

# FCC TEST REPORT

for

## 47 CFR, Part 15, Subpart C

Equipment : 56K Bluetooth Modem

Model No. : AME-CA31B, AME-CE31B; PBT-CM31

FCC ID. : RC6AME-CA31B

Filing Type : Certification

Applicant : **Amigo Technology, Inc.**  
No. 6, Lane 35, Jihu Rd., Neihu, Taipei, Taiwan 114, R.O.C.

- The test result refers exclusively to the test presented test model / sample.
- Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.
- **Certificate or Test Report must not be used by the applicant to claim the product in this test report endorsement by NVLAP or any agency of U.S. government.**

***SPORTON International Inc.***

6F, No.106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.

## Table of Contents

<b>History of this test report .....</b>	ii
<b>CERTIFICATE OF COMPLIANCE.....</b>	1
<b>1. General Description of Equipment under Test.....</b>	2
1.1. Applicant.....	2
1.2. Manufacturer .....	2
1.3. Basic Description of Equipment under Test.....	2
1.4. Feature of Equipment under Test .....	2
<b>2. Test Configuration of Equipment under Test .....</b>	4
2.1. Test Manner .....	4
2.2. Description of Test System .....	5
2.3. Connection Diagram of Test System .....	5
<b>3. Test Software .....</b>	5
<b>4. General Information of Test.....</b>	6
4.1. Test Voltage .....	6
4.2. Standard for Methods of Measurement.....	6
4.3. Test in Compliance with .....	6
4.4. Frequency Range Investigated .....	6
4.5. Test Distance .....	6
<b>5. Report of Measurements and Examinations .....</b>	7
5.1. List of Measurements and Examinations .....	7
5.2. Hopping Channel Separation .....	8
5.3. Number of Hopping Frequency .....	9
5.4 Hopping Channel Bandwidth .....	10
5.5 Dwell Time of Each Frequency within a 30 Seconds Period.....	11
5.6 Output Power .....	12
5.7 100KHz Bandwidth of Frequency Band Edges .....	13
5.8 Test of Conducted Emission .....	14
5.9 Test of Radiated Emission .....	18
<b>6 EMI Suppression Component List .....</b>	33
<b>7 Antenna Requirements .....</b>	34
<b>8 RF Exposure.....</b>	35
<b>9 Antenna Factor &amp; Cable Loss .....</b>	37
<b>10List of Measuring Equipments Used .....</b>	38
<b>11Uncertainty of Test Site .....</b>	39

## History of this test report

Original Report Issue Date: Jul. 14, 2003

No additional attachment.

Additional attachment were issued as following record:

Certificate No. : F360910

# CERTIFICATE OF COMPLIANCE

for

## 47 CFR, Part 15, Subpart C

Equipment : 56K Bluetooth Modem

Model No. : AME-CA31B, AME-CE31B; PBT-CM31

FCC ID. : RC6AME-CA31B

Filing Type : Certification

Applicant : **Amigo Technology, Inc.**

No. 6, Lane 35, Jihu Rd., Neihu, Taipei, Taiwan 114,  
R.O.C.

I HEREBY CERTIFY THAT :

The measurements shown in this test report were made in accordance with the procedures given in **ANSI C63.4 - 1992** and the equipment under test was **passed** all test items required in FCC Part 15 subpart C, relative to the equipment under test. Testing was carried out on Jul. 02, 2003 at **SPORTON International Inc.** LAB.

*Tom Guo Lin for July 21, 2003*  
K. J. Lin  
Manager

**SPORTON International Inc.**

6F, No.106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.

## 1. General Description of Equipment under Test

### 1.1. Applicant

Amigo Technology, Inc.  
No. 6, Lane 35, Jihu Rd., Neihu, Taipei, Taiwan 114, R.O.C.

### 1.2. Manufacturer

FAIR WAY ELECTRONICS FACTORY  
HUANG CHONG NO. 3, IND AREA, ZHONG TANG TOWN,  
DONG GUAN CITY, GUANG DONG, P. R. CHINA

### 1.3. Basic Description of Equipment under Test

Equipment : 56K Bluetooth Modem  
Model No. : AME-CA31B, AME-CE31B; PBT-CM31  
FCC ID : RC6AME-CA31B  
Trade Name : Amigo  
Telephone Line x 2 : Non-Shielded, 10m  
Power Supply Type : Linear  
AC Power Input : Wall-Mount, 2pin  
DC Power Cable : Non-Shielded, 1.8m

### 1.4. Feature of Equipment under Test

1. Host/Radio Interface	FHSS
2. Type of Modulation	GFSK
3. Number of Channels	USA/Canada:79
4. Frequency Band	2402—2483.5MHz
5. Carrier Frequency of each channel	2402MHz+(n-1)*1MHz n=channel number
6. Bandwidth of each channel	1MHz
7. Maximum Output Power to Antenna	13dBm
8. IF & L.O. frequency	28.224MHz
9. Type of Antenna Connector (Ex: SMA, TNC, MCX, MMCX, UFC.....etc)	undetachable
10. Antenna Type / Class and Gain	Solder antenna
11. Function Type	Transceiver
12. Power Rating (DC/AC , Voltage)	9VAC 1A from power adapter
13. Duty Cycle	100%
14. Basic function of product	Data/Fax Transmission

Channel	Frequency	Channel	Frequency
00	2402	40	2442
01	2403	41	2443
02	2404	42	2444
03	2405	43	2445
04	2406	44	2446
05	2407	45	2447
06	2408	46	2448
07	2409	47	2449
08	2410	48	2450
09	2411	49	2451
10	2412	50	2452
11	2413	51	2453
12	2414	52	2454
13	2415	53	2455
14	2416	54	2456
15	2417	55	2457
16	2418	56	2458
17	2419	57	2459
18	2420	58	2460
19	2421	59	2461
20	2422	60	2462
21	2423	61	2463
22	2424	62	2464
23	2425	63	2465
24	2426	64	2466
25	2427	65	2467
26	2428	66	2468
27	2429	67	2469
28	2430	68	2470
29	2431	69	2471
30	2432	70	2472
31	2433	71	2473
32	2434	72	2474
33	2435	73	2475
34	2436	74	2476
35	2437	75	2477
36	2438	76	2478
37	2439	77	2479
38	2440	78	2480
39	2441		

## 2. Test Configuration of Equipment under Test

### 2.1. Test Manner

- a. The EUT has been associated with peripherals pursuant to ANSI C63.4-1992 and configuration operated in a manner, which tended to maximize its emission characteristics in a typical application.
- b. The complete test system included remote DYNA MITE CO, TRANBON Telephone and EUT for EMI test.
- c. This device is an integration of an SIG qualified BlueTooth module. The used codes for modulating IF carrier is of course pseudo-random. The hopping sequence is determined by the address of the piconet master. Here is the hopping sequence indicated by channel number:  
02, 17, 68, 55, 4, 77, 56, 27, 70, 80, 22, 33, 57, 34, 29, 79, 44, 50, 3, 71, 66, 36, 78, 20, 67, 30, 24, 11, 37, 69, 23, 7, 41 38, 63, 14, 31, 59, 40, 13, 6, 25, 65, 15, 61, 73, 58, 47, 19, 28, 54, 76, 74, 48, 52, 75, 5, 42, 64, 72, 62, 51, 60, 18, 45, 53, 16, 39, 46, 32, 49, 43, 8, 21, 9, 12, 10, 26, 35
- d. For 15.247(g), during data transmission, the carrier frequency is repeatedly switched on 79 hopping frequencies, any 2 hopping frequencies will not be available on the spectrum simultaneously. So, this device can be taken as true frequency hopping device.
- e. For 15.247(h), the hopping sequence is determined by the address of piconet master. Each piconet master will have its unique address at any moment, so re-use of the hopping sequence is completely not possible. Within the piconet, one master can be communicated with many slaves via the same hopping sequence, but at any moment only one ( master or slave) can be "talk". It is determined by the master that who should be "listen" or "talk". Any slave who wants to "talk" has to send "inquiry" to master first. So, 2 slaves (or one slave one master) is not possible to be on "talk" mode simultaneously.
- f. The following test modes were pretested:  
Mode 1: CH00 ( 2402MHz )  
Mode 2: CH39 ( 2441MHz )  
Mode 3: CH78 ( 2480MHz )

b. Frequency range investigated: conduction 150 KHz to 30 MHz, radiation 30 MHz to 24800MHz.

