



# **EMC TEST REPORT**

**Report No. : EME-030096**

**Model No. : MBT-1101**

**Issued Date : Feb. 12, 2003**

**Applicant : Microlink Communications Inc.**  
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**Taiwan**

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**Hsinchu, Taiwan**

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Project Engineer

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Reviewed By

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### Summary of Tests

#### **Bluetooth USB Dongle, Class II/III-Model: MBT-1101**

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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



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### 1. General information

#### 1.1 Identification of the EUT

Applicant	: Microlink Communications Inc.
Product	: Bluetooth USB Dongle, Class II/III
Model No.	: MBT-1101
FCC ID.	: QVZ10010000
Frequency Range	: 2402MHz to 2480MHz
Channel Number	: 79
Frequency of Each Channel	: $2402 + k$ (MHz), $k: 0 \sim 78$
Type of Modulation	: 2GFSK
Power Supply	: 5Vdc from Notebook
Power Cord	: N/A
Sample Received	: Jan. 20, 2003
Test Date(s)	: Jan. 23, 2003 to Jan. 30, 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.

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



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### 1.3 Antenna description

The EUT uses a permanently connected antenna.

Antenna Gain : 2.8 dBi

Antenna Type : PCB Printed Antenna

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 AC power conducted emissions was investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz. (15.207 paragraph)

Radiated emissions were investigated 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 recorded also on the report.

The test of radiated measurements according to FCC Part 15 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, and run the test program “Bluetest.exe” under Windows OS, which provided by manufacturer. The main function of the test program are (a) Mode transfer, (b) Channel control, (c) Output power control, (d) Hopping control.

The EUT was transmitted continuously during the test.



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### 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: 65 %  
Atmospheric Pressure 1023 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 30 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	2402.036	792	1MHz
Middle	2441.036	768	1MHz
High	2480.032	764	1MHz

\* The EUT has its hopping function disable.



#### 4. Carrier Frequency Separation test

##### 4.1 Operating environment

Temperature: 23  
Relative Humidity: 65 %  
Atmospheric Pressure 1023 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	2402.032	1.004
2	2403.036	

\* The EUT has its hopping function enable.



## 5. Number of hopping frequencies test

### 5.1 Operating environment

Temperature: 23  
Relative Humidity: 65 %  
Atmospheric Pressure 1023 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: 23  
Relative Humidity: 65 %  
Atmospheric Pressure 1023 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 RBW set at 1MHz, the VBW RBW, and the zero span function of spectrum analyzer was enable. The EUT has its hopping function enable.

The data mode for dwell time test is DH1.

The time of occupancy (Dwell time) is  $(30 \times 420\text{us})(\text{dwell time in 3 sec}) \times 10 = 126\text{ms}$   
 $< 0.4\text{s}$  in 30sec.

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: 60 %  
Atmospheric Pressure 1023 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 (1.5dB) 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 low, middle and high.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	1.5	2.1	3.6	2.291	1
Middle	2441	1.5	0.96	2.46	1.762	1
Highest	2480	1.5	-0.27	1.23	1.327	1

\* The EUT has its hopping function disable.

