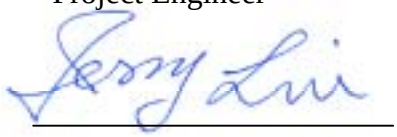
EMC
TEST REPORT

Report No. : EME-051133
Model No. : AWBSH3
Issued Date : Apr. 20, 2006

Applicant : Asia Pacific Microsystems, Inc.
No. 2, R&D Road 6, Science-Based Industrial Park,
Hsinchu, Taiwan

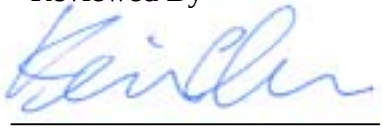
Test By : Intertek Testing Services Taiwan Ltd.
No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li,
Shiang-Shan District, Hsinchu City, Taiwan

Project Engineer



Jerry Liu

Reviewed By



Kevin Chen

Table of Contents

Summary of Tests

Bluetooth Earphone-Model: AWBSH3
FCC ID: RU5AWBSH3

Test	Reference	Results
Maximum Output Power test	15.247(b)	PASS
Carrier Frequency Separation test	15.247(a)(1)	PASS
Number of hopping frequencies test	15.247(a)(1)	PASS
Time of Occupancy (dwell time) test	15.247(a)(1)	PASS
20dB Bandwidth test	15.247(a)(1)	PASS
Radiated Spurious Emission test	15.205, 15.209	PASS
Emission on the Band Edge test	15.247(d)	PASS
AC Power Line Conducted Emission test	15.207	PASS

1. General information

1.1 Identification of the EUT

Applicant	: Asia Pacific Microsystems, Inc.
Product	: Bluetooth Earphone
Model No.	: AWBSH3
FCC ID.	: RU5AWBSH3
Frequency Range	: 2400MHz ~ 2483.5MHz
Channel Number	: 79 channels
Frequency of Each Channel	: 2402 + k MHz; k = 0-78
Type of Modulation	: GFSK
Rated Power	: DC 5V from Notebook PC
Power Cord	: N/A
Sample Received	: Oct. 7, 2005
Test Date(s)	: Oct. 12, 2005 ~ Apr. 3, 2006

A FCC DoC report has been generated for the client.

1.2 Additional information about the EUT

AWBSH3 is a high performance Bluetooth module that provides off-the-shelf wireless function for stereo audio application. It combines Bluetooth chip, CODEC, crystal and Flash memory into a surface mount module with a compact size of 18mm by 2mm.
The specified profiles and firmware are pre-loaded into the built-in Flash memory of apm1882 for Bluetooth audio transmission and receiving. It can be easily embedded into portable multimedia and audio systems for Bluetooth wireless communication.

The models listed below are identical to model AWBSH3 (EUT).
Different brand serves as marking strategy.

Trade Name	Model Number
Fun Twist	BH-20
ASMART	ABS-1030
APM	AWBSH3

For more detail features, please refer to User's manual as file name “Installation guide.pdf”

1.3 Antenna description

The EUT uses a permanently connected antenna.

Antenna Gain : 0.38dBi max
Antenna Type : PCB Printed antenna
Connector Type : N/A

1.4 Peripherals equipment

Peripherals	Manufacturer	Product No.	Serial No.	FCC ID
Notebook PC	HP	Compaq x5000	CNU411174K	N/A

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 15 Subpart C Section §15.205、§15.207、§15.209、§15.247 and ANSI C63.4/2003.

The test of radiated measurements according to FCC Part15 Section 15.33(a) had been conducted and the field strength of this frequency band were all meet limit requirement, thus we evaluate the EUT pass the specified test.

2.2 Operation mode

The EUT was transmitted continuously during the test.

2.3 Test equipment

Equipment	Brand	Frequency range	Model No.	Intertek ID No.	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	9kHz~2.75GHz	ESCS 30	EC303	04/16/2007
EMI Test Receiver	Rohde & Schwarz	20Hz~26.5GHz	ESMI	EC317	08/07/2006
Spectrum Analyzer	Rohde & Schwarz	9kHz~30GHz	FSP 30	EC353	07/24/2006
Spectrum Analyzer	Rohde & Schwarz	20Hz~40GHz	FSEK 30	EC365	11/01/2006
Horn Antenna	SCHWARZBECK	1GHz~18GHz	BBHA 9120 D	EC371	12/22/2007
Horn Antenna	SCHWARZBECK	14GHz~40GHz	BBHA 9170	EC351	07/08/2007
Bilog Antenna	SCHWARZBECK	25MHz~2GHz	VULB 9168	EC347	12/23/2007
Pre-Amplifier	MITEQ	100MHz~26.5GHz	919981	EC373	12/29/2006
Wideband Peak Power Meter/ Sensor	Anritsu	100MHz~18GHz	ML2497A/ MA2491A	EC396	11/10/2006
Controller	HDGmbH	N/A	CM 100	EP346	N/A
Antenna Tower	HDGmbH	N/A	MA 240	EP347	N/A
LISN	Rohde & Schwarz	9KHz~30MHz	ESH3-Z5	EC344	01/12/2007

Note: 1. The above equipments are within the valid calibration period.
2. The test antennas (receiving antenna) are calibration per 3 years.

3. 20dB Bandwidth test

3.1 Operating environment

Temperature:	25	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1023	hPa

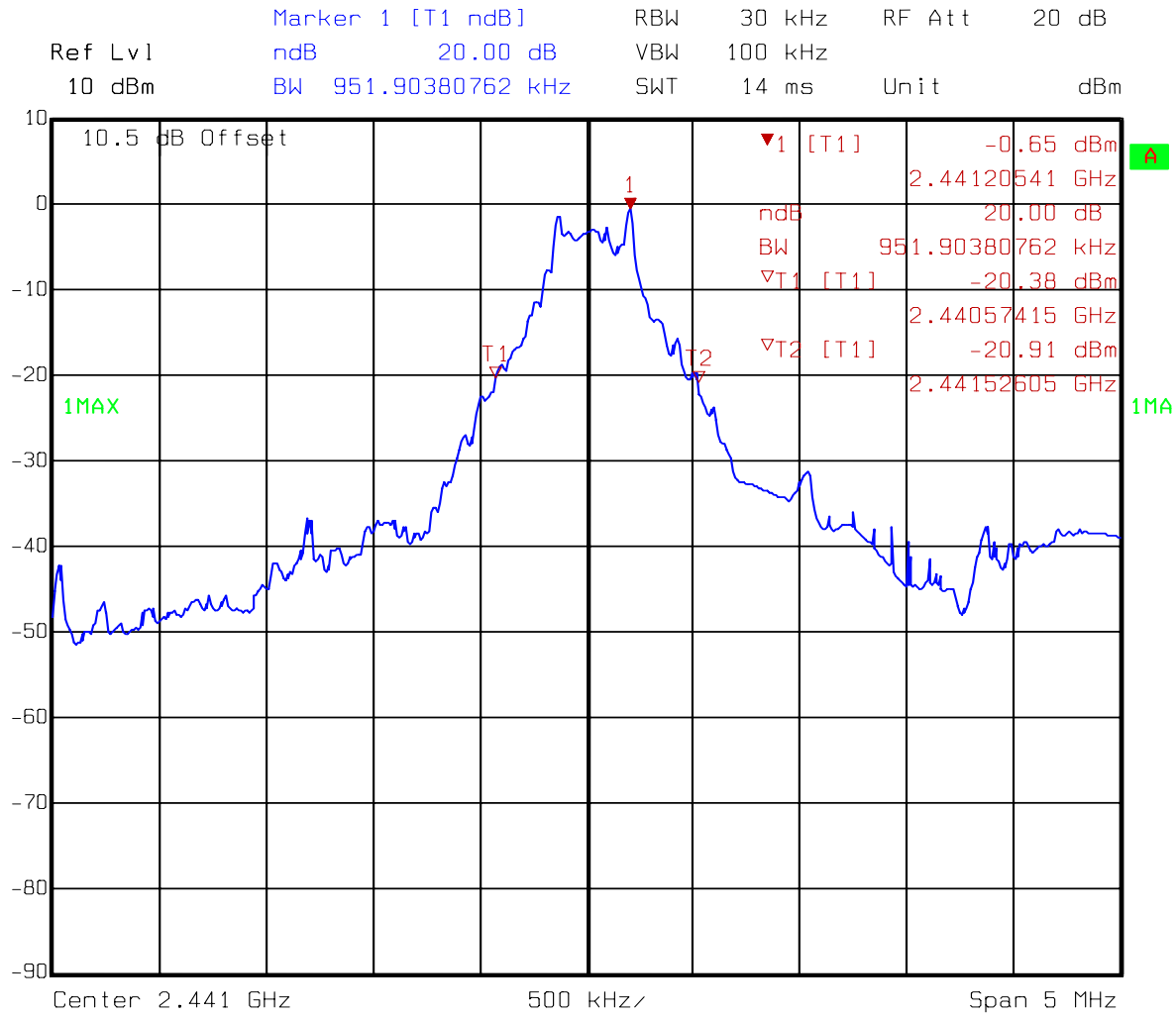
3.2 Test setup & procedure

The 20dB bandwidth per FCC §15.247(a)(1)(i) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at 100 kHz, the video bandwidth≧RBW, and the SPAN may equal to approximately 2 to 3 times the 20dB bandwidth. The maximum 20dB modulation bandwidth is in the following Table.

