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CETECOM ICT Services
consulting - testing - certification >>>

TEST REPORT

Test report no.: 1-2673-02-04/10-A



Deutsche
Akkreditierungsstelle
D-PL-12076-01-01

Testing laboratory

CETECOM ICT Services GmbH
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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/Satellite Communications

Applicant

ifm electronic gmbh
ifm-Straße 1
88069 Tettngang / GERMANY
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Fax: +49 754 251-8561439
Contact: Alexander Riedle
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Phone: +49 754 251-81439

Manufacturer

ifm electronic gmbh
ifm-Straße 1
88069 Tettngang / 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
Low-power Licence-exempt Radiocommunication Devices (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: ANT513
FCC ID: UN6-DTRHFMC
IC: 6799A-DTRHFMC
Frequency: 13.56 MHz
Power supply: 24.00 V DC by Power Supply
Temperature range: -20 °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 authorised:

Test performed:

Jakob Reschke
Testing Manager

Marco Bertolino
Testing Manager

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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:	2010-12-22
Date of receipt of test item:	2011-03-30
Start of test:	2011-03-30
End of test:	2011-03-31
Person(s) present during the test:	-/-

3 Test standard/s

Test standard	Version	Test standard description
47 CFR Part 15	2009-10	Title 47 of the Code of Federal Regulations; Chapter I Part 15 - Radio frequency devices
RSS - 210 Issue 8	2010-12	Spectrum Management and Telecommunications - Radio Standards Specification Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment

4 Test environment

Temperature:	T_{nom}	+24 °C during room temperature tests
	T_{max}	+55 °C during high temperature test
	T_{min}	-20 °C during low temperature test
Relative humidity content:		33 %
Air pressure:		not relevant for this kind of testing
Power supply:	V_{nom}	24.00 V DC by Power Supply
	V_{max}	27.60 V
	V_{min}	20.40 V

5 Test item

Kind of test item	:	13,56 MHz RFID READER
Type identification	:	ANT513
S/N serial number	:	Unknown
HW hardware status	:	Unknown
SW software status	:	Unknown
Frequency band [MHz]	:	13.56 MHz
Type of modulation	:	ASK
Number of channels	:	1
Antenna	:	Integrated antenna
Power supply	:	24.00 V DC by Power Supply
Temperature range	:	-20°C to 55 °C

6 Test laboratories sub-contracted

None

7 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, Annex 2.6	Passed	2011-10-26	-/-

Test Specification Clause	Test Case	Temperature Conditions	Power Source Voltages	Pass	Fail	NA	NP	Results (max.)
§ 15.35 (c)/ RSS-GEN Issue 2 Section 4.5	Timing of the transmitter (Duty cycle correction factor)	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§ 15.225 (a)/ RSS-210 Issue 8 Annex 2.6	Fieldstrength of Fundamental	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§ 15.209/ RSS-210 Issue 8 Annex 2.6	Fieldstrength of harmonics and spurious	Nominal	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
§ 15.225 (e)/ RSS-210 Issue 8 Annex 2.6	Frequency tolerance	Nominal	Extreme	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	complies
		Extreme	Nominal	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Note: NA = Not Applicable; NP = Not Performed

