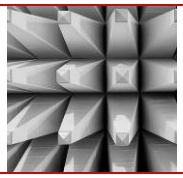




CETECOM™
CETECOM ICT Services
consulting - testing - certification

TEST REPORT

DAkkS Deutsche Akkreditierungsstelle D-PL-12075-01-01

Test report no.: 1-3010-01-03/11-A

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 test laboratory:
The test laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025
DAkkS registration number: D-PL-12076-01-01

Area of Testing: Radio/Satellite Communications

Applicant

Roche Diagnostics AG
Forrenstrasse
6343 Rotkreuz / SWITZERLAND
Phone: +41 41 799 0
Fax: +41 41 798 56 74
Contact: Paul Kieffer
e-mail: paul.kieffer@roche.com
Phone: +41 41 799 22 24

Manufacturer

Roche Diagnostics AG
Forrenstrasse
6343 Rotkreuz / SWITZERLAND

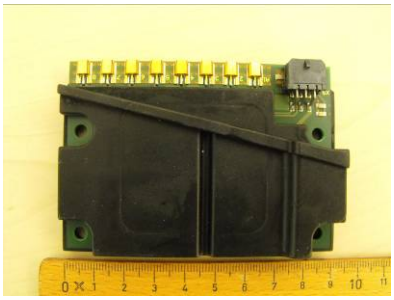
Test standard/s

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 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:	**RF-ID Reader 13.56 MHz**
Model name:	**RWF1**
FCC ID:	**YQF-RWF1**
IC:	**3100D-RWF1**
Frequency:	**13.56 MHz**
Power supply:	**24 V DC**
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 performed:

cn=Stefan Boes, o=Cetecom ICT Services GmbH, ou=BOE-100817, email=Stefan.Boes@cetecom.com, c=DE
2011.09.07 09:57:47 +02'00'

Stefan Bös

Test report authorised:

cn=Marco Bertolino, o=CETECOM ICT Services GmbH, ou=BTL-100826, email=marco.bertolino@cetecom.com, c=DE
2011.09.07 10:03:27 +02'00'

Marco Bertolino

1 Table of contents

2 General information

2.1 Notes

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 generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM ICT Services GmbH.
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.

2.2 Application details

Date of receipt of order:	2011-04-21
Date of receipt of test item:	2011-05-06
Start of test:	2011-05-06
End of test:	2011-06-21
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}	+23 °C during room temperature tests
	T_{max}	+55 °C during high temperature test
	T_{min}	-20 °C during low temperature test
Relative humidity content:		53 %
Air pressure:		not relevant for this kind of testing
Power supply:	V_{nom}	24.0 V DC
	V_{max}	27.0 V
	V_{min}	20.0 V

5 Test item

Kind of test item	:	RF-ID Reader 13.56 MHz
Type identification	:	RWF1
S/N serial number	:	Reader: 02142833 (EUT) Antenna: 2113758
HW hardware status	:	Not specified
SW software status	:	Not specified
Frequency band [MHz]	:	13.56 MHz
Type of modulation	:	N0N
Number of channels	:	1
Antenna	:	External loop antenna
Power supply	:	24.0 V DC
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	2011-09-07	-/-

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	☐	☐	☒	☐	-/-
§ 15.225 (a)/ RSS-210 Issue 8 Annex 2.6	Field strength of Fundamental	Nominal	Nominal	☒	☐	☐	☐	complies
§ 15.209/ RSS-210 Issue 8 Annex 2.6	Field strength 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/ RSS-210 Issue 8 Annex 6.6	Spurious emissions conducted < 30 MHz	Nominal	Nominal	☒	☐	☐	☐	complies

Note: NA = Not Applicable; NP = Not Performed

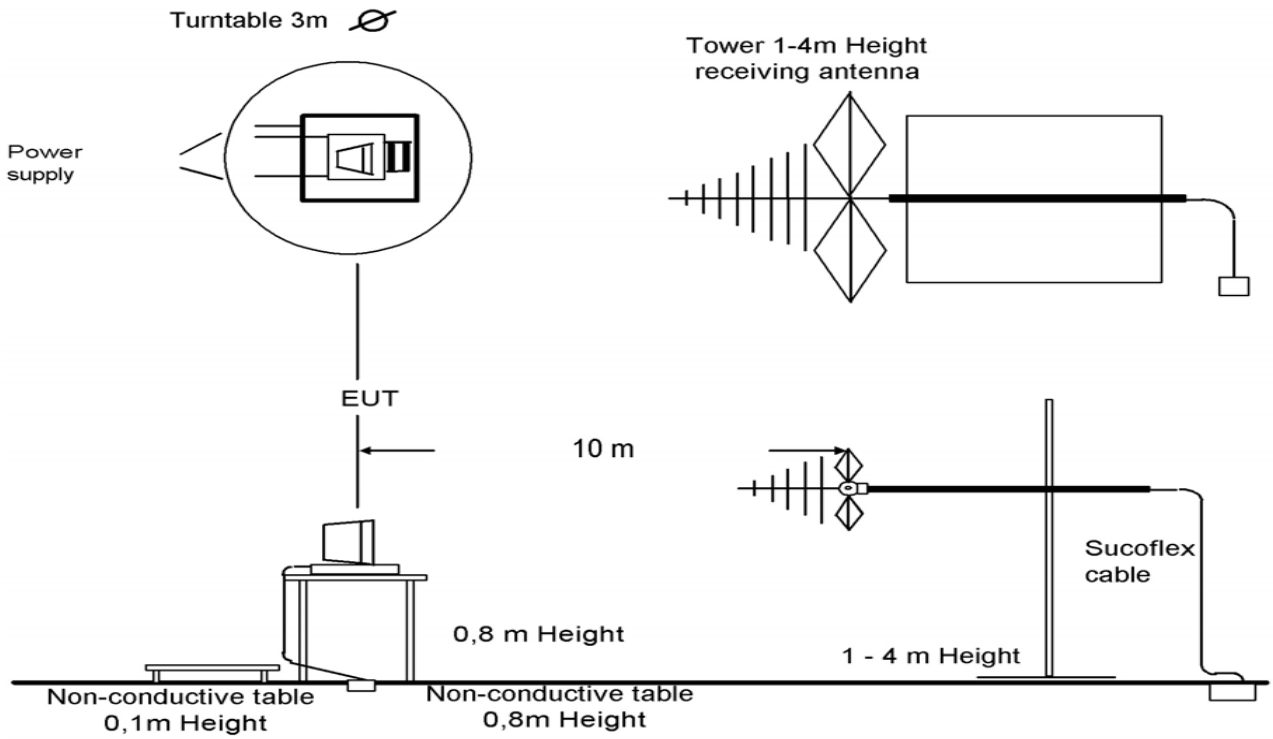
8 RF measurements

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 C63.4-2009 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 C63-4-2009 clause 4.2.
Antennas are confirmed with ANSI C63.2-1996 item 15.

Semi anechoic chamber



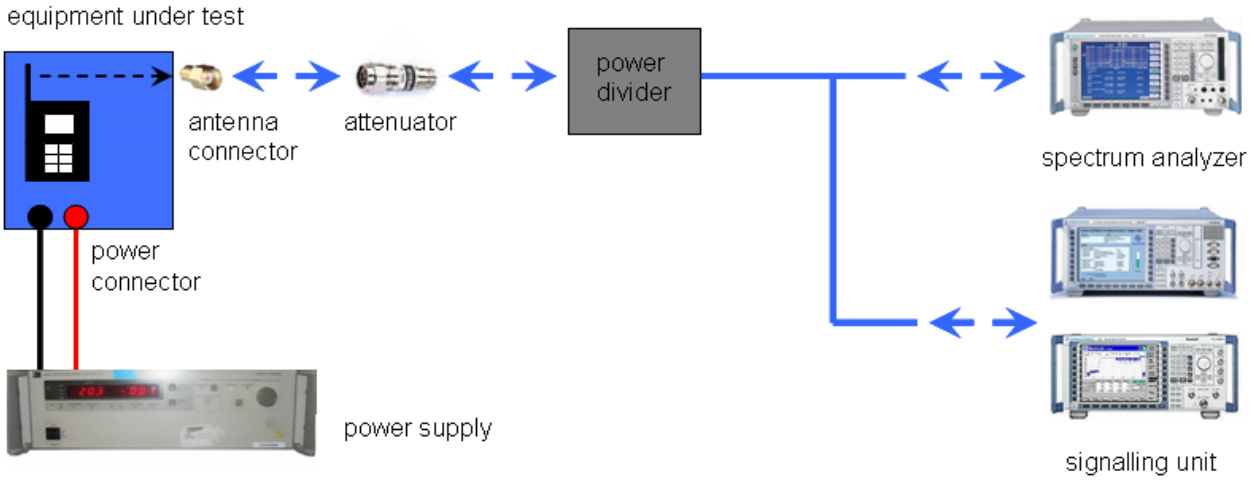
Picture 1: Diagram radiated measurements

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: The module transmits only with one antenna per time. Therefore the radiated measurements (Radiated field strength) were performed using the antenna with the shortest antenna cable.

