



RADIO TEST REPORT

Test Report No. : 13328641H-B-R2

Applicant : Pioneer Corporation
Type of EUT : Car Audio with Bluetooth / WLAN
Model Number of EUT : SN211
FCC ID : AJDK115
Test regulation : FCC Part 15 Subpart E: 2020
Test Result : Complied (Refer to SECTION 3.2)

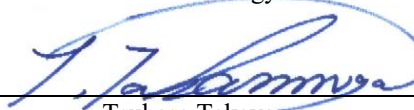
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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
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6. 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 13328641H-B-R1. 13328641H-B-R1 is replaced with this report.

Date of test: April 20 to May 9, 2020

Representative test engineer:


Junki Nagatomi
Engineer
Consumer Technology Division

Approved by:


Tsubasa Takayama
Leader
Consumer Technology Division



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- ☐ This report contains data that are not covered by the NVLAP accreditation.
☒ There is no testing item of "Non-accreditation".

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REVISION HISTORY

Original Test Report No.: 13328461H-B

Revision	Test report No.	Date	Page revised	Contents
- (Original)	13328641H-B	June 12, 2020	-	-
1	13328641H-B-R1	July 1, 2020	P.6	Deletion of sentence about simultaneously transmission.
1	13328641H-B-R1	July 1, 2020	P.11	Correction of power setting value for each mode
1	13328641H-B-R1	July 1, 2020	P.18	Correction of 99 % Occupied Bandwidth data.
1	13328641H-B-R1	July 1, 2020	P.37-42	Corrected the Result (dBm and mW) calculations for Average Output Power.
2	13328641H-B-R2	July 8, 2020	P.37-42	Correction of calculation formula.

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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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SECTION 1: Customer information

Company Name	:	Pioneer Corporation
Address	:	28-8, Honkomagome 2-chome, Bunkyo-ku, Tokyo 113-0021, Japan
Telephone Number	:	+81-49-228-7681
Facsimile Number	:	+81-49-228-6172
Contact Person	:	Yoshifumi Takahashi

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 with Bluetooth / WLAN
Model Number	:	SN211
Serial Number	:	Refer to SECTION 4.2
Rating	:	DC 10 V - 16 V, 10 A
Receipt Date	:	April 20, 2020
Country of Mass-production	:	Thailand
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: SN211 (referred to as the EUT in this report) is a Car Audio with Bluetooth / WLAN.

Information of the Factory

Factory Name	:	PIONEER MANUFACTURING(THAILAND) CO., LTD.
Address	:	Rojana Industrial Park, 1/31 Moo 5 Tambol Kanham, Amphur U-Thai Pranakornsriayutthaya 13210 Thailand

Radio Specification

WLAN (IEEE 802.11a/n/ac) *1)

Type of radio	IEEE802.11a/n/ac (20 M band)	IEEE802.11n/ac (40 M band)	IEEE802.11ac (80 M band)
Frequency of operation	5745 MHz - 5825 MHz	5755 MHz - 5795 MHz	5775 MHz
Type of modulation	OFDM (64QAM, 16QAM, QPSK, BPSK)		
Channel spacing	20 MHz	40 MHz	80 MHz
Antenna type	Internal Antenna		
Antenna Gain	-1.37 dBi		
Clock frequency (Maximum)	125 MHz		

Bluetooth (BR / EDR function)

Type of radio	Bluetooth Version 4.2
Frequency of operation	2402 MHz - 2480 MHz
Type of modulation	FHSS
Channel spacing	1 MHz
Antenna type	Internal Antenna
Antenna Gain	-5.38 dBi
Clock frequency (Maximum)	125 MHz

[GNSS]

Radio Type	:	Receiver
Frequency of Operation	:	See table below.
Antenna type	:	External Antenna
Antenna Gain	:	20 dBi

Supported GNSS and GNSS signals

GNSS	RNSS Frequency Band / Frequency [MHz]		
	1559 to 1610	1215 to 1300	1164 to 1215
BDS	☐ B1I 1561.098	-	-
Galileo	☐ E1 1575.42	☐ E6 1278.75	☐ E5a 1176.45 ☐ E5b 1207.14
GLONASS	☒ G1 1598.063 - 1605.375	☐ G2 1242.9375 - 1248.625	-
GPS	☒ L1 1575.42	☐ L2 1227.6	☐ L5 1176.45
SBAS	☒ L1 1575.42	-	☐ L5 1176.45

☒ Supported GNSS signal

☐ Not supported GNSS signal

AM / FM / DAB

Type of radio	FM	AM	DAB
Equipment Type	Receiver		
Frequency of Operation	87.5 MHz to 108.0 MHz	522 kHz to 1629 kHz	Band III: 174.928 MHz to 239.200 MHz L-Band: 1452.96 MHz to 1490.624 MHz
Type of Modulation	FM	AM	OFDM
Antenna Connector Type	Custom	Custom	Custom
Impedance	75 ohm	75 ohm	50 ohm
Reception method	Conducted	Conducted	Conducted

*1) This test report is applies to WLAN.

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart E
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 E
Unlicensed National Information Infrastructure Devices
Section 15.407 General technical requirements

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

* The customer has declared that the EUT has complies with FCC Part 15 Subpart B as SDoC.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 ISED: RSS-Gen 8.8	FCC: 15.407 (b) (6) / 15.207 ISED: RSS-Gen 8.8	N/A	N/A	*1)
26 dB Emission Bandwidth	FCC: KDB Publication Number 789033 ISED: -	FCC: 15.407 (a) (1) (2) (3) ISED: -	N/A	N/A	*2)
Maximum Conducted Output Power	FCC: KDB Publication Number 789033 ISED: -	FCC: 15.407 (a) (1) (2) (3) ISED: RSS-247 6.2.1.1 6.2.2.1 6.2.3.1 6.2.4.1		Complied a)	Conducted
Maximum Power Spectral Density	FCC: KDB Publication Number 789033 ISED: -	FCC : 15.407 (a) (1) (2) (3) ISED: RSS-247 6.2.1.1 6.2.2.1 6.2.3.1 6.2.4.1		N/A b)	Conducted
Spurious Emission Restricted Band Edge	FCC: ANSI C63.10-2013 KDB Publication Number 789033 ISED: -	FCC: 15.407 (b), 15.205 and 15.209 ISED: RSS-247 6.2.1.2 6.2.2.2 6.2.3.2 6.2.4.2	11.9 dB 208.674 MHz, QP, Vert.	Complied c) / d)	Conducted (< 30 MHz)/ Radiated (> 30 MHz) *3)
6 dB Emission Bandwidth	FCC: ANSI C63.10-2013 ISED: -	FCC: 15.407 (e) ISED: RSS-247 6.2.4.1	See data	Complied e)	Conducted
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) The test is not applicable since the EUT does not support W53 and W56 bands. *3) Radiated test was selected over 30 MHz based on FCC 15.407 (b) and KDB 789033 D02 G.3.b). a) Refer to APPENDIX 1 (data of Maximum Conducted Output Power) b) Refer to APPENDIX 1 (data of Maximum Power Spectral Density) c) Refer to APPENDIX 1 (data of Radiated Spurious Emission) d) Refer to APPENDIX 1 (data of Conducted Spurious Emission) e) Refer to APPENDIX 1 (data of 6 dB Bandwidth) Symbols: Complied The data of this test item has enough margin, more than the measurement uncertainty. Complied# The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.					

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

FCC Part 15.31 (e)

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

FCC Part 15.203 Antenna requirement

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

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % Occupied Band Width	ISED: RSS-Gen 6.7	ISED: -	N/A	- a)	Conducted

a) Refer to APPENDIX 1 (data of 26 dB Emission Bandwidth and 99 % Occupied Bandwidth)

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

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3.4 Uncertainty

There is no applicable rule of uncertainty in this applied standard. Therefore, the following 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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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)	4.8 dB
		5.0 dB
	200 MHz to 1000 MHz (Horizontal)	5.2 dB
		6.3 dB
10 m	30 MHz to 200 MHz (Horizontal)	4.8 dB
		4.8 dB
	200 MHz to 1000 MHz (Horizontal)	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
0.5 m	26.5 GHz to 40 GHz	5.5 dB
10 m	1 GHz to 18 GHz	5.2 dB

Antenna Terminal test

Test Item	Uncertainty (+/-)
26 dB Emission Bandwidth / 6 dB Emission Bandwidth /	0.96 %
Maximum Conducted Output Power / Average Output Power	1.4 dB
Burst Rate	0.10 %
Maximum Power Spectral Density	2.6 dB
Spurious Emission (Conducted)	2.6 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.

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 802.11a (11a)	54 Mbps, PN9
IEEE 802.11n SISO 20 MHz BW (11n-20)	MCS 7 (Long GI), PN9
IEEE 802.11n SISO 40 MHz BW (11n-40)	MCS 7 (Long GI), PN9
IEEE 802.11ac SISO 20 MHz BW (11ac-20)	MCS 7 (Long GI), PN9
IEEE 802.11ac SISO 40 MHz BW (11ac-40)	MCS 7 (Long GI), PN9
IEEE 802.11ac SISO 80 MHz BW (11ac-80)	MCS 0 (Long GI), PN9
*Power of the EUT was set by the software as follows; Power settings: 11a, 11n-20, 11ac-20: 14 dBm 11n-40, 11ac-40: 13 dBm 11ac-80: 8 dBm Software: R.A2.00.12.65.20.00.00 (Date: April 20, 2020, Storage location: EUT memory) *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 Operation mode(s)

Test Item	Operating Mode	Tested Frequency
99 % Occupied Bandwidth, 6 dB Bandwidth, Maximum Conducted Output Power, Maximum Power Spectral Density	11a Tx	5745 MHz
	11n-20 Tx	5785 MHz
	11ac-20 Tx	5825 MHz
	11n-40 Tx	5755 MHz
	11ac-40 Tx	5795 MHz
	11ac-80 Tx	5775 MHz
Radiated Spurious Emission (Below 1 GHz)	11ac-80 Tx *1)	5775 MHz
Radiated Spurious Emission (Above 1 GHz)	11ac-20 Tx	5745 MHz
		5785 MHz
		5825 MHz
	11ac-40 Tx	5755 MHz
		5895 MHz
	11ac-80 Tx	5775 MHz
Conducted Spurious Emission	11ac-20 Tx *2)	5785 MHz
*1) The mode was tested as a representative, because it had the highest power at worst mode.		
*2) The mode was tested as a representative, because it had the highest power at antenna terminal test.		

4.2 Configuration and peripherals

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 with Bluetooth / WLAN	SN211	KATA035	Pioneer Corporation	EUT
B	USB Memory	U202	1942QF0935MSQ 1RL1L	TOSHIBA	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC & Signal Cable	2.0	Unshielded	Unshielded	-
2	USB Cable	1.5	Shielded	Shielded	-

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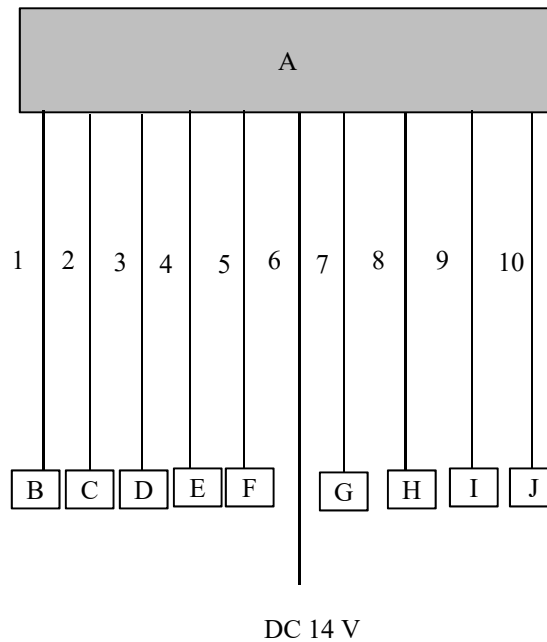
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Radiated Spurious Emission



* 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 with Bluetooth / WLAN	SN211	KATA036	Pioneer Corporation	EUT
B	USB Memory	U202	1942QF0935MSQ 1RL1L	TOSHIBA	-
C	Terminator	-	-	-	-
D	GNSS Antenna	DA15-D010	A388619	MITSUMI ELEC.	-
E	Terminator	-	-	-	-
F	Jig Board	-	-	-	-
G	Mic	39813-59S00	-	-	-
H	Dummy Speaker	-	-	-	-
I	Camera	-	-	-	-
J	Terminator	-	-	-	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	2.0	Shielded	Shielded	-
2	DAB Cable	2.0	Shielded	Shielded	-
3	GNSS Antenna Cable	2.0	Shielded	Shielded	-
4	HDMI Cable	1.2	Shielded	Shielded	-
5	Signal Cable	2.0	Unshielded	Unshielded	-
6	DC Cable	2.8	Unshielded	Unshielded	-
7	MIC Cable	2.0	Unshielded	Unshielded	-
8	Speaker Cable	2.0	Unshielded	Unshielded	-
9	Signal Cable	2.2	Unshielded	Unshielded	-
10	AM/FM Cable	2.0	Shielded	Shielded	-

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SECTION 5: Radiated Spurious Emission and Band Edge Compliance

Test Procedure

< Below 1GHz >

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.

< Above 1GHz >

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.

< Below 1GHz >

The result also satisfied with the general limits specified in section 15.209 (a).

< Above 1GHz >

Inside of restricted bands (Section 15.205):

Apply to limit in the Section 15.209 (a).

Outside of the restricted bands:

Apply to limit 68.2 dBuV/m, 3 m (-27 dBm e.i.r.p. *) in the Section 15.407 (b) (1) (2) (3).

-27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge in the section 15.407(b)(4)(i).

Restricted band edge:

Apply to limit in the Section 15.209 (a).

Since this limit is severer than the limit of the inside of restricted bands.

*Electric field strength to e.i.r.p. conversion:

$$E = \frac{1000000 \sqrt{30 P}}{3} \text{ (uV/m)} \quad : P \text{ is the e.i.r.p. (Watts)}$$

Test Antennas are used as below;

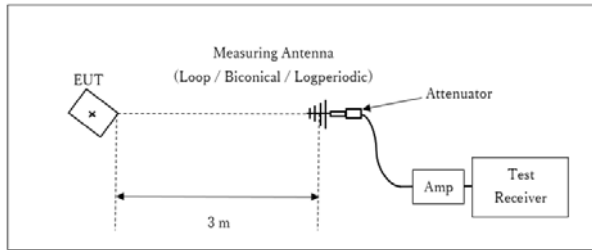
Frequency	30 MHz to 200 MHz	200 MHz to 1 GHz	Above 1 GHz
Antenna Type	Biconical	Logperiodic	Horn

Frequency	Below 1 GHz	Above 1 GHz	
Instrument used	Test Receiver	Spectrum Analyzer	
Detector	QP	Peak	Average
IF Bandwidth	BW: 120 kHz	RBW: 1 MHz VBW: 3 MHz	Method AD *1) RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: ≥ 100 traces If duty cycle was less than 98%, a duty factor was added to the results.

*1) The test method was also referred to KDB 789033 D02 General UNII Test Procedures New Rules v02r01 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E".

Figure 2: Test Setup

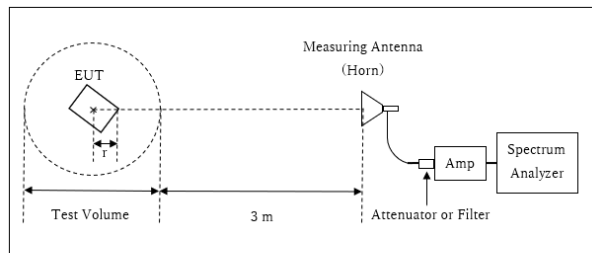
Below 1 GHz



x : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz



r : Radius of an outer periphery of EUT

x : Center of turn table

Distance Factor: $20 \times \log (3.85 \text{ m} / 3.0 \text{ m}) = 2.17 \text{ dB}$

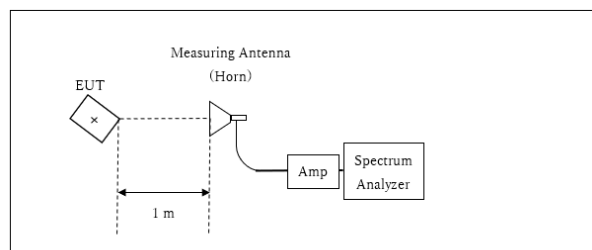
* Test Distance: $(3 + \text{Test Volume} / 2) - r = 3.85 \text{ m}$

Test Volume : 2.0 m

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

$r = 0.15 \text{ m}$

10 GHz - 26.5 GHz



x : Center of turn table

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 0 degree and 40 degree as tilt angle 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 - 40 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 and Test method
99 % Occupied Bandwidth *1)	Enough width to display emission skirts	1 % to 5 % of OBW	≥ 3 RBW	Auto	Peak	Max Hold	Spectrum Analyzer
6 dB Bandwidth	Enough to capture the emission	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Conducted Output Power	-	-	-	Auto	Average	-	Power Meter (Sensor: 80 MHz BW) (Method PM-G)
Maximum Power Spectral Density	Encompass the entire EBW	470 kHz *2)	≥ 3 RBW	Auto	Power Averaging (200 times)	Clear Write	Spectrum Analyzer
Conducted Spurious Emission*3) *4)	9 kHz – 150 kHz 150 kHz – 30 MHz	200 Hz 9.1 kHz	620 Hz 27 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

* The test method was also referred to KDB 789033 D02 General UNII Test Procedures New Rules v02r01 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E".

