EMC
TEST REPORT

Report No. : EME-021030
Model No. : CBT1000
Issued Date : Sep. 25, 2002

Applicant : AboCom Systems, Inc.
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Test By : Intertek Testing Services Taiwan Ltd.
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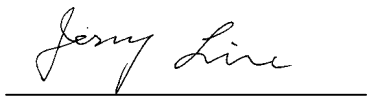
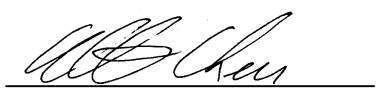
Project Engineer



Jerry Liu

Reviewed By



Elton Chen

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Summary of Tests

Bluetooth CompactFlash card -Model: CBT1000
FCC ID: MQ4CBT1K

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
RF Antenna Conducted Spurious test	15.247(c)	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

Manufacturer	: AboCom System, Inc.
Product	: Bluetooth CompactFlash card
Model No.	: CBT1000
FCC ID.	: MQ4CBT1K
Frequency Range	: 2402MHz to 2480MHz
Channel Number	: 79
Frequency of Each Channel	: 2402 + k (MHz), k: 0 ~78
Type of Modulation	: GFSK
Power Supply	: 3.3/5Vdc from Notebook
Power Cord	: N/A
Sample Received	: Sep. 5, 2002
Test Date(s)	: Sep. 5, 2002 to Sep. 12, 2002

A FCC DoC report has been generated for the client.

1.2 Additional information about the EUT

The EUT allows user to make short-range wireless connections between Bluetooth devices such as cellular phones, personal digital assistants (PDA), and desktop and notebook computers.

The EUT uses radio transmission, voice and data are transmitted almost immediately. Bluetooth™ transmission ensures both protection from interference and secure data transfers. It helps people share and access the information that's important to them more easily.

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 : 1.74dBi max
Antenna Type : Internal antenna
Connector Type : N/A

1.4 Peripherals equipment

Peripherals	Manufacturer	Product No.	Serial No.	FCC ID
Notebook	Twinhead	P79T	H0905483	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 §15.207、§15.209 、§15.247 and ANSI C63.4/1992.

The AC power conducted emissions was invested over the frequency range from 0.45MHz to 30MHz using a receiver bandwidth of 9kHz. (15.207 paragraph)

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 recorded also on the report.

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

Plug the EUT into notebook via a CF extended card. Turn on the notebook power run the test program “Blue test.exe” which provided by manufacture.

The EUT was continuously transmit during the test.

2.4 Test equipment

Equipment	Brand	Frequency range	Model No.	Series No.	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	100189	June 4, 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, 2001
RF Power Meter	Boonton	10kHz~100GHz	4231A	79401	May 22, 2002
Power Sensor	Boonton	30MHz~8GHz	51011-EMC	32482	May 25, 2002

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

3. 20dB Bandwidth test

3.1 Operating environment

Temperature: 20 ℃
Relative Humidity: 59 %

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	2401.988	278	500kHz
Middle	2440.994	280	500kHz
High	2479.990	282	500kHz

＊ The EUT has its hopping function disable.

4. Carrier Frequency Separation test

4.1 Operating environment

Temperature: 20 ℃
Relative Humidity: 59 %

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	2401.992	1
2	2402.992	

＊ The EUT has its hopping function enable.

5. Number of hopping frequencies test

5.1 Operating environment

Temperature: 20 ℃
Relative Humidity: 59 %

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:	20	℃
Relative Humidity:	59	%

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 (31 × 400us)(dwell time in 3 sec) × 10 = 124ms ＜0.4s 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 %

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 power meter via power sensor. Power was read directly and cable loss correction (1dB) 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).

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	2402.00	1	3.41	4.41	2.760	1
Middle	2441.00	1	3.87	4.87	3.069	1
Highest	2480.00	1	2.28	3.28	2.128	1

＊ The EUT has its hopping function disable.

8. RF Antenna Conducted Spurious test

8.1 Operating environment

Temperature: 20 ℃
Relative Humidity: 59 %

8.2 Test setup & procedure

The measurements were performed from 30MHz to 25GHz RF antenna conducted per FCC 15.247 (c) was measured from the EUT antenna port using a 50ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 300 kHz.
Harmonics and spurious noise must be at least 20dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW. The table below is the results from the highest emission for each channel within the authorized band. This table was used to determine the spurious limits for each channel.

See RF Antenna Conducted plot as file name “RF Antenna Conducted plot.pdf”

8.3 Measured data of the highest RF Antenna Conducted Spurious test result

Channel	Max Spurious level at Frequency (MHz)	Spurious Emission level (dBuV)	Limit (dBuV)
Low	25000.00	59.34	90.15
Middle	24594.70	59.04	90.43
High	24864.90	58.8	88.84

＊ The EUT has its hopping function disable.

Note: 1. Limit = peak power output (in 100kHz RBW) – 20dB
2. All the other emissions were very low the limit.

