

RADIO TEST REPORT

Test Report No. 15405430H-A-R1

Customer	Denso Wave Incorporated
Description of EUT	RF Tag Handy Terminal
Model Number of EUT	BHT-1408QUMWB
FCC ID	PZWBHT1408QUM
Test Regulation	FCC Part 15 Subpart C
Test Result	Complied
Issue Date	October 31, 2024
Remarks	Wireless LAN (2.4 GHz band) and Bluetooth Low Energy part(s)

Representative Test EngineerJunya Okuno
Engineer**Approved By**Ryota Yamanaka
Engineer

CERTIFICATE 5107.02

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

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REVISION HISTORY

Original Test Report No. 15405430H-A

This report is a revised version of 15405430H-A. 15405430H-A is replaced with this report.

Revision	Test Report No.	Date	Page Revised Contents
- (Original)	15405430H-A	September 26, 2024	-
1	15405430H-A-R1	October 31, 2024	Correction of the note *1) in Section 3.2.
1	15405430H-A-R1	October 31, 2024	Correction of erroneous description in Figure 1: Test Setup (1 GHz to 10 GHz).
1	15405430H-A-R1	October 31, 2024	Addition of ""*1)" to the Remarks for 2486.0 MHz in Radiated Spurious Emission test data (BT LE 2480 MHz).
1	15405430H-A-R1	October 31, 2024	Addition of following the LIMS ID; WLAN: 141950, BT LE: 141583

Reference: Abbreviations (Including words undescribed in this report)

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

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SECTION 1: Customer Information

Company Name	Denso Wave Incorporated
Address	1 Yoshiike, Kusagi, Agui-cho, Chita-gun, Aichi 470-2297 Japan
Telephone Number	+81-569-49-5284
Contact Person	Shoji Ogiso

The information provided by the customer is as follows;

- Customer, Description 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 and Test Date
- SECTION 4: Operation of EUT during testing

SECTION 2: Equipment Under Test (EUT)

2.1 Identification of EUT

Description	RF Tag Handy Terminal
Model Number	BHT-1408QUMWB
Serial Number	Refer to SECTION 4.2
Condition	Engineering prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	No Modification by the test lab
Receipt Date	April 9, 17 and July 22, 2024
Test Date	April 10 to July 31, 2024

2.2 Product Description

General Specification

Rating	DC 3.7 V
Operating temperature	-20 deg. C to 50 deg. C

Radio Specification

This report contains data provided by the customer which can impact the validity of results. UL Japan, Inc. is only responsible for the validity of results after the integration of the data provided by the customer. The data provided by the customer is marked "a)" in the table below.

UHF

Equipment Type	Transceiver
Frequency of Operation	915.25 MHz to 927.50 MHz
Type of Modulation	PR-ASK
Antenna Gain	2.0 dBi

WLAN (IEEE802.11b/11g/11n-20)

Equipment Type	Transceiver
Frequency of Operation	2412 MHz to 2462 MHz
Type of Modulation	DSSS, OFDM
Antenna Gain ^{a)}	0.75 dBi

Bluetooth (BR / EDR / Low Energy)

Equipment Type	Transceiver
Frequency of Operation	2402 MHz to 2480 MHz
Type of Modulation	BR / EDR: GFSK, $\pi/4$ DQPSK, 8 DPSK Low Energy: GFSK
Antenna Gain ^{a)}	0.75 dBi

* WLAN and Bluetooth do not transmit simultaneously.

SECTION 3: Test Specification, Procedures & Results

3.1 Test Specification

Test Specification	FCC Part 15 Subpart C The latest version on the first day of the testing period
Title	FCC 47 CFR Part 15 Radio Frequency Device Subpart C Intentional Radiators Section 15.207 Conducted limits Section 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

* Also the EUT complies with FCC Part 15 Subpart B.

3.2 Procedures and Results

Item	Test Procedure	Specification	Worst Margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods ISED: RSS-Gen 8.8	FCC: Section 15.207 ISED: RSS-Gen 8.8	-	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	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	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	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	4.1 dB 2390.0 MHz, Horizontal, AV	Complied	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *2)
Note: UL Japan, Inc.'s EMI Work Procedures: Work Instructions-ULID-003591 and Work Instructions-ULID-003593. * In case any questions arise about test procedure, ANSI C63.10: 2013 is also referred. *1) The test is not applicable since the battery is charged using a dedicated charger and is not charged via AC power from the main unit. *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.					

FCC Part 15.31 (e)

The EUT is a battery-operated device and test was performed with the full-charged battery. 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.

3.3 Addition to Standard

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

Other than above, no addition, exclusion nor deviation has been made from the standard.

3.4 Uncertainty

Measurement uncertainty is not taken into account when stating conformity with a specified requirement.
Note: When margins obtained from test results are less than the measurement uncertainty, the test results may exceed the limit.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k = 2$.

[WLAN]

Radiated emission

Measurement distance	Frequency range	Unit	Calculated Uncertainty (+/-)
3 m	9 kHz to 30 MHz	dB	3.3
10 m		dB	3.1
3 m	30 MHz to 200 MHz	Horizontal	4.7
		Vertical	4.7
	200 MHz to 1000 MHz	Horizontal	4.8
		Vertical	6.0
10 m	30 MHz to 200 MHz	Horizontal	5.2
		Vertical	5.1
	200 MHz to 1000 MHz	Horizontal	5.2
		Vertical	5.2
3 m	1 GHz to 6 GHz	dB	5.1
	6 GHz to 18 GHz	dB	5.4
1 m	10 GHz to 18 GHz	dB	5.4
	18 GHz to 26.5 GHz	dB	5.3
	26.5 GHz to 40 GHz	dB	4.8
0.5 m	26.5 GHz to 40 GHz	dB	5.0

Antenna Terminal Conducted

Item	Unit	Calculated Uncertainty (+/-)
Antenna terminated conducted emission / Power density / Burst power	dB	3.47
Adjacent channel power (ACP)	dB	2.28
Bandwidth (OBW)	%	0.96
Time readout (time span upto 100 msec)	%	0.11
Time readout (time span upto 1000 msec)	%	0.11
Time readout (time span upto 60 sec)	%	0.02
Power measurement (Power meter < 8 GHz)	dB	1.46
Power measurement (Call box < 6 GHz)	dB	1.69
Frequency readout (Frequency counter)	ppm	0.67
Frequency readout (Spectrum analyzer frequency readout function)	ppm	2.13
Temperature (constant temperature bath)	deg. C	0.69
Humidity (constant temperature bath)	%RH	2.98
Modulation characteristics	%	6.93
Frequency for mobile	ppm	0.08
Contention-based protocol	dB	2.26

[BT LE]

Radiated emission

Measurement distance	Frequency range	Unit	Calculated Uncertainty (+/-)
3 m	9 kHz to 30 MHz	dB	3.3
10 m		dB	3.1
3 m	30 MHz to 200 MHz	Horizontal	4.7
		Vertical	4.7
	200 MHz to 1000 MHz	Horizontal	4.8
		Vertical	6.0
10 m	30 MHz to 200 MHz	Horizontal	5.2
		Vertical	5.1
	200 MHz to 1000 MHz	Horizontal	5.2
		Vertical	5.2
3 m	1 GHz to 6 GHz	dB	5.0
	6 GHz to 18 GHz	dB	5.2
1 m	10 GHz to 18 GHz	dB	5.3
	18 GHz to 26.5 GHz	dB	5.2
	26.5 GHz to 40 GHz	dB	4.7
0.5 m	26.5 GHz to 40 GHz	dB	4.8

Antenna Terminal Conducted

Item	Unit	Calculated Uncertainty (+/-)
Antenna terminated conducted emission / Power density / Burst power	dB	3.47
Adjacent channel power (ACP)	dB	2.28
Bandwidth (OBW)	%	0.96
Time readout (time span upto 100 msec)	%	0.11
Time readout (time span upto 1000 msec)	%	0.11
Time readout (time span upto 60 sec)	%	0.02
Power measurement (Power meter < 8 GHz)	dB	1.46
Power measurement (Call box < 6 GHz)	dB	1.69
Frequency readout (Frequency counter)	ppm	0.67
Frequency readout (Spectrum analyzer frequency readout function)	ppm	2.13
Temperature (constant temperature bath)	deg. C	0.69
Humidity (constant temperature bath)	%RH	2.98
Modulation characteristics	%	6.93
Frequency for mobile	ppm	0.08
Contention-based protocol	dB	2.26

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.

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

Telephone: +81-596-24-8999

A2LA Certificate Number: 5107.02 / FCC Test Firm Registration Number: 884919

ISED Lab Company Number: 2973C / CAB identifier: JP0002

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.10 shielded room	3.8 x 2.8 x 2.8	3.8 x 2.8	-	-
No.11 measurement room	4.0 x 3.4 x 2.5	N/A	-	-
No.12 measurement room	2.6 x 3.4 x 2.5	N/A	-	-
Large Chamber	16.9 x 22.1 x 10.17	16.9 x 22.1	-	10 m
Small Chamber	5.3 x 6.69 x 3.59	5.3 x 6.69	-	-

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)

[WLAN]

Mode	Remarks*
IEEE 802.11b (11b)	1 Mbps, PN9
IEEE 802.11g (11g)	48 Mbps, PN9
IEEE 802.11n MHz BW (11n-20)	MCS 4, PN9
*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 Setting: 11b: 15.5 dBm, 11g: 11.0 dBm, 11n-20: 11.0 dBm Software: QRCT Version: 3.0.156.0 (Date: 2015.10.19, 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. 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.	

*The Details of Operating Mode(s)

Test Item	Operating Mode	Tested Frequency
Radiated Spurious Emission (Below 1 GHz)	Tx 11n-20 *1)	2462 MHz
99% Occupied Bandwidth, 6dB Bandwidth, Maximum Peak Output Power, Power Density	Tx 11b Tx 11g Tx 11n-20	2412 MHz 2437 MHz 2462 MHz
Radiated Spurious Emission (Above 1 GHz) *2)	Tx 11b Tx 11n-20	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.

[BT LE]

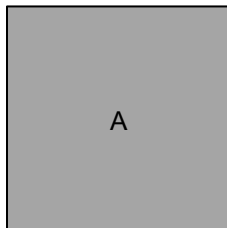
Mode	Remarks*
Bluetooth Low Energy (BT LE)	Maximum Packet Size, PRBS9
*Power of the EUT was set by the software as follows; Power Setting: 3.2 dBm Software: QRCT Version: 3.0.156.0 (Date: 2015.10.19, Storage location: Driven by connected PC) *This setting of software is the worst case. Any conditions 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 Frequency
Radiated Spurious Emission (Below 1 GHz), Conducted Spurious Emission	Tx BT LE *1)	2480 MHz
99% Occupied Bandwidth, 6dB Bandwidth, Maximum Peak Output Power, Radiated Spurious Emission (Above 1 GHz), Power Density	Tx BT LE	2402 MHz 2440 MHz 2480 MHz
*1) Conducted emissions and Spurious emissions for frequencies below 1 GHz were limited to the channel that had the highest power during the antenna terminal test, as preliminary testing indicated that changing the operating frequency had no significant impact on the emissions in those frequency bands.		

4.2 Configuration and Peripherals

Radiated Emission test

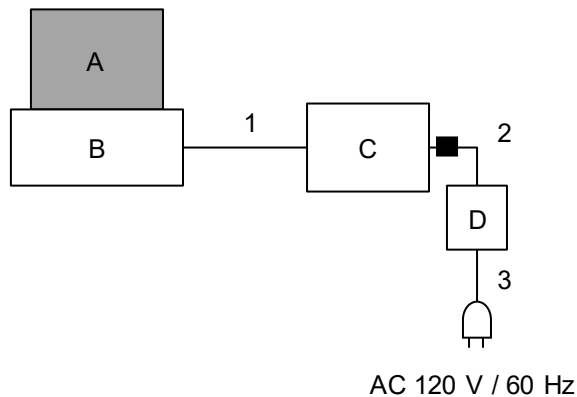


* Setup was taken into consideration and test data was taken under worse case conditions.

Description of EUT

No.	Item	Model number	Serial Number	Manufacturer	Remarks
A	RF Tag Handy Terminal	BHT-1408QUMWB	4969005020300825 for WLAN	Denso Wave Incorporated	EUT
			4969005020300824 for BT LE		

Antenna Terminal Conducted Tests



■ : Standard Ferrite Core

* 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	RF Tag Handy Terminal	BHT-1408QUMWB	4969005020300821 for WLAN 4969005020300820 for BT LE	Denso Wave Incorporated	EUT
B	Battery Charger	CU-AU1-14	46320-2373 for WLAN 46320-2344 for BT LE	Denso Wave Incorporated	-
C	Laptop PC	X1 Carbon	R9-OH8OBW 15/9	LENOVO	-
D	AC Adapter	ADXL45NCC2A	11S45N0299Z1ZS944 B6KBR	LENOVO	-

List of Cables Used

No.	Name	Length (m)	Shield Cable	Connector	Remarks
1	USB Cable	2.1 for WLAN 1.0 for BT LE	Shielded	Shielded	-
2	DC Cable	1.7	Unshielded	Unshielded	-
3	AC Cable	1.0	Unshielded	Unshielded	-

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. 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 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.

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

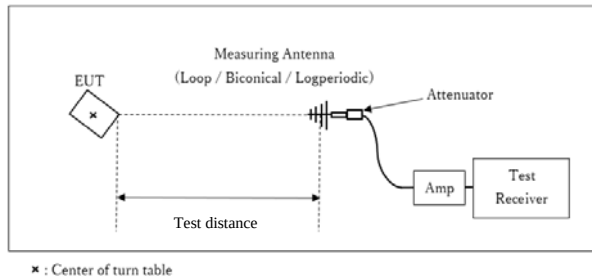
In any 100 kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired 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	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	11.12.2.5.1 (11b / BT LE) RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces 11.12.2.5.2 (BT LE) The duty cycle was less than 98% for detected noise, a duty factor was added to the 11.12.2.5.1 results. 11.12.2.5.3 (11n-20) RBW: 1 MHz VBW: 1/T Detector: Power Averaging (RMS)	RBW: 100 kHz VBW: 300 kHz

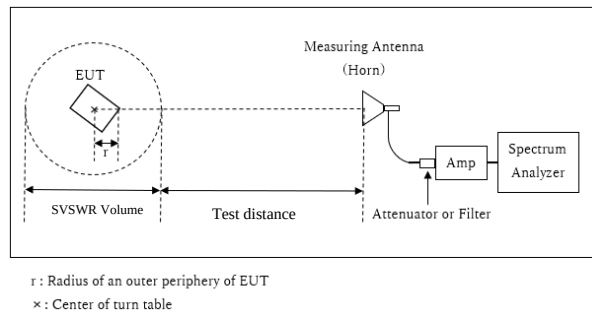
Figure 1: Test Setup

Below 1 GHz



Test Distance: 3 m

1 GHz to 10 GHz



1 GHz to 6 GHz

Distance Factor: $20 \times \log (3.9 \text{ m}^* / 3.0 \text{ m}) = 2.28 \text{ dB}$
*(Test Distance + SVSWR Volume / 2) - r = 3.9 m

Test Distance: 3 m

SVSWR Volume : 2.0 m

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

r = 0.1 m

6 GHz to 10 GHz

[No.1 Semi Anechoic Chamber]

Distance Factor: $20 \times \log (5.9 \text{ m}^* / 3.0 \text{ m}) = 5.88 \text{ dB}$

*(Test Distance + SVSWR Volume / 2) - r = 5.9 m

Test Distance: 5.16 m

SVSWR Volume : 1.68 m

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

r = 0.1 m

[No.4 Semi Anechoic Chamber]

Distance Factor: $20 \times \log (4.9 \text{ m}^* / 3.0 \text{ m}) = 4.27 \text{ dB}$

*(Test Distance + SVSWR Volume / 2) - r = 4.9 m

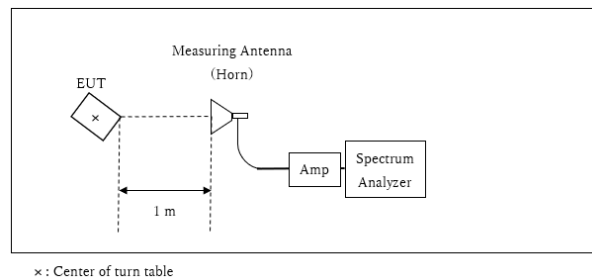
Test Distance: 4.3 m

SVSWR Volume : 1.4 m

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

r = 0.1 m

10 GHz to 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 to see the position of maximum noise, and the test was made at the position that has the maximum noise.

