RADIO TEST REPORT

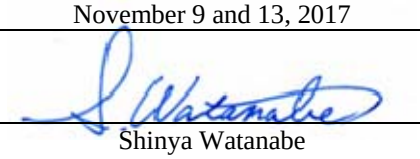
Test Report No. : 12022270H-A

Applicant	:	**TOKAI RIKA CO., LTD.**
Type of Equipment	:	**Smart Key Box**
Model No.	:	**B2Y2L2L**
Test regulation	:	**FCC Part 15 Subpart C: 2017**
FCC ID	:	**MOZB2Y2L2L**
Test Result	:	**Complied**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.
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: November 9 and 13, 2017

Representative test engineer:



Shinya Watanabe
Engineer
Consumer Technology Division

Approved by:

Motoya Imura
Engineer
Consumer Technology Division

NVLAP TESTING
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.
*As for the range of Accreditation in NVLAP, you may refer to the WEB address,
http://japan.ul.com/resources/emc_accredited/

REVISION HISTORY

Original Test Report No.: 12022270H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	12022270H-A	November 27, 2017	-	-

CONTENTS **PAGE**

SECTION 1: Customer information

Company Name	:	TOKAI RIKA CO., LTD
Address	:	3-260 Toyota, Oguchi-cho, Niwa-gun, Aichi-ken, 480-0195 Japan
Telephone Number	:	+81-587-95-0093
Facsimile Number	:	+81-587-95-5471
Contact Person	:	Hiroki Unno

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

2.1 Identification of E.U.T.

Type of Equipment	:	Smart Key Box
Model No.	:	B2Y2L2L
Serial No.	:	Refer to Clause 4.2
Rating	:	DC 12.0 V
Receipt Date of Sample	:	October 31 2017
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 No: B2R2L2L (referred to as the EUT in this report) is the Electronic Key mainly performs the functions in a Smart Key System and RKE System.

General Specification

Clock frequencies in the system	:	CPU: 8 MHz(main), 32.768 kHz(sub) IC UHF: 18.37 MHz

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	Channel1: 314.35 MHz Channel2: 312.10 MHz
Modulation	:	FSK
Method of Frequency Generation	:	Crystal
Antenna Type	:	Pattern Antenna, 3D Antenna
Operating Temperature Range	:	-30 deg. C to +80 deg. C
Operating Voltage Range	:	DC 8 V to 16 V
Receiving frequency of Operation	:	134.2 kHz *1)

*1) The test of receiver part was performed separately from this test report, and the conformability is confirmed.

[Bluetooth Specification]*

Frequency of Operation	:	2402 MHz - 2480 MHz
Type of Modulation	:	GFSK

*The BLE module is a FCC certificated module.

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C FCC Part 15 final revised on November 2, 2017
Title	:	FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators Section 15.231 Periodic operation in the band 40.66 - 40.70MHz and above 70MHz

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted emission	**FCC:** ANSI C63.10:2013 6 Standard test methods **IC:** RSS-Gen 8.8	**FCC:** Section 15.207 **IC:** RSS-Gen 8.8	N/A	N/A*1)	-
Automatically Deactivate	**FCC:** ANSI C63.10:2013 6 Standard test methods **IC:** -	**FCC:** Section 15.231(a)(1) **IC:** RSS-210 A1.1	N/A	Complied	Radiated
Electric Field Strength of Fundamental Emission	**FCC:** ANSI C63.10:2013 6 Standard test methods **IC:** RSS-Gen 6.12	**FCC:** Section 15.231(b) **IC:** RSS-210 A1.2	1.9 dB 314.350 MHz Vertical, PK with Duty Factor	Complied	Radiated
Electric Field Strength of Spurious Emission	**FCC:** ANSI C63.10:2013 6 Standard test methods **IC:** RSS-Gen 6.13	**FCC:** Section 15.205 Section 15.209 Section 15.231(b) **IC:** RSS-210 A1.2, 4.4 RSS-Gen 8.9	4.4 dB 628.700 MHz Vertical PK with Duty factor <314.35 MHz>	Complied	Radiated
-20dB Bandwidth	**FCC:** ANSI C63.10:2013 6 Standard test methods **IC:** -	**FCC:** Section 15.231(c) **IC:** Reference data	N/A	Complied	Radiated
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422. *1) The test is not applicable since the EUT does not have AC Mains.					

FCC Part 15.31 (e)
This EUT provides stable voltage (DC 3.3 V) constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

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

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99 % Occupied Bandwidth	**IC:** RSS-Gen 6.6	**IC:** RSS-210 A1.3	N/A	Complied	Radiated

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.

Polarity	Radiated emission (Below 1 GHz)			
	(3 m*)(+/-)		(10 m*)(+/-)	
	30 MHz to 200 MHz	200 MHz to 1000 MHz	30 MHz to 200 MHz	200 MHz to 1000 MHz
Horizontal	5.0 dB	5.3 dB	5.0 dB	5.0 dB
Vertical	5.2 dB	6.3 dB	5.0 dB	5.0 dB

Radiated emission (Above 1 GHz)				
(3 m*)(+/-)		(1 m*)(+/-)		(10 m*)(+/-)
1 GHz to 6 GHz	6 GHz to 18 GHz	10 GHz to 26.5 GHz	26.5 GHz to 40 GHz	1 GHz to 18 GHz
5.2 dB	5.5 dB	5.5 dB	5.4 dB	5.5 dB

* Measurement distance

Radiated emission test(3 m)
The data listed in this report meets the limits unless the uncertainty is taken into consideration.

