



FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

Bluetooth Class2 Audio Dongle

Model : GMHSBTAD

Brand Name : BILLIONTON

Issued for

BILLIONTON SYSTEMS INC.

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

Issued by

Compliance Certification Services Inc.

Hsinchu Lab.

Rm. 258, Bldg. 17, NO.195, Sec.4 Chung Hsing Rd.,
Chu Tung Chen, Hsinchu, Taiwan 310, R.O.C

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TEST REPORT CERTIFICATION

Applicant : BILLIONTON SYSTEMS INC.
Address : No. 21, Sui-Lih Rd., Hsin-Chu, 300, Taiwan
Equipment Under Test : Bluetooth Class2 Audio Dongle
Model : GMHSBTAD
Brand Name : BILLIONTON
Tested Date : May 20 ~ 30, 2005

APPLICABLE STANDARD	
STANDARD	TEST RESULT
FCC Part 15 Subpart C (2004)	No non-compliance noted

Approved by:

Reviewed by:

C. F. Wu June 09, 2005 Alan Pan June 09, 2005
C. F. Wu Alan Pan
Manager of Hsinchu Laboratory Test Engineer of Hsinchu Laboratory
Compliance Certification Services Inc. Compliance Certification Services Inc.



WE HEREBY CERTIFY THAT: The measurements shown in the attachment were made in accordance with the procedures indicated, and the energy emitted by the equipment was found to be within the limits applicable. We assume full responsibility for the accuracy and completeness of these measurements and vouch for the qualifications of all persons taking them.



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1. EUT DESCRIPTION

1.1 DESCRIPTION OF EUT & POWER

Product Name	Bluetooth Class2 Audio Dongle
Model Number	GMHSBTAD
Frequency Range	2402MHz to 2480MHz $f = 2402 + n\text{MHz}$, $n = 0, \dots, 78$
Output Power	3.75dBm
Channel Spacing	1MHz
Channel Number	79
Air Data Rate	723kbps
Type of Modulation	Frequency Hopping Spread Spectrum
Frequency Selection	by software / firmware
Transmitter Classification	portable device
Antenna Type	SMD Antenna, Antenna Gain : 4.1dBi
Power Source	3.7 ~ 4.2VDC from rechargeable battery (Battery charged from USB interface of Notebook PC)

Note : For more details, please refer to the User's manual of the EUT.

Multiple List :

Company	Address	Product Name	Model No.
Anubis	Am Langfeld 38 66130 Saarbrücken, Germany	Bluetooth Class2 Audio Dongle	MHSBTAD-N-AN
Medion	Am Zehnthof 77 D-45127 Essen, Germany	Bluetooth Class2 Audio Dongle	MHSBTAD-N-MD
Sitecom	Lichtenauerlaan 222 3062 ME Rotterdam, The Netherlands	Bluetooth Class2 Audio Dongle	MHSBTAD-N-SC
Vivanco	Ewige Weide 15 22926 Ahrensburg, Germany	Bluetooth Class2 Audio Dongle	MHSBTAD-N-VV
Hama	Dresdner Strabe 9 86653 Monheim, Germany	Bluetooth Class2 Audio Dongle	MHSBTAD-N-HM
Careca	Via Borsellino 14-42010 Arceto (Reggio Emilia), Italy	Bluetooth Class2 Audio Dongle	MHSBTAD-N-HA
Anycom	Broichmühlenweg 42 DE-41066 Monchengladbach, Germany	Bluetooth Class2 Audio Dongle	MHSBTAD-N-AY
2L INTERNATIONAL BV	DATABANKWEG 7-3821 AL AMERSFOORT, PO BOX 150-3800 AD AMERSFOORT, NE	Bluetooth Class2 Audio Dongle	MHSBTAD-N-2L2
ASBISC ENTERPRISES LIMITED	63 KOLONAKIOU STREET, CY-4013 LIMASSOL, CYPRUS 4013 CYPRUS	Bluetooth Class2 Audio Dongle	MHSBTAD-N-CYT
BANDBRIDGE EUROPE N.V.	BANDBRIDGE INT'L ASIA R602, 6F EMPRES 17-19, CHATHAM RD SOUTH KOWLOON HK	Bluetooth Class2 Audio Dongle	MHSBTAD-N-BB
DATAMATIC S.P.A.	VIA AGORDAT, 34 MILANO MI 20124 ITALY	Bluetooth Class2 Audio Dongle	MHSBTAD-N-DM
CityCom Corp.	3F, NO. 532, SEC.2, JHONGSHAN RD., JHONGHE CITY, TAIPEI HSIEN, TAIWAN, R.O.C.	Bluetooth Class2 Audio Dongle	MHSBTAD-N-CTC
Ting Immediately Ind Co., LTd.	NO25 Lane80 Ta Hsin Rd., Tan Tzu Hsiang Taichung Hsien, Taiwan, R.O.C.	Bluetooth Class2 Audio Dongle	MHSBTAD-N-TL
MDB TE-Group	EDWARD GAERTSSTRAAT 39-2180 EKEREN, BELGIUM	Bluetooth Class2 Audio Dongle	MHSBTAD-N-MDB
DSG Retail Ltd.	Dixons House, 200 The Campus Maylands Avenue, Hemel Hempstead, Hertfordshire, HP2 7IG, United Kingdom	Bluetooth Class2 Audio Dongle	MHSBTAD-N-DX
CABLES DIRECT LIMITED	UNIT C HEAGE RD., INDUSTRIAL ESTATE, HEAGE RD RIPLEY, DERBYSHIRE DE5 3GH	Bluetooth Class2 Audio Dongle	MHSBTAD-N-CDL



2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4 and FCC CRF 47 2.1046, 2046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 and 15.247.

3. FACILITIES AND ACCREDITATION

SITE DESCRIPTION :

FCC Certificate NO. : 90585
BSMI Certificate NO. : SL2-IN-E-0002
NVLAP Lab Code : 200118-0
CNLA Certificate NO. : CNLA-ZL97018E
VCCI Certificate NO. : R-1189, C-1250
TÜV Rheinland Certificate NO. : 10008375

NAME OF SITE : Compliance Certification Services Inc. Hsinchu Lab.

SITE LOCATION : Rm.258, Bldg.17, NO.195 , Sec. 4, Chung Hsing Rd.,
Chu-Tung Chen. Hsin-Chu, Taiwan 310 R.O.C.



4. CALIBRATION AND UNCERTAINTY

4.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 1000 MHz	+/- 3.2 dB
Radiated Emission, 1 to 26.5GHz	+/- 3.2 dB
Power Line Conducted Emission	+/- 2.9 dB

Uncertainty figures are valid to a confidence level of 95%

5. DESCRIPTION OF TEST MODES

There are three channels have been tested as following:

Channel	Frequency (MHz)
Low	2402
Middle	2441
High	2480

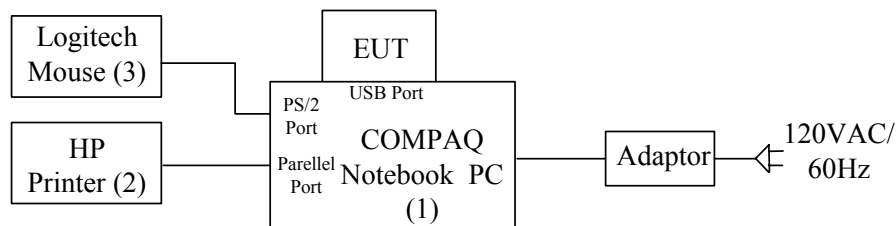


6. SETUP OF EQUIPMENT UNDER TEST

SUPPORT EQUIPMENT

No.	Product	Manufacturer	Model No.	Serial No.	Input Power	Output Power
1	Notebook PC	COMPAQ	N800V	5Y33KSQZMOXV 1YR	18.5VDC, 3.4A (From Power Adapter)	-----
	Adapter	COMPAQ	PPP009H	-----	100~240VAC, 50/60Hz, 1.7A	20VDC/3.5A
2	Printer	HP	Deskjet 948C	CN19T6S011	100~240VAC, 50/60Hz, 0.7A	-----
3	Mouse	Logitech	M-BJ58	LNA14607307	5VDC (From Notebook PC)	-----

SETUP DIAGRAM FOR TESTS



EUT OPERATING CONDITION

1. Setup all computers like the setup diagram.
2. Run CSR Blue Test software.
3. TX mode
 - (1) TXSTART
 - (2) LO Freq : 2402, 2441, 2480
 - (3) Power (EXT, Int) : 255, 53
 - (4) Modulation Freq : 0
4. RX mode
 - (1) RXSTART1
 - (2) LO Freq : 2402, 2441, 2480
 - (3) RX Attenuation 0
5. All of the function are under run.
6. Start test.



7. APPLICABLE LIMITS AND TEST RESULTS

7.1 20dB BANDWIDTH FOR HOPPING

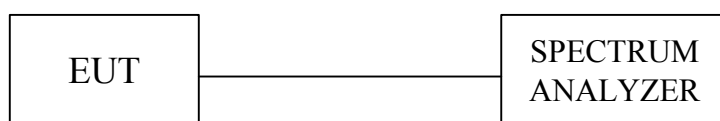
LIMIT

Limit : N/A

TEST EQUIPMENTS

Description & Manufacturer	Model No.	Serial No.	Date of Calibration
ROHDE & SCHWARZ SPECTRUM ANALYZER	FSEK30	835253/002	September 06, 2004

TEST SETUP



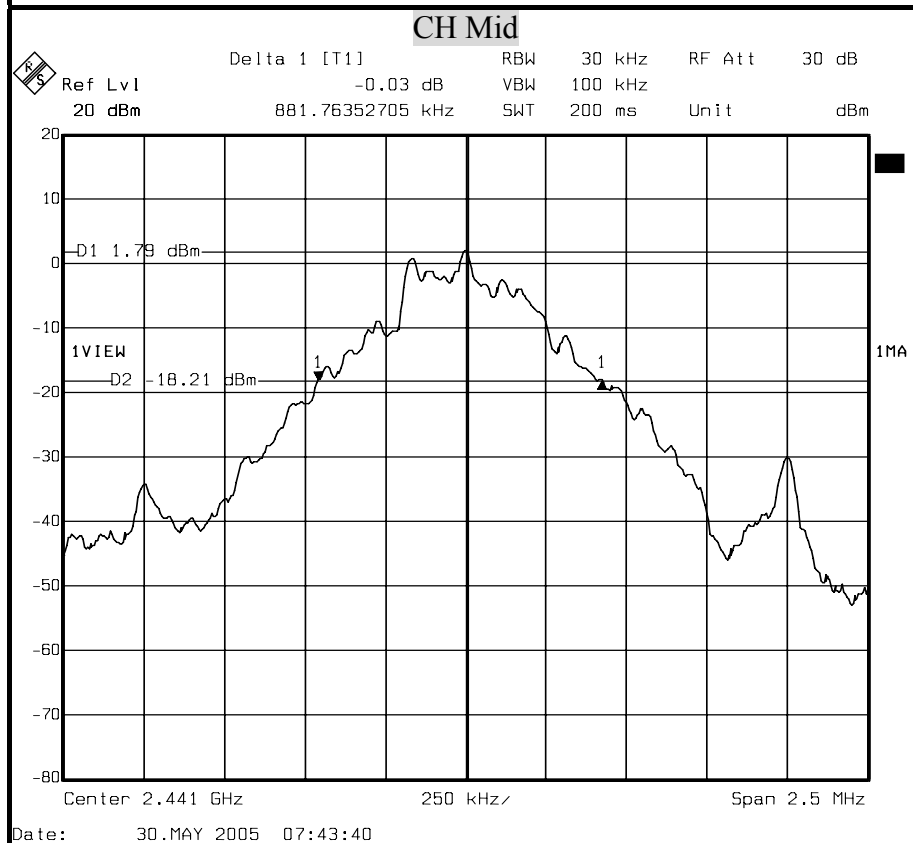
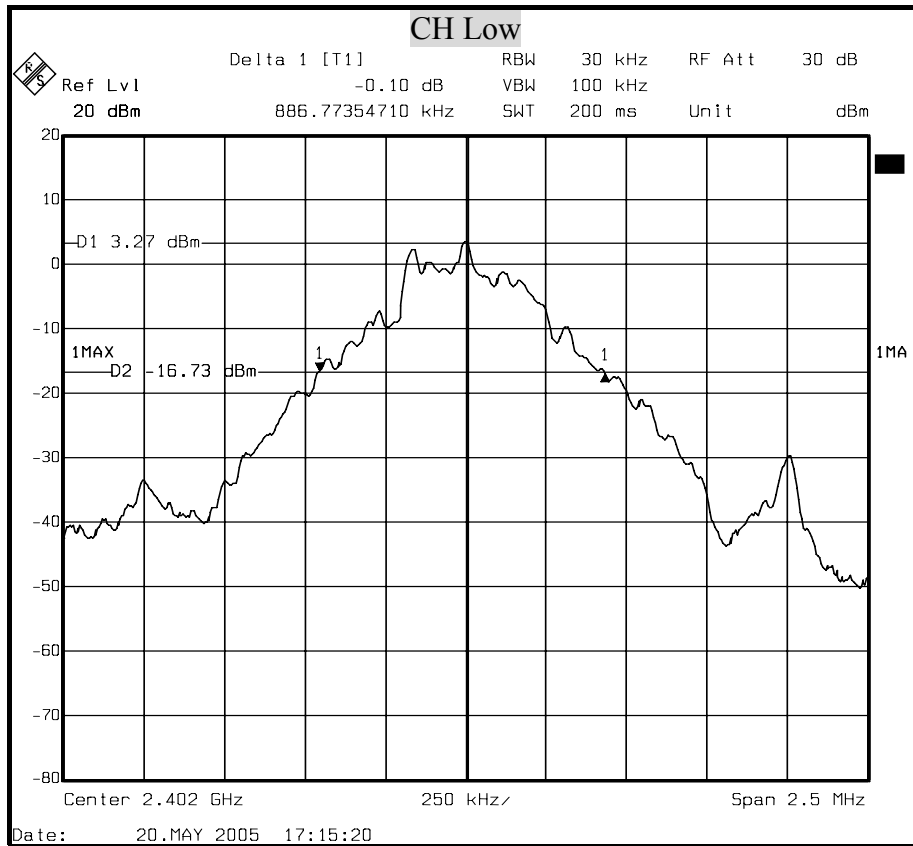
TEST PROCEDURE