## 2.2. Description of Test System

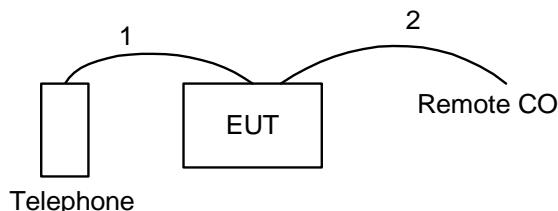
Support Unit 1. -- Telephone (TRANBON) --for local workstation

FCC ID	: N/A
Model No.	: TE-003
Serial No.	: SP0129
Data Cable	: Non-Shielded, 10m

Support Unit 2. -- CO (DYNA MITE) --for remote workstation

FCC ID	: N/A
Model No.	: Premier
Serial No.	: SP0274

## 2.3. Connection Diagram of Test System



1. The Telephone line is connected from EUT to the support unit 1.
2. The Telephone line is connected from EUT to the remote CO.

## 3. Test Software

During testing, EUT kept sending signal at fix frequency.

## **4. General Information of Test**

Test Site Location : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park,  
Kwei-Shan Hsiag, Tao Yuan Hsien, Taiwan, R.O.C.  
TEL : 886-3-327-3456  
FAX : 886-3-318-0055  
Test Site No : CO01-HY, 03CH03-HY

### **4.1. Test Voltage**

110V/60Hz

### **4.2. Standard for Methods of Measurement**

ANSI C63.4-1992

### **4.3. Test in Compliance with**

ANSI C63.4-1992 for conducted power line test and radiated emission test,  
DA 00-705 for test of hopping channel separation  
DA 00-705 for test of number of hopping frequency used  
DA 00-705 for test of hopping channel bandwidth  
DA 00-705 for test of dwell time of each frequency within a 30 second period  
DA 00-705 for test of output power  
DA 00-705 for test of 100khz bandwidth of frequency band edges

### **4.4. Frequency Range Investigated**

- a. Conduction: from 150 KHz to 30 MHz
- b. Radiation: from 30 MHz to 24800MHz

### **4.5. Test Distance**

The test distance of radiated emission from antenna to EUT is 3 M.

## 5. Report of Measurements and Examinations

### 5.1. List of Measurements and Examinations

FCC Rule	Description of Test	Result
15.247(a)(1)(ii)	Hopping Channel Bandwidth	Pass
<u>15.247(a)(1)</u>	Hopping Channel Separation	Pass
<u>15.247(a)(1)(ii)</u>	Number of Hopping Frequency Used	Pass
<u>15.247(a)(1)(ii)</u>	Dwell Time of Each Frequency within a 30 Second Period	Pass
<u>15.247(b)</u>	Output Power	Pass
15.247(c)	100KHz Bandwidth of Frequency Band Edges	Pass
<u>15.107/15.207</u>	Conducted Emission	Pass
15.209	Radiated Emission	Pass
<u>15.203</u>	Antenna Requirement	Pass

## 5.2. Hopping Channel Separation

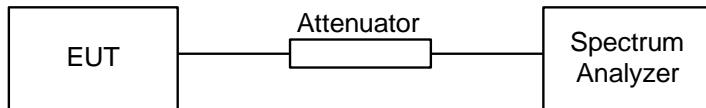
### 5.2.1. Measuring Instruments :

As described in chapter 9 of this test report.

### 5.2.2. Test Procedure :

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 100KHz and VBW to 100KHz.
3. The Hopping Channel Separation is defined as the channel is separated with the next channel.

### 5.2.3. Test Setup Layout :



### 5.2.4. Test Result : The spectrum analyzer plots are attached as below

- Temperature: 27°C
- Relative Humidity: 65 %
- Duty cycle of the equipment during the test X = 100%

Channel	Frequency ( MHz )	Hopping Channel Separation ( KHz )	Limits ( KHz )	Plot
00	2402	1000.0000	25	1
39	2441	1000.0000	25	2
78	2480	1000.0000	25	3

### 5.2.5. Test Configuration ( EUT Operating Condition ) :

The software provided by client to enable the EUT under transmission condition.

The EUT have its hopping function enabled.

### 5.3. Number of Hopping Frequency

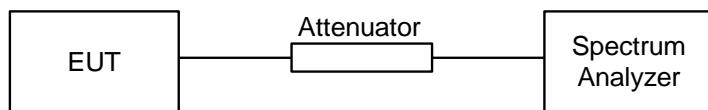
#### 5.3.1. Measuring Instruments :

As described in chapter 9 of this test report.

#### 5.3.2. Test Procedure :

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 100KHz and VBW to 100KHz.
3. The number of hopping frequency used is defined as the device has the numbers of total channel.

#### 5.3.3. Test Setup Layout :



#### 5.3.4. Test Result : See spectrum analyzer plots below

- Temperature: 27°C
- Relative Humidity: 65 %
- Duty cycle of the equipment during the test X = 100%

Number of Hopping Frequency (Channel)	Limits (Channel)	Plot Ref. No.
79	75	1

#### 5.3.5. Test Configuration ( EUT Operating Condition ) :

The software provided by client to enable the EUT under transmission condition.

The EUT have its hopping function enabled.

## 5.4 Hopping Channel Bandwidth

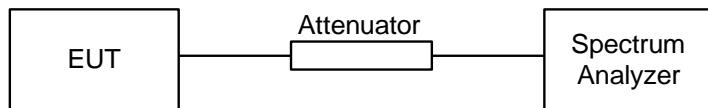
### 5.4.1 Measuring Instruments :

As described in chapter 9 of this test report.

### 5.4.2 Test Procedure :

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 100KHz and VBW to 100KHz.
3. The Hopping Channel bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20 dB.

### 5.4.3 Test Setup Layout :



### 5.4.4 Test Result : See spectrum analyzer plots below

- Temperature: 27°C
- Relative Humidity: 65 %
- Duty cycle of the equipment during the test X = 100%

Channel	Frequency (MHz)	Hopping Channel Bandwidth (MHz)	Limits (MHz)	Plot
				Ref. No.
00	2402	0.2760	1.0	1
39	2441	0.2690	1.0	2
78	2480	0.2690	1.0	3

### 5.4.5 Test Configuration ( EUT Operating Condition ) :

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies respectively.

## 5.5 Dwell Time of Each Frequency within a 30 Seconds Period

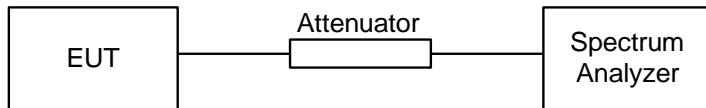
### 5.5.1 Measuring Instruments :

As described in chapter 9 of this test report.

### 5.5.2 Test Procedure :

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to **1MHz** and VBW to **1MHz**.
3. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
4. **The calculate =  $30 * (1600/79) * t$  ( ie: t = the time duration of one single pulse )**

### 5.5.3 Test Setup Layout :



### 5.5.4 Test Result : See spectrum analyzer plots below

- Temperature: 27°C
- Relative Humidity: 65 %
- Duty cycle of the equipment during the test X = 100%

Channel	Frequency (MHz)	Dwell Time (s)	Limits (s)	Plot
				Ref. No.
00	2402	0.256162025	0.4	1
39	2441	0.256162025	0.4	2
78	2480	0.256162025	0.4	3

### 5.5.5 Test Configuration ( EUT Operating Condition ) :

Same as Section 5.2.5.

