TEST REPORT

Report Number : A-003-13-C

Date of Issue: 25 October 2013

FCC Rules and Regulations Part 15 Subpart C Intentional Radiators.

This test report is to certify that the device was tested according to the requirements of the above.
The results of this report should not be construed to imply compliance of devices other than the sample tested.
Without the laboratory approval by the documents, this report should not be copied in part.

1. Applicant

Company Name	: TAIYO YUDEN CO., LTD.
Mailing Address	: 8-1, Sakae-cho, Takasaki-shi, Gunma 370-8522, Japan

2. Identification of Tested Device

Type of Device	: Transmitter
FCC ID	: RYYEYSFCN
Device Name	: Bluetooth Low Energy module
Model Number	: EYSFCN
Serial Number	: 1
Trade Name	: TAIYO YUDEN
Type of Test	: ☐ Production ☐ Pre-production ☒ Prototype

3. Test Items

AC Power Line Conducted Emission Measurement	☒ Pass	☐ Fail	☐ N/A
Carrier Separation Measurement (FHSS only)	☐ Pass	☐ Fail	☒ N/A (*1)
Time of Occupancy (Dwell Time) Measurement (FHSS only)	☐ Pass	☐ Fail	☒ N/A (*1)
Number of Hopping Measurement (FHSS only)	☐ Pass	☐ Fail	☒ N/A (*1)
20dB Bandwidth Measurement (FHSS only)	☐ Pass	☐ Fail	☒ N/A (*1)
6dB Bandwidth Measurement (DSSS only)	☒ Pass	☐ Fail	☐ N/A
Peak Conducted Output Power Measurement	☒ Pass	☐ Fail	☐ N/A
Spurious Emissions Measurement	☒ Pass	☐ Fail	☐ N/A
Peak Power Spectral Density Measurement (DSSS only)	☒ Pass	☐ Fail	☐ N/A

Refer the below reason(s) with respect to the decision and justification not to test.
(*1) EUT Specifications (*2) Request of Applicant (*3) According to Test Plan

KEC Electronic Industry Development Center Testing Division
3-2-2, Hikari-dai, Seika-cho, Soraku-gun, Kyoto 619-0237 Japan

Test Engineer(s)

Naoki Norimoto

ilac-MRA LAB JAB Testing RTL02810

Approved by Ikuya Minematsu / Group Manager

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0. REVISION HISTORY

Report Version	Page	Description	Date of Issue
A	-	Initial issue of report	25 October 2013

1. LABORATORY INFORMATION

1.1. Laboratory Accreditation

The KEC has been accredited by the following organizations based on their criteria for testing laboratory (ISO/IEC 17025).

(1) American Association for Laboratory Accreditation (A2LA) : Accreditation Number: 2070.01
(2) Japan Accreditation Board for Conformity Assessment (JAB) : Accreditation Number: RTL02810
(3) Voluntary EMC Laboratory Accreditation Center Inc. (VLAC) : Accreditation Number: VLAC-005

1.2. Test Facility

All tests described in this report were performed by:

Name: KEC Electronic Industry Development Center
Testing Division

Address: 3-2-2, Hikari-dai, Seika-cho, Soraku-gun, Kyoto 619-0237 Japan

Anechoic Chamber	: ☐ No.1	☐ No.2	☒ No.3	☐ No.6	☐ No.7
	☐ No.8	☐ No.9	☐ No.10	☐ No.11	☐ No.12
Shielded Room	: ☐ No.1	☐ No.7	☐ No.8	☒ No.9	☒ No.10
Harmonic Current Meas. Room	: ☐				

1.3. Measurement Uncertainty

The result of a measurement is only an approximation or estimate of the value of a specific quantity.
And thus the measurand is complete only when a statement of uncertainty is given.
KEC quotes Measurement Uncertainty (U) as follows.

Conducted Disturbance at Mains Port (150kHz-30MHz)	+2.5 / -2.8 dB
Conducted Disturbance at Mains Port (9kHz-30MHz)	+2.9 / -3.4 dB
Conducted Disturbance at Telecommunication Ports ISN method (None-Shield type)	+2.5 / -2.8 dB
Conducted Disturbance at Telecommunication Ports ISN method (Shield type)	+2.4 / -2.6 dB
Conducted Disturbance at Telecommunication Ports Current Probe method	+2.2 / -2.7dB
Conducted Disturbance at Telecommunication Ports 150Ω Load voltage method (using a 150Ω Load to the out side surface of the shield)	+1.8 / -2.4 dB
Conducted Disturbance at Telecommunication Ports None Invasive method (using a combination of current probe and capacitive voltage probe)	+2.7 / -3.8 dB
Conducted Disturbance at Lead Terminals and Additional Terminals	+2.0 / -2.4 dB
Disturbance Power (30MHz -300MHz)	+3.1 / -4.0 dB
Radiated Disturbance at Frequency Range from 9kHz up to 30MHz 60cm Loop Antenna method	+3.6 / -4.1 dB
Radiated Disturbance at Frequency Range from 9kHz up to 30MHz LLA method	+2.1 / -2.7 dB
Radiated Disturbance at Frequency Range from 30MHz up to 300MHz 3m method	+3.1 / -4.5 dB
Radiated Disturbance at Frequency Range from 300MHz up to 1GHz 3m method	+3.4 / -3.6 dB
Radiated Disturbance at Frequency Range from 30MHz up to 300MHz 10m method	+3.4 / -3.6 dB
Radiated Disturbance at Frequency Range from 300MHz up to 1GHz 10m method	+3.8 / -3.9 dB
Radiated Disturbance at Frequency Range from 30MHz up to 1GHz 10m method (Hybrid Antenna used measurement)	+4.2 / -5.1 dB
Radiated Disturbance at Frequency Range from 1GHz up to 6GHz 3m method	+4.6 / -5.7 dB
Radiated Disturbance at Frequency Range from 6GHz up to 26.5GHz 3m method	+4.6 / -5.2 dB
Harmonics Currents Emissions	+/-4.4%
Voltage Change, Voltage Fluctuations and Flicker	+5.0 / -5.1%

Expiration Date : 2014/9/30

The above values are calculated as Expanded Uncertainty (k=2 [95%]).

[Note]

If the measured result is below the specification limit and a margin is less than the above measurement uncertainty, it is impossible to determine compliance at a level of confidence of 95%. However, the measured result indicates high probability that the tested device complies with the specification limit.

2. GENERAL INFORMATION

2.1. Product Description

(1) Radio Specifications

- Type of Radio : Transceiver
- Type of Equipment : Bluetooth Low Energy Module
- Frequency of Operation : 2402-2480MHz
- Type of Modulation : GFSK
- Channel spacing : 2MHz
- Antenna type : Monopole Antenna
- Antenna gain : 1.3dBi

(2) Maximum Oscillators Frequency

- Reference clock (NX1612AA) : 32MHz (Crystal)

(3) Software Version : Test control sheet_20131002.xls

(4) Firmware Version : s110_nrf51822_6.0.0-1.alpha_softdevice

(5) Interface and Provide Terminal

- SMA connector : RF I/O
- GPIO P0.00-P0.30 : General purpose I/O (UART:Test control interface)
- VCC : DC power supply
- SWD : Debugger support

(6) Rated Power Supply : DC 3.0V (Test for DC 3.0V)

3. TESTED SYSTEM

3.1. Reference Rule and Specification

(1) Reference Rule and Regulation	: FCC Rule Part 15 Subpart C, Section 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz, 5725-5850MHz ☒ Section 15.205 ☒ Section 15.207 ☒ Section 15.209 ☐ Section 15.247 (a)(1) ☒ Section 15.247 (a)(2) ☐ Section 15.247 (b)(1) ☒ Section 15.247 (b)(3) ☒ Section 15.247 (d) ☒ Section 15.247 (e)
(2) Test Procedure	: ANSI C63.4-2003

3.2. Date of Test

Receipt of Test Sample : 4 October 2013
Condition of Test Sample : ☒ Damage is not found on the set.
☐ Damage is found on the set. (Details are described in this report)

Test Completed on : 25 October 2013
Condition of Test Sample : ☒ Damage is not found on the set.
☐ Damage is found on the set. (Details are described in this report)

3.3. Deviation of Standard

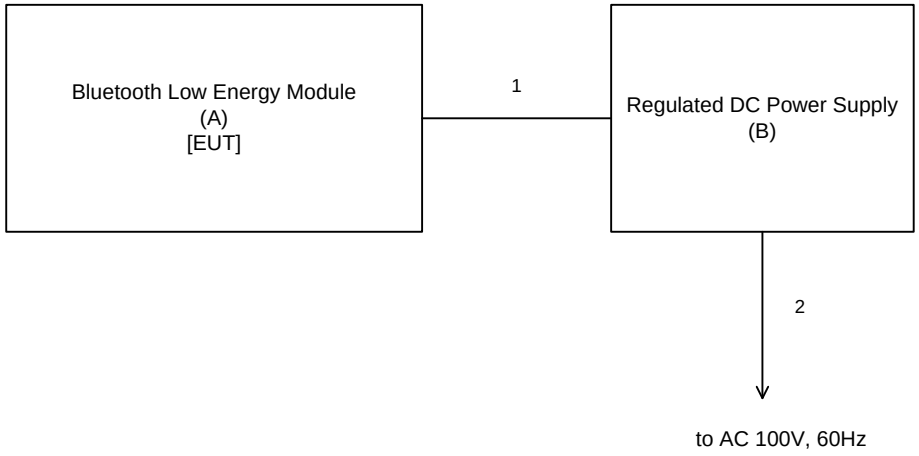
☒ without deviation, ☐ with deviation (details are found inside of this report)

3.4. Test Mode

Test Item	Frequency	Power Setting
AC Power Line Conducted Emission	2402MHz/2440MHz/2480MHz	4dBm(Fixed)
6dB Bandwidth		
Peak Conducted Output Power		
Spurious Emissions/Restricted Band Edges (Radiated/Conducted)		
Peak Power Spectral Density		

[Note]
(1) The setting of software was performed by the worst case condition. (packet: PRBS9, Length: 37)
(2) The power setting is fixed and it is not change by the software.
(3) The spurious emissions (Radiated) ware checked in three orthogonal axes, and the data of the producing the maximum emissions were reported at each frequency.

