InterLab®

FCC Measurement/Technical Report on

UHF - Reader
UNI900F1

FCC ID: XAM300011GR07
IC: 8311A-300011GR07

Report Reference: MDE_ECOM_1302_FCCb

Test Laboratory:
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40880 Ratingen

DAkkS
Deutsche
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D-PL-12140-01-01

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0 Applied Standards and Test Summary

0.1 Technical Report Summary

Type of Authorization
Certification for an Intentional Radiator (Digital Device / Spread Spectrum).

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 and 15 (10-1-13 Edition). The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification

Part 15, Subpart C – Intentional Radiators

§ 15.201 Equipment authorization requirement

§ 15.207 Conducted limits

§ 15.209 Radiated emission limits; general requirements

§ 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz

Note:

Instead of applying ANSI C63.4–1992 which is referenced in the FCC Public Note, the newer ANSI C63.4–2009 is applied.

Summary Test Results:

The EUT complied with all performed tests as listed in chapter 0.3 Measurement Summary.

0.2 FCC and IC Correlation Table

Correlation of measurement requirements for FHSS devices (e.g. Bluetooth) equipment

The following tables show the correlation of measurement requirements for FHSS (e.g. Bluetooth) equipment from FCC and IC standards.

FHSS equipment

Measurement	FCC reference	IC reference
Conducted emissions on AC Mains	§ 15.207	RSS-Gen Issue 3: 7.2.4
Occupied bandwidth	§ 15.247 (a) (1)	RSS-210 Issue 8: A8.1 (b)
Peak conducted output power	§ 15.247 (b) (2) or (3), (4)	RSS-210 Issue 8: A8.4 (1)
Transmitter spurious RF conducted emissions	§ 15.247 (d)	RSS-Gen Issue 3: 4.9; RSS-210 Issue 8: A8.5
Transmitter spurious radiated emissions	§ 15.247 (d); § 15.209 (a)	RSS-Gen Issue 3: 7.2.5; RSS-210 Issue 8: A8.5
Band edge compliance	§ 15.247 (d)	RSS-210 Issue 8: A8.5
Dwell time	§ 15.247 (a) (1) (i)	RSS-210 Issue 8: A8.1 (c)
Channel separation	§ 15.247 (a) (1)	RSS-210 Issue 8: A8.1 (b)
No. of hopping frequencies	§ 15.247 (a) (1) (i)	RSS-210 Issue 8: A8.1 (c)
Hybrid systems (only)	§ 15.247 (f); § 15.247 (e)	RSS-210 Issue 8: A8.3
Antenna requirement	§ 15.203 / 15.204	RSS-Gen Issue 3: 7.1.2
Receiver spurious emissions	–	RSS-210 Issue 8: 2.3; RSS Gen Issue 3: 6 *)

*) Receivers which are part of Transceivers are exempted with respect to Notice 2012-DRS0126.

0.3 Measurement Summary

FCC Part 15, Subpart C	§ 15.207		
Conducted emissions (AC power line)			
The measurement was performed according to ANSI C63.4			
OP-Mode	**Setup**	**Port**	**Final Result**
-	-	AC port	N/A

FCC Part 15, Subpart C	§ 15.247 (a) (1)		
Occupied bandwidth			
The measurement was performed according to FCC § 15.31			
OP-Mode	**Setup**	**Port**	**Final Result**
op-mode 1	Setup_01	Temp.ant.connector	passed
op-mode 2	Setup_01	Temp.ant.connector	passed
op-mode 3	Setup_01	Temp.ant.connector	passed

FCC Part 15, Subpart C	§ 15.247 (b) (1)		
Peak power output			
The measurement was performed according to FCC § 15.31			
OP-Mode	**Setup**	**Port**	**Final Result**
op-mode 1	Setup_01	Temp.ant.connector	passed
op-mode 2	Setup_01	Temp.ant.connector	passed
op-mode 3	Setup_01	Temp.ant.connector	passed

FCC Part 15, Subpart C	§ 15.247 (d), § 15.35 (b), § 15.207		
Spurious conducted emissions			
The measurement was performed according to ANSI C63.4			
OP-Mode	**Setup**	**Port**	**Final Result**
op-mode 1	Setup_01	Temp.ant.connector	passed
op-mode 2	Setup_01	Temp.ant.connector	passed
op-mode 3	Setup_01	Temp.ant.connector	passed

FCC Part 15, Subpart C	§ 15.247 (d), § 15.35 (b), § 15.209		
Spurious radiated emissions			
The measurement was performed according to ANSI C63.4			
OP-Mode	**Setup**	**Port**	**Final Result**
op-mode 1	Setup_02	Enclosure	passed
op-mode 2	Setup_02	Enclosure	passed
op-mode 3	Setup_02	Enclosure	passed

FCC Part 15, Subpart C	§ 15.247 (d)		
Band edge compliance			
The measurement was performed according to FCC § 15.31 / ANSI C63.4			
OP-Mode	**Setup**	**Port**	**Final Result**
op-mode 1	Setup_01	Temp.ant.connector	passed
op-mode 2	Setup_01	Temp.ant.connector	passed
op-mode 3	Setup_01	Temp.ant.connector	passed

FCC Part 15, Subpart C	**§ 15.247 (a)(1)**		
Carrier Frequency Separation			
The measurement was performed according to FCC § 15.31			
OP-Mode	**Setup**	**Port**	**Final Result**
op-mode 1	Setup_01	Temp.ant.connector	passed
op-mode 2	Setup_01	Temp.ant.connector	passed
op-mode 3	Setup_01	Temp.ant.connector	passed

FCC Part 15, Subpart C	**§ 15.247 (a)(1)**		
Number of Hopping Channels			
The measurement was performed according to FCC § 15.31			
OP-Mode	**Setup**	**Port**	**Final Result**
op-mode 1	Setup_01	Temp.ant.connector	passed
op-mode 2	Setup_01	Temp.ant.connector	passed
op-mode 3	Setup_01	Temp.ant.connector	passed

FCC Part 15, Subpart C	**§ 15.247 (a)(1)**		
Dwell Time			
The measurement was performed according to FCC § 15.31			
OP-Mode	**Setup**	**Port**	**Final Result**
op-mode 1	Setup_01	Temp.ant.connector	passed
op-mode 2	Setup_01	Temp.ant.connector	passed
op-mode 3	Setup_01	Temp.ant.connector	passed

N/A not applicable (the EUT is powered by DC)

Responsible for Accreditation Scope: Digitally signed by Andreas Petz DN: cn=Andreas Petz, sn=Petz, givenName=Andreas, o=7Layers AG, serialNumber=001000000001202918000 1, email=andreas.petz@7layers.de Reason: I am approving this document Date: 2014.09.29 18:17:00 +02'00'

Responsible for Test Report: Digitally signed by Marco Kullik DN: cn=Marco Kullik, sn=Kullik, givenName=Marco, o=7 Layers AG, serialNumber=001000000012029050 002, email=Marco.Kullik@7Layers.de Reason: I am the author of this document Date: 2014.09.29 17:54:05 +02'00'

1 Administrative Data

1.1 Testing Laboratory

Company Name:	7 Layers AG
Address	Borsigstr. 11 40880 Ratingen Germany

This facility has been fully described in a report submitted to the FCC and accepted under the registration number 96716 .

The test facility is also accredited by the following accreditation organisation:

Laboratory accreditation no.:	DAkkS D-PL-12140-01-01
Responsible for Accreditation Scope:	Dipl.-Ing. Bernhard Retka Dipl.-Ing. Robert Machulec Dipl.-Ing. Thomas Hoell Dipl.-Ing. Andreas Petz Dipl.-Ing. Marco Kullik
Report Template Version:	2014-09-11

1.2 Project Data

Responsible for testing and report:	Dipl.-Ing. Marco Kullik
Date of Test(s):	2014-05-27 – 2014-06-03
Date of Report:	2014-09-25

1.3 Applicant Data

Company Name:	Ecom instruments GmbH
Address:	Industriestraße 2 97959 Assamstadt Germany
Contact Person:	Mr. Harald Fiederlein

1.4 Manufacturer Data

Company Name:	Please see applicant data
Address:	
Contact Person:	

2 Test object Data

2.1 General EUT Description

Equipment under Test:	915 MHz RFID Head
Type Designation:	UHF - Reader UNI900F1
Kind of Device: (optional)	-
Voltage Type:	DC
Voltage Level:	3.7 V
Tested Modulation Type:	Normal modulation
No of Hopping Channels	50
Hopping Rate:	2.5 [1/s]

General product description:

The EUT is a 915 MHz RFID head and is part of an intrinsically safe handheld PDA. This PDA supports the wireless technologies GSM 850/900/1800/1900, UMTS in the Bands FDDI / II / IV / V / VIII, WLAN 2.4 GHz with the modes b,g,n, WLAN 5 GHz with the modes a, n, and Bluetooth. It can be also equipped with different RFID readers in the frequency ranges 125 kHz, 134 kHz,13.56 MHz in combination with a scanner and 915 MHz or measurement heads without wireless technologies. During normal operation the EUT is intended for portable use.

