

KANSAI ELECTRONIC INDUSTRY DEVELOPMENT CENTERHEAD OFFICE
6-8-7 NISHITENMA
KITA-KU OSAKA 530-0047 JAPAN

Corporate Juridical Person

IKOMA TESTING LABORATORY
12128 TAKAYAMA-CHO
IKOMA-CITY NARA 630-0101 JAPAN**TEST REPORT****Report No.**A-006-03-C**Date:** 14 July 2003

This test report is to certify that the tested device properly complies with the requirements of:

FCC Rules and Regulations Part 15 Subpart C Intentional Radiators.

All the tests necessary to show compliance to the requirements were performed and these results met the specifications of requirement. The results of this report should not be construed to imply compliance of equipment other than that, which was tested. Unless the laboratory permission, this report should not be copied in part.

1. Applicant

Company Name : Welcat Inc.
Mailing Address : IWATA Bldg. 1-17-12, Shin-Yokohama, Kouhoku-ku, Yokohama,
Kanagawa-ken, 222-0033 Japan

2. Identification of Tested Device

Type of Device : SS Transmitter
Type of Modulation : ☐: FHSS ☒: DSSS ☐: Other method
Kind of Equipment Authorization : ☐: DoC ☒: Certification ☐: Verification
FCC ID : Q98CTR80011W
Device Name : Wireless Hand-held Terminal
Trade Name : —
Model Number : CRT-800-11W
Serial Number : 17 (for Radiated Emission),
11 (for Other test)
☐: Prototype ☒: Pre-production ☐: Production
Date of Manufacture : June 2003

3. Test Items and Procedure

☒: 6 dB Bandwidth Measurement
☒: Peak Output Power Measurement
☒: Band Edge RF Conducted Emission Measurement
☒: Spurious RF Conducted Emission Measurement
☒: Power Density Measurement
☒: Radiated Spurious Emission Measurement
☐: AC Power Line Conducted Emission Measurement

Above all tests were performed under: FCC Public Notice DA00-705(March 30,2000)
and ANSI C63.4 – 1992

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

4. Date of Test

Receipt of Test Sample : 30 June 2003
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 : 1 July 2003

Seiichi Izumi
General Manager/ Ikoma Testing Laboratory

Table of Contents

0. LABORATORY ACCREDITATION AND MEASUREMENT UNCERTAINTY	3
0.1. Laboratory Accreditation.....	3
0.2. Measurement Uncertainty	3
1. CERTIFICATION OF THE COMPLIANCE.....	3
2. GENERAL INFORMATION	4
2.1. Product Description	4
2.2. Description for Equipment Authorization.....	5
2.3. Test Facility.....	5
3. TESTED SYSTEM	6
3.1. Test Mode	6
3.2. Operation of EUT System	6
3.3. Characterization and condition of EUT System	6
3.4. Test Setup Diagram.....	7
4. 6 dB BANDWIDTH MEASUREMENT (§ 15.247 (a) (2)).....	10
4.1. Test Procedure.....	10
4.2. Test Results	10
5. PEAK OUTPUT POWER MEASUREMENT (§ 15.247 (b) (3))	13
5.1. Test Procedure.....	13
5.2. Test Results	14
6. BAND EDGE RF CONDUCTED EMISSION MEASUREMENT (§ 15.247 (c)).....	17
6.1. Test Procedure.....	17
6.2. Test Results	18
7. SPURIOUS RF CONDUCTED EMISSION MEASUREMENT (§ 15.247 (c)).....	20
7.1. Test Procedure.....	20
7.2. Test Results	21
8. PEAK POWER DENSITY MEASUREMENT (§ 15.247 (d)).....	24
8.1. Test procedure.....	24
8.2. Test Results	25
9. RADIATED EMISSION MEASUREMENT (§ 15.247 (c)), (§ 15.209 (a)).....	28
9.1. Test Procedure.....	28
9.2. Test Results	29
10. USED TEST EQUIPMENTS AND CALIBRATION STATUS	39

0. LABORATORY ACCREDITATION AND MEASUREMENT UNCERTAINTY

0.1. Laboratory Accreditation

KEC is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) for the specific scope of accreditation under Lab Code: 200207-0.

When the test report concerns with the NVLAP accreditation test, the first page of the test report is signed by NVLAP Approved Signatory accompanied by the NVLAP logo.

The report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

0.2. 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)

- of $\pm 3 \times 10^{-9}$ for 6dB Bandwidth Measurement
- of ± 0.7 dB for Peak Output Power Measurement
- of ± 0.7 dB for Band Edge RF Conducted Measurement
- of ± 0.7 dB for Spurious RF Conducted Emission Measurement
- of ± 0.7 dB for Power Density
- of ± 4.9 dB for Radiated Emissions
- of ± 2.2 dB for Conducted Emissions

1. CERTIFICATION OF THE COMPLIANCE

This test report is to certify that the tested device properly complies with the requirements of FCC Rules and Regulations Part 15 Subpart C Intentional Radiators.

KEC evaluation criteria for compliance:

The Product complies, if

the measured results are below the specification limit by a margin more than or equal to

- U 3×10^{-9} for 6dB Bandwidth Measurement
- U (0.7 dB) for Peak Output Power Measurement
- U (0.7 dB) for Band Edge RF Conducted Measurement
- U (0.7 dB) for Spurious RF Conducted Emission Measurement
- U (0.7 dB) for Power Density
- 1/2 U (2.5 dB) for Radiated Emissions
- U (2.2 dB) for Conducted Emissions

2. GENERAL INFORMATION

2.1. Product Description

Model No. CTR-800-11W (referred as EUT in this report) is a Wireless Hand-held Terminal.

(1) Technical Specifications

- Access type : DSSS
- Tx Frequency range : 2412 – 2462 MHz
- Rx Frequency range : 2412 – 2462 MHz
- Antenna : Built in antenna (Gain 2.14 dBi (typ.)),
Impedance 50Ω (Unballanced)

(2) Used Oscillating Frequency

- SS Base band processor : 44.0 MHz
- Micro computer clock : 11.0592 MHz
- Real time clock : 32.768 kHz

(4) Rated Power Supply

: DC 3.7V, 500mA (with Li-ion battery)
(Li-ion battery Model No. HBC-51, trade name Welcat.)

2.2. Description for Equipment Authorization

(1) Type of device	: ☒ Intentional Radiators
(2) Reference Rule and Specification	: FCC Rule Part 15 Subpart C, Section 15.247 Operation with in the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz
(3) Kind of Equipment Authorization	: ☐ DoC ☒ Certification ☐ Verification
(4) Procedure of Application	: ☒ Original Equipment ☐ Modification
(5) Highest Frequency used in the Device	: 2412 – 2462 MHz
(6) Upper Frequency of Radiated Emission Measurement Range	: ☐ 1000 MHz ☐ 2000 MHz ☐ 5000 MHz ☒ Tenth harmonics of the highest fundamental frequency

2.3. Test Facility

All tests described in this report were performed by:	
Name:	KANSAI ELECTRONIC INDUSTRY DEVELOPMENT CENTER (KEC) IKOMA TESTING LABORATORY
OpenArea Test Site	☐ No.1 ☐ No.3 ☐ No.4
Anechoic Chamber	☐ No.1 ☒ No.3
Shielded Room	☐ No.1 ☐ No.2 ☒ No.4 ☐ No.5 ☐ No.6
Address:	12128, Takayama-cho Ikoma-city, Nara, 630-0101 Japan
These test facilities have been filed with the FCC under the criteria of ANSI C63.4-1992. The KEC has been accredited by the NVLAP (Lab. Code: 200207-0) based on ISO/IEC 17025. Also the laboratory has been authorized by TUV Product Service (GER) and TUV Rheinland (GER) based on their criteria for testing laboratory (ISO/IEC 17025). EMC M.C. Anechoic Chamber No.3 has been filed with the Industry Canada under the criteria of RSS212, issue 1. (File number : IC4149-3)	

3. TESTED SYSTEM

3.1. Test Mode

The following operation modes were used under the test.

- Op-mode 1 : Transmitting continuous data at 2412 MHz with modulation (11 Mbps)
- Op-mode 2 : Transmitting continuous data at 2437 MHz with modulation (11 Mbps)
- Op-mode 3 : Transmitting continuous data at 2462 MHz with modulation (11 Mbps)
- Op-mode 4 : Receiving (Tx standby)

- a) 20dB Bandwidth measurement : Op-mode 1, Op-mode 2 and Op-mode 3
- b) Peak Output Power measurement : Op-mode 1 ,Op-mode 2 and Op-mode 3
- c) Band Edge RF Conducted measurement : Op-mode 1 ,Op-mode 2 and Op-mode 3
- d) Spurious RF Conducted emission measurement : Op-mode 1 ,Op-mode 2 and Op-mode 3
- e) Power Density measurement : Op-mode 1 ,Op-mode 2 and Op-mode 3
- f) Radiated Emission measurement : Op-mode 1 ,Op-mode 2, Op-mode 3 and Op-mode 4

3.2. Operation of EUT System

Transmitting (Op-mode 1~3)

1. Turn on the EUT with key in “trigger key” (more than 5 times).
2. Displaying the menu and select “1:RF Technical Test”.
3. Choice the test mode
 - a. Tx / Rx mode : Transmitting mode
 - b. Select frequency (ch.) : ch.1 : 2412 MHz, ch.6 : 2437 MHz and ch.11 : 2462 MHz

Then, the EUT was set in the continuous transmitting operation.

Receiving mode(Op-mode 4)

1. Turn on the EUT with key in “trigger key” (more than 5 times).
2. Displaying the menu and select “1:RF Technical Test”.
3. Choice the test mode
 - a. Tx / Rx mode : Receiving mode
 - b. Select frequency : ch.1 : 2412 MHz, ch.6 : 2437 MHz and ch.11 : 2462 MHz

Then, the EUT was set in the continuous receiving operation.

