

# Certification of Compliance

## CFR 47 Part 15 Subpart C

Test Report File No. : 09-IST-0383      Date of Issue : June 05, 2009

Model(s) : O2USZM01  
Kind of Product : Wireless Laundry Payment Device  
FCC ID : XERO2USZM01  
Applicant : Otwo CashKorea.Ltd  
Address : 103-1519 hyundai the loft, 536-2, Bupyeong-dong, Bupyeong-gu,  
Incheon-si, Korea  
Manufacturer : Otwo CashKorea.Ltd  
Address : 103-1519 hyundai the loft, 536-2, Bupyeong-dong, Bupyeong-gu,  
Incheon-si, Korea

### Test Result

☒ Positive

☐ Negative

Reviewed By

Approved By



S.J.CHO / EMC Group Manager



B.S.KIM / Chief

### Comment (s)

- Investigations requested : Measurement to the relevant clauses of FCC rules and regulations Part 15 Subpart C.

- The test report with appendix consists of 40 pages.

- The test result only responds to the tested sample.

- It is not allowed to copy this report even partly without the allowance of IST EMC Laboratory.

- This equipment as for has been shown to be capable of continued compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4

I assume full responsibility for accuracy and completeness of these data.



## TABLE OF CONTENTS

Table of contents	2
Information of test laboratory, Environmental conditions, Power used, Product information	3
Descriptions of Test	4
- Conducted Emission	4
- Radiated Emission	5
- Radiated Emission, 9KHz to 30MHz(Magnetic Field Test)	6
Measurement Uncertainty Calculations	7
Equipment Under Test	8
Summary	9
- Conducted Emission	11
- Zigbee Mode (2405 MHz~2480 MHz)	14
Radiated Emission	14
Peak power output	21
Band edge	23
6dB Band	30
Power Density	32
- RFID Mode(13.56 MHz)	34
Radiated Emission-15.225(a)	34
Radiated Field Emission-15.225(b)(c)	35
Radiated Field Emission-15.109, 15.209&15.225(d)	36
Frequency Stability -15.225(e)	37
- Test Photo of Test Setup	38
- The Photos of Equipment Under Test	40

Note:

## INFORMATIONS OF TEST LABORATORY

EMC LABORATORY of IST Co., Ltd. (FCC Filing Lab-400603.)

Singal-dong, Giheung-gu, Yongin-City

Kyonggi-Do, 400-19, Korea

TEL : +82 31 326 6700

FAX : +82 31 326 6797

## ENVIRONMENTAL CONDITIONS

Temperature 19.53 °C Humidity 454 %

Atmospheric pressure 1018 mbar

## POWER SUPPLY SYSTEM USED

Power supply system DC 12V(Refer to the product information)

## PRODUCT INFORMATION

	Item	Specification
Wireless Communication part	Frequency	2400 ~ 2483.5MHz
	Output Power	7dBm(±1dB)
	Rx Sensitivity	-94dBm
	RF Data Rate	250 Kbps
	Networking Topology	point-to- point
	Hardware interface	UART
	Spread Spectrum Type	DSSS (Direct Sequence Spread Spectrum)
	Channel Capacity	16 Direct Sequence Channels (software selectable)
	CPU	8 Bit Micro Processor
	Antenna/Gain	Chip Antenna / 1dBi
	Operating Temperature	-20~ 50 °C (Relative humidity 90%)
	Operating Voltage Range	DC 12V / 200mA
RF Card	Frequency	13.56MHz
	Output Power	MAX 500mW
	Antenna	PCB Loop Antenna
	Operating Voltage Range	5VDC ± 5%
	Operating Temperature	-20~50 °C (Relative humidity 90%)

- Regards to the frequency band operation; the highest that was included the lowest, middle and highest frequency of channel were selected to perform the test, and then shown on this report.

- Please refer to user's manual.

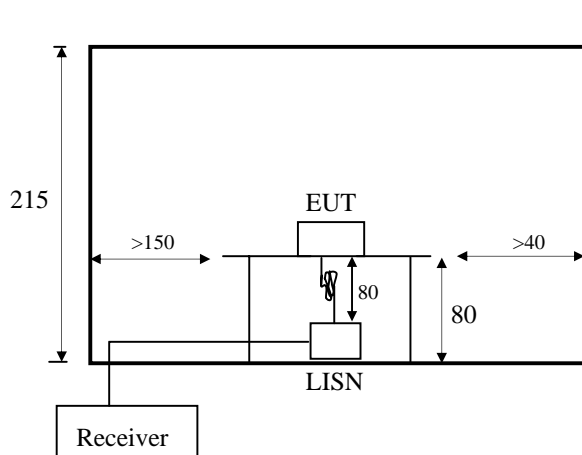
## DESCRIPTION OF TEST

### Conducted Emissions:

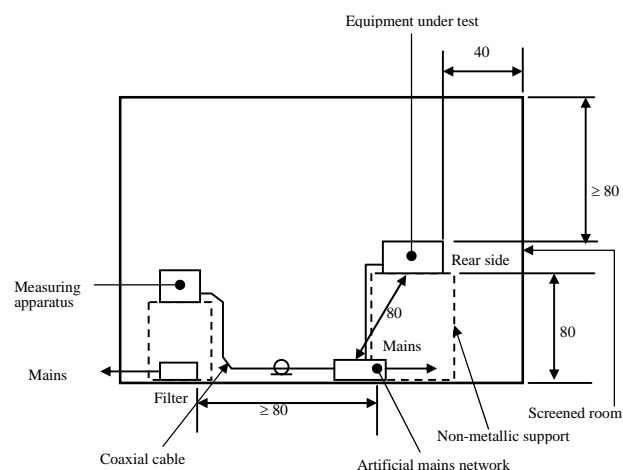
The measurement were performed over the frequency range of 0.15 MHz to 30 MHz using a 50  $\Omega$ /50  $\mu$ H LISN as the input transducer to a Spectrum Analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 10KHz or for "quasi-peak" & "Average" within a bandwidth of 9 KHz.

#### -Procedure of Test

The line-conducted facility is located inside a shielded room No.1. A 1 m X 1.5 m wooden table 80 cm height is placed 40 cm away from the vertical wall and 1.5 m away from the other wall of the shielded room. The R/S ESCI and Hyup-Rip KNW-407 LISN are bonded to bottom of the shielded room. The EUT is located on the wooden table with distance more than 80 cm from the LISN and powered from the EMCO LISN .The peripheral equipment is powered from the other LISN. Power to the LISNs are filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner  $\phi$  1.2 cm. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the EMCO LISN. All interconnecting cables more than 1m were shortened by non-inductive bundling to a 1m length. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating conditions. The RF output of the LISN was connected to the R/S receiver to determine the frequency producing the maximum emission from the EUT. The frequency producing the maximum level was reexamined using Quasi-Peak mode by manual measurement, after scanned by automatic Peak mode for frequency range from 0.15 to 30 MHz. The bandwidth of the receiver was set to 10 kHz. The EUT, peripheral equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission.



< Side View >



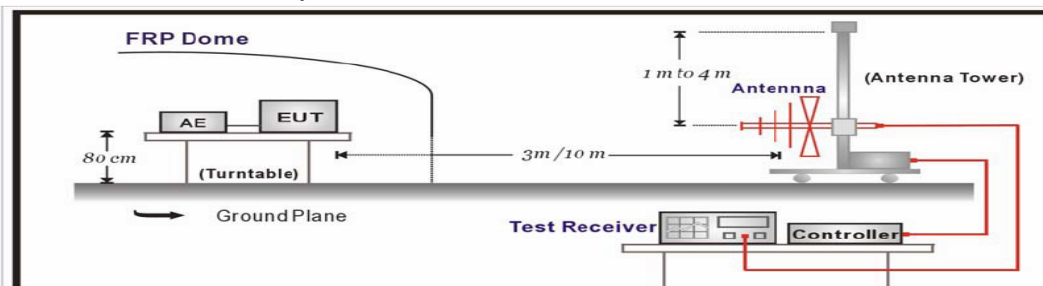
< Concept Drawing >

## **Radiated Emissions:**

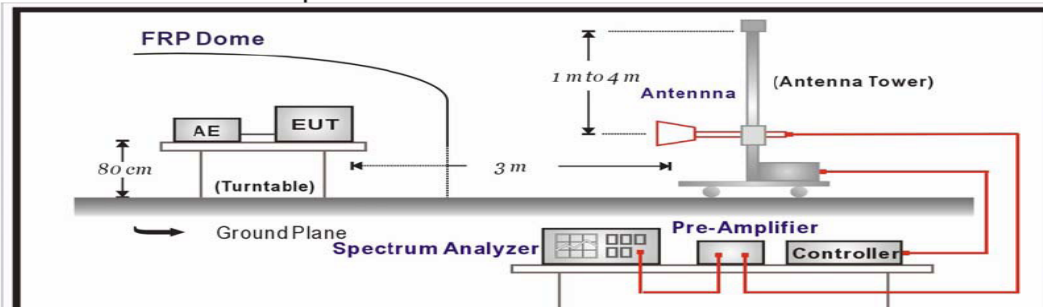
The measurement was performed over the frequency range of 30MHz to 1GHz using antenna as the input transducer to a Spectrum analyzer or a Field Intensity Meter. The measurement was made with the detector set for "quasi-peak" within a bandwidth of 120kHz. Procedure of Test

Preliminary measurements were made at 3 meter using bi-log antennas, and spectrum analyzer to determine the frequency producing the max. emission in anechoic chamber. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turn-table azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30MHz to 1000MHz using bi-log antenna. Above 1GHz, linearly polarized double ridge horn antennas were used. Final measurements were made at open site with 3-meters test distance using bi-log antenna or horn antenna. The OATS have been verified in regular for its normalized site attenuation. The test equipment was placed on a wooden table. Sufficient time for the EUT, peripheral equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined by manual. The detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 120kHz or 1MHz depending on the frequency of type of signal. The EUT, peripheral equipment and interconnecting cables were re-configured to the set-up producing the max. emission for the frequency and were placed on top of a 0.8-meter high nonmetallic 1 x 1.5 meter table. The EUT, peripheral equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by: varying the mode of operation to the EUT and/or peripheral equipment and changing the polarity of the antenna, whichever determined the worst-case emission. (The bandwidth below 1GHz setting on the field strength meter is 120KHz and above 1GHz is 1MHz.)

**Under 1GHz Test Setup:**



**Above 1GHz Test Setup:**



## **Radiated Emissions Test, 9 kHz to 30 MHz(Magnetic Field Test)**

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions at a distance of 3 meters according to Section 15.31(f)(2).
2. The EUT was placed on the top of the 0.8-meter height, 1 x 1.5 meter non-metallic table.
3. Emissions from the EUT are maximized by adjusting the orientation of the Loop antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions if applicable.
4. To obtain the final measurement data, each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector with specified bandwidth.

## Measurement Uncertainty Calculations

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994).