Specific product description for the EUT:

The EUT is a RFID head which can only be used together with the handheld PDA i.roc Ci70-Ex. It uses the Frequency Hopping Spread Spectrum (FHSS) technology with 50 channels spaced in the 902 – 928 MHz frequency range.

The EUT provides the following ports:

Ports
Enclosure
Data Port (ANC1)

The main components of the EUT are listed and described in Chapter 2.2

2.2 EUT Main components

Type, S/N, Short Descriptions etc. used in this Test Report

Short Description	Equipment under Test	Type Designation	Serial No.	HW Status	SW Status
EUT A (Code: 4E020c06)	RFID Head	UHF - Reader UNI900F1	RFID_UHF_0085	UHF-02	98.02
Remark: EUT A is equipped with a temporary antenna connector.					
EUT B (Code: 4E020b06)	RFID Head	UHF - Reader UNI900F1	RFID_UHF_0076	UHF-02	98.02
Remark: EUT B is equipped with an integral antenna with a maximum gain of 3.9 dBi in the 902 - 928 MHz frequency range.					

NOTE: The short description used to simplify the identification of the EUT in this test report.

2.3 Ancillary Equipment

For the purposes of this test report, ancillary equipment is defined as equipment, which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Ancillary Equipment can influence the test results.

Short Description	Equipment under Test	Type Designation	Serial No.	HW Status	SW Status
ANC1	Handheld PDA	i.roc Ci70-ex	22321245032	P4	1.50.19.00 2.2

2.4 Auxiliary Equipment

For the purposes of this test report, auxiliary equipment is defined as equipment, which is used temporarily to enable operational and control features especially used for the tests of the EUT, which is not used during normal operation or equipment that is used during the tests in combination with the EUT but is not subject of this test report. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Auxiliary Equipment can influence the test results.

Short Description	Equipment under Test	Type Designation	Serial No.	HW Status	SW Status
–	–	–	–	–	–

2.5 EUT Setups

This chapter describes the combination of EUTs and equipment used for testing. The rationale for selecting the EUTs, ancillary and auxiliary equipment and interconnecting cables, is to test a representative configuration meeting the requirements of the referenced standards.

Setup	Combination of EUTs	Description and Rationale
Setup_01	EUT A + ANC1	setup for conducted radio measurements
Setup_02	EUT B + ANC1	setup for radiated measurements

2.6 Operating Modes

This chapter describes the operating modes of the EUTs used for testing.

2.6.1 Test Channels

Band:								
900 MHz 902 - 928 MHz			**2.4 GHz ISM 2400 - 2483.5 MHz**			**5 GHz ISM 5725 - 5850 MHz**		
Bottom	**Middle**	**Top**	**Bottom**	**Middle**	**Top**	**Bottom**	**Middle**	**Top**
1	25	50						
902.7	914.7	927.2						

Shortcuts for operating modes

Operating Mode / Frequency [MHZ]	902.7	914.2	927.2
Transmitter on, normal modulation	1	2	3

The duty cycle of the device when set on a single frequency (special test mode for testing), is 100 %.

2.7 Special software used for testing

The software UHF CM Tool Version: 1.0.2.0 was used to set the required operating modes. Power setting 9 was used for testing.

2.8 Product labelling

2.8.1 FCC ID label

Please refer to the documentation of the applicant.

2.8.2 Location of the label on the EUT

Please refer to the documentation of the applicant.

3 Test Results

3.1 20 dB Bandwidth

Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.31

3.1.1 Test Description

The Equipment Under Test (EUT) was set up to perform the occupied bandwidth measurements.
The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical.
The results recorded were measured with the modulation which produce the worst-case (widest) occupied bandwidth.
The EUT was connected to spectrum analyzer via a short coax cable with a known loss.
Analyzer settings:
- Resolution Bandwidth (RBW): 10 kHz
- Video Bandwidth (VBW): 30 kHz
- Span: 500 kHz
- Trace: Maxhold

3.1.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (a) (1)
For frequency hopping systems operating in the 902-928 MHz band:…
The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

3.1.3 Test Protocol

Temperature: 25 °C
Air Pressure: 1003 hPa
Humidity: 43 %

3.1.3.1 20 dB bandwidth

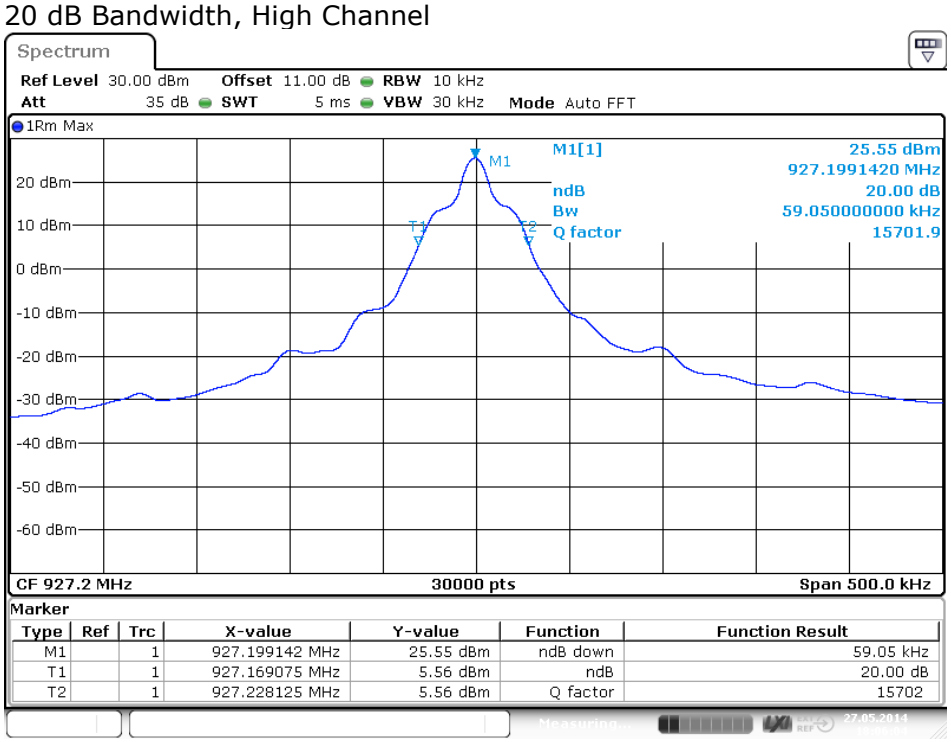
Transmitter on, normal modulation					
Band	**Channel No.**	**Frequency [MHz]**	**20 dB Bandwidth [kHz]**	**Limit [kHz]**	**Margin to Limit [kHz]**
900 MHz	1	902.7	57.983	250	192.017
	25	914.7	55.233	250	194.767
	50	927.2	59.050	250	190.950

3.1.3.2 99% bandwidth

Transmitter on, normal modulation					
Band	**Channel No.**	**Frequency [MHz]**	**20 dB Bandwidth [kHz]**	**Limit [kHz]**	**Margin to Limit [kHz]**
900 MHz	1	902.7	57.233	250	192.767
	25	914.7	58.166	250	191.834
	50	927.2	27.650	250	222.350

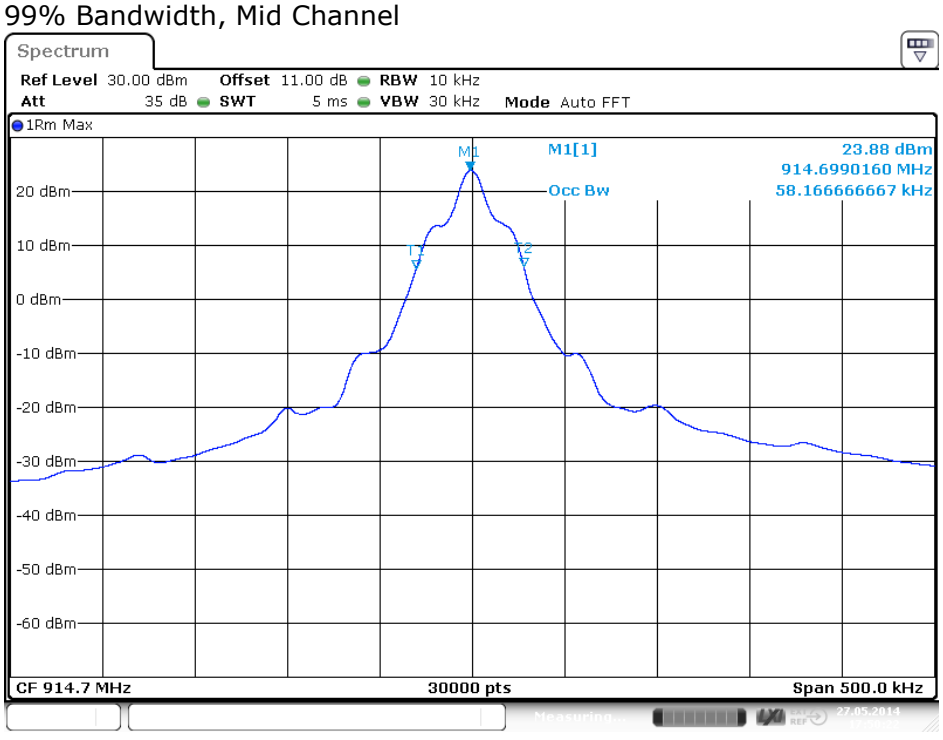
3.1.4 Measurement Plot (showing the highest value, "worst case")

