



RADIO TEST REPORT

Test Report No. : 12406767S-A-R3

Applicant : TAIYO YUDEN CO., LTD.
Type of Equipment : Bluetooth low energy / ANT Module
Model No. : EYSLSN
FCC ID : RYYEYSLSN
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.
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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 12406767S-A-R2. 12406767S-A-R2 is replaced with this report.

Date of test: July 17 to August 27, 2018

Representative test engineer:

Shiro Kobayashi
Engineer
Consumer Technology Division

Approved by:

Hikaru Shirasawa
Engineer
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".

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 12406767S-A

[illegible]

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SECTION 1: Customer information

Company Name	:	TAIYO YUDEN CO., LTD.
Address	:	8-1, Sakae-cho, Takasaki-shi, Gunma 370-8522, Japan
Telephone Number	:	+81-27-324-2313
Facsimile Number	:	+81-27-324-2314
Contact Person	:	Hideki Kato

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

2.1 Identification of E.U.T.

Type of Equipment	:	Bluetooth low energy / ANT Module
Model No.	:	EYSLSN
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 1.7 V - 3.6 V, 0.02 A
Receipt Date of Sample	:	July 13, 2018
Country of Mass-production	:	Japan
Condition of EUT	:	Engineering 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: EYSLSN (referred to as the EUT in this report) is a Bluetooth low energy / ANT Module.

Radio Specification

Bluetooth Low Energy

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	GFSK
Antenna type	:	Monopole Antenna
Antenna Gain	:	-3.7 dBi
Clock frequency (Maximum)	:	32 MHz

< ANT (1 Mbps) >

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	GFSK
Antenna type	:	Monopole Antenna
Antenna Gain	:	-3.7 dBi
Clock frequency (Maximum)	:	32 MHz

< Nordic Original (2 Mbps) >

Radio Type	:	Transceiver
Frequency of Operation	:	2402 MHz - 2480 MHz
Modulation	:	GFSK
Antenna type	:	Monopole Antenna
Antenna Gain	:	-3.7 dBi
Clock frequency (Maximum)	:	32 MHz

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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	15.7 dB, 0.44137 MHz, N, AV, Tx BT LE 1 Mbps 2402 MHz	Complied	-
6dB 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)		N/A	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	0.6 dB 7440.00 MHz, AV, Hori. Tx BT LE 1 Mbps 2480 MHz (+4 dBm setting) Tx BT LE 2 Mbps 2480 MHz (+4 dBm setting)	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 RF Module has its own regulator. The RF Module is constantly provided voltage through the regulator regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

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

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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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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

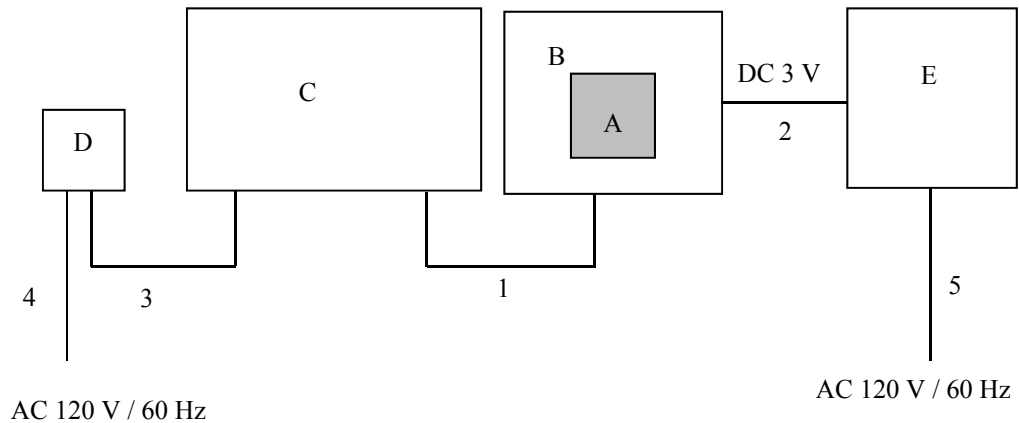
4.1 Operating Mode(s)

Mode	Remarks*
Bluetooth(BT) Low Energy (LE) 1 Mbps	Maximum Packet Size, PRBS9
Bluetooth(BT) Low Energy (LE) 2 Mbps	Maximum Packet Size, PRBS9
ANT 1 Mbps	1 Mbps
Nordic Original 2 Mbps	2 Mbps
*Power of the EUT was set by the software as follows; Power settings: +4 dBm 10_BLE_TEST_tool-BT5 (for BT LE mode) Radio_test_tool_20180709 (for ANT and Nordic Original mode except receiver blocking test) Blocking_tool (for receiver blocking test) *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)

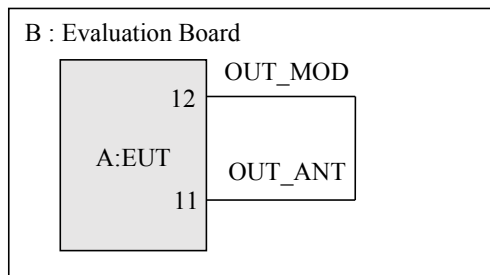
Test Item	Operating Mode	Tested frequency
Conducted Emission, Spurious Emission (Radiated) Spurious Emission (Conducted) 6dB Bandwidth Maximum Peak Output Power Power Density 99% Occupied Bandwidth	Tx BT LE 1 Mbps	2402 MHz
	Tx BT LE 2 Mbps	2440 MHz
		2480 MHz
	Tx ANT	2402 MHz
Spurious Emission (Radiated, Band-edge)	Tx Nordic Original	2441 MHz
		2480 MHz
	Tx BT LE 1 Mbps	2402 MHz
	Tx BT LE 2 Mbps	2480 MHz
	Tx ANT	
	Tx Nordic Original	

4.2 Configuration and peripherals

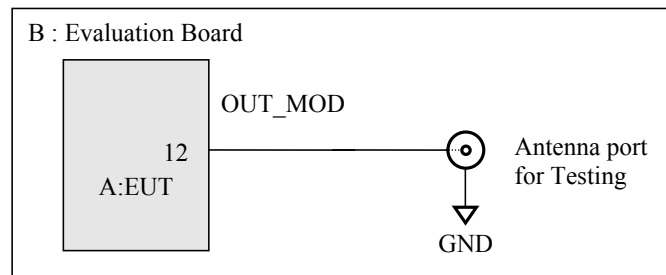


Circuit Description

For Radiated Emission



For Antenna Terminal Test



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

The circuit of the evaluation board is designed based on the complete design required by the manufacturer of the module, and nothing is included between OUT_MOD and OUT_ANT.

Description of EUT and support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Bluetooth low energy / ANT Module	EYSLSN	82 *1) 83 *2) 11 *3) 14 *4) 81 *5) 12 *6)	TAIYO YUDEN	EUT
B	Evaluation Board	TE8817	-	TAIYO YUDEN	-
C	Laptop PC	CF-T2	4CKSA46826	Panasonic	-
D	AC Adaptor	CF-AA1625A	1625AM406Z21913F	Panasonic	-
E	DC Power Supply	PAN35-10A	DE001677	Kikusui	-

*1) Used for BT LE mode (+4 dBm setting) for Antenna Terminal conducted test

*2) Used for BT LE mode (-40 dBm setting) for Antenna Terminal conducted test

*3) Used for BT LE mode (+4 dBm setting) for Radiated Emission test

*4) Used for BT LE mode (-40 dBm setting) for Radiated Emission test

*5) Used for ANT and Nordic Original mode for Antenna Terminal conducted test

*6) Used for ANT and Nordic Original mode for Radiated Emission test

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List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	1.8	Shielded	Shielded	-
2	DC Cable	0.5 + 2.0	Unshielded	Unshielded	-
3	DC Cable	1.2	Unshielded	Unshielded	-
4	AC Cable	0.8	Unshielded	Unshielded	-
5	AC Cable	1.8	Unshielded	Unshielded	-

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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 rear of tabletop was located 40 cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80 cm from a Line Impedance Stabilization Network (LISN) / Artificial mains Network (AMN) and excess AC cable was bundled in center.

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

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

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

An overview sweep with peak detection has been performed.

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

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

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, 0.5 m by 0.5 m, raised 0.8 m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

[For above 1 GHz]

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

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

The height of the measuring antenna varied between 1 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
Test Distance	3 m	3.99 m *2) (1 GHz – 13 GHz), 1 m *3) (13 GHz – 26.5 GHz)		3.99 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: $20 \times \log(3.99 \text{ m} / 3.0 \text{ m}) = 2.48 \text{ dB}$

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

- 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.

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

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

SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

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

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6dB Bandwidth	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)	-	Spectrum Analyzer *3), *4)
Peak Power Density	1.5 times the 6 dB Bandwidth	3 kHz	9.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer *5)
Conducted Spurious Emission *6)	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) Peak Power Measurement was performed based on Section 9.1.1 Method of "KDB 558074 D01 DTS Meas Guidance v04".

*4) Average Power Measurement was performed based on Section 9.2.2.4 Method AVGSA-2 of "KDB 558074 D01 DTS Meas Guidance v04".

*5) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v04".

*6) 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

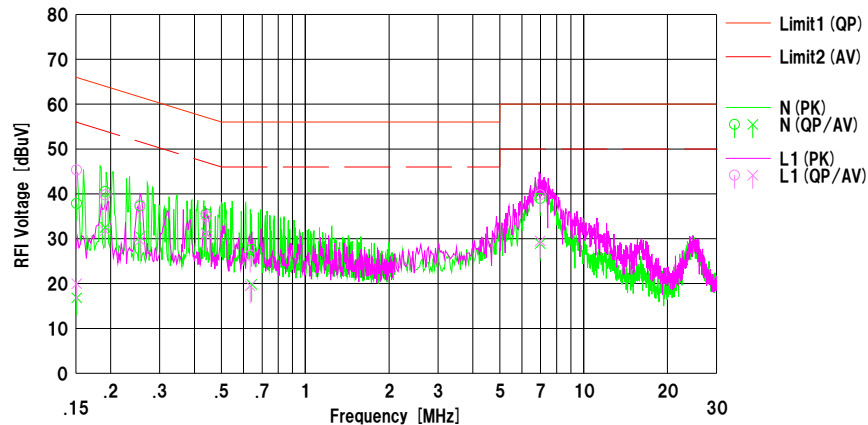
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Date : 2018/07/20

Mode : Tx BT LE 1 Mbps 2402 MHz
Power : DC 3 V (AC 120 V/60 Hz)
Temp./Humi. : 22 deg.C / 52 %RH

Remarks : -

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

Engineer : Takahiro Suzuki



No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<OP> [dBuV]	<AV> [dBuV]		<OP> [dBuV]	<AV> [dBuV]	<OP> [dBuV]	<AV> [dBuV]	<OP> [dB]	<AV> [dB]		
1	0.15108	25.45	4.42	12.39	37.84	16.81	65.94	55.94	28.1	39.1	N	
2	0.19130	28.13	20.15	12.37	40.50	32.52	63.98	53.98	23.4	21.4	N	
3	0.25523	24.86	18.13	12.39	37.25	30.52	61.59	51.59	24.3	21.0	N	
4	0.44137	23.09	18.84	12.42	35.51	31.26	57.04	47.04	21.5	15.7	N	
5	0.64241	15.13	7.38	12.45	27.58	19.83	56.00	46.00	28.4	26.1	N	
6	6.98357	26.15	16.13	12.78	38.93	28.91	60.00	50.00	21.0	21.0	N	
7	0.15108	32.94	7.57	12.39	45.33	19.96	65.94	55.94	20.6	35.9	L1	
8	0.19130	27.38	19.39	12.37	39.75	31.76	63.98	53.98	24.2	22.2	L1	
9	0.25523	25.17	17.19	12.39	37.56	29.58	61.59	51.59	24.0	22.0	L1	
10	0.44137	22.57	18.64	12.42	34.99	31.06	57.04	47.04	22.0	15.9	L1	
11	0.63399	13.86	7.04	12.45	26.31	19.49	56.00	46.00	29.6	26.5	L1	
12	6.98357	26.96	16.71	12.78	39.74	29.49	60.00	50.00	20.2	20.5	L1	

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

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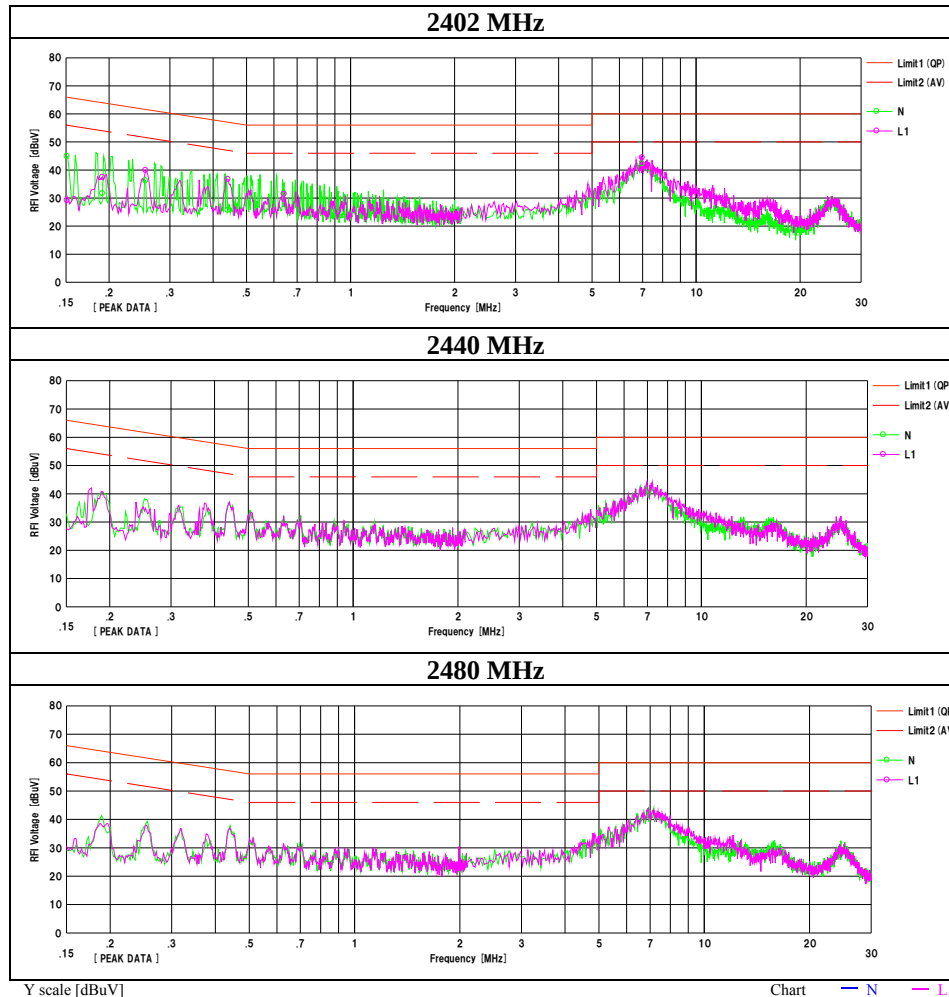
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Conducted Emission

Report No. 12406767S-A-R3
Test place Shonan EMC Lab. No.3 Shielded Room
Date July 20, 2018
Temperature / Humidity 22 deg. C / 52 % RH
Engineer Takahiro Suzuki
Mode Tx BT LE 1 Mbps



Conducted Emission

DATA OF CONDUCTED EMISSION TEST

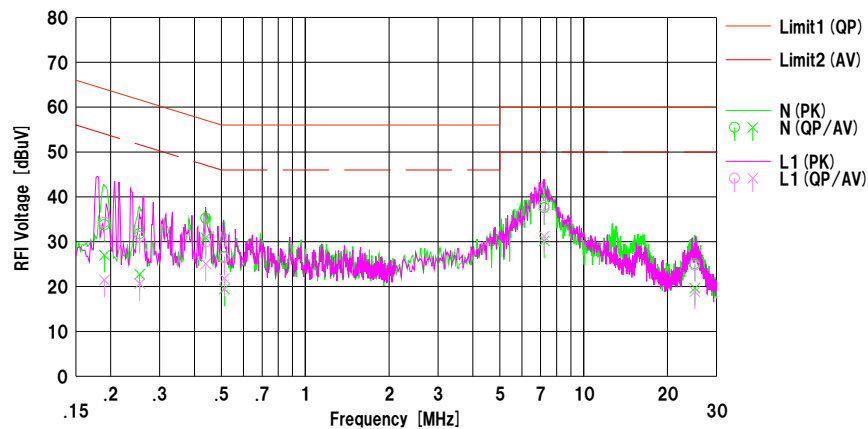
UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2018/07/20

Mode : Tx BT LE 2 Mbps 2402 MHz
Power : DC 3 V (AC 120 V/60 Hz)
Temp./Humi. : 22 deg.C / 52 %RH

Remarks : -

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

Engineer : Takahiro Suzuki

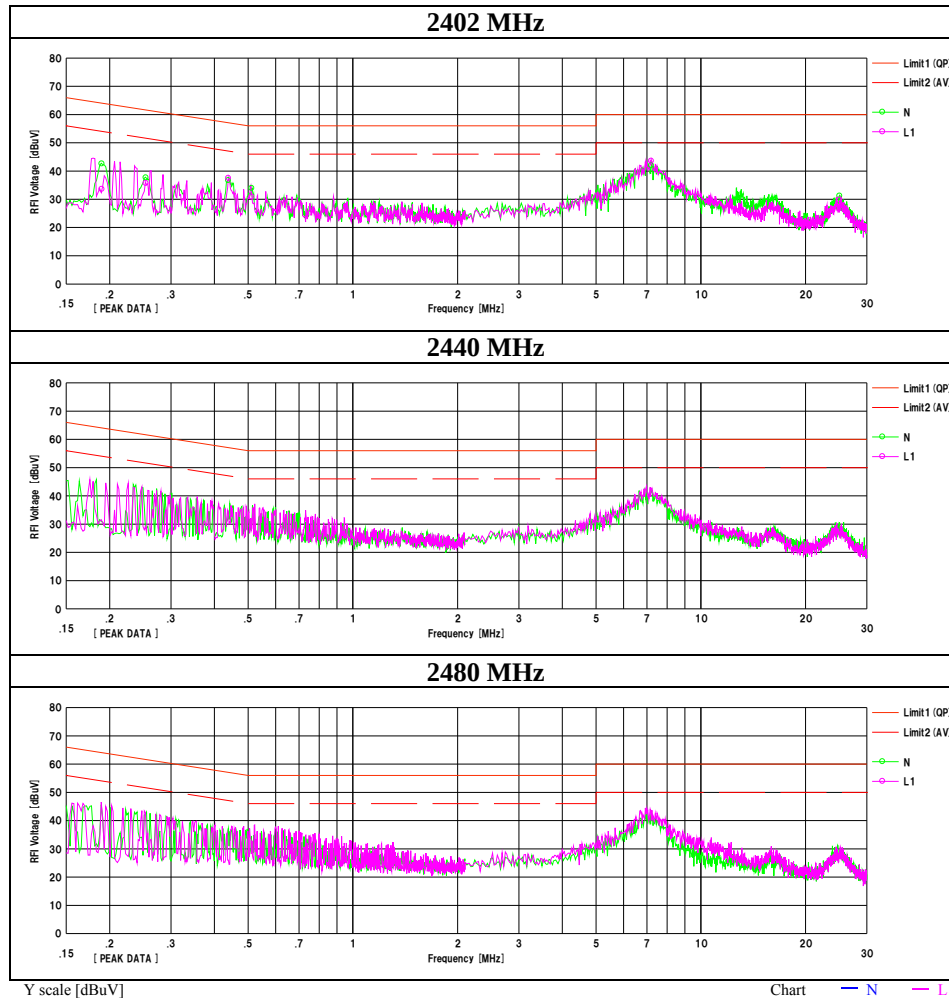


No.	Freq. [MHz]	Reading		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.19001	21.38	14.62	12.38	33.76	27.00	64.04	54.04	30.2	27.0	N	
2	0.25440	19.36	10.34	12.39	31.75	22.73	61.61	51.61	29.8	28.8	N	
3	0.43903	22.81	18.47	12.42	35.23	30.89	57.08	47.08	21.8	16.1	N	
4	0.51239	14.26	7.03	12.42	26.68	19.45	56.00	46.00	29.3	26.5	N	
5	7.21704	24.81	17.44	12.78	37.59	30.22	60.00	50.00	22.4	19.7	N	
6	25.08798	11.63	6.17	13.47	25.10	19.64	60.00	50.00	34.9	30.3	N	
7	0.19001	21.94	9.06	12.38	34.32	21.44	64.04	54.04	29.7	32.6	L1	
8	0.25440	18.77	8.26	12.39	31.16	20.65	61.61	51.61	30.4	30.9	L1	
9	0.43903	17.52	12.64	12.42	29.94	25.06	57.08	47.08	27.1	22.0	L1	
10	0.51239	14.00	9.38	12.42	26.42	21.80	56.00	46.00	29.5	24.2	L1	
11	7.21704	25.27	18.39	12.78	38.05	31.17	60.00	50.00	21.9	18.8	L1	
12	25.08798	11.25	5.38	13.47	24.72	18.85	60.00	50.00	35.2	31.1	L1	

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

Conducted Emission

Report No. 12406767S-A-R3
Test place Shonan EMC Lab. No.3 Shielded Room
Date July 20, 2018
Temperature / Humidity 22 deg. C / 52 % RH
Engineer Takahiro Suzuki
Mode Tx BT LE 2 Mbps



Conducted Emission

DATA OF CONDUCTED EMISSION TEST

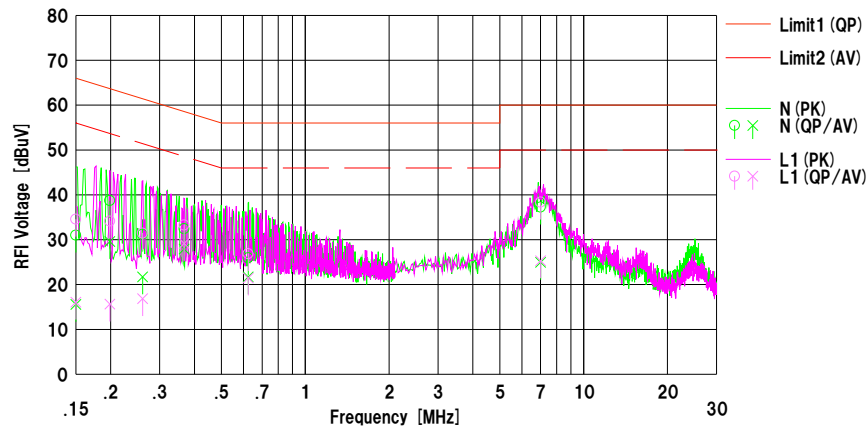
UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2018/07/20

Mode : Tx ANT 2441 MHz
Power : DC 3 V (AC 120 V/60 Hz)
Temp./Humi. : 22 deg.C / 52 %RH

Remarks : -

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

Engineer : Takahiro Suzuki

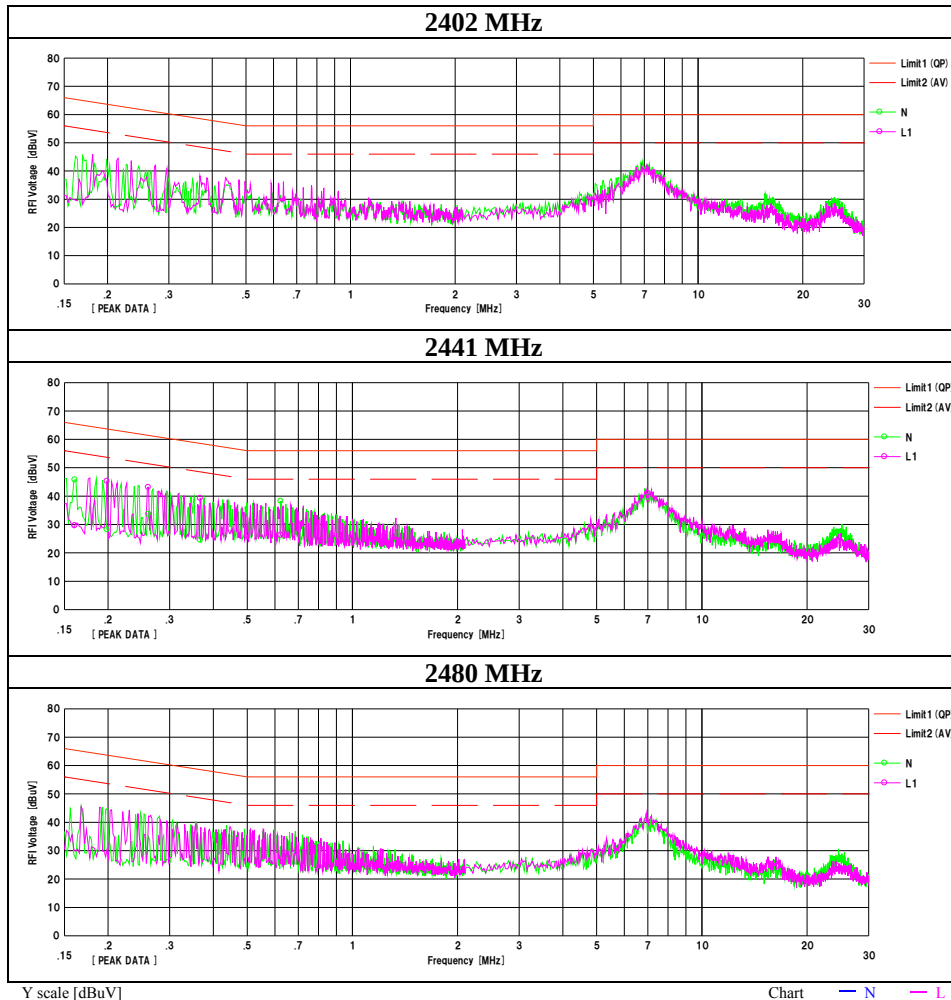


No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15000	18.62	3.15	12.39	31.01	15.54	66.00	56.00	34.9	40.4	N	
2	0.19877	26.37	17.24	12.36	38.73	29.60	63.66	53.66	24.9	24.0	N	
3	0.26062	18.83	9.31	12.39	31.22	21.70	61.41	51.41	30.1	29.7	N	
4	0.36725	20.02	15.48	12.42	32.44	27.90	58.56	48.56	26.1	20.6	N	
5	0.62411	13.52	9.25	12.44	25.96	21.69	56.00	46.00	30.0	24.3	N	
6	7.00711	24.48	12.16	12.78	37.26	24.94	60.00	50.00	22.7	25.0	N	
7	0.15000	22.17	3.66	12.39	34.56	16.05	66.00	56.00	31.4	39.9	L1	
8	0.19877	21.78	3.29	12.36	34.14	15.65	63.66	53.66	29.5	38.0	L1	
9	0.26062	19.05	4.46	12.39	31.44	16.85	61.41	51.41	29.9	34.5	L1	
10	0.36725	20.85	16.73	12.42	33.27	29.15	58.56	48.56	25.2	19.4	L1	
11	0.62411	14.42	9.03	12.44	26.86	21.47	56.00	46.00	29.1	24.5	L1	
12	7.00711	25.59	12.52	12.78	38.37	25.30	60.00	50.00	21.6	24.7	L1	

