

InterLab[®]

Final Report on

TOBY-L201 Data Module

FCC ID XPYTOBYL201

IC: 8595A-TOBYL201

Report Reference: MDE_UBLOX_1502_FCCe
according to FCC Part 15, subpart B

Date: May 21, 2015

Test Laboratory:

7Layers AG
Borsigstr. 11
40880 Ratingen
Germany



Note:

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

7Layers AG
Borsigstrasse 11
40880 Ratingen, Germany
Phone: +49 (0) 2102 749 0
Fax: +49 (0) 2102 749 350
www.7Layers.com

Aufsichtsratsvorsitzender •
Chairman of the Supervisory Board:
Peter Mertel
Vorstand • Board:
Dr. H. Ansorge

Registergericht • registered in:
Düsseldorf, HRB 44096
USt-IdNr • VAT No.:
DE 203159652
TAX No. 147/5869/0385

1 Administrative Data

1.1 Project Data

Project Responsible: Andreas Tübel
Date Of Test Report: 2015/05/21
Date of first test: 2015/04/01
Date of last test: 2015/04/04

1.2 Applicant Data

Company Name: u-blox AG
Street: Zürcherstrasse 68,
CH-8800 Thalwil
Country: Switzerland
Contact Person: Giulio Comar
Function: Wireless Products Certification
Department: Wireless R&D center
Phone: +41 44 722 7462
Fax: +41 44 722 7447
E-Mail: giulio.comar@u-blox.com

1.3 Test Laboratory Data

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

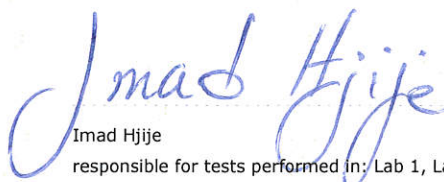
7 layers DE

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


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

1.5 Signature of the Accreditation Responsible


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: TOBY-L201 Data Module

Type / Model / Family:

TOBY-L201 Data Module
FCC ID XPYTOBYL201
IC: 8595A-TOBYL201

Product Category:

Module

Manufacturer:

Company Name:

Please see applicant data

Contact Person:

-

Parameter List:

Parameter name

Value

2.2 Detailed Description of OUT Samples

Sample : ae02

| | | | |
|---------------------------|--------------------------|---------------------|--------|
| <i>OUT Identifier</i> | TOBY-L201 | | |
| <i>Sample Description</i> | Standard for FCC and RSE | | |
| <i>Serial No.</i> | 358502060012930 | | |
| <i>HW Status</i> | 218A02 | | |
| <i>SW Status</i> | 09.82 | | |
| <i>Date of Receipt</i> | 2015/03/05 | | |
| <i>Low Voltage</i> | 3.3 V | <i>Low Temp.</i> | -20 °C |
| <i>High Voltage</i> | 4.4 V | <i>High Temp.</i> | 55 °C |
| <i>Nominal Voltage</i> | 3.8 V | <i>Normal Temp.</i> | 25 °C |

2.3 OUT Features

Features for OUT: TOBY-L201

| <i>Designation</i> | <i>Description</i> | <i>Allowed Values</i> | <i>Supported Value(s)</i> |
|-----------------------------------|---|-----------------------|---------------------------|
| Features for scope: FCC_v2 | | | |
| AC | The OUT is powered by or connected to AC Mains | | |
| Dant | removable antenna supplied and type tested with the radio equipment, designed as an example part of the equipment | | |
| FDD2 | EUT supports UMTS FDD2 in the band 1850 MHz - 1910 MHz | | |
| FDD5 | EUT supports UMTS FDD5 in the band 824 MHz - 849 MHz | | |
| HSDPA-FDD2 | EUT supports UMTS FDD2 HSDPA in the band 1850 MHz - 1910 MHz | | |
| HSDPA-FDD5 | EUT supports UMTS FDD5 HSDPA in the band 824 MHz - 849 MHz | | |
| HSUPA-FDD2 | EUT supports UMTS FDD2 HSUPA in the band 1850 MHz - 1910 MHz | | |
| HSUPA-FDD5 | EUT supports UMTS FDD5 HSUPA in the band 824 MHz - 849 MHz | | |
| PantC | permanent fixed antenna connector, which may be built-in, designed as an indispensable part of the equipment | | |

