



Test report No. : 11261639H-A-R1
Page : 1 of 24
Issued date : August 1, 2016
FCC ID : HYQU22A0

RADIO TEST REPORT

Test Report No. : 11261639H-A-R1

Applicant : DENSO CORPORATION
Type of Equipment : Passive Entry Passive Start System (LF Transmitter)
Model No. : U22A0
FCC ID : HYQU22A0
Test regulation : FCC Part 15 Subpart C: 2016
Test Result : Complied

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2. The results in this report apply only to the sample tested.
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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. This report is a revised version of 11261639H-A. 11261639H-A is replaced with this report.

Date of test: May 3 to 25, 2016

Representative test engineer:

Shinya Watanabe
Engineer
Consumer Technology Division

Approved by:

Motoya Imura
Engineer
Consumer Technology Division



NVLAP LAB CODE: 200572-0

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13-EM-F0429

REVISION HISTORY

Original Test Report No.: 11261639H-A

[illegible]

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CONTENTS	PAGE
SECTION 1: Customer information	4
SECTION 2: Equipment under test (E.U.T.).....	4
SECTION 3: Test specification, procedures & results	6
SECTION 4: Operation of E.U.T. during testing.....	9
SECTION 5: Radiated emission (Fundamental and Spurious Emission).....	10
SECTION 6: -26dB Bandwidth.....	12
SECTION 7: 99% Occupied Bandwidth.....	12
APPENDIX 1: Test data	13
Radiated Emission below 30MHz (Fundamental and Spurious Emission).....	13
Radiated Emission above 30MHz (Spurious Emission).....	15
Duty Cycle.....	17
-26dB Bandwidth and 99% Occupied Bandwidth	19
APPENDIX 2: Test instruments	21
APPENDIX 3: Photographs of test setup	22
Radiated Emission.....	22
Worst Case Position	23

SECTION 1: Customer information

Company Name : DENSO CORPORATION
Address : 1-1 Showa-cho, Kariya-shi, Aichi-ken, 448-8661 Japan
Telephone Number : +81-566-61-5234
Facsimile Number : +81-566-25-4837
Contact Person : Akihiro Taguchi

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

2.1 Identification of E.U.T.

Type of Equipment : Passive Entry Passive Start System (LF Transmitter)
Model No. : U22A0
Serial No. : Refer to Section 4, Clause 4.2
Receipt Date of Sample : April 20, 2016
Country of Mass-production : United states of America and China
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 No: U22A0 (referred to as the EUT in this report) is the Passive Entry Passive Start System (LF Transmitter).

General Specification

Clock frequency(ies) in the system : MPU: 4MHz

Radio Specification

[Transmitter part]

Radio Type : LF Transmitter
Frequency of Operation : 125kHz
Oscillation circuit : Ceramic resonator
Oscillator frequency : 8MHz
Modulation : OOK
Power Supply (inner) : DC 12.0 V
Antenna type : Ant1: External Antenna
Ant2: External Antenna
Ant3: External Antenna
Ant4: External Antenna
Ant5: External Antenna
Ant6: External Antenna
*The EUT does not transmit simultaneously from mutiple antennas.
Antenna specification : Ferrite antenna coil
Transmitting out put current : 50mA - 1000mA [End user cannot control output current since it is fixed depending on each system]

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[Receiver part]*

Frequency of Operation	:	433.92MHz
Oscillator frequency	:	21.948717MHz
Type of receiving system	:	Super-heterodyne
Power Supply (inner)	:	DC 5.0V
Antenna type	:	Internal antenna (loop antenna)
Receiver Bandwidth	:	156kHz

*The test was not performed the receiver part because the EUT has the same specification as Model No. U22B0.
The result of receiver part is included in Test Report No. 10291830H-J.

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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 15.207 Conducted Emission
Section 15.209 Radiated emission limits, general requirements

* Also the EUT complies with FCC Part 15 Subpart B.

