




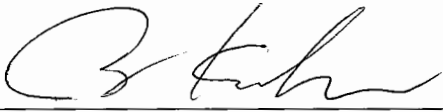
MEASUREMENT / TECHNICAL REPORT

FCC Part 15 Subpart C

Issued: March 31, 2011

Name and Address of the Applicant:	Panasonic Electric Works SUNX Co., Ltd. 2431-1, Ushiyama-cho, Kasugai, Aichi 486-0901, Japan
Test Item:	KR20 WIRELESS UNIT
Identification:	AKR2002
Serial No.:	00002303
FCC ID:	Y45AKR2002
Sample Receipt Date:	February 24, 2011
Test Specification:	FCC Part 15 Subpart C, 15.247
Date of Testing:	March 3, 7, 8 and 9, 2011
Test Result:	PASS

Report Prepared by:	Cosmos Corporation 3571-2 Ohnoki, Watarai-cho, Watarai-gun, Mie, Japan 516-2102 Phone: +81-596-63-0707 Fax: +81-596-63-0777
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Tested by:	 O. Itogawa, EMC Dept. EMC Engineer	March 31, 2011 Date
Reviewed by:	 Y. Kawahara, EMC Dept. EMC Manager	March 31, 2011 Date

Notes:

1. This Test Report should not be reproduced except in full, without the written approval of Cosmos Corporation.
2. All measurement data contained in this Test Report may have uncertainty. A judgment for the limitation should be taken into the count.
3. This Test Report is based on the tests made for sample provided, and it is not applicable to individual product identical to the sample.

Revision History

Revision	Issue Date	Description	Effect Page	Revised By
00	March 17, 2011	Initial Issue	-	-
01	March 31, 2011	Correction of Frequency span and Resolution bandwidth	17	Yoshida

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1. Description of Equipment under Test

1.1 Product Description

Manufacturer	Panasonic Electric Works SUNX Co., Ltd.
Model (referred to as the EUT)	AKR2002
Transmitter Type	<input type="checkbox"/> WLAN <input type="checkbox"/> Bluetooth <input type="checkbox"/> Zigbee <input type="checkbox"/> RFID <input checked="" type="checkbox"/> Other (Original)
Nominal Voltage	DC 24V
Type of Modulation	FSK
Mode of Operation	<input type="checkbox"/> duplex <input checked="" type="checkbox"/> 1/2 duplex <input type="checkbox"/> simplex <input type="checkbox"/> other
Type of Equipment	<input checked="" type="checkbox"/> Stand-alone <input type="checkbox"/> Combined Equipment <input type="checkbox"/> Plug -In Card <input type="checkbox"/> Other (Module Unit)
Type of Antenna	<input type="checkbox"/> Integral <input checked="" type="checkbox"/> external <input type="checkbox"/> Other
Type of Power source	<input type="checkbox"/> AC mains <input type="checkbox"/> Dedicated AC adapter (V) <input checked="" type="checkbox"/> DC Voltage <input type="checkbox"/> Battery
Type of Battery (if applicable)	N/A
Type of Operation	<input checked="" type="checkbox"/> Continuous <input type="checkbox"/> Burst <input type="checkbox"/> Intermittent
Stand by Mode	<input type="checkbox"/> Available <input checked="" type="checkbox"/> N/A
Intended Functions	Data Circuit Terminating Equipment
Bandwidth of the IF filters	1.024MHz
Frequency Band Lower limit	2400MHz
Upper limit	2483.5MHz
Frequency of Operating	2403.328 - 2480.128MHz
Thermal Limitation	-10 to +50 degree C

1.2 Antenna Description

The connector jack of antenna is reversible therefore unique.

The user can not replace the antenna easily.

Therefore, the equipment complies with the antenna requirement of Section 15.203.

No.	Type Name	Gain	Antenna Type	Remarks
1	AP09-A00-0 (REVERSE)	<2 dBi	Dipole	Pencil type Antenna
2	IWF-HP01RS2X	<2 dBi	Dipole	Antenna with cable and reverse SMA plug

1.3 Accompanied Peripherals Description

No.	Equipment Name	Manufacturer	Type Name	Serial Number	Remarks
1	PC	DELL	PP17L	CN-0N8719-48643-57F-1500	
2	AC Adaptor	DELL	HP-OQ065B83	CN-0N2765-4790-47D-8266	
3	DC Power supply	LEADER	LPS-163A	5060010	

2. General Information

2.1 Test Methodology

All measurement subject to the present report was carried out according to the procedures in ANSI C63.4: 2003.

2.2 Test Facility

All measurement was performed in the following facility;

Cosmos Corporation EMC Lab. Ohnoki

3571-2 Ohnoki, Watarai-cho, Watarai-gun, Mie-ken 516-2102, Japan
FCC registration number: 604492

2.3 Traceability

The calibration of measurement equipment used in the test subject to the present report is designed and operated to ensure that the measurement is traceable to national standards of measurement or equivalent abroad.

3. Summary of Test Results

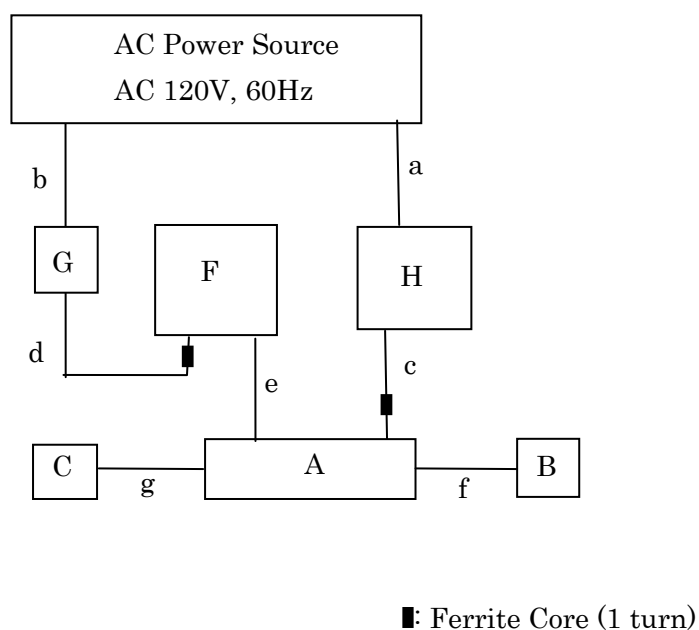
Section	Test Item	Limit	Result
15. 207	AC Power Conducted Emission	See 5.1.2	Pass
15. 247(a)(1)	Spectrum Bandwidth of Frequency Hopping Spread Spectrum System	< 1MHz if using less than 15 non-overlapping channels	N/A
15. 247(a)(1)	Channel Separation	> 2/3 of 20dB BW for systems with output power < 125mW	N/A
15. 247(a)(1)	Number of Channels	> 15 channels	N/A
15. 247(a)(1)	Time of Occupancy	< 0.4 sec in 30 sec period	N/A
15. 247(a)(2)	Spectrum Bandwidth of Direct Sequence Spread Spectrum System	Min. 500kHz	Pass
15. 247(b)	Maximum Peak Output Power	Max. 1W (30dBm)	Pass
15. 247(d) 15. 209	Transmitter Radiated Emissions	See 5.4.2 See 5.5.2	Pass
15. 247(e)	Power Spectrum Density	Max. 8dBm	Pass
15. 247(d)	Band Edge Measurement	See 5.7.2	Pass
15.215(c)	20 dB Bandwidth.	---	Pass

4. Test Configuration

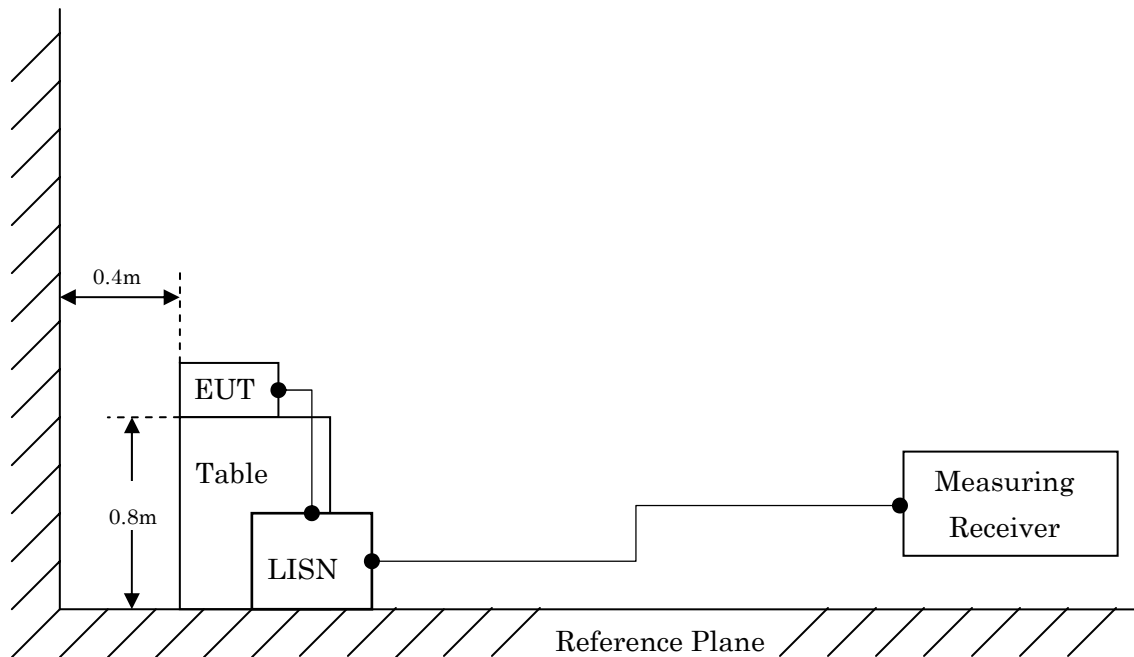
	Instrument	Model	Rating
A	KR20 WIRELESS UNIT (EUT1)	AKR2002	DC12 – 24V, 150mA
B	Dipole Antenna (EUT2)	IWF-HP01RS2X	---
C	Dipole Antenna (EUT3)	IWF-HP01RS2X	---
D	Dipole Antenna (EUT4)	AP09-A00-0	---
E	Dipole Antenna (EUT5)	AP09-A00-0	---
F	PC	PP17L	DC19.5V, 4.62A
G	AC Adaptor	HP-OQ065B83	AC100-240V, 50/60Hz, 1.5A
H	DC Power supply	LPS-163A	AC90-264V, 50/60Hz, 2.5A

	Cable	Length	Shield	Ferrite Core
a	AC Power Cable	2.0 m	No	No
b	AC Power Cable	0.9 m	No	No
c	DC Power Cable	2.0 m	No	Yes
d	DC Power Cable	1.9 m	No	Yes
e	RS232C Cable	1.8 m	Yes	No
f	Antenna Cable	2.0 m	Yes	No
g	Antenna Cable	2.0 m	Yes	No

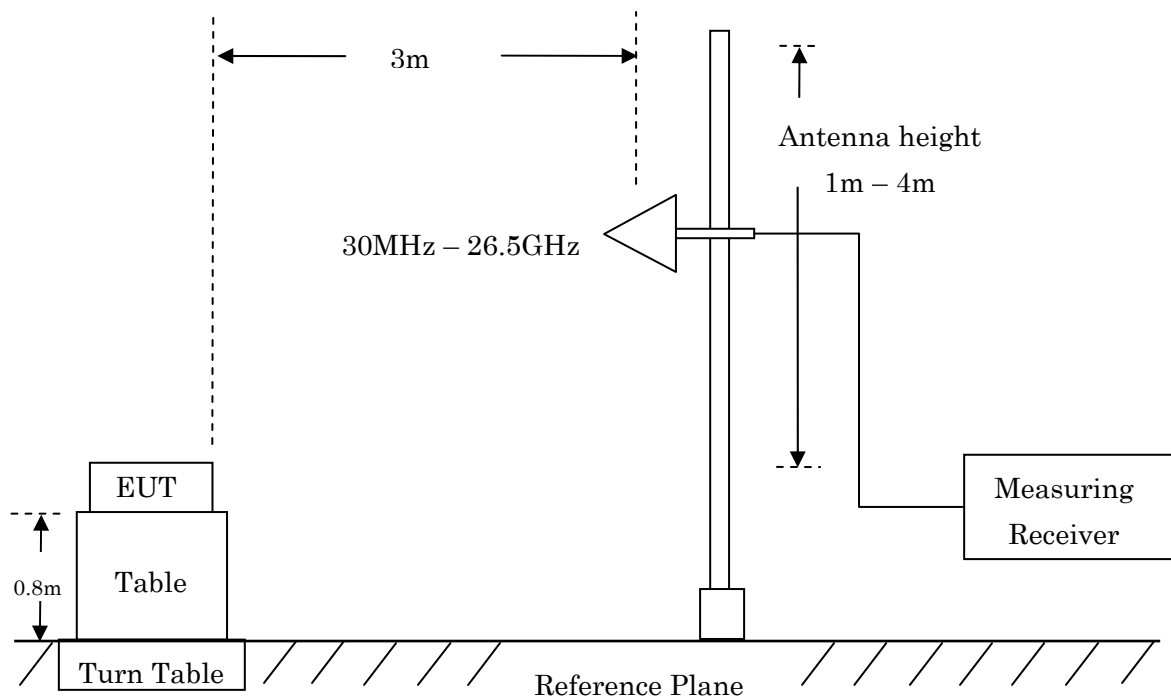
Setup diagram of tested system



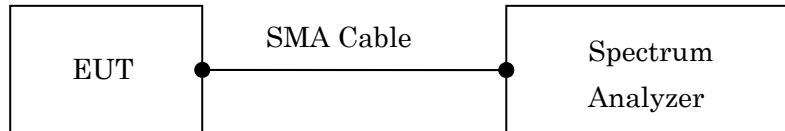
4.1 15. 207 AC Power Conducted Emission in Shield Room



4.2 15. 247(d), 15.209 Transmitter Radiated Emissions, 15.247(d) Band Edge (Radiated), 15.215 (c) 20 dB Bandwidth and 15.247(a)(2) 6dB Bandwidth in 3m Anechoic Chamber



4.3 All Other Test Items



4.4 Test Mode

In all test configurations above, EUT makes continuous RF transmitting with manufacturer's specified power.