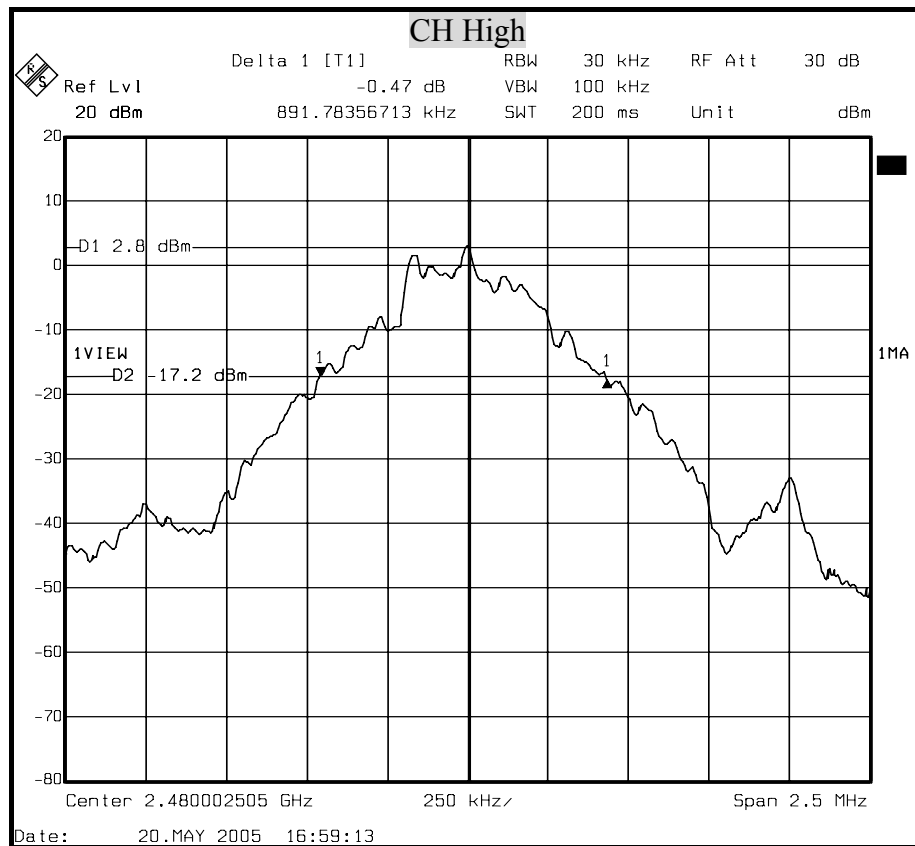
The 20dB band width was measured with a spectrum analyzer connected to RF antenna connector(conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency. The analyzer center frequency was set to the EUT carrier frequency, using the analyzer. Display Line and Marker Delta functions, the 20dB band width of the emission was determined.

TEST RESULTS

No non-compliance noted

Channel	Channel Frequency (MHz)	20dB Bandwidth (KHz)	Pass / Fail
Low	2402	886.77	N/A
Middle	2441	881.76	N/A
High	2480	891.78	N/A

**20db BANDWIDTH**





7.2 MAXIMUM PEAK OUTPUT POWER

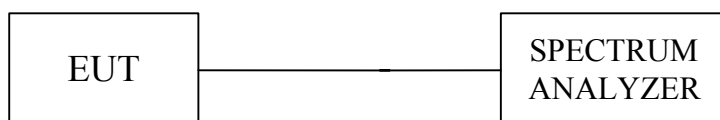
LIMIT

§15.247(b)(1) The Maximum Peak Output Power Measurement is 125mW for frequency hopping systems operating in 2400~2483.5 MHz employing at least 15 hopping channels.

TEST EQUIPMENTS

Description & Manufacturer	Model No.	Serial No.	Date of Calibration
ROHDE & SCHWARZ SPECTRUM ANALYZER	FSEK30	835253/002	September 06, 2004

TEST SETUP



TEST PROCEDURE

The RF power output was measured with a Spectrum analyzer connected to the RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency, A spectrum analyzer was used to record the shape of the transmit signal.

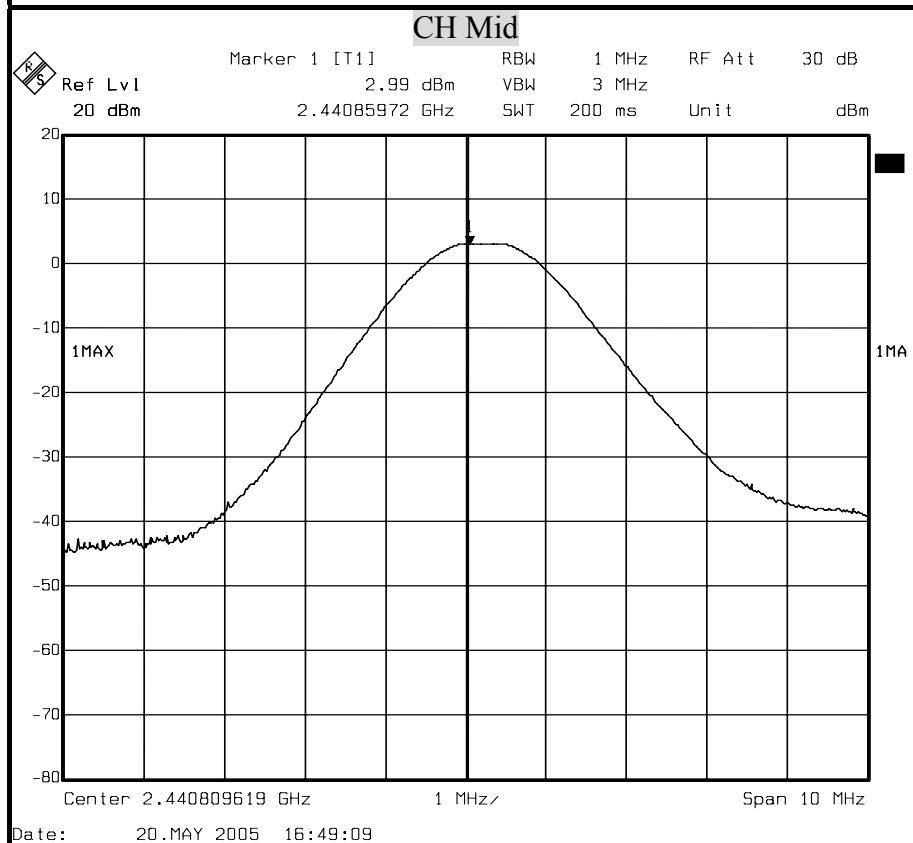
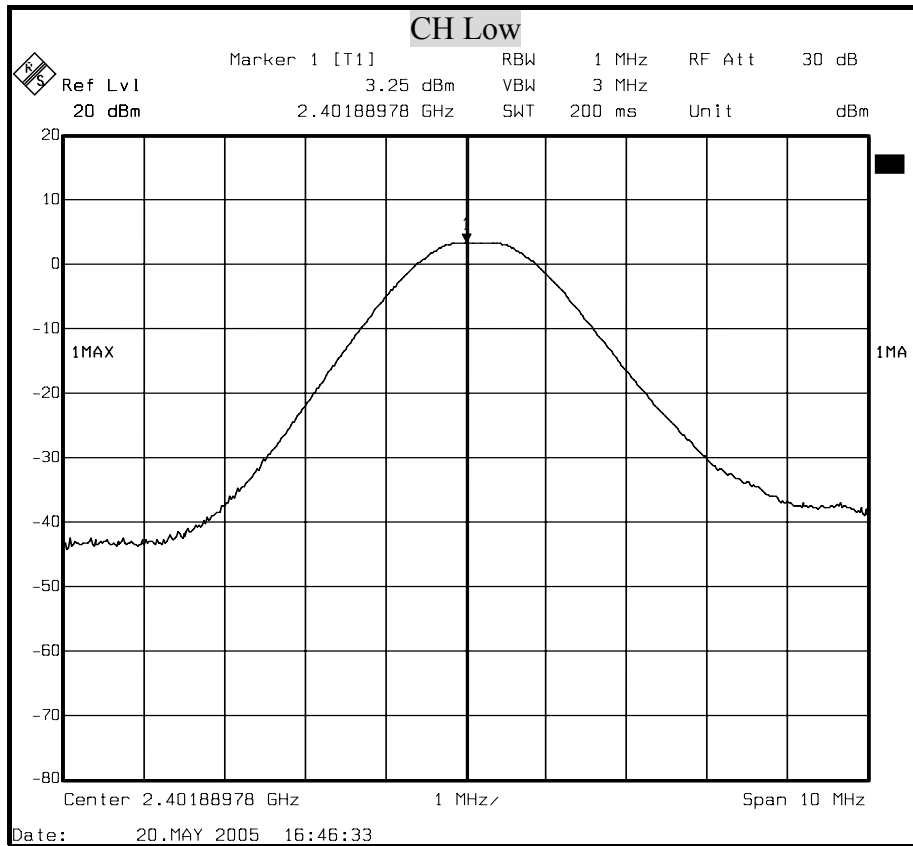
TEST RESULTS

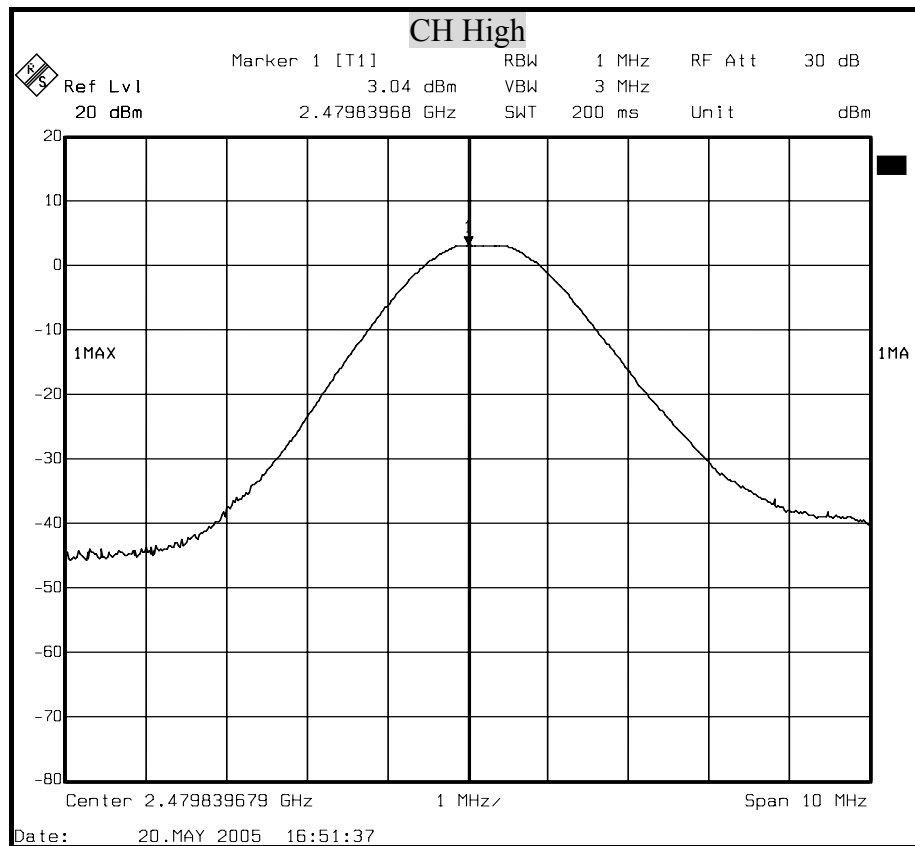
No non-compliance noted

Channel	Channel Frequency (MHz)	Peak Power Output Reading (dBm)	Cable loss (dB)	Peak Power Output (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2402	3.25	0.5	3.75	20.97	PASS
Middle	2441	2.99	0.5	3.49	20.97	PASS
High	2480	3.04	0.5	3.54	20.97	PASS

Note :

1. At final test to get the worst-case emission at 1Mbps.
2. The result basic equation calculation as follow :
$$\text{Peak Power Output} = \text{Peak Power Reading} + \text{Cable loss}$$

**MAXIMUM PEAK OUTPUT POWER**





7.3 HOPPING CHANNEL SEPARATION

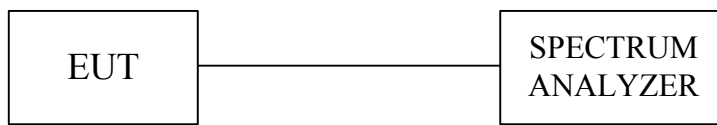
LIMIT

§15.247(a)(1) Frequency hopping system operating in 2400-2483.5MHz. Band may have hopping channel carrier frequencies that are separated by 25kHz or two-third of 20dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125mW.

