FCC TEST REPORT

REPORT NO.: RF931122H02
MODEL NO.: MDCBTASC32, MDCBTACC32
RECEIVED: Nov. 22, 2004
TESTED: Dec. 03 to 13, 2004

APPLICANT: BILLIONTON SYSTEMS INC

ADDRESS: No.21, Sui-Lih Rd., Hsin-Chu, 300, Taiwan

ISSUED BY: Advance Data Technology Corporation

LAB LOCATION: No. 81-1, Lu Liao Keng, 9 Ling, Wu Lung Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien, Taiwan, R.O.C.

0536
ILAC MRA

No. 2177-01

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1 CERTIFICATION

PRODUCT :	Bluetooth + MDC Modem Card
BRAND NAME :	Billionton
MODEL NO. :	MDCBTASC32, MDCBTACC32
APPLICANT :	BILLIONTON SYSTEMS INC
TESTED DATE:	Dec. 03 to 13, 2004
TEST ITEM :	ENGINEERING SAMPLE
STANDARDS :	FCC Part 15, Subpart C (Section 15.247), ANSI C63.4-2003

The above equipment (Model: MDCBTASC32) 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 : Midoli Peng , **DATE:** Dec. 16, 2004
(Midoli Peng)

TECHNICAL ACCEPTANCE : Hank Chung , **DATE:** Dec. 16, 2004
Responsible for RF
(Hank Chung)

APPROVED BY : , **DATE:** Dec. 16, 2004
(Eric Lin, Manager)

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 –10.58dB at 0.400 MHz
15.247(a)(1)(I)-(ii)	Number of Hopping Frequency Used Spec.: At least 15 channels	PASS	Meet the requirement of limit
15.247(a)(1)(ii)	Dwell Time on Each Channel Spec. : Max. 0.4 second within 31.6 second	PASS	Meet the requirement of limit
15.247(a)(1)(I)-(ii)	Hopping Channel Separation Spec. : Min. 25 kHz or 20 dB bandwidth, which ever is greater	PASS	Meet the requirement of limit
15.247(a)(2)	Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System Spec.: Max. 1 MHz	PASS	Meet the requirement of limit
15.247(b)	Maximum Peak Output Power Spec.: max. 30dBm	PASS	Meet the requirement of limit
15.247(c)	Transmitter Radiated Emissions Spec.: Table 15.209	PASS	Meet the requirement of limit Minimum passing margin is –10.9dB at 2486.0MHz
15.247(c)	Band Edge Measurement	PASS	Meet the requirement of limit

3 GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Bluetooth + MDC Modem Card
MODEL NO.	MDCBTASC32, MDCBTACC32
POWER SUPPLY	3.3Vdc from host equipment
MODULATION TYPE	FHSS
MODULATION TECHNOLOGY	GFSK
FREQUENCY RANGE	2400MHz ~ 2483.5MHz
NUMBER OF CHANNEL	79
OUTPUT POWER	4.36dBm
ANTENNA TYPE	PIFA antenna with –0.5dBi antenna gain
DATA CABLE	NA
I/O PORTS	NA
ASSOCIATED DEVICES	NA

NOTE:

1. Bluetooth technology is used for the EUT.
2. The EUT has two model names which are identical to each other in all aspects except for the followings:

Brand	**Model No.**	**Note**
Billionton	MDCBTASC32	For different customer's need
Billionton	MDCBTACC32	

From the above models, model: **MDCBTASC32** was selected as representative model for the test and its data was recorded in this report.

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

3.2 DESCRIPTION OF TEST MODES

Seventy-nine 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		

NOTE:

1. Below 1 GHz, the channel 0, 39, and 78 were pre-tested in chamber. The channel 78, worst case one, was chosen for final test.
2. Above 1 GHz, the channel 0, 39, and 78 were tested individually.

3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a Bluetooth + MDC Modem Card. 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

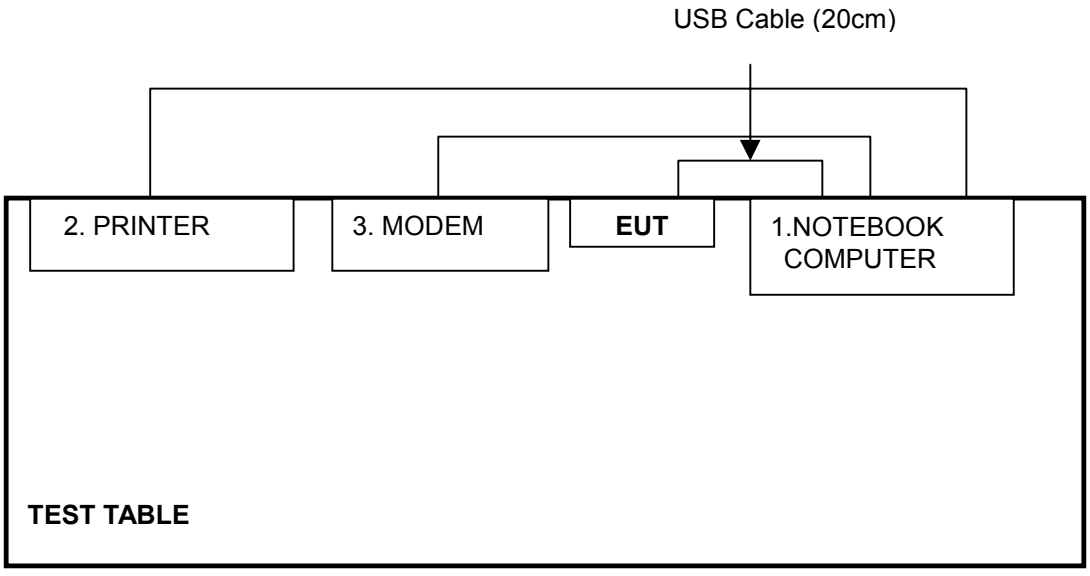
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

No.	Product	Brand	Model No.	Serial No.	FCC ID
1	NOTEBOOK COMPUTER	Dell	PP01L	TW-0791UH-12800-0CK-3735	DoC
2	PRINTER	HP	C2642A	MY79F1C3MZ	NA
3	MODEM	ACEEX	1414	0206026779	IFAXDM1414

No.	Signal cable description
1	NA
2	1.6 m braid shielded wire, terminated with DB25 and Centronics connector via metallic frame, w/o core
3	1.1 m braid shielded wire, terminated with DB25 and DB9 connector via metallic frame, w/o core.

Note: 1. All power cords of the above support units are unshielded (1.8m).

3.5 CONFIGURATION OF SYSTEM UNDER TEST



NOTE:

1. Please refer to the photos of test configuration in Item 5 also.

4 TEST PROCEDURES AND RESULTS

4.1 CONDUCTED EMISSION MEASUREMENT

4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

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

Notes:

1. The lower limit shall apply at the transition frequencies.
2. 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
*ROHDE & SCHWARZ Test Receiver	ESCS 30	847124/029	Dec. 07, 2005
*ROHDE & SCHWARZ LISN (for EUT)	ESHS-Z5	848773/004	Nov. 08, 2005
*KYORITSU LISN (for peripheral)	KNW-407	8/1395/12	Jul. 23, 2005
*RF Cable (JETBAO)	RG233/U	Cable_CA_01	Jul. 02, 2005
*Terminator(for KYORITSU)	50	3	May 10, 2005
*Software	Cond-V2e	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 ADT Shielded Room No. A.
3 The VCCI Con A Registration No. is C-817.
4 * = These equipment are used for the final measurement.
5 The measurement uncertainty is 2.53 dB, which is calculated as per the document CISPR 16-4

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.

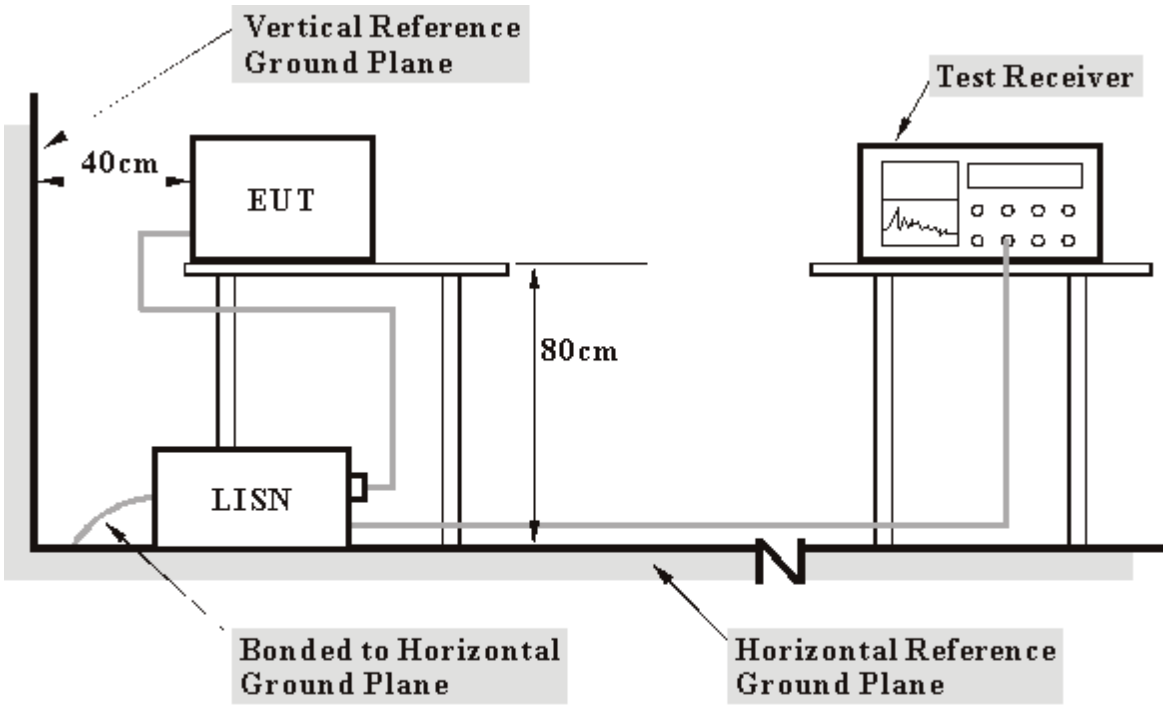
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

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) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

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

4.1.6 EUT OPERATING CONDITIONS

a. Plug the EUT into the support unit 1 (Notebook computer) which placed on a testing table.

b. The support unit 1 (Notebook computer) ran a test program “Blue test .exe” to enable EUT under transmission condition continuously at specific channel frequency.

c. Notebook computer sends "H" messages to modem.