8 RF measurement testing

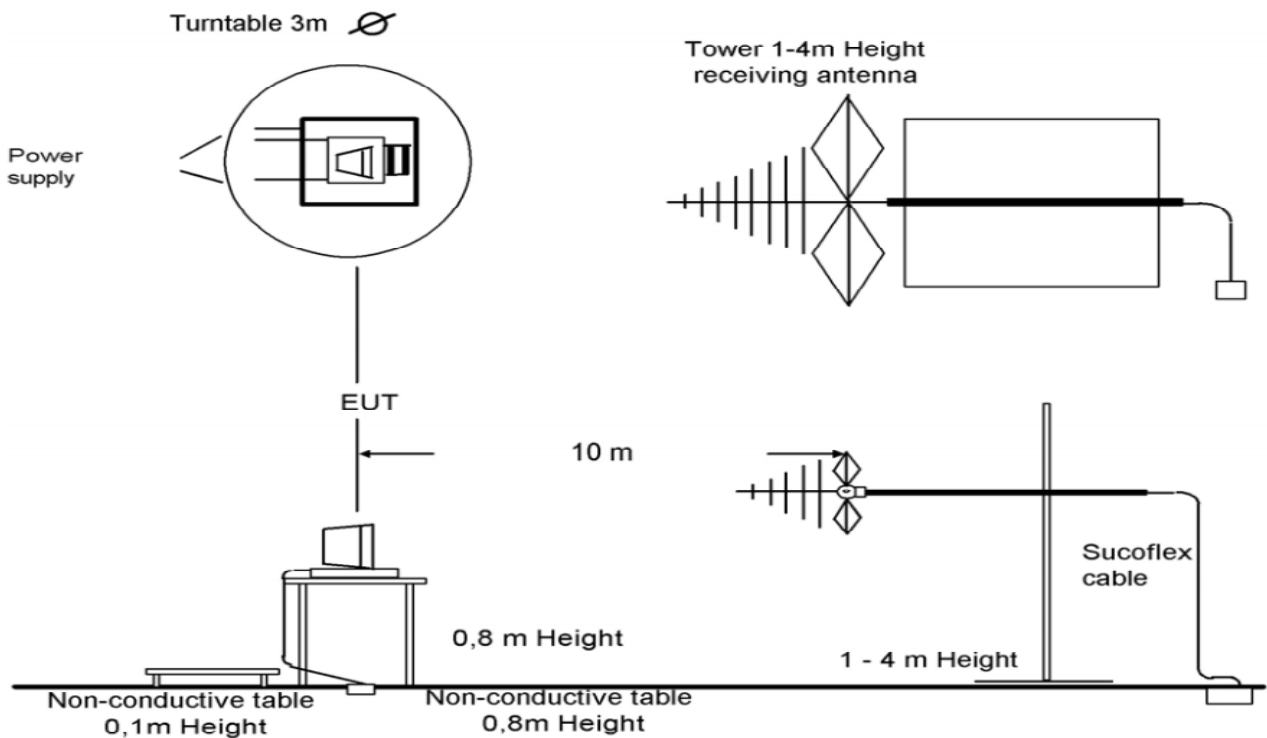
8.1 Description of test setup

8.1.1 Radiated measurements

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 9 kHz to 25 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 C63.2-1996 clause 15 and ANSI C63.4-2003 clause 4.1.5. 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 C63-4-2003 clause 4.2.

Antennas are confirmed with ANSI C63.2-1996 item 15.

Semi anechoic chamber



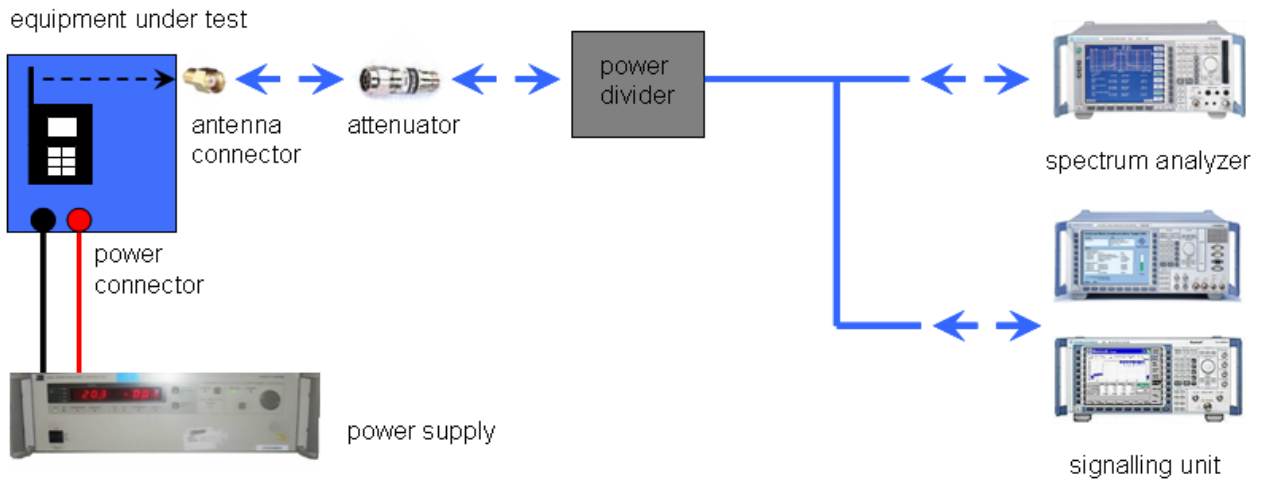
Picture 1: Diagram radiated measurements

9 kHz - 30 MHz:	active loop antenna
30 MHz – 1 GHz:	tri-log antenna
> 1 GHz:	horn antenna

The EUT is powered by an external power supply with nominal voltage. The signalling is performed from outside the chamber with a signalling unit (CMU200 or other) by air link using signalling antenna.

8.1.2 Conducted measurements

The EUT's RF signal is coupled out by the antenna connector which is supplied by the manufacturer. The signal is first 10dB attenuated before it is power divided (~6dB loss per branch). One of the signal paths is connected to the communication base Station (CMU200 or other), the other one is connected to the spectrum analyzer. The specific losses for both signal paths are first checked within a calibration. The measurement readings on the signalling unit/spectrum analyzer are corrected by the specific test set-up loss. The attenuator, power divider, signalling unit and the spectrum analyzer are impedance matched on 50 Ohm.



