RADIO TEST REPORT

Test Report No. : 12299284S-R2

Applicant	:	**CAR MATE MFG. CO., LTD.**
Type of Equipment	:	**DRIVE ACTION RECORDER**
Model No.	:	**DC3000**
FCC ID	:	**2AP43-CMDC3000**
Test regulation	:	**FCC Part 15 Subpart C: 2018**
Test Result	:	**Complied**

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this test report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by any agency of the Federal Government.
6. This test report covers EMC technical requirements.
   It does not cover administrative issues such as Manual or non-EMC 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 12299284S-R1. 12299284S-R1 is replaced with this report.

Date of test: June 29 to July 8, 2018

Representative test engineer:
Kazuya Noda
Engineer
Consumer Technology Division

Approved by:
Hikaru Shirasawa
Engineer
Consumer Technology Division

RTL02610

☐ 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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REVISION HISTORY

Original Test Report No.: 12299284S

Revision	Test report No.	Date	Page revised	Contents
- (Original)	12299284S	August 10, 2018	-	-
1	12299284S-R1	August 31, 2018	23, 25, 26, 28, 30, 31, 33, 35, 36	Correction of data selected mistake described
			46	Replace of the photo of 3 axes
2	12299284S-R2	September 5, 2018	23, 25, 26, 28, 30, 31, 33, 35, 36	The data of radiated emissions was returned to the original data, and it was added the complement comment.

CONTENTS **PAGE**

SECTION 1: Customer information

Company Name	:	CAR MATE MFG. CO., LTD.
Address	:	5-33-11 Nagasaki, Toshima-ku, Tokyo 171-0051, Japan
Telephone Number	:	+81-3-5926-1004
Facsimile Number	:	+81-3-5926-1250
Contact Person	:	Tomoaki Sasaki

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

2.1 Identification of E.U.T.

Type of Equipment	:	DRIVE ACTION RECORDER
Model No.	:	DC3000
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 5 V (USB) DC 3.7 V (Battery)
Receipt Date of Sample	:	June 26, 2018
Country of Mass-production	:	Indonesia
Condition of EUT	:	Production model
Modification of EUT	:	No Modification by the test lab.

2.2 Product Description

Model: DC3000 (referred to as the EUT in this report) is a DRIVE ACTION RECORDER.

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2412 MHz - 2462 MHz
Modulation	:	DSSS, OFDM
Antenna type	:	Pattern antenna
Antenna Gain	:	-4.42 dBi
Clock frequency (Maximum)	:	26 MHz

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

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

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	**FCC:** ANSI C63.10-2013 6. Standard test methods **IC:** RSS-Gen 8.8	**FCC:** Section 15.207 **IC:** RSS-Gen 8.8	-	N/A	*1)
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	2.5 dB 320.762 MHz, QP, Horizontal, Tx, 11g 2437 MHz	Complied#	Conducted (below 30 MHz)/ Radiated (above 30 MHz) *2)

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
*1) The test is not applicable since the EUT has no AC mains.
*2) 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.
Instead of a new battery, DC power supply was used for the test. That does not affect the test result, therefore the EUT complies with the requirement.

FCC Part 15.203 Antenna requirement
The antenna is not removable from 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

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
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	-	-
	18 GHz-40 GHz	5.6 dB	5.6 dB	5.6 dB	-	-
Radiated emission (Measurement distance: 1 m)	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

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
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 b/g/n testing - Managing Complex Regulatory Approvals - " of TCB Council Workshop October 2009.

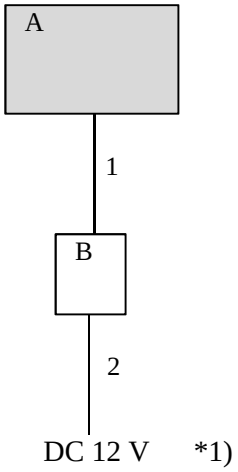
Mode	Remarks*
Transmitting (Tx), IEEE 802.11b (11b)	2 Mbps, PN9
Transmitting (Tx), IEEE 802.11g (11g)	12 Mbps, PN9
Transmitting (Tx), IEEE 802.11n 20 MHz BW (11n-20)	MCS 3 , PN9
*The worst condition was determined based on the test result of Maximum Peak Output Power (Mid Channel)	
*Power of the EUT was set by the software as follows; Power settings (gain setting): 11b.=29, 11g.=29, 11n-20.=25 Software: 223620M Ver. 1.0.0 *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)

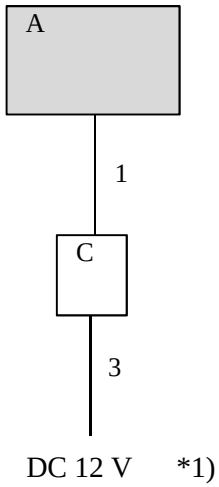
Test Item	Operating Mode	Tested frequency	Connection method *2)
Spurious Emission (30 MHz -1 GHz)	Tx, 11g *1)	2437 MHz *1)	Connected 1
Spurious Emission	Tx, 11b Tx, 11g Tx, 11n-20	2412 MHz 2437 MHz 2462 MHz	Connected 1
6 dB Bandwidth Maximum Peak Output Power Power Density 99 % Occupied Bandwidth	Tx, 11b Tx, 11g Tx, 11n-20	2412 MHz 2437 MHz 2462 MHz	Connected 1
*1) The mode was tested as a representative, because it had the highest power at antenna terminal test. *2) The carrier level and noise levels were confirmed in 3 connection methods shown in 4.2, and the test was made with the condition that has the maximum noise.			

4.2 Configuration and peripherals

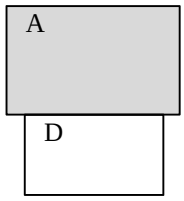
Connected 1.
with USB socket adapter



Connected 2.
with Security Add-On adapter



Connected 3. with battery



*1) DC power supply (Model No.PAN60-10A) was used for DC 12 V / GND input.

* 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	DRIVE ACTION RECORDER	DC3000	71M060990 *2) 71E000003 *3)	CAR MATE	EUT
B	USB Power socket	-	-	CAR MATE	-
C	Security Add-ON	DC200	81A15	CAR MATE	-
D	Battery	DC1	0001550	CAR MATE	-

*2) Used for Antenna Terminal conducted test
*3) Used for Radiated Emission test

List of cables used

No.	Cable name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB	4.0	Shielded	Shielded	-
2	DC	4.0	Unshielded	Unshielded	-
3	DC (BATT/ACC/GND)	2.0	Unshielded	Unshielded	-

SECTION 5: 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 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 expanded polystyrol and expanded polypropylene and the table top is covered with polycarbonate. That has very low permittivity.
The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 0.5 m, raised 1.5 m above the conducting ground plane.
The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with absorbent materials lined on a ground plane.

The height of the measuring antenna varied between 1 m and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field strength.
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: 12.2.5.2 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
Test Distance	3 m	3.96 m *2) (1 GHz – 13 GHz), 1 m *3) (13 GHz – 26.5 GHz)		3.96 m *2) (1 GHz – 13 GHz), 1 m *3) (13 GHz – 26.5 GHz)

*1) Average Power Measurement was performed based on 6. 0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v04".
*2) Distance Factor: 20 x log (3.96 m / 3.0 m) = 2.42 dB
*3) Distance Factor: 20 x log (1.0 m / 3.0 m) = -9.54 dB

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.

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

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

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

SECTION 6: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6 dB Bandwidth	50 MHz	100 kHz	300 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *2)	-	Power Meter (Sensor: 50 MHz BW)
Peak Power Density	1.5 times the 6 dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9kHz to 150kHz	200 Hz	620 Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	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 30MHz, RBW was narrowed to separate the noise contents.
Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.
(9 kHz - 150 kHz: RBW = 200 Hz, 150 kHz - 30 MHz: RBW = 10 kHz)

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

Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

6 dB Bandwidth and 99 % Occupied Bandwidth

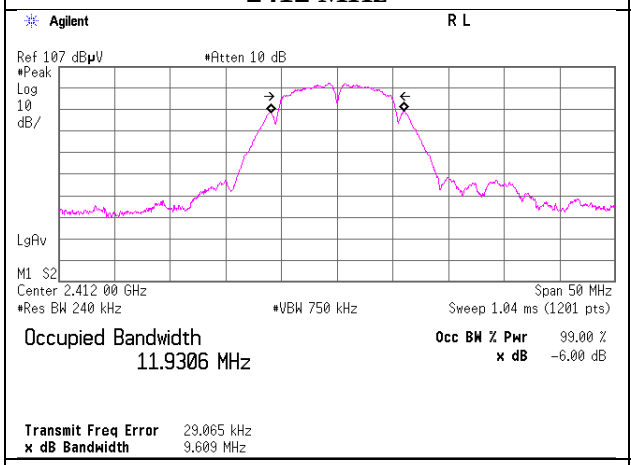
Report No.	12299284S-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	July 3, 2018
Temperature / Humidity	25 deg. C / 45 % RH
Engineer	Kazutaka Takeyama
Mode	Tx

Mode	Frequency [MHz]	99 % Occupied Bandwidth [kHz]	6 dB Bandwidth [MHz]	Limit for 6 dB Bandwidth [MHz]
11b	2412	11930.6	9.495	> 0.5000
	2437	11897.3	9.318	> 0.5000
	2462	11924.8	8.823	> 0.5000
11g	2412	16898.0	16.498	> 0.5000
	2437	16927.0	16.416	> 0.5000
	2462	16874.8	16.449	> 0.5000
11n-20	2412	17884.6	17.744	> 0.5000
	2437	17884.2	17.747	> 0.5000
	2462	17933.1	17.745	> 0.5000

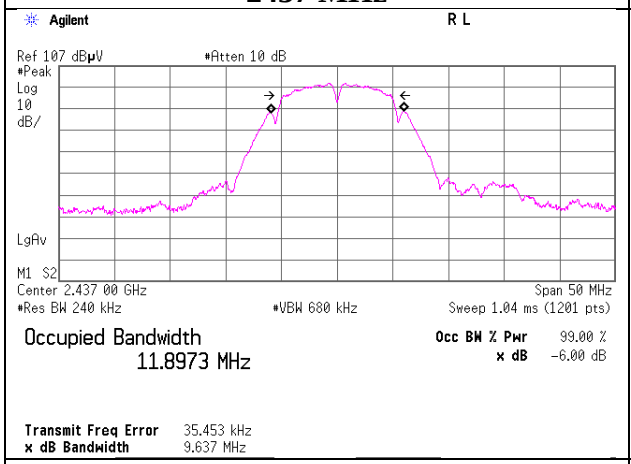
99 % Occupied Bandwidth

11b

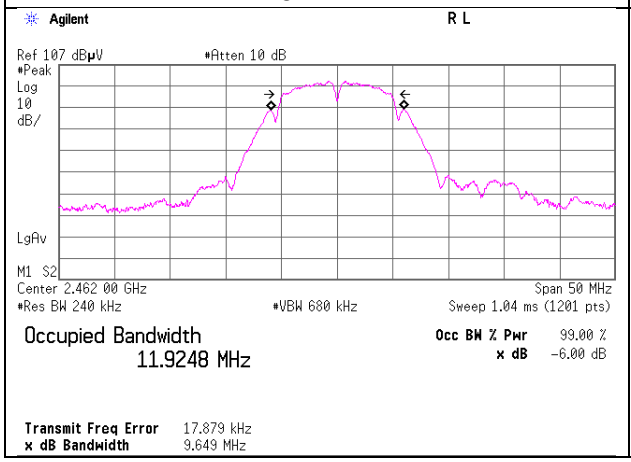
2412 MHz



2437 MHz

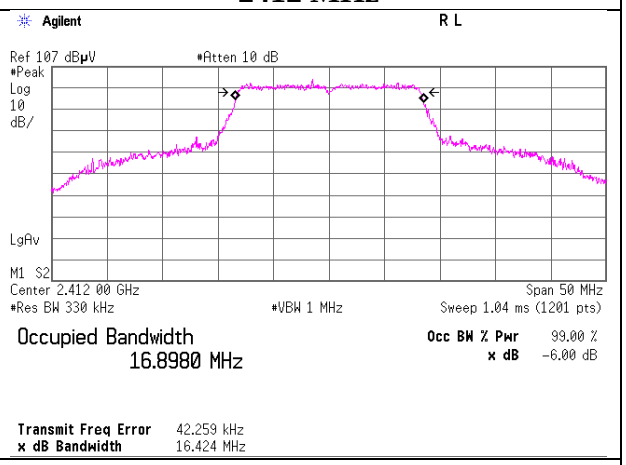


2462 MHz



11g

2412 MHz



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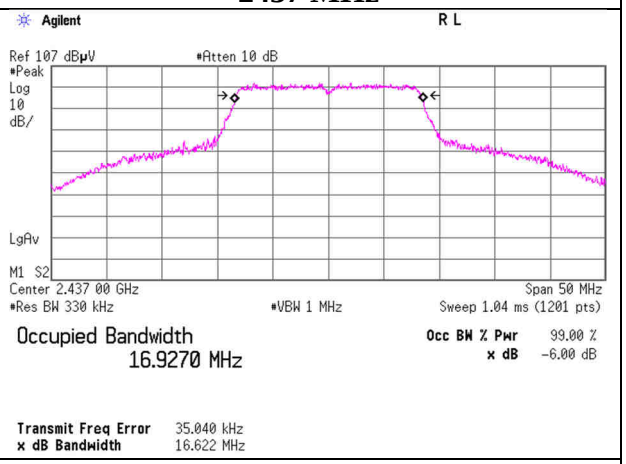
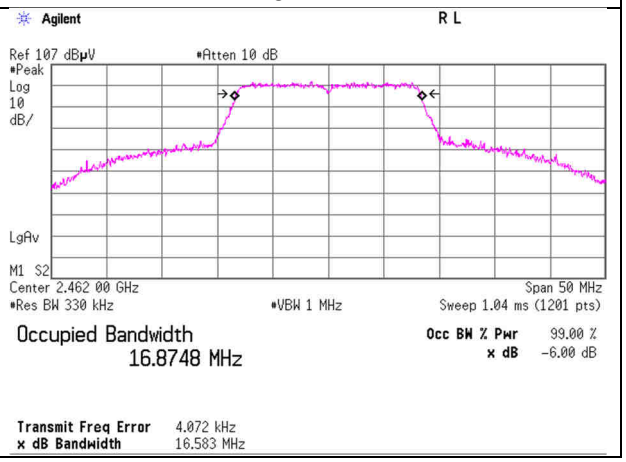


