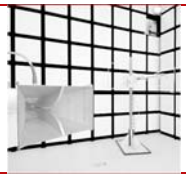
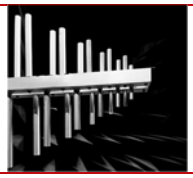
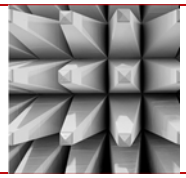

CETECOM™

CETECOM ICT Services
consulting - testing - certification

TEST REPORT

Test report no.: 1-0852/15-01-02-A

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

Pilz GmbH & Co. KG
Felix-Wankel-Straße 2
73760 Ostfildern / GERMANY
Phone: +49 711 340-90
Fax: +49 711 340-99691
Contact: Jürgen Kitzing
e-mail: j.kitzing@pilz.de
Phone: +49 711 340-9691

Manufacturer

ELESTA GmbH
Heuteilstr. 18
7310 Bad Ragaz / SWITZERLAND

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

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

Test Item

Kind of test item:	**RFID Proximity switch**
Model name:	**PSEN ml b 2.1, PSEN ml b 1.1, PSEN ml b 2.2**
Frequency:	125 kHz
Technology tested:	RFID
Antenna:	Integrated antenna
Power supply:	24 V DC by external power supply
Temperature range:	0°C to +55°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 authorized:

p.o.
cn=Stefan Boes, o=CETECOM ICT Services GmbH, ou=BOE-111011, email=Stefan.Boes@cetecom.com, c=DE
2016.07.07 11:57:07 +02'00'

Andreas Luckenbill
Lab Manager
Radio Communications & EMC

Test performed:

p.o.
cn=Marco Bertolino, o=CETECOM ICT Services GmbH, ou=BTL-150828, email=marco.bertolino@cetecom.com, c=DE
2016.07.07 11:11:26 +02'00'

Stefan Sachs
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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In no case this test report can be considered as a Letter of Approval.

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.

This test report replaces test report 1-0852/15-01-02 issued 2016-04-01.

2.2 Application details

Date of receipt of order:	2016-03-10
Date of receipt of test item:	2016-03-10
Start of test:	2016-03-11
End of test:	2016-04-01
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	December 2010 Updated May 2015	Spectrum Management and Telecommunications Radio Standards Specification - Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
RSS - Gen Issue 4	November 2014	Spectrum Management and Telecommunications Radio Standards Specifications - General Requirements and Information for the Certification of Radio Apparatus

4 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	20 °C during room temperature tests No tests under extreme conditions No tests under extreme conditions
Relative humidity content	:		47 %
Barometric pressure	:		not relevant for this kind of testing
Power supply	:	V_{nom} V_{max} V_{min}	24 V DC by external power supply No tests under extreme conditions No tests under extreme conditions

5 Test item

5.1 General description

Kind of test item	:	RFID Proximity switch
Type identification	:	PSEN ml b 2.1, PSEN ml b 1.1, PSEN ml b 2.2
S/N serial number	:	-/-
PMN	:	PSEN ml
HMN	:	-/-
HVIN	:	PSEN ml b 2.1, PSEN ml b 1.1, PSEN ml b 2.2
FVIN	:	-/-
HW hardware status	:	107337-06
SW software status	:	V1.00, 2.1 coding
Frequency band	:	125 kHz
Type of radio transmission Use of frequency spectrum	: :	modulated carrier
Type of modulation	:	Manchester ASK
Number of channels	:	1
Antenna	:	Integrated antenna
Power supply	:	24 V DC by external power supply
Temperature range	:	0 °C to +55 °C

5.2 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: 1-0852/15-01-01_AnnexA
1-0852/15-01-01_AnnexB
1-0852/15-01-01_AnnexC

