
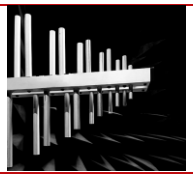
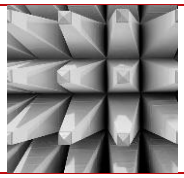

CETECOM™
CETECOM ICT Services
consulting - testing - certification

TEST REPORT

Test report no.: 1-9424/15-01-05-C

ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12076-01-00

Testing laboratory

CETECOM ICT Services GmbH
Untertuerkheimer Strasse 6 – 10
66117 Saarbruecken / Germany
Phone: + 49 681 5 98 - 0
Fax: + 49 681 5 98 - 9075
Internet: http://www.cetecom.com
e-mail: ict@cetecom.com

Accredited Testing Laboratory:
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2005) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12076-01-00

Applicant

Leica Microsystems CMS GmbH
Am Friedensplatz 3
68165 Mannheim / GERMANY
Phone: -/-
Fax: -/-
Contact: Jürgen Schulz
e-mail: juergen.schulz@leica-microsystems.com
Phone: +49 621 7028 2203

Manufacturer

Leica Microsystems CMS GmbH
Am Friedensplatz 3
68165 Mannheim / GERMANY

Test standard/s

47 CFR Part 15	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 8	Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
RSS - 210 Issue 8 Amendment 1	RSS-210, Amendment 1 — Licence-Exempt, Low-Power Radio Apparatus Operating in the Television Bands (February 2015)

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item:	**RF-ID 13.56 MHz module**
Model name:	**LID-Module 1.0**
FCC ID:	**2AEOL-LID-MODUL-1-0**
IC:	**20050-LIDMODUL1**
Frequency:	13.56 MHz
Technology tested:	RFID
Antenna:	Integrated PCB antenna
Power supply:	5.00 V DC by external power supply
Temperature range:	-5°C to +65°C

This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Test report authorised:

cn=Marco Bertolino, o=CETECOM ICT Services GmbH, ou=BTL-100826, email=marco.bertolino@cetecom.com, c=DE
2015.07.22 07:37:21 +02'00'

Marco Bertolino
Lab Manager
Radio Communications & EMC

Test performed:

p.o.

cn=Andreas Luckenbill, o=CETECOM ICT Services GmbH, ou=LUC-111202, email=andreas.luckenbill@cetecom.com, c=DE
2015.07.22 07:17:25 +02'00'

Tobias Wittenmeier
Testing Manager
Radio Communications & EMC

1 Table of contents

2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. CETECOM ICT Services GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.
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This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

2.2 Application details

Date of receipt of order:	2015-04-21
Date of receipt of test item:	2015-06-08
Start of test:	2015-06-08
End of test:	2015-06-10
Person(s) present during the test:	-/-

3 Test standard/s

Test standard	Date	Test standard description
47 CFR Part 15	-/-	Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 8	01.12.2010	Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
RSS - 210 Issue 8 Amendment 1	05.02.2015	RSS-210, Amendment 1 — Licence-Exempt, Low-Power Radio Apparatus Operating in the Television Bands (February 2015)
RSS - Gen Issue 4	01.11.2014	General Requirements & Information for the Certification of Radio Apparatus under test standards.

4 Test environment

Temperature:	T_{nom}	+22 °C	during room temperature tests
	T_{max}	+65 °C	during high temperature tests
	T_{min}	-5 °C	during low temperature tests
Relative humidity content:		55 %	
Barometric pressure:		not relevant for this kind of testing	
Power supply:	V_{nom}	5.00 V	DC by external power supply
	V_{max}	5.25 V	
	V_{min}	4.75 V	

5 Test item

Kind of test item	:	RF-ID 13.56 MHz module
Type identification	:	LID-Module 1.0
PMN	:	LID Module 1.0
HMN	:	-/-
HVIN	:	LID Module 1.0
FVIN	:	-/-
S/N serial number	:	987654
Frequency band	:	13.56 MHz
Type of radio transmission **Use of frequency spectrum**	: :	modulated carrier
Type of modulation	:	ASK
Number of channels	:	1
Antenna	:	Integrated PCB antenna
Power supply	:	5.00 V DC by external power supply
Temperature range	:	-5°C to +65°C

5.1 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup- and EUT-photos are included in test report: 1-9424/15-01-01_AnnexA
1-9424/15-01-01_AnnexB
1-9424/15-01-01_AnnexD

6 Test laboratories sub-contracted

None

7 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signalling equipment as well as measuring receivers and analysers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

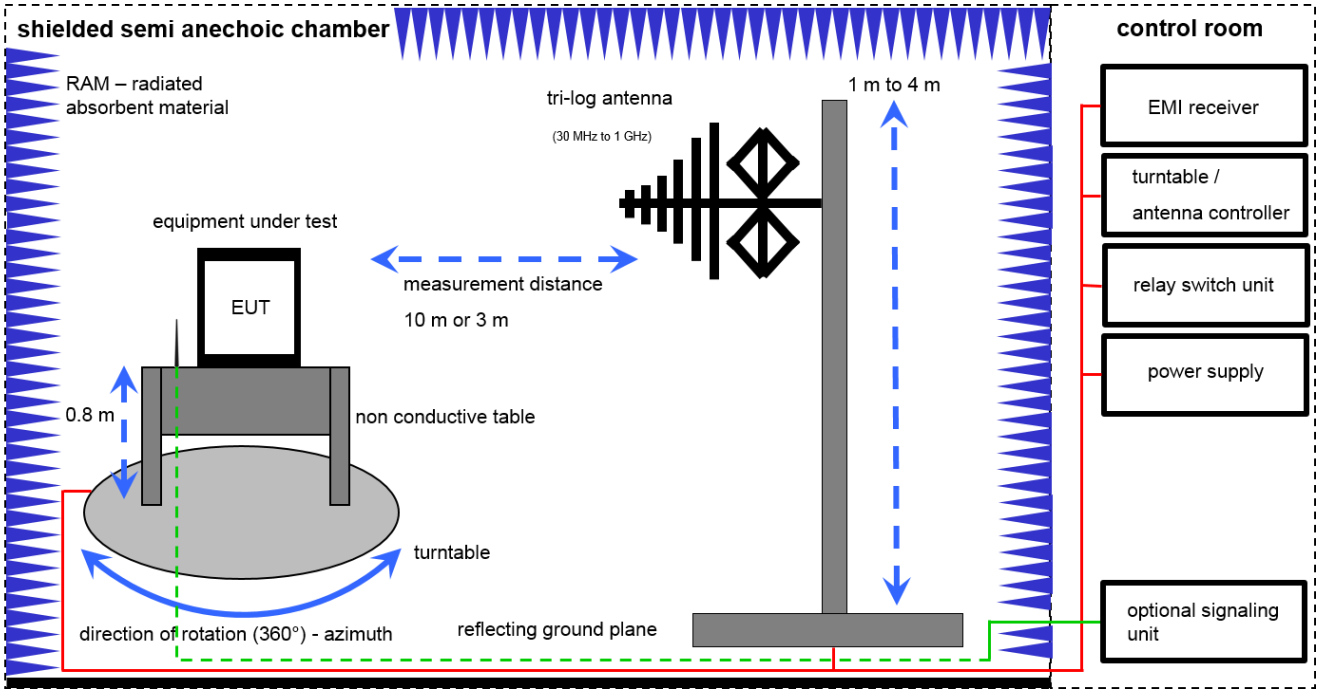
In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Agenda: Kind of Calibration

