



RADIO TEST REPORT

Test Report No. : 10291830H-A-R2

Applicant : DENSO CORPORATION
Type of Equipment : Passive Entry Passive Start System (LF Transmitter)
Model No. : U2NA0
FCC ID : HYQU2NA0
Test regulation : FCC Part 15 Subpart C: 2014
Test Result : Complied

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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 report is a revised version of 10291830H-A-R1. 10291830H-A-R1 is replaced with this report.

Date of test: May 26 to June 9, 2014

Representative test engineer:

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Engineer

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Approved by:

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Leader
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NVLAP LAB CODE: 200572-0

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13-EM-F0429

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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 : +81-566-61-5234
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. : U2NA0
Serial No. : Refer to Section 4, Clause 4.2
Receipt Date of Sample : April 24, 2014
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: U2NA0 (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

Radio Type : LF Transmitter
Frequency of Operation : 125kHz
Oscillation circuit : Ceramic resonator
Oscillator frequency : 8MHz
Modulation : OOK
Power Supply (inner) : DC 12.0V
Antenna port type : Port type1: Ant 1, 2, 6
(Not inserted resistance between LF Drive Circuit and Output Port in series)
Port type2: Ant 3, 4, 5
(Inserted resistance between LF Drive Circuit and Output Port in series)
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]

This system has six ports: three Port type1 and three Port type2.

These 6 ports do not transmit simultaneously.

The application document indicats a relationship between transmitting output current and output field strength by the difference in an antenna impedance.

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2014, final revised on May 1, 2014 and effective June 2, 2014

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted Emission
Section 15.209 Radiated emission limits, general requirements

* The revision on May 1, 2014 does not affect the test specification applied to the EUT.

FCC 15.31 (e)

This test was performed with the New Battery (DC 12V) and the constant voltage was supplied to this EUT during the tests. 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.

3.2 Procedures and results

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	Conducted Emission	<FCC> ANSI C63.4:2003 7. AC powerline conducted emission measurements <IC> RSS-Gen 7.2.4	<FCC> Section 15.207 <IC> RSS-Gen 7.2.4	-	N/A *1)	N/A	N/A
2	Electric Field Strength of Fundamental Emission	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> RSS-Gen 4.8, 4.11	<FCC> Section 15.209 <IC> RSS-210 2.5.1 RSS-Gen 7.2.5	Radiated	N/A	9.8dB 0.12500MHz 0 deg. PK with Duty factor (Ant1)	Complied
3	Electric Field Strength of Spurious Emission	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <IC> RSS-Gen 4.9, 4.11	<FCC> Section 15.209 <IC> RSS-210 2.5.1 RSS-Gen 7.2.5	Radiated	N/A	8.8dB 128.100MHz Vertivcal, QP (Ant3)	Complied
4	-26dB Bandwidth	<FCC> ANSI C63.4:2003 13. Measurement of intentional radiators <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.

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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 4.6.1	RSS-Gen 4.6.1	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.

Test room (semi-anechoic chamber)	Radiated emission (10m*)(±dB)		
	9kHz -30MHz	30MHz -300MHz	300MHz -1GHz
No.1	4.0dB	5.1dB	4.7dB
No.2	-	-	-
No.3	-	-	-
No.4	-	-	-

Test room (semi-anechoic chamber)	Radiated emission						
	(3m*)(±dB)				(1m*)(±dB)		(0.5m*)(±dB)
	9kHz -30MHz	30MHz -300MHz	300MHz -1GHz	1GHz -10GHz	10GHz -18GHz	18GHz -26.5GHz	26.5GHz -40GHz
No.1	4.0dB	5.1dB	5.0dB	5.1dB	6.0dB	4.9dB	4.3dB
No.2	3.9dB	5.2dB	5.0dB	4.9dB	5.9dB	4.7dB	4.2dB
No.3	4.3dB	5.1dB	5.2dB	5.2dB	6.0dB	4.8dB	4.2dB
No.4	4.6dB	5.2dB	5.0dB	5.2dB	6.0dB	5.7dB	4.2dB

*3m/1m/0.5m = Measurement distance

Radiated emission test(3m and 10m)

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 Data of EMI, Test instruments, and Test set up

Refer to APPENDIX.