2.4 Auxiliary Equipment

| AE No. | Type Designation | Serial No. | HW Status | SW Status | Description |
|---------|--------------------------------|--------------|--------------|-----------|------------------------|
| AE AE01 | | | | | Adapter Board |
| AE AE02 | | | | | Interface Board |
| AE 02 | Fujitsu LIFEBOOK E Series E781 | DSCK013817 | | | Laptop RE |
| AE 01 | LG L17NB-3 | 504WAHS3J881 | | | EMC TFT 1 |
| AE 04 | Logitech M-BT58 | HC60915A2XC | | | Mouse 1 |
| AE 05 | Logitech Ultrax Media Keyboard | ST635J01624 | | | Keyboard |
| AE 03 | SED100P2-19.0 | 07Y17323A | | | AC Adapter 2 Laptop RE |
| AE AE04 | UTRA/E-UTRA | | | | External Antenna Aux |
| AE AE03 | UTRA/E-UTRA | | | | External Antenna Main |
| AE AE05 | UUX324-1215 | E01-0103700 | 120V/60HZ AC | | AC/DC Adapter |

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 |
| S01_AE02 | (FCC Sample) | | | |
| | Sample: ae02 | Standard for FCC and RSE | AE AE01 | Adapter Board |
| | | | AE AE02 | Interface Board |
| | | | AE 02 | Laptop RE |
| | | | AE 01 | EMC TFT 1 |
| | | | AE 04 | Mouse 1 |
| | | | AE 05 | Keyboard |
| | | | AE 03 | AC Adapter 2 Laptop RE |
| | | | AE AE04 | External Antenna Aux |
| | | | AE AE03 | External Antenna Main |
| | | | AE AE05 | AC/DC Adapter |

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. The current HW and SW versions of the module are: HW 218A03 SW 09.87. The tests were performed with an older SW and HW version, see DUT description. According to the information provided by the applicant, changes have only been made to Hard- and Software related to bands not covered by this report, so no additional testing was performed

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>Lab</i> | | |
|--|---------------|---------------------|-------------|--------------|
| <i>Test (condition)</i> | <i>Result</i> | <i>Date of Test</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 | 2015/04/04 | Lab 1 | S01_AE02 |
| 15b.2 Spurious Radiated Emissions §15.109 | | | | |
| 15b.2; Mode = Generating a high power consumption | Passed | 2015/04/01 | Lab 2 | S01_AE02 |

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_AE02 |
| <i>Date of Test:</i> | 2015/04/04 17:30 |
| <i>Body:</i> | FCC47CFRChIPART15bRADIO FREQUENCY DEVICES |
| <i>Test Specification:</i> | FCC part 2 and 15 |

