InterLab®

Final Report on

Secure Online Banking Device - Seal One 8300 pro

FCC ID: 2ABBY8300

Report Reference: MDE_SEAL_1302_FCCb

acc. Title 47 CFR chapter I part 15 subpart B, Class B

Date: August 27, 2014

Test Laboratory:
Borsigstr. 11

Germany

7Layers AG

40880 Ratingen

DAkkS Deutsche Akkreditierungsstelle D-PL-12140-01-01

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:	Patrick Menge
Date Of Test Report:	2014/08/27
Date of first test:	2014/07/22
Date of last test:	2014/08/23

1.2 Applicant Data

Company Name: Seal One AG

Street:	Berliner Str. 44
City:	60311 Frankfurt/Main
Country:	Germany

Contact Person: Hr. Maik Stohn

Phone:	+49 (69) 1301468-59
Fax:	+49 (69) 1301468-56
Mobile:	+49 (160) 90 112 777
E-Mail:	maik.stohn@seal-one.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.com

Laboratory Details

Lab ID	*Identification*	*Responsible*	*Accreditation Info*
Lab 1	Conducted Emissions	Mr. Andreas Petz Mr. Wolfgang Richter	DAkkS-Registration no. D-PL-12140-01-01
Lab 2	Radiated Emissions	Mr. Marco Kullik Mr. Robert Machulec	DAkkS-Registration no. D-PL-12140-01-01

1.4 Signature of the Testing Responsible

7layers

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

Marco Kullik
responsible for tests performed in: Lab 1, Lab 2

1.5 Signature of the Accreditation Responsible

B. Retka [B. RETKA]

Accreditation scope responsible person
responsible for Lab 1, Lab 2

2 Test Object Data

2.1 General OUT Description

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

OUT: Secure Online Banking Device - Seal One 8300 pro

Type / Model / Family:	Secure Online Banking Device - Seal One 8300 pro
Product Category:	Computer Accessory
Manufacturer:	
Company Name:	See applicant data:
Contact Person:	-

Parameter List:

Parameter name	*Value*
Parameter for Scope FCC_v2:	
DC Power Supply	5 (V)

2.2 Detailed Description of OUT Samples

Sample : c01

OUT Identifier	Secure Online Banking Device - Seal One 8300 pro		
Sample Description	Sample #03		
SW Status	1_2014		
Date of Receipt	2014/03/18		
Low Voltage	4.2 V	*Low Temp.*	0 °C
High Voltage	6.5 V	*High Temp.*	45 °C
Nominal Voltage	5 V	*Normal Temp.*	20 °C

2.3 OUT Features

Features for OUT: Secure Online Banking Device - Seal One 8300 pro

Designation	*Description*	*Allowed Values*	*Supported Value(s)*
Features for scope: FCC_v2			
BTLE	Support of Bluetooth Low Energy		
DC	The OUT is powered by or connected to DC		

2.4 Auxiliary Equipment

AE No.	*Type Designation*	*Serial No.*	*HW Status*	*SW Status*	*Description*
AE _AE01					USB Cradle
AE AE94	Cherry RS6000	G 0000273 2P28			Keyboard
AE AE92	Fujitsu Siemens 0335C2065	A30638114250			AC Adapter laptop
AE AE91	Fujitsu Siemens Amilo Pro V3205	YK2H014267			Laptop
AE AE90	LG Flatron L1740BQ	509WANF1W607			TFT Display
AE AE93	Logitech MBB48	LZC90505478			Mouse

2.5 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.

Setup No.	*List of OUT samples*		*List of auxiliary equipment*	
	Sample No.	*Sample Description*	*AE No.*	*AE Description*
C01 (Setup #03)				
	Sample: c01	Sample #03	AE _AE01	USB Cradle
			AE AE94	Keyboard
			AE AE92	AC Adapter laptop
			AE AE91	Laptop
			AE AE90	TFT Display
			AE AE93	Mouse

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.
Note:	The environmental conditions are recorded and available in the InterLab system for each performed test.