20 dB Bandwidth, High Channel



Date: 27.MAY.2014 18:06:04

99% Bandwidth, Mid Channel



Date: 27.MAY.2014 17:50:22

3.2 Peak power output

Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.31

3.2.1 Test Description

The Equipment Under Test (EUT) was set up to perform the output power measurements. The results recorded were measured with the modulation which produces the worst-case (highest) output power. The reference level of the spectrum analyzer was set higher than the output power of the EUT. The EUT was connected to the spectrum analyzer via a short coax cable with a known loss.
Analyzer settings:
- RBW: 100 kHz
- VBW: 1 MHz
- Detector: Peak
- Trace:Maxhold

3.2.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (b) (2)
For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

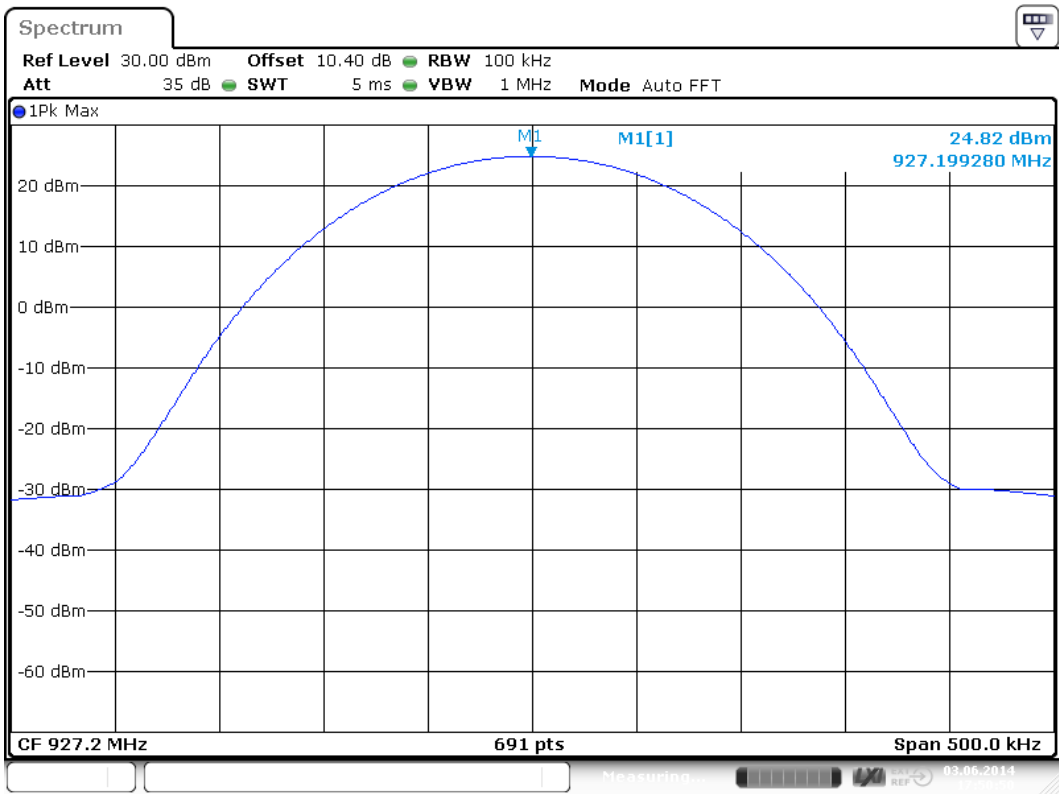
Used conversion factor: Limit (dBm) = 10 log (Limit (W)/1mW)

3.2.3 Test Protocol

Temperature: 25 °C
Air Pressure: 1003 hPa
Humidity: 43 %

Transmitter on, normal modulation						
Band	**Channel No.**	**Frequency [MHz]**	**Peak Power [dBm]**	**Limit [dBm]**	**Margin to Limit [dB]**	**E.I.R.P [dBm]**
900 MHz	1	902.7	24.2	30.0	5.8	28.1
	25	914.7	24.7	30.0	5.3	28.6
	50	927.2	24.8	30.0	5.2	28.7

3.2.3.1 Measurement Plot (showing the highest value, "worst case")



Date: 3.JUN.2014 17:50:49

3.3 Spurious RF conducted emissions

Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.31

3.3.1 Test Description

The Equipment Under Test (EUT) was set up to perform the spurious emissions measurements.
The EUT was connected to spectrum analyzer via a short coax cable with a known loss.
Analyzer settings:

- Detector:	Peak
- Frequency range:	30 – 18000 MHz
- Resolution Bandwidth (RBW):	100 kHz
- Video Bandwidth (VBW):	300 kHz
- Sweep Time:	coupled
- Trace:	maxhold

The reference value for the measurement of the spurious RF conducted emissions is determined during the test "band edge compliance" (cf. chapter 3.5). This value is used to calculate the 20 dBc limit.

3.3.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (c)
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

3.3.3 Test Protocol

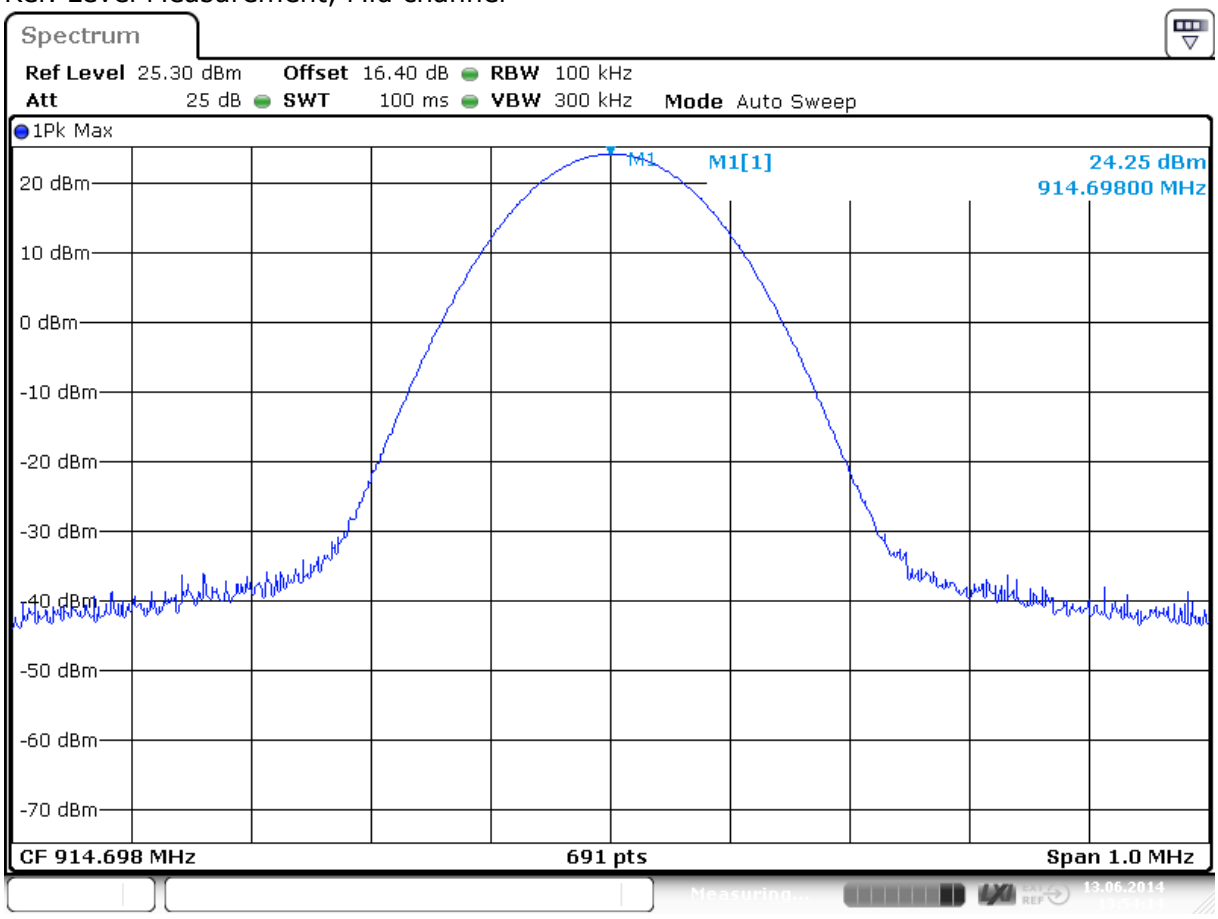
Temperature: 23 °C
Air Pressure: 1003 hPa
Humidity: 45 %