TYPE	Contribution	Probability Distribution	Uncertainty	Remark
B	<b>AMN</b>			
	Impedance	Triangular	+2.6/-2.7 dB	CISPR
	Voltage Division Factor	normal(k=2)	±0.2	
	Attenuation : AMN to Receiver	normal(k=2)	±0.1	
	<b>Receiver(ESCI(S/N:100374))</b>			
	Sine-Wave Voltage Accuracy	normal(k=2)	±1.0 dB	CISPR
	Pulse Amplitude Response	Rectangular	±1.5 dB	
	Pulse Repetition Rate Response	Rectangular	±1.5 dB	
	Mismatch AMN to Receiver	U-Shaped	+0.7/-0.8 dB	CISPR
	Reading	normal(k=1)	±0.1	
Combined Standard Uncertainty		normal	± 1.8 dB	
Expanded Uncertainty U		normal(k=2)	± 3.6 dB	95 %

$U = -3.70 / +3.42$  (k=2, 95.45% confidence level)

T Y P E	Contribution	Probability Distribution	Uncertainty	Remark
B	<b>Antenna</b>			
	AF factor	Normal(k=2)	±0.56	CAL.
	AF frequency interpolation	Rectangular	±0.30 dB	CISPR
	AF height deviations	Rectangular	±0.50 dB	CISPR
	directivity difference	Rectangular	±0.30 dB	CISPR
	phase center location(3 m)	Rectangular	+1.0/-0.0 dB	CISPR
	phase center location(10 m)	Rectangular	±1.0 dB	CISPR
	<b>Receiver</b>			
	Sine Wave Voltage Accuracy	Normal(k=2)	±0.20 dB	CAL.
	Pulse Amplitude Sensibility	Normal(k=2)	±0.40 dB	CAL.
	Pulse Frequency Response	Normal(k=2)	±0.57 dB	CAL.
	Random Noise	Normal(k=2)	±0.35 dB	CAL.
	Mismatch : Antenna - receiver	U-Shaped	+0.9/-1.0 dB	CISPR
	Table height	Normal(k=2)	±0.01 dB	CISPR
	Separation distance(3 m) Separation distance(10 m)	Rectangular	±0.30 dB ±0.10 dB	CISPR
Combined standard Uncertainty		Normal	± 1.13	
Expanded Uncertainty U		Normal(k=2)	± 2.26 dB	95 %

$U = \pm 2.26$  (k=2, 95% confidence level)

## Equipment Under Test

### EUT Type :

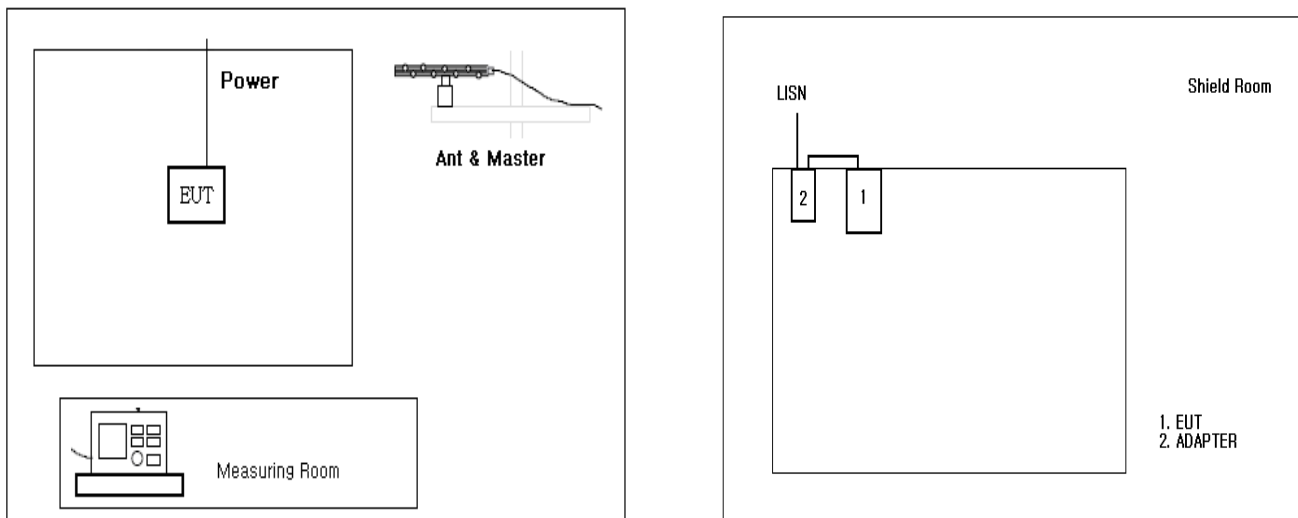
- ☐ Table-Top.                      ☐ Floor-Standing.  
☐ Table-Top and Floor-Standing(Combination).  
☒ Built-in

### Operation – mode of the E.U.T. :

The equipment under test was operated during the measurement under following conditions :

- ☐ Standby Mode  
☒ Operational Condition :                      Continue Transmitting

## Test Set-Up Configuration



### Radiated/Conducted Emissions



## SUMMARY

### Zigbee Mode ( 2405 MHz ~ 2480 MHz)

#### Test Descriptions

■ Conducted Emission	PASS
-Conducted Emission result	
■ Radiated Emission	PASS
- Radiated Emission Result	
■ Peak power output	PASS
- Test result	
■ Band edge	PASS
- Test result	
■ 6dB Band(Occupied Bandwidth)	PASS
- Test Result	
■ Power Density	PASS
- Test Result	

### RFID Mode ( 13.56 MHz)

#### Test Descriptions

■ Conducted Emission	PASS
-Conducted Emission result	
■ Radiated Emission-15.225(a)	PASS
- Radiated Emission Result	
■ Radiated Electric Field Emission-15.225(b)(c)	PASS
- Test result	
■ Radiated Electric Field Emission-15.109, 15.225(d)	PASS
- Test result	
■ Frequency Stability -15.225(e)	PASS

#### Test Result

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

#### Note :

- ■ means that the test is applicable,
- □ means that the test is not applicable.

**Test Date**

Begin of Testing : May 07, 2009 - End of Testing : June 05, 2009

Prepared By



---

U.H. Ryu / Senior Engineer

### Conducted Emissions

[Applicable]

◆ Test Equipment Used

Model Name	Description	Manufacturer	Calibration Date	Serial No.
ESCI	Test Receiver	Rohde & Schwarz	Jun. 26, 2008	100373
KNW-407	LISN	HyupRip	Oct. 11, 2008	8-833-10
ESH3-Z2	Pulse Limiter	Rohde & Schwarz	May. 21, 2008	357.8810.52

◆ Test Accessories Used

◆ Test Program                      Continue Transmit

◆ Test Date                              June 05, 2009

◆ Test Area                              Conducted Room No.1

Note ∴

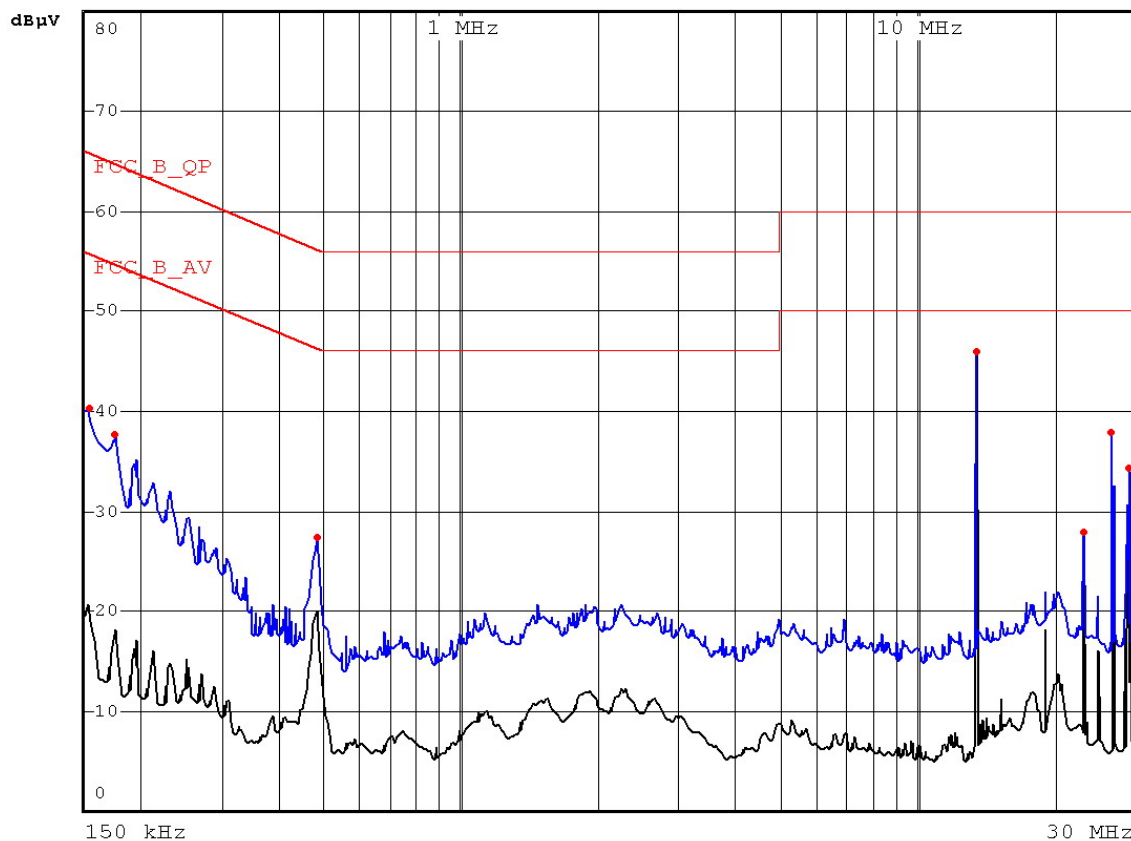
## Conducted Emissions Result

Phase : Live



RBW 9 kHz  
MT 160 ms  
PREAMP OFF

Att 10 dB



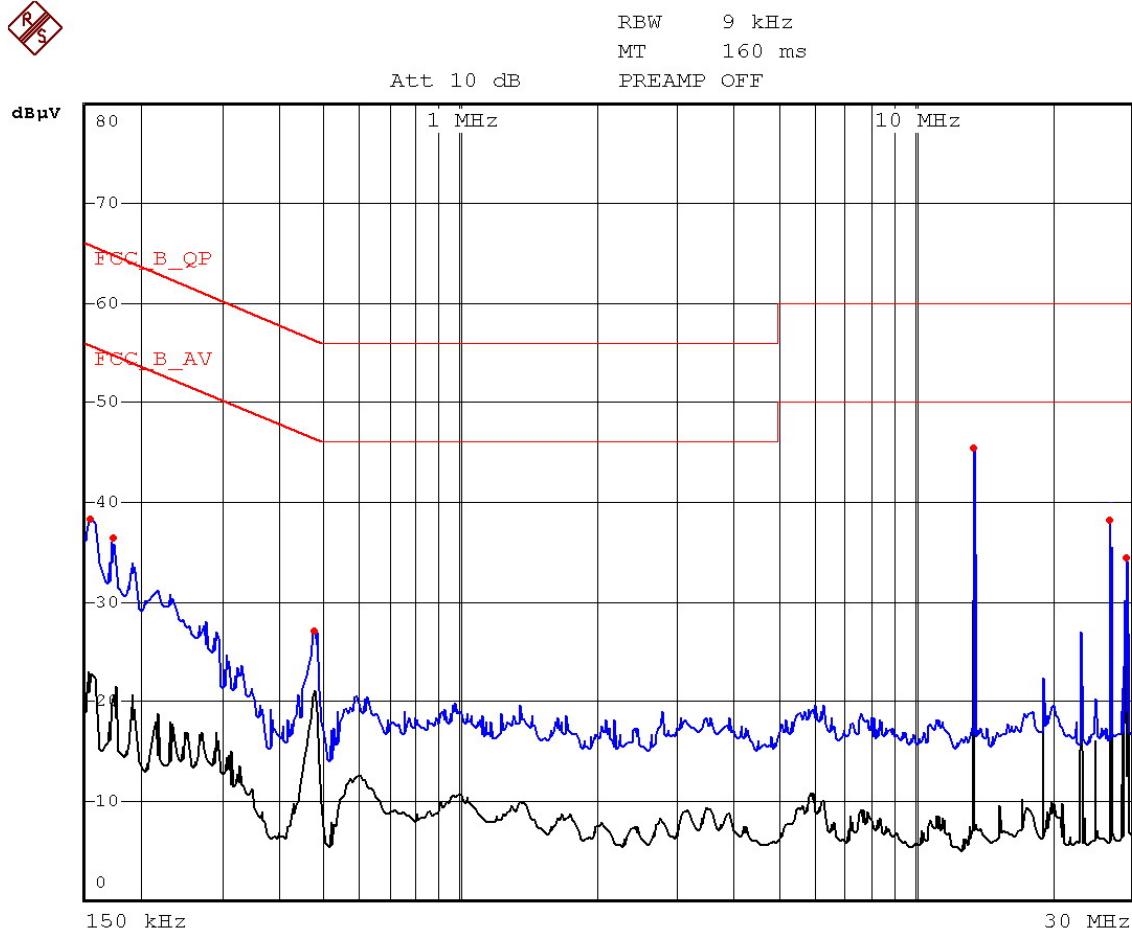
Model Name : O2USZM01 Op : 120Vac 60Hz Phase : Live

