

InterLab®

Final Report on

Remote Control for USLT-USB and SpotChecker RC 24 Receiver

FCC ID W9I-GEIT-RC24R

Report Reference: MDE_GE_1501_FCCa_rev002
acc. Title 47 CFR chapter I part 15 subpart B, Class B

Date: November 23, 2015

Test Laboratory:

7layers GmbH
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40880 Ratingen
Germany



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: Lars Liggesmeier
Date Of Test Report: 2015/11/23
Date of first test: 2015/10/22
Date of last test: 2015/11/04

1.2 Applicant Data

Company Name: GE Sensing & Inspection Technologies GmbH
Street: Robert-Bosch-Str. 3
City: 50354 Huerth
Country: Germany
Contact Person: Jürgen Schmitt
Phone: +49 (2233) 601 385
E-Mail: juergen.schmitt@ge.com

1.3 Test Laboratory Data

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

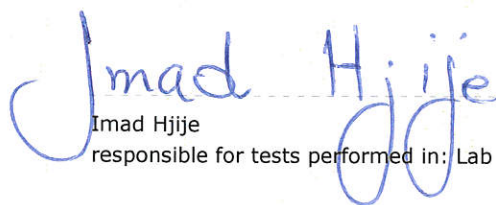
7 layers DE

Company Name : 7layers GmbH
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	Accreditation Info
Lab 1	Conducted Emissions	DAkkS-Registration no. D-PL-12140-01-01
Lab 2	Radiated Emissions	DAkkS-Registration no. D-PL-12140-01-01

1.4 Signature of the Testing Responsible



Imad Hjije
responsible for tests performed in: Lab 1, Lab 2

1.5 Signature of the Accreditation Responsible

 [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: RC 24 Receiver

Type / Model / Family:

Remote Control for USLT-USB and SpotChecker
RC 24 Receiver

FCC ID W9I-GEIT-RC24R

Product Category:

Computer Accessory

Manufacturer:

Company Name:

See applicant data:

Contact Person:

-

Parameter List:

Parameter name	Value
highest internal frequency of host equipment	< 190 (MHz)
Operating Frequency	2.4330 (GHz)

2.2 Detailed Description of OUT Samples

Sample : AE01

OUT Identifier

RC 24 Receiver

Sample Description

Remote Control for USLT-USB

Serial No.

36830-01-1107

HW Status

005WWCA0304

2.3 OUT Features

Supported Features for OUT: RC 24 Receiver

<i>Designation</i>	<i>Description</i>	<i>Supported Value(s)</i>
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	
Iant	Integral Antenna: permanent fixed antenna, which may be built-in, designed as an indispensable part of the equipment	
SRD	EUT is a short range device	

2.4 Auxiliary Equipment

<i>AE No.</i>	<i>Type Designation</i>	<i>Serial No.</i>	<i>HW Status</i>	<i>SW Status</i>	<i>Description</i>
AE AUX06		36818-01-1374	005WWCA0298		RC 24 Transmitter
AE AUX01	Fujitsu Lifebook Eseries E781	DSCK013817	2012-03		Laptop
AE AUX05	Fujitsu Ltd. PJW1942NA	13300281B			AC Adapter
AE AUX04	LG Flatron L1740BQ	509WANF1W607			TFT Display
AE AUX02	Logitech M-BT58	HC60915A2XC			Mouse
AE AUX03	Logitech RS 6000 USB ON	G 0000273 2P28			Keyboard

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.

<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.</i>	<i>AE Description</i>
S01_ab01				
	Sample: AE01	Remote Control for USLT-USB	AE AUX06	RC 24 Transmitter
			AE AUX01	Laptop
			AE AUX05	AC Adapter
			AE AUX04	TFT Display
			AE AUX02	Mouse
			AE AUX03	Keyboard

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:

1. All tests are performed under environmental conditions within the requirements of the specifications. Environmental conditions are available at the laboratory.

