



EUROFINS PRODUCT SERVICE GMBH



Testing Cert #1983.01

TEST- REPORT

Compliance Test Report

FCC PART 15 SUBPART F, 15.509

Wallscanner D-tect 150

3 601 K10 013

TEST REPORT NUMBER: G0M20910-2631-C-1



Eurofins Product Service GmbH
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1 General Information

1.1 Notes

The purpose of conformity testing is to increase the probability of adherence to the essential requirements or conformity specifications, as appropriate.

The complexity of the technical specifications, however, means that full and thorough testing is impractical for both technical and economic reasons.

Furthermore, there is no guarantee that a test sample which has passed all the relevant tests conforms to a specification.

Neither is there any guarantee that such a test sample will interwork with other genuinely open systems.


The existence of the tests nevertheless provides the confidence that the test sample possesses the qualities as maintained and that its performance generally conforms to representative cases of communications equipment.

The test results of this test report relate exclusively to the item tested as specified in 1.5.

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Operator:

26.10.2009		T. Jahn	
Date	Eurofins-Lab.	Name	Signature

Technical responsibility for area of testing:

26.10.2009		J. Zimmermann	
Date	Eurofins	Name	Signature

1.2 Testing laboratory

EUROFINS PRODUCT SERVICE GMBH
Storkower Strasse 38c
D-15526 Reichenwalde b. Berlin
Germany
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DAR ACCREDITED TESTING LABORATORY
DAR-REGISTRATION NUMBER: DAT-P-268/08

RECOGNIZED NOTIFIED BODY EMC
REGISTRATION NUMBER: BNetzA-bS EMV-07/61

RECOGNIZED NOTIFIED BODY R&TTE
REGISTRATION NUMBER: BNetzA-bS-02/51-53

FCC FILED TEST LABORATORY
REG.-NO. 96970

A2LA ACCREDITED TESTING LABORATORY
CERTIFICATE NO. 1983.01

BLUETOOTH QUALIFICATION TEST FACILITY (BQTF)
ACCREDITED BY BLUETOOTH QUALIFICATION REVIEW BOARD

INDUSTRY CANADA FILED TEST LABORATORY
REG. No. IC 3470

Test location, where different:

Name : ./.
Street : ./.
Town : ./.
Country : ./.
Telephone : ./.
Fax : ./.

Test Report No.: G0M20910-2631-C-1

EUROFINS PRODUCT SERVICE GMBH
STORKOWER STR. 38C, D-15526 REICHENWALDE B. BERLIN

1.3 Details of approval holder

Name : Robert Bosch GmbH
Street : Postfach 10 01 56
Town : D-70745 Leinfelden-Echterdingen
Country : Germany
Telephone : +49 711758-2909
Fax : +49 711 811-518 309

Contact : Herr Heiko Braun
Telephone : +49 711758-2909

1.4 Application details

Date of receipt of application : 15.10.2009
Date of receipt of test item : 15.10.2009
Date of test : 21.10.2009

1.5 Test item

Description of test item : Wallscanner D-tect 150
Type identification : 3 601 K10 013
HW-Version : Japan-Mask
Brand Name : Bosch

Technical data

Frequency range : 1 - 6GHz
Antenna : integrated
Power supply : 6.0VDC (Battery 4xAA)

Manufacturer:
(if applicable)

Name : Robert Bosch GmbH
Street : Postfach 10 01 56
Town : D-70745 Leinfelden-Echterdingen
Country : Germany

1.6 Test standards

Technical standard : **FCC PART 15 SUBPART F § 15.509**
FCC PART 15 SUBPART C § 15.209

1.7 Acronyms and Abbreviations

EUT : Equipment under Test
UWB : Ultra Wideband
TX : Transmission
RX : Reception
EIRP : Equivalent isotropic radiated power
 T_{nom} : Nominal Temperature
 T_{min} : Minimum Temperature
 T_{max} : Maximum Temperature
 V_{nom} : Nominal Supply Voltage
 V_{min} : Minimum Supply Voltage
 V_{max} : Maximum Supply Voltage

2 Technical test

2.1 Summary of test results

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

or

The deviations as specified in 2.4 were ascertained in the course of the tests performed.

2.2 Test environment

Temperature : 22 ... 26°C
Relative humidity content : 20 ... 75%
Air pressure : 86 ... 103kPa
Extreme conditions parameters:
V_{nom} : 6VDC
T_{nom} : 25°C

2.3 Test equipment utilized

Measurement Equipment List			
No.	Measurement device:	Type:	Manufacturer:
ETS 0019	Horn Antenna	BBHA 9120D	Schwarzbeck
ETS 0030	Biconical Antenna	HK 116	Rohde & Schwarz
ETS 0336	LPD Antenna	HL 223	Rohde & Schwarz
ETS 0481	Horn Antenna	22240-25	Flann Microwave
ETS 0496	Spectrum Analyzer	FSP 30	Rohde & Schwarz
ETS 0476	Measurement Receiver	ESCS 30	Rohde & Schwarz
	Amplifier Matrix		

2.4 Test results

 1st test

 test after modification

 production test

Test case	Subclause	Required	Test passed	Test failed
TRANSMITTER PARAMETERS				
10dB Bandwidth	FCC § 15.503	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	FCC § 15.509			
Cease of operation time	FCC § 15.509	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Peak emission level	FCC § 15.509	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Radiated spurious emissions	FCC § 15.209	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	FCC § 15.509			

3 Transmitter parameters

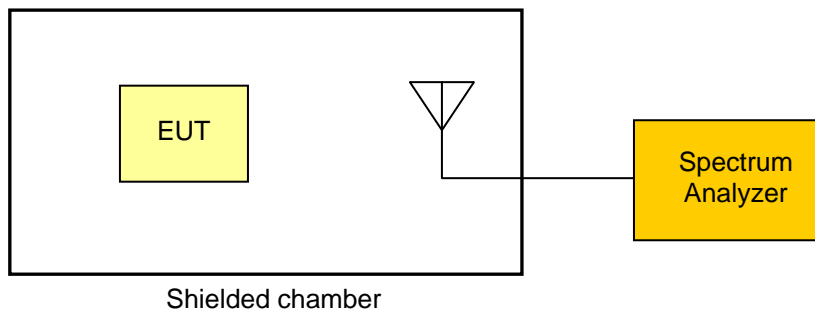
3.1 10dB Bandwidth

The UWB emission bandwidth occupied by the transmitted signal is reported as the frequency band bounded by the points that are 10dB below the highest radiated emission.