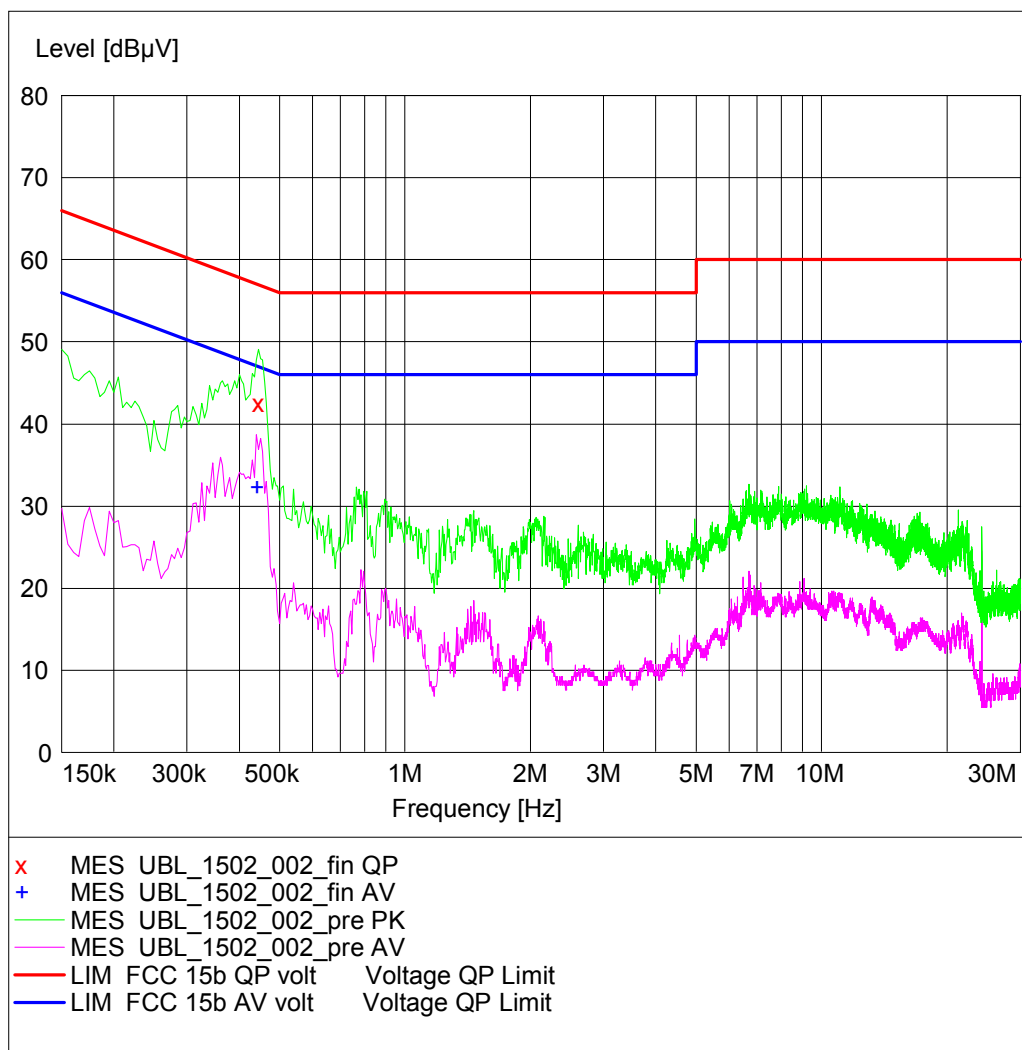
Detailed Results:

AC MAINS CONDUCTED

EUT: (DE1015014ae02)
 Manufacturer: UBLOX
 Operating Condition: GSM 850 TCH190, USB traffic, computer peripheral; 120V/60Hz
 Test Site: 7 layers Ratingen
 Operator: URO
 Test Specification: ANSI C63.4; FCC 15.107 / 15.207
 Comment: Class B
 Start of Test: 04.04.2015 / 17:42:26

SCAN TABLE: "FCC Voltage"

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



MEASUREMENT RESULT: "UBL_1502_002_fin QP"

04.04.2015 17:51

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Line | PE |
|------------------|---------------|--------------|---------------|--------------|------|-----|
| 0.445000 | 42.60 | 10.1 | 57 | 14.3 | N | GND |

MEASUREMENT RESULT: "UBL_1502_002_fin AV"

04.04.2015 17:51

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Line | PE |
|------------------|---------------|--------------|---------------|--------------|------|-----|
| 0.440000 | 32.30 | 10.1 | 47 | 14.8 | N | FLO |

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_AE02 |
| <i>Date of Test:</i> | 2015/04/01 16:00 |
| <i>Body:</i> | FCC47CFRChIPART15bRADIO FREQUENCY DEVICES |
| <i>Test Specification:</i> | FCC part 2 and 15 |