2. This report is a revision of MDE_GE_1501_FCCa.
Corresponding revision table can be found in the Annex.

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>	FCC part 2 and 15
<i>Version</i>	10-1-13 Edition
<i>Title:</i>	PART 2 - GENERAL RULES AND REGULATIONS PART 15 - RADIO FREQUENCY DEVICES

3.4 Summary

<i>Test Case Identifier / Name</i> <i>Test (condition)</i>	<i>Verdict</i>	<i>Date of Test</i>	<i>Lab</i> <i>Ref.</i>	<i>Setup</i>
15b.1 Conducted Emissions (AC Power Line) §15.107				
15b.1; Mode = generating a high power consumption	Passed	2015/11/04	Lab 1	S01_ab01
15b.2 Spurious Radiated Emissions §15.109				
15b.2; Mode = generating a high power consumption	Passed	2015/10/22	Lab 2	S01_ab01

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

<i>Result:</i>	Passed
<i>Setup No.:</i>	S01_ab01
<i>Date of Test:</i>	2015/11/04 14:21
<i>Body:</i>	FCC47CFRChIPART15bRADIO FREQUENCY DEVICES
<i>Test Specification:</i>	FCC part 2 and 15

Detailed Results:

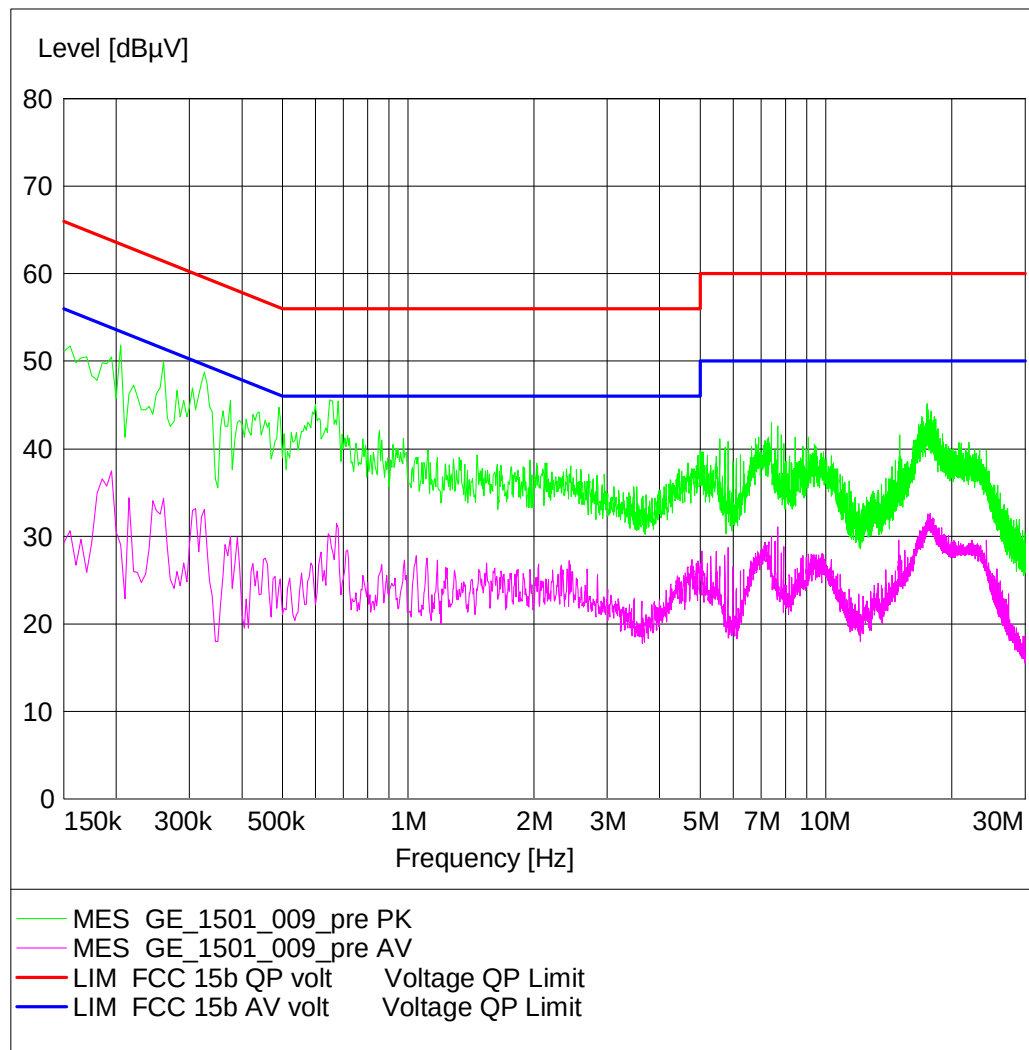
AC MAINS CONDUCTED

Diagram 1.01

EUT: (DE1061001aa01+DE1061001ae01)
 Manufacturer: GE Sensing & Inspection Technologies
 Operating Condition: TX on 2,4 GHz; connection Transmitter to Receiver
 Test Site: 7 layers Ratingen
 Operator: Mit
 Test Specification: ANSI C63.4/10; FCC 15.107 / 15.207
 Comment: 120 V / 60 Hz; computer peripheral setup; USB traffic
 Start of Test: 04.11.2015 / 14:21:07