3.3 Measured data of modulated bandwidth test results

Channel	Frequency (MHz)	Bandwidth (kHz)
Channel 39	2441.000	951.904

Please see the plot below.



Comment A: 20dB Bandwith
Date: 13.OCT.2005 09:56:37

4. Carrier Frequency Separation test

4.1 Operating environment

Temperature:	25	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1023	hPa

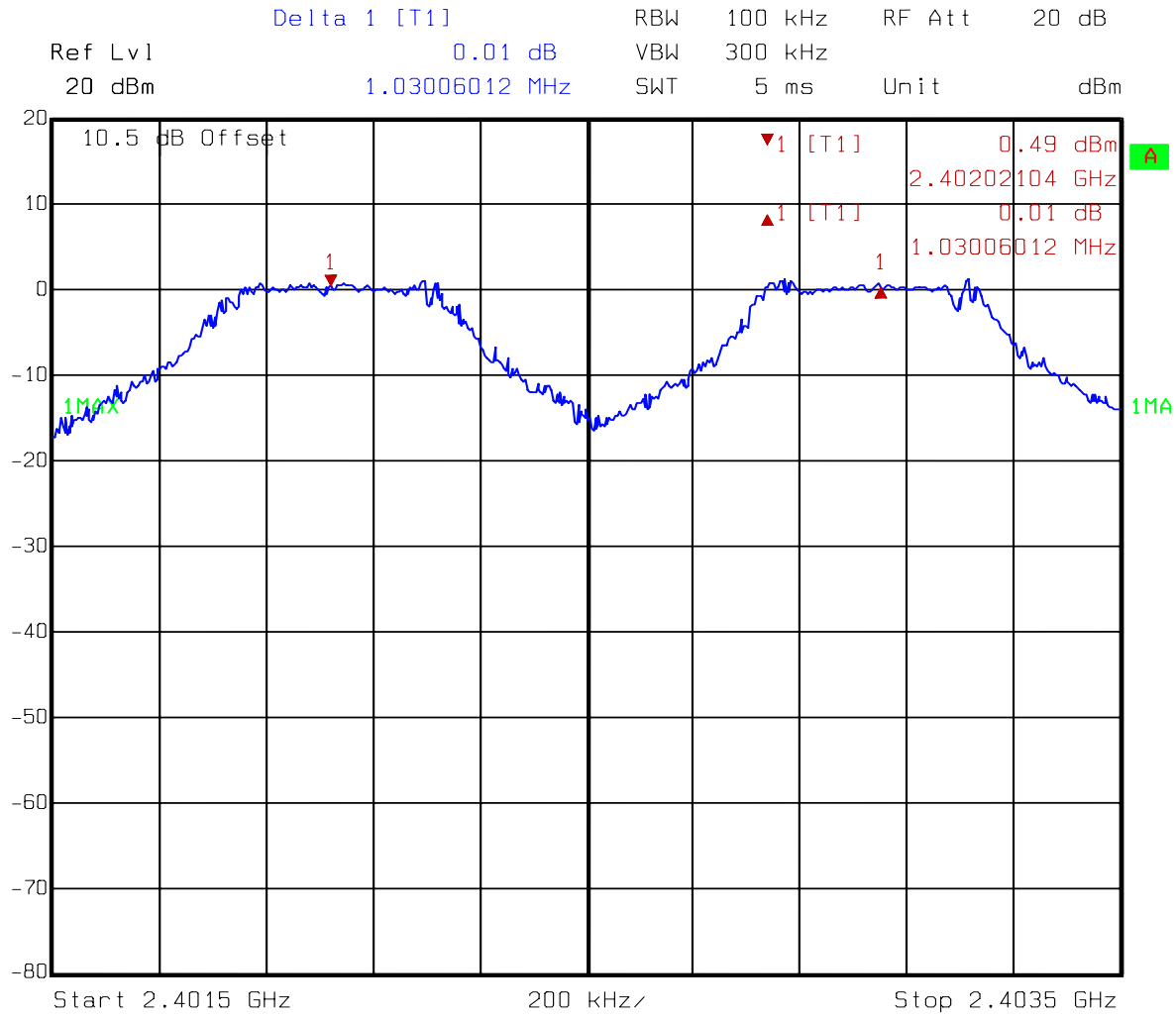
4.2 Test setup & procedure

The carrier frequency separation per FCC §15.247(a)(1) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at ≧1％of the span, the video bandwidth≧RBW, and the SPAN was wide enough to capture the peaks of two adjacent channels. The carrier frequency separation result is in the following Table.

4.3 Measured data of Carrier Frequency Separation test result

Channel	Frequency (MHz)	Measurement Frequency separation (kHz)
1	2402	1030.06
2	2403	

Please see the plot below.



Comment A: Carrier frequencies separation between CH1 and CH2
Date: 13.OCT.2005 10:17:59