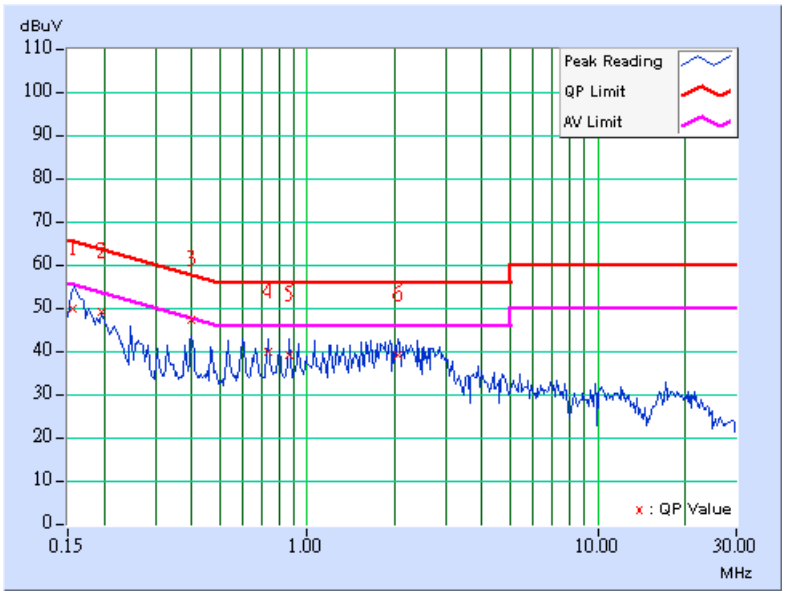
d. Notebook computer sends "H" messages to printer, and the printer prints them on paper.

4.1.7 TEST RESULTS

EUT	Bluetooth + MDC Modem Card	**MODEL**	MDCBTASC32
CHANNEL	78	**6dB BANDWIDTH**	9 kHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	**PHASE**	Line (L)
ENVIRONMENTAL CONDITIONS	25 deg. C, 70%RH, 979 hPa	**TESTED BY**	Phoenix Huang

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.156	0.31	49.31	-	49.62	-	65.66	55.66	-16.04	-
2	0.197	0.31	48.60	-	48.91	-	63.74	53.74	-14.83	-
3	**0.400**	**0.33**	**46.94**	**-**	**47.27**	**-**	**57.85**	**47.85**	**-10.58**	**-**
4	0.732	0.38	39.50	-	39.88	-	56.00	46.00	-16.12	-
5	0.869	0.40	38.54	-	38.94	-	56.00	46.00	-17.06	-
6	2.064	0.54	38.74	-	39.28	-	56.00	46.00	-16.72	-

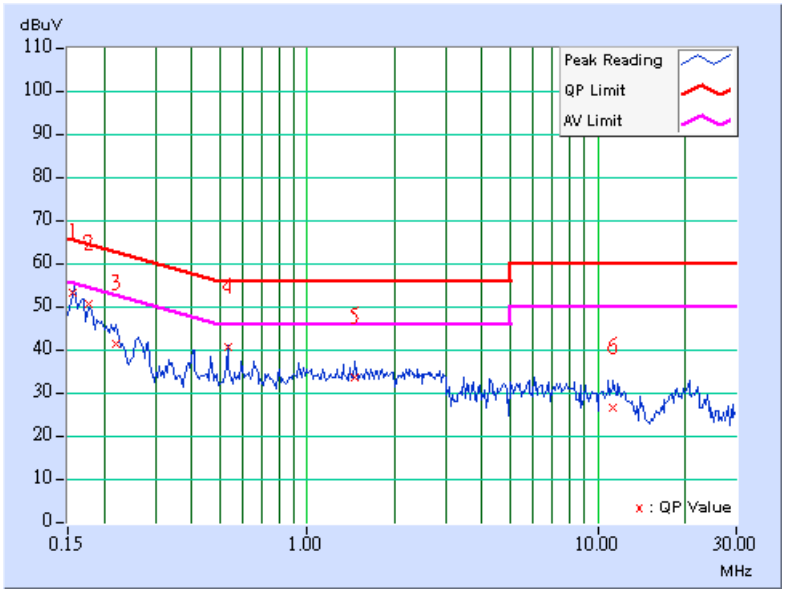
REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission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



EUT	Bluetooth + MDC Modem Card	**MODEL**	MDCBTASC32
CHANNEL	78	**6dB BANDWIDTH**	9 kHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	**PHASE**	Neutral (N)
ENVIRONMENTAL CONDITIONS	25 deg. C, 70%RH, 979 hPa	**TESTED BY**	Phoenix Huang

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.156	0.31	52.25	-	52.56	-	65.65	55.65	-13.10	-
2	0.177	0.31	49.33	-	49.64	-	64.62	54.62	-14.98	-
3	0.220	0.31	40.16	-	40.47	-	62.81	52.81	-22.34	-
4	0.533	0.35	39.54	-	39.89	-	56.00	46.00	-16.11	-
5	1.463	0.47	32.45	-	32.92	-	56.00	46.00	-23.08	-
6	11.344	1.24	25.26	-	26.50	-	60.00	50.00	-33.50	-

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 NUMBER OF HOPPING FREQUENCY USED

4.2.1 LIMIT OF HOPPING FREQUENCY USED

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

4.2.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
R&S SPECTRUM ANALYZER	FSP40	100037	May. 06, 2005

Note:

1. The measurement uncertainty is 226Hz,which is calculated as per the document ETSI TR 100 028.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

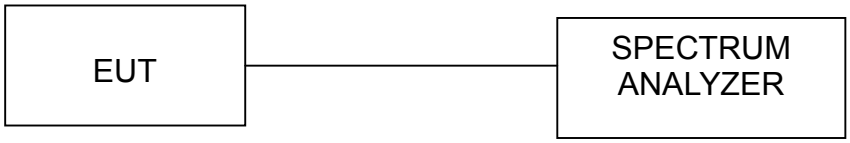
4.2.3 TEST PROCEDURES

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

4.2.4 DEVIATION FROM TEST STANDARD

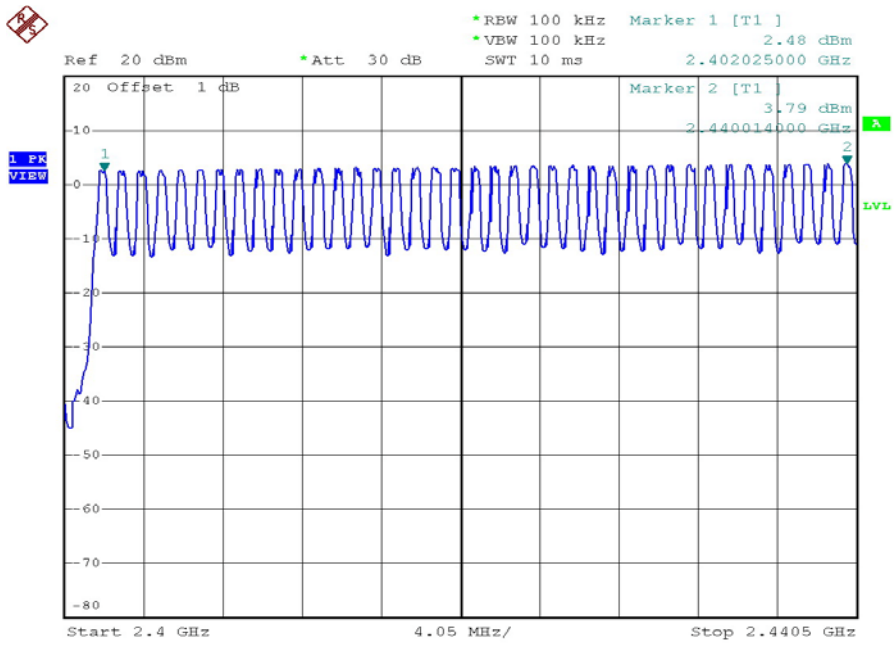
No deviation

4.2.5 TEST SETUP

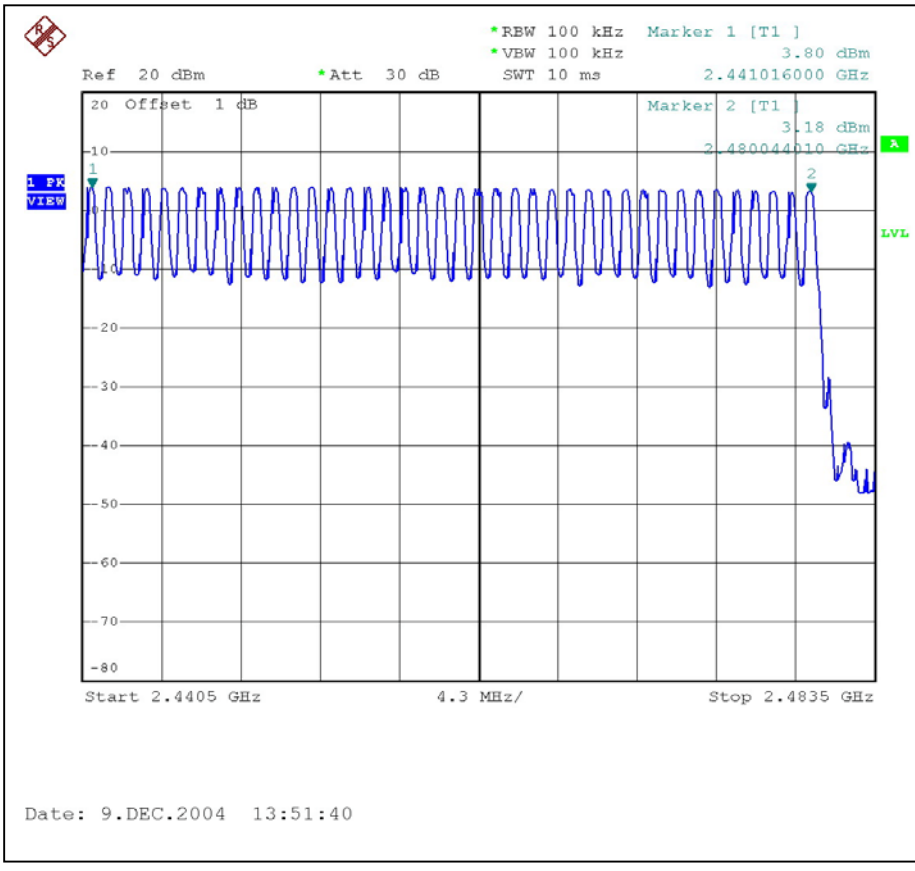


4.2.6 TEST RESULTS

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



Date: 9.DEC.2004 13:36:31



Date: 9.DEC.2004 13:51:40

4.3 DWELL TIME ON EACH CHANNEL

4.3.1 LIMIT OF DWELL TIME USED

For FHSS, the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 31.6 second period. For hybrid systems, the average time of occupancy on any frequency should not exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4.