SCAN TABLE: "FCC Voltage"

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



3.5.2 15b.2 Spurious Radiated Emissions §15.109

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

<i>Result:</i>	Passed
<i>Setup No.:</i>	S01_ab01
<i>Date of Test:</i>	2015/10/22 13:17
<i>Body:</i>	FCC47CFRChIPART15bRADIO FREQUENCY DEVICES
<i>Test Specification:</i>	FCC part 2 and 15

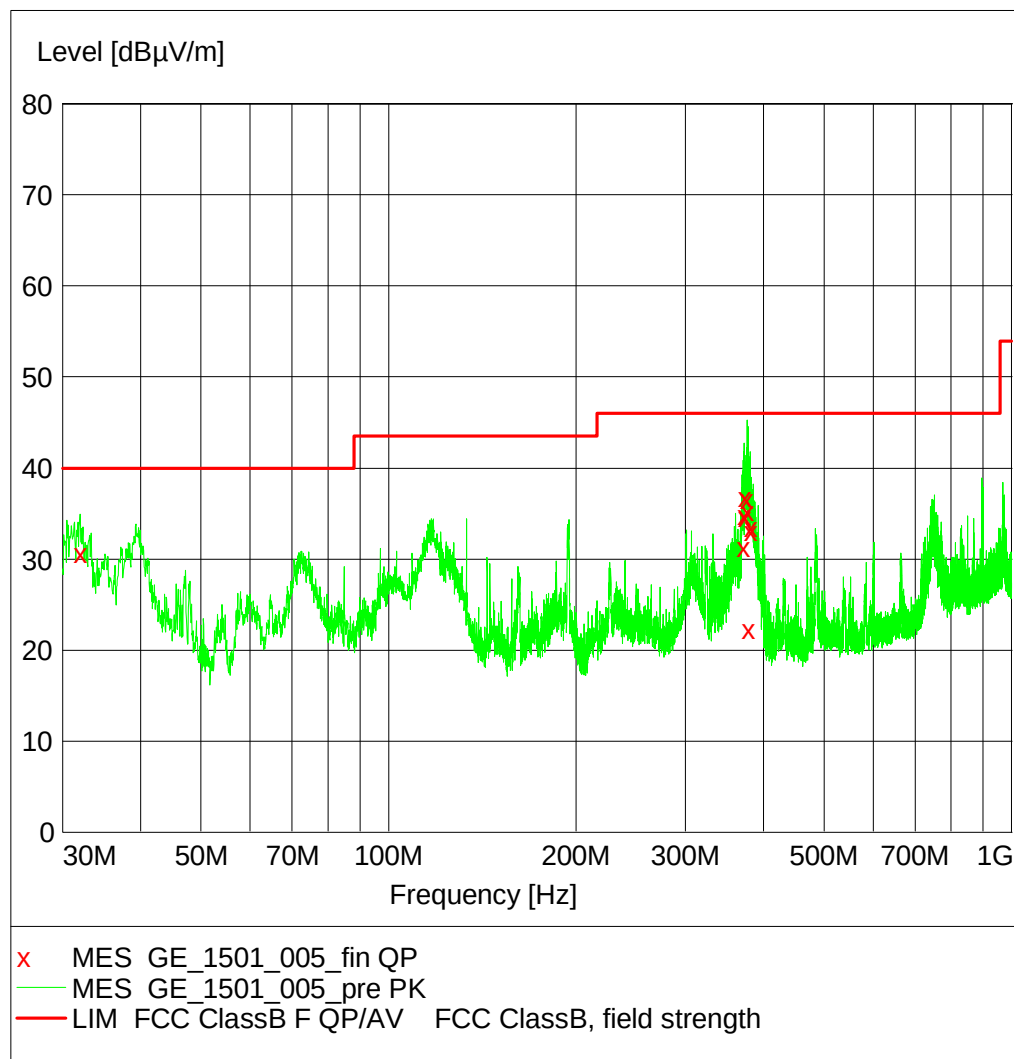
Detailed Results:

EMI RADIATED TEST

EUT: (DE1061001aa01+DE1061001ae01)
 Manufacturer: GE Sensing & Inspection Technologies
 Operating Condition: TX on 2,4 GHz; connection Trasmitter to Receiver; computer peripheral; USB traffic; 120V/60Hz
 Test Site: 7 layers, Ratingen
 Operator: Mit
 Test Specification: FCC Part 15 B Class B
 Comment: Horizontal EUT position, Horizontal+Vertical antenna polaris
 Start of Test: 22.10.2015 / 12:05:38

SCAN TABLE: "FCC part 15 b"

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



MEASUREMENT RESULT: "GE_1501_005_fin QP"

22.10.2015 13:03

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Height cm	Azimuth deg	Polarisation
31.980000	30.70	19.3	40.0	9.3	105.0	292.00	VERTICAL
370.740000	31.40	14.2	46.0	14.6	110.0	348.00	HORIZONTAL
371.460000	34.90	14.3	46.0	11.1	108.0	17.00	HORIZONTAL
372.180000	34.70	14.3	46.0	11.3	126.0	338.00	HORIZONTAL
372.540000	36.80	14.3	46.0	9.2	100.0	338.00	HORIZONTAL
376.020000	36.60	14.4	46.0	9.4	100.0	0.00	HORIZONTAL
376.200000	35.30	14.4	46.0	10.7	125.0	292.00	HORIZONTAL
378.060000	22.30	14.4	46.0	23.7	112.0	202.00	HORIZONTAL
380.700000	33.10	14.4	46.0	12.9	125.0	338.00	HORIZONTAL
381.000000	33.50	14.4	46.0	12.5	117.0	338.00	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
Description:	Anechoic Chamber for radiated testing
Type:	10.58x6.38x6.00 m ³
Calibration Details	
NSA (FCC)	Last Execution 2014/01/09 Next Exec. 2017/01/09

Single Devices for Anechoic Chamber

Single Device Name	Type	Serial Number	Manufacturer
Air compressor	none	-	
Anechoic Chamber	10.58 x 6.38 x 6.00 m ³	none	
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	-	
EMC camera Nr.2	CCD-400E	0005033	
Filter ISDN	B84312-C110-E1		
Filter Universal 1A	BB4312-C30-H3	-	

Test Equipment Auxiliary Equipment for Conducted emissions

Lab ID:	Lab 1
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
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

Single Devices for Auxiliary Equipment for Conducted emissions (continued)

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>	
One-Line V-Network	ESH 3-Z6	100489	Rohde & Schwarz GmbH & Co. KG	
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>	
	standard calibration		2014/06/18	2017/11/30
One-Line V-Network	ESH 3-Z6	100570	Rohde & Schwarz GmbH & Co. KG	
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>	
	Standard Calibration		2013/11/25	2016/11/24
Two-Line V-Network	ESH 3-Z5	828304/029	Rohde & Schwarz GmbH & Co. KG	
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>	
	DAkKS Calibration		2015/03/30	2017/03/31
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>	
	DAkKS Calibration		2015/03/30	2017/03/31

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	AM4.0/180/11920 513	Maturo GmbH
Biconical Broadband Antenna	SBA 9119	9119-005	
Biconical dipole	VUBA 9117	9117-108	
Broadband Amplifier 1 GHz - 4 GHz	AFS4-01000400-1Q-10P-4	-	
Broadband Amplifier 18 GHz - 26 GHz	JS4-18002600-32-5P	849785	
Broadband Amplifier 30 MHz - 18 GHz	JS4-00101800-35-5P	896037	
Cable "ESI to EMI Antenna"	EcoFlex10	W18.01-2+W38.01-2	
Cable "ESI to Horn Antenna"	SucoFlex	W18.02-2+W38.02-2	
Double-ridged horn	HF 906	357357/002	Rohde & Schwarz GmbH & Co. KG
<i>Calibration Details</i>			<i>Last Execution Next Exec.</i>
Standard Calibration			2015/06/23 2018/06/22
Double-ridged horn	HF 907	102444	Rohde & Schwarz GmbH & Co. KG
<i>Calibration Details</i>			<i>Last Execution Next Exec.</i>
Standard Calibration			2015/05/11 2018/05/10
Double-ridged horn-duplicated 2015-07-15 10:47:55	HF 906	357357/001	Rohde & Schwarz GmbH & Co. KG
High Pass Filter	4HC1600/12750-1.5-KK	9942011	
High Pass Filter	5HC2700/12750-1.5-KK	9942012	
High Pass Filter	5HC3500/18000-1.2-KK	200035008	
High Pass Filter	WHKX 7.0/18G-8SS	09	
Horn Antenna Schwarzbeck 15-26.5 GHz BBHA 9170	BBHA 9170	BBHA9170262	
Log.-per. Antenna	HL 562 Ultralog	100609	Rohde & Schwarz GmbH & Co. KG
<i>Calibration Details</i>			<i>Last Execution Next Exec.</i>
Standard Calibration			2012/12/18 2015/12/17
Log.-per. Antenna (upgraded)	HL 562 Ultralog new biconicals	830547/003	Rohde & Schwarz GmbH & Co. KG
<i>Calibration Details</i>			<i>Last Execution Next Exec.</i>
Standard Calibration			2015/06/30 2018/06/29
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz GmbH & Co. KG
<i>Calibration Details</i>			<i>Last Execution Next Exec.</i>
DKD Calibration			2014/11/27 2017/11/27