15.247(b) Maximum Peak Output Power measurement is performed with an external stabilized power supply voltage varied between 85% and 115% of the nominal rated supply voltage in accordance with the section 15.31 (e) of the part.

Antenna A communication, Antenna B communication and diversity communication were performed in all conducted measurement and the worst data was listed. (Refer to P.42 6.1 Photo of the EUT)

5. Measurement Result

5.1 15. 207 AC Power Conducted Emission

5.1.1 Setting Remarks

Configure the EUT System in accordance with ANSI C63.4-2003.

Non-conductive board (12mm thick) for EUT and non-conductive table (80cm high) for personal computer were used.

Other power cord of support equipment is connected to another LISN to isolate its emission from the measured emission of EUT.

The measuring port of LISN for support equipment was terminated by the 50Ω

Activate the EUT System and run the software prepared for the test, if necessary.

Refer to test configuration figure 4.1.

5.1.2 Minimum Standard

15. 207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

5.1.3 Result

EUT complies with the requirement.

Uncertainty of measurement : ± 2.26 dB
Temperature, Humidity : 25°C, 45 %

5.1.4 Measured Data

Measured Value Table

<<Conducted Emission>>

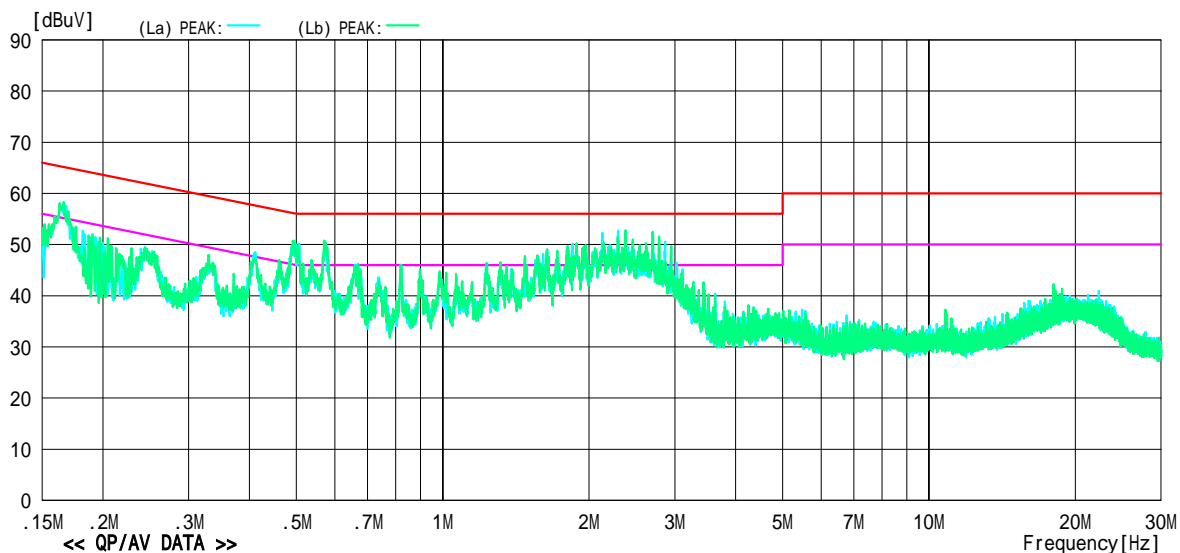
Cosmos Corporation Onoki Lab.
Date : 2011/03/09

Model Name : Model AKR2002
Serial No. : 00002303
Operator : O.Itogawa
Power Supply : AC120V,60Hz/DC24V

Job No : CJ10-100347E
Temp/Humi : 25 /45%
Condition : Operated
Remark :

Memo : RBW:9kHz(150k-30MHz)

LIMIT : FCC 15.207(QP)
FCC 15.207(AV)



No	Freq. [MHz]	Reading Level		C.Fac [dB]	Results		Limit		Margin		Phase	Comment
		QP	AV		QP	AV	QP	AV	QP	AV		
		[dBuV]	[dBuV]		[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]		
1	0.16235	45.5	41.7	10.3	55.8	52.0	65.3	55.3	9.5	3.3	La	
2	0.49123	37.1	30.1	10.2	47.3	40.3	56.1	46.1	8.8	5.8	La	
3	0.57201	38.0	28.2	10.2	48.2	38.4	56.0	46.0	7.8	7.7	La	
4	2.30406	37.9	29.4	10.3	48.2	39.7	56.0	46.0	7.8	6.3	La	
5	10.82830	17.6	13.3	11.0	28.6	24.3	60.0	50.0	31.4	25.8	La	
6	19.85159	23.2	17.6	11.3	34.5	28.9	60.0	50.0	25.5	21.1	La	
7	0.16175	45.2	40.9	10.3	55.5	51.2	65.4	55.4	9.9	4.2	Lb	
8	0.49826	37.7	30.5	10.2	47.9	40.7	56.0	46.0	8.1	5.3	Lb	
9	0.57297	37.9	27.5	10.2	48.1	37.7	56.0	46.0	7.9	8.3	Lb	
10	2.38092	41.1	34.5	10.3	51.4	44.8	56.0	46.0	4.6	1.2	Lb	
11	10.67935	17.0	12.8	11.0	28.0	23.8	60.0	50.0	32.0	26.2	Lb	
12	19.88960	22.7	17.3	11.4	34.1	28.7	60.0	50.0	26.0	21.3	Lb	

-TEPT0-DV/CE Ver1.50.0128

5.2 15. 247(a)(2) Spectrum Bandwidth of Direct Sequence Spread Spectrum System

5.2.1 Setting Remarks

- The both side of 6dB down value from peak power are measured by using delta-maker function of the spectrum analyzer.
- The spectrum analyzer is set-up as following;

✓ Frequency Span	: 10 MHz
✓ Resolution bandwidth	: 100 kHz
✓ Video bandwidth	: 300 kHz
✓ Sweep	: Auto
✓ Detector function	: Peak
✓ Trace Mode	: Max Hold

- See test configuration figure 4.2.

5.2.2 Minimum Standard

15.247 (a) (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.

5.2.3 Result

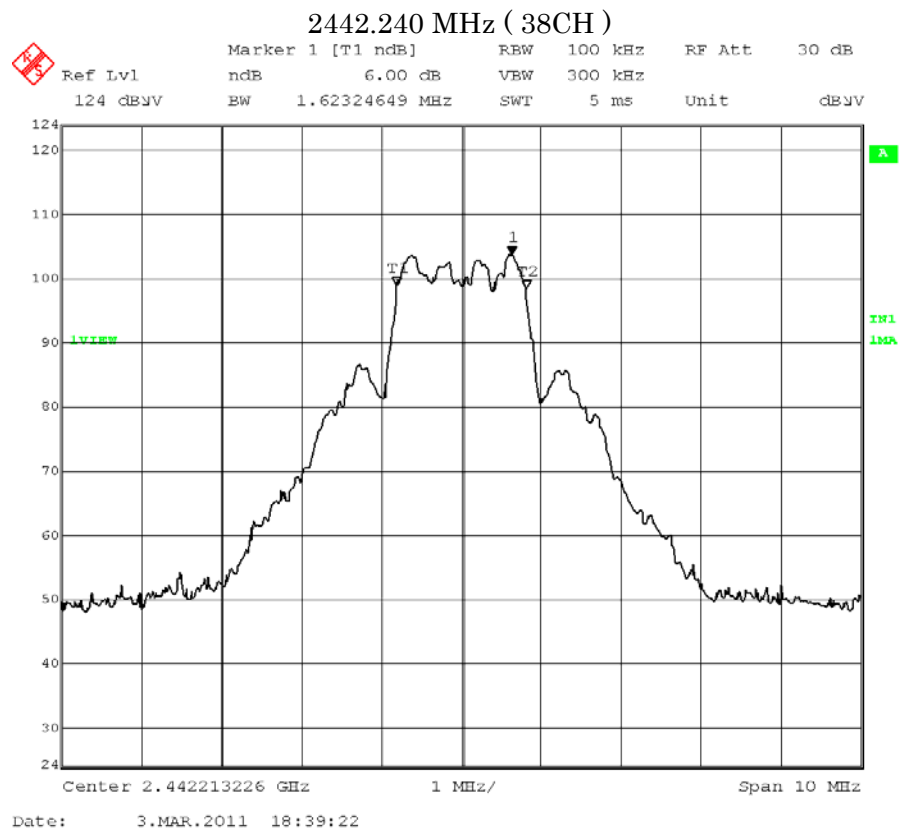
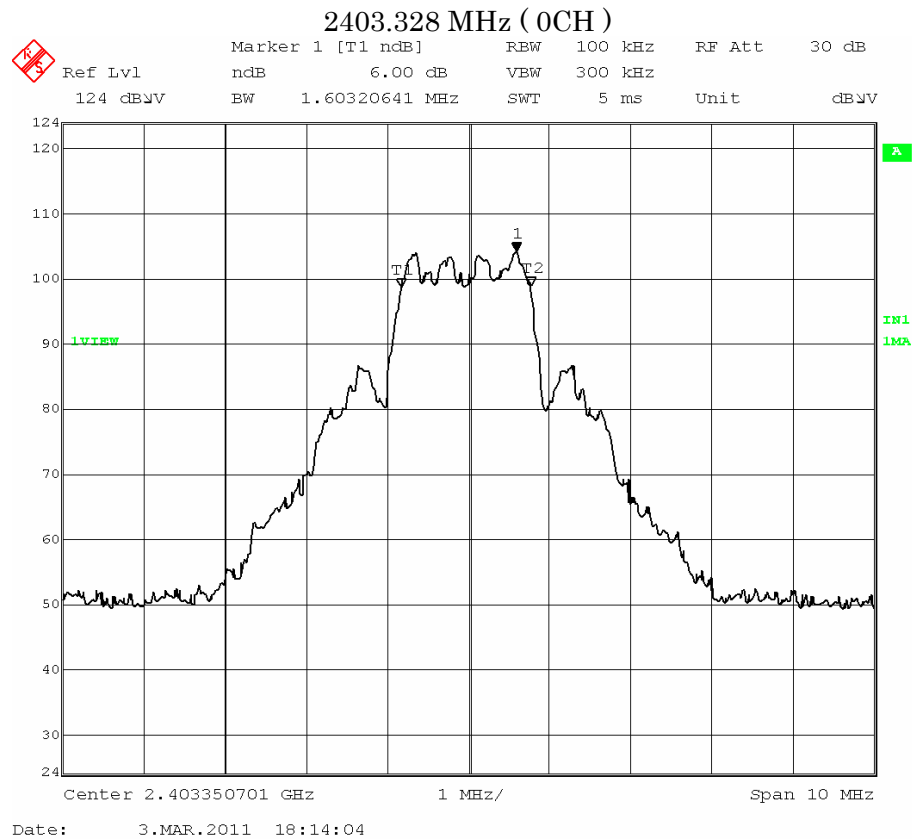
EUT complies with the requirement.

Uncertainty of measurement result: ± 0.8 dB
Temperature, Humidity : 25°C, 41 %

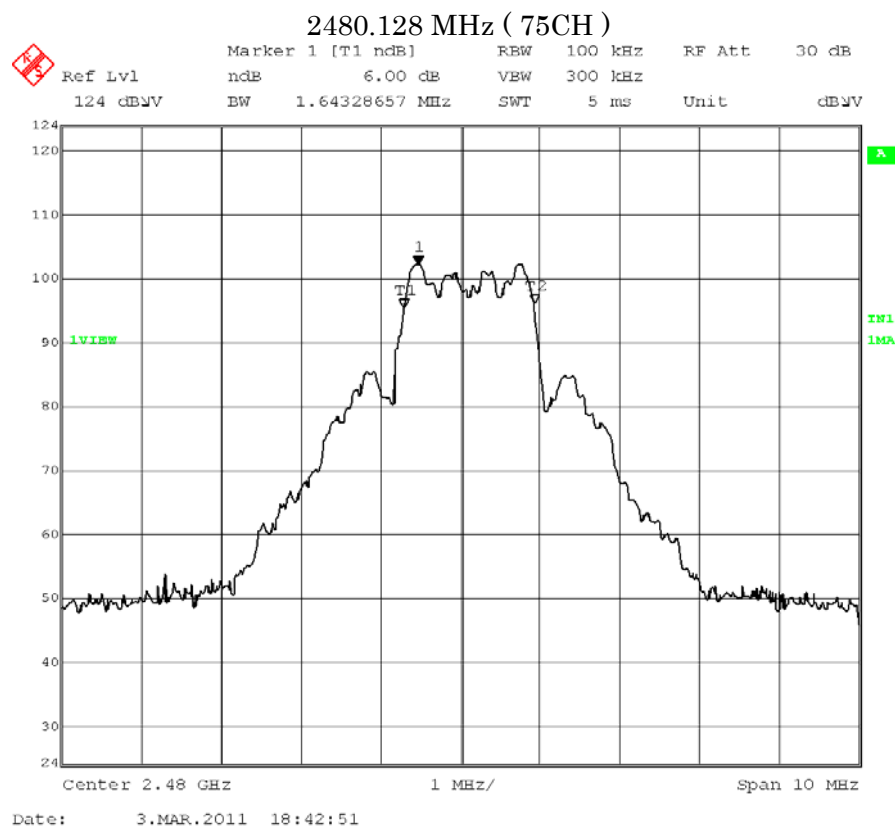
5.2.4 Measured Data

Frequency (MHz)	Measured Bandwidth (MHz)	Limit (MHz)
6 dB Bandwidth		
2403.328 (0ch)	1.603206	> 0.5
2442.240 (38ch)	1.623246	> 0.5
2480.128 (75ch)	1.643286	> 0.5

5.2.4 Measured Data (Continued)



5.2.4 Measured Data (Continued)



5.3 15. 247(b) Maximum Peak Output Power

5.3.1 Setting Remarks

- See test configuration figure 4.3.
- The maximum peak output power is measured as following;

EUT directly connects to the spectrum analyzer via calibrated coaxial cable and a suitable attenuator.