4.3.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
R&S SPECTRUM ANALYZER	FSP40	100037	May. 06, 2005

Note:

1. The measurement uncertainty is 226Hz,which is calculated as per the document ETSI TR 100 028.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.3.3 TEST PROCEDURES

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

4.3.4 DEVIATION FROM TEST STANDARD

No deviation

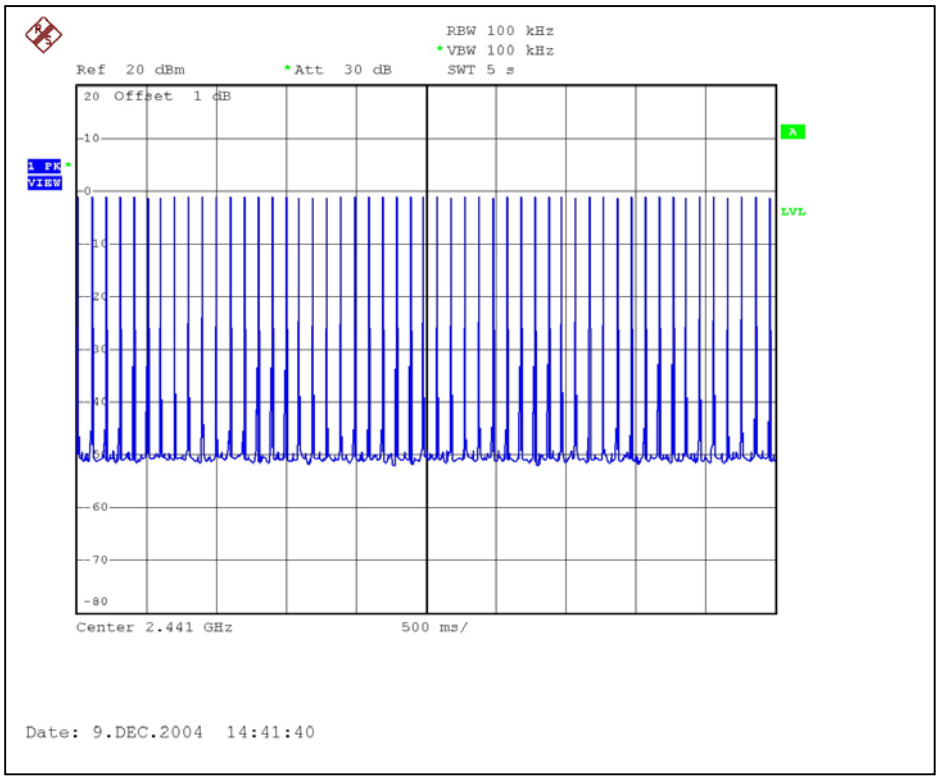
4.3.5 TEST SETUP

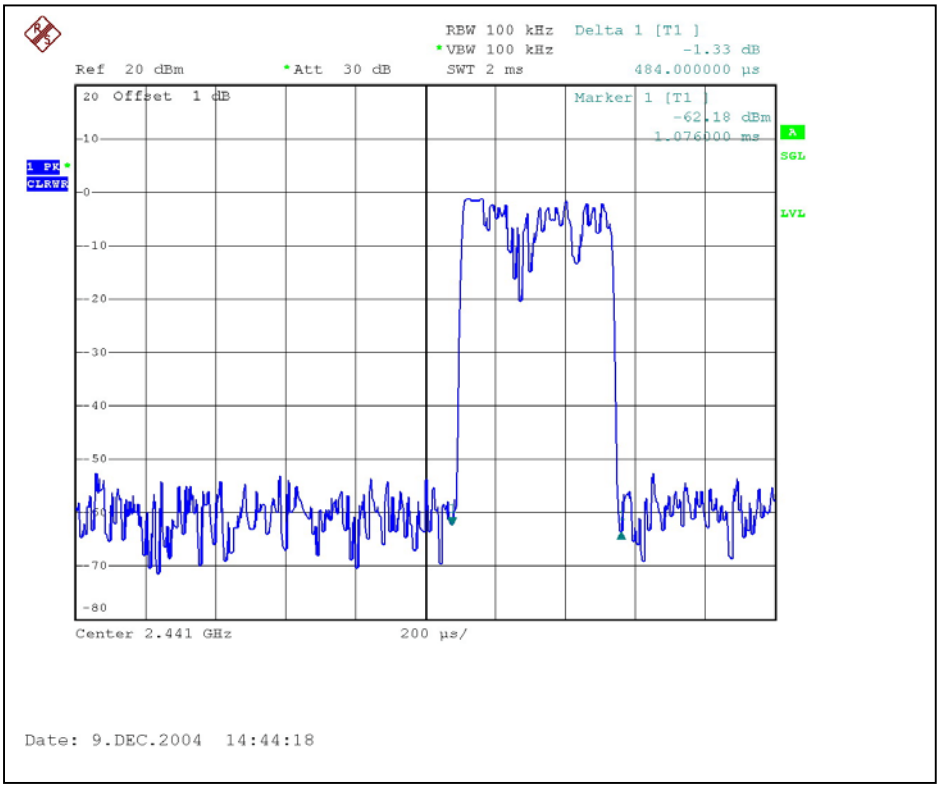
4.3.6 TEST RESULTS

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	0.484	156.00	400
DH3	25 (times / 5 sec) *6.32=158.00 times	1.740	274.92	400
DH5	17 (times / 5 sec) *6.32=107.44 times	2.980	320.17	400

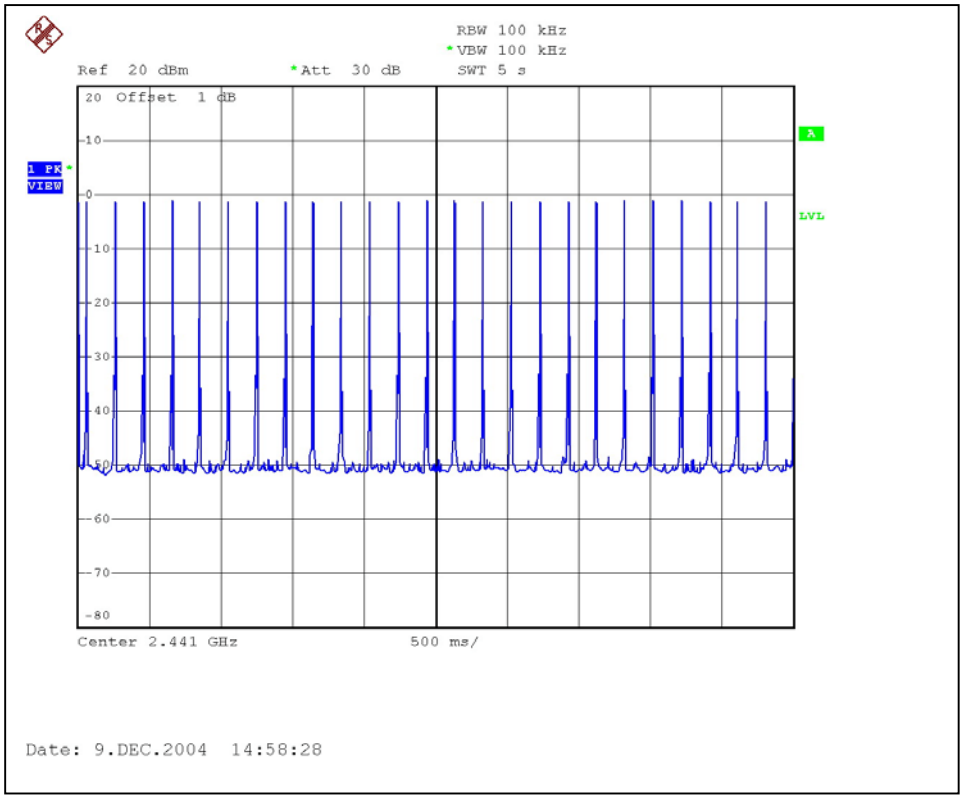
Test plots of the transmitting time slot are shown on next six pages.

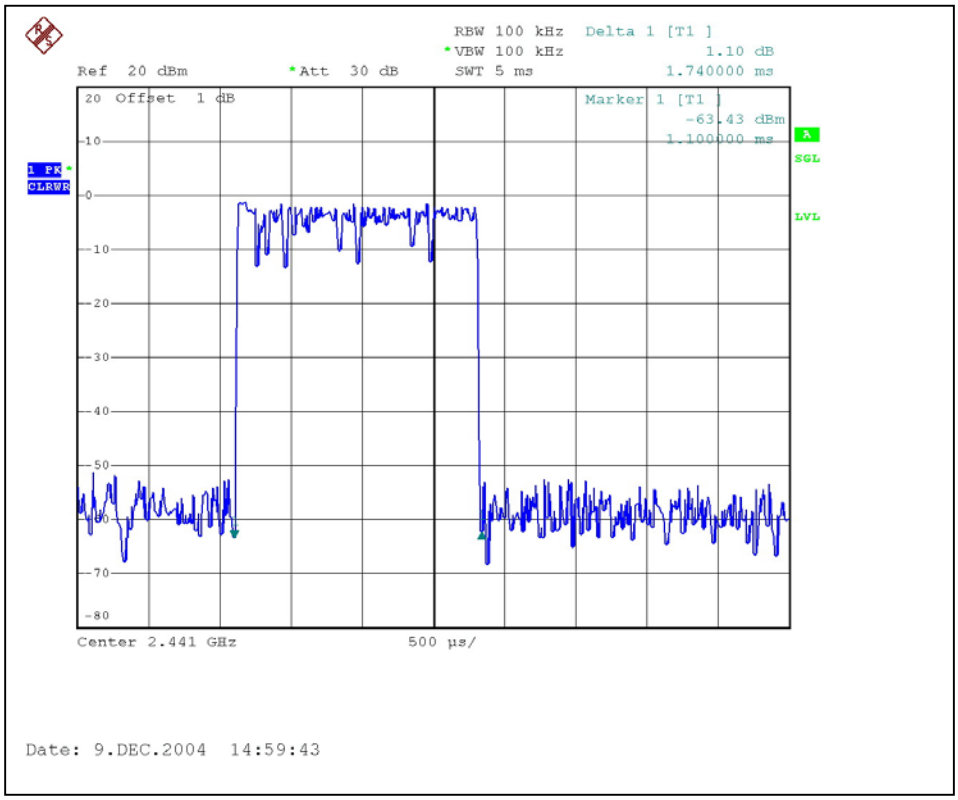
DH1


RBW 100 kHz
*VBW 100 kHz
Ref 20 dBm
*Att 30 dB
SWT 5 s
20 Offset 1 dB
1 PK VIEW
A
LVL
Center 2.441 GHz
500 ms/
Date: 9.DEC.2004 14:41:40