Freq. [MHz]	Measurement [dB $\mu$ V]		Limit [dB $\mu$ V]		Insertion Loss [dB]	Cable Loss [dB $\mu$ V]	Result [dB $\mu$ V]		Margin [dB]	
	Q-peak	Average	Q-peak	Average			Q-peak	Average	Q-peak	Average
0.150	35.02	19.16	66.00	56.00	0.38	0.60	36.00	20.14	30.00	35.86
0.174	34.07	18.62	64.77	54.77	0.41	0.60	35.08	19.63	29.68	35.13
0.482	23.85	20.21	56.30	46.30	0.22	0.77	24.84	21.20	31.46	25.10
13.560	46.97	44.93	60.00	50.00	0.38	0.70	48.05	46.01	11.96	4.00
23.165	26.15	25.61	60.00	50.00	0.59	0.70	27.44	26.90	32.56	23.10
27.120	38.57	38.10	60.00	50.00	0.67	1.00	40.24	39.77	19.76	10.23
29.490	36.62	36.81	60.00	50.00	0.70	0.80	38.12	38.31	21.88	11.69

Note : Continue Transmit Mode

## Conducted Emissions Result

Phase : Neutral



Model Name : O2USZM01 Op : 120Vac 60Hz Phase : Neutral

Freq. [MHz]	Measurement [dB μV]		Limit [dB μV]		Insertion Loss	Cable Loss	Result [dB μV]		Margin [dB]	
	Q-peak	Average	Q-peak	Average			Q-peak	Average	Q-peak	Average
0.150	33.58	20.84	66.00	56.00	0.38	0.60	34.56	21.82	31.44	34.18
0.174	32.92	31.59	64.77	54.77	0.41	0.60	33.93	32.60	30.83	22.16
0.482	24.08	20.54	56.30	46.30	0.22	0.77	25.07	21.53	31.23	24.77
13.560	47.15	45.87	60.00	50.00	0.38	0.70	48.23	46.95	11.78	3.06
27.120	38.77	37.65	60.00	50.00	0.67	1.00	40.44	39.32	19.56	10.68
29.490	37.08	37.10	60.00	50.00	0.70	0.80	38.58	38.60	21.42	11.40

Note : Continue Transmit Mode

### Radiated Emission

[Applicable]

#### ◆ Test Equipment Used

Name	Type	Manufacturer	Calibration. Date	Serial Number
ESCS30	EMI Receiver	Rohde & Schwarz	Sep. 10, 2008	100171
SPECTRUM ANALYZER	R3273	ADVANTEST	Sep. 12, 2008	110600587
Loop Antenna	HFH2-Z2	Rohde & Schwarz	Oct. 23, 2008	8620771017
Log-bicon Antenna	VULB9161SE	Schwarz beck	Aug. 28, 2007	4089
HORN-Antenna	3115	EMCO	Dec. 26, 2007	9012-3602
HORN-Antenna	SAS-571	A.H. SYSTEMS	Dec. 26, 2007	500
PRE AMPLIFIER	8449B OPT H02	Rohde & Schwarz	Oct. 11, 2008	3008A0530

*Note : 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to RRL, KRISS, KTL and HCT.*

*2. The calibration interval of horn ant. and loop ant. is 24 months*

#### Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. For the limit is employed average value, therefore the peak value can be transferred to average value by subtracting the duty factor. The basic equation with a sample calculation is as follows:

$$\text{Peak} = \text{Reading} + \text{Corrected Factor}$$

Where

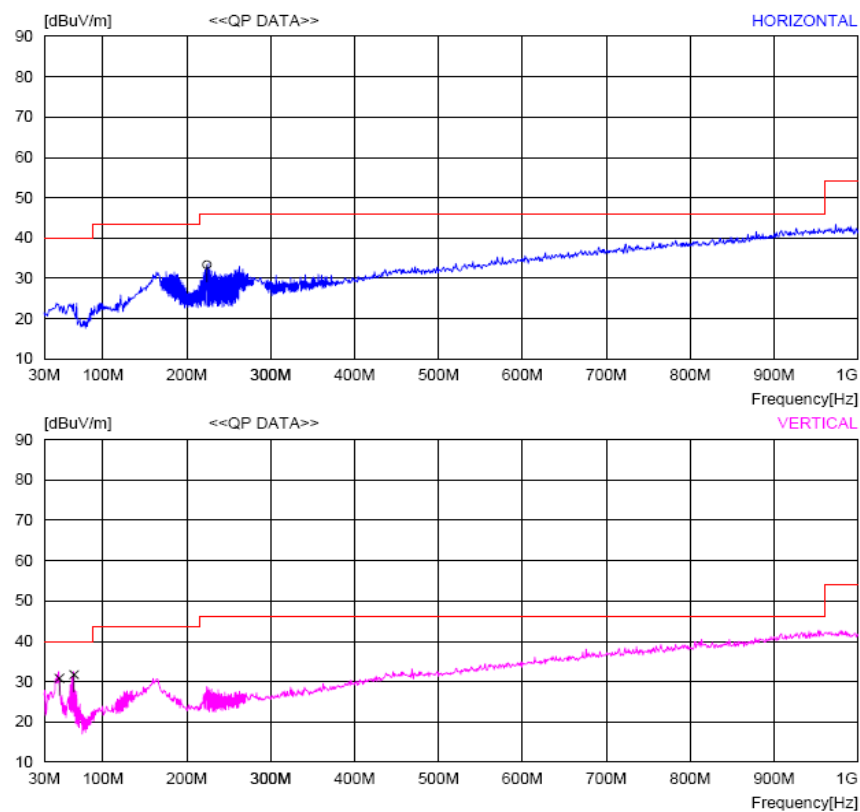
Corr. Factor = Antenna Factor + Cable Factor - Amplifier Gain (if any)

## Zigbee Mode ( 2405 MHz ~ 2480 MHz)

### Radiated Emission Result

[Applicable]

EUT	O2USZM01	PROBE	0.3GHz~1GHz
POWER	DC 12 V	NOTE	TX-CH1 ( 2405 MHz )



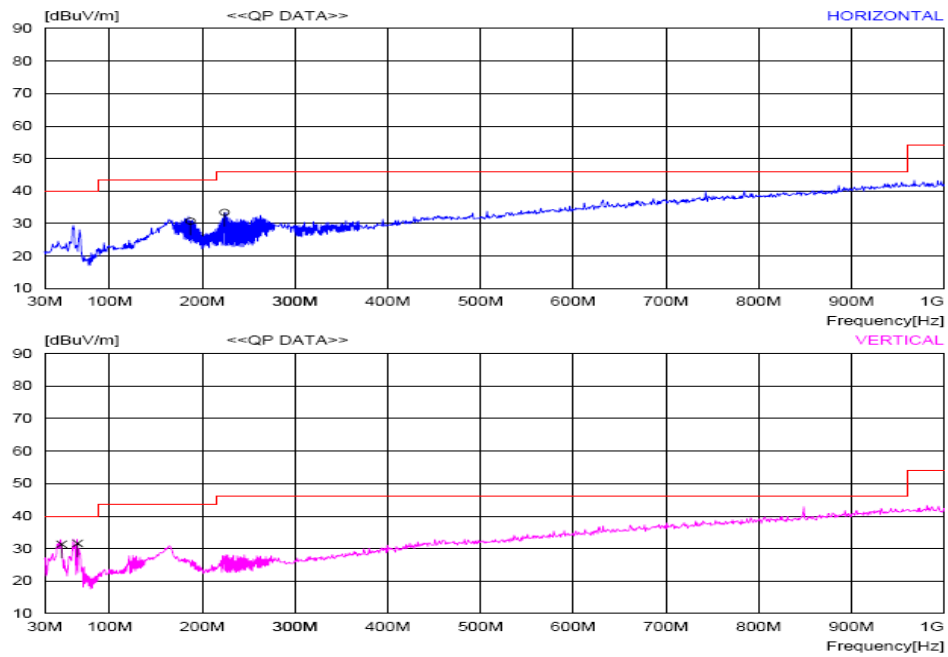
Frequency MHz	Reading dBuV	P (H, V)	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV	Total dBuV	Margin dB
48.31	18.4	V	11.4	1.1	0.0	40.00	30.9	9.2
*65.69	20.4	V	10.2	1.1	0.0	40.00	31.7	8.3
224.13	20.1	H	10.7	2.6	0.0	46.0	33.4	12.6

Note :

1. Remark "\*" means that the data is the worst emission level.
2. All reading levels are Quasi-peak value.
3. Measurement level = reading level + correct factor

[Applicable]

EUT	O2USZM01	PROBE	0.3GHz~1GHz
POWER	DC 12 V	NOTE	TX-CH8 ( 2445 MHz )



Frequency MHz	Reading dBuV	P (H, V)	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV	Total dBuV	Margin dB
48.31	18.9	V	11.4	1.1	0.0	40.00	31.4	8.6
*65.69	20.3	V	10.2	1.1	0.0	40.0	31.6	8.4
187.43	16.1	H	12.4	2.3	0.0	43.5	30.8	12.8
224.14	20.1	H	10.7	2.6	0.0	46.0	33.4	12.6

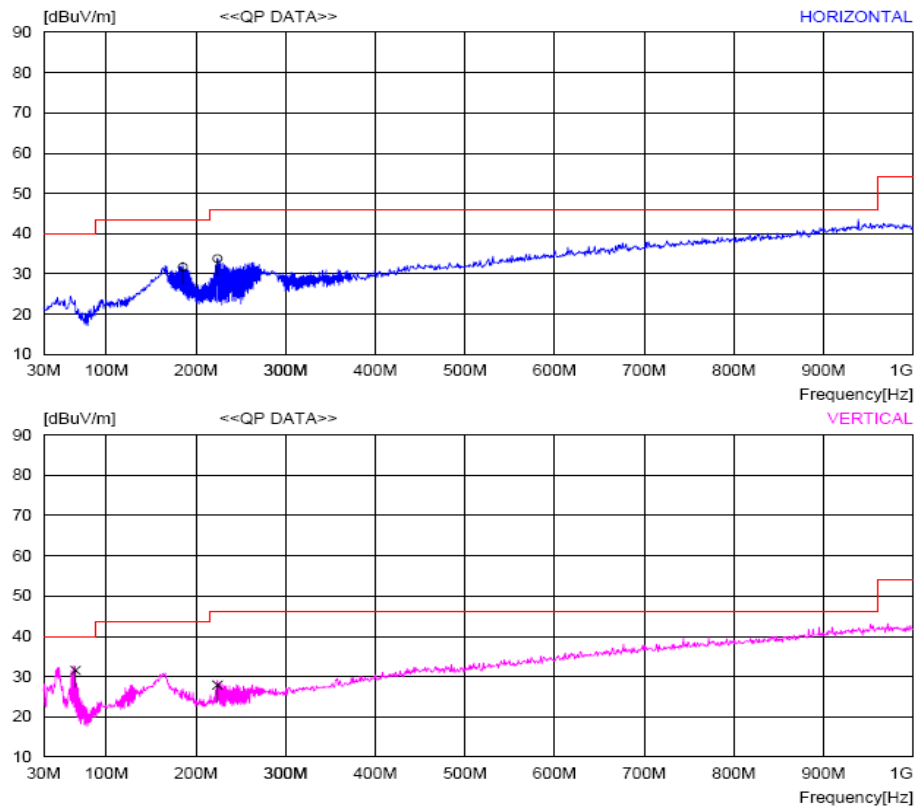
Note :

