KANSAI ELECTRONIC INDUSTRY DEVELOPMENT CENTER

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IKOMA TESTING LABORATORY
12128 TAKAYAMA-CHO
IKOMA-CITY NARA 630-0101 JAPAN

Corporate Juridical Person

TEST REPORT

Report No. A-011-07-C-a Date: 21 December 2007

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 : SANWA ELECTRONIC INSTRUMENT CO., LTD.

Mailing Address : 1-2-50 Yoshidahonmachi, higashiosaka, Osaka 578-0982

2. Identification of Tested Device

Type of Device : Direct Sequence Spread Spectrum Transmitter
Type of Modulation : ☒ FHSS ☐ DSSS ☐ Other method
FCC ID : L73ATX90354
Device Name : Radio Control
Trade Name : SANWA
Model Number : RDS8000 (90354)
Serial Number : 107
☐ Production ☒ Pre-production ☐ Prototype

3. Test Items and Procedure

☒ Carrier Frequency Separation Measurement
☒ Number of Hopping Frequencies Measurement
☒ Time of Occupancy (Dwell Time) Measurement
☐ 20 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: ANSI C63.4-2003
☒ without deviation, ☐ with deviation (details are found inside of this report)

4. Date of Test

Receipt of Test Sample : 5 November 2007
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 : 21 December 2007

Seiichi Izumi
General Manager / Ikoma Testing Laboratory

Table of Contents

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 +/- 3×10^{-9} for Carrier Frequency Separation Measurement
of +/- 3×10^{-9} for Number of Hopping Frequencies Measurement
of +/- 3×10^{-9} for 20dB Bandwidth Measurement
of +/- 3×10^{-9} for Time of Occupancy (Dwell time) 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.

2. GENERAL INFORMATION

2.1. Product Description

The SANWA Model No. RDS8000 (90354) (referred to as the EUT in this report) is a transmitter for radio controller module (2.4GHz band).

(1) Technical Specification

- · Access type : Frequency Hopping Spread Spectrum Method
- · Tx Frequency range : 2415(CH13) ~ 2465MHz (63ch)
- · Output power : 20dBm (typical)
- · Antenna : Built in antenna, Antenna Gain 1.1 ~ 1.9dBi
  Impedance 50Ω (Unbalanced)

(2) Used Oscillators Frequencies

- · RF TRANSCEIVER IC Clock : 13.000MHz
- · CPU Clock : 24.000MHz

(3) Provided Terminals

- · Battery Connector : for connected Ni-Cd battery

(4) Rated Power Supply : DC 10V
The rated power is supplied from Ni-Cd battery.

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 ~ 928MHz, 2400 ~ 2483.5MHz, and 5725 ~ 5850MHz
(3) Kind of Equipment Authorization	: ☐ DoC ☒ Certification ☐ Verification
(4) Procedure of Application	: ☒ Original Equipment ☐ Modification
(5) Highest Frequency used in the Device	: 2415 ~ 2465MHz
(6) Upper Frequency of Radiated Emission	Measurement Range : ☐ 1000MHz ☐ 2000MHz ☐ 5000MHz ☒ 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

Open Area Test Site	☐ No.1 ☐ No.4
Anechoic Chamber	☐ No.1 ☐ No.3 ☐ No.10 ☒ No.11
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 C63.4-2003.
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 SUD JAPAN and TUV Rheinland Japan 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 compliance test was performed under test modes.

Op-mode 1: Transmitting at 2415MHz without hopping
Op-mode 2: Transmitting at 2440MHz without hopping
Op-mode 3: Transmitting at 2465MHz without hopping
Op-mode 4: Transmitting with Hopping

The EUT is designed both of a horizontally placed and vertically place. In radiated emission measurement, each condition was conducted.
As a result, the emission that produce the maximum operation modes were reported.

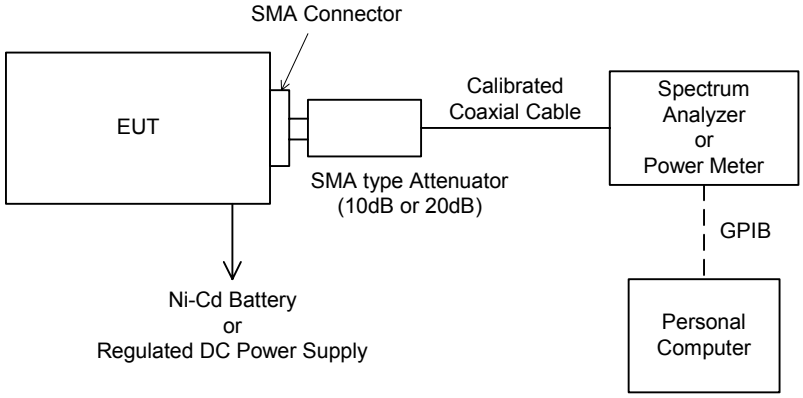
a) Currier Frequency Separation measurement	: Op-mode 4
b) Number of Hopping Frequencies measurement	: Op-mode 4
c) Time of Occupancy measurement	: Op-mode 4
d) Peak Output Power measurement	: Op-mode 1 ,Op-mode 2 and Op-mode 3
e) Band Edge RF Conducted measurement	: Op-mode 4
f) Spurious RF Conducted emission measurement	: Op-mode 1 ,Op-mode 2 and Op-mode 3
g) Radiated Emission measurement	: Op-mode 1 ,Op-mode 2 and Op-mode 3

3.2. Characterization and condition of EUT System

☒ normal, ☐ not normal (that is)

3.3. Test Setup Diagram

· Carrier Frequency Separation
· Number of Hopping Frequencies
· Time of Occupancy (Dwell Time)
· Peak Output Power
· Band Edge RF Conducted Emission
· Spurious RF Conducted Emission

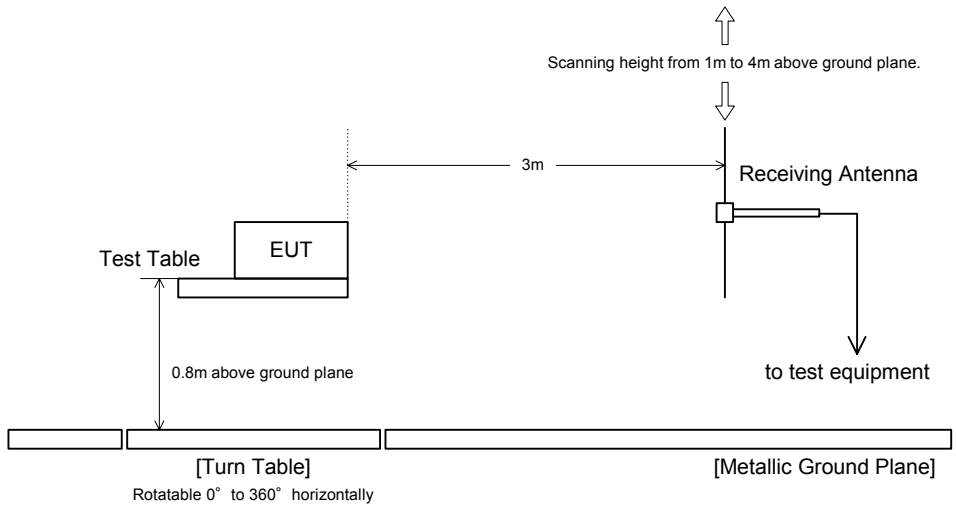


[Note]
Regulated DC Power Supply is not used in this report.

- Continued -

· Radiated Emission Measurement

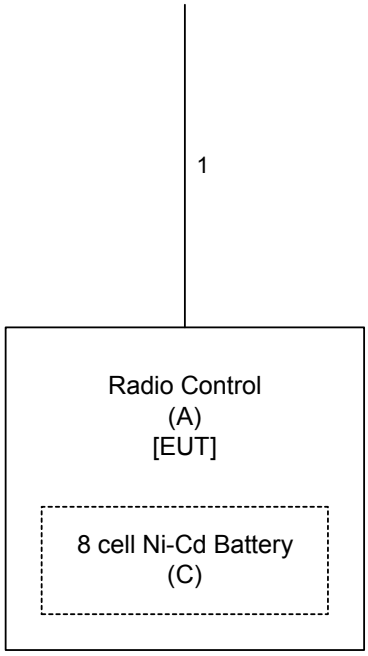
[Open Area Test Site or Anechoic Chamber]



[Note]

Test Table size	: 1.0m × 1.0m, Height 0.8m, Material : Expanded Polystyrene
Receiving Antenna	: Tuned dipole antenna, Biconical antenna (30-300MHz) or Log-periodic antenna (30-1000MHz) or Standard gain horn antenna (Above 1GHz) Scan from 1.0m to 4.0m above ground plane expect for vertical polarization the minimum height of center of antenna is increased so that the lowest point of the bottom of the antenna clears the ground surface by at least 25cm.
Interconnecting cables	: Excess part of the interconnecting cables longer than 1meter are bundled in the center. Cables that hang closer than 40cm to the ground plane is folded back and forth forming bundled 30 to 40 cm long, hanging approx, in the middle between the ground plane and table.
AC Power Cables	: All AC Power cord drape to the floor and are routed over the receptacle. In case of floor-Standing Equipment, Excess power cords are bundled in the center or shortened to appropriate length.
Floor-Standing Equipment	: EUT and all cables are insulated from the ground plane by 3mm to 12mm of insulating material

3.4. Block Diagram of EUT System



[Note]
See 3.5. List of EUT System and 3.6. List of Cables

3.5. List of EUT System

No	Device Name	Model Number (Serial Number)	FCC ID (Trade Name)	Note
A	Radio Control	RDS8000 (90354) (107)	L73ATX90354 (SANWA)	EUT
B	8 cell Ni-Cd Battery	8KR-1100AAU (–)	N/A (Cadnica)	

[Attention]
N/A : Not Applicable

3.6. List of Cables

No	Cable Name	Shielded (Y/N)	Length (m)	Note	Remark
1	Antenna	Y	0.1		

4. CARRIER FREQUENCY SEPARATION MEASUREMENT (§ 15.247 (a) (1))

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 separation between the peaks of the peaks of adjacent channel were measured by using delta-maker function of the spectrum analyzer (*1).
[Note] (*1) Spectrum Analyzer Set Up Conditions Frequency Span : 5MHz Resolution bandwidth : 10kHz Video bandwidth : ≧RBW Sweep : Auto Detector function : Peak Trace Mode : Max Hold

4.2. Test Results

Carrier Frequency Separation [MHz]	Limit [MHz]
1.000	> 0.025

[Note]
See next page figure 1.

[Test Condition]
EUT operation : Data transmission
EUT channel : Hopping

[Environment]
Temperature: 22 °C Humidity: 45 %

[Tested Date / Tester]
21 December 2007 Signature

Hironobu Matsuyama

Spectrum Chart

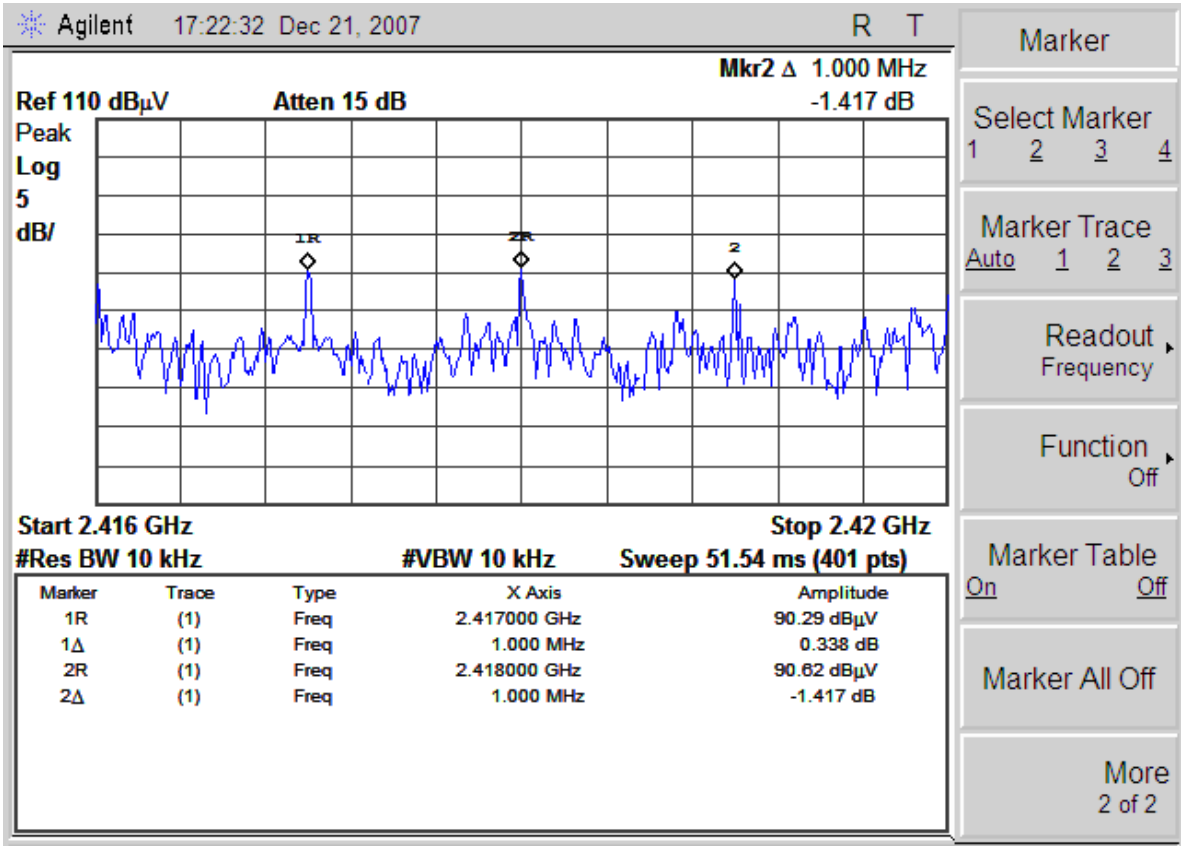


Figure 1 Carrier Frequency Separation Fc = 2440 MHz

5. NUMBER OF HOPPING FREQUENCIES MEASUREMENT (§ 15.247 (a) (1) (iii)

5.1. Test Procedure

(1) Connect the EUT RF output port to spectrum analyzer (*1) via calibrated coaxial cable and suitable attenuator (if necessary). (2) Activates the EUT System and 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 spectrums are scanned and allow the trace to stabilize. (5) The number of hopping frequencies were counted on the spectrum analyzer and recorded.
[Note] (*1) Spectrum Analyzer Set Up Conditions Frequency Span : 60 MHz, fc = 2440 MHz Resolution bandwidth : 300 kHz Sweep : Auto Detector function : Peak detector Trace : Max Hold

