



# ADDEMDUM TEST REPORT

**Test Report No. : 11708031M**

**Applicant** : TAIYO YUDEN CO., LTD.  
**Type of Equipment** : Bluetooth Smart / ANT Module  
**Model No.** : EYSHJN  
**Test standard** : EN 300 328 V2.1.1  
(Except radiated emission tests)  
**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 the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. The opinions and the interpretations to the result of the description in this report are outside scopes where UL Japan has been accredited.
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:** April 5, 20, 2017

**Representative test operator:**

*K. Ando*

Kazuhiro Ando  
Engineer  
Consumer Technology Division

**Approved by :**

*T. Yamashita*

Tomoyuki Yamashita  
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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**Kashima EMC Lab.**

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## **SECTION 1: Customer information**

Company Name : TAIYO YUDEN CO., LTD.  
Address : 8-1 Sakaecho, Takasaki-Shi, Gunma, 370-8522, Japan  
Telephone Number : +81-27-324-2313  
Facsimile Number : +81-27-324-2314  
Contact Person : Mitsuo Takagi

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

### **2.1 Identification of E.U.T.**

Type of Equipment : Bluetooth Smart / ANT Module  
Model No. : EYSHJN  
Serial No. : Refer to Clause 4.2  
Rating : DC 3 V, 1.7 V - 3.6 V, 0.02 A, 0.1 W  
Receipt Date of Sample : March 30, 2017  
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: EYSHJN (referred to as the EUT in this report) is a Bluetooth Smart / ANT Module.

### **General Specification**

Clock frequency(ies) in the system : 32 MHz

## **Radio Specification**

### **< Bluetooth(BT) Low Energy (LE)>**

Radio Type : Transceiver  
Frequency of Operation : 2402 MHz - 2480 MHz  
Modulation : GFSK  
Power Supply (inner) : DC 1.3 V  
Antenna type : Monopole Antenna  
Antenna Gain : -1.5 dBi  
Operating Temperature : -40 deg. C to +105 deg. C

### **< Bluetooth (Ver. 5.0)>**

Radio Type : Transceiver  
Frequency of Operation : 2402 MHz - 2480 MHz  
Modulation : GFSK  
Power Supply (inner) : DC 1.3 V  
Antenna type : Monopole Antenna  
Antenna Gain : -1.5 dBi  
Operating Temperature : -40 deg. C to +105 deg. C

### **<ANT>**

Equipment Type : Transceiver  
Frequency of Operation : 2402 MHz - 2480 MHz  
Type of Modulation : GFSK  
Power Supply (inner) : DC 1.3 V  
Antenna Type : Monopole Antenna  
Antenna Gain : -1.5 dBi  
Operating Temperature : -40 deg. C to +105 deg. C

### **<Nordic Original>**

Equipment Type : Transceiver  
Frequency of Operation : 2402 MHz - 2480 MHz  
Type of Modulation : GFSK  
Power Supply (inner) : DC 1.3 V  
Antenna Type : Monopole Antenna  
Antenna Gain : -1.5 dBi  
Operating Temperature : -40 deg. C to +105 deg. C

Receiver category : Category 2

## **SECTION 3: Test specification, procedures & results**

### **3.1 Test Specification**

Radio : EN 300 328 V2.1.1

Title : Wideband transmission systems; Data transmission equipment operating in the 2.4GHz ISM band and using wide band modulation techniques;  
Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

Purpose of test : Compliance with the harmonized RE directive 2014/53/EU.

Test reports: 11347417M and 11708031M (this report) include information of all the requirements in EN 300 328 V2.1.1.

11708031M is for updating the test standard: EN 300 328 from V1.9.1 to V2.1.1 and it only includes the requirements newly introduced in EN 300 328 V2.1.1.

Therefore only following test was performed in this report (See clause 3.2).