3.5 Test Location

UL Japan, Inc. Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone: +81 596 24 8999, Facsimile: +81 596 24 8124
NVLAP Lab. code: 200572-0 / FCC Test Firm Registration Number: 199967

Test site	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms	Maximum measurement distance
No.1 semi-anechoic chamber	2973C-1	19.2 x 11.2 x 7.7	7.0 x 6.0	No.1 Power source room	10 m
No.2 semi-anechoic chamber	2973C-2	7.5 x 5.8 x 5.2	4.0 x 4.0	-	3 m
No.3 semi-anechoic chamber	2973C-3	12.0 x 8.5 x 5.9	6.8 x 5.75	No.3 Preparation room	3 m
No.3 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.4 semi-anechoic chamber	2973C-4	12.0 x 8.5 x 5.9	6.8 x 5.75	No.4 Preparation room	3 m
No.4 shielded room	-	4.0 x 6.0 x 2.7	N/A	-	-
No.5 semi-anechoic chamber	-	6.0 x 6.0 x 3.9	6.0 x 6.0	-	-
No.6 shielded room	-	4.0 x 4.5 x 2.7	4.0 x 4.5	-	-
No.6 measurement room	-	4.75 x 5.4 x 3.0	4.75 x 4.15	-	-
No.7 shielded room	-	4.7 x 7.5 x 2.7	4.7 x 7.5	-	-
No.8 measurement room	-	3.1 x 5.0 x 2.7	N/A	-	-
No.9 measurement room	-	8.8 x 4.6 x 2.8	2.4 x 2.4	-	-
No.11 measurement room	-	6.2 x 4.7 x 3.0	4.8 x 4.6	-	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 m 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.

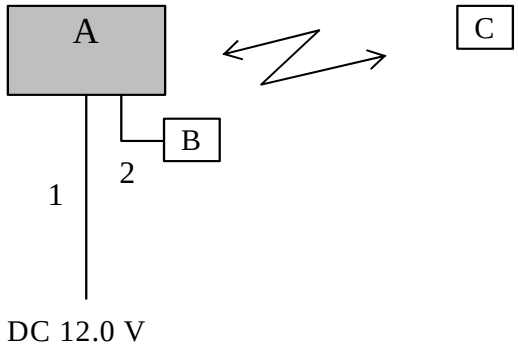
Refer to APPENDIX.

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

4.1 Operating Modes

Test Item*	Mode
Automatically Deactivate	Normal use mode *2)
Electric Field Strength of Fundamental Emission Electric Field Strength of Spurious Emission	Transmitting mode (Tx) *1), *3) Transmitting mode under BLE communication *1), *4)
-20 dB & 99 % Occupied Bandwidth	Transmitting mode (Tx)
* The system was configured in typical fashion (as a user would normally use it) for testing. *1) End users cannot change the settings of the output power of the product. *2) Once UHF transmission from Smartphone operating *3) UHF continuous transmission (stand-alone) *4) UHF continuous transmission under pairing the Smart phone	

4.2 Configuration and peripherals



*Item: iPhone was set on the corner in the anechoic chamber.
* Test data was taken under worse case conditions.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Smart Key Box	B2Y2L2L	001 *1) 002 *2)	TOKAI RIKA CO., LTD	EUT
B	Control Switch	-	-	-	-
C	iPhone	MG472J/A	FFPQ5DS2G5MN	Apple	-

*1) Used for Transmitting mode only.
*2) Used for Normal use mode only.

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC Cable	1.50	Unshielded	Unshielded	-
2	Signal Cable	0.02	Unshielded	Unshielded	-

SECTION 5: Radiated emission (Electric Field Strength of Fundamental and Spurious Emission)

Test Procedure and conditions

[For below 1GHz]
EUT was placed on a urethane platform of nominal size, 0.5 m by 1.0 m, raised 0.8 m above the conducting ground plane.
The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane.

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

Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength.
Photographs of the set up are shown in Appendix 3.

[Transmitting mode]
(Below 30 MHz)
The noise level was checked by moving a search-coil (Loop Antenna) close to the EUT.

(Above 30 MHz)
The Radiated Electric Field Strength has been measured on Semi anechoic chamber with a ground plane and at a distance of 3 m.
The measuring antenna height was 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.
The radiated emission measurements were made with the following detector function of the test receiver / spectrum analyzer.

Test Antennas are used as below;

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

	From 9 kHz to 90 kHz and From 110 kHz to 150 kHz	From 90 kHz to 110 kHz	From 150 kHz to 490 kHz	From 490 kHz to 30 MHz	From 30 MHz to 1 GHz	Above 1 GHz
Detector Type	Peak	Peak	Peak	Peak	Peak and Peak with Duty factor	Peak and Peak with Duty factor
IF Bandwidth	200 Hz	200 Hz	9.1 kHz	9.1 kHz	120 kHz	PK: S/A: RBW 1 MHz, VBW: 3 MHz

- The carrier level (or, noise levels) was (or were) measured at each position of all three axes X, Y and Z, and the position that has the maximum noise was determined.
Noise levels of all the frequencies were measured at the position.

*The result is rounded off to the second decimal place, so some differences might be observed.

Measurement range : 9 kHz - 3.2 GHz
Test data : APPENDIX
Test result : Pass

SECTION 6: Automatically deactivate

Test Procedure

The measurement was performed with Electric field strength using a spectrum analyzer.

