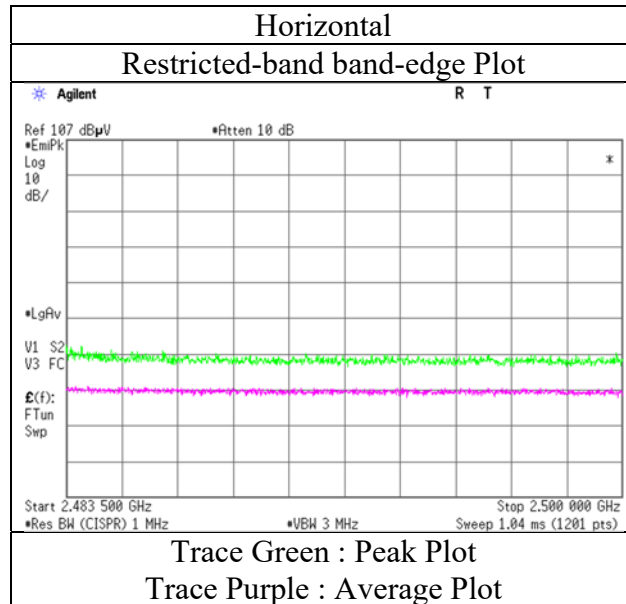
10 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Duty factor refer to "Burst rate confirmation" sheet.

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

Radiated Spurious Emission (Reference Plot for band-edge)

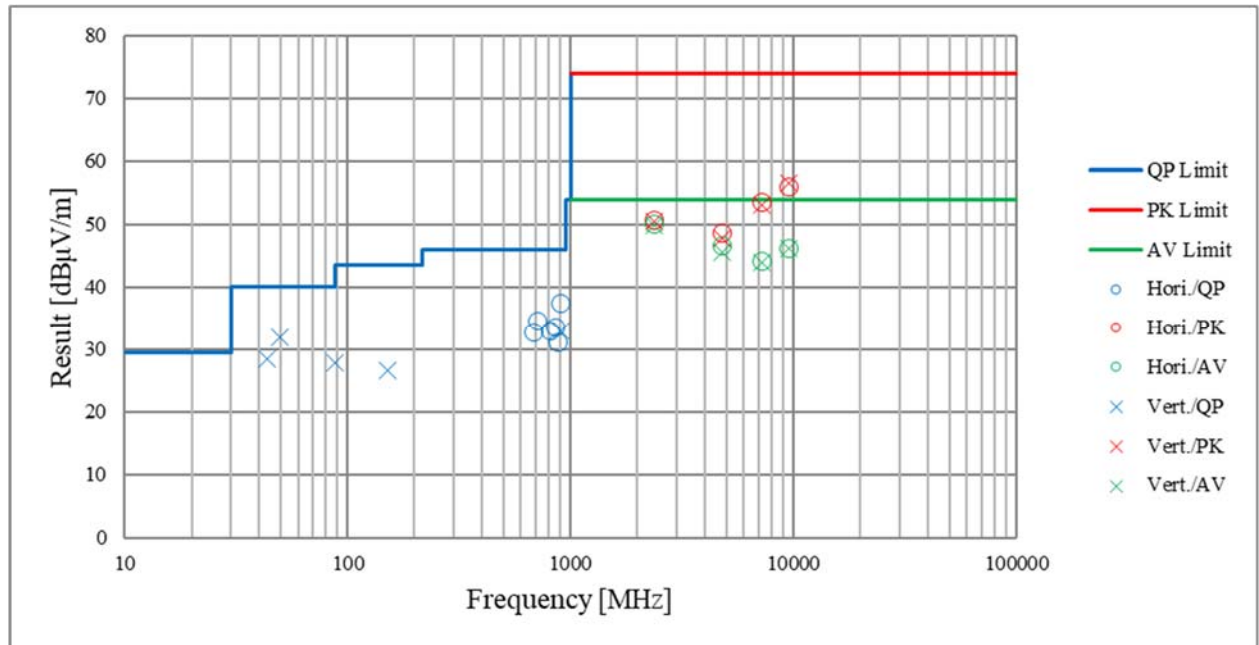
Report No.	13554183S-A
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	3
Date	November 23, 2020
Temperature / Humidity	22 deg.C, 45 %RH
Engineer	Yasumasa Owaki (1 GHz -2.8 GHz)
Mode	Tx BT LE 2 M-PHY 2480 MHz with Module A 11n-20 5320 MHz and Module B 11n-20 5580 MHz



* 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)

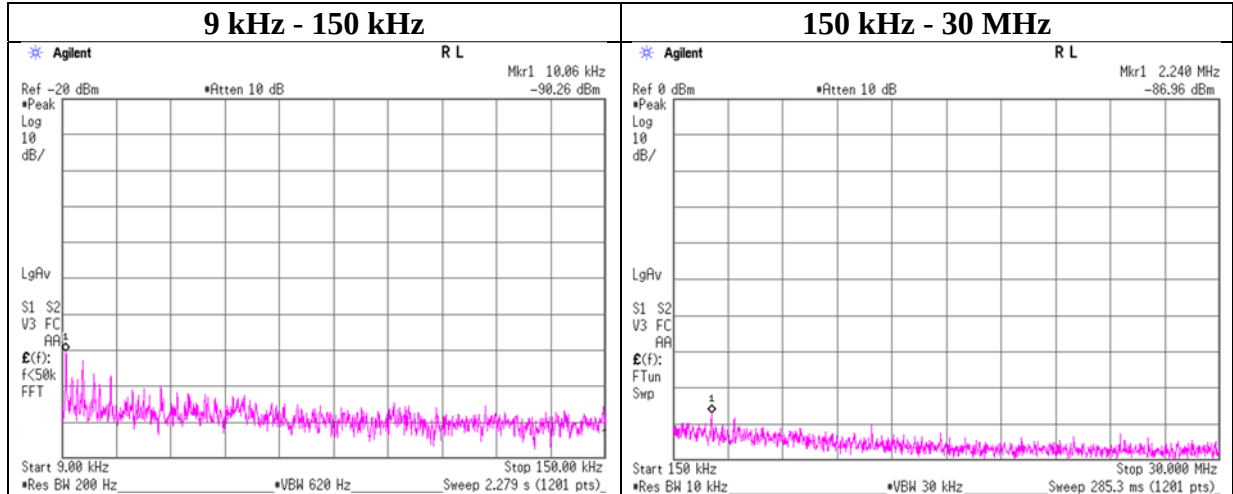
Report No.	13554183S-A			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	1	1	3	1
Date	November 27, 2020	November 24, 2020	November 23, 2020	November 26, 2020
Temperature / Humidity	20 deg.C, 46 %RH	21 deg.C, 41 %RH	22 deg.C, 45 %RH	21 deg.C, 48 %RH
Engineer	Yosuke Murakami	Yosuke Murakami	Yasumasa Owaki	Yosuke Murakami
	(30 MHz -1 GHz)	(1 GHz -2.8 GHz)	(2.8 GHz -10 GHz)	(10 GHz -26.5 GHz)
Mode	Tx BT LE 2 M-PHY 2402 MHz with Module A 11n-20 5320 MHz and Module B 11n-20 5580 MHz			



