**CETECOM™****CETECOM ICT Services**
consulting - testing - certification >>>

TEST REPORT

Test report no.: 1-8575/14-02-02

Deutsche
Akkreditierungsstelle
D-PL-12076-01-00

Testing laboratory

CETECOM ICT Services GmbH

Untertuerkheimer Strasse 6 – 10

66117 Saarbruecken / Germany

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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

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ifm-Straße 1

88069 Tett nang / GERMANY

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Contact: Bernd Kehr

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Manufacturer

ifm electronic gmbh

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88069 Tett nang / 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

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

Test Item

Kind of test item: 13.56 MHz RFID Reader**Model name:** DTM425**FCC ID:** UN6-DTMHFGN**IC:** 6799A-DTMHFGN

Frequency: 13.56 MHz

Technology tested: RFID

Antenna: Integrated antenna

Power supply: 24 V DC by external power supply

Temperature range: -20°C to +85°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
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2015.02.10 15:12:12 +01'00'

Marco Bertolino
Radio Communications & EMC

Test performed:

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Christoph Schneider
Radio Communications & EMC

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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:	2015-01-09
Date of receipt of test item:	2014-12-09
Start of test:	2015-01-26
End of test:	2015-01-30
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

4 Test environment

Temperature:	T_{nom}	+22 °C during room temperature tests
	T_{max}	+85 °C during high temperature tests
	T_{min}	-20 °C during low temperature tests
Relative humidity content:		38 %
Barometric pressure:		not relevant for this kind of testing
Power supply:	V_{nom}	24 V DC by external power supply
	V_{max}	32 V
	V_{min}	9 V

5 Test item

Kind of test item	:	13.56 MHz RFID Reader
Type identification	:	DTM425
S/N serial number	:	-/-
HW hardware status	:	-/-
SW software status	:	-/-
Frequency band	:	13.56 MHz
Type of radio transmission	:	Modulated carrier
Use of frequency spectrum	:	
Type of modulation	:	N1N
Number of channels	:	1
Antenna	:	Integrated antenna
Power supply	:	24 V DC by external power supply
Temperature range	:	-20°C to +85 °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: 1-8575/14-02-01_AnnexA
 1-8575/14-02-01_AnnexB
 1-8575/14-02-01_AnnexD

