



RADIO TEST REPORT

Test Report No. : 13828809H-A-R1

Applicant : DENSO TEN Limited
Type of EUT : Car Audio
Model Number of EUT : TN0023A
FCC ID : BABTN0023A
Test regulation : FCC Part 15 Subpart C: 2021
*WLAN and Bluetooth Low Energy parts
Test Result : Complied (Refer to SECTION 3)

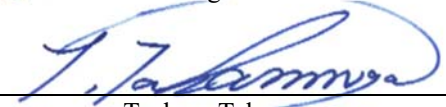
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6. This test report covers Radio technical requirements.
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7. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan, Inc. has been accredited.
9. The information provided from the customer for this report is identified in SECTION 1.
10. This report is a revised version of 13828809H-A. 13828809H-A is replaced with this report.

Date of test: June 11 to October 19, 2021

Representative test engineer:


Junki Nagatomi
Engineer

Approved by:


Tsubasa Takayama
Leader



CERTIFICATE 5107.02

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

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Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Report Cover Page - 13-EM-F0429 Issue # 19.0

REVISION HISTORY

Original Test Report No.: 13828809H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13828809H-A	October 20, 2021	-	-
1	13828809H-A-R1	October 26, 2021	P.10	Addition of Tested Antenna to Simultaneous transmission table
1	13828809H-A-R1	October 26, 2021	P.10	Correction of sentence *1) in Simultaneous transmission table

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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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Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

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SECTION 1: Customer information

Company Name	:	DENSO TEN Limited
Address	:	2-28, Goshō-dori 1-Chome, Hyogo-ku, Kobe, 652-8510 JAPAN
Telephone Number	:	+81-78-682-2159
Facsimile Number	:	+81-78-682-2169
Contact Person	:	Kaoru Abe

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	:	Car Audio
Model Number	:	TN0023A
Serial Number	:	Refer to SECTION 4.2
Rating	:	DC 12 V
Receipt Date	:	June 4, 2021
Country of Mass-production	:	Japan
Condition	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification	:	No Modification by the test lab.

2.2 Product Description

Model: TN0023A (referred to as the EUT in this report) is a Car Audio.

Radio Specification

Radio Type : Transceiver
Clock frequency(ies) : 7.3333333 GHz

	IEEE802.11b	IEEE802.11g/n (20 M band)	IEEE802.11a/n/ac (20 M band)	IEEE802.11n/ac (40 M band)	IEEE802.11ac (80 M band)
Frequency of operation	2412 MHz - 2462 MHz	2412 MHz - 2462 MHz	5180 MHz - 5240 MHz 5745 MHz - 5825 MHz	5190 MHz - 5230 MHz 5755 MHz - 5795 MHz	5210 MHz 5775 MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK, 256QAM (IEEE802.11ac only))		
Channel spacing	5MHz		20MHz	40MHz	80MHz
Antenna type	Inverted F Antenna				
Antenna Connector type	U.FL-R-SMT-1(80)				
Antenna Gain	-1.41 dBi (Peak): 2.4 GHz Band 3.28 dBi (Peak) (ANT 1) / 1.79 dBi (Peak) (ANT 2) : 5 GHz Band				

	Bluetooth Ver.5.0 with EDR function
Frequency of operation	2402 MHz - 2480 MHz
Type of modulation	BT: FHSS (GFSK, $\pi/4$ -DQPSK, 8-DPSK) LE: GFSK
Channel spacing	BT: 1 MHz LE: 2 MHz
Antenna type	Inverted F Antenna
Antenna Connector type	U.FL-R-SMT-1(80)
Antenna Gain	0.70 dBi (Peak)

	Broadcast Receiver
Radio Type	Receiver
Frequency of Operation	AM, HD_AM: 530 kHz - 1710 kHz FM, RBDS/HD_FM: 87.75 MHz - 107.9 MHz SDARS: 2320 MHz - 2345 MHz
Channel spacing	AM, HD_AM: 10 kHz FM, RBDS/HD_FM: 200 kHz
Antenna connector type	HFC IV

*1) This test report applies to WLAN (2.4 GHz Band) and BT LE only.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on May 3, 2021 and effective July 2, 2021

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

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods ----- ISED: RSS-Gen 8.8	FCC: Section 15.207 ----- ISED: RSS-Gen 8.8	-	N/A	*1)
6dB Bandwidth	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ----- ISED: -	FCC: Section 15.247(a)(2) ----- ISED: RSS-247 5.2(a)	See data.	Complied a)	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ----- ISED: RSS-Gen 6.12	FCC: Section 15.247(b)(3) ----- ISED: RSS-247 5.4(d)		Complied b)	Conducted
Power Density	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ----- ISED: -	FCC: Section 15.247(e) ----- ISED: RSS-247 5.2(b)		Complied c)	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 15.247 Meas Guidance v05r02 ----- ISED: RSS-Gen 6.13	FCC: Section 15.247(d) ----- ISED: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	3.2 dB 5000.000 MHz, AV, Vert.	Complied# d), e)	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *2)
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422. *1) The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line. *2) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r02 8.5 and 8.6. a) Refer to APPENDIX 1 (data of 6 dB Bandwidth and 99 % Occupied Bandwidth) b) Refer to APPENDIX 1 (data of Maximum Peak Output Power) c) Refer to APPENDIX 1 (data of Power Density) d) Refer to APPENDIX 1 (data of Conducted Spurious Emission) e) Refer to APPENDIX 1 (data of Radiated Spurious Emission) Symbols: Complied The data of this test item has enough margin, more than the measurement uncertainty. Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.					

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

FCC Part 15.31 (e)

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

FCC Part 15.203 Antenna requirement

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

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

3.3 Addition to standard

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

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

3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the results are derived depending on whether or not laboratory uncertainty is applied.

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

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

Radiated emission

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

3.5 Test Location

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

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

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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.10 shielded room	3.8 x 2.8 x 2.8	3.8 x 2.8	-	-
No.11 measurement room	4.0 x 3.4 x 2.5	N/A	-	-
No.12 measurement room	2.6 x 3.4 x 2.5	N/A	-	-

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

SECTION 4: Operation of EUT during testing

4.1 Operating Mode(s)

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

Mode	Remarks*
IEEE 802.11b (11b)	5.5 Mbps, PN9
IEEE 802.11g (11g)	48 Mbps, PN9
IEEE 802.11n 20 MHz BW (11n-20)	MCS 7 (Short GI), PN9
Bluetooth Low Energy (BT LE)	Maximum Packet Size, PN9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; Power settings: 11b : 14 dBm 11g/11n : 6 dBm BT LE : 0 dBm Software: for WLAN: QCA RCT Ver 3.0.144.0 (Date: October 9, 2017) TeraTerm ver.4.104 (Date: August 30, 2019) for BT LE: BSDT Ver 5.2.0 (Date: October 9, 2019) TeraTerm ver.4.104 (Date: August 30, 2019) (Storage location: Driven by connected PC)	
*This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	

*The details of Operating mode(s)

Test Item	Operating Mode	Tested frequency
Spurious Emission (Radiated)	11b Tx 11n-20 Tx *1)	2412 MHz 2437 MHz 2462 MHz
	BT LE Tx	2402 MHz 2440 MHz 2480 MHz
6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth	11b Tx 11g Tx 11n-20 Tx	2412 MHz 2437 MHz 2462 MHz
	BT LE Tx	2402 MHz 2440 MHz 2480 MHz
Spurious Emission (Conducted)	11n-20 Tx *1)	2437 MHz
	BT LE Tx	2402 MHz 2440 MHz 2480 MHz

*1) Since 11g and 11n-20 have the same modulation method and no differences in transmitting specification, test was performed on the representative mode that had the highest peak output power.

Simultaneous transmission

Test Item	Mode *1)	Tested Antenna
Radiated Spurious Emission	Tx BT LE 2402 MHz + Tx 11a 5180 MHz Tx BT LE 2440 MHz + Tx 11a 5180 MHz Tx BT LE 2480 MHz + Tx 11a 5180 MHz	Bluetooth LE (Antenna 2) + 11a (Antenna 2)
*1) The test was performed on the mode as a representative, because it had the highest power (11a mode /Antenna 2) of 5 GHz band at antenna terminal test.		

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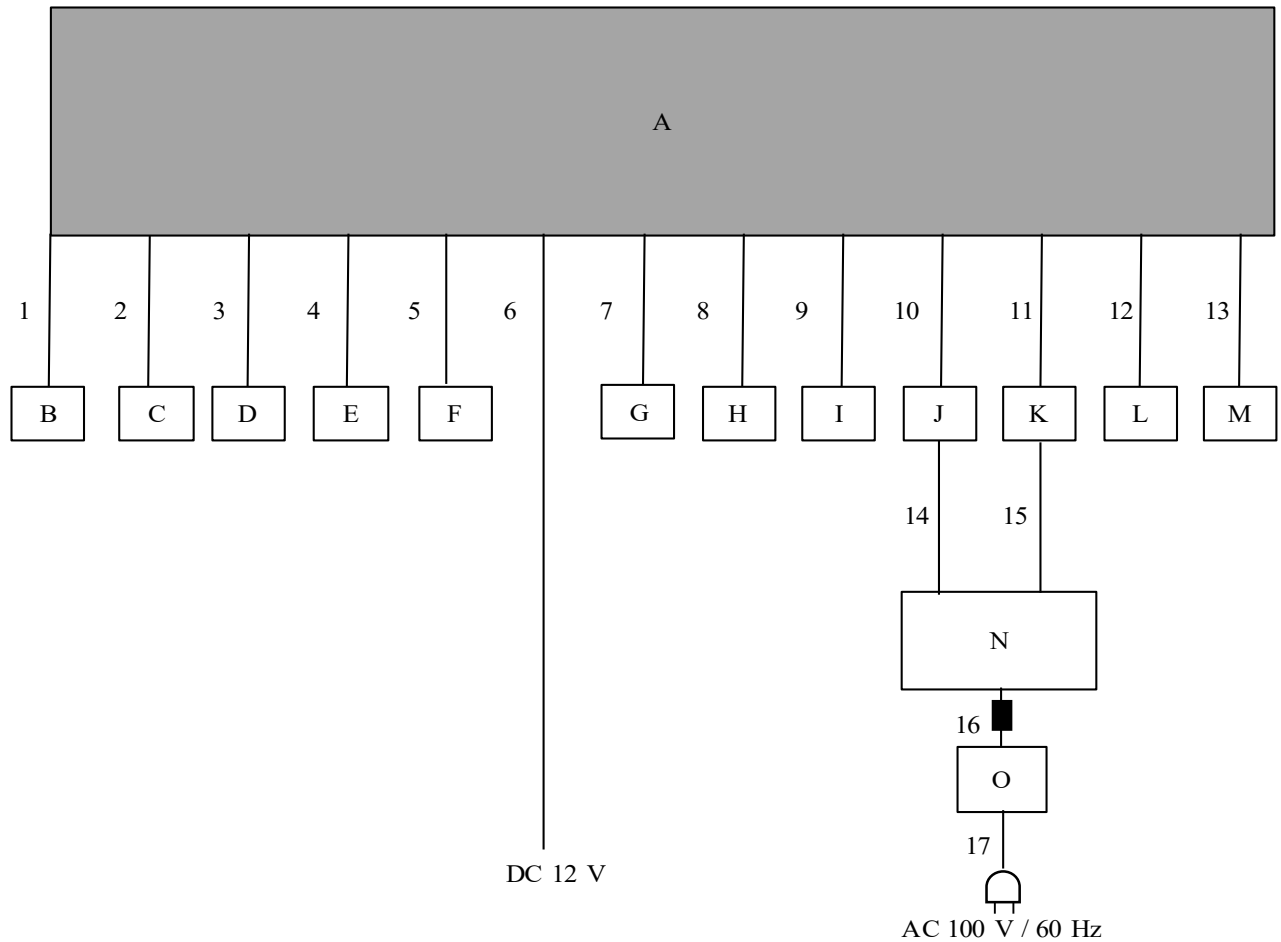
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4.2 Configuration and peripherals

For Antenna Terminal Conducted Tests



* 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	Car Audio	TN0023A	AT300014	DENSO TEN Limited	EUT
B	Switch	-	-	-	-
C	DCM	19MC_DCM	E-033720026/008	DENSO Corporation	-
D	Steering Switch	PA6-GF30	39	TOYOTA	-
E	Low noise Amp	ZX60-242GLN-S+	S 2036302044	Mini-Circuits	-
F	GPS Antenna	23D900113	No.48	yokowo co.,ltd.	-
G	FM/AM connector (Main)	86300-30C30	AS500586	DENSO TEN Limited	-
H	FM/AM connector (Sub)	86300-30C70	AS400124	DENSO TEN Limited	-
I	Back Camera	GP-KD7301RC	85C602752	Panasonic	-
J	USB LAN transfer	ETX3-US2	G000024	I-O DATA	-
K	Jig Board	135943-58990920	3700980A186	DENSO TEN Limited	-
L	Mic	SDA3510A	0AC067100	Panasonic	-
M	Mic	SDA3510A	0AC067082	Panasonic	-
N	Laptop PC	CF-LX4EDHCS	5GKSA17377	Panasonic	-
O	AC Adapter	CF-AA62J2C	64B2CM114703755B	Panasonic	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	2.4	Unshielded	Unshielded	-
2	Signal Cable	2.4	Unshielded	Unshielded	-
3	Signal Cable	2.4	Unshielded	Unshielded	-
4	Signal Cable	1.0	Unshielded	Unshielded	-
5	GNSS Antenna Cable	2.6	Shielded	Shielded	-
6	DC Cable	3.4	Unshielded	Unshielded	-
7	Signal Cable	2.6	Unshielded	Unshielded	-
8	Signal Cable	2.6	Unshielded	Unshielded	-
9	Signal Cable	2.4	Unshielded	Unshielded	-
10	USB Cable	3.2	Shielded	Shielded	-
11	Signal Cable	0.1	Unshielded	Unshielded	-
12	Signal Cable	2.7	Unshielded	Unshielded	-
13	Signal Cable	2.7	Unshielded	Unshielded	-
14	LAN Cable	1.0	Unshielded	Unshielded	-
15	USB Cable	0.2	Shielded	Shielded	-
16	DC Cable	0.9	Unshielded	Unshielded	-
17	AC Cable	0.8	Unshielded	Unshielded	-

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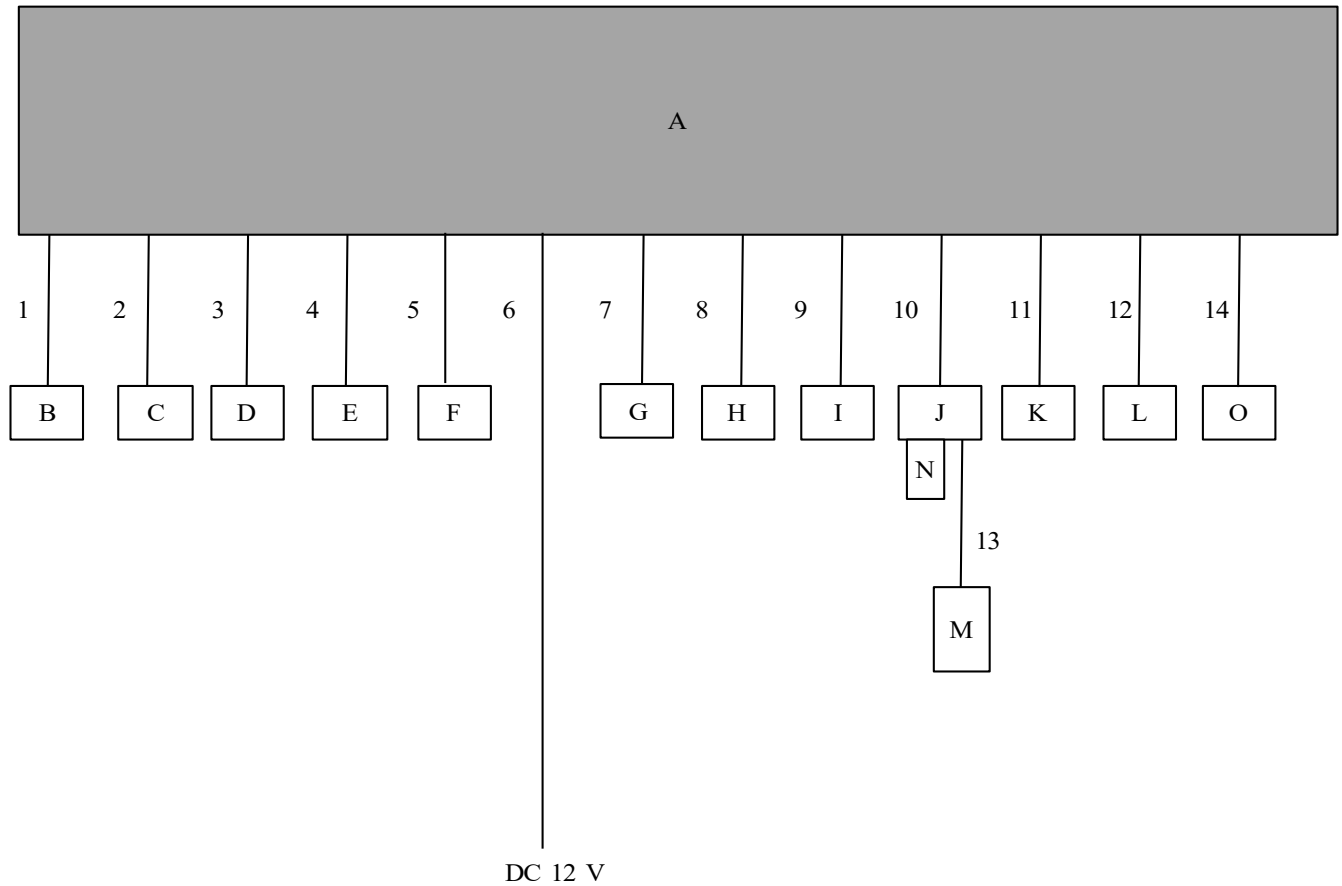
Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

For Radiated Spurious Emission



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

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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Car Audio	TN0023A	AT300013	DENSO TEN Limited	EUT
B	Switch	-	-	-	-
C	DCM	19MC_DCM	E-033720026/006	DENSO Corporation	-
D	Steering Switch	PA6-GF30	48	TOYOTA	-
E	Low noise Amp	ZX60-242GLN-S+	S 2036302044	Mini-Circuits	-
F	GPS Antenna	23D90058	No.17	yokowo co.,ltd.	-
G	FM/AM connector (Main)	86300-30C30	PS600112	DENSO TEN Limited	-
H	FM/AM connector (Sub)	86300-30C70	PS6020494	DENSO TEN Limited	-
I	Back Camera	GP-KD7301RC	64F000037	Panasonic	-
J	USB/AUX socket	86190-12040	No.17	Kojima Industries Corporation	-
K	Mic	SDA3510A	0DC040830	Panasonic	-
L	Mic	SDA3510A	0DC040817	Panasonic	-
M	iPod touch	A1367	CCQ50WDDCPC	Apple	-
N	USB Memory	USM4GR B	17116 DGGNN	SONY	-
O	Speaker Dummy	-	-	-	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	2.4	Unshielded	Unshielded	-
2	Signal Cable	2.4	Unshielded	Unshielded	-
3	Signal Cable	2.4	Unshielded	Unshielded	-
4	Signal Cable	1.0	Unshielded	Unshielded	-
5	GNSS Antenna Cable	2.6	Shielded	Shielded	-
6	DC Cable	3.4	Unshielded	Unshielded	-
7	Signal Cable	2.6	Unshielded	Unshielded	-
8	Signal Cable	2.6	Unshielded	Unshielded	-
9	Signal Cable	2.4	Unshielded	Unshielded	-
10	USB Cable	3.2	Shielded	Shielded	-
11	Signal Cable	2.7	Unshielded	Unshielded	-
12	Signal Cable	2.7	Unshielded	Unshielded	-
13	Audio Cable	1.5	Shielded	Shielded	-
14	Speaker Cable	3.2	Unshielded	Unshielded	-

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Ise EMC Lab.