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

Conducted Emission

Report No. 12406767S-A-R3
Test place Shonan EMC Lab. No.3 Shielded Room
Date July 20, 2018
Temperature / Humidity 22 deg. C / 52 % RH
Engineer Takahiro Suzuki
Mode Tx ANT



Conducted Emission

DATA OF CONDUCTED EMISSION TEST

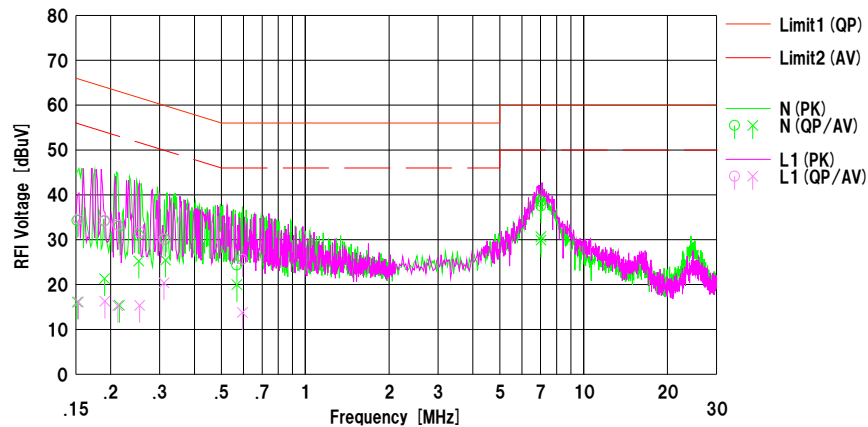
UL Japan, Inc. Shonan EMC Lab. No.3 Shielded Room
Date : 2018/07/20

Mode : Tx Nordic Original 2402 MHz
Power : DC 3 V (AC 120 V/60 Hz)
Temp./Humi. : 22 deg.C / 52 %RH

Remarks : -

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

Engineer : Takahiro Suzuki

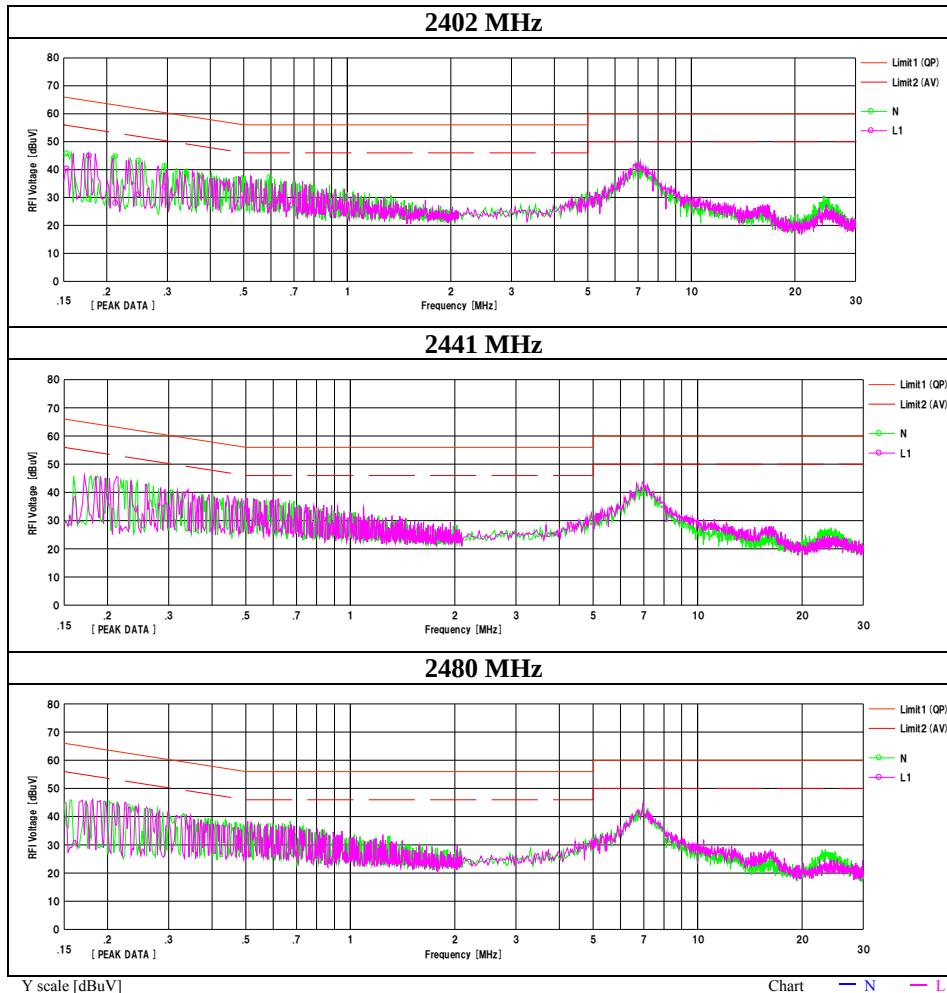


No.	Freq. [MHz]	Reading		C.Fac	Results		Limit		Margin		Phase	Comment
		<QP> [dBuV]	<AV> [dBuV]		<QP> [dBuV]	<AV> [dBuV]	<QP> [dBuV]	<AV> [dBuV]	<QP> [dB]	<AV> [dB]		
1	0.15180	21.91	3.72	12.39	34.30	18.11	65.90	55.90	31.6	39.7	N	
2	0.19010	21.76	8.93	12.38	34.14	21.31	64.03	54.03	29.8	32.7	N	
3	0.21510	20.60	3.01	12.38	32.98	15.39	63.01	53.01	30.0	37.6	N	
4	0.25243	18.61	12.84	12.39	31.00	25.23	61.68	51.68	30.6	26.4	N	
5	0.31512	17.63	13.03	12.41	30.04	25.44	59.83	49.83	29.7	24.3	N	
6	0.56811	11.90	7.57	12.43	24.33	20.00	56.00	46.00	31.6	26.0	N	
7	7.02346	25.76	17.92	12.78	38.54	30.70	60.00	50.00	21.4	19.3	N	
8	7.02598	24.73	17.12	12.78	37.51	29.90	60.00	50.00	22.4	20.1	N	
9	0.15332	22.17	3.70	12.39	34.56	16.09	65.82	55.82	31.2	39.7	L1	
10	0.19066	21.88	3.89	12.38	34.26	16.27	64.01	54.01	29.7	37.7	L1	
11	0.21221	20.90	2.93	12.37	33.27	15.30	63.12	53.12	29.8	37.8	L1	
12	0.25416	19.35	2.94	12.39	31.74	15.33	61.62	51.62	29.8	36.2	L1	
13	0.31092	17.70	7.98	12.41	30.11	20.39	59.95	49.95	29.8	29.5	L1	
14	0.59513	13.16	1.32	12.44	25.60	13.76	56.00	46.00	30.4	32.2	L1	

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

Conducted Emission

Report No. 12406767S-A-R3
Test place Shonan EMC Lab. No.3 Shielded Room
Date July 20, 2018
Temperature / Humidity 22 deg. C / 52 % RH
Engineer Takahiro Suzuki
Mode Tx Nordic Original



UL Japan, Inc.

Shonan EMC Lab.

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

Telephone : +81 463 50 6400

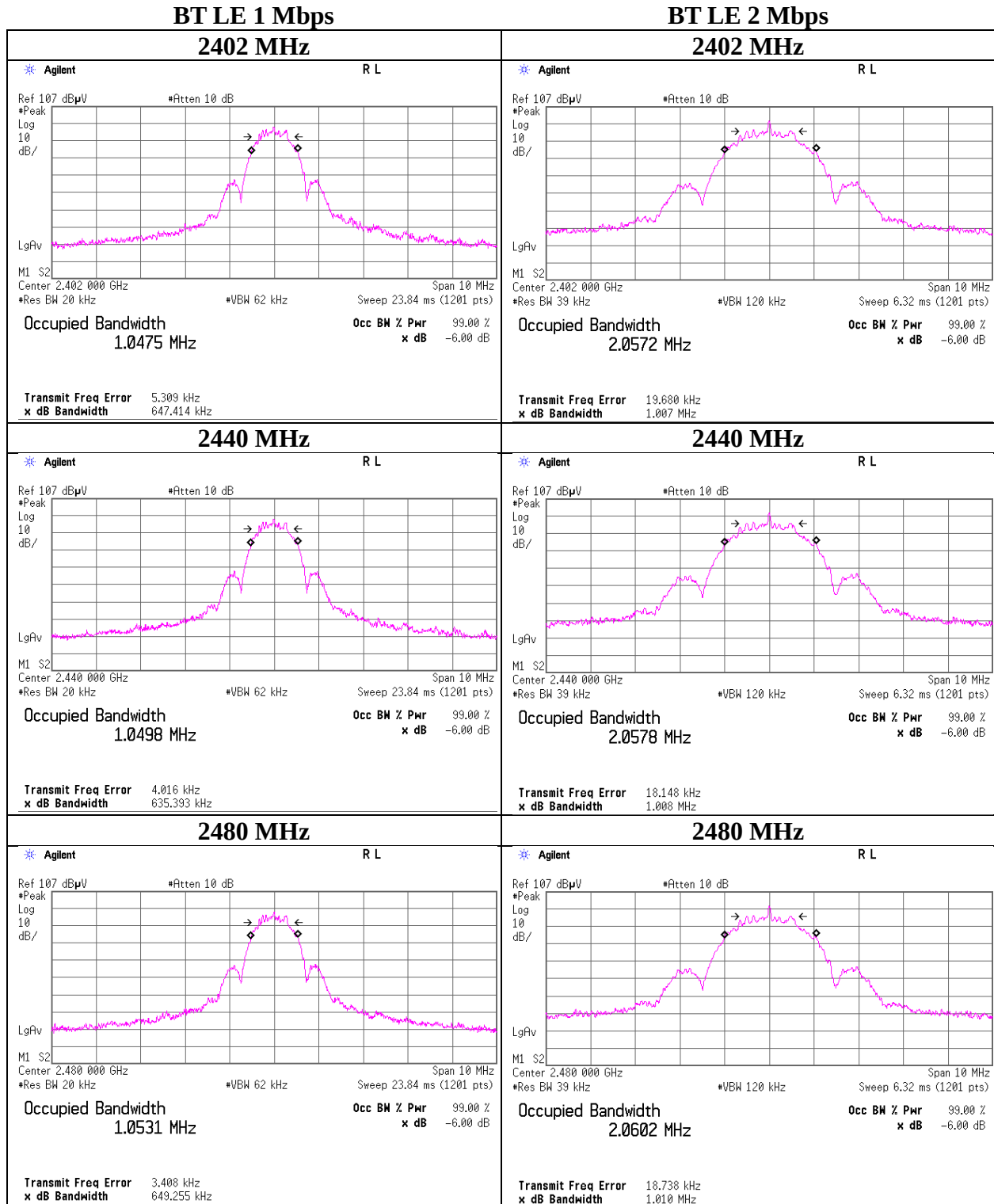
Facsimile : +81 463 50 6401

6 dB Bandwidth and 99 % Occupied Bandwidth

Report No.	12406767S-A-R3	
Test place	Shonan EMC Lab. No.5 and No.6 Shielded Room	
Date	July 17, 2018	July 20, 2018
Temperature / Humidity	26 deg. C / 47 % RH	25 deg. C / 50 % RH
Engineer	Yosuke Ishikawa	Shiro Kobayashi
Mode	Tx	

Mode	Frequency [MHz]	99% Occupied Bandwidth [kHz]	6dB Bandwidth [MHz]	Limit for 6dB Bandwidth [MHz]
BT LE 1 Mbps	2402	1047.5	0.730	> 0.5000
	2440	1049.8	0.716	> 0.5000
	2480	1053.1	0.729	> 0.5000
BT LE 2 Mbps	2402	2057.2	1.148	> 0.5000
	2440	2057.8	1.167	> 0.5000
	2480	2060.2	1.169	> 0.5000
ANT 1 Mbps	2402	879.2	0.509	> 0.5000
	2441	880.6	0.504	> 0.5000
	2480	875.9	0.506	> 0.5000
Nordic Original 2 Mbps	2402	1729.5	0.848	> 0.5000
	2441	1734.2	0.846	> 0.5000
	2480	1732.8	0.843	> 0.5000

99% Occupied Bandwidth



UL Japan, Inc.

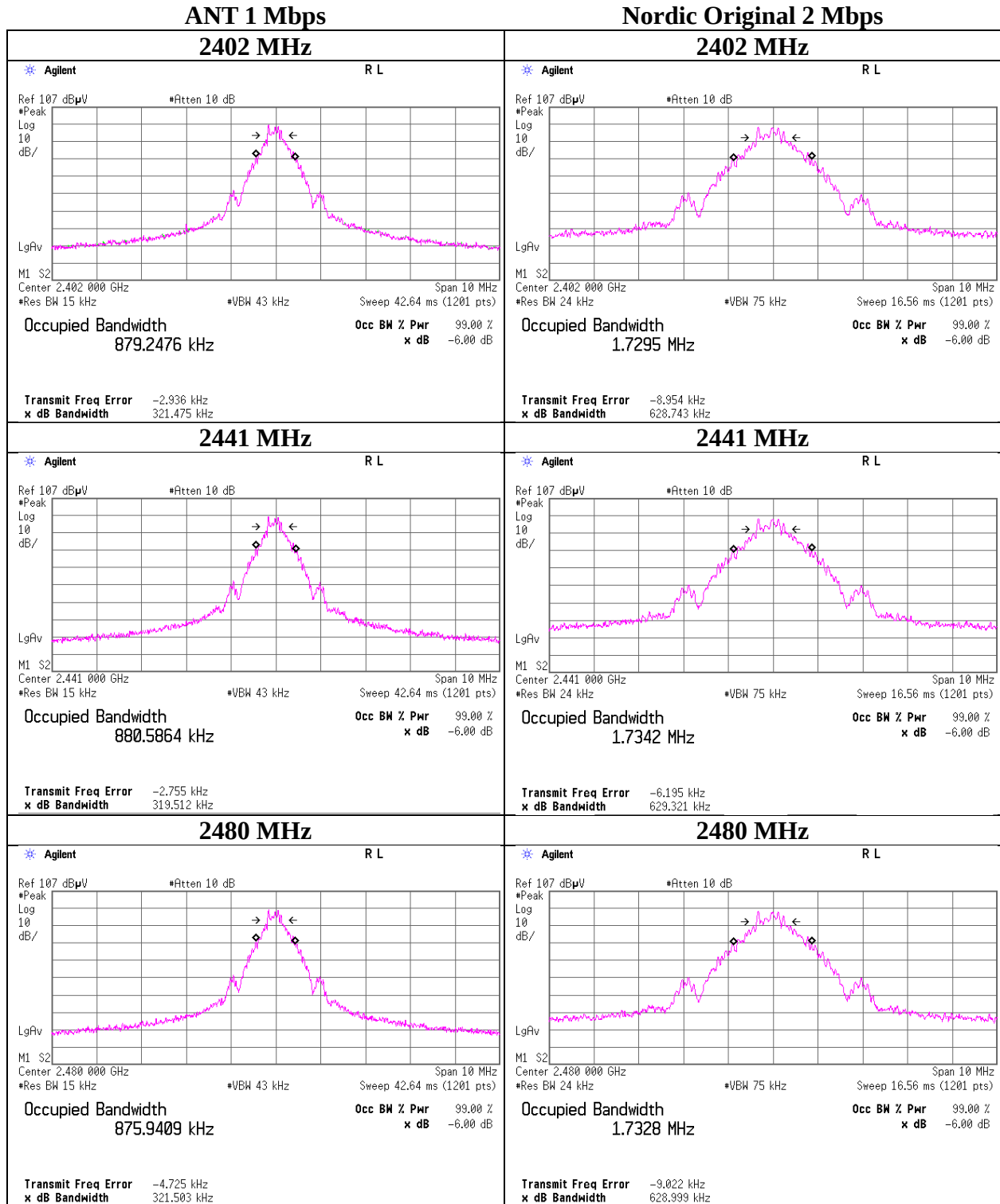
Shonan EMC Lab.