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

Conducted Spurious Emission

Report No. 13554183S-A
Test place Shonan EMC Lab. No.5 Shielded Room
Date November 7, 2020
Temperature / Humidity 23 deg. C / 40 % RH
Engineer Makoto Hosaka
Mode Tx 11n-20 2437 MHz
Antenna ANT 1



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
10.06	-90.26	0.01	9.74	2.0	2	-75.5	300	6.0	-14.2	47.5	61.7	-
2240.00	-86.96	0.04	9.74	2.0	2	-72.2	30	6.0	9.1	29.5	20.5	-

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

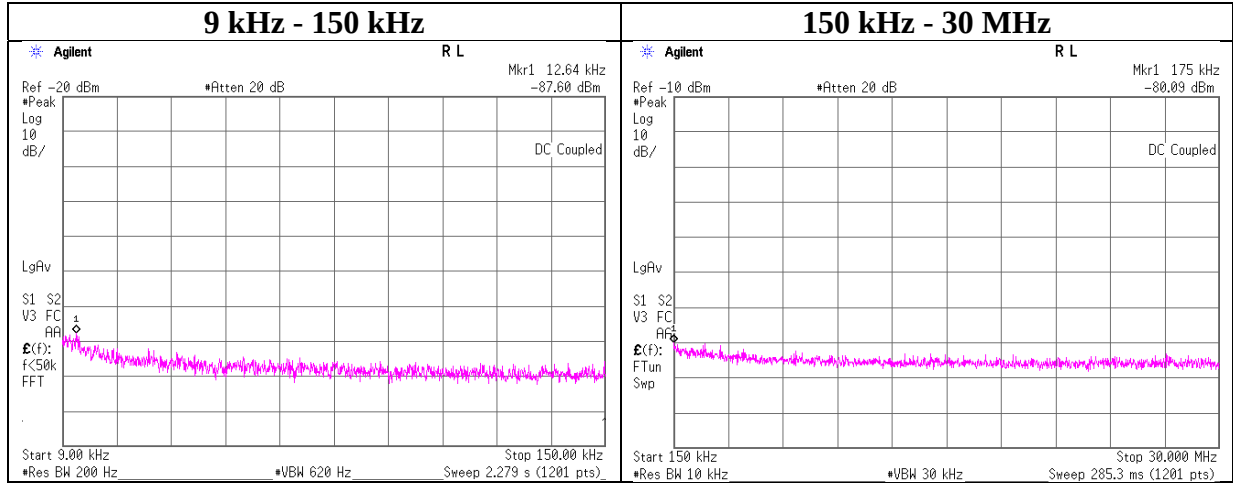
$EIRP [dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

N: Number of output

*2.0 dBi was applied to the test result based on ANSI C63.10 since antenna gain was less than 2.0 dBi.

Conducted Spurious Emission

Report No. 13554183S-A
Test place Shonan EMC Lab. No.6 Shielded Room
Date October 14, 2020
Temperature / Humidity 27 deg. C / 45 % RH
Engineer Kazuya Noda
Mode Tx BT LE 1 M-PHY 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
12.64	-87.60	0.01	9.73	3.54	1	-74.3	300	6.0	-13.1	45.5	58.6	-
175.00	-80.09	0.01	9.74	3.54	1	-66.8	300	6.0	-5.5	22.7	28.2	-

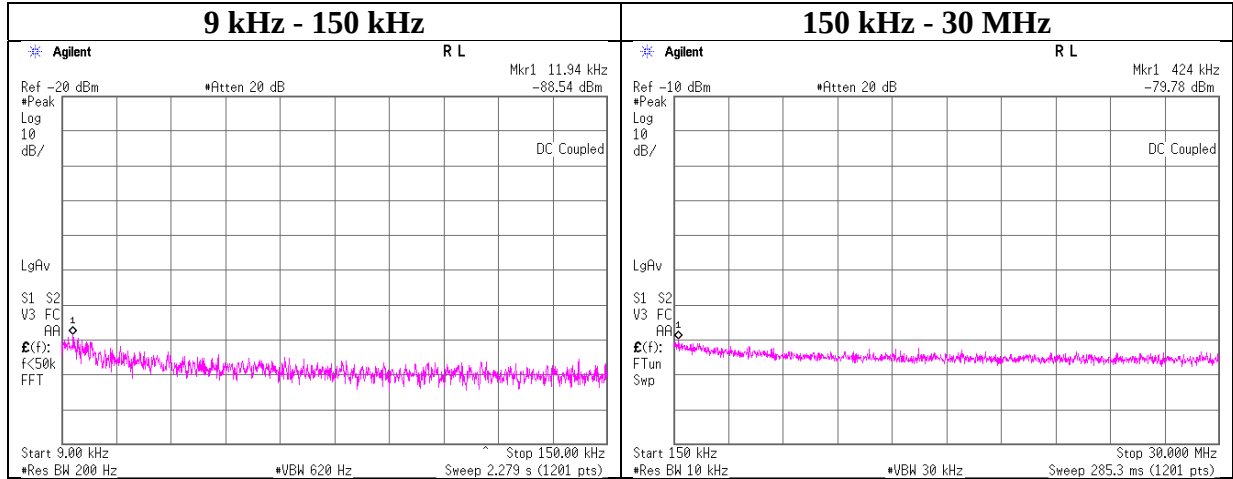
$E [dBuV/m] = EIRP [dBm] - 20 \log (Distance [m]) + Ground\ bounce [dB] + 104.8 [dBuV/m]$

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

N: Number of output

Conducted Spurious Emission

Report No. 13554183S-A
Test place Shonan EMC Lab. No.6 Shielded Room
Date October 14, 2020
Temperature / Humidity 27 deg. C / 45 % RH
Engineer Kazuya Noda
Mode Tx BT LE 1 M-PHY 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
11.94	-88.54	0.01	9.73	3.54	1	-75.3	300	6.0	-14.0	46.0	60.0	-
424.00	-79.78	0.02	9.74	3.54	1	-66.5	300	6.0	-5.2	15.0	20.2	-

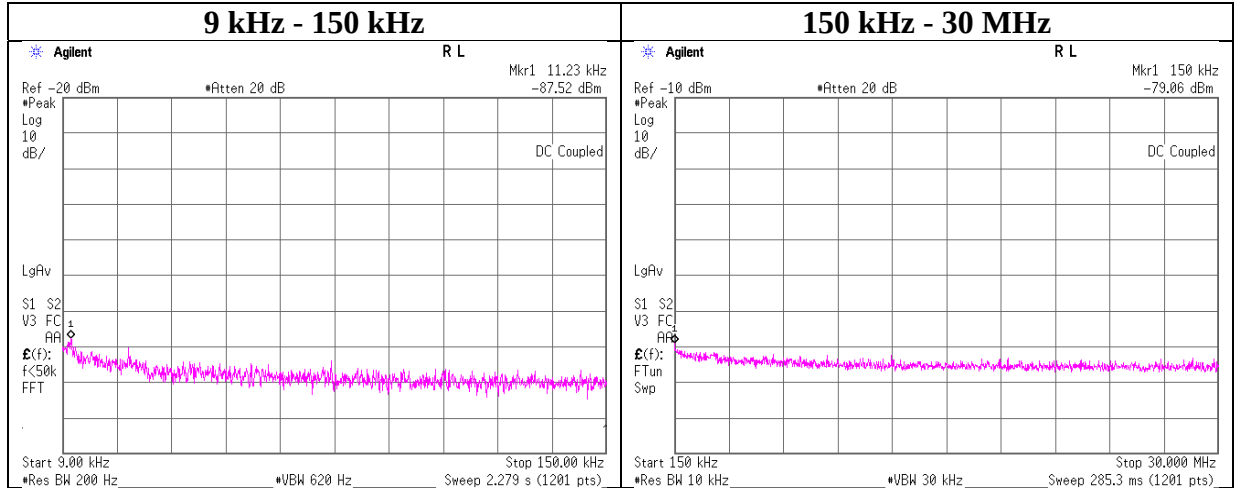
$E [dBuV/m] = EIRP [dBm] - 20 \log (Distance [m]) + Ground\ bounce [dB] + 104.8 [dBuV/m]$

