



RADIO TEST REPORT

Test Report No. : 12496758H-A-R1

Applicant : **DENSO CORPORATION**
Type of Equipment : **Remote Keyless Entry System (Transmitter)**
Model No. : **12BFZ**
FCC ID : **HYQ12BFZ**
Test regulation : **FCC Part 15 Subpart C: 2018**
Test Result : **Complied**

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2. The results in this report apply only to the sample tested.
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)
7. The all test items in this test report are conducted by UL Japan, Inc. Ise EMC Lab.
8. This report is a revised version of 12496758H-A. 12496758H-A is replaced with this report.

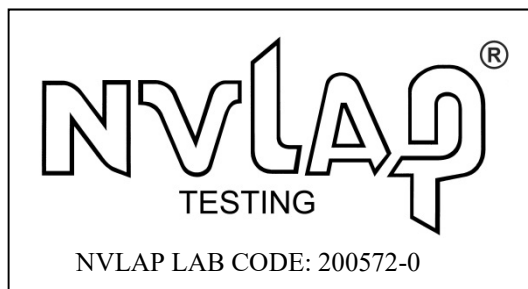
Date of test: September 20, 2018

Representative test engineer:

A. Maeda
Akihiko Maeda
Engineer
Consumer Technology Division

Approved by:

M. Imura
Motoya Imura
Leader
Consumer Technology Division



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SECTION 1: Customer information

Company Name	:	DENSO CORPORATION
Address	:	1-1, Showa-cho, Kariya-shi, Aichi-ken, 448-8661, Japan
Telephone Number	:	+81-566-20-3953
Facsimile Number	:	+81-566-25-4837
Contact Person	:	MASASHI URABE

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

2.1 Identification of E.U.T.

Type of Equipment	:	Remote Keyless Entry System (Transmitter)
Model No.	:	12BFZ
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC 3.0 V
Receipt Date of Sample	:	September 12, 2018
Country of Mass-production	:	Japan
Condition of EUT	:	Production 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: 12BFZ (referred to as the EUT in this report) is a Remote Keyless Entry System (Transmitter).

Radio Specification

Radio Type	:	Transmitter
Frequency of Operation	:	433.92 MHz
Clock frequency(ies) in the system	:	33.6 MHz Crystal
Modulation	:	ASK (A1D)
Type of Battery	:	One lithium battery
Antenna type	:	Built-in type (Fixed)

SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C
FCC Part 15 final revised on March 12, 2018 and effective April 11, 2018

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.231 Periodic operation in the band 40.66-40.70 MHz and above 70 MHz.

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 *1)	N/A	-
	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)	5.3 dB 433.920 MHz Horizontal	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)	11.6 dB 4339.200 MHz Horizontal	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.					
Symbols:					
Complied		The data of this test item has enough margin, more than the measurement uncertainty.			
Complied#		The data of this test item meets the limits unless the measurement uncertainty is taken into consideration.			

FCC 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.

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3.3 Addition to standard

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

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

Test distance	Radiated emission (+/-)
	9 kHz to 30 MHz
3 m	3.8 dB
10 m	3.6 dB

*Measurement distance

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	4.8 dB	5.2 dB	4.8 dB	5.0 dB
Vertical	5.0 dB	6.3 dB	4.9 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	5.9 dB	5.9 dB	5.5 dB

* Measurement distance

3.5 Test Location

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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 2.0 m 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

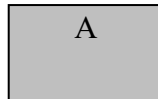
Refer to APPENDIX.

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

4.1 Operating Mode(s)

Test Item*	Mode
Automatically Deactivate	Normal use mode
Electric Field Strength of Fundamental Emission Electric Field Strength of Spurious Emission -20 dB & 99 % Occupied Bandwidth Duty Cycle	Transmitting mode (Tx) *1)
* 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.	

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	Remote Keyless Entry System (Transmitter)	12BFZ	No.1 *1) No.2 *2)	DENSO CORPORATION	EUT

*1) Used for Transmitting mode.

*2) Used for Normal use mode.

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

Test Procedure and conditions

[For below 30 MHz]

The noise level was checked by moving a search-coil (Loop Antenna) close to the EUT.