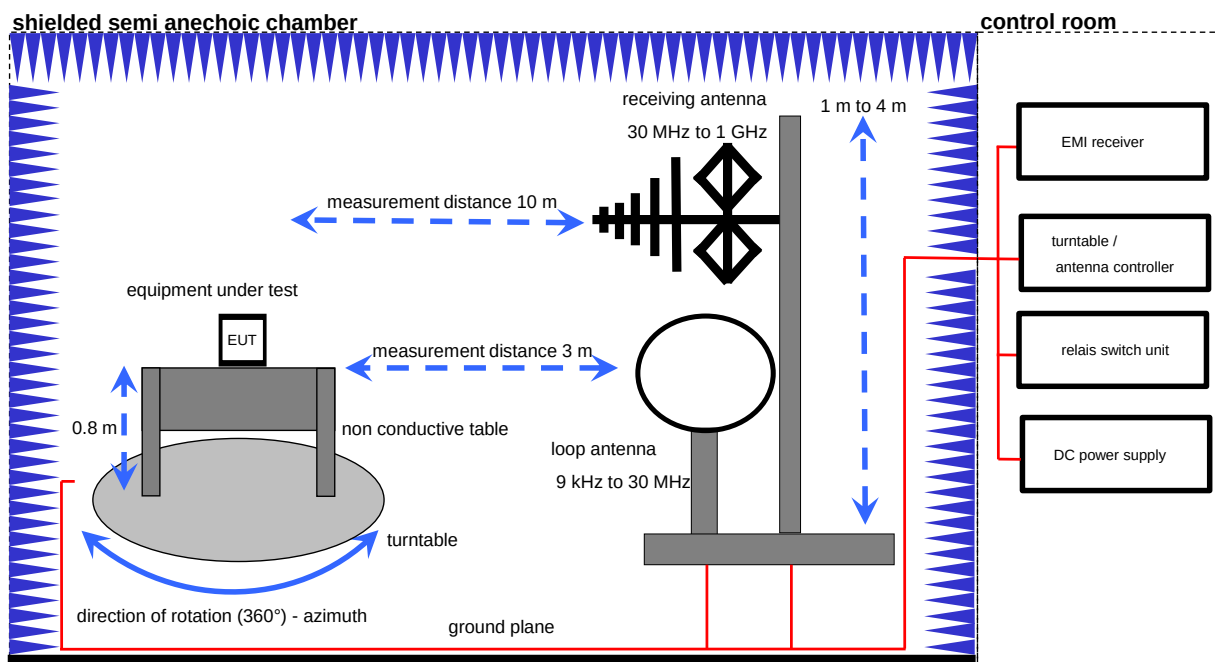
6 Test laboratories sub-contracted

None

7 Description of the test setup

7.1 Radiated measurements

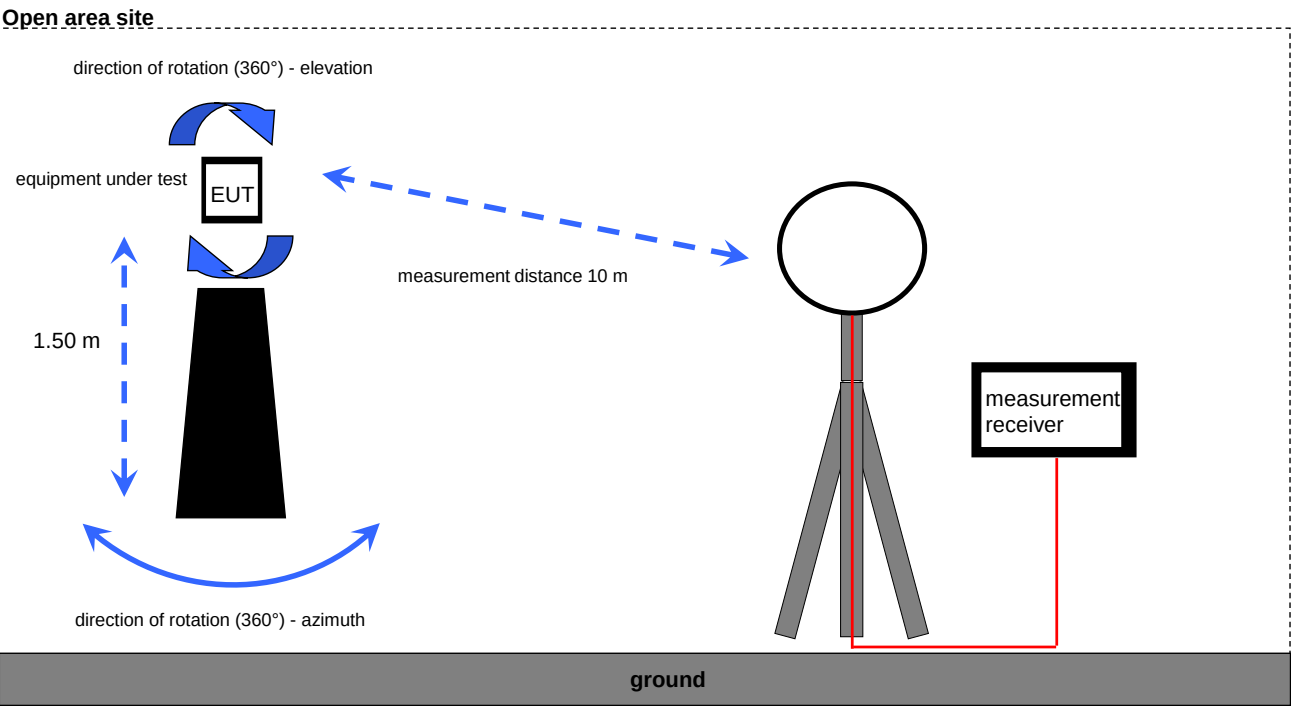
The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are confirmed with specifications ANSI C63. 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.



Equipment table:

Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom
Software	EMC32 V. 9.12.05	R&S	-/-	-/-
Switch-Unit	3488A	HP Meßtechnik	2719A14505	300000368
DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2920A04466	300000580
EMI Test Receiver	ESCI 3	R&S	100083	300003312
Amplifier	JS42-00502650-28-5A	MITEQ	1084532	300003379
Antenna Tower	Model 2175	ETS-LINDGREN	64762	300003745
Positioning Controller	Model 2090	ETS-LINDGREN	64672	300003746
Turntable Interface-Box	Model 105637	ETS-LINDGREN	44583	300003747
TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	295	300003787
Test Receiver	ESH2	R&S	871921/095	300002505
Loop Antenna 9 KHz - 30 MHz	HFH2-Z2	R&S	872096/61	300001824
EMI Test Receiver 9 kHz - 3 GHz incl. Preselector	ESPI3	R&S	101713	300004059