Transmitter on, normal modulation								
Channel No	**Channel Center Freq. [MHz]**	**Spurious Freq. [MHz]**	**Spurious Level [dBm]**	**Detector**	**RBW [kHz]**	**Ref. Level [dBm]**	**Limit [dBm]**	**Margin to Limit [dB]**
1	902.7	–	–	PEAK	100	24.0	4.0	- - -
25	914.7	–	–	PEAK	100	24.3	4.3	- - -
50	927.2	–	–	PEAK	100	24.4	4.4	- - -

Note: No (further) spurious emissions in the range 20 dB below the limit found.

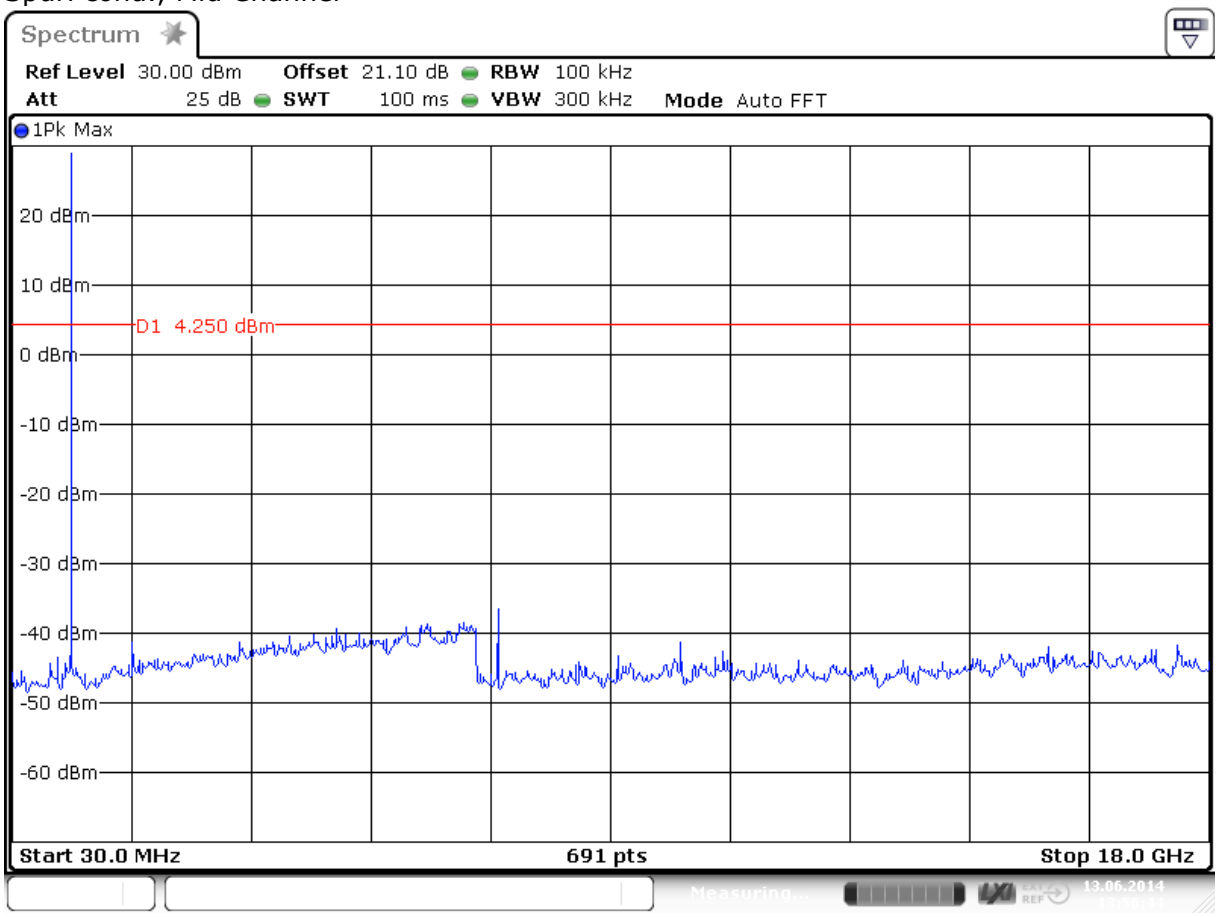
3.3.4 Measurement Plot (showing the highest value, "worst case")

Ref. Level Measurement, Mid channel



Date: 13.JUN.2014 13:54:14

Spuri cond., Mid Channel



Date: 13.JUN.2014 13:56:45

3.4 Spurious radiated emissions

Standard FCC Part 15, Subpart C

The test was performed according to: ANSI C63.4

3.4.1 Test Description

The test set-up was made in accordance to the general provisions of ANSI C63.4 in a typical installation configuration. The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m² in the semi-anechoic chamber. The influence of the EUT support table that is used between 30–1000 MHz was evaluated.
The measurement procedure is implemented into the EMI test software ES-K1 from R&S. 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 performed while the EUT is powered from a DC power sourse.

1. Measurement up to 30 MHz
The Loop antenna HFH2-Z2 is used.
Step 1: pre measurement
- Anechoic chamber
- Antenna distance: 10 m
- Detector: Peak-Maxhold
- Frequency range: 0.009 - 0.15 MHz and 0.15 – 30 MHz
- Frequency steps: 0.1 kHz and 5 kHz
- IF–Bandwidth: 0.2 kHz and 10 kHz
- Measuring time / Frequency step: 100 ms

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.
Step 2: final measurement
For the relevant emissions determined in step 1, an additional measurement with the following settings will be performed. Intention of this step is to find the maximum emission level.
- Open area test side
- Antenna distance: according to the Standard
- Detector: Quasi-Peak
- Frequency range: 0.009 – 30 MHz
- Frequency steps: measurement at frequencies detected in step 1
- IF–Bandwidth: 0.2 - 10 kHz
- Measuring time / Frequency step: 100 ms

2. Measurement above 30 MHz and up to 1 GHz

Step 1: Preliminary scan

This is a preliminary test to identify the highest amplitudes relative to the limit.

Settings for step 1:

- Antenna distance: 3 m
- 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

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

Step 2: second measurement

For the relevant emissions determined in step 1, an additional measurement with the following settings will be performed. Intention of this step is, to find out the approximate turntable angle and antenna height for each frequency.

- 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 slowly vary 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 will also slowly vary 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: 100 ms
- Turntable angle range: ± 22.5 ° around the determined value
- Height variation range: ± 25 cm 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 (< 1 GHz)
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

After the measurement a plot will be generated which contains a diagram with the results of the preliminary scan and a chart with the frequencies and values of the results of the final measurement.

3. Measurement above 1 GHz
The following modifications apply to the measurement procedure for the frequency range above 1 GHz:
The Equipment Under Test (EUT) was set up on a non-conductive support at 1.4 m height in the fully-anechoic chamber. 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 reference level 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 are omitted. Step 1 was performed with one height of the receiving antenna only.
EMI receiver settings:
- Detector: Peak, Average
- IF Bandwidth = 1 MHz

For the data rate in mode n the test is performed as worst-case-check in order to verify that emissions have a comparable level as found at modes b and g. Typically, the measurement is performed in the frequency range 1 to 8 GHz but it depends on the emissions found during the test for the modes b and g. Please refer to the results for the used frequency range.