1. Remark "\*" means that the data is the worst emission level.
2. All reading levels are Quasi-peak value.
3. Measurement level = reading level + correct factor



[Applicable]

EUT	O2USZM01	PROBE	0.3GHz~1GHz
POWER	DC 12 V	NOTE	TX-CH15 ( 2480 MHz )



Frequency MHz	Reading dBuV	P (H, V)	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Limit dBuV	Total dBuV	Margin dB
*65.69	20.2	V	10.2	1.1	0.0	40.0	31.5	8.5
185.48	16.6	H	12.8	2.3	0.0	43.5	31.7	11.8
224.12	20.5	H	10.7	2.6	0.0	46.0	33.8	12.2
224.13	14.6	V	10.7	2.6	0.0	46.0	27.9	18.1

Note :

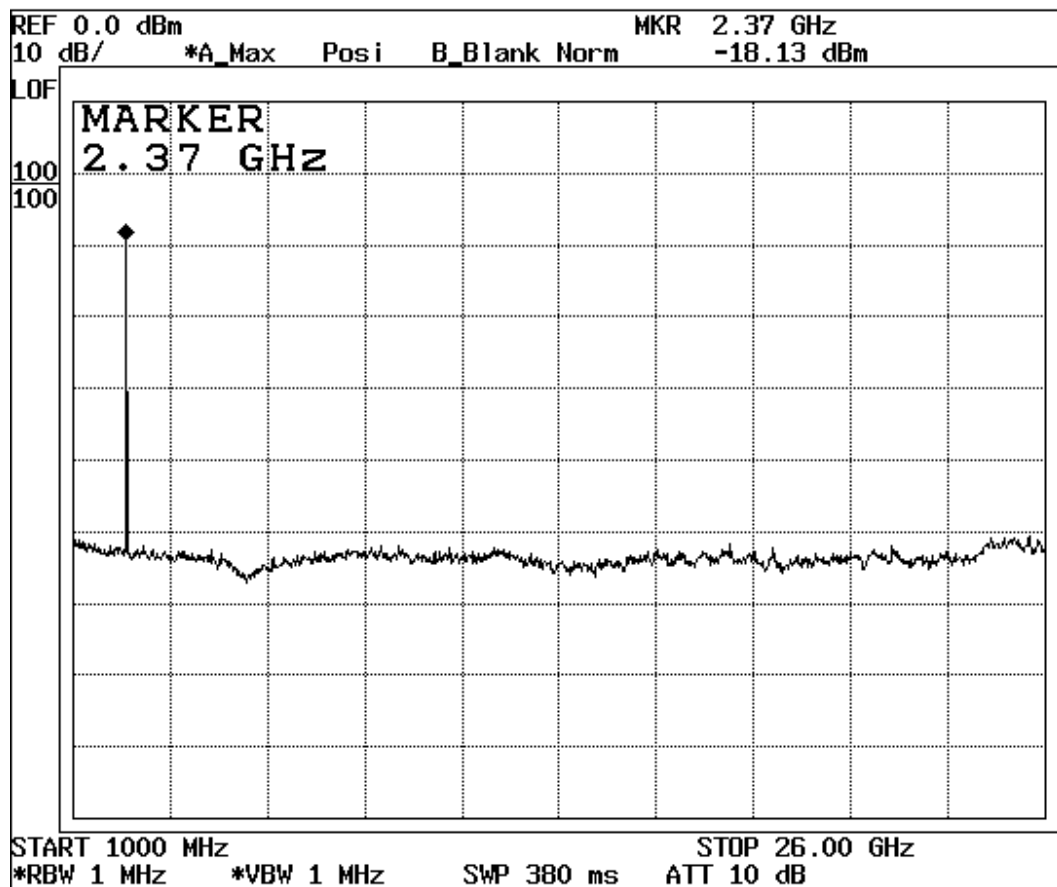
1. Remark "\*" means that the data is the worst emission level.
2. All reading levels are Quasi-peak value.
3. Measurement level = reading level + correct factor

## Radiated Emissions Result

(Disturbance Radiation)

[Applicable]

EUT	O2USZM01	PROBE	RF 1GHZ~26GHz
POWER	DC 12 V	NOTE	TX-CH1 (2405 MHz)

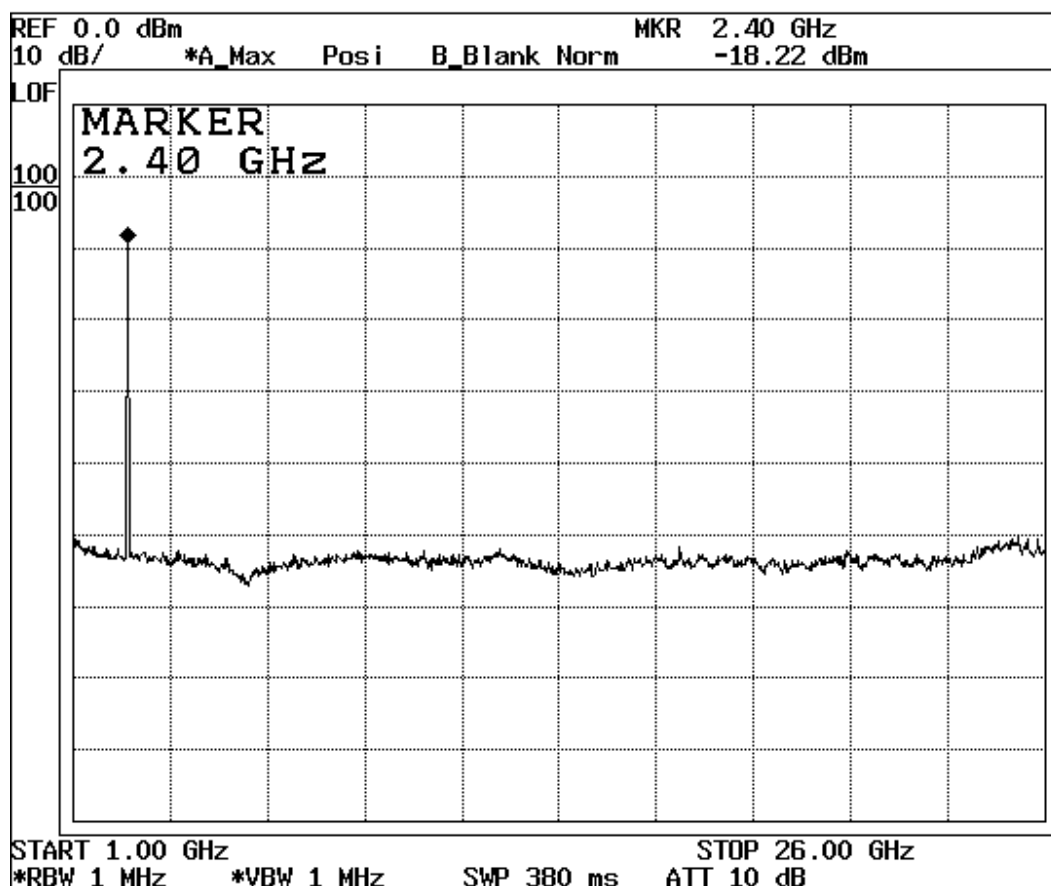


Frequency MHz	Reading dBuV	P (H, V)	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Total dBuV	Limit dBuV	Margin dB
-	-	-	-	-	-	-	-	-

Note : Other emissions don't exceed the level of 20 dB below the applicable Limit.

[Applicable]

EUT	O2USZM01	PROBE	RF 1GHZ~26GHz
POWER	DC 12 V	NOTE	TX-CH8 (2445 MHz)

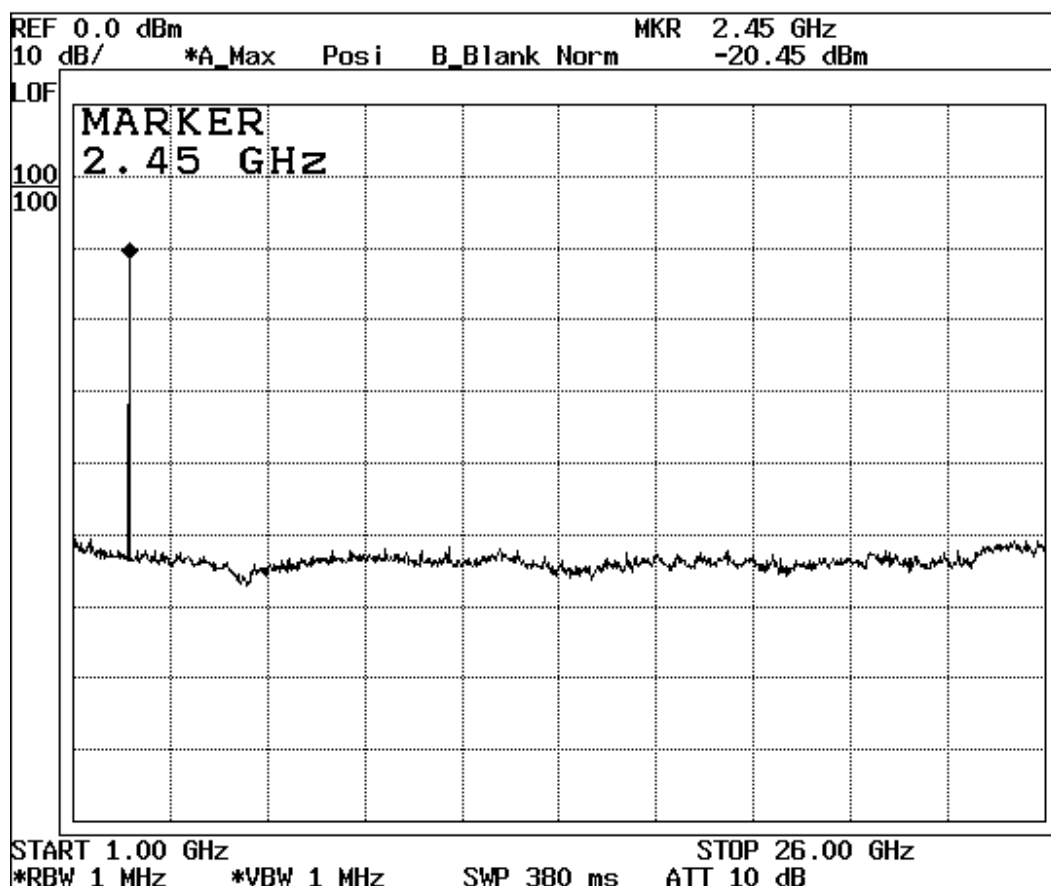


Frequency MHz	Reading dBuV	P (H, V)	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Total dBuV	Limit dBuV	Margin dB
-	-	-	-	-	-	-	-	-

Note : Other emissions don't exceed the level of 20 dB below the applicable Limit.

[Applicable]

EUT	O2USZM01	PROBE	RF 1GHZ~26GHz
POWER	DC 12 V	NOTE	TX-CH15(2480 MHz)



Frequency MHz	Reading dBuV	P (H, V)	Ant. Factor dB	Cable Loss dB	AMP GAIN dB	Total dBuV	Limit dBuV	Margin dB
-	-	-	-	-	-	-	-	-

Note : Other emissions don't exceed the level of 20 dB below the applicable Limit.