Single Devices for Auxiliary Equipment for Radiated emissions (continued)

Single Device Name	Type	Serial Number	Manufacturer
Standard Gain / Pyramidal Horn Antenna 40 GHz	3160-10	00086675	
Tilt device Maturo (Rohacell)	Antrieb TD1.5-10kg	TD1.5- 10kg/024/379070 9	Maturo GmbH

Test Equipment Auxiliary Test Equipment

Lab ID:	Lab 2
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	
Broadband Power Divider SMA	WA1515	A855	
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383	
		<i>Calibration Details</i>	<i>Last Execution Next Exec.</i>
		Customized calibration	2013/12/04 2015/12/03
Digital Multimeter 13 (Clamp Meter)	Fluke 325	31270091WS	FLUKE
Fibre optic link Satellite (Aux)	FO RS232 Link	181-018	
Fibre optic link Transceiver (Aux)	FO RS232 Link	182-018	
Isolating Transformer	LTS 604	1888	
Notch Filter Ultra Stable (Aux)	WRCA800/960-6EEK	24	
Signal Analyzer	FSV30	103005	Rohde & Schwarz GmbH & Co. KG
		<i>Calibration Details</i>	<i>Last Execution Next Exec.</i>
		Standard	2014/02/10 2016/02/09
Spectrum Analyser	FSU26	200418	
		<i>Calibration Details</i>	<i>Last Execution Next Exec.</i>
		Standard calibration	2015/10/20 2016/10/19
Spectrum Analyzer	FSP3	836722/011	Rohde & Schwarz GmbH & Co. KG
		<i>Calibration Details</i>	<i>Last Execution Next Exec.</i>
		DKD calibration	2015/06/23 2018/06/22
Vector Signal Generator	SMIQ 03B	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
CMW500	CMW500	107500	Last Execution Next Exec.
	Calibration Details		
	Standard calibration		2014/01/27 2016/01/26
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		
	DKD calibration		2014/12/02 2017/12/01
Universal Radio Communication Tester	CMU 200	837983/052	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		
	DKD calibration		2014/12/03 2017/12/02
	HW/SW Status		Date of Start Date of End
	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		

	SW:		2008/11/03
	K62, K69		
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		
EMI Receiver / Spectrum Analyzer	ESR 7	101424			
	Calibration Details			Last Execution	Next Exec.
	Initial Factory Calibration			2014/11/13	2016/11/12
Personal Computer	Dell	30304832059			
Power Meter	NRVD	828110/016			
	Calibration Details			Last Execution	Next Exec.
	Standard calibration			2015/05/11	2016/05/10
Sensor Head A	NRV-Z1	827753/005			
	Calibration Details			Last Execution	Next Exec.
	Standard calibration			2015/05/11	2016/05/10
Signal Generator	SMR 20	846834/008	Rohde & Schwarz GmbH & Co. KG		
	Calibration Details			Last Execution	Next Exec.
	Standard Calibration			2014/06/24	2017/06/23
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	
Spectrum Analyzer	FSW 43	103779			
	Calibration Details			Last Execution	Next Exec.
	Initial Factory Calibration			2014/11/17	2016/11/16

