



RADIO TEST REPORT

Test Report No. : 10763602H-A

Applicant : Aplix IP Holdings Corporation
Type of Equipment : JM1
Model No. : JM1L2L
FCC ID : O8CJM1L2L
Test regulation : FCC Part 15 Subpart C: 2015
Test Result : Complied

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2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
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6. This test report covers Radio technical requirements. It does not cover administrative issues such as Manual or non-Radio test related Requirements. (if applicable)

Date of test: May 11 and 15, 2015

Representative test engineer:


Yuta Moriya

Engineer

Consumer Technology Division

Approved by:


Takayuki Shimada

Engineer

Consumer Technology Division



NVLAP LAB CODE: 200572-0

This laboratory is accredited by the NVLAP LAB CODE 200572-0, U.S.A. The tests reported herein have been performed in accordance with its terms of accreditation.
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13-EM-F0429

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SECTION 1: Customer information

Company Name : Aplix IP Holdings Corporation
Address : 2-20-9 Nishiwaseda, Shinjuku-ku, Tokyo, 169-0051 JAPAN
Telephone Number : +81-50-3786-1702
Facsimile Number : +81-50-3730-5857
Contact Person : Manabu Yoshioka

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

2.1 Identification of E.U.T.

Type of Equipment : JM1
Model Number : JM1L2L
Serial Number : Refer to 4.2 in this report.
Rating : DC 3.0 V
Country of Mass-production : Japan, China, Taiwan
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Receipt Date of Sample : May 7, 2015
Modification of EUT : No modification by the test lab.

2.2 Product Description

Model: JM1L2L (referred to as the EUT in this report) is JM1.

Clock frequency(ies) in the system : 16MHz, 32.768kHz

<Radio part>

Equipment type : Transceiver
Frequency of operation : 2402 - 2480 MHz
Bandwidth : 1 MHz
Channel spacing : 2 MHz
Type of modulation : DSSS
Power Supply (inner) : DC 3.0 V
Antenna type : Pattern antenna
Antenna gain : -2.53 dBi
ITU code : F1D
Operation temperature range : -20 to +75 deg. C

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2015, final revised on January 21, 2015

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 C63.4-2009 7. AC powerline Conducted Emission measurements ----- IC: RSS-Gen 8.8	FCC: Section 15.207 ----- IC: RSS-Gen 8.8	QP 19.8 dB, 0.15174 MHz, N AV 25.6 dB, 24.94100 MHz, L	Complied	-
6dB Bandwidth	FCC: KDB 558074 D01 DTS Meas Guidance v03r03 ----- IC: -	FCC: Section 15.247(a)(2) ----- IC: RSS-247 5.2(1)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: KDB 558074 D01 DTS Meas Guidance v03r03 ----- IC: RSS-Gen 6.12	FCC: Section 15.247(b)(3) ----- IC: RSS-247 5.4(4)		Complied	Conducted
Power Density	FCC: KDB 558074 D01 DTS Meas Guidance v03r03 ----- IC: -	FCC: Section 15.247 (e) ----- IC: RSS-247 5.2(2)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: KDB 558074 D01 DTS Meas Guidance v03r03 ----- 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 4804.000 MHz, Horizontal, AV	Complied	Conducted (below 30MHz)/ Radiated (above 30MHz) *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 v03r03 12.2.7.

* In case any questions arise about test procedure, ANSI C63.4: 2009 is also referred.

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FCC Part 15.31 (e)

The RF Module has own regulator.

The RF Module is constantly provided voltage through own regulator regardless of input voltage (DC 3.0 V).

Therefore, this EUT complies with the requirement.

FCC Part 15.203/212 Antenna requirement

It is impossible for end users to replace the antenna, because it is soldered on the circuit board. Therefore the equipment complies with the requirement of 15.203/212.

3.3 Addition to standard

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

Test room (semi-anechoic chamber)	Conducted emission (+dB)
	150kHz-30MHz
No.1	3.5dB
No.2	3.5dB
No.3	3.4dB
No.4	3.5dB

Test room (semi-anechoic chamber)	Radiated emission						
	(3m*)(+dB)				(1m*)(+dB)		(0.5m*)(+dB)
	9kHz -30MHz	30MHz -300MHz	300MHz -1GHz	1GHz -10GHz	10GHz -18GHz	18GHz -26.5GHz	26.5GHz -40GHz
No.1	4.3dB	5.5dB	6.3dB	5.5dB	5.8dB	5.8dB	4.3dB
No.2	4.2dB	5.4dB	6.3dB	5.4dB	5.7dB	5.9dB	5.6dB
No.3	4.4dB	5.4dB	6.4dB	5.2dB	5.5dB	5.8dB	5.5dB
No.4	4.7dB	5.6dB	6.4dB	5.3dB	5.7dB	5.9dB	5.5dB

*3m/1m/0.5m = Measurement distance

Power meter (+dB)	
Below 1GHz	Above 1GHz
0.7dB	1.5dB

Antenna terminal conducted emission and Power density (+dB)			Antenna terminal conducted emission (+dB)		Channel power (+dB)
Below 1GHz	1GHz-3GHz	3GHz-18GHz	18GHz-26.5GHz	26.5GHz-40GHz	
1.5dB	1.7dB	2.8dB	2.8dB	2.9dB	2.6dB

Conducted Emission test

The data listed in this test report has enough margin, more than the site margin.

Radiated emission test (3m)

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

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3.5 Test Location

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	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.3 Preparation room
No.3 shielded room	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.4 Preparation room
No.4 shielded room	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9m	6.0 x 6.0m	-
No.6 shielded room	-	4.0 x 4.5 x 2.7m	4.0 x 4.5 m	-
No.6 measurement room	-	4.75 x 5.4 x 3.0m	4.75 x 4.15 m	-
No.7 shielded room	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	8.0 x 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	6.2 x 4.7 x 3.0m	4.8 x 4.6m	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test data, Test instruments, and Test set up

Refer to APPENDIX.

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

4.1 Operating Mode(s)

Mode	Remarks*
Transmitting (Tx) Bluetooth Low Energy (BT LE)	Maximum Packet Size, PN9
*Power of the EUT was set by the software as follows; Power settings: 0dBm Software: Connection Manager Version 3.0.6.0 *This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	

*The details of Operating mode(s)

Test Item	Operating Mode	Tested frequency
Conducted Emission, 6dB Bandwidth, Maximum Peak Output Power, Spurious Emission (Radiated / Conducted), Power Density, 99% Occupied Bandwidth	Tx BT LE	2402 MHz 2440 MHz 2480 MHz