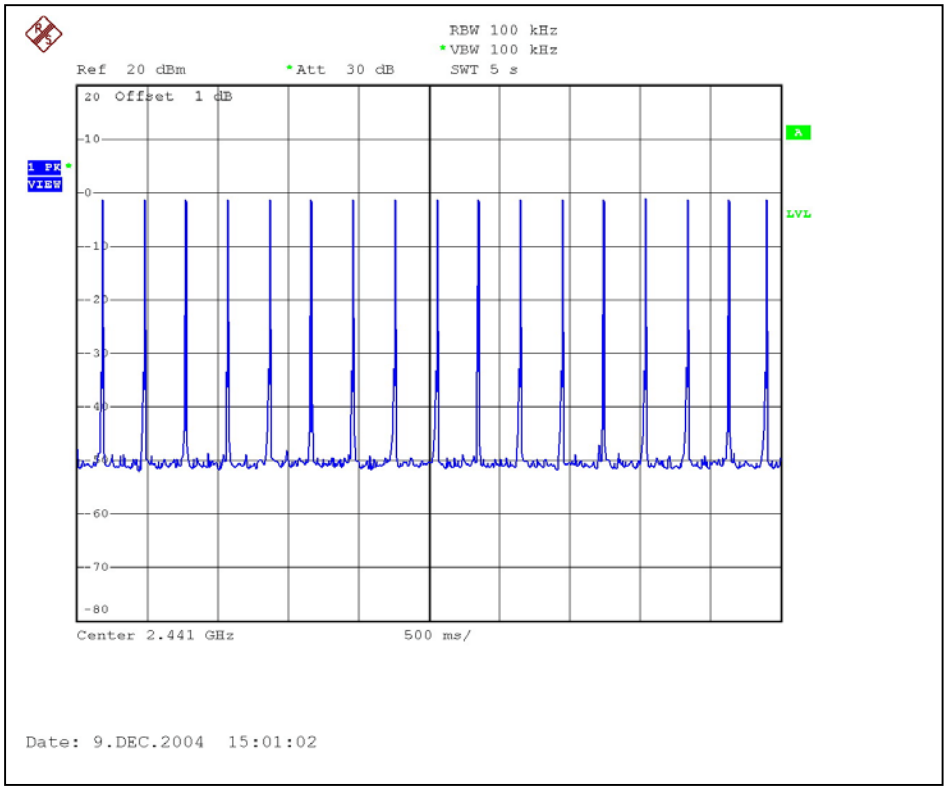

RBW 100 kHz
Delta 1 [T1]
*VBW 100 kHz
-1.33 dB
Ref 20 dBm
*Att 30 dB
SWT 2 ms
484.000000 µs
20 Offset 1 dB
Marker 1 [T1]
-62.18 dBm
1.076000 ms
1 PK CLRWR
A
SGL
LVL
Center 2.441 GHz
200 µs/
Date: 9.DEC.2004 14:44:18

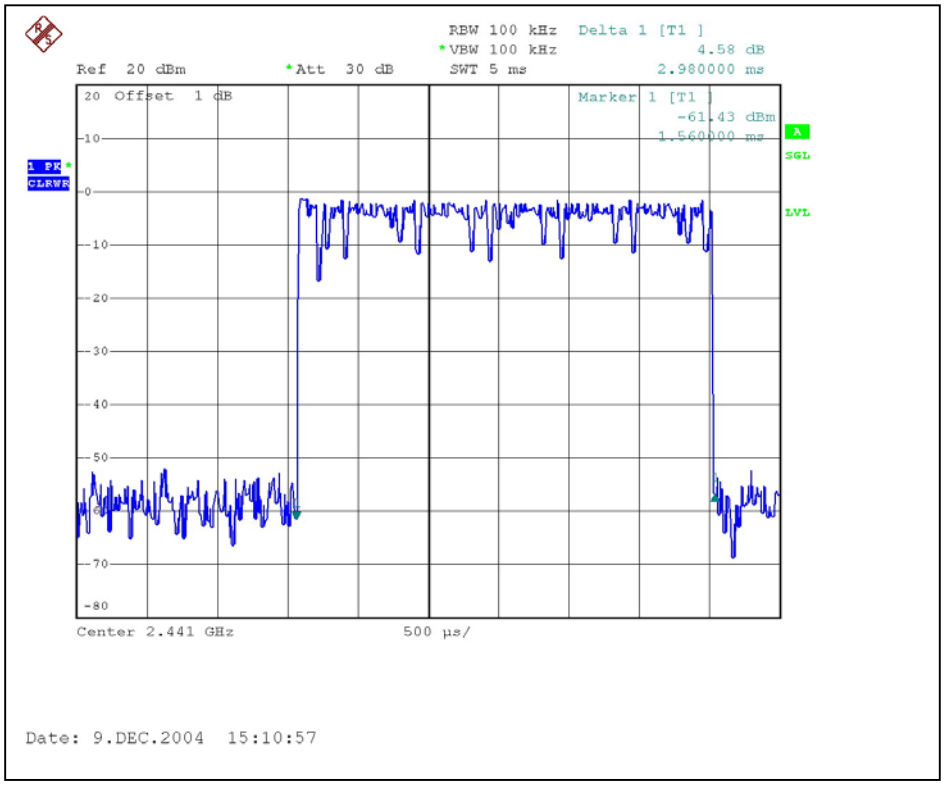
DH3


RBW 100 kHz
*VBW 100 kHz
Ref 20 dBm
*Att 30 dB
SWT 5 s
20 Offset 1 dB
1 PK
VIEW
A
LVL
Center 2.441 GHz
500 ms/
Date: 9.DEC.2004 14:58:28


RBW 100 kHz
Delta 1 [T1]
*VBW 100 kHz
1.10 dB
Ref 20 dBm
*Att 30 dB
SWT 5 ms
1.740000 ms
20 Offset 1 dB
Marker 1 [T1]
-63.43 dBm
1.100000 ms
1 PK
CLRWR
A
SGL
LVL
Center 2.441 GHz
500 µs/
Date: 9.DEC.2004 14:59:43

DH5


RBW 100 kHz
VBW 100 kHz
Ref 20 dBm
Att 30 dB
SWT 5 s
20 Offset 1 dB
1 PK VIEW
A
LVL
Center 2.441 GHz
500 ms/
Date: 9.DEC.2004 15:01:02


RBW 100 kHz
Delta 1 [T1]
VBW 100 kHz
4.58 dB
Ref 20 dBm
Att 30 dB
SWT 5 ms
2.980000 ms
20 Offset 1 dB
Marker 1 [T1]
-61.43 dBm
1.560000 ms
1 PK CLRWR
A
SGL
LVL
Center 2.441 GHz
500 µs/
Date: 9.DEC.2004 15:10:57

4.4 CHANNEL BANDWIDTH

4.4.1 LIMITS OF CHANNEL BANDWIDTH

For frequency hopping system operating in the 2400-2483.5 MHz and 5725-5850 MHz bands, the maximum 20dB bandwidth of the hopping channel is 1 MHz.

4.4.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
R&S SPECTRUM ANALYZER	FSP40	100037	May 06, 2005

Note:

1. The measurement uncertainty is 226Hz,which is calculated as per the document ETSI TR 100 028.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.4.3 TEST PROCEDURE

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

4.4.4 DEVIATION FROM TEST STANDARD

No deviation

4.4.5 TEST SETUP

4.4.6 EUT OPERATING CONDITION

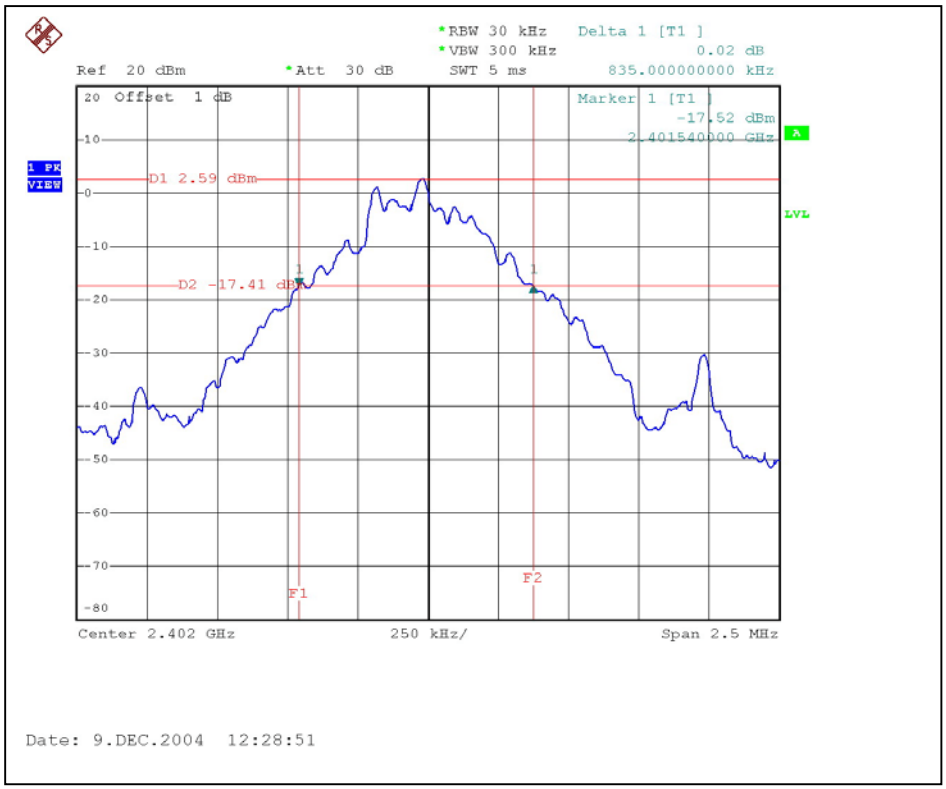
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.4.7 TEST RESULTS

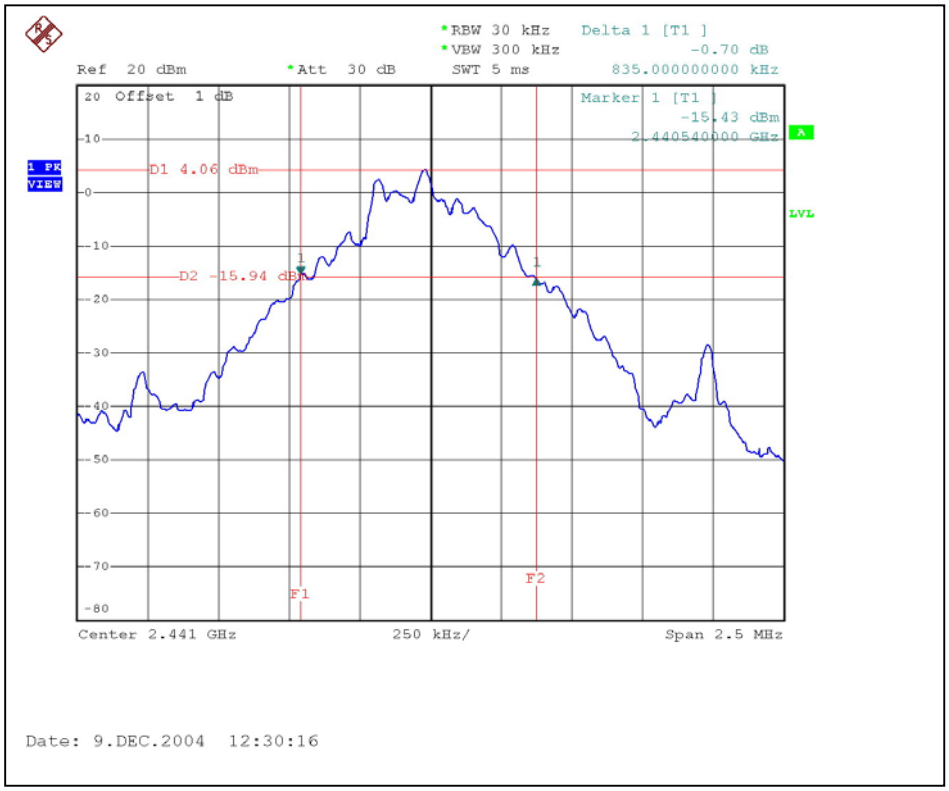
EUT	Bluetooth + MDC Modem Card	**MODEL**	MDCBTASC32
ENVIRONMENTAL CONDITIONS	25deg. C, 60%RH, 979 hPa	**INPUT POWER (SYSTEM)**	120Vac, 60 Hz
TESTED BY	Sky Liao		

