



RADIO TEST REPORT

Test Report No. : 13395143H-A-R1

Applicant : Panasonic Corporation of North America

Type of EUT : Body Worn Camera

Model Number of EUT : WV-BWC4000

FCC ID : ACJ9TAWV-BWC4000

Test regulation : FCC Part 15 Subpart C: 2020

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.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by the A2LA accreditation body.
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. Ise EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. The information provided from the customer for this report is identified in Section 1.
10. This report is a revised version of 13395143H-A. 13395143H-A is replaced with this report.

Date of test: June 11 to September 8, 2020

Representative test engineer:

Junki Nagatomi
Engineer

Consumer Technology Division

Approved by:

Tsubasa Takayama
Leader

Consumer Technology Division



CERTIFICATE 5107.02

- ☐ 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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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

REVISION HISTORY

Original Test Report No.: 13395143H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13395143H-A	August 24, 2020	-	-
1	13395143H-A-R1	September 11, 2020	P12 - 13	Corrected Model number of Item No. A; WV-BWC-4000 → WV-BWC4000
1	13395143H-A-R1	September 11, 2020	P26	Remeasured Maximum Peak Output Power on BT LE mode

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Reference: Abbreviations (Including words undescribed in this report)

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

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

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SECTION 1: Customer information

Applicant

Company Name	Panasonic Corporation of North America	
Address	Two Riverfront Plaza, Newark, NJ 07102-5490	
Contact Person	Vir Angelo Lontoc	Ben Botros
Telephone Number	+1-201-348-7724	+1-201-348-7760
Facsimile Number	+1-201-392-4564	-
E-mail	virangelo.lontoc@us.panasonic.com	Ben.Botros@us.panasonic.com

Manufacturer

Company Name	Panasonic i-PRO Sensing Solutions Co., Ltd.
Address	1-62, 4-chome, Minoshima, Hakata-ku, Fukuoka 812-8531 Japan
Telephone Number	+81-80-3358-7203
Contact Person	Koji Yamasaki

***Remarks:**

Panasonic Corporation of North America designates Panasonic i-PRO Sensing Solutions Co., Ltd. as manufacturer of the product (Body Worn Camera).

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	:	Body Worn Camera
Model Number	:	WV-BWC4000
Serial Number	:	Refer to SECTION 4.2
Rating	:	DC 3 V to DC 4.15 V < Rechargeable Li-ion Battery Pack > Model: WV-BWC40B1 Nominal Voltage: DC 3.6 V Rated Capacity: 2670mAh, 9.6Wh
Receipt Date	:	June 1, 2020
Country of Mass-production	:	Japan
Condition	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	:	No Modification by the test lab.

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2.2 Product Description

Model: WV-BWC4000 (referred to as the EUT in this report) is a Body Worn Camera.

Radio Specification

Specification of Wireless LAN (IEEE802.11b/g/a/n-20/n-40/11ac-20/11ac-40/11ac-80)

Type of radio	IEEE802.11b	IEEE802.11g/n (20 M band)	IEEE802.11a/n/ac (20 M band)	IEEE802.11n/ac (40 M band)	IEEE802.11ac (80 M band)
Equipment Type	Transceiver				
Frequency of operation	2412 MHz - 2462 MHz	2412 MHz - 2462 MHz	5280 MHz - 5320 MHz 5500 MHz - 5580 MHz 5660 MHz - 5720 MHz 5745 MHz - 5825 MHz	5310 MHz 5510 MHz - 5550 MHz 5670 MHz - 5710 MHz 5755 MHz - 5795 MHz	5530 MHz 5690 MHz 5775 MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK, 256QAM(IEEE802.11ac only))		
Channel spacing	5 MHz		20 MHz	40 MHz	80 MHz
Bandwidth	20MHz		20 MHz	40 MHz	80 MHz
Antenna type	2.4 GHz: FPC Antenna 5 GHz: Pattern Antenna				
Antenna Gain	2.4 GHz: 1.5 dBi 5 GHz: 4 dBi				
Operating temperature range	-20 deg. C. to +50 deg. C.				

Specification of Bluetooth (Low Energy: LE)

	Bluetooth
Equipment Type	Transceiver
Frequency of operation	2402 MHz -2480 MHz
Type of modulation	GFSK
Bandwidth & Channel spacing	Bandwidth : 1 MHz Channel spacing : 2 MHz
Antenna type	FPC Antenna
Antenna Gain	1.5 dBi
Operating temperature range	-20 deg. C. to +50 deg. C.

GNSS

Radio Type	: Receiver
Frequency of Operation	: See table below.
Antenna type	: Active Antenna
Antenna Gain	: 8.56 dBic

Supported GNSS and GNSS signals

GNSS	RNSS Frequency Band / Frequency [MHz]		
	1559 to 1610	1215 to 1300	1164 to 1215
BDS	☐ B1I 1561.098	-	-
Galileo	☐ E1 1575.42	☐ E6 1278.75	☐ E5a 1176.45 ☐ E5b 1207.14
GLONASS	☐ G1 1598.0625 - 1605.375	☐ G2 1242.9375 - 1248.625	-
GPS	☒ L1 1575.42	☐ L2 1227.6	☐ L5 1176.45
SBAS	☐ L1 1575.42	-	☐ L5 1176.45

- ☒ Supported GNSS signal
☐ Not supported GNSS signal

* This test report applies to Wireless LAN (2.4 GHz Band) and Bluetooth Low Energy.
* Wireless LAN and Bluetooth Low Energy do not transmit simultaneously.

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on June 26, 2020 and effective July 27, 2020 except 15.258

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

* The revision does not affect the test result conducted before its effective date.

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	-	N/A	*1)
6dB 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 a)	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 b)	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 c)	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	1.6 dB 816.001 MHz / 816.007 MHz, QP, Horizontal	Complied# d), e)	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *2)

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.

*1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.

*2) 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 6 dB Bandwidth and 99 % Occupied Bandwidth)

b) Refer to APPENDIX 1 (data of Maximum Peak Output Power)

c) Refer to APPENDIX 1 (data of Power Density)

d) Refer to APPENDIX 1 (data of Conducted Spurious Emission)

e) Refer to APPENDIX 1 (data of Radiated Spurious Emission)

Symbols:

Complied The data of this test item has enough margin, more than the measurement uncertainty.

Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.

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

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FCC Part 15.31 (e)

The test was performed with the New Battery and the stable voltage was supplied to the EUT during the tests. Therefore, the 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.

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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Antenna Terminal test

Test Item	Uncertainty (+/-)
20 dB Bandwidth / 99 % Occupied Bandwidth	0.96 %
Maximum Peak Output Power / Average Output Power	1.4 dB
Carrier Frequency Separation	0.42 %
Dwell time / Burst rate	0.10 %
Conducted Spurious Emission	2.6 dB

Radiated emission

Measurement distance	Frequency range	Uncertainty (+/-)
3 m	9 kHz to 30 MHz	3.3 dB
10 m		3.2 dB
3 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
		5.0 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.2 dB
		6.3 dB
10 m	30 MHz to 200 MHz (Horizontal) (Vertical)	4.8 dB
		4.8 dB
	200 MHz to 1000 MHz (Horizontal) (Vertical)	5.0 dB
		5.0 dB
3 m	1 GHz to 6 GHz	4.9 dB
	6 GHz to 18 GHz	5.2 dB
1 m	10 GHz to 26.5 GHz	5.5 dB
	26.5 GHz to 40 GHz	5.5 dB
10 m	1 GHz to 18 GHz	5.2 dB

3.5 Test Location

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*A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 199967 / ISED Lab Company Number: 2973C

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Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124

Test site	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.5 measurement room	6.4 x 6.4 x 3.0	6.4 x 6.4	-	-
No.6 shielded room	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	3.1 x 5.0 x 2.7	3.1 x 5.0	-	-
No.9 measurement room	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0 m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

Test operating mode was determined as follows according to “Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009.

Mode	Remarks*
IEEE 802.11b (11b)	2 Mbps, PN9
IEEE 802.11g (11g)	12 Mbps, PN9
IEEE 802.11n SISO 20 MHz BW (11n-20)	MCS 1 (Long GI), PN9
Bluetooth Low Energy (BT LE)	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: <WLAN> See Table 1 <BT LE> 6 dBm (Same as production model) Software: Teraterm, Version 4.87 (Date: May 31, 2015 / 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.	

*Details of Operating mode for WLAN

Test Item	Operating Mode	Tested frequency
Radiated Spurious Emission (Below 1 GHz) Conducted Spurious Emission	11n-20 Tx *1)	2437 MHz
Radiated Spurious Emission (Above 1 GHz)	11b Tx 11n-20 Tx *2)	2412 MHz 2437 MHz 2462 MHz
6dB Bandwidth 99% Occupied Bandwidth Maximum Peak Output Power Power Density	11b Tx 11g Tx 11n-20 Tx	2412 MHz 2437 MHz 2462 MHz
*1) The mode was tested as a representative, because it had the highest power at antenna terminal test. *2) Since 11g and 11n-20 have the same modulation method and no differences in transmitting specification, test was performed on the representative mode that had the highest peak output power.		

*Details of Operating mode for BT LE

Test Item	Operating Mode	Tested frequency
Radiated Spurious Emission Maximum Peak Output Power Power Density 6dB Bandwidth 99% Occupied Bandwidth Conducted Spurious Emission	BT LE	2402 MHz 2440 MHz 2480 MHz

[Table 1: Power settings]

Mode	data rate/Mbps	Power (max) [dBm]
11b	1, 2, 5.5, 11	18
11g	24, 36, 48, 54 6, 9, 12, 18	10 12
11n-20	MCS 5, 6, 7 MCS 0, 1, 2, 3, 4	10 12

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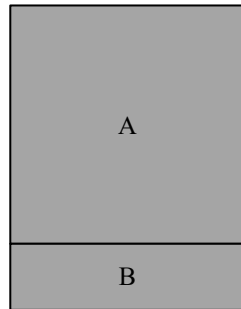
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4.2 Configuration and peripherals

For Radiated Spurious Emission test

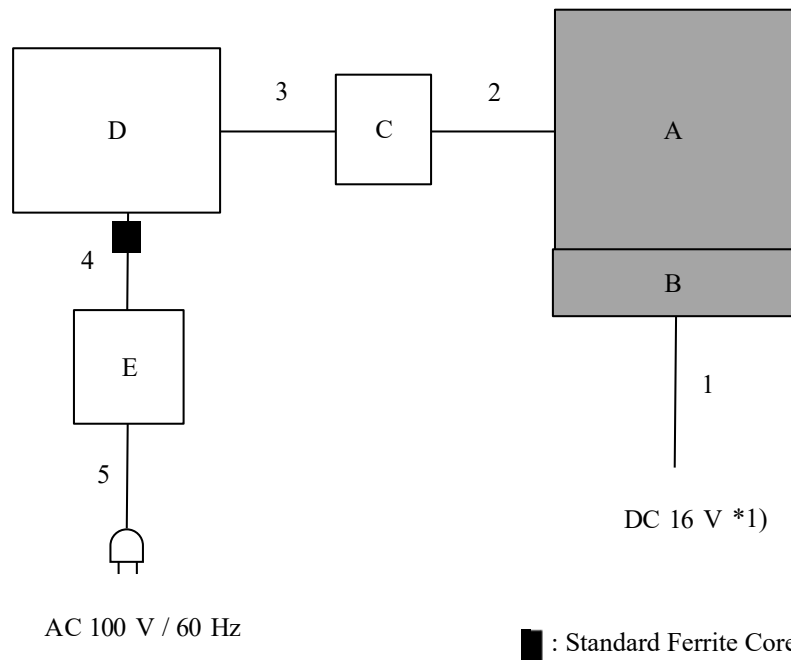


* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Body Worm Camera	WV-BWC4000	52	Panasonic i-PRO Sensing Solutions Co., Ltd.	EUT
B	Rechargeable Li-ion Battery Pack	WV-BWC40B1	20031170056	Panasonic i-PRO Sensing Solutions Co., Ltd.	EUT

For Antenna Terminal Conducted Tests



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

*1) The test was conducted while charging the battery (DC 16 V). DC 3.6 V is constantly supplied to the EUT through the battery.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Body Worm Camera	WV-BWC4000	48	Panasonic i-PRO Sensing Solutions Co., Ltd.	EUT
B	Rechargeable Li-ion Battery Pack	WV-BWC40B1	20031170033	Panasonic i-PRO Sensing Solutions Co., Ltd.	EUT
C	Jig	-	-	-	-
D	Laptop PC	CF-N8HWCDPS	9LKSA04258	Panasonic	-
E	AC Adapter	CF-AA6372B	6372BM409X14 190B	Panasonic	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	0.60	Unshielded	Unshielded	-
2	Signal Cable	0.17	Unshielded	Unshielded	-
3	USB Cable	2.00	Shielded	Shielded	-
4	DC Cable	1.00	Unshielded	Unshielded	-
5	AC Cable	1.00	Unshielded	Unshielded	-

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Facsimile : +81 596 24 8124

SECTION 5: 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 FCC15.205 / Table 6 of RSS-Gen 8.10 (ISED).

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	11.12.2.5.1 RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces 11.12.2.5.2 The duty cycle was less than 98% for detected noise, a duty factor was added to the 11.12.2.5.1 results.	RBW: 100 kHz VBW: 300 kHz

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

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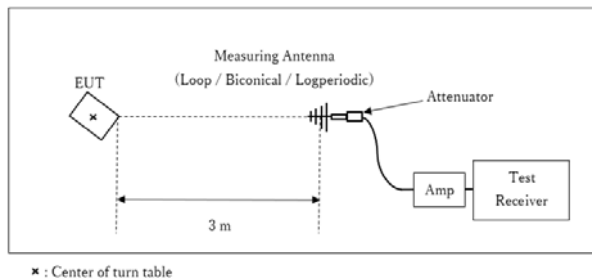
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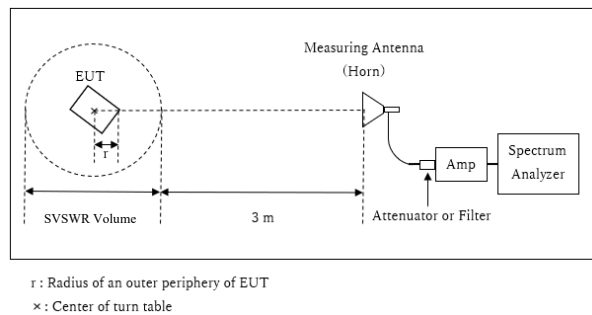
Figure 2: Test Setup

Below 1 GHz



Test Distance: 3 m

1 GHz - 10 GHz



Distance Factor: $20 \times \log (3.95 \text{ m} / 3.0 \text{ m}) = 2.39 \text{ dB}$

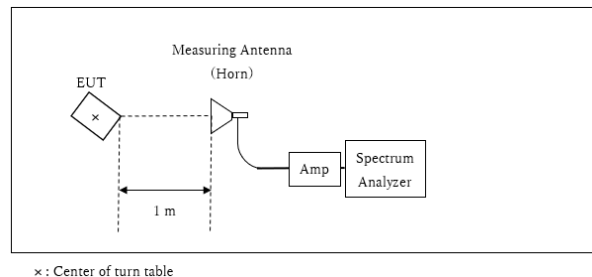
* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 3.95 \text{ m}$

SVSWR Volume : 2.0 m

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

$r = 0.05 \text{ m}$

10 GHz – 26.5 GHz



Distance Factor: $20 \times \log (1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

*Test Distance: 1 m

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT and EUT on cradle to see the position of maximum noise, and the test was made at the position that has the maximum noise.