3.2 List of the Applicable Body

(Body for Scope: FCC_v2)

Designation	*Description*
FCC47CFRChIPART15bRADIO FREQUENCY DEVICES	Part 15, Subpart B - Unintentional Radiators

3.3 List of Test Specification

Test Specification:	**FCC part 2 and 15**
Version	10-1-13 Edition
Title:	PART 2 - GENERAL RULES AND REGULATIONS PART 15 - RADIO FREQUENCY DEVICES

3.4 Summary

Test Case Identifier / Name *Test (condition)*	*Cat*	*Result*	*Date of Test*	*Lab Ref.*	*Setup*
15b.1 Conducted Emissions (AC Power Line) §15.107					
15b.1; Mode = generating a high power consumption	-	Passed	2014/08/23	Lab 1	C01
15b.2 Spurious Radiated Emissions §15.109					
15b.2; Mode = generating a high power consumption	-	Passed	2014/07/22	Lab 2	C01

3.5 Detailed Results

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

Test: 15b.1; Mode = generating a high power consumption

Result:	Passed
Setup No.:	C01
Date of Test:	2014/08/23 23:22
Body:	NO BODY
Test Specification:	FCC part 2 and 15

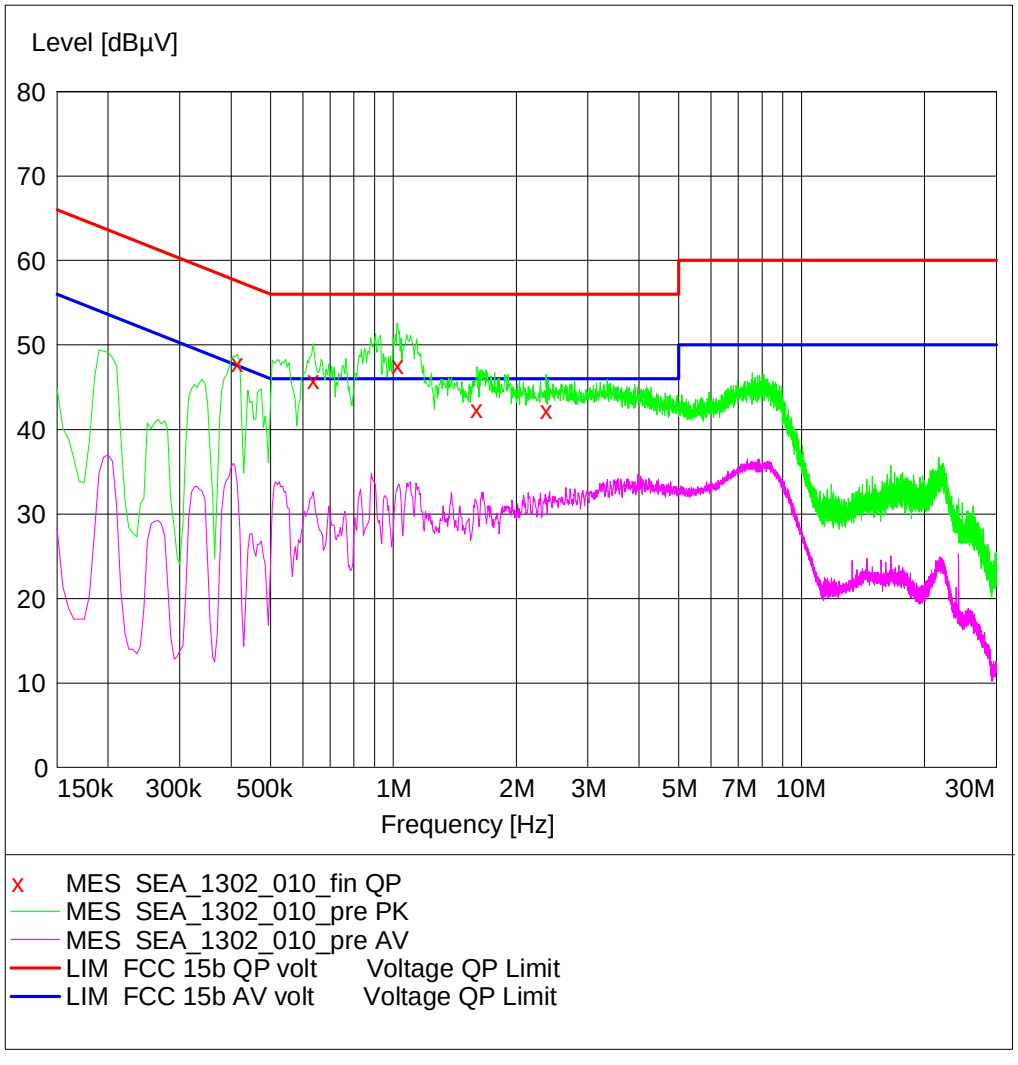
Detailed Results:

AC MAINS CONDUCTED

```
EUT:                  (VQ000c02)
Manufacturer:         SEAL
Operating Condition:  BT low energy TX on 2440 MHz, data transfer via USB
Test Site:            7 layers Ratingen
Operator:             URO
Test Specification:   ANSI C63.4; FCC 15.107 / 15.207 Class B
Comment:              computer peripheral setup; 120V/60Hz
Start of Test:        23.08.2014 / 23:40:16
```

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: "SEA_1302_010_fin QP"

23.08.2014 23:45

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.415000	47.80	10.1	58	9.8	L1	FLO
0.635000	45.90	10.1	56	10.1	L1	FLO
1.025000	47.70	10.1	56	8.3	L1	GND
1.600000	42.40	10.1	56	13.6	N	GND
2.365000	42.30	10.2	56	13.7	L1	GND

3.5.2 15b.2 Spurious Radiated Emissions §15.109

Test: 15b.2; Mode = generating a high power consumption

Result:	Passed
Setup No.:	C01
Date of Test:	2014/07/22 19:59
Body:	FCC47CFRChIPART15bRADIO FREQUENCY DEVICES
Test Specification:	FCC part 2 and 15

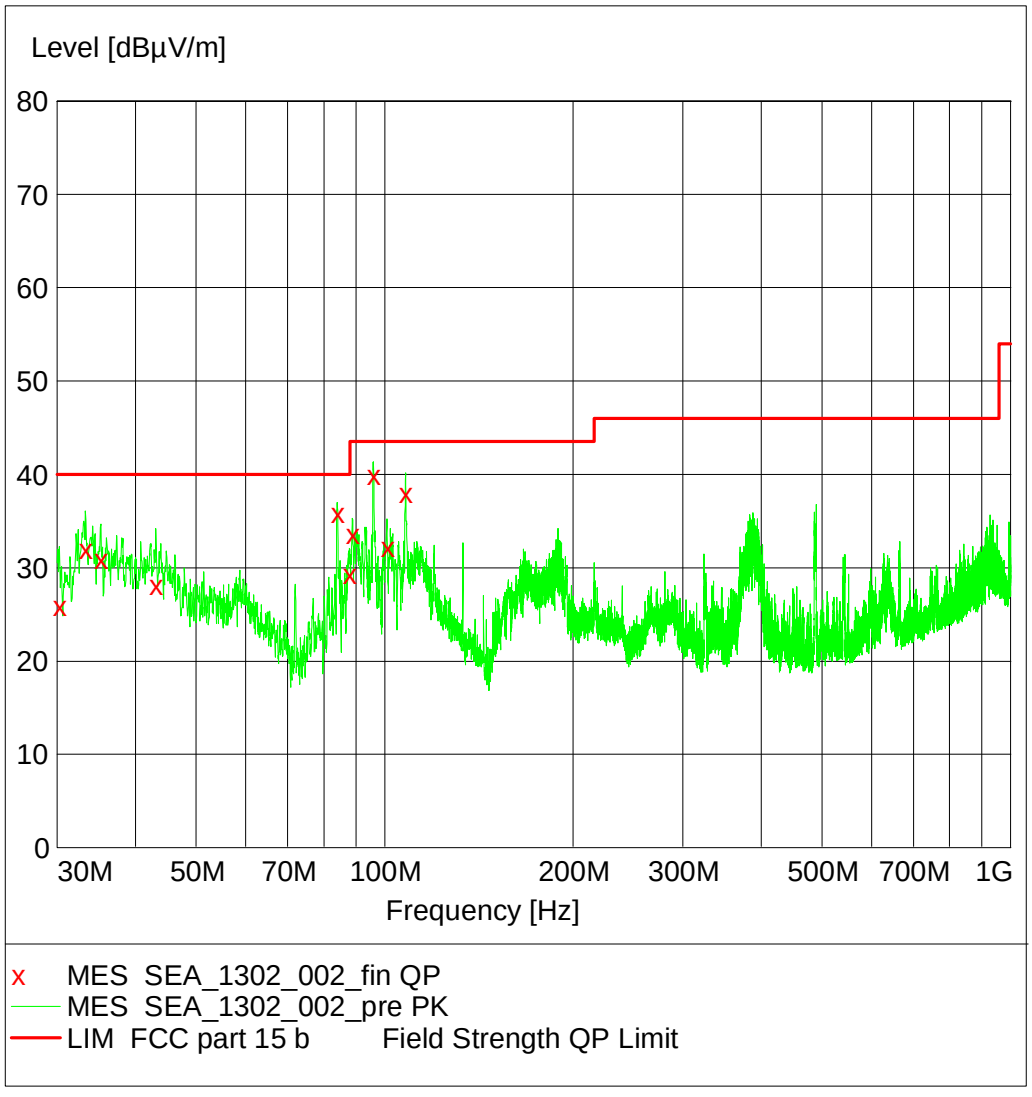
Detailed Results:

EMI RADIATED TEST

```
EUT:                 (VQ000c02)
Manufacturer:        SEAL
Operating Condition: BT low energy TX mode, data transfer via USB to laptop 120V / 60Hz
Test Site:           7 layers, Ratingen
Operator:            URO
Test Specification:  FCC part 15 b
Comment:             Horizontal EUT position / Computer Peripheral Setup
Start of Test:       22.07.2014 / 19:59:18
```

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: "SEA_1302_002_fin QP"

22.07.2014 20:57

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
30.240000	25.90	21.0	40.0	14.1	121.0	157.00	VERTICAL
33.300000	32.00	19.3	40.0	8.0	100.0	112.00	VERTICAL
35.220000	30.90	18.4	40.0	9.1	100.0	67.00	VERTICAL
43.080000	28.10	14.1	40.0	11.9	100.0	157.00	VERTICAL
84.000000	35.90	10.7	40.0	4.1	224.0	352.00	HORIZONTAL
87.900000	29.30	11.0	40.0	10.7	244.0	5.00	HORIZONTAL
88.920000	33.60	11.0	43.5	9.9	275.0	0.00	HORIZONTAL
96.060000	39.90	11.2	43.5	3.6	298.0	359.00	HORIZONTAL
100.920000	32.20	11.4	43.5	11.3	275.0	0.00	HORIZONTAL
108.000000	38.10	11.7	43.5	5.4	291.0	0.00	HORIZONTAL

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

Lab ID:	**Lab 2**		
Manufacturer:	Frankonia		
Description:	Anechoic Chamber for radiated testing		
Type:	10.58x6.38x6.00 m³		
	Calibration Details	*Last Execution*	*Next Exec.*
	NSA (FCC)	2014/01/09	2017/01/09

Single Devices for Anechoic Chamber

Single Device Name	*Type*	*Serial Number*	*Manufacturer*	
Air compressor	none	-	Atlas Copco	
Anechoic Chamber	10.58 x 6.38 x 6.00 m³	none	Frankonia	
	Calibration Details		*Last Execution*	*Next Exec.*
	FCC listing 96716 3m Part15/18		2014/01/09	2017/01/08
Controller Maturo	MCU	961208	Maturo 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

Lab ID:	**Lab 1**
Manufacturer:	Rohde & Schwarz GmbH & Co.KG
Description:	EMI Conducted Auxiliary Equipment

Single Devices for Auxiliary Equipment for Conducted emissions

Single Device Name	*Type*	*Serial Number*	*Manufacturer*	
Cable "LISN to ESI"	RG214	W18.03+W48.03	Huber&Suhner	
Impedance Stabilization Network	ISN T800	36159	Teseq GmbH	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard Calibration		2014/02/06	2016/02/28
Impedance Stabilization Network, Coupling Decoupling Network	ISN/CDN ENY41	100002	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard calibration		2013/03/01	2015/03/31
Impedance Stabilization Network, Coupling Decoupling Network	ISN/CDN ST08	36292	Teseq GmbH	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard calibration		2014/01/10	2016/01/31
Impedance Stabilization Network, Coupling Decoupling Network	ISN/CDN T8-Cat6	32187	Teseq GmbH	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard Calibration		2014/01/08	2016/01/31
One-Line V-Network	ESH 3-Z6	100489	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Exec.*
	standard calibration		2014/06/18	2017/11/30
One-Line V-Network	ESH 3-Z6	100570	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard Calibration		2013/11/25	2016/11/24
Two-Line V-Network	ESH 3-Z5	828304/029	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standart Calibration		2013/03/01	2015/02/28
Two-Line V-Network	ESH 3-Z5	829996/002	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard Calibration		2013/03/01	2015/02/28