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SECTION 5: Radiated Spurious Emission

Test Procedure

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

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 1.0 m by 1.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

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

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

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

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

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

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

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

Test Antennas are used as below;

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

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

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

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

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

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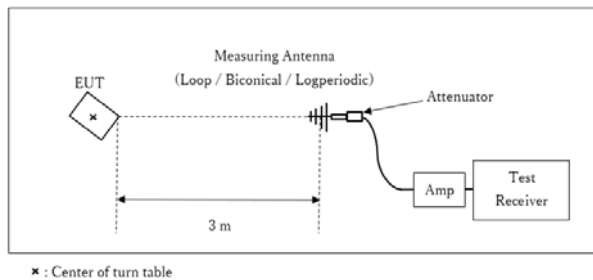
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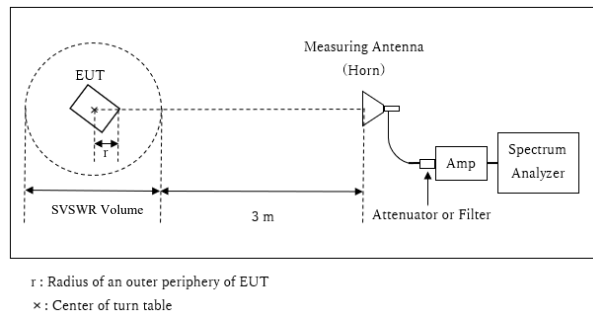
Figure 1: Test Setup

Below 1 GHz



Test Distance: 3 m

1 GHz - 10 GHz



Distance Factor: $20 \times \log (3.6 \text{ m} / 3.0 \text{ m}) = 1.59 \text{ dB}$

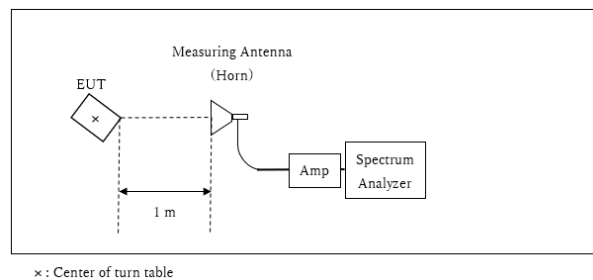
* Test Distance: $(3 + \text{SVSWR Volume} / 2) - r = 3.6 \text{ m}$

SVSWR Volume : 1.5 m

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

$r = 0.15 \text{ m}$

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 test was made on EUT at the normal use position.

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

Measurement range : 30 MHz - 26.5 GHz

Test data : APPENDIX

Test result : Pass

SECTION 6: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6dB Bandwidth	20 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3 kHz	10 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3) *4)
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.
 (9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 9.1 kHz).
 *5) The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377 Ohms. For example, the measurement at frequency 9 kHz resulted in a level of 45.5 dBuV/m, which is equivalent to 45.5 - 51.5 = -6.0 dBuA/m, which has the same margin, 3 dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

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

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

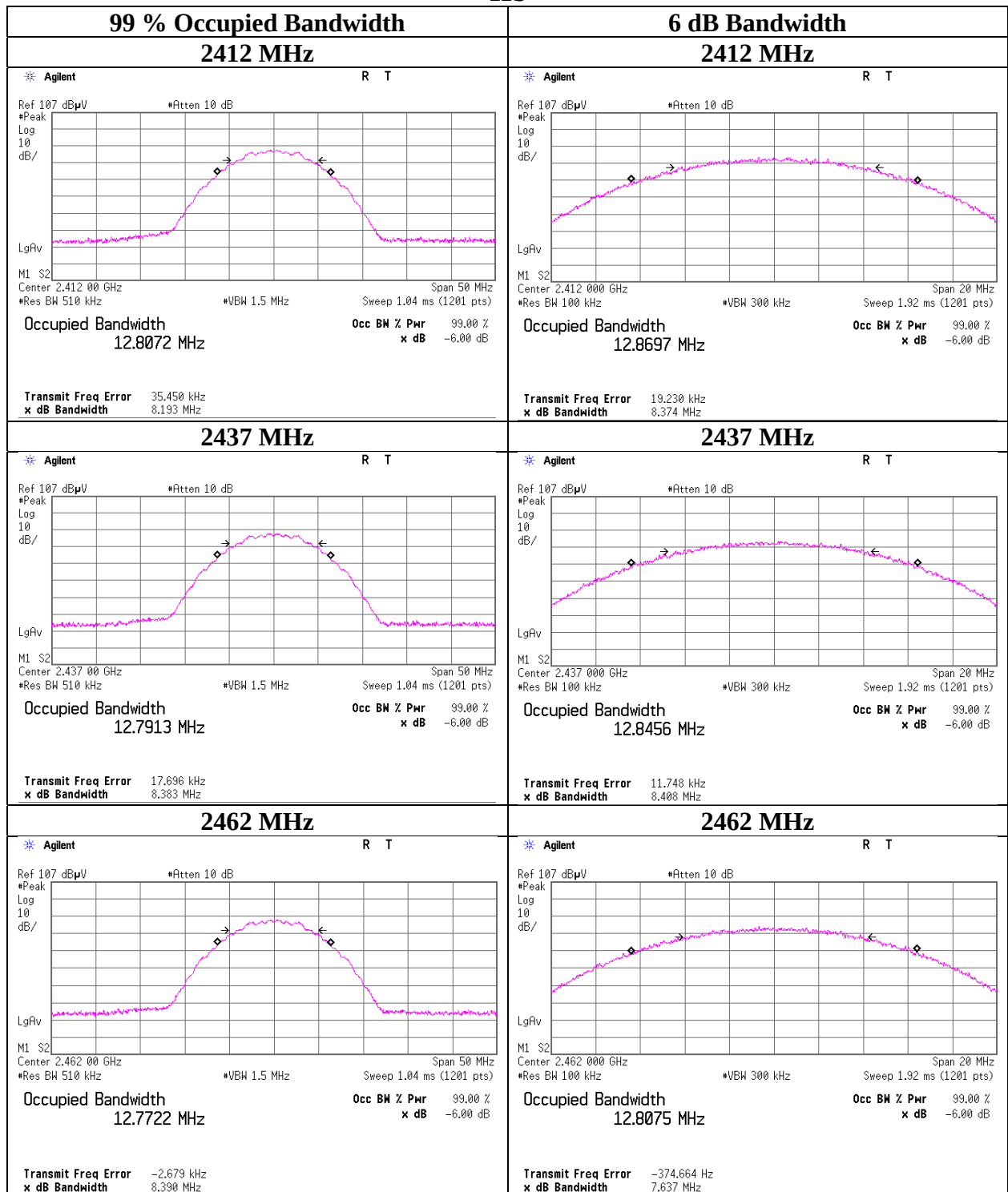
99 % Occupied Bandwidth and 6 dB Bandwidth

Report No.	13828809H	
Test place	Ise EMC Lab. No.6 Measurement Room	
Date	June 16, 2021	June 22, 2021
Temperature / Humidity	25 deg. C / 54 % RH	24 deg. C / 55 % RH
Engineer	Takafumi Noguchi	Nachi Konegawa
Mode	Tx	

Mode	Frequency [MHz]	99 % Occupied Bandwidth [kHz]	6 dB Bandwidth [MHz]	Limit for 6 dB Bandwidth [MHz]
11b	2412	12807.2	8.374	> 0.5000
	2437	12791.3	8.408	> 0.5000
	2462	12772.2	7.637	> 0.5000
11g	2412	17118.7	16.469	> 0.5000
	2437	17260.5	16.509	> 0.5000
	2462	17170.5	16.483	> 0.5000
11n-20	2412	18205.9	17.699	> 0.5000
	2437	18226.4	17.710	> 0.5000
	2462	18194.8	17.726	> 0.5000
BTLE	2402	1063.6	0.675	> 0.5000
	2440	1062.9	0.671	> 0.5000
	2480	1062.3	0.673	> 0.5000

99 % Occupied Bandwidth and 6 dB Bandwidth

11b



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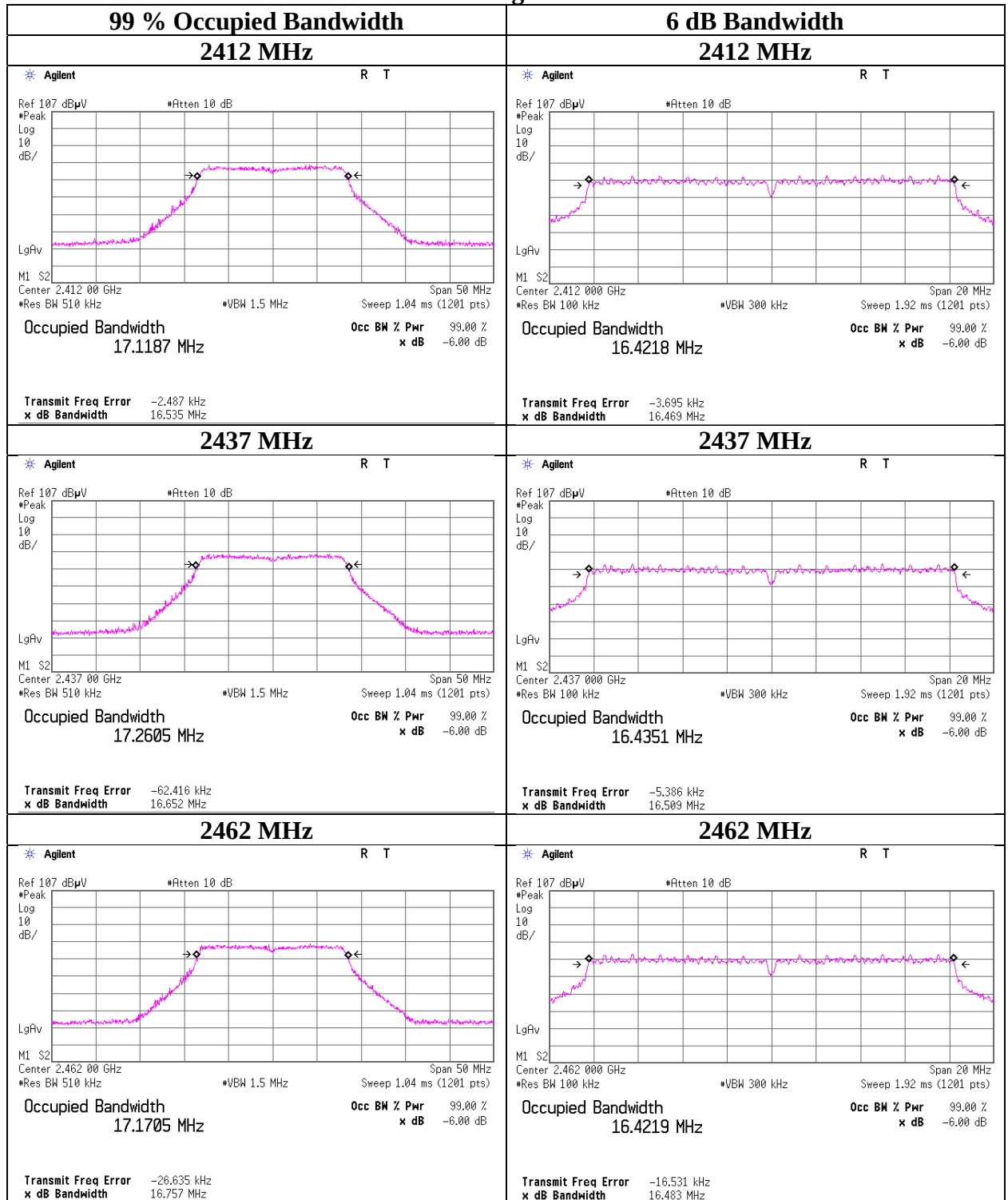
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99 % Occupied Bandwidth and 6 dB Bandwidth

11g



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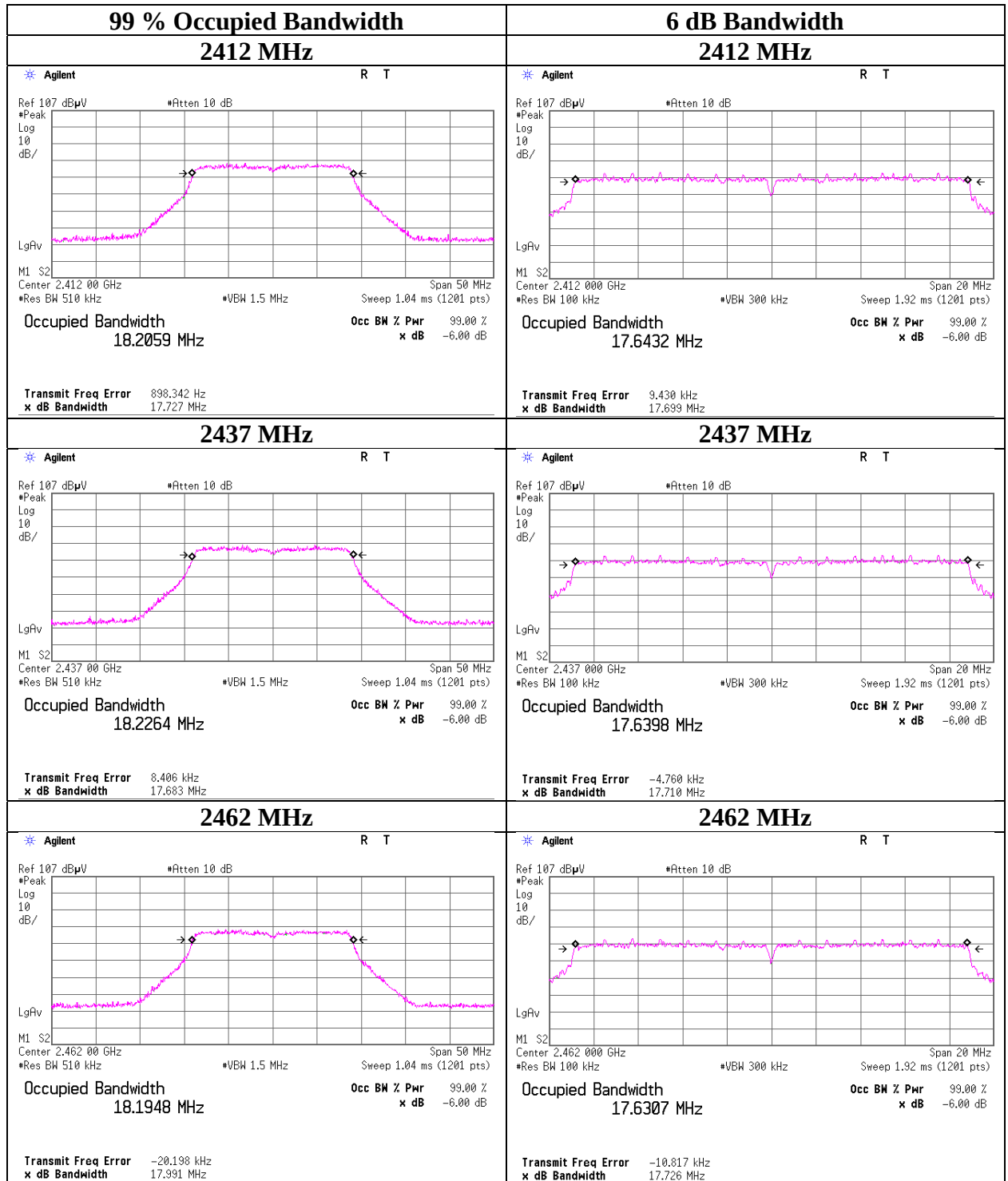
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

99 % Occupied Bandwidth and 6 dB Bandwidth

11n-20



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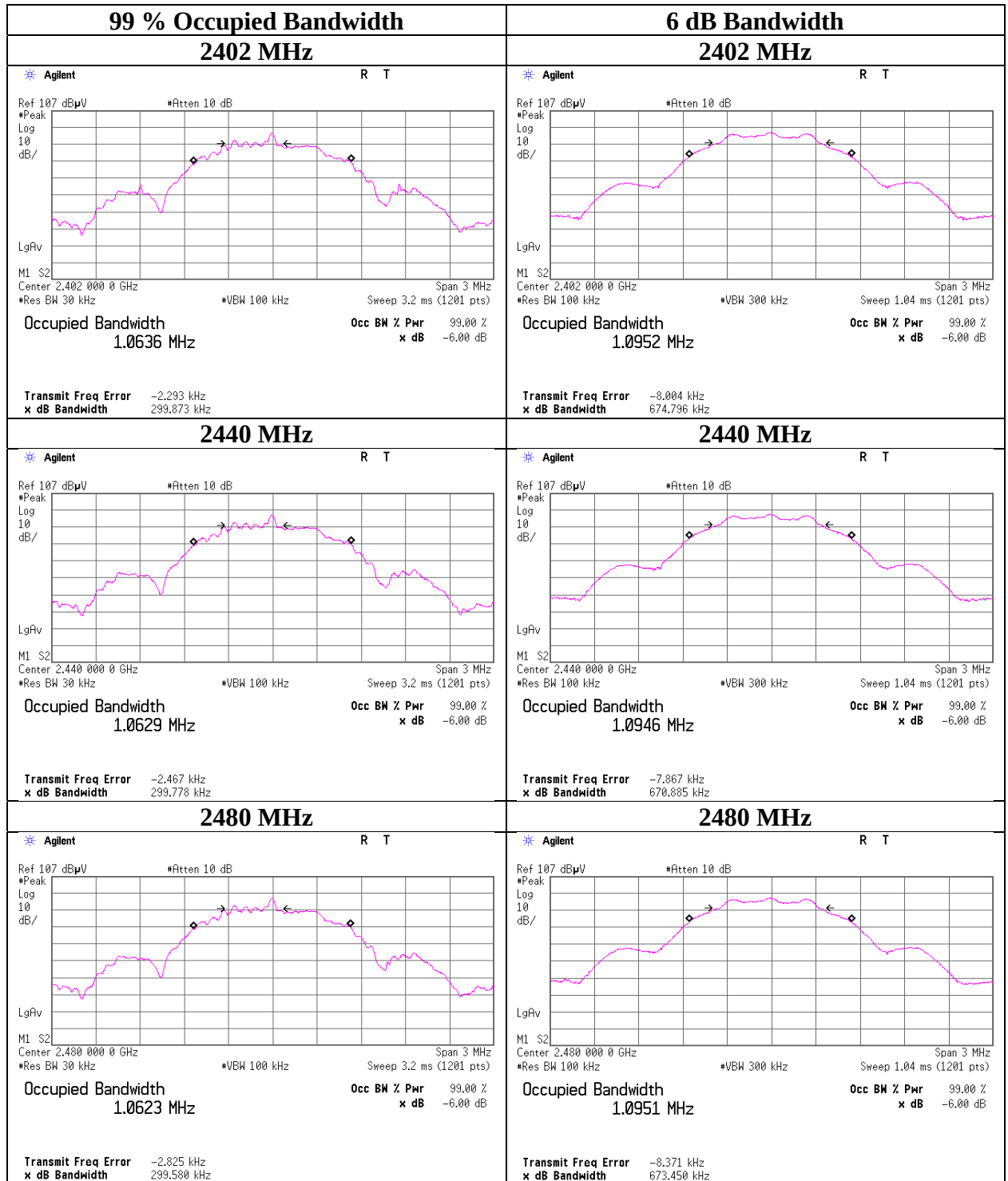
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99 % Occupied Bandwidth and 6 dB Bandwidth

BT LE



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Maximum Peak Output Power

Report No. 13828809H
Test place Ise EMC Lab. No.6 Measurement Room
Date June 16, 2021
Temperature / Humidity 25 deg. C / 54 % RH
Engineer Takafumi Noguchi
Mode Tx 11b

				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	4.13	1.41	10.04	15.58	36.14	30.00	1000	14.42	-1.41	14.17	26.12	36.02	4000	21.85
2437	4.42	1.41	10.04	15.87	38.64	30.00	1000	14.13	-1.41	14.46	27.93	36.02	4000	21.56
2462	4.54	1.42	10.04	16.00	39.81	30.00	1000	14.00	-1.41	14.59	28.77	36.02	4000	21.43

Sample Calculation:

Result = Reading + Cable Loss + 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.

