

FCC RF Test Report

APPLICANT : Motorola, Inc.
EQUIPMENT : Bluetooth Handsfree System TK30
BRAND NAME : MOTOROLA
MODEL NAME : TK30
FCC ID : IHDP6KQ1
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : Digital Spread Spectrum (DSS)

The product was received on Jul. 08, 2009 and completely tested on Sep. 10, 2009. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.4-2003 and shown the compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by:



Roy Wu / Manager



SPORTON INTERNATIONAL INC.

No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.



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APPENDIX A. PHOTOGRAPHS OF EUT

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SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(1)	A8.4(2)	Number of Channels	≥ 15Chs	Pass	
3.2	15.247(a)(1)	A8.1(a)	20dB Bandwidth	NA	Pass	-
3.2	-	Gen 4.4.1	99% Bandwidth	-	Pass	-
3.3	15.247(a)(1)	A8.1(b)	Channel Separation	≥ 2/3 of 20dB BW	Pass	-
3.4	15.247(a)(1)	A8.1(d)	Dwell Time of Each Channel	≤ 0.4sec in 31.6sec period	Pass	-
3.5	15.247(b)(1)	A8.1(b)	Peak Output Power	≤ 1W	Pass	-
3.6	15.247(d)	A8.5	Frequency Band Edges	≤ 20dBc	Pass	-
3.7	15.247(d)	A8.5	Transmitter Radiated Emission	15.209(a) & 15.247(d)	Pass	Under limit 6.06 dB at 721.40 MHz
3.8	15.203 & 15.247(b)	A8.4	Antenna Requirement	N/A	Pass	-



1 General Description

1.1 Applicant

Motorola, Inc.

600 N. U.S. Highway 45, Libertyville, IL 60048, U.S.A.

1.2 Manufacturer

PRIMAX ELECTRONICS LTD.

Liu Wu Industrial Zone, Shek Kit Town, DongGuan City, Guang Dong Province, China, Postcode: 523300

1.3 Feature of Equipment Under Test

Product Feature & Specification	
Equipment	Bluetooth Handsfree System TK30
Brand Name	MOTOROLA
Model Name	TK30
FCC ID	IHDP6KQ1
Tx/Rx Frequency Range	2400 MHz ~ 2483.5 MHz
Number of Channels	79
Carrier Frequency of Each Channel	2402+n*1 MHz; n=0~78
Channel Spacing	1 MHz
Maximum Output Power to Antenna	Bluetooth (1Mbps) : 3.28 dBm (2.13 mW) Bluetooth EDR (2Mbps) : 3.58 dBm (2.28 mW) Bluetooth EDR (3Mbps) : 3.84 dBm (2.42 mW)
Antenna Type	PIFA Antenna with gain -1.31 dBi
HW Version	V0.3
SW Version	SW TK30_N_00.03.AEI / BT SW TK30_N_00_02.ABI
Type of Modulation	Bluetooth (1Mbps) : GFSK Bluetooth EDR (2Mbps) : π /4-DQPSK Bluetooth EDR (3Mbps) : 8-DPSK
EUT Stage	Production Unit

Remark:

1. For other wireless features of this EUT, test report will be issued separately.
2. This test report recorded only product characteristics and test results of Digital Spread Spectrum (DSS).

List of Accessory:

Specification of Accessory		
TK30	Signal Line Type	1.5 meter shielded cable with ferrite core
Vehicle Integration Hub TH10	Brand Name	Motorola
	Model Name	TH10
ISO Cable	Brand Name	Motorola
	Model Name	SKN6386A
	Signal Line Type	0.6 meter non-shielded cable without ferrite core
Car kit audio cable (USB / Aux.)	Brand Name	Motorola
	Model Name	SKN6389A
	Signal Line Type	1.6 meter shielded cable with ferrite core
Car kit audio cable (iPod)	Brand Name	Motorola
	Model Name	SKN6387A
	Signal Line Type	0.2 meter shielded cable without ferrite core
Microphone	Brand Name	Motorola
	Model Name	SMN4095C
	Signal Line Type	3.05 meter non-shielded cable without ferrite core

Remark:

1. The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.
2. For accessories equipped with this EUT, please refer to the appendix of the external photo.

1.4 Testing Site

Test Site	SPORTON INTERNATIONAL INC.	
Test Site Location	No. 52, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-3273456 / FAX: +886-3-3284978	
Test Site No.	Sporton Site No.	FCC/IC Registration No.
	03CH06-HY	TW1022/4086B-1



1.5 Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- FCC Public Notice DA 00-705
- ANSI C63.4-2003
- IC RSS-210 Issue 7

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B (DoC), recorded in a separate test report.

1.6 Ancillary Equipment List

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Base Station	R&S	CBT32	N/A	N/A	Unshielded, 1.8 m
2.	i-Pod	Apple	A1199	FCC DoC	Shielded, 1.0 m	N/A
3.	DVD Player	Sieheguoji	DV-A355	FCC DoC	N/A	Unshielded, 1.7 m
4.	Car Battery	YUASA	46B24R(S)	N/A	N/A	N/A

2 Test Configuration of Equipment Under Test

2.1 RF Output Power

Preliminary tests were performed in different data rate and recorded the RF output power in the following table:

Channel	Frequency	Bluetooth RF Output Power		
		Data Rate / Modulation		
		GFSK	π /4-DQPSK	8-DPSK
		1Mbps	2Mbps	3Mbps
Ch00	2402MHz	3.28 dBm	3.58 dBm	3.84 dBm
Ch39	2441MHz	2.89 dBm	3.10 dBm	3.40 dBm
Ch78	2480MHz	2.71 dBm	2.85 dBm	3.15 dBm

Remark:

1. The data rate was set in 3Mbps for all the test items due to the highest RF output power.
2. The EUT is programmed to transmit signals continuously for all testing.

2.2 Test Mode

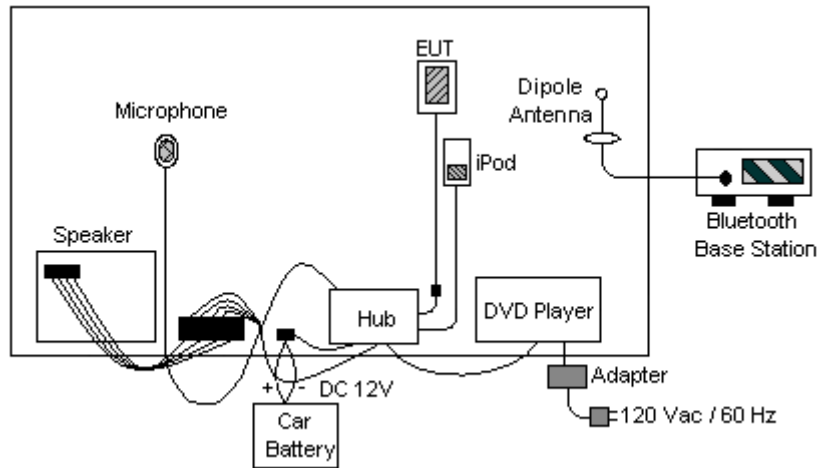
The EUT has been associated with peripherals pursuant to ANSI C63.4-2003 and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction (150 kHz to 30 MHz), radiation (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

Pre-scanned tests were conducted to determine the final configuration from all possible combinations.

The following tables are showing the test modes as the worst cases and recorded in this report.

Test Cases			
Test Item	Data Rate / Modulation		
	Bluetooth 1Mbps GFSK	Bluetooth EDR 2Mbps π /4-DQPSK	Bluetooth EDR 3Mbps 8-DPSK
Conducted TCs	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz	Mode 4: CH00_2402 MHz Mode 5: CH39_2441 MHz Mode 6: CH78_2480 MHz	Mode 7: CH00_2402 MHz Mode 8: CH39_2441 MHz Mode 9: CH78_2480 MHz
Radiated TCs	N/A	N/A	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz
Remark: For radiated TCs, the data rate was set in 3Mbps due to the highest RF output power; only the data of these modes was reported.			

2.3 Connection Diagram of Test System



2.4 RF Utility

For Bluetooth function, the RF utility, "Enter BT Test Mode" was installed in EUT which was programmed in order to make the EUT into the engineering modes to contact with BT base station for transmitting and receiving signals continuously.

3 Test Result

3.1 Number of Channel Measurement

3.1.1 Limits of Number of Hopping Frequency

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

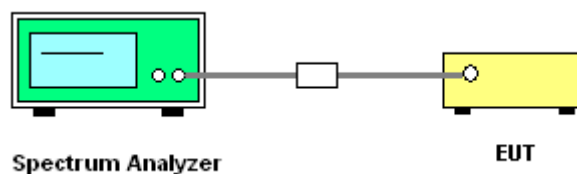
3.1.2 Measuring Instruments

See list of measuring instruments of this test report.

3.1.3 Test Procedure

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
3. The modulation types of EUT are irrelevant to number of hopping channels deviation.
4. The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Span = the frequency band of operation; $RBW \geq 1\%$ of the span; $VBW \geq RBW$; Sweep = auto;
Detector function = peak; Trace = max hold.
5. The number of hopping frequency used is defined as the device has the numbers of total channel.

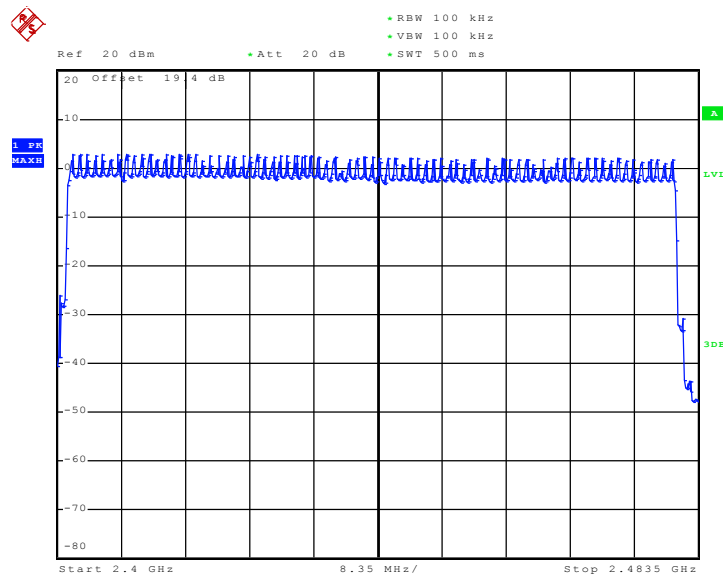
3.1.4 Test Setup



3.1.5 Test Result of Number of Hopping Frequency

Test Mode :	Mode 7~9	Temperature :	26.4°C
Test Engineer :	Ken Hsu	Relative Humidity :	50%
Number of Hopping Channels (Channel)		Limits (Channel)	
79		> 15	
		Pass/Fail	
		Pass	

Number of Hopping Channel Plot on Channel 00 - 78



Date: 9.SEP.2009 17:57:35

3.2 20dB and 99% Bandwidth Measurement

3.2.1 Limit of 20dB Bandwidth

N/A

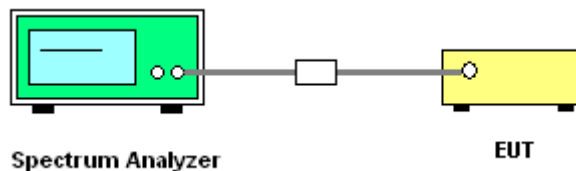
3.2.2 Measuring Instruments

See list of measuring instruments of this test report.