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

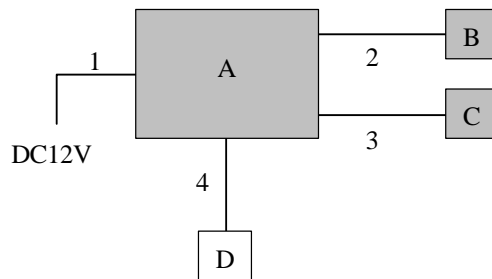
4.1 Operating Modes

Mode	Remarks
(1) Transmitting mode (Tx) Ant1 Output current 1000mA	*1)
(2) Transmitting mode (Tx) Ant3 Output current 1000mA	*1)

*For reference, fundamental level was measured with Ant1 and Ant3, output current 50mA.

*1) The test was performed with one representative antenna on continuous transmitting mode.
This transmission timing was worse than the one using six antennas of normal use.

4.2 Configuration and peripherals



* For two Antenna ports (Port type1 and Port type2), it was checked that there was no difference between the ports, and then one representative port was evaluated.

Also, the number of connected antennas was no difference within this confirmation, although it was confirmed that some antennas would be added.

* 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)	U2NA0	1114 0370 0050 0402	DENSO CORPORATION	EUT
B	Ant1 (for port type1)	Normal-L	01	DENSO CORPORATION	EUT
C	Ant3 (for port type2)	Normal-L	01	DENSO CORPORATION	EUT
D	Evaluation Bench	-	-	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

The Radiated Electric Field Strength intensity has been measured on No. 1 semi anechoic chamber with a ground plane and at a distance of 10m.

Frequency : From 9kHz to 30MHz at distance 10m

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: 0deg., 45deg., 90deg., and 135 deg.) and horizontal polarization.

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

Frequency : From 30MHz to 1GHz at distance 3m

The measuring antenna height varied between 1 and 4m 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.

Measurements were performed with a QP and PK detector.

The radiated emission measurements were made with the following detector function of the test receiver.

	From 9kHz to 90kHz and From 110kHz to 150kHz	From 90kHz to 110kHz	From 150kHz to 490kHz	From 490kHz to 30MHz	From 30MHz to 1GHz	From 1GHz to 2GHz	
Detector Type	PK/AV	QP	PK/AV	QP	QP	-	-
IF Bandwidth	200Hz	200Hz	9kHz	9kHz	120kHz	-	-
Distance factor *1)	-59.1dB	-59.1dB	-59.1dB	-19.1dB	-	-	-

*1) -59.1dB = 40 x log (10m/300m)

-19.1dB = 40 x log (10m/30m)

- 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.

With the position, the noise levels of all the frequencies were measured.

Test data : APPENDIX 1

Test result : Pass

Date: May 26 and June 4, 2014

Test engineer: Shinya Watanabe

UL Japan, Inc.

Ise EMC Lab.

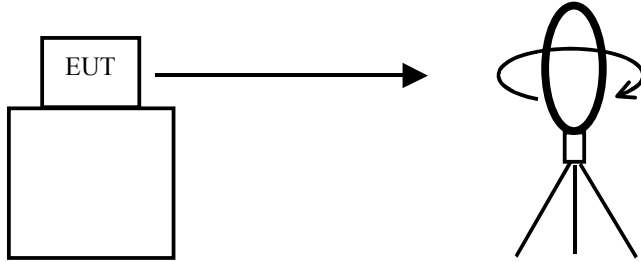
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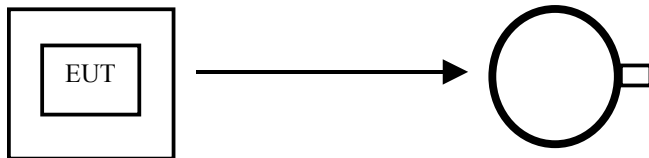
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Figure 1: Direction of the Loop Antenna

Side View (Vertical)

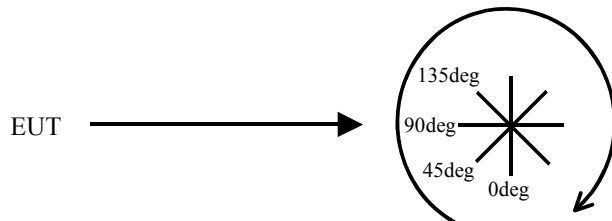


.....
Top View (Horizontal)



Antenna was not rotated.