5.2. Test Results

Measured Value	Number of Limit
51	> 15

[Note] See next page figure 2.
[Test Condition] EUT operation : Data transmission EUT channel : Hopping

[Environment]

Temperature: 22 °C Humidity: 45 %

[Tested Date / Tester]

10 December 2007 Signature

Hironobu Matsuyama

Spectrum Chart

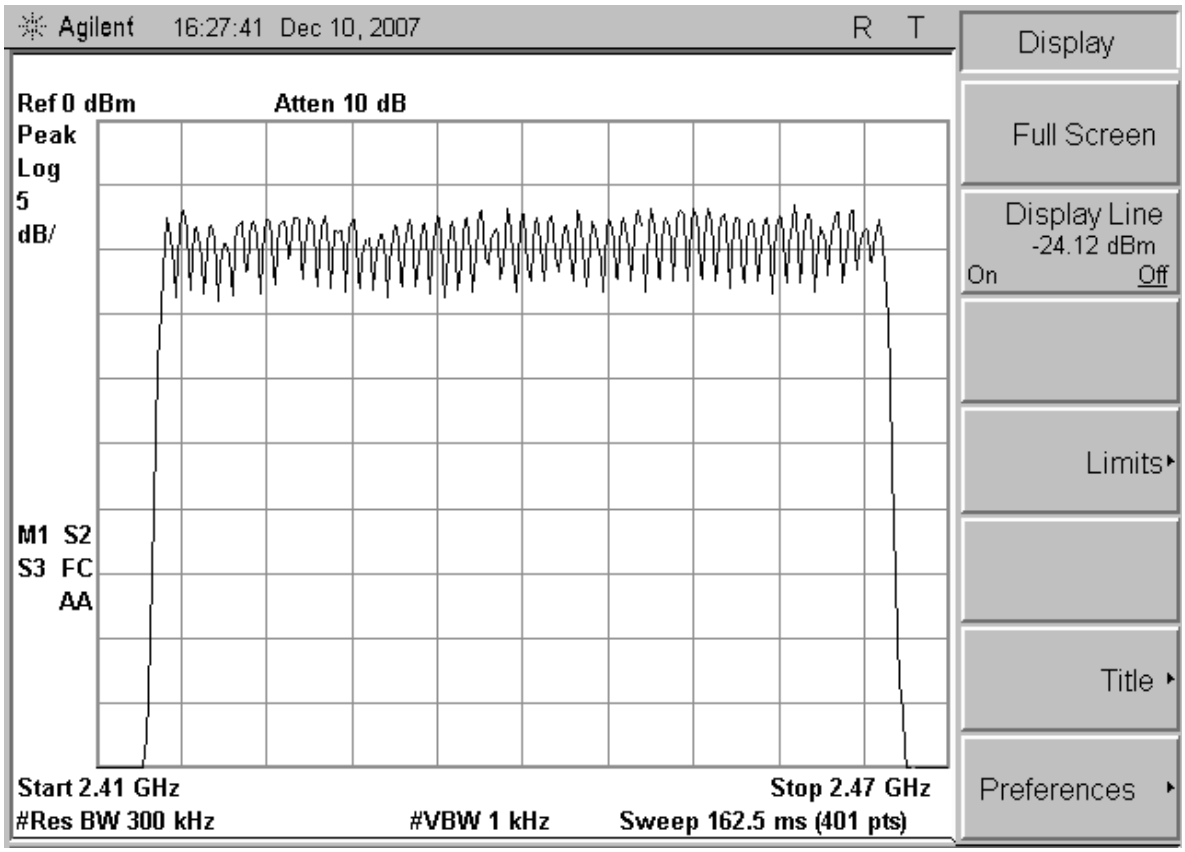


Figure 2 Number of Hopping frequency

6. TIME OF OCCUPANCY (DWELL TIME) MEASUREMENT (§ 15.247 (a) (1) (iii))

6.1. 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 span of spectrum analyzer was set to zero (sweep time 30msec). The occupied time at center on a hopping frequency was observed and recorded as “Ton”.
(5) The spectrums are scanned by using the spectrum analyzer (*1). And the numbers of occupied channel per Nsec(period of 0.4 seconds multiplied by the number of hopping channels employed) were counted by using the delta-marker function of spectrum analyzer and recorded as “N”.
(6) The dwell time was calculated by Ton × N.

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

Frequency Span	: Zero span
Resolution bandwidth	: 100 kHz ~ 1 MHz
Video bandwidth	:≧ RBW
Sweep	: as necessary to capture the entire dwell time per hopping channel
Detector function	: Peak
Trace Mode	: Max Hold

6.2. Test Results

Hopping mode (See figure 3 and 4)

Measured Value [sec]	Limit [sec]
0.179	< 0.400

In measurement time of 20.4s, total 17 transmissions occurred. The duration of one transmission was 10.5ms.
Time of occupancy at 20.4s is obtained : 17×10.5ms =178.5ms

[Note] See next page figure 3 to 4.
[Test Condition] EUT operation : Data transmission EUT channel : Hopping

[Environment]

Temperature: 22 °C Humidity: 45 %

[Tested Date / Tester]

10 December 2007 Signature

Hironobu Matsuyama

Spectrum Chart

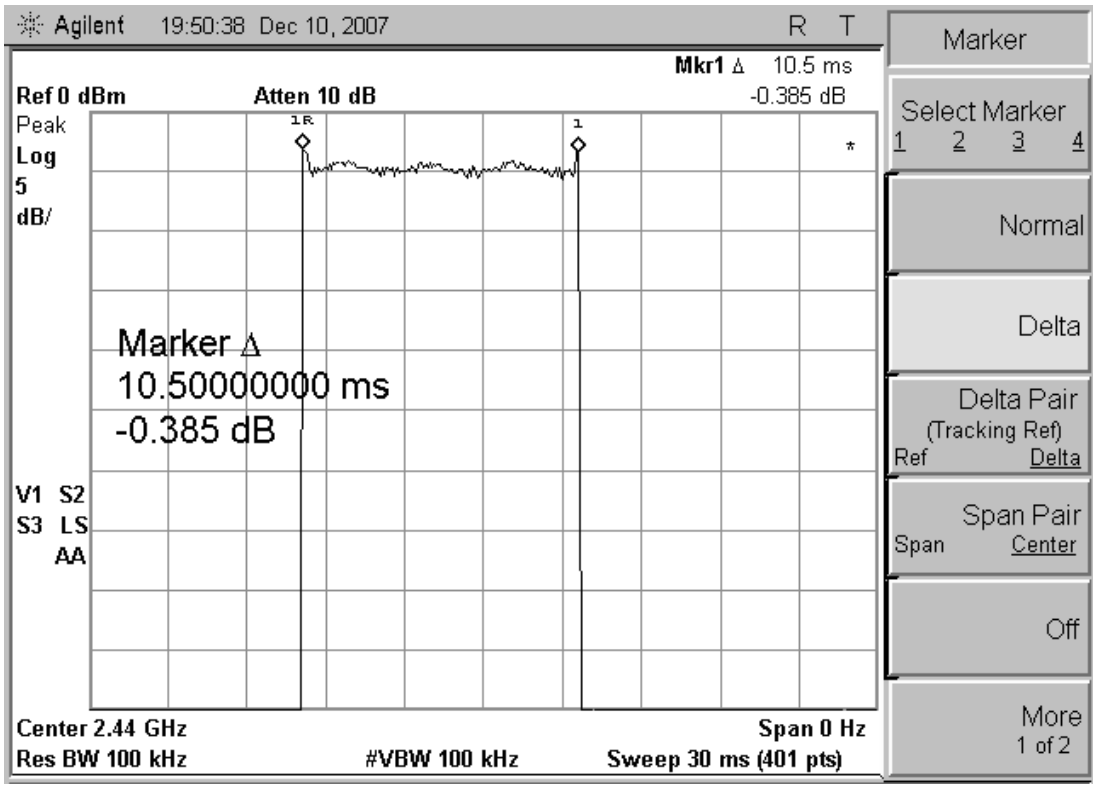


Figure 3 Number of transmission at 20.4s

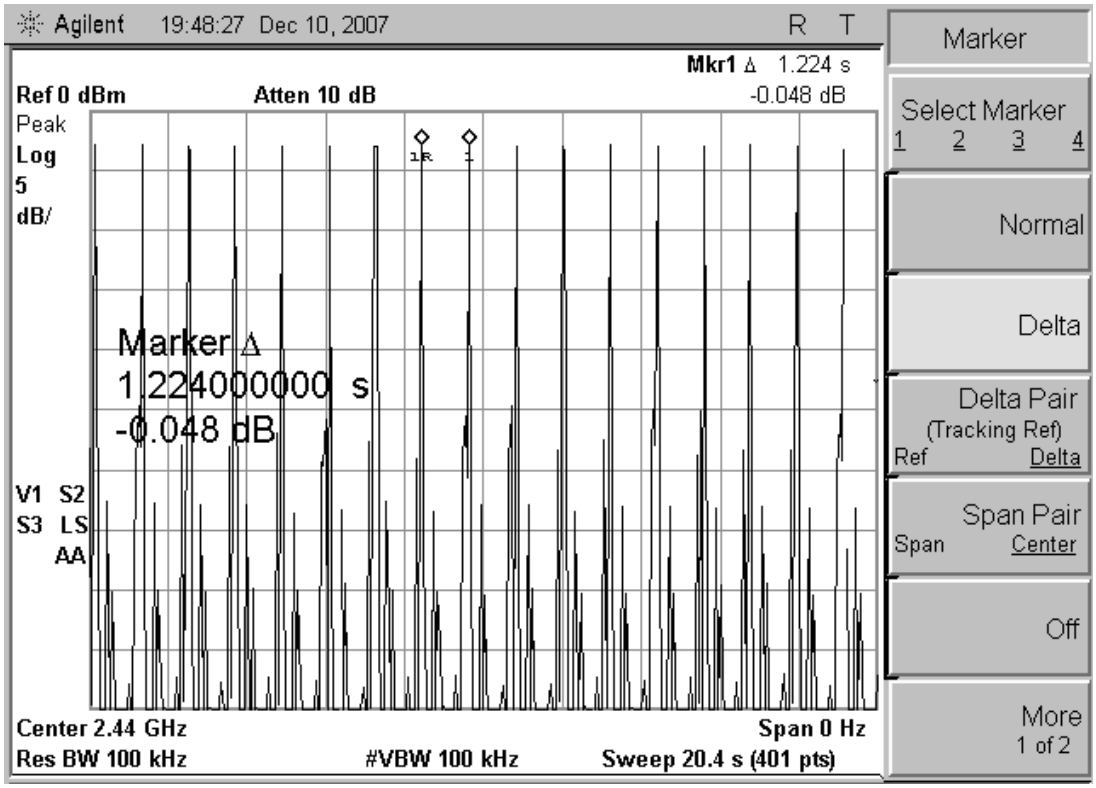


Figure 4 Duration of one transmission

7. PEAK OUTPUT POWER MEASUREMENT (§15.247 (b) (1))

7.1. 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 peak type power meter.

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

Frequency Span	: 20dB bandwidth of the emission being measured
Resolution bandwidth	: 1MHz
Video bandwidth	: ≧RBW
Sweep	: Auto
Detector function	: Peak
Trace Mode	: Max Hold

7.2. Test Results

Measured Frequency [MHz]	Correction Factor [dB]	Meter Reading [dBm]	Output Power [dBm]	Limit [dBm]	Margin for Limit [dB]
2415	21.9	-3.2	18.7	20.9	2.2
2440	21.9	-2.8	19.1	20.9	1.8
2465	21.9	-2.5	19.4	20.9	1.5

[Note]
(1) Correction Factor includes the both loss of attenuator and cable used in the measurement.
(2) The measurement was performed by spectrum analyzer.
(3) See next page figure 5 to 7.

