

TEST REPORT

Test Report Reference: F080535E1

Equipment under Test: CT-GateCom Compact

Applicant: CeoTronics AG

Manufacturer: CeoTronics AG

**Test Laboratory
(CAB)**

**accredited by DATech in der TGA GmbH
in compliance with DIN EN ISO/IEC 17025
under the Reg. No. DAT-P-105/99-21,**

**recognized by Bundesnetzagentur
under the Reg.-No. BNetzA-CAB-02/21-104/1,**

CAB Designation Number DE0004,

**listed by
FCC 31040/SIT1300F2
FCC Test site registration number 90877**

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1 IDENTIFICATION

1.1 APPLICANT

Name:	CeoTronics AG
Address:	Adam-Opel-Str. 6 63322 Rödermark
Country:	Germany
Name for contact purposes:	Mr. Neuhaus
Tel:	+49 6074 8751631
Fax:	+49 6074 8751659
e-mail address:	entwicklung@ceotronics.com

1.2 MANUFACTURER

Name:	CeoTronics AG
Address:	Adam-Opel-Str. 6 63322 Rödermark
Country:	Germany
Name for contact purposes:	Mr. Neuhaus
Tel:	+49 6074 8751631
Fax:	+49 6074 8751659
e-mail address:	entwicklung@ceotronics.com

1.3 DATES

Date of receipt of test sample:	14 March 2008
Start of test:	18 March 2008
Finish of test:	26 March 2008

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1.4 TEST LABORATORY

The tests were carried out at:

PHOENIX TESTLAB GmbH
Königswinkel 10
D-32825 Blomberg
Germany

Phone: +49 (0) 52 35 / 95 00-0
Fax: +49 (0) 52 35 / 95 00-10

Test engineer: Dieter SÜTTHOFF

Name



Signature

19 May 2008

Date

Test report checked: Bernd STEINER

Name



Signature

19 May 2008

Date

PHOENIX TESTLAB GmbH
Königswinkel 10
32825 Blomberg
Tel. 0 52 35 / 95 00-0
Fax 0 52 35 / 95 00-10

Stamp

1.5 RESERVATION

This test report is only valid in its original form.

Any reproduction of its contents without written permission of the accredited test laboratory
PHOENIX TESTLAB GmbH is prohibited.

The test results herein refer only to the tested sample. PHOENIX TESTLAB GmbH is not responsible for any generalisations or conclusions drawn from these test results concerning further samples. Any modification of the tested samples is prohibited and leads to the invalidity of this test report. Each page necessarily contains the PHOENIX TESTLAB Logo and the TEST REPORT REFERENCE.

1.6 NORMATIVE REFERENCES

- [1] **ANSI C63.4:2003** American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- [2] **FCC 47 CFR Part 2** General Rules and Regulations
- [3] **FCC 47 CFR Part 15** Radio Frequency Devices (Subpart B)

1.7 TEST RESULTS

The requirements of this test document are fulfilled by the equipment under test. The complete test results are presented in the following.

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2 TECHNICAL DATA OF EQUIPMENT

2.1 DEVICE UNDER TEST

Marketing Name of EUT	CT-GateCom Compact				
Article Number: *	1410070				
Type of equipment:	Small sized digital communication system for aircraft push-back and ground handling				

Mainboard:

Highest operating frequency	3.6864MHz *				
Supply Voltage: *	$U_{\text{Nom}} =$	3.6 V DC	$U_{\text{Min}} =$	-	$U_{\text{Max}} =$
Power Supply: *	Battery powered (3 * 1.2V AA- batteries NiMH)				

Module inside EUT:

Module inside	DECT M5 Radio Module CeoTronics, FP (fixed part)				
FCC ID	L52CT-M5CEO1				
Frequency Band(s) of Operation:	1921.54 - 1928.45 MHz				
No. of Channels	12 duplex				
Channel frequency spacing	1728 kHz				
Type of Modulation	GFSK				
Data rate	1152 kbit/s				
Antenna type (if applicable all used antennas)	2 Printed Circuit Board Antennas (1/4 wave antenna)				
Antenna gain	0 dBi				

* declared by the applicant.

2.2 ADDITIONAL INFORMATION

The tested samples were not marked with a type plate according to the FCC-rules.