Test data : APPENDIX
Test result : Pass

SECTION 7: -20 dB and 99 % Occupied Bandwidth

Test Procedure

The test was measured with a spectrum analyzer using a test fixture.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
20 dB Bandwidth	150 kHz	1.5 kHz	5.1 kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99 % Occupied Bandwidth	Enough width to display emission skirts	1 to 5 % of OBW	Three times of RBW	Auto	Peak	Max Hold	Spectrum Analyzer
Peak hold was applied as Worst-case measurement.							

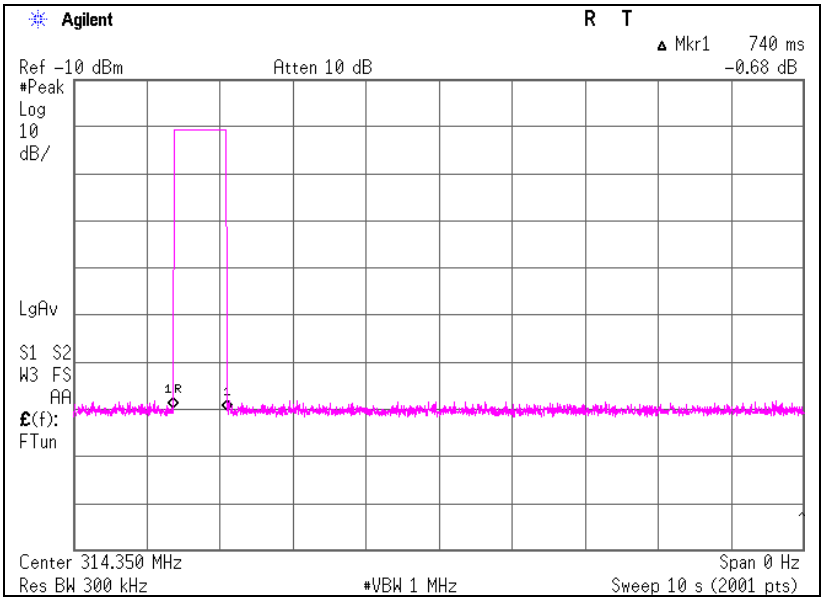
Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Automatically deactivate
314.35 MHz

Test place	Ise EMC Lab. No.1 Measurement Room
Report No.	12022270H
Date	11/09/2017
Temperature/ Humidity	21 deg. C / 51 % RH
Engineer	Shinya Watanabe
Mode	Normal use mode (314.35 MHz)

Time of Transmitting [sec]	Limit [sec]	Result
0.74	5.00	Pass

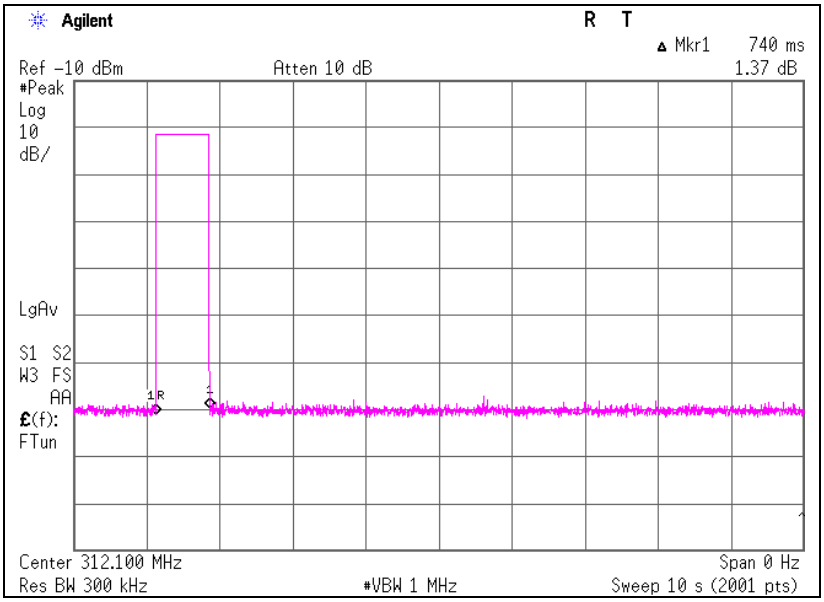


* The test was performed by a request signal (BLE) from Smart phone operation as representative, because the EUT transmits UHF when LF signal is received from a vehicle or a request signal (BLE) from Smart phone is received, and the UHF transmission is stopped within 5 seconds even when receiving LF signal from vehicle.
(Refer to Theory of operation-specification.)

Automatically deactivate
312.10 MHz

Test place	Ise EMC Lab. No.1 Measurement Room
Report No.	12022270H
Date	11/09/2017
Temperature/ Humidity	21 deg. C / 51 % RH
Engineer	Shinya Watanabe
Mode	Normal use mode (312.10 MHz)

Time of Transmitting [sec]	Limit [sec]	Result
0.74	5.00	Pass



* The test was performed by a request signal (BLE) from Smart phone operation as representative, because the EUT transmits UHF when LF signal is received from a vehicle or a request signal (BLE) from Smart phone is received, and the UHF transmission is stopped within 5 seconds even when receiving LF signal from vehicle.
(Refer to Theory of operation-specification.)

Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

314.35 MHz

Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.1	No.3
Report No.	12022270H	
Date	11/09/2017	11/13/2017
Temperature / Humidity	21 deg. C / 51 % RH	23 deg. C / 49 % RH
Engineer	Shinya Watanabe (Below 1 GHz)	Shinya Watanabe (Above 1 GHz)
Mode	Transmitting mode 314.35 MHz	

PK

Frequency	Detector	Reading [dBuV]		Ant Factor	Loss	Gain	Duty Factor	Result [dBuV/m]		Limit	Margin [dB]		Remark Inside or Outside
[MHz]		Hor	Ver	[dB/m]	[dB]	[dB]	[dB]	Hor	Ver	[dBuV/m]	Hor	Ver	of Restricted Bands
314.350	PK	86.1	87.9	13.8	10.6	38.7	-	71.8	73.6	95.5	23.7	21.9	Carrier
628.700	PK	53.9	57.0	19.3	12.9	38.1	-	48.0	51.1	75.5	27.5	24.4	Outside
943.050	PK	41.4	39.2	22.4	14.7	37.8	-	40.7	38.5	75.5	34.8	37.0	Outside
1257.400	PK	45.2	46.3	25.2	5.3	34.3	-	41.4	42.5	75.5	34.1	33.0	Outside
1571.750	PK	43.9	43.6	25.8	5.6	33.5	-	41.8	41.5	73.9	32.1	32.4	Inside
1886.100	PK	42.3	43.0	26.6	5.7	32.9	-	41.7	42.4	75.5	33.8	33.1	Outside
2200.450	PK	43.1	42.3	27.3	5.9	32.5	-	43.8	43.0	73.9	30.1	30.9	Inside
2514.800	PK	45.0	44.4	27.9	6.1	32.4	-	46.6	46.0	75.5	28.9	29.5	Outside
2829.150	PK	46.3	46.2	28.7	6.3	32.2	-	49.1	49.0	73.9	24.8	24.9	Inside
3143.500	PK	43.0	43.4	29.2	6.4	32.1	-	46.5	46.9	75.5	29.0	28.6	Outside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amprifier)

PK with Duty factor

Frequency	Detector	Reading [dBuV]		Ant Factor	Loss	Gain	Duty Factor	Result [dBuV/m]		Limit	Margin [dB]		Remark
[MHz]		Hor	Ver	[dB/m]	[dB]	[dB]	[dB]	Hor	Ver	[dBuV/m]	Hor	Ver	
314.350	PK	86.1	87.9	13.8	10.6	38.7	0.0	71.8	73.6	75.5	3.7	1.9	Carrier
628.700	PK	53.9	57.0	19.3	12.9	38.1	0.0	48.0	51.1	55.5	7.5	4.4	Outside
943.050	PK	41.4	39.2	22.4	14.7	37.8	0.0	40.7	38.5	55.5	14.8	17.0	Outside
1257.400	PK	45.2	46.3	25.2	5.3	34.3	0.0	41.4	42.5	55.5	14.1	13.0	Outside
1571.750	PK	43.9	43.6	25.8	5.6	33.5	0.0	41.8	41.5	53.9	12.1	12.4	Inside
1886.100	PK	42.3	43.0	26.6	5.7	32.9	0.0	41.7	42.4	55.5	13.8	13.1	Outside
2200.450	PK	43.1	42.3	27.3	5.9	32.5	0.0	43.8	43.0	53.9	10.1	10.9	Inside
2514.800	PK	45.0	44.4	27.9	6.1	32.4	0.0	46.6	46.0	55.5	8.9	9.5	Outside
2829.150	PK	46.3	46.2	28.7	6.3	32.2	0.0	49.1	49.0	53.9	4.8	4.9	Inside
3143.500	PK	43.0	43.4	29.2	6.4	32.1	0.0	46.5	46.9	55.5	9.0	8.6	Outside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amprifier) + Duty factor

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

Sample calculation:
Result of PK = Reading + Ant Factor + Loss (Cable + Attenuator + Filter) - Gain (Amplifier)
Result of PK with Duty factor = Reading + Ant Factor + Loss (Cable + Attenuator + Filter) - Gain (Amplifier) + Duty factor

For above 1GHz: Distance Factor: 20 x log (4.45 m/3.0 m) = 3.42 dB
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

Since the peak emission result satisfied the average limit, duty factor was omitted.
The result of AV (PK with Duty factor) was calculated by applying Duty 100%.

Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

314.35 MHz under BLE communication

Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.1	No.3
Report No.	12022270H	
Date	11/09/2017	11/13/2017
Temperature / Humidity	21 deg. C / 51 % RH	23 deg. C / 49 % RH
Engineer	Shinya Watanabe	Shinya Watanabe
	(Below 1 GHz)	(Above 1 GHz)
Mode	Transmitting mode 314.35 MHz under BLE communication	

PK

Frequency	Detector	Reading [dBuV]		Ant Factor	Loss	Gain	Duty Factor	Result [dBuV/m]		Limit	Margin [dB]		Remark Inside or Outside
[MHz]		Hor	Ver	[dB/m]	[dB]	[dB]	[dB]	Hor	Ver	[dBuV/m	Hor	Ver	of Restricted Bands
314.350	PK	85.1	86.6	13.8	10.6	38.7	-	70.8	72.3	95.5	24.7	23.2	Carrier
628.700	PK	54.5	56.6	19.3	12.9	38.1	-	48.6	50.7	75.5	26.9	24.8	Outside
943.050	PK	39.2	39.1	22.4	14.7	37.8	-	38.5	38.4	75.5	37.0	37.1	Outside
1257.400	PK	45.2	44.4	25.2	5.3	34.3	-	41.4	40.6	75.5	34.1	34.9	Outside
1571.750	PK	43.3	43.7	25.8	5.6	33.5	-	41.2	41.6	73.9	32.7	32.3	Inside
1886.100	PK	42.8	43.4	26.6	5.7	32.9	-	42.2	42.8	75.5	33.3	32.7	Outside
2200.450	PK	29.9	43.2	27.3	5.9	32.5	-	30.6	43.9	73.9	43.3	30.0	Inside
2514.800	PK	43.9	43.6	27.9	6.1	32.4	-	45.5	45.2	75.5	30.0	30.3	Outside
2829.150	PK	45.7	45.5	28.7	6.3	32.2	-	48.5	48.3	73.9	25.4	25.6	Inside
3143.500	PK	43.2	43.1	29.2	6.4	32.1	-	46.7	46.6	75.5	28.8	28.9	Outside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amprifier)

