



FCC TEST REPORT

REPORT NO.: RF960522L15

MODEL NO.: 1115

RECEIVED: May 25, 2007

TESTED: May 25 ~ Jun. 05, 2007

ISSUED: Jun. 08, 2007

APPLICANT: Microsoft Corporation

ADDRESS: One Microsoft Way, Redmond WA 98052-6399, U.S.A

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.

This test report consists of 57 pages in total. It may be duplicated completely for legal use with the approval of the applicant. It should not be reproduced except in full, without the written approval of our laboratory. The client should not use it to claim product endorsement by CNLA, A2LA or any government agencies. The test results in the report only apply to the tested sample.





TABLE OF CONTENTS

1. CERTIFICATION.....	4
2. SUMMARY OF TEST RESULTS.....	5
2.1 MEASUREMENT UNCERTAINTY	5
3. GENERAL INFORMATION.....	6
3.1. GENERAL DESCRIPTION OF EUT.....	6
3.2. DESCRIPTION OF TEST MODES.....	8
3.2.1. CONFIGURATION OF SYSTEM UNDER TEST	8
3.2.2. TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL.....	9
3.2.3. GENERAL DESCRIPTION OF APPLIED STANDARDS	11
3.2.4. DESCRIPTION OF SUPPORT UNITS	11
4. TEST TYPES AND RESULTS	12
4.1. CONDUCTED EMISSION MEASUREMENT	12
4.1.1. LIMITS OF CONDUCTED EMISSION MEASUREMENT.....	12
4.1.2. TEST INSTRUMENTS	12
4.1.3. TEST PROCEDURES	13
4.1.4. DEVIATION FROM TEST STANDARD	13
4.1.5. TEST SETUP	14
4.1.6. EUT OPERATING CONDITIONS	14
4.1.7. TEST RESULTS	15
4.2. RADIATED EMISSION MEASUREMENT	21
4.2.1. LIMITS OF RADIATED EMISSION MEASUREMENT.....	21
4.2.2. TEST INSTRUMENTS	22
4.2.3. TEST PROCEDURES	23
4.2.4. DEVIATION FROM TEST STANDARD	23
4.2.5. TEST SETUP	24
4.2.6. EUT OPERATING CONDITIONS	24
4.2.7. TEST RESULTS	25
4.3. NUMBER OF HOPPING FREQUENCY USED	30
4.3.1. LIMIT OF HOPPING FREQUENCY USED	30
4.3.2. TEST INSTRUMENTS	30
4.3.3. TEST PROCEDURES	30
4.3.4. DEVIATION FROM TEST STANDARD	31
4.3.5. TEST SETUP	31
4.3.6. TEST RESULTS	31
4.4. DWELL TIME ON EACH CHANNEL	33
4.4.1. LIMIT OF DWELL TIME USED.....	33
4.4.2. TEST INSTRUMENTS	33
4.4.3. TEST PROCEDURES	33
4.4.4. DEVIATION FROM TEST STANDARD	33
4.4.5. TEST SETUP	34
4.4.6. TEST RESULTS	34
4.5. CHANNEL BANDWIDTH.....	36
4.5.1. LIMITS OF CHANNEL BANDWIDTH.....	36
4.5.2. TEST INSTRUMENTS	36
4.5.3. TEST PROCEDURE	36
4.5.4. DEVIATION FROM TEST STANDARD	37
4.5.5. TEST SETUP	37
4.5.6. EUT OPERATING CONDITION	37
4.5.7. TEST RESULTS	37



4.6. HOPPING CHANNEL SEPARATION	40
4.6.1. LIMIT OF HOPPING CHANNEL SEPARATION	40
4.6.2. TEST INSTRUMENTS	40
4.6.3. TEST PROCEDURES	40
4.6.4. DEVIATION FROM TEST STANDARD	41
4.6.5. TEST SETUP	41
4.6.6. TEST RESULTS	41
4.7. MAXIMUM PEAK OUTPUT POWER	44
4.7.1. LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT	44
4.7.2. TEST INSTRUMENTS	44
4.7.3. TEST PROCEDURES	44
4.7.4. DEVIATION FROM TEST STANDARD	44
4.7.5. TEST SETUP	45
4.7.6. EUT OPERATING CONDITION	45
4.7.7. TEST RESULTS	45
4.8. BAND EDGES MEASUREMENT	48
4.8.1. LIMITS OF BAND EDGES MEASUREMENT	48
4.8.2. TEST INSTRUMENTS	48
4.8.3. TEST PROCEDURE	48
4.8.4. DEVIATION FROM TEST STANDARD	48
4.8.5. EUT OPERATING CONDITION	48
4.8.6. TEST RESULTS	49
4.9. ANTENNA REQUIREMENT	54
4.9.1. STANDARD APPLICABLE	54
4.9.2. ANTENNA CONNECTED CONSTRUCTION	54
5. PHOTOGRAPHS OF THE TEST CONFIGURATION	55
6. INFORMATION ON THE TESTING LABORATORIES	56
APPENDIX-A.....	A-1



1. CERTIFICATION

PRODUCT: Microsoft® Mobile Memory Mouse 8000
MODEL NO.: 1115
BRAND NAME: Microsoft®
APPLICANT: Microsoft Corporation
TESTED: May 25 ~ Jun. 05, 2007
TEST SAMPLE: ENGINEERING SAMPLE
STANDARDS: FCC Part 15, Subpart C (Section 15.247),
ANSI C63.4-2003

The above equipment (model: 1115) have 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 : Andrea Hsia , **DATE:** Jun. 08, 2007
Andrea Hsia / Specialist

**TECHNICAL
ACCEPTANCE** : Long Chen , **DATE:** Jun. 08, 2007
Responsible for RF Long Chen / Senior Engineer

APPROVED BY : Gary Chang , **DATE:** Jun. 08, 2007
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	PASS	Meet the requirement of limit. Minimum passing margin is -10.93dB at 0.174MHz.
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 -6.22dB at 160.17MHz.
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	3.62 dB
	200MHz ~ 1000MHz	3.64 dB
	1GHz ~ 18GHz	2.26 dB
	18GHz ~ 40GHz	1.94 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.



3. GENERAL INFORMATION

3.1. GENERAL DESCRIPTION OF EUT

PRODUCT	Microsoft® Mobile Memory Mouse 8000
MODEL NO.	1115
FCC ID	C3K1115
POWER SUPPLY	1.2Vdc from battery (battery mode) 5.0Vdc from host equipment (charger mode)
MODULATION TYPE	GFSK
RADIO TECHNOLOGY	FHSS
TRANSFER RATE	172.8kbps
FREQUENCY RANGE	2402~2480 MHz
NUMBER OF CHANNEL	79
OUTPUT POWER	0.800mW
ANTENNA TYPE	PCB antenna with 0.40dBi gain
I/O PORT	USB
DATA CABLE	0.9m non-shielded USB cable without core
ACCESSORY DEVICES	NA

NOTE:

1. Bluetooth technology is used in this EUT.
2. This EUT has transmission function during the charger mode.
3. Pluto Configuration Information:

Configuration #:		Comments: EV2 phase Mouse unit for formal report			
Manufacturer	Component type	Part no.	Revision no.	Description	BOM (if known)
Microsoft	Mouse			Model: 1115	
Infineon	Optical Sensor, BT IC	11300699200	3.0	SINATRA, 52P, UAB9651OC	11300699200
Freescale	Microcontroller	11300837200		MC9S08QG8CFE	11300837200
Microchip	EEProm	11300788200		24128, 8P, EEPROM	11300788200
ULM	Laser	ULM855-G2-T N-SSMDTL	NA	VCSEL (850nm), SMD	11740049200
Microsoft	firmware			blvelvet_TR30_P35_1FXP09(Alvin)_button_test.sdf	
KYE	PCB Assy	20001042200	02	ALVIN, BT MOUSE, POWER, HANDSOLDER, FREESCALE	20001042200
Express	PCB	10230728200	03	ALVIN P/W BD, SP802, 2L, 49.73X37, OM-060072	10230728200
KYE	PCB Assy	20001035201	01	ALVIN, BT MOUSE, MAIN, HANDSOLDER	20001035201
Happy	PCB	10230727200	03	ALVIN, SINATRA, BT, 4L, 40.41X48.3, OM-060072	10230727200
KYE	PCB Assy	20001040200	02	ALVIN, BT MOUSE, SWITCH, HANDSOLDER	20001040200
Ta Chien	PCB	10230729200	03	ALVIN SW BOARD, S2L, 38.8X64.5, OM-060072	10230729200

Definition of configuration #: The configuration number (#) is used for traceability to a particular BOM (Bill of Materials). It is an easy way to readily identify and convey the construction of a without having to include all of the details of a BOM on every test data sheet. If two sets of test data have test samples with the same configuration # then the construction details of those test samples can readily be determined (as long as the configuration # correctly corresponds to a BOM) and that these two test samples have been constructed identically.

Detailed information on the configuration of the tested samples is required in order to track performance changes across various revisions of the hardware and to document that the samples tested are



representative of the final configuration that will be manufactured in production.

Any prototype or pre-production components must be clearly identified in the configuration table.

4. The details of EUT samples listed as below:

Sample	Serial No.
Mouse sample 1	277
Mouse sample 2	272
Mouse sample 3	287

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

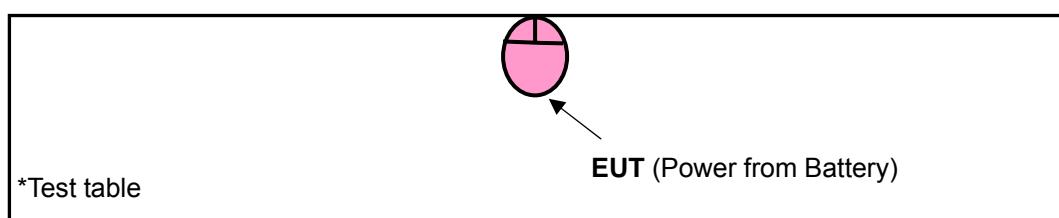
3.2. DESCRIPTION OF TEST MODES

79 channels are provided to this EUT:

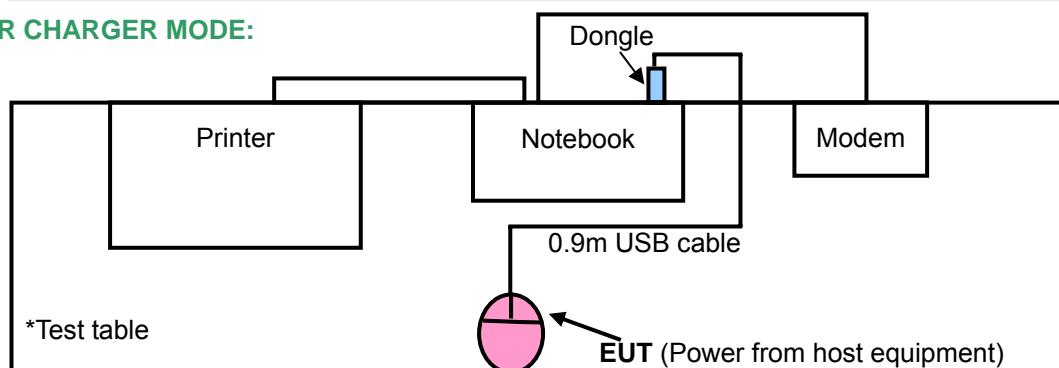
CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	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

FOR BATTERY MODE:



FOR CHARGER MODE:





3.2.2. TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	Applicable to				Description
	PLC	RE<1G	RE≥1G	APCM	
A	NOTE 1	√	-	-	Battery Mode
B	√	√	√	√	Charger Mode

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

NOTE 1: No need to concern of Conducted Emission due to the EUT is powered by battery.

NOTE 2: “-“ means no effect.

POWER LINE CONDUCTED EMISSION TEST:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types.
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	SERIAL NO OF SAMPLE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
B	272	0 to 78	0, 39, 78	FHSS	GFSK	DH1

RADIATED EMISSION TEST (BELOW 1 GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types.
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	SERIAL NO OF SAMPLE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
A	272	0 to 78	78	FHSS	GFSK	DH1
B	272	0 to 78	78	FHSS	GFSK	DH1

RADIATED EMISSION TEST (ABOVE 1 GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types.
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	SERIAL NO OF SAMPLE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
B	272	0 to 78	0, 39, 78	FHSS	GFSK	DH1



BANDEdge MEASUREMENT:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types.
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	SERIAL NO OF SAMPLE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
B	277	0 to 78	0, 78	FHSS	GFSK	DH1
B	272	0 to 78	0, 78	FHSS	GFSK	DH1
B	287	0 to 78	0, 78	FHSS	GFSK	DH1

ANTENNA PORT CONDUCTED MEASUREMENT:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and packet types.
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	SERIAL NO OF SAMPLE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
B	272	0 to 78	0, 39, 78	FHSS	GFSK	DH1



3.2.3. 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.

3.2.4. DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	NOTEBOOK COMPUTER	DELL	PP05L	16484462992	E2K24CLNS
2	PRINTER	EPSON	LQ-300+	DCGY054147	FCC DoC Approved
3	MODEM	ACEEX	1414V/3	0401008269	IFAXDM1414
4	Microsoft® 2.4 GHz Transceiver with Memory v1.0	Microsoft®	1116	GU-EV2-125	C3K1116

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	NA
2	1.2m shielded cable
3	1.2m shielded cable
4	NA

NOTE:

1. All power cords of the above support units are non shielded (1.8m).
2. Item 4 was supplied from client.



4. TEST TYPES AND RESULTS

4.1. CONDUCTED EMISSION MEASUREMENT

4.1.1. LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB μ V)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56	56 to 46
0.5 ~ 5	56	46
5 ~ 30	60	50

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

4.1.2. TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
Test Receiver ROHDE & SCHWARZ	ESCS30	100288	Sep. 25, 2007
RF signal cable Woken	5D-FB	Cable-HYCO3-01	Jan. 06, 2008
LISN ROHDE & SCHWARZ	ESH2-Z5	100100	Jan. 08, 2008
LISN ROHDE & SCHWARZ	ESH3-Z5	100311	Jan. 16, 2008
Software ADT	ADT_Cond_V3	NA	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 Shielded Room 2.
3. The VCCI Site Registration No. is C-2047.