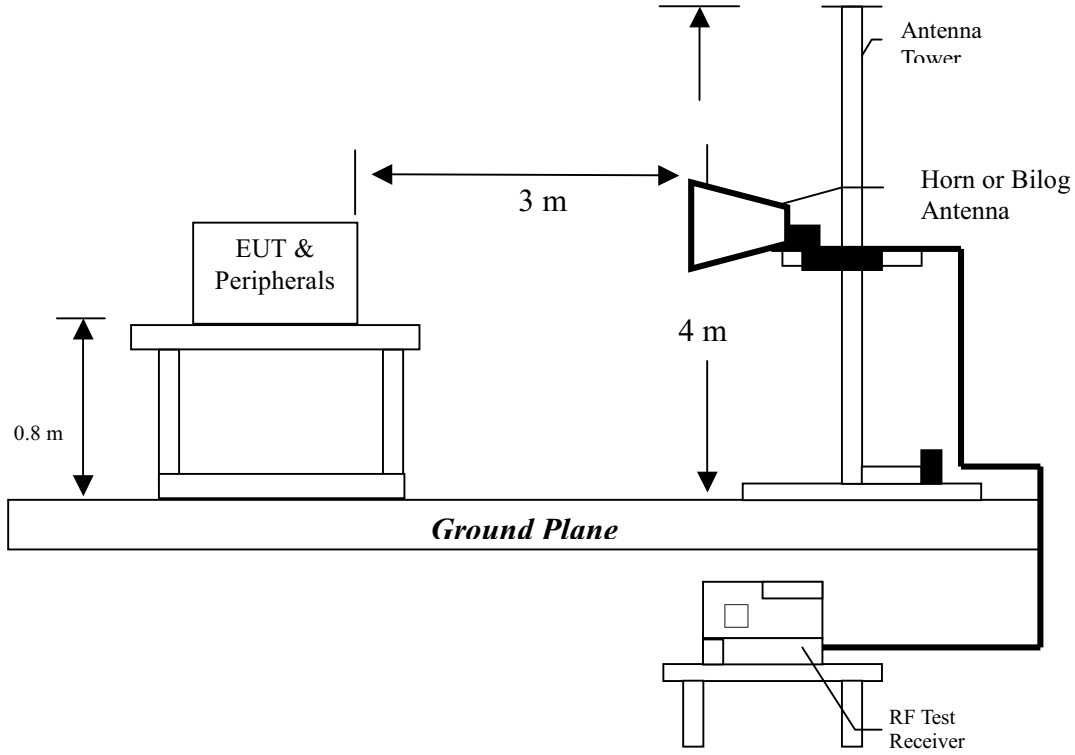
9. Radiated Emission test

9.1 Operating environment

Temperature:	20	℃
Relative Humidity:	59	%

9.2 Test setup & procedure

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



The signal is maximized through rotation and placement in the three orthogonal axes.
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.

9.3 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 ±3.078 dB.

9.4 Radiated spurious emission test data

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

EUT : CBT1000
Test Mode : Transmitted mode (Hopping enable)

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
199.75000	QP	V	12.03	23.32	35.35	43.50	-8.15
266.68000	QP	V	13.32	22.55	35.87	46.00	-10.13
299.66000	QP	V	14.39	22.14	36.53	46.00	-9.47
332.64000	QP	V	15.30	27.21	42.51	46.00	-3.49
655.65000	QP	V	21.49	19.56	41.05	46.00	-4.95
691.54000	QP	V	21.80	19.17	40.97	46.00	-5.03
299.66000	QP	H	14.39	23.72	38.11	46.00	-7.89
333.61000	QP	H	15.30	23.03	38.33	46.00	-7.67
623.64000	QP	H	21.31	16.04	37.35	46.00	-8.65
655.65000	QP	H	21.49	16.62	38.11	46.00	-7.89
691.54000	QP	H	21.80	18.63	40.43	46.00	-5.57
733.25000	QP	H	22.79	15.77	38.56	46.00	-7.44

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

9.4.2 Measurement results: frequency above 1GHz

EUT : CBT1000
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 Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
4804	PK	V	28.02	35.07	39.15	46.2	74	-27.8
4804	AV	V	28.02	35.07	26.37	33.42	54	-20.58
7206	PK	V	28.02	38.82	40.14	50.94	74	-23.06
7206	AV	V	28.02	38.82	26.8	37.6	54	-16.4
9608	PK	V	28.02	41.75	-	-	74	-
9608	AV	V	28.02	41.75	-	-	54	-
4804	PK	H	28.02	35.07	37.85	44.9	74	-29.1
4804	AV	H	28.02	35.07	25.11	32.16	54	-21.84
7206	PK	H	28.02	38.82	39.93	50.73	74	-23.27
7206	AV	H	28.02	38.82	27.23	38.03	54	-15.97
9608	PK	H	28.02	41.75	-	-	74	-
9608	AV	H	28.02	41.75	-	-	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.