3.2 Procedures and results

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	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 *1)	N/A	N/A
2	Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <IC> RSS-Gen 6.4, 6.12	<FCC> Section 15.209 <IC> RSS-210 2.5.1 RSS-Gen 8.9	Radiated	N/A	0.5 dB 0.12500 MHz 0 deg. PK with Duty factor (Air Antenna)	Complied
3	Electric Field Strength of Spurious Emission	<FCC> ANSI C63.10:2013 6 Standard test methods <IC> RSS-Gen 6.4, 6.13	<FCC> Section 15.209 <IC> RSS-210 2.5.1 RSS-Gen 8.9	Radiated	N/A	10.3 dB 143.773 MHz, Vertical, QP (Metal Antenna)	Complied
4	-26dB Bandwidth	<FCC> ANSI C63.10:2013 6 Standard test methods <IC> -	<FCC> Reference data <IC> -	Radiated	N/A	N/A	N/A

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 is not the device that is designed to be connected to the public utility (AC) power line.

FCC 15.31 (e)

The test was performed with the New Battery (DC 12.0 V) and the EUT constantly provides the stable voltage to RF part through the regulator regardless of input voltage from New Battery. 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 vehicle. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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3.3 Addition to standard

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99% Occupied Band Width	RSS-Gen 6.6	-	Radiated	N/A	N/A	N/A

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 1GHz)			
	(3 m*)(+dB)		(10 m*)(+dB)	
	30 – 200 MHz	200 – 1000MHz	30 – 200 MHz	200 – 1000MHz
Horizontal	4.9 dB	5.2 dB	4.9 dB	5.0 dB
Vertical	4.6 dB	5.9 dB	5.0 dB	5.0 dB

Radiated emission				
(3 m*)(+dB)		(1 m*)(+dB)	(0.5 m*)(+dB)	(10 m*)(+dB)
1 – 6GHz	6 – 18GHz	10 – 26.5 GHz	26.5 – 40GHz	1 -18 GHz
5.1 dB	5.3 dB	5.1 dB	5.1 dB	5.3 dB

* Measurement distance

Radiated emission test(3 m)

[Electric Field Strength of Fundamental Emission]

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

[Electric Field Strength of Spurious Emission]

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

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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.

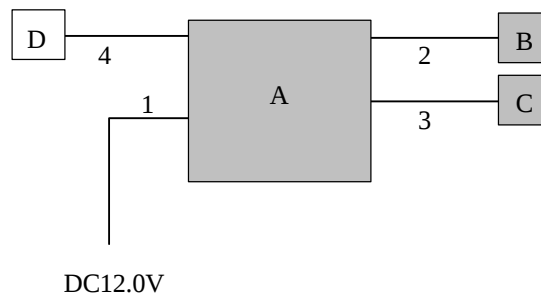
SECTION 4: Operation of E.U.T. during testing

4.1 Operating Modes

Mode	Remarks
(1)Transmitting mode (Tx) Ant6 Output current 1000mA	Metal
(2)Transmitting mode (Tx) Ant4 Output current 1000mA	Air

*For reference, fundamental level was measured with output current 50mA.

4.2 Configuration and peripherals



- * The types of antenna ports are all identical.
- * Three types of antennas are connected to this system.
- * Since the continuous transmission for tests could be created with one port only, three antennas evaluation was performed by replacing three antennas to the port (antenna port 1).
- * This transmitting timing is worse than that of normal use mode which six antennas are used.
- * Cabling and setup 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	Passive Entry Passive Start System (LF Transmitter)	U22A0	00500357	DENSO CORPORATION	EUT
B	Ant6	Metal	120907UA	DENSO CORPORATION	EUT
C	Ant4	Air	130309UA	DENSO CORPORATION	EUT
D	Switch Box	-	-	DENSO CORPORATION	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	DC Cable	3.0	Unshielded	Unshielded	-
2	Antenna Cable	3.0	Unshielded	Unshielded	-
3	Antenna Cable	3.0	Unshielded	Unshielded	-
4	Signal Cable	3.0	Unshielded	Unshielded	-

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SECTION 5: Radiated emission (Fundamental and Spurious Emission)

Test Procedure

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.

Frequency : From 9 kHz to 30 MHz

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for vertical polarization (antenna angle: 0 deg., 45 deg., 90 deg., and 135 deg.) and horizontal polarization.

*Refer to Figure 1 about Direction of the Loop Antenna.

Frequency: From 30 MHz to 1 GHz

The measuring antenna height varied between 1 and 4 m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for both vertical and horizontal antenna polarization.

