



Inter**Lab**<sup>®</sup>

Final Report on

Twig Protector Device TGP81EU

**Report Reference:** MDE\_GEOS\_0901\_FCCa  
acc. title 47 cfr chapter I part 15 subpart B

**Date:** April 28, 2010

**Test Laboratory:**

7 layers AG  
Borsigstr. 11  
40880 Ratingen  
Germany



DGA-PL-192/99-02

**Note:**

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the test laboratory.

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## 1 Administrative Data

### 1.1 Project Data

*Project Responsible:* Holger Leutfeld  
*Date Of Test Report:* 2010/04/13  
*Date of first test:* 2010/03/08  
*Date of last test:* 2010/03/08

### 1.2 Applicant Data

*Company Name:* GeoSentric plc.  
*Street:* Merinitynkatu 11  
*City:* 24101 Salo  
*Country:* Finland  
*Contact Person:* Mr. Jari-Pekka Savojoki  
*Function:* R&D Project Manager  
*Phone:* +358 20 770 0892  
*Fax:* +358 2 733 2633  
*E-Mail:* jsavojoki@gypsii.com

### 1.3 Test Laboratory Data

The following list shows all places and laboratories involved for test result generation:


#### 7 layers DE

*Company Name :* 7 layers AG  
*Street :* Borsigstrasse 11  
*City :* 40880 Ratingen  
*Country :* Germany  
*Contact Person :* Mr. Michael Albert  
*Phone :* +49 2102 749 201  
*Fax :* +49 2102 749 444  
*E Mail :* michael.albert@7Layers.de

#### Laboratory Details

Lab ID	Identification	Responsible	Accreditation Info
Lab 1	Conducted Emissions	Mr. Robert Machulec Mr. Andreas Petz	DAR-Registration no. DGA-PL-192/99-02
Lab 2	Radiated Emissions	Mr. Robert Machulec Mr. Andreas Petz	DAR-Registration no. DGA-PL-192/99-02

### 1.4 Signature of the Testing Responsible



Andreas Petz  
responsible for tests performed in: Lab 1, Lab 2



7 layers AG, Borsigstr. 11  
40880 Ratingen, Germany  
Phone +49 (0)2102 749 0

## 1.5 Signature of the Accreditation Responsible



Accreditation scope responsible person  
responsible for Lab 1, Lab 2



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40860 Ratingen, Germany  
Phone +49 (0)2102 749 0

## 2 Test Object Data

### 2.1 General OUT Description

The following section lists all OUTs (Object's Under Test) involved during testing.

#### OUT: Twig Protector Device TGP81EU

*Product Category:* Mobile Phone

**Manufacturer:**  
*Company Name:* see applicant

#### Parameter List:

Parameter name	Value
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#### Ancillary Equipment: AC/DC charger

*Type / Model / Family:* FWHK FW7600/05

*Product Category:* Mobile Phone Accessory

**Manufacturer:**  
*Company Name:* please see applicant data

*Contact Person:* please see applicant data

#### Ancillary Equipment: Desktop Cradle

*Type / Model / Family:* GeoSentric CTA81

*Product Category:* Mobile Phone Accessory

**Manufacturer:**  
*Company Name:* please see applicant data

*Contact Person:* please see applicant data

#### Ancillary Equipment: USB charging adapter

*Product Category:* Mobile Phone Accessory

## 2.2 OUT Features

### Features for OUT: AC/DC charger

<i>Designation</i>	<i>Description</i>	<i>Allowed Values</i>	<i>Supported Value(s)</i>
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#### Features for scope: FCC\_v2

AC	The OUT is powered by or connected to AC Mains
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### Features for OUT: Twig Protector Device TGP81EU

<i>Designation</i>	<i>Description</i>	<i>Allowed Values</i>	<i>Supported Value(s)</i>
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#### Features for scope: FCC\_v2

AC	The OUT is powered by or connected to AC Mains
DC	The OUT is powered by or connected to DC Mains
EDGE850	EUT supports EDGE in the band 824 MHz - 849 MHz
EDGE1900	EUT supports EDGE in the band 1850 MHz - 1910 MHz
GSM850	EUT supports GSM850 band 824MHz - 849MHz
Iant	Integral Antenna: permanent fixed antenna, which may be built-in, designed as an indispensable part of the equipment
PCS1900	EUT supports PCS1900 band 1850MHz - 1910MHz

## 2.3 Operating Mode(s)

<i>Ref. -No.</i>	<i>Description</i>
G0850	Device is transmitting in GSM 850 on traffic channel TCH 190, GPS active. The device is powered by the internal battery and is connected to AC mains.
G1900	Device is transmitting in GSM 1900 on traffic channel 661, GPS active. The device is powered by the internal battery and is connected to AC mains.