[For 30 MHz to 1 GHz]

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 1 GHz]

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

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

The 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.

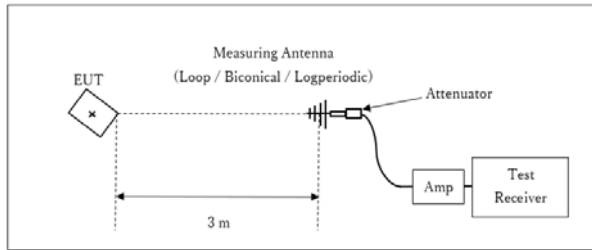
Test Antennas are used as below;

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

Figure 1: Test Setup

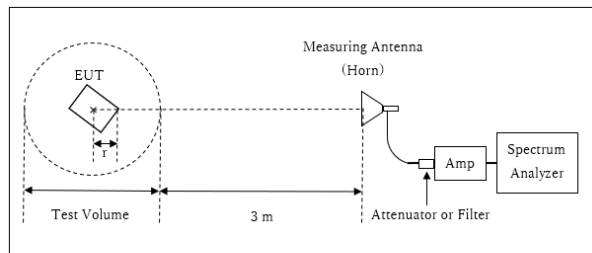
Below 1 GHz



x : Center of turn table

Test Distance: 3 m

1 GHz - 10 GHz



r : Radius of an outer periphery of EUT

x : Center of turn table

Distance Factor: $20 \times \log (3.75 \text{ m} / 3.0 \text{ m}) = 1.94 \text{ dB}$

* Test Distance: $(3 + \text{Test Volume} / 2) - r = 3.75 \text{ m}$

Test Volume : 1.5 m

(Test Volume has been calibrated based on CISPR 16-1-4.)

$r = 0.0 \text{ m}$

* The test was performed with $r = 0.0 \text{ m}$ since EUT is small and it was the rather conservative condition.

- 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 - 4.4 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	300 kHz	3 kHz	9.1 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.							

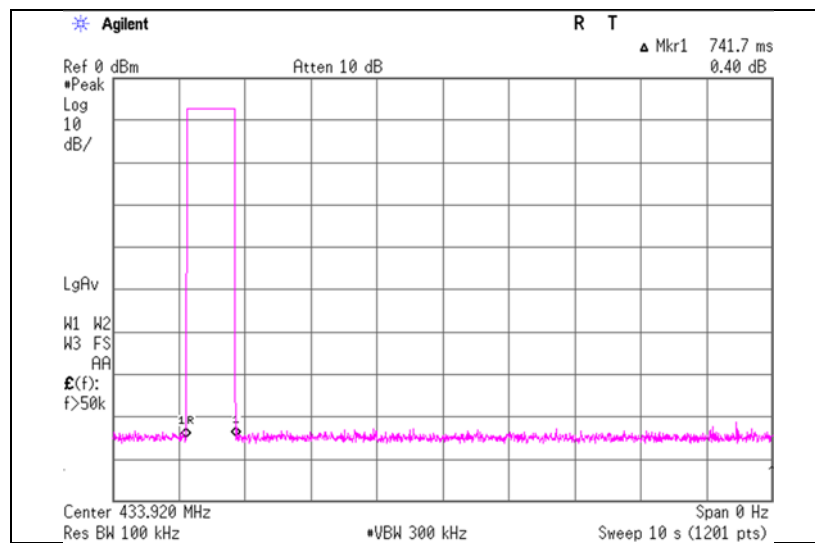
Test data : APPENDIX
Test result : Pass

APPENDIX 1: Test data

Automatically deactivate

Report No.	12496758H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	September 20, 2018
Temperature / Humidity	23 deg. C / 63 % RH
Engineer	Akihiko Maeda
Mode	Normal use mode

Tx Freq [MHz]	Time of Transmitting [sec]	Limit [sec]	Result
433.92	0.7417	5.00	Pass



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

Report No. 12496758H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date September 20, 2018
Temperature / Humidity 23 deg. C / 63 % RH
Engineer Akihiko Maeda
Mode Transmitting mode, 433.92 MHz