k	calibration / calibrated	EK	limited calibration
ne	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
vlkl!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

7.1 Shielded semi anechoic chamber

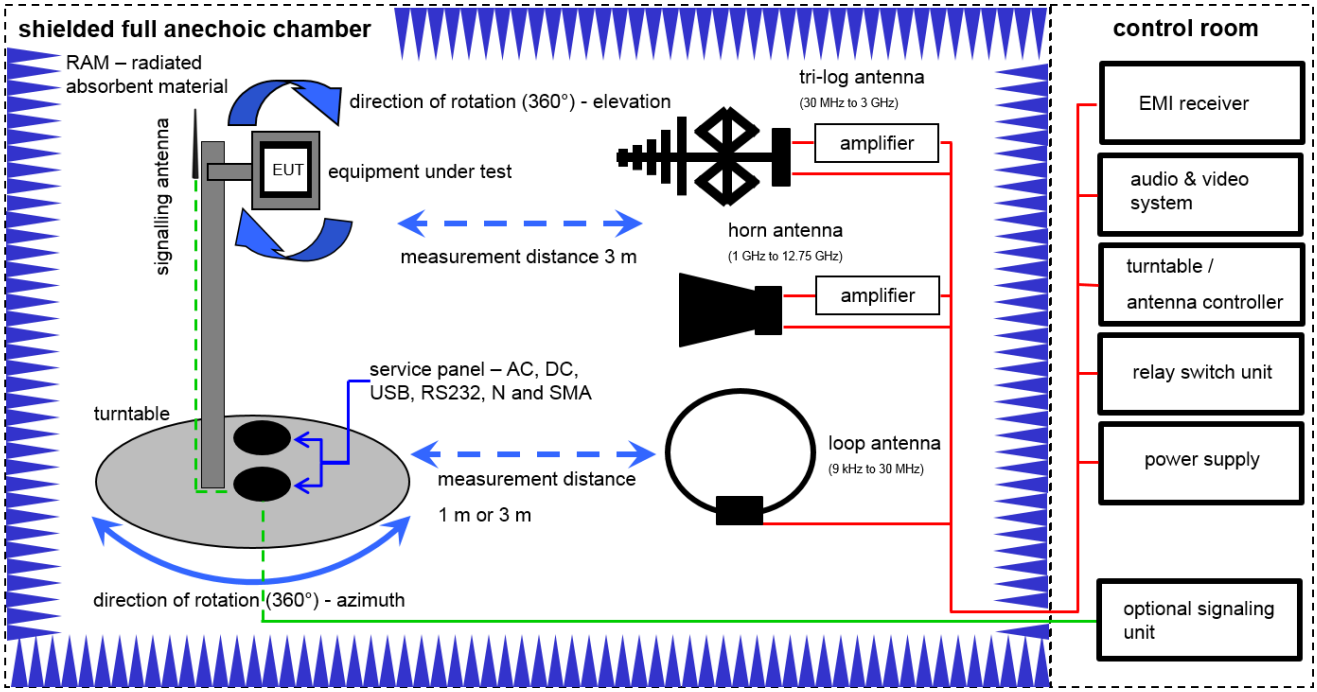
The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63.4-2013, American National Standard for Testing Unlicensed Wireless Devices. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analysers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.4-2013 and ANSI C63.10-2014



Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	45	Switch-Unit	3488A	HP	2719A14505	300000368	ev		
2	45	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	26.01.2015	26.01.2016
3	45	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	11.02.2014	11.02.2016
4	45	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw		
5	45	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw		
6	45	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw		
7	45	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787	k	22.04.2014	22.04.2016
8	45	Spectrum-Analyzer	FSU26	R&S	200809	300003874	k	26.01.2015	26.01.2016
9	45	Breitband Doppelsteg-Hornantenne	BBHA9120 B	Schwarzbeck	188	300003896	k	20.05.2015	20.05.2017

7.2 Shielded full anechoic chamber

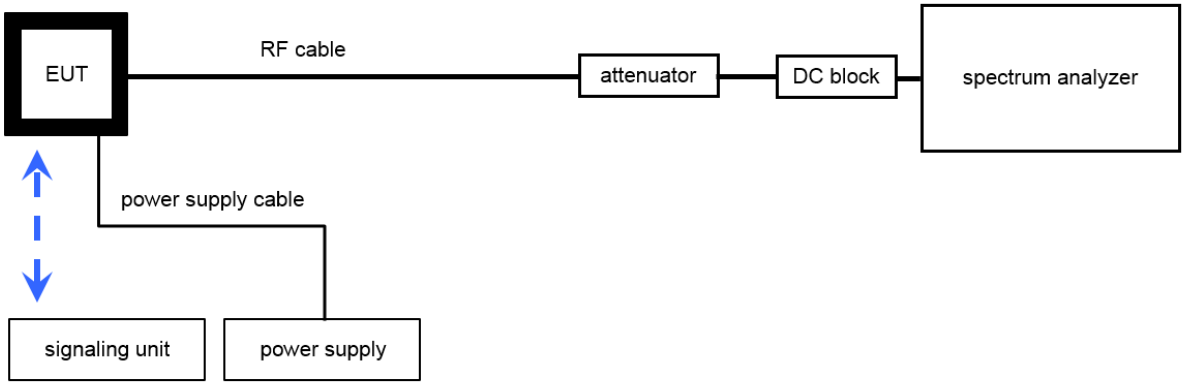


Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
2	n. a.	Switch / Control Unit	3488A	HP	*	300000199	ne		
3	90	Active Loop Antenna 10 kHz to 30 MHz	6502	Kontron Psychotech	8905-2342	300000256	k	13.06.2013	13.06.2015
4	90	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne		
5	90	MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	06.03.2015	06.03.2016
6	90	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne		