TEST EQUIPMENTS

Description & Manufacturer	Model No.	Serial No.	Date of Calibration
ROHDE & SCHWARZ SPECTRUM ANALYZER	FSEK30	835253/002	September 06, 2004

TEST SETUP



TEST PROCEDURE

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in test setup without connection to measurement instrument. 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 adjacent channels.
4. Measure the frequency difference of these two adjacent channels by spectrum analyzer MARK function. And then plot the result on spectrum analyzer screen.
5. Repeat above procedures until all frequencies measured were complete.

TEST RESULTS

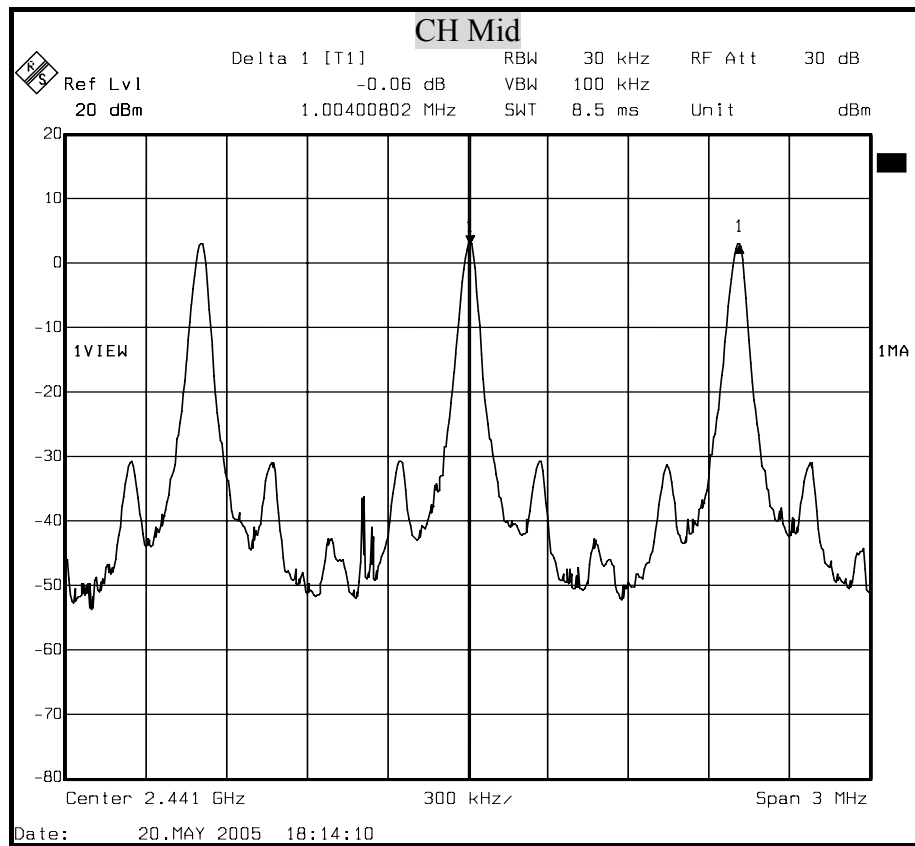
No non-compliance noted

Refer to section 7.1, 20dB bandwidth measurement, the measured channel separation should be greater than two-third of 20dB bandwidth or Minimum bandwidth.

Channel	Adjacent Hopping Channel Separation (kHz)	Two –third of 20dB bandwidth (kHz)	Minimum Bandwidth	Result
2441MHz (Mid)	1004kHz	587.84kHz	25 kHz	PASS



HOPPING CHANNEL SEPARATION





7.4 NUMBER OF HOPPING FREQUENCY USED

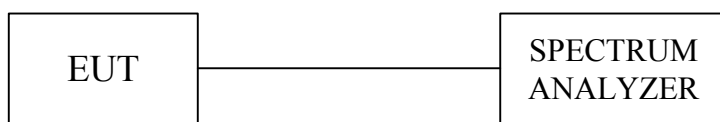
LIMIT

§15.247(a)(1)(iii) For frequency hopping system operating in the 2400-2483.5MHz bands shall use at least 15 hopping frequencies

TEST EQUIPMENTS

Description & Manufacturer	Model No.	Serial No.	Date of Calibration
ROHDE & SCHWARZ SPECTRUM ANALYZER	FSEK30	835253/002	September 06, 2004

TEST SETUP



TEST PROCEDURE

- 1 Check the calibration of the measuring instrument (spectrum analyzer) using either an internal calibrator or a known signal from an external generator.
- 2 Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument 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 spectrum analyzer 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 spectrum analyzer on View mode and then plot the result on spectrum analyzer screen.
- 5 Repeat above procedures until all frequencies measured were complete.

TEST RESULTS

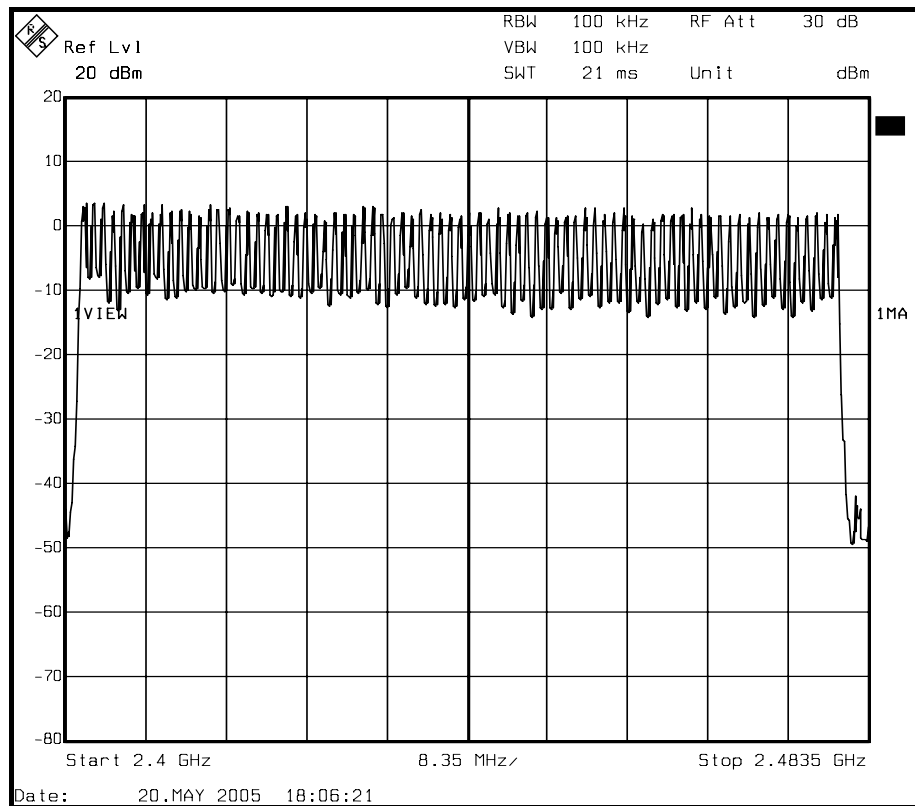
No non-compliance noted

Refer to the attached plot.

There are 79 hopping frequencies in a hopping sequence.



NUMBER OF HOPPING FREQUENCY USED





7.5 DWELL TIME ON EACH CHANNEL

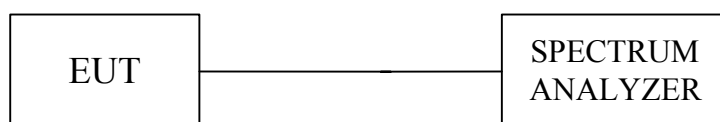
LIMIT

§15.247(a)(1)(iii) For frequency hopping system operating in the 2400-2483.5MHz band, the average time of occupancy on any frequency shall not be greater than 0.4 second within a 31.6 second period.

TEST EQUIPMENTS

Description & Manufacturer	Model No.	Serial No.	Date of Calibration
ROHDE & SCHWARZ SPECTRUM ANALYZER	FSEK30	835253/002	September 06, 2004

TEST SETUP



TEST PROCEDURE

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument 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 spectrum analyzer on any frequency be measured and set spectrum analyzer 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.
6. The Bluetooth Class2 Audio Dongle has 3 type of payload, DH1, DH3, DH5. The hopping rate is 1600 per second.
The longer the payload is, the slower the hopping rate is.

**TEST RESULTS**

No non-compliance noted

Time of occupancy on the TX channel in 31.6sec = time domain slot length $\times$ hop rate $\div$ number of hop per channel $\times$ 31.6

Refer to the attached graph.

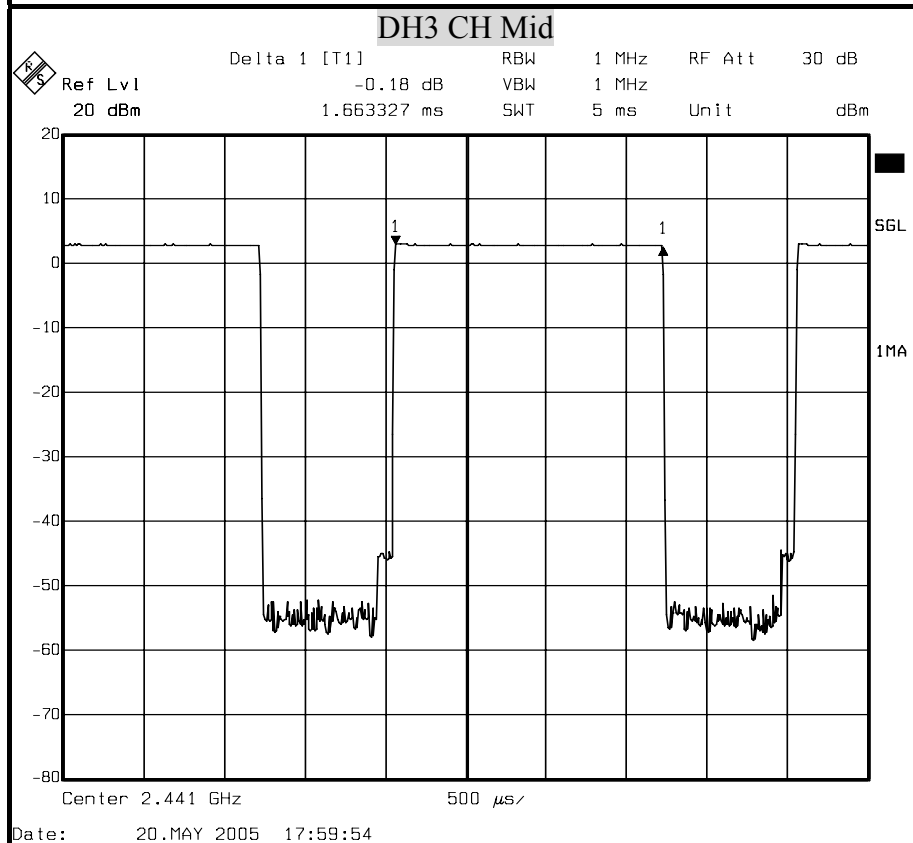
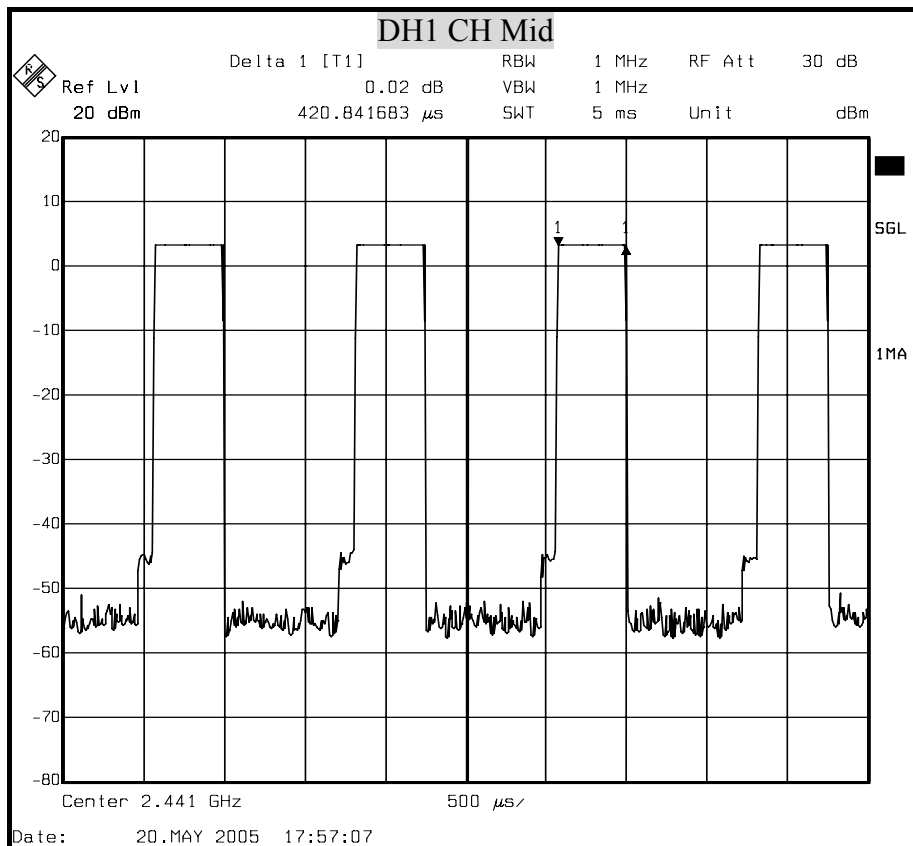
The hopping rates of Bluetooth devices change with different types of payload. The longer the payload is, the slower the hopping rate. The hopping rate scenario is defined in Bluetooth core specification.

