



RADIO TEST REPORT

Test Report No. : 10169391H-A-R1

Applicant : FUJITSU TEN LIMITED
Type of Equipment : Radio Detection and Ranging Device for Vehicle
Model No. : FT0047A
FCC ID : BABFT0047A
Test regulation : FCC Part 15 Subpart C: 2013
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.
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 10169391H-A. 10169391H-A is replaced with this report.

Date of test: October 21, 2013 to February 10, 2014

Representative test engineer:

Hironobu Ohnishi
Engineer of WiSE Japan,
UL Verification Service

Approved by:

Masanori Nishiyama
Manager of WiSE Japan,
UL Verification Service



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://www.ul.com/japan/jpn/pages/services/emc/about/mark1/index.jsp#nvlap>

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

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SECTION 1: Customer information

Company Name : FUJITSU TEN LIMITED
Address : 2-28 GOSHO-DORI, 1-CHOME, HYOGO-KU, KOBE 652-8510 Japan
Telephone Number : +81-78-682-2159
Facsimile Number : +81-78-671-7160
Contact Person : Shotatsu Yo

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

2.1 Identification of E.U.T.

Type of Equipment : Radio Detection and Ranging Device for Vehicle
Model No. : FT0047A
Serial No. : Refer to Clause 4.2
Rating : DC12.0/24.0 V(Nominal), DC8-32V (Operating Voltage)
Receipt Date of Sample : October 7, 2013
Country of Mass-production : Japan and Spain
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

General Specification

Clock frequency(ies) in the system : CPU: 10MHz

Radio Specification

Radio Type : Transceiver
Frequency of Operation : 76-77GHz
Modulation : FM-CW
Duty: (Transmitting time) / (1cycle) = 23.9%
Transmission time per 1 cycle: 11.96msec
Antenna Type : Microstrip Antenna
Antenna Connector : No external connector
Antenna Gain : 18.7dBi (max)
Steerable Antenna : None
Usage location : Vehicle-mounted
Power Supply (inner) : DC 3.3V
Description : Radio Detection and Ranging Device for Vehicle

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part 15 Subpart C: 2013, final revised on September 30, 2013 and effective October 30, 2013

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators Section 15.253 Operation within the bands 46.7-46.9GHz and 76.0-77.0GHz.

*The EUT complies with FCC Part 15 Subpart B: 2013, final revised on September 30, 2013 and effective October 30, 2013.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
Conducted Emission	FCC: ANSI C63.4:2003 7. AC power line Conducted Emission measurements ----- IC: RSS-Gen 7.2.4	FCC: Section 15.207 ----- IC: RSS-Gen 7.2.4	N/A	N/A	*1)
26dB Bandwidth	FCC: "MILLIMETER WAVE TEST PROCEDURES" ----- IC: -	FCC: Section 15.253(f) ----- IC: RSS-210 A13.1.5	See data.	Complied	Radiated
Power Density	FCC: "MILLIMETER WAVE TEST PROCEDURES" ----- IC: -	FCC: Section 15.253(d) ----- IC: RSS-210 A13.1.2(1)		Complied	Radiated
Spurious Emissions	FCC: ANSI C63.4:2003, "MILLIMETER WAVE TEST PROCEDURES" ----- IC: RSS-Gen 4.9	FCC: Section 15.253(d) ----- IC: RSS-210 A13.1.2(2), A13.1.4, RSS-Gen 7.2.3	2.8dB 64.000MHz, QP, Vertical	Complied	Radiated
Frequency Stability	FCC: "MILLIMETER WAVE TEST PROCEDURES" ----- IC: RSS-Gen 4.7, 7.2.4	FCC: Section 15.253(f) ----- IC: RSS-210 A13.1.5	See data.	Complied	Radiated

*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.
Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.
Millimeter wave measurement was performed accordance with FCC KDB 200443 (MILLIMETER WAVE TEST PROCEDURES).
Power density measurement was performed accordance with FCC KDB 662911 D01 (Multiple Transmitter Output)

* In case any questions arise about test procedure, ANSI C63.4: 2003 is also referred.

FCC 15.31 (e)

This EUT provides stable voltage (DC3.3V) constantly to RF Part regardless of input voltage. Therefore, this EUT complies with the requirement. As for the Frequency Stability, the test was performed based on 15.253 (f).