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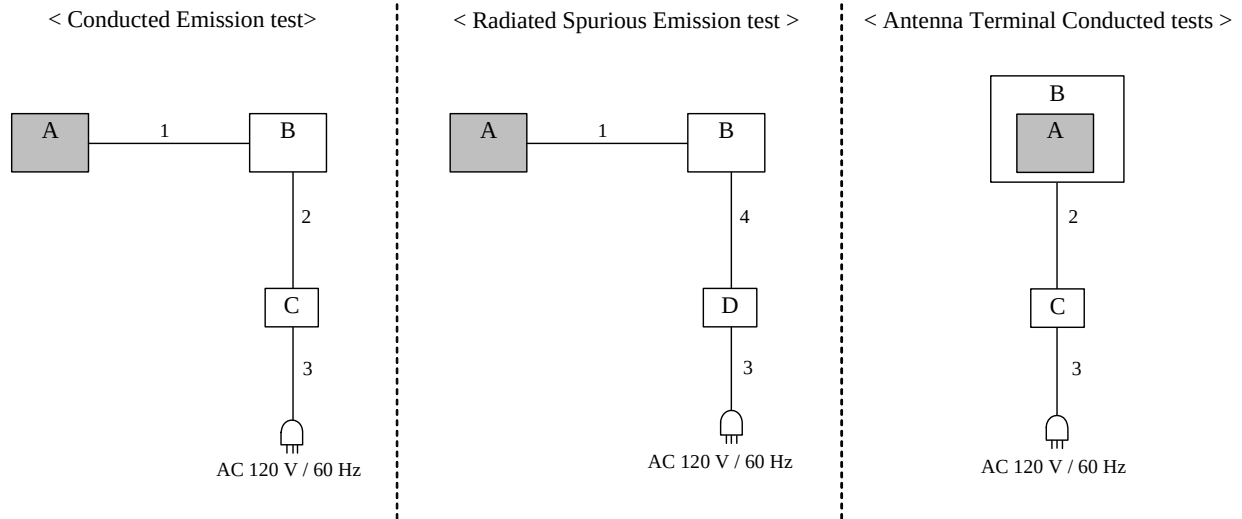
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4.2 Configuration and peripherals



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

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	JM1	JM1L2L	A002593612 for AT* A002593700 for other tests	Aplix IP Holdings Corporation	EUT
B	Jig	-	-	Aplix IP Holdings Corporation	-
C	DC Power Supply	PW8-3ATP	09067054	KENWOOD	for CE, AT*
D	DC Power Supply	PMC35-2A	02871	KIKUSUI	for RE*

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	Signal Cable	0.1	Unshielded	Unshielded	-
2	DC Cable	0.6	Unshielded	Unshielded	for CE, AT*
3	AC Cable	1.8	Unshielded	Unshielded	-
4	DC Cable	1.2	Unshielded	Unshielded	for RE*

*CE: Conducted Emission test, RE: Radiated Spurious Emission test, AT: Antenna Terminal Conducted tests

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, raised 0.8m above the conducting ground plane. The rear of tabletop was located 40cm 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 80cm 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 30cm to 40cm long and were hanged at a 40cm height to the ground plane. All unused 50ohm connectors of the LISN(AMN) were resistivity terminated in 50ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.

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	: 0.15-30MHz
Test data	: APPENDIX
Test result	: Pass

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SECTION 6: Radiated Spurious Emission

Test Procedure

It was measured based on "11.0 Emissions in non-restricted frequency bands" of "558074 D01 DTS Meas Guidance v03r03".

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m, raised 0.8m above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane. The height of the measuring antenna varied between 1 and 4m 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	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Biconical	Logperiodic	Horn

In any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

20dBc 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 1GHz	Above 1GHz		20dBc
Instrument used	Test Receiver	Spectrum Analyzer		Spectrum Analyzer
Detector	QP	PK	AV *1)	PK
IF Bandwidth	BW 120kHz	RBW: 1MHz VBW: 3MHz	Average Power Method: <u>12.2.5.2</u> RBW: 1 MHz VBW: 3 MHz Detector: Power Averaging (RMS) Trace: 100 traces Duty factor was added to the results. Integration Method: <u>13.3.1</u> RBW: 100kHz VBW: 300kHz Span: 2MHz Detector: Power Averaging (RMS) Trace: 100 traces	RBW: 100kHz VBW: 300kHz
Test Distance	3m	3m (below 10GHz), 1m *2) (above 10GHz)		3m (below 10GHz), 1m *2) (above 10GHz)

*1) Average Power Measurement was performed based on 6.0 & 12.2.5 of "KDB 558074 D01 DTS Meas Guidance v03r03".

*2) Distance Factor: $20 \times \log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$

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

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

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

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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	3MHz	100kHz	300kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth *1)	Enough width to display emission skirts	1 to 5% of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/Average *2)	-	Power Meter (Sensor: 50MHz BW)
Peak Power Density	1.5 times the 6dB Bandwidth	3kHz	10kHz	Auto	Peak	Max Hold	Spectrum Analyzer *3)
Conducted Spurious Emission *4)	9kHz to 150kHz	200Hz	620Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1kHz	27kHz				
Band Edge confirmation	10MHz	100kHz	300kHz	Auto	Peak	Max Hold	Spectrum Analyzer
*1) Peak hold was applied as Worst-case measurement. *2) Reference data *3) Section 10.2 Method PKPSD (peak PSD) of "KDB 558074 D01 DTS Meas Guidance v03r03". *4) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was low enough as shown in the chart.(9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=9.1kHz).							

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

Test data : APPENDIX
Test result : Pass

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APPENDIX 1: Test data

Conducted Emission

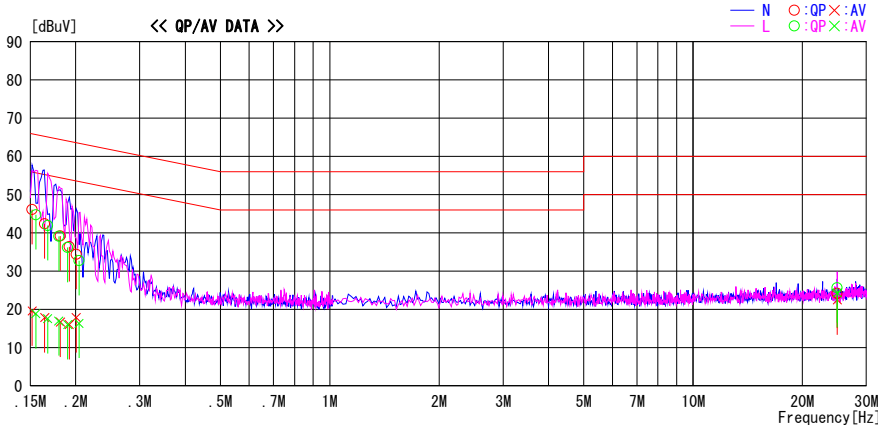
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No. 4 Semi Anechoic Chamber
Date : 2015/05/15

Report No. : 10763602H
Temp./Humi. : 24deg. C / 36% RH
Engineer : Yuta Moriya

Mode / Remarks : BT LE Tx 2440MHz

LIMIT : FCC15.207 QP
FCC15.207 AV



Frequency	Reading Level		Corr.	Results		Limit		Margin		Phase	Comment
	QP	AV		QP	AV	QP	AV	QP	AV		
[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
0.15174	32.8	6.3	13.3	46.1	19.6	65.9	55.9	19.8	36.3	N	
0.16418	29.1	4.5	13.3	42.4	17.8	65.2	55.2	22.8	37.4	N	
0.18138	25.9	3.4	13.3	39.2	16.7	64.4	54.4	25.2	37.7	N	
0.19184	23.1	2.7	13.3	36.4	16.0	64.0	54.0	27.6	38.0	N	
0.20056	21.0	4.5	13.3	34.3	17.8	63.6	53.6	29.3	35.8	N	
24.94220	9.4	7.7	14.8	24.2	22.5	60.0	50.0	35.8	27.5	N	
0.15523	31.4	5.6	13.3	44.7	18.9	65.7	55.7	21.0	36.8	L	
0.16744	28.6	4.3	13.3	41.9	17.6	65.1	55.1	23.2	37.5	L	
0.17964	25.8	3.7	13.3	39.1	17.0	64.5	54.5	25.4	37.5	L	
0.19010	22.9	2.7	13.3	36.2	16.0	64.0	54.0	27.8	38.0	L	
0.20405	19.4	3.1	13.3	32.7	16.4	63.4	53.4	30.7	37.0	L	
24.94100	10.8	9.6	14.8	25.6	24.4	60.0	50.0	34.4	25.6	L	

CHART : WITH FACTOR, Peak hold data. CALCULATION : RESULT[dBuV] = READING[dBuV] + C.F[dB] (LISN + CABLE + ATTEN)
Except for the above table : adequate margin data below the limits.