The spectrum analyzer is set-up as following;

✓ Frequency span	: 10 MHz
✓ Resolution bandwidth	: 3 MHz
✓ Video bandwidth	: 3 MHz
✓ Sweep	: Auto
✓ Detector function	: Peak
✓ Trace Mode	: Max Hold

5.3.2 Minimum Standard

The maximum peak output power shall not exceed 1 watt. If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.3.3 Result

EUT complies with the requirement.

Uncertainty of measurement result: ± 0.5 dB

Temperature, Humidity : 24°C, 46%

5.3.4 Measured Data

【Voltage -15%】

Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
DSSS			
2403.328 (0ch)	8.89	30	21.11
2442.240 (38ch)	8.66	30	21.34
2480.128 (75ch)	7.37	30	22.63
CW			
2403.328 (0ch)	8.89	30	21.11
2442.240 (38ch)	8.63	30	21.37
2480.128 (75ch)	7.28	30	22.72

【Normal Voltage】

Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
DSSS			
2403.328 (0ch)	8.94	30	21.06
2442.240 (38ch)	8.67	30	21.33
2480.128 (75ch)	7.42	30	22.58
CW			
2403.328 (0ch)	8.90	30	21.10
2442.240 (38ch)	8.65	30	21.35
2480.128 (75ch)	7.35	30	22.65

【Voltage + 15%】

Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
DSSS			
2403.328 (0ch)	8.92	30	21.08
2442.240 (38ch)	8.64	30	21.36
2480.128 (75ch)	7.39	30	22.61
CW			
2403.328 (0ch)	8.91	30	21.09
2442.240 (38ch)	8.64	30	21.36
2480.128 (75ch)	7.30	30	22.70

5.4 15. 247(d) Transmitter Spurious Emissions (Conducted)

5.4.1 Setting Remarks

- EUT directly connects to the spectrum analyzer via calibrated coaxial cable and 10 dB attenuator.
- The Spectrums are scanned from the lowest generated frequency of EUT up to the 10th harmonics by using the spectrum analyzer.
- The spectrum analyzer is set-up as following;

✓ Resolution bandwidth	: 100 kHz
✓ Video bandwidth	: 100 kHz
✓ Sweep	: Auto
✓ Detector function	: Peak
✓ Trace Mode	: Max Hold

- See test configuration figure 4.3.

5.4.2 Minimum Standard

15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required.

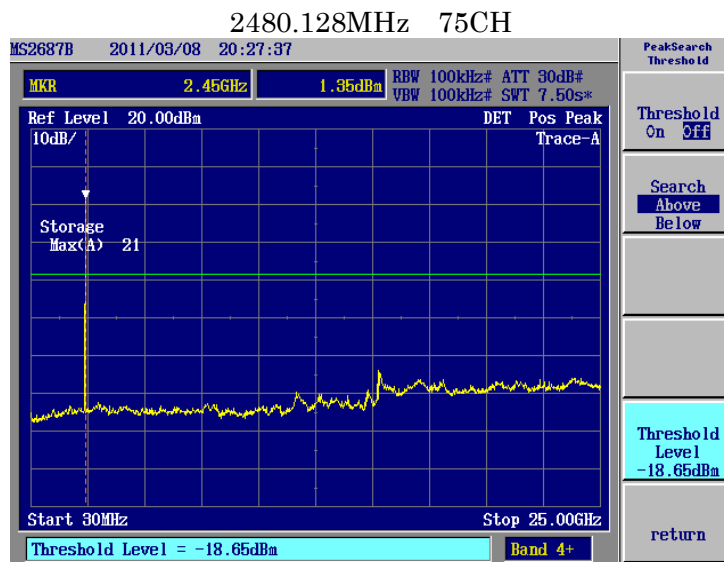
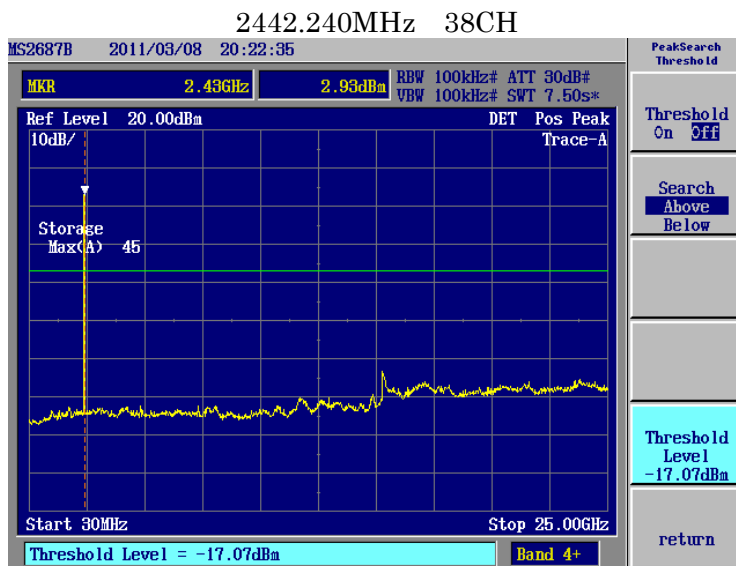
5.4.3 Result

EUT complies with the requirement.

Uncertainty of measurement result: ± 0.8 dB

Temperature, Humidity : 24°C, 46%

5.4.3 Measured Data



5.5 15. 247(d) Transmitter Radiated Emissions (Radiated)

5.5.1 Setting Remarks

- The data lists in “5.5.4 Measured Data “ list the significant emission frequencies, measured levels, correction factor (includes cable and antenna corrections), the corrected reading, plus the limit.
- In the frequency range between 30MHz to 25GHz (as 10th harmonics), the Electric Field Strength is measured in accordance with ANSI C63.4: 2003 and CISPR22: 1997.
- The test setup is made in accordance with ANSI C63.4: 2003.
- The antenna is measured at 1-4m height.
- The EUT is placed on the non-conductive table in the center of turntable. The height of this table is 0.8m.
- The measurement is carried out with both horizontal and vertical antenna polarization.
- The highest radiation from the equipment is recorded.
- By varying the configuration of the test sample and the cable routing, it is attempted to maximize the emission.
- The test receiver with Quasi Peak and Average detector is in compliance with CISPR 16-1:1993.
- The spectrum analyzer is set-up as following;
- The carrier level (or,noise levels) was (or were) measured at each position of all three axes X,Y and Z,and the position that has the maximum noise was determined.
- With the position,the noise levels of all the frequencies was measured.

(Frequency range : 30 - 1000 MHz)

- ✓ Resolution bandwidth : 100 kHz
- ✓ Video bandwidth : 300 kHz
- ✓ Detector function : Peak
- ✓ Trace Mode : Max Hold

(Frequency range : Above 1000 MHz)

- ✓ Resolution bandwidth : 1 MHz
- ✓ Video bandwidth : 1 MHz
- ✓ Detector function : Peak
- ✓ Trace Mode : Max Hold

- EMI Test Receiver analyzer is set-up as following;

- ✓ IF bandwidth : 120 kHz (Quasi-Peak Detector)
- ✓ IF bandwidth : 1 MHz (Average Detector)

- See test configuration figure 4.2.

5.5.2 Minimum Standard

In addition, radiated emissions 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)).

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
Above 960	500	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., § 15.231 and § 15.241.

5.5.3 Result

EUT complies with the requirement.

Uncertainty of measurement result: ± 3.28 dB
Temperature, Humidity: Refer to each data table

5.5.4 Measured Data

30MHz to 1GHz

<<Radiated Emission>>

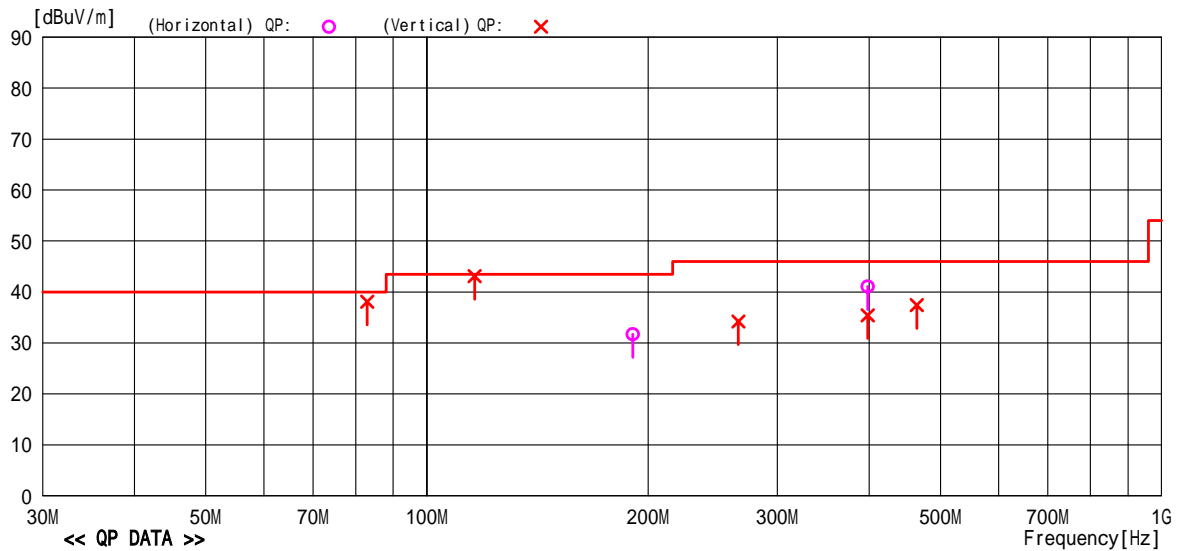
Cosmos Corporation Onoki Lab.
Date : 2011/03/03 22:47:00

Model Name : Model AKR2002
Serial No. : 00002303
Operator : O. Itogawa
Power Supply : DC24V

Job No : CJ10-100347E
Temp./Humi. : 25 /41%
Condition : Tx 0CH 2403.328MHz
Remark :

Memo : RBW:30M ~ 1GHz(120kHz)

LIMIT : Fcc15C 15_209 (3m) 30MHz-1000MHz



No	Freq.	Reading	Ant.Fac	Loss	Gain	Result	Limit	Margin	Pola.	Height	Angle	Ant	Comment
	[MHz]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[H/V]	[cm]	[deg]	Type	
1	190.696	39.9	14.0	5.6	27.8	31.7	43.5	11.8	Hori.	172	316	BC	
2	398.196	45.5	16.3	7.5	28.2	41.1	46.0	4.9	Hori.	161	303	LP	
3	82.953	52.8	8.8	4.7	28.2	38.1	40.0	1.9	Vert.	100	281	BC	
4	116.117	55.3	10.7	5.2	28.1	43.1	43.5	0.4	Vert.	100	213	BC	
5	265.426	38.4	16.8	6.4	27.4	34.2	46.0	11.8	Vert.	100	335	BC	
6	398.151	39.8	16.3	7.5	28.2	35.4	46.0	10.6	Vert.	100	182	LP	
7	464.484	40.9	17.2	7.9	28.6	37.4	46.0	8.6	Vert.	107	343	LP	

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5.5.4 Measured Data (Continued)

<<Radiated Emission>>

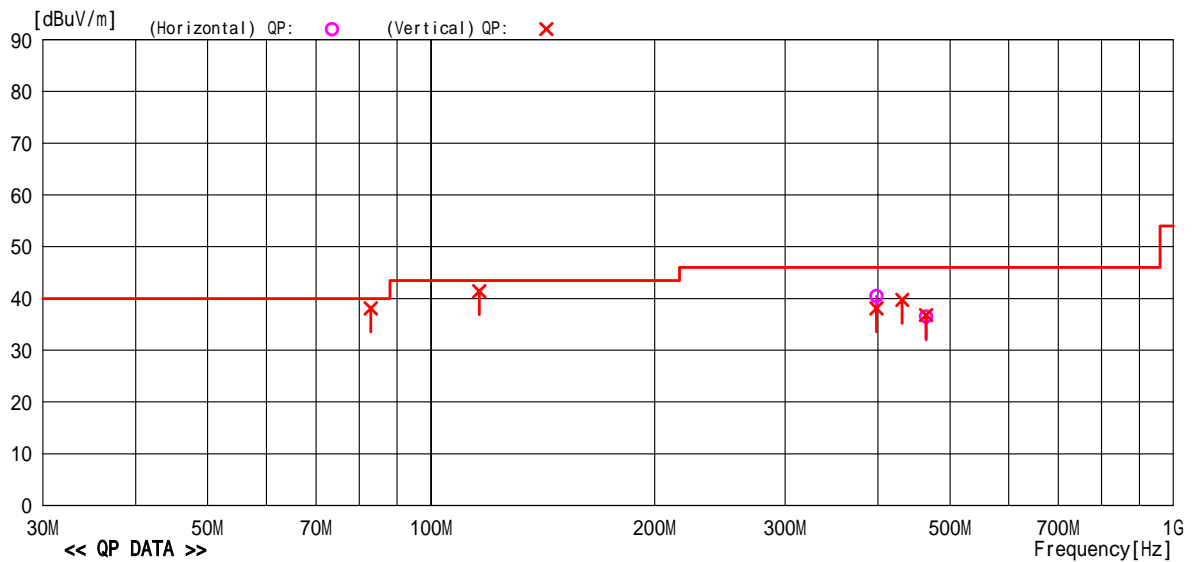
Cosmos Corporation Onoki Lab.
Date : 2011/03/07 23:20:15