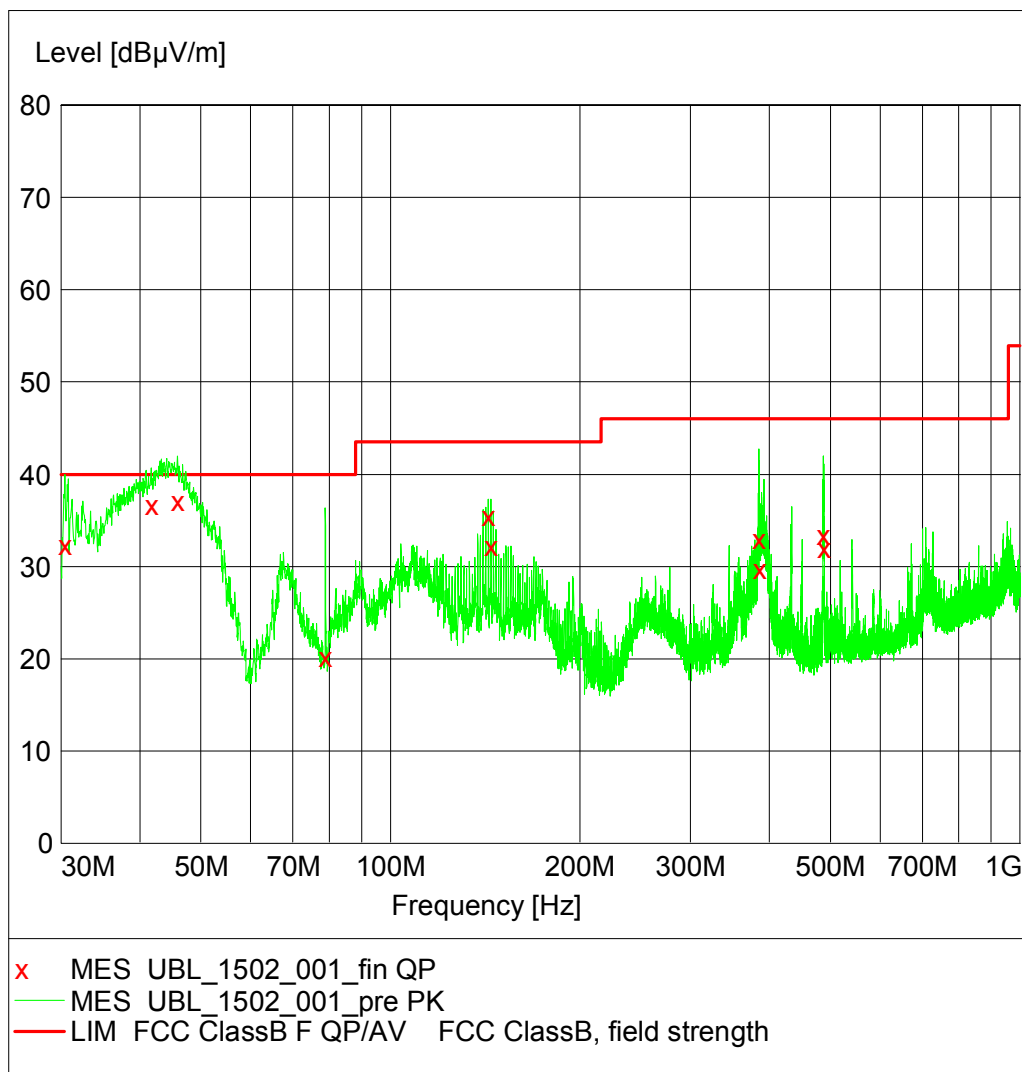
Detailed Results:

EMI RADIATED TEST

EUT: (DE1015014ae02)
 Manufacturer: UBLOX
 Operating Condition: FDD2 TCH 9400; USB traffic; computer peripheral; 120V/60Hz
 Test Site: 7 layers, Ratingen
 Operator: MIT/DOE
 Test Specification: FCC Part 15 B Class B
 Comment: Horizontal EUT position, Horizontal+Vertical antenna polaris
 Start of Test: 31.03.2015 / 16:34:30