PK with Duty factor

Frequency	Detector	Reading [dBuV]		Ant Factor	Loss	Gain	Duty Factor	Result [dBuV/m]		Limit	Margin [dB]		Remark
[MHz]		Hor	Ver	[dB/m]	[dB]	[dB]	[dB]	Hor	Ver	[dBuV/m]	Hor	Ver	
314.350	PK	85.1	86.6	13.8	10.6	38.7	0.0	70.8	72.3	75.5	4.7	3.2	Carrier
628.700	PK	54.5	56.6	19.3	12.9	38.1	0.0	48.6	50.7	55.5	6.9	4.8	Outside
943.050	PK	39.2	39.1	22.4	14.7	37.8	0.0	38.5	38.4	55.5	17.0	17.1	Outside
1257.400	PK	45.2	44.4	25.2	5.3	34.3	0.0	41.4	40.6	55.5	14.1	14.9	Outside
1571.750	PK	43.3	43.7	25.8	5.6	33.5	0.0	41.2	41.6	53.9	12.7	12.3	Inside
1886.100	PK	42.8	43.4	26.6	5.7	32.9	0.0	42.2	42.8	55.5	13.3	12.7	Outside
2200.450	PK	29.9	43.2	27.3	5.9	32.5	0.0	30.6	43.9	53.9	23.3	10.0	Inside
2514.800	PK	43.9	43.6	27.9	6.1	32.4	0.0	45.5	45.2	55.5	10.0	10.3	Outside
2829.150	PK	45.7	45.5	28.7	6.3	32.2	0.0	48.5	48.3	53.9	5.4	5.6	Inside
3143.500	PK	43.2	43.1	29.2	6.4	32.1	0.0	46.7	46.6	55.5	8.8	8.9	Outside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amprifier) + Duty factor

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

Sample calculation:
Result of PK = Reading + Ant Factor + Loss (Cable + Attenuator + Filter) - Gain (Amplifier)
Result of PK with Duty factor = Reading + Ant Factor + Loss (Cable + Attenuator + Filter) - Gain (Amplifier) + Duty factor

For above 1GHz: Distance Factor: 20 x log (4.45 m/3.0 m) = 3.42 dB
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

Since the peak emission result satisfied the average limit, duty factor was omitted.
The result of AV (PK with Duty factor) was calculated by applying Duty 100%.

Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)
312.10 MHz

Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.1	No.3
Report No.	12022270H	
Date	11/09/2017	11/13/2017
Temperature / Humidity	21 deg. C / 51 % RH	23 deg. C / 49 % RH
Engineer	Shinya Watanabe (Below 1 GHz)	Shinya Watanabe (Above 1 GHz)
Mode	Transmitting mode 312.10 MHz	

PK

Frequency	Detector	Reading [dBuV]		Ant Factor	Loss	Gain	Duty Factor	Result [dBuV/m]		Limit	Margin [dB]		Remark Inside or Outside
[MHz]		Hor	Ver	[dB/m]	[dB]	[dB]	[dB]	Hor	Ver	[dBuV/m]	Hor	Ver	of Restricted Bands
312.100	PK	84.7	85.8	13.8	10.6	38.7	-	70.4	71.5	95.4	25.0	23.9	Carrier
624.200	PK	54.5	56.7	19.3	12.9	38.1	-	48.6	50.8	75.4	26.8	24.6	Outside
936.300	PK	41.6	37.2	22.3	14.6	37.8	-	40.7	36.3	75.4	34.7	39.1	Outside
1248.400	PK	44.9	44.9	25.2	5.3	34.3	-	41.1	41.1	75.4	34.3	34.3	Outside
1560.500	PK	44.0	44.0	25.8	5.6	33.5	-	41.9	41.9	73.9	32.0	32.0	Inside
1872.600	PK	41.8	42.3	26.6	5.7	32.9	-	41.2	41.7	75.4	34.2	33.7	Outside
2184.700	PK	42.5	42.8	27.3	5.9	32.5	-	43.2	43.5	75.4	32.2	31.9	Outside
2496.800	PK	44.4	44.8	27.8	6.1	32.4	-	45.9	46.3	73.9	28.0	27.6	Inside
2808.900	PK	45.4	46.2	28.6	6.3	32.2	-	48.1	48.9	73.9	25.8	25.0	Inside
3121.000	PK	42.3	41.2	29.2	6.4	32.1	-	45.8	44.7	75.4	29.6	30.7	Outside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amprifier)