3.2.3 Test Procedures

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
3. The EUT should be transmitting at its maximum data rate as the worst cases.
4. Use the following spectrum analyzer settings:
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel;
RBW \geq 1% of the 20 dB bandwidth; VBW \geq RBW; Sweep = auto; Detector function = peak;
Trace = max hold.
5. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

3.2.4 Test Setup



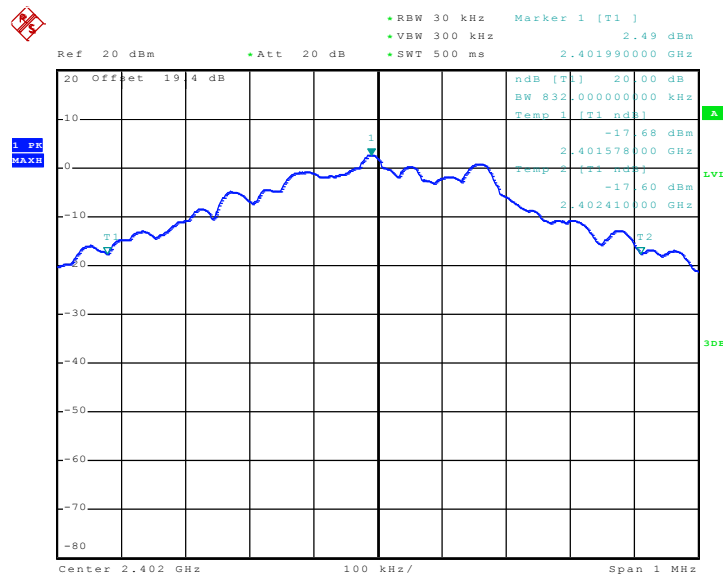


3.2.5 Test Result of 20dB Bandwidth

Test Mode :	Mode 1, 2, 3	Temperature :	26.4°C
Test Engineer :	Ken Hsu	Relative Humidity :	50%

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	0.832
39	2441	0.830
78	2480	0.832

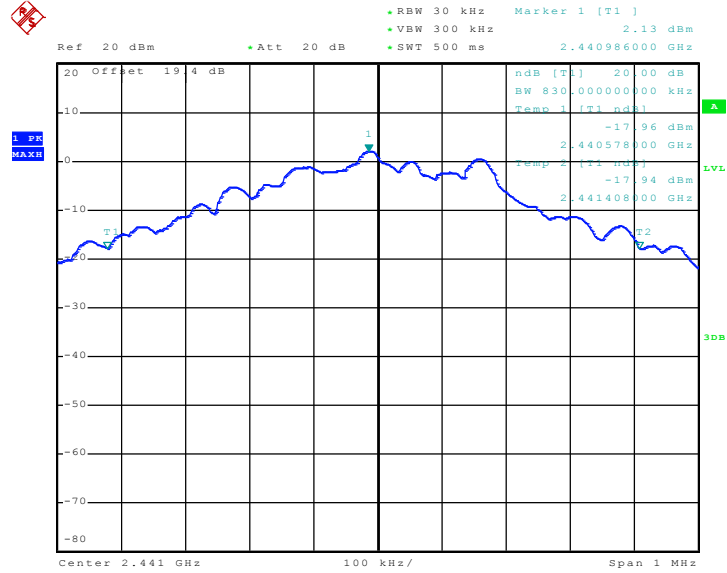
20 dB Bandwidth Plot on Channel 00



Date: 9.SEP.2009 16:46:03

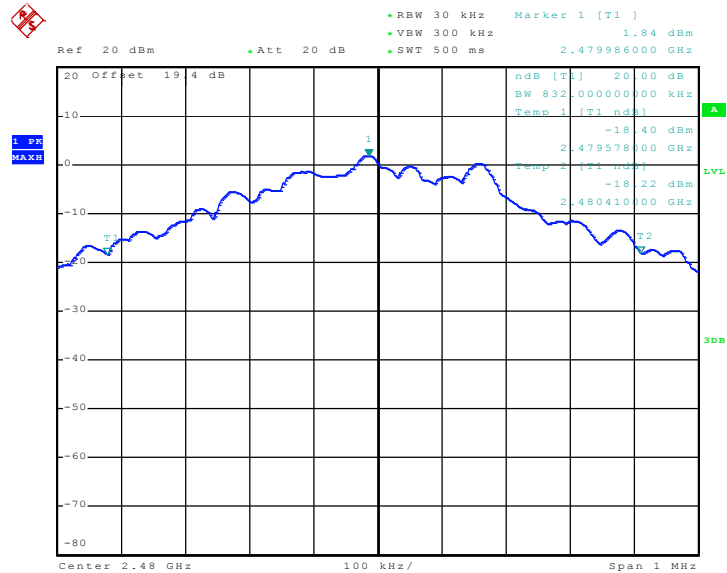


20 dB Bandwidth Plot on Channel 39



Date: 9.SEP.2009 16:46:43

20 dB Bandwidth Plot on Channel 78



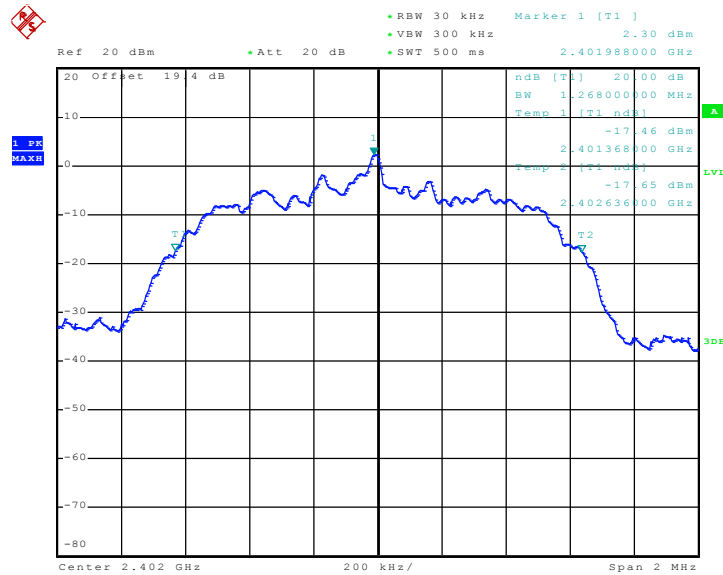
Date: 9.SEP.2009 16:47:09



Test Mode :	Mode 4, 5, 6	Temperature :	26.4°C
Test Engineer :	Ken Hsu	Relative Humidity :	50%

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	1.268
39	2441	1.272
78	2480	1.276

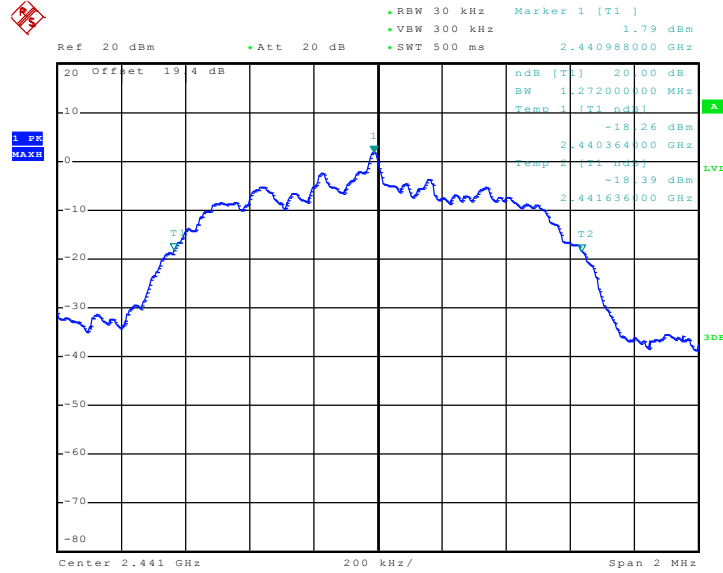
20 dB Bandwidth Plot on Channel 00



Date: 9.SEP.2009 16:48:42

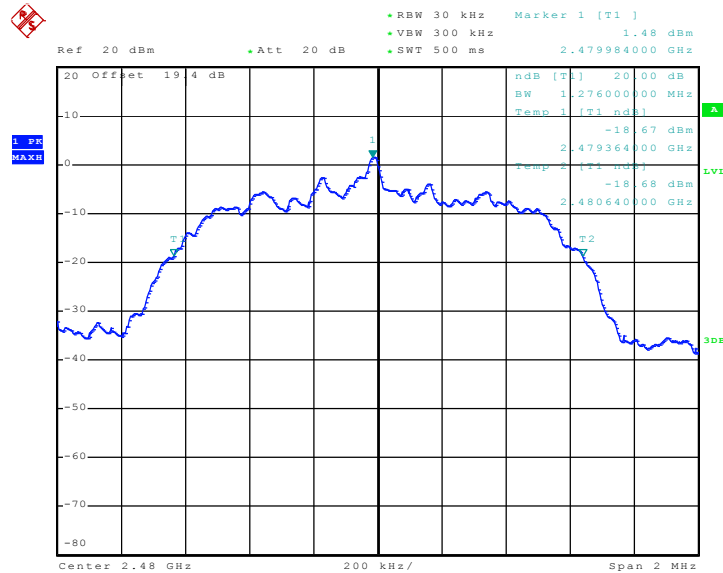


20 dB Bandwidth Plot on Channel 39



Date: 9.SEP.2009 16:50:22

20 dB Bandwidth Plot on Channel 78



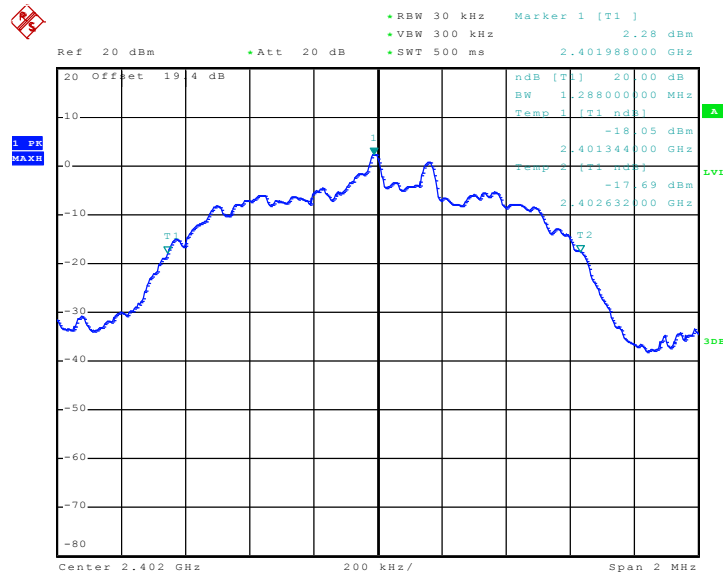
Date: 9.SEP.2009 16:47:44



Test Mode :	Mode 7, 8, 9	Temperature :	26.4°C
Test Engineer :	Ken Hsu	Relative Humidity :	50%

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	1.288
39	2441	1.288
78	2480	1.284

