

TEST REPORT

Report number: Z071C-09061

Issue Date: June 26, 2009

The device, as described herewith, was tested pursuant to applicable test procedure indicated below and complies with the requirements of;

FCC Part15 Subpart C / IC RSS-210

The test results are traceable to the international or national standards.

Applicant	: Seiko Instruments Inc. 8, Nakase 1-chome, Mihama-ku, Chiba-shi, Chiba 261-8507 Japan Phone: +81-43-211-7683 Fax: +81-43-211-8055
Equipment under test (EUT)	: Thermal Printer
FCC ID	: C4ZAB000003
IC Certification Number	: 4445A-AB000003
Model Number	: DPU-S245
Serial Number	: 1000001A, 1000003A
EUT Condition	: Pre-production

Test procedure	: ANSI C63.4-2003
Date of test	: June 3-5, 8, 26, 2009
Test place	: 3m Semi-anechoic chamber, OATS, Shielded room
Test results	: Complied

Zacta Technology Corporation certifies that no party to the application is subject to a denial of federal benefits that include FCC benefits, pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 853(a).

The results in this report are applicable only to the samples tested.

This report shall not be re-produced except in full without the written approval of ZACTA Technology Corporation.

This test report must not be used by client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

Tested by:

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NVLAP[®]
NVLAP LAB CODE 200306-0

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1. Summary of Test

1.1 Purpose of test

It is the original test in order to verify conformance to standards listed in section 1.2.

1.2 Standards

CFR47 FCC Part 15 Subpart C, RSS-210

1.3 Summary of test results

Table-A presents the list of the measurement items for Spread Spectrum, Frequency hopping devices under FCC Part 15 Subpart C and Industry Canada RSS-210 Issue 7.

Table-A: List of the measurements

Test Items Section	Test Items	Condition	Result
	Transmit mode [Tx]:		
15.247(a)(1) RSS-210 A8.1(a)	Occupied Bandwidth (20dB Bandwidth)	Conducted	Pass
RSS-Gen 4.6.1	99% Occupied bandwidth	Conducted	Pass
15.247(a)(1) RSS-210 A8.1(b)	Carrier Frequency Separation	Conducted	Pass
15.247(a)(1)(iii) RSS-210 A8.1(d)	Number of Hopping Frequencies	Conducted	Pass
15.247(a)(1)(iii) RSS-210 A8.1(d)	Time of Occupancy (Dwell Time)	Conducted	Pass
15.247(b)(1) 15.31(e) RSS-210 A8.4(2)	Maximum Peak Output Power - Conducted -	Conducted	Pass
15.247(d) RSS-210 A8.5	Band Edge Compliance of RF Conducted Emissions	Conducted	Pass
15.247(d) RSS-210 A8.5 RSS-Gen 4.9, 4.10	Spurious Emissions	Conducted Radiated	Pass
15.247(d) 15.205 15.209 RSS-210 2.2	Restricted Bands of Operation	Radiated	Pass
15.247(e) RSS-210 A8.2(b)	Transmitter power spectral density	Conducted	Pass
15.207 RSS-Gen 7.2.2	AC Power Line Conducted Emissions 150kHz – 30MHz	Conducted	Pass

1.4 Deviation from the standard

None

1.5 Modification to the EUT by laboratory

None

2. Equipment description

2.1 General Description of equipment

EUT is Thermal Printer.

2.2 EUT information

No.	EUT	Company	Model No.	Serial No.	FCC ID/DoC	Comment
1	Thermal Printer	Seiko Instruments	DPU-S245	1000001A* 1000003A	C4ZAB000003	EUT *1
2	AC adapter for EUT	Seiko Instruments	PW-0904-W2-E	090413 No.1* 090413 No.3	-	Option
3	Battery Pack	Seiko Instruments	BP-L0715-A1-E	BP01A* BP03A	-	Option

*: Used for Conducted Emission only.

*1: Tested type: DPU-S245-01A-E

Max. frequency : 12MHz

Power ratings : DC 7.4V (Li-ion battery) 1500mAh
AC 100-240V 50/60Hz 4.0A
[Power supply for EUT in testing was AC 120V 60Hz for AC adapter.]

Size : (W) 83 x (D) 130 x (H) 45 mm

Type of equipment : Stand-alone

Environment : Indoor use

Thermal limitation : -10°C to 50°C

Operating mode : Tx mode, Standby / Rx mode, H print mode

Variation of the family model(s) : DPU-S245
(EUT is classification into the following Type Number.)
Type Number: DPU-S245-00X-E (Bluetooth-unsupported model)
Type Number: DPU-S245-01X-E (Bluetooth-supporting model)
'X' may be changed by difference of enclosure color or firmware.
DPU-S245-01A-E *Tested Type

[RF Specification]

Protocol : Bluetooth

Spread method : Frequency hopping spread spectrum (FHSS)

Communication method : TDD

Frequency Range : 2402MHz - 2480MHz

Number of FR Channels : 79 Channels

Modulation Method/Data rate : GFSK (1Mbps), $\pi/4$ -DQPSK (2Mbps), 8-DPSK (3Mbps)

Nominal Bit Rates : 1600hops/s

Channel Separation : 1MHz

Output power : 1.094mW

Antenna (Rx and Tx) : Chip antenna

Antenna gain : 2.0dBi

RF type : Transceiver

Intended use : Data transmission

RF emission type designator : 862KF1D (GFSK)
1M15G1D (8-DPSK)

2.3 Operating channels and frequencies

Channel	Frequency [MHz]	Channel	Frequency [MHz]	Channel	Frequency [MHz]
1	2402	28	2429	55	2456
2	2403	29	2430	56	2457
3	2404	30	2431	57	2458
4	2405	31	2432	58	2459
5	2406	32	2433	59	2460
6	2407	33	2434	60	2461
7	2408	34	2435	61	2462
8	2409	35	2436	62	2463
9	2410	36	2437	63	2464
10	2411	37	2438	64	2465
11	2412	38	2439	65	2466
12	2413	39	2440	66	2467
13	2414	40	2441	67	2468
14	2415	41	2442	68	2469
15	2416	42	2443	69	2470
16	2417	43	2444	70	2471
17	2418	44	2445	71	2472
18	2419	45	2446	72	2473
19	2420	46	2447	73	2474
20	2421	47	2448	74	2475
21	2422	48	2449	75	2476
22	2423	49	2450	76	2477
23	2424	50	2451	77	2478
24	2425	51	2452	78	2479
25	2426	52	2453	79	2480
26	2427	53	2454		
27	2428	54	2455		

2.4 Operating mode

【Tx mode】

- i) Bluetooth test program set up
- ii) Select a test mode
 - Operating frequency: No hopping (CH.1, 40, 79), Hopping
 - Packet type: DH1, DH5, 3-DH5
- iii) Start test mode

Note: Tests were performed in DH5 and 3-DH5 which have the maximum bandwidth.

【Standby / Rx mode】

- i) Bluetooth test program set up
- ii) Select a test mode
 - Write Receive only
 - Operating frequency: No hopping (CH.1, 40, 79)
- iii) Start test mode

【H print mode】

- i) “H” characters data are sent to EUT from Pocket PC.
- ii) Print “H” characters.
- iii) i) and ii) is repeated.

3. Configuration information

3.1 Peripheral(s) used

No.	Equipment	Company	Model No.	Serial No.	FCC ID/DoC	Comment
4	Personal Computer (PC)	lenovo	ThinkPad R30 Type 2656	1465	DoC	-
5	AC adapter for PC	lenovo	02K6746 AA21131	N/A	-	-
6	Pocket PC	Toshiba	CET0101A	1725	DoC	*
7	Cradle	Toshiba	CEX0108A	012124523A1	-	*
8	Bluetooth card	Toshiba	SD-BT00U	0002C709C387	CJ6SD00UBT	*
9	AC adapter for Pocket PC	Toshiba	CEX0107A	0052628	-	*

*: Used for AC power line Conducted emissions test only.

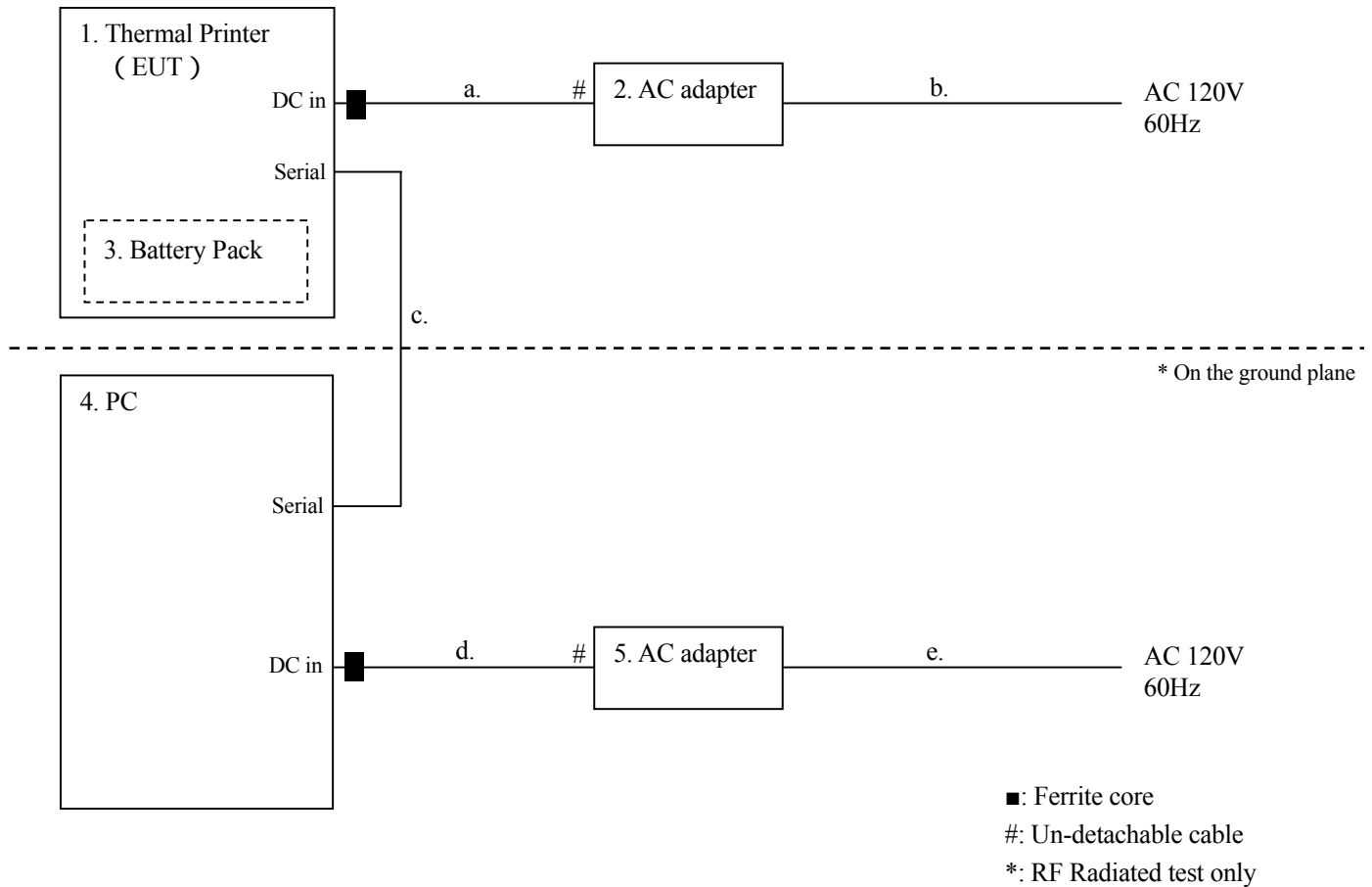
3.2 Cable(s) information

No.	Cable	Length [m]	Shield	Connector	Comment
a	DC cable for EUT AC adapter	1.5	No	Metal	Option
b	AC Power cord for EUT AC adapter	1.9	No	Plastic	Option
c	Serial cable	1.9	Yes	Metal	Option
d	DC cable for PC AC adapter	1.8	No	Metal	-
e	AC Power cord for PC AC adapter	1.0	No	Plastic	-
f	USB cable	1.2	Yes	Metal	*
g	DC cable for Pocket PC	1.5	No	Metal	*
h	AC Power cord for Pocket PC AC adapter	0.5	No	Plastic	*

*: Used for AC power line Conducted emissions test only.

3.3 System configuration

[RF Conducted test / RF Radiated test]

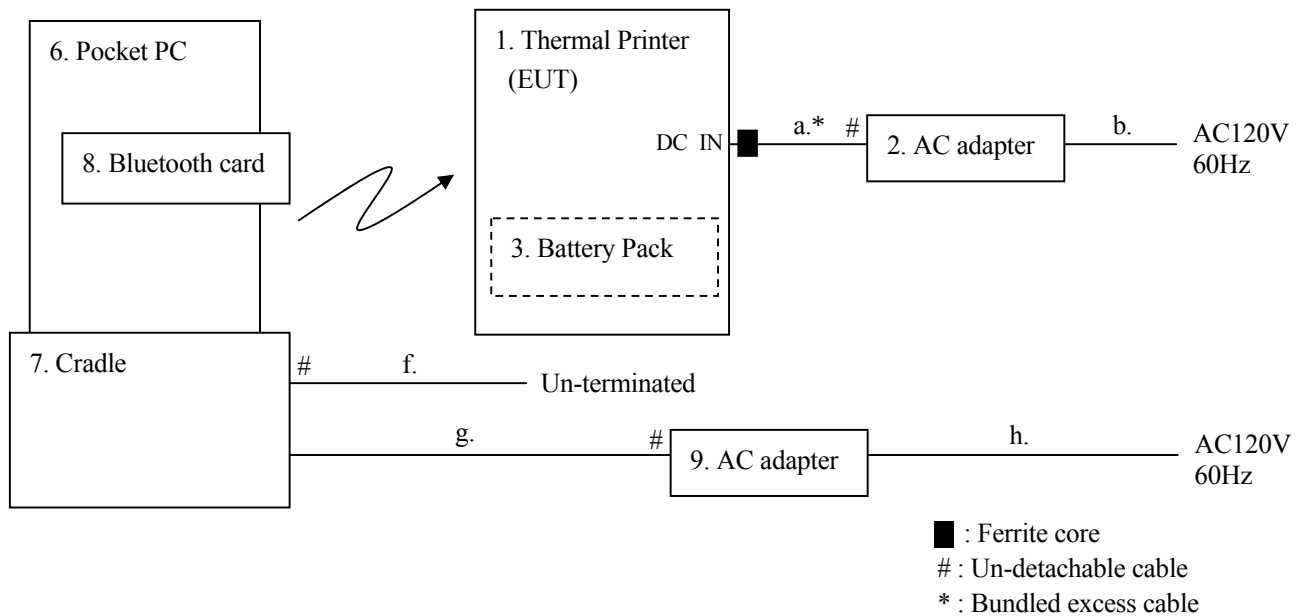


Note1: Numbers assigned to equipment or cables on this diagram are corresponded to the list in “2.2 EUT information”, “3.1 Peripheral(s) used and “3.2 Cable(s) information”.

Note2: DC cable (No.a) with one ferrite core is accessory for AC adapter (No.2).

Note3: DC cable (No.d) with one ferrite core is accessory for AC adapter (No.5).

[Conducted emission test]



Note1: Numbers assigned to equipment or cables on this diagram correspond to the list in "2.2 EUT information", "3.1 Peripheral(s) used" and "3.2 Cable(s) used".

Note2: DC cable (No.a) with one ferrite core is accessory for AC adapter (No.2).

4. Test Instruments

List of Measuring Instruments

Equipment	Company	Model No.	Serial No.	Cal. due	Cal. date
Spectrum Analyzer (3Hz – 42.98GHz)	Agilent Technologies	E4447A	MY46180188	Feb. 2010	Feb. 27, 2009
Preamplifier (100kHz-1.2GHz)	ANRITSU	MH648A	M96057	Jun. 2009	Jun. 14, 2008
Preamplifier (1GHz-26.5GHz)	Agilent Technologies	8449B	3008A00589	Nov. 2009	Nov. 5, 2008
Preamplifier (1GHz-26.5GHz)	Agilent Technologies	8449B	3008A01008	Dec. 2009	Dec. 11, 2007
EMI Receiver	ROHDE&SCHWARZ	ESCI	100765	May. 2010	May. 27, 2009
EMI Receiver	ROHDE&SCHWARZ	ESCI	100451	May. 2010	May. 20, 2009
Loop antenna	ROHDE&SCHWARZ	HFH2-Z2	891847/17	Feb. 2010	Feb. 12, 2009
Coaxial cable	N/A	RG213	N/A	Feb. 2010	Feb. 12, 2009
TRILOG Antenna	Schwarzbeck	VULB9160	9160-3221	Apr. 2010	Apr. 13, 2009
Attenuator (6dB)	TDC	TAT-43B-06	N/A	Aug. 2009	Aug. 8, 2008
Double Ridged Guide Antenna	EMCO	3115	9408-4327	Sep. 2009	Sep. 26, 2008
Double Ridged Guide Antenna	EMCO	3115	4328	Dec. 2010	Dec. 10, 2008
Microwave cable	STORM	MFR-57500	90-660-591 (15m)	Dec. 2009	Dec. 11, 2008
	SUHNER	SUCOFLEX 104	199119/4 (1m)	Dec. 2009	Dec. 11, 2008
Microwave cable	SUHNER	SUCOFLEX 106	60929/6 (15m)	Nov. 2009	Nov. 12, 2008
	SUHNER	SUCOFLEX 106	60959/6 (1m)	Nov. 2009	Nov. 12, 2008
Coaxial cable	Fujikura	5D-2W/10m	#AEC3R-001	Feb. 2010	Feb. 5, 2009
		5D-2W/1.5m	#AEC3R-003	Feb. 2010	Feb. 5, 2009
		5D-2W/1m	#AEC3R-004	Feb. 2010	Feb. 5, 2009
		SUCOFLEX_106/7m	#AEC3R-002	Feb. 2010	Feb. 5, 2009
Coaxial cable	Fujikura	8D-2W/15m	OATS#3C	May. 2010	May. 29, 2009
		5D-2W/1m	OATS#3RC-001	May. 2010	May. 29, 2009
Microwave cable	SUHNER	SUCOFLEX104	199511/4	Nov. 2009	Nov. 12, 2008
Attenuator	Weinschel	56-10	J4180	Nov. 2009	Nov. 12, 2008
Line impedance stabilization network for EUT	Kyoritsu Electrical Works, Ltd.	KNW-407	8-693-20	Mar. 2010	Mar. 13, 2009
Line impedance stabilization network for EUT	Kyoritsu Electrical Works, Ltd.	KNW-242C	8-1094-5	Mar. 2010	Mar. 13, 2009
Transient limiter	Agilent Technologies	11947A	3107A03923	Jan. 2010	Jan. 7, 2009
PC	DELL	DIMENSION E521	85465BX	N/A	N/A
PC	IBM	6892-44J	97-43012	N/A	N/A
Software	TOYO Corporation	EP5/RE-AJ	0611193/V3.4	N/A	N/A
Site attenuation	ZACTA Technology	3m Semi-anechoic chamber	5192Z	May. 2010	May. 18, 2009

*The calibrations of the above equipment are traceable to NIST or equivalent standards of the reference organizations.

