



RADIO TEST REPORT

Test Report No. : 12432580S-A-R2

Applicant : CASIO COMPUTER CO., LTD.
Type of Equipment : Smart Outdoor Watch
Model No. : WSD-F30
(Wireless LAN & Bluetooth Low Energy part)
FCC ID : BBQ-WSDF30
Test regulation : FCC Part 15 Subpart C: 2018
Test Result : Complied

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3. This sample tested is in compliance with the limits of the above regulation.
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6. This test report covers Radio technical requirements.
It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)
7. The all test items in this test report are conducted by UL Japan, Inc. Shonan EMC Lab.
8. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
9. This report is a revised version of 12432580S-A-R1. 12432580S-A-R1 is replaced with this report.

Date of test: June 22 to August 24, 2018

Representative test engineer:

Yosuke Ishikawa

Engineer

Consumer Technology Division

Approved by:

Akio Hayashi

Leader

Consumer Technology Division



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

UL Japan, Inc.

Shonan EMC Lab.

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 12432580S-A

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SECTION 1: Customer information

Company Name	:	CASIO COMPUTER CO., LTD.
Address	:	2-1, Sakaecho 3 chome, Hamura-shi, Tokyo 205-8555 Japan
Telephone Number	:	+81-42-579-7282
Contact Person	:	Hiroaki Suzuki

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	Smart Outdoor Watch
Model No.	:	WSD-F30
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3.7 V typical (battery) (DC 3.5 V to 4.2 V), DC 5 V typical (AC Adapter)
Receipt Date of Sample	:	June 18, 2018
Country of Mass-production	:	Japan, Thailand
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

Model: WSD-F30 (referred to as the EUT in this report) is a Smart Outdoor Watch.

Radio Specification

Bluetooth (Ver.4.1 with EDR function)

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz- 2480 MHz
Modulation	:	(BDR/EDR): GFSK, $\pi/4$ DQPSK, 8DPSK, (LE): GFSK
Antenna type	:	Inverted F type
Antenna Gain	:	-6.81 dBi (max)

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

Radio Type	:	Transceiver
Frequency of Operation	:	2412 MHz- 2462 MHz
Modulation	:	DSSS/CCK, OFDM
Antenna type	:	Inverted F type
Antenna Gain	:	-6.81 dBi (max)

* Wireless LAN and Bluetooth do not transmit simultaneously.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on March 12, 2018 and effective April 11, 2018

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928MHz,
2400-2483.5MHz, and 5725-5850MHz

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.10-2013 6. Standard test methods ----- IC: RSS-Gen 8.8	FCC: Section 15.207 ----- IC: RSS-Gen 8.8	19.4 dB 16.22840 MHz, AV, N, Tx, BLE, 2480 MHz	Complied	-
6 dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v04 ----- IC: -	FCC: Section 15.247(a)(2) ----- IC: RSS-247 5.2(a)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v04 ----- IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) ----- IC: RSS-247 5.4(d)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v04 ----- IC: -	FCC: Section 15.247(e) ----- IC: RSS-247 5.2(b)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v04 IC: RSS-Gen 6.13	FCC: Section15.247(d) ----- IC: RSS-247 5.5 RSS-Gen 8.9 RSS-Gen 8.10	1.5 dB 52.354 MHz, QP, Vertical Tx 11g 2437 MHz	Complied#	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *1)

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

*1) Radiated test was selected over 30 MHz based on section 15.247(d) and KDB 558074 D01 DTS Meas Guidance v04 12.2.7.

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)

The EUT provides stable voltage constantly to the wireless transmitter regardless of input voltage.
Therefore the EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

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

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % Occupied Bandwidth	IC: RSS-Gen 6.6	IC: -	N/A	Complied	Conducted

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

3.4 Uncertainty

EMI

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

Shonan EMC Lab.

Item	Frequency range	Uncertainty (+/-)				
		No. 1 SAC / SR	No. 2 SAC / SR	No. 3 SAC / SR	No. 4 SAC / SR	No. 5,6,8 SR
Conducted emission (AC Mains) LISN	150 kHz-30 MHz	2.5 dB	2.5 dB	2.5 dB	2.6 dB	2.6 dB
Radiated emission (Measurement distance: 3 m)	9 kHz-30 MHz	3.2 dB	3.2 dB	3.3 dB	-	-
	30 MHz-200 MHz	4.9 dB	4.8 dB	4.9 dB	-	-
	200 MHz-1 GHz	6.1 dB	6.1 dB	6.1 dB	-	-
	1 GHz-6 GHz	4.7 dB	4.7 dB	4.7 dB	-	-
	6 GHz-18 GHz	5.3 dB	5.3 dB	5.3 dB	-	-
Radiated emission (Measurement distance: 1 m)	18 GHz-40 GHz	5.6 dB	5.6 dB	5.6 dB	-	-
	1 GHz-18 GHz	5.6 dB	5.6 dB	5.6 dB	-	-
	18 GHz-40 GHz	5.9 dB	5.9 dB	5.9 dB	-	-

SAC=Semi-Anechoic Chamber

SR= Shielded Room is applied besides radiated emission

Antenna terminal test	Uncertainty (+/-)
Power Measurement above 1 GHz (Average Detector)_SPM-06	0.48 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-06	0.66 dB
Power Measurement above 1 GHz (Average Detector)_SPM-07	0.47 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-07	0.64 dB
Power Measurement above 1 GHz (Average Detector)_SPM-13	0.90 dB
Power Measurement above 1 GHz (Peak Detector)_SPM-13	1.04 dB
Spurious emission (Conducted) below 1GHz	1.8 dB
Spurious emission (Conducted) 1 GHz-3 GHz	1.7 dB
Spurious emission (Conducted) 3 GHz-18 GHz	2.5 dB
Spurious emission (Conducted) 18 GHz-26.5 GHz	2.5 dB
Spurious emission (Conducted) 26.5 GHz-40 GHz	2.7 dB
Bandwidth Measurement	1.01 %
Duty cycle and Time Measurement	0.012 %

3.5 Test Location

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Telephone: +81 463 50 6400, Facsimile: +81 463 50 6401
JAB Accreditation No. RTL02610
FCC Test Firm Registration Number: 839876

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Maximum measurement distance
No.1 Semi-anechoic chamber	2973D-1	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.2 Semi-anechoic chamber	2973D-2	20.6 x 11.3 x 7.65	20.6 x 11.3	10 m
No.3 Semi-anechoic chamber	2973D-3	12.7 x 7.7 x 5.35	12.7 x 7.7	5 m
No.4 Semi-anechoic chamber	-	8.1 x 5.1 x 3.55	8.1 x 5.1	-
No.1 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.2 Shielded room	-	6.8 x 4.1 x 2.7	6.8 x 4.1	-
No.3 Shielded room	-	6.3 x 4.7 x 2.7	6.3 x 4.7	-
No.4 Shielded room	-	4.4 x 4.7 x 2.7	4.4 x 4.7	-
No.5 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.6 Shielded room	-	7.8 x 6.4 x 2.7	7.8 x 6.4	-
No.8 shielded room	-	3.45 x 5.5 x 2.4	3.45 x 5.5	-
No.1 Measurement room	-	2.55 x 4.1 x 2.5	-	-

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

SECTION 4: Operation of E.U.T. during testing

4.1 Operating Mode(s)

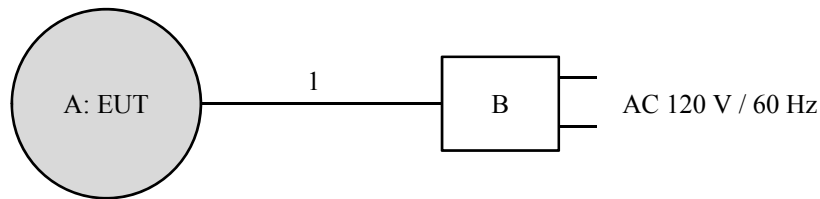
Test operating mode was determined as follows according to “Section 1 of 6 802.11 a/b/g/n testing - Managing Complex Regulatory Approvals - ” of TCB Council Workshop October 2009.

Mode	Remarks*
Tx (Transmitting), IEEE 802.11b (11b)	2 Mbps, PN9
Tx (Transmitting), IEEE 802.11g (11g)	6 Mbps, PN9
Tx (Transmitting), IEEE 802.11n 20 SISO MHz BW (11n-20)	MCS 1, PN9
Tx (Transmitting), Bluetooth Low Energy (BT LE)	Maximum Packet Size, PRBS9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; Power settings: Fixed Software: WSD-F30-radio ver1.0 *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
Conducted Emission	Tx 11g *1)	2437 MHz *1)
	Tx BT LE	2402 MHz 2440 MHz 2480 MHz
Spurious Emission (below 1 GHz)	Tx 11g *1)	2437 MHz *1)
	Tx BT LE	2402 MHz 2440 MHz 2480 MHz
Spurious Emission (above 1 GHz)	Tx 11b Tx 11g Tx 11n-20	2412 MHz 2437 MHz 2462 MHz
	Tx BT LE	2402 MHz 2440 MHz 2480 MHz
6 dB Bandwidth Maximum Peak Output Power Power Density 99 % Occupied Bandwidth	Tx 11b Tx 11g Tx 11n-20	2412 MHz 2437 MHz 2462 MHz
	Tx BT LE	2402 MHz 2440 MHz 2480 MHz
*1) The mode was tested as a representative, because it had the highest power at antenna terminal test.		

4.2 Configuration and peripherals



* 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	Smart Outdoor Watch	WSD-F30	8 *1) 16 *2)	CASIO COMPUTER CO., LTD.	EUT
B	AC Adapter	AD-W50100U1	073	CASIO COMPUTER CO., LTD.	-

*1) Used for Antenna Terminal conducted test

*2) Used for Conducted Emission test and Radiated Emission test

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC	0.8	Unshielded	Unshielded	-

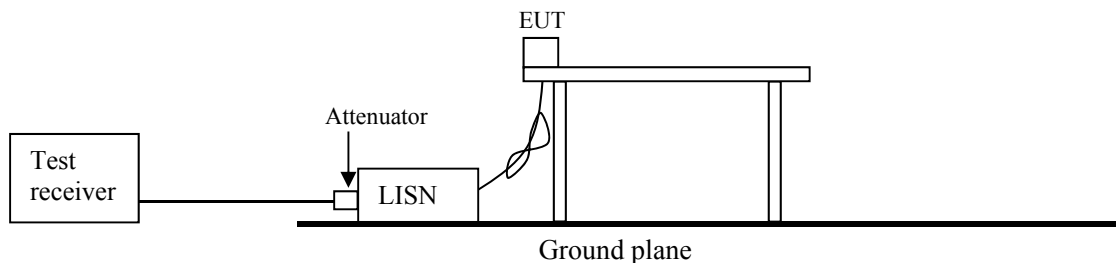
SECTION 5: Conducted Emission

Test Procedure and conditions

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

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

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



The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT via AC adapter in a Shielded room

The EUT via AC adapter was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

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

SECTION 6: Radiated Spurious Emission

Test Procedure

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "KDB 558074 D01 DTS Meas Guidance v04".

[For below 1 GHz]

EUT was placed on a urethane platform of nominal size, 2.0 m by 1.0 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.

The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

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

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

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

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

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

Test Antennas are used as below;

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

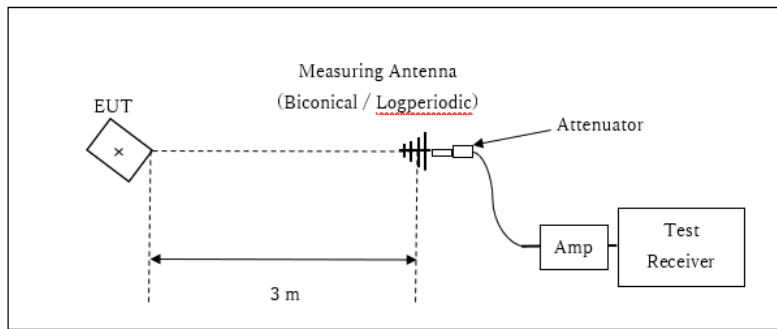
In any 100 kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired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

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

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	Average Power Method: <u>12.2.5.2</u> RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (Linear voltage) Trace: 100 traces Duty factor was added to the results.	RBW: 100 kHz VBW: 300 kHz

*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v04".

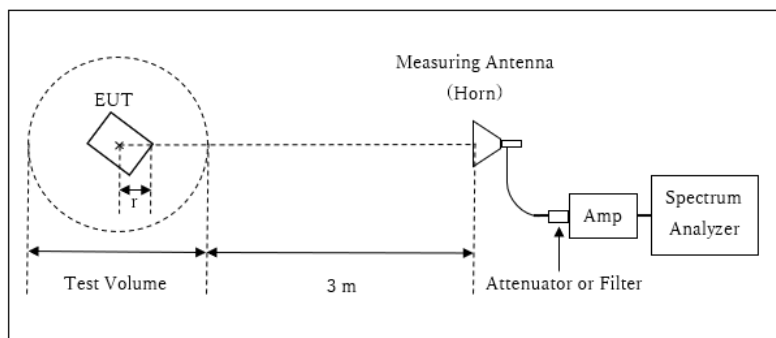
Below 1 GHz



x : Center of turn table

Test Distance : 3 m

1 GHz - 13 GHz



r : Radius of an outer periphery of EUT

x : Center of turn table

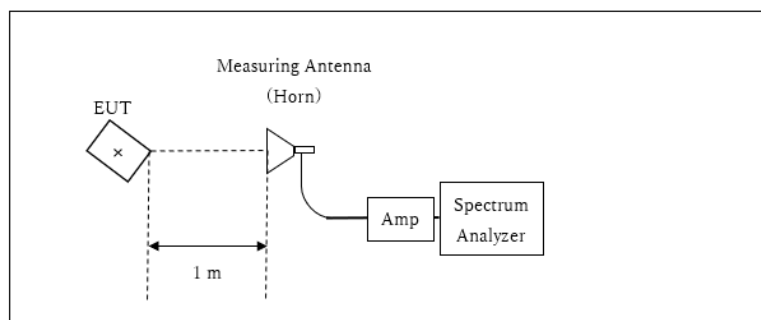
Distance Factor: $20 \times \log (3.97 \text{ m}^*/3.0 \text{ m}) = 2.44 \text{ dB}$

*Test Distance : $(3 + \text{Test Volume} / 2) - r = 3.97 \text{ m}$

Test Volume : 2 m (Test Volume has been calibrated based on CISPR16-1-4.)

$r = 0.03 \text{ m}$

13 GHz - 26.5 GHz



x : Center of turn table

Distance Factor: $20 \times \log (1.0 \text{ m}^* / 3.0 \text{ m}) = -9.54 \text{ dB}$

*Test Distance : 1 m

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

Test Antenna	Frequency Carrier	Spurious			
		30 MHz-1 GHz	1-13 GHz	13-18 GHz	18-26 GHz
Horizontal	Z	X	Z	Z	Z
Vertical	Y	X	Z	Z	Z

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

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

SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6 dB Bandwidth	50 MHz or 10 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: 160 MHz BW)
Peak Power Density	1.5 times the 6 dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9 kHz to 150 kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150 kHz to 30 MHz	10 kHz	30 kHz				
*1) Peak hold was applied as Worst-case measurement.							
*2) Reference data							
*3) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v04".							
*4) 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 = 10 kHz)							

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

Test data	: APPENDIX
Test result	: Pass

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APPENDIX 1: Test data

Conducted Emission

DATA OF CONDUCTED EMISSION TEST

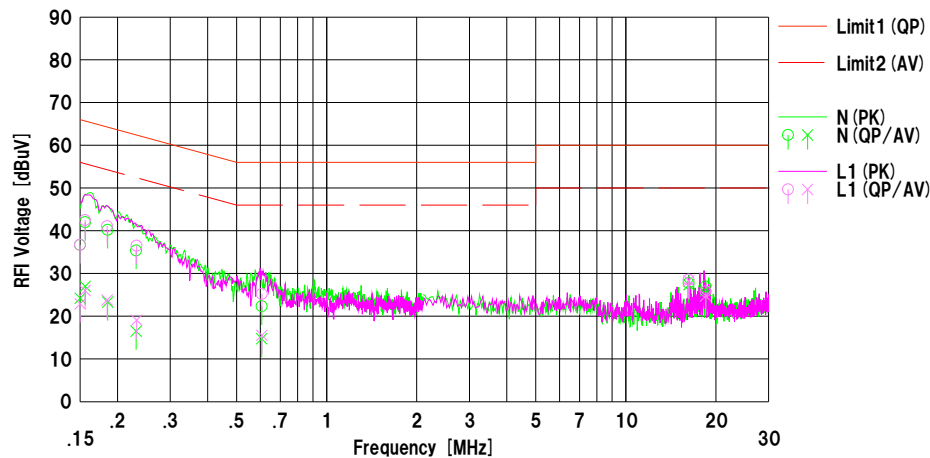
UL Japan, Inc. Shonan EMC Lab. No.1 Shielded Room
Date : 2018/08/24

Mode : Tx, 11g, 2437 MHz
Power : AC 120 V, 60 Hz (AC adapter input)
Temp./Humi. : 24 deg.C / 48 %RH

Remarks : -

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

Engineer : Kazutaka Takeyama



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	24.20	11.70	12.49	36.69	24.19	66.00	56.00	29.3	31.8	N	
2	0.15590	29.50	14.50	12.49	41.99	28.99	65.68	55.68	23.6	28.6	N	
3	0.18540	27.70	10.80	12.49	40.19	23.29	64.24	54.24	24.0	30.9	N	
4	0.23090	22.90	4.00	12.48	35.38	16.48	62.42	52.42	27.0	35.9	N	
5	0.60670	9.80	2.20	12.53	22.33	14.73	56.00	46.00	33.6	31.2	N	
6	16.22840	13.20	12.80	14.55	27.75	27.35	60.00	50.00	32.2	22.6	N	
7	18.48760	12.20	11.30	14.73	26.93	26.03	60.00	50.00	33.0	23.9	N	
8	0.15000	24.20	10.40	12.49	36.69	22.89	66.00	56.00	29.3	33.1	L1	
9	0.15580	30.00	13.50	12.49	42.49	25.99	65.68	55.68	23.1	29.6	L1	
10	0.18460	28.60	11.30	12.49	41.09	23.79	64.28	54.28	23.1	30.4	L1	
11	0.23160	24.00	6.60	12.48	36.48	19.08	62.39	52.39	25.9	33.3	L1	
12	0.60750	12.70	3.00	12.53	25.23	15.53	56.00	46.00	30.7	30.4	L1	
13	16.22810	14.00	13.70	14.55	28.55	28.25	60.00	50.00	31.4	21.7	L1	
14	18.48730	11.10	10.00	14.73	25.83	24.73	60.00	50.00	34.1	25.2	L1	

Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN (AMN) + Cable + ATT) [dB]
LISN (AMN) = SLS-02

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Conducted Emission

DATA OF CONDUCTED EMISSION TEST

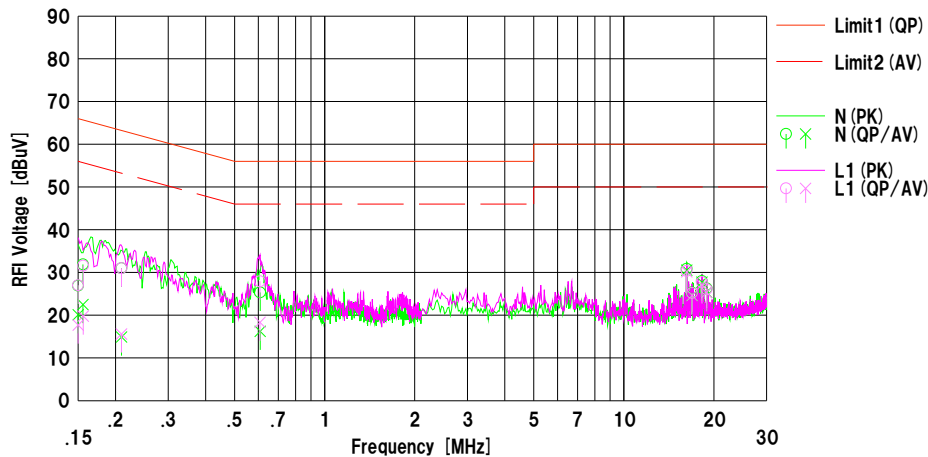
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Date : 2018/08/24

Mode : Tx, BLE, 2480 MHz
Power : AC 120 V, 60 Hz (AC adapter input)
Temp./Humi. : 24 deg.C / 48 %RH

