



Test report No. : 32CE0244-HO-01-B-R2
Page : 1 of 41
Issued date : August 5, 2013
Revised date : August 8, 2013
FCC ID : KSNAD1321-10MW

RADIO TEST REPORT

Test Report No. : 32CE0244-HO-01-B-R2

Applicant : A&D Company Limited
Type of Equipment : Wireless Module
Model No. : AD1321-10MW
FCC ID : KSNAD1321-10MW
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.
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6. This report is a revised version of 32CE0244-HO-01-B-R1. 32CE0244-HO-01-B-R1 is replaced with this report.

Date of test: June 15 to July 25, 2013

Representative test engineer:

T. Nakagawa

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Engineer of WiSE Japan,
UL Verification Service

Approved by:

M. Nishiyama
Masanori Nishiyama
Manager of WiSE Japan,
UL Verification Service



NVLAP LAB CODE: 200572-0

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

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13-EM-F0429

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SECTION 1: Customer information

Company Name	:	A&D Company Limited
Address	:	1-243 asahi Kitamoto-city Saitama-prefectiure, 364-8585 Japan
Telephone Number	:	+81-48-593-1342
Facsimile Number	:	+81-48-593-1117
Contact Person	:	Onodera Fukushi

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

2.1 Identification of E.U.T.

Type of Equipment	:	Wireless Module
Model No.	:	AD1321-10MW
Serial No.	:	Refer to Section 4, Clause 4.2
Rating	:	DC3.0V
Receipt Date of Sample	:	May 15, 2013
Country of Mass-production	:	Japan
Condition of EUT	:	Production model
Modification of EUT	:	No Modification by the test lab

2.2 Product Description

This Module is using ZigBeePRO protocol, on general-purpose, in the ISM band of the 2.4GHz zone at 10mW. It has an external antenna terminal. It can be controlled by an AT command and sent data by SPI protocol which is serial communication as I/O.

General Specification

Clock frequency(ies) in the system	:	32MHz
------------------------------------	---	-------

Radio Specification

Radio Type	:	Transceiver
Frequency of Operation	:	2405-2480MHz
Modulation	:	Offset QPSK
Power Supply	:	DC1.8V
Type of Antenna	:	$\lambda/4$ whip Antenna 12mmPatch Antenna
Antenna Gain	:	2.14dBi ($\lambda/4$ whip Antenna) 2.00dBi (12mmPatch Antenna)
Antenna connector type	:	U.FL

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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 June 11, 2013 and effective July 11, 2013

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928MHz,
2400-2483.5MHz, and 5725-5850MHz

* The revision on June 11, 2013 does not affect the test specification applied to the EUT.

* The EUT complies with FCC Part 15 Subpart B: 2013, final revised on June 11, 2013 and effective July 11, 2013.

3.2 Procedures and results

Item	Test Procedure	Specification	Worst margin	Results	Remarks
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	[QP] 22.7dB 8.27837MHz, N [AV] 17.4dB 8.27837MHz, N	Complied	Conducted
6dB Bandwidth	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on April 9, 2013)" ----- IC: RSS-Gen 4.6.2	FCC: Section 15.247(a)(2) ----- IC: RSS-210 A8.2(a)	See data.	Complied	Conducted
Maximum Peak Output Power	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on April 9, 2013)" ----- IC: RSS-Gen 4.8	FCC: Section 15.247(b)(3) ----- IC: RSS-210 A8.4(4)		Complied	Conducted
Power Density	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on April 9, 2013)" ----- IC: -	FCC: Section 15.247 (e) ----- IC: RSS-210 A8.2(b)		Complied	Conducted
Spurious Emission Restricted Band Edges	FCC: "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247(issued on April 9, 2013)" ----- IC: RSS-Gen 4.9	FCC: Section15.247(d) ----- IC: RSS-210 A8.5 RSS-Gen 7.2.3	1.6dB 2483.50MHz, PK, Vert.	Complied	Conducted/ Radiated

Note: UL Japan, Inc.'s EMI Work Procedures No. 13-EM-W0420 and 13-EM-W0422.

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

FCC 15.31 (e)

The RF Module has its own regulator.

The RF Module is constantly provided voltage (DC1.8V) through the regulator regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203/212 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

3.3 Addition to standard

Item	Test Procedure	Specification	Worst margin	Results	Remarks
99% Occupied Bandwidth	IC: RSS-Gen 4.6.1	IC: RSS-Gen 4.6.1	N/A	-	Conducted

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)	Conducted emission (+dB)
	150kHz-30MHz
No.1	3.5dB
No.2	3.6dB
No.3	3.6dB
No.4	3.6dB

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	4.3dB	5.0dB	5.1dB	4.9dB	5.8dB	4.4dB	4.3dB
No.2	4.3dB	5.2dB	5.1dB	5.0dB	5.7dB	4.3dB	4.2dB
No.3	4.6dB	5.0dB	5.1dB	5.0dB	5.7dB	4.5dB	4.2dB
No.4	4.8dB	5.2dB	5.0dB	5.0dB	5.7dB	5.2dB	4.2dB

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

Power meter (+dB)	
Below 1GHz	Above 1GHz
0.7dB	1.5dB

Antenna terminal conducted emission and Power density (+dB)			Antenna terminal conducted emission (+dB)		Channel power (+dB)
Below 1GHz	1GHz-3GHz	3GHz-18GHz	18GHz-26.5GHz	26.5GHz-40GHz	
1.5dB	1.7dB	2.8dB	2.8dB	2.9dB	2.6dB

Conducted Emission test

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

Radiated emission test(3m)

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

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3.5 Test Location

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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	4.75 x 5.4 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	-	-	8.8 x 4.6 x 2.8m	2.4 x 2.4m	-
No.11 measurement room	-	-	3.1 x 3.4 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.

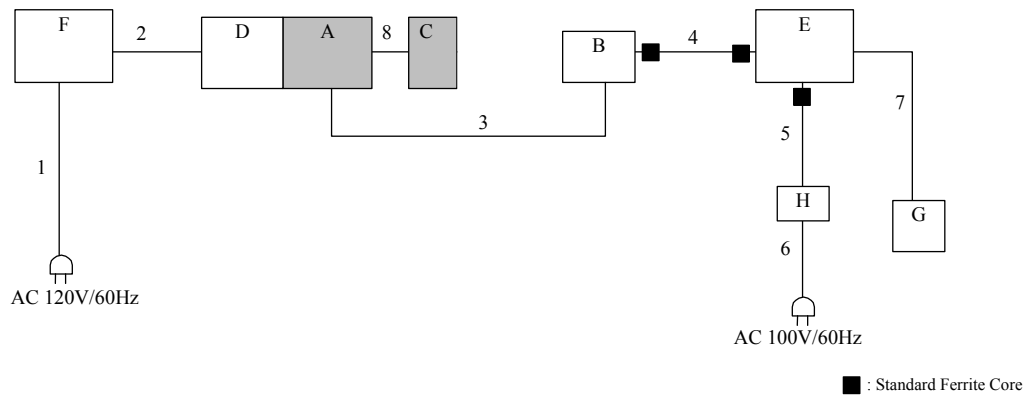
SECTION 4: Operation of E.U.T. during testing

4.1 Operating Mode(s)

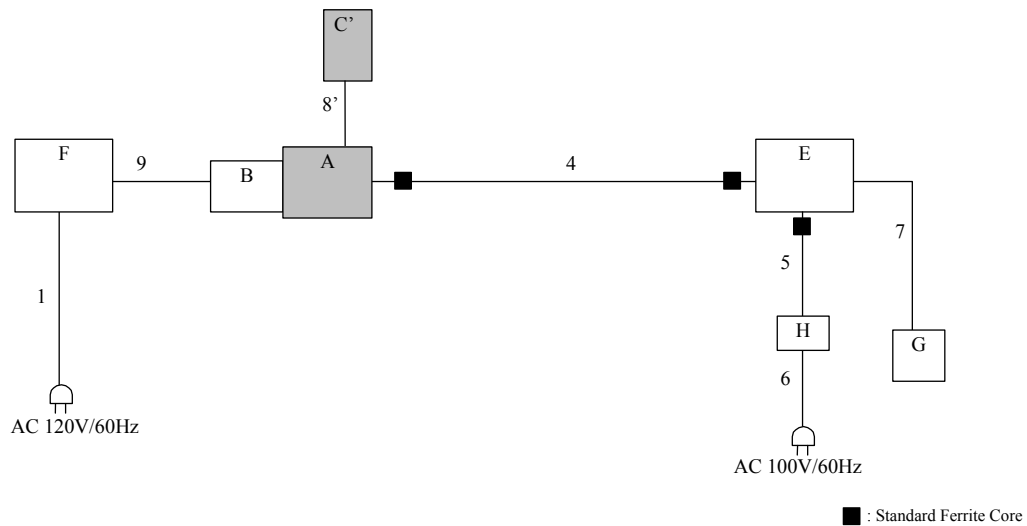
Mode	Tested Frequency
Transmitting mode (Tx mode)	2405MHz 2440MHz 2480MHz
*Power of the EUT was set by the software as follows; Power settings: [2405MHz] Lr253 : 0C, Lr274 : 81, ATT : -8dB Lr203 : C0 ATT : -5.3dB TOTAL_ATT : -13.3dB [2440MHz] Lr253 : 0C, Lr274 : 81, ATT : -8dB Lr203 : A8 ATT : -4.4dB TOTAL_ATT : -12.4dB [2480MHz] Lr253 : 0C, Lr274 : 81, ATT : -8dB Lr203 : 90 ATT : -3.6dB TOTAL_ATT : -11.6dB Software: Hardware EMI Test program 2007 skyley Network 2009 A&D *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.	

4.2 Configuration and peripherals

[Conducted Emission test (12mmPatch Antenna)]

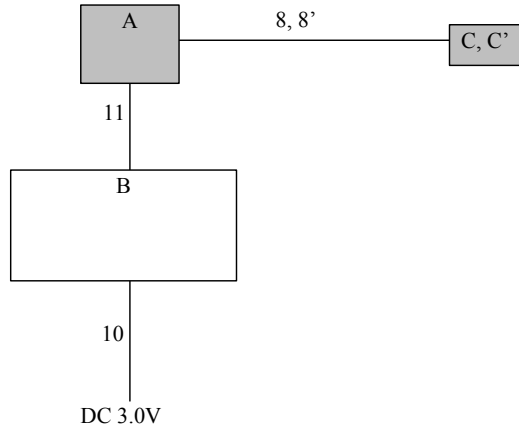


[Conducted Emission test (Lambda / 4 whip Antenna)]



* Cabling and setup(s) were taken into consideration and test data was taken under worse case conditions.