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

N: Number of output

Conducted Spurious Emission

Report No.	13554183S-A
Test place	Shonan EMC Lab. No.6 Shielded Room
Date	October 14, 2020
Temperature / Humidity	27 deg. C / 45 % RH
Engineer	Kazuya Noda
Mode	Tx BT LE 1 M-PHY 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
11.23	-87.52	0.01	9.73	3.54	1	-74.2	300	6.0	-13.0	46.5	59.5	-
150.00	-79.06	0.01	9.74	3.54	1	-65.8	300	6.0	-4.5	24.0	28.5	-

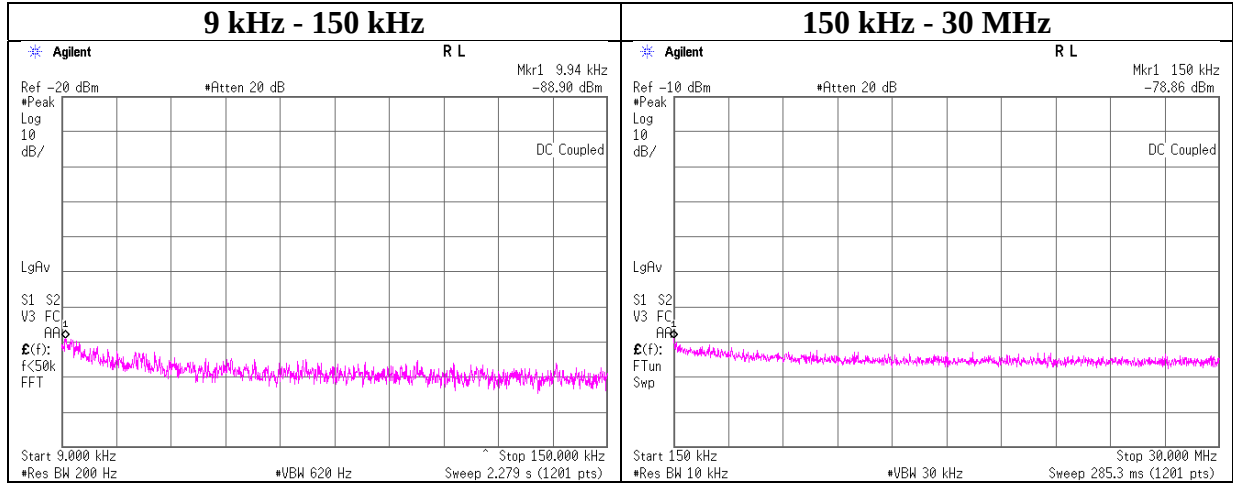
$E [dBuV/m] = EIRP [dBm] - 20 \log (Distance [m]) + Ground\ bounce [dB] + 104.8 [dBuV/m]$

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

N: Number of output

Conducted Spurious Emission

Report No. 13554183S-A
Test place Shonan EMC Lab. No.6 Shielded Room
Date October 14, 2020
Temperature / Humidity 27 deg. C / 45 % RH
Engineer Kazuya Noda
Mode Tx BT LE 2 M-PHY 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
9.94	-88.90	0.01	9.73	3.54	1	-75.6	300	6.0	-14.4	47.6	62.0	-
150.00	-78.86	0.01	9.74	3.54	1	-65.6	300	6.0	-4.3	24.0	28.3	-

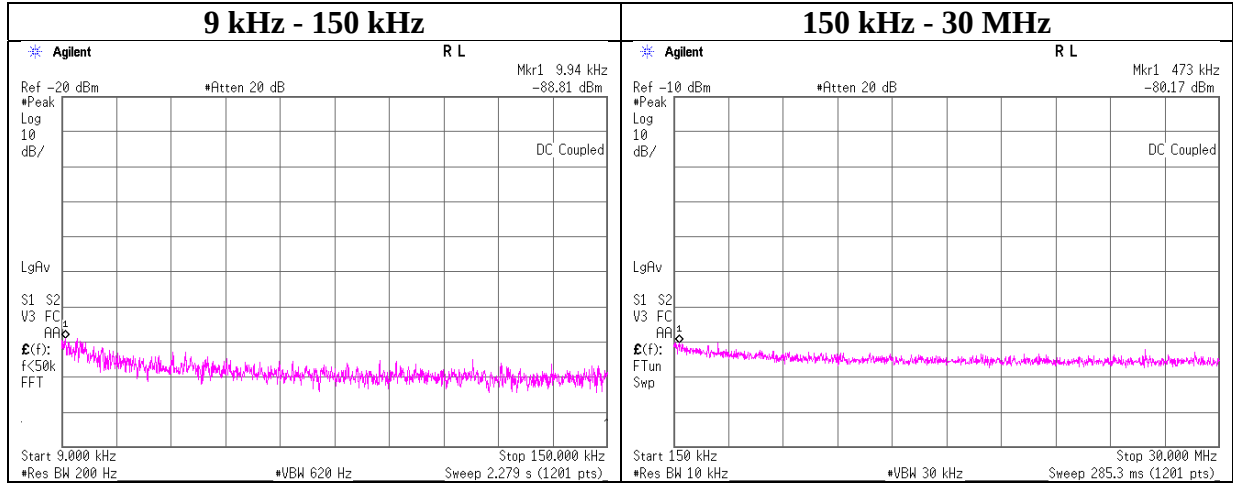
$E [dBuV/m] = EIRP [dBm] - 20 \log (Distance [m]) + Ground\ bounce [dB] + 104.8 [dBuV/m]$

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

N: Number of output

Conducted Spurious Emission

Report No. 13554183S-A
Test place Shonan EMC Lab. No.6 Shielded Room
Date October 14, 2020
Temperature / Humidity 27 deg. C / 45 % RH
Engineer Kazuya Noda
Mode Tx BT LE 2 M-PHY 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
9.94	-88.81	0.01	9.73	3.54	1	-75.5	300	6.0	-14.3	47.6	61.9	-
473.00	-80.17	0.02	9.74	3.54	1	-66.9	300	6.0	-5.6	14.1	19.7	-