Test results are rounded off and limit are rounded down, so some differences might be observed.

Measurement Range : 30 MHz to 26.5 GHz
Test Data : APPENDIX
Test Result : Pass

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	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	10 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *2)
Conducted Spurious Emission *3), *4)	9 kHz to 150 kHz 150 kHz to 30 MHz	200 Hz 10 kHz	620 Hz 30 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

*1) Peak hold was applied as Worst-case measurement.

*2) Section 11.10.2 Method PKPSD (peak PSD) of "ANSI C63.10-2013".

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

Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.
(9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz)

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

Test results are rounded off and limit are rounded down, 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

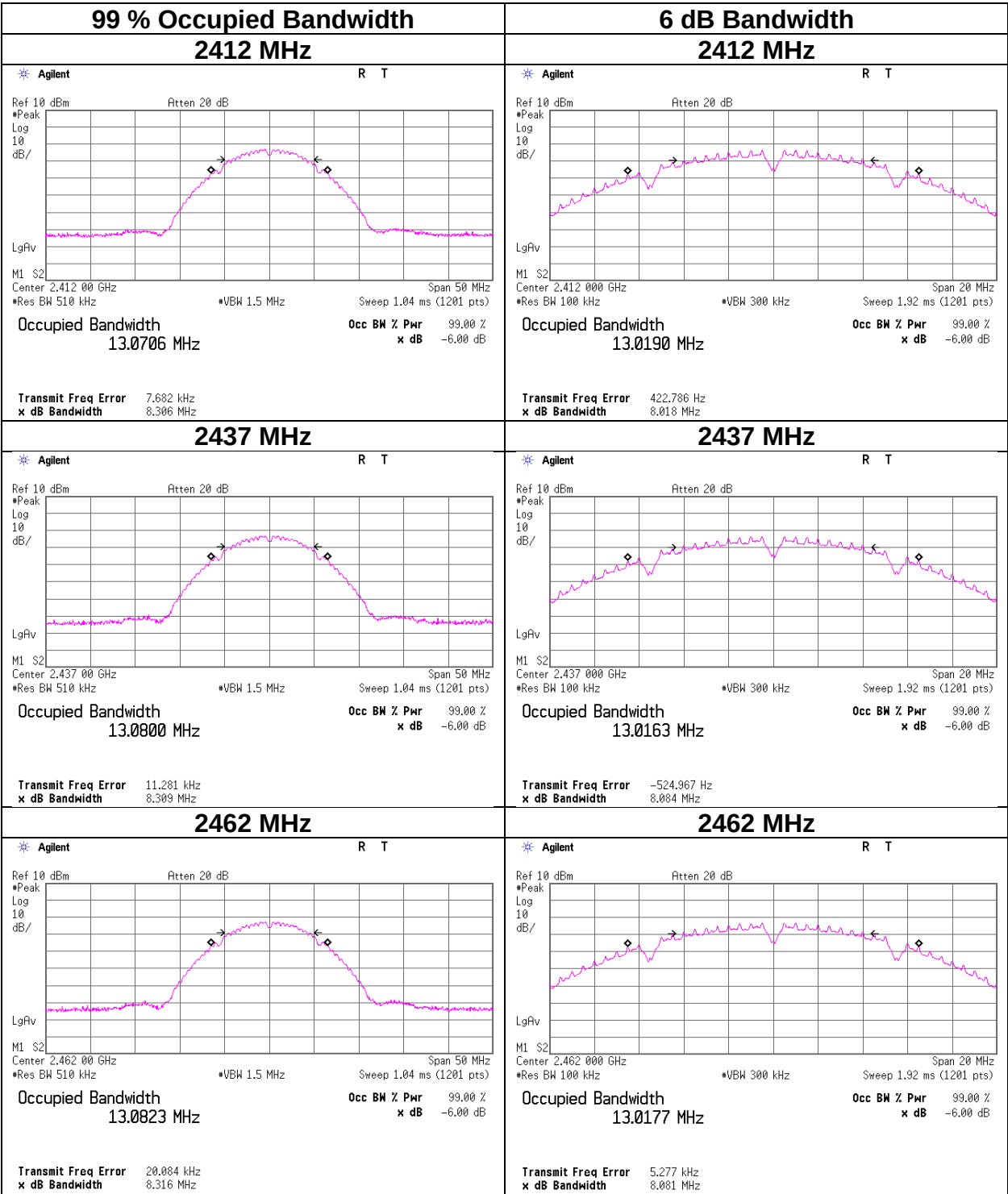
99 % Occupied Bandwidth and 6 dB Bandwidth

Test place	Ise EMC Lab.	
	No.4 Preparation Room	No.8 Measurement Room
Date	April 11, 2024	July 25, 2024
Temperature / Humidity	21 deg. C / 48 % RH	22 deg. C / 60 % RH
Engineer	Nachi Konegawa (BT LE)	Junya Okuno (WLAN)
Mode	Tx	

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
11b	2412	13070.6	8.018	> 0.5000
	2437	13080.0	8.084	> 0.5000
	2462	13082.3	8.081	> 0.5000
11g	2412	17207.9	16.481	> 0.5000
	2437	17160.5	16.486	> 0.5000
	2462	17202.8	16.484	> 0.5000
11n-20	2412	18231.6	17.699	> 0.5000
	2437	18251.5	17.690	> 0.5000
	2462	18283.2	17.740	> 0.5000
BT LE	2402	1062.0	0.673	> 0.5000
	2440	1062.1	0.661	> 0.5000
	2480	1062.7	0.670	> 0.5000

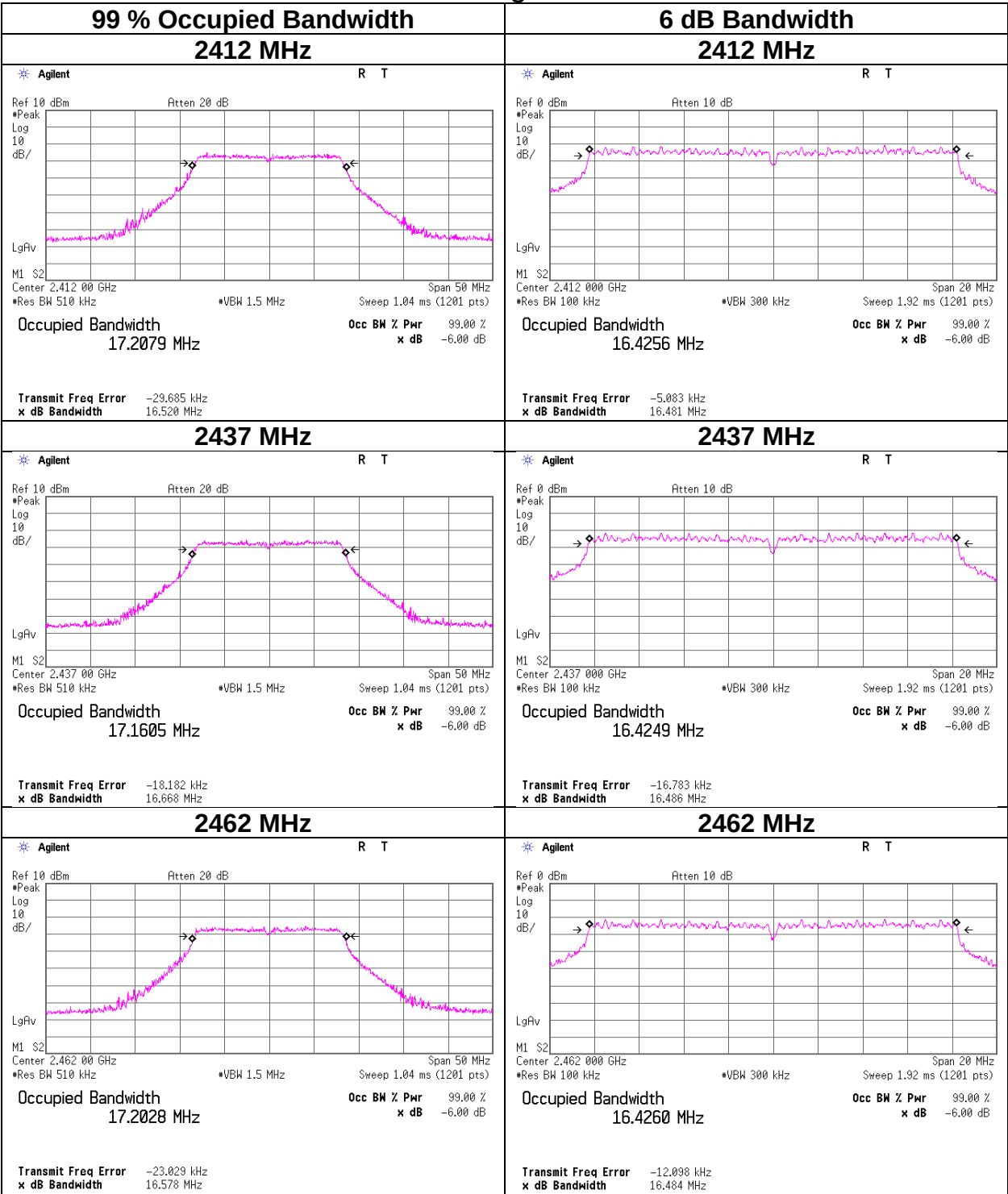
99 % Occupied Bandwidth and 6 dB Bandwidth

11b



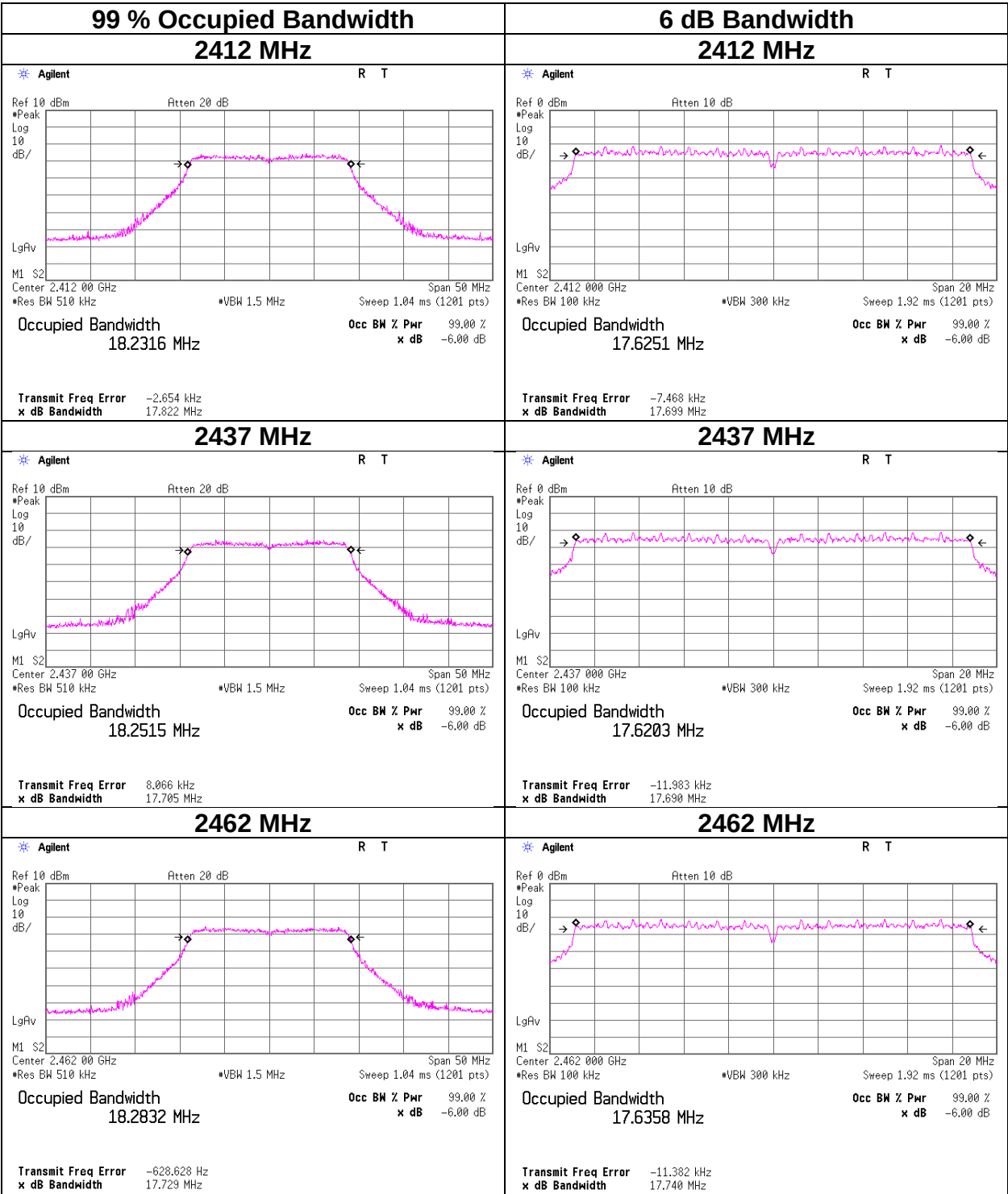
99 % Occupied Bandwidth and 6 dB Bandwidth