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

[Test Condition]
EUT operation : Data transmission
EUT channel : 13, 38, 63 (2415, 2440, 2465MHz)

[Environment]
Temperature: 23 °C Humidity: 42 %

[Tested Date / Tester]
4 December 2007 Signature

Hironobu Matsuyama

Spectrum Chart

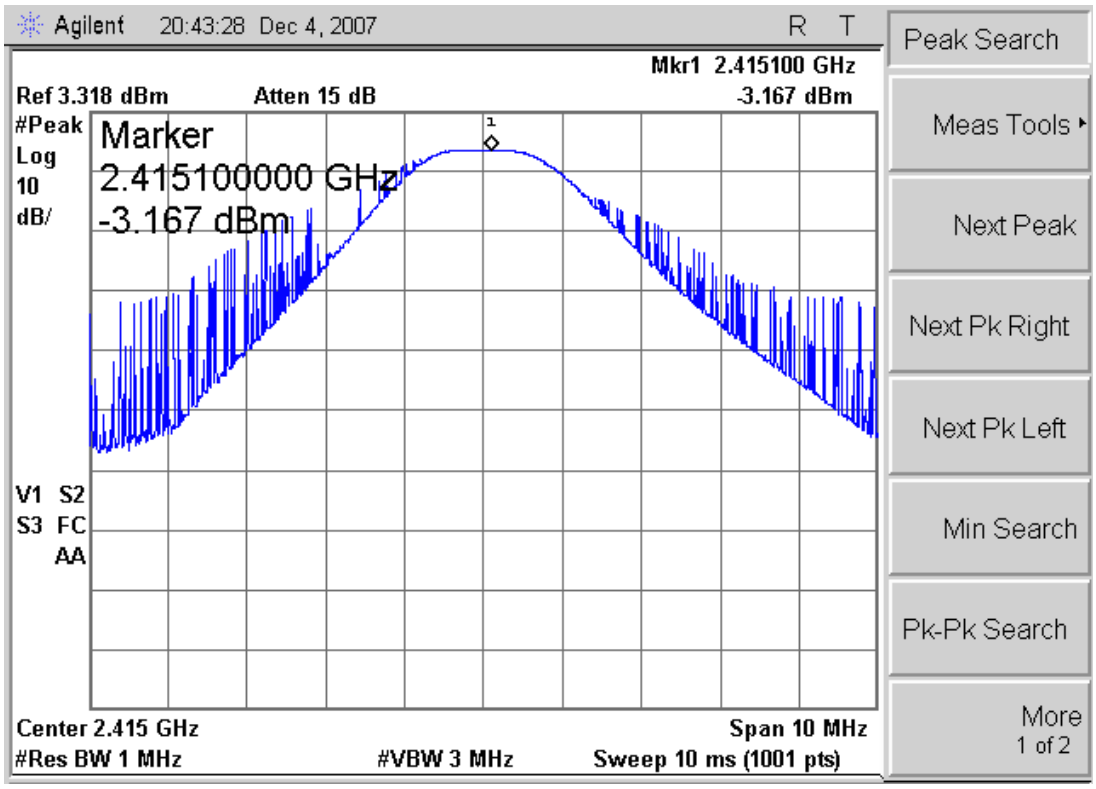


Figure 5 2415MHz (channel 0)

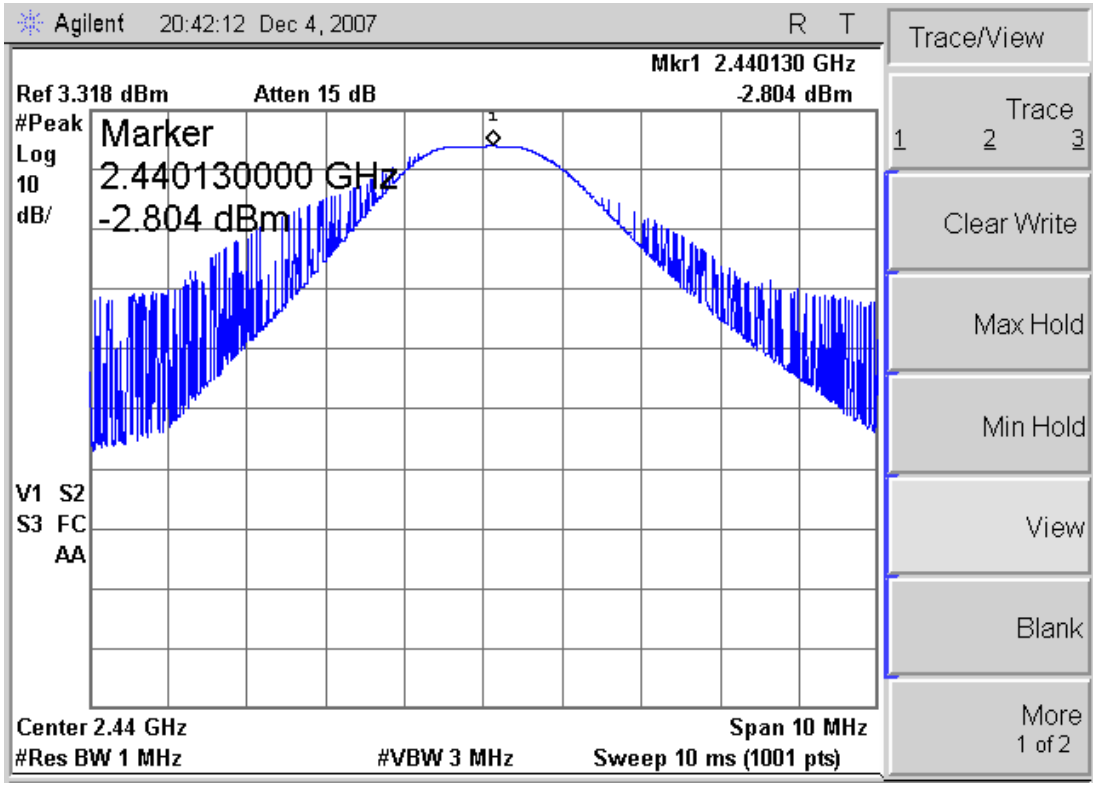


Figure 6 2440MHz (channel 25)

- Continued -

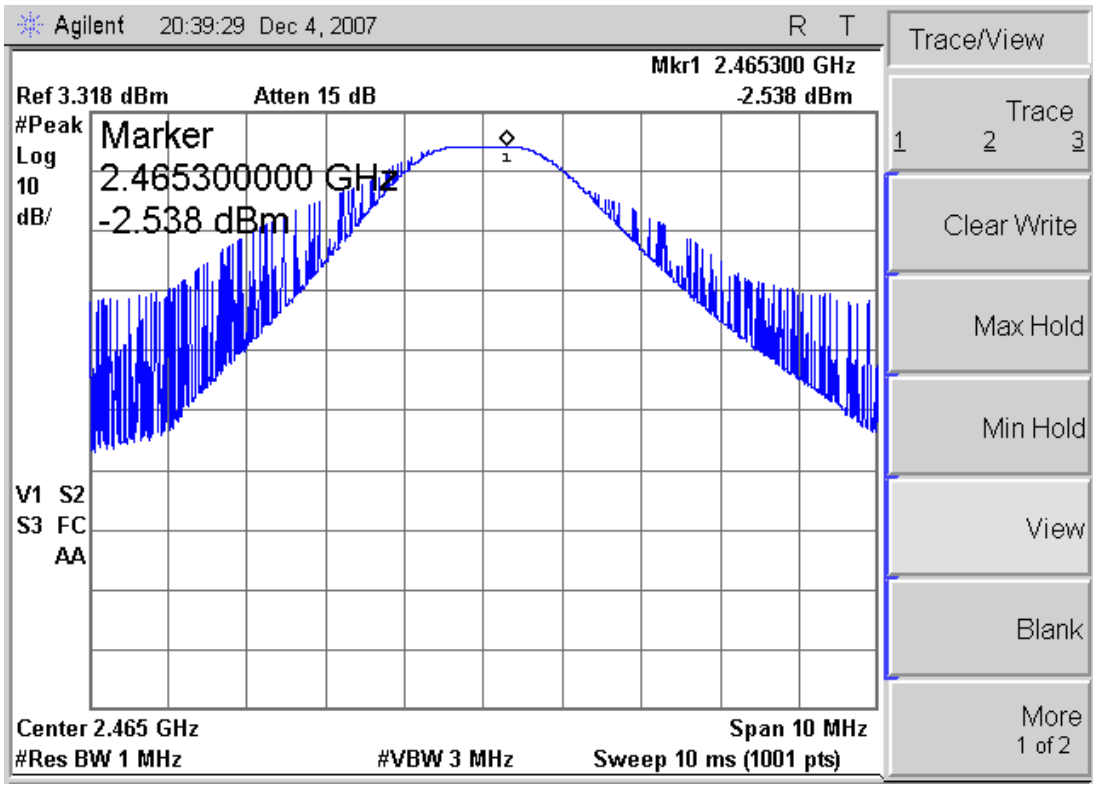


Figure 7 2465MHz (channel 51)

8. BAND EDGE RF CONDUCTED EMISSION MEASUREMENT (§15.247 (d))

8.1. 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 : 100kHz Video bandwidth : ≧RBW Sweep : Auto Detector function : Peak Trace Mode : Max Hold

8.2. Test Results

Measured Frequency [MHz]	Measured Separation From Carrier [dBc]	Limit [dBc]	Margin For Limit [dB]
2390.00	< 50.0	20	> 30.0
2483.50	< 50.0	20	> 30.0

[Note]
See next page figure 8 to 9.