The device under test is classified as a class B device according to FCC 47 CFR Part 15 [3] by the manufacturer. DECT module (FCC ID: L52CT-M5CEO1) is used inside the EUT. An evaluation of the module is not part of this document.

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2.3 EXTERNAL I/O:

Ports/Connectors

Connector (Type)	Cable	Length / m	Shielding (Yes / No)	Connector (Type)
6.3 mm audio plug	7 wires	1.5	Yes	6.3 mm audio plug

*: Length during the test.

2.4 PERIPHERY DEVICES

- CT DECT Multi
- GateCom Compact GroundCom Audio Box for terminating Audio lines

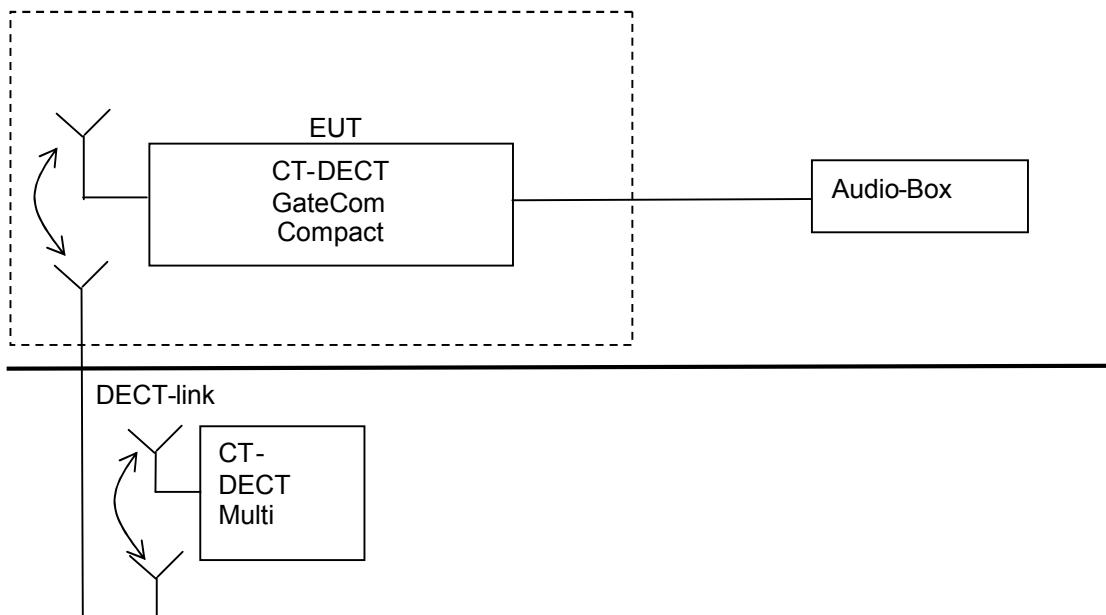
TEST REPORT REFERENCE: F080535E1

3 OPERATIONAL STATES AND PHYSICAL BOUNDARIES

The operation mode of the equipment under test was defined as follows:

- During the tests, the EUT was not sealed or labelled with a FCC-label.
- The EUT was battery supplied with 3.6 V DC.
- DECT link between EUT and CT-DECT Multi was active during the tests.
- During the tests the audio up- and downlink of the EUT were active.
- The audio lines were terminated in an audio box (GateCom Compact GroundCom).

The physical boundaries of the EUT are shown below:



4 EMC MEASURES

none

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5 TESTOVERVIEW

5.1 EMISSION

Conducted emissions FCC 47 CFR Part 15 section 15.107 (b)[3]					
Application	Frequency range	Limits	Reference standard	Remark	Status
On AC supply line	0.15 to 0.5 MHz 0.5 to 5 MHz 5 to 30 MHz	66 to 56 dB μ V (QP)* 56 to 46 dB μ V (AV)* 56 dB μ V (QP) 46 dB μ V (AV) 60 dB μ V (QP) 50 dB μ V (AV)	ANSI C63.4 (2003)	Battery powered No charging mode inside EUT	Not Applicable
Radiated emissions FCC 47 CFR Part 15 section 15.109 (b)[3]					
Application	Frequency range	Limits	Reference standard	Remark	Status
Radiated emissions	30 – 88 MHz 88 – 216 MHz 216 – 960 MHz above 960 MHz	40 dB μ V/m 43.5 dB μ V/m 46.0 dB μ V/m 53.9 dB μ V/m	ANSI C63.4 (2003);	Class B equipment	Passed

* Decreases with the logarithm of the frequency.