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	AM 4.0	AM4.0/180/11920513	Maturo GmbH
Biconical Broadband Antenna	SBA 9119	9119-005	Schwarzbeck
Biconical dipole	VUBA 9117	9117-108	Schwarzbeck
	Calibration Details		*Last Execution* *Next Exec.*
	Standard Calibration		2012/01/18 2015/01/17
Broadband Amplifier 18MHz-26GHz	JS4-18002600-32-5P	849785	Miteq
Broadband Amplifier 1GHz-4GHz	AFS4-01000400-1Q-10P-4	-	Miteq
Broadband Amplifier 30MHz-18GHz	JS4-00101800-35-5P	896037	Miteq
Cable "ESI to EMI Antenna"	EcoFlex10	W18.01-2+W38.01-2	Kabel Kusch
Cable "ESI to Horn Antenna"	UFB311A+UFB293C	W18.02-2+W38.02-2	Rosenberger Micro-Coax
Double-ridged horn	HF 906	357357/001	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard Calibration		2012/05/18 2015/05/17
Double-ridged horn	HF 906	357357/002	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard Calibration		2012/06/26 2015/06/25
High Pass Filter	4HC1600/12750-1.5-KK	9942011	Trilithic
High Pass Filter	5HC2700/12750-1.5-KK	9942012	Trilithic
High Pass Filter	5HC3500/12750-1.2-KK	200035008	Trilithic
High Pass Filter	WHKX 7.0/18G-8SS	09	Wainwright
Horn Antenna Schwarzbeck 15-26 GHz BBHA 9170	BBHA 9170		
Log.-per. Antenna	HL 562 Ultralog	100609	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard Calibration		2012/12/18 2015/12/17
Log.-per. Antenna	HL 562 Ultralog	830547/003	Rohde & Schwarz GmbH & Co. KG
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard calibration		2011/10/27 2014/10/26
Pyramidal Horn Antenna 26,5 GHz	3160-09	00083069	EMCO Elektronik GmbH

Single Devices for Auxiliary Equipment for Radiated emissions (continued)

Single Device Name	*Type*	*Serial Number*	*Manufacturer*
Pyramidal Horn Antenna 40 GHz	3160-10	00086675	EMCO Elektronik GmbH
Tilt device Maturo (Rohacell)	Antrieb TD1.5-10kg	TD1.5-10kg/024/3790709	Maturo GmbH

Test Equipment Auxiliary Test Equipment

Lab ID:	**Lab 2**
Manufacturer:	see single devices
Description:	Single Devices for various Test Equipment
Type:	various
Serial Number:	none

Single Devices for Auxiliary Test Equipment

Single Device Name	*Type*	*Serial Number*	*Manufacturer*
Broadband Power Divider N (Aux)	1506A / 93459	LM390	Weinschel Associates
Broadband Power Divider SMA	WA1515	A855	Weinschel Associates
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383	Fluke Europe B.V.
	Calibration Details		*Last Execution* *Next Exec.*
	Customized calibration		2013/12/04 2015/12/03
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
Signal Analyzer	FSV30	103005	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard		2014/02/10 2016/02/09
Spectrum Analyser	FSP3	836722/011	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard		2012/06/13 2015/06/12
Spectrum Analyser	FSU26	200418	Rohde & Schwarz GmbH & Co.KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard calibration		2013/07/29 2014/07/28
	Standard calibration		2014/07/29 2015/07/28
Vector Signal Generator	SMIQ 03B	832492/061	Rohde & Schwarz GmbH & Co.KG

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
	Calibration Details		*Last Execution* *Next Exec.*
	Standard calibration		2011/11/24 2014/11/23
CMW500	CMW500	107500	Rohde & Schwarz GmbH & Co.KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard calibration		2014/01/27 2016/01/26
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard calibration		2011/11/28 2014/11/27
Universal Radio Communication Tester	CMU 200	102366	Rohde & Schwarz GmbH & Co. KG
	HW/SW Status		*Date of Start* *Date of End*
	Hardware: B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B56V14, B68 3v04, PCMCIA, U65V04 Software: 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 ---		2007/07/16
Universal Radio Communication Tester	CMU 200	837983/052	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard calibration		2011/12/07 2014/12/06
	HW/SW Status		*Date of Start* *Date of End*
	HW options: 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 ---		2007/01/02
	SW: K62, K69		2008/11/03
Vector Signal Generator	SMU200A	100912	Rohde & Schwarz GmbH & Co. KG

