FCC TEST REPORT

REPORT NO.: RF940406L09

MODEL NO.: BT2400A

RECEIVED: Apr. 06, 2006

TESTED: Apr. 07 ~ Apr. 13, 2006

ISSUED: Jul. 10, 2006

APPLICANT: NTN Buzztime, Inc.

ADDRESS: 5966 La Place Court, Suite 100 Carlsbad, CA 92008

ISSUED BY: Advance Data Technology Corporation

LAB ADDRESS: No. 47, 14th Ling, Chia Pau Tsuen, Lin Kou Hsiang 244, Taipei Hsien, Taiwan, R.O.C.

TEST LOCATION: No. 19, Hwa Ya 2nd Rd., Wen Hwa Tsuen, Kwei Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C.

ACCREDITED
No. 2177-01

0528

TABLE OF CONTENTS

1 CERTIFICATION

PRODUCT :	2.4GHz Playmaker System
BRAND NAME :	NTN/Buzztime
MODEL NO. :	BT2400A
APPLICANT :	NTN Buzztime, Inc.
TESTED :	Apr. 07 ~ Apr. 13, 2006
TEST SAMPLE :	ENGINEERING SAMPLE
STANDARDS :	FCC Part 15, Subpart C (Section 15.247) ANSI C63.4-2003

The above equipment has been tested by **Advance Data Technology Corporation**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

PREPARED BY : Wendy Liao , **DATE:** Jul. 10, 2006
(Wendy Liao)

TECHNICAL ACCEPTANCE : Long Chen , **DATE:** Jul. 10, 2006
Responsible for RF (Long Chen)

APPROVED BY : Gary Chang , **DATE:** Jul. 10, 2006
(Gary Chang / Supervisor)

2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 15, Subpart C			
Standard Section	**Test Type and Limit**	**Result**	**REMARK**
15.207	AC Power Conducted Emission	N/A	Power supply is 4.8Vdc from batteries
15.247(a)(1)(iii)	Number of Hopping Frequency Used Spec.: At least 15 channels	PASS	Meet the requirement of limit
15.247(a)(1)(iii)	Dwell Time on Each Channel Spec. : Max. 0.4 second within 31.6 second	PASS	Meet the requirement of limit
15.247(a)(1)	1. Hopping Channel Separation Spec. : Min. 25 kHz or 20 dB bandwidth, whichever is greater 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	PASS	Meet the requirement of limit
15.247(b)	Maximum Peak Output Power Spec.: max. 30dBm	PASS	Meet the requirement of limit
15.247(d)	Transmitter Radiated Emissions Spec.: Table 15.209	PASS	Meet the requirement of limit Minimum passing margin is –11.11dB at 206.89 MHz
15.247(d)	Band Edge Measurement	PASS	Meet the requirement of limit

2.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4:

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.44 dB
Radiated emissions	30MHz ~ 200MHz	3.63 dB
	200MHz ~1000MHz	3.65 dB
	1GHz ~ 18GHz	2.20 dB
	18GHz ~ 40GHz	1.88 dB

3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	2.4GHz Playmaker System
MODEL NO.	BT2400A
FCC ID	M8SNTN2400
POWER SUPPLY	4.8Vdc from batteries
MODULATION TYPE	GFSK
MODULATION TECHNOLOGY	FHSS
FREQUENCY RANGE	2402 MHz ~ 2480 MHz
NUMBER OF CHANNEL	79
OUTPUT POWER	137.404mW
ANTENNA TYPE	Wire antenna with 3dBi gain
DATA CABLE	NA
I/O PORTS	NA

NOTE:

1. The above EUT information was declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

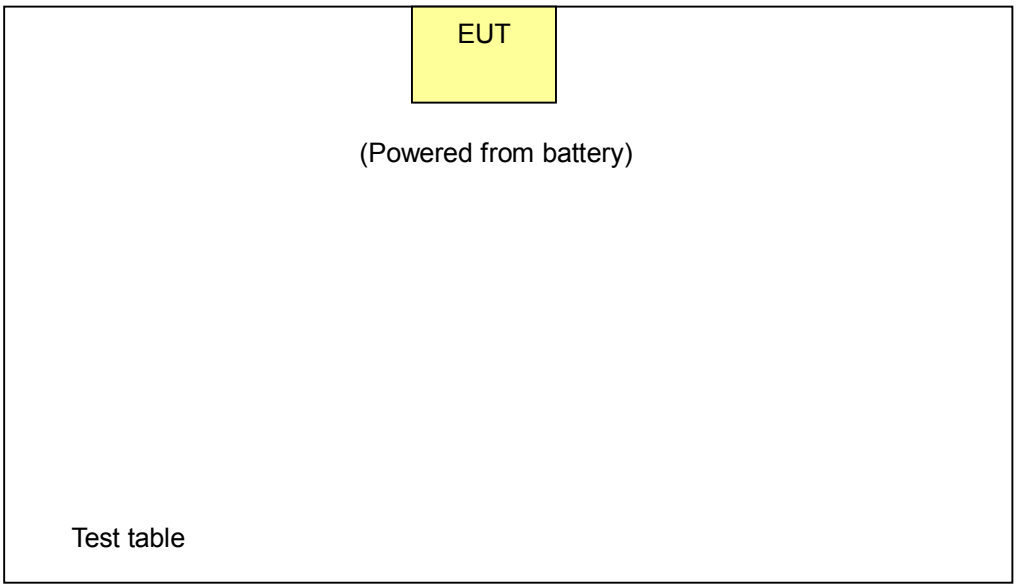
3.2 DESCRIPTION OF TEST MODES

Operated in 2400 ~ 2483.5MHz Band:

79 channels are provided to this EUT.

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2431	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

3.2.1 CONFIGURATION OF SYSTEM UNDER TEST



3.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL:

EUT configure mode	Applicable to			Description
	RE<1G	RE≥1G	APCM	
-	√	√	√	NA

Where RE<1G RE: Radiated Emission below 1GHz RE≥1G: Radiated Emission above 1GHz
APCM: Antenna Port Conducted Measurement

Radiated Emission Test (Below 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations.

☒ Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type
0 to 78	78	FHSS	GFSK

Radiated Emission Test (Above 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations.

☒ Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type
0 to 78	0, 39, 78	FHSS	GFSK

Bandedge Measurement:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations.

☒ Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type
0 to 78	0, 78	FHSS	GFSK

Antenna Port Conducted Measurement:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations.

☒ Following channel(s) was (were) selected for the final test as listed below.

Available Channel	Tested Channel	Modulation Technology	Modulation Type
0 to 78	0, 39, 78	FHSS	GFSK

3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C. (15.247)
ANSI C63.4-2003

All test items have been performed and recorded as per the above standards.

NOTE: The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

3.4 DESCRIPTION OF SUPPORT UNITS

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	NA	NA	NA	NA	NA

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	NA

NOTE: All power cords of the above support units are non shielded (1.8m).

4 TEST PROCEDURES AND RESULTS

4.1 CONDUCTED EMISSION MEASUREMENT

NA

4.2 NUMBER OF HOPPING FREQUENCY USED

4.2.1 LIMIT OF HOPPING FREQUENCY USED

At least 15 channels frequencies, and should be equally spaced.

4.2.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SPECTRUM ANALYZER	FSEK30	100049	Aug. 14, 2006

NOTE:
The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.

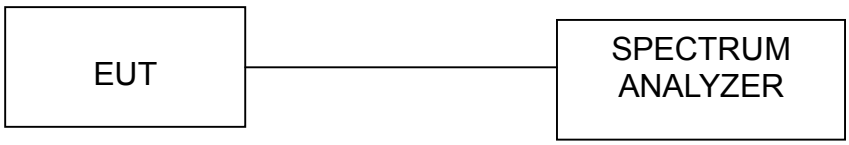
4.2.3 TEST PROCEDURES

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Set the SA on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