11g



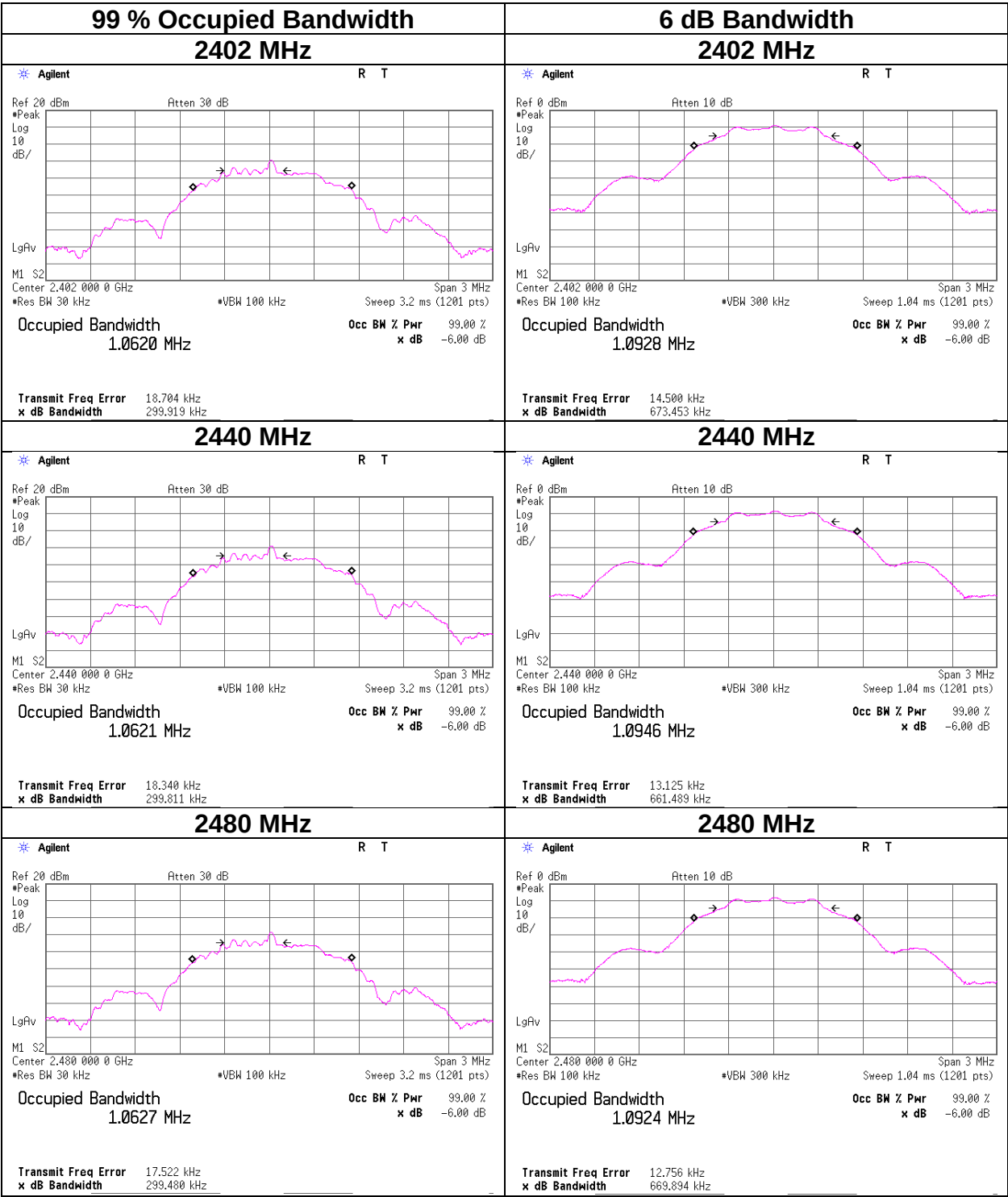
99 % Occupied Bandwidth and 6 dB Bandwidth

11n-20



99 % Occupied Bandwidth and 6 dB Bandwidth

BT LE



Maximum Peak Output Power

Test place Ise EMC Lab. No.8 Measurement Room
Date July 25, 2024
Temperature / Humidity 22 deg. C / 60 % RH
Engineer Junya Okuno
Mode Tx 11b

Freq.	Reading	Cable Loss	Atten. Loss	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
				[dBm]	[mW]	[dBm]	[mW]	[dB]		[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	-3.15	1.04	20.00	17.89	61.52	30.00	1000	12.11	0.75	18.64	73.11	36.02	4000	17.38
2437	-3.21	1.05	20.00	17.84	60.81	30.00	1000	12.16	0.75	18.59	72.28	36.02	4000	17.43
2462	-2.73	1.05	20.00	18.32	67.92	30.00	1000	11.68	0.75	19.07	80.72	36.02	4000	16.95

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]	
1	-3.21	*
2	-3.26	
5.5	-3.24	
11	-3.26	

*: Worst Rate
All comparison were carried out on same frequency and measurement factors.

Maximum Peak Output Power

Test place Ise EMC Lab. No.8 Measurement Room
Date July 25, 2024
Temperature / Humidity 22 deg. C / 60 % RH
Engineer Junya Okuno
Mode Tx 11g

Freq.	Reading	Cable Loss	Atten. Loss	Conducted Power					Antenna Gain	e.i.r.p. for RSS-247				
				Result		Limit		Margin		Result		Limit		Margin
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	1.20	1.04	20.00	22.24	167.49	30.00	1000	7.76	0.75	22.99	199.07	36.02	4000	13.03
2437	1.34	1.05	20.00	22.39	173.38	30.00	1000	7.61	0.75	23.14	206.06	36.02	4000	12.88
2462	1.57	1.05	20.00	22.62	182.81	30.00	1000	7.38	0.75	23.37	217.27	36.02	4000	12.65

Sample Calculation:

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

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

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

2437 MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
6	-3.10	
9	-3.22	
12	-3.06	
18	-3.10	
24	1.21	
36	1.24	
48	1.34	*
54	1.26	

*: Worst Rate

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

Maximum Peak Output Power

Test place Ise EMC Lab. No.8 Measurement Room
Date July 25, 2024
Temperature / Humidity 22 deg. C / 60 % RH
Engineer Junya Okuno
Mode Tx 11n-20

Freq.	Reading	Cable Loss	Atten. Loss	Conducted Power					Antenna Gain	e.i.r.p. for RSS-247				
				Result		Limit		Margin		Result		Limit		Margin
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dB]		
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	1.20	1.04	20.00	22.24	167.49	30.00	1000	7.76	0.75	22.99	199.07	36.02	4000	13.03
2437	1.38	1.05	20.00	22.43	174.98	30.00	1000	7.57	0.75	23.18	207.97	36.02	4000	12.84
2462	1.58	1.05	20.00	22.63	183.23	30.00	1000	7.37	0.75	23.38	217.77	36.02	4000	12.64

Sample Calculation:

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

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

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

2437 MHz

MCS Number	Reading [dBm]	Remark
0	-3.14	
1	-2.94	
2	-3.17	
3	1.29	
4	1.38	*
5	1.28	
6	1.25	
7	1.22	

*: Worst MCS

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

Maximum Peak Output Power

Test place Ise EMC Lab. No.8 Measurement Room
Date April 10, 2024
Temperature / Humidity 20 deg. C / 45 % RH
Engineer Nachi Konegawa
Mode Tx BT LE

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]			[dBm]	[mW]	[dBm]	[mW]	
2402	-9.02	0.89	9.75	1.62	1.45	30.00	1000	28.38	0.75	2.37	1.73	36.02	4000	33.65
2440	-8.37	0.89	9.76	2.28	1.69	30.00	1000	27.72	0.75	3.03	2.01	36.02	4000	32.99
2480	-8.10	0.90	9.76	2.56	1.80	30.00	1000	27.44	0.75	3.31	2.14	36.02	4000	32.71

Sample Calculation:

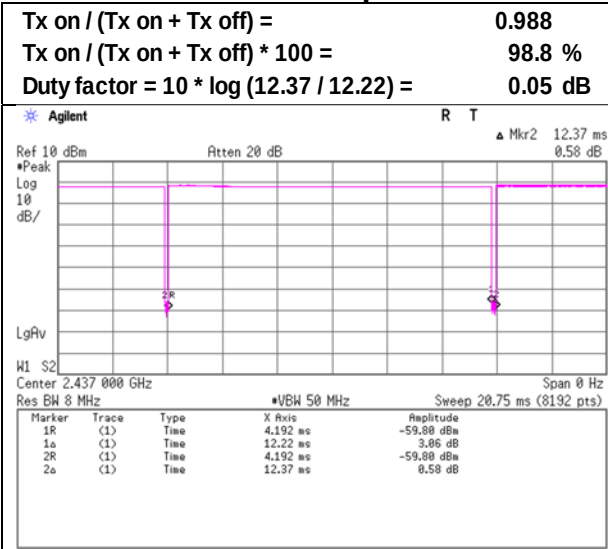
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

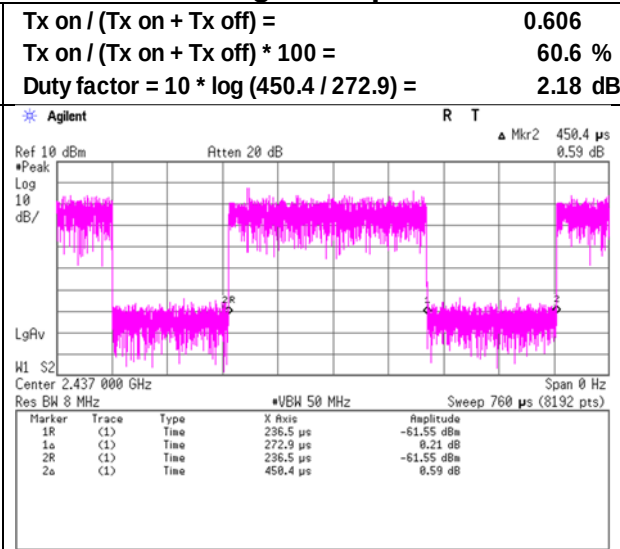
Burst rate confirmation

Test place	Ise EMC Lab.	No.8 Measurement Room
Date	No.4 Preparation Room	July 25, 2024
Temperature / Humidity	April 11, 2024	22 deg. C / 60 % RH
Engineer	21 deg. C / 48 % RH	Junya Okuno
	Nachi Konegawa	(WLAN)
	(BT LE)	
Mode	Tx	

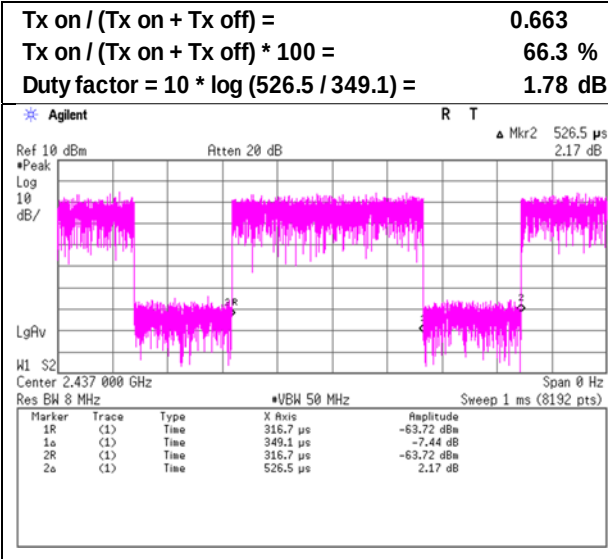
11b 1 Mbps



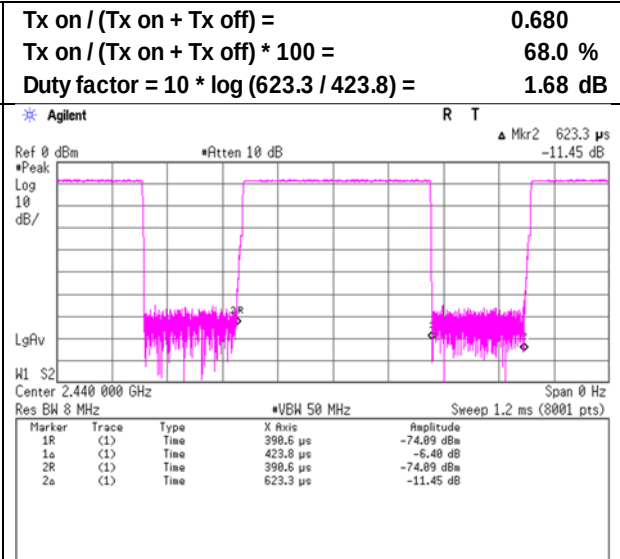
11g 48 Mbps



11n-20 MCS 4



BT LE



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

Radiated Spurious Emission

Test place	Ise EMC Lab.	No.1
Semi Anechoic Chamber	No.1	No.1
Date	July 28, 2024	July 31, 2024
Temperature / Humidity	26 deg. C / 60 % RH	24 deg. C / 49 % RH
Engineer	Junya Okuno	Ken Fujita
	(1 GHz to 6 GHz)	(Above 6 GHz)
Mode	Tx 11b 2412 MHz	

Polarity	Frequency	Reading (QP / PK)	Reading (AV)	Ant. Factor	Loss	Gain	Duty Factor	Result (QP / PK)	Result (AV)	Limit (QP / PK)	Limit (AV)	Margin (QP / PK)	Margin (AV)	Remark
[Hori/Vert]	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]	
Hori.	2390.0	56.2	47.6	27.7	5.0	36.0	-	52.8	44.3	73.9	53.9	21.1	9.7	
Hori.	4824.0	47.8	43.3	31.5	6.9	35.6	-	50.6	46.1	73.9	53.9	23.3	7.8	
Hori.	7236.0	40.3	32.0	35.6	10.6	32.1	-	54.5	46.1	73.9	53.9	19.4	7.8	Floor noise
Hori.	9648.0	41.1	32.1	35.8	11.5	32.3	-	56.1	47.0	73.9	53.9	17.9	6.9	Floor noise
Vert.	2390.0	56.5	47.9	27.7	5.0	36.0	-	53.1	44.6	73.9	53.9	20.8	9.3	
Vert.	4824.0	47.5	43.0	31.5	6.9	35.6	-	50.3	45.8	73.9	53.9	23.6	8.1	
Vert.	7236.0	41.1	31.9	35.6	10.6	32.1	-	55.3	46.0	73.9	53.9	18.7	7.9	Floor noise
Vert.	9648.0	41.8	31.0	35.8	11.5	32.3	-	56.7	45.9	73.9	53.9	17.2	8.0	Floor noise

Result (QP / PK) = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
Result (AV)= 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).
*QP detector was used up to 1GHz.