[Radiated Emission and Antenna Terminal Conducted tests]



* 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	Wireless Module	AD1321-10MW	00-09-1F00-1C-D7	A&D Company Limited	EUT
B	Jig board	-	-	A&D Company Limited	-
C	12mmPatch Antenna	CABPB1240A	-	TDK	EUT
C'	Lambda / 4 whip Antenna	C234-RF-001	-	SHENZHEN SHI EXCELLENCE DEVELOPMENT WORLD CO. LTD	EUT
D	Wrench machine	UDBP-TA40(P)	MZA047TA40	URYU SEISAKU, LTD.	-
E	Laptop PC	PP22L	JX189A00	DELL	-
F	DC Power Supply	PMC35-2A	13090501	KIKUSUI	-
G	Mouse	MOC5UO	050370V	DELL	-
H	AC Adaptor	LA90PS0-00	CN-0DF266 71615-841-68ED	DELL	-

List of cables used

No.	Name	Length (m)	Shield		Remarks
			Cable	Connector	
1	AC Cable	2.2	Unshielded	Unshielded	-
2	DC Cable	0.6	Unshielded	Unshielded	-
3	Signal Cable	2.7	Unshielded	Unshielded	-
4	USB Cable	2.9	Shielded	Shielded	-
5	DC Cable	1.7	Unshielded	Unshielded	-
6	AC Cable	0.8	Unshielded	Unshielded	-
7	Mouse Cable	1.8	Shielded	Shielded	-
8	Antenna Cable	0.2	Unshielded	Unshielded	-
8'	Antenna Cable	0.1	Unshielded	Unshielded	-
9	DC Cable	0.3	Unshielded	Unshielded	-
10	DC Cable	1.5	Unshielded	Unshielded	-
11	Signal and Power supply Cable	0.1	Unshielded	Unshielded	-

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, raised 0.8m above the conducting ground plane.

The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

For the tests on EUT with other peripherals (as a whole system)

I/O cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. All unused 50ohm connectors of the LISN(AMN) were resistivity terminated in 50ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber.

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

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

Detector	: QP and CISPR AV
Measurement range	: 0.15-30MHz
Test data	: APPENDIX
Test result	: Pass

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SECTION 6: Radiated Spurious Emission

Test Procedure

The Radiated Electric Field Strength has been measured on Semi anechoic chamber with a ground plane and at a distance of 3m.

The measuring antenna height was varied between 1 and 4m 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 30MHz	30MHz to 300MHz	300MHz to 1GHz	Above 1GHz
Antenna Type	Loop	Biconical	Logperiodic	Horn

In any 100kHz bandwidth outside the restricted band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

20dBc was applied to the frequency over the limit of FCC 15.209 / Table 5 of RSS-Gen 7.2.5(IC) and outside the restricted band of FCC15.205 / Table 3 of RSS-Gen 7.2.2 (IC).

Frequency	Below 1GHz	Above 1GHz	20dBc
Instrument used	Test Receiver	Spectrum Analyzer	Spectrum Analyzer
Detector	QP	PK and PK with Duty factor	PK
IF Bandwidth	BW 120kHz(T/R)	RBW: 1MHz VBW: 3MHz	RBW: 100kHz VBW: 300kHz (S/A)
Test Distance	3m	3m (below 10GHz), 1m *1) (above 10GHz)	3m (below 10GHz), 1m *1) (above 10GHz)

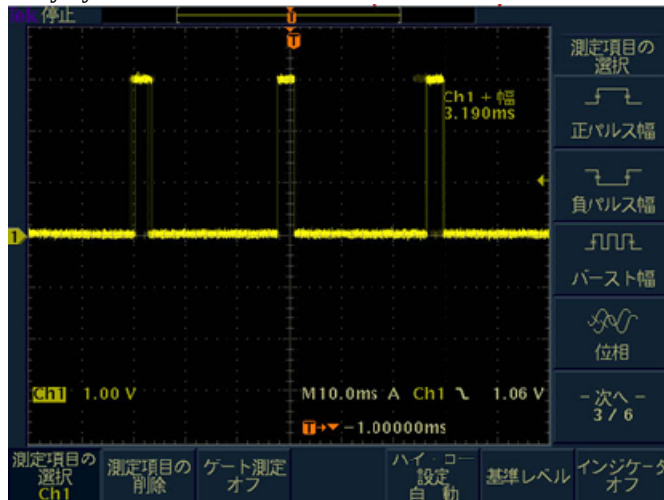
*1) Distance Factor: $20 \times \log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of Wireless Module and two Antennas 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 : 30M-26.5GHz
Test data : APPENDIX
Test result : Pass

Duty cycle correction factor



One pulse is 3.190msec

Pulse train during 100msec is 9.57msec ($3.190 \times 3 = 9.57\text{msec}$)

Only 3 pulses appear at most in 100 msec due to product specification. (Waiting time after 3 pulses' output: 90.43msec)

§12.1 Radiated emission measurements of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (Issued on April 9, 2013)" refers to ANSI 63.10, so in this report, Radiated emission was conducted based on § 13.1.4.2 Final radiated emission measurements of ANSI C63.4: 2003 which is similar to §7.5 Procedure of ANSI 63.10 -2009 for determining the average value of pulsed emissions of ANSI 63.10.

Duty cycle correction factor is $20 \log (9.57/100) = -20.38 \text{ dB}$

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SECTION 7: Antenna Terminal Conducted Tests

Test Procedure

The tests were made with below setting connected to the antenna port.

Test	Span	RBW	VBW	Sweep time	Detector	Trace	Instrument used
6dB Bandwidth	10MHz	100kHz	300kHz	Auto	Peak	Max Hold	Spectrum Analyzer
99% Occupied Bandwidth	Enough width to display 20dB Bandwidth	1 to 3% of Span	Three times of RBW	Auto	Sample	Clear write	Spectrum Analyzer
Maximum Peak Output Power	-	-	-	Auto	Peak/ Average *4)	-	Power Meter (Sensor: 50MHz BW)
Peak Power Density	3MHz	30kHz	100kHz	3.2m sec	Peak	Max Hold	Spectrum Analyzer *1) *2)
Conducted Spurious Emission *3)	9kHz to 150kHz	200Hz	620Hz	Auto	Peak	Max Hold	Spectrum Analyzer
	150kHz to 30MHz	9.1kHz	27kHz				

*1) Section 10.2 Method PKPSD (peak PSD) of "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 (Issued on April 9, 2013)".

*2) The test was not performed at RBW:3kHz however the measurement is to be performed with RBW:3kHz in the regulation, because, the measurement value with RBW:3kHz is less than the value of RBW:30kHz and the test data met the limit with RBW:30kHz.

*3) In the frequency range below 30MHz, RBW was narrowed to separate the noise contents. Then, wide-band noise near the limit was checked separately, however the noise was not detected as shown in the chart.(9kHz-150kHz:RBW=200Hz, 150kHz-30MHz:RBW=9.1kHz)

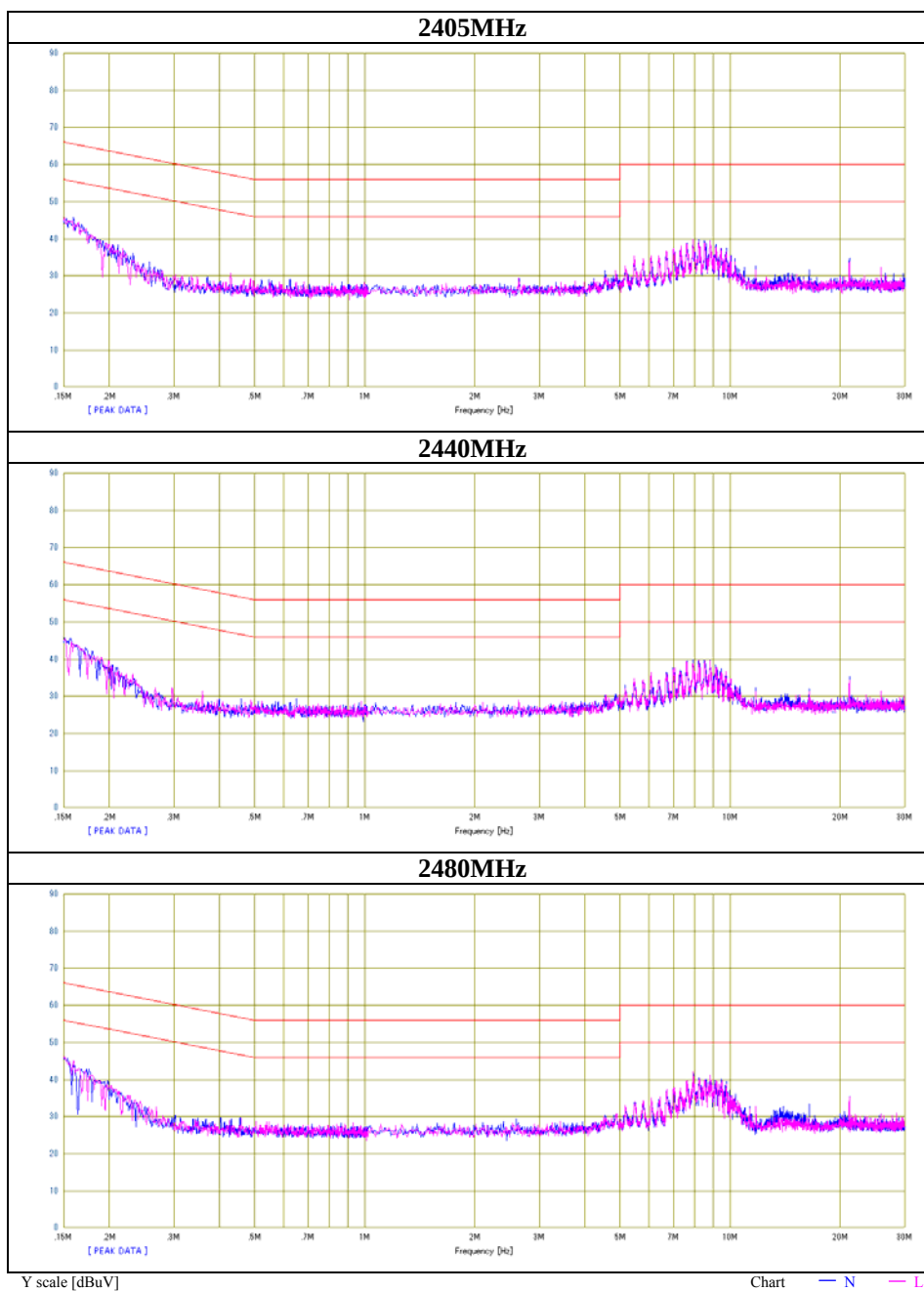
*4) Testing using an average detector was performed in order to confirm that the output power of the EUT met the exclusion limits stated in FCC Part 2 Section 2.1093 and the EUT was exempt from RF exposure SAR evaluation.