## Peak Power Output

### ◆Test Equipment

The following test equipment are used during the test:

Item	Equipment	Manufacturer	Model no/Serial No.	Last Cal.
1	Spectrum Analyzer	ADVANTEST	R3273 / 95090431	Aug. 01, 2008
2	RF ROOM			

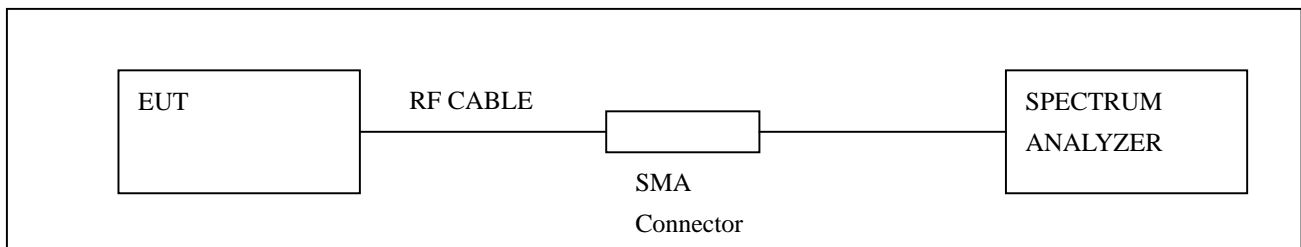
*Note : All equipment upon which need to calibrated are with calibration period of 1 year.*

### ◆Limits

The maximum peak output power of the intentional radiator shall not exceed the following :

- According to § 15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz : 1Watt.
- According to § 15.247(b)(4), the conducted output power limit specified in paragraph(b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph(c) of this section, is transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs(b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi

### ◆Test Setup



### ◆Test Procedure

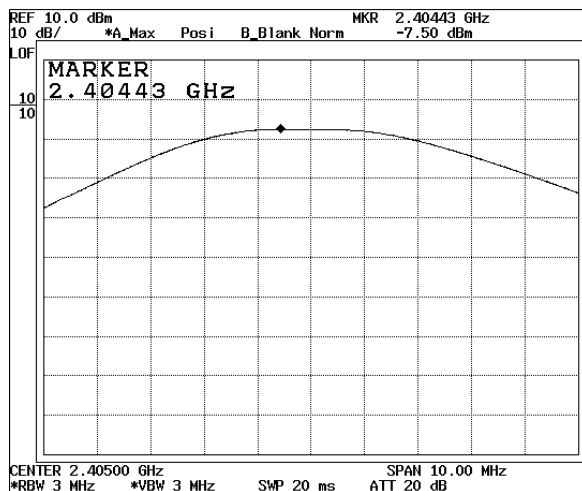
The transmitter output is connected to the Spectrum analyzer. The Spectrum analyzer is set to the peak power detection.

### Peak Power Test result

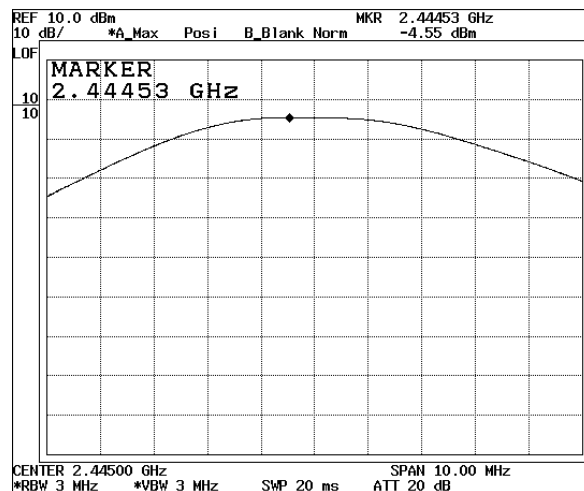
Product	O2USZM01
Test Item	Peak Power Output
Test Mode	Transmit
Test Site	RF Room
Measurement Method	Conducted

Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
1	2405	-7.50	1Watt=30dBm	Pass
8	2445	-4.55	1Watt=30dBm	Pass
15	2480	-3.41	1Watt=30dBm	Pass

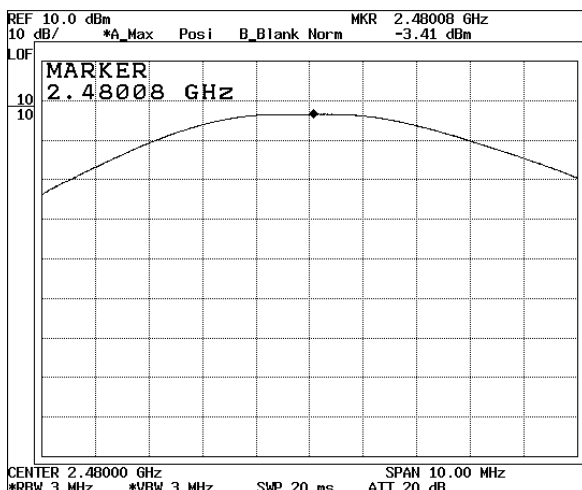
Channel 1.



Channel 8.



Channel 15



Note : Measurement level = reading level + correct factor

## Band Edge

### ◆TEST Equipment

The following test equipment are used during the test:

Name	Type	Manufacturer	Calibration. Date	Serial Number
ESCS30	EMI Receiver	Rohde & Schwarz	Sep. 10, 2008	100171
SPECTRUM ANALYZER	R3273	ADVANTEST	Sep. 12, 2008	95095431
BICONILOG Antenna	VULB 9160	Schwarz beck	Aug. 28, 2007	3047
HORN-Antenna	3115	EMCO	Dec. 26, 2007	9012-3602
HORN-Antenna	SAS-571	A.H. SYSTEMS	Dec. 26, 2007	500
PRE AMPLIFIER	8449B OPT H02	Rohde & Schwarz	Oct. 11, 2008	3008A0530

*Note : 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to RRL, KRISS, KTL and HCT.*

*2. The calibration interval of horn ant. and loop ant. is 24 months*

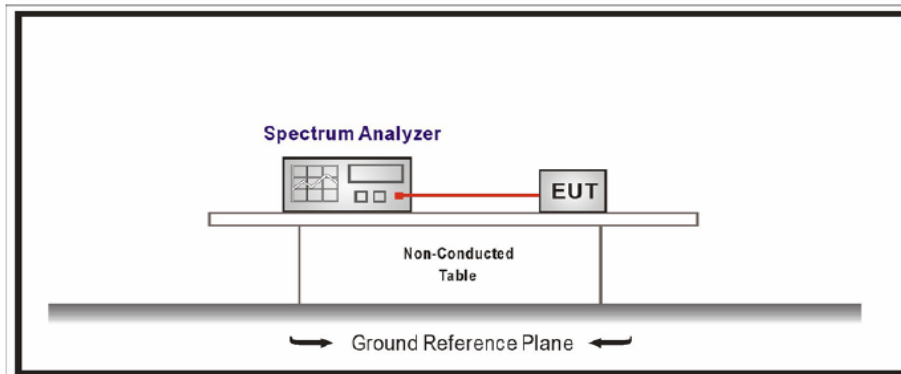
### ◆Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio Frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within The band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

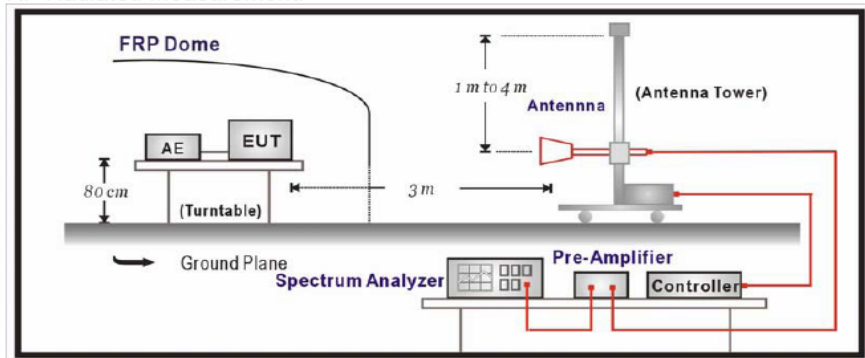
Attenuation below the general limits specified in section 15.209(a) is not required. In addition, radiated emission which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a)(see Section 15.205(c)).

## ◆Test setup

RF Conducted Measurement:



RF Radiated Measurement:



## ◆Test procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters. The antenna can move up and down between 1 meter and 4 meters to fine out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.4:2003 on radiated measurement.

The bandwidth below 1 GHz setting on the field strength meter is 120 kHz, above 1GHz are 1MHz.

Test specification

According to FCC Part 15 Subpart C paragraph 15.247:2005

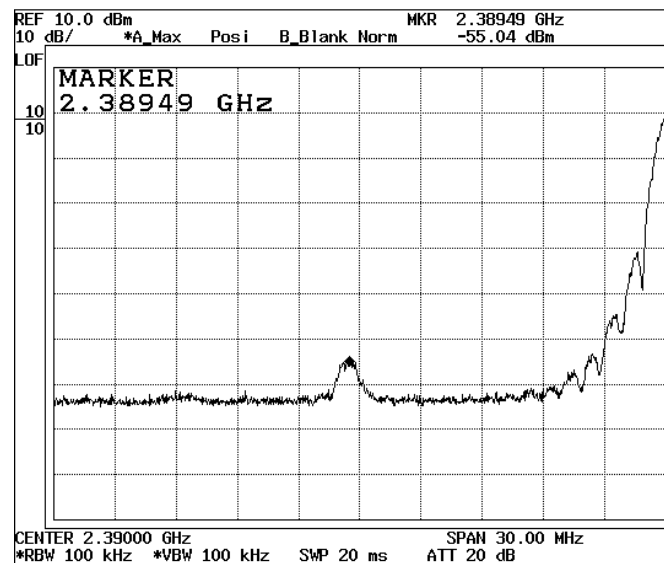


### Band Edge Test result

Product	O2USZM01
Test Item	Band Edge
Test Mode	Transmit
Test Site	RF Room
Measurement Method	Conducted

Detect mode : Peak

Channel : 1 CH(2405 MHz)



Detect mode : Peak

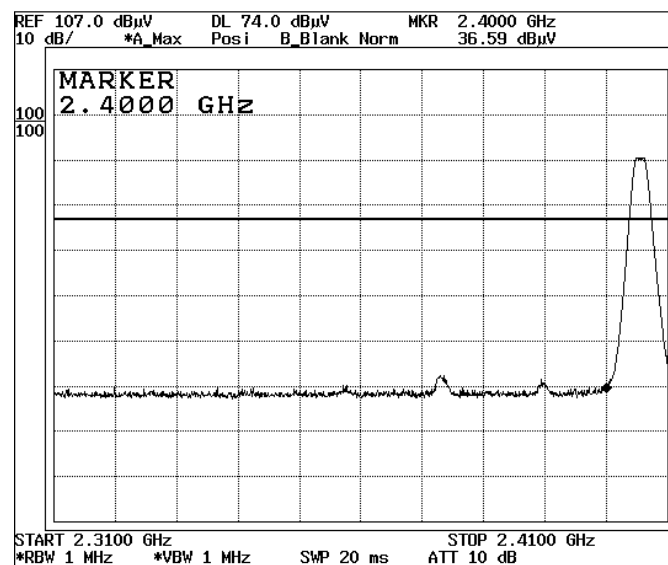
Channel : 15 CH(2480 MHz)



Product	O2USZM01
Test Item	Band Edge
Test Mode	Transmit
Test Site	Radiated Measure Room #1
Measurement Method	Radiated

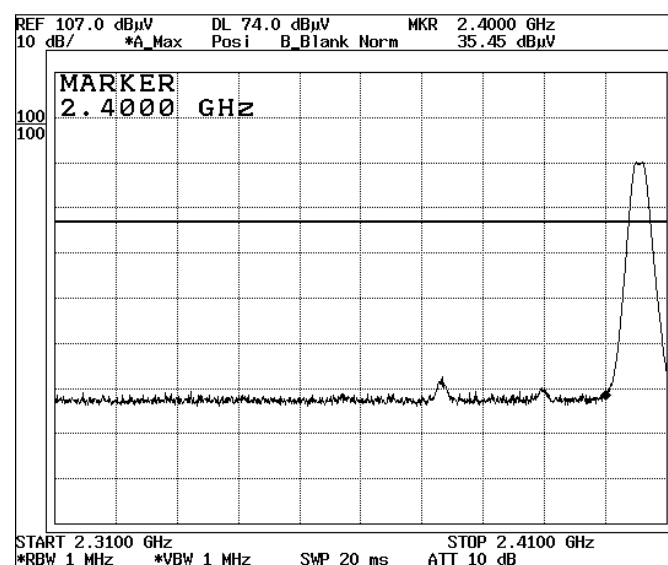
Detect mode : Peak

Channel : 1 CH(2405 MHz)-Ver.