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

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

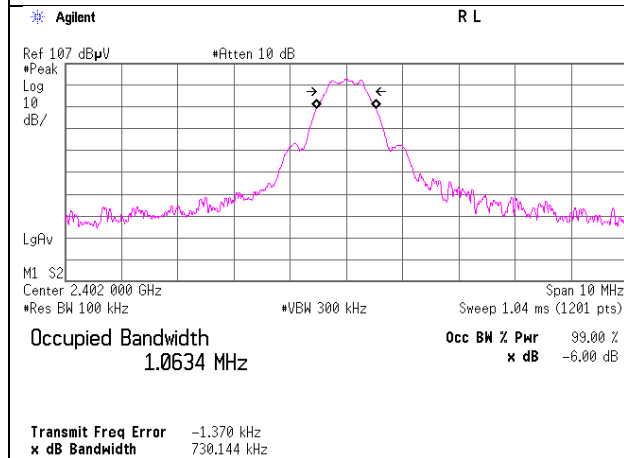
99% Occupied Bandwidth



6dB Bandwidth

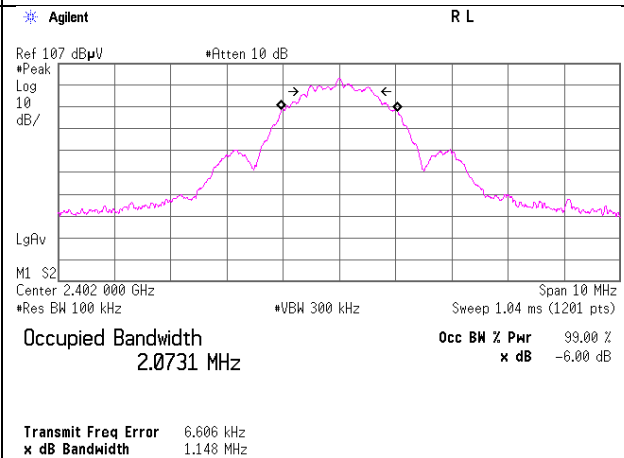
BT LE 1 Mbps

2402 MHz

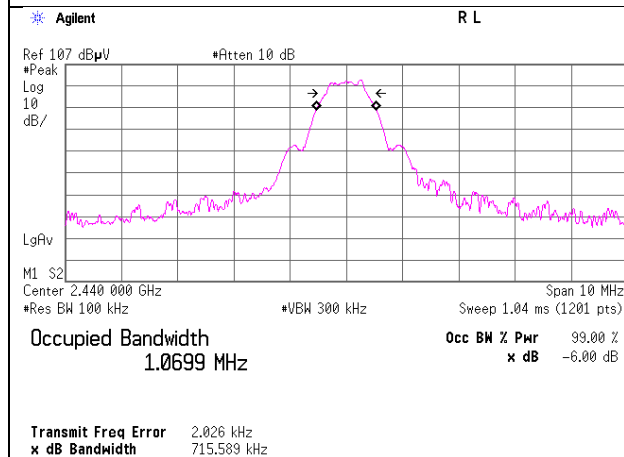


BT LE 2 Mbps

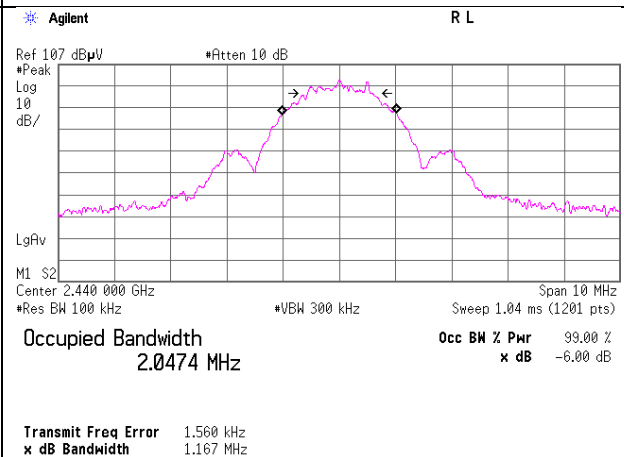
2402 MHz



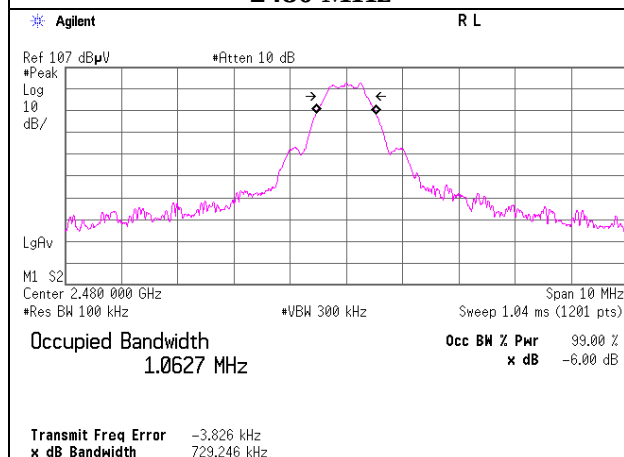
2440 MHz



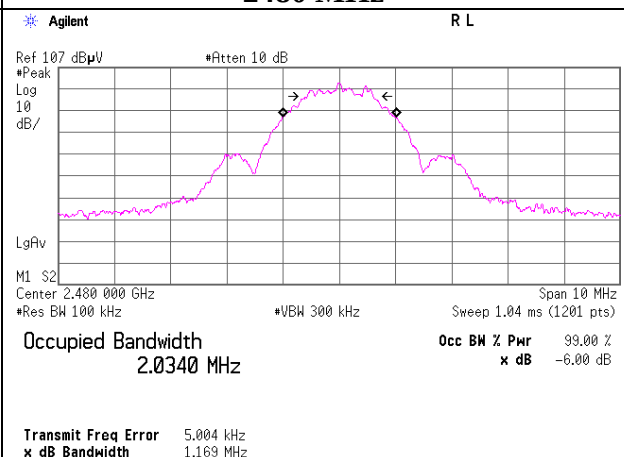
2440 MHz



2480 MHz



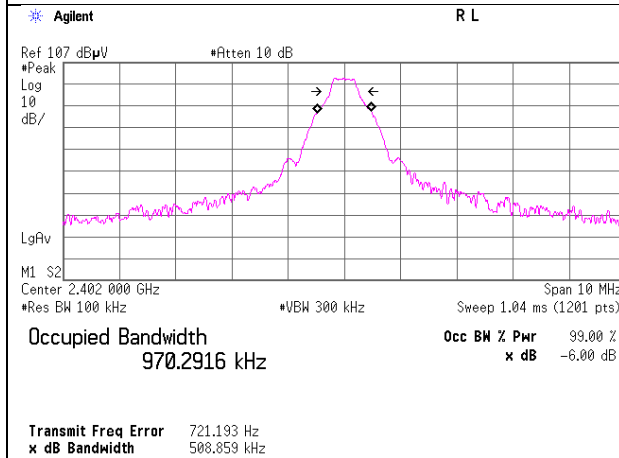
2480 MHz



6dB Bandwidth

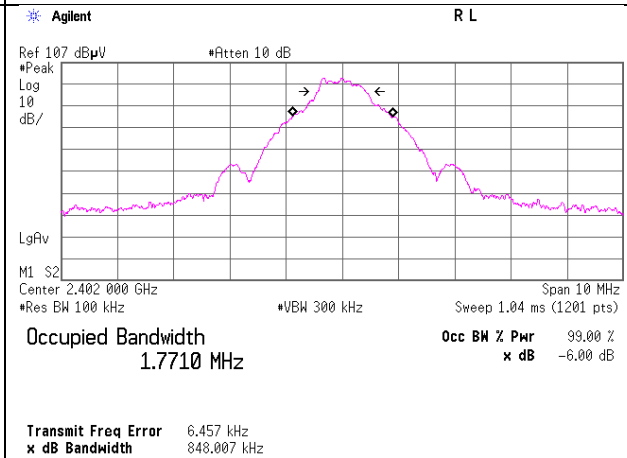
ANT 1 Mbps

2402 MHz

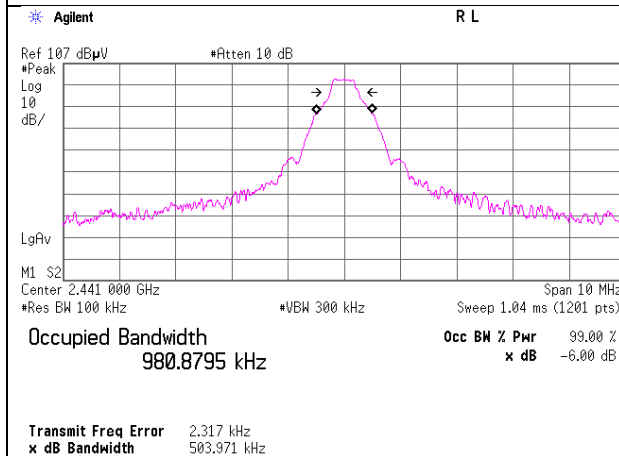


Nordic Original 2 Mbps

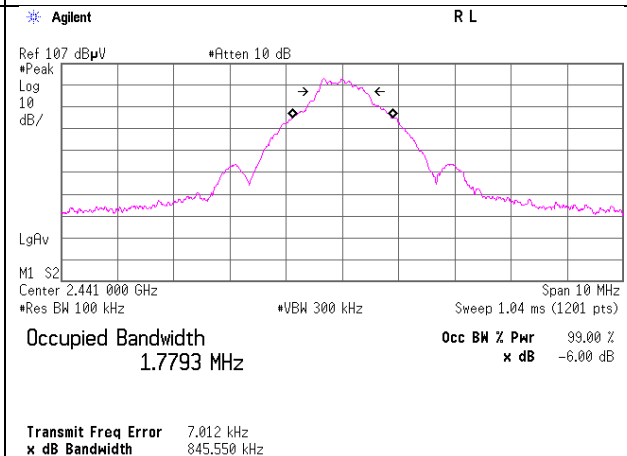
2402 MHz



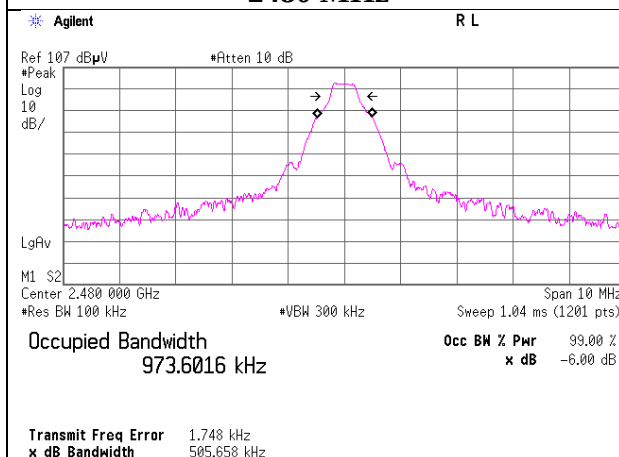
2441 MHz



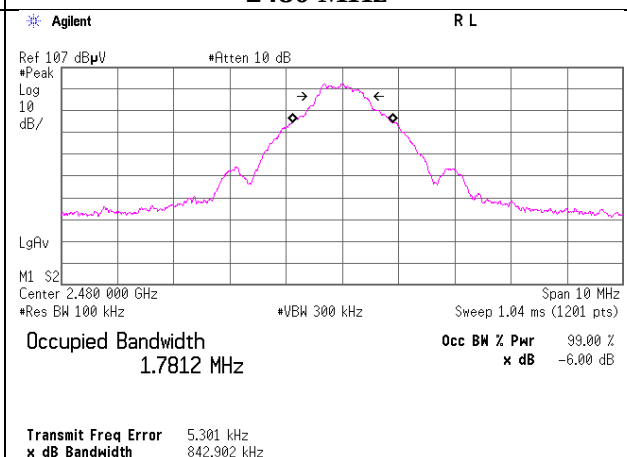
2441 MHz



2480 MHz



2480 MHz



Maximum Peak Output Power

Report No. 12406767S-A-R3
Test place Shonan EMC Lab. No.5 and No.6 Shielded Room
Date July 17, 2018 July 20, 2018 August 27, 2018
Temperature / Humidity 26 deg. C / 47 % RH 25 deg. C / 50 % RH 24 deg. C / 53 % RH
Engineer Yosuke Ishikawa Shiro Kobayashi Kazuya Noda
Mode Tx (+4 dBm Setting)

BT LE 1 Mbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-7.16	1.72	9.82	4.38	2.74	30.00	1000	25.62	-3.70	0.68	1.17	36.02	4000	35.34
2440	-7.19	1.73	9.82	4.36	2.73	30.00	1000	25.64	-3.70	0.66	1.16	36.02	4000	35.36
2480	-7.29	1.74	9.82	4.27	2.67	30.00	1000	25.73	-3.70	0.57	1.14	36.02	4000	35.45

BT LE 2 Mbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-7.03	1.74	9.82	4.53	2.84	30.00	1000	25.47	-3.70	0.83	1.21	36.02	4000	35.19
2440	-7.16	1.73	9.82	4.39	2.75	30.00	1000	25.61	-3.70	0.69	1.17	36.02	4000	35.33
2480	-7.26	1.74	9.82	4.30	2.69	30.00	1000	25.70	-3.70	0.60	1.15	36.02	4000	35.42

ANT 1 Mbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-7.25	1.72	9.82	4.29	2.69	30.00	1000	25.71	-3.70	0.59	1.15	36.02	4000	35.43
2441	-7.23	1.73	9.82	4.32	2.70	30.00	1000	25.68	-3.70	0.62	1.15	36.02	4000	35.40
2480	-7.34	1.74	9.82	4.22	2.64	30.00	1000	25.78	-3.70	0.52	1.13	36.02	4000	35.50

Nordic Original 2 Mbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-7.20	1.72	9.82	4.34	2.72	30.00	1000	25.66	-3.70	0.64	1.16	36.02	4000	35.38
2441	-7.33	1.73	9.82	4.22	2.64	30.00	1000	25.78	-3.70	0.52	1.13	36.02	4000	35.50
2480	-7.23	1.77	9.82	4.36	2.73	30.00	1000	25.64	-3.70	0.66	1.16	36.02	4000	35.36

Sample Calculation:

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

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

Maximum Peak Output Power

Report No. 12406767S-A-R3
Test place Shonan EMC Lab. No.5 and No.6 Shielded Room
Date July 17, 2018 July 20, 2018 August 27, 2018
Temperature / Humidity 26 deg. C / 47 % RH 25 deg. C / 50 % RH 24 deg. C / 53 % RH
Engineer Yosuke Ishikawa Shiro Kobayashi Kazuya Noda
Mode Tx (-40 dBm Setting)

BT LE 1 Mbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-39.21	1.72	0.00	-37.49	0.00018	30.00	1000	67.49	-3.70	-41.19	0.00008	36.02	4000	77.21
2440	-39.03	1.73	0.00	-37.30	0.00019	30.00	1000	67.30	-3.70	-41.00	0.00008	36.02	4000	77.02
2480	-38.86	1.74	0.00	-37.12	0.00019	30.00	1000	67.12	-3.70	-40.82	0.00008	36.02	4000	76.84

BT LE 2 Mbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-39.15	1.72	0.00	-37.43	0.00018	30.00	1000	67.43	-3.70	-41.13	0.00008	36.02	4000	77.15
2440	-38.96	1.73	0.00	-37.23	0.00019	30.00	1000	67.23	-3.70	-40.93	0.00008	36.02	4000	76.95
2480	-38.79	1.74	0.00	-37.05	0.00020	30.00	1000	67.05	-3.70	-40.75	0.00008	36.02	4000	76.77

ANT 1 Mbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-39.38	1.72	0.00	-37.66	0.00017	30.00	1000	67.66	-3.70	-41.36	0.00007	36.02	4000	77.38
2441	-39.02	1.76	0.00	-37.26	0.00019	30.00	1000	67.26	-3.70	-40.96	0.00008	36.02	4000	76.98
2480	-38.91	1.77	0.00	-37.14	0.00019	30.00	1000	67.14	-3.70	-40.84	0.00008	36.02	4000	76.86

Nordic Original 2 Mbps				Conducted Power					e.i.r.p. for RSS-247					
Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result		Limit		Margin [dB]	Antenna Gain [dBi]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]			[dBm]	[mW]	[dBm]	[mW]	
2402	-39.32	1.72	0.00	-37.60	0.00017	30.00	1000	67.60	-3.70	-41.30	0.00007	36.02	4000	77.32
2441	-39.29	1.73	0.00	-37.56	0.00018	30.00	1000	67.56	-3.70	-41.26	0.00007	36.02	4000	77.28
2480	-38.89	1.74	0.00	-37.15	0.00019	30.00	1000	67.15	-3.70	-40.85	0.00008	36.02	4000	76.87

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.

Average Output Power (Reference data for RF Exposure)

Report No. 12406767S-A-R3
Test place Shonan EMC Lab. No.5 and No.6 Shielded Room
Date July 17, 2018 July 20, 2018 August 27, 2018
Temperature / Humidity 26 deg. C / 47 % RH 25 deg. C / 50 % RH 24 deg. C / 53 % RH
Engineer Yosuke Ishikawa Shiro Kobayashi Kazuya Noda
Mode Tx (+4 dBm Setting)

BT LE 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]
2402	-7.88	1.72	9.82	3.66	2.32	0.67	4.33	2.71
2440	-8.23	1.73	9.82	3.32	2.15	0.67	3.99	2.51
2480	-8.29	1.74	9.82	3.27	2.12	0.67	3.94	2.48

BT LE 2 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]
2402	-9.60	1.74	9.82	1.96	1.57	2.38	4.34	2.72
2440	-9.84	1.73	9.82	1.71	1.48	2.38	4.09	2.56
2480	-9.65	1.74	9.82	1.91	1.55	2.38	4.29	2.69

ANT 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]
2402	-7.61	1.72	9.82	3.93	2.47	0.22	4.15	2.60
2441	-7.51	1.73	9.82	4.04	2.54	0.22	4.26	2.67
2480	-7.90	1.74	9.82	3.66	2.32	0.22	3.88	2.44

Nordic Original 2 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]
2402	-7.64	1.72	9.82	3.90	2.45	0.44	4.34	2.72
2441	-7.83	1.73	9.82	3.72	2.36	0.44	4.16	2.61
2480	-7.76	1.77	9.82	3.83	2.42	0.44	4.27	2.67

Sample Calculation:

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

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

Average Output Power (Reference data for RF Exposure)

Report No. 12406767S-A-R3
Test place Shonan EMC Lab. No.5 and No.6 Shielded Room
Date July 17, 2018 July 20, 2018 August 27, 2018
Temperature / Humidity 26 deg. C / 47 % RH 25 deg. C / 50 % RH 24 deg. C / 53 % RH
Engineer Yosuke Ishikawa Shiro Kobayashi Kazuya Noda
Mode Tx (-40 dBm Setting)

BT LE 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]
2402	-40.25	1.72	0.00	-38.53	0.000140	0.67	-37.86	0.000164
2440	-40.07	1.73	0.00	-38.34	0.000147	0.67	-37.67	0.000171
2480	-40.09	1.74	0.00	-38.35	0.000146	0.67	-37.68	0.000171

BT LE 2 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]
2402	-41.92	1.72	0.00	-40.20	0.000095	2.38	-37.82	0.000165
2440	-41.80	1.73	0.00	-40.07	0.000098	2.38	-37.69	0.000170
2480	-41.70	1.74	0.00	-39.96	0.000101	2.38	-37.58	0.000175

ANT 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]
2402	-40.28	1.72	0.00	-38.56	0.000139	0.22	-38.34	0.000147
2441	-39.58	1.76	0.00	-37.82	0.000165	0.22	-37.60	0.000174
2480	-39.38	1.77	0.00	-37.61	0.000173	0.22	-37.39	0.000182

Nordic Original 2 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]
2402	-40.52	1.72	0.00	-38.80	0.000132	0.44	-38.36	0.000146
2441	-40.01	1.73	0.00	-38.28	0.000149	0.44	-37.84	0.000164
2480	-40.11	1.74	0.00	-38.37	0.000146	0.44	-37.93	0.000161

Sample Calculation:

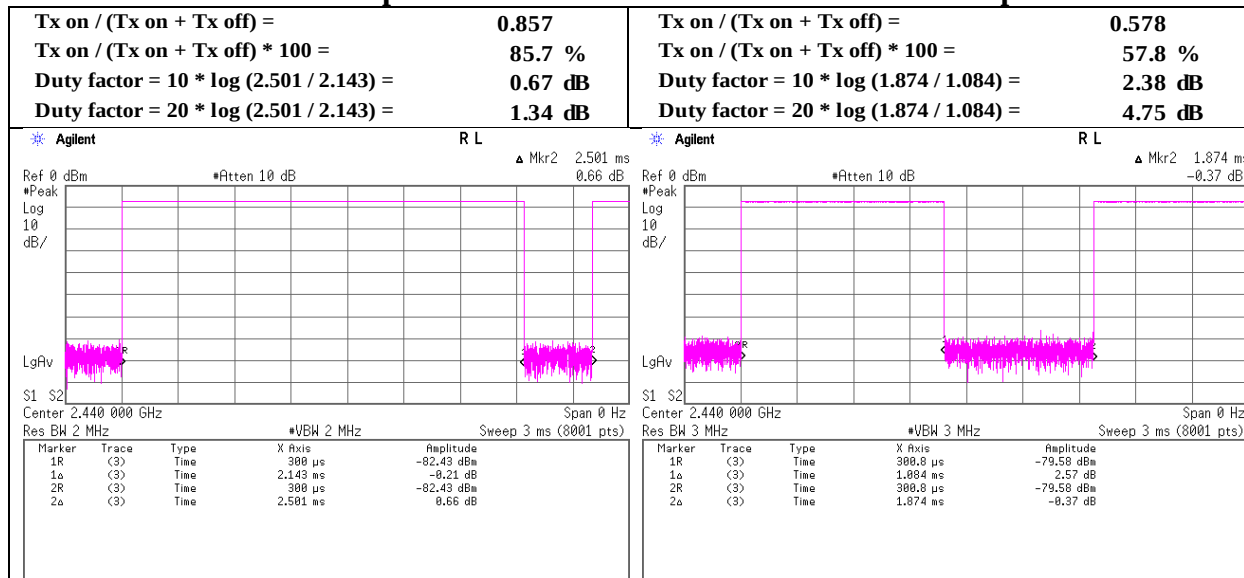
Result (Time average) = Reading + Cable Loss (including the cable(s) customer supplied) + Attenuator Loss
Result (Burst power average) = Time average + Duty factor

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

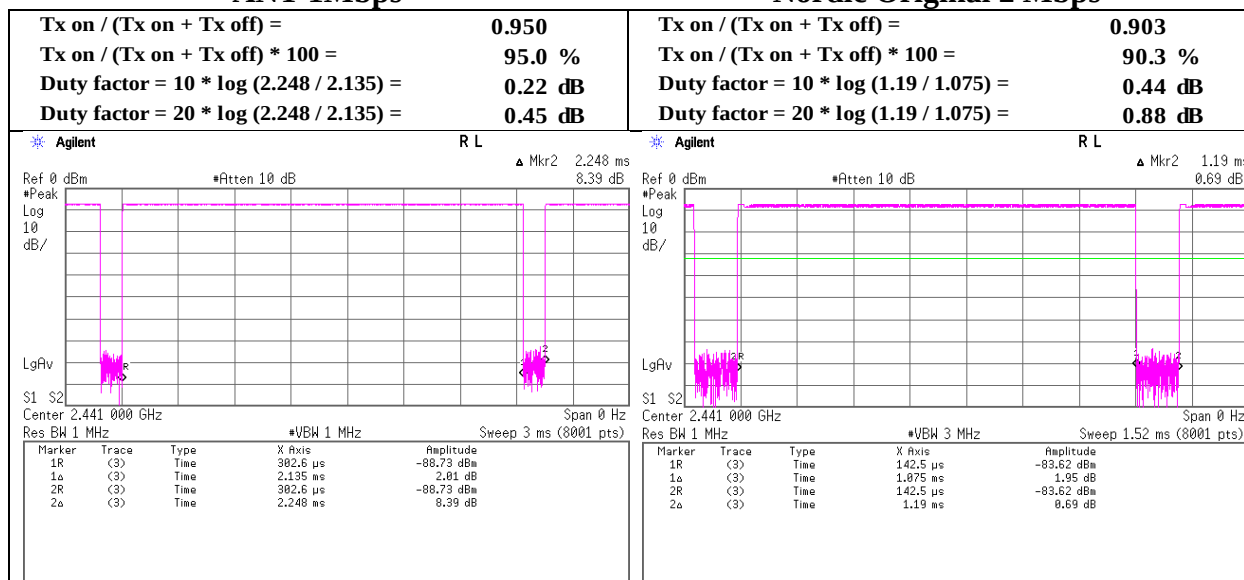
Burst rate confirmation

Report No. 12406767S-A-R3
Test place Shonan EMC Lab. No.5 Shielded Room
Date July 17, 2018
Temperature / Humidity 26 deg. C / 47 % RH
Engineer Yosuke Ishikawa
Mode Tx

BTLE 1Mbps



ANT 1Mbps



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

UL Japan, Inc.

Shonan EMC Lab.

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Radiated Spurious Emission

Report No. 12406767S-A-R3
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1 No.3 No.3 No.3
Date July 21, 2018 July 18, 2018 July 19, 2018 July 20, 2018
Temperature / Humidity 21 deg. C / 54 % RH 22 deg. C / 52 % RH 23 deg. C / 56 % RH 23 deg. C / 53 % RH
Engineer Shiro Kobayashi Takahiro Suzuki Takahiro Suzuki Takahiro Suzuki
(30 MHz - 1000 MHz) (1 GHz - 13 GHz) (13 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx BT LE 1 Mbps 2402 MHz (+4 dBm setting)

(* 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.	33.062	QP	21.97	17.50	7.19	31.84	0.00	14.82	40.00	25.1	100	1	
Hori.	100.890	QP	21.48	10.39	8.17	31.81	0.00	8.23	43.50	35.2	100	1	
Hori.	435.196	QP	21.07	16.26	7.63	31.87	0.00	13.09	46.00	32.9	100	2	
Hori.	919.983	QP	20.46	22.10	9.73	31.21	0.00	21.08	46.00	24.9	150	2	
Hori.	2390.000	PK	49.20	27.26	14.09	44.13	2.48	48.90	73.90	25.0	160	1	
Hori.	4804.000	PK	49.38	31.40	6.42	44.45	2.48	45.23	73.90	28.6	167	336	
Hori.	7206.000	PK	54.28	36.56	8.24	43.99	2.48	57.57	73.90	16.3	100	330	
Hori.	9608.000	PK	50.28	38.61	9.14	43.83	2.48	56.68	73.90	17.2	102	356	
Vert.	35.781	QP	21.90	16.41	7.24	31.83	0.00	13.72	40.00	26.2	100	1	
Vert.	174.336	QP	21.43	15.85	8.95	31.78	0.00	14.45	43.50	29.0	100	2	
Vert.	512.008	QP	21.28	17.77	7.97	31.93	0.00	15.09	46.00	30.9	100	2	
Vert.	595.225	QP	21.13	19.20	8.30	32.01	0.00	16.62	46.00	29.3	100	1	
Vert.	2390.000	PK	50.02	27.26	14.09	44.13	2.48	49.72	73.90	24.1	156	257	
Vert.	4804.000	PK	51.15	31.40	6.42	44.45	2.48	47.00	73.90	26.9	135	126	
Vert.	7206.000	PK	54.89	36.56	8.24	43.99	2.48	58.18	73.90	15.7	144	330	
Vert.	9608.000	PK	50.59	38.61	9.14	43.83	2.48	56.99	73.90	16.9	159	344	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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	39.93	27.26	14.09	44.13	1.34	2.48	40.97	53.90	12.9	*1)
Hori.	4804.000	AV	41.22	31.40	6.42	44.45	1.34	2.48	38.41	53.90	15.5	
Hori.	7206.000	AV	46.79	36.56	8.24	43.99	1.34	2.48	51.42	53.90	2.5	
Hori.	9608.000	AV	42.23	38.61	9.14	43.83	1.34	2.48	49.97	53.90	3.9	
Vert.	2390.000	AV	40.80	27.26	14.09	44.13	1.34	2.48	41.84	53.90	12.1	*1)
Vert.	4804.000	AV	39.47	31.40	6.42	44.45	1.34	2.48	36.66	53.90	17.2	
Vert.	7206.000	AV	44.97	36.56	8.24	43.99	1.34	2.48	49.60	53.90	4.3	
Vert.	9608.000	AV	39.63	38.61	9.14	43.83	1.34	2.48	47.37	53.90	6.5	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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.	2402.000	PK	89.31	27.29	14.10	44.14	2.48	89.04	-	-	
Hori.	2400.000	PK	41.79	27.29	14.10	44.14	2.48	41.52	69.04	27.5	
Vert.	2402.000	PK	91.06	27.29	14.10	44.14	2.48	90.79	-	-	
Vert.	2400.000	PK	39.14	27.29	14.10	44.14	2.48	38.87	70.79	31.9	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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

UL Japan, Inc.

Shonan EMC Lab.