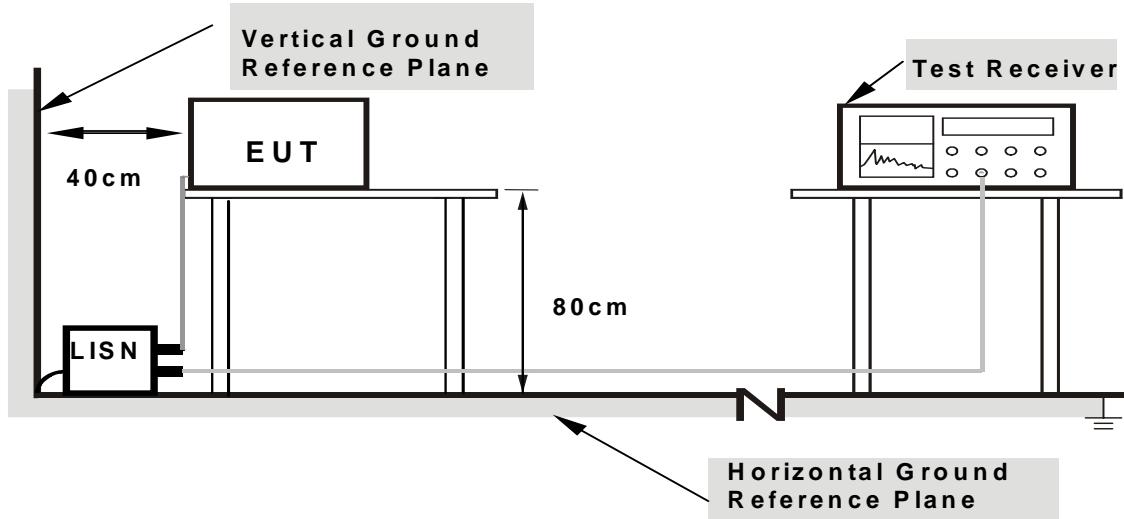
4.1.3. TEST PROCEDURES

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

4.1.4. DEVIATION FROM TEST STANDARD

No deviation.

4.1.5. TEST SETUP



Note:

1. Support units were connected to second LISN.
2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.6. EUT OPERATING CONDITIONS

- a. Connected EUT with notebook system via USB cable and placed on a testing table.
- b. The notebook system ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
- c. The necessary accessories enable the EUT in full functions.

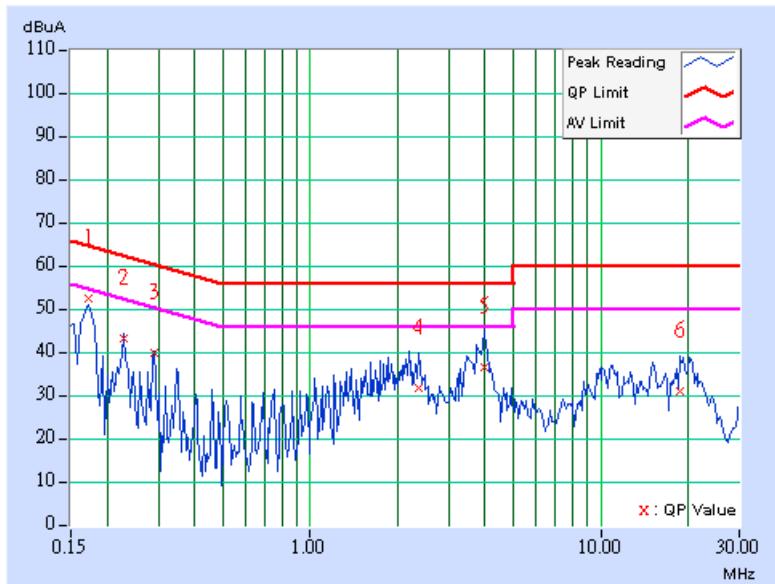
4.1.7. TEST RESULTS CONDUCTED WORST-CASE DATA

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	PHASE	Line 1
MODULATION TYPE	GFSK	6dB BANDWIDTH	9 kHz
ENVIRONMENTAL CONDITIONS	20 deg. C, 60%RH, 991hPa	INPUT POWER (SYSTEM)	120Vac, 60 Hz
TEST MODE	B	TESTED BY	Match Tsui

No	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
			Factor	[dB (uV)]	[dB (uV)]	[dB (uV)]	[dB (uV)]	(dB)	Q.P.	AV.
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.174	0.10	51.96	-	52.06	-	64.79	54.79	-12.73	-
2	0.228	0.10	42.63	-	42.73	-	62.51	52.51	-19.78	-
3	0.291	0.10	39.36	-	39.46	-	60.48	50.48	-21.02	-
4	2.368	0.23	31.18	-	31.41	-	56.00	46.00	-24.59	-
5	3.989	0.28	36.17	-	36.45	-	56.00	46.00	-19.55	-
6	18.703	0.55	30.67	-	31.22	-	60.00	50.00	-28.78	-

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.

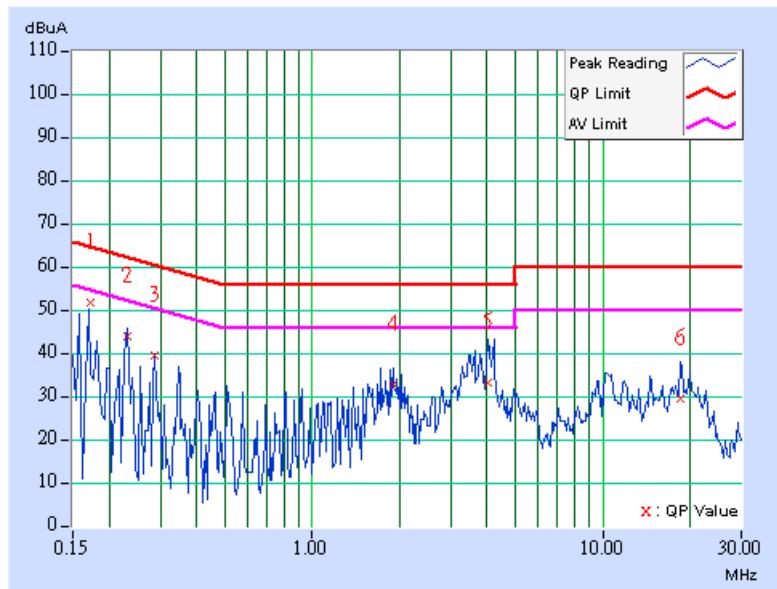


EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 0	PHASE	Line 2
MODULATION TYPE	GFSK	6dB BANDWIDTH	9 kHz
ENVIRONMENTAL CONDITIONS	20 deg. C, 60%RH, 991hPa	INPUT POWER (SYSTEM)	120Vac, 60 Hz
TEST MODE	B	TESTED BY	Match Tsui

No	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
			Factor [MHz]	[dB (uV)]	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.172	0.10	51.15	-	51.25	-	64.86	54.86	-13.61	-
2	0.232	0.10	43.55	-	43.65	-	62.38	52.38	-18.73	-
3	0.287	0.10	39.22	-	39.32	-	60.62	50.62	-21.30	-
4	1.906	0.22	32.26	-	32.48	-	56.00	46.00	-23.52	-
5	4.031	0.28	32.86	-	33.14	-	56.00	46.00	-22.86	-
6	18.590	0.54	28.99	-	29.53	-	60.00	50.00	-30.47	-

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.

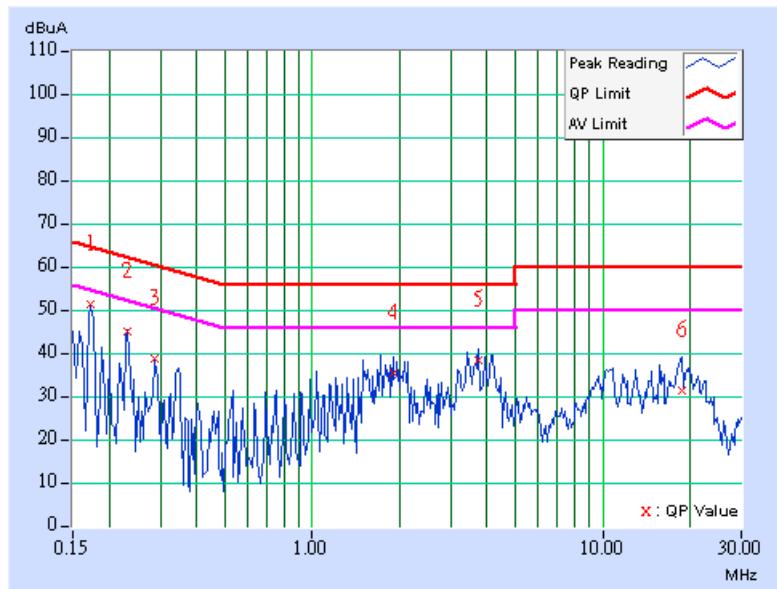


EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 39	PHASE	Line 1
MODULATION TYPE	GFSK	6dB BANDWIDTH	9 kHz
ENVIRONMENTAL CONDITIONS	20 deg. C, 60%RH, 991hPa	INPUT POWER (SYSTEM)	120Vac, 60 Hz
TEST MODE	B	TESTED BY	Match Tsui

No	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
			Factor [MHz]	[dB (uV)]	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.173	0.10	51.07	-	51.17	-	64.79	54.79	-13.62	-
2	0.232	0.10	44.80	-	44.90	-	62.38	52.38	-17.48	-
3	0.287	0.10	38.30	-	38.40	-	60.62	50.62	-22.22	-
4	1.906	0.21	35.00	-	35.21	-	56.00	46.00	-20.79	-
5	3.750	0.27	37.97	-	38.24	-	56.00	46.00	-17.76	-
6	18.813	0.55	31.09	-	31.64	-	60.00	50.00	-28.36	-

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.

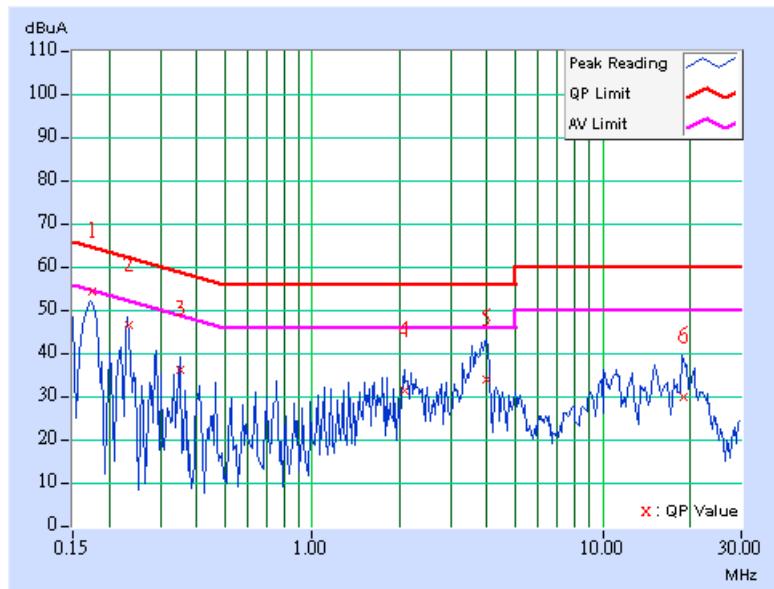


EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 39	PHASE	Line 2
MODULATION TYPE	GFSK	6dB BANDWIDTH	9 kHz
ENVIRONMENTAL CONDITIONS	20 deg. C, 60%RH, 991hPa	INPUT POWER (SYSTEM)	120Vac, 60 Hz
TEST MODE	B	TESTED BY	Match Tsui

No	Freq. [MHz]	Corr. (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.174	0.10	53.74	-	53.84	-	64.77	54.77	-10.93	-
2	0.234	0.10	46.14	-	46.24	-	62.32	52.32	-16.08	-
3	0.349	0.10	35.85	-	35.95	-	58.98	48.98	-23.03	-
4	2.090	0.22	31.04	-	31.26	-	56.00	46.00	-24.74	-
5	3.977	0.28	33.57	-	33.85	-	56.00	46.00	-22.15	-
6	18.870	0.55	29.29	-	29.84	-	60.00	50.00	-30.16	-

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.

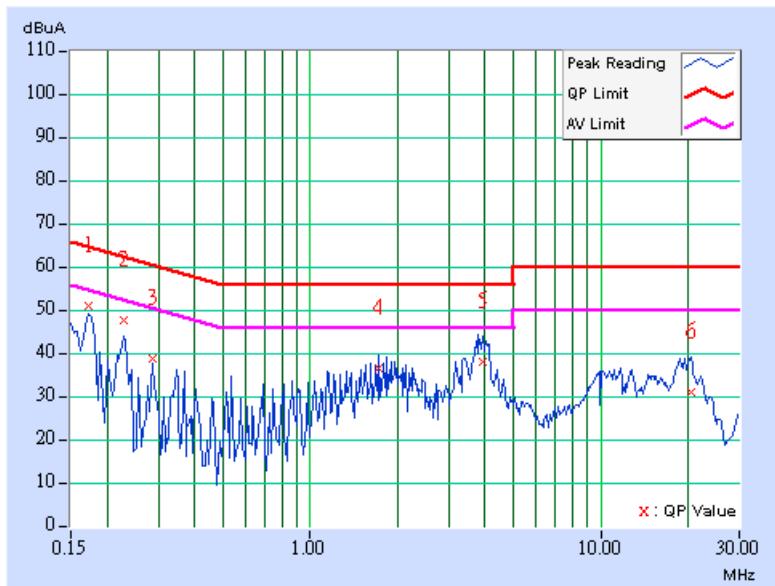


EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	PHASE	Line 1
MODULATION TYPE	GFSK	6dB BANDWIDTH	9 kHz
ENVIRONMENTAL CONDITIONS	20 deg. C, 60%RH, 991hPa	INPUT POWER (SYSTEM)	120Vac, 60 Hz
TEST MODE	B	TESTED BY	Match Tsui

	Freq.	Corr.	Reading Value	Emission Level		Limit		Margin	
No	Factor		[dB (uV)]	[dB (uV)]	[dB (uV)]	Q.P.	AV.	Q.P.	AV.
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	(dB)
1	0.173	0.10	50.57	-	50.67	-	64.79	54.79	-14.12
2	0.228	0.10	47.24	-	47.34	-	62.52	52.52	-15.18
3	0.287	0.10	38.22	-	38.32	-	60.62	50.62	-22.30
4	1.730	0.19	36.01	-	36.20	-	56.00	46.00	-19.80
5	3.922	0.28	37.54	-	37.82	-	56.00	46.00	-18.18
6	20.402	0.59	30.46	-	31.05	-	60.00	50.00	-28.95

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.

