

Radio Satellite Communication  
Untertürkheimer Straße 6–10, D-66117 Saarbrücken,  
Telephone +49 (0) 681 598- 0, Fax +49 (0) 598 9075

Test report No.: 2-3876-01-03/05

This test report consists of 25 pages

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Recognized by the  
Federal Communications Commission  
**Anechoic chamber registration no.: 90462 (FCC)**  
**Anechoic chamber registration no.: 3463 (IC)**  
**TCB ID: DE 0001**



Accredited by the  
German Accreditation Council  
**DAR-Registration Number**  
**TTI-P-G 081/94-D0**



Independent ETSI  
compliance test house



**Accredited Bluetooth® Test Facility (BQTF)**

**Test report No. :2-3876-01-03/05**  
**Standard :FCC Part15/RSS210**  
**Applicant :EnOcean GmbH**  
**Type :STM250**  
**FCC-ID :SYK-STM250**  
**IC :5713A-STM250**

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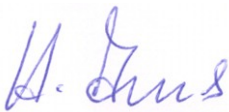
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## 1 General information

### 1.1 Notes

The test results of this test report relate exclusively to the test item specified in 1.5. The 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 the CETECOM ICT Services GmbH.

#### Test laboratory manager:

2005-03-11	RSC - 8414	Ames	
Date	Section	Name	Signature

#### Technical responsibility for area of testing:

2005-03-11	RSC - 8412	Hausknecht D.	
Date	Section	Name	Signature

## 1.2 Testing laboratory

CETECOM ICT Services GmbH

Untertürkheimer Straße 6 - 10

66117 Saarbrücken

Germany

Telephone : + 49 681 598 - 0

Telefax : + 49 681 598 - 9075

E-mail : info@ict.cetecom.de

Internet : www.cetecom-ict.de

Accredited testing laboratory

The test laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025.

DAR registration number: TTI-P-G-081/94-D0

Listed by: Federal Communications Commission (FCC)

Identification/Registration No: 90462

Anechoic chamber registration no.: 3463 (IC)

[Accredited Bluetooth® Test Facility \(BQTF\)](#)

## 1.3 Details of applicant

Name : EnOcean GmbH

Street : Kolpingring 18a

City : 82041 Oberhaching

Country : Germany

Telephone: + 49 (0) 89 6734 689 33

Fax :

Mobile : +49 171 228 2856

### Contact person:

Name : Mr. Armin Anders

Telephone: + 49 (0) 89 6734 689 33

Fax :

Mobile : +49 171 228 2856

E-mail : Armin.anders@enocean.com

## 1.4 Application details

Date of test: 2005-03-09 to 2005-03-11

## 1.5 Test item

Type of equipment : Wireless burglar alarm for windows  
Type designation : STM250  
Manufacturer : - applicant -  
Street :  
City :  
Country :  
Serial number : - / -

### Additional information :

Frequency : 868.3 MHz  
Type of modulation : 200K0A1D  
Channel spacing : >25 kHz  
Number of channels : 1  
Antenna : Rolled wire antenna  
Max. ERP : Peak: 100.4 dB $\mu$ V/m ; Average: 63.3 dB $\mu$ V/m (at 3m distance)  
Power supply : Via build-in solar cell  
FCC-ID : SYK-STM250  
IC No : 5713A-STM250

## 1.6 Test specifications:

**CANADA RSS-210 ( 11/2001 )**  
**FCC Part15.231**

## Test Report Cover Sheet/Performance Test Data

TEST REPORT NUMBER: **2-3876-01-03/05**

EQUIPMENT MODEL NUMBER: **STM250**

CERTIFICATION NO: **5713A-STM250**

MANUFACTURER : **EnOcean GmbH**

TESTED TO RADIO STANDARDS SPECIFICATION NO. : **RSS210 Issue 5**

OPEN AREA TEST SITE INDUSTRY CANADA NUMBER: **3463**

FREQUENCY RANGE (or fixed frequency): **868.3 MHz**

R.F. POWER IN WATTS AND ANTENNA INFORMATION: **rolled wire antenna, EIRP 0.002W**  
**Peak: 100.4 dB $\mu$ V/m ; Average: 63.3 dB $\mu$ V/m at 3m**

OCCUPIED BANDWIDTH (99% BW): **152.5 kHz**

TYPE OF MODULATION: **A1D (ASK)**

EMISSION DESIGNATOR (TRC-43): **152KA1D**

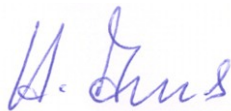
TRANSMITTER SPURIOUS (worst case): **47.9 dB $\mu$ V/m at 3m**

RECEIVER SPURIOUS (worst case): **n.a.**

### ATTESTATION:

**DECLARATION OF COMPLIANCE:** I declare 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.

Signature:



Date: **2005-03-11**

## **2 Technical test**

### **2.1 Summary of test results**

The radiated measurements were performed vertical and horizontal over the complete frequency range. We start at 1 m high with vertical receiving antenna and rotate the dish continuously. During rotation we use the antenna lift system to vary the high from 1 to 4 m. So we find maximum radiation output. At this points we do manual re-measurements. After this we do the same measurements in horizontal position of the receiving antenna. This (horizontal and vertical) is made for all the three planes of the test sample. We use the maximum received results.

The detector function and selection of bandwidth are according ANSI C63.2-1996 item 8.2.1 and ANSI C63.4-2003 Item 4.2.

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

150 kHz - 30 MHz: Quasi Peak measurement, 9kHz Bandwidth, loop antenna.

