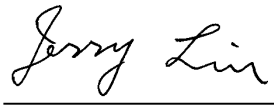
EMC
TEST REPORT

Report No. : EME-030368
Model No. : MBT-1102
Issued Date : April 16, 2003

Applicant : Microlink Communications Inc.
6F, No. 30, Raykuang Rd., Neihu, Taipei,
Taiwan

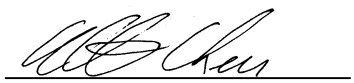
Test By : Intertek Testing Services Taiwan Ltd.
No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li,
Shiang-Shan District, Hsinchu City, Taiwan

Project Engineer



Jerry Liu

Reviewed By



Elton Chen

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Summary of Tests

Bluetooth USB Dongle-Model: MBT-1102
FCC ID: QVZ10020000

Test	Reference	Results
Maximum Output Power test	15.247(b)	Complies
Carrier Frequency Separation test	15.247(a)(1)	Complies
Number of hopping frequencies test	15.247(a)(1)	Complies
Time of Occupancy (dwell time) test	15.247(a)(1)	Complies
20dB Bandwidth test	15.247(a)(1)	Complies
Radiated Spurious Emission test	15.205, 15.209	Complies
Power Line Conducted Emission test	15.207	Complies

1. General information

1.1 Identification of the EUT

Applicant	: Microlink Communications Inc.
Product	: Bluetooth USB Dongle
Model No.	: MBT-1102
FCC ID.	: QVZ10020000
Frequency Range	: 2402MHz to 2480MHz
Channel Number	: 79
Frequency of Each Channel	: 2402 + k (MHz), k: 0 ~78
Type of Modulation	: GFSK
Rated Power	: 5VDC +/- 10%
Power Cord	: N/A
Power Supply	: 5Vdc from Notebook
Sample Received	: April 10, 2003
Test Date(s)	: April 10, 2003 to April 13, 2003

A FCC DoC report has been generated for the client.

1.2 Additional information about the EUT

The Bluetooth USB Dongle is specifically designed to plug into an available USB port connecting to a desktop or laptop. It is the best solution for quick and easy connection and access to user’s Ethernet Local Area Network (LAN) and other shared resources without cables or wires.

The model ALL1574 is identical to model MBT-1102 (EUT), the different model number serves as marketing strategy.

For more detail features, please refer to User's manual as file name “Installation guide.pdf”

1.3 Antenna description

The EUT uses a permanently connected antenna.

Antenna Gain : 2dBi
Antenna Type : PCB printed
Connector Type : N/A

1.4 Peripherals equipment

Peripherals	Manufacturer	Product No.	Serial No.	FCC ID
Notebook	HP	Brio BA410	SG11304267	FCC DoC Approved
Printer	HP	C2642A	TH86K1N2ZB	FCC DoC Approved
Modem	Dynalink	V1456VQE	00V230A00051494	FCC DoC Approved

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 15 Subpart C Section §15.205、§15.207、§15.209、§15.247 and ANSI C63.4/1992.

The test of radiated measurements according to FCC Part15 Section 15.33(a) had been conducted and the field strength of this frequency band were all meet limit requirement, thus we evaluate the EUT pass the specified test.

The EUT setup configurations please refer to the photo of test configuration in item.

2.2 Operation mode

Settle the EUT into notebook. Run the test program “Bluetest” under Windows OS, which provided by manufacturer.

The EUT was transmitted continuously during the test.

2.3 Test equipment

Equipment	Brand	Frequency range	Model No.	Series No.	Last Cal.Date
EMI Test Receiver	Rohde & Schwarz	9kHz~2.75GHz	ESCS 30	825788/014	May 24, 2002
EMI Test Receiver	Rohde & Schwarz	20Hz~26.5GHz	ESMI	825428/005	June 10, 2002
Spectrum Analyzer	Rohde & Schwarz	9kHz~30GHz	FSP 30	100137	July 10, 2002
Spectrum Analyzer	Rohde & Schwarz	20Hz~40GHz	FSEK 30	100186	Oct. 9, 2002
Horn Antenna	EMCO	1GHz~18GHz	3115	9906-5890	Sep. 19, 2002
Horn Antenna	SCHWARZBECK	14GHz~40GHz	BBHA 9170	159	June 20, 2002
Bilog Antenna	SCHWARZBECK	25MHz~1.7GHz	VULB 9160	3111	June 20, 2002
Turn Table	HDGmbH	N/A	DS 420S	420/669/01	N/A
Antenna Tower	HDGmbH	N/A	MA 240	240/573	N/A
Microwave Amplifier	Agilent	2GHz~26.5GHz	8348A	3111A00567	Dec. 20, 2002

Note:
1. The calibration interval of the above instruments is 12 months.