3.1.1 Limits

The intentional radiation transmitted by any UWB transmitter must have, at any point in time, a fractional bandwidth equal to or greater than 0.20 or a UWB bandwidth equal to or greater than 500MHz regardless of the fractional bandwidth. Ground penetrating radars or wall imaging systems provided after FCC § 15.509 must have a UWB bandwidth below 10.6GHz.

3.1.2 Measurement procedure



The EUT is placed in a shielded chamber and set to transmission mode under normal test conditions. A measurement antenna is connected to a spectrum analyzer. The span of the analyzer is set wide enough to capture all significant emissions of the intended transmitted spectrum. The maximum emission frequency is identified and the two edge frequencies with a power level 10dB lower than the power level of the maximum emission frequency are identified and recorded.

3.1.3 Results

Transmitter 10dB bandwidth	
Measurement Conditions	
Bandedge criteria :	-10dBc
Maximum emission frequency [MHz]	Bandwidth [MHz]
2157.1	2157.1
See attached diagram in Annex	
Verdict	PASS

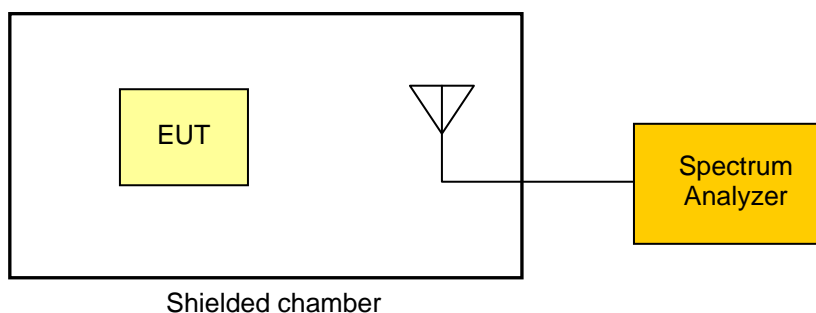
3.2 Cease of operation time

The device, if designed for manual operation, shall be equipped with a switch that causes the transmitter to cease operation within 10s.

3.2.1 Limits

The transmitter shall cease operation after 10s.

3.2.2 Measurement procedure



The EUT is placed in a shielded chamber and set to transmission mode under normal test conditions. A measurement antenna is connected to a spectrum analyzer. The EUT is switched off and the time until the transmitter ceases its operation is recorded.

3.2.3 Results

Cease of operation time	
Time for cease of operation [s]	
< 10s	
Verdict	PASS

3.3 Peak emission level

If the frequency of the highest emission frequency of the UWB transmitter is above 960MHz a limit on the peak level of the emission within a 50MHz bandwidth is defined.

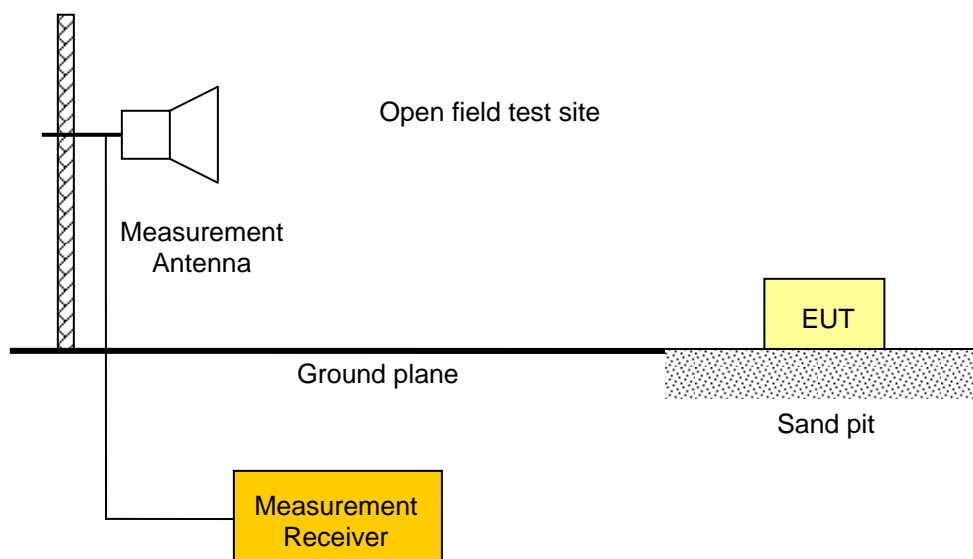
3.3.1 Limits

The peak emission level within a 50MHz bandwidth centered on the highest emission frequency f_M has to be lower or equal than 0dBm EIRP.

If a different resolution bandwidth is used the limit can be adjusted according the following equation (15.521) :

$$L[\text{dBm}] = 20 \log_{10} \left(\frac{\text{RWB}[\text{MHz}]}{50} \right)$$

3.3.2 Measurement procedure



According to FCC 02-48 the EUT is placed on a sand pit and actived in transmission mode. The measurement antenna is pointed directly to the EUT. The radiated emissions are measured in the frequency range of the intentional radiation using peak dectector and resolution bandwidth of 1MHz. In order to maximize the emission the EUT is measured at 8 positions (every 45°). The measurement is performed for horizontal and vertical polarization of the measurement antenna.