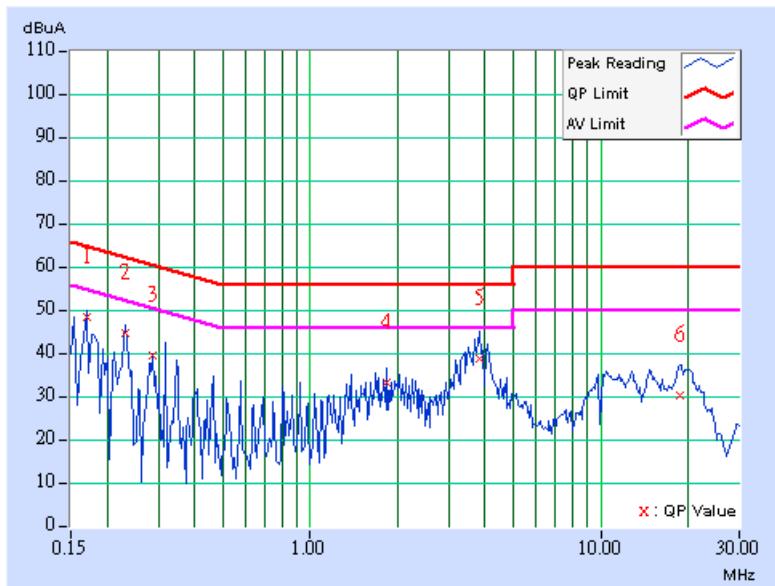


EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	PHASE	Line 2
MODULATION TYPE	GFSK	6dB BANDWIDTH	9 kHz
ENVIRONMENTAL CONDITIONS	20 deg. C, 60%RH, 991hPa	INPUT POWER (SYSTEM)	120Vac, 60 Hz
TEST MODE	B	TESTED BY	Match Tsui

	Freq.	Corr.	Reading Value	Emission Level		Limit		Margin	
No	Factor		[dB (uV)]	[dB (uV)]	[dB (uV)]	Q.P.	AV.	Q.P.	AV.
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	(dB)
1	0.170	0.10	48.09	-	48.19	-	64.98	54.98	-16.79
2	0.232	0.10	44.34	-	44.44	-	62.38	52.38	-17.94
3	0.287	0.10	39.10	-	39.20	-	60.62	50.62	-21.42
4	1.844	0.22	32.83	-	33.05	-	56.00	46.00	-22.95
5	3.809	0.27	38.22	-	38.49	-	56.00	46.00	-17.51
6	18.633	0.55	29.85	-	30.40	-	60.00	50.00	-29.60

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.





4.2. RADIATED EMISSION MEASUREMENT

4.2.1. 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:

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



4.2.2. TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
Test Receiver ROHDE & SCHWARZ	ESCI	100424	Aug. 04, 2007
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100269	Aug. 07, 2007
BILOG Antenna SCHWARZBECK	VULB9168	9168-153	Jan. 04, 2008
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-563	Jul. 26, 2007
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170242	Jan. 16, 2008
Loop Antenna	HFH2-Z2	100070	Nov. 28, 2007
Preamplifier Agilent	8449B	3008A01911	Sep. 13, 2007
Preamplifier Agilent	8447D	2944A10638	Dec. 20, 2007
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	218188/218189	Nov. 14, 2007
RF signal cable Worken	8D-FB	Cable-HYCH9-01	Aug. 16, 2007
Software	ADT_Radiated_V7.6	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA
Turn Table EMCO	2087-2.03	NA	NA
Antenna Tower & Turn Table Controller EMCO	2090	NA	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 9.
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 IC3789B-9.



4.2.3. TEST PROCEDURES

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter 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 lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

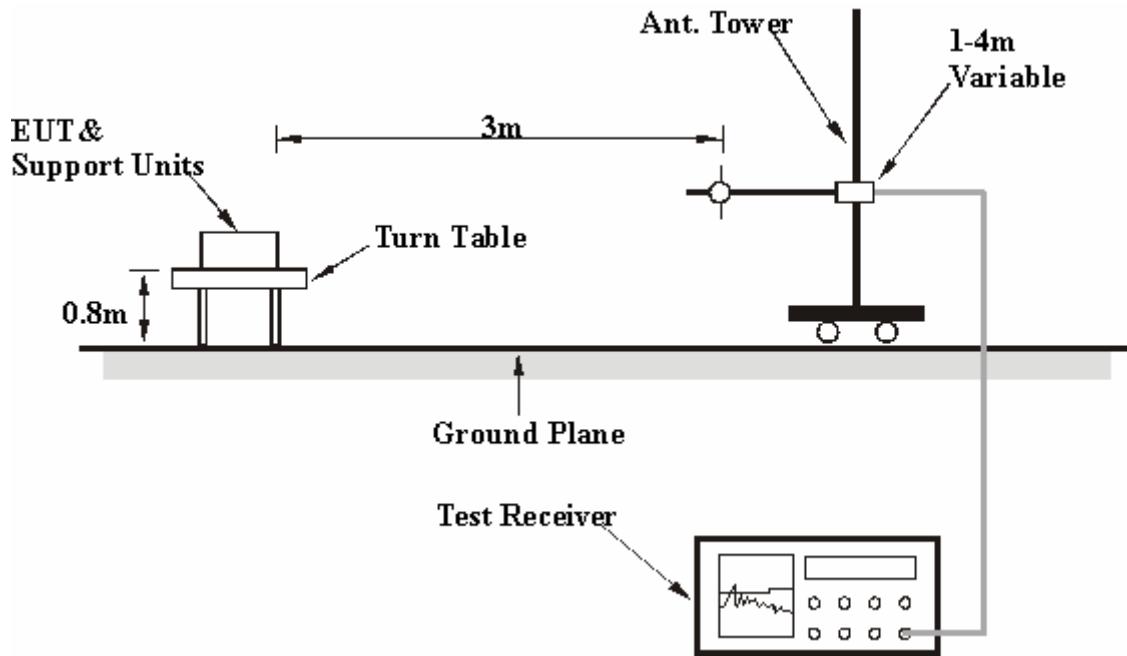
NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.

4.2.4. DEVIATION FROM TEST STANDARD

No deviation

4.2.5. TEST SETUP



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6. EUT OPERATING CONDITIONS

Same as 4.1.6



4.2.7. 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
INPUT POWER (SYSTEM)	120Vac, 60 Hz	ENVIRONMENTAL CONDITIONS	25deg. C, 71%RH, 991hPa
TEST MODE	A	TESTED BY	Match Tsui

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	543.19	25.97 QP	46.00	-20.03	1.00 H	88	6.21	19.77
2	698.74	25.39 QP	46.00	-20.61	1.50 H	262	3.41	21.98
3	801.78	24.32 QP	46.00	-21.68	1.00 H	259	-0.07	24.38
4	823.17	24.27 QP	46.00	-21.73	1.50 H	25	-0.32	24.59
5	856.22	24.82 QP	46.00	-21.18	2.00 H	40	-0.08	24.90
6	885.39	25.61 QP	46.00	-20.39	1.50 H	301	0.43	25.18
7	932.05	26.07 QP	46.00	-19.93	1.50 H	196	0.49	25.58
8	951.49	29.71 QP	46.00	-16.29	1.00 H	166	3.97	25.73

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	438.20	26.06 QP	46.00	-19.94	1.00 V	238	9.20	16.86
2	698.74	26.50 QP	46.00	-19.50	1.00 V	223	4.52	21.98
3	799.84	25.55 QP	46.00	-20.45	1.00 V	226	1.19	24.36
4	819.28	24.26 QP	46.00	-21.74	1.00 V	202	-0.29	24.55
5	871.78	24.94 QP	46.00	-21.06	1.00 V	250	-0.11	25.05
6	904.83	25.39 QP	46.00	-20.61	2.00 V	37	0.03	25.36
7	930.11	25.26 QP	46.00	-20.74	1.50 V	307	-0.31	25.56
8	947.60	31.29 QP	46.00	-14.71	1.00 V	145	5.59	25.71

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.



EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 78	FREQUENCY RANGE	Below 1000MHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION	Quasi-Peak
INPUT POWER (SYSTEM)	120Vac, 60 Hz	ENVIRONMENTAL CONDITIONS	25deg. C, 71%RH, 991hPa
TEST MODE	B	TESTED BY	Match Tsui

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	96.01	35.25 QP	43.50	-8.25	2.00 H	199	26.15	9.10
2	160.17	37.28 QP	43.50	-6.22	2.00 H	358	23.83	13.45
3	597.63	31.10 QP	46.00	-14.90	1.50 H	292	10.06	21.04
4	685.13	31.57 QP	46.00	-14.43	1.00 H	55	9.71	21.86
5	700.68	31.50 QP	46.00	-14.50	1.00 H	100	9.49	22.01
6	739.57	34.84 QP	46.00	-11.16	1.00 H	73	11.89	22.94
7	759.01	32.11 QP	46.00	-13.89	1.00 H	79	8.71	23.40
8	797.89	31.60 QP	46.00	-14.40	1.00 H	10	7.29	24.32
9	832.89	31.72 QP	46.00	-14.28	1.00 H	31	7.04	24.68

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	82.40	25.13 QP	40.00	-14.87	3.00 V	169	16.96	8.17
2	111.56	34.56 QP	43.50	-8.94	1.50 V	10	24.01	10.55
3	154.33	30.82 QP	43.50	-12.68	2.00 V	334	17.24	13.58
4	166.00	30.38 QP	43.50	-13.12	2.00 V	328	17.35	13.03
5	199.05	33.77 QP	43.50	-9.73	1.00 V	85	23.37	10.40
6	702.62	35.26 QP	46.00	-10.74	1.50 V	232	13.20	22.06
7	951.49	35.34 QP	46.00	-10.66	1.00 V	10	9.61	25.73

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)
INPUT POWER (SYSTEM)	120Vac, 60 Hz	ENVIRONMENTAL CONDITIONS		25deg. C, 71%RH, 991hPa
TEST MODE	B	TESTED BY		Match Tsui

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	2388.00	38.97 PK	74.00	-35.03	1.04 H	42	7.75	31.22
2	2388.00	29.47 AV	54.00	-24.53	1.04 H	42	-1.75	31.22
3	*2402.00	91.67 PK			1.05 H	42	60.46	31.21
4	*2402.00	53.61 AV			1.05 H	42	22.40	31.21
5	4804.00	43.97 PK	74.00	-30.03	1.04 H	132	7.53	36.44
6	4804.00	5.91 AV	54.00	-48.09	1.04 H	132	-30.53	36.44

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	2388.00	30.82 PK	74.00	-43.18	1.00 V	0	-0.40	31.22
2	2388.00	21.32 AV	54.00	-32.68	1.00 V	0	-9.90	31.22
3	*2402.00	83.52 PK			1.00 V	0	52.31	31.21
4	*2402.00	45.46 AV			1.00 V	0	14.25	31.21
5	4804.00	44.25 PK	74.00	-29.75	1.06 V	51	7.81	36.44
6	4804.00	6.19 AV	54.00	-47.81	1.06 V	51	-30.25	36.44

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. The DH1 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on $0.625 * 2$ per 1.25ms per channel. Therefore, the duty cycle be equal to: $20\log(1.25/100) = -38.06$ dB.
6. Average value = peak reading –38.06.



EUT TEST CONDITION			MEASUREMENT DETAIL	
CHANNEL		Channel 39		FREQUENCY RANGE
MODULATION TYPE		GFSK		DETECTOR FUNCTION
INPUT POWER (SYSTEM)		120Vac, 60 Hz		ENVIRONMENTAL CONDITIONS
TEST MODE		B		TESTED BY
Match Tsui				

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	89.05 PK			1.05 H	19	57.83	31.22
2	*2441.00	50.99 AV			1.05 H	19	19.77	31.22
3	4882.00	44.57 PK	74.00	-29.43	1.33 H	149	7.98	36.59
4	4882.00	6.51 AV	54.00	-47.49	1.33 H	149	-30.08	36.59

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	81.12 PK			1.05 V	35	49.90	31.22
2	*2441.00	43.06 AV			1.05 V	35	11.84	31.22
3	4882.00	46.38 PK	74.00	-27.62	1.21 V	199	9.79	36.59
4	4882.00	8.32 AV	54.00	-45.68	1.21 V	199	-28.27	36.59

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. The DH1 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 2 per 1.25ms per channel. Therefore, the duty cycle be equal to: $20\log(1.25/100) = -38.06$ dB.
6. Average value = peak reading –38.06.



EUT TEST CONDITION		MEASUREMENT DETAIL		
CHANNEL	Channel 78	FREQUENCY RANGE		1 ~ 25GHz
MODULATION TYPE	GFSK	DETECTOR FUNCTION		Peak (PK) Average (AV)
INPUT POWER (SYSTEM)	120Vac, 60 Hz	ENVIRONMENTAL CONDITIONS		25deg. C, 71%RH, 991hPa
TESTED BY	Match Tsui			

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	86.00 PK			1.05 H	20	54.77	31.23
2	*2480.00	47.94 AV			1.05 H	20	16.71	31.23
3	2483.50	28.99 PK	74.00	-45.01	1.05 H	20	-2.25	31.24
4	2483.50	19.49 AV	54.00	-34.51	1.05 H	20	-11.75	31.24
5	4960.00	45.34 PK	74.00	-28.66	1.41 H	152	8.59	36.74
6	4960.00	7.28 AV	54.00	-46.72	1.41 H	152	-29.47	36.74

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	78.85 PK			1.11 V	46	47.62	31.23
2	*2480.00	40.79 AV			1.11 V	46	9.56	31.23
3	2483.50	21.84 PK	74.00	-52.16	1.11 V	46	-9.40	31.24
4	2483.50	12.34 AV	54.00	-41.66	1.11 V	46	-18.90	31.24
5	4960.00	47.09 PK	74.00	-26.91	1.44 V	292	10.34	36.74
6	4960.00	9.03 AV	54.00	-44.97	1.44 V	292	-27.72	36.74

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. The DH1 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on $0.625 * 2$ per 1.25ms per channel. Therefore, the duty cycle be equal to: $20\log(1.25/100) = -38.06$ dB.
6. Average value = peak reading -38.06 .