6 Test laboratories sub-contracted

None

7 Description of the test setup

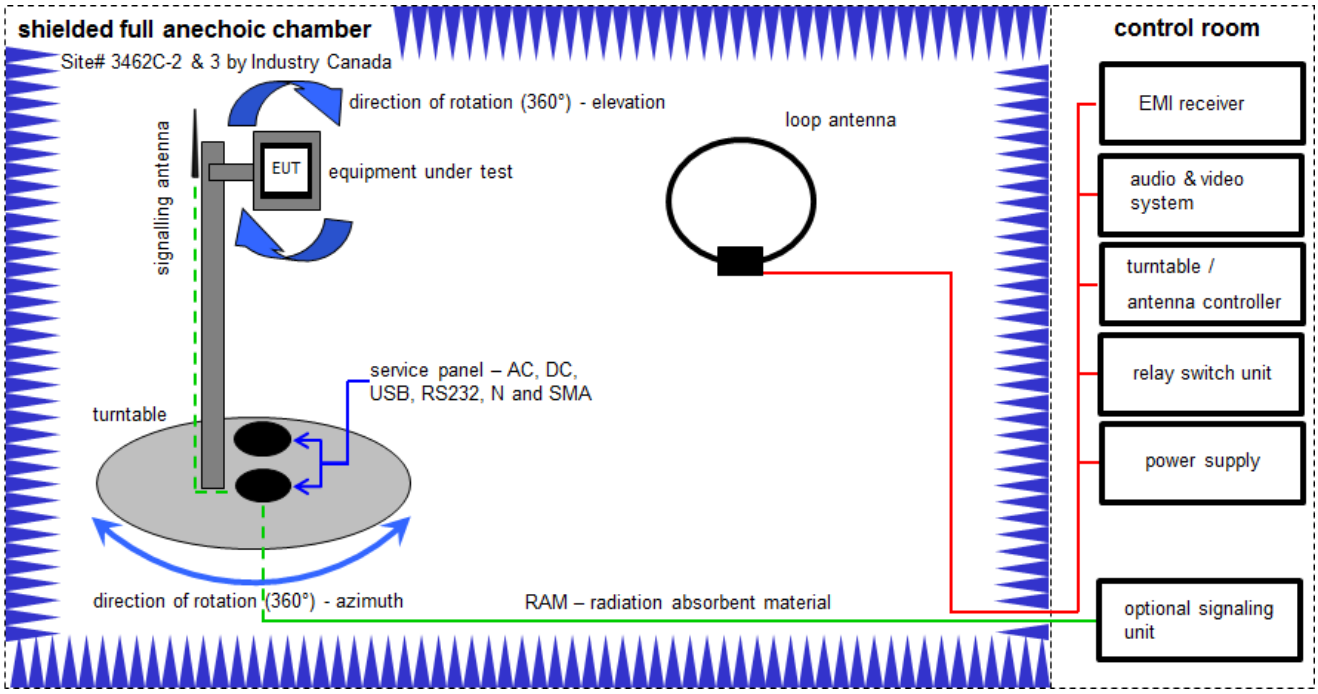
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers 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 fully anechoic chamber



Measurement distance: loop antenna 3 meter

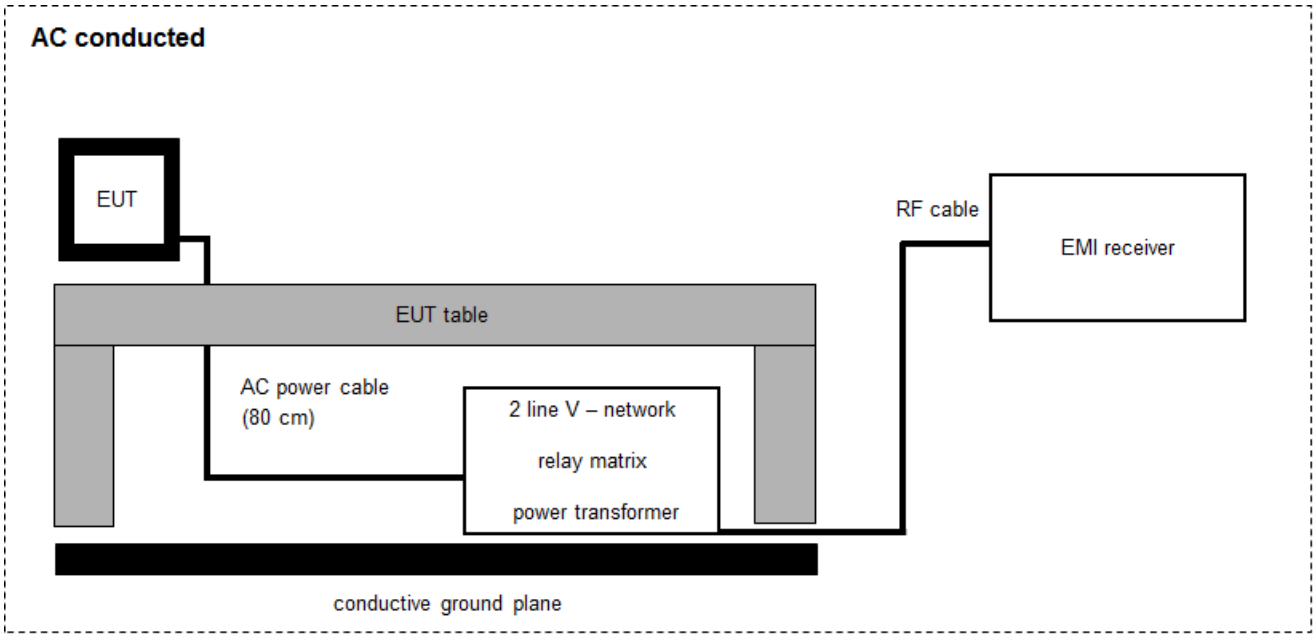
FS = UR + CA + AF
(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