3.5. Block Diagram of TEST System



3.6. List of Test System

No.	Device Name	Model Number	Serial Number	Trade Name	Note
A	Bluetooth Low Energy module	EYSFCN	1	TAIYO YUDEN	EUT
B	REGULATED DC POWER SUPPLY	PAD35-20L	—	KIKUSUI ELECTRONICS CORP.	
		PAB18-3A			(1)

[Note]
(1) : AC Power Line Conducted Emission Measurement

3.7. List of Cables

No.	Cable Name	Shielded (Y/N)	Length (m)	Note	
1	DC Power Cord	N	1.1		
2	AC Power Cord	N	1.5		(1)

[Note]
(1) : Undetachable cable type
(2) : Accessories cable of EUT
(3) : 3-wires type,earth plug is grounded
(4) : 2-wires type

4. AC POWER LINE CONDUCTED EMISSION MEASUREMENT

4.1. Test Procedure

(1) The EUT is placed in accordance with ANSI C63.4-2003 section 7.
(2) The EUT is activated as to simulate an actual operation.
(3) Connect the EUT's AC power cord to one Line Impedance Stabilization Network (LISN).
(4) Any other power cord of other equipment is connected to a LISN different from the LISN used for the EUT.
(5) Connect the spectrum analyzer (*1) to the measuring port of the LISN for the EUT, using a calibrated coaxial cable.
(6) To find out the maximum emission of the configuration of the EUT System, the operation mode and the position of the cables are changed, then preliminary conducted measurement are performed.
(7) The spectrums are scanned from 150kHz to 30MHz and collect the six highest emissions minimum on the spectrum analyzer relative to the limits in the whole range.
(8) The test receiver (*2) is connected to the LISN for the EUT, and the six highest emissions minimum recorded above are measured.

[Note]
(*1) Spectrum Analyzer Set Up Conditions

Frequency range	: 150kHz – 30MHz
Resolution bandwidth	: 10kHz
Video bandwidth	: 1MHz
Detector function	: Peak mode

(*2) Test Receiver Set Up Conditions

Detector function	: Quasi – Peak / Average (if necessary)
IF bandwidth	: 10kHz

4.2. Test Results

2402MHz/2440MHz/2480MHz

Measurement with the Quasi-peak (Q-Peak) Detector and Average Detector

Measured Frequency	LISN Factor	Meter Reading				Maximum RF Voltage		Limit		Margin for Limit	
		Q-Peak		Average							
		Va	Vb	Va	Vb	Q-Peak	Average	Q-Peak	Average	Q-Peak	Average
(MHz)	(dB)	(dBμV)	(dBμV)	(dBμV)	(dBμV)	(dBμV)	(dBμV)	(dBμV)	(dBμV)	(dB)	(dB)
0.206	10.3	18.4	17.9	14.8	14.2	28.7	25.1	63.4	53.4	34.7	28.3
1.000	10.2	<0.0	<0.0	<0.0	<0.0	<10.2	<10.2	56.0	46.0	>45.8	>35.8
5.000	10.4	<0.0	<0.0	<0.0	<0.0	<10.4	<10.4	56.0	46.0	>45.6	>35.6
10.000	10.5	<0.0	<0.0	<0.0	<0.0	<10.5	<10.5	60.0	50.0	>49.5	>39.5
20.000	11.0	<0.0	<0.0	<0.0	<0.0	<11.0	<11.0	60.0	50.0	>49.0	>39.0
30.000	11.4	<0.0	<0.0	<0.0	<0.0	<11.4	<11.4	60.0	50.0	>48.6	>38.6

[Note]
LISN Factor includes the cable loss and attenuator loss.

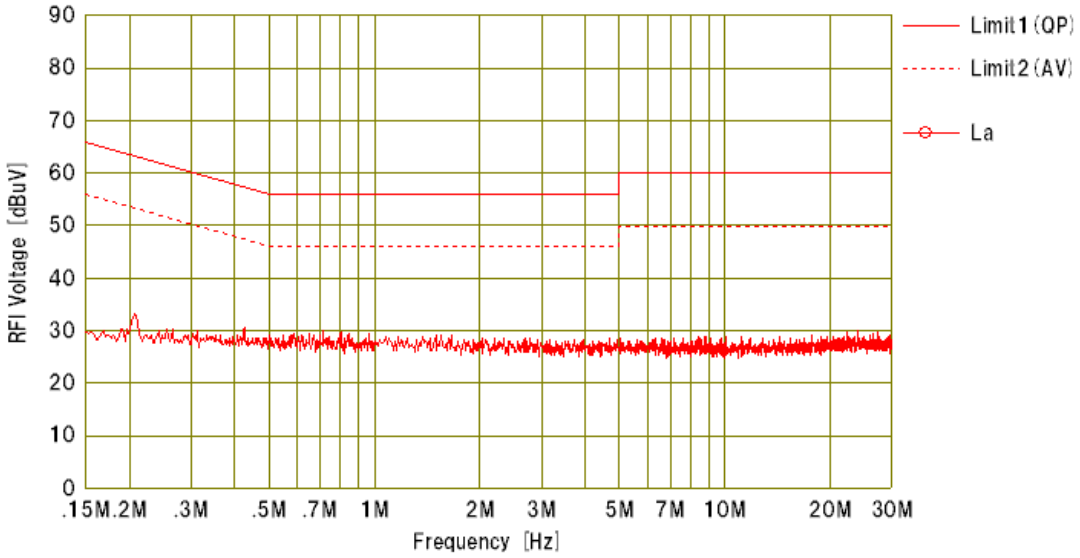
[Calculation method]
Maximum RF Voltage (dBμV)
= Meter Reading (at maximum level of Va or Vb) (dBμV) + LISN Factor (dB)

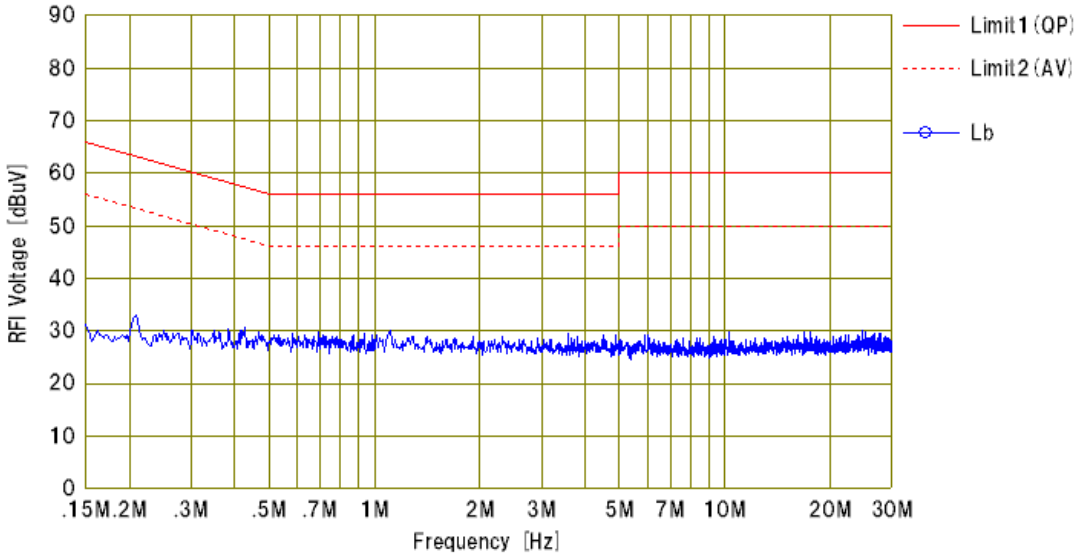
At the next page, the result of exploratory conducted emission measurement by using the spectrum analyzer is shown by the spectrum chart.