.....
Top View (Vertical)



Front side: 0 deg.
Forward direction: clockwise

SECTION 6: -26dB Bandwidth

Test Procedure

The measurement was performed in the antenna height to gain the maximum of Electric field strength.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
-26dB Bandwidth	200kHz	2kHz	6.2kHz	Auto	Peak	Max Hold	Spectrum Analyzer

Test data : APPENDIX 1
Test result : Pass

SECTION 7: 99% Occupied Bandwidth

Test Procedure

The measurement was performed in the antenna height to gain the maximum of Electric field strength.

Test	Span	RBW	VBW	Sweep	Detector	Trace	Instrument used
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 % of Span	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%.

Test data : APPENDIX 1
Test result : Pass

APPENDIX 1: Data of EMI test

Radiated Emission below 30MHz (Fundamental and Spurious Emission)
[Ant1]

Test place Ise EMC Lab. No.1 Semi Anechoic Chamber
Order No. 10291830H
Date 05/26/2014
Temperature/ Humidity 23 deg. C / 63% RH
Engineer Shinya Watanabe
Mode Transmitting mode (Tx) Ant1 Output current 1000mA / 50mA (carrier only)

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	91.7	20.0	-53.0	38.9	-	19.8	45.6	25.8	Fundamental
45	0.12500	PK	90.0	20.0	-53.0	38.9	-	18.1	45.6	27.5	
90	0.12500	PK	90.0	20.0	-53.0	38.9	-	18.1	45.6	27.5	
135	0.12500	PK	91.2	20.0	-53.0	38.9	-	19.3	45.6	26.3	
0	0.12500	PK	77.0	20.0	-53.0	38.9	-	5.1	45.6	40.5	Ant. Hor.
0	0.12500	PK	87.2	20.0	-53.0	38.9	-	15.3	45.6	30.3	50mA
0	0.25000	PK	53.8	19.9	-52.9	38.9	-	-18.1	39.6	57.7	
0	0.37500	PK	46.0	19.8	-52.9	38.9	-	-26.0	36.1	62.1	
0	0.50000	QP	39.2	19.8	-12.9	38.9	-	7.2	33.6	26.4	
0	0.62500	QP	38.6	19.8	-12.8	38.9	-	6.7	31.7	25.0	
0	0.75000	QP	38.1	19.8	-12.8	38.9	-	6.2	30.1	23.9	
0	0.87500	QP	37.8	19.8	-12.8	38.9	-	5.9	28.7	22.8	
0	1.00000	QP	37.5	19.8	-12.8	38.9	-	5.6	27.6	22.0	
0	1.12500	QP	37.4	19.8	-12.8	38.9	-	5.5	26.5	21.0	
0	1.25000	QP	37.3	19.8	-12.7	38.9	-	5.5	25.6	20.1	

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	91.7	20.0	-53.0	38.9	-4.0	15.8	25.6	9.8	
45	0.125	PK	90.0	20.0	-53.0	38.9	-4.0	14.1	25.6	11.5	
90	0.125	PK	90.0	20.0	-53.0	38.9	-4.0	14.1	25.6	11.5	
135	0.125	PK	91.2	20.0	-53.0	38.9	-4.0	15.3	25.6	10.3	
0	0.125	PK	77.0	20.0	-53.0	38.9	-4.0	1.1	25.6	24.5	Ant. Hor.
0	0.125	PK	87.2	20.0	-53.0	38.9	-4.0	11.3	25.6	14.3	50mA
0	0.250	PK	53.8	19.9	-52.9	38.9	-4.0	-22.1	19.6	41.7	
0	0.375	PK	46.0	19.8	-52.9	38.9	-4.0	-30.0	16.1	46.1	

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.

Results of the fundamental emission at 10m without Distance factor

PK or QP

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	0.12500	PK	91.7	20.0	6.1	38.9	-	78.9	-	-	Fundamental

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

* All spurious emissions lower than these results.