[Test Condition]
EUT operation : Data transmission
EUT channel : Hopping

[Environment]
Temperature: 22 °C Humidity: 45 %

[Tested Date / Tester]
10 December 2007 Signature

Hironobu Matsuyama

Spectrum Chart

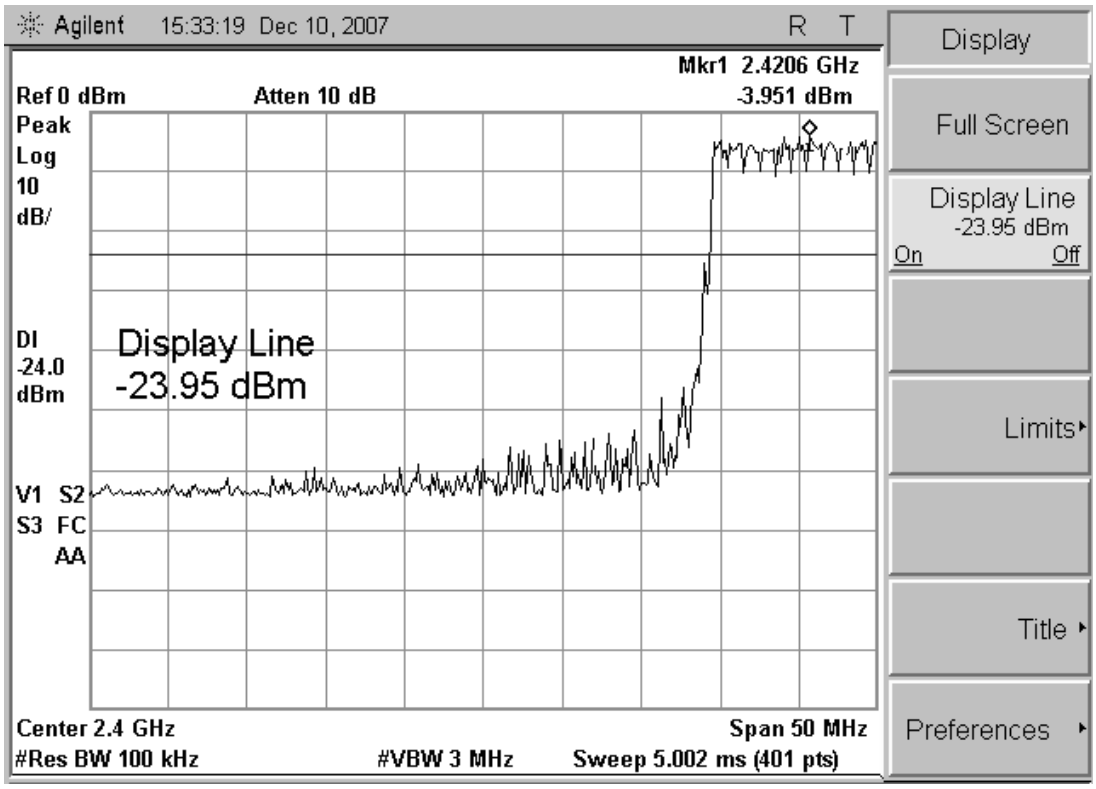


Figure 8 Band Edge Low Frequency side

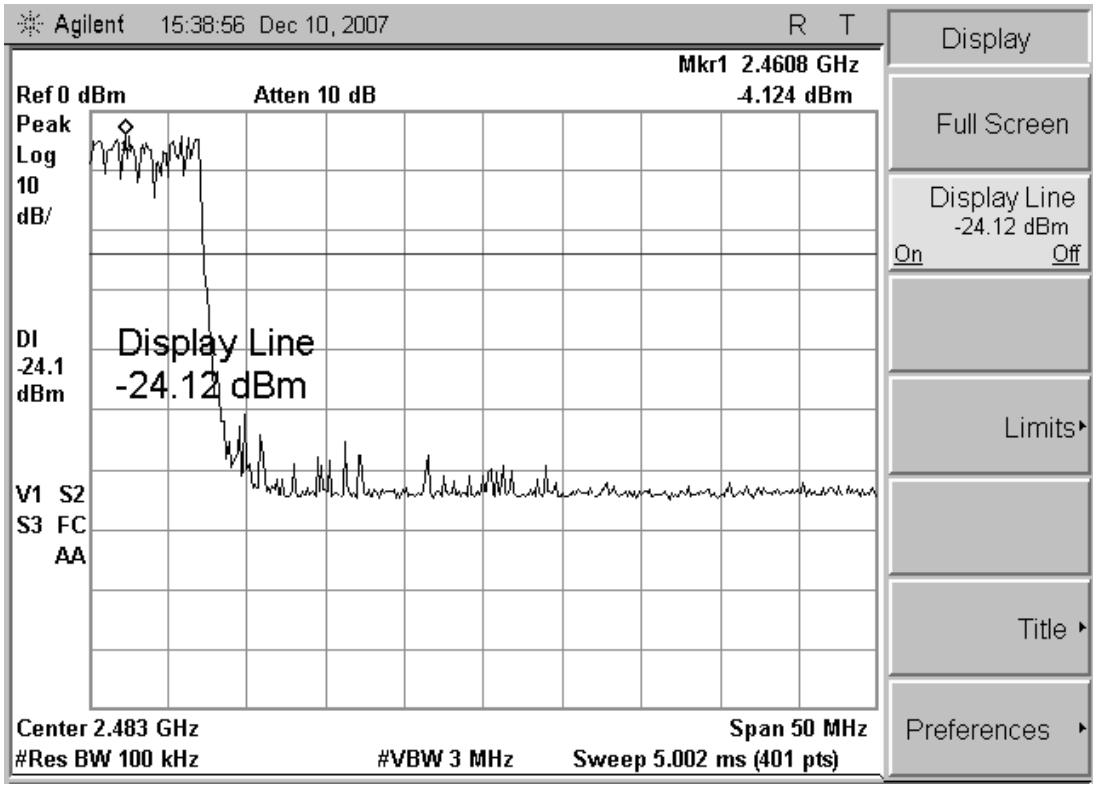


Figure9 Band Edge High Frequency side

9. SPURIOUS RF CONDUCTED EMISSION MEASUREMENT (§15.247 (d))

9.1. 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 : 100kHz Video bandwidth : ≧RBW Sweep : Auto Detector function : Peak Trace Mode : Max Hold

9.2. Test Results

Measured Frequency [MHz]	Correction Factor [dB]	Meter Reading [dBm]	Conducted Spurious [dBm]	Separation From Carrier [dBc]	Limit [dBc]
[Fc =2415MHz, Carrier Power : 18.7dBm]					
7245.00	23.5	-67.1	-43.6	62.4	20.0
9660.00	24.1	-66.1	-42.0	60.8	20.0
[Fc =2440MHz, Carrier Power : 19.1dBm]					
7320.00	23.5	-63.5	-40.0	59.8	20.0
9760.00	24.1	-63.1	-39.0	58.9	20.0
[Fc =2465MHz, Carrier Power : 19.4dBm]					
7395.00	23.5	-63.8	-40.3	59.7	20.0
9860.00	24.1	-66.6	-42.5	61.9	20.0

[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 10 to 12.

[Calculation method]
Spurious RF Emission (dBm) = Meter Reading (dBm) + Correction Factor (dB)
Separation From Carrier (dBc) = Spurious RF Emission (dBm) – Perk Output Power (dBm)

[Test Condition]
EUT operation : Data transmission
EUT channel : 13, 38, 65 (2415, 2440, 2465MHz)

[Environment]
Temperature: 23 °C Humidity: 42 %

[Tested Date / Tester]
4 December 2007 Signature

Hironobu Matsuyama

Spectrum Chart

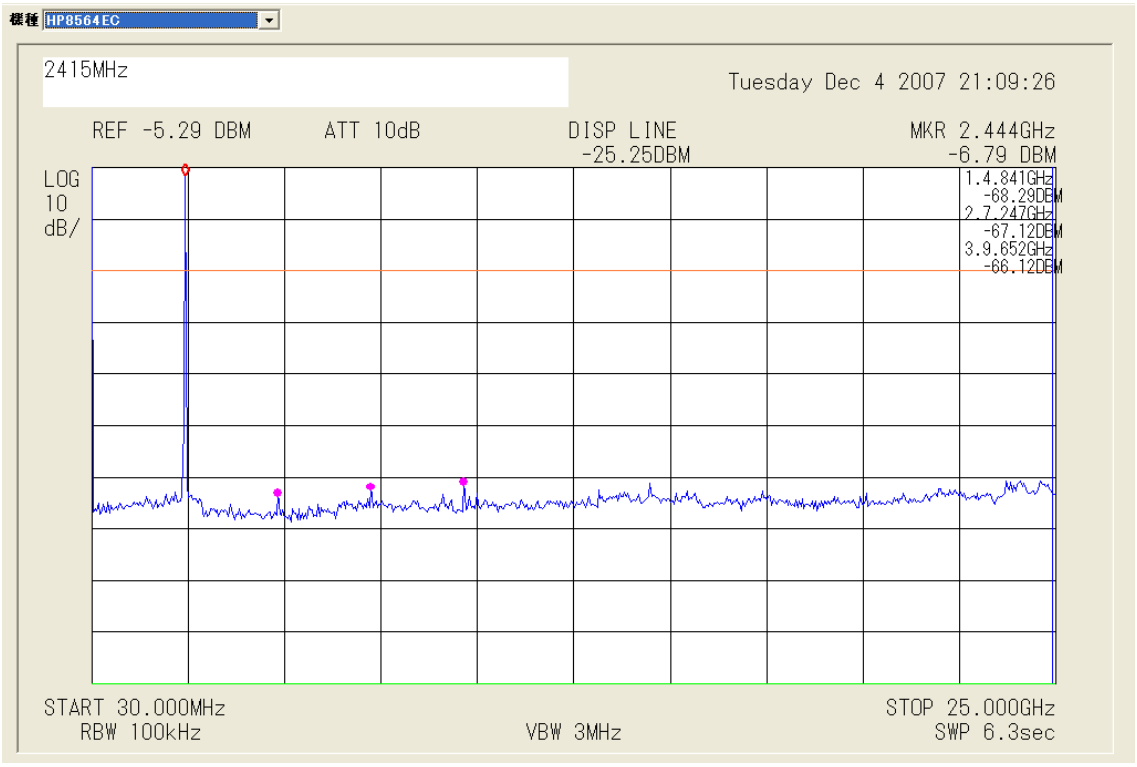


Figure 10 Spurious RF Conducted Emission, Tx on 2415MHz

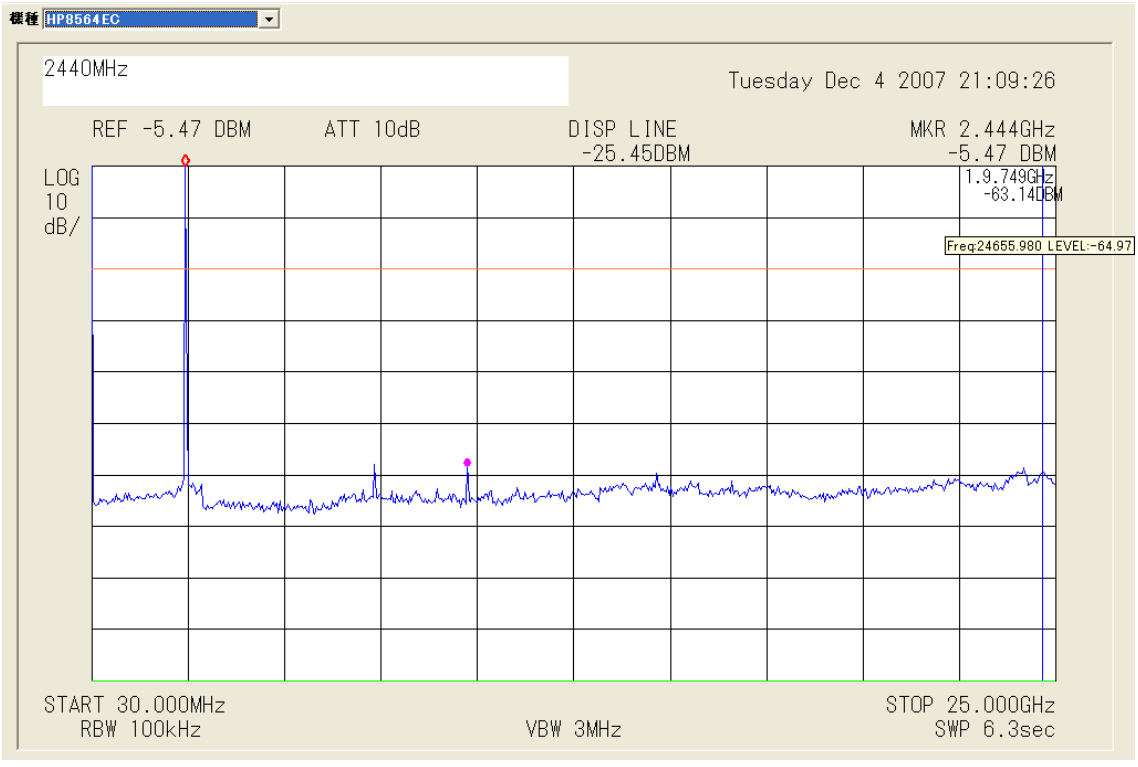


Figure 11 Spurious RF Conducted Emission, Tx on 2440MHz

- Continued -

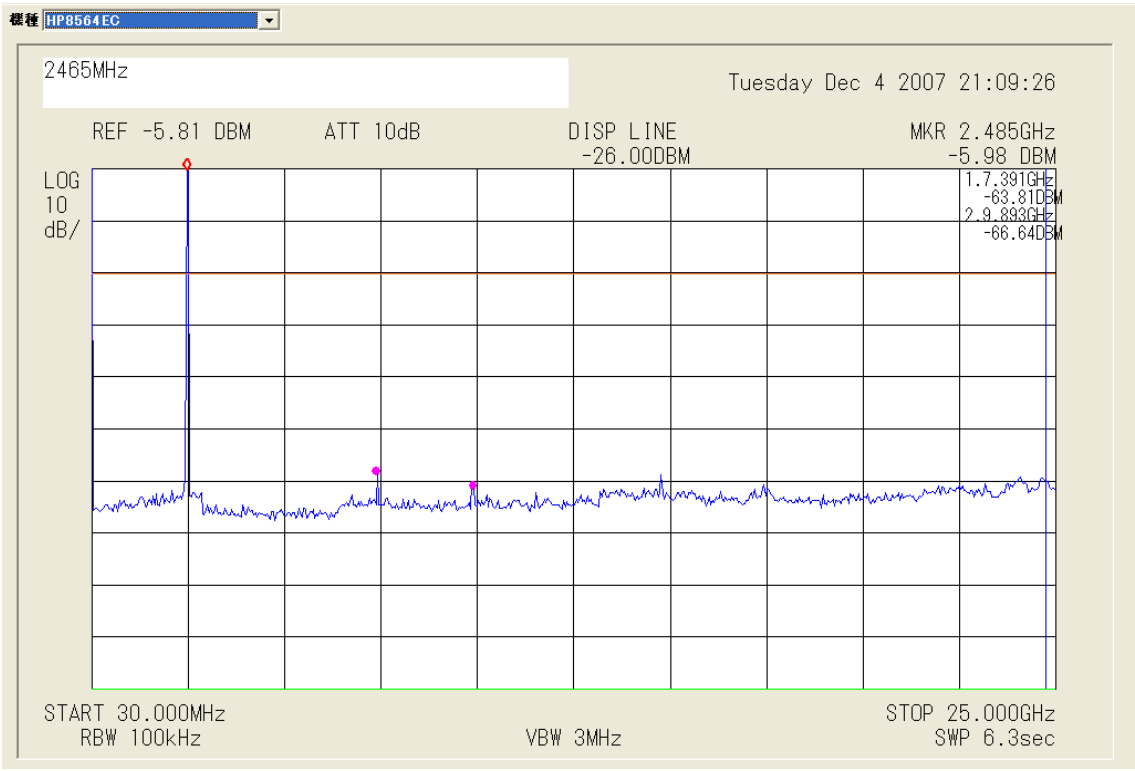


Figure 12 Spurious RF Conducted Emission, Tx on 2465MHz

10. RADIATED EMISSION MEASUREMENT (§15.247 (d)), (§15.209 (a))

10.1. Test Procedure

(1) Configure the EUT System in accordance with ANSI C63.4-2003 section 8.
☒: 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) Preliminary Measurement.
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) with pre-amplifier and the broad band antenna.
In the frequency above 1GHz, 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 30MHz to the upper frequency of measurement range with rotated the turn table from 0 to 360 degree, and collect the six highest emissions minimum on the spectrum analyzer relative to the limits in the whole range.
(8) Final Measurement.
The EUT is operated in the worst case condition where maximum emission is detected by the preliminary 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 1GHz, the measurements are performed by the horn antenna and
☐ the test receiver (*4).
☒ the spectrum analyzer (*2) or (*5) with pre-amplifier.
(9) So that maximum field strength, the turntable azimuth and receiving antenna are adjusted the position.