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

Measurement range	: 30 MHz - 26.5 GHz
Test data	: APPENDIX
Test result	: Pass

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SECTION 6: 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
6dB Bandwidth	20 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: 50 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	30 kHz	100 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3) *4)
Conducted Spurious Emission *5) *6)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1 kHz	27 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) The test was not performed at RBW:3 kHz however the measurement is to be performed with RBW:3kHz in the regulation, because, the measurement value with RBW:3 kHz is less than the value of RBW:30 kHz and the test data met the limit with RBW:30 kHz.
*5) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents.
Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.
(9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 kHz)
*6) The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohms. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to $45.5 - 51.5 = -6.0$ dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

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

Test data : APPENDIX
Test result : Pass

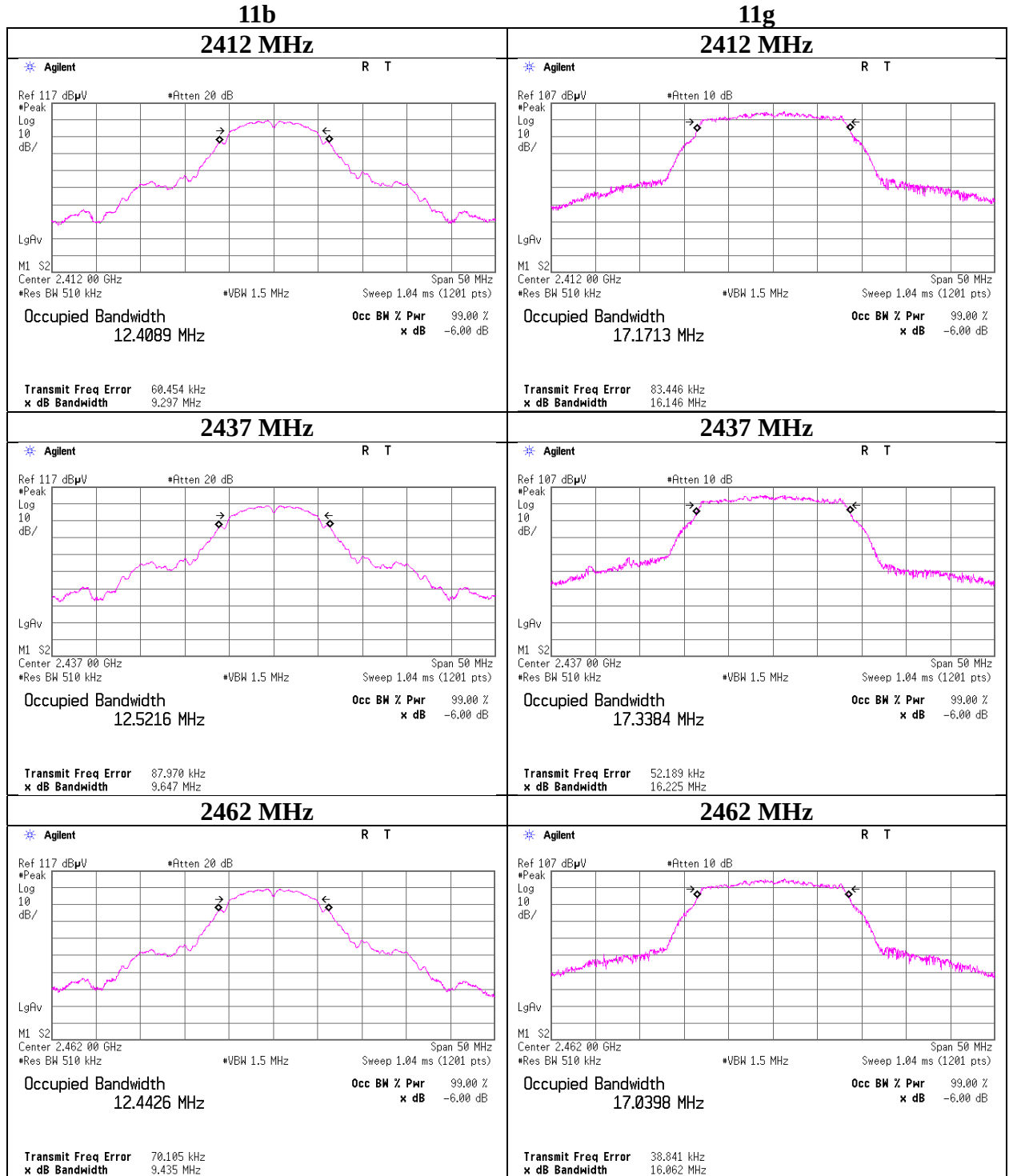
APPENDIX 1: Test data

6 dB Bandwidth and 99 % Occupied Bandwidth

Report No.	13395143H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.4	No.4
Date	June 11, 2020	June 14, 2020	June 16, 2020
Temperature / Humidity	22 deg. C / 51 % RH	23deg. C / 58 % RH	22 deg. C / 52 % RH
Engineer	Junki Nagatomi	Noguchi Takafumi	Junki Nagatomi
Mode	Tx		

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
11b	2412	12408.9	8.993	> 0.5000
	2437	12521.6	8.870	> 0.5000
	2462	12442.6	8.211	> 0.5000
11g	2412	17171.3	15.734	> 0.5000
	2437	17338.4	16.260	> 0.5000
	2462	17039.9	15.434	> 0.5000
11n-20	2412	18184.3	16.590	> 0.5000
	2437	18314.4	17.535	> 0.5000
	2462	18098.0	16.518	> 0.5000
BLE	2402	1064.8	0.711	> 0.5000
	2440	1064.2	0.716	> 0.5000
	2480	1065.5	0.714	> 0.5000

99% Occupied Bandwidth



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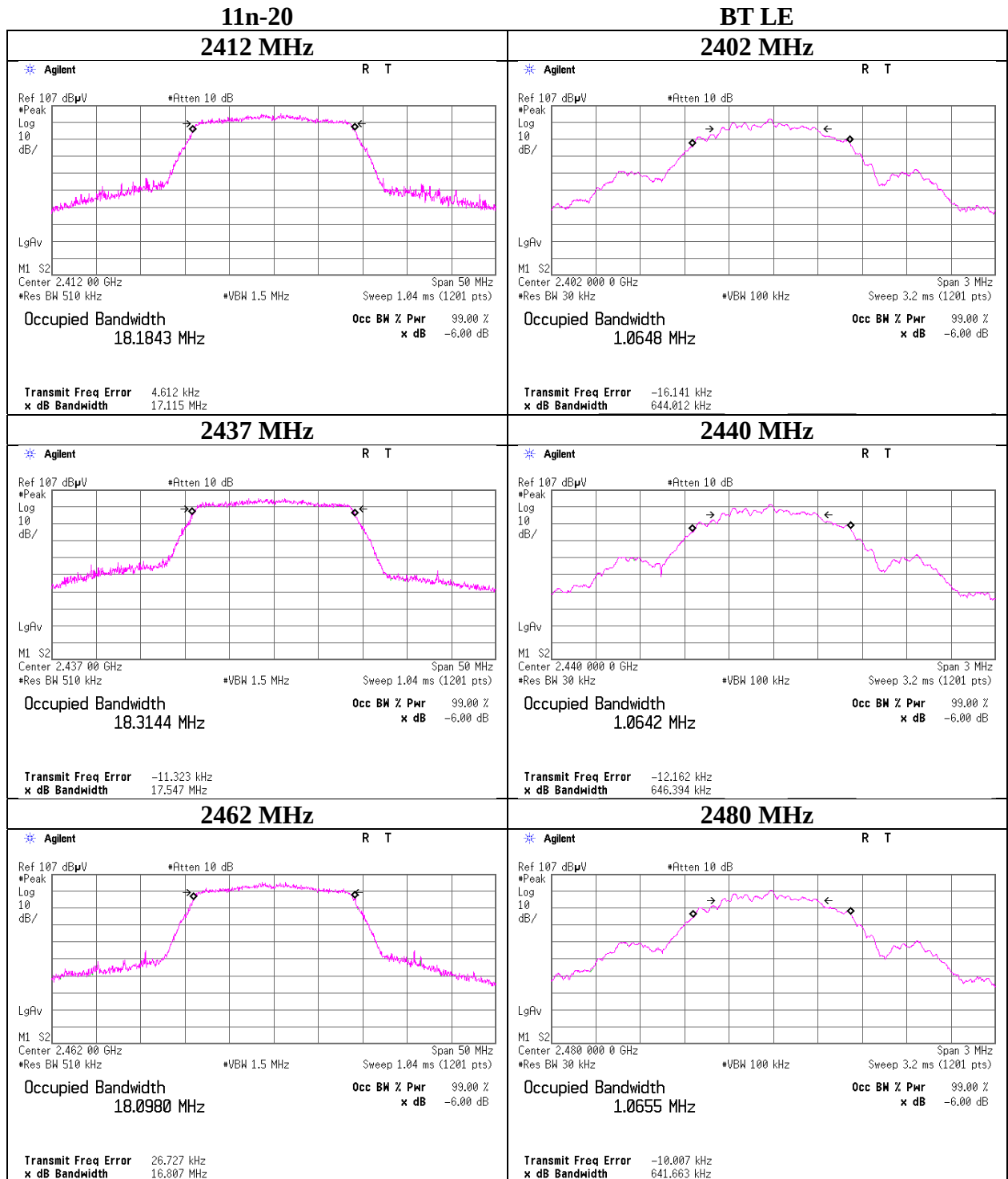
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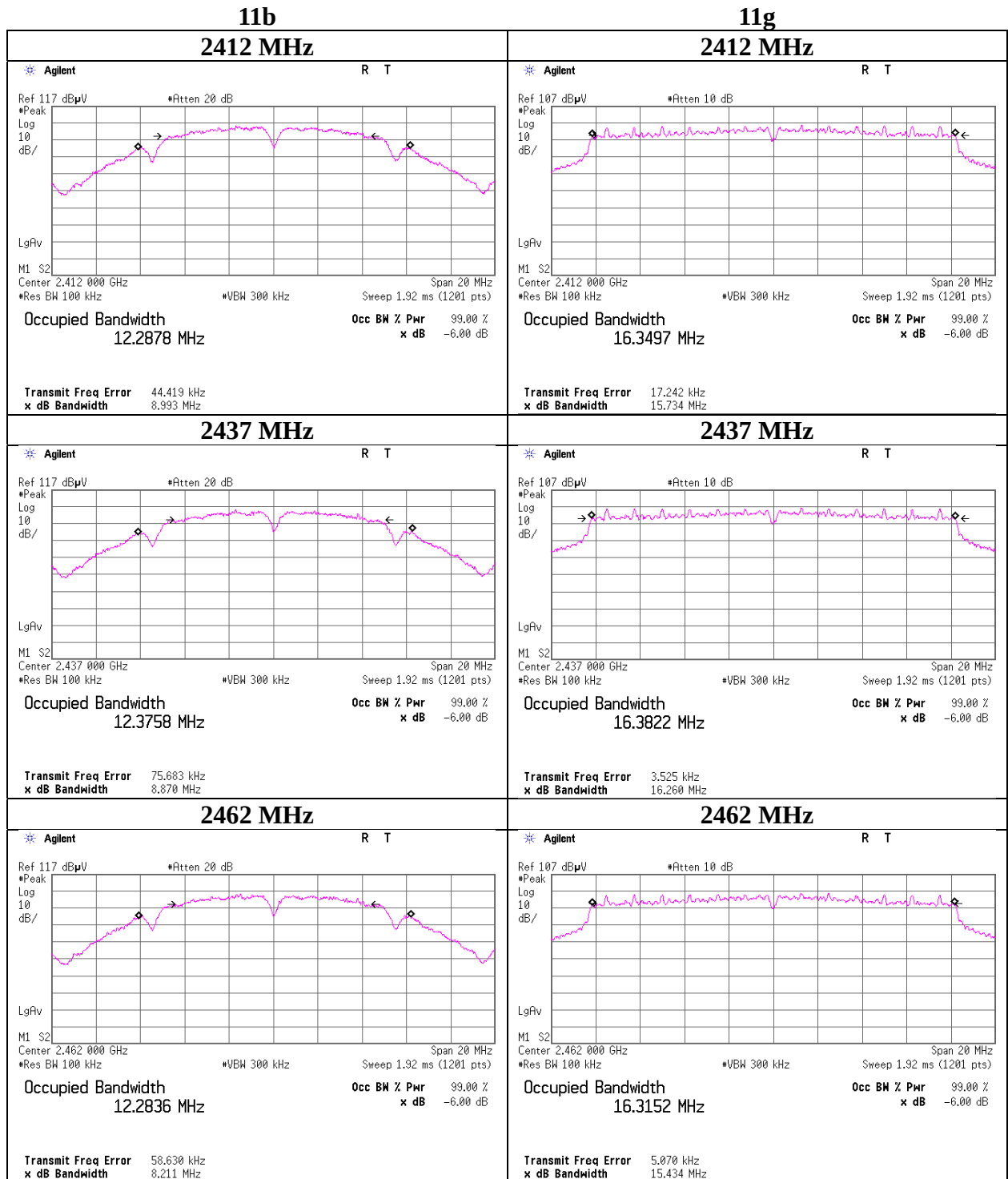
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99% Occupied Bandwidth