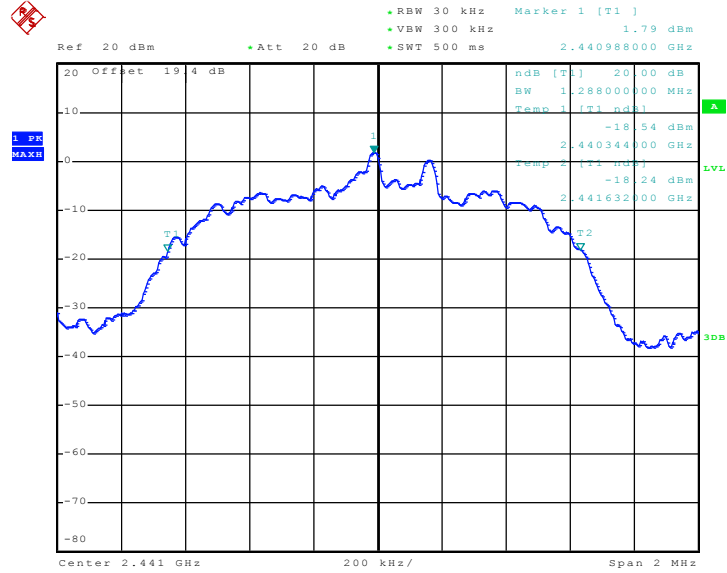
20 dB Bandwidth Plot on Channel 00



Date: 9.SEP.2009 16:51:39

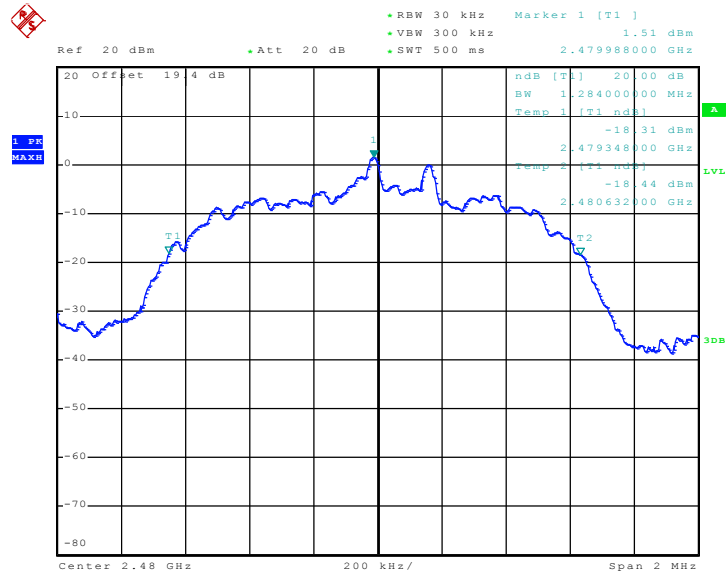


20 dB Bandwidth Plot on Channel 39



Date: 9.SEP.2009 16:52:40

20 dB Bandwidth Plot on Channel 78



Date: 9.SEP.2009 16:52:57

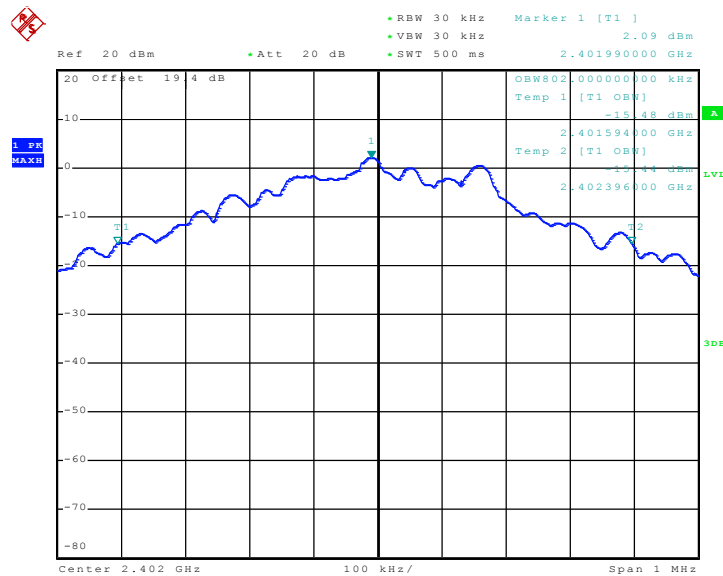


3.2.6 Test Result of 99% Occupied Bandwidth

Test Mode :	Mode 1, 2, 3	Temperature :	26.4°C
Test Engineer :	Ken Hsu	Relative Humidity :	50%

Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)
00	2402	0.802
39	2441	0.802
78	2480	0.804

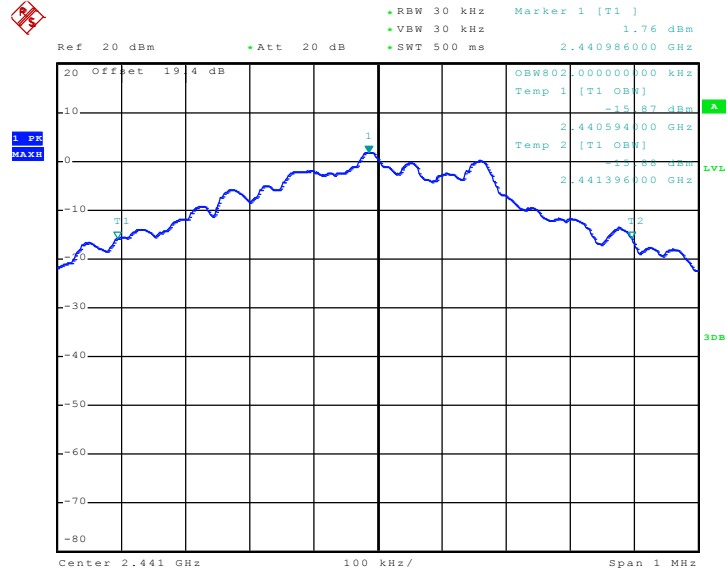
99% Bandwidth Plot on Channel 00



Date: 9.SEP.2009 16:55:56

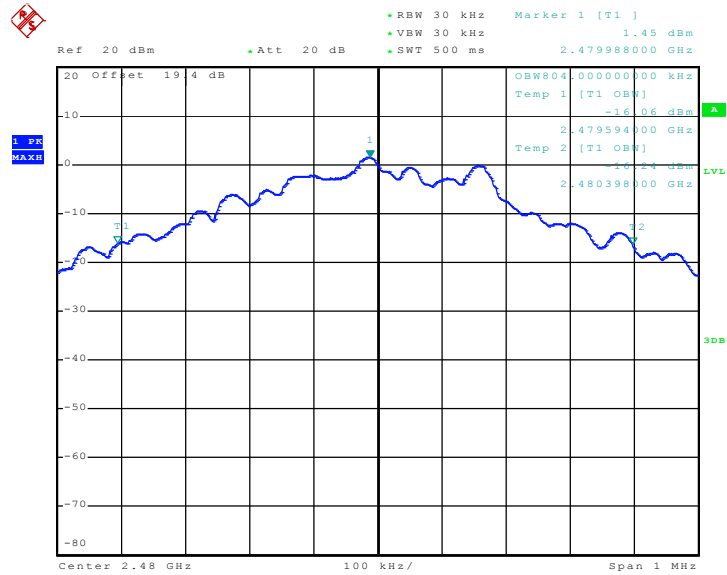


99% Occupied Bandwidth Plot on Channel 39



Date: 9.SEP.2009 16:56:17

99% Occupied Bandwidth Plot on Channel 78



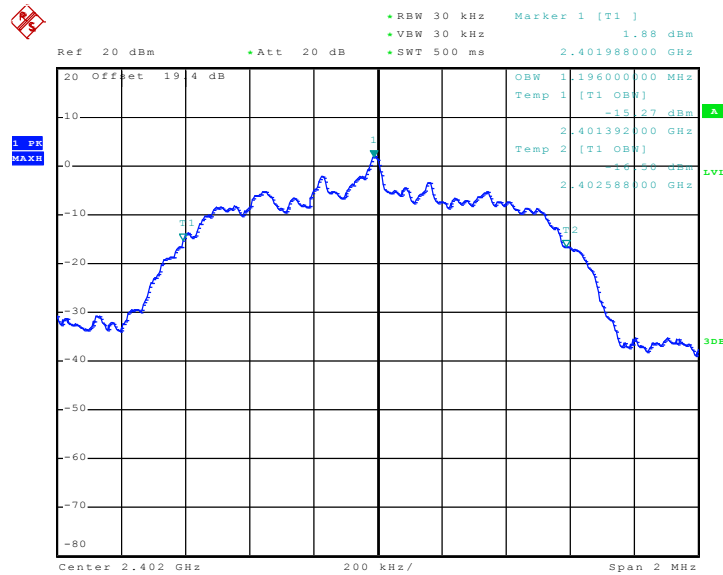
Date: 9.SEP.2009 16:56:39



Test Mode :	Mode 4, 5, 6	Temperature :	26.4°C
Test Engineer :	Ken Hsu	Relative Humidity :	50%

Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)
00	2402	1.196
39	2441	1.196
78	2480	1.196

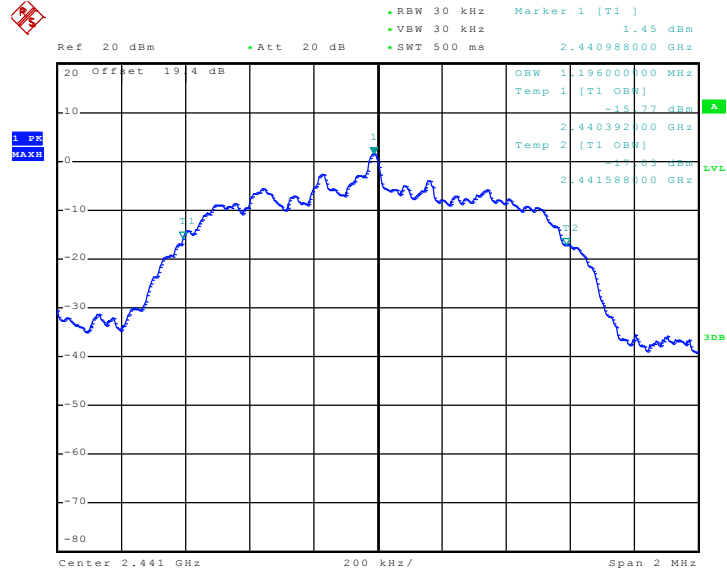
99% Bandwidth Plot on Channel 00



Date: 9.SEP.2009 16:57:01

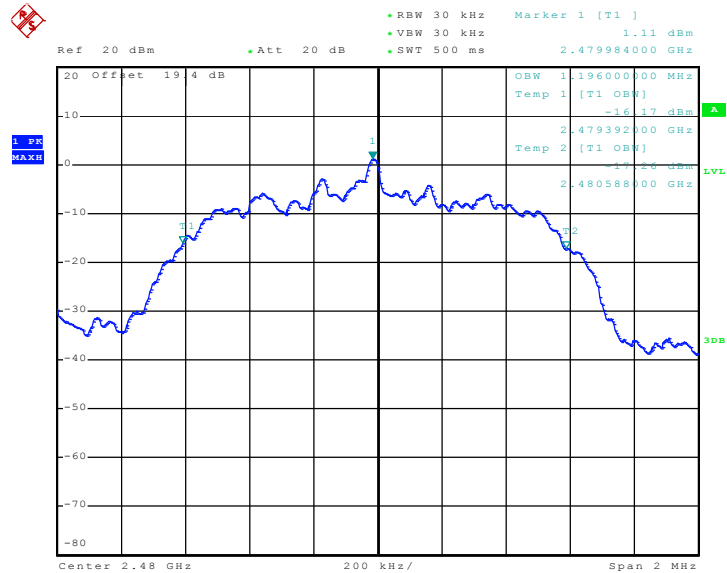


99% Occupied Bandwidth Plot on Channel 39



Date: 9.SEP.2009 16:57:19

99% Occupied Bandwidth Plot on Channel 78



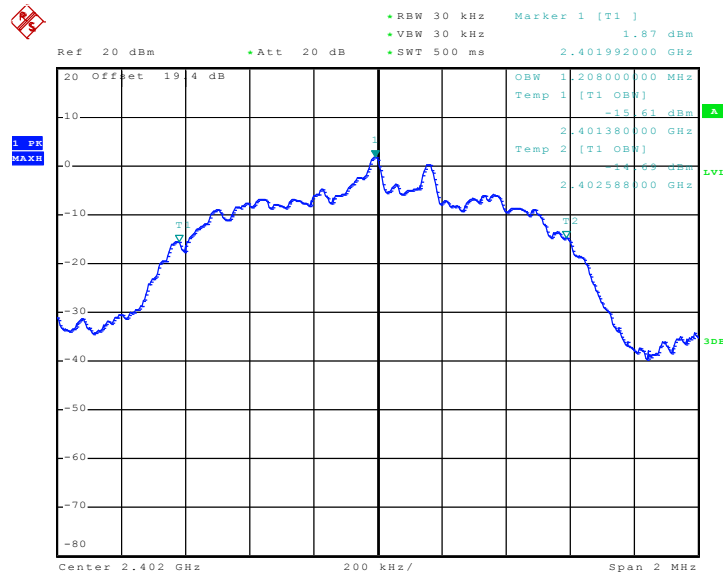
Date: 9.SEP.2009 16:57:43



Test Mode :	Mode 7, 8, 9	Temperature :	26.4°C
Test Engineer :	Ken Hsu	Relative Humidity :	50%