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

*2) KDB 789033 D02 says that RBW is set to be 500 kHz for 5.725 GHz-5.850 GHz, but it is not possible with spectrum analyzer, so RBW Correction Factor ($10 \log(500 \text{ kHz} / 470 \text{ kHz})$) was added to the test result.

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

Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.
(9 kHz-150 kHz: RBW = 200 Hz, 150 kHz-30 MHz: RBW = 9.1 kHz)

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

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

Report No.	13328641H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	April 23, 2020
Temperature / Humidity	24 deg. C / 23 % RH
Engineer	Yuta Moriya
Mode	Tx

11a

Antenna	Tested Frequency [MHz]	26 dB Emission Bandwidth [MHz]	99 % Occupied Bandwidth [kHz]
Antenna 1	5745	-	16783.6
	5785	-	16757.7
	5825	-	16784.3

11n-20

Antenna	Tested Frequency [MHz]	26 dB Emission Bandwidth [MHz]	99 % Occupied Bandwidth [kHz]
Antenna 1	5745	-	17767.5
	5785	-	17834.8
	5825	-	17750.2

11ac-20

Antenna	Tested Frequency [MHz]	26 dB Emission Bandwidth [MHz]	99 % Occupied Bandwidth [kHz]
Antenna 1	5745	-	17802.4
	5785	-	17781.3
	5825	-	17723.3

11n-40

Antenna	Tested Frequency [MHz]	26 dB Emission Bandwidth [MHz]	99 % Occupied Bandwidth [kHz]
Antenna 1	5755	-	36210.5
	5795	-	36234.1

11ac-40

Antenna	Tested Frequency [MHz]	26 dB Emission Bandwidth [MHz]	99 % Occupied Bandwidth [kHz]
Antenna 1	5755	-	36230.4
	5795	-	36290.3

11ac-80

Antenna	Tested Frequency [MHz]	26 dB Emission Bandwidth [MHz]	99 % Occupied Bandwidth [kHz]
Antenna 1	5775	-	76317.2

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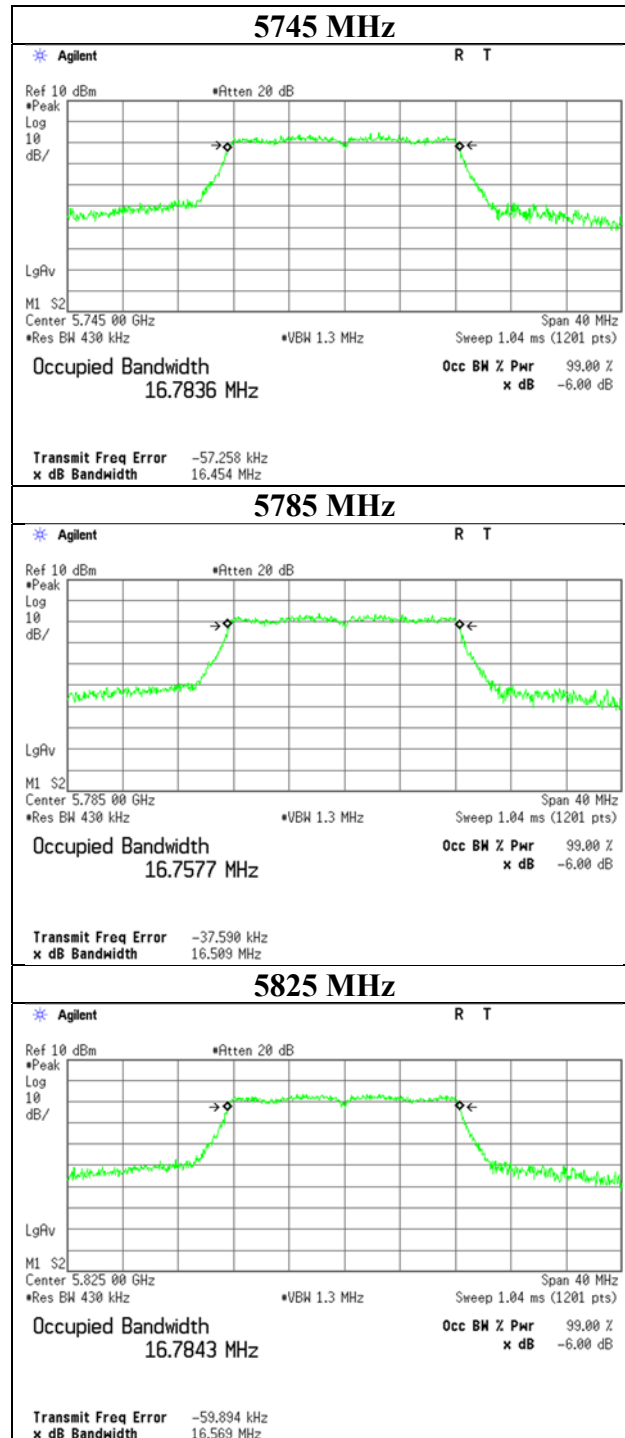
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

99 % Occupied Bandwidth

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 23, 2020
Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx 11a

11a



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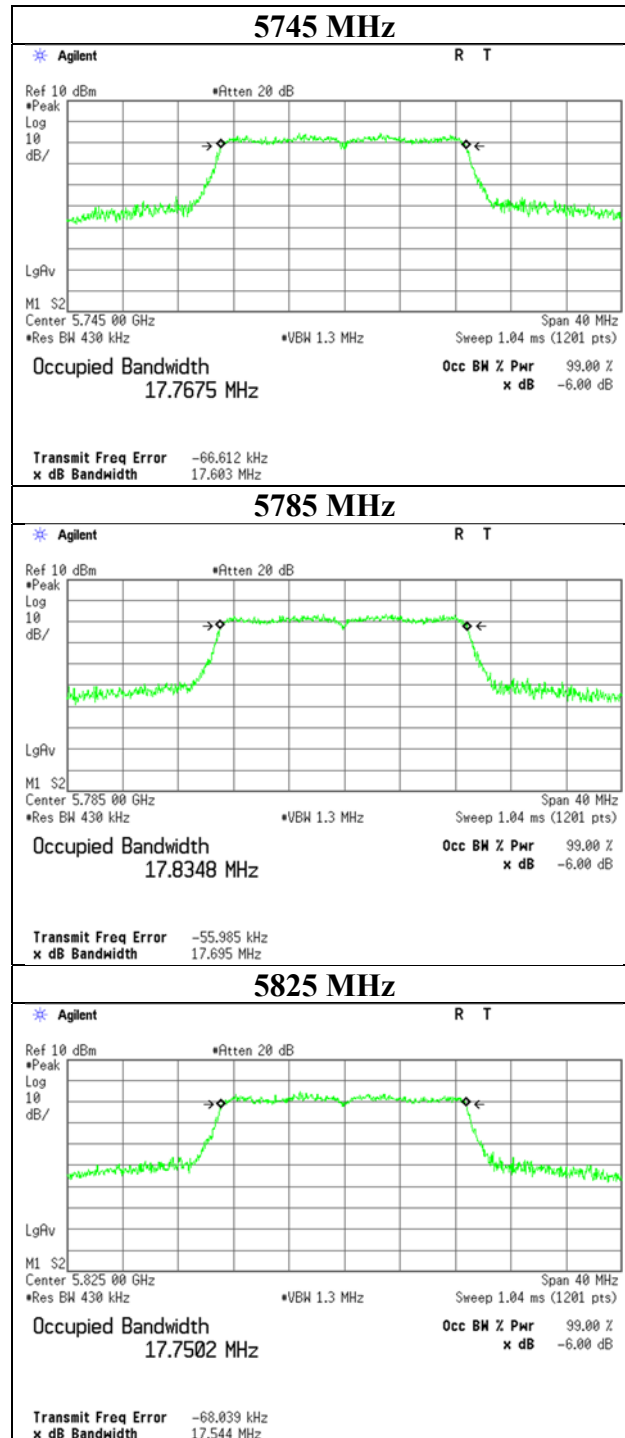
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

99 % Occupied Bandwidth

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 23, 2020
Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx 11n-20

11n-20



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Telephone : +81 596 24 8999

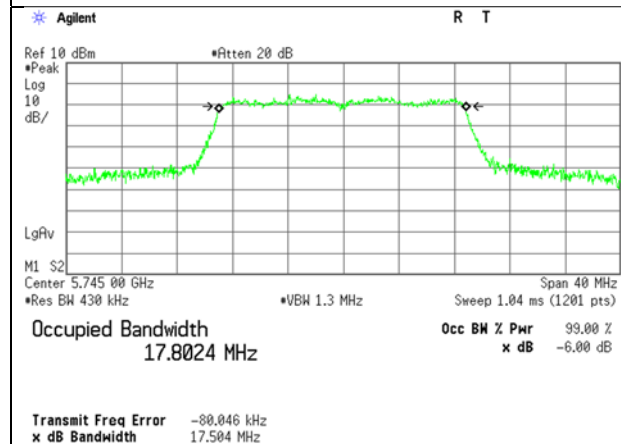
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99 % Occupied Bandwidth

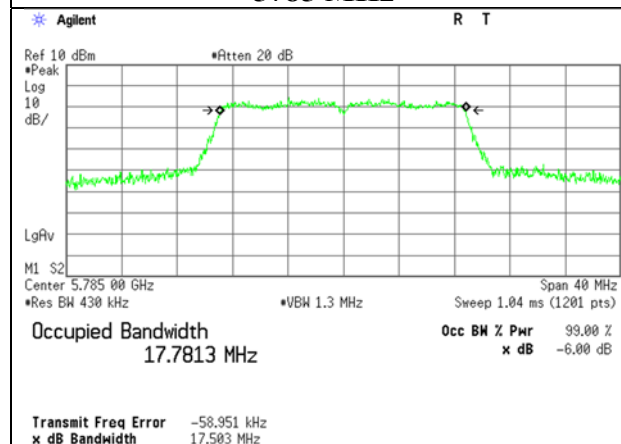
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Test place Ise EMC Lab. No.6 Measurement Room
Date April 23, 2020
Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx 11ac-20

11ac-20

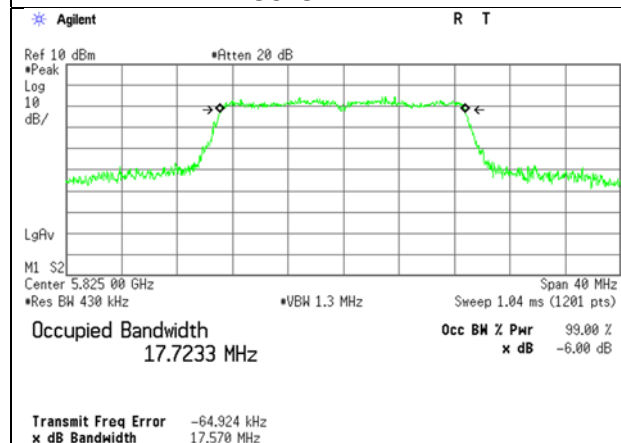
5745 MHz



5785 MHz



5825 MHz



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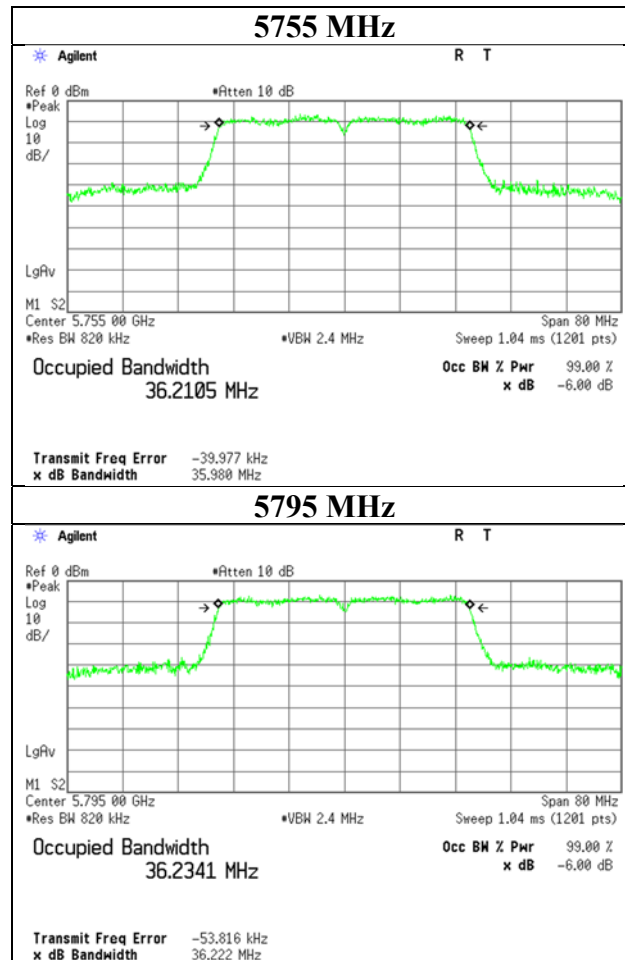
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

99 % Occupied Bandwidth

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 23, 2020
Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx 11n-40

11n-40



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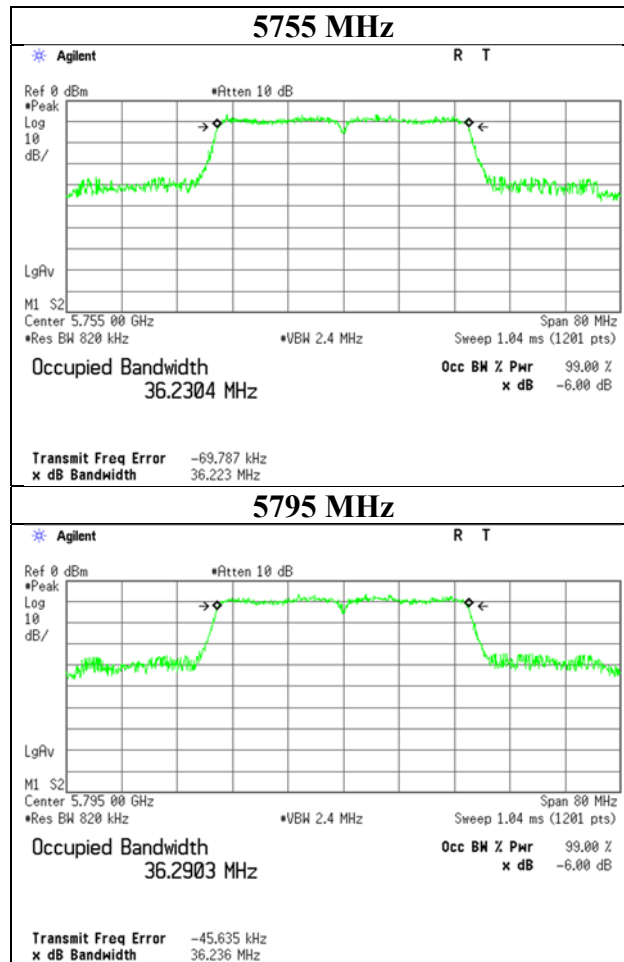
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

99 % Occupied Bandwidth

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 23, 2020
Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx 11ac-40

11ac-40



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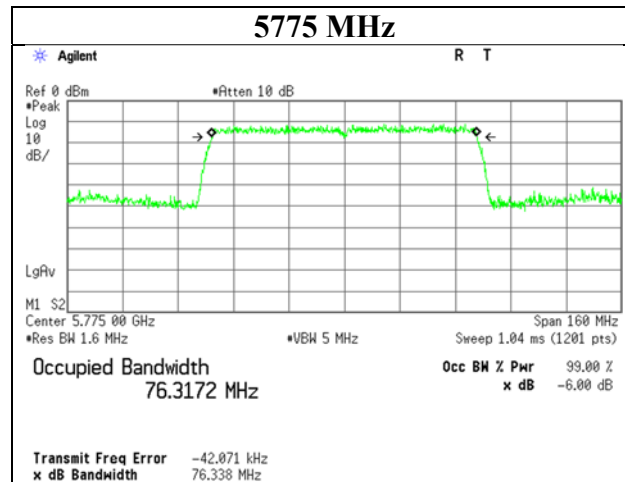
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