2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	4.39	
2	4.40	
5.5	4.42	*
11	4.41	

*: Worst Rate

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

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Maximum Peak Output Power

Report No. 13828809H
Test place Ise EMC Lab. No.6 Measurement Room
Date June 16, 2021
Temperature / Humidity 25 deg. C / 54 % RH
Engineer Takafumi Noguchi
Mode Tx 11g

Freq. c [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2412	5.05	1.41	10.04	16.50	44.67	30.00	1000	13.50	-1.41	15.09	32.28	36.02	4000	20.93
2437	5.20	1.41	10.04	16.65	46.24	30.00	1000	13.35	-1.41	15.24	33.42	36.02	4000	20.78
2462	5.31	1.42	10.04	16.77	47.53	30.00	1000	13.23	-1.41	15.36	34.36	36.02	4000	20.66

Sample Calculation:

Result = Reading + Cable Loss + Attenuator Loss

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

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

2437 MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
6	4.65	
9	4.64	
12	4.76	
18	5.02	
24	5.09	
36	4.74	
48	5.20	*
54	5.14	

*: Worst Rate

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

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Maximum Peak Output Power

Report No. 13828809H
Test place Ise EMC Lab. No.6 Measurement Room
Date June 16, 2021
Temperature / Humidity 25 deg. C / 54 % RH
Engineer Takafumi Noguchi
Mode Tx 11n-20

Freq. c [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2412	5.15	1.41	10.04	16.60	45.71	30.00	1000	13.40	-1.41	15.19	33.04	36.02	4000	20.83
2437	5.40	1.41	10.04	16.85	48.42	30.00	1000	13.15	-1.41	15.44	34.99	36.02	4000	20.58
2462	5.32	1.42	10.04	16.78	47.64	30.00	1000	13.22	-1.41	15.37	34.43	36.02	4000	20.65

Sample Calculation:

Result = Reading + Cable Loss + Attenuator Loss

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

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

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Maximum Peak Output Power

Report No. 13828809H
Test place Ise EMC Lab. No.6 Measurement Room
Date June 16, 2021
Temperature / Humidity 25 deg. C / 54 % RH
Engineer Takafumi Noguchi
Mode Tx 11n-20

2437 MHz, Short GI

MCS Number	Reading [dBm]	Remark
0	4.87	
1	4.75	
2	4.77	
3	4.65	
4	4.51	
5	5.13	
6	4.41	
7	5.40	*

* Worst MCS

MCS Number	Reading [dBm]	GI	Remark
7	5.05	Long	
7	5.40	Short	*

* Worst Condition

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

Maximum Peak Output Power

Report No. 13828809H
Test place Ise EMC Lab. No.6 Measurement Room
Date June 22, 2021
Temperature / Humidity 24 deg. C / 55 % RH
Engineer Nachi Konegawa
Mode Tx BT LE

				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2402	-11.96	0.63	10.04	-1.29	0.74	30.00	1000	31.29	0.70	-0.59	0.87	36.02	4000	36.61
2440	-11.54	0.64	10.04	-0.86	0.82	30.00	1000	30.86	0.70	-0.16	0.96	36.02	4000	36.18
2480	-11.55	0.64	10.04	-0.87	0.82	30.00	1000	30.87	0.70	-0.17	0.96	36.02	4000	36.19

Sample Calculation:

Result = Reading + Cable Loss + Attenuator Loss

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

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

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Average Output Power (Reference data for RF Exposure)

Report No. 13828809H
Test place Ise EMC Lab. No.6 Measurement Room
Date June 16, 2021 June 22, 2021
Temperature / Humidity 25 deg. C / 54 % RH 24 deg. C / 55 % RH
Engineer Takafumi Noguchi Nachi Konegawa
Mode Tx

11b 1 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	1.42	1.41	10.04	12.87	19.36	0.06	12.93	19.63
2437	1.71	1.41	10.04	13.16	20.70	0.06	13.22	20.99
2462	1.82	1.42	10.04	13.28	21.28	0.06	13.34	21.58

11g 6 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-6.69	1.41	10.04	4.76	2.99	0.36	5.12	3.25
2437	-6.58	1.41	10.04	4.87	3.07	0.36	5.23	3.34
2462	-6.52	1.42	10.04	4.94	3.12	0.36	5.30	3.39

11n-20 MCS 0 Short GI

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	-6.64	1.41	10.04	4.81	3.03	0.41	5.22	3.32
2437	-6.43	1.41	10.04	5.02	3.18	0.41	5.43	3.49
2462	-6.48	1.42	10.04	4.98	3.15	0.41	5.39	3.46

BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-14.25	0.63	10.04	-3.58	0.44	1.74	-1.84	0.65
2440	-13.75	0.64	10.04	-3.07	0.49	1.74	-1.33	0.74
2480	-13.80	0.64	10.04	-3.12	0.49	1.74	-1.38	0.73

Sample Calculation:

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

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

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

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

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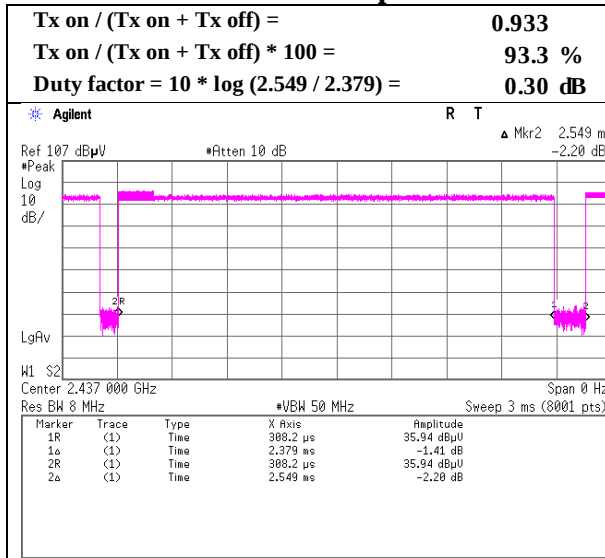
Telephone : +81 596 24 8999

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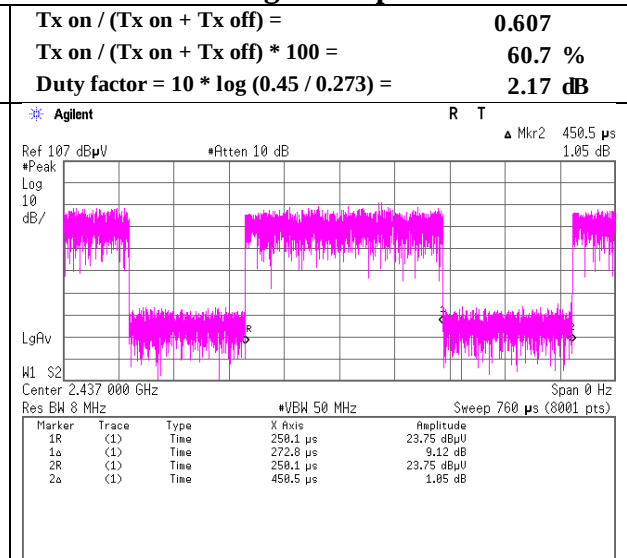
Burst rate confirmation

Report No. 13828809H
Test place Ise EMC Lab. No.6 Measurement Room
Date June 16, 2021
Temperature / Humidity 25 deg. C / 54 % RH
Engineer Takafumi Noguchi
Mode Tx

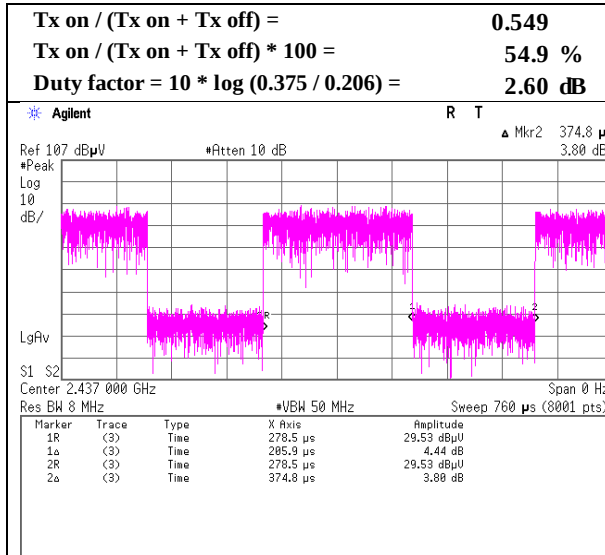
11b 5.5 Mbps



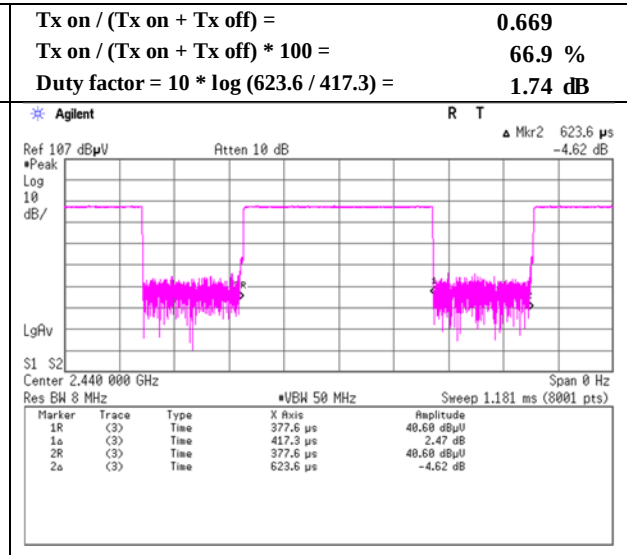
11g 48 Mbps



11n-20 MCS 7 SGI



BT LE

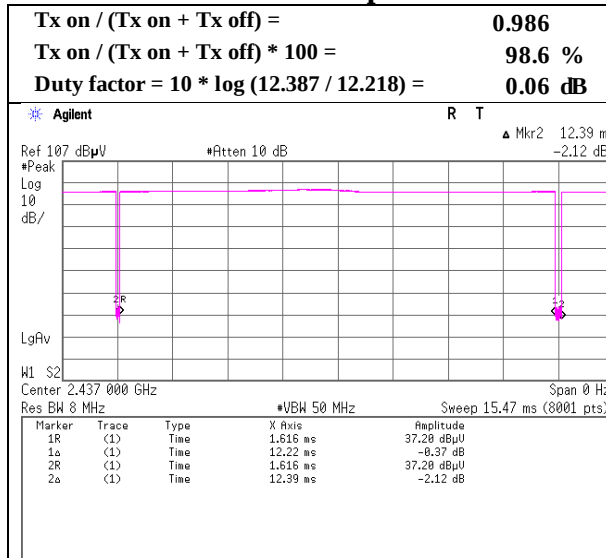


* Since the burst rate is not different between the channels, the data has been obtained on the representative channel.

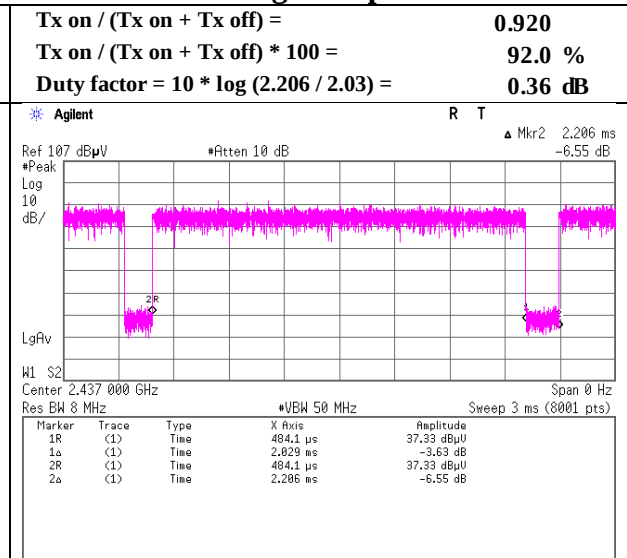
Burst rate confirmation

Report No. 13828809H
Test place Ise EMC Lab. No.6 Measurement Room
Date June 16, 2021
Temperature / Humidity 25 deg. C / 54 % RH
Engineer Takafumi Noguchi
Mode Tx

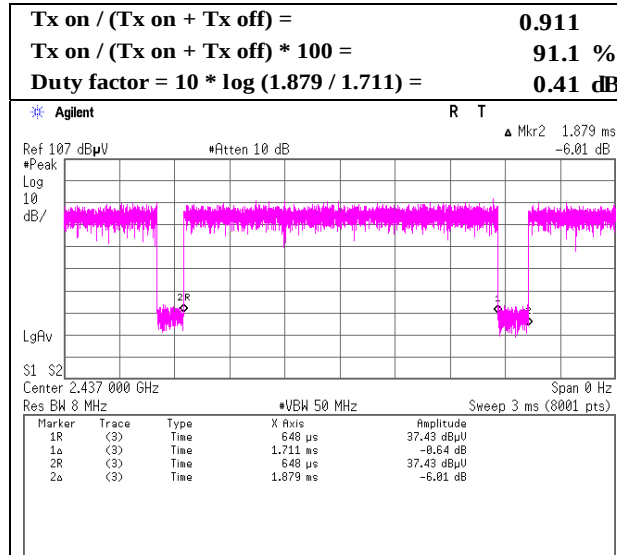
11b 1 Mbps



11g 6 Mbps



11n-20 MCS 0 SGI



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

Radiated Spurious Emission

Report No. 13828809H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date June 17, 2021 June 18, 2021
Temperature / Humidity 20 deg. C / 60 % RH 23 deg. C / 68 % RH
Engineer Junya Okuno Junki Nagatomi
(10 GHz - 26.5 GHz) (1 GHz - 10 GHz)
Mode Tx 11b 2412 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	1579.808	PK	56.7	25.3	4.1	35.1	-	50.9	73.9	23.0	Floor noise
Hori.	2390.000	PK	49.1	27.6	4.7	34.6	-	46.8	73.9	27.1	
Hori.	4824.000	PK	43.4	31.6	6.8	33.8	-	48.0	73.9	25.9	
Hori.	5000.015	PK	49.2	31.6	6.8	33.8	-	53.7	73.9	20.2	
Hori.	7236.000	PK	42.7	36.0	8.1	33.6	-	53.2	73.9	20.7	
Hori.	9648.000	PK	43.4	38.6	8.6	34.2	-	56.4	73.9	17.6	
Hori.	10000.000	PK	49.8	39.3	-2.5	34.3	-	52.3	73.9	21.6	
Hori.	1579.808	AV	49.5	25.3	4.1	35.1	-	43.7	53.9	10.3	*1) Floor noise
Hori.	2390.000	AV	40.3	27.6	4.7	34.6	0.3	38.2	53.9	15.7	
Hori.	4824.000	AV	34.1	31.6	6.8	33.8	-	38.7	53.9	15.2	
Hori.	5000.015	AV	43.2	31.6	6.8	33.8	-	47.7	53.9	6.2	
Hori.	7236.000	AV	34.6	36.0	8.1	33.6	-	45.1	53.9	8.8	
Hori.	9648.000	AV	34.9	38.6	8.6	34.2	-	47.8	53.9	6.1	
Hori.	10000.000	AV	45.5	39.3	-2.5	34.3	-	48.1	53.9	5.9	
Vert.	1579.942	PK	62.4	25.3	4.1	35.1	-	56.6	73.9	17.3	Floor noise
Vert.	2390.000	PK	48.9	27.6	4.7	34.6	-	46.5	73.9	27.4	
Vert.	4824.000	PK	42.7	31.6	6.8	33.8	-	47.3	73.9	26.6	
Vert.	5000.000	PK	50.7	31.6	6.8	33.8	-	55.2	73.9	18.7	
Vert.	7236.000	PK	42.9	36.0	8.1	33.6	-	53.4	73.9	20.5	
Vert.	9648.000	PK	43.6	38.6	8.6	34.2	-	56.5	73.9	17.4	
Vert.	10000.000	PK	47.3	39.3	-2.5	34.3	-	49.8	73.9	24.1	
Vert.	1579.942	AV	49.4	25.3	4.1	35.1	-	43.6	53.9	10.3	*1) Floor noise
Vert.	2390.000	AV	40.2	27.6	4.7	34.6	0.3	38.2	53.9	15.7	
Vert.	4824.000	AV	34.1	31.6	6.8	33.8	-	38.7	53.9	15.2	
Vert.	5000.000	AV	44.5	31.6	6.8	33.8	-	49.0	53.9	4.9	
Vert.	7236.000	AV	34.6	36.0	8.1	33.6	-	45.1	53.9	8.8	
Vert.	9648.000	AV	34.9	38.6	8.6	34.2	-	47.8	53.9	6.1	
Vert.	10000.000	AV	42.6	39.3	-2.5	34.3	-	45.2	53.9	8.8	

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 $20\log(3.6\text{ m} / 3.0\text{ m}) = 1.59\text{ dB}$

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.	2412.000	PK	98.8	27.5	4.7	34.6	96.4	-	-	Carrier
Hori.	2400.000	PK	46.9	27.6	4.7	34.6	44.5	76.4	31.9	
Vert.	2412.000	PK	101.2	27.5	4.7	34.6	98.8	-	-	Carrier
Vert.	2400.000	PK	47.1	27.6	4.7	34.6	44.7	78.8	34.1	

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

UL Japan, Inc.

Ise EMC Lab.

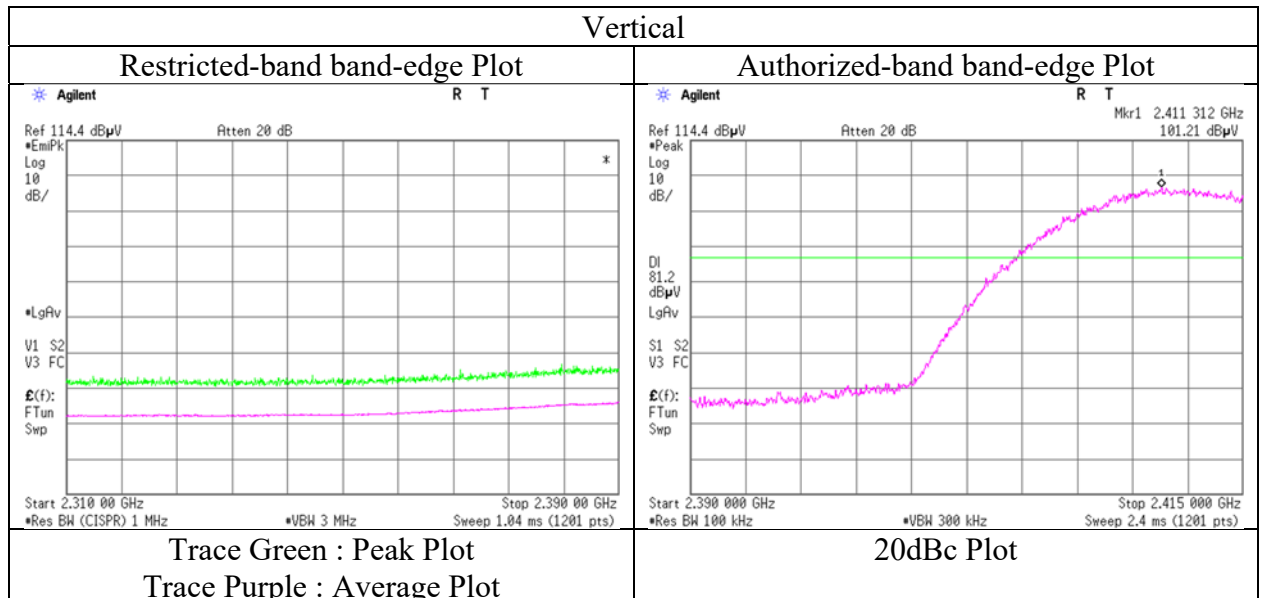
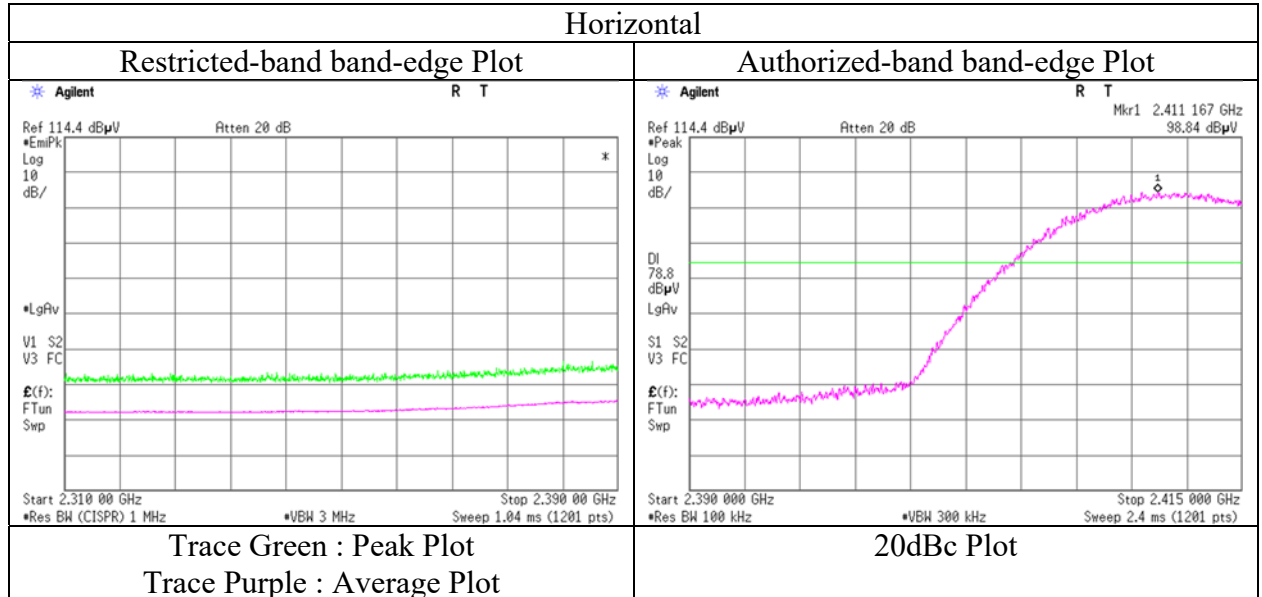
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13828809H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	June 18, 2021
Temperature / Humidity	23 deg. C / 68 % RH
Engineer	Junki Nagatomi
	(1 GHz - 10 GHz)
Mode	Tx 11b 2412 MHz



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

UL Japan, Inc.