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

Frequency	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	
Instrument used	Test Receiver					Spectrum Analyzer	
Detector	PK / AV	QP	PK / AV	QP	QP	PK	AV
IF Bandwidth	200 Hz	200 Hz	9 kHz	9 kHz	120 kHz	RBW: 1 MHz VBW: 3 MHz	RBW: 1 MHz VBW: 10 Hz
Test Distance	3 m *1)	3 m *1)	3 m *1)	3 m *2)	3 m	3 m	3 m

*1) Distance Factor: $40 \times \log(3 \text{ m} / 300 \text{ m}) = -80 \text{ dB}$

*2) Distance Factor: $40 \times \log(3 \text{ m} / 30 \text{ m}) = -40 \text{ dB}$

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 m open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.

These tests were performed in semi anechoic chamber. Therefore the measured level of emissions may be higher than if measurements were made without a ground plane.

However test results were confirmed to pass against standard limit.

- 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 : 9 kHz - 1 GHz

Test data : APPENDIX 1

Test result : Pass

Date: May 3 and 4, 2016

Test engineer: Shinya Watanabe

UL Japan, Inc.

Ise EMC Lab.

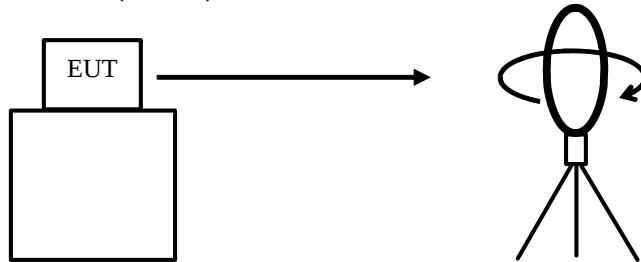
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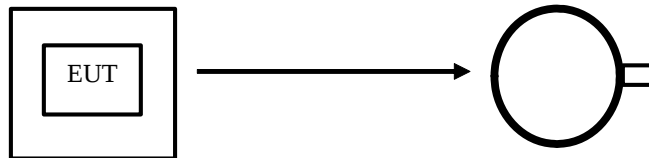
Figure 1: Direction of the Loop Antenna

Side View (Vertical)



.....

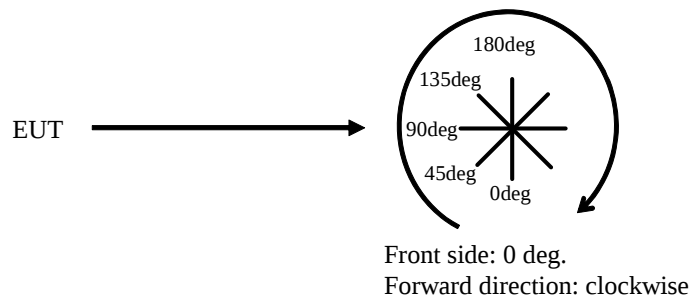
Top View (Horizontal)



Antenna was not rotated.

.....

Top View (Vertical)



SECTION 6: -26dB Bandwidth

Test Procedure

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

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
-26 dB Bandwidth	100 kHz	1 kHz	3 kHz	Auto	Peak	Max Hold	Spectrum Analyzer

Test data : APPENDIX 1

Test result : Pass

SECTION 7: 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
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 1

Test result : Pass

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APPENDIX 1: Test data

Radiated Emission below 30MHz (Fundamental and Spurious Emission)

Metal Antenna

Test place : Ise EMC Lab. No.1 Semi Anechoic Chamber
Order No. : 11261639H
Date : 05/03/2016
Temperature/ Humidity : 22 deg. C / 59% RH
Engineer : Shinya Watanabe
Mode : Tx 125kHz

