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

TEST REPORT

Test report no.: 1-6965/13-09-04

Deutsche
Akkreditierungsstelle
D-PL-12076-01-01

Testing laboratory

CETECOM ICT Services GmbH

Untertuerkheimer Strasse 6 – 10

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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-12076-01-01

Area of Testing:

Radio Communications & EMC (RCE)

Applicant

Sony Mobile Communications AB

Nya Vattentornet

22188 Lund / SWEDEN

Phone: +46 46 19 30 00

Fax: -/-

Contact: Mikael Nilsson

e-mail: Micke.nilsson@sonymobile.com

Phone: +46 7 03 22 75 03

Manufacturer

Sony Mobile Communications AB

Nya Vattentornet

22188 Lund / SWEDEN

Test standard/s

47 CFR Part 15

Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices

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

Test Item

Kind of test item: Smart Phone GPRS/EGPRS 850/900/1800/1900; UMTS HSPA FDDI/V/VII/XIX; LTE FDD1/3/19/21; WLAN b/g/n/a/ac; BT 4.0; RFID; A-GPS

FCC ID: PY7PM-0741

Frequency: 13.56 MHz

Technology tested: RFID

Antenna: Integrated antenna

Power supply: 3.7 V DC by Li - polymer battery

Temperature range: -30°C to +60°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 2014.02.19 13:08:58 +01'00'

Marco Bertolino
Testing Manager

Test performed:

cn=Christoph Schneider, o=CETECOM ICT Services GmbH, ou=SND-120402, email=christoph.schneider@cetecom.com, c=DE 2014.02.19 13:10:36 +01'00'

Christoph Schneider
Expert

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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:	2013-12-19
Date of receipt of test item:	2014-01-20
Start of test:	2014-01-28
End of test:	2014-02-13
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

4 Test environment

Temperature:	T_{nom}	+22 °C during room temperature tests
	T_{max}	+60 °C during high temperature tests
	T_{min}	-30 °C during low temperature tests
Relative humidity content:		40 %
Barometric pressure:		not relevant for this kind of testing
Power supply:	V_{nom}	3.7 V DC by Li - polymer battery
	V_{max}	4.2 V
	V_{min}	3.3 V

5 Test item

Kind of test item :	Smart Phone GPRS/EGPRS 850/900/1800/1900; UMTS HSPA FDDI/V/VI/XIX; LTE FDD1/3/19/21; WLAN b/g/n/a/ac; BT 4.0; RFID; A-GPS
S/N serial number :	CB5A1X9G4R
HW hardware status :	AP2.0
SW software status :	Test Software
Frequency band [MHz] :	13.56 MHz
Type of radio transmission :	Modulated carrier
Use of frequency spectrum :	
Type of modulation :	N0N
Number of channels :	1
Antenna :	Integrated antenna
Power supply :	3.7 V DC by Li - polymer battery
Temperature range :	-30°C to +60°C

5.1 Additional information

Test setup- and EUT-photos are included in test report: 1-6965/13-09-01_AnnexA
 1-6965/13-09-01_AnnexB
 1-6965/13-09-01_AnnexE