Conducted Emission

Test place

Report No.

Date

Temperature/ Humidity

Engineer

Mode

Ise EMC Lab. No.4 Semi Anechoic Chamber

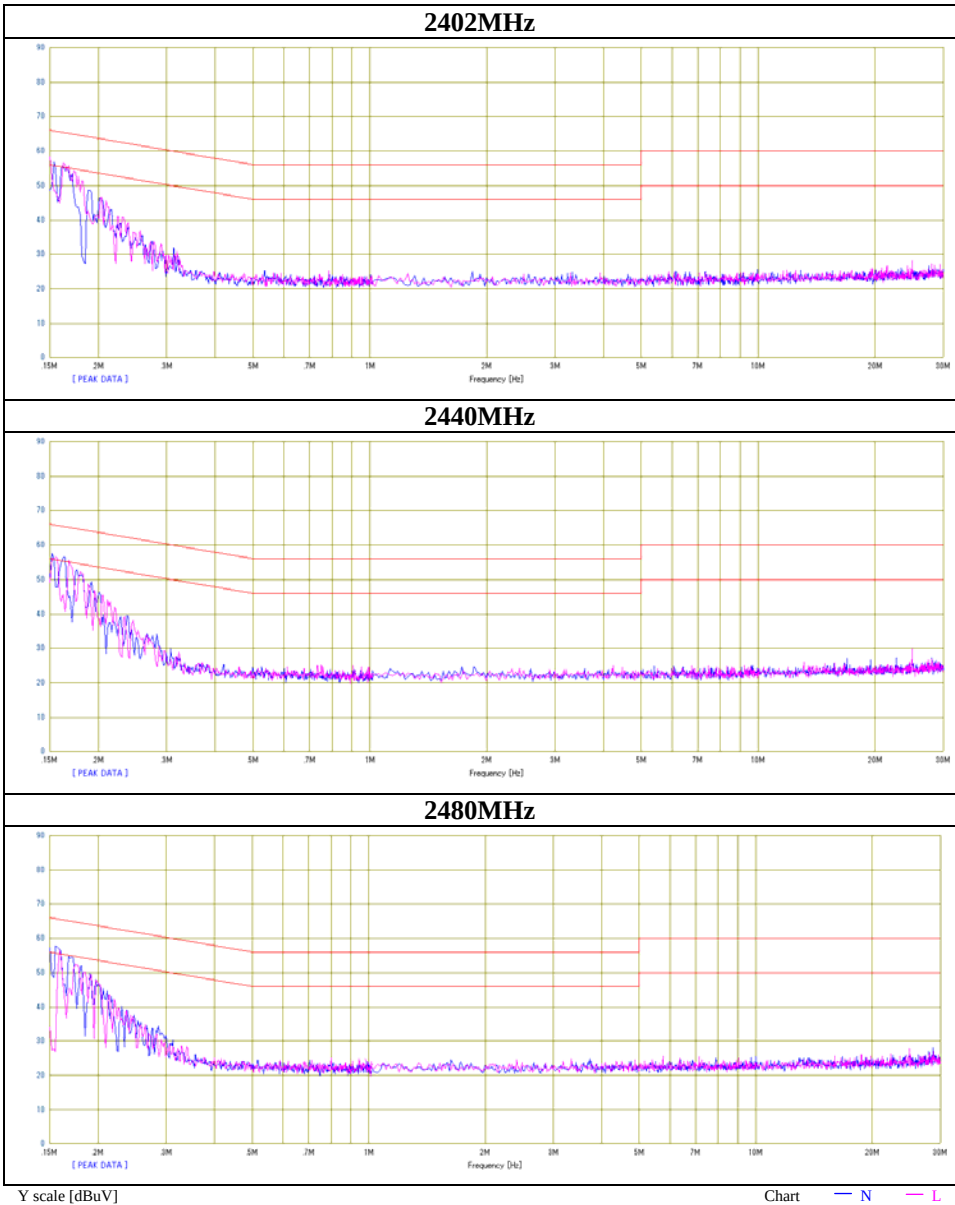
10763602H

05/15/2015

23deg. C / 36% RH

Yuta Moriya

Tx BT LE



6dB Bandwidth

Test place Ise EMC Lab. No.4 shielded room
Report No. 10763602H
Date 05/15/2015
Temperature/ Humidity 23deg. C / 36% RH
Engineer Yuta Moriya
Mode Tx BT LE

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2402	0.683	>500
2440	0.687	>500
2480	0.696	>500

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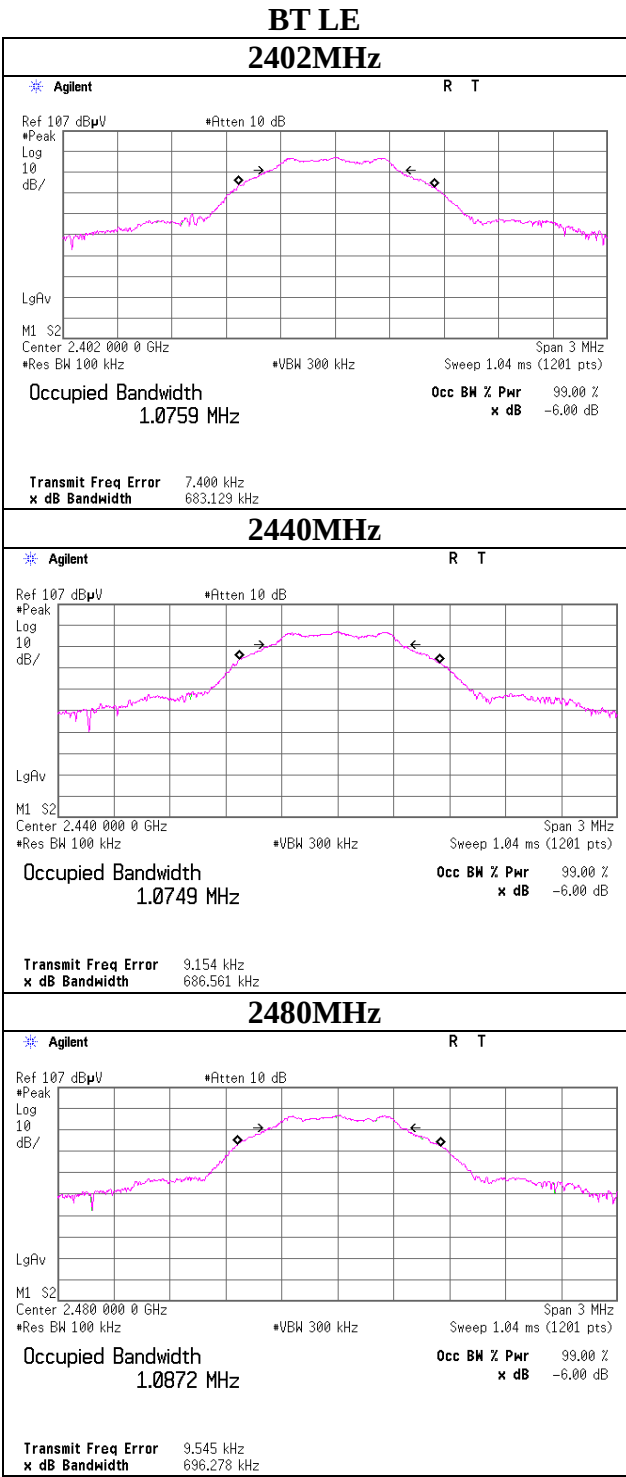
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6dB Bandwidth