## 2.4 Setups used for Testing

For each setup a relation is given to determine if and which samples and auxiliary equipment is used. The left side list all OUT samples and the right side lists all auxiliary equipment for the given setup.

<i>Setup No.</i>	<i>List of OUT samples</i>	<i>List of auxiliary equipment</i>
<i>Sample No.</i>	<i>Sample Description</i>	<i>AE No.      AE Description</i>

### FCC15B\_ACDG (OUT connected to dedicated AC/DC adapter)

<i>Sample:</i> DC01	AC/DC adapter 100-240 V50-60 Hz
<i>Sample:</i> SK01	Desktop adapter
<i>Sample:</i> B01	

### 3 Results

#### 3.1 General

**Documentation of tested devices:**

Available at the test laboratory.

**Interpretation of the test results:**

The results of the inspection are described on the following pages, where 'Conformity' or 'Passed' means that the certification criteria were verified and that the tested device is conform to the applied standard.

In cases where 'Declaration' is printed, the required documents are available in the manufacturers product documentation.

In cases where 'not applicable' is printed, the test case requirements are not relevant to the specific equipment implementation.

#### 3.2 List of the Applicable Body

(Body for Scope: FCC\_v2)

<i>Designation</i>	<i>Description</i>
FCC47CFRChIPART15bRADIO FREQUENCY DEVICES	Part 15, Subpart B - Unintentional Radiators

#### 3.3 List of Test Specification

<i>Test Specification:</i>	<b>FCC part 2 and 15</b>
<i>Version</i>	10-1-09 Edition
<i>Title:</i>	PART 2 - GENERAL RULES AND REGULATIONS PART 15 - RADIO FREQUENCY DEVICES



Reference: MDE\_GEOS\_0901\_FCCa  
acc. title 47 cfr chapter I part 15 subpart B

### 3.4 Summary

<i>Test Case Identifier / Name</i>	<i>Result</i>	<i>Date of Test</i>	<i>Lab Ref.</i>	<i>Setup</i>
<b>15b.1 Conducted Emissions (AC Power Line) §15.107</b>				
15b.1; Mode = transmit	Passed	2010/03/08	Lab 1	FCC15B_ACDC
operating mode: G0850				
<b>15b.2 Spurious Radiated Emissions §15.109</b>				
15b.2; Mode = transmit	Passed	2010/03/08	Lab 2	FCC15B_ACDC
operating modes: G1900				



### 3.5 Detailed Results

#### 3.5.1 15b.1 Conducted Emissions (AC Power Line) §15.107

**Test: 15b.1; Mode = transmit**

<i>Result:</i>	Passed
<i>Setup No.:</i>	FCC15B_ACDC
<i>Date of Test:</i>	2010/03/08 10:59
<i>Body:</i>	FCC47CFRChIPART15bRADIO FREQUENCY DEVICES
<i>Test Specification:</i>	FCC part 2 and 15
<i>Test Equipment Environmental Conditions</i>	
<i>Temperature:</i>	23°C
<i>Air Pressure:</i>	1023hPa
<i>Rel. Humidity:</i>	32%