## 5.6 Output Power

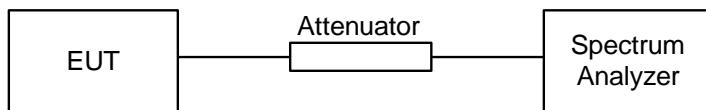
### 5.6.1 Measuring Instruments :

As described in chapter 9 of this test report.

### 5.6.2 Test Procedure :

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. The center frequency of the spectrum analyzer was set to the fundamental frequency and set RBW to 1MHz and VBW to 1MHz.

### 5.6.3 Test Setup Layout :



### 5.6.4 Test Result : See spectrum analyzer plots below

- Temperature: 27°C
- Relative Humidity: 65 %
- Duty cycle of the equipment during the test X = 100%

Channel	Frequency	Measured Output Power	Measured Output Power	Limits
	(MHz)	(dBm)	(mWatt)	(Watt/dBm )
00	2402	12.15	16.40589773	1W/30 dBm
39	2441	12.06	16.06941253	1W/30 dBm
78	2480	11.48	14.06047524	1W/30 dBm

### 5.6.5 Test Configuration ( EUT Operating Condition ) :

Same as Section 5.4.5.

## 5.7 100KHz Bandwidth of Frequency Band Edges

### 5.7.1 Measuring Instruments :

As described in chapter 9 of this test report.

### 5.7.2 Test Procedure :

1. The transmitter output was connected to the spectrum analyzer via a low loss cable.
2. Set both RBW and VBW of spectrum analyzer to 100KHz with convenient frequency span including 100 KHz bandwidth from band edge.
3. The band edges was measured and recorded.

### 5.7.3 Test Result :

Test Result in lower band (Channel 00) :	PASS
Test Result in higher band(Channel 78) :	PASS

### 5.7.4 Note on Band edge Emission

The band edge emission plot on page 30. shows 57.38dB delta between carrier maximum power and local maximum emission in the restricted band (2.4835GHz).

Polarity	The emission of carrier power		The maximum field strength in restrict band		Margin	Detector	Result
	strength	(dB $\mu$ V/m)	strength	(dB $\mu$ V/m)	Limit	(dB)	
H	105.76	48.38	74.00	74.00	-25.62	Peak	Pass
H	105.22	47.84	54.00	54.00	-6.16	Average	Pass
V	108.61	51.23	74.00	74.00	-22.77	Peak	Pass
V	108.45	51.07	54.00	54.00	-2.93	Average	Pass

\* The maximum field strength in restricted band is the emission of carrier power strength subtract to the delta between carrier maximum power and local maximum emission in the restricted band.

### 5.7.5 Test Configuration ( EUT Operating Condition ) :

The software provided by client to enable the EUT under transmission condition continuously at lowest, and highest channel frequencies respectively.

## **5.8 Test of Conducted Emission**

Conducted Emissions were measured from 150 KHz to 30 MHz with a bandwidth of 9 KHz and return leads of the EUT according to the methods defined in ANSI C63.4-1992 Section 3.1. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

### **5.8.1 Major Measuring Instruments :**

• Test Receiver	(R&S ESCS 30)
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 KHz

### **5.8.2 Test Procedures :**

- a. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
- b. Connect EUT to the power mains through a line impedance stabilization network (LISN).
- c. All the support units are connect to the other LISN.
- d. The LISN provides 50 ohm coupling impedance for the measuring instrument.
- e. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
- f. Both sides of AC line were checked for maximum conducted interference.
- g. The frequency range from 150 KHz to 30 MHz was searched.
- h. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

## 5.8.3 Test Result of Conducted Emission :

- Test Mode: Mode 1
- Frequency Range of Test: from 150KHz to 30 MHz
- Temperature: 27.6°C
- Relative Humidity: 66 %
- Test Date: 2003-07-02

**The test was passed at the minimum margin that marked by a frame in the following data**

Site	C001-HY						
	CISPR CLASS-B 2003 2001/008 LIME						
EUT	2.4G RF Blue Tooth Router						
Power	110V/60Hz						
Model	AME-CA31B,CE31B,PBT-CM31						
Memo	TX CH00						
	Freq	Over Level	Limit	Read Line	Probe Level	Cable Factor	Cable Loss Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB
1	0.150	20.81	-35.19	56.00	20.61	0.10	0.10 Average
2	0.150	48.23	-17.77	66.00	48.03	0.10	0.10 QP
3	0.163	44.58	-20.73	65.31	44.40	0.10	0.08 QP
4	0.163	20.94	-34.37	55.31	20.76	0.10	0.08 Average
5	0.184	39.90	-24.40	64.30	39.74	0.10	0.06 QP
6	0.184	15.25	-39.05	54.30	15.09	0.10	0.06 Average
7	0.223	35.72	-26.99	62.71	35.58	0.10	0.04 QP
8	0.223	14.97	-37.74	52.71	14.83	0.10	0.04 Average
9	0.371	24.32	-24.16	48.48	24.16	0.10	0.06 Average
10	0.371	31.65	-26.83	58.48	31.49	0.10	0.06 QP
11	0.437	27.01	-20.11	47.12	26.85	0.10	0.06 Average
12	0.437	32.82	-24.30	57.12	32.66	0.10	0.06 QP
Site	C001-HY						
Condition	CISPR CLASS-B 2003 2001/008 NEUTRAL						
EUT	2.4G RF Blue Tooth Router						
Power	110V/60Hz						
Model	AME-CA31B,CE31B,PBT-CM31						
Memo	TX CH00						
	Freq	Over Level	Limit	Read Line	Probe Level	Cable Factor	Cable Loss Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB
1	0.161	23.05	-32.38	55.43	22.87	0.10	0.08 Average
2	0.161	45.20	-20.23	65.43	45.02	0.10	0.08 QP
3	0.182	19.23	-35.16	54.39	19.07	0.10	0.06 Average
4	0.182	41.20	-23.19	64.39	41.04	0.10	0.06 QP
5	0.216	37.02	-25.95	62.97	36.88	0.10	0.04 QP
6	0.216	16.02	-36.95	52.97	15.88	0.10	0.04 Average
7	0.379	34.40	-23.82	58.30	34.32	0.10	0.06 QP
8	0.379	28.50	-19.80	48.30	28.34	0.10	0.06 Average
9	0.449	30.42	-16.47	46.89	30.26	0.10	0.06 Average
10	0.449	37.10	-19.79	56.89	36.94	0.10	0.06 QP
11	0.513	27.79	-28.21	56.00	27.63	0.10	0.06 QP
12	0.513	21.13	-24.87	46.00	20.97	0.10	0.06 Average



Test Engineer: \_\_\_\_\_

John Huang

- Test Mode: Mode 2
- Frequency Range of Test: from 150KHz to 30 MHz
- Temperature: 27.6°C
- Relative Humidity: 66 %
- Test Date: 2003-07-02

**The test was passed at the minimum margin that marked by a frame in the following data**

Site : C001-HY  
 Condition : CISPR CLASS-B 2003 2001/008 LINE  
 EUT : 2.4G RF Blue Tooth Router  
 Power : 110V/60Hz  
 Model : AME-CA31B,CE31B,PBT-CM31  
 Memo : TX CH39

Freq	Level	Limit	Over	Limit	Read	Probe	Cable
			Line	Level	Factor	Loss	Remark
MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.162	22.13 -33.23	55.36	21.95	0.10	0.08	Average
2	0.162	44.68 -20.68	65.36	44.50	0.10	0.08	QP
3	0.188	40.20 -23.92	64.12	40.05	0.10	0.05	QP
4	0.188	16.29 -37.83	54.12	16.14	0.10	0.05	Average
5	0.228	35.40 -27.12	62.52	35.26	0.10	0.04	QP
6	0.228	14.48 -38.04	52.52	14.34	0.10	0.04	Average
7	0.389	26.41 -21.68	48.09	26.25	0.10	0.06	Average
8	0.389	32.58 -25.51	58.09	32.42	0.10	0.06	QP
9	0.461	34.93 -21.74	56.67	34.77	0.10	0.06	QP
10	0.461	27.39 -19.28	46.67	27.23	0.10	0.06	Average
11	0.853	18.23 -37.77	56.00	18.06	0.10	0.07	QP
12	0.853	14.98 -31.02	46.00	14.81	0.10	0.07	Average