4.2.4 DEVIATION FROM TEST STANDARD

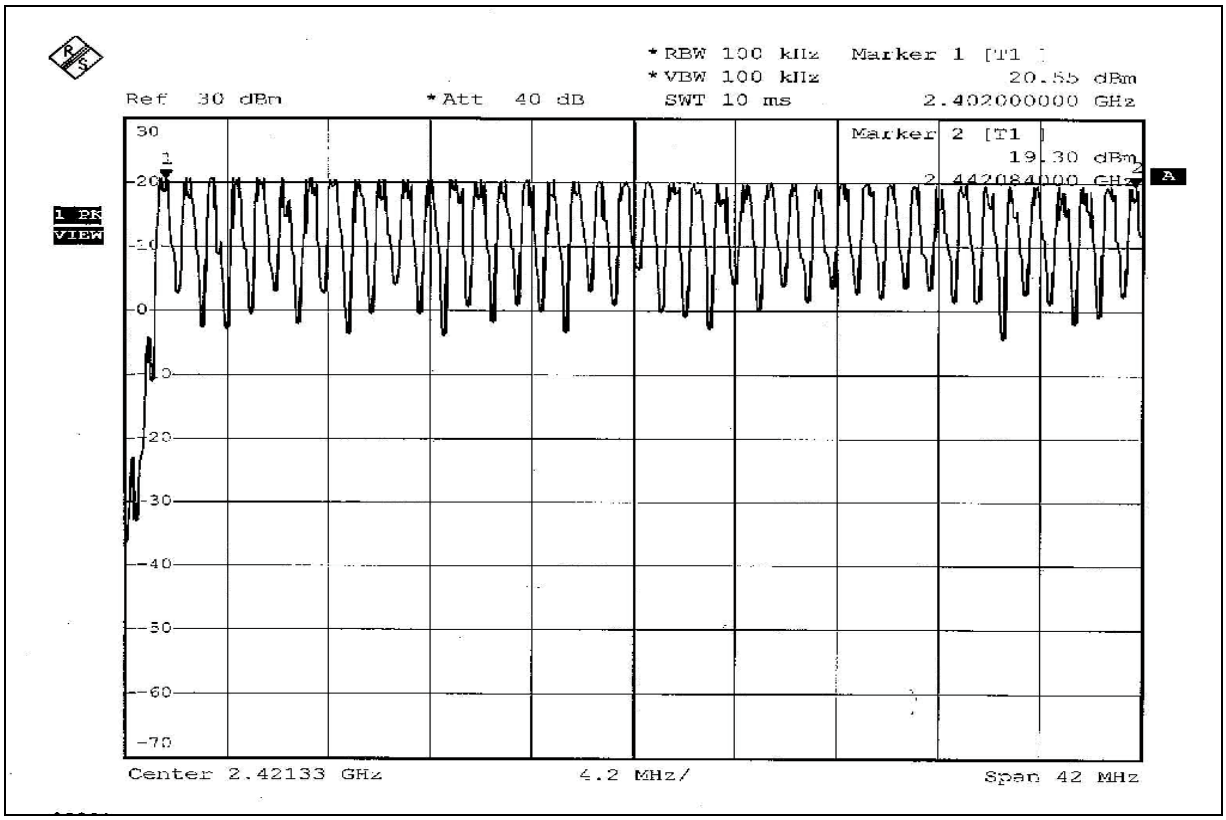
No deviation

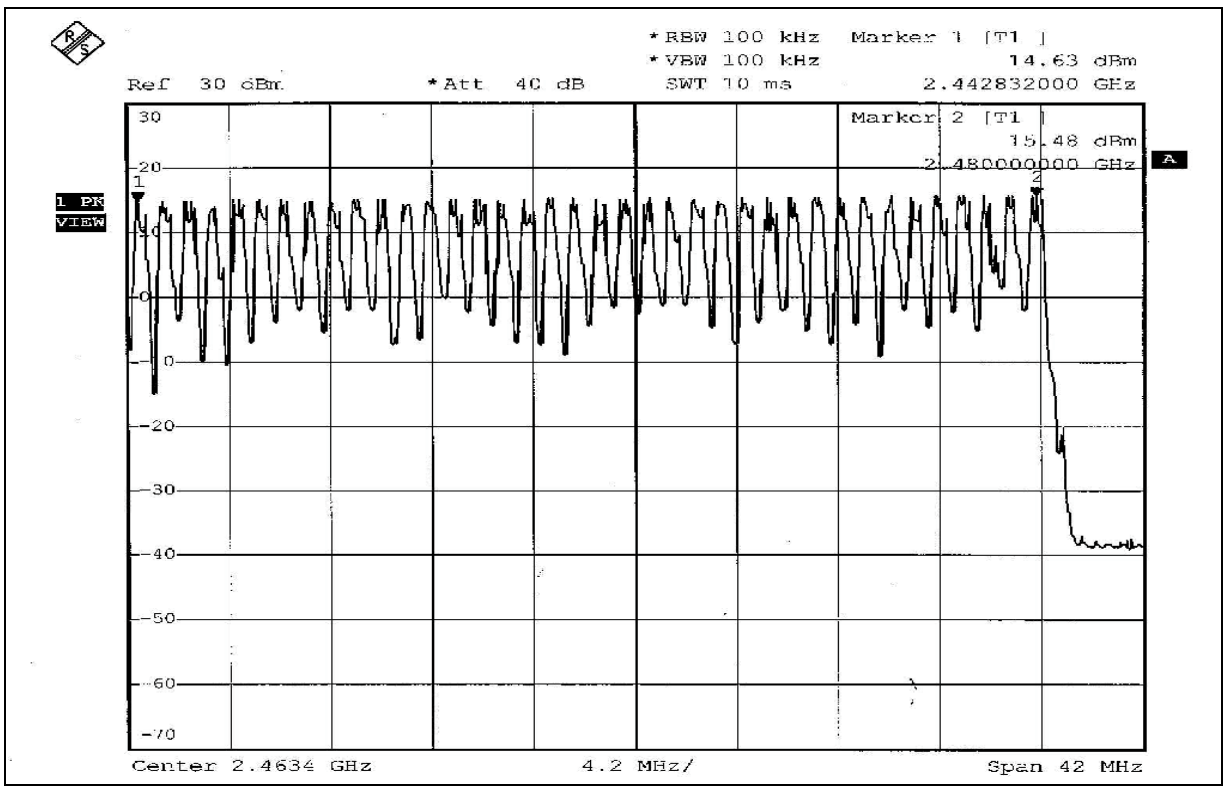
4.2.5 TEST SETUP



4.2.6 TEST RESULTS

There are 79 hopping frequencies in the hopping mode. Please refer to next page for the test result. On the plots, it shows that the hopping frequencies are equally spaced.


*RBW 100 kHz
*VBW 100 kHz
SWT 10 ms
Marker 1 [T1]
20.55 dBm
2.402000000 GHz
Ref 30 dBm
*Att 40 dB
Marker 2 [T1]
19.30 dBm
2.442084000 GHz
1 PK
VIEW
A
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 2.42133 GHz
4.2 MHz/
Span 42 MHz


*RBW 100 kHz
*VBW 100 kHz
SWT 10 ms
Marker 1 [T1]
14.63 dBm
2.442832000 GHz
Ref 30 dBm
*Att 40 dB
Marker 2 [T1]
15.48 dBm
2.480000000 GHz
1 PK
VIEW
A
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 2.4634 GHz
4.2 MHz/
Span 42 MHz

4.3 DWELL TIME ON EACH CHANNEL

4.3.1 LIMIT OF DWELL TIME USED

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.

4.3.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SPECTRUM ANALYZER	FSEK30	100049	Aug. 14, 2006

NOTE:
The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.

4.3.3 TEST PROCEDURES

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect its antenna terminal to measurement via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all frequencies measured were complete.

4.3.4 DEVIATION FROM TEST STANDARD

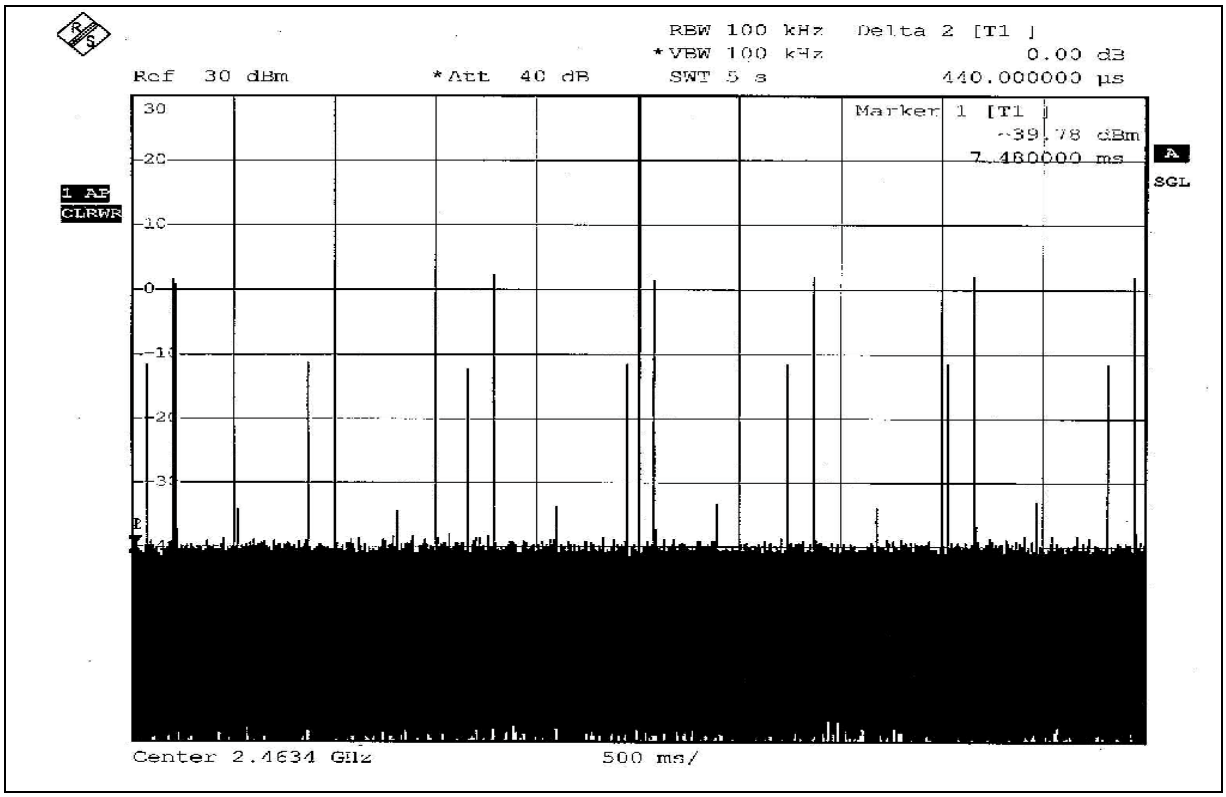
No deviation

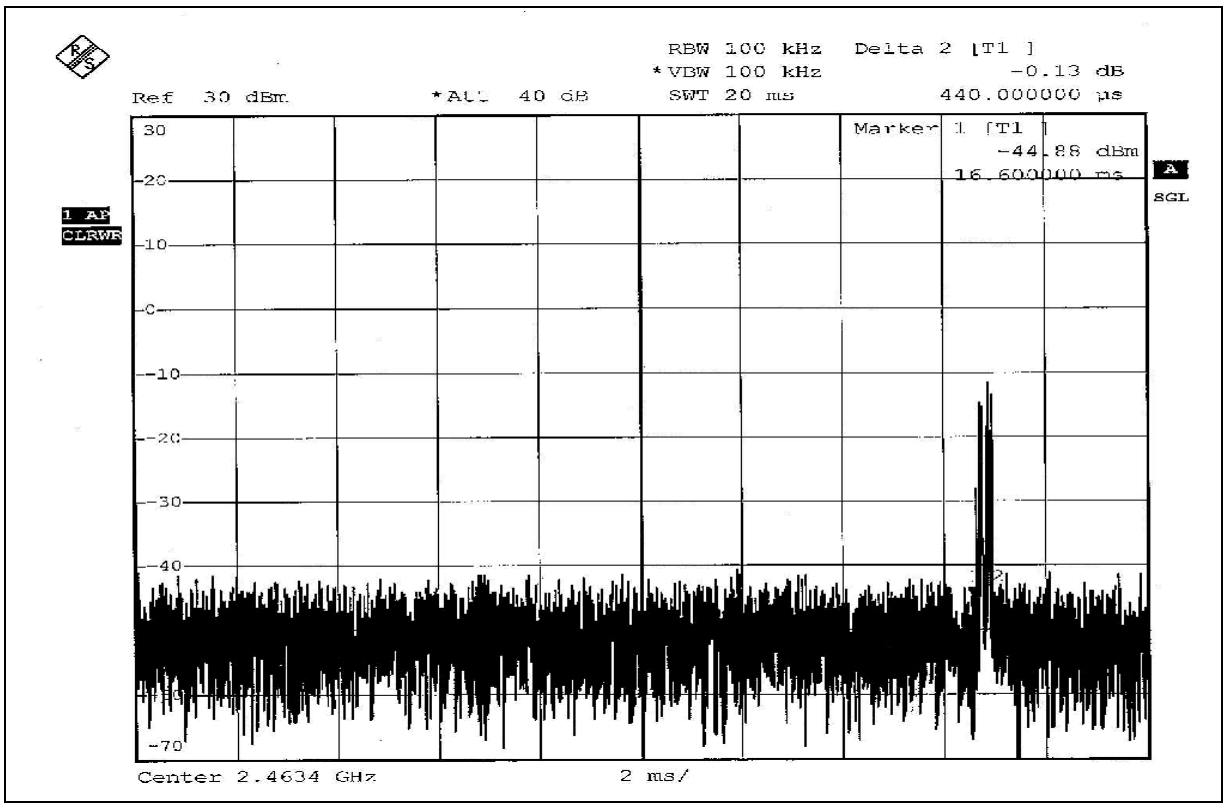
4.3.5 TEST SETUP

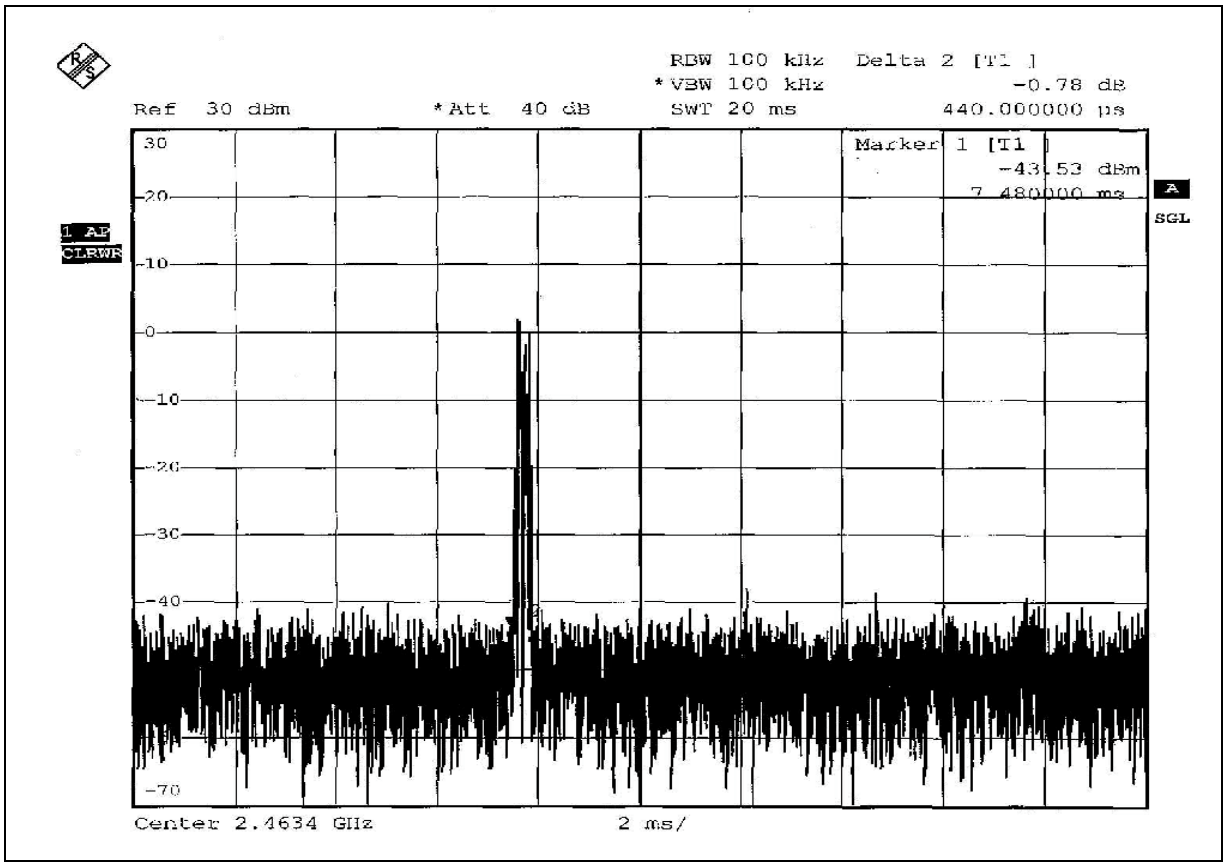
4.3.6 TEST RESULTS

Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
14 (times / 5 sec) *6.32=88.48times	0.440	38.93	400

Test plots of the transmitting time slot are shown on next 2 pages.