[Note]

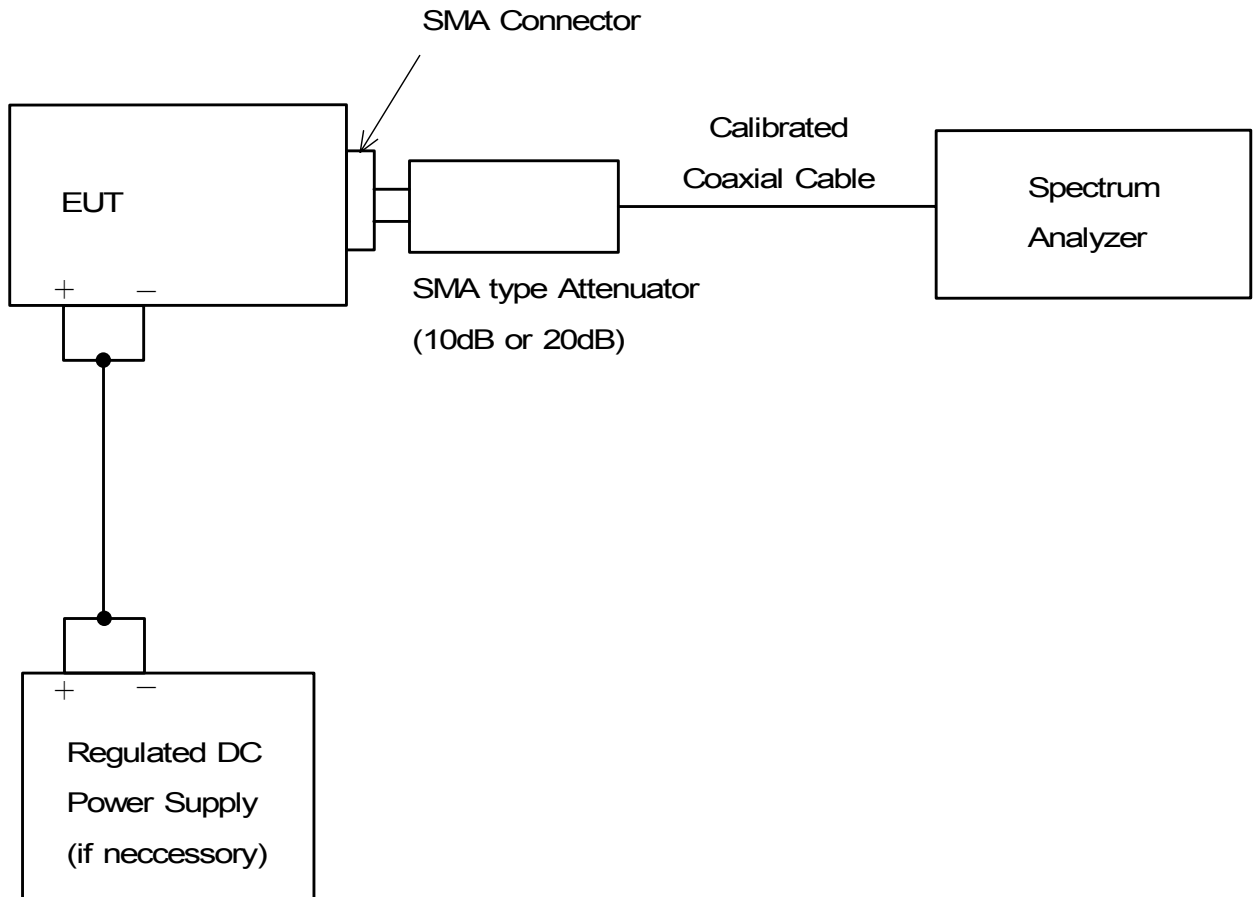
The test program is prepared by manufacture.

3.3. Characterization and condition of EUT System

☒ : normal, ☐ : not normal (that is)

3.4. Test Setup Diagram

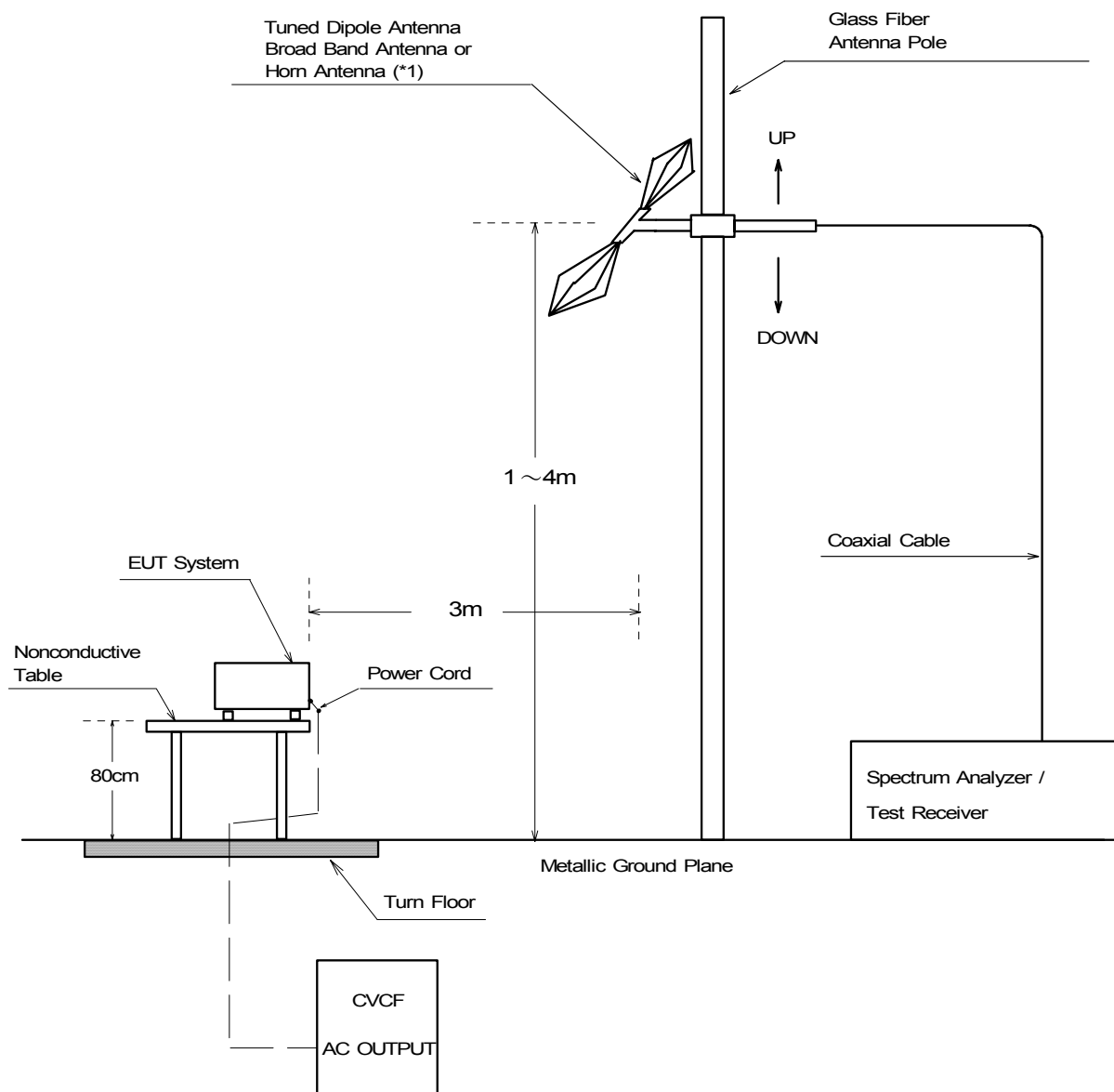
- 6dB Bandwidth
- Peak Output Power
- Band Edge RF Conducted Emission
- Spurious RF Conducted Emission
- Peak Power Density



- Continued -

• Radiated Emission Measurement

[Open Site or Anechoic Chamber]

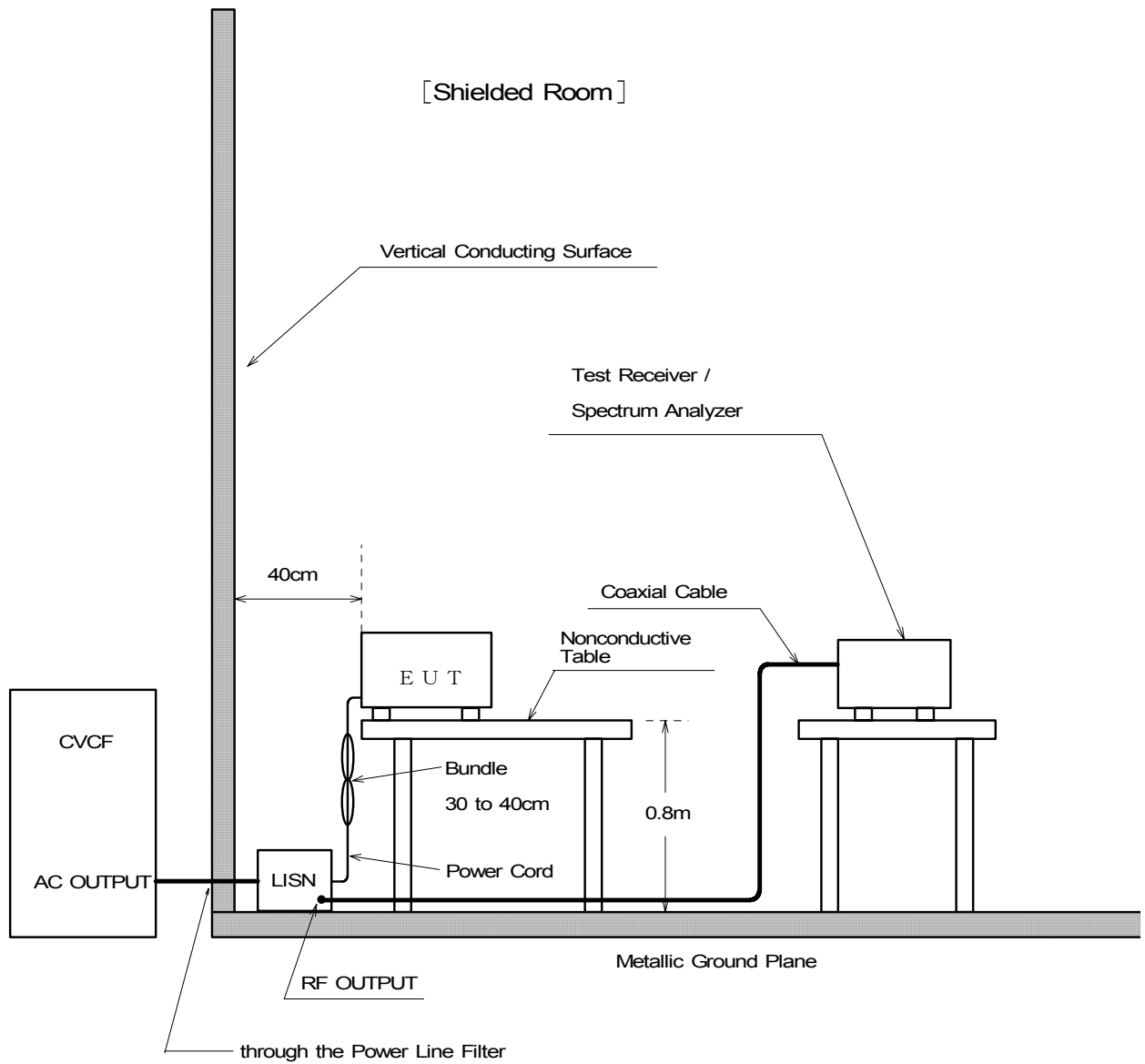


[Note]

(1*) : Above 1GHz

- Continued -

• Conducted Emission Measurement



4. 6 dB BANDWIDTH MEASUREMENT (§ 15.247 (a) (2))

4.1. Test Procedure

(1)	Connect the EUT RF output port to spectrum analyzer 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)	The Spectrums are scanned and allow the trace stabilized.
(5)	The both side of 6dB down value from peak power were measured by using delta-maker function of the spectrum analyzer (*1).
(6)	Above measurement were performed under low-band hopping frequency, mid-band hopping frequency and high band hopping frequency.
[Note]	
(*1)	Spectrum Analyzer Set Up Conditions
	Frequency Span : 50 MHz
	Resolution bandwidth : 1 MHz
	Video bandwidth : $\geq$ RBW
	Sweep : Auto
	Detector function : Peak
	Trace Mode : Max Hold

4.2. Test Results

Measured Frequency	Measured Bandwidth	Limit
[MHz]	[MHz]	[kHz]
2412.00	11.83	>500
2437.00	12.08	>500
2462.00	11.83	>500

[Note]	
See next page figure 1 to 3.	
[Test Condition]	
EUT operation	: Data transmission
EUT channel	: 1, 6, 11 (2412, 2437, 2462 MHz)

[Environment]

Temperature 24°C Humidity 66%

[Tested Date / Tester]