Picture 2: Diagram conducted measurements

8.2 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: None

8.3 RSP100 test report cover sheet / performance test data

Test Report Number	:	1-2673-02-04/10-A
Equipment Model Number	:	ANT513
Certification Number	:	6799A-DTRHFMC
Manufacturer (complete Address)	:	ifm electronic gmbh ifm-Straße 1 88069 Tettnang / GERMANY
Tested to radio standards specification no.	:	RSS 210, Issue 8, Annex 8
Open Area Test Site IC No.	:	IC 3462C-1
Frequency Range or fixed frequency	:	13.56 MHz
Field Strength [dB μ V/m] (at which distance)	:	72 dB μ V/m at 3m
Occupied bandwidth (99%-BW) [kHz]	:	100 kHz
Type of modulation	:	ASK
Emission Designator (TRC-43)	:	100KA1D
Antenna Information	:	Integrated antenna
Transmitter Spurious (worst case) [μ V/m @ 10m]:		68 μ V/m @ 962.722 MHz
Receiver Spurious (worst case) [μ V/m @ 10m]:		Not applicable

ATTESTATION:

DECLARATION OF COMPLIANCE:

I attest that the testing was performed or supervised by me; that the test measurements were made in accordance with the above-mentioned Industry Canada standard(s); and that the equipment identified in this application has been subjected to all the applicable test conditions specified in the Industry Canada standards and all of the requirements of the standard have been met.

Laboratory Manager:

2011-10-26
Date

Marco Bertolino
Name


Signature

9 Measurement results

9.1 Timing of the transmitter

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	1 se
Resolution bandwidth:	1 MHz
Video bandwidth:	1 MHz
Span:	-/-
Trace-Mode:	Clear Write

Result:

The EUT is an RFID Equipment which has an duty cycle of 100%

Limits:

FCC	IC
CFR Part SUBCLAUSE § 15.35 (c)	RSS-GEN Issue 2 Section 4.5
Timing of the transmitter	
<p>(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.</p>	

Result: The result of the measurement is passed.

9.2 Field strength of the fundamental

Measurement:

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

Limits:

FCC		IC	
CFR Part SUBCLAUSE § 15.231 (b)		RSS-210 Issue 8 Section A1.1.2 / 2.7 Table 4	
Fundamental Frequency (MHz)	Field strength of Fundamental ($\mu\text{V/m}$)	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		at 3 m distance	at 30 m distance
T_{nom}	V_{nom}	72	32*
Measurement uncertainty		±3dB	

*recalculated with 40dB/dec acc. to Part 15.31

Result: The result of the measurement is passed.

9.3 Field strength of the harmonics and spurious

Measurement:

Measurement parameter	
Detector:	Average / Quasi Peak
Sweep time:	Auto
Resolution bandwidth:	9 kHz
Video bandwidth:	9 kHz
Span:	100 MHz Steps
Trace-Mode:	Max Hold

Limits:

FCC	IC	
SUBCLAUSE § 15.209	-/-	
Field strength of the harmonics and spurious.		
Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.0009 – 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

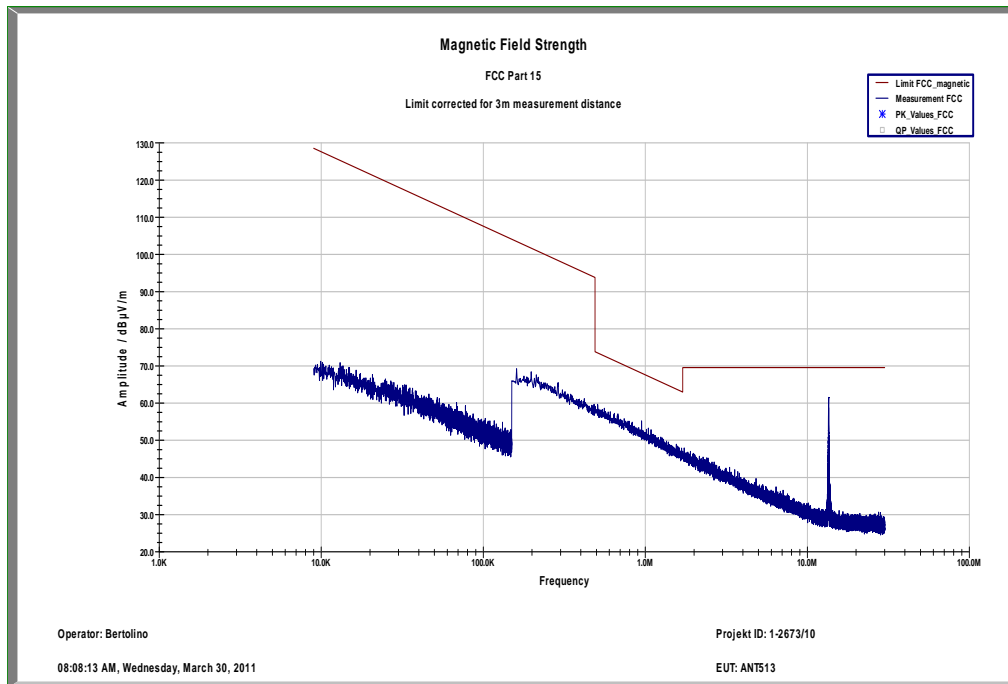
Result:

EMISSION LIMITATIONS				
f [MHz]	Detector	Limit max. allowed [dBµV/m]	Amplitude of emission [dBµV/m]	Results
Please see table below Plot 2				

Result: The result of the measurement is passed.