4.3. NUMBER OF HOPPING FREQUENCY USED

4.3.1. LIMIT OF HOPPING FREQUENCY USED

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

4.3.2. TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSP40	100040	Jun. 07, 2007

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

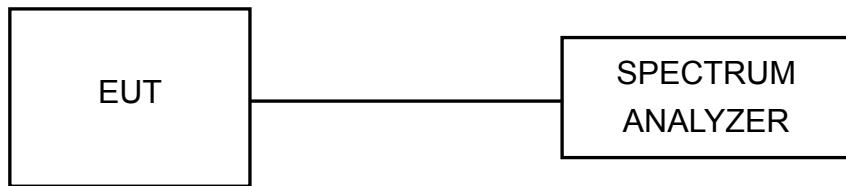
4.3.3. TEST PROCEDURES

- a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- b. 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.
- c. 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.
- d. Set the SA on View mode and then plot the result on SA screen.
- e. Repeat above procedures until all frequencies measured were complete.

4.3.4. DEVIATION FROM TEST STANDARD

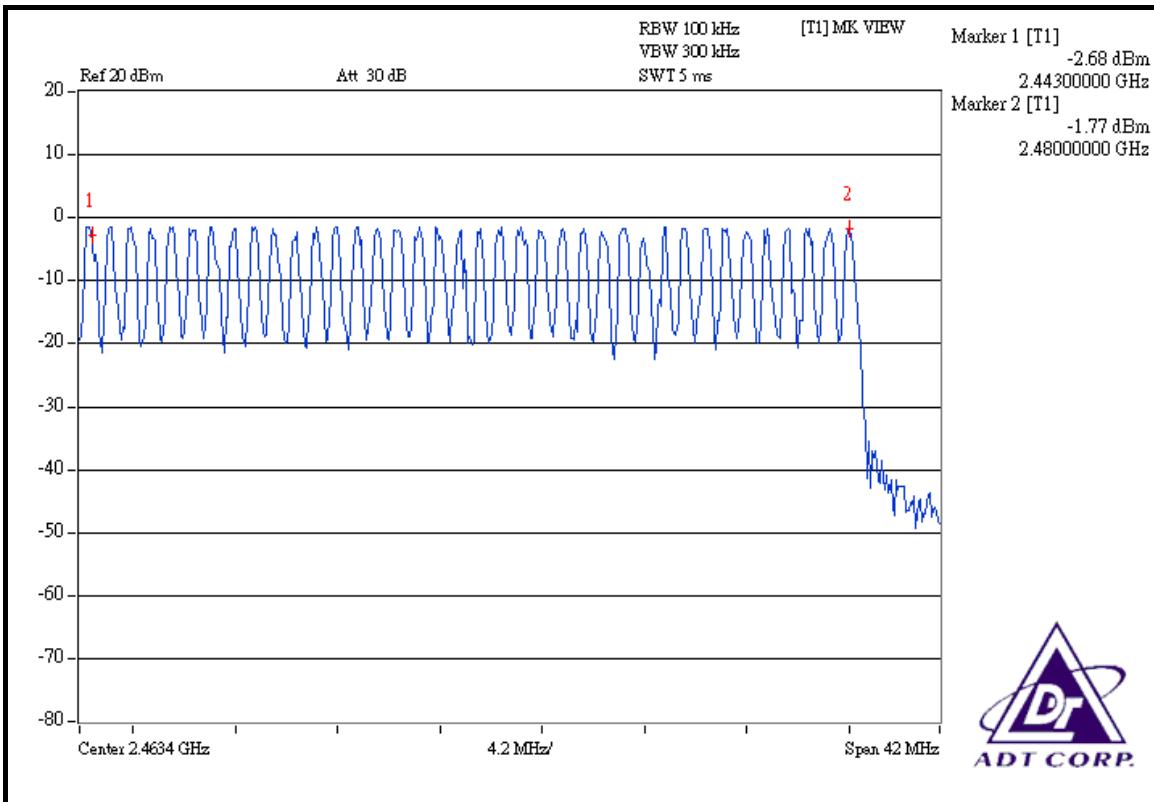
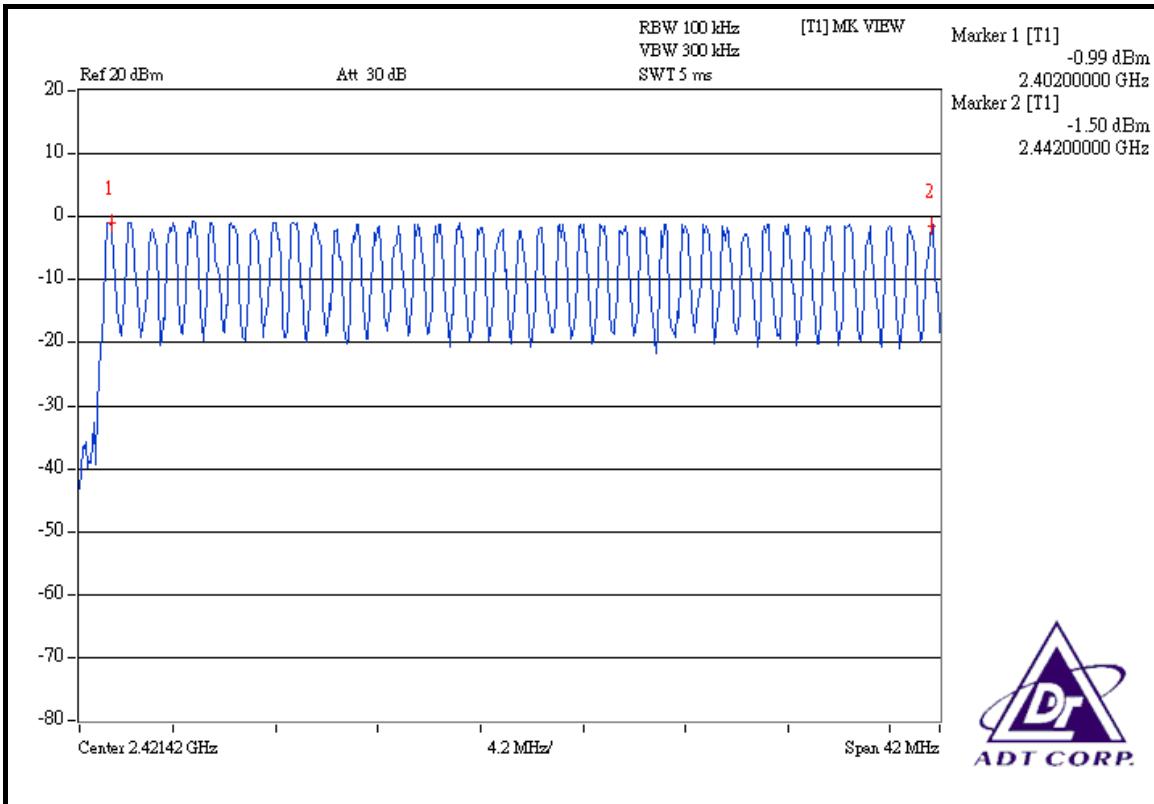
No deviation.

4.3.5. TEST SETUP



4.3.6. TEST RESULTS

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.





4.4. DWELL TIME ON EACH CHANNEL

4.4.1. 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.

4.4.2. TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSP40	100040	Jun. 07, 2007

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

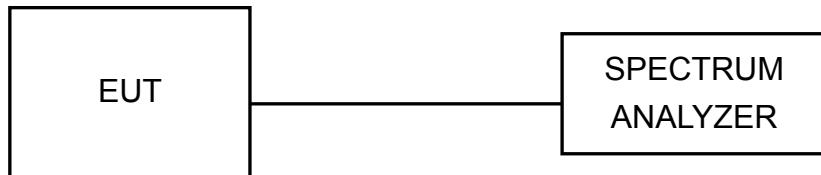
4.4.3. TEST PROCEDURES

- a. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
- b. 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.
- c. Adjust the center frequency of SA on any frequency to be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
- d. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
- e. Repeat above procedures until all different time-slot modes have been completed.

4.4.4. DEVIATION FROM TEST STANDARD

No deviation.

4.4.5. TEST SETUP



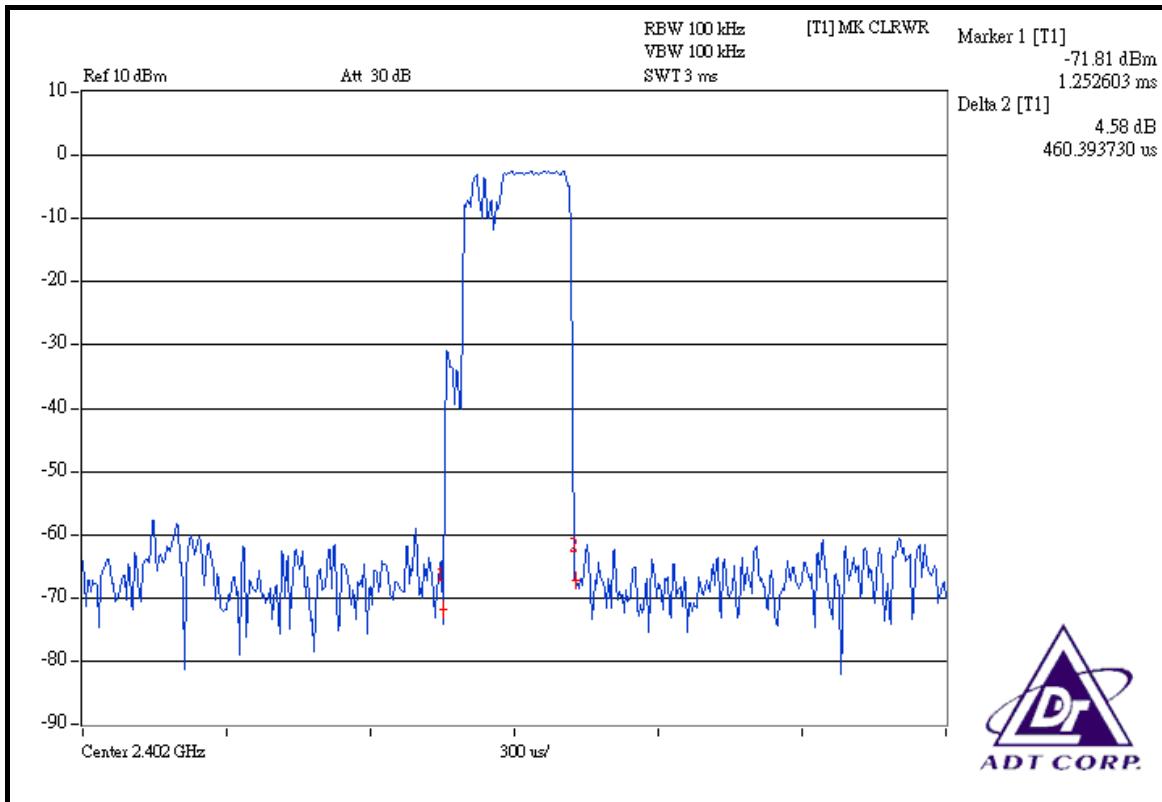
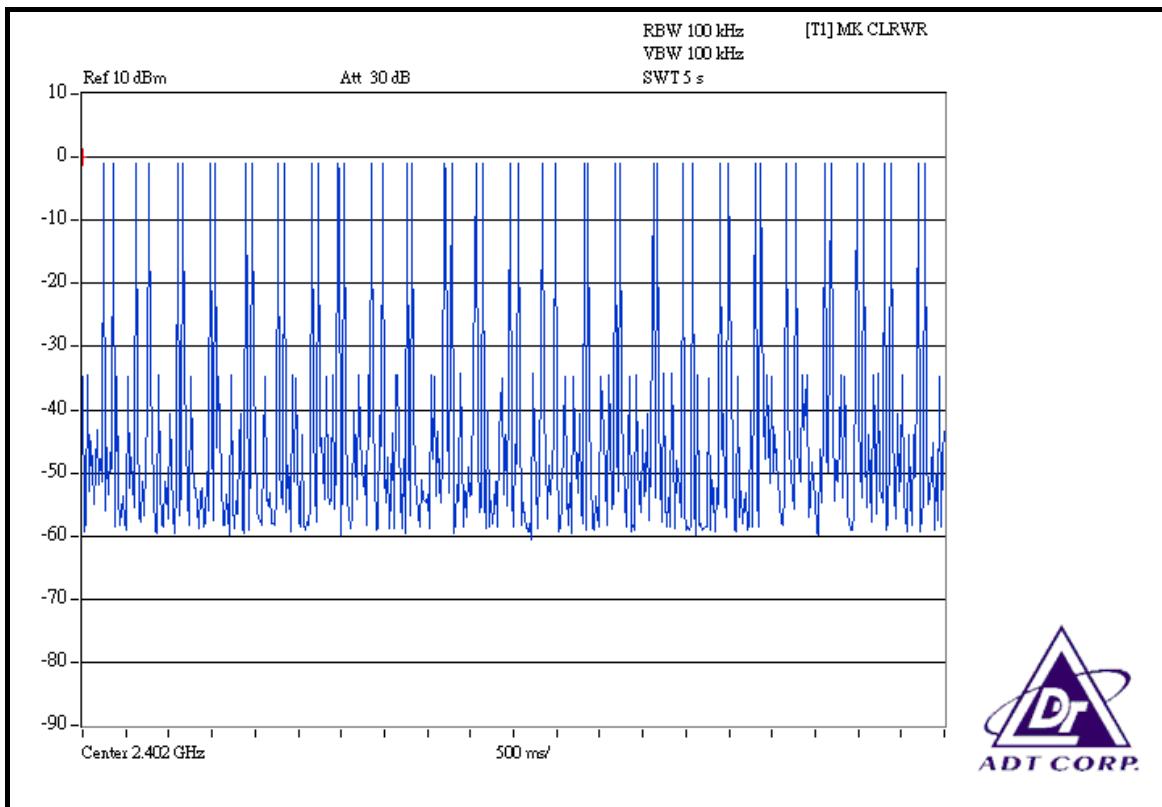
4.4.6. TEST RESULTS

Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	50 (times / 5 sec) *6.32=316.00 times	0.46	145.36	400

NOTE: Test plots of the transmitting time slot are shown on next 1 pages.