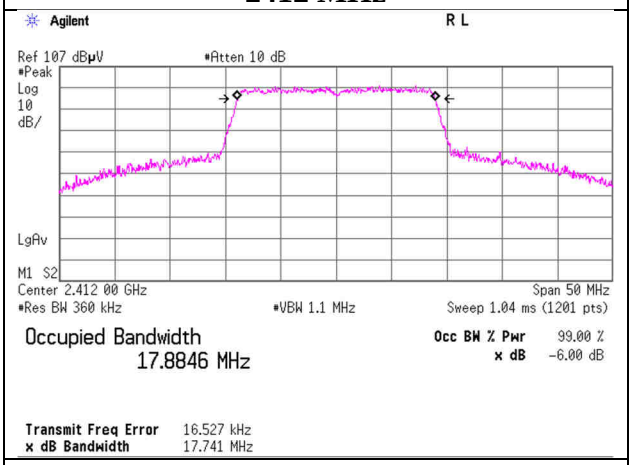
2462 MHz



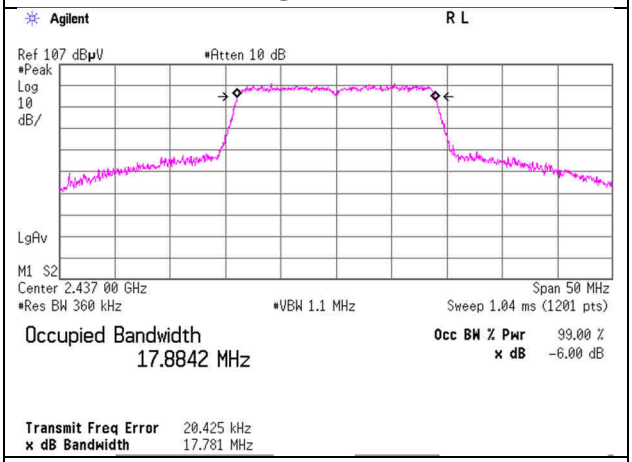
99 % Occupied Bandwidth

11n-20

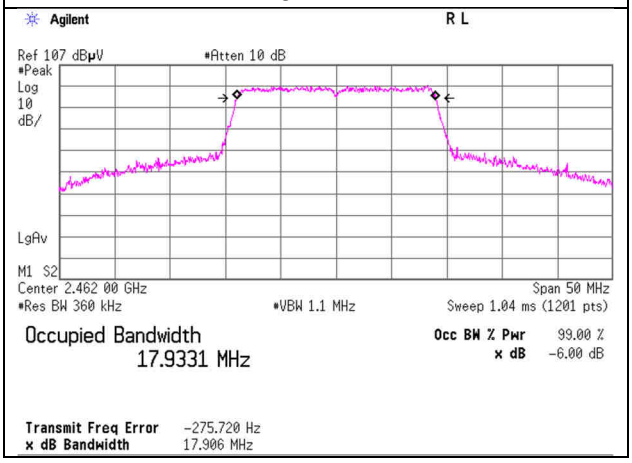
2412 MHz



2437 MHz



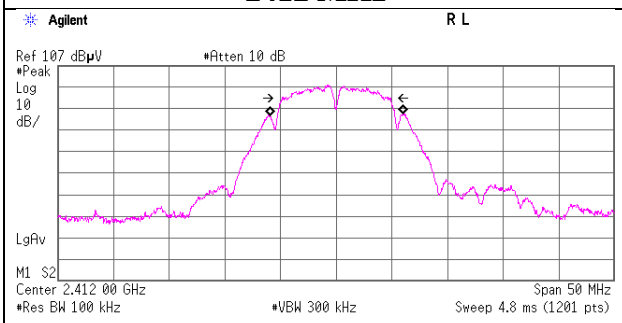
2462 MHz



6 dB Bandwidth

11b

2412 MHz

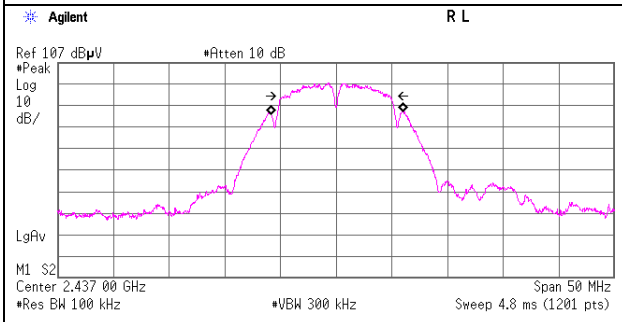


Occupied Bandwidth
11.9417 MHz

Occ BW % Pwr 99.00 %
x dB -6.00 dB

Transmit Freq Error 36.246 kHz
x dB Bandwidth 9.495 MHz

2437 MHz

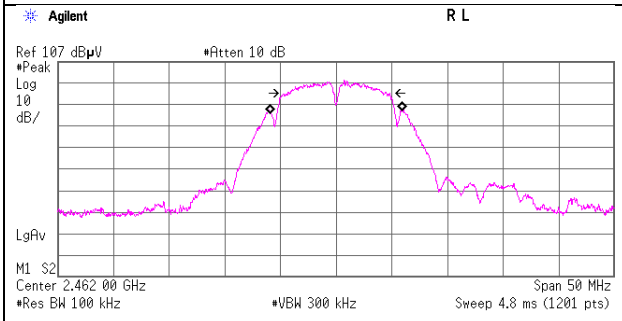


Occupied Bandwidth
11.8493 MHz

Occ BW % Pwr 99.00 %
x dB -6.00 dB

Transmit Freq Error 60.581 kHz
x dB Bandwidth 9.318 MHz

2462 MHz



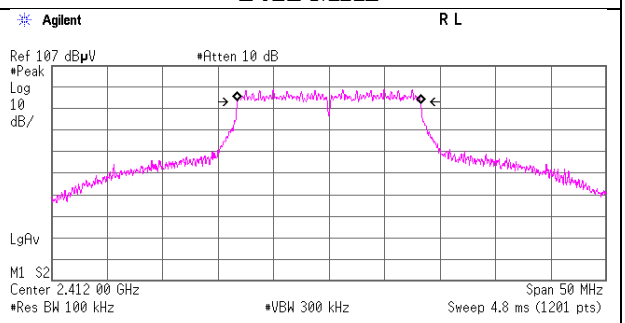
Occupied Bandwidth
11.8839 MHz

Occ BW % Pwr 99.00 %
x dB -6.00 dB

Transmit Freq Error 21.738 kHz
x dB Bandwidth 8.823 MHz

11g

2412 MHz

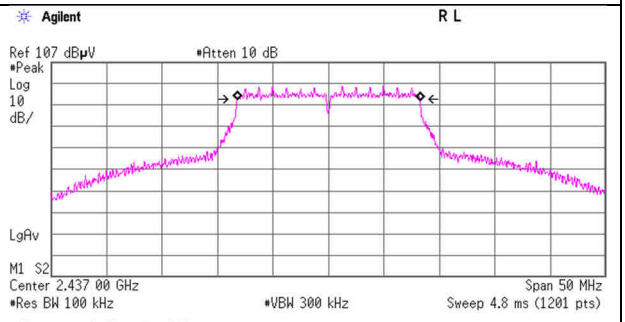


Occupied Bandwidth
16.4837 MHz

Occ BW % Pwr 99.00 %
x dB -6.00 dB

Transmit Freq Error 5.938 kHz
x dB Bandwidth 16.498 MHz

2437 MHz

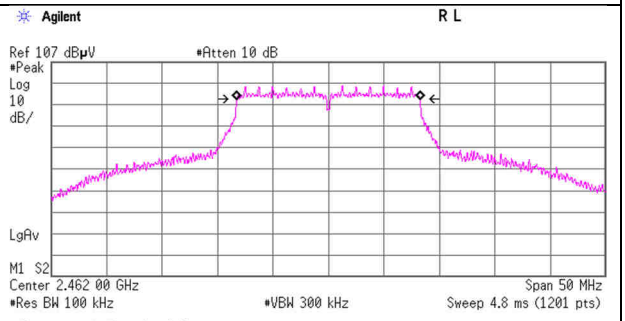


Occupied Bandwidth
16.4743 MHz

Occ BW % Pwr 99.00 %
x dB -6.00 dB

Transmit Freq Error 11.563 kHz
x dB Bandwidth 16.416 MHz

2462 MHz



Occupied Bandwidth
16.4766 MHz

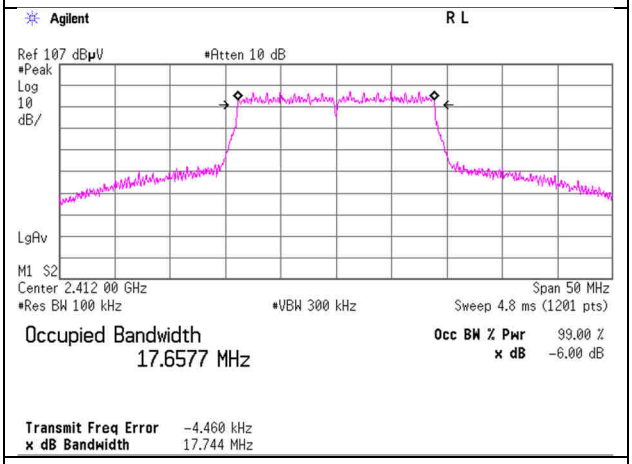
Occ BW % Pwr 99.00 %
x dB -6.00 dB

Transmit Freq Error 4.283 kHz
x dB Bandwidth 16.449 MHz

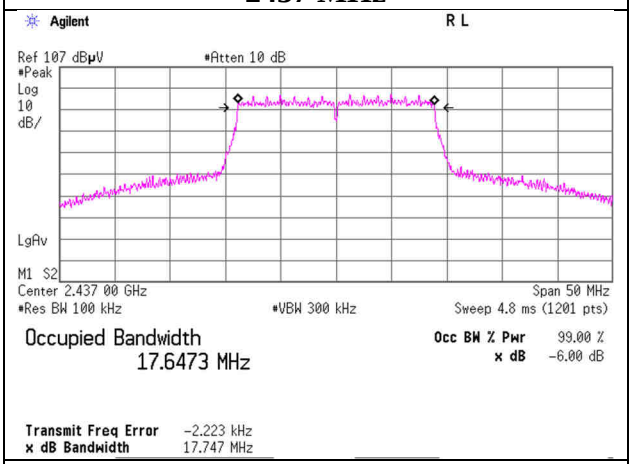
6 dB Bandwidth

11n-20

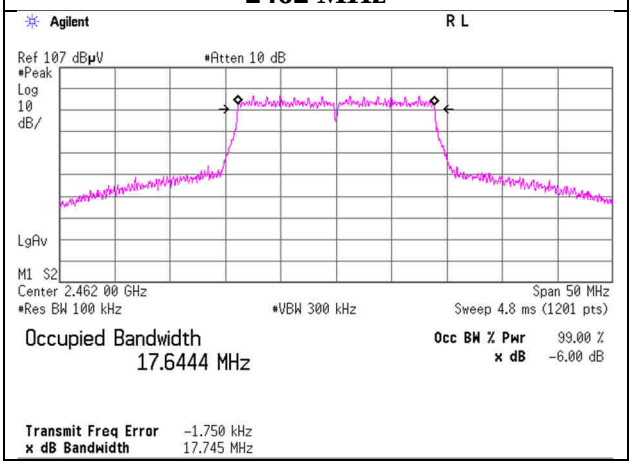
2412 MHz



2437 MHz



2462 MHz



Maximum Peak Output Power

Report No.	12299284S-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	June 29, 2018
Temperature / Humidity	24 deg. C / 54 % RH
Engineer	Kazuya Noda
Mode	Tx 11b

				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	3.19	2.32	9.88	15.39	34.59	30.00	1000	14.61	-4.42	10.97	12.50	36.02	4000	25.05
2437	3.08	2.36	9.88	15.32	34.04	30.00	1000	14.68	-4.42	10.90	12.30	36.02	4000	25.12
2462	3.01	2.37	9.88	15.26	33.57	30.00	1000	14.74	-4.42	10.84	12.13	36.02	4000	25.18

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
e.i.r.p. Result = Conducted Power Result + Antenna Gain
*The equipment and cables were not used for factor 0 dB of the data sheets.

2437MHz

Rate [Mbps]	Reading [dBm]	Remark
1	2.93	
2	3.08	*
5.5	2.84	
11	2.80	

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

Maximum Peak Output Power

Report No.	12299284S-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	June 29, 2018
Temperature / Humidity	23 deg. C / 68 % RH
Engineer	Kazuya Noda
Mode	Tx 11g

				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	6.68	2.32	9.88	18.88	77.27	30.00	1000	11.12	-4.42	14.46	27.93	36.02	4000	21.56
2437	7.10	2.36	9.88	19.34	85.90	30.00	1000	10.66	-4.42	14.92	31.05	36.02	4000	21.10
2462	6.75	2.37	9.88	19.00	79.43	30.00	1000	11.00	-4.42	14.58	28.71	36.02	4000	21.44

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
e.i.r.p. Result = Conducted Power Result + Antenna Gain
*The equipment and cables were not used for factor 0 dB of the data sheets.