5. Number of hopping frequencies test

5.1 Operating environment

Temperature:	25	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1023	hPa

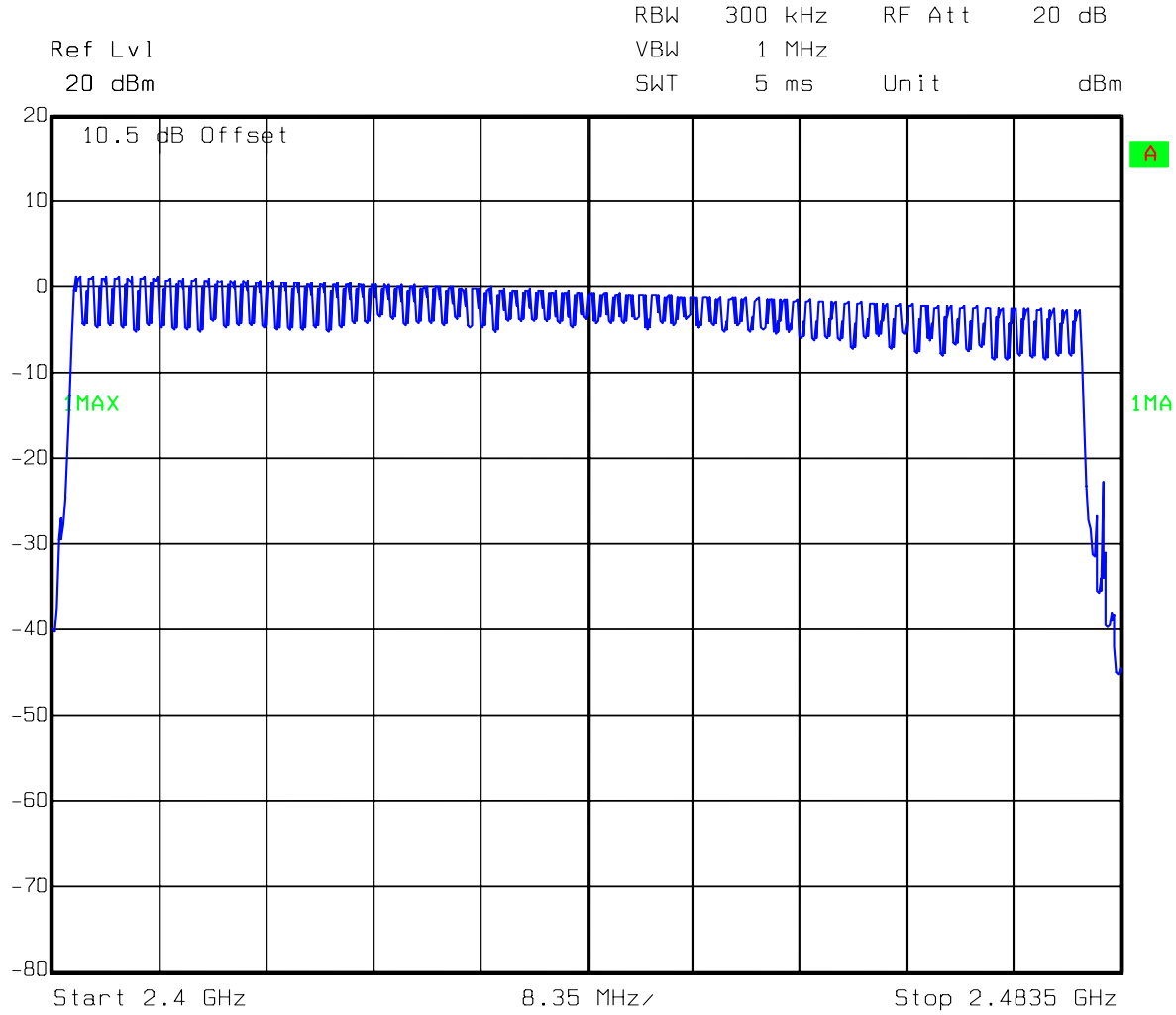
5.2 Test setup & procedure

The number of hopping frequencies per FCC §15.247(a)(1) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at ≧1 % of the span, the video bandwidth≧RBW, and the SPAN was the frequency band of operation. The carrier frequency separation result is in the following Table.

5.3 Measured data of number of hopping frequencies test result

Frequency Range (MHz)	Total hopping channels
2400 ~ 2483.5	79

Please see the plot below.



Comment A: Number of hopping
Date: 13.OCT.2005 10:23:26

6. Time of Occupancy (dwell time) test

6.1 Operating environment

Temperature:	25	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1023	hPa

6.2 Test setup & procedure

The time of occupancy (dwell time) per FCC §15.247(a)(1) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at 1MHz, the video bandwidth≧RBW, and the zero span function of spectrum analyzer was enable. The EUT has its hopping function enable.

The system makes worst case 1600 hops per second or 1 time slot has a length of 625μs with 79 channels.

Time of occupancy (dwell time) for DH1

Dwell time = 404.008 μs * 1600 * 1/2 * 1/s / 79 *31.6s
= 129.283 ms (in a 31.6s period)

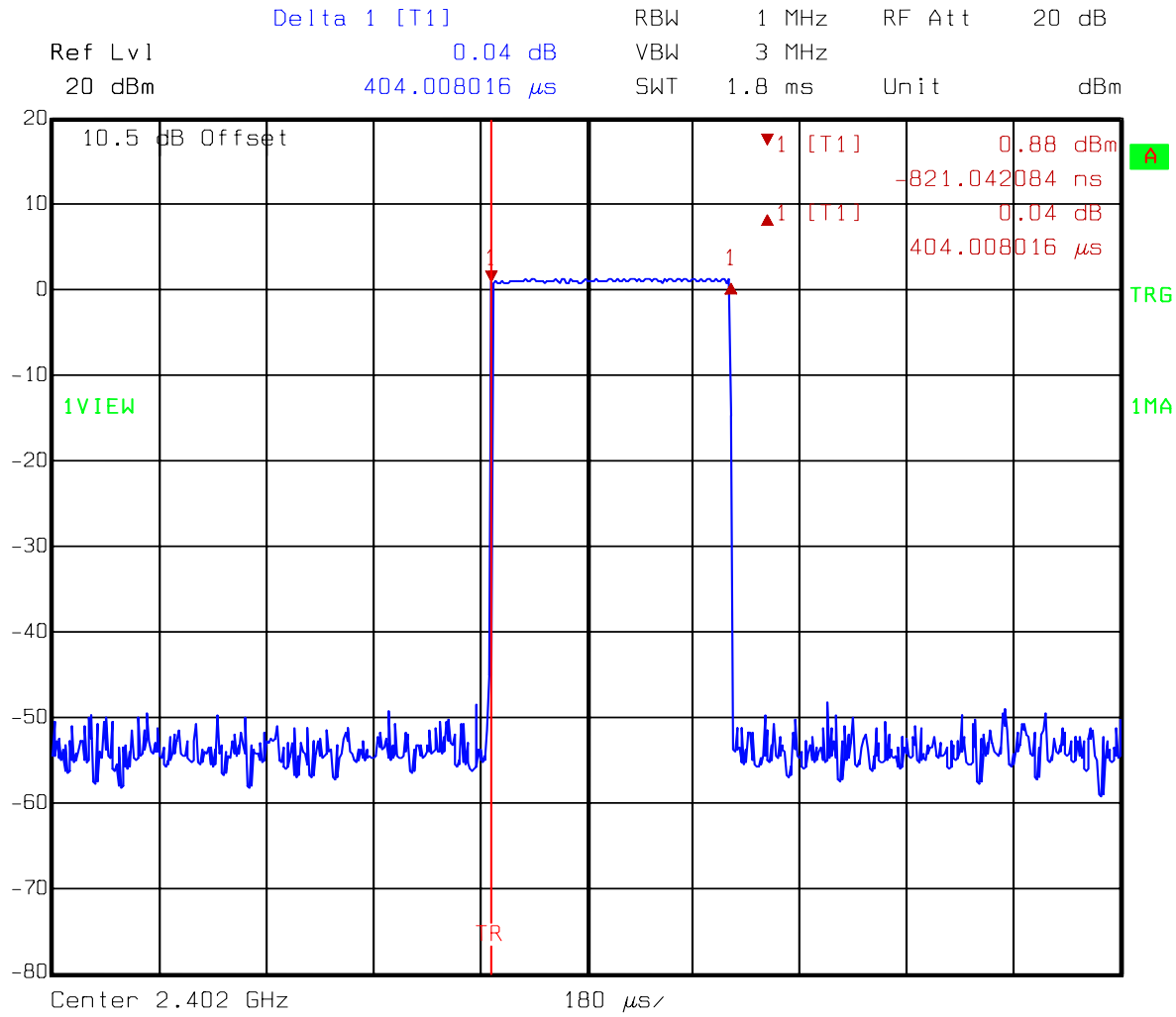
Time of occupancy (dwell time) for DH3

Dwell time = 1.663 ms * 1600 * 1/4 * 1/s / 79 *31.6s
= 266.080 ms (in a 31.6s period)