Test Equipment Harmonic & Flicker measurement system and AC Source

Lab ID: Lab 1
Manufacturer: Spitzenberger & Spieß GmbH & Co. KG
Description: EN61000-3-2&3 test system, source for magnetic field EN61000-4-8
Type: PHE 1200/B Spitzenberger&Spies
Serial Number: B6280

Single Devices for Harmonic & Flicker measurement system and AC Source

Single Device Name	Type	Serial Number	Manufacturer
Amplifier with integrated variable Oscillator	EP 1200/B, NA/B1	B6278	Spitzenberger & Spieß GmbH & Co. KG
	Calibration Details		Last Execution Next Exec.
	Standard Calibration		2015/07/23 2018/07/30
Flickermeter / Harmonic Analyzer	B10	M70579	Spitzenberger & Spieß GmbH & Co. KG
	Calibration Details		Last Execution Next Exec.
	Standard Calibration		2015/07/23 2018/07/30
Line impedance simulation system	1-pase 16A	B6279	Spitzenberger & Spieß GmbH & Co. KG
	Calibration Details		Last Execution Next Exec.
	Standard Calibration		2015/07/22 2018/07/30

Test Equipment Multimeter 03

Lab ID: Lab 2
Description: Fluke 177
Serial Number: 86670383

Single Devices for Multimeter 03

Single Device Name	Type	Serial Number	Manufacturer
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383	
	Calibration Details		Last Execution Next Exec.
	Customized calibration		2013/12/04 2015/12/03

Test Equipment Shielded Room 02

Lab ID: Lab 1
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: Luft 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	
	Calibration Details		Last Execution Next Exec.
	Customized calibration		2015/02/27 2017/02/26

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	
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
Customized calibration			2015/02/27 2017/02/26

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	
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
Customized calibration			2015/03/10 2017/03/09

4.2 Laboratory Environmental Conditions

Laboratory	Date	Temperature	Humidity	Air Pressure
Lab 1	2015/11/04	23 °C	39 %	1017 hPa
Lab 2	2015/10/22	23 °C	42 %	1008 hPa

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, 2014

Test Description

The test set-up was made in accordance to the general provisions of ANSI C 63.4-2014.

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 connected to a 50 μ H || 50 Ohm Line Impedance Stabilization Network (LISN), which meets the requirements of ANSI C63.4-2014, Annex B, in the frequency range of the measurements. The LISN's unused connections were terminated with 50 Ohm loads. AC Power supply voltage for EUT: 120 V 60 Hz (if not stated within the measurement plot and/or test result).

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 μ V)	AV Limit (dB μ 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).

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, 2014

Test Description

Measurement below 1 GHz:

The test set-up was made in accordance to the general provisions of ANSI C 63.4-2014.

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. AC Power supply voltage for EUT: 120 V 60 Hz (if not stated within the measurement plot and/or test result).

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
- Polarization: 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
- Polarizations: 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)
30 – 88	40.0
88 – 216	43.5
216 – 960	46.0
above 960	54.0

Frequency Range (MHz)	Class A Limit (dBµV/m) / @ 3 m!
30 - 88	49.5
88 - 216	54.0
216 - 960	56.9
above 960	60.0

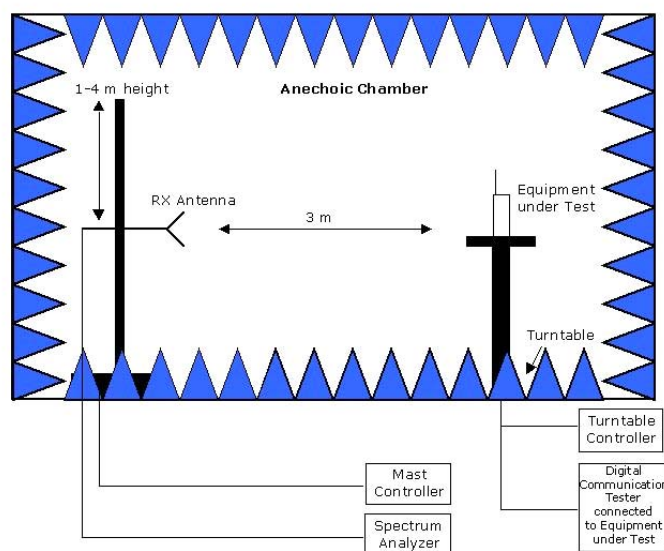
§15.35(b)

..., 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)