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: "UBL_1502_001_fin QP"

31.03.2015 17:27

| Frequency MHz | Level dBµV/m | Transd dB | Limit dBµV/m | Margin dB | Height cm | Azimuth deg | Polarisation |
|------------------|-----------------|--------------|-----------------|--------------|--------------|----------------|--------------|
| 30.420000 | 32.40 | 20.9 | 40.0 | 7.6 | 118.0 | 157.00 | VERTICAL |
| 41.700000 | 36.70 | 14.9 | 40.0 | 3.3 | 100.0 | 157.00 | VERTICAL |
| 45.900000 | 37.10 | 12.4 | 40.0 | 2.9 | 104.0 | 264.00 | VERTICAL |
| 78.840000 | 20.20 | 10.4 | 40.0 | 19.8 | 122.0 | 323.00 | VERTICAL |
| 143.100000 | 35.50 | 10.5 | 43.5 | 8.0 | 100.0 | 9.00 | VERTICAL |
| 144.480000 | 32.20 | 10.4 | 43.5 | 11.3 | 100.0 | 0.00 | VERTICAL |
| 385.140000 | 32.90 | 15.1 | 46.0 | 13.1 | 103.0 | 333.00 | HORIZONTAL |
| 386.040000 | 29.70 | 15.1 | 46.0 | 16.3 | 125.0 | 10.00 | HORIZONTAL |
| 486.900000 | 33.40 | 17.2 | 46.0 | 12.6 | 100.0 | 22.00 | VERTICAL |
| 488.220000 | 32.00 | 17.2 | 46.0 | 14.0 | 100.0 | 22.00 | 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

| | | | |
|----------------------|---------------------------------------|-----------------------|-----------------------|
| Lab ID: | Lab 2 | | |
| Manufacturer: | Frankonia | | |
| Description: | Anechoic Chamber for radiated testing | | |
| Type: | 10.58x6.38x6.00 m ³ | | |
| | <i>Calibration Details</i> | <i>Last Execution</i> | <i>Next Execution</i> |
| | NSA (FCC) | 2014/01/09 | 2017/01/09 |

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 6.00 m ³ | none | Frankonia | |
| | <i>Calibration Details</i> | | <i>Last Execution</i> | <i>Next Execution</i> |
| | 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 | | |
| | <i>Calibration Details</i> | | | <i>Last Execution</i> | <i>Next Execution</i> |
| | 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 | | |
| | <i>Calibration Details</i> | | | <i>Last Execution</i> | <i>Next Execution</i> |
| | Standard calibration | | | 2014/01/10 | 2016/01/31 |
| Impedance Stabilization Network, Coupling Decoupling Network | ISN/CDN T8-Cat6 | 32187 | Teseq GmbH | | |
| | <i>Calibration Details</i> | | | <i>Last Execution</i> | <i>Next Execution</i> |
| | Standard Calibration | | | 2014/01/08 | 2016/01/31 |
| One-Line V-Network | ESH 3-Z6 | 100489 | Rohde & Schwarz GmbH & Co. KG | | |
| | <i>Calibration Details</i> | | | <i>Last Execution</i> | <i>Next Execution</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 Execution</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 Execution</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 Execution</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 | Schwarzbeck |
| Biconical dipole | VUBA 9117 | 9117-108 | Schwarzbeck |
| 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 |
| <i>Calibration Details</i> | | | <i>Last Execution</i> <i>Next Execution</i> |
| Standard Calibration | | | 2012/05/18 2015/05/17 |
| Double-ridged horn | HF 906 | 357357/002 | Rohde & Schwarz GmbH & Co. KG |
| <i>Calibration Details</i> | | | <i>Last Execution</i> <i>Next Execution</i> |
| 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 | BBHA9170262 | |
| Log.-per. Antenna | HL 562 Ultralog | 100609 | Rohde & Schwarz GmbH & Co. KG |
| <i>Calibration Details</i> | | | <i>Last Execution</i> <i>Next Execution</i> |
| 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 |
| <i>Calibration Details</i> | | | <i>Last Execution</i> <i>Next Execution</i> |
| DKD Calibration | | | 2014/11/27 2017/11/27 |
| Standard Gain / 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 |
|---|--------------------|--------------------------------|----------------------|
| Standard Gain / Pyramidal Horn Antenna 40 GHz | 3160-10 | 00086675 | EMCO Elektronik GmbH |
| 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 |
| 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. |
| <i>Calibration Details</i> | | | <i>Last Execution</i> <i>Next Execution</i> |
| 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 Transformatorwerke GmbH |
| Notch Filter Ultra Stable (Aux) | WRCA800/960-6EEK | 24 | Wainwright |
| Signal Analyzer | FSV30 | 103005 | Rohde & Schwarz GmbH & Co. KG |
| <i>Calibration Details</i> | | | <i>Last Execution</i> <i>Next Execution</i> |
| Standard | | | 2014/02/10 2016/02/09 |
| Spectrum Analyser | FSP3 | 836722/011 | Rohde & Schwarz GmbH & Co. KG |
| <i>Calibration Details</i> | | | <i>Last Execution</i> <i>Next Execution</i> |
| Standard | | | 2012/06/13 2015/06/12 |
| Spectrum Analyser | FSU26 | 200418 | Rohde & Schwarz GmbH & Co.KG |
| <i>Calibration Details</i> | | | <i>Last Execution</i> <i>Next Execution</i> |
| 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 1, Lab 2