1 July 2003

Signature



Ikuya Minematsu

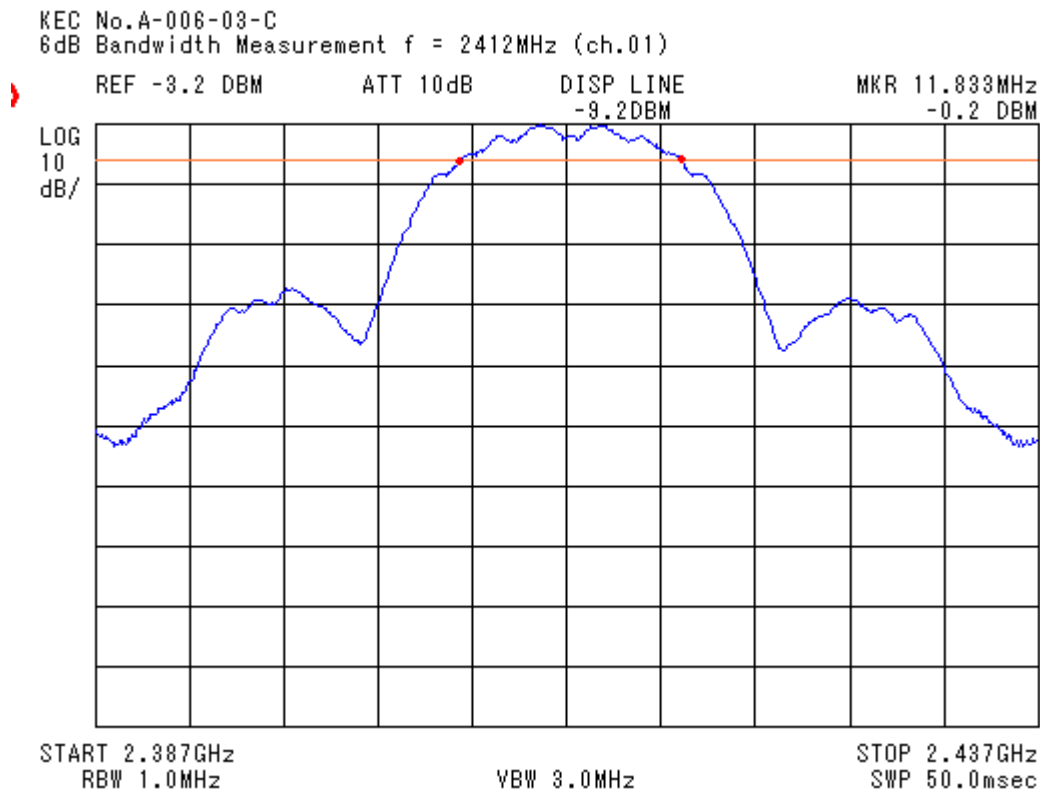


figure 1 6dB Bandwidth $f_c = 2412$ MHz

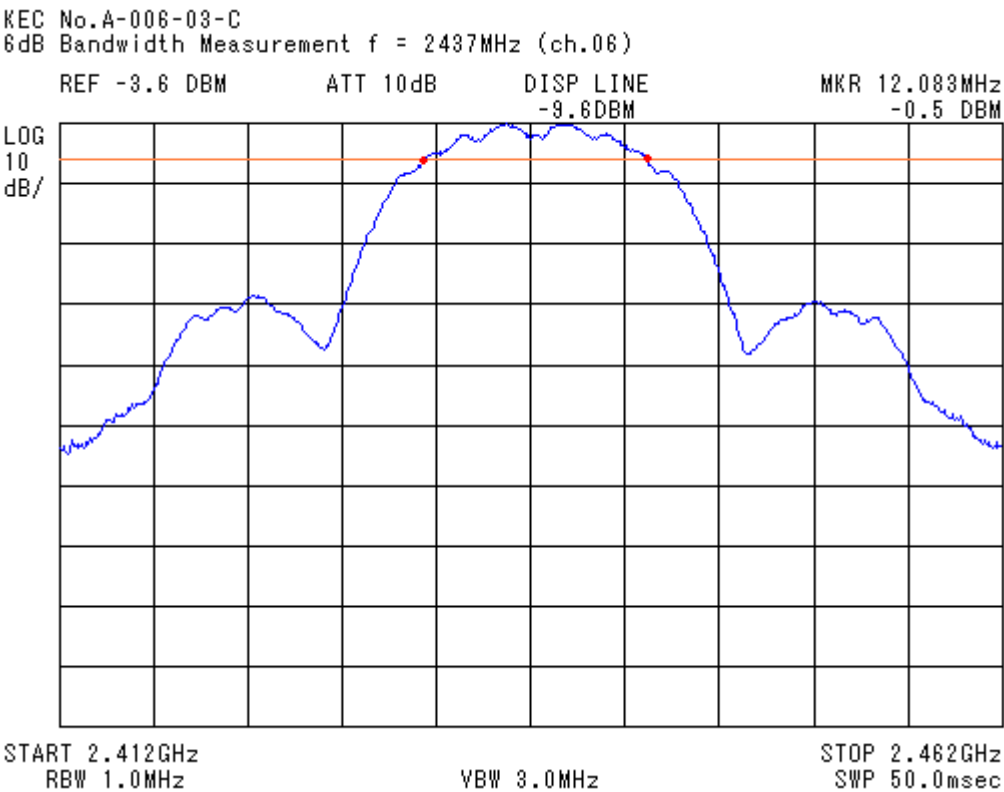


figure 2 6dB Bandwidth $f_c = 2437$ MHz

- Continued -

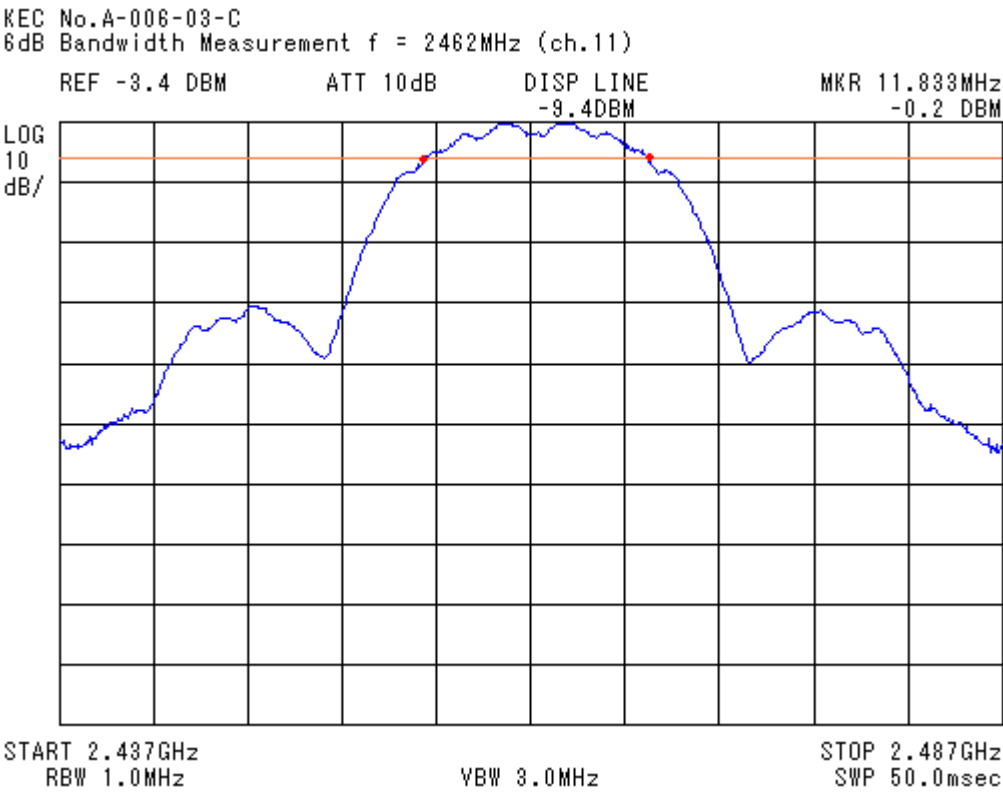


figure 3 6dB Bandwidth fc = 2462 MHz

5. PEAK OUTPUT POWER MEASUREMENT (§ 15.247 (b) (3))

5.1. Test Procedure

(1)	Connect the EUT RF output port to spectrum analyzer via calibrated coaxial cable and suitable attenuator (if necessary).
(2)	Activates the EUT System and executes the software prepared for test, if necessary.
(3)	To find out the worst case, the transmitting data rate of EUT is varied with the different modes of operation. The final test condition is recorded in this report.
(4)	The spectrums are scanned and allow the trace to stabilize.
(5)	The peak output power was determined by using the marker-data function of spectrum analyzer (*1) or power meter.
[Note]	
(*1)	Spectrum Analyzer Set Up Conditions
	Frequency Span : 20 dB bandwidth of the emission being measured
	Resolution bandwidth : 1 MHz
	Video bandwidth : $\geq$ RBW
	Sweep : Auto
	Detector function : Peak
	Trace Mode : Max Hold

5.2. Test Results

Measured Frequency [MHz]	Correction Factor [dB]	Meter Reading [dBm]	Output Power [dBm]	Limit [dBm]	Margin for Limit [dB]
2412.00	11.7	3.1	14.8	30.0	15.2
2437.00	11.8	3.0	14.8	30.0	15.2
2462.00	11.8	2.4	14.2	30.0	15.8

[Note]

- (1) Correction Factor includes the both loss of attenuator and cable used in the measurement.
- (2) The measurement was performed by power meter.
- (3) See next page figure 4, 5 and 6.

[Calculation method]

Peak Output Power (dBm) = Meter Reading (dBm) + Correction Factor (dB)

[Test Condition]

EUT operation : Data transmission
EUT channel : 1, 6, 11 (2412, 2437, 2462 MHz)

[Environment]

Temperature 24°C Humidity 66%

[Tested Date / Tester]

1 July 2003

Signature

Ikuya Minematsu

Spectrum Chart

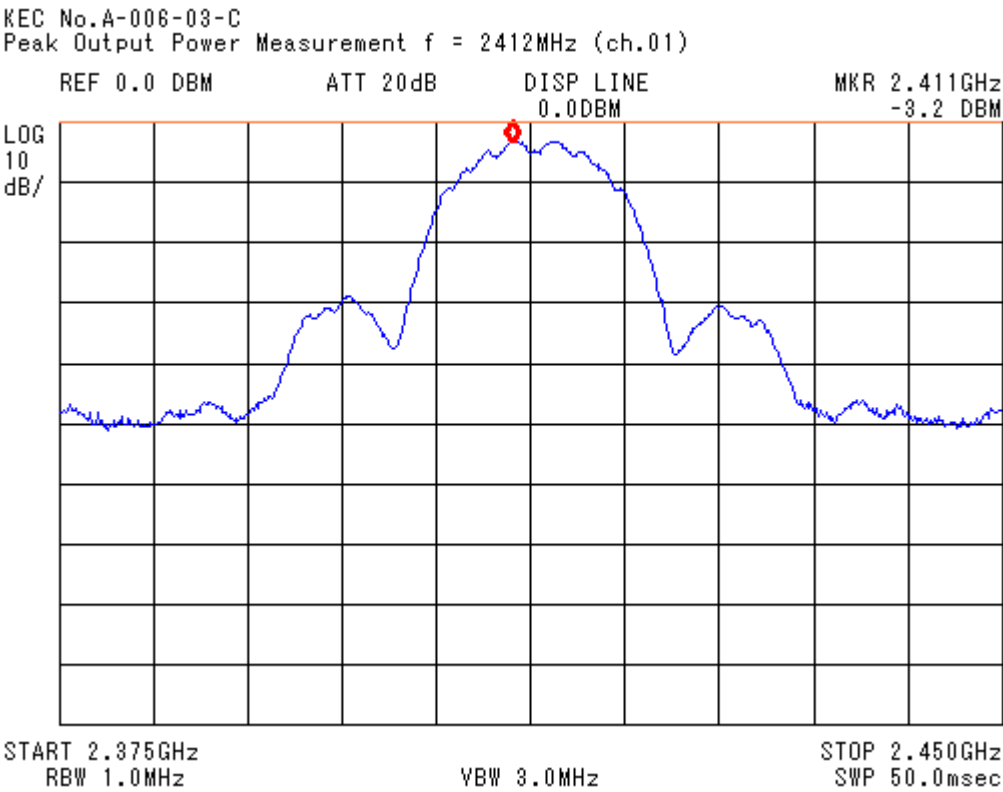


figure 4 2412 MHz (channel 1)