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

Test data : APPENDIX
Test result : Pass

Conducted Emission 12mmPatch Antenna

Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No.	32CE0244-HO-01
Date	07/25/2013
Temperature/ Humidity	25 deg. C / 61% RH
Engineer	Keisuke Kawamura
Mode	Tx



Conducted Emission
Lambda / 4 whip Antenna

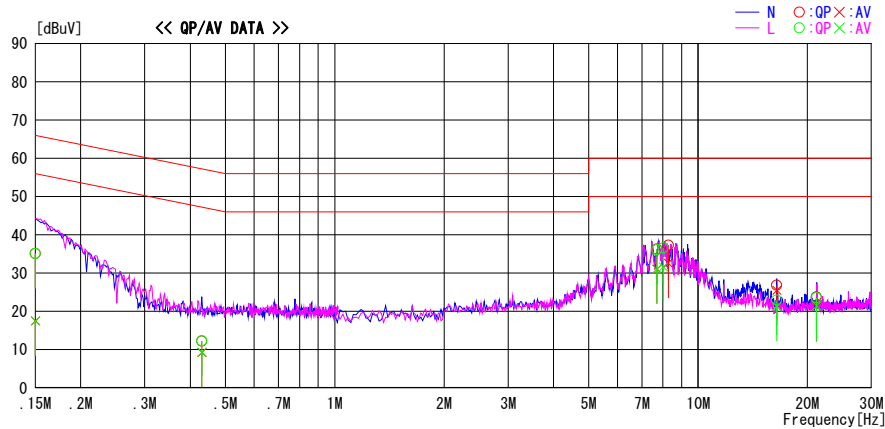
DATA OF CONDUCTED EMISSION TEST

UL Japan, Inc. Head Office EMC Lab. No. 4 Semi Anechoic Chamber
Date : 2013/07/16

Report No. : 32CE0244-HO-01
Power : DC 3.0V
Temp./Humi. : 23deg.C. / 61%
Engineer : Tomohisa Nakagawa

Mode / Remarks : Tx 2480MHz

LIMIT : FCC15.207 QP
FCC15.207 AV

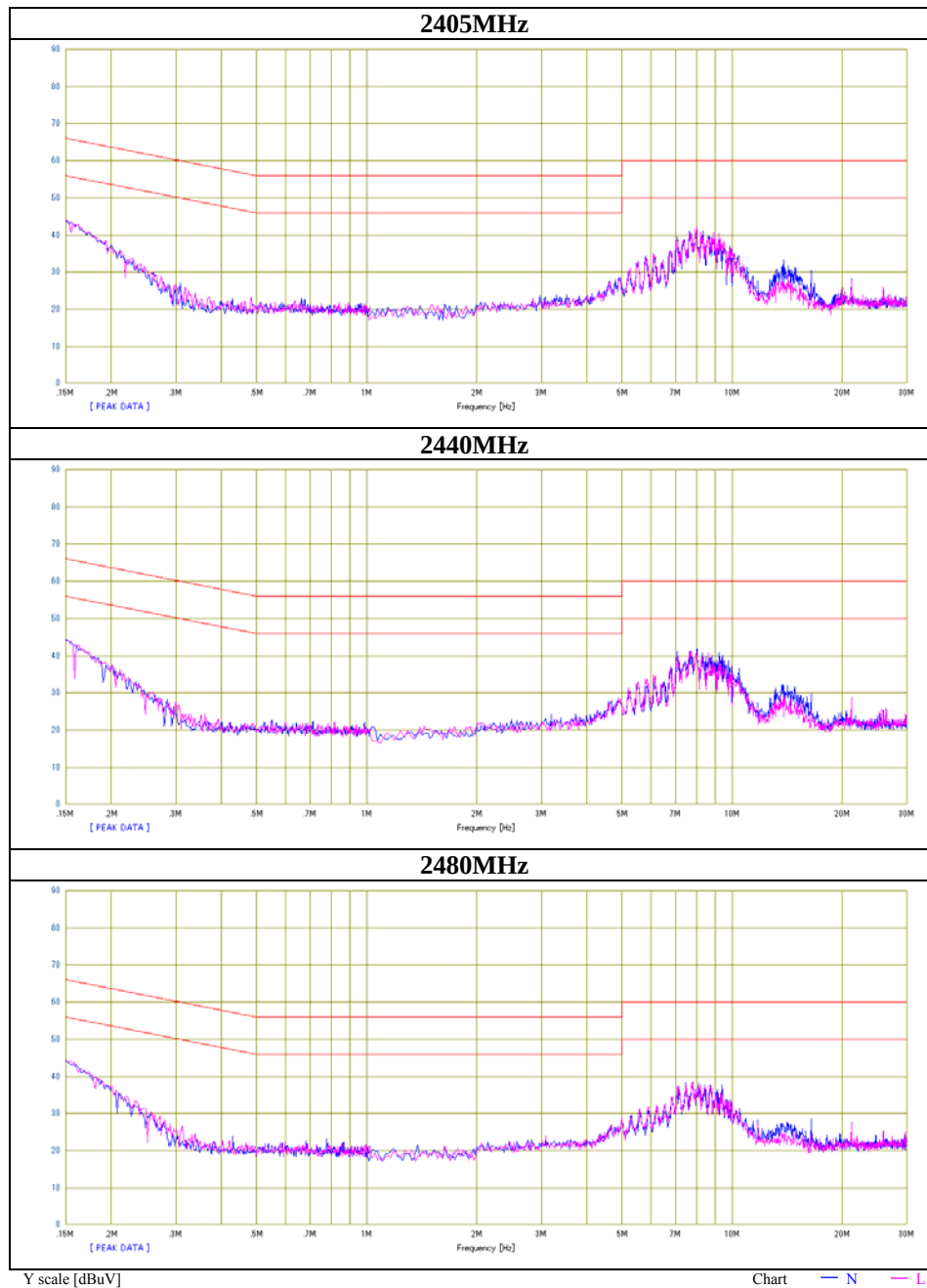


Frequency	Reading Level		Corr.	Results		Limit		Margin		Phase	Comment
	QP	AV		QP	AV	QP	AV	QP	AV		
[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
0.15000	21.9	4.3	13.2	35.1	17.5	66.0	56.0	30.9	38.5	N	
0.43070	-1.1	-4.1	13.3	12.2	9.2	57.2	47.2	45.0	38.0	N	
7.70299	22.7	17.5	13.6	36.3	31.1	60.0	50.0	23.7	18.9	N	
8.27837	23.7	19.0	13.6	37.3	32.6	60.0	50.0	22.7	17.4	N	
16.46189	12.9	11.6	13.9	26.8	25.5	60.0	50.0	33.2	24.5	N	
21.17086	9.7	7.2	14.0	23.7	21.2	60.0	50.0	36.3	28.8	N	
0.15000	21.9	4.3	13.2	35.1	17.5	66.0	56.0	30.9	38.5	L	
0.43070	-1.0	-4.0	13.3	12.3	9.3	57.2	47.2	44.9	37.9	L	
7.69939	22.5	17.4	13.6	36.1	31.0	60.0	50.0	23.9	19.0	L	
8.01599	23.0	18.0	13.6	36.6	31.6	60.0	50.0	23.4	18.4	L	
16.46419	9.0	7.4	13.9	22.9	21.3	60.0	50.0	37.1	28.7	L	
21.17046	9.6	7.4	14.0	23.6	21.4	60.0	50.0	36.4	28.6	L	

CHART: WITH FACTOR, Peak hold data. CALCULATION: RESULT=READING+C.F (LISN LOSS+ATT LOSS +CABLE LOSS)
Except for the above table : adequate margin data below the limits.

Conducted Emission
Lambda / 4 whip Antenna

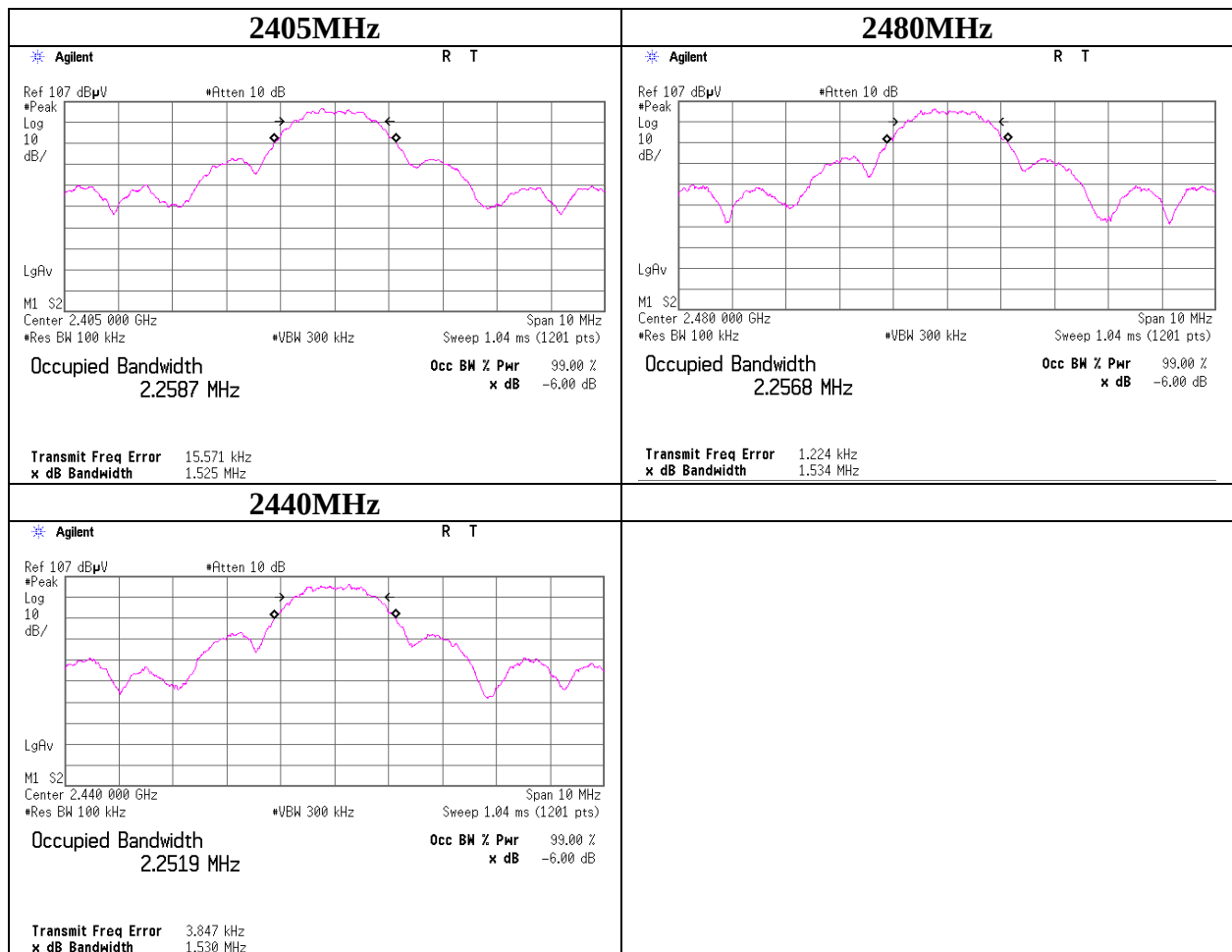
Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No.	32CE0244-HO-01
Date	07/16/2013
Temperature/ Humidity	23 deg. C / 61% RH
Engineer	Tomohisa Nakagawa
Mode	Tx