**Used Test Parameter:**

<i>Name</i>	<i>Value</i>
Mode	GSM 850 transmitting, GPS

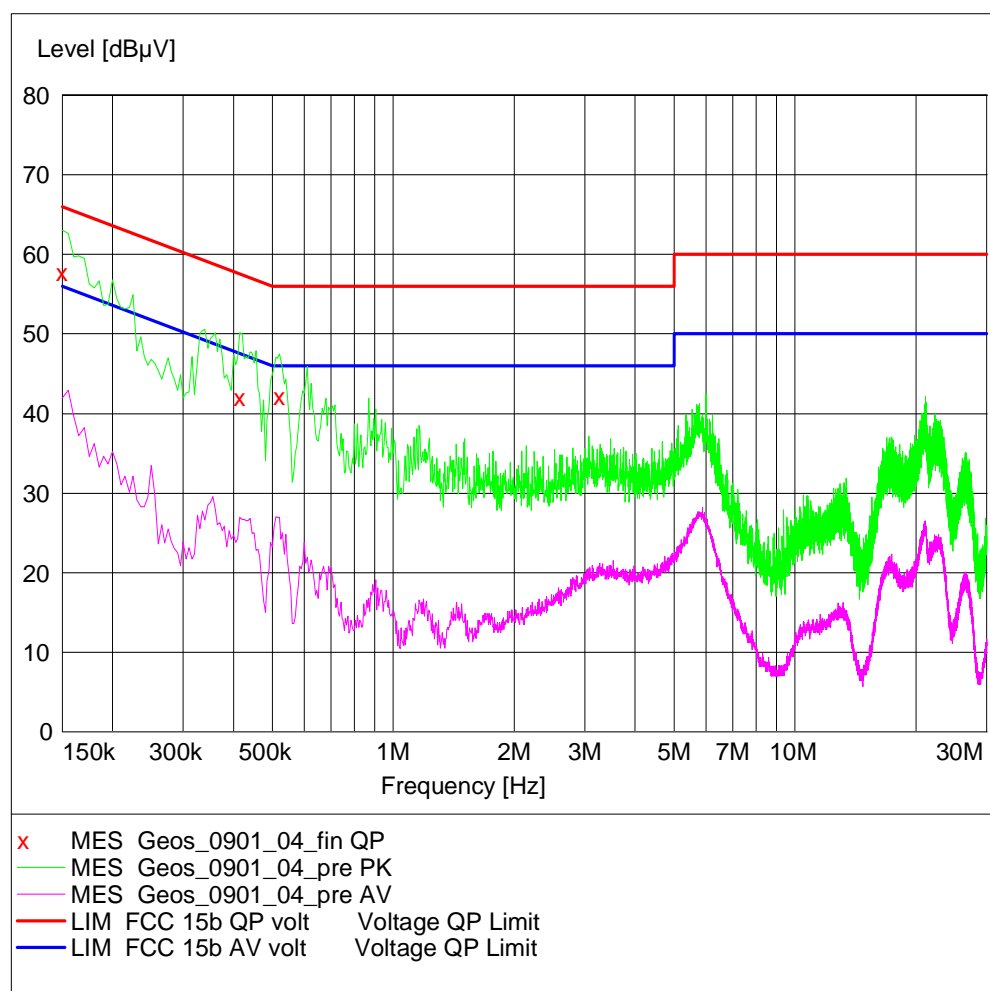
## Detailed Results:

### AC MAINS CONDUCTED

EUT: Twig Protector (ES000b01)  
Manufacturer: GeoSentric plc.  
Operating Condition: GSM 850 TCH 190, GPS active, charging  
Test Site: 7 layers Ratingen  
Operator: Pet  
Test Specification: ANSI C63.4; FCC 15.107 / 15.207  
Comment: Desktop Charger; AC 120 V / 60 Hz  
Start of Test: 08.03.2010 / 10:34:54

### SCAN TABLE: "FCC Voltage"

Short Description:			FCC Voltage				
Start	Stop	Step	Detector	Meas.	IF	Transducer	
Frequency	Frequency	Width		Time	Bandw.		
150.0 kHz	30.0 MHz	5.0 kHz	MaxPeak	20.0 ms	9 kHz	ESH3-Z5	
			Average				



### MEASUREMENT RESULT: "Geos\_0901\_04\_fin QP"

Frequency	Level	Transd	Limit	Margin	Line	PE
MHz	dBμV	dB	dBμV	dB		
0.150000	57.70	10.0	66	8.3	N	FLO
0.415000	42.00	9.9	58	15.6	N	GND
0.520000	42.20	10.0	56	13.8	L1	FLO



### 3.5.2 15b.2 Spurious Radiated Emissions §15.109

**Test: 15b.2; Mode = transmit**

<i>Result:</i>	Passed
<i>Setup No.:</i>	FCC15B_ACDC
<i>Date of Test:</i>	2010/03/08 10:54
<i>Body:</i>	FCC47CFRChIPART15bRADIO FREQUENCY DEVICES
<i>Test Specification:</i>	FCC part 2 and 15
<i>Test Equipment Environmental Conditions</i>	
<i>Temperature:</i>	23°C
<i>Air Pressure:</i>	1023hPa
<i>Rel. Humidity:</i>	31%