99 % Occupied Bandwidth

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 23, 2020
Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx 11ac-80

11ac-80



6 dB Bandwidth

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 23, 2020
Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx

11a

Antenna	Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]
Antenna 1	5745	16.501	> 0.500
	5785	16.407	> 0.500
	5825	16.434	> 0.500

11n-20

Antenna	Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]
Antenna 1	5745	17.642	> 0.500
	5785	17.665	> 0.500
	5825	17.684	> 0.500

11ac-20

Antenna	Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]
Antenna 1	5745	17.663	> 0.500
	5785	17.625	> 0.500
	5825	17.631	> 0.500

11n-40

Antenna	Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]
Antenna 1	5755	36.294	> 0.500
	5795	35.893	> 0.500

11ac-40

Antenna	Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]
Antenna 1	5755	36.073	> 0.500
	5795	36.367	> 0.500

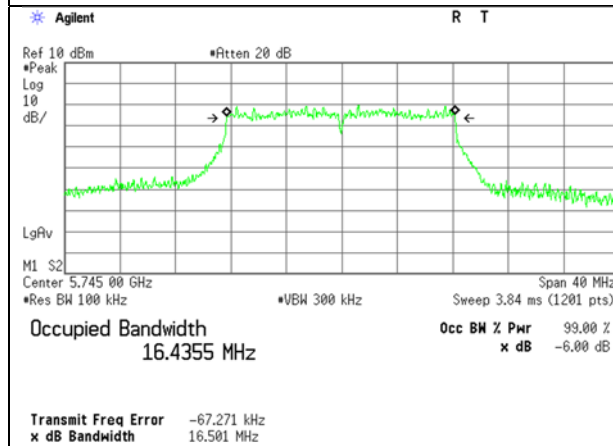
11ac-80

Antenna	Tested Frequency [MHz]	6 dB Bandwidth [MHz]	Limit [MHz]
Antenna 1	5775	76.492	> 0.500

6 dB Bandwidth

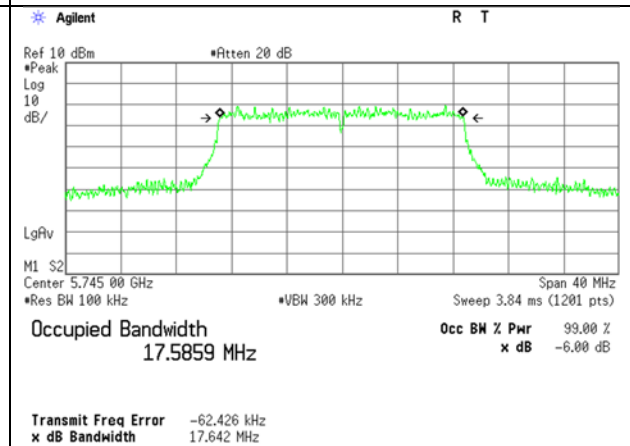
11a, Antenna 1

5745 MHz

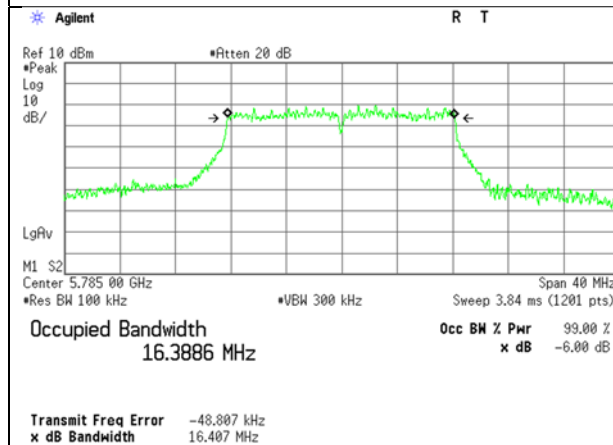


11n-20, Antenna 1

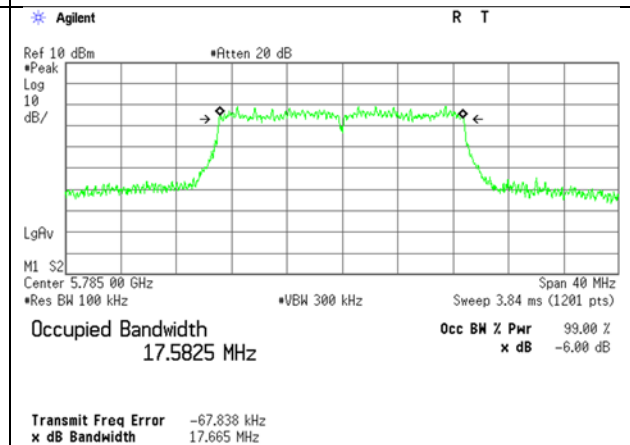
5745 MHz



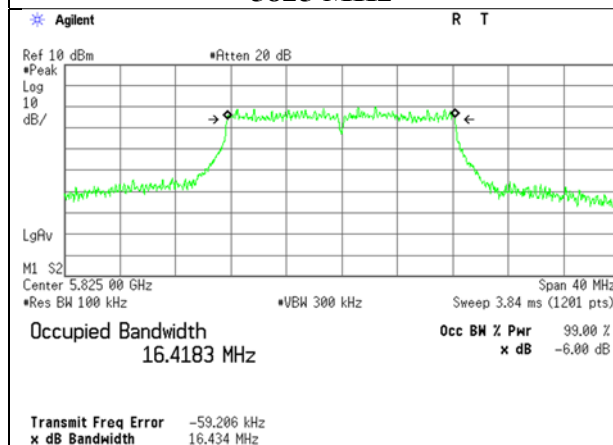
5785 MHz



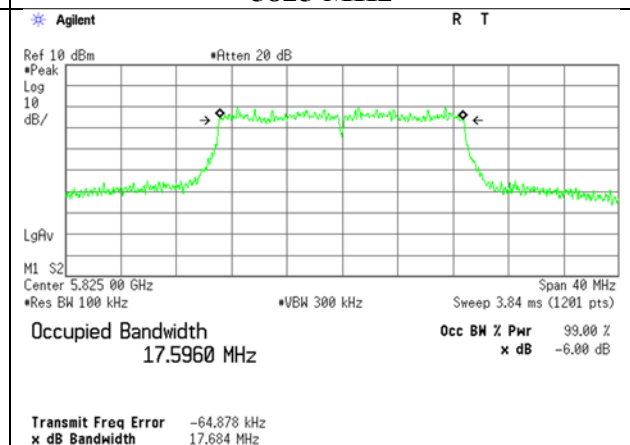
5785 MHz



5825 MHz



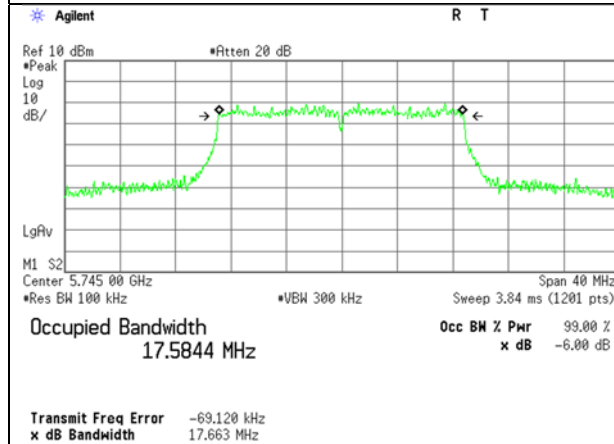
5825 MHz



6 dB Bandwidth

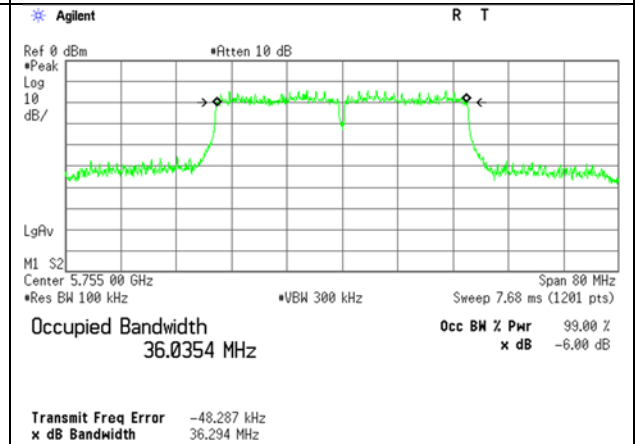
11ac-20, Antenna 1

5745 MHz

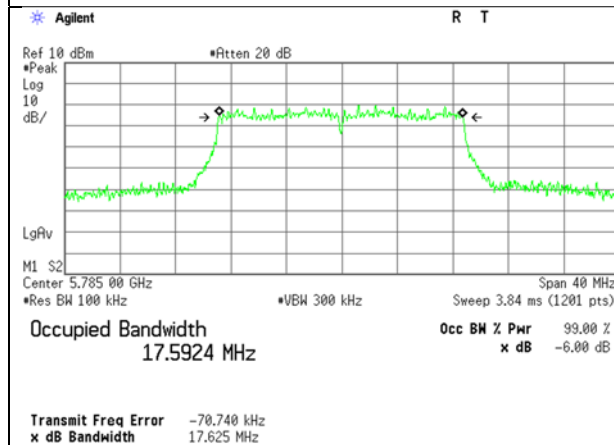


11n-40, Antenna 1

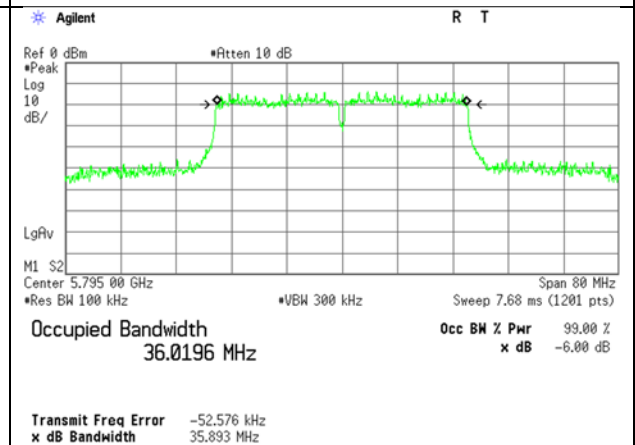
5755 MHz



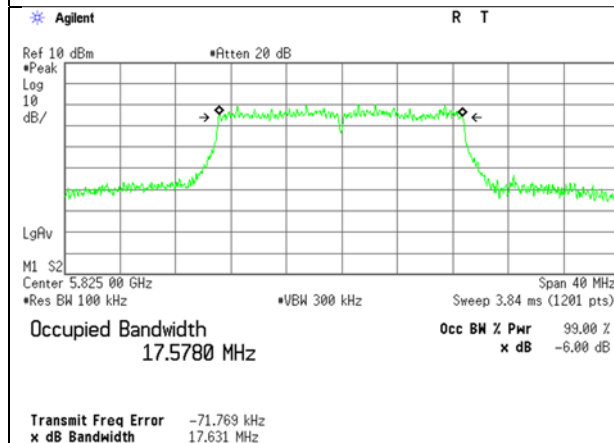
5785 MHz



5795 MHz



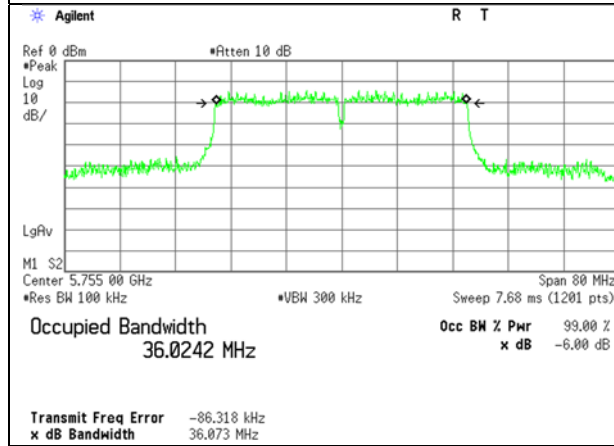
5825 MHz



6 dB Bandwidth

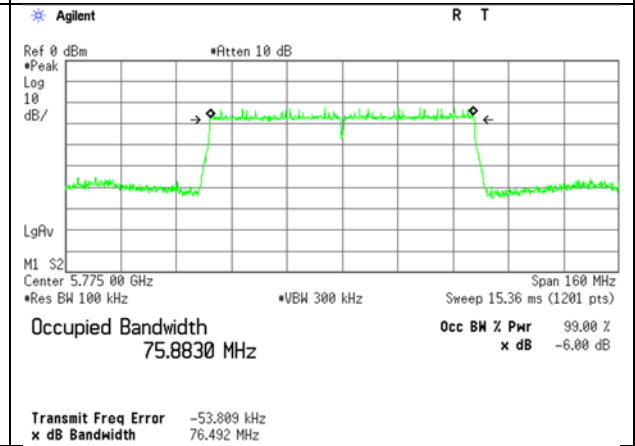
11ac-40, Antenna 1

5755 MHz

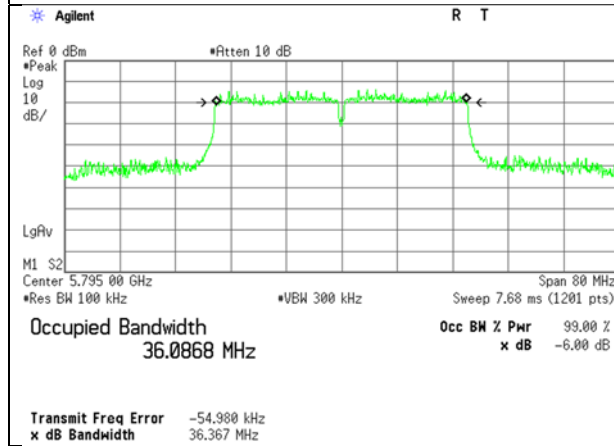


11ac-80, Antenna 1

5775 MHz



5795 MHz



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Maximum Conducted Output Power

Report No. 13328641H
Test place Ise EMC Lab. No.3 Measurement Room
Date May 7, 2020
Temperature / Humidity 21 deg. C / 50 % RH
Engineer Junki Nagatomi
Mode Tx 11a

11a

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	26 dB EBW (B for FCC) [MHz]	99% OBW (B for IC) [MHz]	Conducted Power				e.i.r.p.			
								Result	Limit	Margin		Result	Limit	Margin	
								[dBm]	[mW]	[dBm]	[dB]	[dBm]	[mW]	[dBm]	[dB]
5745	-0.25	3.05	10.12	0.00	-1.37	-	16.784	12.92	19.59	30.00	17.08	11.55	14.29	36.00	24.45
5785	-0.23	3.06	10.12	0.00	-1.37	-	16.758	12.95	19.72	30.00	17.05	11.58	14.39	36.00	24.42
5825	-0.27	3.07	10.12	0.00	-1.37	-	16.784	12.92	19.59	30.00	17.08	11.55	14.29	36.00	24.45

Sample Calculation:

Conducted Power Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

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

Conducted Power Limit (5725 MHz-5850 MHz) = 1W

The test was performed with Gate function.

Maximum Conducted Output Power

Report No. 13328641H
Test place Ise EMC Lab. No.3 Measurement Room
Date May 7, 2020
Temperature / Humidity 21 deg. C / 50 % RH
Engineer Junki Nagatomi
Mode Tx 11n-20

11n-20

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	26 dB EBW (B for FCC) [MHz]	99% OBW (B for IC) [MHz]	Conducted Power				e.i.r.p.			
								Result	Limit	Margin		Result	Limit	Margin	
								[dBm]	[mW]	[dBm]	[dB]	[dBm]	[mW]	[dBm]	[dB]
5745	-0.07	3.05	10.12	0.00	-1.37	-	17.768	13.10	20.42	30.00	16.90	11.73	14.89	36.00	24.27
5785	-0.06	3.06	10.12	0.00	-1.37	-	17.835	13.12	20.51	30.00	16.88	11.75	14.96	36.00	24.25
5825	-0.15	3.07	10.12	0.00	-1.37	-	17.750	13.04	20.14	30.00	16.96	11.67	14.69	36.00	24.33

Sample Calculation:

Conducted Power Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

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

Conducted Power Limit (5725 MHz-5850 MHz) = 1W

The test was performed with Gate function.