RBW 100 kHz
*VBW 100 kHz
SWT 5 s
Delta 2 [T1]
0.00 dB
440.000000 µs
Ref 30 dBm
*Att 40 dB
Marker 1 [T1]
-39.78 dBm
7.480000 ms
1 AP
CLRWR
A
SGL
30
20
10
0
-10
-20
-30
-40
Center 2.4634 GHz
500 ms/


RBW 100 kHz
*VBW 100 kHz
SWT 20 ms
Delta 2 [T1]
-0.13 dB
440.000000 µs
Ref 30 dBm
*Att 40 dB
Marker 1 [T1]
-44.88 dBm
16.600000 ms
1 AP
CLRWR
A
SGL
30
20
10
0
-10
-20
-30
-40
-70
Center 2.4634 GHz
2 ms/


RBW 100 kHz
Delta 2 [T1]
*VBW 100 kHz
-0.78 dB
Ref 30 dBm
*Att 40 dB
SWT 20 ms
440.000000 µs
Marker 1 [T1]
-43.53 dBm
7.480000 ms
1 AP
CLRWR
A
SGL
30
20
10
0
-10
-20
-30
-40
-70
Center 2.4634 GHz
2 ms/

4.4 CHANNEL BANDWIDTH

4.4.1 LIMITS OF CHANNEL BANDWIDTH

For frequency hopping system operating in the 2400-2483.5MHz, If the 20dB bandwidth of hopping channel is greater than 25kHz, the 20dBbandwidth of hopping channel shell be a minimum limit for the hopping channel separation.

4.4.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SPECTRUM ANALYZER	FSEK30	100049	Aug. 14, 2006

NOTE:
The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.

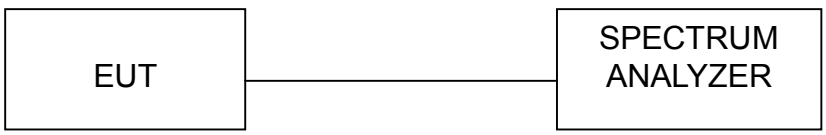
4.4.3 TEST PROCEDURE

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

4.4.4 DEVIATION FROM TEST STANDARD

No deviation

4.4.5 TEST SETUP



4.4.6 EUT OPERATING CONDITION

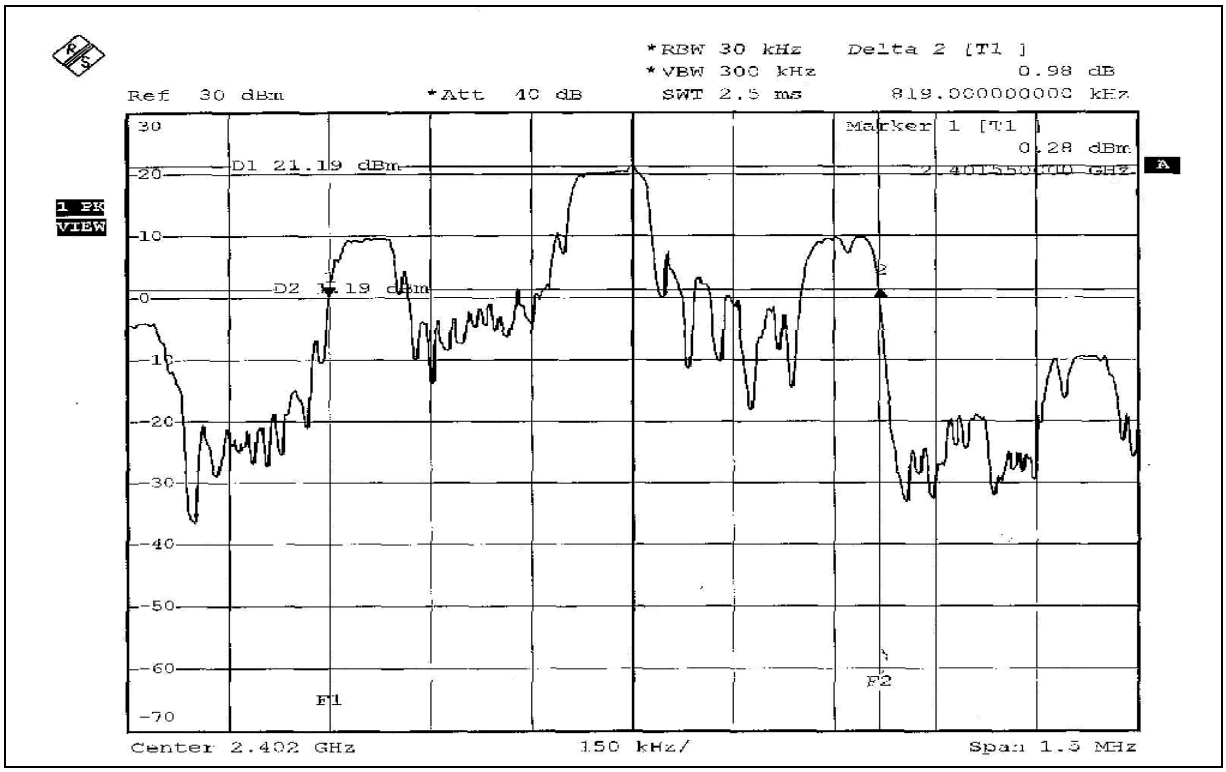
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.4.7 TEST RESULTS

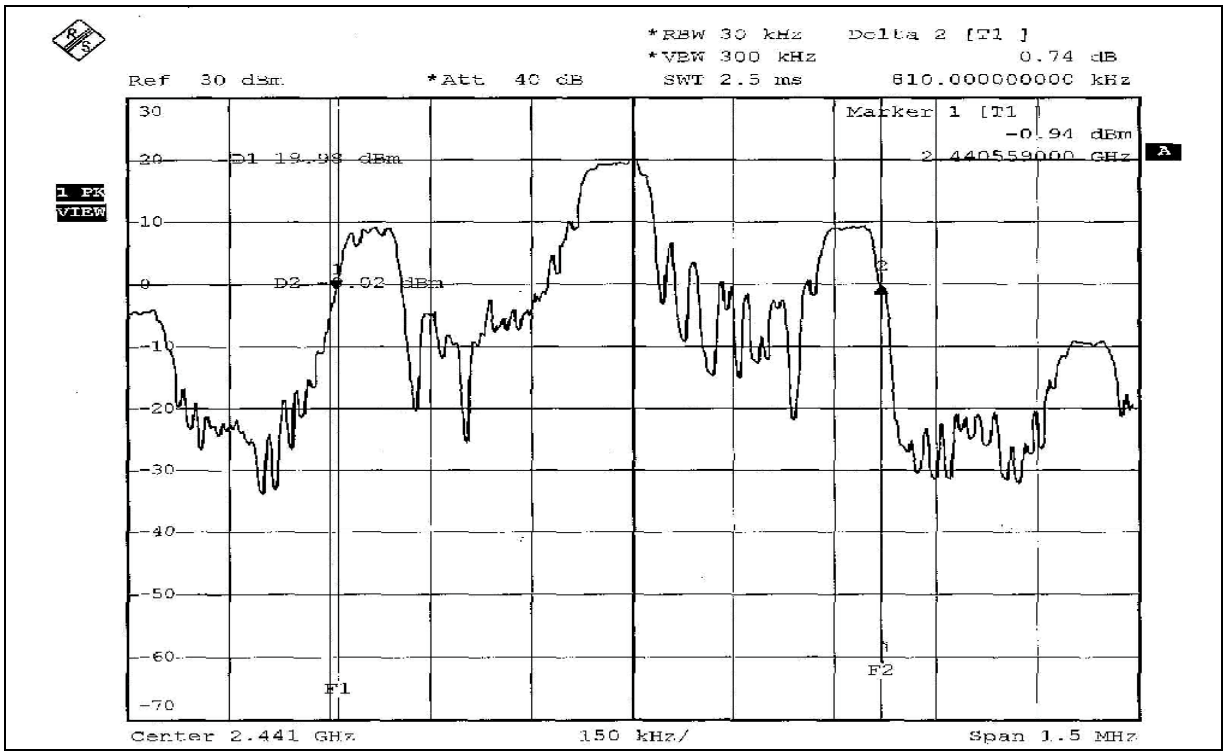
MODULATION TYPE	GFSK	ENVIRONMENTAL CONDITIONS	23 deg. C, 52% RH, 991 hPa
INPUT POWER (SYSTEM)	120Vac, 60 Hz	TESTED BY	Gary Chang

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (kHz)	More Than 25kHz
0	2402	819.00	Yes
39	2441	810.00	Yes
78	2480	804.00	Yes

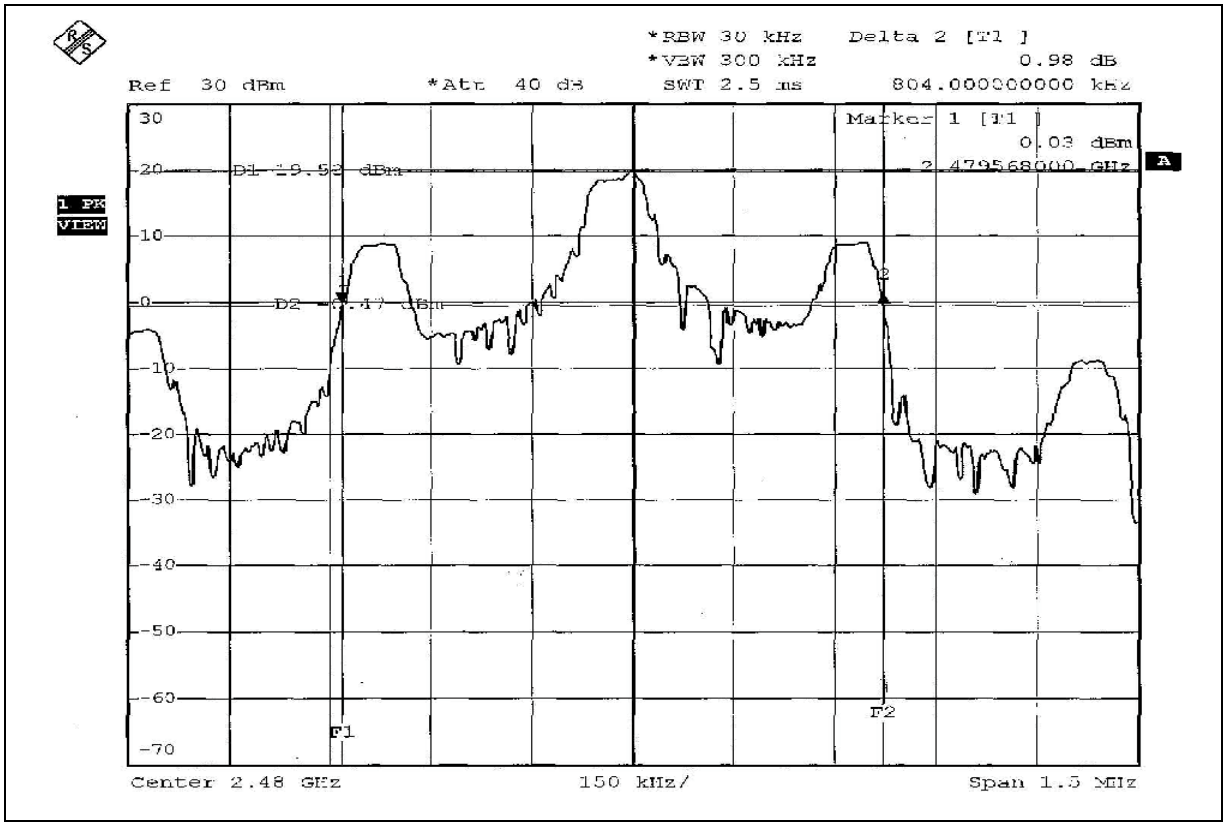
Channel 0



Channel 39



Channel 78


*RBW 30 kHz
*VBW 300 kHz
SWT 2.5 ms
Delta 2 [T1]
0.98 dB
804.000000000 kHz
Ref 30 dBm
*Atn 40 dB
Marker 1 [T1]
0.03 dBm
2.479568000 GHz
D1 19.52 dBm
D2 -0.47 dBm
1 PK
VIEW
A
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
F1
F2
Center 2.48 GHz
150 kHz/
Span 1.5 MHz

4.5 HOPPING CHANNEL SEPARATION

4.5.1 LIMIT OF HOPPING CHANNEL SEPARATION

At least 25kHz or 20dB bandwidth (whichever is greater).

