RADIO TEST REPORT

Test Report No. : 11217143H-A

Applicant	:	**U-SHIN LTD.**
Type of Equipment	:	**TRANSMITTER, KEYLESS ENTRY**
Model No.	:	**K7001TX**
Test regulation	:	**FCC Part 15 Subpart C: 2016**
FCC ID	:	**2AJMDK7001TX**
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 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: September 13, 2016

Representative test engineer:
Satofumi Matsuyama
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.: 11217143H-A

Revision	Test report No.	Date	Page revised	Contents
- (Original)	11217143H-A	October 24, 2016	-	-

CONTENTS **PAGE**

SECTION 1: Customer information

Company Name	:	U-SHIN LTD.
Address	:	4-1-1 Tennou Oohama Kure-shi Hiroshima 737-8541 Japan
Telephone Number	:	+81-823-30-0364
Facsimile Number	:	+81-823-38-1630
Contact Person	:	Kohei Yamaguchi

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

2.1 Identification of E.U.T.

Type of Equipment	:	TRANSMITTER, KEYLESS ENTRY
Model No.	:	K7001TX
Serial No.	:	Refer to Clause 4.2
Rating	:	DC 3.0 V (CR2032)
Receipt Date of Sample	:	August 18, 2016
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 No: K7001TX (referred to as the EUT in this report) is the TRANSMITTER, KEYLESS ENTRY.

General Specification

Clock frequency(ies) in the system	:	1 MHz (Control Circuit) / 32 MHz (PLL Circuit)

Radio Specification

Equipment type	:	Transmitter
Frequency of operation	:	315 MHz
Type of modulation	:	AM
Power Supply (radio part input)	:	DC 3.0 V
Antenna type	:	PWB Pattern Antenna

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification	:	FCC Part 15 Subpart C FCC part 15 final revised on April 6, 2016.
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	**FCC:** Section 15.207	N/A	N/A *1)	-
	IC: RSS-Gen 8.8	**IC:** RSS-Gen 8.8			
Automatically Deactivate	**FCC:** ANSI C63.10:2013 6 Standard test methods	**FCC:** Section 15.231(a)(1)	N/A	Complied	Radiated
	IC: -	**IC:** RSS-210 A1.1			
Electric Field Strength of Fundamental Emission	**FCC:** ANSI C63.10:2013 6 Standard test methods	**FCC:** Section 15.231(b)	15.5 dB 315.000 MHz Horizontal PK with Duty factor	Complied	Radiated
	IC: RSS-Gen 6.12	**IC:** RSS-210 A1.2			
Electric Field Strength of Spurious Emission	**FCC:** ANSI C63.10:2013 6 Standard test methods	**FCC:** Section 15.205 Section 15.209 Section 15.231(b)	5.0 dB 3150.000 MHz Horizontal PK with Duty factor	Complied	Radiated
	IC: RSS-Gen 6.13	**IC:** RSS-210 A1.2, 4.4 RSS-Gen 8.9			
-20dB Bandwidth	**FCC:** ANSI C63.10:2013 6 Standard test methods	**FCC:** Section 15.231(c)	N/A	Complied	Radiated
	IC: -	**IC:** Reference data			
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 test was performed with the New Battery (DC 3.0 V) during the tests. Therefore, the 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 $k = 2$.

Test distance	Radiated emission (±dB)
	9 kHz - 30 MHz
3m	3.8 dB
10m	3.7 dB

*Measurement distance

Polarity	Radiated emission (Below 1GHz)			
	(3 m*)(+/-)		(10 m*)(+/-)	
	30 – 200 MHz	200 – 1000MHz	30 – 200 MHz	200 – 1000MHz
Horizontal	5.0 dB	5.3 dB	5.0 dB	5.0 dB
Vertical	4.7 dB	5.9 dB	5.0 dB	5.1 dB

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

* Measurement distance

Radiated emission test(3 m)
[Electric Field Strength of Fundamental Emission]
The data listed in this test report has enough margin, more than the site margin.