**Used Test Parameter:**

<i>Name</i>	<i>Value</i>
Mode	GSM 1900 transmitting, GPS

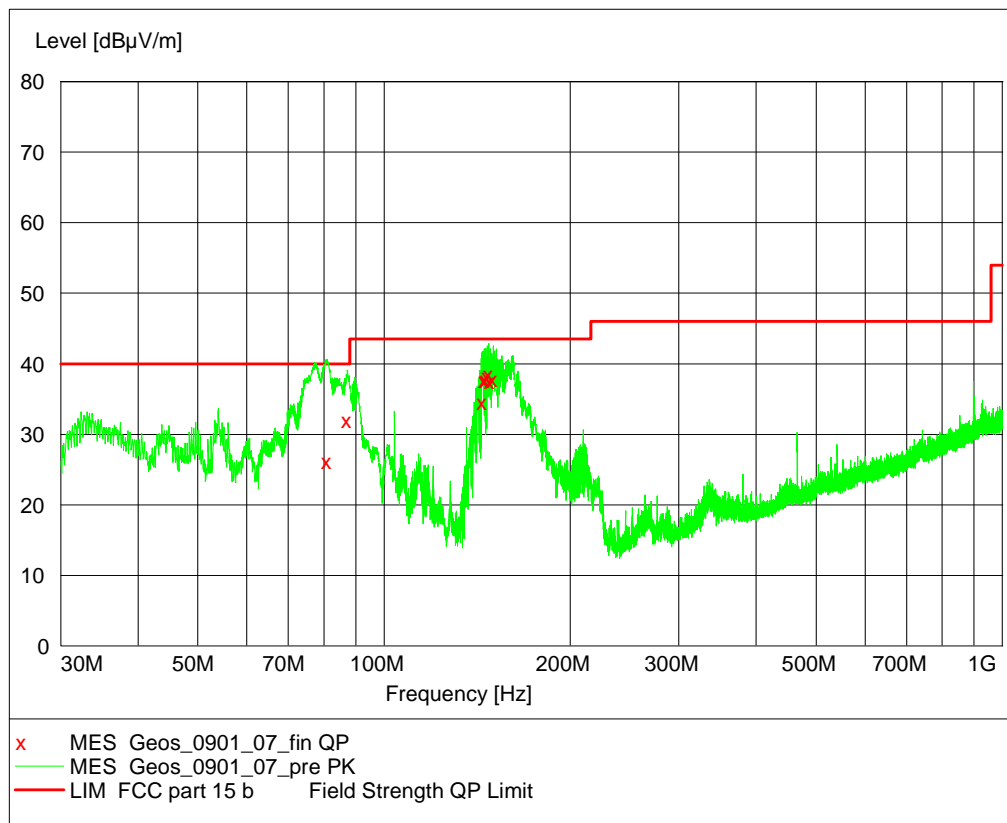
## Detailed Results:

### EMI RADIATED TEST

EUT: Twig Protector (ES000b01)  
Manufacturer: GeoSentric plc.  
Operating Condition: GSM 1900 TCH 661, GPS active, charging  
Test Site: 7 layers, Ratingen  
Operator: Gal  
Test Specification: FCC part 15 b  
Comment: Horizontal EUT position, desktop Charger, AC 120 V / 60 Hz  
Start of Test: 08.03.2010 / 14:00:02

### SCAN TABLE: "FCC part 15 b"

Short Description: FCC part 15 b  
Start Stop Step Detector Meas. IF Transducer  
Frequency Frequency Width Time Bandw.  
30.0 MHz 1.0 GHz 60.0 kHz MaxPeak 1.0 ms 120 kHz HL562



### MEASUREMENT RESULT: "Geos\_0901\_07\_fin QP"

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
80.880000	26.20	9.8	40.0	13.8	180.0	157.00	VERTICAL
87.300000	31.90	10.2	40.0	8.1	319.0	157.00	HORIZONTAL
144.420000	34.60	9.7	43.5	8.9	100.0	292.00	VERTICAL
145.260000	37.70	9.6	43.5	5.8	100.0	112.00	VERTICAL
145.680000	37.60	9.6	43.5	5.9	100.0	94.00	VERTICAL
146.040000	37.80	9.6	43.5	5.7	100.0	94.00	VERTICAL
146.880000	38.20	9.5	43.5	5.3	100.0	102.00	VERTICAL
147.660000	38.40	9.5	43.5	5.1	100.0	97.00	VERTICAL
148.500000	37.50	9.5	43.5	6.0	102.0	67.00	VERTICAL
150.180000	37.80	9.4	43.5	5.7	100.0	100.00	VERTICAL

## 4 Test Equipment Details

### 4.1 List of Used Test Equipment

The calibration, hardware and software states are shown for the testing period.