Remarks : -

Limit1 : FCC 15C (15.207) QP
Limit2 : FCC 15C (15.207) AV

Engineer : Kazutaka Takeyama

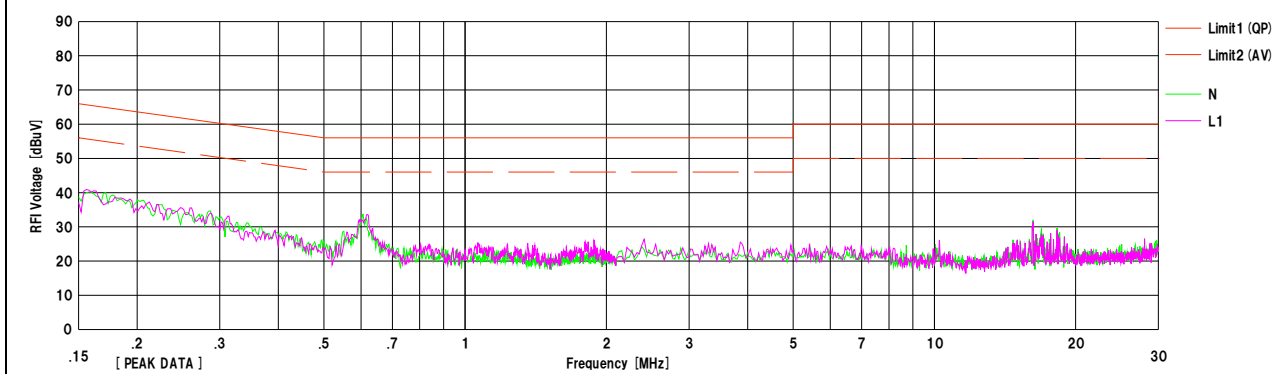


No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP>	<AV>		<QP>	<AV>	<QP>	<AV>	<QP>	<AV>		
		[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.15000	14.40	7.60	12.49	26.89	20.09	66.00	56.00	39.1	35.9	N	
2	0.15570	19.40	10.00	12.49	31.89	22.49	65.69	55.69	33.8	33.2	N	
3	0.20950	18.50	2.40	12.49	30.99	14.89	63.23	53.23	32.2	38.3	N	
4	0.60870	12.80	3.70	12.53	25.33	16.23	56.00	46.00	30.6	29.7	N	
5	16.22840	16.30	16.00	14.55	30.85	30.55	60.00	50.00	29.1	19.4	N	
6	16.90040	10.70	10.00	14.60	25.30	24.60	60.00	50.00	34.7	25.4	N	
7	18.24420	13.30	13.00	14.71	28.01	27.71	60.00	50.00	31.9	22.2	N	
8	18.91500	11.50	10.60	14.77	26.27	25.37	60.00	50.00	33.7	24.6	N	
9	0.15000	14.50	5.20	12.49	26.99	17.69	66.00	56.00	39.0	38.3	L1	
10	0.15605	19.10	7.30	12.49	31.59	19.79	65.67	55.67	34.0	35.8	L1	
11	0.20933	18.50	3.10	12.49	30.99	15.59	63.23	53.23	32.2	37.6	L1	
12	0.60800	15.40	5.80	12.53	27.93	18.33	56.00	46.00	28.0	27.6	L1	
13	16.22810	15.80	15.60	14.55	30.35	30.15	60.00	50.00	29.6	19.8	L1	
14	16.90030	10.60	10.00	14.60	25.20	24.60	60.00	50.00	34.8	25.4	L1	
15	18.24310	13.00	12.40	14.71	27.71	27.11	60.00	50.00	32.2	22.8	L1	
16	18.91530	11.30	10.50	14.77	26.07	25.27	60.00	50.00	33.9	24.7	L1	

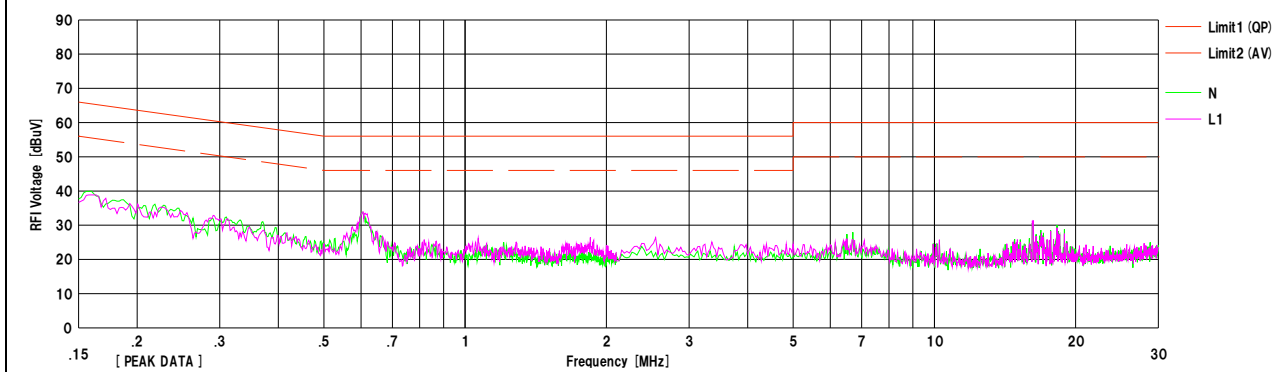
Calculation: Result [dBuV] = Reading [dBuV] + C.Fac (LISN (AMN) + Cable + ATT) [dB]
LISN (AMN) = SLS-02

Conducted Emission

Tx, BT LE
2402 MHz



2440 MHz



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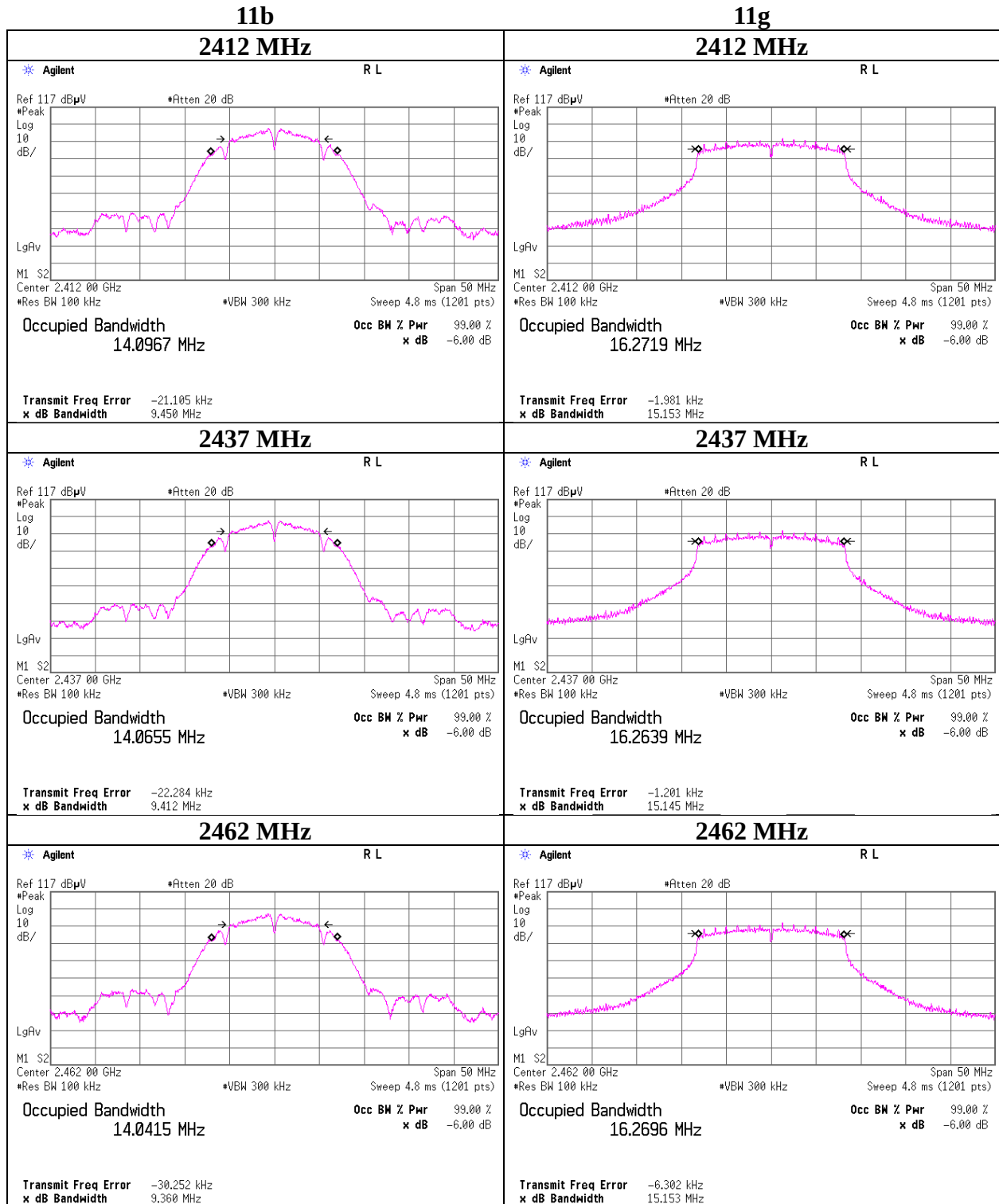
Facsimile : +81 463 50 6401

6 dB Bandwidth and 99 % Occupied Bandwidth

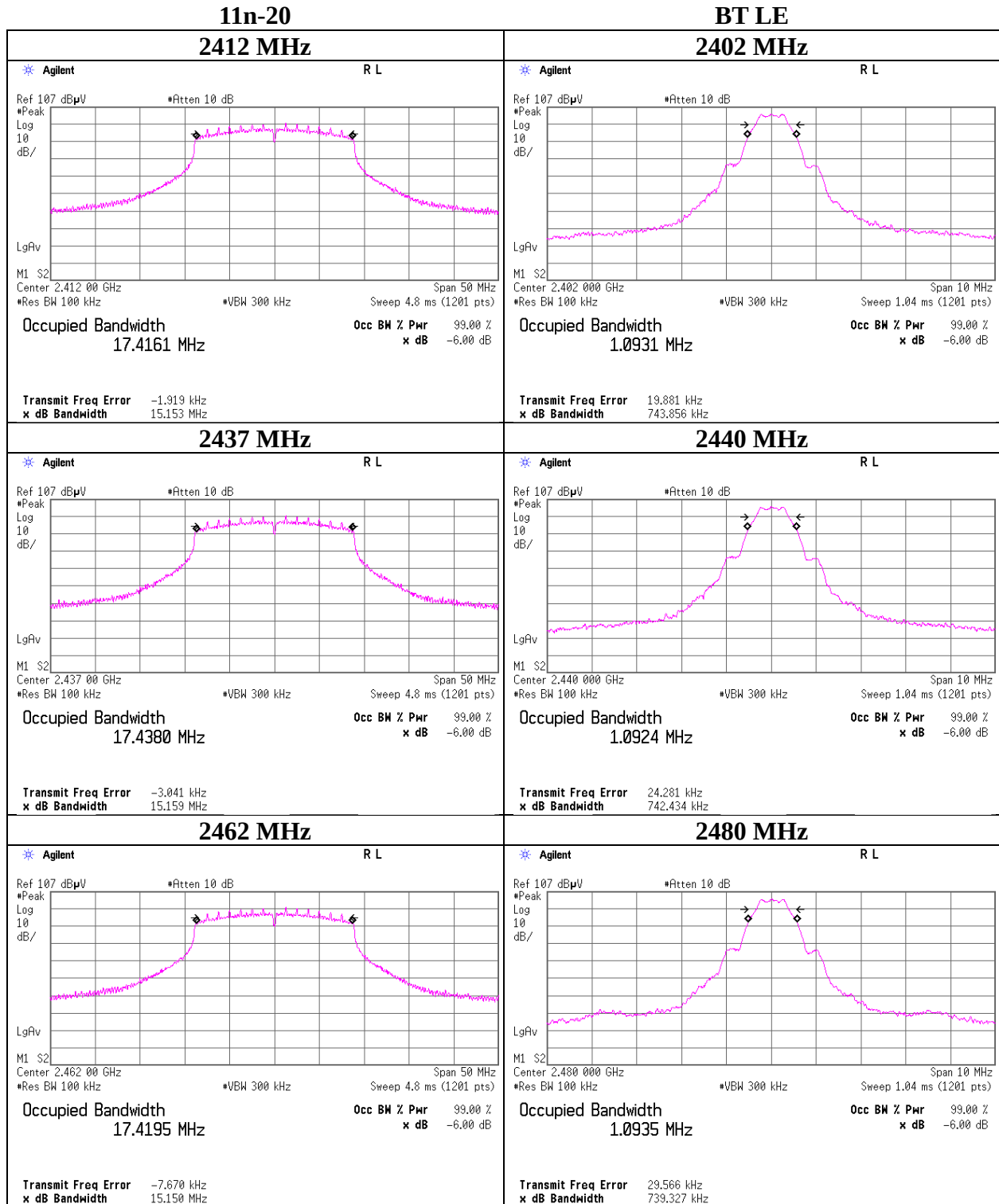
Report No. 12432580S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date July 2, 2018
Temperature / Humidity 25 deg. C / 45 % RH
Engineer Shiro Kobayashi
Mode Tx

Mode	Frequency [MHz]	6 dB Bandwidth [MHz]	Limit for 6 dB Bandwidth [MHz]	99 % Occupied Bandwidth [kHz]
11b	2412	9.450	> 0.5000	14091.0
	2437	9.412	> 0.5000	14070.5
	2462	9.360	> 0.5000	14069.5
11g	2412	15.153	> 0.5000	16487.8
	2437	15.145	> 0.5000	16465.5
	2462	15.153	> 0.5000	16487.5
11n-20	2412	15.153	> 0.5000	17629.4
	2437	15.159	> 0.5000	17605.7
	2462	15.150	> 0.5000	17609.8
BT LE	2402	0.744	> 0.5000	1066.0
	2440	0.742	> 0.5000	1066.5
	2480	0.739	> 0.5000	1066.4

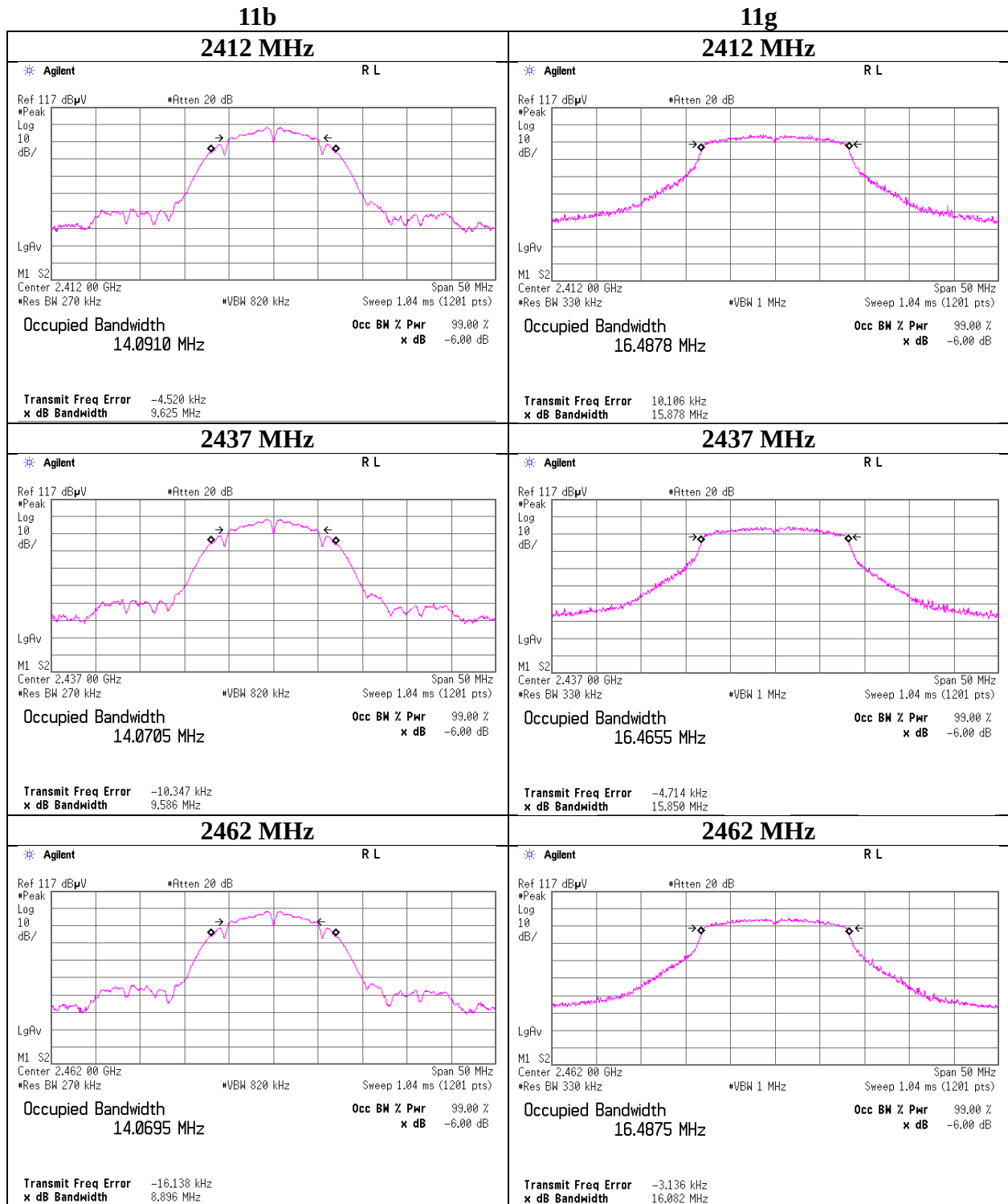
6 dB Bandwidth



6 dB Bandwidth



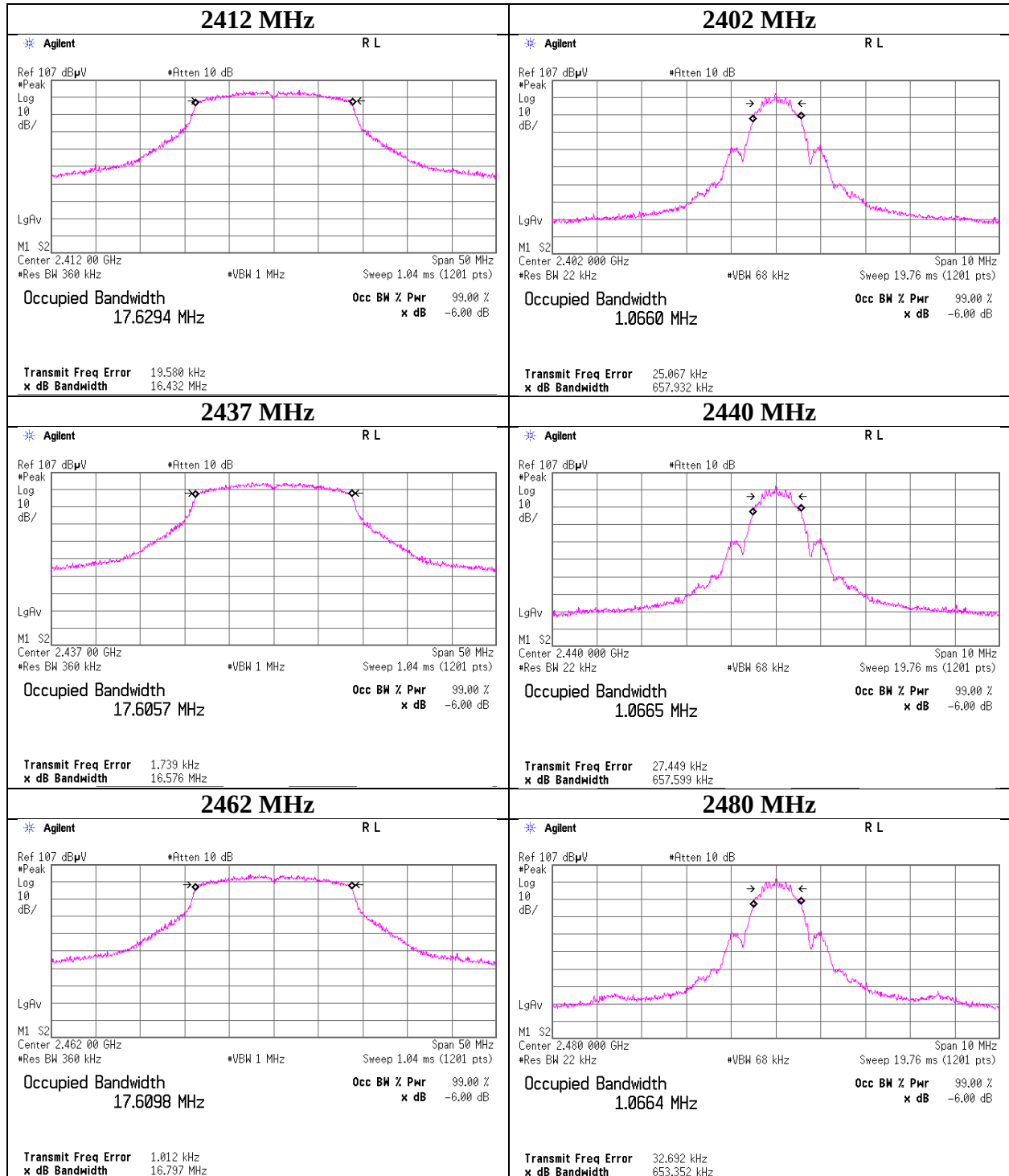
99 % Occupied Bandwidth



99 % Occupied Bandwidth

11n-20

BT LE



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Maximum Peak Output Power

Report No. 12432580S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date June 22, 2018
Temperature / Humidity 26 deg. C / 49 % RH
Engineer Yosuke Ishikawa
Mode Tx 11b

