



RADIO TEST REPORT

Test Report No. : 13292801H-A-R2

Applicant : silex technology, Inc.
Type of EUT : BLE Module
Model Number of EUT : SX-23BT
FCC ID : N6C-23BT
Test regulation : FCC Part 15 Subpart C: 2020
Test Result : Complied (Refer to SECTION 3.2)

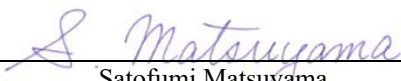
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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report covers Radio technical requirements.
It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
6. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
7. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.
8. The information provided from the customer for this report is identified in Section 1.
9. This report is a revised version of 13292801H-A-R1. 13292801H-A-R1 is replaced with this report.

Date of test: June 9 to 17, 2020

Representative test engineer:


Yuta Moriya
Engineer
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Approved by:


Satofumi Matsuyama
Engineer
Consumer Technology Division



This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
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☒ There is no testing item of "Non-accreditation".

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REVISION HISTORY

Original Test Report No.: 13292801H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13292801H-A	July 16, 2020	-	-
1	13292801H-A-R1	July 27, 2020	P 1 P 9	Change of A2LA logo to NVLAP. Change of A2LA Certificate Number to NVLAP Lab. Code.
1	13292801H-A-R1	July 27, 2020	P 5	Correction of Antenna Gain of Chip Antenna in SECTION 2.2 1.5 dBi→1.6 dBi
1	13292801H-A-R1	July 27, 2020	P 5	Correction of Receipt Date in SECTION 2.1 June 11, 2020→June 9, 2020
1	13292801H-A-R1	July 27, 2020	P 29	Deletion of below note in APPENDIX 1: Test data (Average Output Power) 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.
2	13292801H-A-R2	August 19, 2020	P 1	Correction of Date of test June 9 to July 13, 2020→ June 9 to 17, 2020
2	13292801H-A-R2	August 19, 2020	P 5	Correction of Maximum clock frequency in SECTION 2.2 2480 MHz→32 MHz
2	13292801H-A-R2	August 19, 2020	P 10	Deletion of 0 dBm (Maximum Peak Output Power only) in SECTION 4.1 Addition of explanatory note *1)
2	13292801H-A-R2	August 19, 2020	P 27 to 29	Deletion of 0 dBm power setting data in APPENDIX 1: Test data (Maximum Peak Output Power and Average Output Power)

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Reference: Abbreviations (Including words undescribed in this report)

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

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CONTENTS	PAGE
SECTION 1: Customer information.....	5
SECTION 2: Equipment under test (EUT).....	5
SECTION 3: Test specification, procedures & results.....	6
SECTION 4: Operation of EUT during testing	10
SECTION 5: Conducted Emission.....	12
SECTION 6: Radiated Spurious Emission	13
SECTION 7: Antenna Terminal Conducted Tests.....	15
APPENDIX 1: Test data	16
Conducted Emission	16
6 dB Bandwidth and 99 % Occupied Bandwidth.....	24
Maximum Peak Output Power	27
Average Output Power	29
Radiated Spurious Emission	31
Conducted Spurious Emission	52
Power Density	58
APPENDIX 2: Test instruments	60
APPENDIX 3: Photographs of test setup	62
Conducted Emission	62
Radiated Spurious Emission	64
Worst Case Position	66

SECTION 1: Customer information

Company Name : silex technology, Inc.
Address : 2-3-1 Hikaridai, Seika-cho, Soraku-gun, Kyoto 619-0237, Japan
Telephone Number : +81-774-98-3878
Facsimile Number : +81-774-98-3758
Contact Person : Yoshinori Nakai

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 : BLE Module
Model Number : SX-23BT
Serial Number : Refer to SECTION 4.2
Rating : DC 3.3 V
Receipt Date : June 9, 2020
Country of Mass-production : Japan
Condition : Engineering prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification : No Modification by the test lab.

2.2 Product Description

Model: SX-23BT (referred to as the EUT in this report) is a BLE Module.

Radio Specification

Bluetooth (Low Energy)

Equipment Type	Transceiver	
Frequency of Operation	2402 MHz to 2480 MHz	
Type of Modulation	BT LE: GFSK	
Bandwidth / Channel spacing	BT LE: 1 MHz & 2 MHz / 2 MHz	
Antenna Type	Chip Antenna	PCB Antenna
Antenna Gain	1.6 dBi	2.9 dBi
Maximum clock frequency	32 MHz	

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on May 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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods ISED: RSS-Gen 8.8	FCC: Section 15.207 ISED: RSS-Gen 8.8	18.15 dB, 0.19958 MHz, QP, L	Complied a)	-
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 b)	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.12	FCC: Section 15.247(b)(3) ISED: RSS-247 5.4(d)		Complied c)	Conducted
Power Density	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: -	FCC: Section 15.247(e) ISED: RSS-247 5.2(b)		Complied d)	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ISED: RSS-Gen 6.13	FCC: Section 15.247(d) ISED: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	5.3 dB 2484.900 MHz, Horizontal, AV (PCB Antenna)	Complied# e), f)	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422. *1) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r02 8.5 and 8.6. a) Refer to APPENDIX 1 (data of Conducted Emission) b) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth) c) Refer to APPENDIX 1 (data of Maximum Peak Output Power) d) Refer to APPENDIX 1 (data of Power Density) e) Refer to APPENDIX 1 (data of Conducted Spurious Emission) f) Refer to APPENDIX 1 (data of Radiated Spurious Emission) Symbols: Complied The data of this test item has enough margin, more than the measurement uncertainty. Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.					

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

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FCC Part 15.31 (e)

This EUT provides the stable voltage constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

[Chip antenna]

It is impossible for end users to replace the antenna, because it is soldered on the circuit board.
Therefore the equipment complies with the requirement of 15.203/212.

[PCB antenna]

The EUT has a unique coupling/antenna connector (MHF4).
Therefore the equipment complies with the requirement of 15.203.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	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

Conducted emission

using Item	Frequency range	Uncertainty (+/-)
AMN (LISN)	0.009 MHz to 0.15 MHz	3.4 dB
	0.15 MHz to 30 MHz	2.9 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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*NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967 / ISED Lab Company Number: 2973C

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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)

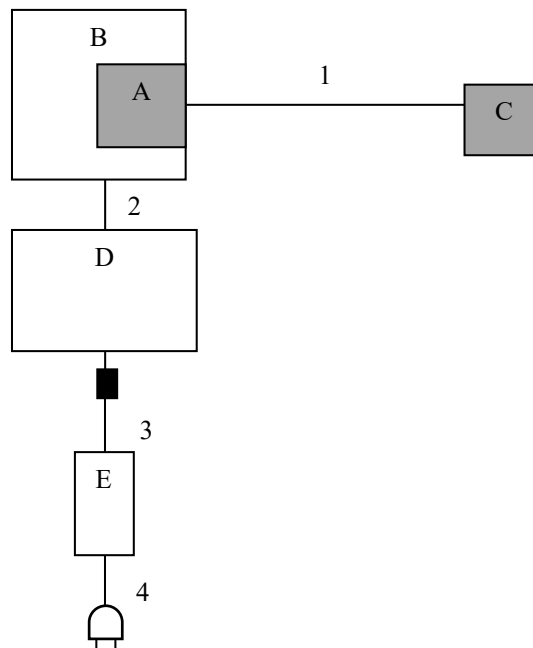
Test operating mode was determined as follows according to “Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009.

Mode	Remarks*
Bluetooth Low Energy (BT LE) Coded-PHY 125kbps	Maximum Packet Size, PRBS9
Bluetooth Low Energy (BT LE) Uncoded 2M-PHY	Maximum Packet Size, PRBS9
*Power of the EUT was set by the software as follows; Power settings: 4 dBm *1) Software: Bluetooth Trial Tool Suite Version 1.0.0.0 (Date: 2020.06.09, Storage location: Driven by connected PC) *1) This power setting value is adjusted to the maximum output of the product specifications. It is different from product specification value. *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

Test Item	Operating Mode	Tested Antenna	Tested frequency
Conducted Emission	BT LE, Coded-PHY 125kbps *1) BT LE, Uncoded 2M-PHY	Chip Antenna PCB Antenna	2402 MHz 2440 MHz 2480 MHz
Radiated Spurious Emission	BT LE, Coded-PHY 125kbps *1) BT LE, Uncoded 2M-PHY	Chip Antenna PCB Antenna	2402 MHz 2440 MHz 2480 MHz
Maximum Peak Output Power Power Density 6dB Bandwidth 99% Occupied Bandwidth Conducted Spurious Emission	BT LE, Coded-PHY 125kbps *1) BT LE, Uncoded 2M-PHY	PCBAntenna *2)	2402 MHz 2440 MHz 2480 MHz
*1) This EUT has three kinds of data rate and the test was performed only with 125kBps which is the worst case in pre-check of Maximum Peak Output Power. *2) From the RF chip to the SPDT switch, the RF circuit is the same. Since the RF output power to the Chip antenna and the PCB antenna are the same, the test was performed with the PCB antenna as a representative.			

4.2 Configuration and peripherals



AC 120 V / 60 Hz

* 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	BLE Module	SX-23BT	1	Silex Technology, Inc.	EUT *1)
B	Jig Board	PW104060AX	1	Silex Technology, Inc.	-
C	PCB Antenna	H2B1PC1A1C (AA258)	1	Unictron	EUT
D	Laptop PC	CF-LX4EDHCS	5GKSA17377	Panasonic	-
E	AC Adapter	CF-AA62J2C	64B2CM1147037 55B	Panasonic	-

*1) The test was performed with the module that as normal assumed implementation conditions.

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Antenna Cable	0.15	Shielded	Shielded	-
2	USB Cable	3.00	Shielded	Shielded	-
3	DC Cable	1.00	Unshielded	Unshielded	-
4	AC Cable	1.00	Unshielded	Unshielded	-

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SECTION 5: Conducted Emission

Test Procedure and conditions

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

For the tests on EUT with other peripherals (as a whole system)

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30 cm to 40 cm long and were hanged at a 40 cm height to the ground plane. All unused 50ohm connectors of the LISN (AMN) were resistivity terminated in 50 ohm when not connected to the measuring equipment.

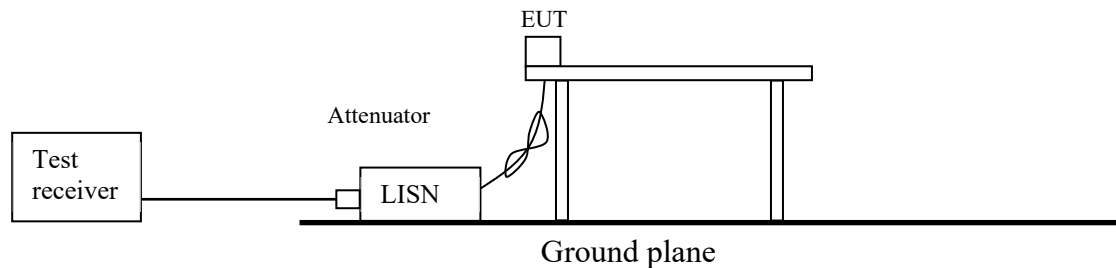
The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber. The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

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

Figure 1: Test Setup



SECTION 6: Radiated Spurious Emission

Test Procedure

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

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

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

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

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

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

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

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

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

Test Antennas are used as below;

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

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

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

Frequency	Below 1 GHz	Above 1 GHz		20 dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120 kHz	RBW: 1 MHz VBW: 3 MHz	11.12.2.5.1 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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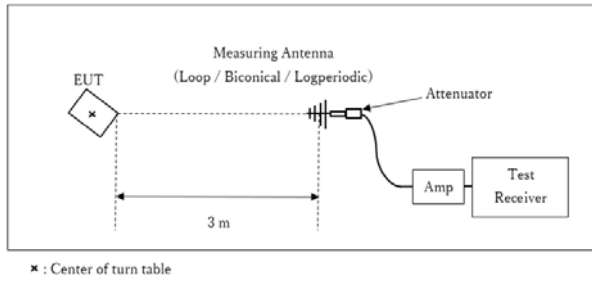
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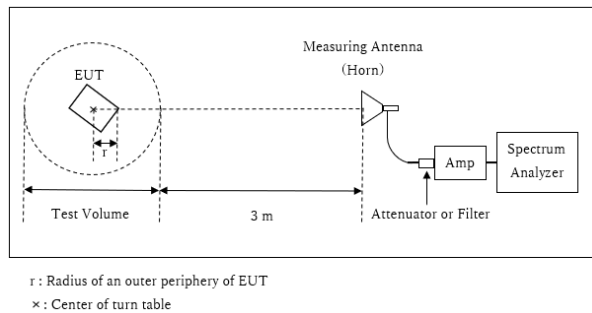
Figure 2: Test Setup

Below 1 GHz



Test Distance: 3 m

1 GHz - 10 GHz



[Chip Antenna]

Distance Factor: $20 \times \log (3.7 \text{ m} / 3.0 \text{ m}) = 1.83 \text{ dB}$

* Test Distance: $(3 + \text{Test Volume} / 2) - r = 3.7 \text{ m}$

Test Volume : 1.5 m

(Test Volume has been calibrated based on CISPR 16-1-4.)
 $r = 0.05 \text{ m}$

[PCB Antenna]

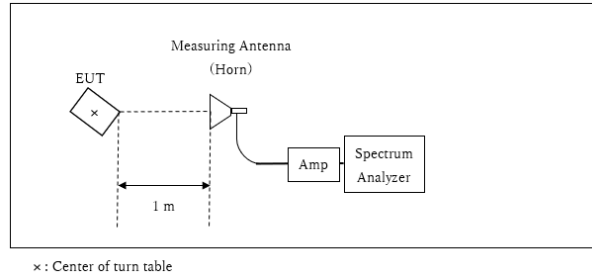
Distance Factor: $20 \times \log (3.65 \text{ m} / 3.0 \text{ m}) = 1.71 \text{ dB}$

* Test Distance: $(3 + \text{Test Volume} / 2) - r = 3.65 \text{ m}$

Test Volume : 1.5 m

(Test Volume has been calibrated based on CISPR 16-1-4.)
 $r = 0.10 \text{ m}$

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 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

SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6dB Bandwidth	3 MHz, 5 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	3 kHz	10 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4) *5)	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) 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 low enough as shown in the chart.
 *5) The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohms. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to $45.5 - 51.5 = -6.0$ dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

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

Test data : APPENDIX

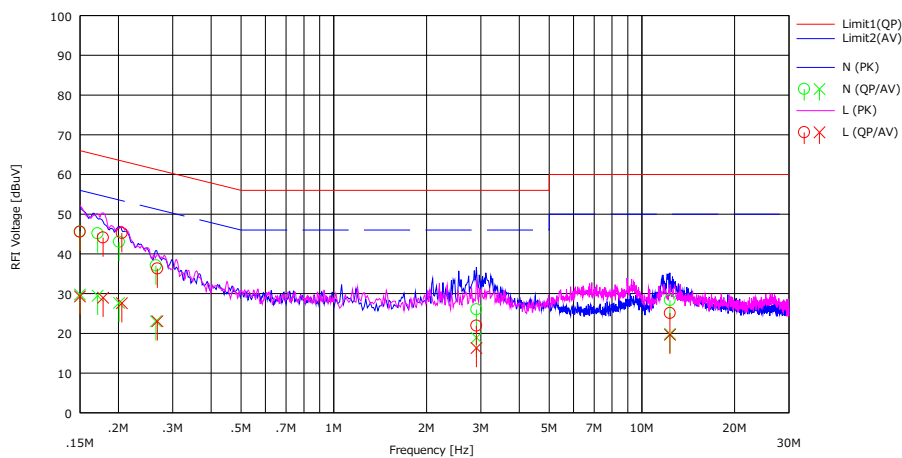
Test result : Pass

APPENDIX 1: Test data

Conducted Emission

Report No. 13292801H
Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Date June 14, 2020
Temperature / Humidity 22 deg. C / 68 % RH
Engineer Yuta Moriya
Mode Tx BT LE 2402 MHz,
Coded-PHY 125kbps (Chip Antenna)

Limit : FCC_Part 15 Subpart C(15.207)



No.	Freq. [MHz]	Reading		USN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]			<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	32.40	16.54	0.07	13.15	45.62	29.76	66.00	56.00	20.38	26.24	N	
2	0.17125	31.95	16.28	0.07	13.15	45.17	29.50	64.90	54.90	19.73	25.40	N	
3	0.20100	29.80	14.46	0.07	13.16	43.03	27.69	63.60	53.60	20.57	25.91	N	
4	0.26475	23.84	9.82	0.07	13.17	37.08	23.06	61.30	51.30	24.22	28.24	N	
5	2.90500	12.41	5.30	0.11	13.50	26.02	18.91	56.00	46.00	29.98	27.09	N	
6	12.33333	14.10	5.61	0.26	14.03	28.39	19.90	60.00	50.00	31.61	30.10	N	
7	0.15000	32.33	16.09	0.07	13.15	45.55	29.31	66.00	56.00	20.45	26.69	L	
8	0.17833	30.87	15.74	0.07	13.16	44.10	28.97	64.60	54.60	20.50	25.63	L	
9	0.20525	32.00	14.38	0.07	13.16	45.23	27.61	63.40	53.40	18.17	25.79	L	
10	0.26759	23.07	9.81	0.06	13.17	36.30	23.04	61.20	51.20	24.90	28.16	L	
11	2.90500	8.30	2.72	0.12	13.50	21.92	16.34	56.00	46.00	34.08	29.66	L	
12	12.33333	10.76	5.36	0.29	14.03	25.08	19.68	60.00	50.00	34.92	30.32	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + LISN + LOSS (CABLE + ATT)
Except for the above table: adequate margin data below the limits.

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Ise EMC Lab.

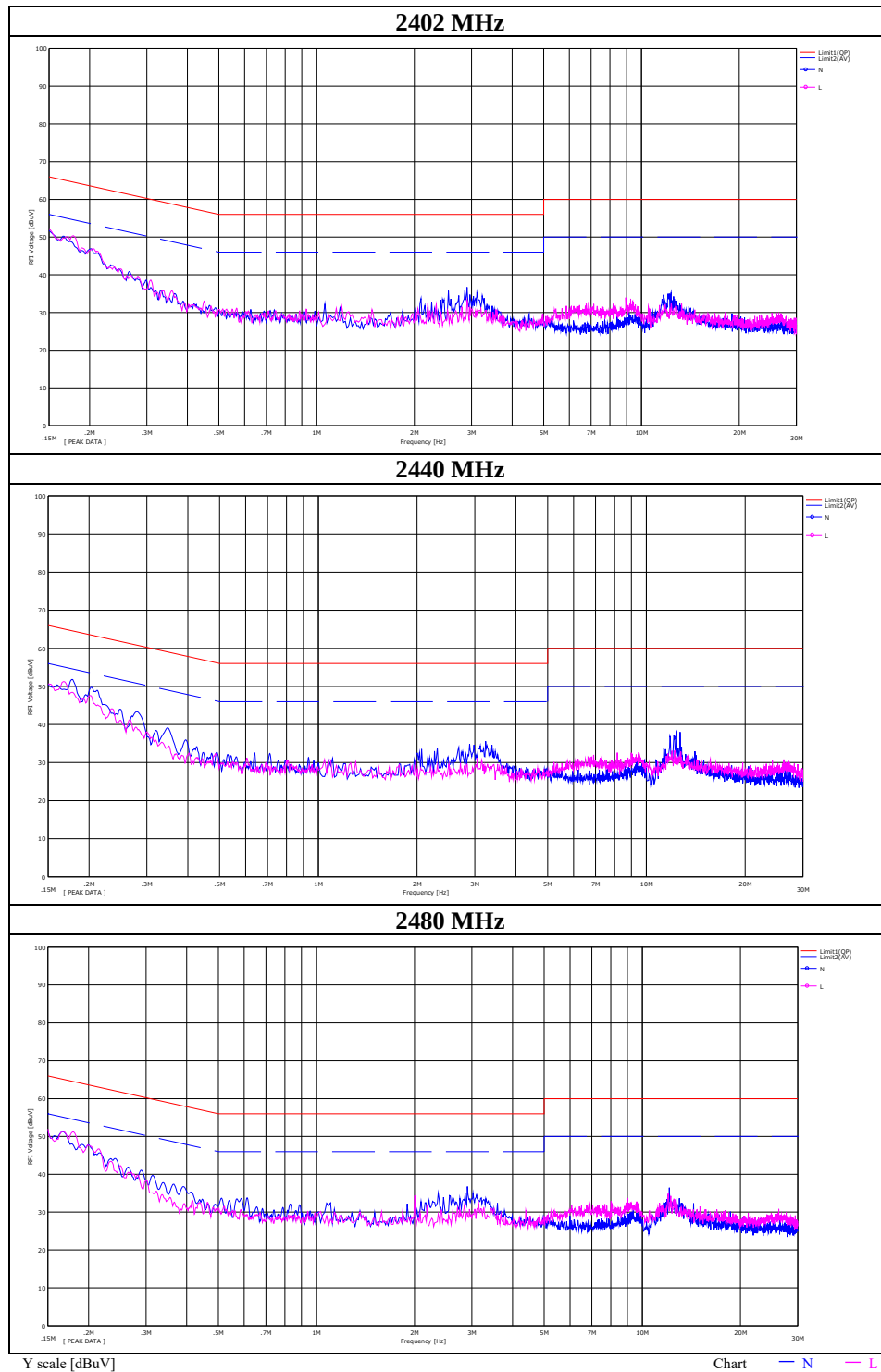
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Emission

Report No. 13292801H
Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Date June 14, 2020
Temperature / Humidity 22 deg. C / 68 % RH
Engineer Yuta Moriya
Mode Tx BT LE
Coded-PHY 125kbps (Chip Antenna)



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Ise EMC Lab.