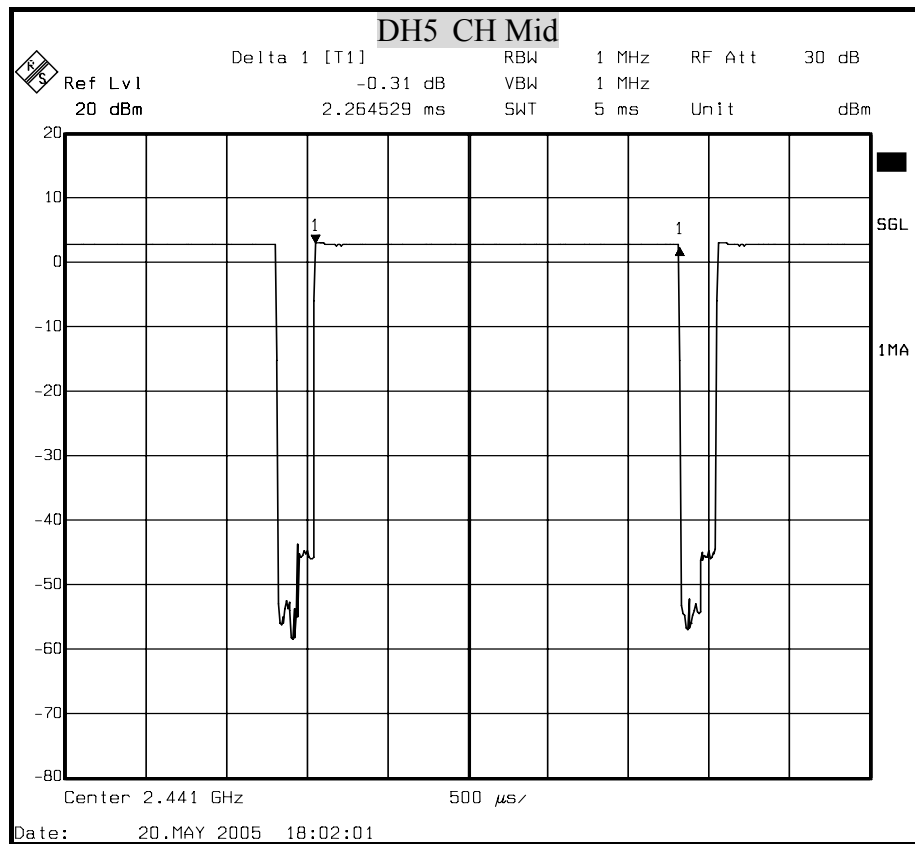
Transmitting Frequency	Packet type	Dwell time (ms)	Time of occupancy on the TX channel in 31.6sec (ms)	Limit for Time of occupancy on the TX channel in 31.6sec (ms)	Results
2441MHz	DH1	0.421	134.72	400	PASS
2441MHz	DH3	1.663	266.08	400	PASS
2441MHz	DH5	2.625	280.00	400	PASS

DH1 Dwell time = $0.421 \text{ ms} \times (1600 \div 2) \div 79 \times 31.6 = 134.72 \text{ (ms)}$

DH3 Dwell time = $1.663 \text{ ms} \times (1600 \div 4) \div 79 \times 31.6 = 266.08 \text{ (ms)}$

DH5 Dwell time = $2.625 \text{ ms} \times (1600 \div 6) \div 79 \times 31.6 = 280.00 \text{ (ms)}$

**DWELL TIME ON EACH PAYLOAD**





7.6 POWER SPECTRAL DENSITY MEASUREMENT

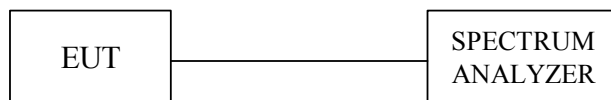
LIMIT

§15.247(e) The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission

TEST EQUIPMENTS

Description & Manufacturer	Model No.	Serial No.	Date Of Calibration	Calibration Period
ROHDE & SCHWARZ SPECTRUM ANALYZER	FSEK30	835253/002	September 06, 2004	1 Year

TEST SETUP



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator, the bandwidth of the fundamental frequency was measured with the spectrum analyzer using 3KHz RBW and 30KHz VBW, set sweep time=span / 3KHz.

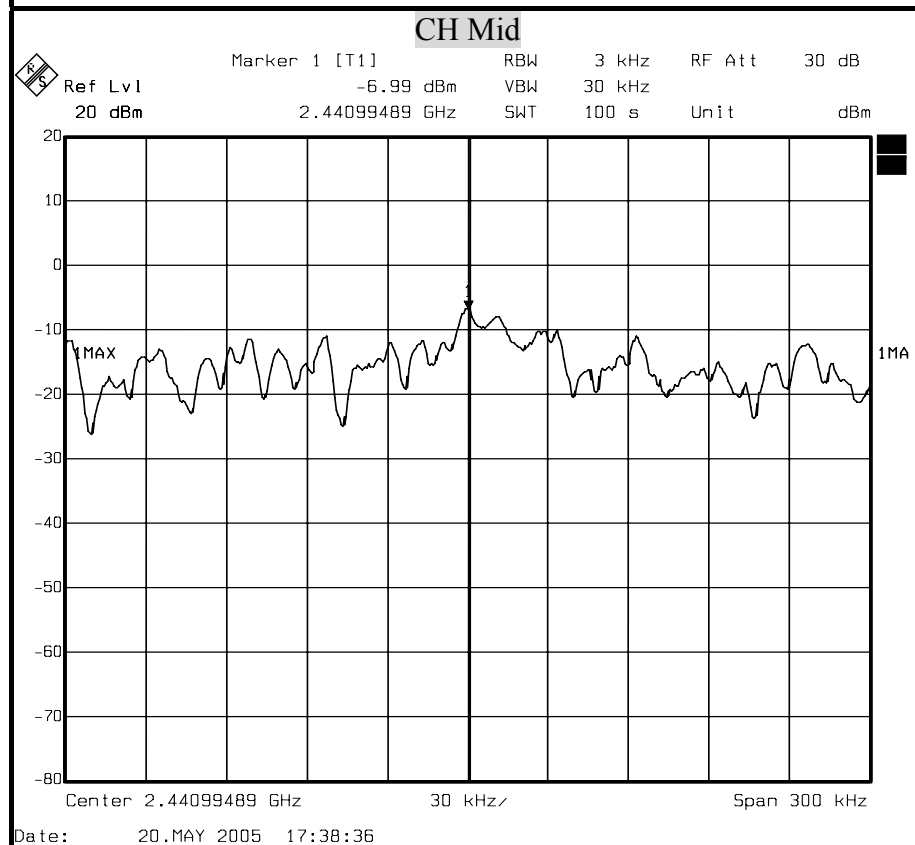
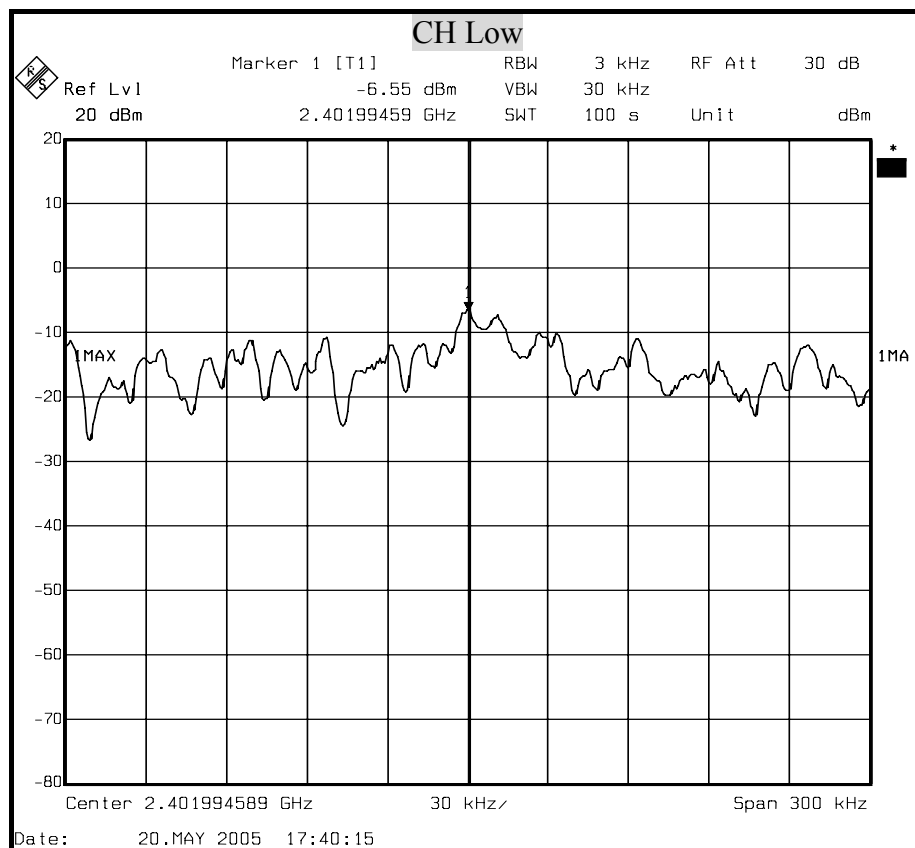
The power spectral density was measured and recorded.

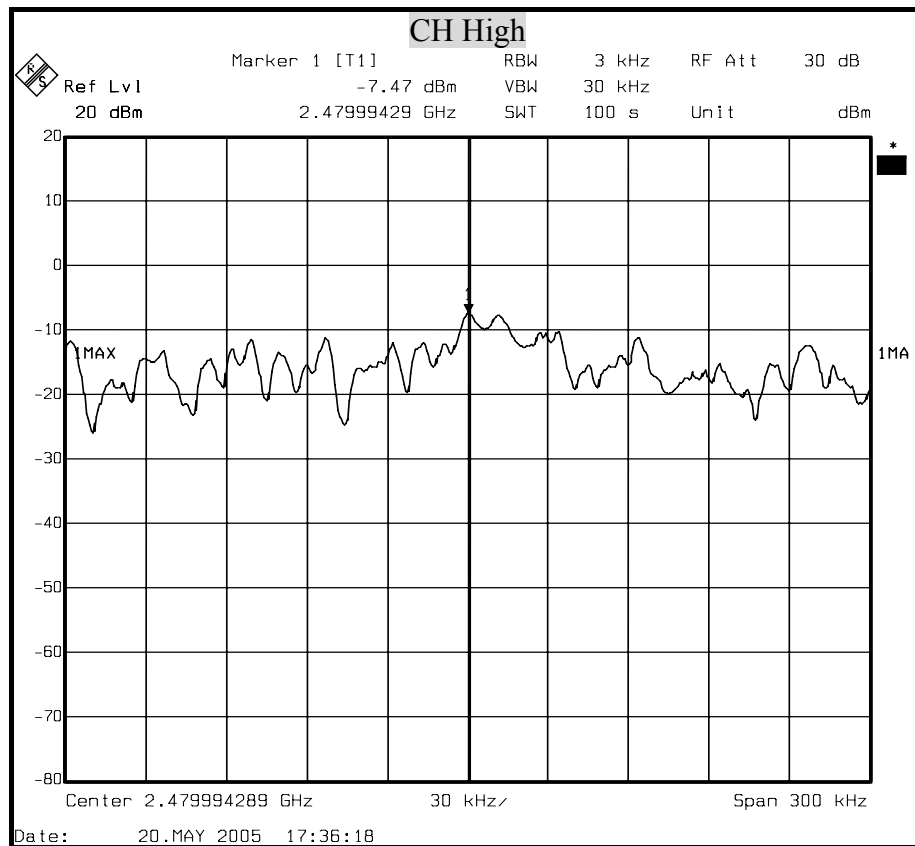
The sweep time is allowed to be longer than span / 3KHz for a full response of the mixer in the spectrum analyzer.