DH1





4.5. CHANNEL BANDWIDTH

4.5.1. 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 20dB bandwidth of hopping channel shall be a minimum limit for the hopping channel separation.

4.5.2. TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSP40	100040	Jun. 07, 2007

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

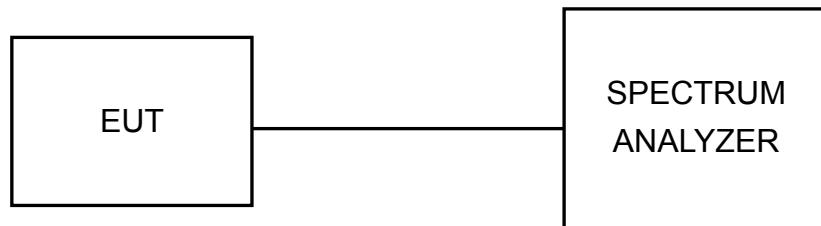
4.5.3. TEST PROCEDURE

- a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b. 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.
- c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
- d. 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. EUT OPERATING CONDITION

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

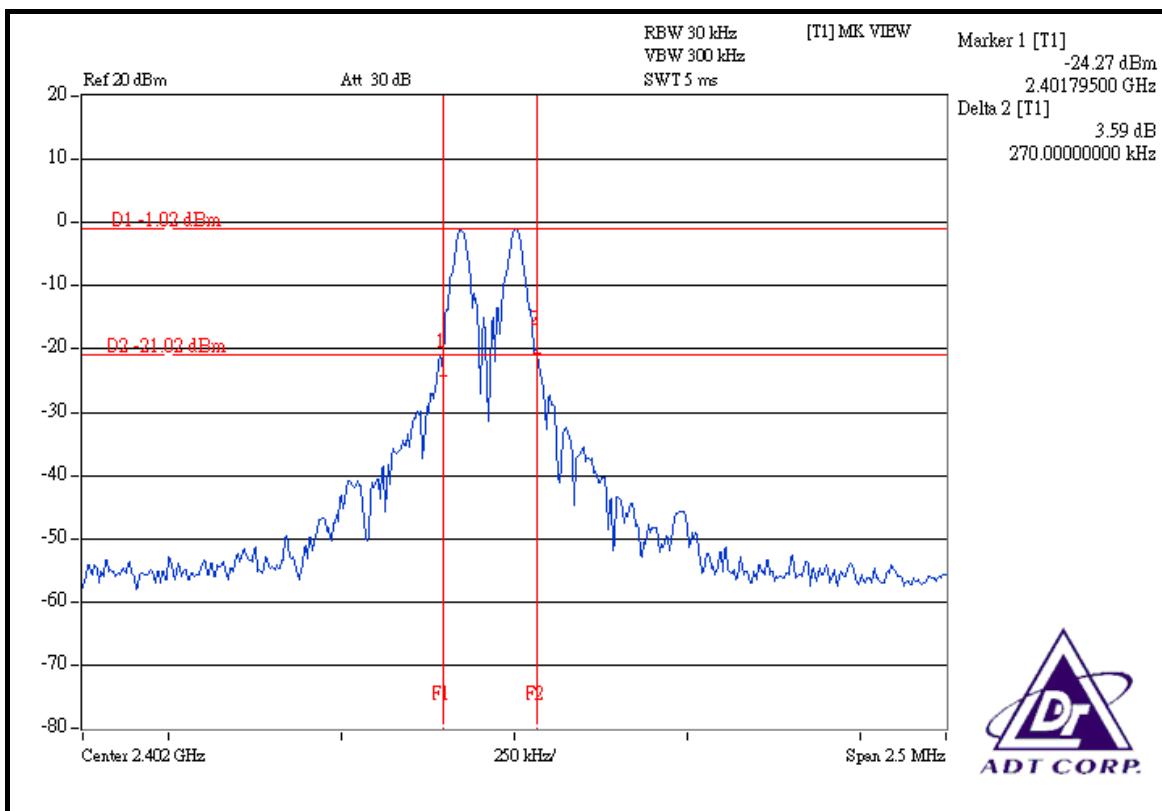
4.5.7. TEST RESULTS

MODULATION TYPE	GFSK	ENVIRONMENTAL CONDITIONS	25deg. C, 68%RH, 991hPa
INPUT POWER (SYSTEM)	120Vac, 60 Hz	TESTED BY	Morgan Chen

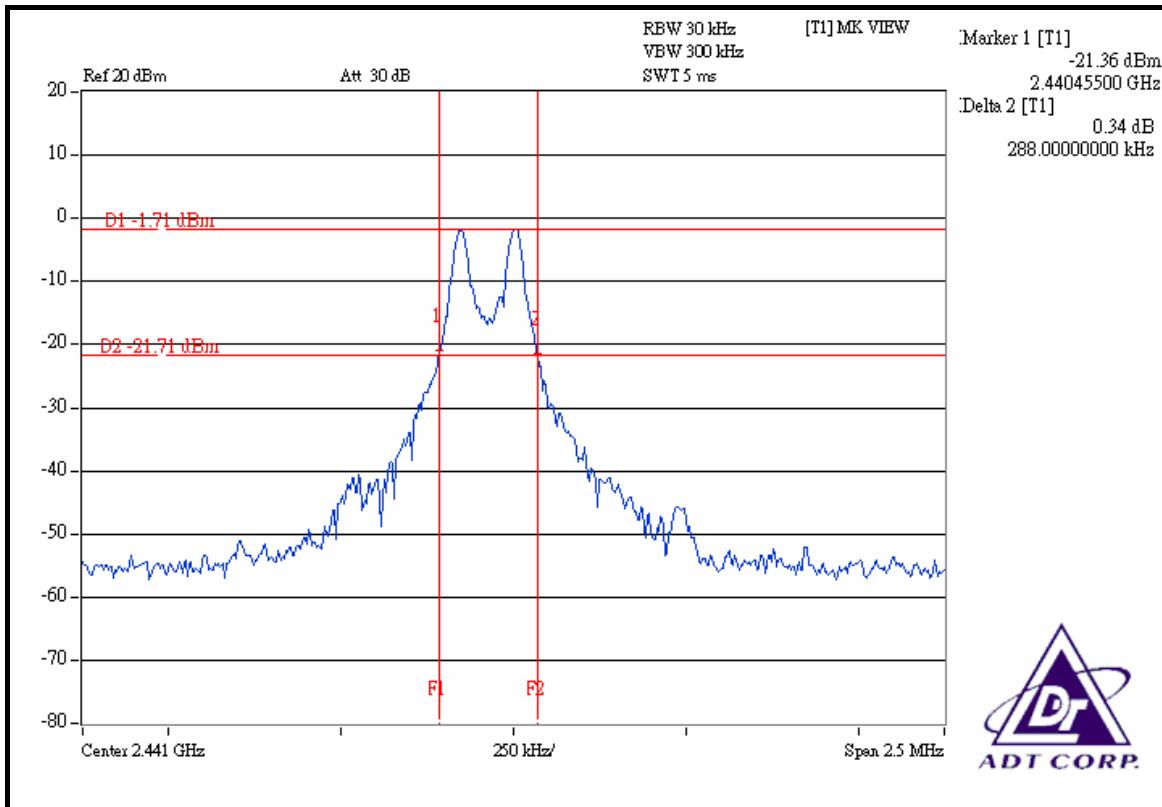
CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (MHz)
0	2402	0.270
39	2441	0.288
78	2480	0.285

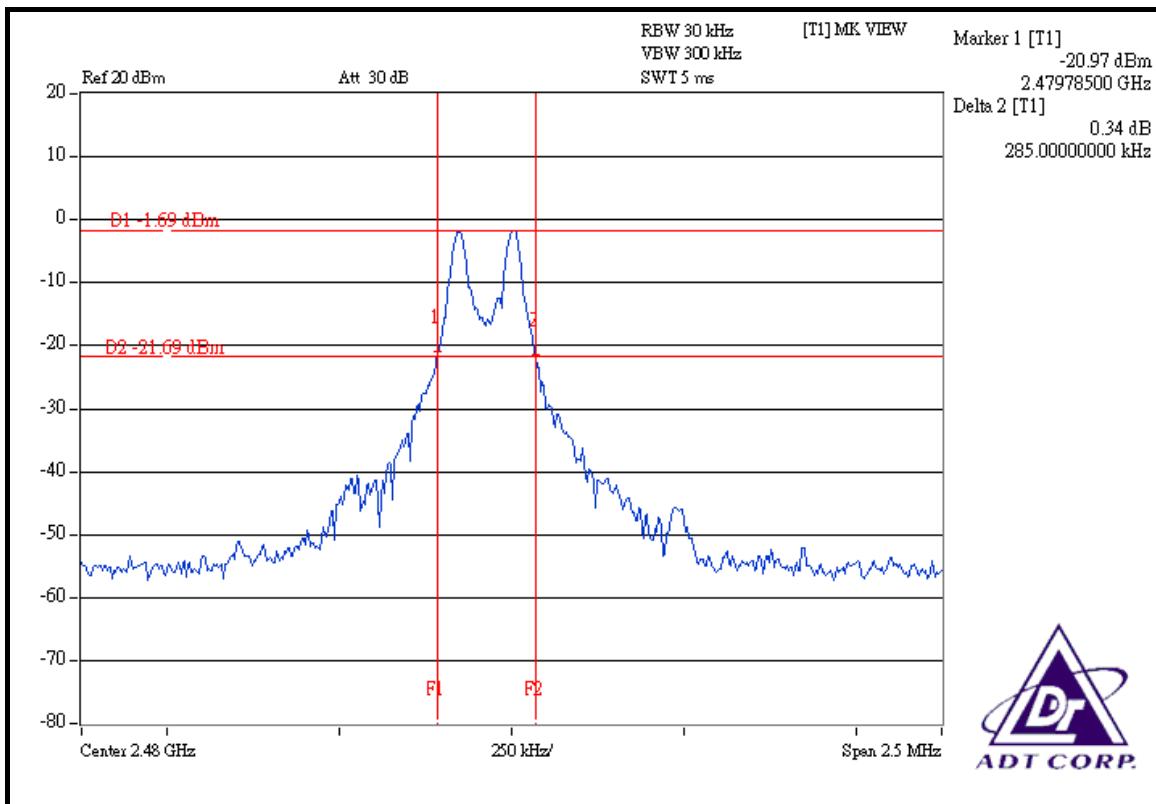


CH 0



Ch 39



CH 78




4.6. HOPPING CHANNEL SEPARATION

4.6.1. LIMIT OF HOPPING CHANNEL SEPARATION

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

4.6.2. TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSP40	100040	Jun. 07, 2007

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

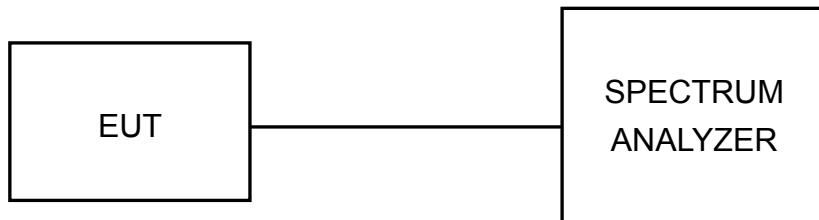
4.6.3. TEST PROCEDURES

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.
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.

4.6.4. DEVIATION FROM TEST STANDARD

No deviation.