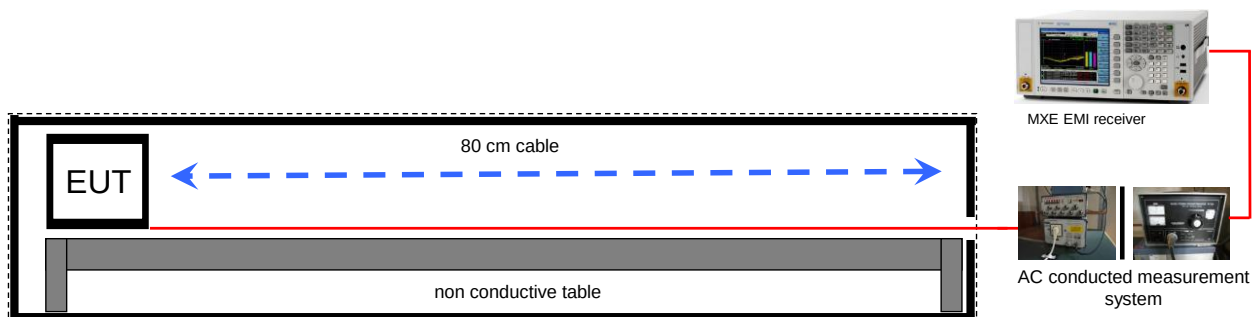
7.2 Open area site



Equipment table:

Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom
Test Receiver	ESH2	R&S	871921/095	300002505
Loop Antenna 9 KHz - 30 MHz	HFH2-Z2	R&S	872096/61	300001824

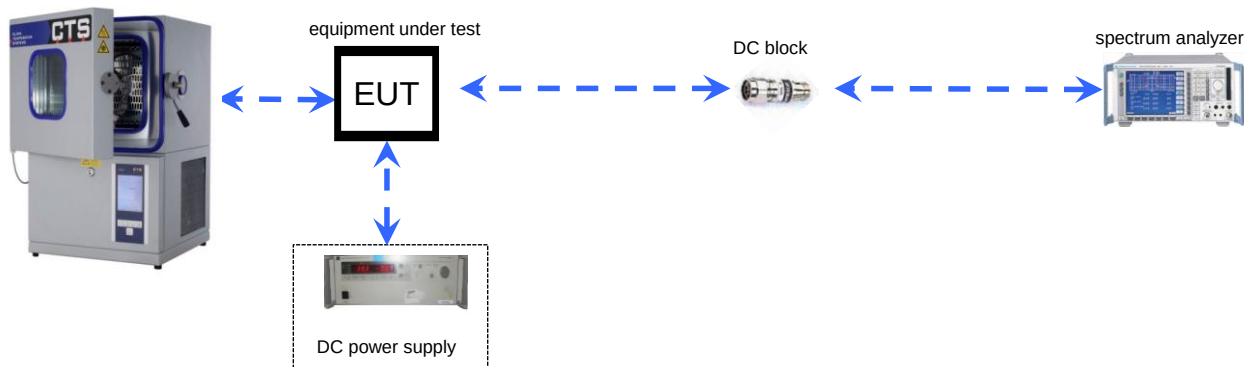
7.3 AC conducted



Equipment table:

Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom
MXE EMI Receiver 20 Hz bis 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405
Isolating Transformer	MPL IEC625 Bus Regeltrenntravo	Erfi	91350	300001155
Switch / Control Unit	3488A	HP Meßtechnik	*	300000199
Switch / Control Unit	3488A	HP Meßtechnik	2719A15013	300001168
Artificial Mains 9 kHz to 30 MHz	ESH3-Z5	R&S	828576/020	300001210

7.4 Conducted measurements



Equipment table:

Equipment	Type	Manufacturer	Serial No.	INV. No Cetecom
DC Power Supply 0 – 32V	1108-32	Heiden	001802	300001383
Temperature Test Chamber	T-40/50	CTS GmbH	064023	300003540
Spectrum Analyzer 20 Hz - 50 GHz	FSU50	R&S	200012	300003443

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 210 Issue 8 RSS GEN Issue 4	Passed	2015-02-10	-/-