### **3.2 Procedures and results**

No.	Item	Test Procedure	Limit	Remarks	Worst margin	Exclusions	Results
1	RF output power	Clause 5.4.2	Clause 4.3.2.2	Conducted	See Data	N/A	Complied
2	Power Spectral Density	Clause 5.4.3	Clause 4.3.2.3	Conducted	See Data	N/A	Complied
3	Duty cycle, Tx-sequence, Tx-gap	Clause 5.4.2	Clause 4.3.2.4	Conducted	-	N/A	N/A *1)
4	Medium Utilisation (MU) factor	Clause 5.4.2	Clause 4.3.2.5	Conducted	-	N/A	N/A *1)
5	Adaptivity (adaptive equipment using modulations other than FHSS)	Clause 5.4.6	Clause 4.3.2.6	Conducted	-	N/A	N/A *2)
6	Occupied Channel Bandwidth	Clause 5.4.7	Clause 4.3.2.7	Conducted	See Data	N/A	Complied
7	Transmitter unwanted emissions in the out-of-band domain	Clause 5.4.8	Clause 4.3.2.8	Conducted	See Data	N/A	Complied
8	Transmitter unwanted emissions in the spurious domain	Clause 5.4.9	Clause 4.3.2.9	Radiated	-	N/A	N/A *3)
9	Receiver Spurious emissions	Clause 5.4.10	Clause 4.3.2.10	Radiated	-	N/A	N/A *3)
10	Transmitter unwanted emissions in the spurious domain	Clause 5.4.9	Clause 4.3.2.9	Conducted	-	N/A	N/A *3)
11	Receiver Spurious emissions	Clause 5.4.10	Clause 4.3.2.10	Conducted	-	N/A	N/A *3)
12	Receiver Blocking	Clause 5.4.11	Clause 4.3.2.11	Conducted	See Data	N/A	Complied
13	Geo-location capability	-	Clause 4.3.2.12	-	-	N/A	N/A *4)

Note: UL Japan, Inc.'s EMI Work Procedure 13-EM-W0420.

\*1) The test is not applicable since the EUT is an adaptive equipment and does not operate in a non-adaptive mode.

\*2) The test is not applicable since the RF output power of the EUT is less than 10 dBm (e.i.r.p.).

\*3) This test is not applicable since customer request.

\*4) The EUT does not have Geo-location capability.

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### 3.3 Additions or deviations to standards

No addition, exclusion nor deviation has been made from the standard.

### 3.4 Uncertainty

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

Antenna terminal test	Uncertainty (+/-)
Power measurement above 1GHz	0.7dB
Spurious emissions, Power density measurement (below 1GHz)	1.6dB
Spurious emissions, Power density measurement (1G-3GHz)	1.4dB
Spurious emissions, Power density measurement (3G-18GHz)	2.8dB
Frequency measurement	$5.3 \times 10^{-6}$
Bandwidth measurement	5.4%
Duty cycle and Time measurement	0.012%
Receiver Blocking	3.1 dB

### 3.5 Test Location

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JAB Accreditation No. : RTL02610

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 Open site	4659A-1	6.0 x 5.5 x 2.5	20 x 40	10 m
No.2 Open site	4659A-2	4.4 x 4.4 x 2.15	18 x 20	10 m
No.5 Open site	4659A-5	8.6 x 7.1 x 2.4	18 x 23	10 m
No.1 Shielded room	4659A-1	5.4 x 4.5 x 2.3	-	-
No.2 Shielded room	4659A-2	3.6 x 2.7 x 2.3	-	-
No.3 Shielded room	-	5.4 x 3.6 x 2.3	-	-
No.4 Shielded Room	-	6.1 x 6.1 x 3.1	-	-
No.5 Shielded Room	4659A-5	4.2 x 3.1 x 2.5	-	-
No.3 Fully Anechoic Chamber	-	7.0 x 3.5 x 3.5	-	-
No.6 Semi-anechoic Chamber	4659A-6	8.5 x 5.5 x 5.2	-	3 m
No.10 Semi-anechoic Chamber	4659A-10	18.4 x 9.9 x 7.7	-	10 m
No.11 Semi-anechoic Chamber	4659A-7	9.0 x 6.5 x 5.2	-	3 m
No.1 Measurement room	-	5.0 x 3.7 x 2.6	-	-
No.2 Measurement room	-	4.3 x 4.4 x 2.7	-	-
No.3 Measurement room	-	4.3 x 4.4 x 2.7	-	-