Model Name : Model AKR2002
Serial No. : 00002303
Operator : O.Iitogawa
Power Supply : DC24V

Job No : CJ10-100347E
Temp./Humi. : 21 /41%
Condition : Tx 38CH 2442.240MHz
Remark :

Memo : RBW:30M ~ 1GHz(120kHz)

LIMIT : Fcc15C 15_209 (3m) 30MHz-1000MHz



No	Freq.	Reading	Ant.Fac	Loss	Gain	Result	Limit	Margin	Pola.	Height	Angle	Ant	Comment
	[MHz]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[H/V]	[cm]	[deg]	Type	
1	398.111	44.9	16.3	7.5	28.2	40.5	46.0	5.5	Hori.	100	136	LP	
2	464.464	40.0	17.2	7.9	28.6	36.5	46.0	9.5	Hori.	100	0	LP	
3	82.933	52.8	8.8	4.7	28.2	38.1	40.0	1.9	Vert.	100	114	BC	
4	116.117	53.6	10.7	5.2	28.1	41.4	43.5	2.1	Vert.	100	180	BC	
5	398.121	42.5	16.3	7.5	28.2	38.1	46.0	7.9	Vert.	130	45	LP	
6	431.297	43.7	16.7	7.7	28.4	39.7	46.0	6.3	Vert.	124	18	LP	
7	464.484	40.3	17.2	7.9	28.6	36.8	46.0	9.2	Vert.	127	284	LP	

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5.5.4 Measured Data (Continued)

<<Radiated Emission>>

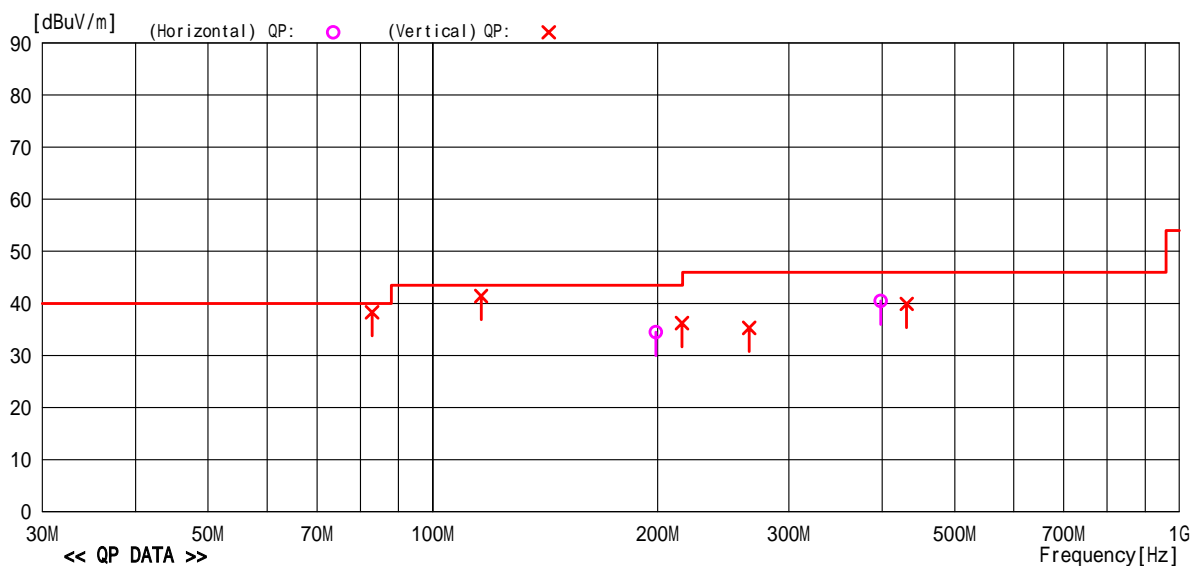
Cosmos Corporation Onoki Lab.
Date : 2011/03/08 00:07:27

Model Name : Model AKR2002
Serial No. : 00002303
Operator : O.Itogawa
Power Supply : DC24V

Job No : CJ10-100347E
Temp./Humi. : 21 /41%
Condition : Tx 75CH 2480.128MHz
Remark :

Memo : RBW:30M ~ 1GHz(120kHz)

LIMIT : Fcc15C 15_209 (3m) 30MHz-1000MHz



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5.5.4 Measured Data (Continued)

1GHz to 18GHz

RADIATED EMISSION

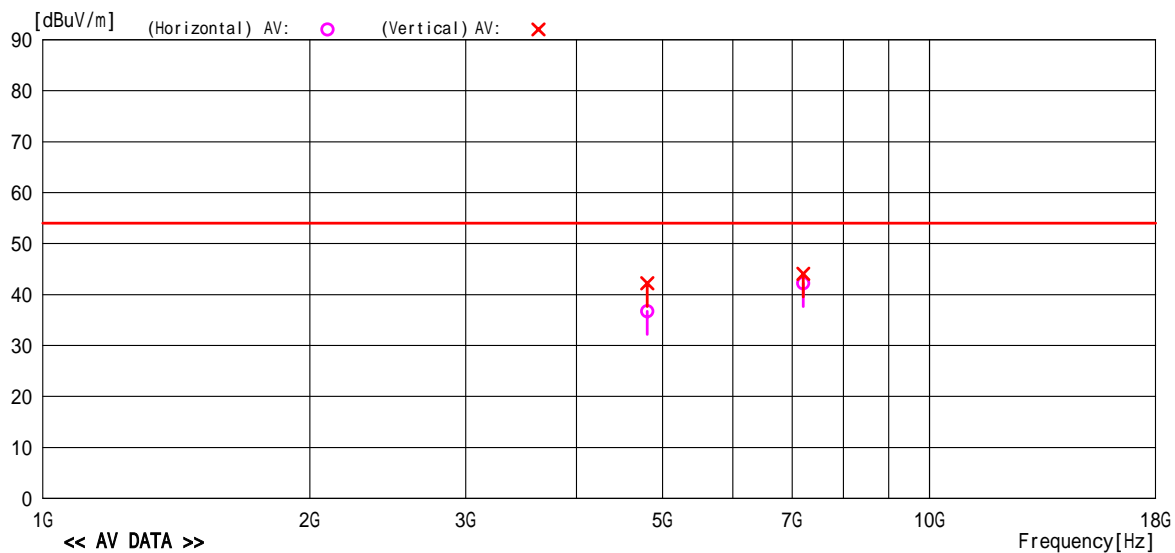
Cosmos Corporation Onoki Lab.
Date : 2011/03/03 21:26:02

Model Name : Model AKR2002
Serial No. : 00002303
Operator : O.Itogawa
Power Supply : DC24V

Job No. : CJ10-100347E
Temp/Humi : 25 /41%
Condition : Tx OCH 2403.328MHz
Remark :

Memo : RBW:1GHz ~ (1MHz)

LIMIT : FCC Subpart C 15.209 (3m) 1G-26.5GHz(AV)



No	Freq.	Reading	Ant.Fac	Loss	Gain	Result	Limit	Margin	Pola.	Height	Angle	Ant	Comment
	[MHz]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[H/V]	[cm]	[deg]	Type	
1	4807.553	35.6	31.0	6.3	36.2	36.7	54.0	17.3	Hori.	100	226	AV	
2	7208.349	33.3	35.1	7.5	33.7	42.2	54.0	11.8	Hori.	103	154	AV	
3	4805.682	41.1	31.0	6.3	36.2	42.2	54.0	11.8	Vert.	100	345	AV	
4	7208.390	35.2	35.1	7.5	33.7	44.1	54.0	9.9	Vert.	100	4	AV	

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5.5.4 Measured Data (Continued)

RADIATED EMISSION

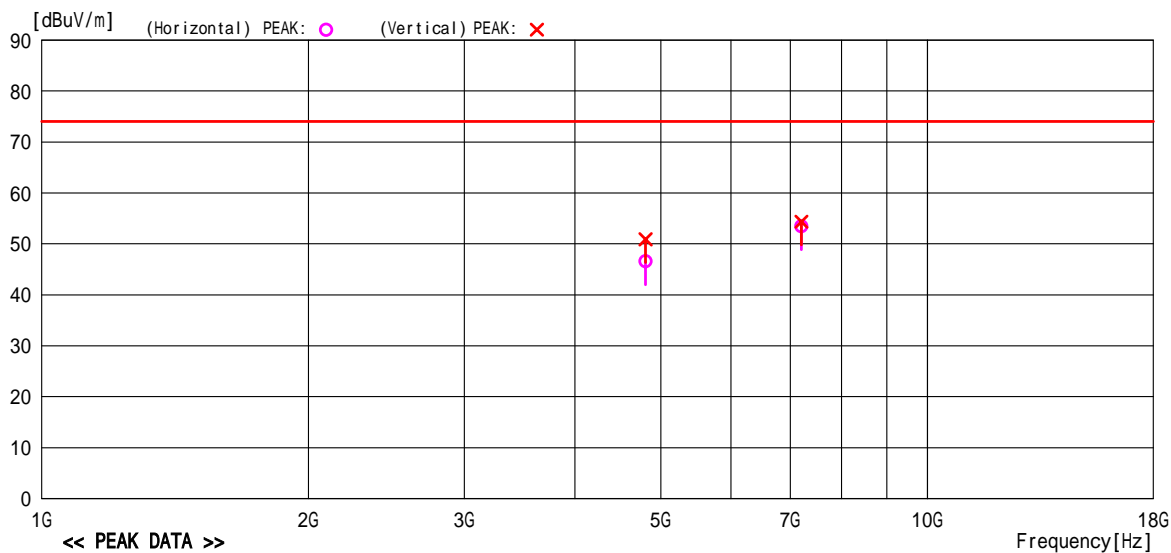
Cosmos Corporation Onoki Lab.
Date : 2011/03/03 21:26:02

Model Name : Model AKR2002
Serial No. : 00002303
Operator : O. Itogawa
Power Supply : DC24V

Job No. : CJ10-100347E
Temp/Humi : 25 /41%
Condition : Tx OCH 2403.328MHz
Remark :

Memo : RBW:1GHz ~ (1MHz)

LIMIT : FCC Subpart C 15.209 (3m) 1G-26.5GHz(PK)



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5.5.4 Measured Data (Continued)

RADIATED EMISSION

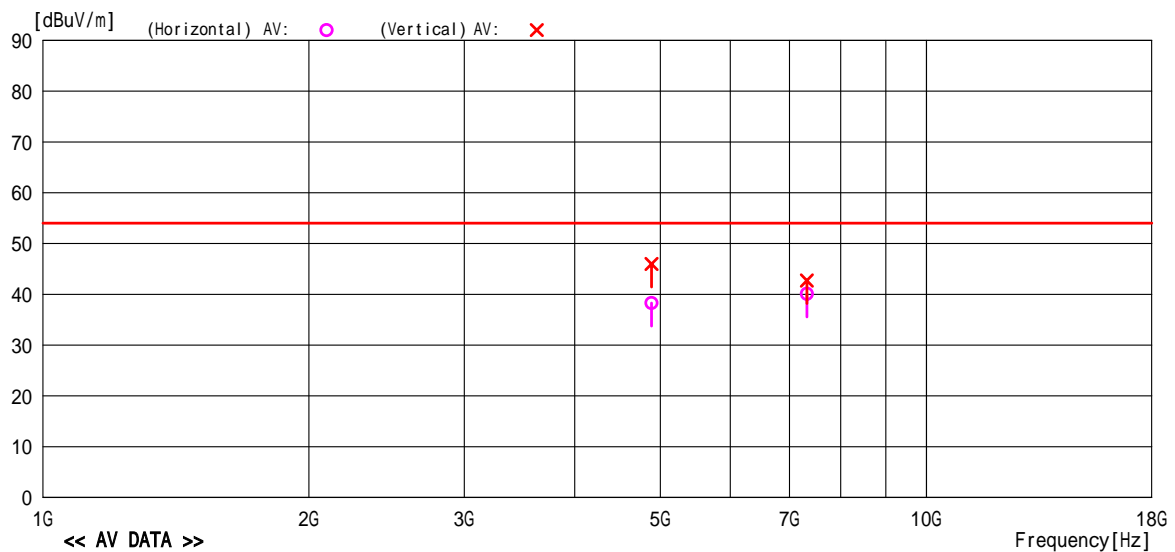
Cosmos Corporation Onoki Lab.
Date : 2011/03/07 20:56:03

Model Name : Model AKR2002
Serial No. : 00002303
Operator : O.Itogawa
Power Supply : DC24V

Job No. : CJ10-100347E
Temp/Humi : 21 /41%
Condition : Tx 38CH 2442.240MHz
Remark :

Memo : RBW:1GHz ~ (1MHz)

LIMIT : FCC Subpart C 15.209 (3m) 1G-26.5GHz(AV)