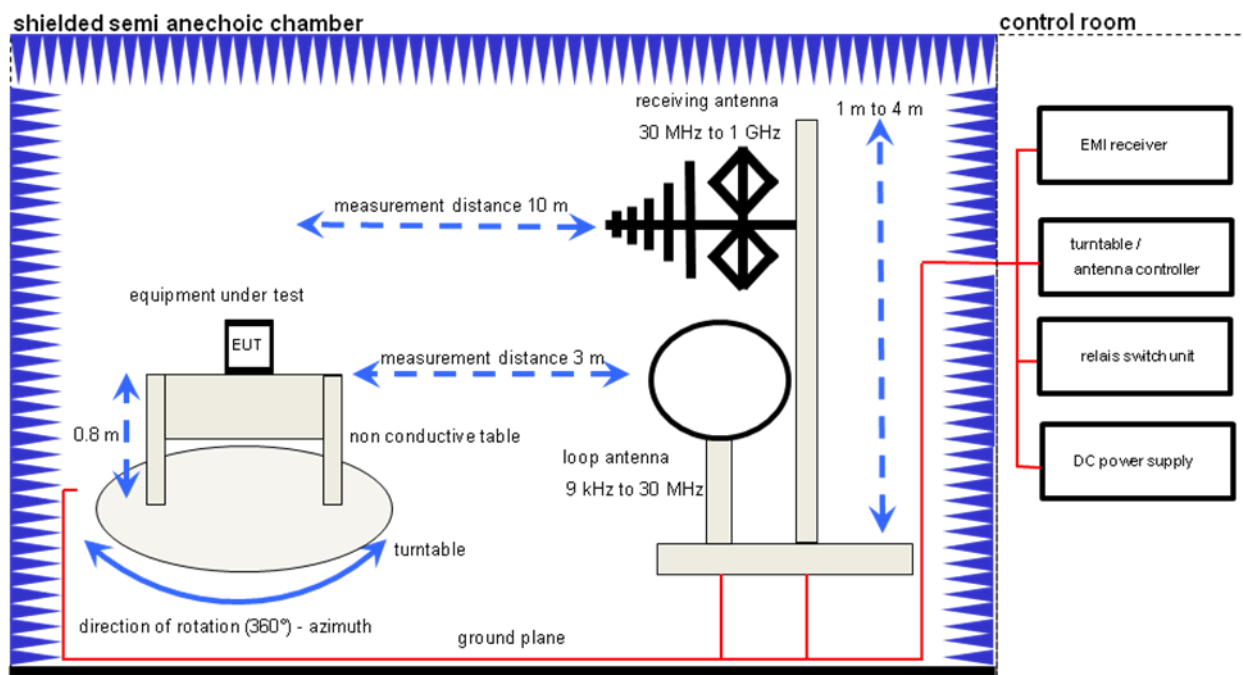
6 Test laboratories sub-contracted

None

7 Description of the test setup

7.1 Radiated measurements

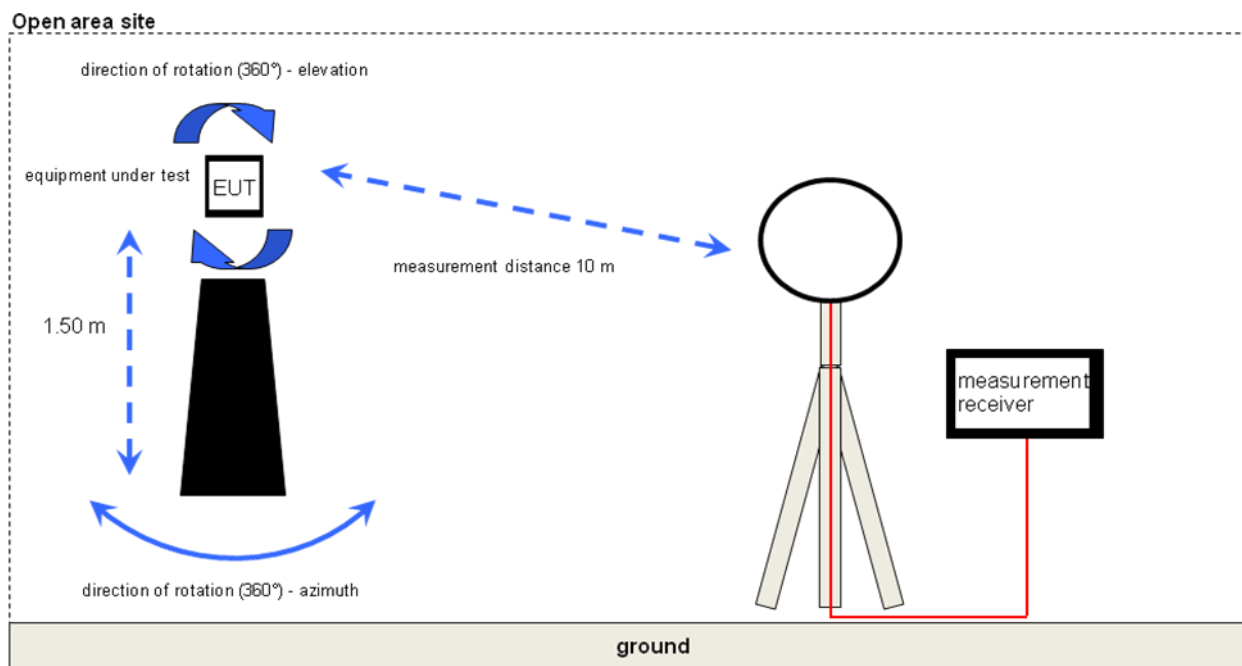
The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas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