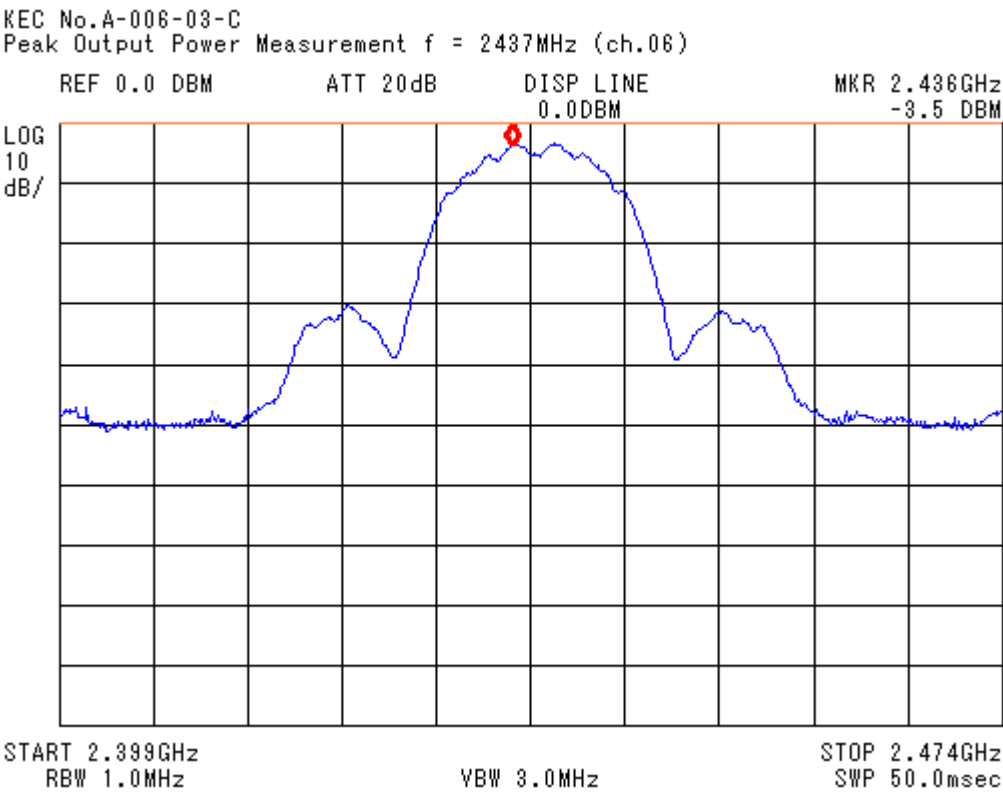


figure 5 2437 MHz (channel 6)

- Continued -

Spectrum Chart

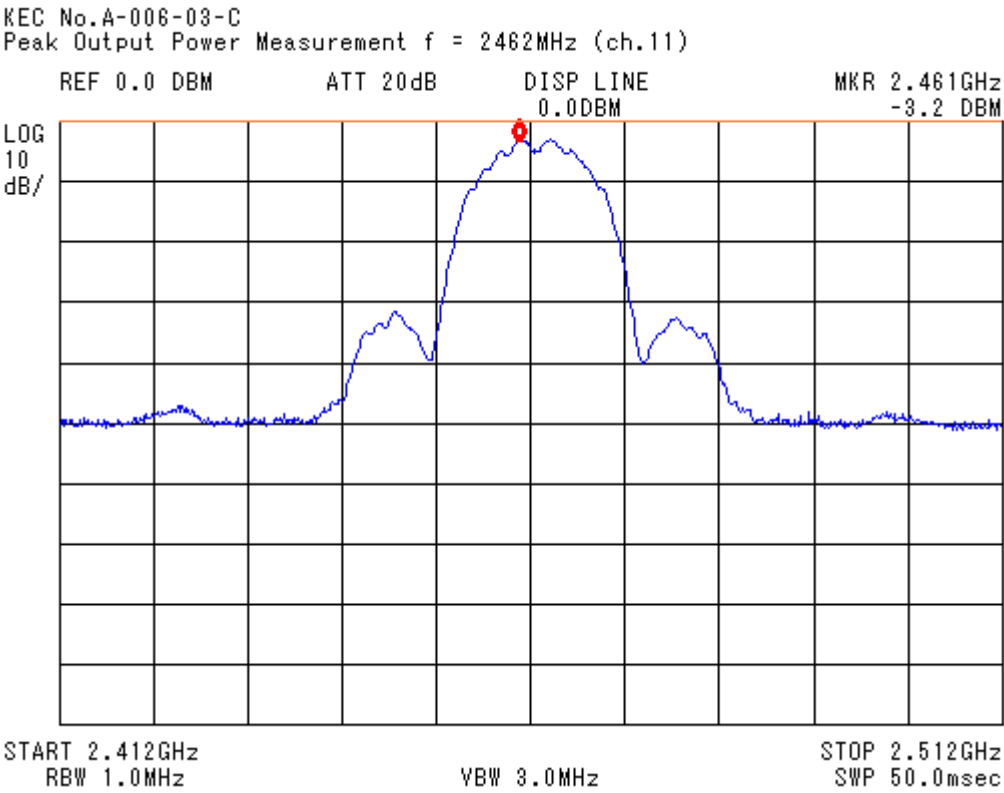


figure 6 2462 MHz (channel 11)

6. BAND EDGE RF CONDUCTED EMISSION MEASUREMENT (§ 15.247 (c))

6.1. Test Procedure

- | | |
|-----|---|
| (1) | Connect the EUT RF output port to the spectrum analyzer via calibrated coaxial cable and suitable attenuator (if necessary). |
| (2) | Activates the EUT System and executes 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) | The spectrum are scanned. |
| (5) | The emission at the band edge or the highest modulation product outside of band were measured by using the marker function of spectrum analyzer (*1). |
| (6) | The peak of the in-band emission were measured by using the marker to peak function of spectrum analyzer. |
| (7) | Above measurement were repeated at other side band edge. |

- | | |
|--------|--|
| [Note] | |
| (*1) | Spectrum Analyzer Set Up Conditions |
| | Frequency Span : Wide enough to capture the peak level of emission on the closest to the band edge |
| | Resolution bandwidth : 100 kHz |
| | Video bandwidth : $\geq$ RBW |
| | Sweep : Auto |
| | Detector function : Peak |
| | Trace Mode : Max Hold |

6.2. Test Results

Measured Frequency	Limits	Results
[MHz]	[dBc]	[dBc]
2483.5	-20	<-30
2310 - 2390	-20	<-30

[Note]
See next page figure 7, 8.

[Calculation method]
Deviation From Carrier (dBc) = Spurious RF Emission (dBm) – Peak Output Power (dBm)

[Test Condition]
EUT operation : Data transmission
EUT channel : 1, 6, 11 (2412, 2437, 2462 MHz)