TEST RESULTS

No non-compliance noted

Channel	Channel Frequency (MHz)	Final RF Power Level in 3KHz BW (dBm)	Maximum Limit (dBm)	Pass / Fail
01(Low)	2402	-6.55	8	PASS
40(Mid)	2441	-6.99	8	PASS
79(High)	2480	-7.47	8	PASS

**POWER SPECTRAL DENSITY MEASUREMENT**





7.7 CONDUCTED SPURIOUS EMISSION

LIMITS

§ 15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

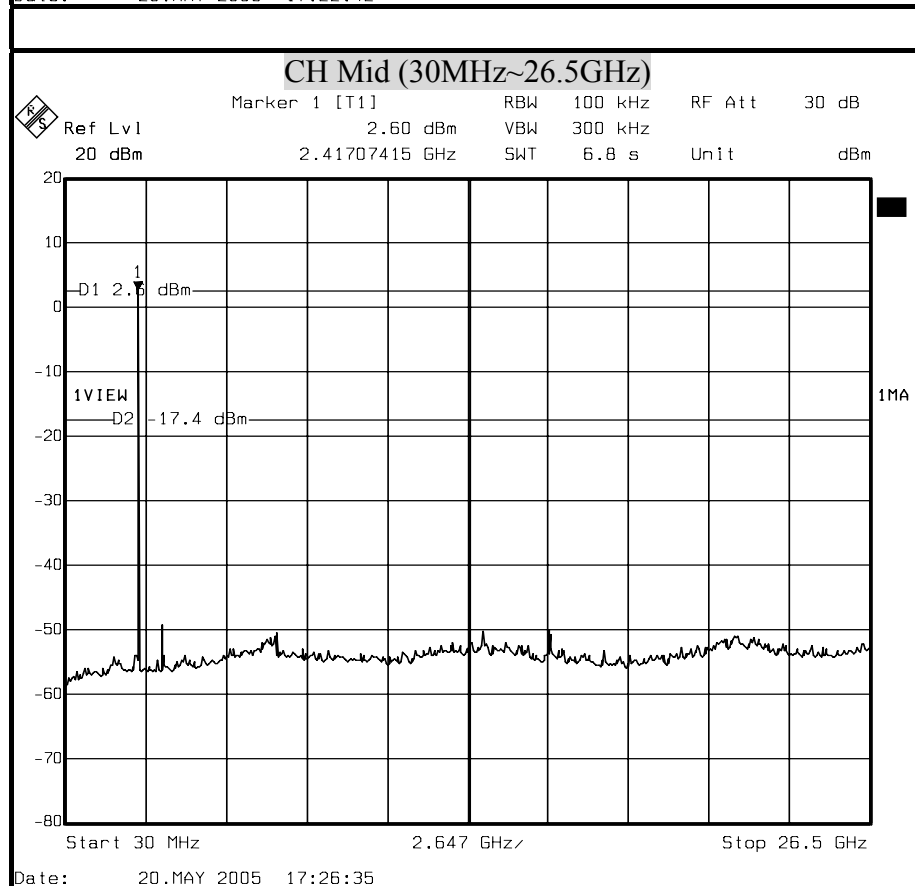
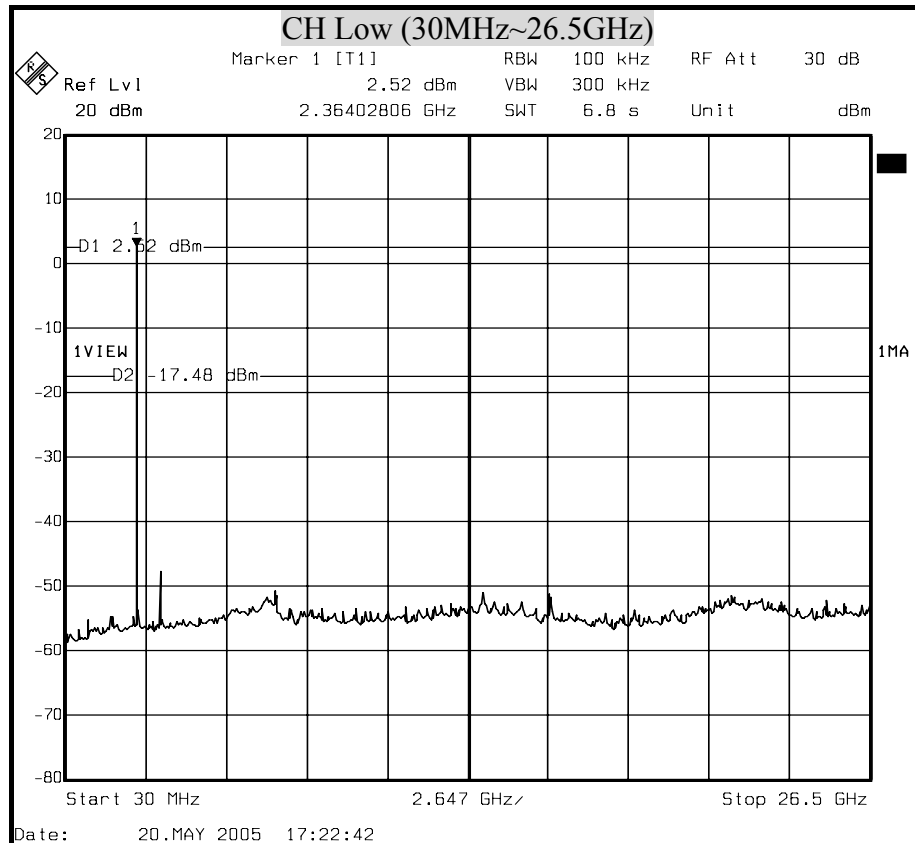
TEST PROCEDURE

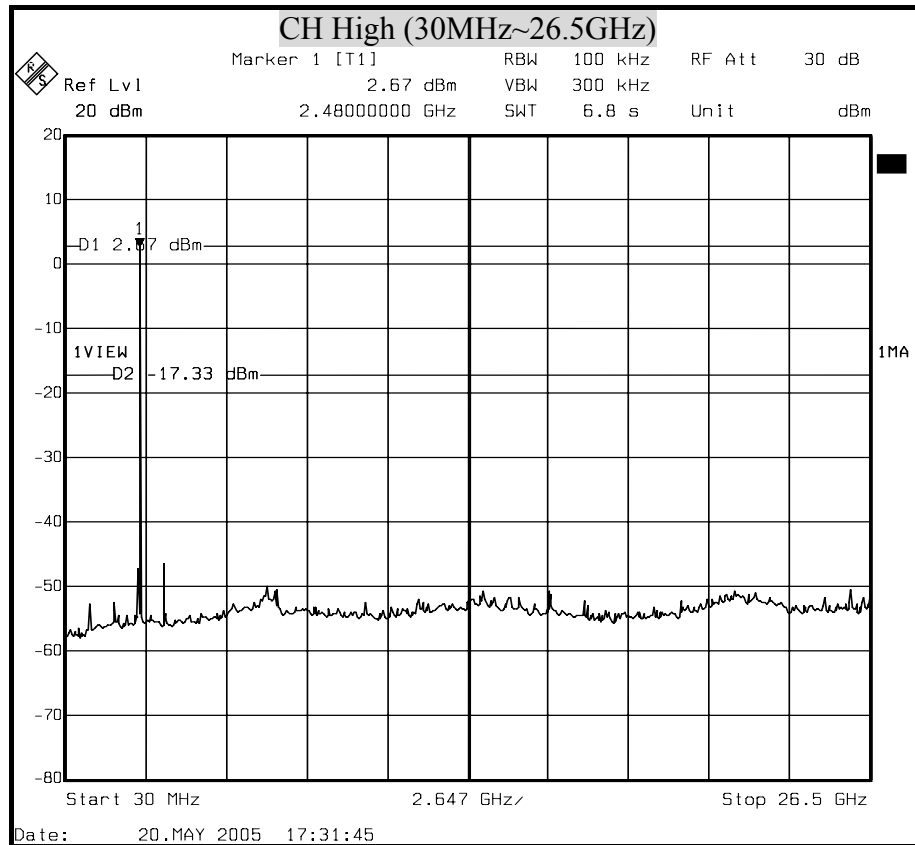
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

The spectrum from 30 MHz to 26.5 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

TEST RESULTS

No non-compliance noted

**BAND EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS****OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT**





7.8 RADIATED EMISSIONS

7.8.1 TRANSMITTER RADIATED SUPURIOUS EMSSIONS

LIMITS

§ 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3338	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41			

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

§ 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.



§ 15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz, However, operation within these frequency bands is permitted under other sections of this Part, e-g, Sections 15.231 and 15.241.

§ 15.209 (b) In the emission table above, the tighter limit applies at the band edges.

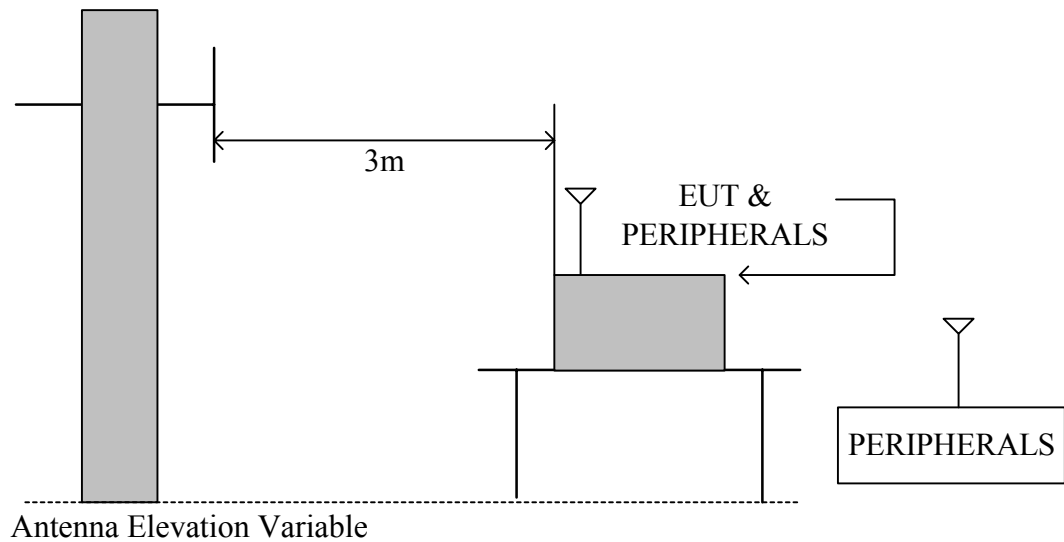
TEST EQUIPMENTS

The following test equipments are utilized in making the measurements contained in this report.

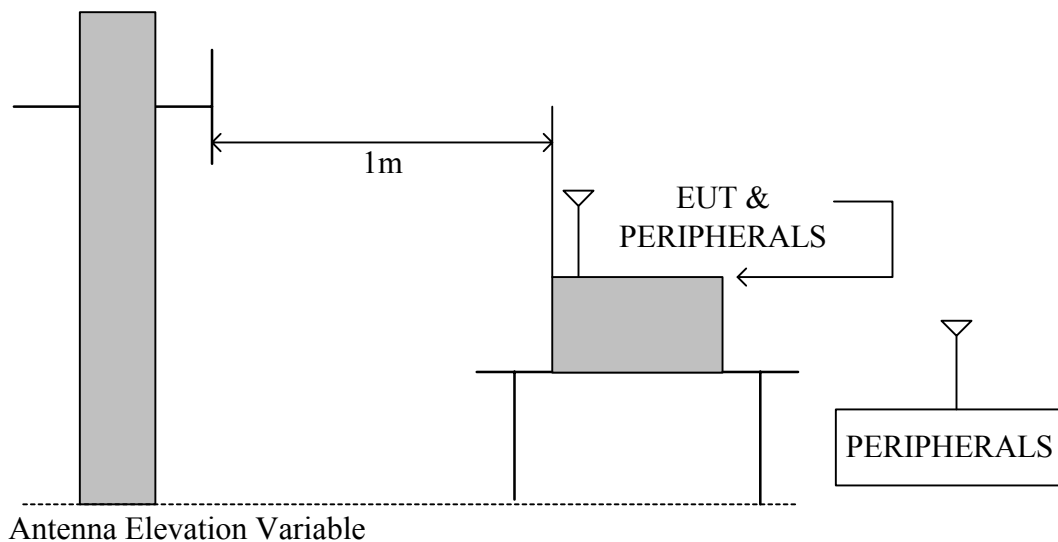
Manufacturer or Type	Model No.	Serial No.	Date of Calibration	Calibration Period	Remark
CHASE BI-LOG ANTENNA	CBL6112B	2817	March 22, 2005	1 Year	FINAL
R/S SPECTRUM ANALYZER	FSEK30	835253/002	September 06, 2004	1 Year	FINAL
R/S EMI TEST RECEIVER	ESCS30	83548/008	September 05, 2004	1 Year	FINAL
OPEN SITE	-----	No.2	May 07, 2005	1 Year	FINAL
N TYPE COAXIAL CABLE	CHA9525	4	June 03, 2004	1 Year	FINAL
Horn Antenna	96001	2698	April 09, 2005	1 Year	FINAL
HP Pre-amplifier	8449B	3008A01471	November 24, 2004	1 Year	FINAL
HP High pass filter	84300/80038	002	CAL. ON USE	1 Year	FINAL

TEST SETUP

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 to 1GHz.



The diagram below shows the test setup that is utilized to make the measurements for emission above 1GHz.





TEST PROCEDURE

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. While measuring the radiated emission below 1GHz, the EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. While measuring the radiated emission above 1GHz, the EUT was set 1 meters away from the interference-receiving antenna
- 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 polarization 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 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 120 KHz 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 and 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.

TEST RESULTS

No non-compliance noted



7.8.2 WORST-CASE RADIATED EMISSION BELOW 1 GHz

Product Name	Bluetooth Class2 Audio Dongle	Test Date	2005/05/25
Model Name	GMHSBTAD	Test By	Alan Fan
Test Mode	CH Low TX	TEMP & Humidity	26.3 °C, 52%

Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading at 3m(dBμV)		Limits (dBμV/m)	Emission Level at 3m(dBμV/m)	
			Horizontal	Vertical		Horizontal	Vertical
177.00	10.45	2.84	13.30	12.40	43.50	26.59	25.69
286.00	13.89	4.22	14.50	11.30	46.00	32.61	29.41
353.00	15.68	4.59	16.20	15.20	46.00	36.48	35.48
402.00	17.04	4.86	13.50	13.10	46.00	35.39	34.99
538.00	19.07	5.36	16.70	14.70	46.00	41.13	39.13
669.00	20.33	6.08	12.10	11.70	46.00	38.51	38.11
803.00	21.63	6.81	10.30	9.60	46.00	38.74	38.04

Note:

1. Emission level (dBμV/M) = Antenna Factor (dB/m) + Cable loss (dB) + Meter Reading (dBμV).
2. According to technical experience, all spurious emission at channel Low, Middle and High are almost the same below 1GHz, so the spurious emission test result of the channel Low was chosen as representative in final test.



