FCC TEST REPORT

REPORT NO.: RF950712A05

MODEL NO.: RF-BTMKY

RECEIVED: July 12, 2006

TESTED: July 18 ~ 25, 2006

ISSUED: Aug. 1, 2006

APPLICANT: PRIMAX ELECTRONICS LTD.

ADDRESS: No. 669, Ruey Kuang Road, Neihu, Taipei, Taiwan, R.O.C.

ISSUED BY: Advance Data Technology Corporation

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

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1 CERTIFICATION

PRODUCT :	Bluetooth Desktop Wireless Keyboard
BRAND NAME:	PRIMAX, ROCKETFISH
MODEL NO.:	RF-BTMKY
APPLICANT :	PRIMAX ELECTRONICS LTD.
TESTED :	July 18 ~ 25, 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 : Annie Chang , **DATE:** Aug. 1, 2006
(Annie Chang)

TECHNICAL ACCEPTANCE : Ken Liu , **DATE:** Aug. 1, 2006
Responsible for RF
(Ken Liu)

APPROVED BY : Gary Chang , **DATE:** Aug. 1, 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	NA	Power supply is 3Vdc 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)	Hopping Channel Separation Spec. : Min. 25 kHz or 20 dB bandwidth, whichever is greater 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 -7.65 dB at 2390.00 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:

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

MEASUREMENT	UNCERTAINTY
Radiated emissions	3.55 dB

3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Bluetooth Desktop Wireless Keyboard
MODEL NO.	RF-BTMKY
FCC ID	EMJK303B3
POWER SUPPLY	3.0Vdc from batteries
MODULATION TYPE	GFSK
MODULATION TECHNOLOGY	FHSS
TRANSFER RATE	585.6Kbps
FREQUENCY RANGE	2402 MHz ~ 2480 MHz
NUMBER OF CHANNEL	79
OUTPUT POWER	1.294mW
ANTENNA TYPE	Printed antenna with 0dBi gain
DATA CABLE	N/A
I/O PORTS	N/A

NOTE:

1. The EUT is a wireless keyboard, with Bluetooth technology.

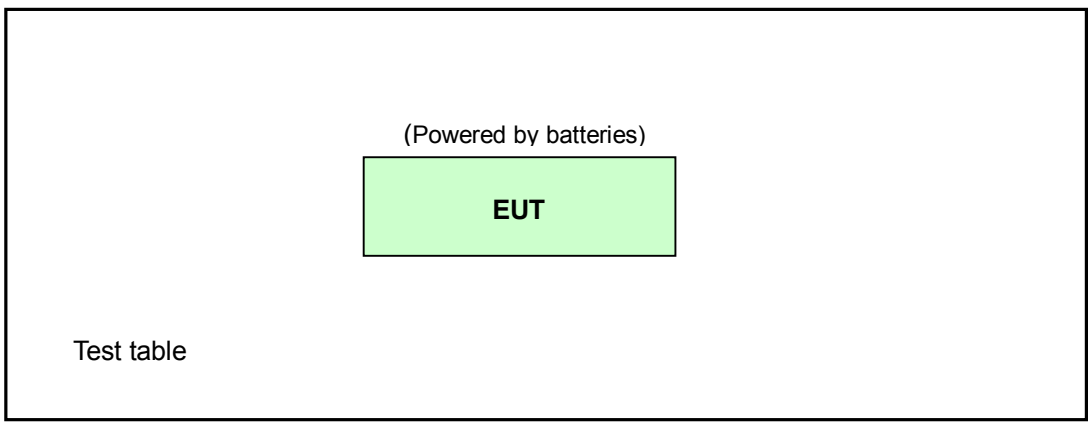
2. The above EUT information was declared by the manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

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



3.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	PLC	RE<1G	RE≥1G	APCM	
-	-	√	√	√	-

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

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

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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
0 TO 78	78	FHSS	GFSK	DH3

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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
0 TO 78	0, 39, 78	FHSS	GFSK	DH3

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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
0 TO 78	0, 78	FHSS	GFSK	DH3

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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
0 TO 78	0, 39, 78	FHSS	GFSK	DH3

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

N/A

4 TEST PROCEDURES AND RESULTS

4.1 CONDUCTED EMISSION MEASUREMENT

N/A

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: 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.

4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
HP Preamplifier	8447D	2432A03504	May 21, 2007
HP Preamplifier	8449B	3008A01924	Sep. 06, 2006
HP Preamplifier	8449B	3008A01638	Sep. 21, 2006
ROHDE & SCHWARZ TEST RECEIVER	ESI7	836697/012	Nov. 01, 2006
Schwarzbeck Antenna	VULB 9168	137	Feb. 21, 2007
Schwarzbeck Antenna	VHBA 9123	480	Mar. 30, 2007
EMCO Horn Antenna	3115	6714	Oct. 26, 2006
EMCO Horn Antenna	3115	9312-4192	Mar. 14, 2007
ADT. Turn Table	TT100	0306	NA
ADT. Tower	AT100	0306	NA
Software	ADT_Radiated_V 7.6.011	NA	NA
TIMES RF cable	LL142	CABLE-CH6-01	Dec. 19, 2006
ROHDE & SCHWARZ Spectrum Analyzer	FSP 40	100036	Mar. 16. 2007

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 horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3. The test was performed in ADT Chamber No. 6.
4. The Industry Canada Reference No. IC 3789-6.

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 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 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.

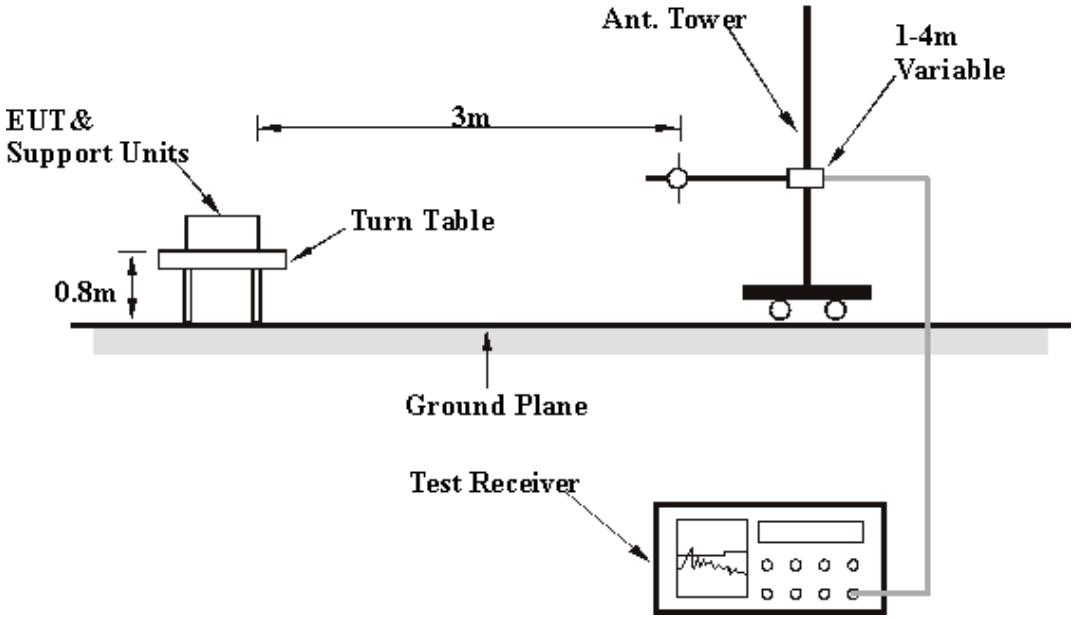
NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for 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 (PK) 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 related item – Photographs of the Test Configuration.

4.2.6 EUT OPERATING CONDITIONS

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

4.2.7 TEST RESULTS

RADIATED WORST CASE DATA: BELOW 1GHz

MODULATION TYPE	GFSK	**CHANNEL**	78
INPUT POWER	3.0Vdc	**FREQUENCY RANGE**	Below 1 GHz
ENVIRONMENTAL CONDITIONS	25 deg. C, 78% RH, 1000 hPa	**DETECTOR FUNCTION**	Quasi-Peak
TESTED BY	Jamison Chan		

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	766.73	26.67 QP	46.00	-19.33	1.53 H	307	-1.21	27.88
2	809.50	26.40 QP	46.00	-19.60	1.76 H	214	-1.72	28.12
3	840.60	28.55 QP	46.00	-17.45	2.01 H	46	0.17	28.38
4	875.59	28.45 QP	46.00	-17.55	1.33 H	94	-0.56	29.01
5	910.58	28.63 QP	46.00	-17.37	1.88 H	49	-1.15	29.78
6	949.46	29.51 QP	46.00	-16.49	1.67 H	112	-1.15	30.67

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	755.07	26.93 QP	46.00	-19.07	1.07 V	325	-0.89	27.82
2	809.50	26.66 QP	46.00	-19.34	1.00 V	139	-1.46	28.12
3	846.43	28.04 QP	46.00	-17.96	1.00 V	196	-0.39	28.43
4	879.48	27.98 QP	46.00	-18.02	1.21 V	268	-1.12	29.10
5	910.58	27.72 QP	46.00	-18.28	1.13 V	1	-2.06	29.78
6	955.29	29.67 QP	46.00	-16.33	1.02 V	97	-0.96	30.64

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

MODULATION TYPE	GFSK	**CHANNEL**	0
INPUT POWER	3.0Vdc	**FREQUENCY RANGE**	1 ~ 25 GHz
ENVIRONMENTAL CONDITIONS	25 deg. C, 78% RH, 1000 hPa	**DETECTOR FUNCTION**	Peak(PK) Average (AV)
TESTED BY	Jamison Chan		