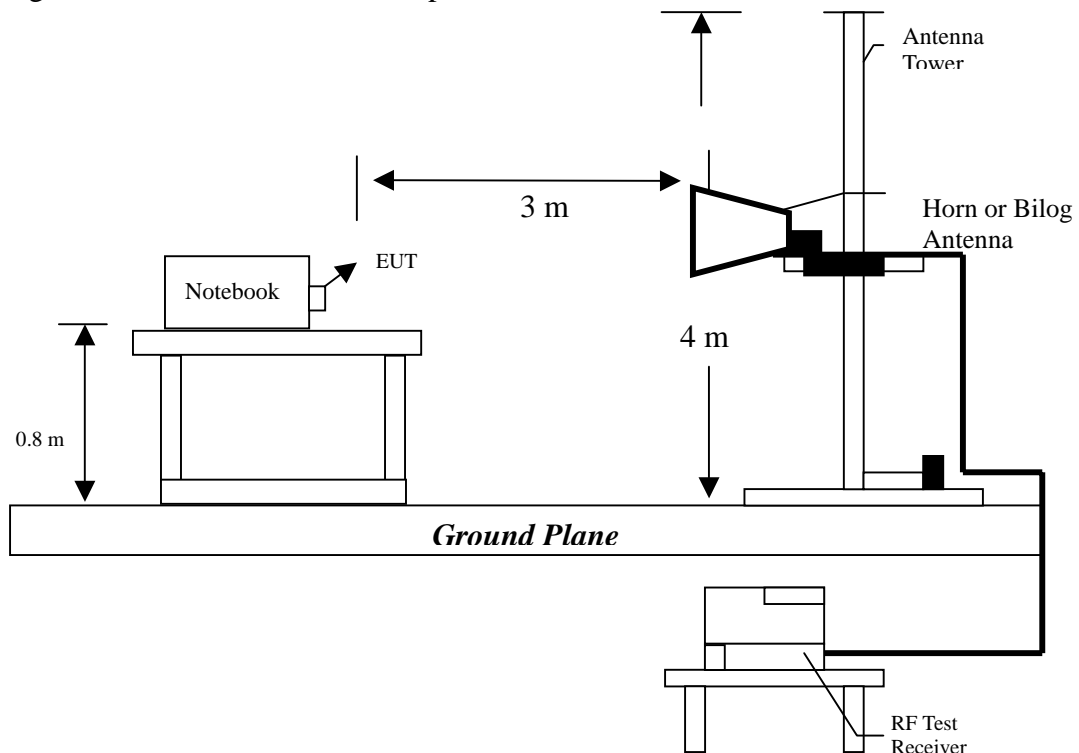
## 8. Radiated Emission test

### 8.1 Operating environment

Temperature: 22  
 Relative Humidity: 65 %  
 Atmospheric Pressure 1023 hPa

### 8.2 Test setup & procedure

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



Radiated emission measurements were performed from 30MHz to 25GHz. Spectrum Analyzer Resolution Bandwidth is 100kHz or greater for frequencies 30MHz to 1GHz, 1MHz – for frequencies above 1GHz.

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 $\mu$ 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  $\pm 3.078$  dB.

Expanded uncertainty (k=2) of conducted emission measurement is  $\pm 2.02$  dB.



#### 8.4 Radiated spurious emission test data

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

EUT : MBT-1101  
Test Mode : 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)
64.90000	QP	V	10.64	11.66	22.30	40.00	-17.70
132.80000	QP	V	9.73	22.07	31.80	43.50	-11.70
196.80000	QP	V	12.59	23.11	35.70	43.50	-7.80
260.90000	QP	V	14.77	24.33	39.10	46.00	-6.90
458.70000	QP	V	21.15	18.05	39.20	46.00	-6.80
524.70000	QP	V	22.91	16.69	39.60	46.00	-6.40
80.40000	QP	H	8.67	9.33	18.00	40.00	-22.00
198.80000	QP	H	12.59	22.51	35.10	43.50	-8.40
332.60000	QP	H	17.56	18.24	35.80	46.00	-10.20
398.60000	QP	H	19.53	21.27	40.80	46.00	-5.20
431.60000	QP	H	20.30	16.00	36.30	46.00	-9.70
524.70000	QP	H	22.91	18.59	41.50	46.00	-4.50

Remark:

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





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### 8.4.2 Measurement results: frequency above 1GHz

EUT : MBT-1101

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)
1201	PK	V	28.02	25.71	50.99	48.68	74	-25.32
1201	AV	V	28.02	25.71	34.13	31.82	54	-22.18
3603	PK	V	28.02	33.46	-	-	74	-
3603	AV	V	28.02	33.46	-	-	54	-
4804	PK	V	28.02	35.47	40.4	47.85	74	-26.15
4804	AV	V	28.02	35.47	28.09	35.54	54	-18.46
6005	PK	V	28.02	37.74	-	-	74	-
6005	AV	V	28.02	37.74	-	-	54	-
7206	PK	V	28.02	38.42	-	-	74	-
7206	AV	V	28.02	38.42	-	-	54	-
1201	PK	H	28.02	25.71	47.08	44.77	74	-29.23
1201	AV	H	28.02	25.71	32.68	30.37	54	-23.63
3603	PK	H	28.02	33.46	-	-	74	-
3603	AV	H	28.02	33.46	-	-	54	-
4804	PK	H	28.02	35.47	42.41	49.86	74	-24.14
4804	AV	H	28.02	35.47	28.54	35.99	54	-18.01
6005	PK	H	28.02	37.74	-	-	74	-
6005	AV	H	28.02	37.74	-	-	54	-
7206	PK	H	28.02	38.42	-	-	74	-
7206	AV	H	28.02	38.42	-	-	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.



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EUT : MBT-1101

Test Condition : Tx at middle channel (Hopping disable)

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamplifier (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
1221	PK	V	28.02	25.71	47.82	45.51	74	-28.49
1221	AV	V	28.02	25.71	32.2	29.89	54	-24.11
3663	PK	V	28.02	33.46	-	-	74	-
3663	AV	V	28.02	33.46	-	-	54	-
4882	PK	V	28.02	35.47	44.21	51.66	74	-22.34
4882	AV	V	28.02	35.47	32.53	39.98	54	-14.02
6105	PK	V	28.02	37.74	-	-	74	-
6105	AV	V	28.02	37.74	-	-	54	-
7323	PK	V	28.02	38.42	-	-	74	-
7323	AV	V	28.02	38.42	-	-	54	-
1221	PK	H	28.02	25.71	46.01	43.7	74	-30.3
1221	AV	H	28.02	25.71	32	29.69	54	-24.31
3663	PK	H	28.02	33.46	-	-	74	-
3663	AV	H	28.02	33.46	-	-	54	-
4882	PK	H	28.02	35.47	45.23	52.68	74	-21.32
4882	AV	H	28.02	35.47	31.13	38.58	54	-15.42
6105	PK	H	28.02	37.74	-	-	74	-
6105	AV	H	28.02	37.74	-	-	54	-
7323	PK	H	28.02	38.42	-	-	74	-
7323	AV	H	28.02	38.42	-	-	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.