Configuration descriptions: None

9 Measurement results

9.1 Timing of the transmitter

Not applicable!

(The EUT was prepared to transmit continuously).

Limits:

FCC	IC
CFR Part SUBCLAUSE § 15.35 (c)	RSS-GEN Issue 2 Section 4.5
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.	

9.2 Field strength of the fundamental

Result:

TEST CONDITIONS		MAXIMUM POWER (dBµV/m)	
Frequency		13.56 MHz	13.56 MHz
Mode		at 10 m distance (measured)	at 30 m distance (calculated)
T_{nom}	V_{nom}	60.5	41.4
Measurement uncertainty		±3dB	

(To convert the measuring distance from 10m to 30m a correction factor from 40 dB/decade was used acc. to FCC part15.31 (f2). Here we used 19.1 dB to recalculate from 10m to 30m).

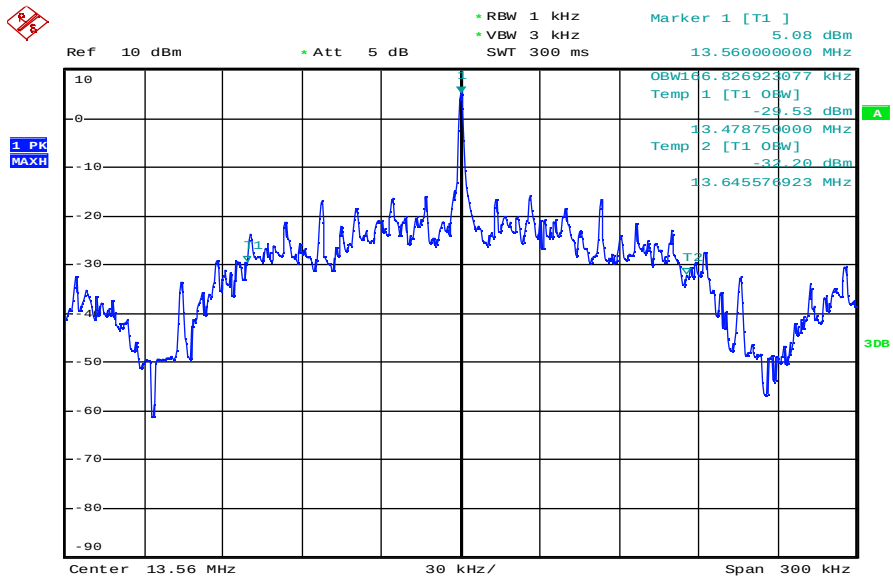
FCC		IC
CFR Part SUBCLAUSE § 15.225		RSS-210 Issue 8 Section A1.1.2 / 2.7 Table 4
Fundamental Frequency (MHz)	**Field strength of Fundamental (µV/m)**	**Measurement distance (m)**
13.553 to 13.567	15848 µV/m (84 dBµV/m)	30
	158489 µV/m (104 dBµV/m)	10 (Recalculated acc. to FCC part15.31 (f2))

RBW/VBW: 200 Hz up to 150 kHz, 9 kHz up to 30 MHz, 120 kHz up to 1 GHz

Result: **The result of the measurement is passed.**

9.3 Occupied bandwidth

For information only



Result: **OBW = 166.83 kHz**

9.4 Field strength of the harmonics and spurious

Measurement:

Measurement parameter	
Detector:	Average / Quasi Peak
Sweep time:	Auto
Resolution bandwidth:	120 kHz
Video bandwidth:	100 kHz
Span:	Steps of 3 MHz < 30 MHz Steps of 100 MHz > 30 MHz
Trace-Mode:	Max hold

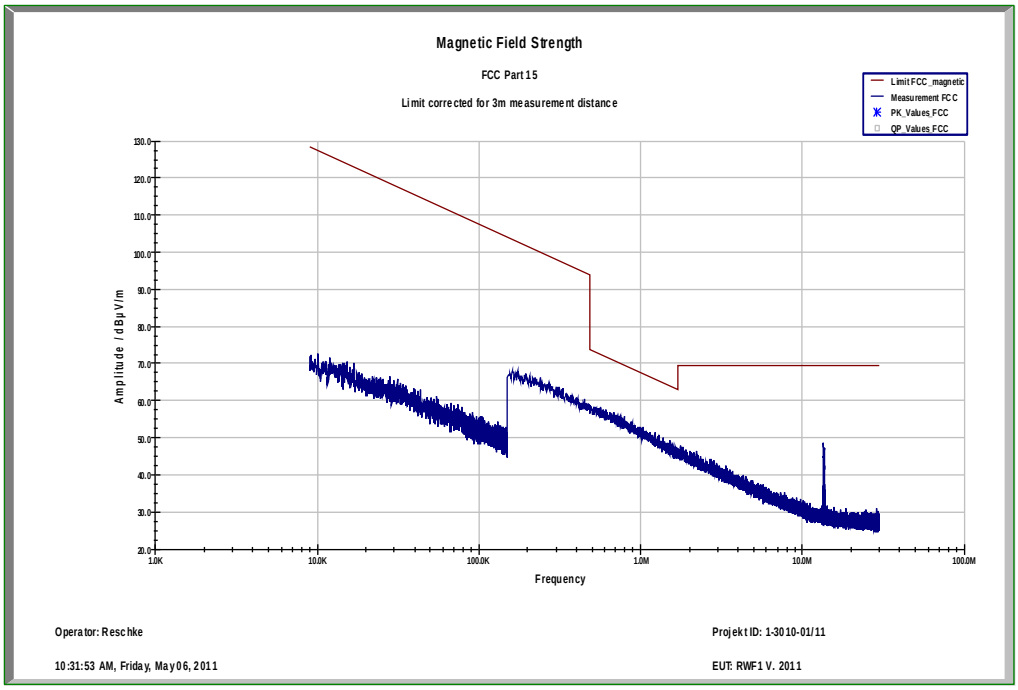
Limits:

FCC		IC
SUBCLAUSE § 15.209		
Field strength of the harmonics and spurious.		
Frequency (MHz)	**Field strength (µV/m)**	**Measurement distance (m)**
0.009 – 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: **The result of the measurement is passed.**