Maximum Peak Output Power

Test place Ise EMC Lab. No.4 shielded room
Report No. 10763602H
Date 05/15/2015
Temperature/ Humidity 23deg. C / 36% RH
Engineer Yuta Moriya
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2402	-12.33	0.96	10.11	-1.26	0.75	30.00	1000	31.26
2440	-12.66	0.96	10.11	-1.59	0.69	30.00	1000	31.59
2480	-12.58	0.97	10.11	-1.50	0.71	30.00	1000	31.50

Sample Calculation:

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

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Maximum Average Output Power (Reference data)

Test place Ise EMC Lab. No.4 shielded room
Report No. 10763602H
Date 05/15/2015
Temperature/ Humidity 23deg. C / 36% RH
Engineer Yuta Moriya
Mode Tx BT LE

[AV]

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Duty factor [dB]	Result with Duty factor	
				[dBm]	[mW]		[dBm]	[mW]
2402	-14.67	0.96	10.11	-3.60	0.44	2.02	-1.58	0.70
2440	-15.00	0.96	10.11	-3.93	0.40	2.02	-1.91	0.64
2480	-14.93	0.97	10.11	-3.85	0.41	2.02	-1.83	0.66

Sample Calculation:

Result with Duty factor = Result + Duty factor

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Radiated Spurious Emission

Test place	Ise EMC Lab. No.2 and 4 Semi Anechoic Chamber		
Report No.	10763602H		
Date	05/11/2015 (Day)	05/11/2015 (Night)	05/15/2015
Temperature/ Humidity	24deg. C / 38% RH	24deg. C / 36% RH	23deg. C / 36% RH
Engineer	Takumi Shimada	Shinichi Miyazono	Yuta Moriya
	(Below 1GHz)	(1-10GHz)	(Above 10GHz)
Mode	Tx BT LE 2402MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	75.000	QP	22.9	6.5	7.2	28.4	-	8.2	40.0	31.8	
Hori	120.672	QP	27.6	12.7	7.6	28.2	-	19.7	43.5	23.8	
Hori	186.341	QP	29.4	16.4	8.1	27.9	-	26.0	43.5	17.5	
Hori	195.000	QP	30.5	16.5	8.1	27.9	-	27.2	43.5	16.3	
Hori	330.990	QP	30.8	15.5	9.0	27.7	-	27.6	46.0	18.4	
Hori	600.000	QP	22.4	19.7	10.2	28.5	-	23.8	46.0	22.2	
Hori	2390.000	PK	60.2	29.3	3.5	35.0	-	58.0	73.9	15.9	
Hori	4804.000	PK	51.7	32.7	5.8	34.2	-	56.0	73.9	17.9	
Hori	7206.000	PK	42.6	36.8	7.2	34.1	-	52.5	73.9	21.4	Floor Noise
Hori	9608.000	PK	43.0	38.9	8.1	34.7	-	55.3	73.9	18.6	Floor Noise
Hori	2390.000	AV	46.5	29.3	3.5	35.0	2.0	46.3	53.9	7.6	*1
Hori	4804.000	AV	47.0	32.7	5.8	34.2	2.0	53.3	53.9	0.6	
Hori	7206.000	AV	34.4	36.8	7.2	34.1	-	44.3	53.9	9.6	Floor Noise
Hori	9608.000	AV	35.1	38.9	8.1	34.7	-	47.4	53.9	6.5	Floor Noise
Vert	75.000	QP	22.9	6.5	7.2	28.4	-	8.2	40.0	31.8	
Vert	120.672	QP	22.8	12.7	7.6	28.2	-	14.9	43.5	28.6	
Vert	186.341	QP	32.7	16.4	8.1	27.9	-	29.3	43.5	14.2	
Vert	195.000	QP	31.7	16.5	8.1	27.9	-	28.4	43.5	15.1	
Vert	330.990	QP	22.4	15.5	9.0	27.7	-	19.2	46.0	26.8	
Vert	600.000	QP	22.3	19.7	10.2	28.5	-	23.7	46.0	22.3	
Vert	2390.000	PK	62.8	29.3	3.5	35.0	-	60.6	73.9	13.3	
Vert	4804.000	PK	50.1	32.7	5.8	34.2	-	54.4	73.9	19.5	
Vert	7206.000	PK	42.5	36.8	7.2	34.1	-	52.4	73.9	21.5	Floor Noise
Vert	9608.000	PK	43.4	38.9	8.1	34.7	-	55.7	73.9	18.2	Floor Noise
Vert	2390.000	AV	47.6	29.3	3.5	35.0	2.0	47.4	53.9	6.5	*1
Vert	4804.000	AV	45.5	32.7	5.8	34.2	2.0	51.8	53.9	2.1	
Vert	7206.000	AV	34.7	36.8	7.2	34.1	-	44.6	53.9	9.3	Floor Noise
Vert	9608.000	AV	34.8	38.9	8.1	34.7	-	47.1	53.9	6.8	Floor Noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty factor

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

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

*1 Not out of Band emission (Leakage Power)

20dBc Data Sheet

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2402.000	PK	99.0	29.3	3.5	35.0	96.8	-	-	Carrier
Hori	2400.000	PK	60.6	29.3	3.5	35.0	58.4	76.8	18.4	
Vert	2402.000	PK	98.6	29.3	3.5	35.0	96.4	-	-	Carrier
Vert	2400.000	PK	62.3	29.3	3.5	35.0	60.1	76.4	16.3	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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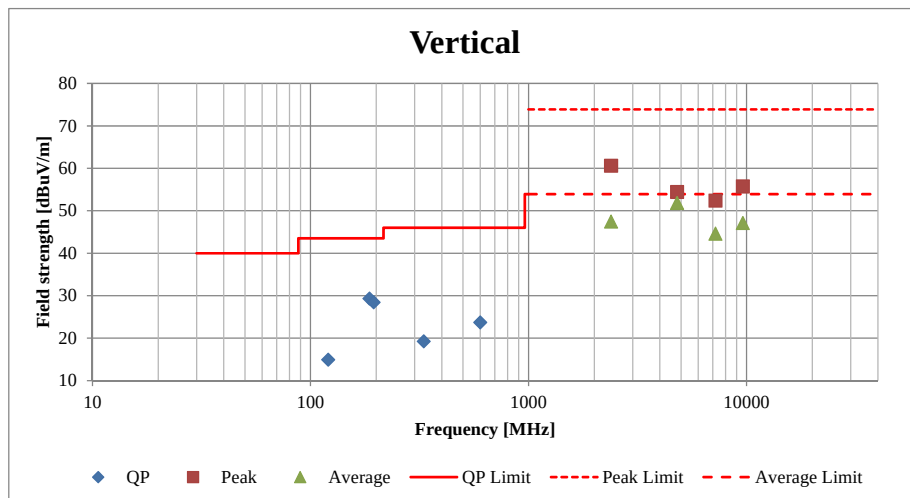
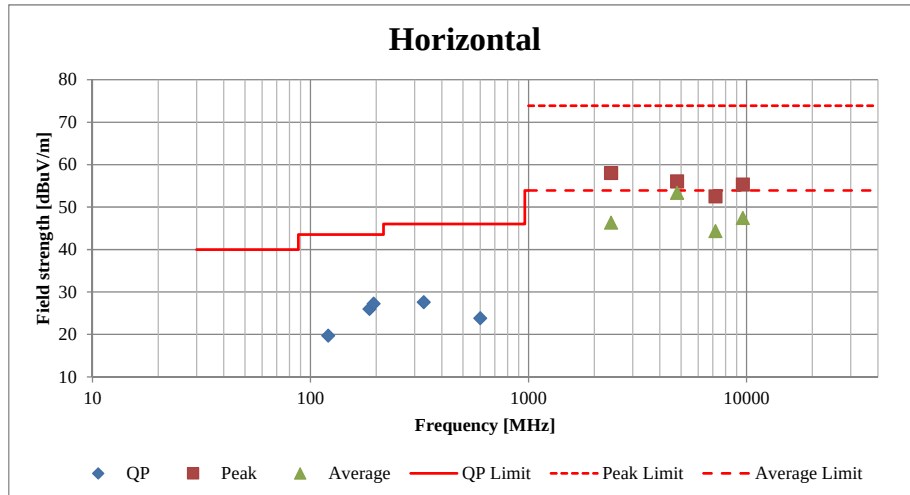
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Radiated Spurious Emission **(Plot data, Worst case)**