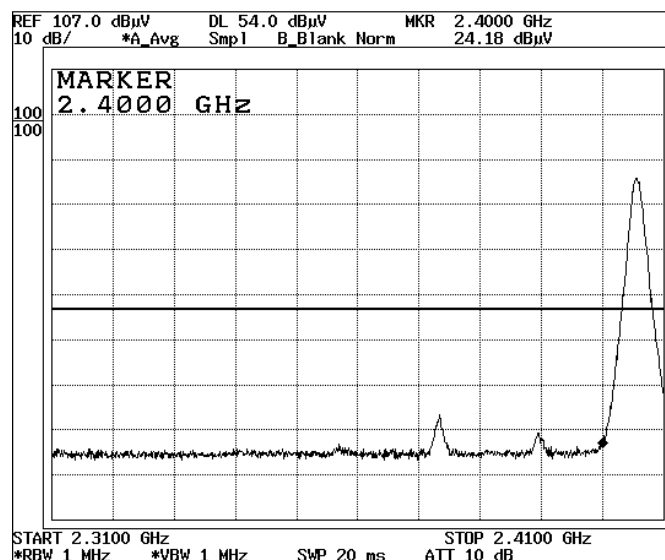
Detect mode : Peak

Channel : 1 CH(2405 MHz)-Hor.



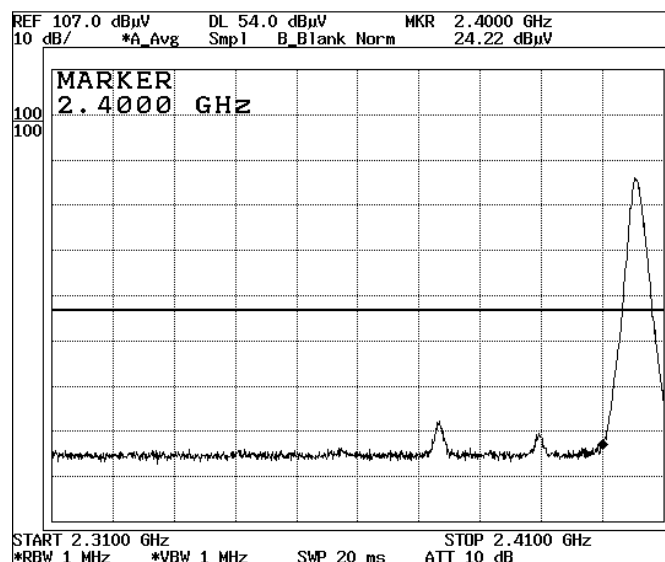
Detect mode : Average

Channel : 1 CH(2405 MHz)-Ver.



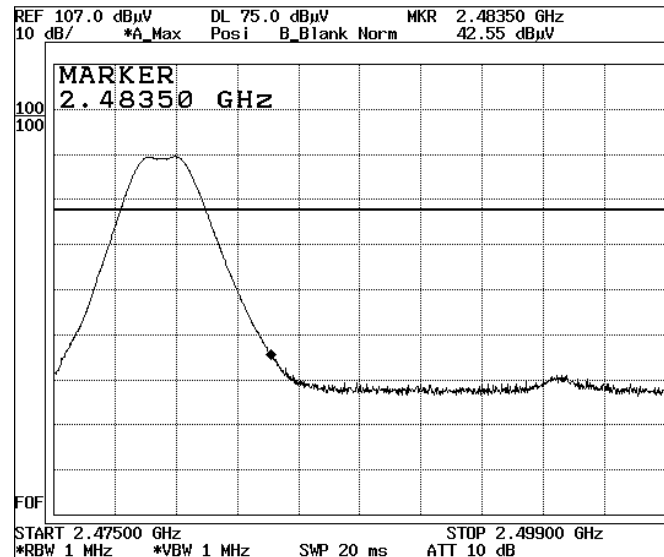
Detect mode : Average

Channel : 1 CH(2405MHz)-Hor.



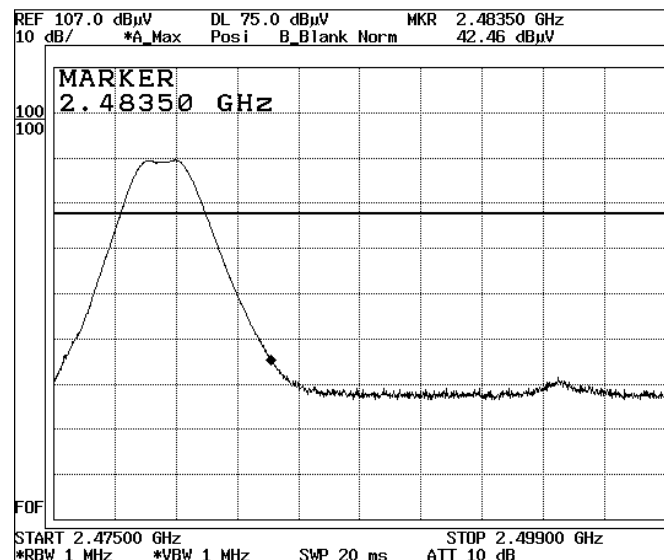
Detect mode : Peak

Channel : 15 CH(2480 MHz)-Ver.



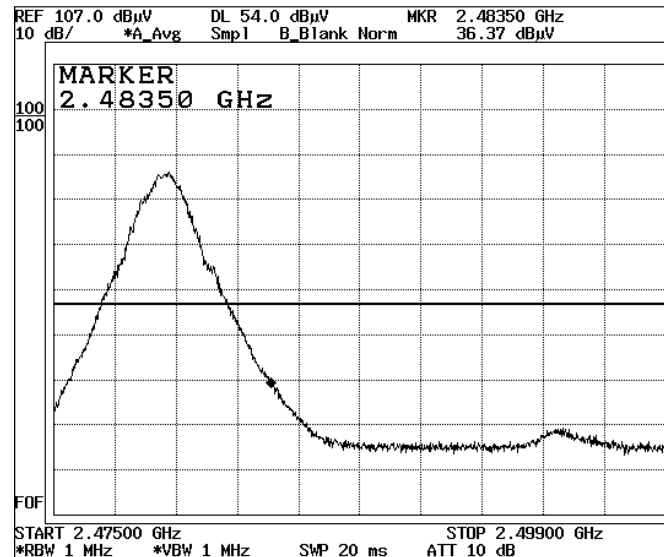
Detect mode : Peak

Channel : 15 CH(2408 MHz)-Hor.



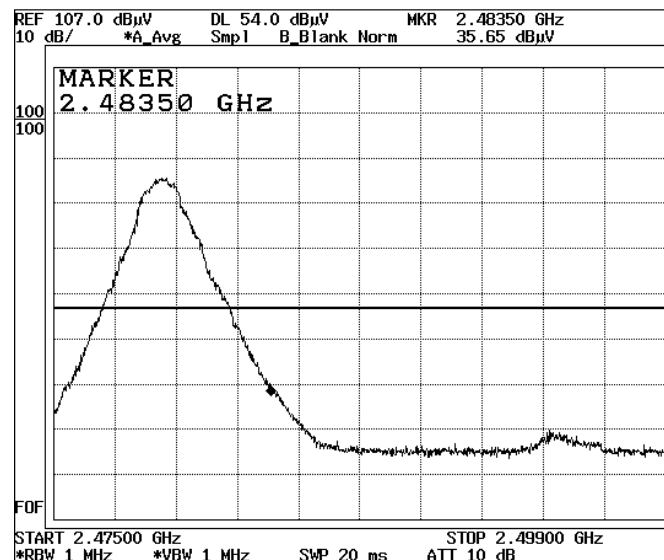
Detect mode : Average

Channel : 15 CH(2480 MHz)-Ver.



Detect mode : Average

Channel : 15 CH(2480 MHz)-Hor.



## 6dB Band

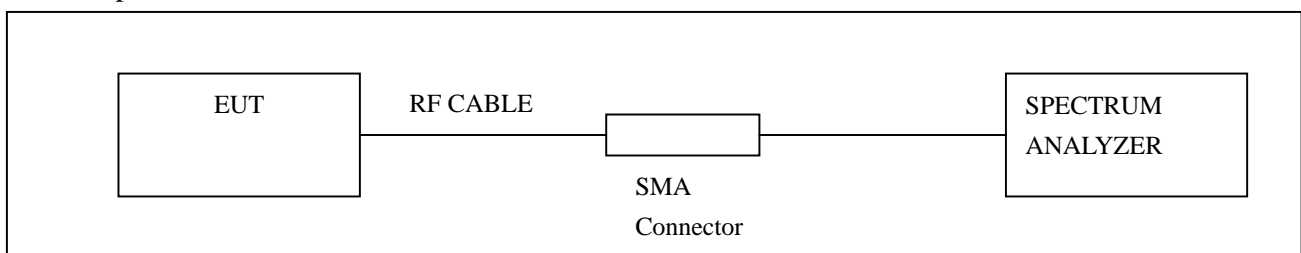
### ◆Test Equipment

The following test equipment are used during the test:

Item	Equipment	Manufacturer	Model no/Serial No.	Last Cal.
1	Spectrum Analyzer	ADVANTEST	R3273 / 95090431	Sep.12, 2008
2	RF ROOM			

*Note : All equipment upon which need to calibrated are with calibration period of 1 year.*

### ◆Test Setup



### ◆Limits

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions :

(2) systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

### ◆Test Procedure

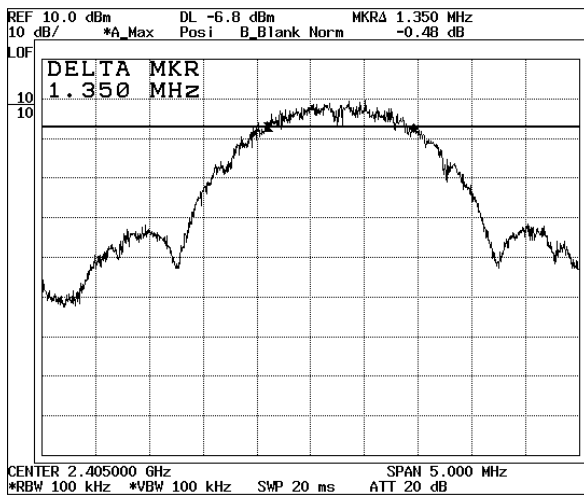
The transmitter output is connected to the Spectrum analyzer. The Spectrum analyzer is set to the 6dB Band(Occupied Bandwidth). According to FCC CFR Title 47 Part 15 Subpart C Section 15.247:2005