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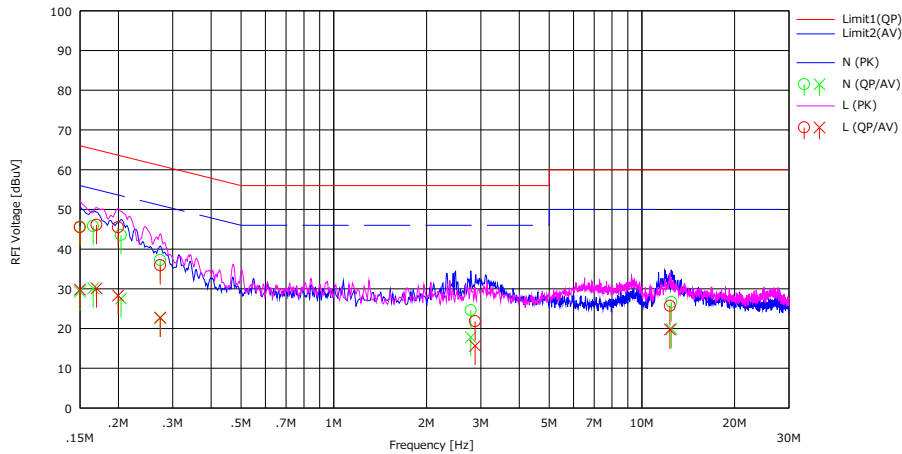
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Emission

Report No. 13292801H
Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Date June 14, 2020
Temperature / Humidity 22 deg. C / 68 % RH
Engineer Yuta Moriya
Mode Tx BT LE 2402 MHz,
Uncoded 2M-PHY (Chip Antenna)

Limit : FCC_Part 15 Subpart C(15.207)

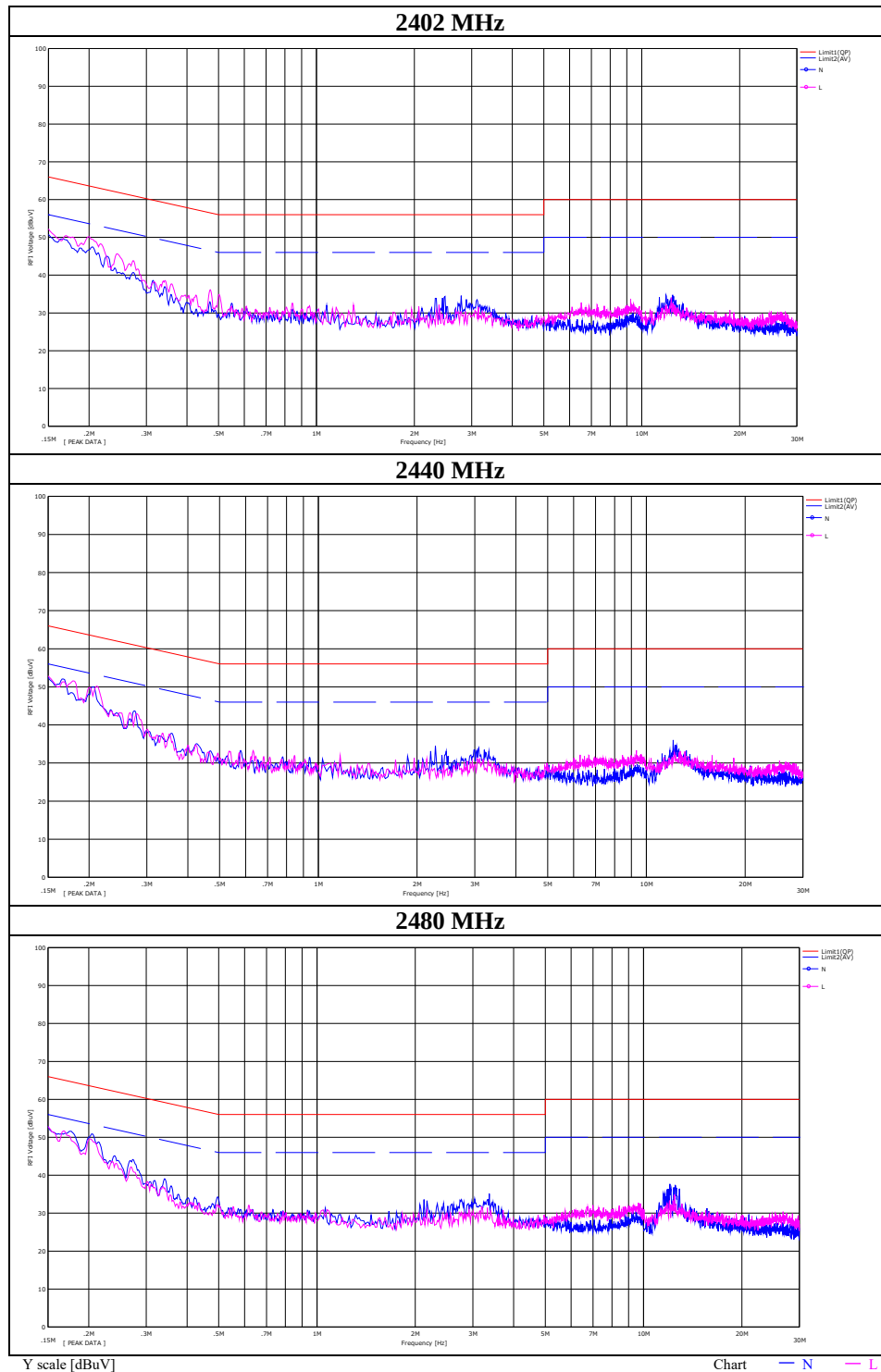


No.	Freq. [MHz]	Reading		LISN	LOSS	Results		Limit		Margin		Phase	Comment
		(QP) [dBuV]	(AV) [dBuV]			(QP) [dBuV]	(AV) [dBuV]	(QP) [dBuV]	(AV) [dBuV]	(QP) [dB]	(AV) [dB]		
1	0.15000	32.40	16.08	0.07	13.15	45.62	29.30	66.00	56.00	20.38	26.70	N	
2	0.16558	32.56	16.91	0.07	13.15	45.78	30.13	65.20	55.20	19.42	25.07	N	
3	0.20383	30.28	14.30	0.07	13.16	43.51	27.53	63.50	53.50	19.99	25.97	N	
4	0.27325	23.98	9.52	0.07	13.17	37.22	22.76	61.00	51.00	23.78	28.24	N	
5	2.78500	10.99	4.23	0.11	13.49	24.59	17.83	56.00	46.00	31.41	28.17	N	
6	12.46666	12.36	5.59	0.26	14.03	26.65	19.88	60.00	50.00	33.35	30.12	N	
7	0.15000	32.25	16.56	0.07	13.15	45.47	29.78	66.00	56.00	20.53	26.22	L	
8	0.16983	32.86	16.91	0.07	13.15	46.08	30.13	65.00	55.00	18.92	24.87	L	
9	0.19958	32.22	15.07	0.07	13.16	45.45	28.30	63.60	53.60	18.15	25.30	L	
10	0.27325	22.66	9.47	0.06	13.17	35.89	22.70	61.00	51.00	25.11	28.30	L	
11	2.87500	8.21	2.03	0.12	13.50	21.83	15.65	56.00	46.00	34.17	30.35	L	
12	12.33333	11.34	5.43	0.29	14.03	25.66	19.75	60.00	50.00	34.34	30.25	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + LISN + LOSS (CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Conducted Emission

Report No. 13292801H
Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Date June 14, 2020
Temperature / Humidity 22 deg. C / 68 % RH
Engineer Yuta Moriya
Mode Tx BT LE
Uncoded 2M-PHY (Chip Antenna)



UL Japan, Inc.

Ise EMC Lab.

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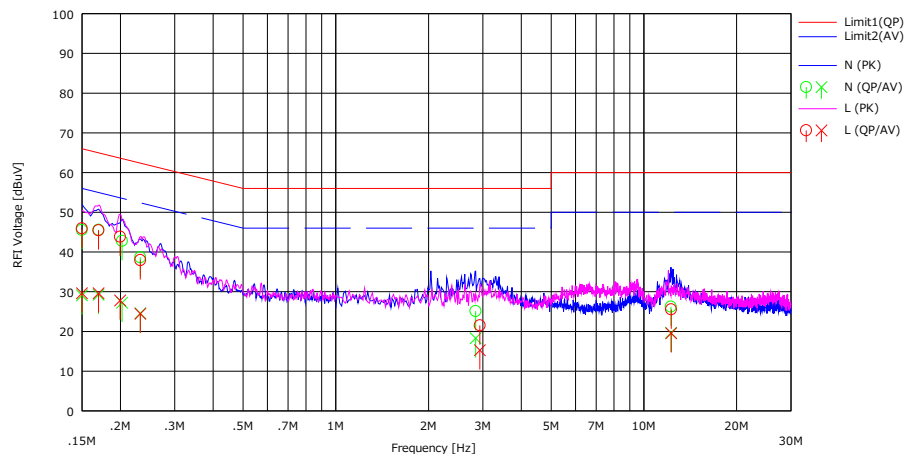
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Emission

Report No. 13292801H
Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Date June 14, 2020
Temperature / Humidity 22 deg. C / 68 % RH
Engineer Yuta Moriya
Mode Tx BT LE 2402 MHz,
Coded-PHY 125kbps (PCB Antenna)

Limit : FCC_Part 15 Subpart C(15.207)

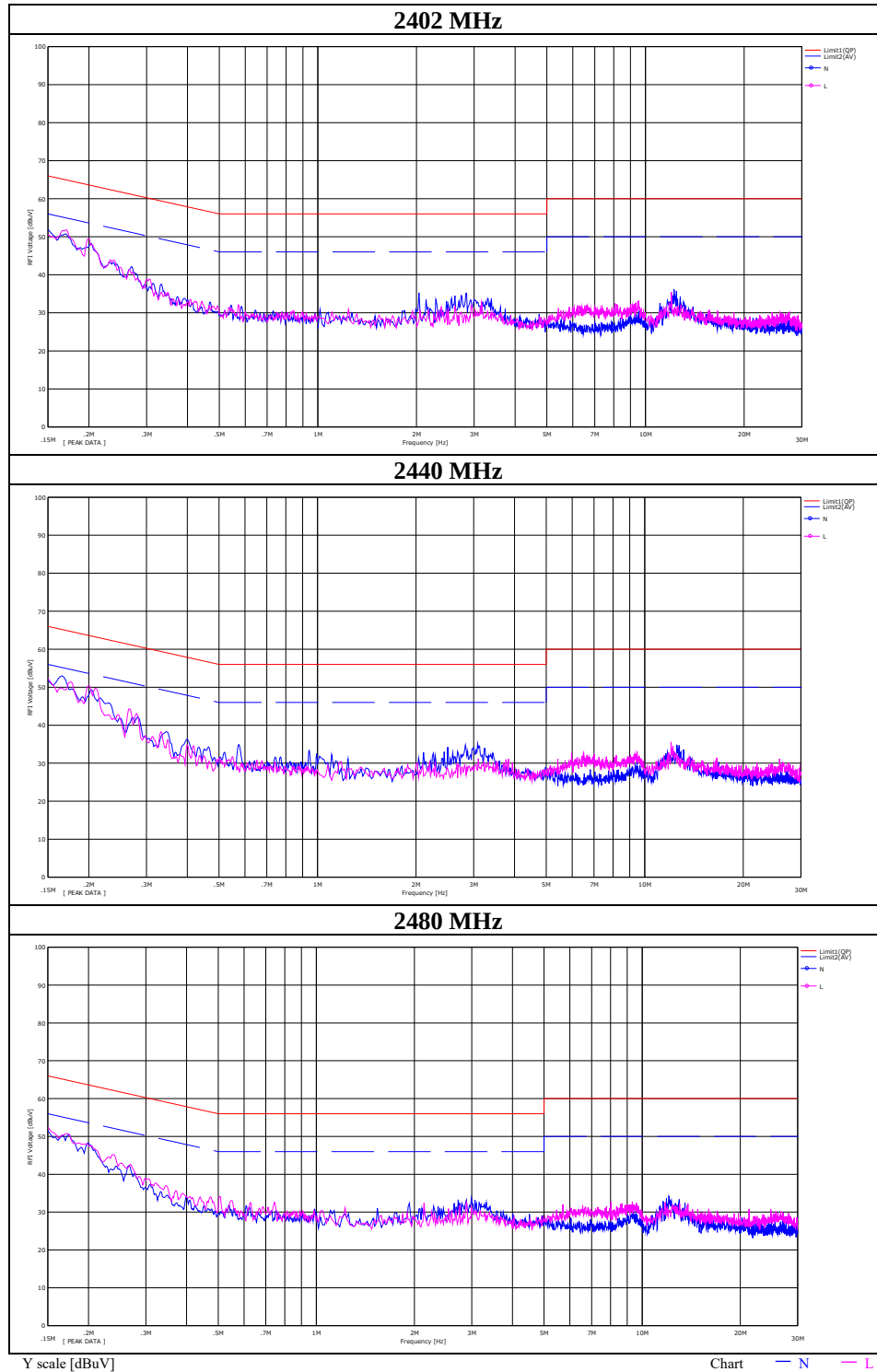


No.	Freq. [MHz]	Reading		LISN	LOSS	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]			<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	32.30	15.85	0.07	13.15	45.52	29.07	66.00	56.00	20.48	26.93	N	
2	0.16983	32.33	16.02	0.07	13.15	45.55	29.24	65.00	55.00	19.45	25.76	N	
3	0.20242	29.53	14.00	0.07	13.16	42.76	27.23	63.50	53.50	20.74	26.27	N	
4	0.23217	25.40	11.35	0.07	13.17	38.64	24.59	62.40	52.40	23.76	27.81	N	
5	2.84500	11.51	4.70	0.11	13.49	25.11	18.30	56.00	46.00	30.89	27.70	N	
6	12.23333	11.96	5.40	0.25	14.02	26.23	19.67	60.00	50.00	33.77	30.33	N	
7	0.15000	32.70	16.40	0.07	13.15	45.92	29.62	66.00	56.00	20.08	26.38	L	
8	0.16983	32.20	16.40	0.07	13.15	45.42	29.62	65.00	55.00	19.58	25.38	L	
9	0.19958	30.60	14.57	0.07	13.16	43.83	27.80	63.60	53.60	19.77	25.80	L	
10	0.23217	24.70	11.23	0.07	13.17	37.94	24.47	62.40	52.40	24.46	27.93	L	
11	2.93500	7.90	1.64	0.12	13.50	21.52	15.26	56.00	46.00	34.48	30.74	L	
12	12.26666	11.20	5.20	0.29	14.03	25.52	19.52	60.00	50.00	34.48	30.48	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + LISN + LOSS (CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Conducted Emission

Report No. 13292801H
Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Date June 14, 2020
Temperature / Humidity 22 deg. C / 68 % RH
Engineer Yuta Moriya
Mode Tx BT LE
Coded-PHY 125kbps (PCB Antenn)



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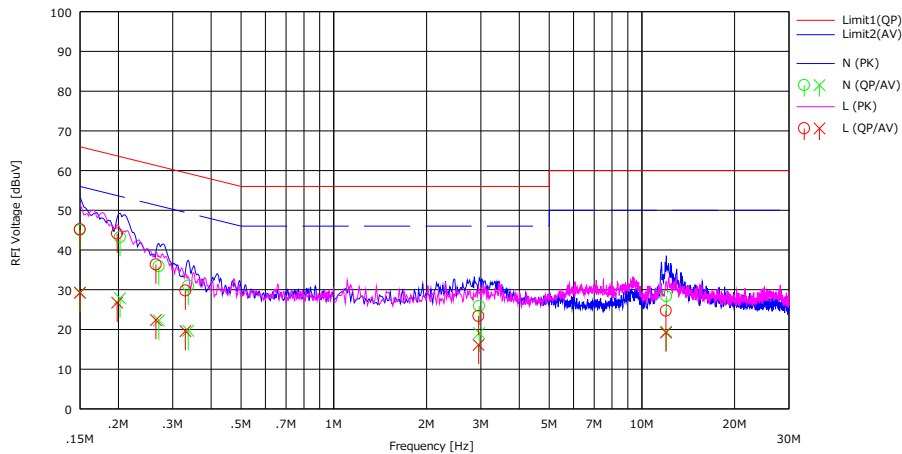
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Emission

Report No. 13292801H
Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Date June 14, 2020
Temperature / Humidity 22 deg. C / 68 % RH
Engineer Yuta Moriya
Mode Tx BT LE 2402 MHz,
Uncoded 2M-PHY (PCB Antenn)

Limit : FCC_Part 15 Subpart C(15.207)

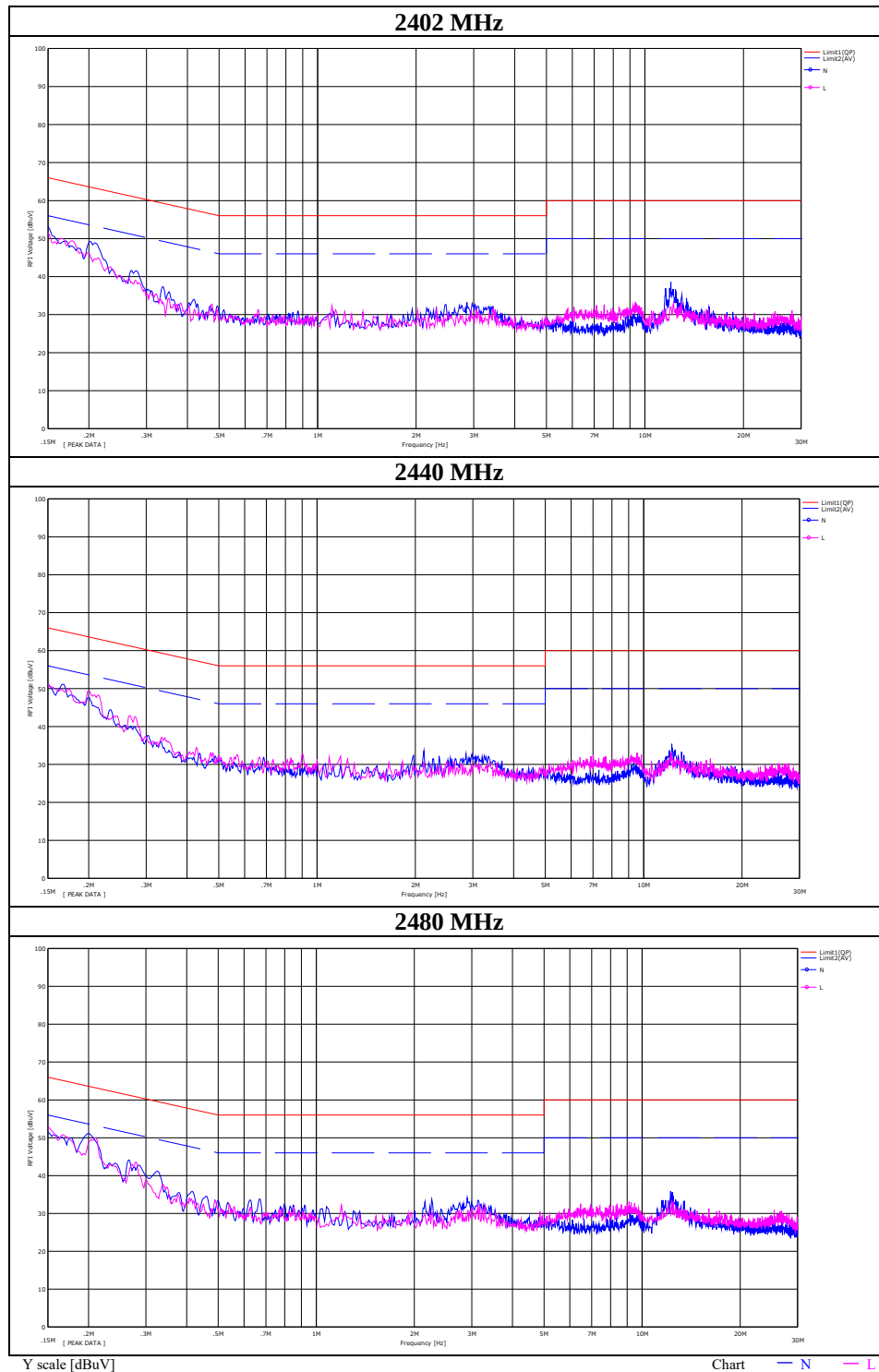


No.	Freq. [MHz]	Reading		USN [dB]	LOSS [dB]	Results		Limit		Margin		Phase	Comment
		(QP) [dBuV]	(AV) [dBuV]			(QP) [dBuV]	(AV) [dBuV]	(QP) [dBuV]	(AV) [dBuV]	(QP) [dB]	(AV) [dB]		
1	0.15000	31.77	16.10	0.07	13.15	44.99	29.32	66.00	56.00	21.01	26.68	N	
2	0.20242	30.00	14.60	0.07	13.16	43.23	27.83	63.50	53.50	20.27	25.67	N	
3	0.27042	22.65	9.03	0.07	13.17	35.89	22.27	61.10	51.10	25.21	28.83	N	
4	0.33700	17.70	6.40	0.07	13.19	30.96	19.66	59.30	49.30	28.34	29.64	N	
5	2.96500	12.30	5.50	0.11	13.51	25.92	19.12	56.00	46.00	30.08	26.88	N	
6	12.00000	14.10	5.19	0.25	14.01	28.36	19.45	60.00	50.00	31.64	30.55	N	
7	0.15000	32.00	15.99	0.07	13.15	45.22	29.21	66.00	56.00	20.78	26.79	L	
8	0.19817	30.89	13.52	0.07	13.16	44.12	26.75	63.70	53.70	19.58	26.95	L	
9	0.26475	23.10	9.16	0.06	13.17	36.33	22.39	61.30	51.30	24.97	28.91	L	
10	0.32992	16.50	6.32	0.06	13.19	29.75	19.57	59.50	49.50	29.75	29.93	L	
11	2.95000	9.75	2.49	0.12	13.50	23.37	16.11	56.00	46.00	32.63	29.89	L	
12	11.96666	10.42	4.96	0.28	14.01	24.71	19.25	60.00	50.00	35.29	30.75	L	

CHART: WITH FACTOR Peak hold data. CALCULATION : RESULT = READING + LISN + LOSS (CABLE + ATT)
Except for the above table: adequate margin data below the limits.