Test place	Ise EMC Lab. No.2 and 4 Semi Anechoic Chamber		
Report No.	10763602H		
Date	05/11/2015 (Day)	05/11/2015 (Night)	05/15/2015
Temperature/ Humidity	24deg. C / 38% RH	24deg. C / 36% RH	23deg. C / 36% RH
Engineer	Takumi Shimada (Below 1GHz)	Shinichi Miyazono (1-10GHz)	Yuta Moriya (Above 10GHz)
Mode	Tx BT LE 2402MHz		



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Radiated Spurious Emission

Test place : Ise EMC Lab. No.2 and 4 Semi Anechoic Chamber
Report No. : 10763602H
Date : 05/11/2015 (Day) 05/11/2015 (Night) 05/15/2015
Temperature/ Humidity : 24deg. C / 38% RH 24deg. C / 36% RH 23deg. C / 36% RH
Engineer : Takumi Shimada Shinichi Miyazono Yuta Moriya
(Below 1GHz) (1-10GHz) (Above 10GHz)
Mode : Tx BT LE 2440MHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	75.000	QP	23.0	6.5	7.2	28.4	-	8.3	40.0	31.7	
Hori	120.674	QP	27.8	12.7	7.6	28.2	-	19.9	43.5	23.6	
Hori	186.343	QP	29.6	16.4	8.1	27.9	-	26.2	43.5	17.3	
Hori	195.000	QP	30.4	16.5	8.1	27.9	-	27.1	43.5	16.4	
Hori	330.992	QP	30.8	15.5	9.0	27.7	-	27.6	46.0	18.4	
Hori	600.000	QP	22.3	19.7	10.2	28.5	-	23.7	46.0	22.3	
Hori	4880.000	PK	51.8	32.8	5.9	34.2	-	56.3	73.9	17.6	
Hori	7320.000	PK	42.5	36.8	7.1	34.1	-	52.3	73.9	21.6	Floor Noise
Hori	9760.000	PK	42.8	39.0	8.1	34.7	-	55.2	73.9	18.7	Floor Noise
Hori	4880.000	AV	46.5	32.8	5.9	34.2	2.0	53.0	53.9	0.9	
Hori	7320.000	AV	34.6	36.8	7.1	34.1	-	44.4	53.9	9.5	Floor Noise
Hori	9760.000	AV	34.9	39.0	8.1	34.7	-	47.3	53.9	6.6	Floor Noise
Vert	75.000	QP	22.9	6.5	7.2	28.4	-	8.2	40.0	31.8	
Vert	120.674	QP	22.9	12.7	7.6	28.2	-	15.0	43.5	28.5	
Vert	186.343	QP	32.5	16.4	8.1	27.9	-	29.1	43.5	14.4	
Vert	195.000	QP	31.8	16.5	8.1	27.9	-	28.5	43.5	15.0	
Vert	330.992	QP	22.6	15.5	9.0	27.7	-	19.4	46.0	26.6	
Vert	600.000	QP	22.3	19.7	10.2	28.5	-	23.7	46.0	22.3	
Vert	4880.000	PK	50.7	32.8	5.9	34.2	-	55.2	73.9	18.7	
Vert	7320.000	PK	42.5	36.8	7.1	34.1	-	52.3	73.9	21.6	Floor Noise
Vert	9760.000	PK	42.7	39.0	8.1	34.7	-	55.1	73.9	18.8	Floor Noise
Vert	4880.000	AV	45.7	32.8	5.9	34.2	2.0	52.2	53.9	1.7	
Vert	7320.000	AV	34.7	36.8	7.1	34.1	-	44.5	53.9	9.4	Floor Noise
Vert	9760.000	AV	34.4	39.0	8.1	34.7	-	46.8	53.9	7.1	Floor Noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty factor

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

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

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Radiated Spurious Emission

Test place	Ise EMC Lab. No.2 and 4 Semi Anechoic Chamber		
Report No.	10763602H		
Date	05/11/2015 (Day)	05/11/2015 (Night)	05/15/2015
Temperature/ Humidity	24deg. C / 38% RH	24deg. C / 36% RH	23deg. C / 36% RH
Engineer	Takumi Shimada	Shinichi Miyazono	Yuta Moriya
	(Below 1GHz)	(1-10GHz)	(Above 10GHz)
Mode	Tx BT LE 2480MHz		

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Duty factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	75.000	QP	22.9	6.5	7.2	28.4	-	8.2	40.0	31.8	
Hori	120.671	QP	27.7	12.7	7.6	28.2	-	19.8	43.5	23.7	
Hori	186.340	QP	29.8	16.4	8.1	27.9	-	26.4	43.5	17.1	
Hori	195.000	QP	30.5	16.5	8.1	27.9	-	27.2	43.5	16.3	
Hori	330.992	QP	31.0	15.5	9.0	27.7	-	27.8	46.0	18.2	
Hori	600.000	QP	22.4	19.7	10.2	28.5	-	23.8	46.0	22.2	
Hori	2483.500	PK	70.9	29.3	3.5	34.9	-	68.8	73.9	5.1	
Hori	4960.000	PK	50.4	33.0	5.9	34.3	-	55.0	73.9	18.9	
Hori	7440.000	PK	43.3	36.8	7.0	34.2	-	52.9	73.9	21.0	Floor Noise
Hori	9920.000	PK	44.0	39.0	8.2	34.7	-	56.5	73.9	17.4	Floor Noise
Hori	2483.500	AV	46.4	29.3	3.5	34.9	2.0	46.3	53.9	7.6	Integration Method *1
Hori	4960.000	AV	46.1	33.0	5.9	34.3	2.0	52.7	53.9	1.2	
Hori	7440.000	AV	34.5	36.8	7.0	34.2	-	44.1	53.9	9.8	Floor Noise
Hori	9920.000	AV	34.9	39.0	8.2	34.7	-	47.4	53.9	6.5	Floor Noise
Vert	75.000	QP	22.9	6.5	7.2	28.4	-	8.2	40.0	31.8	
Vert	120.671	QP	23.0	12.7	7.6	28.2	-	15.1	43.5	28.4	
Vert	186.340	QP	32.6	16.4	8.1	27.9	-	29.2	43.5	14.3	
Vert	195.000	QP	31.9	16.5	8.1	27.9	-	28.6	43.5	14.9	
Vert	330.992	QP	22.7	15.5	9.0	27.7	-	19.5	46.0	26.5	
Vert	600.000	QP	22.3	19.7	10.2	28.5	-	23.7	46.0	22.3	
Vert	2483.500	PK	69.8	29.3	3.5	34.9	-	67.7	73.9	6.2	
Vert	4960.000	PK	50.3	33.0	5.9	34.3	-	54.9	73.9	19.0	
Vert	7440.000	PK	42.7	36.8	7.0	34.2	-	52.3	73.9	21.6	Floor Noise
Vert	9920.000	PK	43.1	39.0	8.2	34.7	-	55.6	73.9	18.3	Floor Noise
Vert	2483.500	AV	45.6	29.3	3.5	34.9	2.0	45.5	53.9	8.4	Integration Method *1
Vert	4960.000	AV	44.8	33.0	5.9	34.3	2.0	51.4	53.9	2.5	
Vert	7440.000	AV	34.5	36.8	7.0	34.2	-	44.1	53.9	9.8	Floor Noise
Vert	9920.000	AV	34.9	39.0	8.2	34.7	-	47.4	53.9	6.5	Floor Noise