EUT : CBT1000
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 Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
4882	PK	V	28.02	35.07	40.9	47.95	74	-26.05
4882	AV	V	28.02	35.07	26.4	33.45	54	-20.55
7323	PK	V	28.02	38.82	37.25	48.05	74	-25.95
7323	AV	V	28.02	38.82	25.11	35.91	54	-18.09
9764	PK	V	28.02	41.75	-	-	74	-
9764	AV	V	28.02	41.75	-	-	54	-
4882	PK	H	28.02	35.07	38.9	45.95	74	-28.05
4882	AV	H	28.02	35.07	25.47	32.52	54	-21.48
7323	PK	H	28.02	38.82	36.85	47.65	74	-26.35
7323	AV	H	28.02	38.82	24.09	34.89	54	-19.11
9764	PK	H	28.02	41.75	-	-	74	-
9764	AV	H	28.02	41.75	-	-	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.

EUT : CBT1000
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 Reading (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)
4960	PK	V	28.02	35.07	39.91	46.96	74	-27.04
4960	AV	V	28.02	35.07	26.97	34.02	54	-19.98
7440	PK	V	28.02	38.78	36.05	46.81	74	-27.19
7440	AV	V	28.02	38.78	24.88	35.64	54	-18.36
9920	PK	V	28.02	41.95	-	-	74	-
9920	AV	V	28.02	41.95	-	-	54	-
4960	PK	H	28.02	35.07	38.15	45.2	74	-28.8
4960	AV	H	28.02	35.07	26.02	33.07	54	-20.93
7440	PK	H	28.02	38.78	37.29	48.05	74	-25.95
7440	AV	H	28.02	38.78	25.11	35.87	54	-18.13
9920	PK	H	28.02	41.95	-	-	74	-
9920	AV	H	28.02	41.95	-	-	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.

10. 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.

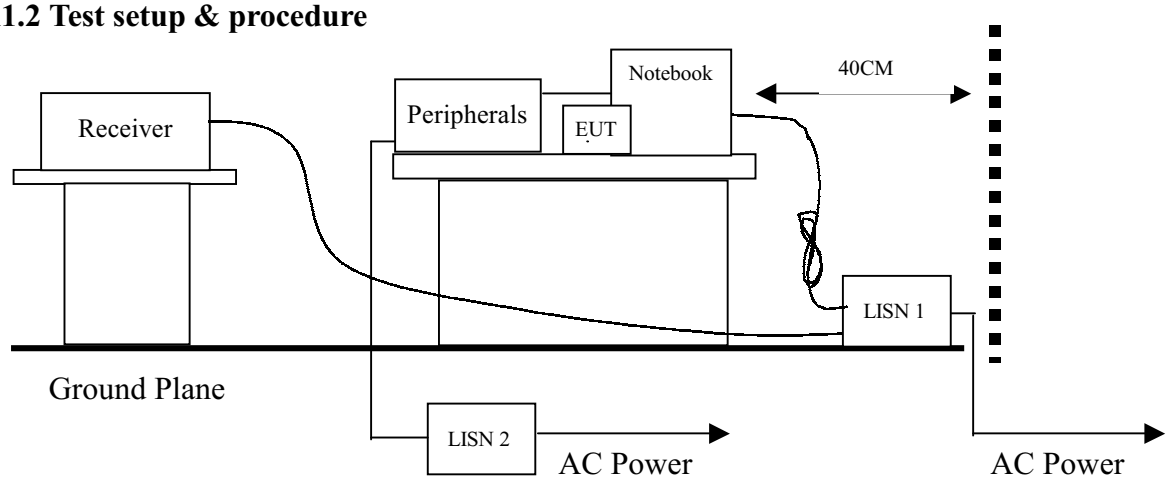
See band-edge plot as file name “Band-edge plot.pdf”.

11. Power Line Conducted Emission test §FCC 15.207

11.1 Operating environment

Temperature: 24 ℃
Relative Humidity: 59 %

11.2 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

FCC Part 15 Paragraph 15.207		
Freq. (MHz)	Maximum RF Line Voltage	
	uV	dBuV
0.45 - 30	250	48.0

11.3 Power Line Conducted Emission test data

EUT : CBT1000
Test Mode : Transmitted mode (Hopping enable)

Power Line (circle)	Freq. (MHz)	Reading (dB μ V) QP	Limit (dB μ V) QP	Margin (dB) QP
LINE	0.46600	31.8	48.00	-16.20
LINE	0.74600	25.7	48.00	-22.30
LINE	5.02600	31.7	48.00	-16.30
LINE	6.23400	27.2	48.00	-20.80
LINE	20.76200	16.3	48.00	-31.70
LINE	22.44200	17.3	48.00	-30.70
NEUTRAL	0.46600	33.0	48.00	-15.00
NEUTRAL	0.65000	23.1	48.00	-24.90
NEUTRAL	0.74600	26.6	48.00	-21.40
NEUTRAL	1.02600	24.4	48.00	-23.60
NEUTRAL	1.30600	23.3	48.00	-24.70
NEUTRAL	6.15400	28.6	48.00	-19.40

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.