Channel	Frequency (MHz)	99% Occupied Bandwidth (MHz)
00	2402	1.208
39	2441	1.208
78	2480	1.208

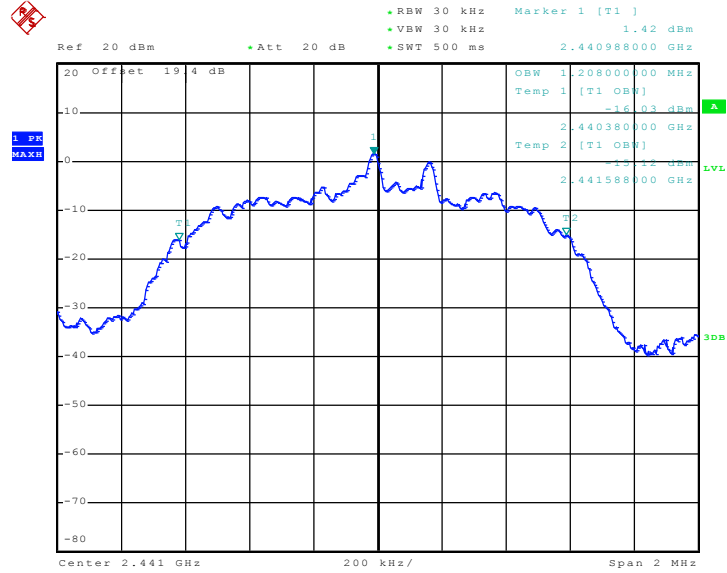
99% Bandwidth Plot on Channel 00



Date: 9.SEP.2009 16:58:14

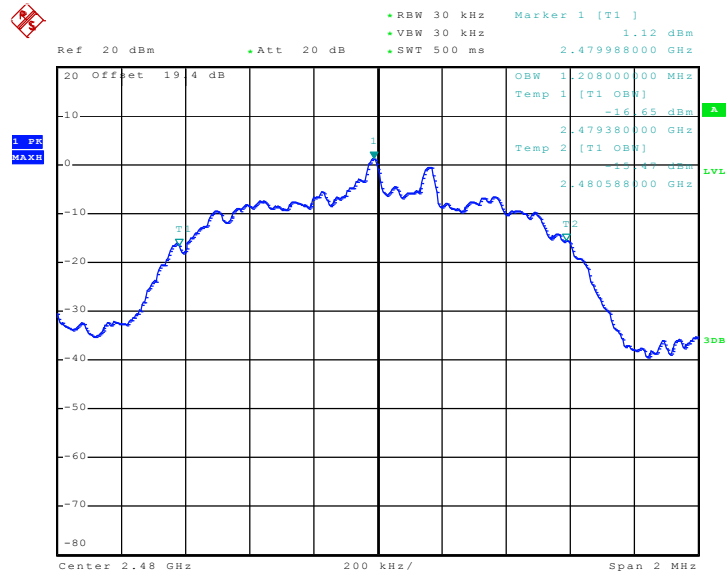


99% Occupied Bandwidth Plot on Channel 39



Date: 9.SEP.2009 16:58:29

99% Occupied Bandwidth Plot on Channel 78



Date: 9.SEP.2009 16:58:50

3.3 Hopping Channel Separation Measurement

3.3.1 Limit of Hopping Channel Separation

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

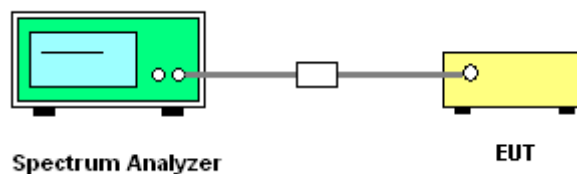
3.3.2 Measuring Instruments

See list of measuring instruments of this test report.

3.3.3 Test Procedures

1. Please refer FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
3. The EUT should be transmitting at its maximum data rate as the worst cases.
4. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels; $RBW \geq 1\%$ of the span;
VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold.
5. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

3.3.4 Test Setup



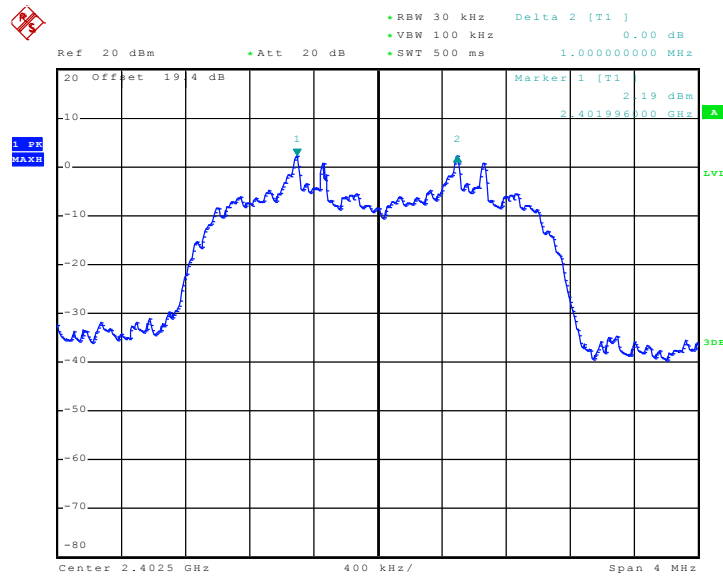


3.3.5 Test Result of Hopping Channel Separation

Test Mode :	Mode 7, 8, 9	Temperature :	26.4°C
Test Engineer :	Ken Hsu	Relative Humidity :	50%

Channel	Frequency (MHz)	Frequency Separation (MHz)	(2/3 of 20dB BW) Limits (MHz)	Pass/Fail
00	2402	1.000	0.859	Pass
39	2441	1.000	0.859	Pass
78	2480	1.008	0.856	Pass

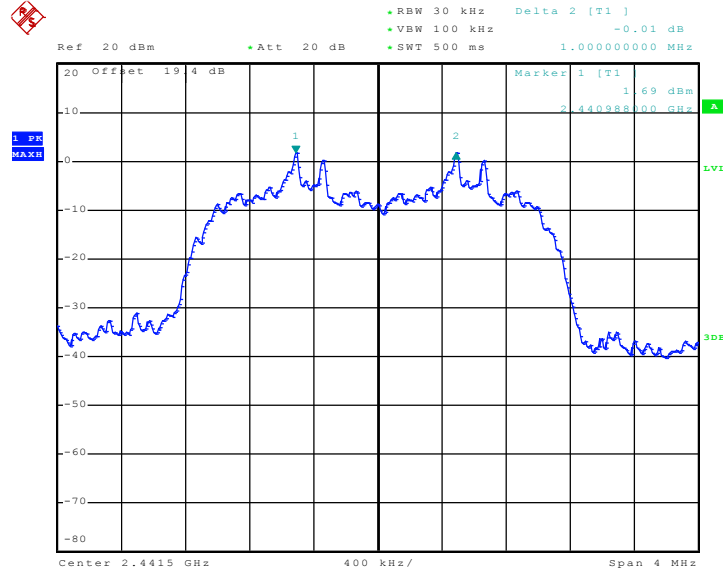
Channel Separation Plot on Channel 00 - 01



Date: 9.SEP.2009 17:24:06

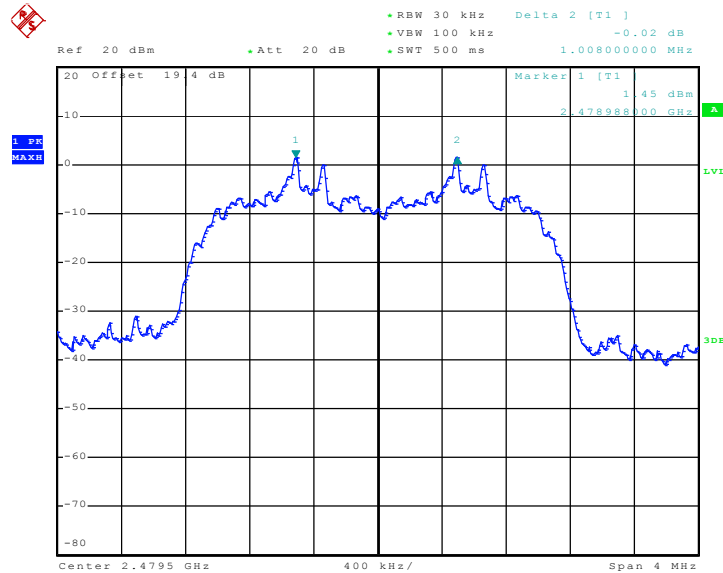


Channel Separation Plot on Channel 39 - 40



Date: 9.SEP.2009 17:25:25

Channel Separation Plot on Channel 77 - 78



Date: 9.SEP.2009 17:26:09

3.4 Dwell Time Measurement

3.4.1 Limit of 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.

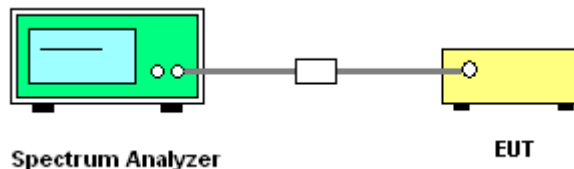
3.4.2 Measuring Instruments

See list of measuring instruments of this test report.

3.4.3 Test Procedures

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.
3. The EUT should be transmitting at its maximum data rate as the worst cases.
4. The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Span = zero span, centered on a hopping channel; RBW = 1 MHz; VBW ≥ RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
5. Use the marker-delta function to calculate the dwell time.