[Electric Field Strength of Spurious Emission]
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. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999 Facsimile : +81 596 24 8124

	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.

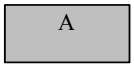
Refer to APPENDIX.

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

4.1 Operating Modes

Test Item*	Mode
Automatically Deactivate Duty Cycle Electric Field Strength of Fundamental Emission Electric Field Strength of Spurious Emission -20 dB & 99 % Occupied Bandwidth	Transmitting mode (Tx) *1)
* The system was configured in typical fashion (as a user would normally use it) for testing. *1) The software of this mode is the same as one of normal product, except that EUT continues to transmit when transmitter button is being pressed (For Normal use mode, EUT stops to transmit in a given time, even if transceiver button is being pressed.) End users cannot change the settings of the output power of the product.	

4.2 Configuration and peripherals



* Test data was taken under worse case conditions.

Description of EUT

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	TRANSMITTER, KEYLESS ENTRY	K7001TX	KLETXMF016	U-SHIN LTD.	EUT

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 was 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 *1)	Max Hold *1)	Spectrum Analyzer
*1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100 %. Peak hold was applied as Worst-case measurement.							

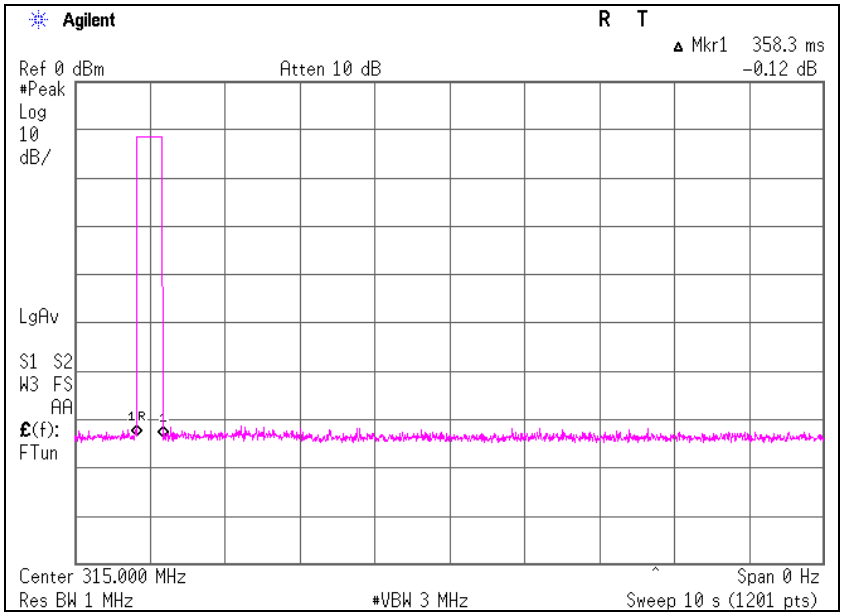
Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Automatically deactivate

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11217143H
Date	September 13, 2016
Temperature/ Humidity	24 deg. C / 57 % RH
Engineer	Satofumi Matsuyama
Mode	Transmitting mode

Time of Transmitting [sec]	Limit [sec]	Result
0.36	5.00	Pass



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

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11217143H
Date	September 13, 2016
Temperature/ Humidity	24 deg. C / 57 % RH
Engineer	Satofumi Matsuyama
Mode	Transmitting mode