Plots of the measurements

Plot 1: 9 kHz – 30 MHz;
Part 15.209 Magnetics, Measurement distance 3m



Plot 2: 30 MHz – 1000 MHz

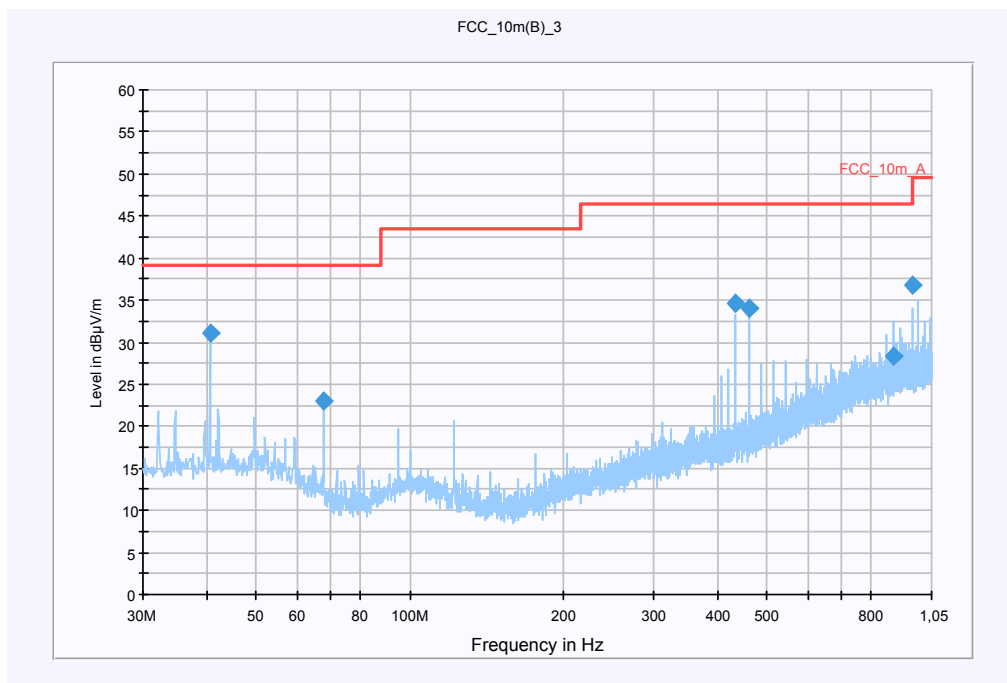
Common Information

EUT: ANT513
 Serial Number: unknown
 Test Description: FCC part 15 @ 10 m
 Operating Conditions: RFID Tag detected
 Operator Name: Hennemann
 Comment: DC: 24 V

Scan Setup: STAN_Fin [EMI radiated]

Hardware Setup: Electric Field (NOS)
 Level Unit: dBµV/m

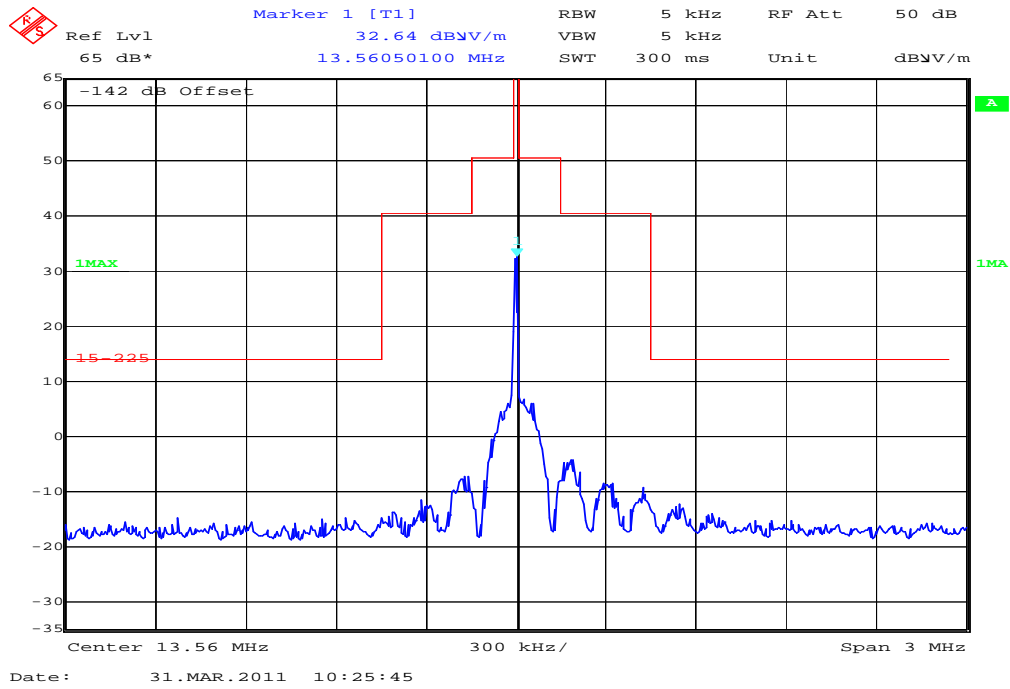
Subrange **Detectors** **IF Bandwidth** **Meas. Time** **Receiver**
 30 MHz - 2 GHz QuasiPeak 120 kHz 15 s Receiver