### 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)**

<b>Mode</b>	<b>Remarks*</b>
Bluetooth(BT) Low Energy (LE)	2MHz, Maximum Packet Size, PRBS9
ANT	1Mbps
*Power of the EUT was set by the software as follows; Power settings: +4dBm Software: ANT_TEST_tool-52 (except for Receiver blocking) EYSHCN_Blocking_tool_20170317 (Receiver blocking only) *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.	

#### Details of Operating Mode(s)

<b>Test Item</b>	<b>Operating Mode</b>	<b>Tested frequency</b>
RF output power, Power Spectral Density	BT LE (2MHz) Tx	2402 MHz 2440 MHz 2480 MHz
Occupied channel bandwidth, Transmitter unwanted emissions in the out-of-band domain	BT LE (2MHz) Tx	2402 MHz 2480 MHz
Receiver blocking	ANT Tx (Direct test mode)	2402 MHz 2480 MHz

<b><u>Extreme test condition</u></b>	
Temperature	-40 deg. C to + 105 deg. C : operating temperature range of EUT
Voltage	Vnom: DC 3.0 V, Vmin: DC 1.7 V, Vmax: DC 3.6 V: operating voltage range of EUT

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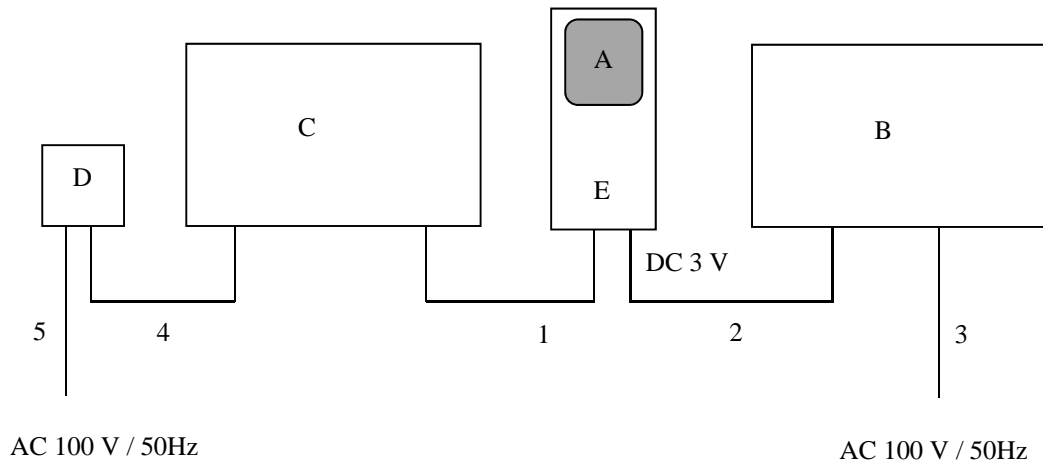
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## 4.2 Configuration and peripherals



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

### Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Bluetooth Smart / ANT Module	EYSHJN	1 *1) 2 *2)	TAIYO YUDEN	EUT
B	DC Power Supply	GSV3000	1303141419	DIAMOND ANTENNA	-
C	PC	CF-T2	4CKSA46826	Panasonic	-
D	AC Adaptor	CF-AA1625A	1625AM406Z21913F	Panasonic	-
E	Evaluation Board	EBSHJNZXZ	1 *1) 2 *2)	TAIYO YUDEN	-

\*1) Used for Antenna Terminal conducted tests

\*2) Used for Receiver blocking test

### List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	USB Cable	1.8	Shielded	Shielded	-
2	DC Cable	0.5 + 1.5	Unshielded	Unshielded	-
3	AC Cable	1.7	Unshielded	Unshielded	-
4	DC Cable	1.2	Unshielded	Unshielded	-
5	AC Cable	0.8	Unshielded	Unshielded	-