6dB Bandwidth



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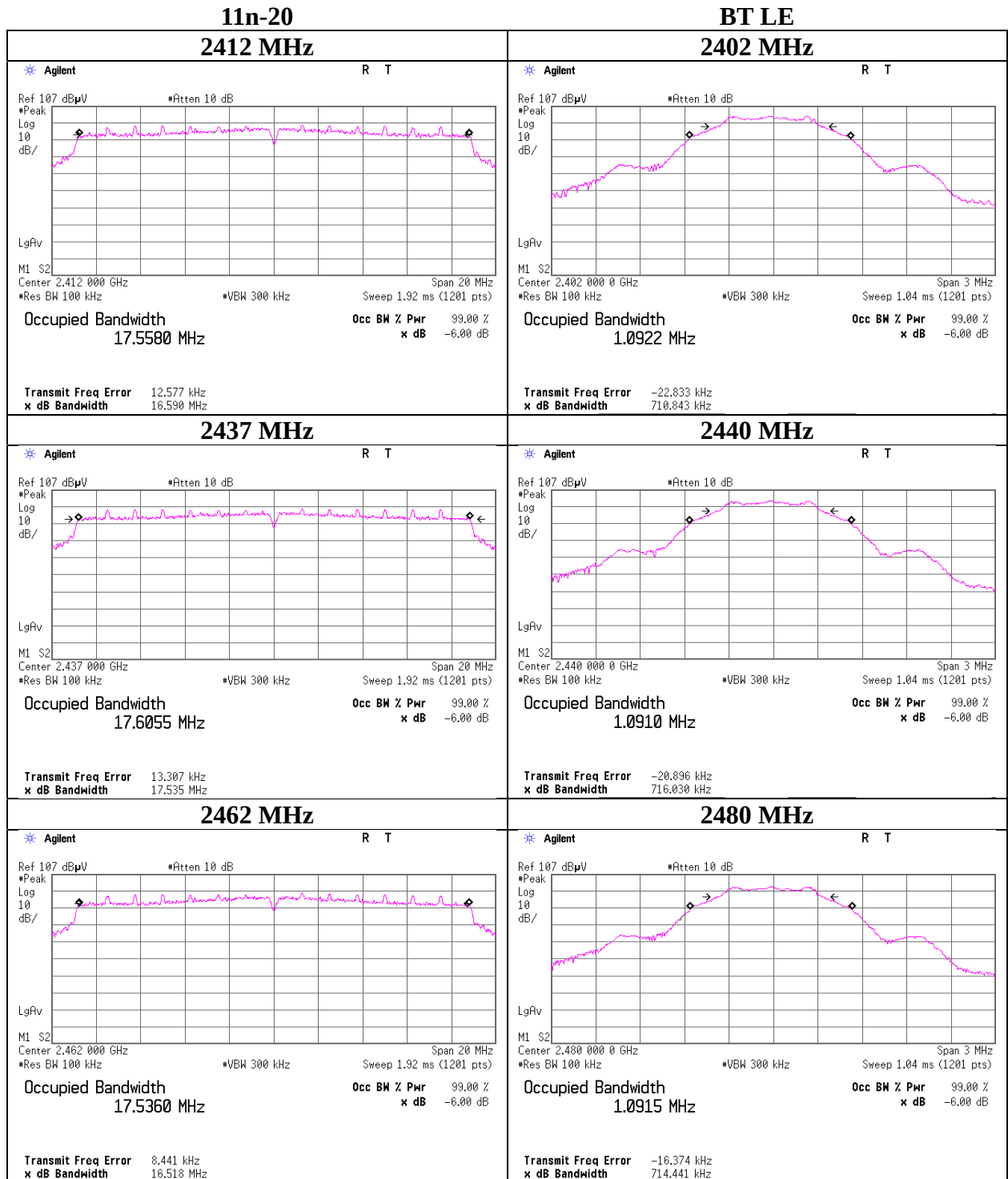
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6dB Bandwidth



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Maximum Peak Output Power

Report No. 13395143H
Test place Ise EMC Lab. No.3 Measurement Room
Date June 9, 2020
Temperature / Humidity 23 deg. C / 54 % RH
Engineer Junki Nagatomi
Mode Tx 11b

Freq.	Reading	Cable Loss	Atten. Loss	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
				[dBm]	[mW]	[dBm]	[mW]			[dB]	[dBm]	[mW]	[dBm]	
2412	9.81	0.90	10.09	20.80	120.23	30.00	1000	9.20	1.50	22.30	169.82	36.02	4000	13.72
2437	9.65	0.90	10.09	20.64	115.88	30.00	1000	9.36	1.50	22.14	163.68	36.02	4000	13.88
2462	9.77	0.90	10.09	20.76	119.12	30.00	1000	9.24	1.50	22.26	168.27	36.02	4000	13.76

Sample Calculation:

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

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

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

Antenna 1, 2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	8.85	
2	9.63	*
5.5	9.59	
11	9.62	

*: Worst Rate

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

Maximum Peak Output Power

Report No.	13395143H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.4
Date	June 9, 2020	June 16, 2020
Temperature / Humidity	23 deg. C / 54 % RH	22 deg. C / 52 % RH
Engineer	Junki Nagatomi	Junki Nagatomi
Mode	Tx 11g	

Antenna 1				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2412	10.37	0.90	10.09	21.36	136.77	30.00	1000	8.64	1.50	22.86	193.20	36.02	4000	13.16
2437	10.62	0.90	10.09	21.61	144.88	30.00	1000	8.39	1.50	23.11	204.64	36.02	4000	12.91
2462	9.79	0.90	10.09	20.78	119.67	30.00	1000	9.22	1.50	22.28	169.04	36.02	4000	13.74

Sample Calculation:

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

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

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

Antenna 1, 2437 MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
6	13.03	
9	13.05	
12	13.21	*
18	13.07	
24	12.48	
36	12.61	
48	13.02	
54	12.49	

*: Worst Rate

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

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Maximum Peak Output Power

Report No.	13395143H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.3	No.4
Date	June 9, 2020	June 16, 2020
Temperature / Humidity	Junki Nagatomi	22 deg. C / 52 % RH
Engineer	23 deg. C / 54 % RH	Junki Nagatomi
Mode	Tx 11n-20	

Antenna 1				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2412	10.70	0.90	10.09	21.69	147.57	30.00	1000	8.31	1.50	23.19	208.45	36.02	4000	12.83
2437	11.29	0.90	10.09	22.28	169.04	30.00	1000	7.72	1.50	23.78	238.78	36.02	4000	12.24
2462	11.03	0.90	10.09	22.02	159.22	30.00	1000	7.98	1.50	23.52	224.91	36.02	4000	12.50

Sample Calculation:

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

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

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

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Maximum Peak Output Power

Report No. 13395143H
Test place Ise EMC Lab. No.3 Measurement Room
Date June 9, 2020
Temperature / Humidity 23 deg. C / 54 % RH
Engineer Junki Nagatomi
Mode Tx 11n-20

Antenna 1, 2437 MHz, Short GI

MCS Number	Reading [dBm]	Remark
0	13.04	
1	13.14	*
2	12.99	
3	13.04	
4	12.97	
5	12.89	
6	12.61	
7	12.52	

* Worst MCS

MCS Number	Reading [dBm]	GI	Remark
1	13.18	Long	*
1	13.14	Short	

* Worst Condition

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

Maximum Peak Output Power

Report No. 13395143H
Test place Ise EMC Lab. No.3 Measurement Room
Date September 8, 2020
Temperature / Humidity 23 deg. C / 56 % RH
Engineer Junki Nagatomi
Mode Tx BT LE

Antenna 1				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-5.65	0.90	10.09	5.34	3.42	30.00	1000	24.66	1.50	6.84	4.83	36.02	4000	29.18
2440	-5.77	0.90	10.09	5.22	3.33	30.00	1000	24.78	1.50	6.72	4.70	36.02	4000	29.30
2480	-5.87	0.90	10.09	5.12	3.25	30.00	1000	24.88	1.50	6.62	4.59	36.02	4000	29.40

Sample Calculation:

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

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

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

Average Output Power (Reference data for SAR testing)

Report No. 13395143H
Test place Ise EMC Lab. No.3 Measurement Room
Date June 9, 2020 June 14, 2020
Temperature / Humidity 23 deg. C / 54 % RH 23deg. C / 58 % RH
Engineer Junki Nagatomi Noguchi Takafumi
Mode Tx

11b 1 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	6.05	0.90	10.09	17.04	50.58	0.04	17.08	51.05
2437	5.74	0.90	10.09	16.73	47.10	0.04	16.77	47.53
2462	5.95	0.90	10.09	16.94	49.43	0.04	16.98	49.89

11g 6 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-0.16	0.90	10.09	10.83	12.11	0.29	11.12	12.94
2437	0.05	0.90	10.09	11.04	12.71	0.29	11.33	13.58
2462	-0.49	0.90	10.09	10.50	11.22	0.29	10.79	11.99

11n-20 MCS 0 Long GI

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-0.76	0.90	10.09	10.23	10.54	0.31	10.54	11.32
2437	-0.48	0.90	10.09	10.51	11.25	0.31	10.82	12.08
2462	-0.82	0.90	10.09	10.17	10.40	0.31	10.48	11.17

BLE

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	-9.27	0.90	10.09	1.72	1.49	3.57	5.29	3.38
2440	-9.36	0.90	10.09	1.63	1.46	3.57	5.20	3.31
2480	-9.92	0.90	10.09	1.07	1.28	3.57	4.64	2.91

Sample Calculation:

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

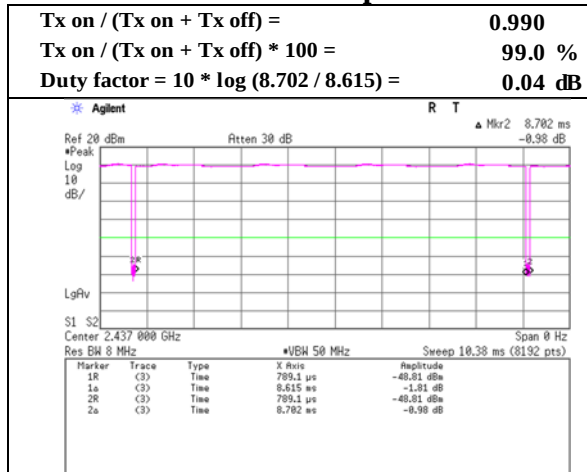
Result (Burst power average) = Time average + Duty factor

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

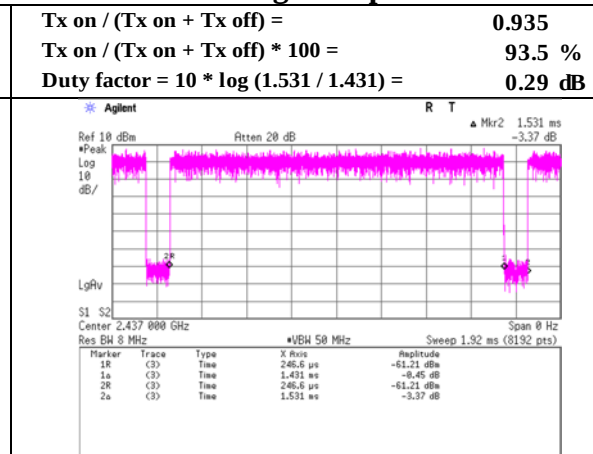
Burst rate confirmation

Report No. 13395143H
Test place Ise EMC Lab. No.3 Measurement Room
Date June 11, 2020
Temperature / Humidity 22 deg. C / 51 % RH
Engineer Junki Nagatomi
Mode Tx

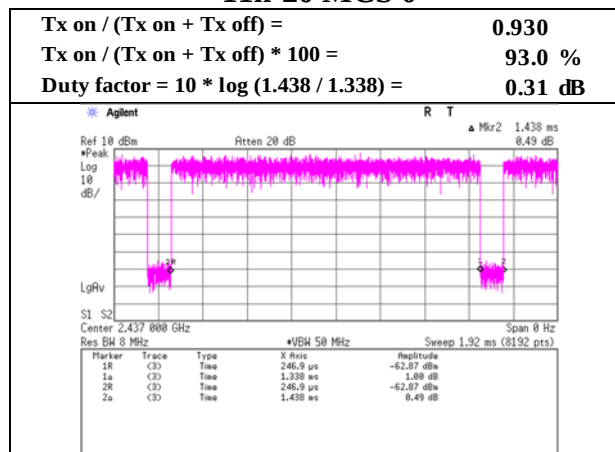
11b 1Mbps



11g 6 Mbps



11n-20 MCS 0

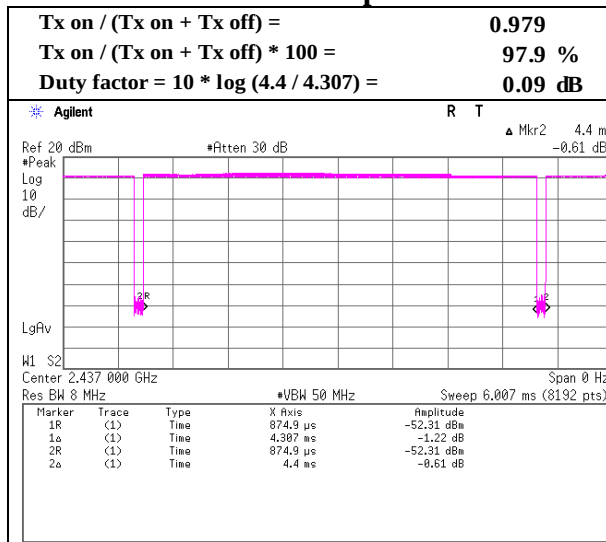


* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

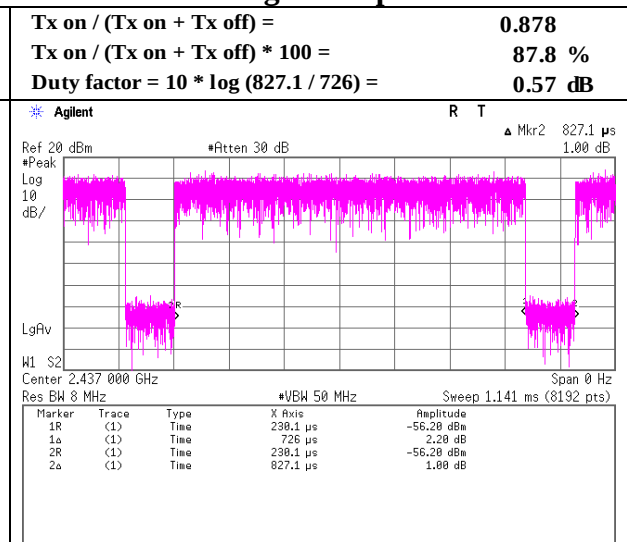
Burst rate confirmation

Report No. 13395143H
Test place Ise EMC Lab. No.3 Measurement Room
Date June 11, 2020
Temperature / Humidity 22 deg. C / 51 % RH
Engineer Junki Nagatomi
Mode Tx