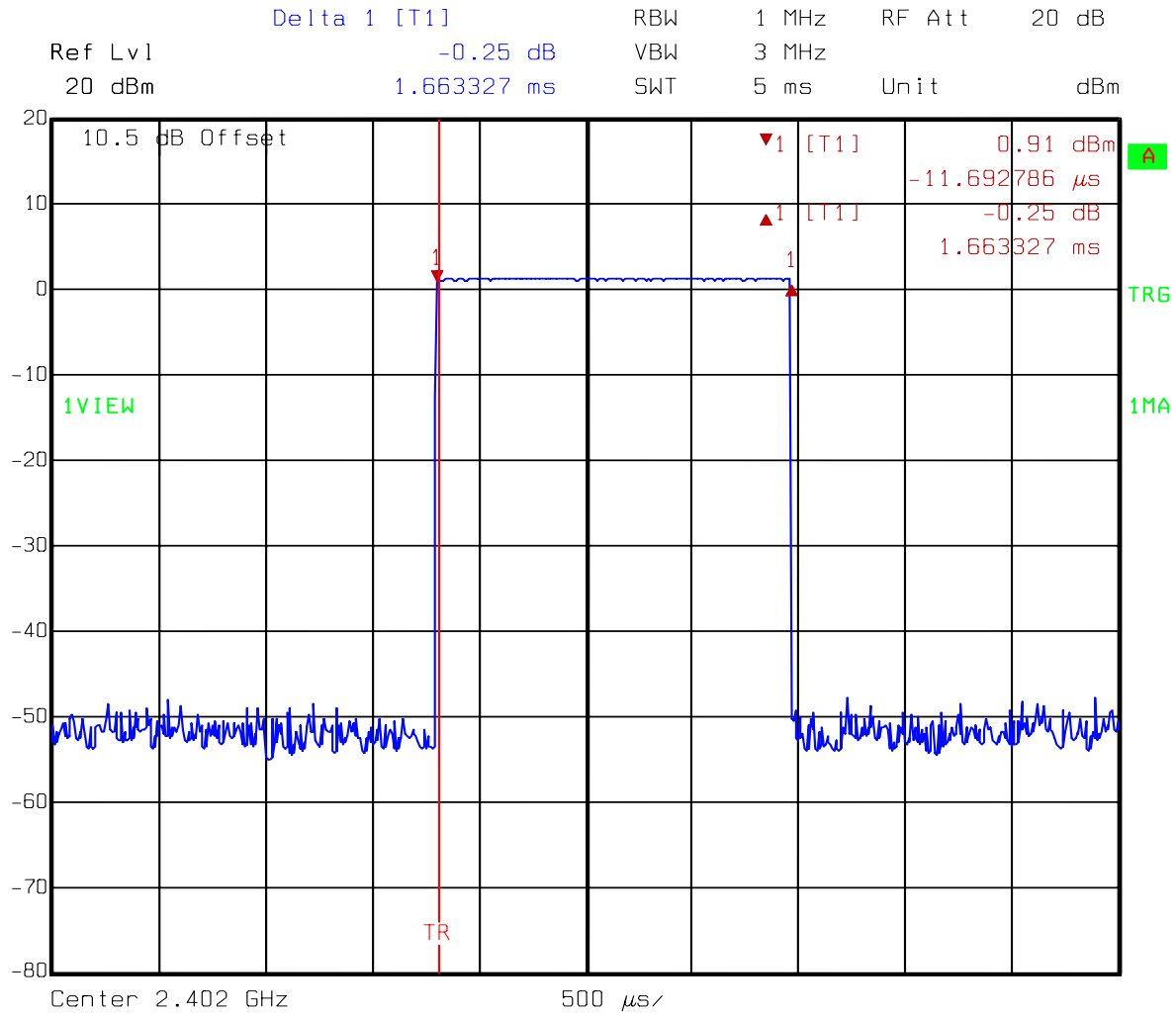
Time of occupancy (dwell time) for DH5

Dwell time = 2.906 ms * 1600 * 1/6 * 1/s / 79 *31.6s
= 309.973 ms (in a 31.6s period)

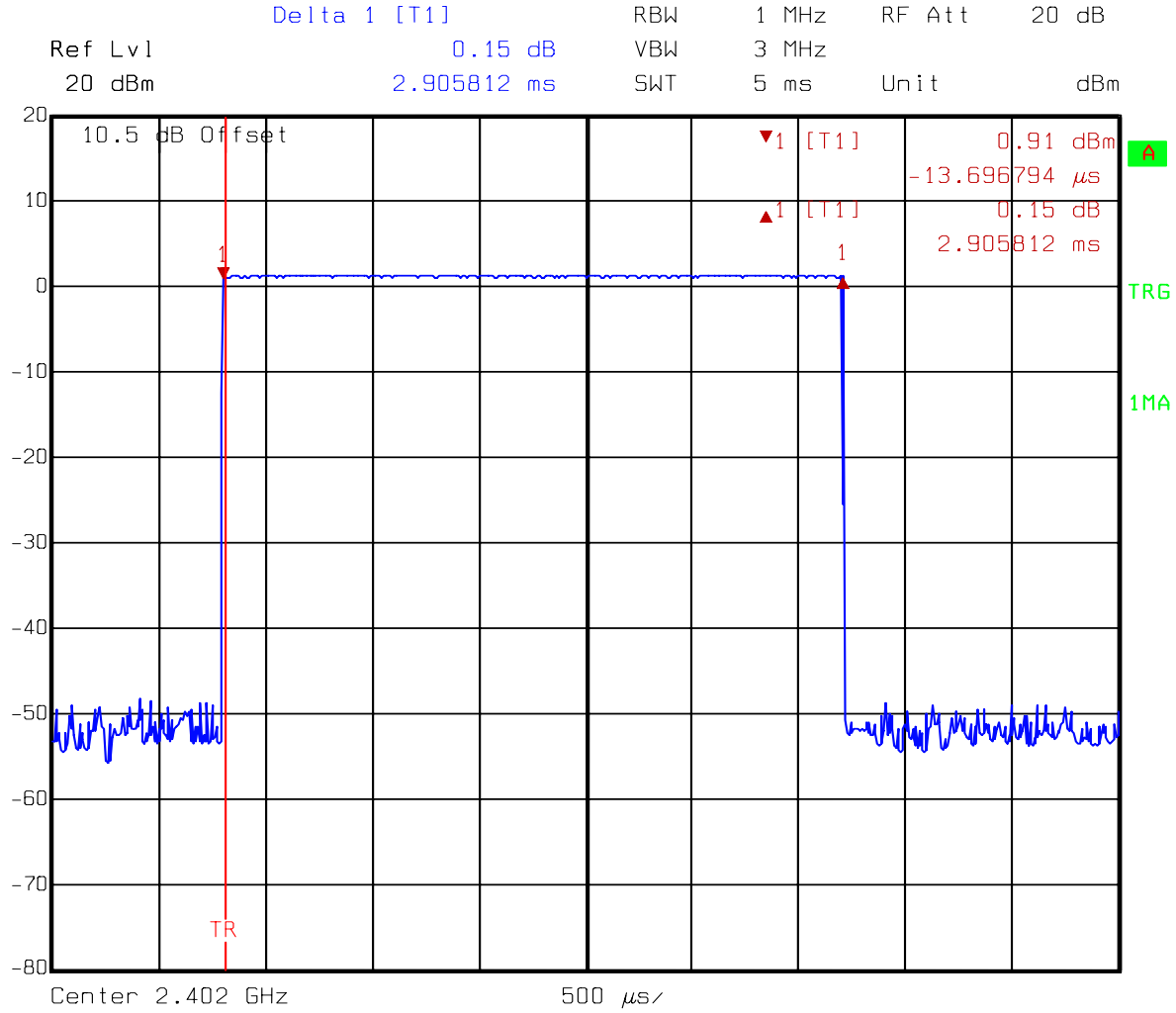
Please see the plot below.



Comment A: Dwell time of DH1 mode
Date: 13.OCT.2005 10:45:01



Comment A: Dwell time of DH3 mode
Date: 13.OCT.2005 10:41:03



Comment A: Dwell time of DH5 mode
Date: 13.OCT.2005 10:38:17

7. Maximum Output Power test

7.1 Operating environment

Temperature: 25 ℃
Relative Humidity: 50 %
Atmospheric Pressure: 1022 hPa

7.2 Test setup & procedure

The power output per FCC §15.247(b) was measured on the EUT using a 50 ohm SMA cable connected to peak power meter via power sensor. Power was read directly and cable loss correction (1 dB) was added to the reading to obtain power at the EUT antenna terminals. The test was performed at 3 channels (lowest, middle and highest channel).

7.3 Measured data of Maximum Output Power test results

Channel	Freq. (MHz)	C.L. (dB)	Reading (dBm)	Conducted Peak Output Power		Limit (dBm)
				(dBm)	(mW)	
0 (lowest)	2402	1	-0.11	0.89	1.2274	30
39 (middle)	2442	1	-1.71	-0.71	0.8492	30
78 (highest)	2480	1	-3.67	-2.67	0.5408	30

Remark:
Conducted Peak Output Power = Reading + C.L.