6dB Bandwidth

Test place	Head Office EMC Lab. No.2 semi-anechoic chamber
Report No.	32CE0244-HO-01
Date	06/18/2013
Temperature/ Humidity	22 deg. C / 67% RH
Engineer	Tomohisa Nakagawa
Mode	Tx

Frequency [MHz]	6dB Bandwidth [MHz]	Limit [kHz]
2405	1.525	>500
2440	1.530	>500
2480	1.534	>500



Maximum Peak Output Power

Test place Head Office EMC Lab. No.2 semi-anechoic chamber
Report No. 32CE0244-HO-01
Date 06/18/2013
Temperature/ Humidity 22 deg. C / 67% RH
Engineer Tomohisa Nakagawa
Mode Tx

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2405	-0.68	0.00	10.01	9.33	8.57	30.00	1000	20.67
2440	-0.67	0.00	10.01	9.34	8.59	30.00	1000	20.66
2480	-0.65	0.00	10.01	9.36	8.63	30.00	1000	20.64

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

Average Output Power (Reference data for MPE)

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result		Limit		Margin [dB]
				[dBm]	[mW]	[dBm]	[mW]	
2405	-1.52	0.00	10.01	8.49	7.06	30.00	1000	21.51
2440	-1.51	0.00	10.01	8.50	7.08	30.00	1000	21.50
2480	-1.53	0.00	10.01	8.48	7.05	30.00	1000	21.52

Sample Calculation:

Result = Reading + Cable Loss + Attenuator

Radiated Spurious Emission 12mmPatch Antenna

Test place : Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No. : 32CE0244-HO-01
Date : 06/15/2013 06/16/2013
Temperature/ Humidity : 23 deg. C / 68% RH 23 deg. C / 57% RH
Engineer : Tomohisa Nakagawa Tomohisa Nakagawa
(1-10GHz) Other frequencies
Mode : Tx 2405MHz 12mmPatch Antenna

PK or QP

Polarity [Hori/Ver]	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
Hori	60.15	QP	22.8	8.2	7.6	32.2	-	6.4	40.0	33.6	
Hori	80.00	QP	22.8	6.7	7.8	32.1	-	5.2	40.0	34.8	
Hori	115.00	QP	22.5	12.8	8.3	31.9	-	11.7	43.5	31.8	
Hori	125.00	QP	22.5	13.8	8.4	31.9	-	12.8	43.5	30.7	
Hori	250.00	QP	22.2	17.7	9.5	31.9	-	17.5	46.0	28.5	
Hori	384.00	QP	22.0	17.6	10.4	32.0	-	18.0	46.0	28.0	
Hori	2373.47	PK	50.6	27.5	2.6	32.4	-	48.3	73.9	25.6	
Hori	2390.00	PK	52.3	27.5	2.6	32.4	-	50.0	73.9	23.9	
Hori	4810.00	PK	56.8	31.3	4.7	31.6	-	61.2	73.9	12.7	
Hori	7215.00	PK	55.1	35.8	5.6	32.7	-	63.8	73.9	10.1	
Hori	9620.00	PK	47.4	38.3	6.4	33.3	-	58.8	73.9	15.1	
Hori	12025.00	PK	49.9	39.9	-1.9	33.4	-	54.5	73.9	19.4	
Vert	60.16	QP	32.4	8.2	7.6	32.2	-	16.0	40.0	24.0	
Vert	80.00	QP	33.5	6.7	7.8	32.1	-	15.9	40.0	24.1	
Vert	115.00	QP	22.5	12.8	8.3	31.9	-	11.7	43.5	31.8	
Vert	125.00	QP	22.6	13.8	8.4	31.9	-	12.9	43.5	30.6	
Vert	250.00	QP	22.2	17.7	9.5	31.9	-	17.5	46.0	28.5	
Vert	384.00	QP	21.9	17.6	10.4	32.0	-	17.9	46.0	28.1	
Vert	2373.47	PK	51.7	27.5	2.6	32.4	-	49.4	73.9	24.5	
Vert	2390.00	PK	52.8	27.5	2.6	32.4	-	50.5	73.9	23.4	
Vert	4810.00	PK	49.5	31.3	4.7	31.6	-	53.9	73.9	20.0	
Vert	7215.00	PK	52.9	35.8	5.6	32.7	-	61.6	73.9	12.3	
Vert	9620.00	PK	47.7	38.3	6.4	33.3	-	59.1	73.9	14.8	
Vert	12025.00	PK	44.8	39.9	-1.9	33.4	-	49.4	73.9	24.5	

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

PK with Duty factor

Polarity [Hori/Ver]	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
Hori	2373.470	AV	50.6	27.5	2.6	32.4	-20.4	27.9	53.9	26.0	
Hori	2390.000	AV	52.3	27.5	2.6	32.4	-20.4	29.6	53.9	24.3	Not Out of band emission(Leakage Power)
Hori	4810.000	AV	56.8	31.3	4.7	31.6	-20.4	40.8	53.9	13.1	
Hori	7215.000	AV	55.1	35.8	5.6	32.7	-20.4	43.4	53.9	10.5	
Hori	9620.000	AV	47.4	38.3	6.4	33.3	-20.4	38.4	53.9	15.5	
Hori	12025.000	AV	49.9	39.9	-1.9	33.4	-20.4	34.1	53.9	19.8	
Vert	2373.470	AV	51.7	27.5	2.6	32.4	-20.4	29.0	53.9	24.9	
Vert	2390.000	AV	52.8	27.5	2.6	32.4	-20.4	30.1	53.9	23.8	Not Out of band emission(Leakage Power)
Vert	4810.000	AV	49.5	31.3	4.7	31.6	-20.4	33.5	53.9	20.4	
Vert	7215.000	AV	52.9	35.8	5.6	32.7	-20.4	41.2	53.9	12.7	
Vert	9620.000	AV	47.7	38.3	6.4	33.3	-20.4	38.7	53.9	15.2	
Vert	12025.000	AV	44.8	39.9	-1.9	33.4	-20.4	29.0	53.9	24.9	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier) + Duty factor (Refer to Duty factor data sheet)

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

*Measurement values above 1GHz are related with carrier frequency.

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

Radiated Spurious Emission
12mmPatch Antenna

Test place : Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No. : 32CE0244-HO-01
Date : 06/15/2013
Temperature/ Humidity : 23 deg. C / 68% RH
Engineer : Tomohisa Nakagawa
(1-10GHz)
Mode : Tx 2405MHz 12mmPatch Antenna

20dBc Data Sheet

Polarity	Frequency	Detector	Reading	Ant Factor	Loss	Gain	Result	Limit	Margin	Remark
	[MHz]		[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
Hori	2405.000	PK	98.3	27.5	2.6	32.4	96.0	-	-	Carrier
Hori	2400.000	PK	57.6	27.5	2.6	32.4	55.3	76.0	20.7	
Vert	2405.000	PK	100.6	27.5	2.6	32.4	98.3	-	-	Carrier
Vert	2400.000	PK	59.1	27.5	2.6	32.4	56.8	78.3	21.5	

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

Radiated Spurious Emission 12mmPatch Antenna

Test place : Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No. : 32CE0244-HO-01
Date : 06/15/2013 06/16/2013
Temperature/ Humidity : 23 deg. C / 68% RH 23 deg. C / 57% RH
Engineer : Tomohisa Nakagawa Tomohisa Nakagawa
(1-10GHz) Other frequencies
Mode : Tx 2440MHz 12mmPatch Antenna

PK or QP

Polarity [Hori/Ver]	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
Hori	60.15	QP	22.8	8.2	7.6	32.2	-	6.4	40.0	33.6	
Hori	80.00	QP	22.9	6.7	7.8	32.1	-	5.3	40.0	34.7	
Hori	115.00	QP	22.4	12.8	8.3	31.9	-	11.6	43.5	31.9	
Hori	125.00	QP	22.5	13.8	8.4	31.9	-	12.8	43.5	30.7	
Hori	250.00	QP	22.3	17.7	9.5	31.9	-	17.6	46.0	28.4	
Hori	384.00	QP	21.9	17.6	10.4	32.0	-	17.9	46.0	28.1	
Hori	2311.65	PK	46.0	27.6	2.6	32.5	-	43.7	73.9	30.2	
Hori	4880.00	PK	44.8	31.5	4.7	31.6	-	49.4	73.9	24.5	
Hori	7320.00	PK	43.6	35.8	5.6	32.7	-	52.3	73.9	21.6	
Hori	9760.00	PK	43.8	38.4	6.5	33.4	-	55.3	73.9	18.6	
Hori	12200.00	PK	43.4	40.0	-1.8	33.3	-	48.3	73.9	25.6	
Vert	60.16	QP	32.5	8.2	7.6	32.2	-	16.1	40.0	23.9	
Vert	80.00	QP	33.5	6.7	7.8	32.1	-	15.9	40.0	24.1	
Vert	115.00	QP	22.5	12.8	8.3	31.9	-	11.7	43.5	31.8	
Vert	125.00	QP	22.6	13.8	8.4	31.9	-	12.9	43.5	30.6	
Vert	250.00	QP	22.2	17.7	9.5	31.9	-	17.5	46.0	28.5	
Vert	384.00	QP	21.9	17.6	10.4	32.0	-	17.9	46.0	28.1	
Vert	2311.65	PK	46.0	27.6	2.6	32.5	-	43.7	73.9	30.2	
Vert	4880.00	PK	45.0	31.5	4.7	31.6	-	49.6	73.9	24.3	
Vert	7320.00	PK	46.3	35.8	5.6	32.7	-	55.0	73.9	18.9	
Vert	9760.00	PK	44.9	38.4	6.5	33.4	-	56.4	73.9	17.5	
Vert	12200.00	PK	42.6	40.0	-1.8	33.3	-	47.5	73.9	26.4	