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier) + Duty factor

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

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

*1 Not out of Band emission (Leakage Power)

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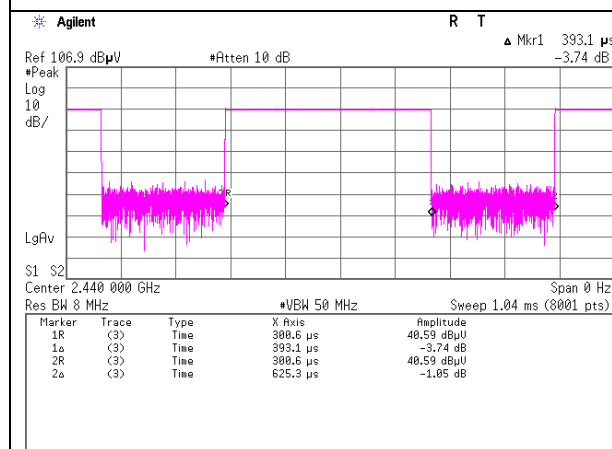
Facsimile : +81 596 24 8124

Burst rate confirmation

Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10763602H
Date 05/11/2015 Night
Temperature/ Humidity 24deg. C / 36% RH
Engineer Shinichi Miyazono
Mode Tx BT LE

BT LE

Tx on / (Tx on + Tx off) = 0.629
Tx on / (Tx on + Tx off) * 100 = 62.9 %
Duty factor = 10 * log (625.3 / 393.1) = 2.02 dB



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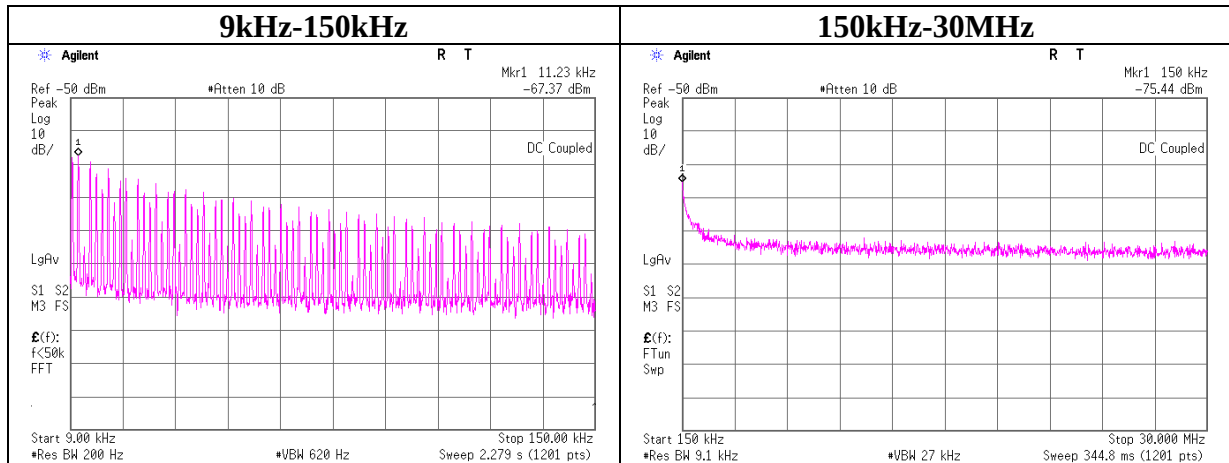
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place : Ise EMC Lab. No.4 shielded room
Report No. : 10763602H
Date : 05/15/2015
Temperature/ Humidity : 23deg. C / 36% RH
Engineer : Yuta Moriya
Mode : Tx BT LE

BT LE Tx 2402MHz



Frequency	Reading	Cable Loss	Attenuator	Antenna Gain	EIRP	Distance	Ground bounce	E (field strength)	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dBi]	[dBm]	[m]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
11.23	-67.4	0.01	10.0	2.0	-55.4	300	6.0	5.9	46.5	40.6	
150.00	-75.4	0.01	10.0	2.0	-63.4	300	6.0	-2.2	24.0	26.2	

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

$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator} + \text{Antenna Gain} + 10 * \log(N)$

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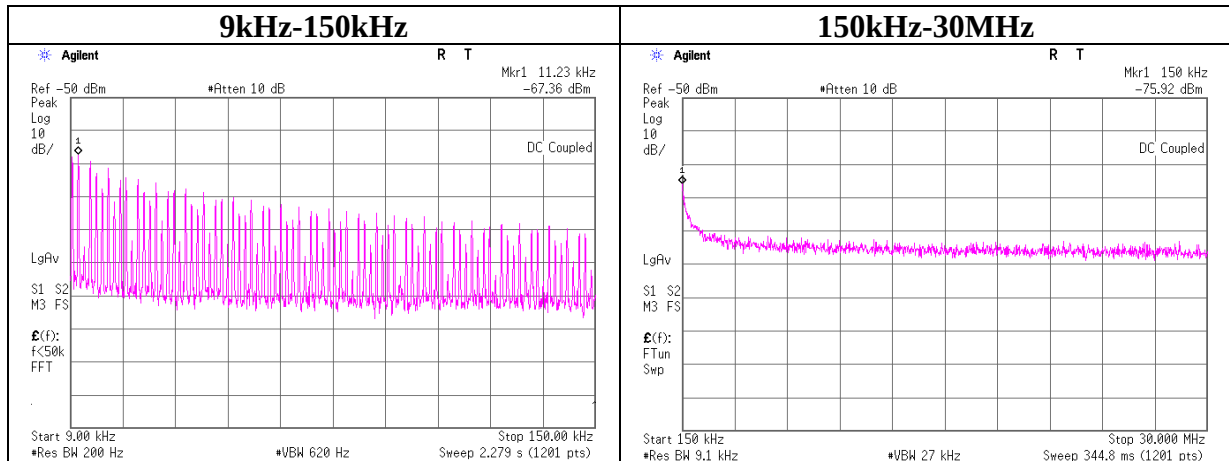
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place Ise EMC Lab. No.4 shielded room
Report No. 10763602H
Date 05/15/2015
Temperature/ Humidity 23deg. C / 36% RH
Engineer Yuta Moriya
Mode Tx BT LE