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	60.14 PK	74.00	-13.86	1.04 H	323	23.92	36.22
1	**2390.00**	**46.35 AV**	**54.00**	**-7.65**	**1.04 H**	**323**	**10.13**	**36.22**
2	*2402.00	95.82 PK			1.04 H	323	59.59	36.23
2	*2402.00	61.32 AV			1.04 H	323	25.09	36.23
3	4804.00	54.76 PK	74.00	-19.24	1.18 H	64	10.25	44.51
3	4804.00	20.26 AV	54.00	-33.74	1.18 H	64	-24.25	44.51

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	59.87 PK	74.00	-14.13	1.32 V	39	23.65	36.22
1	2390.00	45.43 AV	54.00	-8.57	1.32 V	39	9.21	36.22
2	*2402.00	91.07 PK			1.32 V	39	54.84	36.23
2	*2402.00	56.57 AV			1.32 V	39	20.34	36.23
3	4804.00	54.49 PK	74.00	-19.51	1.36 V	243	9.98	44.51
3	4804.00	19.99 AV	54.00	-34.01	1.36 V	243	-24.52	44.51

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 DH3 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*3 per 247 ms per channel. Therefore, the duty cycle be equal to: 20log(1.875/100)= -34.5 dB
6. Average value = peak reading +20log(duty cycle)

MODULATION TYPE	GFSK	**CHANNEL**	39
INPUT POWER	3.0Vdc	**FREQUENCY RANGE**	1 ~ 25 GHz
ENVIRONMENTAL CONDITIONS	25 deg. C, 78% RH, 1000 hPa	**DETECTOR FUNCTION**	Peak(PK) Average (AV)
TESTED BY	Jamison Chan		

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	97.22 PK			1.06 H	321	60.90	36.32
1	*2441.00	62.72 AV			1.06 H	321	26.40	36.32
2	4882.00	56.32 PK	74.00	-17.68	1.00 H	317	11.98	44.33
2	4882.00	21.82 AV	54.00	-32.18	1.00 H	317	-22.52	44.33

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	92.93 PK			1.54 V	226	56.61	36.32
1	*2441.00	58.43 AV			1.54 V	226	22.11	36.32
2	4882.00	57.13 PK	74.00	-16.87	1.10 V	98	12.79	44.33
2	4882.00	22.63 AV	54.00	-31.37	1.10 V	98	-21.71	44.33

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 DH3 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*3 per 247 ms per channel. Therefore, the duty cycle be equal to: 20log(1.875/100)= -34.5 dB
6. Average value = peak reading +20log(duty cycle)

MODULATION TYPE	GFSK	**CHANNEL**	78
INPUT POWER	3.0Vdc	**FREQUENCY RANGE**	1 ~ 25 GHz
ENVIRONMENTAL CONDITIONS	25 deg. C, 78% RH, 1000 hPa	**DETECTOR FUNCTION**	Peak(PK) Average (AV)
TESTED BY	Jamison Chan		

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	95.77 PK			1.03 H	332	59.36	36.41
1	*2480.00	61.27 AV			1.03 H	332	24.86	36.41
2	2483.50	61.02 PK	74.00	-12.98	1.03 H	332	24.61	36.41
2	2483.50	46.00 AV	54.00	-8.00	1.03 H	332	9.59	36.41
3	4960.00	56.82 PK	74.00	-17.18	1.43 H	62	12.39	44.43
3	4960.00	22.32 AV	54.00	-31.68	1.43 H	62	-22.11	44.43

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	91.65 PK			1.19 V	226	55.24	36.41
1	*2480.00	57.15 AV			1.19 V	226	20.74	36.41
2	2483.50	61.14 PK	74.00	-12.86	1.19 V	226	24.73	36.41
2	2483.50	45.94 AV	54.00	-8.06	1.19 V	226	9.53	36.41
3	4960.00	55.91 PK	74.00	-18.09	1.56 V	247	11.48	44.43
3	4960.00	21.41 AV	54.00	-32.59	1.56 V	247	-23.02	44.43

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 DH3 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*3 per 247 ms per channel. Therefore, the duty cycle be equal to: 20log(1.875/100)= -34.5 dB
6. Average value = peak reading +20log(duty cycle)

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	FSP 40	100036	Mar. 16. 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

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.

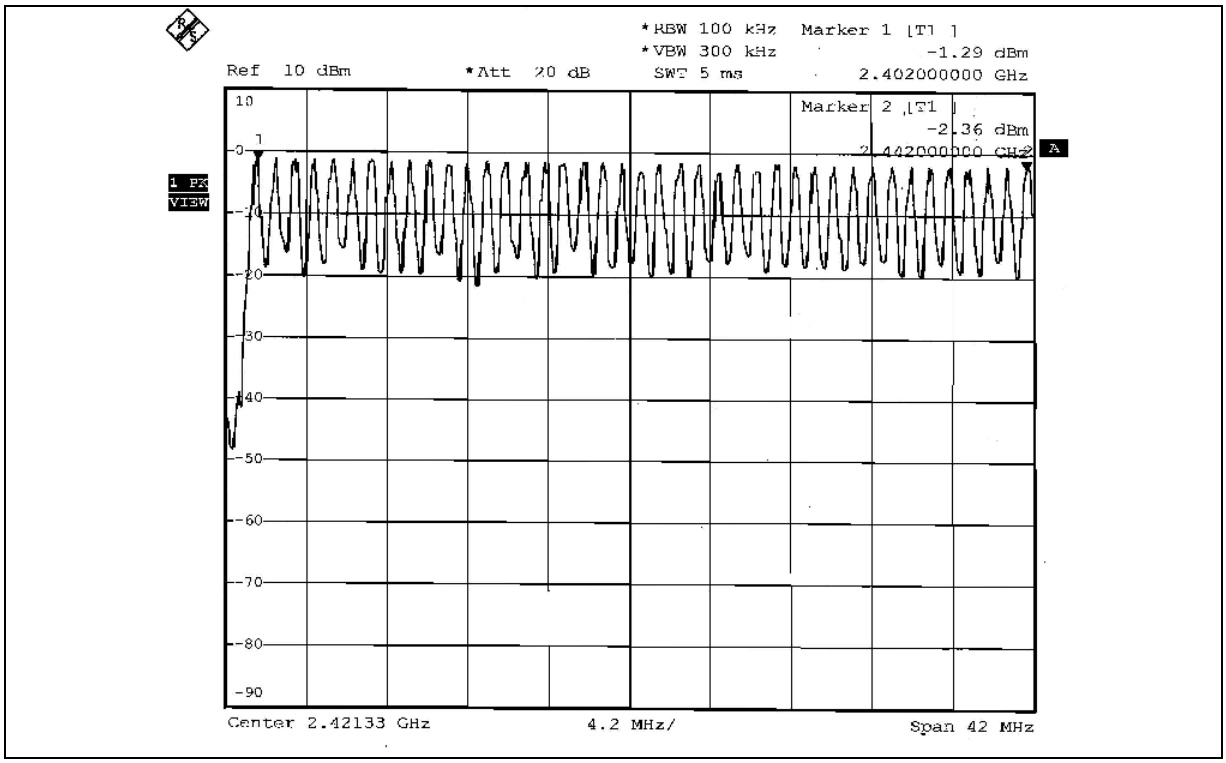
4.3.4 DEVIATION FROM TEST STANDARD

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 two pages for the test result. On the plots, it shows that the hopping frequencies are equally spaced.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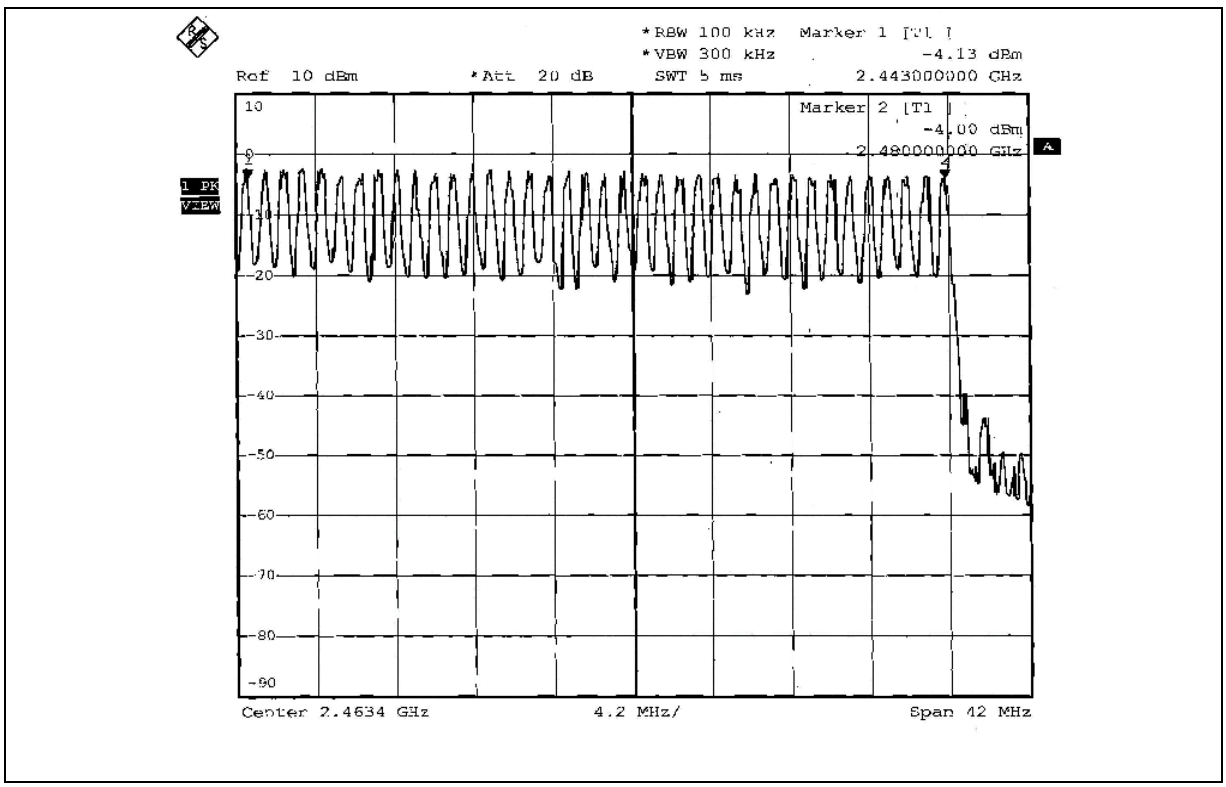
*VBW 300 kHz
Ref 10 dBm
*Att 20 dB
SWT 5 ms
Marker 1 [T1]
-1.29 dBm
2.402000000 GHz
Marker 2 [T1]
-2.36 dBm
2.442000000 GHz
1 PK
VIEW
A
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.42133 GHz
4.2 MHz/
Span 42 MHz