5. Test Type and Results

5.1 20dB Bandwidth / Occupied Bandwidth

5.1.1 Test Procedure [FCC 15.247(a)(1), IC RSS-210 A8.1(a)]

The bandwidth at 20 dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to:

- RBW=30kHz, VBW=300kHz, Span=3MHz, Sweep=auto

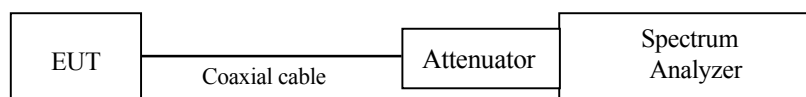
The EUT was set to operate with following conditions.

- No hopping [ch 1 (low), ch 40 (mid) and ch 79 (high)]

The test mode of EUT is as follows.

- Tx mode

5.1.2 Measurement Setup



5.1.3 Limit of Bandwidth at 20 dB below

None

5.1.4 Measurement Result

Channel	Packet type	Center Frequency [MHz]	20dB Bandwidth [MHz]	Occupied Bandwidth [MHz]
1	DH5	2402.0	0.939	0.862
	3-DH5	2402.0	1.274	1.153
40	DH5	2441.0	0.937	0.859
	3-DH5	2441.0	1.262	1.148
79	DH5	2480.0	0.938	0.861
	3-DH5	2480.0	1.262	1.147

5.1.5 Trace Data

Test Personnel:

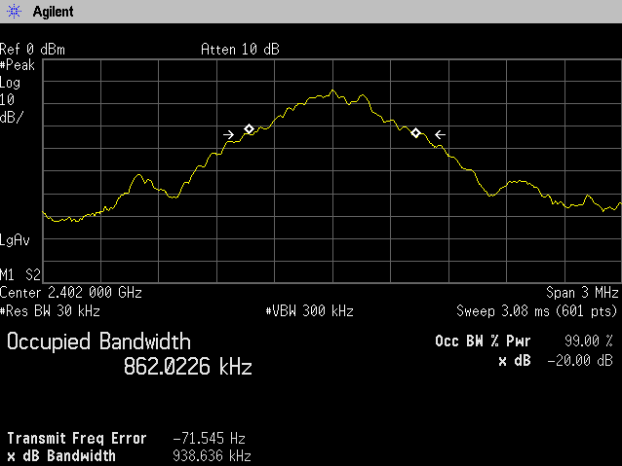
Tested by: Hiroaki Suzuki

Date : Jun. 5, 2009
 Temperature : 21.0 [°C]
 Humidity : 68.0 [%]
 Test place : Shielded room

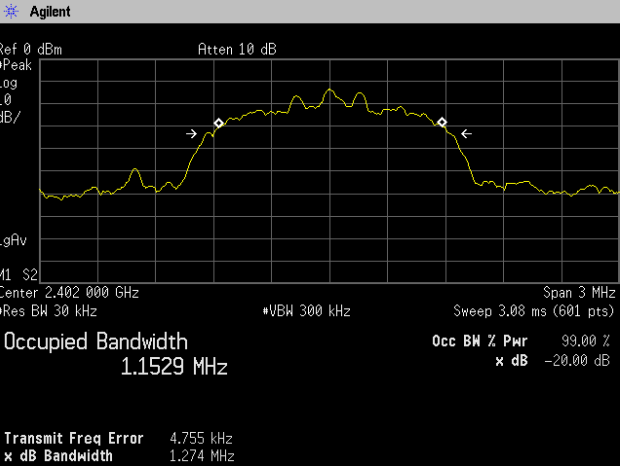
20dB Bandwidth/Occupied Bandwidth

Channel Low: 2402.0MHz [Channel 1]

DH5

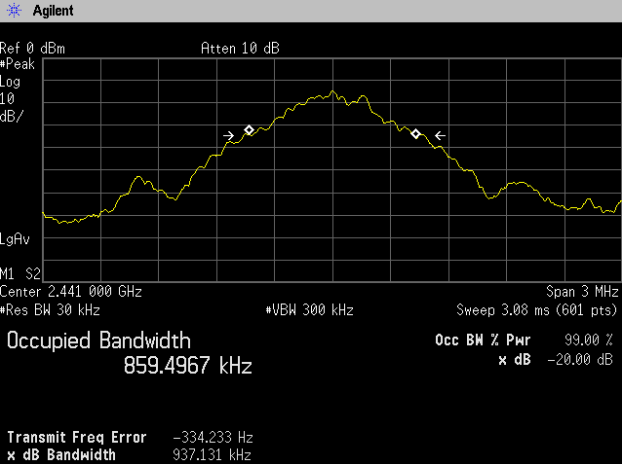


3-DH5

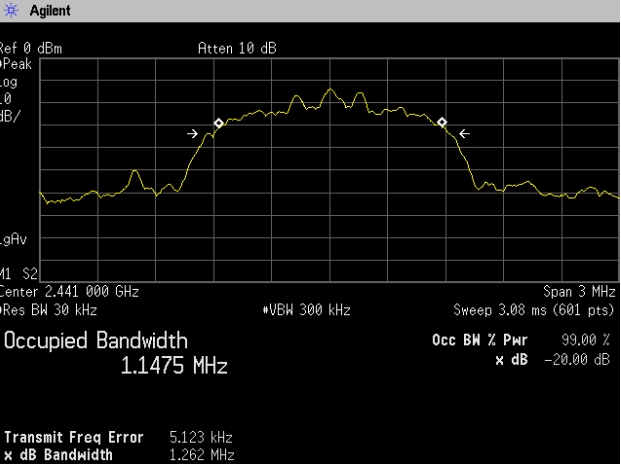


Channel Middle: 2441.0MHz [Channel 40]

DH5

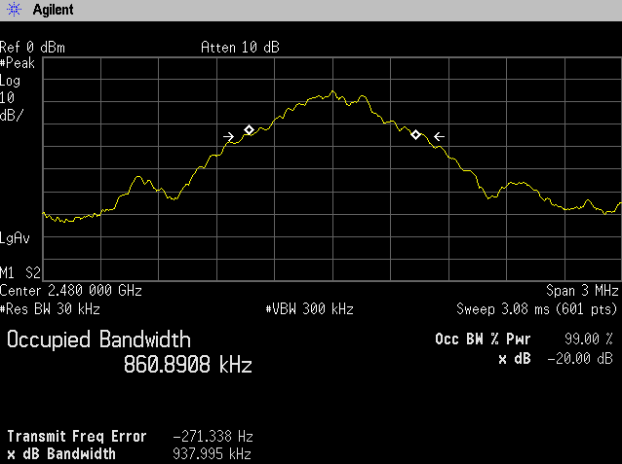


3-DH5

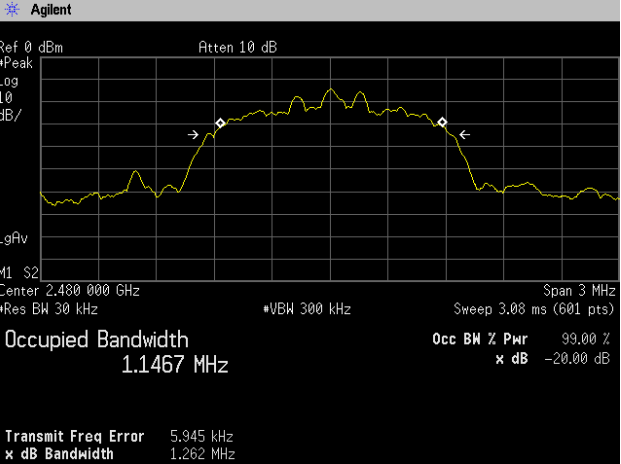


Channel High: 2480.0MHz [Channel 79]

DH5



3-DH5



5.2 Carrier Frequency Separation

5.2.1 Test Procedure [FCC 15.247(a)(1), IC RSS-210 A8.1(b)]

The adjacent channel interval is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to:

- RBW=30kHz, VBW=30kHz, Span=3MHz, Sweep=auto

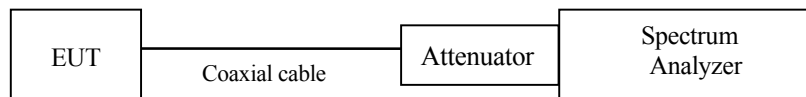
The EUT was set to operate with following conditions.

- Hopping [ch 40 (mid)]

The test mode of EUT is as follows.

- Tx mode

5.2.2 Measurement Setup



5.2.3 Limit of Carrier Frequency Separation

Systems shall have hopping channel carrier frequencies separated by a minimum of; 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

5.2.4 Measurement Result

Packet type	Channel Separation [MHz]	Limit [MHz]	PASS / FAIL
DH5	1.005	>two-thirds of the 20dB Bandwidth =625kHz	PASS
3-DH5	1.005	>two-thirds of the 20dB Bandwidth =841kHz	PASS

5.2.5 Trace Data

Test Personnel:

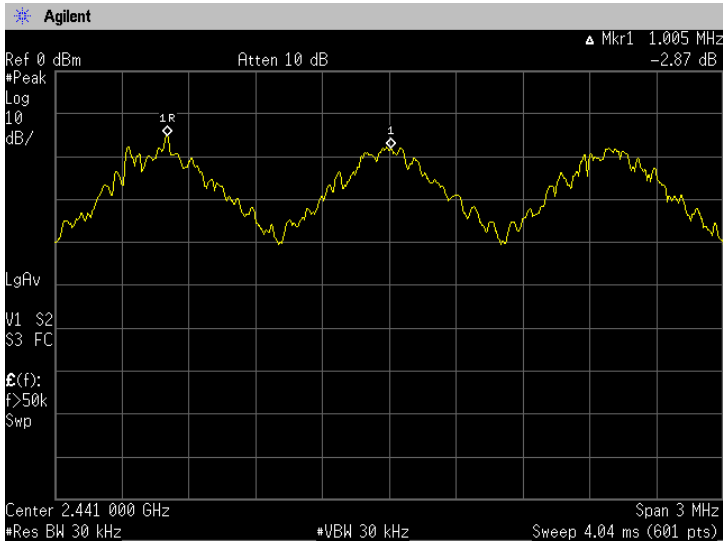
Tested by: Hiroaki Suzuki

Date : Jun. 8, 2009
 Temperature : 21.0 [°C]
 Humidity : 68.0 [%]
 Test place : Shielded room

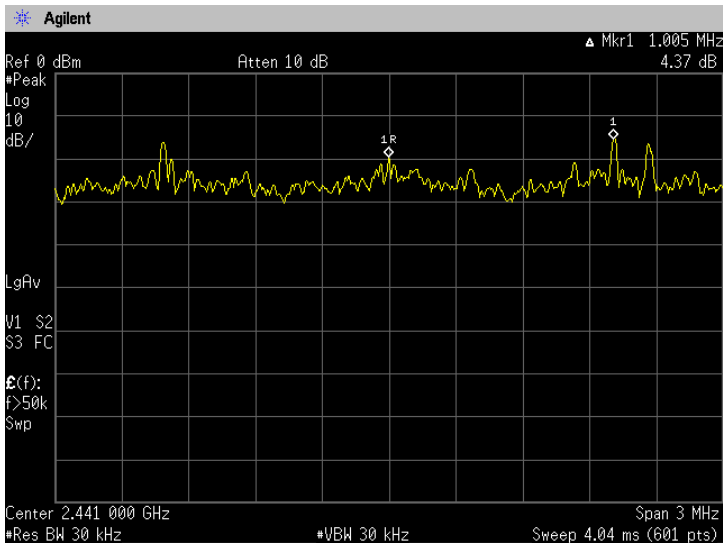
Carrier Frequency Separation

Channel Middle: 2441.0MHz [Channel 40]

DH5



3-DH5



5.3 Number of Hopping Frequencies

5.3.1 Test Procedure [FCC 15.247(a)(1)(iii), IC RSS-210 A8.1(d)]

The number of hopping channels is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to:

- RBW=100kHz, VBW=300kHz, Span=Arbitrary setting, Sweep=auto

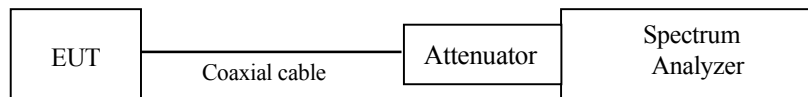
The EUT was set to operate with following conditions.

- Hopping

The test mode of EUT is as follows.

- Tx mode

5.3.2 Measurement Setup



5.3.3 Limit of Number of Hopping Frequencies

Shall have more than 15 channels.

5.3.4 Measurement Result

Number of channels	Limit	PASS / FAIL
79	15 channel	PASS

5.3.5 Trace Data

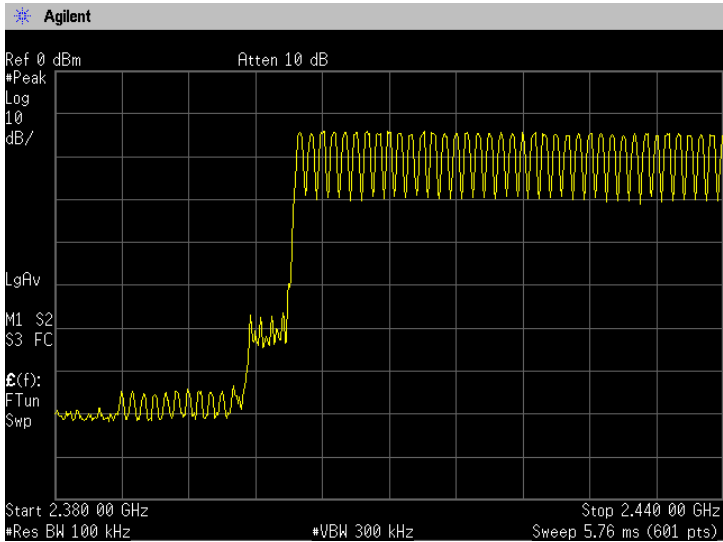
Test Personnel:

Tested by: Hiroaki Suzuki

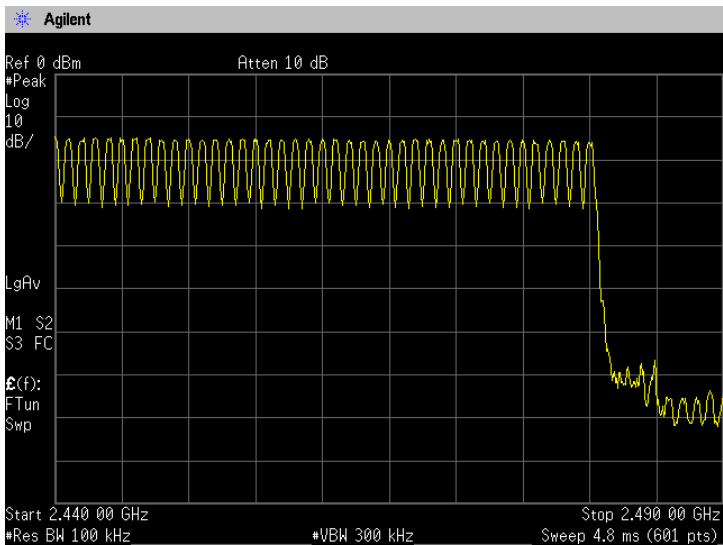
Date : Jun. 8, 2009
Temperature : 21.0 [°C]
Humidity : 68.0 [%]
Test place : Shielded room

Number of Hopping Frequencies

Low



High



5.4 Time of Occupancy (Dwell Time)

5.4.1 Test Procedure [FCC 15.247(a)(1)(iii), IC RSS-210 A8.1(d)]

The time occupancy of hopping channel is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to:

- RBW=1MHz, VBW=1MHz, Span=0MHz, Sweep=5ms, 10ms

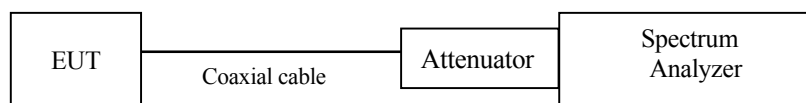
The EUT was set to operate with following conditions.

- Hopping [ch 1 (low), ch 40 (mid) and ch 79 (high)]

The test mode of EUT is as follows.

- Tx mode

5.4.2 Measurement Setup



5.4.3 Limit of Time of Occupancy (Dwell Time)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

5.4.4 Measurement Result

Channel	Frequency [MHz]	Packet type	Dwell Time [ms]	Occupancy time of 31.6 seconds [s]	Limit	PASS / FAIL
1	2402.0	DH1	0.383	0.123	< 0.4 s	PASS
		DH5	2.900	0.309		PASS
		3-DH5	2.917	0.311		PASS
40	2441.0	DH1	0.383	0.123		PASS
		DH5	2.900	0.309		PASS
		3-DH5	2.917	0.311		PASS
79	2480.0	DH1	0.375	0.120		PASS
		DH5	2.883	0.308		PASS
		3-DH5	2.900	0.309		PASS

The hopping rates of Bluetooth devices change with different types of payload. The longer the payload is, the slower the hopping rate. The hopping rate scenario is defined in Bluetooth core specification.