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

Single Device Name	*Type*	*Serial Number*	*Manufacturer*
Personal Computer	Dell	30304832059	Dell
Power Meter	NRVD	828110/016	Rohde & Schwarz GmbH & Co.KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard calibration		2014/05/13 2015/05/12
Sensor Head A	NRV-Z1	827753/005	Rohde & Schwarz GmbH & Co.KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard calibration		2014/05/13 2015/05/12
Signal Generator	SMR 20	846834/008	Rohde & Schwarz GmbH & Co. KG
Spectrum Analyzer	ESIB 26	830482/004	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard Calibration		2014/01/07 2016/01/31
	HW/SW Status		*Date of Start* *Date of End*
	Firmware-Update 4.34.4 from 3.45 during calibration		2009/12/03

Test Equipment Shielded Room 02

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

Test Equipment T/A Logger 13

Lab ID:	**Lab 1, Lab 2**
Description:	Lufft Opus10 TPR
Type:	Opus10 TPR
Serial Number:	13936

Single Devices for T/A Logger 13

Single Device Name	*Type*	*Serial Number*	*Manufacturer*
ThermoAirpressure Datalogger 13 (Environ)	Opus10 TPR (8253.00)	13936	Lufft Mess- und Regeltechnik GmbH
	Calibration Details		*Last Execution* *Next Exec.*
	Customized calibration		2013/02/07 2015/02/06

Test Equipment T/H Logger 02

Lab ID:	**Lab 1**
Description:	Lufft Opus10
Serial Number:	7489

Single Devices for T/H Logger 02

Single Device Name	*Type*	*Serial Number*	*Manufacturer*
ThermoHygro Datalogger 02 (Environ)	Opus10 THI (8152.00)	7489	Lufft Mess- und Regeltechnik GmbH

Calibration Details	*Last Execution*	*Next Exec.*
Customized calibration	2013/02/07	2015/02/06

Test Equipment T/H Logger 12

Lab ID:	**Lab 2**
Description:	Lufft Opus10
Serial Number:	12482

Single Devices for T/H Logger 12

Single Device Name	*Type*	*Serial Number*	*Manufacturer*
ThermoHygro Datalogger 12 (Environ)	Opus10 THI (8152.00)	12482	Lufft Mess- und Regeltechnik GmbH

Calibration Details	*Last Execution*	*Next Exec.*
Customized calibration	2013/01/07	2015/01/06

5 Annex

5.1 Additional Information for Report

Test Description

Conducted emissions (AC power line)

Standard FCC Part 15 Subpart B

The test was performed according to: ANSI C 63.4, 2009

Test Description
The test set-up was made in accordance to the general provisions of ANSI C 63.4-2009.
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 50µH || 50 Ohm Line Impedance Stabilization Network (LISN) which meets the requirements of ANSI C63.4–2009, Annex B, in the frequency range of the measurements. 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 (dBµV)	AV Limit (dBµV)
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).

NOTES:
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.
The chosen operating mode is selected as representative mode to generate "worst-case" conditions, i.e. high power consumption.

Spurious radiated emissions

Standard FCC Part 15, Subpart B

The test was performed according to: ANSI C 63.4, 2009

Test Description

Measurement below 1 GHz:
The test set-up was made in accordance to the general provisions of ANSI C 63.4-2009.
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 influence of the EUT support table that is used between 30–1000 MHz was evaluated.
The test was performed at the distance of 3 m between the EUT and the receiving antenna. The measurement procedure is implemented into the EMI test software ES-K1 from R&S. The radiated emissions measurements were made in a typical installation configuration. Exploratory tests are performed at 3 orthogonal axes to determine the worst-case orientation of a body-worn or handheld EUT. The final test on all kind of EUTs is performed at 2 axes. A pre-check is also performed while the EUT is powered from both AC and DC (battery) power in order to find the worst-case operating condition.