30 MHz - 200 MHz: Quasi Peak measurement, 120KHz Bandwidth, biconical antenna

200MHz - 1GHz: Quasi Peak measurement, 120KHz Bandwidth, log periodic antenna

>1GHz: Average, RBW 1MHz, VBW 10 MHz, wave-guide horn

The product fulfills the also the requirements for CANADA RSS-210

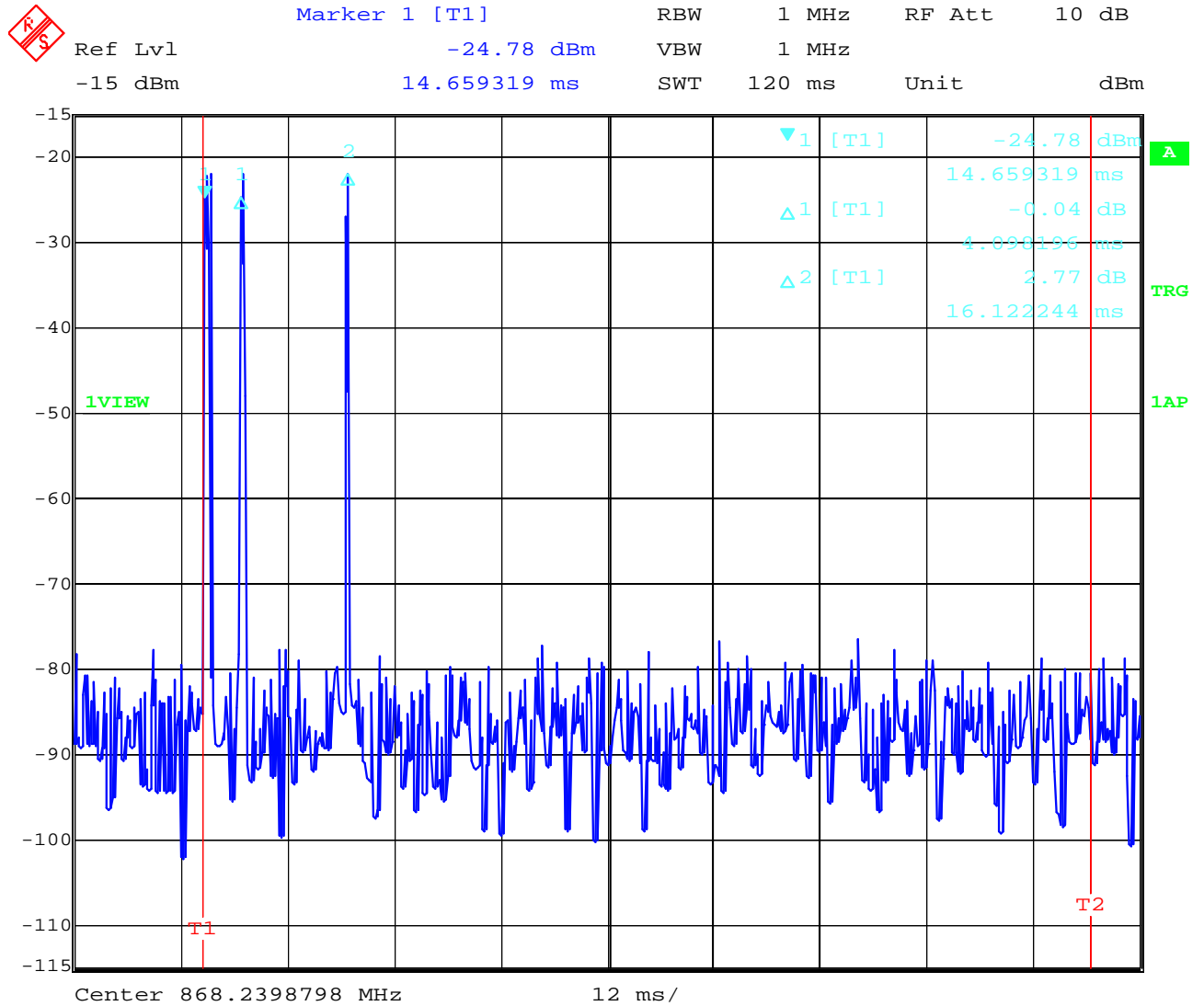
No deviations from the technical specification(s) were ascertained in the course of the tests performed.

**During test the sample was fed via cable with 3.0 V DC instead of the solar cell**

## 2.2 Test results

### 2.2.1 Timing behavior 15.231(a1)

The transmitter stops after having transmitted 3 packets within max. 16.1 ms



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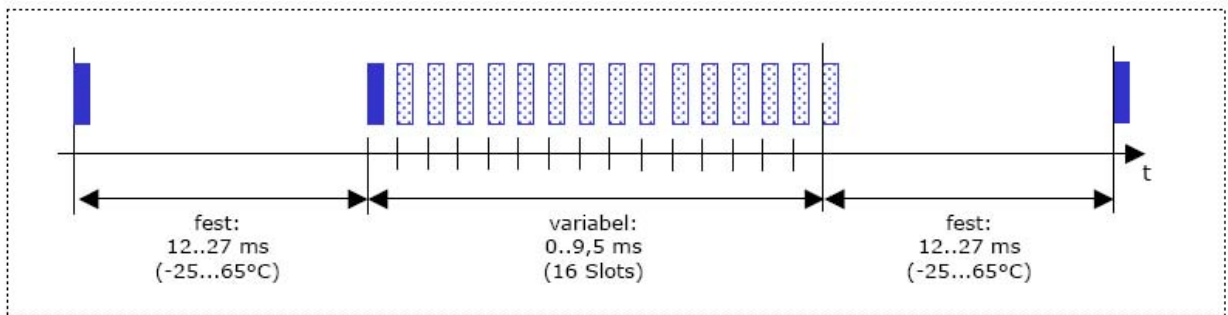
The red lines show the 100ms window according to FCC 15.35 (c)

The TX stops transmitting after 16.1 ms.

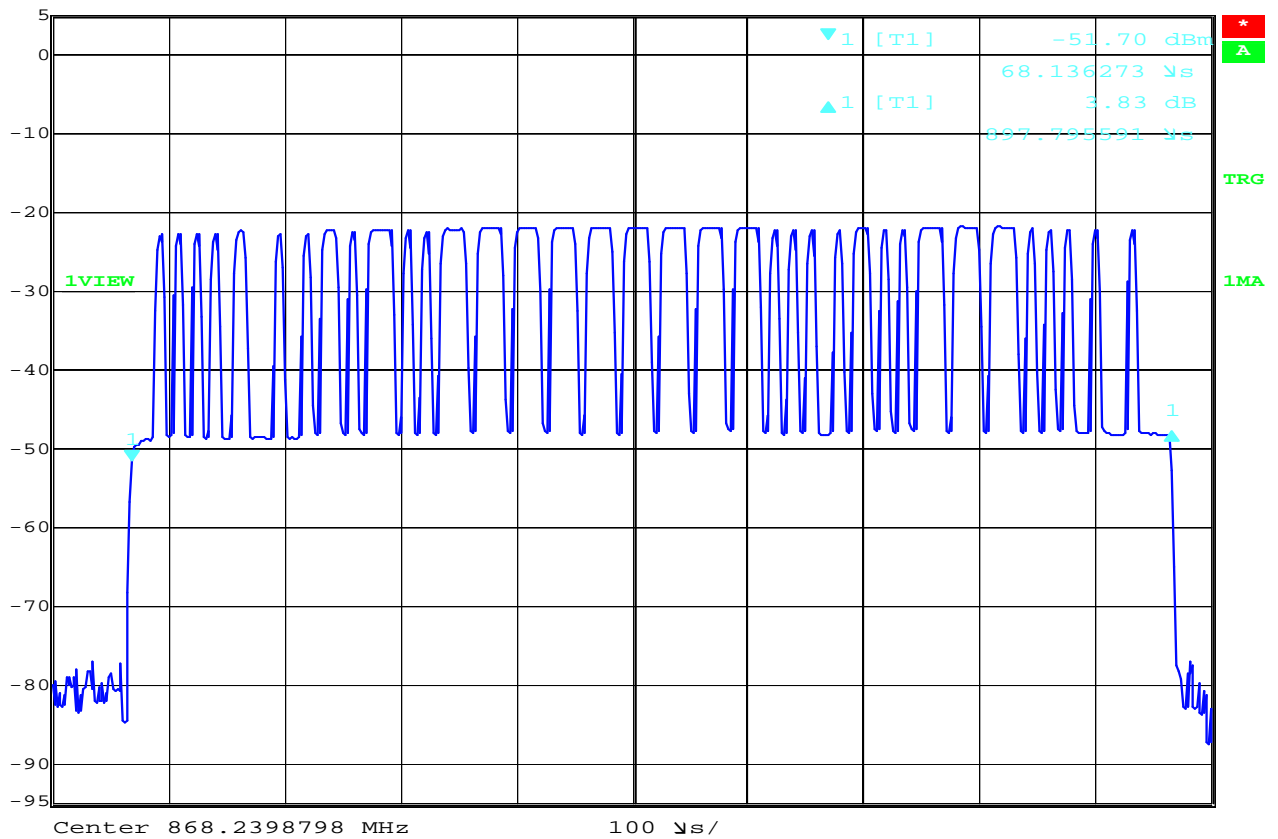
There are maximal 3 pulses possible within 100 ms. (worst case)