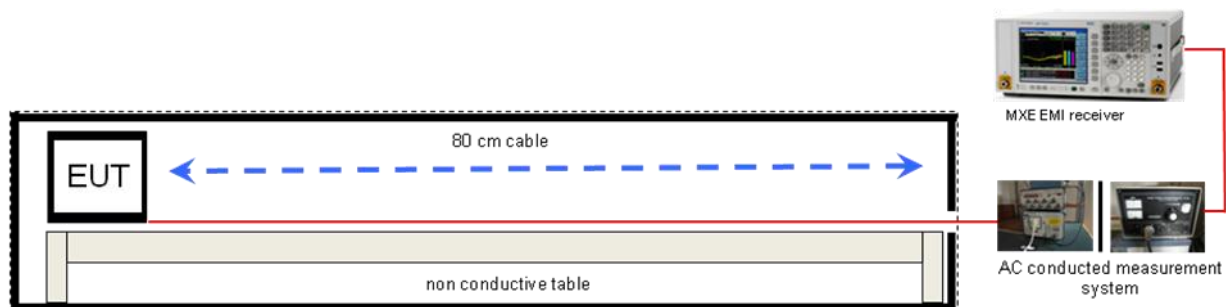
7.2 Open area site



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

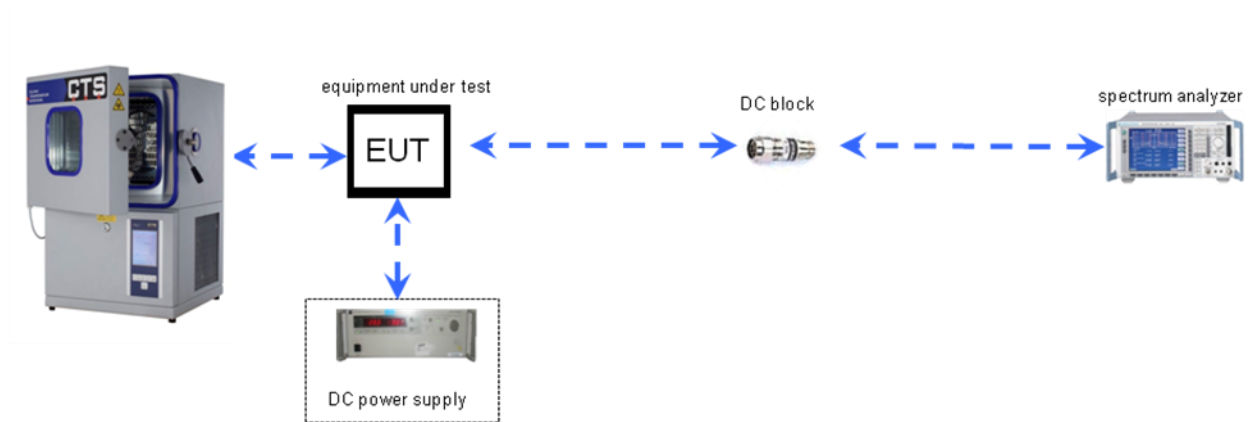
7.3 AC conducted



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	Erft	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	Passed	2014-02-19	-/-