Calculation:

Occupancy time of 31.6 seconds * = time domain slot length x hop rate / number of hopper channel / 79 x 31.6

EX.) For Ch. 1, DH1 = 0.383 ms x 1600 / 2 / 79 x 31.6 = 123.0 ms

5.4.5 Trace Data

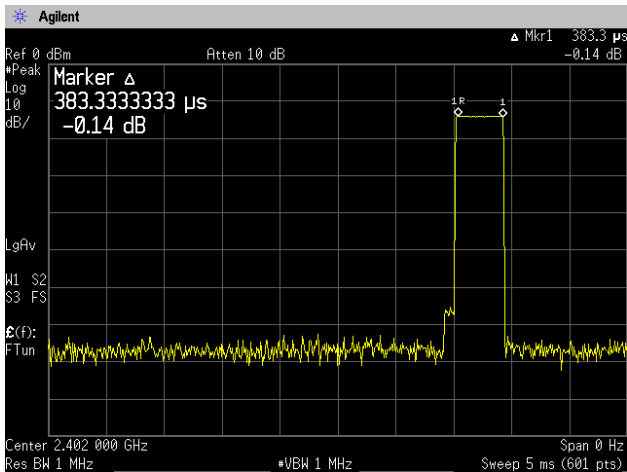
Test Personnel:

Tested by: Hiroaki Suzuki

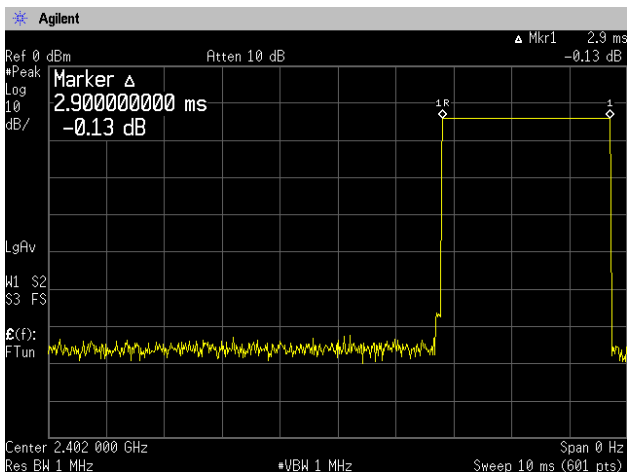
Date : Jun. 8, 2009
Temperature : 21.0 [°C]
Humidity : 68.0 [%]
Test place : Shielded room

Dwell Time

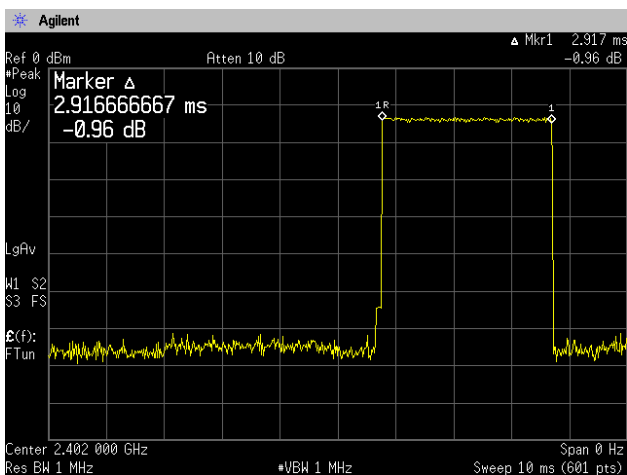
Channel Low: 2402.0MHz [Channel 1] DH1



Channel Low: 2402.0MHz [Channel 1] DH5

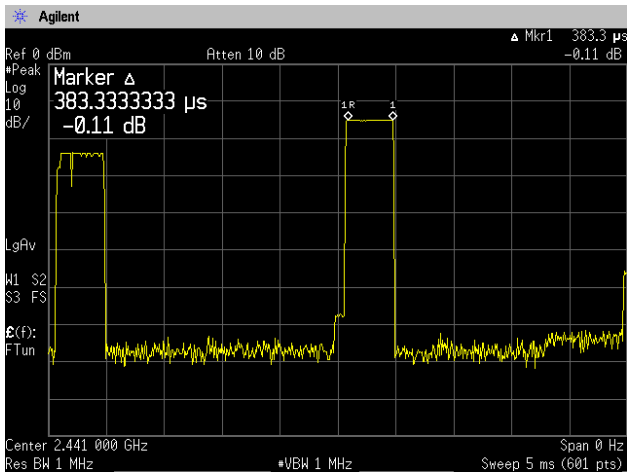


Channel Low: 2402.0MHz [Channel 1] 3-DH5

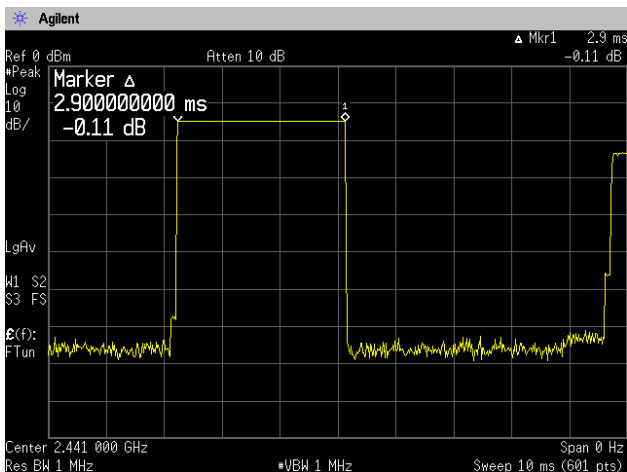


Dwell Time

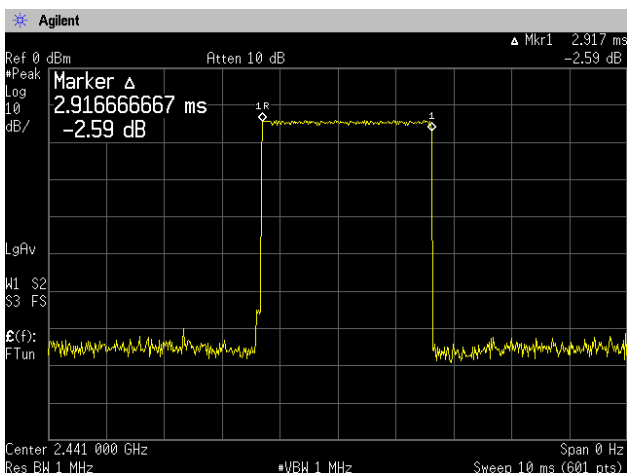
Channel Middle: 2441.0MHz [Channel 40] DH1



Channel Middle: 2441.0MHz [Channel 40] DH5

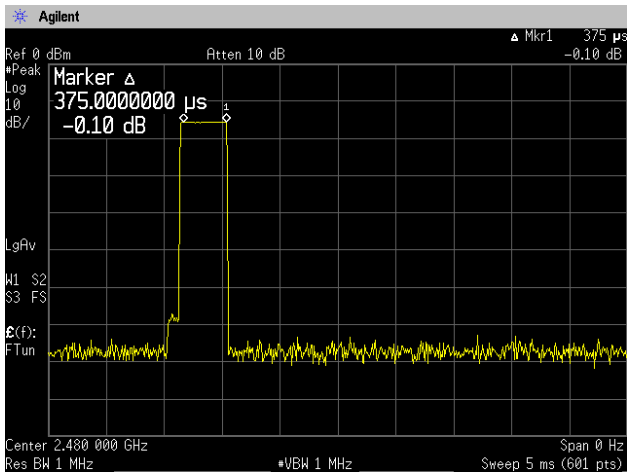


Channel Middle: 2441.0MHz [Channel 40] 3-DH5

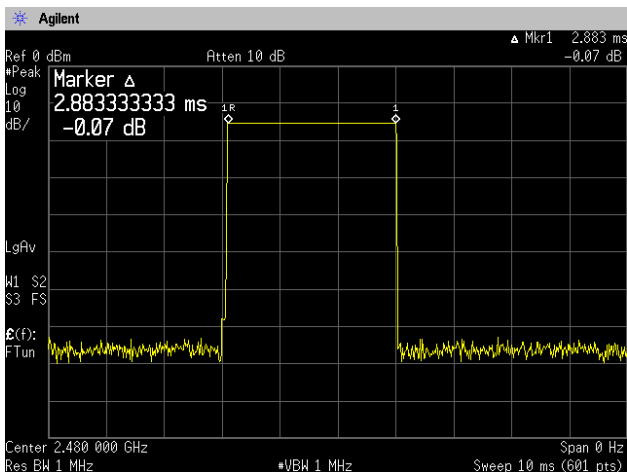


Dwell Time

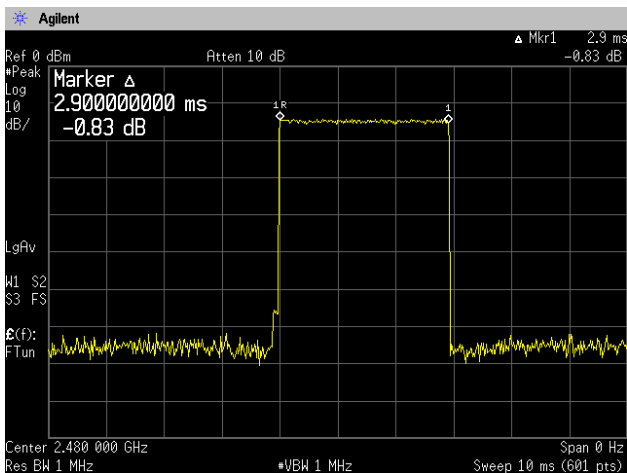
Channel High: 2480.0MHz [Channel 79] DH1



Channel High: 2480.0MHz [Channel 79] DH5



Channel High: 2480.0MHz [Channel 79] 3-DH5



5.5 Maximum Peak Output Power - Conducted -

5.5.1 Test Procedure [FCC 15.247(b)(1), 15.31(e), IC RSS-210 A8.4(2)]

The peak power is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to:

- RBW=3MHz, VBW=3MHz, Span=10MHz, Sweep=auto

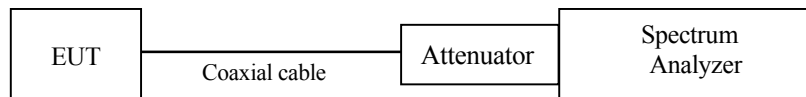
The EUT was set to operate with following conditions.

- No hopping [ch 1 (low), ch 40 (mid) and ch 79 (high)]

The test mode of EUT is as follows.

- Tx mode in Battery operation. (Full charge)

5.5.2 Test Instruments and Measurement Setup



5.5.3 Limit of Maximum Peak Output Power

0.125 watt or less.

5.5.4 Measurement Result

[Test mode in Battery operation (Full charge) DC 7.4V]

Channel	Center Frequency [MHz]	Packet type	Factor [dB]	Reading [dBm]	Antenna Gain of EUT [dBi]	Level [dBm]	Peak Output Power [mW]	Limit [mW]	PASS /FAIL
1	2402.0	DH5	10.66	-14.00	2.0	-1.34	0.735	125	PASS
		3-DH5	10.66	-12.39	2.0	0.27	1.064	125	PASS
40	2441.0	DH5	10.66	-14.70	2.0	-2.04	0.625	125	PASS
		3-DH5	10.66	-12.91	2.0	-0.25	0.944	125	PASS
79	2480.0	DH5	10.66	-15.32	2.0	-2.66	0.542	125	PASS
		3-DH5	10.66	-13.39	2.0	-0.73	0.845	125	PASS

Calculation:

$$\text{Reading (dBm)} + \text{Factor (dB)} + \text{Antenna Gain of EUT (dBi)} = \text{Level (dBm)}$$

$$10\log P = \text{Level (dBm)}$$

$$P = 10^{(\text{Maximum Peak Output Power (dBm)} / 10)} (\text{mW})$$

[Test mode in AC power operation AC 102V]

Channel	Center Frequency [MHz]	Packet type	Factor [dB]	Reading [dBm]	Antenna Gain of EUT [dBi]	Level [dBm]	Peak Output Power [mW]	Limit [mW]	PASS /FAIL
1	2402.0	DH5	10.66	-13.85	2.0	-1.19	0.760	125	PASS
		3-DH5	10.66	-12.38	2.0	0.28	1.067	125	PASS
40	2441.0	DH5	10.66	-14.68	2.0	-2.02	0.628	125	PASS
		3-DH5	10.66	-12.91	2.0	-0.25	0.944	125	PASS
79	2480.0	DH5	10.66	-15.07	2.0	-2.41	0.574	125	PASS
		3-DH5	10.66	-13.35	2.0	-0.69	0.853	125	PASS

[Test mode in AC power operation AC 120V]

Channel	Center Frequency [MHz]	Packet type	Factor [dB]	Reading [dBm]	Antenna Gain of EUT [dBi]	Level [dBm]	Peak Output Power [mW]	Limit [mW]	PASS /FAIL
1	2402.0	DH5	10.66	-13.97	2.0	-1.31	0.740	125	PASS
		3-DH5	10.66	-12.37	2.0	0.29	1.069	125	PASS
40	2441.0	DH5	10.66	-14.53	2.0	-1.87	0.650	125	PASS
		3-DH5	10.66	-12.96	2.0	-0.30	0.933	125	PASS
79	2480.0	DH5	10.66	-15.02	2.0	-2.36	0.581	125	PASS
		3-DH5	10.66	-13.33	2.0	-0.67	0.857	125	PASS

[Test mode in AC power operation AC 138V]

Channel	Center Frequency [MHz]	Packet type	Factor [dB]	Reading [dBm]	Antenna Gain of EUT [dBi]	Level [dBm]	Peak Output Power [mW]	Limit [mW]	PASS /FAIL
1	2402.0	DH5	10.66	-13.84	2.0	-1.18	0.762	125	PASS
		3-DH5	10.66	-12.27	2.0	0.39	1.094	125	PASS
40	2441.0	DH5	10.66	-14.57	2.0	-1.91	0.644	125	PASS
		3-DH5	10.66	-12.87	2.0	-0.21	0.953	125	PASS
79	2480.0	DH5	10.66	-15.10	2.0	-2.44	0.570	125	PASS
		3-DH5	10.66	-13.28	2.0	-0.62	0.867	125	PASS

Calculation :

Reading (dBm) + Factor (dB) + Antenna Gain of EUT (dBi) = Level (dBm)

$10\log P = \text{Level (dBm)}$

$P = 10^{(\text{Maximum Peak Output Power (dBm)} / 10)} (\text{mW})$

5.5.5 Trace Data

Test Personnel:

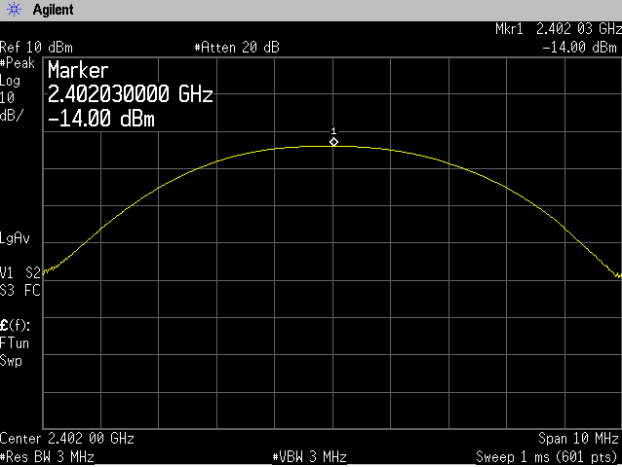
Tested by: Hiroaki Suzuki

Date : Jun. 5, 2009
Temperature : 22.0 [°C]
Humidity : 62.0 [%]
Test place : Shielded room

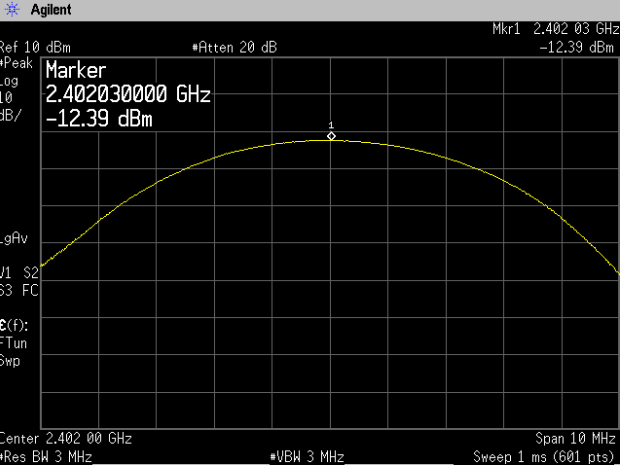
Maximum Peak Output Power - Conducted - [Full charge]

Channel Low: 2402.0MHz [Channel 1]

DH5

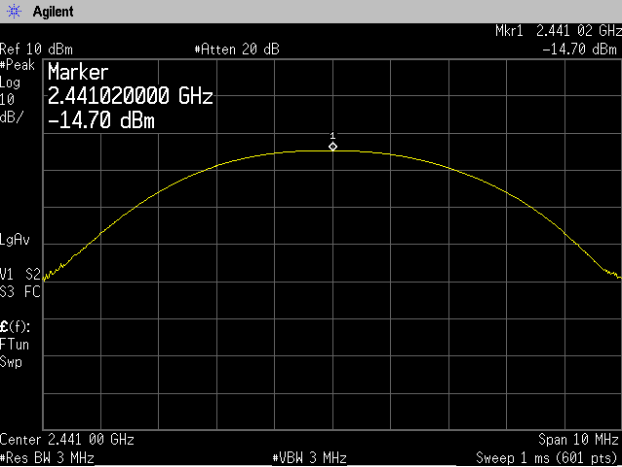


3-DH5

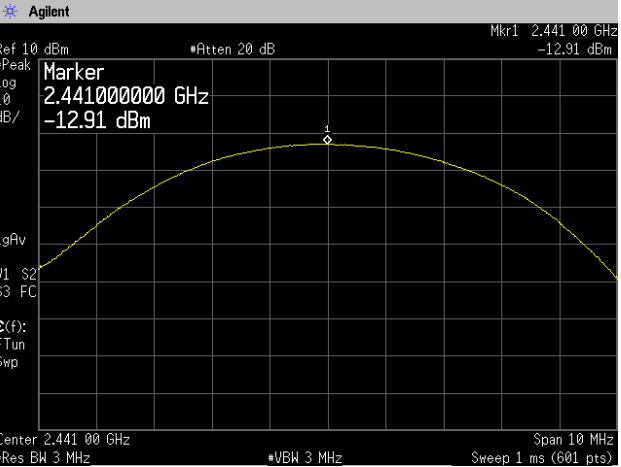


Channel Middle: 2441.0MHz [Channel 40]

DH5

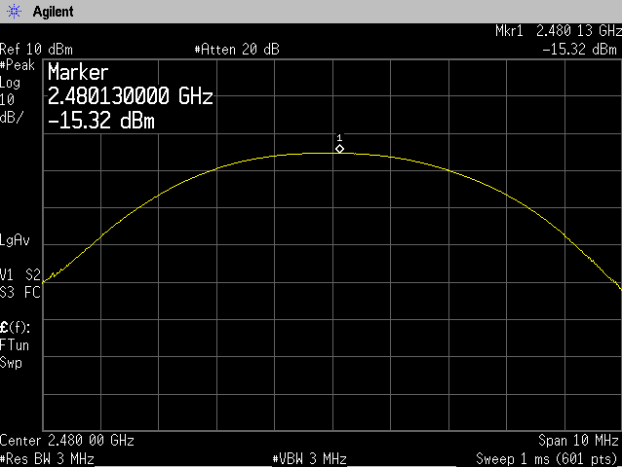


3-DH5

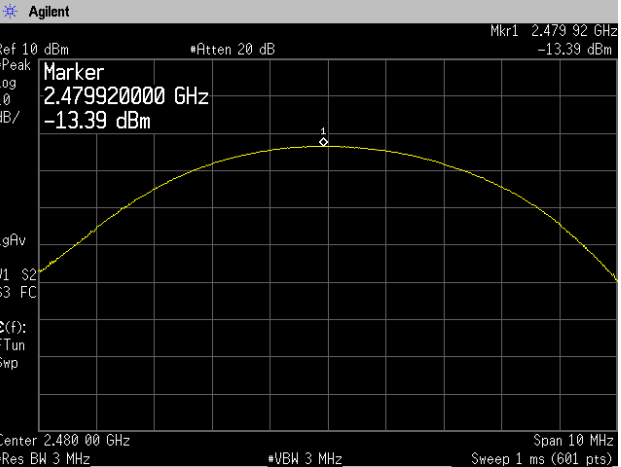


Channel High: 2480.0MHz [Channel 79]