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Facsimile : +81 596 24 8124

Maximum Conducted Output Power

Report No. 13328641H
Test place Ise EMC Lab. No.3 Measurement Room
Date May 7, 2020
Temperature / Humidity 21 deg. C / 50 % RH
Engineer Junki Nagatomi
Mode Tx 11ac-20

11ac-20

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	26 dB EBW (B for FCC) [MHz]	99% OBW (B for IC) [MHz]	Conducted Power				e.i.r.p.			
								Result	Limit	Margin		Result	Limit	Margin	
								[dBm]	[mW]	[dBm]	[dB]	[dBm]	[mW]	[dBm]	[dB]
5745	-0.02	3.05	10.12	0.00	-1.37	-	17.802	13.15	20.65	30.00	16.85	11.78	15.07	36.00	24.22
5785	-0.02	3.06	10.12	0.00	-1.37	-	17.781	13.16	20.70	30.00	16.84	11.79	15.10	36.00	24.21
5825	-0.12	3.07	10.12	0.00	-1.37	-	17.723	13.07	20.28	30.00	16.93	11.70	14.79	36.00	24.30

Sample Calculation:

Conducted Power Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

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

Conducted Power Limit (5725 MHz-5850 MHz) = 1W

The test was performed with Gate function.

UL Japan, Inc.

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

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Maximum Conducted Output Power

Report No. 13328641H
Test place Ise EMC Lab. No.3 Measurement Room
Date May 7, 2020
Temperature / Humidity 21 deg. C / 50 % RH
Engineer Junki Nagatomi
Mode Tx 11n-40

11n-40

Applied limit: 15.407, mobile and portable client device

Tested Frequency	Power Meter Reading	Cable Loss	Atten. Loss	Duty Factor	Antenna Gain	26 dB EBW (B for FCC)	99% OBW (B for IC)	Conducted Power				e.i.r.p.			
								Result		Limit	Margin	Result		Limit	Margin
								[dBm]	[mW]	[dBm]	[dB]	[dBm]	[mW]	[dBm]	[dB]
[MHz]	[dBm]	[dB]	[dB]	[dB]	[dBi]	[MHz]	[MHz]	[dBm]	[mW]	[dBm]	[dB]	[dBm]	[mW]	[dBm]	[dB]
5755	-1.13	3.06	10.12	0.00	-1.37	-	36.211	12.05	16.03	30.00	17.95	10.68	11.69	36.00	25.32
5795	-1.12	3.06	10.12	0.00	-1.37	-	36.234	12.06	16.07	30.00	17.94	10.69	11.72	36.00	25.31

Sample Calculation:

Conducted Power Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

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

Conducted Power Limit (5725 MHz-5850 MHz) = 1W

The test was performed with Gate function.

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Maximum Conducted Output Power

Report No. 13328641H
Test place Ise EMC Lab. No.3 Measurement Room
Date May 7, 2020
Temperature / Humidity 21 deg. C / 50 % RH
Engineer Junki Nagatomi
Mode Tx 11ac-40

11ac-40

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	26 dB EBW (B for FCC) [MHz]	99% OBW (B for IC) [MHz]	Conducted Power				e.i.r.p.			
								Result	Limit	Margin		Result	Limit	Margin	
								[dBm]	[mW]	[dBm]	[dB]	[dBm]	[mW]	[dBm]	[dB]
5755	-1.12	3.06	10.12	0.00	-1.37	-	36.230	12.06	16.07	30.00	17.94	10.69	11.72	36.00	25.31
5795	-1.10	3.06	10.12	0.00	-1.37	-	36.290	12.08	16.14	30.00	17.92	10.71	11.78	36.00	25.29

Sample Calculation:

Conducted Power Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

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

Conducted Power Limit (5725 MHz-5850 MHz) = 1W

The test was performed with Gate function.

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Maximum Conducted Output Power

Report No. 13328641H
Test place Ise EMC Lab. No.3 Measurement Room
Date May 7, 2020
Temperature / Humidity 21 deg. C / 50 % RH
Engineer Junki Nagatomi
Mode Tx 11ac-80

11ac-80

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	26 dB EBW (B for FCC) [MHz]	99% OBW (B for IC) [MHz]	Conducted Power				e.i.r.p.			
								Result		Limit	Margin	Result		Limit	Margin
								[dBm]	[mW]	[dBm]	[dB]	[dBm]	[mW]	[dBm]	[dB]
5775	-5.94	3.06	10.12	0.00	-1.37	-	76.317	7.24	5.30	30.00	22.76	5.87	3.86	36.00	30.13

Sample Calculation:

Conducted Power Result = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor

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

Conducted Power Limit (5725 MHz-5850 MHz) = 1W

The test was performed with Gate function.

UL Japan, Inc.

Ise EMC Lab.

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

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Maximum Conducted Output Power

Report No.	13328641H
Test place	Ise EMC Lab. No.6 Measurement Room
Date	April 20, 2020
Temperature / Humidity	23 deg. C / 38 % RH
Engineer	Junya Okuno
Mode	Tx

11a 5745 MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
6	0.00	
9	0.03	
12	-0.02	
18	-0.03	
24	-0.07	
36	0.00	
48	0.08	
54	0.09	*

*: Worst Rate

11n-20 5745 MHz

MCS	Reading	Remark
	[dBm]	
0	0.03	
1	0.09	
2	0.15	
3	0.16	
4	0.24	
5	0.25	
6	0.28	
7	0.31	*

*: Worst Rate

11ac-20 5745 MHz

MCS	Reading	Remark
	[dBm]	
0	-0.01	
1	0.04	
2	0.08	
3	0.03	
4	0.14	
5	0.18	
6	0.19	
7	0.24	*
8	-5.75	

*: Worst Rate

Cable Loss and Attenuator Loss are included in the P/M(AV) Reading

All comparisons were carried out on same frequency and meas

The difference between the worst rate check data and formal test results is due to the different test condition.

Maximum Conducted Output Power

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 20, 2020
Temperature / Humidity 23 deg. C / 38 % RH
Engineer Junya Okuno
Mode Tx

11n-40 5755 MHz

MCS	Reading	Remark
	[dBm]	
0	-1.02	
1	-1.02	
2	-0.98	
3	-1.02	
4	-0.95	
5	-0.89	
6	-0.89	
7	-0.84	*

*: Worst Rate

11ac-40 5755 MHz

MCS	Reading	Remark
	[dBm]	
0	-0.97	
1	-1.05	
2	-1.09	
3	-0.99	
4	-0.97	
5	-0.99	
6	-0.92	
7	-0.85	*
8	-5.78	
9	-5.73	

*: Worst Rate

11ac-80 5775 MHz

MCS	Reading	Remark
	[dBm]	
0	-5.44	*
1	-5.96	
2	-5.92	
3	-5.50	
4	-5.99	
5	-5.92	
6	-5.92	
7	-5.85	
8	-5.86	
9	-5.85	

*: Worst Rate

Cable Loss and Attenuator Loss are included in the P/M(AV) Reading

All comparisons were carried out on same frequency and meas

The difference between the worst rate check data and formal test results is due to the different test condition.

Average Output Power
(Reference data for RF Exposure)

Report No. 13328641H
Test place Ise EMC Lab. No.3 Measurement Room
Date May 7, 2020
Temperature / Humidity 21 deg. C / 50 % RH
Engineer Junki Nagatomi
Mode Tx 11a

Antenna 1

Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Burst power average)	
				[dBm]	[mW]
5745	-0.41	3.05	10.12	12.76	18.88
5785	-0.35	3.06	10.12	12.83	19.19
5825	-0.36	3.07	10.12	12.83	19.19

Sample Calculation:

Result (Burst power average) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss

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.

The test was performed with Gate function.

Average Output Power
(Reference data for RF Exposure)

Report No. 13328641H
Test place Ise EMC Lab. No.3 Measurement Room
Date May 7, 2020
Temperature / Humidity 21 deg. C / 50 % RH
Engineer Junki Nagatomi
Mode Tx 11n-20

Antenna 1

Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Burst power average)	
				[dBm]	[mW]
5745	-0.24	3.05	10.12	12.93	19.63
5785	-0.23	3.06	10.12	12.95	19.72
5825	-0.32	3.07	10.12	12.87	19.36

Sample Calculation:

Result (Burst power average) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss

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.

The test was performed with Gate function.

Average Output Power
(Reference data for RF Exposure)

Report No. 13328641H
Test place Ise EMC Lab. No.3 Measurement Room
Date May 7, 2020
Temperature / Humidity 21 deg. C / 50 % RH
Engineer Junki Nagatomi
Mode Tx 11ac-20

Antenna 1

Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Burst power average)	
				[dBm]	[mW]
5745	-0.22	3.05	10.12	12.95	19.72
5785	-0.20	3.06	10.12	12.98	19.86
5825	-0.30	3.07	10.12	12.89	19.45

Sample Calculation:

Result (Burst power average) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss

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.

The test was performed with Gate function.

Average Output Power
(Reference data for RF Exposure)

Report No. 13328641H
Test place Ise EMC Lab. No.3 Measurement Room
Date May 7, 2020
Temperature / Humidity 21 deg. C / 50 % RH
Engineer Junki Nagatomi
Mode Tx 11n-40

Antenna 1

Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Burst power average)	
				[dBm]	[mW]
5755	-1.42	3.06	10.12	11.76	15.00
5795	-1.29	3.06	10.12	11.89	15.45

Sample Calculation:

Result (Burst power average) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss

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.

The test was performed with Gate function.

Average Output Power
(Reference data for RF Exposure)

Report No. 13328641H
Test place Ise EMC Lab. No.3 Measurement Room
Date May 7, 2020
Temperature / Humidity 21 deg. C / 50 % RH
Engineer Junki Nagatomi
Mode Tx 11ac-40

Antenna 1

Tested Frequency [MHz]	Power Meter Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Burst power average)	
				[dBm]	[mW]
5755	-1.44	3.06	10.12	11.74	14.93
5795	-1.36	3.06	10.12	11.82	15.21

Sample Calculation:

Result (Burst power average) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss

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.

The test was performed with Gate function.

Average Output Power
(Reference data for RF Exposure)

Report No. 13328641H
Test place Ise EMC Lab. No.3 Measurement Room
Date May 7, 2020
Temperature / Humidity 21 deg. C / 50 % RH
Engineer Junki Nagatomi
Mode Tx 11ac-80

Antenna 1

Tested Frequency	Power Meter Reading	Cable Loss	Atten. Loss	Result (Burst power average)	
				[dBm]	[mW]
5775	-5.94	3.06	10.12	7.24	5.30

Sample Calculation:

Result (Burst power average) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss

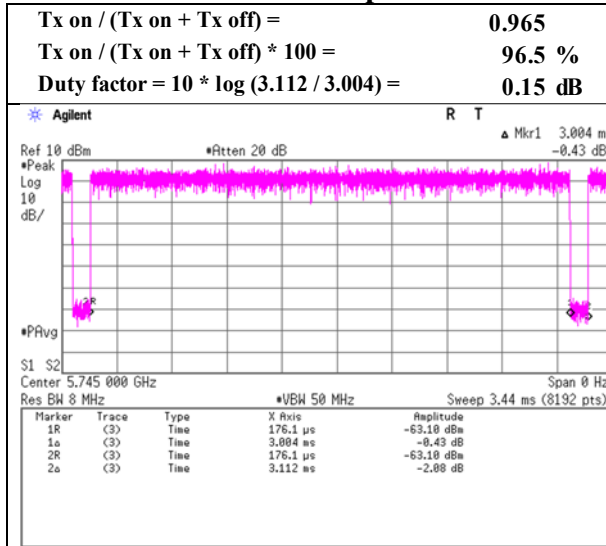
The average output power was measured with the lowest order modulation and lowest data rate configuration in each IEEE 802.11 mode based on KDB 248227 D01.

The test was performed with Gate function.

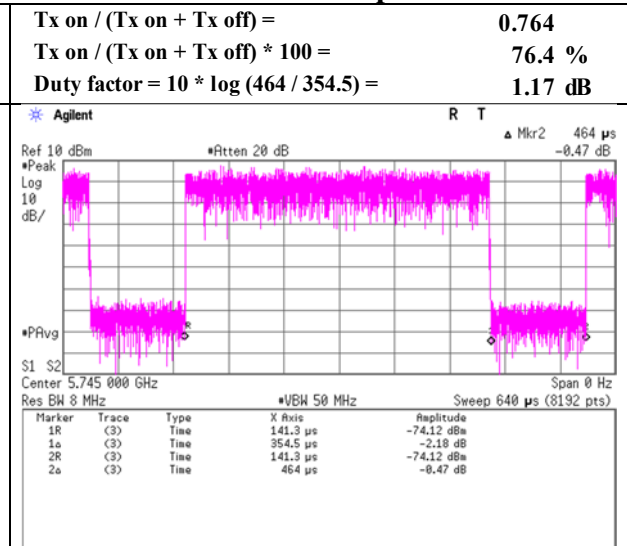
Burst rate confirmation

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 23, 2020
Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx

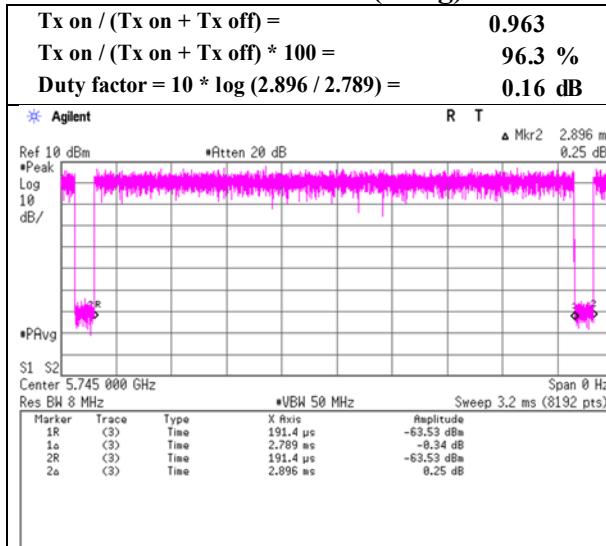
11a 6 Mbps



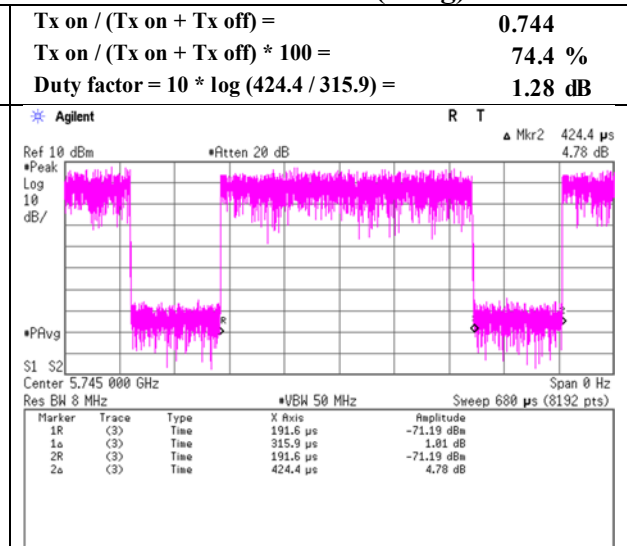
11a 54 Mbps



11n-20 MCS 0 (Long)



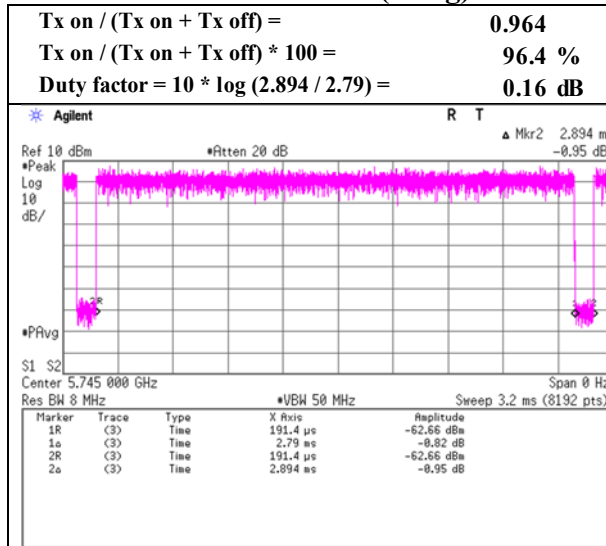
11n-20 MCS 7 (Long)



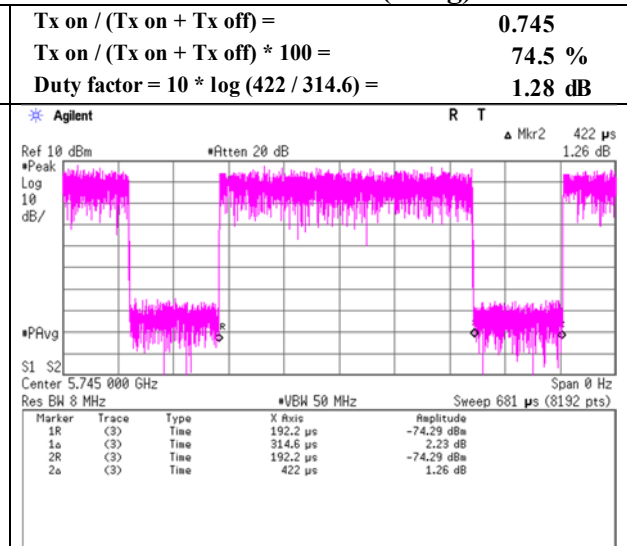
Burst rate confirmation

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 23, 2020
Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx

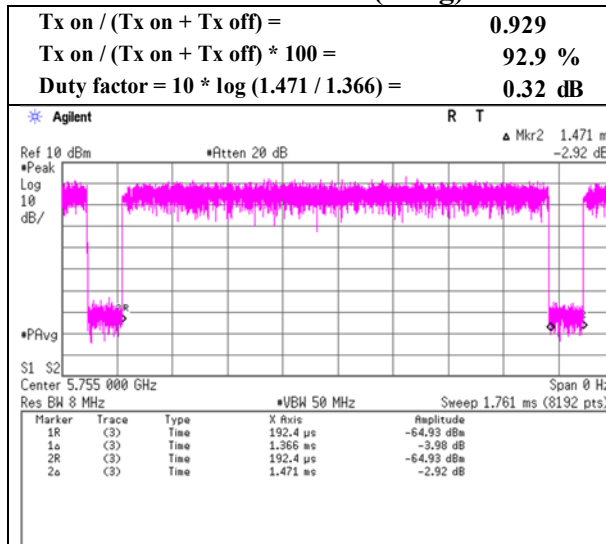
11ac-20 MCS 0 (Long)



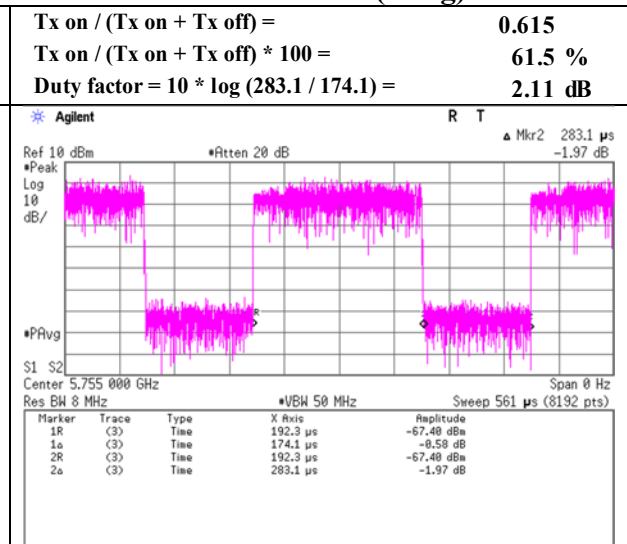
11ac-20 MCS 7 (Long)



11n-40 MCS 0 (Long)



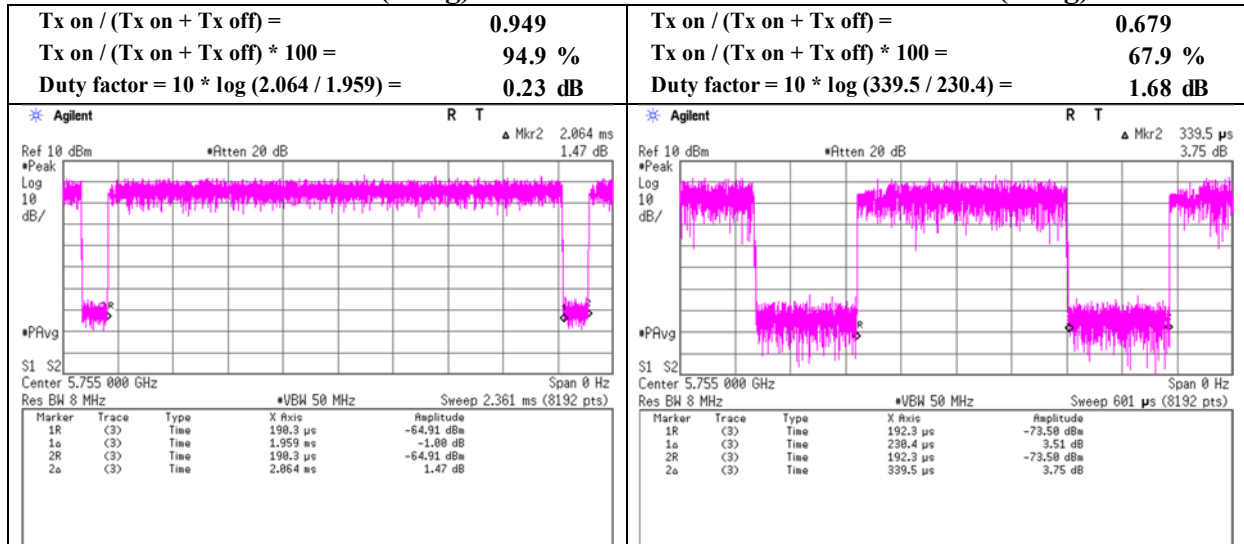
11n-40 MCS 7 (Long)



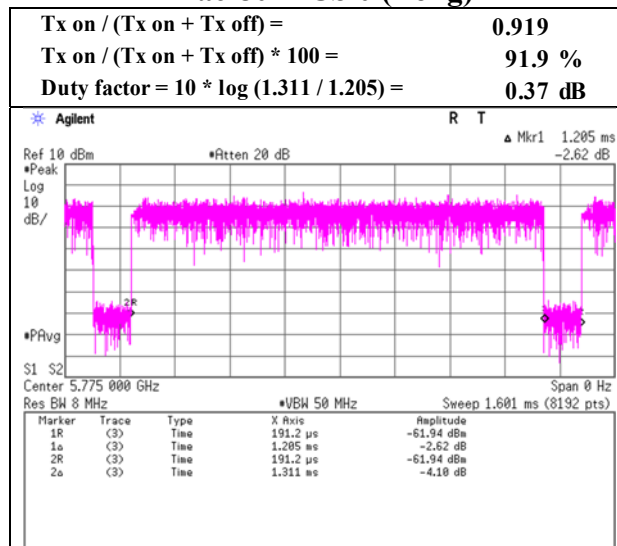
Burst rate confirmation

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 23, 2020
Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx

11ac-40 MCS 0 (Long)



11ac-80 MCS 0 (Long)



Maximum Power Spectral Density

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 23, 2020
Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx 11a

Antenna 1

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	PSD Reading [dBm /MHz]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	RBW Correction Factor [dB]	PSD (Conducted)			PSD (e.i.r.p.)		
							Result [dBm /MHz]	Limit [dBm /MHz]	Margin [dB]	Result [dBm /MHz]	Limit [dBm /MHz]	Margin [dB]
5745	-14.27	3.05	10.11	1.17	-1.37	0.27	0.33	30.00	29.67	-1.04	36.00	37.04
5785	-13.91	3.06	10.11	1.17	-1.37	0.27	0.70	30.00	29.30	-0.67	36.00	36.67
5825	-14.25	3.07	10.11	1.17	-1.37	0.27	0.37	30.00	29.63	-1.00	36.00	37.00

Sample Calculation:

PSD: Power Spectral Density

The PSD within 5725 MHz to 5825 MHz are based on any 500 kHz band.

RBW Correction Factor = $10 * \log (\text{Specified bandwidth} / \text{Measured bandwidth})$

PSD Result (Conducted) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor + RBW Correction Factor

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

The conducted PSD limit was reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. (All frequencies for FCC, 5725 MHz-5850 MHz for IC)

Maximum Power Spectral Density

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 23, 2020
Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx 11n-20

Antenna 1

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	PSD Reading [dBm /MHz]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	RBW Correction Factor [dB]	PSD (Conducted)			PSD (e.i.r.p.)		
							Result [dBm /MHz]	Limit [dBm /MHz]	Margin [dB]	Result [dBm /MHz]	Limit [dBm /MHz]	Margin [dB]
5745	-14.34	3.05	10.11	1.28	-1.37	0.27	0.37	30.00	29.63	-1.00	36.00	37.00
5785	-14.73	3.06	10.11	1.28	-1.37	0.27	-0.01	30.00	30.01	-1.38	36.00	37.38
5825	-14.37	3.07	10.11	1.28	-1.37	0.27	0.36	30.00	29.64	-1.01	36.00	37.01

Sample Calculation:

PSD: Power Spectral Density

The PSD within 5725 MHz to 5825 MHz are based on any 500 kHz band.

RBW Correction Factor = $10 * \log (\text{Specified bandwidth} / \text{Measured bandwidth})$

PSD Result (Conducted) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor + RBW Correction Factor

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

The conducted PSD limit was reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. (All frequencies for FCC, 5725 MHz-5850 MHz for IC)

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Maximum Power Spectral Density

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 23, 2020
Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx 11ac-20

Antenna 1

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	PSD Reading [dBm /MHz]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	RBW Correction Factor [dB]	PSD (Conducted)			PSD (e.i.r.p.)		
							Result [dBm /MHz]	Limit [dBm /MHz]	Margin [dB]	Result [dBm /MHz]	Limit [dBm /MHz]	Margin [dB]
5745	-14.28	3.05	10.11	1.28	-1.37	0.27	0.43	30.00	29.57	-0.94	36.00	36.94
5785	-14.45	3.06	10.11	1.28	-1.37	0.27	0.27	30.00	29.73	-1.10	36.00	37.10
5825	-14.23	3.07	10.11	1.28	-1.37	0.27	0.49	30.00	29.51	-0.88	36.00	36.88

Sample Calculation:

PSD: Power Spectral Density

The PSD within 5725 MHz to 5825 MHz are based on any 500 kHz band.

RBW Correction Factor = $10 * \log (\text{Specified bandwidth} / \text{Measured bandwidth})$

PSD Result (Conducted) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor + RBW Correction Factor

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

The conducted PSD limit was reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. (All frequencies for FCC, 5725 MHz-5850 MHz for IC)

Maximum Power Spectral Density

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 23, 2020
Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx 11n-40

Antenna 1

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	PSD Reading [dBm /MHz]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	RBW Correction Factor [dB]	PSD (Conducted)			PSD (e.i.r.p.)		
							Result [dBm /MHz]	Limit [dBm /MHz]	Margin [dB]	Result [dBm /MHz]	Limit [dBm /MHz]	Margin [dB]
5755	-19.17	3.06	10.11	2.11	-1.37	0.27	-3.62	30.00	33.62	-4.99	36.00	40.99
5795	-18.98	3.06	10.11	2.11	-1.37	0.27	-3.43	30.00	33.43	-4.80	36.00	40.80

Sample Calculation:

PSD: Power Spectral Density

The PSD within 5725 MHz to 5825 MHz are based on any 500 kHz band.

RBW Correction Factor = $10 \cdot \log (\text{Specified bandwidth} / \text{Measured bandwidth})$

PSD Result (Conducted) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor + RBW Correction Factor

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

The conducted PSD limit was reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. (All frequencies for FCC, 5725 MHz-5850 MHz for IC)

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Maximum Power Spectral Density

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 23, 2020
Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx 11ac-40

Antenna 1

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	PSD Reading [dBm /MHz]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	RBW Correction Factor [dB]	PSD (Conducted)			PSD (e.i.r.p.)		
							Result [dBm /MHz]	Limit [dBm /MHz]	Margin [dB]	Result [dBm /MHz]	Limit [dBm /MHz]	Margin [dB]
5755	-18.91	3.06	10.11	1.68	-1.37	0.27	-3.79	30.00	33.79	-5.16	36.00	41.16
5795	-18.72	3.06	10.11	1.68	-1.37	0.27	-3.60	30.00	33.60	-4.97	36.00	40.97

Sample Calculation:

PSD: Power Spectral Density

The PSD within 5725 MHz to 5825 MHz are based on any 500 kHz band.

RBW Correction Factor = $10 * \log (\text{Specified bandwidth} / \text{Measured bandwidth})$

PSD Result (Conducted) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor + RBW Correction Factor

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

The conducted PSD limit was reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. (All frequencies for FCC, 5725 MHz-5850 MHz for IC)

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Maximum Power Spectral Density

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 23, 2020
Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx 11ac-80

Antenna 1

Applied limit: 15.407, mobile and portable client device

Tested Frequency [MHz]	PSD Reading [dBm /MHz]	Cable Loss [dB]	Atten. Loss [dB]	Duty Factor [dB]	Antenna Gain [dBi]	RBW Correction Factor [dB]	PSD (Conducted)			PSD (e.i.r.p.)		
							Result [dBm /MHz]	Limit [dBm /MHz]	Margin [dB]	Result [dBm /MHz]	Limit [dBm /MHz]	Margin [dB]
5775	-26.28	3.06	10.11	0.37	-1.37	0.27	-12.47	30.00	42.47	-13.84	36.00	49.84

Sample Calculation:

PSD: Power Spectral Density

The PSD within 5725 MHz to 5825 MHz are based on any 500 kHz band.

RBW Correction Factor = $10 * \log (\text{Specified bandwidth} / \text{Measured bandwidth})$

PSD Result (Conducted) = Reading + Cable Loss (including the cable(s) customer supplied) + Atten. Loss + Duty Factor + RBW Correction Factor

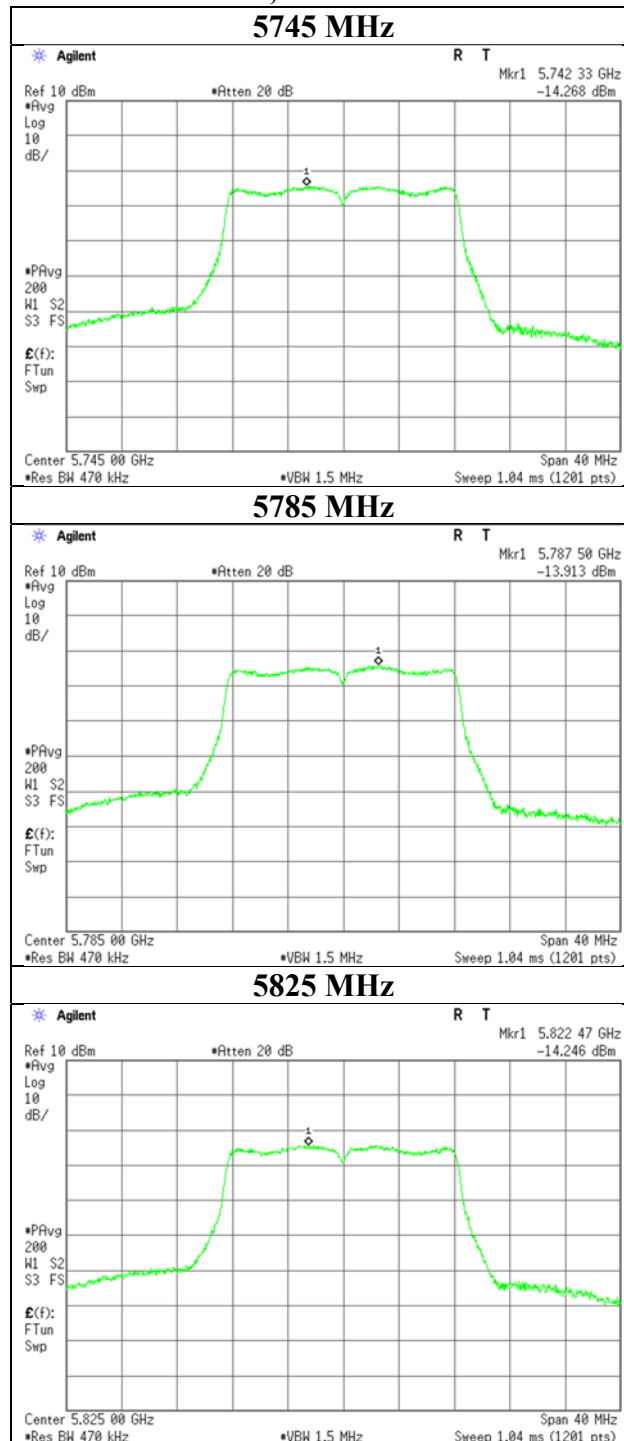
PSD Result (e.i.r.p.) = Conducted PSD Result + Antenna Gain

The conducted PSD limit was reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. (All frequencies for FCC, 5725 MHz-5850 MHz for IC)

Maximum Power Spectral Density

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
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Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx 11a