Tested Date	Environment	
	Temperature	Humidity
25 October 2013	24 °C	58 %

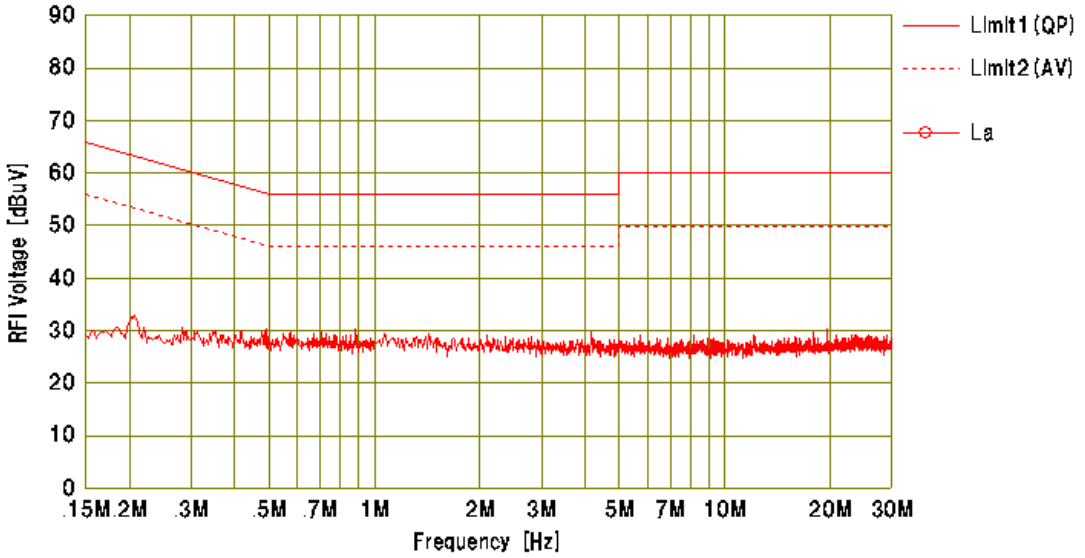
Test Results in Graph

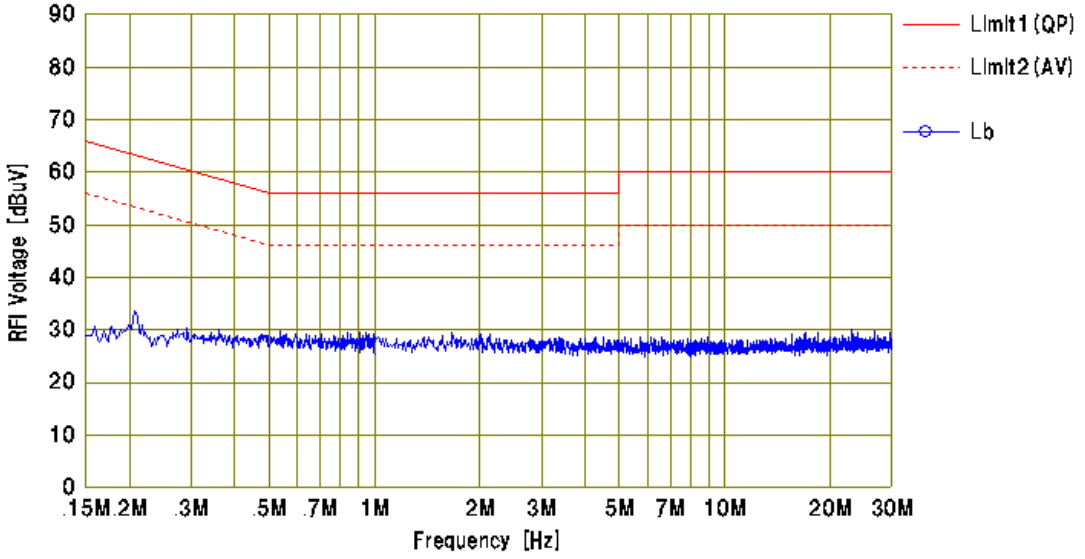
2402MHz





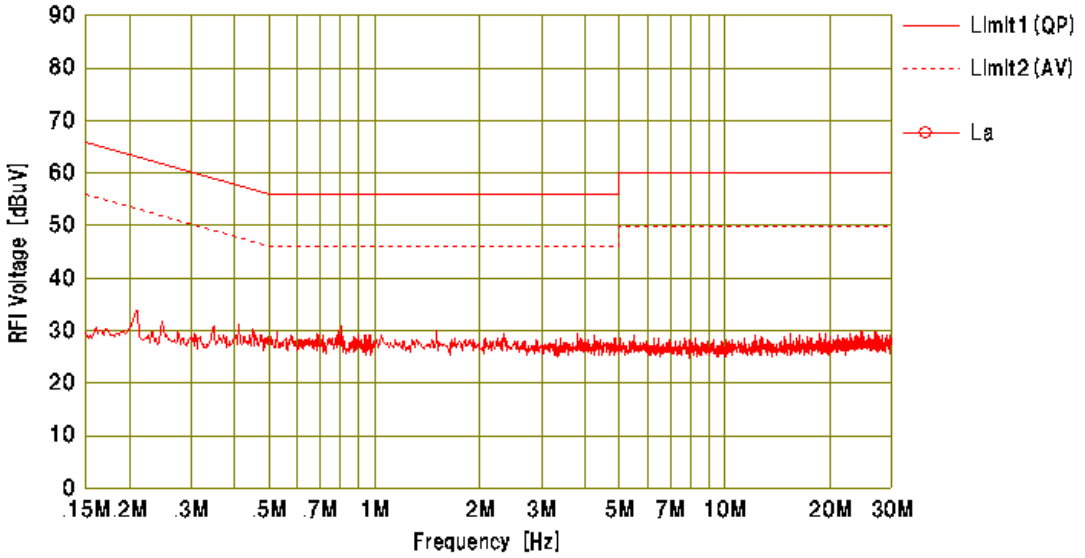
2440MHz

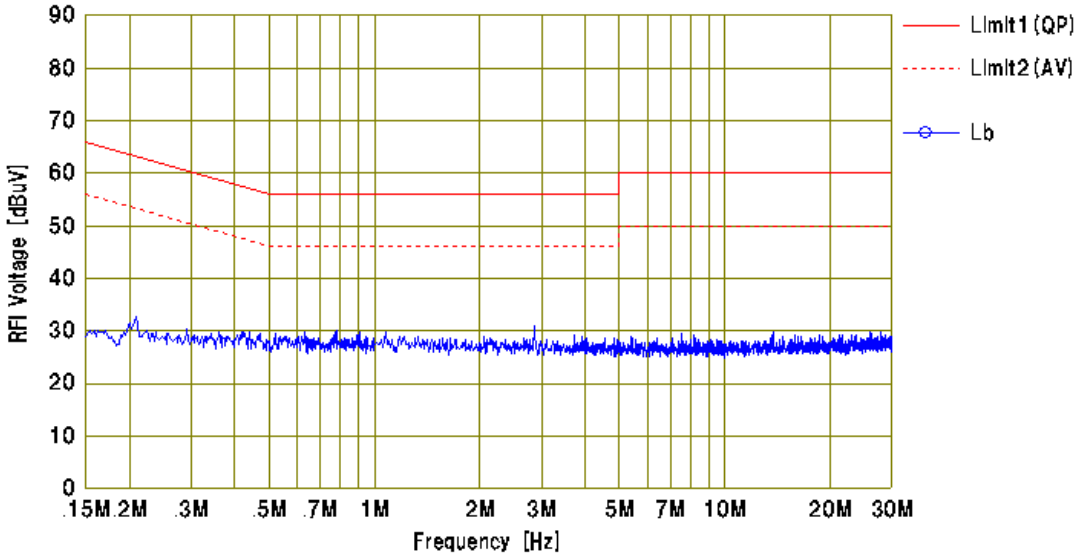

90
80
70
60
50
40
30
20
10
0
RFI Voltage [dBuV]
.15M
.2M
.3M
.5M
.7M
1M
2M
3M
5M
7M
10M
20M
30M
Frequency [Hz]
Limit1 (QP)
Limit2 (AV)
La


90
80
70
60
50
40
30
20
10
0
RFI Voltage [dBuV]
.15M
.2M
.3M
.5M
.7M
1M
2M
3M
5M
7M
10M
20M
30M
Frequency [Hz]
Limit1 (QP)
Limit2 (AV)
Lb

Test Results in Graph

2480MHz





5. 6dB BANDWIDTH MEASUREMENT

5.1. Test Procedure

(1) Connect the EUT RF output port to spectrum analyzer (*1) via calibrated coaxial cable and suitable attenuator (if necessary).
(2) Activates the EUT System and execute the software prepared for test, if necessary.
(3) To find out the maximum emission condition, the transmitting data rate of EUT is set to maximum data rate.
(4) 6dB Bandwidth is measured using the function of spectrum analyzer.

[Note]
(*1) Spectrum Analyzer Set Up Conditions

Frequency Span	: Wide enough
Resolution bandwidth	: 100kHz
Video bandwidth	: 3 x RBW
Detector function	: Peak
x dB	: -6dB

5.2. Test Results

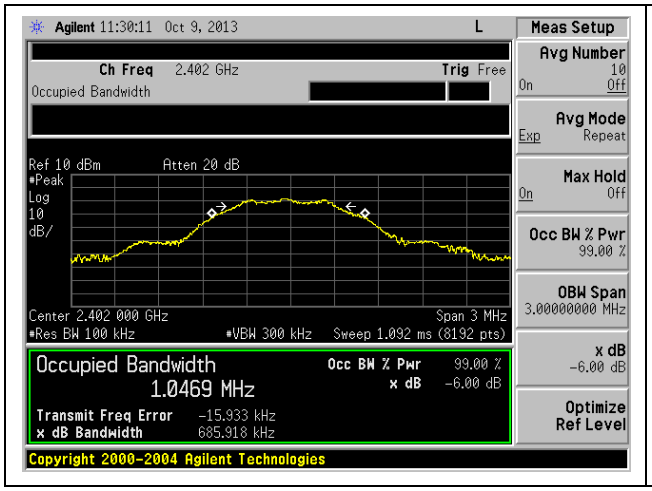
Measured Frequency (MHz)	6dB Bandwidth (kHz)	Minimum Limit (kHz)
2402	685.91	>500
2440	696.98	>500
2480	687.04	>500

[Note]
(1) See next page figure.