2437 MHz

Rate [Mbps]	Reading [dBm]	Remark
6	7.05	
9	6.89	
12	7.10	*
18	6.95	
24	7.05	
36	6.84	
48	6.93	
54	6.92	

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

Maximum Peak Output Power

Report No.	12299284S-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	June 29, 2018
Temperature / Humidity	23 deg. C / 68 % RH
Engineer	Kazuya Noda
Mode	Tx 11n-20

				Conducted Power					e.i.r.p. for RSS-247					
Freq.	Reading	Cable Loss	Atten. Loss	Result		Limit		Margin	Antenna Gain	Result		Limit		Margin
[MHz]	[dBm]	[dB]	[dB]	[dBm]	[mW]	[dBm]	[mW]	[dB]	[dBi]	[dBm]	[mW]	[dBm]	[mW]	[dB]
2412	6.17	2.32	9.88	18.37	68.71	30.00	1000	11.63	-4.42	13.95	24.83	36.02	4000	22.07
2437	6.80	2.36	9.88	19.04	80.17	30.00	1000	10.96	-4.42	14.62	28.97	36.02	4000	21.40
2462	6.43	2.37	9.88	18.68	73.79	30.00	1000	11.32	-4.42	14.26	26.67	36.02	4000	21.76

Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
e.i.r.p. Result = Conducted Power Result + Antenna Gain
*The equipment and cables were not used for factor 0 dB of the data sheets.

2437 MHz

MCS Number	Reading [dBm]	Remark
0	6.63	
1	6.61	
2	6.54	
3	6.80	*
4	6.53	
5	6.23	
6	6.57	
7	6.47	

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

Average Output Power
(Reference data for RF Exposure)

Report No.	12299284S-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	June 29, 2018
Temperature / Humidity	23 deg. C / 68 % RH
Engineer	Kazuya Noda
Mode	Tx

11b **1 Mbps**

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average) [dBm]	Result (Time average) [mW]	Duty factor [dB]	Result (Burst power average) [dBm]	Result (Burst power average) [mW]
2412	-0.34	1.98	9.88	11.52	14.19	0.01	11.53	14.22
2437	-0.40	1.99	9.88	11.47	14.03	0.01	11.48	14.06
2462	-0.47	2.00	9.88	11.41	13.84	0.01	11.42	13.87

11g **6 Mbps**

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average) [dBm]	Result (Time average) [mW]	Duty factor [dB]	Result (Burst power average) [dBm]	Result (Burst power average) [mW]
2412	-0.40	1.98	9.88	11.46	14.00	0.10	11.56	14.32
2437	-0.49	1.99	9.88	11.38	13.74	0.10	11.48	14.06
2462	-0.55	2.00	9.88	11.33	13.58	0.10	11.43	13.90

11n-20 **MCS 0**

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result (Time average) [dBm]	Result (Time average) [mW]	Duty factor [dB]	Result (Burst power average) [dBm]	Result (Burst power average) [mW]
2412	-2.08	1.98	9.88	9.78	9.51	0.11	9.89	9.75
2437	-2.25	1.99	9.88	9.62	9.16	0.11	9.73	9.40
2462	-2.28	2.00	9.88	9.60	9.12	0.11	9.71	9.35

Sample Calculation:
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
Result (Burst power average) = Time average + Duty factor

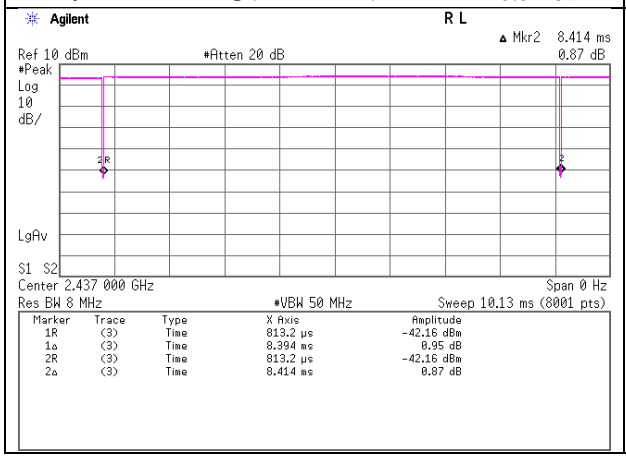
The average output power was measured with the lowest order modulation and lowest data rate configuration in each IEEE 802.11 mode based on KDB 248227 D01.

Duty factor Calculation chart (for Average Output Power)

Report No.	12299284S-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	June 29, 2018
Temperature / Humidity	23 deg. C / 68 % RH
Engineer	Kazuya Noda
Mode	Tx

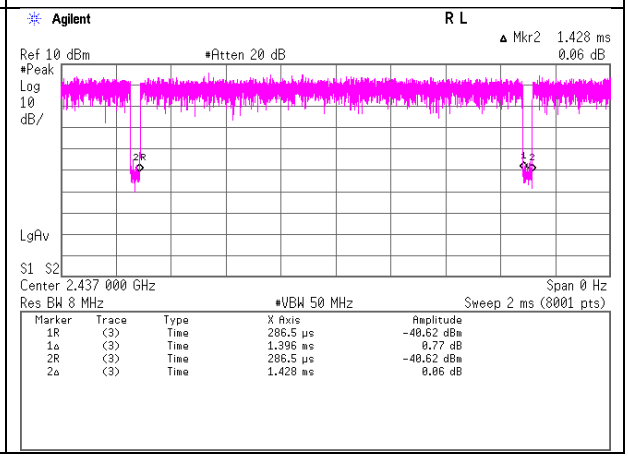
11b 1 Mbps

Tx on / (Tx on + Tx off) =	0.998
Tx on / (Tx on + Tx off) * 100 =	99.8 %
Duty factor = 10 * log (8.414 / 8.394) =	0.01 dB



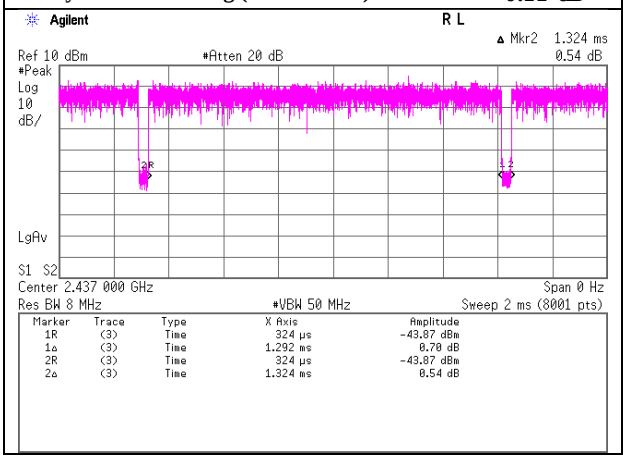
11g 6 Mbps

Tx on / (Tx on + Tx off) =	0.978
Tx on / (Tx on + Tx off) * 100 =	97.8 %
Duty factor = 10 * log (1.428 / 1.396) =	0.10 dB



11n-20 MCS 0

Tx on / (Tx on + Tx off) =	0.976
Tx on / (Tx on + Tx off) * 100 =	97.6 %
Duty factor = 10 * log (1.324 / 1.292) =	0.11 dB



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

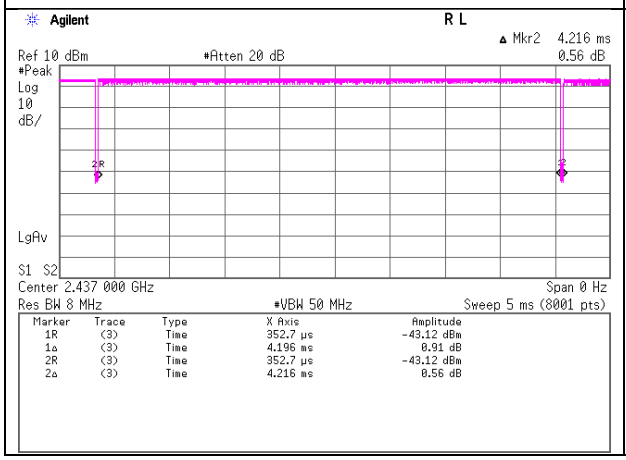
Duty factor Calculation chart (for Radiated Emission)

Report No.	12299284S-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	June 29, 2018
Temperature / Humidity	23 deg. C / 68 % RH
Engineer	Kazuya Noda
Mode	Tx

(Reference) 11b 2 Mbps

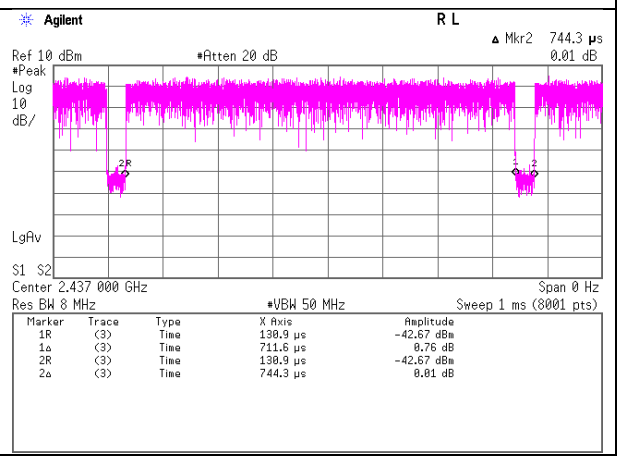
Tx on / (Tx on + Tx off) =	**0.995**
Tx on / (Tx on + Tx off) * 100 =	**99.5 %**
Duty factor = 20 * log (4.216 / 4.196) =	**0.04 dB**

(* This factor not used)



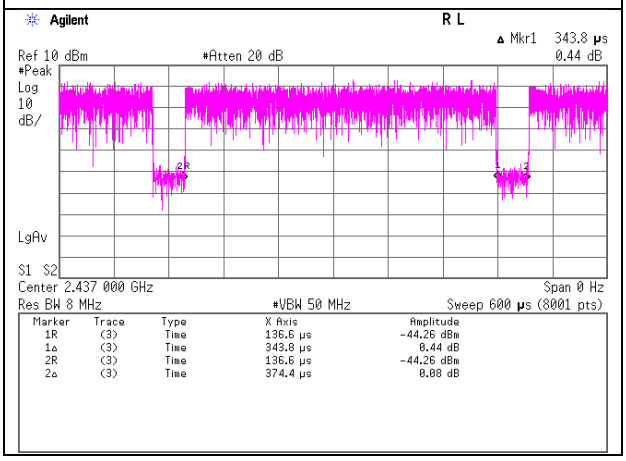
11g 12 Mbps

Tx on / (Tx on + Tx off) =	**0.956**
Tx on / (Tx on + Tx off) * 100 =	**95.6 %**
Duty factor = 20 * log (0.7443 / 0.7116) =	**0.39 dB**



11n-20 MCS 3

Tx on / (Tx on + Tx off) =	**0.918**
Tx on / (Tx on + Tx off) * 100 =	**91.8 %**
Duty factor = 20 * log (0.3744 / 0.3438) =	**0.74 dB**



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

Radiated Spurious Emission

Report No.	12299284S-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.3			
Date	July 8, 2018	July 6, 2018	July 7, 2018	July 8, 2018
Temperature / Humidity	20 deg. C / 57 % RH	22 deg. C / 55 % RH	25 deg. C / 59 % RH	20 deg. C / 57 % RH
Engineer	Yasumasa Owaki (30 MHz - 1 GHz)	Kazuya Noda (1 GHz – 2.8 GHz)	Kenichi Adachi (2.8 GHz - 18 GHz)	Yasumasa Owaki (18 MHz – 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.	2390.000	PK	48.87	27.26	14.17	44.13	2.42	48.59	73.90	25.3	134	42	
Hori.	4824.000	PK	50.43	31.46	6.52	44.46	2.42	46.37	73.90	27.5	185	209	
Hori.	7236.000	PK	47.48	36.62	8.34	44.00	2.42	50.86	73.90	23.0	150	0	
Hori.	9648.000	PK	47.59	38.66	9.21	43.83	2.42	54.05	73.90	19.9	150	0	
Hori.	12060.000	PK	47.54	39.29	10.97	43.36	2.42	56.86	73.90	17.0	150	0	
Hori.	2390.000	AV	39.55	27.26	14.17	44.13	2.42	39.27	53.90	14.6	134	42	
Hori.	4824.000	AV	41.76	31.46	6.52	44.46	2.42	37.70	53.90	16.2	185	209	
Hori.	7236.000	AV	38.29	36.62	8.34	44.00	2.42	41.67	53.90	12.2	150	0	
Hori.	9648.000	AV	38.76	38.66	9.21	43.83	2.42	45.22	53.90	8.7	150	0	
Hori.	12060.000	AV	38.02	39.29	10.97	43.36	2.42	47.34	53.90	6.6	150	0	
Vert.	2390.000	PK	48.73	27.26	14.17	44.13	2.42	48.45	73.90	25.5	115	241	
Vert.	4824.000	PK	50.52	31.46	6.52	44.46	2.42	46.46	73.90	27.4	152	248	
Vert.	7236.000	PK	47.57	36.62	8.34	44.00	2.42	50.95	73.90	23.0	150	0	
Vert.	9648.000	PK	47.64	38.66	9.21	43.83	2.42	54.10	73.90	19.8	150	0	
Vert.	12060.000	PK	47.48	39.29	10.97	43.36	2.42	56.80	73.90	17.1	150	0	
Vert.	2390.000	AV	39.25	27.26	14.17	44.13	2.42	38.97	53.90	14.9	115	241	
Vert.	4824.000	AV	41.84	31.46	6.52	44.46	2.42	37.78	53.90	16.1	152	248	
Vert.	7236.000	AV	38.38	36.62	8.34	44.00	2.42	41.76	53.90	12.1	150	0	
Vert.	9648.000	AV	38.79	38.66	9.21	43.83	2.42	45.25	53.90	8.7	150	0	
Vert.	12060.000	AV	38.16	39.29	10.97	43.36	2.42	47.48	53.90	**6.4**	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 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)