11a, Antenna 1



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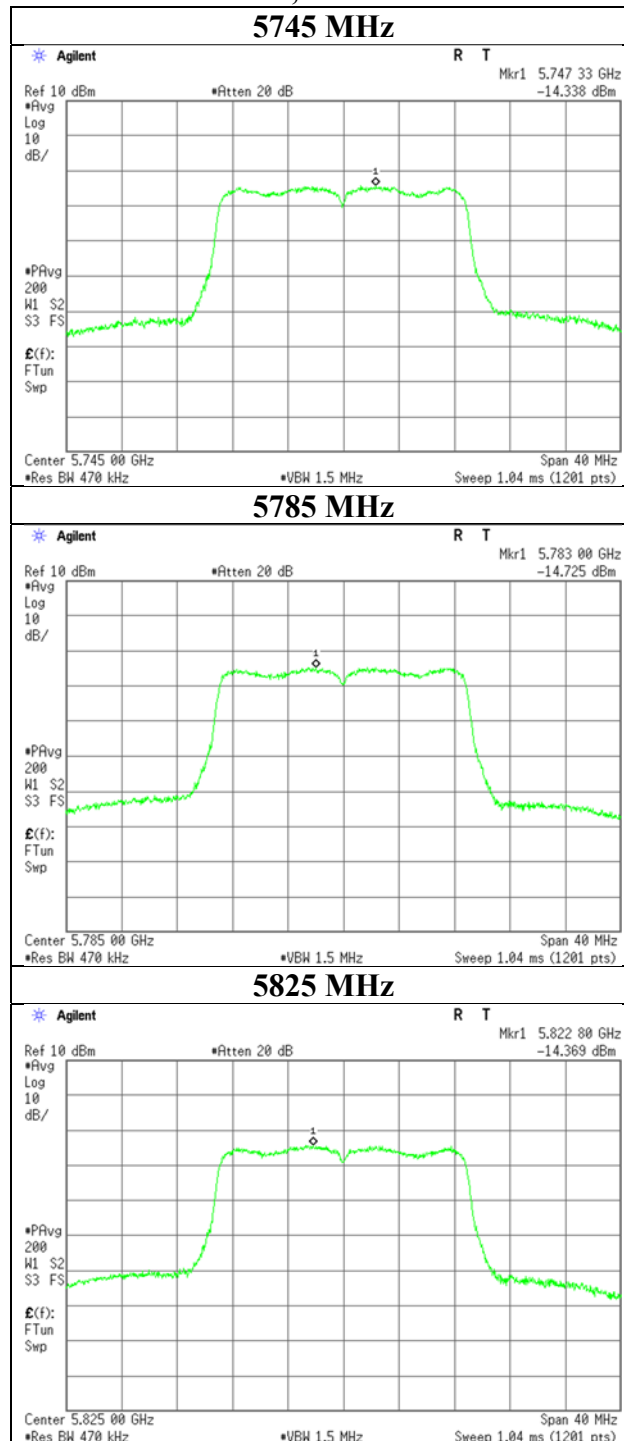
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Maximum Power Spectral Density

Report No. 13328641H
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Mode Tx 11n-20

11n-20, Antenna 1



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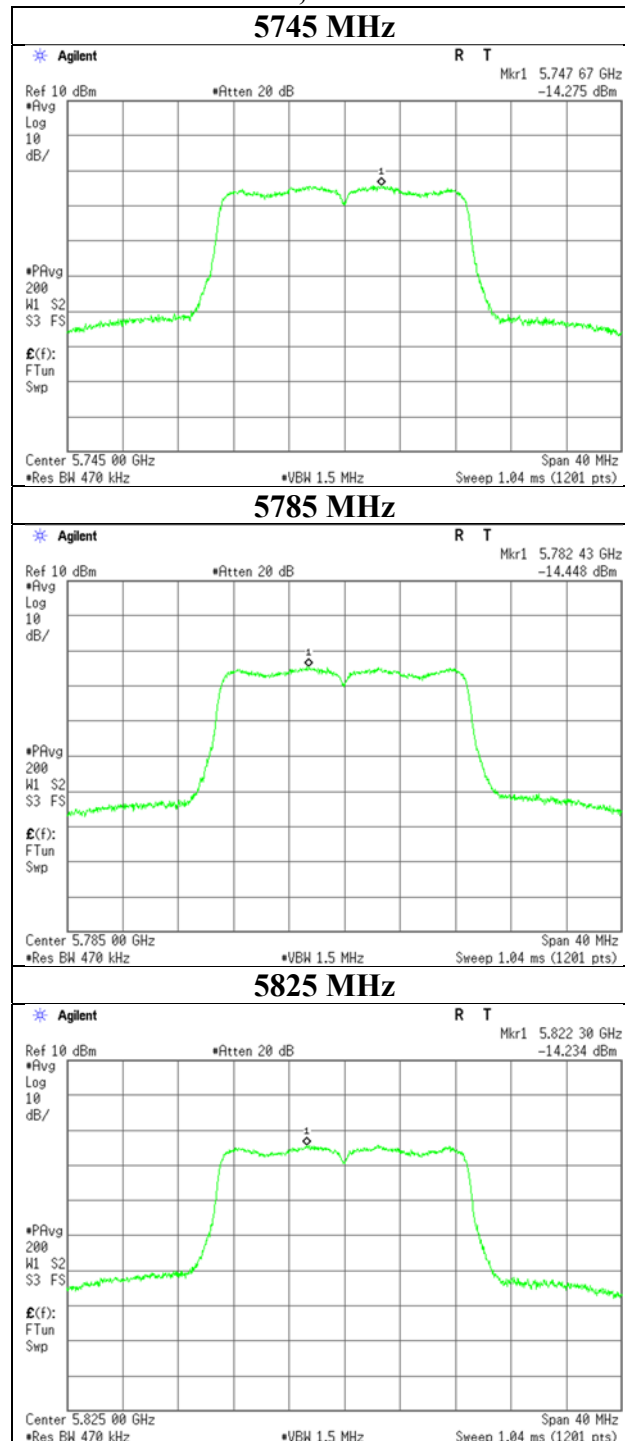
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Maximum Power Spectral Density

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 23, 2020
Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx 11ac-20

11ac-20, Antenna 1



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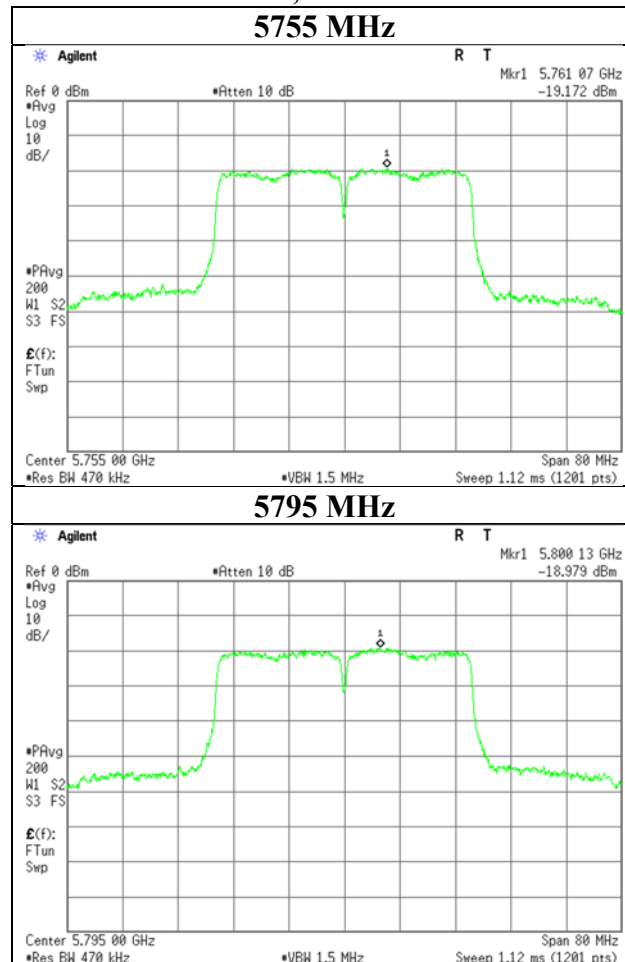
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Maximum Power Spectral Density

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
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Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx 11n-40

11n-40, Antenna 1



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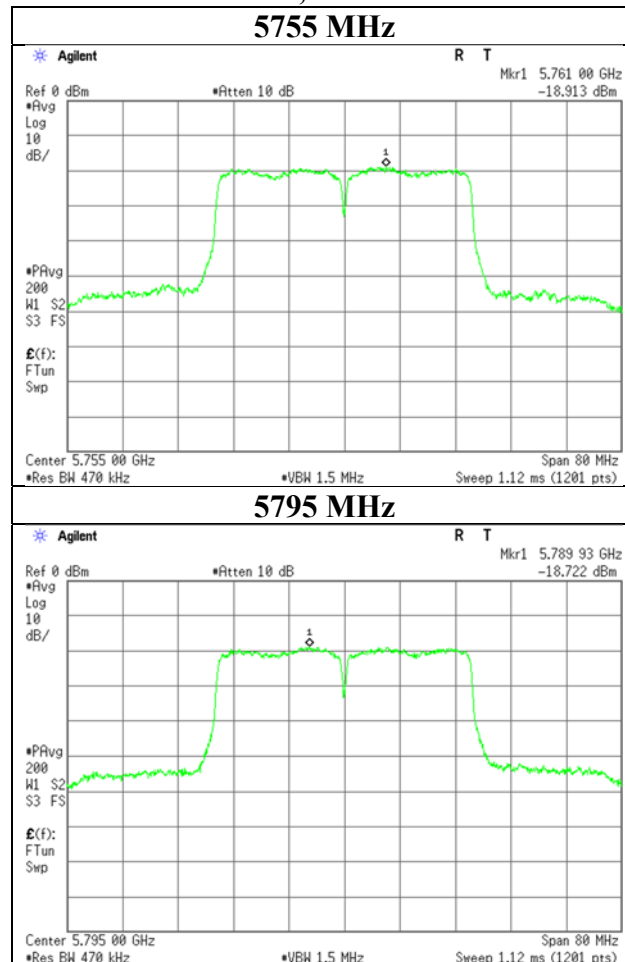
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Maximum Power Spectral Density

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 23, 2020
Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx 11ac-40

11ac-40, Antenna 1



UL Japan, Inc.

Ise EMC Lab.

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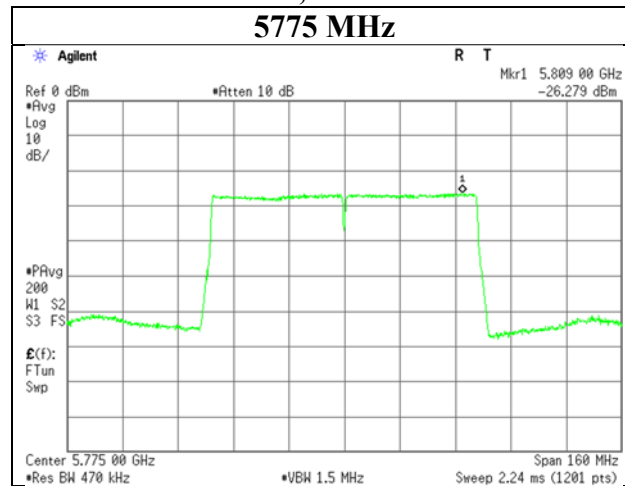
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Maximum Power Spectral Density

Report No. 13328641H
Test place Ise EMC Lab. No.6 Measurement Room
Date April 23, 2020
Temperature / Humidity 24 deg. C / 23 % RH
Engineer Yuta Moriya
Mode Tx 11ac-80

11ac-80, Antenna 1



Radiated Spurious Emission

Report No. 13328641H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date May 2, 2020
Temperature / Humidity 22 deg. C / 53 % RH
Engineer Junki Nagatomi
(1 GHz - 40 GHz)
Mode Tx 11ac-20 5745 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.	5650.000	PK	41.6	32.3	6.3	31.4	-	48.9	68.2	19.3	
Hori.	5672.917	PK	46.7	32.4	6.4	31.4	-	54.1	85.2	31.2	
Hori.	5700.000	PK	46.6	32.5	6.4	31.4	-	54.0	105.2	51.2	
Hori.	5720.000	PK	56.1	32.5	6.4	31.4	-	63.7	110.8	47.2	
Hori.	5725.000	PK	64.3	32.5	6.4	31.4	-	71.8	122.2	50.4	
Hori.	11490.000	PK	42.5	40.1	-1.7	33.3	-	47.6	73.9	26.3	Floor noise
Hori.	17235.000	PK	43.9	41.6	0.0	32.7	-	52.8	68.2	15.4	Floor noise
Hori.	11490.000	AV	33.8	40.1	-1.7	33.3	-	38.9	53.9	15.0	Floor noise
Vert.	5650.000	PK	41.2	32.3	6.3	31.4	-	48.5	68.2	19.7	
Vert.	5672.917	PK	44.9	32.4	6.4	31.4	-	52.3	85.2	33.0	
Vert.	5700.000	PK	45.3	32.5	6.4	31.4	-	52.8	105.2	52.4	
Vert.	5720.000	PK	57.0	32.5	6.4	31.4	-	64.5	110.8	46.3	
Vert.	5725.000	PK	62.6	32.5	6.4	31.4	-	70.1	122.2	52.1	
Vert.	11490.000	PK	42.3	40.1	-1.7	33.3	-	47.4	73.9	26.5	Floor noise
Vert.	17235.000	PK	44.5	41.6	0.0	32.7	-	53.4	68.2	14.8	Floor noise
Vert.	11490.000	AV	33.8	40.1	-1.7	33.3	-	38.9	53.9	15.0	Floor noise

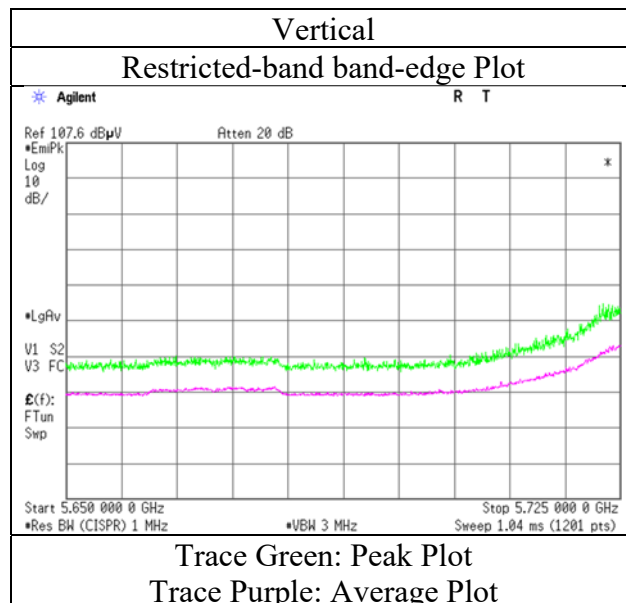
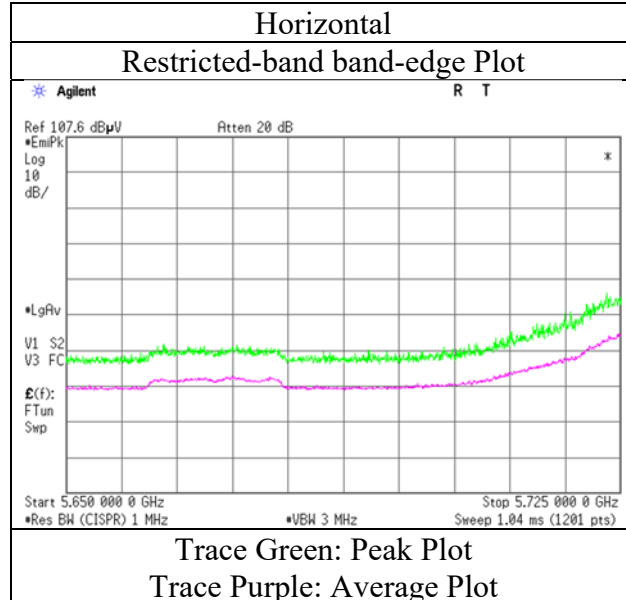
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

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

Distance factor: 1 GHz - 10 GHz $20\log(3.85\text{ m} / 3.0\text{ m}) = 2.17\text{ dB}$
10 GHz - 40 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

Radiated Spurious Emission

Report No.	13328641H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	May 2, 2020
Temperature / Humidity	22 deg. C / 53 % RH
Engineer	Junki Nagatomi
Mode	Tx 11ac-20 5745 MHz



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

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

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Ise EMC Lab.