Test Specification Clause	Test Case	Temperature Conditions	Power Source Voltages	Pass	Fail	NA	NP	Remark
§ 15.35 (c)	Timing of the transmitter (Duty cycle correction factor)	Nominal	Nominal	☒	☐	☐	☐	complies
	99 % emission bandwidth	Nominal	Nominal	☒	☐	☐	☐	complies
§ 15.225 (a)	Fieldstrength of Fundamental	Nominal	Nominal	☒	☐	☐	☐	complies
§ 15.209	Fieldstrength of harmonics and spurious	Nominal	Nominal	☒	☐	☐	☐	complies
§ 15.225 (e)	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	
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 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		
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}	38	18*
Measurement uncertainty		$\pm 3\text{dB}$	

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

Result: passed

10.3 99 % emission bandwidth

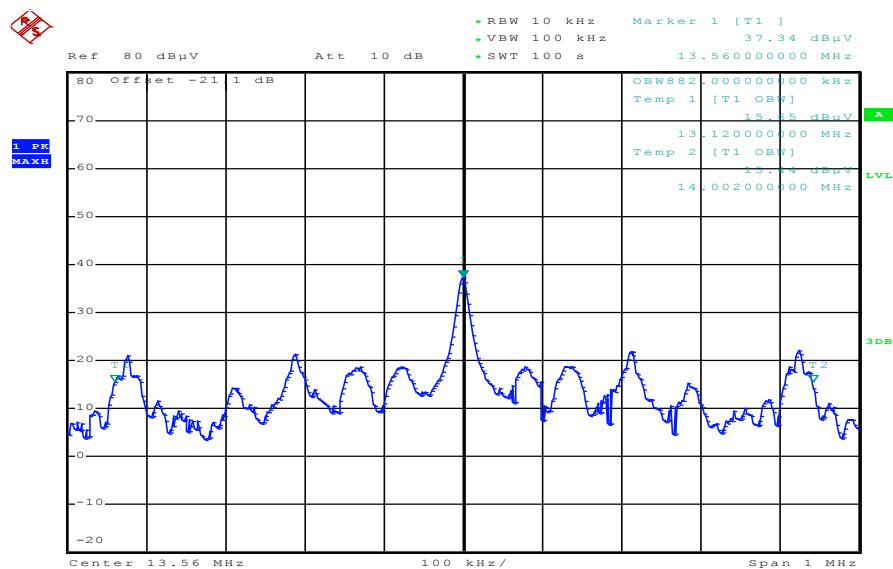
Measurement:

Measurement parameter	
Detector:	Peak
Resolution bandwidth:	> 1 % span
Video bandwidth:	≥ RBW
Trace-Mode:	Max Hold

Results:

TEST CONDITIONS		99 % emission bandwidth (kHz)
Frequency		13.56 MHz
T _{nom}	V _{nom}	882
Measurement uncertainty		± RBW

Plot:



Date: 18.FEB.2014 12:54:41

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 ($\mu\text{V/m}$)	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 dB $\mu\text{V/m}$)	30
30 – 88	100 (40 dB $\mu\text{V/m}$)	3
88 – 216	150 (43.5 dB $\mu\text{V/m}$)	3
216 – 960	200 (46 dB $\mu\text{V/m}$)	3

Result:

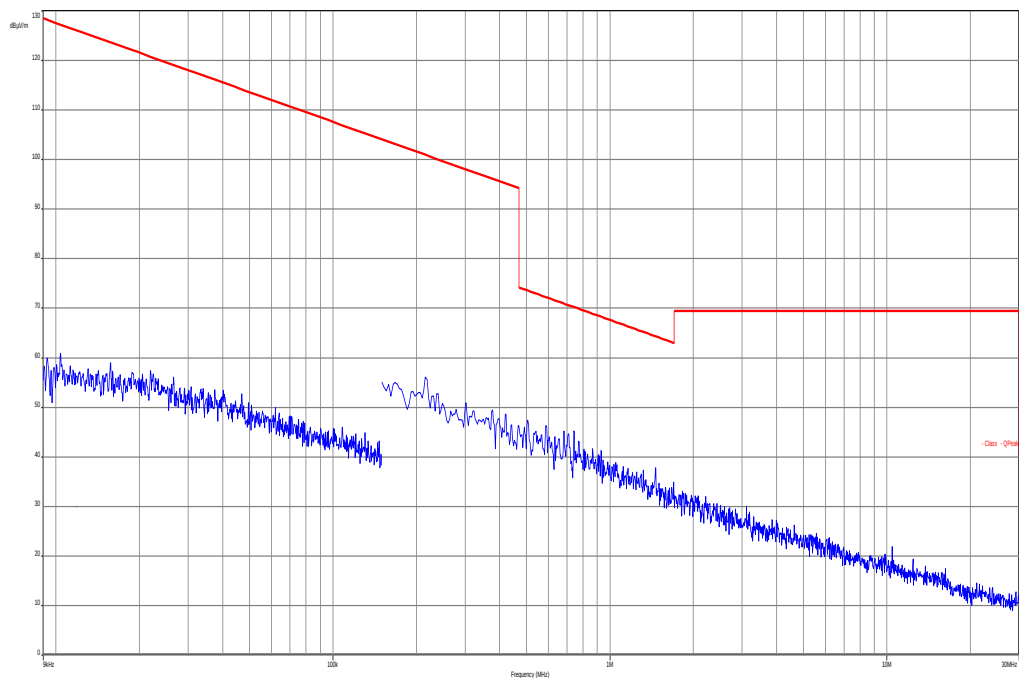
EMISSION LIMITATIONS				
f [MHz]	Detector	Limit max. allowed [dB $\mu\text{V/m}$]	Amplitude of emission [dB $\mu\text{V/m}$]	Results
No emissions detected.				