PK or QP

Ant Deg [deg] or Polarity [Hori/Vert]	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
0	0.12500	PK	79.4	19.6	-74.0	0.0	-	25.0	45.6	20.6	Fundamental
45	0.12500	PK	77.1	19.6	-74.0	0.0	-	22.7	45.6	22.9	
90	0.12500	PK	75.1	19.6	-74.0	0.0	-	20.7	45.6	24.9	
135	0.12500	PK	78.1	19.6	-74.0	0.0	-	23.7	45.6	21.9	
180	0.12500	PK	79.3	19.6	-74.0	0.0	-	24.9	45.6	20.7	
180	0.12500	PK	71.4	19.6	-74.0	0.0	-	17.0	45.6	28.6	Ant Hor.
0	0.12500	PK	58.1	19.6	-74.0	0.0	-	3.7	45.6	41.9	50mA
0	0.25000	PK	25.1	19.6	-73.9	0.0	-	-29.2	39.6	68.8	
0	0.37500	PK	26.0	19.6	-73.9	0.0	-	-28.3	36.1	64.4	
0	0.50000	QP	10.1	19.5	-33.9	0.0	-	-4.3	33.6	37.9	
0	0.62500	QP	9.2	19.5	-33.9	0.0	-	-5.2	31.7	36.9	
0	0.75000	QP	8.1	19.5	-33.8	0.0	-	-6.2	30.1	36.3	
0	0.87500	QP	7.5	19.5	-33.8	0.0	-	-6.8	28.7	35.5	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier)

PK with Duty factor

Ant Deg [deg]	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
0	0.125	PK	79.4	19.6	-74.0	0.0	-3.8	21.2	25.6	4.4	Fundamental
45	0.125	PK	77.1	19.6	-74.0	0.0	-3.8	18.9	25.6	6.7	
90	0.125	PK	75.1	19.6	-74.0	0.0	-3.8	16.9	25.6	8.7	
135	0.125	PK	78.1	19.6	-74.0	0.0	-3.8	19.9	25.6	5.7	
180	0.125	PK	79.3	19.6	-74.0	0.0	-3.8	21.1	25.6	4.5	
180	0.125	PK	71.4	19.6	-74.0	0.0	-3.8	13.2	25.6	12.4	Ant Hor.
0	0.125	PK	58.1	19.6	-74.0	0.0	-3.8	-0.1	25.6	25.7	50mA
0	0.250	PK	25.1	19.6	-73.9	0.0	-3.8	-33.0	19.6	52.6	
0	0.375	PK	26.0	19.6	-73.9	0.0	-3.8	-32.1	16.1	48.2	

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

*The test result is rounded off to one or two decimal places, so some differences might be observed.

PK or QP (Result of the fundamental emission at 3m without Distance factor)

Ant Deg [deg]	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
0	0.125	PK	79.4	19.6	6.0	0.0	-	105.0	-	-	Fundamental

* All spurious emissions lower than this result.

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Radiated Emission below 30MHz (Fundamental and Spurious Emission)

Air Antenna

Test place : Ise EMC Lab. No.1 Semi Anechoic Chamber
Order No. : 11261639H
Date : 05/03/2016
Temperature/ Humidity : 22 deg. C / 59% RH
Engineer : Shinya Watanabe
Mode : Tx 125kHz

PK or QP

Ant Deg [deg] or Polarity [Hori/Vert]	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
0	0.12500	PK	83.1	19.6	-74.0	0.0	-	28.7	45.6	16.9	Fundamental
45	0.12500	PK	81.3	19.6	-74.0	0.0	-	26.9	45.6	18.7	
90	0.12500	PK	77.9	19.6	-74.0	0.0	-	23.5	45.6	22.1	
135	0.12500	PK	81.3	19.6	-74.0	0.0	-	26.9	45.6	18.7	
180	0.12500	PK	83.0	19.6	-74.0	0.0	-	28.6	45.6	17.0	
180	0.12500	PK	77.3	19.6	-74.0	0.0	-	22.9	45.6	22.7	Ant Hor.
0	0.12500	PK	58.7	19.6	-74.0	0.0	-	4.3	45.6	41.3	50mA
0	0.25000	PK	26.5	19.6	-73.9	0.0	-	-27.8	39.6	67.4	
0	0.37500	PK	19.7	19.6	-73.9	0.0	-	-34.6	36.1	70.7	
0	0.50000	QP	10.6	19.5	-33.9	0.0	-	-3.8	33.6	37.4	
0	0.62500	QP	9.3	19.5	-33.9	0.0	-	-5.1	31.7	36.8	
0	0.75000	QP	8.2	19.5	-33.8	0.0	-	-6.1	30.1	36.2	
0	0.87500	QP	7.4	19.5	-33.8	0.0	-	-6.9	28.7	35.6	

Result = Reading + Ant Factor + Loss (Cable + Attenuator + Filter + D.Factor) - Gain(Amplifier)