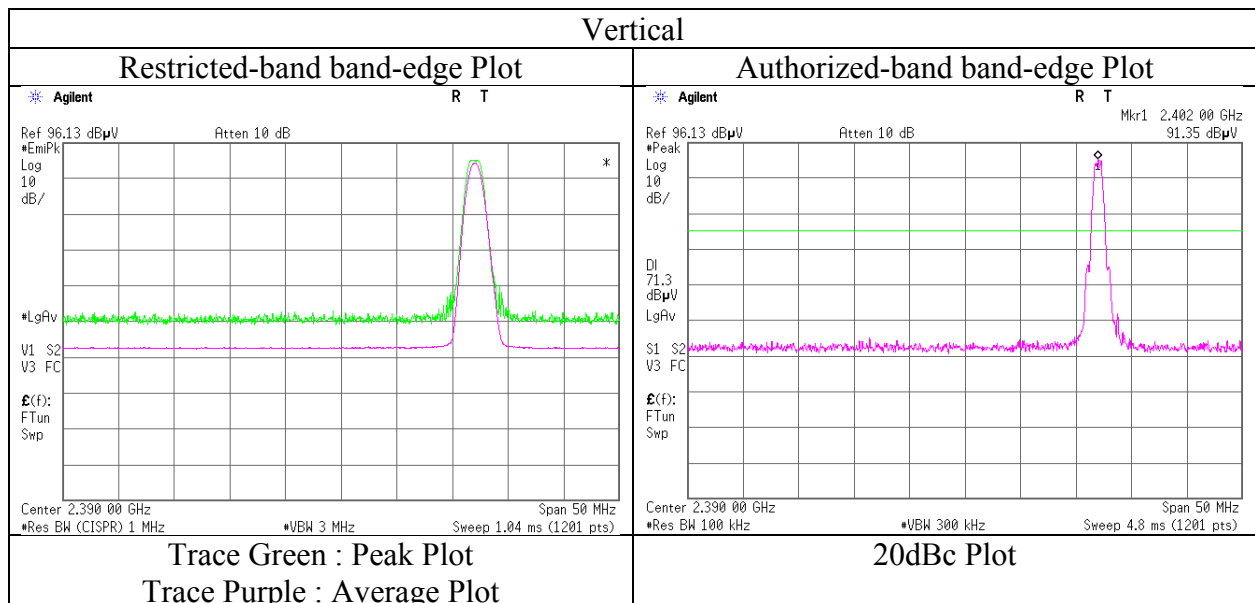
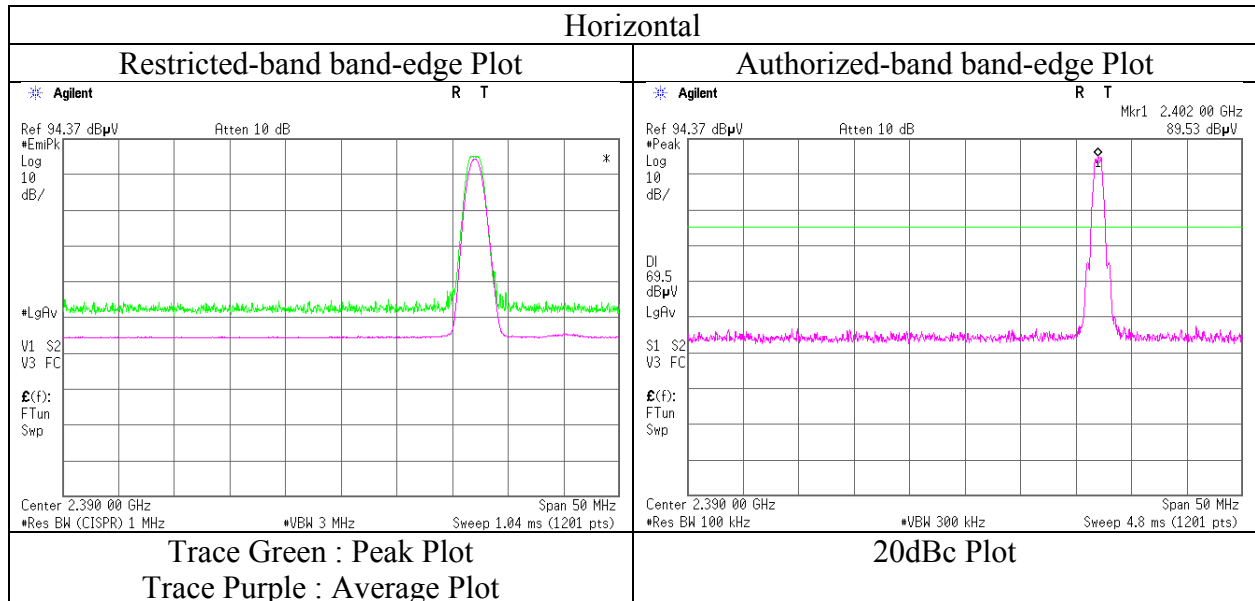
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Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12406767S-A-R3
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 18, 2018
Temperature / Humidity	22 deg. C / 52 % RH
Engineer	Takahiro Suzuki
	(1 GHz – 13 GHz)
Mode	Tx BT LE 1 Mbps 2402 MHz (+4 dBm setting)



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

Radiated Spurious Emission

Report No. 12406767S-A-R3
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1 No.3 No.3 No.3
Date July 21, 2018 July 18, 2018 July 19, 2018 July 20, 2018
Temperature / Humidity 21 deg. C / 54 % RH 22 deg. C / 52 % RH 23 deg. C / 56 % RH 23 deg. C / 53 % RH
Engineer Shiro Kobayashi Takahiro Suzuki Takahiro Suzuki Takahiro Suzuki
(30 MHz - 1000 MHz) (1 GHz - 13 GHz) (13 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx BT LE 1 Mbps 2440 MHz (+4 dBm setting)

(* 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.	33.061	QP	22.03	17.50	7.19	31.84	0.00	14.88	40.00	25.1	100	1	
Hori.	100.891	QP	21.48	10.39	8.17	31.81	0.00	8.23	43.50	35.2	100	2	
Hori.	435.172	QP	21.06	16.26	7.63	31.87	0.00	13.08	46.00	32.9	100	1	
Hori.	919.970	QP	20.41	22.10	9.73	31.21	0.00	21.03	46.00	24.9	100	1	
Hori.	4880.000	PK	47.78	31.61	6.45	44.48	2.48	43.84	73.90	30.0	137	357	
Hori.	7320.000	PK	53.11	36.76	8.32	44.03	2.48	56.64	73.90	17.2	123	320	
Hori.	9760.000	PK	48.46	38.79	9.17	43.85	2.48	55.05	73.90	18.8	122	204	
Vert.	35.787	QP	21.97	16.40	7.24	31.83	0.00	13.78	40.00	26.2	100	2	
Vert.	174.341	QP	21.45	15.85	8.95	31.78	0.00	14.47	43.50	29.0	100	2	
Vert.	512.019	QP	21.37	17.77	7.97	31.93	0.00	15.18	46.00	30.8	100	1	
Vert.	595.232	QP	21.27	19.20	8.30	32.01	0.00	16.76	46.00	29.2	100	2	
Vert.	4880.000	PK	48.76	31.61	6.45	44.48	2.48	44.82	73.90	29.0	139	84	
Vert.	7320.000	PK	52.08	36.76	8.32	44.03	2.48	55.61	73.90	18.2	146	342	
Vert.	9760.000	PK	48.59	38.79	9.17	43.85	2.48	55.18	73.90	18.7	114	3	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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.	4880.000	AV	40.13	31.61	6.45	44.48	1.34	2.48	37.53	53.90	16.4	
Hori.	7320.000	AV	46.65	36.76	8.32	44.03	1.34	2.48	51.52	53.90	2.4	
Hori.	9760.000	AV	40.49	38.79	9.17	43.85	1.34	2.48	48.42	53.90	5.5	
Vert.	4880.000	AV	39.82	31.61	6.45	44.48	1.34	2.48	37.22	53.90	16.7	
Vert.	7320.000	AV	44.66	36.76	8.32	44.03	1.34	2.48	49.53	53.90	4.4	
Vert.	9760.000	AV	40.05	38.79	9.17	43.85	1.34	2.48	47.98	53.90	5.9	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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

Report No. 12406767S-A-R3
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1 No.3 No.3 No.3
Date July 21, 2018 July 18, 2018 July 19, 2018 July 20, 2018
Temperature / Humidity 21 deg. C / 54 % RH 22 deg. C / 52 % RH 23 deg. C / 56 % RH 23 deg. C / 53 % RH
Engineer Shiro Kobayashi Takahiro Suzuki Takahiro Suzuki Takahiro Suzuki
(30 MHz - 1000 MHz) (1 GHz - 13 GHz) (13 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx BT LE 1 Mbps 2480 MHz (+4 dBm setting)

(* 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.	33.062	QP	22.07	17.50	7.19	31.84	0.00	14.92	40.00	25.0	100	1	
Hori.	100.882	QP	21.44	10.39	8.17	31.81	0.00	8.19	43.50	35.3	100	1	
Hori.	435.124	QP	21.04	16.26	7.63	31.87	0.00	13.06	46.00	32.9	100	2	
Hori.	919.925	QP	20.47	22.10	9.73	31.21	0.00	21.09	46.00	24.9	100	358	
Hori.	2483.500	PK	49.13	27.55	14.18	44.16	2.48	49.18	73.90	24.7	100	171	
Hori.	4880.000	PK	49.67	31.61	6.45	44.48	2.48	45.73	73.90	28.1	124	129	
Hori.	7440.000	PK	54.73	36.97	8.41	44.08	2.48	58.51	73.90	15.3	100	328	
Hori.	9920.000	PK	48.84	38.98	9.22	43.87	2.48	55.65	73.90	18.2	107	191	
Vert.	35.759	QP	21.98	16.41	7.24	31.83	0.00	13.80	40.00	26.2	100	2	
Vert.	174.341	QP	21.47	15.85	8.95	31.78	0.00	14.49	43.50	29.0	100	3	
Vert.	512.025	QP	21.38	17.77	7.97	31.93	0.00	15.19	46.00	30.8	100	1	
Vert.	592.249	QP	21.36	19.08	8.29	32.01	0.00	16.72	46.00	29.2	100	2	
Vert.	2483.500	PK	53.19	27.55	14.18	44.16	2.48	53.24	73.90	20.6	112	280	
Vert.	4960.000	PK	51.12	31.83	6.48	44.51	2.48	47.40	73.90	26.5	154	184	
Vert.	7440.000	PK	53.55	36.97	8.41	44.08	2.48	57.33	73.90	16.5	100	1	
Vert.	9920.000	PK	48.00	38.98	9.22	43.87	2.48	54.81	73.90	19.0	105	8	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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	40.05	27.55	14.18	44.16	1.34	2.48	41.44	53.90	12.5	*1)
Hori.	4880.000	AV	40.08	31.61	6.45	44.48	1.34	2.48	37.48	53.90	16.4	
Hori.	7440.000	AV	48.14	36.97	8.41	44.08	1.34	2.48	53.26	53.90	0.6	
Hori.	9920.000	AV	40.09	38.98	9.22	43.87	1.34	2.48	48.24	53.90	5.7	
Vert.	2483.500	AV	41.43	27.55	14.18	44.16	1.34	2.48	42.82	53.90	11.1	*1)
Vert.	4960.000	AV	40.56	31.83	6.48	44.51	1.34	2.48	38.18	53.90	15.7	
Vert.	7440.000	AV	47.87	36.97	8.41	44.08	1.34	2.48	52.99	53.90	0.9	
Vert.	9920.000	AV	39.99	38.98	9.22	43.87	1.34	2.48	48.14	53.90	5.8	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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.

UL Japan, Inc.

Shonan EMC Lab.

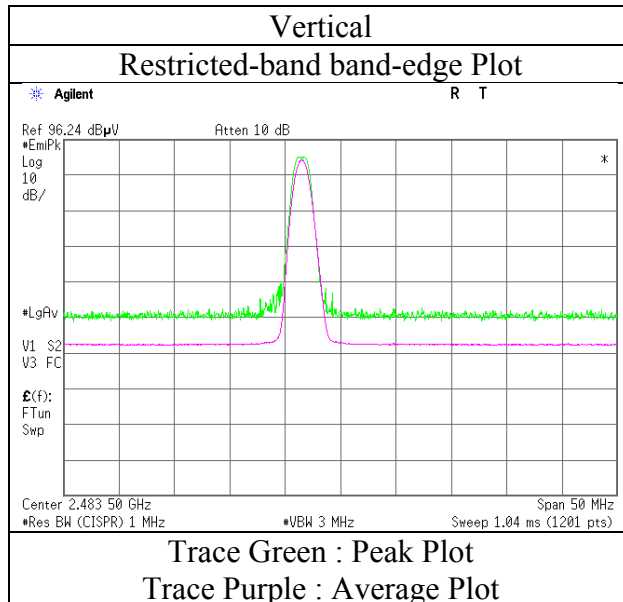
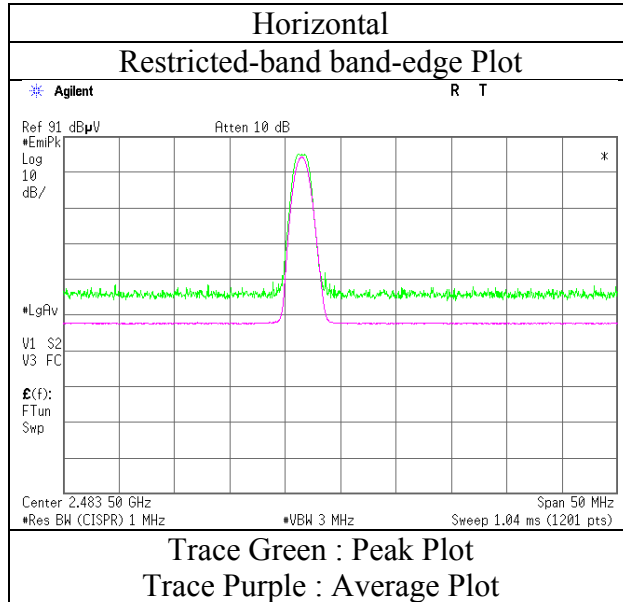
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

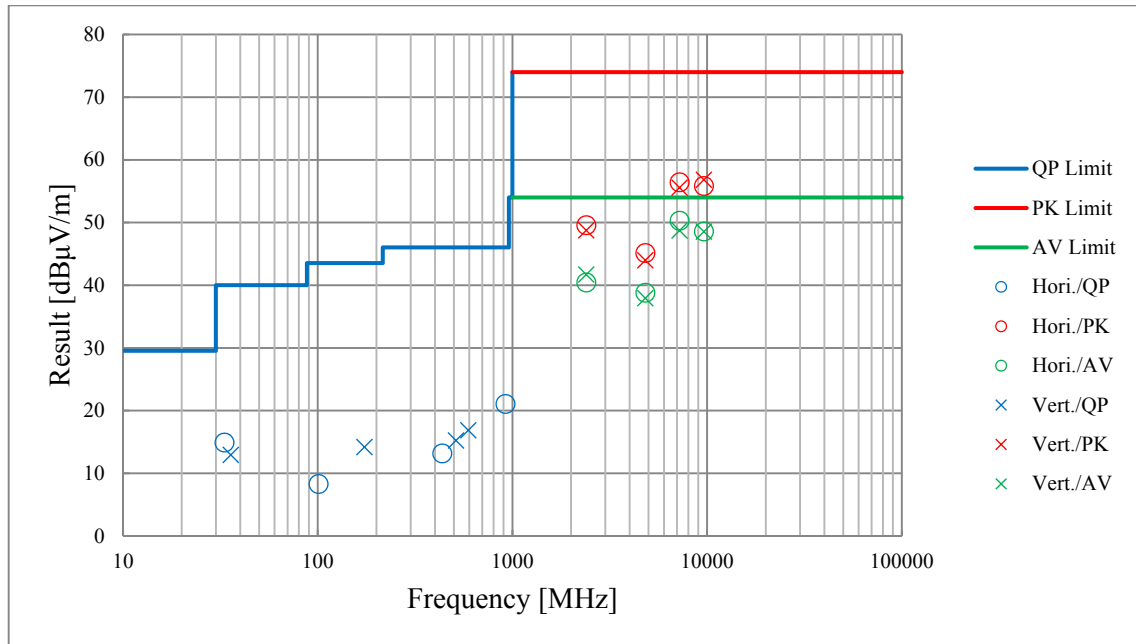
Report No.	12406767S-A-R3
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 18, 2018
Temperature / Humidity	22 deg. C / 52 % RH
Engineer	Takahiro Suzuki
	(1 GHz – 13 GHz)
Mode	Tx BT LE 1 Mbps 2480 MHz (+4 dBm setting)



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

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	12406767S-A-R3			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.1	No.3	No.3	No.3
Date	July 21, 2018	July 18, 2018	July 19, 2018	July 20, 2018
Temperature / Humidity	21 deg. C / 54 % RH	22 deg. C / 52 % RH	23 deg. C / 56 % RH	23 deg. C / 53 % RH
Engineer	Shiro Kobayashi	Takahiro Suzuki	Takahiro Suzuki	Takahiro Suzuki
	(30 MHz - 1000 MHz)	(1 GHz - 13 GHz)	(13 GHz - 18 GHz)	(18 GHz - 26.5 GHz)
Mode	Tx BT LE 1 Mbps 2402 MHz (+4 dBm setting)			



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

Radiated Spurious Emission

Report No. 12406767S-A-R3
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1 No.3 No.3 No.3
Date July 21, 2018 July 19, 2018 July 19, 2018 July 20, 2018
Temperature / Humidity 21 deg. C / 54 % RH 23 deg. C / 59 % RH 23 deg. C / 56 % RH 23 deg. C / 53 % RH
Engineer Shiro Kobayashi Shiro Kobayashi Takahiro Suzuki Takahiro Suzuki
(30 MHz - 1000 MHz) (1 GHz - 13 GHz) (13 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx BT LE 2 Mbps 2402 MHz (+4 dBm setting)

(* 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.	33.064	QP	21.98	17.50	7.19	31.84	0.00	14.83	40.00	25.1	100	1	
Hori.	100.887	QP	21.54	10.39	8.17	31.81	0.00	8.29	43.50	35.2	100	2	
Hori.	435.160	QP	21.05	16.26	7.63	31.87	0.00	13.07	46.00	32.9	100	2	
Hori.	919.955	QP	20.45	22.10	9.73	31.21	0.00	21.07	46.00	24.9	100	2	
Hori.	2390.000	PK	50.02	27.26	14.09	44.13	2.48	49.72	73.90	24.1	142	136	
Hori.	4804.000	PK	49.42	31.40	6.42	44.45	2.48	45.27	73.90	28.6	130	161	
Hori.	7206.000	PK	54.37	36.56	8.24	43.99	2.48	57.66	73.90	16.2	142	330	
Hori.	9608.000	PK	50.68	38.61	9.14	43.83	2.48	57.08	73.90	16.8	100	18	
Vert.	35.788	QP	22.03	16.40	7.24	31.83	0.00	13.84	40.00	26.1	100	357	
Vert.	174.350	QP	21.47	15.85	8.95	31.78	0.00	14.49	43.50	29.0	100	1	
Vert.	512.044	QP	21.39	17.77	7.97	31.93	0.00	15.20	46.00	30.8	100	2	
Vert.	592.296	QP	21.44	19.08	8.29	32.01	0.00	16.80	46.00	29.2	100	1	
Vert.	2390.000	PK	49.75	27.26	14.09	44.13	2.48	49.45	73.90	24.4	255	257	
Vert.	4804.000	PK	49.07	31.40	6.42	44.45	2.48	44.92	73.90	28.9	102	348	
Vert.	7206.000	PK	53.49	36.56	8.24	43.99	2.48	56.78	73.90	17.1	147	263	
Vert.	9608.000	PK	49.78	38.61	9.14	43.83	2.48	56.18	73.90	17.7	102	15	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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	39.86	27.26	14.09	44.13	4.75	2.48	44.31	53.90	9.6	*1)
Hori.	4804.000	AV	40.39	31.40	6.42	44.45	4.75	2.48	40.99	53.90	12.9	
Hori.	7206.000	AV	43.54	36.56	8.24	43.99	4.75	2.48	51.58	53.90	2.3	
Hori.	9608.000	AV	41.26	38.61	9.14	43.83	4.75	2.48	52.41	53.90	1.5	
Vert.	2390.000	AV	39.86	27.26	14.09	44.13	4.75	2.48	44.31	53.90	9.6	*1)
Vert.	4804.000	AV	40.24	31.40	6.42	44.45	4.75	2.48	40.84	53.90	13.1	
Vert.	7206.000	AV	43.39	36.56	8.24	43.99	4.75	2.48	51.43	53.90	2.5	
Vert.	9608.000	AV	40.74	38.61	9.14	43.83	4.75	2.48	51.89	53.90	2.0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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.	2402.000	PK	88.73	27.29	14.10	44.14	2.48	88.46	-	-	
Hori.	2400.000	PK	56.53	27.29	14.10	44.14	2.48	56.26	68.46	12.2	
Vert.	2402.000	PK	93.79	27.29	14.10	44.14	2.48	93.52	-	-	
Vert.	2400.000	PK	61.58	27.29	14.10	44.14	2.48	61.31	73.52	12.2	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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

UL Japan, Inc.

Shonan EMC Lab.

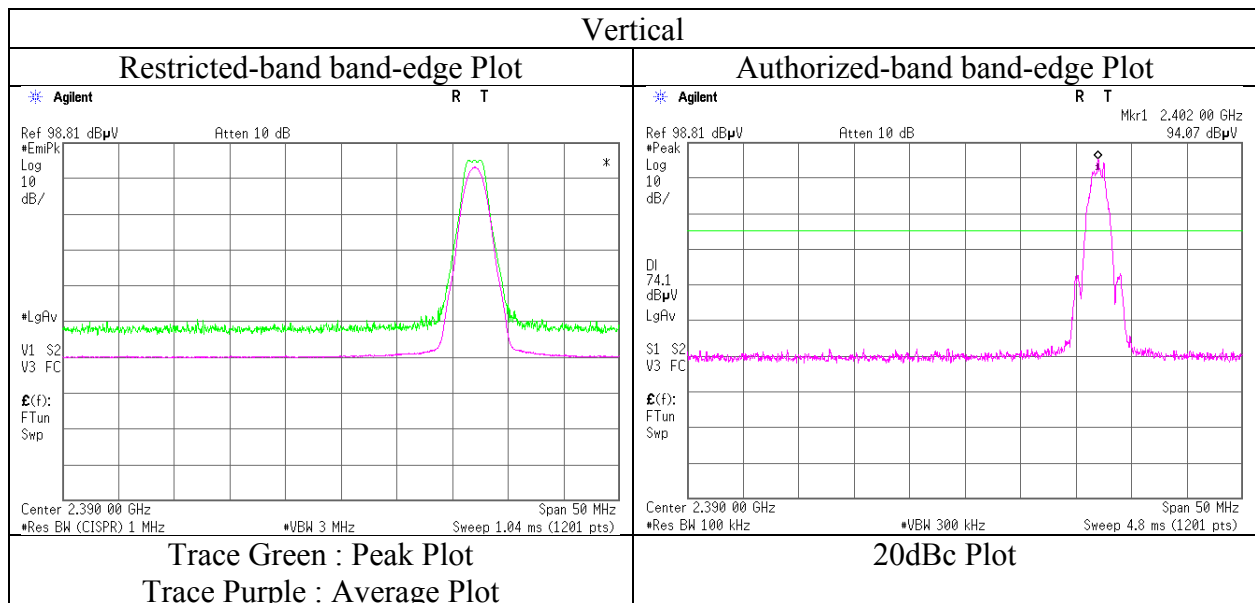
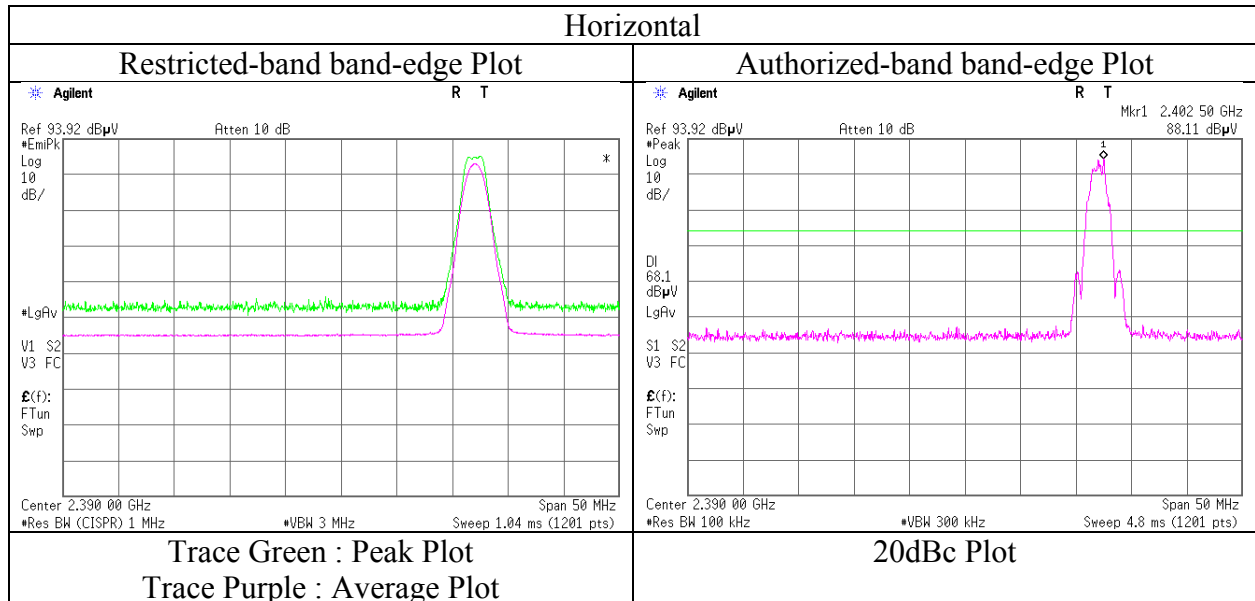
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12406767S-A-R3
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 19, 2018
Temperature / Humidity	23 deg. C / 59 % RH
Engineer	Shiro Kobayashi
	(1 GHz – 13 GHz)
Mode	Tx BT LE 2 Mbps 2402 MHz (+4 dBm setting)



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

Radiated Spurious Emission

Report No. 12406767S-A-R3
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1 No.3 No.3 No.3
Date July 21, 2018 July 19, 2018 July 19, 2018 July 20, 2018
Temperature / Humidity 21 deg. C / 54 % RH 23 deg. C / 59 % RH 23 deg. C / 56 % RH 23 deg. C / 53 % RH
Engineer Shiro Kobayashi Shiro Kobayashi Takahiro Suzuki Takahiro Suzuki
(30 MHz - 1000 MHz) (1 GHz - 13 GHz) (13 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx BT LE 2 Mbps 2440 MHz (+4 dBm setting)

(* 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.	33.055	QP	22.07	17.50	7.19	31.84	0.00	14.92	40.00	25.0	100	1	
Hori.	100.872	QP	21.56	10.39	8.17	31.81	0.00	8.31	43.50	35.1	100	2	
Hori.	435.118	QP	21.05	16.26	7.63	31.87	0.00	13.07	46.00	32.9	100	2	
Hori.	919.939	QP	20.43	22.10	9.73	31.21	0.00	21.05	46.00	24.9	100	1	
Hori.	4880.000	PK	49.29	31.61	6.45	44.48	2.48	45.35	73.90	28.5	103	4	
Hori.	7320.000	PK	54.10	36.76	8.32	44.03	2.48	57.63	73.90	16.2	100	330	
Hori.	9760.000	PK	48.94	38.79	9.17	43.85	2.48	55.53	73.90	18.3	138	29	
Vert.	35.786	QP	22.03	16.40	7.24	31.83	0.00	13.84	40.00	26.1	100	2	
Vert.	174.348	QP	21.47	15.85	8.95	31.78	0.00	14.49	43.50	29.0	100	1	
Vert.	512.013	QP	21.42	17.77	7.97	31.93	0.00	15.23	46.00	30.7	100	2	
Vert.	592.191	QP	21.45	19.08	8.29	32.01	0.00	16.81	46.00	29.1	100	2	
Vert.	4880.000	PK	48.98	31.61	6.45	44.48	2.48	45.04	73.90	28.8	116	319	
Vert.	7320.000	PK	53.25	36.76	8.32	44.03	2.48	56.78	73.90	17.1	110	357	
Vert.	9760.000	PK	48.91	38.79	9.17	43.85	2.48	55.50	73.90	18.4	104	9	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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.	4880.000	AV	39.78	31.61	6.45	44.48	4.75	2.48	40.59	53.90	13.3	
Hori.	7320.000	AV	43.93	36.76	8.32	44.03	4.75	2.48	52.21	53.90	1.7	
Hori.	9760.000	AV	39.84	38.79	9.17	43.85	4.75	2.48	51.18	53.90	2.7	
Vert.	4880.000	AV	39.99	31.61	6.45	44.48	4.75	2.48	40.80	53.90	13.1	
Vert.	7320.000	AV	43.43	36.76	8.32	44.03	4.75	2.48	51.71	53.90	2.2	
Vert.	9760.000	AV	40.40	38.79	9.17	43.85	4.75	2.48	51.74	53.90	2.2	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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. 12406767S-A-R3
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1 No.3 No.3 No.3
Date July 21, 2018 July 19, 2018 July 19, 2018 July 20, 2018
Temperature / Humidity 21 deg. C / 54 % RH 23 deg. C / 59 % RH 23 deg. C / 56 % RH 23 deg. C / 53 % RH
Engineer Shiro Kobayashi Shiro Kobayashi Takahiro Suzuki Takahiro Suzuki
(30 MHz - 1000 MHz) (1 GHz - 13 GHz) (13 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx BT LE 2 Mbps 2480 MHz (+4 dBm setting)