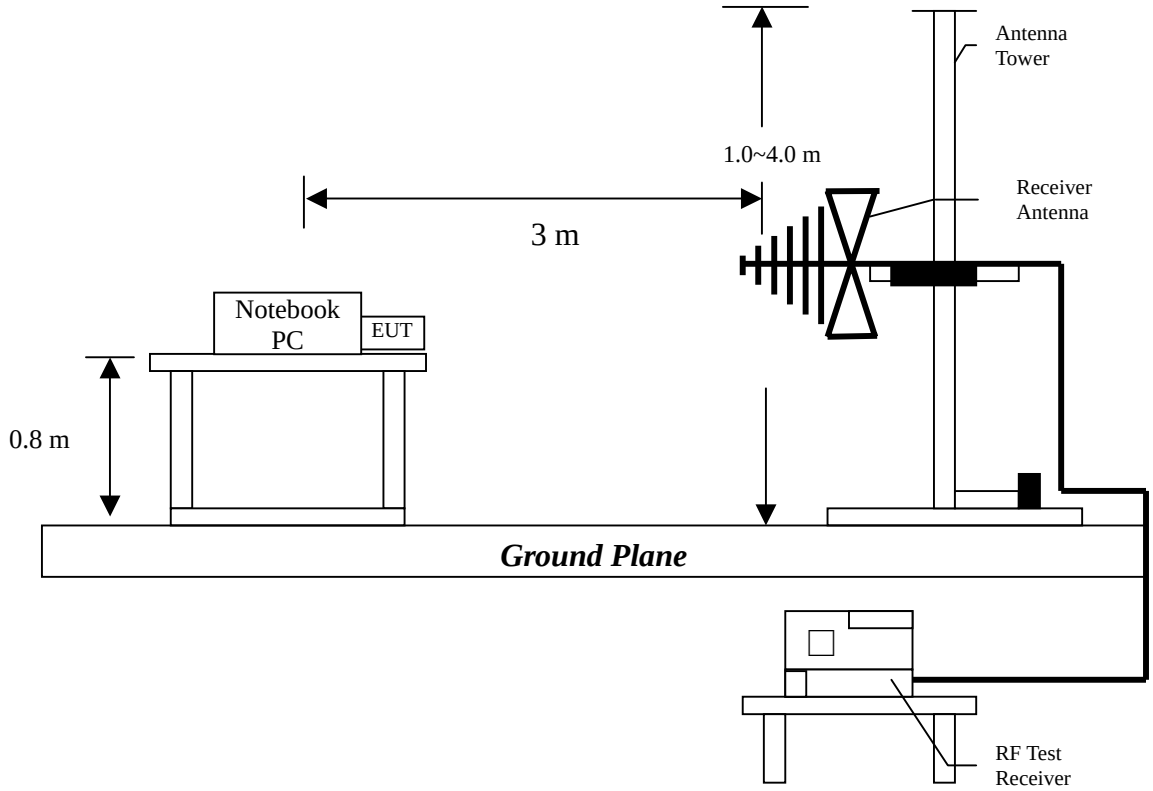
8. Radiated Emission test

8.1 Operating environment

Temperature:	23	℃
Relative Humidity:	53	%
Atmospheric Pressure:	1023	hPa

8.2 Test setup & procedure

The Diagram below shows the test setup, which is utilized to make these measurements.



Radiated emissions were invested cover the frequency range from 30MHz to 1000MHz using a receiver RBW of 120kHz record QP reading, and the frequency over 1GHz using a spectrum analyzer RBW of 1MHz and 10Hz VBW record Average reading. (15.209 paragraph), the Peak reading (1MHz RBW/VBW) recorded also on the report.
The EUT for testing is arranged on a wooden turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent 3 meter reading using inverse scaling with distance.

The EUT configuration please refer to the “Spurious set-up photo.pdf”.

8.3 Emission limits

The spurious Emission shall test through the 10th harmonic. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

Frequency (MHz)	Limits (dB μ V/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:
1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

   Uncertainty was calculated in accordance with NAMAS NIS 81.
   Expanded uncertainty (k=2) of radiated emission measurement is 4.98 dB.

8.4 Radiated spurious emission test data

8.4.1 Measurement results: frequencies equal to or less than 1 GHz

EUT : AWBSH3
Test Condition : Tx at channel 39

Antenna Polariz. (V/H)	Freq. (MHz)	Receiver Detector	Corr. Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)	Antenna high (cm)	Turn Table angle (degree)
V	66.860	QP	12.23	23.07	35.30	40.00	-4.70	100	198
V	95.960	QP	7.38	28.46	35.84	43.50	-7.67	100	66
V	173.560	QP	14.96	20.19	35.15	43.50	-8.36	100	341
V	371.440	QP	15.06	18.05	33.11	46.00	-12.89	198	28
V	394.720	QP	16.40	17.62	34.02	46.00	-11.98	196	69
V	419.940	QP	16.47	19.92	36.39	46.00	-9.61	234	222
H	66.860	QP	12.99	23.37	36.36	40.00	-3.64	400	196
H	111.480	QP	10.54	30.92	41.46	43.50	-2.05	400	336
H	198.780	QP	11.27	23.92	35.19	43.50	-8.32	400	333
H	371.440	QP	15.48	25.34	40.82	46.00	-5.19	210	298
H	394.720	QP	16.74	24.28	41.02	46.00	-4.98	208	56
H	419.940	QP	16.81	25.52	42.33	46.00	-3.67	186	294

Remark:
1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor

8.4.2 Measurement results: frequency above 1GHz

EUT : AWBSH3
Test Condition : Tx at channel 0, 39, 78

No spurious emission was found above the spectrum analyzer's noise floor.
The noise floor are listed as below:

For PK:
1GH-3GH: 50dBmV
3GH-4GH: 54dBmV
14GH-26.5GH: 60dBmV

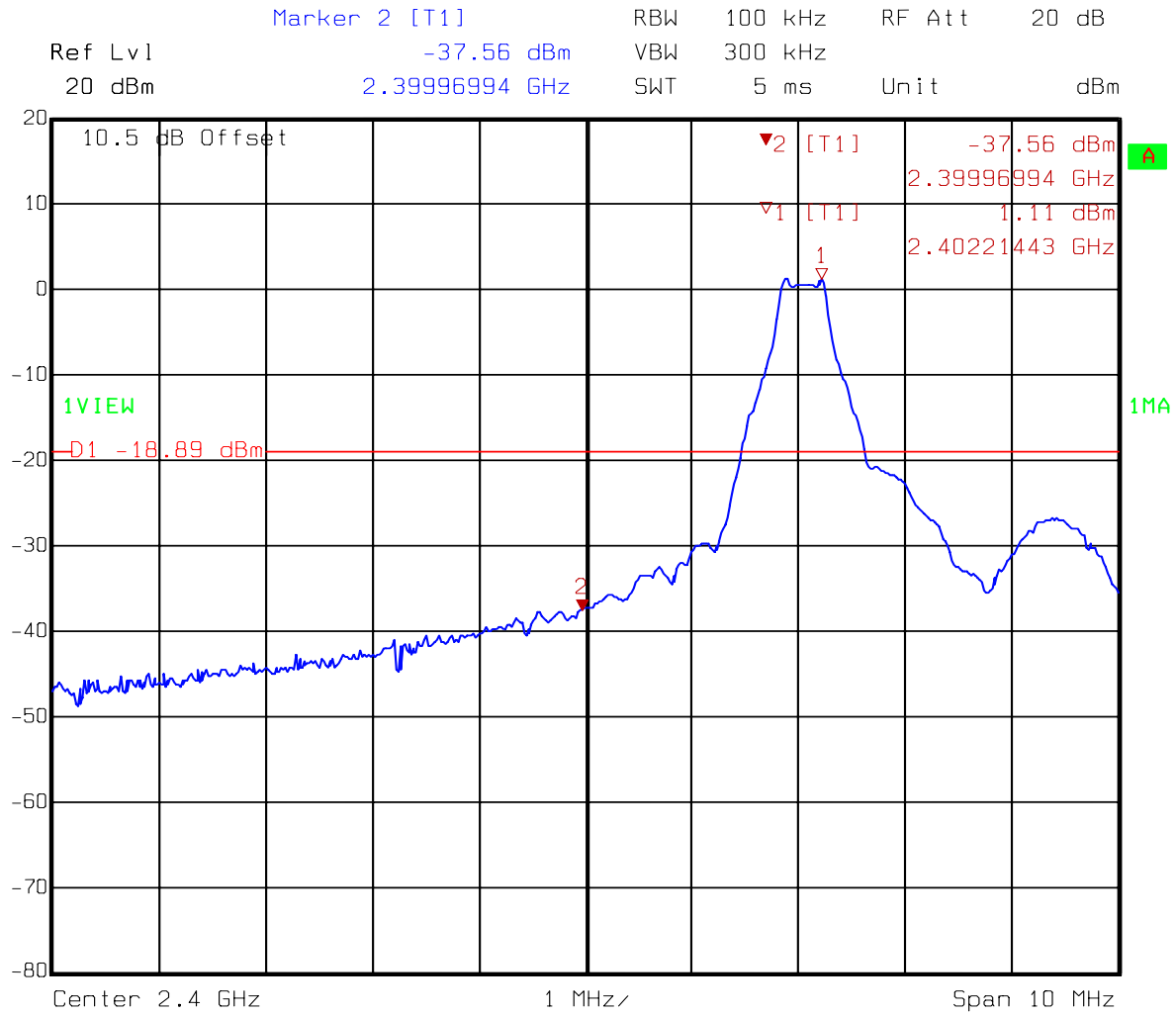
For AV:
1GH-3GH: 41.5dBmV
3GH-4GH: 46dBmV
14GH-26.5GH: 46.5dBmV