PK with Duty factor

Frequency	Detector	Reading [dBuV]		Ant Factor	Loss	Gain	Duty Factor	Result [dBuV/m]		Limit	Margin [dB]		Remark
[MHz]		Hor	Ver	[dB/m]	[dB]	[dB]	[dB]	Hor	Ver	[dBuV/m]	Hor	Ver	
312.100	PK	84.7	85.8	13.8	10.6	38.7	0.0	70.4	71.5	75.4	5.0	3.9	Carrier
624.200	PK	54.5	56.7	19.3	12.9	38.1	0.0	48.6	50.8	55.4	6.8	4.6	Outside
936.300	PK	41.6	37.2	22.3	14.6	37.8	0.0	40.7	36.3	55.4	14.7	19.1	Outside
1248.400	PK	44.9	44.9	25.2	5.3	34.3	0.0	41.1	41.1	55.4	14.3	14.3	Outside
1560.500	PK	44.0	44.0	25.8	5.6	33.5	0.0	41.9	41.9	53.9	12.0	12.0	Inside
1872.600	PK	41.8	42.3	26.6	5.7	32.9	0.0	41.2	41.7	55.4	14.2	13.7	Outside
2184.700	PK	42.5	42.8	27.3	5.9	32.5	0.0	43.2	43.5	55.4	12.2	11.9	Outside
2496.800	PK	44.4	44.8	27.8	6.1	32.4	0.0	45.9	46.3	53.9	8.0	7.6	Inside
2808.900	PK	45.4	46.2	28.6	6.3	32.2	0.0	48.1	48.9	53.9	5.8	5.0	Inside
3121.000	PK	42.3	41.2	29.2	6.4	32.1	0.0	45.8	44.7	55.4	9.6	10.7	Outside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amprifier) + Duty factor

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

Sample calculation:
Result of PK = Reading + Ant Factor + Loss (Cable + Attenuator + Filter) - Gain (Amplifier)
Result of PK with Duty factor = Reading + Ant Factor + Loss (Cable + Attenuator + Filter) - Gain (Amplifier) + Duty factor

For above 1GHz: Distance Factor: 20 x log (4.45 m/3.0 m) = 3.42 dB
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

Since the peak emission result satisfied the average limit, duty factor was omitted.
The result of AV (PK with Duty factor) was calculated by applying Duty 100%.

Radiated Emission (Electric Field Strength of Fundamental and Spurious Emission)

312.10 MHz under BLE communication

Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.1	No.3
Report No.	12022270H	
Date	11/09/2017	11/13/2017
Temperature / Humidity	21 deg. C / 51 % RH	23 deg. C / 49 % RH
Engineer	Shinya Watanabe (Below 1 GHz)	Shinya Watanabe (Above 1 GHz)
Mode	Transmitting mode 312.10 MHz under BLE communication	

PK

Frequency [MHz]	Detector	Reading [dBuV] Hor	Reading [dBuV] Ver	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m] Hor	Result [dBuV/m] Ver	Limit [dBuV/m]	Margin [dB] Hor	Margin [dB] Ver	Remark Inside or Outside of Restricted Bands
312.100	PK	84.6	85.9	13.8	10.6	38.7	-	70.3	71.6	95.4	25.1	23.8	Carrier
624.200	PK	54.6	56.6	19.3	12.9	38.1	-	48.7	50.7	75.4	26.7	24.7	Outside
936.300	PK	41.1	37.1	22.3	14.6	37.8	-	40.2	36.2	75.4	35.2	39.2	Outside
1248.400	PK	45.0	45.5	25.2	5.3	34.3	-	41.2	41.7	75.4	34.2	33.7	Outside
1560.500	PK	44.4	44.5	25.8	5.6	33.5	-	42.3	42.4	73.9	31.6	31.5	Inside
1872.600	PK	41.9	41.8	26.6	5.7	32.9	-	41.3	41.2	75.4	34.1	34.2	Outside
2184.700	PK	42.4	43.0	27.3	5.9	32.5	-	43.1	43.7	75.4	32.3	31.7	Outside
2496.800	PK	44.5	44.8	27.8	6.1	32.4	-	46.0	46.3	73.9	27.9	27.6	Inside
2808.900	PK	46.2	44.6	28.6	6.3	32.2	-	48.9	47.3	73.9	25.0	26.6	Inside
3121.000	PK	41.5	42.5	29.2	6.4	32.1	-	45.0	46.0	75.4	30.4	29.4	Outside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amprifier)

PK with Duty factor

Frequency [MHz]	Detector	Reading [dBuV] Hor	Reading [dBuV] Ver	Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m] Hor	Result [dBuV/m] Ver	Limit [dBuV/m]	Margin [dB] Hor	Margin [dB] Ver	Remark
312.100	PK	84.6	85.9	13.8	10.6	38.7	0.0	70.3	71.6	75.4	5.1	3.8	Carrier
624.200	PK	54.6	56.6	19.3	12.9	38.1	0.0	48.7	50.7	55.4	6.7	4.7	Outside
936.300	PK	41.1	37.1	22.3	14.6	37.8	0.0	40.2	36.2	55.4	15.2	19.2	Outside
1248.400	PK	45.0	45.5	25.2	5.3	34.3	0.0	41.2	41.7	55.4	14.2	13.7	Outside
1560.500	PK	44.4	44.5	25.8	5.6	33.5	0.0	42.3	42.4	53.9	11.6	11.5	Inside
1872.600	PK	41.9	41.8	26.6	5.7	32.9	0.0	41.3	41.2	55.4	14.1	14.2	Outside
2184.700	PK	42.4	43.0	27.3	5.9	32.5	0.0	43.1	43.7	55.4	12.3	11.7	Outside
2496.800	PK	44.5	44.8	27.8	6.1	32.4	0.0	46.0	46.3	53.9	7.9	7.6	Inside
2808.900	PK	46.2	44.6	28.6	6.3	32.2	0.0	48.9	47.3	53.9	5.0	6.6	Inside
3121.000	PK	41.5	42.5	29.2	6.4	32.1	0.0	45.0	46.0	55.4	10.4	9.4	Outside