*RBW 100 kHz
*VBW 300 kHz
Ref 10 dBm
*Att 20 dB
SWT 5 ms
Marker 1 [T1]
-4.13 dBm
2.443000000 GHz
Marker 2 [T1]
-4.00 dBm
2.480000000 GHz
1 PK
VIEW
A
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.4634 GHz
4.2 MHz/
Span 42 MHz

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	FSP 40	100036	Mar. 16. 2007

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

4.4.3 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 different time-slot modes have been completed.

4.4.4 DEVIATION FROM TEST STANDARD

No deviation.

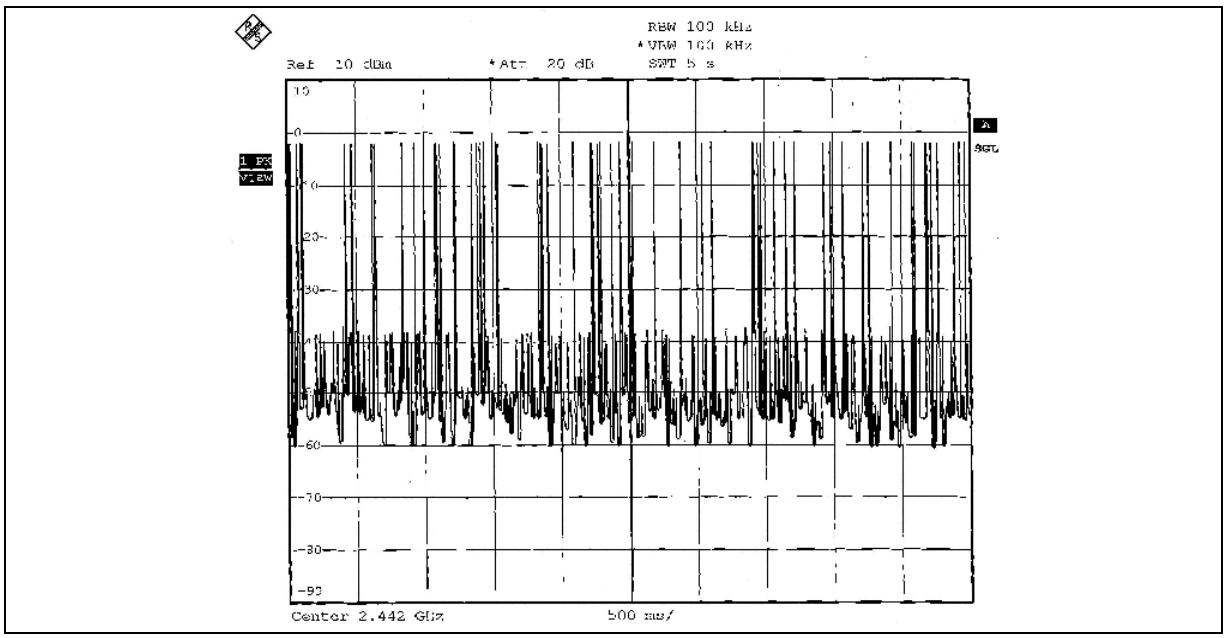
4.4.5 TEST SETUP

4.4.6 TEST RESULTS

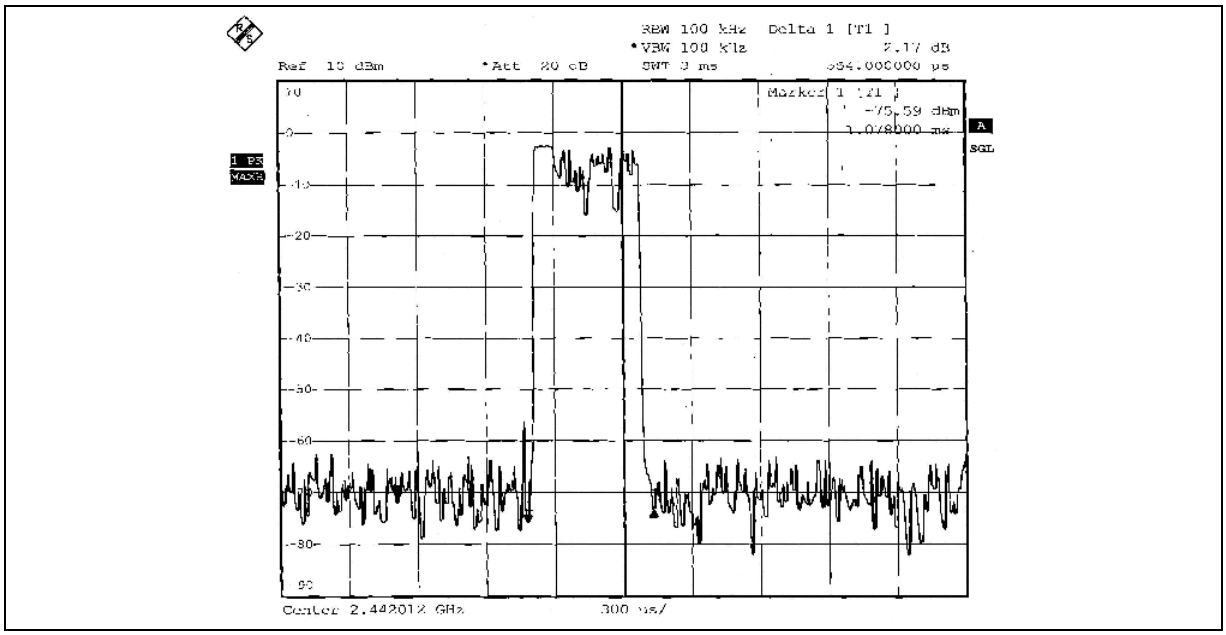
Mode	Number of transmission in a 31.6 (79Hopping*0.4)	Length of transmission time (msec)	Result (msec)	Limit (msec)
DH1	51 (times / 5 sec) *6.32=322.32 times	0.554	178.5653	400
DH3	24 (times / 5 sec) *6.32=151.68 times	1.760	266.9568	400

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

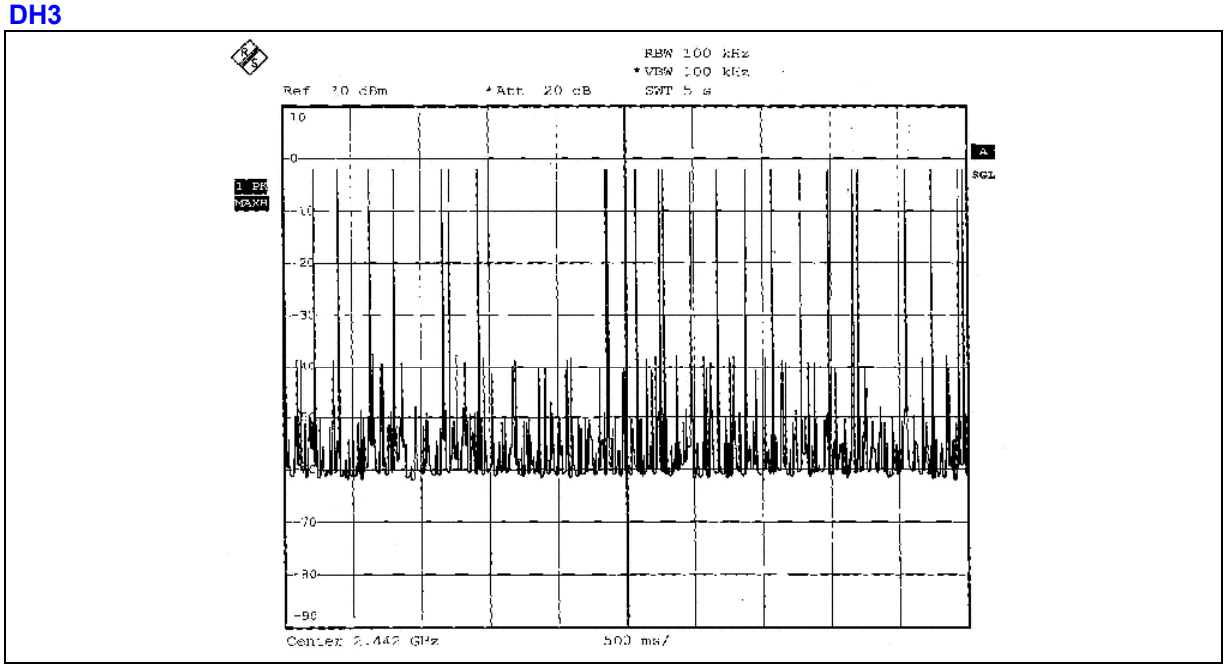
DH1


RBW 100 kHz
*VBW 100 kHz
Ref 10 dBm
*Att 20 dB
SWT 5 s
1 PK
VIEW
A
SGL
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.442 GHz
500 ms/