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. 13828809H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date June 17, 2021 June 18, 2021
Temperature / Humidity 20 deg. C / 60 % RH 23 deg. C / 68 % RH
Engineer Junya Okuno Junki Nagatomi
(10 GHz - 26.5 GHz) (1 GHz - 10 GHz)
Mode Tx 11b 2437 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	1580.092	PK	60.3	25.3	4.1	35.1	-	54.5	73.9	19.4	Floor noise
Hori.	4874.000	PK	43.6	31.6	6.8	33.8	-	48.2	73.9	25.7	
Hori.	4999.853	PK	46.3	31.6	6.8	33.8	-	50.8	73.9	23.1	
Hori.	7311.000	PK	42.6	36.2	8.1	33.6	-	53.3	73.9	20.6	
Hori.	9748.000	PK	43.0	38.8	8.6	34.2	-	56.1	73.9	17.8	
Hori.	10000.000	PK	49.5	39.3	-2.5	34.3	-	52.0	73.9	21.9	Floor noise
Hori.	1580.092	AV	49.8	25.3	4.1	35.1	-	44.0	53.9	9.9	Floor noise
Hori.	4874.000	AV	34.2	31.6	6.8	33.8	-	38.8	53.9	15.1	
Hori.	4999.853	AV	41.4	31.6	6.8	33.8	-	45.9	53.9	8.0	
Hori.	7311.000	AV	34.5	36.2	8.1	33.6	-	45.2	53.9	8.7	
Hori.	9748.000	AV	34.1	38.8	8.6	34.2	-	47.2	53.9	6.7	
Hori.	10000.000	AV	45.3	39.3	-2.5	34.3	-	47.9	53.9	6.0	Floor noise
Vert.	1580.066	PK	58.6	25.3	4.1	35.1	-	52.8	73.9	21.1	Floor noise
Vert.	4874.000	PK	43.6	31.6	6.8	33.8	-	48.2	73.9	25.7	
Vert.	5000.000	PK	46.5	31.6	6.8	33.8	-	51.1	73.9	22.9	
Vert.	7311.000	PK	43.1	36.2	8.1	33.6	-	53.8	73.9	20.1	
Vert.	9748.000	PK	44.1	38.8	8.6	34.2	-	57.2	73.9	16.7	
Vert.	10000.000	PK	46.9	39.3	-2.5	34.3	-	49.4	73.9	24.5	Floor noise
Vert.	1580.066	AV	50.1	25.3	4.1	35.1	-	44.3	53.9	9.6	Floor noise
Vert.	4874.000	AV	34.2	31.6	6.8	33.8	-	38.8	53.9	15.1	
Vert.	5000.000	AV	40.9	31.6	6.8	33.8	-	45.4	53.9	8.5	
Vert.	7311.000	AV	34.5	36.2	8.1	33.6	-	45.2	53.9	8.7	
Vert.	9748.000	AV	34.1	38.8	8.6	34.2	-	47.2	53.9	6.7	
Vert.	10000.000	AV	42.6	39.3	-2.5	34.3	-	45.1	53.9	8.8	Floor noise

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

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

Distance factor: 1 GHz - 10 GHz 20log (3.6 m / 3.0 m) = 1.59 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No. 13828809H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date June 17, 2021 June 19, 2021
Temperature / Humidity 20 deg. C / 60 % RH 21 deg. C / 70 % RH
Engineer Junya Okuno Junki Nagatomi
(10 GHz - 26.5 GHz) (1 GHz - 10 GHz)
Mode Tx 11b 2462 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	1579.837	PK	62.8	25.3	4.1	35.1	-	57.0	73.9	16.9	Floor noise
Hori.	2483.500	PK	49.7	27.4	4.7	34.6	-	47.2	73.9	26.7	
Hori.	2499.955	PK	47.8	27.4	4.7	34.6	-	45.4	73.9	28.6	
Hori.	4924.000	PK	41.9	31.5	6.8	33.8	-	46.5	73.9	27.5	
Hori.	5000.005	PK	46.6	31.6	6.8	33.8	-	51.1	73.9	22.8	
Hori.	7386.000	PK	43.5	36.1	8.1	33.6	-	54.0	73.9	19.9	
Hori.	9848.000	PK	42.9	39.0	8.6	34.3	-	56.3	73.9	17.7	
Hori.	10000.000	PK	49.3	39.3	-2.5	34.3	-	51.8	73.9	22.1	
Hori.	1579.837	AV	51.1	25.3	4.1	35.1	-	45.3	53.9	8.6	*1) Floor noise
Hori.	2483.500	AV	40.6	27.4	4.7	34.6	0.3	38.4	53.9	15.5	
Hori.	2499.955	AV	41.3	27.4	4.7	34.6	-	38.9	53.9	15.0	
Hori.	4924.000	AV	34.3	31.5	6.8	33.8	-	38.8	53.9	15.1	
Hori.	5000.005	AV	41.4	31.6	6.8	33.8	-	45.9	53.9	8.0	
Hori.	7386.000	AV	34.2	36.1	8.1	33.6	-	44.7	53.9	9.2	
Hori.	9848.000	AV	34.4	39.0	8.6	34.3	-	47.7	53.9	6.2	
Hori.	10000.000	AV	45.4	39.3	-2.5	34.3	-	48.0	53.9	5.9	
Vert.	1579.837	PK	62.9	25.3	4.1	35.1	-	57.1	73.9	16.8	Floor noise
Vert.	2483.500	PK	50.6	27.4	4.7	34.6	-	48.2	73.9	25.7	
Vert.	2499.955	PK	50.1	27.4	4.7	34.6	-	47.7	73.9	26.3	
Vert.	4924.000	PK	43.2	31.5	6.8	33.8	-	47.8	73.9	26.2	
Vert.	5000.005	PK	47.2	31.6	6.8	33.8	-	51.7	73.9	22.2	
Vert.	7386.000	PK	42.7	36.1	8.1	33.6	-	53.2	73.9	20.7	
Vert.	9848.000	PK	43.9	39.0	8.6	34.3	-	57.2	73.9	16.7	
Vert.	10000.000	PK	47.0	39.3	-2.5	34.3	-	49.6	73.9	24.3	
Vert.	1579.837	AV	50.9	25.3	4.1	35.1	-	45.1	53.9	8.8	*1) Floor noise
Vert.	2483.500	AV	41.0	27.4	4.7	34.6	0.3	38.8	53.9	15.1	
Vert.	2499.955	AV	41.6	27.4	4.7	34.6	-	39.2	53.9	14.7	
Vert.	4924.000	AV	34.3	31.5	6.8	33.8	-	38.8	53.9	15.1	
Vert.	5000.005	AV	42.1	31.6	6.8	33.8	-	46.7	53.9	7.3	
Vert.	7386.000	AV	34.2	36.1	8.1	33.6	-	44.7	53.9	9.2	
Vert.	9848.000	AV	34.4	39.0	8.6	34.3	-	47.7	53.9	6.2	
Vert.	10000.000	AV	42.6	39.3	-2.5	34.3	-	45.1	53.9	8.8	

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

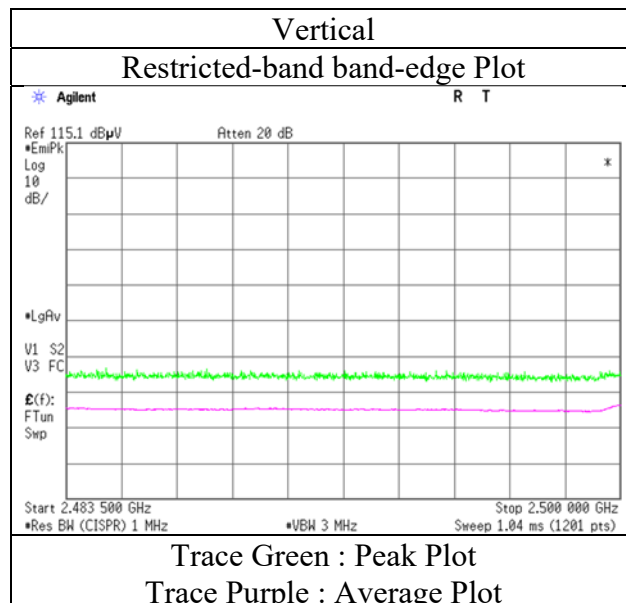
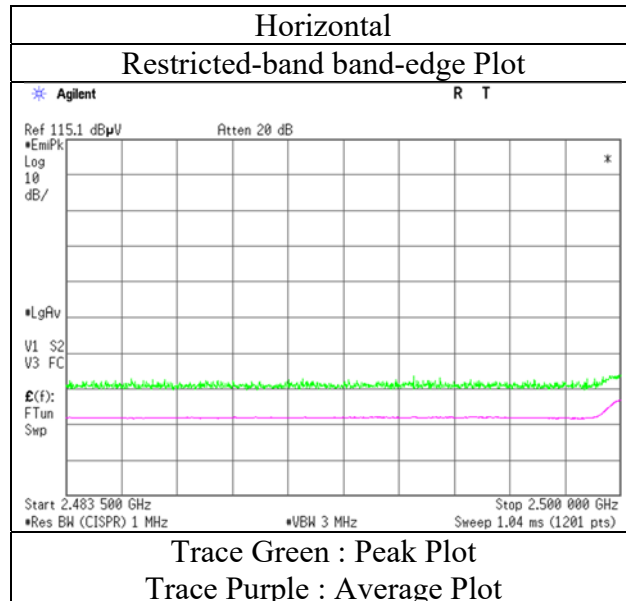
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (3.6 m / 3.0 m) = 1.59 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.	13828809H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	June 19, 2021
Temperature / Humidity	21 deg. C / 70 % RH
Engineer	Junki Nagatomi (1 GHz - 10 GHz)
Mode	Tx 11b 2462 MHz



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

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. 13828809H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date June 17, 2021 June 19, 2021
Temperature / Humidity 20 deg. C / 60 % RH 21 deg. C / 70 % RH
Engineer Junya Okuno Junki Nagatomi
(10 GHz - 26.5 GHz) (1 GHz - 10 GHz)
Mode Tx 11n-20 2412 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	1580.187	PK	62.3	25.3	4.1	35.1	-	56.5	73.9	17.4	Floor noise
Hori.	2390.000	PK	48.5	27.6	4.7	34.6	-	46.1	73.9	27.8	
Hori.	4824.000	PK	42.0	31.6	6.8	33.8	-	46.6	73.9	27.3	
Hori.	4999.842	PK	46.7	31.6	6.8	33.8	-	51.2	73.9	22.7	
Hori.	7236.000	PK	43.3	36.0	8.1	33.6	-	53.8	73.9	20.1	
Hori.	9648.000	PK	44.0	38.6	8.6	34.2	-	57.0	73.9	16.9	
Hori.	10000.000	PK	49.1	39.3	-2.5	34.3	-	51.6	73.9	22.3	
Hori.	1580.187	AV	50.9	25.3	4.1	35.1	-	45.1	53.9	8.8	*1) Floor noise
Hori.	2390.000	AV	36.7	27.6	4.7	34.6	2.6	37.0	53.9	16.9	
Hori.	4824.000	AV	33.8	31.6	6.8	33.8	-	38.4	53.9	15.5	
Hori.	4999.842	AV	41.8	31.6	6.8	33.8	-	46.3	53.9	7.6	
Hori.	7236.000	AV	34.7	36.0	8.1	33.6	-	45.2	53.9	8.7	
Hori.	9648.000	AV	34.9	38.6	8.6	34.2	-	47.9	53.9	6.0	
Hori.	10000.000	AV	45.4	39.3	-2.5	34.3	-	48.0	53.9	5.9	
Vert.	1580.187	PK	64.0	25.3	4.1	35.1	-	58.2	73.9	15.7	Floor noise
Vert.	2390.000	PK	48.1	27.6	4.7	34.6	-	45.7	73.9	28.2	
Vert.	4824.000	PK	42.6	31.6	6.8	33.8	-	47.2	73.9	26.7	
Vert.	4999.842	PK	46.8	31.6	6.8	33.8	-	51.3	73.9	22.6	
Vert.	7236.000	PK	43.5	36.0	8.1	33.6	-	54.0	73.9	19.9	
Vert.	9648.000	PK	43.5	38.6	8.6	34.2	-	56.5	73.9	17.4	
Vert.	10000.000	PK	47.3	39.3	-2.5	34.3	-	49.8	73.9	24.1	
Vert.	1580.187	AV	49.9	25.3	4.1	35.1	-	44.1	53.9	9.8	*1) Floor noise
Vert.	2390.000	AV	37.0	27.6	4.7	34.6	2.6	37.3	53.9	16.6	
Vert.	4824.000	AV	33.8	31.6	6.8	33.8	-	38.4	53.9	15.5	
Vert.	4999.842	AV	41.7	31.6	6.8	33.8	-	46.2	53.9	7.7	
Vert.	7236.000	AV	34.7	36.0	8.1	33.6	-	45.2	53.9	8.7	
Vert.	9648.000	AV	34.9	38.6	8.6	34.2	-	47.9	53.9	6.0	
Vert.	10000.000	AV	42.5	39.3	-2.5	34.3	-	45.1	53.9	8.8	

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 (3.6 m / 3.0 m) = 1.59 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

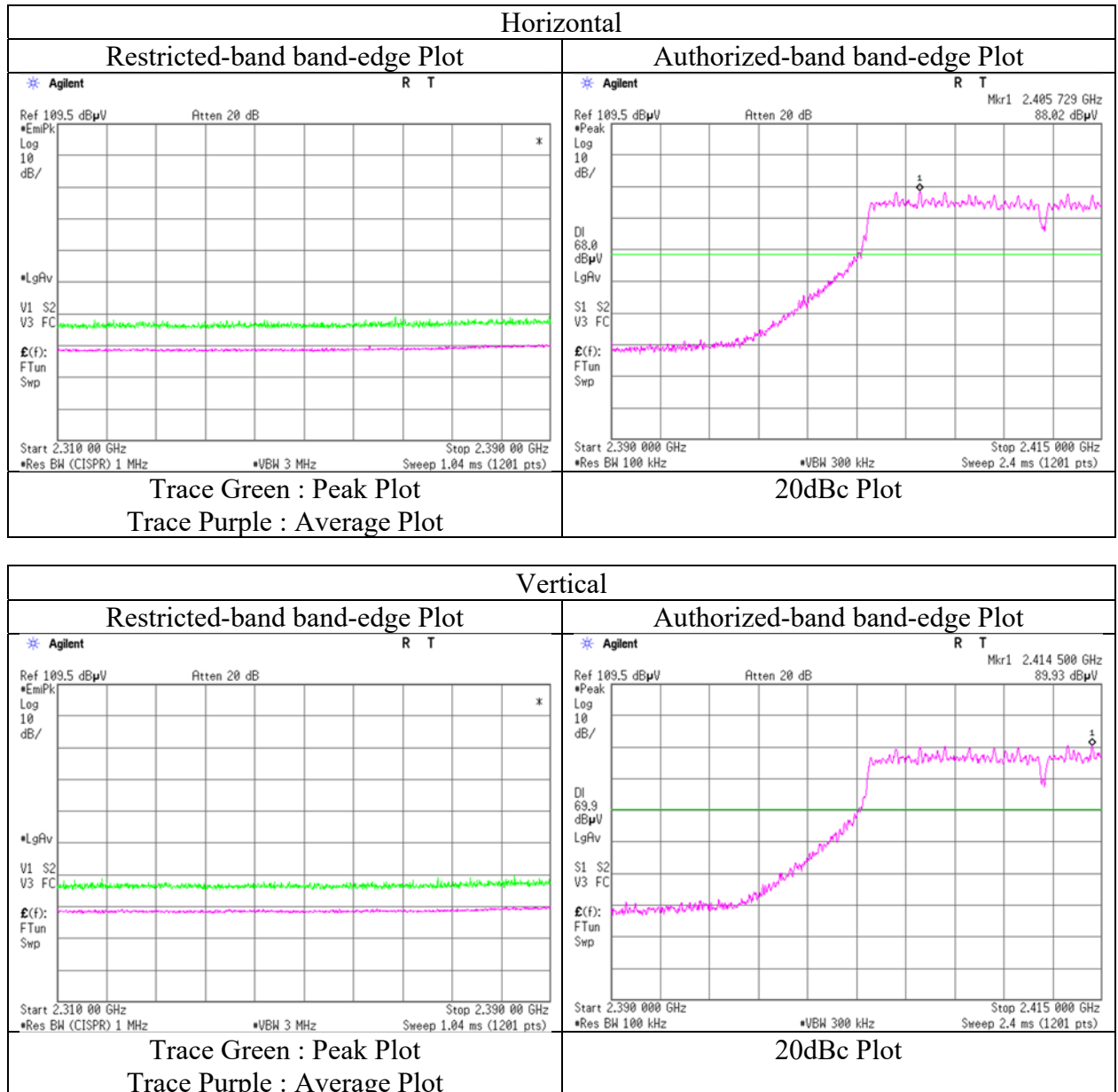
20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	88.0	27.5	4.7	34.6	85.6	-	-	Carrier
Hori.	2400.000	PK	54.7	27.6	4.7	34.6	52.3	65.6	13.3	
Vert.	2412.000	PK	89.9	27.5	4.7	34.6	87.5	-	-	Carrier
Vert.	2400.000	PK	55.3	27.6	4.7	34.6	52.9	67.5	14.6	

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

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13828809H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	June 19, 2021
Temperature / Humidity	21 deg. C / 70 % RH
Engineer	Junki Nagatomi
	(1 GHz - 10 GHz)
Mode	Tx 11n-20 2412 MHz