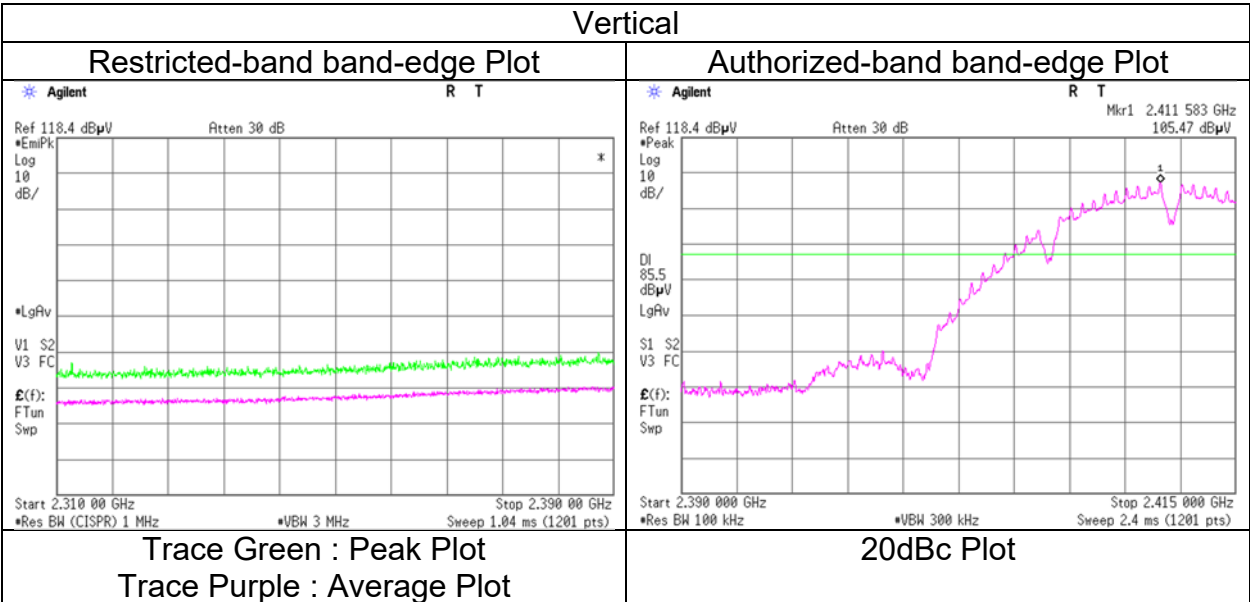
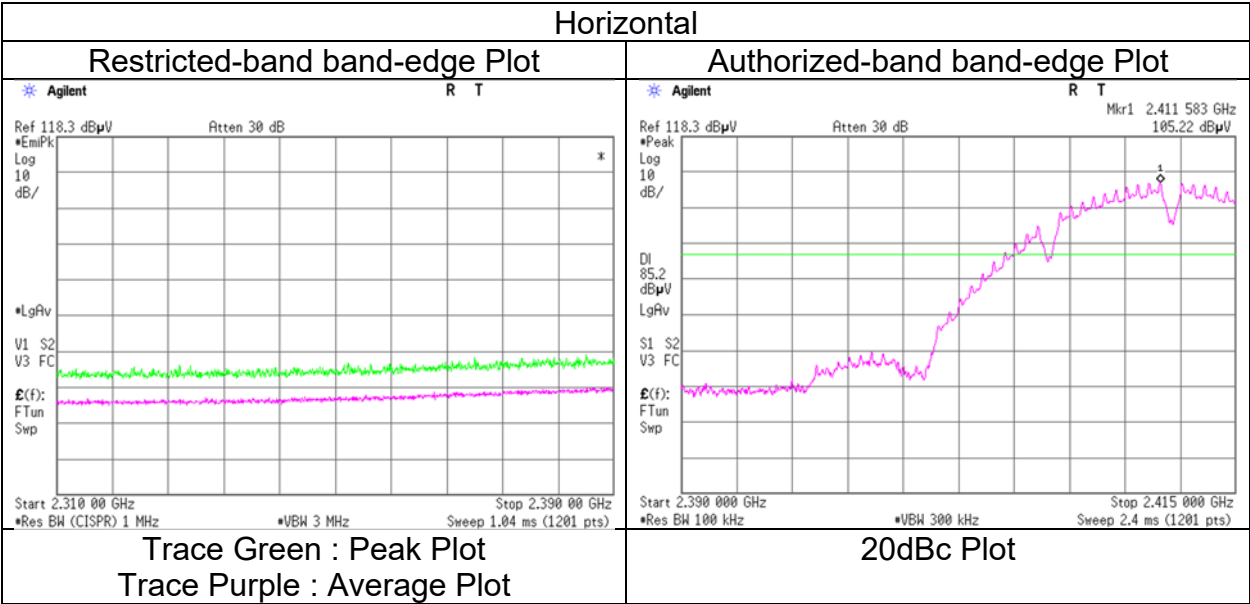
20dBc Data Sheet

Polarity	Frequency	Reading (PK)	Ant Factor	Loss	Gain	Result	Limit	Margin	Remark
[Hori/Vert]	[MHz]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
Hori.	2412.0	105.2	27.7	5.0	36.0	101.9	-	-	Carrier
Hori.	2398.6	58.0	27.7	5.0	36.0	54.6	81.9	27.3	
Hori.	2400.0	53.4	27.7	5.0	36.0	50.1	81.9	31.8	
Vert.	2412.0	105.5	27.7	5.0	36.0	102.1	-	-	Carrier
Vert.	2398.6	58.6	27.7	5.0	36.0	55.2	82.1	26.9	
Vert.	2400.0	52.8	27.7	5.0	36.0	49.5	82.1	32.7	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
Distance factor: 1 GHz - 6 GHz 20log (3.9 m / 3.0 m) = 2.28 dB
6 GHz - 10 GHz 20log (5.9 m / 3.0 m) = 5.88 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.1
Date	July 28, 2024
Temperature / Humidity	26 deg. C / 60 % RH
Engineer	Junya Okuno
	(1 GHz to 6 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 and authorized band edge were shown in tabular data.

Radiated Spurious Emission

Test place
Semi Anechoic Chamber
Date
Temperature / Humidity
Engineer

Mode

Ise EMC Lab.
No.1
July 28, 2024
26 deg. C / 60 % RH
Junya Okuno
(1 GHz to 6 GHz)
Tx 11b 2437 MHz

No.1
July 31, 2024
24 deg. C / 49 % RH
Ken Fujita
(Above 6 GHz)

Polarity	Frequency	Reading (QP / PK)	Reading (AV)	Ant. Factor	Loss	Gain	Duty Factor	Result (QP / PK)	Result (AV)	Limit (QP / PK)	Limit (AV)	Margin (QP / PK)	Margin (AV)	Remark
[Hori/Vert]	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]	
Hori.	4874.0	47.2	41.6	31.6	6.9	35.6	-	50.1	44.4	73.9	53.9	23.9	9.5	
Hori.	7311.0	41.3	32.1	35.5	10.7	32.1	-	55.4	46.2	73.9	53.9	18.5	7.7	Floor noise
Hori.	9748.0	41.2	31.9	36.0	11.5	32.4	-	56.3	47.0	73.9	53.9	17.6	6.9	Floor noise
Vert.	4874.0	47.0	40.9	31.6	6.9	35.6	-	49.9	43.8	73.9	53.9	24.0	10.1	
Vert.	7311.0	41.6	33.3	35.5	10.7	32.1	-	55.7	47.4	73.9	53.9	18.2	6.5	Floor noise
Vert.	9748.0	41.5	31.7	36.0	11.5	32.4	-	56.6	46.8	73.9	53.9	17.3	7.1	Floor noise

Result (QP / PK) = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
Result (AV)= 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).
*QP detector was used up to 1GHz.

Distance factor: 1 GHz - 6 GHz 20log (3.9 m / 3.0 m) = 2.28 dB
 6 GHz - 10 GHz 20log (5.9 m / 3.0 m) = 5.88 dB
 10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.1	No.1
Date	July 28, 2024	July 31, 2024
Temperature / Humidity	26 deg. C / 60 % RH	24 deg. C / 49 % RH
Engineer	Junya Okuno	Ken Fujita
	(1 GHz to 6 GHz)	(Above 6 GHz)
Mode	Tx 11b 2462 MHz	

Polarity	Frequency	Reading (QP / PK)	Reading (AV)	Ant. Factor	Loss	Gain	Duty Factor	Result (QP / PK)	Result (AV)	Limit (QP / PK)	Limit (AV)	Margin (QP / PK)	Margin (AV)	Remark
[Hori/Vert]	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]	
Hori.	2483.5	55.1	46.8	27.6	5.0	36.0	-	51.7	43.4	73.9	53.9	22.2	10.5	
Hori.	4924.0	46.0	41.6	31.7	6.9	35.6	-	49.0	44.5	73.9	53.9	24.9	9.4	
Hori.	7386.0	41.5	32.0	35.5	10.7	32.1	-	55.5	46.1	73.9	53.9	18.4	7.8	Floor noise
Hori.	9848.0	41.0	31.8	36.1	11.6	32.4	-	56.3	47.0	73.9	53.9	17.6	6.9	Floor noise
Vert.	2483.5	54.7	45.9	27.6	5.0	36.0	-	51.3	42.5	73.9	53.9	22.6	11.4	
Vert.	4924.0	45.7	41.0	31.7	6.9	35.6	-	48.6	44.0	73.9	53.9	25.3	10.0	
Vert.	7386.0	41.6	33.7	35.5	10.7	32.1	-	55.7	47.7	73.9	53.9	18.2	6.2	Floor noise
Vert.	9848.0	41.6	31.9	36.1	11.6	32.4	-	56.8	47.1	73.9	53.9	17.1	6.8	Floor noise

Result (QP / PK) = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
Result (AV)= 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).
*QP detector was used up to 1GHz.

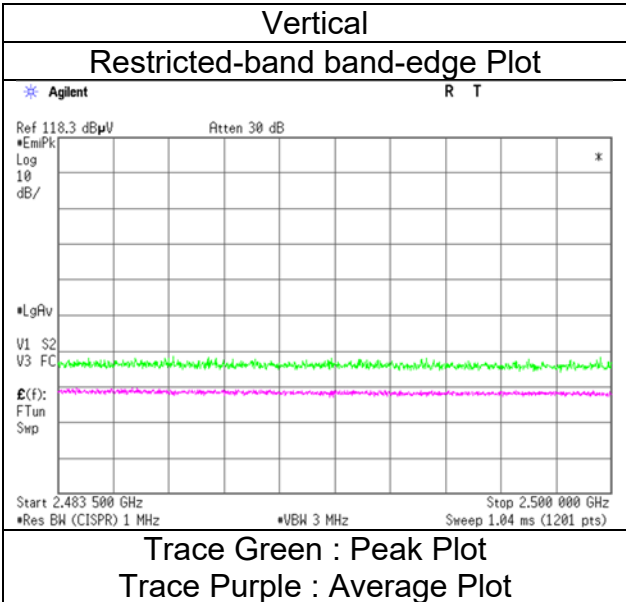
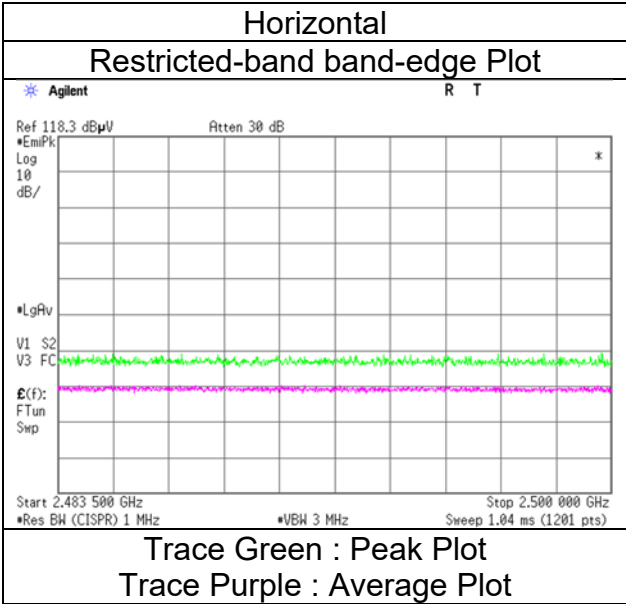
Distance factor: 1 GHz - 6 GHz $20\log(3.9\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$
 6 GHz - 10 GHz $20\log(5.9\text{ m} / 3.0\text{ m}) = 5.88\text{ dB}$
 10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place
Semi Anechoic Chamber
Date
Temperature / Humidity
Engineer

Mode

Ise EMC Lab.
No.1
July 28, 2024
26 deg. C / 60 % RH
Junya Okuno
(1 GHz to 6 GHz)
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

Test place	Ise EMC Lab.	No.1
Semi Anechoic Chamber	No.1	No.1
Date	July 28, 2024	July 31, 2024
Temperature / Humidity	26 deg. C / 60 % RH	24 deg. C / 49 % RH
Engineer	Junya Okuno	Ken Fujita
	(1 GHz to 6 GHz)	(Above 6 GHz)
Mode	Tx 11n-20 2412 MHz	

Polarity	Frequency	Reading (QP / PK)	Reading (AV)	Ant. Factor	Loss	Gain	Duty Factor	Result (QP / PK)	Result (AV)	Limit (QP / PK)	Limit (AV)	Margin (QP / PK)	Margin (AV)	Remark
[Hori/Vert]	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]	
Hori.	2390.0	66.9	53.1	27.7	5.0	36.0	-	63.6	49.8	73.9	53.9	10.3	4.1	
Hori.	4824.0	43.7	35.0	31.5	6.9	35.6	-	46.5	37.9	73.9	53.9	27.4	16.0	Floor noise
Hori.	7236.0	41.3	32.0	35.6	10.6	32.1	-	55.5	46.1	73.9	53.9	18.4	7.8	Floor noise
Hori.	9648.0	41.5	32.1	35.8	11.5	32.3	-	56.5	47.0	73.9	53.9	17.4	6.9	Floor noise
Vert.	2390.0	67.0	53.1	27.7	5.0	36.0	-	63.7	49.7	73.9	53.9	10.2	4.2	
Vert.	4824.0	43.8	35.0	31.5	6.9	35.6	-	46.7	37.8	73.9	53.9	27.3	16.1	Floor noise
Vert.	7236.0	41.7	32.0	35.6	10.6	32.1	-	55.8	46.2	73.9	53.9	18.1	7.7	Floor noise
Vert.	9648.0	42.1	32.3	35.8	11.5	32.3	-	57.1	47.2	73.9	53.9	16.9	6.7	Floor noise

Result (QP / PK) = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
 Result (AV)= 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).
 *QP detector was used up to 1GHz.