Site : C001-HY  
 Condition : CISPR CLASS-B 2003 2001/008 NEUTRAL  
 EUT : 2.4G RF Blue Tooth Router  
 Power : 110V/60Hz  
 Model : AME-CA31B,CE31B,PBT-CM31  
 Memo : TX CH39

Freq	Level	Limit	Over	Limit	Read	Probe	Cable
			Line	Level	Factor	Loss	Remark
MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.158	22.30 -33.27	55.57	22.11	0.10	0.09	Average
2	0.158	45.83 -19.74	65.57	45.64	0.10	0.09	QP
3	0.182	41.18 -23.21	64.39	41.02	0.10	0.06	QP
4	0.182	17.21 -37.18	54.39	17.05	0.10	0.06	Average
5	0.221	36.40 -26.38	62.78	36.26	0.10	0.04	QP
6	0.221	15.25 -37.53	52.78	15.11	0.10	0.04	Average
7	0.379	28.58 -19.72	48.30	28.42	0.10	0.06	Average
8	0.379	34.44 -23.86	58.30	34.28	0.10	0.06	QP
9	0.449	36.84 -20.05	56.89	36.68	0.10	0.06	QP
10	0.449	30.55 -16.34	46.89	30.39	0.10	0.06	Average
11	0.513	27.77 -28.23	56.00	27.61	0.10	0.06	QP
12	0.513	21.03 -24.97	46.00	20.87	0.10	0.06	Average

Test Engineer: John

John Huang

- Test Mode: Mode 3
- Frequency Range of Test: from 150KHz to 30 MHz
- Temperature: 27.6°C
- Relative Humidity: 66 %
- Test Date: 2003-07-02

**The test was passed at the minimum margin that marked by a frame in the following data**

Site : C001-HY  
 Condition : CISPR CLASS-B 2003 2001/008 LINE  
 EUT : 2.4G RF Blue Tooth Router  
 Power : 110V/60Hz  
 Model : AME-CA31B,CE31B,PBT-CM31  
 Memo : TX CH78

Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss		Remark
						dBmV	dB	
1	0.164	44.33	-20.95	65.28	44.15	0.10	0.08	QP
2	0.164	21.68	-33.60	55.28	21.50	0.10	0.08	Average
3	0.188	40.20	-23.92	64.12	40.05	0.10	0.05	QP
4	0.188	16.21	-37.91	54.12	16.06	0.10	0.05	Average
5	0.220	13.59	-39.23	52.82	13.45	0.10	0.04	Average
6	0.220	36.38	-26.44	62.82	36.24	0.10	0.04	QP
7	0.419	26.03	-21.44	47.47	25.97	0.10	0.06	Average
8	0.419	32.74	-24.73	57.47	32.58	0.10	0.06	QP
9	0.461	27.39	-19.28	46.67	27.23	0.10	0.06	Average
10	0.461	34.93	-21.74	56.67	34.77	0.10	0.06	QP
11	0.853	14.93	-31.07	46.00	14.76	0.10	0.07	Average
12	0.853	18.27	-37.73	56.00	18.10	0.10	0.07	QP

Site : C001-HY  
 Condition : CISPR CLASS-B 2003 2001/008 NEUTRAL  
 EUT : 2.4G RF Blue Tooth Router  
 Power : 110V/60Hz  
 Model : AME-CA31B,CE31B,PBT-CM31  
 Memo : TX CH78

Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss		Remark
						dBmV	dB	
1	0.163	44.64	-20.67	65.31	44.46	0.10	0.08	QP
2	0.163	22.28	-33.03	55.31	22.10	0.10	0.08	Average
3	0.187	16.90	-37.27	54.17	16.75	0.10	0.05	Average
4	0.187	40.52	-23.65	64.17	40.37	0.10	0.05	QP
5	0.224	20.41	-32.26	52.67	20.27	0.10	0.04	Average
6	0.224	36.16	-26.51	62.67	36.02	0.10	0.04	QP
7	0.387	29.78	-18.35	48.13	29.62	0.10	0.06	Average
8	0.387	35.74	-22.39	58.13	35.58	0.10	0.06	QP
9	0.417	34.51	-23.00	57.51	34.35	0.10	0.06	QP
10	0.417	28.20	-19.31	47.51	28.04	0.10	0.06	Average
11	0.463	37.43	-19.21	56.64	37.27	0.10	0.06	QP
12	0.463	30.10	-16.54	46.64	29.94	0.10	0.06	Average

Test Engineer: John

John Huang

## 5.9 Test of Radiated Emission

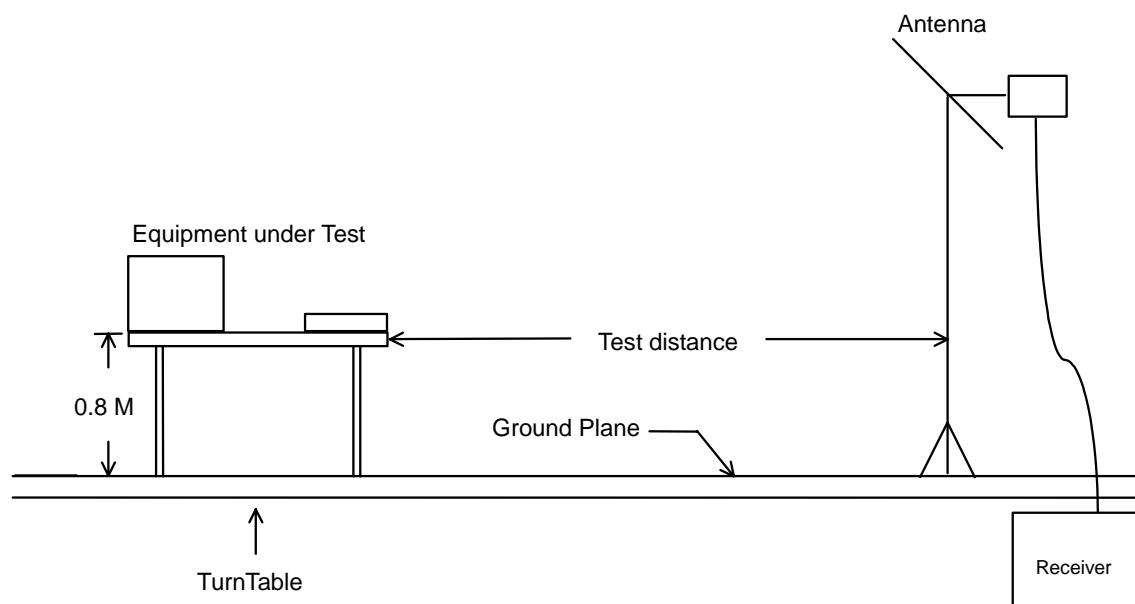
Radiated emissions from 30 MHz to 24.8 GHz were measured according to the methods defines in ANSI C63.4-1992. The EUT was placed on a nonmetallic stand, 0.8 meter above the ground plane, as shown in section 5.9.3. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions

### 5.9.1 Major Measuring Instruments

- Amplifier (MITEQ AFS44)
  - RF Gain 40 dB
  - Signal Input 100 MHz to 26.5 GHz
- Amplifier (HP 8447D)
  - RF Gain 30 dB
  - Signal Input 100 KHz to 1.3 GHz
- Spectrum analyzer (R&S FSP40)
  - Attenuation 10 dB
  - Start Frequency 1 GHz
  - Stop Frequency 24 GHz
  - Resolution Bandwidth 1 MHz
  - Video Bandwidth 1 MHz
  - Signal Input 9 KHz to 40 GHz
- Test Receiver (SCHAFFNER SCR3501)
  - Resolution Bandwidth 120 KHz
  - Frequency Band 9 K – 1 GHz
  - Quasi-Peak Detector ON for Quasi-Peak Mode  
OFF for Peak Mode