4.6.5. TEST SETUP

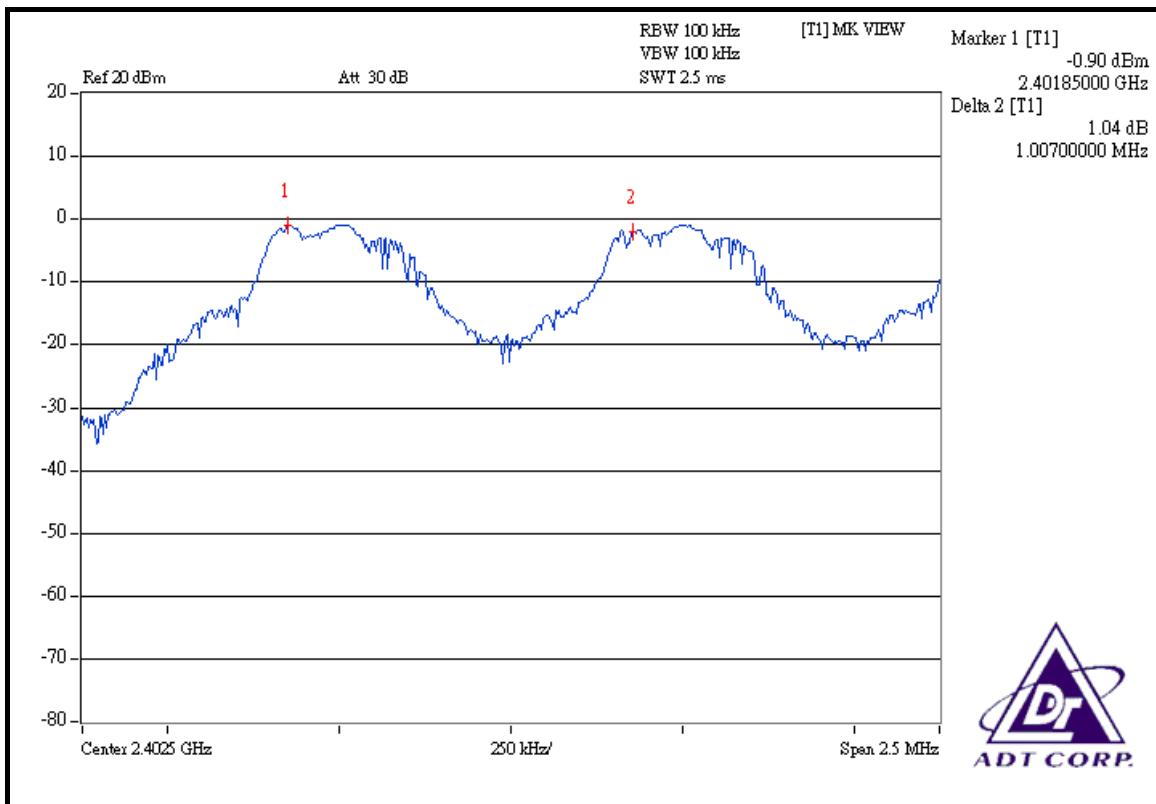
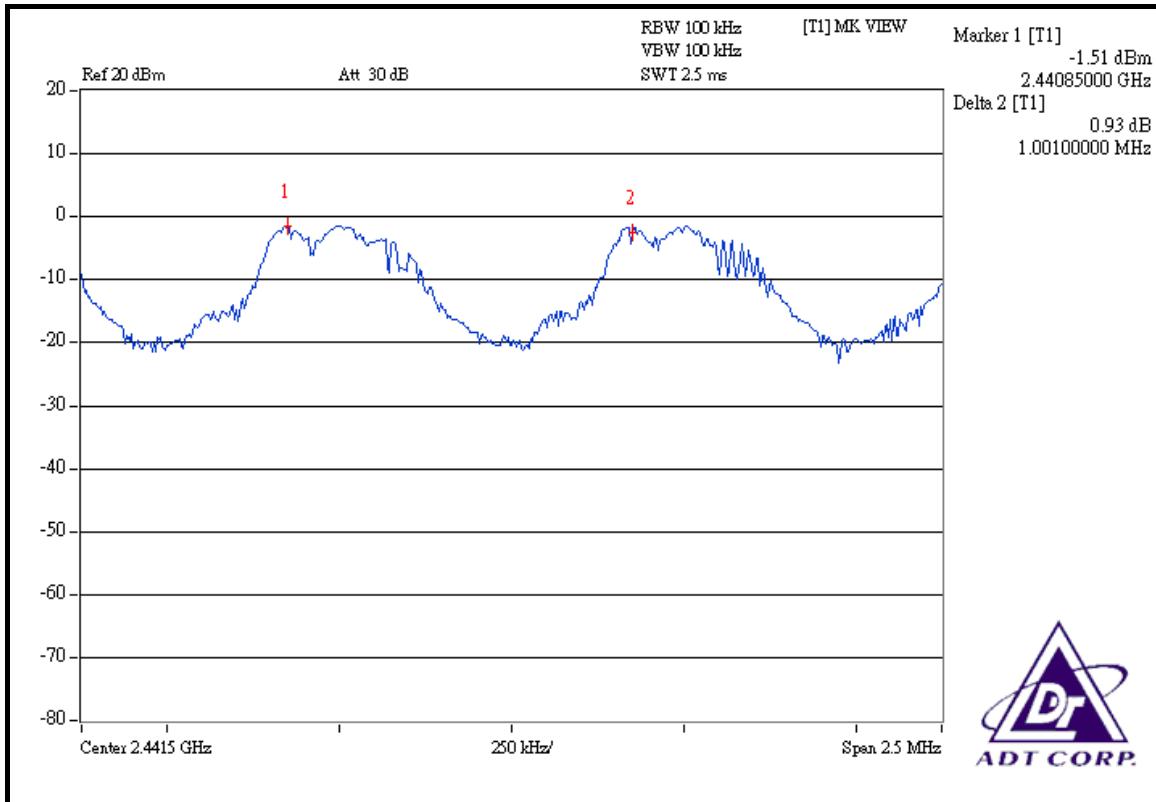


4.6.6. TEST RESULTS

MODULATION TYPE	GFSK	ENVIRONMENTAL CONDITIONS	25deg. C, 68%RH, 991hPa
INPUT POWER (SYSTEM)	120Vac, 60 Hz	TESTED BY	Morgan Chen

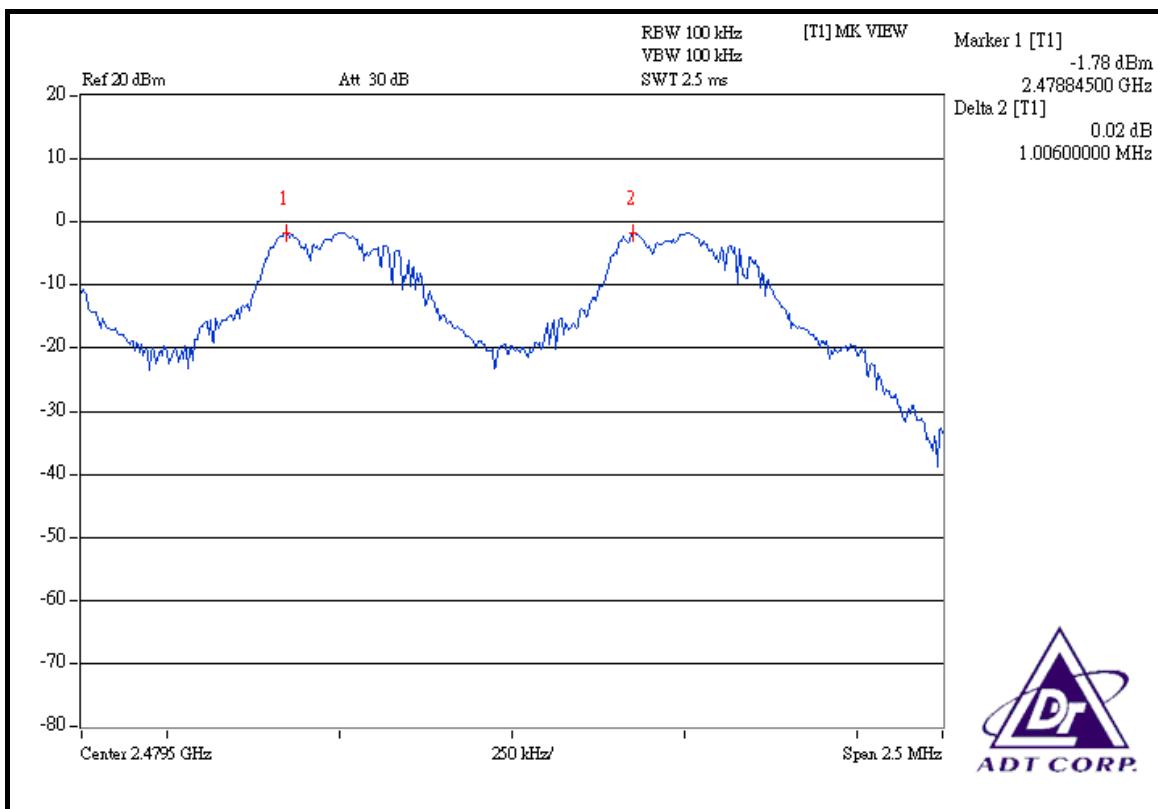
CHANNEL	FREQUENCY (MHz)	ADJACENT CHANNEL SEPARATION (MHz)	20dB BANDWIDTH (MHz)	PASS / FAIL
0	2402	1.007	0.270	PASS
39	2441	1.001	0.288	PASS
78	2480	1.006	0.285	PASS

NOTE: The minimum limit is 20dB bandwidth. Test results please refer to next two pages.

CH 0

CH 39




CH 78





4.7. MAXIMUM PEAK OUTPUT POWER

4.7.1. LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT

The Maximum Peak Output Power Measurement is 30dBm.

4.7.2. TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSP40	100040	Jun. 07, 2007

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

4.7.3. TEST PROCEDURES

- a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b. 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.
- c. The center frequency of the spectrum analyzer is set to the fundamental frequency and using 3MHz RBW and 10 MHz VBW.
- d. Measure the captured power within the band and recording the plot.
- e. Repeat above procedures until all frequencies required were complete.

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 CONDITION

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

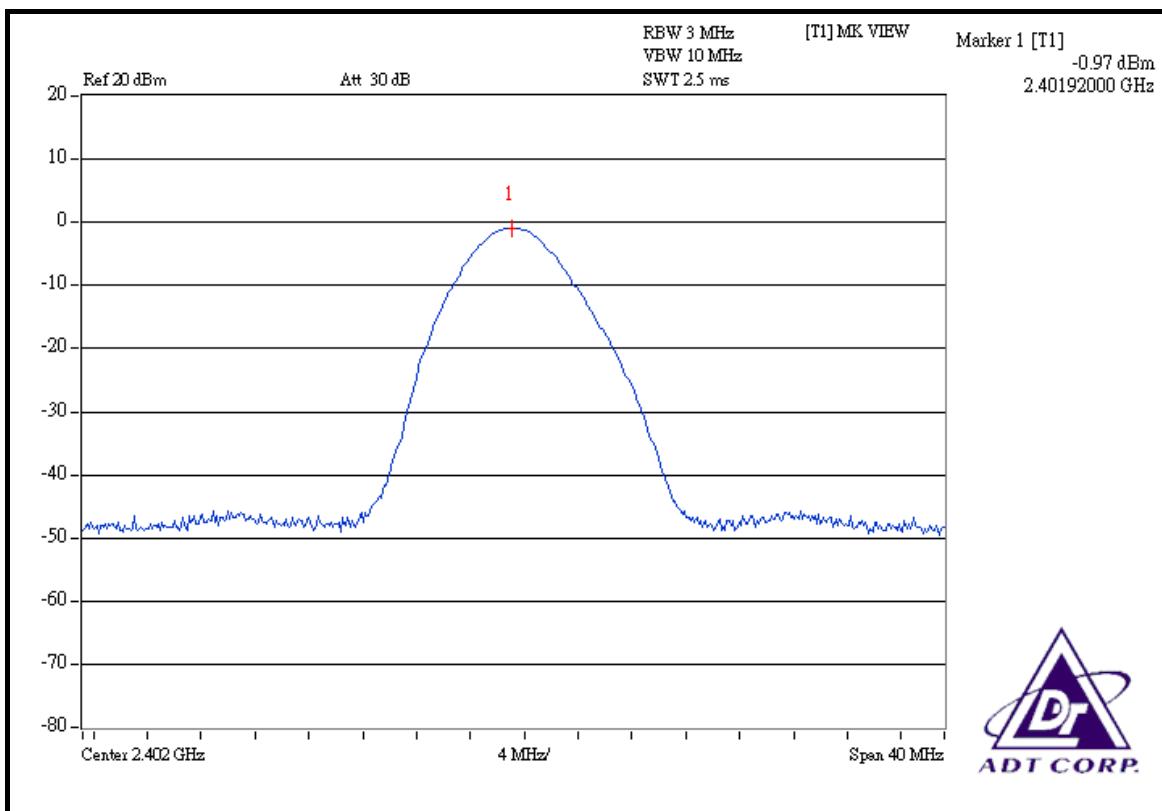
4.7.7. TEST RESULTS

MODULATION TYPE	GFSK	ENVIRONMENTAL CONDITIONS	25deg. C, 68%RH, 991hPa
INPUT POWER (SYSTEM)	120Vac, 60 Hz	TESTED BY	Morgan Chen

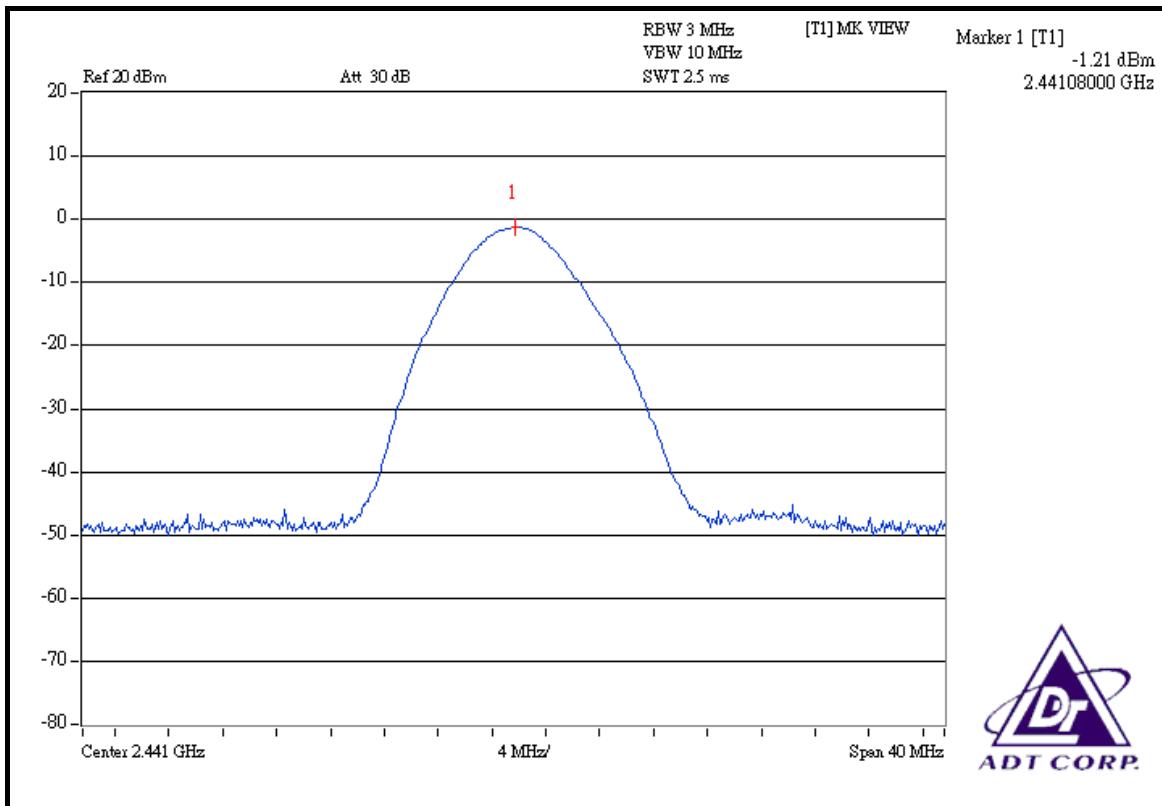
CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	PEAK POWER LIMIT (dBm)	PASS/FAIL
0	2402	0.800	-0.97	30	PASS
39	2441	0.757	-1.21	30	PASS
78	2480	0.700	-1.55	30	PASS