QP or PK

Frequency [MHz]	Detector	Reading [dBuV]		Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]		Limit dBuV/m	Margin [dB]		Remark Inside or Outside of Restricted Bands
		Hor	Ver					Hor	Ver		Hor	Ver	
433.920	PK	84.9	84.3	16.1	9.5	29.8	-	80.7	80.1	100.8	20.1	20.7	Carrier
867.840	PK	35.3	34.3	21.8	11.2	28.2	-	40.1	39.1	80.8	40.7	41.7	Outside
1301.760	PK	46.6	46.4	25.8	5.5	35.3	-	42.6	42.4	73.9	31.3	31.5	Inside
1735.680	PK	45.5	46.3	24.9	5.1	34.8	-	40.7	41.5	80.8	40.1	39.3	Outside
2169.600	PK	44.3	45.1	27.9	5.2	34.5	-	42.9	43.7	80.8	37.9	37.1	Outside
2603.520	PK	44.5	44.2	27.4	5.3	34.4	-	42.8	42.5	80.8	38.0	38.3	Outside
3037.440	PK	44.6	45.1	28.5	5.4	34.3	-	44.2	44.7	80.8	36.6	36.1	Outside
3471.360	PK	44.7	45.3	29.2	5.6	33.9	-	45.6	46.2	80.8	35.2	34.6	Outside
3905.280	PK	44.1	44.4	29.8	5.7	33.6	-	46.0	46.3	73.9	27.9	27.6	Inside
4339.200	PK	44.5	44.1	30.6	6.0	33.6	-	47.5	47.1	73.9	26.4	26.8	Inside

PK with Duty factor

Frequency [MHz]	Detector	Reading [dBuV]		Ant Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]		Limit dBuV/m	Margin [dB]		Remark
		Hor	Ver					Hor	Ver		Hor	Ver	
433.920	PK	84.9	84.3	16.1	9.5	29.8	-5.2	75.5	74.9	80.8	5.3	5.9	Carrier
867.840	PK	35.3	34.3	21.8	11.2	28.2	-5.2	34.9	33.9	60.8	25.9	26.9	Outside
1301.760	PK	46.6	46.4	25.8	5.5	35.3	-5.2	37.4	37.2	53.9	16.5	16.7	Inside
1735.680	PK	45.5	46.3	24.9	5.1	34.8	-5.2	35.5	36.3	60.8	25.3	24.5	Outside
2169.600	PK	44.3	45.1	27.9	5.2	34.5	-5.2	37.7	38.5	60.8	23.1	22.3	Outside
2603.520	PK	44.5	44.2	27.4	5.3	34.4	-5.2	37.6	37.3	60.8	23.2	23.5	Outside
3037.440	PK	44.6	45.1	28.5	5.4	34.3	-5.2	39.0	39.5	60.8	21.8	21.3	Outside
3471.360	PK	44.7	45.3	29.2	5.6	33.9	-5.2	40.4	41.0	60.8	20.4	19.8	Outside
3905.280	PK	44.1	44.4	29.8	5.7	33.6	-5.2	40.8	41.1	53.9	13.1	12.8	Inside
4339.200	PK	44.5	44.1	30.6	6.0	33.6	-5.2	42.3	41.9	53.9	11.6	12.0	Inside

Sample calculation:

Result of PK = Reading + Ant Factor + Loss {Cable + Attenuator + Filter (above 1GHz) +Distance factor (above 1 GHz)} - Gain (Amplifier)