7.3 Conducted measurements

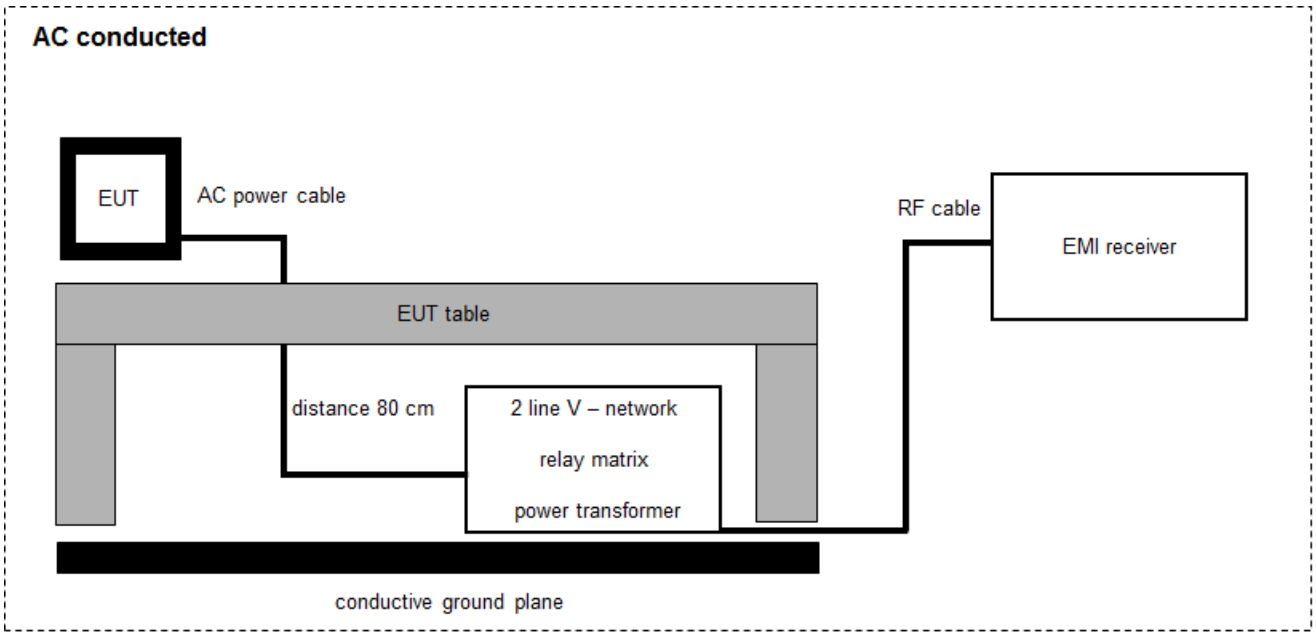
Conducted measurements normal conditions



Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Spectrum Analyzer 9kHz to 30GHz -140..+30dBm	FSP30	R&S	100886	300003575	k	26.08.2014	26.08.2016

7.4 AC conducted



Equipment table:

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	Isolating Transformer	RT5A	Grundig	8041	300001626	g		
2	9	Artificial Mains 9 kHz to 30 MHz	ESH3-Z5	R&S	828576/020	300001210	Ve	30.01.2014	30.01.2016
3	9	Relais Matrix	PSU	R&S	890167/024	300001168	ne		

8 Summary of measurement results

☒	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained
☐	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS 210 Issue 8 RSS Gen Issue 4	See table!	2015-07-22	-/-

Test specification clause	Test case	Temperature conditions	Power source conditions	Pass	Fail	NA	NP	Remark
RSS Gen Issue 4	Occupied bandwidth	Nominal	Nominal	☒	☐	☐	☐	complies
§ 15.225 (a)	Field strength of the fundamental	Nominal	Nominal	☒	☐	☐	☐	complies
§ 15.209 & § 15.225 (b-d)	Field strength of the harmonics and spurious	Nominal	Nominal	☒	☐	☐	☐	complies
§ 15.109	Receiver spurious emissions and cabinet radiations	Nominal	Nominal	☒	☐	☐	☐	complies
§15.107 §15.207	Conducted limits	Nominal	Nominal	☒	☐	☐	☐	complies
§ 15.225 (a)	Frequency tolerance	Normal & extreme conditions	Normal & extreme conditions	☒	☐	☐	☐	complies

Note: NA = Not Applicable; NP = Not Performed

9 Additional comments

Reference documents: None

Special test descriptions: The EUT was controlled by a special control box to operate in test mode.

Configuration descriptions: None

10 Measurement results

10.1 Occupied bandwidth

Measurement:

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal.