7.8.3 TRANSMITTER RADIATED EMISSION ABOVE 1 GHz

Product Name	Bluetooth Class2 Audio Dongle	Test Date	2005/05/25
Model Name	GMHSBTAD	Test By	Alan Fan
Test Mode	CH Low TX	TEMP & Humidity	28.5°C, 80%

Measurement Distance at 1m Horizontal polarity											
Freq. (MHz)	Reading (dBμV)	AF (dBμV)	Cable (dB)	Pre-amp (dB)	Dist (dB)	Filter (dB)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Mark (P/Q/A)	Height (Meter)
* 1602.30	48.41	28.94	2.99	35.54	9.50	0.00	35.30	74.00	-38.70	P	1.00
* 1602.30	41.77	28.94	2.99	35.54	9.50	0.00	28.66	54.00	-25.34	A	1.00
* 4803.55	48.81	34.30	5.08	35.14	9.50	2.09	45.63	74.00	-28.37	P	1.00
* 4803.55	35.38	34.30	5.08	35.14	9.50	2.09	32.20	54.00	-21.80	A	1.00
Measurement Distance at 1m Vertical polarity											
Freq. (MHz)	Reading (dBμV)	AF (dBμV)	Cable (dB)	Pre-amp (dB)	Dist (dB)	Filter (dB)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Mark (P/Q/A)	Height (Meter)
* 1601.92	53.61	28.94	2.99	35.54	9.50	0.00	40.50	74.00	-33.50	P	1.00
* 1601.92	49.27	28.94	2.99	35.54	9.50	0.00	36.16	54.00	-17.84	A	1.00
* 4804.23	51.52	34.31	5.08	35.14	9.50	2.08	48.34	74.00	-25.66	P	1.00
* 4804.23	36.42	34.31	5.08	35.14	9.50	2.08	33.24	54.00	-20.76	A	1.00

Note:

1. The measurement was searched to 10th harmonic.
2. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (3.5GHz)
3. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
4. Dist : correction to extra plate reading to 3m specification distance 1m measurement distance = -9.5dB
5. The result basic equation calculation is as follow:
Level=Reading + AF + Cable – Preamp + Filter – Dist, Margin = Level-Limit
6. The other emission levels were 20dB below the limit
7. The test limit distance is 3M limit.



Product Name	Bluetooth Class2 Audio Dongle	Test Date	2005/05/25
Model Name	GMHSBTAD	Test By	Alan Fan
Test Mode	CH Middle TX	TEMP & Humidity	28.5°C, 80%

Measurement Distance at 1m Horizontal polarity											
Freq. (MHz)	Reading (dBμV)	AF (dBμV)	Cable (dB)	Pre-amp (dB)	Dist (dB)	Filter (dB)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Mark (P/Q/A)	Height (Meter)
* 4882.10	51.02	34.82	5.10	35.21	9.50	1.77	48.01	74.00	-25.99	P	1.00
* 4882.10	36.27	34.82	5.10	35.21	9.50	1.77	33.26	54.00	-20.74	A	1.00
* 7322.48	45.03	39.77	6.80	35.64	9.50	2.00	48.46	74.00	-25.54	P	1.00
* 7322.48	31.46	39.77	6.80	35.64	9.50	2.00	34.89	54.00	-19.11	A	1.00
Measurement Distance at 1m Vertical polarity											
Freq. (MHz)	Reading (dBμV)	AF (dBμV)	Cable (dB)	Pre-amp (dB)	Dist (dB)	Filter (dB)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Mark (P/Q/A)	Height (Meter)
* 4882.10	53.38	34.82	5.10	35.21	9.50	1.77	50.37	74.00	-23.63	P	1.00
* 4882.10	37.89	34.82	5.10	35.21	9.50	1.77	34.88	54.00	-19.12	A	1.00
* 7322.48	43.33	39.77	6.80	35.64	9.50	2.00	46.76	74.00	-27.24	P	1.00
* 7322.48	30.96	39.77	6.80	35.64	9.50	2.00	34.39	54.00	-19.61	A	1.00

Note:

1. The measurement was searched to 10th harmonic.
2. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (3.5GHz)
3. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
4. Dist : correction to extra plate reading to 3m specification distance 1m measurement distance = -9.5dB
5. The result basic equation calculation is as follow:
$$\text{Level} = \text{Reading} + \text{AF} + \text{Cable} - \text{Preamp} + \text{Filter} - \text{Dist}, \text{Margin} = \text{Level} - \text{Limit}$$
6. The other emission levels were 20dB below the limit
7. The test limit distance is 3M limit.



Product Name	Bluetooth Class2 Audio Dongle	Test Date	2005/05/25
Model Name	GMHSBTAD	Test By	Alan Fan
Test Mode	CH High TX	TEMP & Humidity	28.5°C, 80%

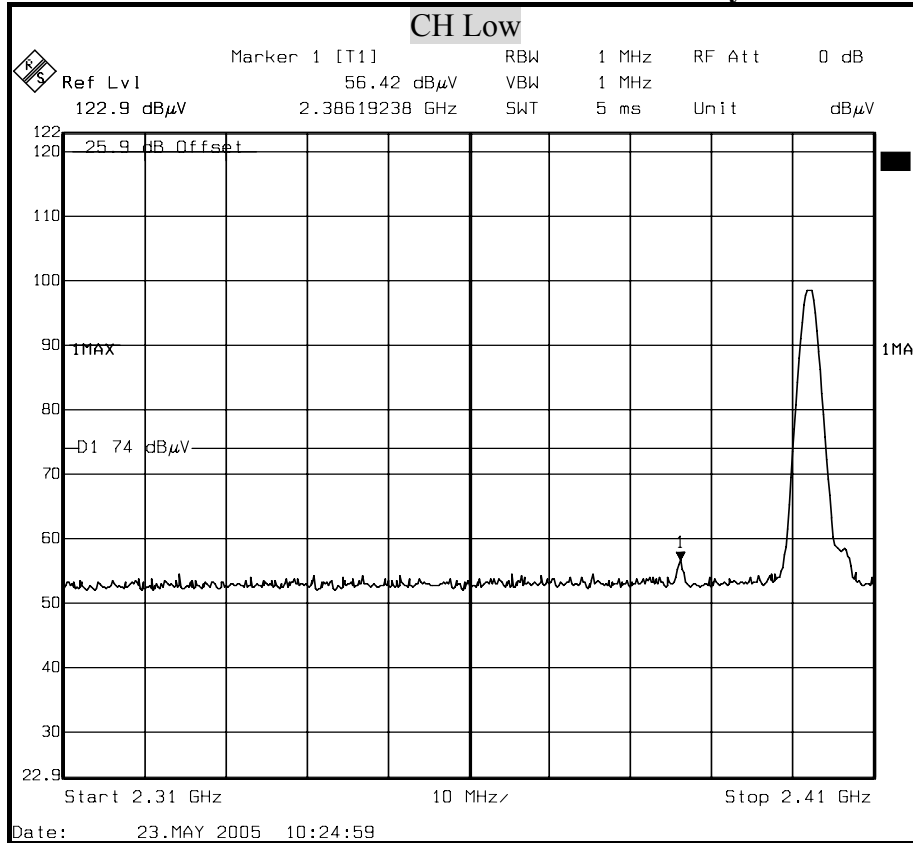
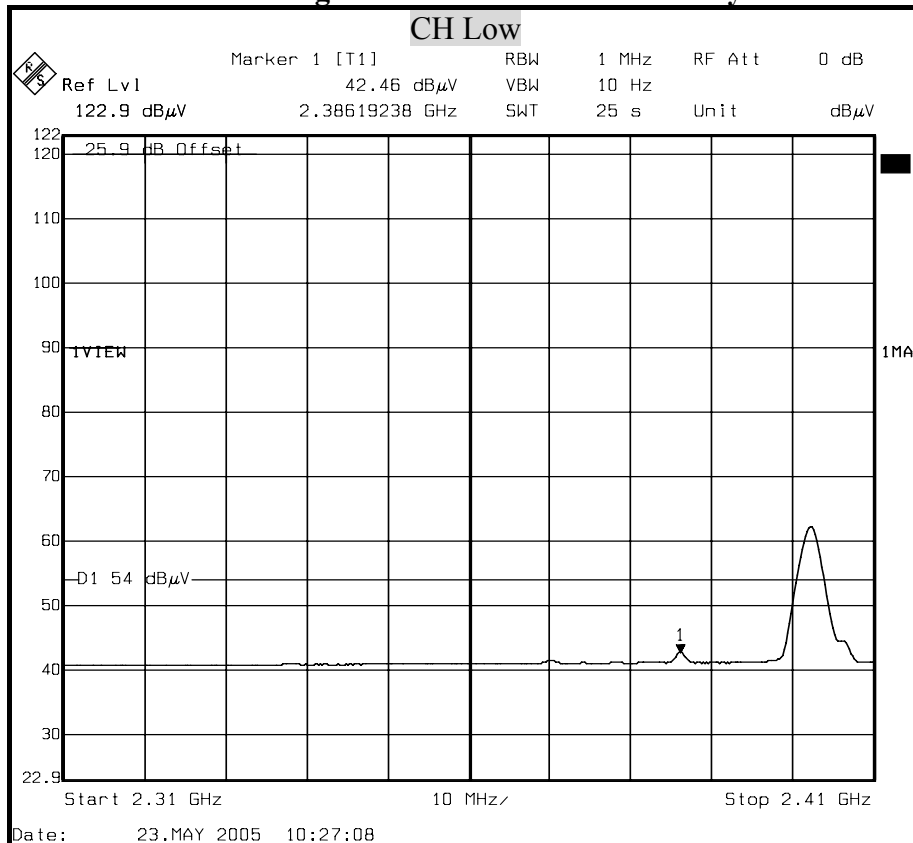
Measurement Distance at 1m Horizontal polarity											
Freq. (MHz)	Reading (dBμV)	AF (dBμV)	Cable (dB)	Pre-amp (dB)	Dist (dB)	Filter (dB)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Mark (P/Q/A)	Height (Meter)
* 4959.93	51.59	53.47	5.13	35.27	9.50	1.46	66.88	74.00	-7.12	P	1.00
* 4959.93	36.85	37.51	5.13	35.27	9.50	1.46	36.18	54.00	-17.82	A	1.00
* 7440.02	43.02	39.72	6.88	35.61	9.50	2.00	46.51	74.00	-27.49	P	1.00
* 7440.02	31.43	39.72	6.88	35.61	9.50	2.00	34.92	54.00	-19.08	A	1.00
Measurement Distance at 1m Vertical polarity											
Freq. (MHz)	Reading (dBμV)	AF (dBμV)	Cable (dB)	Pre-amp (dB)	Dist (dB)	Filter (dB)	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Mark (P/Q/A)	Height (Meter)
* 4959.93	54.73	35.34	5.13	35.27	9.50	1.46	51.89	74.00	-22.11	P	1.00
* 4959.93	50.28	35.34	5.13	35.27	9.50	1.46	47.44	54.00	-6.56	A	1.00
* 7440.02	44.73	39.72	6.88	35.61	9.50	2.00	48.22	74.00	-25.78	P	1.00
* 7440.02	31.26	39.72	6.88	35.61	9.50	2.00	34.75	54.00	-19.25	A	1.00

Note:

1. The measurement was searched to 10th harmonic.
2. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (3.5GHz)
3. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz
4. Dist : correction to extra plate reading to 3m specification distance 1m measurement distance = -9.5dB
5. The result basic equation calculation is as follow:
$$\text{Level} = \text{Reading} + \text{AF} + \text{Cable} - \text{Preamp} + \text{Filter} - \text{Dist}, \text{Margin} = \text{Level} - \text{Limit}$$
6. The other emission levels were 20dB below the limit
7. The test limit distance is 3M limit.