20dBc Data Sheet

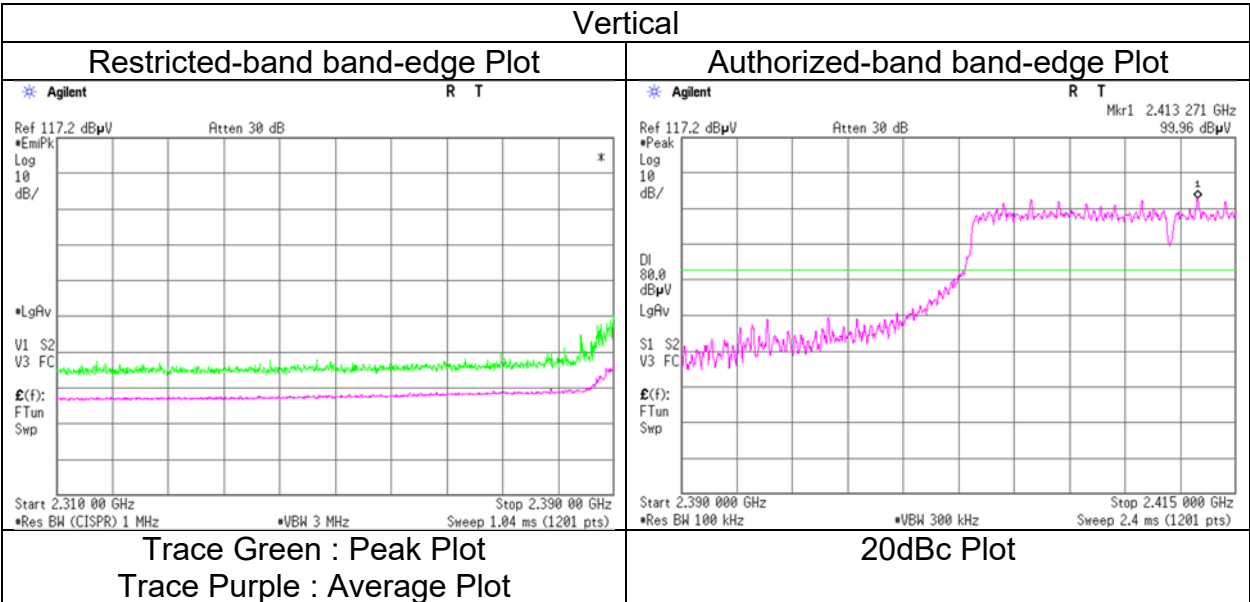
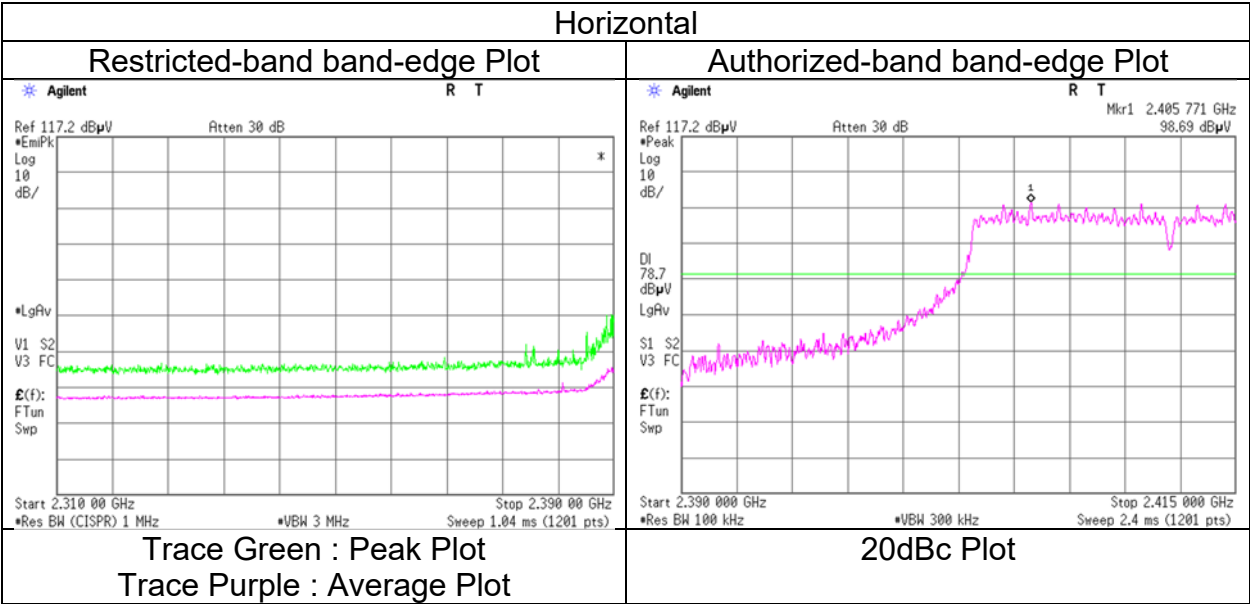
Polarity	Frequency	Reading (PK)	Ant Factor	Loss	Gain	Result	Limit	Margin	Remark
[Hori/Vert]	[MHz]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
Hori.	2412.0	98.7	27.7	5.0	36.0	95.3	-	-	Carrier
Hori.	2400.0	66.8	27.7	5.0	36.0	63.4	75.3	11.9	
Vert.	2412.0	100.0	27.7	5.0	36.0	96.6	-	-	Carrier
Vert.	2400.0	66.6	27.7	5.0	36.0	63.2	76.6	13.4	

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

Distance factor:
 1 GHz - 6 GHz 20log (3.9 m / 3.0 m) = 2.28 dB
 6 GHz - 10 GHz 20log (5.9 m / 3.0 m) = 5.88 dB
 10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.1
Date	July 28, 2024
Temperature / Humidity	26 deg. C / 60 % RH
Engineer	Junya Okuno
	(1 GHz to 6 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 and authorized band edge were shown in tabular data.

Radiated Spurious Emission

Test place	Ise EMC Lab.	No.1
Semi Anechoic Chamber	No.1	No.1
Date	July 28, 2024	July 31, 2024
Temperature / Humidity	26 deg. C / 60 % RH	24 deg. C / 49 % RH
Engineer	Junya Okuno	Ken Fujita
	(1 GHz to 6 GHz)	(Above 6 GHz)
Mode	Tx 11n-20 2437 MHz	

Polarity	Frequency	Reading (QP / PK)	Reading (AV)	Ant. Factor	Loss	Gain	Duty Factor	Result (QP / PK)	Result (AV)	Limit (QP / PK)	Limit (AV)	Margin (QP / PK)	Margin (AV)	Remark
[Hori/Vert]	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]	
Hori.	4874.0	43.3	34.6	31.6	6.9	35.6	-	46.1	37.4	73.9	53.9	27.8	16.5	Floor noise
Hori.	7311.0	41.2	32.0	35.5	10.7	32.1	-	55.3	46.1	73.9	53.9	18.6	7.8	Floor noise
Hori.	9748.0	41.4	32.8	36.0	11.5	32.4	-	56.5	47.9	73.9	53.9	17.4	6.0	Floor noise
Vert.	4874.0	43.4	34.6	31.6	6.9	35.6	-	46.2	37.5	73.9	53.9	27.7	16.5	Floor noise
Vert.	7311.0	41.4	33.0	35.5	10.7	32.1	-	55.6	47.1	73.9	53.9	18.4	6.8	Floor noise
Vert.	9748.0	42.3	32.6	36.0	11.5	32.4	-	57.4	47.7	73.9	53.9	16.5	6.2	Floor noise

Result (QP / PK) = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
Result (AV)= 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).
*QP detector was used up to 1GHz.

Distance factor:	1 GHz - 6 GHz	$20\log (3.9 \text{ m} / 3.0 \text{ m}) = 2.28 \text{ dB}$
	6 GHz - 10 GHz	$20\log (5.9 \text{ m} / 3.0 \text{ m}) = 5.88 \text{ dB}$
	10 GHz - 26.5 GHz	$20\log (1.0 \text{ m} / 3.0 \text{ m}) = -9.5 \text{ dB}$

Radiated Spurious Emission

Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.1	No.1
Date	July 28, 2024	July 31, 2024
Temperature / Humidity	26 deg. C / 60 % RH	24 deg. C / 49 % RH
Engineer	Junya Okuno (1 GHz to 6 GHz)	Ken Fujita (Above 6 GHz) (Below 1 GHz)
Mode	Tx 11n-20 2462 MHz	

Polarity	Frequency	Reading (QP / PK)	Reading (AV)	Ant. Factor	Loss	Gain	Duty Factor	Result (QP / PK)	Result (AV)	Limit (QP / PK)	Limit (AV)	Margin (QP / PK)	Margin (AV)	Remark
[Hori/Vert]	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]	
Hori.	39.3	22.3	-	15.0	7.5	38.9	-	5.9	-	40.0	-	34.2	-	
Hori.	98.6	24.5	-	9.8	8.4	38.9	-	3.8	-	43.5	-	39.7	-	
Hori.	151.7	20.2	-	15.1	9.1	39.0	-	5.4	-	43.5	-	38.2	-	
Hori.	574.1	22.1	-	18.6	12.4	38.3	-	14.8	-	46.0	-	31.2	-	
Hori.	656.2	20.3	-	19.2	12.9	38.3	-	14.2	-	46.0	-	31.8	-	
Hori.	839.7	20.4	-	21.3	13.9	38.2	-	17.5	-	46.0	-	28.5	-	
Hori.	2483.5	68.6	52.8	27.6	5.0	36.0	-	65.2	49.4	73.9	53.9	8.7	4.5	
Hori.	4924.0	42.7	34.9	31.7	6.9	35.6	-	45.6	37.8	73.9	53.9	28.3	16.1	Floor noise
Hori.	7386.0	41.1	33.6	35.5	10.7	32.1	-	55.2	47.6	73.9	53.9	18.8	6.3	Floor noise
Hori.	9848.0	40.9	32.6	36.1	11.6	32.4	-	56.2	47.9	73.9	53.9	17.7	6.1	Floor noise
Vert.	39.3	22.6	-	15.0	7.4	38.9	-	6.2	-	40.0	-	33.8	-	
Vert.	98.6	23.9	-	9.8	8.4	38.9	-	3.2	-	43.5	-	40.3	-	
Vert.	151.7	20.1	-	15.1	9.1	39.0	-	5.3	-	43.5	-	38.3	-	
Vert.	574.1	34.2	-	18.6	12.4	38.3	-	26.9	-	46.0	-	19.1	-	
Vert.	656.2	36.3	-	19.2	12.9	38.3	-	30.2	-	46.0	-	15.8	-	
Vert.	839.7	30.2	-	21.3	13.9	38.2	-	27.3	-	46.0	-	18.7	-	
Vert.	2483.5	67.0	51.6	27.6	5.0	36.0	-	63.6	48.2	73.9	53.9	10.3	5.8	
Vert.	4924.0	42.6	34.8	31.7	6.9	35.6	-	45.6	37.7	73.9	53.9	28.3	16.2	Floor noise
Vert.	7386.0	41.2	32.9	35.5	10.7	32.1	-	55.3	47.0	73.9	53.9	18.6	6.9	Floor noise
Vert.	9848.0	41.5	32.0	36.1	11.6	32.4	-	56.7	47.2	73.9	53.9	17.2	6.7	Floor noise

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

$$\text{Result (AV)} = \text{Reading} + \text{Ant Factor} + \text{Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz))} - \text{Gain(Amplifier)} + \text{Duty factor}$$

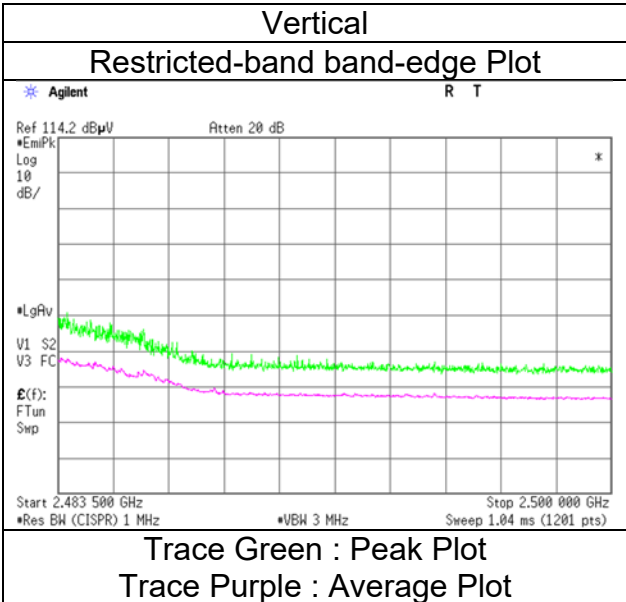
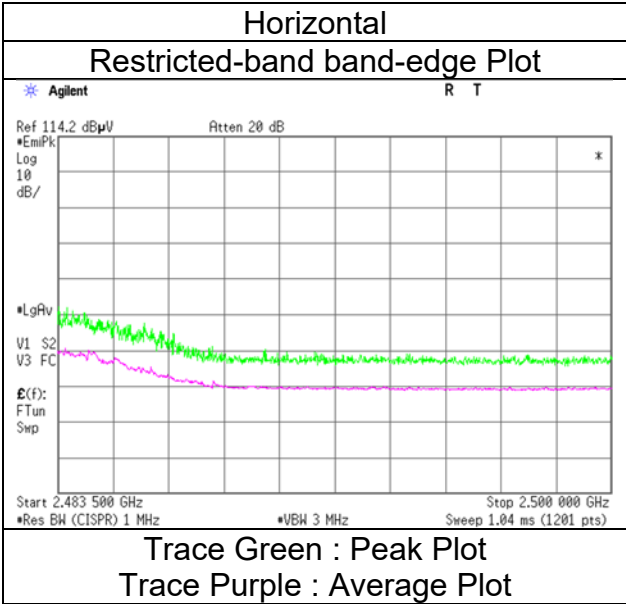
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

*QP detector was used up to 1GHz

Distance factor:	1 GHz - 6 GHz	$20\log (3.9 \text{ m} / 3.0 \text{ m}) = 2.28 \text{ dB}$
	6 GHz - 10 GHz	$20\log (5.9 \text{ m} / 3.0 \text{ m}) = 5.88 \text{ dB}$
	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)

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.1
Date	July 28, 2024
Temperature / Humidity	26 deg. C / 60 % RH
Engineer	Junya Okuno
	(1 GHz to 6 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

Test place	Ise EMC Lab.	No.4
Semi Anechoic Chamber	No.4	No.4
Date	April 24, 2024	April 26, 2024
Temperature / Humidity	21 deg. C / 60 % RH	21 deg. C / 45 % RH
Engineer	Yuichiro Yamazaki	Ken Fujita
	(1 GHz to 6 GHz)	(Above 6 GHz)
Mode	Tx BT LE 2402 MHz	

Polarity	Frequency	Reading	Reading	Ant.	Loss	Gain	Duty	Result	Result	Limit	Limit	Margin	Margin	Remark
[Hori/Vert]	[MHz]	(QP / PK)	(AV)	Factor	[dB]	[dB]	Factor	(QP / PK)	(AV)	(QP / PK)	(AV)	(QP / PK)	(AV)	
		[dBuV]	[dBuV]	[dB/m]				[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]	
Hori.	2390.0	43.0	33.5	27.8	5.3	31.8	1.7	44.3	36.5	73.9	53.9	29.6	17.4	*1)
Hori.	4804.0	43.1	34.4	31.3	7.5	30.9	1.7	51.1	44.0	73.9	53.9	22.8	9.9	
Hori.	7206.0	41.5	34.7	35.6	8.0	33.4	-	51.7	44.9	73.9	53.9	22.2	9.0	Floor noise
Hori.	9608.0	41.4	33.9	35.7	8.6	34.0	-	51.6	44.2	73.9	53.9	22.3	9.7	Floor noise
Vert.	2390.0	43.7	33.6	27.8	5.3	31.8	1.7	45.0	36.6	73.9	53.9	28.9	17.3	*1)
Vert.	4804.0	42.7	34.5	31.3	7.5	30.9	1.7	50.6	44.1	73.9	53.9	23.3	9.8	
Vert.	7206.0	41.6	34.7	35.6	8.0	33.4	-	51.8	44.9	73.9	53.9	22.1	9.0	Floor noise
Vert.	9608.0	41.4	33.9	35.7	8.6	34.0	-	51.6	44.2	73.9	53.9	22.3	9.7	Floor noise

Result (QP / PK) = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
Result (AV)= 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).
*QP detector was used up to 1 GHz.
*1) Not Out of Band emission(Leakage Power)