Example calculation:
FS [dBµV/m] = 40.0 [dBµV/m] + (-35.8) [dB] + 32.9 [dB/m] = 37.1 [dBµV/m] (71.61 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1		DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	Ve	20.01.2015	20.01.2018
2		Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
3		Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
4		Active Loop Antenna 10 kHz to 30 MHz	6502	EMCO/2	8905-2342	300000256	k	24.06.2015	24.06.2017
5		4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
6		EMI Test Receiver 9kHz-26,5GHz	ESR26	R&S	101376	300005063	k	04.09.2015	04.09.2016

7.2 AC conducted



FS = UR + CF + VC
(FS-field strength; UR-voltage at the receiver; CR-loss of the cable and filter; VC-correction factor of the ISN)

Example calculation:
FS [dBµV/m] = 37.62 [dBµV/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dBµV/m] (244.06 µV/m)

Equipment table:

No.	Lab / Item	Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	A	Two-line V-Network (LISN) 9 kHz to 30 MHz	ESH3-Z5	R&S	892475/017	300002209	k	17.06.2014	17.06.2016
2	A	MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	06.03.2015	06.03.2016
3	A	software	SPS_PHE 1.4f	Spitzenberger & Spiess	B5981; 5D1081;B5979	300000210	ne	-/-	-/-
4	A	Power supply	NGSM 32/10	R&S	192.0810.31	-/-	Ne……	-/-	-/-

8 Summary of measurement results

☒ **No deviations from the technical specifications were ascertained**

☐ There were deviations from the technical specifications ascertained

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS Gen. Issue 3	Passed	2016-07-07	-/-

Test Specification Clause	Test Case	Temperature Conditions	Power Source Voltages	C	NC	NA	NP	Results
§ 15.35 (c) / RSS-GEN Issue 3 Section 4.5	Timing of the transmitter (Duty cycle correction factor)	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 2.1049 / RSS-Gen.	Bandwidth of the modulated carrier	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.209 / RSS-Gen.	Fieldstrength of fundamental	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.209 (a) / RSS-Gen.	Fieldstrength of harmonics and spurious	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.109 / RSS-Gen.	Receiver spurious emissions	Nominal	Nominal	☐	☐	☒	☐	Co-located receiver
§ 15.107 / § 15.207	Conducted limits	Nominal	Nominal	☒	☐	☐	☐	-/-

Note: C = Compliant; NC = Not Compliant; NA = Not Applicable; NP = Not Performed

8.1 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: None

9 Measurement results

9.1 Timing of the transmitter

Limits:

FCC	IC
Timing of the transmitter	
(c) Unless otherwise specified, e.g. Section 15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.	

Duty cycle of the sample with test mode: 100%

In normal use the duty cycle is approximately 100% (declared by the manufacturer).

9.2 Bandwidth of the modulated carrier

Limits:

FCC	IC
Bandwidth of the modulated carrier	

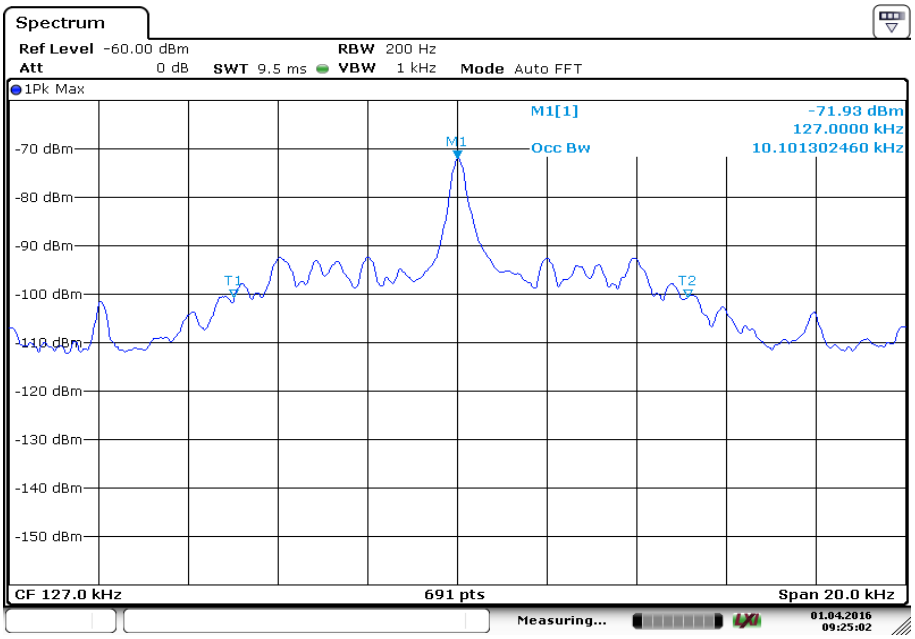
Measured with the integrated OBW-function of the spectrum analyzer Rohde&Schwarz FSV40 (measurement criteria is the integrated power in %)

Result:

	Occupied Bandwidth (kHz)
99%-bandwidth	10.1

Plots of the measurement

Plot 1: 99% – bandwidth



Date: 1.APR.2016 09:25:02

9.3 Field strength of the fundamental

Measurement:

Measurement parameter	
Detector:	AVG
Resolution bandwidth:	10 kHz
Trace-Mode:	Max Hold

Limits:

FCC		IC
Fundamental Frequency (MHz)	**Field strength of Fundamental (dBµV/m)**	**Measurement distance (m)**
125 kHz	19.2	300

Result:

TEST CONDITIONS		MAXIMUM POWER (dBµV/m)	
Frequency		125 kHz	125 kHz
Mode		at 1 m distance	at 300 m distance
T_{nom}	V_{nom}	46	-54
Measurement uncertainty		±3dB	

Recalculation to a measurement distance of 300m with a correction of 40 dB/decade.

9.4 Field strength of the harmonics and spurious

Measurement:

Measurement parameter	
Detector:	Peak / Average / Quasi Peak
Sweep time:	Auto
Resolution bandwidth:	F < 150 kHz: 200 Hz 150 kHz > F > 30 MHz: 9 kHz F > 30 MHz: 120 kHz
Video bandwidth:	F < 150 kHz: 1 kHz 150 kHz > F > 30 MHz: 100 kHz F > 30 MHz: 300 kHz
Span:	See plot
Trace-Mode:	Max Hold

Limits:

FCC		IC
Field strength of the harmonics and spurious.		
Frequency (MHz)	**Field strength (µV/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

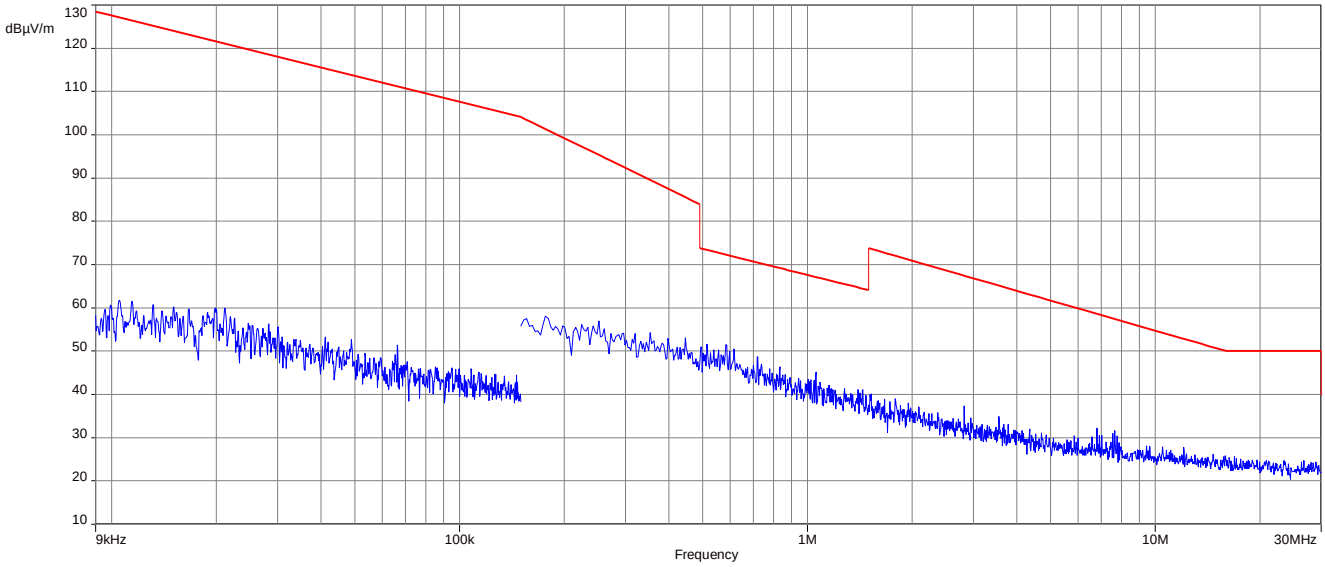
Result:

EMISSION LIMITATIONS				
f [MHz]	Detector	Limit max. allowed [dBµV/m]	Amplitude of emission [dBµV/m]	Results
All detected emissions are more than 10 dB below the limit.				

Note: The limit was recalculated with 20 dB / decade (Part 15.31) for all radiated spurious emissions 30 MHz to 1 GHz from 3 meter limit to a 10 meter distance. (40dB/decade for emissions < 30MHz)

Plots of the measurements

Plot 1: 9 kHz – 30 MHz



9.5 Conducted limits

Measurement:

Measurement parameter	
Detector:	Peak / Quasi-Peak / Average
Sweep time:	Auto
Resolution bandwidth:	9 kHz
Video bandwidth:	50 kHz
Span:	30 MHz
Trace-Mode:	Max Hold

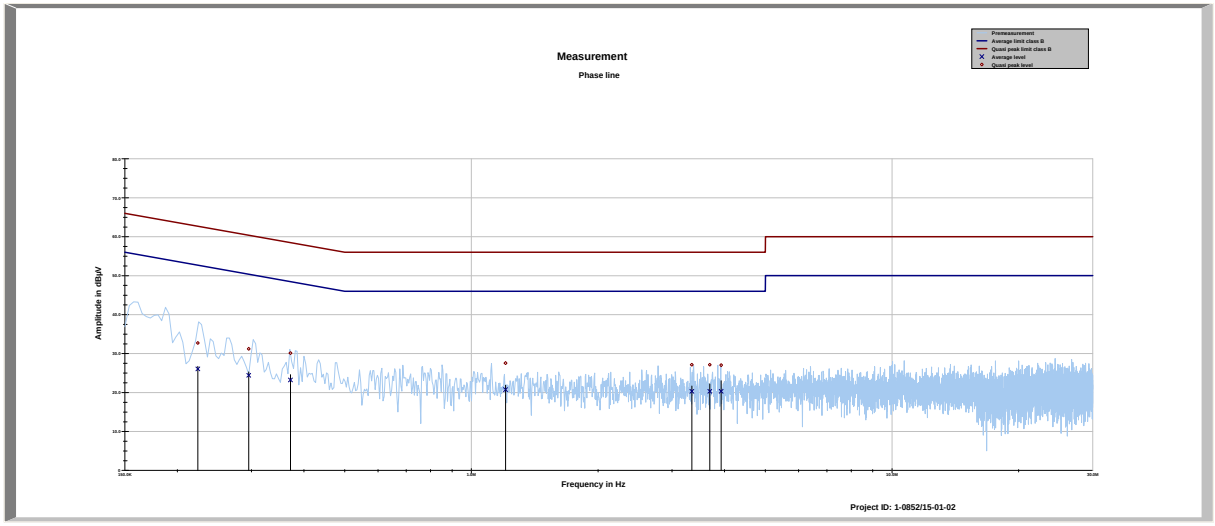
Limits:

FCC	IC	
Conducted limits		
Frequency of Emission (MHz)	**Conducted Limit (dBµV)**	
	Quasi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 - 30	60	50