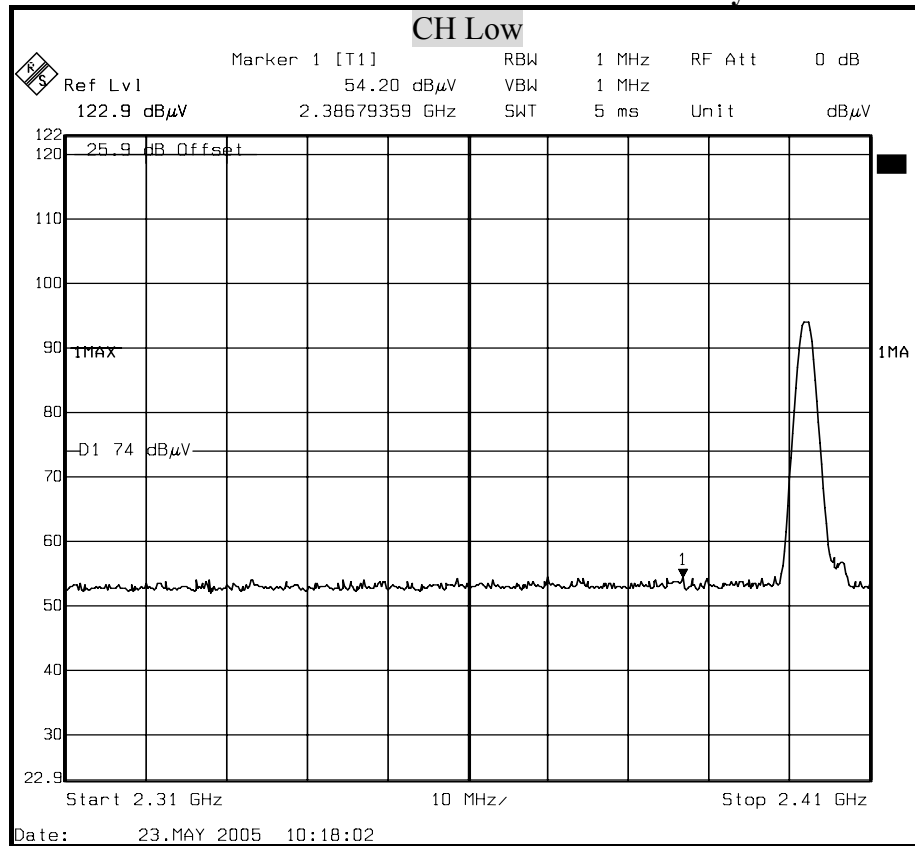
7.8.4 RESTRICTED BAND EDGES

Detector mode : Peak**Polarity : Horizontal****Detector mode : Average****Polarity : Horizontal**



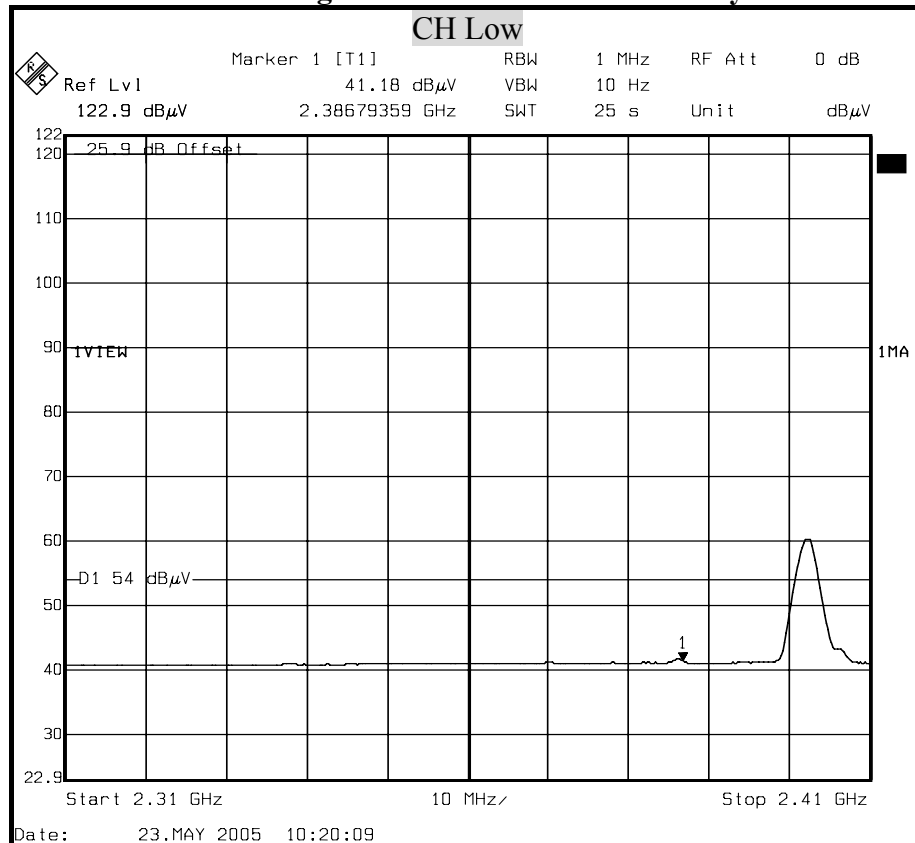
Detector mode : Peak

Polarity : Vertical



Detector mode : Average

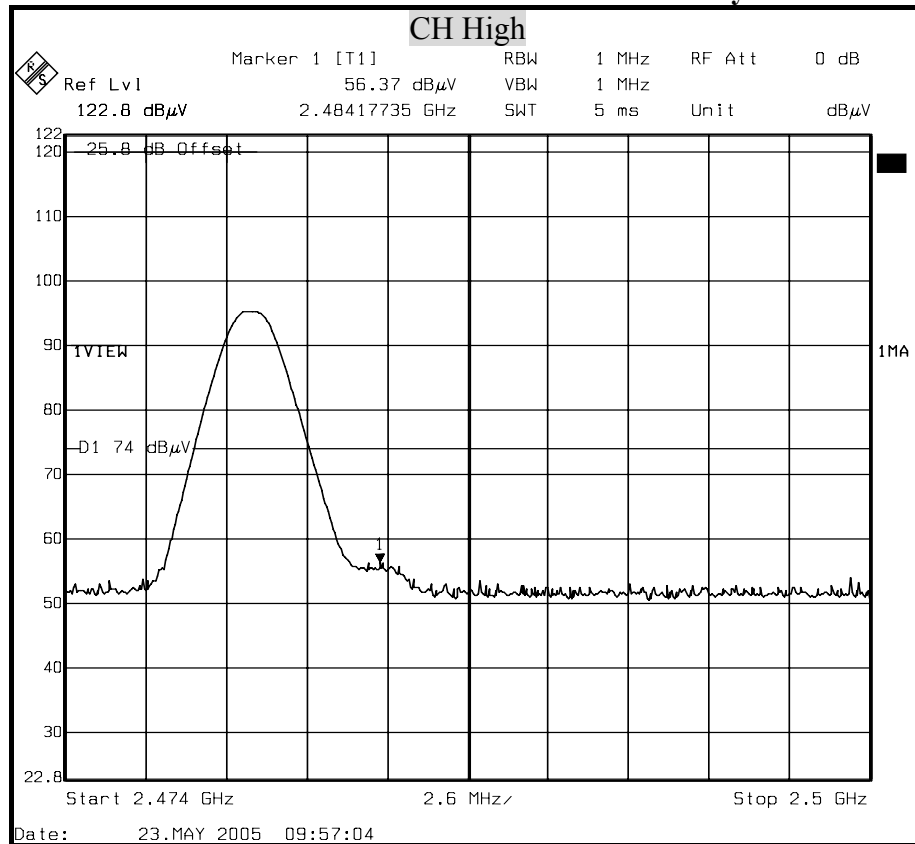
Polarity : Vertical





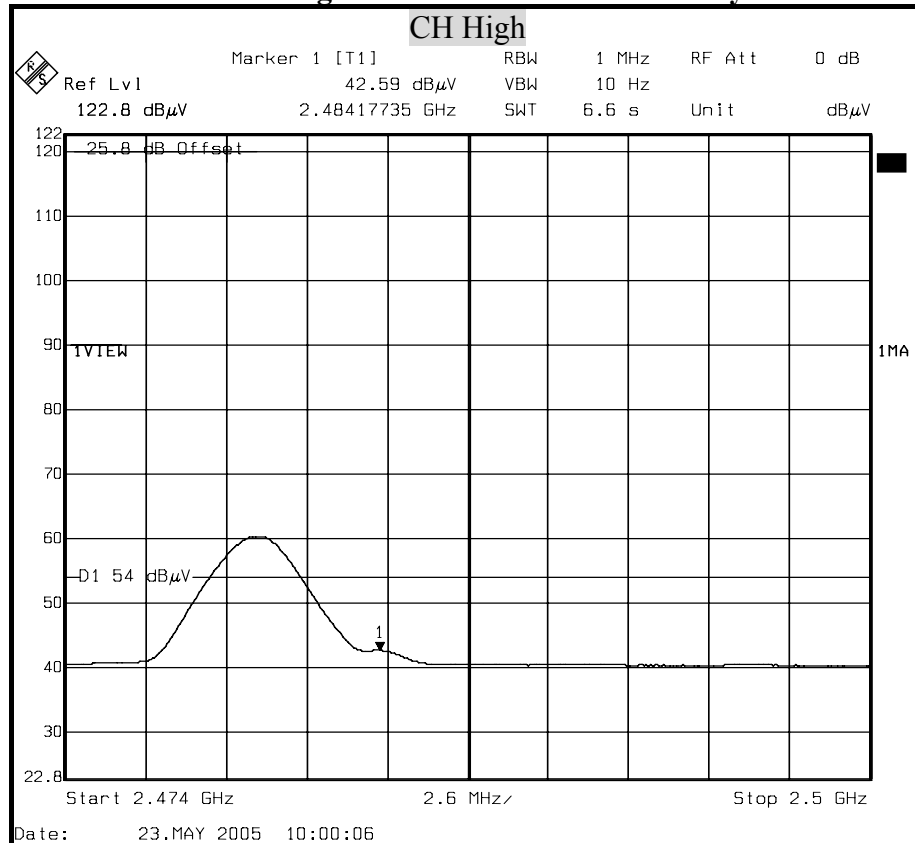
Detector mode : Peak

Polarity : Horizontal



Detector mode : Average

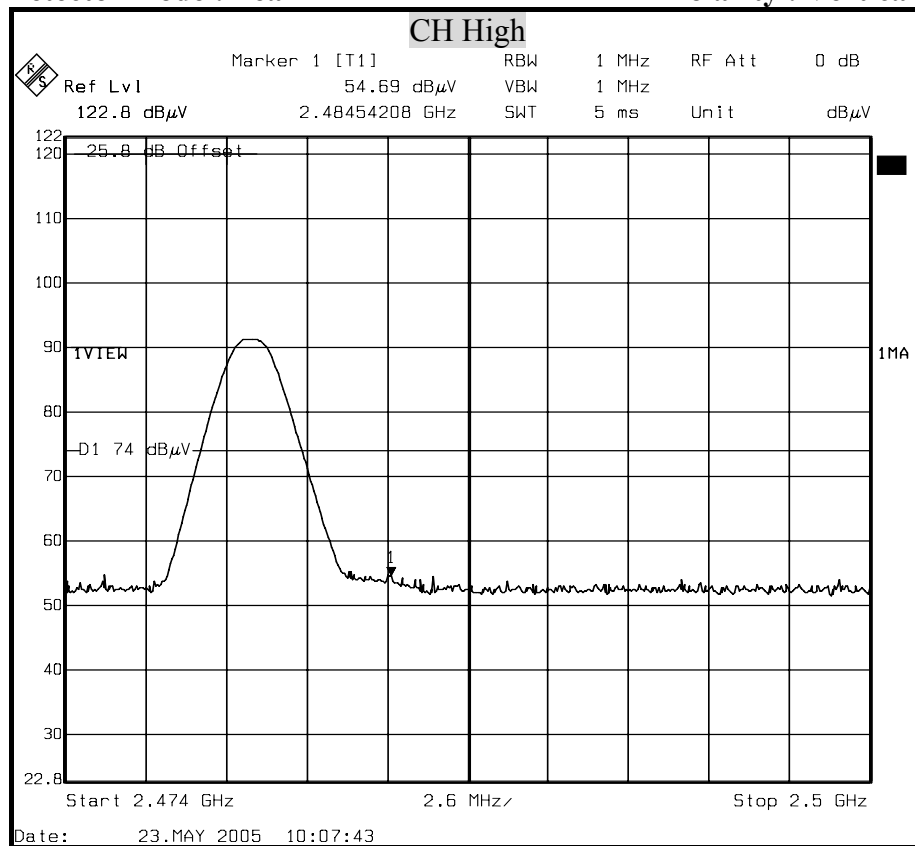
Polarity : Horizontal





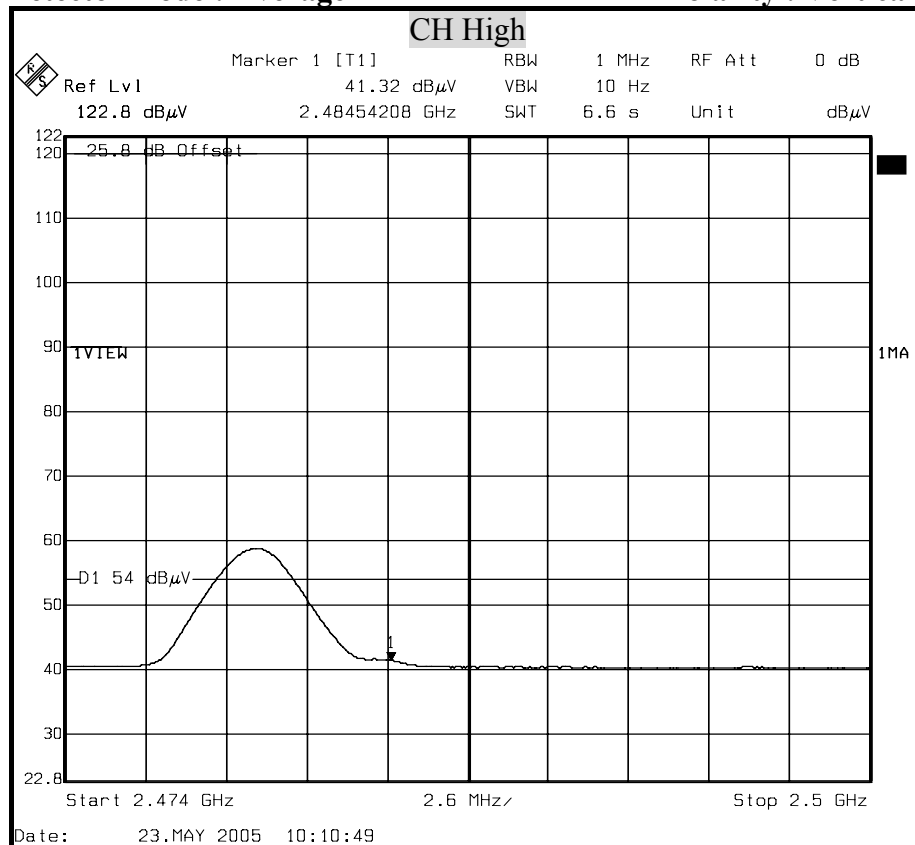
Detector mode : Peak

Polarity : Vertical



Detector mode : Average

Polarity : Vertical





7.9 POWERLINE CONDUCTED EMISSIONS

LIMITS

§ 15.207 (a) Except as shown in paragraph (b) and (c) this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