[Note]
(*1) Spectrum Analyzer Set Up Conditions
Frequency range : 30 - 1000MHz
Resolution bandwidth : 100kHz
Detector function : Peak mode
(*2) Spectrum Analyzer Set Up Conditions (Peak detector Measurement)
Frequency range : 1GHz - Upper frequency of measurement range
Resolution bandwidth : 2MHz (Impulse Bandwidth ≒ 1MHz)
Video bandwidth : 1MHz
Attenuator : 10dB
Detector function : Peak mode
(*3) Test Receiver Set Up Conditions
Detector function : Quasi-Peak
IF bandwidth : 120kHz
The test receiver is complied with the specification of CISPR Publication 16.
(*4) Test Receiver Set Up Conditions
Detector function : Average
IF bandwidth : 1MHz
(*5) Spectrum Analyzer Set Up Conditions (Average detector Measurement)
Frequency range : 1GHz - Upper frequency of measurement range
Resolution bandwidth : 2MHz (Impulse Bandwidth ≒ 1MHz)
Video bandwidth : 10Hz or 30Hz
Attenuator : 10dB
Y axis : Liner

10.2. Test Results

(1) In the Frequency Range : below 1GHz

Measurement Distance ☒: 3m ☐: 10m

Measured Frequency	Antenna Factor	Meter Reading		Ant. Height and Turn Table Angle at maximum level of Horizontal or Vertical		Maximum Field Strength	Limit	Margin for Limit
		Horizontal Polarization	Vertical Polarization					
(MHz)	(dB/m)	(dBμV)	(dBμV)	Height (m)	Angle (°)	(dBμV/m)	(dBμV/m)	(dB)
100.00	13.6	8.2	10.7	1.00	186	24.3	43.5	19.2
120.00	14.7	8.7	8.0	1.58	189	23.4	43.5	20.1
180.00	17.3	11.1	7.9	1.84	283	28.4	43.5	15.1
190.00	18.2	13.4	8.0	1.00	094	31.6	43.5	11.9
200.00	19.0	9.0	7.6	1.65	068	28.0	43.5	15.5
210.00	19.6	10.5	2.7	1.59	076	30.1	43.5	13.4
330.03	20.3	14.6	4.2	1.00	329	34.9	46.0	11.1
350.03	20.6	15.0	11.3	1.00	289	35.6	46.0	10.4
370.00	20.6	12.3	12.0	1.00	260	32.9	46.0	13.1

[Note]

For spurious emission measurement, the compliance tests were performed both of horizontally placed and vertically placed in EUT(X position, Y position, Z position). As a results, the data of operation mode that produce the maximum emission were reported.

- Continued -

(2) In the Frequency Range : above 1 GHz (Restricted Bands)

Measurement Distance ☒: 3m ☐: 10m

Fc = 2415 MHz (Ch.13) Transmitting operation

Measured Frequency [MHz]	Antenna Factor [dB/m]	Meter Reading Horizontal Polarization [dBμV]	Meter Reading Vertical Polarization [dBμV]	Maximum Field Strength [dBμV/m]	Limit [dBμV/m]	Margin for Limits [dB]
[Peak Detector Measurement]						
2415.00	29.3	87.5	86.5	116.8	-	-
4830.00	-2.7	59.9	57.6	57.2	74.0	16.8
7245.00	-0.7	59.5	56.0	58.8	74.0	15.2
9660.00	2.4	53.6	52.5	56.0	74.0	18.0
12075.00	6.5	51.5	49.5	58.0	74.0	16.0
14490.00	8.3	52.5	52.8	61.1	74.0	12.9
16905.00	10.1	<45.0	<45.0	<55.1	74.0	>18.9
19320.00	5.1	<45.0	<45.0	<50.1	74.0	>23.9
21735.00	5.4	<45.0	<45.0	<50.4	74.0	>23.6
24150.00	6.7	<45.0	<45.0	<51.7	74.0	>22.3
[Average Detector Measurement] (*1)						
4830.00	-2.7	52.8	51.3	50.1	54.0	3.9
7245.00	-0.7	51.8	47.4	51.1	55.0	3.9
9660.00	2.4	44.8	43.3	47.2	54.0	6.8
12075.00	6.5	41.4	39.7	47.9	54.0	6.1
14490.00	8.3	41.3	41.4	49.7	54.0	4.3
16905.00	10.1	<35.0	<35.0	<45.1	54.0	>8.9
19320.00	5.1	<35.0	<35.0	<40.1	54.0	>13.9
21735.00	5.4	<35.0	<35.0	<40.4	54.0	>13.6
24150.00	6.7	<35.0	<35.0	<41.7	54.0	>12.3

[Note]

For spurious emission measurement, the compliance tests were performed both of horizontally placed and vertically placed in EUT(X position, Y position, Z position). As a results, the data of operation mode that produce the maximum emission were reported.

- Continued -

Measurement Distance ☒: 3m ☐: 10m

Fc = 2440 MHz (Ch.38) Transmitting operation

Measured Frequency [MHz]	Antenna Factor [dB/m]	Meter Reading Horizontal Polarization [dBμV]	Meter Reading Vertical Polarization [dBμV]	Maximum Field Strength [dBμV/m]	Limit [dBμV/m]	Margin for Limits [dB]
[Peak Detector Measurement]						
2440.00	29.2	87.0	86.9	116.2	-	-
4880.00	-2.6	58.9	57.8	56.3	74.0	17.7
7320.00	-0.7	59.4	56.0	58.7	74.0	15.3
9760.00	2.4	53.4	51.0	55.8	74.0	18.2
12200.00	6.8	48.3	48.0	55.1	74.0	18.9
14640.00	8.4	52.1	53.4	61.8	74.0	>12.2
17080.00	10.3	<45.0	<45.0	<55.3	74.0	>18.7
19520.00	5.3	<45.0	<45.0	<50.3	74.0	>23.7
21960.00	5.4	<45.0	<45.0	<50.4	74.0	>23.6
24400.00	6.8	<45.0	<45.0	<51.8	74.0	>22.2
[Average Detector Measurement] (*1)						
4880.00	-2.6	51.8	51.1	49.2	54.0	4.8
7320.00	-0.7	51.6	47.7	50.9	55.0	4.1
9760.00	2.4	46.9	44.1	49.3	54.0	4.7
12200.00	6.8	39.2	37.6	46.0	54.0	8.0
14640.00	8.4	41.9	43.7	52.1	54.0	1.9
17080.00	10.3	<35.0	<35.0	<45.3	54.0	>8.7
19520.00	5.3	<35.0	<35.0	<40.3	54.0	>13.7
21960.00	5.4	<35.0	<35.0	<40.4	54.0	>13.6
24400.00	6.8	<35.0	<35.0	<41.8	54.0	>12.2

[Note]

For spurious emission measurement, the compliance tests were performed both of horizontally placed and vertically placed in EUT(X position, Y position, Z position). As a results, the data of operation mode that produce the maximum emission were reported.

- Continued -

Measurement Distance ☒: 3m ☐: 10m

Fc = 2465 MHz (ch.63) Transmitting operation

Measured Frequency [MHz]	Antenna Factor [dB/m]	Meter Reading Horizontal Polarization [dBμV]	Meter Reading Vertical Polarization [dBμV]	Maximum Field Strength [dBμV/m]	Limit [dBμV/m]	Margin for Limits [dB]
[Peak Detector Measurement]						
2465.00	29.2	86.7	86.3	115.9	-	-
4930.00	-2.6	56.5	57.6	55.0	74.0	19.0
7395.00	-0.6	60.2	56.9	59.6	74.0	14.4
9860.00	2.7	54.0	51.4	56.7	74.0	17.3
12325.00	7.2	49.0	47.0	56.2	74.0	17.8
14790.00	8.5	52.0	53.2	61.7	74.0	12.3
17255.00	10.6	<45.0	<45.0	<55.6	74.0	>18.4
19720.00	5.4	<45.0	<45.0	<50.4	74.0	>23.6
22185.00	5.5	<45.0	<45.0	<50.5	74.0	>23.5
24650.00	6.7	<45.0	<45.0	<51.7	74.0	>22.3
[Average Detector Measurement] (*1)						
4930.00	-2.6	49.6	51.3	48.7	54.0	5.3
7395.00	-0.6	52.3	48.3	51.7	54.0	2.3
9860.00	2.7	44.5	40.7	47.2	54.0	6.8
12325.00	7.2	38.8	36.6	46.0	54.0	8.0
14790.00	8.5	41.9	42.7	51.2	54.0	2.8
17255.00	10.6	<35.0	<35.0	<45.6	54.0	>8.4
19720.00	5.4	<35.0	<35.0	<40.4	54.0	>13.6
22185.00	5.5	<35.0	<35.0	<40.5	54.0	>13.5
24650.00	6.7	<35.0	<35.0	<41.7	55.0	>13.3

[Note]

For spurious emission measurement, the compliance tests were performed both of horizontally placed and vertically placed in EUT(X position, Y position, Z position). As a results, the data of operation mode that produce the maximum emission were reported.

- Continued -

Measurement Distance ☒: 3m ☐: 10m

Measured Frequency [MHz]	Antenna Factor [dB/m]	Meter Reading Horizontal Polarization [dBμV]	Meter Reading Vertical Polarization dBμV	Maximum Field Strength [dBμV/m]	Limit [dBμV/m]	Margin for Limits [dB]
[Average Detector (Band Edge) Measurement]						
(*) 2390.00	29.3	22.4	22.5	51.8	54.0	2.2
(*) 2483.50	29.2	22.5	22.5	51.7	54.0	2.3
[Peak Detector (Band Edge) Measurement]						
2390.00	29.3	43.8	44.2	73.5	74.0	0.5
2483.50	29.2	44.3	44.1	73.5	74.0	0.5

[Remark]
(*1) : Spectrum analyzer setup condition.
Detector : Peak
RBW : 1MHz
VBW : 30Hz

[Note]
(1) The measurement were performed both of transmitting operation and receiving operation.
(2) Antenna Factor includes both of the cable loss, Pre-amplifier gain and BEF loss.
(3) See next page figure 13 to 24.
(4) Above 1GHz, antenna factor includes both of the cable loss and pre-amplifier gain.
(5) In frequency range 1to 2GHz and 3 to 4GHz, the band eliminate filter (Cut off frequency 2.4GHz) was used.

[Calculation method at Peak detector]
Maximum Field Strength (dBμV/m)
= Meter Reading (at maximum level of Horizontal or Vertical) (dBμV) + Antenna Factor (dB/m)

[Environment]
Temperature: 24 °C Humidity: 50 %

[Tested Date / Tester]
28 November 2007 Signature

Hironobu Matsuyama

Spectrum Chart

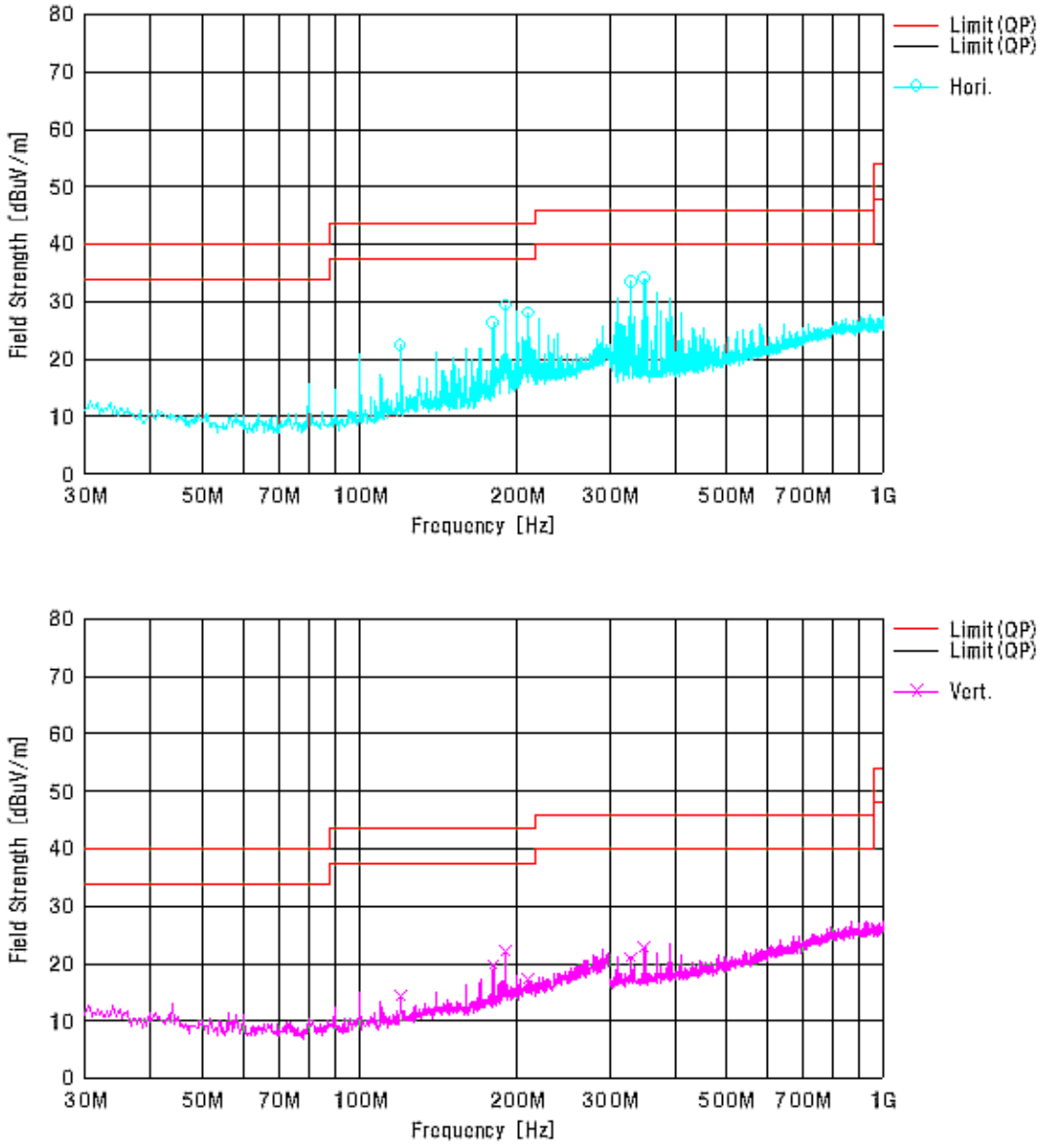


Figure 13 30MHz - 1GHz Spectrum Chart (X Position Antenna Horizontal)