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

PK with Duty factor

Polarity [Hori/Ver]	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
Hori	2311.650	AV	46.0	27.6	2.6	32.5	-20.4	23.3	53.9	30.6	
Hori	4880.000	AV	44.8	31.5	4.7	31.6	-20.4	29.0	53.9	24.9	
Hori	7320.000	AV	43.6	35.8	5.6	32.7	-20.4	31.9	53.9	22.0	
Hori	9760.000	AV	43.8	38.4	6.5	33.4	-20.4	34.9	53.9	19.0	
Hori	12200.000	AV	43.4	40.0	-1.8	33.3	-20.4	27.9	53.9	26.0	
Vert	2311.650	AV	46.0	27.6	2.6	32.5	-20.4	23.3	53.9	30.6	
Vert	4880.000	AV	45.0	31.5	4.7	31.6	-20.4	29.2	53.9	24.7	
Vert	7320.000	AV	46.3	35.8	5.6	32.7	-20.4	34.6	53.9	19.3	
Vert	9760.000	AV	44.9	38.4	6.5	33.4	-20.4	36.0	53.9	17.9	
Vert	12200.000	AV	42.6	40.0	-1.8	33.3	-20.4	27.1	53.9	26.8	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier) + Duty factor (Refer to Duty factor data sheet)

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

*Measurement values above 1GHz are related with carrier frequency.

Distance factor: 10GHz-26.5GHz $20\log(3.0\text{m}/1.0\text{m}) = 9.5\text{dB}$

Radiated Spurious Emission 12mmPatch Antenna

Test place	Head Office EMC Lab. No.4 Semi Anechoic Chamber		
Report No.	32CE0244-HO-01		
Date	06/15/2013	06/16/2013	
Temperature/ Humidity	23 deg. C / 68% RH	23 deg. C / 57% RH	
Engineer	Tomohisa Nakagawa	Tomohisa Nakagawa	
	(1-10GHz)	Other frequencies	
Mode	Tx 2480 12mmPatch Antenna		

PK or QP

Polarity [Hori/Ver]	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
Hori	60.15	QP	22.8	8.2	7.6	32.2	-	6.4	40.0	33.6	
Hori	80.00	QP	22.9	6.7	7.8	32.1	-	5.3	40.0	34.7	
Hori	115.00	QP	22.5	12.8	8.3	31.9	-	11.7	43.5	31.8	
Hori	125.00	QP	22.4	13.8	8.4	31.9	-	12.7	43.5	30.8	
Hori	250.00	QP	22.3	17.7	9.5	31.9	-	17.6	46.0	28.4	
Hori	384.00	QP	21.9	17.6	10.4	32.0	-	17.9	46.0	28.1	
Hori	2384.42	PK	45.0	27.5	2.6	32.4	-	42.7	73.9	31.2	
Hori	2483.50	PK	63.6	27.5	2.7	32.4	-	61.4	73.9	12.5	
Hori	4960.00	PK	48.9	31.8	4.8	31.6	-	53.9	73.9	20.0	
Hori	7440.00	PK	46.8	35.9	5.7	32.8	-	55.6	73.9	18.3	
Hori	9920.00	PK	46.1	38.6	6.6	33.5	-	57.8	73.9	16.1	
Hori	12400.00	PK	43.8	40.0	-1.8	33.2	-	48.8	73.9	25.1	
Vert	60.16	QP	32.2	8.2	7.6	32.2	-	15.8	40.0	24.2	
Vert	80.00	QP	33.4	6.7	7.8	32.1	-	15.8	40.0	24.2	
Vert	115.00	QP	22.5	12.8	8.3	31.9	-	11.7	43.5	31.8	
Vert	125.00	QP	22.6	13.8	8.4	31.9	-	12.9	43.5	30.6	
Vert	250.00	QP	22.2	17.7	9.5	31.9	-	17.5	46.0	28.5	
Vert	384.00	QP	21.9	17.6	10.4	32.0	-	17.9	46.0	28.1	
Vert	2384.42	PK	55.1	27.5	2.6	32.4	-	52.8	73.9	21.1	
Vert	2483.50	PK	63.0	27.5	2.7	32.4	-	60.8	73.9	13.1	
Vert	4960.00	PK	44.9	31.8	4.8	31.6	-	49.9	73.9	24.0	
Vert	7440.00	PK	47.1	35.9	5.7	32.8	-	55.9	73.9	18.0	
Vert	9920.00	PK	47.5	38.6	6.6	33.5	-	59.2	73.9	14.7	
Vert	12400.00	PK	44.4	40.0	-1.8	33.2	-	49.4	73.9	24.5	

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

PK with Duty factor

Polarity [Hori/Ver]	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
Hori	2384.420	AV	45.0	27.5	2.6	32.4	-20.4	22.3	53.9	31.6	
Hori	2483.500	AV	63.6	27.5	2.7	32.4	-20.4	41.0	53.9	12.9	Not Out of band emission(Leakage Power)
Hori	4960.000	AV	48.9	31.8	4.8	31.6	-20.4	33.5	53.9	20.4	
Hori	7440.000	AV	46.8	35.9	5.7	32.8	-20.4	35.2	53.9	18.7	
Hori	9920.000	AV	46.1	38.6	6.6	33.5	-20.4	37.4	53.9	16.5	
Hori	12400.000	AV	43.8	40.0	-1.8	33.2	-20.4	28.4	53.9	25.5	
Vert	2384.420	AV	55.1	27.5	2.6	32.4	-20.4	32.4	53.9	21.5	
Vert	2483.500	AV	63.0	27.5	2.7	32.4	-20.4	40.4	53.9	13.5	Not Out of band emission(Leakage Power)
Vert	4960.000	AV	44.9	31.8	4.8	31.6	-20.4	29.5	53.9	24.4	
Vert	7440.000	AV	47.1	35.9	5.7	32.8	-20.4	35.5	53.9	18.4	
Vert	9920.000	AV	47.5	38.6	6.6	33.5	-20.4	38.8	53.9	15.1	
Vert	12400.000	AV	44.4	40.0	-1.8	33.2	-20.4	29.0	53.9	24.9	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier) + Duty factor (Refer to Duty factor data sheet)

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

*Measurement values above 1GHz are related with carrier frequency.

Distance factor: 10GHz-26.5GHz $20\log(3.0\text{m}/1.0\text{m})= 9.5\text{dB}$

Radiated Spurious Emission Lambda / 4 whip Antenna

Test place Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No. 32CE0244-HO-01
Date 06/15/2013 06/16/2013
Temperature/ Humidity 23 deg. C / 68% RH 23 deg. C / 57% RH
Engineer Tomohisa Nakagawa Tomohisa Nakagawa
(1-10GHz) Other frequencies
Mode Tx 2405MHz Lambda / 4 whip Antenna

PK or QP

Polarity [Hori/Ver]	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
Hori	60.15	QP	23.0	8.2	7.6	32.2	-	6.6	40.0	33.4	
Hori	80.00	QP	22.6	6.7	7.8	32.1	-	5.0	40.0	35.0	
Hori	115.00	QP	22.6	12.8	8.3	31.9	-	11.8	43.5	31.7	
Hori	125.00	QP	22.4	13.8	8.4	31.9	-	12.7	43.5	30.8	
Hori	250.00	QP	22.2	17.7	9.5	31.9	-	17.5	46.0	28.5	
Hori	384.00	QP	33.8	17.6	10.4	32.0	-	29.8	46.0	16.2	
Hori	2373.47	PK	57.2	27.5	2.6	32.4	-	54.9	73.9	19.0	
Hori	2390.00	PK	58.1	27.5	2.6	32.4	-	55.8	73.9	18.1	
Hori	4810.00	PK	50.4	31.3	4.7	31.6	-	54.8	73.9	19.1	
Hori	7215.00	PK	50.8	35.8	5.6	32.7	-	59.5	73.9	14.4	
Hori	9620.00	PK	46.1	38.3	6.4	33.3	-	57.5	73.9	16.4	
Hori	12025.00	PK	47.1	39.9	-1.9	33.4	-	51.7	73.9	22.2	
Vert	60.16	QP	31.3	8.2	7.6	32.2	-	14.9	40.0	25.1	
Vert	80.00	QP	33.8	6.7	7.8	32.1	-	16.2	40.0	23.8	
Vert	115.00	QP	22.6	12.8	8.3	31.9	-	11.8	43.5	31.7	
Vert	125.00	QP	22.5	13.8	8.4	31.9	-	12.8	43.5	30.7	
Vert	250.00	QP	22.3	17.7	9.5	31.9	-	17.6	46.0	28.4	
Vert	384.00	QP	30.4	17.6	10.4	32.0	-	26.4	46.0	19.6	
Vert	2373.47	PK	57.4	27.5	2.6	32.4	-	55.1	73.9	18.8	
Vert	2390.00	PK	58.3	27.5	2.6	32.4	-	56.0	73.9	17.9	
Vert	4810.00	PK	48.0	31.3	4.7	31.6	-	52.4	73.9	21.5	
Vert	7215.00	PK	47.9	35.8	5.6	32.7	-	56.6	73.9	17.3	
Vert	9620.00	PK	44.5	38.3	6.4	33.3	-	55.9	73.9	18.0	
Vert	12025.00	PK	45.0	39.9	-1.9	33.4	-	49.6	73.9	24.3	