3.4.4 Test Setup



3.4.5 Test Result of Dwell Time

Test Mode :	Mode 8	Temperature :	26.4°C
Test Engineer :	Ken Hsu	Relative Humidity :	50%

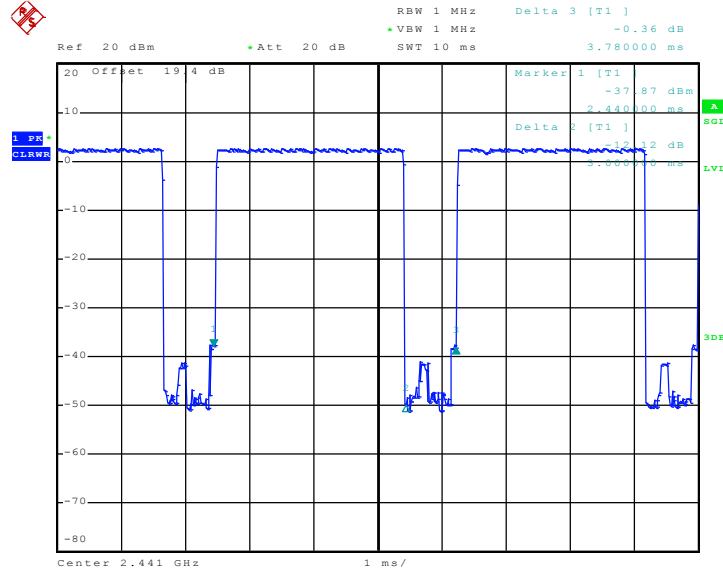
Package Mode	Average Hopping Channel	Package Transfer Time (usec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
3DH5	3.20	3000.00	0.30	0.4	Pass

Remark:

1. Dwell Time=79(channels) x 0.4(s) x average hopping channel x package transfer time
2. 79 channels come from the Hopping Channel number.
3. Average Hopping Channel = hops/sweep time
4. t: Package Transfer Time(us)

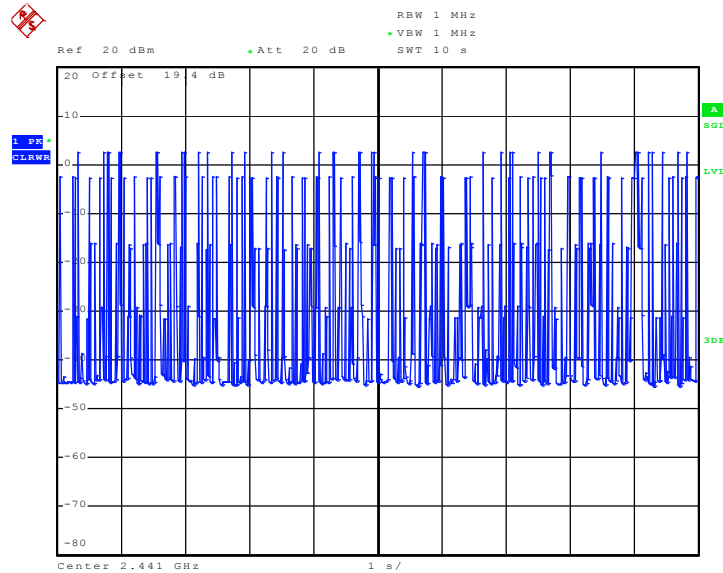


3DH5 Dwell Time (One Pulse) Plot on Channel 39



Date: 9.SEP.2009 17:36:14

3DH5 Dwell Time (Count Pulses) Plot on Channel 39



Date: 9.SEP.2009 18:08:18

3.5 Peak Output Power Measurement

3.5.1 Limit of Peak Output Power

Frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels: 1W (30 dBm).

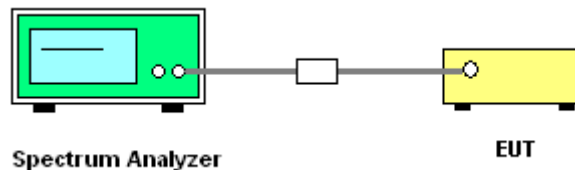
3.5.2 Measuring Instruments

See list of measuring instruments of this test report.

3.5.3 Test Procedures

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable.

3.5.4 Test Setup



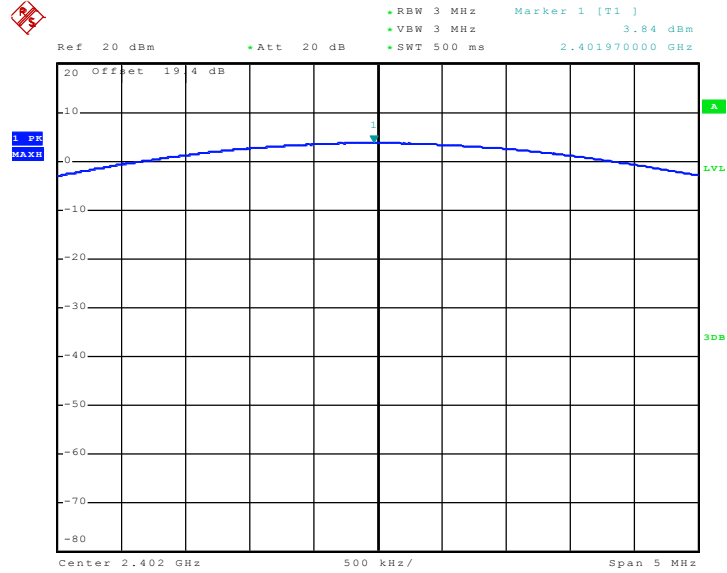
3.5.5 Test Result of Peak Output Power

Test Mode :	Mode 7, 8, 9	Temperature :	26.4°C
Test Engineer :	Ken Hsu	Relative Humidity :	50%

Channel	Frequency (MHz)	RF Power (dBm)		
		8-DPSK	Max. Limits (dBm)	Pass/Fail
		3 Mbps		
00	2402	3.84	30	Pass
39	2441	3.40	30	Pass
78	2480	3.15	30	Pass

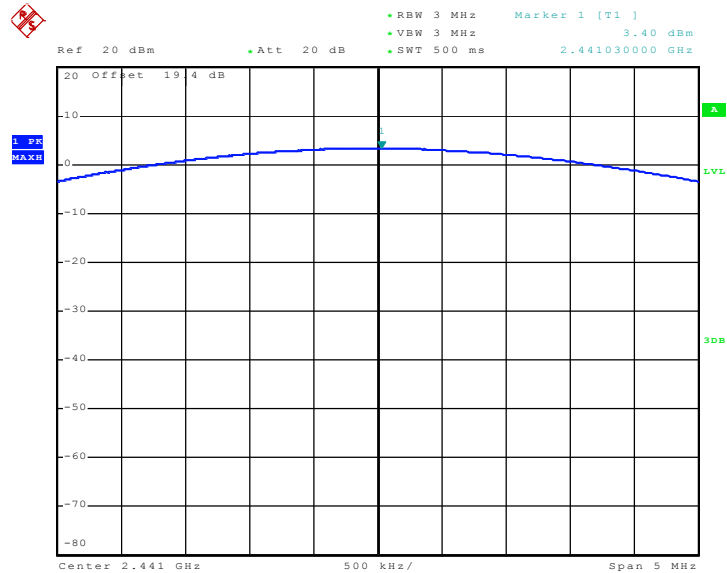


Peak Output Power Plot on Channel 00



Date: 9.SEP.2009 16:26:25

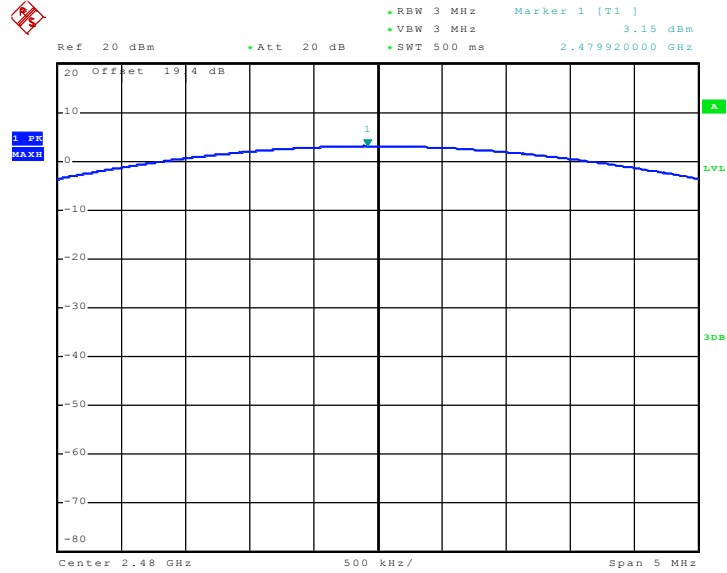
Peak Output Power Plot on Channel 39



Date: 9.SEP.2009 16:32:36



Peak Output Power Plot on Channel 78



Date: 9.SEP.2009 16:34:26

3.6 Band Edges Measurement

3.6.1 Limit of Band Edges

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

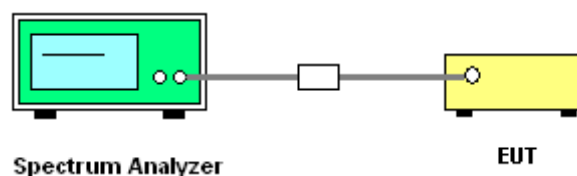
3.6.2 Measuring Instruments

See list of measuring instruments of this test report.

3.6.3 Test Procedures

1. The testing follows the guidelines in ANSI C63.4-2003 and FCC Public Notice DA 00-705 Measurement Guidelines.
2. RF antenna conducted test: Set RBW = 100 kHz, Video bandwidth (VBW) > RBW, scan up through 10th harmonic. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW. Note: If the device complies with the use of power option 2 the attenuation under this paragraph shall be 30 dB instead of 20 dB.
3. Radiated emission test: Applies to band edge emissions that fall in the restricted bands listed in FCC Section 15.205. The maximum permitted average field strength is listed in FCC Section 15.209. A pre-amp is necessary for this measurement. For measurements above 1 GHz, set RBW = 1MHz, VBW = 10 Hz, Sweep: Auto. If the emission is pulsed, modify the unit for continuous operation; use the settings shown above, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation. See FCC Section 15.35(b) and (c).

3.6.4 Test Setup





3.6.5 Test Result of Radiated Band Edges

Test Mode :	Mode 1	Temperature :	23~24°C
Test Channel :	00	Relative Humidity :	42~43%
		Test Engineer :	Elvis Chen

ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2389.42	62.96	-11.04	74.00	63.46	31.86	3.92	36.28	155	304	Peak
2389.42	42.61	-11.39	54.00	43.11	31.86	3.92	36.28	155	304	Average

Remark:

<Delta Marker>

Delta marker at 1% RBW of span = 38.17 + 2.71 = 40.88 dB (can be referred to section 3.6.6)

Peak band edge at 2389.42 MHz (RBW = VBW = 1MHz) = 103.84 dBuV/m - 40.88 dB = 62.96 dBuV/m

Duty factor = 20 x log ((Package Transfer Times(ms) x Avg Hopping Channel) / 100 ms)

$$= 20 \times \log ((3.0 \times 3.2) / 100) = -20.35$$

Average band edge = Peak band edge + Duty factor = 62.96 dBuV/m + (-20.35) = 42.61 dBuV/m

ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2389.42	54.98	-19.02	74.00	55.48	31.86	3.92	36.28	104	43	Peak
2389.42	34.63	-19.37	54.00	35.13	31.86	3.92	36.28	104	43	Average

Remark:

<Delta Marker>

Delta marker at 1% RBW of span = 38.17 + 2.71 = 40.88 dB (can be referred to section 3.6.6)

Peak band edge at 2389.42 MHz (RBW = VBW = 1MHz) = 95.86 dBuV/m - 40.88 dB = 54.98 dBuV/m

Duty factor = 20 x log ((Package Transfer Times(ms) x Avg Hopping Channel) / 100 ms)

$$= 20 \times \log ((3.0 \times 3.2) / 100) = -20.35$$

Average band edge = Peak band edge + Duty factor = 54.98 dBuV/m + (-20.35) = 34.63 dBuV/m



Test Mode :	Mode 3	Temperature :	23~24°C
Test Channel :	78	Relative Humidity :	42~43%
		Test Engineer :	Elvis Chen

ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.50	55.02	-18.98	74.00	55.29	31.98	4.05	36.30	100	320	Peak
2483.50	34.67	-19.33	54.00	34.94	31.98	4.05	36.30	100	320	Average

Remark:

<Delta Marker>

Delta marker at 1% RBW of span = 46.33 + 1.24 = 47.57 dB (can be referred to section 3.6.6)

Peak band edge at 2483.50 MHz (RBW = VBW = 1MHz) = 102.59 dBuV/m – 47.57 dB = 55.02 dBuV/m