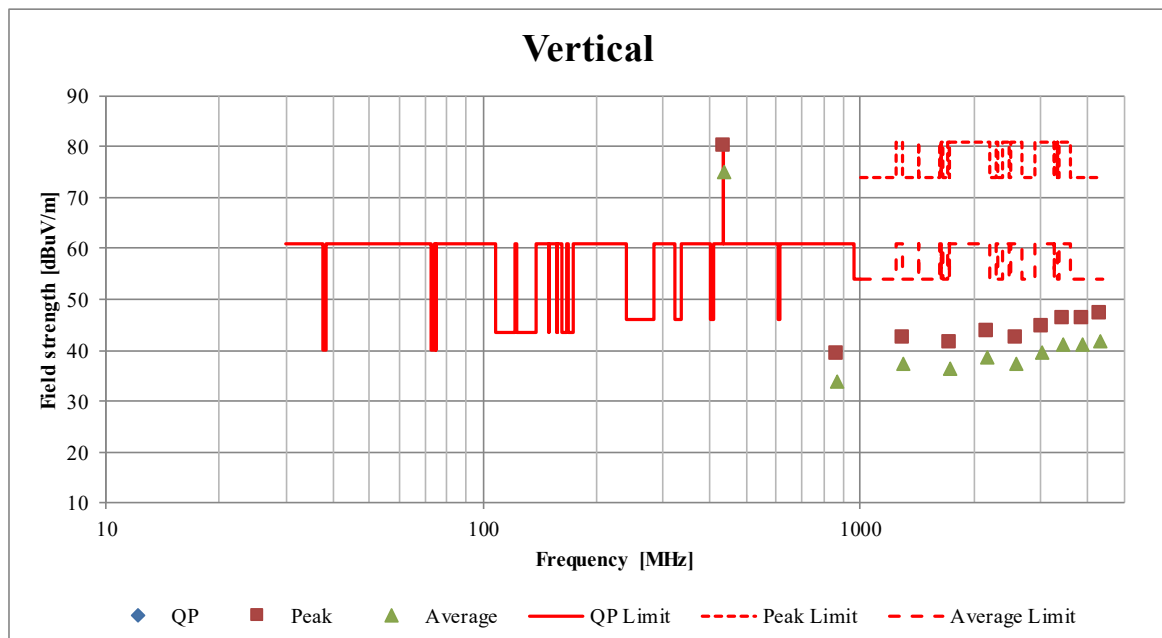
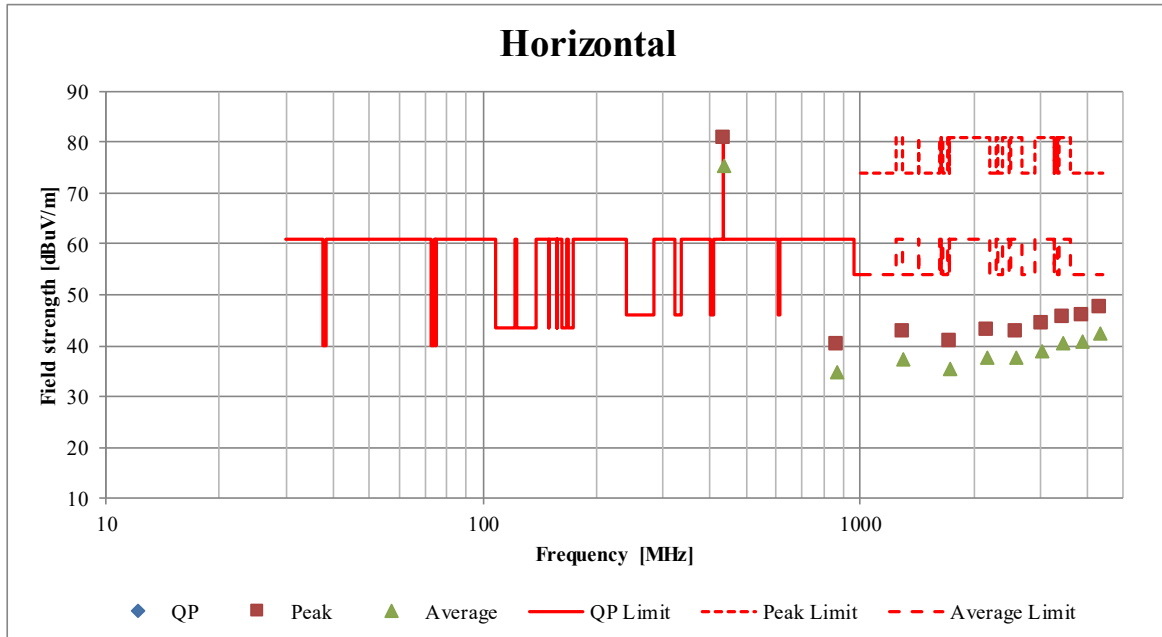
Result of PK with Duty factor = Reading + Ant Factor + Loss {Cable + Attenuator + Filter (above 1 GHz) +Distance factor (above 1 GHz)} - Gain (Amplifier) + Duty factor (Refer to Duty factor data sheet)