**5.9.2 Test Procedures**

1. The EUT was placed on a rotatable table top 0.8 meter above ground.
2. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation.
4. The antenna is a broadband antenna and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
5. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.
7. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
8. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

**5.9.3 Typical Test Setup Layout of Radiated Emission**

## 5.9.4 Test Result of Radiated Emission

- Test Mode: Mode 1
- Test Distance: 3 M
- Temperature: 27 °C
- Relative Humidity: 65 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level
- Test Date: 2003-06-28

**The test was passed at the minimum margin that marked by the frame in the following test record**

■ Spurious Emission

Site : 03CH03-HY  
 Condition : 3m 03CH03-MAT HORIZONTAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH00 2402MHz  
 : F360910

Freq	Level	Over Limit		Read Line	Probe Level	Cable Preamp		Remark	Ant	Table
		MHz	dBuV/m			dB	dBuV/m		Pos	Pos
1	84.540	35.28	-4.72	40.00	53.29	7.40	1.62	27.03 Peak	100	37
2	88.860	36.23	-7.27	43.50	53.15	8.65	1.45	27.02 Peak	---	---
3	197.130	34.37	-9.13	43.50	51.40	7.31	2.27	26.61 Peak	---	---

Site : 03CH03-HY  
 Condition : 3m 03CH03-MAT HORIZONTAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH00 2402MHz  
 : F360910

Freq	Level	Over Limit		Read Line	Probe Level	Cable Preamp		Remark	Ant	Table
		MHz	dBuV/m			dB	dBuV/m		Pos	Pos
1	397.300	32.86	-13.14	46.00	41.99	14.54	3.51	27.18 Peak	---	---
2	430.900	29.51	-16.49	46.00	38.25	15.07	3.54	27.35 Peak	---	---
3	847.400	31.25	-14.75	46.00	34.89	19.09	5.18	27.91 Peak	---	---

Site : 03CH03-HY  
 Condition : 3m 03CH03-MAT VERTICAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH00 2402MHz  
 : F360910

Freq	Level	Over	Limit	Read	Probe	Cable	Preamp	Ant	Table	
		Limit	Line	Level	Factor	Loss	Factor			
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB	cm	deg
1	30.000	24.39	-15.61	40.00	35.13	15.35	1.01	27.10	Peak	---
2	90.210	27.62	-15.88	43.50	44.39	8.80	1.45	27.02	Peak	---
3	197.130	30.61	-12.89	43.50	47.64	7.31	2.27	26.61	Peak	---

Site : 03CH03-HY  
 Condition : 3m 03CH03-MAT VERTICAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH00 2402MHz  
 : F360910

Freq	Level	Over	Limit	Read	Probe	Cable	Preamp	Ant	Table	
		Limit	Line	Level	Factor	Loss	Factor			
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB	cm	deg
1	399.400	29.35	-16.65	46.00	38.44	14.60	3.51	27.20	Peak	---
2	430.900	28.74	-17.26	46.00	37.48	15.07	3.54	27.35	Peak	---
3	564.600	27.08	-18.92	46.00	34.03	16.84	4.10	27.89	Peak	---

Site : 03CH03-HY  
 Condition : 3m HORN-ANT-10094-0417 HORIZONTAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH00 2402MHz  
 : F360910

Freq	Level	Over	Limit	Read	Probe	Cable	Preamp	Ant	Table	
		Limit	Line	Level	Factor	Loss	Factor			
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB	cm	deg
1	2212.000	52.38	-21.62	74.00	52.30	30.38	5.96	36.26	Peak	---
2	2212.000	48.95	-5.05	54.00	48.87	30.38	5.96	36.26	Average	---
3	2380.000	51.53	-22.47	74.00	51.38	30.21	6.18	36.24	Peak	---
4	2380.000	42.46	-11.54	54.00	42.31	30.21	6.18	36.24	Average	---
7	2596.000	52.40	-21.60	74.00	51.94	30.08	6.52	36.14	Peak	---
8	2596.000	43.57	-10.43	54.00	43.11	30.08	6.52	36.14	Average	---
9	2612.000	51.16	-22.84	74.00	50.67	30.08	6.54	36.13	Peak	---
10	2612.000	41.61	-12.39	54.00	41.12	30.08	6.54	36.13	Average	---

Site : 03CH03-HY  
 Condition : 3m HORN-ANT-10094-0417 HORIZONTAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH00 2402MHz  
 : F360910

Site : 03CH03-HY  
 Condition : 3m HORN-ANT-10094-0417 VERTICAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH00 2402MHz  
 : F360910

Freq	Over Level	Limit Line	Read Level	Probe Factor	Cable Preamp		Ant Pos	Table Pos
					dB	dB		
MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	cm	deg
1	2148.000	50.80	-23.20	74.00	50.75	30.44	5.88	36.27 Peak
2	2148.000	38.55	-15.45	54.00	38.50	30.44	5.88	36.27 Average
3	2164.000	38.62	-15.38	54.00	38.56	30.43	5.90	36.27 Average
4	2164.000	51.36	-22.64	74.00	51.30	30.43	5.90	36.27 Peak
5	2196.000	50.74	-23.26	74.00	50.67	30.40	5.94	36.27 Peak
6	2196.000	39.31	-14.69	54.00	39.24	30.40	5.94	36.27 Average
7	2212.000	52.97	-21.03	74.00	52.89	30.38	5.96	36.26 Peak
8	2212.000	42.16	-11.84	54.00	42.08	30.38	5.96	36.26 Average
9	2388.000	44.05	-9.95	54.00	43.90	30.20	6.19	36.24 Average
10	2388.000	54.73	-19.27	74.00	54.58	30.20	6.19	36.24 Peak
13	2500.000	53.85	-20.15	74.00	53.62	30.10	6.34	36.21 Peak
14	2500.000	43.66	-10.34	54.00	43.43	30.10	6.34	36.21 Average
15	2516.000	40.43	-13.57	54.00	40.17	30.09	6.37	36.20 Average
16	2516.000	51.83	-22.17	74.00	51.57	30.09	6.37	36.20 Peak
17	2596.000	43.92	-10.08	54.00	43.46	30.08	6.52	36.14 Average
18	2596.000	54.62	-19.38	74.00	54.16	30.08	6.52	36.14 Peak

Site : 03CH03-HY  
 Condition : 3m HORN-ANT-10094-0417 VERTICAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH00 2402MHz  
 : F360910

➤ For 5GHz ~ 25GHz

Remark: Frequency from 5000MHz to 25000MHz, the emission emitted by the EUT is too low to be measured

## ■ Field strength of fundamental and harmonics

Frequency ( MHz )	Antenna Polarity	Cable Factor	Reading Loss	Limits	Emission ( dBuV/m )	Level ( uV/m )	Margin ( dB )	Detect Mode
2404.000	H	30.19	6.21	62.93	-	99.33	92576.34	A.V.
2404.000	H	30.19	6.21	65.72	-	102.12	127643.88	Peak
2404.000	V	30.19	6.21	66.55	-	102.95	140442.97	A.V.
2404.000	V	30.19	6.21	69.84	-	106.24	205116.22	Peak
4804.000	V/H					-		Peak, A.V.
7206.000	V/H					-		Peak, A.V.
9608.000	V/H					-		Peak, A.V.
12010.000	V/H					-		Peak, A.V.
14412.000	V/H					-		Peak, A.V.
16814.000	V/H					-		Peak, A.V.
19216.000	V/H					-		Peak, A.V.
21618.000	V/H					-		Peak, A.V.
24020.000	V/H					-		Peak, A.V.