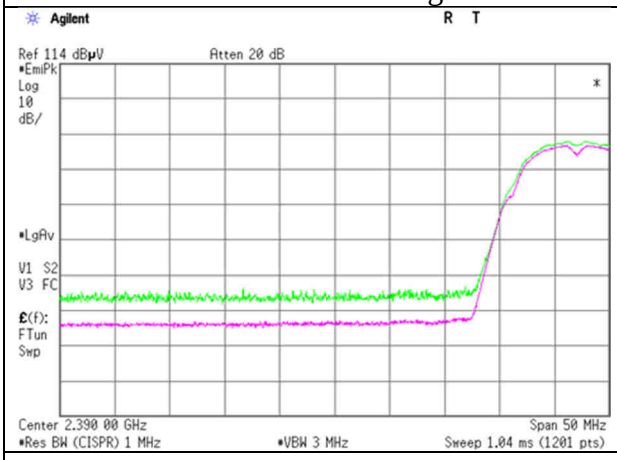
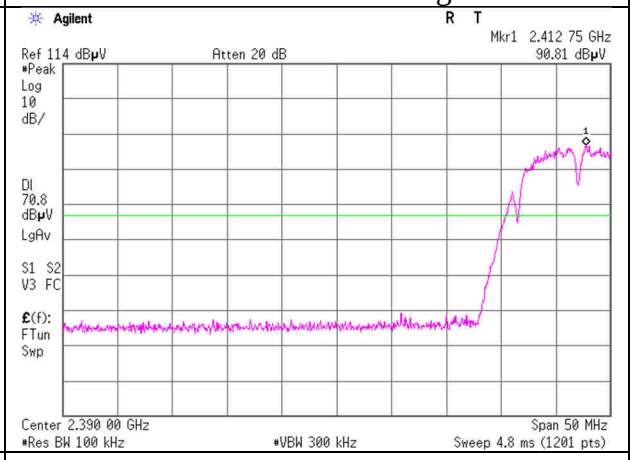
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark	Height [cm]	Angle [deg]
Hori.	2412.000	PK	90.52	27.33	14.19	44.14	2.42	90.32	-	-	carrier	134	42
Hori.	2400.000	PK	40.42	27.29	14.18	44.14	2.42	40.17	70.32	30.2		134	42
Hori.	6432.058	PK	49.73	34.64	7.84	44.67	2.42	49.96	70.32	20.4		192	162
Vert.	2412.000	PK	90.41	27.33	14.19	44.14	2.42	90.21	-	-	carrier	115	241
Vert.	2400.000	PK	40.37	27.29	14.18	44.14	2.42	40.12	70.21	30.1		115	241
Vert.	6432.058	PK	49.29	34.64	7.84	44.67	2.42	49.52	70.21	20.7		144	223

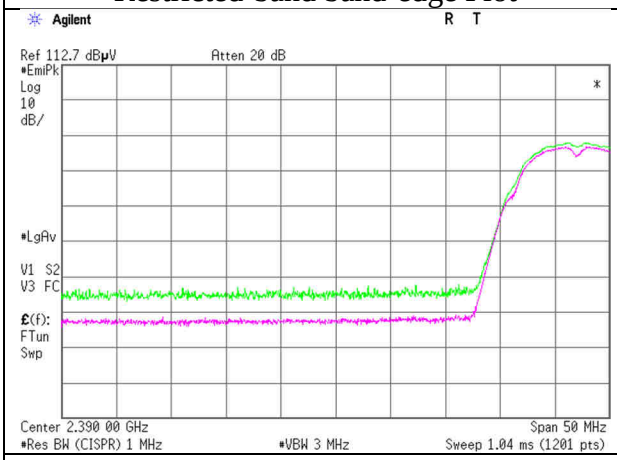
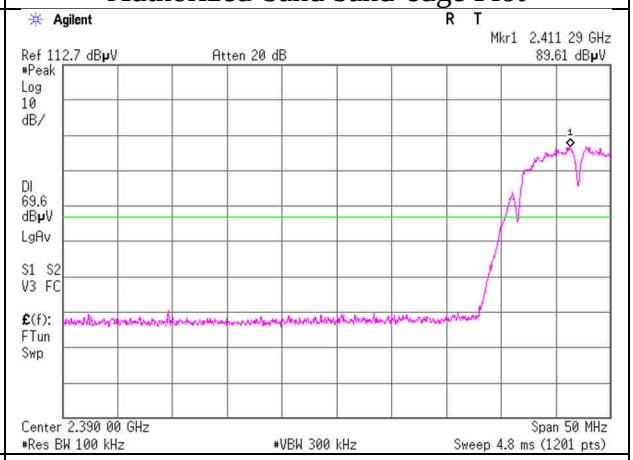
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

*1) The noise of 6432.058 MHz applied 15.247(d) limit (-20 dBc limit), since the noise of 6432.058 MHz was from radio circuit part.

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12299284S-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 6, 2018
Temperature / Humidity	22 deg. C / 55 % RH
Engineer	Kazuya Noda (1 GHz – 2.8 GHz)
Mode	Tx 11b 2412 MHz

Horizontal	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

Vertical	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

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

Radiated Spurious Emission

Report No.	12299284S-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.3			
Date	July 8, 2018	July 6, 2018	July 7, 2018	July 8, 2018
Temperature / Humidity	20 deg. C / 57 % RH	22 deg. C / 55 % RH	25 deg. C / 59 % RH	20 deg. C / 57 % RH
Engineer	Yasumasa Owaki (30 MHz - 1 GHz)	Kazuya Noda (1 GHz – 2.8 GHz)	Kenichi Adachi (2.8 GHz - 18 GHz)	Yasumasa Owaki (18 MHz – 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	49.98	31.59	6.52	44.47	2.42	46.04	73.90	27.9	181	207	
Hori.	7311.000	PK	47.02	36.75	8.40	44.03	2.42	50.56	73.90	23.3	150	0	
Hori.	9748.000	PK	47.32	38.78	9.22	43.84	2.42	53.90	73.90	20.0	150	0	
Hori.	12185.000	PK	45.41	39.28	11.19	43.36	2.42	54.94	73.90	19.0	150	0	
Hori.	4874.000	AV	42.06	31.59	6.52	44.47	2.42	38.12	53.90	15.8	181	207	
Hori.	7311.000	AV	37.72	36.75	8.40	44.03	2.42	41.26	53.90	12.6	150	0	
Hori.	9748.000	AV	37.89	38.78	9.22	43.84	2.42	44.47	53.90	9.4	150	0	
Hori.	12185.000	AV	36.54	39.28	11.19	43.36	2.42	46.07	53.90	7.8	150	0	
Vert.	4874.000	PK	50.17	31.59	6.52	44.47	2.42	46.23	73.90	27.7	154	251	
Vert.	7311.000	PK	47.11	36.75	8.40	44.03	2.42	50.65	73.90	23.3	150	0	
Vert.	9748.000	PK	47.23	38.78	9.22	43.84	2.42	53.81	73.90	20.1	150	0	
Vert.	12185.000	PK	45.33	39.28	11.19	43.36	2.42	54.86	73.90	19.0	150	0	
Vert.	4874.000	AV	42.24	31.59	6.52	44.47	2.42	38.30	53.90	15.6	154	251	
Vert.	7311.000	AV	37.77	36.75	8.40	44.03	2.42	41.31	53.90	12.6	150	0	
Vert.	9748.000	AV	37.96	38.78	9.22	43.84	2.42	44.54	53.90	9.4	150	0	
Vert.	12185.000	AV	36.59	39.28	11.19	43.36	2.42	46.12	53.90	**7.8**	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 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	Height [cm]	Angle [deg]
Hori.	2437.000	PK	88.45	27.40	14.20	44.14	2.42	88.33	-	-	carrier	112	25
Hori.	6498.745	PK	48.24	34.90	7.92	44.64	2.42	48.84	68.33	19.5		189	160
Vert.	2437.000	PK	87.93	27.40	14.20	44.14	2.42	87.81	-	-	carrier	148	241
Vert.	6498.745	PK	48.12	34.90	7.92	44.64	2.42	48.72	67.81	19.1		143	21

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

*1) The noise of 6498.745 MHz applied 15.247(d) limit (-20 dBc limit), since the noise of 6498.745 MHz was from radio circuit part.

Radiated Spurious Emission

Report No.	12299284S-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.3			
Date	July 8, 2018	July 6, 2018	July 7, 2018	July 8, 2018
Temperature / Humidity	20 deg. C / 57 % RH	22 deg. C / 55 % RH	25 deg. C / 59 % RH	20 deg. C / 57 % RH
Engineer	Yasumasa Owaki (30 MHz - 1 GHz)	Kazuya Noda (1 GHz – 2.8 GHz)	Kenichi Adachi (2.8 GHz - 18 GHz)	Yasumasa Owaki (18 MHz – 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	49.33	27.55	14.26	44.16	2.42	49.40	73.90	24.5	191	17	
Hori.	4924.000	PK	50.36	31.73	6.54	44.49	2.42	46.56	73.90	27.3	179	206	
Hori.	7386.000	PK	46.48	36.88	8.46	44.06	2.42	50.18	73.90	23.7	150	0	
Hori.	9848.000	PK	46.58	38.90	9.23	43.86	2.42	53.27	73.90	20.6	150	0	
Hori.	12310.000	PK	44.51	39.27	11.43	43.36	2.42	54.27	73.90	19.6	150	0	
Hori.	2483.500	AV	40.33	27.55	14.26	44.16	2.42	40.40	53.90	13.5	191	17	
Hori.	4924.000	AV	41.66	31.73	6.54	44.49	2.42	37.86	53.90	16.0	179	206	
Hori.	7386.000	AV	38.13	36.88	8.46	44.06	2.42	41.83	53.90	12.1	150	0	
Hori.	9848.000	AV	38.33	38.90	9.23	43.86	2.42	45.02	53.90	8.9	150	0	
Hori.	12310.000	AV	35.94	39.27	11.43	43.36	2.42	45.70	53.90	8.2	150	0	
Vert.	2483.500	PK	50.11	27.55	14.26	44.16	2.42	50.18	73.90	23.7	120	260	
Vert.	4924.000	PK	50.49	31.73	6.54	44.49	2.42	46.69	73.90	27.2	155	253	
Vert.	7386.000	PK	46.43	36.88	8.46	44.06	2.42	50.13	73.90	23.8	150	0	
Vert.	9848.000	PK	46.64	38.90	9.23	43.86	2.42	53.33	73.90	20.6	150	0	
Vert.	12310.000	PK	44.56	39.27	11.43	43.36	2.42	54.32	73.90	19.6	150	0	
Vert.	2483.500	AV	41.74	27.55	14.26	44.16	2.42	41.81	53.90	12.1	120	260	
Vert.	4924.000	AV	41.78	31.73	6.54	44.49	2.42	37.98	53.90	15.9	155	253	
Vert.	7386.000	AV	38.09	36.88	8.46	44.06	2.42	41.79	53.90	12.1	150	0	
Vert.	9848.000	AV	38.42	38.90	9.23	43.86	2.42	45.11	53.90	8.8	150	0	
Vert.	12310.000	AV	35.97	39.27	11.43	43.36	2.42	45.73	53.90	**8.2**	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 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	Height [cm]	Angle [deg]
Hori.	2462.000	PK	88.91	27.48	14.24	44.15	2.42	88.90	-	-	carrier	191	17
Hori.	6565.389	PK	48.12	35.07	7.96	44.54	2.42	49.03	68.90	19.9		194	163
Vert.	2462.000	PK	87.95	27.48	14.24	44.15	2.42	87.94	-	-	carrier	120	260
Vert.	6565.389	PK	47.52	35.07	7.96	44.54	2.42	48.43	67.94	19.5		141	14

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

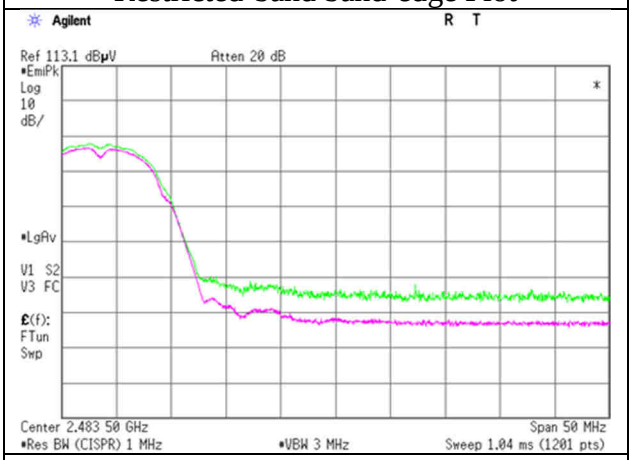
*1) The noise of 6565.389 MHz applied 15.247(d) limit (-20 dBc limit), since the noise of 6565.389 MHz was from radio circuit part.