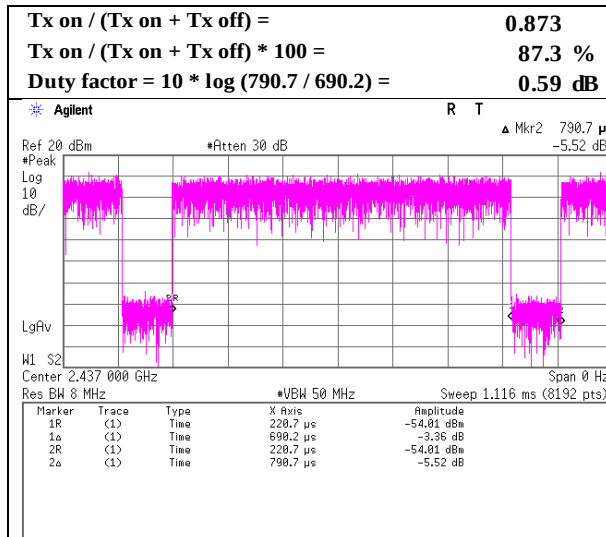
11b 2Mbps



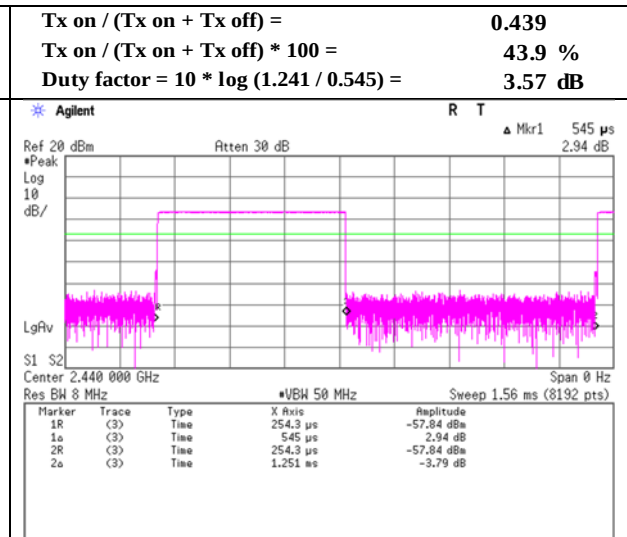
11g 12 Mbps



11n-20 MCS 1



BT LE



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

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Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No.	13395143H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.4
Date	June 11, 2020	June 13, 2020	June 14, 2020
Temperature / Humidity	23 deg. C / 70 % RH	22 deg. C / 65 % RH	22 deg. C / 70 % RH
Engineer	Akihiko Maeda	Takeshi Hiyaji	Akihiko Maeda
	(1 GHz - 10 GHz)	(10 GHz - 18 GHz)	(Above 18 GHz)
Mode	Tx 11b 2412 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	PK	54.5	27.8	5.4	31.9	-	55.9	73.9	18.0	
Hori.	4824.000	PK	40.8	31.6	7.6	31.3	-	48.8	73.9	25.1	Floor noise
Hori.	7236.000	PK	41.9	36.5	8.9	32.4	-	54.8	73.9	19.1	Floor noise
Hori.	9648.000	PK	41.8	38.1	9.6	32.8	-	56.7	73.9	17.2	Floor noise
Hori.	2390.000	AV	43.9	27.8	5.4	31.9	0.1	45.4	53.9	8.5	*1)
Hori.	4824.000	AV	32.4	31.6	7.6	31.3	-	40.4	53.9	13.5	Floor noise
Hori.	7236.000	AV	33.6	36.5	8.9	32.4	-	46.5	53.9	7.4	Floor noise
Hori.	9648.000	AV	32.8	38.1	9.6	32.8	-	47.7	53.9	6.2	Floor noise
Vert.	2390.000	PK	53.4	27.8	5.4	31.9	-	54.8	73.9	19.1	
Vert.	4824.000	PK	40.6	31.6	7.6	31.3	-	48.6	73.9	25.3	Floor noise
Vert.	7236.000	PK	41.7	36.5	8.9	32.4	-	54.6	73.9	19.3	Floor noise
Vert.	9648.000	PK	41.9	38.1	9.6	32.8	-	56.8	73.9	17.1	Floor noise
Vert.	2390.000	AV	42.9	27.8	5.4	31.9	0.1	44.4	53.9	9.5	*1)
Vert.	4824.000	AV	32.5	31.6	7.6	31.3	-	40.5	53.9	13.4	Floor noise
Vert.	7236.000	AV	33.5	36.5	8.9	32.4	-	46.4	53.9	7.5	Floor noise
Vert.	9648.000	AV	32.7	38.1	9.6	32.8	-	47.6	53.9	6.3	Floor noise

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

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log(3.95 m / 3.0 m) = 2.39 dB
10 GHz - 26.5 GHz 20log(1.0 m / 3.0 m) = -9.5 dB

*1) Not Out of Band emission(Leakage Power)

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	102.8	27.8	5.5	31.9	104.2	-	-	Carrier
Hori.	2398.367	PK	61.5	27.8	5.5	31.9	62.9	84.2	21.3	
Hori.	2400.000	PK	57.1	27.8	5.5	31.9	58.5	84.2	25.7	
Vert.	2412.000	PK	101.3	27.8	5.5	31.9	102.7	-	-	Carrier
Vert.	2398.367	PK	61.3	27.8	5.5	31.9	62.7	82.7	20.0	
Vert.	2400.000	PK	55.8	27.8	5.5	31.9	57.2	82.7	25.5	

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

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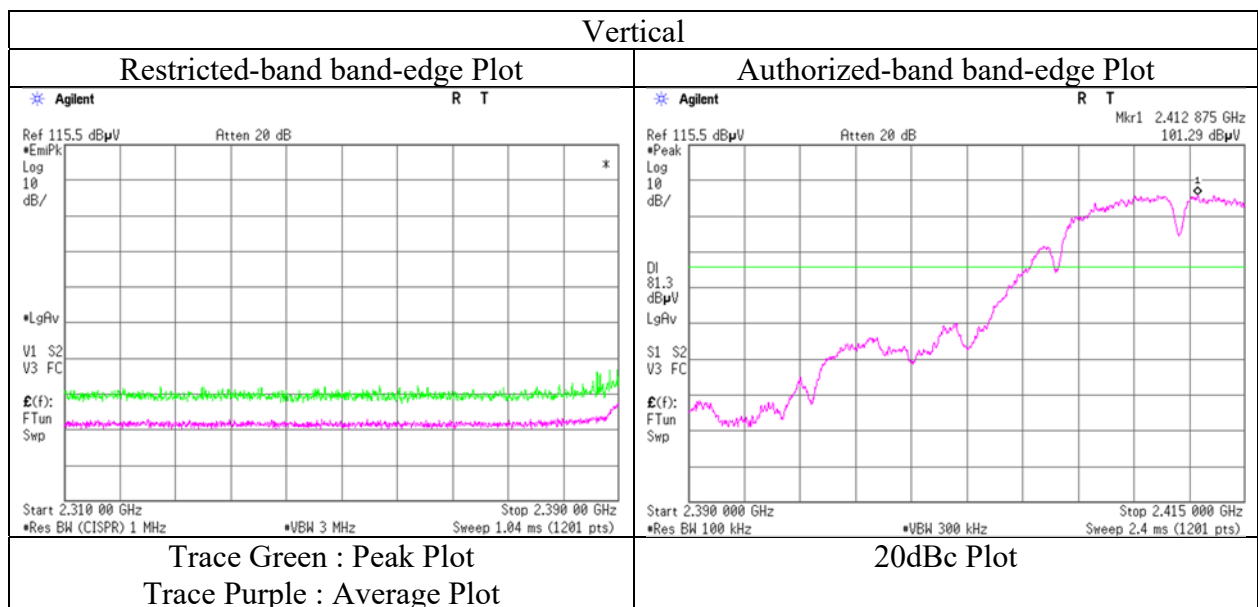
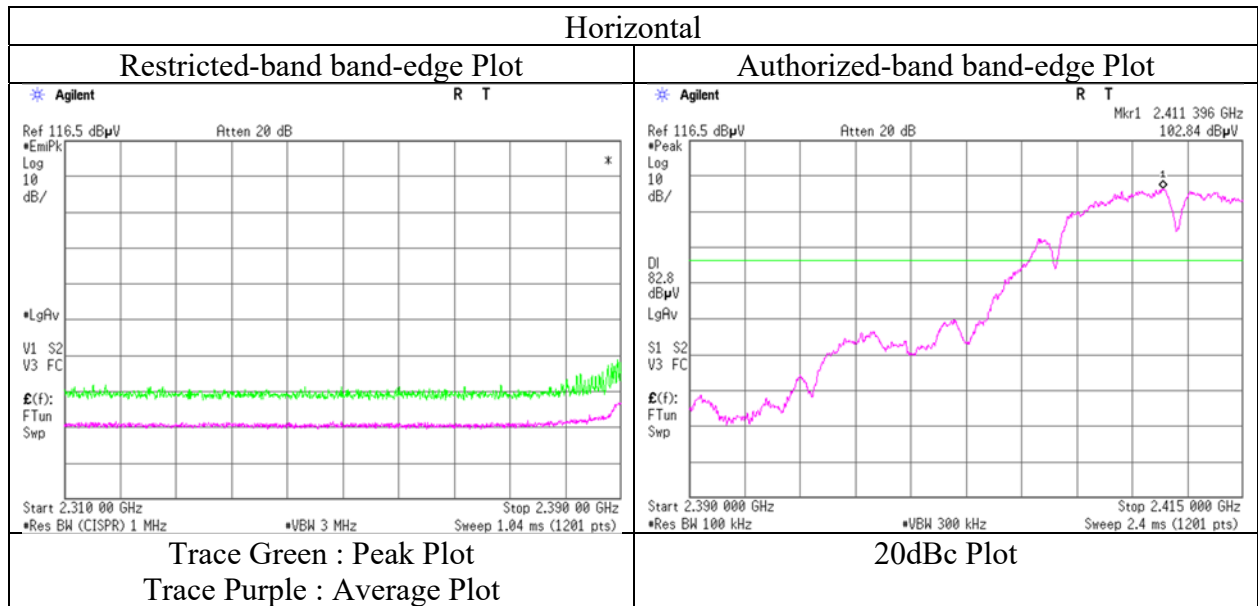
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13395143H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 11, 2020
Temperature / Humidity	23 deg. C / 70 % RH
Engineer	Akihiko Maeda
Mode	Tx 11b 2412 MHz



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

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

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Radiated Spurious Emission

Report No.	13395143H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 13, 2020
Temperature / Humidity	22 deg. C / 65 % RH
Engineer	Takeshi Hiyaji
	(1 GHz - 18 GHz)
Mode	Tx 11b 2437 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4874.000	PK	41.3	31.6	7.6	31.2	-	49.3	73.9	24.6	Floor noise
Hori.	7311.000	PK	41.8	36.6	8.9	32.5	-	54.8	73.9	19.2	Floor noise
Hori.	9748.000	PK	41.3	38.4	9.7	32.9	-	56.5	73.9	17.4	Floor noise
Hori.	4874.000	AV	32.6	31.6	7.6	31.2	-	40.5	53.9	13.4	Floor noise
Hori.	7311.000	AV	33.3	36.6	8.9	32.5	-	46.3	53.9	7.6	Floor noise
Hori.	9748.000	AV	32.4	38.4	9.7	32.9	-	47.6	53.9	6.3	Floor noise
Vert.	4874.000	PK	41.1	31.6	7.6	31.2	-	49.1	73.9	24.8	Floor noise
Vert.	7311.000	PK	41.8	36.6	8.9	32.5	-	54.8	73.9	19.1	Floor noise
Vert.	9748.000	PK	40.9	38.4	9.7	32.9	-	56.1	73.9	17.8	Floor noise
Vert.	4874.000	AV	31.3	31.6	7.6	31.2	-	39.3	53.9	14.6	Floor noise
Vert.	7311.000	AV	33.8	36.6	8.9	32.5	-	46.8	53.9	7.1	Floor noise
Vert.	9748.000	AV	32.2	38.4	9.7	32.9	-	47.4	53.9	6.5	Floor noise

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

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No. 13395143H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date June 13, 2020 No.4
Temperature / Humidity 22 deg. C / 65 % RH June 14, 2020
Engineer Takeshi Hiyaji Akihiko Maeda
(1 GHz - 18 GHz) (Above 18 GHz)
Mode Tx 11b 2462 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	PK	51.8	27.7	5.5	31.8	-	53.2	73.9	20.7	
Hori.	4924.000	PK	41.1	31.5	7.6	31.2	-	49.0	73.9	24.9	Floor noise
Hori.	7386.000	PK	41.9	36.7	8.9	32.5	-	55.0	73.9	18.9	Floor noise
Hori.	9848.000	PK	42.0	38.7	9.7	32.9	-	57.4	73.9	16.5	Floor noise
Hori.	2483.500	AV	46.0	27.7	5.5	31.8	0.1	47.5	53.9	6.4	*1)
Hori.	4924.000	AV	32.2	31.5	7.6	31.2	-	40.1	53.9	13.8	Floor noise
Hori.	7386.000	AV	32.1	36.7	8.9	32.5	-	45.2	53.9	8.7	Floor noise
Hori.	9848.000	AV	31.5	38.7	9.7	32.9	-	47.0	53.9	6.9	Floor noise
Vert.	2483.500	PK	51.0	27.7	5.5	31.8	-	52.4	73.9	21.6	
Vert.	4924.000	PK	41.6	31.5	7.6	31.2	-	49.5	73.9	24.4	Floor noise
Vert.	7386.000	PK	41.4	36.7	8.9	32.5	-	54.5	73.9	19.4	Floor noise
Vert.	9848.000	PK	40.7	38.7	9.7	32.9	-	56.2	73.9	17.8	Floor noise
Vert.	2483.500	AV	44.7	27.7	5.5	31.8	0.1	46.1	53.9	7.8	*1)
Vert.	4924.000	AV	32.5	31.5	7.6	31.2	-	40.4	53.9	13.5	Floor noise
Vert.	7386.000	AV	31.4	36.7	8.9	32.5	-	44.5	53.9	9.4	Floor noise
Vert.	9848.000	AV	31.8	38.7	9.7	32.9	-	47.3	53.9	6.6	Floor noise

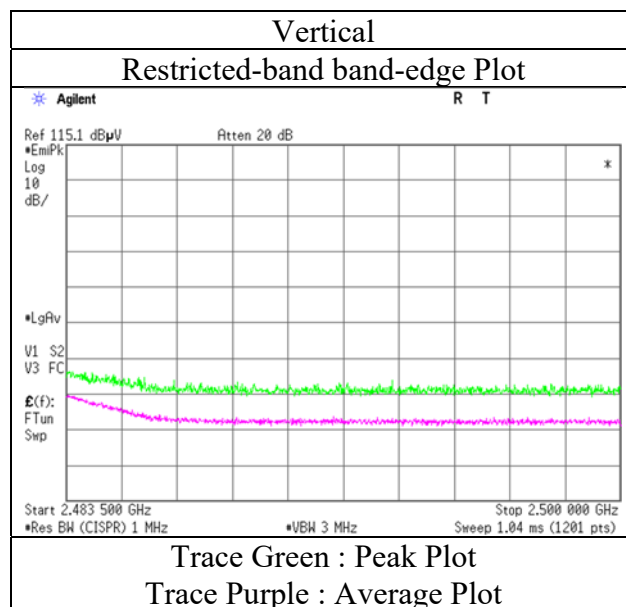
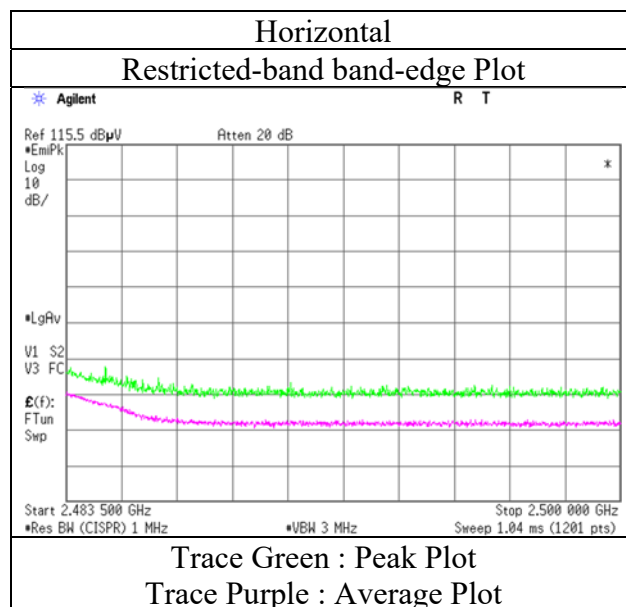
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier) + Duty factor

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(3.95 \text{ m} / 3.0 \text{ m}) = 2.39 \text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13395143H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 13, 2020
Temperature / Humidity	22 deg. C / 65 % RH
Engineer	Takeshi Hiyaji
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.