## Pulse Train



	Delta 1 [T1]	RBW	1 MHz	RF Att	30 dB
Ref Lvl	3.83 dB	VBW	1 MHz		
5 dBm	897.795591 $\mu$ s	SWT	1 ms	Unit	dBm



## Duty Cycle:

On pulse train is min. 24 ms, max 63.3 ms.

The length of one packet is 0.9 ms. Within a packet the duty cycle is ~50%, ~ 0.45 ms.

One pulse train consists of 3 packets within 100 ms.

Added we have a TX-time  $3 \cdot 0.45$  ms within 100ms, this is a duty cycle of 1.4%.

The average value is  $(\text{Peak} - 20 \cdot \log(1.4/100)) = \text{Peak} - 37.1$  dB.

Radiated field strength is 100.4 dB $\mu$ V/m at 3m distance PEAK .

**The calculated AVERAGE is 100.4 dB $\mu$ V/m – 37.1 dB = 63.3 dB $\mu$ V/m at 3m distance.**

**The limit for 868.3 MHz according to FCC15.231 is 82 dB $\mu$ V/m.**

**The product complies with the FCC and IC requirements.**

## 2.2.2 Field Strength 15.231(b1)

**(RADIATED)**

TEST CONDITIONS		MAXIMUM AVERAGE FIELD STRENGTH ( $\mu\text{V/m}$ )
Frequency 868.3 MHz		
$T_{\text{nom}}$ ( 23 )°C	$V_{\text{nom}}$	104713 $\mu\text{V/m}$ <b>PEAK</b> (100.4 dB $\mu\text{V/m}$ )  1462 $\mu\text{V/m}$ <b>AVERAGE</b> (63.3 dB $\mu\text{V/m}$ )
Maximum deviation from output power under extreme test conditions (dBc)		not applicable
Measurement uncertainty		$\pm 3\text{dB}$

RBW/VBW : 1 MHz

**Limit for 868.3 MHz : 12500  $\mu\text{V/m}$  (82.0 dB $\mu\text{V/m}$ ) Average**

### Limits

Frequency (MHz)	Field strength ( $\mu\text{V/m}$ )	Field strength of Spurious emissions ( $\mu\text{V/m}$ )
40.66-407	2250	225
70-130	1250	125
130-174	1 250 to 3 750 **	125 to 375 **
174-260	3750	375
260-470	3 750 to 12 500 **	375 to 1 250 **
Above 470	12500	1250
** linear interpolations		

**15.231(b1) Field Strengths and Frequency Bands**

<b>EMISSION LIMITATIONS</b>					
f (MHz)	amplitude of emission (dBμV/m) Peak	amplitude of emission (dBμV/m) Average	limit max. allowed emission power	Actual attenuation below frequency of operation (dB)	results
868.3	100.4 Peak	63.3 AV	82.0 dBμV/m Average		Operating frequency
1736.6	47.9 Peak	10.8 AV	20 dBc/62.0 dBμV/m	52.5	complies
<b>Measurement uncertainty</b>			<b>± 3dB</b>		

**Limits**

<b>Fundamental Frequency (MHz)</b>	<b>Field strength (μV/m) of the fundamental</b>	<b>Field strength of Spurious emissions (μV/m)</b>
40.66-407	2250 / 67 dBμV/m	225 / 47 dBμV/m
70-130	1250 / 62 dBμV/m	125 / 42 dBμV/m
130-174	1250 to 3750 ** 62 – 71.5 dBμV/m	125 to 375 ** 42 – 51.5 dBμV/m
174-260	3750 / 71.5 dBμV/m	375
260-470	2750 to 12500 ** 71.5 – 82 dBμV/m	375 to 1250 ** 51.5 – 62 dBμV/m
Above 470	12500 / 82 dBμV/m	1250 / 62 dBμV/m
** linear interpolations		