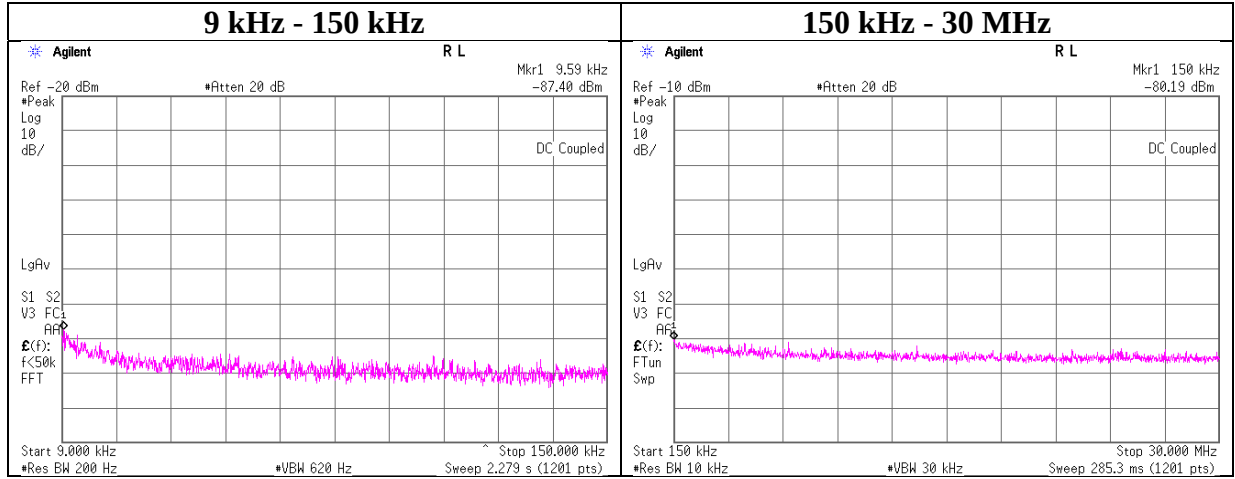
$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log (\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$

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

N: Number of output

Conducted Spurious Emission

Report No. 13554183S-A
Test place Shonan EMC Lab. No.6 Shielded Room
Date October 14, 2020
Temperature / Humidity 27 deg. C / 45 % RH
Engineer Kazuya Noda
Mode Tx BT LE 2 M-PHY 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
9.59	-87.40	0.01	9.73	3.54	1	-74.1	300	6.0	-12.9	47.9	60.8	-
150.00	-80.19	0.01	9.74	3.54	1	-66.9	300	6.0	-5.6	24.0	29.6	-

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

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

N: Number of output

Power Density

Report No. 13554183S-A
Test place Shonan EMC Lab. No.5 Shielded Room
Date November 7, 2020
Temperature / Humidity 23 deg. C / 40 % RH
Engineer Makoto Hosaka
Mode Tx 11b

11b

ANT 0 + ANT 1

Freq. [MHz]	Antenna A Result	Antenna B Result	Result		Limit	Margin
	[mW]	[mW]	[dBm]	[mW]	[dBm]	[dB]
2412.00	2.19	2.88	7.05	5.07	8.00	0.95
2437.00	2.37	2.75	7.09	5.12	8.00	0.91
2462.00	2.56	2.70	7.21	5.26	8.00	0.79

Sample Calculation:

Result = ANT 0 Result + ANT 1 Result

ANT 0

Freq. [MHz]	Reading	Cable Loss	Atten. Loss	Result		Limit	Margin
	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[dB]
2412.00	-7.20	0.97	9.63	3.40	2.19	8.00	4.60
2437.00	-6.86	0.97	9.63	3.74	2.37	8.00	4.26
2462.00	-6.50	0.96	9.63	4.09	2.56	8.00	3.91

ANT 1

Freq. [MHz]	Reading	Cable Loss	Atten. Loss	Result		Limit	Margin
	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[dB]
2412.00	-6.19	0.98	9.81	4.60	2.88	8.00	3.40
2437.00	-6.39	0.97	9.82	4.40	2.75	8.00	3.60
2462.00	-6.46	0.97	9.80	4.31	2.70	8.00	3.69

Sample Calculation:

Result = Reading + Cable Loss + Attenuator Loss

Power Density

Report No. 13554183S-A
Test place Shonan EMC Lab. No.5 Shielded Room
Date November 7, 2020 October 14, 2020
Temperature / Humidity 23 deg. C / 40 % RH 27 deg. C / 45 % RH
Engineer Makoto Hosaka Kazuya Noda
Mode Tx 11g

11g

ANT 0 + ANT 1

Freq. [MHz]	Antenna A Result	Antenna B Result	Result		Limit	Margin
	[mW]	[mW]	[dBm]	[mW]	[dBm]	[dB]
2412.00	0.04	0.05	-10.20	0.10	8.00	18.20
2437.00	0.04	0.05	-10.42	0.09	8.00	18.42
2462.00	0.05	0.05	-10.33	0.09	8.00	18.33

Sample Calculation:

Result = ANT 0 Result + ANT 1 Result

ANT 0

Freq. [MHz]	Reading	Cable Loss	Atten. Loss	Result		Limit	Margin
	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[dB]
2412.00	-24.35	0.97	9.63	-13.75	0.04	8.00	21.75
2437.00	-24.58	0.97	9.63	-13.98	0.04	8.00	21.98
2462.00	-24.02	0.96	9.63	-13.43	0.05	8.00	21.43

ANT 1

Freq. [MHz]	Reading	Cable Loss	Atten. Loss	Result		Limit	Margin
	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[dB]
2412.00	-23.52	0.98	9.81	-12.73	0.05	8.00	20.73
2437.00	-23.73	0.97	9.82	-12.94	0.05	8.00	20.94
2462.00	-24.01	0.97	9.80	-13.24	0.05	8.00	21.24

Sample Calculation:

Result = Reading + Cable Loss + Attenuator Loss

Power Density

Report No. 13554183S-A
Test place Shonan EMC Lab. No.5 Shielded Room
Date November 7, 2020 November 13, 2020
Temperature / Humidity 23 deg. C / 40 % RH 24 deg. C / 49 % RH
Engineer Makoto Hosaka Yusuke Tanikawara
Mode Tx 11n-20

11n-20

ANT 0 + ANT 1

Freq. [MHz]	Antenna A Result [mW]	Antenna B Result [mW]	Result		Limit [dBm]	Margin [dB]
			[dBm]	[mW]		
2412.00	0.04	0.06	-9.94	0.10	8.00	17.94
2437.00	0.07	0.07	-8.57	0.14	8.00	16.57
2462.00	0.06	0.06	-9.15	0.12	8.00	17.15

Sample Calculation:

Result = ANT 0 Result + ANT 1 Result

ANT 0

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit [dBm]	Margin [dB]
				[dBm]	[mW]		
2412.00	-24.52	0.97	9.63	-13.92	0.04	8.00	21.92
2437.00	-22.25	0.97	9.63	-11.65	0.07	8.00	19.65
2462.00	-22.78	0.96	9.63	-12.19	0.06	8.00	20.19

ANT 1

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit [dBm]	Margin [dB]
				[dBm]	[mW]		
2412.00	-22.94	0.98	9.81	-12.15	0.06	8.00	20.15
2437.00	-22.30	0.97	9.82	-11.51	0.07	8.00	19.51
2462.00	-22.90	0.97	9.80	-12.13	0.06	8.00	20.13