Plots of the measurements

Plot 1: TX-Mode, 9 kHz – 30 MHz @ 3 m



Plot 2: TX-Mode, 30 MHz to 1 GHz @ 10 m

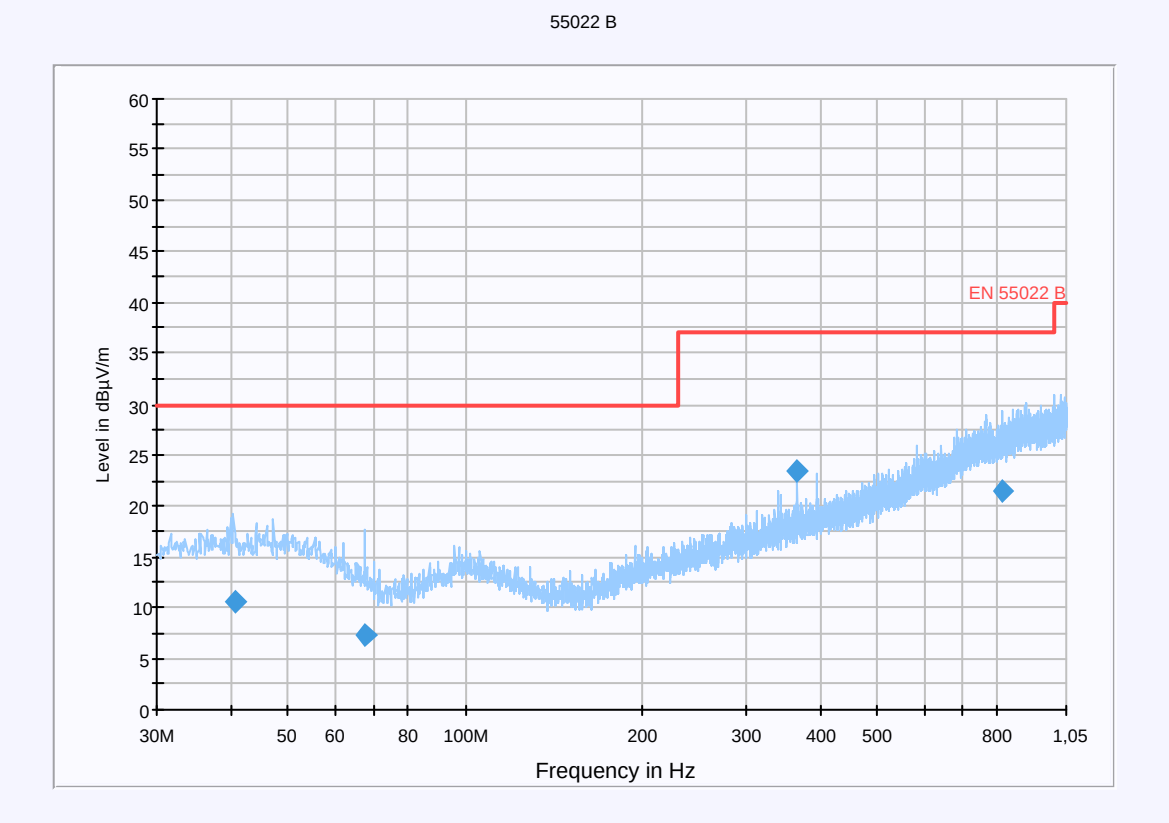
Common Information

EUT:	RWF1
Serial Number:	02142844
Test Description:	EN 55011 class B @ 10 m
Operating Conditions:	cont. TX 13,56 MHz (RFID)
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
40.678950	10.7	15000.000	120.000	200.0	H	149.0	13.4	19.3	30.0	
67.903050	7.2	15000.000	120.000	340.0	V	44.0	9.8	22.8	30.0	
366.127350	23.4	15000.000	120.000	100.0	V	-1.0	16.3	13.6	37.0	
814.860600	21.4	15000.000	120.000	234.0	H	97.0	24.0	15.6	37.0	

Hardware Setup: EMI radiated\Electric Field (NOS) - [EMI radiated]

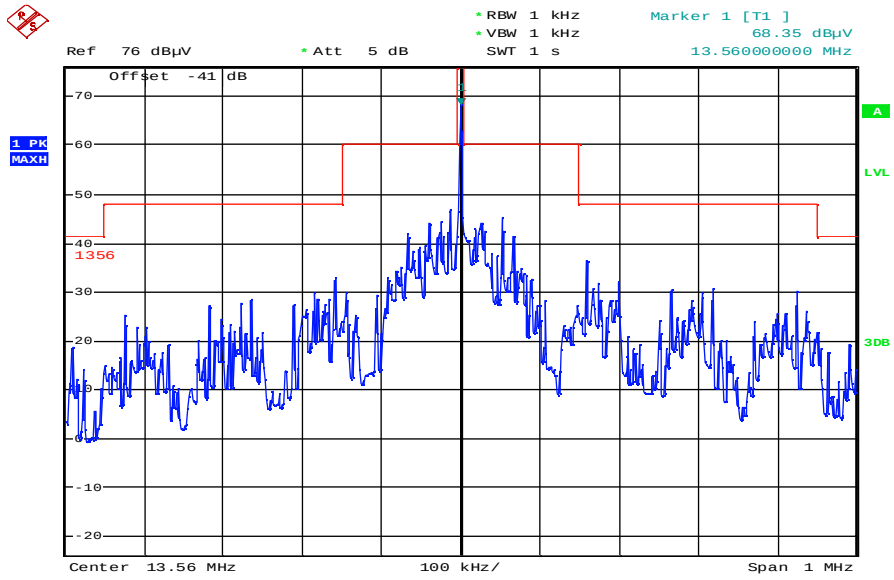
Subrange 1

Frequency Range:	30 MHz - 2 GHz
Receiver:	Receiver [ESCI 3] @ GPIB0 (ADR 20), SN 100083/003, FW 4.42
Signal Path:	without Notch FW 1.0
Antenna:	VULB 9163 SN 9163-295, FW --- Correction Table (vertical): VULP6113 Correction Table (horizontal): VULP6113 Correction Table: Cable_EN_1GHz (1005)
Antenna Tower:	Tower [EMCO 2090 Antenna Tower] @ GPIB0 (ADR 8), FW REV 3.12
Turntable:	Turntable [EMCO Turntable] @ GPIB0 (ADR 9), FW REV 3.12

EMC 32 Version 8.10.00

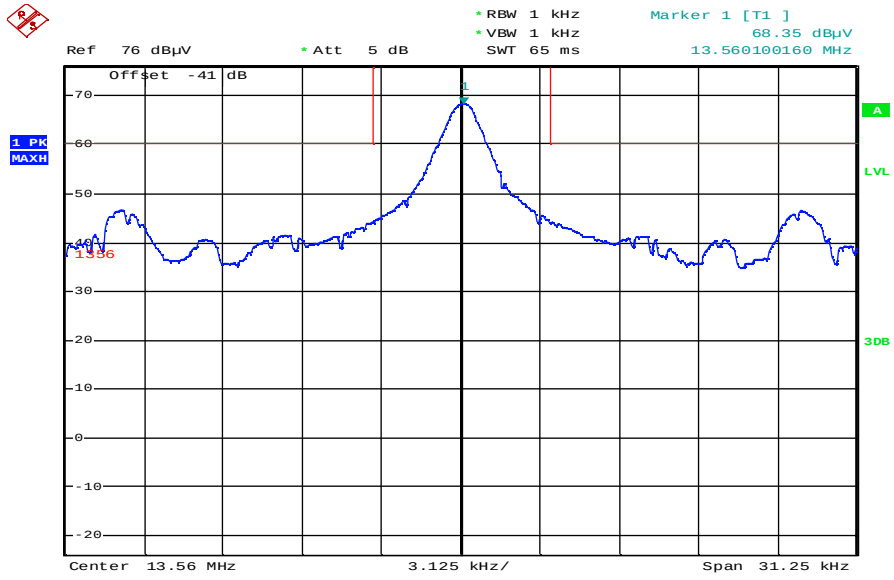
Plot 3: Spectrum mask part 15.225 (a, b, c, d)

Normal conditions



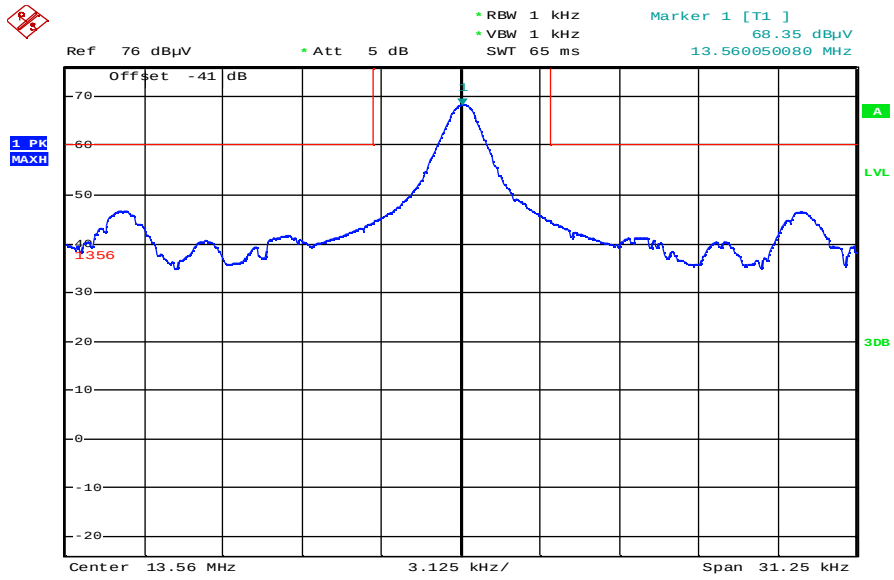
Date: 7.JUN.2011 14:29:48

Normal conditions (Zoom)