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No. 13395143H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date June 13, 2020 No.4
Temperature / Humidity 22 deg. C / 65 % RH June 14, 2020
Engineer Takeshi Hiyaji Akihiko Maeda
(1 GHz - 18 GHz) (Above 18 GHz)
Mode Tx 11n-20 2412 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	PK	52.4	27.8	5.4	31.9	-	53.8	73.9	20.1	
Hori.	4824.000	PK	40.5	31.6	7.6	31.3	-	48.5	73.9	25.4	Floor noise
Hori.	7236.000	PK	42.3	36.5	8.9	32.4	-	55.2	73.9	18.7	Floor noise
Hori.	9648.000	PK	42.0	38.1	9.6	32.8	-	56.9	73.9	17.0	Floor noise
Hori.	2390.000	AV	40.3	27.8	5.4	31.9	0.6	42.3	53.9	11.6	*1)
Hori.	4824.000	AV	32.1	31.6	7.6	31.3	-	40.1	53.9	13.8	Floor noise
Hori.	7236.000	AV	33.3	36.5	8.9	32.4	-	46.2	53.9	7.7	Floor noise
Hori.	9648.000	AV	32.6	38.1	9.6	32.8	-	47.5	53.9	6.4	Floor noise
Vert.	2390.000	PK	50.9	27.8	5.4	31.9	-	52.2	73.9	21.7	
Vert.	4824.000	PK	40.0	31.6	7.6	31.3	-	48.0	73.9	25.9	Floor noise
Vert.	7236.000	PK	41.8	36.5	8.9	32.4	-	54.7	73.9	19.2	Floor noise
Vert.	9648.000	PK	42.0	38.1	9.6	32.8	-	56.9	73.9	17.0	Floor noise
Vert.	2390.000	AV	38.2	27.8	5.4	31.9	0.6	40.2	53.9	13.7	*1)
Vert.	4824.000	AV	32.3	31.6	7.6	31.3	-	40.3	53.9	13.6	Floor noise
Vert.	7236.000	AV	33.4	36.5	8.9	32.4	-	46.3	53.9	7.6	Floor noise
Vert.	9648.000	AV	32.6	38.1	9.6	32.8	-	47.5	53.9	6.4	Floor noise

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

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	92.8	27.8	5.5	31.9	94.2	-	-	Carrier
Hori.	2400.000	PK	59.3	27.8	5.5	31.9	60.7	74.2	13.5	
Vert.	2412.000	PK	92.7	27.8	5.5	31.9	94.1	-	-	Carrier
Vert.	2400.000	PK	60.3	27.8	5.5	31.9	61.7	74.1	12.4	

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

UL Japan, Inc.

Ise EMC Lab.

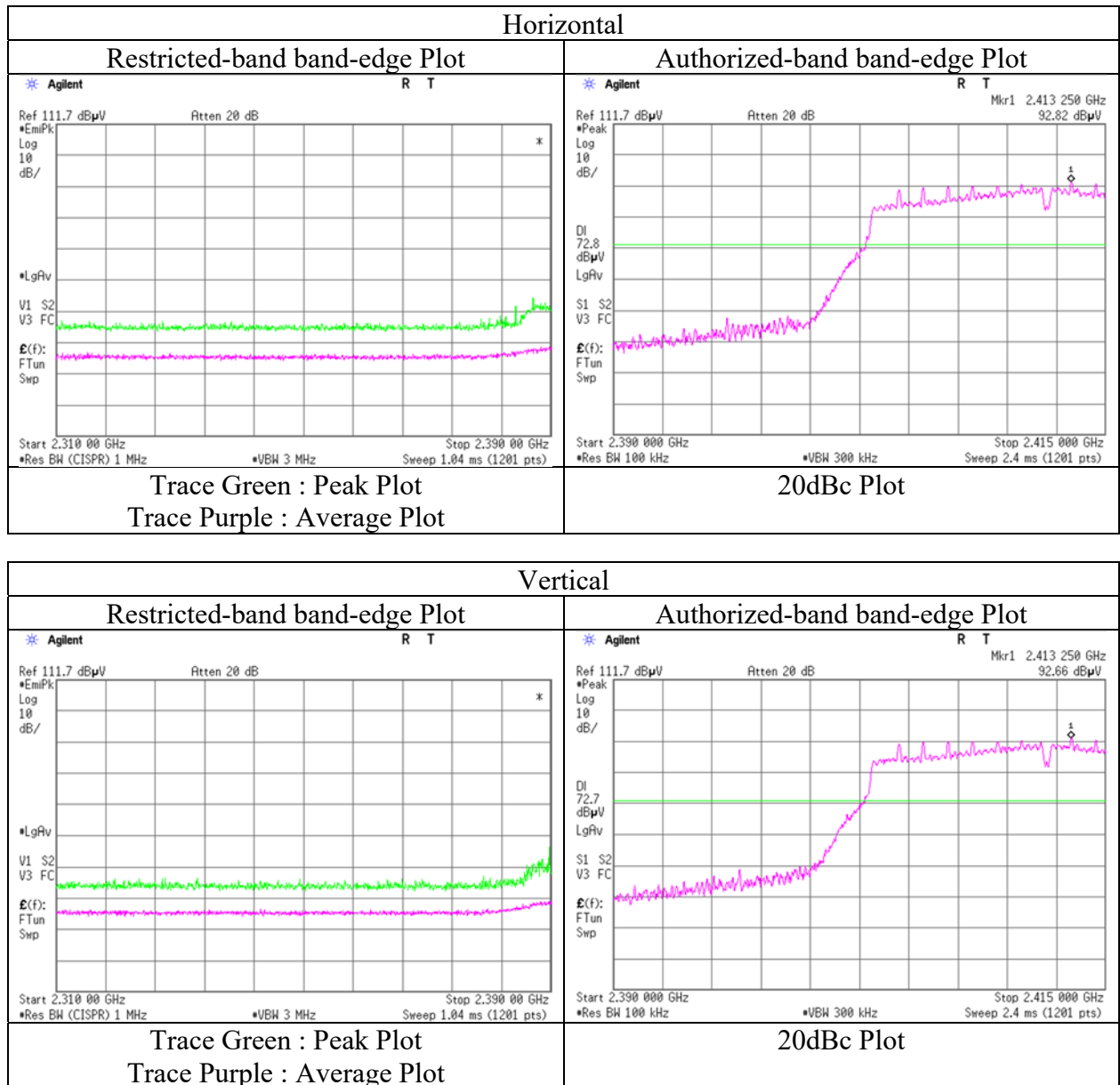
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13395143H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 13, 2020
Temperature / Humidity	22 deg. C / 65 % RH
Engineer	Takeshi Hiyaji
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.

UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Radiated Spurious Emission

Report No. 13395143H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date June 13, 2020 No.4
Temperature / Humidity 22 deg. C / 65 % RH June 14, 2020
Engineer Takeshi Hiyaji Akihiko Maeda
(1 GHz - 18 GHz) (Above 18 GHz)
(Below 1 GHz)
Mode Tx 11n-20 2437 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	432.008	QP	34.8	16.3	10.5	31.8	-	29.8	46.0	16.2	
Hori.	672.007	QP	35.4	19.5	11.8	32.1	-	34.7	46.0	11.4	
Hori.	768.006	QP	32.4	20.4	12.3	31.7	-	33.3	46.0	12.7	
Hori.	816.003	QP	42.4	20.9	12.5	31.5	-	44.3	46.0	1.7	
Hori.	863.999	QP	34.1	21.6	12.7	31.3	-	37.1	46.0	8.9	
Hori.	912.003	QP	37.5	22.0	12.9	31.0	-	41.4	46.0	4.7	
Hori.	4874.000	PK	39.8	31.6	7.6	31.2	-	47.8	73.9	26.1	Floor noise
Hori.	7311.000	PK	41.1	36.6	8.9	32.5	-	54.1	73.9	19.8	Floor noise
Hori.	9748.000	PK	40.2	38.4	9.7	32.9	-	55.4	73.9	18.5	Floor noise
Hori.	4874.000	AV	32.5	31.6	7.6	31.2	-	40.5	53.9	13.4	Floor noise
Hori.	7311.000	AV	32.6	36.6	8.9	32.5	-	45.6	53.9	8.3	Floor noise
Hori.	9748.000	AV	32.2	38.4	9.7	32.9	-	47.4	53.9	6.5	Floor noise
Vert.	432.008	QP	36.5	16.3	10.5	31.8	-	31.5	46.0	14.5	
Vert.	672.007	QP	34.1	19.5	11.8	32.1	-	33.4	46.0	12.7	
Vert.	768.006	QP	29.4	20.4	12.3	31.7	-	30.3	46.0	15.7	
Vert.	816.003	QP	37.7	20.9	12.5	31.5	-	39.6	46.0	6.4	
Vert.	863.999	QP	32.7	21.6	12.7	31.3	-	35.7	46.0	10.3	
Vert.	912.003	QP	34.9	22.0	12.9	31.0	-	38.8	46.0	7.3	
Vert.	4874.000	PK	40.2	31.6	7.6	31.2	-	48.2	73.9	25.7	Floor noise
Vert.	7311.000	PK	41.1	36.6	8.9	32.5	-	54.1	73.9	19.8	Floor noise
Vert.	9748.000	PK	40.2	38.4	9.7	32.9	-	55.4	73.9	18.5	Floor noise
Vert.	4874.000	AV	32.1	31.6	7.6	31.2	-	40.1	53.9	13.8	Floor noise
Vert.	7311.000	AV	32.7	36.6	8.9	32.5	-	45.7	53.9	8.2	Floor noise
Vert.	9748.000	AV	32.3	38.4	9.7	32.9	-	47.5	53.9	6.5	Floor noise

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

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission

Report No. 13395143H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date June 13, 2020 No.4
Temperature / Humidity 22 deg. C / 65 % RH June 14, 2020
Engineer Takeshi Hiyaji Akihiko Maeda
(1 GHz - 18 GHz) (Above 18 GHz)
Mode Tx 11n-20 2462 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	PK	53.2	27.7	5.5	31.8	-	54.5	73.9	19.4	
Hori.	4924.000	PK	40.8	31.5	7.6	31.2	-	48.7	73.9	25.2	Floor noise
Hori.	7386.000	PK	42.5	36.7	8.9	32.5	-	55.6	73.9	18.3	Floor noise
Hori.	9848.000	PK	42.9	38.7	9.7	32.9	-	58.4	73.9	15.5	Floor noise
Hori.	2483.500	AV	40.0	27.7	5.5	31.8	0.6	41.9	53.9	12.0	*1)
Hori.	4924.000	AV	32.6	31.5	7.6	31.2	-	40.5	53.9	13.4	Floor noise
Hori.	7386.000	AV	33.4	36.7	8.9	32.5	-	46.5	53.9	7.4	Floor noise
Hori.	9848.000	AV	32.3	38.7	9.7	32.9	-	47.8	53.9	6.1	Floor noise
Vert.	2483.500	PK	55.7	27.7	5.5	31.8	-	57.0	73.9	16.9	
Vert.	4924.000	PK	40.8	31.5	7.6	31.2	-	48.7	73.9	25.2	Floor noise
Vert.	7386.000	PK	42.5	36.7	8.9	32.5	-	55.6	73.9	18.3	Floor noise
Vert.	9848.000	PK	42.7	38.7	9.7	32.9	-	58.2	73.9	15.7	Floor noise
Vert.	2483.500	AV	38.5	27.7	5.5	31.8	0.6	40.4	53.9	13.5	*1)
Vert.	4924.000	AV	32.5	31.5	7.6	31.2	-	40.4	53.9	13.5	Floor noise
Vert.	7386.000	AV	33.4	36.7	8.9	32.5	-	46.5	53.9	7.4	Floor noise
Vert.	9848.000	AV	32.4	38.7	9.7	32.9	-	47.9	53.9	6.0	Floor noise

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

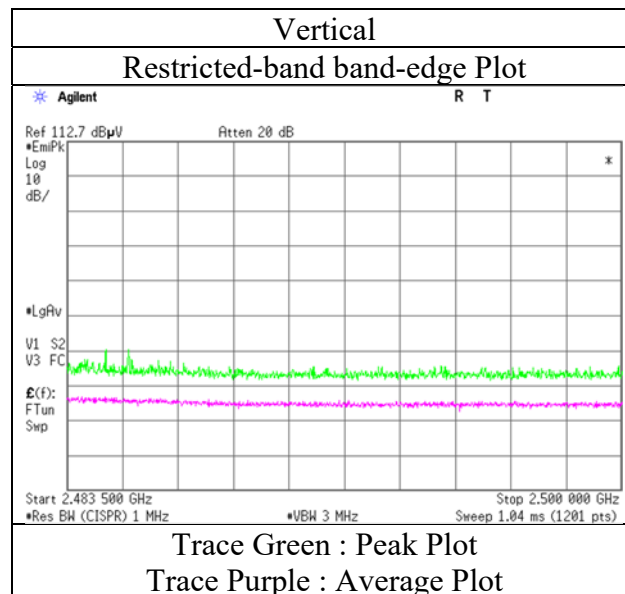
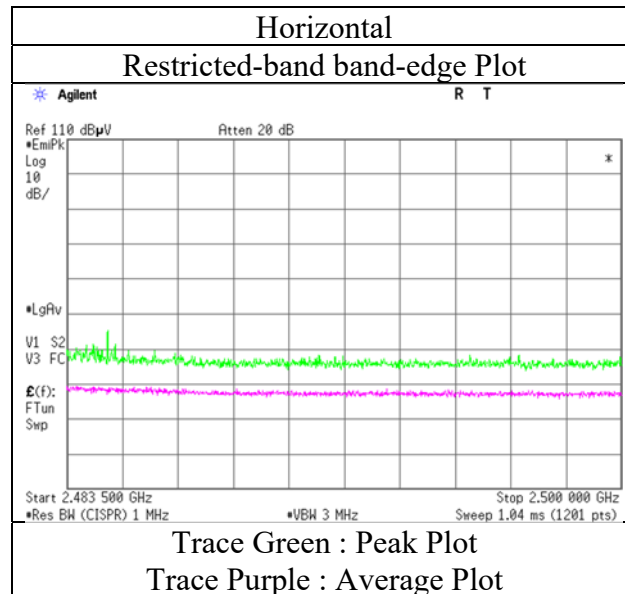
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

*1) Not Out of Band emission(Leakage Power)

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13395143H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 13, 2020
Temperature / Humidity	22 deg. C / 65 % RH
Engineer	Takeshi Hiyaji
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