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12299284S-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 6, 2018
Temperature / Humidity	22 deg. C / 55 % RH
Engineer	Kazuya Noda (1 GHz – 2.8 GHz)
Mode	Tx 11b 2462 MHz

Horizontal

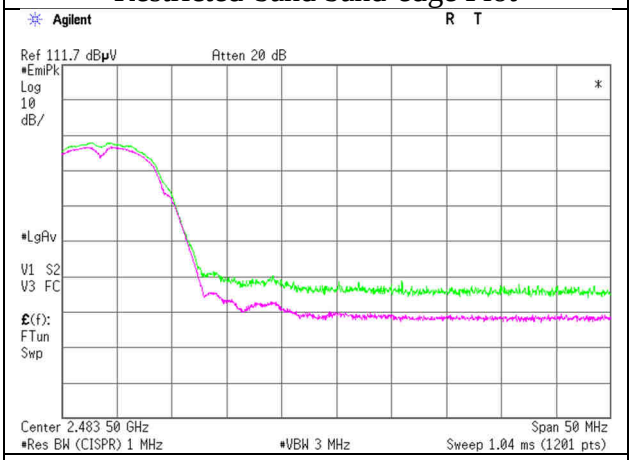
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

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

Radiated Spurious Emission

Report No.	12299284S-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.3			
Date	July 8, 2018	July 6, 2018	July 7, 2018	July 8, 2018
Temperature / Humidity	20 deg. C / 57 % RH	22 deg. C / 55 % RH	25 deg. C / 59 % RH	20 deg. C / 57 % RH
Engineer	Yasumasa Owaki (30 MHz - 1 GHz)	Kazuya Noda (1 GHz – 2.8 GHz)	Kenichi Adachi (2.8 GHz - 18 GHz)	Yasumasa Owaki (18 MHz – 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	55.81	27.26	14.17	44.13	2.42	55.53	73.90	18.4	133	37	
Hori.	4824.000	PK	50.79	31.46	6.52	44.46	2.42	46.73	73.90	27.2	184	211	
Hori.	7236.000	PK	47.53	36.62	8.34	44.00	2.42	50.91	73.90	23.0	150	0	
Hori.	9648.000	PK	47.62	38.66	9.21	43.83	2.42	54.08	73.90	19.8	150	0	
Hori.	12060.000	PK	47.57	39.29	10.97	43.36	2.42	56.89	73.90	17.0	150	0	
Vert.	2390.000	PK	54.58	27.26	14.17	44.13	2.42	54.30	73.90	19.6	125	251	
Vert.	4824.000	PK	50.93	31.46	6.52	44.46	2.42	46.87	73.90	27.0	154	258	
Vert.	7236.000	PK	47.46	36.62	8.34	44.00	2.42	50.84	73.90	23.1	150	0	
Vert.	9648.000	PK	47.58	38.66	9.21	43.83	2.42	54.04	73.90	19.9	150	0	
Vert.	12060.000	PK	47.52	39.29	10.97	43.36	2.42	56.84	73.90	17.1	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 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	42.83	27.26	14.17	44.13	0.39	2.42	42.94	53.90	11.0	*1)
Hori.	4824.000	AV	41.86	31.46	6.52	44.46	0.39	2.42	38.19	53.90	15.7	
Hori.	7236.000	AV	38.31	36.62	8.34	44.00	0.39	2.42	42.08	53.90	11.8	
Hori.	9648.000	AV	38.77	38.66	9.21	43.83	0.39	2.42	45.62	53.90	8.3	
Hori.	12060.000	AV	38.11	39.29	10.97	43.36	0.39	2.42	47.82	53.90	**6.1**	
Vert.	2390.000	AV	42.07	27.26	14.17	44.13	0.39	2.42	42.18	53.90	11.7	*1)
Vert.	4824.000	AV	41.98	31.46	6.52	44.46	0.39	2.42	38.31	53.90	15.6	
Vert.	7236.000	AV	38.26	36.62	8.34	44.00	0.39	2.42	42.03	53.90	11.9	
Vert.	9648.000	AV	38.74	38.66	9.21	43.83	0.39	2.42	45.59	53.90	8.3	
Vert.	12060.000	AV	38.04	39.29	10.97	43.36	0.39	2.42	47.75	53.90	6.2	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 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)**

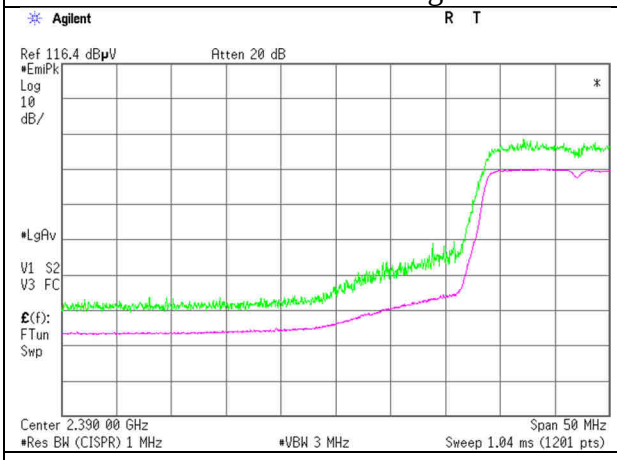
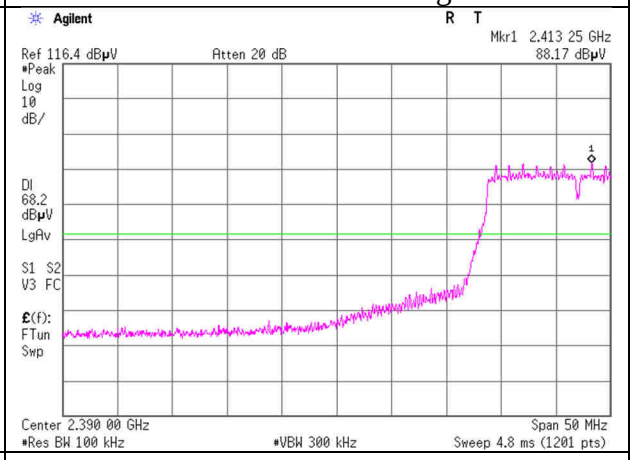
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark	Height [cm]	Angle [deg]
Hori.	2412.000	PK	88.71	27.33	14.19	44.14	2.42	88.51	-	-	carrier	133	37
Hori.	2400.000	PK	51.48	27.29	14.18	44.14	2.42	51.23	68.51	17.3		133	37
Hori.	6432.062	PK	49.38	34.64	7.84	44.67	2.42	49.61	68.51	18.9		191	159
Vert.	2412.000	PK	86.70	27.33	14.19	44.14	2.42	86.50	-	-	carrier	125	251
Vert.	2400.000	PK	50.67	27.29	14.18	44.14	2.42	50.42	66.50	16.1		125	251
Vert.	6432.062	PK	49.16	34.64	7.84	44.67	2.42	49.39	66.50	17.1		147	228

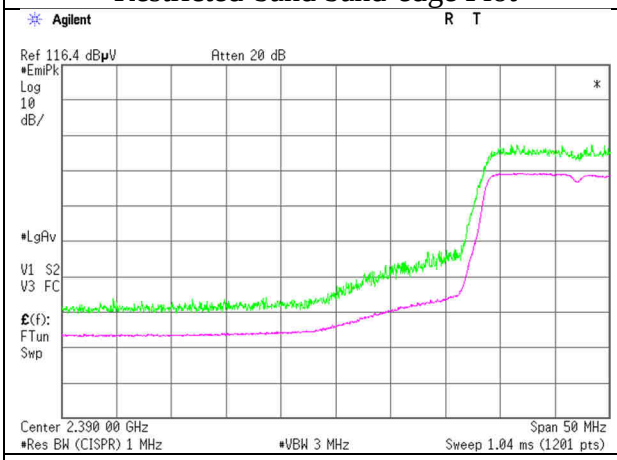
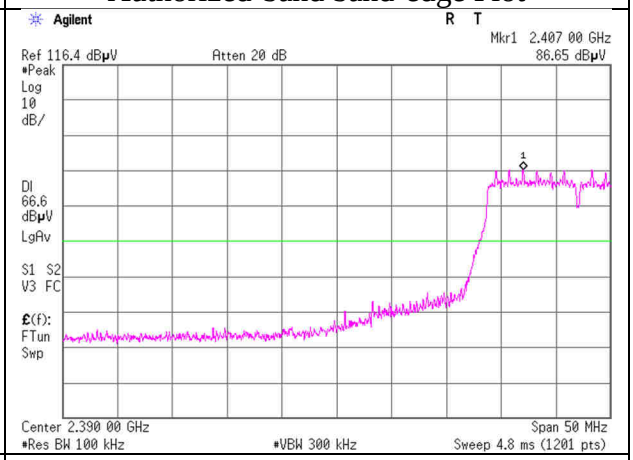
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

*1) The noise of 6432.062 MHz applied 15.247(d) limit (-20 dBc limit), since the noise of 6432.062 MHz was from radio circuit part.

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12299284S-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 6, 2018
Temperature / Humidity	22 deg. C / 55 % RH
Engineer	Kazuya Noda (1 GHz – 2.8 GHz)
Mode	Tx 11g 2412 MHz

Horizontal	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

Vertical	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

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

Radiated Spurious Emission

Report No.	12299284S-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.3			
Date	July 8, 2018	July 6, 2018	July 7, 2018	July 8, 2018
Temperature / Humidity	20 deg. C / 57 % RH	22 deg. C / 55 % RH	25 deg. C / 59 % RH	20 deg. C / 57 % RH
Engineer	Yasumasa Owaki (30 MHz - 1 GHz)	Kazuya Noda (1 GHz – 2.8 GHz)	Kenichi Adachi (2.8 GHz - 18 GHz)	Yasumasa Owaki (18 MHz – 26.5 GHz)
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.	126.643	QP	22.71	13.59	7.34	32.14	0.00	11.50	43.50	32.0	100	1	
Hori.	240.703	QP	46.21	11.66	8.32	32.03	0.00	34.16	46.00	11.8	123	191	
Hori.	320.762	QP	52.32	14.30	8.84	31.99	0.00	43.47	46.00	**2.5**	122	9	
Hori.	401.271	QP	48.21	15.89	9.26	31.98	0.00	41.38	46.00	4.6	108	176	
Hori.	597.599	QP	38.78	19.21	9.99	31.95	0.00	36.03	46.00	10.0	116	17	
Hori.	4874.000	PK	50.24	31.59	6.52	44.47	2.42	46.30	73.90	27.6	178	205	
Hori.	7311.000	PK	46.96	36.75	8.40	44.03	2.42	50.50	73.90	23.4	150	0	
Hori.	9748.000	PK	47.37	38.78	9.22	43.84	2.42	53.95	73.90	20.0	150	0	
Hori.	12185.000	PK	45.57	39.28	11.19	43.36	2.42	55.10	73.90	18.8	150	0	
Vert.	62.141	QP	37.66	7.77	6.51	32.18	0.00	19.76	40.00	20.2	100	308	
Vert.	84.018	QP	38.12	7.03	7.59	32.17	0.00	20.57	40.00	19.4	103	82	
Vert.	96.935	QP	31.46	9.61	7.42	32.16	0.00	16.33	43.50	27.2	111	350	
Vert.	108.709	QP	32.87	11.74	7.26	32.15	0.00	19.72	43.50	23.8	100	56	
Vert.	133.947	QP	34.56	14.12	7.48	32.13	0.00	24.03	43.50	19.5	105	229	
Vert.	182.735	QP	31.91	16.09	7.84	32.09	0.00	23.75	43.50	19.8	100	177	
Vert.	240.638	QP	46.08	11.66	8.32	32.03	0.00	34.03	46.00	12.0	100	22	
Vert.	320.893	QP	47.81	14.31	8.84	31.99	0.00	38.97	46.00	7.0	100	52	
Vert.	401.149	QP	43.76	15.88	9.25	31.98	0.00	36.91	46.00	9.1	148	212	
Vert.	597.601	QP	35.93	19.21	9.99	31.95	0.00	33.18	46.00	12.8	100	216	
Vert.	4874.000	PK	50.79	31.59	6.52	44.47	2.42	46.85	73.90	27.1	158	259	
Vert.	7311.000	PK	47.00	36.75	8.40	44.03	2.42	50.54	73.90	23.3	150	0	
Vert.	9748.000	PK	47.32	38.78	9.22	43.84	2.42	53.90	73.90	20.0	150	0	
Vert.	12185.000	PK	45.38	39.28	11.19	43.36	2.42	54.91	73.90	18.9	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 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	42.11	31.59	6.52	44.47	0.39	2.42	38.56	53.90	15.3	
Hori.	7311.000	AV	37.62	36.75	8.40	44.03	0.39	2.42	41.55	53.90	12.4	
Hori.	9748.000	AV	38.05	38.78	9.22	43.84	0.39	2.42	45.02	53.90	8.9	
Hori.	12185.000	AV	36.60	39.28	11.19	43.36	0.39	2.42	46.52	53.90	7.4	
Vert.	4874.000	AV	42.67	31.59	6.52	44.47	0.39	2.42	39.12	53.90	14.8	
Vert.	7311.000	AV	37.69	36.75	8.40	44.03	0.39	2.42	41.62	53.90	12.3	
Vert.	9748.000	AV	37.98	38.78	9.22	43.84	0.39	2.42	44.95	53.90	9.0	
Vert.	12185.000	AV	36.53	39.28	11.19	43.36	0.39	2.42	46.45	53.90	7.5	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB
Duty factor refer to "Duty factor Calculation chart" sheet.

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	Height [cm]	Angle [deg]
Hori.	2437.000	PK	86.51	27.40	14.20	44.14	2.42	86.39	-	-	carrier	114	34
Hori.	6498.744	PK	46.31	34.90	7.92	44.64	2.42	46.91	66.39	19.5		193	164
Vert.	2437.000	PK	86.04	27.40	14.20	44.14	2.42	85.92	-	-	carrier	150	282
Vert.	6498.744	PK	46.13	34.90	7.92	44.64	2.42	46.73	65.92	19.2		148	22

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

*1) The noise of 6498.744 MHz applied 15.247(d) limit (-20 dBc limit), since the noise of 6498.744 MHz was from radio circuit part.