4.5.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SPECTRUM ANALYZER	FSEK30	100049	Aug. 14, 2006

NOTE:

The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.

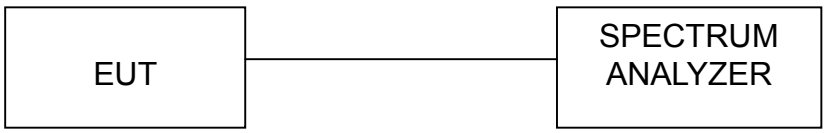
4.5.3 TEST PROCEDURES

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the MaxHold function record the separation of two adjacent channels.
4. Measure the frequency difference of these two adjacent channels by SA MARK function. And then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.

4.5.4 DEVIATION FROM TEST STANDARD

No deviation

4.5.5 TEST SETUP



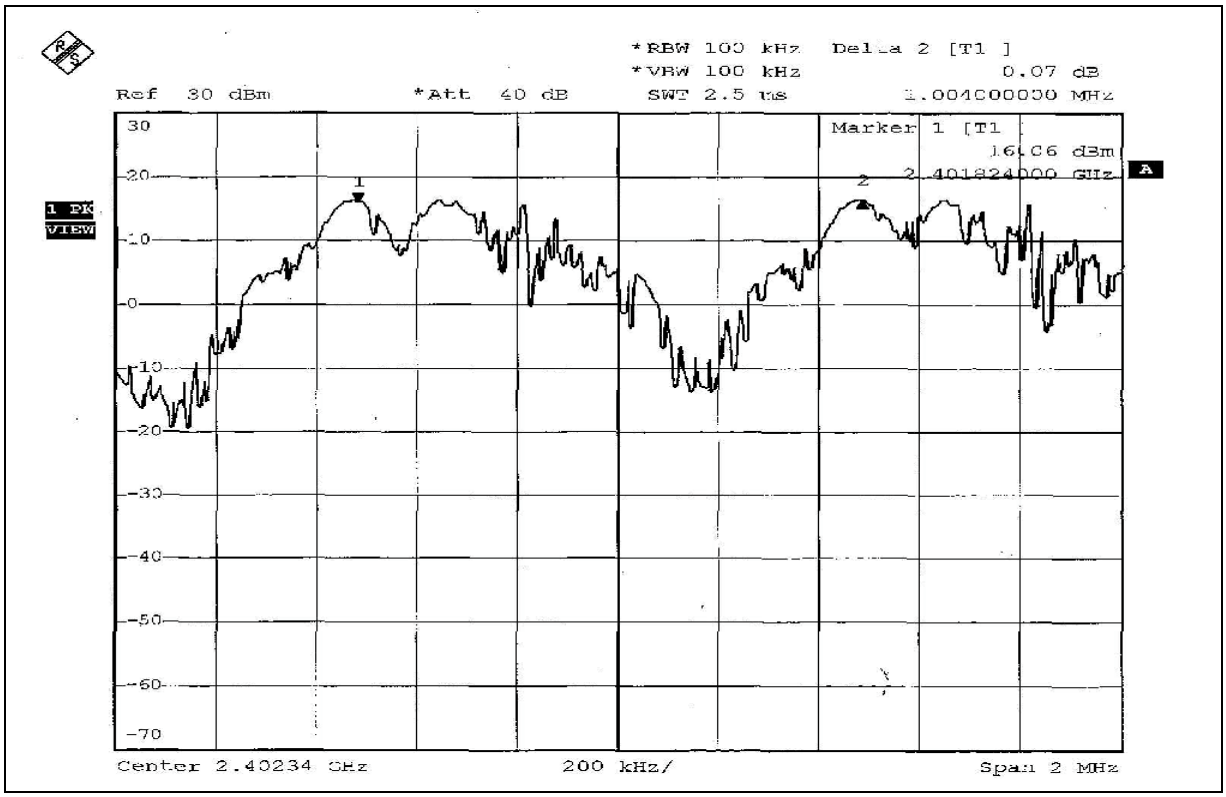
4.5.6 TEST RESULTS

MODULATION TYPE	GFSK	ENVIRONMENTAL CONDITIONS	23 deg. C, 52% RH, 991 hPa
INPUT POWER (SYSTEM)	120Vac, 60 Hz	TESTED BY	Gary Chang

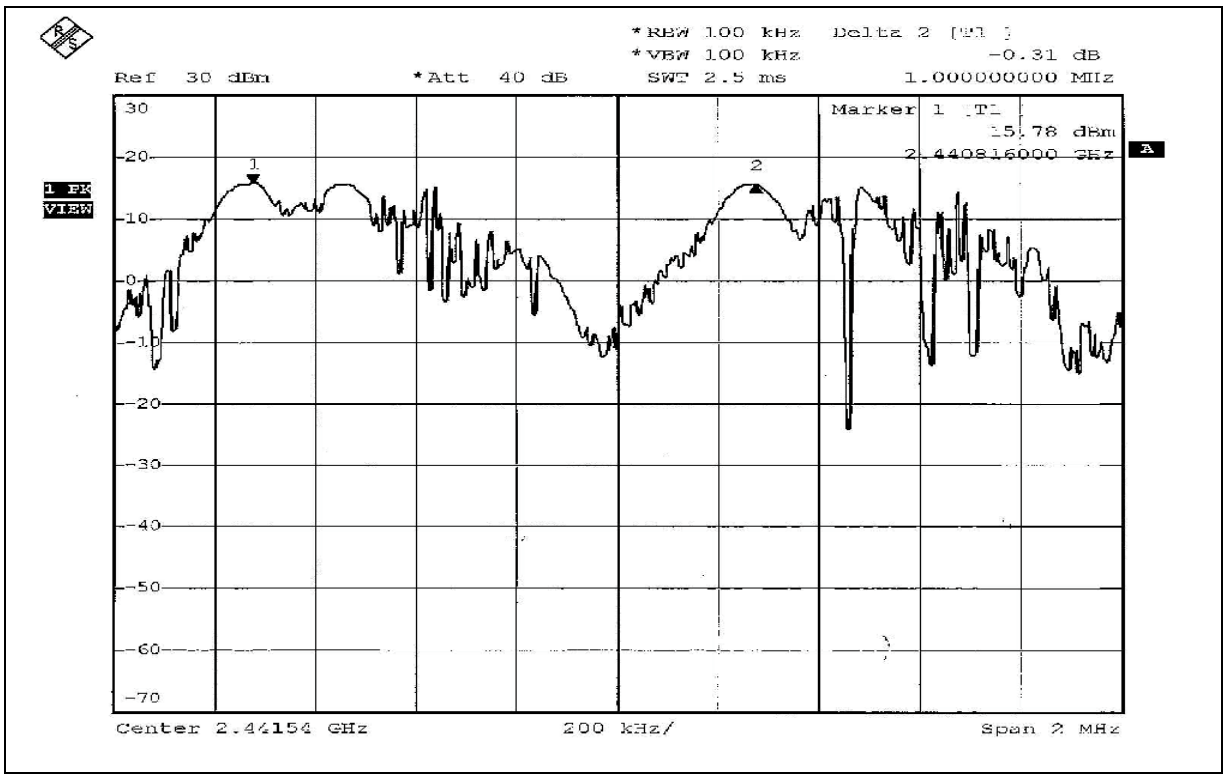
Channel	Frequency (MHz)	Adjacent Channel Separation	Minimum Limit (kHz)	Pass / Fail
0	2402	1.004 MHz	819.00	PASS
39	2441	1.000 MHz	810.00	PASS
78	2480	1.000 MHz	804.00	PASS

The minimum limit is 20dB bandwidth. Test results please refer to next 2 pages.

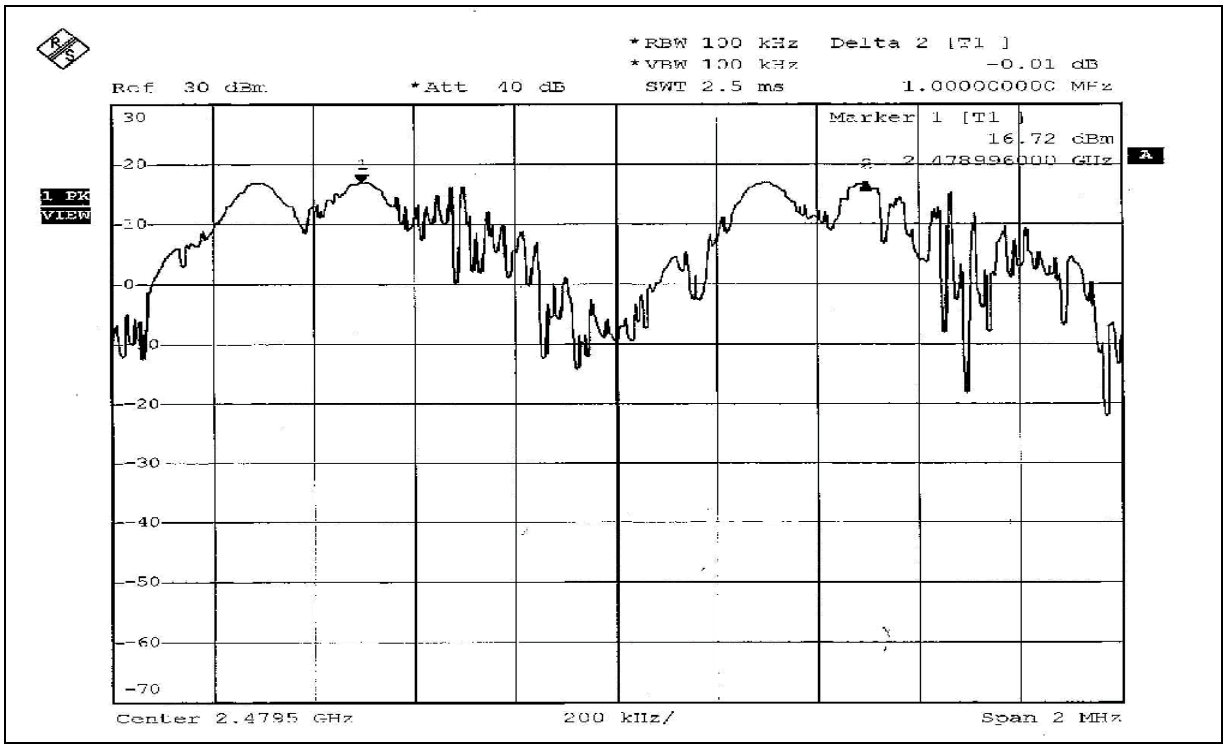
Channel 0



Channel 39



Channel 78


*RBW 100 kHz
*VBW 100 kHz
SWT 2.5 ms
Delta 2 [T1]
-0.01 dB
1.00000000E MHz
Ref 30 dBm
*Att 40 dB
Marker 1 [T1]
16.72 dBm
2.47899600 GHz
1 PK
VIEW
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 2.4795 GHz
200 kHz/
Span 2 MHz

4.6 MAXIMUM PEAK OUTPUT POWER

4.6.1 LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT

The Maximum Peak Output Power Measurement is 30dBm.