(* 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.	33.041	QP	22.06	17.51	7.19	31.84	0.00	14.92	40.00	25.0	100	1	
Hori.	100.885	QP	21.57	10.39	8.17	31.81	0.00	8.32	43.50	35.1	100	2	
Hori.	435.182	QP	21.07	16.26	7.63	31.87	0.00	13.09	46.00	32.9	100	2	
Hori.	919.937	QP	20.44	22.10	9.73	31.21	0.00	21.06	46.00	24.9	100	358	
Hori.	2483.500	PK	51.59	27.55	14.18	44.16	2.48	51.64	73.90	22.2	165	173	
Hori.	4960.000	PK	49.63	31.83	6.48	44.51	2.48	45.91	73.90	27.9	157	347	
Hori.	7440.000	PK	55.30	36.97	8.41	44.08	2.48	59.08	73.90	14.8	102	331	
Hori.	9920.000	PK	48.22	38.98	9.22	43.87	2.48	55.03	73.90	18.8	116	203	
Vert.	35.794	QP	22.09	16.40	7.24	31.83	0.00	13.90	40.00	26.1	100	2	
Vert.	174.374	QP	21.57	15.85	8.95	31.78	0.00	14.59	43.50	28.9	100	359	
Vert.	512.033	QP	21.37	17.77	7.97	31.93	0.00	15.18	46.00	30.8	100	2	
Vert.	592.283	QP	21.44	19.08	8.29	32.01	0.00	16.80	46.00	29.2	100	1	
Vert.	2483.500	PK	52.55	27.55	14.18	44.16	2.48	52.60	73.90	21.3	141	163	
Vert.	4960.000	PK	50.12	31.83	6.48	44.51	2.48	46.40	73.90	27.5	119	328	
Vert.	7440.000	PK	53.39	36.97	8.41	44.08	2.48	57.17	73.90	16.7	130	4	
Vert.	9920.000	PK	48.30	38.98	9.22	43.87	2.48	55.11	73.90	18.7	118	174	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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	40.15	27.55	14.18	44.16	4.75	2.48	44.95	53.90	8.9	*1)
Hori.	4960.000	AV	40.38	31.83	6.48	44.51	4.75	2.48	41.41	53.90	12.5	
Hori.	7440.000	AV	44.76	36.97	8.41	44.08	4.75	2.48	53.29	53.90	0.6	
Hori.	9920.000	AV	39.24	38.98	9.22	43.87	4.75	2.48	50.80	53.90	3.1	
Vert.	2483.500	AV	40.80	27.55	14.18	44.16	4.75	2.48	45.60	53.90	8.3	*1)
Vert.	4960.000	AV	40.63	31.83	6.48	44.51	4.75	2.48	41.66	53.90	12.2	
Vert.	7440.000	AV	43.23	36.97	8.41	44.08	4.75	2.48	51.76	53.90	2.1	
Vert.	9920.000	AV	39.37	38.98	9.22	43.87	4.75	2.48	50.93	53.90	3.0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

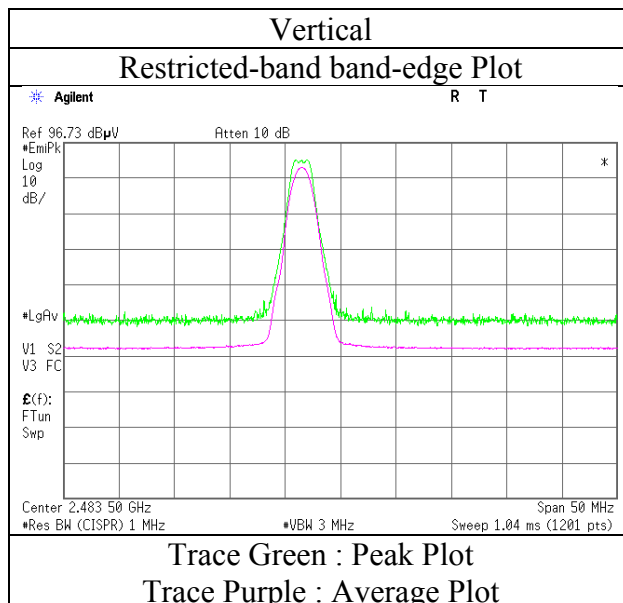
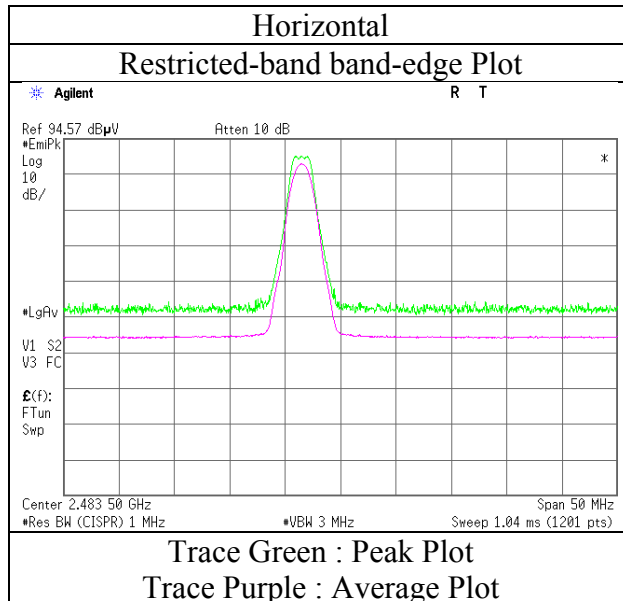
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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)

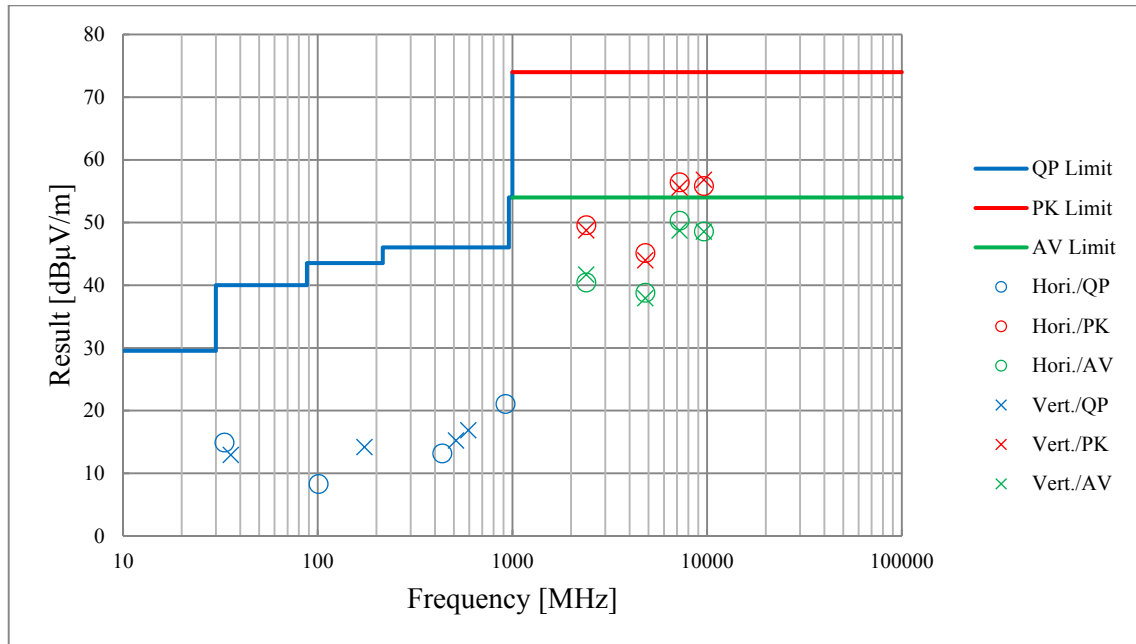
Report No.	12406767S-A-R3
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 19, 2018
Temperature / Humidity	23 deg. C / 59 % RH
Engineer	Shiro Kobayashi
	(1 GHz – 13 GHz)
Mode	Tx BT LE 2 Mbps 2480 MHz (+4 dBm setting)



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

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	12406767S-A-R3			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.1	No.3	No.3	No.3
Date	July 21, 2018	July 19, 2018	July 19, 2018	July 20, 2018
Temperature / Humidity	21 deg. C / 54 % RH	23 deg. C / 59 % RH	23 deg. C / 56 % RH	23 deg. C / 53 % RH
Engineer	Shiro Kobayashi	Shiro Kobayashi	Takahiro Suzuki	Takahiro Suzuki
	(30 MHz - 1000 MHz)	(1 GHz - 13 GHz)	(13 GHz - 18 GHz)	(18 GHz - 26.5 GHz)
Mode	Tx BT LE 2 Mbps 2402 MHz (+4 dBm setting)			



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

Radiated Spurious Emission

Report No. 12406767S-A-R3
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1 No.3 No.3 No.3
Date July 21, 2018 July 19, 2018 July 19, 2018 July 20, 2018
Temperature / Humidity 21 deg. C / 54 % RH 23 deg. C / 59 % RH 23 deg. C / 56 % RH 23 deg. C / 53 % RH
Engineer Shiro Kobayashi Shiro Kobayashi Takahiro Suzuki Takahiro Suzuki
(30 MHz - 1000 MHz) (1 GHz - 13 GHz) (13 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx ANT 1 Mbps 2402 MHz (+4 dBm setting)

(* 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.	33.085	QP	21.97	17.49	7.19	31.84	0.00	14.81	40.00	25.1	100	1	
Hori.	100.889	QP	21.53	10.39	8.17	31.81	0.00	8.28	43.50	35.2	100	2	
Hori.	435.194	QP	21.11	16.26	7.63	31.87	0.00	13.13	46.00	32.8	100	1	
Hori.	920.009	QP	20.47	22.10	9.73	31.21	0.00	21.09	46.00	24.9	100	1	
Hori.	2390.000	PK	48.73	27.26	14.09	44.13	2.48	48.43	73.90	25.4	107	182	
Hori.	4804.000	PK	50.98	31.40	6.42	44.45	2.48	46.83	73.90	27.0	156	160	
Hori.	7206.000	PK	55.13	36.56	8.24	43.99	2.48	58.42	73.90	15.4	138	331	
Hori.	9608.000	PK	50.87	38.61	9.14	43.83	2.48	57.27	73.90	16.6	108	12	
Vert.	35.797	QP	22.05	16.40	7.24	31.83	0.00	13.86	40.00	26.1	100	358	
Vert.	173.382	QP	21.22	15.76	8.94	31.78	0.00	14.14	43.50	29.3	100	357	
Vert.	512.019	QP	21.36	17.77	7.97	31.93	0.00	15.17	46.00	30.8	100	3	
Vert.	592.231	QP	21.41	19.08	8.29	32.01	0.00	16.77	46.00	29.2	100	2	
Vert.	2390.000	PK	49.25	27.26	14.09	44.13	2.48	48.95	73.90	24.9	151	164	
Vert.	4804.000	PK	50.91	31.40	6.42	44.45	2.48	46.76	73.90	27.1	170	169	
Vert.	7206.000	PK	53.41	36.56	8.24	43.99	2.48	56.70	73.90	17.2	106	332	
Vert.	9608.000	PK	51.05	38.61	9.14	43.83	2.48	57.45	73.90	16.4	106	4	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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	39.75	27.26	14.09	44.13	0.45	2.48	39.90	53.90	14.0	*1)
Hori.	4804.000	AV	41.64	31.40	6.42	44.45	0.45	2.48	37.94	53.90	16.0	
Hori.	7206.000	AV	48.95	36.56	8.24	43.99	0.45	2.48	52.69	53.90	1.2	
Hori.	9608.000	AV	42.01	38.61	9.14	43.83	0.45	2.48	48.86	53.90	5.0	
Vert.	2390.000	AV	39.78	27.26	14.09	44.13	0.45	2.48	39.93	53.90	14.0	*1)
Vert.	4804.000	AV	42.37	31.40	6.42	44.45	0.45	2.48	38.67	53.90	15.2	
Vert.	7206.000	AV	46.39	36.56	8.24	43.99	0.45	2.48	50.13	53.90	3.8	
Vert.	9608.000	AV	42.39	38.61	9.14	43.83	0.45	2.48	49.24	53.90	4.7	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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.	2402.000	PK	90.53	27.29	14.10	44.14	2.48	90.26	-	-	
Hori.	2400.000	PK	42.31	27.29	14.10	44.14	2.48	42.04	70.26	28.2	
Vert.	2402.000	PK	92.29	27.29	14.10	44.14	2.48	92.02	-	-	
Vert.	2400.000	PK	48.99	27.29	14.10	44.14	2.48	48.72	72.02	23.3	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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

UL Japan, Inc.

Shonan EMC Lab.

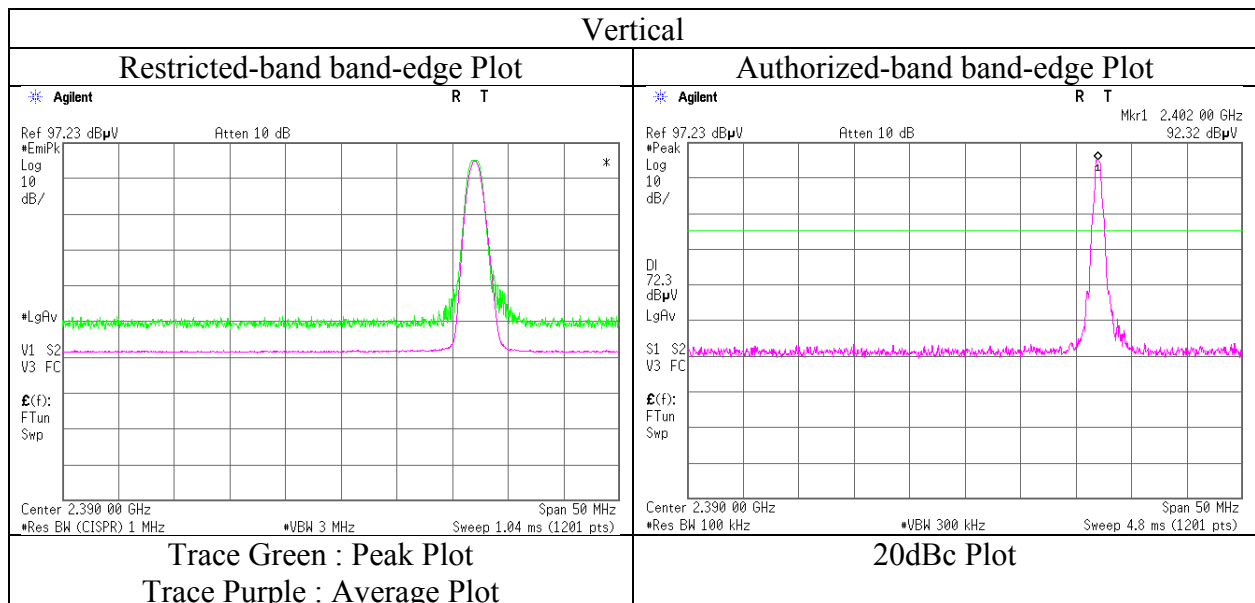
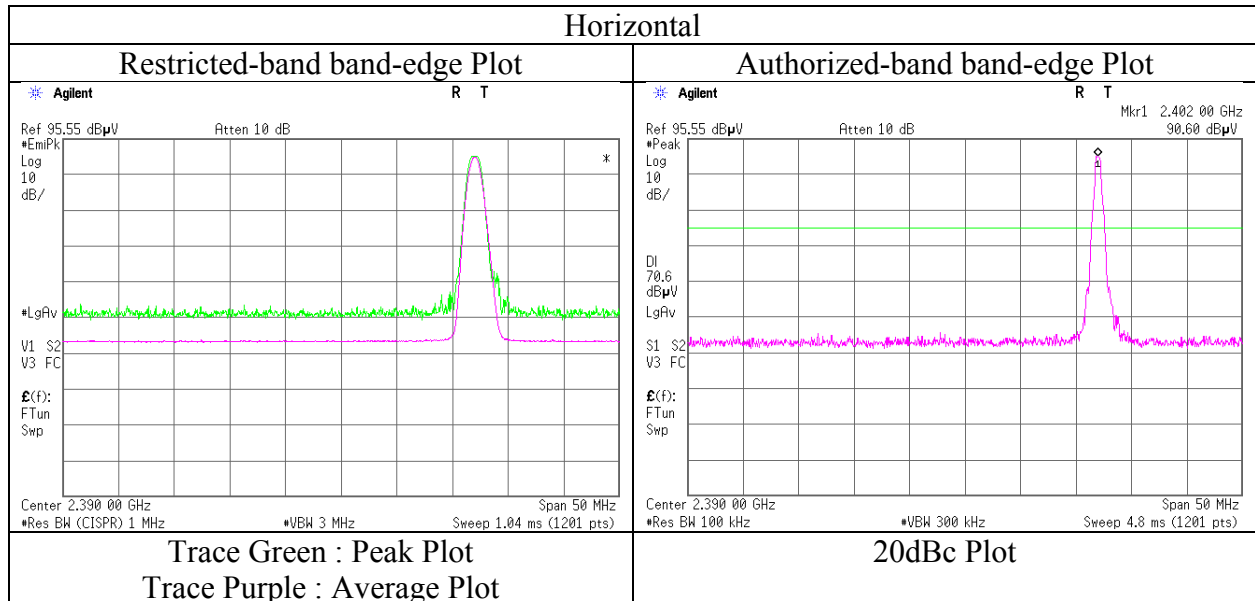
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12406767S-A-R3
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 19, 2018
Temperature / Humidity	23 deg. C / 59 % RH
Engineer	Shiro Kobayashi
	(1 GHz – 13 GHz)
Mode	Tx ANT 1 Mbps 2402 MHz (+4 dBm setting)



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

Radiated Spurious Emission

Report No. 12406767S-A-R3
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1 No.3 No.3 No.3
Date July 21, 2018 July 19, 2018 July 19, 2018 July 20, 2018
Temperature / Humidity 21 deg. C / 54 % RH 23 deg. C / 59 % RH 23 deg. C / 56 % RH 23 deg. C / 53 % RH
Engineer Shiro Kobayashi Shiro Kobayashi Takahiro Suzuki Takahiro Suzuki
(30 MHz - 1000 MHz) (1 GHz - 13 GHz) (13 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx ANT 1 Mbps 2441 MHz (+4 dBm setting)

(* 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.	33.095	QP	22.04	17.49	7.19	31.84	0.00	14.88	40.00	25.1	100	1	
Hori.	100.894	QP	21.54	10.39	8.17	31.81	0.00	8.29	43.50	35.2	100	2	
Hori.	435.156	QP	21.09	16.26	7.63	31.87	0.00	13.11	46.00	32.8	100	2	
Hori.	919.967	QP	20.49	22.10	9.73	31.21	0.00	21.11	46.00	24.8	100	1	
Hori.	4882.000	PK	49.82	31.62	6.45	44.48	2.48	45.89	73.90	28.0	136	338	
Hori.	7323.000	PK	55.21	36.77	8.32	44.03	2.48	58.75	73.90	15.1	140	323	
Hori.	9764.000	PK	50.30	38.80	9.17	43.85	2.48	56.90	73.90	17.0	100	0	
Vert.	35.783	QP	22.03	16.41	7.24	31.83	0.00	13.85	40.00	26.1	100	358	
Vert.	173.392	QP	21.22	15.76	8.94	31.78	0.00	14.14	43.50	29.3	100	359	
Vert.	512.041	QP	21.36	17.77	7.97	31.93	0.00	15.17	46.00	30.8	100	2	
Vert.	592.275	QP	21.48	19.08	8.29	32.01	0.00	16.84	46.00	29.1	100	1	
Vert.	4882.000	PK	49.47	31.62	6.45	44.48	2.48	45.54	73.90	28.3	116	9	
Vert.	7323.000	PK	53.81	36.77	8.32	44.03	2.48	57.35	73.90	16.5	101	340	
Vert.	9764.000	PK	50.38	38.80	9.17	43.85	2.48	56.98	73.90	16.9	108	158	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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.	4882.000	AV	39.96	31.62	6.45	44.48	0.45	2.48	36.48	53.90	17.4	
Hori.	7323.000	AV	49.03	36.77	8.32	44.03	0.45	2.48	53.02	53.90	0.9	
Hori.	9764.000	AV	40.93	38.80	9.17	43.85	0.45	2.48	47.98	53.90	5.9	
Vert.	4882.000	AV	40.14	31.62	6.45	44.48	0.45	2.48	36.66	53.90	17.2	
Vert.	7323.000	AV	47.51	36.77	8.32	44.03	0.45	2.48	51.50	53.90	2.4	
Vert.	9764.000	AV	41.06	38.80	9.17	43.85	0.45	2.48	48.11	53.90	5.8	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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. 12406767S-A-R3
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1 No.3 No.3 No.3
Date July 21, 2018 July 19, 2018 July 19, 2018 July 20, 2018
Temperature / Humidity 21 deg. C / 54 % RH 23 deg. C / 59 % RH 23 deg. C / 56 % RH 23 deg. C / 53 % RH
Engineer Shiro Kobayashi Shiro Kobayashi Takahiro Suzuki Takahiro Suzuki
(30 MHz - 1000 MHz) (1 GHz - 13 GHz) (13 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx ANT 1 Mbps 2480 MHz (+4 dBm setting)

(* 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.	33.073	QP	22.18	17.50	7.19	31.84	0.00	15.03	40.00	24.9	100	358	
Hori.	100.843	QP	21.58	10.38	8.17	31.81	0.00	8.32	43.50	35.1	100	1	
Hori.	435.177	QP	21.12	16.26	7.63	31.87	0.00	13.14	46.00	32.8	100	1	
Hori.	920.006	QP	20.54	22.10	9.73	31.21	0.00	21.16	46.00	24.8	100	356	
Hori.	2483.500	PK	50.68	27.55	14.18	44.16	2.48	50.73	73.90	23.1	211	178	
Hori.	4960.000	PK	50.19	31.83	6.48	44.51	2.48	46.47	73.90	27.4	112	8	
Hori.	7440.000	PK	55.75	36.97	8.41	44.08	2.48	59.53	73.90	14.3	113	346	
Hori.	9920.000	PK	49.33	38.98	9.22	43.87	2.48	56.14	73.90	17.7	112	186	
Vert.	35.731	QP	22.05	16.42	7.24	31.83	0.00	13.88	40.00	26.1	100	2	
Vert.	173.383	QP	21.26	15.76	8.94	31.78	0.00	14.18	43.50	29.3	100	358	
Vert.	512.010	QP	21.41	17.77	7.97	31.93	0.00	15.22	46.00	30.7	100	2	
Vert.	592.311	QP	21.44	19.08	8.29	32.01	0.00	16.80	46.00	29.2	100	2	
Vert.	2483.500	PK	52.76	27.55	14.18	44.16	2.48	52.81	73.90	21.0	148	125	
Vert.	4960.000	PK	49.97	31.83	6.48	44.51	2.48	46.25	73.90	27.6	124	14	
Vert.	7440.000	PK	54.38	36.97	8.41	44.08	2.48	58.16	73.90	15.7	100	352	
Vert.	9920.000	PK	48.83	38.98	9.22	43.87	2.48	55.64	73.90	18.2	118	256	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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	40.09	27.55	14.18	44.16	0.45	2.48	40.59	53.90	13.3	*1)
Hori.	4960.000	AV	41.19	31.83	6.48	44.51	0.45	2.48	37.92	53.90	16.0	
Hori.	7440.000	AV	48.76	36.97	8.41	44.08	0.45	2.48	52.99	53.90	0.9	
Hori.	9920.000	AV	40.23	38.98	9.22	43.87	0.45	2.48	47.49	53.90	6.4	
Vert.	2483.500	AV	40.14	27.55	14.18	44.16	0.45	2.48	40.64	53.90	13.3	*1)
Vert.	4960.000	AV	41.95	31.83	6.48	44.51	0.45	2.48	38.68	53.90	15.2	
Vert.	7440.000	AV	48.35	36.97	8.41	44.08	0.45	2.48	52.58	53.90	1.3	
Vert.	9920.000	AV	38.94	38.98	9.22	43.87	0.45	2.48	46.20	53.90	7.7	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