DH5



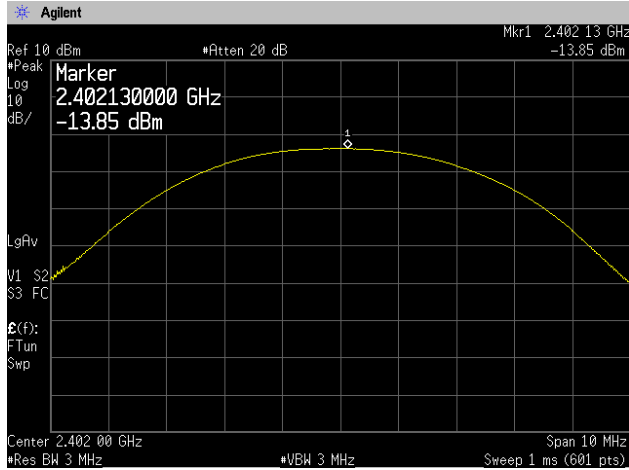
3-DH5



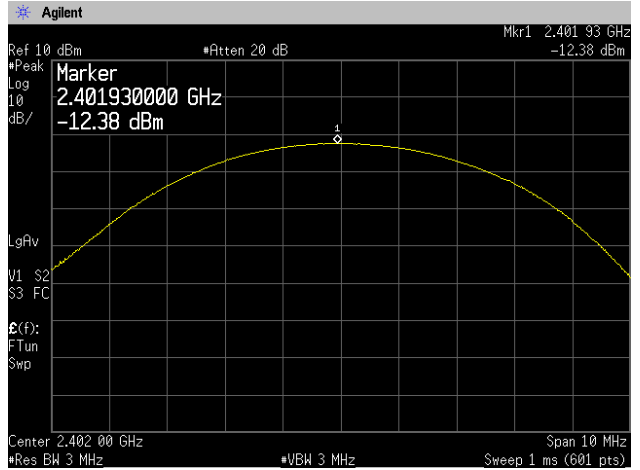
Maximum Peak Output Power - Conducted - [AC102V]

Channel Low: 2402.0MHz [Channel 1]

DH5

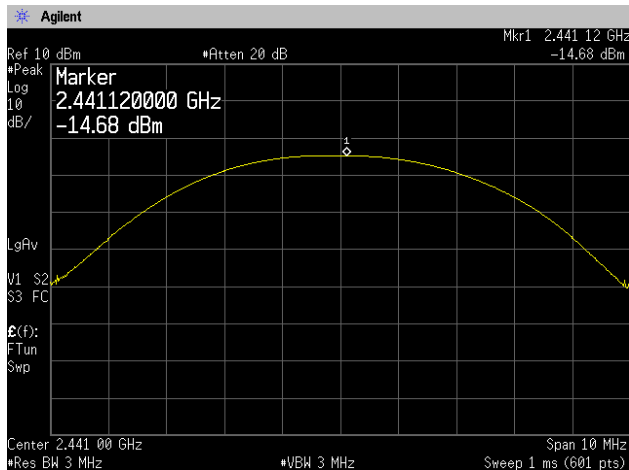


3-DH5

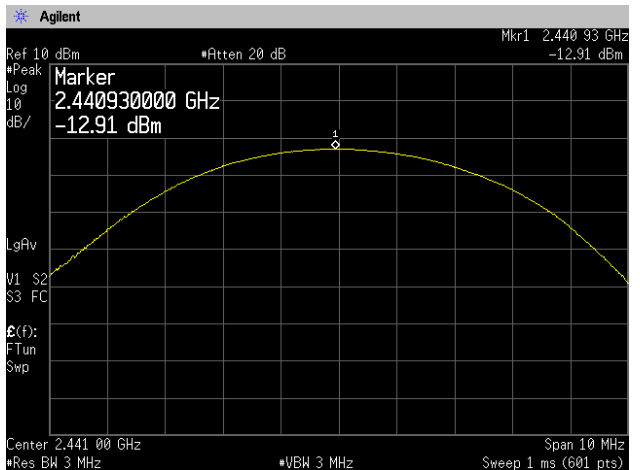


Channel Middle: 2441.0MHz [Channel 40]

DH5

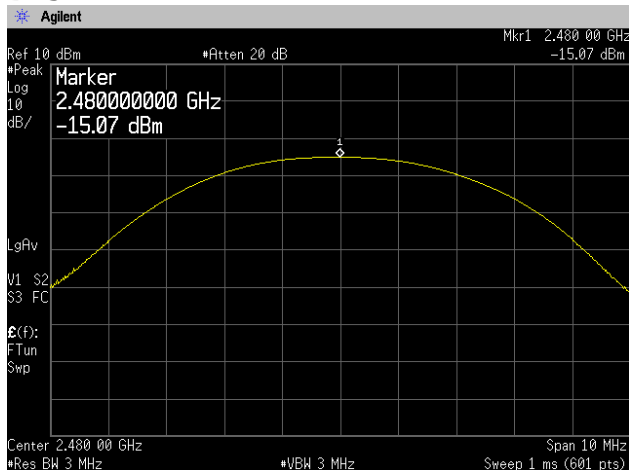


3-DH5

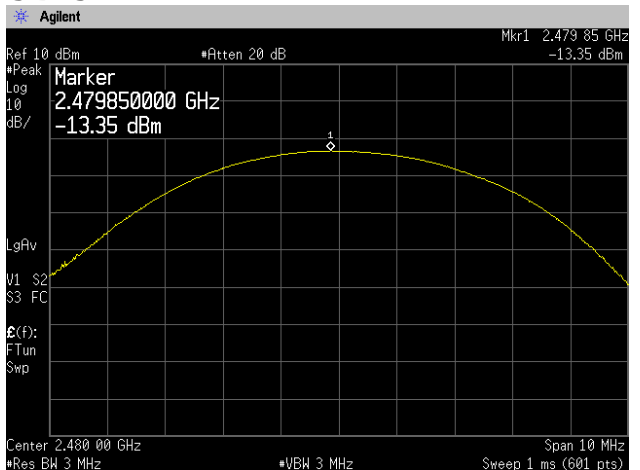


Channel High: 2480.0MHz [Channel 79]

DH5

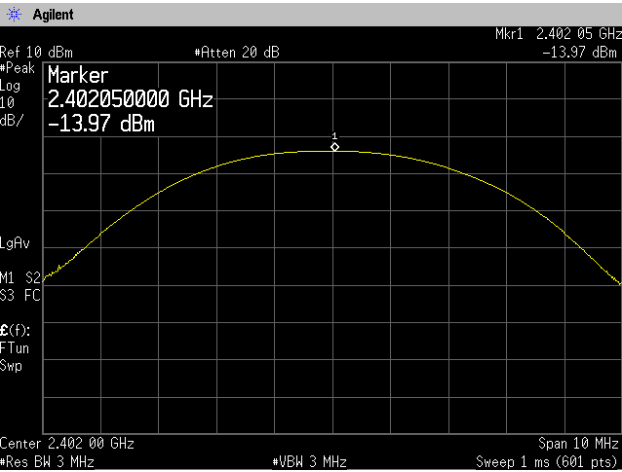


3-DH5

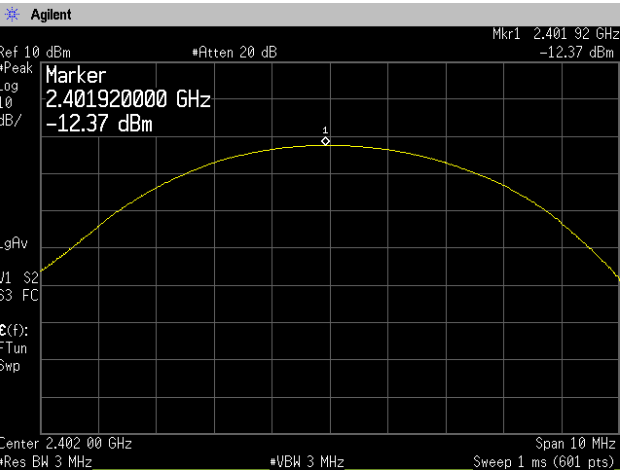


Maximum Peak Output Power - Conducted - [AC120V]

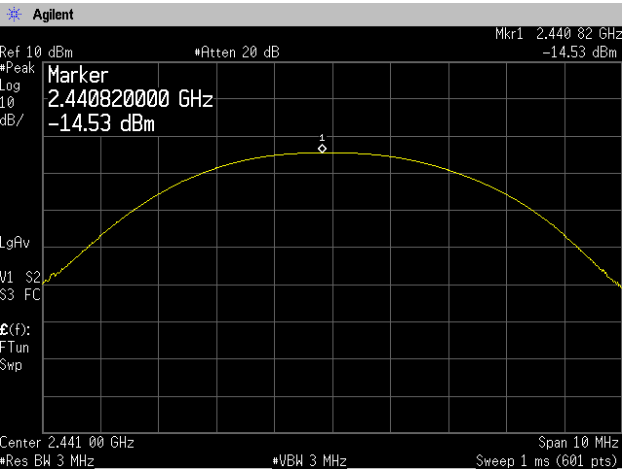
**Channel Low: 2402.0MHz [Channel 1]
DH5**



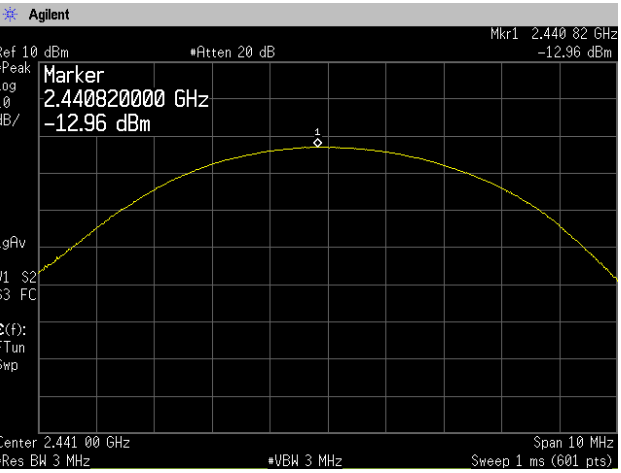
3-DH5



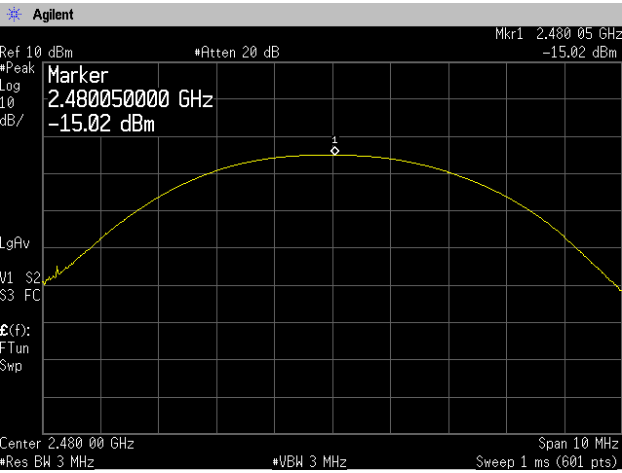
**Channel Middle: 2441.0MHz [Channel 40]
DH5**



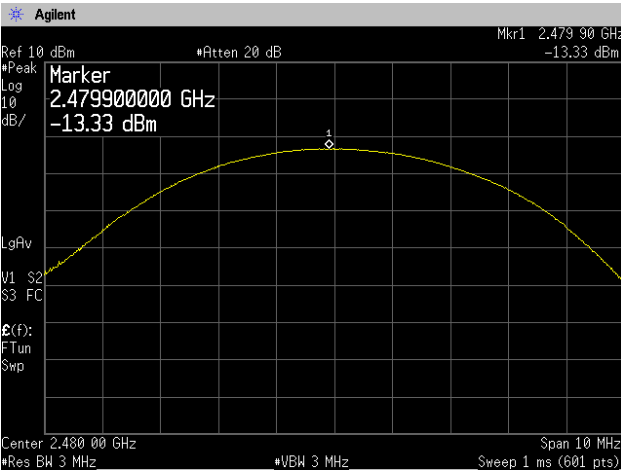
3-DH5



**Channel High: 2480.0MHz [Channel 79]
DH5**



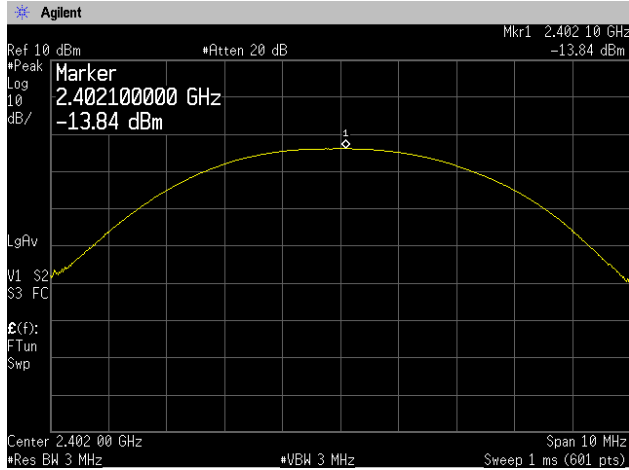
3-DH5



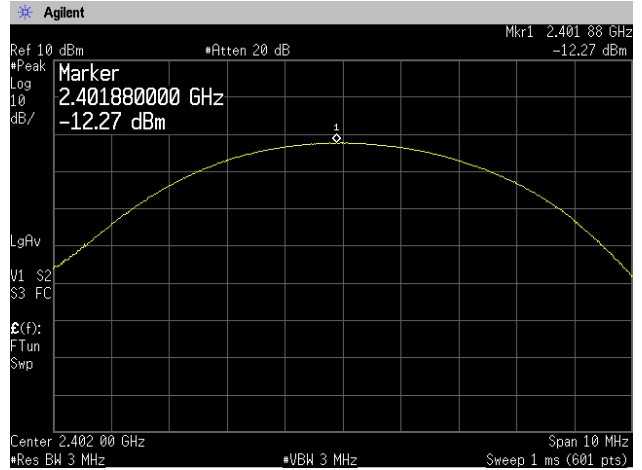
Maximum Peak Output Power - Conducted - [AC138V]

Channel Low: 2402.0MHz [Channel 1]

DH5

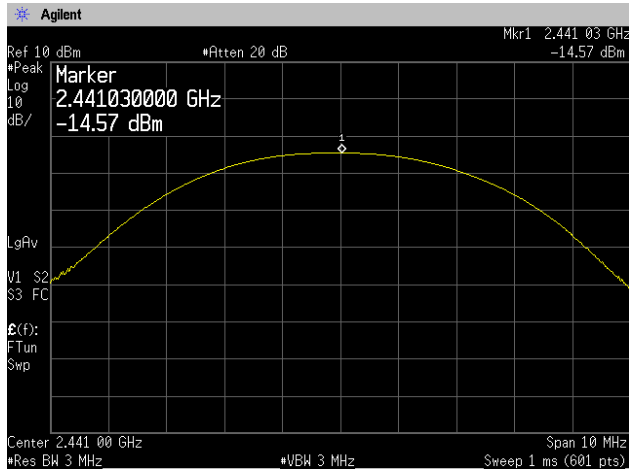


3-DH5

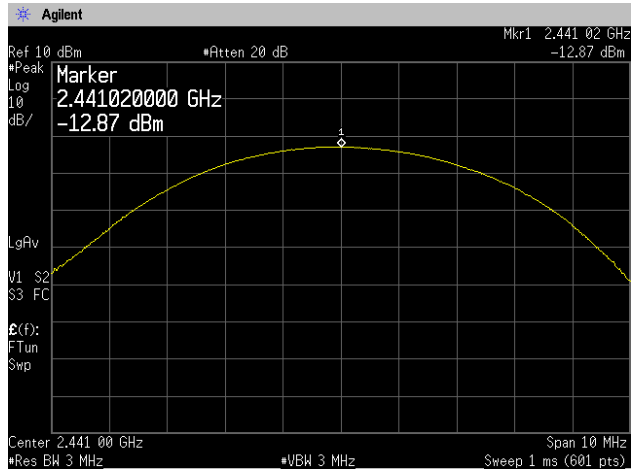


Channel Middle: 2441.0MHz [Channel 40]

DH5

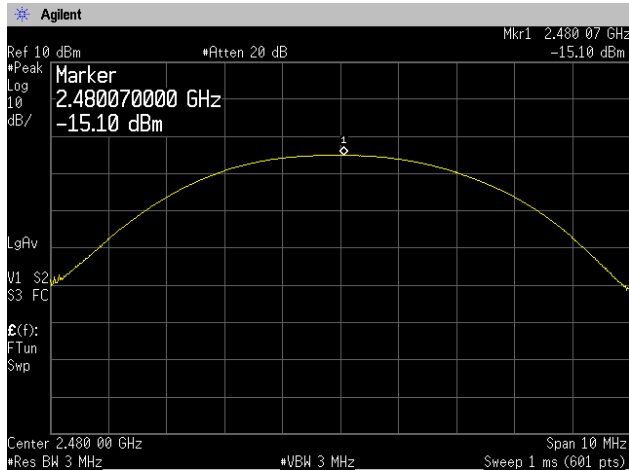


3-DH5

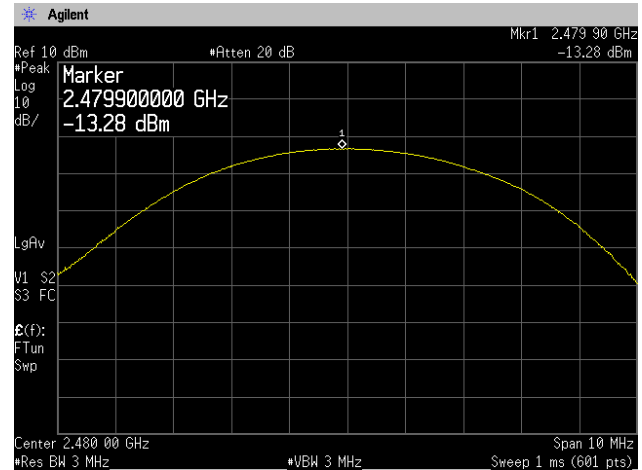


Channel High: 2480.0MHz [Channel 79]

DH5



3-DH5



5.6 Band Edge Compliance of RF Conducted Emissions

5.6.1 Test Procedure [FCC 15.247 (d), IC RSS-210 A8.5]

The Band Edge is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to :

- RBW=100kHz, VBW=100kHz, Span=15MHz, Sweep=Auto

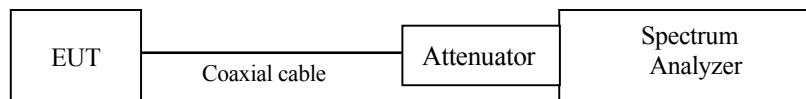
The EUT was set to operate with following conditions.