Conducted Emission

Report No. 13292801H
Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Date June 14, 2020
Temperature / Humidity 22 deg. C / 68 % RH
Engineer Yuta Moriya
Mode Tx BT LE
Uncoded 2M-PHY (PCB Antenn)



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6 dB Bandwidth and 99 % Occupied Bandwidth

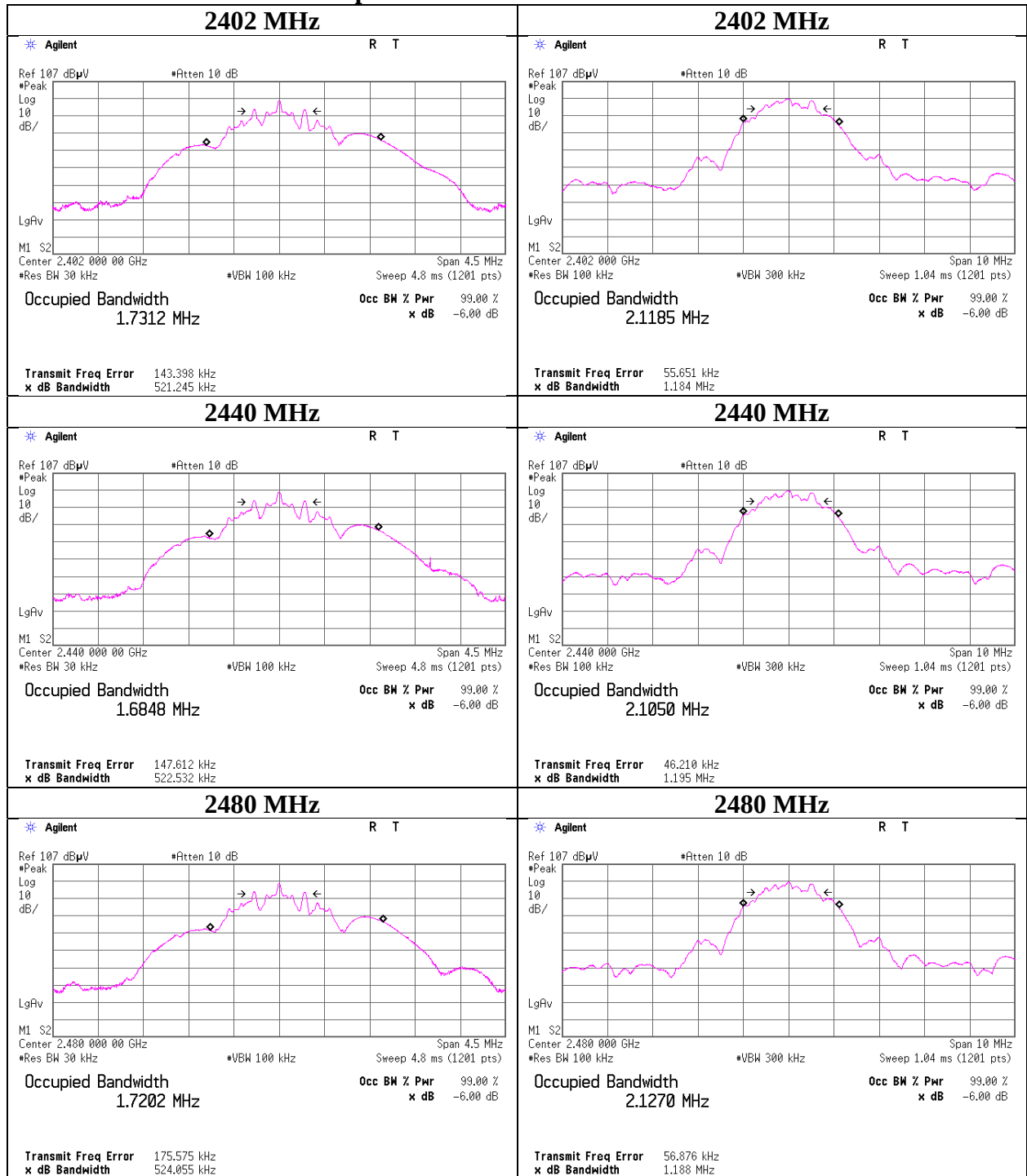
Report No. 13292801H
Test place Ise EMC Lab. No.6 Measurement Room
Date June 17, 2020
Temperature / Humidity 22 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx BT LE

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
Coded-PHY 125kbps	2402	1731.2	0.673	> 0.5000
	2440	1684.8	0.701	> 0.5000
	2480	1720.2	0.705	> 0.5000
Uncoded 2M-PHY	2402	2118.5	1.156	> 0.5000
	2440	2105.0	1.165	> 0.5000
	2480	2127.0	1.159	> 0.5000

99 % Occupied Bandwidth

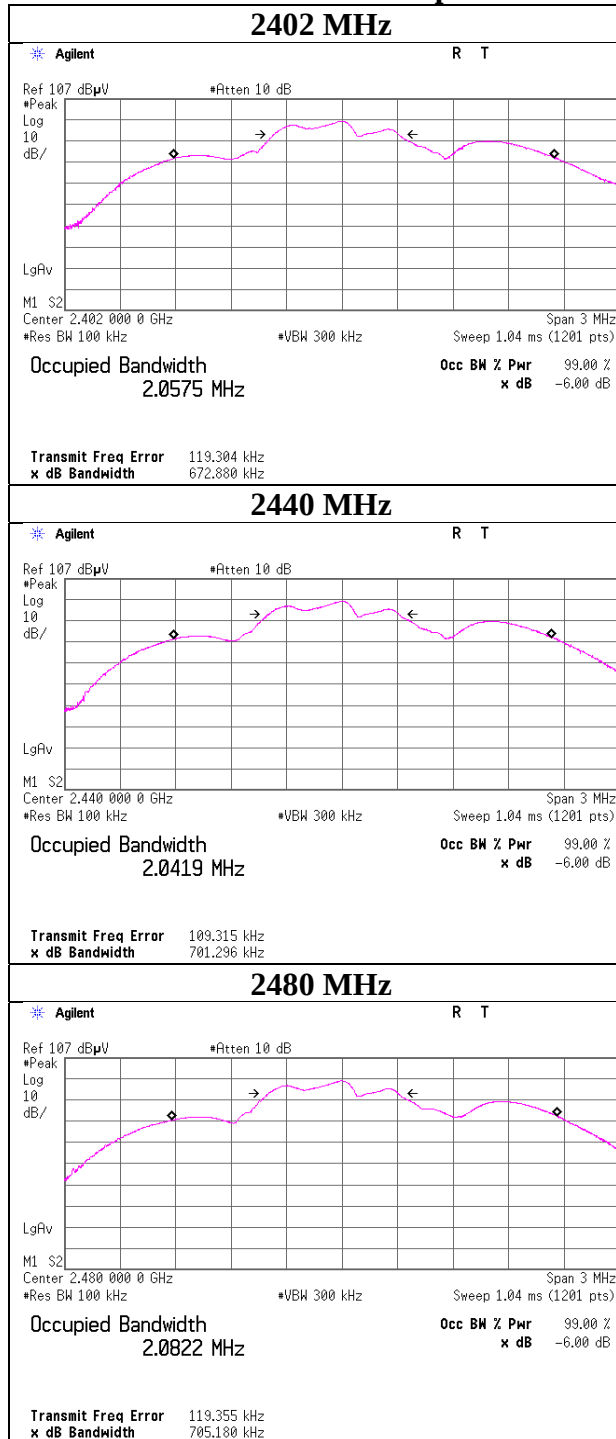
Coded-PHY 125kbps

Uncoded 2M-PHY

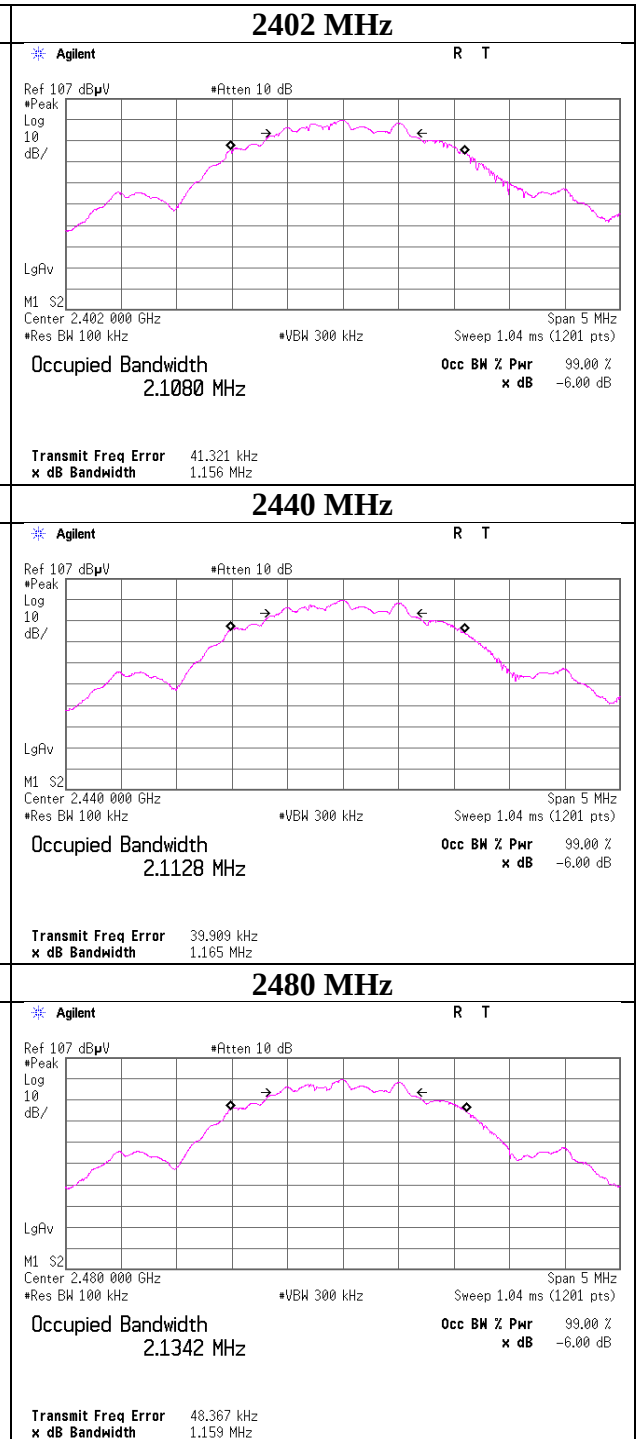


6 dB Bandwidth

Coded-PHY 125kbps



Uncoded 2M-PHY



Maximum Peak Output Power

Report No. 13292801H
Test place Ise EMC Lab.
No.2 Measurement Room
Date June 11, 2020
Temperature / Humidity 23 deg. C / 68 % RH
Engineer Takeshi Hiyaji
Mode Tx BT LE
Coded-PHY 125kbps

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	-9.27	0.70	10.01	1.44	1.39	30.00	1000	28.56	2.90	4.34	2.72	36.02	4000	31.68
2440	-9.32	0.70	10.01	1.39	1.38	30.00	1000	28.61	2.90	4.29	2.69	36.02	4000	31.73
2480	-9.45	0.70	10.01	1.26	1.34	30.00	1000	28.74	2.90	4.16	2.61	36.02	4000	31.86

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.

2440 MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1M	-9.86	
Coded 125 k	-9.84	*
Coded 500 k	-9.86	

*: Worst Rate

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

Maximum Peak Output Power

Report No. 13292801H
Test place Ise EMC Lab.
No.2 Measurement Room
Date June 11, 2020
Temperature / Humidity 23 deg. C / 68 % RH
Engineer Takeshi Hiyaji
Mode Tx BT LE
Uncoded 2M-PHY

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	-9.28	0.70	10.01	1.43	1.39	30.00	1000	28.57	2.90	4.33	2.71	36.02	4000	31.69
2440	-9.33	0.70	10.01	1.38	1.37	30.00	1000	28.62	2.90	4.28	2.68	36.02	4000	31.74
2480	-9.44	0.70	10.01	1.27	1.34	30.00	1000	28.73	2.90	4.17	2.61	36.02	4000	31.85

Sample Calculation:

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

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

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

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

UL Japan, Inc.

Ise EMC Lab.

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

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Average Output Power (Reference data for RF Exposure)

Report No. 13292801H
Test place Ise EMC Lab.
No.2 Measurement Room
Date June 11, 2020
Temperature / Humidity 23 deg. C / 68 % RH
Engineer Takeshi Hiyaji
Mode Tx

Coded-PHY 125kbps

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	-9.61	0.70	10.01	1.10	1.29	0.08	1.18	1.31
2440	-9.66	0.70	10.01	1.05	1.27	0.08	1.13	1.30
2480	-9.79	0.70	10.01	0.92	1.24	0.08	1.00	1.26

Uncoded 2M-PHY

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-11.74	0.70	10.01	-1.03	0.79	2.01	0.98	1.25
2440	-11.80	0.70	10.01	-1.09	0.78	2.01	0.92	1.24
2480	-11.91	0.70	10.01	-1.20	0.76	2.01	0.81	1.21

Sample Calculation:

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

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

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

2440 MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1M	-10.66	
Coded (125 k)	-10.16	*
Coded (500 k)	-10.42	

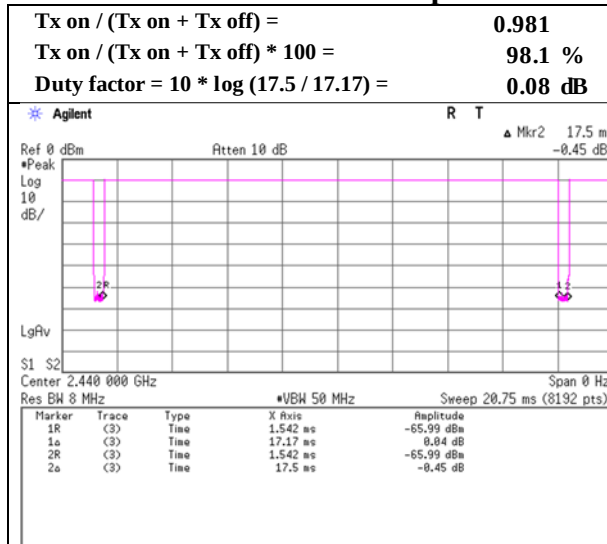
*: Worst Rate

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

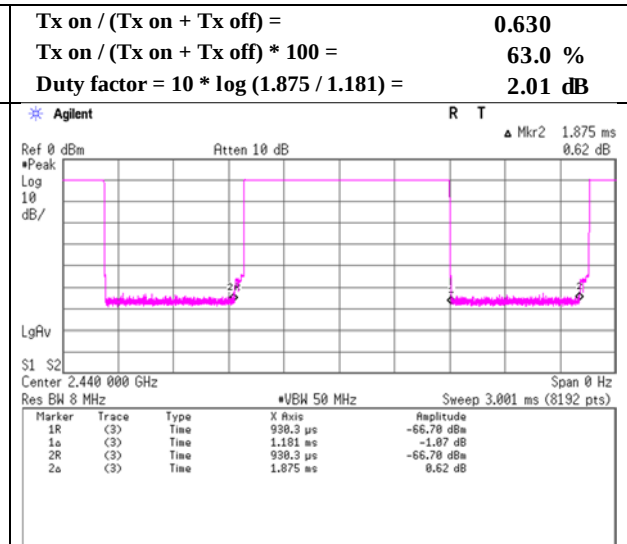
Burst rate confirmation

Report No. 13292801H
Test place Ise EMC Lab. No.6 Measurement Room
Date June 9, 2020
Temperature / Humidity 23 deg. C / 68 % RH
Engineer Takeshi Hiyaji
Mode Tx

Coded-PHY 125kbps



Uncoded 2M-PHY



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

Radiated Spurious Emission

Report No. 13292801H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2 No.2
Date June 11, 2020 June 12, 2020
Temperature / Humidity 22 deg. C / 60 % RH 21 deg. C / 53 % RH
Engineer Junya Okuno Yuta Moriya
(1 GHz - 10 GHz) (10 GHz - 26.5 GHz)
Mode Tx BT LE 2402 MHz
Coded-PHY 125kbps (Chip Antenna)

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.	57.730	QP	22.1	8.6	7.5	28.6	-	9.6	40.0	30.4	
Hori.	64.722	QP	22.1	6.8	7.6	28.6	-	7.9	40.0	32.1	
Hori.	104.480	QP	27.2	11.0	8.1	28.5	-	17.7	43.5	25.8	
Hori.	186.695	QP	22.1	16.2	8.9	28.1	-	19.1	43.5	24.4	
Hori.	308.058	QP	33.1	13.6	9.9	27.9	-	28.7	46.0	17.3	
Hori.	353.240	QP	26.0	15.0	10.2	28.1	-	23.1	46.0	22.9	
Hori.	2390.000	PK	48.3	27.7	4.9	32.7	-	48.2	73.9	25.8	
Hori.	4804.000	PK	42.5	31.6	7.0	31.7	-	49.4	73.9	24.5	
Hori.	7206.000	PK	42.4	36.0	8.4	32.6	-	54.2	73.9	19.7	Floor noise
Hori.	9608.000	PK	41.8	38.5	8.9	33.3	-	55.9	73.9	18.0	Floor noise
Hori.	12010.000	PK	42.2	39.3	-1.7	33.9	-	45.9	73.9	28.0	Floor noise
Hori.	14412.000	PK	45.5	40.1	-0.9	32.8	-	51.9	73.9	22.0	
Hori.	16814.000	PK	44.2	41.0	-0.1	33.6	-	51.5	73.9	22.4	
Hori.	19216.000	PK	45.1	38.0	-2.2	32.7	-	48.2	73.9	25.7	
Hori.	2390.000	AV	33.1	27.7	4.9	32.7	-	33.0	53.9	20.9	
Hori.	4804.000	AV	34.8	31.6	7.0	31.7	-	41.7	53.9	12.2	
Hori.	7206.000	AV	33.0	36.0	8.4	32.6	-	44.8	53.9	9.1	Floor noise
Hori.	9608.000	AV	32.3	38.5	8.9	33.3	-	46.5	53.9	7.5	Floor noise
Hori.	12010.000	AV	33.8	39.3	-1.7	33.9	-	37.5	53.9	16.4	Floor noise
Hori.	14412.000	AV	37.6	40.1	-0.9	32.8	-	44.0	53.9	9.9	
Hori.	16814.000	AV	36.1	41.0	-0.1	33.6	-	43.3	53.9	10.6	
Hori.	19216.000	AV	36.6	38.0	-2.2	32.7	-	39.7	53.9	14.2	
Vert.	57.730	QP	35.6	8.6	7.5	28.6	-	23.0	40.0	17.0	
Vert.	64.722	QP	30.2	6.8	7.6	28.6	-	16.0	40.0	24.0	
Vert.	104.480	QP	33.0	11.0	8.1	28.5	-	23.5	43.5	20.0	
Vert.	186.695	QP	22.4	16.2	8.9	28.1	-	19.4	43.5	24.1	
Vert.	308.058	QP	32.8	13.6	9.9	27.9	-	28.4	46.0	17.6	
Vert.	353.240	QP	27.1	15.0	10.2	28.1	-	24.2	46.0	21.8	
Vert.	2390.000	PK	46.1	27.7	4.9	32.7	-	46.0	73.9	27.9	
Vert.	4804.000	PK	41.3	31.6	7.0	31.7	-	48.2	73.9	25.7	
Vert.	7206.000	PK	42.3	36.0	8.4	32.6	-	54.2	73.9	19.8	Floor noise
Vert.	9608.000	PK	41.7	38.5	8.9	33.3	-	55.9	73.9	18.0	Floor noise
Vert.	12010.000	PK	42.0	39.3	-1.7	33.9	-	45.8	73.9	28.1	Floor noise
Vert.	14412.000	PK	45.1	40.1	-0.9	32.8	-	51.5	73.9	22.4	
Vert.	19216.000	PK	47.0	38.0	-2.2	32.7	-	50.1	73.9	23.8	
Vert.	2390.000	AV	33.9	27.7	4.9	32.7	-	33.8	53.9	20.1	
Vert.	4804.000	AV	34.8	31.6	7.0	31.7	-	41.7	53.9	12.2	
Vert.	7206.000	AV	33.1	36.0	8.4	32.6	-	44.9	53.9	9.0	Floor noise
Vert.	9608.000	AV	32.3	38.5	8.9	33.3	-	46.4	53.9	7.5	Floor noise
Vert.	12010.000	AV	33.8	39.3	-1.7	33.9	-	37.5	53.9	16.4	Floor noise
Vert.	14412.000	AV	36.6	40.1	-0.9	32.8	-	43.0	53.9	10.9	
Vert.	19216.000	AV	38.7	38.0	-2.2	32.7	-	41.7	53.9	12.2	

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 20log (3.7 m / 3.0 m) = 1.83 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 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.	2402.000	PK	91.0	27.7	4.9	32.7	90.9	-	-	Carrier
Hori.	2398.554	PK	45.3	27.7	4.9	32.7	45.2	70.9	25.7	
Hori.	2400.000	PK	41.3	27.7	4.9	32.7	41.2	70.9	29.7	
Vert.	2402.000	PK	88.0	27.7	4.9	32.7	87.8	-	-	Carrier
Vert.	2398.554	PK	41.7	27.7	4.9	32.7	41.6	67.8	26.2	
Vert.	2400.000	PK	39.3	27.7	4.9	32.7	39.2	67.8	28.6	

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

UL Japan, Inc.

Ise EMC Lab.