## 2.2.3 Bandwidth of Emissions 15.231(c)



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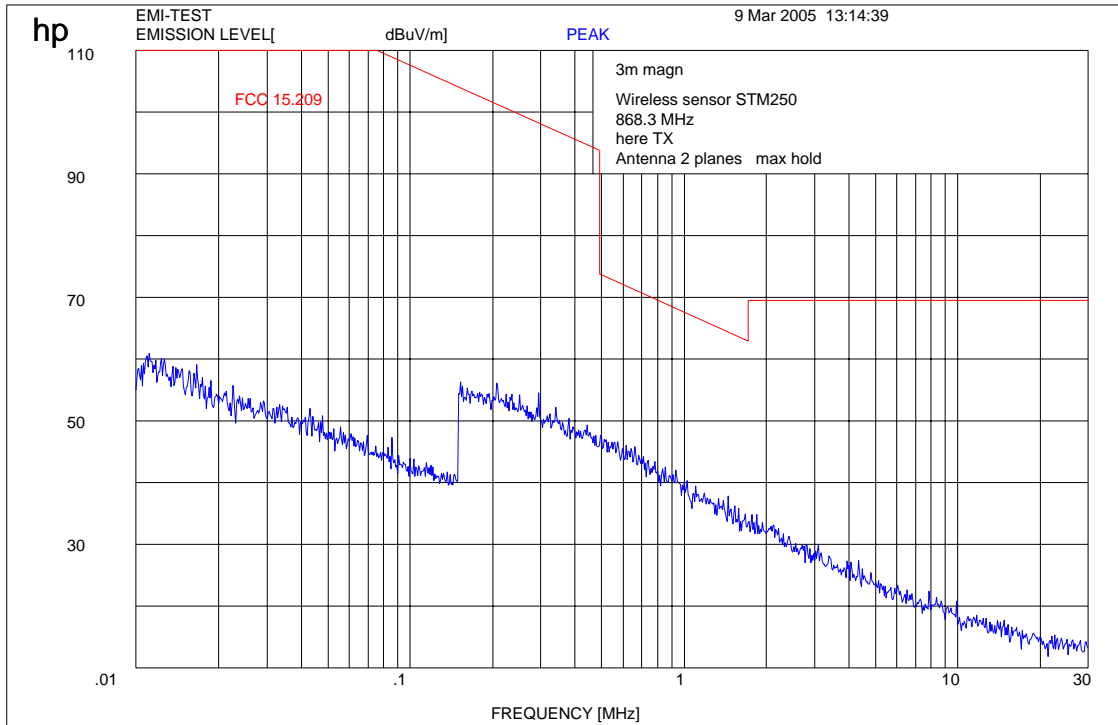
**The occupied bandwidth (20 dB / 99.0%) is 152.5 kHz .**

**Limit**

**< 0.25% of the centre frequency, here 2.17 MHz**

**2.2.4 Spurious Emission (radiated)**

**9 kHz to 30 MHz**



To convert the measuring distance from 3m to 30m and 30 to 300m a correction factor from 40 dB/decade was used (FCC15.31 (f)(2))

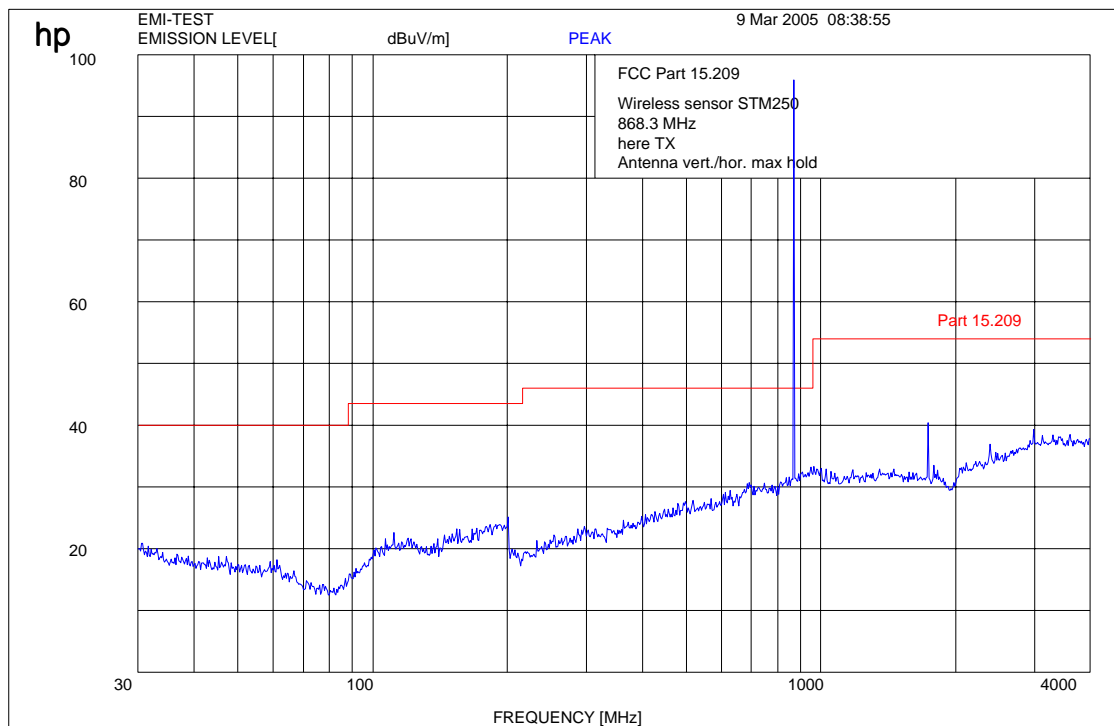
Measurement distance 3m

This measurement was done in 3 polarisation's, the plot shows the worst case

**Limits: (general requirements)**

Frequency	Field strength( $\mu\text{V/m}$ )	Measuring distance (m)
0.009 to 0.490 MHz	2400/F(MHz)	300
0.490 to 1.705 MHz	24000/F(MHz)	30
1.705 to 30.0 MHz	30	30