CHANNEL	CHANNEL FREQUENCY (MHz)	20dB BANDWIDTH (kHz)	MAXIMUM LIMIT (MHz)	PASS/FAIL
0	2402	835	1	PASS
39	2441	835	1	PASS
78	2480	845	1	PASS

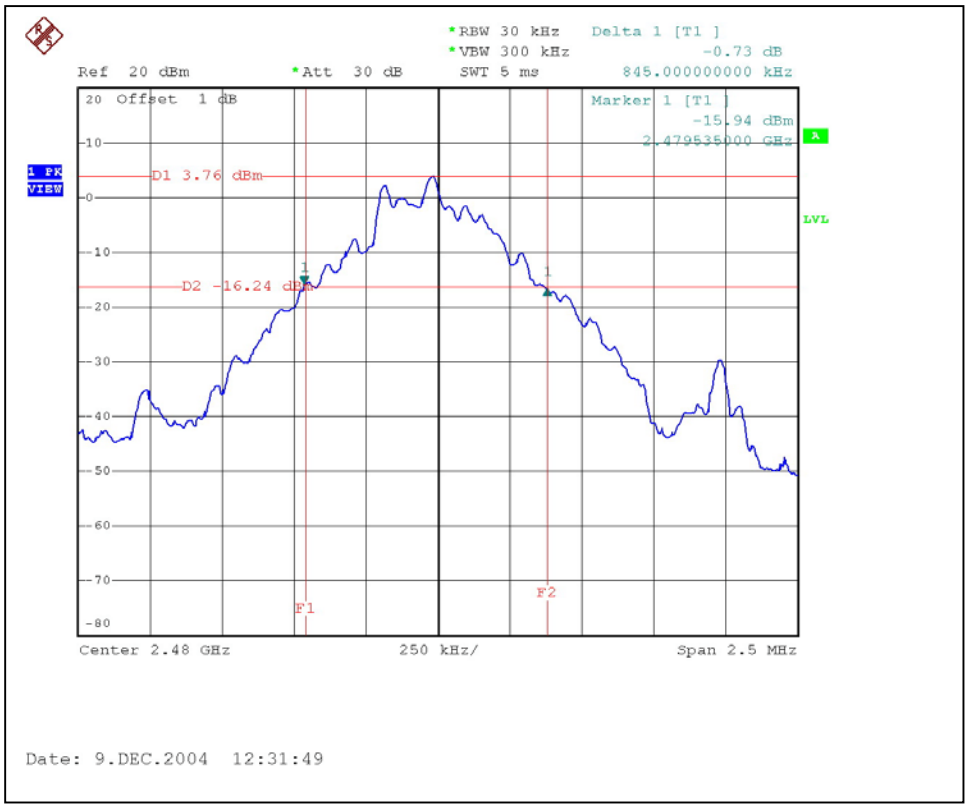
Channel 0



Channel 39



Channel 78


*RBW 30 kHz
*VBW 300 kHz
SWT 5 ms
Delta 1 [T1]
-0.73 dB
845.000000000 kHz
Ref 20 dBm
*Att 30 dB
20 Offset 1 dB
Marker 1 [T1]
-15.94 dBm
2.479535000 GHz
D1 3.76 dBm
D2 -16.24 dBm
1 PK VIEW
LVL
F1
F2
Center 2.48 GHz
250 kHz/
Span 2.5 MHz
Date: 9.DEC.2004 12:31:49

4.5 HOPPING CHANNEL SEPARATION

4.5.1 LIMIT OF HOPPING CHANNEL SEPARATION

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

4.5.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
R&S SPECTRUM ANALYZER	FSP40	100037	May 06, 2005

Note:

1. The measurement uncertainty is 226Hz,which is calculated as per the document ETSI TR 100 028.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

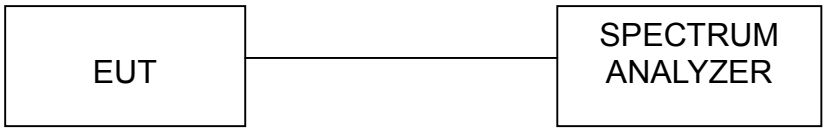
4.5.3 TEST PROCEDURES

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

4.5.4 DEVIATION FROM TEST STANDARD

No deviation

4.5.5 TEST SETUP



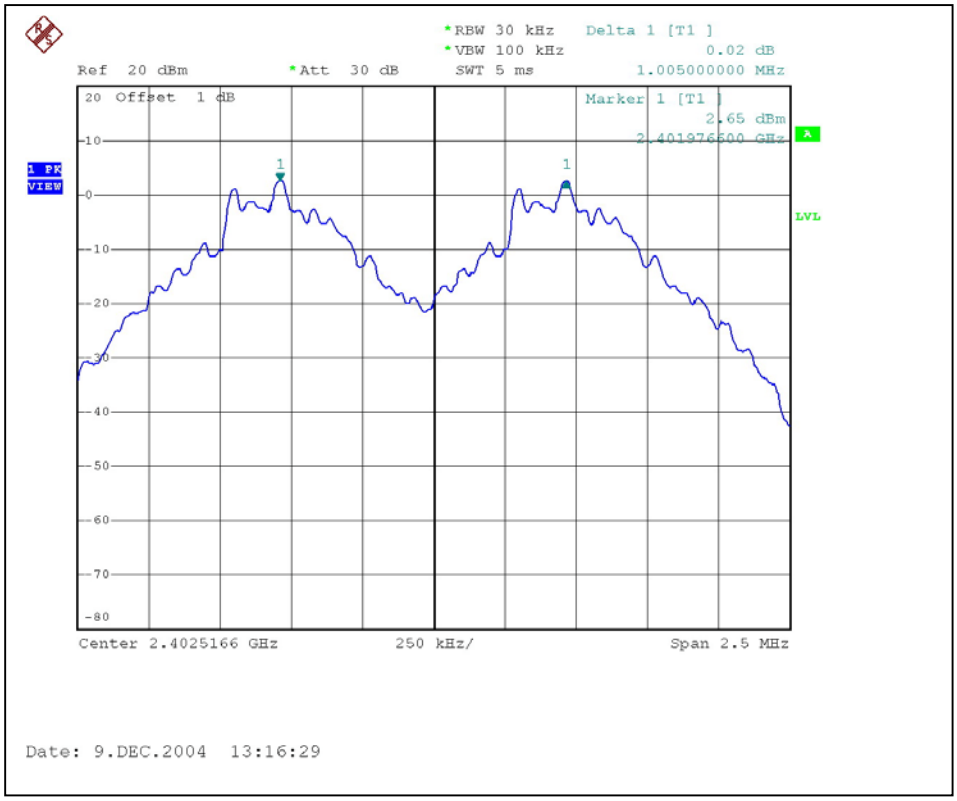
4.5.6 TEST RESULTS

EUT	Bluetooth + MDC Modem Card	**MODEL**	MDCBTASC32
ENVIRONMENTAL CONDITIONS	25 deg. C, 60%RH, 979 hPa	**INPUT POWER (SYSTEM)**	120Vac, 60 Hz
TESTED BY	Sky Liao		

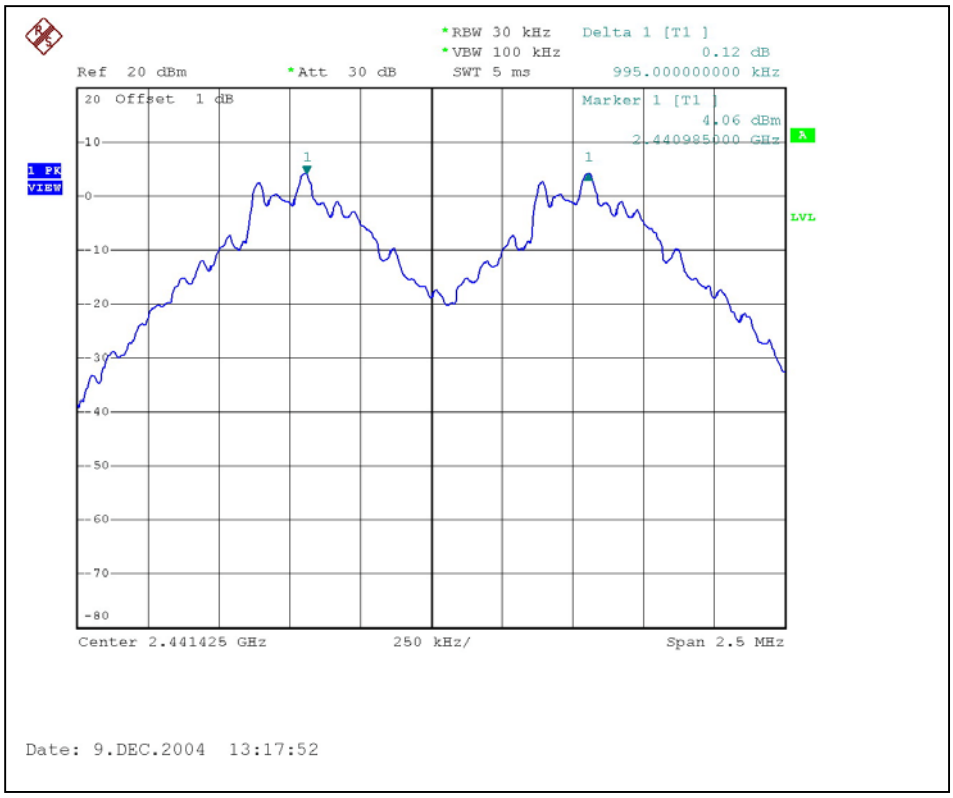
Channel	Frequency (MHz)	Adjacent Channel Separation	Minimum Limit (kHz)	Pass / Fail
0	2402	1.005MHz	835	PASS
39	2441	0.995MHz	835	PASS
78	2480	1.005MHz	845	PASS