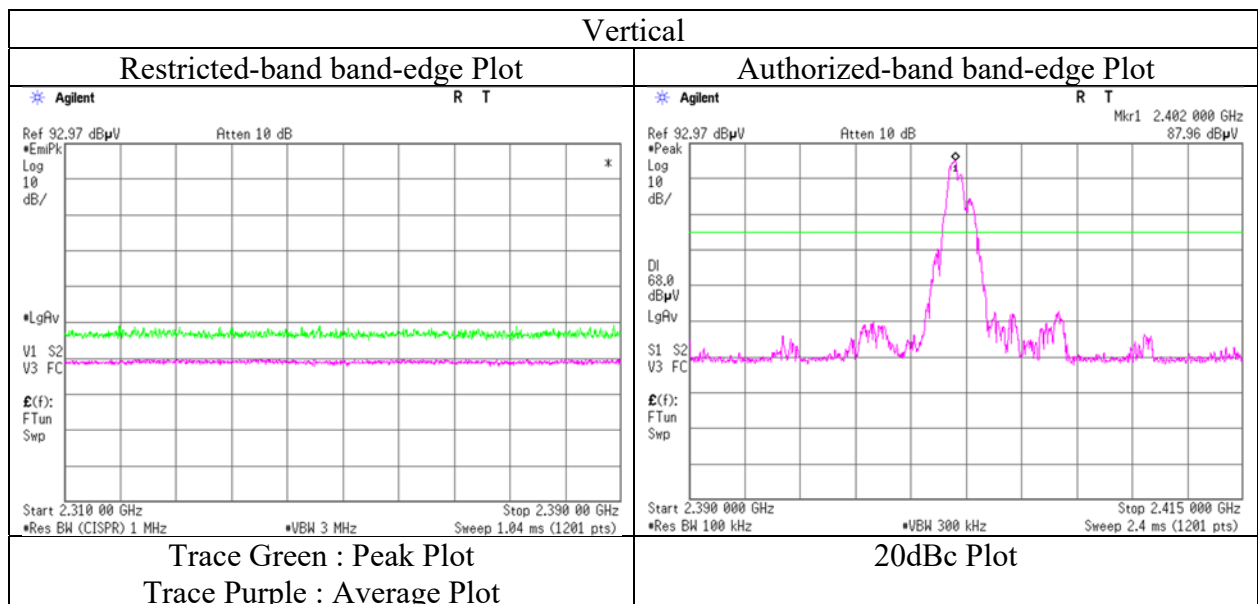
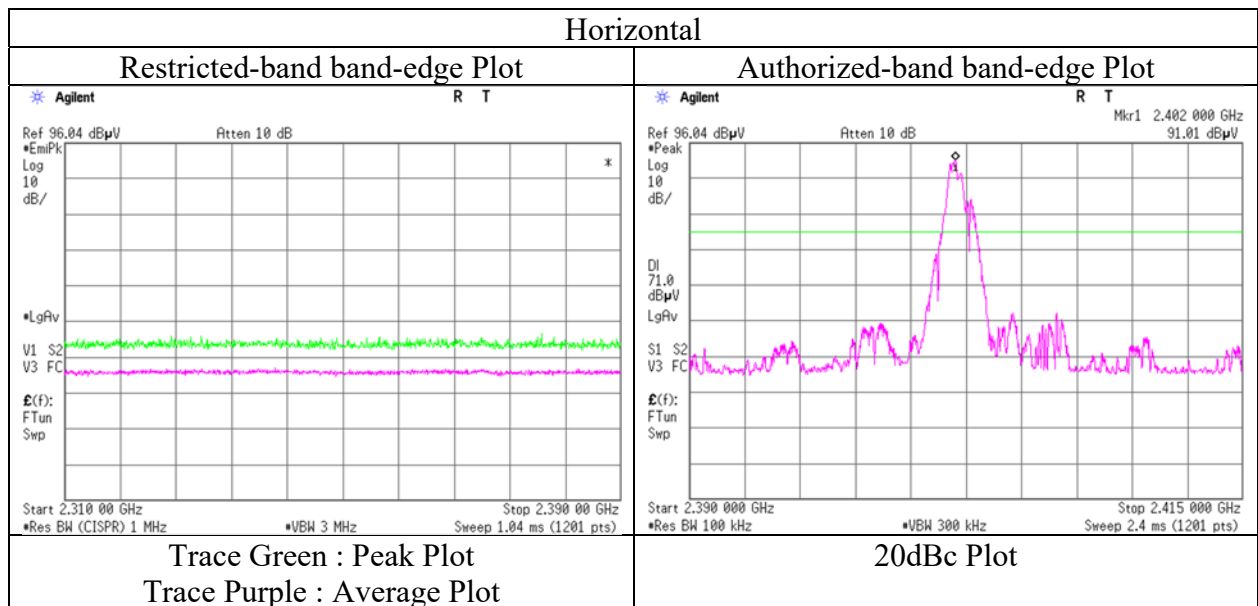
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13292801H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	June 11, 2020
Temperature / Humidity	22 deg. C / 60 % RH
Engineer	Junya Okuno
	(1 GHz - 10 GHz)
Mode	Tx BT LE 2402 MHz
	Coded-PHY 125kbps (Chip Antenna)



* 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. 13292801H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date June 11, 2020 No.2
Temperature / Humidity 22 deg. C / 60 % RH 21 deg. C / 53 % RH
Engineer Junya Okuno Yuta Moriya
(1 GHz - 10 GHz) (10 GHz - 26.5 GHz)
Mode Tx BT LE 2440 MHz
Coded-PHY 125kbps (Chip Antenna)

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.	57.730	QP	23.1	8.6	7.5	28.6	-	10.6	40.0	29.4	
Hori.	64.722	QP	22.1	6.8	7.6	28.6	-	7.9	40.0	32.1	
Hori.	104.880	QP	27.7	11.1	8.1	28.5	-	18.3	43.5	25.2	
Hori.	186.695	QP	22.7	16.2	8.9	28.1	-	19.7	43.5	23.8	
Hori.	308.058	QP	33.7	13.6	9.9	27.9	-	29.3	46.0	16.7	
Hori.	353.240	QP	26.1	15.0	10.2	28.1	-	23.2	46.0	22.8	
Hori.	4880.000	PK	42.7	31.5	7.0	31.6	-	49.6	73.9	24.3	
Hori.	7320.000	PK	42.4	36.2	8.4	32.6	-	54.4	73.9	19.6	Floor noise
Hori.	9760.000	PK	41.7	38.8	8.9	33.4	-	56.1	73.9	17.8	Floor noise
Hori.	12200.000	PK	43.5	39.1	-1.7	33.8	-	47.2	73.9	26.8	Floor noise
Hori.	14640.000	PK	46.9	40.0	-0.8	33.0	-	53.1	73.9	20.8	
Hori.	17080.000	PK	44.7	41.0	0.0	33.3	-	52.3	73.9	21.6	
Hori.	4880.000	AV	35.6	31.5	7.0	31.6	-	42.5	53.9	11.4	
Hori.	7320.000	AV	32.2	36.2	8.4	32.6	-	44.2	53.9	9.7	Floor noise
Hori.	9760.000	AV	32.2	38.8	8.9	33.4	-	46.5	53.9	7.4	Floor noise
Hori.	12200.000	AV	34.9	39.1	-1.7	33.8	-	38.6	53.9	15.3	Floor noise
Hori.	14640.000	AV	39.7	40.0	-0.8	33.0	-	46.0	53.9	8.0	
Hori.	17080.000	AV	36.9	41.0	0.0	33.3	-	44.5	53.9	9.4	
Vert.	57.730	QP	40.4	8.6	7.5	28.6	-	27.9	40.0	12.1	
Vert.	64.722	QP	29.8	6.8	7.6	28.6	-	15.6	40.0	24.4	
Vert.	104.880	QP	30.6	11.1	8.1	28.5	-	21.2	43.5	22.3	
Vert.	186.695	QP	23.0	16.2	8.9	28.1	-	20.0	43.5	23.5	
Vert.	308.058	QP	33.3	13.6	9.9	27.9	-	28.9	46.0	17.1	
Vert.	353.240	QP	27.0	15.0	10.2	28.1	-	24.1	46.0	21.9	
Vert.	4880.000	PK	42.3	31.5	7.0	31.6	-	49.2	73.9	24.7	
Vert.	7320.000	PK	42.2	36.2	8.4	32.6	-	54.2	73.9	19.7	Floor noise
Vert.	9760.000	PK	41.7	38.8	8.9	33.4	-	56.1	73.9	17.8	Floor noise
Vert.	12200.000	PK	43.8	39.1	-1.7	33.8	-	47.5	73.9	26.5	Floor noise
Vert.	14640.000	PK	43.7	40.0	-0.8	33.0	-	49.9	73.9	24.0	
Vert.	19520.000	PK	47.6	37.9	-2.2	33.0	-	50.3	73.9	23.6	
Vert.	4880.000	AV	34.6	31.5	7.0	31.6	-	41.5	53.9	12.4	
Vert.	7320.000	AV	32.2	36.2	8.4	32.6	-	44.2	53.9	9.7	Floor noise
Vert.	9760.000	AV	32.1	38.8	8.9	33.4	-	46.4	53.9	7.5	Floor noise
Vert.	12200.000	AV	34.7	39.1	-1.7	33.8	-	38.3	53.9	15.6	Floor noise
Vert.	14640.000	AV	36.1	40.0	-0.8	33.0	-	42.3	53.9	11.6	
Vert.	19520.000	AV	38.7	37.9	-2.2	33.0	-	41.5	53.9	12.5	

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 $20\log(3.7\text{ m} / 3.0\text{ m}) = 1.83\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission

Report No. 13292801H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2 No.2
Date June 11, 2020 June 12, 2020
Temperature / Humidity 22 deg. C / 60 % RH 21 deg. C / 53 % RH
Engineer Junya Okuno Yuta Moriya
(1 GHz - 10 GHz) (10 GHz - 26.5 GHz)
Mode Tx BT LE 2480 MHz
Coded-PHY 125kbps (Chip Antenna)

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.	57.730	QP	23.2	8.6	7.5	28.6	-	10.7	40.0	29.3	
Hori.	64.722	QP	22.0	6.8	7.6	28.6	-	7.8	40.0	32.2	
Hori.	104.160	QP	28.3	10.9	8.0	28.5	-	18.8	43.5	24.7	
Hori.	186.695	QP	23.3	16.2	8.9	28.1	-	20.3	43.5	23.2	
Hori.	308.058	QP	33.6	13.6	9.9	27.9	-	29.2	46.0	16.8	
Hori.	353.240	QP	26.0	15.0	10.2	28.1	-	23.1	46.0	22.9	
Hori.	2483.500	PK	58.9	27.5	5.0	32.7	-	58.6	73.9	15.3	
Hori.	2484.900	PK	60.9	27.5	5.0	32.7	-	60.6	73.9	13.3	
Hori.	4960.000	PK	42.6	31.6	7.0	31.6	-	49.5	73.9	24.4	
Hori.	7440.000	PK	42.2	36.3	8.4	32.7	-	54.3	73.9	19.6	Floor noise
Hori.	9920.000	PK	42.3	38.9	9.0	33.5	-	56.7	73.9	17.2	Floor noise
Hori.	12400.000	PK	41.9	38.9	-1.6	33.7	-	45.5	73.9	28.4	Floor noise
Hori.	14880.000	PK	47.1	38.9	-0.6	33.2	-	52.3	73.9	21.7	
Hori.	17360.000	PK	43.6	43.1	0.0	33.2	-	53.5	73.9	20.4	
Hori.	2483.500	AV	40.3	27.5	5.0	32.7	-	40.1	53.9	13.8	
Hori.	2484.900	AV	42.5	27.5	5.0	32.7	-	42.3	53.9	11.6	
Hori.	4960.000	AV	35.4	31.6	7.0	31.6	-	42.4	53.9	11.5	
Hori.	7440.000	AV	33.1	36.3	8.4	32.7	-	45.2	53.9	8.8	Floor noise
Hori.	9920.000	AV	32.2	38.9	9.0	33.5	-	46.6	53.9	7.3	Floor noise
Hori.	12400.000	AV	34.5	38.9	-1.6	33.7	-	38.1	53.9	15.8	Floor noise
Hori.	14880.000	AV	40.2	38.9	-0.6	33.2	-	45.3	53.9	8.6	
Hori.	17360.000	AV	36.2	43.1	0.0	33.2	-	46.1	53.9	7.8	
Vert.	57.730	QP	40.3	8.6	7.5	28.6	-	27.8	40.0	12.2	
Vert.	64.722	QP	30.0	6.8	7.6	28.6	-	15.8	40.0	24.2	
Vert.	104.160	QP	33.7	10.9	8.0	28.5	-	24.2	43.5	19.3	
Vert.	186.695	QP	23.5	16.2	8.9	28.1	-	20.5	43.5	23.0	
Vert.	308.058	QP	33.2	13.6	9.9	27.9	-	28.8	46.0	17.2	
Vert.	353.240	QP	27.1	15.0	10.2	28.1	-	24.2	46.0	21.8	
Vert.	2483.500	PK	56.5	27.5	5.0	32.7	-	56.3	73.9	17.6	
Vert.	2484.900	PK	58.4	27.5	5.0	32.7	-	58.1	73.9	15.8	
Vert.	4960.000	PK	41.9	31.6	7.0	31.6	-	48.8	73.9	25.1	
Vert.	7440.000	PK	42.3	36.3	8.4	32.7	-	54.4	73.9	19.6	Floor noise
Vert.	9920.000	PK	42.4	38.9	9.0	33.5	-	56.8	73.9	17.1	Floor noise
Vert.	12400.000	PK	42.1	38.9	-1.6	33.7	-	45.8	73.9	28.1	Floor noise
Vert.	14880.000	PK	44.8	38.9	-0.6	33.2	-	49.9	73.9	24.0	
Vert.	17360.000	PK	44.2	43.1	0.0	33.2	-	54.1	73.9	19.8	
Vert.	19840.000	PK	47.1	37.8	-2.1	33.4	-	49.4	73.9	24.5	
Vert.	2483.500	AV	39.2	27.5	5.0	32.7	-	38.9	53.9	15.0	
Vert.	2484.900	AV	40.0	27.5	5.0	32.7	-	39.7	53.9	14.2	
Vert.	4960.000	AV	34.4	31.6	7.0	31.6	-	41.4	53.9	12.5	
Vert.	7440.000	AV	33.0	36.3	8.4	32.7	-	45.0	53.9	8.9	Floor noise
Vert.	9920.000	AV	32.2	38.9	9.0	33.5	-	46.6	53.9	7.3	Floor noise
Vert.	12400.000	AV	34.7	38.9	-1.6	33.7	-	38.3	53.9	15.6	Floor noise
Vert.	14880.000	AV	37.1	38.9	-0.6	33.2	-	42.2	53.9	11.7	
Vert.	17360.000	AV	35.5	43.1	0.0	33.2	-	45.3	53.9	8.6	
Vert.	19840.000	AV	38.5	37.8	-2.1	33.4	-	40.8	53.9	13.1	

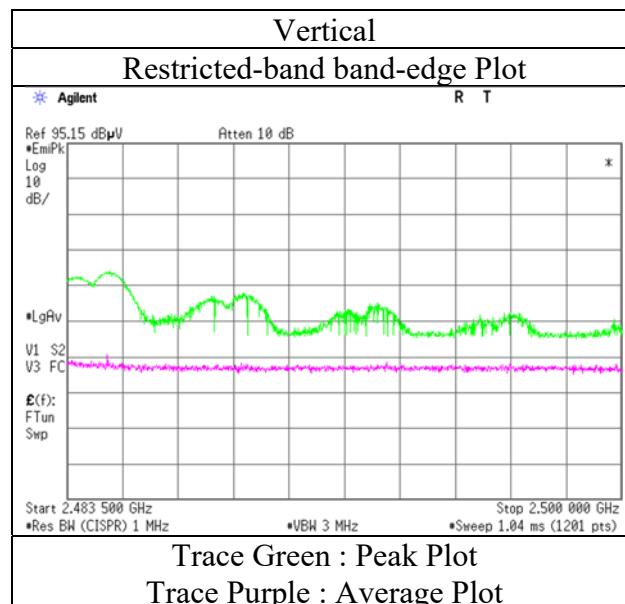
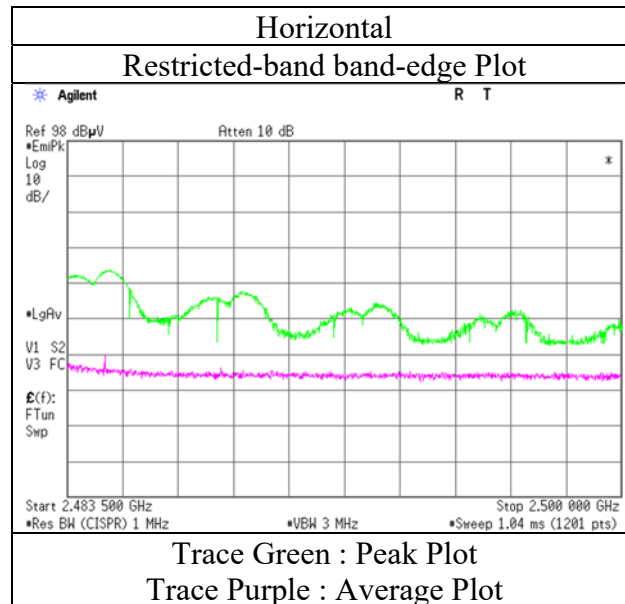
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz 20log (3.7 m / 3.0 m) = 1.83 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13292801H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	June 11, 2020
Temperature / Humidity	22 deg. C / 60 % RH
Engineer	Junya Okuno
	(1 GHz - 10 GHz)
Mode	Tx BT LE 2480 MHz
	Coded-PHY 125kbps (Chip Antenna)



* 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. 13292801H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2 No.2
Date June 11, 2020 June 12, 2020
Temperature / Humidity 22 deg. C / 60 % RH 21 deg. C / 53 % RH
Engineer Junya Okuno Yuta Moriya
(1 GHz - 10 GHz) (10 GHz - 26.5 GHz)
Mode Tx BT LE 2402 MHz
Uncoded 2M-PHY (Chip Antenna)

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.	60.000	QP	22.4	7.9	7.5	28.6	-	9.2	40.0	30.8	
Hori.	64.722	QP	22.1	6.8	7.6	28.6	-	7.9	40.0	32.1	
Hori.	103.040	QP	30.6	10.8	8.0	28.5	-	20.9	43.5	22.6	
Hori.	186.695	QP	22.3	16.2	8.9	28.1	-	19.3	43.5	24.2	
Hori.	308.058	QP	33.3	13.6	9.9	27.9	-	28.9	46.0	17.1	
Hori.	353.240	QP	25.9	15.0	10.2	28.1	-	23.0	46.0	23.0	
Hori.	2390.000	PK	50.1	27.7	4.9	32.7	-	50.0	73.9	23.9	
Hori.	4804.000	PK	41.2	31.6	7.0	31.7	-	48.1	73.9	25.8	
Hori.	7206.000	PK	42.4	36.0	8.4	32.6	-	54.2	73.9	19.7	Floor noise
Hori.	9608.000	PK	42.0	38.5	8.9	33.3	-	56.1	73.9	17.8	Floor noise
Hori.	12010.000	PK	42.5	39.3	-1.7	33.9	-	46.2	73.9	27.7	Floor noise
Hori.	14412.000	PK	45.1	40.1	-0.9	32.8	-	51.5	73.9	22.4	
Hori.	19216.000	PK	44.8	38.0	-2.2	32.7	-	47.8	73.9	26.1	
Hori.	2390.000	AV	35.0	27.7	4.9	32.7	2.0	36.9	53.9	17.0	*1)
Hori.	4804.000	AV	31.7	31.6	7.0	31.7	2.0	40.7	53.9	13.2	
Hori.	7206.000	AV	33.1	36.0	8.4	32.6	-	44.9	53.9	9.0	Floor noise
Hori.	9608.000	AV	32.4	38.5	8.9	33.3	-	46.5	53.9	7.4	Floor noise
Hori.	12010.000	AV	34.0	39.3	-1.7	33.9	-	37.8	53.9	16.2	Floor noise
Hori.	14412.000	AV	36.3	40.1	-0.9	32.8	2.0	44.7	53.9	9.2	
Hori.	19216.000	AV	35.9	38.0	-2.2	32.7	2.0	41.0	53.9	12.9	
Vert.	60.000	QP	34.6	7.9	7.5	28.6	-	21.4	40.0	18.6	
Vert.	64.722	QP	30.3	6.8	7.6	28.6	-	16.1	40.0	23.9	
Vert.	103.040	QP	36.8	10.8	8.0	28.5	-	27.1	43.5	16.4	
Vert.	186.695	QP	22.2	16.2	8.9	28.1	-	19.2	43.5	24.3	
Vert.	308.058	QP	33.0	13.6	9.9	27.9	-	28.6	46.0	17.4	
Vert.	353.240	QP	27.0	15.0	10.2	28.1	-	24.1	46.0	21.9	
Vert.	2390.000	PK	46.8	27.7	4.9	32.7	-	46.7	73.9	27.2	
Vert.	4804.000	PK	41.1	31.6	7.0	31.7	-	48.1	73.9	25.9	
Vert.	7206.000	PK	41.0	36.0	8.4	32.6	-	52.8	73.9	21.1	Floor noise
Vert.	9608.000	PK	42.1	38.5	8.9	33.3	-	56.2	73.9	17.7	Floor noise
Vert.	12010.000	PK	42.4	39.3	-1.7	33.9	-	46.1	73.9	27.8	Floor noise
Vert.	14412.000	PK	42.6	40.1	-0.9	32.8	-	49.0	73.9	24.9	
Vert.	19216.000	PK	45.8	38.0	-2.2	32.7	-	48.9	73.9	25.0	
Vert.	2390.000	AV	33.6	27.7	4.9	32.7	2.0	35.5	53.9	18.4	*1)
Vert.	4804.000	AV	32.9	31.6	7.0	31.7	2.0	41.9	53.9	12.0	
Vert.	7206.000	AV	33.1	36.0	8.4	32.6	-	44.9	53.9	9.0	Floor noise
Vert.	9608.000	AV	32.3	38.5	8.9	33.3	-	46.4	53.9	7.5	Floor noise
Vert.	12010.000	AV	34.3	39.3	-1.7	33.9	-	38.0	53.9	15.9	Floor noise
Vert.	14412.000	AV	35.1	40.1	-0.9	32.8	2.0	43.5	53.9	10.4	
Vert.	19216.000	AV	37.1	38.0	-2.2	32.7	2.0	42.2	53.9	11.7	

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 $20\log(3.7\text{ m} / 3.0\text{ m}) = 1.83\text{ dB}$
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)

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	91.1	27.7	4.9	32.7	90.9	-	-	Carrier
Hori.	2400.000	PK	56.8	27.7	4.9	32.7	56.6	70.9	14.3	
Vert.	2402.000	PK	87.9	27.7	4.9	32.7	87.8	-	-	Carrier
Vert.	2400.000	PK	53.7	27.7	4.9	32.7	53.6	67.8	14.2	

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

UL Japan, Inc.

Ise EMC Lab.