Signalling equipment for various wireless technologies.

Single Devices for Digital Signalling Devices

| Single Device Name | Type | Serial Number | Manufacturer | |
|--------------------------------------|--|---------------|-------------------------------|----------------|
| CMW500 | CMW500 | 107500 | Rohde & Schwarz GmbH & Co.KG | |
| | Calibration Details | | Last Execution | Next Execution |
| | 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 Execution |
| | DKD calibration | | 2014/12/02 | 2017/12/01 |
| 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 Execution |
| | DKD calibration | | 2014/12/03 | 2017/12/02 |
| | 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 --- 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 | | |
|-------------------------------------|---|---------------|----------------------------------|-----------------------|-----------------------|
| EMI Receiver / Spectrum Analyser | ESR 7 | 101424 | Rohde & Schwarz | | |
| | <i>Calibration Details</i> | | | <i>Last Execution</i> | <i>Next Execution</i> |
| | Initial Factory Calibration | | | 2014/11/13 | 2016/11/12 |
| Personal Computer | Dell | 30304832059 | Dell | | |
| Power Meter | NRVD | 828110/016 | Rohde & Schwarz GmbH & Co.KG | | |
| | <i>Calibration Details</i> | | | <i>Last Execution</i> | <i>Next Execution</i> |
| | Standard calibration | | | 2014/05/13 | 2015/05/10 |
| Sensor Head A | NRV-Z1 | 827753/005 | Rohde & Schwarz GmbH & Co.KG | | |
| | <i>Calibration Details</i> | | | <i>Last Execution</i> | <i>Next Execution</i> |
| | Standard calibration | | | 2014/05/13 | 2015/05/10 |
| Signal Generator | SMR 20 | 846834/008 | Rohde & Schwarz GmbH & Co. KG | | |
| | <i>Calibration Details</i> | | | <i>Last Execution</i> | <i>Next Execution</i> |
| | Standard Calibration | | | 2014/06/24 | 2017/06/23 |
| Spectrum Analyser | FSW 43 | 103779 | Rohde & Schwarz | | |
| | <i>Calibration Details</i> | | | <i>Last Execution</i> | <i>Next Execution</i> |
| | Initial Factory Calibration | | | 2014/11/17 | 2016/11/16 |
| Spectrum Analyzer | ESIB 26 | 830482/004 | Rohde & Schwarz GmbH & Co. KG | | |
| | <i>Calibration Details</i> | | | <i>Last Execution</i> | <i>Next Execution</i> |
| | Standard Calibration | | | 2014/01/07 | 2016/01/31 |
| | <i>HW/SW Status</i> | | | <i>Date of Start</i> | <i>Date of End</i> |
| | 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 | | |
| | <i>Calibration Details</i> | | | <i>Last Execution</i> | <i>Next Execution</i> |
| | 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 | Lufft Mess- und Regeltechnik GmbH | | |
| | <i>Calibration Details</i> | | | <i>Last Execution</i> | <i>Next Execution</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 | Lufft Mess- und Regeltechnik GmbH | | |
| | <i>Calibration Details</i> | | | <i>Last Execution</i> | <i>Next Execution</i> |
| | Customized calibration | | | 2015/03/10 | 2017/03/09 |