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

PK with Duty factor

Polarity [Hori/Ver]	Frequency [MHz]	Detector	Reading [dBuV]	Factor [dB/m]	Loss [dB]	Gain [dB]	Duty Factor [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Remark
Hori	2373.47	AV	57.2	27.5	2.6	32.4	-20.4	34.5	53.9	19.4	
Hori	2390.00	AV	58.1	27.5	2.6	32.4	-20.4	35.4	53.9	18.5	Not Out of band emission(Leakage Power)
Hori	4810.00	AV	50.4	31.3	4.7	31.6	-20.4	34.4	53.9	19.5	
Hori	7215.00	AV	50.8	35.8	5.6	32.7	-20.4	39.1	53.9	14.8	
Hori	9620.00	AV	46.1	38.3	6.4	33.3	-20.4	37.1	53.9	16.8	
Hori	12025.00	AV	47.1	39.9	-1.9	33.4	-20.4	31.3	53.9	22.6	
Vert	2373.47	AV	57.4	27.5	2.6	32.4	-20.4	34.7	53.9	19.2	
Vert	2390.00	AV	58.3	27.5	2.6	32.4	-20.4	35.6	53.9	18.3	Not Out of band emission(Leakage Power)
Vert	4810.00	AV	48.0	31.3	4.7	31.6	-20.4	32.0	53.9	21.9	
Vert	7215.00	AV	47.9	35.8	5.6	32.7	-20.4	36.2	53.9	17.7	
Vert	9620.00	AV	44.5	38.3	6.4	33.3	-20.4	35.5	53.9	18.4	
Vert	12025.00	AV	45.0	39.9	-1.9	33.4	-20.4	29.2	53.9	24.7	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier) + Duty factor (Refer to Duty factor data sheet)

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

*Measurement values above 1GHz are related with carrier frequency.

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

Radiated Spurious Emission
Lambda / 4 whip Antenna

Test place Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No. 32CE0244-HO-01
Date 06/15/2013
Temperature/ Humidity 23 deg. C / 68% RH
Engineer Tomohisa Nakagawa
 (1-10GHz)
Mode Tx 2405MHz Lambda / 4 whip Antenna

20dBc Data Sheet

Polarity	Frequency	Detector	Reading	Ant Factor	Loss	Gain	Result	Limit	Margin	Remark
	[MHz]		[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	
Hori	2405.000	PK	106.4	27.5	2.6	32.4	104.1	-	-	Carrier
Hori	2400.000	PK	65.0	27.5	2.6	32.4	62.7	84.1	21.4	
Vert	2405.000	PK	100.6	27.5	2.6	32.4	98.3	-	-	Carrier
Vert	2400.000	PK	59.1	27.5	2.6	32.4	56.8	78.3	21.5	

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

Radiated Spurious Emission Lambda / 4 whip Antenna

Test place Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No. 32CE0244-HO-01
Date 06/15/2013 06/16/2013
Temperature/ Humidity 23 deg. C / 68% RH 23 deg. C / 57% RH
Engineer Tomohisa Nakagawa Tomohisa Nakagawa
(1-10GHz) Other frequencies
Mode Tx 2440MHz Lambda / 4 whip Antenna

PK or QP

Polarity [Hori/Ver]	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
Hori	60.15	QP	22.9	8.2	7.6	32.2	-	6.5	40.0	33.5	
Hori	80.00	QP	22.6	6.7	7.8	32.1	-	5.0	40.0	35.0	
Hori	115.00	QP	22.5	12.8	8.3	31.9	-	11.7	43.5	31.8	
Hori	125.00	QP	22.4	13.8	8.4	31.9	-	12.7	43.5	30.8	
Hori	250.00	QP	22.3	17.7	9.5	31.9	-	17.6	46.0	28.4	
Hori	384.00	QP	33.8	17.6	10.4	32.0	-	29.8	46.0	16.2	
Hori	2343.95	PK	55.3	27.5	2.6	32.5	-	52.9	73.9	21.0	
Hori	4880.00	PK	50.5	31.5	4.7	31.6	-	55.1	73.9	18.8	
Hori	7320.00	PK	49.8	35.8	5.6	32.7	-	58.5	73.9	15.4	
Hori	9760.00	PK	45.4	38.4	6.5	33.4	-	56.9	73.9	17.0	
Hori	12200.00	PK	45.8	40.0	-1.8	33.3	-	50.7	73.9	23.2	
Vert	60.16	QP	31.8	8.2	7.6	32.2	-	15.4	40.0	24.6	
Vert	80.00	QP	33.3	6.7	7.8	32.1	-	15.7	40.0	24.3	
Vert	115.00	QP	22.6	12.8	8.3	31.9	-	11.8	43.5	31.7	
Vert	125.00	QP	22.5	13.8	8.4	31.9	-	12.8	43.5	30.7	
Vert	250.00	QP	22.3	17.7	9.5	31.9	-	17.6	46.0	28.4	
Vert	384.00	QP	30.2	17.6	10.4	32.0	-	26.2	46.0	19.8	
Vert	2343.95	PK	57.3	27.5	2.6	32.5	-	54.9	73.9	19.0	
Vert	4880.00	PK	45.2	31.5	4.7	31.6	-	49.8	73.9	24.1	
Vert	7320.00	PK	48.5	35.8	5.6	32.7	-	57.2	73.9	16.7	
Vert	9760.00	PK	44.9	38.4	6.5	33.4	-	56.4	73.9	17.5	
Vert	12200.00	PK	43.3	40	-1.8	33.3	-	48.2	73.9	25.7	

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

PK with Duty factor

Polarity [Hori/Ver]	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
Hori	2343.95	AV	55.3	27.5	2.6	32.5	-20.4	32.5	53.9	21.4	
Hori	4880.00	AV	50.5	31.5	4.7	31.6	-20.4	34.7	53.9	19.2	
Hori	7320.00	AV	49.8	35.8	5.6	32.7	-20.4	38.1	53.9	15.8	
Hori	9760.00	AV	45.4	38.4	6.5	33.4	-20.4	36.5	53.9	17.4	
Hori	12200.00	AV	45.8	40.0	-1.8	33.3	-20.4	30.3	53.9	23.6	
Vert	2343.95	AV	57.3	27.5	2.6	32.5	-20.4	34.5	53.9	19.4	
Vert	4880.00	AV	45.2	31.5	4.7	31.6	-20.4	29.4	53.9	24.5	
Vert	7320.00	AV	48.5	35.8	5.6	32.7	-20.4	36.8	53.9	17.1	
Vert	9760.00	AV	44.9	38.4	6.5	33.4	-20.4	36.0	53.9	17.9	
Vert	12200.00	AV	43.3	40.0	-1.8	33.3	-20.4	27.8	53.9	26.1	

Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier) + Duty factor (Refer to Duty factor data sheet)

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

*Measurement values above 1GHz are related with carrier frequency.

Distance factor: 10GHz-26.5GHz $20\log(3.0\text{m}/1.0\text{m})= 9.5\text{dB}$

Radiated Spurious Emission Lambda / 4 whip Antenna

Test place Head Office EMC Lab. No.4 Semi Anechoic Chamber
Report No. 32CE0244-HO-01
Date 06/15/2013 06/16/2013
Temperature/ Humidity 23 deg. C / 68% RH 23 deg. C / 57% RH
Engineer Tomohisa Nakagawa Tomohisa Nakagawa
(1-10GHz) Other frequencies
Mode Tx 2480MHz Lambda / 4 whip Antenna

PK or QP

Polarity [Hori/Ver]	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
Hori	60.15	QP	23.4	8.2	7.6	32.2	-	7.0	40.0	33.0	
Hori	80.00	QP	22.6	6.7	7.8	32.1	-	5.0	40.0	35.0	
Hori	115.00	QP	22.5	12.8	8.3	31.9	-	11.7	43.5	31.8	
Hori	125.00	QP	22.4	13.8	8.4	31.9	-	12.7	43.5	30.8	
Hori	250.00	QP	22.2	17.7	9.5	31.9	-	17.5	46.0	28.5	
Hori	384.00	QP	33.7	17.6	10.4	32.0	-	29.7	46.0	16.3	
Hori	2352.14	PK	53.4	27.5	2.6	32.4	-	51.1	73.9	22.8	
Hori	2483.50	PK	72.4	27.5	2.7	32.4	-	70.2	73.9	3.7	
Hori	4960.00	PK	50.1	31.8	4.8	31.6	-	55.1	73.9	18.8	
Hori	7440.00	PK	52.5	35.9	5.7	32.8	-	61.3	73.9	12.6	
Hori	9920.00	PK	45.5	38.6	6.6	33.5	-	57.2	73.9	16.7	
Hori	12400.00	PK	45.4	40.0	-1.8	33.2	-	50.4	73.9	23.5	
Vert	60.15	QP	31.7	8.2	7.6	32.2	-	15.3	40.0	24.7	
Vert	80.00	QP	33.5	6.7	7.8	32.1	-	15.9	40.0	24.1	
Vert	115.00	QP	22.5	12.8	8.3	31.9	-	11.7	43.5	31.8	
Vert	125.00	QP	22.4	13.8	8.4	31.9	-	12.7	43.5	30.8	
Vert	250.00	QP	22.3	17.7	9.5	31.9	-	17.6	46.0	28.4	
Vert	384.00	QP	30.0	17.6	10.4	32.0	-	26.0	46.0	20.0	
Vert	2352.14	PK	57.2	27.5	2.6	32.4	-	54.9	73.9	19.0	
Vert	2483.50	PK	74.5	27.5	2.7	32.4	-	72.3	73.9	1.6	
Vert	4960.00	PK	46.3	31.8	4.8	31.6	-	51.3	73.9	22.6	
Vert	7440.00	PK	50.6	35.9	5.7	32.8	-	59.4	73.9	14.5	
Vert	9920.00	PK	48.1	38.6	6.6	33.5	-	59.8	73.9	14.1	
Vert	12400.00	PK	44.9	40	-1.8	33.2	-	49.9	73.9	24.0	