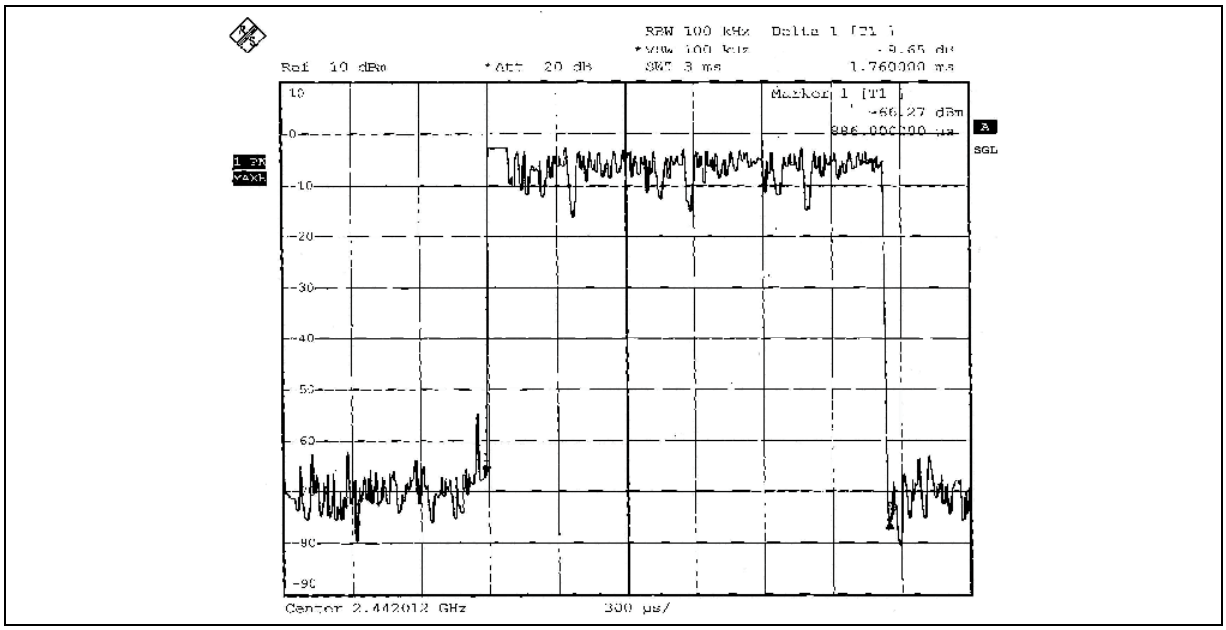
DH1


RBW 100 kHz
Delta 1 [T1]
*VBW 100 kHz
2.17 dB
Ref 10 dBm
*Att 20 dB
SWT 3 ms
954.000000 µs
Marker 1 [T1]
-75.59 dBm
1.0/8000 ms
1 PK
MAXH
A
SGL
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.442012 GHz
300 µs/

DH3


RBW 100 kHz
*VBW 100 kHz
Ref 10 dBm
*Att 20 dB
SWT 5 s
10
0
-10
-20
-30
-40
-70
-80
-90
1 PK
MAXH
A
SGL
Center 2.442 GHz
500 ms/

DH3


RBW 100 kHz
Delta 1 [T1]
*VBW 100 kHz
-9.65 dB
Ref 10 dBm
*Att 20 dB
SWT 3 ms
1.760000 ms
Marker 1 [T1]
+66.27 dBm
886.00000 µs
10
0
-10
-20
-30
-40
-50
-60
-80
-90
1 PK
MAXH
A
SGL
Center 2.442012 GHz
300 µs/

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, 20dBbandwidth of hopping channel shell be a minimum limit for the hopping channel separation.

4.5.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SPECTRUM ANALYZER	FSP 40	100036	Mar. 16. 2007

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

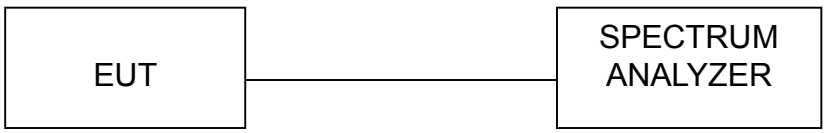
4.5.3 TEST PROCEDURE

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.

4.5.4 DEVIATION FROM TEST STANDARD

No deviation.

4.5.5 TEST SETUP



4.5.6 EUT OPERATING CONDITION

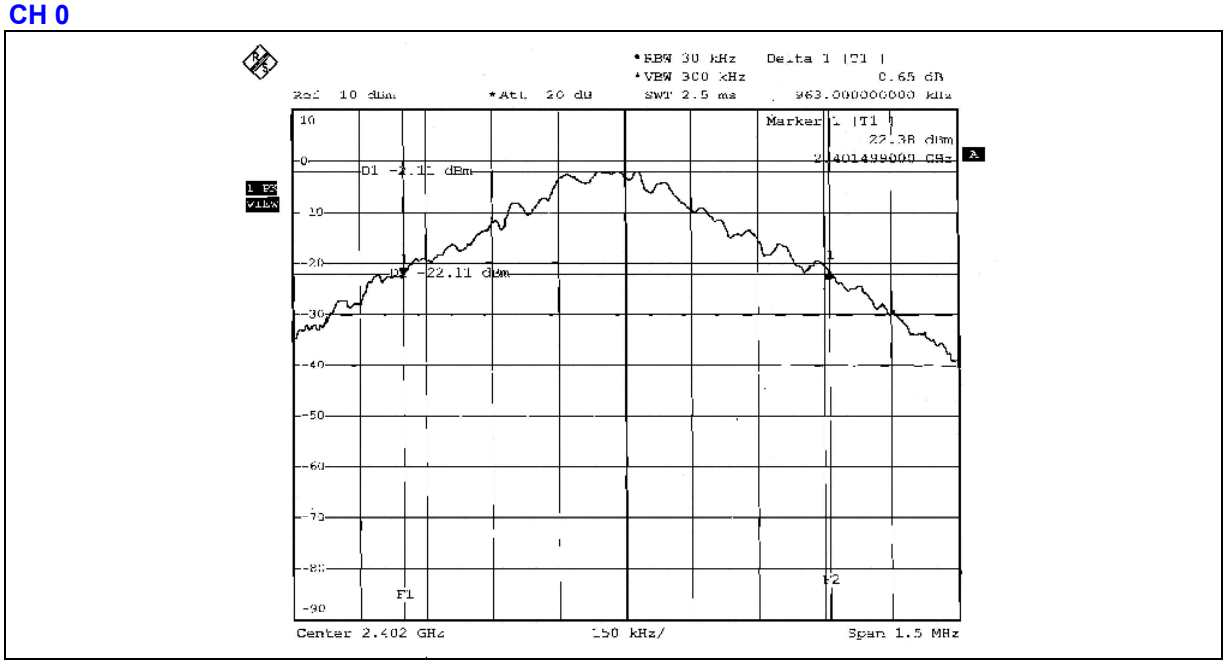
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.5.7 TEST RESULTS

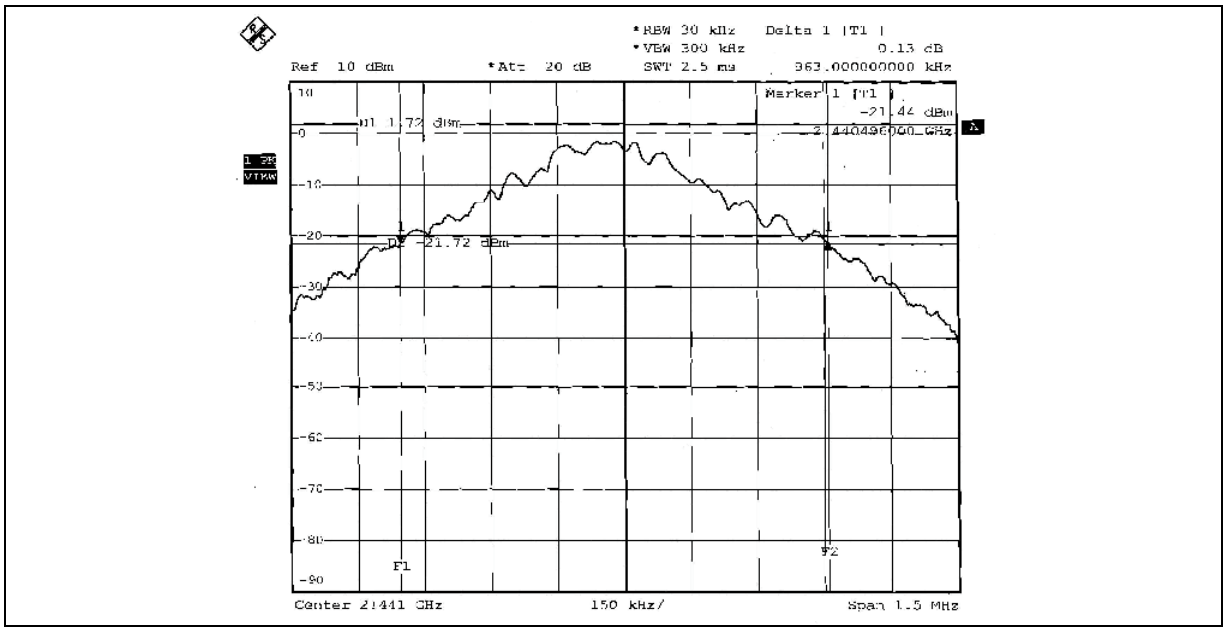
MODULATION TYPE	GFSK	CHANNEL	0, 39, 78
INPUT POWER	3.0Vdc	ENVIRONMENTAL CONDITIONS	26deg. C, 70%RH, 985hPa
TESTED BY	Jamison Chan		