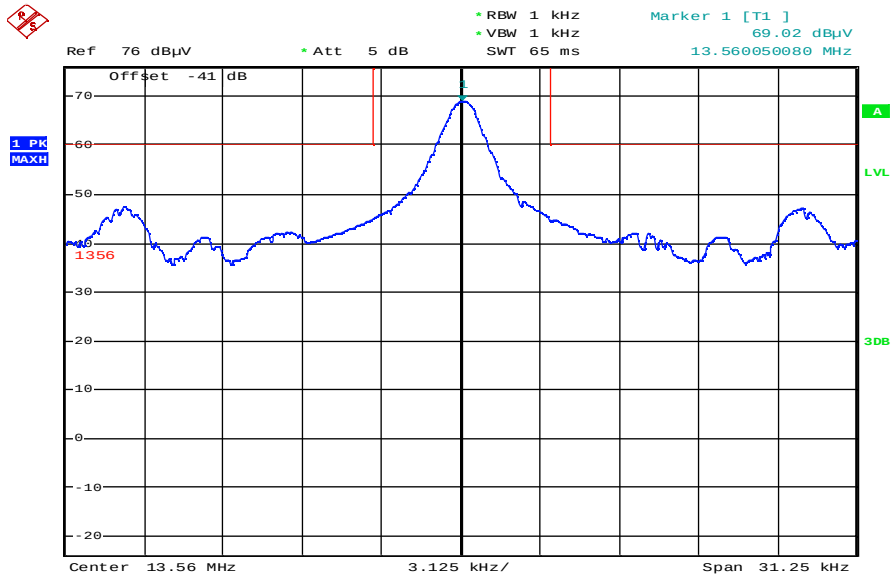
Date: 7.JUN.2011 14:31:01

Extreme conditions (T_{high} and V_{high})



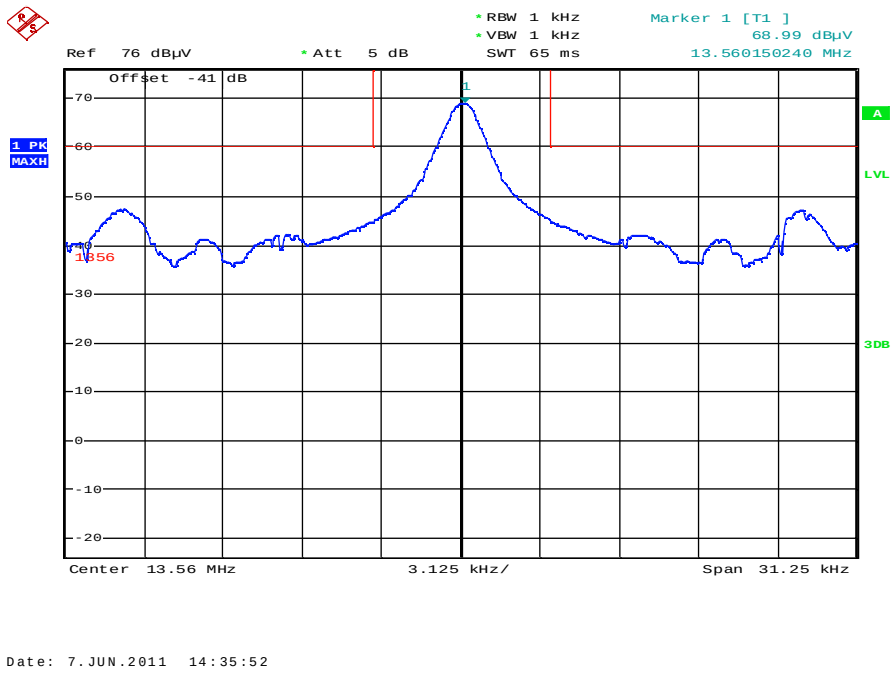
Date: 7.JUN.2011 14:32:41

Extreme conditions (T_{high} and V_{low})



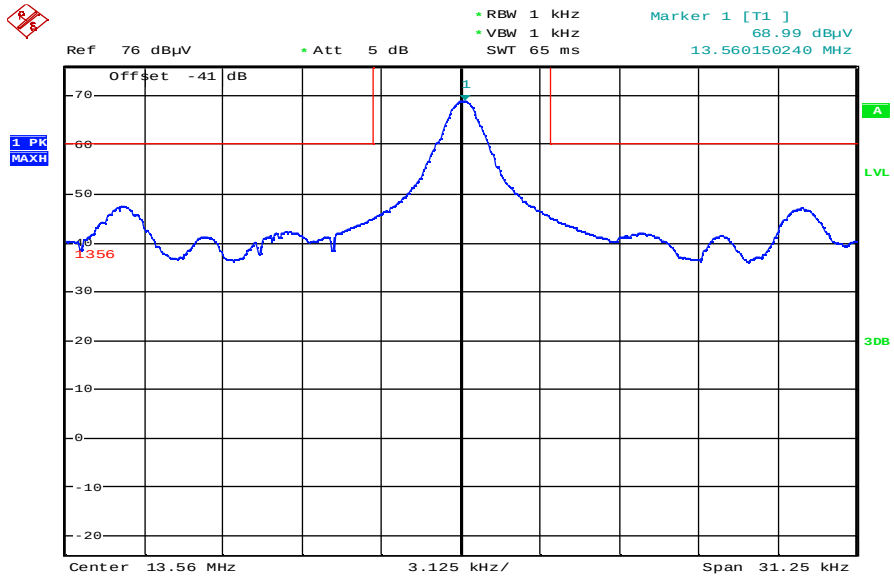
Date: 7.JUN.2011 14:34:17

Extreme conditions (T_{low} and V_{high})



Date: 7.JUN.2011 14:35:52

Extreme conditions (T_{low} and V_{low})



Date: 7.JUN.2011 14:37:44

RBW /VBW 1 kHz
The transmitter fulfils the requirements of FCC 15.225 (a, b, c and d)

Limits recalculated from 30m to 3m with 40 dB/decade according to FCC 15.31 (f2).

9.5 Frequency tolerance

Measurement:

Measurement parameter	
Detector:	Max peak
Sweep time:	Auto
Resolution bandwidth:	1 kHz
Video bandwidth:	1 kHz
Span:	50 kHz
Trace-Mode:	Max hold

Limits:

FCC	IC
SUBCLAUSE § 15.225	RSS-210 Issue 8 Annex 2.6
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.	

Frequency tolerance								
Over temperature variation			Over voltage variation			-/-		
Limit is +/- 1.356 kHz			Limit is +/- 1.356 kHz			-/-		
T [C]	Frequency [MHz]	result	Power voltage	Frequency [MHz]	result	-/-	-/-	-/-
-20°	13.56015	Pass	20 V DC	13.56010	Pass			
-10°	13.56015	Pass	21 V DC	13.56010	Pass			
0°	13.56010	Pass	22 V DC	13.56010	Pass			
10°	13.56010	Pass	23 V DC	13.56010	Pass			
20°	13.56010	Pass	24 V DC	13.56010	Pass			
30°	13.56010	Pass	25 V DC	13.56010	Pass			
40°	13.56005	Pass	26 V DC	13.56010	Pass			
50°	13.56005	Pass	27 V DC	13.56010	Pass			
Measurement uncertainty			±100 Hz					