3.3.3 Results

Peak emission level								
Measurement Conditions								
Resolution bandwidth:		3MHz						
Measurement Distance:		1.5m						
Emission Limit:		-24.4dBm						
Detector:		Peak						
Frequency [MHz]	Pol.	Reading [dB μ V]	AF [dB/m]	Cable Loss [dB]	Pre-Amp. Gain [dB]	Net Field Strength [dB μ V/m]	Limit [dB μ V/m]	Delta [dB]
2200.4	V	60	26	1.3	44.5	42.8	76.8	-34.0
2200.4	H	59	26	1.3	44.5	41.8	76.8	-35.0
Verdict						PASS		

Note : The field strength limits are calculated by $E[\text{dB}\mu\text{V}/\text{m}] = P[\text{dBm}] + 95.2$ for a measurement distance of 3m according 15.521 or $E[\text{dB}\mu\text{V}/\text{m}] = P[\text{dBm}] - 20 \log(D[\text{m}]) + 104.8$ for measurement distance D according NTIA 01-43 sec. 2.2.1..

3.4 Transmitter spurious emissions

The radiated emission from the device have to comply with the emission limits stated in paragraph 15.209 and 15.509 of the FCC rules.

3.4.1 Limits

Below 960MHz the radiated emissions have to comply with the limits stated in 15.209. Paragraph 15.209 defines the following emission limits in the frequency range from 9kHz to 960MHz when measured with quasi-peak detector.

Tranmitter spurious emission limits below 960MHz				
Tx-state	Frequency range [MHz]	Limit 3m [μ V/m]	Calculated Limit 3m [dB μ V/m]	Limit Distance [m]
Operational	0.009 – 0.490	2400/F[kHz]	48.5 – 13.8	300
	0.490 – 1.705	2400/F[kHz]	33.8 - 23	30
	1.705 – 30.0	30	29.5	30
	30 – 88	100	40.0	3
	88 – 216	150	43.5	3
	216 – 960	200	46.0	3
	> 960	500	54.0	3

The radiated emission limits above 960MHz are stated in 15.509. The measurements are performed with an RMS detector and a resolution bandwidth of 1MHz and the following limits shall not be exceeded.

Tranmitter spurious emission limits above 960MHz, RBW 1MHz				
Tx-state	Frequency range [MHz]	Limit [dBm EIRP]	Limit [dB μ V/m]	Limit Distance [m]
Operational	960 – 1610	-65.3	29.9	3
	1610 – 1990	-53.3	41.9	3
	1990 – 3100	-51.3	43.9	3
	3100 – 10600	-41.3	53.9	3
	> 10600	-51.3	43.9	3

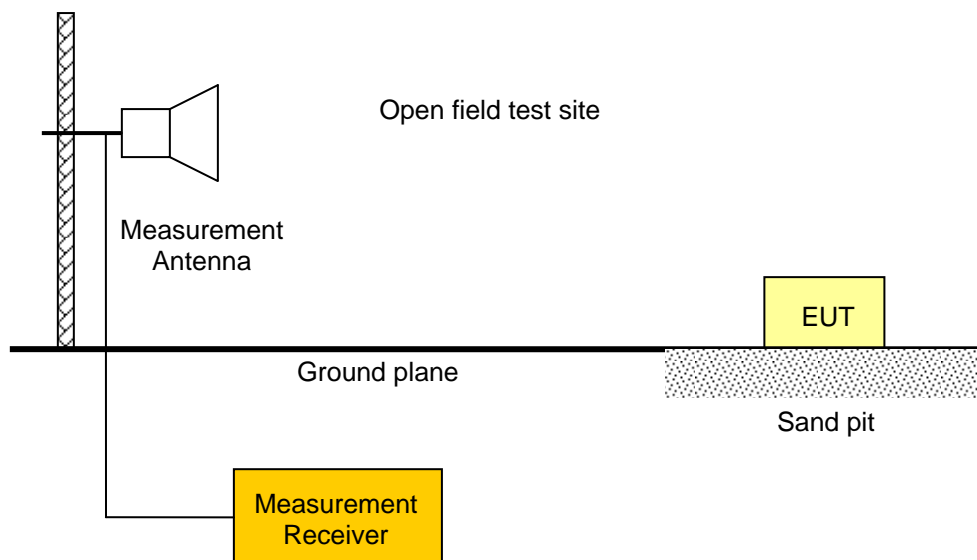
Note : The field strength limits are calculated by $E[\text{dB}\mu\text{V/m}] = P[\text{dBm}] + 95.2$ for a measurement distance of 3m according 15.521 or $E[\text{dB}\mu\text{V/m}] = P[\text{dBm}] - 20 \log(D[\text{m}]) + 104.8$ for measurement distance D according NTIA 01-43 sec. 2.2.1..

In addition the radiated emission limits have to comply with the following limits for a resolution bandwidth of 1kHz and RMS detector.

Tranmitter spurious emission limits above 960MHz, RBW 1kHz				
Tx-state	Frequency range [MHz]	Limit [dBm EIRP]	Limit [dB μ V/m]	Limit Distance [m]
Operational	1164 – 1240	-75.3	19.9	3
	1559 – 1610	-75.3	19.9	3

Note : The field strength limits are calculated by $E[\mu\text{V/m}] = P[\text{dBm}] + 95.2$ for a measurement distance of 3m according 15.521 or $E[\mu\text{V/m}] = P[\text{dBm}] - 20 \log(D[\text{m}]) + 104.8$ for measurement distance D according NTIA 01-43 sec. 2.2.1..

3.4.2 Measurement procedure



According to FCC 02-48 the EUT is placed on a sand pit and actived in transmission mode. The measurement antenna is pointed directly to the EUT. The frequency range from 30MHz to 960MHz is measured using peak/quasi-peak dectector and resolution bandwidths from 1 to 100kHz. Above 960MHz a RMS detector and a resolution bandwidth of 1MHz is used. In addition the frequency range 1164-1240MHz and 1559-1610MHz is measured with a resolution bandwidth of 1kHz. In order to maximize the emission the EUT is measured at 8 positions (every 45°). The measurement is performed for horizontal and vertical polarization of the measurement antenna over the frequency range from 30MHz to 40GHz.