Radiated Emission below 30MHz (Fundamental and Spurious Emission)
[Ant3]

Test place : Ise EMC Lab. No.1 Semi Anechoic Chamber
Order No. : 10291830H
Date : 05/26/2014
Temperature/ Humidity : 23 deg. C / 63% RH
Engineer : Shinya Watanabe
Mode : Transmitting mode (Tx) Ant3 Output current 1000mA / 50mA (carrier only)

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	90.6	20.0	-53.0	38.9	-	18.7	45.6	26.9	Fundamental
45	0.12500	PK	89.3	20.0	-53.0	38.9	-	17.4	45.6	28.2	
90	0.12500	PK	85.7	20.0	-53.0	38.9	-	13.8	45.6	31.8	
135	0.12500	PK	86.1	20.0	-53.0	38.9	-	14.2	45.6	31.4	
0	0.12500	PK	73.1	20.0	-53.0	38.9	-	1.2	45.6	44.4	Ant. Hor.
0	0.12500	PK	66.0	20.0	-53.0	38.9	-	-5.9	45.6	51.5	50mA
0	0.25000	PK	51.9	19.9	-52.9	38.9	-	-20.0	39.6	59.6	
0	0.37500	PK	46.4	19.8	-52.9	38.9	-	-25.6	36.1	61.7	
0	0.50000	QP	39.2	19.8	-12.9	38.9	-	7.2	33.6	26.4	
0	0.62500	QP	38.7	19.8	-12.8	38.9	-	6.8	31.7	24.9	
0	0.75000	QP	38.2	19.8	-12.8	38.9	-	6.3	30.1	23.8	
0	0.87500	QP	37.8	19.8	-12.8	38.9	-	5.9	28.7	22.8	
0	1.00000	QP	37.6	19.8	-12.8	38.9	-	5.7	27.6	21.9	
0	1.12500	QP	37.6	19.8	-12.8	38.9	-	5.7	26.5	20.8	
0	1.25000	QP	37.4	19.8	-12.7	38.9	-	5.6	25.6	20.0	

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	90.6	20.0	-53.0	38.9	-4.0	14.7	25.6	10.9	
45	0.125	PK	89.3	20.0	-53.0	38.9	-4.0	13.4	25.6	12.2	
90	0.125	PK	85.7	20.0	-53.0	38.9	-4.0	9.8	25.6	15.8	
135	0.125	PK	86.1	20.0	-53.0	38.9	-4.0	10.2	25.6	15.4	
0	0.125	PK	73.1	20.0	-53.0	38.9	-4.0	-2.8	25.6	28.4	Ant. Hor.
0	0.125	PK	66.0	20.0	-53.0	38.9	-4.0	-9.9	25.6	35.5	50mA
0	0.250	PK	51.9	19.9	-52.9	38.9	-4.0	-24.0	19.6	43.6	
0	0.375	PK	46.4	19.8	-52.9	38.9	-4.0	-29.6	16.1	45.7	

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.

Results of the fundamental emission at 10m without Distance factor

PK or QP

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	0.12500	PK	90.6	20.0	6.1	38.9	-	77.8	-	-	Fundamental

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

* All spurious emissions lower than these results.

Radiated Emission above 30MHz (Spurious Emission)
[Ant1]

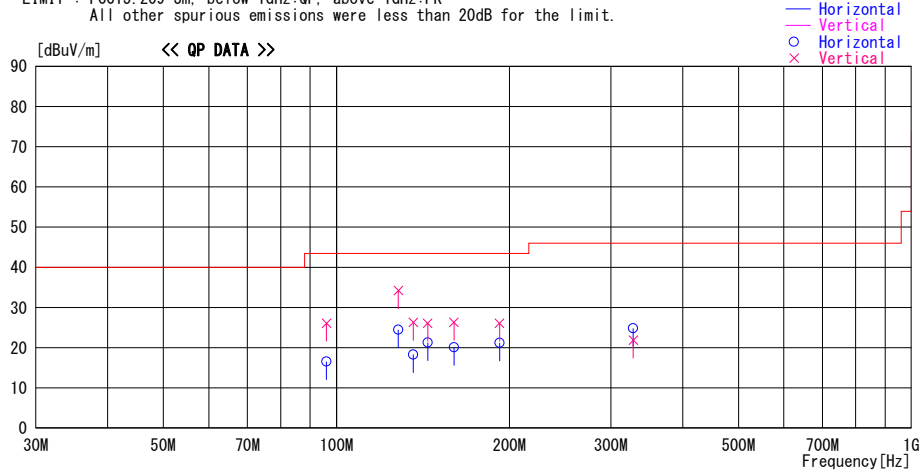
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No.1 Semi Anechoic Chamber
 Date : 2014/06/04