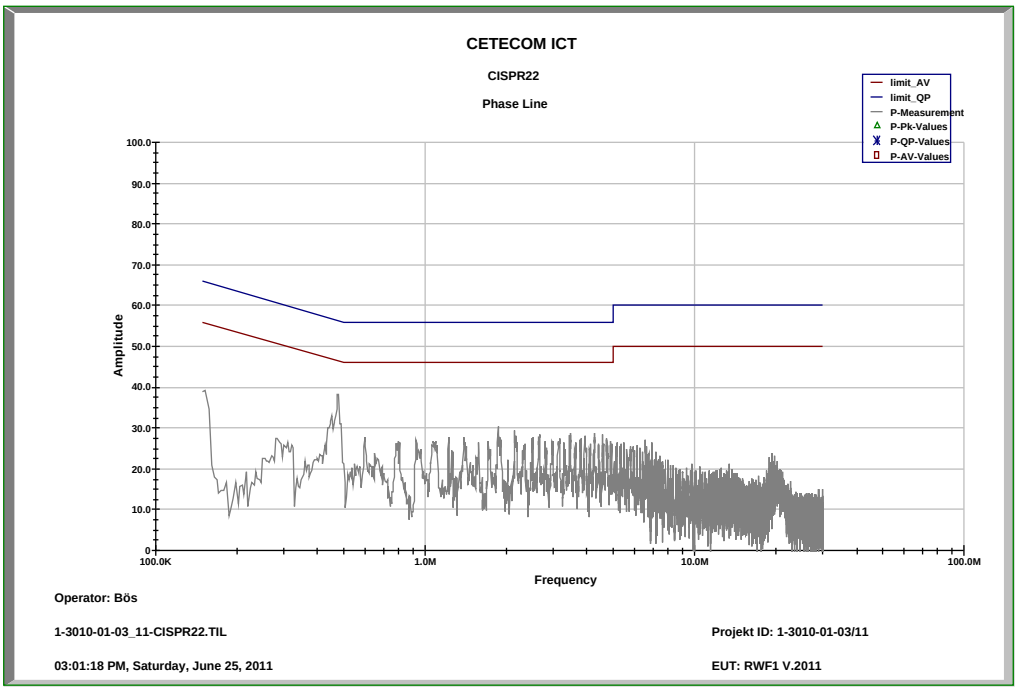
Result: **The result of the measurement is passed.**

9.6 AC line conducted

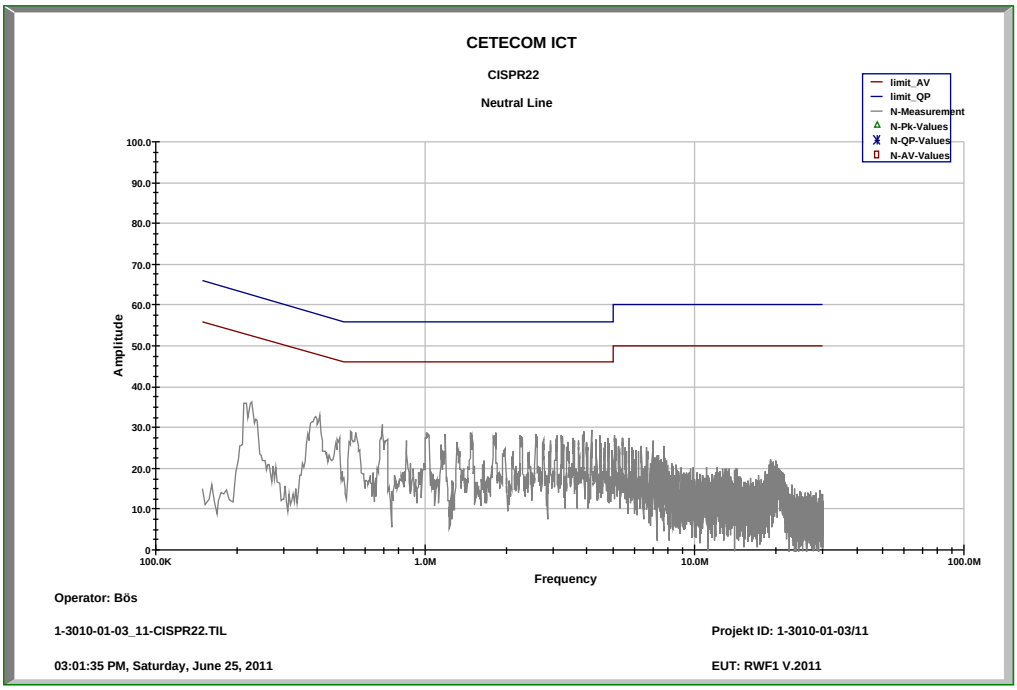
Limits:

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

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	ne		
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	31.07.2009	31.07.2011
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.	Isolating Transformer	RT5A	Grundig	8041	300001626	g		
13	n. a.	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP Meßtechnik	2818A03450	300001040	Ve	08.01.2009	08.01.2012
14	n. a.	Coaxial Attenuator 30dB/500W	8325	Bird	1530	300001595	ev		
15	n. a.	Double-Ridged Waveguide Horn Antenna 1-18.0GHz	3115	EMCO	8812-3088	300001032	vIKI!	05.03.2009	05.09.2011
16	n. a.	Active Loop Antenna	6502	EMCO	2210	300001015	ne		
17	n. a.	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996		23.03.2009	
18	Spec.A. 2_2e	System rack for EMI measurement solution	85900	HP I.V.	*	300000222	ne		
19	9	Artificial Mains 9 kHz to 30 MHz	ESH3-Z5	R&S	828576/020	300001210	Ve	06.01.2010	06.01.2012
20	n. a.	Relais Matrix	3488A	HP Meßtechnik	2719A15013	300001156	ne		
21	n. a.	Relais Matrix	PSU	R&S	890167/024	300001168	ne		
22	n. a.	Isolating Transformer	RT5A	Grundig	9242	300001263	ne		
23	n. a.	Three-Way Power Splitter, 50 Ohm	11850C	HP Meßtechnik		300000997	ne		

24	n. a.	Switch / Control Unit	3488A	HP	2605e08770	300001443	ne		
25	n. a.	Amplifier	js42-00502650-28-5a	Parzich GMBH	928979	300003143	ne		
26	n. a.	Band Reject filter	WRCG1855/1910-1835/1925-40/8SS	Wainwright	7	300003350	ev		
27	n. a.	Band Reject filter	WRCG2400/2483-2375/2505-50/10SS	Wainwright	11	300003351	ev		
28	n. a.	TILE-Software Emission	Quantum Change, Modell TILE-ICS/FULL	EMCO	none	300003451	ne		
29	n. a.	Highpass Filter	WHKX2.9/18G-12SS	Wainwright	1	300003492	ev		
30	n. a.	Highpass Filter	WHK1.1/15G-10SS	Wainwright	3	300003255	ev		
31	n. a.	Highpass Filter	WHKX7.0/18G-8SS	Wainwright	18	300003789	ne		
32	n. a.	PSA Spectrum Analyzer 3 Hz - 26.5 GHz	E4440A	Agilent Technologies	MY48250080	300003812	k	08.09.2010	08.09.2012
33	n. a.	MXG Microwave Analog Signal Generator	N5183A	Agilent Technologies	MY47420220	300003813	k	13.09.2010	13.09.2012
34	n. a.	RF Filter Section 9kHz - 1GHz	N9039A	Agilent Technologies	MY48260003	300003825	vlkl!	08.09.2010	08.09.2012
35	n. a.	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck	371	300003854	vlkl!	17.12.2008	17.12.2011

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
vlkl!	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:

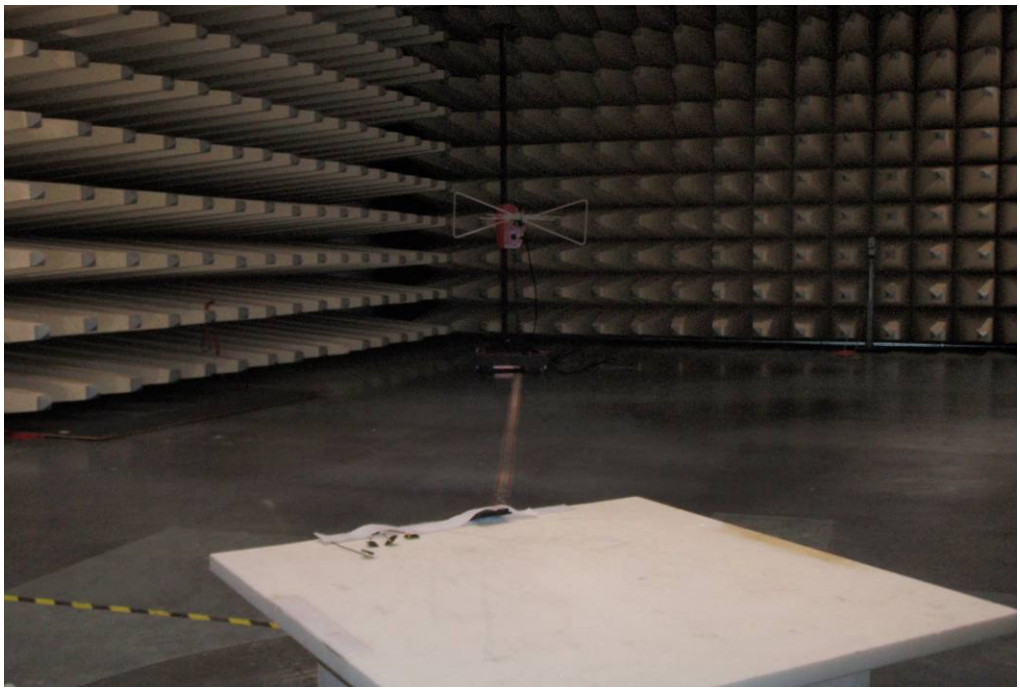


Photo 2:

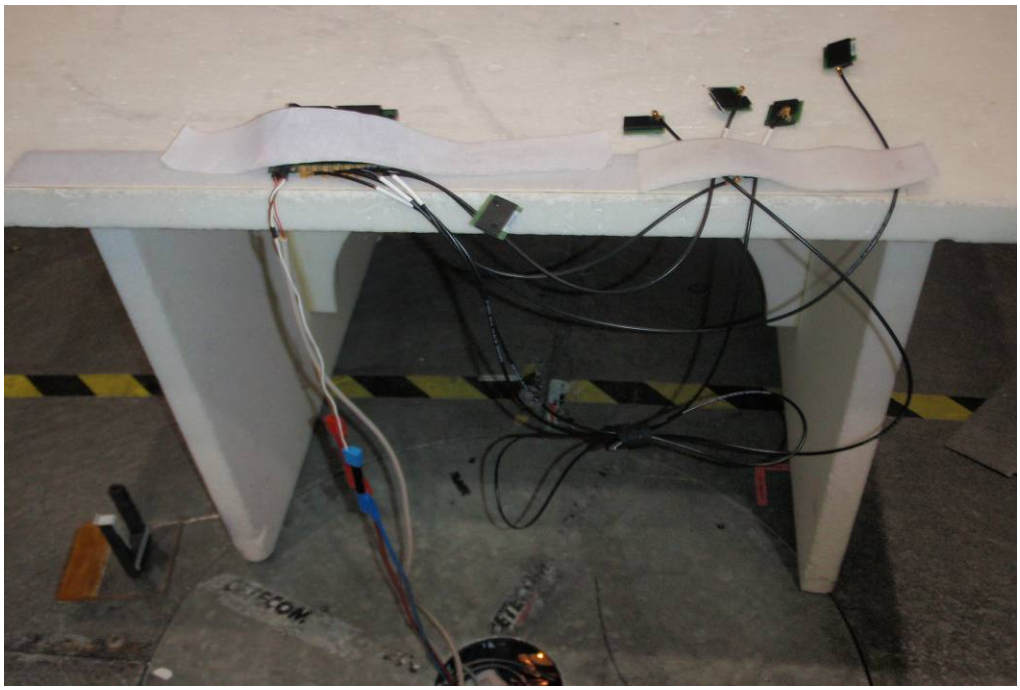


Photo 3:

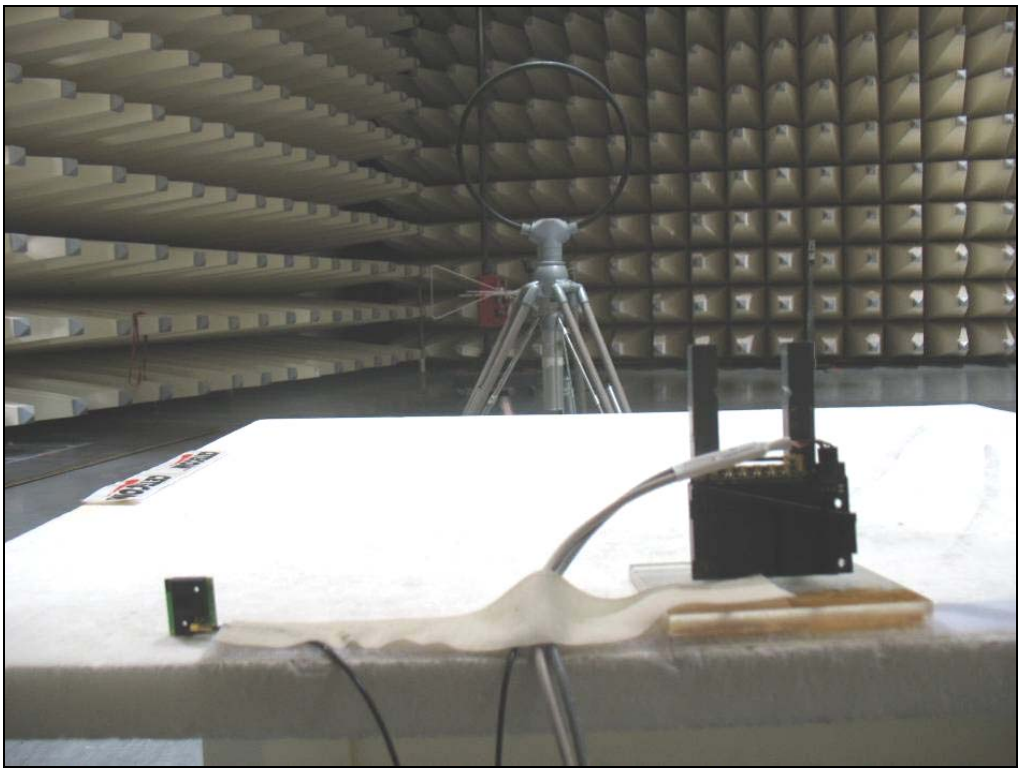


Photo 4:

Annex B External photographs of the EUT

Photo documentation:

Photo 1:

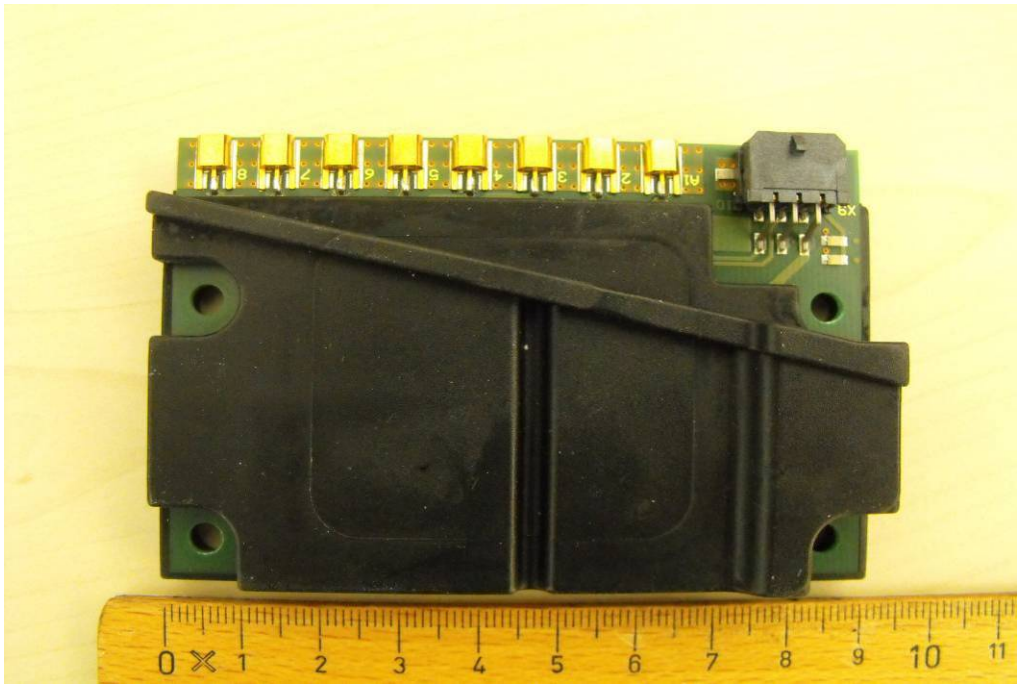


Photo 2:

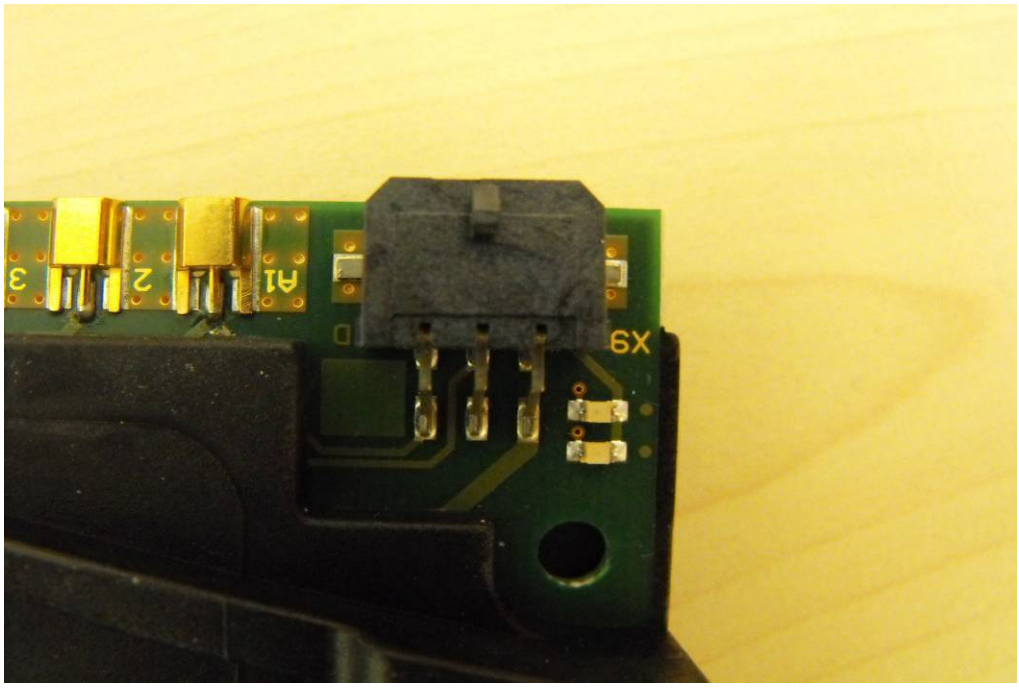


Photo 3:

Photo 4:

Photo 5:

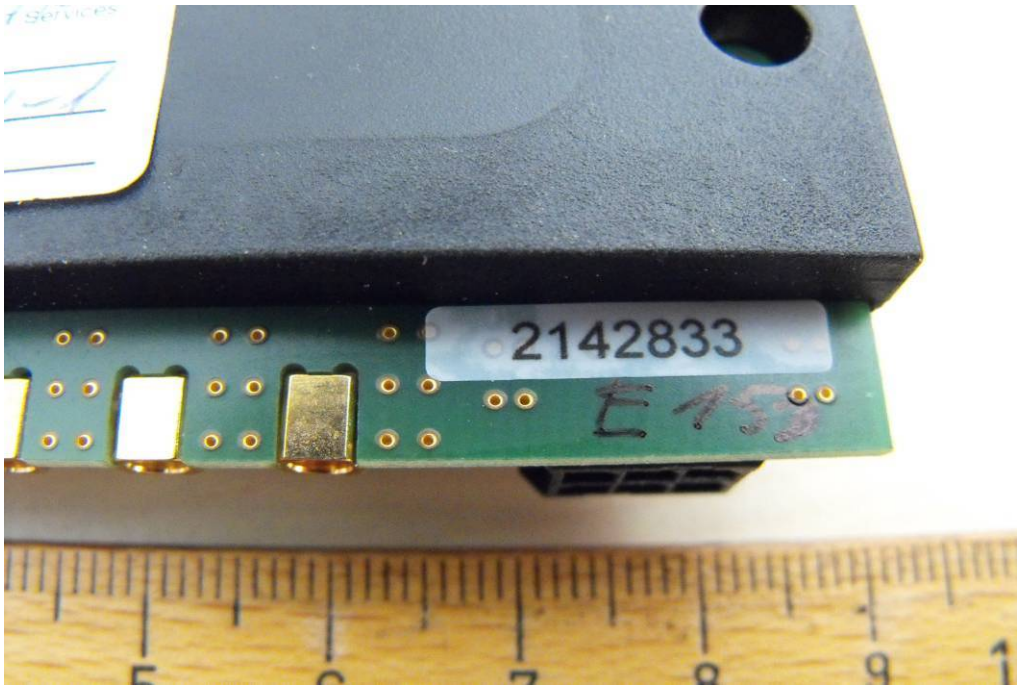


Photo 6:

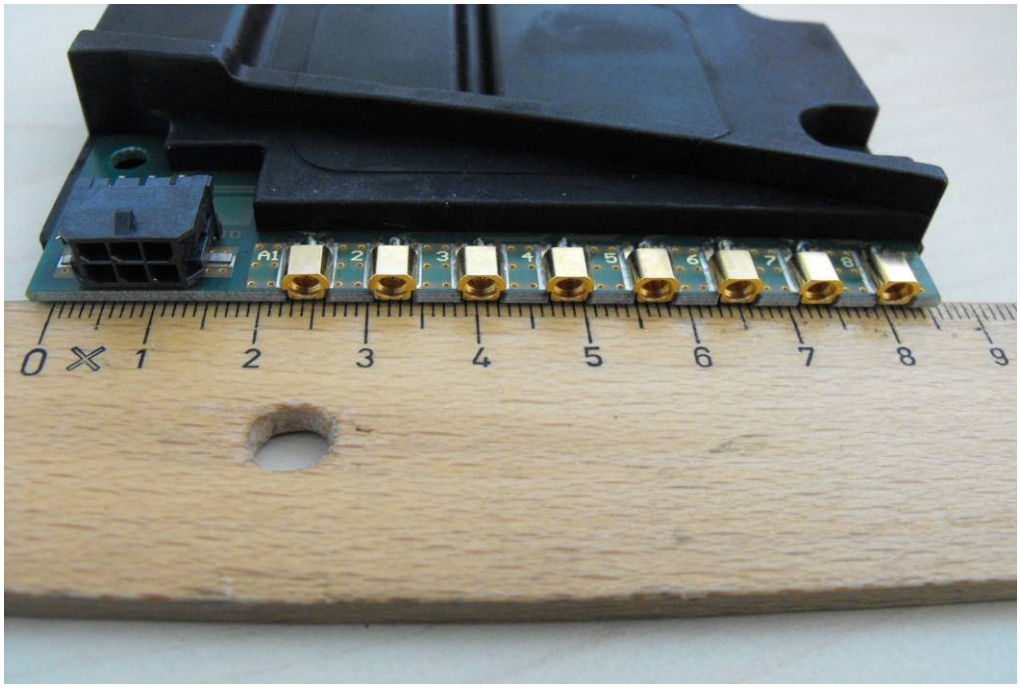


Photo 7: (Antenna)

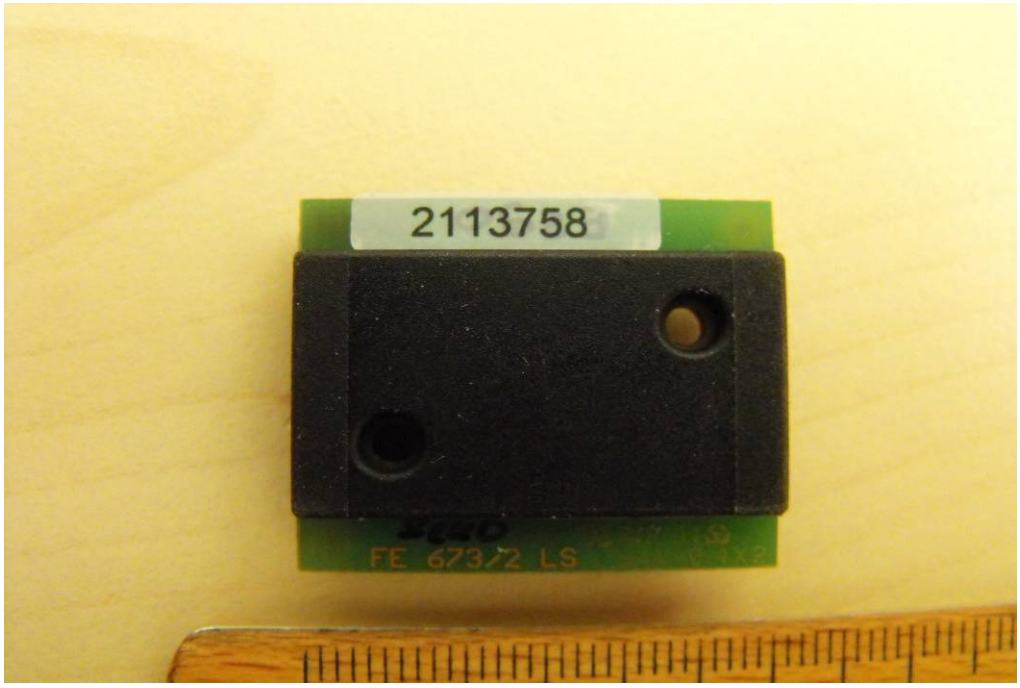


Photo 8: (Antenna)