Freq. [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	8.31	1.69	9.86	19.86	96.83	30.00	1000	10.14	-6.81	13.05	20.18	36.02	4000	22.97	
2437	8.16	1.69	9.86	19.71	93.54	30.00	1000	10.29	-6.81	12.90	19.50	36.02	4000	23.12	
2462	8.14	1.70	9.85	19.69	93.11	30.00	1000	10.31	-6.81	12.88	19.41	36.02	4000	23.14	

Sample Calculation:

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

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

2437MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
1	7.93	
2	8.16	*
5.5	8.10	
11	7.94	

*: Worst Rate

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

Maximum Peak Output Power

Report No. 12432580S-A-R2
Test place Shonan EMC Lab. No.5 Measurement Room
Date June 22, 2018
Temperature / Humidity 26 deg. C / 49 % RH
Engineer Yosuke Ishikawa
Mode Tx 11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Conducted Power					e.i.r.p. for RSS-247					
				Result		Limit		Margin	Antenna Gain [dBi]	Result		Limit		Margin
				[dBm]	[mW]	[dBm]	[mW]	[dB]		[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	13.13	1.69	9.86	24.68	293.76	30.00	1000	5.32	-6.81	17.87	61.24	36.02	4000	18.15
2437	13.32	1.69	9.86	24.87	306.90	30.00	1000	5.13	-6.81	18.06	63.97	36.02	4000	17.96
2462	13.08	1.70	9.85	24.63	290.40	30.00	1000	5.37	-6.81	17.82	60.53	36.02	4000	18.20

Sample Calculation:

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

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

2437 MHz

Rate	Reading	Remark
[Mbps]	[dBm]	
6	13.32	*
9	13.29	
12	12.52	
18	12.36	
24	12.61	
36	12.63	
48	12.29	
54	12.09	

*: Worst Rate

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

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Maximum Peak Output Power

Report No. 12432580S-A-R2
Test place Shonan EMC Lab. No.5 Measurement Room
Date June 22, 2018
Temperature / Humidity 26 deg. C / 49 % RH
Engineer Yosuke Ishikawa
Mode Tx 11n-20

Freq.	Reading	Cable Loss	Atten. Loss	Conducted Power					e.i.r.p. for RSS-247						
				Result		Limit		Margin	Antenna Gain	Result		Limit		Margin	
				[dBm]	[mW]	[dBm]	[mW]			[dBi]	[dBm]	[mW]	[dBm]		[mW]
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]	
2412	11.98	1.69	9.86	23.53	225.42	30.00	1000	6.47	-6.81	16.72	46.99	36.02	4000	19.30	
2437	12.21	1.69	9.86	23.76	237.68	30.00	1000	6.24	-6.81	16.95	49.55	36.02	4000	19.07	
2462	11.56	1.70	9.85	23.11	204.64	30.00	1000	6.89	-6.81	16.30	42.66	36.02	4000	19.72	

Sample Calculation:

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

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

2437 MHz

MCS Number	Reading [dBm]	Remark
0	12.10	
1	12.21	*
2	12.05	
3	11.20	
4	10.87	
5	12.20	
6	10.96	
7	11.09	

* Worst MCS

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

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Maximum Peak Output Power

Report No. 12432580S-A-R2
Test place Shonan EMC Lab. No.5 Measurement Room
Date June 22, 2018
Temperature / Humidity 26 deg. C / 49 % RH
Engineer Yosuke Ishikawa
Mode Tx BT LE

Freq. [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]	
2402	-3.84	1.68	9.86	7.70	5.89	30.00	1000	22.30	-6.81	0.89	1.23	36.02	4000	35.13
2440	-3.66	1.69	9.86	7.89	6.15	30.00	1000	22.11	-6.81	1.08	1.28	36.02	4000	34.94
2480	-3.61	1.70	9.85	7.94	6.22	30.00	1000	22.06	-6.81	1.13	1.30	36.02	4000	34.89

Sample Calculation:

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

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

Average Output Power (Reference data for SAR testing)

Report No.	12432580S-A-R2
Test place	Shonan EMC Lab. No.5 Measurement Room
Date	June 22, 2018
Temperature / Humidity	26 deg. C / 49 % RH
Engineer	Yosuke Ishikawa
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	5.42	1.69	9.86	16.97	49.77	0.04	17.01	50.23
2437	5.38	1.69	9.86	16.93	49.32	0.04	16.97	49.77
2462	5.32	1.70	9.85	16.87	48.64	0.04	16.91	49.09

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	1.59	1.69	9.86	13.14	20.61	0.28	13.42	21.98
2437	1.59	1.69	9.86	13.14	20.61	0.28	13.42	21.98
2462	1.58	1.70	9.85	13.13	20.56	0.28	13.41	21.93

11n-20 MCS 0

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2412	0.21	1.69	9.86	11.76	15.00	0.31	12.07	16.11
2437	0.33	1.69	9.86	11.88	15.42	0.31	12.19	16.56
2462	0.21	1.70	9.85	11.76	15.00	0.31	12.07	16.11

BT LE

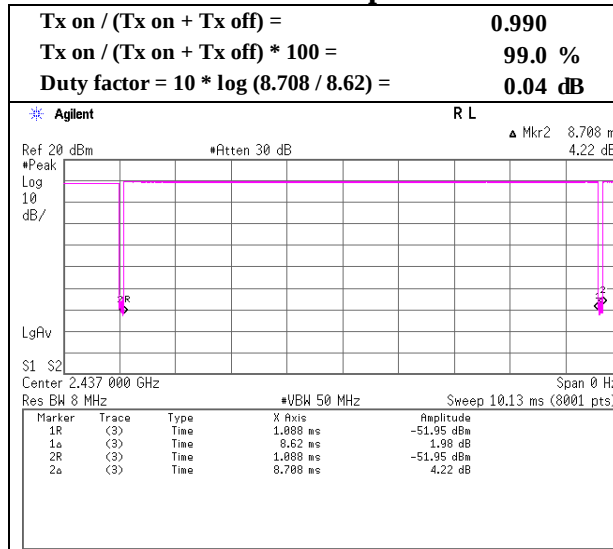
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average)		Duty factor [dB]	Result (Burst power average)	
				[dBm]	[mW]		[dBm]	[mW]
2402	-6.35	1.68	9.86	5.19	3.30	2.18	7.37	5.46
2440	-6.16	1.69	9.86	5.39	3.46	2.18	7.57	5.71
2480	-6.20	1.70	9.85	5.35	3.43	2.18	7.53	5.66

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

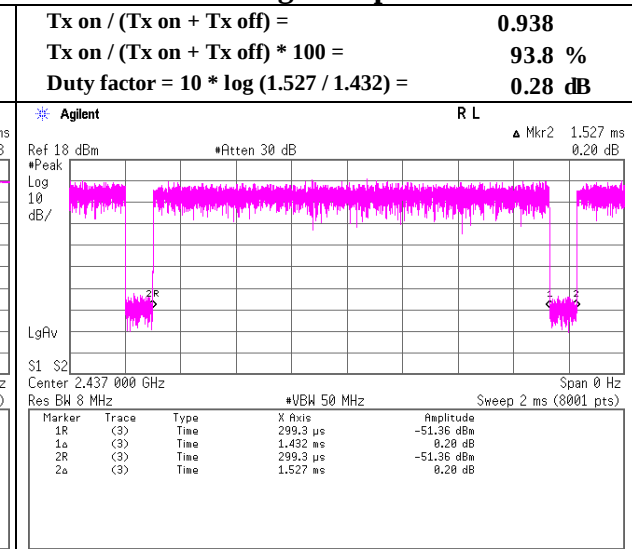
Burst rate confirmation (for Average Output Power)

Report No. 12432580S-A-R2
Test place Shonan EMC Lab. No.5 Measurement Room
Date June 22, 2018
Temperature / Humidity 26 deg. C / 49 % RH
Engineer Yosuke Ishikawa
Mode Tx

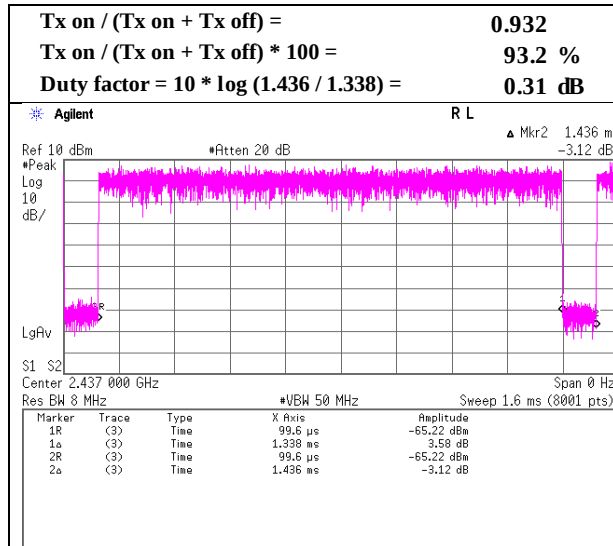
11b 1 Mbps



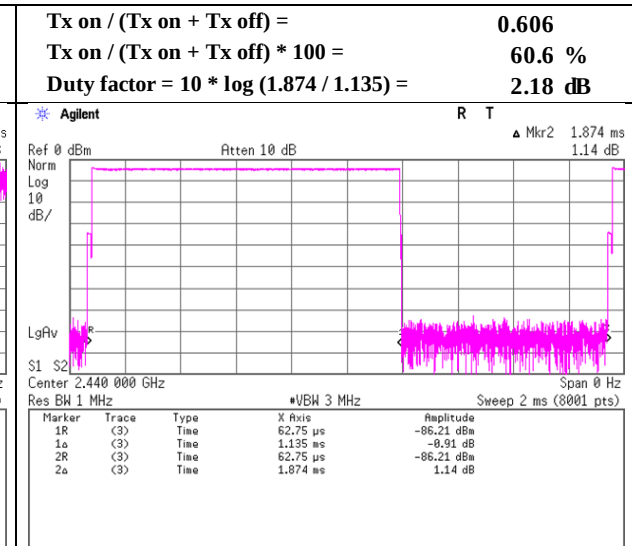
11g 6 Mbps



11n-20 MCS 0



BT LE



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

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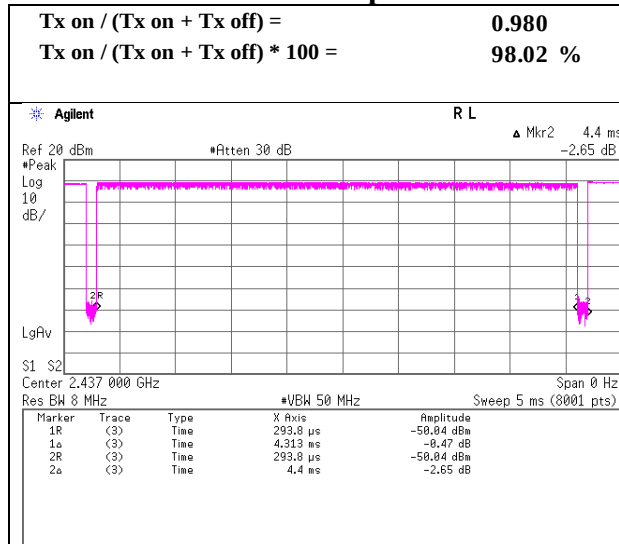
Telephone : +81 463 50 6400

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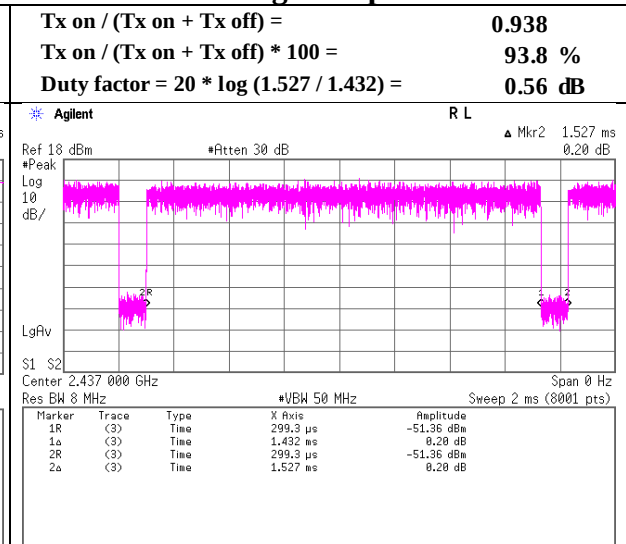
Burst rate confirmation (for Radiated Spurious Emission)

Report No. 12432580S-A-R2
Test place Shonan EMC Lab. No.5 Measurement Room
Date June 22, 2018
Temperature / Humidity 26 deg. C / 49 % RH
Engineer Yosuke Ishikawa
Mode Tx

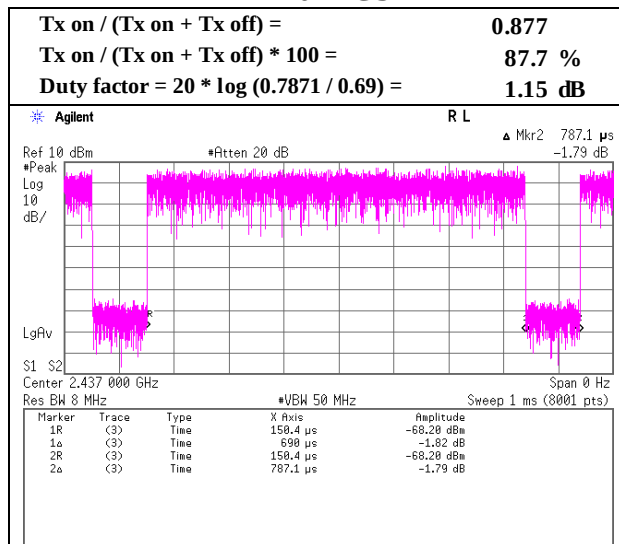
11b 2 Mbps



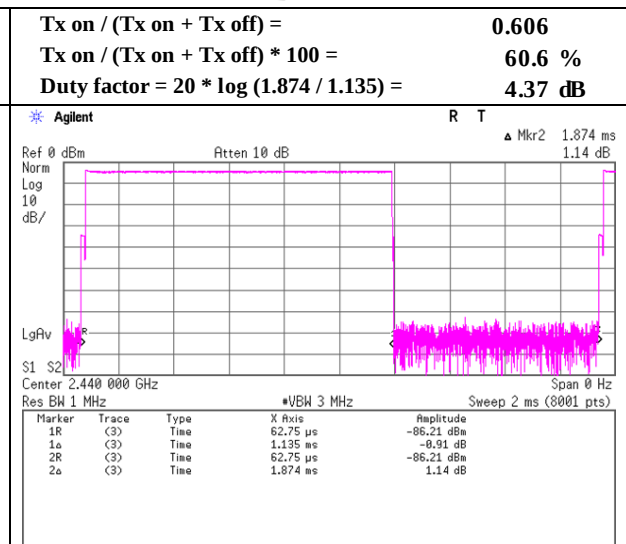
11g 6 Mbps



11n-20 MCS 1



BT LE



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

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Radiated Spurious Emission

Report No. 12432580S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber 2 2 2 2
Date August 13, 2018 August 14, 2018 August 16, 2018 August 18, 2018
Temperature / Humidity 24 deg.C / 57 %RH 23 deg.C / 55 %RH 25 deg.C / 55 %RH 25 deg.C / 50 %RH
Engineer Takahiro Suzuki Takahiro Suzuki Kazutaka Takeyama Kazutaka Takeyama
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 18 GHz) (18 GHz – 26.5 GHz)
Mode Tx 11b 2412 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2389.022	PK	46.57	27.91	13.97	36.58	2.44	54.31	73.90	19.6	171	0	
Hori.	2390.000	PK	48.11	27.91	13.97	36.58	2.44	55.85	73.90	18.1	171	0	
Hori.	4824.000	PK	50.88	31.29	6.60	36.88	2.44	54.33	73.90	19.6	224	69	
Hori.	7236.000	PK	44.60	36.80	7.68	37.30	2.44	54.22	73.90	19.7	150	0	Floor Noise
Hori.	9648.000	PK	45.48	38.29	8.76	38.52	2.44	56.45	73.90	17.5	150	0	Floor Noise
Hori.	12060.000	PK	46.34	39.10	10.20	38.13	2.44	59.95	73.90	14.0	150	0	Floor Noise
Hori.	2389.022	AV	37.25	27.91	13.97	36.58	2.44	44.99	53.90	8.9	171	0	
Hori.	2390.000	AV	36.24	27.91	13.97	36.58	2.44	43.98	53.90	9.9	171	0	
Hori.	4824.000	AV	42.68	31.29	6.60	36.88	2.44	46.13	53.90	7.8	224	69	
Hori.	7236.000	AV	34.19	36.80	7.68	37.30	2.44	43.81	53.90	10.1	150	0	Floor Noise
Hori.	9648.000	AV	35.26	38.29	8.76	38.52	2.44	46.23	53.90	7.7	150	0	Floor Noise
Hori.	12060.000	AV	34.22	39.10	10.20	38.13	2.44	47.83	53.90	6.1	150	0	Floor Noise
Vert.	2389.052	PK	47.16	27.91	13.97	36.58	2.44	54.90	73.90	19.0	100	178	
Vert.	2390.000	PK	48.28	27.91	13.97	36.58	2.44	56.02	73.90	17.9	100	178	
Vert.	4824.000	PK	50.37	31.29	6.60	36.88	2.44	53.82	73.90	20.1	100	294	
Vert.	7236.000	PK	45.11	36.80	7.68	37.30	2.44	54.73	73.90	19.2	150	0	Floor Noise
Vert.	9648.000	PK	44.62	38.29	8.76	38.52	2.44	55.59	73.90	18.3	150	0	Floor Noise
Vert.	12060.000	PK	44.98	39.10	10.20	38.13	2.44	58.59	73.90	15.3	150	0	Floor Noise
Vert.	2389.052	AV	37.61	27.91	13.97	36.58	2.44	45.35	53.90	8.6	100	178	
Vert.	2390.000	AV	36.71	27.91	13.97	36.58	2.44	44.45	53.90	9.5	100	178	
Vert.	4824.000	AV	43.24	31.29	6.60	36.88	2.44	46.69	53.90	7.2	100	294	
Vert.	7236.000	AV	34.65	36.80	7.68	37.30	2.44	44.27	53.90	9.6	150	0	Floor Noise
Vert.	9648.000	AV	35.03	38.29	8.76	38.52	2.44	46.00	53.90	7.9	150	0	Floor Noise
Vert.	12060.000	AV	34.13	39.10	10.20	38.13	2.44	47.74	53.90	6.2	150	0	Floor Noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log (3.97 m / 3.0 m) = 2.44 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	89.67	27.88	13.99	36.57	2.44	97.41	-	-	Carrier
Hori.	2399.513	PK	47.84	27.91	13.98	36.58	2.44	55.59	77.41	21.8	
Hori.	2400.000	PK	43.21	27.91	13.98	36.58	2.44	50.96	77.41	26.5	
Vert.	2412.000	PK	89.98	27.88	13.99	36.57	2.44	97.72	-	-	Carrier
Vert.	2399.433	PK	48.34	27.91	13.98	36.58	2.44	56.09	77.72	21.6	
Vert.	2400.000	PK	44.04	27.91	13.98	36.58	2.44	51.79	77.72	25.9	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log (3.97 m / 3.0 m) = 2.44 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

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Shonan EMC Lab.