Measurement parameters	
Detector:	Peak
Resolution bandwidth:	1 % – 5 % of the occupied bandwidth
Video bandwidth:	≥ 3x RBW
Trace mode:	Max hold
Analyser function:	99 % power function

Limit:

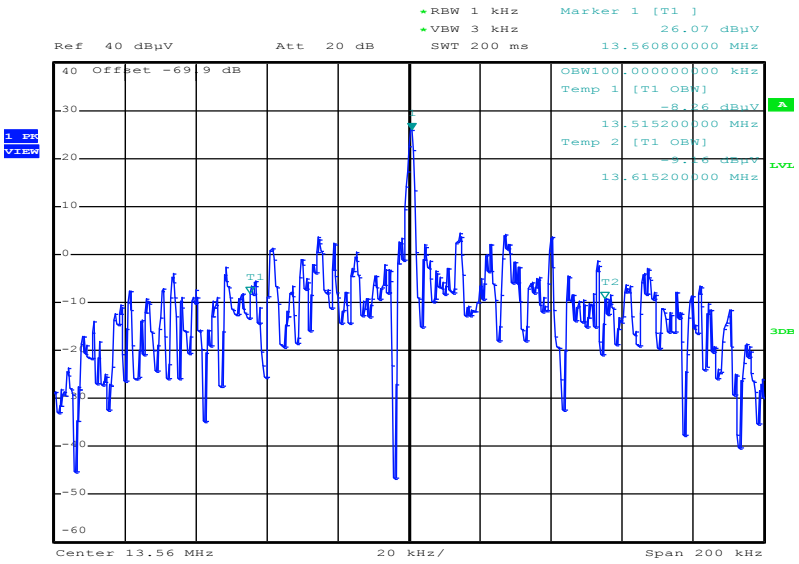
IC
for RSP-100 test report coversheet only

Result:

99% emission bandwidth	
100.0 kHz	
Measurement uncertainty	± RBW

Plot:

Plot 1: 99 % emission bandwidth



Date: 10.JUN.2015 11:11:06

10.2 Field strength of the fundamental

Measurement:

The maximum detected field strength for the carrier signal.

Measurement parameters	
Detector:	Quasi peak / peak (worst case)
Resolution bandwidth:	120 kHz
Video bandwidth:	≥ 3x RBW
Trace mode:	Max hold

Limit:

FCC & IC		
Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
13.553 to 13.567	15,848 (84 dBµV/m)	30

Recalculation:

According to ANSI C63.10		
Frequency	Formula	Correction value
13.56 MHz	$FS_{limit} = FS_{max} - 40\log\left(\frac{d_{nearfield}}{d_{measure}}\right) - 20\log\left(\frac{d_{limit}}{d_{nearfield}}\right)$	-21.76

ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices

Result:

Field strength of the fundamental		
Frequency	13.56 MHz	
Distance	@ 3 m	@ 30 m
Measured / calculated value	53.2 dBµV/m	31.44 dBµV/m
Measurement uncertainty	±3 dB	

10.3 Field strength of the harmonics and spurious

Measurement:

The maximum detected field strength for the harmonics and spurious.

Measurement parameters	
Detector:	Quasi peak / average or peak (worst case – pre-scan)
Resolution bandwidth:	F < 150 kHz: 200 Hz 150 kHz < F < 30 MHz: 9 kHz 30 MHz < F < 1 GHz: 120 kHz
Video bandwidth:	F < 150 kHz: 1 kHz 150 kHz < F < 30 MHz: 100 kHz 30 MHz < F < 1 GHz: 300 kHz
Trace mode:	Max hold

Limit:

FCC & IC		
Frequency (MHz)	Field strength (dBµV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30 (29.5 dBµV/m)	30
30 – 88	100 (40 dBµV/m)	3
88 – 216	150 (43.5 dBµV/m)	3
216 – 960	200 (46 dBµV/m)	3

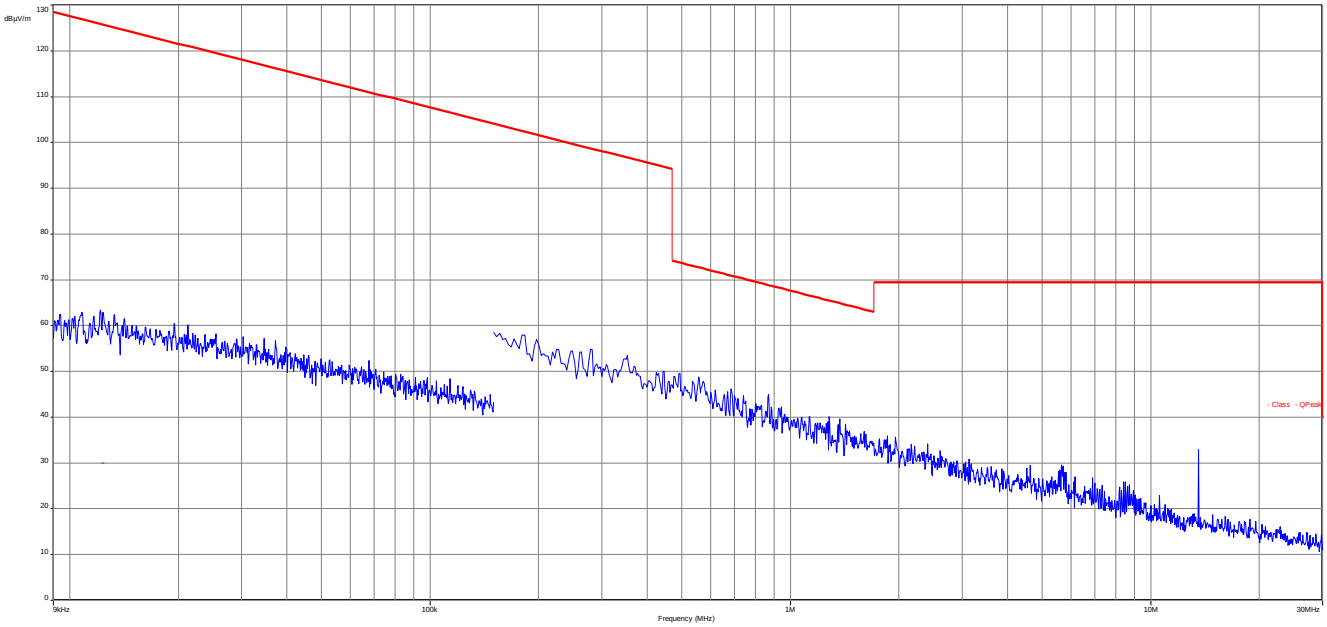
Note: For a reduced measurement distance, please take a look at the limit line and the ANSI C63.10-2013 sub clause 6.4 radiated emissions from unlicensed wireless devices below 30 MHz.