[Environment]
Temperature 24°C Humidity 66%

[Tested Date / Tester]
1 July 2003

Signature



Ikuya Minematsu

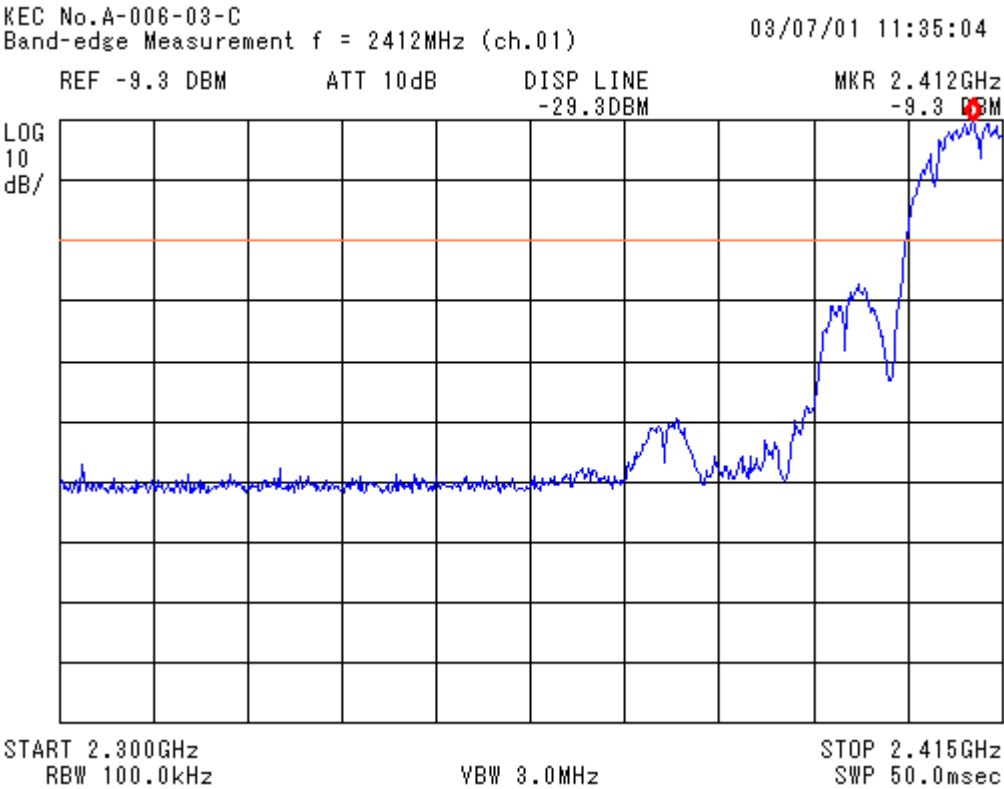


figure 7 Band Edge Low frequency side

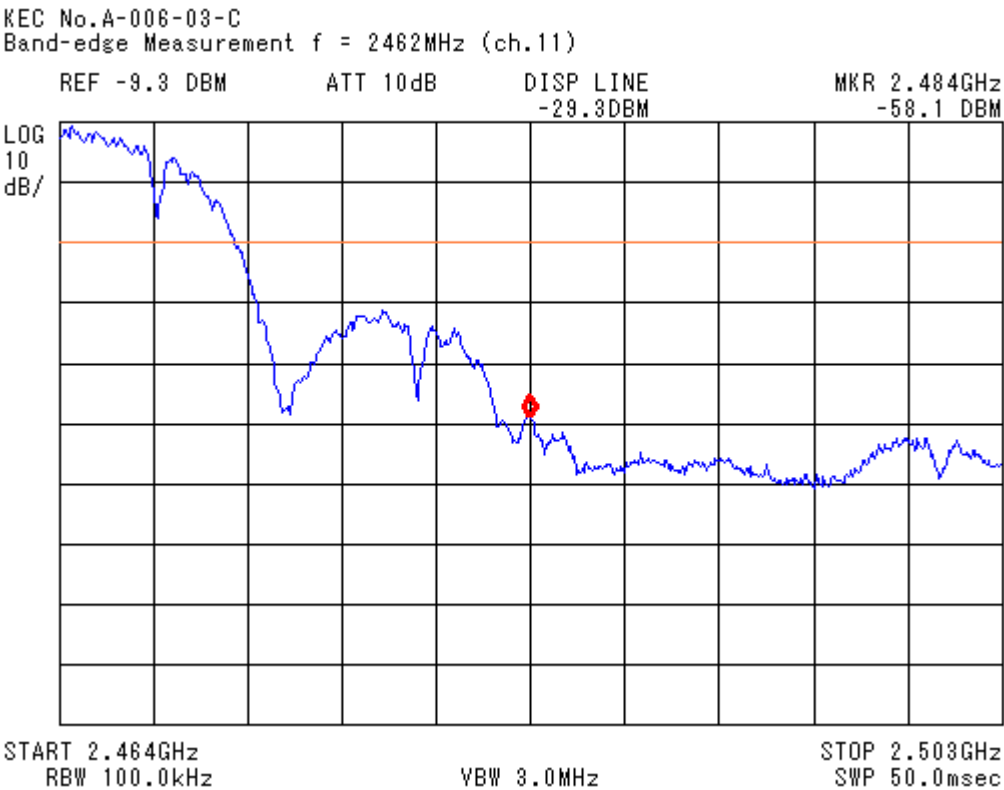


figure 8 Band Edge High frequency side

7. SPURIOUS RF CONDUCTED EMISSION MEASUREMENT (§ 15.247 (c))

7.1. Test Procedure

(1)	Connect the EUT RF output port to the spectrum analyzer via calibrated coaxial cable and suitable attenuator (if necessary).
(2)	Activates the EUT System and executes the software prepared for test, if necessary.
(3)	The Spectrums are scanned from the lowest generated frequency of EUT up to the 10th harmonics by using the spectrum analyzer (*1).
[Note]	
(*1)	Spectrum Analyzer Set Up Conditions
	Resolution bandwidth : 100 kHz
	Video bandwidth : $\geq$ RBW
	Sweep : Auto
	Detector function : Peak detector
	Trance : Max Hold

7.2. Test Results

Measured Frequency [MHz]	Correction Factor (*) [dB]	Meter Reading [dBm]	Conducted Spurious [dBm]	Separation From Carrier [dBc]	Limits [dBc]	Margin for Limit [dB]
[Fc =2412MHz, Carrier Power : 14.8dBm]						
456.67	11.0	-68.4	-57.4	72.2	-20.0	52.2
4824.00	12.0	-74.5	-62.5	77.3	-20.0	57.3
9648.00	12.4	-66.5	-54.1	68.9	-20.0	48.9
[Fc =2437MHz, Carrier Power : 14.8dBm]						
4874.00	12.0	-76.4	-64.4	79.2	-20.0	59.2
9747.00	12.4	-71.4	-59.0	73.8	-20.0	53.8
[Fc =2462MHz, Carrier Power : 14.2dBm]						
506.68	11.0	-69.5	-58.5	72.7	-20.0	52.7
4924.00	12.0	-75.6	-63.6	77.8	-20.0	57.8
9848.00	12.4	-71.6	-59.2	73.4	-20.0	53.4

[Note]	
(1) No other spurious emission found above noise level.	
(2) Correction factor includes both of a cable loss and attenuator loss.	
(3) See next page figure 9, 10 and 11.	
[Calculation method]	
Spurious RF Emission (dBm) = Meter Reading (dBm) + Correction Factor (dB)	
Deviation From Carreier (dBc) = Spurious RF Emission (dBm) – Perk Output Power (dBm)	
[EUT Condition]	
EUT operation	: Data transmission
EUT channel	: 1, 6, 11 (2412, 2437, 2462 MHz)

[Environment]

Temperature 24°C

Humidity 66%

[Tested Date / Tester]