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (MHz)
0	2402	0.963
39	2441	0.963
78	2480	0.957

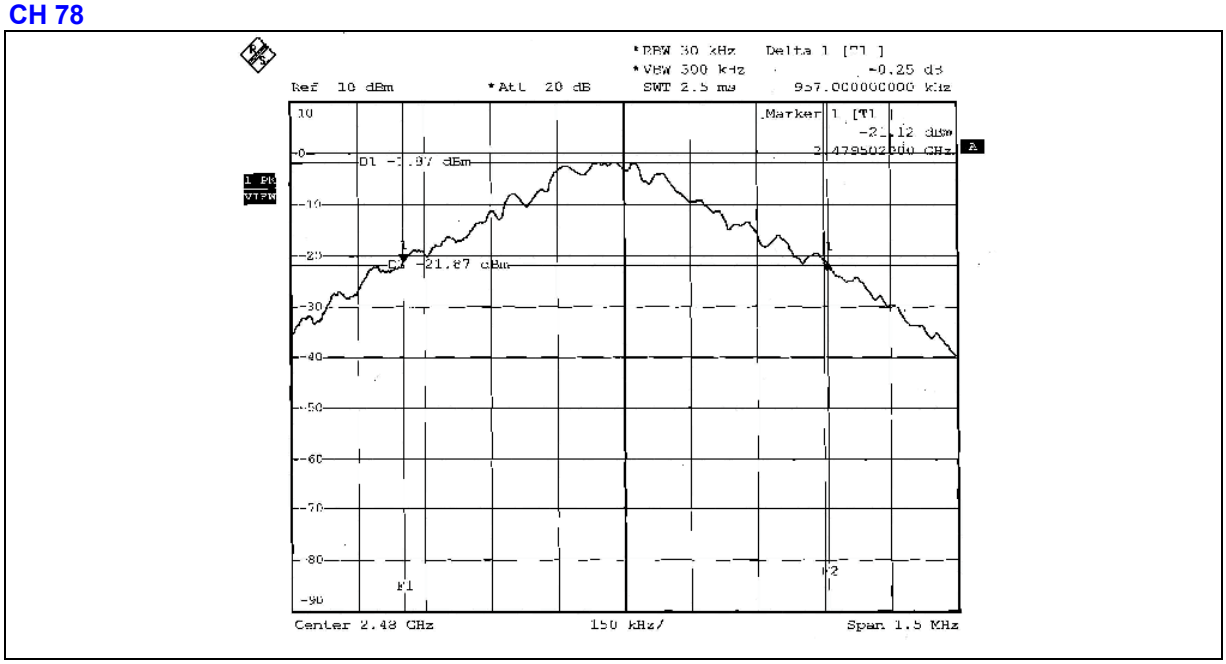
CH 0



CH 39


*RBW 30 kHz
*VBW 300 kHz
SWT 2.5 ms
Delta 1 [T1]
0.13 dB
363.000000000 kHz
Ref 10 dBm
*Att 20 dB
Marker 1 [T1]
-21.44 dBm
2.440496000 GHz
D1 1.72 dBm
D2 -21.72 dBm
F1
F2
Center 2.441 GHz
150 kHz/
Span 1.5 MHz

CH 78


*RBW 30 kHz
*VBW 300 kHz
SWT 2.5 ms
Delta 1 [T1]
-0.25 dB
957.000000000 kHz
Ref 10 dBm
*Att 20 dB
Marker 1 [T1]
-21.12 dBm
2.479502000 GHz
D1 -1.87 dBm
D2 -21.87 dBm
F1
F2
Center 2.48 GHz
150 kHz/
Span 1.5 MHz

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	FSP 40	100036	Mar. 16. 2007

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

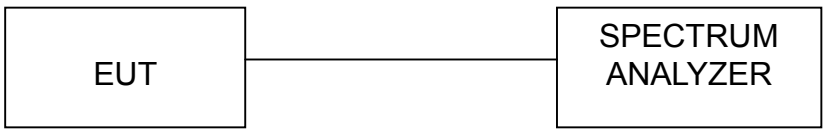
4.6.3 TEST PROCEDURES

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



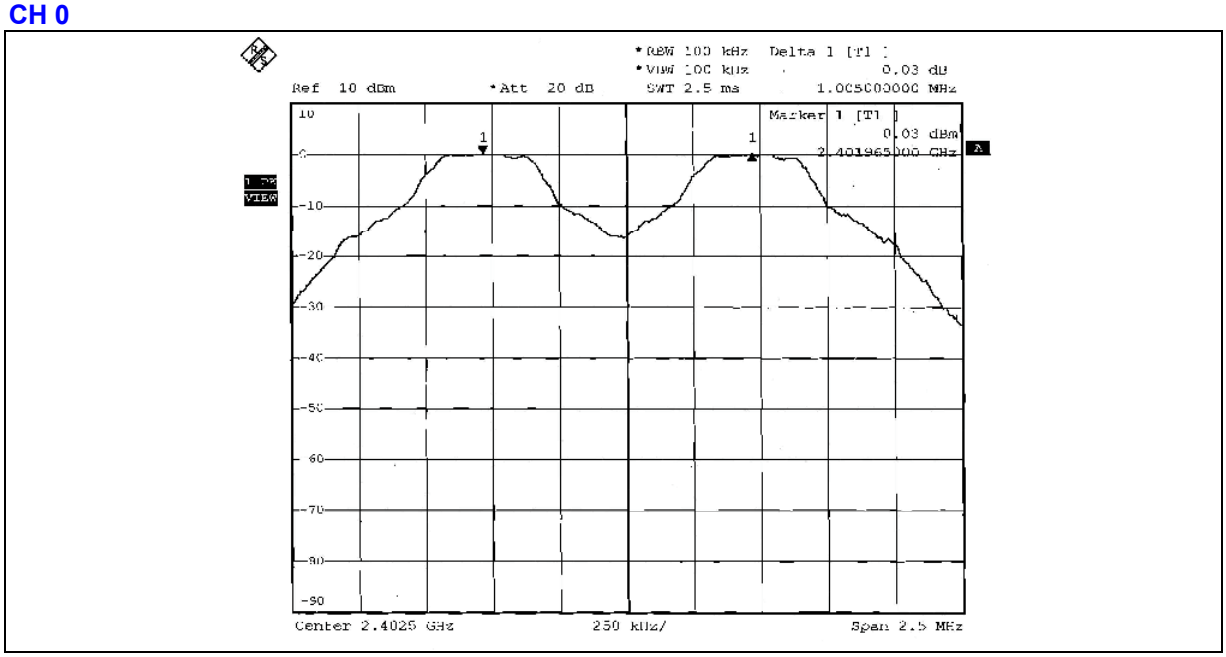
4.6.6 TEST RESULTS

MODULATION TYPE	GFSK	CHANNEL	0, 39, 78
INPUT POWER	3.0Vdc	ENVIRONMENTAL CONDITIONS	26deg. C, 70%RH, 985hPa
TESTED BY	Jamison Chan		

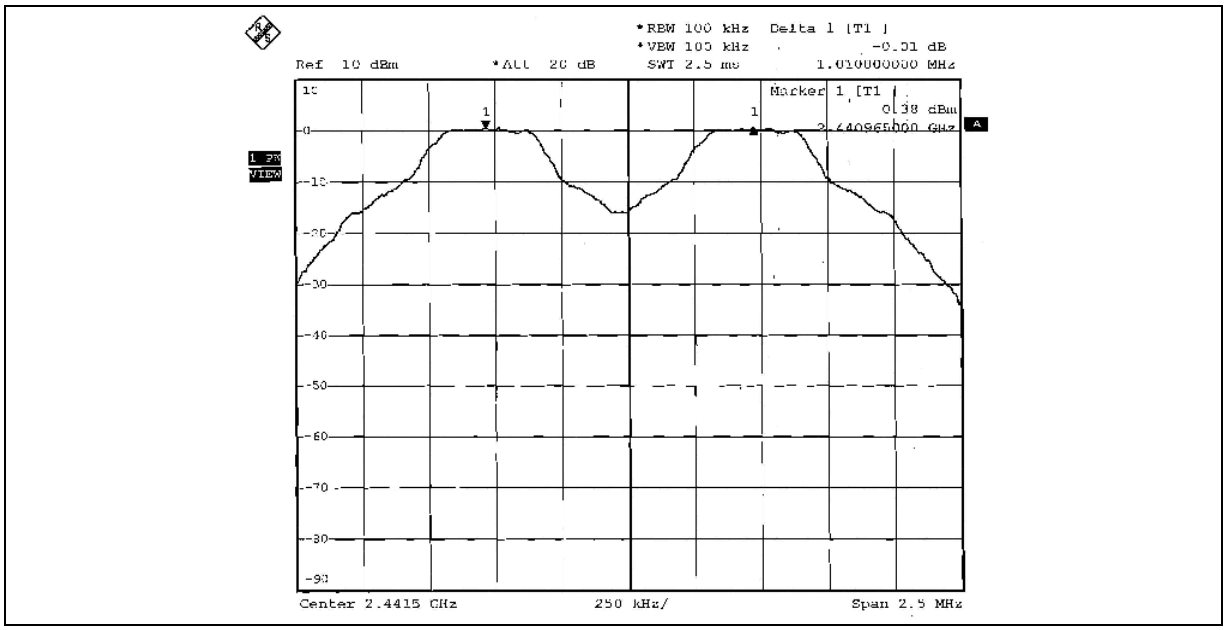
CHANNEL	FREQUENCY (MHz)	ADJACENT CHANNEL SEPARATION (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
0	2402	1.005	0.963	PASS
39	2441	1.010	0.963	PASS
78	2480	1.000	0.957	PASS

NOTE: The minimum limit is 20dB bandwidth. Test results please refer to following three plots.