Duty factor = 20 x log ((Package Transfer Times(ms) x Avg Hopping Channel) / 100 ms)

$$= 20 \times \log ((3.0 \times 3.2) / 100) = -20.35$$

Average band edge = Peak band edge + Duty factor = 55.02 dBuV/m + (-20.35) dB = 34.67 dBuV/m

ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	Level (dBuV/m)	Over Limit (dB)	Limit Line (dBuV/m)	Read Level (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.50	47.61	-26.39	74.00	47.88	31.98	4.05	36.30	101	331	Peak
2483.50	27.26	-26.74	54.00	27.53	31.98	4.05	36.30	101	331	Average

Remark:

<Delta Marker>

Delta marker at 1% RBW of span = 46.33 + 1.24 = 47.57 dB (can be referred to section 3.6.6)

Peak band edge at 2483.50 MHz (RBW = VBW = 1MHz) = 95.18 dBuV/m – 47.57 dB = 47.61 dBuV/m

Duty factor = 20 x log ((Package Transfer Times(ms) x Avg Hopping Channel) / 100 ms)

$$= 20 \times \log ((3.0 \times 3.2) / 100) = -20.35$$

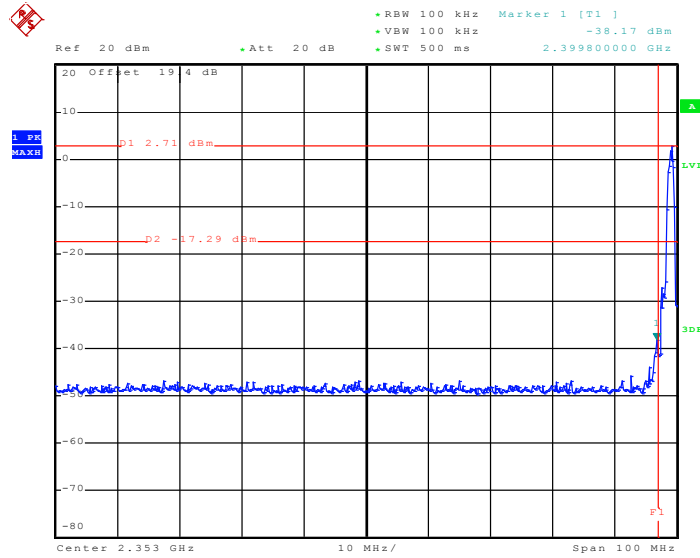
Average band edge = Peak band edge + Duty factor = 47.61 dBuV/m + (-20.35) dB = 27.26 dBuV/m



3.6.6 Test Result of Conducted Band Edges

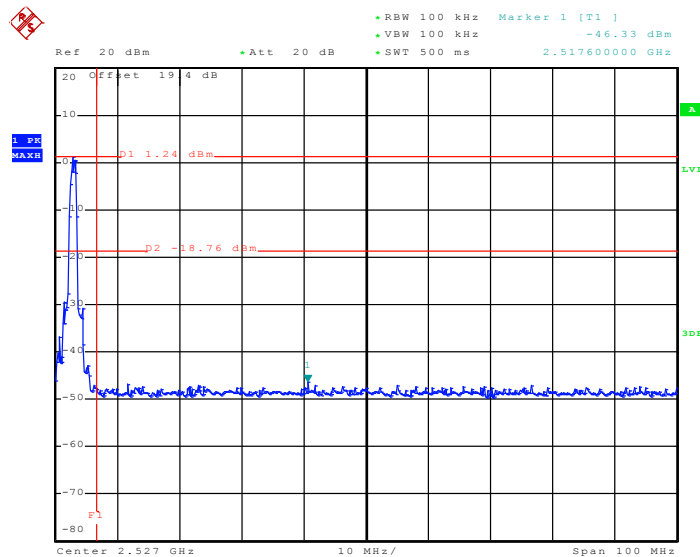
Test Mode :	Mode 7 and 9	Temperature :	26.4°C
Test Channel :	00 and 78	Relative Humidity :	50%
		Test Engineer :	Ken Hsu

Low Band Edge Plot on Channel 00



Date: 10.SEP.2009 08:33:19

High Band Edge Plot on Channel 78



Date: 10.SEP.2009 08:34:03

3.7 Radiated Emission Measurement

3.7.1 Limit of Radiated Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

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

3.7.2 Measuring Instruments

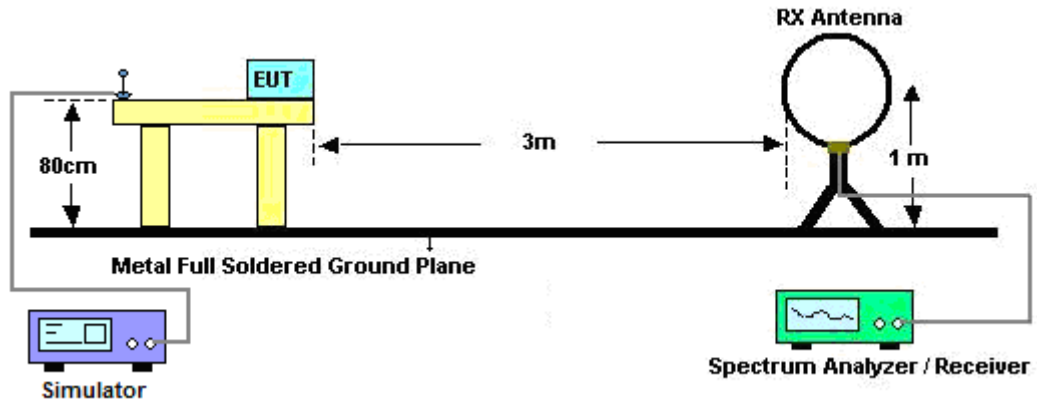
See list of measuring instruments of this test report.

3.7.3 Test Procedures

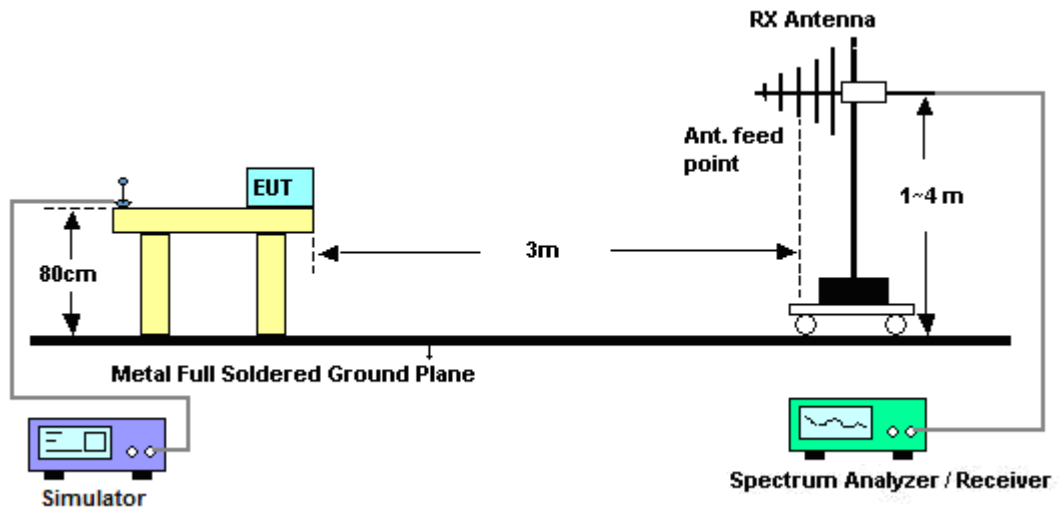
1. The testing follows the guidelines in FCC Public Notice DA 00-705 Measurement Guidelines.
2. Use the following spectrum analyzer settings:
Span = wide enough to fully capture the emission being measured; RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz; VBW \geq RBW; Sweep = auto; Detector function = peak; Trace = max hold.
3. Follow the guidelines in ANSI C63.4-2003 with respect to maximizing the emission by rotating the EUT, measuring the emission for three EUT orthogonal planes, and adjusting the measurement antenna height and polarization. A pre-amp and a high pass filter are used for this test in order to get the good signal level.

3.7.4 Test Setup

For radiated emissions below 30MHz



For radiated emissions above 30MHz





3.7.5 Test Results of Radiated Emissions (9 kHz ~ 30 MHz)

Test Engineer :	Elvis Chen	Temperature :	23~24°C	
		Relative Humidity :	42~43%	
Frequency (MHz)	Level (dBuV)	Over Limit (dB)	Limit Line (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

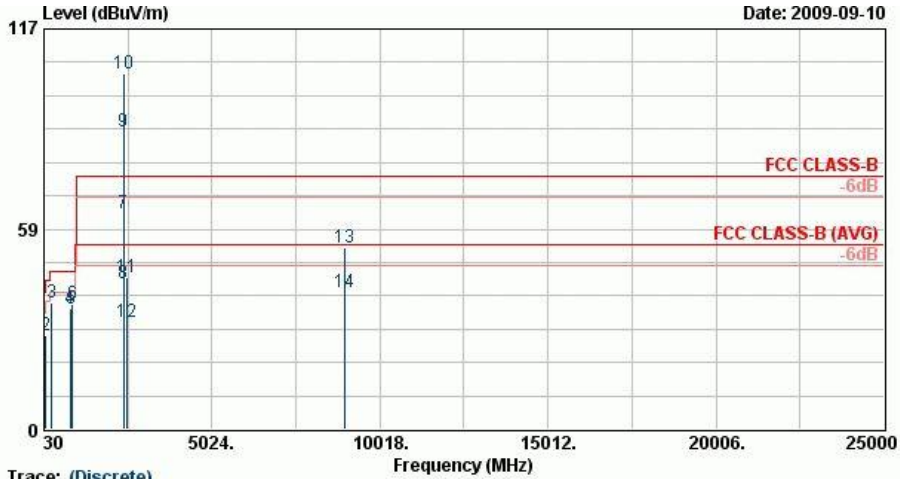
Distance extrapolation factor = $40 \log(\text{specific distance} / \text{test distance})$ (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.



3.7.6 Test Result of Radiated Emission (30 MHz ~ 10th Harmonic)

Test Mode :	Mode 1	Temperature :	23~24°C
Test Channel :	00	Relative Humidity :	42~43%
Test Engineer :	Elvis Chen	Polarization :	Horizontal
Remark :	#9 and #10 are Fundamental Signals which can be ignored.		