No	Freq.	Reading	Ant.Fac	Loss	Gain	Result	Limit	Margin	Pol.	Height	Angle	Ant	Comment
	[MHz]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[H/V]	[cm]	[deg]	Type	
1	4885.304	36.9	31.1	6.3	36.0	38.3	54.0	15.7	Hori.	100	142	AV	
2	7325.094	31.0	35.4	7.7	34.0	40.1	54.0	13.9	Hori.	100	148	AV	
3	4885.384	44.6	31.1	6.3	36.0	46.0	54.0	8.0	Vert.	109	351	AV	
4	7325.094	33.6	35.4	7.7	34.0	42.7	54.0	11.3	Vert.	134	180	AV	

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5.5.4 Measured Data (Continued)

RADIATED EMISSION

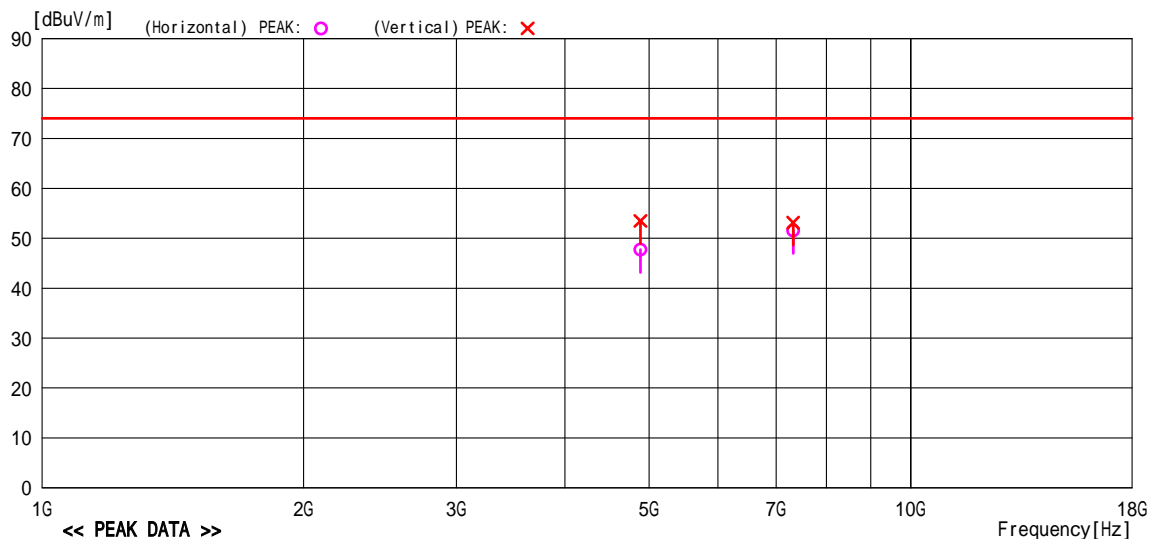
Cosmos Corporation Onoki Lab.
Date : 2011/03/07 20:56:03

Model Name : Model AKR2002
Serial No. : 00002303
Operator : O.Itogawa
Power Supply : DC24V

Job No. : CJ10-100347E
Temp/Humi : 21 /41%
Condition : Tx 38CH 2442.240MHz
Remark :

Memo : RBW:1GHz ~ (1MHz)

LIMIT : FCC Subpart C 15.209 (3m) 1G-26.5GHz(PK)



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5.5.4 Measured Data (Continued)

RADIATED EMISSION

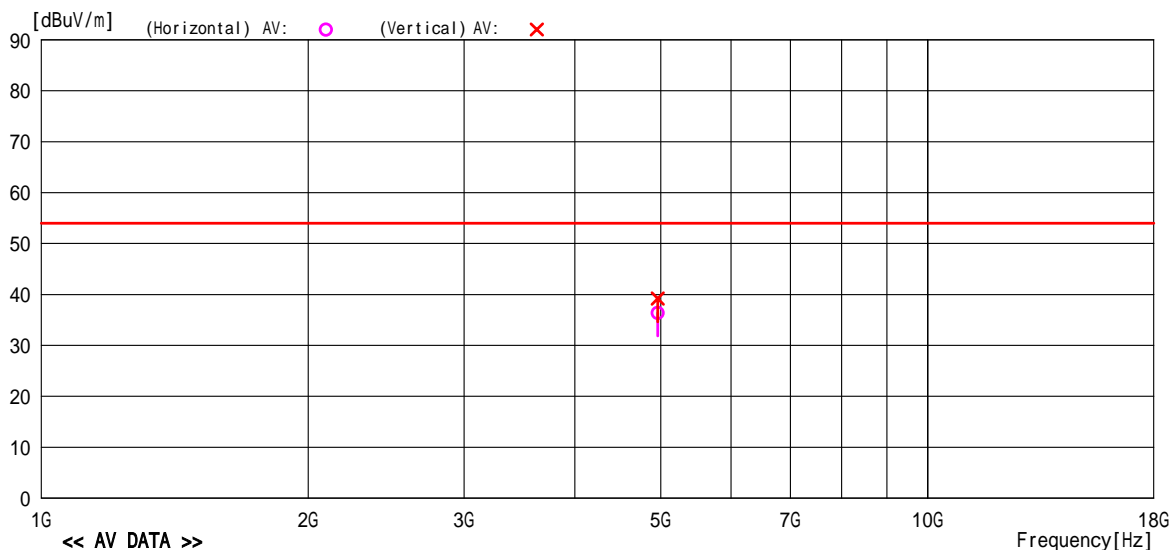
Cosmos Corporation Onoki Lab.
Date : 2011/03/07 21:29:16

Model Name : Model AKR2002
Serial No. : 00002303
Operator : O.Itogawa
Power Supply : DC24V

Job No. : CJ10-100347E
Temp/Humi : 21 /41%
Condition : Tx 75CH 2480.128MHz
Remark :

Memo : RBW:1GHz ~ (1MHz)

LIMIT : FCC Subpart C 15.209 (3m) 1G-26.5GHz(AV)



No	Freq. [MHz]	Reading [dBuV]	Ant.Fac [dB/m]	Loss [dB]	Gain [dB]	Result [dBuV/m]	Limit [dBuV/m]	Margin [dB]	Pol. [H/V]	Height [cm]	Angle [deg]	Ant Type	Comment
1	4959.201	34.8	31.2	6.3	35.9	36.4	54.0	17.6	Hori.	106	208	AV	
2	4961.140	37.6	31.2	6.3	35.9	39.2	54.0	14.8	Vert.	100	145	AV	

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5.5.4 Measured Data (Continued)

RADIATED EMISSION

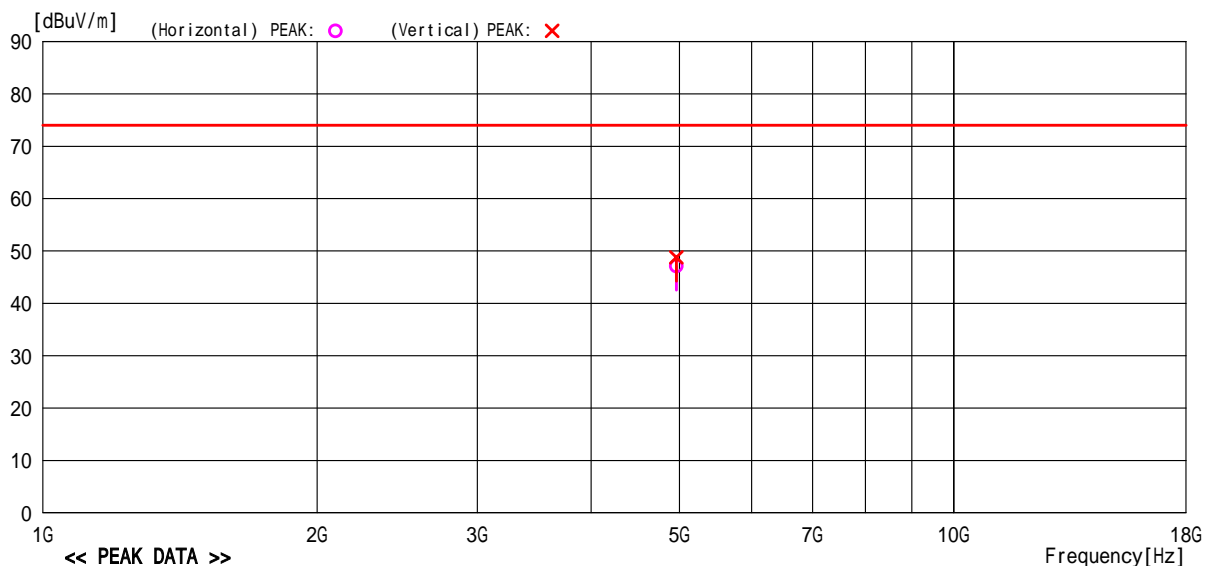
Cosmos Corporation Onoki Lab.
Date : 2011/03/07 21:29:16

Model Name : Model AKR2002
Serial No. : 00002303
Operator : O. Itogawa
Power Supply : DC24V

Job No. : CJ10-100347E
Temp/Humi : 21 /41%
Condition : Tx 75CH 2480.128MHz
Remark :

Memo : RBW:1GHz ~ (1MHz)

LIMIT : FCC Subpart C 15.209 (3m) 1G-26.5GHz(PK)



No	Freq.	Reading	Ant.Fac	Loss	Gain	Result	Limit	Margin	Pola.	Height	Angle	Ant	Comment
	[MHz]	[dBuV]	[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[H/V]	[cm]	[deg]	Type	
1	4959.201	45.5	31.2	6.3	35.9	47.1	74.0	26.9	Hori.	106	208		PK
2	4961.140	47.2	31.2	6.3	35.9	48.8	74.0	25.2	Vert.	100	145		PK

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5.5.4 Measured Data (Continued)

18GHz to 26.5GHz

No spurious emission for RF was found in 18GHz to 26.5GHz.

The measurements of 15. 247(d) Transmitter Radiated Emissions (Radiated) were performed with two type antennas and worst data with antenna of IWF-HP01RS2X were listed.

5.6 15. 247(e) Power Spectrum Density

5.6.1 Setting Remarks

- EUT directly connects to the spectrum analyzer via calibrated coaxial cable and 10 dB attenuator.
- The loss of the coaxial cable is maximum 1 dB.
- The peak output power is determined by using the marker-data function of spectrum analyzer.
- The spectrum analyzer is set-up as following;

✓ Frequency Span	: 1.5 MHz
✓ Resolution bandwidth	: 3 kHz
✓ Video bandwidth	: 3 MHz
✓ Sweep	: 500sec
✓ Detector function	: Peak
✓ Trace Mode	: Max Hold

- See test configuration figure 4.3.

5.6.2 Minimum Standard

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 (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

5.6.3 Result

EUT complies with the requirement.

Uncertainty of measurement result: ± 0.8 dB

Temperature, Humidity : 24°C, 46%

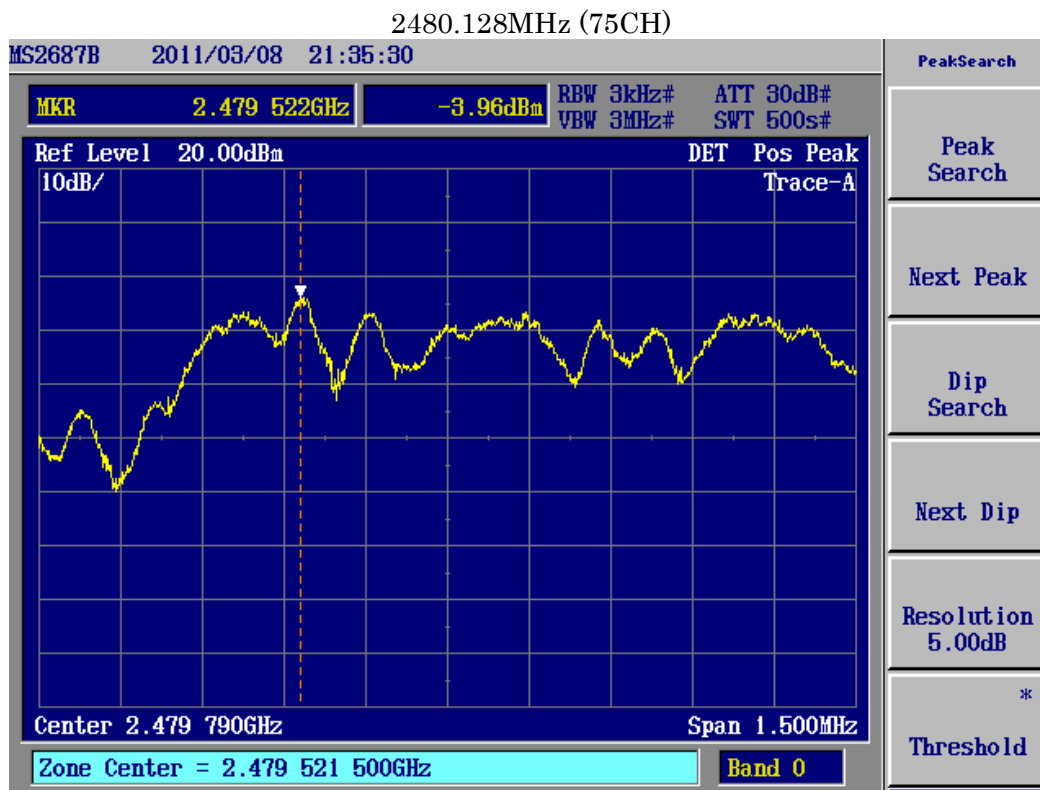
5.6.4 Measured Data

Frequency (MHz)	Correction Factor (dB)	Reading (dBm)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
2403.328 (0ch)	0.36	-3.15	-2.79	8.0	10.79
2442.240 (38ch)	0.36	-2.98	-2.62	8.0	10.62
2480.128 (75ch)	0.36	-3.96	-3.60	8.0	11.60

5.6.4 Measured Data (Continued)



5.6.4 Measured Data (Continued)



5.7 15. 247(d) Band Edge Measurement

5.7.1 Setting Remarks

- EUT directly connects to the spectrum analyzer via calibrated coaxial cable and 10 dB attenuator.
- The loss of the coaxial cable is maximum 1 dB.
- The emission at the band edge is measured by using the marker function of spectrum analyzer.
- The peak of the in-band emission is measured by using the marker to peak function of spectrum analyzer.
- This measurement is repeated in both side of the spectrum.
- The spectrum analyzer is set-up as following;
 - ✓ Frequency Span : 3MHz
 - ✓ Resolution bandwidth : 300kHz (1% of frequency span)
 - ✓ Video bandwidth : > RBW
 - ✓ Sweep : Auto
 - ✓ Detector function : Peak
 - ✓ Trace Mode : Max Hold
- Where band edge spectrum is too rough to find precise edge point, larger RBW i.e. 1MHz, 3MHz shall be applied as severer condition.
- See test configuration figure 4.2.