9. Emission on the band edge §FCC 15.247(C)

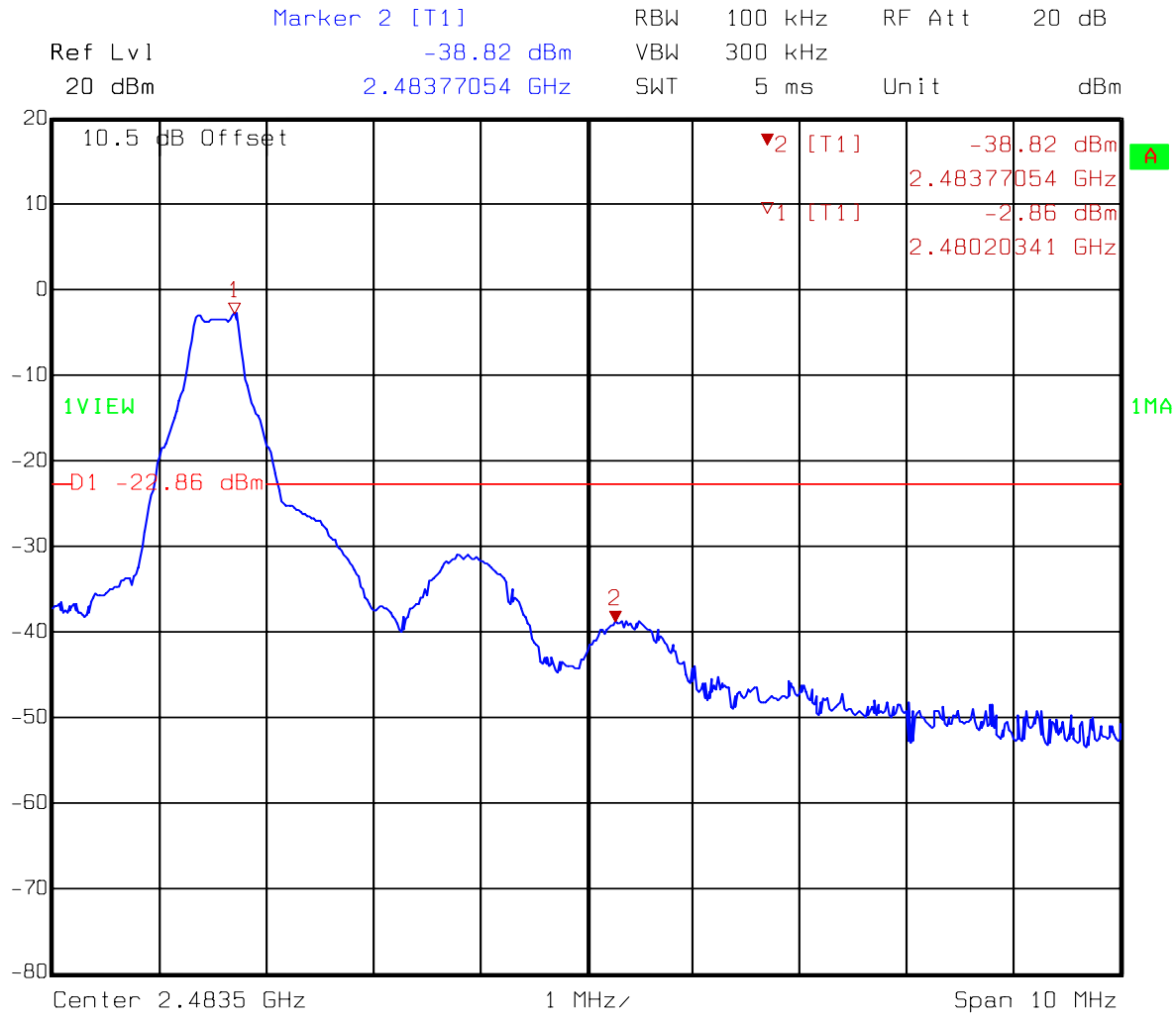
In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 KHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

Please see the plot below.