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 connected to a 50 μ H || 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. 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, 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. 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 $\pm 22.5^\circ$ 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 ± 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 $+22.5^\circ$ 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 (dB μ 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 μ V/m) / @ 3 m! |
|-----------------------|---------------------------------------|
| 30 – 88 | 49.5 |
| 88 – 216 | 54.0 |
| 216 – 960 | 56.9 |
| above 960 | 60.0 |

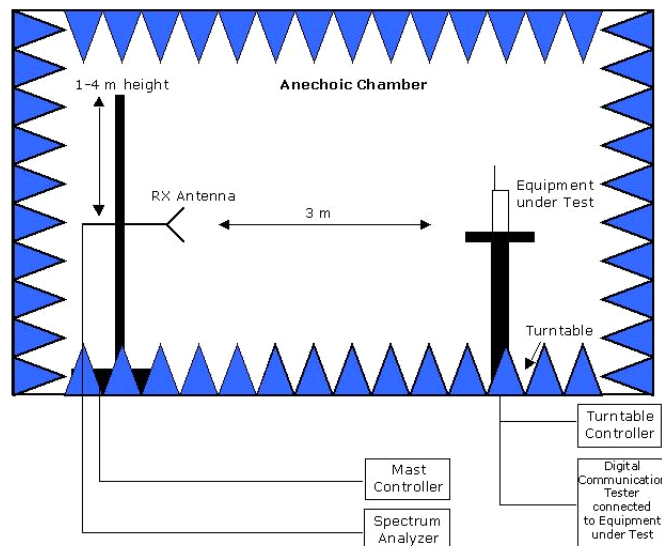
§15.35(b)

..., 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 (dB μ V/m) = 20 log (Limit (μ V/m)/1 μ V/m)

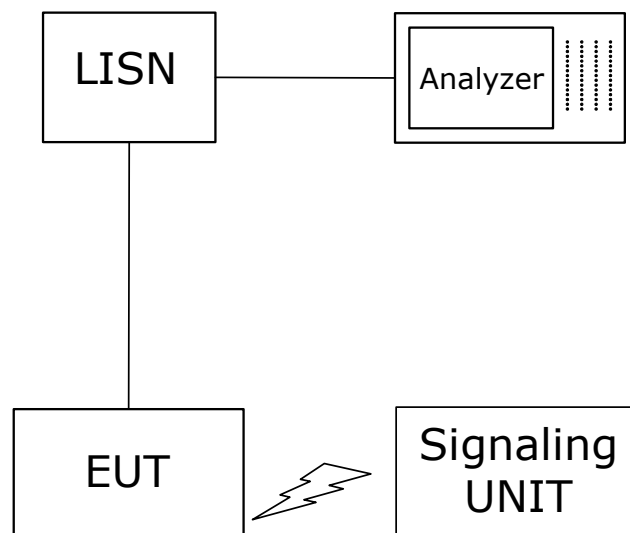
NOTE: A missing result table in the corresponding test report section means, that no final measurement was performed because no relevant frequencies (peaks) were found in the preliminary scan.

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-001 Issue 4 or ICES-003 Issue 5 or RSS- Gen Issue 3 |
| Radiated Spurious Emissions | §15.109 | ICES-001 Issue 4 or ICES-003 Issue 5 or RSS- Gen Issue 3 |

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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