Report No. : 10291830H
 Temp./Humi. : 23deg. C / 64% RH
 Engineer : Shinya Watanabe

Mode / Remarks : Tx 125kHz, LF Power 1000mA, Ant1 Worst-axis

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



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Gain [dB]							
96.074	37.4	QP	9.6	-30.4	16.6	22	194	Hori.	43.5	26.9	
96.074	46.9	QP	9.6	-30.4	26.1	61	100	Vert.	43.5	17.4	
128.100	41.1	QP	13.5	-30.1	24.5	32	273	Hori.	43.5	19.0	
128.100	50.8	QP	13.5	-30.1	34.2	96	100	Vert.	43.5	9.3	
136.052	34.1	QP	14.2	-30.0	18.3	77	221	Hori.	43.5	25.2	
136.052	42.1	QP	14.2	-30.0	26.3	50	100	Vert.	43.5	17.2	
144.113	36.5	QP	14.7	-29.9	21.3	201	276	Hori.	43.5	22.2	
144.113	41.3	QP	14.7	-29.9	26.1	91	100	Vert.	43.5	17.4	
160.126	34.5	QP	15.5	-29.9	20.1	207	171	Hori.	43.5	23.4	
160.126	40.7	QP	15.5	-29.9	26.3	177	100	Vert.	43.5	17.2	
192.154	34.5	QP	16.3	-29.6	21.2	7	275	Hori.	43.5	22.3	
192.154	39.4	QP	16.3	-29.6	26.1	106	100	Vert.	43.5	17.4	
328.247	37.5	QP	15.2	-27.9	24.8	0	210	Hori.	46.0	21.2	
328.247	34.6	QP	15.2	-27.9	21.9	198	100	Vert.	46.0	24.1	

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)
[Ant3]

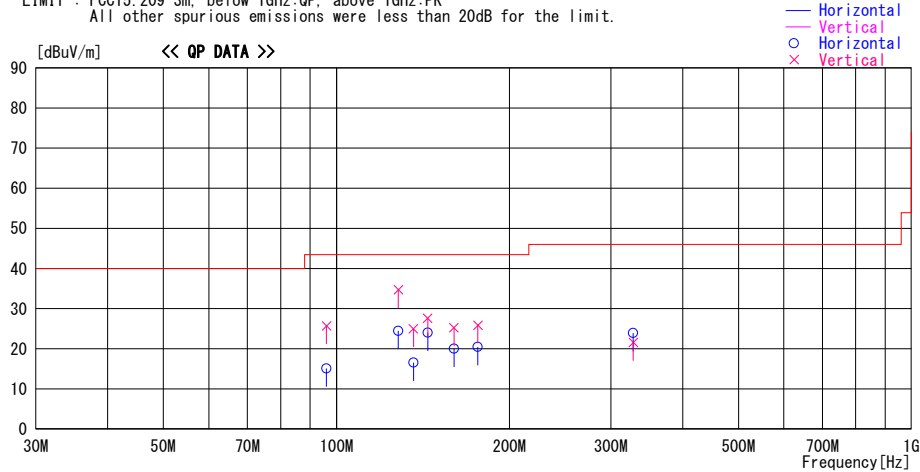
DATA OF RADIATED EMISSION TEST

UL Japan, Inc. Ise EMC Lab. No.1 Semi Anechoic Chamber
 Date : 2014/06/04

Report No. : 10291830H
 Temp./Humi. : 23deg. C / 64% RH
 Engineer : Shinya Watanabe