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amprifier) + Duty factor

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

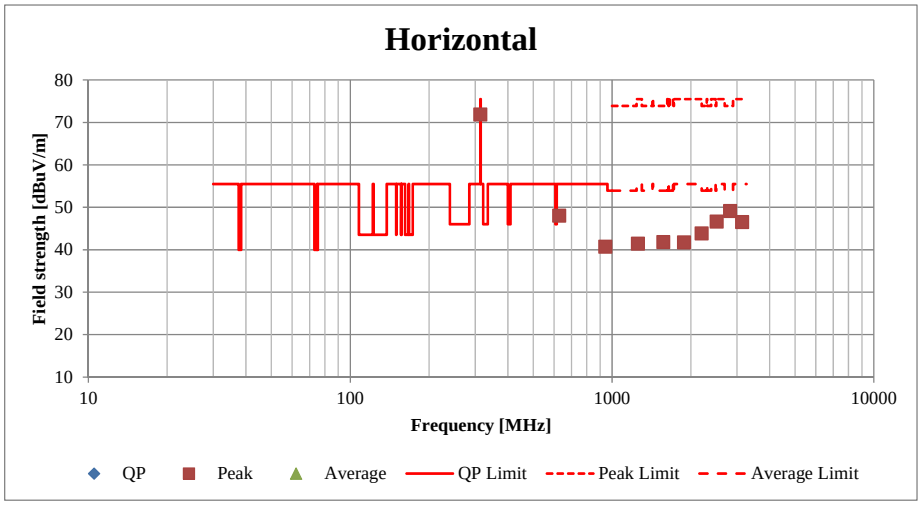
Sample calculation:
Result of PK = Reading + Ant Factor + Loss (Cable + Attenuator + Filter) - Gain (Amplifier)
Result of PK with Duty factor = Reading + Ant Factor + Loss (Cable + Attenuator + Filter) - Gain (Amplifier) + Duty factor

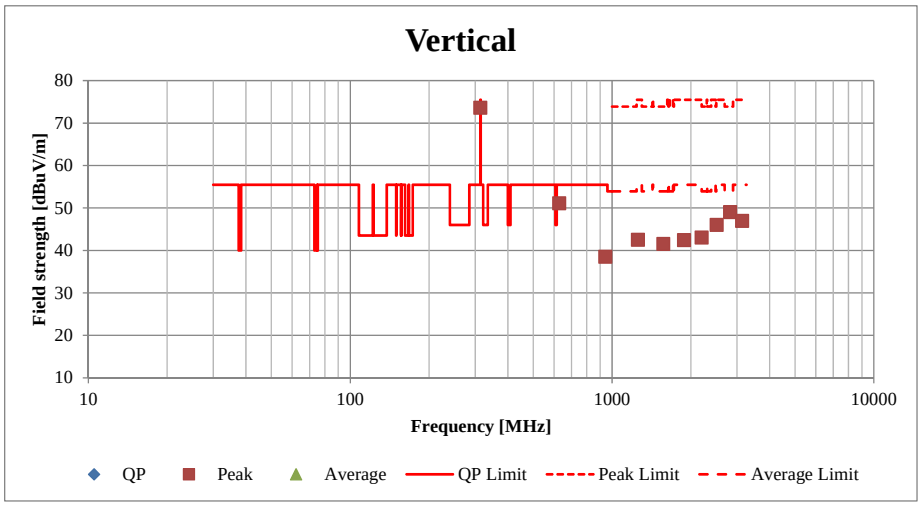
For above 1GHz: Distance Factor: 20 x log (4.45 m/3.0 m) = 3.42 dB
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20dB).

Since the peak emission result satisfied the average limit, duty factor was omitted.
The result of AV (PK with Duty factor) was calculated by applying Duty 100%.

Radiated Spurious Emission
(Plot data, Worst case)

Test place	Ise EMC Lab.	
Semi Anechoic Chamber	No.1	No.3
Report No.	12022270H	
Date	11/09/2017	11/13/2017
Temperature / Humidity	21 deg. C / 51 % RH	23 deg. C / 49 % RH
Engineer	Shinya Watanabe (Below 1 GHz)	Shinya Watanabe (Above 1 GHz)
Mode	Transmitting mode 314.35 MHz	





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

-20 dB and 99 % Occupied Bandwidth

314.35 MHz / 312.10 MHz

Test place	Ise EMC Lab. No.1 Measurement Room
Report No.	12022270H
Date	11/09/2017
Temperature/ Humidity	21 deg. C / 51 % RH
Engineer	Shinya Watanabe
Mode	Transmitting mode 314.35 MHz / 312.10 MHz

Bandwidth Limit : Fundamental Frequency **312.10** MHz x 0.25% = 780.250 kHz

* The above limit was calculated from more stringent nominal frequency.

* Method of KDB 926416 for systems employing non sweeping frequencies was referred.