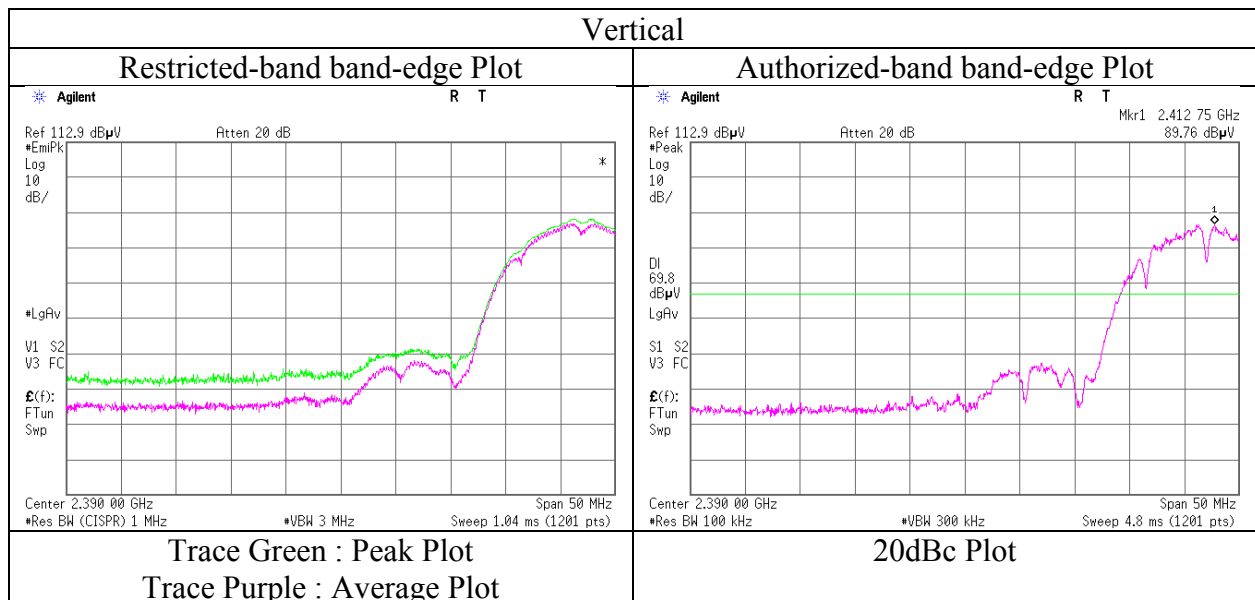
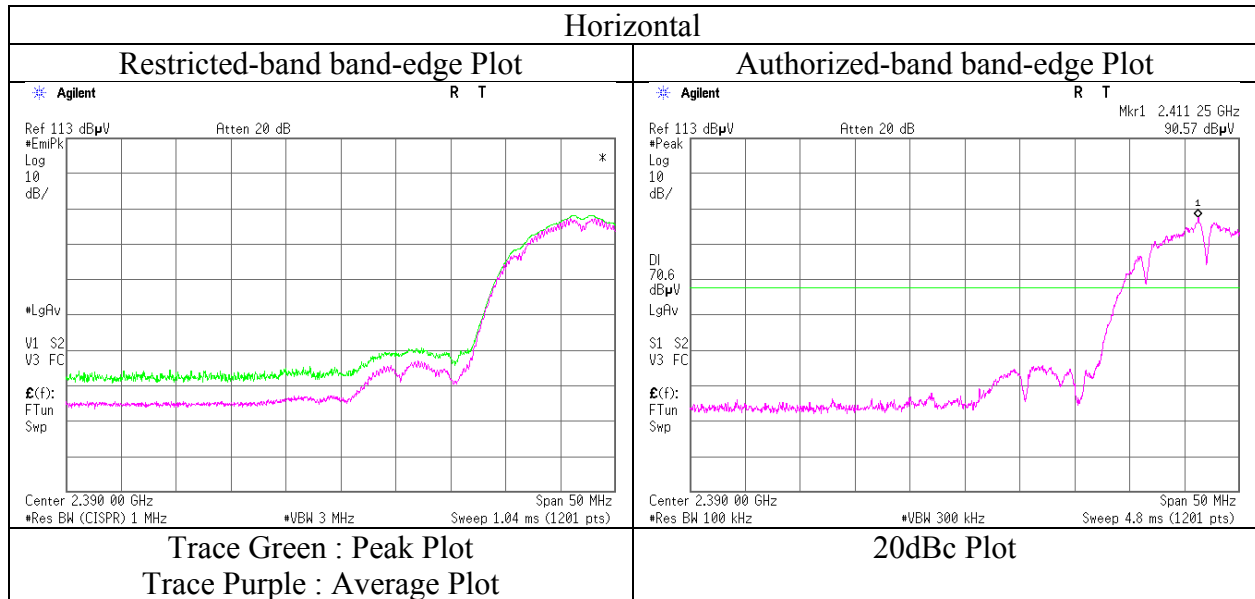
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12432580S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	August 13, 2018
Temperature / Humidity	24 deg.C / 57 %RH
Engineer	Takahiro Suzuki
	(1 GHz – 2.8 GHz)
Mode	Tx 11b 2412 MHz



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

Radiated Spurious Emission

Report No.	12432580S-A-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	2	2	2	2
Date	August 13, 2018	August 14, 2018	August 16, 2018	August 18, 2018
Temperature / Humidity	24 deg.C / 57 %RH	23 deg.C / 55 %RH	25 deg.C / 55 %RH	25 deg.C / 50 %RH
Engineer	Takahiro Suzuki (1 GHz – 2.8 GHz)	Takahiro Suzuki (2.8 GHz – 13 GHz)	Kazutaka Takeyama (13 GHz – 18 GHz)	Kazutaka Takeyama (18 GHz – 26.5 GHz)
Mode	Tx 11b 2437 MHz			

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	4874.000	PK	45.75	31.17	6.63	36.90	2.44	49.09	73.90	24.8	210	57	
Hori.	7311.000	PK	43.13	36.82	7.72	37.42	2.44	52.69	73.90	21.2	150	0	Floor Noise
Hori.	9748.000	PK	42.93	38.55	8.83	38.64	2.44	54.11	73.90	19.8	150	0	Floor Noise
Hori.	12185.000	PK	40.78	39.05	10.29	38.35	2.44	54.21	73.90	19.7	150	0	Floor Noise
Hori.	4874.000	AV	42.62	31.17	6.63	36.90	2.44	45.96	53.90	7.9	210	57	
Hori.	7311.000	AV	34.45	36.82	7.72	37.42	2.44	44.01	53.90	9.9	150	0	Floor Noise
Hori.	9748.000	AV	34.44	38.55	8.83	38.64	2.44	45.62	53.90	8.3	150	0	Floor Noise
Hori.	12185.000	AV	34.36	39.05	10.29	38.35	2.44	47.79	53.90	6.1	150	0	Floor Noise
Vert.	4874.000	PK	49.10	31.17	6.63	36.90	2.44	52.44	73.90	21.5	122	280	
Vert.	7311.000	PK	44.64	36.82	7.72	37.42	2.44	54.20	73.90	19.7	150	0	Floor Noise
Vert.	9748.000	PK	44.43	38.55	8.83	38.64	2.44	55.61	73.90	18.3	150	0	Floor Noise
Vert.	12185.000	PK	41.18	39.05	10.29	38.35	2.44	54.61	73.90	19.3	150	0	Floor Noise
Vert.	4874.000	AV	40.71	31.17	6.63	36.90	2.44	44.05	53.90	9.9	122	280	
Vert.	7311.000	AV	35.55	36.82	7.72	37.42	2.44	45.11	53.90	8.8	150	0	Floor Noise
Vert.	9748.000	AV	35.62	38.55	8.83	38.64	2.44	46.80	53.90	7.1	150	0	Floor Noise
Vert.	12185.000	AV	34.31	39.05	10.29	38.35	2.44	47.74	53.90	6.2	150	0	Floor Noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.97\text{ m} / 3.0\text{ m}) = 2.44\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Radiated Spurious Emission

Report No. 12432580S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber 2 2 2 2
Date August 13, 2018 August 14, 2018 August 16, 2018 August 19, 2018
Temperature / Humidity 24 deg.C / 57 %RH 23 deg.C / 55 %RH 25 deg.C / 55 %RH 25 deg.C / 50 %RH
Engineer Takahiro Suzuki Takahiro Suzuki Kazutaka Takeyama Kazutaka Takeyama
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 18 GHz) (18 GHz – 26.5 GHz)
Mode Tx 11b 2462 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2483.500	PK	47.33	27.67	14.04	36.52	2.44	54.96	73.90	18.9	162	207	
Hori.	2487.448	PK	46.73	27.65	14.04	36.52	2.44	54.34	73.90	19.6	162	207	
Hori.	4924.000	PK	48.05	31.16	6.67	36.92	2.44	51.40	73.90	22.5	222	67	
Hori.	7386.000	PK	44.52	36.88	7.76	37.54	2.44	54.06	73.90	19.8	150	0	Floor Noise
Hori.	9848.000	PK	43.26	38.78	8.92	38.76	2.44	54.64	73.90	19.3	150	0	Floor Noise
Hori.	12310.000	PK	43.18	38.67	10.39	38.57	2.44	56.11	73.90	17.8	150	0	Floor Noise
Hori.	2483.500	AV	34.51	27.67	14.04	36.52	2.44	42.14	53.90	11.8	162	207	
Hori.	2487.448	AV	36.98	27.65	14.04	36.52	2.44	44.59	53.90	9.3	162	207	
Hori.	4924.000	AV	40.66	31.16	6.67	36.92	2.44	44.01	53.90	9.9	222	67	
Hori.	7386.000	AV	35.92	36.88	7.76	37.54	2.44	45.46	53.90	8.4	150	0	Floor Noise
Hori.	9848.000	AV	35.26	38.78	8.92	38.76	2.44	46.64	53.90	7.3	150	0	Floor Noise
Hori.	12310.000	AV	34.56	38.67	10.39	38.57	2.44	47.49	53.90	6.4	150	0	Floor Noise
Vert.	2483.500	PK	46.15	27.67	14.04	36.52	2.44	53.78	73.90	20.1	157	142	
Vert.	2487.572	PK	45.21	27.65	14.04	36.52	2.44	52.82	73.90	21.1	157	142	
Vert.	4924.000	PK	49.82	31.16	6.67	36.92	2.44	53.17	73.90	20.7	197	154	
Vert.	7386.000	PK	43.04	36.88	7.76	37.54	2.44	52.58	73.90	21.3	150	0	Floor Noise
Vert.	9848.000	PK	42.77	38.78	8.92	38.76	2.44	54.15	73.90	19.8	150	0	Floor Noise
Vert.	12310.000	PK	41.74	38.67	10.39	38.57	2.44	54.67	73.90	19.2	150	0	Floor Noise
Vert.	2483.500	AV	34.20	27.67	14.04	36.52	2.44	41.83	53.90	12.1	157	142	
Vert.	2487.572	AV	34.96	27.65	14.04	36.52	2.44	42.57	53.90	11.3	157	142	
Vert.	4924.000	AV	41.65	31.16	6.67	36.92	2.44	45.00	53.90	8.9	197	154	
Vert.	7386.000	AV	35.85	36.88	7.76	37.54	2.44	45.39	53.90	8.5	150	0	Floor Noise
Vert.	9848.000	AV	34.33	38.78	8.92	38.76	2.44	45.71	53.90	8.2	150	0	Floor Noise
Vert.	12310.000	AV	34.36	38.67	10.39	38.57	2.44	47.29	53.90	6.6	150	0	Floor Noise

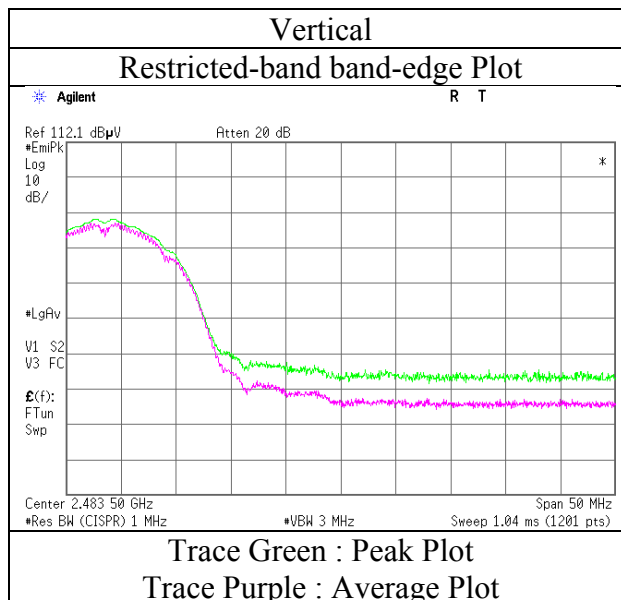
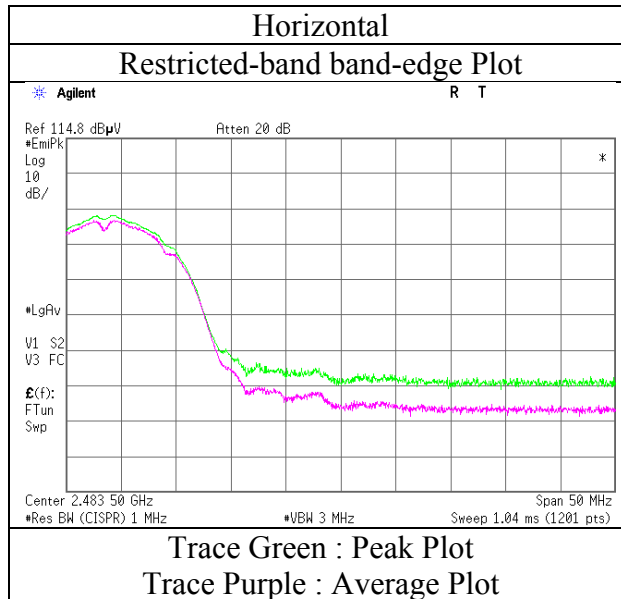
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.97\text{ m} / 3.0\text{ m}) = 2.44\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12432580S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	August 13, 2018
Temperature / Humidity	24 deg.C / 57 %RH
Engineer	Takahiro Suzuki
	(1 GHz – 2.8 GHz)
Mode	Tx 11b 2462 MHz



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

Radiated Spurious Emission

Report No. 12432580S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber 2 2 2 2
Date August 13, 2018 August 14, 2018 August 16, 2018 August 19, 2018
Temperature / Humidity 24 deg.C / 57 %RH 23 deg.C / 55 %RH 25 deg.C / 55 %RH 25 deg.C / 50 %RH
Engineer Takahiro Suzuki Takahiro Suzuki Kazutaka Takeyama Kazutaka Takeyama
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 18 GHz) (18 GHz – 26.5 GHz)
Mode Tx 11g 2412 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2390.000	PK	46.29	27.91	13.97	36.58	2.44	54.03	73.90	19.9	113	57	
Hori.	4824.000	PK	43.33	31.29	6.60	36.88	2.44	46.78	73.90	27.1	146	42	
Hori.	7236.000	PK	43.61	36.80	7.68	37.30	2.44	53.23	73.90	20.7	150	0	Floor Noise
Hori.	9648.000	PK	43.06	38.29	8.76	38.52	2.44	54.03	73.90	19.9	150	0	Floor Noise
Hori.	12060.000	PK	43.02	39.10	10.20	38.13	2.44	56.63	73.90	17.3	150	0	Floor Noise
Hori.	7236.000	AV	34.63	36.80	7.68	37.30	2.44	44.25	53.90	9.6	150	0	Floor Noise
Hori.	9648.000	AV	34.44	38.29	8.76	38.52	2.44	45.41	53.90	8.5	150	0	Floor Noise
Hori.	12060.000	AV	34.13	39.10	10.20	38.13	2.44	47.74	53.90	6.2	150	0	Floor Noise
Vert.	2390.000	PK	50.46	27.91	13.97	36.58	2.44	58.20	73.90	15.7	114	148	
Vert.	4824.000	PK	45.62	31.29	6.60	36.88	2.44	49.07	73.90	24.8	186	159	
Vert.	7236.000	PK	43.57	36.80	7.68	37.30	2.44	53.19	73.90	20.7	150	0	Floor Noise
Vert.	9648.000	PK	43.13	38.29	8.76	38.52	2.44	54.10	73.90	19.8	150	0	Floor Noise
Vert.	12060.000	PK	42.27	39.10	10.20	38.13	2.44	55.88	73.90	18.0	150	0	Floor Noise
Vert.	7236.000	AV	34.88	36.80	7.68	37.30	2.44	44.50	53.90	9.4	150	0	Floor Noise
Vert.	9648.000	AV	34.61	38.29	8.76	38.52	2.44	45.58	53.90	8.3	150	0	Floor Noise
Vert.	12060.000	AV	34.16	39.10	10.20	38.13	2.44	47.77	53.90	6.1	150	0	Floor Noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.97\text{ m} / 3.0\text{ m}) = 2.44\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	34.25	27.91	13.97	36.58	0.56	2.44	42.55	53.90	11.4	*1)
Hori.	4824.000	AV	32.72	31.29	6.60	36.88	0.56	2.44	36.73	53.90	17.2	
Vert.	2390.000	AV	35.38	27.91	13.97	36.58	0.56	2.44	43.68	53.90	10.2	*1)
Vert.	4824.000	AV	34.11	31.29	6.60	36.88	0.56	2.44	38.12	53.90	15.8	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.97\text{ m} / 3.0\text{ m}) = 2.44\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	82.44	27.88	13.99	36.57	2.44	90.18	-	-	Carrier
Hori.	2400.000	PK	47.16	27.91	13.98	36.58	2.44	54.91	70.18	15.3	
Vert.	2412.000	PK	84.74	27.88	13.99	36.57	2.44	92.48	-	-	Carrier
Vert.	2400.000	PK	50.81	27.91	13.98	36.58	2.44	58.56	72.48	13.9	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.97\text{ m} / 3.0\text{ m}) = 2.44\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

UL Japan, Inc.

Shonan EMC Lab.