For above 1GHz : Distance Factor: $20 \times \log(3.75 \text{ m}/3.0 \text{ m}) = 1.94 \text{ dB}$

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

Radiated Spurious Emission
(Plot data, Worst case)

Report No. 12496758H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date September 20, 2018
Temperature / Humidity 23 deg. C / 63 % RH
Engineer Akihiko Maeda
Mode Transmitting mode, 433.92 MHz



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

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-20dB and 99% Occupied Bandwidth

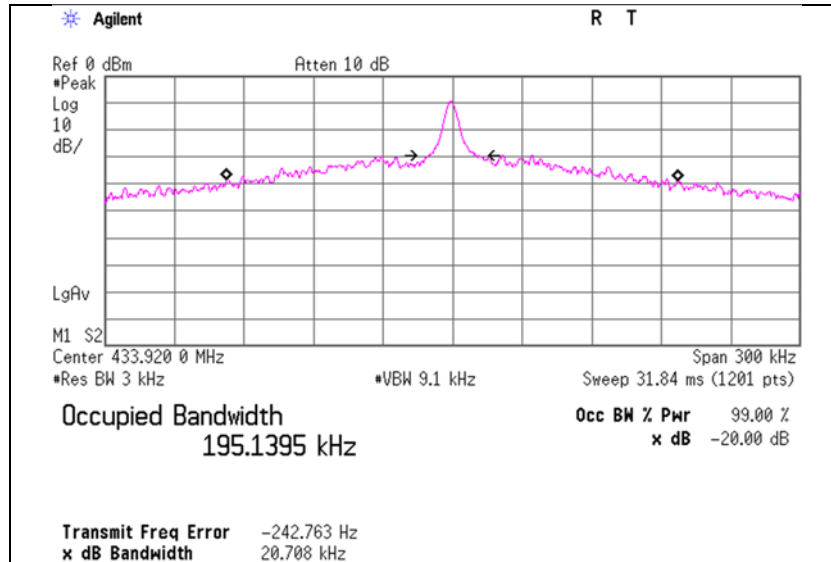
Report No.	12496758H
Test place	Ise EMC Lab.
Semi Anechoic Chamber	No.2
Date	September 20, 2018
Temperature / Humidity	23 deg. C / 63 % RH
Engineer	Akihiko Maeda
Mode	Transmitting mode, 433.92 MHz

Bandwidth Limit : Fundamental Frequency **433.92** MHz x 0.25% = 1084.80 kHz

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

-20dB Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
20.708	1084.80	Pass

99% Occupied Bandwidth [kHz]	Bandwidth Limit [kHz]	Result
195.1395	1084.80	Pass



Duty Cycle

Report No. 12496758H
Test place Ise EMC Lab.
Semi Anechoic Chamber No.2
Date September 20, 2018
Temperature / Humidity 23 deg. C / 63 % RH
Engineer Akihiko Maeda
Mode Transmitting mode, 433.92 MHz

Pulse type	ON time(One pulse) [ms]	Pulse count (Sweep time : 10mS)					Pulse count sum (in 50ms)	ON time(in 50ms) [ms]
		1	2	3	4	5		
A	0.713	4	3	1	4	5	17	12.121
B	0.364	7	9	13	7	6	42	15.288
Total on time in 50mS							27.409	