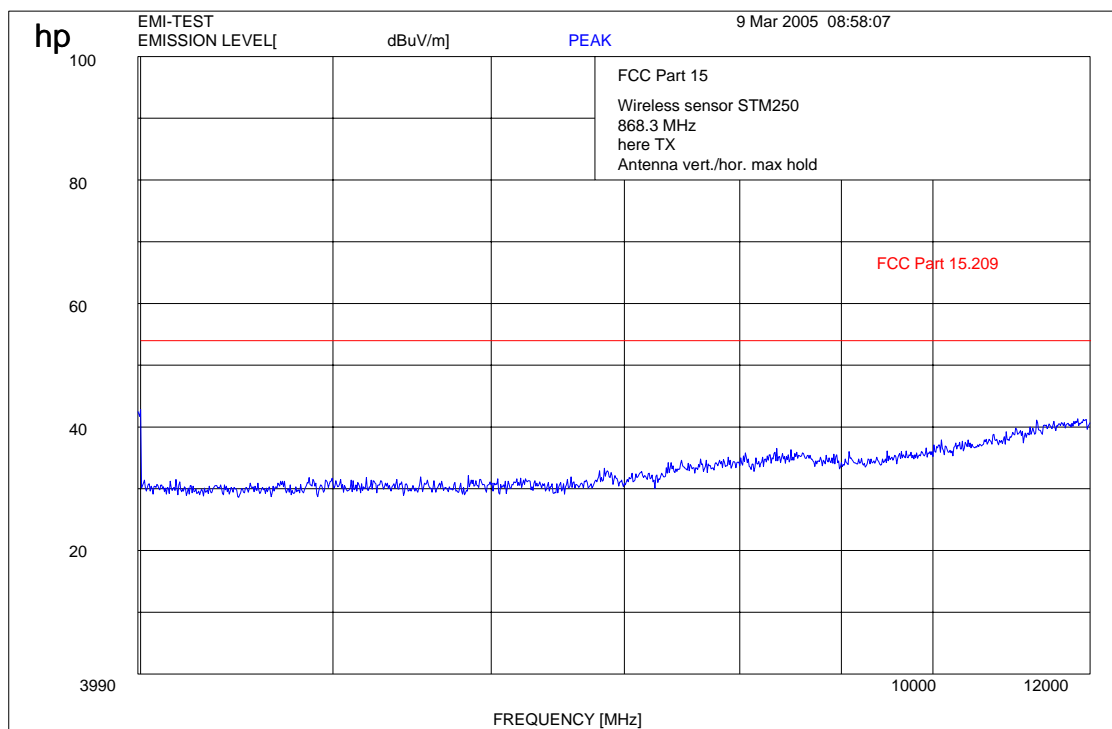
## 30 MHz to 4 GHz



### Limits

Fundamental Frequency (MHz)	Field strength ( $\mu\text{V/m}$ )	Field strength of Spurious emissions ( $\mu\text{V/m}$ )
40.66-407	2250	225
70-130	1250	125
130-174	1 250 to 3 750 **	125 to 375 **
174-260	3750	375
260-470	3 750 to 12 500 **	375 to 1 250 **
Above 470	12500	1250
** linear interpolations		

## 4 GHz to 12 GHz



## Limits

Frequency (MHz)	Field strength ( $\mu\text{V/m}$ )	Field strength of Spurious emissions ( $\mu\text{V/m}$ )
40.66-407	2250	225
70-130	1250	125
130-174	1 250 to 3 750 **	125 to 375 **
174-260	3750	375
260-470	3 750 to 12 500 **	375 to 1 250 **
Above 470	12500	1250
** linear interpolations		



### 3 Test equipment and ancillaries used for tests

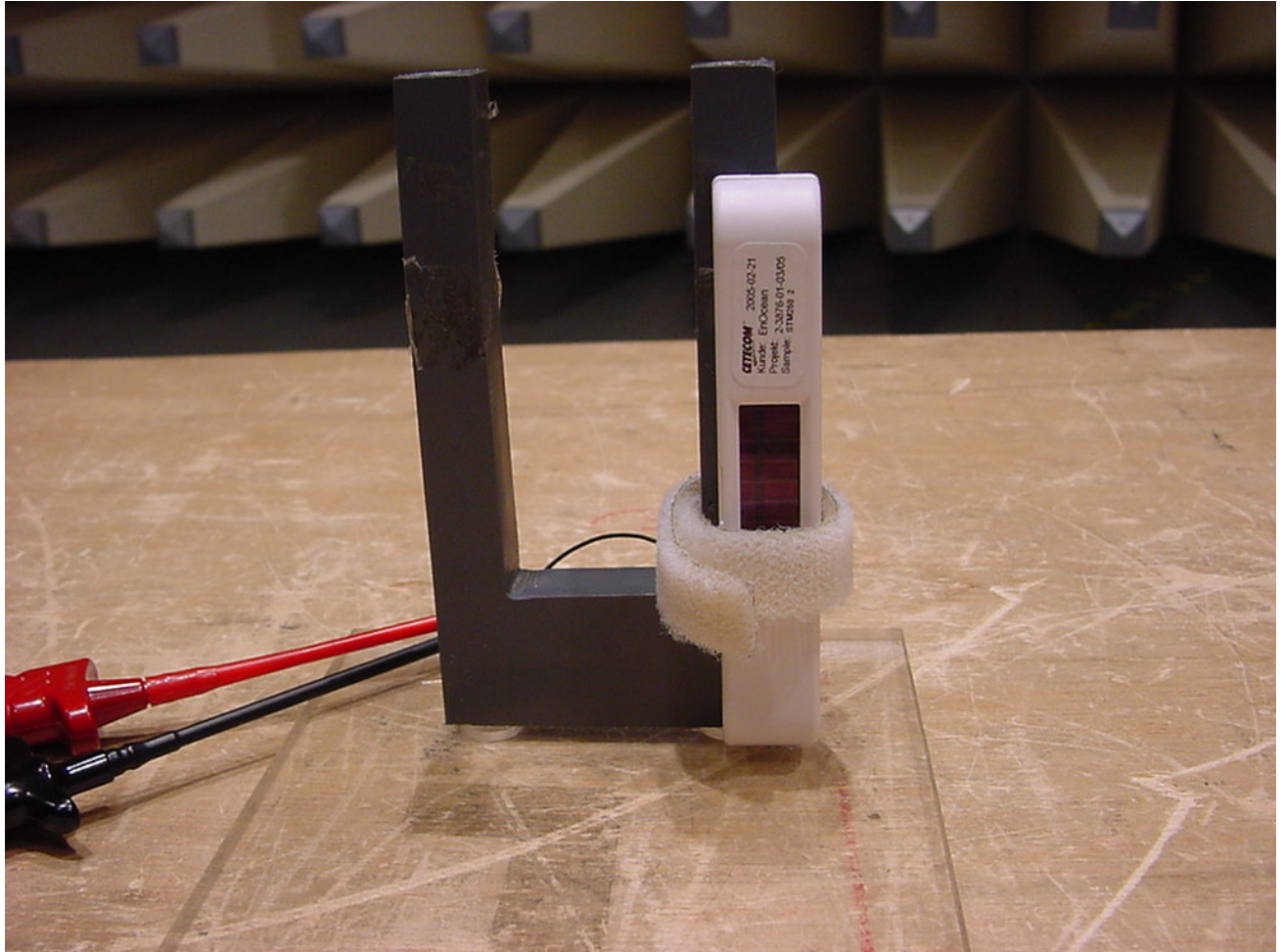
To simplify the identification on each page of the test equipment used, on each page of the test report, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory, below.