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

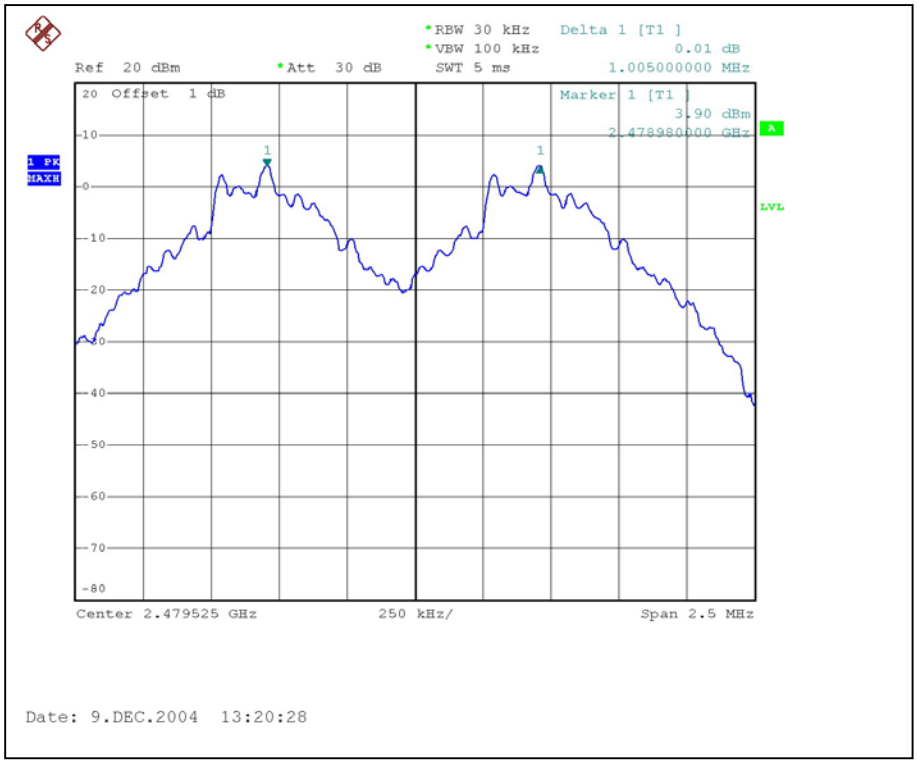
Channel 0



Channel 39



Channel 78


*RBW 30 kHz
*VBW 100 kHz
SWT 5 ms
Delta 1 [T1]
0.01 dB
1.005000000 MHz
Ref 20 dBm
*Att 30 dB
20 Offset 1 dB
Marker 1 [T1]
3.90 dBm
2.478980000 GHz
1 PK
MAXH
A
LVL
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.479525 GHz
250 kHz/
Span 2.5 MHz
Date: 9.DEC.2004 13:20:28

4.6 MAXIMUM PEAK OUTPUT POWER

4.6.1 LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT

The Maximum Peak Output Power Measurement is 30dBm.

4.6.2 INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
R&S SPECTRUM ANALYZER	FSP40	100037	May 06, 2005

Note:

1. The measurement uncertainty is 226Hz,which is calculated as per the document ETSI TR 100 028.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

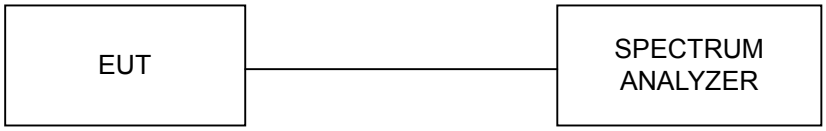
4.6.3 TEST PROCEDURES

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

4.6.4 DEVIATION FROM TEST STANDARD

No deviation

4.6.5 TEST SETUP



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

4.6.6 EUT OPERATING CONDITION

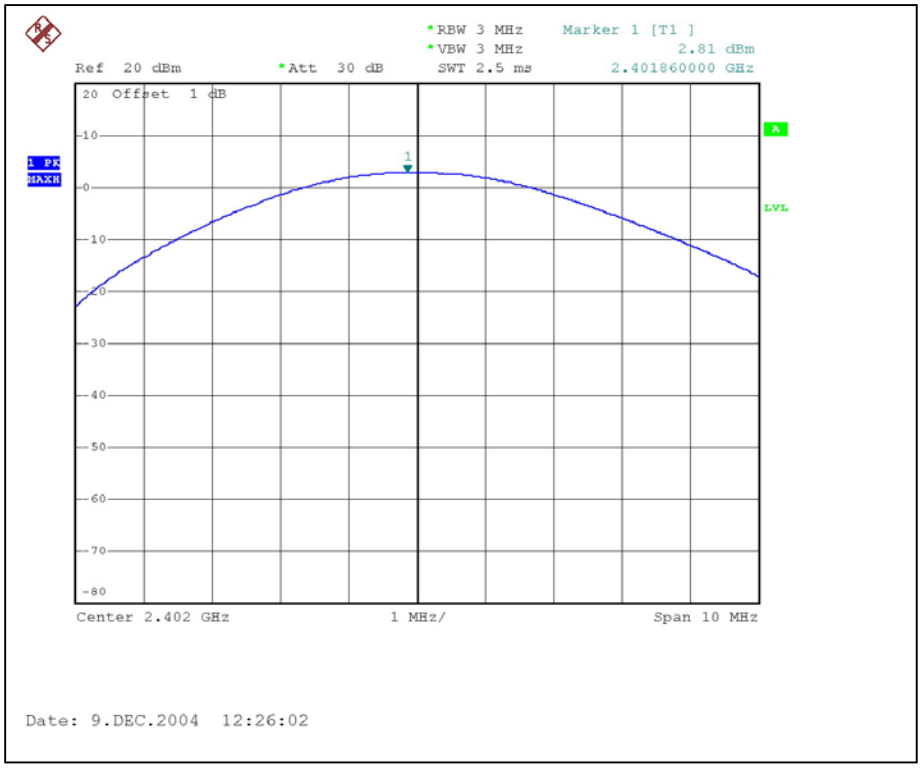
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.6.7 TEST RESULTS

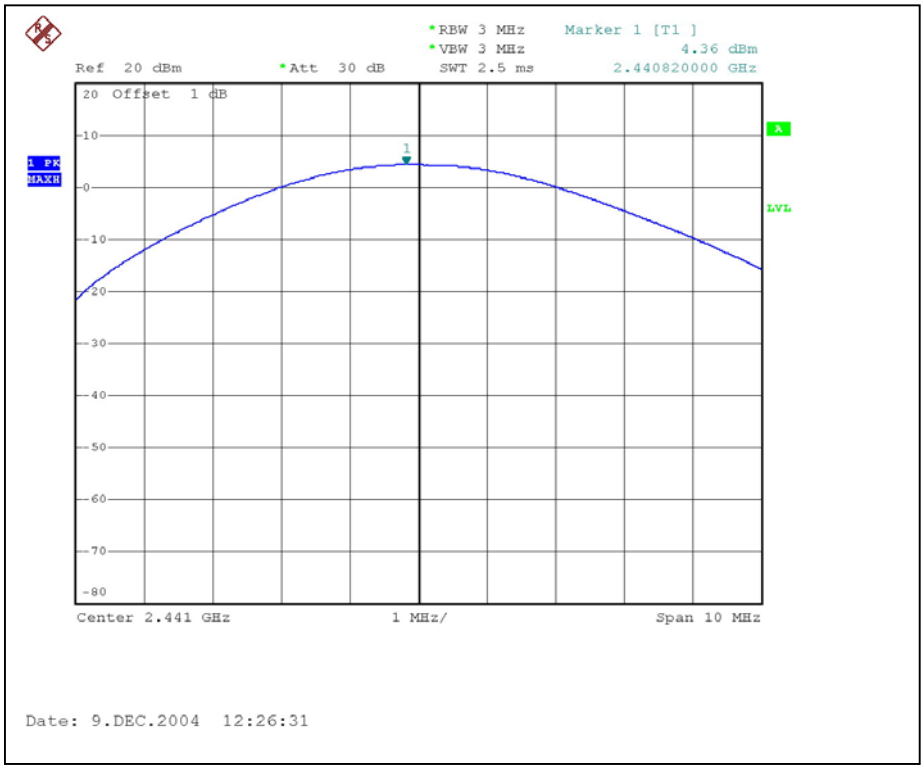
EUT	Bluetooth + MDC Modem Card	MODEL	MDCBTASC32
ENVIRONMENTAL CONDITIONS	25 deg. C, 60%RH, 979 hPa	INPUT POWER (SYSTEM)	120Vac, 60 Hz
TESTED BY	Wen Yu		

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (dBm)	PEAK POWER LIMIT (dBm)	PASS/FAIL
0	2402	2.81	30	PASS
39	2441	4.36	30	PASS
78	2480	4.01	30	PASS

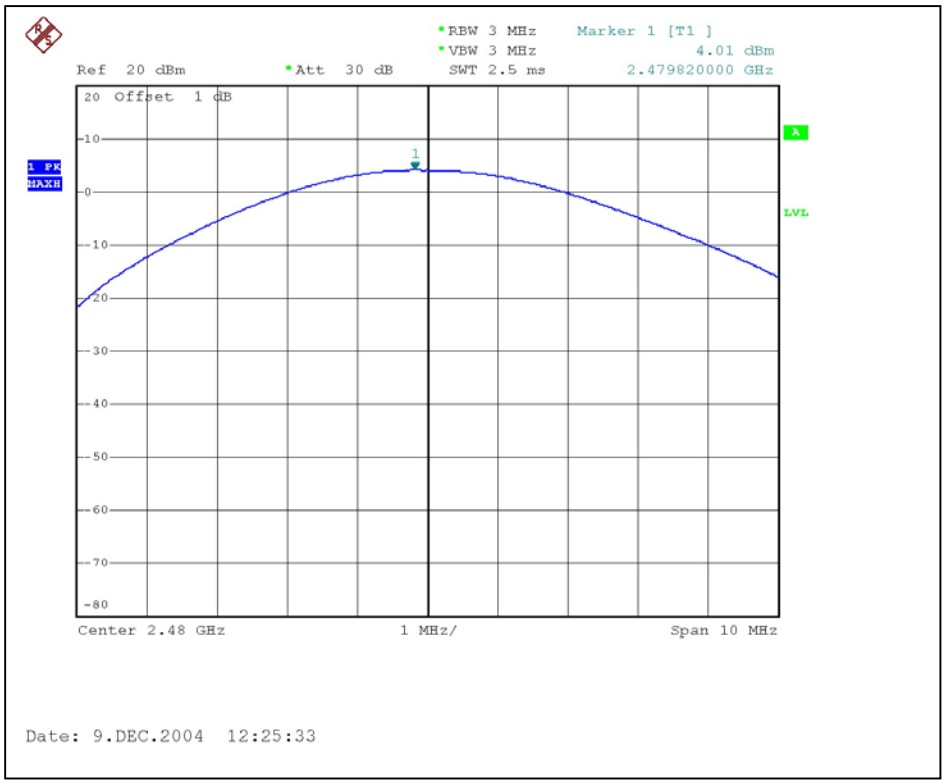
Channel 0



Channel 39



Channel 78


RBW 3 MHz
VBW 3 MHz
SWT 2.5 ms
Marker 1 [T1]
4.01 dBm
2.479820000 GHz
Ref 20 dBm
Att 30 dB
Offset 1 dB
1 PK MAXH
A
LVL
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.48 GHz
1 MHz/
Span 10 MHz
Date: 9.DEC.2004 12:25:33

4.7 RADIATED EMISSION MEASUREMENT

4.7.1 LIMITS OF RADIATED EMISSION MEASUREMENT

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

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

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.