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 4.6.1	IC: RSS-Gen 4.6.1	N/A	-	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 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 (+dB)	
40GHz-50GHz	3.9dB
50GHz-75GHz	4.6dB
75GHz-110GHz	5.0dB
110GHz-170GHz	5.1dB
170GHz-260GHz	5.0dB

Radiated emission test(3m)

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

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

3.5 Test Location

UL Japan, Inc. Head Office EMC Lab. *NVLAP Lab. code: 200572-0
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
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	FCC Registration Number	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	313583	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	655103	2973C-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	148738	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	134570	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	2.4 x 3.4m	-

* 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.

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Facsimile : +81 596 24 8124

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

4.1 Operating Mode(s)

Mode	Test Item
Transmitting mode (Tx)	26dB Bandwidth Power Density Spurious Emission Frequency Stability
Power of the EUT was set by the software as follows; Power settings: Same as production model Software: SW90848A This setting of software is the worst case. Any conditions under the normal use do not exceed the condition of setting. In addition, end users cannot change the settings of the output power of the product.	

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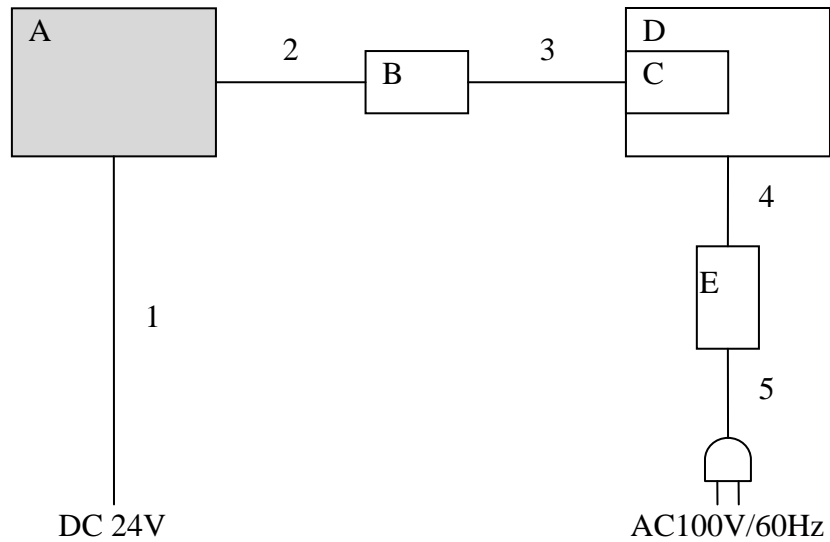
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4.2 Configuration and peripherals



*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	Remark
A	Radio Detection and Ranging Device for Vehicle	FT0047A	C02136B33E3 C02136B3360 *1)	FUJITSU TEN LIMITED	EUT
B	CAN I/F	251	-	Vector	-
C	CANcardXL	007100	008634	Vector	-
D	Laptop PC	FMVNS1SG	R0900352	FUJITSU	-
E	AC Adapter	FMV-AC325A	10733740C	FUJITSU	-

*1) Used for Duty Factor test only

List of cables used

No.	Name	Length (m)	Shield		Remark
			Cable	Connector	
1	DC Cable	2.5	Unshielded	Unshielded	-
2	CAN 1/2 Cable	2.3	Unshielded	Unshielded	-
3	Signal Cable	0.3	Shielded	Shielded	-
4	DC Cable	1.8	Unshielded	Unshielded	-
5	AC Cable	0.9	Unshielded	Unshielded	-

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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SECTION 5: Radiated Emission (Spurious Emission, Power Density)

Test Procedure

[Up to 40GHz]

EUT was placed on a urethane platform of nominal size, 0.5m by 1.0m(9kHz – 10GHz), 0.5m by 0.5m(10 – 40GHz) , raised 0.8m(9kHz – 10GHz), 1.5m(10 - 40GHz) above the conducting ground plane. The Radiated Electric Field Strength has been measured in a Semi Anechoic Chamber with a ground plane. The height of the measuring antenna varied between 1 and 4m (frequency 9kHz – 30MHz: loop antenna was fixed height at 1.0m) 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 with the Test Receiver, or the Spectrum Analyzer. The measurements were made with the following detector function of the test receiver and the Spectrum analyzer (in linear mode).