Mode / Remarks : Tx 125kHz, LF Power 1000mA, Ant3 Worst-axis

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



Frequency [MHz]	Reading [dBuV]	DET	Antenna	Loss&	Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBuV/m]	Margin [dB]	Comment
			Factor [dB/m]	Gain [dB]							
96.074	35.9	QP	9.6	-30.4	15.1	43	202	Hori.	43.5	28.4	
96.074	46.5	QP	9.6	-30.4	25.7	60	100	Vert.	43.5	17.8	
128.100	41.1	QP	13.5	-30.1	24.5	40	253	Hori.	43.5	19.0	
128.100	51.3	QP	13.5	-30.1	34.7	88	100	Vert.	43.5	8.8	
136.110	32.4	QP	14.2	-30.0	16.6	89	218	Hori.	43.5	26.9	
136.110	40.8	QP	14.2	-30.0	25.0	87	100	Vert.	43.5	18.5	
144.119	39.2	QP	14.7	-29.9	24.0	196	272	Hori.	43.5	19.5	
144.119	42.8	QP	14.7	-29.9	27.6	93	100	Vert.	43.5	15.9	
160.128	34.4	QP	15.5	-29.9	20.0	206	173	Hori.	43.5	23.5	
160.128	39.6	QP	15.5	-29.9	25.2	173	100	Vert.	43.5	18.3	
176.139	34.1	QP	16.1	-29.7	20.5	176	241	Hori.	43.5	23.0	
176.139	39.5	QP	16.1	-29.7	25.9	89	100	Vert.	43.5	17.6	
328.247	36.6	QP	15.2	-27.9	23.9	0	206	Hori.	46.0	22.1	
328.247	34.3	QP	15.2	-27.9	21.6	203	100	Vert.	46.0	24.4	

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 [Ant1]

Test place Ise EMC Lab. No.2 Semi Anechoic Chamber
Report No. 10291830H
Date 06/09/2014
Temperature/ Humidity 20 deg. C / 56 % RH
Engineer Masatoshi Nishiguchi
Mode Transmitting mode (Tx) Ant1

(Total)

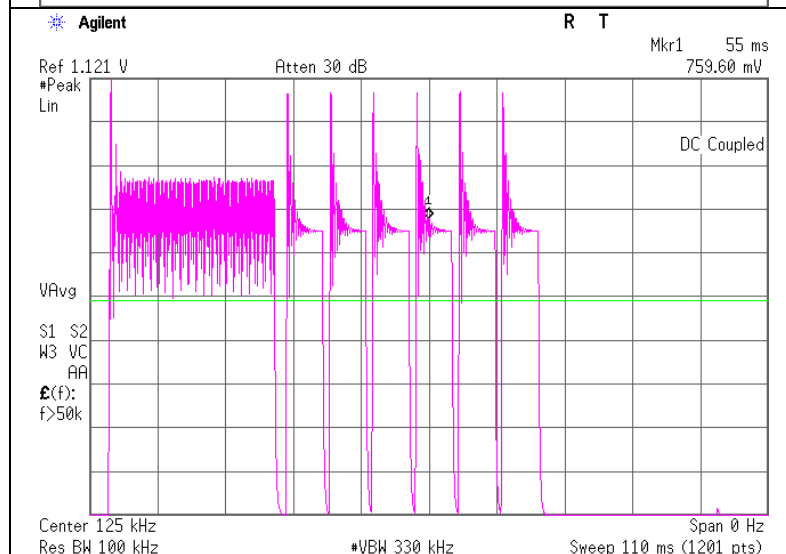
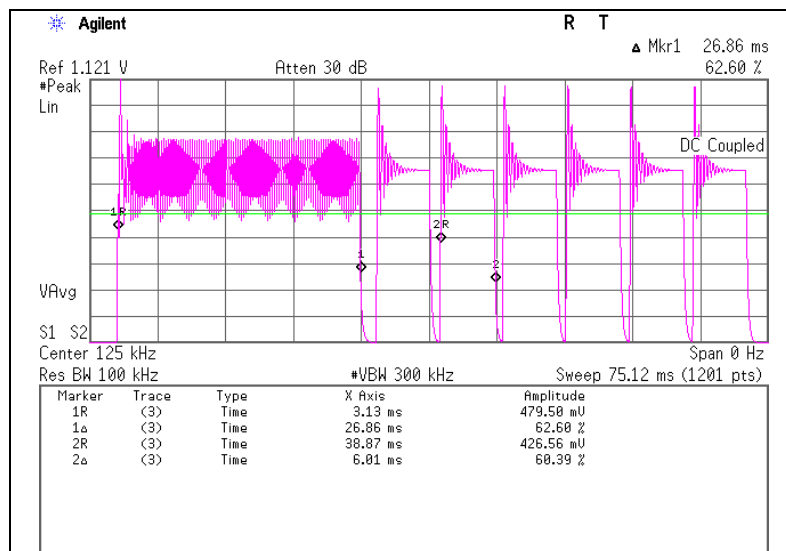
ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
62.92	100.00	0.6292	-4.02