Remark: The emission emitted by the EUT is too low to be measured except the emission listed above

Test Engineer:

Murray  
Murray Lu

- Test Mode: Mode 2
- Test Distance: 3 M
- Temperature: 27 °C
- Relative Humidity: 65 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level
- Test Date: 2003-06-28

**The test was passed at the minimum margin that marked by the frame in the following test record**

■ Spurious Emission

Site : 03CH03-HY  
 Condition : 3m 03CH03-MAT HORIZONTAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH39 2441MHz  
 : F360910

Freq	Level	Over	Limit	Read	Probe	Cable	Preamp	Remark	Ant	Table
		MHz	dBuV/m	dB	dBuV/m	dBuV	dB		Pos	Pos
1	84.540	36.88	-3.12	40.00	54.89	7.40	1.62	27.03 QP	100	68
2	89.130	36.34	-7.16	43.50	53.18	8.74	1.44	27.02 Peak	---	---
3	197.130	31.68	-11.82	43.50	48.71	7.31	2.27	26.61 Peak	---	---

Site : 03CH03-HY  
 Condition : 3m 03CH03-MAT VERTICAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH39 2441MHz  
 : F360910

Freq	Level	Over	Limit	Read	Probe	Cable	Preamp	Remark	Ant	Table
		MHz	dBuV/m	dB	dBuV/m	dBuV	dB		Pos	Pos
1	30.000	33.66	-6.34	40.00	44.40	15.35	1.01	27.10 Peak	---	---
2	89.130	34.98	-8.52	43.50	51.82	8.74	1.44	27.02 Peak	---	---
3	119.370	32.42	-11.08	43.50	47.59	9.96	1.79	26.92 Peak	---	---

Site : 03CH03-HY  
 Condition : 3m 03CH03-MAT VERTICAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH39 2441MHz  
 : F360910

	Freq	Over Level	Limit	Read Line	Probe Level	Cable Factor	Preamp Loss	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB	cm	deg
1	30.000	33.66	-6.34	40.00	44.40	15.35	1.01	27.10 Peak	---	---
2	89.130	34.98	-8.52	43.50	51.82	8.74	1.44	27.02 Peak	---	---
3	119.370	32.42	-11.08	43.50	47.59	9.96	1.79	26.92 Peak	---	---

Site : 03CH03-HY  
 Condition : 3m 03CH03-MAT VERTICAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH39 2441MHz  
 : F360910

	Freq	Over Level	Limit	Read Line	Probe Level	Cable Factor	Preamp Loss	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB	cm	deg
1	397.300	31.82	-14.18	46.00	40.95	14.54	3.51	27.18 Peak	---	---
2	564.600	25.16	-20.84	46.00	32.11	16.84	4.10	27.89 Peak	---	---
3	847.400	25.14	-20.86	46.00	28.78	19.09	5.18	27.91 Peak	---	---

Site : 03CH03-HY  
 Condition : 3m HORN-ANT-10094-0417 HORIZONTAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH39 2441MHz  
 : F360910

	Freq	Over Level	Limit	Read Line	Probe Level	Cable Factor	Preamp Loss	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB	cm	deg
1	2182.000	50.90	-23.10	74.00	50.84	30.41	5.92	36.27 Peak	---	---
2	2182.000	43.45	-10.55	54.00	43.39	30.41	5.92	36.27 Average	---	---
3	2246.000	50.68	-23.32	74.00	50.58	30.35	6.01	36.26 Peak	---	---
4	2246.000	41.73	-12.27	54.00	41.63	30.35	6.01	36.26 Average	---	---
7	2632.000	49.98	-24.02	74.00	49.44	30.07	6.58	36.11 Peak	---	---
8	2632.000	42.67	-11.33	54.00	42.13	30.07	6.58	36.11 Average	---	---
9	2670.000	49.67	-24.33	74.00	49.04	30.06	6.65	36.08 Peak	---	---
10	2670.000	42.09	-11.91	54.00	41.46	30.06	6.65	36.08 Average	---	---

Site : 03CH03-HY  
 Condition : 3m HORN-ANT-10094-0417 HORIZONTAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH39 2441MHz  
       : F360910

Site : 03CH03-HY  
 Condition : 3m HORN-ANT-10094-0417 VERTICAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH39 2441MHz  
       : F360910

Freq	MHz	Over Level	Limit	Read Line	Probe Level	Cable Preamp			Ant Pos	Table Pos
						Factor	Loss	Factor		
1	2182.000	52.07	-21.93	74.00	52.01	30.41	5.92	36.27	Peak	---
2	2182.000	41.40	-12.60	54.00	41.34	30.41	5.92	36.27	Average	---
3	2230.000	52.70	-21.30	74.00	52.62	30.36	5.98	36.26	Peak	---
4	2230.000	41.63	-12.37	54.00	41.55	30.36	5.98	36.26	Average	---
5	2246.000	54.80	-19.20	74.00	54.70	30.35	6.01	36.26	Peak	---
8	2508.000	54.04	-19.96	74.00	53.79	30.10	6.36	36.21	Peak	---
9	2508.000	43.01	-10.99	54.00	42.76	30.10	6.36	36.21	Average	---
10	2540.000	51.50	-22.50	74.00	51.18	30.09	6.41	36.18	Peak	---
11	2540.000	41.26	-12.74	54.00	40.94	30.09	6.41	36.18	Average	---
12	2636.000	52.58	-21.42	74.00	52.03	30.07	6.59	36.11	Peak	---
13	2636.000	41.96	-12.04	54.00	41.41	30.07	6.59	36.11	Average	---

Site : 03CH03-HY  
 Condition : 3m HORN-ANT-10094-0417 VERTICAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH39 2441MHz  
       : F360910

➤ For 5GHz ~ 25GHz

Remark: Frequency from 5000MHz to 25000MHz, the emission emitted by the EUT is too low to be measured

## ■ Field strength of fundamental and harmonics

Frequency ( MHz )	Antenna Polarity	Cable Factor	Reading ( dB )	Loss ( dBuV )	Limits ( dBuV/m )	Emission ( dBuV/m )	Level ( uV/m )	Margin ( dB )	Detect Mode
2438.000	H	30.15	6.26	67.93	-	-	104.34	164816.24	Peak
2438.000	H	30.15	6.26	64.23	-	-	100.64	107646.52	A.V.
2438.000	V	30.15	6.26	73.76	-	-	110.17	322477.93	Peak
2438.000	V	30.15	6.26	67.23	-	-	103.64	152054.75	A.V.
4882.000	V/H						-		Peak, A.V.
7323.000	V/H						-		Peak, A.V.
9764.000	V/H						-		Peak, A.V.
12205.000	V/H						-		Peak, A.V.
14646.000	V/H						-		Peak, A.V.
17087.000	V/H						-		Peak, A.V.
19528.000	V/H						-		Peak, A.V.
21969.000	V/H						-		Peak, A.V.
24410.000	V/H						-		Peak, A.V.

Remark: The emission emitted by the EUT is too low to be measured except the emission listed above

Test Engineer: Murray  
Murray Lu

- Test Mode: Mode 3
- Test Distance: 3 M
- Temperature: 27 °C
- Relative Humidity: 65 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level
- Test Date: 2003-06-28

**The test was passed at the minimum margin that marked by the frame in the following test record**

■ Spurious Emission

Site : 03CH03-HY  
 Condition : 3m 03CH03-MAT HORIZONTAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH78 2480MHz  
 : F360910

Freq	Level	Over Limit		Read Line	Probe Factor	Cable Preamp		Remark	Ant Pos	Table Pos
		MHz	dBuV/m	dB	dBuV/m	dB	dB			
1	84.540	36.12	-3.88	40.00	54.13	7.40	1.62	27.03 Peak	---	---
2	88.860	35.92	-7.58	43.50	52.84	8.65	1.45	27.02 Peak	---	---
3	197.130	31.77	-11.73	43.50	48.80	7.31	2.27	26.61 Peak	---	---

Site : 03CH03-HY  
 Condition : 3m 03CH03-MAT HORIZONTAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH78 2480MHz  
 : F360910