1 July 2003

Signature



Ikuya Minematsu

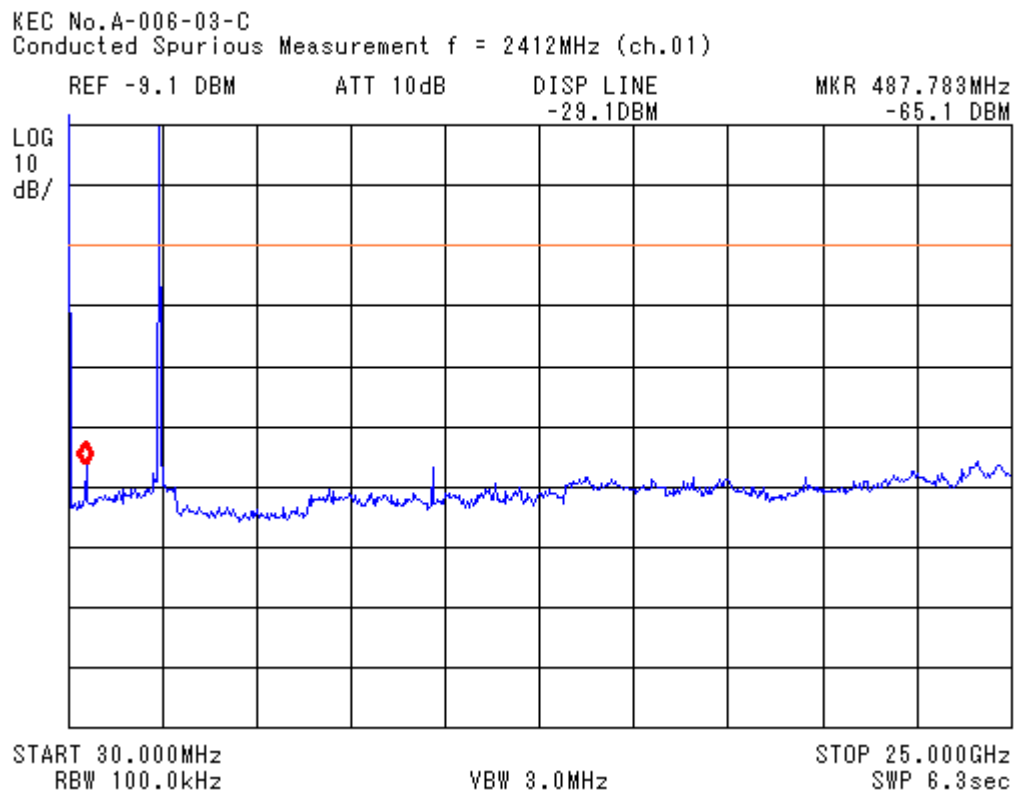


figure 9 Spurious RF conducted emission, Tx on 2412 MHz

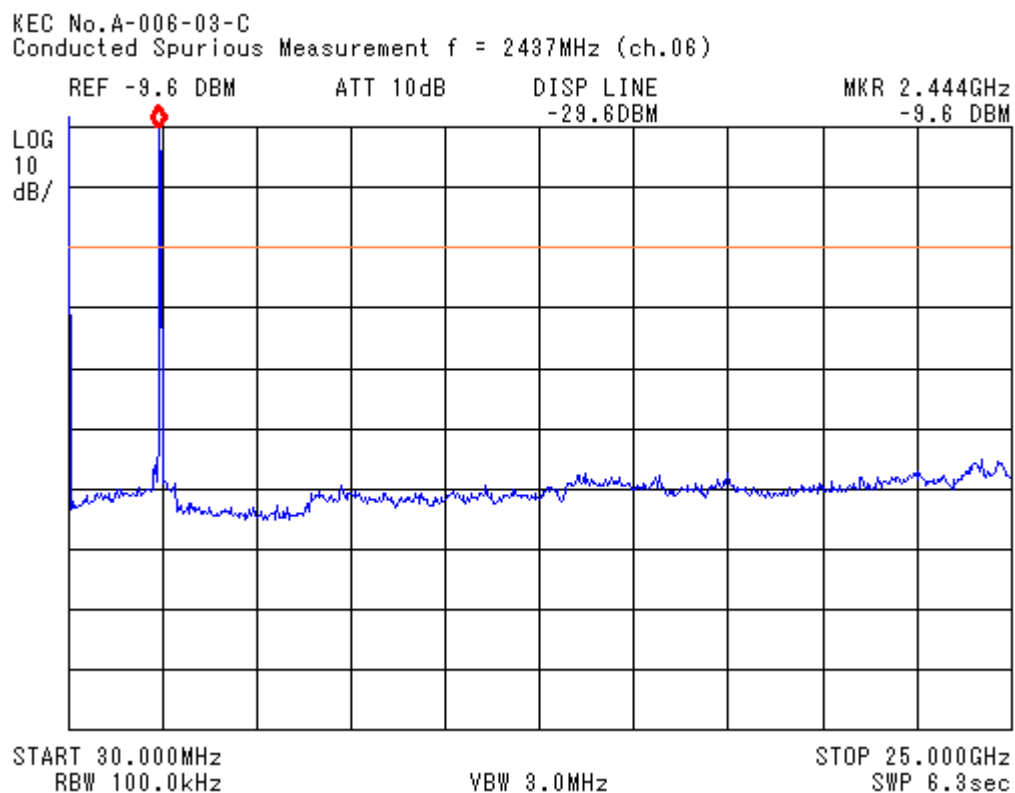


figure 10 Spurious RF conducted emission, Tx on 2437 MHz

- Continued -

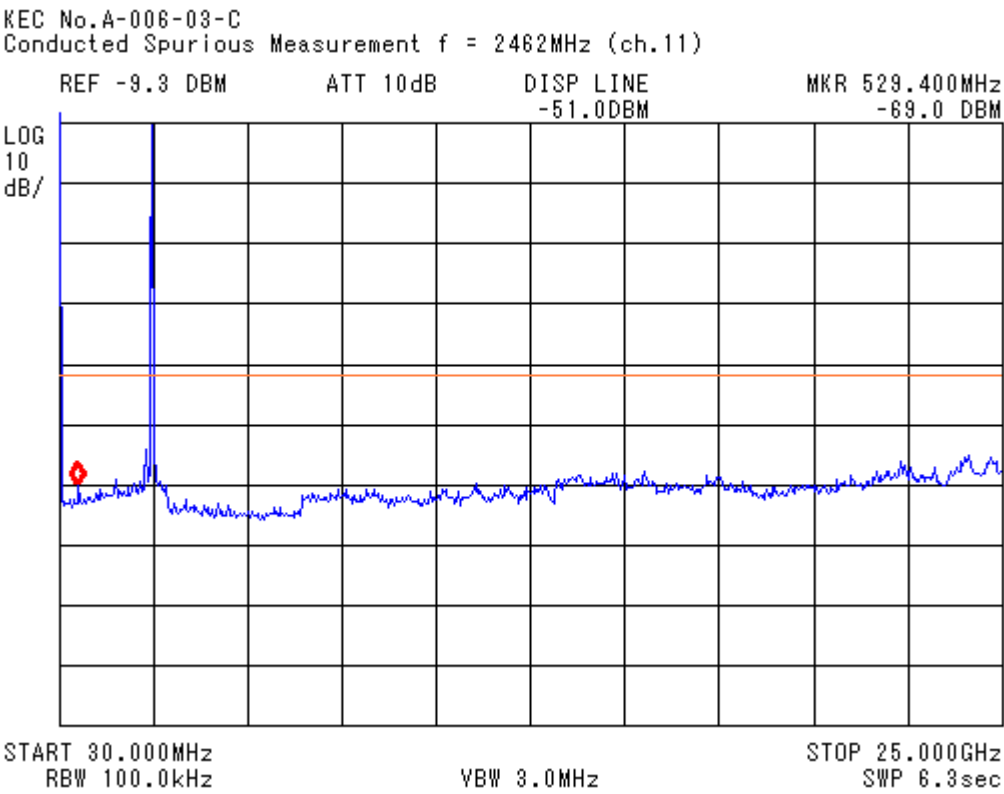


figure 11 Spurious RF conducted emission, Tx on 2462 MHz

8. PEAK POWER DENSITY MEASUREMENT (§ 15.247 (d))

8.1. Test procedure

(1)	Connect the EUT RF output port to spectrum analyzer via calibrated coaxial cable and suitable attenuator (if necessary).
(2)	Activates the EUT System and executes the software prepared for test, if necessary.
(3)	To find out the worst case, the transmitting data rate of EUT is varied with the different modes of operation. The final test condition is recorded in this report.
(4)	The spectrums are scanned and allow the trace to stabilize.
(5)	The peak output power was determined by using the marker-data function of spectrum analyzer (*1).
[Note]	
(*1)	Spectrum Analyzer Set Up Conditions
	Frequency Span : 5 MHz
	Resolution bandwidth : 3 kHz
	Video bandwidth : $\geq$ RBW
	Sweep time : Span / RBW = more than 1666 sec
	Detector function : Peak
	Trace Mode : Max Hold

8.2. Test Results

Measured Frequency [MHz]	Correction Factor [dB]	Meter Reading [dBm/3kHz]	Peak Power Density [dBm]	Limits [dBm / RBW 3kHz]	Margin for Limit [dB]
2412.00	11.7	-21.0	-9.3	8.0	17.3
2437.00	11.8	-21.2	-9.4	8.0	17.4
2462.00	11.8	-20.5	-8.7	8.0	16.7

[Note]

- (1) Correction factor includes both of a cable loss and attenuator loss.
 (2) See next page figure 12, 13 and 14.

[Calculation method]

Power Density [dBm/3kHz] = Meter Reading (dBm) + Correction Factor (dB)

[EUT Condition]

EUT operation : Data transmission
 EUT channel : 1, 6, 11 (2412, 2437, 2462 MHz)

[Environment]

Temperature 24°C Humidity 66%

[Tested Date / Tester]

1 July 2003

Signature

Ikuya Minematsu

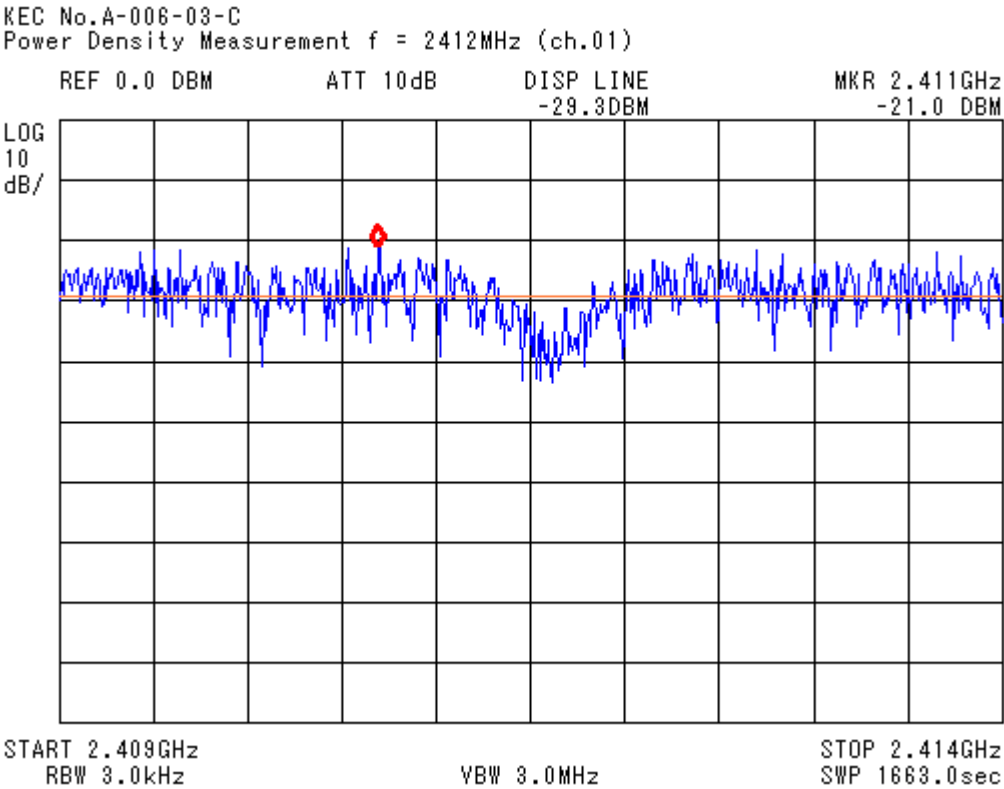


figure 12 Power Density, Tx on channel 1

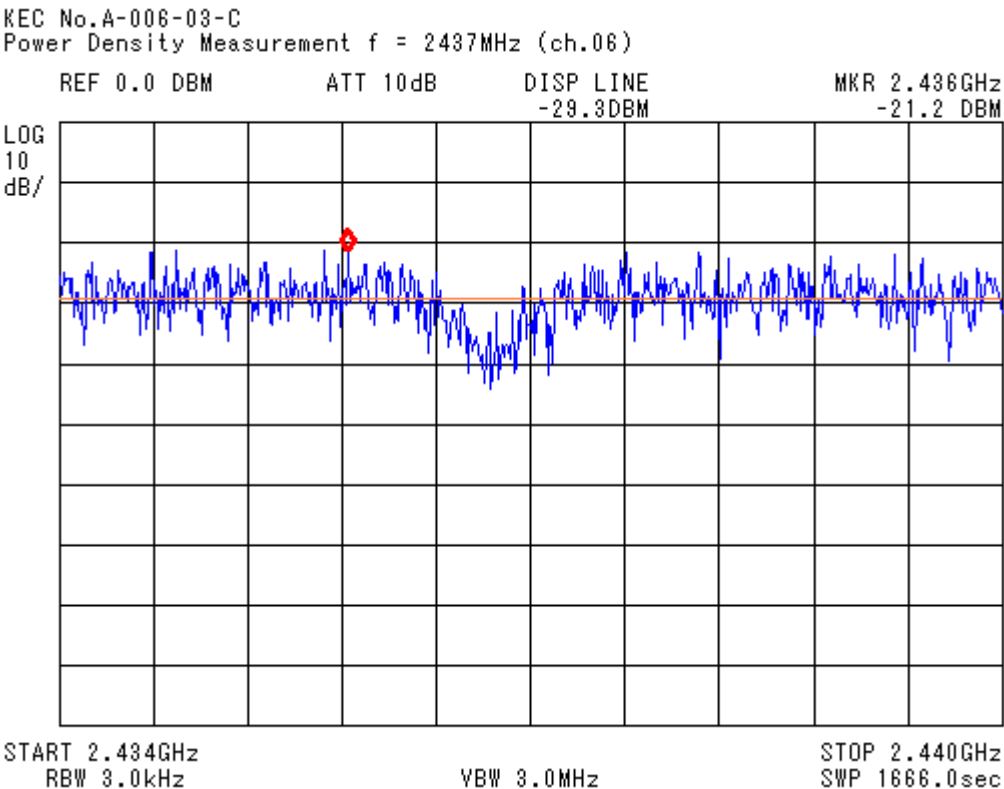


figure 13 Power Density, Tx on channel 6

[illegible]

KEC Ikoma Testing Laboratory 12128 Takayama-cho Ikoma-city Nara 630-0101 Japan

9. RADIATED EMISSION MEASUREMENT (§ 15.247 (c)), (§ 15.209 (a))

9.1. Test Procedure

(1)	Configure the EUT System in accordance with ANSI C63.4-1992 section 8 and 13. ☒ : without deviation, ☐ : with deviation(details are found below) 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 1 GHz, it is performed using the spectrum analyzer (*2) and the horn antenna.
(6)	To find out an 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 30 MHz 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 (*3). In the frequency above 1 GHz, the measurements are performed by the horn antenna and ☐ the test receiver (*4). ☒ the spectrum analyzer(*5) with pre-amplifier.
[Note]	
(*1)	Spectrum Analyzer Set Up Conditions Frequency range : 30 - 1000 MHz Resolution bandwidth : 100 kHz Detector function : Peak mode
(*2)	Spectrum Analyzer Set Up Conditions Frequency range : 1 GHz - Upper frequency of measurement range Resolution bandwidth : 1 MHz Video bandwidth : 1 MHz Attenuator : 10 dB Detector function : Peak mode
(*3)	Test Receiver Set Up Conditions Detector function : Quasi-Peak or Peak IF bandwidth : 120 kHz
(*4)	Test Receiver Set Up Conditions Detector function : Average IF bandwidth : 1 MHz
(*5)	Spectrum Analyzer Set Up Conditions Frequency range : 1 GHz - Upper frequency of measurement range Resolution bandwidth : 1 MHz Video bandwidth : 1 MHz (peak detector), 10Hz (Average detector) Attenuator : 10 dB Detector function : Peak mode

9.2. Test Results

(1) In the frequency range : above 1 GHz

Measurement Distance ☒: 3m ☐: 10m

Fc = 2412 MHz Transmitting operation

Measured Frequency	Antenna Factor	Meter Reading		Maximum Field Strength	Limit	Margin for Limits
		Horizontal Polarization	Vertical Polarization			
[MHz]	[dB/m]	[dBuV]	[dBuV]	[dBuV/m]	[dBuV/m]	[dB]
[Peak Detector Measurement]						
2412.00	45.4	58.6	53.5	104.0	-	-
4824.00	-2.2	51.4	53.8	51.6	74.0	22.4
7236.00	-1.2	46.6	47.1	45.9	74.0	28.1
9648.00	2.5	48.4	49.2	51.7	74.0	22.3
12060.00	6.4	<42.0	<42.0	<48.4	74.0	>25.6
14472.00	8.4	44.3	44.5	52.9	74.0	21.1
16884.00	9.7	<43.0	<43.0	<52.7	74.0	>21.3
19296.00	5.0	46.8	46.0	51.8	74.0	22.2
21708.00	5.5	<40.0	<40.0	<45.5	74.0	>28.5
24120.00	6.6	<42.0	<42.0	<48.6	74.0	>25.4
[Average Detector Measurement] (*1)						
4824.00	-2.2	46.8	50.4	48.2	54.0	5.8
9648.00	2.5	43.2	44.4	46.9	54.0	7.1
12060.00	6.4	<32.0	<32.0	<38.4	54.0	>15.6
14472.00	8.4	36.8	37.1	45.5	54.0	8.5
16884.00	9.7	<34.0	<34.0	<43.7	54.0	>10.3
19296.00	5.0	35.6	37.2	42.2	54.0	11.8
21708.00	5.5	<30.0	<30.0	<35.5	54.0	>18.5
24120.00	6.6	<32.0	<32.0	<38.6	54.0	>15.4

[Remark]

(*) : Spectrum analyzer setup condition.