3.4.3 Results

Transmitter spurious emissions < 960MHz								
Measurement Conditions								
Resolution bandwidth:			120kHz					
Measurement Distance:			3m					
Detector:			Quasi-Peak					
Frequency [MHz]	Pol.	Reading [dB μ V]	AF [dB/m]	Cable Loss [dB]	Pre-Amp. Gain [dB]	Net Field Strength [dB μ V/m]	Limit [dB μ V/m]	Delta [dB]
188	V	11	13.5	0.2	0	24.7	43.5	-18.8
188	H	11	13.5	0.2	0	24.7	43.5	-18.8
200	V	19	9.8	0.2	0	29.0	43.5	-14.5
200	H	16	9.8	0.2	0	26.0	43.5	-17.5
263	V	23	11.4	0.2	0	34.6	46.0	-11.4
263	H	21	11.4	0.2	0	32.6	46.0	-13.4
336	V	11	13.4	0.3	0	24.7	46.0	-21.3
336	H	14	13.4	0.3	0	27.7	46.0	-18.3
362	V	16	14.4	0.3	0	30.7	46.0	-15.3
362	H	16	14.4	0.3	0	30.7	46.0	-15.3
388	V	17	16.9	0.3	0	34.2	46.0	-11.8
388	H	19	16.9	0.4	0	36.2	46.0	-9.8
400	V	21	15.6	0.4	0	37.0	46.0	-9.0
400	H	26	15.6	0.4	0	42	46.0	-4.0
500	V	12	15.6	0.4	0	29.8	46.0	-16.2
500	H	4	17.4	0.4	0	22.8	46.0	-23.2
708	V	13	17.4	0.4	0	34.6	46.0	-11.4
708	H	4	21.0	0.6	0	25.6	46.0	-20.4
750	V	11	20.8	0.6	0	32.4	46.0	-13.6
750	H	6	20.8	0.6	0	27.4	46.0	-18.6
756	V	13	20.8	0.6	0	34.4	46.0	-11.6
756	H	5	20.8	0.6	0	26.4	46.0	-19.6
Verdict						PASS		

Transmitter spurious emissions > 960MHz								
Measurement Conditions								
Resolution bandwidth:		1MHz						
Measurement Distance:		1.5m						
Limit Correction:		6.0dB						
Detector:		RMS						
Frequency [MHz]	Pol.	Reading [dB μ V]	AF [dB/m]	Cable Loss [dB]	Pre-Amp. Gain [dB]	Net Field Strength [dB μ V/m]	Limit [dB μ V/m]	Delta [dB]
1500	V	56	25.4	1.0	44.5	37.9	35.9	2.0
1500	H	57	25.4	1.0	44.5	38.9	35.9	3.0
1700	V	57	24.5	1.1	44.5	38.1	47.9	-9.8
1700	H	59	24.5	1.1	44.5	40.1	47.9	-7.8
2100	V	58	25.6	1.2	43.3	41.5	49.9	-8.4
2100	H	57	25.6	1.2	43.3	40.5	49.9	-9.4
2300	V	54	26.0	1.3	43.3	38.0	49.9	-11.9
2300	H	55	26.0	1.3	43.3	39.0	49.9	-10.9
2800	V	58	28.0	1.4	42.0	45.4	49.9	-4.5
2800	H	56	28.0	1.4	42.0	43.4	49.9	-6.5
2946	V	50	28.1	1.5	42.2	37.4	49.9	-12.5
2946	H	49	28.1	1.5	42.2	36.4	49.9	-13.5
Verdict						PASS		

Note : The field strength limits are calculated by $E[\mu\text{V/m}] = P[\text{dBm}] + 95.2$ for a measurement distance of 3m according 15.521 or $E[\mu\text{V/m}] = P[\text{dBm}] - 20 \log(D[\text{m}]) + 104.8$ for measurement distance D according NTIA 01-43 sec. 2.2.1..

The highlighted emissions are caused by digital circuitry, therefore acc. 15.521 the emission limit of paragraph 15.209 of 60dB μ V/m applies.

Transmitter spurious emissions 1164-1240MHz & 1559-1610MHz								
Measurement Conditions								
Resolution bandwidth:			1kHz					
Measurement Distance:			1.5m					
Limit Correction:			6.0dB					
Detector:			RMS					
Frequency [MHz]	Pol.	Reading [dB μ V]	AF [dB/m]	Cable Loss [dB]	Pre-Amp. Gain [dB]	Net Field Strength [dB μ V/m]	Limit [dB μ V/m]	Delta [dB]
1168	V	32	24.2	0.8	44.1	12.9	25.9	-13.0
1168	H	34	24.2	0.8	44.1	14.9	25.9	-11.0
1188	V	38	24.2	0.8	44.1	18.9	25.9	-7.0
1188	H	37	24.2	0.8	44.1	17.9	25.9	-8.0
1192	V	34	24.9	0.9	44.1	15.7	25.9	-10.2
1192	H	35	24.9	0.9	44.1	16.7	25.9	-9.2
1200	V	41	24.9	0.9	44.1	22.7	25.9	-3.2
1200	H	43	24.9	0.9	44.1	24.7	25.9	-1.2
1208	V	28	24.9	0.9	44.1	9.7	25.9	-16.2
1208	H	31	24.9	0.9	44.1	12.7	25.9	-13.2
1216	V	30	24.9	0.9	44.1	11.7	25.9	-14.2
1216	H	30	24.9	0.9	44.1	11.7	25.9	-14.2
1224	V	33	24.9	0.9	44.1	14.7	25.9	-11.2
1224	H	35	24.9	0.9	44.1	16.7	25.9	-9.2
1232	V	34	24.9	0.9	44.1	15.7	25.9	-10.2
1232	H	32	24.9	0.9	44.1	13.7	25.9	-12.2
1236	V	38	24.9	0.9	44.1	19.7	25.9	-6.2
1236	H	37	24.9	0.9	44.1	18.7	25.9	-7.2
1560	V	38	25.4	1.1	44.5	20.0	25.9	-5.9
1560	H	33	25.4	1.1	44.5	15.0	25.9	-10.9
1568	V	30	25.4	1.1	44.5	12.0	25.9	-13.9
1568	H	29	25.4	1.1	44.5	11.0	25.9	-14.9
1576	V	33	24.8	1.1	44.5	14.4	25.9	-11.5
1576	H	30	24.8	1.1	44.5	11.4	25.9	-14.5
1584	V	42	24.8	1.1	44.5	23.4	25.9	-2.5
1584	H	37	24.8	1.1	44.5	18.4	25.9	-7.5
1587	V	22	24.8	1.1	44.5	3.4	25.9	-22.5
1587	H	18	24.8	1.1	44.5	-0.6	25.9	-26.5
1592	V	30	24.8	1.1	44.5	11.4	25.9	-14.5
1592	H	29	24.8	1.1	44.5	10.4	25.9	-15.5
1600	V	41	24.8	1.1	44.5	22.4	25.9	-3.5
1600	H	39	24.8	1.1	44.5	20.4	25.9	-5.5
1608	V	41	24.8	1.1	44.5	22.4	25.9	-3.5
1608	H	37	24.8	1.1	44.5	18.4	25.9	-7.5
Verdict						PASS		