Sample Calculation:

Result = Reading + Cable Loss + Attenuator Loss

Power Density

Report No. 13554183S-A
Test place Shonan EMC Lab. No.6 Shielded Room
Date October 14, 2020
Temperature / Humidity 27 deg. C / 45 % RH
Engineer Kazuya Noda
Mode Tx BT LE

BT LE 1 M-PHY

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402	-19.61	0.99	9.81	-8.81	8.00	16.81
2440	-19.88	0.98	9.82	-9.08	8.00	17.08
2480	-20.59	0.97	9.82	-9.80	8.00	17.80

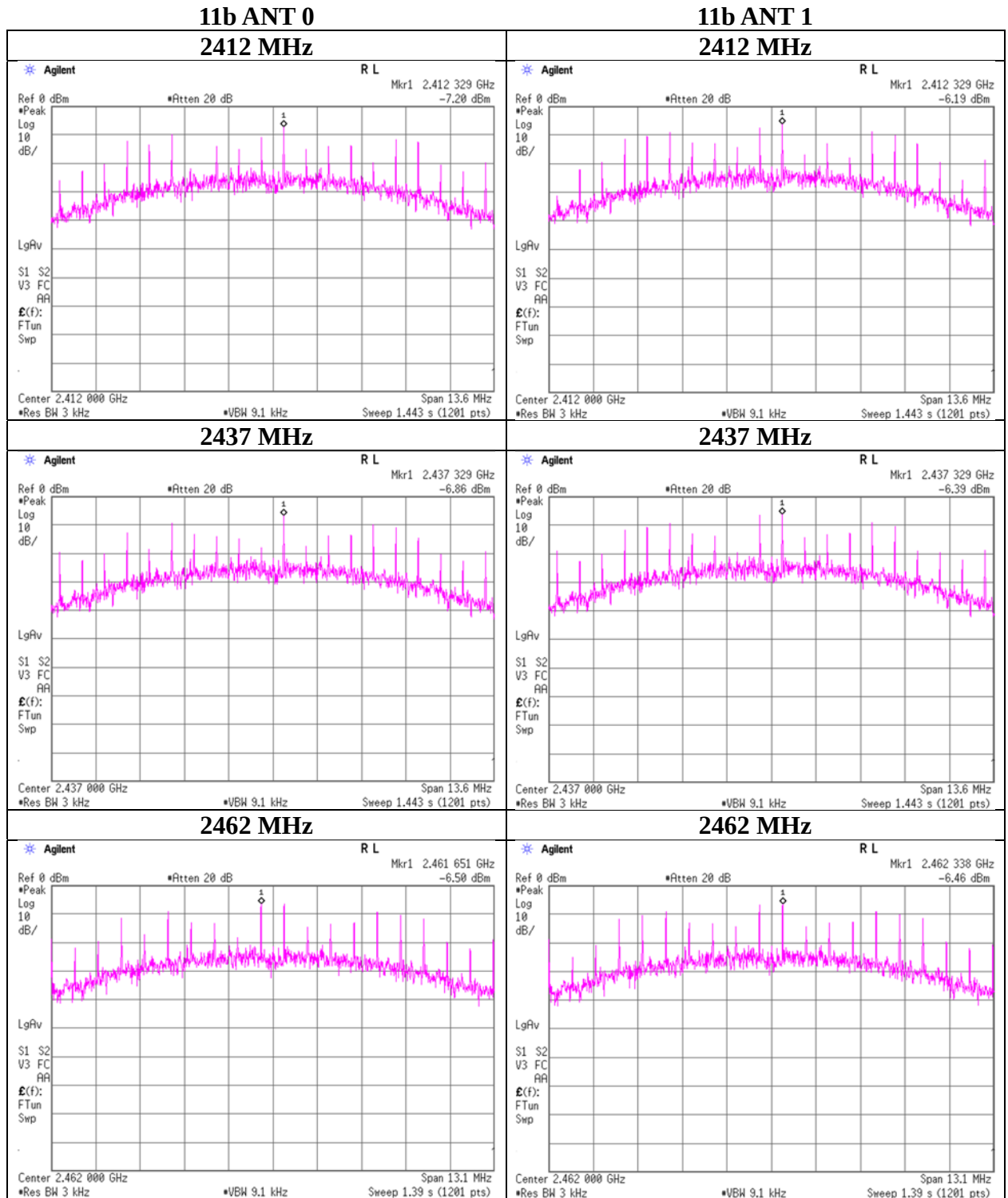
BT LE 2 M-PHY

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402	-22.38	0.99	9.81	-11.58	8.00	19.58
2440	-22.71	0.98	9.82	-11.91	8.00	19.91
2480	-23.43	0.97	9.82	-12.64	8.00	20.64

Sample Calculation:

Result = Reading + Cable Loss + Attenuator Loss

Power Density



UL Japan, Inc.

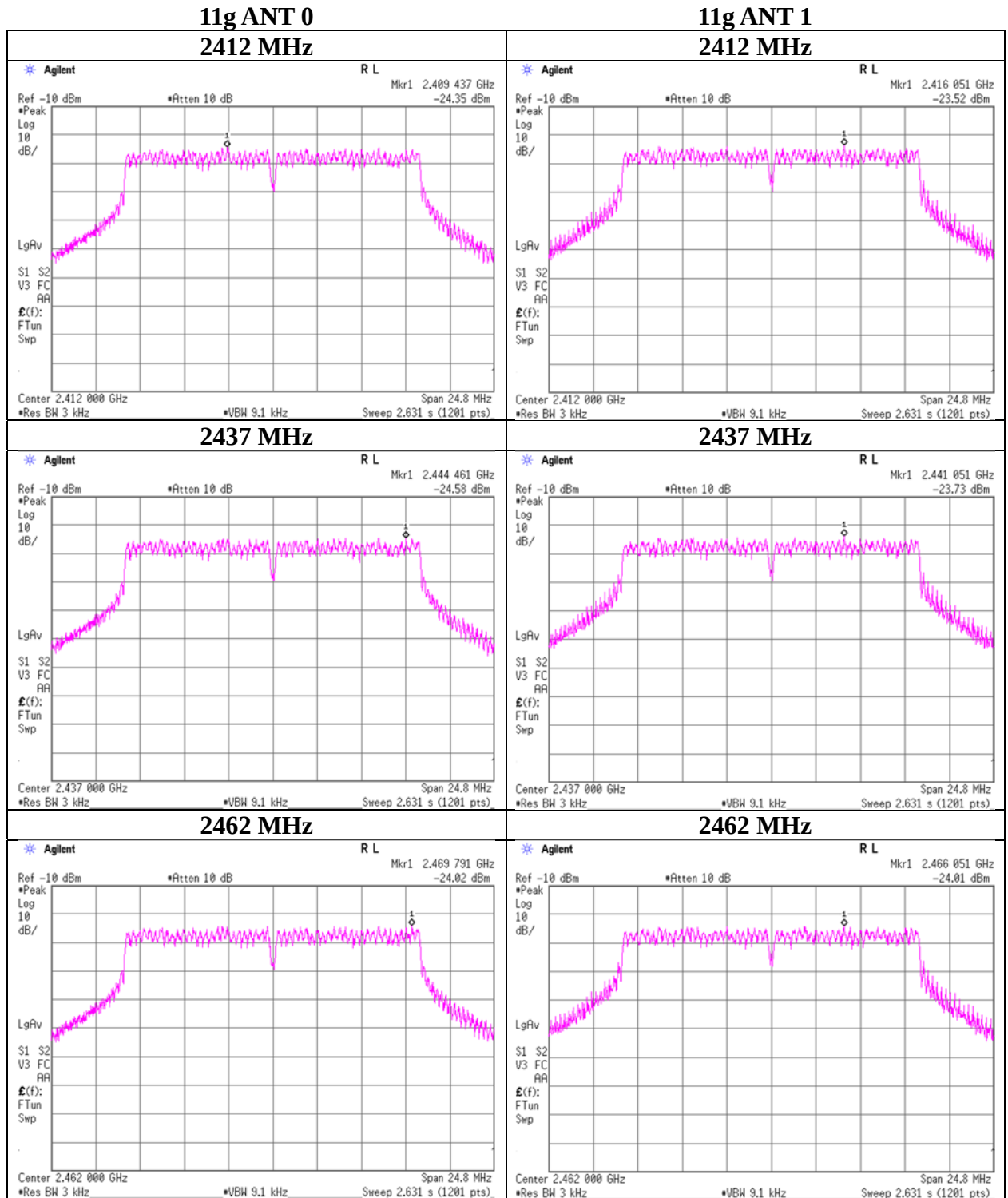
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Power Density