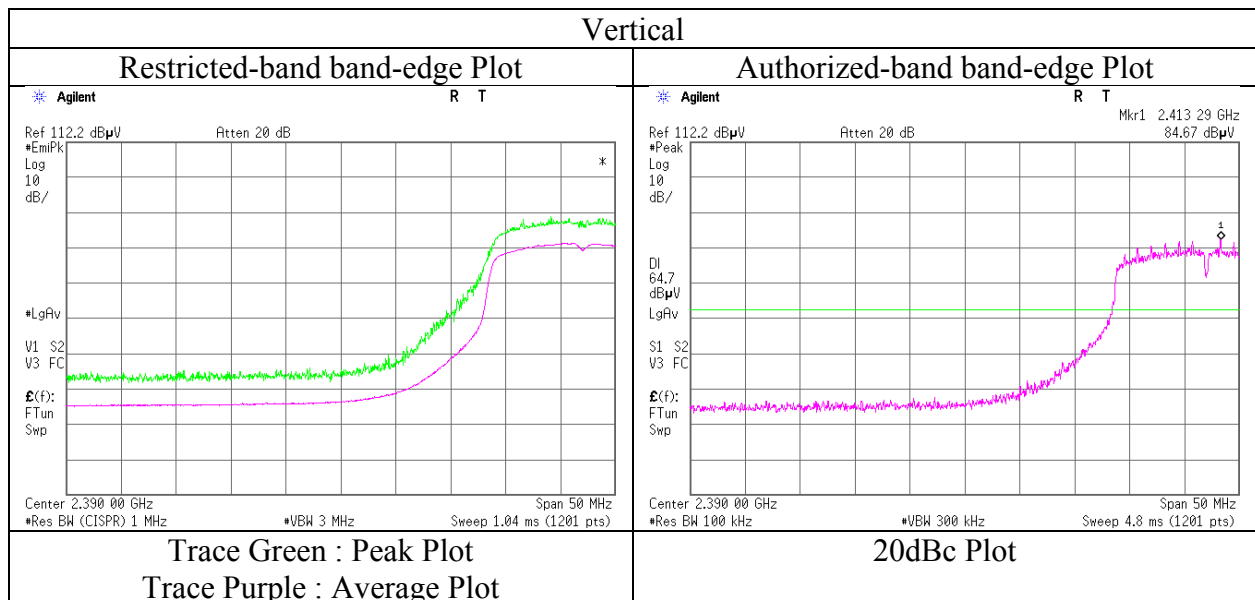
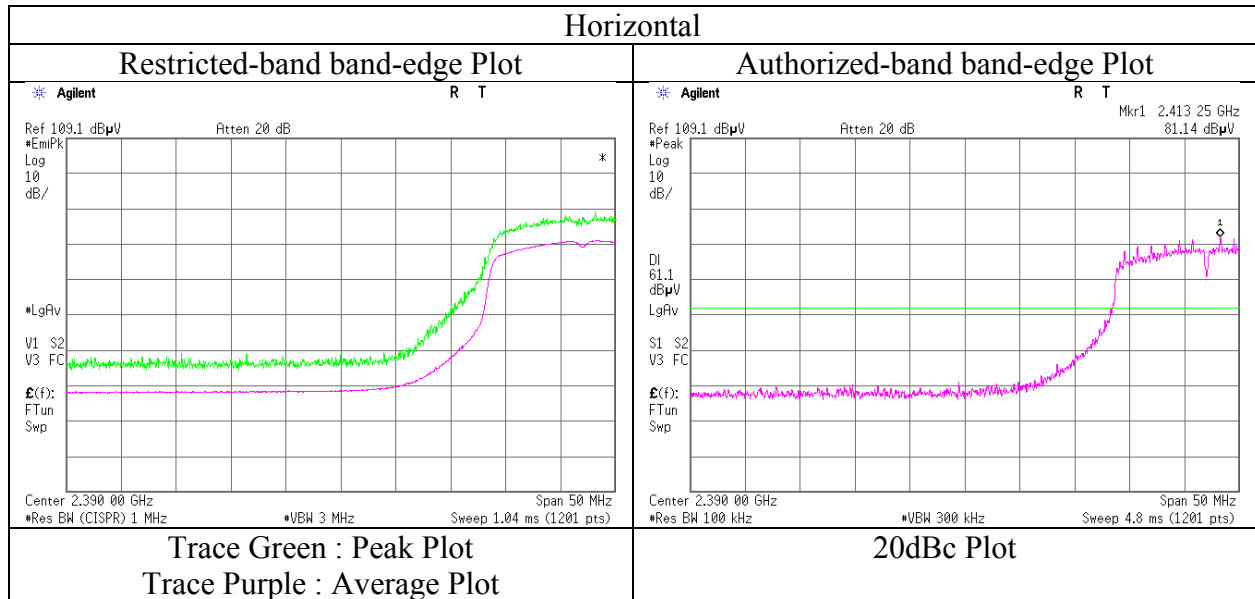
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12432580S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	August 13, 2018
Temperature / Humidity	24 deg.C / 57 %RH
Engineer	Takahiro Suzuki
	(1 GHz – 2.8 GHz)
Mode	Tx 11g 2412 MHz



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

Radiated Spurious Emission

Report No. 12432580S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber 2 2 2 2 2
Date August 13, 2018 August 14, 2018 August 16, 2018 August 19, 2018 August 18, 2018
Temperature / Humidity 24 deg.C / 57 %RH 23 deg.C / 55 %RH 25 deg.C / 55 %RH 25 deg.C / 50 %RH 25 deg.C / 50 %RH
Engineer Takahiro Suzuki Takahiro Suzuki Kazutaka Takeyama Kazutaka Takeyama Kazutaka Takeyama
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 18 GHz) (18 GHz – 26.5 GHz) (30 MHz – 1000 MHz)
Mode Tx 11g 2437 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	52.271	QP	34.70	10.41	7.15	31.91	0.00	20.35	40.00	19.6	300	201	
Hori.	794.412	QP	22.70	20.80	8.65	31.42	0.00	20.73	46.00	25.2	150	248	
Hori.	4874.000	PK	44.95	31.17	6.63	36.90	2.44	48.29	73.90	25.6	100	58	
Hori.	7311.000	PK	44.74	36.82	7.72	37.42	2.44	54.30	73.90	19.6	150	0	Floor Noise
Hori.	9748.000	PK	42.65	38.55	8.83	38.64	2.44	53.83	73.90	20.1	150	0	Floor Noise
Hori.	12185.000	PK	42.51	39.05	10.29	38.35	2.44	55.94	73.90	18.0	150	0	Floor Noise
Hori.	7311.000	AV	34.45	36.82	7.72	37.42	2.44	44.01	53.90	9.9	150	0	Floor Noise
Hori.	9748.000	AV	34.38	38.55	8.83	38.64	2.44	45.56	53.90	8.3	150	0	Floor Noise
Hori.	12185.000	AV	34.16	39.05	10.29	38.35	2.44	47.59	53.90	6.3	150	0	Floor Noise
Vert.	52.354	QP	52.80	10.38	7.15	31.91	0.00	38.42	40.00	1.5	100	239	
Vert.	57.728	QP	52.50	8.70	7.05	31.91	0.00	36.34	40.00	3.6	100	171	
Vert.	76.424	QP	45.00	6.30	7.79	31.89	0.00	27.20	40.00	12.8	100	215	
Vert.	96.039	QP	45.50	9.48	8.01	31.88	0.00	31.11	43.50	12.3	100	221	
Vert.	236.450	QP	27.00	11.47	5.70	31.74	0.00	12.43	46.00	33.5	100	250	
Vert.	4874.000	PK	43.58	31.17	6.63	36.90	2.44	46.92	73.90	27.0	169	304	
Vert.	7311.000	PK	43.67	36.82	7.72	37.42	2.44	53.23	73.90	20.7	150	0	Floor Noise
Vert.	9748.000	PK	42.27	38.55	8.83	38.64	2.44	53.45	73.90	20.5	150	0	Floor Noise
Vert.	12185.000	PK	42.15	39.05	10.29	38.35	2.44	55.58	73.90	18.3	150	0	Floor Noise
Vert.	7311.000	AV	34.23	36.82	7.72	37.42	2.44	43.79	53.90	10.1	150	0	Floor Noise
Vert.	9748.000	AV	34.15	38.55	8.83	38.64	2.44	45.33	53.90	8.6	150	0	Floor Noise
Vert.	12185.000	AV	34.09	39.05	10.29	38.35	2.44	47.52	53.90	6.4	150	0	Floor Noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.97\text{ m} / 3.0\text{ m}) = 2.44\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4874.000	AV	32.82	31.17	6.63	36.90	0.56	2.44	36.72	53.90	17.2	
Vert.	4874.000	AV	33.84	31.17	6.63	36.90	0.56	2.44	37.74	53.90	16.2	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.97\text{ m} / 3.0\text{ m}) = 2.44\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

Radiated Spurious Emission

Report No.	12432580S-A-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	2	2	2	2
Date	August 13, 2018	August 14, 2018	August 16, 2018	August 19, 2018
Temperature / Humidity	24 deg.C / 57 %RH	23 deg.C / 55 %RH	25 deg.C / 55 %RH	25 deg.C / 50 %RH
Engineer	Takahiro Suzuki (1 GHz – 2.8 GHz)	Takahiro Suzuki (2.8 GHz – 13 GHz)	Kazutaka Takeyama (13 GHz – 18 GHz)	Kazutaka Takeyama (18 GHz – 26.5 GHz)
Mode	Tx 11g 2462 MHz			

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2483.500	PK	50.35	27.67	14.04	36.52	2.44	57.98	73.90	15.9	132	0	
Hori.	4924.000	PK	44.27	31.16	6.67	36.92	2.44	47.62	73.90	26.3	139	46	
Hori.	7386.000	PK	43.99	36.88	7.76	37.54	2.44	53.53	73.90	20.4	150	0	Floor Noise
Hori.	9848.000	PK	43.68	38.78	8.92	38.76	2.44	55.06	73.90	18.8	150	0	Floor Noise
Hori.	12310.000	PK	43.20	38.67	10.39	38.57	2.44	56.13	73.90	17.8	150	0	Floor Noise
Hori.	7386.000	AV	34.87	36.88	7.76	37.54	2.44	44.41	53.90	9.5	150	0	Floor Noise
Hori.	9848.000	AV	34.79	38.78	8.92	38.76	2.44	46.17	53.90	7.7	150	0	Floor Noise
Hori.	12310.000	AV	34.68	38.67	10.39	38.57	2.44	47.61	53.90	6.3	150	0	Floor Noise
Vert.	2483.500	PK	48.57	27.67	14.04	36.52	2.44	56.20	73.90	17.7	123	125	
Vert.	4924.000	PK	45.99	31.16	6.67	36.92	2.44	49.34	73.90	24.6	171	305	
Vert.	7386.000	PK	43.78	36.88	7.76	37.54	2.44	53.32	73.90	20.6	150	0	Floor Noise
Vert.	9848.000	PK	42.69	38.78	8.92	38.76	2.44	54.07	73.90	19.8	150	0	Floor Noise
Vert.	12310.000	PK	42.26	38.67	10.39	38.57	2.44	55.19	73.90	18.7	150	0	Floor Noise
Vert.	7386.000	AV	34.92	36.88	7.76	37.54	2.44	44.46	53.90	9.4	150	0	Floor Noise
Vert.	9848.000	AV	34.80	38.78	8.92	38.76	2.44	46.18	53.90	7.7	150	0	Floor Noise
Vert.	12310.000	AV	34.81	38.67	10.39	38.57	2.44	47.74	53.90	6.2	150	0	Floor Noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.97\text{ m} / 3.0\text{ m}) = 2.44\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	36.02	27.67	14.04	36.52	0.56	2.44	44.21	53.90	9.7	*1)
Hori.	4924.000	AV	35.11	31.16	6.67	36.92	0.56	2.44	39.02	53.90	14.9	
Vert.	2483.500	AV	35.69	27.67	14.04	36.52	0.56	2.44	43.88	53.90	10.0	*1)
Vert.	4924.000	AV	35.02	31.16	6.67	36.92	0.56	2.44	38.93	53.90	15.0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.97\text{ m} / 3.0\text{ m}) = 2.44\text{ dB}$

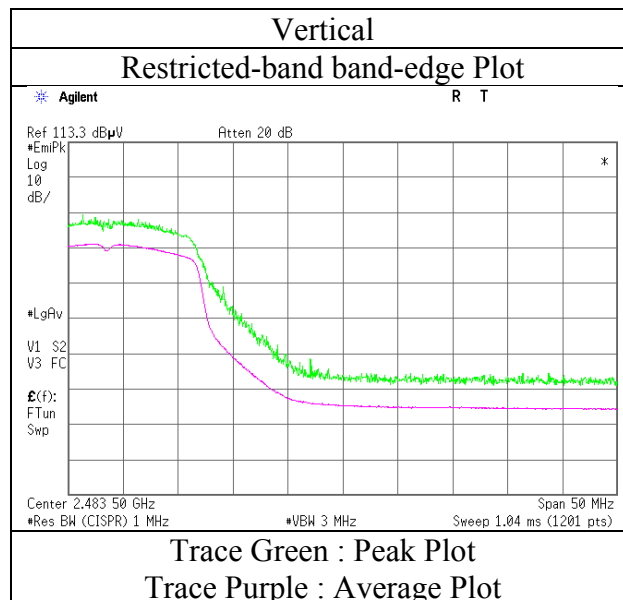
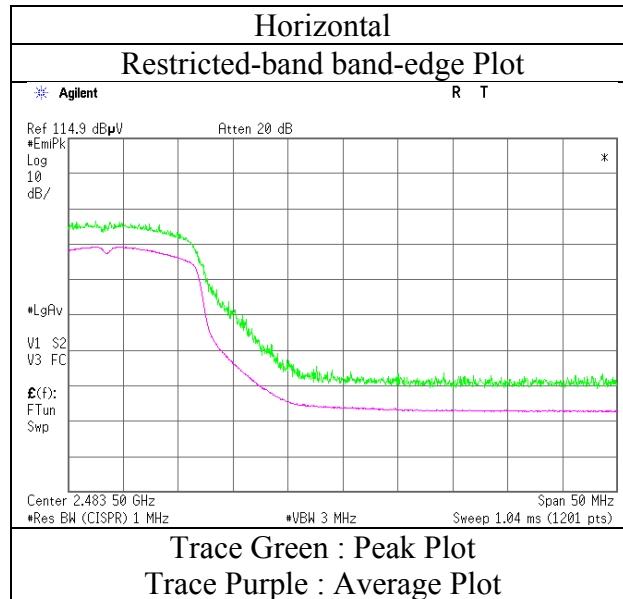
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12432580S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	August 13, 2018
Temperature / Humidity	24 deg.C / 57 %RH
Engineer	Takahiro Suzuki
	(1 GHz – 2.8 GHz)
Mode	Tx 11g 2462 MHz



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

Radiated Spurious Emission

Report No. 12432580S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber 2 2 2 2
Date August 13, 2018 August 14, 2018 August 16, 2018 August 19, 2018
Temperature / Humidity 24 deg.C / 57 %RH 23 deg.C / 55 %RH 25 deg.C / 55 %RH 25 deg.C / 50 %RH
Engineer Takahiro Suzuki Takahiro Suzuki Kazutaka Takeyama Kazutaka Takeyama
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 18 GHz) (18 GHz – 26.5 GHz)
Mode Tx 11n-20 2412 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2390.000	PK	44.88	27.91	13.97	36.58	2.44	52.62	73.90	21.3	163	2	
Hori.	4824.000	PK	43.95	31.29	6.60	36.88	2.44	47.40	73.90	26.5	175	245	
Hori.	7236.000	PK	43.42	36.80	7.68	37.30	2.44	53.04	73.90	20.9	150	0	Floor Noise
Hori.	9648.000	PK	43.17	38.29	8.76	38.52	2.44	54.14	73.90	19.8	150	0	Floor Noise
Hori.	12060.000	PK	43.01	39.10	10.20	38.13	2.44	56.62	73.90	17.3	150	0	Floor Noise
Hori.	7236.000	AV	34.84	36.80	7.68	37.30	2.44	44.46	53.90	9.4	150	0	Floor Noise
Hori.	9648.000	AV	34.57	38.29	8.76	38.52	2.44	45.54	53.90	8.4	150	0	Floor Noise
Hori.	12060.000	AV	34.17	39.10	10.20	38.13	2.44	47.78	53.90	6.1	150	0	Floor Noise
Vert.	2390.000	PK	48.72	27.91	13.97	36.58	2.44	56.46	73.90	17.4	136	165	
Vert.	4824.000	PK	45.38	31.29	6.60	36.88	2.44	48.83	73.90	25.1	126	315	
Vert.	7236.000	PK	45.02	36.80	7.68	37.30	2.44	54.64	73.90	19.3	150	0	Floor Noise
Vert.	9648.000	PK	43.87	38.29	8.76	38.52	2.44	54.84	73.90	19.1	150	0	Floor Noise
Vert.	12060.000	PK	43.15	39.10	10.20	38.13	2.44	56.76	73.90	17.1	150	0	Floor Noise
Vert.	7236.000	AV	35.01	36.80	7.68	37.30	2.44	44.63	53.90	9.3	150	0	Floor Noise
Vert.	9648.000	AV	34.76	38.29	8.76	38.52	2.44	45.73	53.90	8.2	150	0	Floor Noise
Vert.	12060.000	AV	34.25	39.10	10.20	38.13	2.44	47.86	53.90	6.0	150	0	Floor Noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log (3.97 m / 3.0 m) = 2.44 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	34.21	27.91	13.97	36.58	1.15	2.44	43.10	53.90	10.8	*1)
Hori.	4824.000	AV	34.13	31.29	6.60	36.88	1.15	2.44	38.73	53.90	15.2	
Vert.	2390.000	AV	35.92	27.91	13.97	36.58	1.15	2.44	44.81	53.90	9.1	*1)
Vert.	4824.000	AV	34.08	31.29	6.60	36.88	1.15	2.44	38.68	53.90	15.2	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log (3.97 m / 3.0 m) = 2.44 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2412.000	PK	82.86	27.88	13.99	36.57	2.44	90.60	-	-	Carrier
Hori.	2400.000	PK	46.97	27.91	13.98	36.58	2.44	54.72	70.60	15.9	
Vert.	2412.000	PK	83.64	27.88	13.99	36.57	2.44	91.38	-	-	Carrier
Vert.	2400.000	PK	48.97	27.91	13.98	36.58	2.44	56.72	71.38	14.7	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log (3.97 m / 3.0 m) = 2.44 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

UL Japan, Inc.

Shonan EMC Lab.

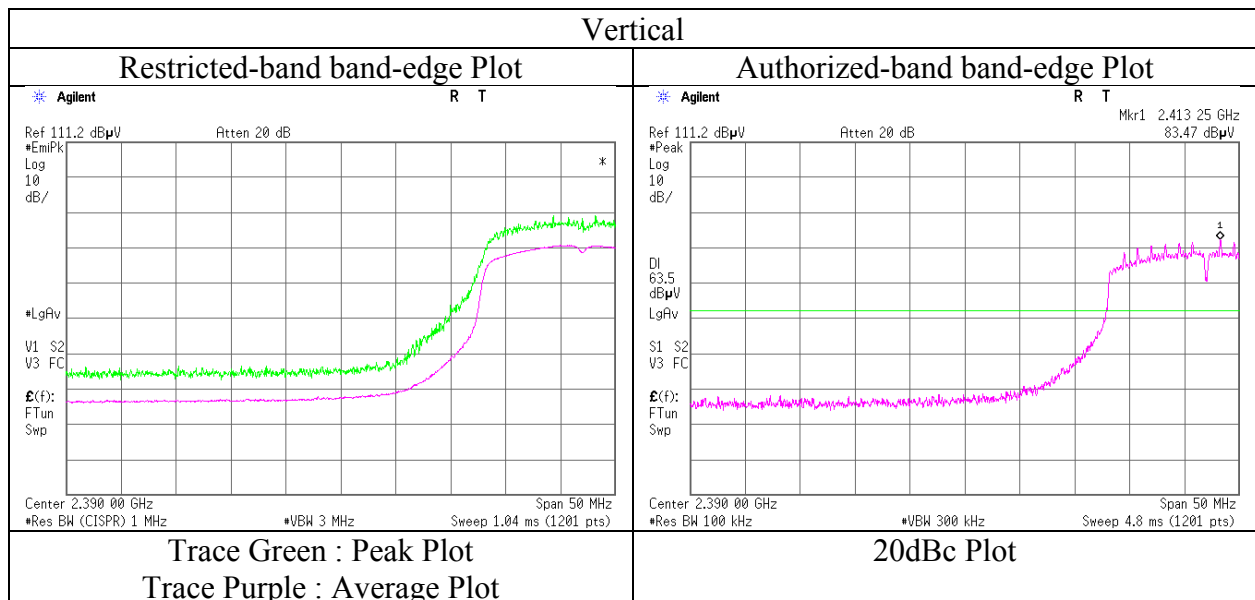
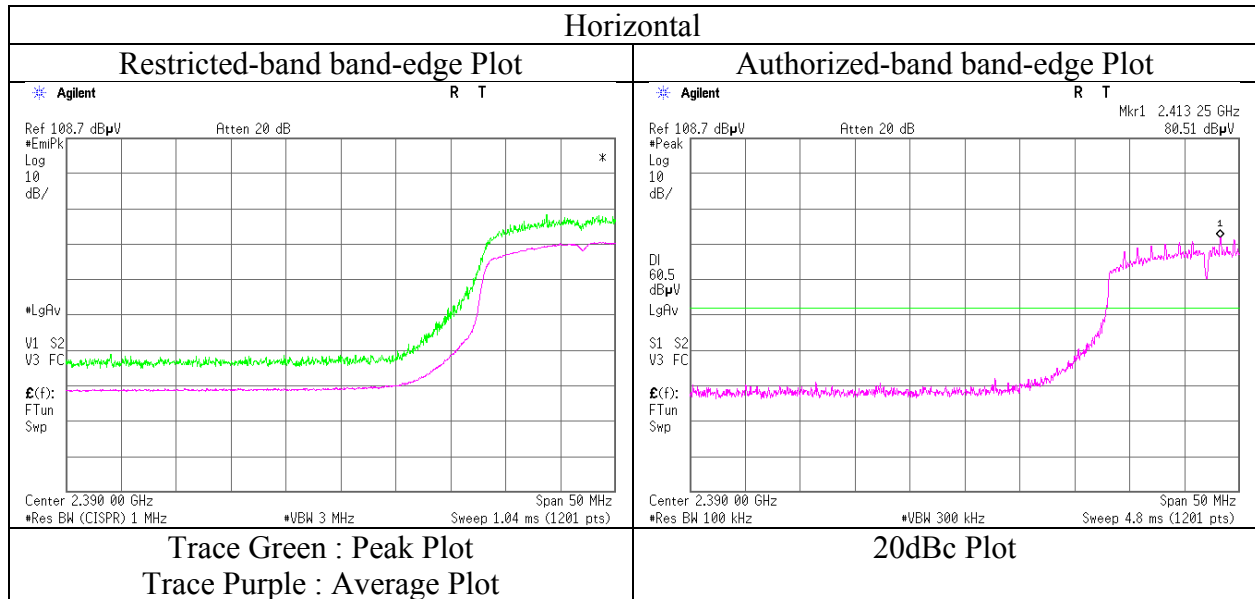
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12432580S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	August 13, 2018
Temperature / Humidity	24 deg.C / 57 %RH
Engineer	Takahiro Suzuki
	(1 GHz – 2.8 GHz)
Mode	Tx 11n-20 2412 MHz