Note : The field strength limits are calculated by $E[\mu\text{V/m}] = P[\text{dBm}] + 95.2$ for a measurement distance of 3m according 15.521 or $E[\mu\text{V/m}] = P[\text{dBm}] - 20 \log(D[\text{m}]) + 104.8$ for measurement distance D according NTIA 01-43 sec. 2.2.1..

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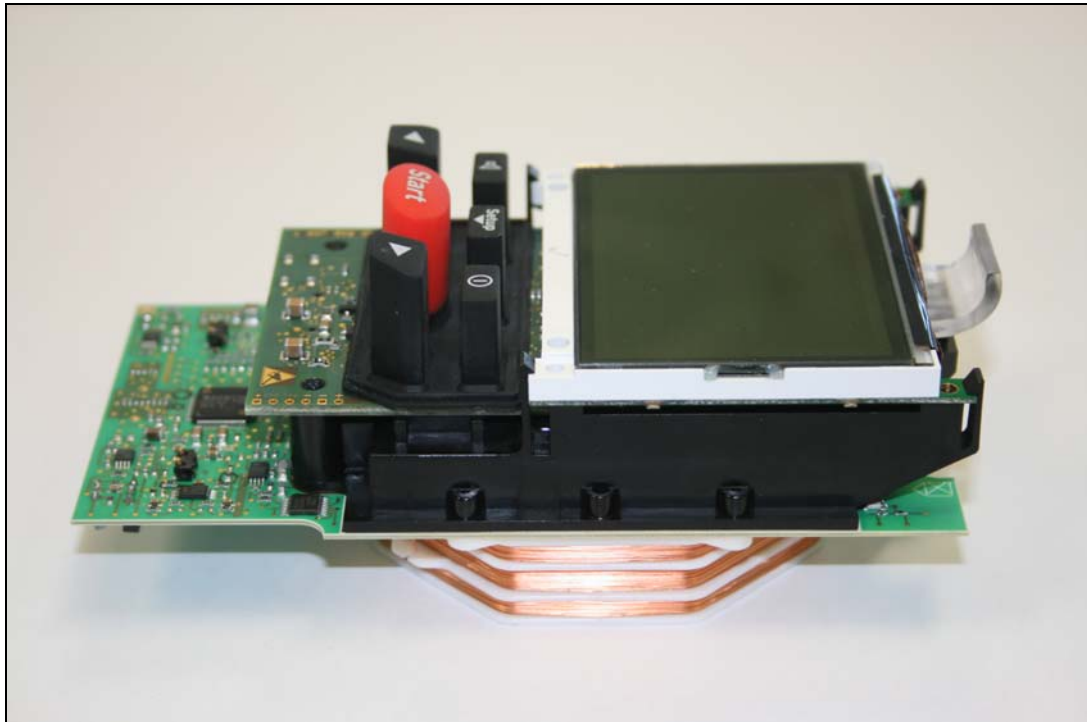
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Annex A Photos