Report No.	13395143H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.4
Date	June 13, 2020	June 14, 2020	June 15, 2020
Temperature / Humidity	22 deg. C / 65 % RH	22 deg. C / 70 % RH	22 deg. C / 50 % RH
Engineer	Takeshi Hiyaji (1 GHz - 18 GHz)	Akihiko Maeda (Above 18 GHz)	Yuta Moriya (Below 1 GHz)
Mode	Tx BT LE 2402 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	528.013	QP	36.5	17.6	11.1	31.9	-	33.3	46.0	12.7	
Hori.	672.005	QP	37.0	19.5	11.8	32.1	-	36.3	46.0	9.8	
Hori.	720.039	QP	34.8	20.1	12.0	32.0	-	34.9	46.0	11.1	
Hori.	816.001	QP	42.5	20.9	12.5	31.5	-	44.4	46.0	1.6	
Hori.	864.010	QP	36.5	21.6	12.7	31.3	-	39.5	46.0	6.5	
Hori.	912.008	QP	38.4	22.0	12.9	31.0	-	42.3	46.0	3.8	
Hori.	2390.000	PK	42.4	27.8	5.4	31.9	-	43.8	73.9	30.1	
Hori.	4804.000	PK	41.9	31.6	7.6	31.3	-	49.9	73.9	24.0	Floor noise
Hori.	7206.000	PK	41.4	36.5	8.9	32.4	-	54.4	73.9	19.5	Floor noise
Hori.	9608.000	PK	41.6	38.0	9.6	32.8	-	56.4	73.9	17.5	Floor noise
Hori.	2390.000	AV	33.6	27.8	5.4	31.9	3.6	38.6	53.9	15.3	*1)
Hori.	4804.000	AV	32.5	31.6	7.6	31.3	-	40.5	53.9	13.4	Floor noise
Hori.	7206.000	AV	31.7	36.5	8.9	32.4	-	44.7	53.9	9.2	Floor noise
Hori.	9608.000	AV	31.0	38.0	9.6	32.8	-	45.8	53.9	8.1	Floor noise
Vert.	528.011	QP	36.7	17.6	11.1	31.9	-	33.5	46.0	12.5	
Vert.	672.011	QP	35.8	19.5	11.8	32.1	-	35.1	46.0	11.0	
Vert.	720.001	QP	31.9	20.1	12.0	32.0	-	32.0	46.0	14.0	
Vert.	816.005	QP	38.3	20.9	12.5	31.5	-	40.2	46.0	5.8	
Vert.	864.006	QP	32.7	21.6	12.7	31.3	-	35.7	46.0	10.3	
Vert.	912.011	QP	35.9	22.0	12.9	31.0	-	39.8	46.0	6.3	
Vert.	2390.000	PK	42.3	27.8	5.4	31.9	-	43.7	73.9	30.2	
Vert.	4804.000	PK	40.9	31.6	7.6	31.3	-	48.9	73.9	25.0	Floor noise
Vert.	7206.000	PK	42.0	36.5	8.9	32.4	-	55.0	73.9	18.9	Floor noise
Vert.	9608.000	PK	41.2	38.0	9.6	32.8	-	56.0	73.9	17.9	Floor noise
Vert.	2390.000	AV	33.6	27.8	5.4	31.9	3.6	38.5	53.9	15.4	*1)
Vert.	4804.000	AV	31.4	31.6	7.6	31.3	-	39.3	53.9	14.6	Floor noise
Vert.	7206.000	AV	31.5	36.5	8.9	32.4	-	44.5	53.9	9.4	Floor noise
Vert.	9608.000	AV	30.9	38.0	9.6	32.8	-	45.7	53.9	8.2	Floor noise

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

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log(3.95 m / 3.0 m) = 2.39 dB
10 GHz - 26.5 GHz 20log(1.0 m / 3.0 m) = -9.5 dB

*1) Not Out of Band emission(Leakage Power)

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	98.1	27.8	5.5	31.9	99.5	-	-	Carrier
Hori.	2400.000	PK	40.3	27.8	5.5	31.9	41.7	79.5	37.8	
Vert.	2402.000	PK	97.8	27.8	5.5	31.9	99.2	-	-	Carrier
Vert.	2400.000	PK	40.2	27.8	5.5	31.9	41.6	79.2	37.6	

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

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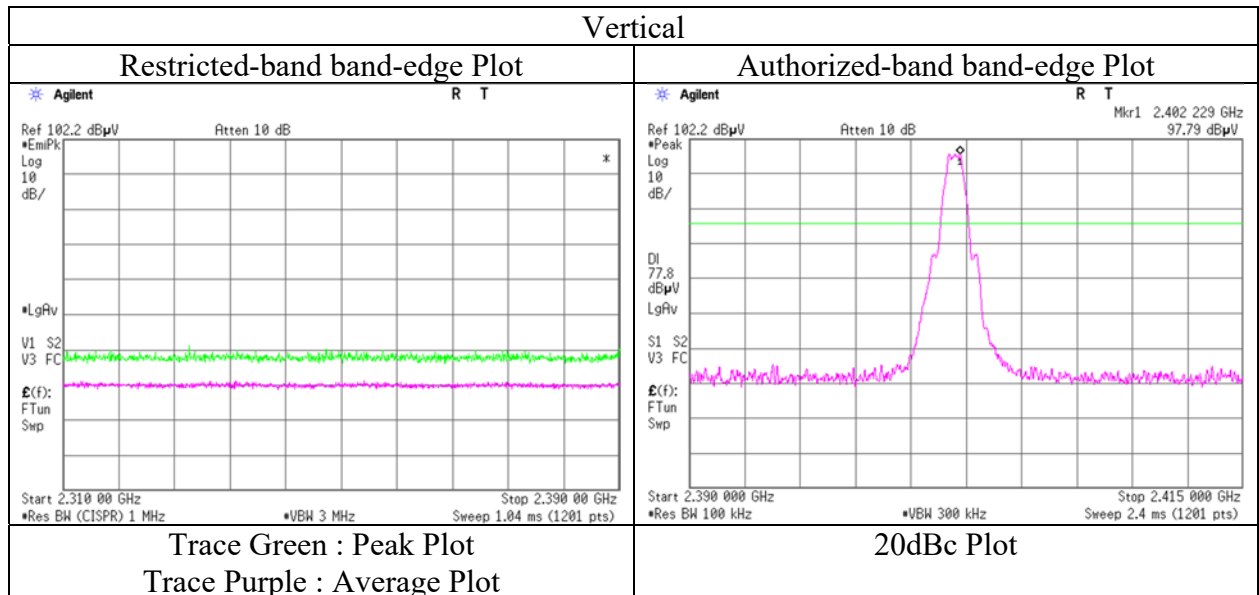
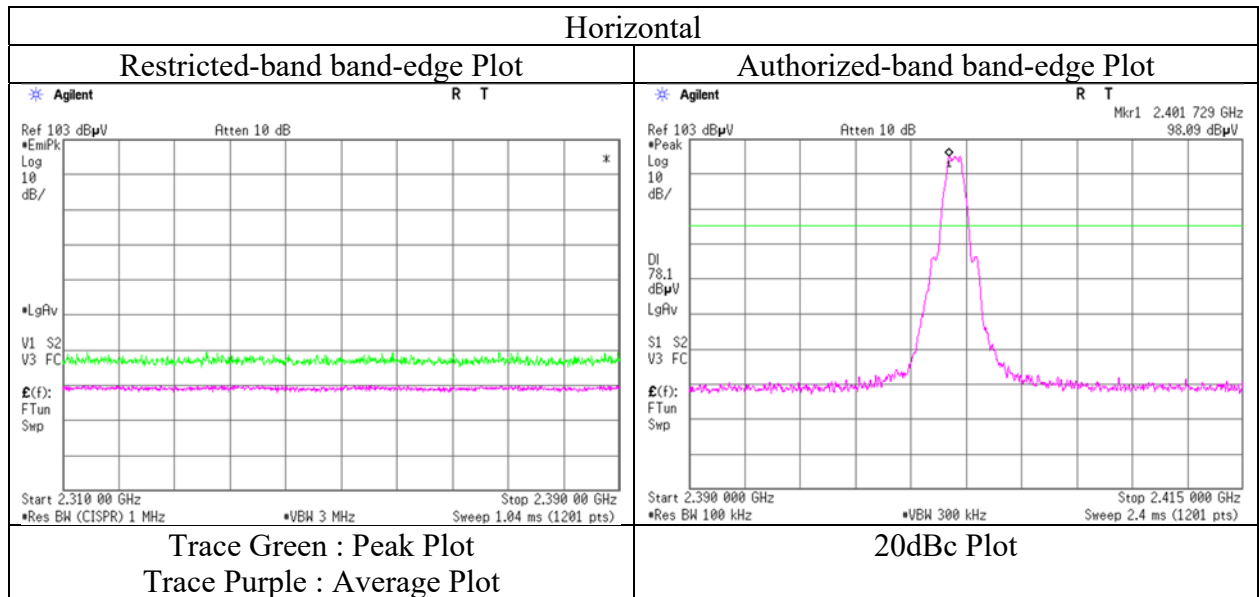
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13395143H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 13, 2020
Temperature / Humidity	22 deg. C / 65 % RH
Engineer	Takeshi Hiyaji
Mode	Tx BT LE 2402 MHz



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

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Ise EMC Lab.

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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No.	13395143H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.4
Date	June 13, 2020	June 14, 2020	June 15, 2020
Temperature / Humidity	22 deg. C / 65 % RH	22 deg. C / 70 % RH	22 deg. C / 50 % RH
Engineer	Takeshi Hiyaji (1 GHz - 18 GHz)	Akihiko Maeda (Above 18 GHz)	Yuta Moriya (Below 1 GHz)
Mode	Tx BT LE 2440 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	528.000	QP	36.6	17.6	11.1	31.9	-	33.4	46.0	12.6	
Hori.	672.014	QP	36.9	19.5	11.8	32.1	-	36.2	46.0	9.8	
Hori.	720.008	QP	34.7	20.1	12.0	32.0	-	34.8	46.0	11.2	
Hori.	816.006	QP	42.4	20.9	12.5	31.5	-	44.3	46.0	1.7	
Hori.	864.007	QP	35.0	21.6	12.7	31.3	-	38.0	46.0	8.0	
Hori.	912.002	QP	38.5	22.0	12.9	31.0	-	42.4	46.0	3.7	
Hori.	4880.000	PK	42.6	31.6	6.9	31.2	-	49.8	73.9	24.1	Floor noise
Hori.	7320.000	PK	42.4	36.6	8.1	32.5	-	54.6	73.9	19.3	Floor noise
Hori.	9760.000	PK	41.1	38.4	9.0	32.9	-	55.6	73.9	18.3	Floor noise
Hori.	4880.000	AV	32.3	31.6	6.9	31.2	-	39.5	53.9	14.4	Floor noise
Hori.	7320.000	AV	32.6	36.6	8.1	32.5	-	44.9	53.9	9.0	Floor noise
Hori.	9760.000	AV	31.4	38.4	9.0	32.9	-	45.9	53.9	8.0	Floor noise
Vert.	527.999	QP	36.5	17.6	11.1	31.9	-	33.3	46.0	12.7	
Vert.	672.007	QP	35.8	19.5	11.8	32.1	-	35.1	46.0	11.0	
Vert.	720.009	QP	32.6	20.1	12.0	32.0	-	32.7	46.0	13.3	
Vert.	816.009	QP	38.6	20.9	12.5	31.5	-	40.5	46.0	5.5	
Vert.	864.002	QP	33.5	21.6	12.7	31.3	-	36.5	46.0	9.5	
Vert.	912.004	QP	36.1	22.0	12.9	31.0	-	40.0	46.0	6.1	
Vert.	4880.000	PK	40.7	31.6	6.9	31.2	-	47.9	73.9	26.0	Floor noise
Vert.	7320.000	PK	41.6	36.6	8.1	32.5	-	53.9	73.9	20.1	Floor noise
Vert.	9760.000	PK	41.3	38.4	9.0	32.9	-	55.8	73.9	18.1	Floor noise
Vert.	4880.000	AV	32.4	31.6	6.9	31.2	-	39.6	53.9	14.3	Floor noise
Vert.	7320.000	AV	32.3	36.6	8.1	32.5	-	44.6	53.9	9.4	Floor noise
Vert.	9760.000	AV	32.0	38.4	9.0	32.9	-	46.5	53.9	7.4	Floor noise

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

*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission

Report No.	13395143H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.4
Date	June 13, 2020	June 14, 2020	June 15, 2020
Temperature / Humidity	22 deg. C / 65 % RH	22 deg. C / 70 % RH	22 deg. C / 50 % RH
Engineer	Takeshi Hiyaji (1 GHz - 18 GHz)	Akihiko Maeda (Above 18 GHz)	Yuta Moriya (Below 1 GHz)
Mode	Tx BT LE 2480 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	528.002	QP	36.9	17.6	11.1	31.9	-	33.7	46.0	12.3	
Hori.	672.004	QP	37.2	19.5	11.8	32.1	-	36.5	46.0	9.6	
Hori.	720.006	QP	34.7	20.1	12.0	32.0	-	34.8	46.0	11.2	
Hori.	816.007	QP	42.5	20.9	12.5	31.5	-	44.4	46.0	1.6	
Hori.	864.010	QP	34.9	21.6	12.7	31.3	-	37.9	46.0	8.1	
Hori.	912.012	QP	38.3	22.0	12.9	31.0	-	42.2	46.0	3.9	
Hori.	2483.500	PK	44.3	27.7	5.5	31.8	-	45.7	73.9	28.3	
Hori.	4960.000	PK	40.7	31.6	7.7	31.2	-	48.8	73.9	25.2	Floor noise
Hori.	7440.000	PK	41.5	36.7	8.9	32.5	-	54.6	73.9	19.3	Floor noise
Hori.	9920.000	PK	41.7	38.6	9.7	33.0	-	57.0	73.9	16.9	Floor noise
Hori.	2483.500	AV	34.8	27.7	5.5	31.8	3.6	39.7	53.9	14.2	*1)
Hori.	4960.000	AV	30.0	31.6	7.7	31.2	-	38.0	53.9	15.9	Floor noise
Hori.	7440.000	AV	31.7	36.7	8.9	32.5	-	44.8	53.9	9.2	Floor noise
Hori.	9920.000	AV	31.1	38.6	9.7	33.0	-	46.5	53.9	7.4	Floor noise
Vert.	528.005	QP	36.7	17.6	11.1	31.9	-	33.5	46.0	12.5	
Vert.	672.006	QP	35.9	19.5	11.8	32.1	-	35.2	46.0	10.9	
Vert.	720.000	QP	31.8	20.1	12.0	32.0	-	31.9	46.0	14.1	
Vert.	816.006	QP	38.6	20.9	12.5	31.5	-	40.5	46.0	5.5	
Vert.	864.002	QP	33.5	21.6	12.7	31.3	-	36.5	46.0	9.5	
Vert.	912.002	QP	36.1	22.0	12.9	31.0	-	40.0	46.0	6.1	
Vert.	2483.500	PK	44.4	27.7	5.5	31.8	-	45.8	73.9	28.2	
Vert.	4960.000	PK	40.9	31.6	7.7	31.2	-	48.9	73.9	25.0	Floor noise
Vert.	7440.000	PK	41.7	36.7	8.9	32.5	-	54.8	73.9	19.1	Floor noise
Vert.	9920.000	PK	41.7	38.6	9.7	33.0	-	57.0	73.9	16.9	Floor noise
Vert.	2483.500	AV	34.7	27.7	5.5	31.8	3.6	39.6	53.9	14.3	*1)
Vert.	4960.000	AV	30.8	31.6	7.7	31.2	-	38.8	53.9	15.1	Floor noise
Vert.	7440.000	AV	31.7	36.7	8.9	32.5	-	44.8	53.9	9.1	Floor noise
Vert.	9920.000	AV	30.9	38.6	9.7	33.0	-	46.3	53.9	7.6	Floor noise