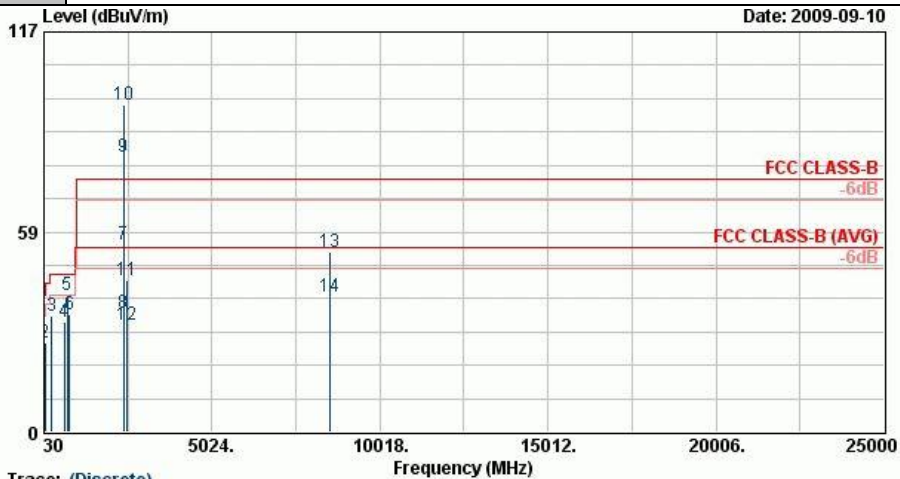


Trace: (Discrete)
 Site : D3CH06-HY
 Condition : FCC CLASS-B 3m SHF-EHF HORN HORIZONTAL
 Power : DC 12V
 Project : FR 970836-01
 Memo : Mode 1

	Freq	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Remark
	MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	
			dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	31.08	30.12	-9.88	40.00	41.78	19.30	0.65	31.61	---	---	Peak
2	81.03	27.52	-12.48	40.00	50.79	7.69	1.08	32.04	---	---	Peak
3	268.14	36.77	-9.23	46.00	53.08	13.53	2.08	31.92	100	107	Peak
4	808.90	35.39	-10.61	46.00	42.80	20.91	3.90	32.22	100	172	QP
5	841.80	35.19	-10.81	46.00	42.20	21.31	4.05	32.37	100	171	QP
6	869.80	36.54	-9.46	46.00	43.00	21.52	4.12	32.11	100	200	QP
7	2389.42	62.96	-11.04	74.00	63.46	31.86	3.92	36.28	155	304	Peak
8	2389.42	42.61	-11.39	54.00	43.11	31.86	3.92	36.28	155	304	Average
9 @	2402.00	87.13			87.63	31.86	3.92	36.28	155	304	Average
10 X	2402.00	103.84			104.32	31.88	3.92	36.28	155	304	Peak
11	2494.00	44.36	-29.64	74.00	44.61	32.00	4.05	36.30	155	304	Peak
12	2494.00	31.32	-22.68	54.00	31.57	32.00	4.05	36.30	155	304	Average
13	8976.00	53.02	-20.98	74.00	46.07	36.07	7.77	36.89	100	143	Peak
14	8976.00	39.95	-14.05	54.00	33.00	36.07	7.77	36.89	100	143	Average



Test Mode :	Mode 1	Temperature :	23~24°C
Test Channel :	00	Relative Humidity :	42~43%
Test Engineer :	Elvis Chen	Polarization :	Vertical
Remark :	#9 and #10 are Fundamental Signals which can be ignored.		

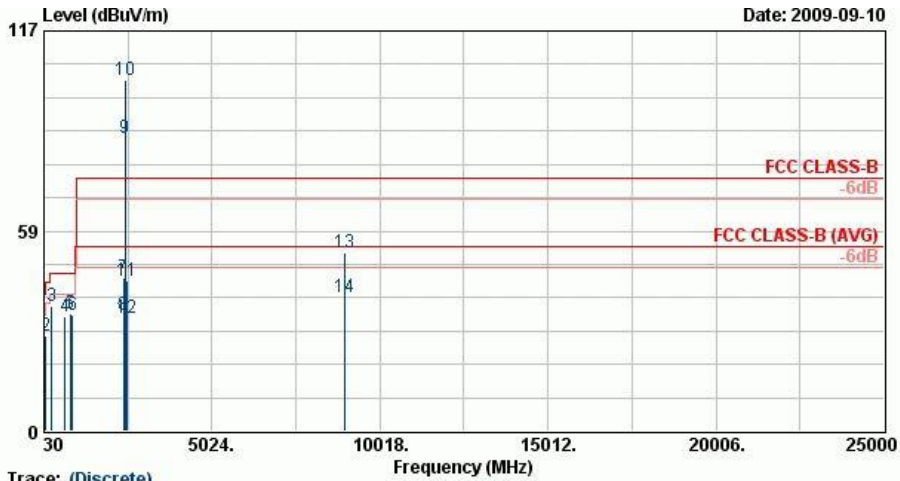


Trace: (Discrete)
 Site : D3CH06-HY
 Condition : FCC CLASS-B 3m SHF-EHF HORN VERTICAL
 Power : DC 12V
 Project : FR 870836-01
 Memo : Mode 1

	Freq	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Remark
	MHz	dBUV/m	Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	
			dB	dBUV/m	dBUV	dB/m	dB	dB	cm	deg	
1	30.00	33.41	-6.59	40.00	44.43	19.90	0.64	31.56	---	---	Peak
2	56.19	26.16	-13.84	40.00	49.58	7.62	0.89	31.93	---	---	Peak
3	268.14	34.12	-11.88	46.00	50.43	13.53	2.08	31.92	---	---	Peak
4	633.90	32.09	-13.91	46.00	41.30	19.37	3.39	31.97	100	347	QP
5	721.40	39.85	-6.15	46.00	48.50	19.96	3.69	32.30	100	84	Peak
6	780.90	34.49	-11.51	46.00	42.20	20.61	3.82	32.13	100	310	QP
7	2389.42	54.98	-19.02	74.00	55.48	31.86	3.92	36.28	104	43	Peak
8	2389.42	34.63	-19.37	54.00	35.13	31.86	3.92	36.28	104	43	Average
9 X	2402.00	80.34			80.84	31.86	3.92	36.28	104	43	Average
10 X	2402.00	95.86			96.34	31.88	3.92	36.28	104	43	Peak
11	2494.00	44.16	-29.84	74.00	44.41	32.00	4.05	36.30	104	43	Peak
12	2494.00	31.26	-22.74	54.00	31.51	32.00	4.05	36.30	104	43	Average
13	8532.00	52.66	-21.34	74.00	46.40	35.73	7.24	36.71	100	69	Peak
14	8532.00	39.55	-14.45	54.00	33.29	35.73	7.24	36.71	100	69	Average



Test Mode :	Mode 2	Temperature :	23~24°C
Test Channel :	39	Relative Humidity :	42~43%
Test Engineer :	Elvis Chen	Polarization :	Horizontal
Remark :	#9 and #10 are Fundamental Signals which can be ignored.		

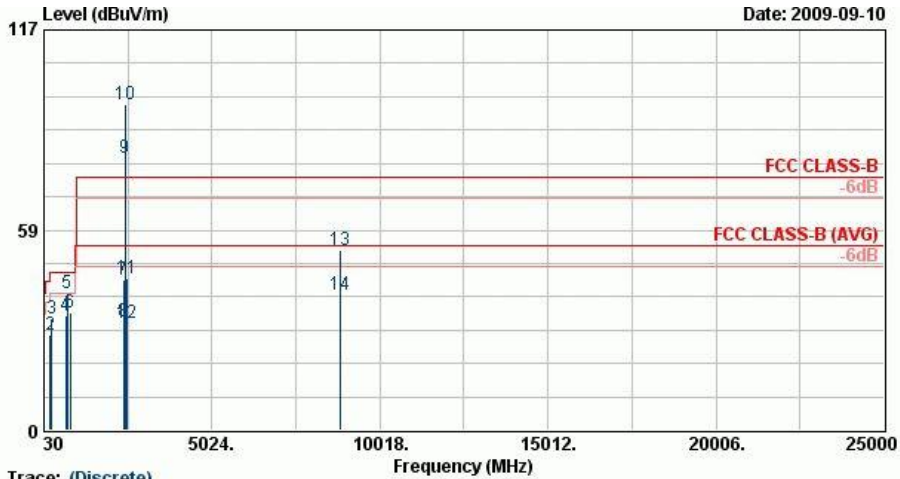


Trace: (Discrete)
 Site : D3CH06-HY
 Condition : FCC CLASS-B 3m SHF-EHF HORN HORIZONTAL
 Power : DC 12V
 Project : FR 970836-01
 Memo : Mode 2

	Freq	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Remark
	MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	
			dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	35.94	28.11	-11.89	40.00	42.91	16.30	0.70	31.80	---	---	Peak
2	81.03	28.00	-12.00	40.00	51.27	7.69	1.08	32.04	---	---	Peak
3	270.03	36.39	-9.61	46.00	52.73	13.50	2.09	31.93	100	4	Peak
4	661.90	33.41	-12.59	46.00	42.39	19.55	3.49	32.02	100	190	QP
5	819.40	34.31	-11.69	46.00	41.59	21.04	3.95	32.27	100	171	QP
6	878.90	33.92	-12.08	46.00	40.19	21.57	4.14	31.98	100	177	QP
7	2390.00	44.99	-29.01	74.00	45.50	31.86	3.92	36.28	101	319	Peak
8	2390.00	33.84	-20.16	54.00	34.34	31.86	3.92	36.28	101	319	Average
9 @	2441.00	85.81			86.19	31.93	3.99	36.29	101	319	Average
10 X	2441.00	102.66			103.04	31.93	3.99	36.29	101	319	Peak
11	2494.00	44.06	-29.94	74.00	44.31	32.00	4.05	36.30	101	319	Peak
12	2494.00	33.01	-20.99	54.00	33.26	32.00	4.05	36.30	101	319	Average
13	8982.00	52.26	-21.74	74.00	45.26	36.09	7.80	36.89	100	92	Peak
14	8982.00	39.18	-14.82	54.00	32.18	36.09	7.80	36.89	100	92	Average



Test Mode :	Mode 2	Temperature :	23~24°C
Test Channel :	39	Relative Humidity :	42~43%
Test Engineer :	Elvis Chen	Polarization :	Vertical
Remark :	#9 and #10 are Fundamental Signals which can be ignored.		

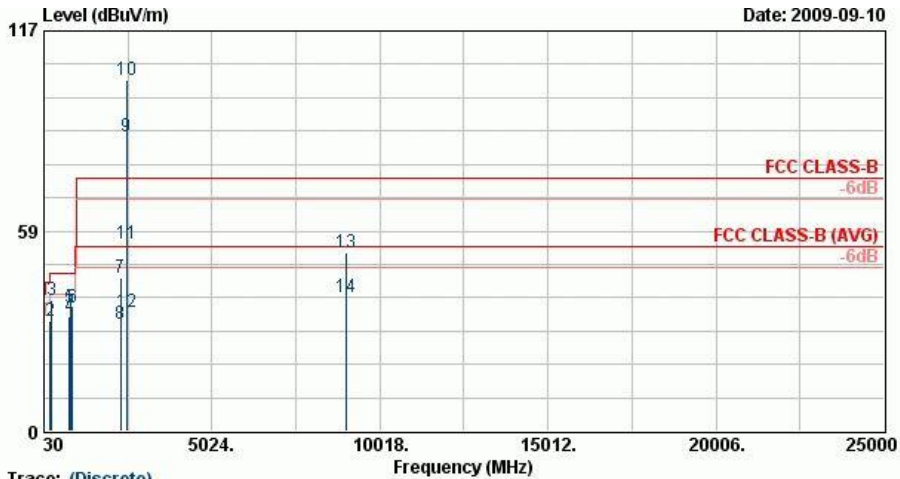


Trace: (Discrete)
 Site : D3CH06-HY
 Condition : FCC CLASS-B 3m SHF-EHF HORN VERTICAL
 Power : DC 12V
 Project : FR 970836-01
 Memo : Mode 2

	Freq	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Remark
	MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	
			dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	35.94	32.56	-7.44	40.00	47.36	16.30	0.70	31.80	---	---	Peak
2	209.28	27.80	-15.70	43.50	47.53	10.66	1.81	32.21	---	---	Peak
3	268.68	32.80	-13.20	46.00	49.11	13.53	2.08	31.92	---	---	Peak
4	689.90	33.40	-12.60	46.00	42.49	19.66	3.61	32.35	100	271	QP
5	721.40	39.94	-6.06	46.00	48.59	19.96	3.69	32.30	100	57	Peak
6	810.30	34.45	-11.55	46.00	41.85	20.92	3.91	32.22	100	226	QP
7	2390.00	44.09	-29.91	74.00	44.59	31.86	3.92	36.28	100	42	Peak
8	2390.00	31.83	-22.17	54.00	32.33	31.86	3.92	36.28	100	42	Average
9 X	2441.00	79.59			79.97	31.93	3.99	36.29	100	42	Average
10 X	2441.00	95.16			95.53	31.93	3.99	36.29	100	42	Peak
11	2500.00	44.35	-29.65	74.00	44.60	32.00	4.05	36.30	100	42	Peak
12	2500.00	31.33	-22.67	54.00	31.58	32.00	4.05	36.30	100	42	Average
13	8856.00	52.70	-21.30	74.00	45.93	35.98	7.62	36.84	100	51	Peak
14	8856.00	39.60	-14.40	54.00	32.84	35.98	7.62	36.84	100	51	Average



Test Mode :	Mode 3	Temperature :	23~24°C
Test Channel :	78	Relative Humidity :	42~43%
Test Engineer :	Elvis Chen	Polarization :	Horizontal
Remark :	#9 and #10 are Fundamental Signals which can be ignored.		