PK

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	Inside or Outside of Restricted Bands
315.000	PK	70.7	66.9	13.8	8.9	27.5	-	65.9	62.1	95.6	29.7	33.5	Carrier
630.000	PK	40.4	39.9	19.3	11.7	32.2	-	39.2	38.7	75.6	36.4	36.9	Outside
945.000	PK	34.7	33.5	22.1	13.2	30.9	-	39.1	37.9	75.6	36.5	37.7	Outside
1260.000	PK	51.2	50.7	25.2	3.7	35.8	-	44.3	43.8	75.6	31.3	31.8	Outside
1575.000	PK	50.6	48.5	25.8	3.9	35.4	-	44.9	42.8	73.9	29.0	31.1	Inside
1890.000	PK	50.6	47.2	26.9	4.0	35.2	-	46.3	42.9	75.6	29.3	32.7	Outside
2205.000	PK	52.5	50.9	27.4	4.2	34.9	-	49.2	47.6	73.9	24.7	26.3	Inside
2520.000	PK	56.3	55.2	27.7	4.4	34.7	-	53.7	52.6	75.6	21.9	23.0	Outside
2835.000	PK	56.0	56.4	28.1	4.6	34.5	-	54.2	54.6	73.9	19.7	19.3	Inside
3150.000	PK	57.5	56.3	28.4	4.7	34.2	-	56.4	55.2	75.6	19.2	20.4	Outside

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

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	
315.000	PK	70.7	66.9	13.8	8.9	27.5	-5.8	60.1	56.3	75.6	15.5	19.3	Carrier
630.000	PK	40.4	39.9	19.3	11.7	32.2	-5.8	33.4	32.9	55.6	22.2	22.7	Outside
945.000	PK	34.7	33.5	22.1	13.2	30.9	-5.8	33.3	32.1	55.6	22.3	23.5	Outside
1260.000	PK	51.2	50.7	25.2	3.7	35.8	-5.8	38.5	38.0	55.6	17.1	17.6	Outside
1575.000	PK	50.6	48.5	25.8	3.9	35.4	-5.8	39.1	37.0	53.9	14.8	16.9	Inside
1890.000	PK	50.6	47.2	26.9	4.0	35.2	-5.8	40.5	37.1	55.6	15.1	18.5	Outside
2205.000	PK	52.5	50.9	27.4	4.2	34.9	-5.8	43.4	41.8	53.9	10.5	12.1	Inside
2520.000	PK	56.3	55.2	27.7	4.4	34.7	-5.8	47.9	46.8	55.6	7.7	8.8	Outside
2835.000	PK	56.0	56.4	28.1	4.6	34.5	-5.8	48.4	48.8	53.9	5.5	5.1	Inside
3150.000	PK	57.5	56.3	28.4	4.7	34.2	-5.8	50.6	49.4	55.6	5.0	6.2	Outside

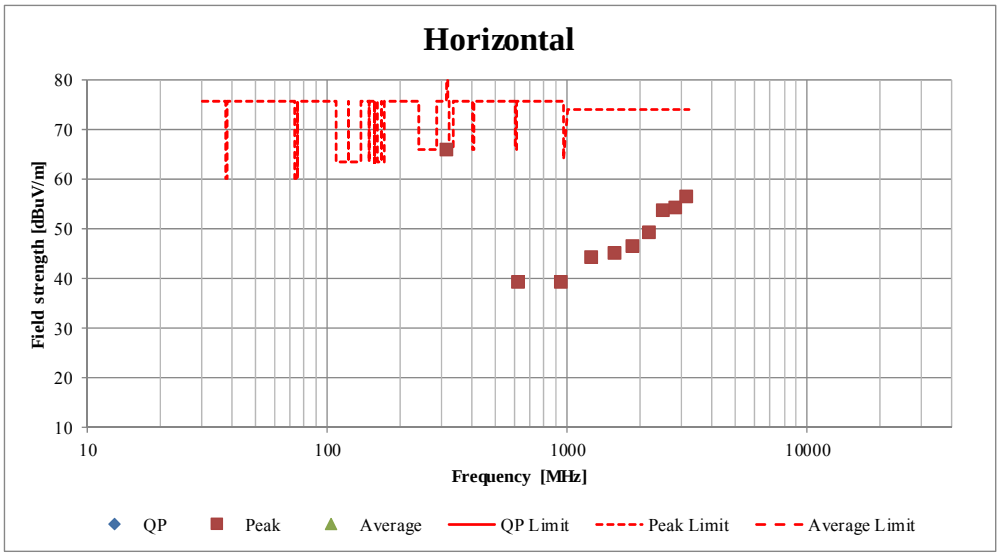
Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter +Distance factor) - Gain (Amplifier) + Duty factor