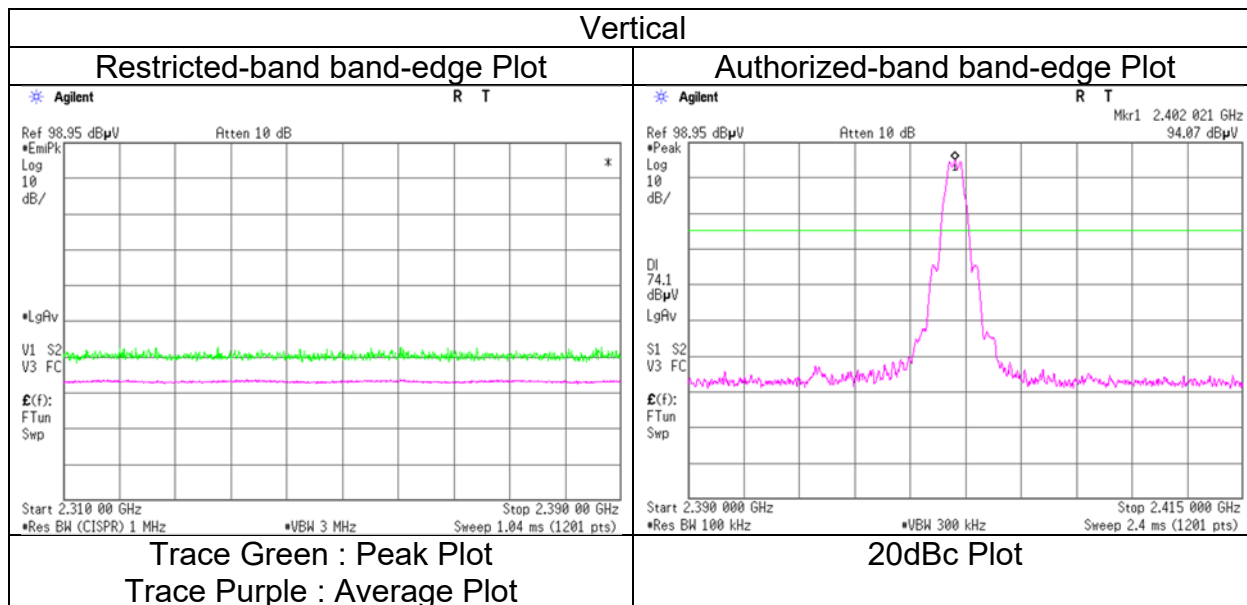
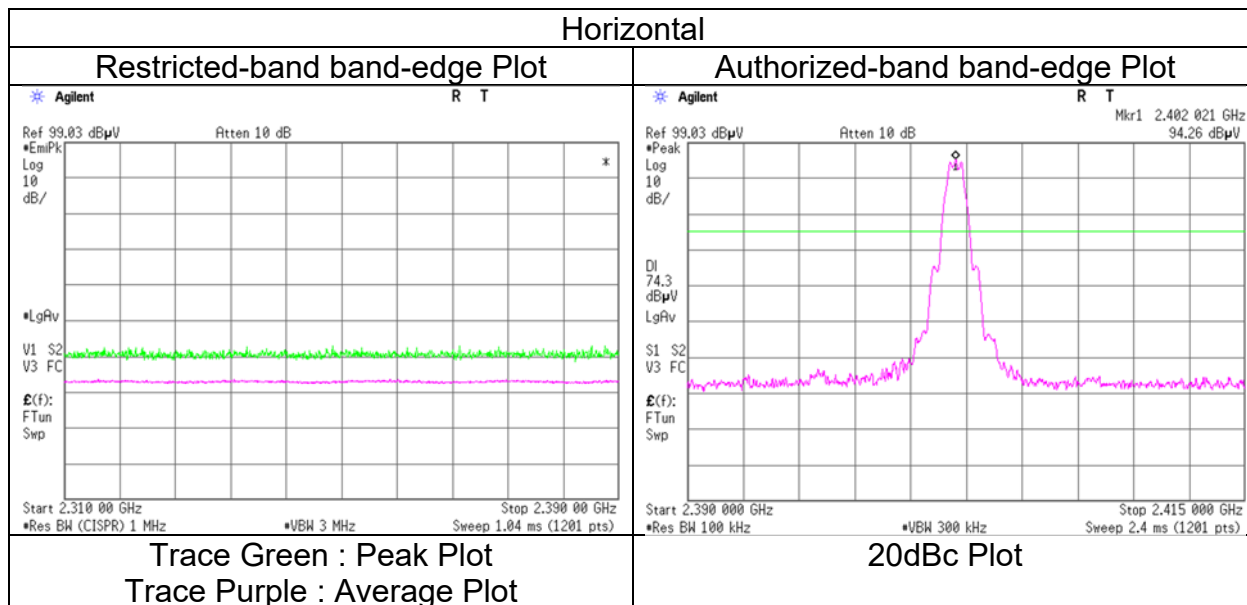
20dBc Data Sheet

Polarity	Frequency	Reading	Ant	Loss	Gain	Result	Limit	Margin	Remark
[Hori/Vert]	[MHz]	(PK)	Factor	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
		[dBuV]	[dB/m]						
Hori.	2402.0	94.3	27.8	5.3	31.8	95.6	-	-	Carrier
Hori.	2400.0	39.6	27.8	5.3	31.8	41.0	75.6	34.7	
Vert.	2402.0	94.1	27.8	5.3	31.8	95.4	-	-	Carrier
Vert.	2400.0	39.1	27.8	5.3	31.8	40.5	75.4	35.0	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
Distance factor:
1 GHz - 6 GHz 20log (3.9 m / 3.0 m) = 2.28 dB
6 GHz - 10 GHz 20log (4.9 m / 3.0 m) = 4.27 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission (Reference Plot for band-edge)

Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	April 24, 2024
Temperature / Humidity	21 deg. C / 60 % RH
Engineer	Yuichiro Yamazaki
	(1 GHz to 6 GHz)
Mode	Tx BT LE 2402 MHz



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

Radiated Spurious Emission

Test place	Ise EMC Lab.	No.4
Semi Anechoic Chamber	No.4	No.4
Date	April 24, 2024	April 26, 2024
Temperature / Humidity	21 deg. C / 60 % RH	21 deg. C / 45 % RH
Engineer	Yuichiro Yamazaki	Ken Fujita
	(1 GHz to 6 GHz)	(Above 6 GHz)
Mode	Tx BT LE 2440 MHz	

Polarity	Frequency	Reading (QP / PK)	Reading (AV)	Ant. Factor	Loss	Gain	Duty Factor	Result (QP / PK)	Result (AV)	Limit (QP / PK)	Limit (AV)	Margin (QP / PK)	Margin (AV)	Remark
[Hori/Vert]	[MHz]	[dBuV]	[dBuV]	[dB/m]	[dB]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]	
Hori.	4880.0	43.0	34.2	31.4	7.5	30.8	1.7	51.1	43.9	73.9	53.9	22.8	10.0	
Hori.	7320.0	42.4	34.4	35.6	8.0	33.5	-	52.6	44.6	73.9	53.9	21.3	9.3	Floor noise
Hori.	9760.0	40.8	33.8	36.0	8.6	34.1	-	51.4	44.4	73.9	53.9	22.5	9.5	Floor noise
Vert.	4880.0	42.9	34.0	31.4	7.5	30.8	1.7	50.9	43.8	73.9	53.9	23.0	10.2	
Vert.	7320.0	41.8	34.4	35.6	8.0	33.5	-	52.0	44.6	73.9	53.9	22.0	9.3	Floor noise
Vert.	9760.0	41.5	33.8	36.0	8.6	34.1	-	52.0	44.4	73.9	53.9	21.9	9.5	Floor noise

Result (QP / PK) = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
Result (AV)= 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).
*QP detector was used up to 1GHz

Distance factor: 1 GHz - 6 GHz $20\log(3.9\text{ m} / 3.0\text{ m}) = 2.28\text{ dB}$
 6 GHz - 10 GHz $20\log(4.9\text{ m} / 3.0\text{ m}) = 4.27\text{ dB}$
 10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission

Test place	Ise EMC Lab.	No.4	No.3
Semi Anechoic Chamber	No.4	No.4	No.3
Date	April 24, 2024	April 26, 2024	April 26, 2024
Temperature / Humidity	21 deg. C / 60 % RH	21 deg. C / 45 % RH	21 deg. C / 52 % RH
Engineer	Yuichiro Yamazaki	Ken Fujita	Nachi Konegawa
	(1 GHz to 6 GHz)	(Above 6 GHz)	(Below 1 GHz)
Mode	Tx BT LE 2480 MHz		

Polarity	Frequency	Reading	Reading	Ant.	Loss	Gain	Duty	Result	Result	Limit	Limit	Margin	Margin	Remark
[Hori/Vert]	[MHz]	(QP / PK)	(AV)	Factor	[dB]	[dB]	Factor	(QP / PK)	(AV)	(QP / PK)	(AV)	(QP / PK)	(AV)	
		[dBuV]	[dBuV]	[dB/m]			[dB]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dBuV/m]	[dB]	[dB]	
Hori.	31.8	20.6	-	17.9	6.9	32.1	-	13.3	-	40.0	-	26.7	-	Floor noise
Hori.	148.2	20.0	-	14.8	8.4	32.0	-	11.2	-	43.5	-	32.4	-	Floor noise
Hori.	191.2	19.5	-	16.5	8.8	32.0	-	12.7	-	43.5	-	30.8	-	Floor noise
Hori.	469.9	19.5	-	17.0	10.8	32.2	-	15.1	-	46.0	-	30.9	-	Floor noise
Hori.	714.3	19.2	-	20.1	12.1	32.2	-	19.1	-	46.0	-	26.9	-	Floor noise
Hori.	947.1	17.7	-	22.0	13.2	30.8	-	22.1	-	46.0	-	23.9	-	Floor noise
Hori.	2483.5	47.3	34.4	27.7	5.4	31.7	1.7	48.6	37.4	73.9	53.9	25.3	16.5	*1)
Hori.	2486.0	46.0	34.4	27.7	5.4	31.7	1.7	47.3	37.5	73.9	53.9	26.6	16.5	*1)
Hori.	4960.0	42.2	34.0	31.6	7.5	30.8	1.7	50.5	44.0	73.9	53.9	23.4	9.9	
Hori.	7440.0	42.2	34.3	35.5	8.0	33.5	-	52.3	44.4	73.9	53.9	21.6	9.5	Floor noise
Hori.	9920.0	40.8	33.8	36.2	8.7	34.1	-	51.6	44.6	73.9	53.9	22.3	9.3	Floor noise
Vert.	31.8	20.6	-	17.9	6.9	32.1	-	13.3	-	40.0	-	26.7	-	Floor noise
Vert.	148.2	20.0	-	14.8	8.4	32.0	-	11.2	-	43.5	-	32.4	-	Floor noise
Vert.	191.2	19.5	-	16.5	8.8	32.0	-	12.7	-	43.5	-	30.8	-	Floor noise
Vert.	469.9	19.5	-	17.0	10.8	32.2	-	15.1	-	46.0	-	30.9	-	Floor noise
Vert.	714.3	19.2	-	20.1	12.1	32.2	-	19.1	-	46.0	-	26.9	-	Floor noise
Vert.	947.1	17.7	-	22.0	13.2	30.8	-	22.1	-	46.0	-	23.9	-	Floor noise
Vert.	2483.5	47.2	34.4	27.7	5.4	31.7	1.7	48.6	37.5	73.9	53.9	25.3	16.4	*1)
Vert.	2486.0	46.1	34.5	27.7	5.4	31.7	1.7	47.4	37.5	73.9	53.9	26.5	16.4	*1)
Vert.	4960.0	41.2	32.8	31.6	7.5	30.8	1.7	49.5	42.8	73.9	53.9	24.4	11.1	
Vert.	7440.0	41.6	34.3	35.5	8.0	33.5	-	51.7	44.4	73.9	53.9	22.2	9.5	Floor noise
Vert.	9920.0	41.3	33.8	36.2	8.7	34.1	-	52.1	44.6	73.9	53.9	21.8	9.3	Floor noise

Result (QP / PK) = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)
Result (AV)= 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).
*QP detector was used up to 1GHz.
*1) Not Out of Band emission(Leakage Power)

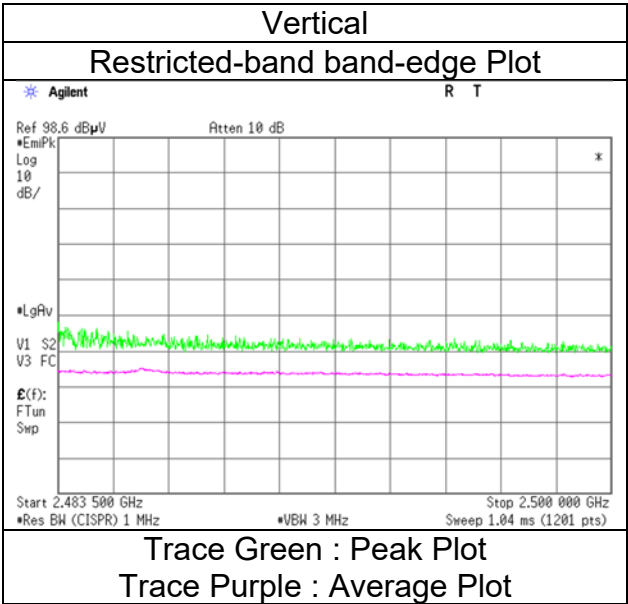
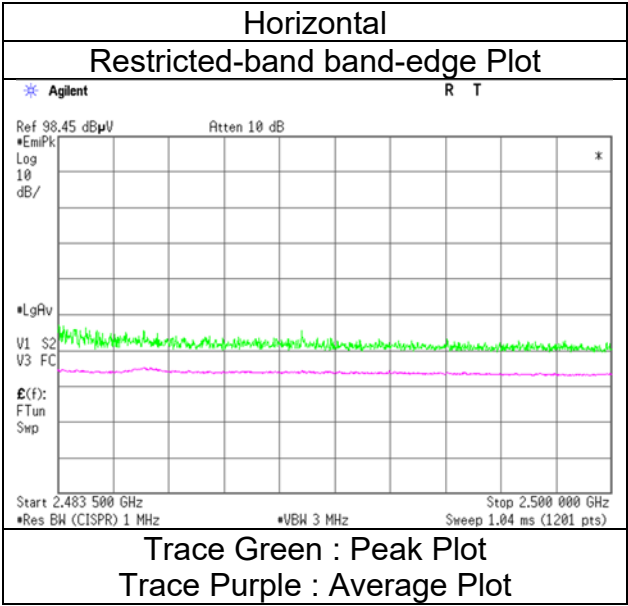
Distance factor: 1 GHz - 6 GHz 20log (3.9 m / 3.0 m) = 2.28 dB
 6 GHz - 10 GHz 20log (4.9 m / 3.0 m) = 4.27 dB
 10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission
(Reference Plot for band-edge)

Test place
Semi Anechoic Chamber
Date
Temperature / Humidity
Engineer

Mode

Ise EMC Lab.
No.4
April 24, 2024
21 deg. C / 60 % RH
Yuichiro Yamazaki
(1 GHz to 6 GHz)
Tx BT LE 2480 MHz