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## **SECTION 5: Antenna Terminal Conducted Tests**

### **Test Procedure**

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

<b>Test</b>	<b>Instrument used</b>	<b>Remark</b>
RF Output Power	Power Meter	Normal and Extreme conditions
Power Spectral Density	Spectrum Analyzer	Normal condition
Occupied Channel Bandwidth	Spectrum Analyzer	Normal condition
Transmitter unwanted emissions in the out-of band domain	Spectrum Analyzer	Normal conditions - Detector mode: RMS - Trace: Max Hold - Band power was used on behalf of the time domain power function. - Filter mode: Gaussian Filter Since the data in this test report has enough margin
Receiver Blocking	Spectrum Analyzer	Normal condition

The test results are rounded off to two decimals place, so some differences might be observed.  
The equipment and cables were not used for factor 0.0 dB of the data sheets.

**Test data** : APPENDIX  
**Test result** : Pass

**APPENDIX 1: Test data**

**RF Output Power**

Test place Kashima EMC Lab. No.2 Measurement Room  
Report No. 11708031M  
Date April 20, 2017  
Temperature / Humidity 24 deg. C / 40 % RH  
Engineer Kazuhiro Ando  
Mode Tx BT LE (2MHz)

Test Condition	Temp.	Volt.	Freq. [MHz]	P/M (AV) Reading [dBm]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result [dBm]	Limit [dBm]	Margin [dB]
nom	nom		2402.0	-7.38	1.51	10.04	-1.50	2.67	20.00	17.33
			2440.0	-7.34	1.51	10.04	-1.50	2.71	20.00	17.29
			2480.0	-7.41	1.52	10.04	-1.50	2.65	20.00	17.35
min	min		2402.0	-6.48	1.51	10.04	-1.50	3.57	20.00	16.43
			2440.0	-6.43	1.51	10.04	-1.50	3.62	20.00	16.38
			2480.0	-6.52	1.52	10.04	-1.50	3.54	20.00	16.46
min	max		2402.0	-6.52	1.51	10.04	-1.50	3.53	20.00	16.47
			2440.0	-6.48	1.51	10.04	-1.50	3.57	20.00	16.43
			2480.0	-6.57	1.52	10.04	-1.50	3.49	20.00	16.51
max	min		2402.0	-9.03	1.51	10.04	-1.50	1.02	20.00	18.98
			2440.0	-8.99	1.51	10.04	-1.50	1.06	20.00	18.94
			2480.0	-9.04	1.52	10.04	-1.50	1.02	20.00	18.98
max	max		2402.0	-8.93	1.51	10.04	-1.50	1.12	20.00	18.88
			2440.0	-8.89	1.51	10.04	-1.50	1.16	20.00	18.84
			2480.0	-8.95	1.52	10.04	-1.50	1.11	20.00	18.89

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

## Power Spectral Density

Test place                   Kashima EMC Lab. No.2 Measurement Room  
Report No.                   11708031M  
Date                         April 20, 2017  
Temperature / Humidity     24 deg. C / 40 % RH  
Engineer                    Kazuhiro Ando  
Mode                         Tx BT LE (2MHz)

Test Condition		Ch Freq. [MHz]	S/A Maximum Reading [dBm/MHz]	S/A Total Power Reading [dBm]	RF Output Power [dBm]	Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]
Temp.	Volt.							
nom	nom	2402.00	-8.52	-7.33	2.67	1.48	10.00	8.52
		2440.00	-8.51	-7.27	2.71	1.47	10.00	8.53
		2480.00	-8.45	-7.29	2.65	1.49	10.00	8.51

Result [dBm/MHz] = S/A Maximum Reading [dBm/MHz] - S/A Total Power Reading [dBm] (\*1) + RF Output Power [dBm] (\*2)