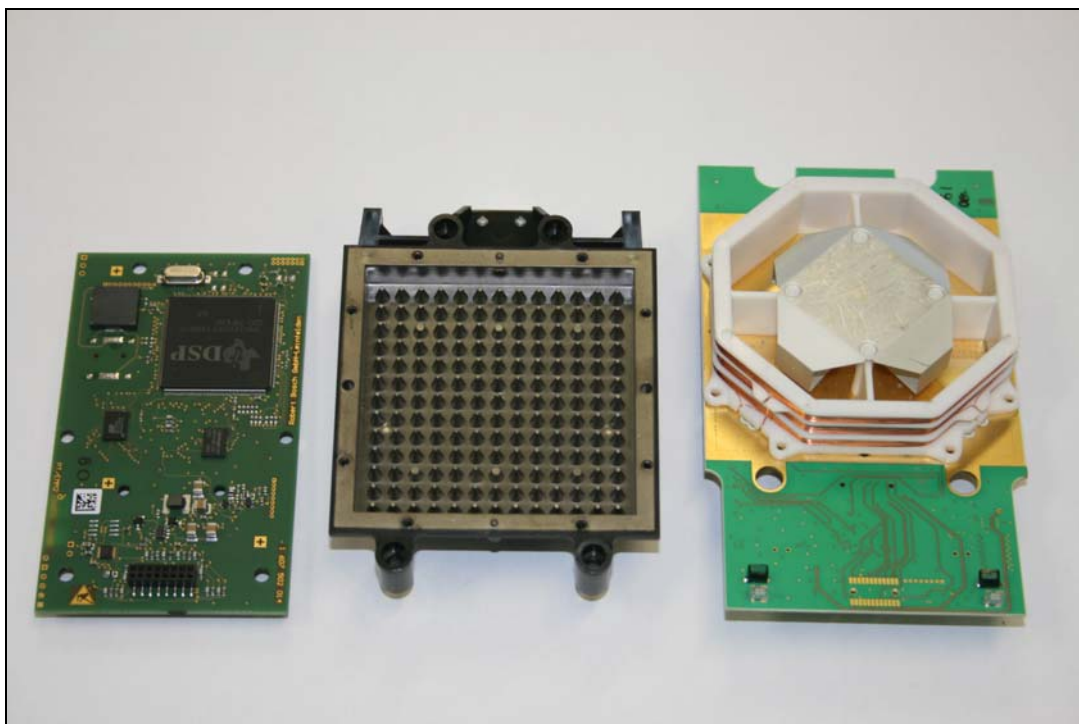
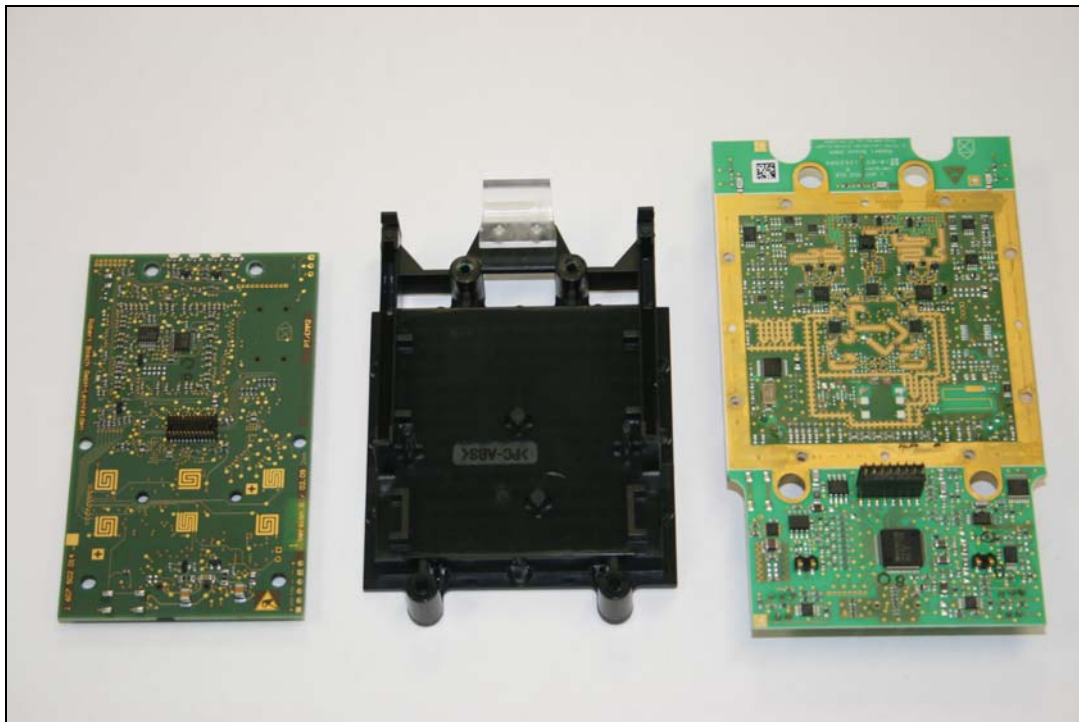
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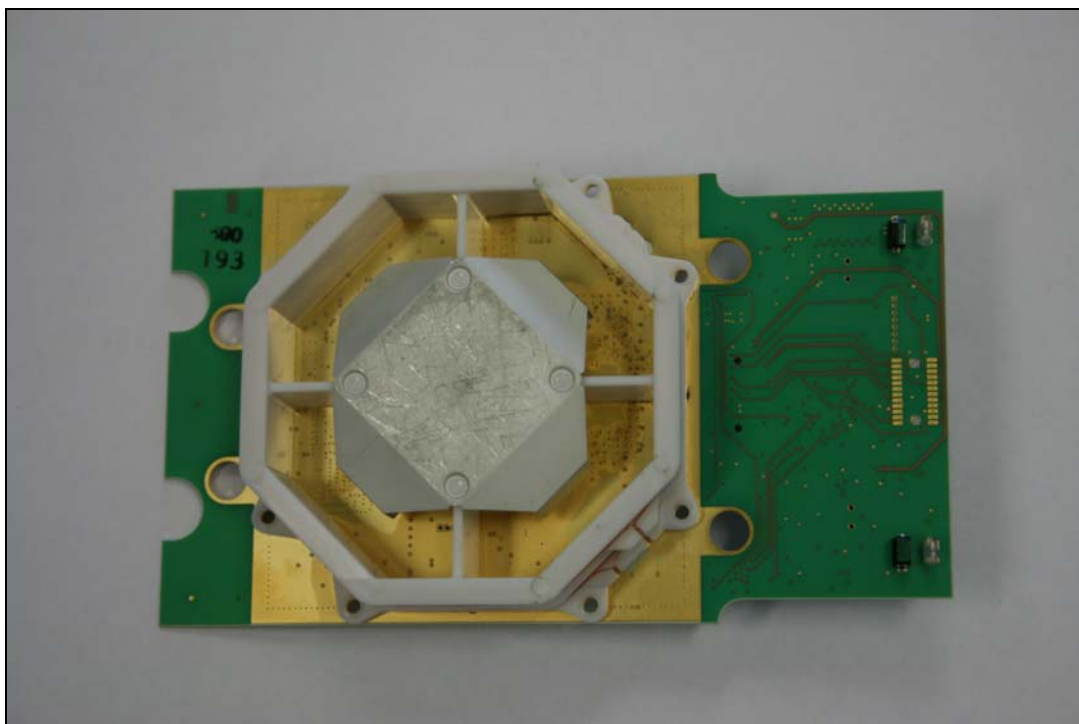
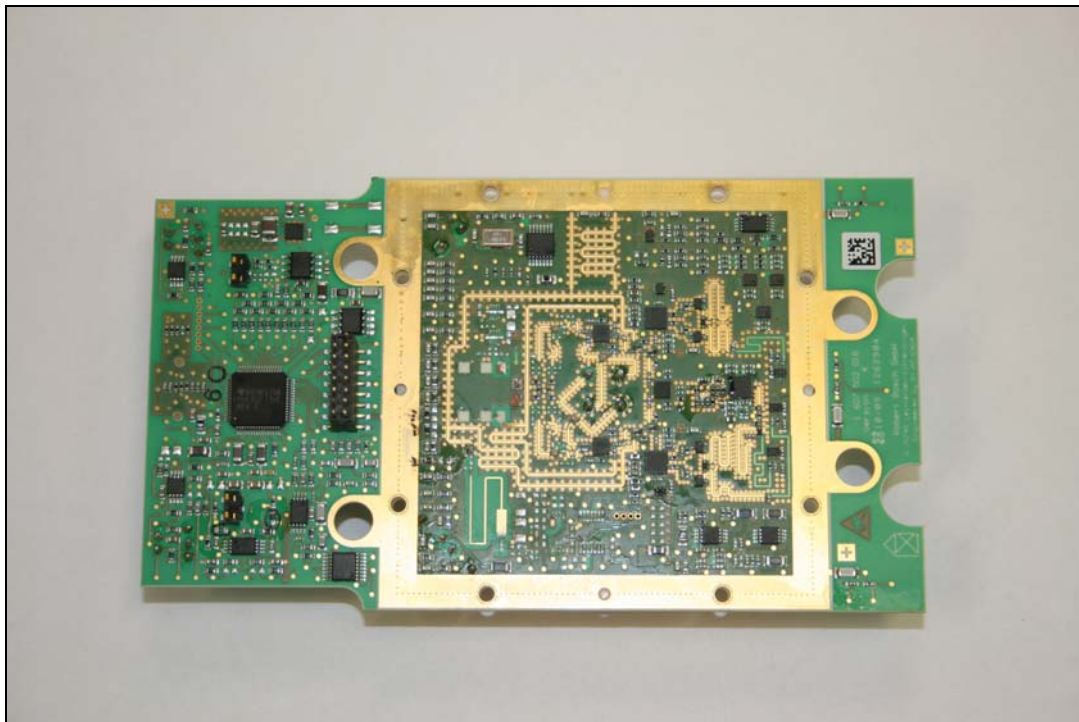