Freq	Level	Over Limit		Read Line	Probe Factor	Cable Preamp		Remark	Ant Pos	Table Pos
		MHz	dBuV/m	dB	dBuV/m	dB	dB			
1	396.600	31.98	-14.02	46.00	41.13	14.52	3.51	27.18 Peak	---	---
2	478.500	28.98	-17.02	46.00	37.13	15.74	3.70	27.59 Peak	---	---
3	847.400	30.60	-15.40	46.00	34.24	19.09	5.18	27.91 Peak	---	---

Site : 03CH03-HY  
 Condition : 3m 03CH03-MAT VERTICAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH78 2480MHz  
 : F360910

Freq	Level	Over Limit		Read Line	Probe Level	Cable Preamp		Remark	Ant Pos	Table Pos
		MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB		
1 !	30.000	34.05	-5.95	40.00	44.79	15.35	1.01	27.10	Peak	---
2	89.130	34.21	-9.29	43.50	51.05	8.74	1.44	27.02	Peak	---
3	132.060	34.08	-9.42	43.50	48.53	10.46	1.96	26.87	Peak	---

Site : 03CH03-HY  
 Condition : 3m 03CH03-MAT VERTICAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH78 2480MHz  
 : F360910

Freq	Level	Over Limit		Read Line	Probe Level	Cable Preamp		Remark	Ant Pos	Table Pos
		MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB		
1	397.300	29.26	-16.74	46.00	38.39	14.54	3.51	27.18	Peak	---
2	564.600	26.63	-19.37	46.00	33.58	16.84	4.10	27.89	Peak	---
3	847.400	25.22	-20.78	46.00	28.86	19.09	5.18	27.91	Peak	---

Site : 03CH03-HY  
 Condition : 3m HORN-ANT-10094-0417 HORIZONTAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH78 2480MHz  
 : F360910

Freq	Level	Over Limit		Read Line	Probe Level	Cable Preamp		Remark	Ant Pos	Table Pos
		MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB		
1	2222.000	49.59	-24.41	74.00	49.51	30.37	5.97	36.26	Peak	---
2	2222.000	40.21	-13.79	54.00	40.13	30.37	5.97	36.26	Average	---
3	2286.000	51.05	-22.95	74.00	50.94	30.30	6.06	36.25	Peak	---
4	2286.000	42.27	-11.73	54.00	42.16	30.30	6.06	36.25	Average	---
7	2492.000	57.76	-16.24	74.00	57.55	30.10	6.33	36.22	Peak	---
8	2492.000	44.39	-9.61	54.00	44.18	30.10	6.33	36.22	Average	---
9	2510.000	54.73	-19.27	74.00	54.48	30.10	6.36	36.21	Peak	---
10 !	2510.000	52.16	-1.84	54.00	51.91	30.10	6.36	36.21	Average	---

Site : 03CH03-HY  
 Condition : 3m HORN-ANT-10094-0417 HORIZONTAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH78 2480MHz  
 : F360910

Site : 03CH03-HY  
 Condition : 3m HORN-ANT-10094-0417 VERTICAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH78 2480MHz  
 : F360910

Freq	MHz	Over Limit		Read	Probe	Cable Preamp		Ant	Table	
		Level	Limit	Line	Level Factor	Loss	Factor			
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB	cm	deg
1	2222.000	52.54	-21.46	74.00	52.46	30.37	5.97	36.26	Peak	---
2	2222.000	46.95	-7.05	54.00	46.87	30.37	5.97	36.26	Average	---
3	2246.000	51.16	-22.84	74.00	51.06	30.35	6.01	36.26	Peak	---
4	2246.000	46.55	-7.45	54.00	46.45	30.35	6.01	36.26	Average	---
5	2270.000	52.69	-21.31	74.00	52.59	30.32	6.04	36.26	Peak	---
6	2270.000	47.50	-6.50	54.00	47.40	30.32	6.04	36.26	Average	---
7	2286.000	55.14	-18.86	74.00	55.03	30.30	6.06	36.25	Peak	---
8	2286.000	52.08	-1.92	54.00	51.97	30.30	6.06	36.25	Average	---
9	2334.000	51.49	-22.51	74.00	51.35	30.26	6.12	36.24	Peak	---
10	2334.000	43.44	-10.56	54.00	43.30	30.26	6.12	36.24	Average	---
11	2366.000	52.99	-21.01	74.00	52.85	30.22	6.16	36.24	Peak	---
12	2366.000	42.37	-11.63	54.00	42.23	30.22	6.16	36.24	Average	---
15	2492.000	58.05	-15.95	74.00	57.84	30.10	6.33	36.22	Peak	---
16	2492.000	47.91	-6.09	54.00	47.70	30.10	6.33	36.22	Average	---
17	2510.000	57.68	-16.32	74.00	57.43	30.10	6.36	36.21	Peak	---
18	2510.000	53.68	-0.32	54.00	53.43	30.10	6.36	36.21	Average	100
										49

Site : 03CH03-HY  
 Condition : 3m HORN-ANT-10094-0417 VERTICAL  
 EUT : 2.4G RF BLUE TOOTH ROUTER  
 Power : 110V/60Hz  
 MODEL : AME-CA31B,AME-CE31B,PBT-CM31  
 MEMO : TX CH78 2480MHz  
 : F360910

➤ For 5GHz ~ 25GHz

Remark: Frequency from 5000MHz to 25000MHz, the emission emitted by the EUT is too low to be measured

## ■ Field strength of fundamental and harmonics

Frequency ( MHz )	Antenna Polarity	Cable Factor	Reading Loss	Limits	Emission ( dBuV/m )	Level ( uV/m )	Margin ( dB )	Detect Mode	
2478.000	H	30.11	6.31	68.80	-	-	105.22	182389.57	A.V.
2478.000	H	30.11	6.31	69.34	-	-	105.76	194088.59	Peak
2478.000	V	30.11	6.31	72.19	-	-	108.61	269463.53	Peak
2478.000	V	30.11	6.31	72.03	-	-	108.45	264545.27	A.V.
4960.000	V/H					-			Peak, A.V.
7440.000	V/H					-			Peak, A.V.
9920.000	V/H					-			Peak, A.V.
12400.000	V/H					-			Peak, A.V.
14880.000	V/H					-			Peak, A.V.
17360.000	V/H					-			Peak, A.V.
19840.000	V/H					-			Peak, A.V.
22320.000	V/H					-			Peak, A.V.
24800.000	V/H					-			Peak, A.V.

Remark: The emission emitted by the EUT is too low to be measured except the emission listed above

Test Engineer:

*Murray*  
Murray Lu

## **6 EMI Suppression Component List**

No EMI suppression components.

## **7 Antenna Requirements**

The EUT use a undetachable antenna. It is considered meet antenna requirement of FCC.

### **7.4.1 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.

### **7.4.2 Antenna Connected Construction**

The maximum Gain antenna used in this product is dipole antenna.

## 8 RF Exposure

FCC Rules and Regulations Part 1.1307,1.1310,2.1091,2.1093:

RF Exposure Compliance

### 8.4.1 Limit For Maximum Permissible Exposure (MPE)

#### (A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm <sup>2</sup> )	Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

#### (B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm <sup>2</sup> )	Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S ( minutes )
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

F=frequency in MHz

\*Plane-wave equivalent power density

## 8.4.2 MPE Calculations

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } P_d \text{ (mW/cm}^2\text{)} = \frac{E^2}{3770}$$

E = Electric field (V/m)

P = Peak output power (mW)

G = Antenna numeric gain (numeric)

d = Separation distance (m)

Because the EUT is belong to General Population/ Uncontrolled Exposure. So the Limit of Power Density is 10 W/m<sup>2</sup>. We can change the formula to:

$$d = \sqrt{\frac{30 \times P \times G}{3770}}$$

Channel NO.	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (W)	Calculated RF Exposure Separation Distance (m)	Minimum RF Exposure Separation Distance (m)
Channel 1	3.00	2.00	10.73	11.83	0.01	20
Channel 6	3.00	2.00	11.05	12.74	0.01	20
Channel 11	3.00	2.00	10.92	12.36	0.01	20

## 8.4.3 FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20cm (8 inches) during normal operation. Proposed RF exposure safety information to include in User's Manual.