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
40.681200	31.1	15000.000	120.000	98.0	V	20.0	13.4	8.0	39.1	
67.792950	23.0	15000.000	120.000	220.0	V	236.0	9.8	16.1	39.1	
433.894800	34.7	15000.000	120.000	98.0	V	177.0	17.4	8.8	43.5	
461.017500	34.0	15000.000	120.000	98.0	V	184.0	17.9	9.5	43.5	
881.341500	28.4	15000.000	120.000	98.0	H	91.0	25.0	18.0	46.4	
962.722950	36.7	15000.000	120.000	167.0	V	87.0	25.5	12.8	49.5	

Plot 3: Spectrum mask part 15.225 (a,b,c,d)



RBW /VBW 5 kHz

The transmitter holds the requirements of FCC 15.225 (a,b,c and d)

9.4 Frequency tolerance

Measurement:

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	100 Hz
Video bandwidth:	100 Hz
Span:	100 kHz
Trace-Mode:	Max Hold

Limits:

FCC	IC
SUBCLAUSE § 15.225	RSS-210 Issue 8 Annex 2.6
<p>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.</p>	

Result: The result of the measurement is passed.

Frequency tolerance								
Over temperature variation			Over voltage variation			MHz		
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°	13.5602	Pass	98V	13.5601	Pass			
-10°	13.5601	Pass	104V	13.5601	Pass			
0°	13.5600	Pass	110V	13.5600	Pass			
10°	13.5600	Pass	115V	13.5600	Pass			
20°	13.5600	Pass	121V	13.5600	Pass			
30°	13.5600	Pass	127V	13.5600	Pass			
40°	13.5600	Pass	132V	13.5601	Pass			
50°	13.5600	Pass						
Measurement uncertainty			±100 Hz					

9.5 AC line conducted

Measurement:

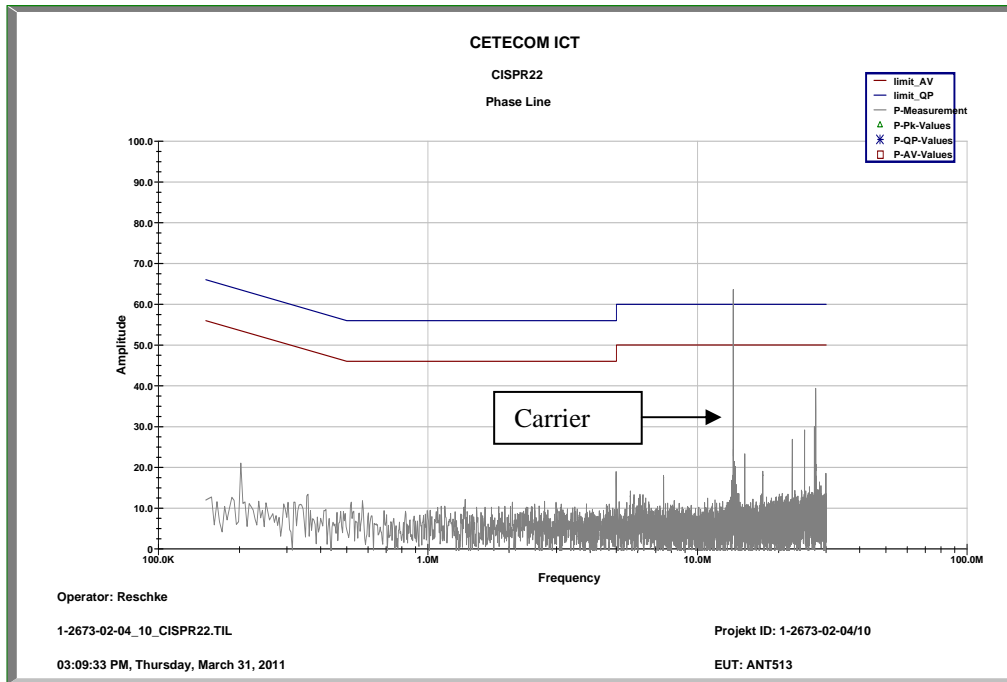
Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	9kHz
Video bandwidth:	9kHz
Span:	1 MHz Steps
Trace-Mode:	Max Hold

Limits:

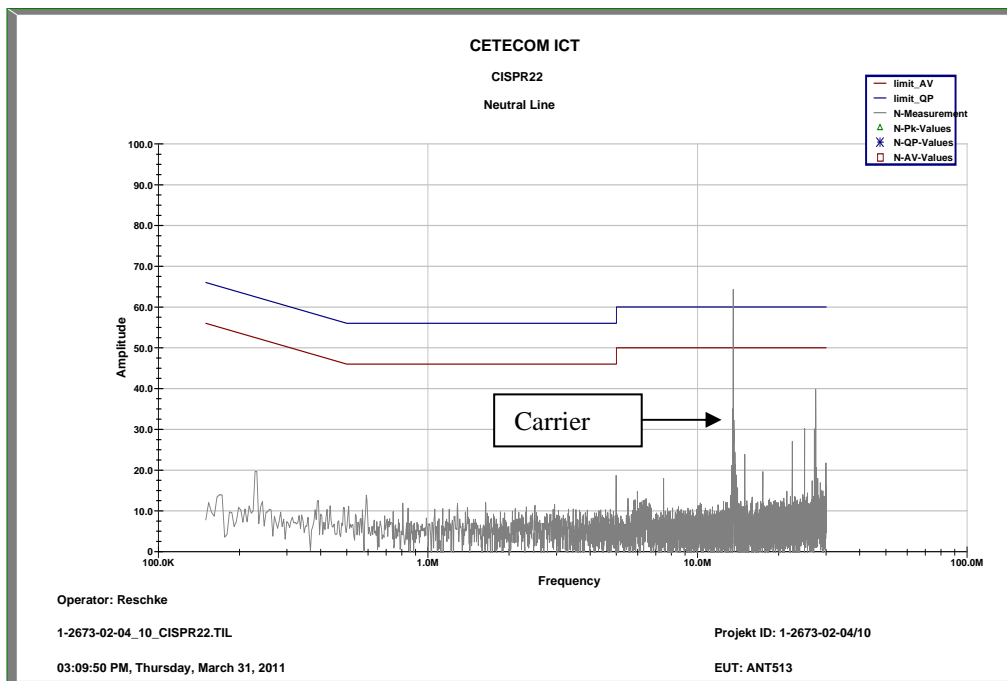
FCC	IC	
SUBCLAUSE § 15.107 / 15.207	RSS-210 Issue 8 Section 6.6, 7.4	
Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 - 30	60	50

Result: The result of the measurement is passed.

Plot 1: Phase Line



Plot 2: Neutral Line



10 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	k	06.01.2009	06.01.2011
3	n. a.	software	SPS_PHE 1.4f	Spitzberger & Spieß	B5981; 5D1081;B5979	300000210	ne		
4	n. a.	EMI Test Receiver	ESCI 1166.5950.03	R&S	100083	300003312	k	05.01.2011	05.01.2013
5	n. a.	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	k	01.06.2009	01.06.2011
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	Schwarzbeck	295	300003787	k	01.04.2010	01.04.2012
11	n. a.	Spectrum-Analyzer	FSU26	R&S	200809	300003874	k	10.01.2011	10.01.2013
12	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2920A04590	300001041	Ve	08.01.2009	08.01.2012
13	n. a.	Temperature Test Chamber	VT 4002	Heraeus Voetsch	521/83761	300002326	Ve	28.05.2009	28.05.2011
14	n. a.	Signal Analyzer 20Hz-26.5GHz-150 to + 30 DBM	FSiQ26	R&S	835111/0004	300002678	Ve	04.11.2010	04.11.2012
15	n. a.	Isolating Transformer	RT5A	Grundig	8041	300001626	g		
16	n. a.	PowerAttenuator	8325	Byrd	1530	300001595	ev		
17	9	Artificial Mains 9 kHz to 30 MHz	ESH3-Z5	R&S	828576/020	300001210	Ve	06.01.2010	06.01.2012
18	n. a.	Relais Matrix	3488A	HP Meßtechnik	2719A15013	300001156	ne		
19	n. a.	Relais Matrix	PSU	R&S	890167/024	300001168	ne		
20	n. a.	Isolating Transformer	RT5A	Grundig	9242	300001263	ne		
21	n. a.	TILE-Software Emission	Quantum Change, Modell TILE-ICS/FULL	EMCO	none	300003451	ne		
22	n. a.	Test Receiver	ESH2	R&S	871921/095	300002505	Ve	12.02.2010	12.02.2012
23	n. a.	EMI Test Receiver 9 kHz - 3 GHz incl. Preselector	ESPI3	R&S	101713	300004059	k	07.09.2010	07.09.2011

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

Annex A Photographs of the test setup

Photo documentation

Photo 1:

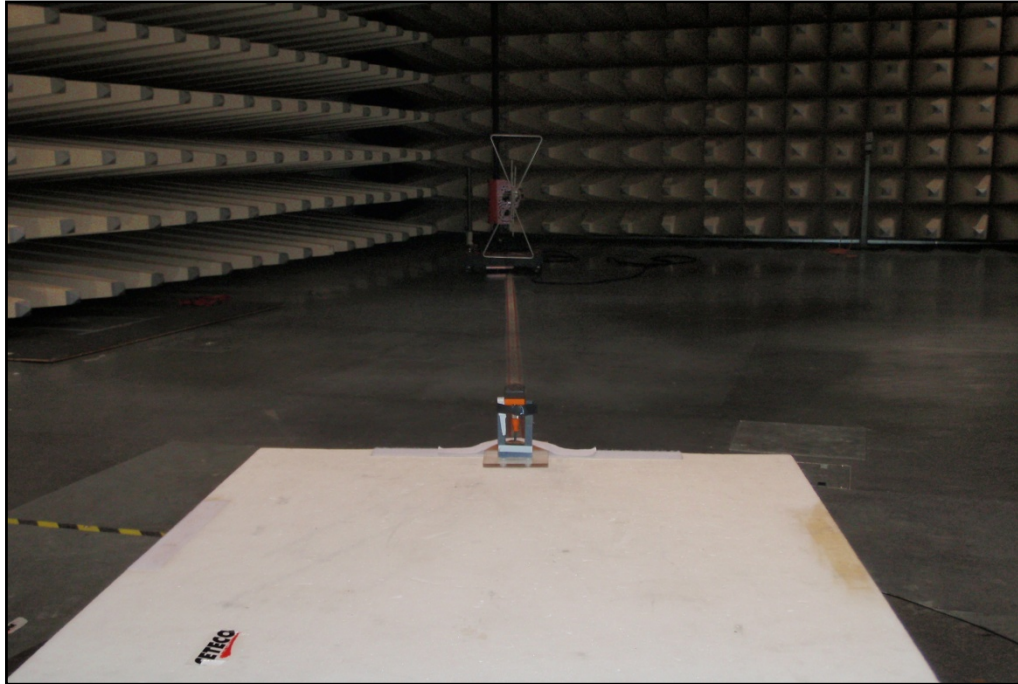
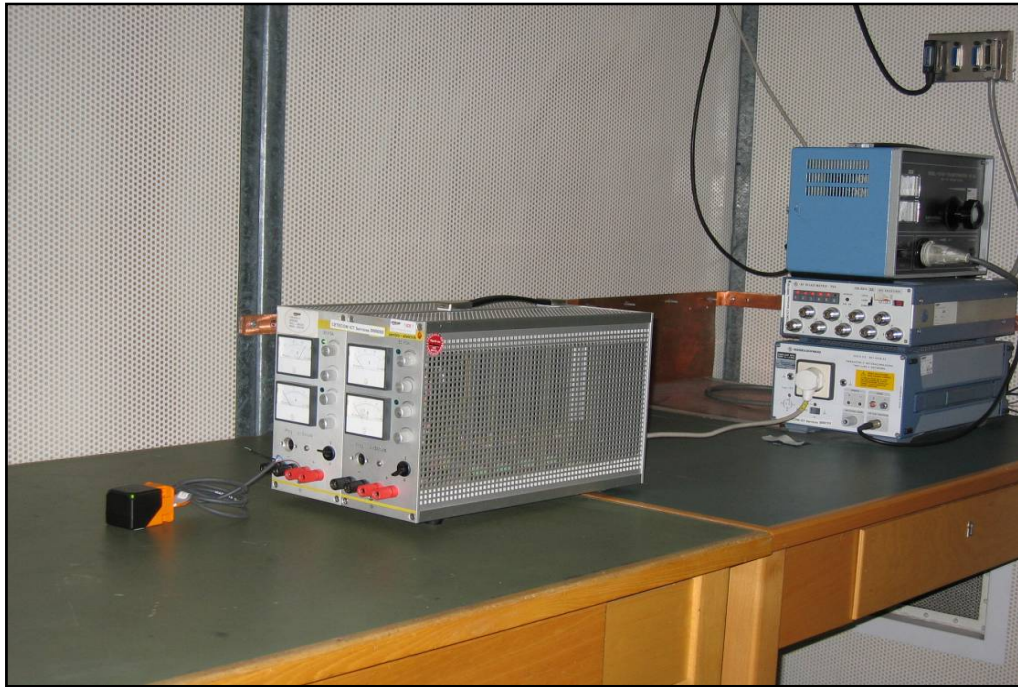


Photo 2:



Photo 3:



Annex B External photographs of the EUT

Photo documentation

Photo 1:



Photo 2:



Photo 3:



Photo 4:



Photo 5:



Photo 6:



Not internal photos possible.
The EUT was poured inside.

Annex C Internal photographs of the EUT

Photo documentation

Photo 7:

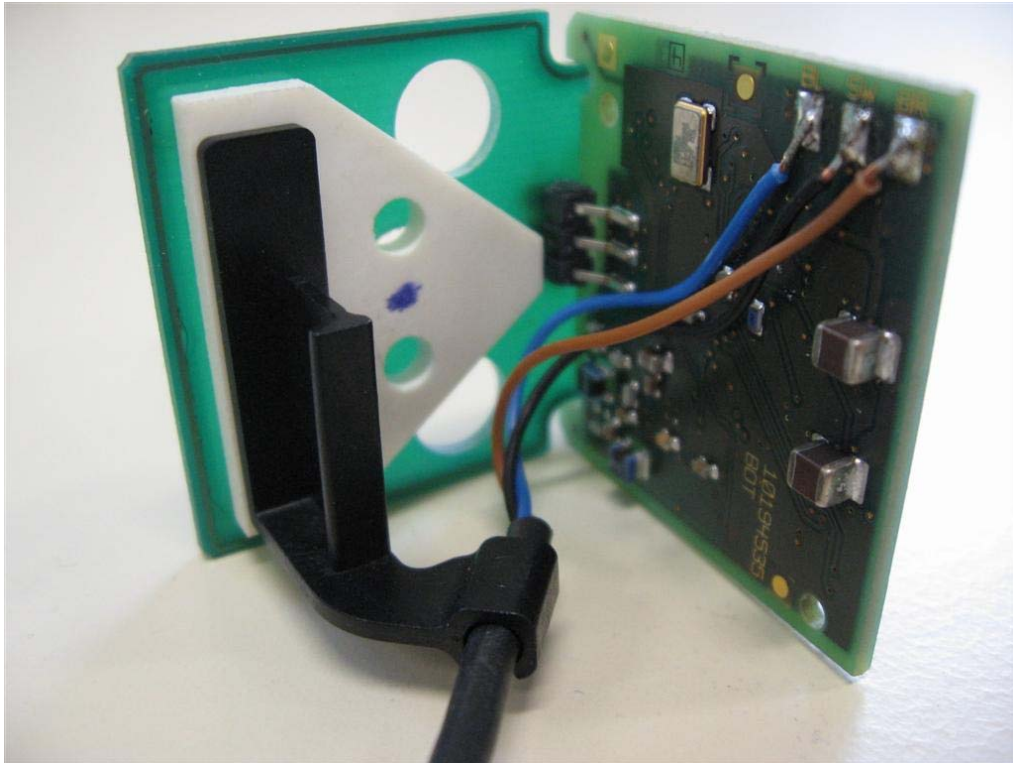
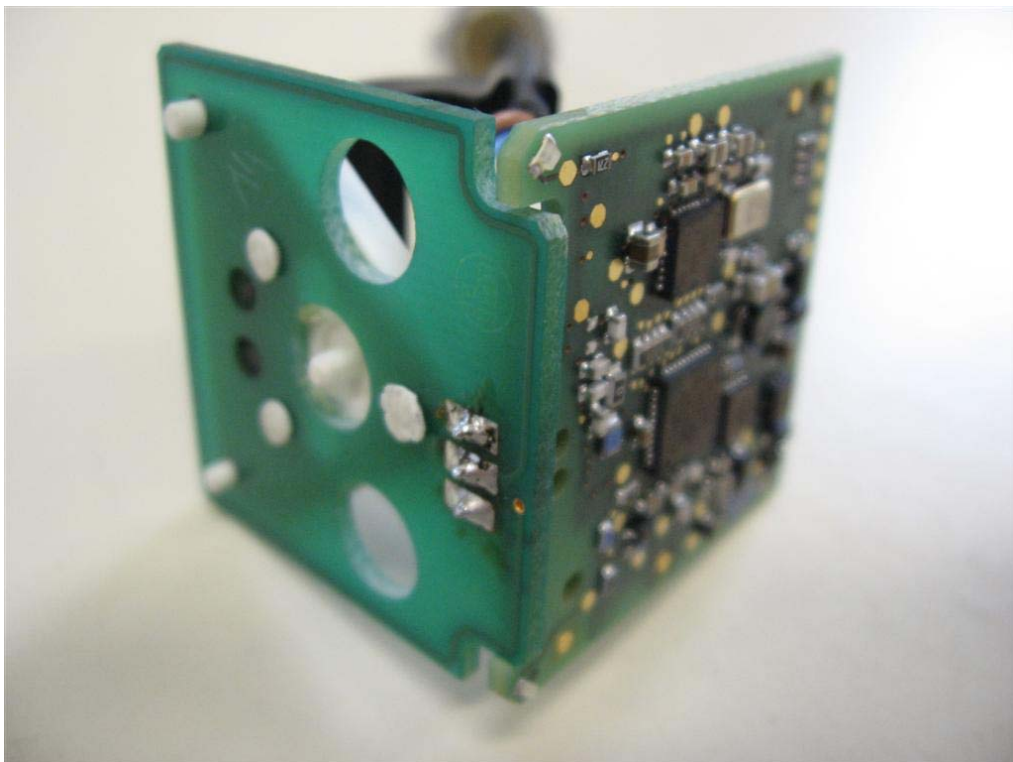


Photo 8:



Annex D Additional Equipment for the EUT

Photo documentation

Photo 3: power cable



Photo 4: tag



Annex E Document history

Version	Applied changes	Date of release
1.0	Initial release	2011-07-04
-A	Typos in cover sheet corrected / internal photos	2011-10-25

Annex F Further information**Glossary**

DUT	-	Device under Test
EMC	-	Electromagnetic Compatibility
EUT	-	Equipment under Test
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
IC	-	Industry Canada
Inv. No.	-	Inventory number
N/A	-	not applicable
S/N	-	Serial Number
SW	-	Software