Radiated Spurious Emission

Report No.	12299284S-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.3			
Date	July 8, 2018	July 6, 2018	July 7, 2018	July 8, 2018
Temperature / Humidity	20 deg. C / 57 % RH	22 deg. C / 55 % RH	25 deg. C / 59 % RH	20 deg. C / 57 % RH
Engineer	Yasumasa Owaki (30 MHz - 1 GHz)	Kazuya Noda (1 GHz – 2.8 GHz)	Kenichi Adachi (2.8 GHz - 18 GHz)	Yasumasa Owaki (18 MHz – 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	56.81	27.55	14.26	44.16	2.42	56.88	73.90	17.0	192	17	
Hori.	4924.000	PK	50.06	31.73	6.54	44.49	2.42	46.26	73.90	27.6	176	206	
Hori.	7386.000	PK	46.64	36.88	8.46	44.06	2.42	50.34	73.90	23.6	150	0	
Hori.	9848.000	PK	46.61	38.90	9.23	43.86	2.42	53.30	73.90	20.6	150	0	
Hori.	12310.000	PK	44.58	39.27	11.43	43.36	2.42	54.34	73.90	19.6	150	0	
Vert.	2483.500	PK	57.42	27.55	14.26	44.16	2.42	57.49	73.90	16.4	114	269	
Vert.	4924.000	PK	50.14	31.73	6.54	44.49	2.42	46.34	73.90	27.6	156	257	
Vert.	7386.000	PK	46.59	36.88	8.46	44.06	2.42	50.29	73.90	23.6	150	0	
Vert.	9848.000	PK	46.69	38.90	9.23	43.86	2.42	53.38	73.90	20.5	150	0	
Vert.	12310.000	PK	44.50	39.27	11.43	43.36	2.42	54.26	73.90	19.6	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 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.	2483.500	AV	44.28	27.55	14.26	44.16	0.39	2.42	44.74	53.90	9.2	*1)
Hori.	4924.000	AV	41.34	31.73	6.54	44.49	0.39	2.42	37.93	53.90	16.0	
Hori.	7386.000	AV	38.23	36.88	8.46	44.06	0.39	2.42	42.32	53.90	11.6	
Hori.	9848.000	AV	38.40	38.90	9.23	43.86	0.39	2.42	45.48	53.90	8.4	
Hori.	12310.000	AV	35.98	39.27	11.43	43.36	0.39	2.42	46.13	53.90	**7.8**	
Vert.	2483.500	AV	44.77	27.55	14.26	44.16	0.39	2.42	45.23	53.90	8.7	*1)
Vert.	4924.000	AV	41.46	31.73	6.54	44.49	0.39	2.42	38.05	53.90	15.9	
Vert.	7386.000	AV	38.15	36.88	8.46	44.06	0.39	2.42	42.24	53.90	11.7	
Vert.	9848.000	AV	38.46	38.90	9.23	43.86	0.39	2.42	45.54	53.90	8.4	
Vert.	12310.000	AV	35.91	39.27	11.43	43.36	0.39	2.42	46.06	53.90	7.8	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 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	Height [cm]	Angle [deg]
Hori.	2462.000	PK	85.79	27.48	14.24	44.15	2.42	85.78	-	-	carrier	192	17
Hori.	6565.387	PK	48.01	35.07	7.96	44.54	2.42	48.92	65.78	16.9		192	159
Vert.	2462.000	PK	85.57	27.48	14.24	44.15	2.42	85.56	-	-	carrier	114	269
Vert.	6565.387	PK	47.48	35.07	7.96	44.54	2.42	48.39	65.56	17.2		146	11

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

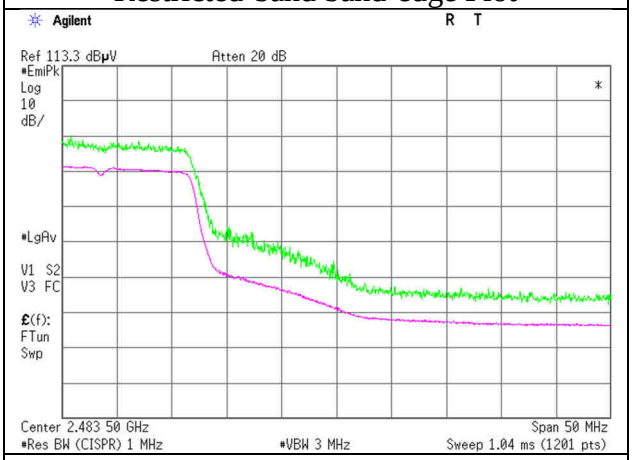
*1) The noise of 6565.387 MHz applied 15.247(d) limit (-20 dBc limit), since the noise of 6565.387 MHz was from radio circuit part.

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12299284S-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 6, 2018
Temperature / Humidity	22 deg. C / 55 % RH
Engineer	Kazuya Noda (1 GHz – 2.8 GHz)
Mode	Tx 11g 2462 MHz

Horizontal

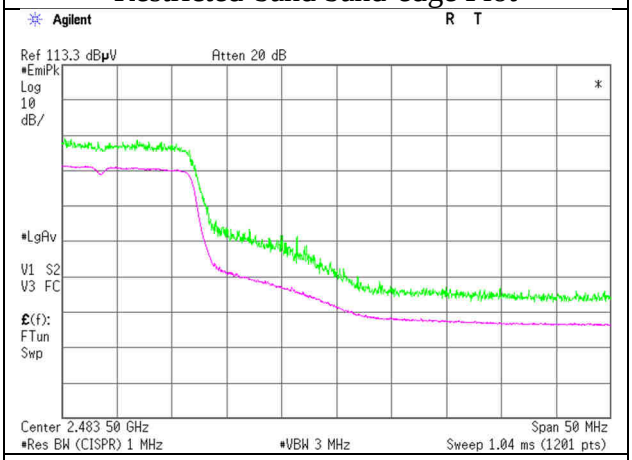
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

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

Radiated Spurious Emission

Report No.	12299284S-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.3			
Date	July 8, 2018	July 6, 2018	July 7, 2018	July 8, 2018
Temperature / Humidity	20 deg. C / 57 % RH	22 deg. C / 55 % RH	25 deg. C / 59 % RH	20 deg. C / 57 % RH
Engineer	Yasumasa Owaki (30 MHz - 1 GHz)	Kazuya Noda (1 GHz – 2.8 GHz)	Kenichi Adachi (2.8 GHz - 18 GHz)	Yasumasa Owaki (18 MHz – 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	53.26	27.26	14.17	44.13	2.42	52.98	73.90	20.9	133	23	
Hori.	4824.000	PK	50.32	31.46	6.52	44.46	2.42	46.26	73.90	27.6	181	208	
Hori.	7236.000	PK	47.59	36.62	8.34	44.00	2.42	50.97	73.90	22.9	150	0	
Hori.	9648.000	PK	47.75	38.66	9.21	43.83	2.42	54.21	73.90	19.7	150	0	
Hori.	12060.000	PK	48.42	39.29	10.97	43.36	2.42	57.74	73.90	16.2	150	0	
Vert.	2390.000	PK	52.97	27.26	14.17	44.13	2.42	52.69	73.90	21.2	115	246	
Vert.	4824.000	PK	50.22	31.46	6.52	44.46	2.42	46.16	73.90	27.7	155	247	
Vert.	7236.000	PK	47.44	36.62	8.34	44.00	2.42	50.82	73.90	23.1	150	0	
Vert.	9648.000	PK	47.68	38.66	9.21	43.83	2.42	54.14	73.90	19.8	150	0	
Vert.	12060.000	PK	48.54	39.29	10.97	43.36	2.42	57.86	73.90	16.0	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 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	40.58	27.26	14.17	44.13	0.74	2.42	41.04	53.90	12.9	*1)
Hori.	4824.000	AV	41.67	31.46	6.52	44.46	0.74	2.42	38.35	53.90	15.6	
Hori.	7236.000	AV	38.36	36.62	8.34	44.00	0.74	2.42	42.48	53.90	11.4	
Hori.	9648.000	AV	38.75	38.66	9.21	43.83	0.74	2.42	45.95	53.90	7.9	
Hori.	12060.000	AV	38.06	39.29	10.97	43.36	0.74	2.42	48.12	53.90	5.8	
Vert.	2390.000	AV	40.63	27.26	14.17	44.13	0.74	2.42	41.09	53.90	12.8	*1)
Vert.	4824.000	AV	41.55	31.46	6.52	44.46	0.74	2.42	38.23	53.90	15.7	
Vert.	7236.000	AV	38.26	36.62	8.34	44.00	0.74	2.42	42.38	53.90	11.5	
Vert.	9648.000	AV	38.82	38.66	9.21	43.83	0.74	2.42	46.02	53.90	7.9	
Vert.	12060.000	AV	38.20	39.29	10.97	43.36	0.74	2.42	48.26	53.90	**5.6**	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 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)

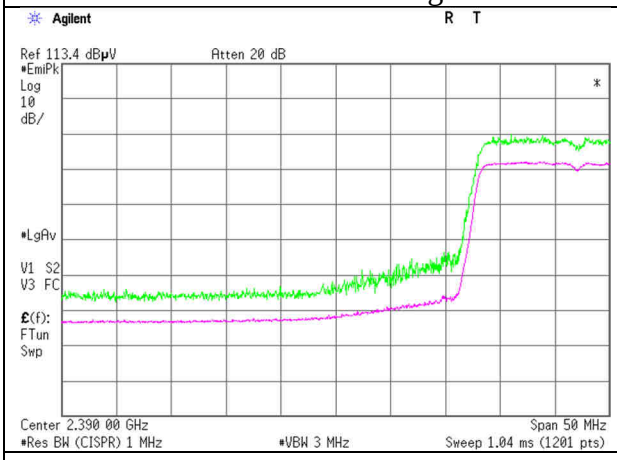
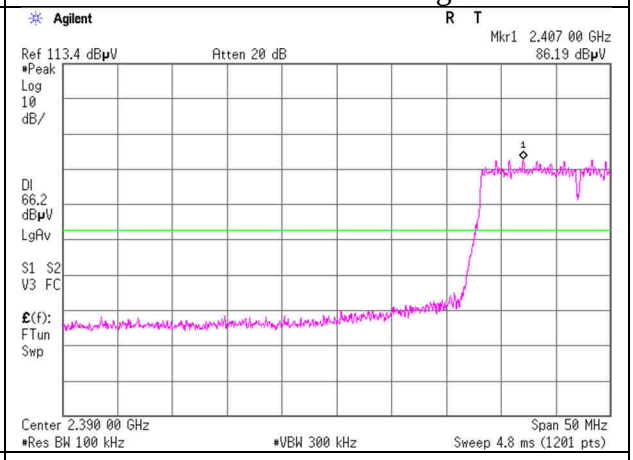
Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Distance Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark	Height [cm]	Angle [deg]
Hori.	2412.000	PK	85.95	27.33	14.19	44.14	2.42	85.75	-	-	carrier	133	23
Hori.	2400.000	PK	46.41	27.29	14.18	44.14	2.42	46.16	65.75	19.6		133	23
Hori.	6432.064	PK	49.79	34.64	7.84	44.67	2.42	50.02	65.75	15.7		193	159
Vert.	2412.000	PK	85.17	27.33	14.19	44.14	2.42	84.97	-	-	carrier	115	246
Vert.	2400.000	PK	45.96	27.29	14.18	44.14	2.42	45.71	64.97	19.3		115	246
Vert.	6432.064	PK	49.68	34.64	7.84	44.67	2.42	49.91	64.97	15.1		142	222

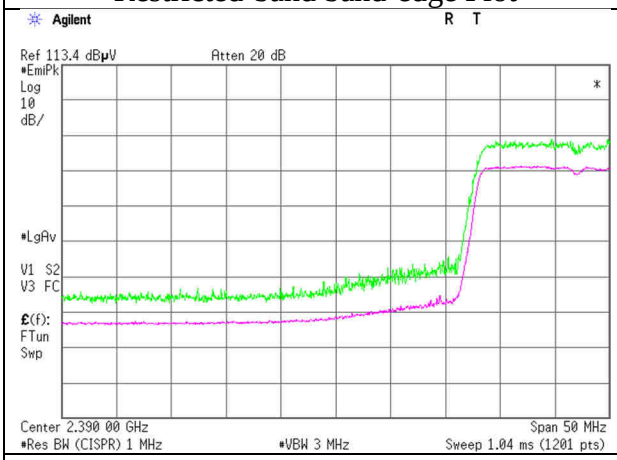
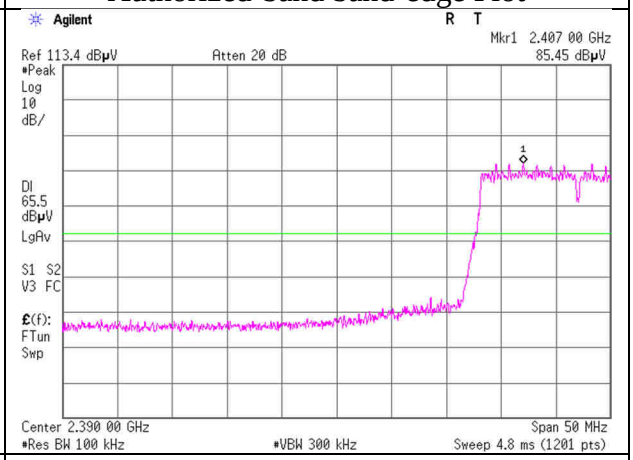
Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

*1) The noise of 6432.064 MHz applied 15.247(d) limit (-20 dBc limit), since the noise of 6432.064 MHz was from radio circuit part.

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12299284S-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 6, 2018
Temperature / Humidity	22 deg. C / 55 % RH
Engineer	Kazuya Noda (1 GHz – 2.8 GHz)
Mode	Tx 11n-20 2412 MHz

Horizontal	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

Vertical	
Restricted-band band-edge Plot	Authorized-band band-edge Plot
	
Trace Green : Peak Plot Trace Purple : Average Plot	20dBc Plot

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

Radiated Spurious Emission

Report No.	12299284S-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.3			
Date	July 8, 2018	July 6, 2018	July 7, 2018	July 8, 2018
Temperature / Humidity	20 deg. C / 57 % RH	22 deg. C / 55 % RH	25 deg. C / 59 % RH	20 deg. C / 57 % RH
Engineer	Yasumasa Owaki (30 MHz - 1 GHz)	Kazuya Noda (1 GHz – 2.8 GHz)	Kenichi Adachi (2.8 GHz - 18 GHz)	Yasumasa Owaki (18 MHz – 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	50.62	31.59	6.52	44.47	2.42	46.68	73.90	27.2	179	212	
Hori.	7311.000	PK	47.09	36.75	8.40	44.03	2.42	50.63	73.90	23.3	150	0	
Hori.	9748.000	PK	47.18	38.78	9.22	43.84	2.42	53.76	73.90	20.1	150	0	
Hori.	12185.000	PK	45.46	39.28	11.19	43.36	2.42	54.99	73.90	18.9	150	0	
Vert.	4874.000	PK	50.78	31.59	6.52	44.47	2.42	46.84	73.90	27.1	157	255	
Vert.	7311.000	PK	46.98	36.75	8.40	44.03	2.42	50.52	73.90	23.4	150	0	
Vert.	9748.000	PK	47.26	38.78	9.22	43.84	2.42	53.84	73.90	20.1	150	0	
Vert.	12185.000	PK	45.37	39.28	11.19	43.36	2.42	54.90	73.90	19.0	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 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	42.52	31.59	6.52	44.47	0.74	2.42	39.32	53.90	14.6	
Hori.	7311.000	AV	37.76	36.75	8.40	44.03	0.74	2.42	42.04	53.90	11.9	
Hori.	9748.000	AV	37.86	38.78	9.22	43.84	0.74	2.42	45.18	53.90	8.7	
Hori.	12185.000	AV	36.58	39.28	11.19	43.36	0.74	2.42	46.85	53.90	**7.1**	
Vert.	4874.000	AV	42.81	31.59	6.52	44.47	0.74	2.42	39.61	53.90	14.3	
Vert.	7311.000	AV	37.70	36.75	8.40	44.03	0.74	2.42	41.98	53.90	11.9	
Vert.	9748.000	AV	38.01	38.78	9.22	43.84	0.74	2.42	45.33	53.90	8.6	
Vert.	12185.000	AV	36.52	39.28	11.19	43.36	0.74	2.42	46.79	53.90	7.1	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB
Duty factor refer to "Duty factor Calculation chart" sheet.