3. 20dB Bandwidth test

3.1 Operating environment

Temperature:	22	℃
Relative Humidity:	52	%
Atmospheric Pressure	1020	hPa

3.2 Test setup & procedure

The 20dB bandwidth per FCC §15.247(a)(1)(i) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at 100 kHz, the video bandwidth ≧RBW, and the SPAN may equal to approximately 2 to 3 times the 20dB bandwidth. The test was performed at 3 channels (lowest, middle and highest channel). The maximum 20dB modulation bandwidth is in the following Table.

See 20dB Bbandwidth plot as file name “20dB Bandwidth plot.pdf”

3.3 Measured data of modulated bandwidth test results

Channel	Frequency (MHz)	Bandwidth (kHz)	Limit
Low	2402.02	809.619	1MHz
Middle	2441.02	805.611	1MHz
High	2480.02	809.619	1MHz

＊ The EUT has its hopping function disable.

4. Carrier Frequency Separation test

4.1 Operating environment

Temperature:	22	℃
Relative Humidity:	52	%
Atmospheric Pressure	1020	hPa

4.2 Test setup & procedure

The carrier frequency separation per FCC §15.247(a)(1) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at ≧1% of the span, the video bandwidth≧RBW, and the SPAN was wide enough to capture the peaks of two adjacent channels. The carrier frequency separation result is in the following Table.

See Carrier Frequency Separation plot as file name "Carrier Frequency Separation plot.pdf"

4.3 Measured data of Carrier Frequency Separation test result

Channel	Frequency (MHz)	Measurement Frequency separation (MHz)
1	2402.001	1.01
2	2403.011	

＊ The EUT has its hopping function enable.

5. Number of hopping frequencies test

5.1 Operating environment

Temperature:	24	℃
Relative Humidity:	52	%
Atmospheric Pressure	1020	hPa

5.2 Test setup & procedure

The number of hopping frequencies per FCC § 15.247(a)(1) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at ≧1% of the span, the video bandwidth≧RBW, and the SPAN was the frequency band of operation. The carrier frequency separation result is in the following Table.

See number of hopping frequencies plot as file name “number of hopping frequencies plot.pdf”

5.3 Measured data of number of hopping frequencies test result

Frequency Range (MHz)	Number of hopping frequencies	Total hopping channels
2400 ~ 2428.5	27	79
2429 ~ 2454.5	26	
2455 ~ 2483.5	26	

∗ The EUT has its hopping function enable.

6. Time of Occupancy (dwell time) test

6.1 Operating environment

Temperature:	24	℃
Relative Humidity:	52	%
Atmospheric Pressure	1020	hPa

6.2 Test setup & procedure

The time of occupancy (dwell time) per FCC § 15.247(a)(1) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at 1MHz, the video bandwidth≧RBW, and the zero span function of spectrum analyzer was enable. The EUT has its hopping function enable.

The time of occupancy (Dwell time) is (32 × 420.841us)(dwell time in 3.2 sec) × 10 = 134.669ms ＜0.4s in 32ec.

See time of occupancy (dwell time) plot as file name “Time of Occupancy (dwell time).pdf”

7. Maximum Output Power test

7.1 Operating environment

Temperature:	22	℃
Relative Humidity:	52	%
Atmospheric Pressure	1020	hPa

7.2 Test setup & procedure

The power output per FCC §15.247(b) was measured on the EUT using a 50 ohm SMA cable connected to spectrum analyzer. The RBW of spectrum analyzer was set to 10MHz, VBW=RBW. Power was read directly and cable loss correction (0.5dB) was added to the reading to obtain power at the EUT antenna terminals. The test was performed at 3 channels (lowest, middle and highest channel).

See Maximum Output Power plot as file name “Maximum Output Power plot CH1, CH6 and CH11.pdf”

7.3 Measured data of Maximum Output Power test results

Channel	Frequency (MHz)	C.B.L. (dB)	Reading (dBm)	Power Output		Limit (W)
				(dBm)	(mW)	
Lowest	2402	0.5	10.06	10.56	11.38	1
Middle	2441	0.5	10.55	11.05	12.74	1
Highest	2480	0.5	10.48	10.95	12.53	1

＊ The EUT has its hopping function disable.