Result:

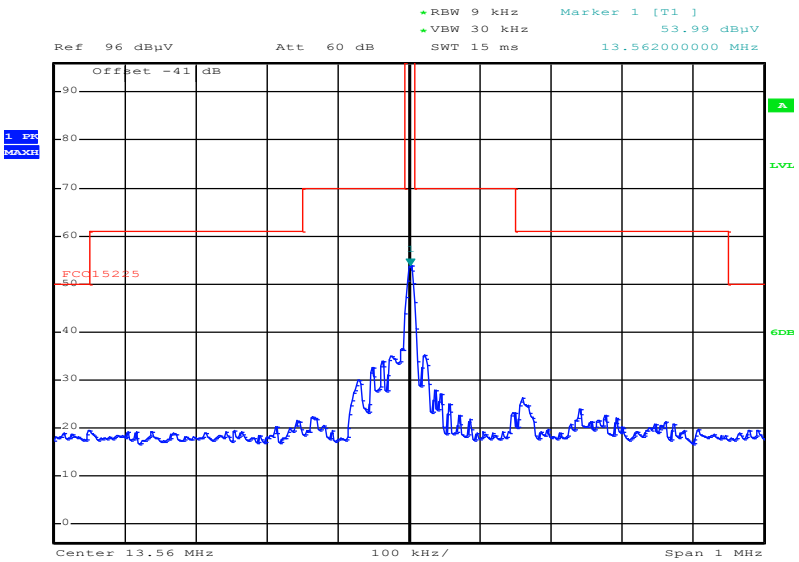
Detected emissions			
Frequency (MHz)	Detector	Resolution bandwidth (kHz)	Detected value
See result table below the 30 MHz to 1 GHz plot.			
Measurement uncertainty		±3 dB	

Plots:

Plot 1: 9 kHz – 30 MHz, magnetic emissions

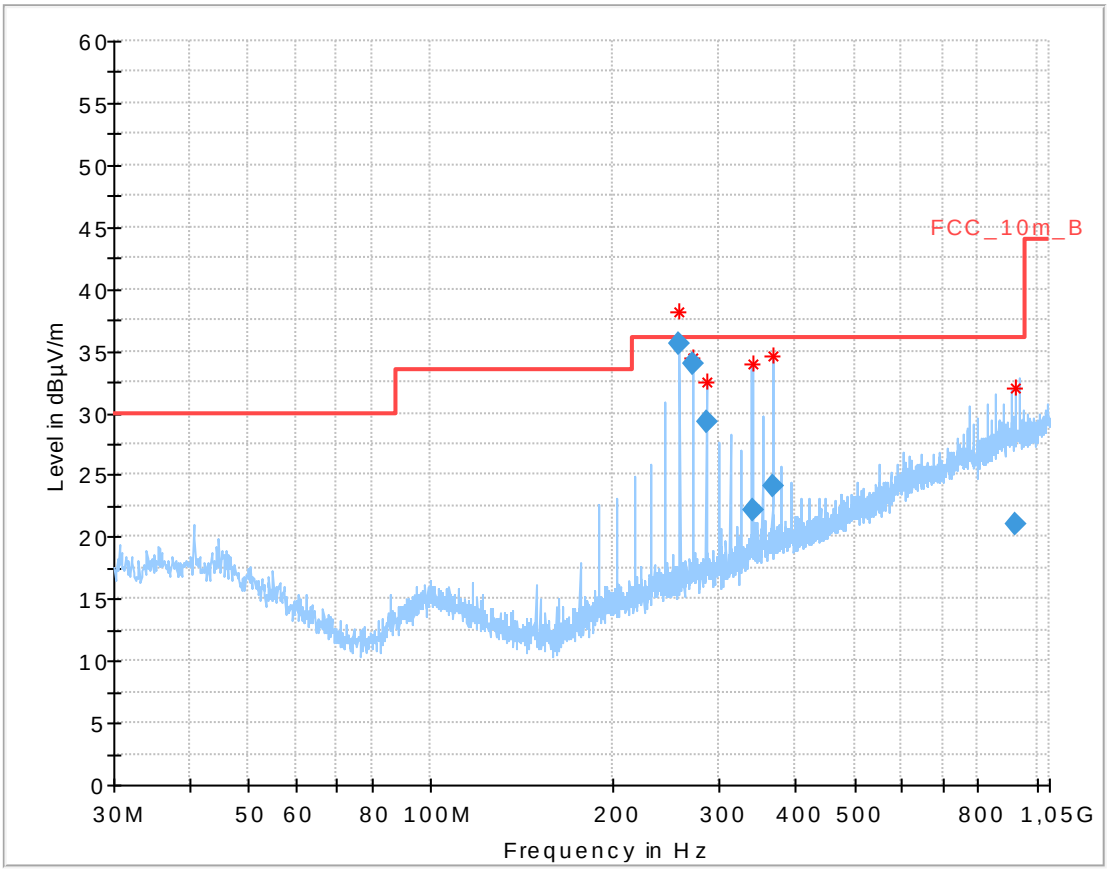


Plot 2: Spectrum mask (the limits are recalculated according to the ANSI C63.10-2013 sub clause 6.4), measured with peak detector (worst case)



Date: 10.JUN.2015 11:28:40

Plot 3: 30 MHz – 1 GHz, vertical and horizontal polarisation



Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
257.652300	35.58	36.00	0.42	1000.0	120.000	100.0	V	28	13.5
271.213500	33.90	36.00	2.10	1000.0	120.000	100.0	V	7	13.8
284.777100	29.27	36.00	6.73	1000.0	120.000	100.0	V	122	14.1
339.025950	22.11	36.00	13.89	1000.0	120.000	100.0	V	7	15.7
366.124350	24.04	36.00	11.96	1000.0	120.000	272.0	H	282	16.3
922.368900	20.96	36.00	15.04	1000.0	120.000	400.0	H	1	24.2

10.4 Receiver spurious emissions and cabinet radiations

Measurement:

The maximum detected field strength for the spurious.