No	Instrument/Ancillary	Type	Manufacturer	Serial No.
01	Spectrum Analyzer	8566 A	Hewlett-Packard	1925A00257
02	Analyzer Display	8566 A	Hewlett-Packard	1925A00860
03	Oscilloscope	7633	Tektronix	230054
04	Radio Communication Analyzer	CMTA 54	Rohde & Schwarz	894 043/010
05	System Power Supply	6038 A	Hewlett-Packard	2848A07027
06	Signal Generator	8111 A	Hewlett-Packard	2215G00867
07	Signal Generator	8662 A	Hewlett-Packard	2224A01012
08	Function Generator	AFGU	Rohde & Schwarz	862 480/032
09	Regulating Transformer	MPL	Erfi	91350
10	LISN	NNLA 8120	Schwarzbeck	8120331
11	Relay-Matrix	PSU	Rohde & Schwarz	893 285/020
12	Power-Meter	436 A	Hewlett-Packard	2101A12378
13	Power-Sensor	8484 A	Hewlett-Packard	2237A10156
14	Power-Sensor	8482 A	Hewlett-Packard	2237A00616
15	Modulation Meter	9008	Racal-Dana	2647
16	Frequency Counter	5340 A	Hewlett-Packard	1532A03899
17	Anechoic Chamber	---	MWB	87400/002
18	Spectrum Analyzer	85660 B	Hewlett-Packard	2747A05306
19	Analyzer Display	85662 A	Hewlett-Packard	2816A16541
20	Quasi Peak Adapter	85650 A	Hewlett-Packard	2811A01131
21	RF-Preselector	85685 A	Hewlett-Packard	2833A00768
22	Biconical Antenna	3104	Emco	3758
23	Log. Per. Antenna	3146	Emco	2130
24	Double Ridged Horn	3115	Emco	3088
25	EMI-Testreceiver	ESAI	Rohde & Schwarz	863 180/013
26	EMI-Analyzer-Display	ESAI-D	Rohde & Schwarz	862 771/008
27	Biconical Antenna	HK 116	Rohde & Schwarz	888 945/013
28	Log. Per. Antenna	HL 223	Rohde & Schwarz	825 584/002
29	Relay-Switch-Unit	RSU	Rohde & Schwarz	375 339/002
30	Highpass	HM985955	FSY Microwave	001
31	Amplifier	P42-GA29	Tron-Tech	B 23602
32	Anechoic Chamber		Frankonia	
33	Control Computer	PSM 7	Rohde & Schwarz	834 621/004
34	EMI Test Receiver	ESMI	Rohde & Schwarz	827 063/010
35	EMI Test Receiver	Display	Rohde & Schwarz	829 808/010

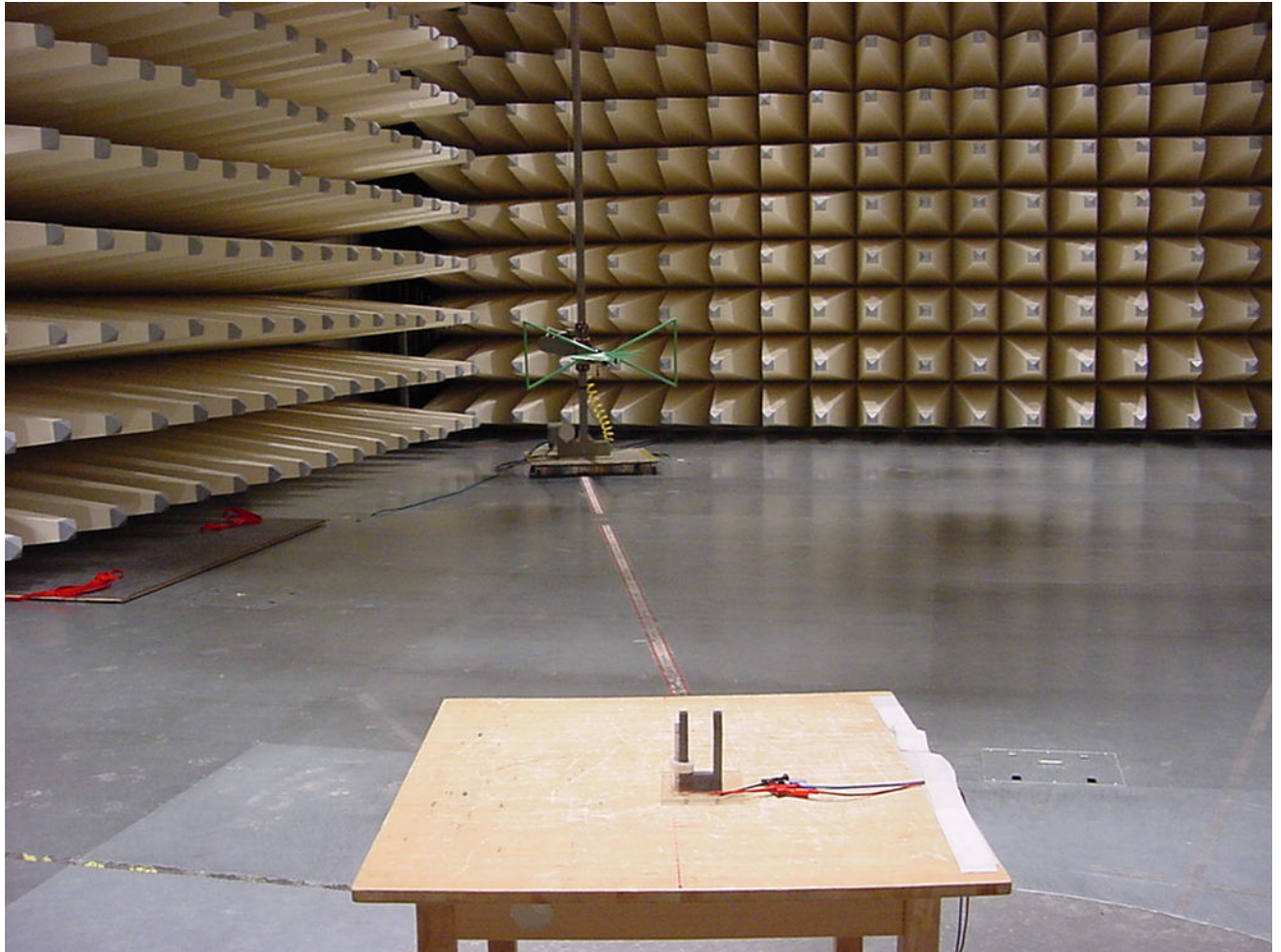
No	Instrument/Ancillary	Type	Manufacturer	Serial No.
36	Control Computer	HD 100	Deisel	100/322/93
37	Relay Matrix	PSN	Rohde & Schwarz	829 065/003
38	Control Unit	GB 016 A2	Rohde & Schwarz	344 122/008
39	Relay Switch Unit	RSU	Rohde & Schwarz	316 790/001
40	Power Supply	6032A	Hewlett Packard	2846A04063
41	Spectrum Monitor	EZM	Rohde & Schwarz	883 720/006
42	Measuring Receiver	ESH 3	Rohde & Schwarz	890 174/002
43	Measuring Receiver	ESVP	Rohde & Schwarz	891 752/005
44	Bicon Ant. 20-300MHz	HK 116	Rohde & Schwarz	833 162/011
45	Logper Ant. 0.3-1 GHz	HL 223	Rohde & Schwarz	832 914/010
46	Amplifier 0.1-4 GHz	AFS4	Miteq Inc.	206461
47	Logper Ant. 1-18 GHz	HL 024 A2	Rohde & Schwarz	342 662/002
48	Polarisation Network	HL 024 Z1	Rohde & Schwarz	341 570/002
49	Double Ridged Horn Antenna 1-26.5 GHz	3115	EMCO	9107-3696
50	Microw. Sys. Amplifier 0.5- 26.5 GHz	8317A	Hewlett Packard	3123A00105
51	Audio Analyzer	UPD	Rohde & Schwarz	1030.7500.04
52	Controler	PSM 7	Rohde & Schwarz	883 086/026
53	DC V-Network	ESH3-Z6	Rohde & Schwarz	861 406/005
54	DC V-Network	ESH3-Z6	Rohde & Schwarz	893 689/012
55	AC 2 Phase V-Network	ESH3-Z5	Rohde & Schwarz	861 189/014
56	AC 2 Phase V-Network	ESH3-Z5	Rohde & Schwarz	894 981/019
57	AC-3 Phase V-Network	ESH2-Z5	Rohde & Schwarz	882 394/007
58	Power Supply	6032A	Rohde & Schwarz	2933A05441
59	RF-Test Receiver	ESVP.52	Rohde & Schwarz	881 487/021
60	Spectrum Monitor	EZM	Rohde & Schwarz	883 086/026
61	RF-Test Receiver	ESH3	Rohde & Schwarz	881 515/002
62	Relay Matrix	PSU	Rohde & Schwarz	882 943/029
63	Relay Matrix	PSU	Rohde & Schwarz	828 628/007
64	Spectrum Analyzer	FSIQ 26	Rohde & Schwarz	119.6001.27
65	Spectrum Analyzer	HP 8565E	Hewlett Packard	3473A00773
66				
67				
68				