*Decreases with the logarithm of the frequency

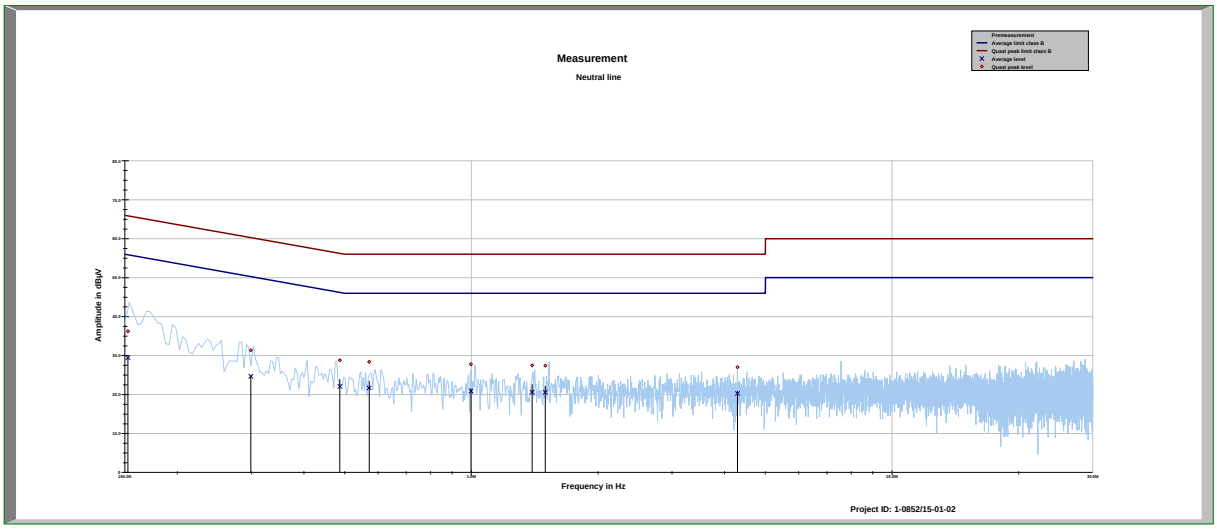
Plots:

Plot 1: phase line



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.146951	17.82			14.41		
0.223677	32.71	29.97	62.681	26.07	27.83	53.895
0.295641	31.20	29.16	60.364	24.43	27.41	51.839
0.371335	30.12	28.35	58.471	23.23	26.45	49.676
1.205399	27.55	28.45	56.000	20.73	25.27	46.000
3.341725	27.12	28.88	56.000	20.31	25.69	46.000
3.687669	27.12	28.88	56.000	20.30	25.70	46.000
3.923586	27.02	28.98	56.000	20.31	25.69	46.000

Plot 2: neutral line



Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.152572	36.23	29.63	65.859	29.46	26.47	55.927
0.298974	31.34	28.93	60.271	24.68	27.07	51.744
0.486744	28.83	27.40	56.223	22.08	24.30	46.379
0.571495	28.38	27.62	56.000	21.69	24.31	46.000
0.998040	27.77	28.23	56.000	20.91	25.09	46.000
1.395500	27.47	28.53	56.000	20.61	25.39	46.000
1.498806	27.40	28.60	56.000	20.57	25.43	46.000
4.293142	27.00	29.00	56.000	20.25	25.75	46.000

Annex A Document history

Version	Applied changes	Date of release
	Initial release	2016-04-01
-A	Editorial corrections	2016-07-07