Measurement parameters	
Detector:	Quasi peak / average or peak (worst case – pre-scan)
Resolution bandwidth:	F < 150 kHz: 200 Hz 150 kHz < F < 30 MHz: 9 kHz 30 MHz < F < 1 GHz: 120 kHz
Video bandwidth:	F < 150 kHz: 1 kHz 150 kHz < F < 30 MHz: 100 kHz 30 MHz < F < 1 GHz: 300 kHz
Trace mode:	Max hold

Limit:

FCC & IC		
Frequency (MHz)	Field strength (dBµV/m)	Measurement distance (m)
30 – 88	100 (40 dBµV/m)	3
88 – 216	150 (43.5 dBµV/m)	3
216 – 960	200 (46 dBµV/m)	3

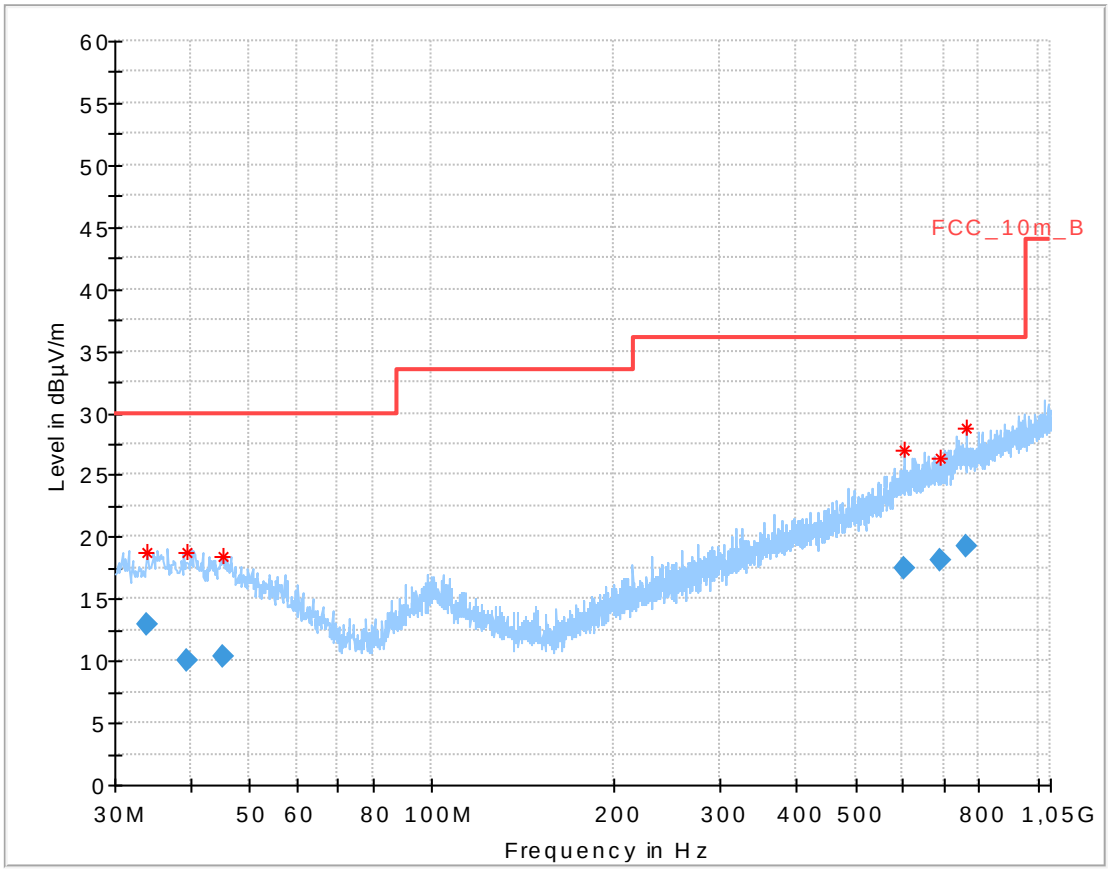
Note: For a reduced measurement distance, please take a look at the limit line and the ANSI C63.10-2013 sub clause 6.4 radiated emissions from unlicensed wireless devices below 30 MHz.

Result:

Detected emissions			
Frequency (MHz)	Detector	Resolution bandwidth (kHz)	Detected value
See result table below the 30 MHz to 1 GHz plot.			
Measurement uncertainty		±3 dB	

Plots:

Plot 1: 30 MHz – 1 GHz, vertical and horizontal polarisation



Final_Result:

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
33.996600	13.00	30.00	17.00	1000.0	120.000	200.0	V	320	13.7
39.313950	10.07	30.00	19.93	1000.0	120.000	103.0	H	256	14.0
45.124950	10.33	30.00	19.67	1000.0	120.000	101.0	V	7	13.8
601.134300	17.43	36.00	18.57	1000.0	120.000	101.0	V	252	20.7
689.136450	18.12	36.00	17.88	1000.0	120.000	200.0	V	142	21.4
761.588850	19.25	36.00	16.75	1000.0	120.000	200.0	H	97	22.7

10.5 Conducted spurious emissions < 30 MHz

Description:

Measurement of the conducted spurious emissions in transmit mode below 30 MHz. Both power lines, phase and neutral line, are measured. Found peaks are re-measured with average and quasi peak detection to show compliance to the limits.

Measurement:

Measurement parameter	
Detector:	Peak - Quasi Peak / Average
Sweep time:	Auto
Video bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Resolution bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Span:	9 kHz to 30 MHz
Trace-Mode:	Max Hold

Limits:

FCC		
Conducted Spurious Emissions < 30 MHz		
Frequency (MHz)	Quasi-Peak (dBµV/m)	Average (dBµV/m)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