PK with Duty factor

Ant Deg [deg]	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
0	0.125	PK	83.1	19.6	-74.0	0.0	-3.6	25.1	25.6	0.5	Fundamental
45	0.125	PK	81.3	19.6	-74.0	0.0	-3.6	23.3	25.6	2.3	
90	0.125	PK	77.9	19.6	-74.0	0.0	-3.6	19.9	25.6	5.7	
135	0.125	PK	81.3	19.6	-74.0	0.0	-3.6	23.3	25.6	2.3	
180	0.125	PK	83.0	19.6	-74.0	0.0	-3.6	25.0	25.6	0.6	
180	0.125	PK	77.3	19.6	-74.0	0.0	-3.6	19.3	25.6	6.3	Ant Hor.
0	0.125	PK	58.7	19.6	-74.0	0.0	-3.6	0.7	25.6	24.9	50mA
0	0.250	PK	26.5	19.6	-73.9	0.0	-3.6	-31.4	19.6	51.0	
0	0.375	PK	19.7	19.6	-73.9	0.0	-3.6	-38.2	16.1	54.3	

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

*The test result is rounded off to one or two decimal places, so some differences might be observed.

PK or QP (Result of the fundamental emission at 3m without Distance factor)

Ant Deg [deg]	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
0	0.125	PK	83.1	19.6	6.0	0.0	-	108.7	-	-	Fundamental

* All spurious emissions lower than this result.

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Radiated Emission above 30MHz (Spurious Emission)
Metal Antenna

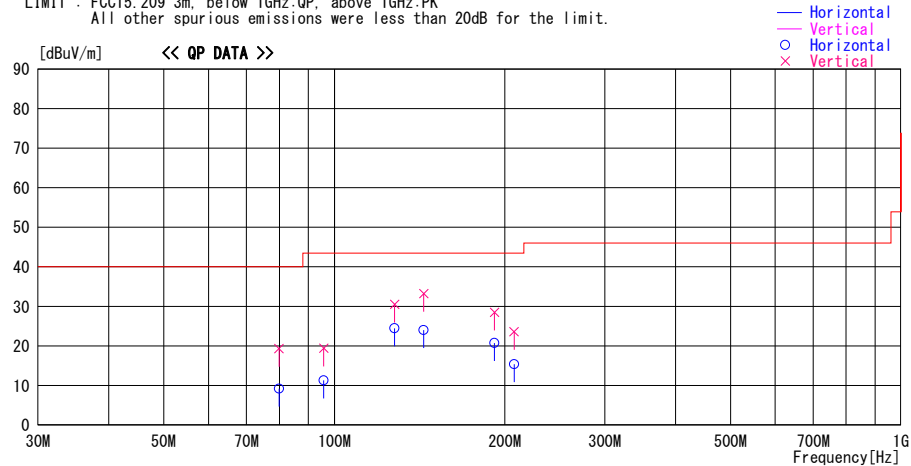
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No.1 Semi Anechoic Chamber
Date : 2016/05/04

Report No. : 11261639H
Temp./Humi. : 22deg. C / 44% RH
Engineer : Shinya Watanabe

Mode / Remarks : Tx 125kHz Metal Antenna X

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK
All other spurious emissions were less than 20dB for the limit.



Frequency	Reading	DET	Antenna	Loss&	Level	Angle	Height	Polar.	Limit	Margin	Comment
			Factor	Gain					[dBuV/m]	[dB]	
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]				
79.875	33.8	QP	6.6	-31.2	9.2	240	222	Hori.	40.0	30.8	
79.875	43.9	QP	6.6	-31.2	19.3	244	100	Vert.	40.0	20.7	
95.850	32.8	QP	9.3	-30.8	11.3	0	240	Hori.	43.5	32.2	
95.850	40.9	QP	9.3	-30.8	19.4	249	100	Vert.	43.5	24.1	
127.797	41.5	QP	13.4	-30.4	24.5	350	245	Hori.	43.5	19.0	
127.797	47.5	QP	13.4	-30.4	30.5	289	100	Vert.	43.5	13.0	
143.773	39.7	QP	14.5	-30.2	24.0	180	300	Hori.	43.5	19.5	
143.773	48.9	QP	14.5	-30.2	33.2	92	100	Vert.	43.5	10.3	
191.697	34.1	QP	16.2	-29.6	20.7	143	316	Hori.	43.5	22.8	
191.697	41.9	QP	16.2	-29.6	28.5	11	100	Vert.	43.5	15.0	
207.668	33.3	QP	11.5	-29.4	15.4	0	264	Hori.	43.5	28.1	
207.668	41.5	QP	11.5	-29.4	23.6	342	100	Vert.	43.5	19.9	