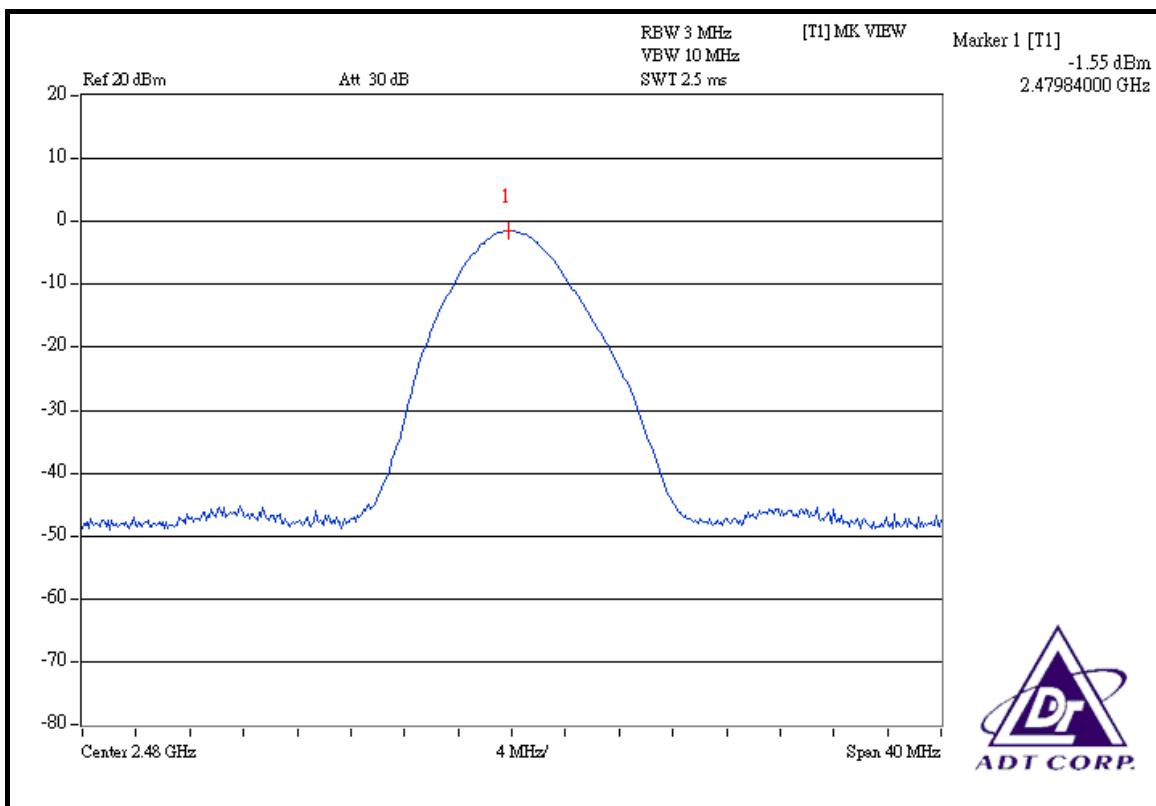
CH 0



Ch 39



Ch 78





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	FSP40	100040	Jun. 07, 2007

NOTES: 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 loss 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 and highest channel frequencies individually.



4.8.6. TEST RESULTS

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

NOTE 1:

The band edge emission plot on the next page shows 47.22dBc between carrier maximum power and local maximum emission in restrict band (2.3132GHz). The emission of carrier strength list in the test result of channel 0 at the item 4.2.7 is 91.67dBuV/m (Peak), so the maximum field strength in restrict band is $91.67 - 47.22 = 44.45$ dBuV/m, which is under 74 dBuV/m limit.

Average value = $44.45 - 38.06 = 6.39$ dBuV/m, which is under 54dBuV/m limit.

*The DH1 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 2 per 1.25ms per channel. Therefore, the duty cycle correlation factor be equal to: $20\log(1.25/100) = -38.06$ dB.

Average value = peak reading -38.06

NOTE 2:

The band edge emission plot on the next second page shows 46.04dBc between carrier maximum power and local maximum emission in restrict band (2.4928GHz). The emission of carrier strength list in the test result of channel 78 at the item 4.2.7 is 86.00dBuV/m (Peak), so the maximum field strength in restrict band is $86.00 - 46.04 = 39.96$ dBuV/m, which is under 74 dBuV/m limit.

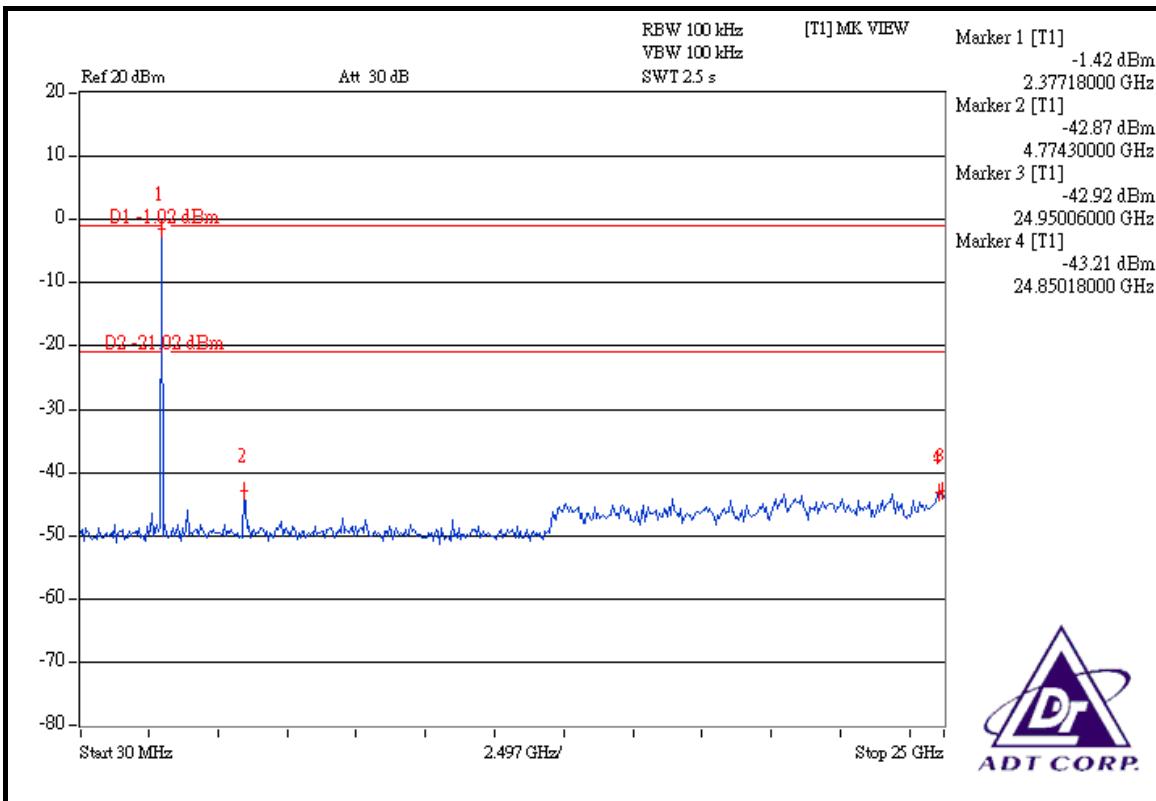
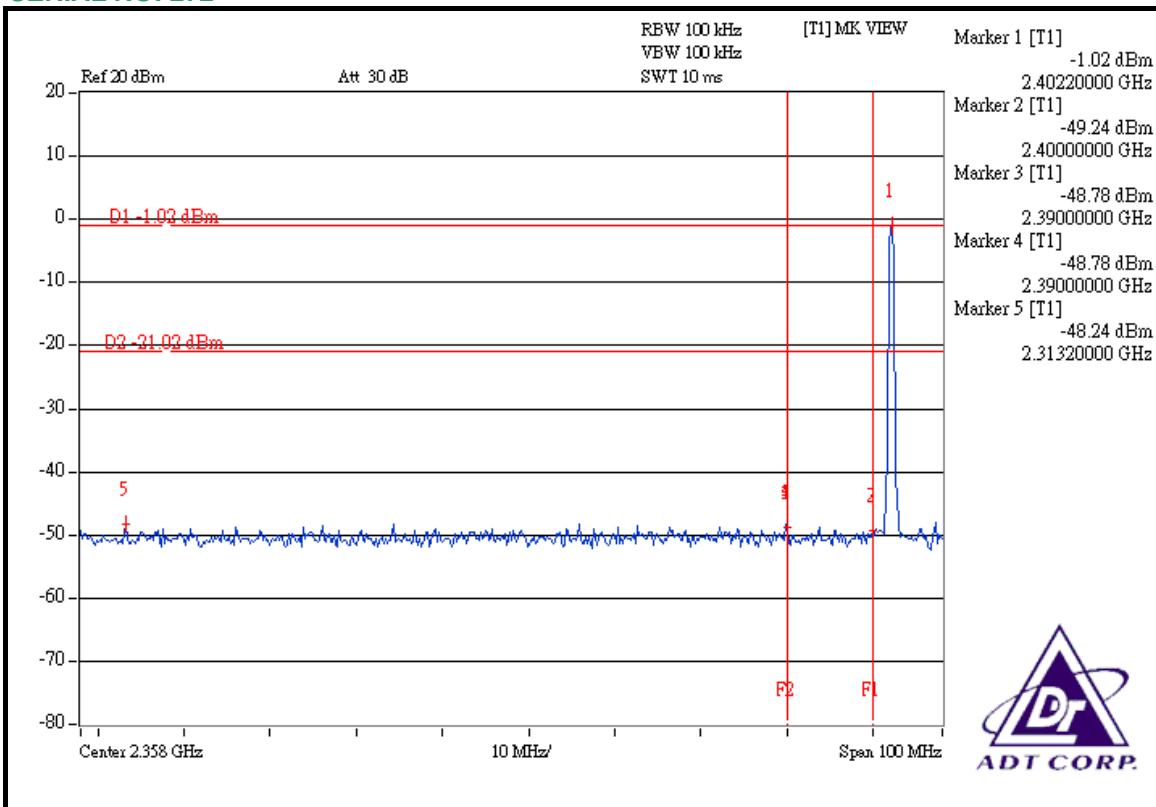
Average value = $39.96 - 38.06 = 1.90$ dBuV/m, which is under 54dBuV/m limit.

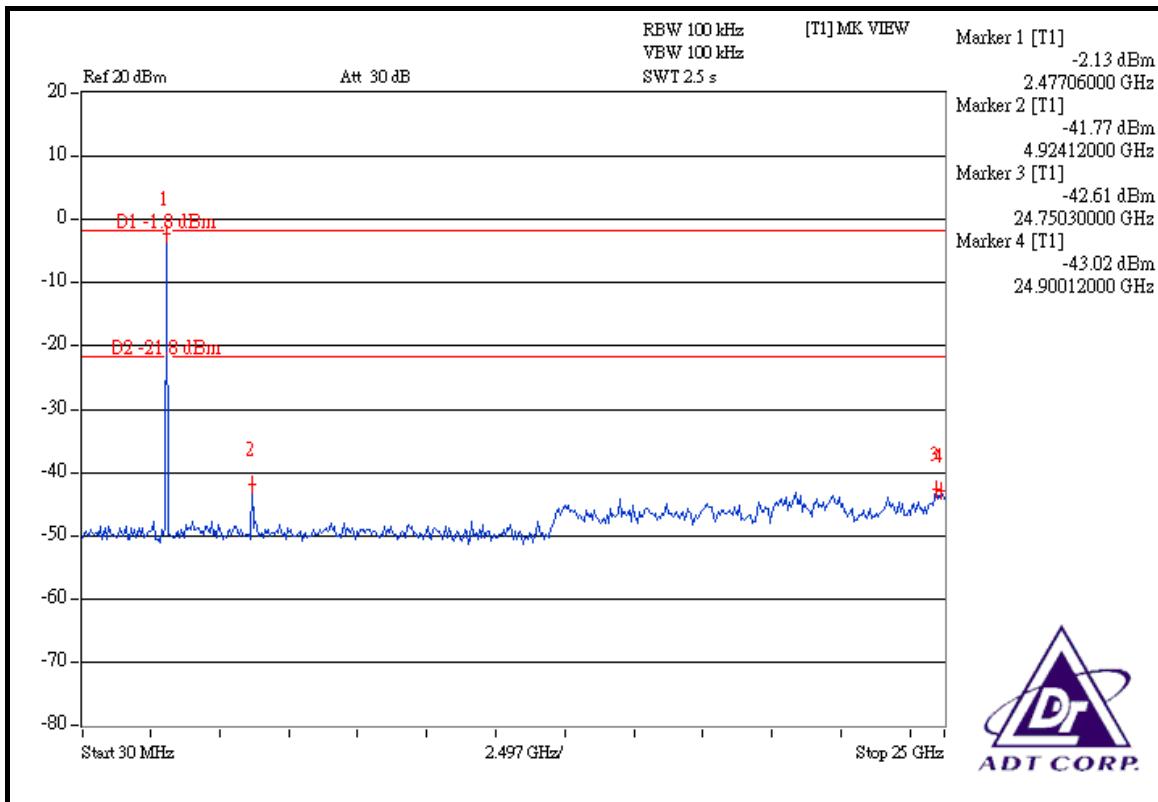
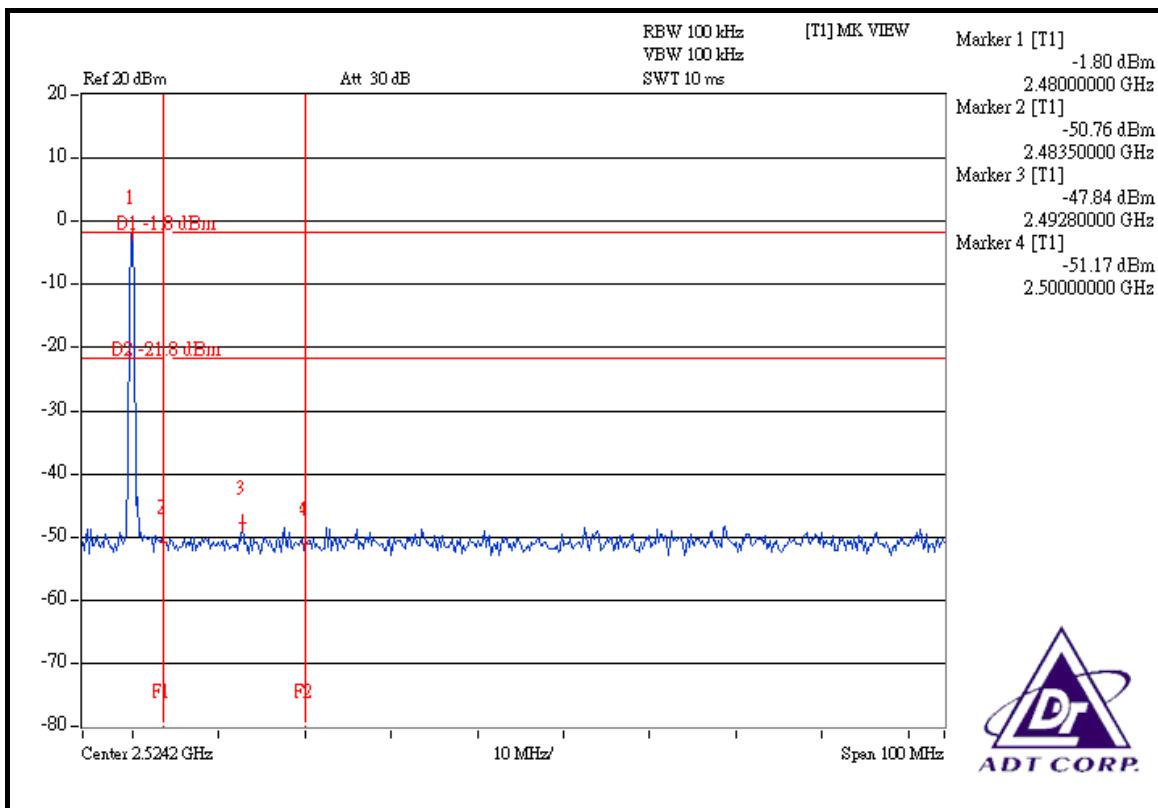
*The DH1 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 2 per 1.25ms per channel. Therefore, the duty cycle correlation factor be equal to: $20\log(1.25/100) = -38.06$ dB.