Detector : Peak
 RBW : 1MHz
 VBW : 10Hz

- Continued -

Measurement Distance ☒: 3m ☐: 10m

Fc = 2437 MHz Transmitting operation

Measured Frequency	Antenna Factor	Meter Reading		Maximum Field Strength	Limit	Margin for Limits
		Horizontal Polarization	Vertical Polarization			
[MHz]	[dB/m]	[dBuV]	[dBuV]	[dBuV/m]	[dBuV/m]	[dB]
[Peak Detector Measurement]						
2437	45.4	59.2	52.5	104.6	-	-
4874	-2.2	51.4	54.3	52.1	74.0	21.9
7311	-1.1	46.1	46.7	45.6	74.0	28.4
9748	2.6	48.8	48.8	51.4	74.0	22.6
12185	6.6	<42.0	<42.0	<48.6	74.0	>25.4
14622	8.3	44.5	44.2	52.8	74.0	21.2
17059	10.1	<43.0	<43.0	<53.1	74.0	>20.9
19496	5.1	47.0	46.1	52.1	74.0	21.9
21933	5.5	<40.0	<40.0	<45.5	74.0	>28.5
24370	6.5	<42.0	<42.0	<48.5	74.0	>25.5
[Average Detector Measurement] (*1)						
4874	-2.2	46.8	51.9	49.7	54.0	4.3
9748	2.6	43.2	43.2	45.8	54.0	8.2
12185	6.6	<32.0	<32.0	<38.6	54.0	>15.4
14622	8.3	36.7	36.6	45.0	54.0	9.0
17059	10.1	<34.0	<34.0	<44.1	54.0	>9.9
19496	5.1	35.8	37.3	42.4	54.0	11.6
21933	5.5	<30.0	<30.0	<35.5	54.0	>18.5
24370	6.5	<32.0	<32.0	<38.5	54.0	>15.5

- Continued -

Measurement Distance ☒: 3m ☐: 10m

Fc = 2462 MHz Transmitting operation

Measured Frequency	Antenna Factor	Meter Reading		Maximum Field Strength	Limit	Margin for Limits
		Horizontal Polarization	Vertical Polarization			
[MHz]	[dB/m]	[dBuV]	[dBuV]	[dBuV/m]	[dBuV/m]	[dB]
[Peak Detector Measurement]						
2462	45.4	59.0	53.1	104.4	-	-
4924	-2.2	51.0	54.8	52.6	74.0	21.4
7386	-1.0	46.3	47.4	46.4	74.0	27.6
9848	2.7	48.2	48.6	51.3	74.0	22.7
12310	6.8	<42.0	<42.0	<48.8	74.0	>25.2
14772	8.3	46.9	47.6	55.9	74.0	18.1
17234	10.3	<43.0	<43.0	<53.3	74.0	>20.7
19696	5.1	48.2	46.8	53.3	74.0	20.7
22158	5.5	<40.0	<40.0	<45.5	74.0	>28.5
24620	6.3	<42.0	<42.0	<48.3	74.0	>25.7
[Average Detector Measurement] (*1)						
4924	-2.2	51.7	46.2	49.5	54.0	4.5
9848	2.7	43.0	43.3	46.0	54.0	8.0
12310	6.8	<32.0	<32.0	<38.8	54.0	>15.2
14772	8.3	36.7	38.4	46.7	54.0	7.3
17234	10.3	<34.0	<34.0	<44.3	54.0	>9.7
19696	5.1	37.0	38.6	43.7	54.0	10.3
22158	5.5	<30.0	<30.0	<35.5	54.0	>18.5
24620	6.3	<32.0	<32.0	<38.3	54.0	>15.7

[Remark]

(*) : Spectrum analyzer setup condition.

Detector : Peak
 RBW : 1MHz
 VBW : 10Hz

- Continued -

(1) In the frequency range : 30 MHz to 1000 MHz (Quasi-peak measurement)

Transmitting and Receiving operation

Measurement Distance ☒: 3m ☐: 10m

Measured Frequency (MHz)	Antenna Factor (dB/m)	Meter Reading		Maximum Field Strength (dB μ V/m)	Limit (dB μ V/m)	Margin for Limit (dB)
		Horizontal Polarization (dB μ V)	Vertical Polarization (dB μ V)			
352.00	18.6	5.4	1.0	24.0	46.0	22.0
381.54	19.1	3.0	0.8	22.1	46.0	23.9
702.29	24.8	4.0	1.0	28.8	46.0	17.2

[Note]

In the restricted band emission of 30MHz to 1000MHz, the spurious emission were compliance with FCC rule. See 15, 16 page test data in graph.

- Continued -

Measurement Distance ☒: 3m ☐: 10m

Receiving Operation

Measured Frequency	Antenna Factor	Meter Reading		Maximum Field Strength	Limit (Average)	Margin for Limits
		Horizontal Polarization	Vertical Polarization			
[MHz]	[dB/m]	[dBuV]	[dBuV]	[dBuV/m]	[dBuV/m]	[dB]
[Peak Detector Measurement]						
(Fundamental)						
2412.00	-10.1	<40.0	<40.0	<29.9	54.0	>24.1
2437.00	-10.1	<40.0	<40.0	<29.9	54.0	>24.1
2462.00	-10.1	<40.0	<40.0	<29.9	54.0	>24.1
(2nd Harmonics)						
4824.00	-2.2	50.0	54.5	52.3	54.0	1.7
4874.00	-2.2	50.8	54.6	52.4	54.0	1.6
4924.00	-2.2	50.2	54.5	52.3	54.0	1.7
(3rd Harmonics)						
7236.00	-1.2	<43.0	<43.0	<41.8	54.0	>12.2
7311.00	-1.1	<43.0	<43.0	<41.9	54.0	>12.1
7386.00	-1.0	<43.0	<43.0	<42.0	54.0	>12.0
(4th Harmonics)						
9648.00	2.5	46.8	47.4	49.9	54.0	4.1
9748.00	2.6	46.8	47.4	50.0	54.0	4.0
9848.00	2.7	48.7	47.6	51.4	54.0	2.6
(5th Harmonics)						
12060.00	6.4	<42.0	<42.0	<48.4	54.0	>5.6
12185.00	6.6	<42.0	<42.0	<48.6	54.0	>5.4
12310.00	6.8	<42.0	<42.0	<48.8	54.0	>5.2
[Average Detector Measurement]						
(2nd Harmonics)						
4824.00	-2.2	47.4	52.5	50.3	54.0	3.7
4874.00	-2.2	48.3	53.4	51.2	54.0	2.8
4924.00	-2.2	48.0	53.1	50.9	54.0	3.1
(4th Harmonics)						
9648.00	2.5	40.1	41.5	44.0	54.0	10.0
9748.00	2.6	40.1	41.5	44.1	54.0	9.9
9848.00	2.7	40.2	41.8	44.5	54.0	9.5

(2) In frequency range : 30 MHz to 1000 MHz
Test data in graph

RADIATED EMISSION

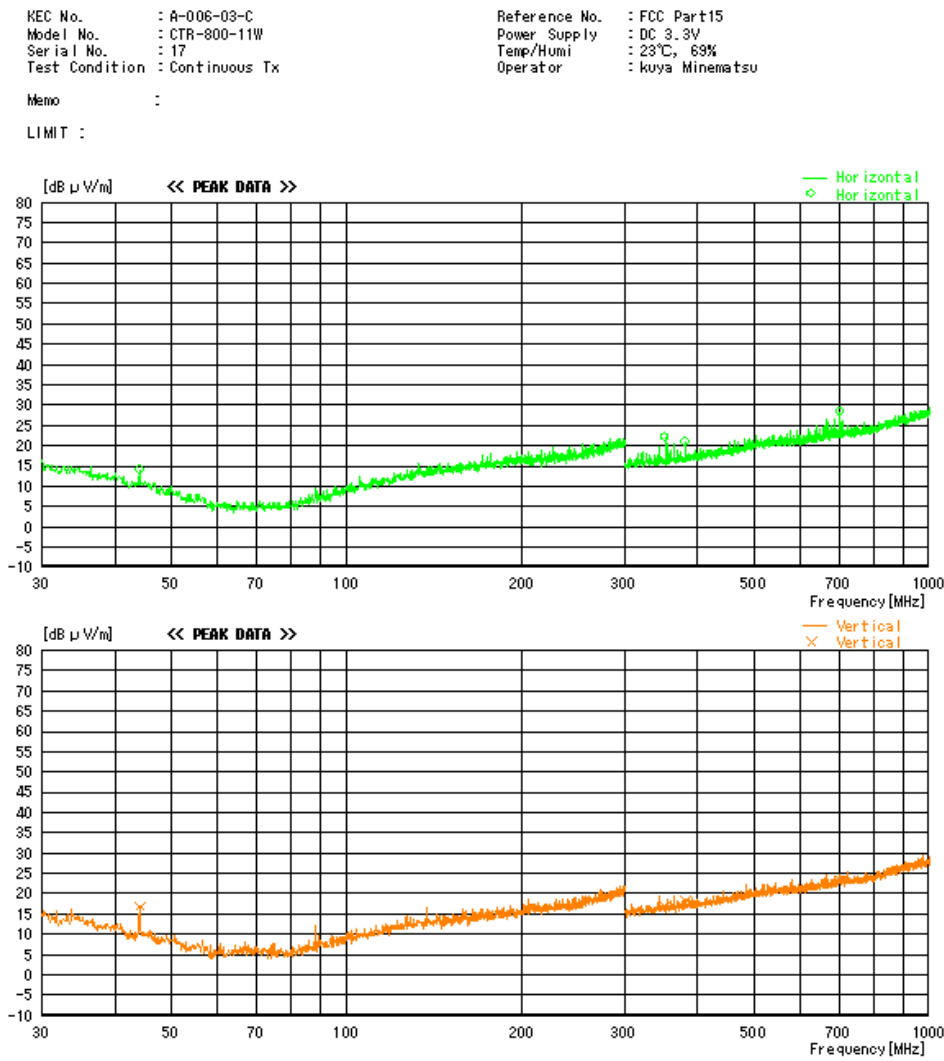


Figure 15

(3) In the frequency range : above 1 GHz (Restricted Bands)