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

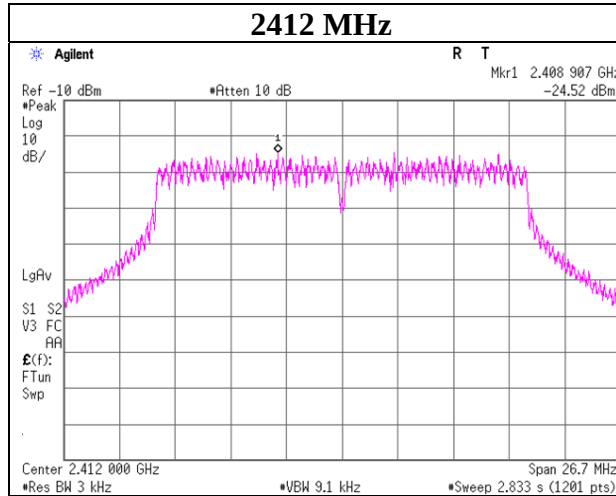
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Power Density

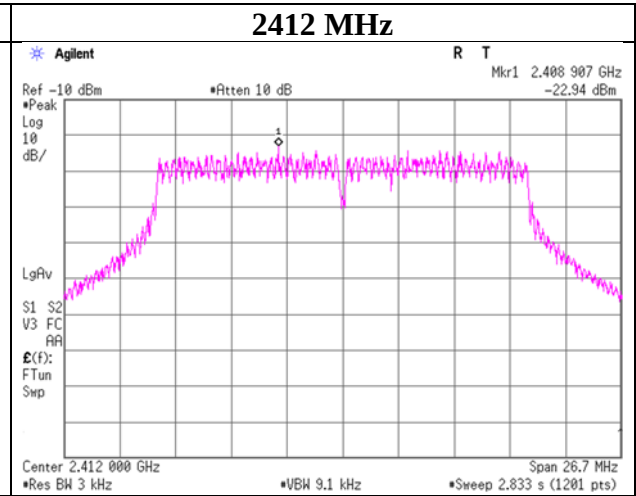
11n-20 ANT 0

2412 MHz

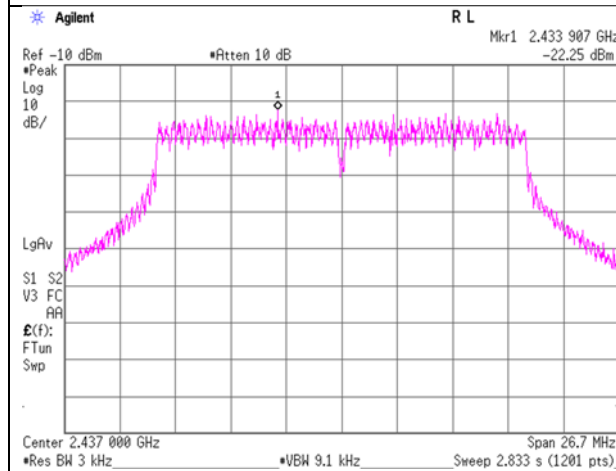


11n-20 ANT 1

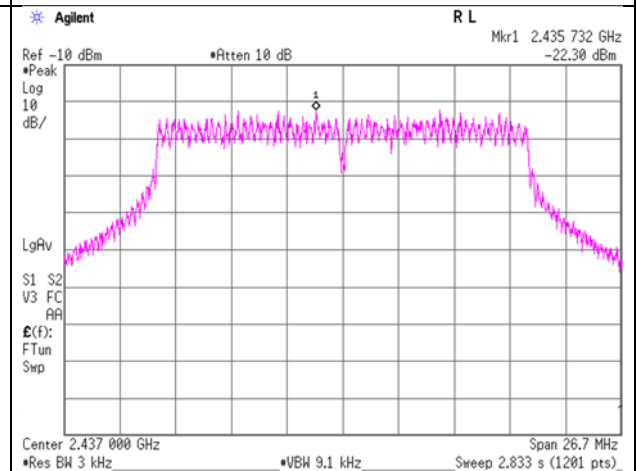
2412 MHz



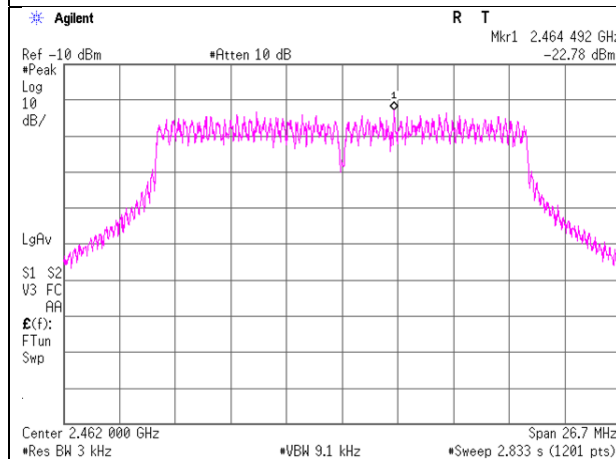
2437 MHz



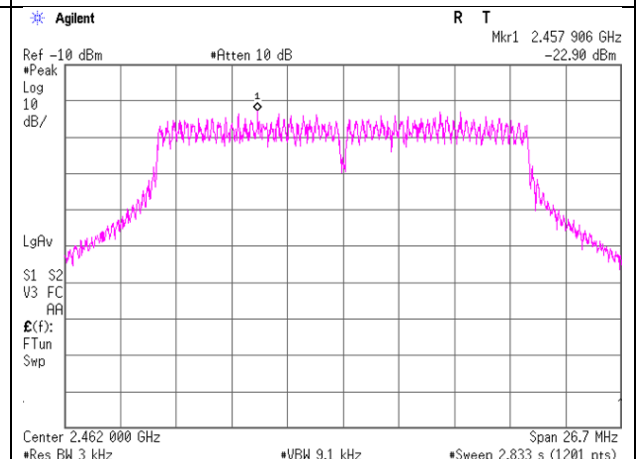
2437 MHz



2462 MHz



2462 MHz