BT LE Tx 2440MHz



Frequency	Reading	Cable Loss	Attenuator	Antenna Gain	EIRP	Distance	Ground bounce	E (field strength)	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dBi]	[dBm]	[m]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
11.23	-67.4	0.01	10.0	2.0	-55.4	300	6.0	5.9	46.5	40.6	
150.00	-75.9	0.01	10.0	2.0	-63.9	300	6.0	-2.6	24.0	26.6	

E=EIRP-20log(D)+Ground bounce +104.8[dBuV/m]

EIRP=Reading+Cable Loss+Attenuator+Antenna Gain+10*log(N)

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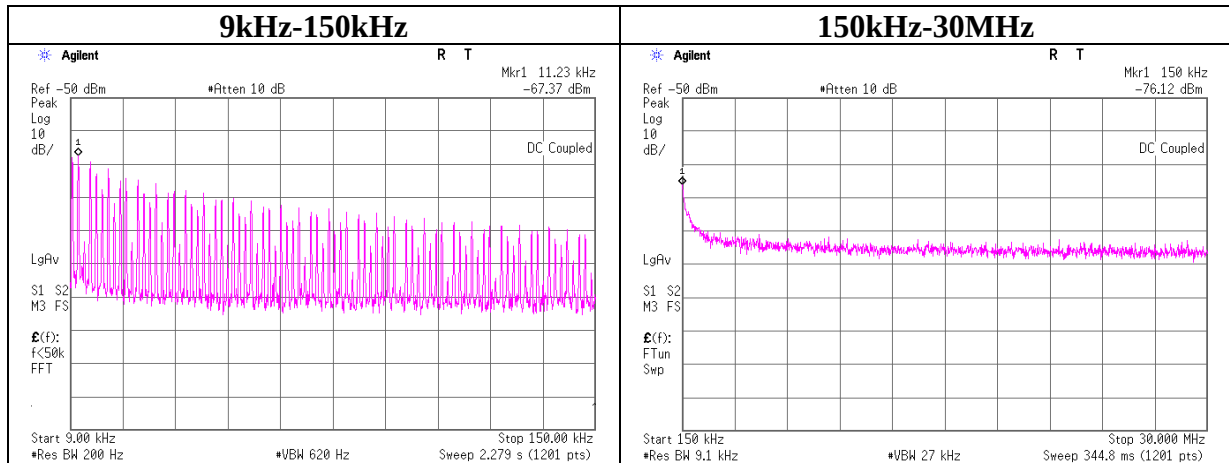
Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

Conducted Spurious Emission

Test place : Ise EMC Lab. No.4 shielded room
Report No. : 10763602H
Date : 05/15/2015
Temperature/ Humidity : 23deg. C / 36% RH
Engineer : Yuta Moriya
Mode : Tx BT LE

BT LE Tx 2480MHz



Frequency	Reading	Cable Loss	Attenuator	Antenna Gain	EIRP	Distance	Ground bounce	E (field strength)	Limit	Margin	Remark
[kHz]	[dBm]	[dB]	[dB]	[dBi]	[dBm]	[m]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
11.23	-67.4	0.01	10.0	2.0	-55.4	300	6.0	5.9	46.5	40.6	
150.00	-76.1	0.01	10.0	2.0	-64.1	300	6.0	-2.9	24.0	26.9	

E=EIRP-20log(D)+Ground bounce +104.8[dBuV/m]

EIRP=Reading+Cable Loss+Attenuator+Antenna Gain+10*log(N)

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Band Edge confirmation

Test place

Ise EMC Lab. No.4 shielded room

Report No.

10763602H

Date

05/15/2015

Temperature/ Humidity

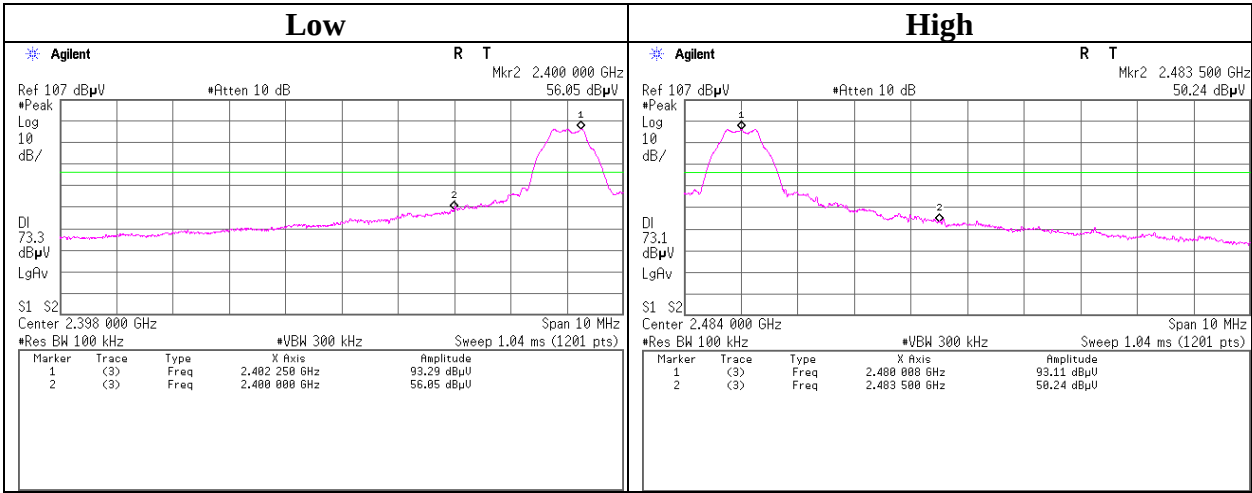
23deg. C / 36% RH

Engineer

Yuta Moriya

Mode

Tx BT LE



Power Density

Test place Ise EMC Lab. No.4 shielded room
Report No. 10763602H
Date 05/15/2015
Temperature/ Humidity 23deg. C / 36% RH
Engineer Yuta Moriya
Mode Tx BT LE

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2402.00	-27.19	0.96	10.11	-16.12	8.00	24.12
2440.00	-27.25	0.96	10.11	-16.18	8.00	24.18
2480.00	-27.33	0.97	10.11	-16.25	8.00	24.25

Sample Calculation:

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

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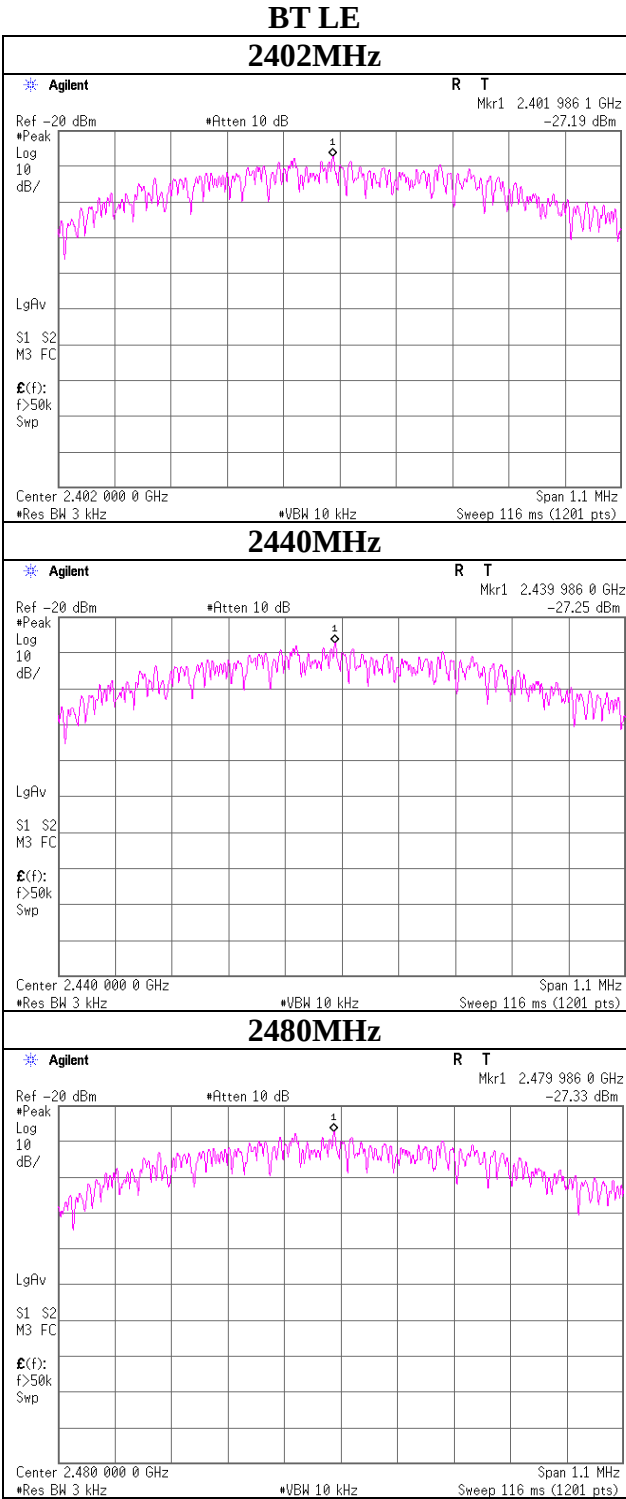
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Power Density



99%Occupied Bandwidth

Test place

Report No.

Date

Temperature/ Humidity

Engineer

Mode

Ise EMC Lab. No.4 shielded room

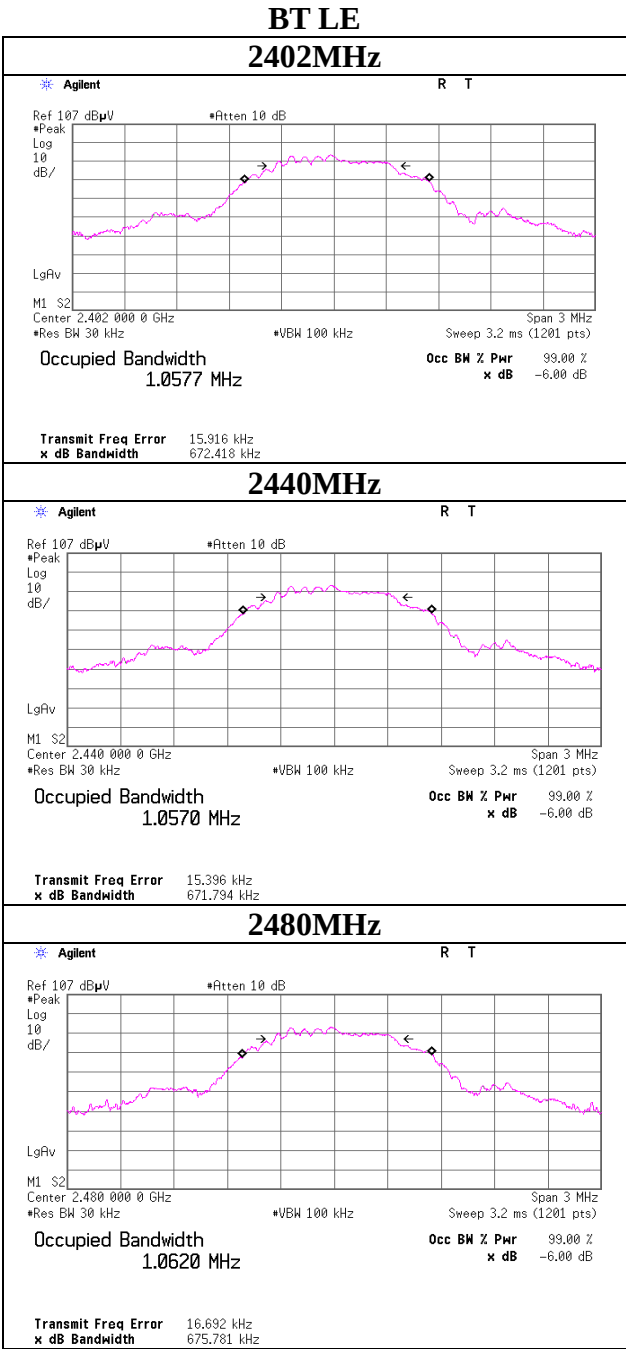
10763602H

05/15/2015

23deg. C / 36% RH

Yuta Moriya

Tx BT LE



APPENDIX 2: Test instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-02	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	RE	2014/06/25 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2015/01/13 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-14	Spectrum Analyzer	Agilent	E4440A	MY48250080	RE/CE/AT	2014/10/17 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2014/06/03 * 12
MBA-02	Biconical Antenna	Schwarzbeck	BBA9106	VHA91032008	RE	2014/10/18 * 12
MLA-02	Logperiodic Antenna	Schwarzbeck	USLP9143	201	RE	2014/10/18 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2015/02/06 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2014/11/11 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2014/09/26 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2015/02/05 * 12
MCC-166	Microwave Cable	Junkosha	MWX221	1303S120(1m) / 1311S167(5m)	RE	2014/09/24 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2015/01/28 * 12
MHF-26	High Pass Filter 3.5-18.0GHz	UL Japan	HPF SELECTOR	002	RE	2014/09/24 * 12
MTW-02	Torque wrench	HUBER+SUHNER	74 Z-0-0-21	98190	RE	2015/01/16 * 36
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE/CE	2015/02/26 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	1501	RE/CE	2015/01/13 * 12
MJM-23	Measure	ASKUL	-	-	RE/CE	-
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2014/08/12 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1405S146(5m)	RE	2014/06/11 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	MY39500780	RE	2015/03/12 * 12
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA9170307	RE	2014/06/11 * 12
MTR-01	Test Receiver	Rohde & Schwarz	ESI40	100084	CE	2014/11/10 * 12
MLS-24	LISN(AMN)	Schwarzbeck	NSLK8127	8127-730	CE(EUT)	2014/07/10 * 12
MAT-67	Attenuator	JFW Industries, Inc.	50FP-013H2 N	-	CE	2015/01/29 * 12
MCC-113	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/ SFM141(5m)/421- 010(1m)/suciform141- PE(1m)/RFM- E121(Switcher)	-/04178	CE	2014/07/15 * 12
MOS-23	Thermo-Hygrometer	Custom	CTH-201	0004	AT	2014/12/22 * 12
MAT-23	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2015/03/13 * 12
MCC-173	Microwave Cable	Junkosha	MWX221	1409S496	AT	2015/03/04 * 12
MPM-08	Power Meter	Anritsu	ML2495A	6K00003338	AT	2014/10/16 * 12
MPSE-11	Power sensor	Anritsu	MA2411B	011737	AT	2014/10/15 * 12
MDPS-05	DC Power Supply	KENWOOD TMI	PW8-3ATP	09067054	CE/AT	Pre Check

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

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