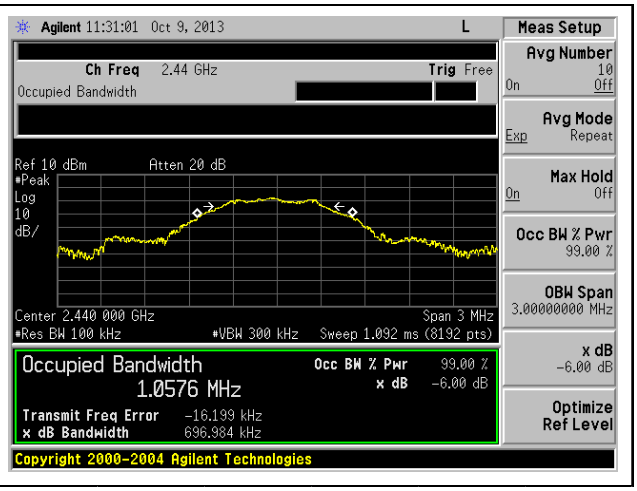
Tested Date	Environment	
	Temperature	Humidity
9 October 2013	23 °C	45 %

Spectrum Chart

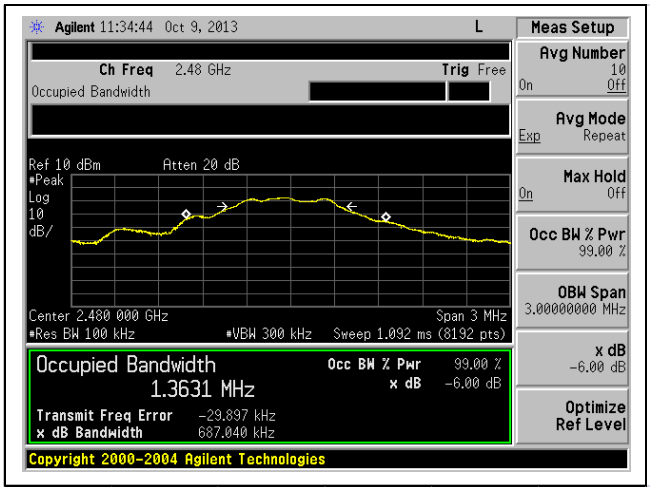
2402MHz



2440MHz



2480MHz



6. PEAK CONDUCTED OUTPUT POWER MEASUREMENT

6.1. Test Procedure

(1) Connect the EUT RF output port to peak power meter via calibrated coaxial cable and suitable attenuator (if necessary).
(2) Activates the EUT System and execute the software prepared for test, if necessary.
(3) To find out the maximum emission condition, the transmitting data rate of EUT is set to maximum data rate.
(4) Measurement is started using the peak power meter.

6.2. Test Results

Measured Frequency (MHz)	Correction Factor (dB)	Meter Reading (dBm)	Peak Output Power (dBm)	Limit (dBm)	Margin for Limit (dB)
2402	10.80	-8.56	2.24	30.00	27.80
2440	10.90	-8.17	2.73	30.00	27.30
2480	10.90	-7.98	2.92	30.00	27.10

[Note]
(1) Correction Factor includes the loss of attenuator and coaxial cables.

[Calculation method]
Peak Output Power (dBm) = Meter Reading (dBm) + Correction Factor (dB)

Tested Date	Environment	
	Temperature	Humidity
9 October 2013	23 °C	45 %

7. SPURIOUS EMISSIONS MEASUREMENT

7.1. Test Procedure

Radiated measurement

(1) Configure the EUT System in accordance with ANSI C63.4-2003 section 8.
See also the block diagram and the photographs of EUT System configuration in this report.
(2) If the EUT system is connected to a public power network, all power cords for the EUT System are connected the receptacle on the turntable.
(3) Warm up the EUT System.
(4) Activate the EUT System and run the prepared software for the test, if necessary.
(5) To find out the emissions of the EUT System, preliminary radiated measurement are performed at a closer distance than that specified for final radiated measurement using the spectrum analyzer (*1) and the broad band antenna.
In the frequency above 1GHz, it is performed using the spectrum analyzer (*2) (*3) and the horn antenna.
(6) To find out the EUT System condition, which produces the maximum emission, the configuration of EUT System, the position of the cables, and the operation mode, are changed under normal usage of the EUT.
(7) The spectrums are scanned from 30MHz to the upper frequency of measurement range, and collect the six highest emissions minimum on the spectrum analyzer relative to the limits in the whole range.
(8) In final compliance test, the six highest emissions minimum, recorded above, are measured at the specified distance using the broad band antenna or the tuned dipole antenna and the test receiver (*4).
In the frequency above 1GHz, the measurements are performed by the horn antenna and the spectrum analyzer with pre-amplifier (*2) (*3).

Conducted measurement

(1) Configure the EUT System in accordance with ANSI C63.4-2003 section 8.
See also the block diagram and the photographs of EUT System configuration in this report.
(2) Warm up the EUT System.
(3) Activate the EUT System and run the prepared software for the test, if necessary.
(4) To find out the emissions of the EUT System, conducted measurement are performed at connect the EUT RF output port to spectrum analyzer (*5) via calibrated coaxial cable and suitable attenuator.

[Note]

(*1) Spectrum Analyzer Set Up Conditions
- Frequency range : 30 – 1000MHz
- Resolution bandwidth : 100kHz
- Detector function : Peak mode

(*2) Spectrum Analyzer Set Up Conditions
- Frequency range : 1GHz – Upper frequency of measurement range
- Resolution bandwidth : 1MHz
- Video bandwidth : 3 x RBW
- Detector function : Peak mode / RMS mode (Average measurement)
- Trace : Trace Average (Average measurement)

(*3) Spectrum Analyzer Set Up Conditions
- Frequency range : Non-Restricted Band
- Resolution bandwidth : 100kHz
- Video bandwidth : 3 x RBW
- Detector function : Peak mode

(*4) Test Receiver Set Up Conditions
- Detector function : Quasi – Peak or Peak
- IF bandwidth : 120kHz

(*5) Spectrum Analyzer Set Up Conditions
- Frequency range : 9 – 150kHz / 150kHz – 30MHz / 30MHz – 25GHz
- Resolution bandwidth : 200Hz / 9kHz / 100kHz
- Video bandwidth : 3 x RBW
- Detector function : Peak mode

7.2. Test Results

Radiated measurement

2402MHz

Measured Frequency (MHz)	Antenna Factor (dB/m)	Meter Reading Horizontal Polarization (dBμV)	Meter Reading Vertical Polarization (dBμV)	Distance Factor from 1m to 3m (dB)	Maximum Field Strength (dBμV/m)	Limit (dBμV/m)	Margin for Limit (dB)
30.00	22.2	<0.0	<0.0	-	<22.2	40.0	>17.8
500.00	24.2	<0.0	<0.0	-	<24.2	46.0	>21.8
1000.00	30.9	<0.0	<0.0	-	<30.9	54.0	>23.1
Peak measurement							
2310.80	-3.7	55.3	56.5	-	52.8	74.0	21.2
2367.70	1.1	53.3	55.7	-	56.8	74.0	17.2
2390.00	5.9	47.6	49.5	-	55.4	74.0	18.6
4804.00	2.3	<45.0	<45.0	-	<47.3	74.0	>26.7
7206.00	1.7	<45.0	<45.0	-	<34.0	74.0	>40.0
9608.00	5.5	<45.0	<45.0	-	<41.5	74.0	>32.5
12010.00	0.0	<45.0	<45.0	9.5	<45.0	74.0	>29.0
24020.00	6.0	<45.0	<45.0	9.5	<51.0	74.0	>23.0
Average measurement							
2390.00	5.9	34.0	34.2	-	40.1	54.0	13.9

[Average measurement with duty cycle factor]

Measured Frequency (MHz)	Antenna Factor (dB/m)	Meter Reading Horizontal Polarization (dBμV)	Meter Reading Vertical Polarization (dBμV)	Distance Factor from 1m to 3m (dB)	Duty Cycle Factor (dB)	Maximum Field Strength (dBμV/m)	Limit (dBμV/m)	Margin for Limit (dB)
2310.80	-3.7	37.1	38.8	-	1.2	36.3	54.0	17.7
2367.70	1.1	40.0	40.7	-	1.2	43.0	54.0	11.0
4804.00	2.3	<35.0	<35.0	-	1.2	<38.5	54.0	>15.5
7206.00	1.7	<35.0	<35.0	-	1.2	<37.9	54.0	>16.1
9608.00	5.5	<35.0	<35.0	-	1.2	<41.7	54.0	>12.3
12010.00	0.0	<35.0	<35.0	9.5	1.2	<26.7	54.0	>27.3
24020.00	6.0	<35.0	<35.0	9.5	1.2	<32.7	54.0	>21.3

[20dBc Data Sheet]

Measured Frequency (MHz)	Antenna Factor (dB/m)	Meter Reading Horizontal Polarization (dBμV)	Meter Reading Vertical Polarization (dBμV)	Maximum Field Strength (dBμV/m)	Limit (dBμV/m)	Margin for Limit (dB)
Peak measurement						
*1) 2402.00	5.9	89.2	-	95.1	-	-
2400.00	5.9	42.7	-	48.6	75.1	26.5
*1) 2402.00	5.9	-	89.6	95.5	-	-
2400.00	5.9	-	42.9	48.8	75.5	26.7