314.35 MHz

-20 dB Bandwidth [kHz]
39.625

312.10 MHz

-20 dB Bandwidth [kHz]
39.513

-20 dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
39.625 + 39.513 = 79.138	780.250	Pass

Bandwidth Limit : Fundamental Frequency **314.35** MHz x 0.25% = 785.875 kHz

99 % Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
42.7463	785.8750	Pass

Bandwidth Limit : Fundamental Frequency **312.10** MHz x 0.25% = 780.250 kHz

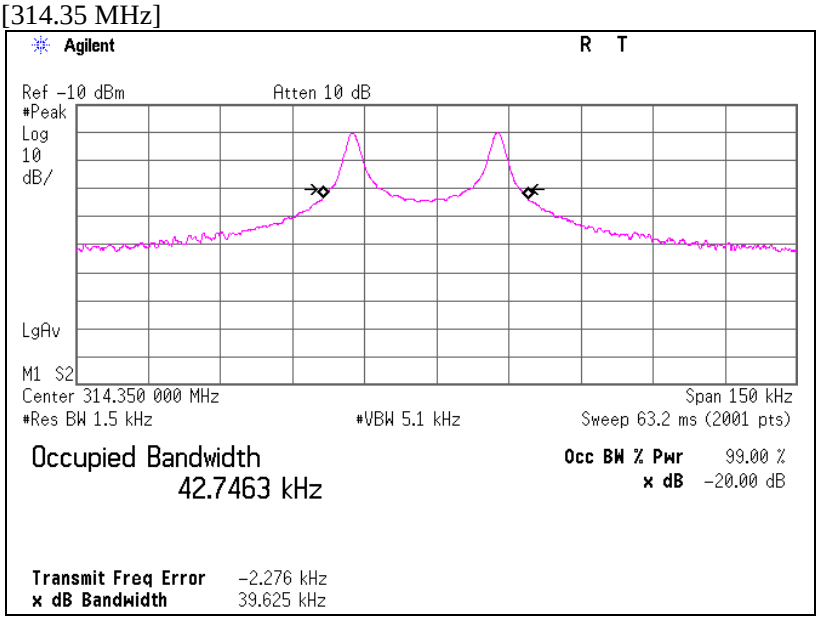
99 % Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
42.8361	780.2500	Pass

-20 dB and 99 % Occupied Bandwidth

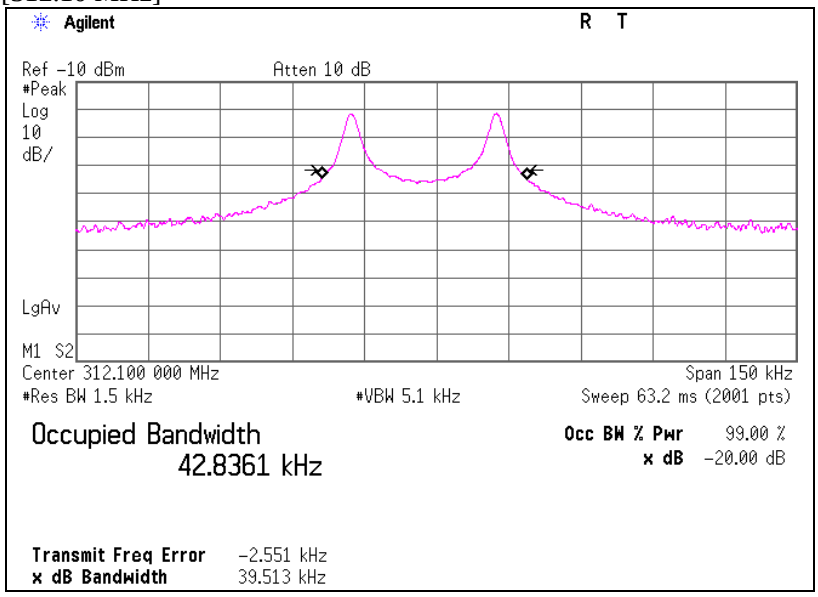
314.35 MHz / 312.10 MHz

Test place	Ise EMC Lab. No.1 Measurement Room
Report No.	12022270H
Date	11/09/2017
Temperature/ Humidity	21 deg. C / 51 % RH
Engineer	Shinya Watanabe
Mode	Transmitting mode 314.35 MHz / 312.10 MHz

[314.35 MHz]



[312.10 MHz]



APPENDIX 2: Test Instruments

EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-01	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 10m	DA-06881	RE	2017/09/30 * 12
MOS-27	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	RE	2017/01/20 * 12
MJM-25	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MTR-09	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	RE	2017/06/27 * 12
KBA-05	Biconical Antenna	Schwarzbeck	BBA9106	2513	RE	2016/11/23 * 12
MLA-20	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-189	RE	2017/01/05 * 12
MAT-08	Attenuator(6dB)	Weinschel Corp	2	BK7971	RE	2016/11/28 * 12
MCC-02	Coaxial Cable	Suhner/storm/Agilent/ TSJ	-	-	RE	2017/09/26 * 12
MPA-19	Pre Amplifier	MITEQ	MLA-10K01-B01-35	1237616	RE	2017/02/08 * 12
MMM-03	Digital Tester	Fluke	FLUKE 26-3	78030621	RE	2017/08/07 * 12
MRENT-140	Spectrum Analyzer	KEYSIGHT	E4440A	MY46187752	RE	2017/11/01 * 12
MAEC-03	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2017/10/31 * 12
MOS-13	Thermo-Hygrometer	Custom	CTH-180	1301	RE	2017/01/20 * 12
MJM-16	Measure	KOMELON	KMC-36	-	RE	-
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2017/08/22 * 12
MHA-20	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	258	RE	2017/05/22 * 12
MCC-167	Microwave Cable	Junkosha	MWX221	1404S374(1m) / 1405S074(5m)	RE	2017/05/29 * 12
MPA-11	MicroWave System Amplifier	Agilent	83017A	MY39500779	RE	2017/03/21 * 12
MMM-08	DIGITAL HiTESTER	Hioki	3805	051201197	RE	2017/01/19 * 12
MLPA-07	Loop Antenna	UL Japan	-	-	RE	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:
RE: Radiated emission, 99 % Occupied Bandwidth, -20 dB bandwidth and Automatically deactivate tests