*Decreases with the logarithm of the frequency

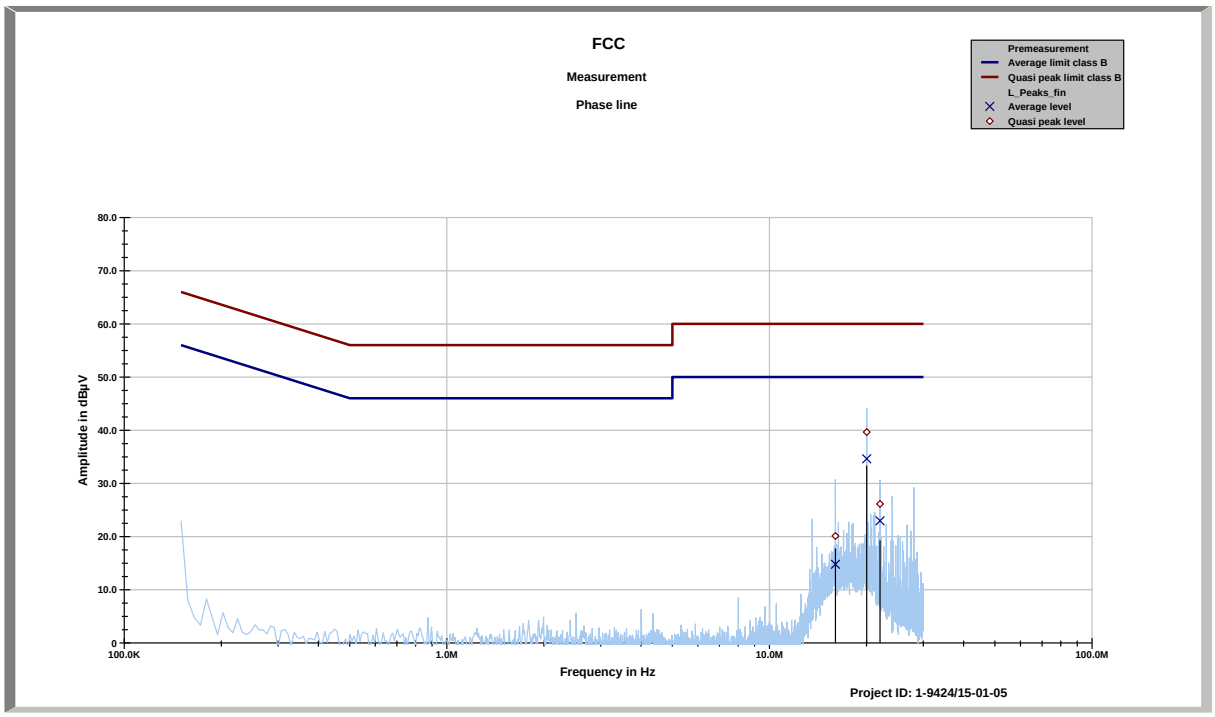
Results:

Conducted Spurious Emissions < 30 MHz [dBµV/m]		
F [MHz]	Detector	Level [dBµV/m]
All emissions were more than 10 dB below the limit.		
Measurement uncertainty	± 3 dB	

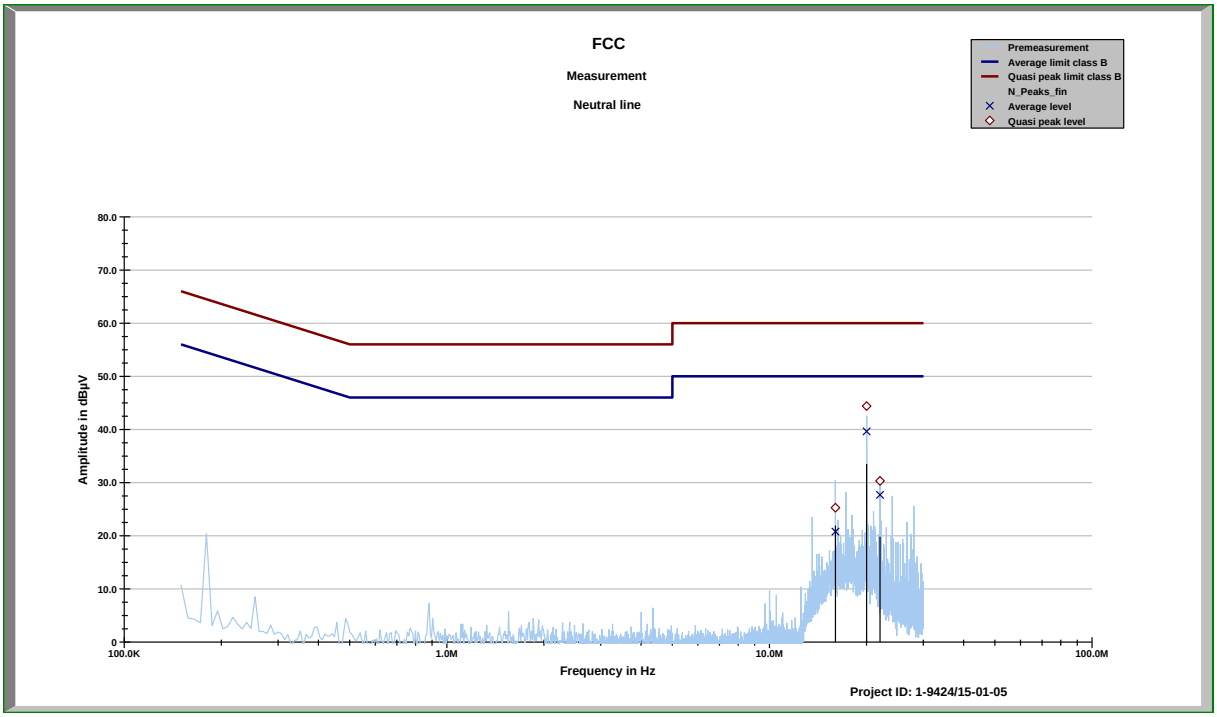
Result: passed.

Plots:

Plot 1: Phase line



Plot 2: Neutral line



10.6 Frequency error

Measurement:

The maximum detected field strength for the spurious.

Measurement parameters	
Detector:	Peak detector
Resolution bandwidth:	100 Hz
Video bandwidth:	> RBW
Trace mode:	Max hold

Limit:

FCC
The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. (±1.356 kHz)

Result: Temperature variation

Frequency tolerance		
Measured frequency (MHz)	Conditions	Result
13.560764	-5 °C & 100% voltage	complies
13.560756	0°C & 100% voltage	complies
13.560732	+10 °C & 100% voltage	complies
13.560762	+20 °C & 100% voltage	complies
13.560644	+30 °C & 100% voltage	complies
13.560608	+40 °C & 100% voltage	complies
13.560568	+50 °C & 100% voltage	complies
13.560544	+65 °C & 100% voltage	complies
Measurement uncertainty		± RBW

Result: Voltage variation

Frequency tolerance		
Measured frequency (MHz)	Temperature	Result
13.560674	+20 °C & 85% voltage	complies
13.560672	+20 °C & 100% voltage	complies
13.560672	+20 °C & 115% voltage	complies
Measurement uncertainty		± RBW

11 Observations

No observations except those reported with the single test cases have been made.