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 30MHz	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Loop	Biconical	Logperiodic	Horn

Frequency	9kHz-150kHz	150kHz-30MHz	30MHz-1GHz	1GHz-231GHz	
Instrument used	Test Receiver	Test Receiver	Test Receiver	Spectrum Analyzer	
Detector	QP, AV	QP, AV	QP	PK	AV
IF Bandwidth	BW 200Hz	BW 9kHz	BW 120kHz	RBW: 1MHz VBW: 3MHz	RBW: 1MHz VBW: 10Hz
Test Distance	3m	3m	3m	3m (below 10GHz), 1m*1) (10 – 26.5GHz), 0.5m*2) (26.5 – 40GHz)	

*1) Distance Factor: $20 \times \log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$

*2) Distance Factor: $20 \times \log(3.0\text{m}/0.5\text{m}) = 15.6\text{dB}$

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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[Above 40GHz]

The test was performed based on "MILLIMETER WAVE TEST PROCEDURES".
The EUT was placed on a urethane platform, raised 1.5m above the conducting ground plane.
The measurements were performed on handheld method.

Set spectrum analyzer RBW, VBW, span, etc., to the proper values. Note these values. Enable two traces—one set to “clear write,” and the other set to “max hold.”

Begin hand-held measurements with the test antenna (horn) at a distance of 1 m from the EUT in a horizontally polarized position. Slowly adjust its position, entirely covering the plane 1 m from the EUT.

Observation of the two active traces on the spectrum analyzer will allow refined horn positioning at the point(s) of maximum field intensity. Repeat with the horn in a vertically polarized position. If the emission cannot be detected at 1 m, reduce the RBW to increase system sensitivity. Note the value. If the emission still cannot be detected, move the horn closer to the EUT, noting the distance at which a measurement is made.

Note the maximum level indicated on the spectrum analyzer. Adjust this level, if necessary, by the antenna gain, conversion loss of the external mixer and gain of LNA used, at the frequency under investigation. Calculate the field strength of the emission at the measurement distance from the Friis' transmission equation.

[Carrier measurement]

The carrier levels were confirmed at maximum direction of transmission. The maximum direction was searched under carefully since beam-widths are extremely narrow.

The carrier levels were measured in the far field. The distance of the far field was calculated from follow equation.

$$r = \frac{2D^2}{\lambda}$$

where

r is the distance from the radiating element of the EUT to the edge of the far field, in m
D is the largest dimension of both the radiating element and the test antenna (horn), in m
Lambda is the wavelength of the emission under investigation [300/f (MHz)], in m

Antenna	Frequency [GHz]	Lambda [mm]	Maximum Dimention			Far Field Boundary r [m]
			H [mm]	V [mm]	Diagonal D [m]	
Tx 1	77.0	3.9	14	14	0.020	0.3
Tx 2	77.0	3.9	16	14	0.021	0.3
Tx 3	77.0	3.9	14	14	0.020	0.3
Tx 4	77.0	3.9	16	14	0.021	0.3

Antenna aperture sizes, refer to exhibit “Theory of operation”.

The test was made on EUT at the normal use position.

The test results and limit are rounded off to one decimal place, so some differences might be observed.

Measurement range : 9k-231GHz
Test data : APPENDIX
Test result : Pass

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SECTION 6: Frequency Stability

Test Procedure

The external mixer was placed in side of the temperature chamber drain hole.

The power supply set to 100 % nominal setting, raise EUT operating temperature to 50 deg. C.

Record the frequency excursion of the EUT emission mask.

Repeat measurements at each 10 deg. C increment down to -20 deg. C.

Varied EUT power supply between 85 % and 115 % of nominal and record the frequency excursion of the EUT emission mask when temperature is 20 deg. C.

Emission mask was measured 26dB bandwidth.

Test data : APPENDIX
Test result : Pass

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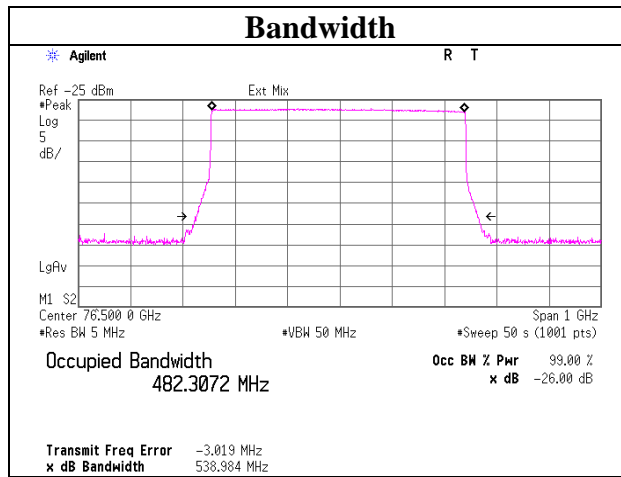
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APPENDIX 1: Data of EMI test

26dB and 99% Bandwidth

Test place Head Office EMC Lab. No.6 Shielded Room
 Report No. 10169391H
 Date 10/23/2013
 Temperature/ Humidity 25 deg. C / 40% RH
 Engineer Hironobu Ohnishi
 Mode Tx 76.5GHz

Frequency [GHz]	26dB Bandwidth [MHz]	99% Occupied Bandwidth [MHz]
76.500	538.984	482.307



*1) The measurement was performed with Peak detector, Max Hold since the duty cycle was not 100%.