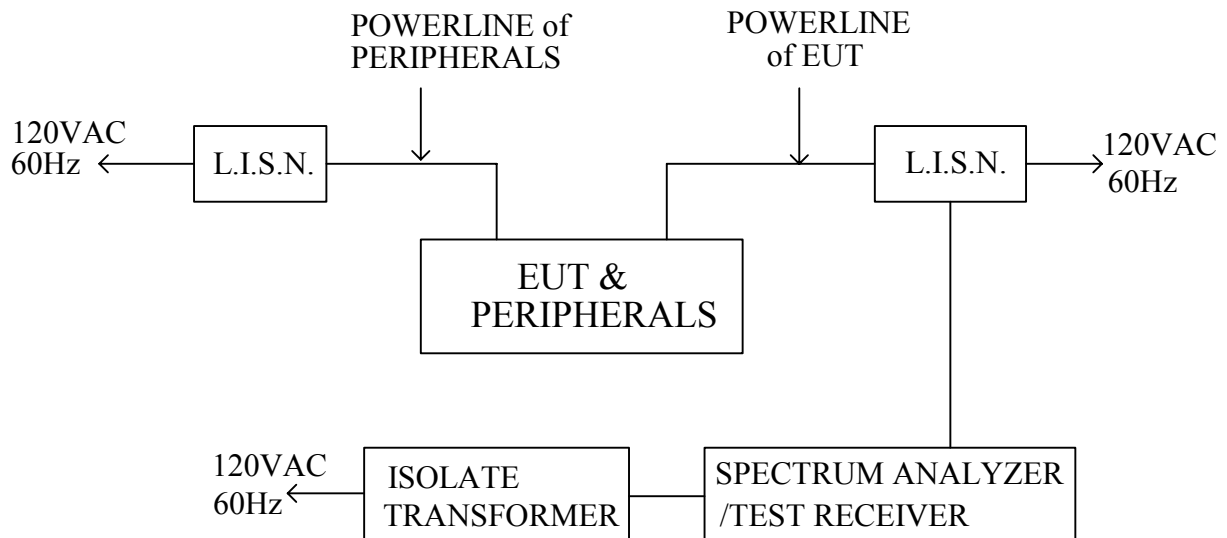
The lower limit applies at the boundary between the frequency ranges.

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

TEST EQUIPMENTS

The following test equipments are used during the conducted powerline tests :

Manufacturer or Type	Model No.	Serial No.	Date of Calibration	Calibration Period	Remark
HP SPECTRUM ANALYZER	8594E	3801A05627	April 28, 2005	1 Year	PRETEST
SOLAR ISOLATION TRANSFORMER	7032-1	N/A	N/A	N/A	FINAL
EMCO L.I.S.N.	3850/2	9311-1025 9401-1028	January 10, 2005 For Characteristic impedance January 10, 2005 For Insertion loss	1 Year	FINAL
R & S TEST RECEIVER	ESHS30	838550/003	February 21, 2005	1 Year	FINAL
KEENE SHIELDED ROOM	5983	No.1	N/A	N/A	FINAL
R & S PULSE LIMIT	EHS3Z2	357.8810.52	July 10, 2004	1 Year	FINAL
N TYPE COAXIAL CABLE	-----	-----	July 10, 2004	1 Year	FINAL
50 Ω TERMINATOR	-----	-----	July 10, 2004	1 Year	FINAL

**TEST SETUP****TEST PROCEDURE**

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80cm above the horizontal ground plane. The EUT IS CONFIGURED IN ACCORDANCE WITH ANSI C63.4.

The resolution bandwidth is set to 9 kHz for both quasi-peak detection and average detection measurements.

Line conducted data is recorded for both NEUTRAL and LINE.

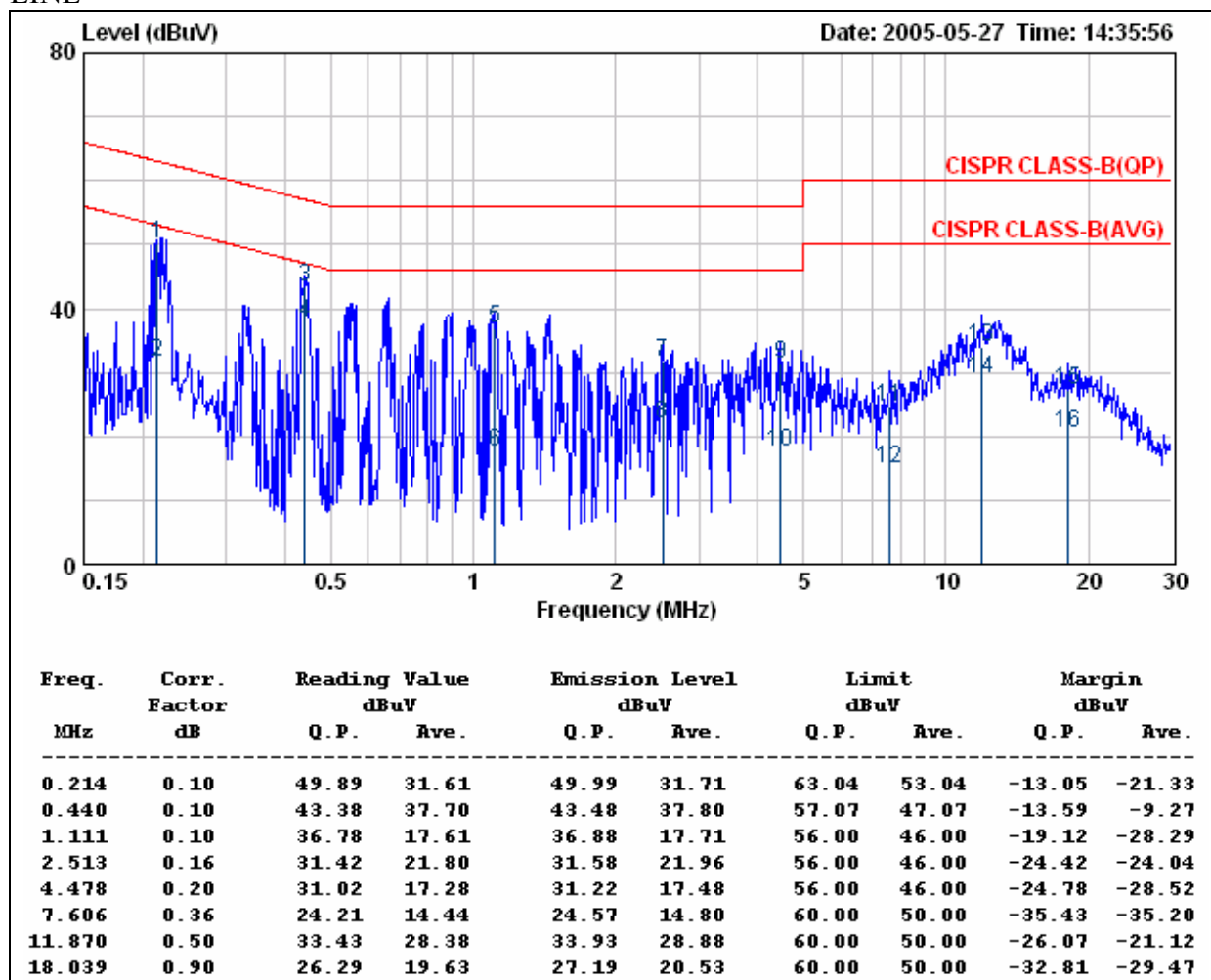
TEST RESULTS

No non-compliance noted

**CONDUCTED RF VOLTAGE MEASUREMENT**

Product Name	Bluetooth Class2 Audio Dongle	Test Date	2005/05/27
Model Name	GMHSBTAD	Test By	Alan Fan
Test Mode	Transmitting mode	TEMP & Humidity	28.5°C, 52%

LINE



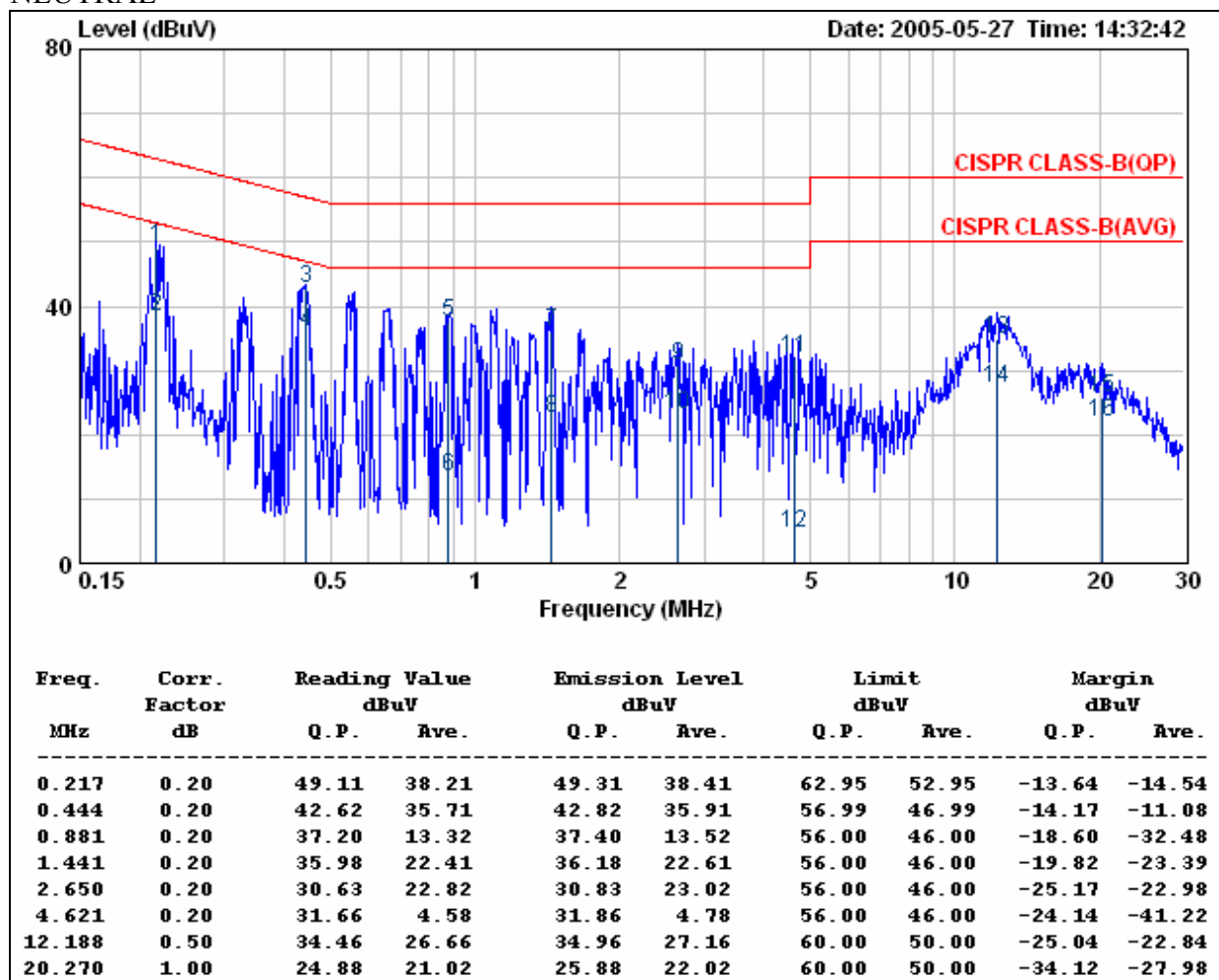
Note:

1. Correction Factor = Insertion loss + cable loss
2. Margin value = Emission level – Limit value
3. The EUT can be operated in transmitting, stand-by and receiving mode. After preliminary scan, EUT in transmitting mode has highest emission.
The EUT was set in transmitting mode at final test to get the worst case test results.



Product Name	Bluetooth Class2 Audio Dongle	Test Date	2005/05/27
Model Name	GMHSBTAD	Test By	Alan Fan
Test Mode	Transmitting mode	TEMP & Humidity	28.5°C, 52%

NEUTRAL



Note:

1. Correction Factor = Insertion loss + cable loss
2. Margin value = Emission level - Limit value
3. The EUT can be operated in transmitting, stand-by and receiving mode. After preliminary scan, EUT in transmitting mode has highest emission.
The EUT was set in transmitting mode at final test to get the worst case test results.



9. ANTENNA REQUIREMENT

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 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

9.2 ANTENNA CONNECTED CONSTRUCTION

The antenna used in this product is Inverter SMD type (layout on PCB) antenna. The maximum Gain of the antenna only 4.1dBi