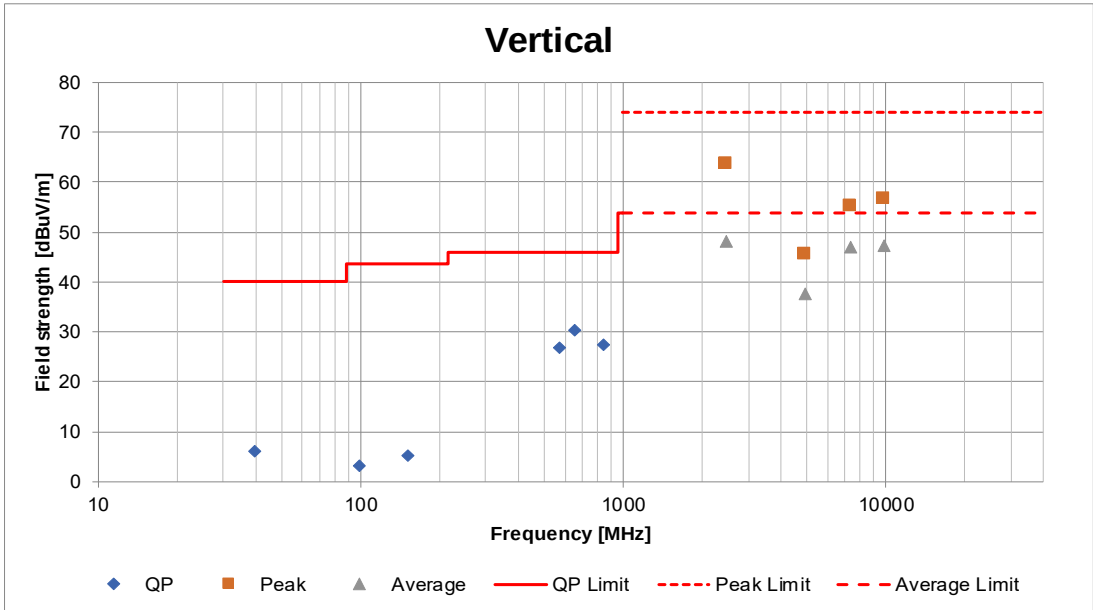
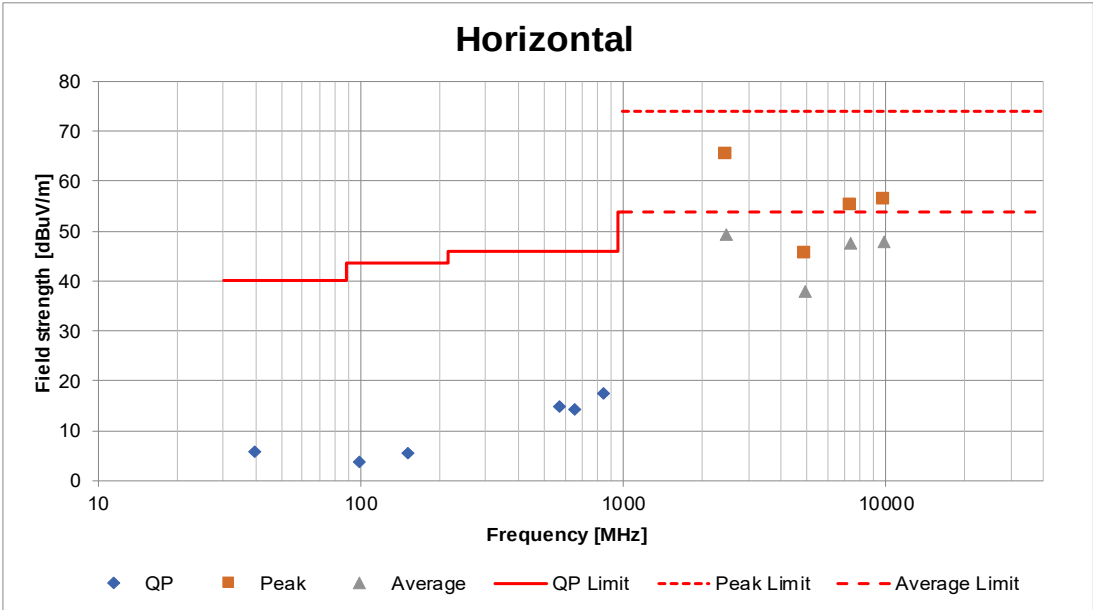


* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.
Final result of restricted band edge was shown in tabular data.

Radiated Spurious Emission
WLAN

(Plot data, Worst case mode for Maximum Peak Output Power)

Test place	Ise EMC Lab.	No.1
Semi Anechoic Chamber	No.1	No.1
Date	July 28, 2024	July 31, 2024
Temperature / Humidity	26 deg. C / 60 % RH	24 deg. C / 49 % RH
Engineer	Junya Okuno (1 GHz to 6 GHz)	Ken Fujita (Above 6 GHz) (Below 1 GHz)
Mode	Tx 11n-20 2462 MHz	

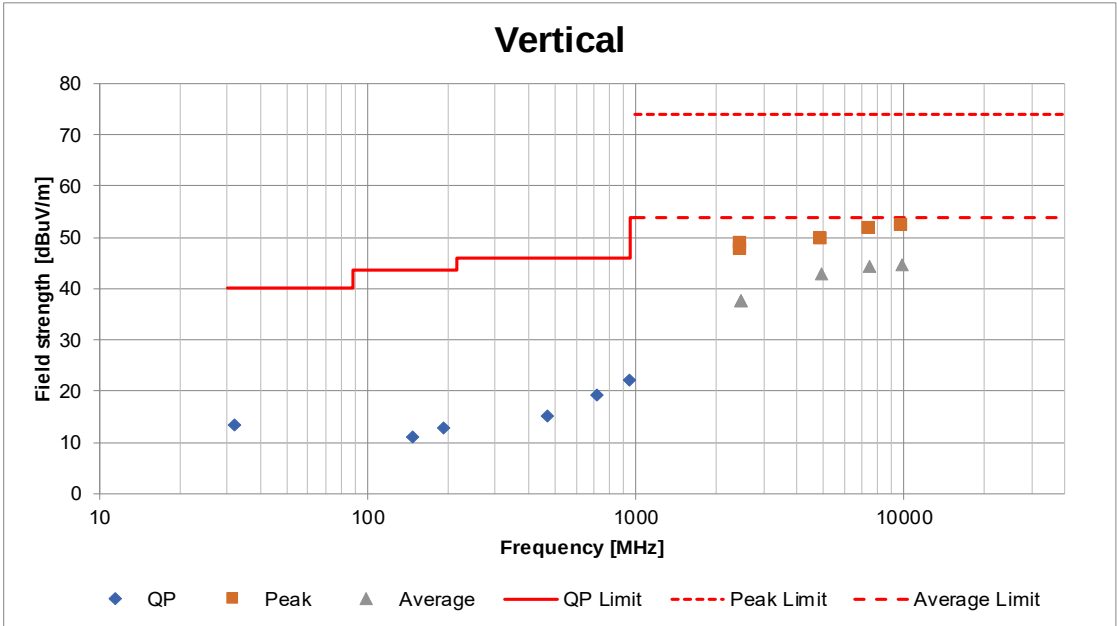
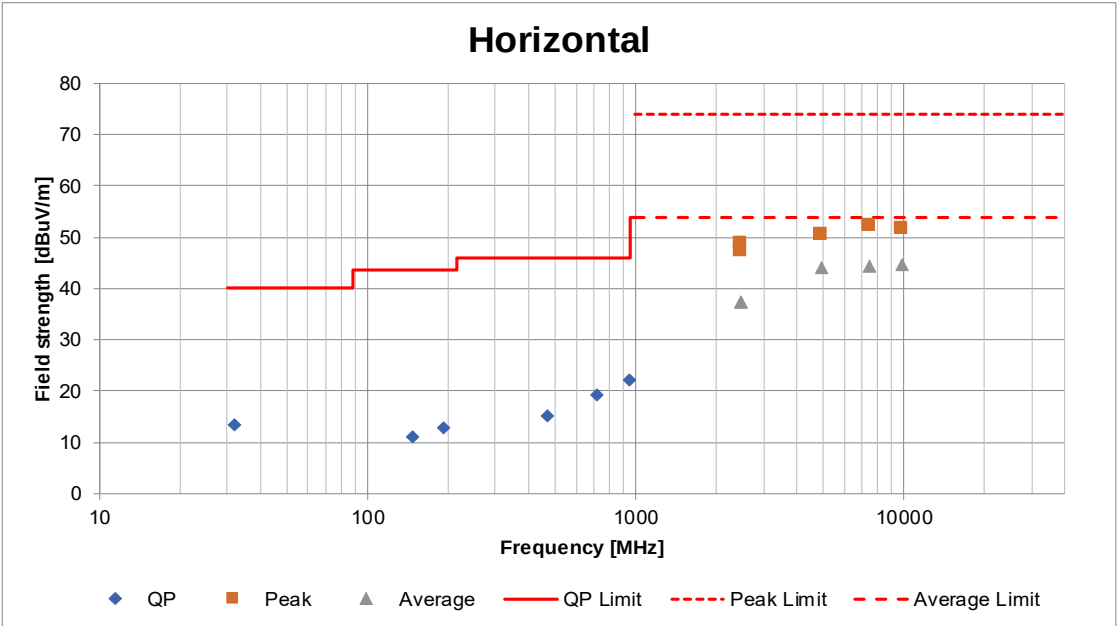


*These plots data contain sufficient number to show the trend of characteristic features for EUT.

Radiated Spurious Emission
BT LE

(Plot data, Worst case mode for Maximum Peak Output Power)

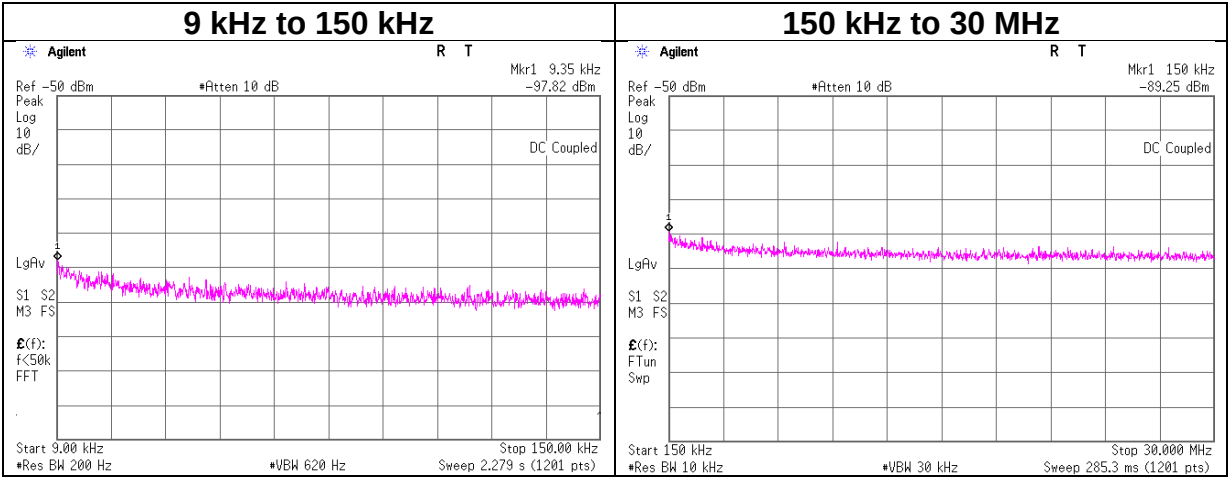
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.4	No.4	No.3
Date	April 24, 2024	April 26, 2024	April 26, 2024
Temperature / Humidity	21 deg. C / 60 % RH	21 deg. C / 45 % RH	21 deg. C / 52 % RH
Engineer	Yuichiro Yamazaki	Ken Fujita	Nachi Konegawa
	(1 GHz to 6 GHz)	(Above 6 GHz)	(Below 1 GHz)
Mode	Tx BT LE 2480 MHz		



Conducted Spurious Emission

Test place
Date
Temperature / Humidity
Engineer
Mode

Ise EMC Lab. No.8 Measurement Room
July 25, 2024
22 deg. C / 60 % RH
Junya Okuno
Tx 11n-20 2462 MHz



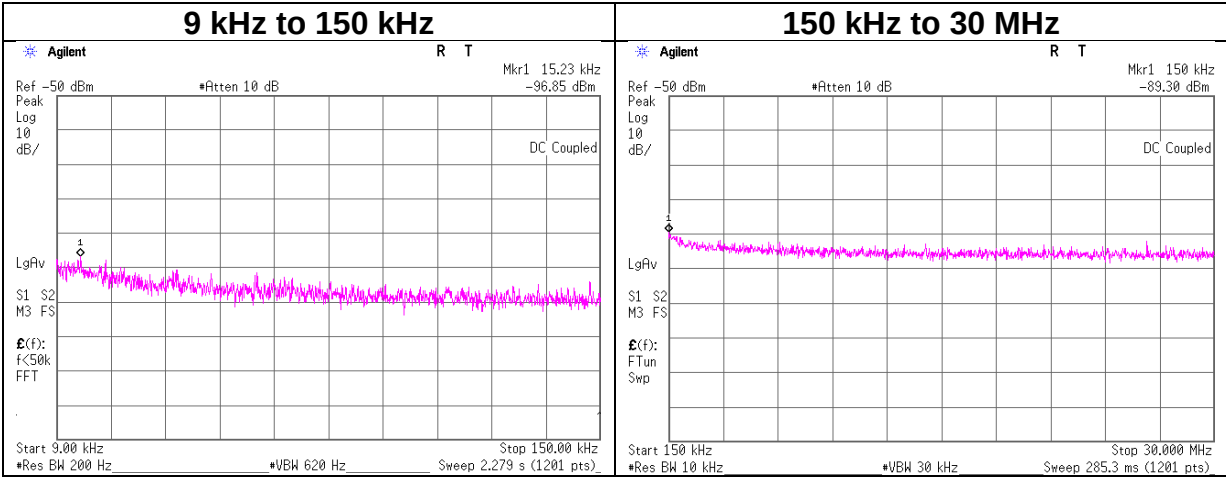
Frequency	Reading	Cable Loss	Attenuator Loss	Antenna Gain*	N	EIRP	Distance	Ground bounce	E	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dBi]	(Number of Output)	[dBm]	[m]	[dB]	(field strength) [dBuV/m]	[dBuV/m]	[dB]	
9.35	-97.8	0.50	9.8	2.0	1	-85.5	300	6.0	-24.2	48.1	72.3	
150.00	-89.3	0.50	9.8	2.0	1	-76.9	300	6.0	-15.7	24.0	39.7	

$E\text{ [dBuV/m]} = EIRP\text{ [dBm]} - 20\log(\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8\text{ [dBuV/m]}$
 $EIRP\text{[dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log(N)$
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

Test place
Date
Temperature / Humidity
Engineer
Mode

Ise EMC Lab. No.4 Preparation Room
April 11, 2024
21 deg. C / 48 % RH
Nachi Konegawa
Tx BT LE 2480 MHz