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

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. 13828809H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date June 17, 2021 June 19, 2021
Temperature / Humidity 20 deg. C / 60 % RH 21 deg. C / 70 % RH
Engineer Junya Okuno Junki Nagatomi
(Below 1GHz) (1 GHz - 10 GHz)
(10 GHz - 26.5 GHz)
Mode Tx 11n-20 2437 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	30.000	QP	22.0	18.5	6.7	28.5	-	18.8	40.0	21.2	
Hori.	106.956	QP	22.7	11.2	7.5	28.3	-	13.2	43.5	30.3	
Hori.	191.470	QP	25.4	16.0	8.1	27.9	-	21.6	43.5	21.9	
Hori.	214.691	QP	29.3	11.2	8.3	27.8	-	21.0	43.5	22.6	
Hori.	233.360	QP	32.4	11.3	8.4	27.7	-	24.4	46.0	21.6	
Hori.	913.958	QP	27.1	22.1	11.4	28.7	-	31.8	46.0	14.2	
Hori.	1579.987	PK	65.3	25.3	4.1	35.1	-	59.5	73.9	14.4	
Hori.	4874.000	PK	43.4	31.6	6.8	33.8	-	48.0	73.9	25.9	Floor noise
Hori.	5000.132	PK	47.5	31.6	6.8	33.8	-	52.1	73.9	21.8	
Hori.	7311.000	PK	43.7	36.2	8.1	33.6	-	54.4	73.9	19.5	Floor noise
Hori.	9748.000	PK	43.8	38.8	8.6	34.2	-	56.9	73.9	17.0	Floor noise
Hori.	10000.000	PK	48.8	39.3	-2.5	34.3	-	51.3	73.9	22.6	
Hori.	1579.987	AV	51.1	25.3	4.1	35.1	-	45.3	53.9	8.6	
Hori.	4874.000	AV	33.5	31.6	6.8	33.8	-	38.0	53.9	15.9	Floor noise
Hori.	5000.132	AV	41.7	31.6	6.8	33.8	-	46.2	53.9	7.7	
Hori.	7311.000	AV	33.8	36.2	8.1	33.6	-	44.5	53.9	9.4	Floor noise
Hori.	9748.000	AV	34.1	38.8	8.6	34.2	-	47.3	53.9	6.7	Floor noise
Hori.	10000.000	AV	45.3	39.3	-2.5	34.3	-	47.8	53.9	6.1	
Vert.	30.618	QP	23.5	18.3	6.7	28.5	-	20.0	40.0	20.0	
Vert.	106.956	QP	25.6	11.2	7.5	28.3	-	16.1	43.5	27.4	
Vert.	191.760	QP	22.6	16.0	8.1	27.9	-	18.8	43.5	24.7	
Vert.	214.688	QP	23.1	11.2	8.3	27.8	-	14.8	43.5	28.8	
Vert.	233.422	QP	25.5	11.3	8.4	27.7	-	17.5	46.0	28.5	
Vert.	913.969	QP	24.6	22.1	11.4	28.7	-	29.3	46.0	16.7	
Vert.	1579.987	PK	65.4	25.3	4.1	35.1	-	59.6	73.9	14.3	
Vert.	4874.000	PK	43.5	31.6	6.8	33.8	-	48.1	73.9	25.9	Floor noise
Vert.	5000.132	PK	47.2	31.6	6.8	33.8	-	51.7	73.9	22.2	
Vert.	7311.000	PK	43.4	36.2	8.1	33.6	-	54.0	73.9	19.9	Floor noise
Vert.	9748.000	PK	44.2	38.8	8.6	34.2	-	57.3	73.9	16.6	Floor noise
Vert.	10000.000	PK	46.9	39.3	-2.5	34.3	-	49.4	73.9	24.5	
Vert.	1579.987	AV	49.8	25.3	4.1	35.1	-	44.0	53.9	9.9	
Vert.	4874.000	AV	33.5	31.6	6.8	33.8	-	38.0	53.9	15.9	Floor noise
Vert.	5000.132	AV	41.0	31.6	6.8	33.8	-	45.5	53.9	8.4	
Vert.	7311.000	AV	33.8	36.2	8.1	33.6	-	44.5	53.9	9.4	Floor noise
Vert.	9748.000	AV	34.1	38.8	8.6	34.2	-	47.3	53.9	6.7	Floor noise
Vert.	10000.000	AV	42.8	39.3	-2.5	34.3	-	45.3	53.9	8.6	

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 $20\log(3.6\text{ m} / 3.0\text{ m}) = 1.59\text{ dB}$
10 GHz - 26.5 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission

Report No. 13828809H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date June 17, 2021 June 19, 2021
Temperature / Humidity 20 deg. C / 60 % RH 21 deg. C / 70 % RH
Engineer Junya Okuno Junki Nagatomi
(10 GHz - 26.5 GHz) (1 GHz - 10 GHz)
Mode Tx 11n-20 2462 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	1580.002	PK	64.1	25.3	4.1	35.1	-	58.3	73.9	15.6	
Hori.	2483.500	PK	48.6	27.4	4.7	34.6	-	46.2	73.9	27.8	
Hori.	2499.915	PK	47.4	27.4	4.7	34.6	-	45.0	73.9	29.0	
Hori.	4924.000	PK	42.2	31.5	6.8	33.8	-	46.7	73.9	27.2	Floor noise
Hori.	5000.034	PK	47.3	31.6	6.8	33.8	-	51.9	73.9	22.1	
Hori.	7386.000	PK	42.9	36.1	8.1	33.6	-	53.4	73.9	20.5	Floor noise
Hori.	9848.000	PK	43.3	39.0	8.6	34.3	-	56.6	73.9	17.3	Floor noise
Hori.	10000.000	PK	49.5	39.3	-2.5	34.3	-	52.0	73.9	21.9	
Hori.	1580.002	AV	51.0	25.3	4.1	35.1	-	45.2	53.9	8.7	
Hori.	2483.500	AV	38.2	27.4	4.7	34.6	2.6	38.4	53.9	15.5	*1)
Hori.	2499.915	AV	41.1	27.4	4.7	34.6	-	38.7	53.9	15.2	
Hori.	4924.000	AV	34.0	31.5	6.8	33.8	-	38.5	53.9	15.4	Floor noise
Hori.	5000.034	AV	42.0	31.6	6.8	33.8	-	46.5	53.9	7.4	
Hori.	7386.000	AV	34.3	36.1	8.1	33.6	-	44.8	53.9	9.1	Floor noise
Hori.	9848.000	AV	34.5	39.0	8.6	34.3	-	47.8	53.9	6.1	Floor noise
Hori.	10000.000	AV	45.3	39.3	-2.5	34.3	-	47.8	53.9	6.1	
Vert.	1580.002	PK	60.5	25.3	4.1	35.1	-	54.7	73.9	19.2	
Vert.	2483.500	PK	48.4	27.4	4.7	34.6	-	46.0	73.9	27.9	
Vert.	2499.915	PK	46.6	27.4	4.7	34.6	-	44.2	73.9	29.7	
Vert.	4924.000	PK	42.9	31.5	6.8	33.8	-	47.4	73.9	26.5	Floor noise
Vert.	5000.034	PK	47.4	31.6	6.8	33.8	-	51.9	73.9	22.0	
Vert.	7386.000	PK	42.7	36.1	8.1	33.6	-	53.2	73.9	20.7	Floor noise
Vert.	9848.000	PK	43.3	39.0	8.6	34.3	-	56.6	73.9	17.3	Floor noise
Vert.	10000.000	PK	47.0	39.3	-2.5	34.3	-	49.6	73.9	24.3	
Vert.	1580.002	AV	49.9	25.3	4.1	35.1	-	44.1	53.9	9.8	
Vert.	2483.500	AV	37.3	27.4	4.7	34.6	2.6	37.4	53.9	16.5	*1)
Vert.	2499.915	AV	40.1	27.4	4.7	34.6	-	37.7	53.9	16.2	
Vert.	4924.000	AV	34.0	31.5	6.8	33.8	-	38.5	53.9	15.4	Floor noise
Vert.	5000.034	AV	41.6	31.6	6.8	33.8	-	46.1	53.9	7.8	
Vert.	7386.000	AV	34.3	36.1	8.1	33.6	-	44.8	53.9	9.1	Floor noise
Vert.	9848.000	AV	34.5	39.0	8.6	34.3	-	47.8	53.9	6.1	Floor noise
Vert.	10000.000	AV	42.8	39.3	-2.5	34.3	-	45.4	53.9	8.6	

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

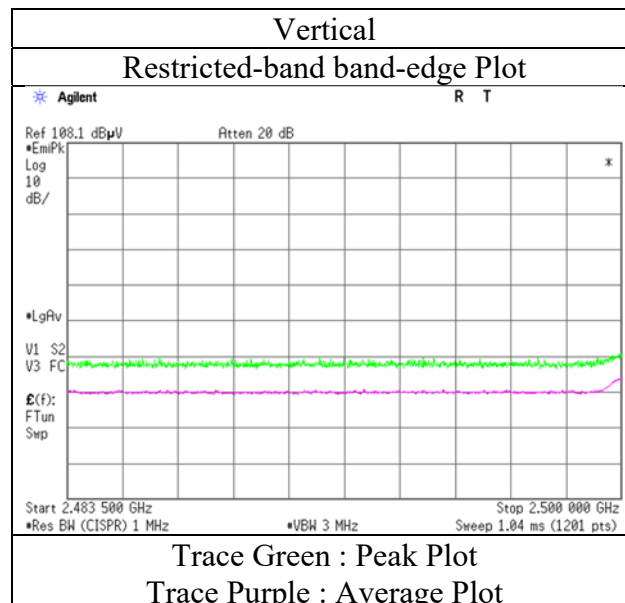
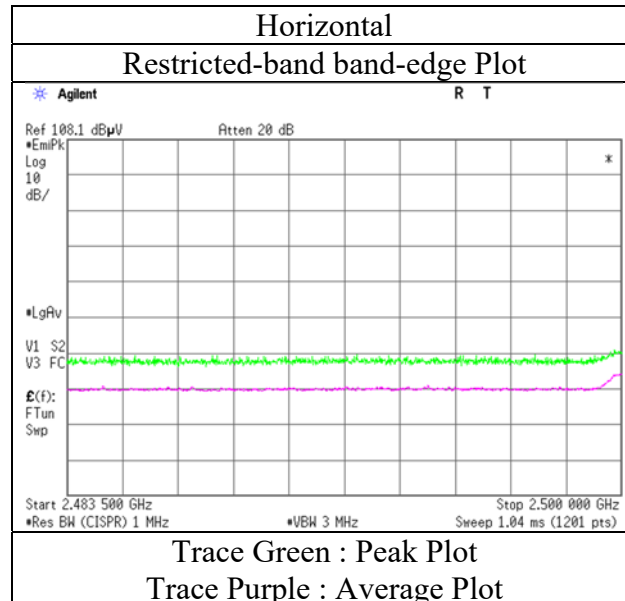
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Distance factor: 1 GHz - 10 GHz 20log (3.6 m / 3.0 m) = 1.59 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.	13828809H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	June 19, 2021
Temperature / Humidity	21 deg. C / 70 % RH
Engineer	Junki Nagatomi (1 GHz - 10 GHz)
Mode	Tx 11g 2462 MHz



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

UL Japan, Inc.

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. 13828809H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date June 11, 2021 No.2 June 13, 2021 No.2 June 17, 2021
Temperature / Humidity 19 deg. C / 54 % RH 24 deg. C / 66 % RH 21 deg. C / 67 % RH
Engineer Junya Okuno Hiroyuki Furutaka Junki Nagatomi
(1 GHz - 10 GHz) (10 GHz - 26.5 GHz) (30MHz - 1GHz)
Mode Tx BT LE 2402 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	30.000	QP	22.0	18.5	6.7	28.5	-	18.8	40.0	21.2	
Hori.	60.092	QP	23.8	7.8	7.1	28.4	-	10.3	40.0	29.7	
Hori.	212.000	QP	28.6	11.1	8.3	27.8	-	20.2	43.5	23.3	
Hori.	233.360	QP	30.7	11.3	8.4	27.7	-	22.7	46.0	23.3	
Hori.	610.970	QP	21.9	19.4	10.2	29.3	-	22.3	46.0	23.7	
Hori.	913.960	QP	26.1	22.1	11.4	28.7	-	30.8	46.0	15.2	
Hori.	1579.101	PK	60.6	25.3	4.1	35.1	-	54.8	73.9	19.1	
Hori.	2390.000	PK	44.5	27.6	4.7	34.6	-	42.2	73.9	31.7	
Hori.	4804.000	PK	42.2	31.6	6.8	33.7	-	46.8	73.9	27.1	Floor noise
Hori.	5000.000	PK	48.4	31.6	6.8	33.8	-	53.0	73.9	20.9	
Hori.	7206.000	PK	43.0	35.8	8.1	33.6	-	53.4	73.9	20.5	Floor noise
Hori.	9608.000	PK	42.4	38.6	8.6	34.2	-	55.3	73.9	18.6	Floor noise
Hori.	10000.000	PK	48.4	39.3	-2.5	34.3	-	50.9	73.9	23.0	
Hori.	1579.101	AV	50.3	25.3	4.1	35.1	-	44.5	53.9	9.4	
Hori.	2390.000	AV	35.6	27.6	4.7	34.6	1.7	35.0	53.9	18.9	*1)
Hori.	4804.000	AV	34.1	31.6	6.8	33.7	-	38.7	53.9	15.2	Floor noise
Hori.	5000.000	AV	44.8	31.6	6.8	33.8	-	49.3	53.9	4.6	
Hori.	7206.000	AV	34.8	35.8	8.1	33.6	-	45.2	53.9	8.7	Floor noise
Hori.	9608.000	AV	34.8	38.6	8.6	34.2	-	47.7	53.9	6.2	Floor noise
Hori.	10000.000	AV	44.3	39.3	-2.5	34.3	-	46.8	53.9	7.1	
Vert.	30.000	QP	22.6	18.5	6.7	28.5	-	19.4	40.0	20.6	
Vert.	61.420	QP	25.7	7.5	7.1	28.4	-	11.9	40.0	28.1	
Vert.	213.120	QP	21.7	11.1	8.3	27.8	-	13.3	43.5	30.2	
Vert.	232.610	QP	24.6	11.3	8.4	27.7	-	16.6	46.0	29.4	
Vert.	602.040	QP	22.5	19.3	10.2	29.3	-	22.8	46.0	23.2	
Vert.	913.960	QP	25.0	22.1	11.4	28.7	-	29.7	46.0	16.3	
Vert.	1579.983	PK	61.5	25.3	4.1	35.1	-	55.7	73.9	18.2	
Vert.	2390.000	PK	45.3	27.6	4.7	34.6	-	43.0	73.9	30.9	
Vert.	4804.000	PK	42.9	31.6	6.8	33.7	-	47.5	73.9	26.4	Floor noise
Vert.	5000.000	PK	49.5	31.6	6.8	33.8	-	54.0	73.9	19.9	
Vert.	7206.000	PK	42.9	35.8	8.1	33.6	-	53.3	73.9	20.6	Floor noise
Vert.	9608.000	PK	43.1	38.6	8.6	34.2	-	56.0	73.9	17.9	Floor noise
Vert.	10000.000	PK	47.0	39.3	-2.5	34.3	-	49.5	73.9	24.4	
Vert.	1579.983	AV	52.4	25.3	4.1	35.1	-	46.6	53.9	7.3	
Vert.	2390.000	AV	35.8	27.6	4.7	34.6	1.7	35.2	53.9	18.8	*1)
Vert.	4804.000	AV	34.0	31.6	6.8	33.7	-	38.6	53.9	15.3	Floor noise
Vert.	5000.000	AV	46.2	31.6	6.8	33.8	-	50.7	53.9	3.2	
Vert.	7206.000	AV	34.5	35.8	8.1	33.6	-	44.8	53.9	9.1	Floor noise
Vert.	9608.000	AV	34.5	38.6	8.6	34.2	-	47.4	53.9	6.5	Floor noise
Vert.	10000.000	AV	41.0	39.3	-2.5	34.3	-	43.5	53.9	10.4	

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 $20\log(3.6\text{ m} / 3.0\text{ m}) = 1.59\text{ dB}$
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	94.2	27.5	4.7	34.6	91.8	-	-	Carrier
Hori.	2400.000	PK	40.3	27.6	4.7	34.6	37.9	71.8	33.9	Carrier
Vert.	2402.000	PK	94.9	27.5	4.7	34.6	92.5	-	-	Carrier
Vert.	2400.000	PK	40.4	27.6	4.7	34.6	38.1	72.5	34.4	

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

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Ise EMC Lab.

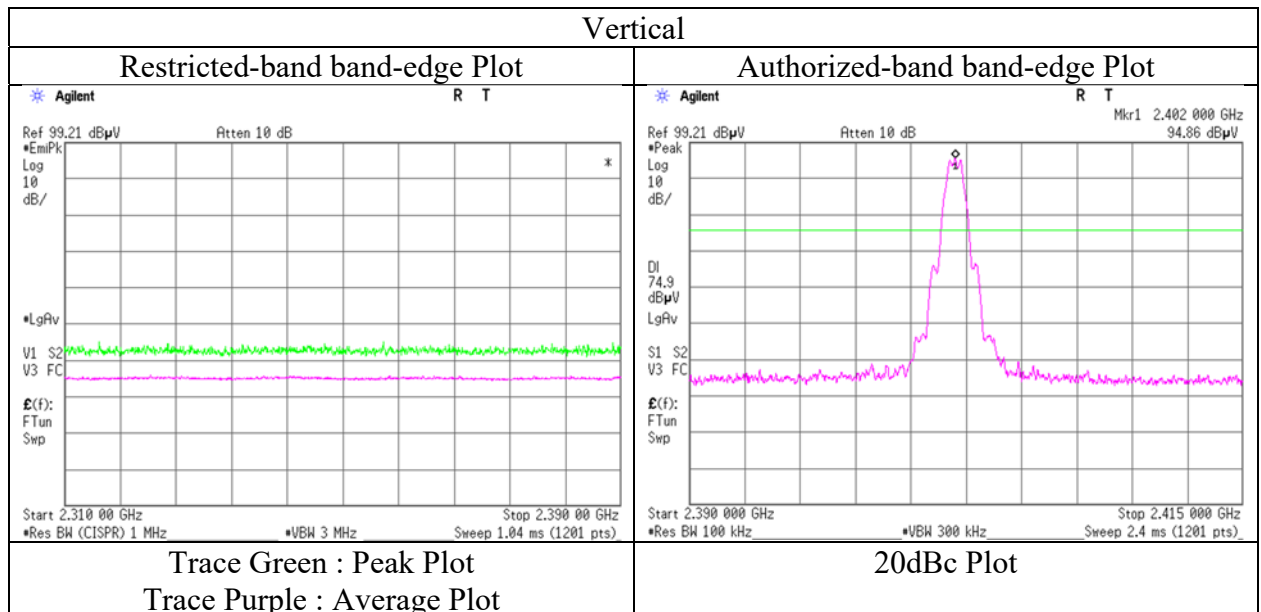
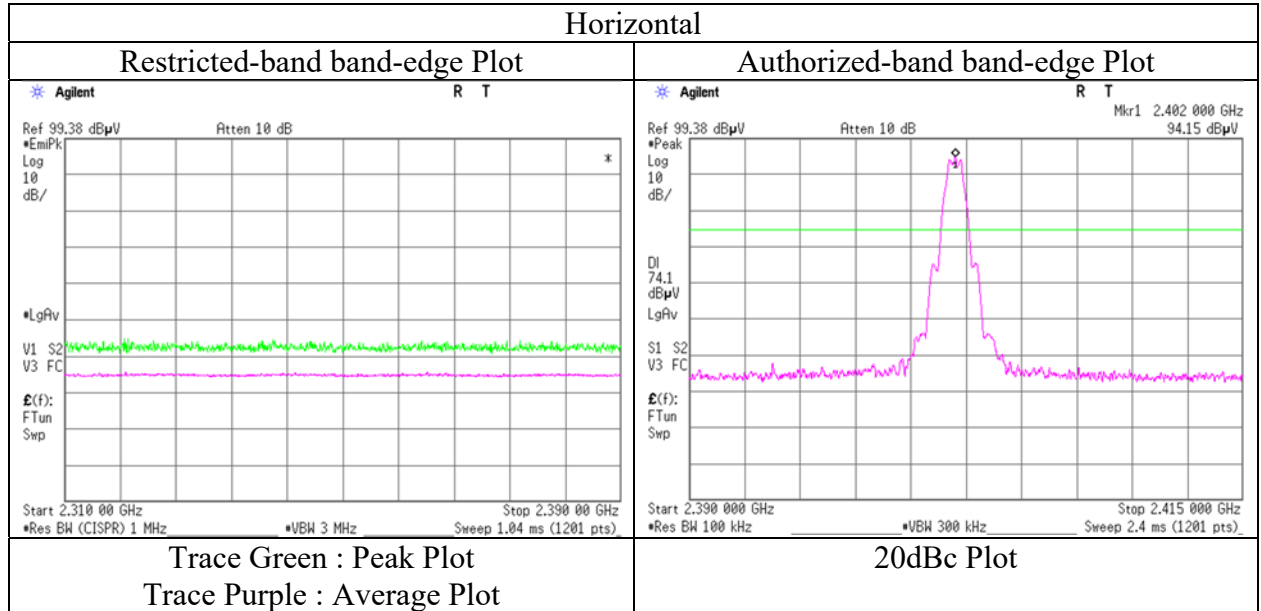
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13828809H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	June 11, 2021
Temperature / Humidity	19 deg. C / 54 % RH
Engineer	Junya Okuno
	(1 GHz - 10 GHz)
Mode	Tx BT LE 2402 MHz



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

UL Japan, Inc.