5.7.2 Minimum Standard

In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits. Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

Frequency of Emission (MHz)	Limit of the band edge spurious emission (dBμV)	
Below 2,390.0	Peak	Average
Above 2,483.5	74	54

5.7.3 Result

EUT complies with the requirement.

Uncertainty of measurement result: ± 2.6 dB

Temperature, Humidity : 21°C, 41%

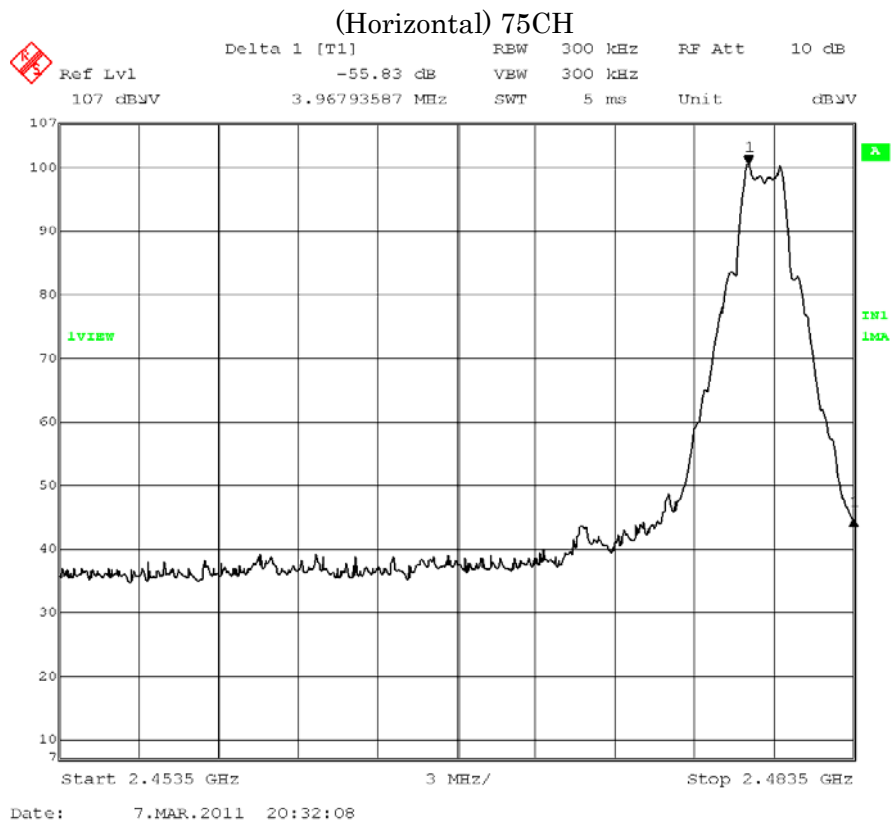
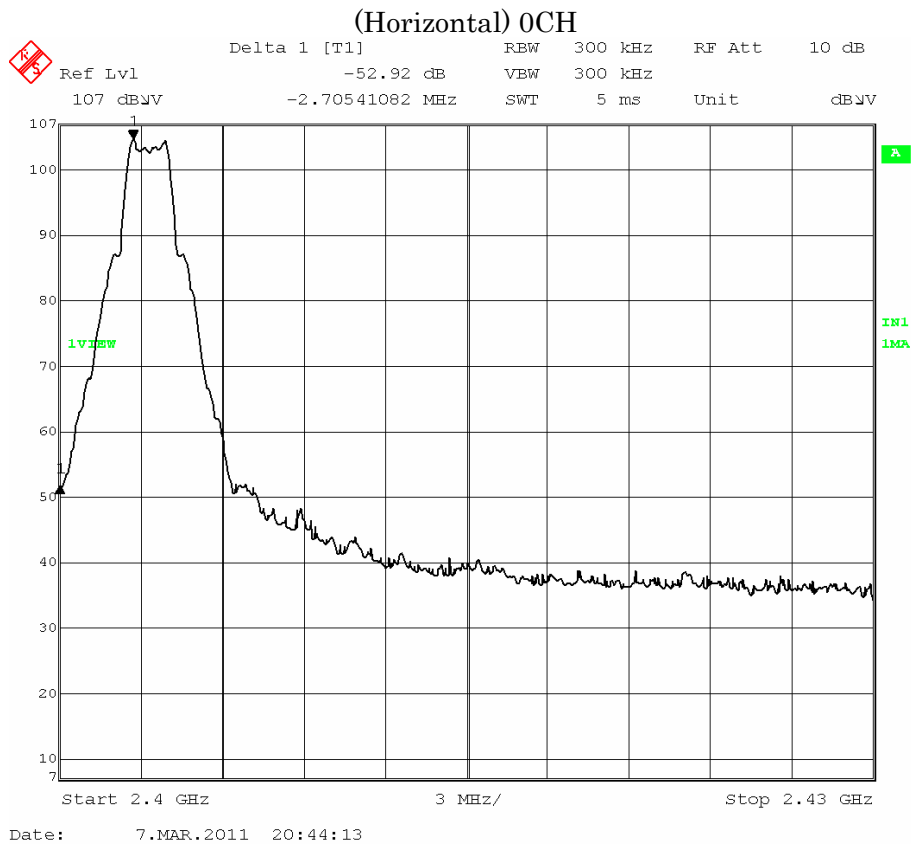
5.7.4 Measured Data

The band edge emissions are calculated as following;

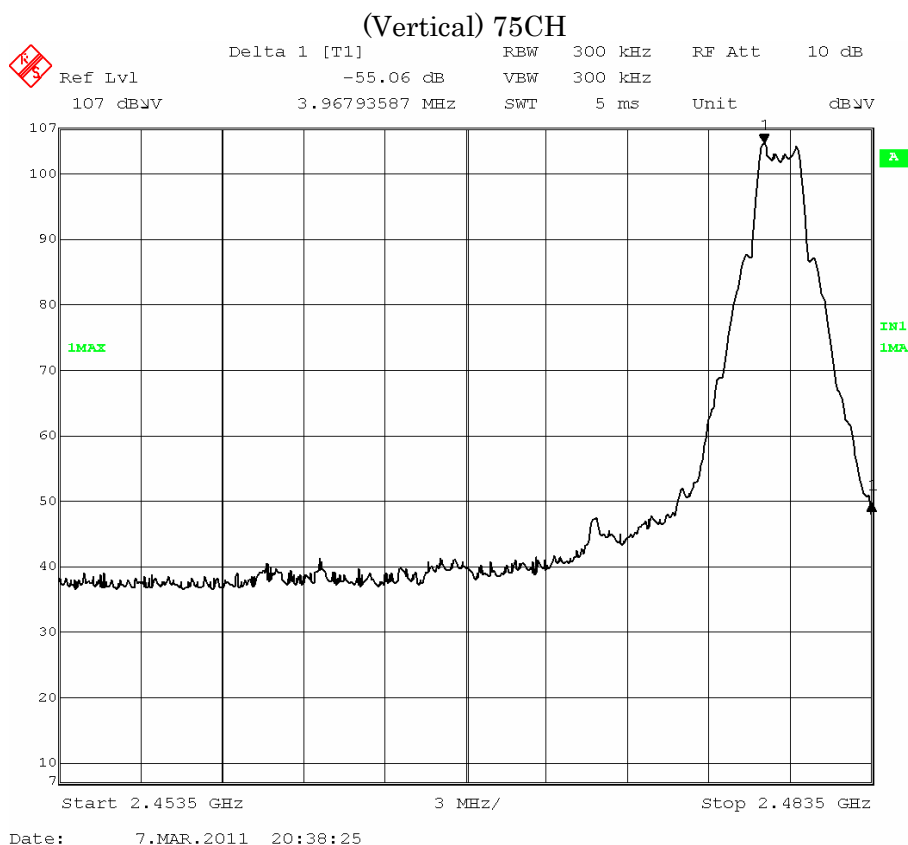
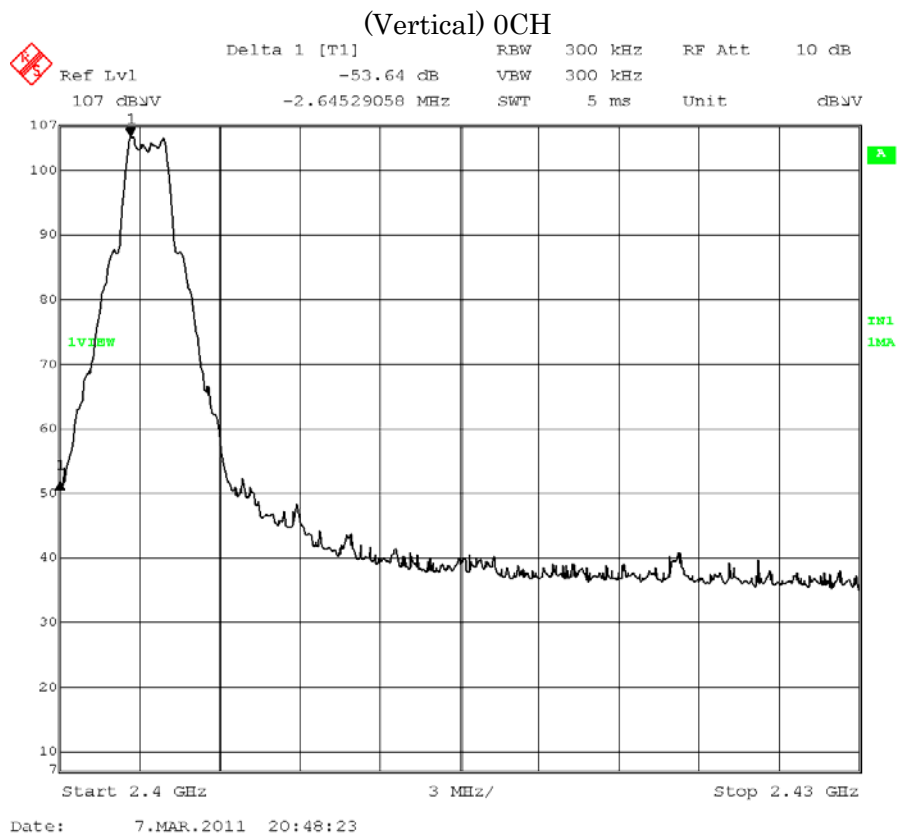
CH	Horizontal		Vertical	
	0CH (2403.328MHz)	75CH (2480.128MHz)	0CH (2403.328MHz)	75CH (2480.128MHz)
P _{max}	104.52	100.47	105.18	104.57
P _{av}	102.24	97.92	102.64	101.37
P _{dev}	52.92	55.83	53.64	55.06
P _{dav}	53.95	53.42	53.59	53.10
c.f	-3.70	-3.70	-3.70	-3.70
E _{be}	47.90	40.94	47.84	45.81
E _{av}	44.59	40.80	45.35	44.57
Limit(E _{be})	74.00	74.00	74.00	74.00
Limit(E _{av})	54.00	54.00	54.00	54.00
Margin(E _{be})	26.10	33.06	26.16	28.19
Margin(E _{av})	9.41	13.20	8.65	9.43

- P_{max} : Maximum peak power of the fundamental.
P_{av} : Average of the fundamental.
P_{dev} : The amplitude delta between the peak power and the band edge emission.
P_{dav} : The amplitude delta between the average power and the band edge emission.
E_{be} : Band edge emission.
E_{av} : Average of the band edge emission.