## 4 Photographs of test site

### Photograph no.: 1

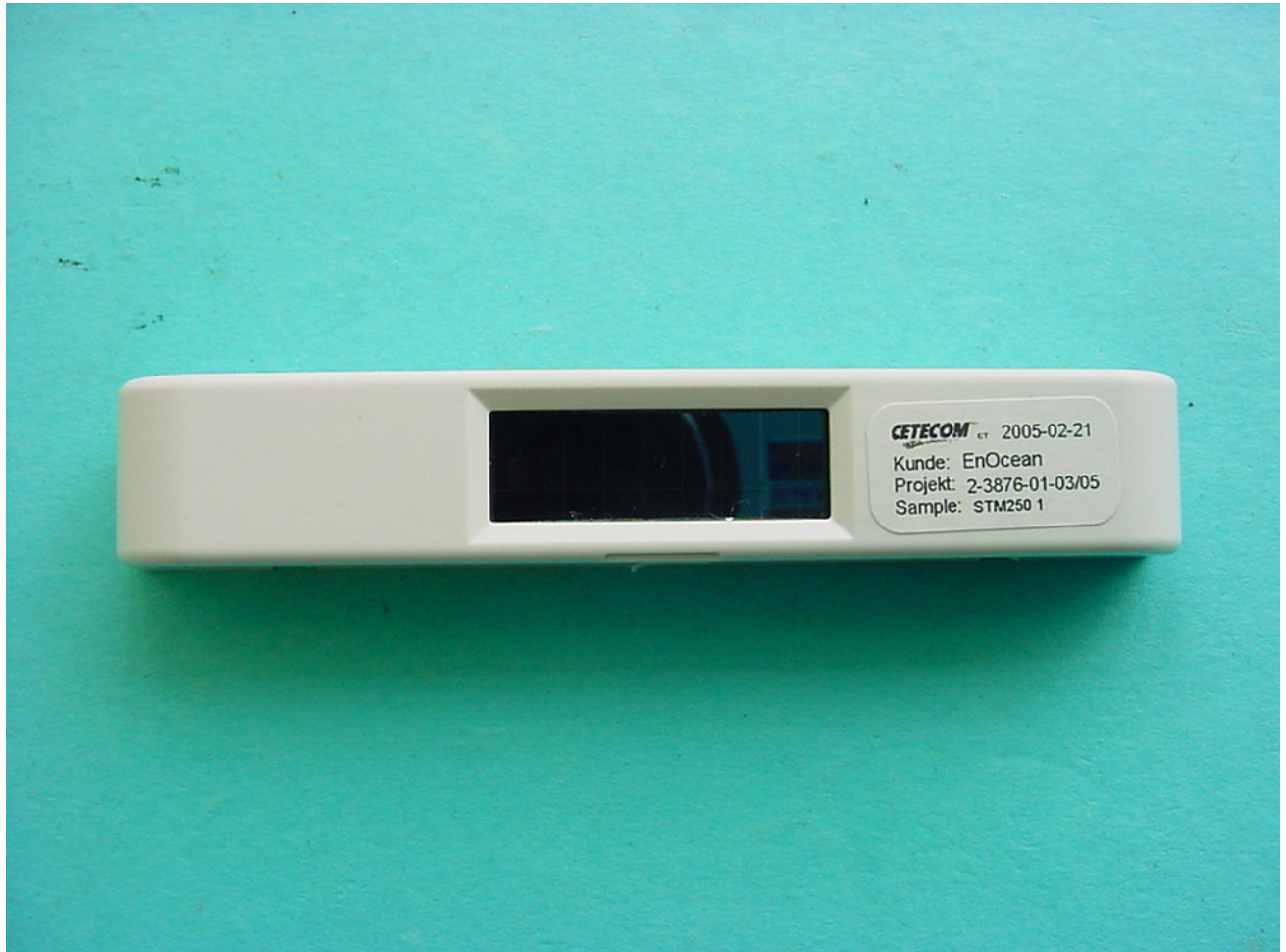


**Photograph no.: 2**

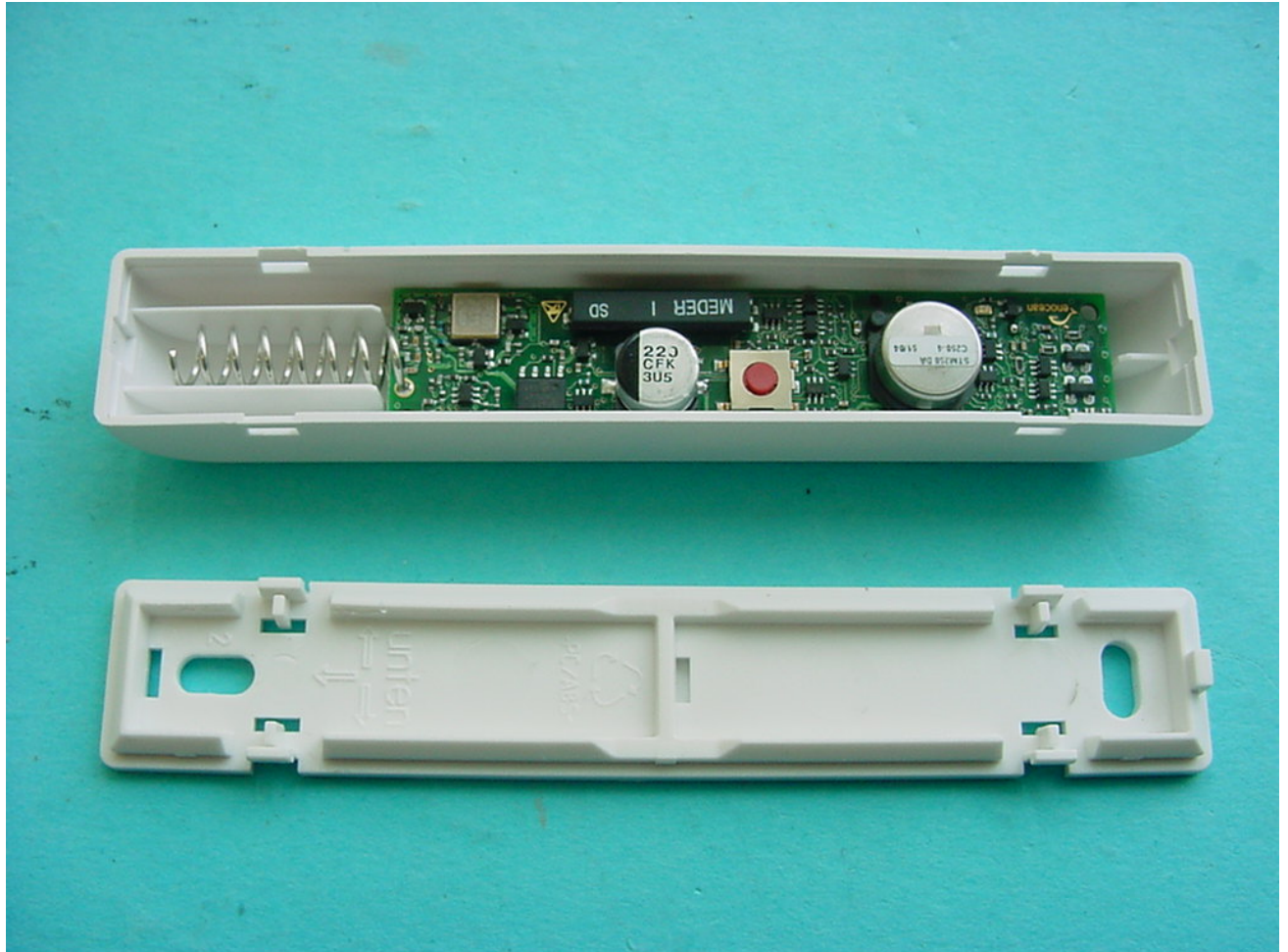