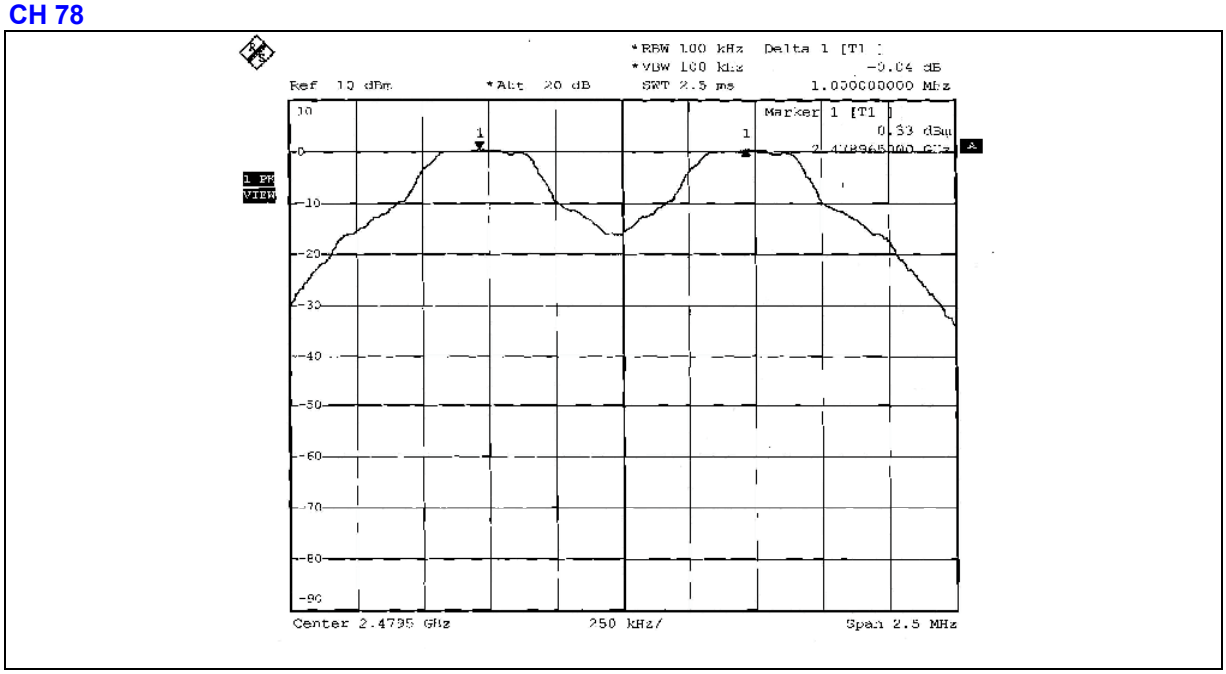
CH 0



CH 39


*RBW 100 kHz
*VBW 100 kHz
SWT 2.5 ms
Delta 1 [T1]
-0.31 dB
1.010000000 MHz
Ref 10 dBm
*Att 20 dB
Marker 1 [T1]
0.38 dBm
2.440965000 GHz
1 PK VIEW
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.4415 GHz
250 kHz/
Span 2.5 MHz

CH 78


*RBW 100 kHz
*VBW 100 kHz
SWT 2.5 ms
Delta 1 [T1]
-0.04 dB
1.000000000 MHz
Ref 10 dBm
*Att 20 dB
Marker 1 [T1]
0.33 dBm
1 PK VIEW
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 2.4795 GHz
250 kHz/
Span 2.5 MHz

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 INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SPECTRUM ANALYZER	FSP 40	100036	Mar. 16. 2007

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

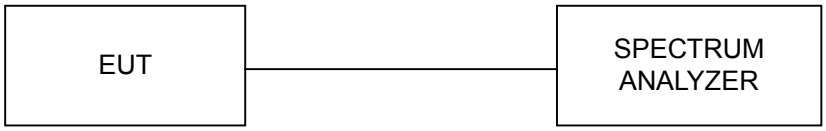
4.7.3 TEST PROCEDURES

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 3 MHz RBW and 10 MHz VBW.
4. Measure the captured power within the band and recoding the plot.
5. 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

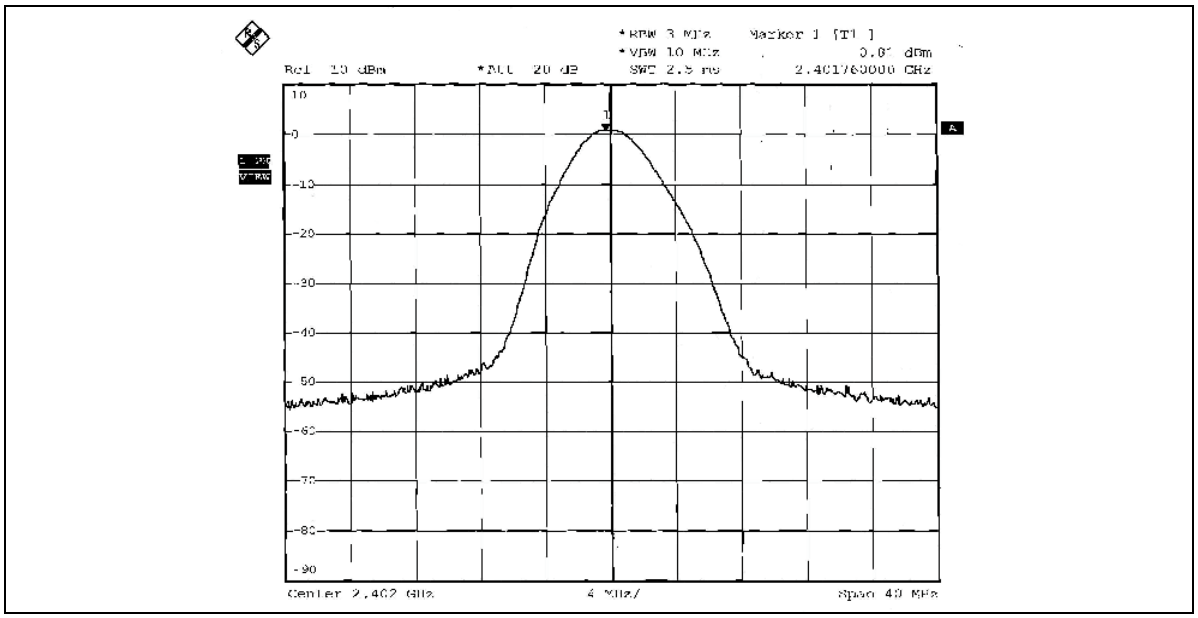
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.7.7 TEST RESULTS

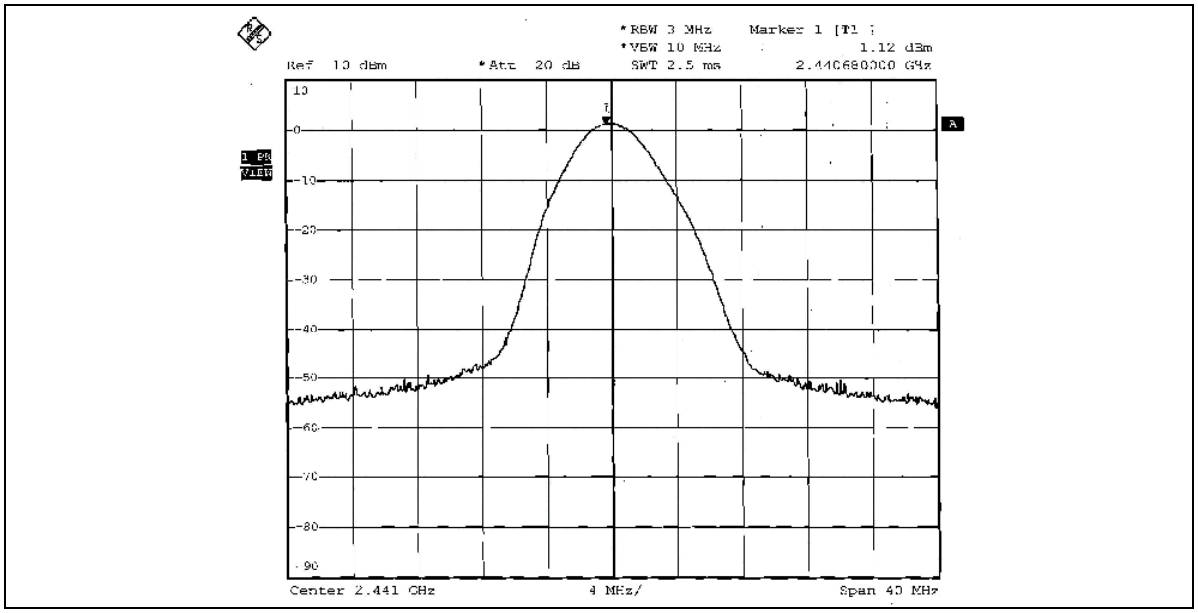
MODULATION TYPE	GFSK	CHANNEL	0, 39, 78
INPUT POWER	3.0Vdc	ENVIRONMENTAL CONDITIONS	26deg. C, 70%RH, 985hPa
TESTED BY	Jamison Chan		