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	Height [cm]	Angle [deg]
Hori.	2437.000	PK	84.42	27.40	14.20	44.14	2.42	84.30	-	-	carrier	113	21
Hori.	6498.749	PK	47.96	34.90	7.92	44.64	2.42	48.56	64.30	15.7		183	158
Vert.	2437.000	PK	84.57	27.40	14.20	44.14	2.42	84.45	-	-	carrier	151	245
Vert.	6498.749	PK	47.88	34.90	7.92	44.64	2.42	48.48	64.45	16.0		141	20

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

*1) The noise of 6498.749 MHz applied 15.247(d) limit (-20 dBc limit), since the noise of 6498.749 MHz was from radio circuit part.

Radiated Spurious Emission

Report No.	12299284S-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.3			
Date	July 8, 2018	July 6, 2018	July 7, 2018	July 8, 2018
Temperature / Humidity	20 deg. C / 57 % RH	22 deg. C / 55 % RH	25 deg. C / 59 % RH	20 deg. C / 57 % RH
Engineer	Yasumasa Owaki (30 MHz - 1 GHz)	Kazuya Noda (1 GHz – 2.8 GHz)	Kenichi Adachi (2.8 GHz - 18 GHz)	Yasumasa Owaki (18 MHz – 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	56.37	27.55	14.26	44.16	2.42	56.44	73.90	17.5	193	21	
Hori.	4924.000	PK	50.68	31.73	6.54	44.49	2.42	46.88	73.90	27.0	184	207	
Hori.	7386.000	PK	46.42	36.88	8.46	44.06	2.42	50.12	73.90	23.8	150	0	
Hori.	9848.000	PK	46.68	38.90	9.23	43.86	2.42	53.37	73.90	20.5	150	0	
Hori.	12310.000	PK	44.62	39.27	11.43	43.36	2.42	54.38	73.90	19.5	150	0	
Vert.	2483.500	PK	56.49	27.55	14.26	44.16	2.42	56.56	73.90	17.3	115	263	
Vert.	4924.000	PK	50.76	31.73	6.54	44.49	2.42	46.96	73.90	26.9	157	257	
Vert.	7386.000	PK	46.53	36.88	8.46	44.06	2.42	50.23	73.90	23.7	150	0	
Vert.	9848.000	PK	46.74	38.90	9.23	43.86	2.42	53.43	73.90	20.5	150	0	
Vert.	12310.000	PK	44.54	39.27	11.43	43.36	2.42	54.30	73.90	19.6	150	0	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 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.	2483.500	AV	41.66	27.55	14.26	44.16	0.74	2.42	42.47	53.90	11.4	*1)
Hori.	4924.000	AV	41.89	31.73	6.54	44.49	0.74	2.42	38.83	53.90	15.1	
Hori.	7386.000	AV	38.04	36.88	8.46	44.06	0.74	2.42	42.48	53.90	11.4	
Hori.	9848.000	AV	38.44	38.90	9.23	43.86	0.74	2.42	45.87	53.90	8.0	
Hori.	12310.000	AV	36.03	39.27	11.43	43.36	0.74	2.42	46.53	53.90	**7.4**	
Vert.	2483.500	AV	42.69	27.55	14.26	44.16	0.74	2.42	43.50	53.90	10.4	*1)
Vert.	4924.000	AV	41.92	31.73	6.54	44.49	0.74	2.42	38.86	53.90	15.0	
Vert.	7386.000	AV	38.12	36.88	8.46	44.06	0.74	2.42	42.56	53.90	11.3	
Vert.	9848.000	AV	38.52	38.90	9.23	43.86	0.74	2.42	45.95	53.90	7.9	
Vert.	12310.000	AV	35.90	39.27	11.43	43.36	0.74	2.42	46.40	53.90	7.5	

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Duty factor + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 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	Height [cm]	Angle [deg]
Hori.	2462.000	PK	83.92	27.48	14.24	44.15	2.42	83.91	-	-	carrier	193	21
Hori.	6565.344	PK	47.34	35.07	7.96	44.54	2.42	48.25	63.91	15.7		195	164
Vert.	2462.000	PK	84.15	27.48	14.24	44.15	2.42	84.14	-	-	carrier	115	263
Vert.	6565.344	PK	47.58	35.07	7.96	44.54	2.42	48.49	64.14	15.7		143	16

Result = Reading + Ant.Fac. + Loss (Cable+(Attenuator or Filter)(below 18 GHz)) - Gain(Amprifier) + Distance factor
Distance factor : 1 GHz - 13 GHz : 20log (3.96 m / 3.0 m) = 2.42 dB
13 GHz - 40 GHz : 20log (1.0 m / 3.0 m) = -9.54 dB

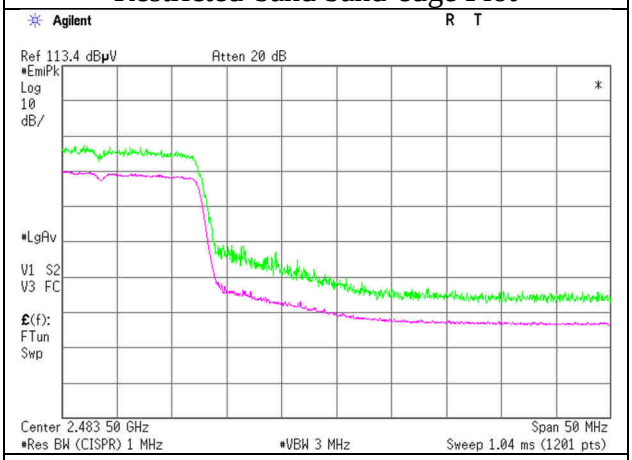
*1) The noise of 6565.344 MHz applied 15.247(d) limit (-20 dBc limit), since the noise of 6565.344 MHz was from radio circuit part.

Radiated Spurious Emission
(Reference Plot for band-edge)

Report No.	12299284S-R2
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 6, 2018
Temperature / Humidity	22 deg. C / 55 % RH
Engineer	Kazuya Noda (1 GHz – 2.8 GHz)
Mode	Tx 11n-20 2462 MHz

Horizontal

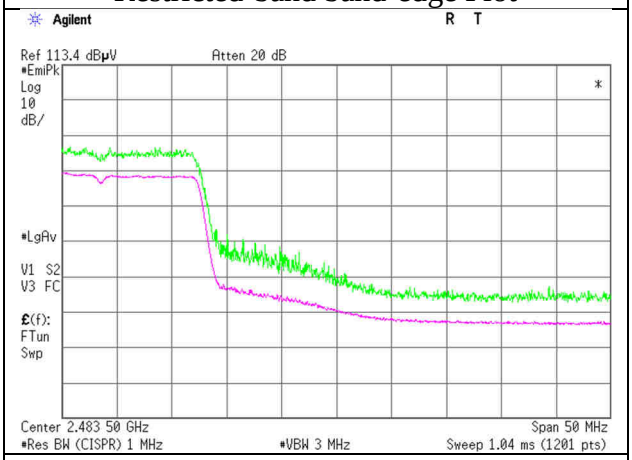
Restricted-band band-edge Plot



Trace Green : Peak Plot
Trace Purple : Average Plot

Vertical

Restricted-band band-edge Plot

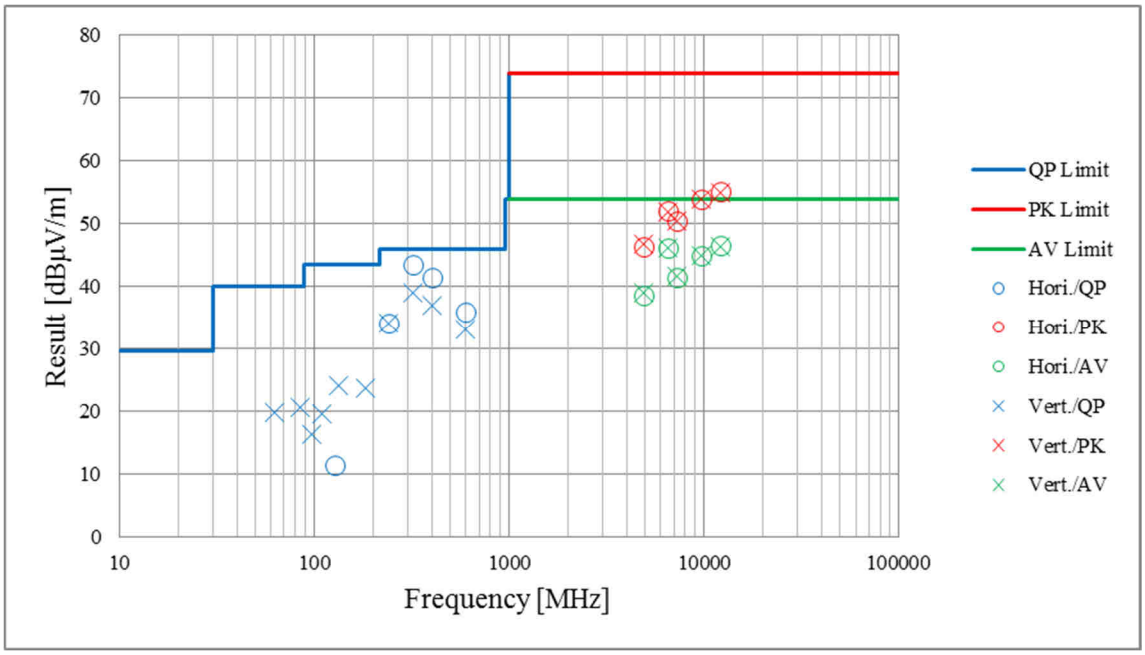


Trace Green : Peak Plot
Trace Purple : Average Plot

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

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	12299284S-R2			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.3			
Date	July 8, 2018	July 6, 2018	July 7, 2018	July 8, 2018
Temperature / Humidity	20 deg. C / 57 % RH	22 deg. C / 55 % RH	25 deg. C / 59 % RH	20 deg. C / 57 % RH
Engineer	Yasumasa Owaki (30 MHz - 1 GHz)	Kazuya Noda (1 GHz – 2.8 GHz)	Kenichi Adachi (2.8 GHz - 18 GHz)	Yasumasa Owaki (18 MHz – 26.5 GHz)
Mode	Tx 11g 2437 MHz			

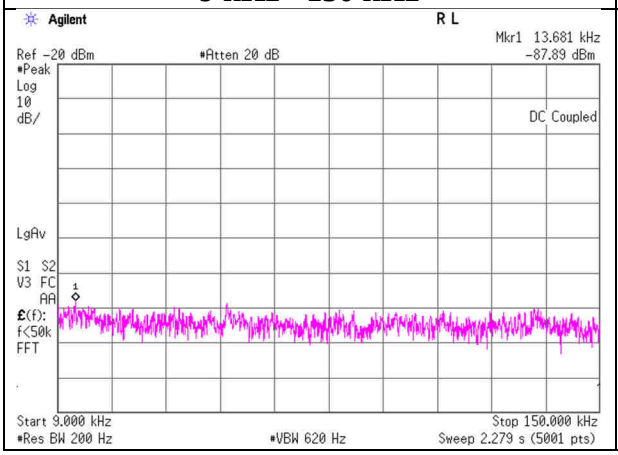


*These plots data contains sufficient number to show the trend of characteristic features for EUT.

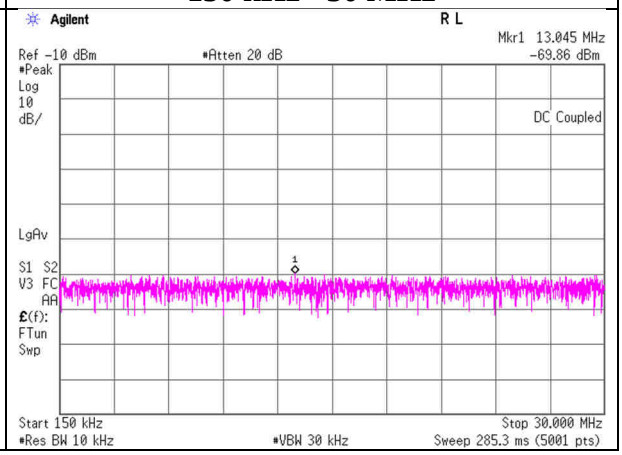
Conducted Spurious Emission

Report No.	12299284S-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	July 3, 2018
Temperature / Humidity	25 deg. C / 45 % RH
Engineer	Kazutaka Takeyama
Mode	Tx 11g 2437MHz

9 kHz - 150 kHz



150 kHz - 30 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
13.68	-87.9	0.01	9.8	2.0	1	-76.1	300	6.0	-14.8	44.8	59.6	
13045.00	-69.9	0.02	9.8	2.0	1	-58.0	30	6.0	23.2	29.5	6.3	

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 558074 since antenna gain was less than 2.0 dBi.