### Test result

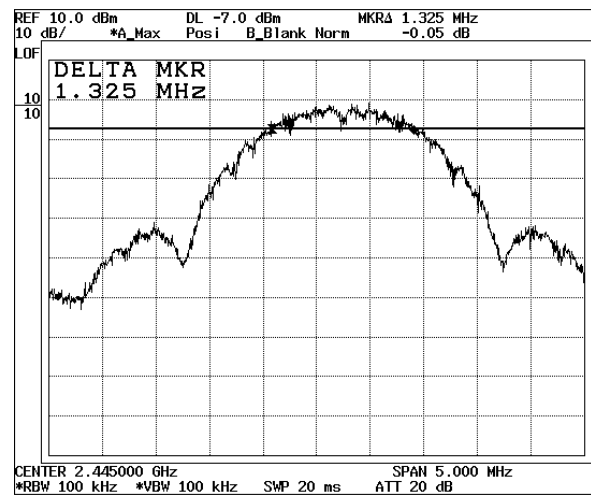
Product	O2USZM01
Test Item	6dB Band
Test Mode	Transmit
Test Site	RF Room
Measurement Method	Conducted

Channel No.	Frequency (MHz)	Measure Level (KHz)	Limit (KHz)	Result
1	2405	1580	>500	Pass
8	2445	1560	>500	Pass
15	2480	1550	>500	Pass

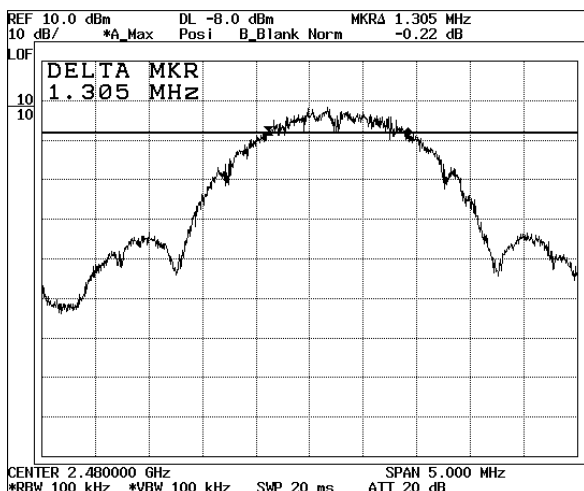
Channel 1.



Channel 8.



Channel 15



## **Power Density**

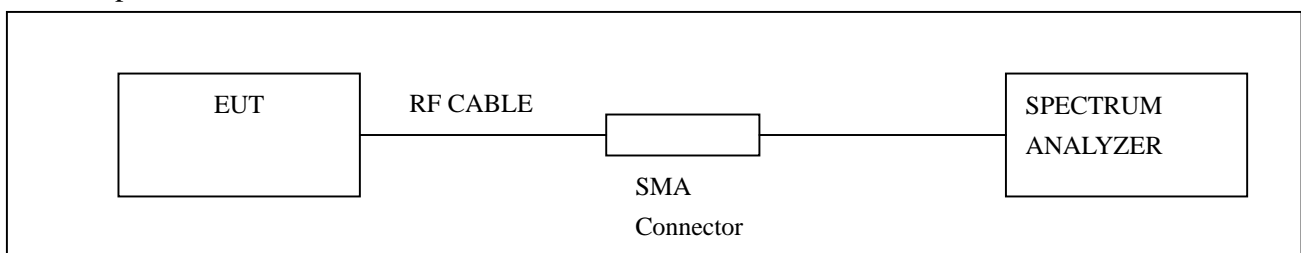
### ◆Test Equipment

The following test equipment are used during the test:

Item	Equipment	Manufacturer	Model no/Serial No.	Last Cal.
1	Spectrum Analyzer	ADVANTEST	R3273 / 95090431	Sep. 12, 2008
2	RF ROOM			

*Note : All equipment upon which need to calibrated are with calibration period of 1 year.*

### ◆Test Setup



### ◆Limits

Section 15.247 (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (v) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

### ◆Test Procedure

The transmitter output is connected to the Spectrum analyzer. The Spectrum analyzer is set to the 6dB Band(Occupied Bandwidth). According to FCC CFR Title 47 Part 15 Subpart C Section 15.247:2005



### Test result

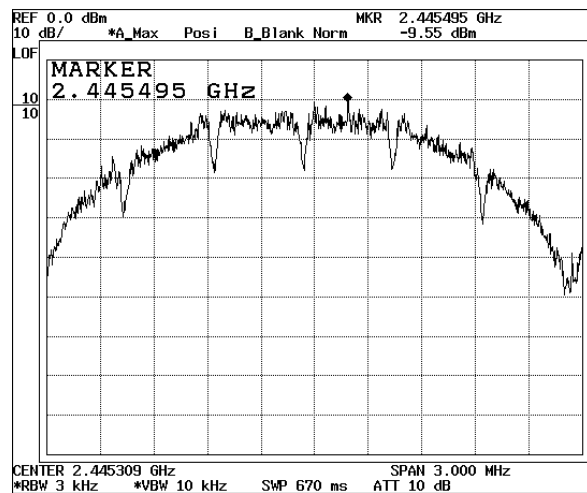
Product	O2USZM010
Test Item	Power Density
Test Mode	Transmit
Test Site	RF Room
Measurement Method	Conducted

Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
1	2405	-22.11	< 8	Pass
8	2445	-19.88	< 8	Pass
15	2480	-18.52	< 8	Pass

Channel 1.



Channel 8.



Channel 15



Note : Measurement level = reading level + correct factor

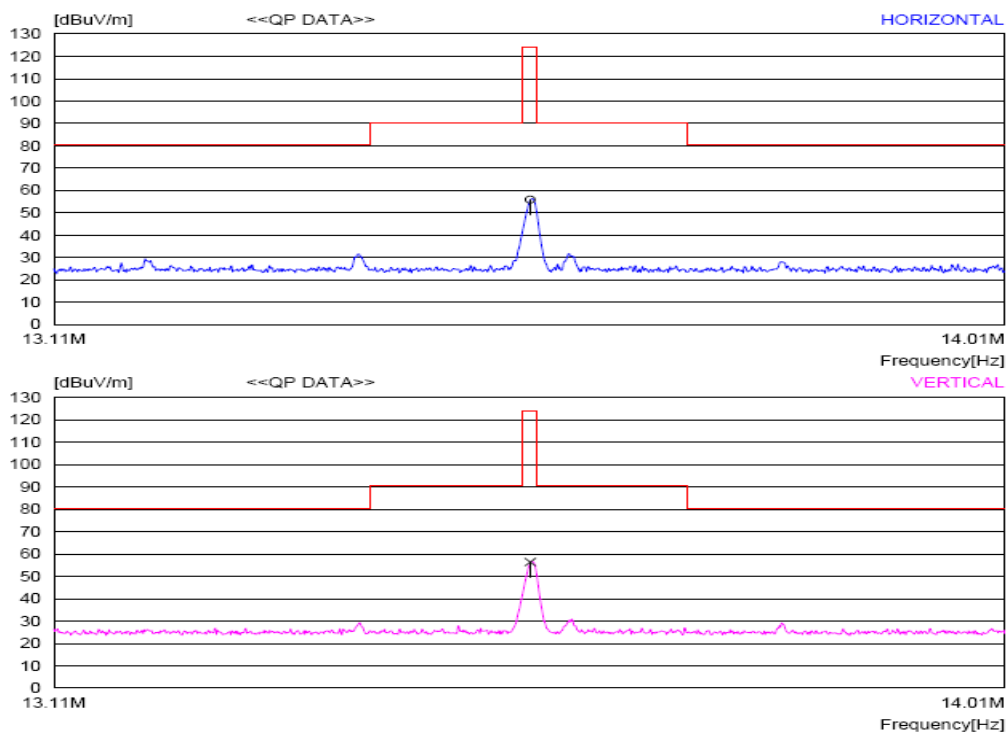
## RFID Mode ( 13.56 MHz )

### Radiated Field Emission-15.225(a)

Frequency(MHz)	Field Strength of Fundamental uV/m	Field Strength of Fundamental dBuV/m(30m)	Field Strength of Fundamental dBuV/m(3m)
13.553 - 13.567	15,848	83.9	123.9

[Applicable]

Freq. [MHz]	Reading [dBuV]	Height [m]	Antenna Factor [dB/m]	Cable Loss [dB]	Polar. [H/V]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
13.5615	37.5	1	18.3	0.1	H	55.9	123.9	68.0
13.56215	38.0	1	18.3	0.1	V	56.4	123.9	67.5



Note :

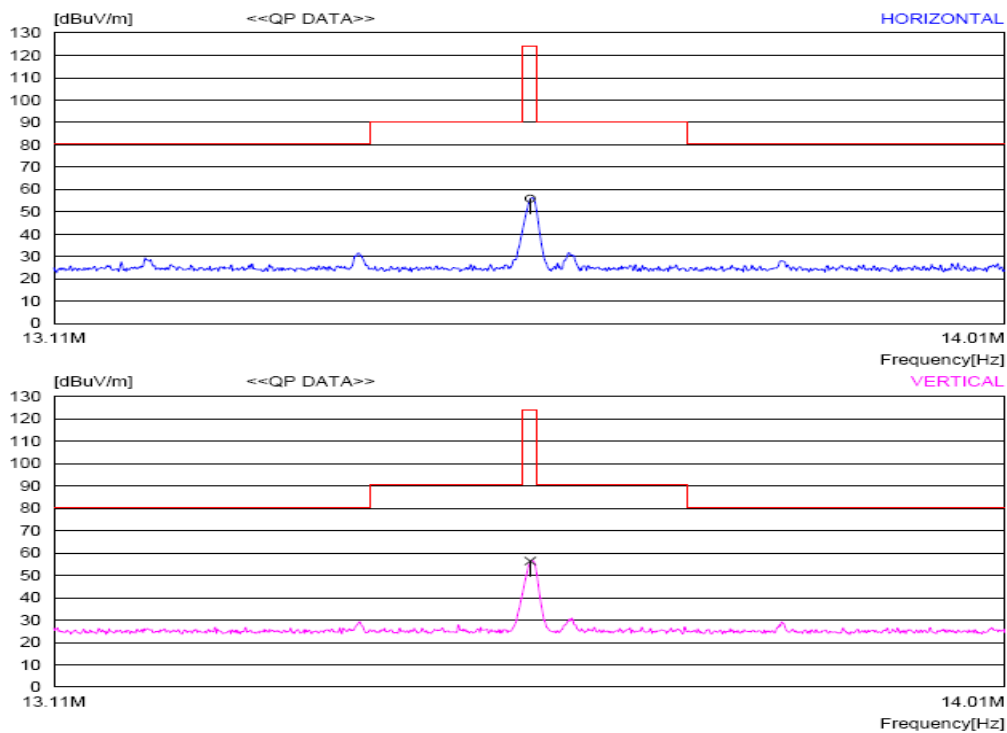
### Radiated Electric Emission-15.225(b)(c)

Frequency (MHz)	Field Strength of Fundamental uV/m	Field Strength of Fundamental dBuV/m(30m)	Field Strength of Fundamental dBuV/m(3m)
13.110 - 13.410	106	40.5	80.5
13.410 - 13.553	334	50.4	90.4
13.567 - 13.710	334	50.4	90.4
13.710 - 14.010	106	40.5	80.5

[Applicable]

Freq. [MHz]	Reading [dBuV]	Height [m]	Antenna Factor [dB/m]	Cable Loss [dB]	Polar. [H/V]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
-	-	-	-	-	-	-	-	-

Note : Other emission don't exceed the level 20dB below the applicable limit.