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Radiated Spurious Emission

Report No.	13828809H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	June 11, 2021	June 13, 2021	June 17, 2021
Temperature / Humidity	19 deg. C / 54 % RH	24 deg. C / 66 % RH	21 deg. C / 67 % RH
Engineer	Junya Okuno	Hiroyuki Furutaka	Junki Nagatomi
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)	(30MHz - 1GHz)
Mode	Tx BT LE 2440 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	33.120	QP	21.9	17.4	6.8	28.5	-	17.6	40.0	22.4	
Hori.	64.920	QP	23.0	6.7	7.1	28.4	-	8.5	40.0	31.5	
Hori.	83.780	QP	22.6	7.0	7.3	28.4	-	8.6	40.0	31.4	
Hori.	217.130	QP	29.0	11.2	8.3	27.8	-	20.7	46.0	25.3	
Hori.	233.320	QP	30.6	11.3	8.4	27.7	-	22.6	46.0	23.4	
Hori.	913.970	QP	26.5	22.1	11.4	28.7	-	31.2	46.0	14.8	
Hori.	1579.983	PK	58.8	25.3	4.1	35.1	-	53.0	73.9	20.9	
Hori.	4880.000	PK	43.4	31.6	6.8	33.8	-	47.9	73.9	26.0	Floor noise
Hori.	5000.000	PK	49.1	31.6	6.8	33.8	-	53.6	73.9	20.3	
Hori.	7320.000	PK	43.7	36.2	8.1	33.6	-	54.4	73.9	19.5	Floor noise
Hori.	9760.000	PK	43.4	38.8	8.6	34.2	-	56.6	73.9	17.3	Floor noise
Hori.	10000.000	PK	48.2	39.3	-2.5	34.3	-	50.7	73.9	23.2	
Hori.	1579.983	AV	51.7	25.3	4.1	35.1	-	45.9	53.9	8.0	
Hori.	4880.000	AV	34.5	31.6	6.8	33.8	-	39.1	53.9	14.8	Floor noise
Hori.	5000.000	AV	44.6	31.6	6.8	33.8	-	49.1	53.9	4.8	
Hori.	7320.000	AV	34.6	36.2	8.1	33.6	-	45.3	53.9	8.6	Floor noise
Hori.	9760.000	AV	34.4	38.8	8.6	34.2	-	47.6	53.9	6.3	Floor noise
Hori.	10000.000	AV	44.2	39.3	-2.5	34.3	-	46.7	53.9	7.2	
Vert.	30.560	QP	24.1	18.3	6.7	28.5	-	20.7	40.0	19.4	
Vert.	61.480	QP	25.0	7.5	7.1	28.4	-	11.2	40.0	28.8	
Vert.	83.400	QP	26.4	7.0	7.3	28.4	-	12.4	40.0	27.6	
Vert.	207.460	QP	24.7	11.2	8.3	27.9	-	16.3	43.5	27.2	
Vert.	232.190	QP	25.3	11.3	8.4	27.7	-	17.3	46.0	28.7	
Vert.	913.930	QP	23.5	22.1	11.4	28.7	-	28.2	46.0	17.8	
Vert.	1579.983	PK	57.2	25.3	4.1	35.1	-	51.4	73.9	22.5	
Vert.	4880.000	PK	43.0	31.6	6.8	33.8	-	47.6	73.9	26.3	Floor noise
Vert.	5000.000	PK	48.2	31.6	6.8	33.8	-	52.8	73.9	21.1	
Vert.	7320.000	PK	43.6	36.2	8.1	33.6	-	54.2	73.9	19.7	Floor noise
Vert.	9760.000	PK	43.5	38.8	8.6	34.2	-	56.7	73.9	17.2	Floor noise
Vert.	10000.000	PK	47.1	39.3	-2.5	34.3	-	49.6	73.9	24.3	
Vert.	1579.983	AV	51.7	25.3	4.1	35.1	-	45.9	53.9	8.0	
Vert.	4880.000	AV	34.5	31.6	6.8	33.8	-	39.0	53.9	14.9	Floor noise
Vert.	5000.000	AV	44.8	31.6	6.8	33.8	-	49.3	53.9	4.6	
Vert.	7320.000	AV	34.3	36.2	8.1	33.6	-	45.0	53.9	8.9	Floor noise
Vert.	9760.000	AV	34.6	38.8	8.6	34.2	-	47.8	53.9	6.1	Floor noise
Vert.	10000.000	AV	41.1	39.3	-2.5	34.3	-	43.6	53.9	10.3	

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 (3.6 m / 3.0 m) = 1.59 dB
 10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

UL Japan, Inc.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No.	13828809H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.2
Date	June 11, 2021	June 13, 2021	June 17, 2021
Temperature / Humidity	19 deg. C / 54 % RH	24 deg. C / 66 % RH	21 deg. C / 67 % RH
Engineer	Junya Okuno	Hiroyuki Furutaka	Junki Nagatomi
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)	(30MHz - 1GHz)
Mode	Tx BT LE 2480 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	35.000	QP	21.9	16.7	6.8	28.5	-	16.9	40.0	23.1	
Hori.	60.000	QP	25.6	7.8	7.1	28.4	-	12.1	40.0	27.9	
Hori.	92.121	QP	25.4	8.6	7.4	28.3	-	13.0	43.5	30.5	
Hori.	214.530	QP	29.4	11.2	8.3	27.8	-	21.1	43.5	22.5	
Hori.	233.490	QP	29.8	11.3	8.4	27.7	-	21.8	46.0	24.2	
Hori.	914.540	QP	24.3	22.1	11.4	28.7	-	29.0	46.0	17.0	
Hori.	1579.983	PK	58.6	25.3	4.1	35.1	-	52.8	73.9	21.1	
Hori.	2483.500	PK	48.7	27.4	4.7	34.6	-	46.3	73.9	27.7	
Hori.	2500.000	PK	44.9	27.4	4.7	34.6	-	42.4	73.9	31.5	
Hori.	4960.000	PK	42.6	31.6	6.8	33.8	-	47.2	73.9	26.7	Floor noise
Hori.	5000.000	PK	46.6	31.6	6.8	33.8	-	51.2	73.9	22.7	
Hori.	7440.000	PK	42.9	36.0	8.1	33.7	-	53.4	73.9	20.5	Floor noise
Hori.	9920.000	PK	43.4	38.9	8.6	34.3	-	56.7	73.9	17.2	Floor noise
Hori.	10000.000	PK	48.4	39.3	-2.5	34.3	-	50.9	73.9	23.0	
Hori.	1579.983	AV	51.4	25.3	4.1	35.1	-	45.6	53.9	8.3	
Hori.	2483.500	AV	35.8	27.4	4.7	34.6	1.7	35.1	53.9	18.8	*1)
Hori.	2500.000	AV	37.5	27.4	4.7	34.6	-	35.1	53.9	18.9	
Hori.	4960.000	AV	34.0	31.6	6.8	33.8	-	38.5	53.9	15.4	Floor noise
Hori.	5000.000	AV	44.2	31.6	6.8	33.8	-	48.8	53.9	5.2	
Hori.	7440.000	AV	34.8	36.0	8.1	33.7	-	45.3	53.9	8.6	Floor noise
Hori.	9920.000	AV	34.4	38.9	8.6	34.3	-	47.7	53.9	6.2	Floor noise
Hori.	10000.000	AV	44.3	39.3	-2.5	34.3	-	46.8	53.9	7.1	
Vert.	30.021	QP	22.0	18.5	6.7	28.5	-	18.8	40.0	21.3	
Vert.	60.216	QP	23.6	7.8	7.1	28.4	-	10.1	40.0	29.9	
Vert.	83.196	QP	27.6	7.0	7.3	28.4	-	13.5	40.0	26.5	
Vert.	207.550	QP	24.9	11.2	8.3	27.9	-	16.5	43.5	27.0	
Vert.	234.100	QP	24.8	11.3	8.4	27.7	-	16.8	46.0	29.2	
Vert.	913.960	QP	25.1	22.1	11.4	28.7	-	29.8	46.0	16.2	
Vert.	1579.983	PK	57.2	25.3	4.1	35.1	-	51.4	73.9	22.5	
Vert.	2483.500	PK	49.6	27.4	4.7	34.6	-	47.1	73.9	26.8	
Vert.	2500.000	PK	46.6	27.4	4.7	34.6	-	44.2	73.9	29.7	
Vert.	4960.000	PK	42.5	31.6	6.8	33.8	-	47.1	73.9	26.8	Floor noise
Vert.	5000.000	PK	47.1	31.6	6.8	33.8	-	51.6	73.9	22.3	
Vert.	7440.000	PK	43.8	36.0	8.1	33.7	-	54.3	73.9	19.6	Floor noise
Vert.	9920.000	PK	42.1	38.9	8.6	34.3	-	55.5	73.9	18.5	Floor noise
Vert.	10000.000	PK	47.3	39.3	-2.5	34.3	-	49.8	73.9	24.1	
Vert.	1579.983	AV	51.4	25.3	4.1	35.1	-	45.6	53.9	8.3	
Vert.	2483.500	AV	36.3	27.4	4.7	34.6	1.7	35.6	53.9	18.3	*1)
Vert.	2500.000	AV	40.3	27.4	4.7	34.6	-	37.9	53.9	16.0	
Vert.	4960.000	AV	33.9	31.6	6.8	33.8	-	38.4	53.9	15.5	Floor noise
Vert.	5000.000	AV	44.4	31.6	6.8	33.8	-	48.9	53.9	5.0	
Vert.	7440.000	AV	34.8	36.0	8.1	33.7	-	45.2	53.9	8.7	Floor noise
Vert.	9920.000	AV	34.6	38.9	8.6	34.3	-	47.9	53.9	6.0	Floor noise
Vert.	10000.000	AV	41.3	39.3	-2.5	34.3	-	43.8	53.9	10.1	

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 (3.6 m / 3.0 m) = 1.59 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

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

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Ise EMC Lab.

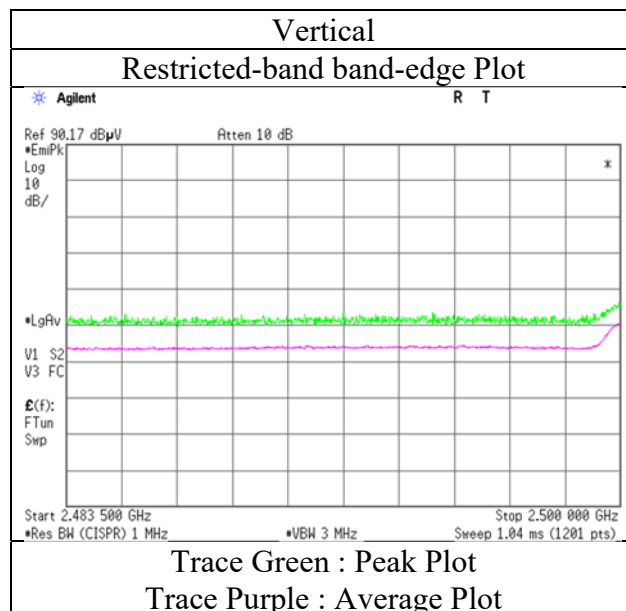
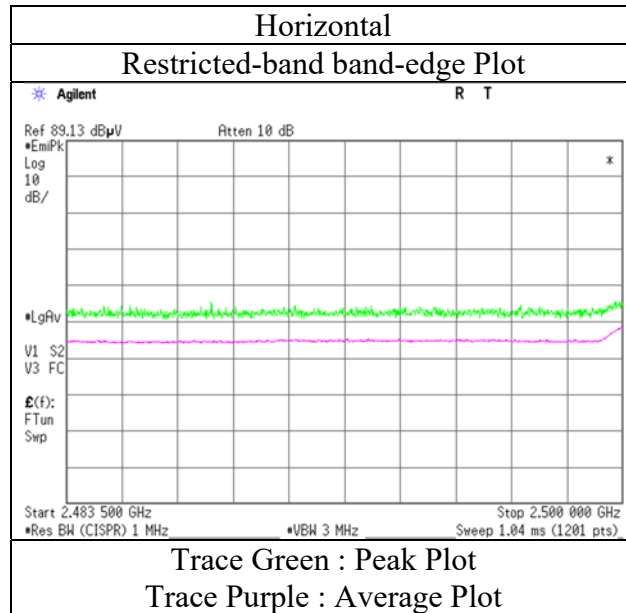
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13828809H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	June 11, 2021
Temperature / Humidity	19 deg. C / 54 % RH
Engineer	Junya Okuno
	(1 GHz - 10 GHz)
Mode	Tx BT LE 2480 MHz



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

UL Japan, Inc.

Ise EMC Lab.

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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No. 13828809H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date October 18, 2021
Temperature / Humidity 21 deg. C / 46 % RH
Engineer Junki Nagatomi
(1 GHz - 10 GHz)
Mode Tx BT LE 2402 MHz + 11a 5180 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	1579.948	PK	63.8	25.1	4.0	35.1	-	57.7	73.9	16.2	
Hori.	2390.000	PK	47.6	27.5	4.6	34.6	-	45.2	73.9	28.7	
Hori.	5000.000	PK	45.9	31.8	6.9	33.8	-	50.8	73.9	23.1	
Hori.	1579.948	AV	48.6	25.1	4.0	35.1	-	42.6	53.9	11.3	
Hori.	2390.000	AV	35.5	27.5	4.6	34.6	1.7	34.8	53.9	19.1	*1)
Hori.	5000.000	AV	39.8	31.8	6.9	33.8	-	44.7	53.9	9.2	
Vert.	1579.948	PK	62.5	25.1	4.0	35.1	-	56.4	73.9	17.5	
Vert.	2390.000	PK	45.8	27.5	4.6	34.6	-	43.3	73.9	30.6	
Vert.	5000.000	PK	45.8	31.8	6.9	33.8	-	50.7	73.9	23.2	
Vert.	1579.948	AV	51.1	25.1	4.0	35.1	-	45.1	53.9	8.8	
Vert.	2390.000	AV	35.6	27.5	4.6	34.6	1.7	34.9	53.9	19.0	*1)
Vert.	5000.000	AV	39.4	31.8	6.9	33.8	-	44.3	53.9	9.6	

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 $20\log(3.6\text{ m} / 3.0\text{ m}) = 1.59\text{ dB}$
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)

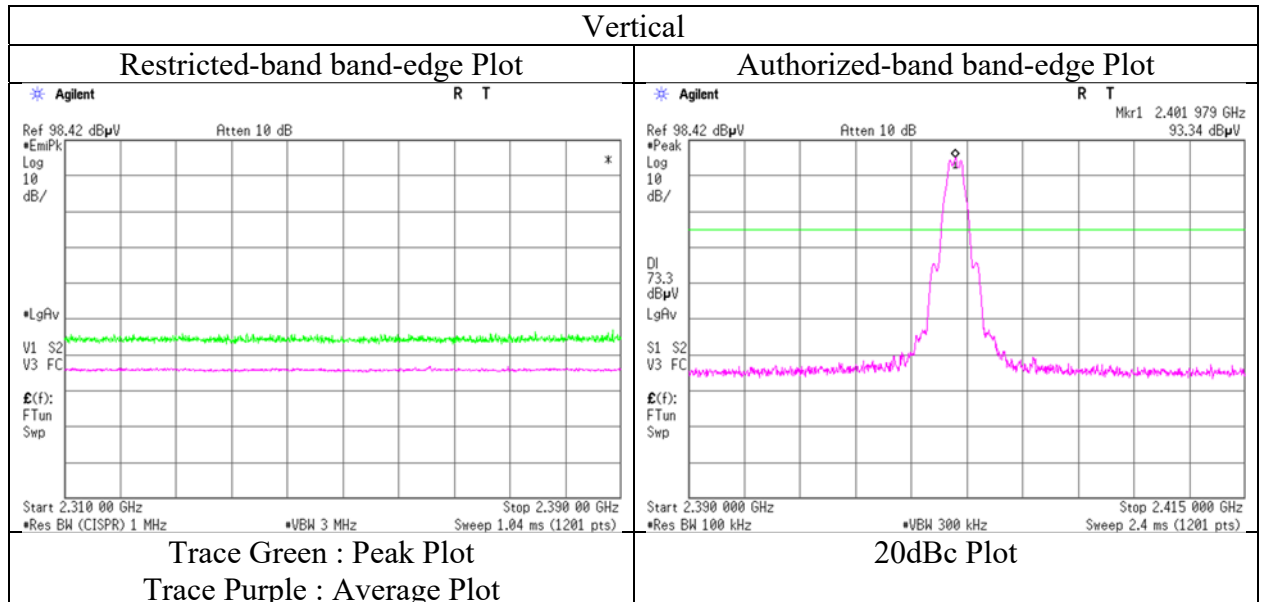
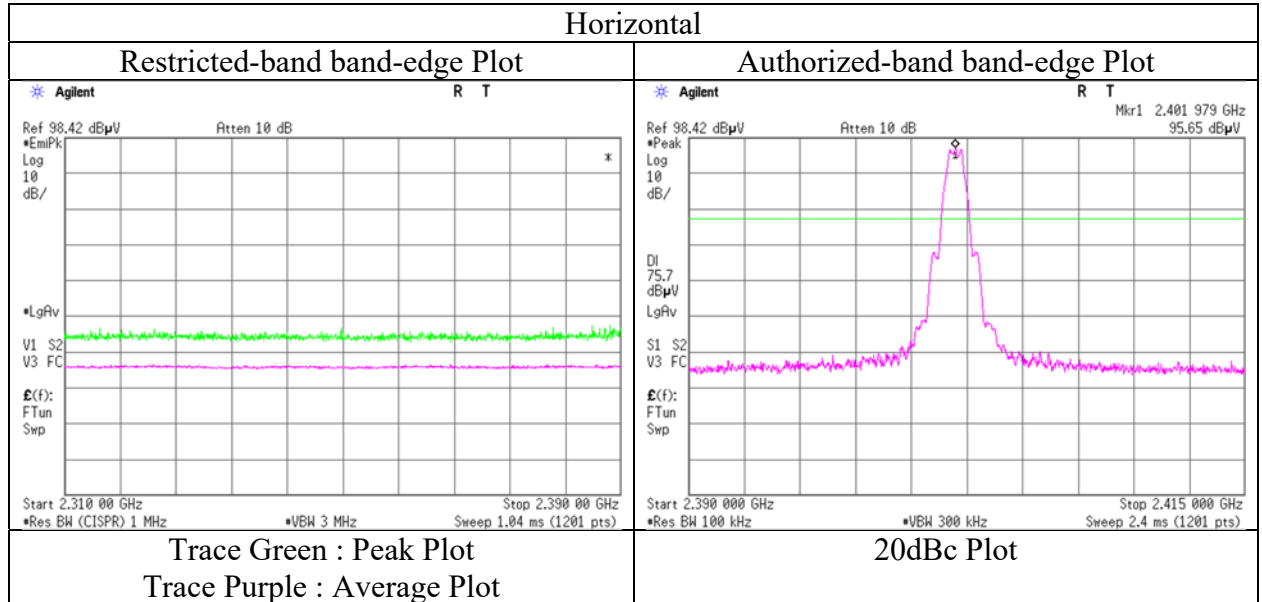
20dBc Data Sheet

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	95.7	27.5	4.6	34.6	93.2	-	-	Carrier
Hori.	2400.000	PK	41.4	27.5	4.6	34.6	38.9	73.2	34.3	
Vert.	2402.000	PK	93.3	27.5	4.6	34.6	90.8	-	-	Carrier
Vert.	2400.000	PK	40.5	27.5	4.6	34.6	38.0	70.8	32.8	

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

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	13828809H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	October 18, 2021
Temperature / Humidity	21 deg. C / 46 % RH
Engineer	Junki Nagatomi
	(1 GHz - 10 GHz)
Mode	Tx BT LE 2402 MHz + 11a 5180 MHz



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

UL Japan, Inc.

Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission

Report No.	13828809H		
Test place	Ise EMC Lab.		
Semi Anechoic Chamber	No.2	No.2	No.3
Date	October 18, 2021	October 18, 2021	October 19, 2021
Temperature / Humidity	21 deg. C / 46 % RH	22 deg. C / 53 % RH	23 deg. C / 55 % RH
Engineer	Junki Nagatomi	Hiroki Numata	Kiyoshiro Okazaki
	(1 GHz - 10 GHz)	(10 GHz - 26.5 GHz)	(30MHz - 1GHz)
Mode	Tx BT LE 2440 MHz + 11a 5180 MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	31.935	QP	22.6	17.9	7.1	32.3	-	15.3	40.0	24.7	
Hori.	134.854	QP	24.3	14.2	8.5	32.2	-	14.8	43.5	28.7	
Hori.	198.641	QP	29.0	16.8	9.2	32.2	-	22.8	43.5	20.8	
Hori.	214.392	QP	33.0	11.7	9.3	32.2	-	21.8	43.5	21.7	
Hori.	238.348	QP	29.9	12.1	9.5	32.1	-	19.4	46.0	26.6	
Hori.	911.377	QP	21.6	22.3	13.6	30.9	-	26.6	46.0	19.4	
Hori.	1579.948	PK	63.9	25.1	4.0	35.1	-	57.8	73.9	16.1	
Hori.	4880.000	PK	44.7	31.5	6.9	33.8	-	49.3	73.9	24.6	
Hori.	5000.000	PK	45.9	31.8	6.9	33.8	-	50.8	73.9	23.1	
Hori.	7320.000	PK	43.8	36.2	8.3	33.6	-	54.7	73.9	19.2	Floor noise
Hori.	9760.000	PK	45.1	39.0	8.9	34.2	-	58.7	73.9	15.2	Floor noise
Hori.	10000.000	PK	47.3	39.2	-2.6	34.3	-	49.6	73.9	24.3	
Hori.	1579.948	AV	48.7	25.1	4.0	35.1	-	42.7	53.9	11.3	
Hori.	4880.000	AV	35.4	31.5	6.9	33.8	1.7	41.7	53.9	12.2	
Hori.	5000.000	AV	39.8	31.8	6.9	33.8	-	44.7	53.9	9.2	
Hori.	7320.000	AV	34.5	36.2	8.3	33.6	-	45.4	53.9	8.5	Floor noise
Hori.	9760.000	AV	34.2	39.0	8.9	34.2	-	47.9	53.9	6.0	Floor noise
Hori.	10000.000	AV	42.2	39.2	-2.6	34.3	-	44.5	53.9	9.4	
Vert.	31.935	QP	26.0	17.9	7.1	32.3	-	18.7	40.0	21.3	
Vert.	134.854	QP	22.5	14.2	8.5	32.2	-	13.0	43.5	30.5	
Vert.	198.641	QP	23.1	16.8	9.2	32.2	-	16.9	43.5	26.7	
Vert.	214.392	QP	32.0	11.7	9.3	32.2	-	20.8	43.5	22.7	
Vert.	238.348	QP	28.8	12.1	9.5	32.1	-	18.3	46.0	27.7	
Vert.	911.377	QP	21.8	22.3	13.6	30.9	-	26.8	46.0	19.2	
Vert.	1579.948	PK	62.3	25.1	4.0	35.1	-	56.2	73.9	17.7	
Vert.	4880.000	PK	44.8	31.5	6.9	33.8	-	49.3	73.9	24.6	
Vert.	5000.000	PK	45.6	31.8	6.9	33.8	-	50.5	73.9	23.4	
Vert.	7320.000	PK	43.9	36.2	8.3	33.6	-	54.8	73.9	19.1	Floor noise
Vert.	9760.000	PK	44.2	39.0	8.9	34.2	-	57.9	73.9	16.0	Floor noise
Vert.	10000.000	PK	45.4	39.2	-2.6	34.3	-	47.7	73.9	26.2	
Vert.	1579.948	AV	51.0	25.1	4.0	35.1	-	45.0	53.9	9.0	
Vert.	4880.000	AV	35.7	31.5	6.9	33.8	1.7	42.0	53.9	11.9	
Vert.	5000.000	AV	39.3	31.8	6.9	33.8	-	44.2	53.9	9.7	
Vert.	7320.000	AV	34.5	36.2	8.3	33.6	-	45.4	53.9	8.5	Floor noise
Vert.	9760.000	AV	34.2	39.0	8.9	34.2	-	47.9	53.9	6.0	Floor noise
Vert.	10000.000	AV	40.2	39.2	-2.6	34.3	-	42.5	53.9	11.4	

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 (3.6 m / 3.0 m) = 1.59 dB
10 GHz - 26.5 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No. 13828809H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date October 18, 2021
Temperature / Humidity 21 deg. C / 46 % RH
Engineer Junki Nagatomi
(1 GHz - 10 GHz)
Mode Tx BT LE 2480 MHz + 11a 5180 MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	1579.948	PK	63.9	25.1	4.0	35.1	-	57.8	73.9	16.1	
Hori.	2483.500	PK	52.1	27.3	4.7	34.6	-	49.6	73.9	24.4	
Hori.	5000.000	PK	45.9	31.8	6.9	33.8	-	50.8	73.9	23.1	
Hori.	1579.948	AV	48.7	25.1	4.0	35.1	-	42.6	53.9	11.3	*1)
Hori.	2483.500	AV	37.4	27.3	4.7	34.6	1.7	36.6	53.9	17.3	
Hori.	5000.000	AV	39.8	31.8	6.9	33.8	-	44.7	53.9	9.2	
Vert.	1579.948	PK	62.2	25.1	4.0	35.1	-	56.1	73.9	17.8	
Vert.	2483.500	PK	50.1	27.3	4.7	34.6	-	47.5	73.9	26.4	
Vert.	5000.000	PK	45.6	31.8	6.9	33.8	-	50.5	73.9	23.4	
Vert.	1579.948	AV	51.1	25.1	4.0	35.1	-	45.0	53.9	8.9	*1)
Vert.	2483.500	AV	36.5	27.3	4.7	34.6	1.7	35.7	53.9	18.3	
Vert.	5000.000	AV	39.3	31.8	6.9	33.8	-	44.2	53.9	9.7	

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).

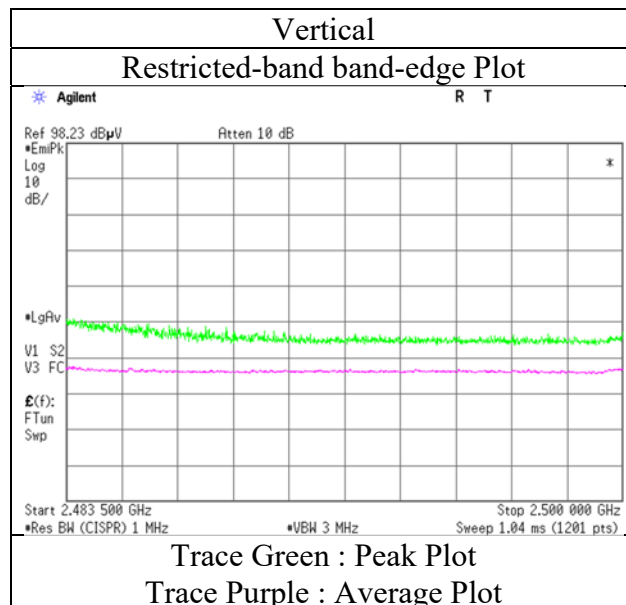
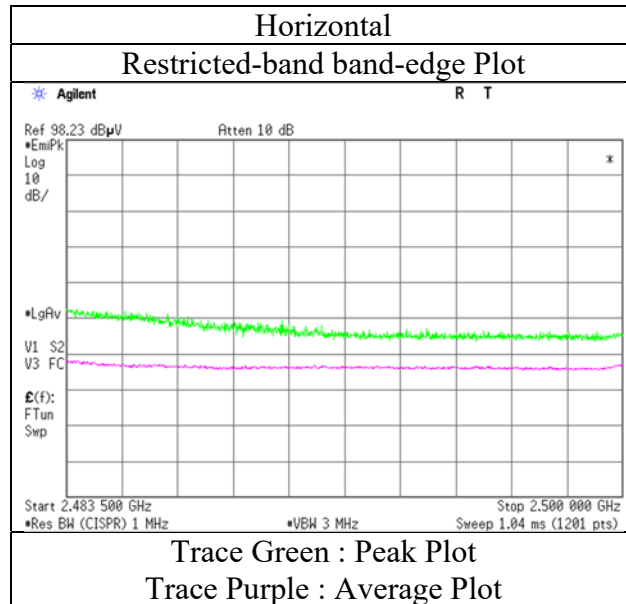
Distance factor: 1 GHz - 10 GHz $20\log(3.6\text{ m} / 3.0\text{ m}) = 1.59\text{ dB}$

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.	13828809H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	October 18, 2021
Temperature / Humidity	21 deg. C / 46 % RH
Engineer	Junki Nagatomi
	(1 GHz - 10 GHz)
Mode	Tx BT LE 2480 MHz + 11a 5180 MHz



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

UL Japan, Inc.

Ise EMC Lab.

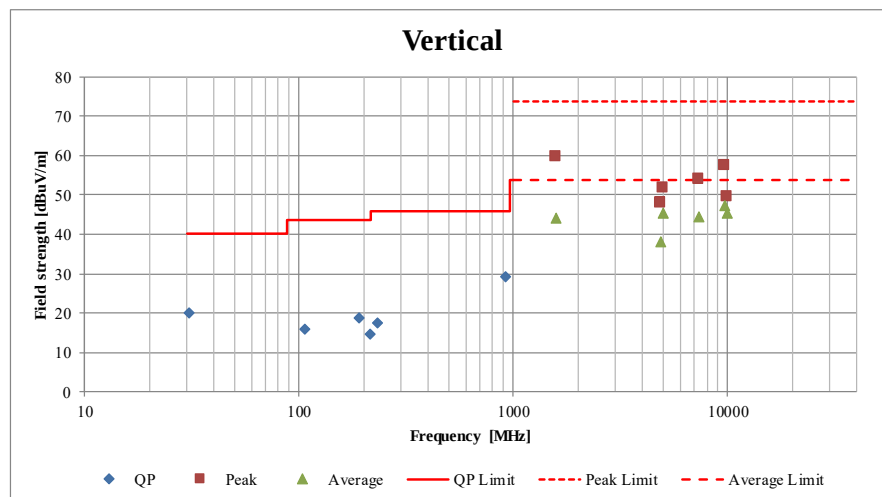
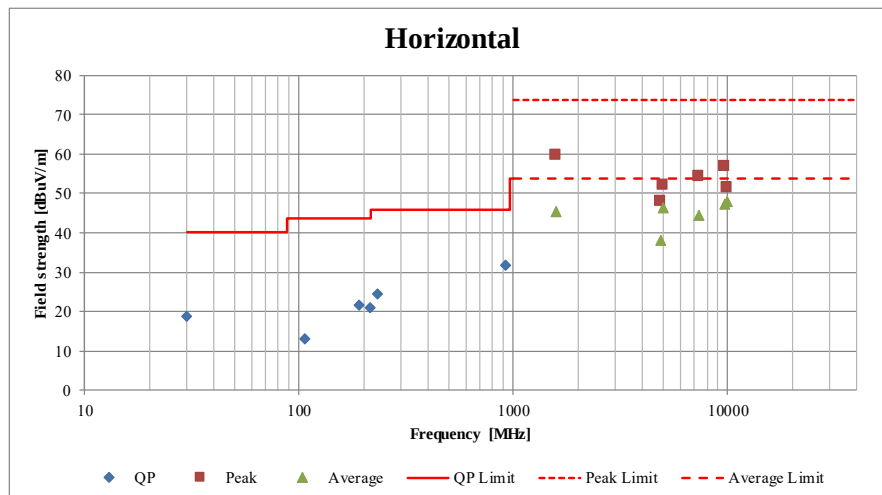
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Facsimile : +81 596 24 8124

Radiated Spurious Emission (Plot data, Worst case)

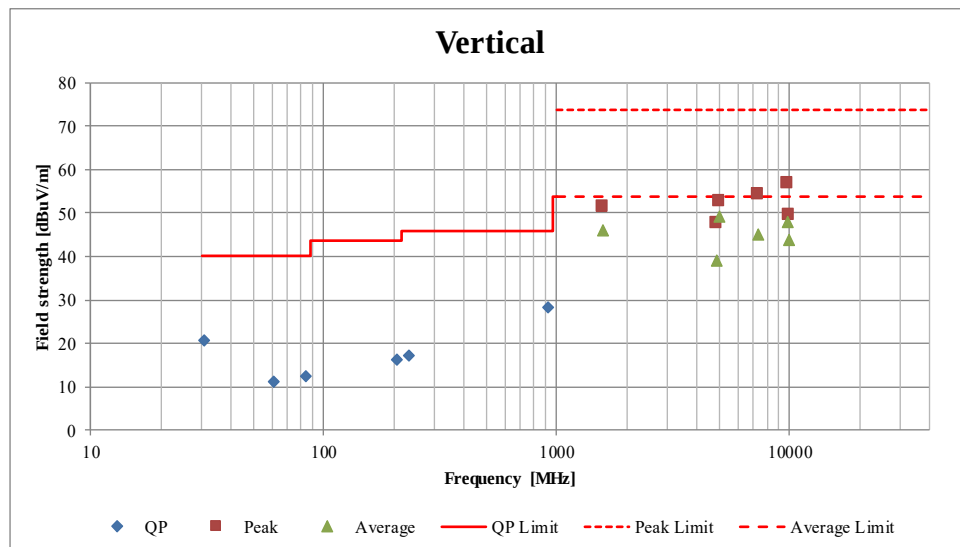
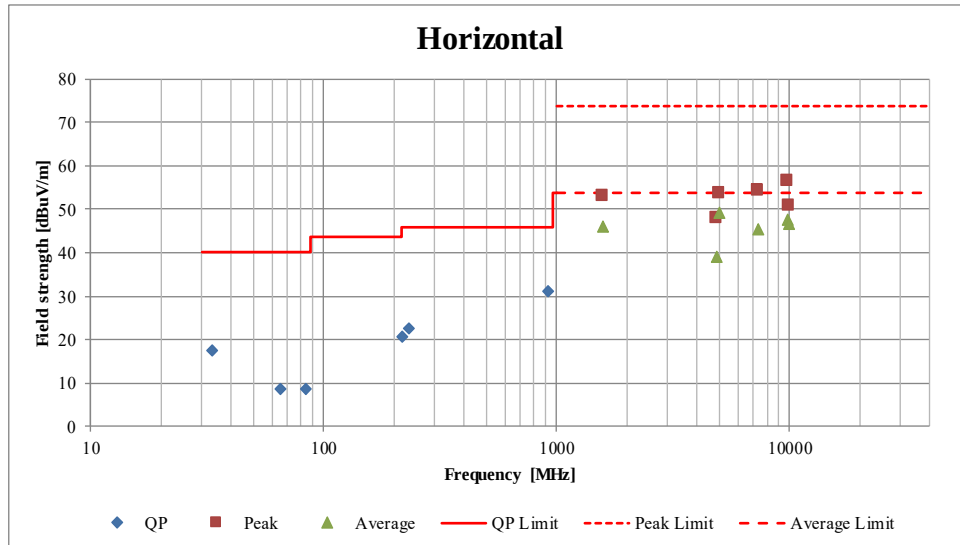
Report No.	13828809H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.2	No.2
Date	June 17, 2021	June 19, 2021
Temperature / Humidity	20 deg. C / 60 % RH	21 deg. C / 70 % RH
Engineer	Junya Okuno (Below 1 GHz) (10 GHz - 26.5 GHz)	Junki Nagatomi (1 GHz - 10 GHz)
Mode	Tx 11n-20 2437 MHz	



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

Radiated Spurious Emission (Plot data, Worst case)

Report No.	13828809H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.2	No.2
Date	June 11, 2021	June 11, 2021
Temperature / Humidity	19 deg. C / 54 % RH	19 deg. C / 54 % RH
Engineer	Junya Okuno	Junya Okuno
	(1 GHz - 10 GHz)	(1 GHz - 10 GHz)
Mode	Tx BT LE 2440 MHz	



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

UL Japan, Inc.

Ise EMC Lab.

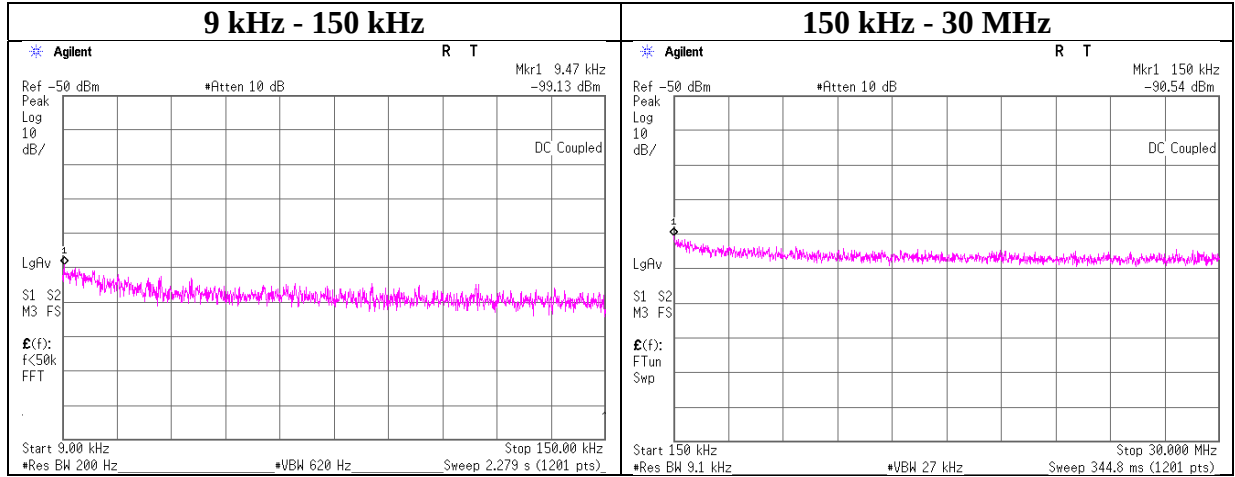
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Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Report No. 13828809H
Test place Ise EMC Lab. No.6 Measurement Room
Date June 16, 2021
Temperature / Humidity 25 deg. C / 54 % RH
Engineer Takafumi Noguchi
Mode Tx 11n-20 2437MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
9.47	-99.1	0.64	9.8	2.0	1	-86.7	300	6.0	-25.4	48.0	73.4	
150.00	-90.5	0.65	9.8	2.0	1	-78.1	300	6.0	-16.8	24.0	40.8	

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

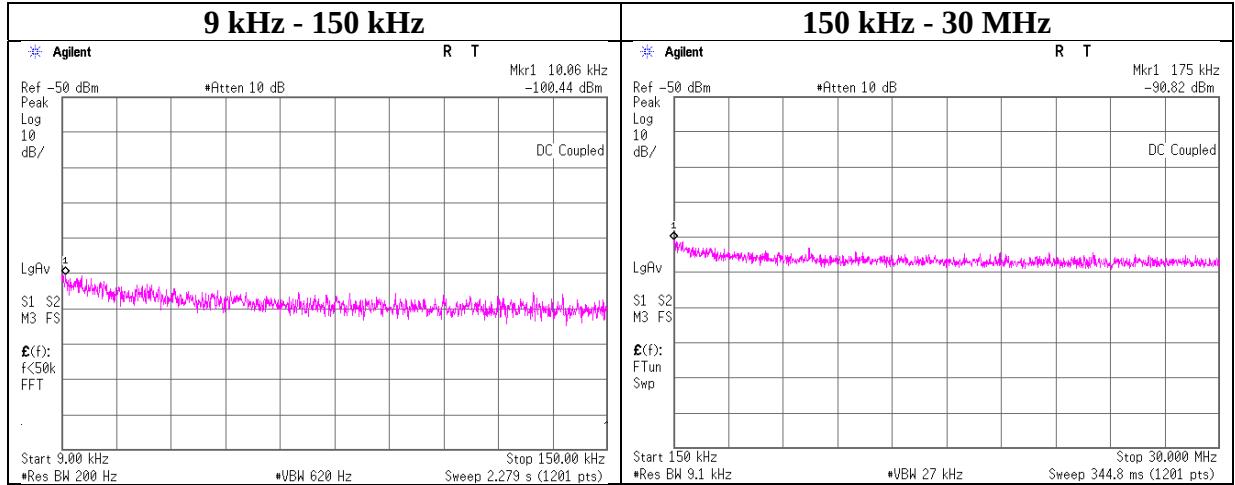
$EIRP[dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