2440MHz

Measured Frequency (MHz)	Antenna Factor (dB/m)	Meter Reading Horizontal Polarization (dBμV)	Meter Reading Vertical Polarization (dBμV)	Distance Factor from 1m to 3m (dB)	Maximum Field Strength (dBμV/m)	Limit (dBμV/m)	Margin for Limit (dB)
30.00	22.2	<0.0	<0.0	-	<22.2	40.0	>17.8
500.00	24.2	<0.0	<0.0	-	<24.2	46.0	>21.8
1000.00	30.9	<0.0	<0.0	-	<30.9	54.0	>23.1
Peak measurement							
4880.00	2.5	<45.0	<45.0	-	<47.5	74.0	>26.5
7320.00	1.9	<45.0	<45.0	-	<46.9	74.0	>27.1
9760.00	5.6	<45.0	<45.0	-	<50.6	74.0	>23.4
12200.00	0.3	<45.0	<45.0	-	<45.3	74.0	>28.7
24400.00	6.0	<45.0	<45.0	-	<34.0	74.0	>40.0

[Average measurement with duty cycle factor]

Measured Frequency (MHz)	Antenna Factor (dB/m)	Meter Reading Horizontal Polarization (dBμV)	Meter Reading Vertical Polarization (dBμV)	Distance Factor from 1m to 3m (dB)	Duty Cycle Factor (dB)	Maximum Field Strength (dBμV/m)	Limit (dBμV/m)	Margin for Limit (dB)
4880.00	2.5	<35.0	<35.0	-	1.2	38.7	54.0	15.3
7320.00	1.9	<35.0	<35.0	-	1.2	38.1	54.0	15.9
9760.00	5.6	<35.0	<35.0	-	1.2	<41.8	54.0	>12.2
12200.00	0.3	<35.0	<35.0	9.5	1.2	<27.0	54.0	>27.0
24400.00	6.0	<35.0	<35.0	9.5	1.2	<32.7	54.0	>21.3

[20dBc Data Sheet]

Measured Frequency (MHz)	Antenna Factor (dB/m)	Meter Reading Horizontal Polarization (dBμV)	Meter Reading Vertical Polarization (dBμV)	Maximum Field Strength (dBμV/m)	Limit (dBμV/m)	Margin for Limit (dB)
Peak measurement						
*1) 2440.00	6.1	88.9	-	95.0	-	-
2561.15	-1.0	45.9	-	44.9	75.0	30.1
*1) 2440.00	6.1	-	89.9	96.0	-	-
2561.50	-1.0	-	43.2	42.2	76.0	33.8

2480MHz

Measured Frequency (MHz)	Antenna Factor (dB/m)	Meter Reading Horizontal Polarization (dBμV)	Meter Reading Vertical Polarization (dBμV)	Distance Factor from 1m to 3m (dB)	Maximum Field Strength (dBμV/m)	Limit (dBμV/m)	Margin for Limit (dB)
30.00	22.2	<0.0	<0.0	-	<22.2	40.0	>17.8
500.00	24.2	<0.0	<0.0	-	<24.2	46.0	>21.8
1000.00	30.9	<0.0	<0.0	-	<30.9	54.0	>23.1
Peak measurement							
2483.50	6.0	53.6	53.8	-	59.8	74.0	14.2
4960.00	2.4	<45.0	<45.0	-	<47.4	74.0	>26.6
7440.00	2.0	<45.0	<45.0	-	<47.0	74.0	>27.0
9920.00	5.9	<45.0	<45.0	-	<50.9	74.0	>23.1
12400.00	-0.7	<45.0	<45.0	-	<34.0	74.0	>40.0
24800.00	5.8	<45.0	<45.0	-	<41.5	74.0	>32.5
Average measurement							
2483.50	6.0	36.4	36.5	-	42.5	54.0	11.5

[Average measurement with duty cycle factor]

Measured Frequency (MHz)	Antenna Factor (dB/m)	Meter Reading Horizontal Polarization (dBμV)	Meter Reading Vertical Polarization (dBμV)	Distance Factor from 1m to 3m (dB)	Duty Cycle Factor (dB)	Maximum Field Strength (dBμV/m)	Limit (dBμV/m)	Margin for Limit (dB)
4960.00	2.4	<35.0	<35.0	-	1.2	<38.6	54.0	>15.4
7440.00	2.0	<35.0	<35.0	-	1.2	<38.2	54.0	>15.8
9920.00	5.9	<35.0	<35.0	-	1.2	<42.1	54.0	>11.9
12400.00	-0.7	<35.0	<35.0	9.5	1.2	<24.8	54.0	>29.2
24800.00	5.8	<35.0	<35.0	9.5	1.2	<31.3	54.0	>22.7

[Remark]
*1) Carrier

[Note]
(1) Antenna Factor includes the cable loss, attenuator loss and pre-amplifier gain.
Above 1000MHz, the antenna factor includes the cable loss, pre-amplifier gain and attenuator loss (if necessary).

(2) * mark in Measured Frequency : Measured with the tuned dipole antenna.
no mark in Measured Frequency : Measured with the broadband antenna.

(3) Upper Frequency : ☒Transmitter Frequency (TX): TX < 10GHz
☒10th harmonic of the highest frequency / ☐Up to 40GHz
☐Transmitter Frequency (TX): 10GHz ≦ TX < 30GHz
☐10th harmonic of the highest frequency / ☐Up to 100GHz
☐Transmitter Frequency (TX): 30GHz ≦ TX
☐10th harmonic of the highest frequency / ☐Up to 200GHz
The emissions were checked to the upper frequency, and the lower emissions than the listed emissions in the above tables were omitted.

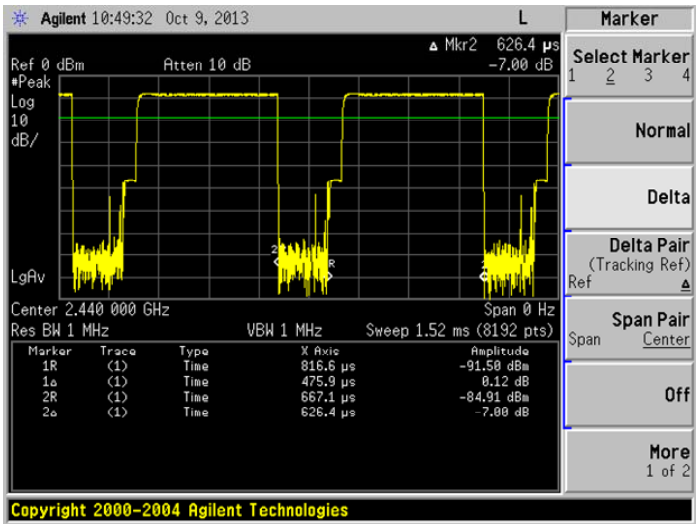
(4) Measurement Distance : <below 1GHz> ☒ 3m ☐ 10m
<above 1GHz> 3m
<above 10GHz> 1m

[Calculation method]
Maximum Field Strength (dBμV/m)
= Meter Reading (at maximum level of Horizontal or Vertical) (dBμV) + Antenna Factor (dB/m) - Distance Factor (dB) (*) + Duty Cycle Factor (dB) (Average measurement)

(*) Applied for Radiated Emission Measurement (above 10GHz) only.
Distance Factor : 20 × log10 (3m/1m) = 9.5dB