Frequency	Reading	Cable Loss	Attenuator Loss	Antenna Gain*	N	EIRP	Distance	Ground bounce	E	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dBi]	(Number of Output)	[dBm]	[m]	[dB]	(field strength) [dBuV/m]	[dBuV/m]	[dB]	
15.23	-96.9	0.50	9.8	2.0	1	-84.5	300	6.0	-23.3	43.9	67.2	
150.00	-89.3	0.50	9.8	2.0	1	-77.0	300	6.0	-15.7	24.0	39.7	

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

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

N: Number of output

*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

Test place	Ise EMC Lab.	No.8 Measurement Room
Date	No.4 Preparation Room	July 25, 2024
Temperature / Humidity	April 11, 2024	22 deg. C / 60 % RH
Engineer	21 deg. C / 48 % RH	Junya Okuno
	Nachi Konegawa	(WLAN)
	(BT LE)	
Mode	Tx	

11b

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm / 3 kHz]	[dB]	[dB]	[dBm / 3 kHz]	[dBm / 3 kHz]	[dB]
2412	-27.65	1.04	20.00	-6.61	8.00	14.61
2437	-27.40	1.05	20.00	-6.35	8.00	14.35
2462	-26.82	1.05	20.00	-5.77	8.00	13.77

11g

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm / 3 kHz]	[dB]	[dB]	[dBm / 3 kHz]	[dBm / 3 kHz]	[dB]
2412	-35.40	1.04	20.00	-14.36	8.00	22.36
2437	-36.22	1.05	20.00	-15.17	8.00	23.17
2462	-35.82	1.05	20.00	-14.77	8.00	22.77

11n-20

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm / 3 kHz]	[dB]	[dB]	[dBm / 3 kHz]	[dBm / 3 kHz]	[dB]
2412	-35.57	1.04	20.00	-14.53	8.00	22.53
2437	-36.25	1.05	20.00	-15.20	8.00	23.20
2462	-35.94	1.05	20.00	-14.89	8.00	22.89

BT LE

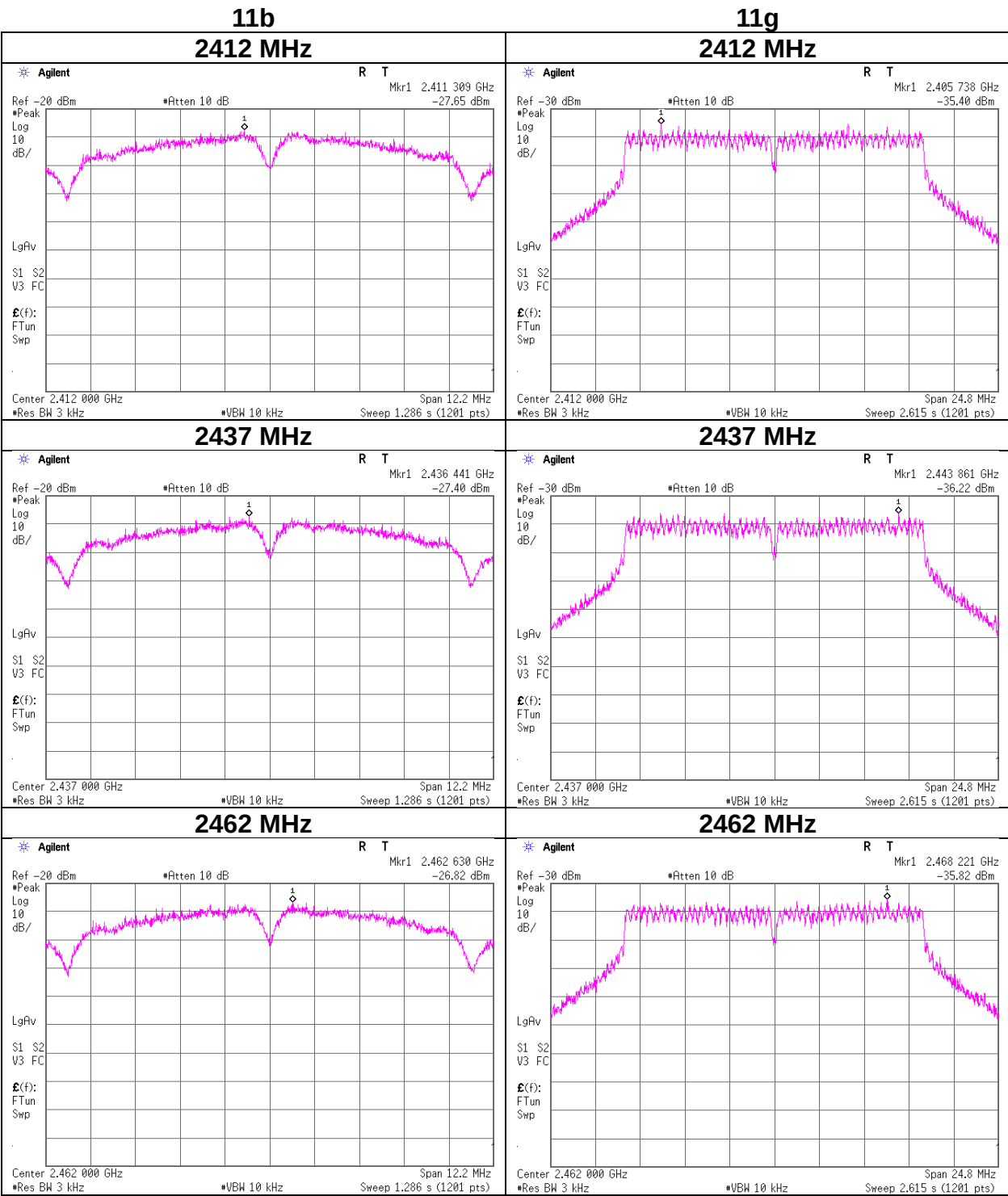
Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm / 3 kHz]	[dB]	[dB]	[dBm / 3 kHz]	[dBm / 3 kHz]	[dB]
2402	-23.63	0.89	9.75	-12.99	8.00	20.99
2440	-23.00	0.89	9.75	-12.36	8.00	20.36
2480	-22.66	0.90	9.76	-12.00	8.00	20.00

Sample Calculation:

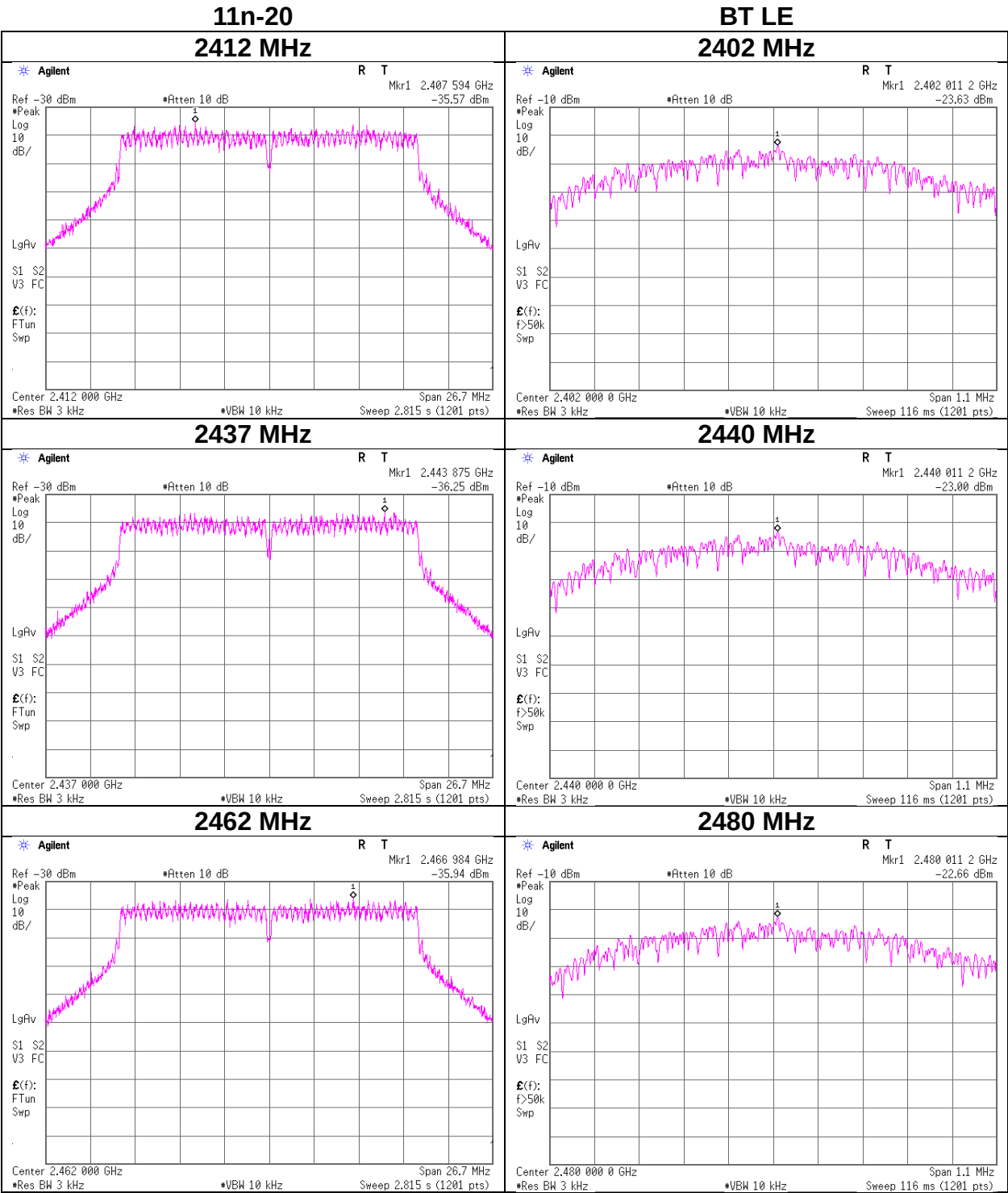
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

Power Density



Power Density



APPENDIX 2: Test Instruments

Test Equipment [WLAN]

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	141198	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103+BBA9106	2513	07/10/2024	12
RE	141213	Attenuator(6dB)	Weinschel Corp	2	BK7971	11/16/2023	12
RE	141350	Coaxial Cable	Suhner/storm/Agilent/TSJ	-	-	03/05/2024	12
RE	141393	Microwave Cable	Junkosha	MWX221	1604S254(1 m) / 1608S088(5 m)	07/06/2024	12
RE	141404	High Pass Filter 3.5-24GHz	TOKIMEC	TF323DCA	601	05/23/2024	12
RE	141503	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	06/25/2024	12
RE	141511	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	253	09/25/2023	12
RE	141530	Digital Tester	Fluke Corporation	FLUKE 26-3	78030621	02/01/2024	12
RE	141568	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	2901	01/10/2024	12
RE	141576	Pre Amplifier	Keysight Technologies Inc	8449B	3008A01671	02/17/2024	12
RE	141585	Pre Amplifier	L3 Narda-MITEQ	MLA-10K01-B01-35	1237616	02/17/2024	12
RE	141903	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46186390	01/26/2024	12
RE	141994	AC1_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 10m	DA-06881	04/20/2023	24
RE	141998	AC1_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	12/06/2023	24
RE	142226	Measure, Tape, Steel	KOMELON	KMC-36	-	-	-
RE	160924	Logperiodic Antenna	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	225	11/29/2023	12
RE	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	245788	Double Ridge Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA 9120 C	690	03/06/2024	12
RE	141581	MicroWave System Amplifier	Keysight Technologies Inc	83017A	00650	10/05/2023	12
RE	141950	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	11/20/2023	12
AT	141156	Attenuator(10dB)	Weinschel Corp	2	BL1173	11/17/2023	12
AT	141174	Attenuator(20dB) (above1GHz)	HIROSE ELECTRIC CO.,LTD.	AT-120	901247	01/15/2024	12
AT	141557	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	070900530	01/31/2024	12
AT	141810	Power Meter	Anritsu Corporation	ML2495A	824014	12/12/2023	12
AT	141832	Power sensor	Anritsu Corporation	MA2411B	738174	12/12/2023	12
AT	141903	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46186390	01/26/2024	12
AT	196430	Microwave Cable	Huber+Suhner	SF102D/11PC24/ 11PC24/1000mm	537059/126EA	02/26/2024	12
AT	244711	Thermo-Hygrometer	HIOKI E.E. CORPORATION	LR5001	231202105	01/25/2024	12

Test Equipment [BT LE]

Test Item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	141266	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-191	08/10/2023	12
RE	141296	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	09/01/2023	12
RE	141323	Coaxial cable	UL Japan	-	-	09/10/2023	12
RE	141424	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103+BBA9106	1915	03/15/2024	12
RE	141503	Horn Antenna 18-26.5GHz	EMCO	3160-09	1265	06/25/2024	12
RE	141508	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	557	05/17/2024	12
RE	141532	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	051201197	01/31/2024	12
RE	141545	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201148	02/01/2024	12
RE	141581	MicroWave System Amplifier	Keysight Technologies Inc	83017A	00650	10/05/2023	12
RE	141900	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46185823	06/16/2023	12
RE	141951	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	05/17/2024	12
RE	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	12/11/2023	24
RE	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/14/2023	24
RE	142183	Measure	KOMELON	KMC-36	-	10/20/2023	12
RE	142230	Measure, Tape, Steel	KOMELON	KMC-36	-	-	-
RE	142314	Attenuator	Pasternack Enterprises	PE7390-6	D/C 1504	06/06/2024	12
RE	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	244709	Thermo-Hygrometer	HIOKI E.E. CORPORATION	LR5001	231202103	01/25/2024	12
RE	244710	Thermo-Hygrometer	HIOKI E.E. CORPORATION	LR5001	231202104	01/25/2024	12
RE	245788	Double Ridge Horn Antenna	Schwarzbeck Mess-Elektronik OHG	BBHA 9120 C	690	03/06/2024	12
RE	246001	Microwave Cable	Huber+Suhner	SF103/11PC35/11PC35/1000mm / SF126E/5000mm	800673(1m) / 610204(5m)	03/06/2024	12
RE	141583	Pre Amplifier	SONOMA INSTRUMENT	310	260833	2024/04/04	12
AT	141156	Attenuator(10dB)	Weinschel Corp	2	BL1173	11/17/2023	12
AT	141312	Attenuator	Weinschel Associates	WA56-10	56100304	-	-
AT	141333	Attenuator(10dB)	Suhner	6810.19.A	-	12/11/2023	12
AT	141375	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	30817/2	05/27/2024	12
AT	141395	Coaxial Cable	UL Japan	-	-	11/21/2023	12
AT	141809	Power Meter	Anritsu Corporation	ML2495A	825002	05/22/2024	12
AT	141830	Power sensor	Anritsu Corporation	MA2411B	738285	05/22/2024	12
AT	141902	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46187105	05/30/2024	12
AT	244710	Thermo-Hygrometer	HIOKI E.E. CORPORATION	LR5001	231202104	01/25/2024	12
AT	244711	Thermo-Hygrometer	HIOKI E.E. CORPORATION	LR5001	231202105	01/25/2024	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

AT: Antenna Terminal Conducted test