5.7.4 Measured Data (Continued)

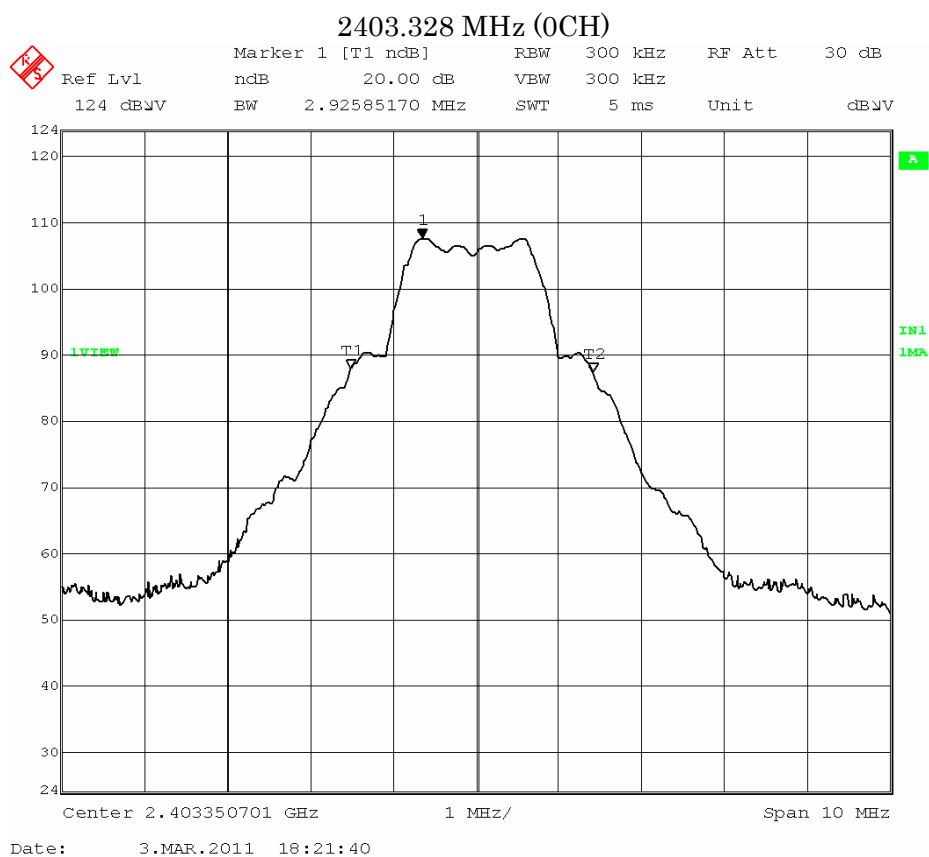


5.7.4 Measured Data (Continued)



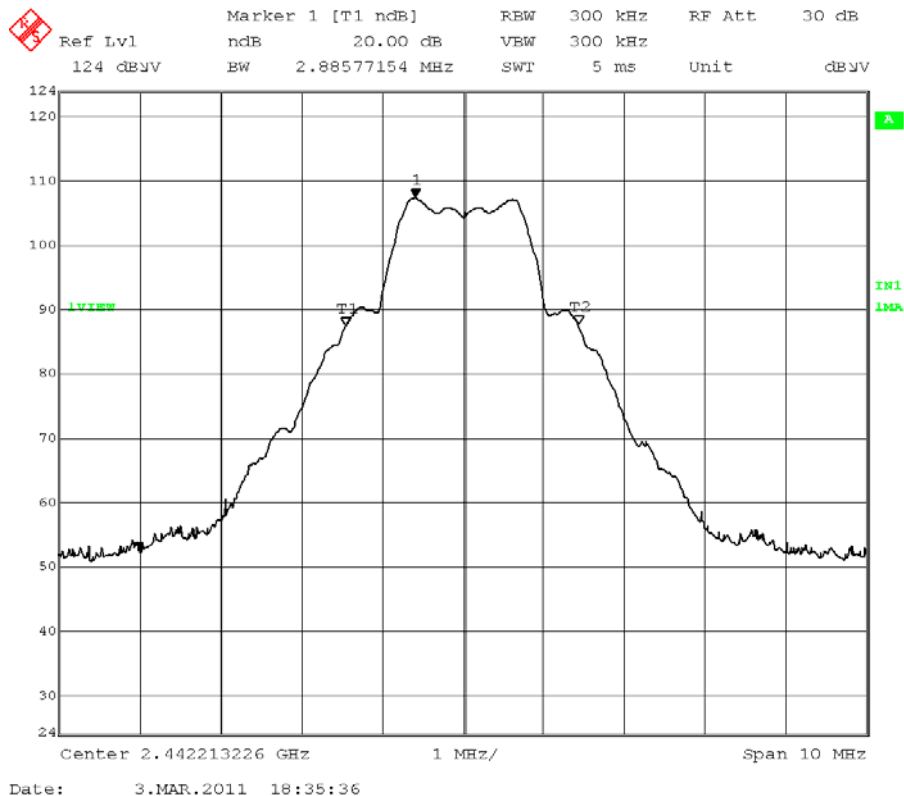
5.8 15.215(c) 20dB Bandwidth
5.8.1 Measured Data

Frequency (MHz)	Measured Bandwidth (kHz)	Limit (MHz)
20 dB Bandwidth		
2403.328 (0ch)	2925.851	---
2442.240 (38ch)	2885.771	---
2480.128 (75ch)	2905.811	---

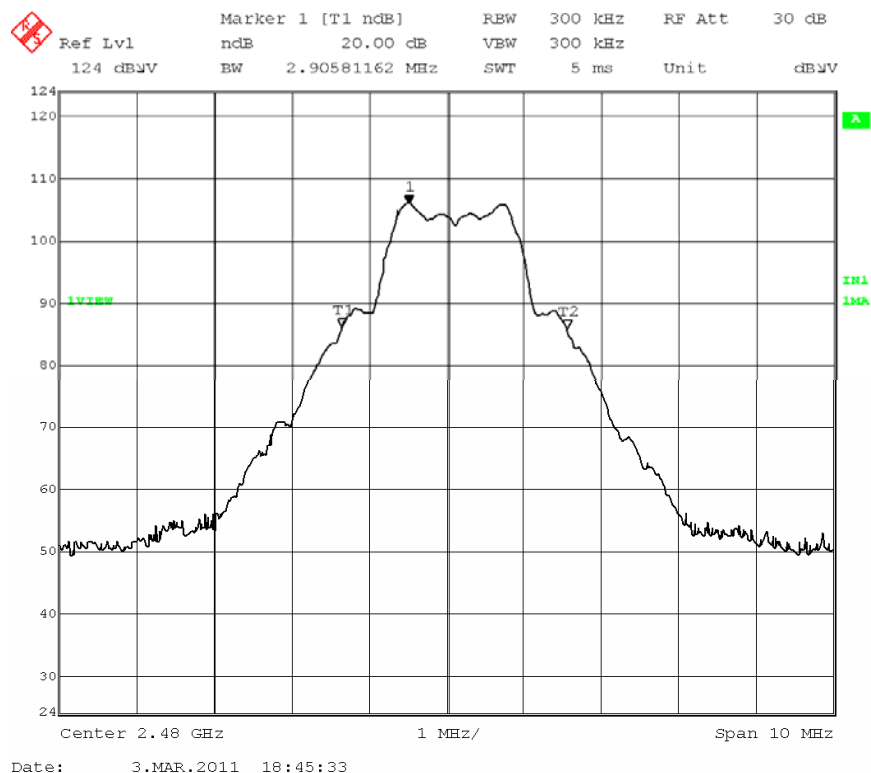


5.8.1 Measured data (Continued)

2442.240 MHz (38CH)

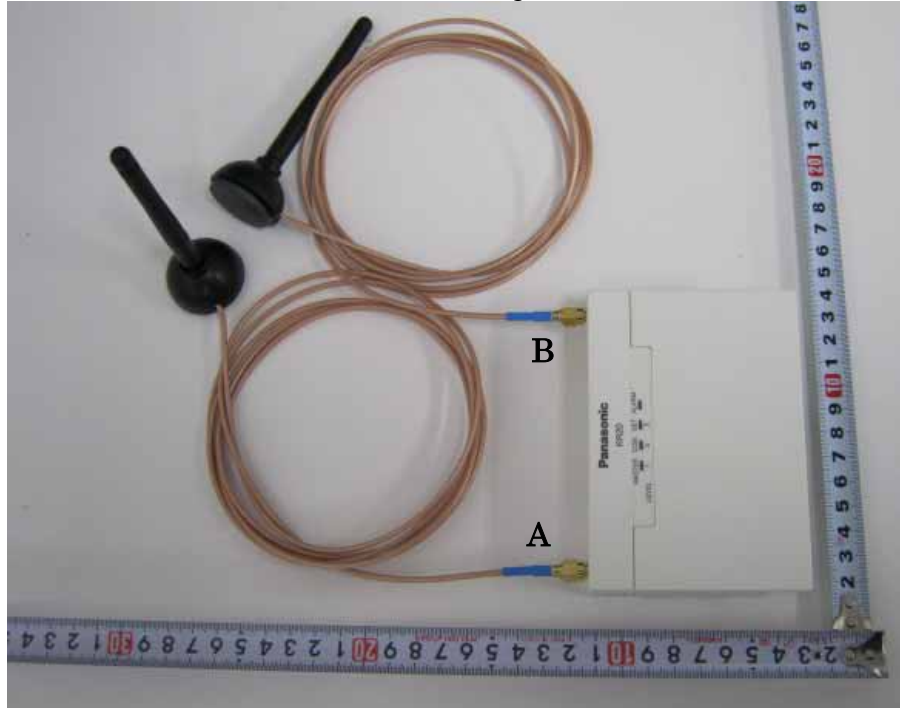


2480.128 MHz (75CH)

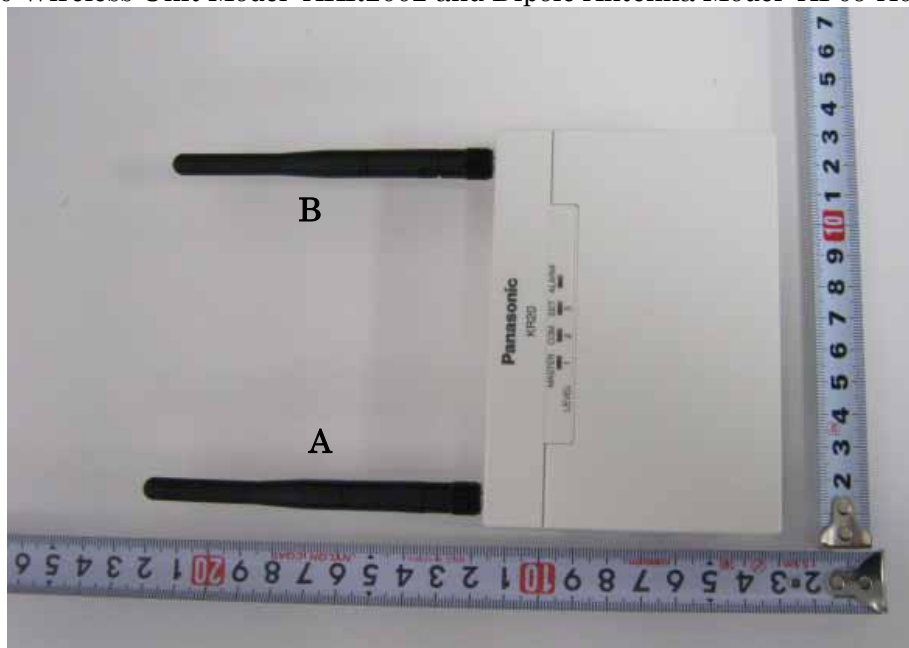


6. Photos

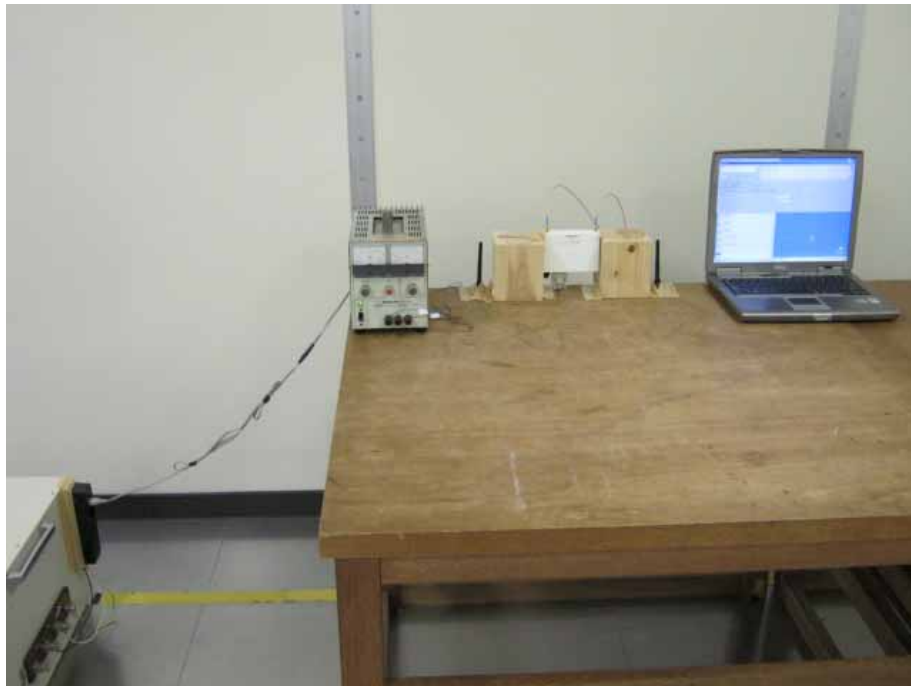
6.1 Photo of the EUT (KR20 Wireless Unit Model: AKR2002 and Dipole Antenna Model: IWF-HP01RS2X)



(KR20 Wireless Unit Model: AKR2002 and Dipole Antenna Model: AP09-A00-0)