3.4.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (d)
... In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

FCC Part 15, Subpart C, §15.209, Radiated Emission Limits

Frequency in MHz	Limit (µV/m)	Measurement distance (m)		Calculated Limits(dBµV/m @10m)	Limits(dBµV/m @10m)
0.009 – 0.49	2400/F(kHz)	300	10	(48.5 – 13.8) + 59.1 dB	107.6 – 72.9
0.49 – 1.705	24000/F(kHz)	30	10	(48.9 – 23.0) + 19.1 dB	60.0 – 42.1
1.705 – 30	30	30	10	29.5 + 19.1 dB	48.6

Frequency in MHz	Limit (µV/m)	Measurement distance (m)	Limit (dBµV/m)
30 – 88	100	3	40.0
88 – 216	150	3	43.5
216 – 960	200	3	46.0
above 960	500	3	54.0

§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)

3.4.3 Test Protocol

Temperature: 24 °C
Air Pressure: 1009 hPa
Humidity: 45 %

Transmitter on, normal modulation				Applied duty cycle correction (AV) [dB]:				0.0
Ch. No.	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBµV/m]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin to Limit [dB]	Limit Type
1	902.7	2708.0	41.9	PEAK	1000	74.0	32.1	RB
1	902.7	2708.0	39.7	AV	1000	54.0	14.3	RB
1	902.7	3611.0	39.0	PEAK	1000	74.0	35.0	RB
1	902.7	3611.0	35.1	AV	1000	54.0	18.9	RB
1	902.7	4514.0	48.8	PEAK	1000	74.0	25.2	RB
1	902.7	4514.0	47.3	AV	1000	54.0	6.7	RB
1	902.7	5416.0	47.6	PEAK	1000	74.0	26.4	RB
1	902.7	5416.0	44.9	AV	1000	54.0	9.1	RB
1	902.7	8125.0	47.7	PEAK	1000	74.0	26.3	RB
1	902.7	8125.0	43.3	AV	1000	54.0	10.7	RB
25	914.7	2744.0	47.2	PEAK	1000	74.0	26.8	RB
25	914.7	2744.0	45.3	AV	1000	54.0	8.7	RB
25	914.7	3659.0	44.8	PEAK	1000	74.0	29.3	RB
25	914.7	3659.0	42.8	AV	1000	54.0	11.2	RB
25	914.7	4574.0	45.9	PEAK	1000	74.0	28.1	RB
25	914.7	4574.0	43.3	AV	1000	54.0	10.7	RB
25	914.7	7318.0	51.1	PEAK	1000	74.0	22.9	RB
25	914.7	7318.0	48.9	AV	1000	54.0	5.1	RB
25	914.7	8233.0	46.1	PEAK	1000	74.0	27.9	RB
25	914.7	8233.0	38.4	AV	1000	54.0	15.6	RB
50	927.2	2782.0	40.7	PEAK	1000	74.0	33.3	RB
50	927.2	2782.0	38.3	AV	1000	54.0	15.7	RB
50	927.2	3709.0	47.5	PEAK	1000	74.0	26.5	RB
50	927.2	3709.0	46.0	AV	1000	54.0	8.0	RB
50	927.2	4636.0	52.3	PEAK	1000	74.0	21.7	RB
50	927.2	4636.0	51.3	AV	1000	54.0	2.7	RB
50	927.2	7418.0	54.5	PEAK	1000	74.0	19.5	RB
50	927.2	7418.0	52.9	AV	1000	54.0	1.1	RB

Note: No (further) spurious emissions in the range 20 dB below the limit found.

3.5 Band edge compliance

Standard FCC Part 15, Subpart C

The test was performed according to: ANSI C63.4–2009, FCC §15.31

3.5.1 Test Description

Show compliance of the lower and higher band edge by a conducted measurement.
For the conducted measurement, the Equipment Under Test (EUT) is placed in a shielded room.
For the lower band edge the EUT is set to transmit as follows:
For a FHSS system in the 902 928 MHz frequency range:
For the lower band edge the EUT is set to transmit on the lowest possible frequency
For the higher band edge the EUT is set to transmit on the highest possible frequency.
These frequencies can be found in the measurement result table.

Analyzer settings for conducted measurement:
- Detector: Peak
- RBW / VBW = 100 / 1000 kHz
- Trace: Maxhold

3.5.2 Test Requirements / Limits

FCC Part 15.247 (d)
"In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. ...
If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c))."

For the conducted measurement the RF power at the band edge shall be "at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power..."

No emission is generated at a band edge in the near of a restricted band, therefore no radiated test will be performed.

3.5.3 Test Protocol

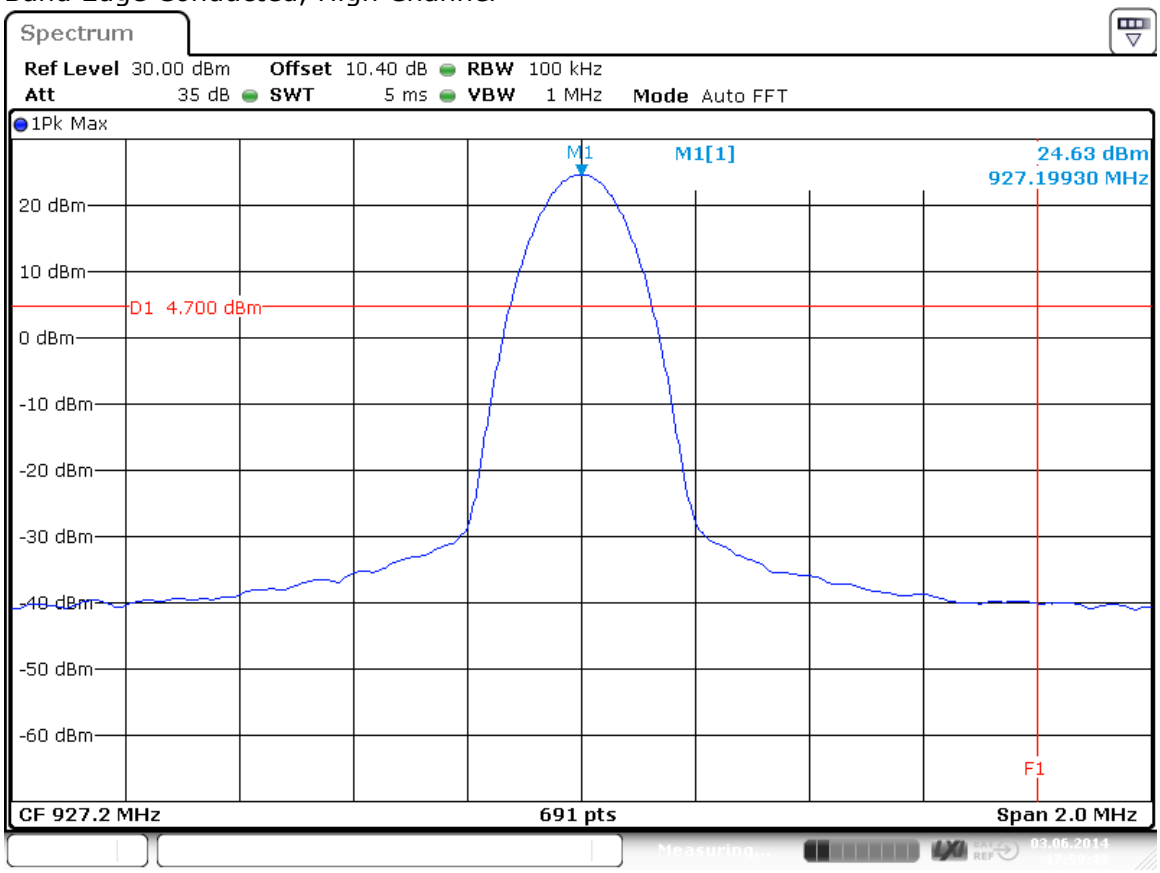
3.5.3.1 Conducted measurement, lower and higher band edge

Temperature: 23 °C
Air Pressure: 45 hPa
Humidity: 1003 %

Transmitter on, normal modulation								
Channel No	Channel Center Frequency [MHz]	Frequency [MHz]	Spurious Level [dBm]	Detector	RBW [kHz]	Ref. Level [dBm]	Limit [dBµV/m]	Margin to Limit [dB]
1	902.7	5725.0	-42.0	PEAK	100	24.3	4.3	46.3
50	927.2	5850.0	-40.0	PEAK	100	24.6	4.6	44.6

3.5.3.2 Measurement Plot (showing the highest value, "worst case")

Band Edge Conducted, High Channel



Date: 3.JUN.2014 17:59:48

3.6 Carrier Frequency Separation

Standard FCC Part 15, Subpart C

The test was performed according to: ANSI C63.4–2009, FCC §15.31

3.6.1 Test Description

The Equipment Under Test (EUT) was set up to perform the channel separation measurements. The channel separation is independent from the modulation pattern. The EUT was connected to spectrum analyzer via a short coax cable.
Analyzer settings:
- Detector: Peak-Maxhold
- Span: approx. 1.5 time the expected channel separation
- Centre Frequency: a mid frequency of the 902 – 928 MHz band
- Resolution Bandwidth (RBW): 3 kHz
- Video Bandwidth (VBW): 3 kHz
- Sweep Time: Coupled
- Trace: Maxhold

3.6.2 Test Requirements / Limits

FCC Part 15.247 (a)(1)