4.6.2 INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SPECTRUM ANALYEER	FSEK30	100049	Aug. 14, 2006

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

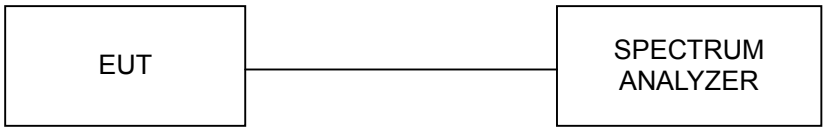
4.6.3 TEST PROCEDURES

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. The center frequency of the spectrum analyzer is set to the fundamental frequency and using 1 MHz RBW and 3 MHz VBW.
4. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
5. Repeat above procedures until all frequencies measured were complete.

4.6.4 DEVIATION FROM TEST STANDARD

No deviation

4.6.5 TEST SETUP



For the actual test configuration, please refer to the related Item – Photographs of the Test Configuration.

4.6.6 EUT OPERATING CONDITION

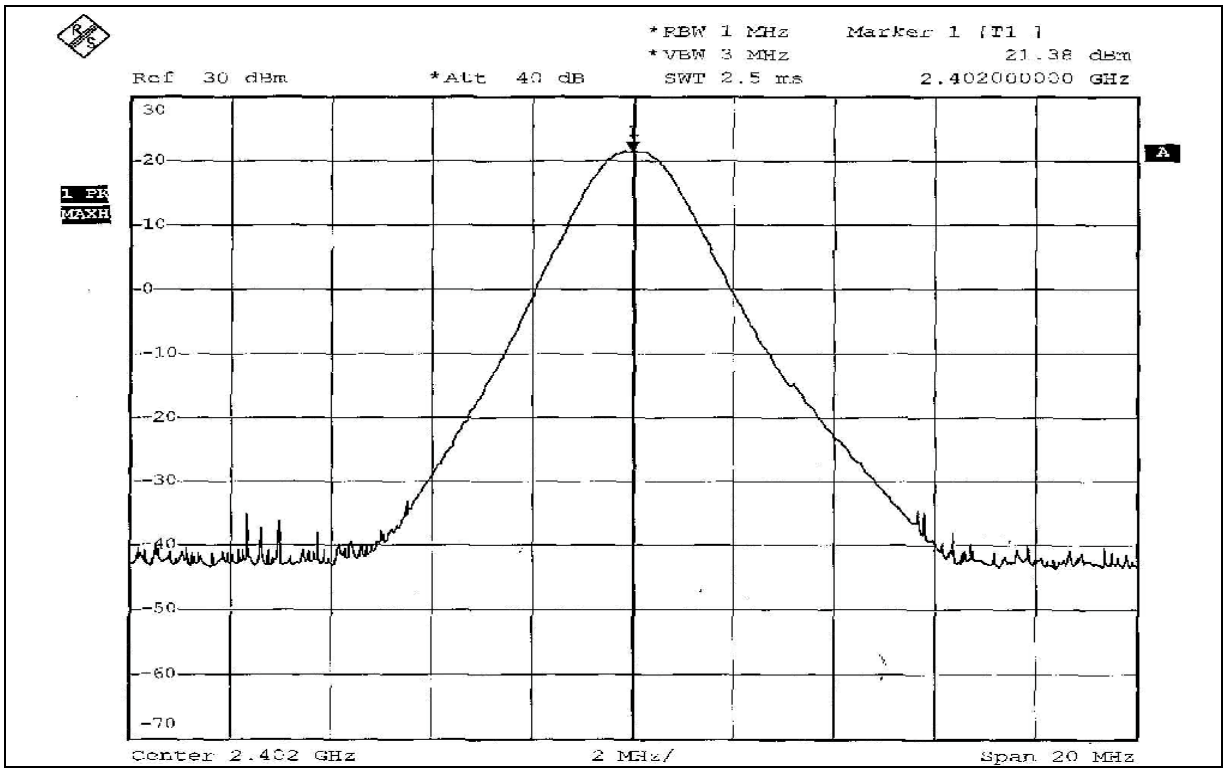
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.6.7 TEST RESULTS

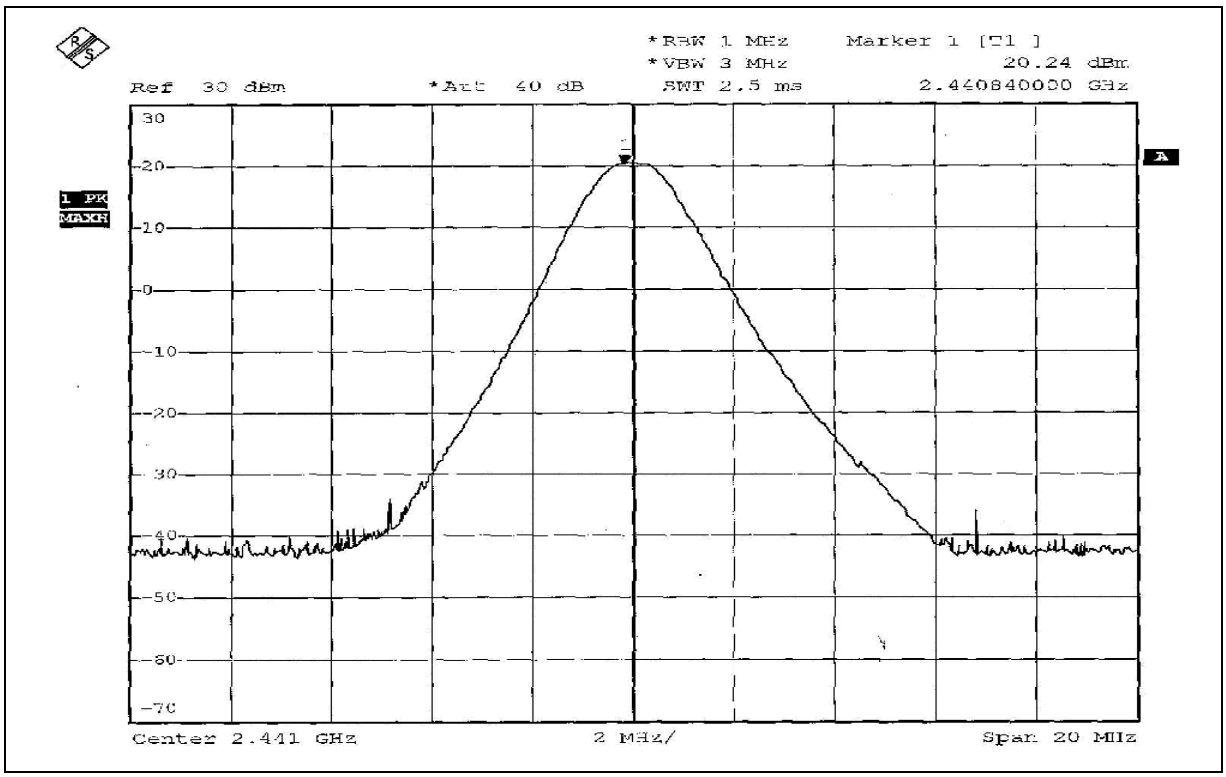
MODULATION TYPE	GFSK	ENVIRONMENTAL CONDITIONS	23 deg. C, 52% RH, 991 hPa
INPUT POWER (SYSTEM)	120Vac, 60 Hz	TESTED BY	Gary Chang

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	PEAK POWER LIMIT (dBm)	PASS/FAIL
0	2402	137.404	21.38	30	PASS
39	2441	105.682	20.24	30	PASS
78	2480	91.622	19.62	30	PASS

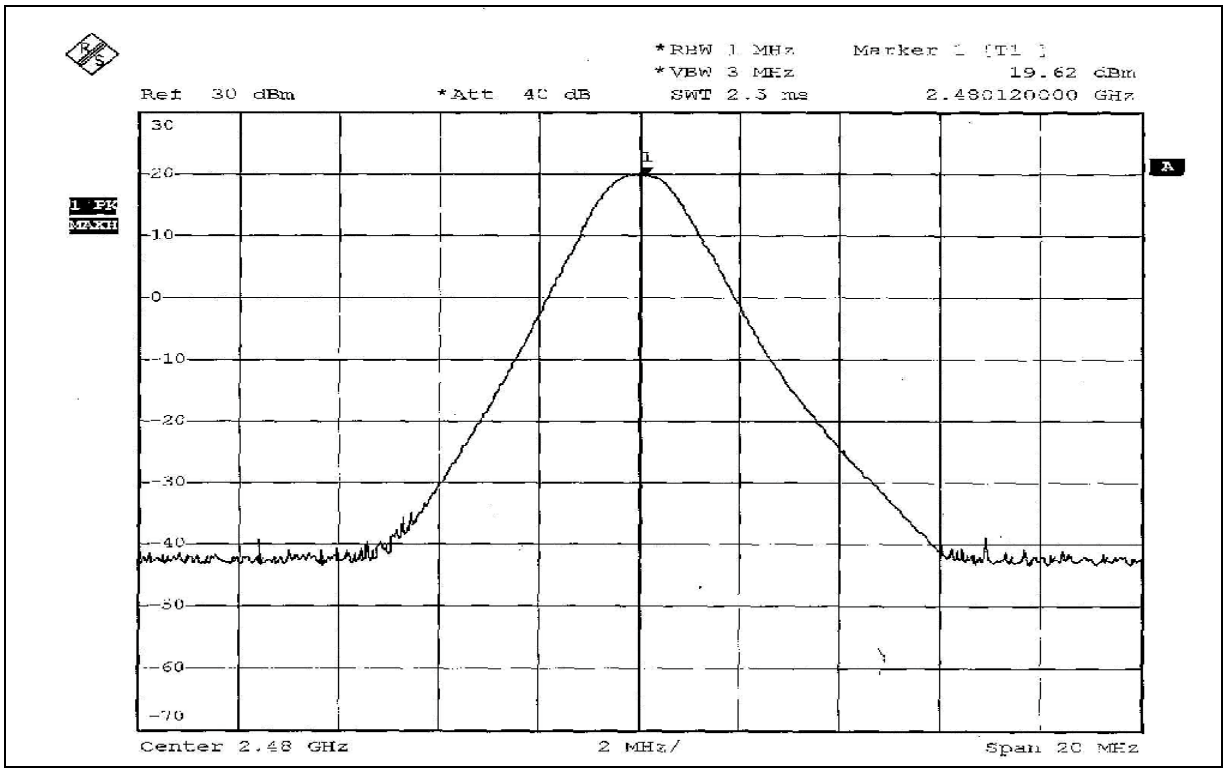
Channel 0



Channel 39



Channel 78


*RBW 1 MHz
*VBW 3 MHz
SWT 2.5 ms
Marker 1 [T1]
19.62 dBm
2.480120000 GHz
Ref 30 dBm
*Att 40 dB
1 PK
MAXH
A
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
Center 2.48 GHz
2 MHz/
Span 20 MHz

4.7 RADIATED EMISSION MEASUREMENT

4.7.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

Frequencies (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

NOTE: The limit for radiated test was performed according to CISPR 22: 1997, which was specified in FCC PART 15B 15.109(g). Also the limits of ICES-003: 2004 and CISPR 22: 1997 are same.

4.7.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
Test Receiver ROHDE & SCHWARZ	ESI7	838496/016	Jan. 01, 2007
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100041	Dec. 04, 2006
BILOG Antenna SCHWARZBECK	VULB9168	9168-155	Jan. 15, 2007
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-404	Jan. 01, 2007
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170242	Jan. 19, 2007
Preamplifier Agilent	8449B	3008A01960	Nov. 09, 2006
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	219268/4	Dec. 20, 2006
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	230129/4	Dec. 20, 2006
Software ADT.	ADT_Radiated_V5.14	NA	NA
Antenna Tower inn-co GmbH	MA 4000	010303	NA
Antenna Tower Controller inn-co GmbH	CO2000	019303	NA
Turn Table ADT.	TT100.	TT93021704	NA
Turn Table Controller ADT.	SC100.	SC93021704	NA

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in HwaYa Chamber 3.

3. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.

4. The IC Site Registration No. is IC4924-4.

4.7.3 TEST PROCEDURES

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meters semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

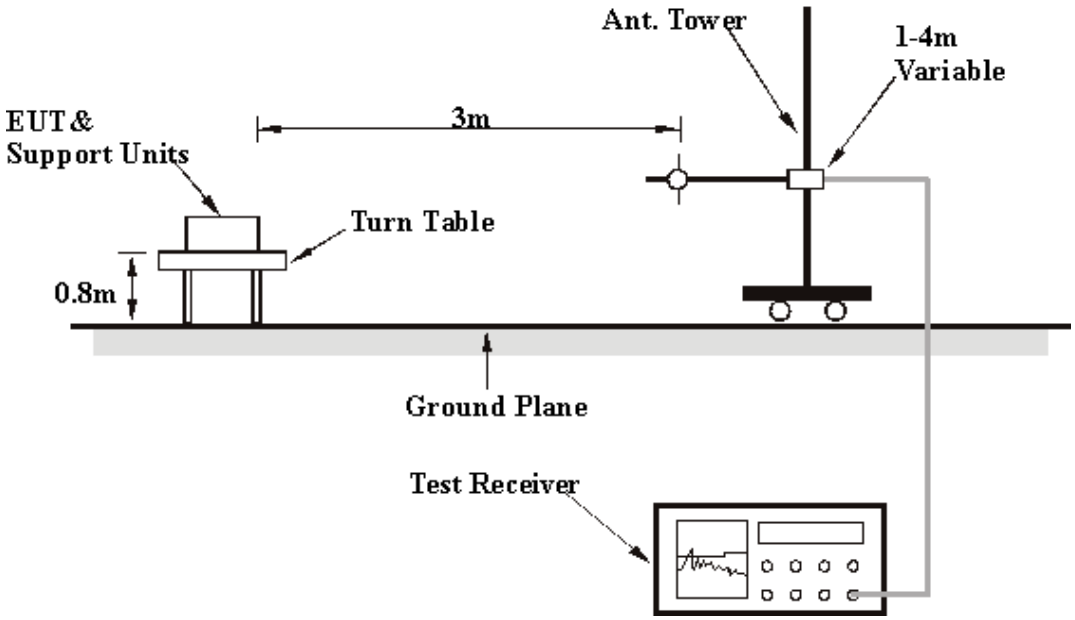
NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection at frequency above 1GHz.

4.7.4 DEVIATION FROM TEST STANDARD

No deviation.

4.7.5 TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

4.7.6 EUT OPERATING CONDITIONS

Set the transmitter part of EUT under transmission condition continuously at specific channel frequency.

4.7.7 TEST RESULTS

Radiated Worst Case Data: Below 1GHZ

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	**FREQUENCY RANGE**	Below 1000MHz
MODULATION TYPE	GFSK	**DETECTOR FUNCTION**	Quasi-Peak
ENVIRONMENTAL CONDITIONS	20 deg. C, 61% RH, 991 hPa	**INPUT POWER (SYSTEM)**	120Vac, 60 Hz
TESTED BY	Brad Wu		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	**206.89**	**32.39 QP**	**43.50**	**-11.11**	**1.00 H**	**82**	**20.96**	**11.42**
2	364.35	31.14 QP	46.00	-14.86	1.00 H	352	15.28	15.87
3	442.10	30.94 QP	46.00	-15.06	2.00 H	346	13.14	17.80
4	597.62	28.47 QP	46.00	-17.53	3.00 H	298	7.70	20.76
5	755.07	30.43 QP	46.00	-15.57	1.00 H	331	7.17	23.26
6	832.83	28.86 QP	46.00	-17.14	1.00 H	16	5.11	23.76

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	31.94	22.73 QP	40.00	-17.27	1.00 V	22	8.73	14.01
2	389.62	29.20 QP	46.00	-16.80	2.00 V	262	12.72	16.48
3	442.10	29.04 QP	46.00	-16.96	1.00 V	43	11.24	17.80
4	832.83	26.97 QP	46.00	-19.03	2.00 V	106	3.22	23.76
5	910.58	28.03 QP	46.00	-17.97	1.00 V	232	3.11	24.92
6	955.29	26.37 QP	46.00	-19.63	3.00 V	1	1.02	25.35

REMARKS: 1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

Radiated Worst Case Data: ABOVE 1GHZ

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	**FREQUENCY RANGE**	1 ~ 25GHz
MODULATION TYPE	GFSK	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	20 deg. C, 61% RH, 991 hPa	**INPUT POWER (SYSTEM)**	120Vac, 60 Hz
TESTED BY	Brad Wu		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	47.00 PK	74.00	-27.00	1.20 H	150	15.13	31.87
2	*2402.00	112.43 PK			1.20 H	150	80.51	31.92
2	*2402.00	64.89 AV			1.20 H	150	32.97	31.92
3	4804.00	53.74 PK	74.00	-20.26	1.24 H	89	15.97	37.77
3	4804.00	6.20 AV	54.00	-47.80	1.24 H	89	-31.57	37.77
4	7206.00	57.76 PK	64.89	-7.13	1.06 H	27	13.57	44.19
4	7206.00	10.22 AV	17.35	-7.13	1.06 H	27	-33.97	44.19
5	9608.00	63.10 PK	64.89	-1.79	1.09 H	158	15.43	47.67
5	9608.00	15.56 AV	17.35	-1.79	1.09 H	158	-32.11	47.67

REMARKS:
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. " * " : Fundamental frequency
6 The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle)

Where the duty factor is calculated from following formula:

$$20\log(\text{Duty cycle}) = 20\log\frac{0.4196}{100\text{ms}} = -47.54\text{dB}$$

please see page 46 for plotted duty

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	**FREQUENCY RANGE**	1 ~ 25GHz
MODULATION TYPE	GFSK	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	20 deg. C, 61% RH, 991 hPa	**INPUT POWER (SYSTEM)**	120Vac, 60 Hz
TESTED BY	Brad Wu		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	51.89 PK	74.00	-22.11	1.02 V	256	20.02	31.87
1	2390.00	4.35 AV	54.00	-49.65	1.02 V	256	-27.52	31.87
2	*2402.00	117.32 PK			1.02 V	256	85.40	31.92
2	*2402.00	69.78AV			1.02 V	256	37.86	31.92
3	4804.00	59.32 PK	74.00	-14.68	1.60 V	159	21.55	37.77
3	4804.00	11.78 AV	54.00	-42.22	1.60 V	159	-25.99	37.77
4	7206.00	62.69 PK	69.78	-7.09	1.30 V	28	18.50	44.19
4	7206.00	15.15 AV	22.24	-7.09	1.30 V	28	-29.04	44.19
5	9608.00	65.01 PK	69.78	-4.77	1.65 V	128	17.34	47.67
5	9608.00	17.47 AV	22.24	-4.77	1.65 V	128	-30.20	47.67

REMARKS:
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. " * " : Fundamental frequency
6 The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle)

Where the duty factor is calculated from following formula:

$$20\log(\text{Duty cycle}) = 20\log\frac{0.4196}{100\text{ms}} = -47.54\text{dB}$$

please see page 46 for plotted duty

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 39	**FREQUENCY RANGE**	1 ~ 25GHz
MODULATION TYPE	GFSK	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	20 deg. C, 61% RH, 991 hPa	**INPUT POWER (SYSTEM)**	120Vac, 60 Hz
TESTED BY	Brad Wu		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2441.00	112.77 PK			1.09 H	180	80.70	32.07
1	*2441.00	65.23 AV			1.09 H	180	33.16	32.07
2	4882.00	53.12 PK	74.00	-20.88	1.15 H	168	15.11	38.01
2	4882.00	5.58 AV	54.00	-48.42	1.15 H	168	-32.43	38.01
3	7323.00	57.26 PK	74.00	-16.74	1.42 H	231	12.72	44.54
3	7323.00	9.72 AV	54.00	-44.28	1.42 H	231	-34.82	44.54
4	9764.00	62.10 PK	65.23	-3.13	1.09 H	325	14.02	48.08
4	9764.00	14.56 AV	17.69	-3.13	1.09 H	325	-33.52	48.08

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2441.00	116.10 PK			1.09 V	288	84.03	32.07
1	*2441.00	68.56 AV			1.09 V	288	36.49	32.07
2	4882.00	57.99 PK	74.00	-16.01	1.06 V	121	19.98	38.01
2	4882.00	10.45 AV	54.00	-43.55	1.06 V	121	-27.56	38.01
3	7323.00	61.93 PK	74.00	-12.07	1.07 V	80	17.39	44.54
3	7323.00	14.39 AV	54.00	-39.61	1.07 V	80	-30.15	44.54
4	9764.00	64.22 PK	68.56	-4.34	1.52 V	237	16.14	48.08
4	9764.00	16.68 AV	21.02	-4.14	1.52 V	237	-31.40	48.08

REMARKS:
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. " * " : Fundamental frequency
6 The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle)

Where the duty factor is calculated from following formula:

$$20\log(\text{Duty cycle}) = 20\log\frac{0.4196}{100\text{ms}} = -47.54\text{dB}$$

please see page 46 for plotted duty

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	**FREQUENCY RANGE**	1 ~ 25GHz
MODULATION TYPE	GFSK	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	20 deg. C, 61% RH, 991 hPa	**INPUT POWER (SYSTEM)**	120Vac, 60 Hz
TESTED BY	Brad Wu		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2480.00	112.55 PK			1.06 H	188	80.32	32.23
1	*2480.00	65.01 AV			1.06 H	188	32.78	32.23
2	4960.00	52.74 PK	74.00	-21.26	1.19 H	124	14.49	38.25
2	4960.00	5.20 AV	54.00	-48.80	1.19 H	124	-33.05	38.25
3	7440.00	56.68 PK	74.00	-17.32	1.39 H	201	11.86	44.82
3	7440.00	9.14 AV	54.00	-44.86	1.39 H	201	-35.68	44.82
4	9920.00	61.78 PK	65.01	-3.23	1.14 H	316	13.26	48.52
4	9920.00	14.24 AV	17.47	-3.23	1.14 H	316	-34.28	48.52