#### Test Equipment Anechoic Chamber

<b>Lab ID:</b>	<b>Lab 2</b>		
<b>Manufacturer:</b>	Frankonia		
<b>Description:</b>	Anechoic Chamber for radiated testing		
<b>Type:</b>	10.58x6.38x6		
	<i>Calibration Details</i>	<i>Last Execution</i>	<i>Next Exec.</i>
	IC renewal	2009/01/21	2011/01/20
	FCC renewal	2009/01/07	2011/01/06

#### Single Devices for Anechoic Chamber

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>
Air compressor	none	-	Atlas Copco
Anechoic Chamber	10.58 x 6.38 x 6	none	Frankonia
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	FCC listing 96716 3m Part15/18		2009/01/07 2011/01/06
	ANSI C64.3 NSA		2009/01/21 2011/01/20
Controller Innco 2000	CO 2000	CO2000/328/1247 0406/L	Innco innovative constructions GmbH
EMC camera	CE-CAM/1	-	CE-SYS
EMC camera Nr.2	CCD-400E	0005033	Mitsubishi
Filter ISDN	B84312-C110-E1		Siemens&Matsushita
Filter Universal 1A	BB4312-C30-H3	-	Siemens&Matsushita

#### Test Equipment Auxiliary Equipment for Conducted emissions

<b>Lab ID:</b>	<b>Lab 1</b>
<b>Manufacturer:</b>	Rohde & Schwarz GmbH & Co.KG
<b>Description:</b>	EMI Conducted Auxiliary Equipment

#### Single Devices for Auxiliary Equipment for Conducted emissions

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>
Cable "LISN to ESI"	RG214	W18.03+W48.03	Huber&Suhner
Coupling-Decoupling- Network	CDN ENY41	100002	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2008/03/06 2011/03/05
Two-Line V-Network	ESH 3-Z5	828304/029	Rohde & Schwarz GmbH & Co. KG
Two-Line V-Network	ESH 3-Z5	829996/002	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	DKD calibration		2008/10/13 2011/10/12

## Test Equipment Auxiliary Equipment for Radiated emissions

**Lab ID:** Lab 2  
**Description:** Equipment for emission measurements  
**Serial Number:** see single devices

### Single Devices for Auxiliary Equipment for Radiated emissions

Single Device Name	Type	Serial Number	Manufacturer
Antenna mast	AS 620 P		HD GmbH
Biconical dipole	VUBA 9117	9117108	Schwarzbeck
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Standard Calibration		2008/10/27 2013/10/26
Broadband Amplifier 18MHz-26GHz	JS4-18002600-32-5P	849785	Miteq
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Path Calibration		2009/11/16 2010/05/15
Broadband Amplifier 1GHz-4GHz	AFS4-01000400-1Q-10P-4	-	Miteq
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Path Calibration		2009/11/16 2010/05/15
Broadband Amplifier 30MHz-18GHz	JS4-00101800-35-5P	896037	Miteq
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Path Calibration		2009/11/16 2010/05/15
Cable "ESI to EMI Antenna"	EcoFlex10	W18.01- 2+W38.01-2	Kabel Kusch
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Path Calibration		2009/11/16 2010/05/15
Cable "ESI to Horn Antenna"	UFB311A+UFB293C	W18.02- 2+W38.02-2	Rosenberger Micro-Coax
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Path Calibration		2009/11/16 2010/05/15
Double-ridged horn	HF 906	357357/001	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Standard Calibration		2009/04/16 2012/04/15
Double-ridged horn	HF 906	357357/002	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Standard Calibration		2009/04/28 2012/04/27
Dreheinheit	DE 325		HD GmbH
High Pass Filter	4HC1600/12750-1.5-KK	9942011	Trilithic
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Path Calibration		2009/11/16 2010/05/15
High Pass Filter	5HC2700/12750-1.5-KK	9942012	Trilithic
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Path Calibration		2009/11/16 2010/05/15
High Pass Filter	5HC3500/12750-1.2-KK	200035008	Trilithic
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Path Calibration		2009/11/16 2010/05/15
Log.-per. Antenna	HL 562 Ultralog	830547/003	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>

### Single Devices for Auxiliary Equipment for Radiated emissions (continued)

Single Device Name	Type	Serial Number	Manufacturer
	Standard Calibration		2009/05/27 2012/05/26
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	DKD calibration		2008/10/07 2011/10/06
Pyramidal Horn Antenna 26,5 GHz	3160-09	00083069	EMCO Elektronik GmbH
Pyramidal Horn Antenna 40 GHz	3160-10	00086675	EMCO Elektronik GmbH

### Test Equipment Auxiliary Test Equipment

<b>Lab ID:</b>	<b>Lab 2</b>
<b>Manufacturer:</b>	see single devices
<b>Description:</b>	Single Devices for various Test Equipment
<b>Type:</b>	various
<b>Serial Number:</b>	none