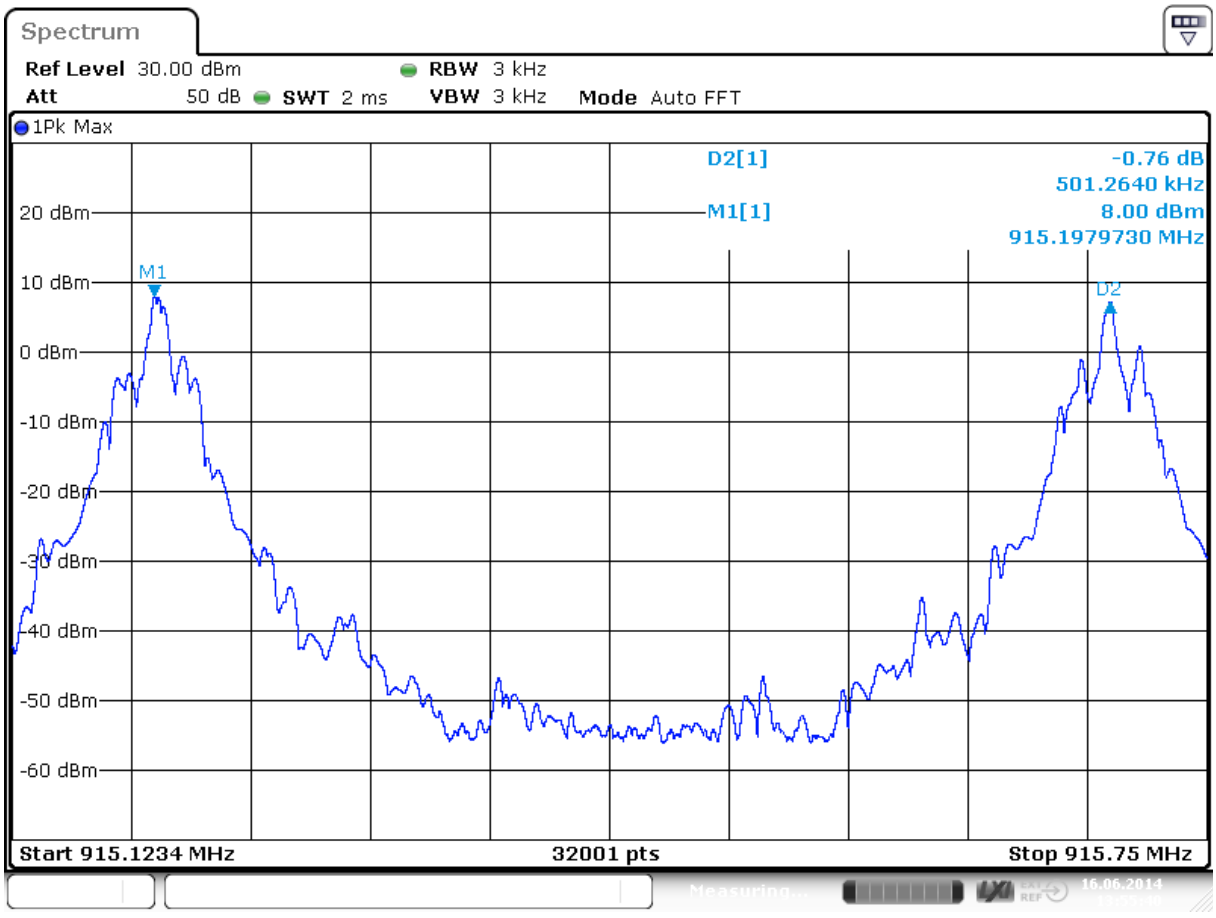
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater…

3.6.3 Test Protocol

Temperature: 23 °C
Air Pressure: 1003 hPa
Humidity: 45 %

Transmitter on, normal modulation				
Band	**Channel No.**	**Channel Separation [kHz]**	**Limit [kHz]**	**Margin to Limit [kHz]**
900 MHz	hopping	501.3	59.1	442.2

3.6.3.1 Measurement Plot (showing the highest value, "worst case")



Date: 16.JUN.2014 13:55:41

3.7 No. Of Hopping Channels

Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.31

3.7.1 Test Description

The Equipment Under Test (EUT) was set up to perform the number of hopping frequencies measurement. The number of hopping frequencies is independent from the modulation pattern.
The EUT was connected to spectrum analyzer via a short coax cable.
Analyzer settings:

- Detector:	Peak Maxhold
- Start frequency:	902 MHz
- Stop frequency:	928 MHz
- Resolution Bandwidth (RBW):	100 kHz
- Video Bandwidth (VBW):	300 kHz
- Sweep Time:	Coupled

3.7.2 Test Requirements / Limits

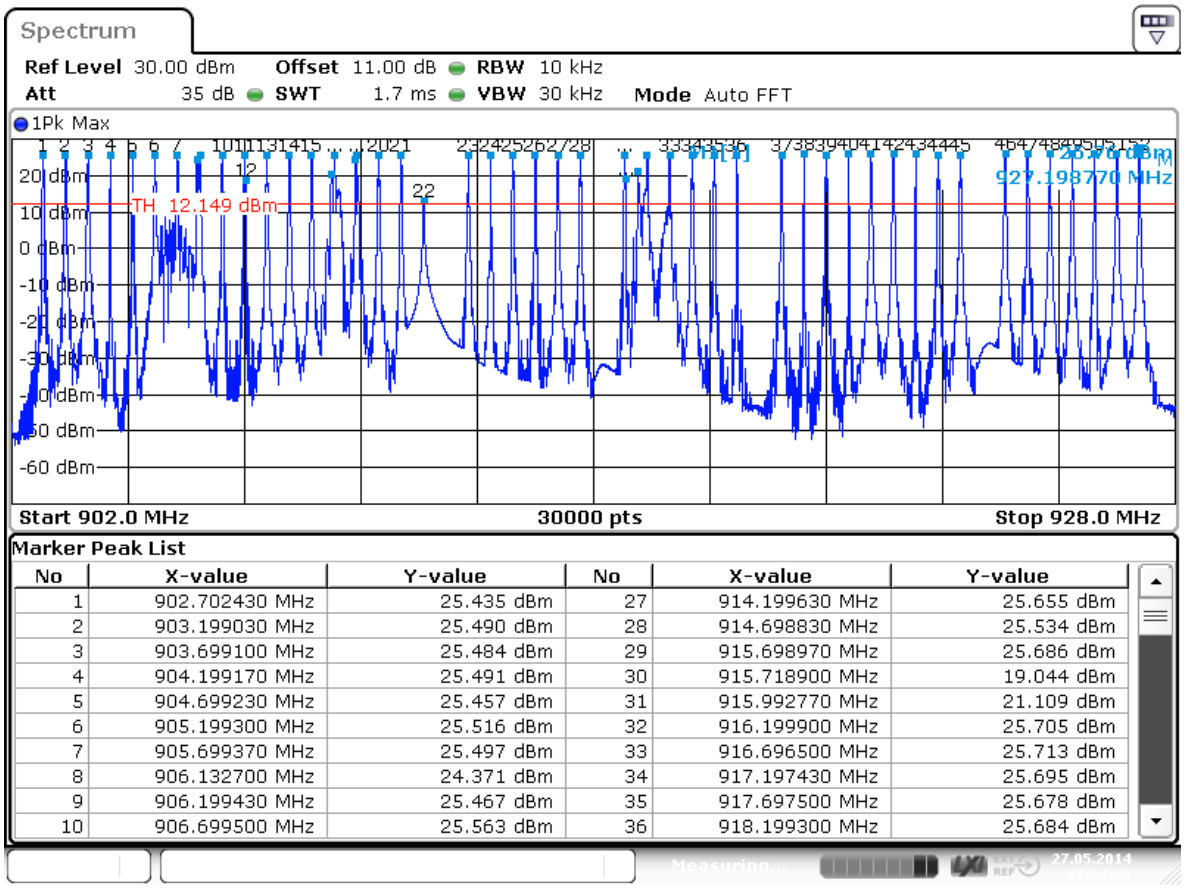
FCC Part 15, Subpart C, §15.247 (a) (i)
For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