Tested Date	Environment	
	Temperature	Humidity
10 October 2013	24 °C	45 %

Duty Cycle

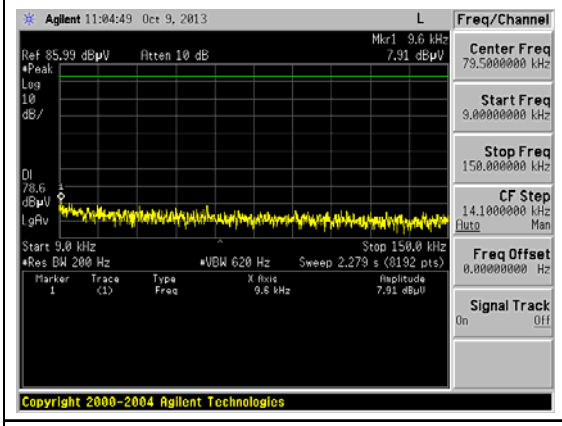
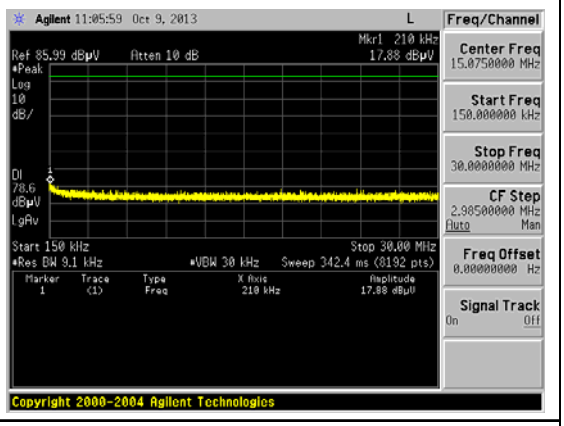
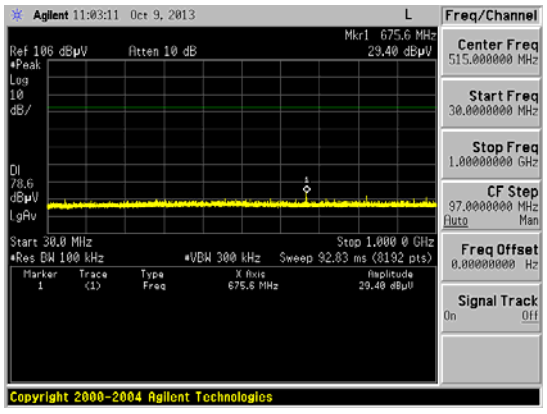
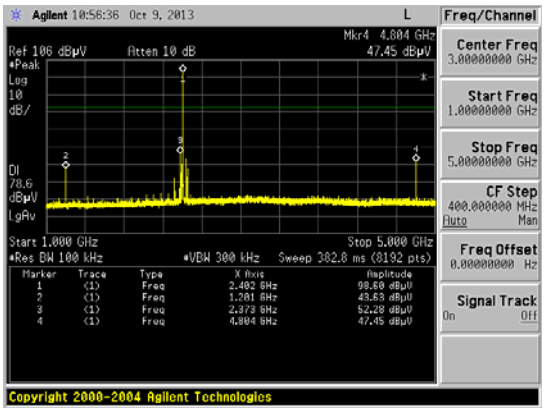
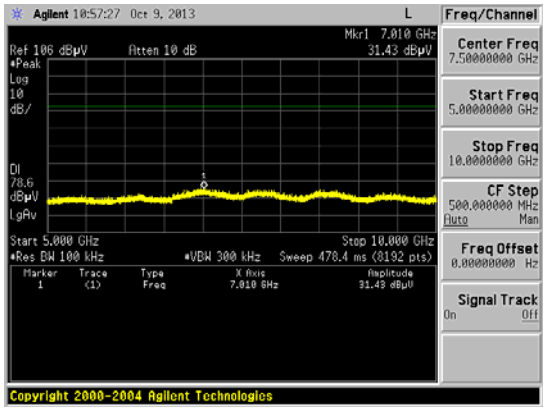
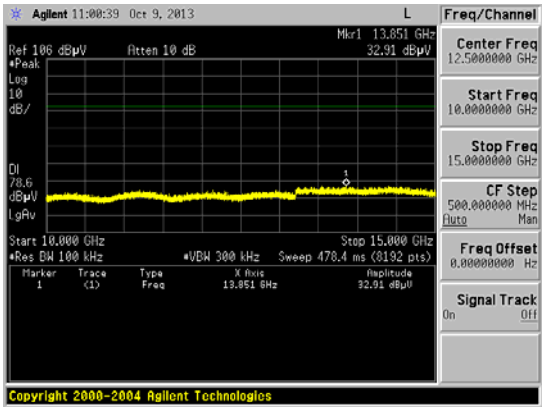
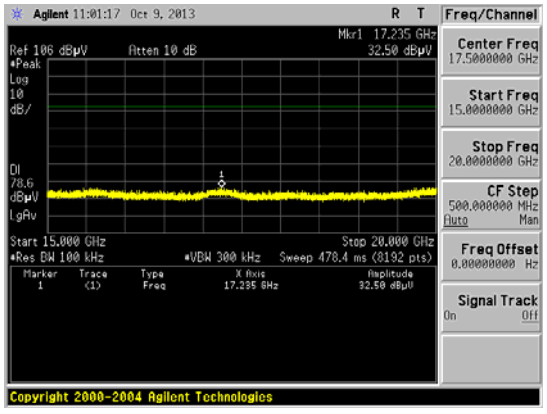
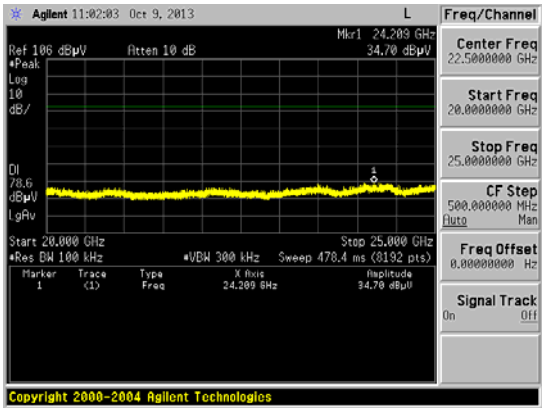


	Bluetooth LE
Tx on	475.9
Tx on + Tx off	626.4
Duty Cycle	0.76
Duty Cycle Factor (dB)	1.19

[Calculation method]
Duty Cycle = (Tx on) / (Tx on + Tx off)
Duty Cycle Factor (dB) = 10×Log(1/Duty Cycle)

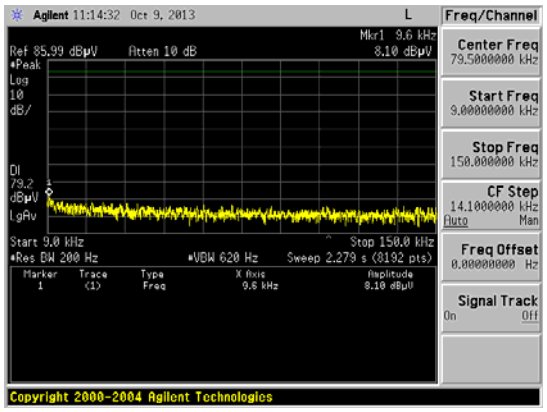
Tested Date	Environment	
	Temperature	Humidity
9 October 2013	23 °C	45 %