CHART:WITH FACTOR ANT TYPE:-30MHz:LOOP, 30-300MHz:BICONICAL, 300MHz-1000MHz:LOGPERIODIC, 1000MHz-:HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE+ATTEN. - GAIN (AMP))

Radiated Emission above 30MHz (Spurious Emission)

Air Antenna

DATA OF RADIATED EMISSION TEST

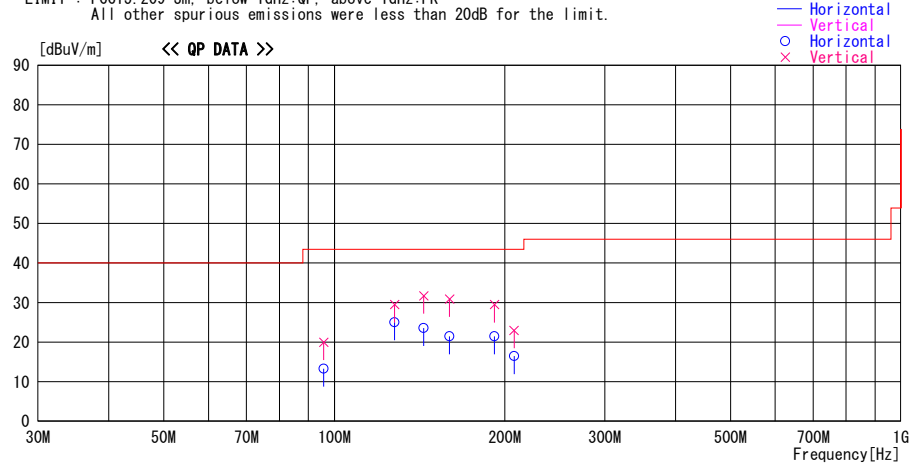
UL Japan, Inc. Ise EMC Lab. No.1 Semi Anechoic Chamber
Date : 2016/05/04

Report No. : 11261639H

Temp./Humi. : 22deg. C / 44% RH
Engineer : Shinya Watanabe

Mode / Remarks : Tx 125kHz Air Antenna

LIMIT : FCC15.209 3m, below 1GHz:QP, above 1GHz:PK
All other spurious emissions were less than 20dB for the limit.



Frequency	Reading	DET	Antenna	Loss&	Level	Angle	Height	Polar.	Limit	Margin	Comment
[MHz]	[dBuV]		Factor	Gain	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]	
95.850	34.8	QP	9.3	-30.8	13.3	0	223	Hori.	43.5	30.2	
95.850	41.5	QP	9.3	-30.8	20.0	239	100	Vert.	43.5	23.5	
127.797	42.0	QP	13.4	-30.4	25.0	354	251	Hori.	43.5	18.5	
127.797	46.5	QP	13.4	-30.4	29.5	286	100	Vert.	43.5	14.0	
143.773	39.3	QP	14.5	-30.2	23.6	189	294	Hori.	43.5	19.9	
143.773	47.4	QP	14.5	-30.2	31.7	83	100	Vert.	43.5	11.8	
159.756	36.2	QP	15.2	-29.9	21.5	19	324	Hori.	43.5	22.0	
159.756	45.6	QP	15.2	-29.9	30.9	175	100	Vert.	43.5	12.6	
191.705	34.9	QP	16.2	-29.6	21.5	137	238	Hori.	43.5	22.0	
191.705	42.9	QP	16.2	-29.6	29.5	11	100	Vert.	43.5	14.0	
207.680	34.4	QP	11.5	-29.4	16.5	167	166	Hori.	43.5	27.0	
207.680	40.9	QP	11.5	-29.4	23.0	323	100	Vert.	43.5	20.5	

CHART:WITH FACTOR ANT TYPE: -30MHz:LOOP. 30-300MHz:BICONICAL. 300MHz-1000MHz:LOGPERIODIC. 1000MHz-:HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS & GAIN(CABLE+ATTEN. - GAIN (AMP))