9.1 Band-edge (Conducted method)

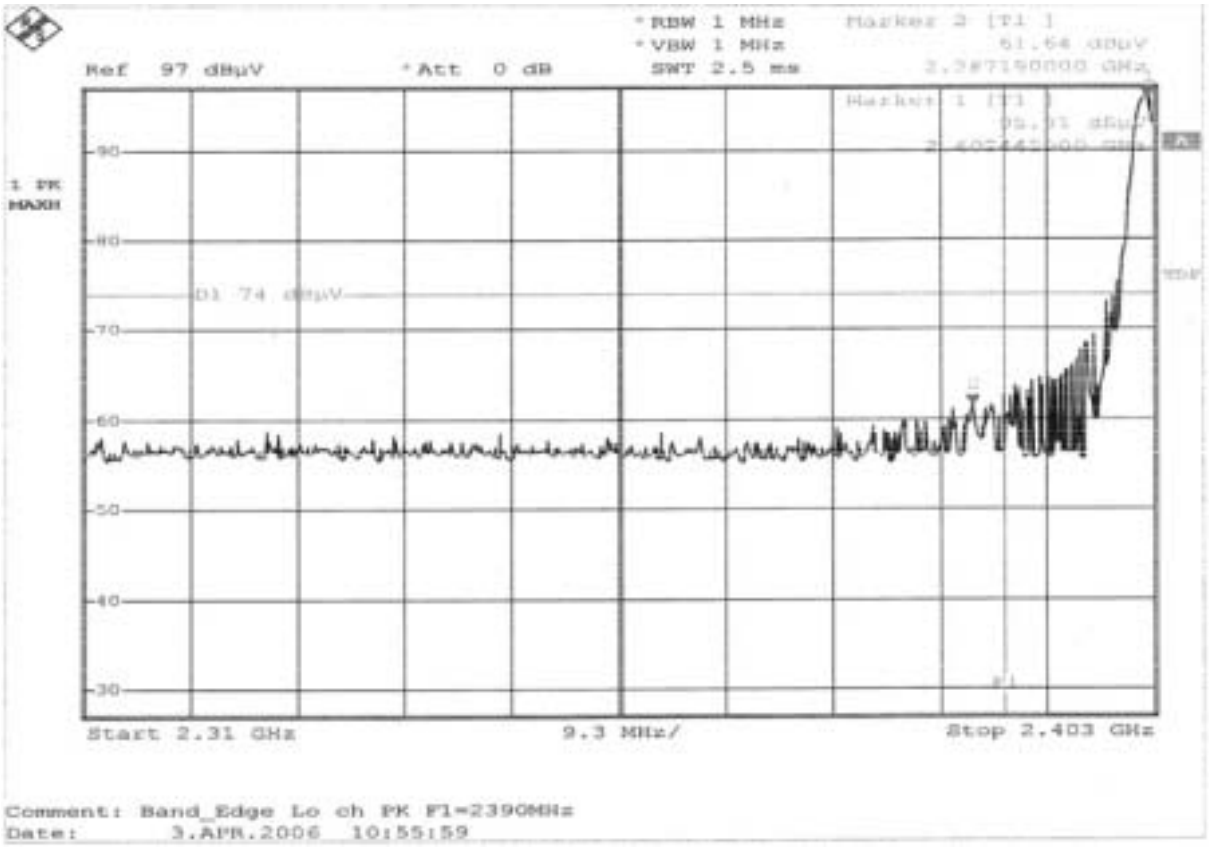


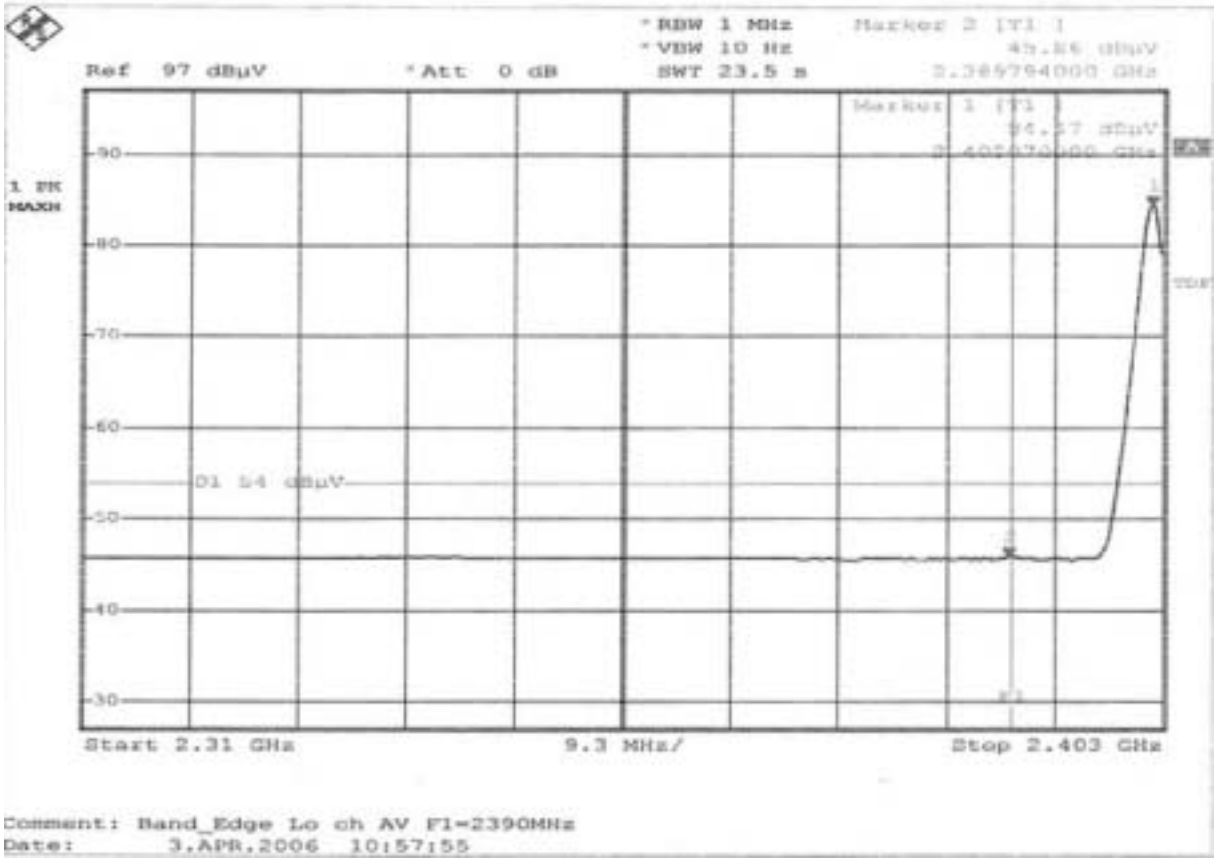
Comment A: Band-edge test at low channel
Date: 13.OCT.2005 10:58:42

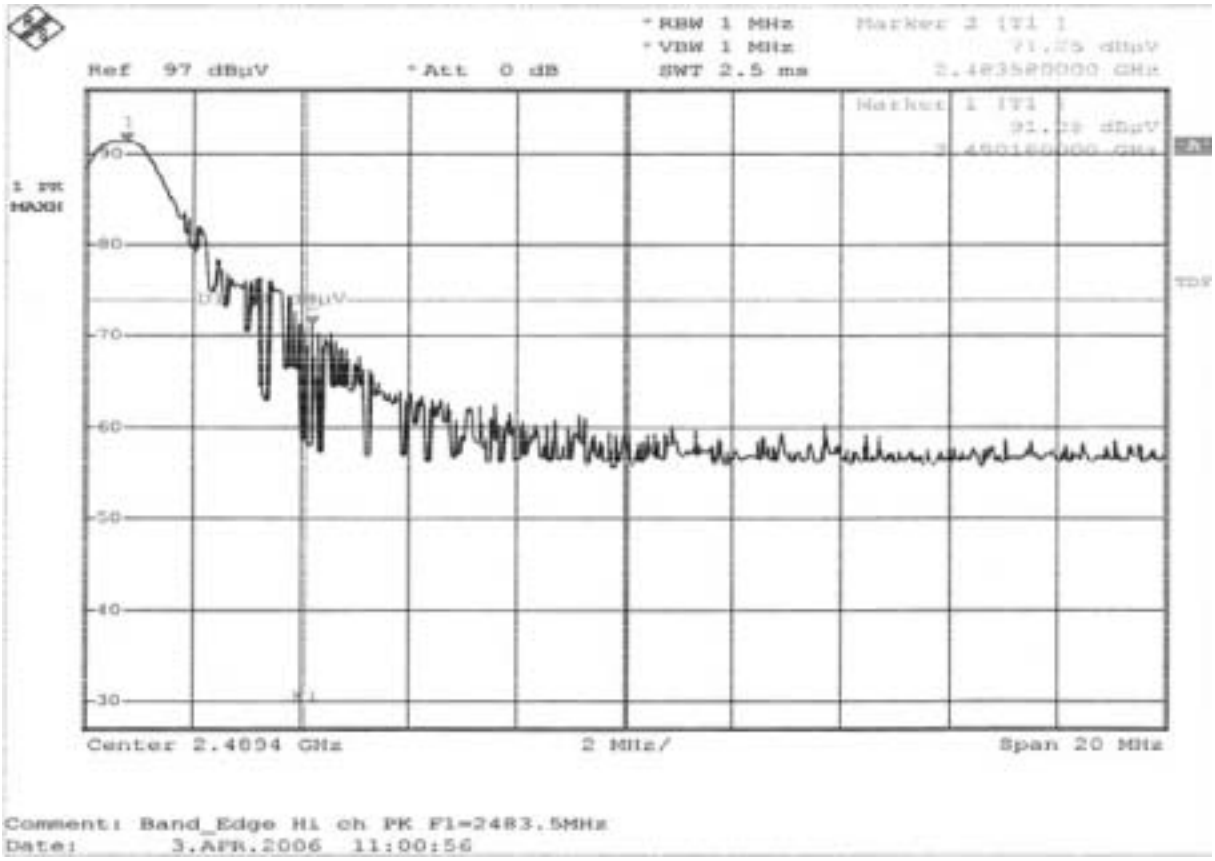


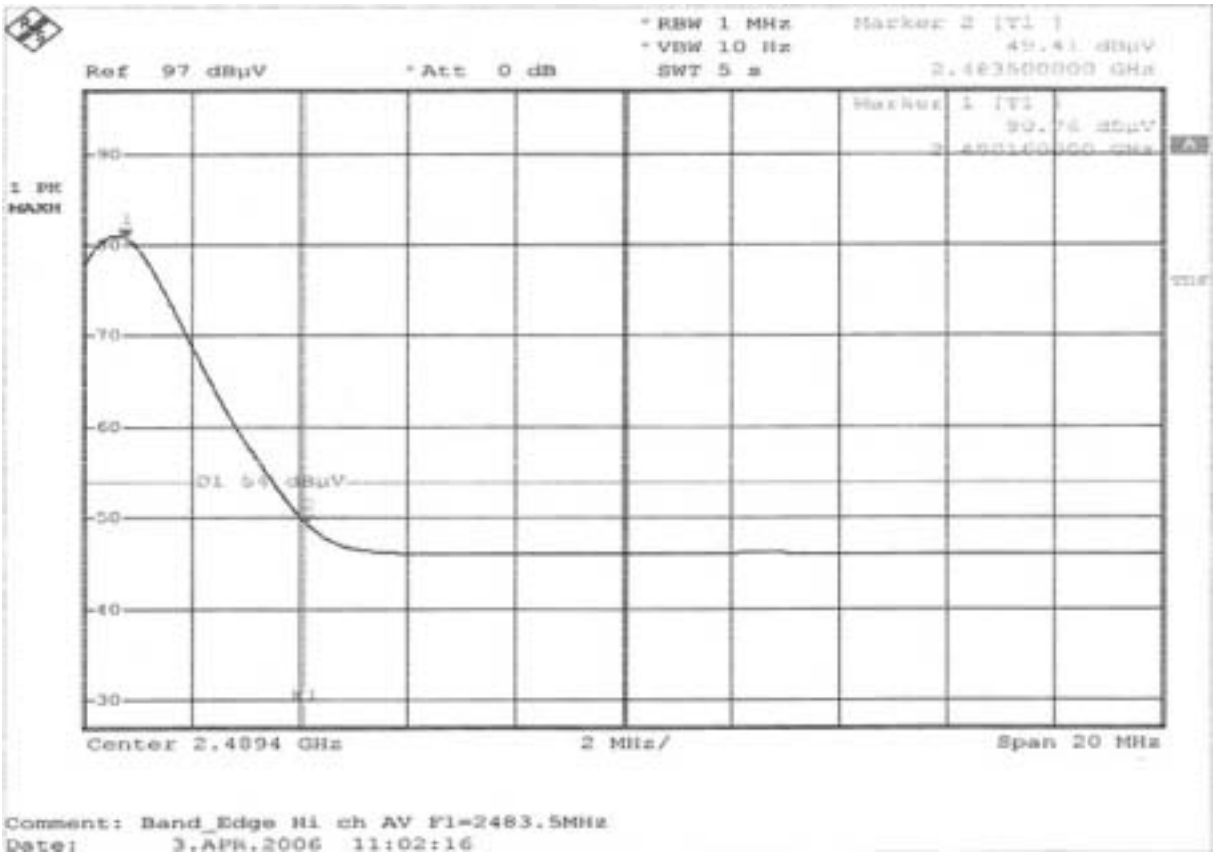
Comment A: Band-edge test at high channel
Date: 13.OCT.2005 11:04:13