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

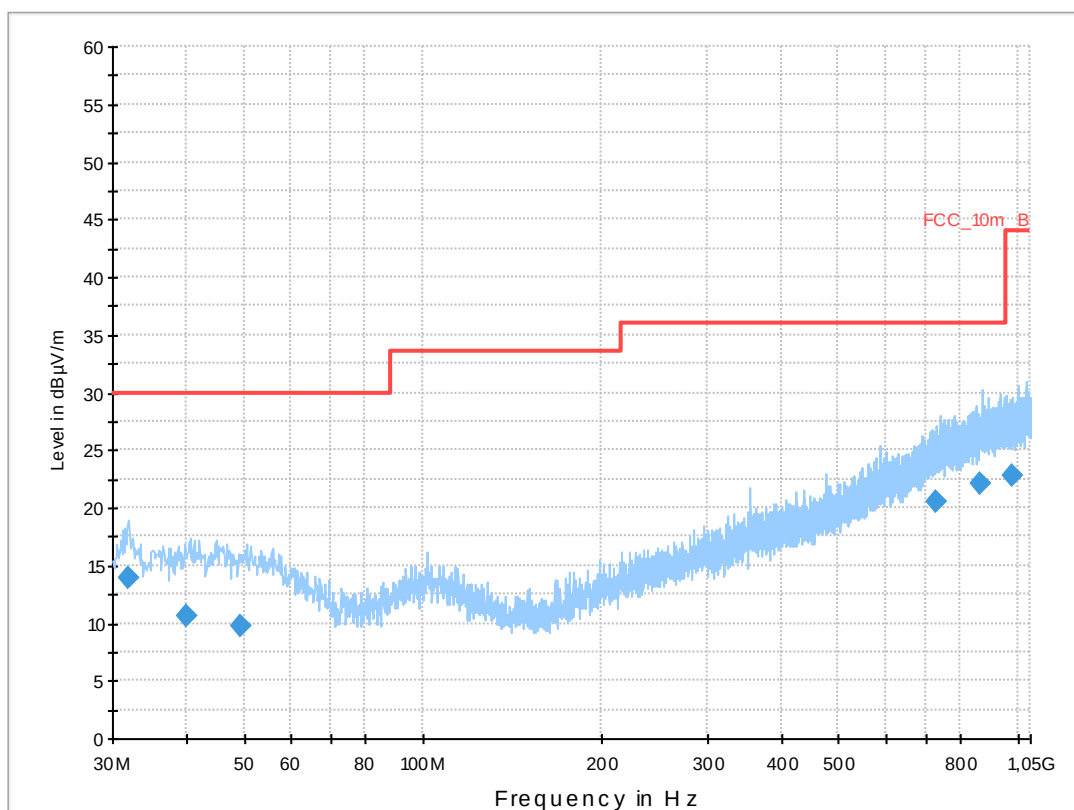
Common Information

Serial Number: CB5a1X9G4R
 Test Description: FCC part 15 class B @ 10 m
 Operating Conditions: RFID TX
 Operator Name: Hennemann
 Comment: battery powered

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup: Electric Field (NOS)
 Receiver: [ESCI 3]
 Level Unit: dB μ V/m

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
30 MHz - 2 GHz	60 kHz	QPK	120 kHz	1 s	20 dB

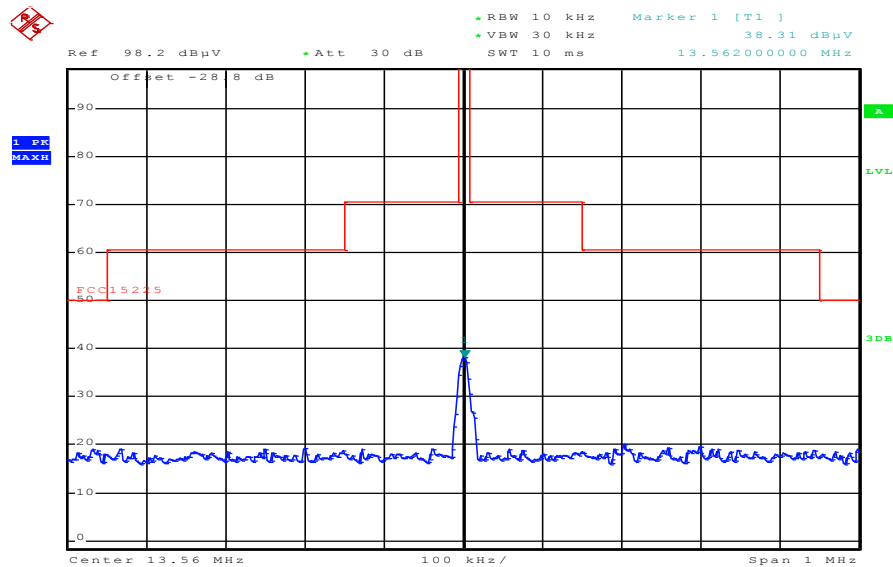


Final Result 1

Frequency (MHz)	QuasiPeak (dB μ V/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)	Comment
32.045550	14.0	1000.0	120.000	170.0	V	10.0	12.7	16.0	30.0	
40.130850	10.6	1000.0	120.000	170.0	V	272.0	13.4	19.4	30.0	
49.465350	9.7	1000.0	120.000	170.0	H	0.0	13.4	20.3	30.0	
728.492850	20.5	1000.0	120.000	170.0	H	175.0	23.2	15.5	36.0	
867.996000	22.1	1000.0	120.000	170.0	V	85.0	24.8	13.9	36.0	
976.356000	22.7	1000.0	120.000	170.0	H	280.0	25.6	21.3	44.0	

Plot 3: Spectrum mask

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



Date: 14.FEB.2014 08:09:49

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]
-30°	13.559656	Pass	3.3 V	13.560012	Pass	-/-		
-20°	13.559769	Pass	3.4 V	13.560015	Pass			
-10°	13.559886	Pass	3.5 V	13.560016	Pass			
0°	13.559965	Pass	3.6 V	13.560018	Pass			
10°	13.559995	Pass	3.7 V	13.560018	Pass			
20°	13.560018	Pass	3.8 V	13.560023	Pass			
30°	13.560057	Pass	3.9 V	13.560024	Pass			
40°	13.556043	Pass	4.0 V	13.560027	Pass			
50°	13.560017	Pass	4.1 V	13.560027	Pass			
60°	13.559995	Pass	4.2 V	13.560029	Pass			
			4.3 V	13.560031	Pass			
			4.4 V	13.560031	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