Duty Cycle

(Total Calculation Metal Antenna)

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11261639H
Date	05/25/2016
Temperature/ Humidity	23 deg. C / 53 % RH
Engineer	Koji Yamamoto
Mode	Normal Transmitting mode (Metal Antenna)

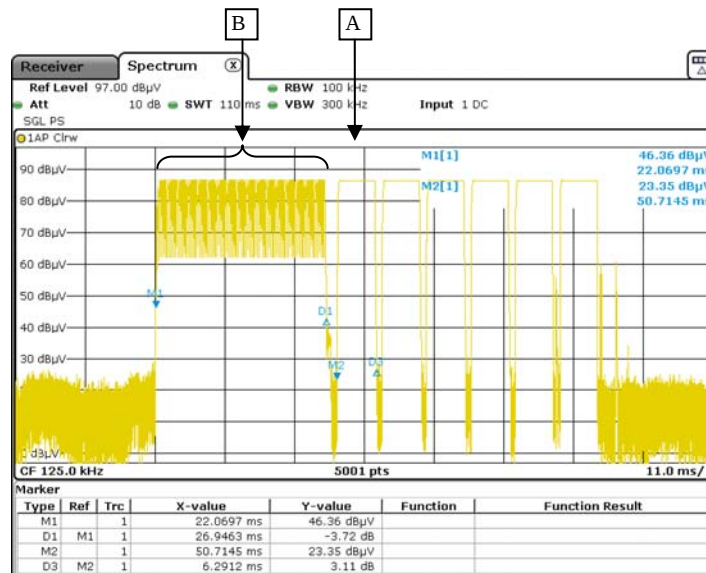
(Total)

ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
64.694	100.00	0.6469	-3.78

$$\begin{aligned} \text{ON time[ms]} &= B + (A \times 6) \\ &= 26.9463 + (6.2912 \times 6) \end{aligned}$$

$$\text{Duty} = 20\log_{10}(\text{ON time/Cycle})$$

* "Timing of transmission" of the application documents was referred, since Intentional off time was unrealizable in measurement circumstance.



Date: 25 MAY 2016 07:51:27

Duty Cycle (Total Calculation Air Antenna)

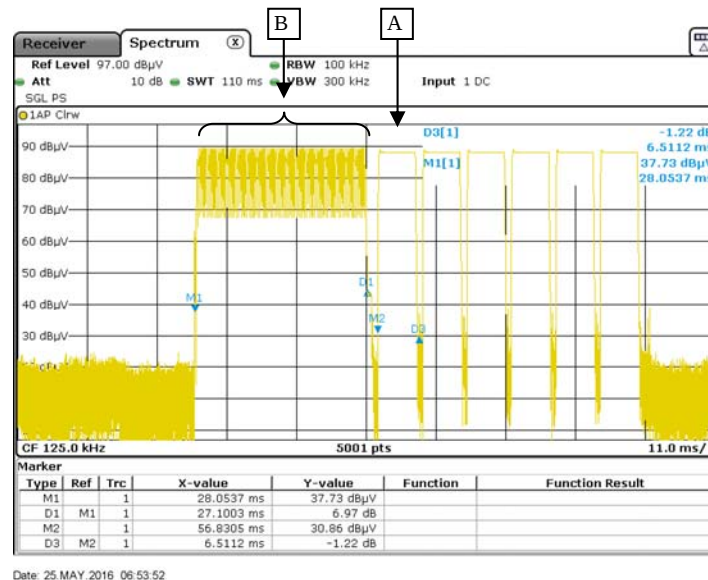
Test place Ise EMC Lab. No.11 Measurement Room
Report No. 11261639H
Date 05/25/2016
Temperature/ Humidity 23 deg. C / 53 % RH
Engineer Koji Yamamoto
Mode Normal Transmitting mode (Air Antenna)

(Total)

ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
66.168	100.00	0.6617	-3.59

ON time[ms] = B+(A*6)
=27.1003+(6.5112*6)
Duty = 20log₁₀(ON time/Cycle)

* "Timing of transmission" of the application documents was referred, since Intentional off time was unrealizable in measurement circumstance.