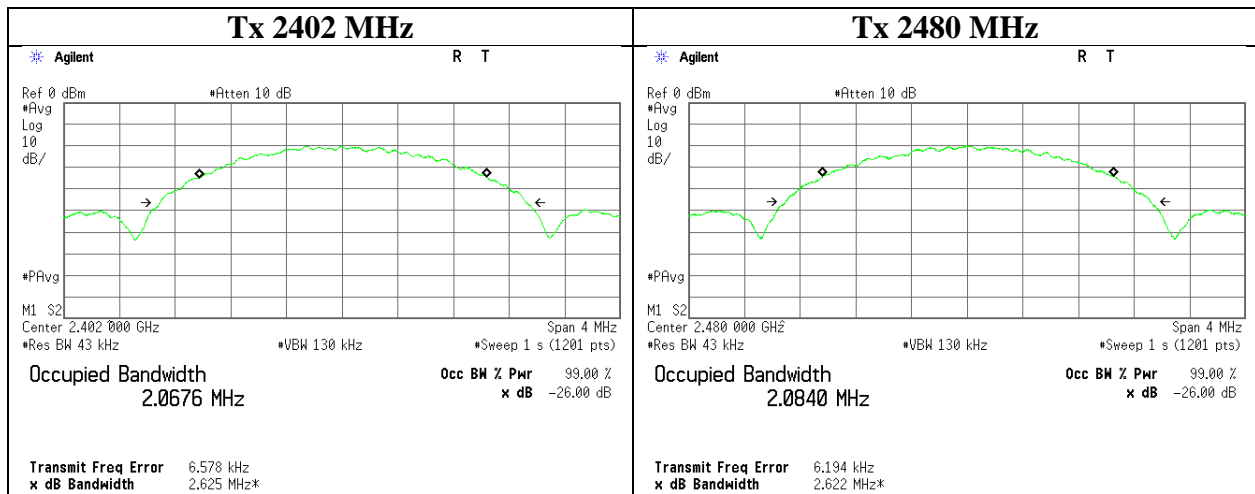
(\*1) Integrated value of 2400 MHz to 2483.5 MHz

(\*2) Refer to RF Output Power

### Occupied Channel Bandwidth

Test place	Kashima EMC Lab. No.2 Measurement Room
Report No.	11708031M
Date	April 20, 2017
Temperature / Humidity	24 deg. C / 40 % RH
Engineer	Kazuhiro Ando
Mode	Tx BT LE (2MHz)

Frequency [MHz]	Bandwidth [MHz]	Result [MHz]	Limit [MHz]
2402	2.0676	2400.9662	> 2400
2480	2.0840	2481.0420	< 2483.5



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## Transmitter unwanted emissions in the out-of-band domain

Test place                   Kashima EMC Lab. No.2 Measurement Room  
Report No.                   11708031M  
Date                         April 20, 2017  
Temperature / Humidity     24 deg. C / 40 % RH  
Engineer                    Kazuhiro Ando  
Mode                         Tx BT LE (2MHz)

Frequency [MHz]	S/A (AV) Reading [dBm/MHz]	Cable Loss [dB]	Atten. Loss [dB]	Antenna Gain [dBi]	Result [dBm/MHz]	Limit [dBm/MHz]	Margin [dB]	Remarks
2397.4	-60.00	1.51	10.04	-1.50	-49.95	-20.00	29.95	Lowest ch 2400 MHz - 2 BW
2399.5	-43.07	1.51	10.04	-1.50	-33.02	-10.00	23.02	Lowest ch 2400 MHz - BW
2484.0	-58.70	1.52	10.04	-1.50	-48.64	-10.00	38.64	Highest ch 2483.5 MHz + BW
2487.2	-61.67	1.52	10.04	-1.50	-51.61	-20.00	31.61	Highest ch 2483.5 MHz + 2 BW

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

\*Above test result was maximum value on each 1 BW.