### Single Devices for Auxiliary Test Equipment

Single Device Name	Type	Serial Number	Manufacturer
AC Power Source	Chroma 6404	64040001304	Chroma ATE INC.
Broadband Power Divider N (Aux)	1506A / 93459	LM390	Weinschel Associates
Broadband Power Divider SMA	WA1515	A855	Weinschel Associates
Digital Multimeter 01 (Multimeter)	Voltcraft M-3860M	IJ096055	Conrad Electronics
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383	Fluke Europe B.V.
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Standard calibration		2009/10/07 2011/10/06
Digital Oscilloscope [SA2] (Aux)	TDS 784C	B021311	Tektronix GmbH
Fibre optic link Satellite (Aux)	FO RS232 Link	181-018	Pontis
Fibre optic link Transceiver (Aux)	FO RS232 Link	182-018	Pontis
Isolating Transformer	LTS 604	1888	Thalheimer Transformatorenwerke GmbH
Notch Filter Ultra Stable (Aux)	WRCA800/960-6EEK	24	Wainwright
Spectrum Analyser	FSP3	836722/011	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	DKD calibration		2008/10/06 2011/10/05
Vector Signal Generator	SMIQ B3	832492/061	

## Test Equipment Digital Signalling Devices

**Lab ID:** Lab 1, Lab 2  
**Description:** Signalling equipment for various wireless technologies.

### Single Devices for Digital Signalling Devices

Single Device Name	Type	Serial Number	Manufacturer
Bluetooth Signalling Unit CBT	CBT	100589	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Standard Calibration		2008/08/14 2011/08/13
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Standard calibration		2008/10/07 2010/10/06
Digital Radio Test Set	6103E	2359	Racal Instruments, Ltd.
Universal Radio Communication Tester	CMU 200	102366	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Standard calibration		2009/02/16 2011/02/15
	<i>HW/SW Status</i>		<i>Date of Start Date of End</i>
	Hardware:		2007/07/16
	B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B56V14, B68 3v04, PCMCIA, U65V04		
	Software:		
Universal Radio Communication Tester	K21 4v21, K22 4v21, K23 4v21, K24 4v21, K42 4v21, K43 4v21, K53 4v21, K56 4v22, K57 4v22, K58 4v22, K59 4v22, K61 4v22, K62 4v22, K63 4v22, K64 4v22, K65 4v22, K66 4v22, K67 4v22, K68 4v22, K69 4v22		
	Firmware:		
	µP1 8v50 02.05.06		
	---		
	CMU 200	837983/052	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Standard calibration		2008/12/01 2011/11/30
Universal Radio Communication Tester	<i>HW/SW Status</i>		<i>Date of Start Date of End</i>
	HW options:		2007/01/02
	B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B54V14, B56V14, B68 3v04, B95, PCMCIA, U65V02		
	SW options:		
	K21 4v11, K22 4v11, K23 4v11, K24 4v11, K27 4v10, K28 4v10, K42 4v11, K43 4v11, K53 4v10, K65 4v10, K66 4v10, K68 4v10,		
	Firmware:		
	µP1 8v40 01.12.05		
Universal Radio Communication Tester	---		
	SW:		2008/11/03
	K62, K69		
Vector Signal Generator	SMU200A	100912	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution Next Exec.</i>
	Standard calibration		2008/10/28 2011/10/27

### Test Equipment Emission measurement devices

**Lab ID:** Lab 1, Lab 2  
**Description:** Equipment for emission measurements  
**Serial Number:** see single devices

#### Single Devices for Emission measurement devices

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>
Personal Computer	Dell	30304832059	Dell
Signal Generator	SMR 20	846834/008	Rohde & Schwarz GmbH & Co. KG
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
Standard Calibration			2007/12/05 2010/12/04
Spectrum Analyzer	ESIB 26	830482/004	Rohde & Schwarz GmbH & Co. KG
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
Standard Calibration			2009/12/03 2011/12/02

### Test Equipment Shielded Room 02

**Lab ID:** Lab 1  
**Manufacturer:** Frankonia  
**Description:** Shielded Room for conducted testing  
**Type:** 12 qm  
**Serial Number:** none

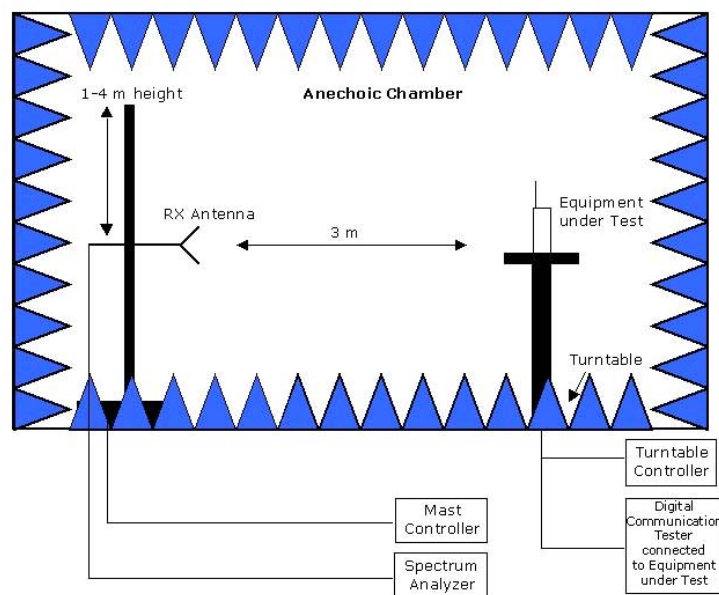
## 4.2 Laboratory Environmental Conditions