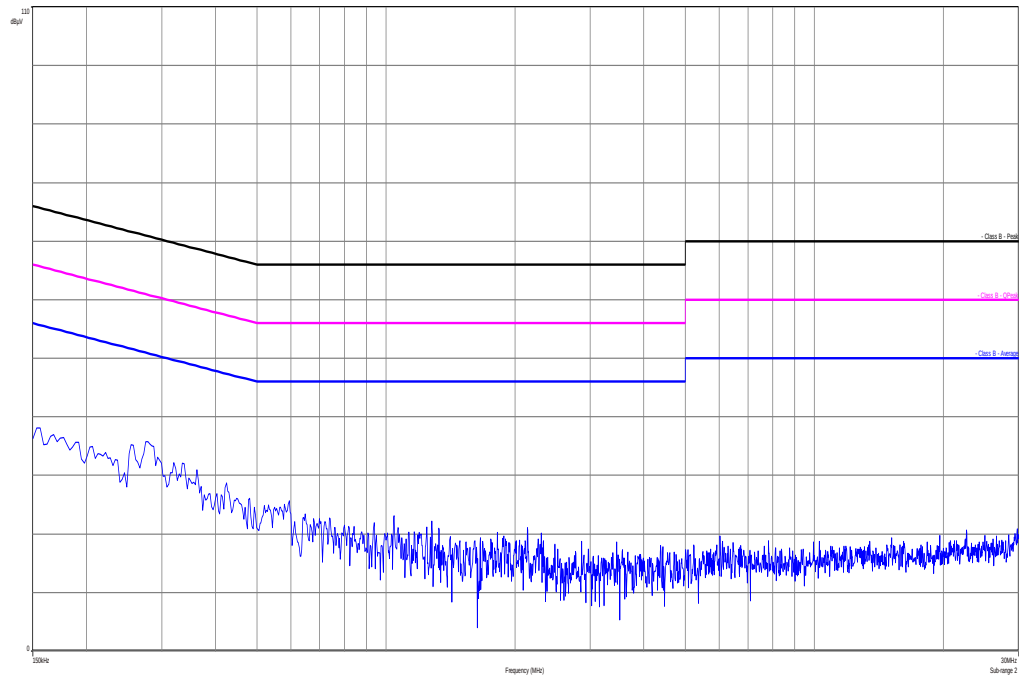
Limits:

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

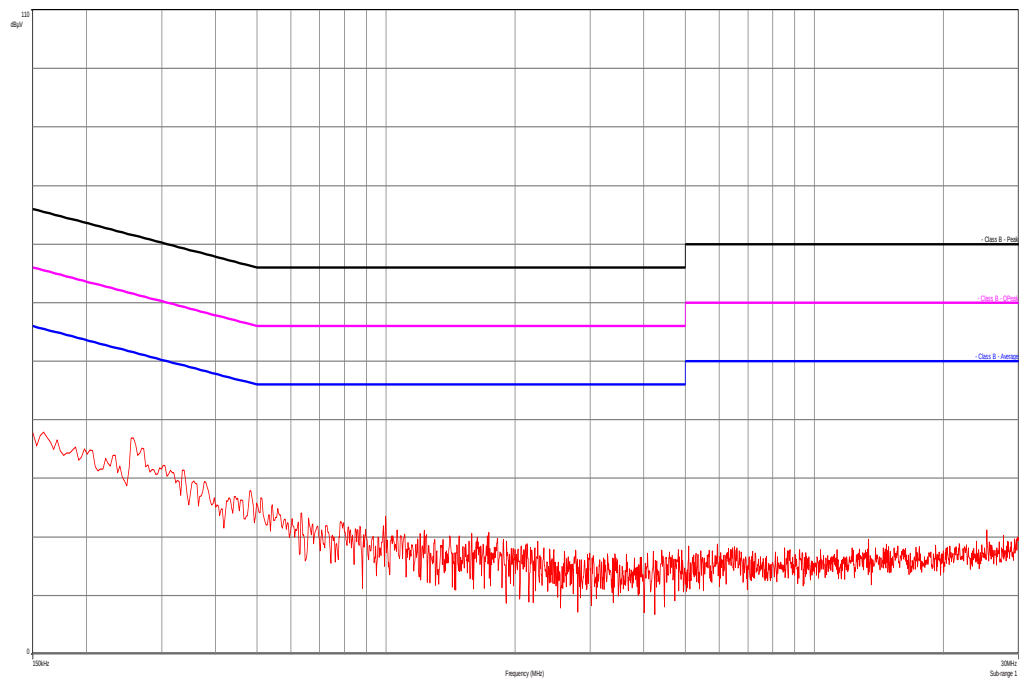
Result: **passed**

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 (Labor/Item).

No.	Lab / Item	Equipment	Type	Manufact.	Serial No.	INV. No Cetecom	Kind of Calibration	Last Calibration	Next Calibration
1	45	Switch-Unit	3488A	HP Meßtechnik	2719A14505	300000368	g		
2	50	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2920A04466	300000580	ne		
3	n. a.	software	SPS_PHE 1.4f	Spitzberger & Spieß	B5981; 5D1081;B597 9	300000210	ne		
4	n. a.	EMI Test Receiver	ESCI 3	R&S	100083	300003312	k	09.01.2013	09.01.2014
5	n. a.	Analyzer- Reference- System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	Ve	14.07.2011	14.01.2014
6	n. a.	Amplifier	JS42- 00502650- 28-5A	MITEQ	1084532	300003379	ev		
7	n. a.	Antenna Tower	Model 2175	ETS- LINDGREN	64762	300003745	izw		
8	n. a.	Positioning Controller	Model 2090	ETS- LINDGREN	64672	300003746	izw		
9	n. a.	Turntable Interface-Box	Model 105637	ETS- LINDGREN	44583	300003747	izw		
10	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbe ck	295	300003787	k	12.04.2012	12.04.2014
11	n. a.	Spectrum- Analyzer	FSU26	R&S	200809	300003874	k	16.01.2013	16.01.2014
12	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev		
13	n. a.	Switch / Control Unit	3488A	HP Meßtechnik	*	300000199	ne		
14	n. a.	Switch / Control Unit	3488A	HP Meßtechnik	2719A15013	300001156	ne		
15	9	Isolating Transformer	MPL IEC625 Bus Regeltrennt ravo	Erfi	91350	300001155	ne		
16	n. a.	Three-Way Power Splitter, 50 Ohm	11850C	HP Meßtechnik		300000997	ne		
17	90	Active Loop Antenna 10 kHz to 30 MHz	6502	Kontron Psychotech	8905-2342	300000256	k	13.06.2013	13.06.2015
18	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbe ck	371	300003854	vIKII	14.10.2011	14.10.2014
19	n. a.	MXE EMI Receiver 20 Hz bis 26,5 GHz	N9038A	Agilent Technologi es	MY51210197	300004405	k	21.02.2013	21.02.2014
20	n. a.	Test Receiver	ESH2	R&S	871921/095	300002505	Ve	12.01.2012	12.01.2014
21	n. a.	Loop Antenna 9 kHz - 30 MHz	HFH2-Z2	R&S	872096/61	300001824	vIKII	09.03.2012	09.03.2015
22	n. a.	Temperature Test Chamber	VT 4002	Heraeus Voetsch	521/84193	300003889	Ve	26.09.2013	26.09.2015
23	n. a.	Power Supply 0-20V, 0-5A	6632B	Agilent Technologi es	GB42110541	400000562	vIKII	10.01.2013	10.01.2016

24	n. a.	Spectrum Analyzer 20 Hz - 50 GHz	FSU50	R&S	200012	300003443	Ve	09.10.2012	09.10.2014
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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
vlk!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

12 Observations

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

Annex A Document history

Version	Applied changes	Date of release
	Initial release	2014-02-19

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

Back side of certificate