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

Radiated Spurious Emission

Report No.	12432580S-A-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	2	2	2	2
Date	August 13, 2018	August 14, 2018	August 16, 2018	August 19, 2018
Temperature / Humidity	24 deg.C / 57 %RH	23 deg.C / 55 %RH	25 deg.C / 55 %RH	25 deg.C / 50 %RH
Engineer	Takahiro Suzuki (1 GHz – 2.8 GHz)	Takahiro Suzuki (2.8 GHz – 13 GHz)	Kazutaka Takeyama (13 GHz – 18 GHz)	Kazutaka Takeyama (18 GHz – 26.5 GHz)
Mode	Tx 11n-20 2437 MHz			

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	4874.000	PK	44.94	31.17	6.63	36.90	2.44	48.28	73.90	25.6	159	172	
Hori.	7311.000	PK	44.62	36.82	7.72	37.42	2.44	54.18	73.90	19.7	150	0	Floor Noise
Hori.	9748.000	PK	44.36	38.55	8.83	38.64	2.44	55.54	73.90	18.4	150	0	Floor Noise
Hori.	12185.000	PK	43.75	39.05	10.29	38.35	2.44	57.18	73.90	16.7	150	0	Floor Noise
Hori.	7311.000	AV	34.75	36.82	7.72	37.42	2.44	44.31	53.90	9.6	150	0	Floor Noise
Hori.	9748.000	AV	34.69	38.55	8.83	38.64	2.44	45.87	53.90	8.0	150	0	Floor Noise
Hori.	12185.000	AV	34.13	39.05	10.29	38.35	2.44	47.56	53.90	6.3	150	0	Floor Noise
Vert.	4874.000	PK	45.03	31.17	6.63	36.90	2.44	48.37	73.90	25.5	100	150	
Vert.	7311.000	PK	44.28	36.82	7.72	37.42	2.44	53.84	73.90	20.1	150	0	Floor Noise
Vert.	9748.000	PK	43.54	38.55	8.83	38.64	2.44	54.72	73.90	19.2	150	0	Floor Noise
Vert.	12185.000	PK	43.31	39.05	10.29	38.35	2.44	56.74	73.90	17.2	150	0	Floor Noise
Vert.	7311.000	AV	34.92	36.82	7.72	37.42	2.44	44.48	53.90	9.4	150	0	Floor Noise
Vert.	9748.000	AV	34.76	38.55	8.83	38.64	2.44	45.94	53.90	8.0	150	0	Floor Noise
Vert.	12185.000	AV	34.25	39.05	10.29	38.35	2.44	47.68	53.90	6.2	150	0	Floor Noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log (3.97 m / 3.0 m) = 2.44 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	4874.000	AV	35.32	31.17	6.63	36.90	1.15	2.44	39.81	53.90	14.1	
Vert.	4874.000	AV	35.38	31.17	6.63	36.90	1.15	2.44	39.87	53.90	14.0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log (3.97 m / 3.0 m) = 2.44 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Duty factor refer to "Duty factor Calculation chart" sheet.

Radiated Spurious Emission

Report No. 12432580S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber 2 2 2 2
Date August 13, 2018 August 14, 2018 August 16, 2018 August 19, 2018
Temperature / Humidity 24 deg.C / 57 %RH 23 deg.C / 55 %RH 25 deg.C / 55 %RH 25 deg.C / 50 %RH
Engineer Takahiro Suzuki Takahiro Suzuki Kazutaka Takeyama Kazutaka Takeyama
(1 GHz – 2.8 GHz) (2.8 GHz – 13 GHz) (13 GHz – 18 GHz) (18 GHz – 26.5 GHz)
Mode Tx 11n-20 2462 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	2483.500	PK	47.78	27.67	14.04	36.52	2.44	55.41	73.90	18.5	151	0	
Hori.	4924.000	PK	46.26	31.16	6.67	36.92	2.44	49.61	73.90	24.3	138	155	
Hori.	7386.000	PK	44.65	36.88	7.76	37.54	2.44	54.19	73.90	19.7	150	0	Floor Noise
Hori.	9848.000	PK	44.27	38.78	8.92	38.76	2.44	55.65	73.90	18.3	150	0	Floor Noise
Hori.	12310.000	PK	43.44	38.67	10.39	38.57	2.44	56.37	73.90	17.5	150	0	Floor Noise
Hori.	7386.000	AV	34.85	36.88	7.76	37.54	2.44	44.39	53.90	9.5	150	0	Floor Noise
Hori.	9848.000	AV	34.76	38.78	8.92	38.76	2.44	46.14	53.90	7.8	150	0	Floor Noise
Hori.	12310.000	AV	34.38	38.67	10.39	38.57	2.44	47.31	53.90	6.6	150	0	Floor Noise
Vert.	2483.500	PK	48.86	27.67	14.04	36.52	2.44	56.49	73.90	17.4	151	135	
Vert.	4924.000	PK	45.86	31.16	6.67	36.92	2.44	49.21	73.90	24.7	100	86	
Vert.	7386.000	PK	45.16	36.88	7.76	37.54	2.44	54.70	73.90	19.2	150	0	Floor Noise
Vert.	9848.000	PK	43.84	38.78	8.92	38.76	2.44	55.22	73.90	18.7	150	0	Floor Noise
Vert.	12310.000	PK	43.41	38.67	10.39	38.57	2.44	56.34	73.90	17.6	150	0	Floor Noise
Vert.	7386.000	AV	34.61	36.88	7.76	37.54	2.44	44.15	53.90	9.7	150	0	Floor Noise
Vert.	9848.000	AV	34.23	38.78	8.92	38.76	2.44	45.61	53.90	8.3	150	0	Floor Noise
Vert.	12310.000	AV	34.31	38.67	10.39	38.57	2.44	47.24	53.90	6.7	150	0	Floor Noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.97\text{ m} / 3.0\text{ m}) = 2.44\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	34.96	27.67	14.04	36.52	1.15	2.44	43.74	53.90	10.2	*1)
Hori.	4924.000	AV	35.13	31.16	6.67	36.92	1.15	2.44	39.63	53.90	14.3	
Vert.	2483.500	AV	35.15	27.67	14.04	36.52	1.15	2.44	43.93	53.90	10.0	*1)
Vert.	4924.000	AV	34.79	31.16	6.67	36.92	1.15	2.44	39.29	53.90	14.6	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.97\text{ m} / 3.0\text{ m}) = 2.44\text{ dB}$

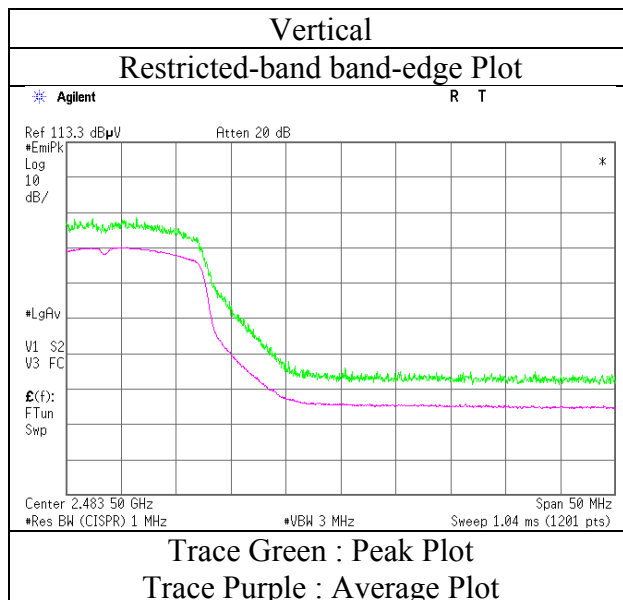
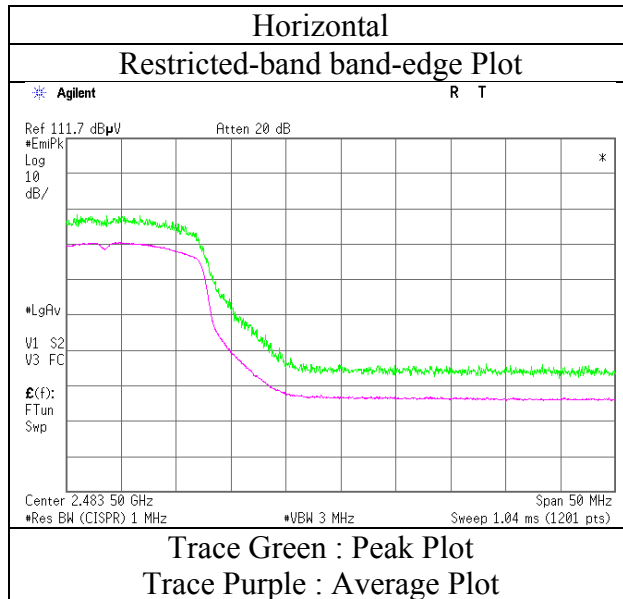
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

Radiated Spurious Emission (Reference Plot for band-edge)

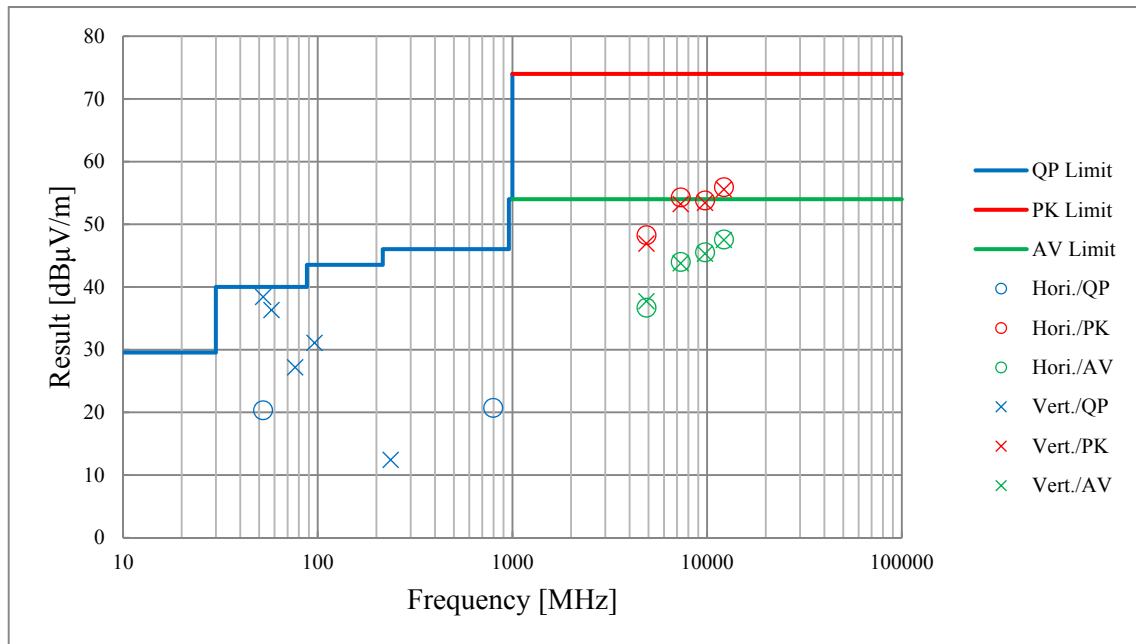
Report No.	12432580S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	August 13, 2018
Temperature / Humidity	24 deg.C / 57 %RH
Engineer	Takahiro Suzuki
	(1 GHz – 2.8 GHz)
Mode	Tx 11n-20 2462 MHz



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

Radiated Spurious Emission (Plot data, Worst case)

Report No.	12432580S-A-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	3	3	3	3
Date	June 28, 2018	June 29, 2018	June 30, 2018	July 1, 2018
Temperature / Humidity	21 deg.C / 60 %RH	26 deg.C / 47 %RH	25 deg.C / 49 %RH	25 deg.C / 59 %RH
Engineer	Shiro Kobayashi (1 GHz – 2.8 GHz)	Shiro Kobayashi (2.8 GHz – 13 GHz)	Yosuke Ishikawa (13 GHz – 18 GHz)	Kenichi Adachi (18 GHz – 26.5 GHz) (30 MHz – 1000 MHz)
Mode	Tx 11g 2437 MHz			



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

Radiated Spurious Emission

Report No. 12432580S-A-R2
Test place Shonan EMC Lab.
Semi Anechoic Chamber 2 2 2 2
Date August 18, 2018 August 13, 2018 August 16, 2018 August 19, 2018
Temperature / Humidity 25 deg.C / 50 %RH 24 deg.C / 57 %RH 25 deg.C / 55 %RH 25 deg.C / 50 %RH
Engineer Kazutaka Takeyama Takahiro Suzuki Kazutaka Takeyama Kazutaka Takeyama
(30 MHz – 1000 MHz) (1 GHz – 13 GHz) (13 GHz – 18 GHz) (18 GHz – 26.5 GHz)
Mode Tx BT LE 2402 MHz

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	96.398	QP	30.00	9.53	8.00	31.88	0.00	15.65	43.50	27.8	236	202	
Hori.	2390.000	PK	45.37	27.91	13.97	36.58	2.44	53.11	73.90	20.8	142	0	
Hori.	4804.000	PK	43.20	31.31	6.60	36.88	2.44	46.67	73.90	27.2	150	0	Floor Noise
Hori.	7206.000	PK	43.30	36.77	7.65	37.26	2.44	52.90	73.90	21.0	150	0	Floor Noise
Hori.	9608.000	PK	44.10	38.11	8.71	38.47	2.44	54.89	73.90	19.0	150	0	Floor Noise
Hori.	12010.000	PK	45.10	39.10	10.16	38.04	2.44	58.76	73.90	15.1	150	0	Floor Noise
Hori.	4804.000	AV	33.20	31.31	6.60	36.88	2.44	36.67	53.90	17.2	150	0	Floor Noise
Hori.	7206.000	AV	34.00	36.77	7.65	37.26	2.44	43.60	53.90	10.3	150	0	Floor Noise
Hori.	9608.000	AV	34.20	38.11	8.71	38.47	2.44	44.99	53.90	8.9	150	0	Floor Noise
Hori.	12010.000	AV	34.40	39.10	10.16	38.04	2.44	48.06	53.90	5.8	150	0	Floor Noise
Vert.	51.511	QP	50.00	10.65	7.16	31.91	0.00	35.90	40.00	4.1	100	184	
Vert.	57.591	QP	44.80	8.74	7.05	31.91	0.00	28.68	40.00	11.3	100	130	
Vert.	76.905	QP	46.70	6.32	7.83	31.89	0.00	28.96	40.00	11.0	100	209	
Vert.	96.519	QP	44.00	9.55	7.99	31.88	0.00	29.66	43.50	13.8	100	15	
Vert.	237.316	QP	27.50	11.48	5.71	31.74	0.00	12.95	46.00	33.0	100	240	
Vert.	2390.000	PK	45.14	27.91	13.97	36.58	2.44	52.88	73.90	21.0	237	157	
Vert.	4804.000	PK	42.70	31.31	6.60	36.88	2.44	46.17	73.90	27.7	150	0	Floor Noise
Vert.	7206.000	PK	43.80	36.77	7.65	37.26	2.44	53.40	73.90	20.5	150	0	Floor Noise
Vert.	9608.000	PK	44.20	38.11	8.71	38.47	2.44	54.99	73.90	18.9	150	0	Floor Noise
Vert.	12010.000	PK	45.00	39.10	10.16	38.04	2.44	58.66	73.90	15.2	150	0	Floor Noise
Vert.	4804.000	AV	33.40	31.31	6.60	36.88	2.44	36.87	53.90	17.0	150	0	Floor Noise
Vert.	7206.000	AV	33.50	36.77	7.65	37.26	2.44	43.10	53.90	10.8	150	0	Floor Noise
Vert.	9608.000	AV	33.90	38.11	8.71	38.47	2.44	44.69	53.90	9.2	150	0	Floor Noise
Vert.	12010.000	AV	34.00	39.10	10.16	38.04	2.44	47.66	53.90	6.2	150	0	Floor Noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log (3.97 m / 3.0 m) = 2.44 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2390.000	AV	33.67	27.91	13.97	36.58	4.37	2.44	45.78	53.90	8.1	*1)
Vert.	2390.000	AV	33.28	27.91	13.97	36.58	4.37	2.44	45.39	53.90	8.5	*1)

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log (3.97 m / 3.0 m) = 2.44 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

20 dBc Data Sheet (RBW 100 kHz, VBW 300 kHz)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2402.000	PK	87.78	27.90	13.98	36.57	2.44	95.53	-	-	
Hori.	2400.000	PK	36.40	27.91	13.98	36.58	2.44	44.15	75.53	31.4	
Vert.	2402.000	PK	89.20	27.90	13.98	36.57	2.44	96.95	-	-	
Vert.	2400.000	PK	35.36	27.91	13.98	36.58	2.44	43.11	76.95	33.8	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : 20log (3.97 m / 3.0 m) = 2.44 dB

13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

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Shonan EMC Lab.