Power Density

Test place : Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No. : 10169391H
Date : 10/21/2013
Temperature/ Humidity : 23 deg. C / 63% RH
Engineer : Hironobu Ohnishi
Mode : Tx 76.5GHz

Antenna	Frequency [GHz]	Measurement Distance [m]	Measured Power [dBm]	Rx Antenna Gain [dBi]	System Loss [dB]	LNA Gain [dB]	Free field Attenuation [dB]	Duty Factor *1) [dB]
Tx 1	76.4972	3	-74.53	22.33	41.92	0.00	79.66	-5.93
Tx 2	76.4972	3	-74.22	22.33	41.92	0.00	79.66	-5.93
Tx 3	76.4972	3	-74.61	22.33	41.92	0.00	79.66	-5.93
Tx 4	76.4972	3	-75.75	22.33	41.92	0.00	79.66	-5.93

*1) Since the measured duty was worse than that of the technical specification, the measured one was used for the calculation.

Antenna	Average Power (EIRP)		Peak Power (EIRP)	
	[dBm]	[mW]	[dBm]	[mW]
Tx 1	18.79	75.6	24.72	296.3
Tx 2	19.10	81.2	25.03	318.3
Tx 3	18.71	74.2	24.64	290.9
Tx 4	17.57	57.1	23.50	223.8

Calculating formula:

Free Field Attenuation = $10 * \log((4 * \pi * \text{Measurement Distance} / \text{Lambda})^2)$
Peak Power = Measured Power - Rx Antenna Gain + System Loss - LNA Gain + Free Field Attenuation
Average Power = Peak Power + Duty Factor

		Result		Limit *2) [dBm]	Margin [dB]
		[mW]	[dBm]		
Tx 1 + Tx 3	Average Power (EIRP)	149.8	21.76	50	28.24
	Peak Power (EIRP)	587.3	27.69	55	27.31
Tx 2 + Tx 4	Average Power (EIRP)	138.3	21.41	50	28.59
	Peak Power (EIRP)	542.0	27.34	55	27.66

*2) Average power density limit: 50dBm EIRP = 88uW/cm² at 3m
Peak power density limit: 55dBm EIRP = 279uW/cm² at 3m

Since combinations of Tx1 + Tx3 and Tx2 + Tx4 make the simultaneous transmission in the actual use, test result was obtained with each combination.

Duty value is the actual one of the product declared by the manufacturer.