<i>Laboratory</i>	<i>Date</i>	<i>Temperature</i>	<i>Humidity</i>	<i>Air Pressure</i>
Lab 1	2010/03/08	23 °C	32 %	1023 hPa
Lab 2	2010/03/08	23 °C	31 %	1023 hPa

## 5 Annex

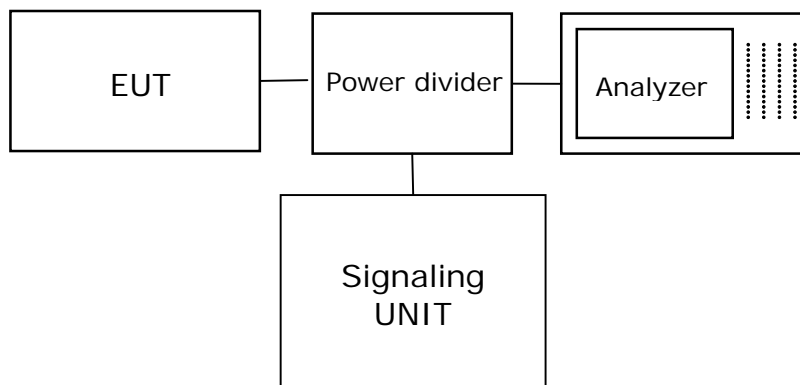
### 5.1 Additional Information for Report

Setup Drawings



Remark: Depending on the frequency range suitable antenna types, attenuators or preamplifiers are used.

Setup in the Anechoic chamber. For measurements below 1 GHz the ground was replaced by a conducting ground plane.



Setup in the shielded room for conducted measurements at AC mains port

#### Test Description

\_\_\_\_\_

\_\_\_\_\_

#### Conducted emissions (AC power line)

Standard     FCC Part 15  
Subpart B

The test was performed according to: ANSI C 63.4, 2003

#### Test Description

The test set-up was made in accordance to the general provisions of ANSI C 63.4-2003.  
The Equipment Under Test (EUT) was setup in a shielded room to perform the conducted emissions measurements in a typical installation configuration. The EUT was powered from 50 $\mu$ H || 50 Ohm Line Impedance Stabilization Network (LISN). The LISN's unused connections were terminated with 50 Ohm loads.

The measurement procedure consists of two steps. It is implemented into the EMI test software ES-K1 from R&S.

#### Step 1: Preliminary scan

Intention of this step is, to determine the conducted EMI-profile of the EUT.

EMI receiver settings:

- Detector: Peak - Maxhold
- Frequency range: 150 kHz – 30 MHz
- Frequency steps: 5 kHz
- IF-Bandwidth: 9 kHz
- Measuring time / Frequency step: 20 ms
- Measurement on phase + neutral lines of the power cords

On basis of this preliminary scan the highest amplitudes and the corresponding frequencies relative to the limit are identified. Emissions above the limit and emissions which are in the 10 dB range below the limit are considered.

#### Step 2: Final measurement

Intention of this step is, to determine the highest emissions with the settings defined in the test specification for the frequencies identified in step 1.

EMI receiver settings:

- Detector: Quasi-Peak
- IF - Bandwidth: 9 kHz
- Measuring time: 1 s / frequency

At each frequency determined in step 1, four measurements are performed in the following combinations:

- 1) Neutral lead - reference ground (PE grounded)
- 2) Phase lead - reference ground (PE grounded)
- 3) Neutral lead - reference ground (PE floating)
- 4) Phase lead - reference ground (PE floating)

The highest value is reported.

#### Test Requirements / Limits

If not stated within the measurement plot and/or test result, class B limits are applied.

FCC Part 15, Subpart B, §15.107, Class B Limit

Frequency Range (MHz)	QP Limit (dB $\mu$ V)	AV Limit (dB $\mu$ V)
0.15 – 0.5	66 to 56	56 to 46
0.5 – 5	56	46
5 – 30	60	50

FCC Part 15, Subpart B, §15.107, Class A Limit

Frequency Range (MHz)	QP Limit (dBµV)	AV Limit (dBµV)
0.15 - 0.5	79	66
0.5 - 30	73	60

Used conversion factor: Limit (dBµV) = 20 log (Limit (µV)/1µV).