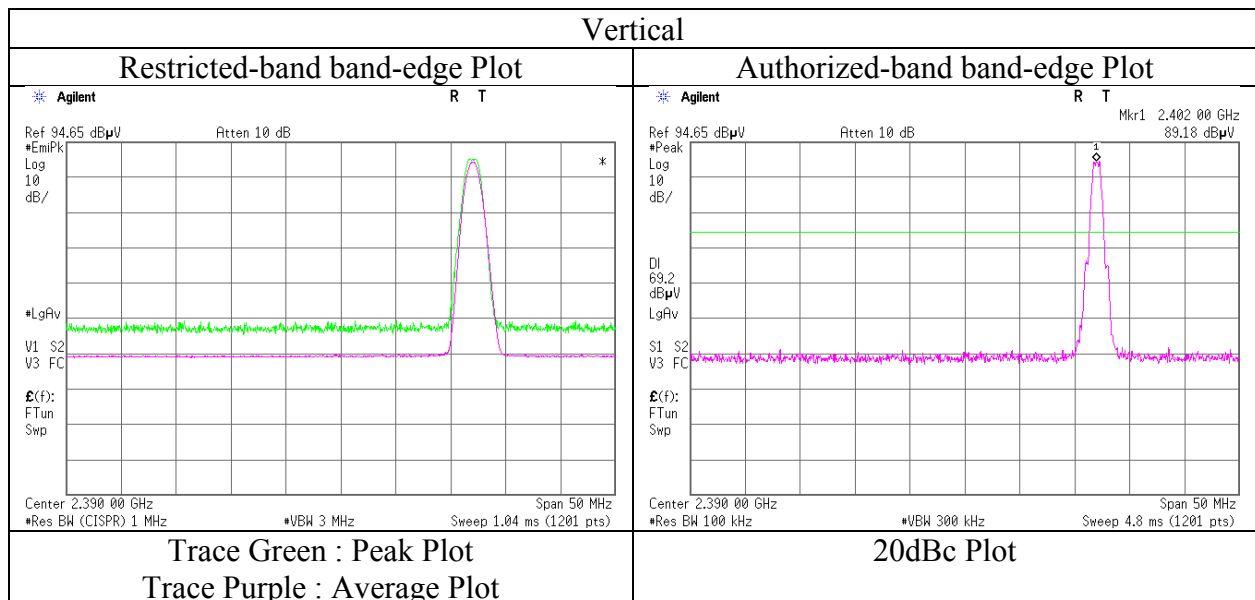
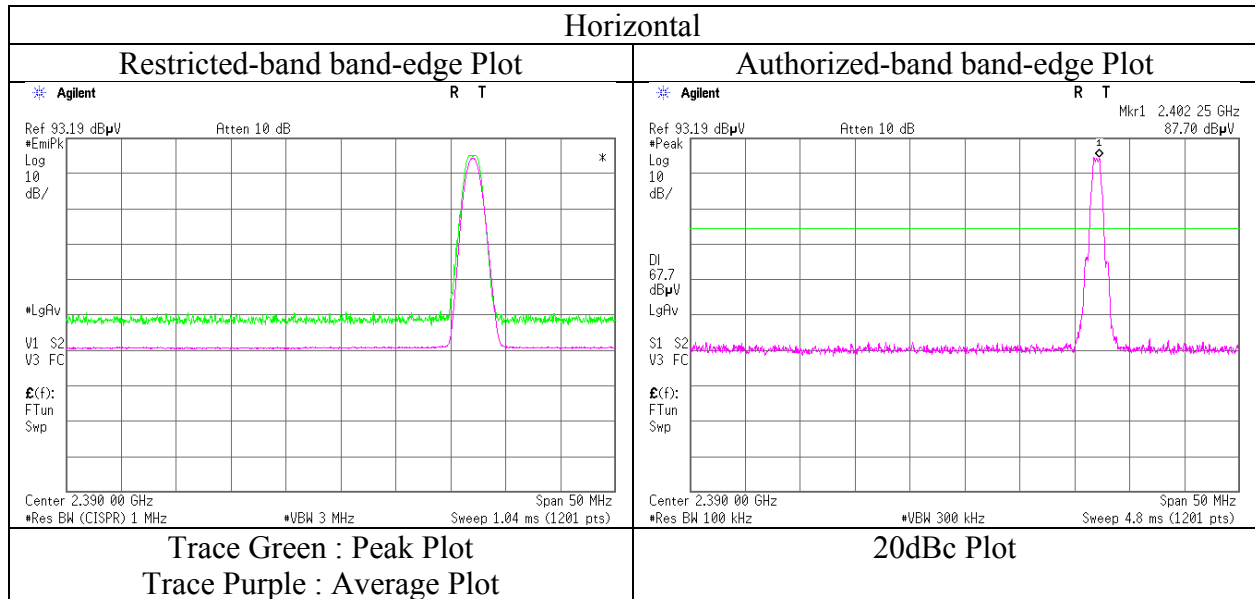
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12432580S-A-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	August 13, 2018
Temperature / Humidity	24 deg.C / 57 %RH
Engineer	Takahiro Suzuki
	(1 GHz – 13 GHz)
Mode	Tx BT LE 2402 MHz



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

Radiated Spurious Emission

Report No.	12432580S-A-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	2	2	2	2
Date	August 18, 2018	August 13, 2018	August 16, 2018	August 19, 2018
Temperature / Humidity	25 deg.C / 50 %RH	24 deg.C / 57 %RH	25 deg.C / 55 %RH	25 deg.C / 50 %RH
Engineer	Kazutaka Takeyama (30 MHz – 1000 MHz)	Takahiro Suzuki (1 GHz – 13 GHz)	Kazutaka Takeyama (13 GHz – 18 GHz)	Kazutaka Takeyama (18 GHz – 26.5 GHz)
Mode	Tx BT LE 2440 MHz			

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	51.533	QP	32.20	10.64	7.16	31.91	0.00	18.09	40.00	21.9	303	204	
Hori.	800.203	QP	22.60	20.83	8.67	31.41	0.00	20.69	46.00	25.3	100	9	
Hori.	4880.000	PK	43.20	31.15	6.64	36.90	2.44	46.53	73.90	27.3	150	0	Floor Noise
Hori.	7320.000	PK	44.50	36.84	7.72	37.44	2.44	54.06	73.90	19.8	150	0	Floor Noise
Hori.	9760.000	PK	44.70	38.58	8.85	38.65	2.44	55.92	73.90	17.9	150	0	Floor Noise
Hori.	12200.000	PK	45.00	39.02	10.30	38.37	2.44	58.39	73.90	15.5	150	0	Floor Noise
Hori.	4880.000	AV	33.20	31.15	6.64	36.90	2.44	36.53	53.90	17.3	150	0	Floor Noise
Hori.	7320.000	AV	33.30	36.84	7.72	37.44	2.44	42.86	53.90	11.0	150	0	Floor Noise
Hori.	9760.000	AV	33.70	38.58	8.85	38.65	2.44	44.92	53.90	8.9	150	0	Floor Noise
Hori.	12200.000	AV	34.30	39.02	10.30	38.37	2.44	47.69	53.90	6.2	150	0	Floor Noise
Vert.	51.536	QP	49.80	10.64	7.16	31.91	0.00	35.69	40.00	4.3	100	304	
Vert.	57.633	QP	45.80	8.73	7.04	31.91	0.00	29.66	40.00	10.3	100	175	
Vert.	76.597	QP	46.50	6.30	7.80	31.89	0.00	28.71	40.00	11.2	100	191	
Vert.	96.409	QP	43.00	9.54	8.00	31.88	0.00	28.66	43.50	14.8	100	285	
Vert.	236.454	QP	27.10	11.47	5.70	31.74	0.00	12.53	46.00	33.4	100	252	
Vert.	4880.000	PK	43.00	31.15	6.64	36.90	2.44	46.33	73.90	27.5	150	0	Floor Noise
Vert.	7320.000	PK	44.30	36.84	7.72	37.44	2.44	53.86	73.90	20.0	150	0	Floor Noise
Vert.	9760.000	PK	44.80	38.58	8.85	38.65	2.44	56.02	73.90	17.8	150	0	Floor Noise
Vert.	12200.000	PK	45.20	39.02	10.30	38.37	2.44	58.59	73.90	15.3	150	0	Floor Noise
Vert.	4880.000	AV	32.80	31.15	6.64	36.90	2.44	36.13	53.90	17.7	150	0	Floor Noise
Vert.	7320.000	AV	33.50	36.84	7.72	37.44	2.44	43.06	53.90	10.8	150	0	Floor Noise
Vert.	9760.000	AV	34.30	38.58	8.85	38.65	2.44	45.52	53.90	8.3	150	0	Floor Noise
Vert.	12200.000	AV	34.50	39.02	10.30	38.37	2.44	47.89	53.90	6.0	150	0	Floor Noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.97\text{ m} / 3.0\text{ m}) = 2.44\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Radiated Spurious Emission

Report No.	12432580S-A-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	2	2	2	2
Date	August 18, 2018	August 13, 2018	August 16, 2018	August 19, 2018
Temperature / Humidity	25 deg.C / 50 %RH	24 deg.C / 57 %RH	25 deg.C / 55 %RH	25 deg.C / 50 %RH
Engineer	Kazutaka Takeyama (30 MHz – 1000 MHz)	Takahiro Suzuki (1 GHz – 13 GHz)	Kazutaka Takeyama (13 GHz – 18 GHz)	Kazutaka Takeyama (18 GHz – 26.5 GHz)
Mode	Tx BT LE 2480 MHz			

(* PK: Peak, AV: Average, QP: Quasi-Peak)

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Height [cm]	Angle [deg]	Remark
Hori.	51.528	QP	32.40	10.64	7.16	31.91	0.00	18.29	40.00	21.7	300	202	
Hori.	800.006	QP	22.50	20.83	8.67	31.41	0.00	20.59	46.00	25.4	100	121	
Hori.	2483.500	PK	46.39	27.67	14.04	36.52	2.44	54.02	73.90	19.9	216	177	
Hori.	4960.000	PK	44.30	31.33	6.69	36.93	2.44	47.83	73.90	26.0	150	0	Floor Noise
Hori.	7440.000	PK	44.00	36.97	7.78	37.63	2.44	53.56	73.90	20.3	150	0	Floor Noise
Hori.	9920.000	PK	43.33	38.80	9.00	38.84	2.44	54.73	73.90	19.1	150	0	Floor Noise
Hori.	12400.000	PK	45.30	38.29	10.44	38.72	2.44	57.75	73.90	16.1	150	0	Floor Noise
Hori.	4960.000	AV	33.30	31.33	6.69	36.93	2.44	36.83	53.90	17.0	150	0	Floor Noise
Hori.	7440.000	AV	33.50	36.97	7.78	37.63	2.44	43.06	53.90	10.8	150	0	Floor Noise
Hori.	9920.000	AV	34.00	38.80	9.00	38.84	2.44	45.40	53.90	8.5	150	0	Floor Noise
Hori.	12400.000	AV	34.40	38.29	10.44	38.72	2.44	46.85	53.90	7.0	150	0	Floor Noise
Vert.	51.530	QP	49.80	10.64	7.16	31.91	0.00	35.69	40.00	4.3	100	54	
Vert.	56.917	QP	45.70	8.94	7.07	31.91	0.00	29.80	40.00	10.2	100	226	
Vert.	76.608	QP	46.40	6.30	7.80	31.89	0.00	28.61	40.00	11.3	100	148	
Vert.	96.457	QP	43.00	9.54	8.00	31.88	0.00	28.66	43.50	14.8	100	280	
Vert.	236.455	QP	27.00	11.47	5.70	31.74	0.00	12.43	46.00	33.5	100	273	
Vert.	2483.500	PK	47.51	27.67	14.04	36.52	2.44	55.14	73.90	18.8	137	148	
Vert.	4960.000	PK	44.70	31.33	6.69	36.93	2.44	48.23	73.90	25.6	150	0	Floor Noise
Vert.	7440.000	PK	44.20	36.97	7.78	37.63	2.44	53.76	73.90	20.1	150	0	Floor Noise
Vert.	9920.000	PK	43.40	38.80	9.00	38.84	2.44	54.80	73.90	19.1	150	0	Floor Noise
Vert.	12400.000	PK	45.70	38.29	10.44	38.72	2.44	58.15	73.90	15.7	150	0	Floor Noise
Vert.	4960.000	AV	33.40	31.33	6.69	36.93	2.44	36.93	53.90	16.9	150	0	Floor Noise
Vert.	7440.000	AV	33.50	36.97	7.78	37.63	2.44	43.06	53.90	10.8	150	0	Floor Noise
Vert.	9920.000	AV	34.20	38.80	9.00	38.84	2.44	45.60	53.90	8.3	150	0	Floor Noise
Vert.	12400.000	AV	34.60	38.29	10.44	38.72	2.44	47.05	53.90	6.8	150	0	Floor Noise

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.97\text{ m} / 3.0\text{ m}) = 2.44\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Average measurement value with duty factor

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori.	2483.500	AV	33.06	27.67	14.04	36.52	4.37	2.44	45.06	53.90	8.8	*1)
Vert.	2483.500	AV	32.78	27.67	14.04	36.52	4.37	2.44	44.78	53.90	9.1	*1)

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amplifier) + Duty factor + Distance factor

Distance factor : 1 GHz - 13 GHz : $20\log(3.97\text{ m} / 3.0\text{ m}) = 2.44\text{ dB}$

13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

Duty factor refer to "Duty factor Calculation chart" sheet.

*1) Not out of band emission (Leakage Power)

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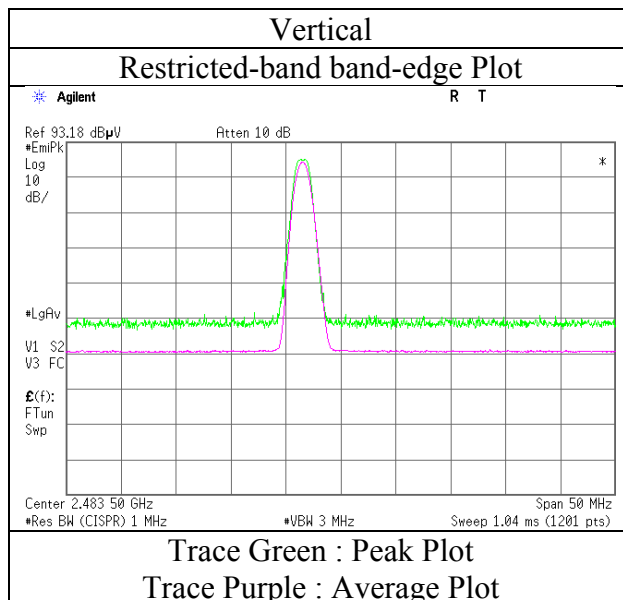
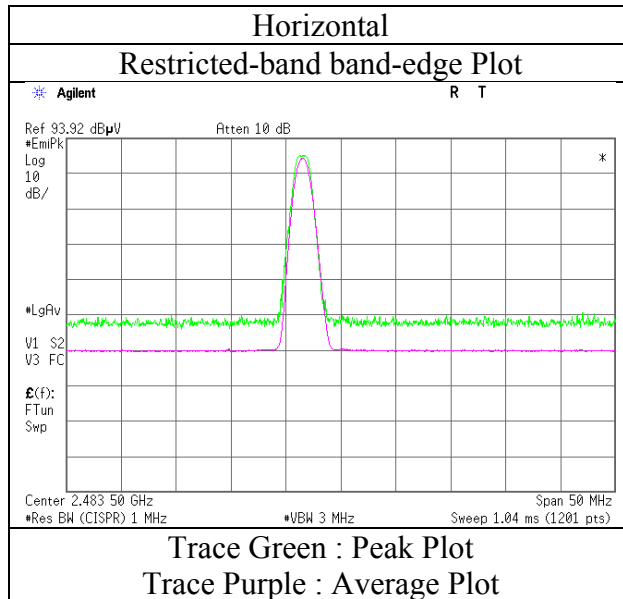
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

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Radiated Spurious Emission (Reference Plot for band-edge)

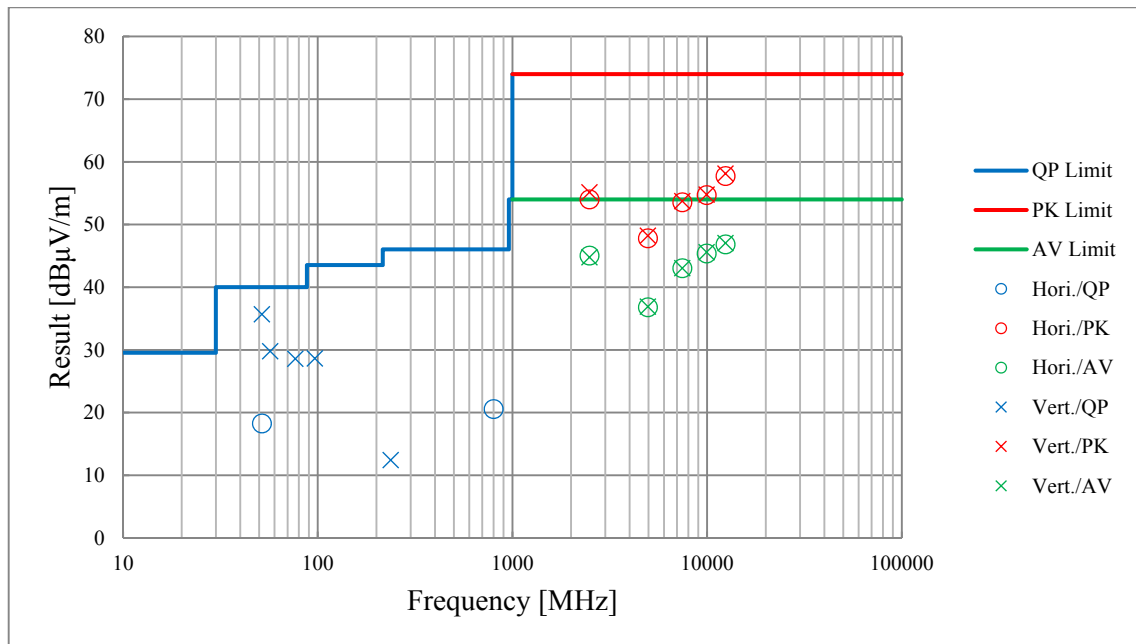
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Test place	Shonan EMC Lab.
Semi Anechoic Chamber	2
Date	August 13, 2018
Temperature / Humidity	24 deg.C / 57 %RH
Engineer	Takahiro Suzuki
	(1 GHz – 13 GHz)
Mode	Tx BT LE 2480 MHz



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

Radiated Spurious Emission (Plot data, Worst case)

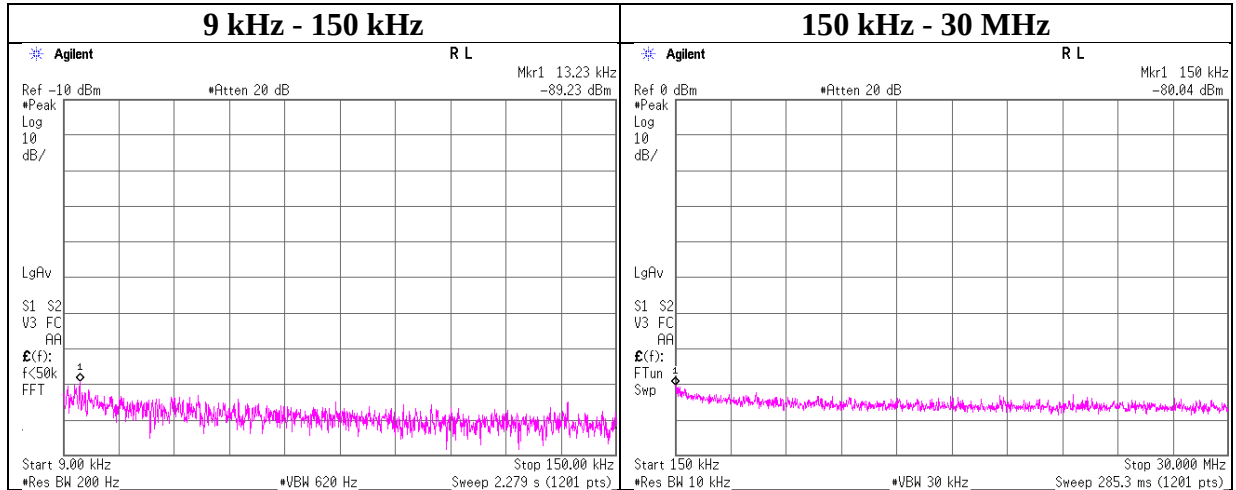
Report No.	12432580S-A-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	2	2	2	2
Date	August 18, 2018	August 13, 2018	August 16, 2018	August 19, 2018
Temperature / Humidity	25 deg.C / 50 %RH	24 deg.C / 57 %RH	25 deg.C / 55 %RH	25 deg.C / 50 %RH
Engineer	Kazutaka Takeyama (30 MHz – 1000 MHz)	Takahiro Suzuki (1 GHz – 13 GHz)	Kazutaka Takeyama (13 GHz – 18 GHz)	Kazutaka Takeyama (18 GHz – 26.5 GHz)
Mode	Tx BT LE 2480 MHz			



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

Conducted Spurious Emission

Report No. 12432580S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date July 2, 2018
Temperature / Humidity 23 deg. C / 45 % RH
Engineer Shiro Kobayashi
Mode Tx 11g 2437 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
13.23	-89.2	0.01	9.8	2.0	1	-77.4	300	6.0	-16.1	45.1	61.2	
150.00	-80.0	0.01	9.8	2.0	1	-68.2	300	6.0	-6.9	24.0	30.9	

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

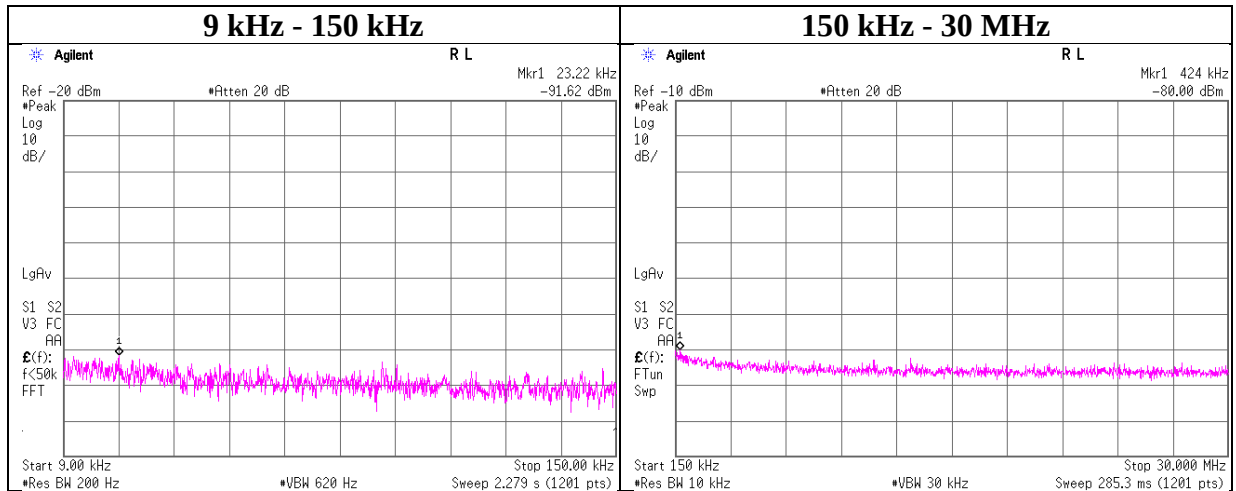
$EIRP[dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

Conducted Spurious Emission

Report No. 12432580S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date July 2, 2018
Temperature / Humidity 23 deg. C / 45 % RH
Engineer Shiro Kobayashi
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
23.22	-91.6	0.01	9.8	2.0	1	-79.8	300	6.0	-18.5	40.2	58.7	
424.00	-80.0	0.02	9.8	2.0	1	-68.1	300	6.0	-6.9	15.0	21.9	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

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Shonan EMC Lab.