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6 TEST RESULTS

6.1 RADIATED EMISSIONS

6.1.1 METHOD OF MEASUREMENT (RADIATED EMISSIONS)

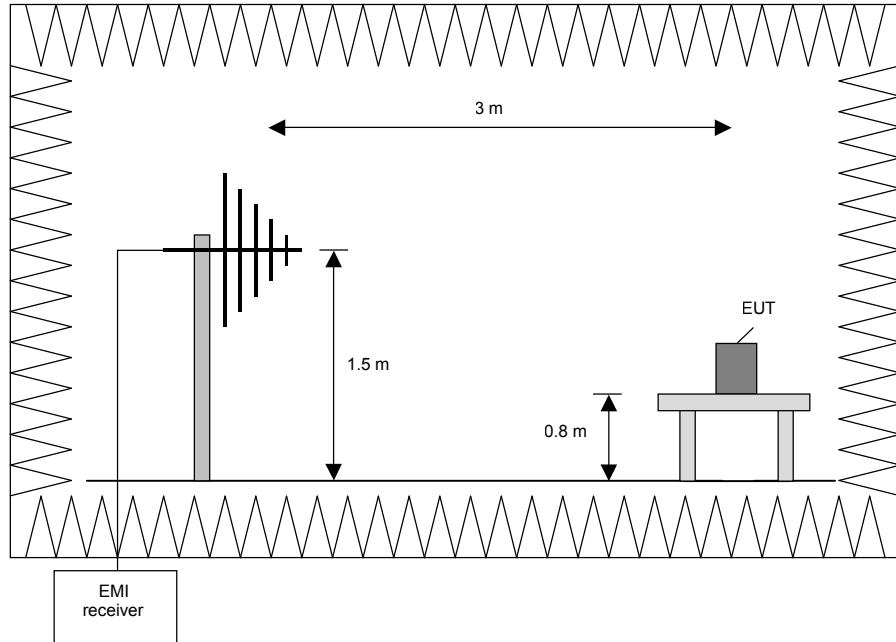
Preliminary measurement (30 MHz to 1 GHz)

In the first stage a preliminary measurement will be performed in a fully anechoic chamber with a measuring distance of 3 meter. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2003 [1].

The frequency range 30 MHz to 1 GHz will be measured with an EMI Receiver set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 °.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 230 MHz	100 kHz
230 MHz to 1 GHz	100 kHz



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Procedure preliminary measurement:

Prescans were performed in the frequency range 30 MHz to 1 GHz.

The following procedure will be used:

1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
6. Repeat 1) to 4) with the other orthogonal axes of the EUT if handheld equipment.
7. Repeat 1) to 5) with the vertical polarisation of the measuring antenna.

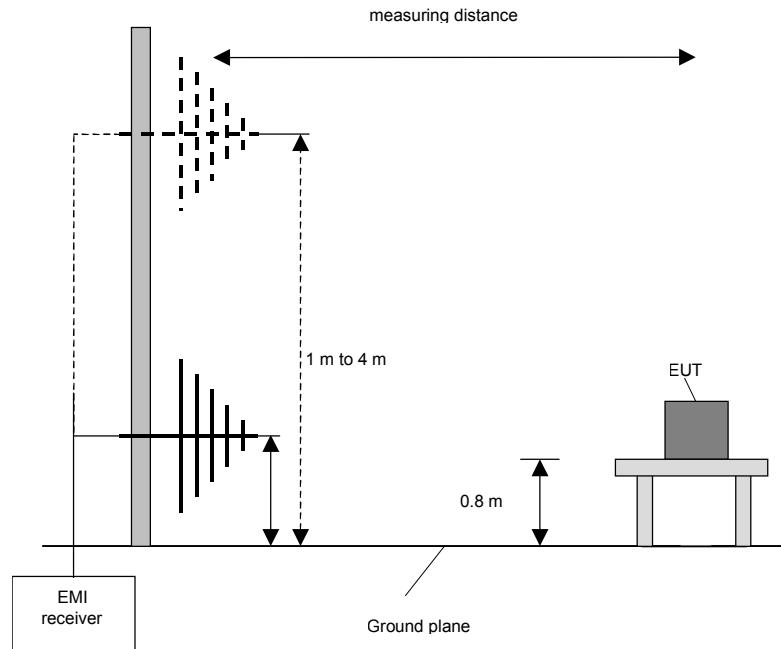
Final measurement (30 MHz to 1 GHz)