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 +/- 22.5° 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 +/- 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° to +22.5° around the determined value
- Height variation range: -0.25 m 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 (dBµV/m)

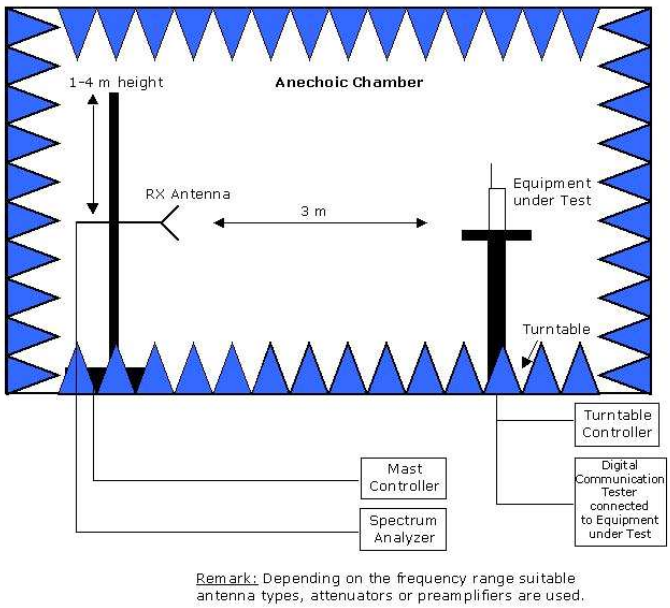
Frequency Range (MHz)	Class B Limit (dBµV/m)
30 – 88	40.0
88 – 216	43.5
216 – 960	46.0
above 960	54.0

Frequency Range (MHz)	Class A Limit (dBµV/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 (dBµV/m) = 20 log (Limit (µV/m)/1µV/m)

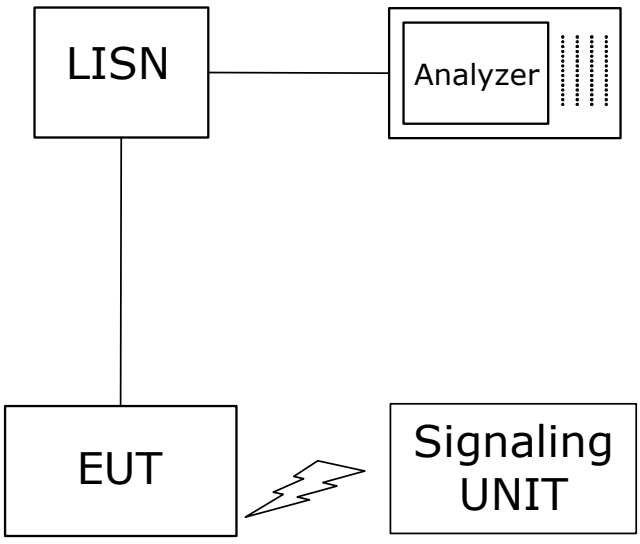
NOTE: A missing result table in the corresponding test report section means, that no final measurement was performed because no relevant frequencies (peaks) were found in the preliminary scan.

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

Correlation of measurement requirements from FCC and IC

Measurement	FCC reference	IC reference
Conducted Emissions (AC Power Line)	§15.107	ICES-003 Issue 5
Radiated Spurious Emissions	§15.109	ICES-003 Issue 5

Remarks:

1. FCC Part 15 subpart B, ICES 003 and CISPR 22 contain different definitions of Class A and Class B limits, i.e. which class is applicable to which kind of EUT.
   ICES 003 and CISPR 22 distinguish between the location where the EUT is intended to operate whilst FCC refers to the method of commercial distribution (distributive trades).
2. The correct assignment of the appropriate class to the concrete EUT is not scope of this test report!
3. A radio apparatus that is specifically subject to an Industry Canada Radio Standard Specification (RSS) and which contains an ITE is not subject to ICES-003 provided the ITE is used only to enable operation of the radio apparatus and the ITE does not control additional functions or capabilities.
4. ISM (Industrial, Scientific or Medical) radio frequency generators, though they may contain ITE, are excluded from the definition of ITE and are not subject to ICES-003. They are instead subject to the Interference-Causing Equipment Standard ICES-001, which specifically addresses ISM radio frequency generators.
5. The kind of EUT (ITE, ISM, Radio) determines which IC Standard is applicable.

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