Conducted measurement
Spectrum Chart

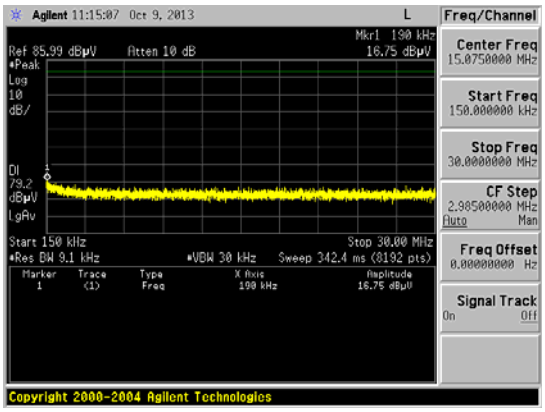
Tx 2402MHz	
9kHz-150kHz	150kHz-30MHz
	
30MHz-1000MHz	1GHz-5GHz
	
5GHz-10GHz	10GHz-15GHz
	
15GHz-20GHz	20GHz-25GHz
	

Tx 2440MHz

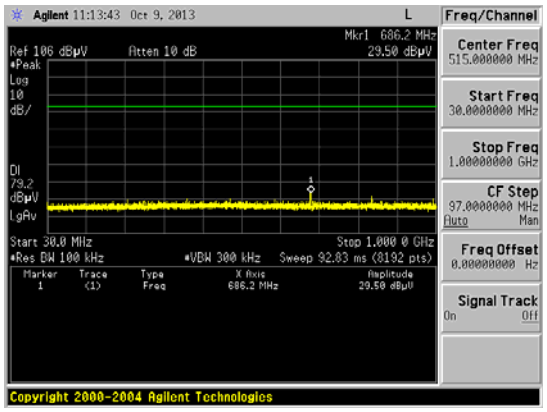
9kHz-150kHz



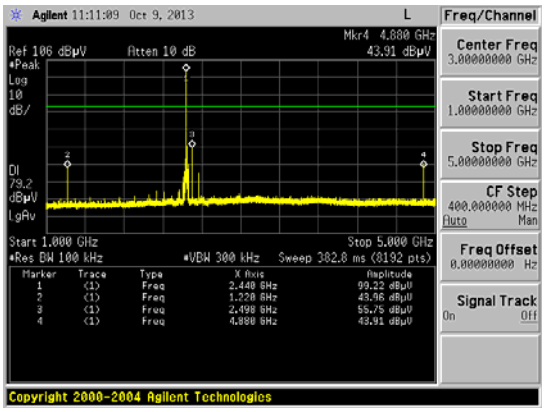
150kHz-30MHz



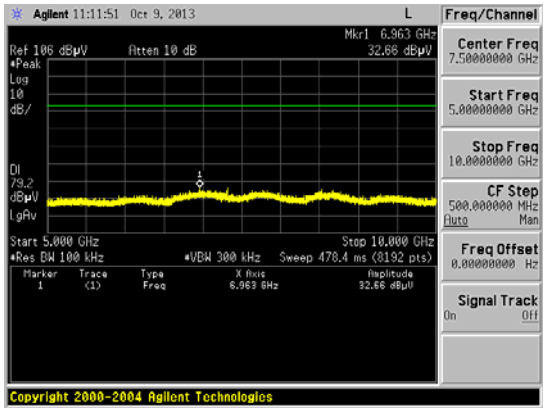
30MHz-1000MHz



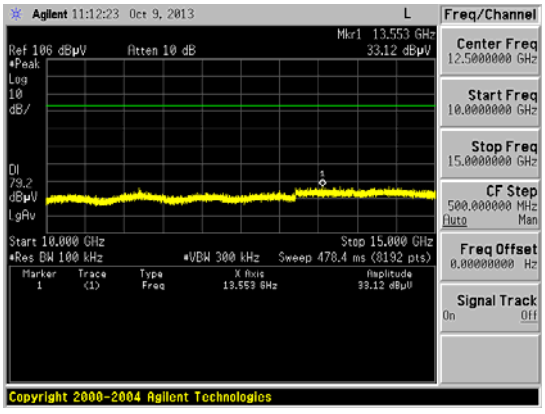
1GHz-5GHz



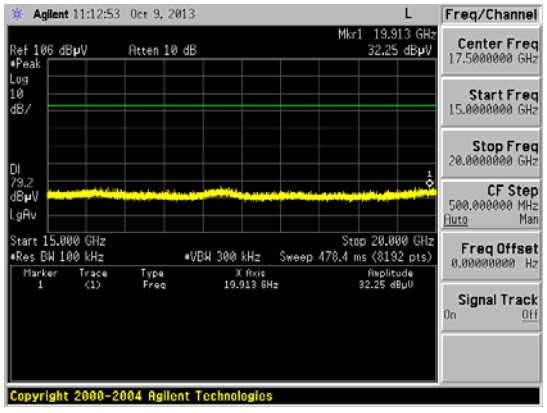
5GHz-10GHz



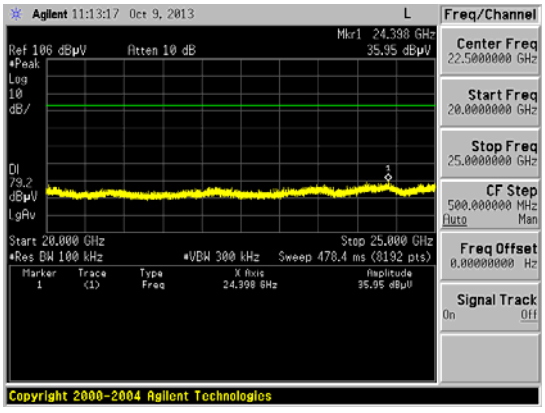
10GHz-15GHz

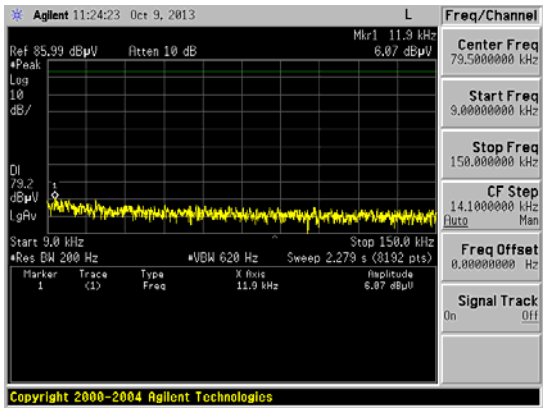
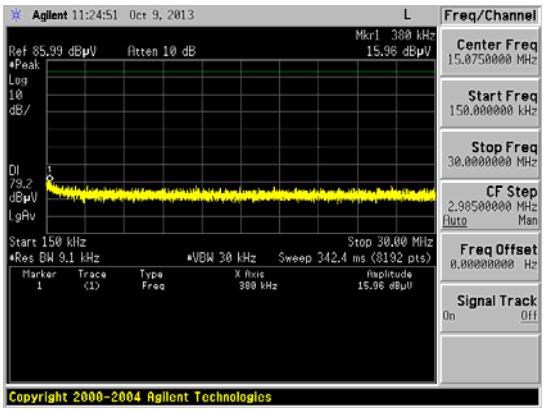
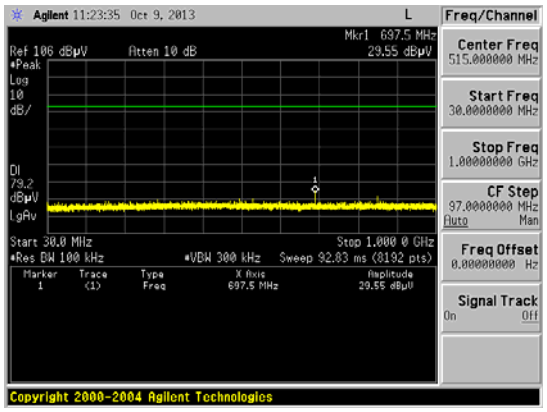
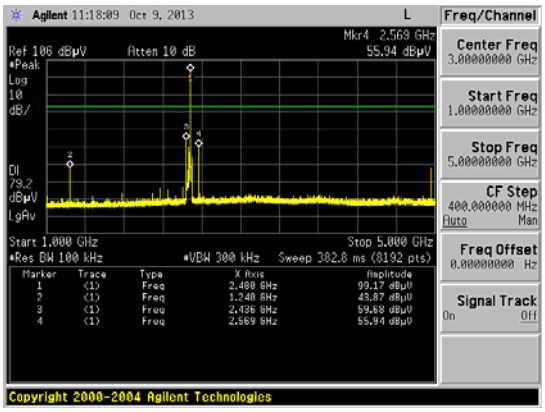
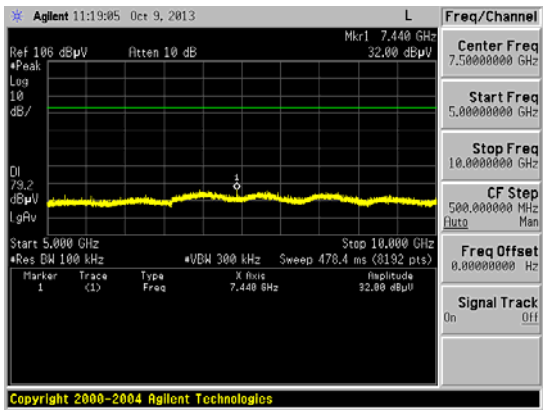
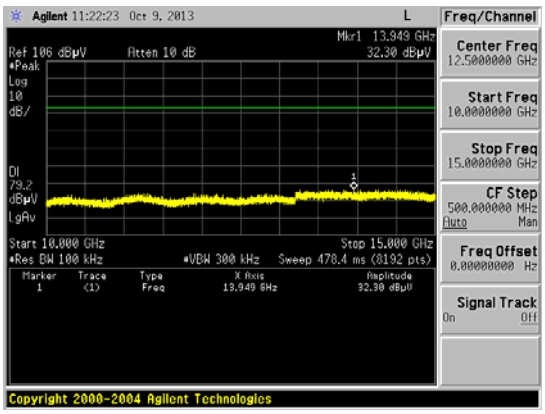
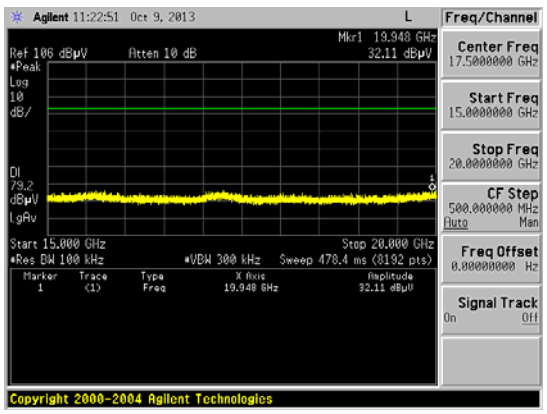
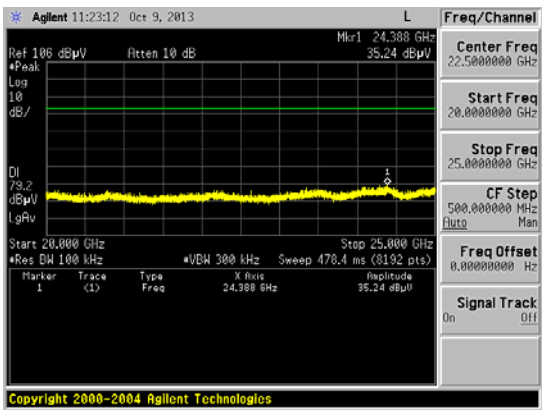


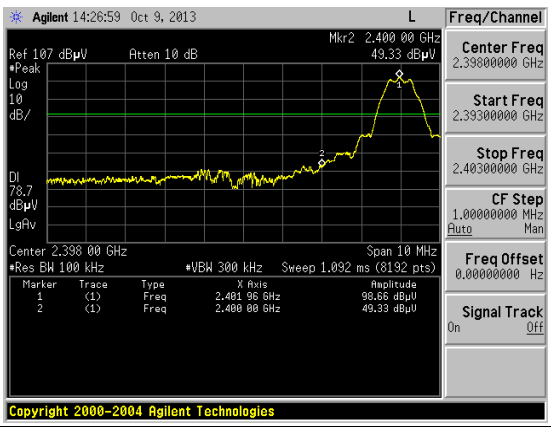
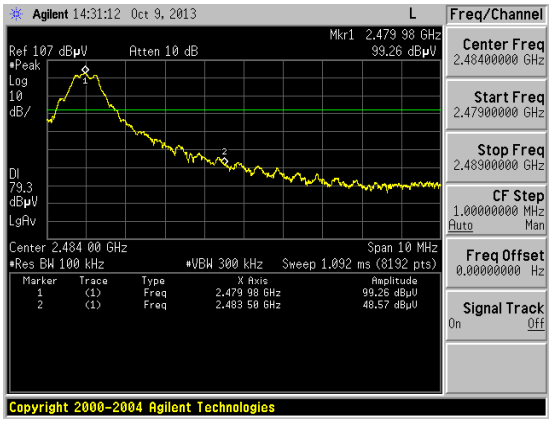
15GHz-20GHz



20GHz-25GHz



Tx 2480MHz	
9kHz-150kHz	150kHz-30MHz
	
30MHz-1000MHz	1GHz-5GHz
	
5GHz-10GHz	10GHz-15GHz
	
15GHz-20GHz	20GHz-25GHz
	

Conducted Emission Band Edge Compliance	
Low	High
	

8. PEAK POWER SPECTRAL DENSITY MEASUREMENT

8.1. Test Procedure

(1) Connect the EUT RF output port to spectrum analyzer (*1) via calibrated coaxial cable and suitable attenuator (if necessary).
(2) Activates the EUT System and execute the software prepared for test, if necessary.
(3) To find out the maximum emission condition, the transmitting data rate of EUT is set to maximum data rate.
(4) Record the spectral density perform peak search using the spectrum analyzer.