Average value = peak reading -38.06



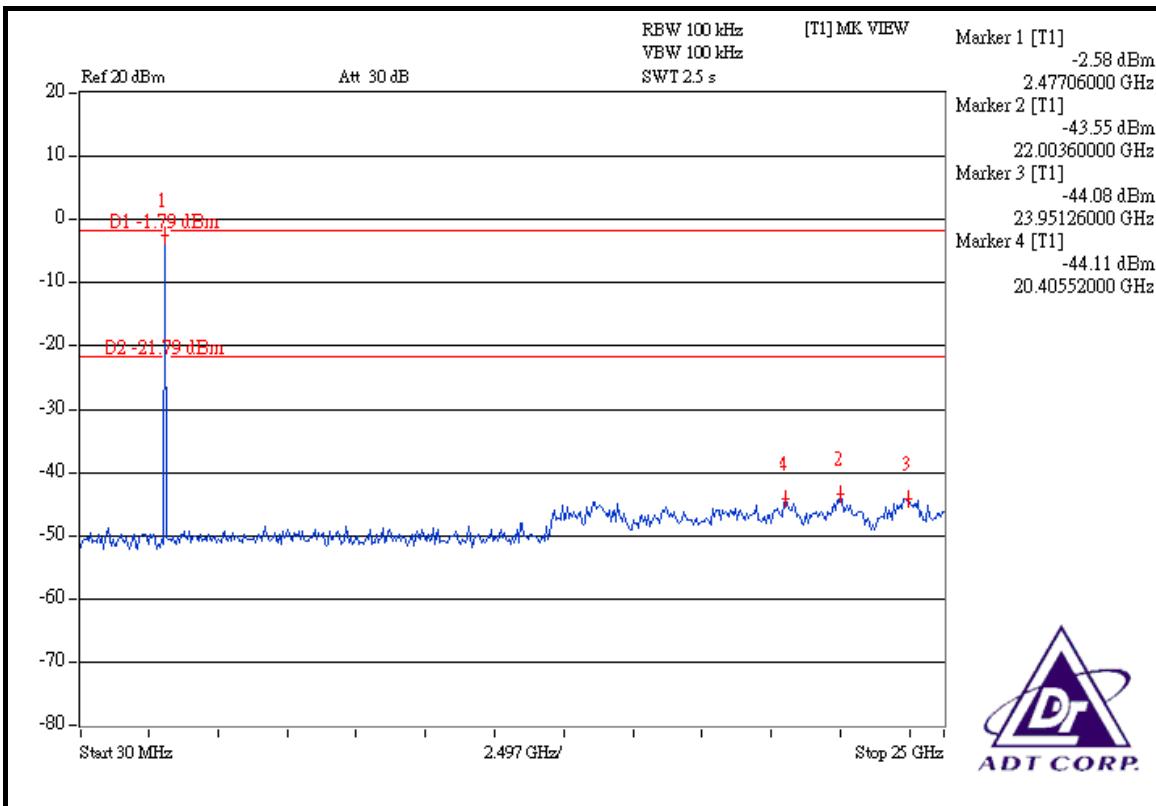
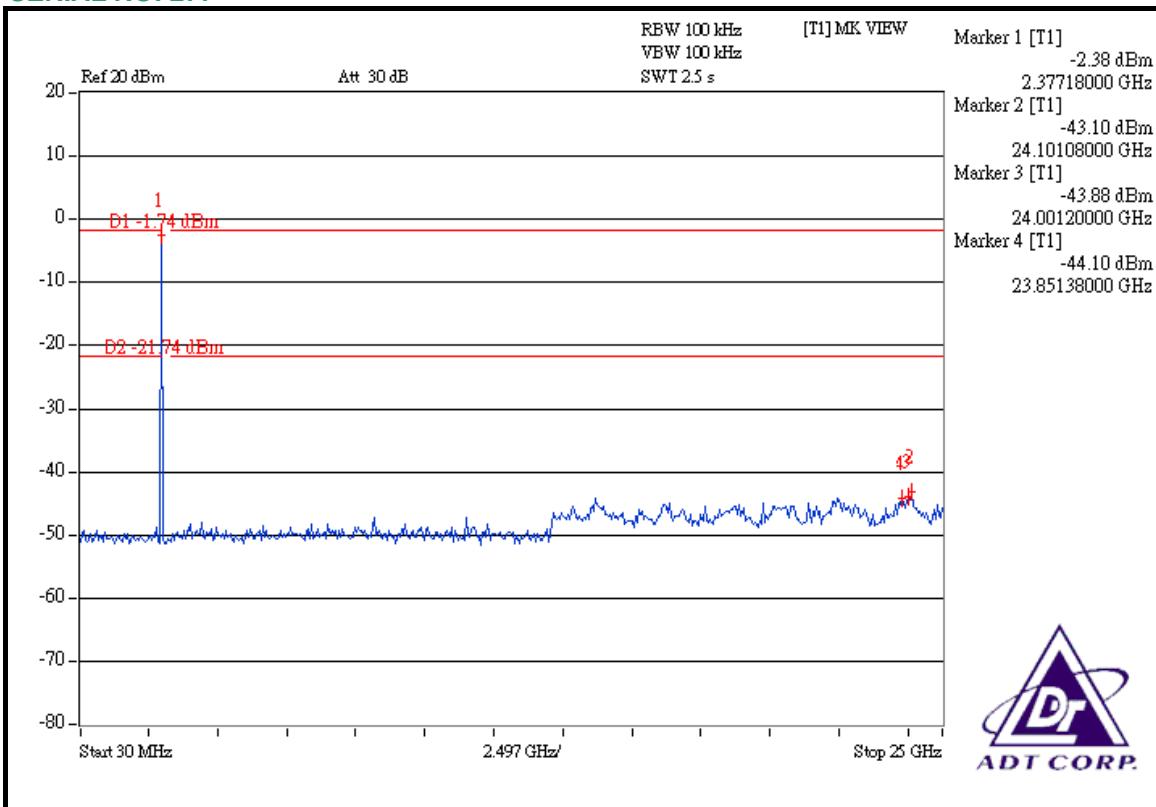
SERIAL NO: 272





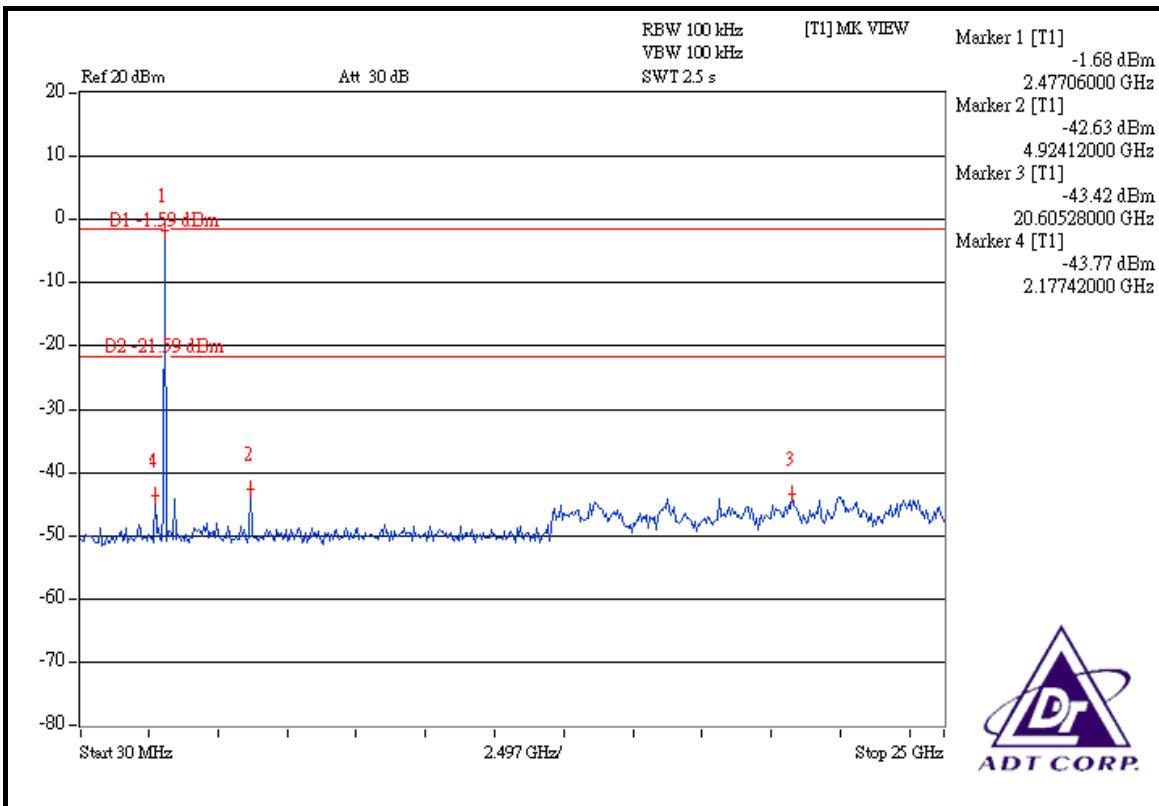
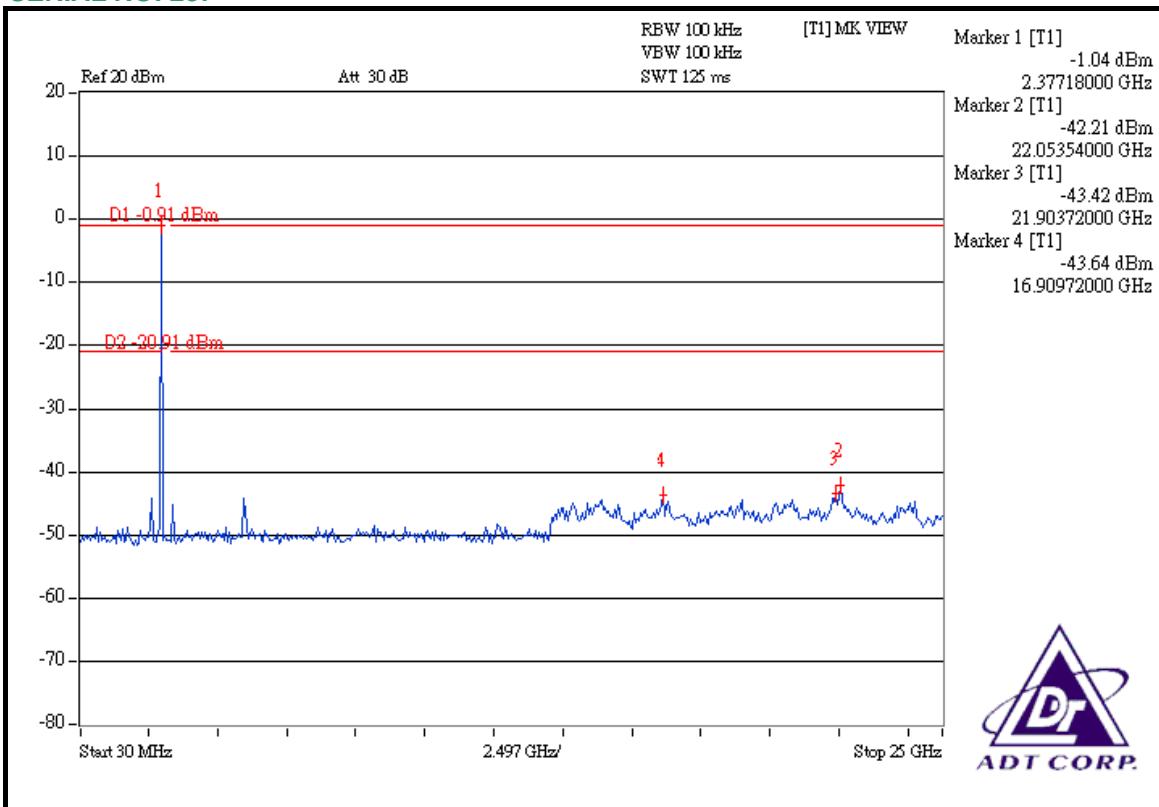


SERIAL NO: 277





SERIAL NO: 287





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 PCB antenna without antenna connector. The maximum gain of this antenna is 0.4dBi.



5. PHOTOGRAPHS OF THE TEST CONFIGURATION

Please refer to the attached file (Test Setup Photo).



6. 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, NCC
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.