Measurement Distance ☒: 3m ☐: 10m

Restricted Band Above 1GHz

Transmitting Operation (Maximum Power output mode) and Receiving Operation

Measured Frequency	Antenna Factor	Meter Reading		Maximum Field Strength	Limit	Margin for Limits
		Horizontal Polarization	Vertical Polarization			
[MHz]	[dB/m]	[dBuV]	[dBuV]	[dBuV/m]	[dBuV/m]	[dB]
[Average Detector Measurement]						
1000.00	-14.0	<35.0	<35.0	<21.0	54.0	>33.0
1240.00	-13.1	<35.0	<35.0	<21.9	54.0	>32.1
1300.00	-12.6	<37.0	<37.0	<24.4	54.0	>29.6
1427.00	-12.4	<37.0	<37.0	<24.6	54.0	>29.4
1435.00	-12.3	<37.0	<37.0	<24.7	54.0	>29.3
1626.50	-12.8	<37.0	<37.0	<24.2	54.0	>29.8
1645.50	-12.7	<37.0	<37.0	<24.3	54.0	>29.7
1646.50	-12.7	<37.0	<37.0	<24.3	54.0	>29.7
1660.00	-12.5	<37.0	<37.0	<24.5	54.0	>29.5
1710.00	-12.2	<37.0	<37.0	<24.8	54.0	>29.2
1718.80	-12.2	<37.0	<37.0	<24.8	54.0	>29.2
1722.20	-12.2	<37.0	<37.0	<24.8	54.0	>29.2
2200.00	-11.1	<36.0	<36.0	<24.9	54.0	>29.1
2300.00	-11.1	<36.0	<36.0	<24.9	54.0	>29.1
2310.00	0.1	<32.0	<32.0	<32.1	54.0	>21.9
(*)2390.00	9.9	<33.0	<33.0	<42.9	54.0	>11.1
(*) 2483.50	9.9	36.1	35.0	46.0	54.0	8.0
2500.00	9.4	<33.0	<33.0	<42.4	54.0	>11.6
2655.00	9.5	<33.0	<33.0	<42.5	54.0	>11.5
2900.00	10.0	<33.0	<33.0	<43.0	54.0	>11.0
3260.00	-8.9	<35.0	<35.0	<26.1	54.0	>27.9
3267.00	-8.8	<35.0	<35.0	<26.2	54.0	>27.8

- Continued -

Measurement Distance ☒: 3m ☐: 10m

Restricted Band Above 1GHz

Measured Frequency	Antenna Factor	Meter Reading		Maximum Field Strength	Limit	Margin for Limits
		Horizontal Polarization	Vertical Polarization			
[MHz]	[dB/m]	[dBuV]	[dBuV]	[dBuV/m]	[dBuV/m]	[dB]
[Average Detector Measurement]						
3332.00	-8.6	<35.0	<35.0	<26.4	54.0	>27.6
3339.00	-8.6	<35.0	<35.0	<26.4	54.0	>27.6
3345.80	-8.6	<35.0	<35.0	<26.4	54.0	>27.6
3358.00	-8.6	<35.0	<35.0	<26.4	54.0	>27.6
3600.00	-8.0	<32.0	<32.0	<24.0	54.0	>30.0
4400.00	-3.3	<32.0	<32.0	<28.7	54.0	>25.3
4500.00	-2.9	<32.0	<32.0	<29.1	54.0	>24.9
4824.00	-2.4	46.8	50.4	48.0	54.0	6.0
4874.00	-2.3	46.8	51.9	49.6	54.0	4.4
4924.00	-2.2	46.2	51.7	49.5	54.0	4.5
5150.00	-1.8	<32.0	<32.0	<30.2	54.0	>23.8
5350.00	-1.6	<32.0	<32.0	<30.4	54.0	>23.6
5460.00	-1.7	<32.0	<32.0	<30.3	54.0	>23.7
7250.00	-1.9	<28.0	<28.0	<26.1	54.0	>27.9
7750.00	-1.5	<28.0	<28.0	<26.5	54.0	>27.5
8025.00	-1.2	<32.0	<32.0	<30.8	54.0	>23.2
8500.00	0.4	<32.0	<32.0	<32.4	54.0	>21.6
9000.00	1.1	<30.0	<30.0	<31.1	54.0	>22.9
9200.00	1.5	<30.0	<30.0	<31.5	54.0	>22.5
9300.00	1.4	<29.0	<29.0	<30.4	54.0	>23.6
9500.00	1.8	<29.0	<29.0	<30.8	54.0	>23.2
10600.00	4.8	<32.0	<32.0	<36.8	54.0	>17.2
12060.00	6.4	<32.0	<32.0	<38.4	54.0	>15.6
12185.00	6.6	<32.0	<32.0	<38.6	54.0	>15.4
12310.00	6.8	<32.0	<32.0	<38.8	54.0	>15.2
12700.00	7.0	<32.0	<32.0	<39.0	54.0	>15.0
13250.00	7.3	<31.0	<31.0	<38.3	54.0	>15.7
13400.00	7.5	<31.0	<31.0	<38.5	54.0	>15.5

-Continued -

Measurement Distance ☒: 3m ☐: 10m

Restricted Band Above 1GHz

Measured Frequency	Antenna Factor	Meter Reading		Maximum Field Strength	Limit	Margin for Limits
		Horizontal Polarization	Vertical Polarization			
[MHz]	[dB/m]	[dBuV]	[dBuV]	[dBuV/m]	[dBuV/m]	[dB]
[Average Detector Measurement]						
14470.00	8.4	<29.0	<29.0	<37.4	54.0	>16.6
14472.00	8.4	36.8	37.1	45.5	54.0	8.5
14500.00	8.4	<30.0	<30.0	<38.4	54.0	>15.6
15350.00	8.5	<30.0	<30.0	<38.5	54.0	>15.5
16200.00	8.7	<30.0	<30.0	<38.7	54.0	>15.3
17700.00	9.7	<30.0	<30.0	<39.7	54.0	>14.3
19260.00	5.0	35.6	37.2	42.2	54.0	11.8
19496.00	5.1	35.8	37.3	42.4	54.0	11.6
19696.00	5.1	37.0	38.6	43.7	54.0	10.3
21400.00	5.4	<30.0	<30.0	<35.4	54.0	>18.6
22010.00	6.1	<31.0	<31.0	<37.1	54.0	>16.9
23120.00	6.1	<31.0	<31.0	<37.1	54.0	>16.9
23600.00	6.3	<32.0	<32.0	<38.3	54.0	>15.7
24000.00	6.2	<32.0	<32.0	<38.2	54.0	>15.8
[Band Edge Measurement](*)						
2439.00	9.9	45.4	46.9	56.8	74.0	17.2
2483.50	9.9	<42.0	<42.0	<51.9	74.0	>22.1

[Remark]

(*) : Spectrum analyzer setup condition.

Detector : Peak
 RBW : 1MHz
 VBW : 1MHz

- Continued -

[Note]

- (1) The measurement were performed both of transmitting operation and receiving operation.
- (2) Antenna Factor includes the cable loss.
- (3) Above 1GHz, antenna factor includes both of the cable loss and pre-amplifier gain.
- (4) In frequency range 1to 2GHz and 3 to 4GHz, the band eliminate filter (Cut off frequency 2.45GHz) was used.

[Calculation method at Peak detector]

Maximum Field Strength (dB μ V/m)= Meter Reading (at maximum level of Horizontal or Vertical) (dB μ V) + Antenna Factor (dB/m)

[Environment]

Temperature: 23°C

Humidity: 70%

[Tested Date/ Tester]

30 June 2003

Signature



Ikuya Minematsu

10. USED TEST EQUIPMENTS AND CALIBRATION STATUS

Equipment	Manufacturer	Model No.	Specifications	KEC Control No.	Test Item (*)	Last Cal.	Next Cal.
Spectrum Analyzer	Agilent Technologies	8564E	Frequency Range 100Hz – 40GHz	SA-39	1,2,3,4,5,6	2003/4	2004/4
	Anritsu	MS8602E	Frequency Range 9kHz – 7.8GHz	SA-46	6	2002/7	2003/7
	Agilent Technologies	E4403B	Frequency Range 9Hz – 3.0GHz	SA-48	N/A	2003/5	2004/5
Test Receiver	Rhode & Schwarz	ESHS10	Frequency Range 9kHz – 30 MHz	FS-83	N/A	2003/1	2004/1
		ESVS10	Frequency Range 20 MHz–1.0 GHz	FS-81	6	2003/5	2004/5
Pre-Amplifier	Hewlett Packard	8449B	Frequency Range 1GHz-26.5GHz Typ. Gain 30 dB	AM-53	6	2003/2	2004/2
	SONOMA Instrument	310N	Frequency Range 0.1MHz-1.3GHz Typ. Gain 30 dB	AM-69	6	2002/8	2003/8
Biconical Antenna	Schwarzbeck	VHA9103	Frequency Range 30MHz-300MHz	AN-180	6	2003/2	2004/2
Log Periodic Dipole Array Antenna	Schwarzbeck	UHAL9108A	Frequency Range 300MHz-1 GHz	AN-215	6	2003/2	2004/2
LISN	Kyoritsu	KNW407	Frequency Range 150kHz-30MHz	FL-106	N/A	2003/4	2004/4
		KNW242	Frequency Range 10kHz-30MHz	FL-110	N/A	2003/4	2004/4
Tuned Dipole Antenna	Kyoritsu	KBA-511AS	Frequency Range 25MHz-500MHz	AN-135	N/A	2003/2	2005/2
		KBA-611S	Frequency Range 500MHz-1GHz	AN-137	N/A	2003/2	2005/2
Standard Gain Horn Antenna	Raven	91888-2	Frequency Range 1GHz – 2GHz	AN-211	6	2001/8	2003/8
		91889-2	Frequency Range 2GHz – 5GHz	AN-212	6	2001/8	2003/8
	Scientific Atlanta	12-3.9	Frequency Range 3.95-5.85GHz	AN-142	6	2002/8	2004/8
		12-5.8	Frequency Range 5.85-8.2GHz	AN-104	6	2002/8	2004/8
		12-8.2	Frequency Range 8.2-12.4GHz	AN-210	6	2002/8	2004/8
		12-12.0	Frequency Range 12.4-18GHz	AN-145	6	2002/8	2004/8
		12-18.0	Frequency Range 18GHz – 26.5GHz	AN-200	6	2002/8	2004/8

- Continued -

Equipment	Manufacturer	Model No.	Specifications	KEC Control No.	Test Item (*)	Last Cal.	Next Cal.
Power Meter	Rhode & Schwarz	NRVD	Frequency Range DC – 18GHz	VV-38	2	2003/3	2004/3
Thermal Power Sensor	Rhode & Schwarz	NRV-Z51	Frequency Range 10MHz – 18GHz 1uW to 100mW	VV-38-1	2	2003/3	2004/3
Precision Attenuator	Hewlett Packard	HP33340C010	Frequency Range DC – 26.5GHz typ. 10dB	AT-40-3	1,2,3,4,5,6	2003/1	2004/1
		HP33340C020	Frequency Range DC – 26.5GHz typ. 20dB	AT-40-4	6	2003/1	2004/1
Band Eliminate Filter	MICRO-TRONICS	BRM12294	Fc=2440MHz Typ. 70dB reduce	FL-174	6	2003/2	2004/2
Low Temperature Chamber	TABAI	MC-710	Temperature -75°C - 100°C	CH-31	N/A	2002/8	2003/8
Coaxial Cable	SUHNER	SUCOFLEX	Length : 10m (SMA type)	CL-45	6	2003/2	2004/2
			Length : 1m (SMA type)	CL-42	6	2003/2	2004/2
			Length : 10m (SMA type)	CL-46	N/A	2003/2	2004/2
			Length : 1.5m (3.5mm type)	CL-620	N/A	2003/2	2004/2
			Length : 2.5m (3.5mm type)	CL-621	6	2003/2	2004/2
			Length : 0.3m (3.5mm type)	CL-619	1,2,3,4,5,6	2003/2	2004/2

[Note]

Test Item (*):

- 1 : 6 dB Bandwidth Measurement
- 2 : Peak Output Power Measurement
- 3 : Band Edge Measurement
- 4 : Spurious RF Conducted Emission Measurement
- 5 : Power Density Measurement
- 6 : Radiated Emission Measurement
- 7 : AC Power Line Conducted Emission Measurement
- N/A : Not Applicable.

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.