A final measurement on an open area test site will be performed on selected frequencies found in the preliminary measurement. During this test the EUT will be rotated in the range of

0 ° to 360 °, the measuring antenna will be set to horizontal and vertical polarisation and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	120 kHz



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Procedure final measurement:

The following procedure will be used:

- 1) Measure on the selected frequencies at an antenna height of 1 m and a EUT azimuth of 23 °.
- 2) Move the antenna from 1 m to 4 m and note the maximum value at each frequency.
- 3) Rotate the EUT by 45 ° and repeat 2) until an azimuth of 337 ° is reached.
- 4) Repeat 1) to 3) for the other orthogonal antenna polarization.
- 5) Move the antenna and the turntable to the position where the maximum value is detected.
- 6) Measure while moving the antenna slowly +/- 1 m.
- 7) Set the antenna to the position where the maximum value is found.
- 8) Measure while moving the turntable +/- 45 °.
- 9) Set the turntable to the azimuth where the maximum value is found.
- 10) Measure with Final detector (QP and AV) and note the value.
- 11) Repeat 5) to 10) for each frequency.
- 12) Repeat 1) to 11) for each orthogonal axes of the EUT if handheld equipment.

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6.1.2 PRELIMINARY MEASUREMENT (30 MHz to 1 GHz)

Ambient temperature	21 °C	Relative humidity	32 %
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Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m (preliminary measurement).

Cable guide: The cables of the EUT were fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