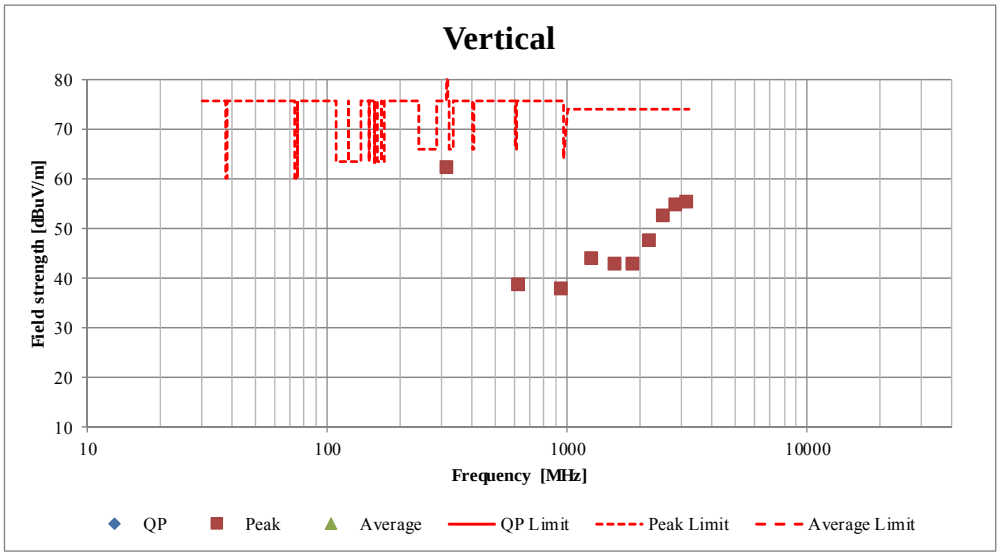
Sample calculation:
Result of PK = Reading + Ant Factor + Loss (Cable + Attenuator + Filter +Distance factor) - Gain (Amplifier)
Result of PK with Duty factor = Reading + Ant Factor + Loss (Cable + Attenuator + Filter +Distance factor) - Gain (Amplifier) + Duty factor

For above 1 GHz : Distance Factor: 20 x log (3.75 m / 3.0 m) = 1.94 dB
*Other frequency noises omitted in this report were not seen or had enough margin (more than 20 dB).

Radiated Spurious Emission
(Plot data, Worst case)

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11217143H
Date	September 13, 2016
Temperature/ Humidity	24 deg. C / 57 % RH
Engineer	Satofumi Matsuyama
Mode	Transmitting mode





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

-20dB and 99% Occupied Bandwidth

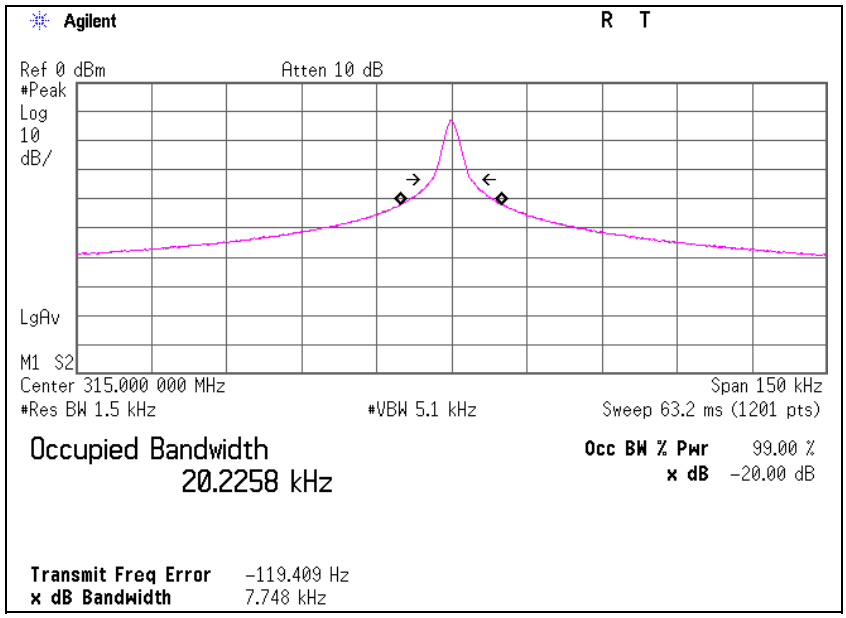
Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11217143H
Date	September 13, 2016
Temperature/ Humidity	24 deg. C / 57 % RH
Engineer	Satofumi Matsuyama
Mode	Transmitting mode