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Radiated Spurious Emission

Report No. 13328641H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date May 2, 2020
Temperature / Humidity 22 deg. C / 53 % RH
Engineer Junki Nagatomi
(1 GHz - 40 GHz)
Mode Tx 11ac-20 5785 MHz

No.4
May 5, 2020
23 deg. C / 43 % RH
Ken Fujita
(Below 1 GHz)

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.	74.253	QP	32.0	6.4	7.8	32.0	-	14.3	40.0	25.8	
Hori.	85.999	QP	32.3	7.9	7.9	31.9	-	16.2	40.0	23.9	
Hori.	172.101	QP	34.1	15.9	8.8	31.9	-	26.9	43.5	16.6	
Hori.	196.644	QP	35.0	16.5	9.0	31.8	-	28.7	43.5	14.8	
Hori.	208.674	QP	38.1	11.2	9.1	31.8	-	26.6	43.5	16.9	
Hori.	294.670	QP	40.2	13.5	9.7	31.8	-	31.6	46.0	14.4	
Hori.	11570.000	PK	42.1	39.9	-1.7	33.3	-	47.0	73.9	26.9	Floor noise
Hori.	17355.000	PK	44.0	42.7	0.1	32.8	-	54.0	68.2	14.2	
Hori.	11570.000	AV	34.3	39.9	-1.7	33.3	-	39.2	53.9	14.7	Floor noise
Vert.	74.253	QP	25.4	6.4	7.8	32.0	-	7.7	40.0	32.4	
Vert.	85.999	QP	29.3	7.9	7.9	31.9	-	13.2	40.0	26.9	
Vert.	172.101	QP	32.3	15.9	8.8	31.9	-	25.1	43.5	18.4	
Vert.	196.644	QP	37.2	16.5	9.0	31.8	-	30.9	43.5	12.6	
Vert.	208.674	QP	43.1	11.2	9.1	31.8	-	31.6	43.5	11.9	
Vert.	294.670	QP	42.4	13.5	9.7	31.8	-	33.8	46.0	12.2	
Vert.	11570.000	PK	42.8	39.9	-1.7	33.3	-	47.7	73.9	26.2	Floor noise
Vert.	17355.000	PK	44.1	42.7	0.1	32.8	-	54.1	68.2	14.1	
Vert.	11570.000	AV	34.3	39.9	-1.7	33.3	-	39.2	53.9	14.7	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 (3.85 m / 3.0 m) = 2.17 dB
10 GHz - 40 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No. 13328641H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date May 2, 2020
Temperature / Humidity 22 deg. C / 53 % RH
Engineer Junki Nagatomi
(1 GHz - 40 GHz)
Mode Tx 11ac-20 5825 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.	5850.000	PK	43.9	32.8	6.4	31.4	-	51.7	122.2	70.5	
Hori.	5855.000	PK	52.6	32.8	6.4	31.4	-	60.5	110.8	50.4	
Hori.	5875.000	PK	43.3	32.8	6.5	31.4	-	51.1	105.2	54.1	
Hori.	5896.677	PK	45.9	32.8	6.5	31.4	-	53.7	89.1	35.5	
Hori.	5925.000	PK	42.0	32.8	6.5	31.4	-	49.8	68.2	18.4	
Hori.	11650.000	PK	43.5	39.4	-1.7	33.3	-	47.9	73.9	26.0	Floor noise
Hori.	17475.000	PK	44.2	43.7	0.2	32.8	-	55.2	68.2	13.0	Floor noise
Hori.	11650.000	AV	34.7	39.4	-1.7	33.3	-	39.1	53.9	14.8	Floor noise
Vert.	5850.000	PK	42.5	32.8	6.4	31.4	-	50.3	122.2	71.9	
Vert.	5855.000	PK	49.3	32.8	6.4	31.4	-	57.1	110.8	53.7	
Vert.	5875.000	PK	41.9	32.8	6.5	31.4	-	49.7	105.2	55.5	
Vert.	5896.677	PK	44.0	32.8	6.5	31.4	-	51.8	89.1	37.4	
Vert.	5925.000	PK	41.4	32.8	6.5	31.4	-	49.3	68.2	18.9	
Vert.	11650.000	PK	43.5	39.4	-1.7	33.3	-	47.9	73.9	26.0	Floor noise
Vert.	17475.000	PK	44.0	43.7	0.2	32.8	-	55.1	68.2	13.2	Floor noise
Vert.	11650.000	AV	34.7	39.4	-1.7	33.3	-	39.1	53.9	14.8	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 $20\log(3.85\text{ m} / 3.0\text{ m}) = 2.17\text{ dB}$
10 GHz - 40 GHz $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.5\text{ dB}$

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Ise EMC Lab.

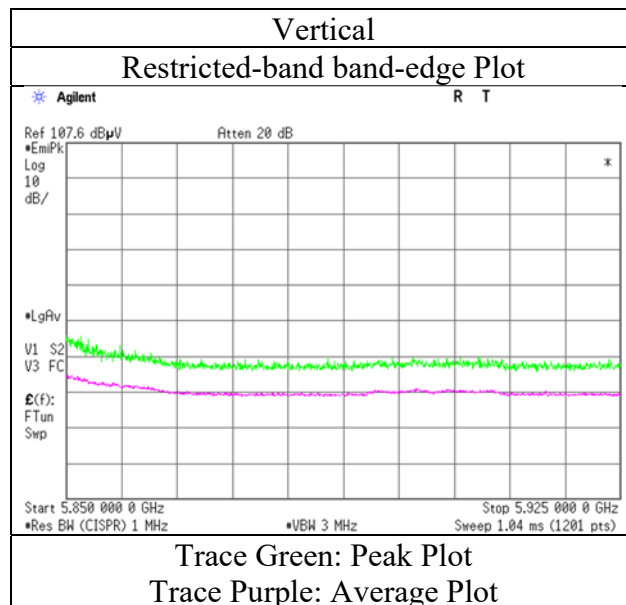
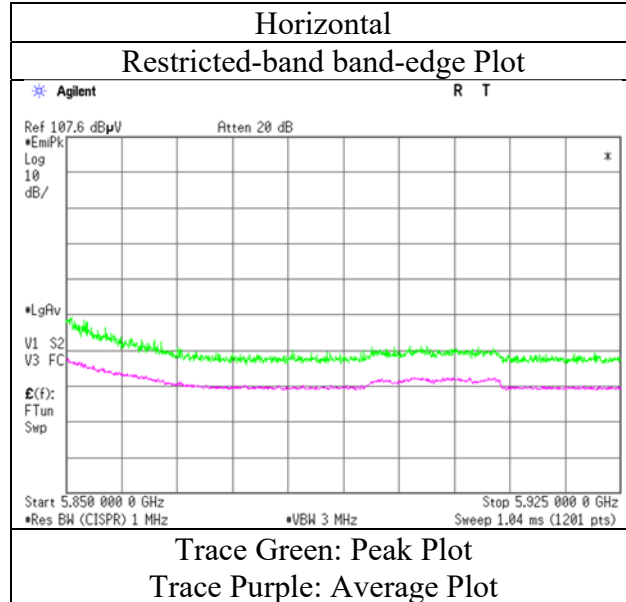
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Radiated Spurious Emission

Report No. 13328641H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date May 2, 2020
Temperature / Humidity 22 deg. C / 53 % RH
Engineer Junki Nagatomi
Mode Tx 11ac-20 5825 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

Report No. 13328641H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date May 2, 2020
Temperature / Humidity 22 deg. C / 53 % RH
Engineer Junki Nagatomi
(1 GHz - 40 GHz)
Mode Tx 11ac-40 5755 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.	5650.000	PK	42.4	32.3	6.3	31.4	-	49.7	68.2	18.5	
Hori.	5700.000	PK	51.4	32.5	6.4	31.4	-	58.9	105.2	46.4	
Hori.	5720.000	PK	64.3	32.5	6.4	31.4	-	71.8	110.8	39.0	
Hori.	5725.000	PK	64.4	32.5	6.4	31.4	-	71.9	122.2	50.3	
Hori.	11510.000	PK	43.2	40.0	-1.6	33.3	-	48.2	73.9	25.7	Floor noise
Hori.	17265.000	PK	44.5	41.7	0.0	32.8	-	53.6	68.2	14.6	Floor noise
Hori.	11510.000	AV	33.9	40.0	-1.6	33.3	-	39.0	53.9	14.9	Floor noise
Vert.	5650.000	PK	41.5	32.3	6.3	31.4	-	48.8	68.2	19.4	
Vert.	5700.000	PK	49.7	32.5	6.4	31.4	-	57.1	105.2	48.1	
Vert.	5720.000	PK	62.3	32.5	6.4	31.4	-	69.8	110.8	41.0	
Vert.	5725.000	PK	62.7	32.5	6.4	31.4	-	70.2	122.2	52.0	
Vert.	11510.000	PK	43.4	40.0	-1.6	33.3	-	48.4	73.9	25.5	Floor noise
Vert.	17265.000	PK	44.8	41.7	0.0	32.8	-	53.8	68.2	14.4	Floor noise
Vert.	11510.000	AV	33.9	40.0	-1.6	33.3	-	39.0	53.9	14.9	Floor noise

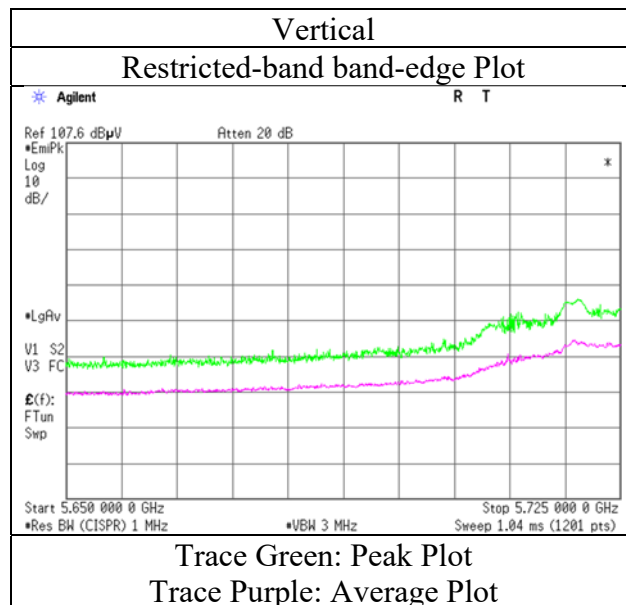
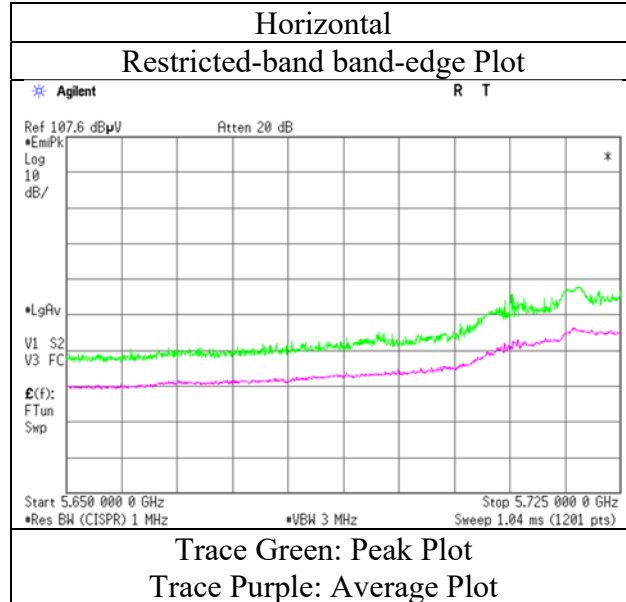
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

*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(3.85 m / 3.0 m) = 2.17 dB
10 GHz - 40 GHz 20log(1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No.	13328641H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	May 2, 2020
Temperature / Humidity	22 deg. C / 53 % RH
Engineer	Junki Nagatomi
Mode	Tx 11ac-40 5755 MHz



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

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

UL Japan, Inc.

Ise EMC Lab.

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

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Radiated Spurious Emission

Report No. 13328641H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date May 2, 2020
Temperature / Humidity 22 deg. C / 53 % RH
Engineer Junki Nagatomi
(1 GHz - 40 GHz)
Mode Tx 11ac-40 5795 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.	5850.000	PK	46.4	32.8	6.4	31.4	-	54.2	122.2	68.0	
Hori.	5855.000	PK	50.2	32.8	6.4	31.4	-	58.1	110.8	52.8	
Hori.	5875.000	PK	45.5	32.8	6.5	31.4	-	53.3	105.2	51.9	
Hori.	5925.000	PK	41.6	32.8	6.5	31.4	-	49.4	68.2	18.8	
Hori.	11590.000	PK	42.9	39.7	-1.7	33.3	-	47.7	73.9	26.2	Floor noise
Hori.	17385.000	PK	43.7	42.9	0.1	32.8	-	54.0	68.2	14.2	Floor noise
Hori.	11590.000	AV	34.2	39.7	-1.7	33.3	-	39.0	53.9	14.9	Floor noise
Vert.	5850.000	PK	43.9	32.8	6.4	31.4	-	51.8	122.2	70.4	
Vert.	5855.000	PK	47.3	32.8	6.4	31.4	-	55.2	110.8	55.6	
Vert.	5875.000	PK	43.9	32.8	6.5	31.4	-	51.7	105.2	53.5	
Vert.	5925.000	PK	42.1	32.8	6.5	31.4	-	49.9	68.2	18.3	
Vert.	11590.000	PK	43.4	39.7	-1.7	33.3	-	48.1	73.9	25.8	Floor noise
Vert.	17385.000	PK	43.9	42.9	0.1	32.8	-	54.2	68.2	14.0	Floor noise
Vert.	11590.000	AV	34.2	39.7	-1.7	33.3	-	39.0	53.9	14.9	Floor noise

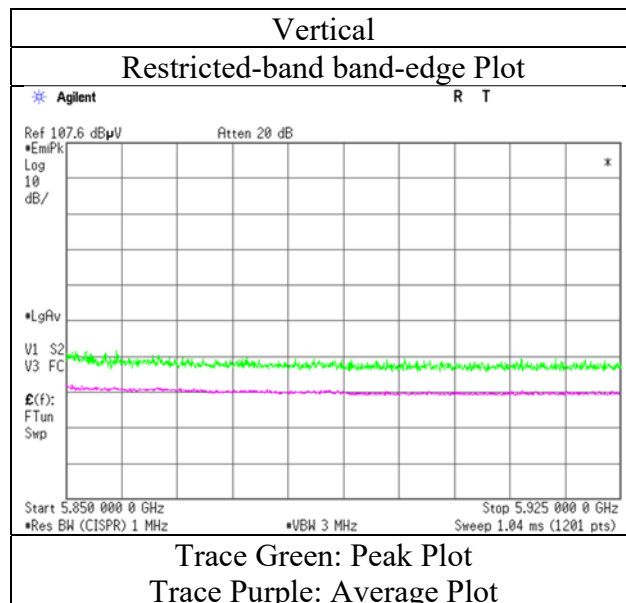
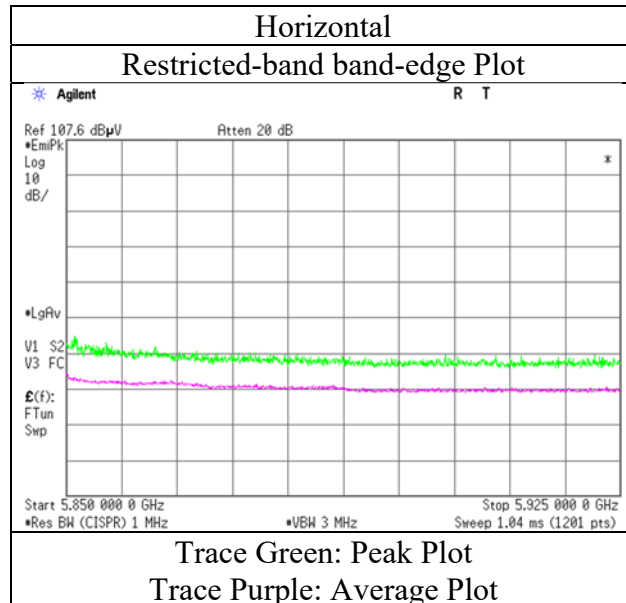
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

*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(3.85 m / 3.0 m) = 2.17 dB
10 GHz - 40 GHz 20log(1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No.	13328641H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	May 2, 2020
Temperature / Humidity	22 deg. C / 53 % RH
Engineer	Junki Nagatomi
Mode	Tx 11ac-40 5795 MHz



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

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

UL Japan, Inc.

Ise EMC Lab.