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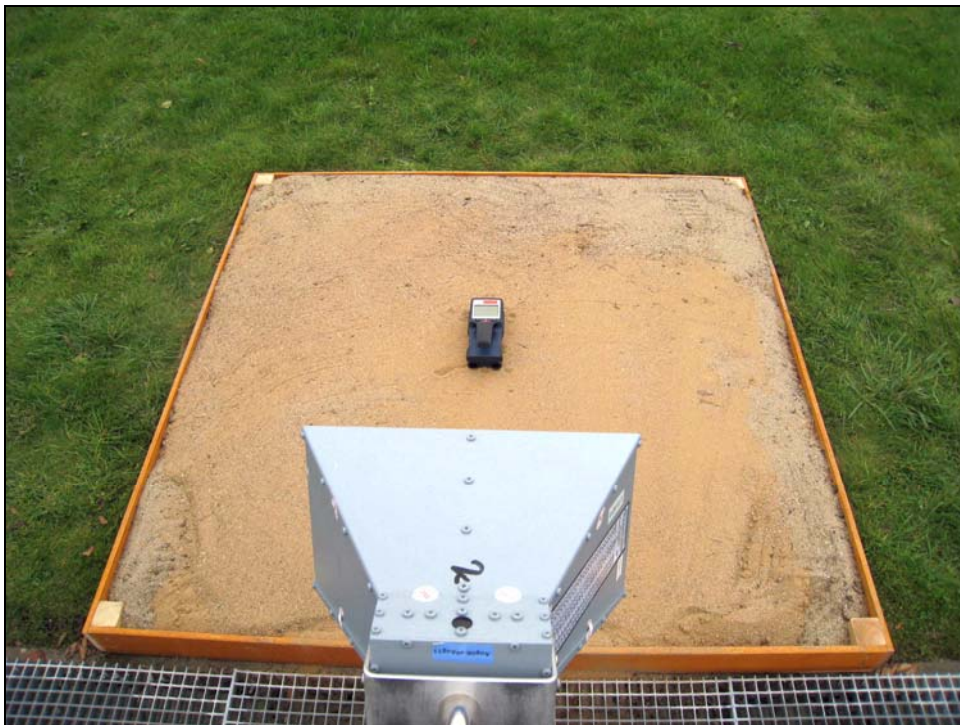
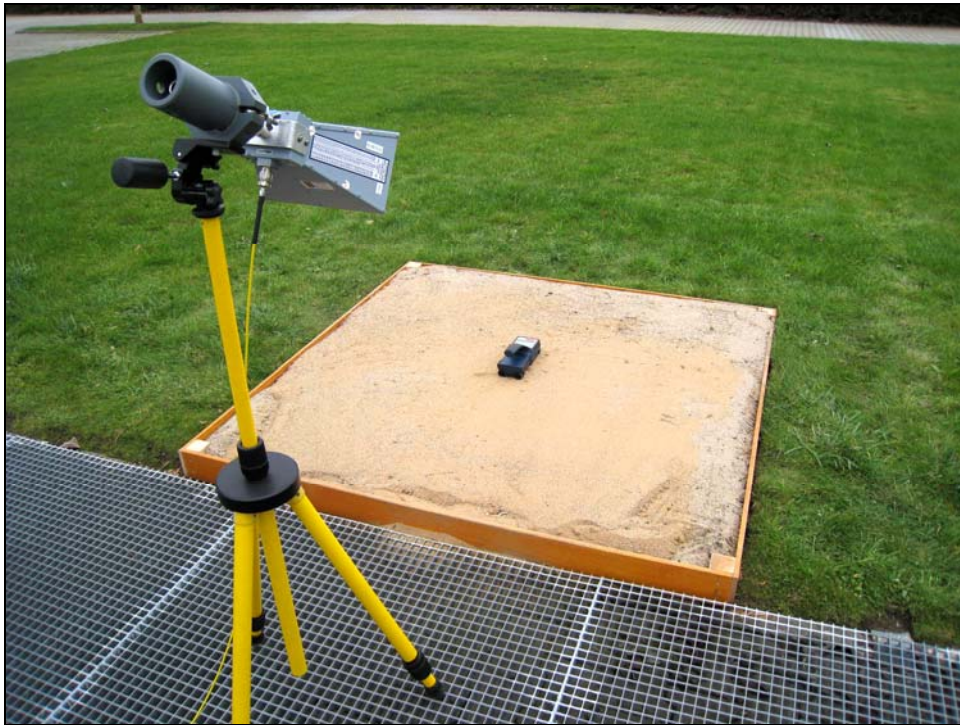
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Test Setup