Bandwidth Limit : Fundamental Frequency **315.00** MHz x 0.25% = 787.50 kHz

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

-20dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
7.75	787.50	Pass

99% Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
20.23	787.50	Pass



Duty Cycle

Test place	Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No.	11217143H
Date	September 13, 2016
Temperature/ Humidity	24 deg. C / 57 % RH
Engineer	Satofumi Matsuyama
Mode	Transmitting mode

Type	Times (in 100ms)	ON time(One pulse) [ms]	ON time(in 100ms) [ms]
A	31	0.521	16.145
B	34	1.025	34.850

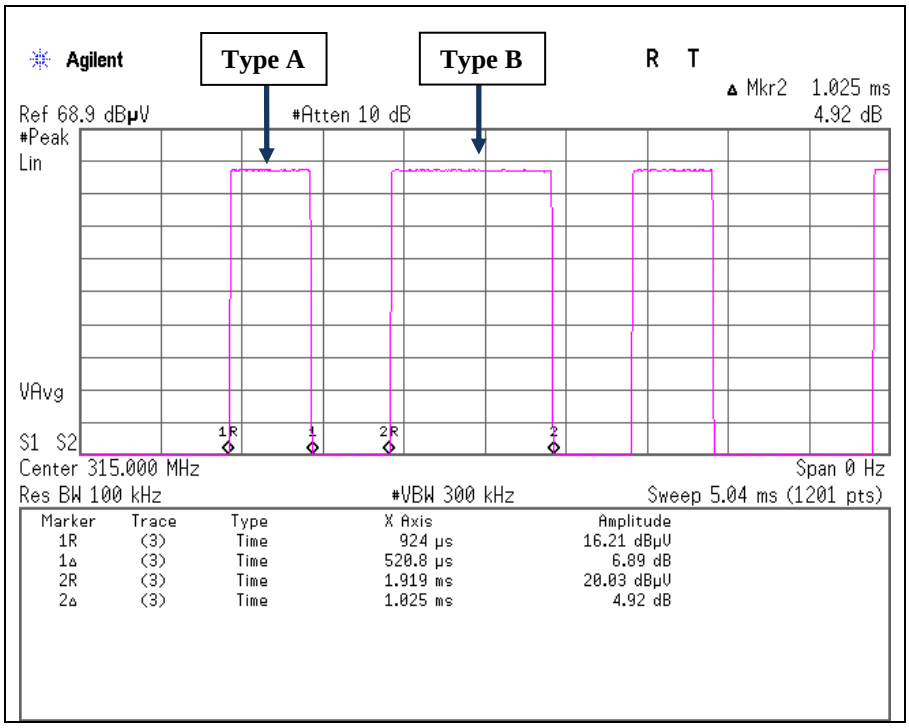
*1)ON time(in 100ms) = Times (in 100ms) * ON time(One pulse)
*2)The train of pulses was exceeding 100msec, and that sampled 100msec was the worst case against the pulse trai

(Total)