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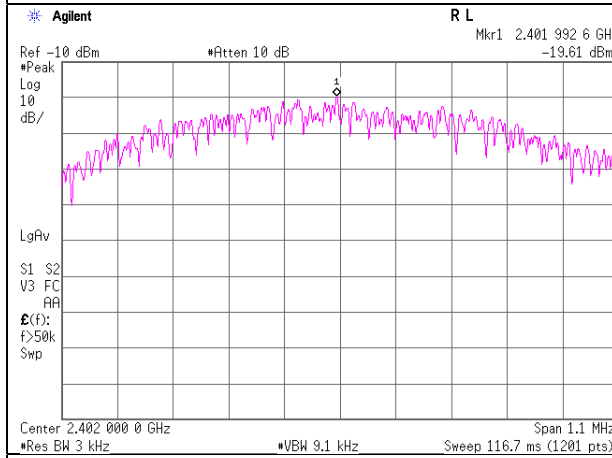
Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Power Density

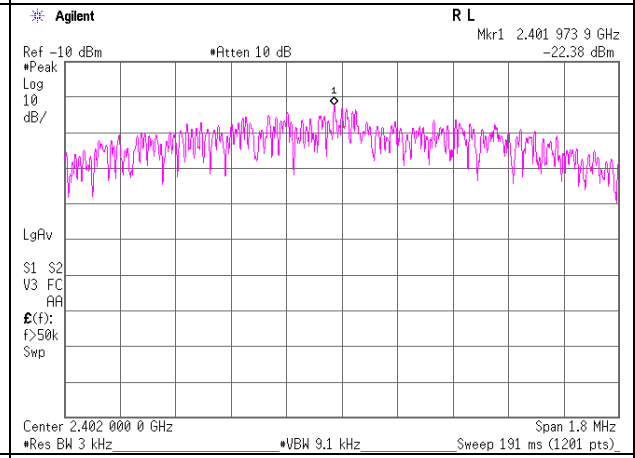
BT LE 1 M-PHY

2402 MHz

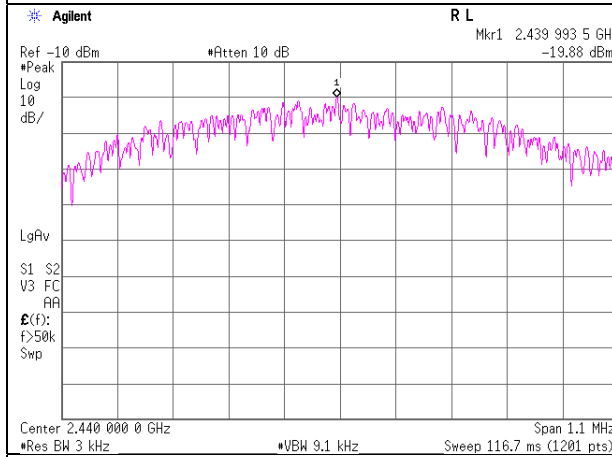


BT LE 2 M-PHY

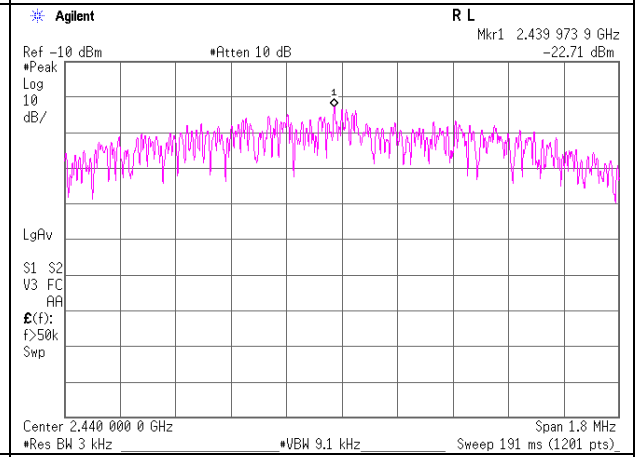
2402 MHz



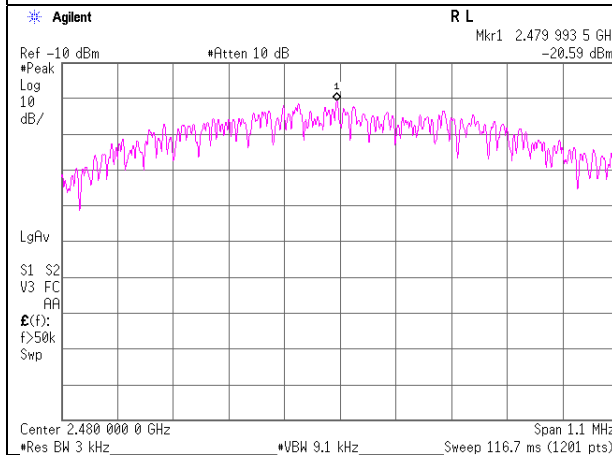
2440 MHz



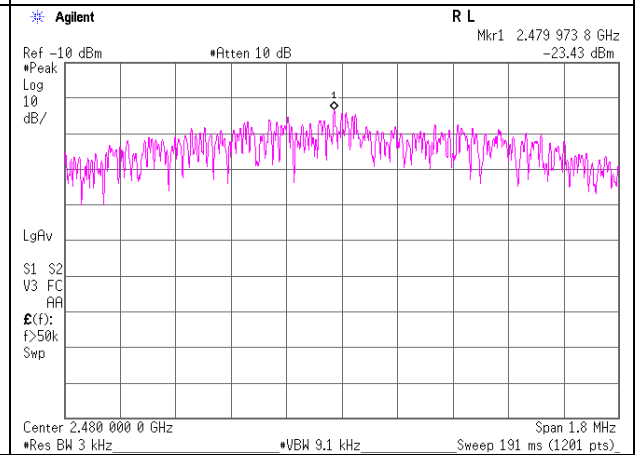
2440 MHz



2480 MHz



2480 MHz



UL Japan, Inc.

Shonan EMC Lab.