- Continued -

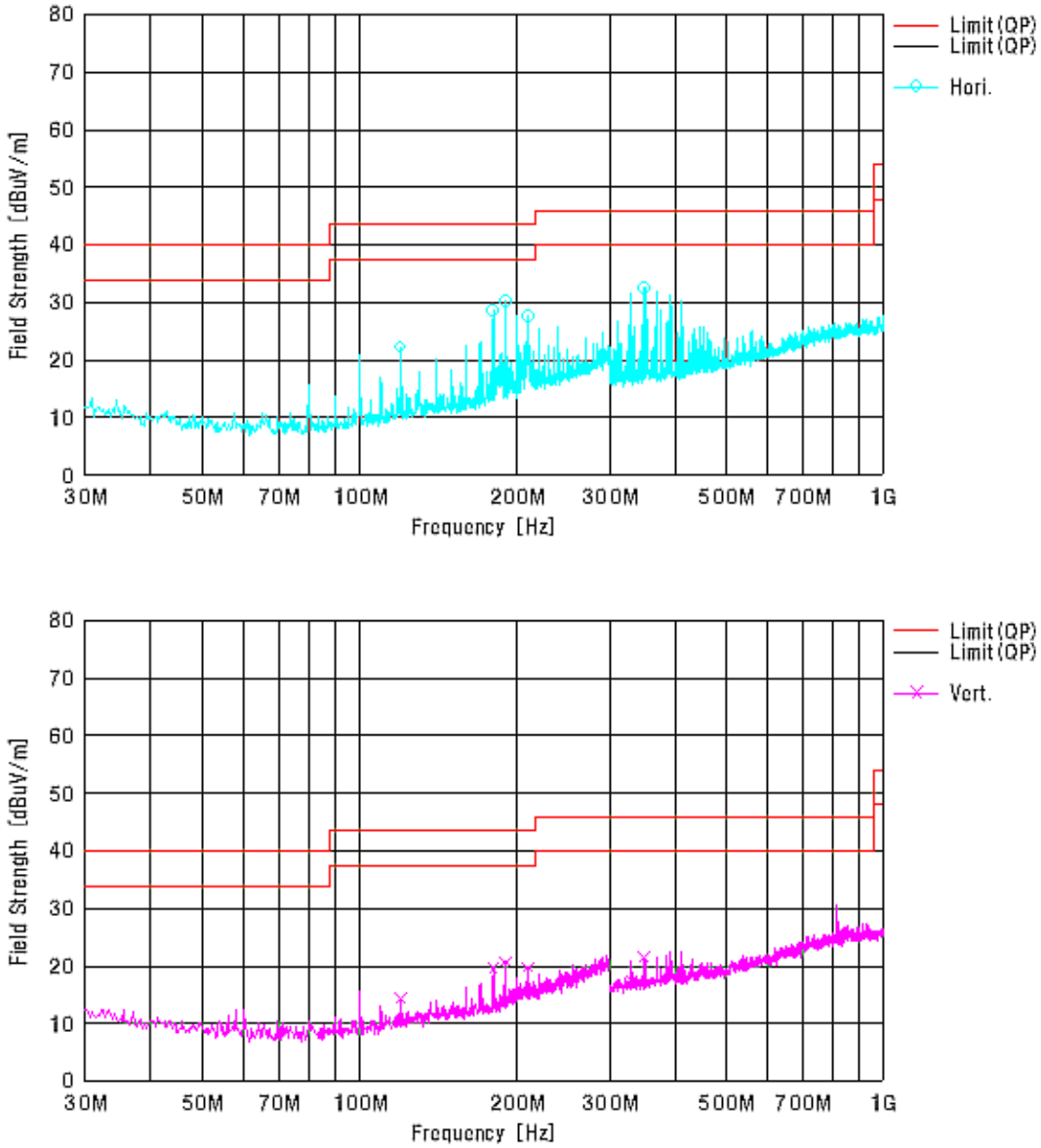


Figure 14 30MHz - 1GHz Spectrum Chart (X Position Antenna Vertical)

- Continued -

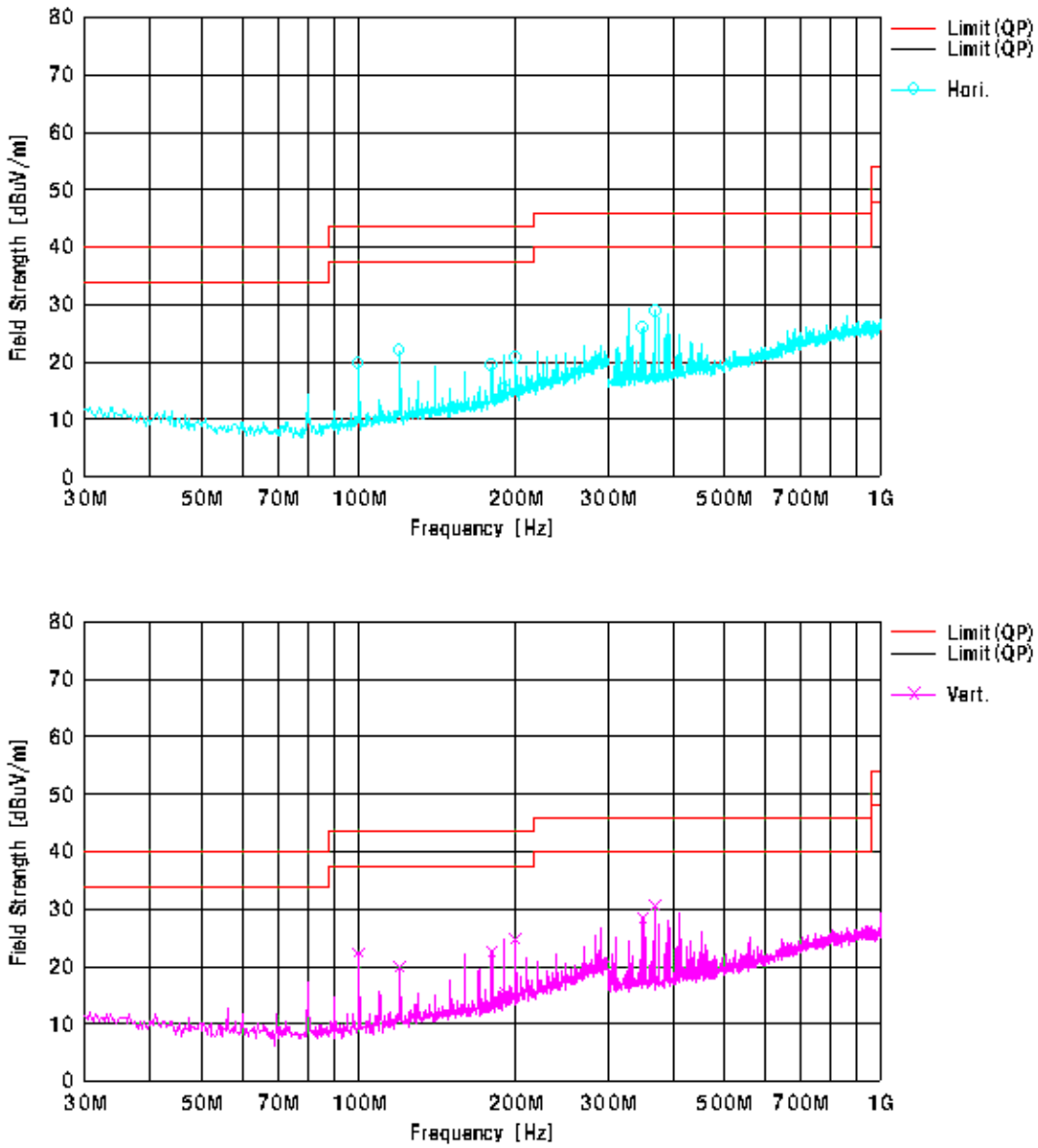


Figure 15 30MHz - 1GHz Spectrum Chart (Y Position)

- Continued -

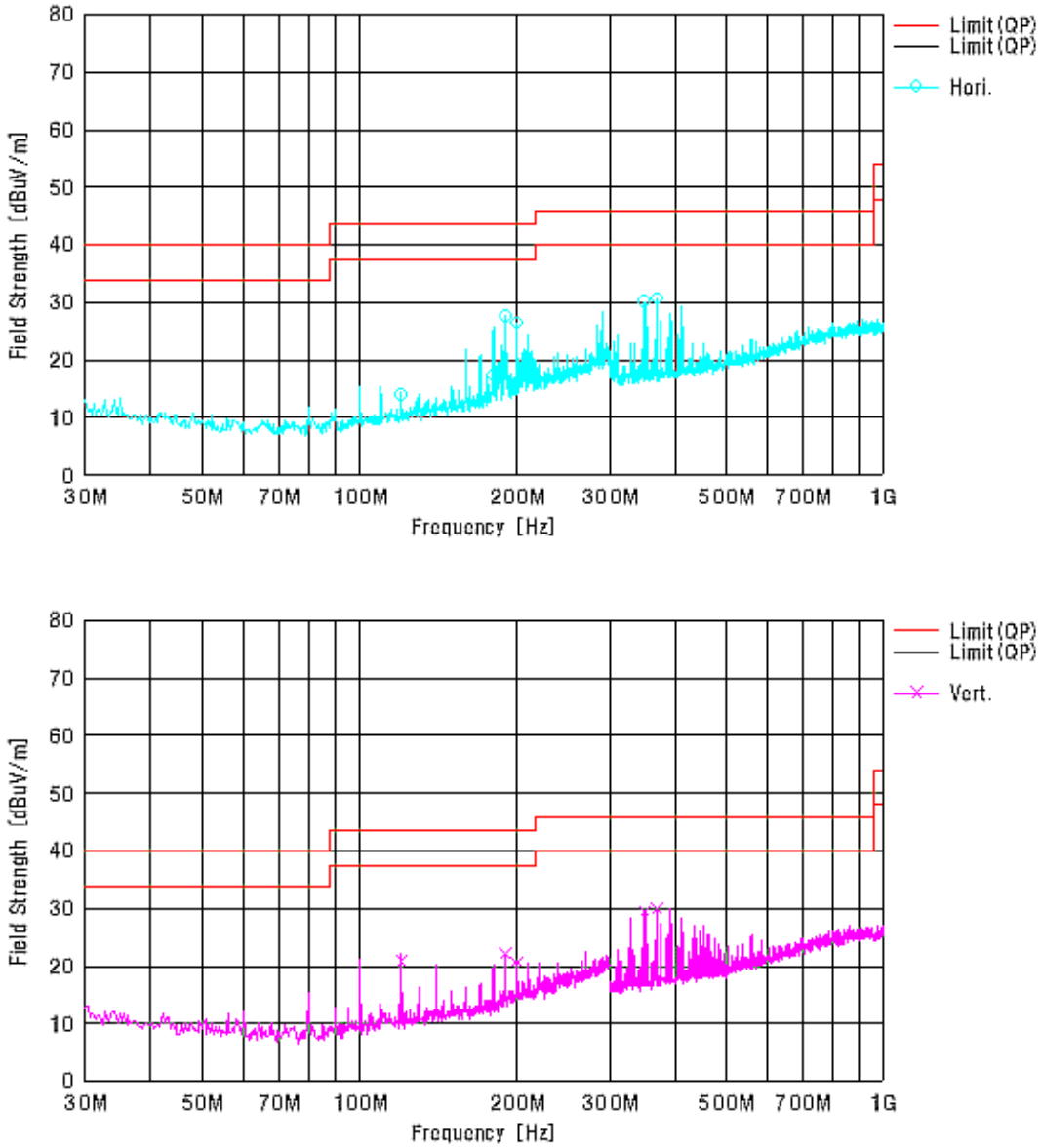


Figure 16 30MHz - 1GHz Spectrum Chart (Z Position)