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (mW)	PEAK POWER OUTPUT (dBm)	PEAK POWER LIMIT (dBm)	PASS/FAIL
0	2402	1.205	0.81	30	PASS
39	2441	1.294	1.12	30	PASS
78	2480	1.294	1.12	30	PASS

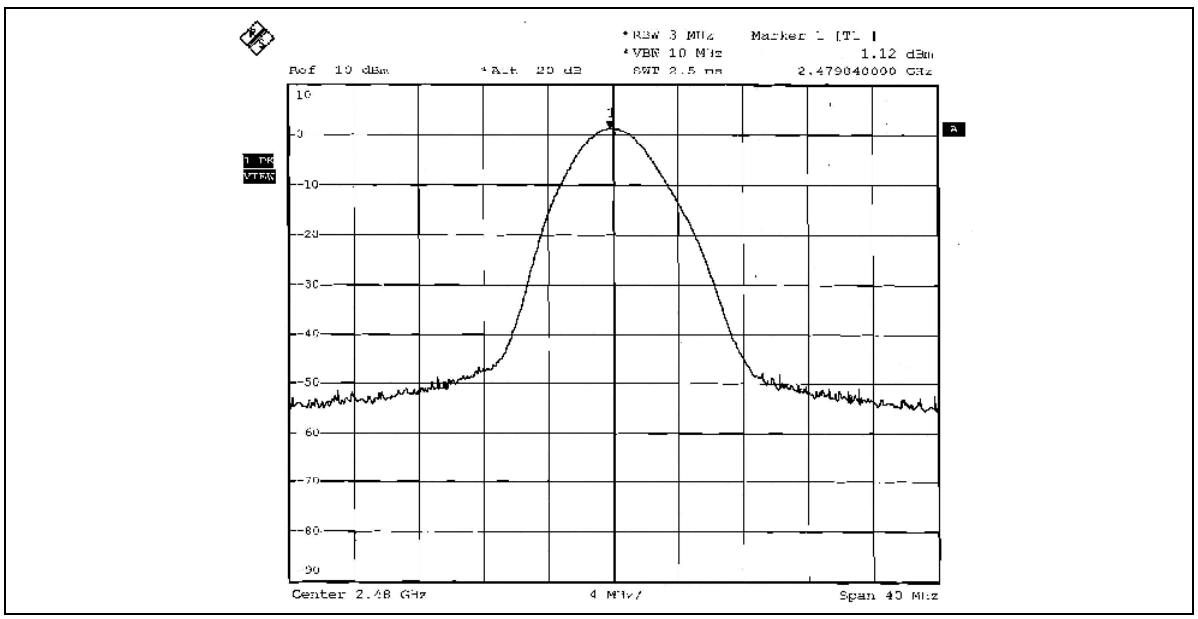
CH 0



CH 39


*RBW 3 MHz
*VBW 10 MHz
Marker 1 [T1]
1.12 dBm
Ref 10 dBm
*Att 20 dB
SWT 2.5 ms
2.440680000 GHz
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
1 PK
VIEW
A
Center 2.441 GHz
4 MHz/
Span 40 MHz

CH 78


*RBW 3 MHz
*VBW 10 MHz
Marker 1 [T1]
1.12 dBm
Ref 10 dBm
*Att 20 dB
SWT 2.5 ms
2.479040000 GHz
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
1 PK
VIEW
A
Center 2.48 GHz
4 MHz/
Span 40 MHz

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	FSP 40	100036	Mar. 16. 2007

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

4.8.3 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 and highest channel frequencies individually.

4.8.6 TEST RESULTS

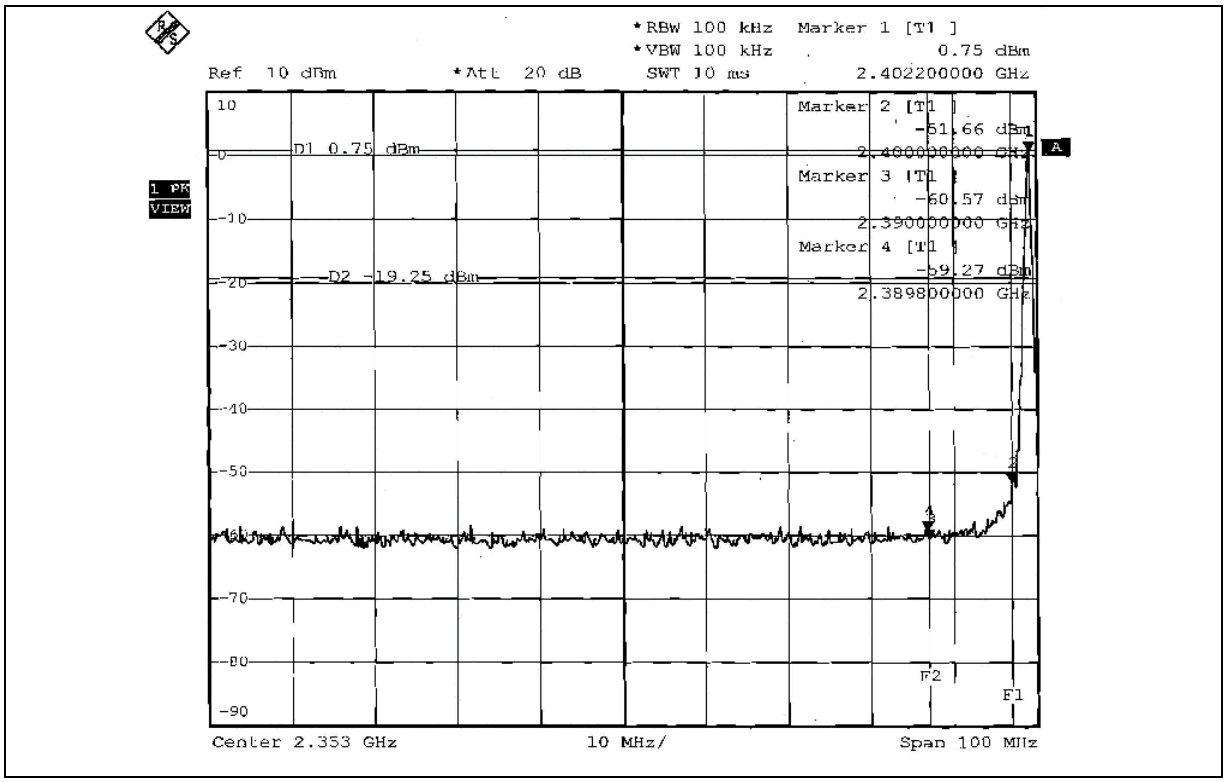
The spectrum plots are attached on the following 4 images. D1 line indicates the highest level, D2 line indicates the 20dB offset below D1. It shows compliance with the requirement in part 15.247(d).

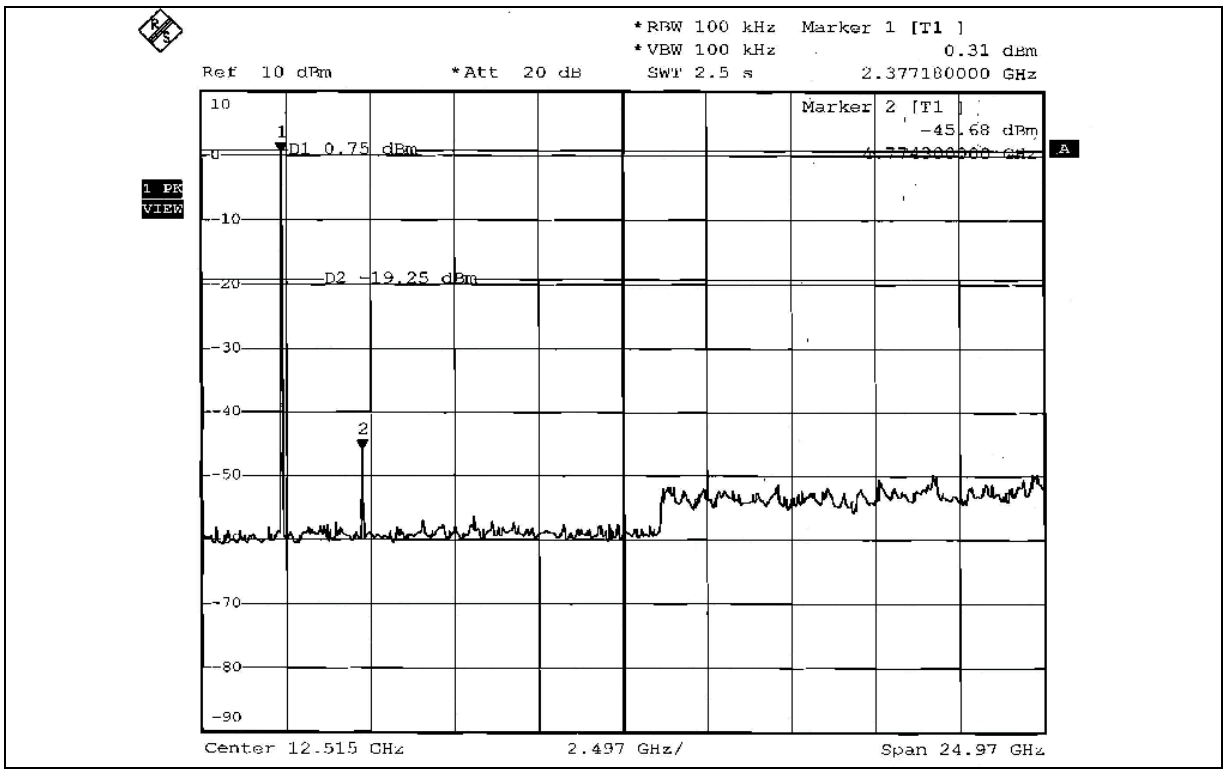
NOTE 1: The band edge emission plot on page 38 shows 60.02dBc between carrier maximum power and local maximum emission in restrict band (2.3898GHz). The emission of carrier strength list in the test result of channel 0 at the item 4.2.7 is 95.82dBuV/m (Peak), so the maximum field strength in restrict band is 95.82-60.02=35.80dBuV/m which is under 74 dBuV/m limit.