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

PK with Duty factor

Polarity [Hori/Ver]	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
Hori	2352.14	AV	53.4	27.5	2.6	32.4	-20.4	30.7	53.9	23.2	
Hori	2483.50	AV	72.4	27.5	2.7	32.4	-20.4	49.8	53.9	4.1	Not Out of band emission(Leakage Power)
Hori	4960.00	AV	50.1	31.8	4.8	31.6	-20.4	34.7	53.9	19.2	
Hori	7440.00	AV	52.5	35.9	5.7	32.8	-20.4	40.9	53.9	13.0	
Hori	9920.00	AV	45.5	38.6	6.6	33.5	-20.4	36.8	53.9	17.1	
Hori	12400.00	AV	45.4	40.0	-1.8	33.2	-20.4	30.0	53.9	23.9	
Vert	2352.14	AV	57.2	27.5	2.6	32.4	-20.4	34.5	53.9	19.4	
Vert	2483.50	AV	74.5	27.5	2.7	32.4	-20.4	51.9	53.9	2.0	Not Out of band emission(Leakage Power)
Vert	4960.00	AV	46.3	31.8	4.8	31.6	-20.4	30.9	53.9	23.0	
Vert	7440.00	AV	50.6	35.9	5.7	32.8	-20.4	39.0	53.9	14.9	
Vert	9920.00	AV	48.1	38.6	6.6	33.5	-20.4	39.4	53.9	14.5	
Vert	12400.00	AV	44.9	40.0	-1.8	33.2	-20.4	29.5	53.9	24.4	

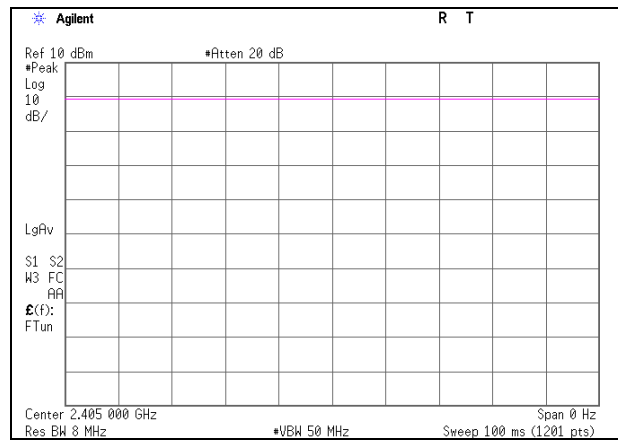
Result = Reading + Ant Factor + Loss (Cable+Attenuator+Filter) - Gain(Amplifier) + Duty factor (Refer to Duty factor data sheet)

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

*Measurement values above 1GHz are related with carrier frequency.

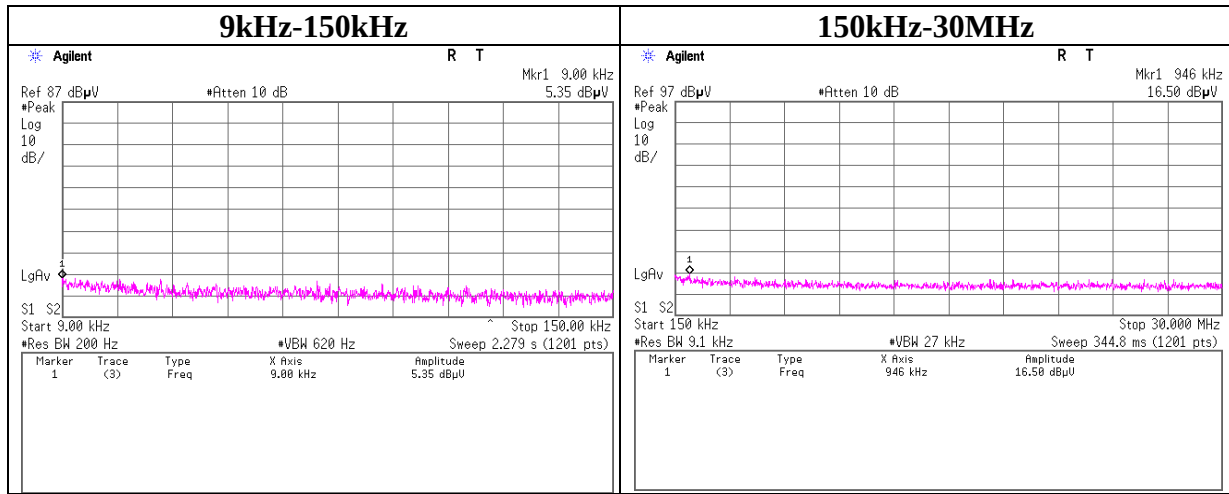
Distance factor: 10GHz-26.5GHz 20log(3.0m/1.0m)= 9.5dB

Burst rate consideration



Conducted Spurious Emission

Tx 2405MHz



Frequency [kHz]	Reading [dBm]	Cable Loss [dB]	Attenuator [dB]	Antenna Gain [dBi]	EIRP [dBm]	Distance [m]	Ground bounce [dB]	E (field strength) [dBuV/m]	Limit [dBuV/m]
9.00	-101.7	0.00	10.0	2.14	-89.5	300.0	6.0	-28.3	48.5
946	-90.5	0.00	10.0	2.14	-78.4	300.0	6.0	-17.1	8.1

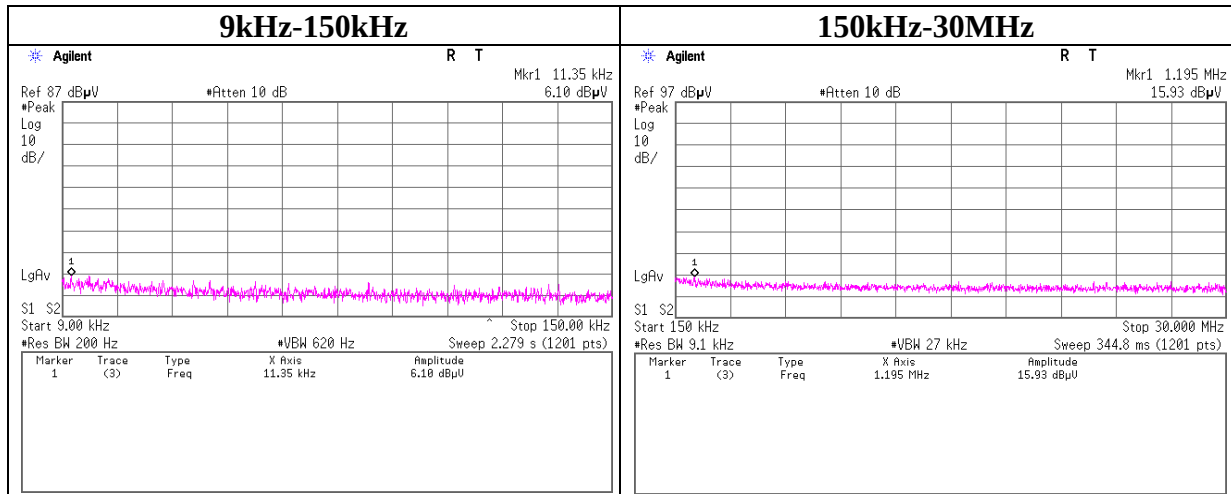
$E = \text{EIRP} - 20 \log(D) + \text{Ground bounce} + 104.8 [\text{dBuV/m}]$

$\text{EIRP} = \text{Reading} + \text{Cable Loss} + \text{Attenuator} + \text{Antenna Gain} - 107$

*There are two kinds of antennas, and the higher antenna gain was used for the above test result.

Conducted Spurious Emission

Tx 2440MHz



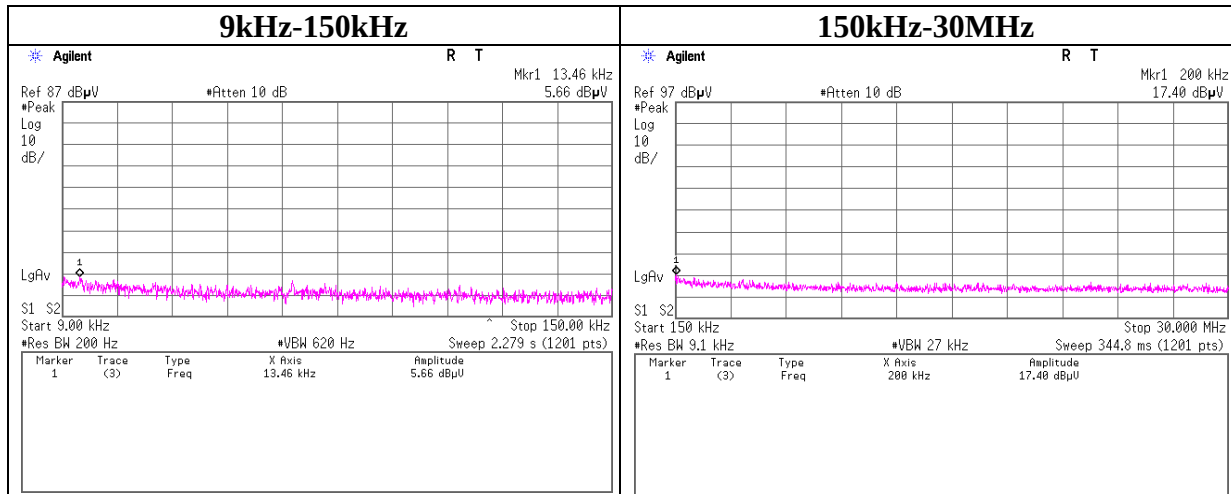
Frequency	Reading	Cable Loss	Attenuator	Antenna Gain	EIRP	Distance	Ground bounce	E (field strength)	Limit
[kHz]	[dBm]	[dB]	[dB]	[dBi]	[dBm]	[m]	[dB]	[dBuV/m]	[dBuV/m]
11.35	-100.9	0.00	10.0	2.14	-88.8	300.0	6.0	-27.5	46.5
1195	-91.1	0.00	10.0	2.14	-78.9	300.0	6.0	-17.7	6.1

$E = EIRP - 20 \log(D) + \text{Ground bounce} + 104.8 [\text{dBuV/m}]$

$EIRP = \text{Reading} + \text{Cable Loss} + \text{Attenuator} + \text{Antenna Gain} - 107$

Conducted Spurious Emission

Tx 2480MHz



Frequency	Reading	Cable	Attenuator	Antenna	EIRP	Distance	Ground	E	Limit
[kHz]	[dBm]	Loss	[dB]	Gain	[dBm]	[m]	bounce	(field strength)	[dBuV/m]
		[dB]		[dBi]			[dB]	[dBuV/m]	[dBuV/m]
13.46	-101.3	0.00	10.0	2.14	-89.2	300.0	6.0	-27.9	45.0
200	-89.6	0.00	10.0	2.14	-77.5	300.0	6.0	-16.2	21.6