- Continued -

Band Edge

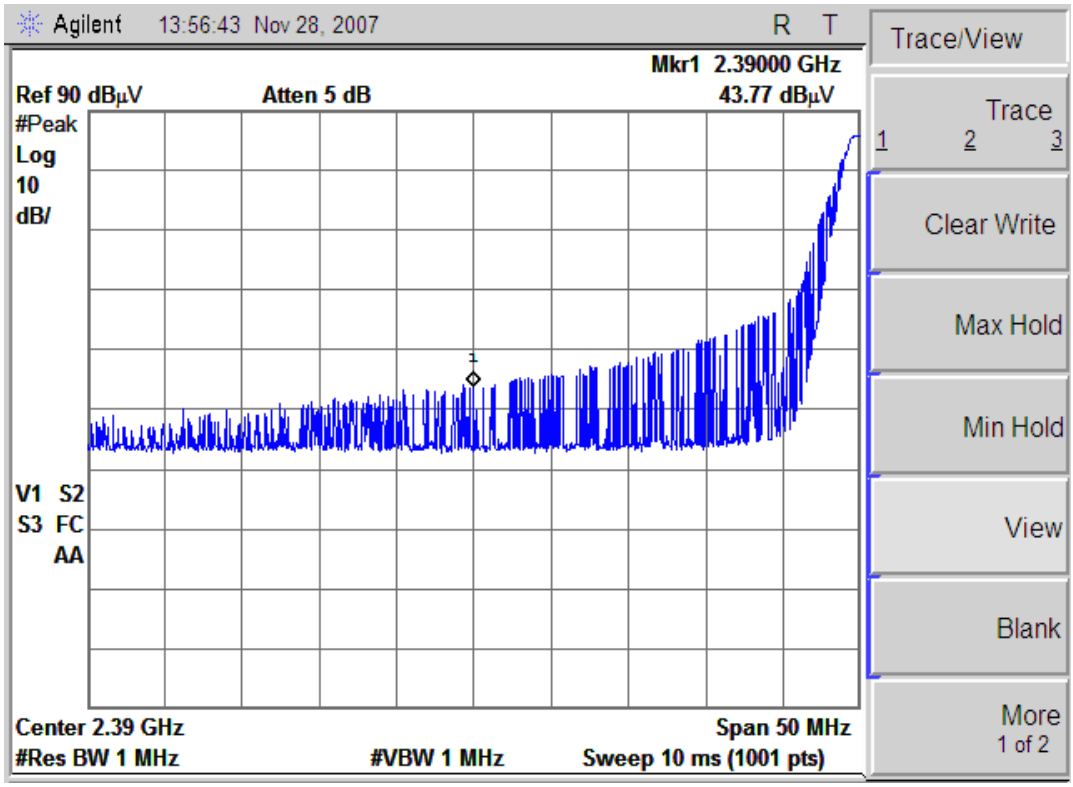


Figure 17: Low Band Band Edge Horizontal [Peak Detector Measurement]

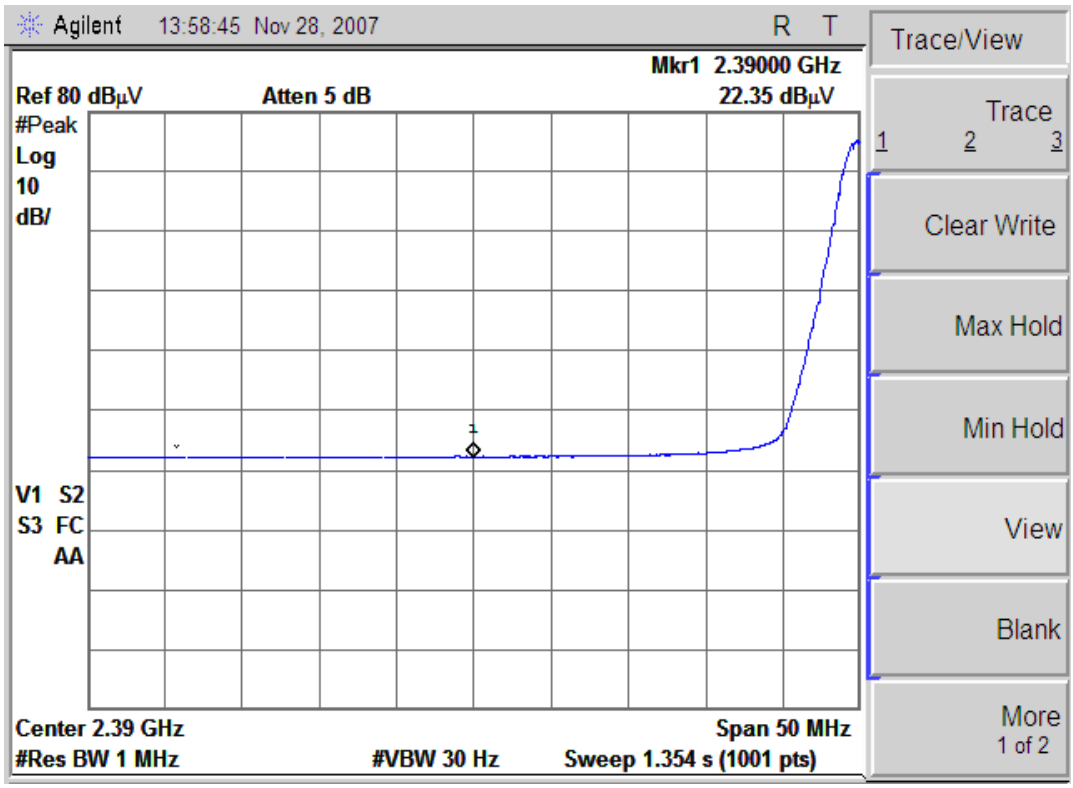


Figure 18: Low Band Band Edge Horizontal [Average Detector Measurement]

- Continued -

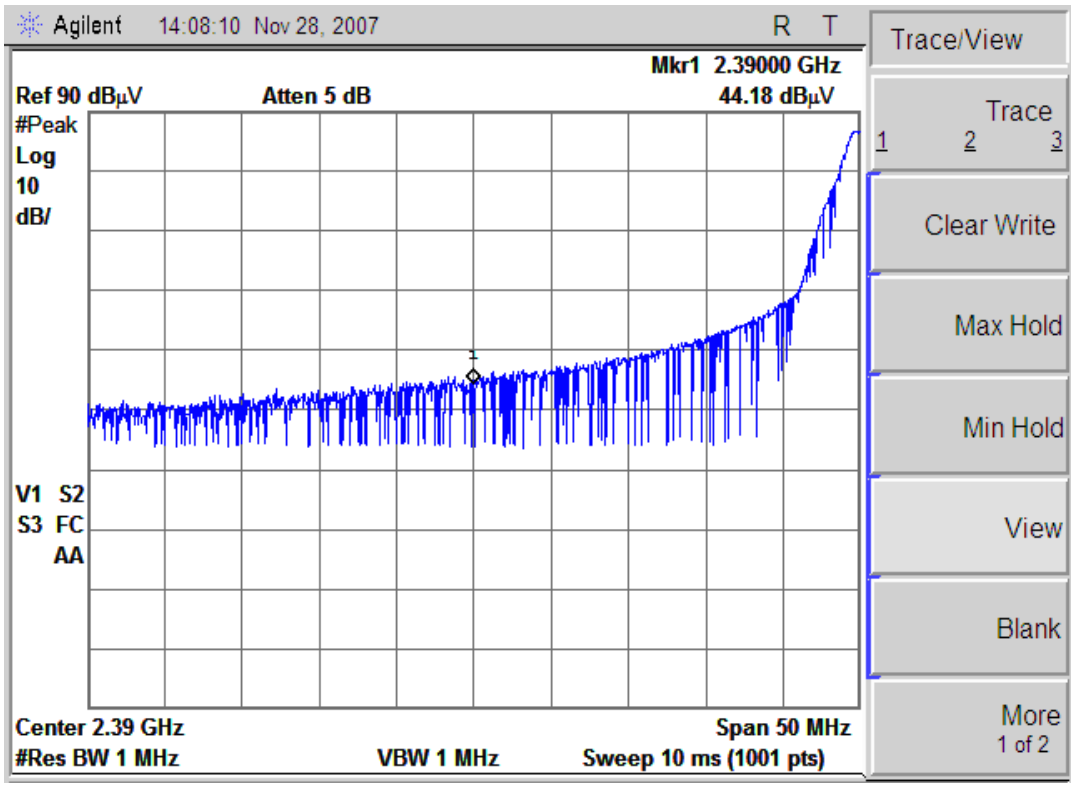


Figure 19: Low Band Band Edge Vertical [Peak Detector Measurement]

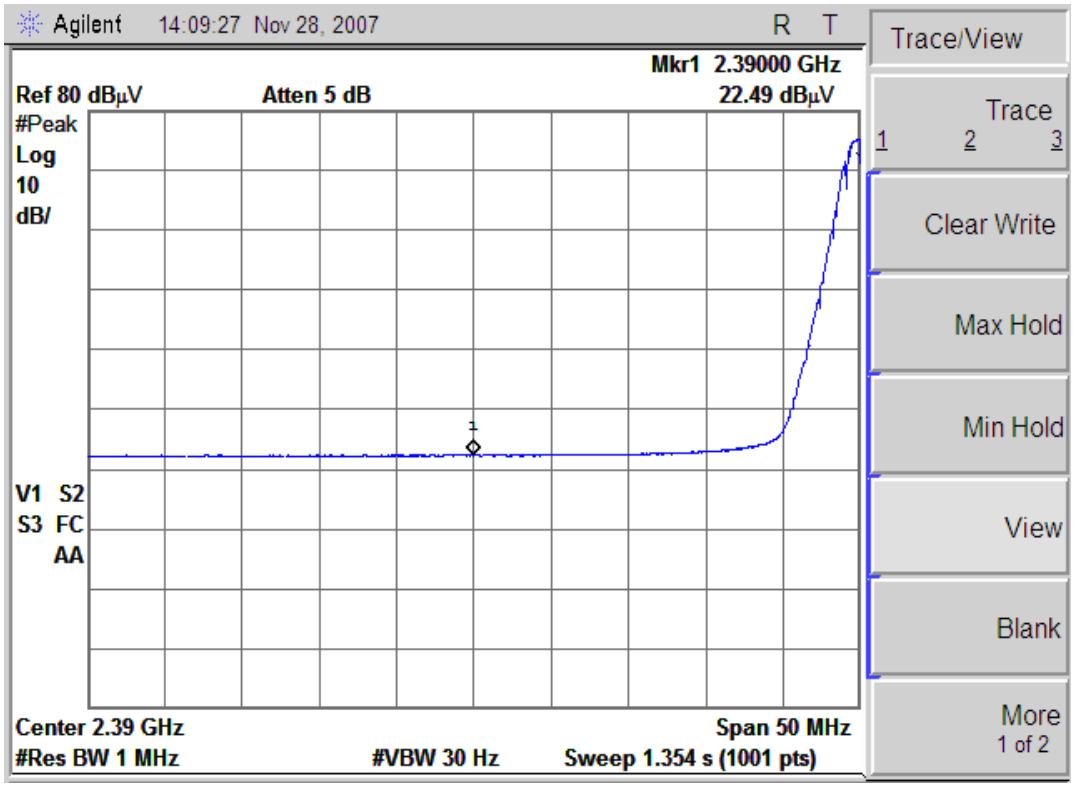


Figure 20: Low Band Band Edge Vertical [Average Detector Measurement]