3.7.3 Test Protocol

Temperature: 23 °C
Air Pressure: 1003 hPa
Humidity: 45 %

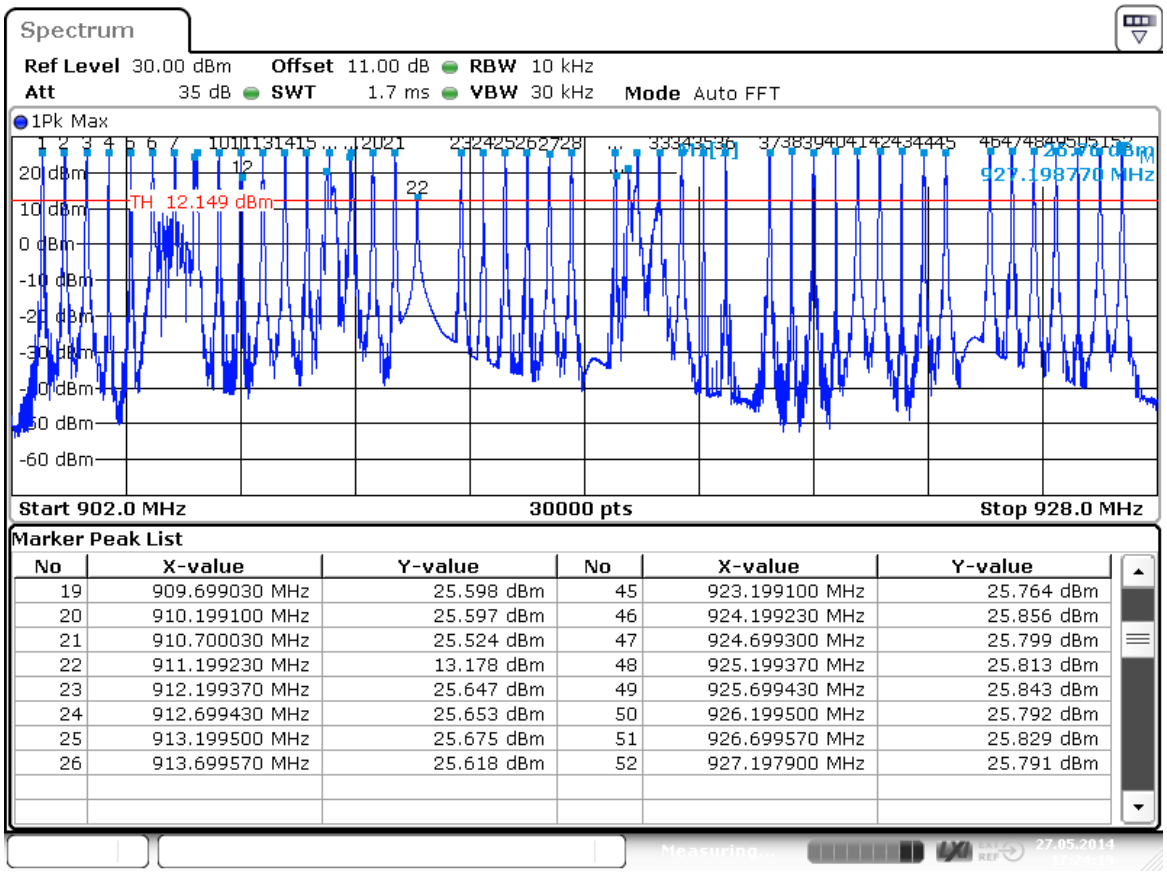
Transmitter on, normal modulation				
Band	**Channel No.**	**Number of Hopping Channels**	**Limit [Channels]**	**Margin to Limit**
900 MHz	hopping	50	50	0

3.7.3.1 Measurement Plot (showing the highest value, "worst case")



No	X-value	Y-value	No	X-value	Y-value
1	902.702430 MHz	25.435 dBm	27	914.199630 MHz	25.655 dBm
2	903.199030 MHz	25.490 dBm	28	914.698830 MHz	25.534 dBm
3	903.699100 MHz	25.484 dBm	29	915.698970 MHz	25.686 dBm
4	904.199170 MHz	25.491 dBm	30	915.718900 MHz	19.044 dBm
5	904.699230 MHz	25.457 dBm	31	915.992770 MHz	21.109 dBm
6	905.199300 MHz	25.516 dBm	32	916.199900 MHz	25.705 dBm
7	905.699370 MHz	25.497 dBm	33	916.696500 MHz	25.713 dBm
8	906.132700 MHz	24.371 dBm	34	917.197430 MHz	25.695 dBm
9	906.199430 MHz	25.467 dBm	35	917.697500 MHz	25.678 dBm
10	906.699500 MHz	25.563 dBm	36	918.199300 MHz	25.684 dBm

Date: 27.MAY.2014 17:24:48



No	X-value	Y-value	No	X-value	Y-value
19	909.699030 MHz	25.598 dBm	45	923.199100 MHz	25.764 dBm
20	910.199100 MHz	25.597 dBm	46	924.199230 MHz	25.856 dBm
21	910.700030 MHz	25.524 dBm	47	924.699300 MHz	25.799 dBm
22	911.199230 MHz	13.178 dBm	48	925.199370 MHz	25.813 dBm
23	912.199370 MHz	25.647 dBm	49	925.699430 MHz	25.843 dBm
24	912.699430 MHz	25.653 dBm	50	926.199500 MHz	25.792 dBm
25	913.199500 MHz	25.675 dBm	51	926.699570 MHz	25.829 dBm
26	913.699570 MHz	25.618 dBm	52	927.197900 MHz	25.791 dBm

Date: 27.MAY.2014 17:24:20

3.8 Dwell Time

Standard FCC Part 15, Subpart C

The test was performed according to: FCC §15.31

3.8.1 Test Description

he Equipment Under Test (EUT) was set up to perform the dwell time measurements. The EUT was connected to the spectrum analyzer via a short coax cable. The dwell time is calculated by:

Dwell time = time slot length * hop rate / number of hopping channels * (10 or 20) s

3.8.2 Test Requirements / Limits

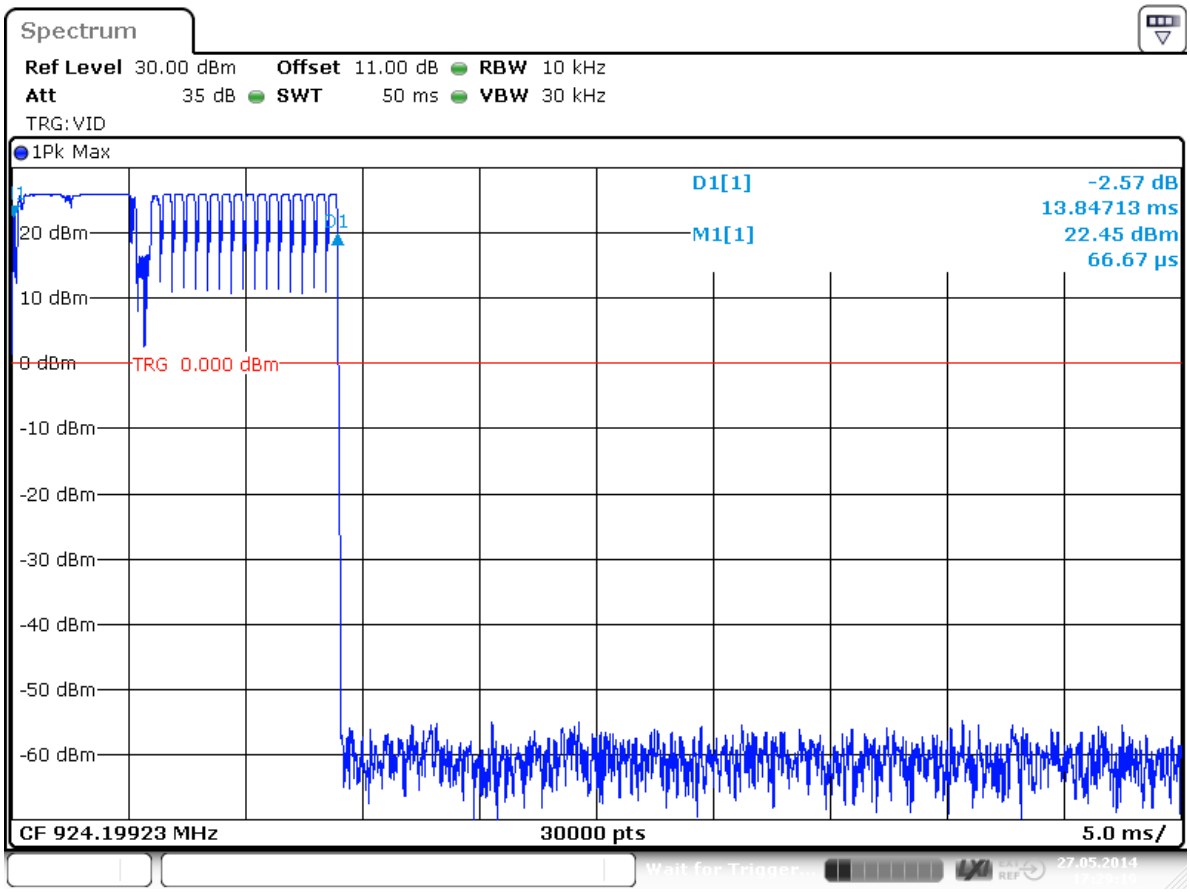
FCC Part 15, Subpart C, §15.247 (a) (i)
For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