NOTE: a missing result table in the corresponding test report section means, that no final measurement was performed because no relevant frequencies (peaks) were found in the preliminary scan.

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Spurious radiated emissions

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Standard     FCC Part 15, Subpart B

The test was performed according to: ANSI C 63.4, 2003

#### Test Description

Measurement below 1 GHz:

The test set-up was made in accordance to the general provisions of ANSI C 63.4-2003.

The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna.

The radiated emissions measurements were made in a typical installation configuration.

The measurement procedure is implemented into the EMI test software ES-K1 from R&S.

Step 1: Preliminary scan (test to identify the highest amplitudes relative to the limit)

Intention of this step is, to determine the radiated EMI-profile of the EUT.

Settings for step 1:

- Detector: Peak-Maxhold
- Frequency range: 30 – 1000 MHz
- Frequency steps: 60 kHz
- IF-Bandwidth: 120 kHz
- Measuring time / Frequency step: 100 µs
- Turntable angle range: –180° to 180°
- Turntable step size: 90°
- Height variation range: 1 – 3 m
- Height variation step size: 2 m
- Polarisation: Horizontal + Vertical

On basis of this preliminary scan the highest amplitudes and the corresponding frequencies relative to the limit are identified. Emissions above the limit and emissions which are in the 10 dB range below the limit are considered.

Step 2:

A further measurement will be performed on the frequencies determined in step 1. Intention of this step is, to find out the approximate turntable angle and antenna height for each frequency.

Settings for step 2:

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range: –180° to 180°
- Turntable step size: 45°
- Height variation range: 1 – 4 m
- Height variation step size: 0.5 m
- Polarisation: horizontal + vertical

After this step the EMI test system has determined the following values for each frequency (of step 1):

- Frequency
- Azimuth value (of turntable)
- Antenna height

The last two values have now the following accuracy:

- Azimuth value (of turntable): 45°
- Antenna height: 0.5 m

### Step 3: final measurement

In this step the accuracy of the turntable azimuth and antenna height will be improved. This is necessary to find out the maximum value of every frequency.

For each frequency, which was determined the turntable azimuth and antenna height will be adjusted. The turntable azimuth will be slowly varied by  $\pm 22.5^\circ$  around this value. During this action the value of emission is continuously measured. The turntable azimuth at the highest emission will be recorded and adjusted. In this position the antenna height is also slowly varied by  $\pm 25$  cm around the antenna height determined. During this action the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100ms
- Turntable angle range:  $-22.5^\circ$  to  $+ 22.5^\circ$  around the determined value
- Height variation range: -0.25m to  $+ 0.25$ m around the determined value

### Step 4: Final measurement (with QP detector)

With the settings determined in step 3, the final measurement will be performed:

EMI receiver settings for step 4:

- Detector: Quasi-Peak(< 1GHz)
- Measured frequencies: in step 3 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

Measurement above 1 GHz:

The following modifications apply to the measurement procedure for the frequency range above 1 GHz: The measurement distance was reduced to 1 m. The results were extrapolated by the extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements, inverse-linear-distance-squared for the power density measurements). Due to the fact that in this frequency range a double ridged wave guided horn antenna (up to 18 GHz) and a horn antenna (18–25 GHz) are used, the steps 2-4 as described before, are omitted. Step 1 was performed at one height of the receiving antenna only.

Detector: Peak, Average (simultaneously)

RBW = VBW = 1 MHz; above 7 GHz 100 kHz

### Test Requirements / Limits

If not stated within the measurement plot and/or test result, class B limits are applied.

FCC Part 15, Subpart B, §15.109, Radiated Emission Limits

Frequency Range (MHz): Class B Limit (dB $\mu$ V/m)

Frequency Range (MHz)	Class B Limit (dB $\mu$ V/m)
30 – 88	40.0
88 – 216	43.5
216 – 960	46.0
above 960	54.0

Frequency Range (MHz)	Class A Limit (dB $\mu$ V/m) / @ 3m !
30 - 88	49.5
88 - 216	54.0
216 - 960	56.9
above 960	60.0

### §15.35(b)

..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit....

Used conversion factor: Limit (dB $\mu$ V/m) =  $20 \log (\text{Limit } (\mu\text{V/m})/1\mu\text{V/m})$

NOTE: a missing result table in the corresponding test report section means, that no final measurement was performed because no relevant frequencies (peaks) were found in the preliminary scan.



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