Title: Preliminary emission measurement according CFR 47 Part 15.109

EUT: CT-GateCom Compact

Manufacturer: CeoTronics AG

Operating Condition: Connected to a CT-DECT Multi

Test site: Fully anechoic chamber M20; PHOENIX TEST LAB GmbH

Operator: D. Sütthoff

Test Specification: Battery supplied

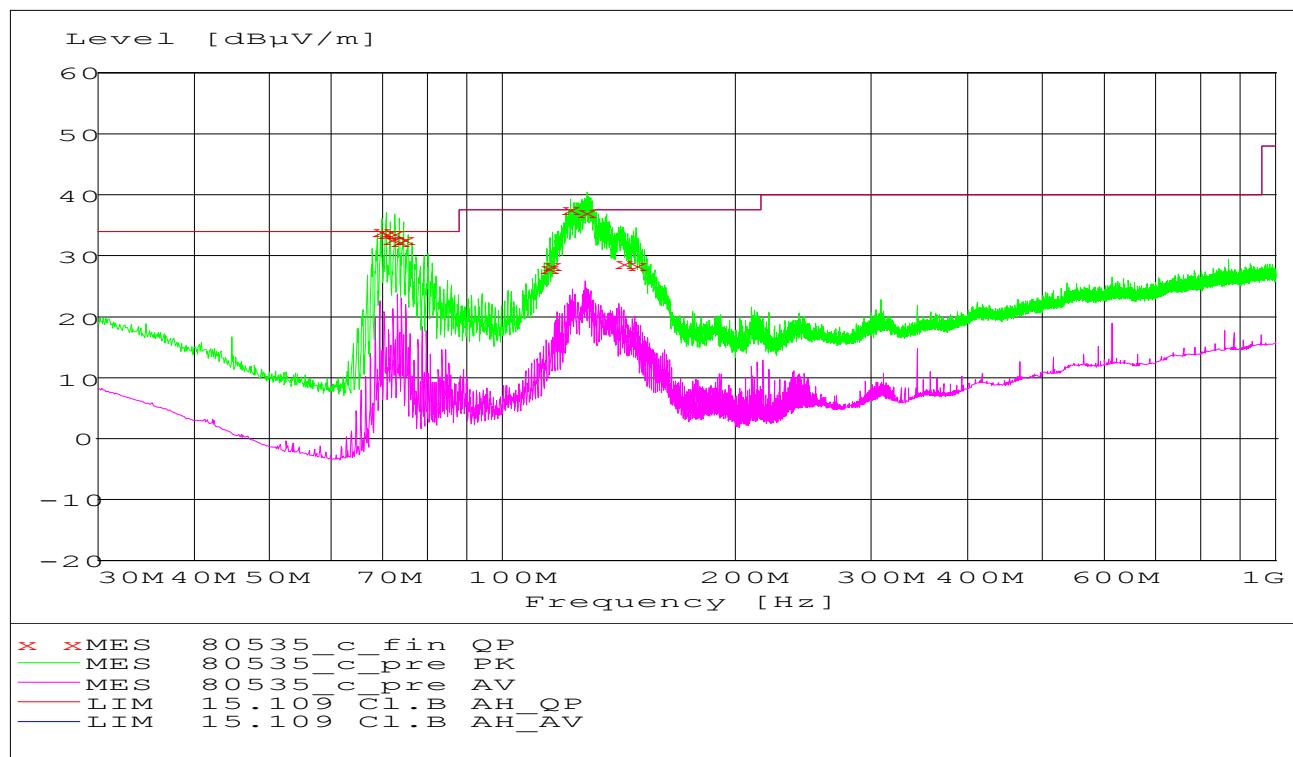
The limit line and measurement curve shown in the diagram below refer to the preliminary measurements. Here, it must be noted that because of the reduced measuring distance and because of the floor absorbers, the measured values do not comply with the values of the above mentioned standard; they only serve as orientation in determining which frequencies must be measured on the open area test site.

The limit line is achieved with the applied standard by converting to a 3m measurement distance (+10 dB) and the correction for the free space in which in the "worst case" the reflected floor wave is missing entirely (-6dB). Therefore 4dB is added to the limit line of the standard concerned.

The curves in the diagram only represent the maximum measured value for each frequency point of all preliminary measurements, which were carried out with the EUT in various positions.

The top measured curve represents the peak measurement. The measured points marked with x are frequency points for which later measurements with a quasi-peak detector were carried out. These values are indicated in the following table. The bottom measured curve represents average values, which are only required for control purposes.

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Data record name: 80535_c

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Result measured with the quasipeak detector:

(These values are marked in the above diagram by x)

Frequency MHz	Level dB μ V/m	Transducer dB	Limit dB μ V/m	Margin dB	Height cm	Azimuth deg	Polarisation
69.816000	34.50	5.8	34.0	-0.5	150.0	184.00	HORIZONTAL
70.788000	34.00	5.9	34.0	0.0	150.0	198.00	HORIZONTAL
71.736000	33.20	6.1	34.0	0.8	150.0	198.00	HORIZONTAL
72.648000	33.90	6.3	34.0	0.1	150.0	193.00	HORIZONTAL
73.632000	32.70	6.5	34.0	1.3	150.0	193.00	HORIZONTAL
74.556000	32.90	6.6	34.0	1.1	150.0	193.00	HORIZONTAL
115.212000	28.00	12.1	37.5	9.5	150.0	331.00	HORIZONTAL
116.172000	28.60	12.1	37.5	8.9	150.0	326.00	HORIZONTAL
122.664000	37.70	12.3	37.5	-0.2	150.0	170.00	HORIZONTAL
128.748000	37.40	12.1	37.5	0.1	150.0	168.00	HORIZONTAL
143.268000	29.20	11.4	37.5	8.3	150.0	171.00	HORIZONTAL
148.860000	28.80	11.1	37.5	8.7	150.0	160.00	HORIZONTAL

Data record name: 80535_c_fin QP

In this case it was necessary to carry out subsequent measurements because at some frequency points a value was above the Qualify limit curve during the preliminary measurements. The results from the standard subsequent measurements on the open area test site are presented in the following.