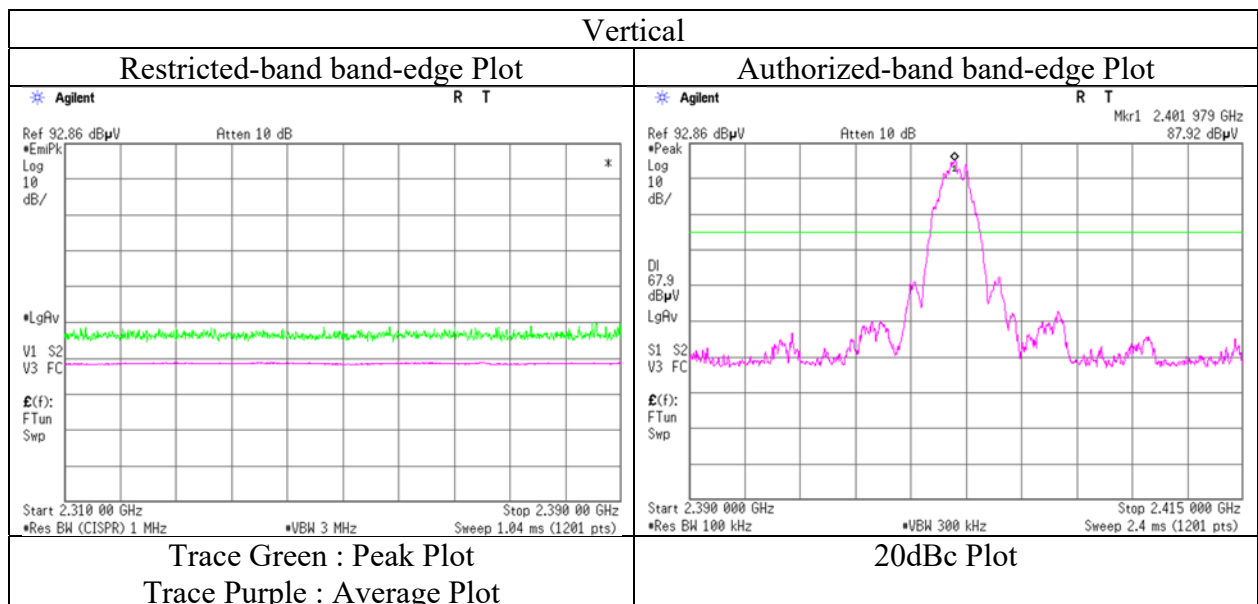
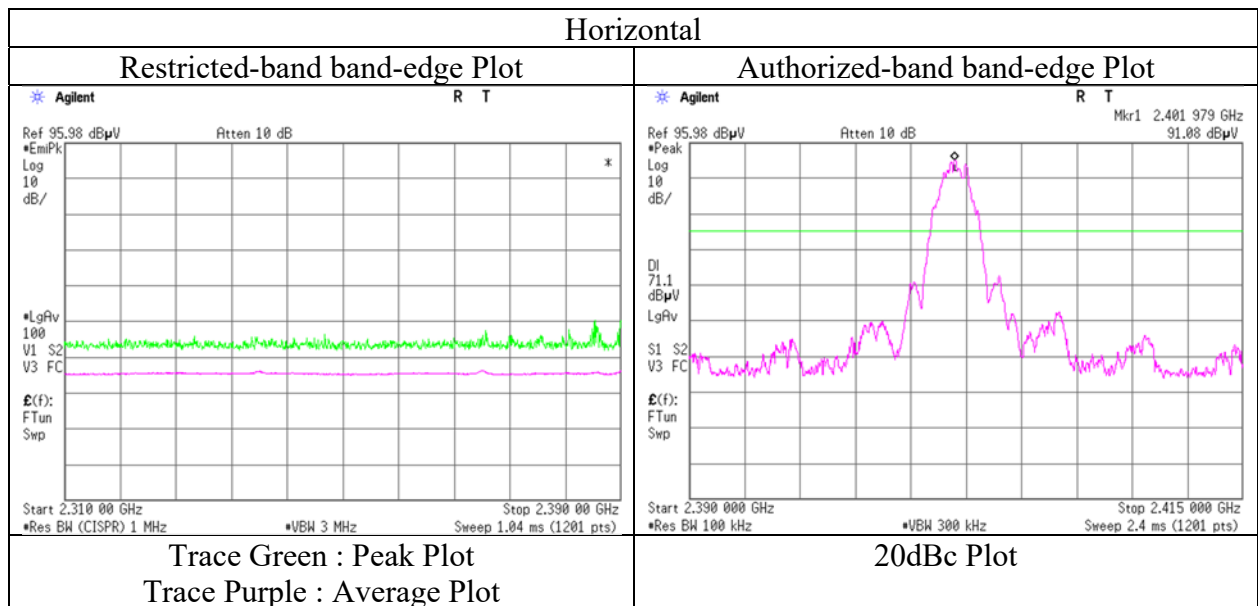
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13292801H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	June 11, 2020
Temperature / Humidity	22 deg. C / 60 % RH
Engineer	Junya Okuno
	(1 GHz - 10 GHz)
Mode	Tx BT LE 2402 MHz
	Uncoded 2M-PHY (Chip Antenna)



* 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. 13292801H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2 No.2
Date June 11, 2020 June 12, 2020
Temperature / Humidity 22 deg. C / 60 % RH 21 deg. C / 53 % RH
Engineer Junya Okuno Yuta Moriya
(1 GHz - 10 GHz) (10 GHz – 26.5 GHz)
Mode Tx BT LE 2440 MHz
Uncoded 2M-PHY (Chip Antenna)

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.	60.000	QP	22.3	7.9	7.5	28.6	-	9.1	40.0	30.9	
Hori.	64.722	QP	22.0	6.8	7.6	28.6	-	7.8	40.0	32.2	
Hori.	104.650	QP	28.0	11.0	8.1	28.5	-	18.6	43.5	24.9	
Hori.	186.695	QP	23.2	16.2	8.9	28.1	-	20.2	43.5	23.3	
Hori.	308.058	QP	33.2	13.6	9.9	27.9	-	28.8	46.0	17.2	
Hori.	353.240	QP	26.0	15.0	10.2	28.1	-	23.1	46.0	22.9	
Hori.	4880.000	PK	42.7	31.5	7.0	31.6	-	49.7	73.9	24.2	
Hori.	7320.000	PK	42.4	36.2	8.4	32.6	-	54.4	73.9	19.5	Floor noise
Hori.	9760.000	PK	41.7	38.8	8.9	33.4	-	56.1	73.9	17.9	Floor noise
Hori.	12200.000	PK	43.7	39.1	-1.7	33.8	-	47.3	73.9	26.6	Floor noise
Hori.	14640.000	PK	45.4	40.0	-0.8	33.0	-	51.6	73.9	22.3	
Hori.	17080.000	PK	45.2	41.0	0.0	33.3	-	52.8	73.9	21.1	
Hori.	4880.000	AV	33.8	31.5	7.0	31.6	2.0	42.7	53.9	11.2	
Hori.	7320.000	AV	32.2	36.2	8.4	32.6	-	44.2	53.9	9.7	Floor noise
Hori.	9760.000	AV	32.1	38.8	8.9	33.4	-	46.4	53.9	7.5	Floor noise
Hori.	12200.000	AV	34.8	39.1	-1.7	33.8	-	38.4	53.9	15.5	Floor noise
Hori.	14640.000	AV	37.5	40.0	-0.8	33.0	2.0	45.7	53.9	8.2	
Hori.	17080.000	AV	35.8	41.0	0.0	33.3	2.0	45.5	53.9	8.4	
Vert.	60.000	QP	34.5	7.9	7.5	28.6	-	21.3	40.0	18.7	
Vert.	64.722	QP	27.2	6.8	7.6	28.6	-	13.0	40.0	27.0	
Vert.	104.650	QP	33.2	11.0	8.1	28.5	-	23.8	43.5	19.7	
Vert.	186.695	QP	23.3	16.2	8.9	28.1	-	20.3	43.5	23.2	
Vert.	308.058	QP	33.0	13.6	9.9	27.9	-	28.6	46.0	17.4	
Vert.	353.240	QP	26.9	15.0	10.2	28.1	-	24.0	46.0	22.0	
Vert.	4880.000	PK	41.3	31.5	7.0	31.6	-	48.2	73.9	25.7	
Vert.	7320.000	PK	42.3	36.2	8.4	32.6	-	54.3	73.9	19.6	Floor noise
Vert.	9760.000	PK	41.6	38.8	8.9	33.4	-	56.0	73.9	17.9	Floor noise
Vert.	12200.000	PK	42.8	39.1	-1.7	33.8	-	46.4	73.9	27.5	Floor noise
Vert.	14640.000	PK	42.5	40.0	-0.8	33.0	-	48.7	73.9	25.2	
Vert.	17080.000	PK	42.9	41.0	0.0	33.3	-	50.6	73.9	23.4	
Vert.	19520.000	PK	47.1	37.9	-2.2	33.0	-	49.8	73.9	24.1	
Vert.	4880.000	AV	33.1	31.5	7.0	31.6	2.0	42.0	53.9	11.9	
Vert.	7320.000	AV	32.1	36.2	8.4	32.6	-	44.1	53.9	9.8	Floor noise
Vert.	9760.000	AV	32.0	38.8	8.9	33.4	-	46.4	53.9	7.5	Floor noise
Vert.	12200.000	AV	34.6	39.1	-1.7	33.8	-	38.2	53.9	15.7	Floor noise
Vert.	14640.000	AV	34.7	40.0	-0.8	33.0	2.0	42.9	53.9	11.0	
Vert.	17080.000	AV	34.8	41.0	0.0	33.3	2.0	44.5	53.9	9.4	
Vert.	19520.000	AV	37.4	37.9	-2.2	33.0	2.0	42.1	53.9	11.8	

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 (3.7 m / 3.0 m) = 1.83 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No. 13292801H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2 No.2
Date June 11, 2020 June 12, 2020
Temperature / Humidity 22 deg. C / 60 % RH 21 deg. C / 53 % RH
Engineer Junya Okuno Yuta Moriya
(1 GHz - 10 GHz) (10 GHz - 26.5 GHz)
Mode Tx BT LE 2480 MHz
Uncoded 2M-PHY (Chip Antenna)

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.	60.000	QP	22.5	7.9	7.5	28.6	-	9.3	40.0	30.7	
Hori.	64.722	QP	22.1	6.8	7.6	28.6	-	7.9	40.0	32.1	
Hori.	104.980	QP	29.5	11.1	8.1	28.5	-	20.1	43.5	23.4	
Hori.	186.695	QP	23.3	16.2	8.9	28.1	-	20.3	43.5	23.2	
Hori.	308.058	QP	33.4	13.6	9.9	27.9	-	29.0	46.0	17.0	
Hori.	597.377	QP	22.0	19.1	11.5	29.4	-	23.3	46.0	22.8	
Hori.	2483.500	PK	58.7	27.5	5.0	32.7	-	58.4	73.9	15.5	
Hori.	2484.900	PK	60.1	27.5	5.0	32.7	-	59.9	73.9	14.0	
Hori.	4960.000	PK	42.0	31.6	7.0	31.6	-	49.0	73.9	24.9	
Hori.	7440.000	PK	42.3	36.3	8.4	32.7	-	54.4	73.9	19.6	Floor noise
Hori.	9920.000	PK	42.1	38.9	9.0	33.5	-	56.5	73.9	17.4	Floor noise
Hori.	12400.000	PK	42.5	38.9	-1.6	33.7	-	46.2	73.9	27.8	Floor noise
Hori.	14880.000	PK	45.6	38.9	-0.6	33.2	-	50.8	73.9	23.2	
Hori.	2483.500	AV	42.5	27.5	5.0	32.7	2.0	44.2	53.9	9.7	*1)
Hori.	2484.900	AV	44.3	27.5	5.0	32.7	2.0	46.1	53.9	7.8	
Hori.	4960.000	AV	33.8	31.6	7.0	31.6	2.0	42.8	53.9	11.1	
Hori.	7440.000	AV	33.0	36.3	8.4	32.7	-	45.0	53.9	8.9	Floor noise
Hori.	9920.000	AV	32.2	38.9	9.0	33.5	-	46.6	53.9	7.3	Floor noise
Hori.	12400.000	AV	34.5	38.9	-1.6	33.7	-	38.1	53.9	15.8	Floor noise
Hori.	14880.000	AV	35.9	38.9	-0.6	33.2	2.0	43.1	53.9	10.9	
Vert.	60.000	QP	33.5	7.9	7.5	28.6	-	20.3	40.0	19.7	
Vert.	64.722	QP	30.4	6.8	7.6	28.6	-	16.2	40.0	23.8	
Vert.	104.980	QP	35.2	11.1	8.1	28.5	-	25.8	43.5	17.7	
Vert.	186.695	QP	23.4	16.2	8.9	28.1	-	20.4	43.5	23.1	
Vert.	308.058	QP	33.0	13.6	9.9	27.9	-	28.6	46.0	17.4	
Vert.	597.377	QP	22.1	19.1	11.5	29.4	-	23.4	46.0	22.7	
Vert.	2483.500	PK	52.8	27.5	5.0	32.7	-	52.5	73.9	21.4	
Vert.	2484.900	PK	54.0	27.5	5.0	32.7	-	53.7	73.9	20.2	
Vert.	4960.000	PK	41.5	31.6	7.0	31.6	-	48.5	73.9	25.4	
Vert.	7440.000	PK	42.2	36.3	8.4	32.7	-	54.3	73.9	19.6	Floor noise
Vert.	9920.000	PK	42.2	38.9	9.0	33.5	-	56.6	73.9	17.3	Floor noise
Vert.	12400.000	PK	42.4	38.9	-1.6	33.7	-	46.0	73.9	27.9	Floor noise
Vert.	14880.000	PK	43.2	38.9	-0.6	33.2	-	48.4	73.9	25.5	
Vert.	19840.000	PK	45.9	37.8	-2.1	33.4	-	48.2	73.9	25.7	
Vert.	2483.500	AV	37.9	27.5	5.0	32.7	2.0	39.7	53.9	14.2	*1)
Vert.	2484.900	AV	36.7	27.5	5.0	32.7	2.0	38.5	53.9	15.5	
Vert.	4960.000	AV	33.1	31.6	7.0	31.6	2.0	42.1	53.9	11.8	
Vert.	7440.000	AV	33.0	36.3	8.4	32.7	-	45.1	53.9	8.8	Floor noise
Vert.	9920.000	AV	32.1	38.9	9.0	33.5	-	46.5	53.9	7.4	Floor noise
Vert.	12400.000	AV	34.2	38.9	-1.6	33.7	-	37.9	53.9	16.0	Floor noise
Vert.	14880.000	AV	35.0	38.9	-0.6	33.2	2.0	42.2	53.9	11.7	
Vert.	19840.000	AV	36.4	37.8	-2.1	33.4	2.0	40.7	53.9	13.2	

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

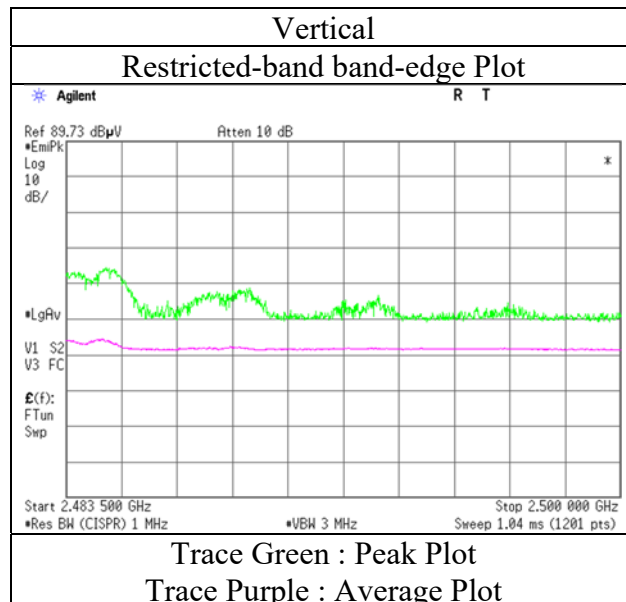
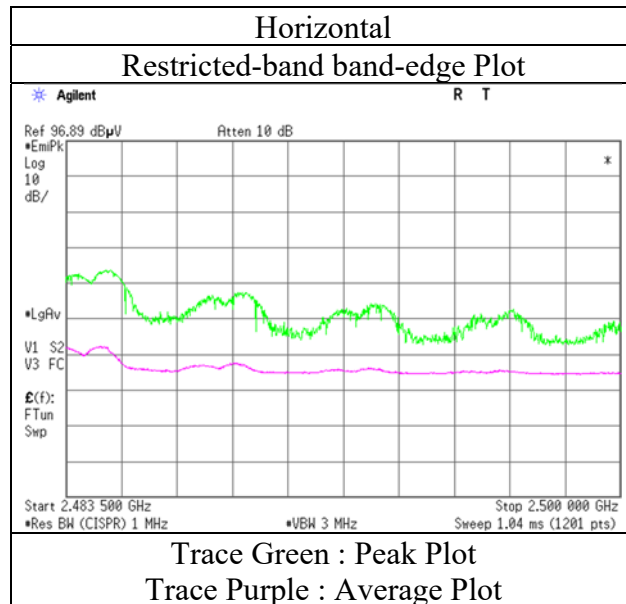
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (3.7 m / 3.0 m) = 1.83 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13292801H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	June 11, 2020
Temperature / Humidity	22 deg. C / 60 % RH
Engineer	Junya Okuno
	(1 GHz - 10 GHz)
Mode	Tx BT LE 2480 MHz
	Uncoded 2M-PHY (Chip Antenna)



* 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. 13292801H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2 No.2
Date June 11, 2020 June 12, 2020
Temperature / Humidity 22 deg. C / 60 % RH 21 deg. C / 53 % RH
Engineer Junya Okuno Yuta Moriya
(1 GHz - 10 GHz) (10 GHz - 26.5 GHz)
Mode Tx BT LE 2402 MHz
Coded-PHY 125kbps (PCB Antenna)

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.	57.600	QP	22.5	8.6	7.5	28.6	-	10.0	40.0	30.0	
Hori.	96.000	QP	26.8	9.6	8.0	28.5	-	15.9	43.5	27.6	
Hori.	103.040	QP	25.7	10.8	8.0	28.5	-	16.0	43.5	27.5	
Hori.	143.860	QP	35.5	14.6	8.5	28.3	-	30.2	43.5	13.3	
Hori.	175.805	QP	29.9	16.0	8.8	28.2	-	26.5	43.5	17.0	
Hori.	353.240	QP	25.4	15.0	10.2	28.1	-	22.5	46.0	23.5	
Hori.	2390.000	PK	52.9	27.7	4.8	32.7	-	52.6	73.9	21.3	
Hori.	4804.000	PK	43.7	31.6	6.9	31.7	-	50.6	73.9	23.4	
Hori.	7206.000	PK	42.3	36.0	8.3	32.6	-	54.0	73.9	19.9	Floor noise
Hori.	9608.000	PK	41.9	38.5	8.8	33.3	-	55.9	73.9	18.0	Floor noise
Hori.	12010.000	PK	42.6	39.3	-1.7	33.9	-	46.3	73.9	27.6	Floor noise
Hori.	14412.000	PK	46.3	40.1	-0.9	32.8	-	52.6	73.9	21.3	
Hori.	19216.000	PK	45.8	38.0	-2.2	32.7	-	48.8	73.9	25.1	
Hori.	2390.000	AV	35.5	27.7	4.8	32.7	-	35.3	53.9	18.6	
Hori.	4804.000	AV	37.0	31.6	6.9	31.7	-	43.8	53.9	10.1	
Hori.	7206.000	AV	33.1	36.0	8.3	32.6	-	44.8	53.9	9.2	Floor noise
Hori.	9608.000	AV	32.4	38.5	8.8	33.3	-	46.4	53.9	7.5	Floor noise
Hori.	12010.000	AV	33.9	39.3	-1.7	33.9	-	37.6	53.9	16.3	Floor noise
Hori.	14412.000	AV	38.3	40.1	-0.9	32.8	-	44.6	53.9	9.3	
Hori.	19216.000	AV	39.1	38.0	-2.2	32.7	-	42.2	53.9	11.7	
Vert.	57.600	QP	35.7	8.6	7.5	28.6	-	23.2	40.0	16.8	
Vert.	96.000	QP	31.1	9.6	8.0	28.5	-	20.2	43.5	23.3	
Vert.	103.040	QP	30.2	10.8	8.0	28.5	-	20.5	43.5	23.0	
Vert.	143.860	QP	30.8	14.6	8.5	28.3	-	25.5	43.5	18.0	
Vert.	175.805	QP	27.0	16.0	8.8	28.2	-	23.6	43.5	19.9	
Vert.	353.240	QP	26.5	15.0	10.2	28.1	-	23.6	46.0	22.4	
Vert.	2390.000	PK	52.6	27.7	4.8	32.7	-	52.4	73.9	21.5	
Vert.	4804.000	PK	43.1	31.6	6.9	31.7	-	49.9	73.9	24.0	
Vert.	7206.000	PK	42.3	36.0	8.3	32.6	-	54.0	73.9	19.9	Floor noise
Vert.	9608.000	PK	41.7	38.5	8.8	33.3	-	55.7	73.9	18.2	Floor noise
Vert.	12010.000	PK	42.4	39.3	-1.7	33.9	-	46.2	73.9	27.7	Floor noise
Vert.	14412.000	PK	46.3	40.1	-0.9	32.8	-	52.7	73.9	21.2	
Vert.	19216.000	PK	45.2	38.0	-2.2	32.7	-	48.3	73.9	25.7	
Vert.	2390.000	AV	37.6	27.7	4.8	32.7	-	37.3	53.9	16.6	
Vert.	4804.000	AV	36.6	31.6	6.9	31.7	-	43.4	53.9	10.5	
Vert.	7206.000	AV	33.1	36.0	8.3	32.6	-	44.8	53.9	9.1	Floor noise
Vert.	9608.000	AV	32.3	38.5	8.8	33.3	-	46.4	53.9	7.5	Floor noise
Vert.	12010.000	AV	33.9	39.3	-1.7	33.9	-	37.6	53.9	16.3	Floor noise
Vert.	14412.000	AV	37.1	40.1	-0.9	32.8	-	43.4	53.9	10.5	
Vert.	19216.000	AV	37.8	38.0	-2.2	32.7	-	40.8	53.9	13.1	

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 $20\log(3.65\text{ m} / 3.0\text{ m}) = 1.71\text{ dB}$
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.	2402.000	PK	96.6	27.7	4.8	32.7	96.3	-	-	Carrier
Hori.	2398.554	PK	47.9	27.7	4.8	32.7	47.6	76.3	28.7	
Hori.	2400.000	PK	44.6	27.7	4.8	32.7	44.4	76.3	31.9	
Vert.	2402.000	PK	96.3	27.7	4.8	32.7	96.0	-	-	Carrier
Vert.	2398.554	PK	46.8	27.7	4.8	32.7	46.5	76.0	29.5	
Vert.	2400.000	PK	44.4	27.7	4.8	32.7	44.1	76.0	31.9	

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

UL Japan, Inc.

Ise EMC Lab.