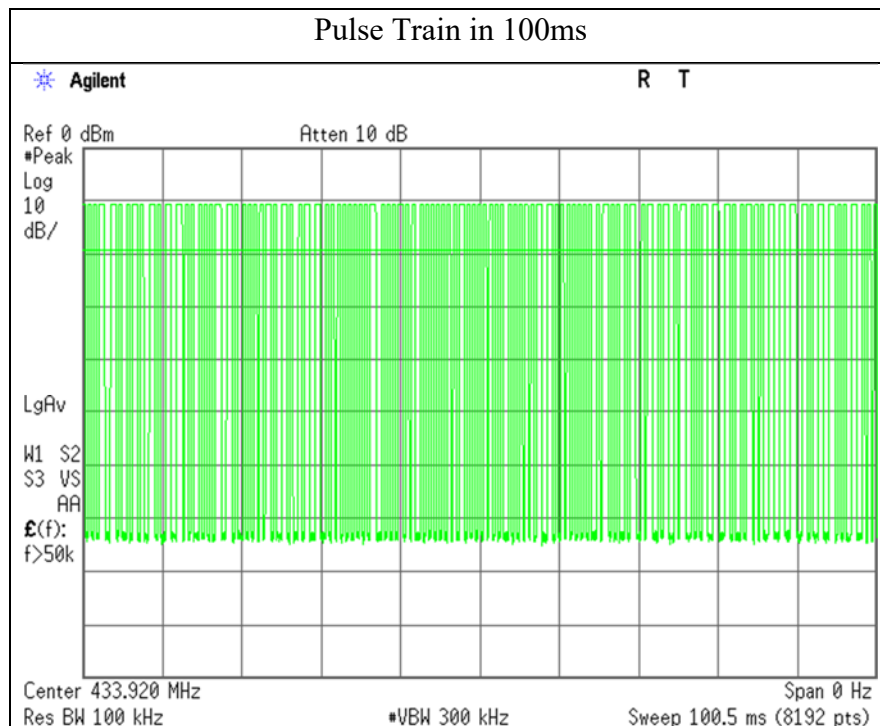
The train of pulses was exceeding 100msec, and that sampled 100msec was the worst case against the pulse train.

(Total)

ON time in 100mS ^{*1)} [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
54.82	100.00	0.55	-5.22

*1)ON time in 100mS = Total on time in 50mS * 2

*2)Duty = 20log₁₀(ON time/Cycle)



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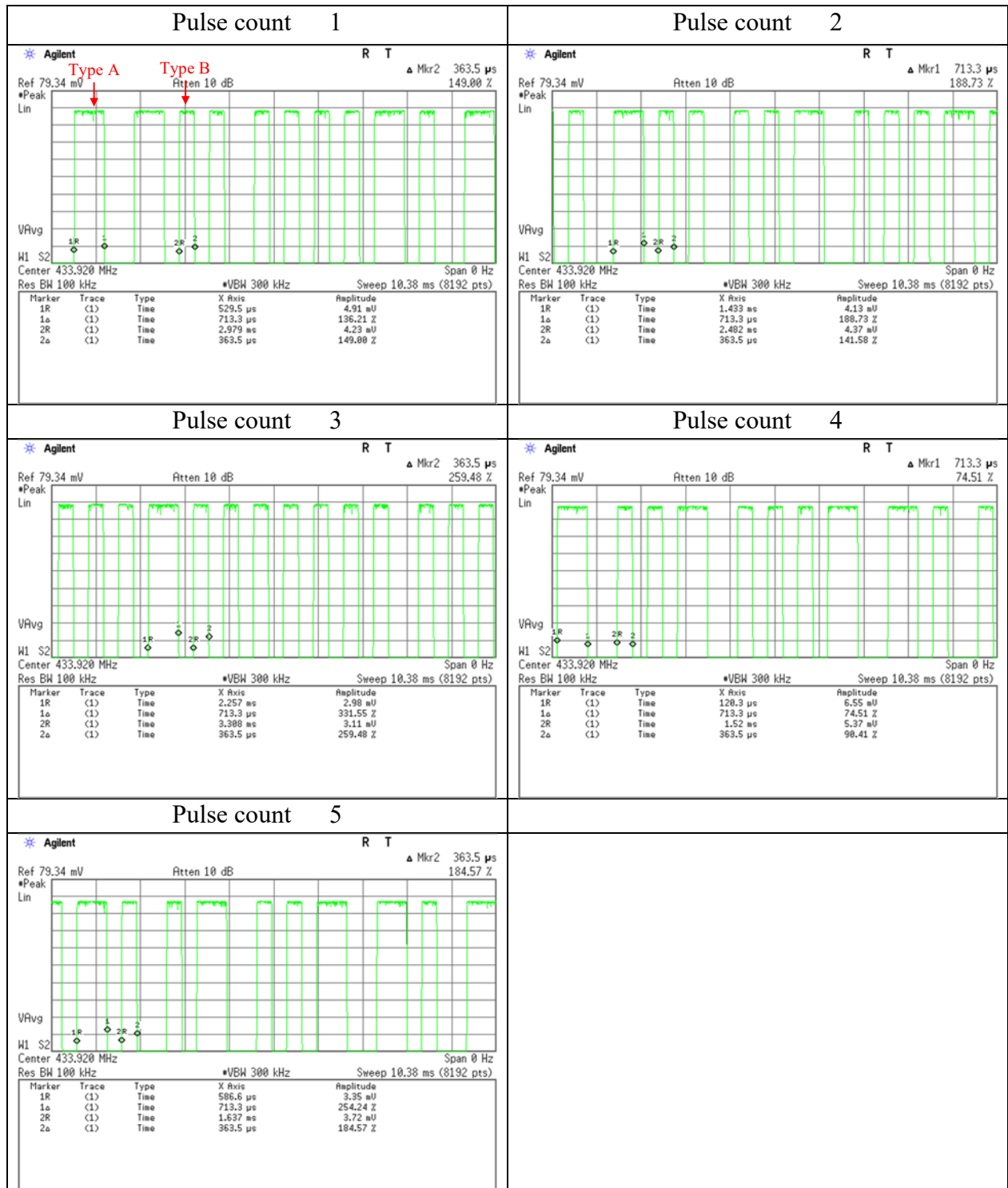
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Duty Cycle