N: Number of output

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

Conducted Spurious Emission

Report No.	13828809H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	June 22, 2021
Temperature / Humidity	24 deg. C / 55 % RH
Engineer	Nachi Konegawa
Mode	Tx BT LE 2402 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
10.06	-100.5	0.63	9.8	2.0	1	-88.0	300	6.0	-26.7	47.5	74.2	
175.00	-90.8	0.64	9.8	2.0	1	-78.3	300	6.0	-17.1	22.7	39.8	

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

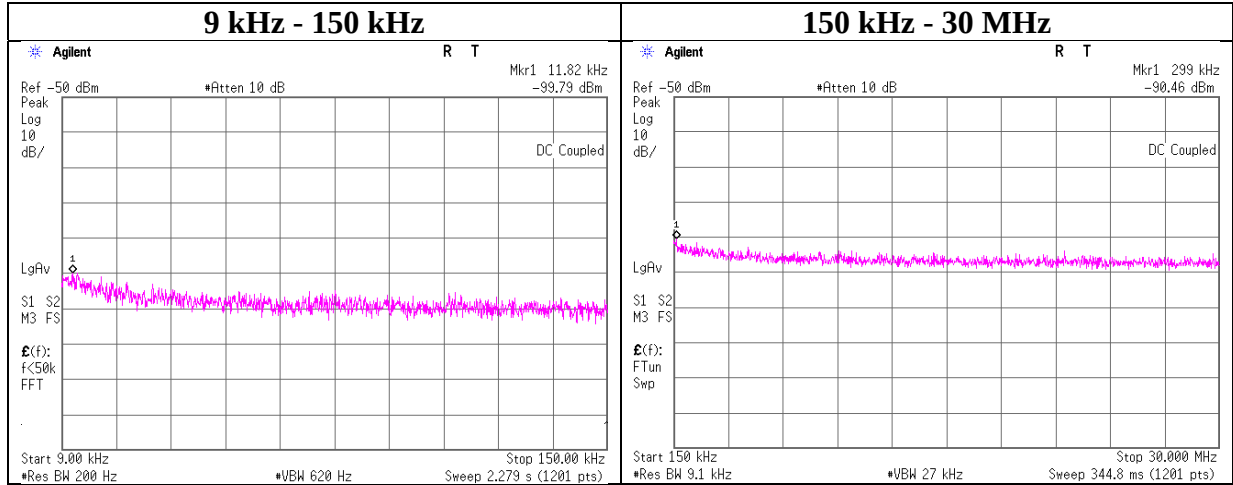
$EIRP [dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

N: Number of output

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

Conducted Spurious Emission

Report No.	13828809H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	June 22, 2021
Temperature / Humidity	24 deg. C / 55 % RH
Engineer	Nachi Konegawa
Mode	Tx BT LE 2440 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
11.82	-99.8	0.64	9.8	2.0	1	-87.3	300	6.0	-26.1	46.1	72.2	
299.00	-90.5	0.65	9.8	2.0	1	-78.0	300	6.0	-16.7	18.0	34.7	

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

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

N: Number of output

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

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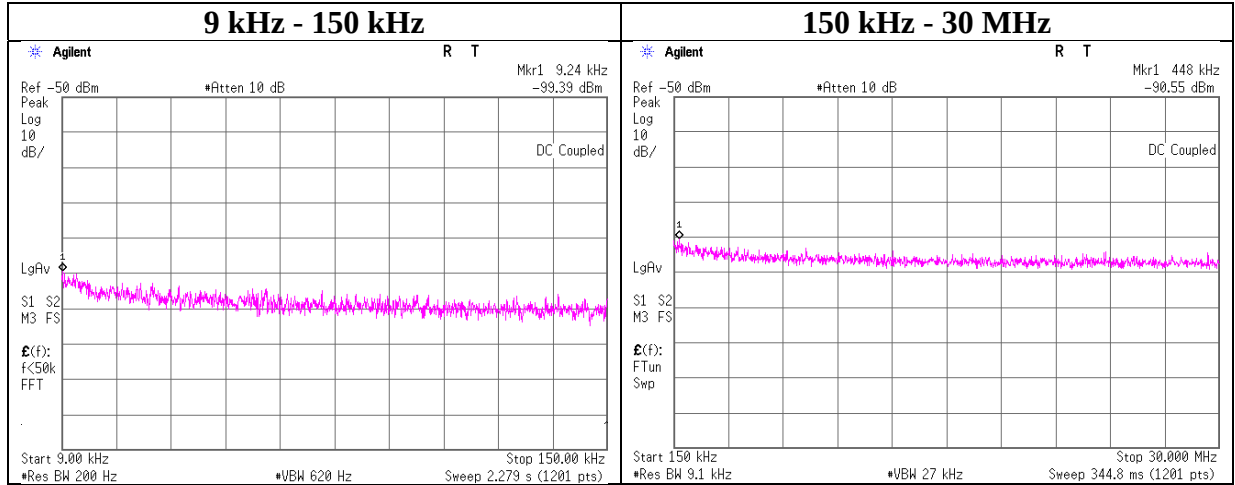
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Report No.	13828809H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	June 22, 2021
Temperature / Humidity	24 deg. C / 55 % RH
Engineer	Nachi Konegawa
Mode	Tx BT LE 2480 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
9.24	-99.4	0.64	9.8	2.0	1	-86.9	300	6.0	-25.7	48.2	73.9	
448.00	-90.6	0.65	9.8	2.0	1	-78.1	300	6.0	-16.8	14.5	31.3	

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

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

N: Number of output

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

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Power Density

Report No.	13828809H	
Test place	Ise EMC Lab. No.6 Measurement Room	
Date	June 16, 2021	June 22, 2021
Temperature / Humidity	25 deg. C / 54 % RH	24 deg. C / 55 % RH
Engineer	Takafumi Noguchi	Nachi Konegawa
Mode	Tx	

11b

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm / 3 kHz]	[dB]	[dB]	[dBm / 3 kHz]	[dBm / 3 kHz]	[dB]
2412	-41.87	1.41	30.04	-10.42	8.00	18.42
2437	-41.25	1.41	30.04	-9.80	8.00	17.80
2462	-40.10	1.42	30.04	-8.64	8.00	16.64

11g

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm / 3 kHz]	[dB]	[dB]	[dBm / 3 kHz]	[dBm / 3 kHz]	[dB]
2412	-52.27	1.41	30.04	-20.82	8.00	28.82
2437	-50.85	1.41	30.04	-19.40	8.00	27.40
2462	-51.99	1.42	30.04	-20.53	8.00	28.53

11n-20

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm / 3 kHz]	[dB]	[dB]	[dBm / 3 kHz]	[dBm / 3 kHz]	[dB]
2412	-52.40	1.41	30.04	-20.95	8.00	28.95
2437	-52.44	1.41	30.04	-20.99	8.00	28.99
2462	-52.56	1.42	30.04	-21.10	8.00	29.10

BT LE

Freq.	Reading	Cable Loss	Atten. Loss	Result	Limit	Margin
[MHz]	[dBm / 3 kHz]	[dB]	[dB]	[dBm / 3 kHz]	[dBm / 3 kHz]	[dB]
2402	-27.57	1.45	10.04	-16.08	8.00	24.08
2440	-27.00	1.47	10.04	-15.49	8.00	23.49
2480	-27.10	1.48	10.04	-15.58	8.00	23.58

Sample Calculation:

Result = Reading + Cable Loss + Attenuator Loss

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

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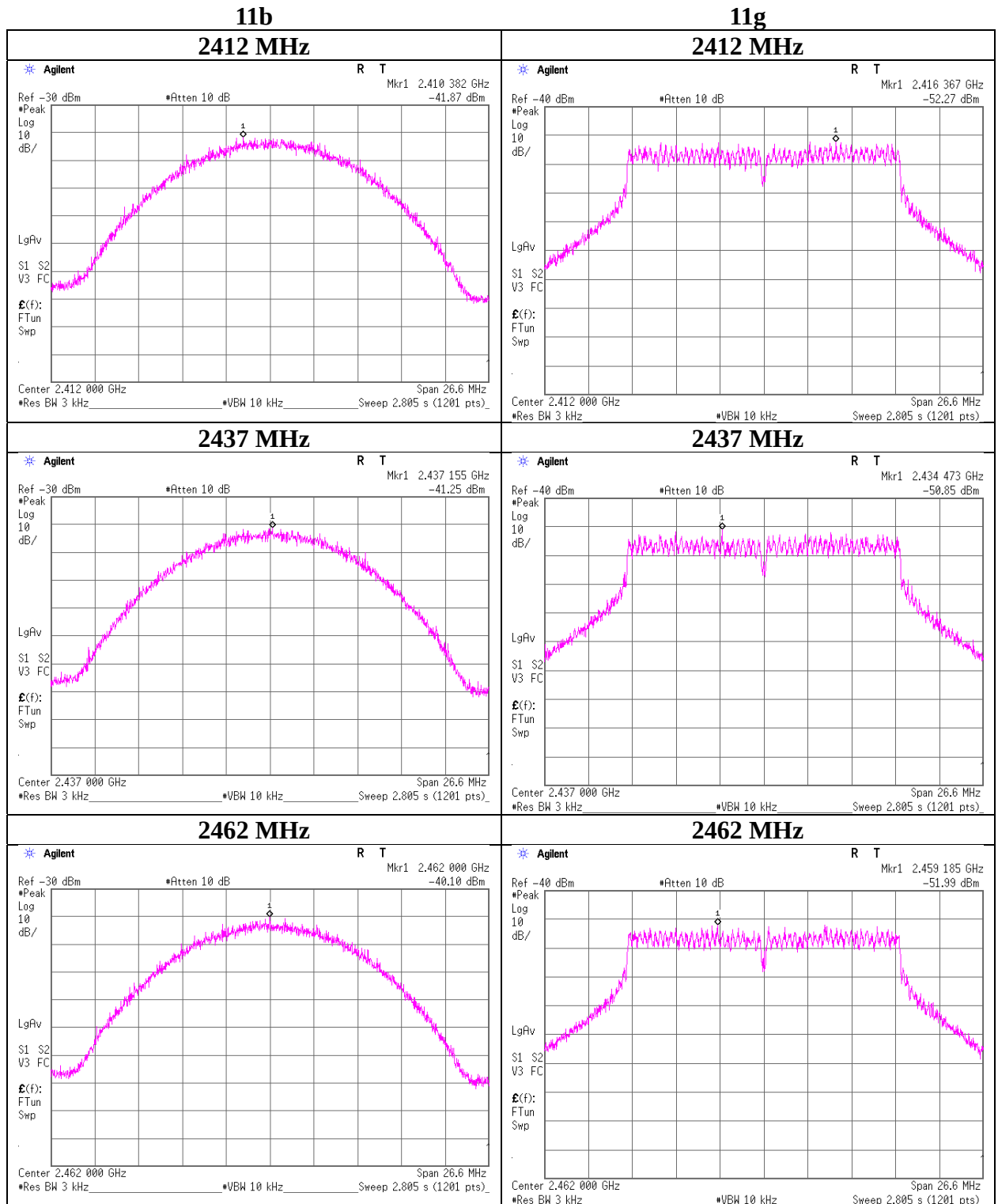
Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Power Density



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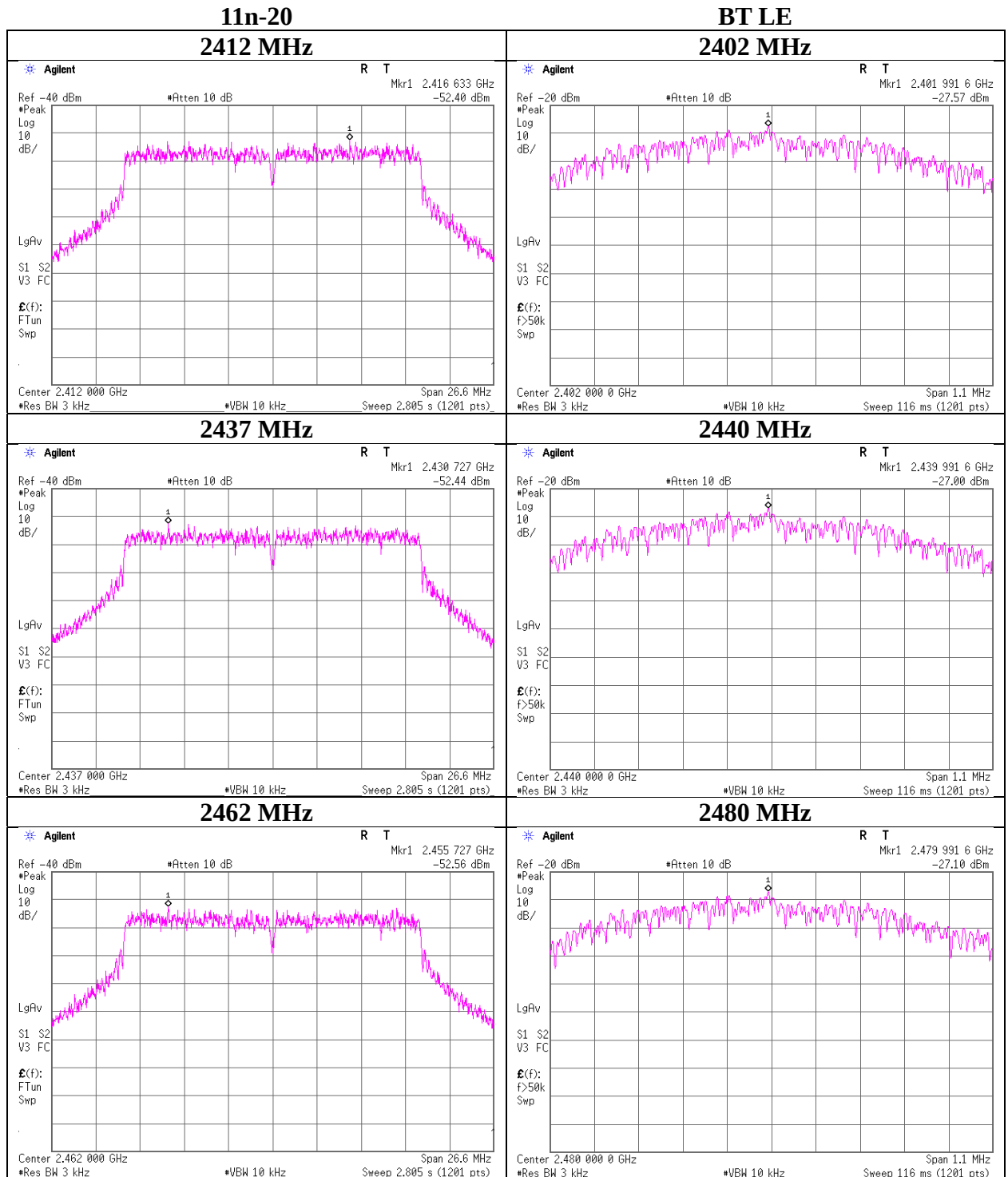
Ise EMC Lab.

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

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

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

APPENDIX 2: Test instruments

Test equipment (Test on June 11 to 22, 2021)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	MOS-41	192300	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0013	12/06/2020	12
RE	MMM-01	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	08/18/2020	12
RE	MJM-27	142228	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MAEC-02-SVSWR	142006	AC2_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-06902	04/09/2021	24
RE	MHA-06	141512	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	254	09/14/2020	12
RE	MCC-218	141394	Microwave Cable	Junkosha	MWX221	1607S141(1 m) / 1608S264(5 m)	09/23/2020	12
RE	MPA-10	141579	Pre Amplifier	Keysight Technologies Inc	8449B	3008A02142	02/18/2021	12
RE	MHF-25	141232	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	09/23/2020	12
RE	MSA-10	141899	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY46180655	08/04/2020	12
RE	MHA-17	141506	Horn Antenna 15-40GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9170	BBHA9170307	07/16/2020	12
AT	MOS-14	141561	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1401	01/15/2021	12
AT	MMM-12	141547	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	60500120	02/01/2021	12
AT	MCC-206	141286	Microwave Cable	RS Pro	R-132G7210200CD	-	02/03/2021	12
AT	MCC-244	197219	Microwave cable	Huber+Suhner	SF126E/11PC35/11PC35/2000MM	536999/126E	03/04/2021	12
AT	MAT-58	141334	Attenuator(10dB)	Suhner	6810.19.A	-	12/07/2020	12
AT	MPM-08	141805	Power Meter	Anritsu Corporation	ML2495A	6K00003338	10/15/2020	12
AT	MCC-38	141395	Coaxial Cable	UL Japan	-	-	11/17/2020	12
AT	MAT-10	141156	Attenuator(10dB)	Weinschel Corp	2	BL1173	11/13/2020	12
AT	MAT-21	141174	Attenuator(20dB) (above1GHz)	HIROSE ELECTRIC CO.,LTD.	AT-120	901247	01/13/2021	12
RE	MAEC-02	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	05/26/2020	24
RE	MAT-07	141203	Attenuator(6dB)	Weinschel Corp	2	BK7970	11/13/2020	12
RE	MBA-08	141427	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103B+BBA9106	8031	07/29/2020	12
RE	MCC-12	141317	Coaxial Cable	UL Japan Inc.	-	-	09/25/2020	12
RE	MLA-21	141265	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-190	07/29/2020	12
RE	MPA-24	141594	Pre Amplifier	Keysight Technologies Inc	8447D	2944A10150	02/18/2021	12
RE	MTR-08	141949	Test Receiver	Rohde & Schwarz	ESCI	100767	08/18/2020	12
RE	MRENT-130	141855	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46187750	11/18/2020	12
RE	MSA-03	141884	Spectrum Analyzer	Keysight Technologies Inc	E4448A	MY44020357	03/10/2021	12
AT	MCC-208	141287	Microwave Cable	RS Pro	R-132G7210200CD	-	02/03/2021	12
AT	MPSE-11	141840	Power sensor	Anritsu Corporation	MA2411B	11737	10/15/2020	12
AT	MSA-16	141903	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46186390	12/18/2020	12

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

Test equipment (Test on October 18 and 19, 2021)

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
RE	MOS-41	192300	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	0013	12/06/2020	12
RE	MMM-01	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	08/10/2021	12
RE	MJM-27	142228	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-MEMI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MAEC-02-SVSWR	142006	AC2_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-06902	04/09/2021	24
RE	MCC-218	141394	Microwave Cable	Junkosha	MWX221	1607S141(1 m) / 1608S264(5 m)	09/30/2021	12
RE	MPA-10	141579	Pre Amplifier	Keysight Technologies Inc	8449B	3008A02142	02/18/2021	12
RE	MHF-25	141232	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	001	09/30/2021	12
RE	MRENT-130	141855	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46187750	11/18/2020	12
RE	MHA-20	141507	Horn Antenna 1-18GHz	Schwarzbeck Mess-Elektronik OHG	BBHA9120D	258	10/01/2020	12
RE	MAEC-03	142008	AC3_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	05/22/2020	24
RE	MOS-13	141554	Thermo-Hygrometer	CUSTOM. Inc	CTH-201	1301	01/15/2021	12
RE	MMM-08	141532	DIGITAL HiTESTER	HIOKI E.E. CORPORATION	3805	51201197	01/07/2021	12
RE	MJM-16	142183	Measure	KOMELON	KMC-36	-	-	-
RE	MAT-95	142314	Attenuator	Pasternack Enterprises	PE7390-6	D/C 1504	06/09/2021	12
RE	MBA-03	141424	Biconical Antenna	Schwarzbeck Mess-Elektronik OHG	VHA9103+BBA9106	1915	08/21/2021	12
RE	MCC-51	141323	Coaxial cable	UL Japan	-	-	07/19/2021	12
RE	MLA-22	141266	Logperiodic Antenna(200-1000MHz)	Schwarzbeck Mess-Elektronik OHG	VUSLP9111B	9111B-191	08/21/2021	12
RE	MPA-13	141582	Pre Amplifier	SONOMA INSTRUMENT	310	260834	02/18/2021	12
RE	MTR-03	141942	Test Receiver	Rohde & Schwarz	ESCI	100300	08/05/2021	12

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

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

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

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

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

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