Annex A Document history

Version	Applied changes	Date of release
	Initial release	2015-06-17
-A	Correction of model name	2015-06-19
-B	Addition of AC Conducted	2015-06-30
-C	Editorial corrections	2015-07-22

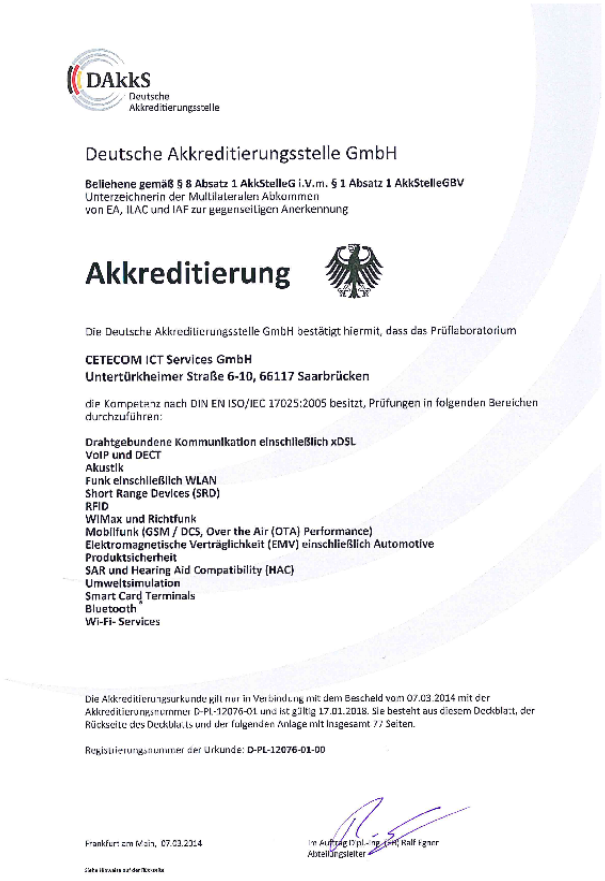
Annex B Further information

Glossary

AVG	-	Average
DUT	-	Device under test
EMC	-	Electromagnetic Compatibility
EN	-	European Standard
EUT	-	Equipment under test
ETSI	-	European Telecommunications Standard Institute
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
IC	-	Industry Canada
Inv. No.	-	Inventory number
N/A	-	Not applicable
PP	-	Positive peak
QP	-	Quasi peak
S/N	-	Serial number
SW	-	Software
PMN		Product marketing name
HMN		Host marketing name
HVIN		Hardware version identification number
FVIN		Firmware version identification number

Annex C Accreditation Certificate

Front side of certificate



DAkkS
Deutsche Akkreditierungsstelle

Deutsche Akkreditierungsstelle GmbH

Beliehene gemäß § 8 Absatz 1 AkkStelleG i.V.m. § 1 Absatz 1 AkkStelleGBV
Unterzeichnerin der Multilateralen Abkommen
von EA, ILAC und IAF zur gegenseitigen Anerkennung

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CETECOM ICT Services GmbH
Untertürkheimer Straße 6-10, 66117 Saarbrücken

die Kompetenz nach DIN EN ISO/IEC 17025:2005 besitzt, Prüfungen in folgenden Bereichen durchzuführen:

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Akustik
Funk einschließlich WLAN
Short Range Devices (SRD)
RFID
WiMax und Richtfunk
Mobilfunk (GSM / DCS, Over the Air (OTA) Performance)
Elektromagnetische Verträglichkeit (EMV) einschließlich Automotive
Produktsicherheit
SAR und Hearing Aid Compatibility (HAC)
Umweltsimulation
Smart Card Terminals
Bluetooth
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Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 07.03.2014 mit der Akkreditierungsnummer D-PL-12076-01 und ist gültig 17.01.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 77 Seiten.

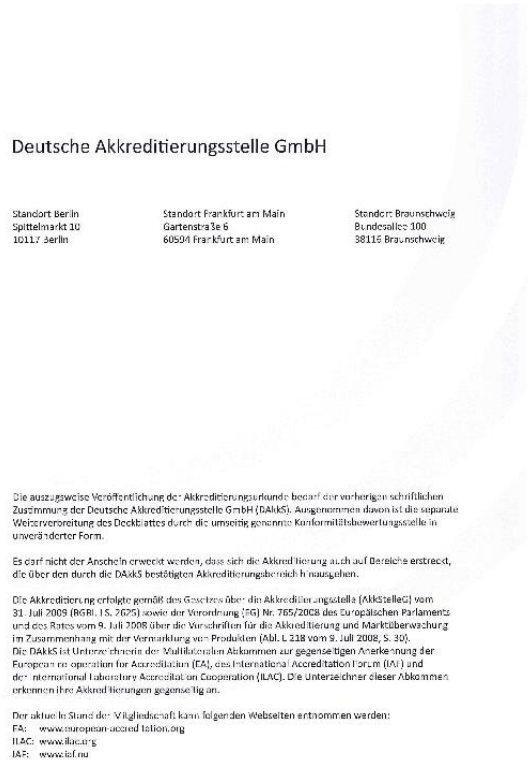
Registrierungsnummer der Urkunde: **D-PL-12076-01-00**

Frankfurt am Main, 07.03.2014

Im Auftrag Dipl.-Ing. (FH) Ralf Egner
Abteilungsleiter

Seite 1 von 2 auf der Rückseite

Back side of certificate



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Die Akkreditierung erfolgte gemäß des Gesetzes über die Akkreditierungsstelle (AkkStelleG) vom 31. Juli 2009 (BGBl. I S. 2625) sowie der Verordnung (EG) Nr. 765/2008 des Europäischen Parlaments und des Rates vom 9. Juli 2008 über die Vorschriften für die Akkreditierung und Marktüberwachung im Zusammenhang mit der Vermarktung von Produkten (Abl. L 218 vom 9. Juli 2008, S. 30).
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Note:

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