TEST EQUIPMENT USED FOR THE TEST:
29, 31 – 35, 43, 53, 54

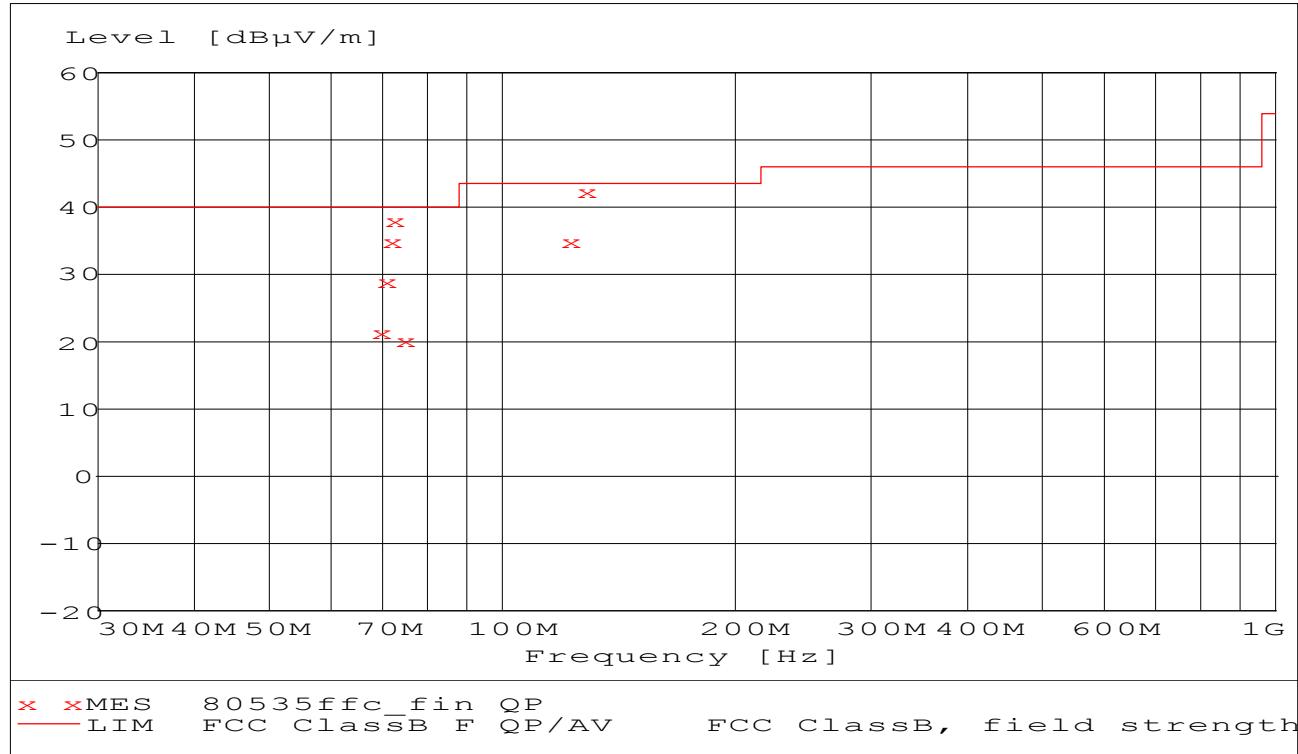
TEST REPORT REFERENCE: F080535E1

6.1.3 FINAL MEASUREMENT (30 MHz to 1 GHz)

Ambient temperature:	20 °C	Relative humidity:	30 %
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Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
 Cable guide: The cables of the EUT were fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.
 Test record: All results are shown in the following.
 Title: Final measurement on 3 m open area test site according to CFR47 Part 15.109
 EUT: CT-GateCom Compact
 Manufacturer: CeoTronics AG
 Operating Condition: Connected to CT DECT Multi
 Test site: PHOENIX TEST-LAB BLOMBERG; open area test site M6
 Operator: D. Sütthoff
 Test Specification: Battery supplied

The measured points and the limit line in the following diagram refer to the standard measurement of the emitted interference in compliance with the above mentioned standard. The measured points marked with x are the measured results of the standard subsequent measurement on the open area test site.



Data record name: 80535ffc

TEST REPORT REFERENCE: F080535E1

The results of the standard subsequent measurement on the open area test site are indicated in the table below. The limits as well as the measured results (levels) refer to the above mentioned standard while taking account of the specified requirements for a 3 m measuring distance.