6.2 Setup Photo (AC Power Conducted Emission)

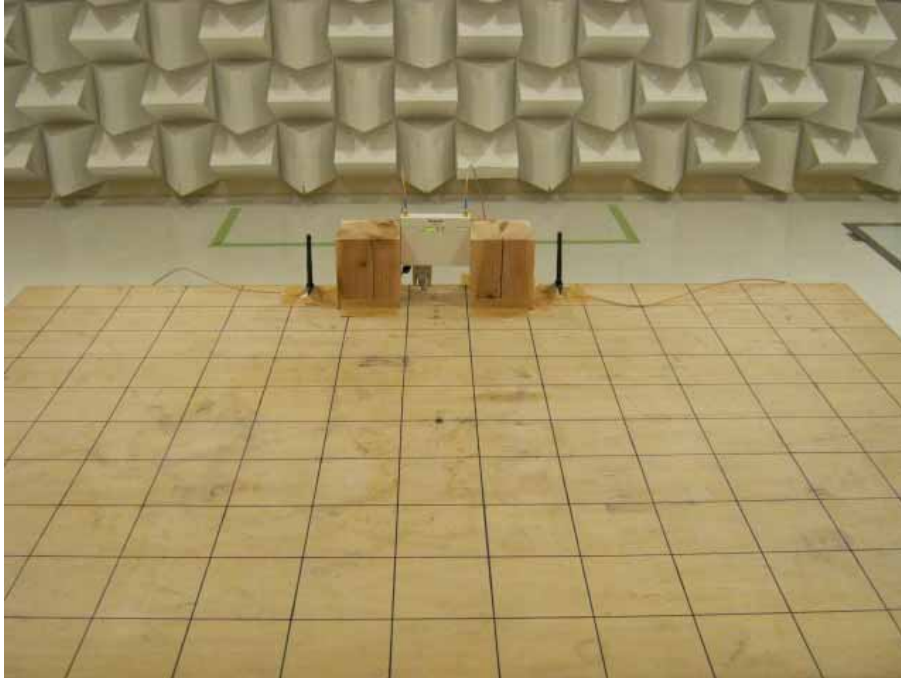


6.3 Setup Photo (Radiated Emission)

30MHz - 1GHz



6.3 Setup Photo (Radiated Emission)

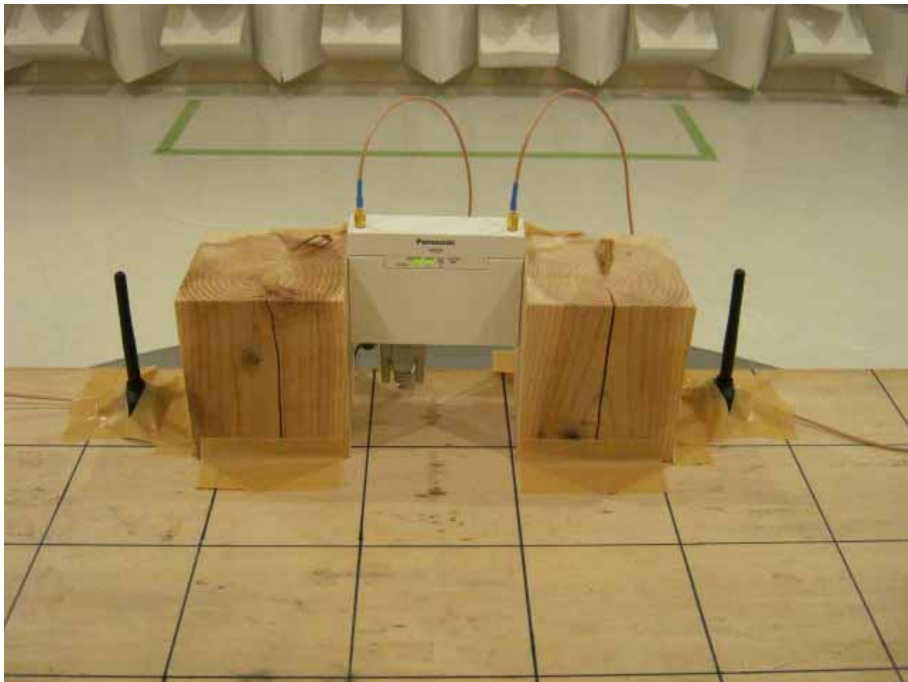
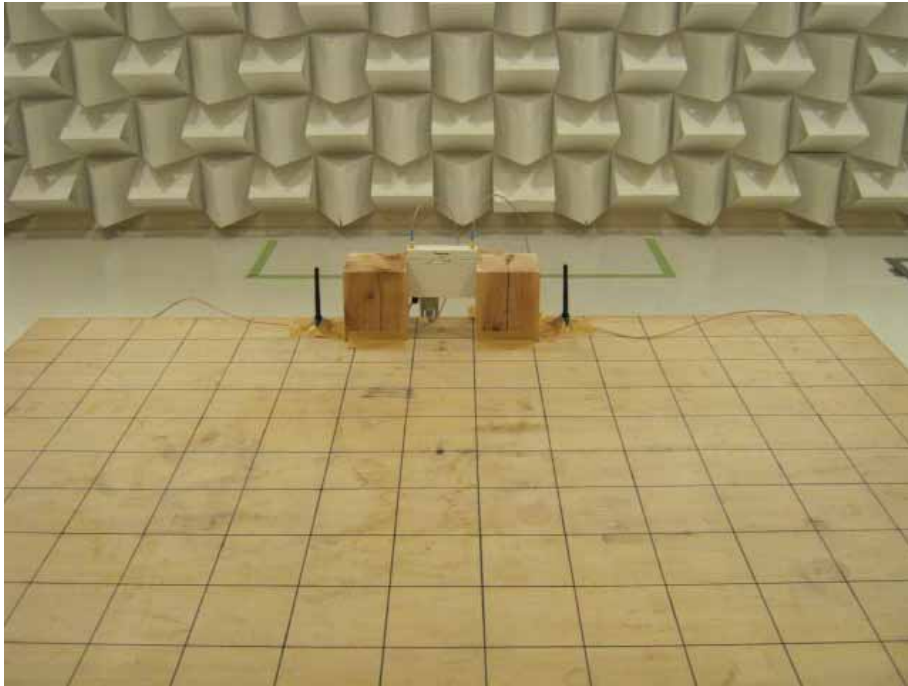


6.3 Setup Photo (Radiated Emission)

1GHz – 18GHz



6.3 Setup Photo (Radiated Emission)

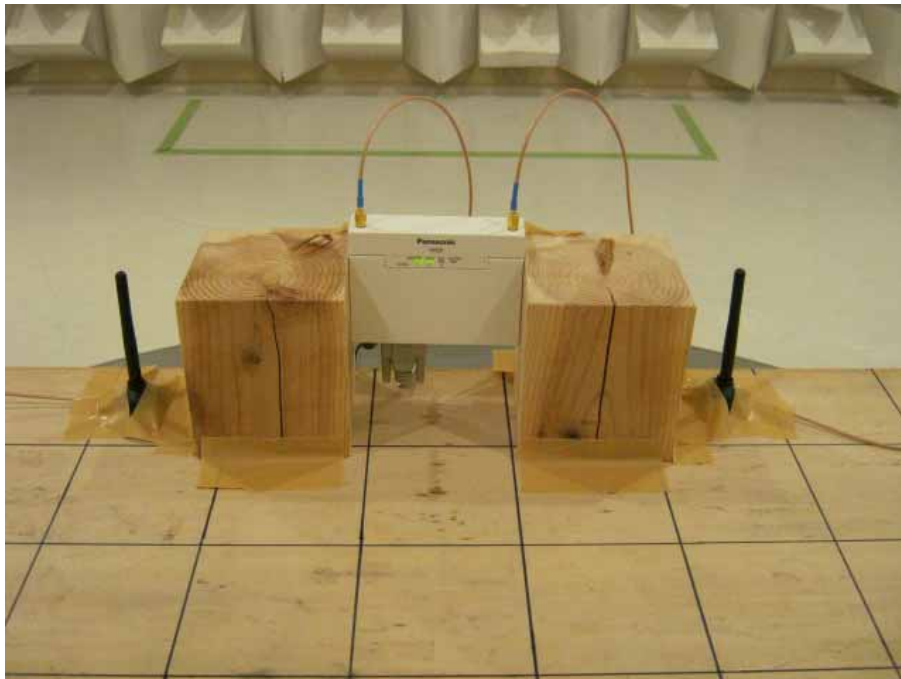
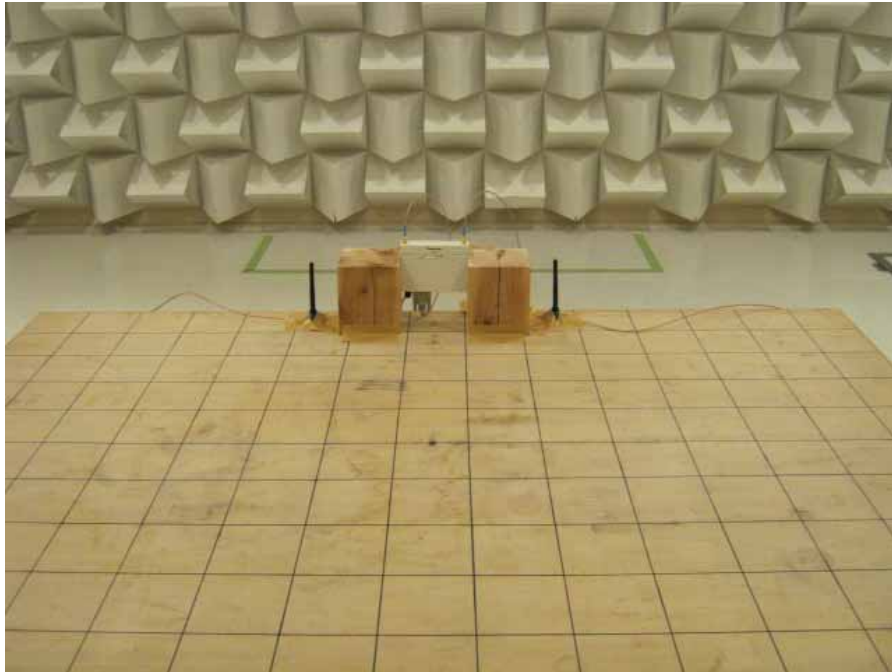


6.3 Setup Photo (Radiated Emission)

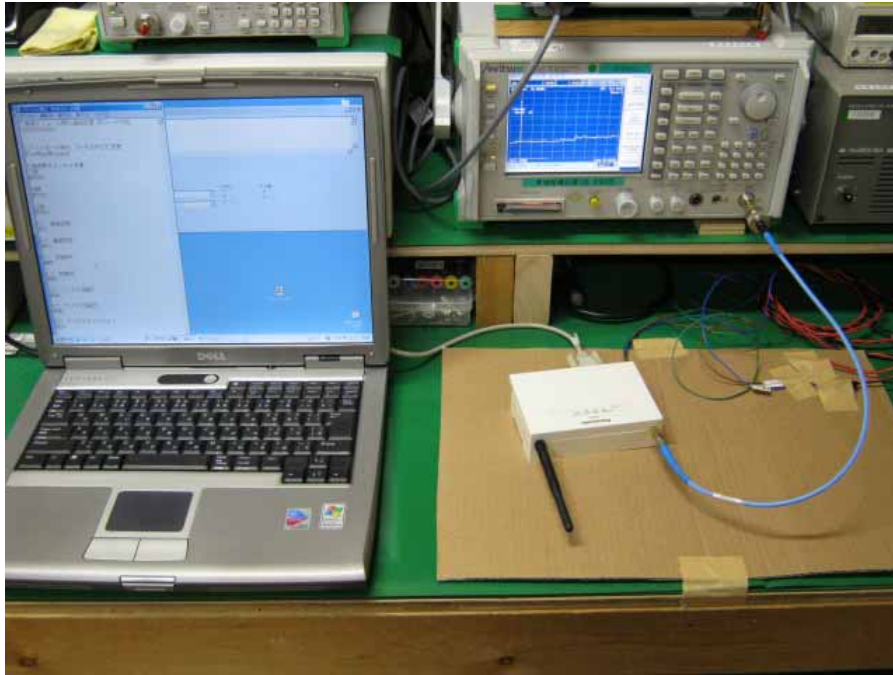
18GHz – 26.5GHz



6.3 Setup Photo (Radiated Emission)



6.4 Setup Photo (All Other Test Items)



7. List of Test Measurement Instruments

7.1 AC Power Conducted Emission

Instruments	Manufacturer	Model / Type	Serial No.	Calibration Date Next Calibration
Spectrum Analyzer	ADVANTEST CORPORATION	R3132	140501174	November, 2010 November, 2011
EMI Test Receiver	ROHDE & SCHWARZ	ESCS30	100335	November, 2010 November, 2011
Artificial-Mains Network	KYORITSU CORPORATION	KNW-341F	8S-2996-1	July, 2010 July, 2011
RF Selector	TSJ	RFM-E221	3148	October, 2010 October, 2011

7.2 Radiated Emission Measurement

Instruments	Manufacturer	Model / Type	Serial No.	Calibration Date Next Calibration
Programmable AC/DC Power Source	NF Corporation	ES18000W	425779	Confirmed Before Test
RF Selector	TSJ	RFM-E121	03149	October, 2010 October, 2011
EMI Test Receiver (20Hz to 40GHz)	ROHDE & SCHWARZ	ESIB40	100211	October, 2010 October, 2011
Biconical Antenna (30MHz to 300MHz)	SCHWARZBECK	VHBB9124 BBA9106	9124-311	November, 2010 November, 2011
Log-Periodic Antenna (300MHz to 1GHz)	SCHWARZBECK	UHALP9108A	645	November, 2010 November, 2011
Horn Antenna (1GHz to 12.5GHz)	SCHWARZBECK	BBHA9120D	443	October, 2010 October, 2011
Horn Antenna (12.5GHz to 18GHz)	ETS LINDGREN	3160-08	00033782	September, 2010 September, 2011
Horn Antenna (18GHz to 26.5GHz)	ETS LINDGREN	3160-09	00034723	September, 2010 September, 2011
Pre Amp (30MHz to 1GHz)	HEWLETT PACKARD	8447D	2944A07891	February, 2011 February, 2012
Pre Amp (1GHz to 12.75GHz)	TSJ	MLA-0120AM L-34	---	January, 2011 January, 2012

7.3 Conducted Radio Measurement

Instruments	Manufacturer	Model / Type	Serial No.	Calibration Date Next Calibration
DC Power Source	KIKUSUI	PAN60-6A	JK002503	---
Spectrum Analyzer	Anritsu	MS2687B	6200162706	April, 2010 April, 2011
Signal Generator	Agilent Technology	E8254A	US41140186	May, 2010 May, 2011