- No hopping [ch 1 (low) and ch 79 (high)]

The test mode of EUT is as follows.

- Tx mode

5.6.2 Test Instruments and Measurement Setup



5.6.3 Limit of Band-edge Compliance of RF Conducted Emissions

In any 100KHz bandwidth outside the frequency band the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100KHz bandwidth within the band that contains the highest level of the desired power.

5.6.4 Measurement Results of Band-edge

Channel	Frequency [MHz]	Packet type	RF power Level [dBm]	Band-edge Frequency [MHz]	Band-edge Level [dBm]	Difference Level [dBm]	Limit [dBm]	PASS / FAIL
1	2402.0	DH5	-14.15	2397.98	-55.55	41.40	At least 20dB below from peak of RF.	PASS
		3-DH5	-13.30	2400.48	-51.45	38.15		PASS
79	2480.0	DH5	-15.47	2484.00	-65.24	49.77		PASS
		3-DH5	-14.42	2482.00	-59.42	45.00		PASS

5.6.5 Trace Data

Test Personnel:

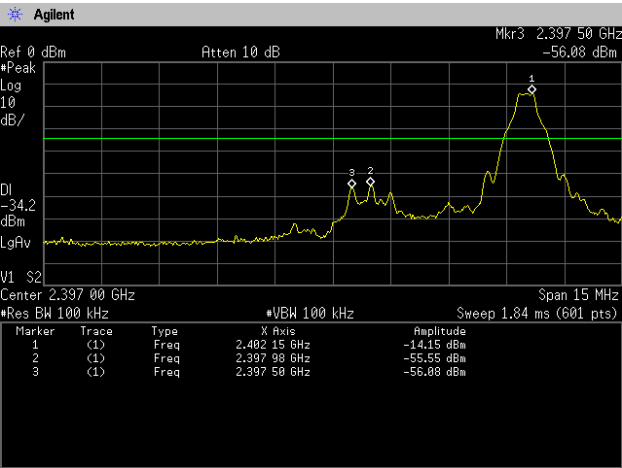
Tested by: Hiroaki Suzuki

Date : Jun. 8, 2009
 Temperature : 21.0 [°C]
 Humidity : 68.0 [%]
 Test place : Shielded room

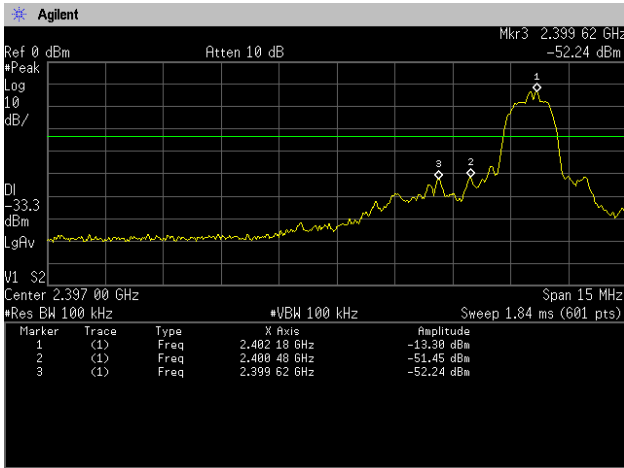
Band Edge Compliance of RF Conducted Emissions

Channel Low: 2402.0MHz [Channel 1]

DH5

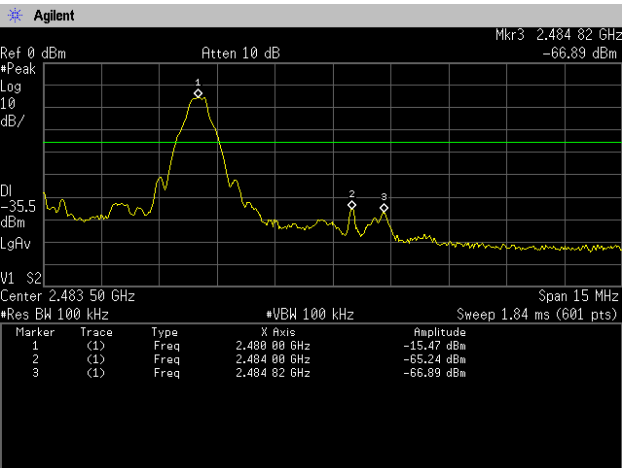


3-DH5

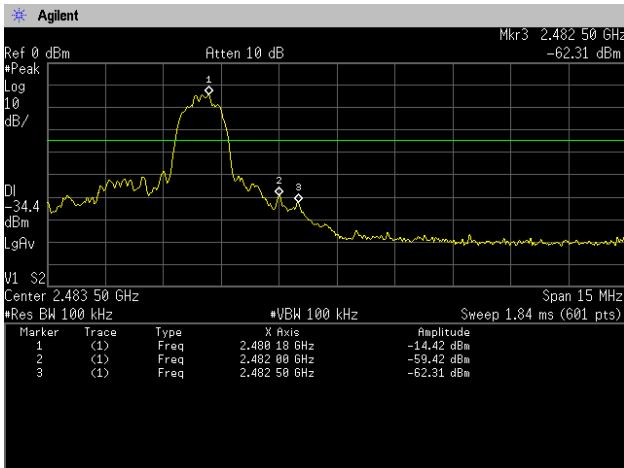


Channel High: 2480.0MHz [Channel 79]

DH5



3-DH5



5.7 Spurious Emissions - Conducted -

5.7.1 Test Procedure [FCC 15.247(d), IC RSS-210 A8.5, RSS-Gen 4.9&4.10]

The spurious emissions (Conducted) are measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to:

- RBW=100kHz, VBW=300kHz, Span=Arbitrary setting, Sweep=Auto

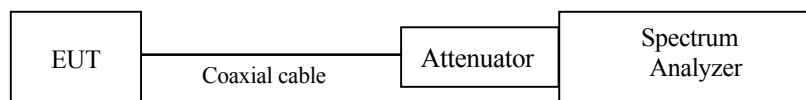
The EUT was set to operate with following conditions.

- No hopping [ch 1 (low), ch 40 (mid) and ch 79 (high)]

The test mode of EUT is as follows.

- Tx mode

5.7.2 Measurement Setup



5.7.3 Limit of Spurious Emissions - Conducted -

In any 100KHz bandwidth outside the frequency band the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100KHz bandwidth within the band that contains the highest level of the desired power.

5.7.4 Measurement Results of Spurious Emissions - Conducted -

Channel	Frequency [MHz]	Limit [dBm]	Results Chart	PASS / FAIL
1	2402.0	At least 20dB below from peak of RF.	See the Trace Data	PASS
40	2441.0	At least 20dB below from peak of RF.	See the Trace Data	PASS
79	2480.0	At least 20dB below from peak of RF.	See the Trace Data	PASS

5.7.5 Trace Data

Test Personnel:

Tested by: Hiroaki Suzuki

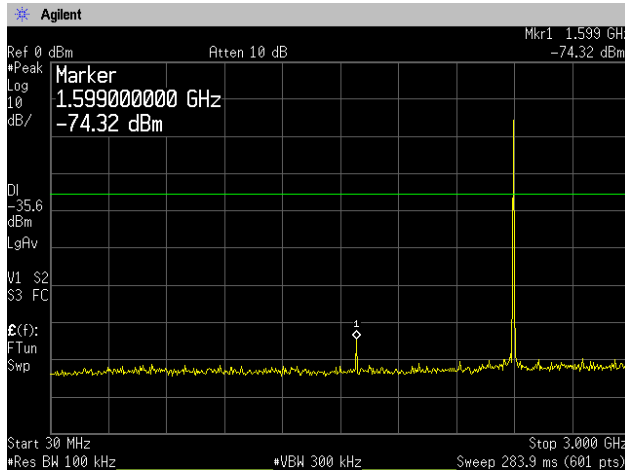
Date : Jun. 8, 2009
 Temperature : 21.0 [°C]
 Humidity : 68.0 [%]
 Test place : Shielded room

Spurious Emissions - Conducted -

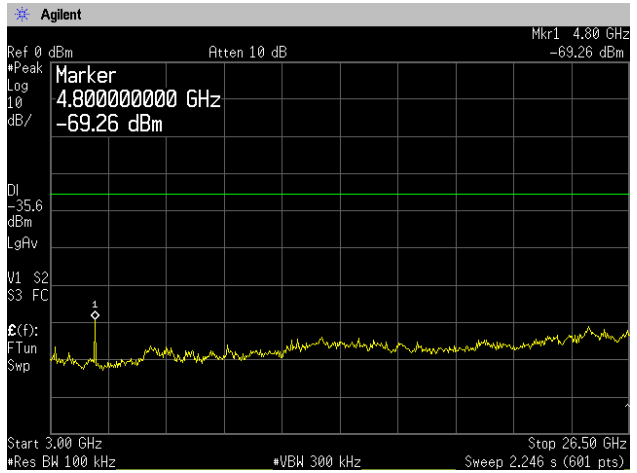
DH5

Channel Low: 2402.0MHz [Channel 1]

30MHz-3GHz

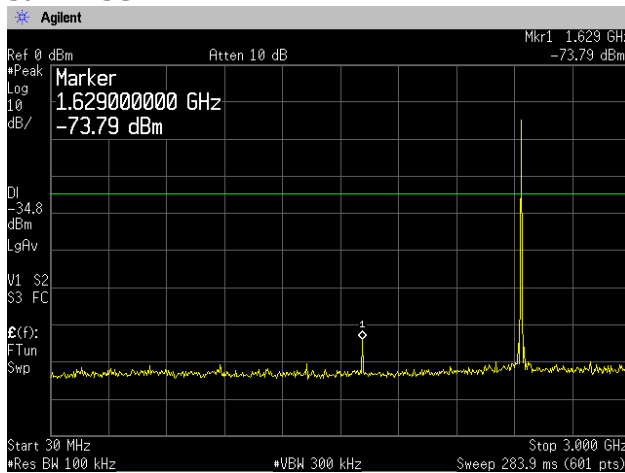


3GHz-26.5GHz

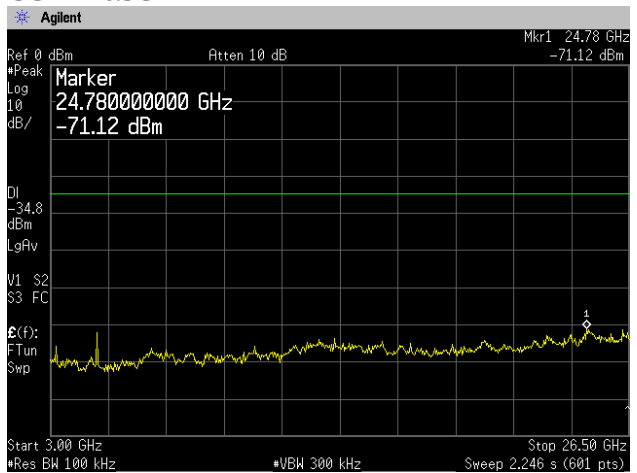


Channel Middle: 2441.0MHz [Channel 40]

30MHz-3GHz

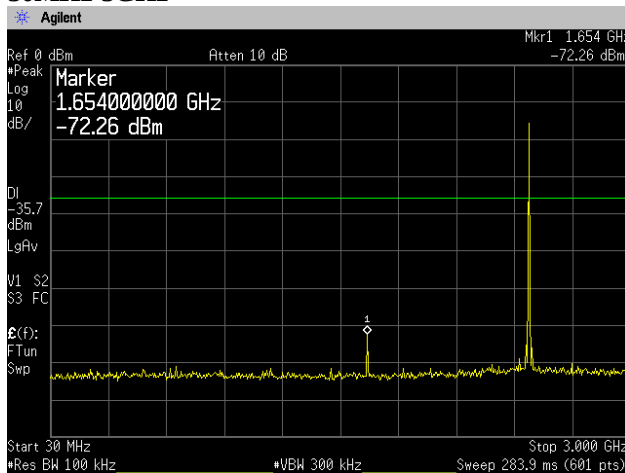


3GHz-26.5GHz

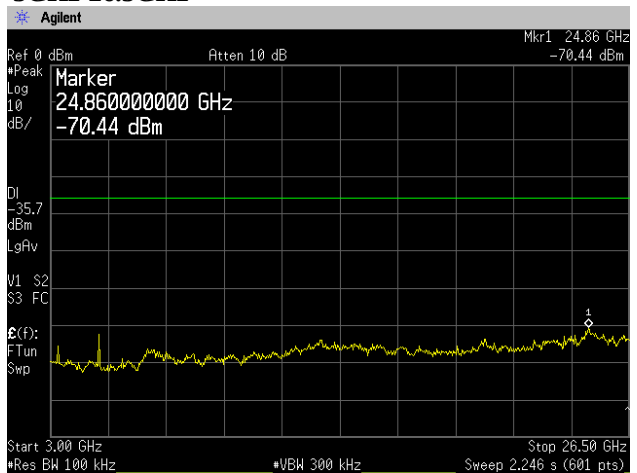


Channel High: 2480.0MHz [Channel 79]

30MHz-3GHz

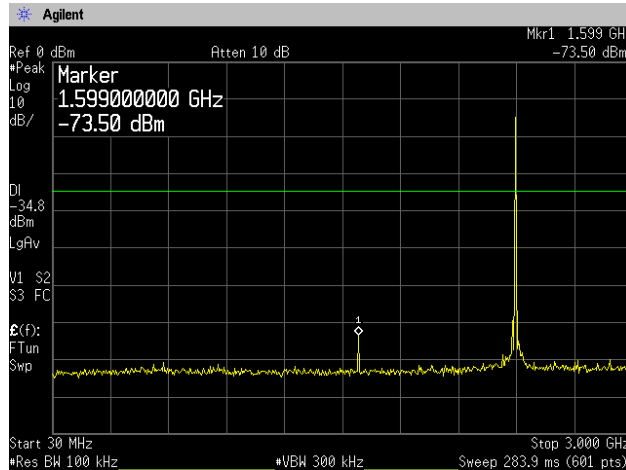


3GHz-26.5GHz

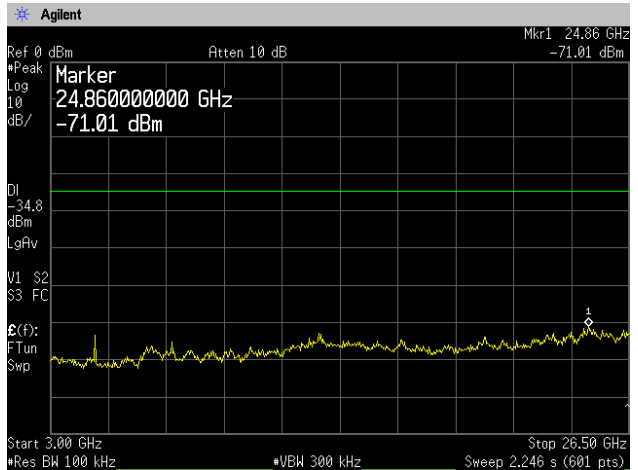


3-DH5

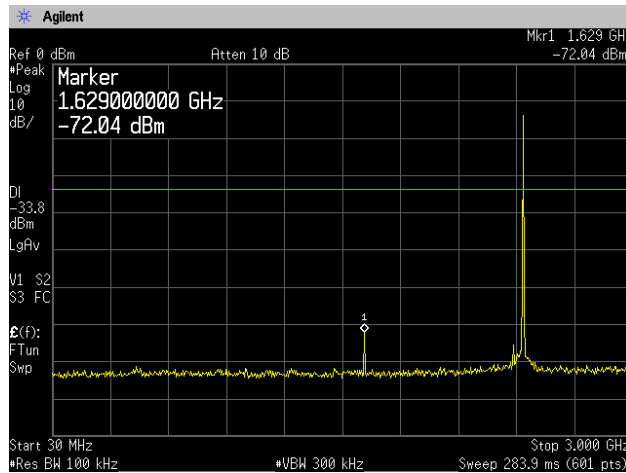
Channel Low: 2402.0MHz [Channel 1]
30MHz-3GHz



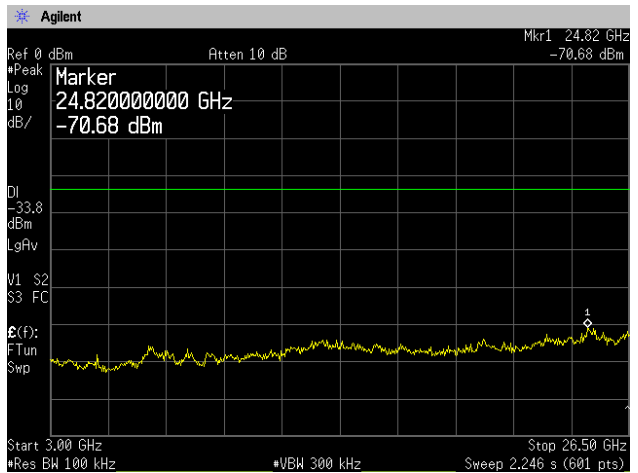
3GHz-26.5GHz



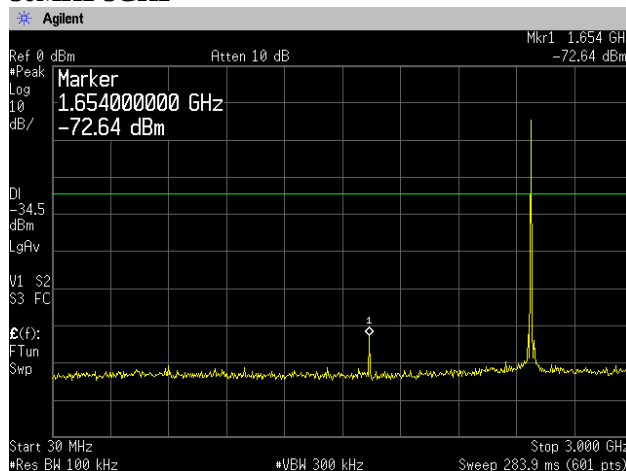
Channel Middle: 2441.0MHz [Channel 40]
30MHz-3GHz



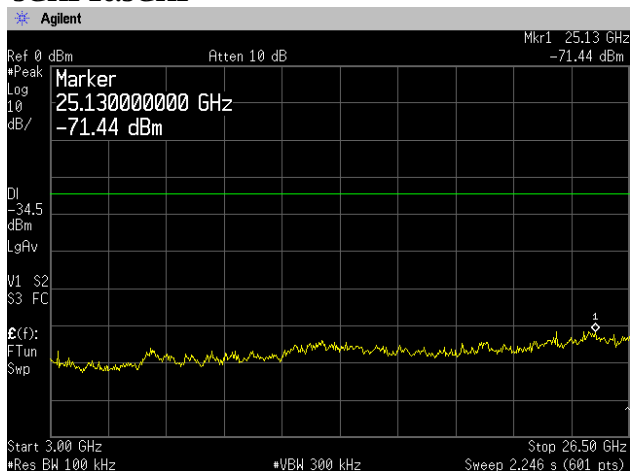
3GHz-26.5GHz



Channel High: 2480.0MHz [Channel 79]
30MHz-3GHz



3GHz-26.5GHz



5.8 Spurious Emissions - Radiated - (9kHz - 25GHz)

5.8.1 Test Procedure [FCC 15.205/209/247(d), IC RSS-210 A8.5, RSS-Gen 4.9&4.10]

Radiated emission measurements are performed at 3m distance with the broadband antenna (Loop antenna, TRILOG antenna, and double-ridged guide antenna). The antenna is positioned both the horizontal and vertical planes of polarization and height is varied 1 to 4 meters and stopped at height producing the maximum emission. As for the Loop antenna, it is positioned with its plane vertical, and the center of the Loop is 1.0meter above the ground plane. Frequency Range: 9kHz –1GHz is scanned and investigated with the test receiver, and above 1GHz, with the spectrum analyzer. The detector function of the test receiver is set to CISPR Quasi-peak mode and the bandwidth is set to 120kHz. Peak and average detectors are used for measurements above 1GHz. The bandwidth of the spectrum analyzer is set to 1MHz.