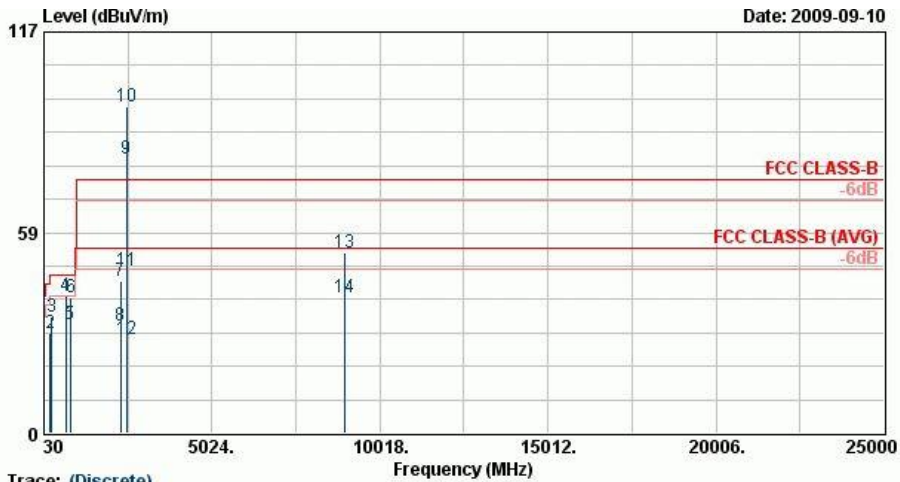


Trace: (Discrete)
 Site : D3CH06-HY
 Condition : FCC CLASS-B 3m SHF-EHF HORN HORIZONTAL
 Power : DC 12V
 Project : FR 970836-01
 Memo : Mode 3

	Freq	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Remark
	MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	
			dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	30.00	26.89	-13.11	40.00	37.91	19.90	0.64	31.56	---	---	Peak
2	208.74	32.09	-11.41	43.50	51.85	10.63	1.81	32.20	---	---	Peak
3	270.03	38.17	-7.83	46.00	54.51	13.50	2.09	31.93	100	129	Peak
4	780.90	33.49	-12.51	46.00	41.20	20.61	3.82	32.13	110	184	QP
5	810.30	36.10	-9.90	46.00	43.50	20.92	3.91	32.22	100	180	QP
6	871.90	36.18	-9.82	46.00	42.60	21.53	4.13	32.08	100	199	QP
7	2318.00	44.94	-29.06	74.00	45.62	31.76	3.82	36.27	100	320	Peak
8	2318.00	31.21	-22.79	54.00	31.89	31.76	3.82	36.27	100	320	Average
9 @	2480.00	86.18			86.45	31.98	4.05	36.30	100	320	Average
10 X	2480.00	102.59			102.86	31.98	4.05	36.30	100	320	Peak
11	2483.50	55.02	-18.98	74.00	55.29	31.98	4.05	36.30	100	320	Peak
12	2483.50	34.67	-19.33	54.00	34.94	31.98	4.05	36.30	100	320	Average
13	9000.00	52.36	-21.64	74.00	45.36	36.10	7.80	36.90	100	77	Peak
14	9000.00	39.19	-14.81	54.00	32.19	36.10	7.80	36.90	100	77	Average



Test Mode :	Mode 3	Temperature :	23~24°C
Test Channel :	78	Relative Humidity :	42~43%
Test Engineer :	Elvis Chen	Polarization :	Vertical
Remark :	#9 and #10 are Fundamental Signals which can be ignored.		



Trace: (Discrete)
 Site : D3CH06-HY
 Condition : FCC CLASS-B 3m SHF-EHF HORN VERTICAL
 Power : DC 12V
 Project : FR 970836-01
 Memo : Mode 3

	Freq	Level	Over	Limit	Read	Antenna	Cable	Preamp	Ant	Table	Remark
	MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	
			dB	dBuV/m	dBuV	dB/m	dB	dB	cm	deg	
1	31.89	32.95	-7.05	40.00	45.26	18.70	0.66	31.67	---	---	Peak
2	208.74	29.21	-14.29	43.50	48.98	10.63	1.81	32.20	---	---	Peak
3	272.19	33.91	-12.09	46.00	50.26	13.50	2.10	31.95	---	---	Peak
4	689.90	39.83	-6.17	46.00	48.92	19.66	3.61	32.35	100	87	Peak
5	805.40	31.64	-14.36	46.00	39.10	20.86	3.88	32.20	100	359	QP
6	840.40	39.56	-6.44	46.00	46.59	21.28	4.04	32.36	---	---	Peak
7	2310.00	44.44	-29.56	74.00	45.14	31.73	3.82	36.26	101	331	Peak
8	2310.00	31.11	-22.89	54.00	31.81	31.73	3.82	36.26	101	331	Average
9 X	2480.00	79.96			80.23	31.98	4.05	36.30	101	331	Average
10 X	2480.00	95.18			95.45	31.98	4.05	36.30	101	331	Peak
11	2483.50	47.61	-26.39	74.00	47.88	31.98	4.05	36.30	101	331	Peak
12	2483.50	27.26	-26.74	54.00	27.53	31.98	4.05	36.30	101	331	Average
13	8991.00	52.61	-21.39	74.00	45.61	36.09	7.80	36.89	100	125	Peak
14	8991.00	39.49	-14.51	54.00	32.49	36.09	7.80	36.89	100	125	Average



3.8 Antenna Requirements

3.8.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

3.8.2 Antenna Connected Construction

The antennas type used in this product is PIFA Antenna without connector and it is considered to meet antenna requirement.

3.8.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Due Date	Remark
Spectrum Analyzer	R&S	FSP40	100055	9kHz~40GHz	Jun. 23, 2009	Jun. 22, 2010	Conducted (TH02-HY)
Power Meter	Agilent	E4416A	GB412923 44	N/A	Feb. 19, 2009	Feb. 18, 2010	Conducted (TH02-HY)
Power Sensor	Agilent	E9327A	US404415 48	N/A	Feb. 19, 2009	Feb. 18, 2010	Conducted (TH02-HY)
Spectrum Analyzer	Agilent	E4408B	MY442110 30	9KHz-26.5GHz	Oct. 24, 2008	Oct. 23, 2009	Radiation (03CH06-HY)
Spectrum Analyzer	R&S	FSP40	100057	9KHz-40GHz	Oct. 16, 2008	Oct. 15, 2009	Radiation (03CH06-HY)
EMI Test Receiver	R&S	ESVS10	834468/00 3	20MHz-1000MHz	Apr. 28, 2009	Apr. 27, 2010	Radiation (03CH06-HY)
Bilog Antenna	SCHAFFNER	CBL6112B	2885	30MHz -2GHz	Nov. 12, 2008	Nov. 11, 2009	Radiation (03CH06-HY)
Double Ridge Horn Antenna	EMCO	3117	00066583	1GHz~18GHz	Aug. 20, 2009	Aug. 19, 2010	Radiation (03CH06-HY)
Double Ridge Horn Antenna	Training Research	AH-0801	95119	8GHz~18GHz	Oct. 28, 2008	Oct. 27, 2009	Radiation (03CH06-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170 251	15GHz- 40GHz	Oct. 16, 2008	Oct. 15, 2009	Radiation (03CH06-HY)
Pre Amplifier	Agilent	8449B	3008A019 17	1GHz- 26.5GHz	Nov. 11, 2008	Nov. 10, 2009	Radiation (03CH06-HY)
Amplifier	Agilent	310N	186713	9KHz~1GHz	Apr. 20, 2009	Apr. 19, 2010	Radiation (03CH06-HY)
Loop Antenna	R&S	HFH2-Z2	860004/00 1	9KHz~30MHz	May 22, 2008	May 21, 2010	Radiation (03CH06-HY)
Bluetooth Base Station	R&S	CBT32	100519	N/A	May 12, 2009	May 11, 2011	Radiation (03CH06-HY)

5 Uncertainty of Evaluation

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Contribution	Uncertainty of x_i		$u(x_i)$
	dB	Probability Distribution	
Receiver reading	0.41	Normal(k=2)	0.21
Antenna factor calibration	0.83	Normal(k=2)	0.42
Cable loss calibration	0.25	Normal(k=2)	0.13
Pre Amplifier Gain calibration	0.27	Normal(k=2)	0.14
RCV/SPA specification	2.50	Rectangular	0.72
Antenna Factor Interpolation for Frequency	1.00	Rectangular	0.29
Site imperfection	1.43	Rectangular	0.83
Mismatch	+0.39/-0.41	U-shaped	0.28
Combined standard uncertainty Uc(y)	1.27		
Measuring uncertainty for a level of confidence of 95% U=2Uc(y)	2.54		

Uncertainty of Radiated Emission Measurement (1 GHz ~ 40 GHz)

Contribution	Uncertainty of x_i		$u(x_i)$	C_i	$C_i * u(x_i)$
	dB	Probability Distribution			
Receiver reading	±0.10	Normal(k=1)	0.10	1	0.10
Antenna factor calibration	±1.70	Normal(k=2)	0.85	1	0.85
Cable loss calibration	±0.50	Normal(k=2)	0.25	1	0.25
Receiver Correction	±2.00	Rectangular	1.15	1	1.15
Antenna Factor Directional	±1.50	Rectangular	0.87	1	0.87
Site imperfection	±2.80	Triangular	1.14	1	1.14
Mismatch Receiver VSWR $\Gamma_1 = 0.197$ Antenna VSWR $\Gamma_2 = 0.194$ Uncertainty = $20 \log(1 - \Gamma_1 * \Gamma_2)$	+0.34/-0.35	U-shaped	0.244	1	0.244
Combined standard uncertainty Uc(y)	2.36				
Measuring uncertainty for a level of confidence of 95% U=2Uc(y)	4.72				

6 Certification of TAF Accreditation



Certificate No. : L1190-090417

財團法人全國認證基金會
Taiwan Accreditation Foundation

Certificate of Accreditation

This is to certify that

Sporton International Inc.
EMC & Wireless Communications Laboratory
No.52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien,
Taiwan, R.O.C.

is accredited in respect of laboratory

Accreditation Criteria	: ISO/IEC 17025:2005
Accreditation Number	: 1190
Originally Accredited	: December 15, 2003
Effective Period	: January 10, 2007 to January 09, 2010
Accredited Scope	: Testing Field, see described in the Appendix
Specific Accreditation Program	: Accreditation Program for Designated Testing Laboratory for Commodities Inspection Accreditation Program for Telecommunication Equipment Testing Laboratory Accreditation Program for BSMI Mutual Recognition Arrangement with Foreign Authorities


Jay-San Chen
President, Taiwan Accreditation Foundation
Date : April 17, 2009

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The Appendix forms an integral part of this Certificate, which shall be invalid when use without the Appendix



Appendix A. Photographs of EUT

Please refer to Sporton report number EP970836-01 as below.