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EUT : MBT-1101

Test Condition : Tx at high channel (Hopping disable)

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamplifier (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
1240	PK	V	28.02	25.71	47.74	45.43	74	-28.57
1240	AV	V	28.02	25.71	33.88	31.57	54	-22.43
3720	PK	V	28.02	33.46	-	-	74	-
3720	AV	V	28.02	33.46	-	-	54	-
4960	PK	V	28.02	35.47	44.97	52.42	74	-21.58
4960	AV	V	28.02	35.47	30.68	38.13	54	-15.87
6200	PK	V	28.02	37.74	-	-	74	-
6200	AV	V	28.02	37.74	-	-	54	-
7440	PK	V	28.02	38.38	-	-	74	-
7440	AV	V	28.02	38.38	-	-	54	-
1240	PK	H	28.02	25.71	48.17	45.86	74	-28.14
1240	AV	H	28.02	25.71	33.55	31.24	54	-22.76
3720	PK	H	28.02	33.46	-	-	74	-
3720	AV	H	28.02	33.46	-	-	54	-
4960	PK	H	28.02	35.47	45.58	53.03	74	-20.97
4960	AV	H	28.02	35.47	30.88	38.33	54	-15.67
6200	PK	H	28.02	37.74	-	-	74	-
6200	AV	H	28.02	37.74	-	-	54	-
7440	PK	H	28.02	38.38	-	-	74	-
7440	AV	H	28.02	38.38	-	-	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”.

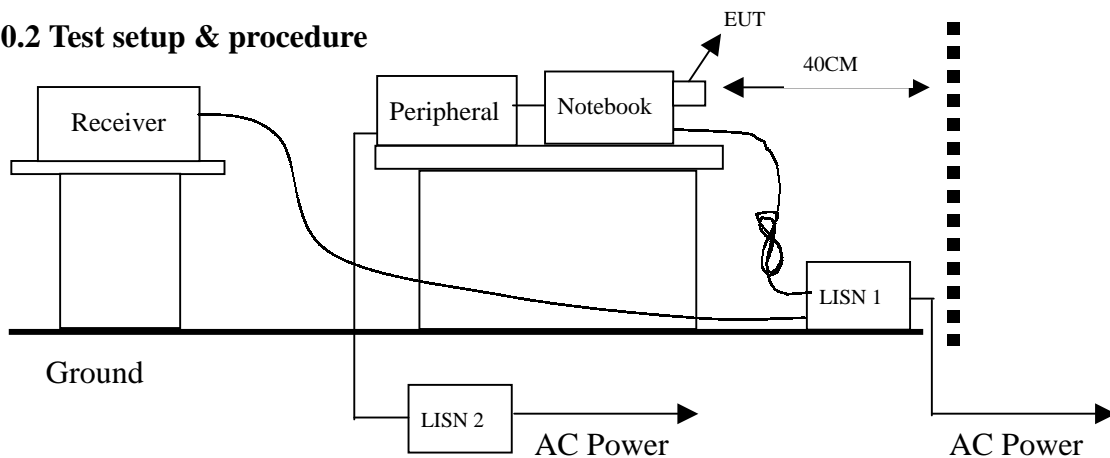


## 10. Power Line Conducted Emission test §FCC 15.207

### 10.1 Operating environment

Temperature: 23  
Relative Humidity: 55 %  
Atmospheric Pressure 1023 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 bandwidth of the field strength meter (R & S Test Receiver ESCS 30) is set at 9kHz.

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-1101

Test Mode : Transmitted mode (Hopping enable)

Freq. (MHz)	Reading (dB $\mu$ V) QP	Limit (dB $\mu$ V) QP	Reading (dB $\mu$ V) AV	Limit (dB $\mu$ V) AV	Margin (dB)	
					QP	AV
0.20600	47.7	63.37	36.5	53.37	-15.67	-16.87
0.27000	42.5	61.12	32.4	51.12	-18.62	-18.72
0.40600	32.4	57.73	27.1	47.73	-25.33	-20.63
0.54200	31.0	56.00	26.9	46.00	-25.00	-19.10
2.16600	33.3	56.00	31.6	46.00	-22.70	-14.40
3.18200	33.6	56.00	31.4	46.00	-22.40	-14.60

#### (2) Neutral

EUT : MBT-1101

Test Mode : Transmitted mode (Hopping enable)

Freq. (MHz)	Reading (dB $\mu$ V) QP	Limit (dB $\mu$ V) QP	Reading (dB $\mu$ V) AV	Limit (dB $\mu$ V) AV	Margin (dB)	
					QP	AV
0.20600	45.9	63.37	35.4	53.37	-17.47	-17.97
0.27000	40.6	61.12	31.7	51.12	-20.52	-19.42
0.40600	33.9	57.73	28.5	47.73	-23.83	-19.23
1.89400	33.2	56.00	31.3	46.00	-22.80	-14.70
2.36600	34.7	56.00	33.6	46.00	-21.30	-12.40
3.11000	34.7	56.00	32.5	46.00	-21.30	-13.50

#### Remark:

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  $\pm 2.6$  dB.