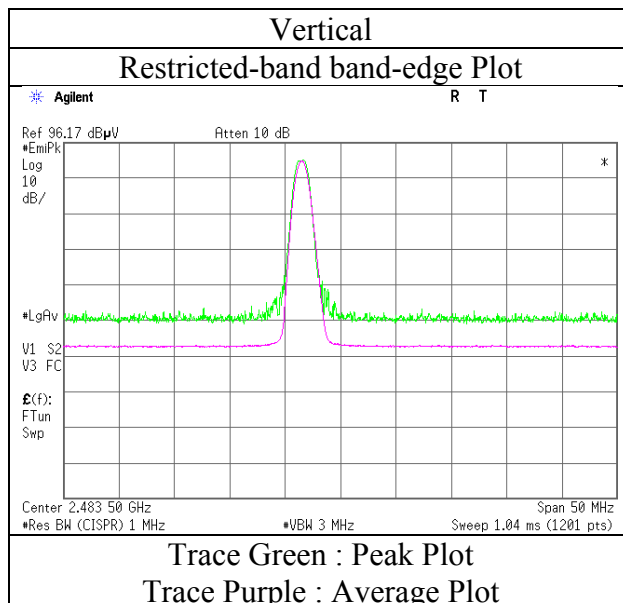
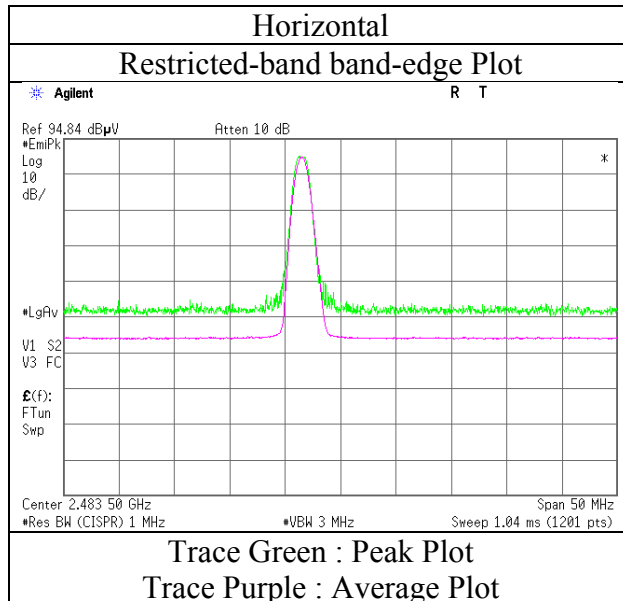
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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)

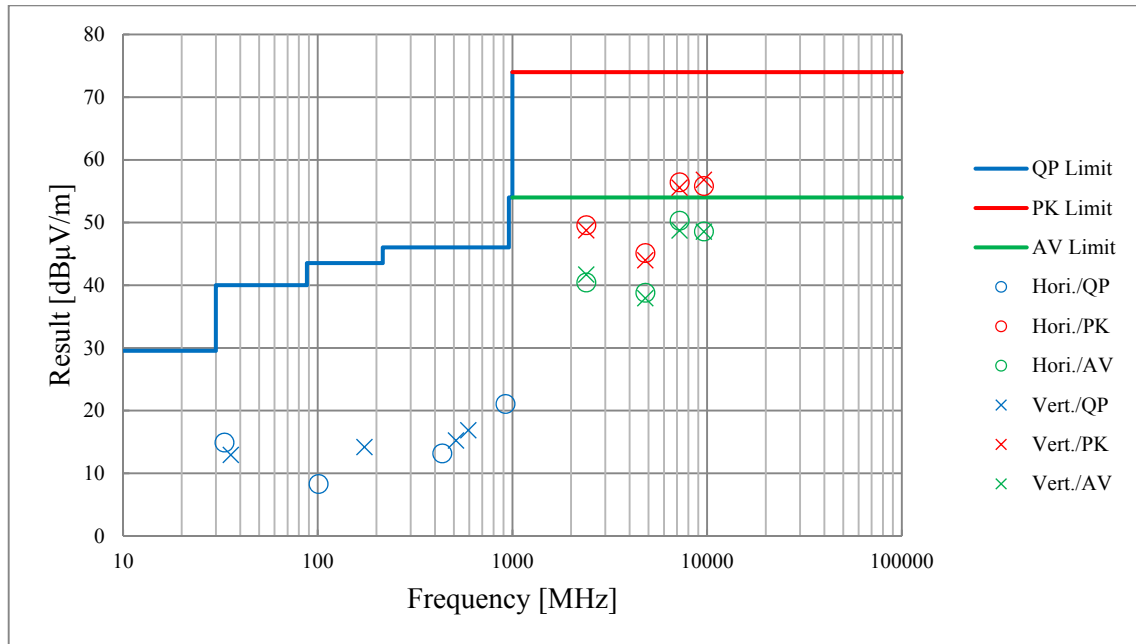
Report No. 12406767S-A-R3
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.3
Date July 19, 2018
Temperature / Humidity 23 deg. C / 59 % RH
Engineer Shiro Kobayashi
(1 GHz – 13 GHz)
Mode Tx ANT 1 Mbps 2480 MHz (+4 dBm setting)



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

Radiated Spurious Emission
(Plot data, Worst case)

Report No.	12406767S-A-R3			
Test place	Shonan EMC Lab.			
Semi Anechoic Chamber	No.1	No.3	No.3	No.3
Date	July 21, 2018	July 19, 2018	July 19, 2018	July 20, 2018
Temperature / Humidity	21 deg. C / 54 % RH	23 deg. C / 59 % RH	23 deg. C / 56 % RH	23 deg. C / 53 % RH
Engineer	Shiro Kobayashi	Shiro Kobayashi	Takahiro Suzuki	Takahiro Suzuki
	(30 MHz - 1000 MHz)	(1 GHz - 13 GHz)	(13 GHz - 18 GHz)	(18 GHz - 26.5 GHz)
Mode	Tx ANT 1 Mbps 2441 MHz (+4 dBm setting)			



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

Radiated Spurious Emission

Report No.	12406767S-A-R3		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.3	No.3
Date	July 21, 2018	July 19, 2018	July 20, 2018
Temperature / Humidity	21 deg. C / 54 % RH	23 deg. C / 56 % RH	23 deg. C / 53 % RH
Engineer	Shiro Kobayashi	Takahiro Suzuki	Takahiro Suzuki
	(30 MHz - 1000 MHz)	(1 GHz - 18 GHz)	(18 GHz - 26.5 GHz)
Mode	Tx Nordic Original 2 Mbps 2402 MHz (+4 dBm setting)		

(* 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.	33.087	QP	22.07	17.49	7.19	31.84	0.00	14.91	40.00	25.0	100	1	
Hori.	100.865	QP	21.56	10.39	8.17	31.81	0.00	8.31	43.50	35.1	100	2	
Hori.	435.122	QP	21.15	16.26	7.63	31.87	0.00	13.17	46.00	32.8	100	357	
Hori.	919.981	QP	20.45	22.10	9.73	31.21	0.00	21.07	46.00	24.9	100	358	
Hori.	2390.000	PK	49.89	27.26	14.09	44.13	2.48	49.59	73.90	24.3	137	83	
Hori.	4804.000	PK	49.29	31.40	6.42	44.45	2.48	45.14	73.90	28.7	129	190	
Hori.	7206.000	PK	53.13	36.56	8.24	43.99	2.48	56.42	73.90	17.4	100	352	
Hori.	9608.000	PK	49.43	38.61	9.14	43.83	2.48	55.83	73.90	18.0	100	190	
Vert.	35.721	QP	21.09	16.43	7.24	31.83	0.00	12.93	40.00	27.0	100	1	
Vert.	173.395	QP	21.25	15.76	8.94	31.78	0.00	14.17	43.50	29.3	100	2	
Vert.	512.067	QP	21.42	17.76	7.97	31.93	0.00	15.22	46.00	30.7	100	2	
Vert.	592.286	QP	21.48	19.08	8.29	32.01	0.00	16.84	46.00	29.1	100	3	
Vert.	2390.000	PK	49.05	27.26	14.09	44.13	2.48	48.75	73.90	25.1	138	197	
Vert.	4804.000	PK	48.11	31.40	6.42	44.45	2.48	43.96	73.90	29.9	134	344	
Vert.	7206.000	PK	52.28	36.56	8.24	43.99	2.48	55.57	73.90	18.3	100	347	
Vert.	9608.000	PK	50.42	38.61	9.14	43.83	2.48	56.82	73.90	17.0	100	9	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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	39.87	27.26	14.09	44.13	0.88	2.48	40.45	53.90	13.4	*1)
Hori.	4804.000	AV	42.08	31.40	6.42	44.45	0.88	2.48	38.81	53.90	15.1	
Hori.	7206.000	AV	46.12	36.56	8.24	43.99	0.88	2.48	50.29	53.90	3.6	
Hori.	9608.000	AV	41.32	38.61	9.14	43.83	0.88	2.48	48.60	53.90	5.3	
Vert.	2390.000	AV	41.12	27.26	14.09	44.13	0.88	2.48	41.70	53.90	12.2	*1)
Vert.	4804.000	AV	41.19	31.40	6.42	44.45	0.88	2.48	37.92	53.90	16.0	
Vert.	7206.000	AV	44.56	36.56	8.24	43.99	0.88	2.48	48.73	53.90	5.2	
Vert.	9608.000	AV	41.25	38.61	9.14	43.83	0.88	2.48	48.53	53.90	5.4	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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.	2402.000	PK	90.32	27.29	14.10	44.14	2.48	90.05	-	-	
Hori.	2400.000	PK	51.12	27.29	14.10	44.14	2.48	50.85	70.05	19.2	
Vert.	2402.000	PK	90.39	27.29	14.10	44.14	2.48	90.12	-	-	
Vert.	2400.000	PK	51.01	27.29	14.10	44.14	2.48	50.74	70.12	19.4	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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

UL Japan, Inc.

Shonan EMC Lab.

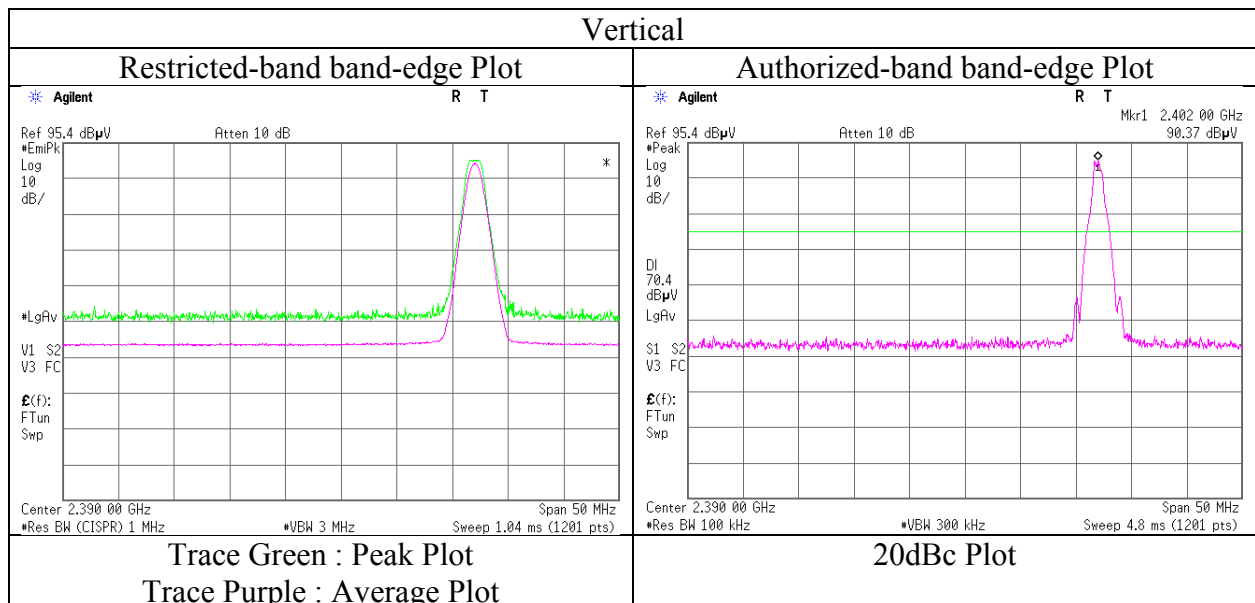
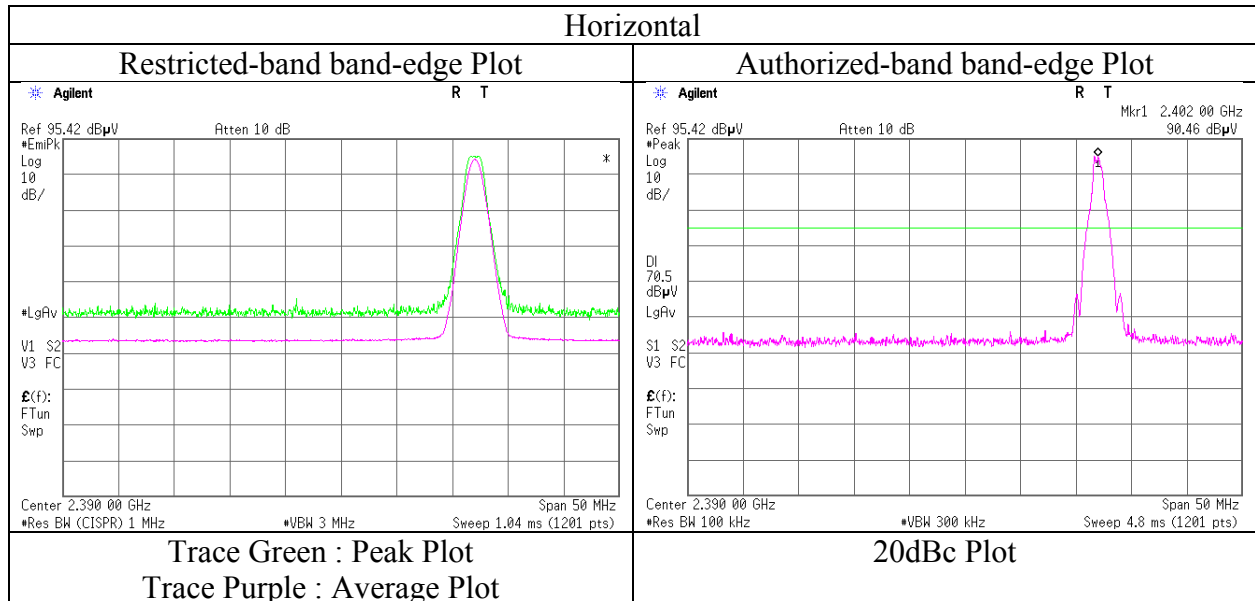
1-22-3 Megumigaoka, Hiratsuka-shi, Kanagawa-ken, 259-1220 JAPAN

Telephone : +81 463 50 6400

Facsimile : +81 463 50 6401

Radiated Spurious Emission (Reference Plot for band-edge)

Report No.	12406767S-A-R3
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 19, 2018
Temperature / Humidity	23 deg. C / 56 % RH
Engineer	Takahiro Suzuki
	(1 GHz – 18 GHz)
Mode	Tx Nordic Original 2 Mbps 2402 MHz (+4 dBm setting)



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

Radiated Spurious Emission

Report No. 12406767S-A-R3
Test place Shonan EMC Lab.
Semi Anechoic Chamber No.1 No.3 No.3
Date July 21, 2018 July 19, 2018 July 20, 2018
Temperature / Humidity 21 deg. C / 54 % RH 23 deg. C / 56 % RH 23 deg. C / 53 % RH
Engineer Shiro Kobayashi Takahiro Suzuki Takahiro Suzuki
(30 MHz - 1000 MHz) (1 GHz - 18 GHz) (18 GHz - 26.5 GHz)
Mode Tx Nordic Original 2 Mbps 2441 MHz (+4 dBm setting)

(* 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.	33.081	QP	22.12	17.49	7.19	31.84	0.00	14.96	40.00	25.0	100	2	
Hori.	100.824	QP	21.55	10.38	8.17	31.81	0.00	8.29	43.50	35.2	100	2	
Hori.	435.195	QP	21.08	16.26	7.63	31.87	0.00	13.10	46.00	32.9	100	3	
Hori.	919.994	QP	20.46	22.10	9.73	31.21	0.00	21.08	46.00	24.9	100	1	
Hori.	4882.000	PK	39.05	31.62	6.45	44.48	2.48	35.12	73.90	38.7	132	105	
Hori.	7323.000	PK	54.93	36.77	8.32	44.03	2.48	58.47	73.90	15.4	100	323	
Hori.	9764.000	PK	48.73	38.80	9.17	43.85	2.48	55.33	73.90	18.5	122	357	
Vert.	35.714	QP	22.06	16.43	7.24	31.83	0.00	13.90	40.00	26.1	100	2	
Vert.	173.397	QP	21.26	15.76	8.94	31.78	0.00	14.18	43.50	29.3	100	2	
Vert.	512.044	QP	21.45	17.77	7.97	31.93	0.00	15.26	46.00	30.7	100	1	
Vert.	592.274	QP	21.39	19.08	8.29	32.01	0.00	16.75	46.00	29.2	100	357	
Vert.	4882.000	PK	48.54	31.62	6.45	44.48	2.48	44.61	73.90	29.2	116	268	
Vert.	7323.000	PK	53.15	36.77	8.32	44.03	2.48	56.69	73.90	17.2	100	1	
Vert.	9764.000	PK	48.93	38.80	9.17	43.85	2.48	55.53	73.90	18.3	121	168	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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.	4882.000	AV	40.29	31.62	6.45	44.48	0.88	2.48	37.24	53.90	16.7	
Hori.	7323.000	AV	47.54	36.77	8.32	44.03	0.88	2.48	51.96	53.90	1.9	
Hori.	9764.000	AV	40.49	38.80	9.17	43.85	0.88	2.48	47.97	53.90	5.9	
Vert.	4882.000	AV	39.99	31.62	6.45	44.48	0.88	2.48	36.94	53.90	17.0	
Vert.	7323.000	AV	45.46	36.77	8.32	44.03	0.88	2.48	49.88	53.90	4.0	
Vert.	9764.000	AV	40.43	38.80	9.17	43.85	0.88	2.48	47.91	53.90	6.0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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.	12406767S-A-R3		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.3	No.3
Date	July 21, 2018	July 19, 2018	July 20, 2018
Temperature / Humidity	21 deg. C / 54 % RH	23 deg. C / 56 % RH	23 deg. C / 53 % RH
Engineer	Shiro Kobayashi	Takahiro Suzuki	Takahiro Suzuki
	(30 MHz - 1000 MHz)	(1 GHz - 18 GHz)	(18 GHz - 26.5 GHz)
Mode	Tx Nordic Original 2 Mbps 2480 MHz (+4 dBm setting)		

(* 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.	33.040	QP	22.10	17.51	7.19	31.84	0.00	14.96	40.00	25.0	100	2	
Hori.	100.869	QP	21.57	10.39	8.17	31.81	0.00	8.32	43.50	35.1	100	1	
Hori.	435.150	QP	21.14	16.26	7.63	31.87	0.00	13.16	46.00	32.8	100	357	
Hori.	919.959	QP	20.58	22.10	9.73	31.21	0.00	21.20	46.00	24.8	100	358	
Hori.	2483.500	PK	51.96	27.55	14.18	44.16	2.48	52.01	73.90	21.8	111	235	
Hori.	4960.000	PK	49.22	31.83	6.48	44.51	2.48	45.50	73.90	28.4	122	3	
Hori.	7440.000	PK	55.07	36.97	8.41	44.08	2.48	58.85	73.90	15.0	118	358	
Hori.	9920.000	PK	47.11	38.98	9.22	43.87	2.48	53.92	73.90	19.9	129	321	
Vert.	35.710	QP	22.05	16.43	7.24	31.83	0.00	13.89	40.00	26.1	100	1	
Vert.	173.320	QP	21.21	15.76	8.94	31.78	0.00	14.13	43.50	29.3	100	2	
Vert.	512.082	QP	21.45	17.76	7.97	31.93	0.00	15.25	46.00	30.7	100	1	
Vert.	592.280	QP	21.49	19.08	8.29	32.01	0.00	16.85	46.00	29.1	100	2	
Vert.	2483.500	PK	53.51	27.55	14.18	44.16	2.48	53.56	73.90	20.3	109	32	
Vert.	4960.000	PK	48.98	31.83	6.48	44.51	2.48	45.26	73.90	28.6	129	202	
Vert.	7440.000	PK	53.95	36.97	8.41	44.08	2.48	57.73	73.90	16.1	124	357	
Vert.	9920.000	PK	48.44	38.98	9.22	43.87	2.48	55.25	73.90	18.6	104	4	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

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	40.76	27.55	14.18	44.16	0.88	2.48	41.69	53.90	12.2	*1)
Hori.	4960.000	AV	41.93	31.83	6.48	44.51	0.88	2.48	39.09	53.90	14.8	
Hori.	7440.000	AV	46.55	36.97	8.41	44.08	0.88	2.48	51.21	53.90	2.7	
Hori.	9920.000	AV	38.88	38.98	9.22	43.87	0.88	2.48	46.57	53.90	7.3	
Vert.	2483.500	AV	41.58	27.55	14.18	44.16	0.88	2.48	42.51	53.90	11.4	*1)
Vert.	4960.000	AV	41.78	31.83	6.48	44.51	0.88	2.48	38.94	53.90	15.0	
Vert.	7440.000	AV	45.97	36.97	8.41	44.08	0.88	2.48	50.63	53.90	3.3	
Vert.	9920.000	AV	30.18	38.98	9.22	43.87	0.88	2.48	37.87	53.90	16.0	

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

Distance factor : 1 GHz - 13 GHz : $20\log(3.99\text{ m} / 3.0\text{ m}) = 2.48\text{ dB}$

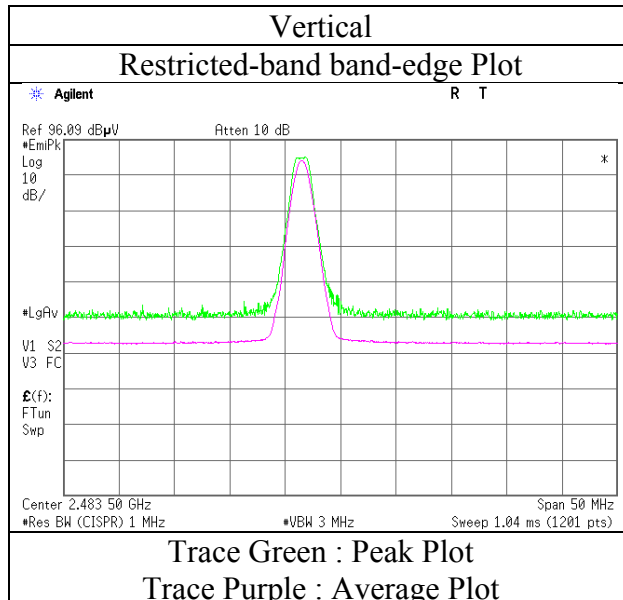
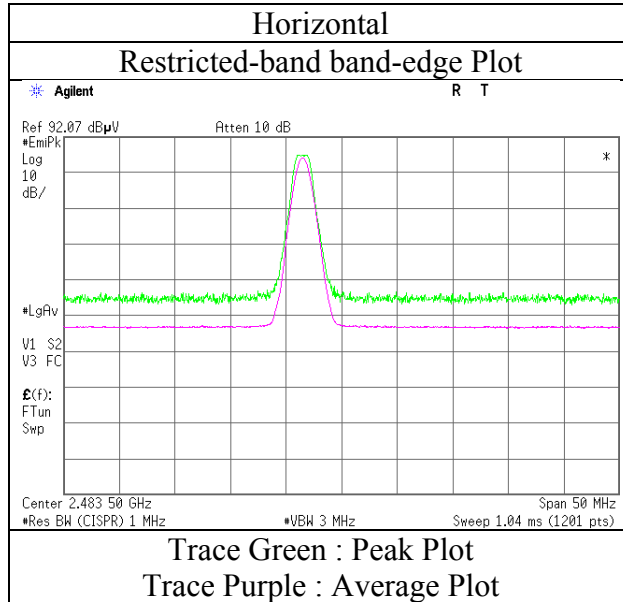
13 GHz - 40 GHz : $20\log(1.0\text{ m} / 3.0\text{ m}) = -9.54\text{ dB}$

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)

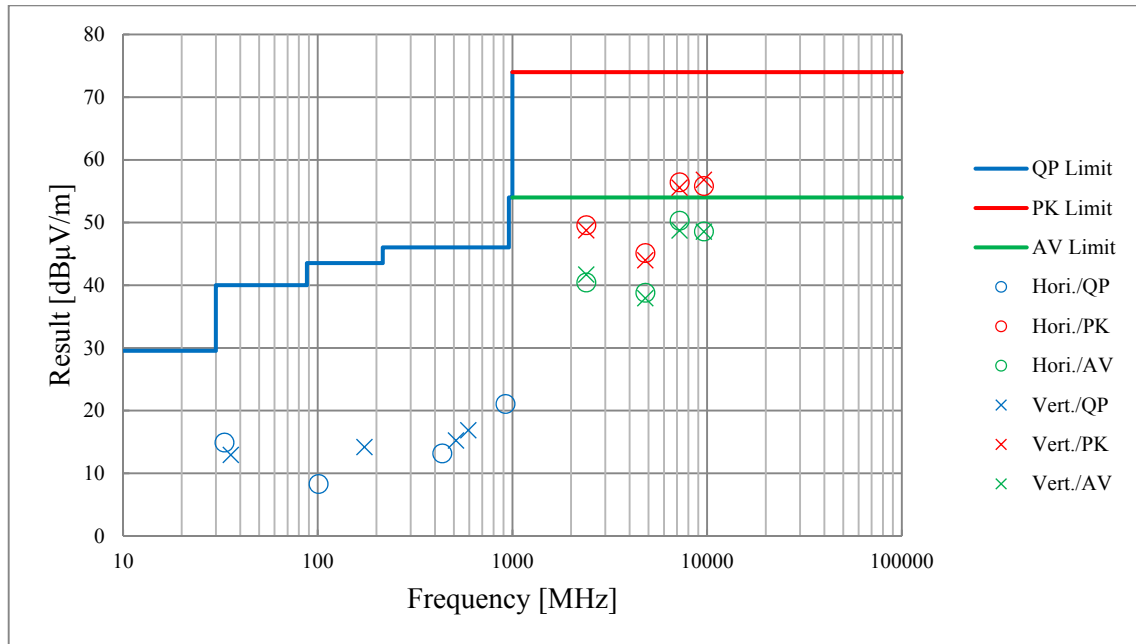
Report No.	12406767S-A-R3
Test place	Shonan EMC Lab.
Semi Anechoic Chamber	No.3
Date	July 19, 2018
Temperature / Humidity	23 deg. C / 56 % RH
Engineer	Takahiro Suzuki
	(1 GHz – 18 GHz)
Mode	Tx Nordic Original 2 Mbps 2480 MHz (+4 dBm setting)