Result measured with the quasipeak detector:

(These values are marked in the above diagram by x)

Frequency MHz	Level dB μ V/m	Transducer dB	Limit dB μ V/m	Margin dB	Height cm	Azimuth deg	Polarisation
69.816000	21.40	7.3	40.0	18.6	151.0	89.00	VERTICAL
70.788000	29.20	7.4	40.0	10.8	136.0	90.00	VERTICAL
71.736000	34.80	7.6	40.0	5.2	136.0	314.00	VERTICAL
72.648000	38.30	7.8	40.0	1.7	122.0	90.00	VERTICAL
74.556000	20.40	7.7	40.0	19.6	125.0	45.00	VERTICAL
122.664000	35.10	13.0	43.5	8.4	325.0	180.00	VERTICAL
128.748000	42.50	12.9	43.5	1.0	121.0	180.00	HORIZONTAL

Data record name: 80535ffc_fin QP

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

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7 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

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No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. due
14	Open area test site	-	Phoenix Test-Lab	-	480085	Weekly verification (system cal.)	
15	Measuring receiver	ESCS30	Rohde & Schwarz	828985/014	480270	02/27/2008	02/2010
16	Controller	HD100	Deisel	100/670	480139	-	-
17	Turntable	DS420HE	Deisel	420/620/80	480087	-	-
18	Antenna support	AS615P	Deisel	615/310	480086	-	-
19	Antenna	CBL6111 A	Chase	1643	480147	08/01/2007	08/2012
20	EMI Software	ES-K1	Rohde & Schwarz	-	480111	-	
29	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Weekly verification (system cal.)	
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	02/25/2008	02/2010
32	Controller	HD100	Deisel	100/670	480326	-	
33	Turntable	DS420HE	Deisel	420/620/80	480315	-	
34	Antenna support	AS615P	Deisel	615/310	480187	-	
35	Antenna	CBL6112 B	Chase	2688	480328	10/11/2005	10/2010
36	Antenna	3115 A	EMCO	9609-4918	480183	08/04/2003	08/2008
37	Standard Gain Horn 11.9 GHz – 18 GHz	18240-20	Flann Microwave	483	480294	Six month verification (system cal.)	
39	Standard Gain Horn 17.9 GHz – 26.7 GHz	20240-20	Flann Microwave	411	480297	Six month verification (system cal.)	
43	RF-cable No. 30	RTK 081	Rosenberger	-	410141	Weekly verification (system cal.)	
44	RF-cable No. 31	RTK 081	Rosenberger	-	410142	Weekly verification (system cal.)	
46	RF-cable 1m	KPS-1533-400-KPS	Insulated Wire	-	480301	Six month verification (system cal.)	
49	Preamplifier	JS3-00101200-23-5A	Miteq	681851	480337	Six month verification (system cal.)	
50	Preamplifier	JS3-12001800-16-5A	Miteq	571667	480343	Six month verification (system cal.)	
51	Preamplifier	JS3-18002600-20-5A	Miteq	658697	480342	Six month verification (system cal.)	
53	EMI Software	ES-K1	Rohde & Schwarz	-	480111	-	
54	Power supply	TOE 8852	Toellner	51712	480233	11/27/2006	11/2008

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8 LIST OF ANNEXES

ANNEX A	PHOTOGRAPHS OF THE TEST SET-UPS:	3 pages
	Test set-up preliminary emission measurement	80535_EMI1.jpg
	Test set-up preliminary emission measurement	80535_EMI2.jpg
	Test set-up final emission measurement	80535_EMIF1.jpg
ANNEX B	PHOTOGRAPHS OF THE TEST SAMPLE:	8 pages
	EUT top view	80535_EUT1.jpg
	EUT rear view	80535_EUT2.jpg
	EUT PCB1 top view	80535_EUT3.jpg
	EUT PCB1 rear view	80535_EUT4.jpg
	EUT PCB2 top view	80535_EUT5.jpg
	EUT PCB2 rear view	80535_EUT6.jpg
	EUT PCB3 top view	80535_EUT7.jpg
	EUT PCB3 rear view	80535_EUT8.jpg