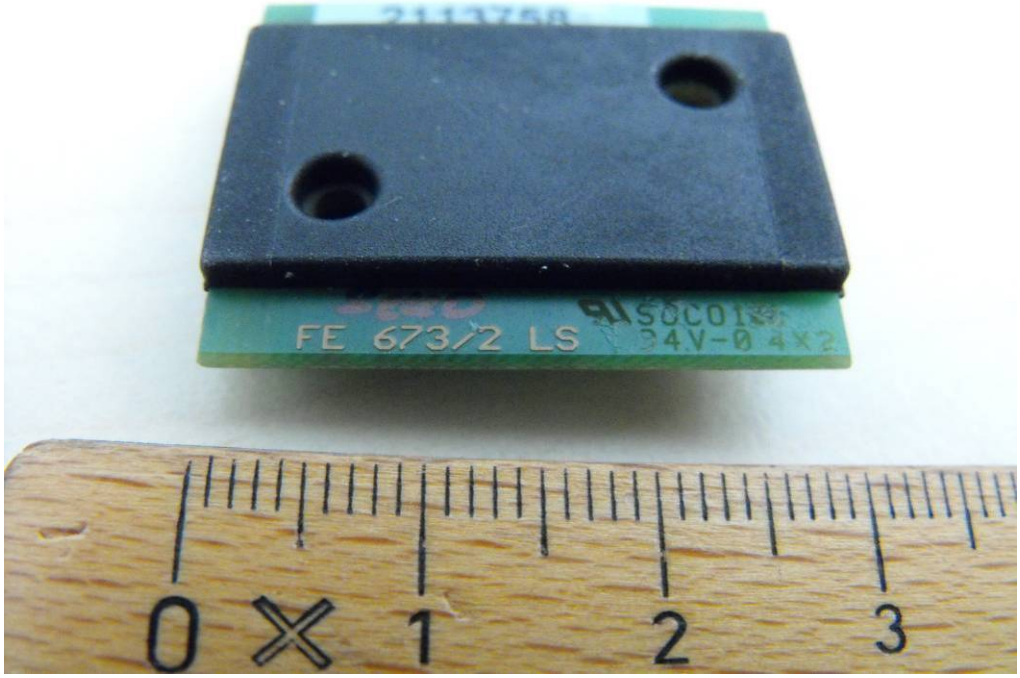


Photo 9: (Antenna)

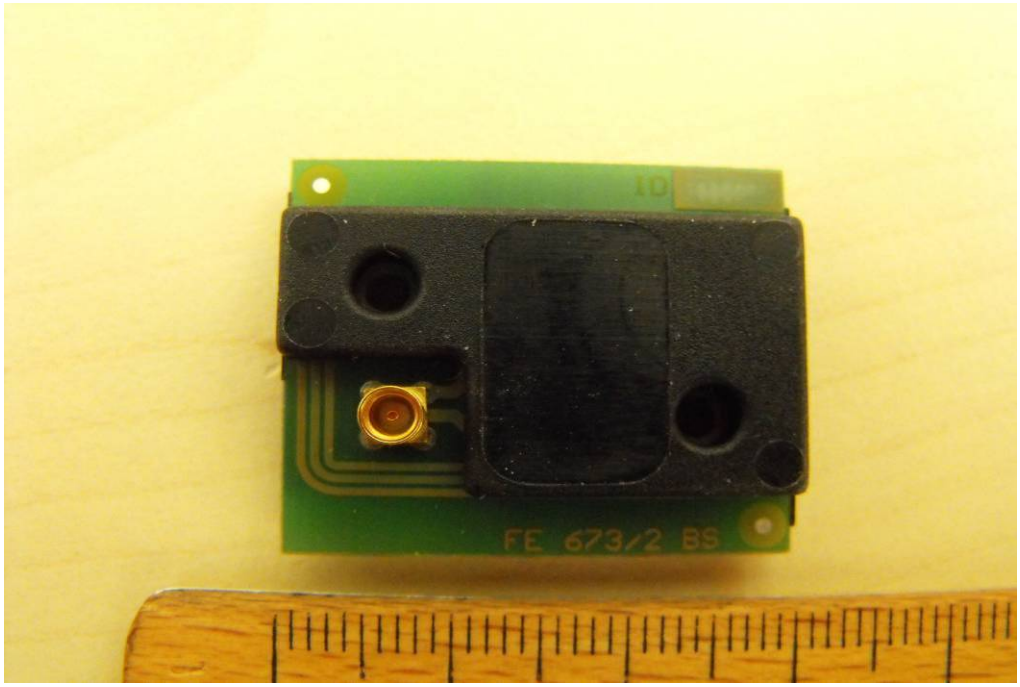
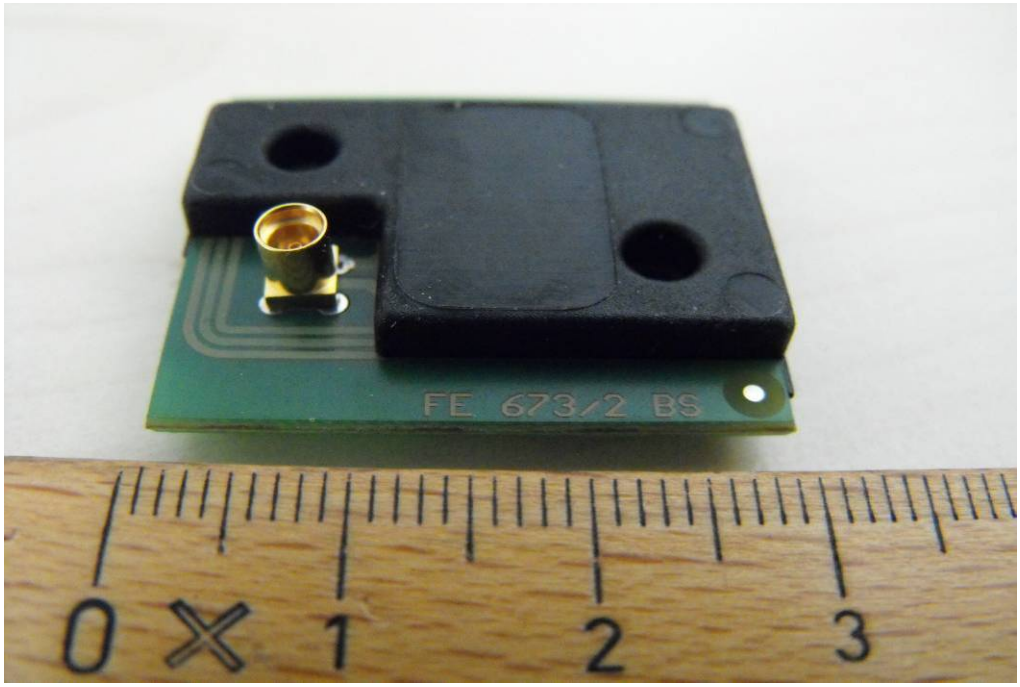


Photo 10: (Antenna)



Annex C Internal photographs of the EUT

Not applicable – PCB (Unit and antenna) sealed

Annex D Document history

Version	Applied changes	Date of release
1.0	Initial release	2011-06-30
-A	Model name changed and test description added, RSP100-Sheet separated	2011-09-07

Annex E 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