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

Radiated Spurious Emission
(Plot data, Worst case)

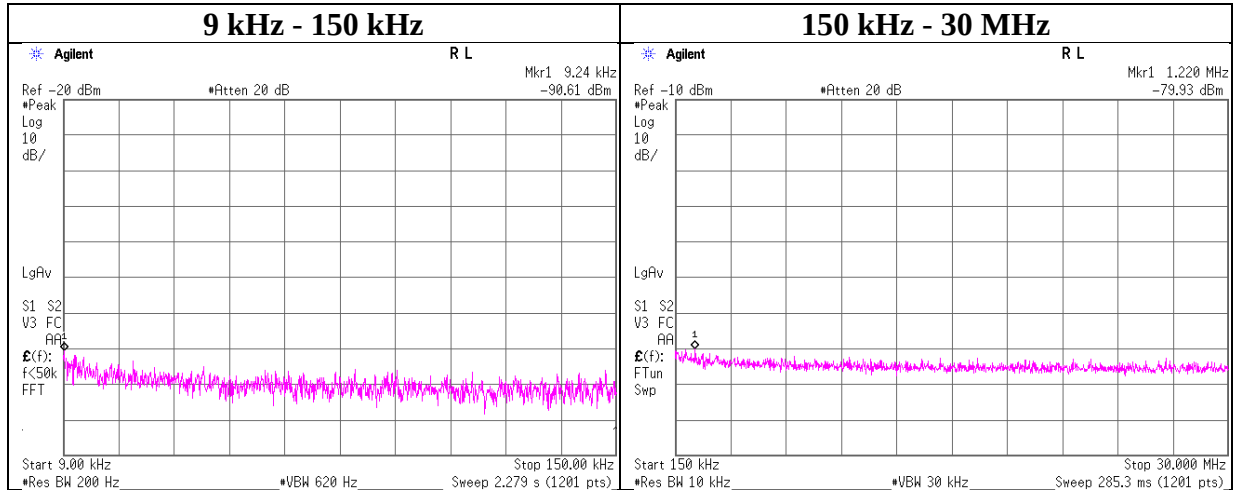
Report No.	12406767S-A-R3		
Test place	Shonan EMC Lab.		
Semi Anechoic Chamber	No.1	No.3	No.3
Date	July 21, 2018	July 19, 2018	July 20, 2018
Temperature / Humidity	21 deg. C / 54 % RH	23 deg. C / 56 % RH	23 deg. C / 53 % RH
Engineer	Shiro Kobayashi	Takahiro Suzuki	Takahiro Suzuki
	(30 MHz - 1000 MHz)	(1 GHz - 18 GHz)	(18 GHz - 26.5 GHz)
Mode	Tx Nordic Original 2 Mbps 2402 MHz (+4 dBm setting)		



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

Conducted Spurious Emission

Report No. 12406767S-A-R3
Test place Shonan EMC Lab. No.6 Shielded Room
Date July 20, 2018
Temperature / Humidity 25 deg. C / 50 % RH
Engineer Shiro Kobayashi
Mode Tx BT LE 1 Mbps 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
9.24	-90.6	0.01	9.7	2.0	1	-78.9	300	6.0	-17.6	48.2	65.8	
1220.00	-79.9	0.03	9.7	2.0	1	-68.2	30	6.0	13.1	25.8	12.7	

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

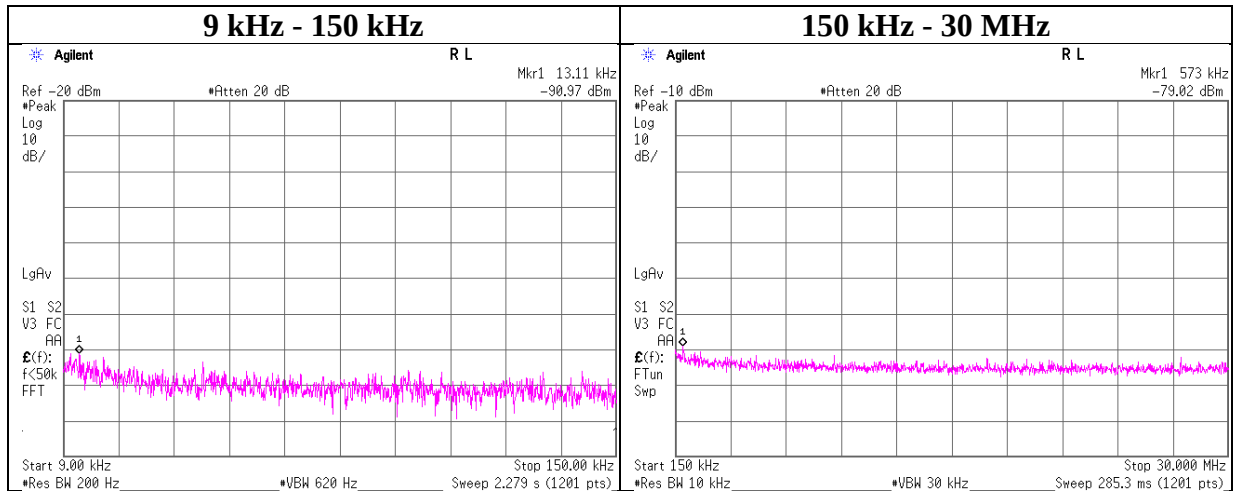
$EIRP[dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

N: Number of output

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

Conducted Spurious Emission

Report No. 12406767S-A-R3
Test place Shonan EMC Lab. No.6 Shielded Room
Date July 20, 2018
Temperature / Humidity 25 deg. C / 50 % RH
Engineer Shiro Kobayashi
Mode Tx BT LE 1 Mbps 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
13.11	-91.0	0.01	9.7	2.0	1	-79.2	300	6.0	-18.0	45.2	63.2	
573.00	-79.0	0.02	9.7	2.0	1	-67.3	30	6.0	14.0	32.4	18.4	

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

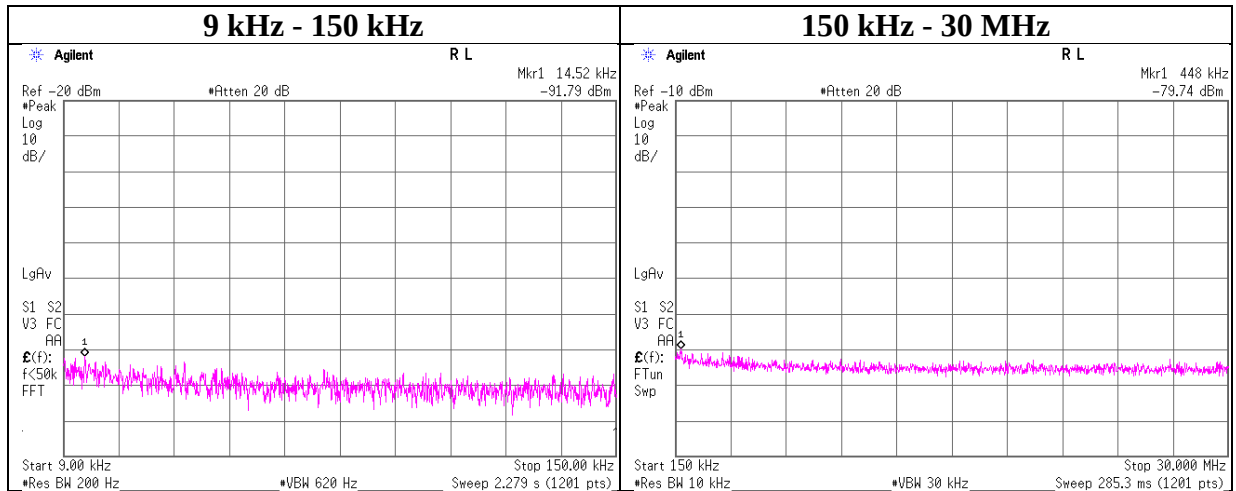
$EIRP [dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

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.

Conducted Spurious Emission

Report No. 12406767S-A-R3
Test place Shonan EMC Lab. No.6 Shielded Room
Date July 20, 2018
Temperature / Humidity 25 deg. C / 50 % RH
Engineer Shiro Kobayashi
Mode Tx BT LE 1 Mbps 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
14.52	-91.8	0.01	9.7	2.0	1	-80.0	300	6.0	-18.8	44.3	63.1	
448.00	-79.7	0.02	9.7	2.0	1	-68.0	300	6.0	-6.7	14.5	21.2	

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

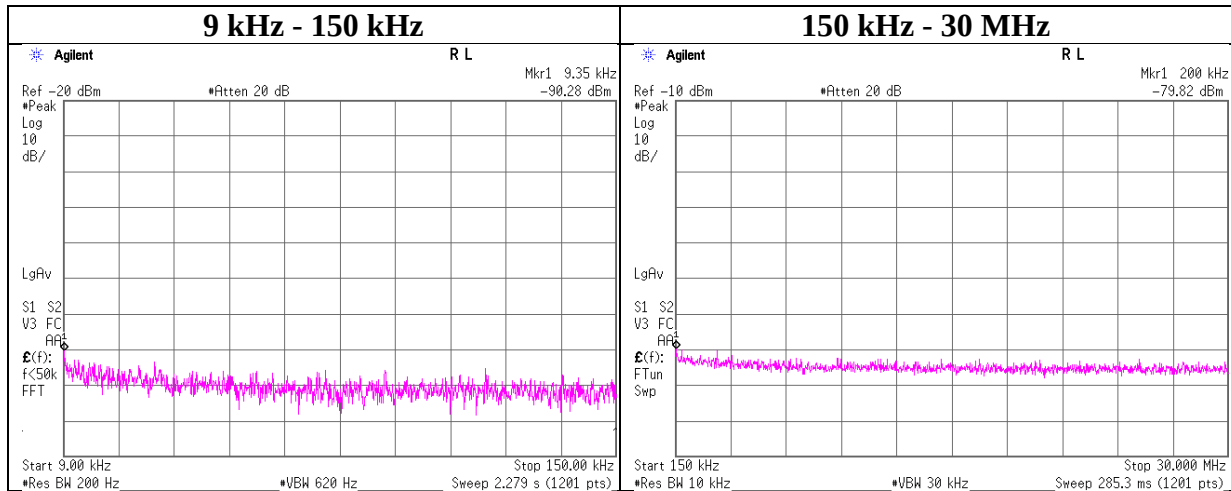
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

N: Number of output

*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. 12406767S-A-R3
Test place Shonan EMC Lab. No.6 Shielded Room
Date July 20, 2018
Temperature / Humidity 25 deg. C / 50 % RH
Engineer Shiro Kobayashi
Mode Tx BT LE 2 Mbps 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
9.35	-90.3	0.01	9.7	2.0	1	-78.5	300	6.0	-17.3	48.1	65.4	
200.00	-79.8	0.02	9.7	2.0	1	-68.1	300	6.0	-6.8	21.5	28.3	

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

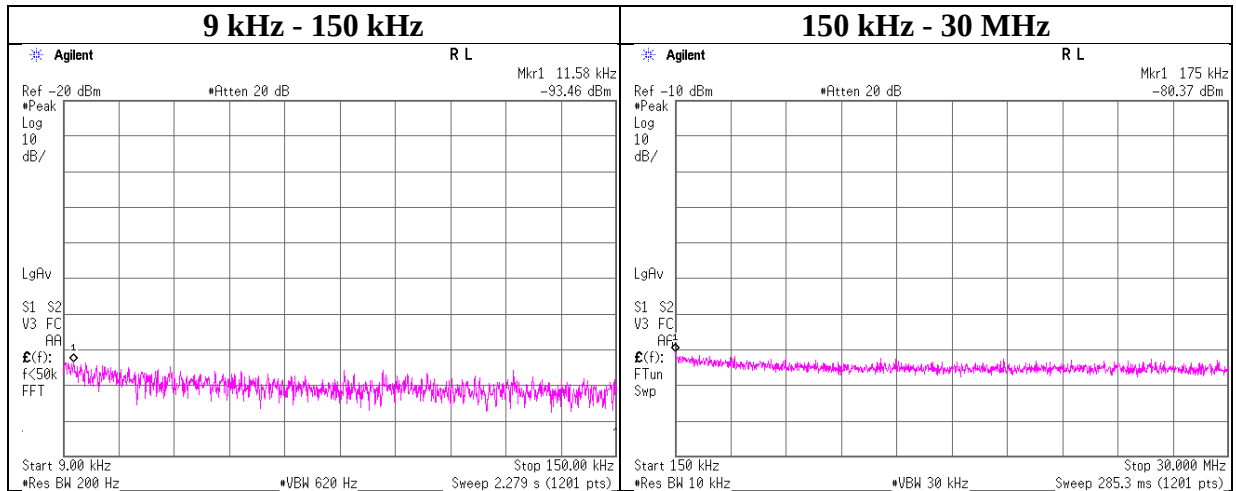
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

N: Number of output

*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. 12406767S-A-R3
Test place Shonan EMC Lab. No.6 Shielded Room
Date July 20, 2018
Temperature / Humidity 25 deg. C / 50 % RH
Engineer Shiro Kobayashi
Mode Tx BT LE 2 Mbps 2440 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
11.58	-93.5	0.01	9.7	2.0	1	-81.7	300	6.0	-20.5	46.3	66.8	
175.00	-80.4	0.02	9.7	2.0	1	-68.6	300	6.0	-7.4	22.7	30.1	

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

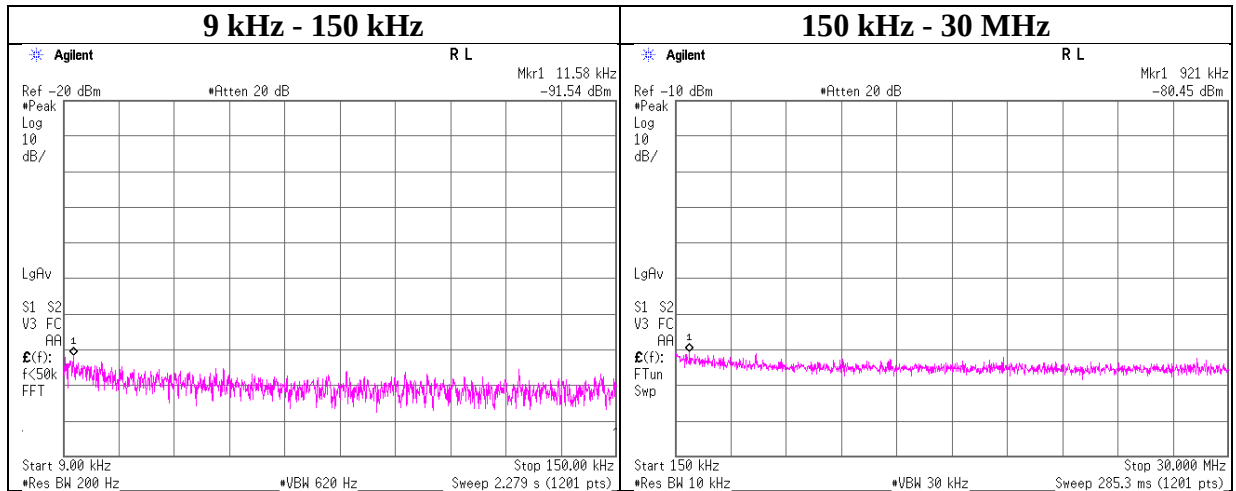
$EIRP [dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

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. 12406767S-A-R3
Test place Shonan EMC Lab. No.6 Shielded Room
Date July 20, 2018
Temperature / Humidity 25 deg. C / 50 % RH
Engineer Shiro Kobayashi
Mode Tx BT LE 2 Mbps 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
11.58	-91.5	0.01	9.7	2.0	1	-79.8	300	6.0	-18.5	46.3	64.8	
921.00	-80.5	0.03	9.7	2.0	1	-68.7	30	6.0	12.6	28.3	15.7	

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

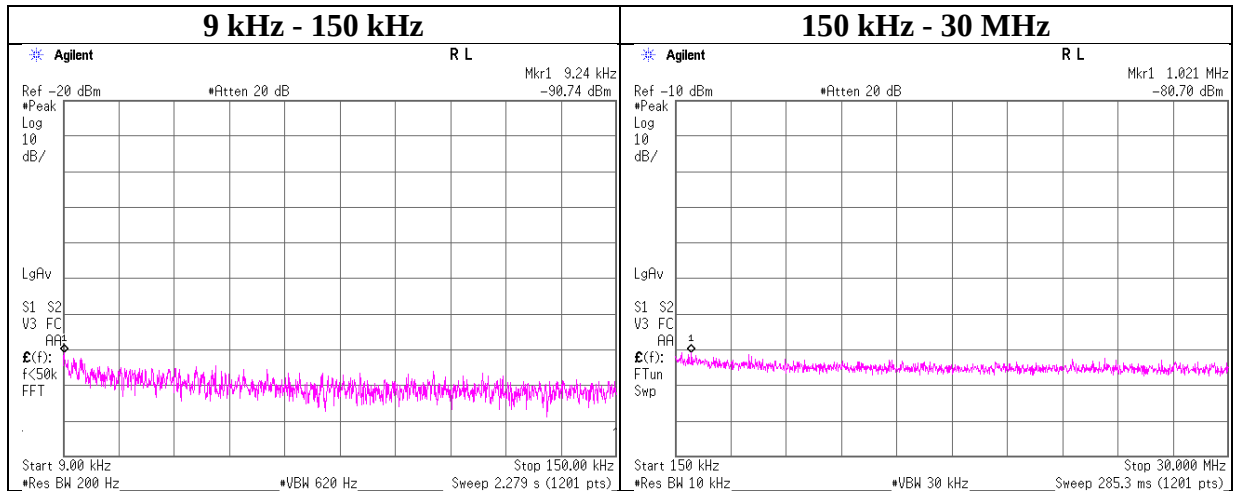
$EIRP [dBm] = Reading [dBm] + Cable\ loss [dB] + Attenuator\ Loss [dB] + Antenna\ gain [dBi] + 10 * \log (N)$

N: Number of output

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

Conducted Spurious Emission

Report No. 12406767S-A-R3
Test place Shonan EMC Lab. No.6 Shielded Room
Date July 20, 2018
Temperature / Humidity 25 deg. C / 50 % RH
Engineer Shiro Kobayashi
Mode Tx ANT 1 Mbps 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
9.24	-90.7	0.01	9.7	2.0	1	-79.0	300	6.0	-17.7	48.2	65.9	
1021.00	-80.7	0.03	9.7	2.0	1	-68.9	30	6.0	12.3	27.4	15.1	

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

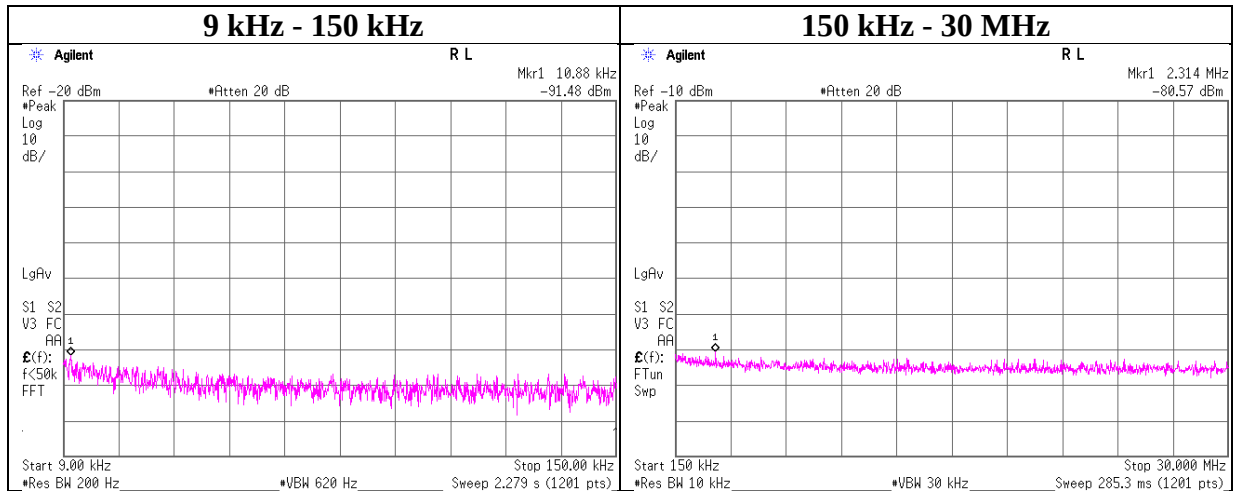
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

N: Number of output

*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. 12406767S-A-R3
Test place Shonan EMC Lab. No.6 Shielded Room
Date July 20, 2018
Temperature / Humidity 25 deg. C / 50 % RH
Engineer Shiro Kobayashi
Mode Tx ANT 1 Mbps 2441 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
10.88	-91.5	0.01	9.7	2.0	1	-79.7	300	6.0	-18.5	46.8	65.3	
2314.00	-80.6	0.04	9.7	2.0	1	-68.8	30	6.0	12.5	29.5	17.1	

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

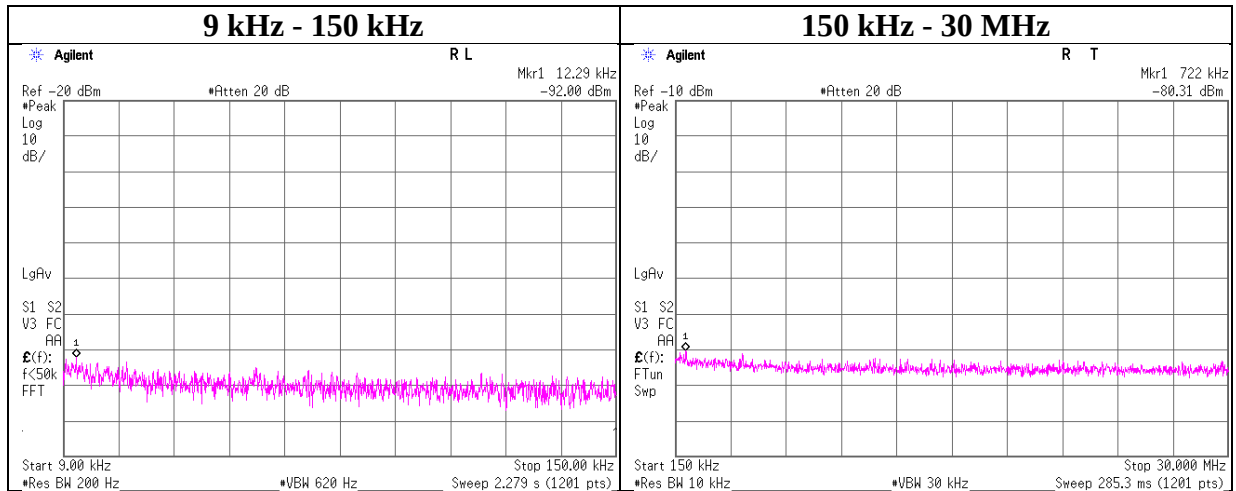
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

N: Number of output

*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. 12406767S-A-R3
Test place Shonan EMC Lab. No.6 Shielded Room
Date July 20, 2018
Temperature / Humidity 25 deg. C / 50 % RH
Engineer Shiro Kobayashi
Mode Tx ANT 1 Mbps 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
12.29	-92.0	0.01	9.7	2.0	1	-80.3	300	6.0	-19.0	45.8	64.8	
722.00	-80.3	0.02	9.7	2.0	1	-68.5	30	6.0	12.7	30.4	17.7	

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

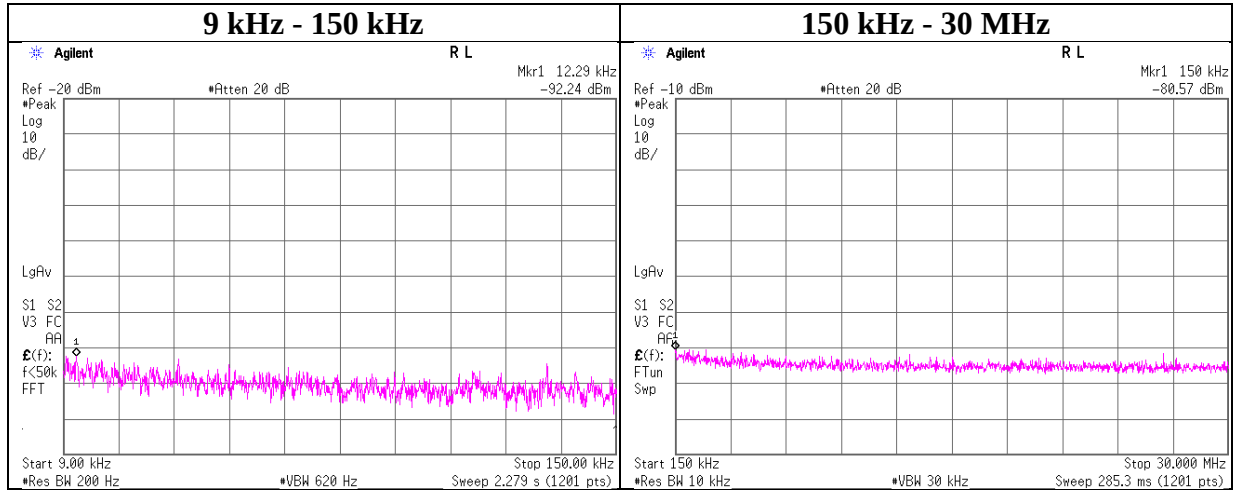
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