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

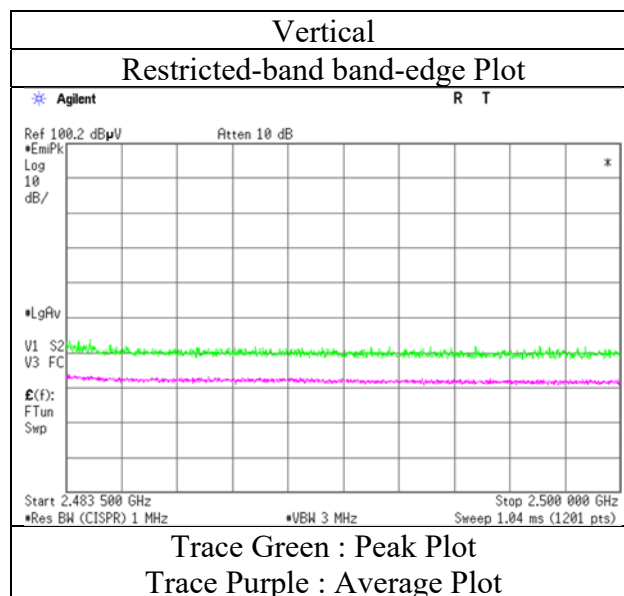
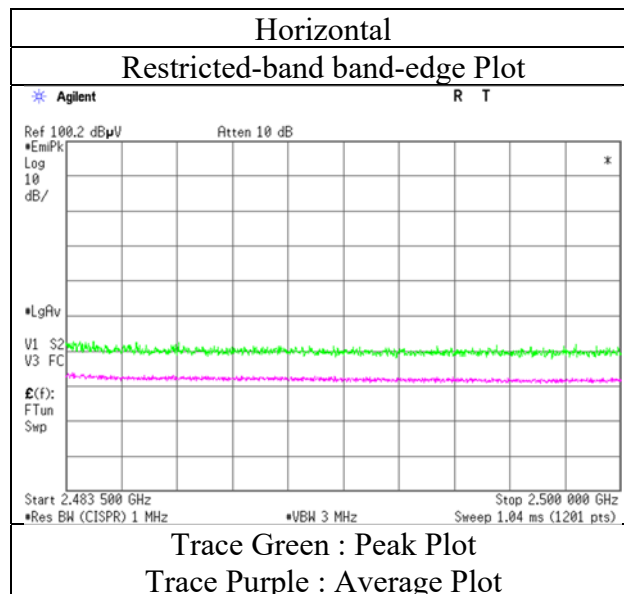
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(3.95\text{ m} / 3.0\text{ m}) = 2.39\text{ dB}$
 10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

*1) Not Out of Band emission(Leakage Power)

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13395143H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	June 13, 2020
Temperature / Humidity	22 deg. C / 65 % RH
Engineer	Takeshi Hiyaji
Mode	Tx BT LE 2480 MHz



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

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Ise EMC Lab.

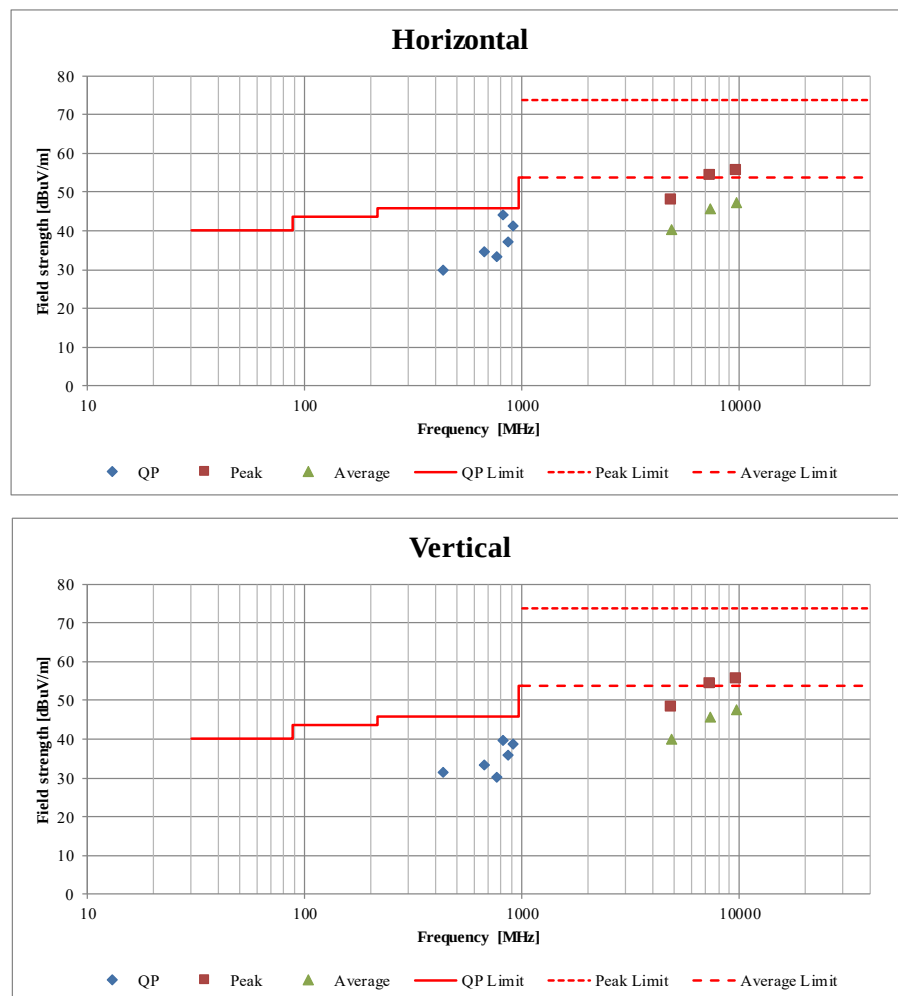
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Plot data, Worst case)

Report No.	13395143H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	June 13, 2020	June 14, 2020
Temperature / Humidity	22 deg. C / 65 % RH	22 deg. C / 70 % RH
Engineer	Takeshi Hiyaji (1 GHz - 18 GHz)	Akihiko Maeda (Above 18 GHz) (Below 1 GHz)
Mode	Tx 11n-20 2437 MHz	



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

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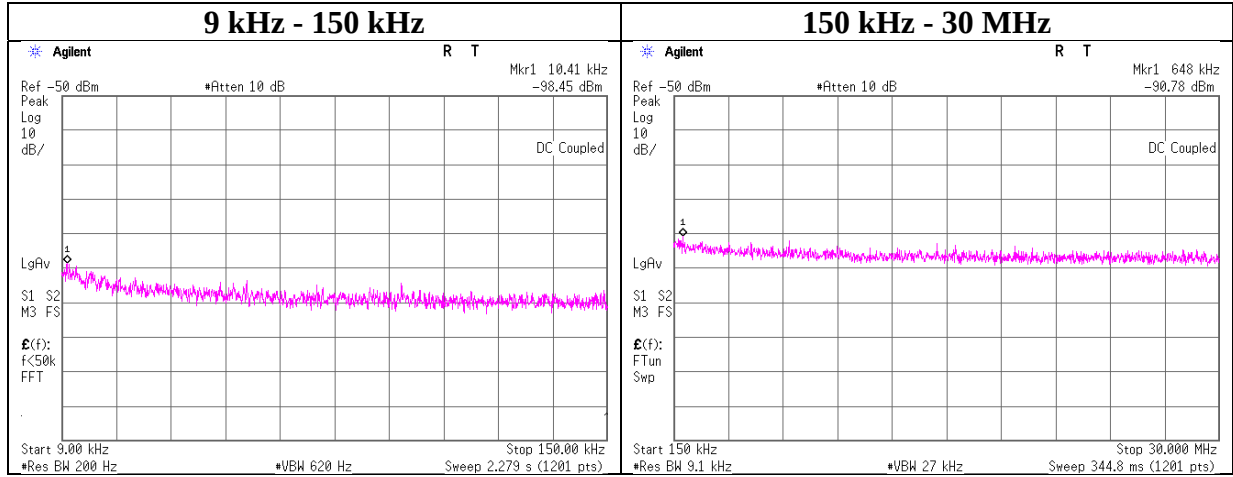
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Facsimile : +81 596 24 8124

Conducted Spurious Emission

Report No. 13395143H
Test place Ise EMC Lab. No.4 Measurement Room
Date June 16, 2020
Temperature / Humidity 22 deg. C / 52 % RH
Engineer Junki Nagatomi
Mode Tx 11n-20 2437 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
10.41	-98.5	0.90	9.9	2.0	1	-85.7	300	6.0	-24.4	47.2	71.6	
648.00	-90.8	0.90	9.9	2.0	1	-78.0	30	6.0	3.2	31.3	28.1	

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

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

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.

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Ise EMC Lab.

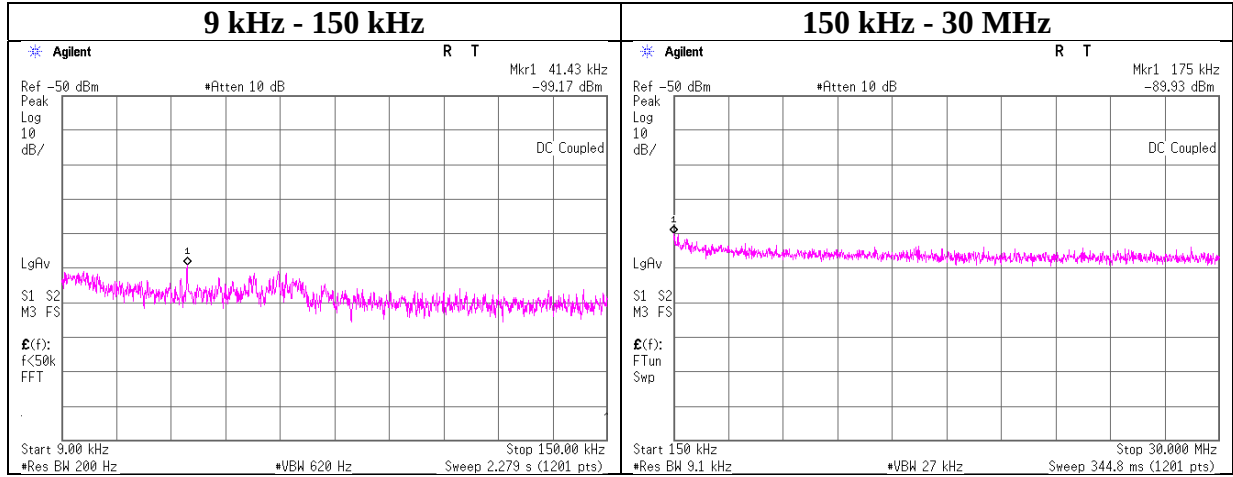
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Report No.	13395143H
Test place	Ise EMC Lab. No.3 Measurement Room
Date	June 11, 2020
Temperature / Humidity	22 deg. C / 51 % RH
Engineer	Junki Nagatomi
Mode	Tx BT LE 2402 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
41.43	-99.2	0.90	9.6	2.0	1	-86.7	300	6.0	-25.4	35.2	60.6	
175.00	-89.9	0.90	9.9	2.0	1	-77.2	300	6.0	-15.9	22.7	38.6	

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

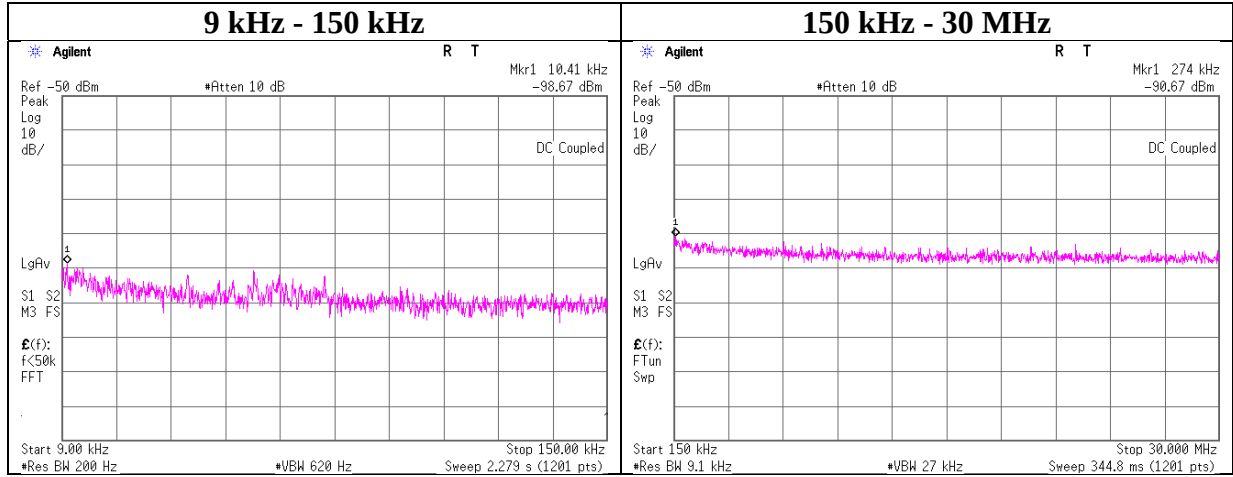
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$

N: Number of output

*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. 13395143H
Test place Ise EMC Lab. No.3 Measurement Room
Date June 11, 2020
Temperature / Humidity 22 deg. C / 51 % RH
Engineer Junki Nagatomi
Mode Tx BT LE 2440 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
10.41	-98.7	0.90	9.7	2.0	1	-86.1	300	6.0	-24.8	47.2	72.0	
274.00	-90.7	0.90	9.9	2.0	1	-77.9	300	6.0	-16.7	18.8	35.5	

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

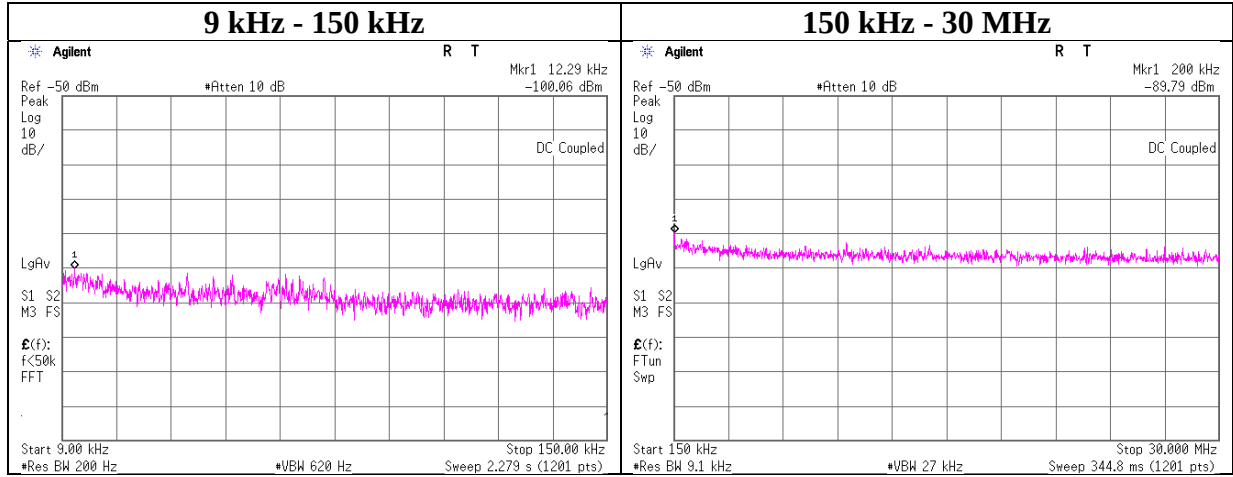
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$