- Continued -

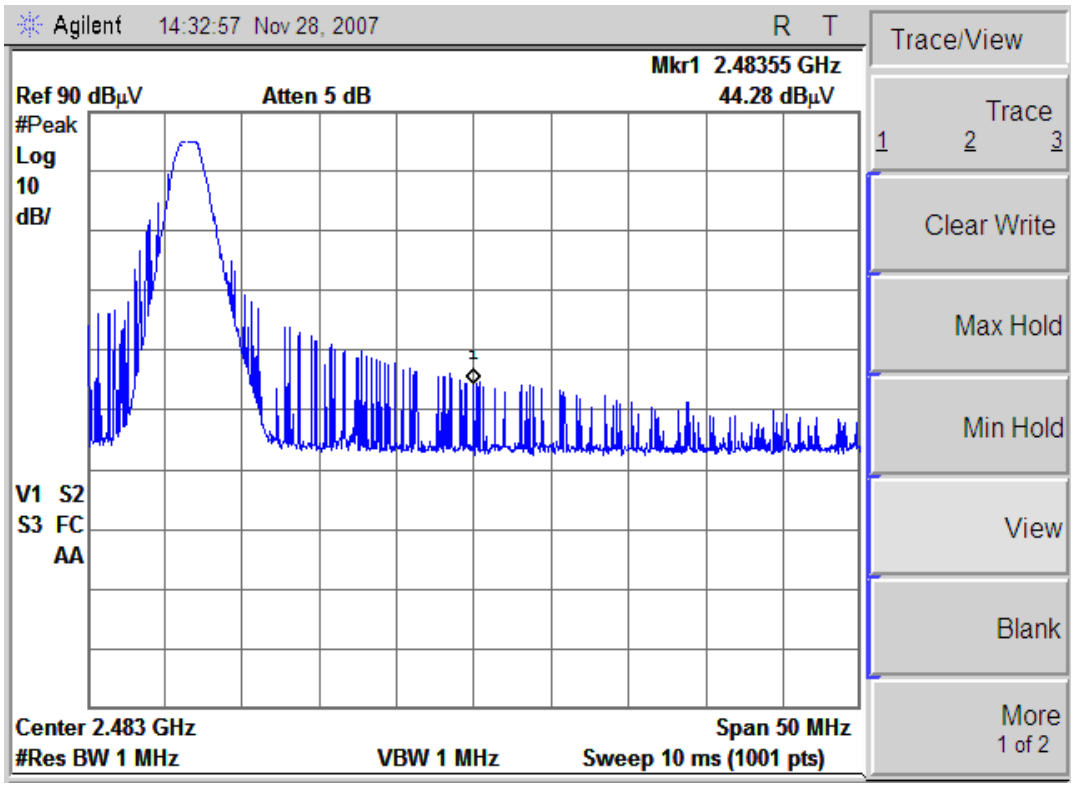


Figure 21: High Band Band Edge Horizontal [Peak Detector Measurement]

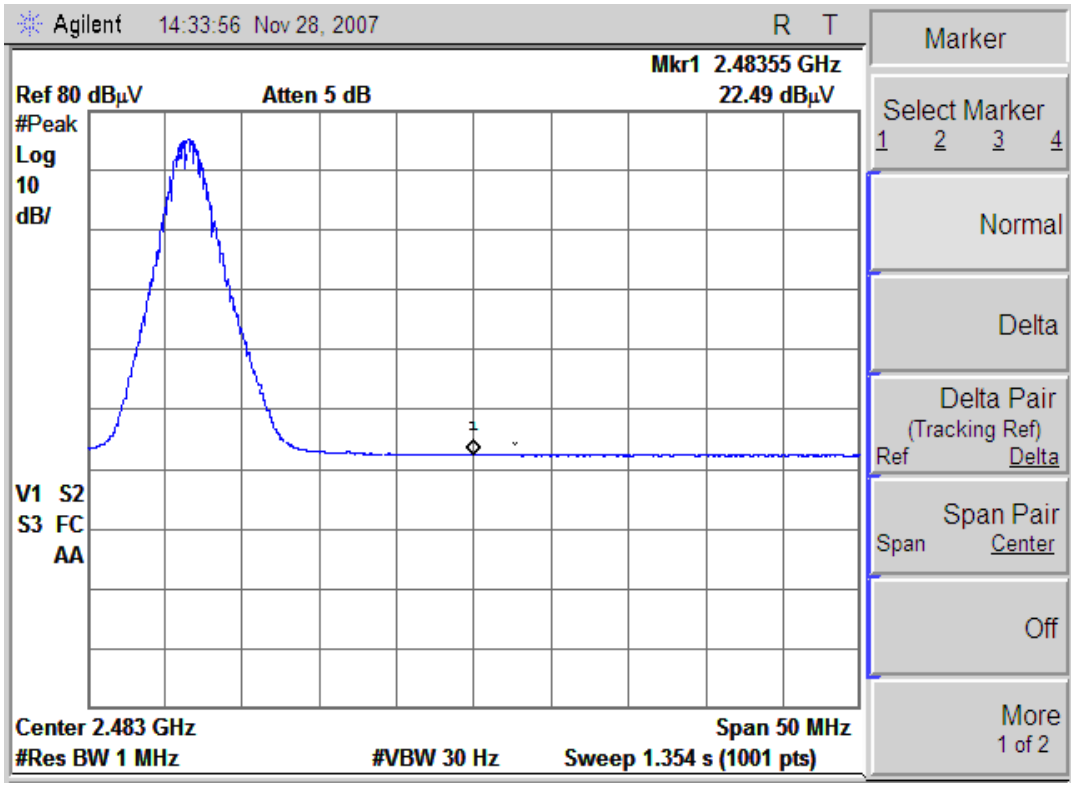


Figure 22: High Band Band Edge Horizontal [Average Detector Measurement]

- Continued -

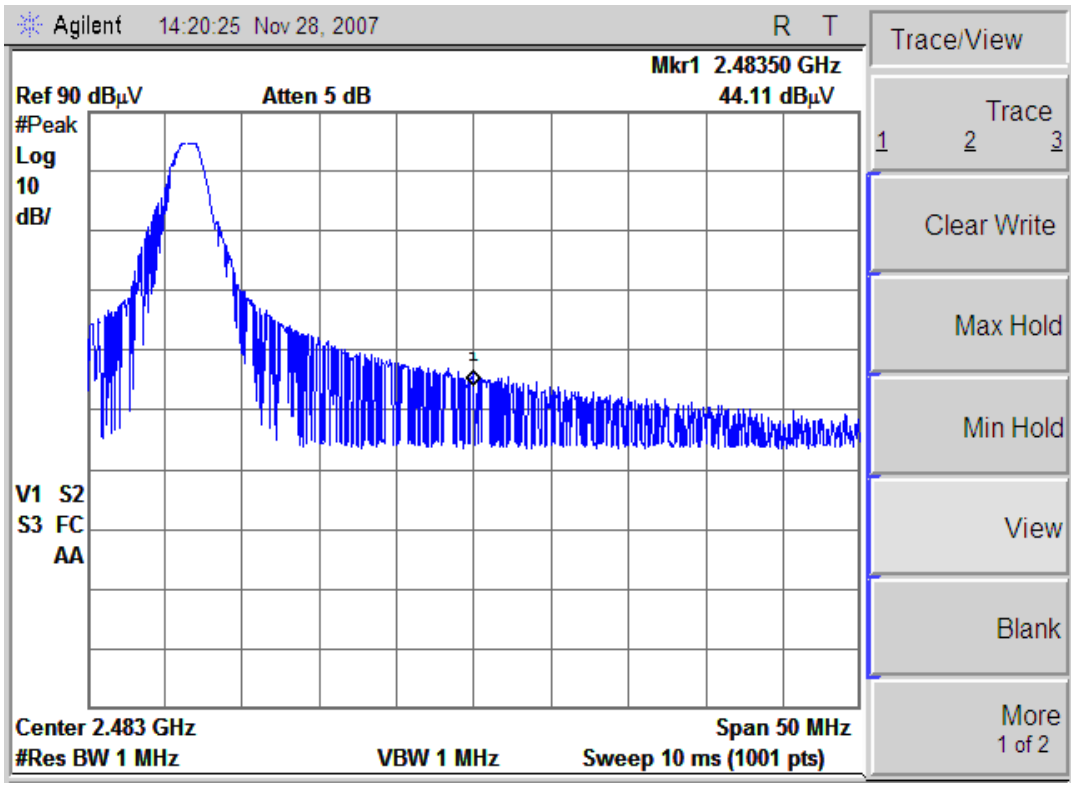


Figure 23: High Band Band Edge Vertical [Peak Detector Measurement]

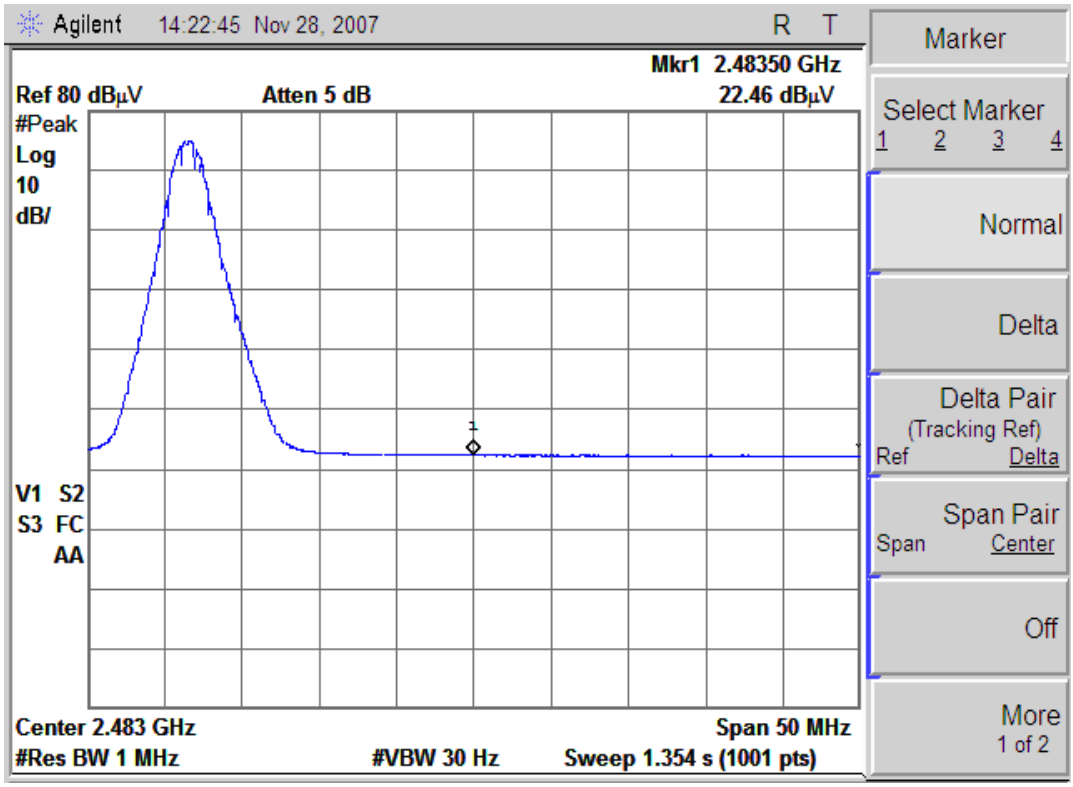


Figure 24: High Band Band Edge Vertical [Average Detector Measurement]

11. CALCULATION OF MAXIMUM PERMISSIBLE EXPOSURE

The maximum measured power output is 87,10 mW (19,40 dBm), the maximum antenna gain is +1.9 dBi = numeric gain 1,55 (see 20 page).

The maximum permissible exposure is defined in 47 CFR 1.1310 with 1 mW/cm².

The Transmitter is using indoor antennas that operate at 20 cm or more from nearby persons.

The maximum permitted level is calculated using the general equation:

$$S = P*G / 4\pi R^2$$

P =87,10 mW,
G = 1,55 (numeric gain; +1.9 dBi = linear power gain relative to the isotropic radiator),
R = 20 cm
π = 3,1416

Solving for S, the power density at 20 cm is 0,0269 mW/cm².
So the 1 mW/cm² limit is kept.

12. USED TEST EQUIPMENTS AND CALIBRATION STATUS

KEC No.	Equipment	Manufacturer	Model No.	Last Cal.	Next Cal.
SA-039	Spectrum Analyzer	Agilent Technologies	8564E	2007/04	2008/04
SA-052		Agilent Technologies	E4446A	2007/09	2008/09
SA-048		Agilent Technologies	E4404B	2007/06	2008/06
FS-062	Test Receiver	Rhode & Schwarz	ESS	2007/05	2008/05
AM-052	Pre-Amplifier	Hewlett Packard	8449B	2007/02	2008/02
AM-098			SONOMA 310N	2007/10	2008/10
AM-097		MITEQ	MLA-100M08-B02-33	2007/12	2008/12
AN-307	Biconical Antenna	Schwarzbeck	VHBB9124	2007/08	2008/02
AN-220	LPDA Antenna	Schwarzbeck	UHALP 9108A	2006/02	2009/02
AN-135	Tuned Dipole Antenna	Kyoritsu	KBA-511AS	2005/02	2008/03
AN-137			KBA-611S	2005/02	2008/03
AN-211	Standard Gain Horn Antenna	Raven	91888-2	2007/12	2009/12
AN-212			91889-2	2007/12	2009/12
AN-142		Scientific Atlanta	12-3.9	2007/12	2009/12
AN-104			12-5.8	2007/12	2009/12
AN-210			12-8.2	2007/12	2009/12
AN-145			12-12.0	2007/12	2009/12
AN-200			12-18.0	2007/12	2009/12
AN-299	DRG Horn Antenna	Schwarzbeck	BBHA9120LF(A)	2007/02	2009/02
AT-040-3	Precision Attenuator	Hewlett Packard	HP33340C010	2007/01	2008/01
AT-040-4			HP33340C020	2007/01	2008/01
FL-174	Band Eliminate Filter	MICRO -TRONICS	BRM12294	2007/11	2008/11
CL-041	Coaxial Cable	SUHNER	SUCOFLEX	2007/03	2008/03
CL-047				2007/03	2008/03
CL-621				2007/02	2008/02
CL-619				2007/02	2008/02

Note : We check the performance, before using this device.

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