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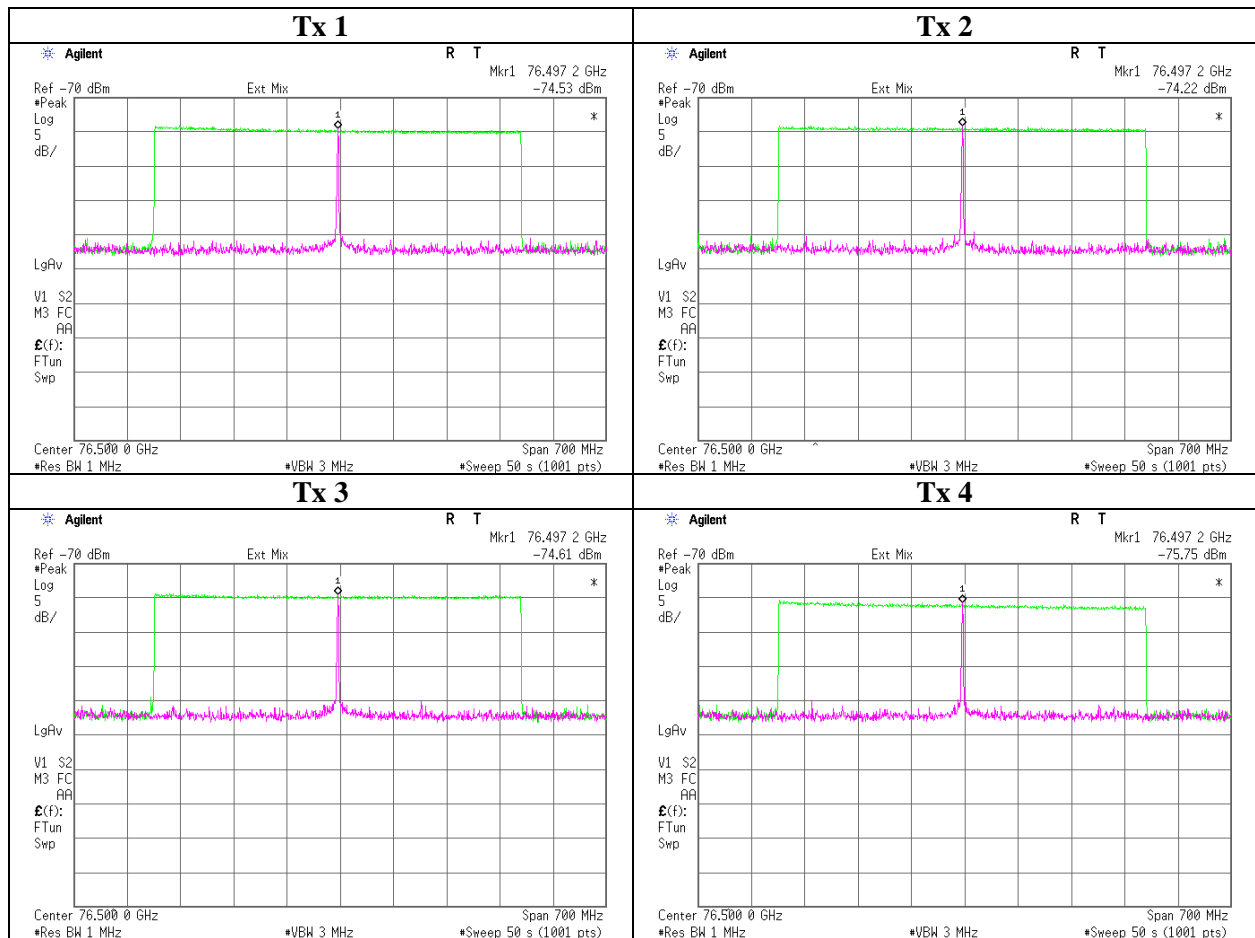
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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

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Power Density



Based on FCC KDB 200443, as the EUT can make the modulation disable, the peak power was measured in the non-modulation mode.

There is no level difference between non-modulation mode and modulation mode.

- Green trace shows modulation mode.
- Purple trace shows non-modulation mode.

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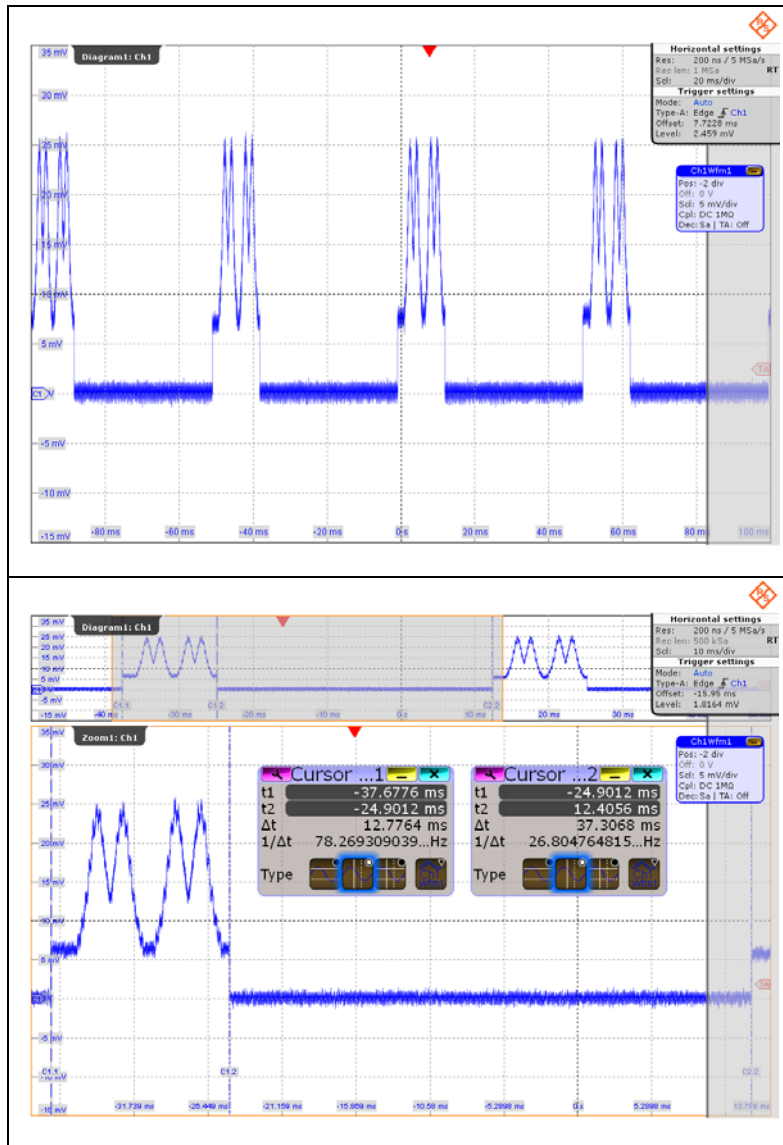
Power Density (Duty Factor)