9.2 Band-edge (Radiated method)




*RBW 1 MHz
*VBW 10 Hz
SWT 23.5 s
Ref 97 dBµV
*Att 0 dB
1 PK
MAXH
90
80
70
60
D1 54 dBµV
50
40
30
Start 2.31 GHz
9.3 MHz/
Stop 2.403 GHz
Comment: Band_Edge Lo ch AV F1=2390MHz
Date: 3.APR.2006 10:57:55


RBW 1 MHz
VBW 1 MHz
SWT 2.5 ms
Ref 97 dBµV
Att 0 dB
Marker 1 [T1]
91.29 dBµV
2.483500000 GHz
1 PK
MAXH
90
80
70
60
50
40
30
Center 2.4694 GHz
2 MHz/
Span 20 MHz
Comment: Band_Edge Hi ch PK F1=2483.5MHz
Date: 3.APR.2006 11:00:56

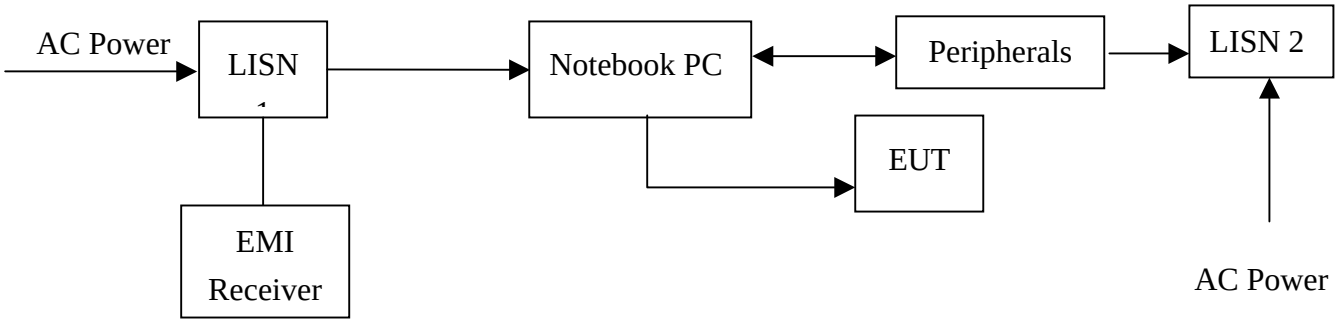

*RBW 1 MHz
*VBW 10 Hz
SWT 5 s
Ref 97 dBµV
*Att 0 dB
Marker 2 [T1]
49.41 dBµV
2.483500000 GHz
Marker 1 [T1]
90.76 dBµV
2.400140000 GHz
1 PK
MAXH
90
80
70
60
D1 54 dBµV
50
40
30
F1
Center 2.4094 GHz
2 MHz/
Span 20 MHz
Comment: Band_Edge Hi ch AV F1=2483.5MHz
Date: 3.APR.2006 11:02:16

10. Power Line Conducted Emission test §FCC 15.207

10.1 Operating environment

Temperature:	25	℃
Relative Humidity:	60	%
Atmospheric Pressure	1023	hPa

10.2 Test setup & procedure



The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50 ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination.
Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4/2003 on conducted measurement.
The bandwidth of the field strength meter (R & S Test Receiver ESCS 30) is set at 9kHz.

The EUT configuration please refer to the “Conducted set-up photo.pdf”.

10.3 Emission limit

Freq. (MHz)	Conducted Limit (dBuV)	
	Q.P.	Ave.
0.15~0.50	66 – 56*	56 – 46*
0.50~5.00	56	46
5.00~30.0	60	50

*Decreases with the logarithm of the frequency.

10.4 Uncertainty of Conducted Emission

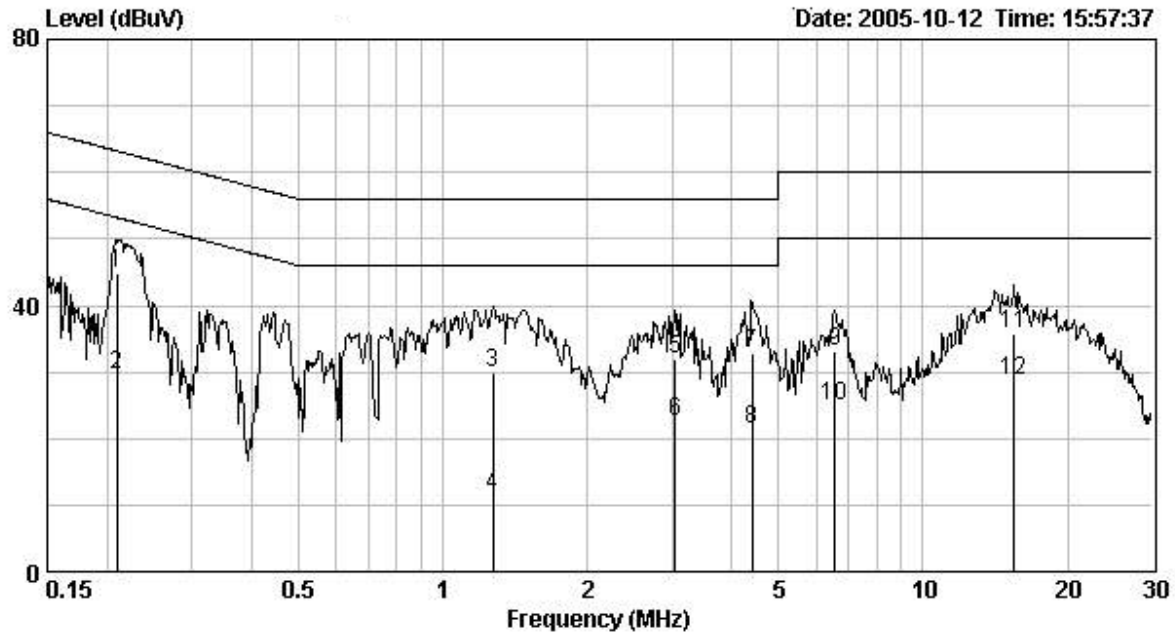
Expanded uncertainty (k=2) of conducted emission measurement is ±2.6 dB.

10.5 Power Line Conducted Emission test data

Phase : Line
EUT : AWBSH3
Test Condition : Normal operating mode

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.209	0.10	44.75	63.24	29.59	53.24	-18.49	-23.65
1.274	0.10	29.82	56.00	11.54	46.00	-26.18	-34.46
3.049	0.15	31.97	56.00	22.47	46.00	-24.03	-23.53
4.409	0.21	32.71	56.00	21.50	46.00	-23.29	-24.50
6.552	0.29	33.20	60.00	24.94	50.00	-26.81	-25.07
15.492	0.71	35.81	60.00	28.71	50.00	-24.19	-21.29

Remark:
1. Correction Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



Phase : Neutral
EUT : AWBSH3
Test Condition : Normal operating mode

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.168	0.10	42.32	65.08	26.06	55.08	-22.76	-29.02
0.231	0.10	46.06	62.40	29.89	52.40	-16.34	-22.51
0.496	0.10	35.83	56.07	24.62	46.07	-20.24	-21.45
4.335	0.20	32.80	56.00	20.95	46.00	-23.20	-25.05
6.552	0.20	33.65	60.00	28.91	50.00	-26.35	-21.09
15.741	0.43	33.77	60.00	28.69	50.00	-26.23	-21.31

Remark:
1. Correction Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)