## 9 Antenna Factor & Cable Loss

Frequency (MHz)	Antenna Factor (dB)	Cable Loss (dB)	Frequency (MHz)	Antenna Factor (dB)	Cable Loss (dB)
30	15.35	1.01	1000	24.30	3.89
35	13.63	1.04	2000	31.10	5.41
40	11.11	1.09	3000	29.60	6.92
45	10.59	1.24	4000	30.80	8.24
50	6.47	1.43	5000	34.20	9.22
55	5.83	1.39	6000	33.30	10.25
60	5.18	1.59	7000	37.80	11.61
65	4.81	1.41	8000	39.40	11.78
70	4.43	1.43	9000	38.40	12.59
75	5.10	1.55	10000	38.90	13.84
80	5.91	1.56	11000	41.10	14.64
85	7.33	1.62	12000	42.70	14.12
90	8.74	1.41	13000	43.90	16.01
95	9.05	1.81	14000	43.70	13.76
100	9.36	1.68	15000	43.40	14.30
110	9.65	1.73	16000	40.90	15.16
120	9.97	1.79	17000	44.40	15.88
130	10.51	1.93	18000	47.10	16.09
140	10.32	2.06	19000	37.60	16.98
150	9.42	2.09	20000	37.30	16.21
160	8.09	2.12	21000	37.00	20.13
170	7.43	2.12	22000	38.00	19.24
180	7.60	2.12	23000	38.70	19.64
190	7.43	2.21	24000	38.60	20.54
200	7.26	2.29	25000	38.90	20.14
220	9.11	2.42	14000	43.70	13.76
240	10.88	2.54	15000	43.40	14.30
260	11.75	2.66	16000	40.90	15.16
280	11.55	2.76	17000	44.40	15.88
300	11.36	2.85	18000	47.10	16.09
320	12.03	3.10	19000	37.60	16.98
340	12.69	3.36	20000	37.30	16.21
360	13.33	3.49	21000	37.00	20.13
380	14.00	3.50	22000	38.00	19.24
400	14.63	3.51	23000	38.70	19.64
450	15.33	3.55	24000	38.60	20.54
500	16.03	3.81	25000	38.90	20.14
550	16.65	4.05			
600	17.29	4.23			
650	17.64	4.63			
700	18.00	4.74			
750	18.39	4.95			
800	18.79	5.06			
850	19.10	5.18			
900	19.42	5.40			
950	19.58	5.91			
1000	19.75	5.58			

## 10 List of Measuring Equipments Used

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMC Receiver	R&S	ESCS 30	100132	9 KHz – 2.75 GHz	Jun. 12, 2003	Conduction (CO01-HY)
LISN	MessTec	NNB-2/16Z	2001-008	9 KHz – 30 MHz	Apr. 29, 2003	Conduction (CO01-HY)
LISN (Support Unit)	MessTec	NNB-2/16Z	2001-009	9 KHz – 30 MHz	Apr. 29, 2003	Conduction (CO01-HY)
EMI Filter	LINDGREN	LRE-2060	1004	< 450 Hz	N/A	Conduction (CO01-HY)
EMI Filter	LINDGREN	N6006	201052	0 ~ 60 Hz	N/A	Conduction (CO01-HY)
RF Cable-CON	Suhner Switzerland	RG223/U	CB029	9KHz~30MHz	Jan. 07, 2003	Conduction (CO01-HY)
50 ohm BNC type Terminal	NOBLE	50ohm	TM009	50 ohm	Apr. 24, 2003	Conduction (CO01-HY)
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz~1GHz 3m	Jun. 21, 2003	Radiation (03CH03-HY)
Spectrum analyzer	R&S	FSP40	100004/040	9KHZ~40GHz	Aug. 07, 2002	Radiation (03CH03-HY)
Receiver	SCHAFFNER	SCR 3501	417	9 KHz –1GHz	Feb. 20, 2003	Radiation (03CH03-HY)
Amplifier	HP	8447D	2944A09072	100KHz – 1.3GHz	Oct. 21, 2002	Radiation (03CH03-HY)
Bilog Antenna	SCHAFFNER	CBL6112B	2687	30MHz –2GHz	Dec. 21, 2002	Radiation (03CH03-HY)
RF Cable-R03m	Jye Bao	RG142	CB021	30MHz~1GHz	Jan. 02, 2003	Radiation (03CH03-HY)
Amplifier	MITEQ	AFS44	879981	100MHz~26.5GHz	Aug. 12, 2002	Radiation (03CH03-HY)
Horn Antenna	COM-POWER	AH-118	10094	1GHz – 18GHz	Apr. 10, 2003	Radiation (03CH03-HY)
Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170154	15GHz~40GHz	Jun. 02, 2003	Radiation
Turn Table	HD	DS 420	420/650/00	0 ~ 360 degree	N/A	Radiation (03CH03-HY)
Antenna Mast	HD	MA 240	240/560/00	1 m - 4 m	N/A	Radiation (03CH03-HY)
RF Cable-HIGH	Jye Bao	RG142	CB030-HIGH	1GHz~29.5GHz	Mar. 14, 2003	Radiation (03CH03-HY)
Power meter	R&S	NRVS	100444	DC~40GHz	May 28, 2003	Conducted
Power sensor	R&S	NRV-Z55	100049	DC~40GHz	May 28, 2003	Conducted
Power Sensor	R&S	NRV-Z32	100057	30MHz-6GHz	May 28, 2003	Conducted
AC power source	HPC	HPA-500W	HPA-9100024	AC 0~300V	May 27, 2003	Conducted
Temp. and Humidity	KSON	THS-C3L	612	N/A	Oct. 02, 2002	Conducted
Power meter	R&S	NRVS	100444	DC~40GHz	May 28, 2003	Conducted

Calibration Interval of instruments listed above is one year.

## 11 Uncertainty of Test Site

### Uncertainty of Radiated Emission Measurement

Contribution	Probability Distribution	3m
Antenna factor calibration	normal(k=2)	±1
cable loss calibration	normal(k=2)	±0.3
RCV/SPA specification	rectangular	±2
Antenna Directivity	rectangular	±3
Antenna Factor V.S. Height	rectangular	±2
Antenna Factor Interpolation for Frequency	rectangular	±0.25
site imperfection	rectangular	±2
Mismatch		
Receiver VSWR Γ1=0.09		
Antenna VSWR Γ2=0.67		
Uncertainty=20log(1-Γ1*Γ2)	U-shaped	±0.54
combined standard uncertainty Ue(y)	normal	±2.7
Measuring uncertainty for a level of confidence of 95% U=2Ue(y)	normal (k=2)	±5.4

U=  $\{(1/2)^2+(0.3/2)^2+(2^2+0.5^2+2^2+0.25^2+2^2)/3+(0.54)^2/2\}=2.2$  for 10m test distance

U=  $\{(1/2)^2+(0.3/2)^2+(2^2+3^2+2^2+0.25^2+2^2)/3+(0.54)^2/2\}=2.7$  for 3m test distance

### Uncertainty of Conducted Emission Measurement

Contribution	Probability Distribution	150KHz – 30MHz
Cable and I/P attenuator calibration	normal(k=2)	±0.3
RCV/SPA specification	rectangular	±2
LISN coupling specification	rectangular	±1.5
Transducer factor frequency interpolation	rectangular	±0.2
Mismatch		
Receiver VSWR Γ1=0.09		
LISN VSWR Γ2=0.33		
Uncertainty=20log(1-Γ1*Γ2)	U-shaped	0.2
combined standard uncertainty Ue(y)	normal	±1.66
Measuring uncertainty for a level of confidence of 95% U=2Ue(y)	normal (k=2)	±3.32

U=  $\{(0.3/2)^2+(2^2+1.5^2+0.2^2)/3+(0.2)^2/2\}=1.66$