Test Specification Clause	Test Case	Temperature Conditions	Power Source Voltages	Pass	Fail	NA	NP	Remark
§ 15.35 (c)/ RSS-GEN Issue 4	Timing of the transmitter (Duty cycle correction factor)	Nominal	Nominal	☒	☐	☐	☐	complies
RSS-GEN Issue 4	99 % emission bandwidth	Nominal	Nominal	☒	☐	☐	☐	complies
§ 15.225 (a)/ RSS-210 Issue 8 Annex 2.6	Fieldstrength of Fundamental	Nominal	Nominal	☒	☐	☐	☐	complies
§ 15.209/ RSS-210 Issue 8 Annex 2.6	Fieldstrength of harmonics and spurious	Nominal	Nominal	☒	☐	☐	☐	complies
§ 15.225 (e)/ RSS-210 Issue 8 Annex 2.6	Frequency tolerance	Nominal	Extreme	☒	☐	☐	☐	complies
		Extreme	Nominal	☒	☐	☐	☐	
§15.107 §15.207	Conducted emissions < 30 MHz	Nominal	Nominal	☒	☐	☐	☐	complies

Note: NA = Not Applicable; NP = Not Performed

9 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: None

10 Measurement results**10.1 Timing of the transmitter****Measurement:**

Measurement parameter	
Detector:	Positive peak
Sweep time:	100 ms
Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Span:	Zero span
Trace-Mode:	Single sweep

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.	

Result:

Duty cycle of the EUT: 100 %

Result: **passed**

10.2 Field strength of the fundamental

Measurement:

Measurement parameter	
Detector:	Quasi Peak
Resolution bandwidth:	200 Hz up to 150 kHz, 9 kHz up to 30 MHz, 120 kHz up to 1 GHz
Video bandwidth:	≥ RBW
Trace-Mode:	Max Hold

Limits:

FCC		IC
Fundamental Frequency (MHz)	Field strength of Fundamental ($\mu\text{V/m}$ / $\text{dB}\mu\text{V/m}$)	Measurement distance (m)
13.553 to 13.567	15848 $\mu\text{V/m}$ (84 $\text{dB}\mu\text{V/m}$)	30
	158489 $\mu\text{V/m}$ (104 $\text{dB}\mu\text{V/m}$)	10 (Recalculated acc. to FCC part15.31 (f2))

Result:

TEST CONDITIONS		MAXIMUM POWER ($\text{dB}\mu\text{V/m}$)	
Frequency		13.56 MHz	13.56 MHz
Mode		@ 10 m distance	@ 30 m distance
T_{nom}	V_{nom}	53.5	33.5*
Measurement uncertainty		±3dB	

* Limits recalculated from 10m to 30m with 40 dB/decade according to FCC 15.31 (f2).

Result: **passed**

10.3 99 % emission bandwidth

Measurement:

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

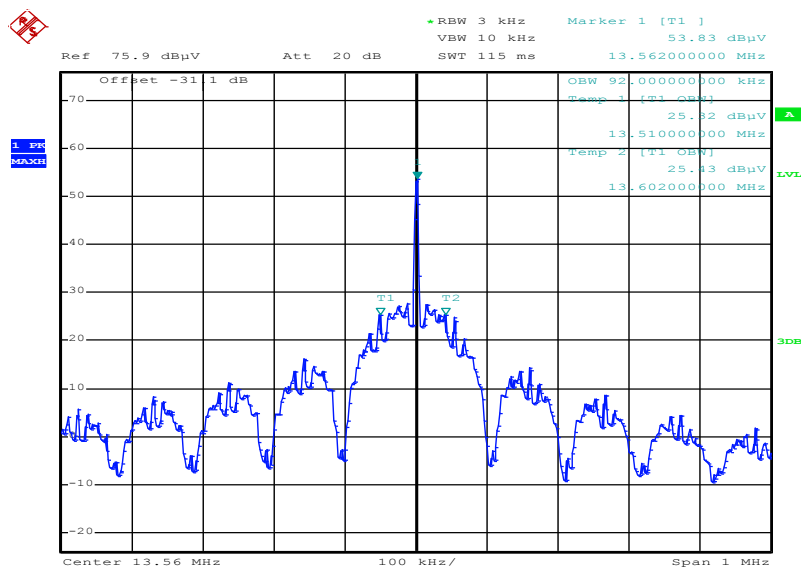
Limit:

IC
for RSP-100 test report coversheet only

Results:

TEST CONDITIONS		99 % emission bandwidth (kHz)
Frequency		13.56 MHz
T _{nom}	V _{nom}	92.0
Measurement uncertainty		± RBW

Plot:



Date: 4.FEB.2015 13:19:08

10.4 Field strength of the harmonics and spurious

Measurement:

Measurement parameter	
Detector:	Quasi Peak / Average
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 plots!
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:

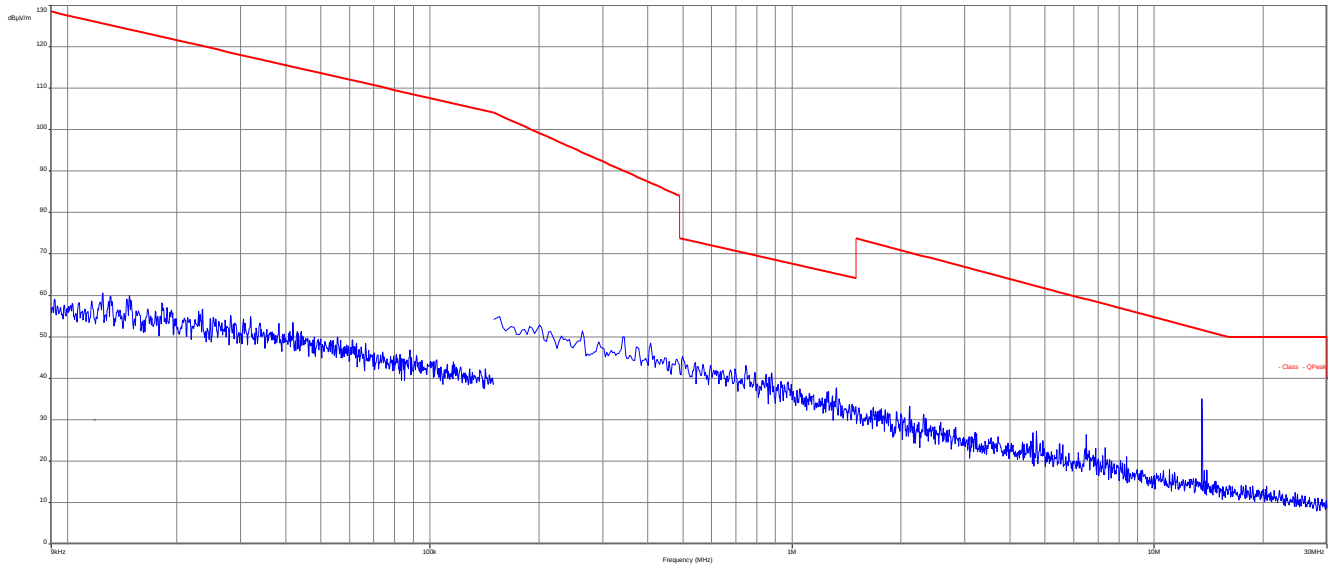
EMISSION LIMITATIONS				
F [MHz]	Detector	Limit max. allowed [dBμV/m]	Amplitude of emission [dBμV/m]	Results
No peaks closer 10 dB to the limit!				