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

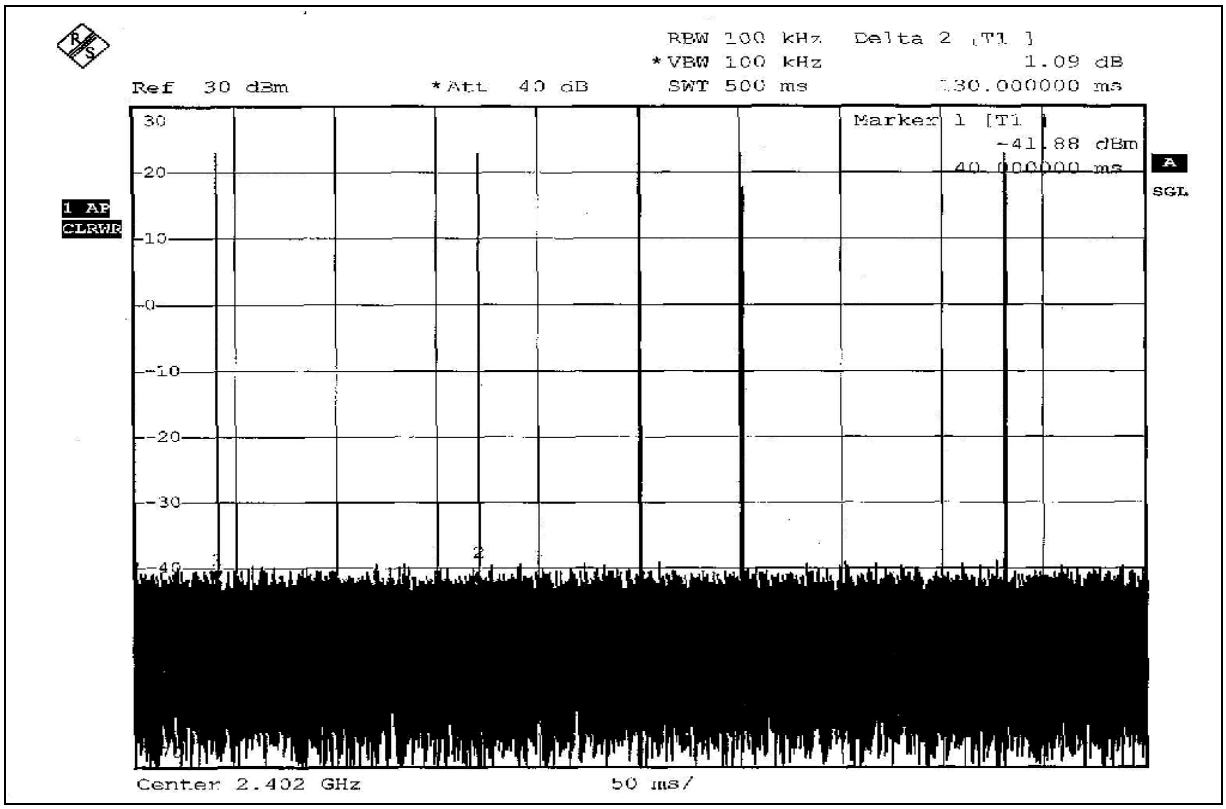
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2480.00	117.11 PK			1.18 V	217	84.88	32.23
1	*2480.00	69.57 AV			1.18 V	217	37.34	32.23
2	2483.50	54.74 PK	74.00	-19.26	1.18 V	217	22.50	32.24
2	2483.50	7.20 AV	54.00	-46.80	1.18 V	217	-25.04	32.24
3	4960.00	57.45 PK	74.00	-16.55	1.24 V	199	19.20	38.25
3	4960.00	9.91 AV	54.00	-44.09	1.24 V	199	-28.34	38.25
4	7440.00	61.13 PK	74.00	-12.87	1.16 V	100	16.31	44.82
4	7440.00	13.59 AV	54.00	-40.41	1.16 V	100	-31.23	44.82
5	9920.00	63.38 PK	69.57	-6.19	1.48 V	245	14.86	48.52
5	9920.00	15.84 AV	22.03	-6.19	1.48 V	245	-32.68	48.52

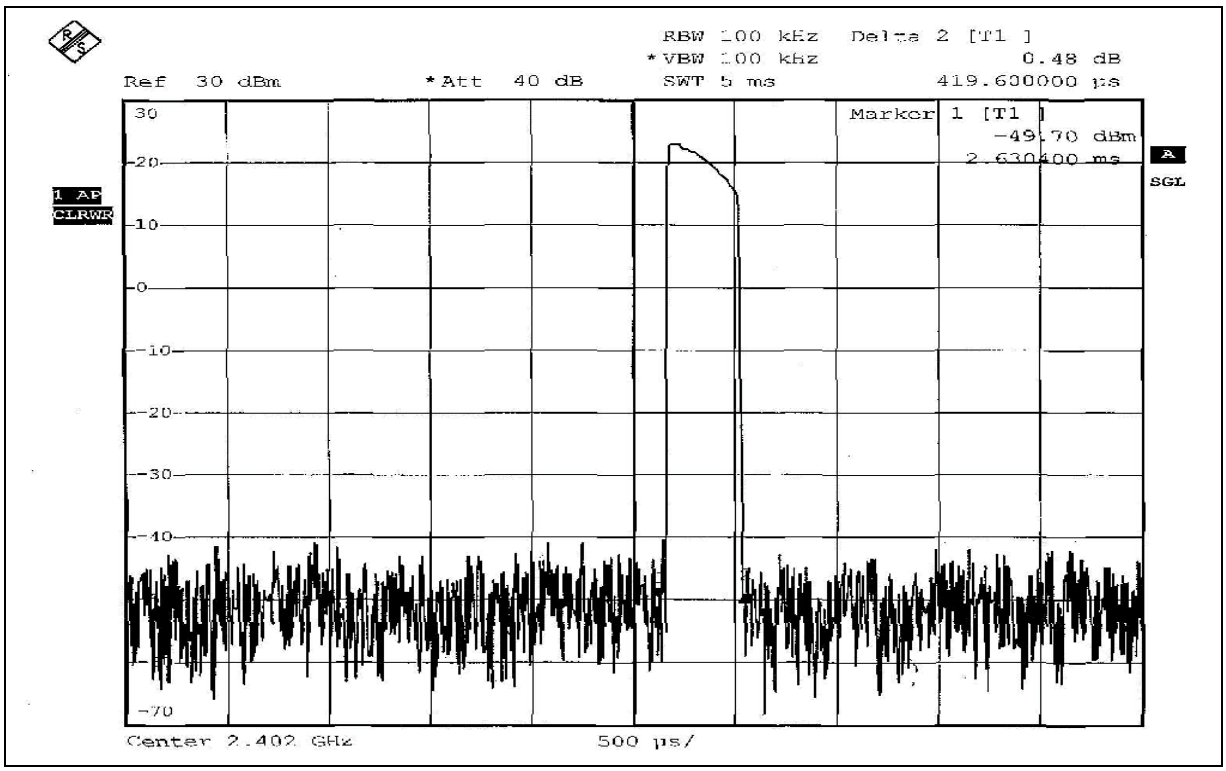
REMARKS:
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. " * " : Fundamental frequency
6 The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle)

Where the duty factor is calculated from following formula:

$$20\log(\text{Duty cycle}) = 20\log\frac{0.4196}{100\text{ms}} = -47.54\text{dB}$$

please see page 46 for plotted duty


RBW 100 kHz
*VBW 100 kHz
SWT 500 ms
Delta 2 [T1]
1.09 dB
130.000000 ms
Ref 30 dBm
*Att 40 dB
Marker 1 [T1]
-41.88 dBm
40.000000 ms
1 AP
CLRWR
A
SGL
30
20
10
0
-10
-20
-30
-40
Center 2.402 GHz
50 ms/


RBW 100 kHz
*VBW 100 kHz
SWT 5 ms
Delta 2 [T1]
0.48 dB
419.600000 µs
Ref 30 dBm
*Att 40 dB
Marker 1 [T1]
-49.70 dBm
2.630400 ms
1 AP
CLRWR
A
SGL
30
20
10
0
-10
-20
-30
-40
-70
Center 2.402 GHz
500 µs/

4.8 BAND EDGES MEASUREMENT

4.8.1 LIMITS OF BAND EDGES MEASUREMENT

Below –20dB of the highest emission level of operating band (in 100KHz RBW).

4.8.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SPECTRUM ANALYZER	FSEK30	100049	Aug. 14, 2006

NOTE:
The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.

4.8.3 TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer via a low lose cable. Set both RBW and VBW of spectrum analyzer to 100 kHz with suitable frequency span including 100 MHz bandwidth from band edge. The band edges was measured and recorded.

4.8.4 DEVIATION FROM TEST STANDARD

No deviation

4.8.5 EUT OPERATING CONDITION

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.8.6 TEST RESULTS

The spectrum plots are attached on the following 4 images. D2 line indicates the highest level, D1 line indicates the 20dB offset below D2. It shows compliance with the requirement in part 15.247(d).

NOTE 1: The band edge emission plot on the next page shows 65.59dBc between carrier maximum power and local maximum emission in restrict band (2.3836GHz). The emission of carrier strength list in the test result of channel 0 at the item 4.7.7 is 117.32dBuV/m (Peak), so the maximum field strength in restrict band is 117.32-65.59=51.73dBuV/m which is under 74 dBuV/m limit.

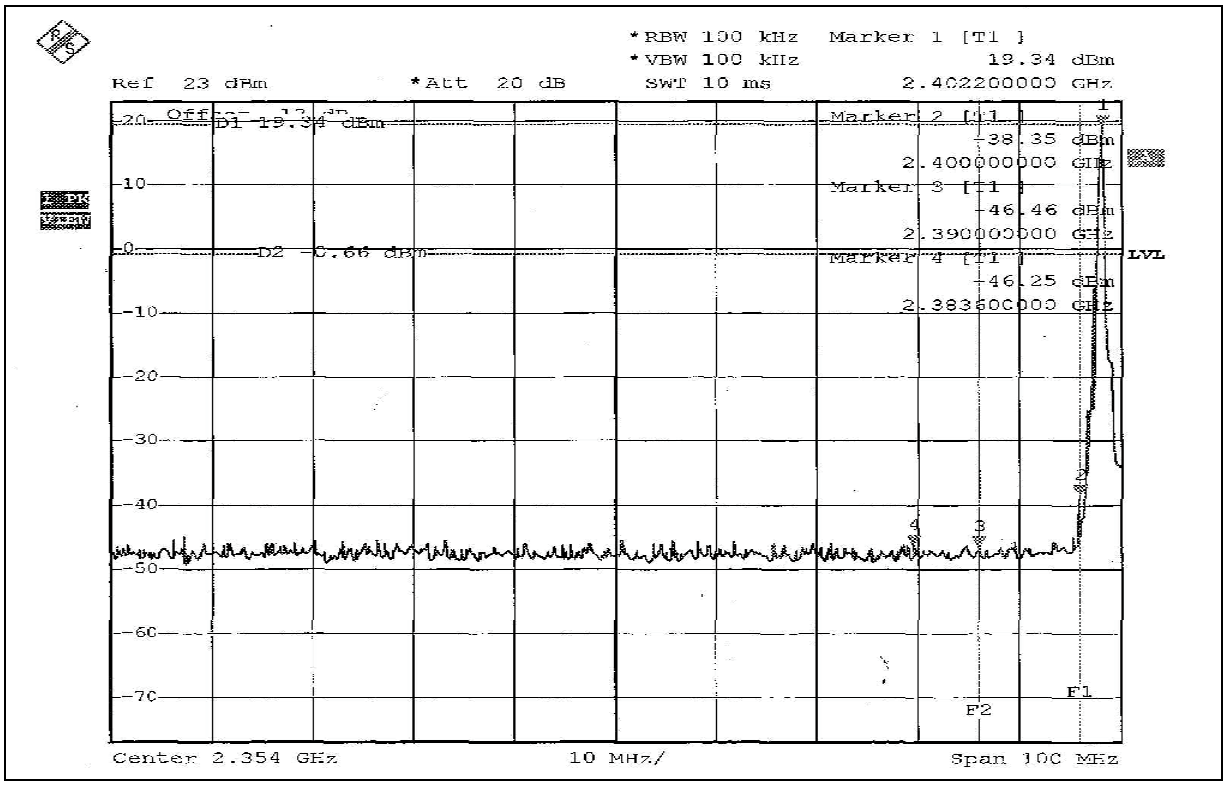
Average value = 51.73-47.54=4.19dBuV/m, which is under 54dBuV/m limit.