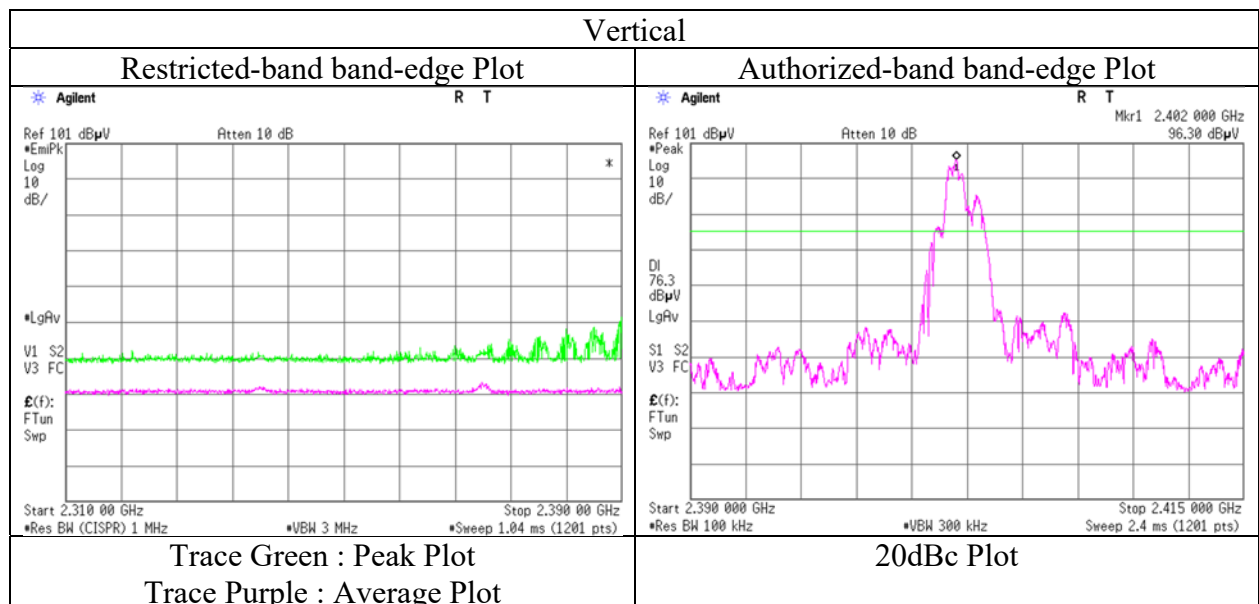
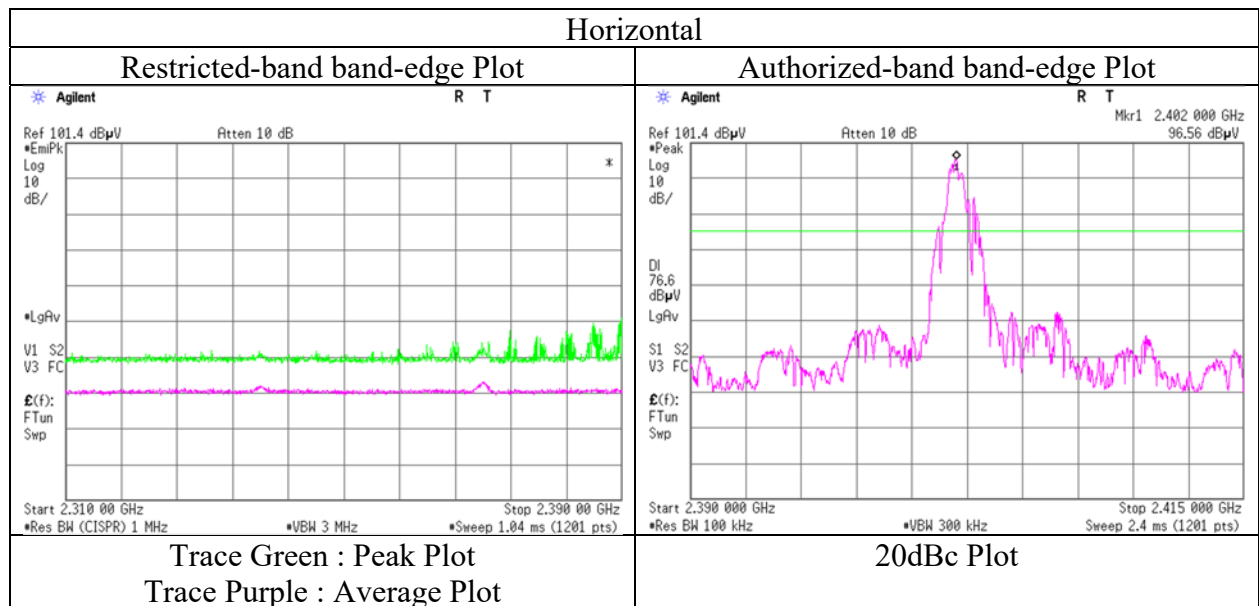
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13292801H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	June 11, 2020
Temperature / Humidity	22 deg. C / 60 % RH
Engineer	Junya Okuno
	(1 GHz - 10 GHz)
Mode	Tx BT LE 2402 MHz
	Coded-PHY 125kbps (PCB Antenna)



* 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. 13292801H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2 No.2
Date June 11, 2020 June 12, 2020
Temperature / Humidity 22 deg. C / 60 % RH 21 deg. C / 53 % RH
Engineer Junya Okuno Yuta Moriya
(1 GHz - 10 GHz) (10 GHz - 26.5 GHz)
Mode Tx BT LE 2440 MHz
Coded-PHY 125kbps (PCB Antenna)

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.	57.600	QP	23.5	8.6	7.5	28.6	-	11.0	40.0	29.0	
Hori.	96.000	QP	27.5	9.6	8.0	28.5	-	16.6	43.5	26.9	
Hori.	143.860	QP	35.5	14.6	8.5	28.3	-	30.2	43.5	13.3	
Hori.	175.805	QP	29.8	16.0	8.8	28.2	-	26.4	43.5	17.1	
Hori.	300.000	QP	34.8	13.4	9.8	27.8	-	30.2	46.0	15.8	
Hori.	353.240	QP	25.5	15.0	10.2	28.1	-	22.6	46.0	23.4	
Hori.	4880.000	PK	42.0	31.5	6.9	31.6	-	48.8	73.9	25.1	
Hori.	7320.000	PK	42.3	36.2	8.3	32.6	-	54.2	73.9	19.8	Floor noise
Hori.	9760.000	PK	41.6	38.8	8.8	33.4	-	55.9	73.9	18.1	Floor noise
Hori.	12200.000	PK	42.8	39.1	-1.7	33.8	-	46.4	73.9	27.5	Floor noise
Hori.	14640.000	PK	44.6	40.0	-0.8	33.0	-	50.9	73.9	23.1	
Hori.	17080.000	PK	44.1	41.0	0.0	33.3	-	51.7	73.9	22.2	
Hori.	19520.000	PK	43.9	37.9	-2.2	33.0	-	46.6	73.9	27.3	
Hori.	4880.000	AV	35.4	31.5	6.9	31.6	-	42.2	53.9	11.7	
Hori.	7320.000	AV	32.2	36.2	8.3	32.6	-	44.0	53.9	9.9	Floor noise
Hori.	9760.000	AV	32.1	38.8	8.8	33.4	-	46.3	53.9	7.6	Floor noise
Hori.	12200.000	AV	34.7	39.1	-1.7	33.8	-	38.3	53.9	15.6	Floor noise
Hori.	14640.000	AV	37.5	40.0	-0.8	33.0	-	43.7	53.9	10.2	
Hori.	17080.000	AV	36.3	41.0	0.0	33.3	-	44.0	53.9	10.0	
Hori.	19520.000	AV	35.5	37.9	-2.2	33.0	-	38.2	53.9	15.7	
Vert.	57.600	QP	38.0	8.6	7.5	28.6	-	25.5	40.0	14.5	
Vert.	96.000	QP	33.0	9.6	8.0	28.5	-	22.1	43.5	21.4	
Vert.	143.860	QP	30.9	14.6	8.5	28.3	-	25.6	43.5	17.9	
Vert.	175.805	QP	26.9	16.0	8.8	28.2	-	23.5	43.5	20.0	
Vert.	300.000	QP	33.8	13.4	9.8	27.8	-	29.2	46.0	16.8	
Vert.	353.240	QP	26.8	15.0	10.2	28.1	-	23.9	46.0	22.1	
Vert.	4880.000	PK	41.4	31.5	6.9	31.6	-	48.2	73.9	25.7	
Vert.	7320.000	PK	42.2	36.2	8.3	32.6	-	54.1	73.9	19.8	Floor noise
Vert.	9760.000	PK	41.6	38.8	8.8	33.4	-	55.8	73.9	18.1	Floor noise
Vert.	12200.000	PK	43.0	39.1	-1.7	33.8	-	46.7	73.9	27.3	Floor noise
Vert.	14640.000	PK	44.2	40.0	-0.8	33.0	-	50.4	73.9	23.5	
Vert.	19520.000	PK	44.5	37.9	-2.2	33.0	-	47.2	73.9	26.7	
Vert.	4880.000	AV	35.1	31.5	6.9	31.6	-	42.0	53.9	12.0	
Vert.	7320.000	AV	32.1	36.2	8.3	32.6	-	44.0	53.9	9.9	Floor noise
Vert.	9760.000	AV	32.1	38.8	8.8	33.4	-	46.3	53.9	7.6	Floor noise
Vert.	12200.000	AV	34.8	39.1	-1.7	33.8	-	38.4	53.9	15.5	Floor noise
Vert.	14640.000	AV	36.5	40.0	-0.8	33.0	-	42.7	53.9	11.2	
Vert.	19520.000	AV	37.3	37.9	-2.2	33.0	-	40.0	53.9	13.9	

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 $20\log(3.65\text{ m} / 3.0\text{ m}) = 1.71\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission

Report No. 13292801H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2 No.2
Date June 11, 2020 June 12, 2020
Temperature / Humidity 22 deg. C / 60 % RH 21 deg. C / 53 % RH
Engineer Junya Okuno Yuta Moriya
(1 GHz - 10 GHz) (10 GHz - 26.5 GHz)
Mode Tx BT LE 2480 MHz
Coded-PHY 125kbps (PCB Antenna)

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.	57.600	QP	23.5	8.6	7.5	28.6	-	11.0	40.0	29.0	
Hori.	96.000	QP	30.6	9.6	8.0	28.5	-	19.7	43.5	23.8	
Hori.	143.860	QP	35.3	14.6	8.5	28.3	-	30.0	43.5	13.5	
Hori.	175.805	QP	29.8	16.0	8.8	28.2	-	26.4	43.5	17.1	
Hori.	305.700	QP	30.0	13.5	9.8	27.8	-	25.5	46.0	20.5	
Hori.	333.100	QP	27.1	14.6	10.1	28.0	-	23.7	46.0	22.3	
Hori.	2483.500	PK	63.2	27.5	4.9	32.7	-	62.8	73.9	11.1	
Hori.	2484.900	PK	65.4	27.5	4.9	32.7	-	65.1	73.9	8.8	
Hori.	4960.000	PK	42.2	31.6	6.9	31.6	-	49.0	73.9	24.9	
Hori.	7440.000	PK	42.1	36.3	8.3	32.7	-	54.0	73.9	19.9	Floor noise
Hori.	9920.000	PK	42.1	38.9	8.8	33.5	-	56.4	73.9	17.5	Floor noise
Hori.	12400.000	PK	41.9	38.9	-1.6	33.7	-	45.5	73.9	28.4	Floor noise
Hori.	14880.000	PK	44.9	38.9	-0.6	33.2	-	50.0	73.9	23.9	
Hori.	17360.000	PK	45.4	43.1	0.0	33.2	-	55.3	73.9	18.6	
Hori.	19840.000	PK	46.0	37.8	-2.1	33.4	-	48.3	73.9	25.6	
Hori.	2483.500	AV	45.1	27.5	4.9	32.7	-	44.7	53.9	9.2	
Hori.	2484.900	AV	46.3	27.5	4.9	32.7	-	45.9	53.9	8.0	
Hori.	4960.000	AV	35.5	31.6	6.9	31.6	-	42.3	53.9	11.6	
Hori.	7440.000	AV	33.1	36.3	8.3	32.7	-	45.0	53.9	8.9	Floor noise
Hori.	9920.000	AV	32.3	38.9	8.8	33.5	-	46.6	53.9	7.4	Floor noise
Hori.	12400.000	AV	34.5	38.9	-1.6	33.7	-	38.1	53.9	15.8	Floor noise
Hori.	14880.000	AV	37.5	38.9	-0.6	33.2	-	42.6	53.9	11.3	
Hori.	17360.000	AV	38.1	43.1	0.0	33.2	-	48.0	53.9	5.9	
Hori.	19840.000	AV	38.2	37.8	-2.1	33.4	-	40.5	53.9	13.4	
Vert.	57.600	QP	38.0	8.6	7.5	28.6	-	25.5	40.0	14.5	
Vert.	96.000	QP	38.1	9.6	8.0	28.5	-	27.2	43.5	16.3	
Vert.	143.860	QP	33.0	14.6	8.5	28.3	-	27.7	43.5	15.8	
Vert.	175.805	QP	26.9	16.0	8.8	28.2	-	23.5	43.5	20.0	
Vert.	305.700	QP	30.0	13.5	9.8	27.8	-	25.5	46.0	20.5	
Vert.	333.100	QP	26.6	14.6	10.1	28.0	-	23.2	46.0	22.8	
Vert.	2483.500	PK	62.5	27.5	4.9	32.7	-	62.2	73.9	11.8	
Vert.	2484.900	PK	64.6	27.5	4.9	32.7	-	64.2	73.9	9.7	
Vert.	4960.000	PK	41.4	31.6	6.9	31.6	-	48.3	73.9	25.6	
Vert.	7440.000	PK	42.2	36.3	8.3	32.7	-	54.1	73.9	19.8	Floor noise
Vert.	9920.000	PK	42.2	38.9	8.8	33.5	-	56.5	73.9	17.4	Floor noise
Vert.	12400.000	PK	43.4	38.9	-1.6	33.7	-	47.1	73.9	26.8	Floor noise
Vert.	14880.000	PK	44.6	38.9	-0.6	33.2	-	49.8	73.9	24.1	
Vert.	19840.000	PK	46.0	37.8	-2.1	33.4	-	48.3	73.9	25.6	
Vert.	2483.500	AV	44.3	27.5	4.9	32.7	-	43.9	53.9	10.0	
Vert.	2484.900	AV	45.5	27.5	4.9	32.7	-	45.1	53.9	8.8	
Vert.	4960.000	AV	35.6	31.6	6.9	31.6	-	42.4	53.9	11.5	
Vert.	7440.000	AV	33.0	36.3	8.3	32.7	-	44.9	53.9	9.0	Floor noise
Vert.	9920.000	AV	32.1	38.9	8.8	33.5	-	46.4	53.9	7.5	Floor noise
Vert.	12400.000	AV	34.5	38.9	-1.6	33.7	-	38.2	53.9	15.8	Floor noise
Vert.	14880.000	AV	36.5	38.9	-0.6	33.2	-	41.6	53.9	12.3	
Vert.	19840.000	AV	37.4	37.8	-2.1	33.4	-	39.7	53.9	14.2	

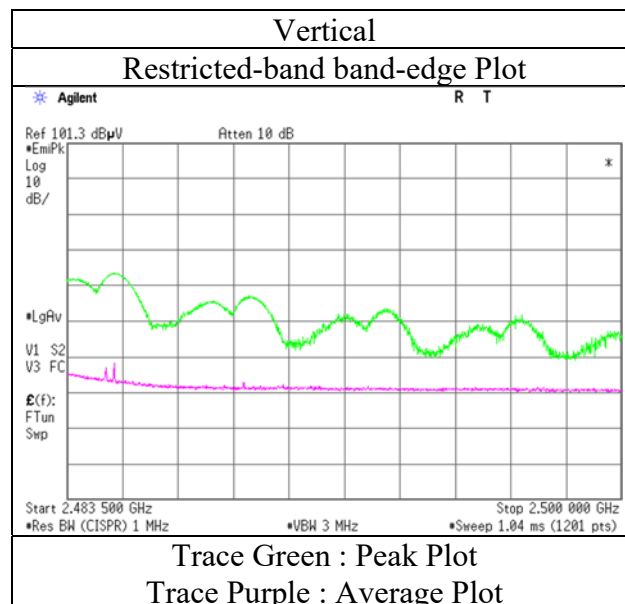
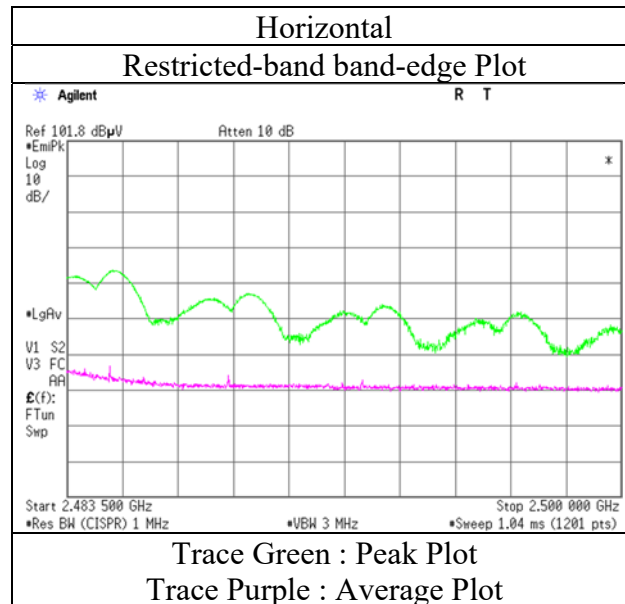
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz $20\log(3.65\text{ m} / 3.0\text{ m}) = 1.71\text{ dB}$
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.	13292801H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	June 11, 2020
Temperature / Humidity	22 deg. C / 60 % RH
Engineer	Junya Okuno
	(1 GHz - 10 GHz)
Mode	Tx BT LE 2480 MHz
	Coded-PHY 125kbps (PCB Antenna)



* 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. 13292801H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date June 11, 2020 June 12, 2020
Temperature / Humidity 22 deg. C / 56 % RH 21 deg. C / 53 % RH
Engineer Takeshi Hiyaji Yuta Moriya
(1 GHz - 10 GHz) (10 GHz - 26.5 GHz)
Mode Tx BT LE 2402 MHz
Uncoded 2M-PHY (PCB Antenna)

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.	57.600	QP	23.8	8.6	7.5	28.6	-	11.3	40.0	28.7	
Hori.	96.000	QP	27.0	9.6	8.0	28.5	-	16.1	43.5	27.4	
Hori.	103.040	QP	22.1	10.8	8.0	28.5	-	12.4	43.5	31.1	
Hori.	143.860	QP	35.6	14.6	8.5	28.3	-	30.3	43.5	13.2	
Hori.	175.805	QP	30.0	16.0	8.8	28.2	-	26.6	43.5	16.9	
Hori.	353.240	QP	25.1	15.0	10.2	28.1	-	22.2	46.0	23.8	
Hori.	2390.000	PK	52.3	27.7	4.8	32.7	-	52.1	73.9	21.9	
Hori.	4804.000	PK	41.6	31.6	6.9	31.7	-	48.4	73.9	25.5	
Hori.	7206.000	PK	42.7	36.0	8.3	32.6	-	54.4	73.9	19.5	Floor noise
Hori.	9608.000	PK	41.6	38.5	8.8	33.3	-	55.6	73.9	18.3	Floor noise
Hori.	12010.000	PK	42.7	39.3	-1.7	33.9	-	46.4	73.9	27.5	Floor noise
Hori.	14412.000	PK	45.9	40.1	-0.9	32.8	-	52.3	73.9	21.6	
Hori.	19216.000	PK	46.3	38.0	-2.2	32.7	-	49.4	73.9	24.5	
Hori.	2390.000	AV	37.2	27.7	4.8	32.7	2.0	39.0	53.9	14.9	*1)
Hori.	4804.000	AV	32.7	31.6	6.9	31.7	2.0	41.6	53.9	12.4	
Hori.	7206.000	AV	33.0	36.0	8.3	32.6	-	44.7	53.9	9.2	Floor noise
Hori.	9608.000	AV	32.4	38.5	8.8	33.3	-	46.4	53.9	7.5	Floor noise
Hori.	12010.000	AV	34.0	39.3	-1.7	33.9	-	37.7	53.9	16.2	Floor noise
Hori.	14412.000	AV	36.1	40.1	-0.9	32.8	2.0	44.5	53.9	9.4	
Hori.	19216.000	AV	37.1	38.0	-2.2	32.7	2.0	42.1	53.9	11.8	
Vert.	57.600	QP	40.1	8.6	7.5	28.6	-	27.6	40.0	12.4	
Vert.	96.000	QP	31.2	9.6	8.0	28.5	-	20.3	43.5	23.2	
Vert.	103.040	QP	30.2	10.8	8.0	28.5	-	20.5	43.5	23.0	
Vert.	143.860	QP	30.9	14.6	8.5	28.3	-	25.6	43.5	17.9	
Vert.	175.805	QP	27.2	16.0	8.8	28.2	-	23.8	43.5	19.7	
Vert.	353.240	QP	26.2	15.0	10.2	28.1	-	23.3	46.0	22.7	
Vert.	2390.000	PK	52.0	27.7	4.8	32.7	-	51.8	73.9	22.1	
Vert.	4804.000	PK	40.8	31.6	6.9	31.7	-	47.7	73.9	26.3	
Vert.	7206.000	PK	42.3	36.0	8.3	32.6	-	54.0	73.9	19.9	Floor noise
Vert.	9608.000	PK	41.6	38.5	8.8	33.3	-	55.6	73.9	18.3	Floor noise
Vert.	12010.000	PK	42.9	39.3	-1.7	33.9	-	46.6	73.9	27.3	Floor noise
Vert.	14412.000	PK	45.0	40.1	-0.9	32.8	-	51.3	73.9	22.6	
Vert.	19216.000	PK	44.5	38.0	-2.2	32.7	-	47.5	73.9	26.4	
Vert.	2390.000	AV	35.6	27.7	4.8	32.7	2.0	37.4	53.9	16.5	*1)
Vert.	4804.000	AV	33.2	31.6	6.9	31.7	2.0	42.1	53.9	11.8	
Vert.	7206.000	AV	33.0	36.0	8.3	32.6	-	44.7	53.9	9.2	Floor noise
Vert.	9608.000	AV	32.3	38.5	8.8	33.3	-	46.3	53.9	7.6	Floor noise
Vert.	12010.000	AV	34.1	39.3	-1.7	33.9	-	37.8	53.9	16.1	Floor noise
Vert.	14412.000	AV	36.0	40.1	-0.9	32.8	2.0	44.4	53.9	9.5	
Vert.	19216.000	AV	35.8	38.0	-2.2	32.7	2.0	40.9	53.9	13.0	

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 (3.65 m / 3.0 m) = 1.71 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	94.9	27.7	4.8	32.7	94.6	-	-	Carrier
Hori	2400.000	PK	60.5	27.7	4.8	32.7	60.3	74.6	14.3	
Vert	2402.000	PK	95.1	27.7	4.8	32.8	94.8	-	-	Carrier
Vert	2400.000	PK	60.4	27.7	4.8	32.7	60.2	74.8	14.6	

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

Distance factor: 1 GHz - 10 GHz 20log (3.65 m / 3.0 m) = 1.71 dB

10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5dB

UL Japan, Inc.

Ise EMC Lab.