**Radiated Field Emission-15.109, 15.225(d)**

Frequency (MHz)	Field Strength of Fundamental uV/m	Field Strength of Fundamental dBuV/m(3m)
1.705 - 30.0	30	49.5
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

**[Applicable]**

Freq. [MHz]	Reading [dBuV]	Height [m]	Antenna Factor [dB/m]	Cable Loss [dB]	Polar. [H/V]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]
18.220	13.89	100	18.35	0.66	V	32.90	49.50	16.60
19.995	5.84	100	18.40	0.69	H	24.93	49.50	24.57
23.335	3.96	100	18.41	0.70	V	23.07	49.50	26.43
24.395	5.18	100	18.41	0.70	H	24.29	49.50	25.21
108.499	17.90	107	10.80	2.30	V	31.0	43.50	12.50
135.624	15.90	120	13.60	2.50	V	32.0	43.50	11.50
352.623	13.60	105	13.80	3.90	H	31.3	46.00	14.70
448.253	18.60	105	16.70	4.50	V	39.8	46.00	6.20
515.382	18.50	104	17.00	4.60	V	40.1	46.00	5.90
596.753	15.10	116	18.70	5.00	H	38.8	46.00	7.20
786.634	14.30	162	21.30	5.50	H	41.1	46.00	4.90
800.194	12.10	101	21.50	5.60	H	39.2	46.00	6.80

### Frequency Stability -15.225(e)

◆ Test Equipment Used

Name	Type	Manufacturer	Calibration. Date	Serial Number
R3273	SPECTRUM ANALYZER	ADVANTEST	Sep. 12, 2008	95090431
PL-4SP	Temp&Humi Chamber	TABAI	Aug. 19, 2008	44VH0266

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery

[Applicable]

Table 1 : Frequency Tolerance

Reference Frequency : 13.5615 MHz, Limit : within  $\pm 1356$  Hz

Environment Temperature [°C]	Power Supplied [Vdc]	Carrier Frequency Measured with Time Elapsed							
		STARTUP		2 minutes		5 minutes		10 minutes	
		[MHz]	Err[Hz]	[MHz]	Err[Hz]	[MHz]	Err[Hz]	[MHz]	Err[Hz]
+50	12	13.561471	-29	13.561453	-47	13.561449	-51	13.561453	-47
+40	12	13.561522	22	13.561536	36	13.561567	67	13.561521	21
+30	12	13.561568	68	13.561542	42	13.561569	69	13.561533	33
+20	12	13.561604	104	13.561597	97	13.561583	83	13.561608	108
+10	12	13.561627	127	13.561605	105	13.561611	111	13.561621	121
0	12	13.561624	124	13.561627	127	13.561625	125	13.561627	127
-10	12	13.561629	129	13.561623	123	13.561636	136	13.561627	127
-20	12	13.561637	137	13.561635	135	13.561638	138	13.561639	139

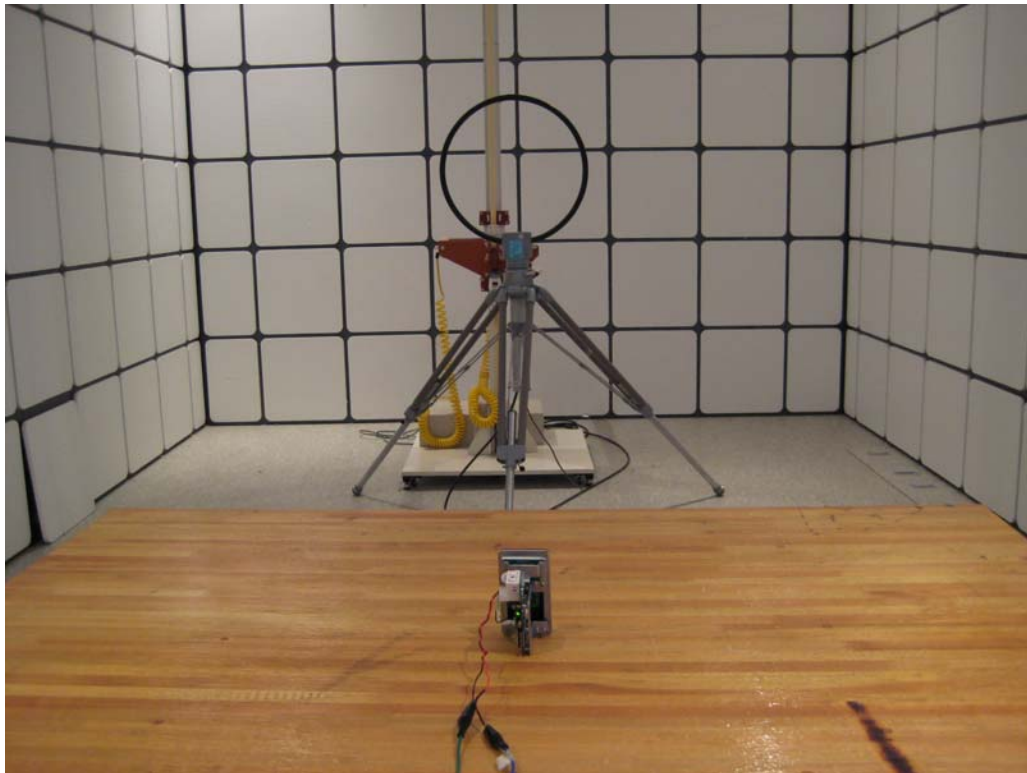
Table 2 : Frequency Tolerance

Reference Frequency : 13.5615 MHz, Limit : within  $\pm 1356$  Hz

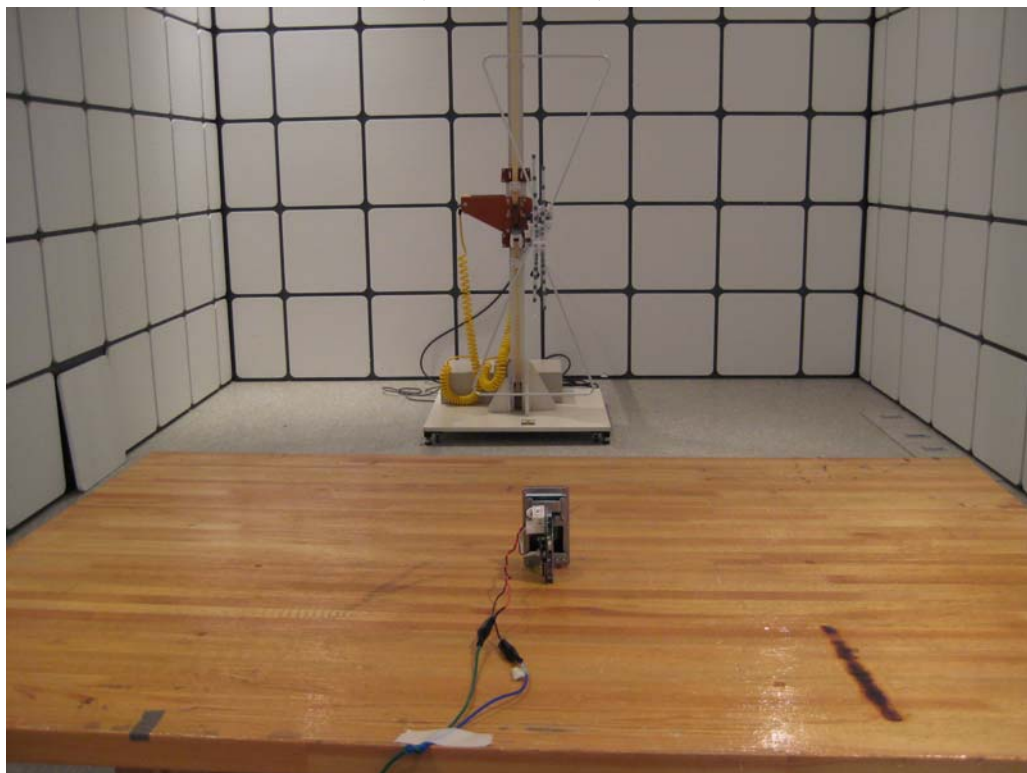
Power Supplied [Vdc]	Carrier Frequency Measured with Time Elapsed							
	STARTUP		2 minutes		5 minutes		10 minutes	
	[MHz]	Err[Hz]	[MHz]	Err[Hz]	[MHz]	Err[Hz]	[MHz]	Err[Hz]
85%	13.561548	48	13.561551	51	13.561563	63	13.561569	69
100%	13.561549	49	13.561553	53	13.561562	62	13.561569	69
115%	13.561548	48	13.561553	53	13.561563	63	13.56157	70

**Err[Hz] = Measured carrier frequency (MHz) – Reference Frequency (13.5615 MHz)**

**Appendix A. The Photos of Test Setup**



**Radiated Emissions(9 KHz~30 MHz) - Continue Transmit**

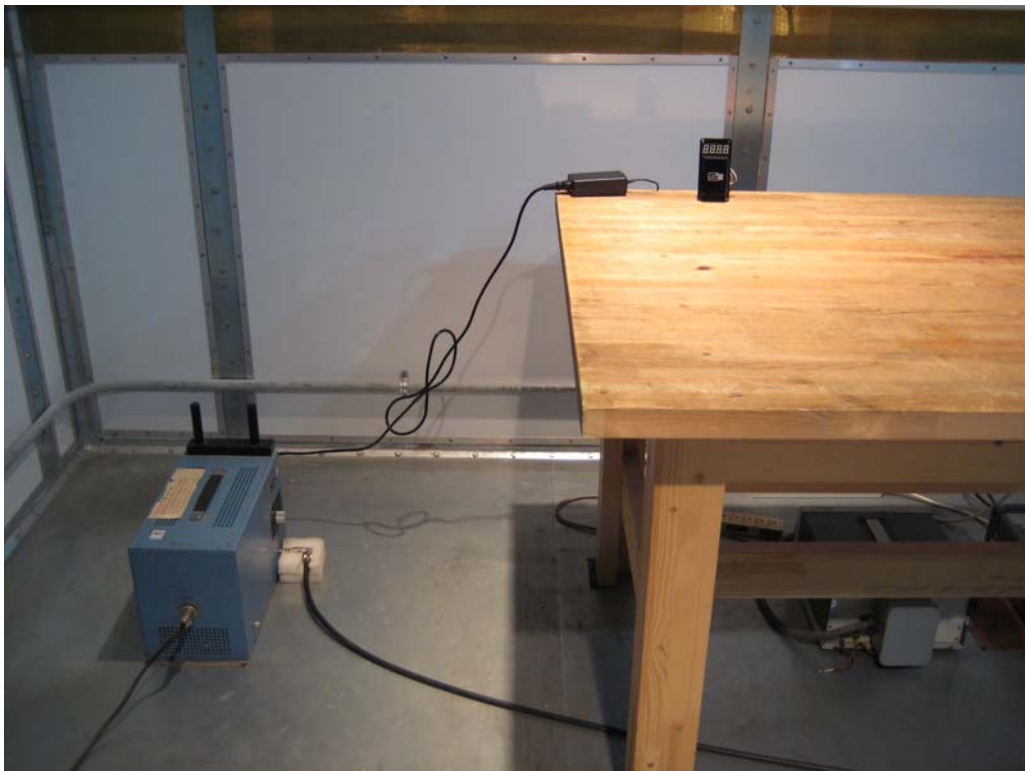


**Radiated Emissions(30 MHz~1000 MHz) - Continue Transmit**

**Appendix A. The Photos of Test Setup**



**Radiated Emissions(1000 MHz~1800MHz) - Continue Transmit**



**Conducted Emissions(150 KHz~30 MHz) - Continue Transmit**



Appendix B. The Photos of Equipment Under Test



Front view



rear view