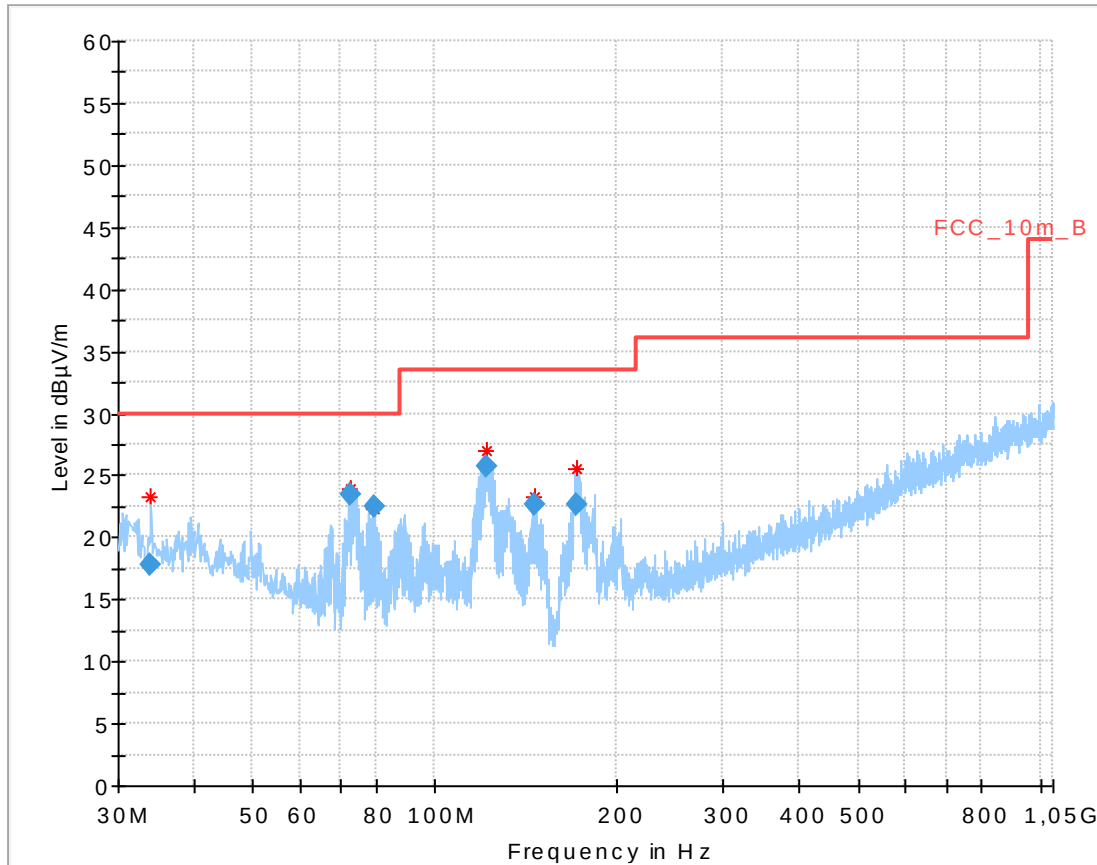
Result: **passed**

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

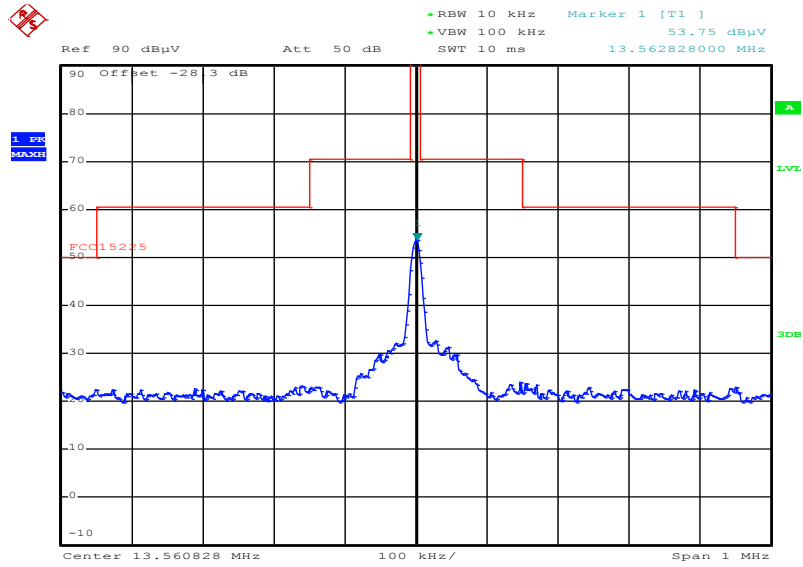


Plot 2: 30 MHz – 1000 MHz, vertical & horizontal polarization


Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
33.966600	17.77	30.00	12.23	1000.0	120.000	200.0	V	230	13.7
72.485850	23.44	30.00	6.56	1000.0	120.000	272.0	V	261	8.3
79.298100	22.51	30.00	7.49	1000.0	120.000	274.0	V	281	8.1
122.010450	25.76	33.50	7.74	1000.0	120.000	103.0	V	5	10.0
146.475450	22.60	33.50	10.90	1000.0	120.000	98.0	V	302	8.8
171.818100	22.60	33.50	10.90	1000.0	120.000	98.0	V	5	9.9

Plot 3: Spectrum mask



Date: 30.JAN.2015 11:03:06

Limits recalculated from 30 m to 10 m with 40 dB/decade according to FCC 15.31 (f2)

10.5 Frequency tolerance

Measurement:

Measurement parameter	
Detector:	Positive peak
Sweep time:	Auto
Resolution bandwidth:	10 Hz
Video bandwidth:	1 MHz
Span:	1 kHz
Trace-Mode:	Clear – write

Limits:

FCC	IC
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.	