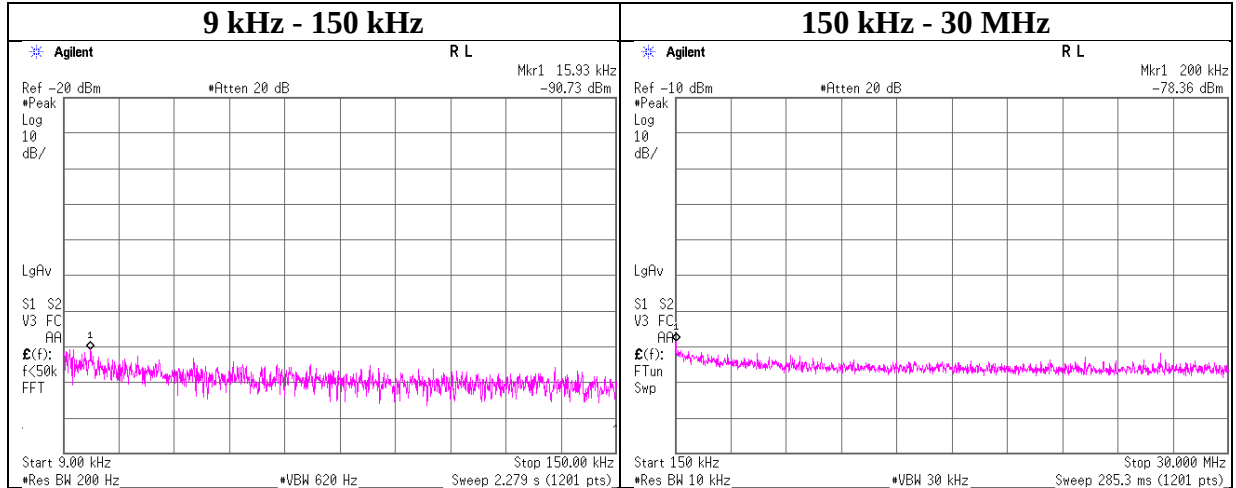
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Conducted Spurious Emission

Report No. 12432580S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date July 2, 2018
Temperature / Humidity 23 deg. C / 45 % RH
Engineer Shiro Kobayashi
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
15.93	-90.7	0.01	9.8	2.0	1	-78.9	300	6.0	-17.6	43.5	61.1	
200.00	-78.4	0.01	9.8	2.0	1	-66.5	300	6.0	-5.3	21.5	26.8	

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

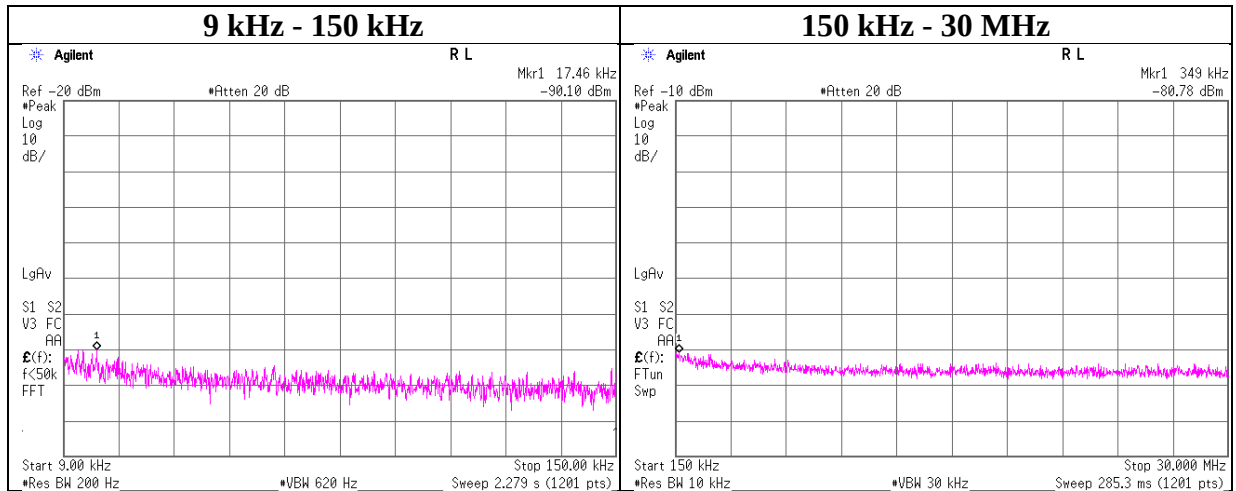
$EIRP[dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

Conducted Spurious Emission

Report No. 12432580S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date July 2, 2018
Temperature / Humidity 23 deg. C / 45 % RH
Engineer Shiro Kobayashi
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
17.46	-90.1	0.01	9.8	2.0	1	-78.3	300	6.0	-17.0	42.7	59.7	
349.00	-80.8	0.02	9.8	2.0	1	-68.9	300	6.0	-7.7	16.7	24.4	

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

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

N: Number of output

*2.0 dBi was applied to the test result based on KDB 558074 since antenna gain was less than 2.0 dBi.

Power Density

Report No. 12432580S-A-R2
Test place Shonan EMC Lab. No.5 Shielded Room
Date July 2, 2018
Temperature / Humidity 23 deg. C / 45 % RH
Engineer Shiro Kobayashi
Mode Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-16.17	1.69	9.86	-4.62	8.00	12.62
2437.00	-16.90	1.69	9.86	-5.35	8.00	13.35
2462.00	-15.61	1.70	9.85	-4.06	8.00	12.06

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-22.47	1.69	9.86	-10.92	8.00	18.92
2437.00	-22.96	1.69	9.86	-11.41	8.00	19.41
2462.00	-21.76	1.70	9.85	-10.21	8.00	18.21

11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-24.32	1.69	9.86	-12.77	8.00	20.77
2437.00	-24.55	1.69	9.86	-13.00	8.00	21.00
2462.00	-23.49	1.70	9.85	-11.94	8.00	19.94

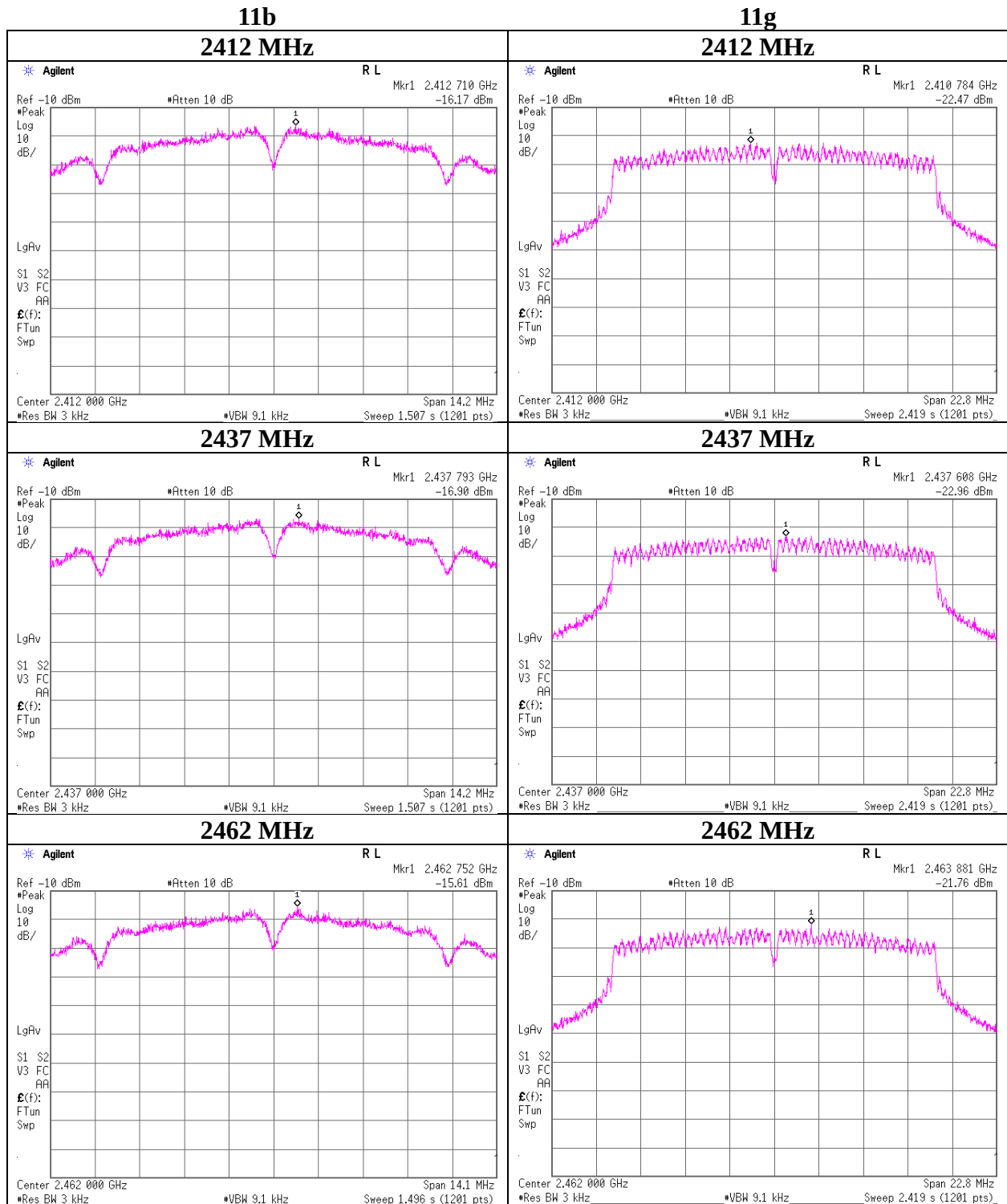
BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-18.86	1.68	9.86	-7.32	8.00	15.32
2440.00	-19.17	1.69	9.86	-7.62	8.00	15.62
2480.00	-19.08	1.70	9.85	-7.53	8.00	15.53

Sample Calculation:

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

Power Density



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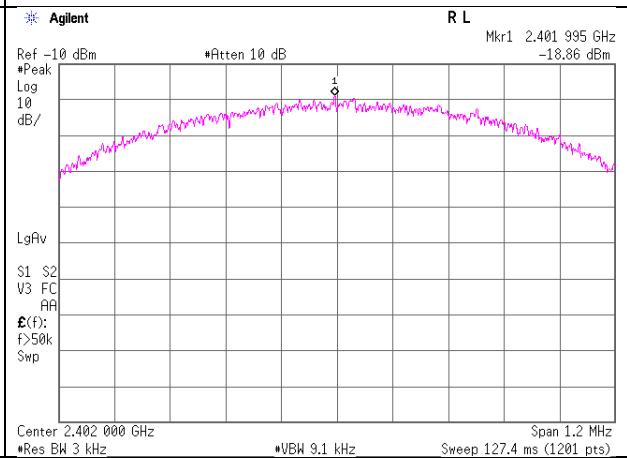
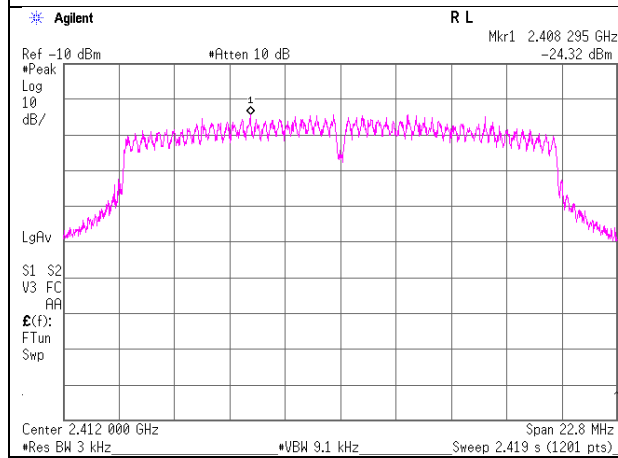
Power Density

11n-20

BT LE

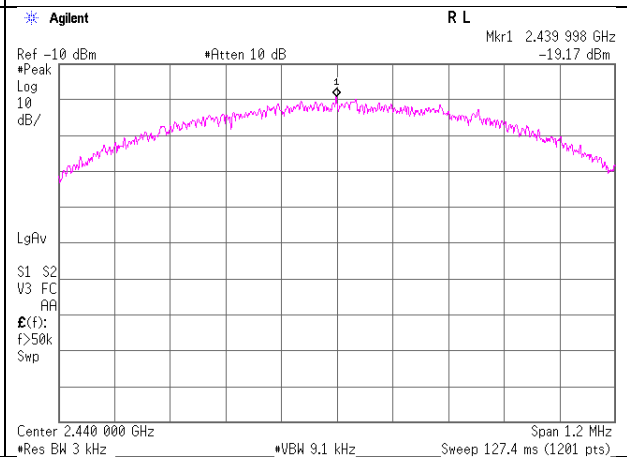
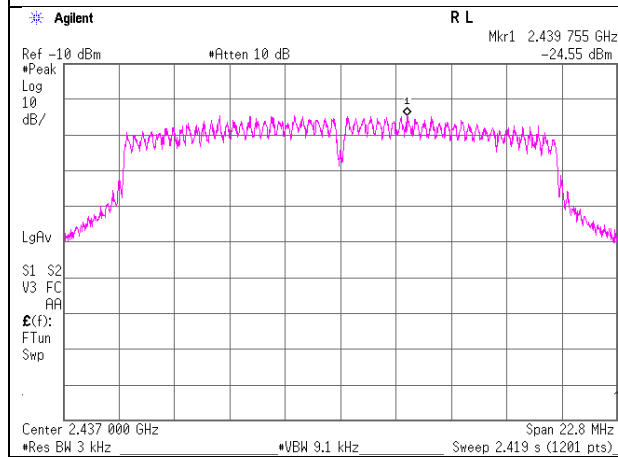
2412 MHz

2402 MHz



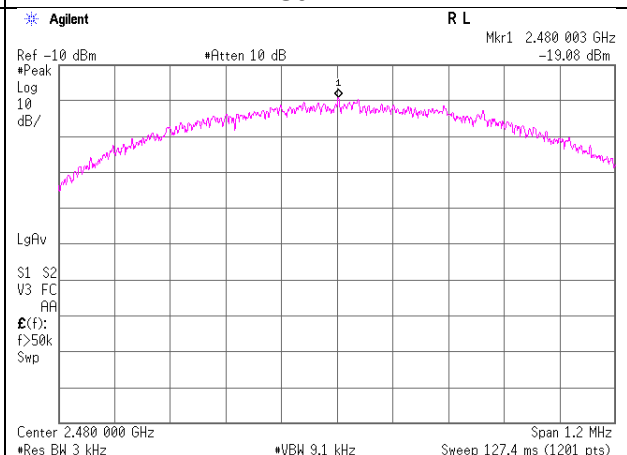
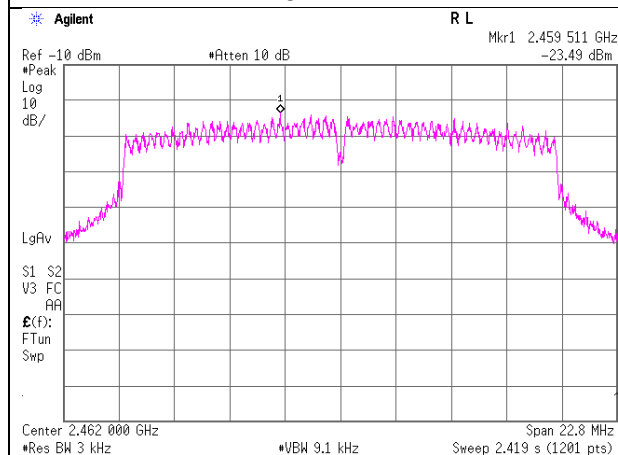
2437 MHz

2440 MHz



2462 MHz

2480 MHz



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APPENDIX 2: Test instruments

Test Instruments

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SSA-02	Spectrum Analyzer	Agilent	E4448A	MY48250106	AT	2018/03/05 * 12
SPM-13	Power Meter	KEYSIGHT	8990B	MY51000448	AT	2018/05/18 * 12
SPSS-06	Power sensor	KEYSIGHT	N1923A	MY57270004	AT	2018/05/18 * 12
SCC-G13	Coaxial Cable	Suhner	SUCOFLEX 102	31599/2	AT	2018/03/19 * 12
SAT10-12	Attenuator	Weinschel Corp.	54A-10	81601	AT	2018/03/22 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2017/12/21 * 12
KTS-07	Digital Tester	SANWA	PC500	7019232	AT	2017/10/11 * 12
SSA-03	Spectrum Analyzer	Agilent	E4448A	MY48250152	AT	2017/08/20 * 12
SAF-05	Pre Amplifier	TOYO Corporation	TPA0118-36	1440490	RE	2018/02/15 * 12
SCC-G41	Coaxial Cable	Junkosha	MWX221-01000NFS NMS/B	1612S006	RE	2018/01/29 * 12
SCC-G43	Coaxial Cable	HUBER+SUHNER	SUCOFLEX_104_E	SN MY 13406/4E	RE	2018/07/10 * 12
SHA-02	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-726	RE	2018/07/23 * 12
SOS-03	Humidity Indicator	A&D	AD-5681	4063325	RE	2017/10/30 * 12
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	RE	2017/10/10 * 12
SJM-09	Measure	PROMART	SEN1935	-	RE,CE	-
SAEC-02(SVSWR)	Semi-Anechoic Chamber	TDK	SAEC-02(SVSWR)	2	RE	2018/07/15 * 12
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE,CE,R FI,MF)	-	RE,CE	-
STS-02	Digital Hitester	Hioki	3805-50	080997819	RE,CE	2018/03/08 * 12
SCC-G44	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 104	800070/4A	RE	2018/03/28 * 12
SFL-18	Highpass Filter	MICRO-TRONICS	HPM50111	119	RE	2018/04/20 * 12
SAT10-06	Attenuator	Agilent	8493C-010	74865	RE	2017/11/22 * 12
SAT10-05	Attenuator(above 1 GHz)	Agilent	8493C-010	74864	AT	2017/11/22 * 12
SRENT-15	Spectrum Analyzer	Agilent	E4440A	MY46185516	AT	2017/12/26 * 12
SCC-G45	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102 E	800137/2EA	RE	2018/03/28 * 12
SHA-04	Horn Antenna	ETS LINDGREN	3160-09	LM9861	RE	2018/07/23 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2018/03/27 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000KM SKMS	-	AT	2018/04/20 * 12
SAF-02	Pre Amplifier	SONOMA	310N	290212	RE	2018/02/16 * 12
SAT6-02	Attenuator	JFW	50HF-006N	-	RE	2018/02/16 * 12
SAT3-11	Attenuator	JFW	50HF-003N	-	RE	2018/02/22 * 12
SBA-02	Biconical Antenna	Schwarzbeck	BBA9106	91032665	RE	2018/06/05 * 12
SCC-B1/B3/B5/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2018/04/07 * 12
SCC-B2/B4/B6/B7/B8/B13/SRSE-02	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhner/Suhner/Suhner/TOYO	8D2W/12DSFA/141PE/141PE/141PE/NS4906	-/0901-270(RF Selector)	RE	2018/04/07 * 12
SLA-06	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	195	RE	2018/06/05 * 12
STR-07	Test Receiver	Rohde & Schwarz	ESU26	100484	RE	2017/09/26 * 12
SAEC-02(NSA)	Semi-Anechoic Chamber	TDK	SAEC-02(NSA)	2	RE	2018/05/31 * 12

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

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

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

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