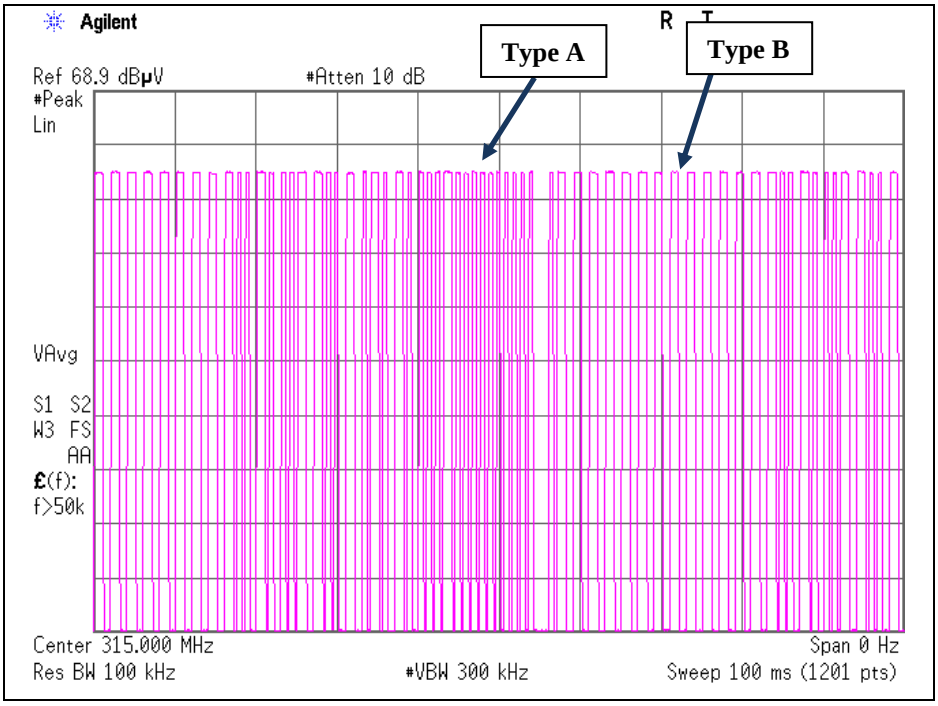
ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
50.995	100.00	0.5099	-5.85

*3)ON time = Type A's ON time (in 100ms) + Type B's ON time (in 100ms)
*4)Duty = 20log10(ON time/Cycle)

*This is a reasonable actual measurement also from specification. Refer to “Theory of Operation”.



Duty Cycle


Agilent
R T
Type A
Type B
Ref 68.9 dBµV
#Atten 10 dB
#Peak
Lin
VAvg
S1 S2
W3 FS
AA
£(f):
f>50k
Center 315.000 MHz
Span 0 Hz
Res BW 100 kHz
#VBW 300 kHz
Sweep 100 ms (1201 pts)

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	2016/08/02 * 12
MOS-22	Thermo-Hygrometer	Custom	CTH-201	0003	RE	2016/01/21 * 12
MJM-14	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MSA-14	Spectrum Analyzer	Agilent	E4440A	MY48250080	RE	2015/10/07 * 12
MTR-03	Test Receiver	Rohde & Schwarz	ESCI	100300	RE	2015/10/11 * 12
KBA-05	Biconical Antenna	Schwarzbeck	BBA9106	2513	RE	2015/11/02 * 12
MLA-21	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-190	RE	2016/01/30 * 12
MCC-12	Coaxial Cable	Fujikura/Agilent	-	-	RE	2016/02/08 * 12
MAT-07	Attenuator(6dB)	Weinschel Corp	2	BK7970	RE	2015/11/10 * 12
MPA-09	Pre Amplifier	Agilent	8447D	2944A10845	RE	2016/09/13 * 12
MMM-01	Digital Tester	Fluke	FLUKE 26-3	78030611	RE	2016/08/23 * 12
MHA-06	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	RE	2016/02/29 * 12
MCC-216	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 1608S087(5 m)	RE	2016/08/29 * 12
MPA-10	Pre Amplifier	Agilent	8449B	3008A02142	RE	2016/01/19 * 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, Automatically deactivate and Duty cycle tests