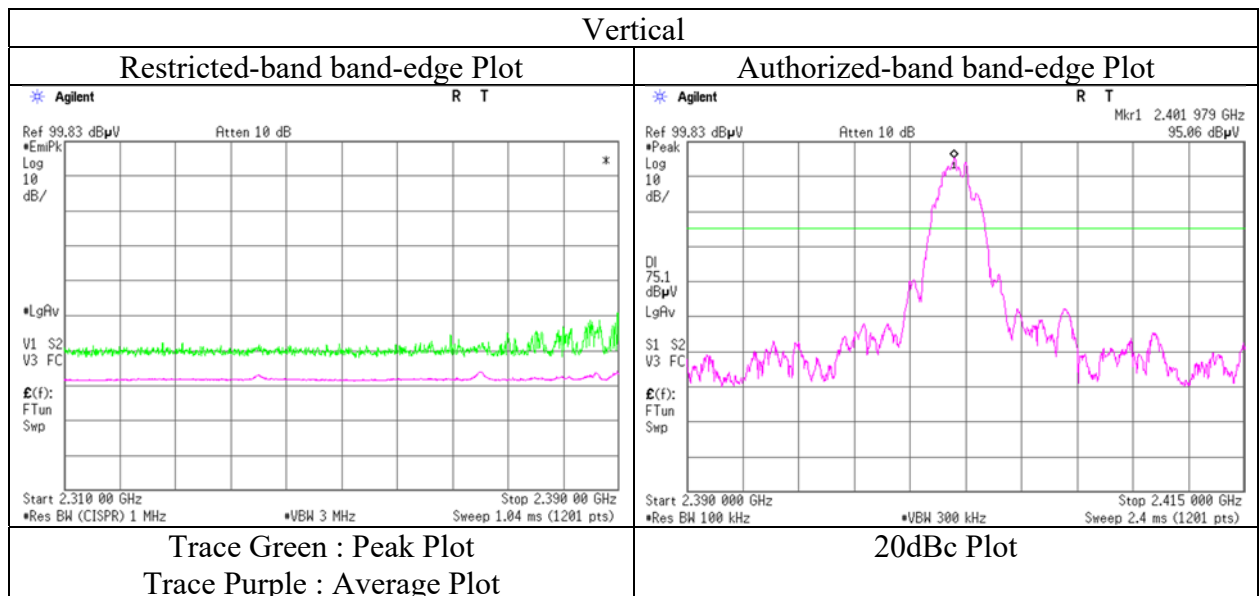
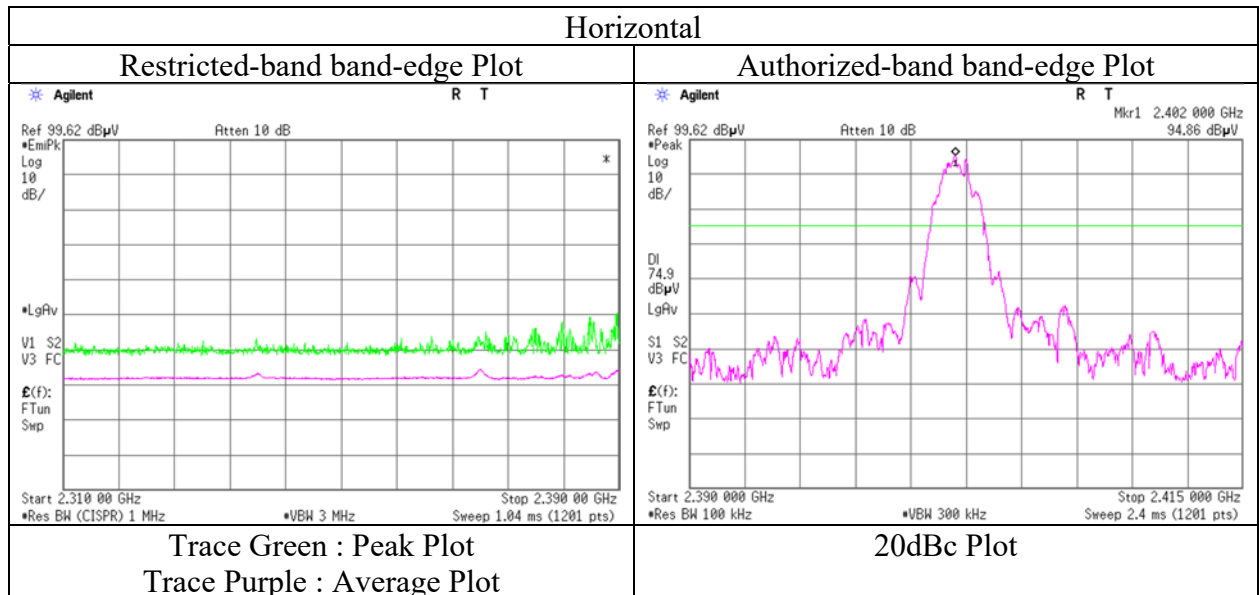
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13292801H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	June 11, 2020
Temperature / Humidity	22 deg. C / 56 % RH
Engineer	Takeshi Hiyaji (1 GHz - 10 GHz)
Mode	Tx BT LE 2402 MHz, Uncoded 2M-PHY (PCB Antenna)



* 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

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Radiated Spurious Emission

Report No. 13292801H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date June 11, 2020 No.2
Temperature / Humidity 22 deg. C / 56 % RH June 12, 2020
Engineer Takeshi Hiyaji Yuta Moriya
(1 GHz - 10 GHz) (10 GHz - 26.5 GHz)
Mode Tx BT LE 2440 MHz,
Uncoded 2M-PHY (PCB Antenna)

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.	57.600	QP	23.7	8.6	7.5	28.6	-	11.2	40.0	28.8	
Hori.	96.000	QP	27.6	9.6	8.0	28.5	-	16.7	43.5	26.8	
Hori.	143.860	QP	35.6	14.6	8.5	28.3	-	30.3	43.5	13.2	
Hori.	175.805	QP	29.9	16.0	8.8	28.2	-	26.5	43.5	17.0	
Hori.	300.000	QP	36.1	13.4	9.8	27.8	-	31.5	46.0	14.5	
Hori.	333.130	QP	28.4	14.6	10.1	28.0	-	25.0	46.0	21.0	
Hori.	4880.000	PK	42.3	31.5	6.9	31.6	-	49.1	73.9	24.8	
Hori.	7320.000	PK	42.3	36.2	8.3	32.6	-	54.2	73.9	19.7	Floor noise
Hori.	9760.000	PK	41.5	38.8	8.8	33.4	-	55.8	73.9	18.2	Floor noise
Hori.	12200.000	PK	43.7	39.1	-1.7	33.8	-	47.3	73.9	26.6	Floor noise
Hori.	14640.000	PK	44.2	40.0	-0.8	33.0	-	50.4	73.9	23.5	
Hori.	4880.000	AV	34.1	31.5	6.9	31.6	2.0	43.0	53.9	10.9	
Hori.	7320.000	AV	33.4	36.2	8.3	32.6	-	45.3	53.9	8.6	Floor noise
Hori.	9760.000	AV	32.0	38.8	8.8	33.4	-	46.3	53.9	7.7	Floor noise
Hori.	12200.000	AV	34.7	39.1	-1.7	33.8	-	38.3	53.9	15.6	Floor noise
Hori.	14640.000	AV	35.0	40.0	-0.8	33.0	2.0	43.3	53.9	10.7	
Vert.	57.600	QP	38.2	8.6	7.5	28.6	-	25.7	40.0	14.3	
Vert.	96.000	QP	32.0	9.6	8.0	28.5	-	21.1	43.5	22.4	
Vert.	143.860	QP	31.0	14.6	8.5	28.3	-	25.7	43.5	17.8	
Vert.	175.805	QP	27.1	16.0	8.8	28.2	-	23.7	43.5	19.8	
Vert.	300.000	QP	34.3	13.4	9.8	27.8	-	29.7	46.0	16.3	
Vert.	333.130	QP	28.4	14.6	10.1	28.0	-	25.0	46.0	21.0	
Vert.	4880.000	PK	42.1	31.5	6.9	31.6	-	48.9	73.9	25.0	
Vert.	7320.000	PK	42.1	36.2	8.3	32.6	-	54.0	73.9	19.9	Floor noise
Vert.	9760.000	PK	41.7	38.8	8.8	33.4	-	55.9	73.9	18.0	Floor noise
Vert.	12200.000	PK	43.7	39.1	-1.7	33.8	-	47.3	73.9	26.6	Floor noise
Vert.	14640.000	PK	43.5	40.0	-0.8	33.0	-	49.7	73.9	24.2	
Vert.	19520.000	PK	45.4	37.9	-2.2	33.0	-	48.1	73.9	25.8	
Vert.	4880.000	AV	33.5	31.5	6.9	31.6	2.0	42.4	53.9	11.6	
Vert.	7320.000	AV	32.1	36.2	8.3	32.6	-	44.0	53.9	9.9	Floor noise
Vert.	9760.000	AV	32.0	38.8	8.8	33.4	-	46.2	53.9	7.7	Floor noise
Vert.	12200.000	AV	34.7	39.1	-1.7	33.8	-	38.3	53.9	15.6	Floor noise
Vert.	14640.000	AV	35.1	40.0	-0.8	33.0	2.0	43.3	53.9	10.6	
Vert.	19520.000	AV	36.1	37.9	-2.2	33.0	2.0	40.8	53.9	13.1	

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 (3.65 m / 3.0 m) = 1.71 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No. 13292801H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2 No.2
Date June 11, 2020 June 12, 2020
Temperature / Humidity 22 deg. C / 56 % RH 21 deg. C / 53 % RH
Engineer Takeshi Hiyaji Yuta Moriya
(1 GHz - 10 GHz) (10 GHz - 26.5 GHz)
Mode Tx BT LE 2480 MHz,
Uncoded 2M-PHY (PCB Antenna)

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.	57.600	QP	23.6	8.6	7.5	28.6	-	11.1	40.0	28.9	
Hori.	96.000	QP	27.6	9.6	8.0	28.5	-	16.7	43.5	26.8	
Hori.	143.860	QP	35.5	14.6	8.5	28.3	-	30.2	43.5	13.3	
Hori.	175.805	QP	30.0	16.0	8.8	28.2	-	26.6	43.5	16.9	
Hori.	305.700	QP	30.1	13.5	9.8	27.8	-	25.6	46.0	20.4	
Hori.	333.100	QP	27.0	14.6	10.1	28.0	-	23.6	46.0	22.4	
Hori.	2483.500	PK	62.2	27.5	4.9	32.7	-	61.9	73.9	12.0	
Hori.	2484.900	PK	64.0	27.5	4.9	32.7	-	63.6	73.9	10.3	
Hori.	4960.000	PK	42.9	31.6	6.9	31.6	-	49.7	73.9	24.2	
Hori.	7440.000	PK	42.0	36.3	8.3	32.7	-	54.0	73.9	19.9	Floor noise
Hori.	9920.000	PK	42.1	38.9	8.8	33.5	-	56.4	73.9	17.5	Floor noise
Hori.	12400.000	PK	42.1	38.9	-1.6	33.7	-	45.7	73.9	28.2	Floor noise
Hori.	14880.000	PK	46.0	38.9	-0.6	33.2	-	51.1	73.9	22.8	
Hori.	19840.000	PK	46.2	37.8	-2.1	33.4	-	48.5	73.9	25.4	
Hori.	2483.500	AV	46.6	27.5	4.9	32.7	2.0	48.2	53.9	5.7	*1)
Hori.	2484.900	AV	46.9	27.5	4.9	32.7	2.0	48.6	53.9	5.3	
Hori.	4960.000	AV	34.4	31.6	6.9	31.6	2.0	43.3	53.9	10.6	
Hori.	7440.000	AV	33.2	36.3	8.3	32.7	-	45.1	53.9	8.8	Floor noise
Hori.	9920.000	AV	32.3	38.9	8.8	33.5	-	46.6	53.9	7.3	Floor noise
Hori.	12400.000	AV	34.4	38.9	-1.6	33.7	-	38.0	53.9	15.9	Floor noise
Hori.	14880.000	AV	36.2	38.9	-0.6	33.2	2.0	43.4	53.9	10.5	
Hori.	19840.000	AV	37.1	37.8	-2.1	33.4	2.0	41.4	53.9	12.5	
Vert.	57.600	QP	37.9	8.6	7.5	28.6	-	25.4	40.0	14.6	
Vert.	96.000	QP	32.0	9.6	8.0	28.5	-	21.1	43.5	22.4	
Vert.	143.860	QP	30.9	14.6	8.5	28.3	-	25.6	43.5	17.9	
Vert.	175.805	QP	27.0	16.0	8.8	28.2	-	23.6	43.5	19.9	
Vert.	305.700	QP	30.2	13.5	9.8	27.8	-	25.7	46.0	20.3	
Vert.	333.100	QP	26.5	14.6	10.1	28.0	-	23.1	46.0	22.9	
Vert.	2483.500	PK	62.4	27.5	4.9	32.7	-	62.0	73.9	11.9	
Vert.	2484.900	PK	66.8	27.5	4.9	32.7	-	66.4	73.9	7.5	
Vert.	4960.000	PK	41.3	31.6	6.9	31.6	-	48.1	73.9	25.8	
Vert.	7440.000	PK	42.0	36.3	8.3	32.7	-	53.9	73.9	20.0	Floor noise
Vert.	9920.000	PK	42.1	38.9	8.8	33.5	-	56.4	73.9	17.5	Floor noise
Vert.	12400.000	PK	43.0	38.9	-1.6	33.7	-	46.6	73.9	27.3	Floor noise
Vert.	14880.000	PK	43.7	38.9	-0.6	33.2	-	48.9	73.9	25.1	
Vert.	19840.000	PK	45.8	37.8	-2.1	33.4	-	48.1	73.9	25.8	
Vert.	2483.500	AV	45.4	27.5	4.9	32.7	2.0	47.0	53.9	6.9	*1)
Vert.	2484.900	AV	45.9	27.5	4.9	32.7	2.0	47.6	53.9	6.3	
Vert.	4960.000	AV	33.5	31.6	6.9	31.6	2.0	42.4	53.9	11.5	
Vert.	7440.000	AV	33.0	36.3	8.3	32.7	-	45.0	53.9	9.0	Floor noise
Vert.	9920.000	AV	32.1	38.9	8.8	33.5	-	46.4	53.9	7.5	Floor noise
Vert.	12400.000	AV	34.4	38.9	-1.6	33.7	-	38.0	53.9	15.9	Floor noise
Vert.	14880.000	AV	35.4	38.9	-0.6	33.2	2.0	42.6	53.9	11.3	
Vert.	19840.000	AV	36.9	37.8	-2.1	33.4	2.0	41.2	53.9	12.7	

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

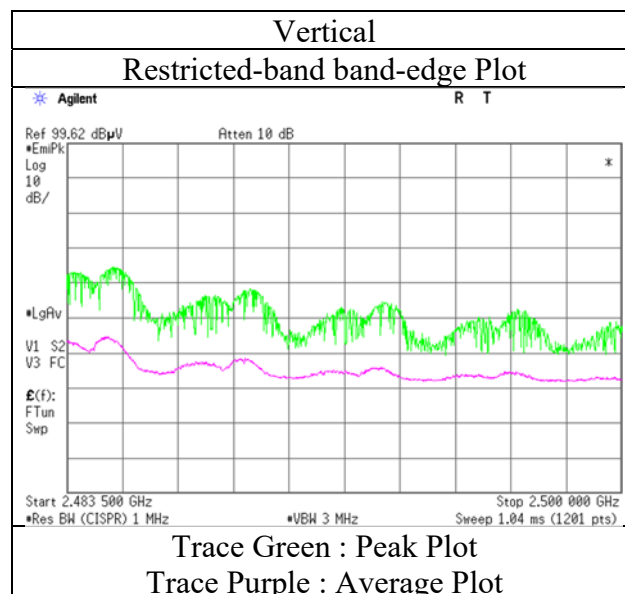
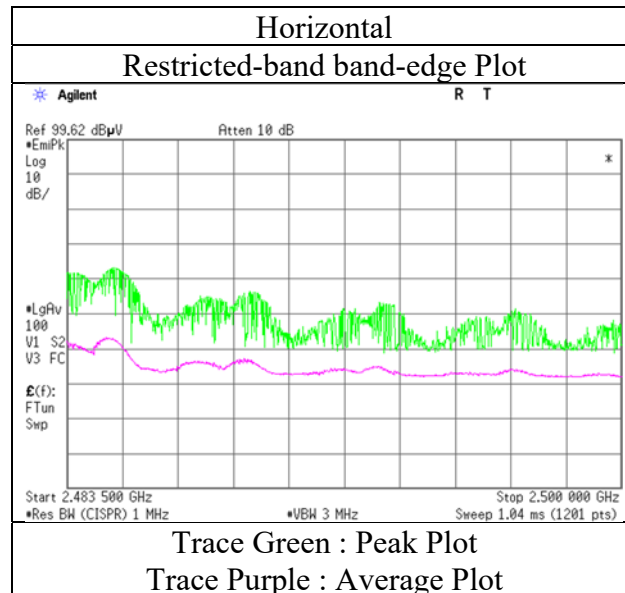
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz $20\log(3.65\text{ m} / 3.0\text{ m}) = 1.71\text{ dB}$
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.	13292801H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	June 11, 2020
Temperature / Humidity	22 deg. C / 56 % RH
Engineer	Takeshi Hiyaji (1 GHz - 10 GHz)
Mode	Tx BT LE 2480 MHz, Uncoded 2M-PHY (PCB Antenna)

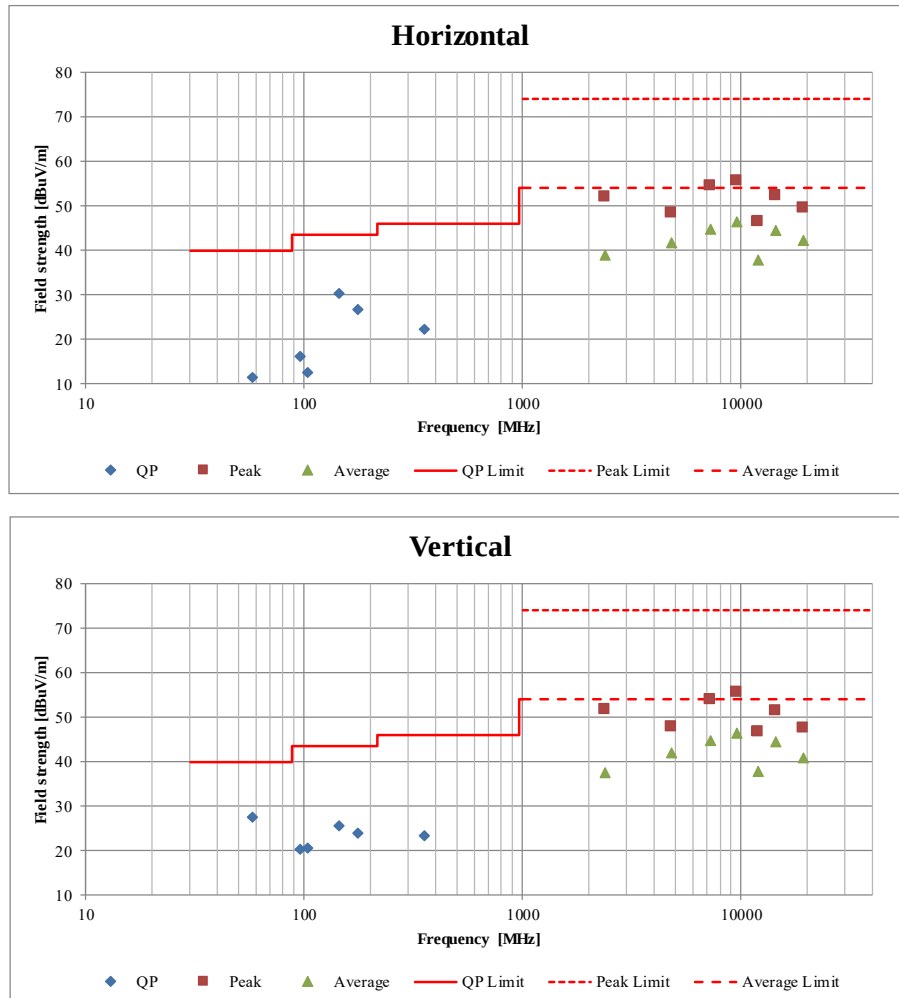


* The measurement was conducted for a sufficiently long enough time to detect any possible spurious emissions.

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

Radiated Spurious Emission (Plot data, Worst case)

Report No.	13292801H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.2	No.2
Date	June 11, 2020	June 12, 2020
Temperature / Humidity	22 deg. C / 56 % RH	21 deg. C / 53 % RH
Engineer	Takeshi Hiyaji (1 GHz - 10 GHz)	Yuta Moriya (10 GHz - 26.5 GHz)
Mode	Tx BT LE 2402 MHz Uncoded 2M-PHY (PCB Antenna)	



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

UL Japan, Inc.

Ise EMC Lab.