4.7.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
HP Spectrum Analyzer	8594E	3710A04861	Sep. 23, 2005
ADVANTEST Spectrum Analyzer	R3271A	85060311	Jun. 29, 2005
CHASE RF Pre_Amplifier	CPA9232	1057	Aug. 06, 2005
HP Pre_Amplifier	8449B	3008A01922	Oct. 13, 2005
ROHDE & SCHWARZ Test Receiver	ESCS30	100287	Dec. 08, 2005
CHASE Broadband Antenna	VULB9168	138	May 22, 2005
Schwarzbeck Horn_Antenna	BBHA9120	D124	Jun. 16, 2005
Schwarzbeck Horn_Antenna	BBHA 9170	BBHA9170192	Feb. 16, 2005
SCHWARZBECK Tunable Dipole Antenna	UHAP	897	Mar. 07, 2005
SCHWARZBECK Tunable Dipole Antenna	VHAP	880	Mar. 07, 2005
RF Switches (ARNITSU)	CS-201	1565157	Jul. 15, 2005
RF CABLE (Chaintek) 1GHz-20GHz	SF102	22054-2	Feb. 10. 2005
RF Cable(RICHTEC)	9913-30M	STCCAB-30M-1GHz-021	Jul. 15, 2005
Software	AS60P8	NA	NA
CHANCE MOST Antenna Tower	AT-100	0203	NA
CHANCE MOST Turn Table	TT-100	0203	NA

Note: 1. The calibration interval of the above test instruments is 12 months (36 months for Tunable Dipole Antenna)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 Open Site No. C.
4. The FCC Site Registration No. is 656396.
5. The VCCI Site Registration No. is R-1626.
6. The CANADA Site Registration No. is IC 4824-3.
7. The following table is for the measurement uncertainty, which is calculated as per the document CISPR 16-4.

Measurement	Value
Radiated emissions (30MHz-1GHz)	2.98 dB
Radiated emissions (1GHz ~18GHz)	2.21 dB
Radiated emissions (18GHz ~20GHz)	1.88 dB

4.7.3 TEST PROCEDURES

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 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 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

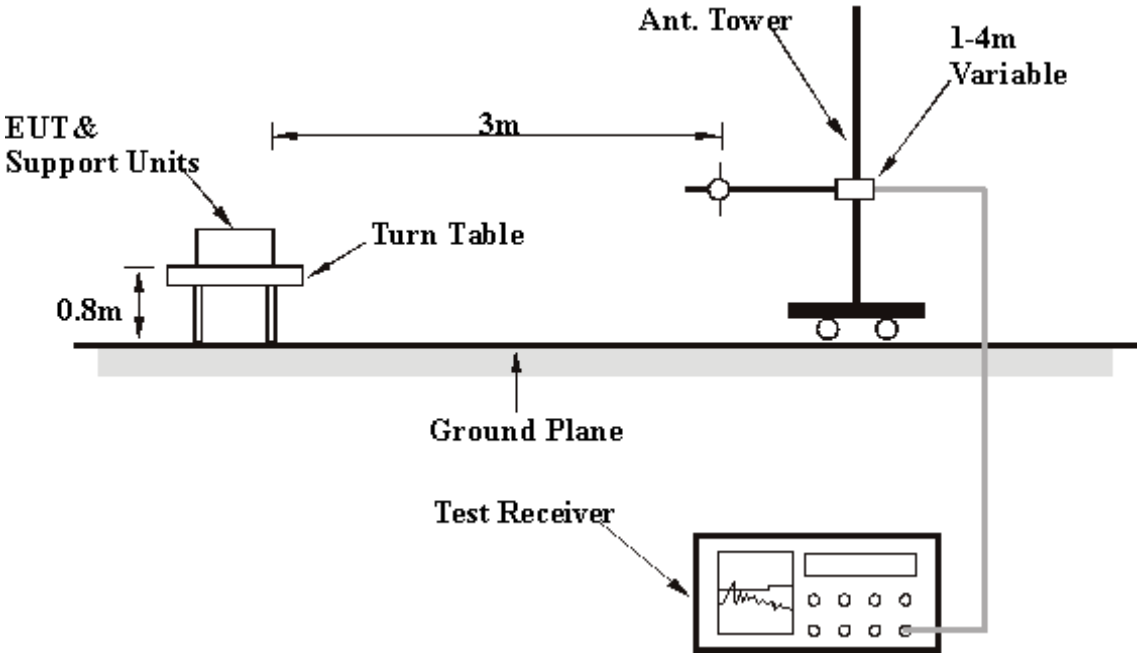
NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1GHz.

4.7.4 DEVIATION FROM TEST STANDARD

No deviation

4.7.5 TEST SETUP



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

4.7.6 TEST RESULTS

EUT	Bluetooth + MDC Modem Card	**MODEL**	MDCBTASC32
CHANNEL	78	**FREQUENCY RANGE**	Below 1GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	**DETECTOR FUNCTION**	Quasi-Peak
ENVIRONMENTAL CONDITIONS	25 deg. C, 60%RH, 979hPa	**TESTED BY**	Rex Huang

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	239.99	30.00 QP	46.00	-16.00	1.19 H	9	17.30	12.80
2	300.12	27.40 QP	46.00	-18.60	1.05 H	74	12.20	15.20
3	400.16	22.60 QP	46.00	-23.40	1.62 H	56	4.20	18.40
4	479.99	24.20 QP	46.00	-21.80	1.39 H	308	4.00	20.20
5	640.12	25.80 QP	46.00	-20.20	1.22 H	179	2.60	23.20
6	720.04	28.00 QP	46.00	-18.00	1.35 H	46	3.20	24.80

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	240.02	21.90 QP	46.00	-24.10	1.00 V	149	9.20	12.80
2	299.94	25.40 QP	46.00	-20.60	1.00 V	257	10.20	15.20
3	400.11	25.60 QP	46.00	-20.40	1.05 V	164	7.20	18.40
4	480.04	26.30 QP	46.00	-19.70	1.15 V	117	6.10	20.20
5	640.02	25.40 QP	46.00	-20.60	1.30 V	265	2.10	23.20
6	720.07	27.40 QP	46.00	-18.60	1.19 V	149	2.60	24.80

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	Bluetooth + MDC Modem Card	**MODEL**	MDCBTASC32
CHANNEL	Channel 0	**FREQUENCY RANGE**	1 ~25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	**DETECTOR FUNCTION**	Peak(PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25 deg. C, 60%RH, 979hPa	**TESTED BY**	Rex Huang

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	42.90 PK	74.00	-31.10	1.05 H	320	9.10	33.80
1	2390.00	35.00 AV	54.00	-19.00	1.05 H	320	1.20	33.80
2	*2402.00	95.20 PK			1.05 H	320	65.30	29.90
2	*2402.00	87.30 AV			1.05 H	320	57.40	29.90
3	4804.00	44.70 PK	74.00	-29.30	1.14 H	13	8.60	36.10
3	4804.00	36.80 AV	54.00	-17.20	1.14 H	13	0.70	36.10
4	7206.00	50.00 PK	74.00	-24.00	1.43 H	258	8.40	41.60
4	7206.00	42.10 AV	54.00	-11.90	1.43 H	258	0.50	41.60

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	45.20 PK	74.00	-28.80	1.06 V	12	11.40	33.80
1	2390.00	37.30 AV	54.00	-16.70	1.06 V	12	3.50	33.80
2	*2402.00	97.50 PK			1.06 V	12	67.60	29.90
2	*2402.00	89.60 AV			1.06 V	12	59.70	29.90
3	4804.00	43.80 PK	74.00	-30.20	1.24 V	352	7.70	36.10
3	4804.00	35.90 AV	54.00	-18.10	1.24 V	352	-0.20	36.10
4	7206.00	48.90 PK	74.00	-25.10	1.10 V	37	7.30	41.60
4	7206.00	41.00 AV	54.00	-13.00	1.10 V	37	-0.60	41.60

REMARKS:
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. " * " : Fundamental frequency
6. The DH5 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*5 per 247 ms per channel.Therefore, the duty cycle be equal to: 20log(3.125/100)= -30dB
7. Average value = peak reading –20log(duty cycle)

EUT	Bluetooth + MDC Modem Card	**MODEL**	MDCBTASC32
CHANNEL	Channel 39	**FREQUENCY RANGE**	1 ~25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	**DETECTOR FUNCTION**	Peak(PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25 deg. C, 60%RH, 979hPa	**TESTED BY**	Rex Huang

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3M

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	95.30 PK			1.00 H	328	65.30	30.00
1	*2441.00	87.40 AV			1.00 H	328	57.40	30.00
2	4882.00	46.20 PK	74.00	-27.80	1.21 H	34	9.70	36.50
2	4882.00	38.30 AV	54.00	-15.70	1.21 H	34	1.80	36.50
3	7323.00	50.10 PK	74.00	-23.90	1.37 H	261	8.30	41.80
3	7323.00	42.20 AV	54.00	-11.80	1.37 H	261	0.40	41.80

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3M

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	97.60 PK			1.02 V	13	67.60	30.00
1	*2441.00	89.70 AV			1.02 V	13	59.70	30.00
2	4882.00	44.20 PK	74.00	-29.80	1.32 V	13	7.70	36.50
2	4882.00	36.30 AV	54.00	-17.70	1.32 V	13	-0.20	36.50
3	7323.00	49.30 PK	74.00	-24.70	1.24 V	357	7.50	41.80
3	7323.00	41.40 AV	54.00	-12.60	1.24 V	357	-0.40	41.80

REMARKS:

1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. " * " : Fundamental frequency
6. The DH5 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*5 per 247 ms per channel.Therefore, the duty cycle be equal to: 20log(3.125/100)= -30dB
7. Average value = peak reading –20log(duty cycle)

EUT	Bluetooth + MDC Modem Card	**MODEL**	MDCBTASC32
CHANNEL	Channel 78	**FREQUENCY RANGE**	1 ~25GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	**DETECTOR FUNCTION**	Peak(PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25 deg. C, 60%RH, 979hPa	**TESTED BY**	Rex Huang

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3M

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	94.80 PK			1.00 H	333	64.70	30.10
1	*2480.00	86.90 AV			1.00 H	333	56.80	30.10
2	2483.50	43.80 PK	74.00	-30.20	1.00 H	333	13.60	30.10
2	2483.50	35.90 AV	54.00	-18.10	1.00 H	333	5.70	30.10
3	2486.00	47.60 PK	74.00	-26.40	1.00 H	333	17.40	30.10
3	2486.00	39.70 AV	54.00	-14.30	1.00 H	333	9.50	30.10
4	4960.00	47.10 PK	74.00	-26.90	1.24 H	23	10.30	36.80
4	4960.00	39.20 AV	54.00	-14.80	1.24 H	23	2.40	36.80
5	7440.00	50.90 PK	74.00	-23.10	1.32 H	14	9.00	41.90
5	7440.00	43.00 AV	54.00	-11.00	1.32 H	14	1.10	41.90