## Receiver Blocking

Report No. 11708031M  
Test place Kashima EMC Lab. No.2 Measurement Room (Shielded Room)  
Date April 5, 2017  
Temperature / Humidity 23 deg. C / 38 % RH  
Engineer Kazuhiro Ando  
Mode Tx ANT

Wanted signal mean power from companion device (dBm)	Measured Receiver Sensitivity (dBm)	
	Lowest Channel	Highest Channel
P <sub>min</sub>	-90.39	-90.39
P <sub>min</sub> + 6 dB	-84.39	-84.39

### Receiver Category 2 equipment

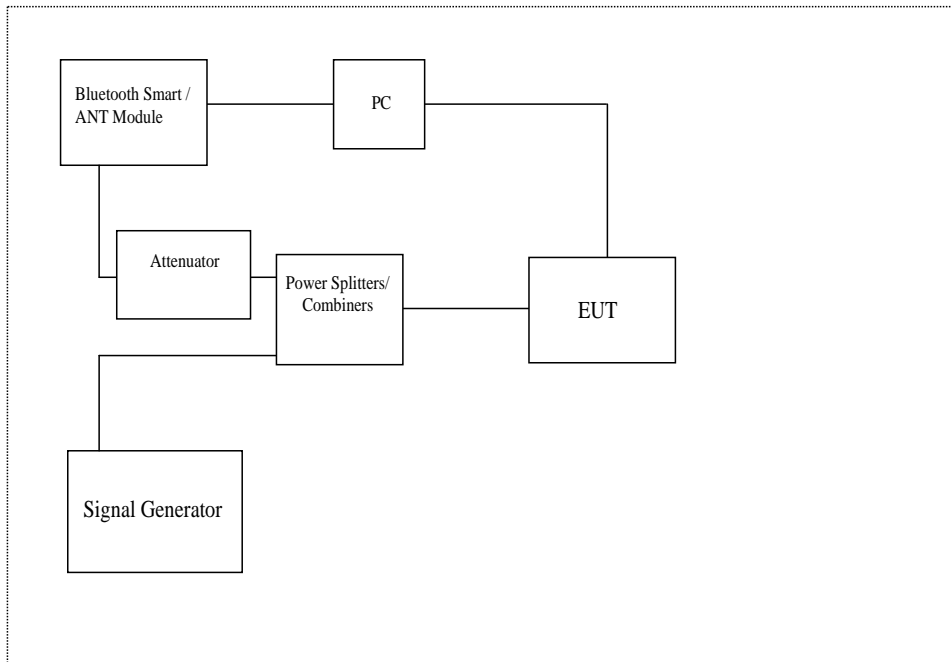
Operating Channel	Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) *1)	Result PER (%)	Limit PER (%)
Lowest Channel	P <sub>min</sub> + 6 dB	2380	-57	0.00	≤ 10
		2503.5		0.00	
	P <sub>min</sub> + 6 dB	2300	-47	0.00	
		2583.5		0.00	
Highest Channel	P <sub>min</sub> + 6 dB	2380	-57	0.00	≤ 10
		2503.5		0.00	
	P <sub>min</sub> + 6 dB	2300	-47	0.00	
		2583.5		0.00	

\*P<sub>min</sub> is the minimum level of wanted signal (in dBm) required to meet the minimum performance criterion a PER less than or equal to 10 % in the absence of any blocking signal.

\*1) Blocking signal power was adjusted by assumed antenna gain 0.0 dBi since it was more severe condition.