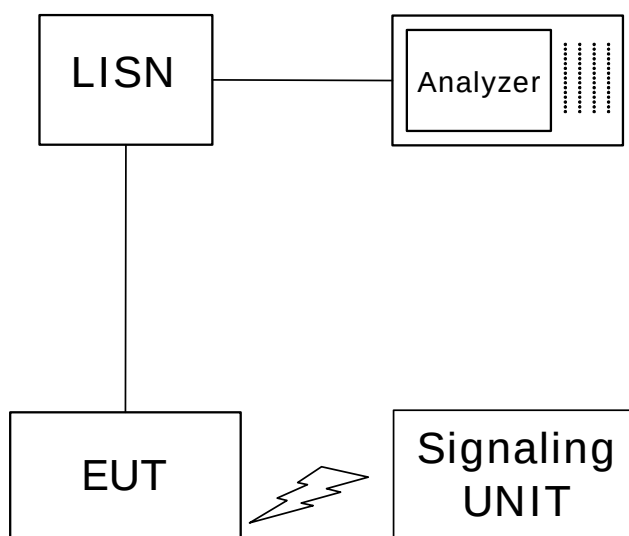
NOTE: A missing result table in the corresponding test report section means, that no final measurement was performed because no relevant frequencies (peaks) were found in the preliminary scan.

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

November, 2014

To Whom This May Concern

**Correlation of measurement requirements for
Information Technology Equipment (ITE) / Digital Circuits
from
FCC and IC**

Information Technology Equipment (ITE) / Radio Apparatus Containing Digital Circuits

Measurement	FCC reference	IC reference
Conducted emissions on AC Mains	§15.107	ICES-003 Issue 5: 6.1
Spurious Radiated Emissions	§15.109	ICES-003 Issue 5: 6.2

Measurement Uncertainties

FCC Part 22, 24, 27, 90
IC RSS-132, RSS-133, RSS-139

Test Case	Parameter	Uncertainty
RF Power Output	Power	± 2.2 dB
Frequency Stability	Frequency	± 25 Hz
Spurious Emissions at antenna terminal	Power	± 2.2 dB
Field strength of spurious radiation	Power	± 4.5 dB
Emission and Occupied Bandwidth	Power Frequency	± 2.9 dB GSM: ± 10.6 kHz UMTS, LTE: ± 120.0 kHz
Band Edge Compliance	Power Frequency	± 2.9 dB GSM: ± 14.6 kHz UMTS, LTE: ± 68.0 kHz

FCC Part 15b
IC ICES-003

Test Case	Parameter	Uncertainty
AC Power Line	Power	± 3.4 dB
Field Strength of spurious radiation	Power+	± 5.5 dB

FCC Part 15c, 15e
IC RSS-210, IC RSS-247

Test Case	Parameter	Uncertainty
AC Power Line	Power	± 3.4 dB
Field Strength of spurious radiation	Power	± 5.5 dB
6 dB / 26 dB / 99% Bandwidth	Power Frequency	± 2.9 dB ± 11.2 kHz
Conducted Output Power		± 2.2 dB
Spurious Emissions at antenna terminal	Power	± 2.2 dB
Band Edge Compliance	Power Frequency	± 2.2 dB ± 11.2 kHz
Frequency Stability	Frequency	± 25 Hz
Power Spectral Density	Power	± 2.2 dB

Revision History

Report version control			
Version	Release date	Change Description	Version validity
rev001	November 05, 2015	Initial version	invalid
rev002	November 23, 2015	Wrong FCC-ID corrected	valid

6 Index

1 Administrative Data	2
1.1 Project Data	2
1.2 Applicant Data	2
1.3 Test Laboratory Data	2
1.4 Signature of the Testing Responsible	2
1.5 Signature of the Accreditation Responsible	3
2 Test Object Data	3
2.1 General OUT Description	3
2.2 Detailed Description of OUT Samples	3
2.3 OUT Features	4
2.4 Auxiliary Equipment	4
2.5 Setups used for Testing	4
3 Results	5
3.1 General	5
3.2 List of the Applicable Body	5
3.3 List of Test Specification	5
3.4 Summary	6
3.5 Detailed Results	7
3.5.1 15b.1 Conducted Emissions (AC Power Line) §15.107	7
3.5.2 15b.2 Spurious Radiated Emissions §15.109	9
4 Test Equipment Details	12
4.1 List of Used Test Equipment	12
4.2 Laboratory Environmental Conditions	19
5 Annex	20
5.1 Additional Information for Report	20
6 Index	28