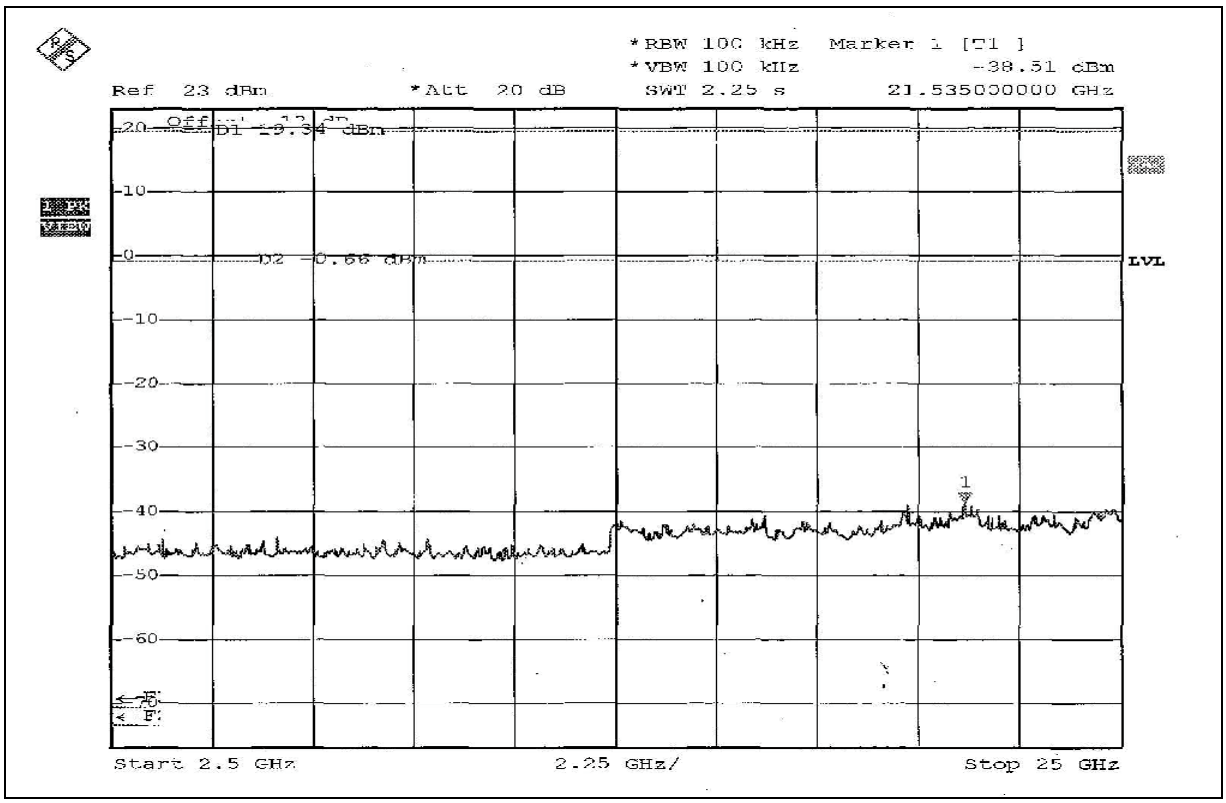
Therefore, the duty cycle be equal to: 20log (0.4196/100)= -47.54dB.
Average value = Peak reading-47.54

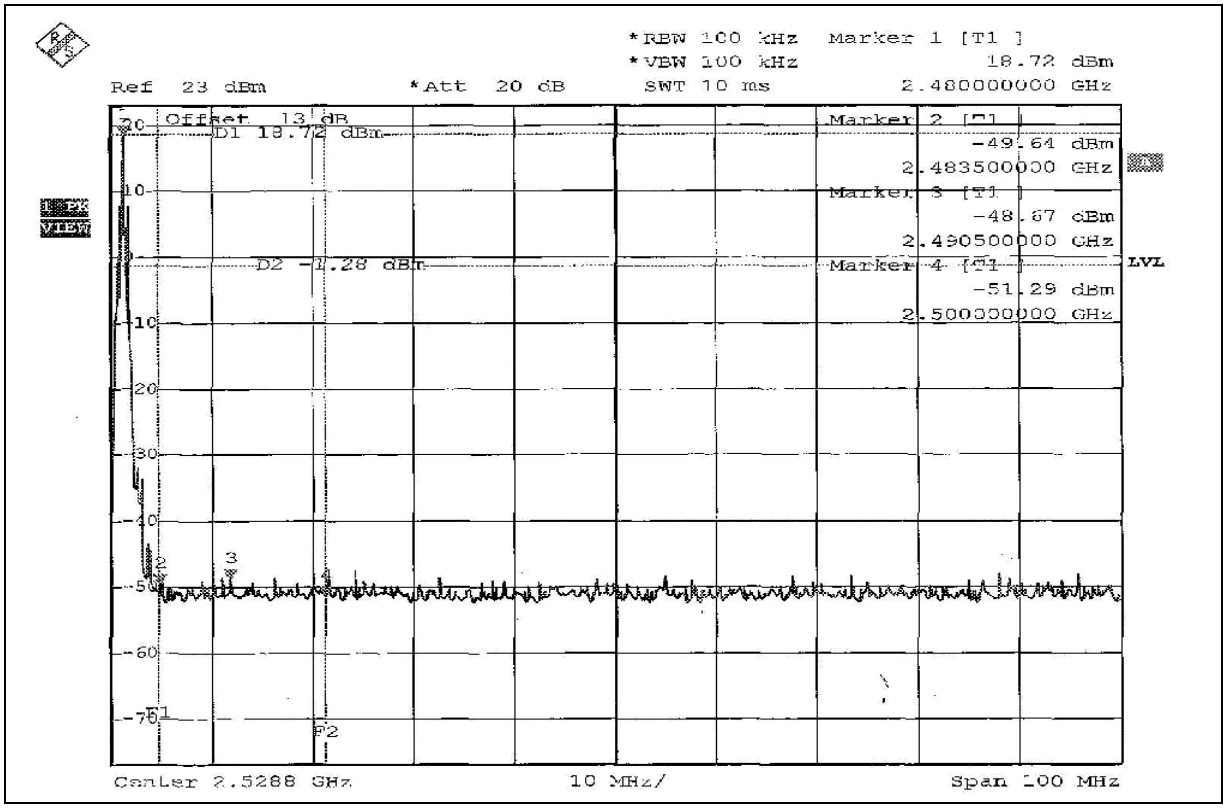
NOTE 2: The band edge emission plot on the next second page shows 67.39dBc between carrier maximum power and local maximum emission in restrict band (2.4905GHz). The emission of carrier strength list in the test result of channel 78 at the item 4.7.7 is 117.11dBuV/m (Peak), so the maximum field strength in restrict band is 117.11-67.39=49.72dBuV/m which is under 74 dBuV/m limit.

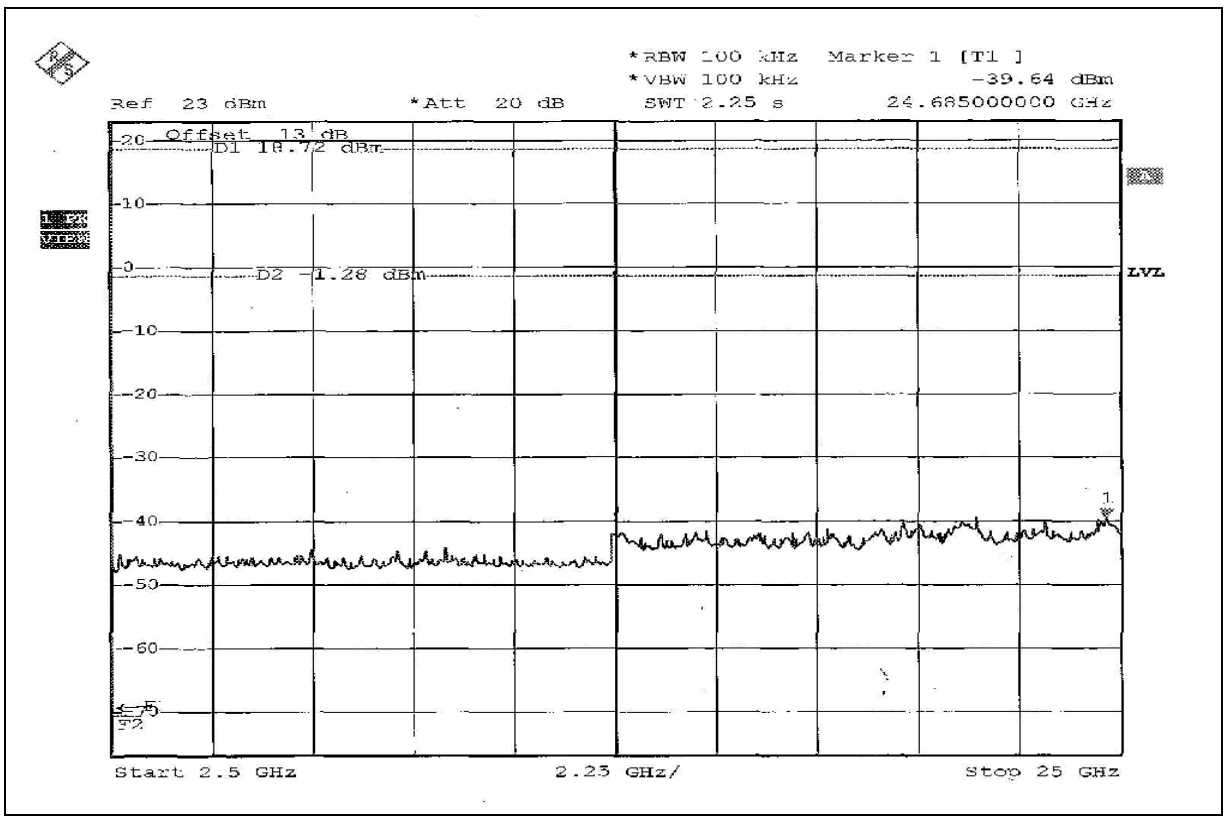
Average value = 49.72-47.54=2.18dBuV/m, which is under 54dBuV/m limit.

Therefore, the duty cycle be equal to: 20log (0.4196/100)= -47.54dB.
Average value = Peak reading-47.54


*RBW 100 kHz
*VBW 100 kHz
Ref 23 dBm
*Att 20 dB
SWT 10 ms
Marker 1 [T1]
19.34 dBm
2.402200000 GHz
Marker 2 [T1]
-38.35 dBm
2.400000000 GHz
Marker 3 [T1]
-46.46 dBm
2.390000000 GHz
Marker 4 [T1]
-46.25 dBm
2.383600000 GHz
D1 19.34 dBm
D2 -0.66 dBm
LVL
F1
F2
Center 2.354 GHz
10 MHz/
Span 100 MHz


*RBW 100 kHz
*VBW 100 kHz
Ref 23 dBm
*Att 20 dB
SWT 2.25 s
Marker 1 [T1]
-38.51 dBm
21.535000000 GHz
D1 19.34 dBm
D2 -0.66 dBm
LVL
Start 2.5 GHz
2.25 GHz/
Stop 25 GHz


*RBW 100 kHz
*VBW 100 kHz
SWT 10 ms
Marker 1 [T1]
18.72 dBm
2.480000000 GHz
Ref 23 dBm
*Att 20 dB
Offset 13 dB
D1 18.72 dBm
D2 -1.28 dBm
Marker 2 [T1]
-49.64 dBm
2.483500000 GHz
Marker 3 [T1]
-48.67 dBm
2.490500000 GHz
Marker 4 [T1]
-51.29 dBm
2.500000000 GHz
LVL
Center 2.5288 GHz
10 MHz/
Span 100 MHz


*RBW 100 kHz
*VBW 100 kHz
SWT 2.25 s
Marker 1 [T1]
-39.64 dBm
24.685000000 GHz
Ref 23 dBm
*Att 20 dB
Offset 13 dB
D1 18.72 dBm
D2 -1.28 dBm
LVL
Start 2.5 GHz
2.23 GHz/
Stop 25 GHz

4.9 ANTENNA REQUIREMENT

4.9.1 STANDARD APPLICABLE

For intentional device, according to FCC 47 CFR 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.
And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.9.2 ANTENNA CONNECTED CONSTRUCTION

The antenna used in this product is Wire antenna without antenna connector. The maximum gain of this antenna is 3dBi.

5 INFORMATION ON THE TESTING LABORATORIES

We, ADT Corp., were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

USA	FCC, UL, A2LA
Germany	TUV Rheinland
Japan	VCCI
Norway	NEMKO
Canada	INDUSTRY CANADA , CSA
R.O.C.	CNLA, BSMI, DGT
Netherlands	Telefication
Singapore	PSB , GOST-ASIA(MOU)
Russia	CERTIS(MOU)

Copies of accreditation certificates of our laboratories obtained from approval agencies can be downloaded from our web site: www.adt.com.tw/index.5/phtml.
If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab:
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF Lab:
Tel: 886-3-5935343
Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety/Telecom Lab:
Tel: 886-3-3183232
Fax: 886-3-3185050

Web Site: www.adt.com.tw

The address and road map of all our labs can be found in our web site also.

APPENDIX-A

MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications are made to the EUT by the lab during the test.