The EUT and support equipment are placed on a 1meter x 2meter surface, 0.8meter height FRP table. The turntable is rotated by 360 degrees and stopped at azimuth of producing the maximum emission.

Interconnecting cables, which hanging closer than 40cm to the horizontal metal ground plane are bundled its excess in center. The highest fundamental frequency generated in the EUT is 2402-2480MHz, therefore the frequency was investigated up to 25GHz, as specified in CFR section 15.33, and at least six highest emissions are reported. The test results represent the worst-case emission for each emission with manipulating the EUT, support equipment, interconnecting cables and varying the mode of operation.

Sufficient time for the EUT, support equipment, and test equipment are allowed in order for them to warm up to their normal operating condition.

The spectrum analyzer is set to:

- Peak: RBW=1MHz, VBW=1MHz, Span=0Hz, Sweep=auto
- Average: RBW=1MHz, VBW=10Hz, Span=0Hz, Sweep=auto

The EUT was set to operate with following conditions.

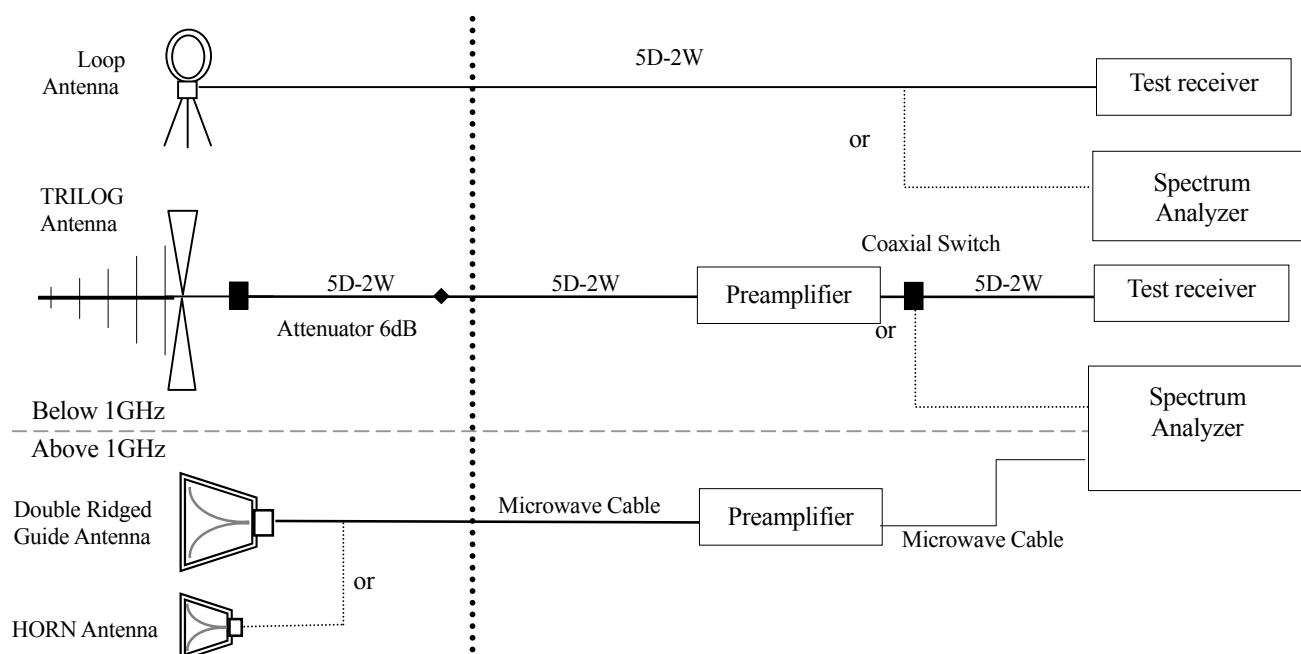
- No hopping [ch 1 (low), ch 40 (mid), ch 79 (high)]

The test mode of EUT is as follows.

- Tx mode, Rx mode

5.8.2 Measurement Setup

Test configuration for Spurious emissions



5.8.3 Limit of Spurious Emission Measurement

Frequency [MHz]	Field Strength	
	[uV/m]	[dBuV/m]
0.009 – 0.490	2400 / F [kHz]	20logE [uV/m]
0.490 – 1.705	24000 / F [kHz]	20logE [uV/m]
1.705-30	30	29.5
30 – 88	100	40.0
88 – 216	150	43.5
216 – 960	200	46.0
Above 960	500	54.0

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level [dBuV/m] = 20 log Emission [uV/m]
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

5.8.4 Sample of field strength calculation

Spurious Emission

$$\text{dB}\mu\text{V/m} = 20\log_{10}(\mu\text{V/m})$$

Limit @ 147.6MHz = 150μV/m = 43.5dBμV/m
Reading = 42.8dBμV
Ant. Factor + Cable Loss - Amp. Gain = 14.2 + 3.0 - 30.0 = -12.8dB
Total = 42.8 - 12.8 = 30.0dBμV/m
Margin = 43.5 - 30.0 = <u>13.5dB</u>

5.8.5 Measurement Results

Test Personnel:

Tested by: Hiroaki Suzuki

Date : Jun. 3, 2009
Temperature : 21.4 [°C]
Humidity : 41.9 [%]
Test place : 3m Semi-anechoic chamber

Test Personnel:

Tested by: Hiroaki Suzuki

Date : Jun. 4, 2009
Temperature : 21.0 [°C]
Humidity : 55.9 [%]
Test place : 3m Semi-anechoic chamber

Test Personnel:

Tested by: Hiroaki Suzuki

Date : Jun. 26, 2009
Temperature : 19.9 [°C]
Humidity : 62.8 [%]
Test place : 3m Semi-anechoic chamber

Spurious Emissions - Radiated

DH5

Tx Channel Low: 2402.0MHz [Channel 1]

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	50.410	V	34.9	-9.5	25.4	40.0	14.6	100.0	191.0
2	95.077	V	40.5	-14.0	26.5	43.5	17.0	100.0	219.0
3	163.639	V	40.5	-8.3	32.2	43.5	11.3	100.0	192.0
4	240.050	V	46.8	-9.8	37.0	46.0	9.0	108.0	180.0
5	336.067	V	42.7	-6.9	35.8	46.0	10.2	100.0	237.0

No.	Frequency [MHz]	(P)	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c.f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [°]
1	4803.993	H		50.8	5.7		56.5	74.0		17.5	104.0	0.0
2	4803.993	H	41.4		5.7	47.1		54.0	6.9		104.0	0.0
3	4804.017	V		53.6	5.7		59.3	74.0		14.7	113.0	277.0
4	4804.017	V	42.6		5.7	48.3		54.0	5.7		113.0	277.0

Tx Channel Middle: 2441.0MHz [Channel 40]

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	50.402	V	35.4	-9.5	25.9	40.0	14.1	100.0	148.0
2	95.124	V	40.6	-14.0	26.6	43.5	16.9	100.0	214.0
3	163.638	V	41.3	-8.3	33.0	43.5	10.5	100.0	196.0
4	240.048	V	43.7	-9.8	33.9	46.0	12.1	100.0	171.0
5	336.057	V	40.5	-6.9	33.6	46.0	12.4	100.0	246.0

No.	Frequency [MHz]	(P)	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c.f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [°]
1	4881.983	H		51.8	5.7		57.5	74.0		16.5	100.0	0.0
2	4881.983	H	42.6		5.7	48.3		54.0	5.7		100.0	0.0
3	4881.958	V		54.9	5.7		60.6	74.0		13.4	100.0	264.0
4	4881.958	V	43.2		5.7	48.9		54.0	5.1		100.0	264.0

Tx Channel High: 2480.0MHz [Channel 79]

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	50.413	V	35.2	-9.5	25.7	40.0	14.3	100.0	144.0
2	95.145	V	40.7	-14.0	26.7	43.5	16.8	100.0	222.0
3	163.624	V	40.4	-8.3	32.1	43.5	11.4	101.0	181.0
4	240.028	V	46.5	-9.8	36.7	46.0	9.3	100.0	178.0
5	336.051	V	42.1	-6.9	35.2	46.0	10.8	100.0	245.0

No.	Frequency [MHz]	(P)	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c.f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [°]
1	4960.000	H		53.4	5.9		59.3	74.0		14.7	100.0	0.0
2	4960.000	H	43.2		5.9	49.1		54.0	4.9		100.0	0.0
3	4960.000	V		52.6	5.9		58.5	74.0		15.5	126.0	273.0
4	4960.000	V	42.0		5.9	47.9		54.0	6.1		126.0	273.0

Note:

1. Emission Level (Margin) = Limit – [Reading + Factor (Antenna + Cable - Amp)]
2. No emissions were detected in frequency range 9kHz to 30MHz at the 3 meters distance.

Spurious Emissions - Radiated

3-DH5

Tx Channel Low: 2402.0MHz [Channel 1]

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	50.400	V	34.5	-9.5	25.0	40.0	15.0	100.0	212.0
2	95.080	V	41.1	-14.0	27.1	43.5	16.4	100.0	220.0
3	163.630	V	41.1	-8.3	32.8	43.5	10.7	100.0	175.0
4	240.050	V	45.8	-9.8	36.0	46.0	10.0	108.0	222.0
5	336.060	V	41.8	-6.9	34.9	46.0	11.1	100.0	210.0

No.	Frequency [MHz]	(P)	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c.f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [°]
1	4803.960	H	49.4	49.4	2.8	52.2	52.2	74.0	24.6	21.8	100.0	10.0
2	4803.960	H	37.3	49.4	2.8	40.1	52.2	54.0	13.9	21.8	100.0	10.0
3	4803.940	V	32.3	57.9	2.8	35.1	60.7	74.0	18.9	13.3	100.0	258.0
4	4803.940	V	32.3	57.9	2.8	35.1	60.7	54.0	18.9	13.3	100.0	258.0
5	7206.360	H	46.1	46.1	6.8	52.9	52.9	74.0	27.8	21.1	100.0	12.0
6	7206.360	H	32.8	46.1	6.8	39.6	52.9	54.0	14.4	21.1	100.0	12.0

Tx Channel Middle: 2441.0MHz [Channel 40]

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	50.410	V	35.0	-9.5	25.5	40.0	14.5	100.0	178.0
2	95.112	V	40.2	-14.0	26.2	43.5	17.3	100.0	210.0
3	163.633	V	40.3	-8.3	32.0	43.5	11.5	100.0	188.0
4	240.035	V	44.5	-9.8	34.7	46.0	11.3	100.0	211.0
5	336.060	V	42.2	-6.9	35.3	46.0	10.7	100.0	240.0

No.	Frequency [MHz]	(P)	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c.f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [°]
1	4882.140	H	51.0	51.0	3.1	54.1	54.1	74.0	23.0	19.9	100.0	14.0
2	4882.140	H	38.3	51.0	3.1	41.4	54.1	54.0	12.6	19.9	100.0	14.0
3	4882.010	V	34.6	57.1	3.1	37.7	60.2	74.0	16.3	13.8	110.0	259.0
4	4882.010	V	34.6	57.1	3.1	37.7	60.2	54.0	16.3	13.8	110.0	259.0
5	7323.340	H	47.6	47.6	7.5	55.1	55.1	74.0	27.4	18.9	100.0	16.0
6	7323.340	H	33.7	47.6	7.5	41.2	55.1	54.0	12.8	18.9	100.0	16.0

Tx Channel High: 2480.0MHz [Channel 79]

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	50.410	V	35.1	-9.5	25.6	40.0	14.4	100.0	153.0
2	95.120	V	40.6	-14.0	26.6	43.5	16.9	100.0	220.0
3	163.630	V	40.0	-8.3	31.7	43.5	11.8	105.0	200.0
4	240.040	V	45.8	-9.8	36.0	46.0	10.0	103.0	187.0
5	336.060	V	42.6	-6.9	35.7	46.0	10.3	100.0	248.0

No.	Frequency [MHz]	(P)	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c.f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [°]
1	4960.170	H	51.5	51.5	3.3	54.8	54.8	74.0	23.2	19.2	100.0	15.0
2	4960.170	H	39.5	51.5	3.3	42.8	54.8	54.0	11.2	19.2	100.0	15.0
3	4960.000	V	32.1	57.3	3.3	35.4	60.6	74.0	18.6	13.4	124.0	259.0
4	4960.000	V	32.1	57.3	3.3	35.4	60.6	54.0	18.6	13.4	124.0	259.0
5	7440.300	H	48.6	48.6	7.7	56.3	56.3	74.0	27.7	17.7	100.0	15.0
6	7440.300	H	34.6	48.6	7.7	42.3	56.3	54.0	11.7	17.7	100.0	15.0

Note:

1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable - Amp)]
2. No emissions were detected in frequency range 9kHz to 30MHz at the 3 meters distance.

Spurious Emissions - Radiated

Rx Channel Low: 2402.0MHz [Channel 1]

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	49.244	V	34.6	-9.4	25.2	40.0	14.8	101.0	145.0
2	94.887	V	41.1	-14.1	27.0	43.5	16.5	101.0	198.0
3	163.623	V	39.2	-8.3	30.9	43.5	12.6	101.0	173.0
4	240.043	V	42.0	-9.8	32.2	46.0	13.8	115.0	171.0
5	336.056	V	37.9	-6.9	31.0	46.0	15.0	100.0	204.0

No.	Frequency [MHz]	(P)	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c.f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [°]
1	2400.492	H		53.4	-2.6		50.8	74.0		23.2	100.0	347.0
2	2400.492	H	47.5		-2.6	44.9		54.0	9.1		100.0	347.0
3	2400.501	V		51.4	-2.6		48.8	74.0		25.2	100.0	258.0
4	2400.501	V	42.4		-2.6	39.8		54.0	14.2		100.0	258.0

Rx Channel Middle: 2441.0MHz [Channel 40]

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	49.231	V	33.8	-9.4	24.4	40.0	15.6	100.0	132.0
2	94.888	V	39.8	-14.1	25.7	43.5	17.8	100.0	232.0
3	163.626	V	40.6	-8.3	32.3	43.5	11.2	100.0	179.0
4	240.032	V	39.6	-9.8	29.8	46.0	16.2	103.0	185.0
5	336.061	V	41.1	-6.9	34.2	46.0	11.8	100.0	232.0

No.	Frequency [MHz]	(P)	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c.f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [°]
1	2439.491	H		52.8	-2.6		50.2	74.0		23.8	100.0	351.0
2	2439.491	H	46.5		-2.6	43.9		54.0	10.1		100.0	351.0
3	2439.494	V		50.5	-2.6		47.9	74.0		26.1	100.0	212.0
4	2439.494	V	41.2		-2.6	38.6		54.0	15.4		100.0	212.0

Rx Channel High: 2480.0MHz [Channel 79]

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	49.231	V	33.9	-9.4	24.5	40.0	15.5	100.0	169.0
2	94.870	V	40.0	-14.1	25.9	43.5	17.6	100.0	180.0
3	163.631	V	41.9	-8.3	33.6	43.5	9.9	100.0	195.0
4	240.038	V	40.2	-9.8	30.4	46.0	15.6	103.0	184.0
5	336.046	V	42.3	-6.9	35.4	46.0	10.6	100.0	242.0

No.	Frequency [MHz]	(P)	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c.f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [°]
1	2478.263	V		50.6	-2.3		48.3	74.0		25.7	100.0	46.0
2	2478.263	V	40.3		-2.3	38.0		54.0	16.0		100.0	46.0
3	2478.495	H		53.6	-2.3		51.3	74.0		22.7	100.0	8.0
4	2478.495	H	47.8		-2.3	45.5		54.0	8.5		100.0	8.0

Note:

1. Emission Level (Margin) = Limit – [Reading + Factor (Antenna + Cable - Amp)]
2. No emissions were detected in frequency range 9kHz to 30MHz at the 3 meters distance.

5.9 Restricted Band of Operation

5.9.1 Test Procedure [FCC 15.205, 15.209, 15.247(d), IC RSS-210 2.2]

The peak power is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to:

- Peak: RBW=1MHz, VBW=1MHz, Span=40MHz, Sweep=auto
- Average: RBW=1MHz, VBW=10Hz, Span=40MHz, Sweep=auto

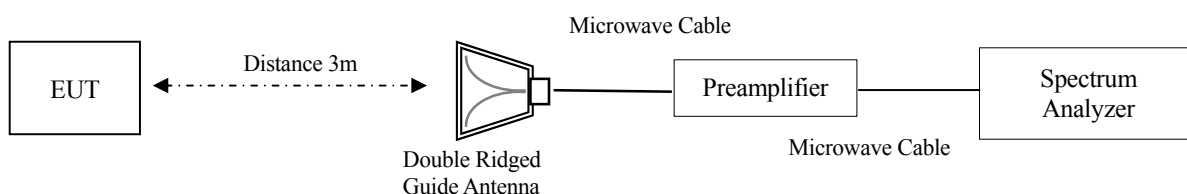
The EUT was set to operate with following conditions.