Power Density

Report No.	12299284S-R2
Test place	Shonan EMC Lab. No.1 Measurement Room
Date	July 3, 2018
Temperature / Humidity	25 deg. C / 45 % RH
Engineer	Kazutaka Takeyama
Mode	Tx

11b

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-21.65	1.98	9.88	-9.79	8.00	17.79
2437.00	-21.89	1.99	9.88	-10.02	8.00	18.02
2462.00	-21.87	2.00	9.88	-9.99	8.00	17.99

11g

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-24.80	1.98	9.88	-12.94	8.00	20.94
2437.00	-24.73	1.99	9.88	-12.86	8.00	20.86
2462.00	-25.42	2.00	9.88	-13.54	8.00	21.54

11n-20

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2412.00	-26.50	1.98	9.88	-14.64	8.00	22.64
2437.00	-27.39	1.99	9.88	-15.52	8.00	23.52
2462.00	-27.08	2.00	9.88	-15.20	8.00	23.20

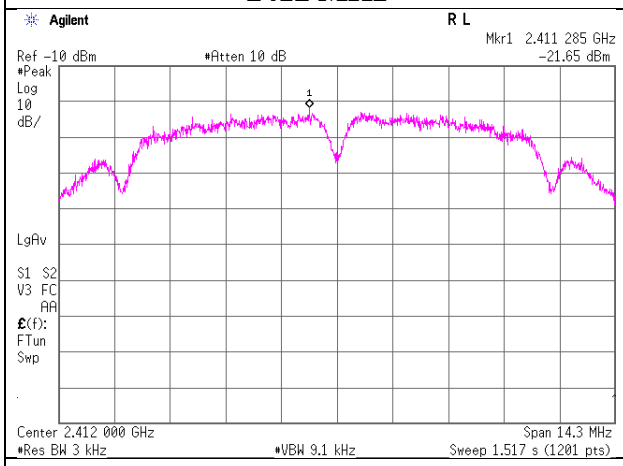
Sample Calculation:
Result = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss

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

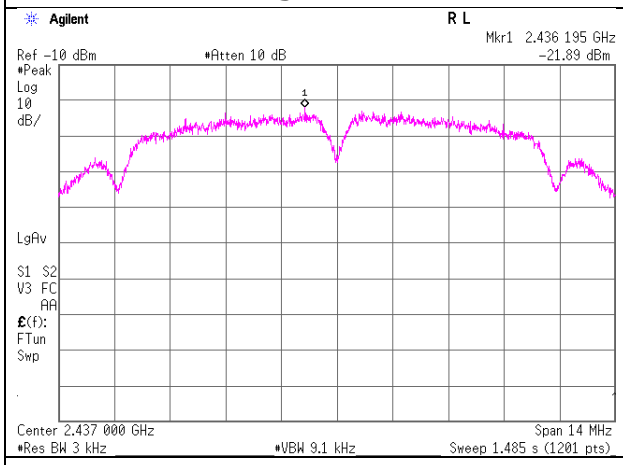
Power Density

11b

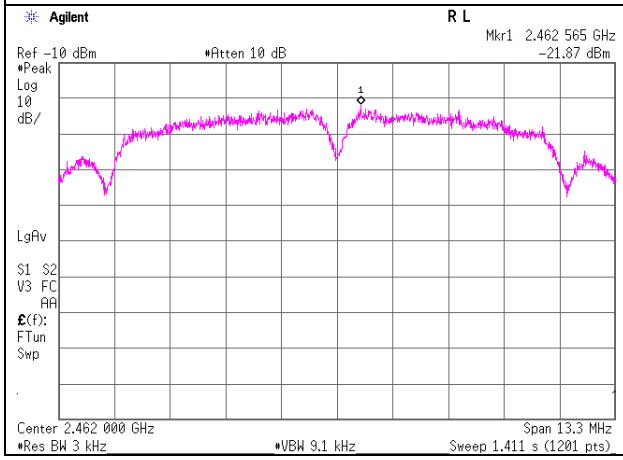
2412 MHz



2437 MHz

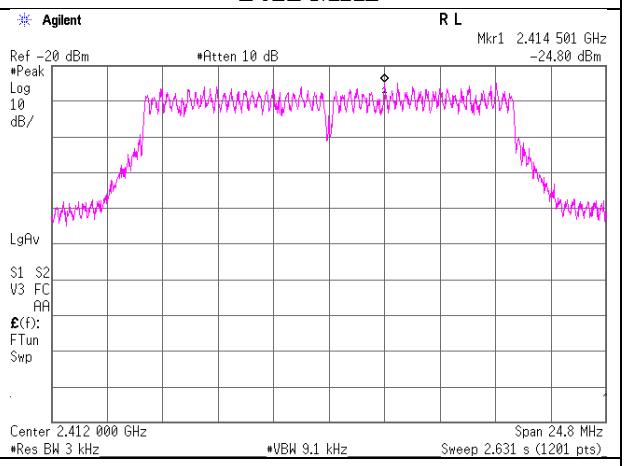


2462 MHz

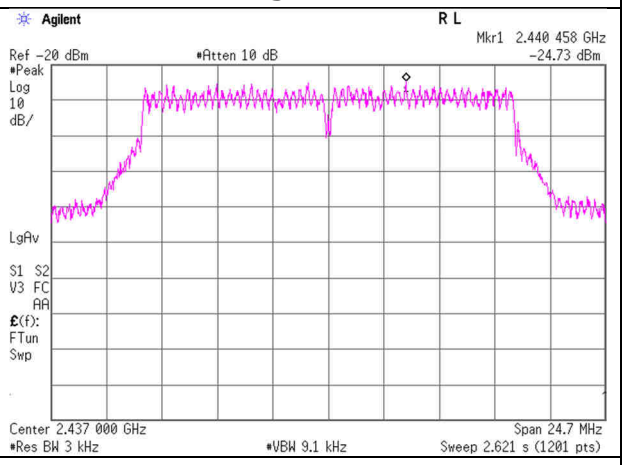


11g

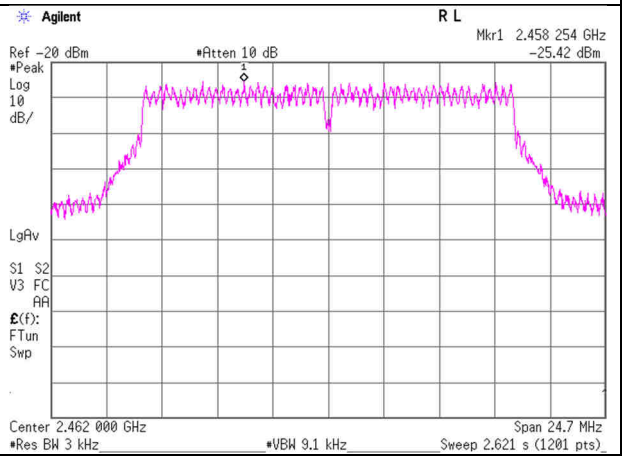
2412 MHz



2437 MHz



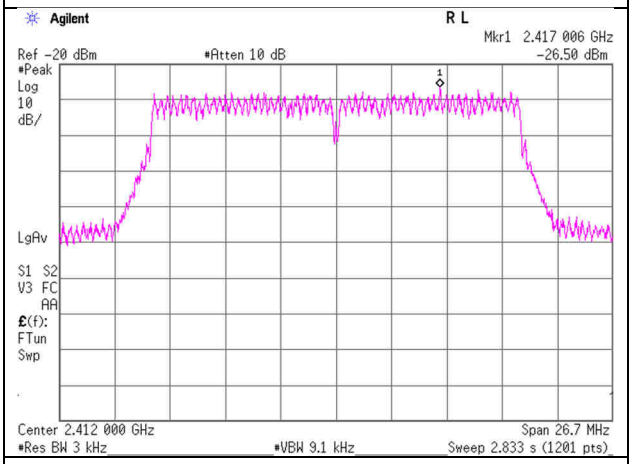
2462 MHz



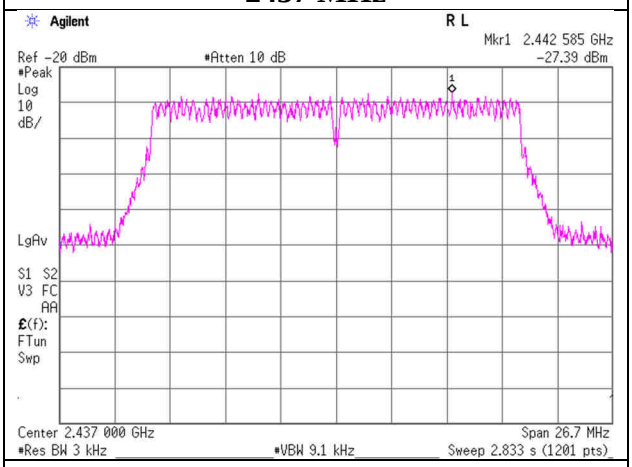
Power Density

11n-20

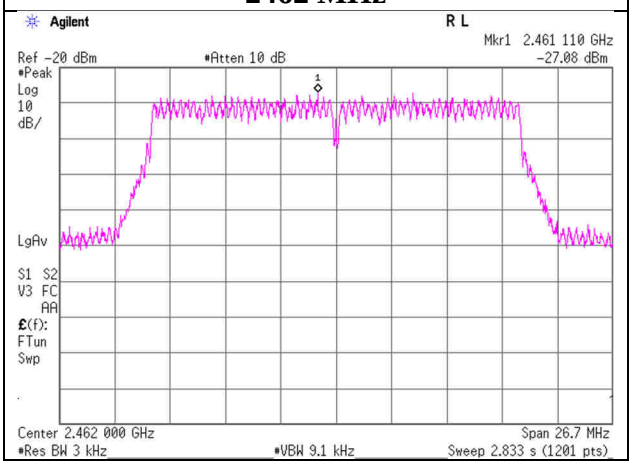
2412 MHz



2437 MHz



2462 MHz



APPENDIX 2: Test instruments

Test Instruments (1/2)

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
KTS-08	AT	145095	Digital Tester	SANWA	PC500	7019224	2018/3/5	2019/3/31	12
SAT10-13	AT	151610	Attenuator	Weinschel Corp.	54A-10	81626	2018/3/19	2019/3/31	12
SCC-G13	AT	145166	Coaxial Cable	Suhner	SUCOFLEX 102	31599/2	2018/3/19	2019/3/31	12
SCC-G32	AT	145183	Coaxial Cable	Junkosha	MWX241-02 000KMSKMS	OCT-09-13 -005	2017/11/22	2018/11/30	12
SOS-13	AT	146321	Humidity Indicator	CUSTOM	CTH-202	Q.C.17	2017/12/21	2018/12/31	12
SPM-06	AT	146267	Power Meter	ANRITSU	ML2495A	850009	2018/5/10	2019/5/31	12
SPSS-03	AT	146309	Power sensor	ANRITSU	MA2411B	917063	2018/5/10	2019/5/31	12
SRENT-09	AT	150461	Analyzer, Spectrum, Electrical	AGILENT (KEYSIGHT)	E4440A	MY461863 92	2017/11/8	2018/11/30	12
COTS-SEM I-1	RE	144865	EMI Software	TSJ	TEPTO-DV(RE,CE,RFI,M F)	-	-	-	-
SAEC-03(N SA)	RE	145565	Semi-Anechoi c Chamber	TDK	SAEC-03(NS A)	3	2018/6/2	2019/6/30	12
SAEC-03(S VSWR)	RE	145566	Semi-Anechoi c Chamber	TDK	SAEC-03(SV SWR)	3	2017/7/17	2018/7/31	12
SAF-03	RE	145126	Pre Amplifier	SONOMA	310N	290213	2018/2/16	2019/2/28	12
SAF-06	RE	145005	Pre Amplifier	Toyo Corporation	TPA0118-36	1440491	2017/9/22	2018/9/30	12
SAF-09	RE	145008	Pre Amplifier	Toyo Corporation	HAP18-26W	18	2017/9/21	2018/9/29	12
SAJ-01	RE	146103	Antenna Tilt Jig	Intelligent System Engineering Co., Ltd	Antenna Tilt Jig	T-S001	-	-	-
SAT10-06	RE	145137	Attenuator	AGILENT	8493C-010	74865	2017/11/22	2018/11/30	12
SAT6-13	RE	167094	Attenuator	JFW	50HF-006N		2018/2/9	2019/2/28	12
SBA-03	RE	145023	Biconical Antenna	Schwarzbeck	BBA9106	91032666	2018/6/17	2019/6/30	12
SCC-C1/C2 /C3/C4/C5/ C10/SRSE-03	RE	145171	Coaxial Cable&RF Selector	Fujikura/Fujikur a/Suhner/Suhner /Suhner/Suhner/ TOYO	8D2W/12DSF A/141PE/141 PE/141PE/14 1P	-/0901-271(RF Selector)	2018/4/9	2019/4/30	12
SCC-G06	RE	145173	Coaxial Cable	Junkosha	J12J102207-0 0	MAY-23-1 6-091	2018/6/1	2019/6/30	12
SCC-G07	RE	155726	Coaxial Cable	Junkosha	J12J103316-0 0-R	OCT-12-17 -054	2017/10/23	2018/10/31	12
SCC-G23	RE	145168	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	2018/5/11	2019/5/31	12
SCC-G33	RE	145184	Coaxial Cable	Junkosha	MWX241-01 000KMSKMS	-	2018/4/20	2019/4/30	12
SCC-G41	RE	151617	Coaxial Cable	Junkosha	MWX221-01 000NFSNMS/ B	1612S006	2018/1/29	2019/1/31	12
SCC-G43	RE	156380	Coaxial Cable	HUBER+SUNE R	SUCOFLEX_ 104_E	SN MY 13406/4E	2017/7/10	2018/7/31	12

Test Instruments (2/2)

Local ID	Test Name	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Calibration Interval (Month)
SCC-G45	RE	168301	Coaxial Cable	HUBER+SUNER	SUCOFLEX 102 E	800137/2EA	2018/3/28	2019/3/31	12
SFL-02	RE	145301	Highpass Filter	MICRO-TRONICS	HPM50111	51	2017/11/16	2018/11/30	12
SHA-03	RE	145501	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	2017/8/23	2018/8/31	12
SHA-05	RE	145513	Horn Antenna	ETS LINDGREN	Sep-60	LM4210	2018/3/20	2019/3/31	12
SJM-02	RE	147479	Measure	KOMELON	KMC-36	-	-	-	-
SLA-07	RE	145529	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	196	2018/6/17	2019/6/30	12
SOS-05	RE	146293	Humidity Indicator	A&D	AD-5681	4062518	2017/10/30	2018/10/31	12
SSA-02	RE	145800	Spectrum Analyzer	AGILENT	E4448A	MY48250106	2018/3/5	2019/3/31	12
STR-08	RE	150463	Test Receiver	Rohde & Schwarz	ESW44	101581	2017/11/24	2018/11/30	12
STS-03	RE	146210	Digital Hitester	HIOKI	3805-50	80997823	2017/10/16	2018/10/31	12

***Hyphens for Last Calibration Date, Calibration Due 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.
All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

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

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