N: Number of output

*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.	13395143H
Test place	Ise EMC Lab. No.3 Measurement Room
Date	June 11, 2020
Temperature / Humidity	22 deg. C / 51 % RH
Engineer	Junki Nagatomi
Mode	Tx BT LE 2480 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
12.29	-100.1	0.90	9.7	2.0	1	-87.5	300	6.0	-26.2	45.8	72.0	
200.00	-89.8	0.90	9.9	2.0	1	-77.0	300	6.0	-15.8	21.5	37.3	

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

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

N: Number of output

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

Power Density

Report No.	13395143H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.3	No.4	No.4
Date	June 11, 2020	June 14, 2020	June 16, 2020
Temperature / Humidity	22 deg. C / 51 % RH	23deg. C / 58 % RH	22 deg. C / 52 % RH
Engineer	Junki Nagatomi	Noguchi Takafumi	Junki Nagatomi
Mode	Tx		

11b

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412	-15.41	0.90	10.09	-4.42	8.00	12.42
2437	-16.42	0.90	10.09	-5.43	8.00	13.43
2462	-15.50	0.90	10.09	-4.51	8.00	12.51

11g

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412	-24.19	0.90	10.09	-13.20	8.00	21.20
2437	-23.75	0.90	10.09	-12.76	8.00	20.76
2462	-23.43	0.90	10.09	-12.44	8.00	20.44

11n-20

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2412	-26.13	0.90	10.09	-15.14	8.00	23.14
2437	-25.59	0.90	10.09	-14.60	8.00	22.60
2462	-25.22	0.90	10.09	-14.23	8.00	22.23

Sample Calculation:

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

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

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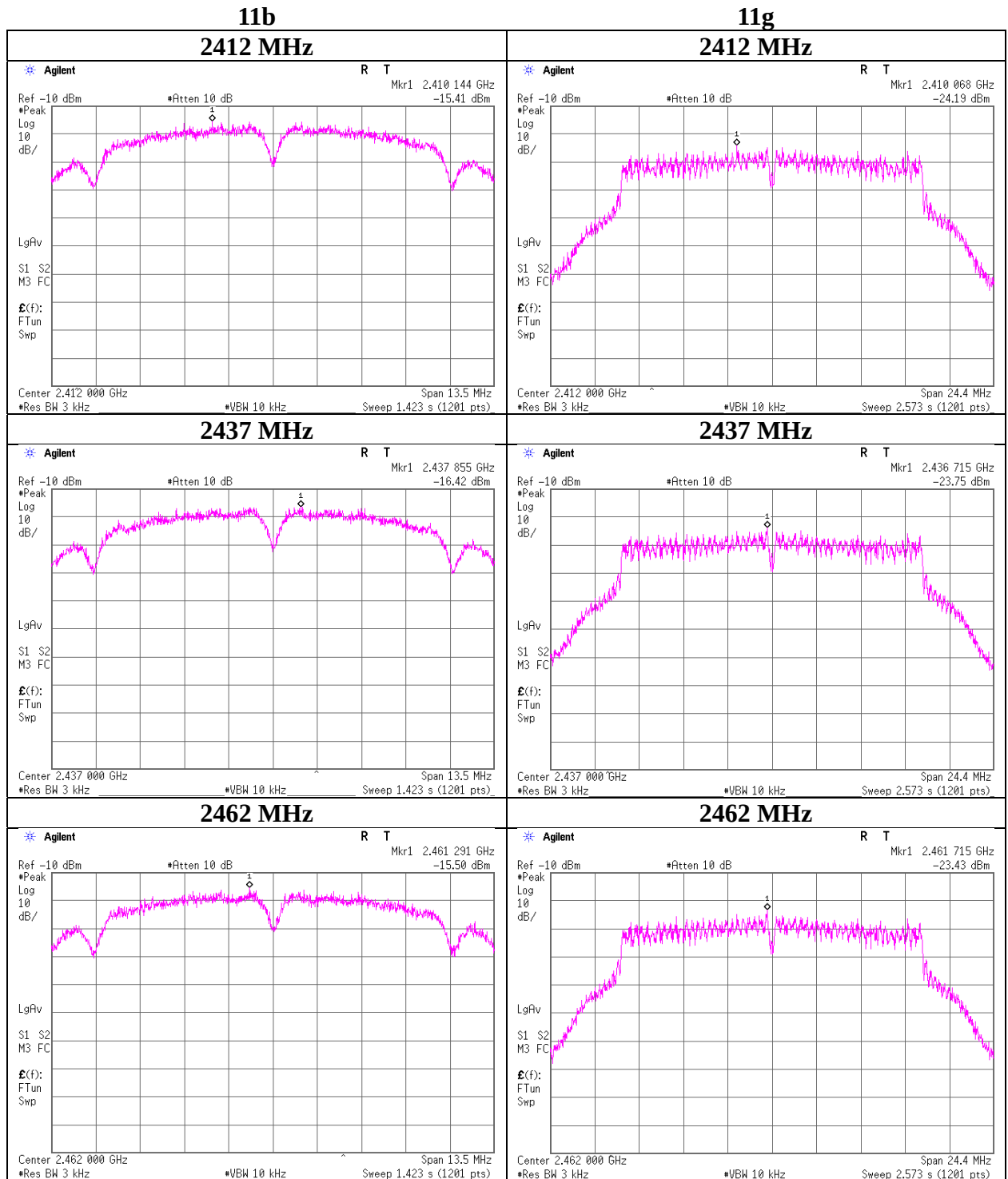
Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

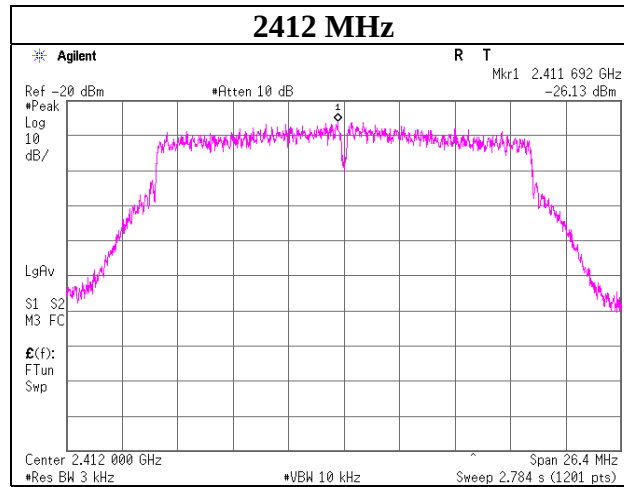
Power Density



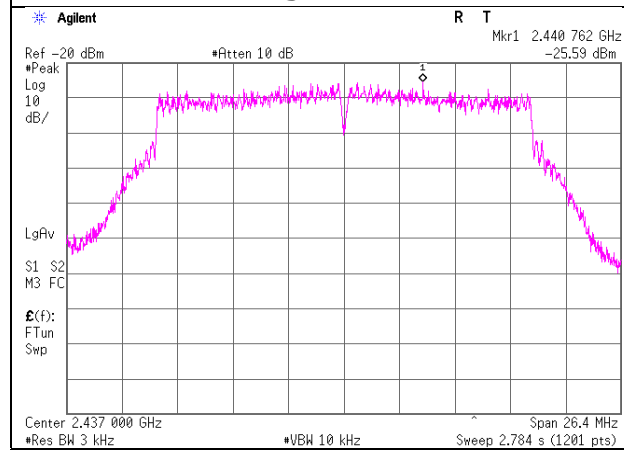
Power Density

11n-20

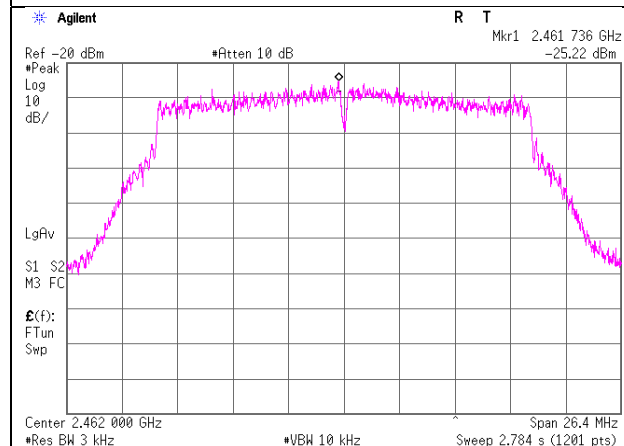
2412 MHz



2437 MHz



2462 MHz



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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Power Density

Report No. 13395143H
Test place Ise EMC Lab. No.3 Measurement Room
Date June 11, 2020
Temperature / Humidity 22 deg. C / 51 % RH
Engineer Junki Nagatomi
Mode Tx BT LE

BT LE

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402	-21.15	0.90	10.09	-10.16	8.00	18.16
2440	-21.36	0.90	10.09	-10.37	8.00	18.37
2480	-21.96	0.90	10.09	-10.97	8.00	18.97

Sample Calculation:

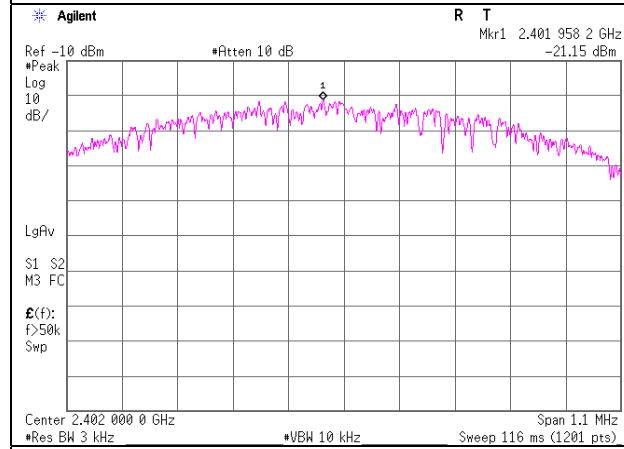
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

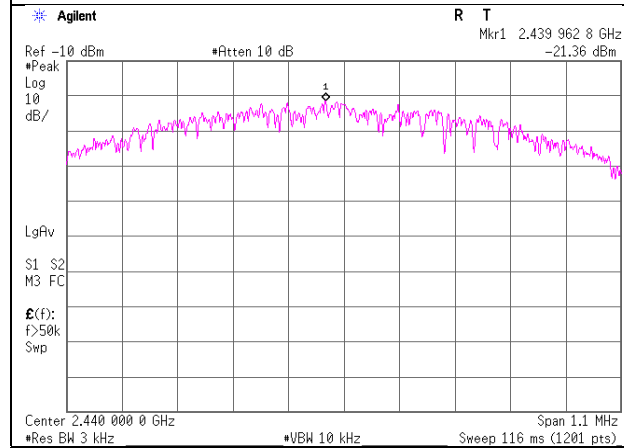
Power Density

BT LE

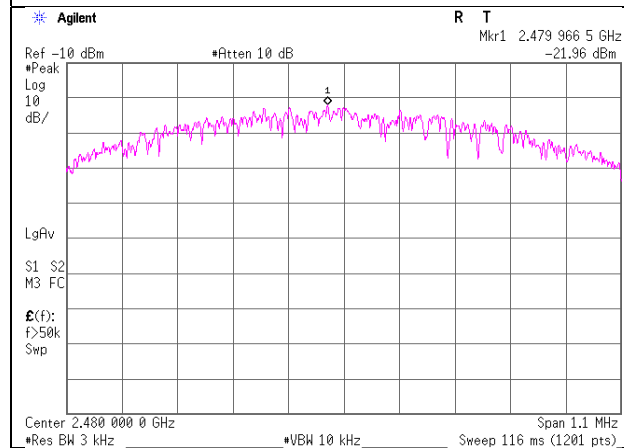
2402 MHz



2440 MHz



2480 MHz



UL Japan, Inc.

Ise EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	MOS-29	141568	Thermo-Hygrometer	CUSTOM	CTH-201	2901	2020/01/07	12
AT	MAT-20	141173	Attenuator(10dB)(above 1GHz)	HIROSE ELECTRIC CO.,LTD.	AT-110	-	2019/12/09	12
AT	MPM-12	141809	Power Meter	ANRITSU	ML2495A	825002	2020/05/07	12
AT	MPSE-17	141830	Power sensor	ANRITSU	MA2411B	738285	2020/05/07	12
AT	MRENT-130	141855	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46187750	2019/11/19	12
RE	MAEC-04-SVSWR	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	2019/04/04	24
RE/AT	MOS-15	141562	Thermo-Hygrometer	CUSTOM	CTH-201	0010	2020/01/07	12
RE	MMM-10	141545	DIGITAL HiTESTER	Hioki	3805	51201148	2020/01/06	12
RE	MJM-26	142227	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MHA-21	141508	Horn Antenna 1-18GHz	Schwarzbeck Mess - Elektronik	BBHA9120D	557	2020/05/22	12
RE	MPA-12	141581	MicroWave System Amplifier	Keysight Technologies Inc	83017A	650	2019/10/16	12
RE	MCC-246	199563	Microwave Cable	HUBER+SUNER	SF126E/11PC35/11P C35/1000M,5000M	537061/126E / 537072/126E	2020/06/11	12
RE	MHF-26	141296	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	2019/09/11	12
RE	MHA-17	141506	Horn Antenna 15-40GHz	Schwarzbeck Mess - Elektronik	BBHA9170	BBHA9170307	2019/10/08	12
RE	MPA-14	141583	Pre Amplifier	SONOMA INSTRUMENT	310	260833	2020/02/18	12
RE	MTR-10	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	2020/03/10	12
RE	MCC-50	141397	Coaxial Cable	UL Japan	-	-	2020/03/24	12
RE	MAT-34	141331	Attenuator(6dB)	TME	UFA-01	-	2020/02/05	12
RE	MBA-05	141425	Biconical Antenna	Schwarzbeck Mess - Elektronik	VHA9103+BBA9106	1302	2019/08/24	12
RE	MLA-23	141267	Logperiodic Antenna(200-1000MHz)	Schwarzbeck Mess - Elektronik	VUSLP9111B	9111B-192	2019/08/24	12
RE	MAEC-04	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	2020/05/25	24
AT	MPM-13	141810	Power Meter	ANRITSU	ML2495A	824014	2019/10/09	12
AT	MPSE-18	141832	Power sensor	ANRITSU	MA2411B	738174	2019/10/09	12
AT	MAT-10	141156	Attenuator(10dB)	Weinschel Corp	2	BL1173	2019/11/07	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: RE: Radiated Emission test
AT: Antenna Terminal Conducted test

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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124