## **5 Photographs of test sample**

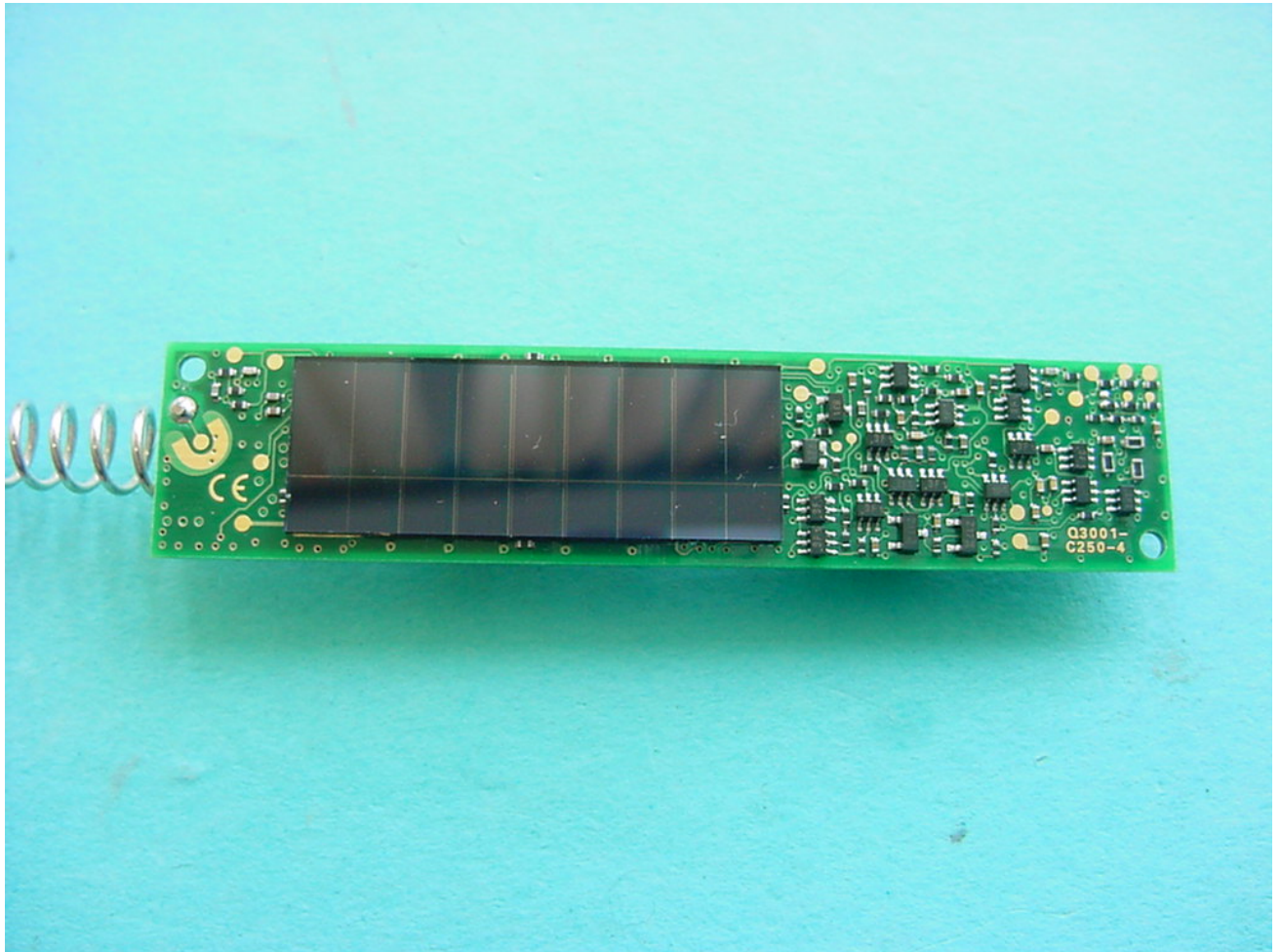
**Photograph no.: 1**



**Photograph no.: 2**



**Photograph no.: 3**



**Photograph no.: 4**