[Note]
(*1) Spectrum Analyzer Set Up Conditions

Center Frequency	: Carrier frequency
Frequency Span	: 1.5 times the emission bandwidth
Resolution bandwidth	: 3kHz
Video bandwidth	: 3 x RBW
Detector function	: Peak

8.2. Test Results

Measured Frequency (MHz)	Correction Factor (dB)	Meter Reading (dBm)	Power Spectral Density (dBm)	Limit (dBm)	Margin for Limit (dB)
2402	10.80	-20.25	-9.45	8.00	17.50
2440	10.90	-19.80	-8.90	8.00	16.90
2480	10.90	-20.09	-9.19	8.00	17.20

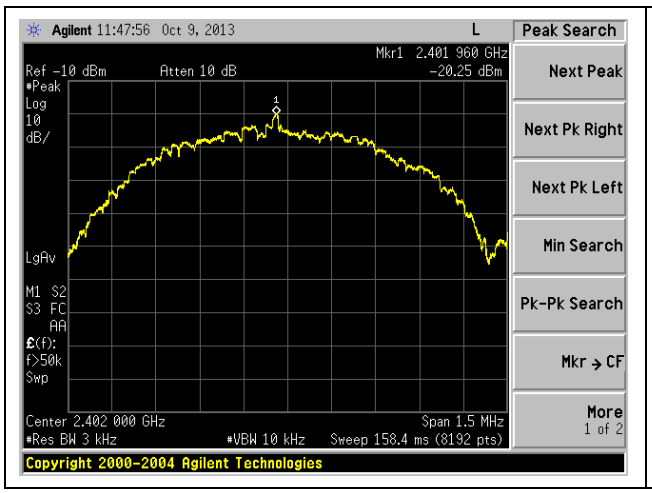
[Note]
(1) Correction Factor includes the cable loss and attenuator loss.
(2) See next page figure.

[Calculation method of Limit line]
Spectral Density (dBm) = Meter Reading (dBm) + Correction Factor (dB)

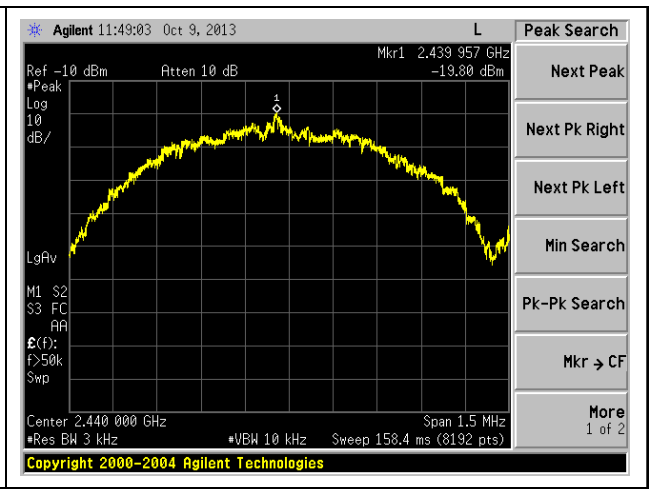
Tested Date	Environment	
	Temperature	Humidity
9 October 2013	23 °C	45 %

Spectrum Chart

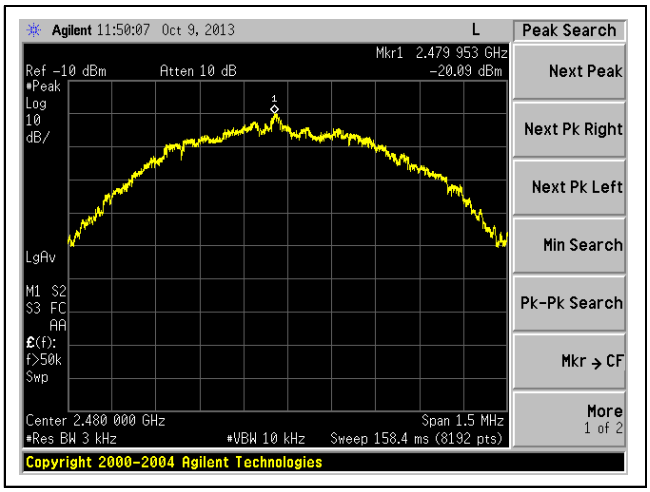
2402MHz



2440MHz



2480MHz



9. TEST EQUIPMENT

· AC Power Line Conducted Emission Measurement

KEC No.	Equipment	Manufacturer	Model No.	Last Cal.	Next Cal.
AT-144	Low Power Attenuator	HUBER+SUHNER	6810.01.A	2013/09	2014/09
FL-107	LISN	KYORITSU	KNW-407	2013/09	2014/09
FS-083	Test Receiver	ROHDE & SCHWARZ	ESHS10	2012/12	2013/12
FS-103	Test Receiver	Schwarzbeck	FCKL1528	2013/01	2014/01
MM-252	RF Relay Matrix	TSJ	RFM-E121	2013/09	2014/09
SA-049	Spectrum Analyzer	Agilent	E4403B	2012/11	2013/11

· 6dB Bandwidth Measurement
· Peak Power Spectral Density Measurement
· Spurious Emissions Measurement (Conducted measurement)

KEC No.	Equipment	Manufacturer	Model No.	Last Cal.	Next Cal.
AT-148	Fixed Attenuator	Anritsu	41KC-10	2013/03	2014/03
SA-052	Spectrum Analyzer	Agilent	E4446A	2012/10	2013/10

· Peak Conducted Output Power Measurement

KEC No.	Equipment	Manufacturer	Model No.	Last Cal.	Next Cal.
AT-148	Fixed Attenuator	Anritsu	41KC-10	2013/03	2014/03
VV-061	Power Meter	Agilent	N1912A	2013/05	2014/05
VV-061-1	Wideband Power Sensor	Agilent	N1921A	2013/05	2014/05

· Spurious Emissions Measurement (Radiated measurement)

KEC No.	Equipment	Manufacturer	Model No.	Last Cal.	Next Cal.
AM-053	Pre-Amplifier	HP	8449B	2013/04	2014/04
AM-041	Pre-Amplifier	Anritsu	MH648A	2013/04	2014/04
AN-104	Std. Gain Horn Antenna	Scientific-Atlanta	12-5.8	2013/05	2015/04
AN-107	Std. Gain Horn Antenna	Scientific-Atlanta	12A-18	2011/07	2013/10
AN-145	Std. Gain Horn Antenna	Scientific-Atlanta	12-12	2013/05	2015/04
AN-210	Std. Gain Horn Antenna	Scientific-Atlanta	12-8.2	2013/05	2015/04
AN-217	LPDA Antenna	Schwarzbeck	UHALP 9108A	2013/04	2014/04
AN-094	Biconical Antenna	Schwarzbeck	VHA9103/BBA9106	2013/04	2014/04
AN-298	DRG Horn Antenna	BBHA9120LF(A)	Schwarzbeck	2013/05	2014/04
AT-105	3dB Attenuator	JFW	50HF-003	2013/04	2014/04
AT-106	3dB Attenuator	JFW	50HF-003	2013/04	2014/04
FL-222	Band-stop Filter	TOYO	8BRM2442/T300	2013/05	2014/04
FS-062	Test Receiver	ROHDE & SCHWARZ	ESS	2013/09	2014/09
MM-530	RF Relay Matrix Unit	TSJ	RFM-E321	2013/04	2014/04
SA-052	Spectrum Analyzer	Agilent	E4446A	2012/10	2013/10

Note : (*1) We check the performance, before using this device.

The overall program of calibration and verification of equipment is designed and operated so as to ensure that measurements made by KEC are traceable to national standards of measurement or equivalent abroad.

APPENDIX A (DECLARATION OF COMPLIANCE TO MAXIMUM PERMISSIBLE EXPOSURE LIMITS FOR HUMANS)

The Model EYSFCN with 2400-2483.5MHz DTS transmitter complies with Maximum permissible exposure limits for humans as called out in §1.1310. It is exempt from Maximum Permissible Exposure based on its operating frequency, and power density 0.04mW/cm^2.

Calculation formula :

$$S = PG / 4\pi D^2$$

S : power density (W/m^2)
P : peak output power (W)
G : antenna gain (isotropic)
D : measurement distance (m)

Where :
P = 2.92dBm (see 15 page)
G = 1.3dBi
D = 0.2

Therefore :

$$S(W/m^2) = \frac{10^{\frac{2.92}{10}} \times 10^{-3} \times 10^{\frac{1.3}{10}}}{4 \times 3.14 \times 0.2 \times 0.2} = 0.005257$$

S≒0.05 (mW/cm^2)

This would be less than 1mW/cm^2 when the separation distance between the user and the device's radiating element is less than 20cm.