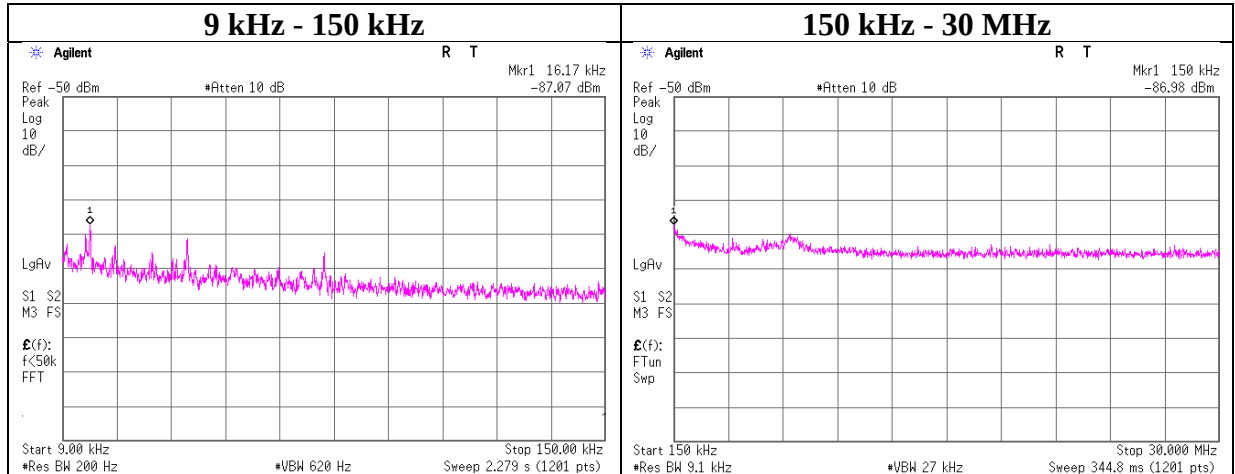
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Conducted Spurious Emission

Report No. 13292801H
Test place Ise EMC Lab. No.6 Measurement Room
Date June 17, 2020
Temperature / Humidity 22 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx BT LE 2402MHz
Coded-PHY 125kbps



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
16.17	-87.07	0.70	9.9	2.9	1	-73.6	300	6.0	-12.3	43.4	55.7	
150.00	-86.98	0.71	9.9	2.9	1	-73.5	300	6.0	-12.3	24.0	36.3	

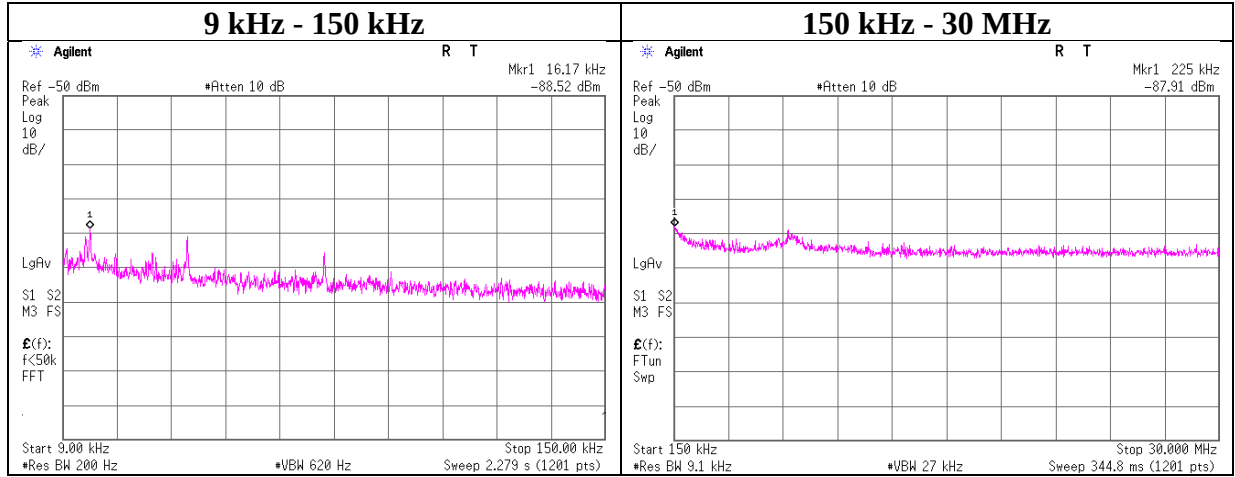
$E [dBuV/m] = EIRP [dBm] - 20 \log (Distance [m]) + Ground\ bounce [dB] + 104.8 [dBuV/m]$

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

N: Number of output

Conducted Spurious Emission

Report No. 13292801H
Test place Ise EMC Lab. No.6 Measurement Room
Date June 17, 2020
Temperature / Humidity 22 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx BT LE 2440MH
Coded-PHY 125kbps



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
16.17	-88.52	0.70	9.9	2.9	1	-75.1	300	6.0	-13.8	43.4	57.2	
225.00	-87.91	0.71	9.9	2.9	1	-74.5	300	6.0	-13.2	20.5	33.7	

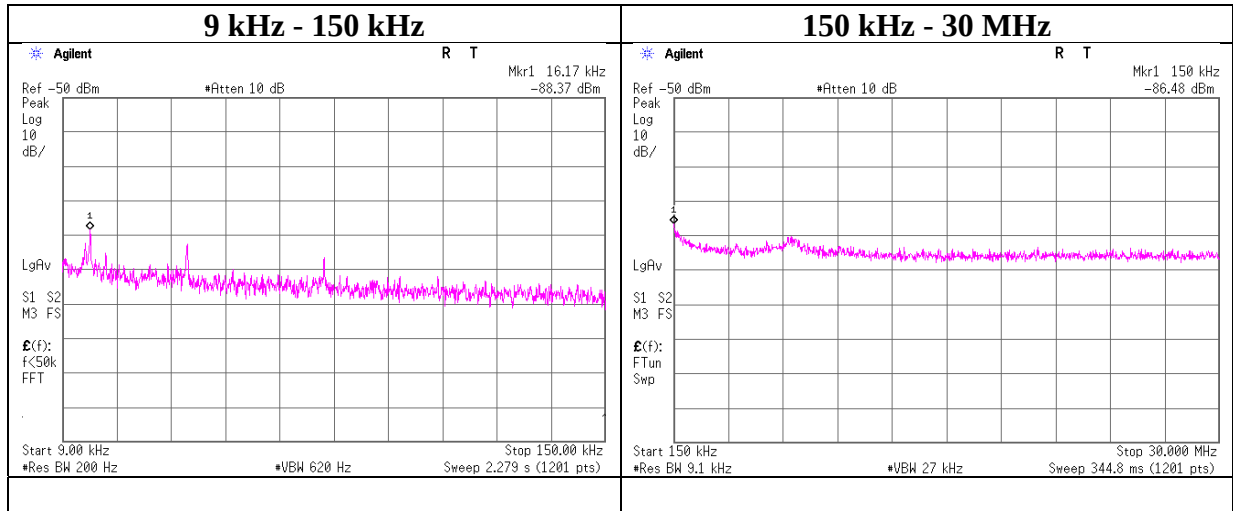
$E [dBuV/m] = EIRP [dBm] - 20 \log (Distance [m]) + Ground\ bounce [dB] + 104.8 [dBuV/m]$

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

N: Number of output

Conducted Spurious Emission

Report No. 13292801H
Test place Ise EMC Lab. No.6 Measurement Room
Date June 17, 2020
Temperature / Humidity 22 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx BT LE 2480MHz
Coded-PHY 125kbps



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
16.17	-88.37	0.70	9.9	2.9	1	-74.9	300	6.0	-13.6	43.4	57.0	
150.00	-86.48	0.71	9.9	2.9	1	-73.0	300	6.0	-11.8	24.0	35.8	

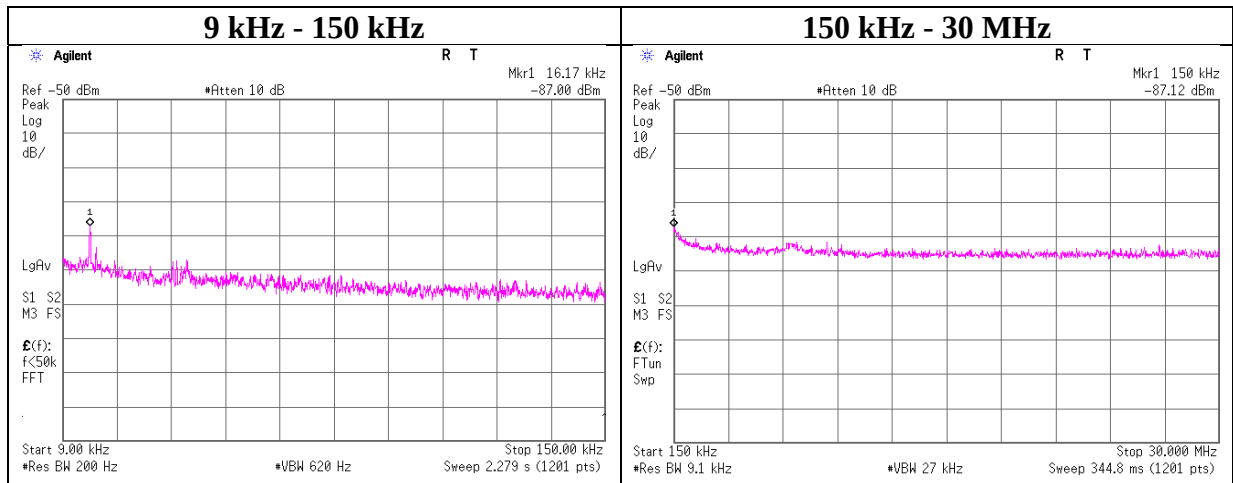
$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log(\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$

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

N: Number of output

Conducted Spurious Emission

Report No. 13292801H
Test place Ise EMC Lab. No.6 Measurement Room
Date June 17, 2020
Temperature / Humidity 22 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx BT LE 2402MHz
Uncoded 2M-PHY



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
16.17	-87.00	0.70	9.9	2.9	1	-73.5	300	6.0	-12.3	43.4	55.7	
150.00	-87.12	0.71	9.9	2.9	1	-73.7	300	6.0	-12.4	24.0	36.4	

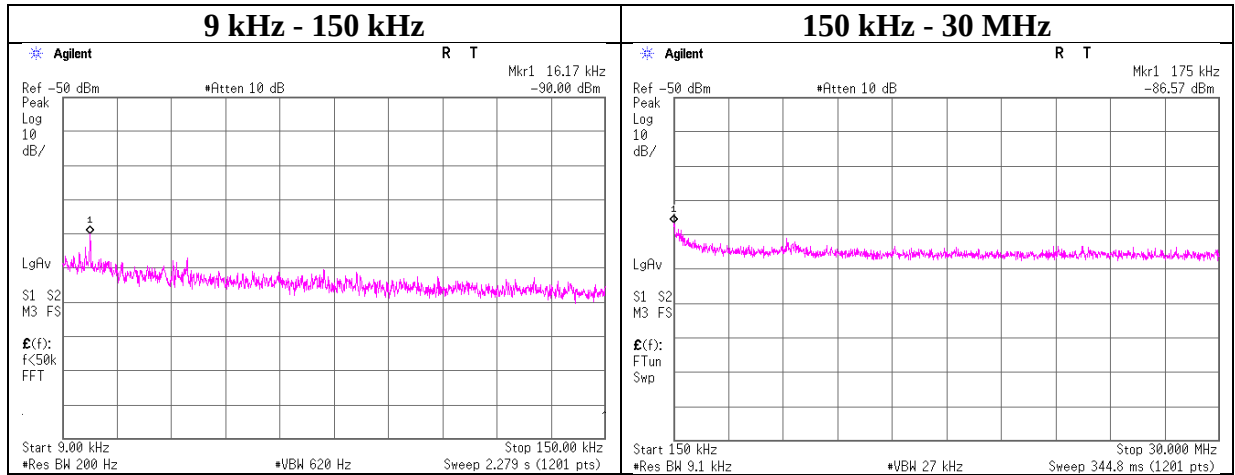
$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log(\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$

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

N: Number of output

Conducted Spurious Emission

Report No. 13292801H
Test place Ise EMC Lab. No.6 Measurement Room
Date June 17, 2020
Temperature / Humidity 22 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx BT LE 2440MHz
Uncoded 2M-PHY



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
16.17	-90.00	0.70	9.9	2.9	1	-76.5	300	6.0	-15.3	43.4	58.7	
175.00	-86.57	0.71	9.9	2.9	1	-73.1	300	6.0	-11.9	22.7	34.6	

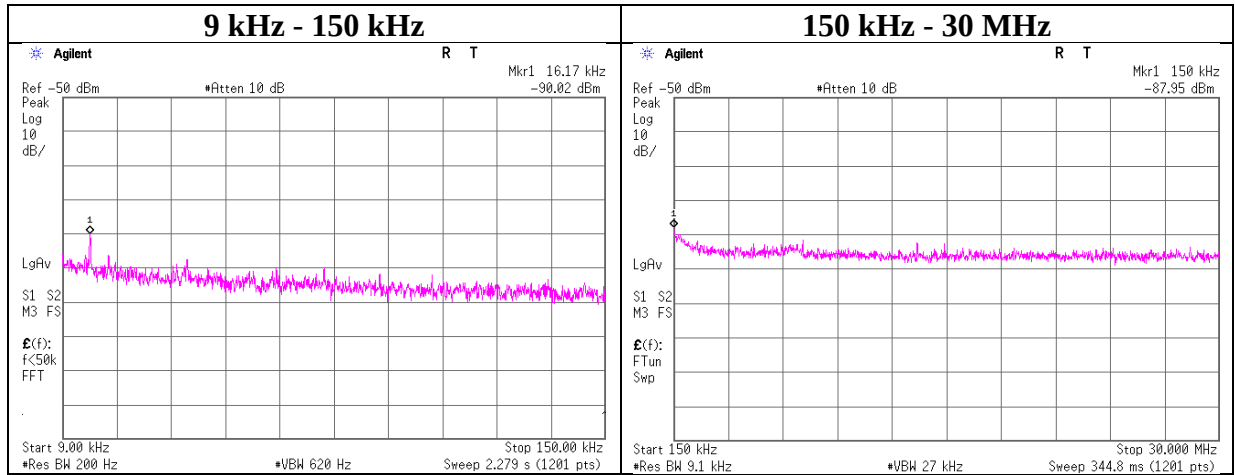
$$E \text{ [dBuV/m]} = \text{EIRP [dBm]} - 20 \log (\text{Distance [m]}) + \text{Ground bounce [dB]} + 104.8 \text{ [dBuV/m]}$$

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

N: Number of output

Conducted Spurious Emission

Report No. 13292801H
Test place Ise EMC Lab. No.6 Measurement Room
Date June 17, 2020
Temperature / Humidity 22 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx BT LE 2480MHz
Uncoded 2M-PHY



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
16.17	-90.02	0.70	9.9	2.9	1	-76.6	300	6.0	-15.3	43.4	58.7	
150.00	-87.95	0.71	9.9	2.9	1	-74.5	300	6.0	-13.2	24.0	37.2	

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

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

N: Number of output

Power Density

Report No. 13292801H
Test place Ise EMC Lab. No.6 Measurement Room
Date June 17, 2020
Temperature / Humidity 22 deg. C / 49 % RH
Engineer Akihiko Maeda
Mode Tx BT LE

Coded-PHY 125kbps

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402	-16.45	2.02	9.78	-4.65	8.00	12.65
2440	-16.54	2.03	9.78	-4.73	8.00	12.73
2480	-16.64	2.04	9.78	-4.82	8.00	12.82

Uncoded 2M-PHY

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[dBm]	[dB]
2402	-24.03	2.02	9.78	-12.23	8.00	20.23
2440	-23.91	2.03	9.78	-12.10	8.00	20.10
2480	-23.94	2.04	9.78	-12.12	8.00	20.12

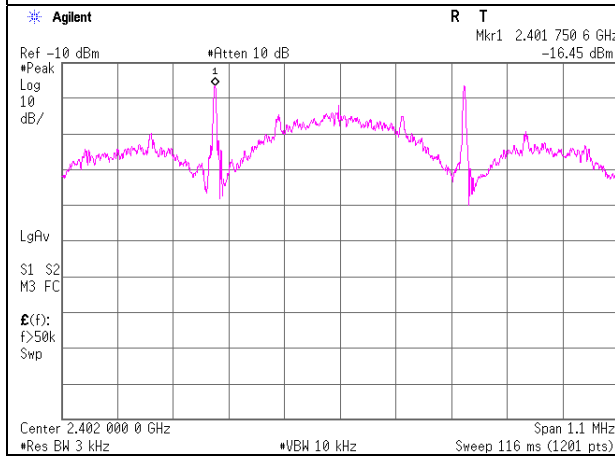
Sample Calculation:

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

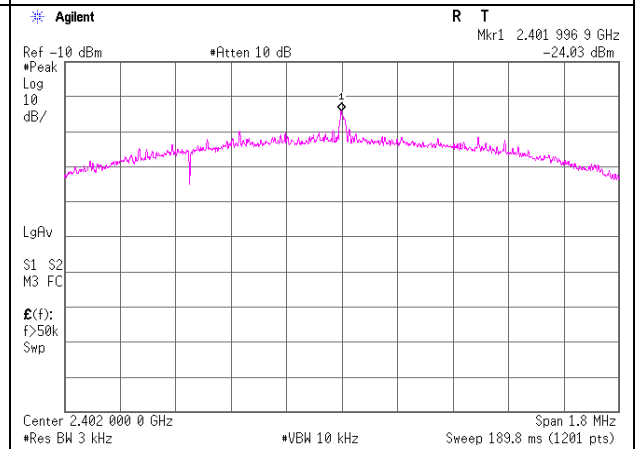
*The equipment and cables were not used for factor 0 dB of the data sheets.

Power Density

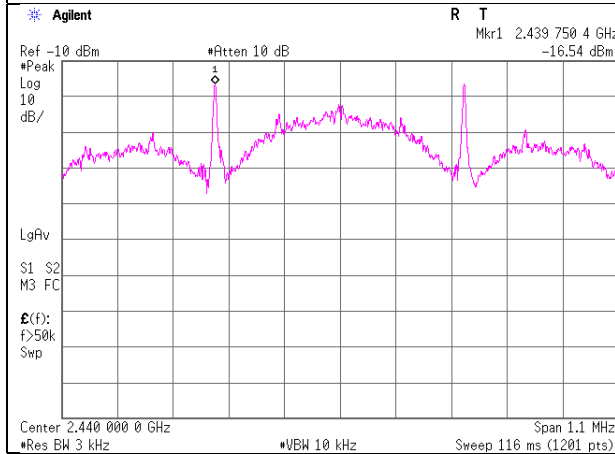
Coded-PHY 125kbps 2402 MHz



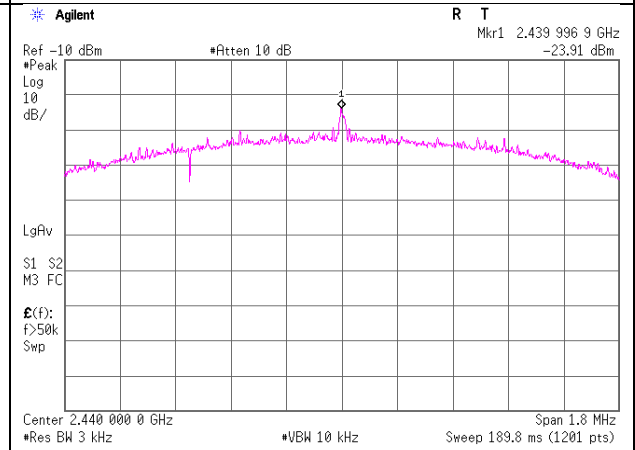
Uncoded 2M-PHY 2402 MHz



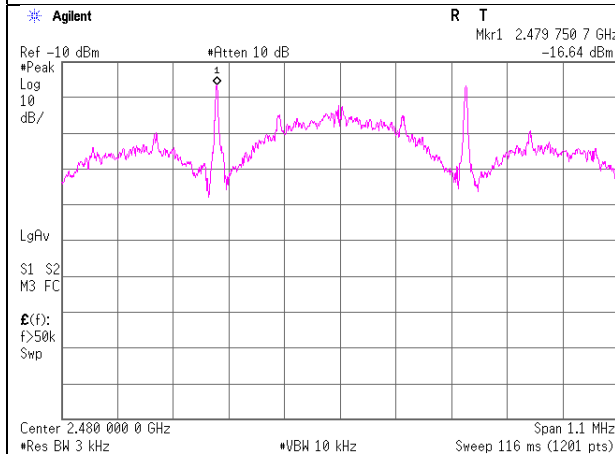
2440 MHz



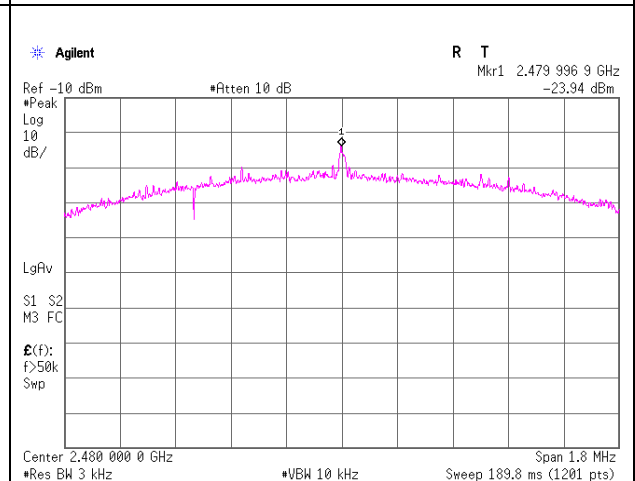
2440 MHz



2480 MHz



2480 MHz



APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	MSA-14	141901	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY48250080	2019/10/06	12
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-23	141361	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	2020/04/21	12
AT	MOS-14	141561	Thermo-Hygrometer	CUSTOM	CTH-201	1401	2020/01/07	12
AT	MMM-12	141547	DIGITAL HiTESTER	Hioki	3805	60500120	2020/02/03	12
AT	MAT-22	141269	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	2020/03/24	12
RE/CE	MSA-16	141903	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46186390	2020/02/06	12
RE	MCC-216	141392	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 537073/126E(5 m)	2020/02/18	12
RE	MPA-10	141579	Pre Amplifier	Keysight Technologies Inc	8449B	3008A02142	2020/01/07	12
RE	MHF-25	141232	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	2019/09/11	12
RE/CE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MHA-16	141513	Horn Antenna 15-40GHz	Schwarzbeck Mess - Elektronik	BBHA9170	BBHA9170306	2020/05/21	12
RE	MHA-06	141512	Horn Antenna 1-18GHz	Schwarzbeck Mess - Elektronik	BBHA9120D	254	2019/09/03	12
RE	MHA-20	141507	Horn Antenna 1-18GHz	Schwarzbeck Mess - Elektronik	BBHA9120D	258	2019/09/26	12
RE/CE	MJM-27	142228	Measure	KOMELON	KMC-36	-	-	-
RE	MAEC-02-SVSWR	142006	AC2_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-06902	2019/04/01	24
RE/CE	MAEC-02	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	2020/05/26	24
RE/CE	MOS-41	192300	Thermo-Hygrometer	CUSTOM	CTH-201	0013	2019/12/19	12
RE/CE	MMM-01	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	2019/08/20	12
RE	MPA-11	141580	MicroWave System Amplifier	Keysight Technologies Inc	83017A	MY39500779	2020/03/24	12
RE	MCC-231	177964	Microwave Cable	Junkosha INC.	MMX221	1901S329(1m)/1902S579(5m)	2020/03/02	12
RE	MAT-07	141203	Attenuator(6dB)	Weinschel Corp	2	BK7970	2019/11/07	12
RE	MBA-08	141427	Biconical Antenna	Schwarzbeck Mess - Elektronik	VHA9103B+BBA9106	8031	2019/08/23	12
RE	MCC-12	141317	Coaxial Cable	Fujikura/Agilent	-	-	2019/09/03	12
RE/CE	MLA-21	141265	Logperiodic Antenna(200-1000MHz)	Schwarzbeck Mess - Elektronik	VUSLP9111B	9111B-190	2019/08/23	12
RE/CE	MPA-24	141594	Pre Amplifier	Keysight Technologies Inc	8447D	2944A10150	2020/02/10	12
RE	MTR-03	141942	Test Receiver	Rohde & Schwarz	ESCI	100300	2019/08/08	12
CE	MLS-23	141357	LISN(AMN)	Schwarzbeck Mess - Elektronik	NSLK8127	8127-729	2019/07/05	12
CE	MCC-13	141222	Coaxial Cable	Fujikura,HP,Mini-Circuits,Fujikura	3D-2W(12m)/5D-2W(5m)/5D-2W(0.8m)/5D-2W(1m)	-	2020/02/25	12
CE	MAT-67	141248	Attenuator	JFW Industries, Inc.	50FP-013H2 N	-	2019/12/02	12
AT	MSA-03	141884	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY44020357	2020/03/04	12
AT	MCC-64	141327	Coaxial Cable	UL Japan	-	-	2020/02/04	12
AT	MCC-67	141329	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28635/2	2020/04/02	12
AT	MAT-10	141156	Attenuator(10dB)	Weinschel Corp	2	BL1173	2019/11/07	12
AT	MAT-92	141421	Attenuator	Weinschel Associates	WA56-10	56100308	2020/05/25	12

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

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

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

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

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