Test place	Head Office EMC Lab. No.2 Semi Anechoic Chamber
Report No.	10169391H
Date	02/10/2014
Temperature/ Humidity	22 deg. C / 30% RH
Engineer	Hironobu Ohnishi
Mode	Tx 76.5GHz

Tx On time [ms]	Tx Off time [ms]	Tx On + Tx Off time [ms]	Duty [%]	Duty Factor [dB]
12.7764	37.3068	50.0832	25.51	-5.93

Calculating formula:

$$\text{Duty Factor} = 10 * \log(\text{Tx On time} / (\text{Tx On time} + \text{Tx Off time}))$$



Spurious Emission

Test place : Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No. : 10169391H
Date : 01/16/2014
Temperature/ Humidity : 24 deg. C / 30% RH
Engineer : Hironobu Ohnishi
Mode : Tx 76.5GHz

Polarity	Frequency [MHz]	Detector	Reading [dBuV]	Ant.Fac. [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	48.000	QP	31.8	11.6	7.4	32.2	18.6	40.0	21.4	
Hori	64.000	QP	41.2	7.4	7.6	32.2	24.0	40.0	16.0	
Hori	96.011	QP	36.5	9.5	8.1	32.0	22.1	43.5	21.4	
Hori	166.373	QP	35.3	15.7	8.8	31.9	27.9	43.5	15.6	
Hori	191.994	QP	34.5	16.4	9.0	31.9	28.0	43.5	15.5	
Hori	256.004	QP	38.7	17.6	9.6	31.9	34.0	46.0	12.0	
Hori	400.000	QP	22.4	17.5	10.6	32.0	18.5	46.0	27.5	
Hori	431.676	QP	30.8	18.1	10.8	32.0	27.7	46.0	18.3	
Hori	38248.530	PK	46.5	44.1	-8.7	20.9	61.0	73.9	12.9	
Hori	38248.530	AV	31.5	44.1	-8.7	20.9	46.0	53.9	7.9	
Vert	48.000	QP	49.3	11.6	7.4	32.2	36.1	40.0	3.9	
Vert	64.000	QP	54.4	7.4	7.6	32.2	37.2	40.0	2.8	
Vert	96.011	QP	45.4	9.5	8.1	32.0	31.0	43.5	12.5	
Vert	166.373	QP	37.3	15.7	8.8	31.9	29.9	43.5	13.6	
Vert	191.994	QP	38.7	16.4	9.0	31.9	32.2	43.5	11.3	
Vert	256.004	QP	36.4	17.6	9.6	31.9	31.7	46.0	14.3	
Vert	400.000	QP	22.4	17.5	10.6	32.0	18.5	46.0	27.5	
Vert	431.676	QP	32.3	18.1	10.8	32.0	29.2	46.0	16.8	
Vert	38248.530	PK	45.8	44.1	-8.7	20.9	60.3	73.9	13.6	
Vert	38248.530	AV	31.5	44.1	-8.7	20.9	46.0	53.9	7.9	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter-Distance factor(above 10GHz)) - Gain(Amplifier)