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3M

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	98.20 PK			1.01 V	11	68.10	30.10
1	*2480.00	90.30 AV			1.01 V	11	60.20	30.10
2	2483.50	47.20 PK	74.00	-26.80	1.01 V	11	17.10	30.10
2	2483.50	39.30 AV	54.00	-14.70	1.01 V	11	9.20	30.10
3	2486.00	51.00 PK	74.00	-23.00	1.01 V	11	20.90	30.10
3	**2486.00**	**43.10 AV**	**54.00**	**-10.90**	**1.01 V**	**11**	**13.00**	**30.10**
4	4960.00	44.60 PK	74.00	-29.40	1.23 V	34	7.80	36.80
4	4960.00	36.70 AV	54.00	-17.30	1.23 V	34	-0.10	36.80
5	7440.00	50.10 PK	74.00	-23.90	1.14 V	11	8.20	41.90
5	7440.00	42.20 AV	54.00	-11.80	1.14 V	11	0.30	41.90

REMARKS:
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. " * " : Fundamental frequency
6. The DH5 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*5 per 247 ms per channel.Therefore, the duty cycle be equal to: 20log(3.125/100)= -30dB
7. Average value = peak reading –20log(duty cycle)

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
R&S SPECTRUM ANALYZER	FSP40	100037	May 06, 2005

Note:
1. The measurement uncertainty is 2.79dB, which is calculated as per the document ETSI TR 100 028
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.8.3 TEST PROCEDURE

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

4.8.4 DEVIATION FROM TEST STANDARD

No deviation

4.8.5 EUT OPERATING CONDITION

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

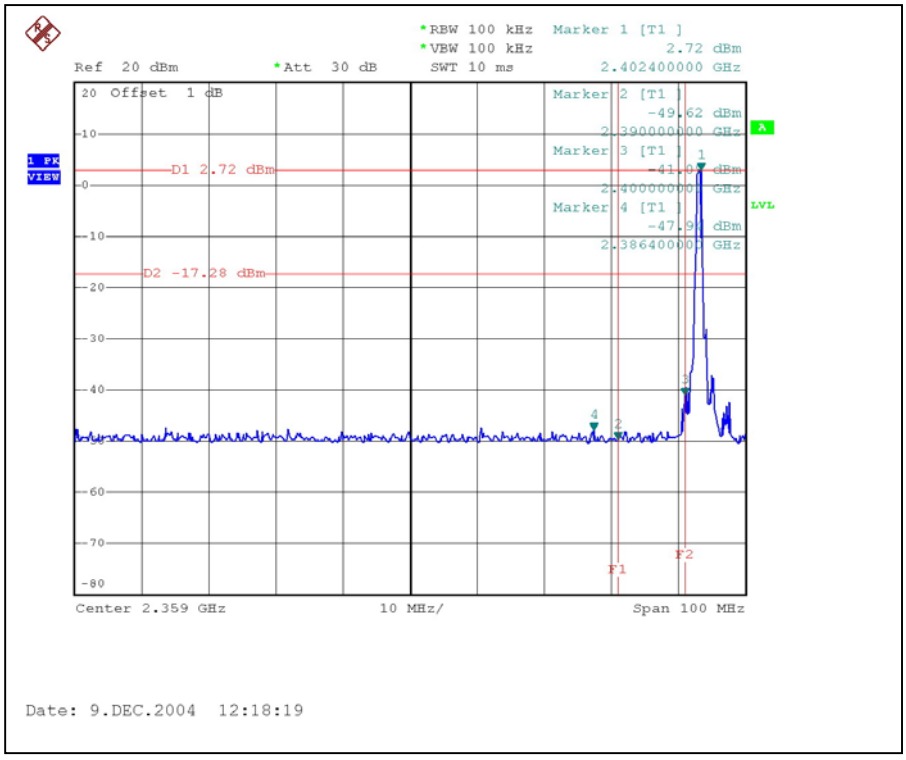
4.8.6 TEST RESULTS

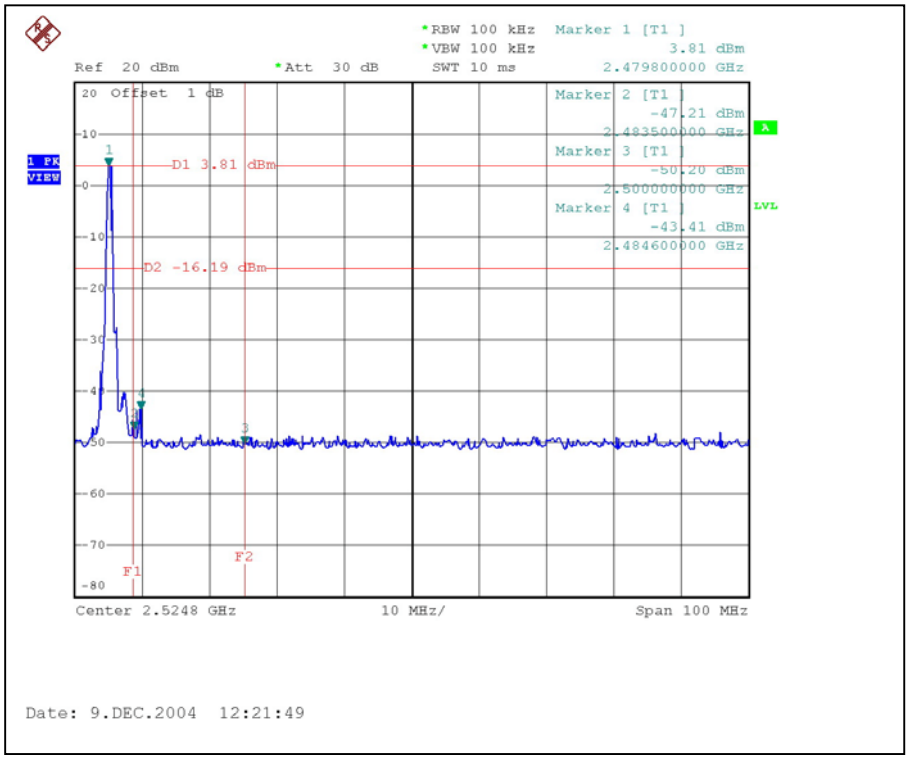
The spectrum plots are attached on the following 2 pages. D2 line indicates the highest level, D1 line indicates the 20dB offset below D2. It shows compliance with the requirement in part 15.247(C).

Note - The delta method is only used up to 2 MHz away from the restricted bandage, The radiated emissions which located in other restricted frequency band, the result, please refer to 4.2.

NOTE1: The band edge emission plot on the following first page shows 52.34dB delta between carrier maximum power and local maximum emission in restrict band (2.3900GHz). The emission of carrier strength list in the test result of channel 0 at the item 4.7.9 is 89.6dBuV/m, so the maximum field strength in restrict band is 89.6-52.34=37.26dBuV/m which is under 54 dBuV/m limit.

NOTE2: The band edge emission plot on the following second page shows 51.02dB delta 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 4.7.9 is 90.3dBuV/m, so the maximum field strength in restrict band is 90.3-51.02=39.28dBuV/m which is under 54 dBuV/m limit.


*RBW 100 kHz
*VBW 100 kHz
SWT 10 ms
Marker 1 [T1]
2.72 dBm
2.402400000 GHz
Ref 20 dBm
*Att 30 dB
20 Offset 1 dB
Marker 2 [T1]
-49.62 dBm
2.390000000 GHz
Marker 3 [T1]
-41.0 dBm
2.400000001 GHz
Marker 4 [T1]
-47.9 dBm
2.386400001 GHz
1 PK VIEW
D1 2.72 dBm
D2 -17.28 dBm
LVL
F1
F2
Center 2.359 GHz
10 MHz/
Span 100 MHz
Date: 9.DEC.2004 12:18:19


*RBW 100 kHz
*VBW 100 kHz
SWT 10 ms
Marker 1 [T1]
3.81 dBm
2.479800000 GHz
Ref 20 dBm
*Att 30 dB
20 Offset 1 dB
Marker 2 [T1]
-47.21 dBm
2.483500000 GHz
Marker 3 [T1]
-50.20 dBm
2.500000000 GHz
Marker 4 [T1]
-43.41 dBm
2.484600000 GHz
1 PK VIEW
D1 3.81 dBm
D2 -16.19 dBm
LVL
F1
F2
Center 2.5248 GHz
10 MHz/
Span 100 MHz
Date: 9.DEC.2004 12:21:49

4.9 ANTENNA REQUIREMENT

4.9.1 STANDARD APPLICABLE

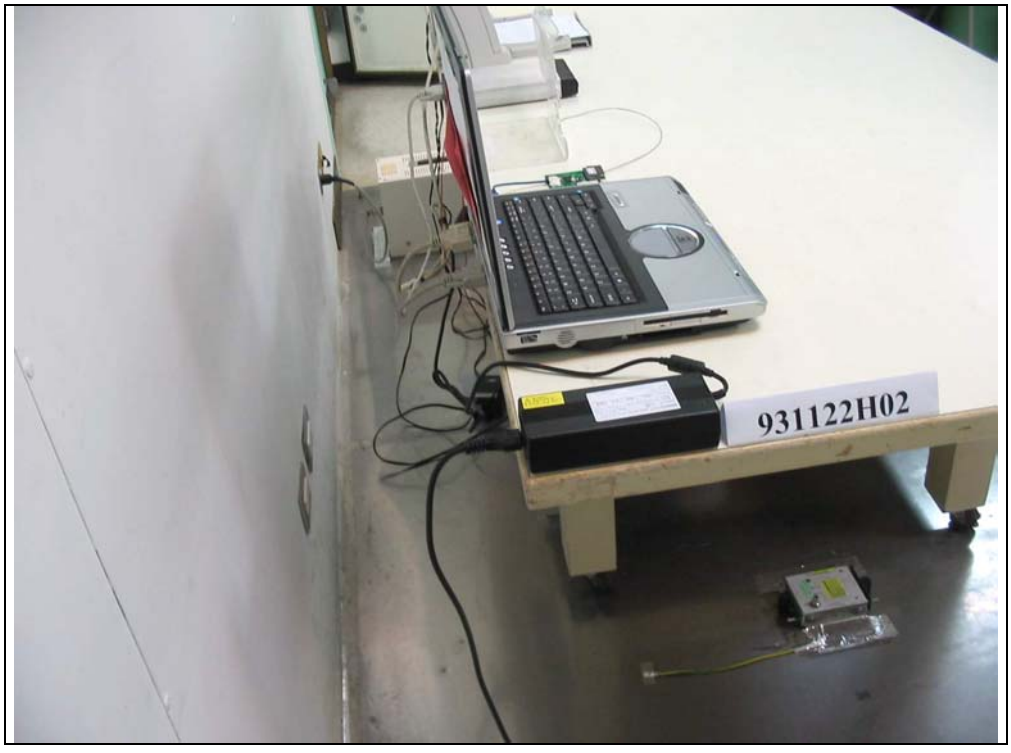
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.
And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional 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 antennas used in this product is PIFA antenna without connector. The maximum Gain of the antenna is –0.5dBi.

5 PHOTOGRAPHS OF THE TEST CONFIGURATION

CONDUCTED EMISSION TEST



RADIATED EMISSION TEST

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

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

Linko EMC/RF Lab:
Tel: 886-2-26052180
Fax: 886-2-26052943

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

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Tel: 886-3-3183232
Fax: 886-3-3185050

Email: service@adt.com.tw
Web Site: www.adt.com.tw

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