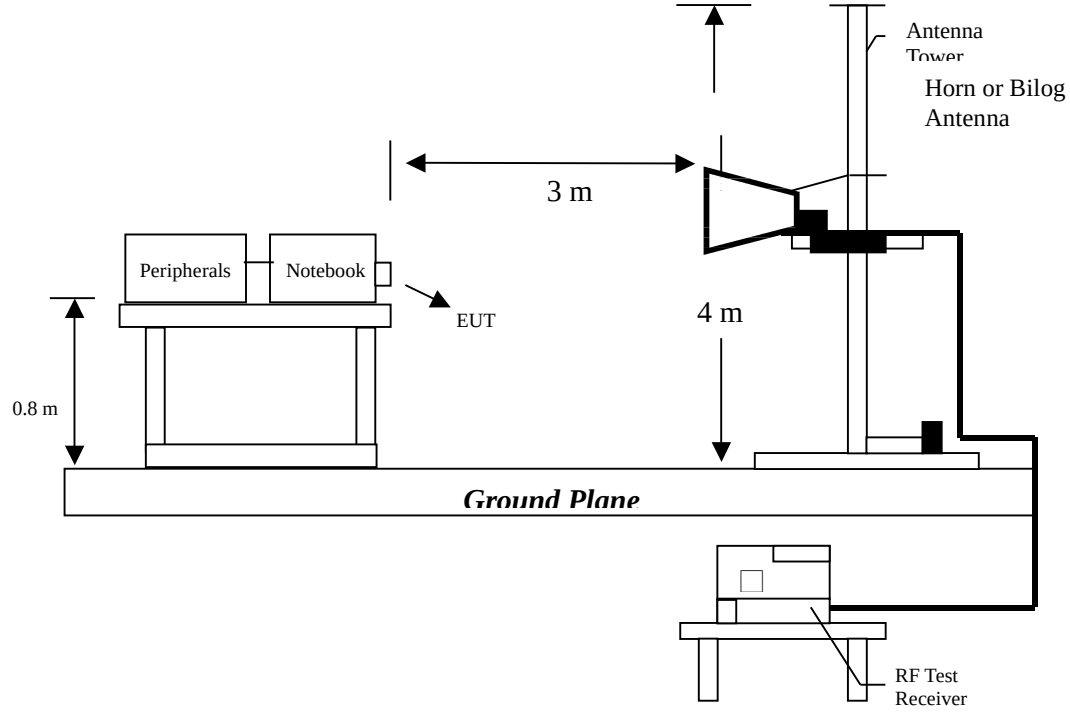
8. Radiated Emission test

8.1 Operating environment

Temperature:	22	℃
Relative Humidity:	52	%
Atmospheric Pressure	1020	hPa

8.2 Test setup & procedure

The Diagram below shows the test setup, which is utilized to make these measurements.



Radiated emissions were invested cover the frequency range from 30MHz to 1000MHz using a receiver RBW of 120kHz record QP reading, and the frequency over 1GHz using a spectrum analyzer RBW of 1MHz and 10Hz VBW record Average reading. (15.209 paragraph), the Peak reading (1MHz RBW/VBW) recorded also on the report.
The EUT for testing is arranged on a wooden turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

8.3 Emission limits

The spurious Emission shall test through the 10th harmonic. 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).

Frequency (MHz)	Limits (dB μ V/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:
1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

Uncertainty was calculated in accordance with NAMAS NIS 81.
Expanded uncertainty (k=2) of radiated emission measurement is ±4.98 dB.
Expanded uncertainty (k=2) of conducted emission measurement is ±2.02 dB.

8.4 Radiated spurious emission test data

8.4.1 Measurement results: frequencies equal to or less than 1 GHz

The radiated emissions at

Frequency(MHz)	Margin
398.6000	-4.90
600.4000	-4.30

are less than uncertainty. This is within the stated measurement uncertainty, this may affect compliance determined in other test arrangements.