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

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APPENDIX 2: Test instruments

Test equipment (1/3)

Test Name	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Interval (Month)
AT	KTS-06	145110	Digital Tester	SANWA	PC500	7019240	2020/04/09	12
AT	KTS-07	145111	Digital Tester	SANWA	PC500	7019232	2020/10/21	12
AT	SAT10-09	145132	Attenuator	Weinschel Corp.	54A-10	W5692	2020/10/05	12
AT	SAT10-14	154591	Attenuator	Weinschel Corp.	54A-10	81595	2020/04/01	12
AT	SCC-G52	179106	Coaxial Cable	Junkosha	MWX241-01000KMSKMS/B	1901Q061-R	2020/04/01	12
AT	SCC-G53	179107	Coaxial Cable	Junkosha	MWX241-01000KMSKMS/B	1901Q062-R	2020/04/01	12
AT	SCC-H21	197395	Microwave cable	RS Pro	R-132G7210100CO	-	2020/04/07	12
AT	SCC-H22	197396	Microwave cable	RS Pro	R-132G7210100CO	-	2020/04/07	12
AT	SCC-H23	199603	Microwave cable	RS Pro	R-132G7210100CO	-	2020/06/12	12
AT	SOS-05	146293	Humidity Indicator	A&D Company	AD-5681	4062518	2020/09/30	12
AT	SOS-27	191845	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2020/09/29	12
AT	SPM-07	146247	Power Meter	Keysight Technologies Inc	8990B	MY5100272	2020/05/27	12
AT	SPM-13	169910	Power Meter	Keysight Technologies Inc	8990B	MY51000448	2020/01/28	12
AT	SPSS-04	146310	Power sensor	Keysight Technologies Inc	N1923A	MY5326009	2020/05/27	12
AT	SPSS-06	169911	Power sensor	Keysight Technologies Inc	N1923A	MY57270004	2020/01/28	12
AT	SPSS-07	169912	Power sensor	Keysight Technologies Inc	N1923A	MY57290005	2020/01/28	12
AT	SRENT-15	160899	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46185516	2020/01/15	12
AT	SSA-02	145800	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY48250106	2020/04/16	12
AT	STM-G7	171614	Terminator	Weinschel - API Technologies Corp	M1459A	88995	2020/06/03	12
AT	STM-G8	171615	Terminator	Weinschel - API Technologies Corp	M1459A	88997	2020/06/03	12
AT	STS-05	146212	Digital Hitester	Hioki	3805-50	80997828	2020/10/19	12
AT	KSA-08	145089	Spectrum Analyzer	Keysight Technologies Inc	E4446A	MY46180525	2019/11/05	12

Test equipment (2/3)

Test Name	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Interval (Month)
RE	COTS-SEMI-5	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,ME,PE)	-	-	-
RE	KAT6-04	144899	Attenuator	Inmet	18N-6dB	-	2019/12/05	12
RE	KJM-02	146432	Measure	TAJIMA	GL19-55	-	-	-
RE	KJM-09	145929	Measure	KOMELON	KMC-36	-	-	-
RE	SAEC-01(NSA)	145597	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	2020/04/08	12
RE	SAEC-01(SVSWR)	145561	Semi-Anechoic Chamber	TDK	SAEC-01(SVSWR)	1	2020/05/04	12
RE	SAEC-03(SVSWR)	145566	Semi-Anechoic Chamber	TDK	SAEC-03(SVSWR)	3	2020/05/11	12
RE	SAF-01	145003	Pre Amplifier	SONOMA	310N	290211	2020/02/19	12
RE	SAF-04	145127	Pre Amplifier	Toyo Corporation	TPA0118-36	2072554	2020/06/02	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	SAT10-05	145136	Attenuator	Keysight Technologies Inc	8493C-010	74864	2020/10/05	12
RE	SAT10-06	145137	Attenuator	Keysight Technologies Inc	8493C-010	74865	2020/10/05	12
RE	SAT3-09	144959	Attenuator	JFW	50HF-003N	-	2020/08/18	12
RE	SBA-01	145161	Biconical Antenna	Schwarzbeck Mess - Elektronik	BBA9106	91032664	2020/04/04	12
RE	SCC-A1/A3/A5/A7/A8/A13/SRSE-01	144967	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	2020/04/12	12
RE	SCC-A2/A4/A6/A7/A8/A13/SRSE-01	144968	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/141PE/NS4906	-/0901-269(RF Selector)	2020/04/12	12
RE	SCC-G05	145039	Coaxial Cable	Junkosha	J12J102207-00	APR-30-15-037	2020/01/31	12
RE	SCC-G15	145176	Coaxial Cable	Suhner	SUCOFLEX 102	32703/2	2020/03/04	12
RE	SCC-G40	166491	Coaxial Cable	Junkosha	MWX221-01000NFSNMS/B	1612S005	2020/01/08	12
RE	SCC-G41	151617	Coaxial Cable	Junkosha	MWX221-01000NFSNMS/B	1612S006	2020/01/08	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+SUNER	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	SCC-G62	196985	Coaxial Cable	HUBER+SUNER	SUCOFLEX 102	803650/2	2020/03/10	12
RE	SCC-G68	200008	Coaxial Cable	HUBER+SUNER	SUCOFLEX 104	575616/4	2020/07/07	12

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Test equipment (3/3)

Test Name	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Interval (Month)
RE	SFL-02	145301	Highpass Filter	MICRO-TRONICS	HPM50111	51	2020/10/05	12
RE	SFL-18	145305	Highpass Filter	MICRO-TRONICS	HPM50111	119	2020/04/03	12
RE	SHA-01	145383	Horn Antenna	Schwarzbeck Mess - Elektronik	BBHA9120D	9120D-725	2020/05/27	12
RE	SHA-03	145501	Horn Antenna	Schwarzbeck Mess - Elektronik	BBHA9120D	9120D-739	2020/06/15	12
RE	SHA-04	145512	Horn Antenna	ETS LINDGREN	3160-09	00094868	2020/06/15	12
RE	SHA-08	194683	Horn Antenna	Schwarzbeck Mess - Elektronik	BBHA 9120 C	694	2020/02/17	12
RE	KSA-08	145089	Spectrum Analyzer	Keysight Technologies Inc	E4446A	MY46180525	2019/11/05	12
RE	SLA-05	145527	Logperiodic Antenna	Schwarzbeck Mess - Elektronik	VUSLP9111B	193	2020/04/04	12
RE	SOS-20	191837	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2020/09/28	12
RE	SOS-23	191840	Humidity Indicator	CUSTOM. Inc	CTH-201	-	2020/09/28	12
RE	SRENT-09	150461	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46186392	2020/02/10	12
RE	SSA-03	145801	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY48250152	2020/08/12	12
RE	STR-07	146209	Receiver, EMI	Rohde & Schwarz	ESU26	100484	2020/09/07	12
RE	STS-01	145792	Digital Hitester	Hioki	3805-50	80997812	2020/10/19	12
RE	STS-03	146210	Digital Hitester	Hioki	3805-50	80997823	2020/10/19	12
RE	STS-04	146211	Digital Hitester	Hioki	3805-50	80997827	2020/04/09	12
CE	COTS-SEMI-5	170932	EMI Software	TSJ (Techno Science Japan)	TEPTO-DV3(RE,CE,ME,PE)	-	-	-
CE	KJM-09	145929	Measure	KOMELON	KMC-36	-	-	-
CE	SAT3-13	150923	Attenuator	JFW	50HF-003N	-	2020/01/30	12
CE	SCC-A12/A13/SRSE-01	144966	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/NS4906	-/0901-269(RF Selector)	2020/04/12	12
CE	SLS-02	145539	LISN	Rohde & Schwarz	ENV216	100512	2020/02/18	12
CE	SOS-16	167990	Humidity Indicator	CUSTOM. Inc	CTH-202	708Q08R	2020/10/01	12
CE	STR-06	146208	Test Receiver	Rohde & Schwarz	ESCI	101259	2020/04/01	12
CE	STS-01	145792	Digital Hitester	Hioki	3805-50	80997812	2020/10/19	12

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

The expiration date of the calibration is the end of the expired month.

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

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

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

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