N: Number of output

*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. 12406767S-A-R3
Test place Shonan EMC Lab. No.6 Shielded Room
Date July 20, 2018
Temperature / Humidity 25 deg. C / 50 % RH
Engineer Shiro Kobayashi
Mode Tx Nordic Original 2 Mbps 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
12.29	-92.2	0.01	9.7	2.0	1	-80.5	300	6.0	-19.2	45.8	65.0	
150.00	-80.6	0.01	9.7	2.0	1	-68.8	300	6.0	-7.6	24.0	31.6	

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

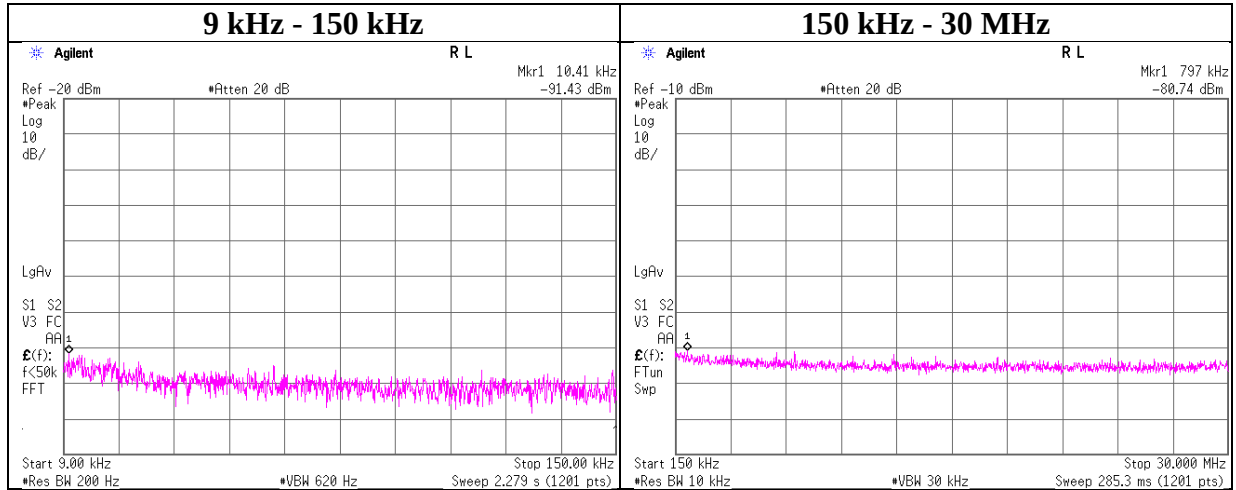
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

N: Number of output

*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. 12406767S-A-R3
Test place Shonan EMC Lab. No.6 Shielded Room
Date July 20, 2018
Temperature / Humidity 25 deg. C / 50 % RH
Engineer Shiro Kobayashi
Mode Tx Nordic Original 2 Mbps 2441 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
10.41	-91.4	0.01	9.7	2.0	1	-79.7	300	6.0	-18.4	47.2	65.6	
797.00	-80.7	0.03	9.7	2.0	1	-69.0	30	6.0	12.3	29.5	17.2	

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

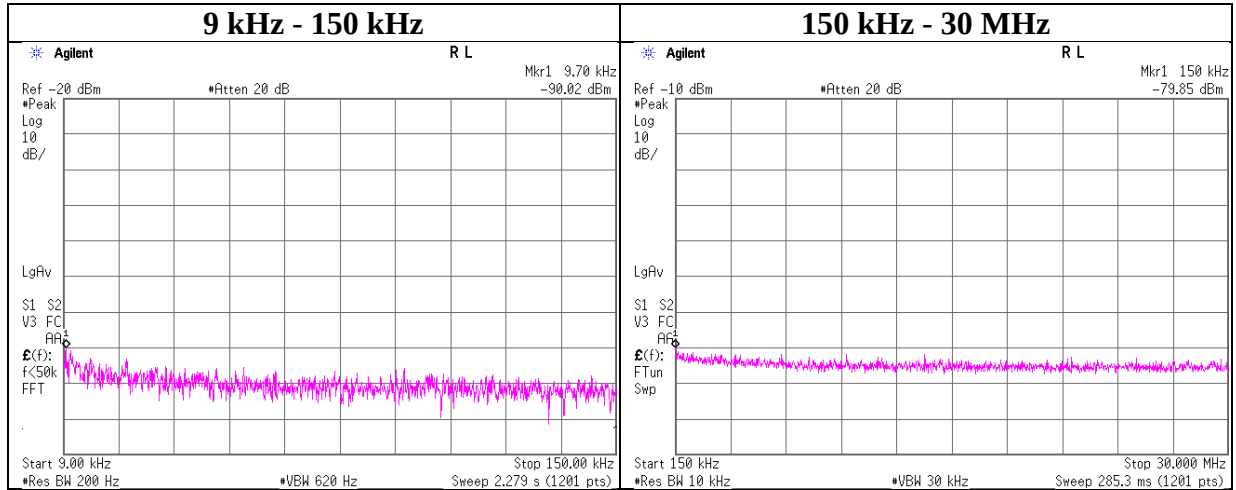
$\text{EIRP [dBm]} = \text{Reading [dBm]} + \text{Cable loss [dB]} + \text{Attenuator Loss [dB]} + \text{Antenna gain [dBi]} + 10 * \log (N)$

N: Number of output

*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. 12406767S-A-R3
Test place Shonan EMC Lab. No.6 Shielded Room
Date July 20, 2018
Temperature / Humidity 25 deg. C / 50 % RH
Engineer Shiro Kobayashi
Mode Tx Nordic Original 2 Mbps 2480 MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator Loss [dB]	Antenna Gain* [dBi]	N (Number of Output)	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
9.70	-90.0	0.01	9.7	2.0	1	-78.3	300	6.0	-17.0	47.8	64.8	
150.00	-79.9	0.01	9.7	2.0	1	-68.1	300	6.0	-6.8	24.0	30.8	

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

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

N: Number of output

*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.	12406767S-A-R3	
Test place	Shonan EMC Lab. No.5 and No.6 Shielded Room	
Date	July 17, 2018	July 20, 2018
Temperature / Humidity	26 deg. C / 47 % RH	25 deg. C / 50 % RH
Engineer	Yosuke Ishikawa	Shiro Kobayashi
Mode	Tx	

BT LE 1 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-22.62	1.72	9.82	-11.08	8.00	19.08
2440.00	-22.80	1.73	9.82	-11.25	8.00	19.25
2480.00	-22.81	1.74	9.82	-11.25	8.00	19.25

BT LE 2 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-24.54	1.72	9.82	-13.00	8.00	21.00
2440.00	-24.61	1.73	9.82	-13.06	8.00	21.06
2480.00	-24.68	1.74	9.82	-13.12	8.00	21.12

ANT 1 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-19.04	1.72	9.82	-7.50	8.00	15.50
2441.00	-19.09	1.73	9.82	-7.54	8.00	15.54
2480.00	-19.20	1.74	9.82	-7.64	8.00	15.64

Nordic Original 2 Mbps

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-21.53	1.72	9.82	-9.99	8.00	17.99
2441.00	-21.85	1.73	9.82	-10.30	8.00	18.30
2480.00	-21.78	1.74	9.82	-10.22	8.00	18.22

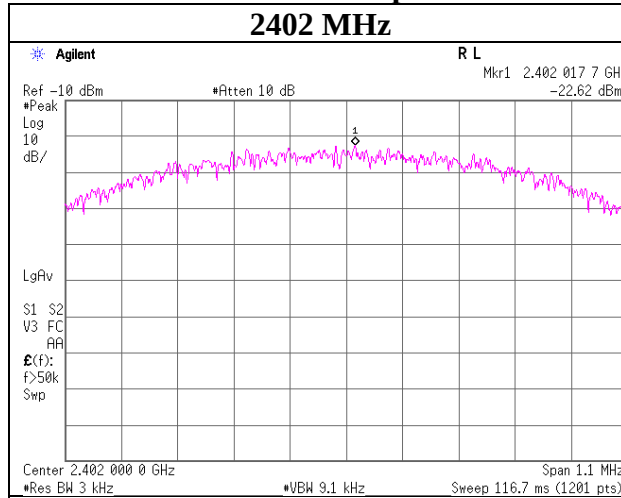
Sample Calculation:

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

Power Density

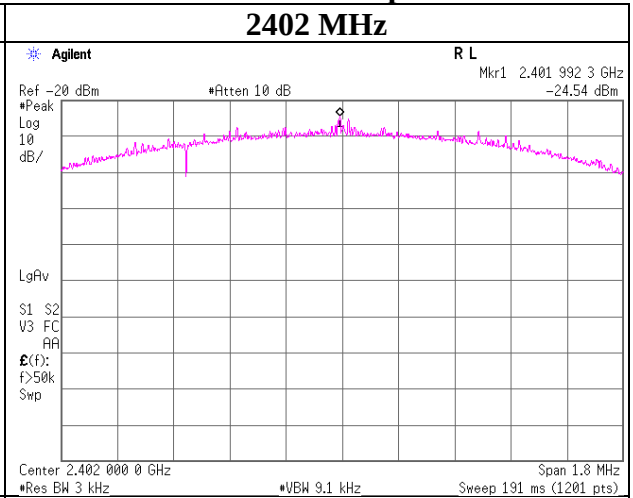
BT LE 1 Mbps

2402 MHz

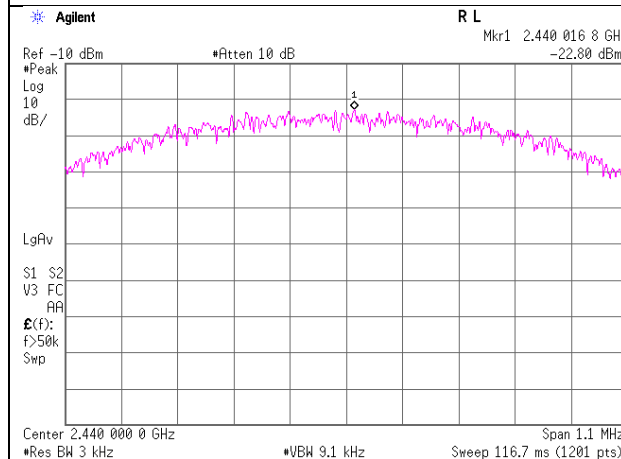


BT LE 2 Mbps

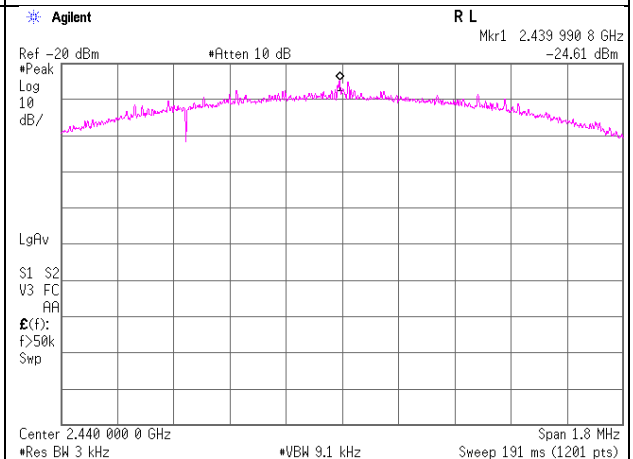
2402 MHz



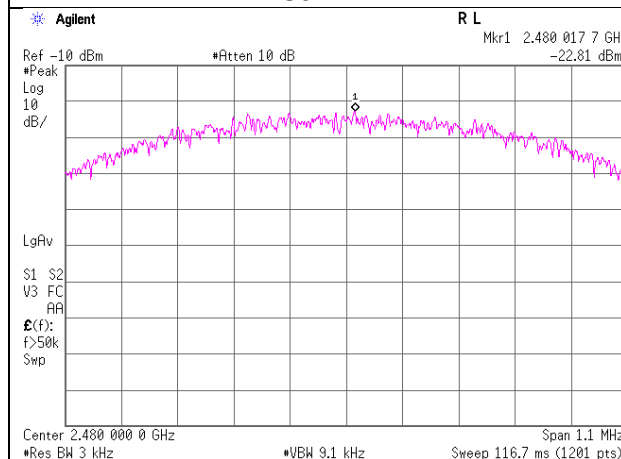
2440 MHz



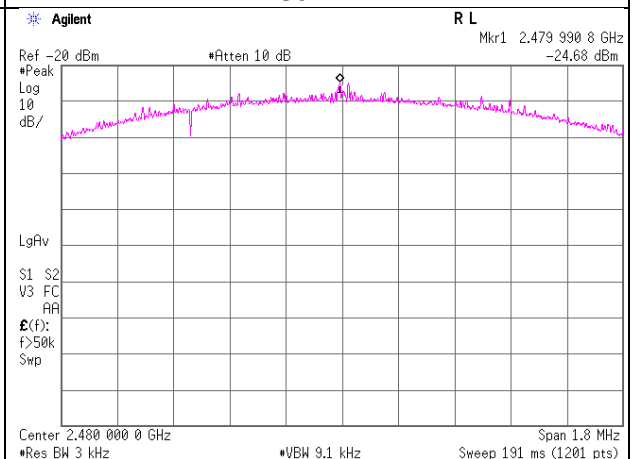
2440 MHz



2480 MHz



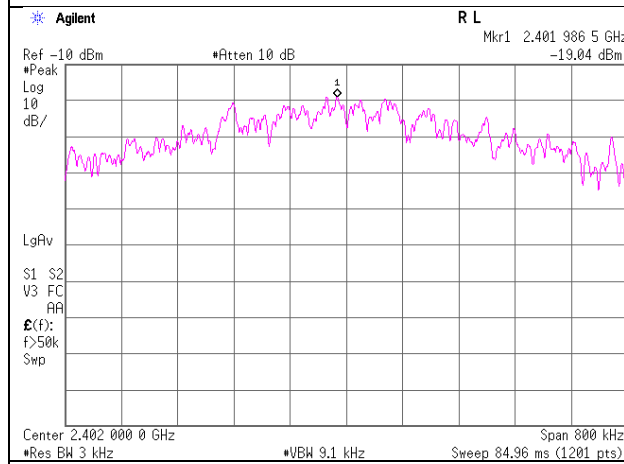
2480 MHz



Power Density

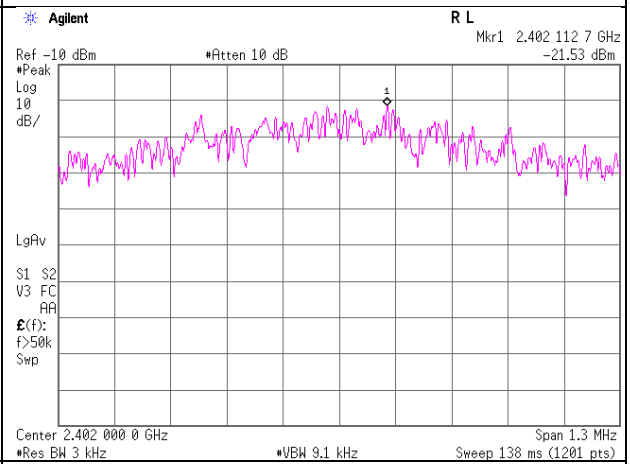
ANT 1Mbps

2402 MHz

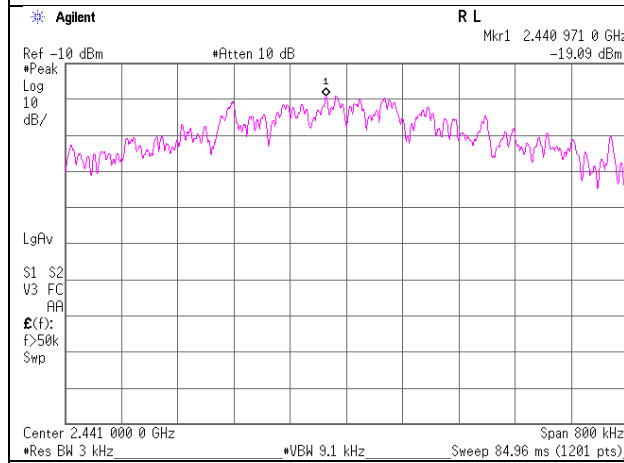


Nordic Original 2 Mbps

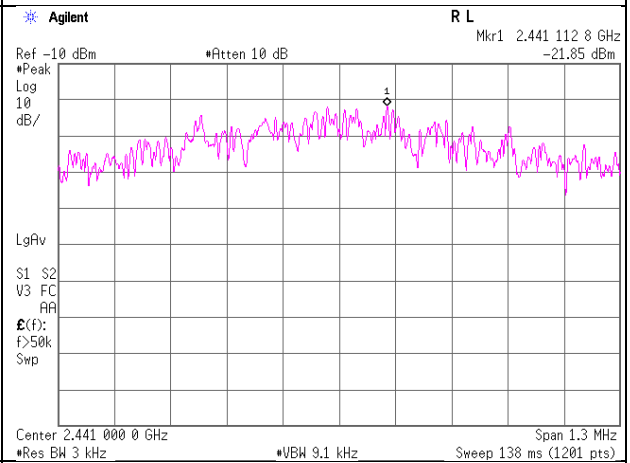
2402 MHz



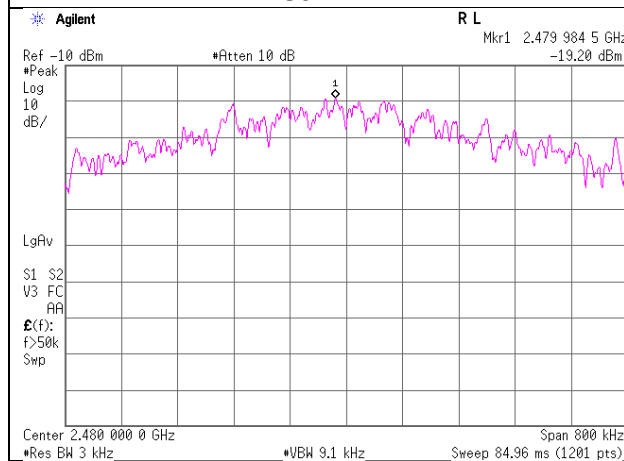
2441 MHz



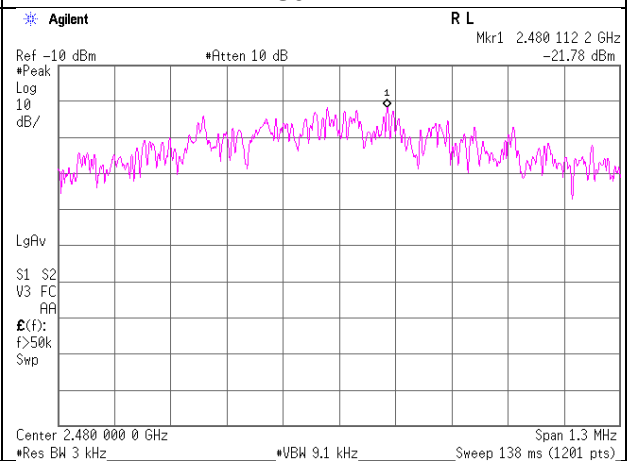
2441 MHz



2480 MHz



2480 MHz



APPENDIX 2: Test instruments

Test Instruments

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
KSA-08	Spectrum Analyzer	Agilent	E4446A	MY46180525	AT,RE	2017/10/10 * 12
SCC-G14	Coaxial Cable	Suhner	SUCOFLEX 102	31600/2	AT	2018/03/19 * 12
SCC-G32	Coaxial Cable	Junkosha	MWX241-02000 KMSKMS	OCT-09-13-005	AT	2017/11/22 * 12
SAT10-14	Attenuator	Weinschel Corp.	54A-10	81595	AT	2018/04/20 * 12
SOS-09	Humidity Indicator	A&D	AD-5681	4061484	AT	2017/12/21 * 12
STS-05	Digital Hitester	Hioki	3805-50	080997828	AT	2017/10/16 * 12
SOS-10	Humidity Indicator	A&D	AD-5681	4064561	AT	2017/10/30 * 12
STS-06	Digital Hitester	Hioki	3805-50	080997830	AT	2018/03/08 * 12
SCC-C9/C10/SR SE-03	Coaxial Cable&RF Selector	Suhner/Suhner/TOYO	RG223U/141PE/ NS4906	-/0901-271(RF Selector)	CE	2018/04/09 * 12
SLS-02	LISN	Rohde & Schwarz	ENV216	100512	CE	2018/02/26 * 12
SAT3-07	Attenuator	JFW	50HF-003N	-	CE	2017/09/08 * 12
SOS-06	Humidity Indicator	A&D	AD-5681	4062118	CE	2017/12/21 * 12
STM-05	Terminator	TME	CT-01 BP	-	CE	2017/12/14 * 12
STR-07	Test Receiver	Rohde & Schwarz	ESU26	100484	CE	2017/09/26 * 12
SJM-02	Measure	KOMELON	KMC-36	-	CE	-
COTS-SEMI-1	EMI Software	TSJ	TEPTO-DV(RE, CE,RFL,MF)	-	CE, RE	-
STS-03	Digital Hitester	Hioki	3805-50	080997823	CE,RE	2017/10/16 * 12
SLS-01	LISN	Rohde & Schwarz	ENV216	100511	CE	2018/02/26 * 12
SAT10-05	Attenuator(above1 GHz)	Agilent	8493C-010	74864	RE	2017/11/22 * 12
SFL-02	Highpass Filter	MICRO-TRONICS	HPM50111	051	RE	2017/11/16 * 12
SAF-06	Pre Amplifier	TOYO Corporation	TPA0118-36	2046104	RE	2017/09/22 * 12
SCC-G23	Coaxial Cable	Suhner	SUCOFLEX 104	297342/4	RE	2018/05/11 * 12
SHA-03	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-739	RE	2017/08/23 * 12
SOS-05	Humidity Indicator	A&D	AD-5681	4062518	RE	2017/10/30 * 12
SJM-02	Measure	KOMELON	KMC-36	-	RE	-
SAEC-03(SVS WR)	Semi-Anechoic Chamber	TDK	SAEC-03(SVSW R)	3	RE	2017/07/17 * 12
STS-03	Digital Hitester	Hioki	3805-50	080997823	RE	2017/10/16 * 12
SCC-G06	Coaxial Cable	Junkosha	J12J102207-00	MAY-23-16-091	RE	2018/06/01 * 12
KHA-04	Horn Antenna	EMCO	3160-09	1278	RE	2018/07/12 * 12
SAF-08	Pre Amplifier	TOYO Corporation	HAP18-26W	00000019	RE	2018/03/27 * 12
SCC-G45	Coaxial Cable	HUBER+SUHNER	SUCOFLEX 102 E	800137/2EA	RE	2018/03/28 * 12
SCC-G33	Coaxial Cable	Junkosha	MWX241-01000 KMSKMS	-	RE	2018/04/20 * 12

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Facsimile : +81 463 50 6401

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
SAF-01	Pre Amplifier	SONOMA	310N	290211	RE	2018/02/16 * 12
KAT6-04	Attenuator	INMET	18N-6dB	-	RE	2017/12/14 * 12
SAT3-09	Attenuator	JFW	50HF-003N	-	RE	2017/08/24 * 12
SBA-01	Biconical Antenna	Schwarzbeck	BBA9106	91032664	RE	2018/06/05 * 12
SCC-A1/A3/A5/ A7/A8/A13/SRS E-01	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhn er/Suhner/Suhner/Suhn er/TOYO	8D2W/12DSFA/ 141PE/141PE/14 1PE/141PE/NS4 906	-/0901-269(RF Selector)	RE	2018/04/12 * 12
SCC-A2/A4/A6/ A7/A8/A13/SRS E-01	Coaxial Cable&RF Selector	Fujikura/Fujikura/Suhn er/Suhner/Suhner/Suhn er/TOYO	8D2W/12DSFA/ 141PE/141PE/14 1PE/141PE/NS4 906	-/0901-269(RF Selector)	RE	2018/04/12 * 12
SLA-05	Logperiodic Antenna	Schwarzbeck	VUSLP9111B	193	RE	2018/06/05 * 12
SOS-01	Humidity Indicator	A&D	AD-5681	4062555	RE	2017/10/30 * 12
STR-01	Test Receiver	Rohde & Schwarz	ESU40	100093	RE	2018/04/13 * 12
KJM-09	Measure	KOMELON	KMC-36	-	RE	-
SAEC-01(NSA)	Semi-Anechoic Chamber	TDK	SAEC-01(NSA)	1	RE	2018/05/29 * 12
STS-01	Digital Hitester	Hioki	3805-50	080997812	RE	2017/10/16 * 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.

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