E=EIRP-20log(D)+Ground bounce +104.8[dBuV/m]

EIRP=Reading+Cable Loss+Attenuator+Antenna Gain-107

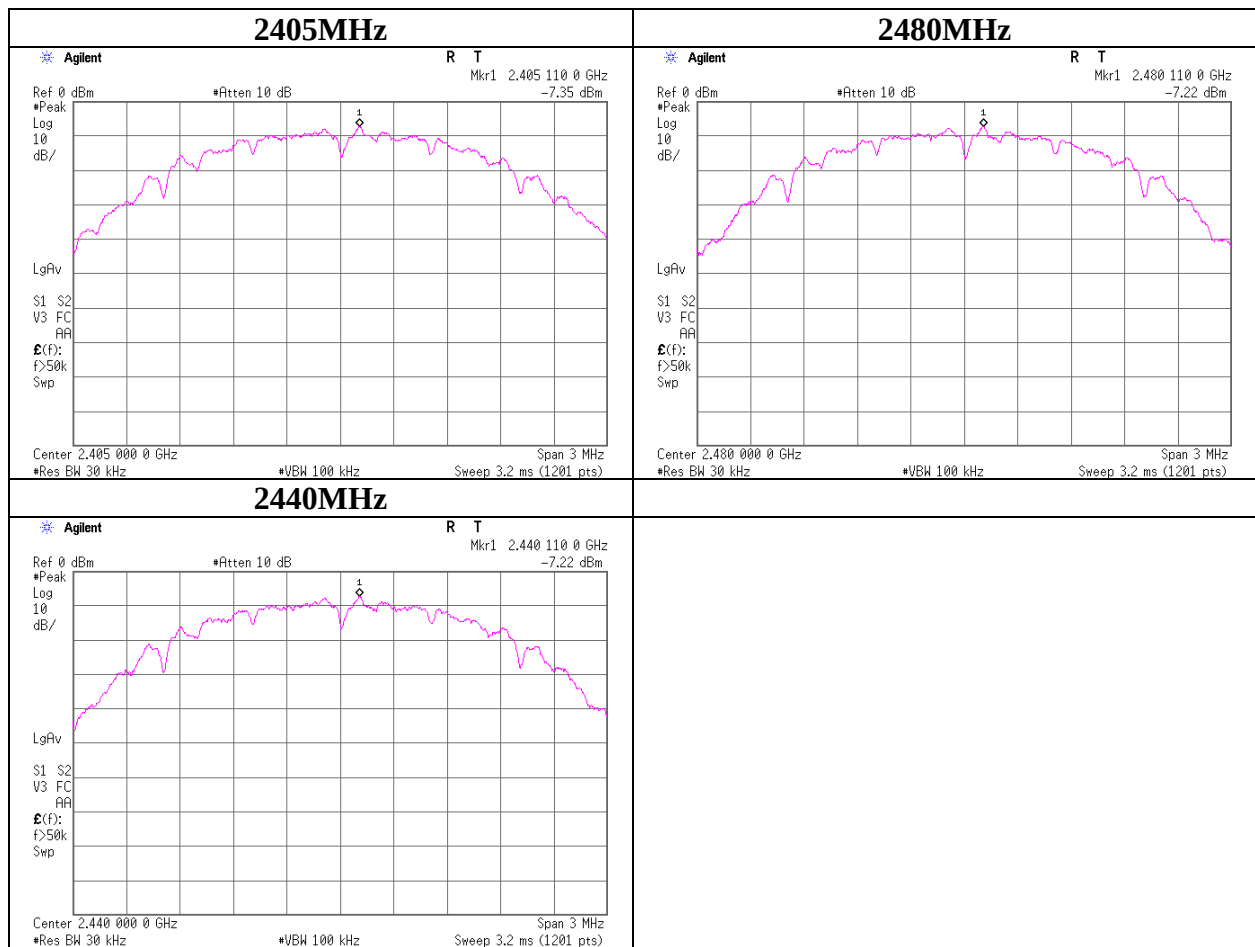
Power Density

Test place Head Office EMC Lab. No.2 semi-anechoic chamber
Report No. 32CE0244-HO-01
Date 06/18/2013
Temperature/ Humidity 22 deg. C / 67% RH
Engineer Tomohisa Nakagawa
Mode Tx

Freq. [MHz]	Reading [dBm]	Cable Loss [dB]	Atten. [dB]	Result [dBm]	Limit [dBm]	Margin [dB]
2405.00	-7.35	0.00	10.01	2.66	8.00	5.34
2440.00	-7.22	0.00	10.01	2.79	8.00	5.21
2480.00	-7.22	0.00	10.01	2.79	8.00	5.21

Sample Calculation:

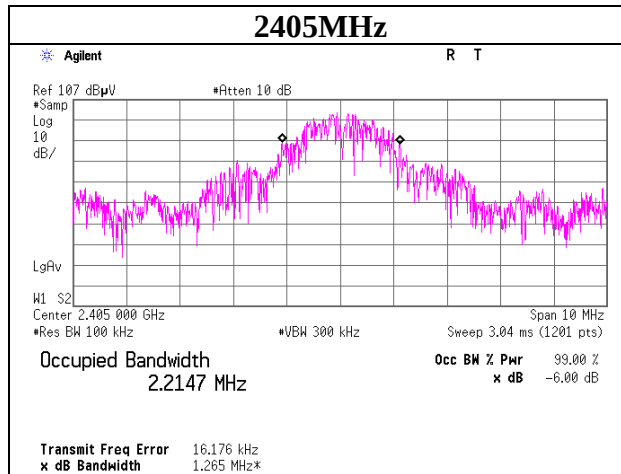
Result = Reading + Cable Loss + Attenuator



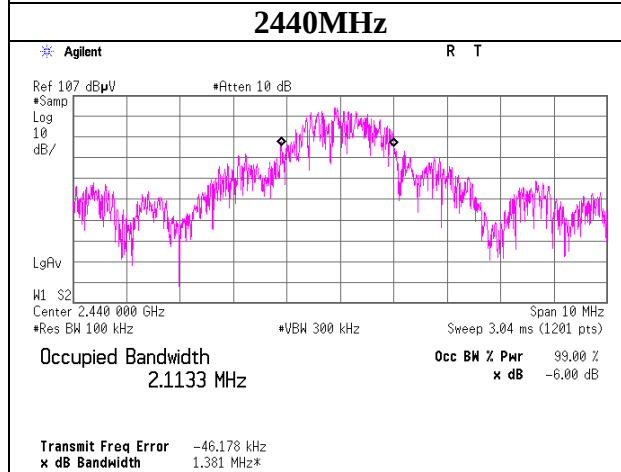
99%Occupied Bandwidth

Tx

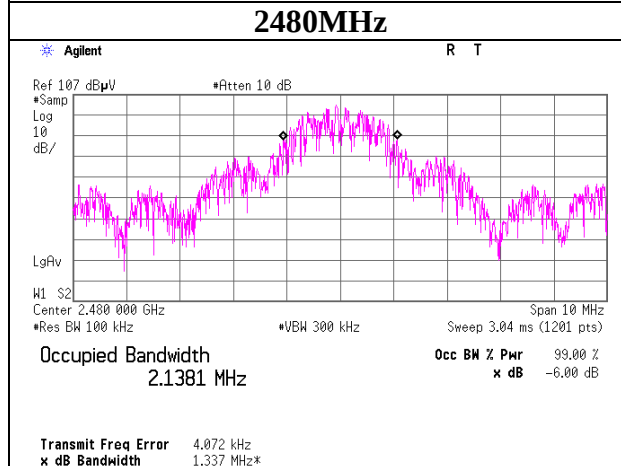
2405MHz



2440MHz



2480MHz



APPENDIX 2: Test instruments

EMI test equipment

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/CE	2013/02/28 * 12
MOS-15	Thermo-Hygrometer	Custom	CTH-180	-	RE/CE	2013/02/26 * 12
MJM-09	Measure	KDS	E19-55	-	RE/CE	-
COTS-MEMI	EMI measurement program	TSJ	TEPTO-DV	-	RE/CE	-
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	RE	2013/02/22 * 12
MTR-07	Test Receiver	Rohde & Schwarz	ESCI	100635	RE/CE	2013/04/10 * 12
MBA-05	Biconical Antenna	Schwarzbeck	BBA9106	1302	RE	2012/11/18 * 12
MLA-08	Logperiodic Antenna	Schwarzbeck	UKLP9140-A	N/A	RE	2012/11/18 * 12
MCC-50	Coaxial Cable	UL Japan	-	-	RE	2012/06/01 * 12 *1)
MAT-68	Attenuator	Anritsu	MP721B	6200961025	RE	2012/11/21 * 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	2012/08/17 * 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	BBHA9170307	RE	2012/06/27 * 12 *1)
MHF-20	High Pass Filter 3.5-18.0GHz	TOKIMEC	TF323DCC	607	RE	2012/09/12 * 12
MSA-10	Spectrum Analyzer	Agilent	E4448A	MY46180655	AT	2013/02/22 * 12
MPM-08	Power Meter	Anritsu	ML2495A	6K00003338	Power Measurement	2012/10/08 * 12
MPSE-11	Power sensor	Anritsu	MA2411B	011737	Power Measurement	2012/10/08 * 12
MAT-22	Attenuator(10dB) 1-18GHz	Orient Microwave	BX10-0476-00	-	AT	2013/03/21 * 12
MSA-05	Spectrum Analyzer	Advantest	R3273	160400285	CE	2012/11/21 * 12
MLS-06	LISN(AMN)	Schwarzbeck	NSLK8127	8127363	CE(EUT)	2013/01/07 * 12
MLS-07	LISN(AMN)	Schwarzbeck	NSLK8127	8127364	CE(AE)	2013/01/07 * 12
MTA-31	Terminator	TME	CT-01	-	CE	2013/01/21 * 12
MAT-67	Attenuator	JFW Industries, Inc.	50FP-013H2 N	-	CE	2013/01/09 * 12
MCC-113	Coaxial cable	Fujikura/Suhner/TSJ	5D-2W(10m)/SFM141(5m)/421-010(1m)/suoform141-PE(1m)/RFM-E121(Switcher)	-/04178	CE	2013/07/23 * 12

*1) This test equipment was used for the tests before the expiration date of the calibration.

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

AT: Antenna Terminal Conducted test

UL Japan, Inc.

Head Office EMC Lab.

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

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