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

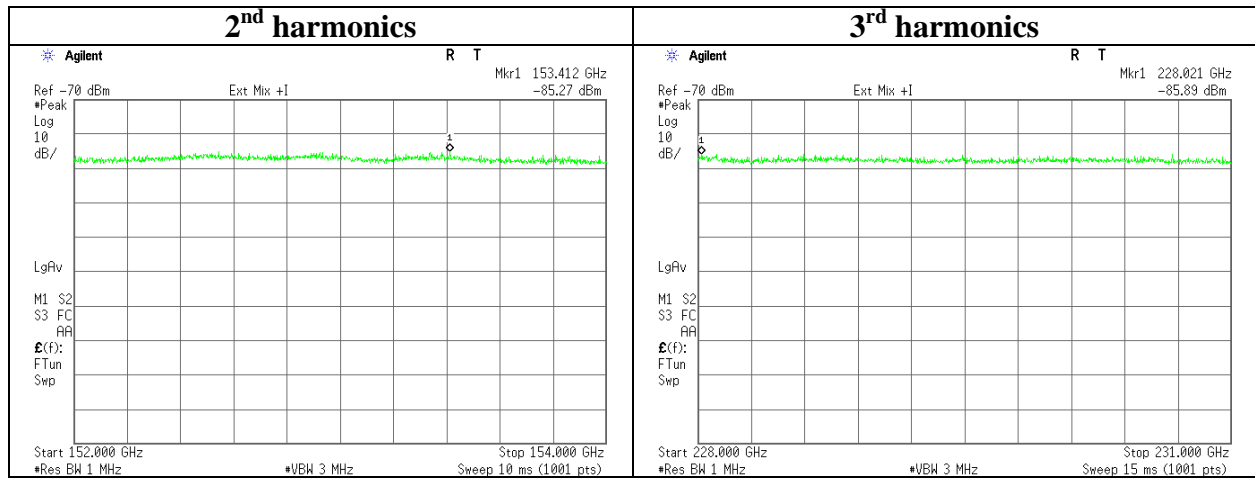
Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB
 26.5GHz-40GHz 20log(3.0m/0.5m)=15.6dB

Spurious Emission (above 40GHz)

Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber		
Report No.	10169391H		
Date	10/21/2013	01/16/2014	01/17/2014
Temperature/ Humidity	23 deg. C / 63% RH	24 deg. C / 30% RH	24 deg. C / 32% RH
Engineer	Hironobu Ohnishi	Hironobu Ohnishi	Hironobu Ohnishi
	(50-170GHz)	(40-50GHz)	(170-231GHz)
Mode	Tx 76.5GHz		

* The peak density is less than the average limit.
 There is no spurious emission from 40GHz to 231GHz except for operating band.

The following shows the measurement results of the harmonics.



Frequency Stability

Test place : Head Office EMC Lab. No.11 Measurement room
Report No. : 10169391H
Date : 01/17/2014
Temperature/ Humidity : 24 deg. C / 25% RH
Engineer : Hironobu Ohnishi
Mode : Tx 76.5GHz

Test Condition		Center Frequency [GHz]	Frequency Error [MHz]	26dB Bandwidth [MHz]	Lower Frequency [GHz]	Upper Frequency [GHz]	Remarks
Temperature [deg. C]	Power Supply [V]						
50	24.0	76.500	-3.356	538.055	76.228	76.766	
40	24.0	76.500	-3.101	535.477	76.229	76.765	
30	24.0	76.500	-2.734	535.315	76.230	76.765	
20	24.0	76.500	-2.423	539.724	76.228	76.767	
10	24.0	76.500	-2.084	540.734	76.228	76.768	
0	24.0	76.500	-1.612	543.101	76.227	76.770	
-10	24.0	76.500	-1.136	543.123	76.227	76.770	
-20	24.0	76.500	-0.652	544.440	76.227	76.772	
20	10.2	76.500	-2.367	538.403	76.228	76.767	85% of 12V
20	27.6	76.500	-2.411	538.883	76.228	76.767	115% of 24V
20	8.0	76.500	-2.422	538.823	76.228	76.767	lower operating voltage
20	32.0	76.500	-2.424	538.616	76.228	76.767	upper operating voltage

Calculating formula:

$$\begin{aligned} \text{Lower Frequency} &= \text{Center Frequency} + \text{Frequency Error} - 26\text{dB Bandwidth} / 2 \\ \text{Upper Frequency} &= \text{Center Frequency} + \text{Frequency Error} + 26\text{dB Bandwidth} / 2 \end{aligned}$$

UL Japan, Inc.

Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124

APPENDIX 2: Test instruments

EMI test equipment (1/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MAEC-04	Semi Anechoic Chamber(NSA)	TDK	Semi Anechoic Chamber 3m	DA-10005	RE	2013/02/28 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	-	RE	2013/02/26 * 12
MJM-09	Measure	KDS	E19-55	-	RE	-
MLDM-04	Digital laser distance meter	BOSCH	DLE 50	781422774	RE	2013/06/26 * 36
MSA-04	Spectrum Analyzer	Agilent	E4448A	US44300523	RE	2013/11/25 * 12
MHA-09	Horn Antenna	WiseWave	ARH1523-02	10766-01	RE	2013/10/25 * 12
MMX-01	Preselected Millimeter Mixer	Agilent	11974V-E01	3001A00412	RE	2013/06/06 * 12
MHA-10	Horn Antenna	WiseWave	ARH1523-02	10766-02	RE	2013/10/25 * 12
MMX-02	Harmonic Mixer	Agilent	11970W	2521 A01909	RE	2013/06/06 * 12
MCC-135	Microwave Cable	HUBER+SUHNER	SUCOFLEX102	37511/2	RE	2013/08/22 * 12
MCC-136	Microwave Cable	HUBER+SUHNER	SUCOFLEX102	37512/2	RE	2013/08/22 * 12
MHF-15	High Pass Filter 81-110GHz	VCSS	HPF-10-778030	201	RE	2013/08/02 * 12
MHA-24	Horn Antenna	Custom Microwave Inc.	HO6R	-	RE	2013/09/26 * 12
MMX-03	Harmonic Mixer	OML Inc.	M06HWD	D100709-1	RE	2013/09/27 * 12
MDPLX-01	Diplexer	OML Inc.	DPL26	-	RE	2013/09/26 * 12
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE	-
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2013/11/24 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2013/11/24 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2013/06/18 * 12
MAT-68	Attenuator	Anritsu	MP721B	6200961025	RE	2013/11/26 * 12
MPA-14	Pre Amplifier	SONOMA INSTRUMENT	310	260833	RE	2013/03/12 * 12
MHA-21	Horn Antenna 1-18GHz	Schwarzbeck	BBHA9120D	9120D-557	RE	2013/08/12 * 12
MCC-141	Microwave Cable	Junkosha	MWX221	1305S002R(1m) / 1204S062(5m)	RE	2013/05/28 * 12
MPA-12	MicroWave System Amplifier	Agilent	83017A	MY39500780	RE	2013/03/19 * 12
MHA-17	Horn Antenna 15-40GHz	Schwarzbeck	BBHA9170	BBHA917030 7	RE	2013/06/30 * 12
MHA-04	Horn Antenna 26.5-40GHz	EMCO	3160-10	1140	RE	2013/11/25 * 12
MCC-140	Microwave Cable	Junkosha	J12J101596-00	JAN-31-12-001	RE	2013/02/26 * 12

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Head Office EMC Lab.

4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

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Facsimile : +81 596 24 8124

EMI test equipment (2/2)

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
MPA-03	Microwave System Power Amplifier	Agilent	83050A	3950M00205	RE	2013/06/20 * 12
MHA-07	Horn Antenna	Custom	HO22R	10766-01	RE	2013/10/25 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2013/02/22 * 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-113	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(5m)/421-010(1m)/sucoform141-PE(1m)/RFM-E121(Switcher)	-/04178	RE	2013/07/23 * 12
MTR-01	Test Receiver	Rohde & Schwarz	ESI40	100084	RE	2013/11/12 * 12
MHA-27	Horn Antenna	Custom Microwave Inc.	HO4R	-	RE	2013/09/26 * 12
MMX-04	Harmonic Mixer	OML Inc.	M04HWD	Y100709-1	RE	2013/09/27 * 12
MCH-06	Temperature and Humidity Chamber	Tabai Espec	PL-1KT	14007630	RE	2013/04/25 * 12
MDT-03	DETECTOR	Agilent	8473C	1822A 05145	RE	Pre Check
MDO-07	Digital Oscilloscope	Rohde & Schwarz	RTO1004	200354	RE	2013/07/30 * 12

The expiration date of the calibration is the end of the expired month.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

[Below 40GHz]

All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

[Above 40GHz]

Acceptance criteria for untraceable equipment was formulated according to ISO/IEC 17025 5.6.2.2.2, and the regular inspection was performed based on it annually.

For 40-110GHz, power sensor is calibrated by manufacturer, and the measured calibration data is used as in-house reference. The calibration data by manufacturer is checked for acceptance by a calorie meter except for some frequency bands.

For above 110GHz, output level of millimeter wave source module is used as the reference, and inspection by the calorie meter is performed.

Electric power is checked with the calorie meter by measuring resistance and voltage of reference resistor.

**Test Item: CE: Conducted Emission
RE: Radiated Emission**

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4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN

Telephone : +81 596 24 8999

Facsimile : +81 596 24 8124