EUT : MBT-1102
Test Condition : Transmitted mode (Hopping enable)

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
398.6000	QP	V	17.66	20.14	37.80	46.00	-8.20
466.5000	QP	V	18.35	18.45	36.80	46.00	-9.20
561.6000	QP	V	20.12	14.28	34.40	46.00	-11.60
581.0000	QP	V	20.85	14.05	34.90	46.00	-11.10
600.4000	QP	V	21.14	17.26	38.40	46.00	-7.60
666.3000	QP	V	21.98	16.52	38.50	46.00	-7.50
398.6000	QP	H	17.66	23.44	41.10	46.00	-4.90
575.1000	QP	H	20.68	17.32	38.00	46.00	-8.00
600.4000	QP	H	21.14	20.56	41.70	46.00	-4.30
666.3000	QP	H	21.98	17.82	39.80	46.00	-6.20
903.0000	QP	H	26.03	11.07	37.10	46.00	-8.90
932.1000	QP	H	26.10	14.70	40.80	46.00	-5.20

Remark:
1.Corrected Level = Reading Level + Correction Factor
2.Correction Factor = Antenna Factor + Cable Loss
3. “-“ means the emission is below the noise floor.

8.4.2 Measurement results: frequency above 1GHz

The radiated spurious emissions at

Frequency(MHz)	Margin
4804	-2.896

are less than uncertainty. This is within the stated measurement uncertainty, this may affect compliance determined in other test arrangements.

EUT : MBT-1102
Test Condition : Tx at low channel (Hopping disable)

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
4804	PK	V	32.496	35.47	48.07	51.044	74	-22.956
4804	AV	V	32.496	35.47	43.27	46.244	54	-7.756
7206	PK	V	34.32	38.42	45.47	49.57	74	-24.43
7206	AV	V	34.32	38.42	36.72	40.82	54	-13.18
9608	PK	V	35.808	41.35	-	-	74	-
9608	AV	V	35.808	41.35	-	-	54	-
4804	PK	H	32.496	35.47	50.91	53.884	74	-20.116
4804	AV	H	32.496	35.47	48.13	51.104	54	-2.896
7206	PK	H	34.32	38.42	45.91	50.01	74	-23.99
7206	AV	H	34.32	38.42	37.05	41.15	54	-12.85
9608	PK	H	35.808	41.35	-	-	74	-
9608	AV	H	35.808	41.35	-	-	54	-

Remark:
1.Corrected Level = Reading Level + Correction Factor－Preamp
2.Correction Factor = Antenna Factor + Cable Loss
3. “-“ means the emission is below the noise floor.

The radiated spurious emissions at

Frequency(MHz)	Margin
4882	-3.496

are less than uncertainty. This is within the stated measurement uncertainty, this may affect compliance determined in other test arrangements.

EUT : MBT-1102
Test Condition : Tx at middle channel (Hopping disable)

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
4882	PK	V	32.496	35.47	47.47	50.444	74	-23.556
4882	AV	V	32.496	35.47	41.94	44.914	54	-9.086
7323	PK	V	34.32	38.42	45.84	49.94	74	-24.06
7323	AV	V	34.32	38.42	37.01	41.11	54	-12.89
9764	PK	V	35.808	41.35	-	-	74	-
9764	AV	V	35.808	41.35	-	-	54	-
4882	PK	H	32.496	35.47	50.93	53.904	74	-20.096
4882	AV	H	32.496	35.47	47.53	50.504	54	-3.496
7323	PK	H	34.32	38.42	46.1	50.2	74	-23.8
7323	AV	H	34.32	38.42	37.03	41.13	54	-12.87
9764	PK	H	35.808	41.35	-	-	74	-
9764	AV	H	35.808	41.35	-	-	54	-

Remark:
1.Corrected Level = Reading Level + Correction Factor－Preamp
2.Correction Factor = Antenna Factor + Cable Loss
3. “-“ means the emission is below the noise floor.

The radiated spurious emissions at

Frequency(MHz)	Margin
4960	-2.886

are less than uncertainty. This is within the stated measurement uncertainty, this may affect compliance determined in other test arrangements.