- No hopping [ch 1 (low), ch 79 (high)]

The test mode of EUT is as follows.

- Tx mode

5.9.2 Measurement Setup



5.9.3 Limit of Restricted Band of Operation

Emission at the boundary of the restricted band provided by 15.205 shall be lower than 15.209 limit.

5.9.4 Measurement Result

DH5

No.	Frequency [MHz]	(P)	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c. f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]
1	2390.000	H		46.8	-2.6		44.2	74.0		29.8
2	2390.000	H	35.2		-2.6	32.6		54.0	21.4	
3	2390.000	V		46.4	-2.6		43.8	74.0		30.2
4	2390.000	V	34.6		-2.6	32.0		54.0	22.0	
5	2483.500	H		57.7	-2.3		55.4	74.0		18.6
6	2483.500	H	45.8		-2.3	43.5		54.0	10.5	
7	2483.500	V		53.5	-2.3		51.2	74.0		22.8
8	2483.500	V	41.5		-2.3	39.2		54.0	14.8	

3-DH5

No.	Frequency [MHz]	(P)	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c. f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]
1	2390.000	H		53.3	-4.3		49.0	74.0		25.0
2	2390.000	H	40.3		-4.3	36.0		54.0	18.0	
3	2390.000	V		49.4	-4.3		45.1	74.0		28.9
4	2390.000	V	38.2		-4.3	33.9		54.0	20.1	
5	2483.500	H		59.0	-4.3		54.7	74.0		19.3
6	2483.500	H	45.0		-4.3	40.7		54.0	13.3	
7	2483.500	V		53.1	-4.3		48.8	74.0		25.2
8	2483.500	V	40.8		-4.3	36.5		54.0	17.5	

5.9.5 Trace Data

Test Personnel:

Tested by: Hiroaki Suzuki

Date : Jun. 4, 2009
Temperature : 21.0 [°C]
Humidity : 55.9 [%]
Test place : 3m Semi-anechoic chamber

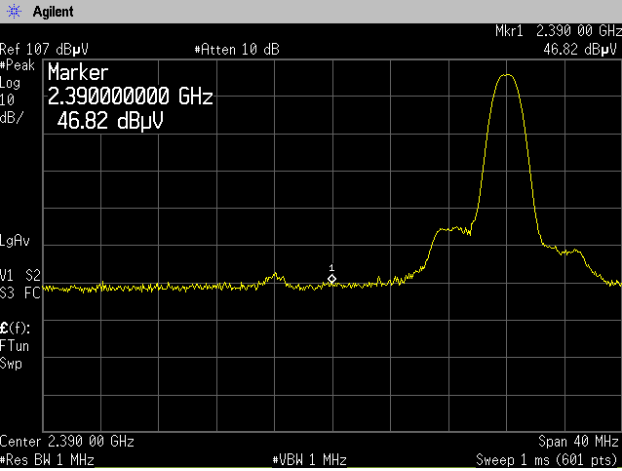
Test Personnel:

Tested by: Hiroaki Suzuki

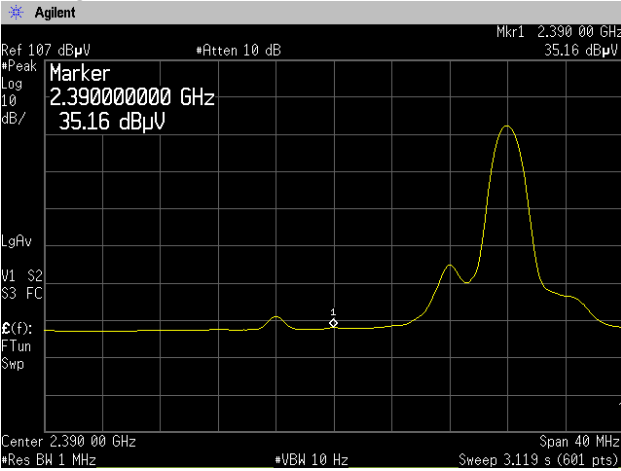
Date : Jun. 26, 2009
Temperature : 19.9 [°C]
Humidity : 62.8 [%]
Test place : 3m Semi-anechoic chamber

Restricted Band of Operation

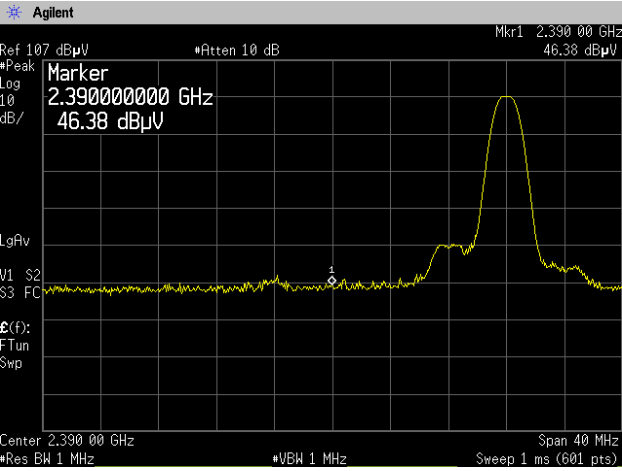
DH5
**Frequency: 2390.0MHz -Horizontal-
Peak**



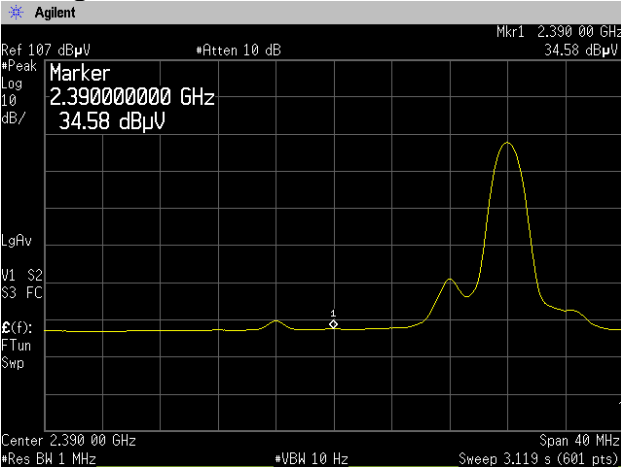
Average



**Frequency: 2390.0MHz -Vertical-
Peak**



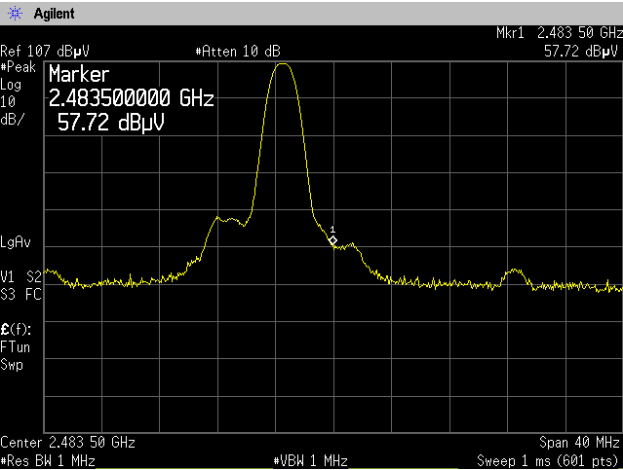
Average



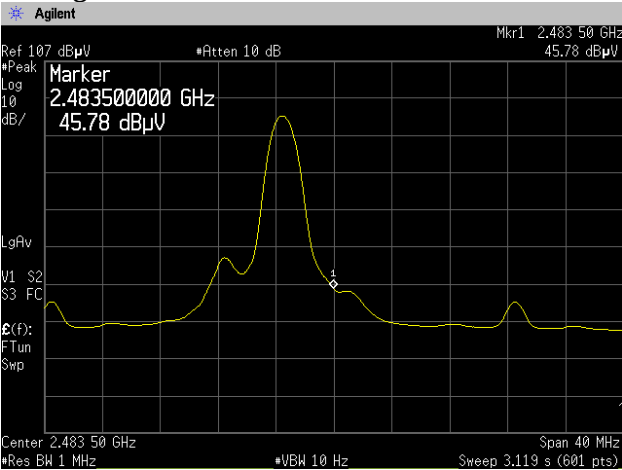
Restricted Band of Operation

DH5

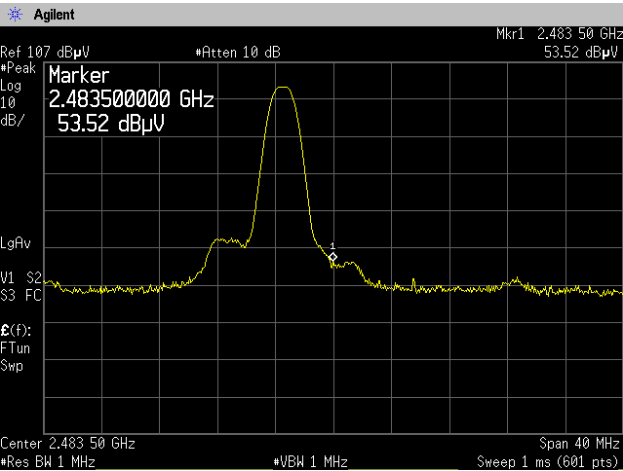
**Frequency: 2483.5MHz -Horizontal-
Peak**



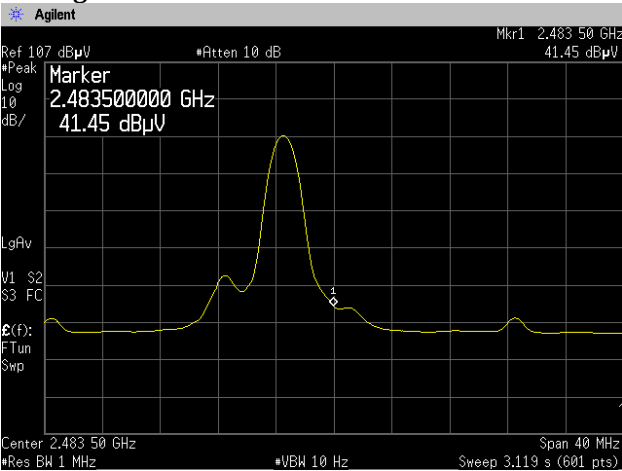
Average



**Frequency: 2483.5MHz -Vertical-
Peak**



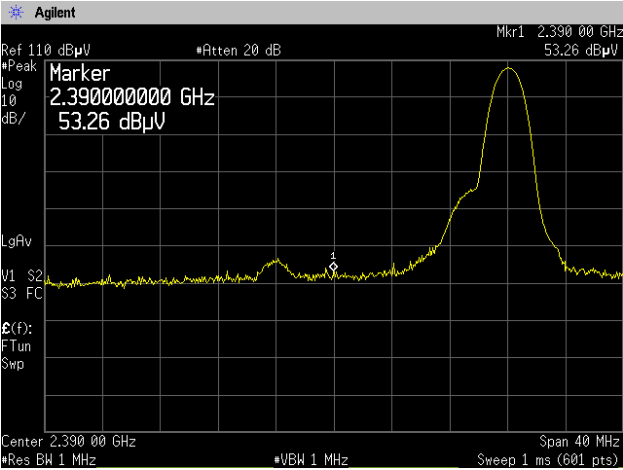
Average



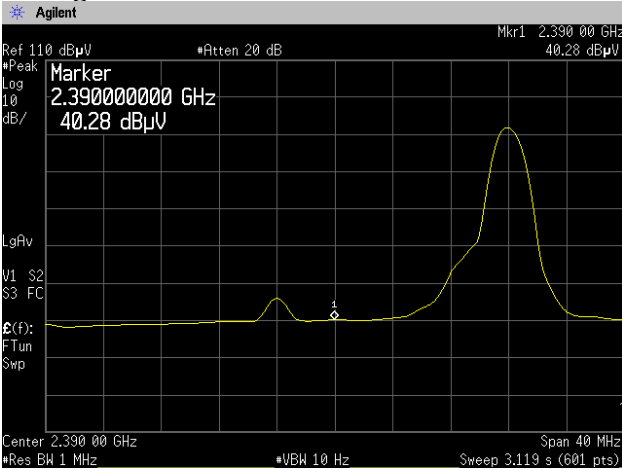
Restricted Band of Operation

3-DH5

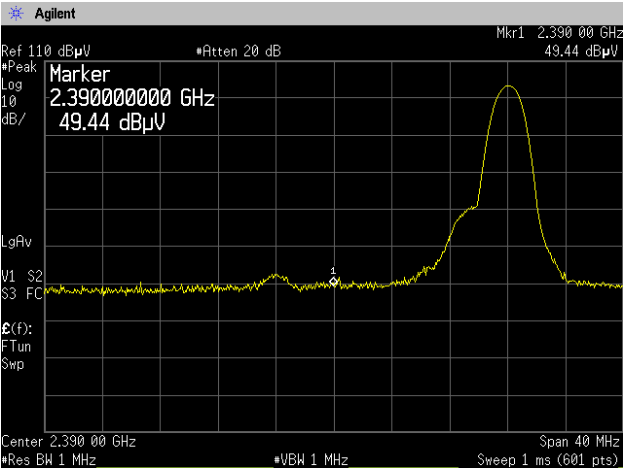
**Frequency: 2390.0MHz -Horizontal-
Peak**



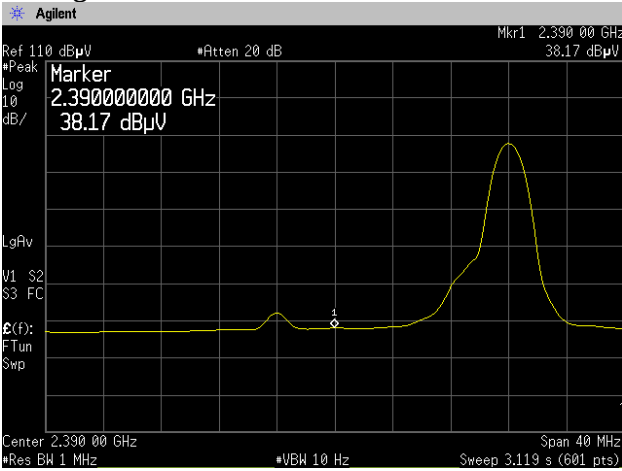
Average



**Frequency: 2390.0MHz -Vertical-
Peak**

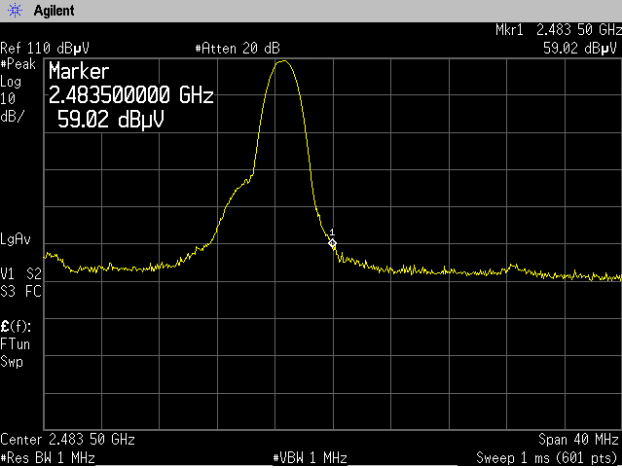


Average

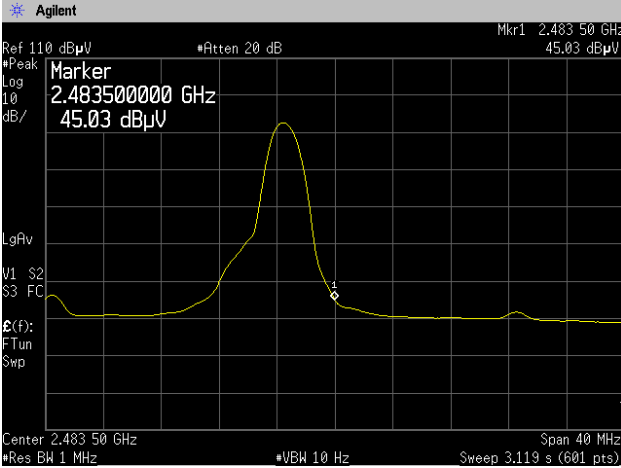


Restricted Band of Operation

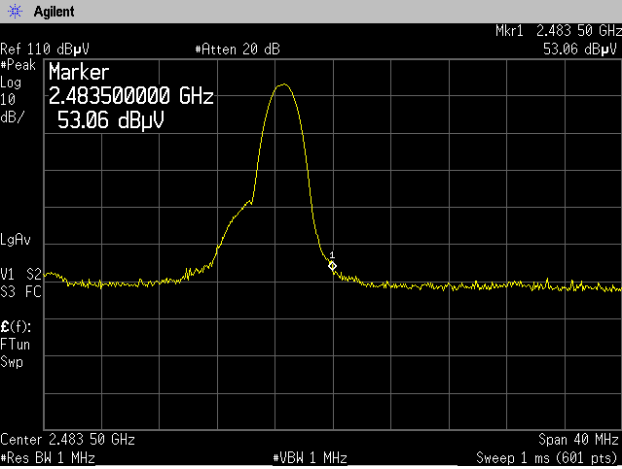
3-DH5
**Frequency: 2483.5MHz -Horizontal-
Peak**



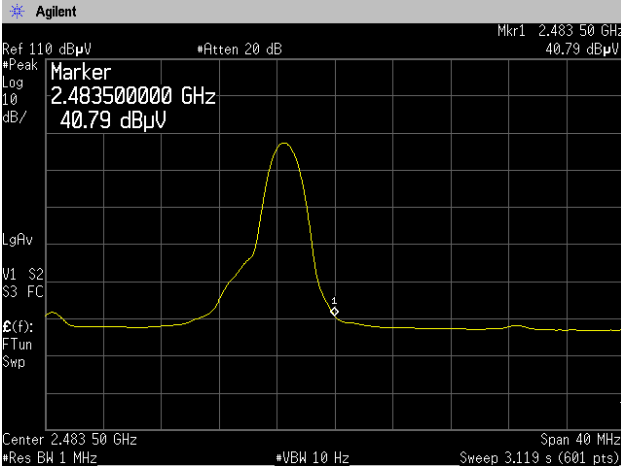
Average



**Frequency: 2483.5MHz -Vertical-
Peak**



Average



5.10 Transmitter Power Spectral Density

5.10.1 Test Procedure [FCC 15.247(d), IC RSS-210 A8.2(b)]

The peak power density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to:

RBW= 3kHz, VBW=3kHz, Span=3MHz, Sweep = 1000sec.