Annex B Further information

Glossary

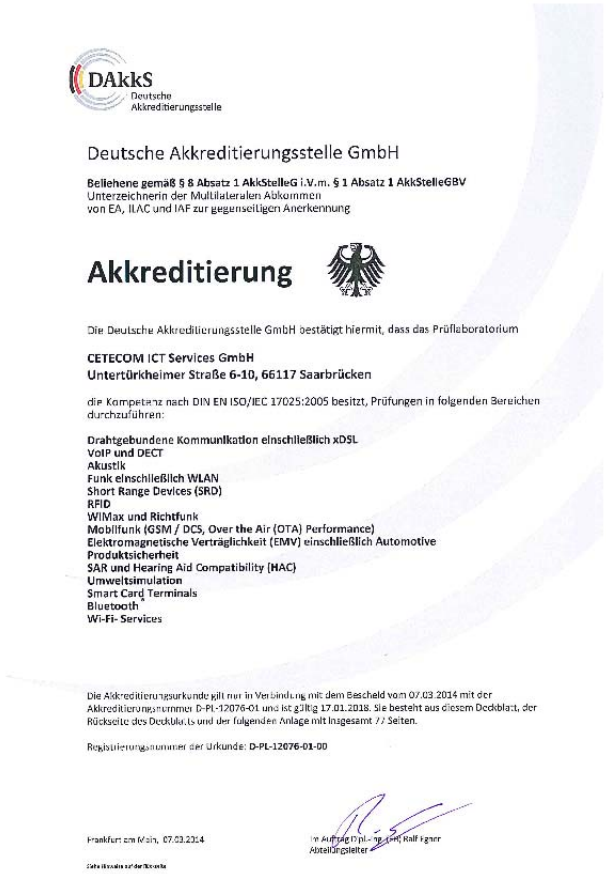
AVG - Average
DUT - Device under test
EMC - Electromagnetic Compatibility
EN - European Standard
EUT - Equipment under test
ETSI - European Telecommunications Standard Institute
FCC - Federal Communication Commission
FCC ID - Company Identifier at FCC
HW - Hardware
IC - Industry Canada
Inv. No. - Inventory 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 Observations

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

Annex D 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

Akkreditierung

Die Deutsche Akkreditierungsstelle GmbH bestätigt hiermit, dass das Prüflaboratorium

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:

Drahtgebundene Kommunikation einschließlich xDSL
VoIP und DECT
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
Wi-Fi- Services

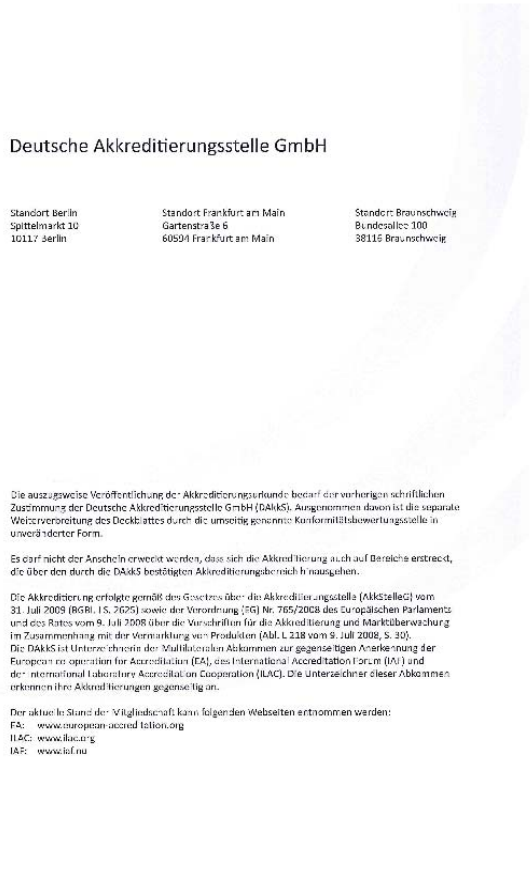
Die Akkreditierungsurkunde gilt nur in Verbindung mit dem Bescheid vom 07.03.2014 mit der Akkreditierungsnummer D-PL-12076-01 und ist gültig 17.01.2018. Sie besteht aus diesem Deckblatt, der Rückseite des Deckblatts und der folgenden Anlage mit insgesamt 77 Seiten.

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

Frankfurt am Main, 07.03.2014

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

Back side of certificate



Deutsche Akkreditierungsstelle GmbH

Standort Berlin
Spittelmarkt 10
10117 Berlin

Standort Frankfurt am Main
Gartenstraße 6
60594 Frankfurt am Main

Standort Braunschweig
Bundesallee 100
38116 Braunschweig

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Die DAkkS ist Unterzeichnerin der Multilateralen Abkommen zur gegenseitigen Anerkennung der European co-operation for Accreditation (EA), des International Accreditation Forum (IAF) und der International Laboratory Accreditation Cooperation (ILAC). Die Unterzeichner dieser Abkommen erkennen ihre Akkreditierungen gegenseitig an.

Der aktuelle Stand der Mitgliedschaft kann folgenden Webseiten entnommen werden:
EA: www.european-accreditation.org
ILAC: www.ilac.org
IAF: www.iaf.nu

Note:
The current certificate including annex may be received from CETECOM ICT Services on request.