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**CONDUCTED METHODS SYSTEM BLOCK DIAGRAM of Receiver Blocking**





## **APPENDIX 2: Test instruments**

### **Test Equipment**

<b>Control No.</b>	<b>Instrument</b>	<b>Manufacturer</b>	<b>Model No</b>	<b>Serial No</b>	<b>Test Item</b>	<b>Calibration Date * Interval(month)</b>
CSA-07	Spectrum Analyzer	Agilent	E4448A	MY52490024 Version A.11.21	AT	2016/05/11 * 12
CAT10-17	10dB Fixed Atten.	Weinschel	54A-10	56251	AT	2016/05/13 * 12
CCC-W01	Micro Wave Cable	SUHNER	SUCOFLEX102	MY3662/2	AT	2016/05/13 * 12
CCH-04	Temperature and Humidity Chamber	ESPEC	PL-1J	15004059	AT	2016/06/30 * 12
CPM-16	Peak Power Analyzer	Agilent	8990B	MY51000276	AT	2016/06/01 * 12
CPSO-24	Power Sensor	Agilent	N1923A	MY54070024	AT	2016/06/01 * 12
COS-05	Temperature & Humidity Indicator	A&D	AD-5681	6975761	AT	2016/07/21 * 12
CTS-18	Digital Multimeter	FLUKE	87-3	85220051	AT	2016/09/26 * 12
CSG-11	Signal Generator	Agilent	N5173B	MY53270188 Version B.01.50	AT	2016/05/12 * 12
CAT20-04	20dB Fixed Atten.	Weinschel	54A-20	41994	AT	2016/05/13 * 12
CAT20-05	20dB Fixed Atten.	Weinschel	54A-20	42054	AT	2016/05/13 * 12
CATS-07	Step Attenuator	Agilent	8495B	MY41110308	AT	2016/09/23 * 12
CATS-08	Step Attenuator	Agilent	8494B	2550A11724	AT	2016/09/23 * 12
CCC-W02	Micro Wave Cable	SUHNER	SUCOFLEX102	MY3773/2	AT	2016/05/12 * 12
CCC-W14	Micro Wave Cable	Suhner	SUCOFLEX104PE	36186	AT	Pre Check
CCC-G12-2	Micro Wave Cable	HUBER+SUHNER	SF104A/11PC3542/ 11N451/1mtr	MY1151/4A	AT	2016/07/28 * 12
CPSC-02	Power Splitters /Combiners	Mini-Circuits	ZFSC-2-10G+	-	AT	2016/06/01 * 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:**

**AT: Antenna Terminal Conducted test**

**UL Japan, Inc.**

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### APPENDIX 3: Photographs of test setup

#### Antenna terminal conducted tests

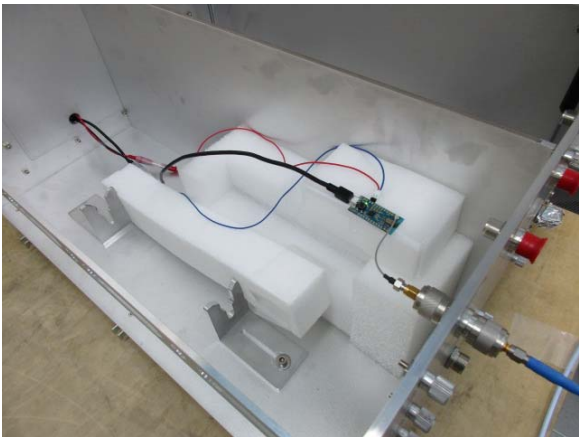


**Photo 1**

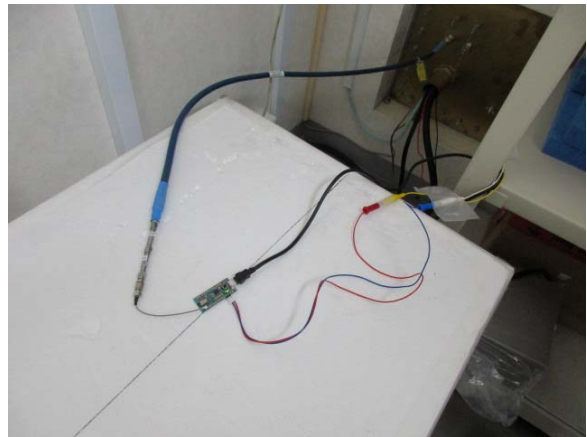
### Receiver Blocking



**Photo 1**



**Photo 2**



**Photo 3**

**End of Report**