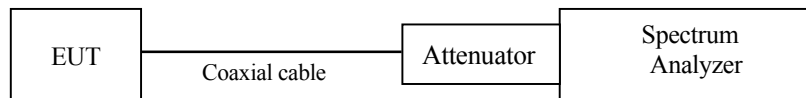
The EUT was set to operate with following conditions.

- No hopping [ch 1 (low), ch 40 (mid), ch 79 (high)]

The test mode of EUT is as follows.

- Tx mode

5.10.2 Measurement Setup



5.10.3 Limit of Transmitter Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band.

5.10.4 Measurement Results

Ch No.	Frequency [MHz]	Packet type	Reading [dBm]	Factor (Cable loss) [dB]	Level [dBm]	Limit [dBm]	Margin [dB]
1	2402.0	DH5	-26.46	10.66	-15.80	8.0	23.80
		3-DH5	-27.10	10.66	-16.44	8.0	24.44
40	2441.0	DH5	-26.82	10.66	-16.16	8.0	24.16
		3-DH5	-28.06	10.66	-17.40	8.0	25.40
79	2480.0	DH5	-27.01	10.66	-16.35	8.0	24.35
		3-DH5	-28.90	10.66	-18.24	8.0	26.24

Note:

1. Transmitter Power Spectral Density Level (Margin) = Limit – [Reading + Factor (Cable)]

5.10.5 Trace Data

Test Personnel:

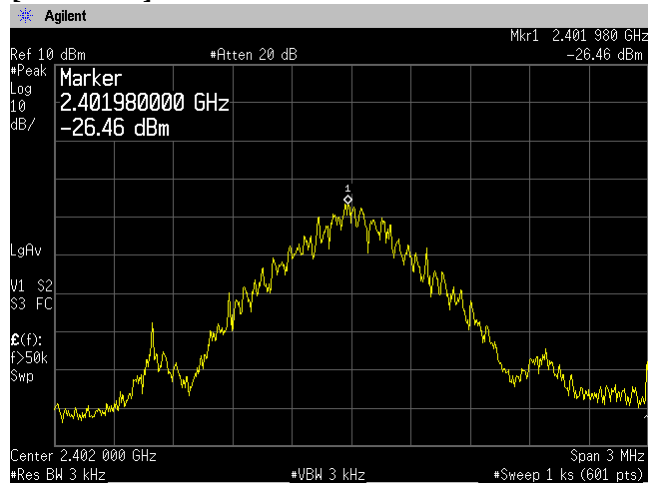
Tested by: Hiroaki Suzuki

Date : Jun. 5, 2009
 Temperature : 22.0 [°C]
 Humidity : 62.0 [%]
 Test place : Shielded room

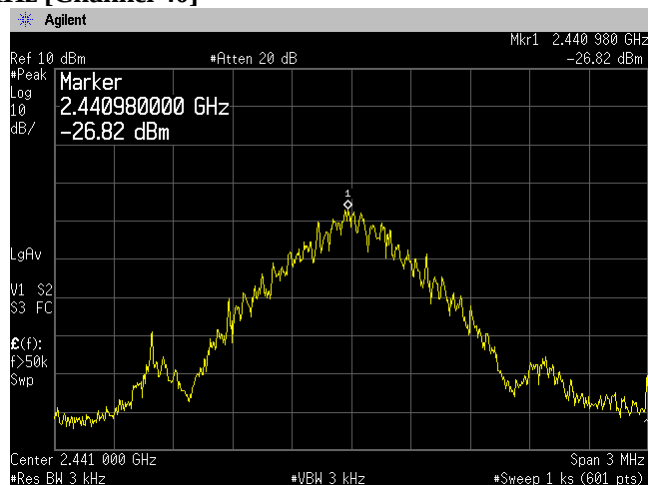
Transmitter Power Spectral Density

DH5

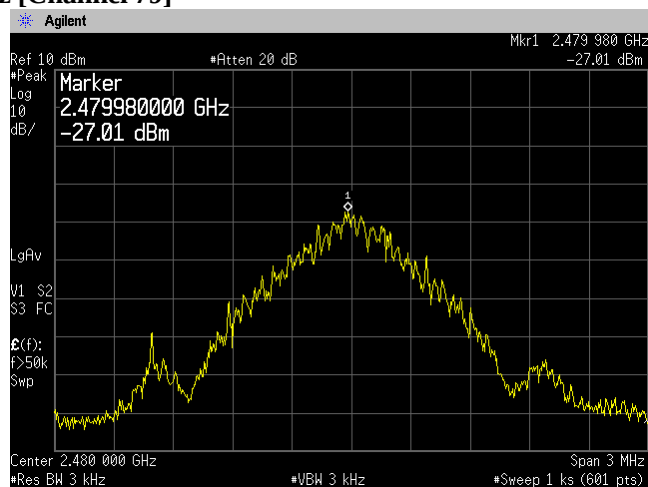
Channel Low: 2402.0MHz [Channel 1]



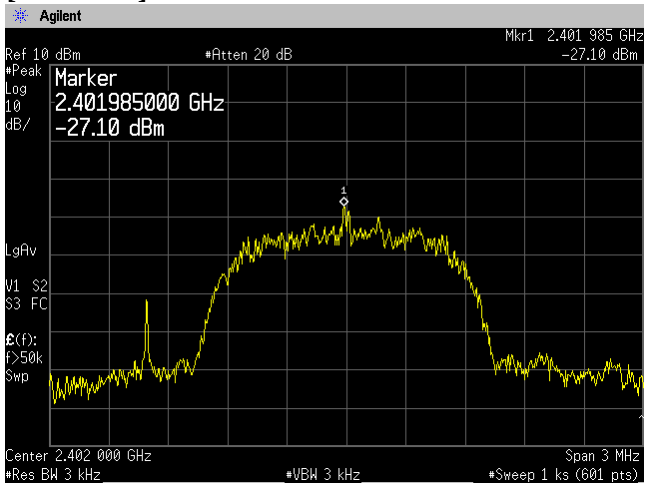
Channel Middle: 2441.0MHz [Channel 40]



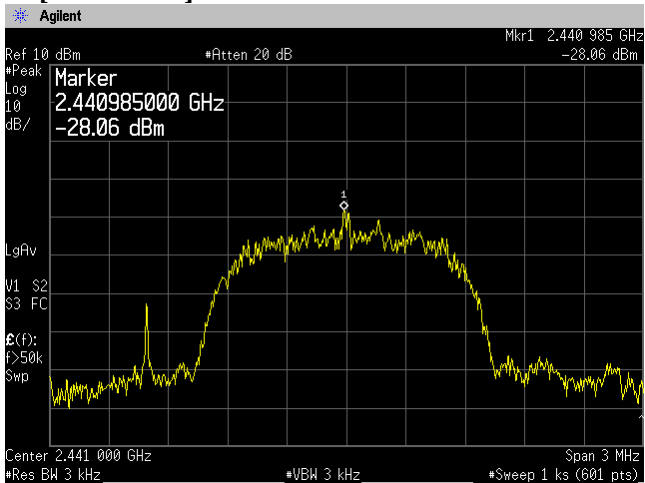
Channel High: 2480.0MHz [Channel 79]



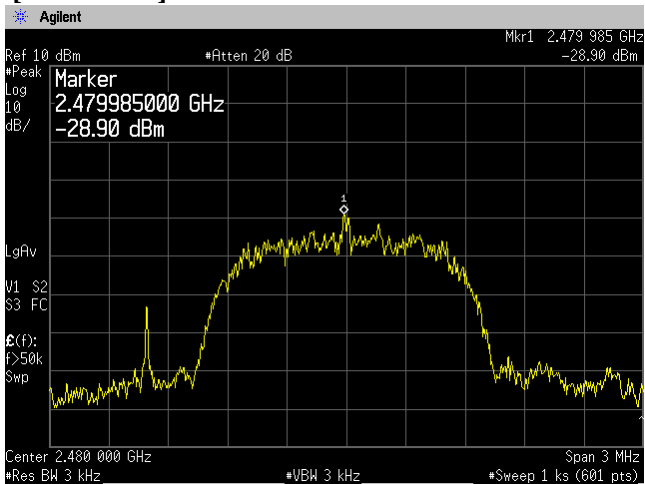
3-DH5
Channel Low: 2402.0MHz [Channel 1]



Channel Middle: 2441.0MHz [Channel 40]



Channel High: 2480.0MHz [Channel 79]



5.11 AC power line Conducted Emissions

5.11.1 Test Procedure [FCC 15.207, IC RSS-Gen 7.2.2]

Conducted emission at AC mains port measurements are performed at open area test site according to ANSI C63.4 section 7.

EUT and support equipment are placed on wooden table of 2.3m(W) × 1.0m(D) × 0.8m(H) in size. EUT is connected to 50Ω/50μH Line impedance stabilization network (LISN) which is placed on reference ground plane, and was placed 80cm away from EUT. Excess of AC power cable is bundled in center. Vertical Metal Reference Plane 2.4m (W) × 2.7m (H) in size is placed 0.4m away from EUT. LISN for peripheral is terminated in 50Ω.

EUT operating mode is selected to emit the maximum noise. Overall frequency range is investigated with spectrum analyzer using peak detector. Maximum emission configuration is determined by manipulating the EUT, support equipment, interconnecting cables. Then, emission measurements are performed with test receiver in above setting to each current-carrying conductor of the mains port. Sufficient time for EUT, support equipment and test equipment are provided in order for them to warm up to their normal operating condition.

Frequency range:

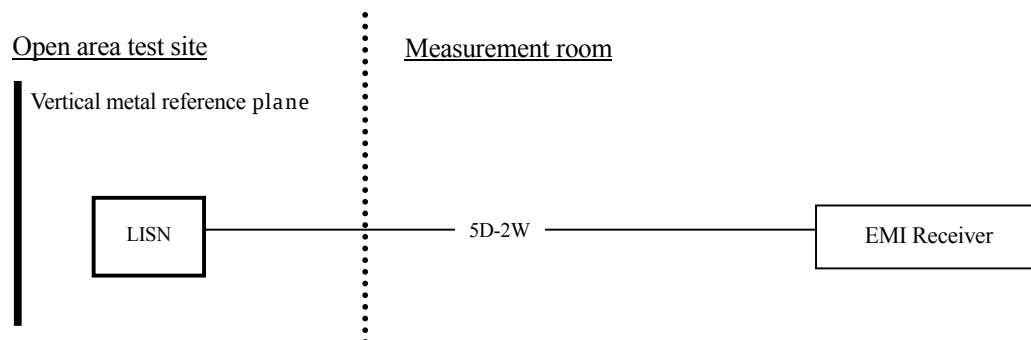
- 0.15MHz to 30MHz

The Test receiver is set to:

- Detector: Quasi-peak, Average
Bandwidth: 9kHz

5.11.2 Measurement Setup

Test configuration for AC power line Conducted Emissions



5.11.3 Limit of AC power line Conducted Emissions Measurement (Sample calculation)

Frequency	Limit		Sample of field strength calculation
	QP(dBμV)	AV(dBμV)	
0.15MHz to 0.5MHz	66 to 56*	56 to 46*	$\text{dB}\mu\text{V} = 20\log_{10}(\mu\text{V})$ Limit @ : 60.0dBμV(Quasi-peak) 6.770MHz : 50.0dBμV(Average)
0.5MHz to 5MHz	56	46	(Quasi peak) Reading = 51.2dBμV Cable loss + AMN factor = 0.3dB Total = 51.2 + 0.3 = 51.5dBμV Margin = 60.0 – 51.5 = 8.5dB
5MHz to 30MHz	60	50	(Average) Reading = 45.0dBμV Cable loss + AMN factor = 0.3dB Total = 45.0 + 0.3 = 45.3dBμV Margin = 50.0 – 45.3 = 4.7dB

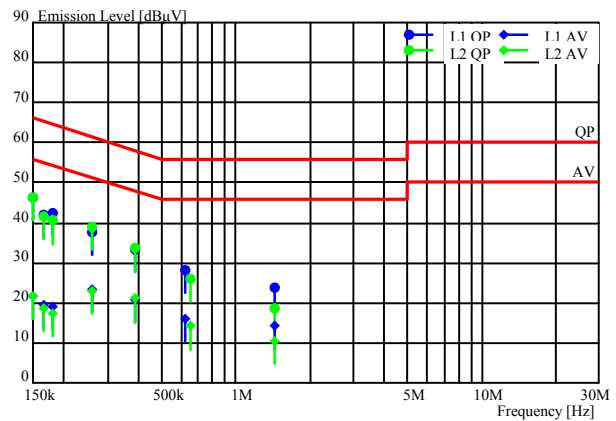
*: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

5.11.4 Measurement Result

***** CONDUCTED EMISSION at MAINS PORT *****

Sheet number : 1

Standard : FCC Part 15 Subpart C
Class : N/A
Terminal : Mains
Date of test : 2009/6/8
Test site : 3
Temperature [] : 21.2
Humidity [%] : 47.0
Operator : T.Yamagishi
Company name : Seiko Instruments Inc.
EUT : Thermal Printer
Model number : DPU-S245
Serial number : 1000001A
Test mode : H Print mode
Comment :



Phase	Frequency [MHz]	Reading		Factor	Emission level		Limit		Margin		Comment
		QP	AV		QP	AV	QP	AV	QP	AV	
		[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dB]	[dB]	
L1	0.150	46.2	21.6	0.1	46.3	21.7	66.0	56.0	19.7	34.3	*
L1	0.165	41.8	19.2	0.1	41.9	19.3	65.2	55.2	23.3	35.9	
L1	0.180	42.5	19.0	0.1	42.6	19.1	64.5	54.5	21.9	35.4	
L1	0.261	37.6	23.2	0.1	37.7	23.3	61.4	51.4	23.7	28.1	
L1	0.388	33.3	20.8	0.1	33.4	20.9	58.1	48.1	24.7	27.2	
L1	0.625	28.0	16.0	0.1	28.1	16.1	56.0	46.0	27.9	29.9	
L1	1.435	23.7	14.0	0.1	23.8	14.1	56.0	46.0	32.2	31.9	
L2	0.150	46.2	21.7	0.1	46.3	21.8	66.0	56.0	19.7	34.2	*
L2	0.165	41.4	18.5	0.1	41.5	18.6	65.2	55.2	23.7	36.6	
L2	0.180	40.4	17.3	0.1	40.5	17.4	64.5	54.5	24.0	37.1	
L2	0.258	38.8	22.8	0.1	38.9	22.9	61.5	51.5	22.6	28.6	
L2	0.388	33.5	20.9	0.1	33.6	21.0	58.1	48.1	24.5	27.1	
L2	0.651	26.0	14.1	0.1	26.1	14.2	56.0	46.0	29.9	31.8	
L2	1.435	18.3	10.5	0.1	18.4	10.6	56.0	46.0	37.6	35.4	

* : The worst emission. Factor : LISN Factor + Cable Loss Ver.2.81 F3#037

5.12 Antenna requirement

According to FCC section 15.203., an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

The antenna is a chip antenna mounted inside of the EUT. Therefore, the EUT complies with the antenna requirement of FCC section 15.203.

6. Uncertainty of measurement

Expanded uncertainties stated were calculated with a coverage Factor $k=2$.

Please note that these results are not taken into account when determining compliance or non-compliance with test result.

Test item	Measurement uncertainty
Conducted emission at mains port (150kHz - 30MHz)	$\pm 2.9\text{dB}$
Radiated emission (9kHz - 30MHz)	$\pm 4.4\text{dB}$
Radiated emission (30MHz – 1000MHz)	$\pm 5.2\text{dB}$
Radiated emission (1000MHz – 26GHz)	$\pm 3.6\text{dB}$

7. Laboratory description

7.1 Location: ZACTA Technology Corporation Yonezawa Testing Center
4149-7 Hachimanpara 5-chome Yonezawa-shi Yamagata 992-1128 Japan
Phone: +81-238-28-2880 Fax: +81-238-28-2888

7.2 Facility filing information:

1) NVLAP accreditation: NVLAP Lab. code: 200306-0

2) FCC filing:

Site name	Registration Number	Expiry Date
Site 2, Site3	91065	November 16, 2011
3m Semi-anechoic chamber 10m Semi-anechoic chamber	540072	March 12, 2010

3) Industry Canada Oats site filing:

Site name	Sites on file: Oats 3m/10m	Expiry Date
Site 2	4224A-2	January 24, 2010
Site 3	4224A-3	January 24, 2010
3m Semi-anechoic chamber	4224A-4	January 24, 2010
10m Semi-anechoic chamber	4224A-5	January 24, 2010

4) VCCI site filing:

Site name	Radiated emission	Conducted Emission for mains port	Expiry Date	Conducted emission for telecom port	Expiry Date
Site 2	R-137	C-133	Nov. 16, 2011	T-1477	Oct. 8, 2011
Site 3	R-138	C-134	Nov. 16, 2011	T-1478	Oct. 8, 2011
10m Semi-anechoic chamber	R-2480	C-2722	Dec. 19, 2009	T-1474	Oct. 8, 2011
3m Semi-anechoic chamber	R-2481	C-2723	Dec. 19, 2009	T-1475	Oct. 8, 2011
Shielded room No.1	R-137	C-2724	Dec. 19, 2009	T-1476	Oct. 8, 2011

5) ETL SEMKO authorization:

Authorized as an EMC test laboratory.

6) TUV Rheinland authorization:

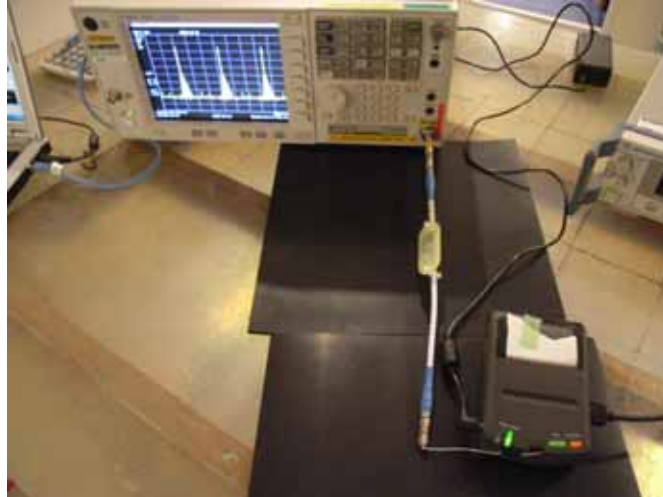
Authorized as an EMC test laboratory.

7) BUREAU VERITAS certification:

Certified as an EMC test laboratory.

8. Test photographs

System configuration (RF Conducted test)



Transmitter Radiated Spurious Emissions (RF Radiated test)



AC power line Conducted Emissions