ON time = Times * ON time(Δ 1) + Times * ON time(Δ2)

Duty = 20log10(ON time/Cycle)

(pulse length(in X))

Type	Times	ON time(One pulse) [ms]	ON time [ms]
1 Δ	1	26.86	26.86
2 Δ	6	6.01	36.06



Duty Cycle

[Ant3]

Test place : Ise EMC Lab. No.2 Semi Anechoic Chamber
 Report No. : 10291830H
 Date : 06/09/2014
 Temperature/ Humidity : 20 deg. C / 56 % RH
 Engineer : Masatoshi Nishiguchi
 Mode : Transmitting mode (Tx) Ant3

(Total)

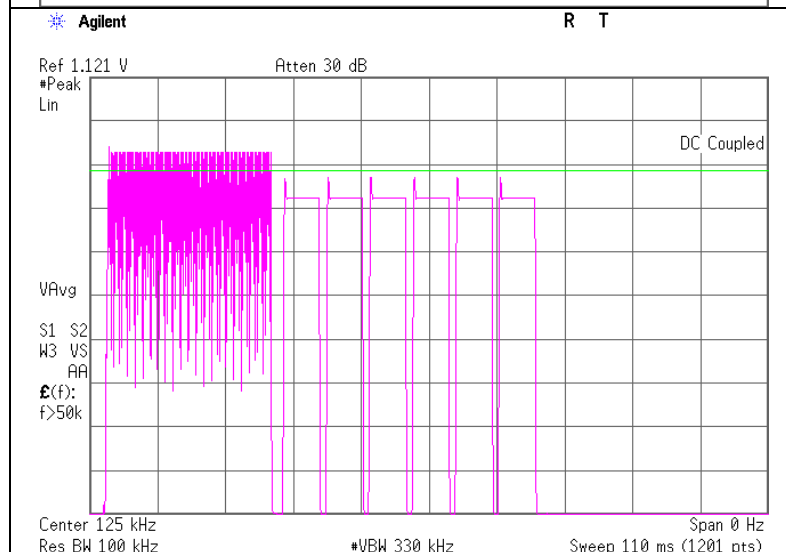
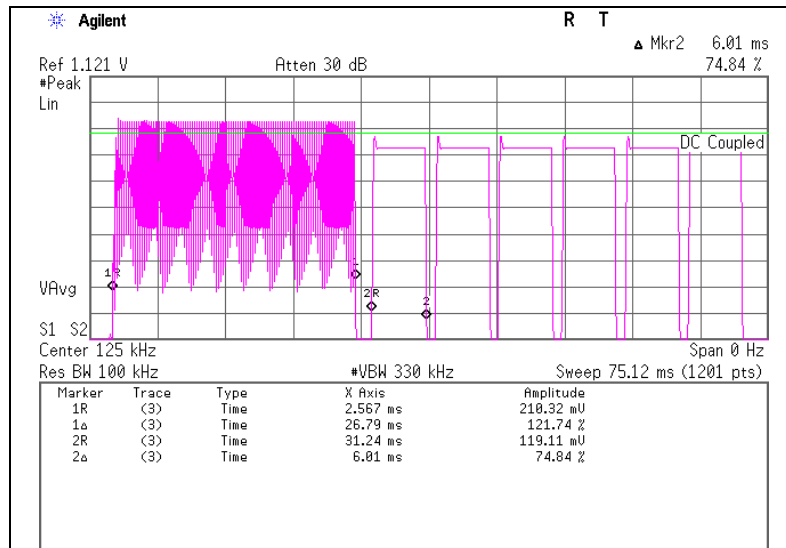
ON time [ms]	Cycle [ms]	Duty (On time/Cycle)	Duty [dB]
62.85	100.00	0.6285	-4.03

ON time = ON time(Δ1) + Times * ON time(Δ2)

Duty = 20log10(ON time/Cycle)

(pulse length(in X))