3.8.3 Test Protocol

Temperature: 23 °C
Air Pressure: 1003 hPa
Humidity: 45 %

Transmitter on, normal modulation							
Band	Channel No.	Time Slot Length [ms]	Hopping Rate [1/s]	No of hopping frequencies	Dwell Time [ms]	Limit [ms]	Margin to Limit [ms]
900 MHz	hopping	13.8470	2.5	50	13.847	400.0	386.2

3.8.3.1 Measurement Plot (showing the highest value, "worst case")



Date:27.MAY.2014 17:29:20

4 Test Equipment

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

Test Equipment Anechoic Chamber

Lab ID:	**Lab 1**
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 Radiated emissions

Lab ID:	**Lab 1**
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	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard Calibration		2009/06/04	2014/06/03
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

Single Devices for Auxiliary Equipment for Radiated emissions (continued)

Single Device Name	*Type*	*Serial Number*	*Manufacturer*
Pyramidal Horn Antenna 26,5 GHz	3160-09	00083069	EMCO Elektronik GmbH
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 1, 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
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**
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 Multimeter 12

Lab ID:	**Lab 3**
Description:	Ex-Tech 520
Serial Number:	05157876

Single Devices for Multimeter 12

Single Device Name	*Type*	*Serial Number*	*Manufacturer*	
Digital Multimeter 12 (Multimeter)	EX520	05157876	Extech Instruments Corp.	
	Calibration Details		*Last Execution*	*Next Exec.*
	Customized calibration		2013/12/04	2015/12/03

Test Equipment Radio Lab Test Equipment

Lab ID:	**Lab 2**
Description:	Radio Lab Test Equipment

Single Devices for Radio Lab Test Equipment

Single Device Name	*Type*	*Serial Number*	*Manufacturer*
Broadband Power Divider SMA	WA1515	A856	Weinschel Associates
Coax Attenuator 10dB SMA 2W	4T-10	F9401	Weinschel Associates
Coax Attenuator 10dB SMA 2W	56-10	W3702	Weinschel Associates
Coax Attenuator 10dB SMA 2W	56-10	W3711	Weinschel Associates
Coax Cable Huber&Suhner	Sucotest 2,0m		Huber&Suhner
Coax Cable Rosenberger Micro Coax FA210A0010003030 SMA/SMA 1,0m	FA210A0010003030	54491-2	Rosenberger Micro-Coax
Power Meter	NRVD	828110/016	Rohde & Schwarz GmbH & Co.KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard calibration		2014/05/13 2015/05/12
RF Step Attenuator RSP	RSP	833695/001	Rohde & Schwarz GmbH & Co.KG
Rubidium Frequency Standard	Datum, Model: MFS	5489/001	Datum-Beverly
	Calibration Details		*Last Execution* *Next Exec.*
	Standard calibration		2013/06/24 2014/07/02
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 SME	SME03	827460/016	Rohde & Schwarz GmbH & Co.KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard calibration		2011/11/25 2014/11/24
Signal Generator SMP	SMP02	836402/008	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard calibration		2013/05/06 2016/05/05
Spectrum Analyser	FSIQ26	840061/005	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		*Last Execution* *Next Exec.*
	Standard Calibration		2013/02/12 2015/02/11

Test Equipment Shielded Room 07

Lab ID:	**Lab 3**
Description:	Shielded Room 4m x 6m

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 03

Lab ID:	**Lab 2**
Description:	Lufft Opus10
Serial Number:	7482

Single Devices for T/H Logger 03

Single Device Name	*Type*	*Serial Number*	*Manufacturer*
ThermoHygro Datalogger 03 (Environ)	Opus10 THI (8152.00)	7482	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 1**
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

Test Equipment T/H Logger 15

Lab ID:	**Lab 3**
Description:	Lufft Opus10
Serial Number:	13985

Single Devices for T/H Logger 15

Single Device Name	*Type*	*Serial Number*	*Manufacturer*
ThermoHygro Datalogger 15 (Environ)	Opus10 THI (8152.00)	13985	Lufft Mess- und Regeltechnik GmbH

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

Test Equipment Temperature Chamber 01

Lab ID:	**Lab 3**
Manufacturer:	see single devices
Description:	Temperature Chamber KWP 120/70
Type:	Weiss
Serial Number:	see single devices

Single Devices for Temperature Chamber 01

Single Device Name	*Type*	*Serial Number*	*Manufacturer*	
Temperature Chamber Weiss 01	KWP 120/70	59226012190010	Weiss Umwelttechnik GmbH	
	Calibration Details		*Last Execution*	*Next Exec.*
	Customized calibration		2014/03/12	2016/03/11

Test Equipment Temperature Chamber 05

Lab ID:	**Lab 2**
Manufacturer:	see single devices
Description:	Temperature Chamber VT4002
Type:	Vötsch
Serial Number:	see single devices

Single Devices for Temperature Chamber 05

Single Device Name	*Type*	*Serial Number*	*Manufacturer*	
Temperature Chamber Vötsch 05	VT 4002	58566080550010	Vötsch	
	Calibration Details		*Last Execution*	*Next Exec.*
	Customized calibration		2014/03/11	2016/03/10

Test Equipment WLAN RF Test Solution

Lab ID:	**Lab 3**
Manufacturer:	7 layers AG
Description:	Regulatory WLAN RF Tests
Type:	WLAN RF
Serial Number:	001

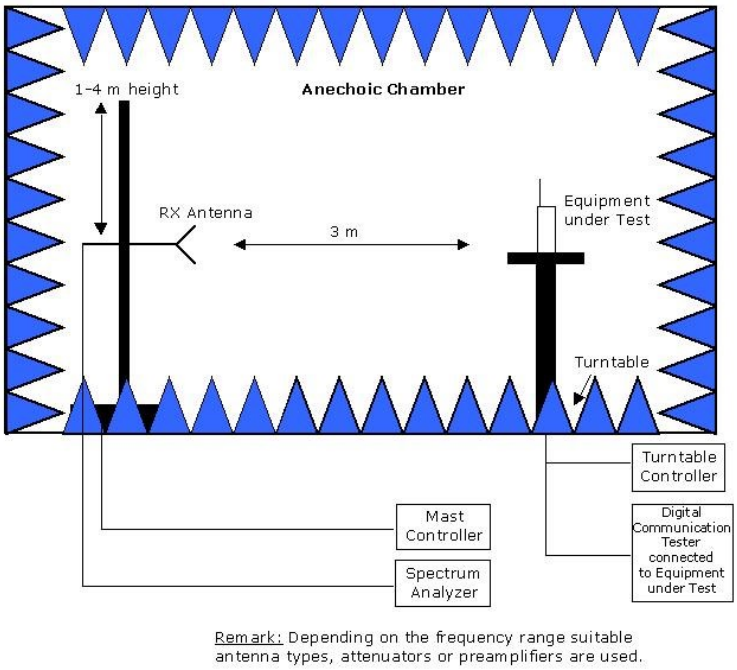
Single Devices for WLAN RF Test Solution

Single Device Name	*Type*	*Serial Number*	*Manufacturer*	
Arbitrary Waveform Generator	TGA12101	284482		
Power Meter NRVD	NRVD	832025/059		
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard calibration		2013/08/26	2014/08/25
Power Sensor NRV Z1 A	PROBE	832279/013		
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard calibration		2013/08/28	2014/08/27
Power Supply	NGSM 32/10	2725		
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard calibration		2013/06/20	2015/06/19
Rubidium Frequency Normal MFS	Datum MFS	002	Datum GmbH	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard calibration		2013/08/27	2014/08/26
Signal Analyser FSIQ26	1119.6001.26	832695/007	Rohde & Schwarz GmbH & Co.KG	
Spectrum Analyser	FSU26	100136	Rohde & Schwarz GmbH & Co.KG	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard Calibration		2014/01/06	2015/01/05
	HW/SW Status		*Date of Start*	*Date of End*
	FSU FW Update to v4.61 SP3, K5 v4.60 and K73 v4.61		2011/12/05	
Spectrum Analyser	FSU3	200046	Rohde & Schwarz GmbH & Co.KG	
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard calibration		2013/06/20	2014/06/30
	HW/SW Status		*Date of Start*	*Date of End*
	Firmware Version 4.51 SP1 Option FS-K72 4.50 SP1 Option FS-K73 4.50 SP1		2011/12/07	
TOCT Switching Unit	Switching Unit	040107	7 layers, Inc.	
Vector Signal Generator SMIQ03B	SMIQ03B	832870/017		
	Calibration Details		*Last Execution*	*Next Exec.*
	Standard calibration		2013/06/21	2016/06/20

5 Photo Report

Please refer to external report.

6 Setup Drawings



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