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

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Radiated Spurious Emission

Report No. 13328641H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.4
Date May 2, 2020
Temperature / Humidity 22 deg. C / 53 % RH
Engineer Junki Nagatomi
(1 GHz - 40 GHz)
Mode Tx 11ac-80 5775 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.	5650.000	PK	43.2	32.3	6.3	31.4	-	50.5	68.2	17.7	
Hori.	5700.000	PK	55.8	32.5	6.4	31.4	-	63.3	105.2	41.9	
Hori.	5720.000	PK	53.2	32.5	6.4	31.4	-	60.7	110.8	50.1	
Hori.	5725.000	PK	52.5	32.5	6.4	31.4	-	60.0	122.2	62.2	
Hori.	5850.000	PK	53.6	32.8	6.4	31.4	-	61.5	122.2	60.7	
Hori.	5855.000	PK	56.0	32.8	6.4	31.4	-	63.8	110.8	47.0	
Hori.	5875.000	PK	48.3	32.8	6.5	31.4	-	56.1	105.2	49.1	
Hori.	5925.000	PK	41.4	32.8	6.5	31.4	-	49.2	68.2	19.0	
Hori.	11550.000	PK	42.7	40.0	-1.7	33.3	-	47.8	73.9	26.1	Floor noise
Hori.	17325.000	PK	43.9	42.4	0.1	32.8	-	53.6	68.2	14.6	Floor noise
Hori.	11550.000	AV	34.2	40.0	-1.7	33.3	-	39.2	53.9	14.7	Floor noise
Vert.	5650.000	PK	47.0	32.3	6.3	31.4	-	54.3	68.2	13.9	
Vert.	5700.000	PK	54.8	32.5	6.4	31.4	-	62.2	105.2	43.0	
Vert.	5720.000	PK	51.3	32.5	6.4	31.4	-	58.8	110.8	52.0	
Vert.	5725.000	PK	51.0	32.5	6.4	31.4	-	58.6	122.2	63.7	
Vert.	5850.000	PK	51.8	32.8	6.4	31.4	-	59.6	122.2	62.6	
Vert.	5855.000	PK	53.3	32.8	6.4	31.4	-	61.1	110.8	49.7	
Vert.	5875.000	PK	45.5	32.8	6.5	31.4	-	53.3	105.2	51.9	
Vert.	5925.000	PK	41.5	32.8	6.5	31.4	-	49.4	68.2	18.8	
Vert.	11550.000	PK	42.4	40.0	-1.7	33.3	-	47.5	73.9	26.4	Floor noise
Vert.	17325.000	PK	44.0	42.4	0.1	32.8	-	53.7	68.2	14.6	Floor noise
Vert.	11550.000	AV	34.2	40.0	-1.7	33.3	-	39.2	53.9	14.7	Floor noise

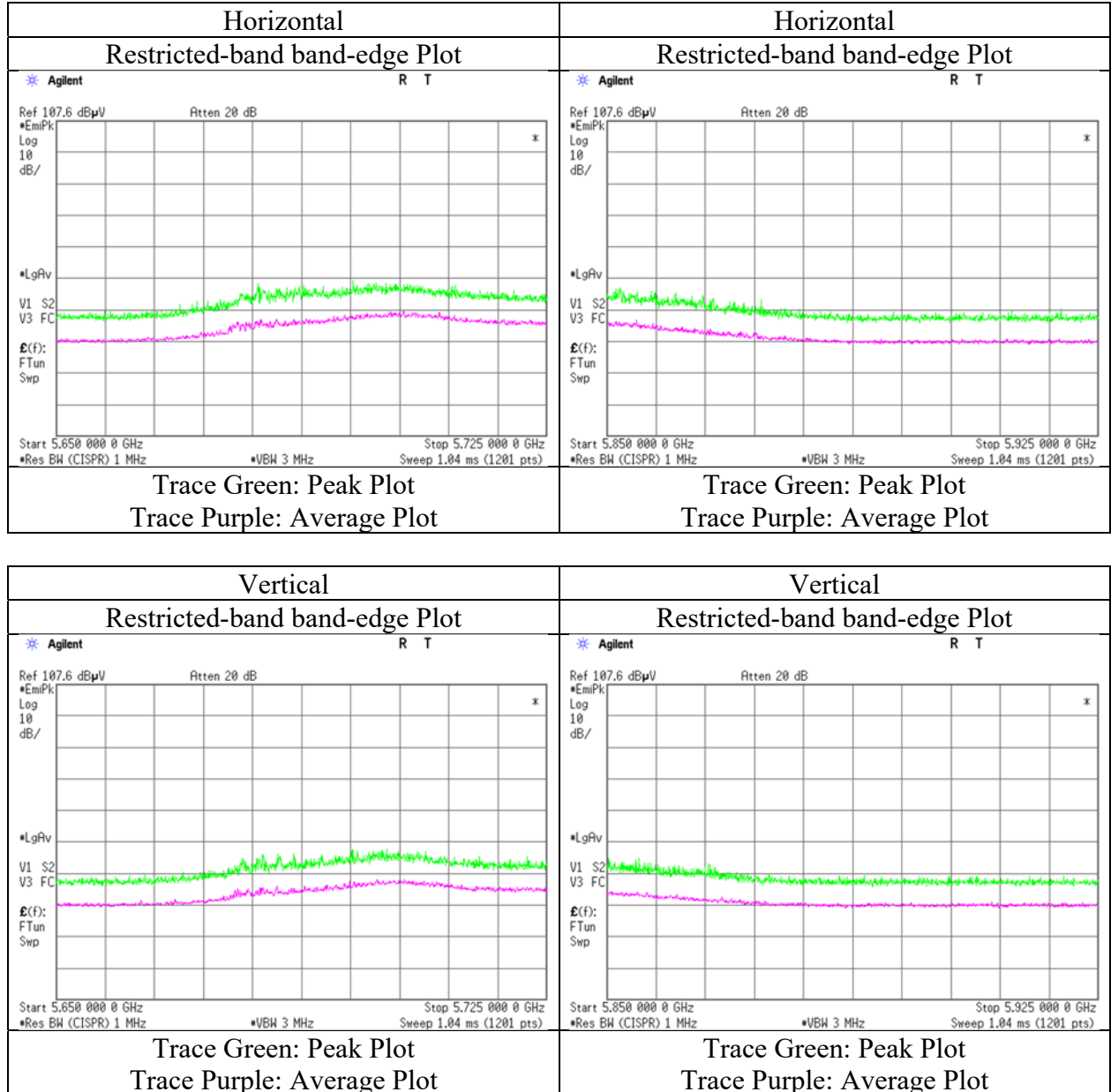
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter+Distance factor(above 1 GHz)) - Gain(Amplifier)

*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 (3.85 m / 3.0 m) = 2.17 dB
10 GHz - 40 GHz 20log (1.0 m / 3.0 m) = -9.5 dB

Radiated Spurious Emission

Report No.	13328641H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.4
Date	May 2, 2020
Temperature / Humidity	22 deg. C / 53 % RH
Engineer	Junki Nagatomi
Mode	Tx 11ac-80 5775 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.

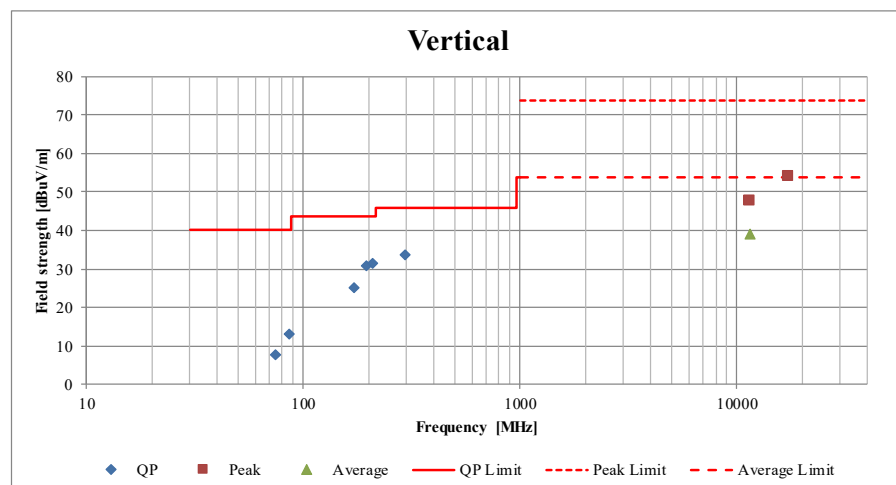
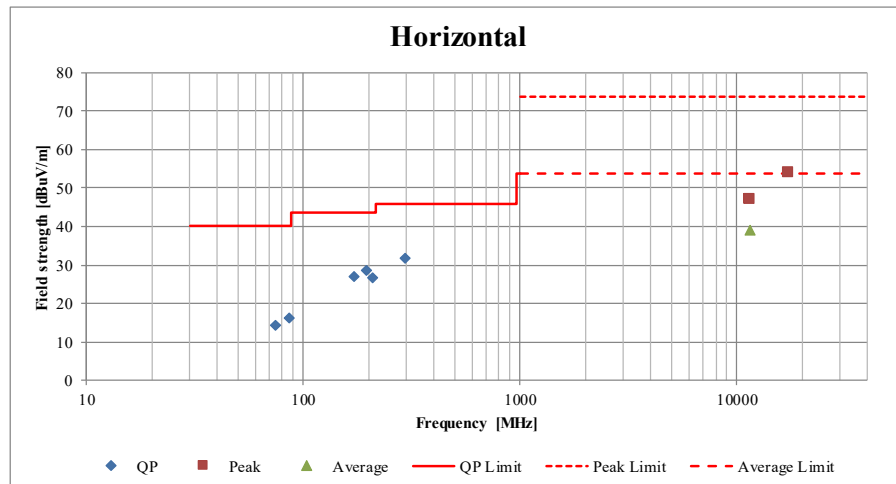
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Radiated Spurious Emission (Plot data, Worst case)

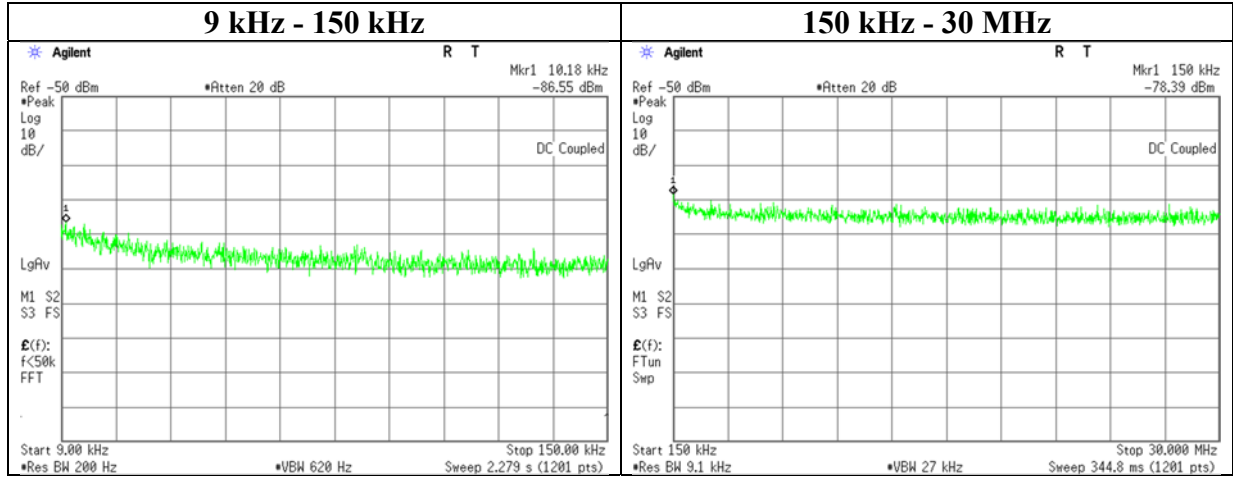
Report No.	13328641H	
Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.4	No.4
Date	May 2, 2020	May 5, 2020
Temperature / Humidity	22 deg. C / 53 % RH	23 deg. C / 43 % RH
Engineer	Junki Nagatomi (1 GHz - 40 GHz)	Ken Fujita (Below 1 GHz)
Mode	Tx 11ac-20 5785 MHz	



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

Conducted Spurious Emission

Report No. 13328641H
Test place Ise EMC Lab. No.3 Measurement Room
Date May 9, 2020
Temperature / Humidity 23 deg. C / 34 % RH
Engineer Junki Nagatomi
Mode Tx 11ac-20 5785 MHz



Frequency	Reading	Cable Loss	Attenuator	Antenna Gain*	N (Number of Output)	EIRP	Distance	Ground bounce	E (field strength)	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dBi]		[dBm]	[m]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
10.18	-86.6	1.00	9.9	2.0	1	-73.7	300	6.0	-12.4	47.4	59.8	
150.00	-78.4	1.01	9.9	2.0	1	-65.5	300	6.0	-4.3	24.0	28.3	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 789033 since antenna gain was less than 2.0 dBi.

APPENDIX 2: Test instruments

Test equipment

Test Item	Local ID	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Cal Int
AT	MOS-14	141561	Thermo-Hygrometer	CUSTOM	CTH-201	1401	01/07/2020	12
AT	MAT-57	141333	Attenuator(10dB)	Suhner	6810.19.A	-	12/09/2019	12
AT	MCC-67	141329	Microwave Cable 1G-40GHz	Suhner	SUCOFLEX102	28635/2	04/02/2020	12
AT	MPM-16	141812	Power Meter	Keysight Technologies Inc	8990B	MY51000271	08/02/2019	12
AT	MPSE-23	141835	Power sensor	Keysight Technologies Inc	N1923A	MY54070004	08/02/2019	12
AT	MMM-12	141547	DIGITAL HiTESTER	Hioki	3805	60500120	02/03/2020	12
AT	MSA-13	141900	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46185823	-	-
AT	MCC-64	141327	Coaxial Cable	UL Japan	-	-	02/04/2020	12
AT	MAT-10	141156	Attenuator(10dB)	Weinschel Corp	2	BL1173	11/07/2019	12
AT	MAT-92	141421	Attenuator	Weinschel Associates	WA56-10	56100308	05/25/2020	12
AT	MPSE-27	165119	Power Sensor	Rohde & Schwarz	NRP6A	1424.6796K02-101380-ez	11/21/2019	12
RE	MOS-15	141562	Thermo-Hygrometer	CUSTOM	CTH-201	0010	01/07/2020	12
RE	MMM-10	141545	DIGITAL HiTESTER	Hioki	3805	51201148	01/06/2020	12
RE	MJM-26	142227	Measure	KOMELON	KMC-36	-	-	-
RE	COTS-ME MI-02	178648	EMI measurement program	TSJ (Techno Science Japan)	TEPTO-DV	-	-	-
RE	MAEC-04-S VSWR	142017	AC4_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-10005	04/04/2019	24
RE	MHA-21	141508	Horn Antenna 1-18GHz	Schwarzbeck Mess - Elektronik	BBHA9120D	557	05/22/2020	12
RE	MPA-12	141581	MicroWave System Amplifier	Keysight Technologies Inc	83017A	650	10/16/2019	12
RE	MCC-141	141412	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	06/17/2019	12
RE	MSA-04	141885	Spectrum Analyzer	Keysight Technologies Inc	E4448A	US44300523	11/21/2019	12
RE	MHA-17	141506	Horn Antenna 15-40GHz	Schwarzbeck Mess - Elektronik	BBHA9170	BBHA9170307	10/08/2019	12
RE	MHA-29	141517	Horn Antenna 26.5-40GHz	ETS LINDGREN	3160-10	152399	09/19/2019	12
RE	MCC-224	160324	Coaxial Cable	Huber+Suhner	SUCOFLEX 102A	MY009/2A	11/22/2019	12
RE	MPA-22	141588	Pre Amplifier	MITEQ, Inc	AMF-6F-2600400-33-8P / AMF-4F-2600400-33-8P	1871355 / 1871328	09/27/2019	12
RE	MCC-178	141227	Microwave Cable	Junkosha	MMX221-00500DMSDMS	1502S305	03/18/2020	12
RE	MHF-23	141294	High Pass Filter 7-20GHz	TOKIMEC	TF37NCCC	603	01/06/2020	12
AT	MOS-29	141568	Thermo-Hygrometer	CUSTOM	CTH-201	2901	01/07/2020	12
AT	MMM-08	141532	DIGITAL HiTESTER	Hioki	3805	51201197	01/06/2020	12
AT	MAT-58	141334	Attenuator(10dB)	Suhner	6810.19.A	-	12/09/2019	12
AT	MOS-29	141568	Thermo-Hygrometer	CUSTOM	CTH-201	2901	01/07/2020	12
AT	MSA-15	141902	Spectrum Analyzer	Keysight Technologies Inc	E4440A	MY46187105	10/09/2019	12
RE	MAT-34	141331	Attenuator(6dB)	TME	UFA-01	-	02/05/2020	12
RE	MBA-05	141425	Biconical Antenna	Schwarzbeck Mess - Elektronik	VHA9103+BBA9106	1302	08/24/2019	12
RE	MCC-50	141397	Coaxial Cable	UL Japan	-	-	03/24/2020	12
RE	MLA-23	141267	Logperiodic Antenna (200-1000MHz)	Schwarzbeck Mess - Elektronik	VUSLP9111B	9111B-192	08/24/2019	12
RE	MPA-14	141583	Pre Amplifier	SONOMA INSTRUMENT	310	260833	02/18/2020	12
RE	MAEC-04	142011	AC4_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	06/28/2018	24
RE	MOS-15	141562	Thermo-Hygrometer	CUSTOM	CTH-201	0010	01/07/2020	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:

RE: Radiated Emission

AT: Antenna Terminal Conducted test