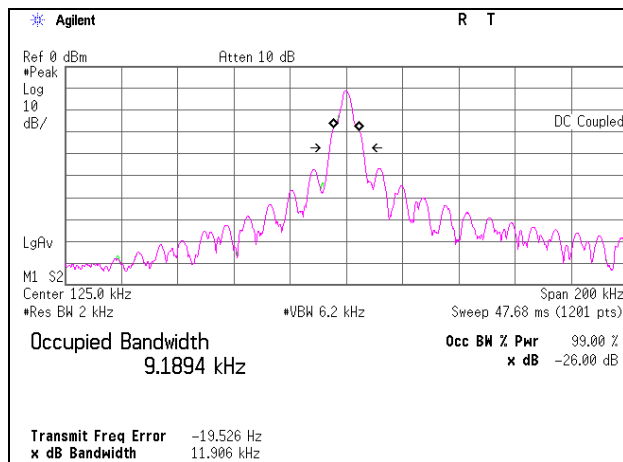
Type	Times	ON time(One pulse) [ms]	ON time [ms]
1 Δ	1	26.79	26.79
2 Δ	6	6.01	36.06



-26dB Bandwidth and 99% Occupied Bandwidth
[Ant1]

Report No. 10291830H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.2
 Date 06/09/2014
 Temperature / Humidity 20 deg. C / 56 % RH
 Engineer Masatoshi Nishiguchi
 Mode Transmitting mode (Tx) Ant1

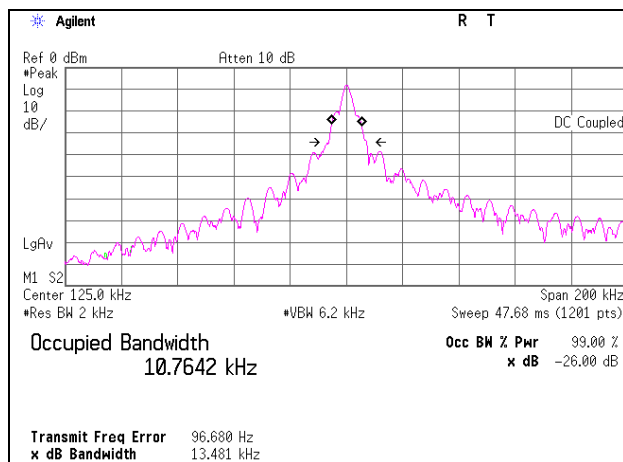
-26dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
11.906	9.1894



-26dB Bandwidth and 99% Occupied Bandwidth
[Ant3]

Report No. 10291830H
 Test place Ise EMC Lab.
 Semi Anechoic Chamber No.2
 Date 06/09/2014
 Temperature / Humidity 20 deg. C / 56 % RH
 Engineer Masatoshi Nishiguchi
 Mode Transmitting mode (Tx) Ant3

-26dB Bandwidth [kHz]	99% Occupied Bandwidth [kHz]
13.481	10.7642



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	2013/08/01 * 12
MOS-27	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q26	RE	2014/02/20 * 12
MJM-21	Measure	KOMELON	KMC-36	-	RE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MTR-09	EMI Test Receiver	Rohde & Schwarz	ESU26	100412	RE	2013/06/07 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100017	RE	2013/10/30 * 12
MCC-143	Coaxial Cable	UL Japan	-	-	RE	2013/07/22 * 12
MCC-03	Coaxial Cable	Fujikura/Suhner/TSJ	5D-2W(20m)/ 3D-2W(7.5m)/ RG400u(1.5m)/ RFM-E421(Switcher)	- /01068(Switcher)	RE	2013/09/12 * 12
MPA-19	Pre Amplifier	MITEQ	MLA-10K01-B01-35	1237616	RE	2014/02/17 * 12
MAT-08	Attenuator(6dB)	Weinschel Corp	2	BK7971	RE	2013/11/26 * 12
KBA-05	Biconical Antenna	Schwarzbeck	BBA9106	2513	RE	2013/11/24 * 12
KLA-04	Logperiodic Antenna	Schwarzbeck	USLP9143	361	RE	2013/11/24 * 12
MCC-02	Coaxial Cable	Suhner/storm/Agilent/ TSJ	-	-	RE	2013/09/12 * 12
MRENT-114	Spectrum Analyzer	Agilent	E4440A	MY46187105	RE	2013/11/11 * 12
MLPA-03	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

UL Japan, Inc.

Ise EMC Lab.

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