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APPENDIX 2: Test instruments

Test Instruments

Test item	LIMS ID	Description	Manufacturer	Model	Serial	Last Calibration Date	Calibration Due Date	Cal Int
RE	142006	AC2_Semi Anechoic Chamber(SVSWR)	TDK	Semi Anechoic Chamber 3m	DA-06902	4/2/2018	4/30/2019	12
RE	141152	EMI measurement program	TSJ	TEPTO-DV	-	-	-	-
RE	141556	Thermo-Hygrometer	CUSTOM	CTH-201	0003	12/21/2017	12/31/2018	12
RE	141542	Digital Tester	Fluke Corporation	FLUKE 26-3	78030611	8/21/2018	8/31/2019	12
RE	142228	Measure	KOMELON	KMC-36	-	-	-	-
RE	141942	Test Receiver	Rohde & Schwarz	ESCI	100300	8/8/2018	8/31/2019	12
RE	141427	Biconical Antenna	Schwarzbeck	VHA9103B	8031	5/31/2018	5/31/2019	12
RE	141265	Logperiodic Antenna (200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-190	5/31/2018	5/31/2019	12
RE	141317	Coaxial Cable	Fujikura/Agilent	-	-	2/23/2018	2/28/2019	12
RE	141578	Pre Amplifier	AGILENT	8447D	2944A10845	9/19/2018	9/30/2019	12
RE	141512	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	254	6/6/2018	6/30/2019	12
RE	141392	Microwave Cable	Junkosha	MWX221	1604S253(1 m) / 1608S087(5 m)	8/8/2018	8/31/2019	12
RE	141297	High Pass Filter(1.1-10GHz)	TOKYO KEIKI	TF219CD1	1001	1/18/2018	1/31/2019	12
RE	141579	Pre Amplifier	AGILENT	8449B	3008A02142	1/23/2018	1/31/2019	12
RE	141203	Attenuator(6dB)	Weinschel Corp	2	BK7970	11/14/2017	11/30/2018	12
RE	142004	AC2_Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-06902	6/29/2018	6/30/2020	24
RE	142645	Loop Antenna	UL Japan	-	-	-	-	-

***Hyphens for Last Calibration Date, Calibration Due Date and Cal Int (month) are instruments that Calibration is not required (e.g. software), or instruments checked in advance before use.**

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

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