Result: passed

Frequency tolerance								
Over temperature variation			Over voltage variation					
Limit is +/- 1.356 kHz			Limit is +/- 1.356 kHz			-/-		
T (°C)]	Frequency	result	Power voltage	Frequency	result	F [MHz]	Detector	Level [µV/m]
-20°	13.560927	Pass	9.0 V	13.560873	Pass	-/-		
-10°	13.560938	Pass	11.0 V	13.560871	Pass			
0°	13.560911	Pass	13.0 V	13.560868	Pass			
10°	13.560855	Pass	15.0 V	13.560867	Pass			
20°	13.560802	Pass	17.0 V	13.560866	Pass			
30°	13.560806	Pass	19.0 V	13.560865	Pass			
40°	13.560765	Pass	21.0 V	13.560864	Pass			
50°	13.560742	Pass	23.0 V	13.560863	Pass			
			25.0 V	13.560861	Pass			
			27.0 V	13.560860	Pass			
			29.0 V	13.560859	Pass			
			32.0 V	13.560858	Pass			
Measurement uncertainty			±100 Hz					

10.6 AC line conducted

Measurement:

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

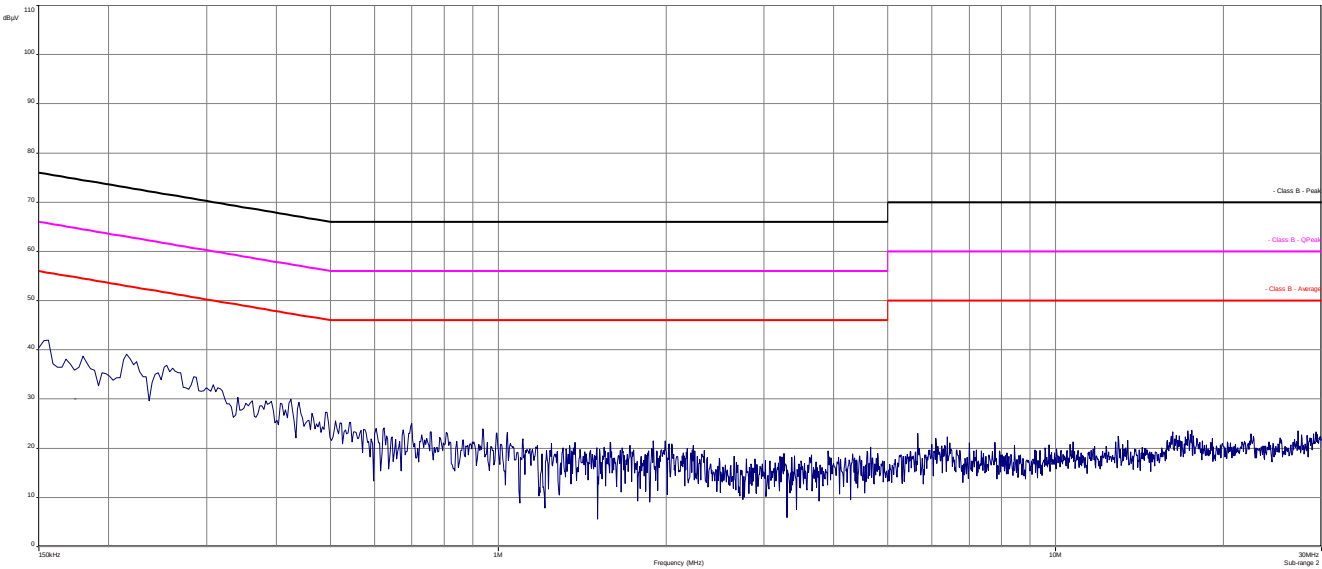
Limits:

FCC	IC	
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

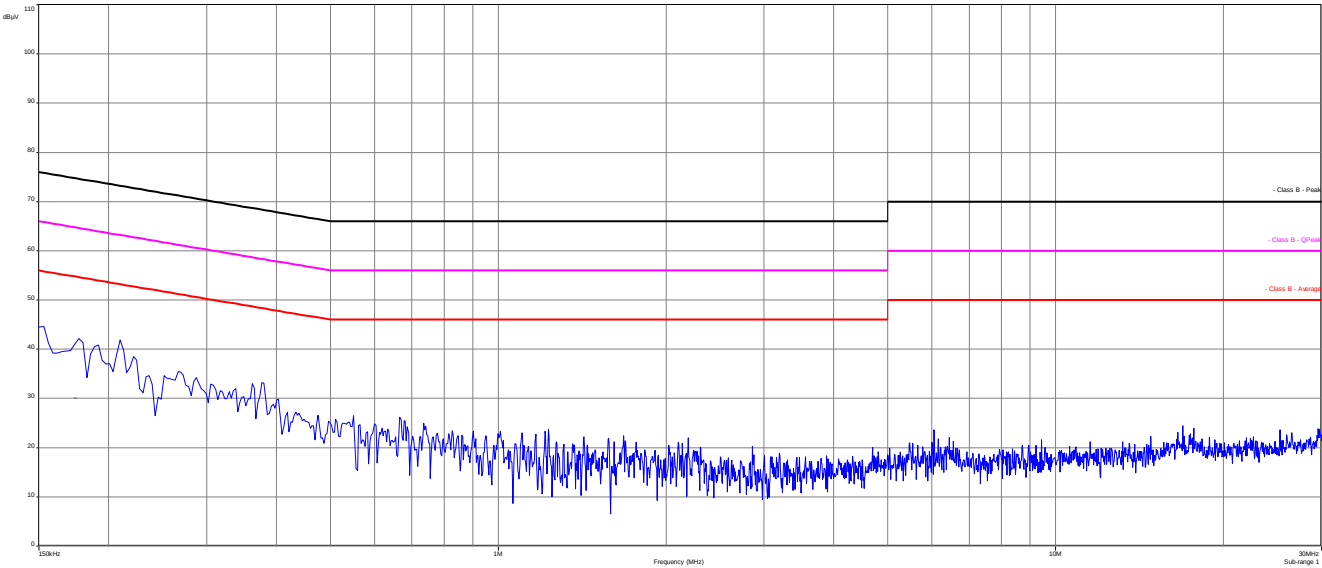
Result: passed

Plots:

Plot 1: phase line



Plot 2: neutral line



11 Test equipment and ancillaries used for tests

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 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).

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2818A03450	300001040	Ve	21.01.2012	20.01.2015
2	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
3	n. a.	Switch / Control Unit	3488A	HP Meßtechnik	*	300000199	ne		
4	90	Active Loop Antenna 10 kHz to 30 MHz	6502	Kontron Psychotech	8905-2342	300000256	k	13.06.2013	13.06.2015
5	90	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vKl!	29.10.2014	29.10.2017
6	90	MXE EMI Receiver 20 Hz to 26,5 GHz	N9038A	Agilent Technologies	MY51210197	300004405	k	13.03.2014	13.03.2015
7	90	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne		
8	n. a.	EMI Test Receiver 9 kHz - 3 GHz incl. Preselector	ESPI3	R&S	101713	300004059	k	23.01.2015	22.01.2016
9	n. a.	DC Power Supply 0 - 32V	1108-32	Heiden	001802	300001383	Ve	29.01.2014	29.01.2017
10	n. a.	Temperature Test Chamber	T-40/50	CTS GmbH	064023	300003540	Ve	26.09.2013	26.09.2015

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
vKl!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

12 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	2015-02-10

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

Annex C Accreditation Certificate

Front side of certificate

Back side of certificate



Deutsche Akkreditierungsstelle GmbH

Bellehene 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 / GPRS, 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

Zehn Minuten auf der Rückseite

Im Auftrag D-PL-12076-01-00
 Hiltner

Deutsche Akkreditierungsstelle GmbH

Standort Berlin
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 10117 Berlin

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 60594 Frankfurt am Main

Standort Braunschweig
 Bundesallee 100
 38115 Braunschweig

Die auszugsweise Veröffentlichung der Akkreditierungsurkunde bedarf der vorherigen schriftlichen
 Zustimmung der Deutschen Akkreditierungsstelle GmbH (DAkkS). Ausgenommen davon ist die separate
 Weiterverbreitung des Deckblattes durch die umseitig genannte Konformitätsbewertungsstelle in
 unveränderter Form.

Es darf nicht der Anschein erweckt werden, dass sich die Akkreditierung auch auf Bereiche erstreckt,
 die über den durch die DAkkS bestätigten Akkreditierungsbereich hinausgehen.

Die Akkreditierung erfolgt gemäß des Gesetzes über die Akkreditierungsstellen (AkkStelleG) vom
 31. Juli 2009 (BGBl. I S. 2675) 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 (Abt. L 218 vom 9. Juli 2008, S. 30).
 Die DAkkS ist Unterzeichnerin der Multilateralen Abkommen zur gegenseitigen Anerkennung der
 European Cooperation 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-lia.org
 IAF: www.iaf-lia.org

Note:

The current certificate including annex is published on our website (see link below) or may be received from CETECOM ICT Services on request.

<http://www.cetecom.com/eu/de/cetecom-group/europa/deutschland-saarbruecken/akkreditierungen.html>