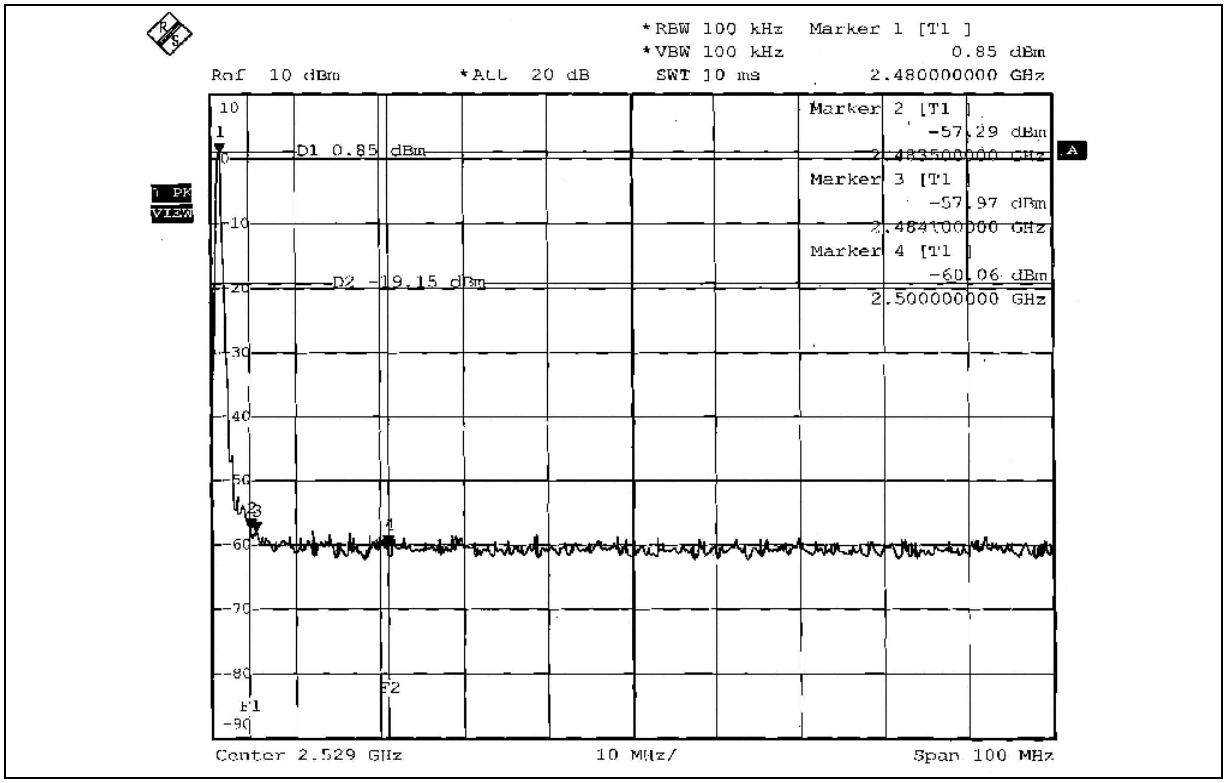
Average value = 35.80-34.5=1.3dBuV/m, which is under 54dBuV/m limit.
*The DH3 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625 * 3 per 247 ms per channel. Therefore, the duty cycle be equal to: 20log(1.875/100)= -34.5 dB.
Average value = peak reading – 34.5.

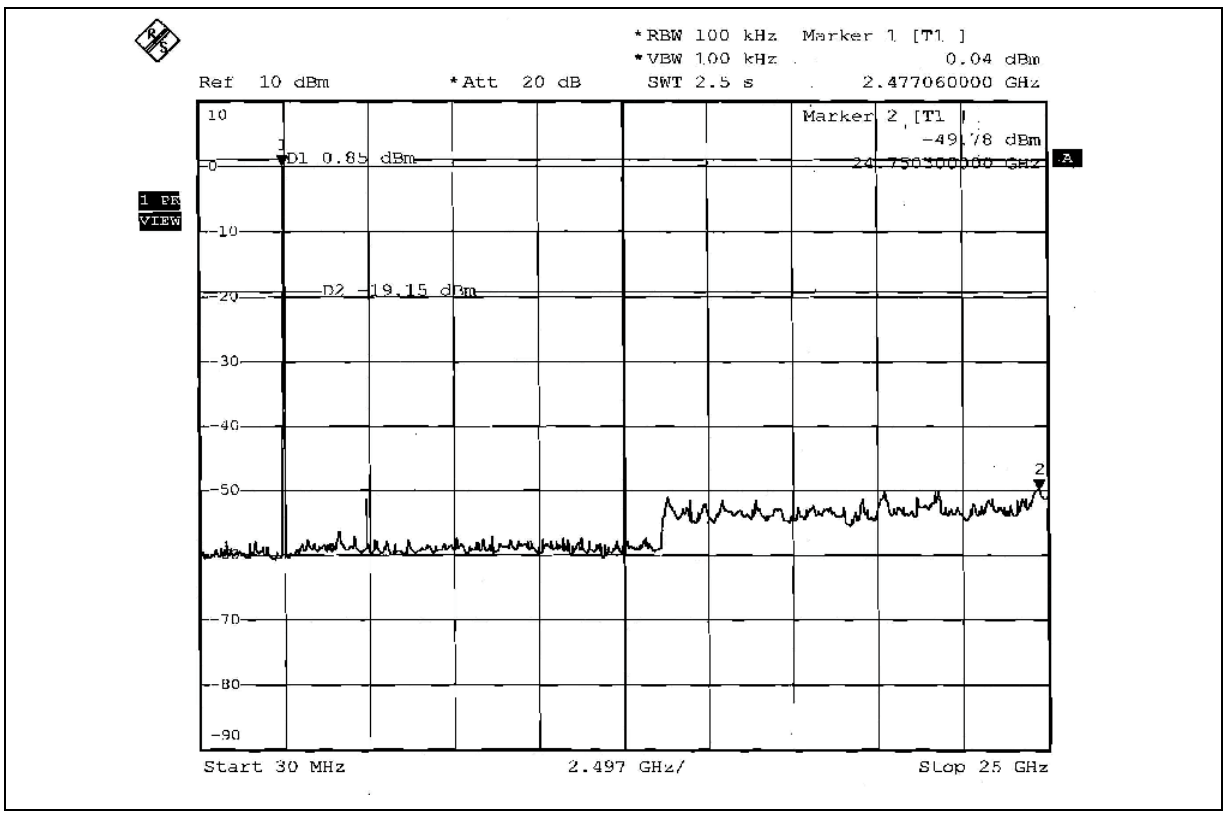
NOTE 2: The band edge emission plot on page 39 shows 58.14dBc between carrier maximum power and local maximum emission in restrict band (2.4835GHz). The emission of carrier strength list in the test result of channel 78 at the item 4.2.7 is 95.77dBuV/m (Peak), so the maximum field strength in restrict band is 95.77-58.14=37.63dBuV/m which is under 74 dBuV/m limit.

Average value = 37.63-34.5=3.13dBuV/m, which is under 54dBuV/m limit.
*The DH3 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 * 3 per 247 ms per channel. Therefore, the duty cycle be equal to: 20log(1.875/100)= -34.5 dB.
Average value = peak reading – 34.5.


*RBW 100 kHz
*VBW 100 kHz
SWT 10 ms
Marker 1 [T1]
0.75 dBm
2.402200000 GHz
Ref 10 dBm
*Att 20 dB
Marker 2 [T1]
-51.66 dBm
2.400000000 GHz
Marker 3 [T1]
-60.57 dBm
2.390000000 GHz
Marker 4 [T1]
-59.27 dBm
2.389800000 GHz
D1 0.75 dBm
D2 -19.25 dBm
1 PK
VIEW
A
F2
F1
Center 2.353 GHz
10 MHz/
Span 100 MHz


*RBW 100 kHz
*VBW 100 kHz
SWT 2.5 s
Marker 1 [T1]
0.31 dBm
2.377180000 GHz
Ref 10 dBm
*Att 20 dB
Marker 2 [T1]
-45.68 dBm
D1 0.75 dBm
D2 -19.25 dBm
1 PK
VIEW
A
Center 12.515 GHz
2.497 GHz/
Span 24.97 GHz


*RBW 100 kHz
*VBW 100 kHz
Ref 10 dBm
*ATT 20 dB
SWT 10 ms
Marker 1 [T1]
0.85 dBm
2.480000000 GHz
Marker 2 [T1]
-57.29 dBm
2.483500000 GHz
Marker 3 [T1]
-57.97 dBm
2.484100000 GHz
Marker 4 [T1]
-60.06 dBm
2.500000000 GHz
D1 0.85 dBm
D2 -19.15 dBm
1 PK
VIEW
Center 2.529 GHz
10 MHz/
Span 100 MHz


*RBW 100 kHz
*VBW 100 kHz
Ref 10 dBm
*Att 20 dB
SWT 2.5 s
Marker 1 [T1]
0.04 dBm
2.477060000 GHz
Marker 2 [T1]
-49.78 dBm
2.750300000 GHz
D1 0.85 dBm
D2 -19.15 dBm
1 PK
VIEW
Start 30 MHz
2.497 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 Printed antenna without antenna connector, and the maximum gain of this antenna is 0dBi.

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, 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.