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Annex B 10dB Bandwidth

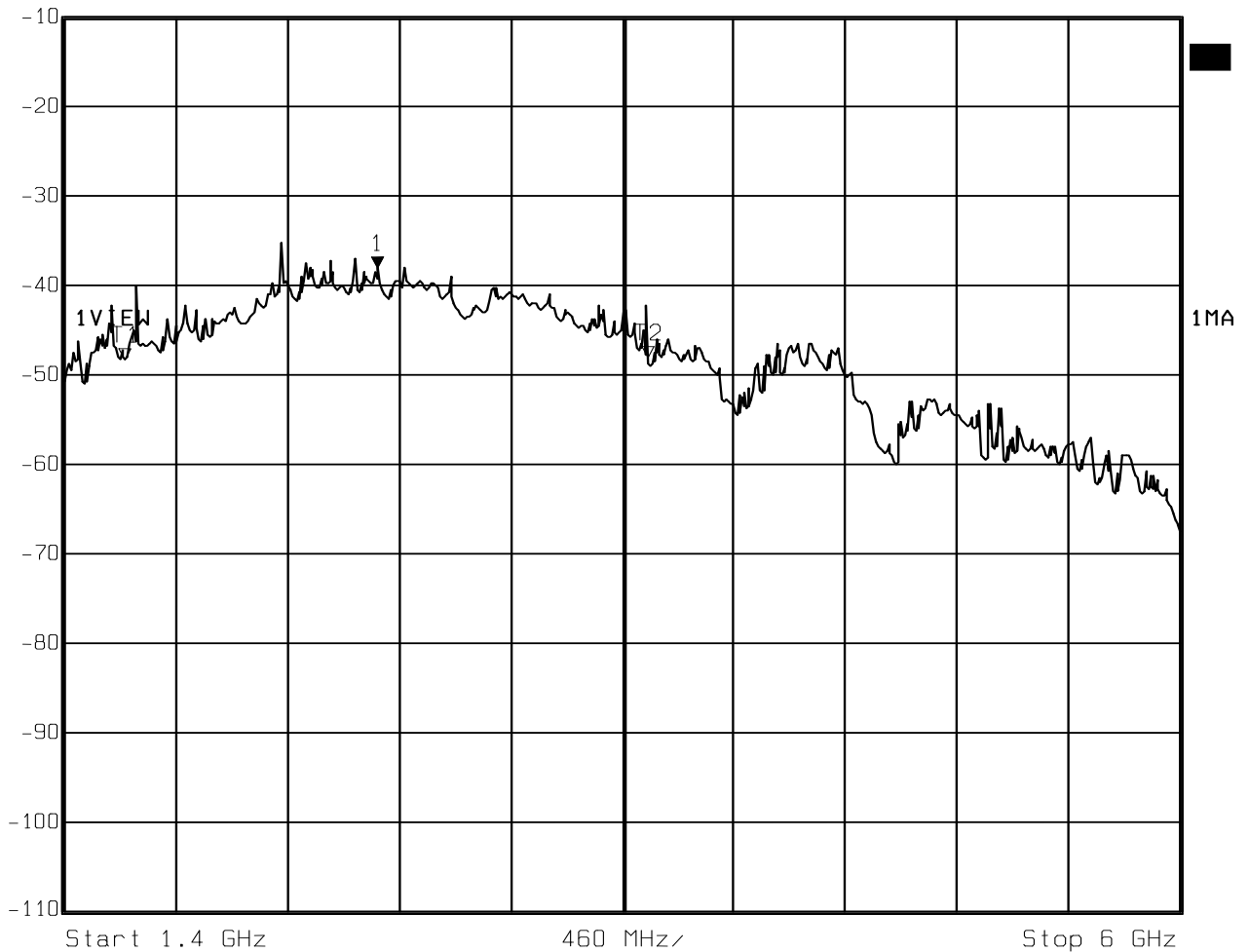
Test Report No.: G0M20910-2631-C-1

EUROFINS PRODUCT SERVICE GMBH
STORKOWER STR. 38C, D-15526 REICHENWALDE B. BERLIN

FCC part 15.503
-10 dB Bandwidth

EUT	Wall penetrating radar
Model	Wallscanner D-tect 150 3 601 K10 013
Approval Holder	Robert Bosch GmbH
Temperature / Voltage	23°C / Unom
Test Site / Operator	Eurofins
Test Specification	FCC part 15 section 503
Comment	Marker 1 2157.114 MHz

	Marker 1 [T1 ndB]	RBW	100 kHz	RF Att	0 dB
	Ref Lvl	ndB 10.00 dB	VBW	10 MHz	
	-10 dBm	BW 2.15711423 GHz	SWT	1.15 s	Unit dBm



Date: 15.OCT.2009 17:17:26

Measurement diagram

Eurofins Product Service GmbH
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