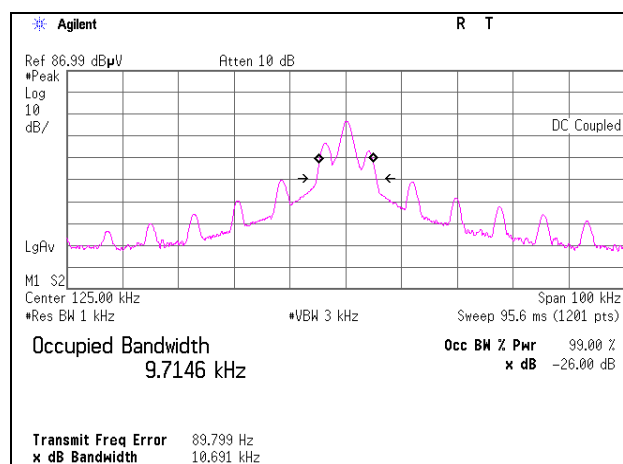
Date: 25 MAY.2016 06:53:52

-26dB Bandwidth and 99% Occupied Bandwidth

Metal Antenna

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11261639H
Date	05/31/2016
Temperature/ Humidity	24 deg. C / 55 % RH
Engineer	Satofumi Matsuyama
Mode	Normal Transmitting mode (Metal Antenna)

-26dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
10.691	9.7146

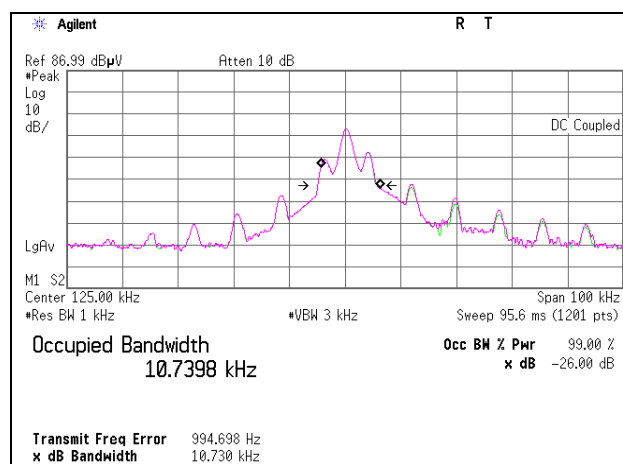


-26dB Bandwidth and 99% Occupied Bandwidth

Air Antenna

Test place	Ise EMC Lab. No.11 Measurement Room
Report No.	11261639H
Date	05/31/2016
Temperature/ Humidity	24 deg. C / 55 % RH
Engineer	Satofumi Matsuyama
Mode	Normal Transmitting mode (Air Antenna)

-26dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
10.730	10.7398



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	2015/09/19 * 12
MOS-27	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	RE	2016/01/21 * 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	2015/06/08 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2015/10/24 * 12
MCC-143	Coaxial Cable	UL Japan	-	-	RE	2015/06/24 * 12
MCC-03	Coaxial Cable	Fujikura/Suhner/TSJ	5D-2W(20m)/ 3D-2W(7.5m)/ RG400u(1.5m)/ RFM-E421(Switcher)	-/01068 (Switcher)	RE	2015/09/29 * 12
MAT-08	Attenuator(6dB)	Weinschel Corp	2	BK7971	RE	2015/11/10 * 12
MMM-03	Digital Tester	Fluke	FLUKE 26-3	78030621	RE	2015/08/19 * 12
KBA-05	Biconical Antenna	Schwarzbeck	BBA9106	2513	RE	2015/11/02 * 12
MLA-20	Logperiodic Antenna(200-1000MHz)	Schwarzbeck	VUSLP9111B	911B-189	RE	2016/01/30 * 12
MCC-02	Coaxial Cable	Suhner/storm/Agilent /TSJ	-	-	RE	2015/09/29 * 12
MPA-19	Pre Amplifier	MITEQ	MLA-10K01-B01-35	1237616	RE	2016/02/25 * 12
MOS-19	Thermo-Hygrometer	Custom	CTH-201	0001	RE	2015/12/08 * 12
MLPA-07	Loop Antenna	UL Japan	-	-	RE	Pre Check
MTR-10	EMI Test Receiver	Rohde & Schwarz	ESR26	101408	RE	2016/01/29 * 12
MMM-17	DIGITAL HiTESTER	Hioki	3805	070900530	RE	2016/01/13 * 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:

RE: Radiated emission

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