EUT : MBT-1102
Test Condition : Tx at high channel (Hopping disable)

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
4960	PK	V	32.496	35.47	47.73	50.704	74	-23.296
4960	AV	V	32.496	35.47	42.68	45.654	54	-8.346
7440	PK	V	34.47	38.38	44.23	48.14	74	-25.86
7440	AV	V	34.47	38.38	34.21	38.12	54	-15.88
9920	PK	V	35.919	41.55	-	-	74	-
9920	AV	V	35.919	41.55	-	-	54	-
4960	PK	H	32.496	35.47	51.35	54.324	74	-19.676
4960	AV	H	32.496	35.47	48.14	51.114	54	-2.886
7440	PK	H	34.47	38.38	46.53	50.44	74	-23.56
7440	AV	H	34.47	38.38	37.21	41.12	54	-12.88
9920	PK	H	35.919	41.55	-	-	74	-
9920	AV	H	35.919	41.55	-	-	54	-

Remark:
1.Corrected Level = Reading Level + Correction Factor－Preamp
2.Correction Factor = Antenna Factor + Cable Loss
3. “-“ means the emission is below the noise floor.

9. Emission on the band edge §FCC 15.247(C)

In any 100kHz 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.

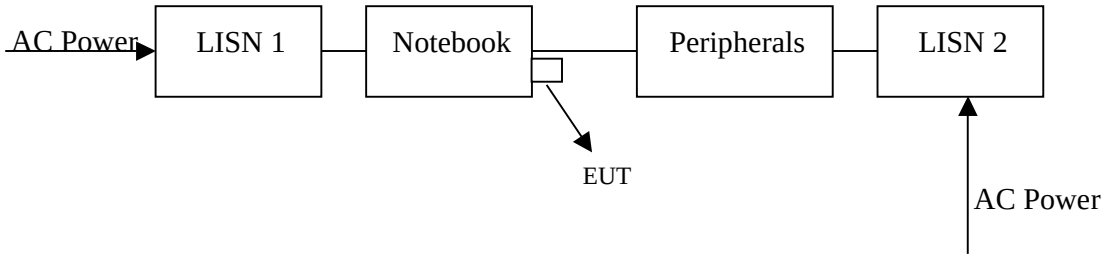
See band-edge plot as file name “Band-edge plot.pdf”.

10. Power Line Conducted Emission test §FCC 15.207

10.1 Operating environment

Temperature:	20	℃
Relative Humidity:	52	%
Atmospheric Pressure	1020	hPa

10.2 Test setup & procedure



The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50 ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination.
Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4/1992 on conducted measurement. The AC power conducted emissions was invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz. (15.207 paragraph)

See Power Line Conducted Emission plot as file name “Power Line Conducted Emission plot.pdf”.

Emission Limit

Freq. (MHz)	Conducted Limit (dBuV)	
	Q.P.	Ave.
0.15~0.50	66 – 56*	56 – 46*
0.50~5.00	56	46
5.00~30.0	60	50

*Decreases with the logarithm of the frequency.

10.3 Power Line Conducted Emission test data

(1) Line

EUT : MBT-1102

Test Condition : Transmitted mode (Hopping enable)

Freq. (MHz)	Reading (dB μ V) QP	Limit (dB μ V) QP	Reading (dB μ V) AV	Limit (dB μ V) AV	Margin (dB)	
					QP	AV
0.20600	48.40	63.37	37.80	53.37	-14.97	-15.57
0.27000	40.40	61.12	29.70	51.12	-20.72	-21.42
0.34200	31.20	59.15	23.20	49.15	-27.95	-25.95
0.40600	35.80	57.73	28.40	47.73	-21.93	-19.33
0.54200	26.70	56.00	20.80	46.00	-29.30	-25.20
3.05400	24.70	56.00	21.20	46.00	-31.30	-24.80

(2) Neutral

EUT : MBT-1102

Test Condition : Transmitted mode (Hopping enable)

Freq. (MHz)	Reading (dB μ V) QP	Limit (dB μ V) QP	Reading (dB μ V) AV	Limit (dB μ V) AV	Margin (dB)	
					QP	AV
0.20600	48.80	63.37	38.00	53.37	-14.57	-15.37
0.27000	40.70	61.12	32.00	51.12	-20.42	-19.12
0.34200	32.70	59.15	25.40	49.15	-26.45	-23.75
0.40600	35.90	57.73	30.30	47.73	-21.83	-17.43
0.54200	28.60	56.00	26.80	46.00	-27.40	-19.20
3.05400	27.20	56.00	23.40	46.00	-28.80	-22.60

Remark:

1. 1. The reading value included cable loss and LISN factor.
2. Uncertainty was calculated in accordance with NAMAS NIS 81.
   Expanded uncertainty (k=2) of conducted emission measurement is ±2.6 dB.