

# CETECOM ICT Services GmbH

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Laboratory for aeronautical radio , microwave radio and radar

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RLS - Laboratory

This test report consists of 13 pages

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Council



**Accredited testing laboratory**

**DAR registration number:  
TTI-P-G166/98-00**

Test Report No.:  
5-2715-A/00  
BOSCH ACC-SCU  
Type number 0 203 000 001

## 1. General information

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### Cross-reference between the standards FCC Part 15 ( 04/1999) and EN 301 091 ( 06/1998)

FCC Part 15		EN 301 091	
Sect.		Clause	
15.253	Operation within the band	7.1	Permitted range of operating frequencies
	76.0 to 77.0 GHz	7.2	Radiated power density
		7.3	Maximum safe level for radiated power density
		7.4	Modulation schemes
		7.4.1	Pulse modulation
		7.4.2	Frequency modulated CW
15.209	Radiated emission limits,	7.5	Radiated spurious emissions
	general requirements for	7.6	Unwanted emissions
	intentional radiators		

- Appendix 1      Photographs      8 pages
- Appendix 2      Test equipment      8 pages
- Appendix 3      Plots, data sheets      16 pages
- Appendix 4      Application form      19 pages

**1 General Information**

**1.1 Notes**

The test results of this test report relate exclusively to the test item specified in 1.5 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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***Tester :***

Date	Name	Signature
01.08.2000	Manfred Paschwitz.....	.....

***Technical responsibility for area of testing :***

Date	Name	Signature
01.08.2000	Klaus Kammerinke.....	.....

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## 1.2 Testing laboratory

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Untertürkheimer Str. 6 - 10, 66117 Saarbrücken  
Germany  
Telephone : + 49 681 5 98 - 84 32  
Fax : + 49 681 5 98 - 90 75  
e-mail : klaus.kammerinke@ict.cetecom.de

Accredited testing laboratory

DAR registration number: TTI-P-G166/98-00

Testing location , if different from CETECOM ICT Services GmbH:

Name :  
Street :  
Town :  
Country :  
Telephone :  
Fax :

## 1.3 Details of applicant

Name : Robert Bosch GmbH  
Street : Siemensstr. 31-33  
Town : D-71254 Ditzingen  
Country : Germany  
Telephone : +49 (0) 711 811 39 93  
Fax : +49 (0) 711 811 39 92

Contact person

Name : J. Hildebrandt  
Telephone : +49 (0) 711 811 243 53  
Fax : +49 (0) 711 811 39 92

## 1.4 Application details

Date of receipt of application : 05.07.2000  
Date of receipt of test item : 25.07.2000  
Date of test : 25.07.2000  
Laboratory number : 001/2000

## 1.5 Test item (EUT)

Description of test item : **77 GHz Automotive Cruise Control**  
Type identification : **BOSCH Distance Control Radar (DCR)**  
**Part number 0 203 000 001**  
Manufacturer : **Robert Bosch GmbH**  
**Postfach 30 02 40**  
**D-71254 Ditzingen**

### Technical data according to the specification

TX frequency range : 76.000 – 77.000 GHz  
Centre frequency : 76.525 000 GHz  
Channel : 1  
Modulation : 544M0F0N (FM CW)  
RF output power (measured) : 10.2 W  
Antenna : Integrated antennas (multiple-beam-system) with one dielectric lens  
Power supply (normal) : 12.0 V DC  
Power supply (extreme) : 9.0 V DC - 16.0 V DC

### 1.5.1 Operation conditions :

TX and RX on, if power supply is switched on.

### 1.5.2 Equipment under test (EUT)

#### **BOSCH Distance Control Radar**

Part number 0 203 000 001

Serial number 66.31-6 750 445

#### **Interface**

See technical customer documentation Y 203K60028

Additional information: Market name for Germany **ACC-SCU 77 GHz**

## 1.6 Standards

**EN 301 091 V1.1.1 (issue 06/1998)** **Technical characteristics and test methods for radar equipment operating in the 76GHz to 77 GHz band**  
**FCC Part 15 (issue 04/1999)** **Radio frequency devices**

## Technical test

### 2.1 Summary of test results

- No deviations from the technical specification (s) were ascertained in the course of the performed tests.**
- The deviations as specified in 2.5 were ascertained in the course of the performed tests.

The test report :

- describes the first test
- describes an additional test according to FCC part 15**
- is a verification of documents
- is only valid with the test report no :

Individual test results are documented in 2.5

Representative for the manufacturer:            Mr. Hildebrandt

### 2.2 Test conditions

The environmental conditions are documented specially for each test

### 2.3 Measurement and test set-up

The measurement and test set-up is in accordance to the specification .

### 2.4 Test equipment

see appendix 2

## 2.5 Test results

### 2.5.1 Test results overview

Additional to the test report no :

Verification of the EUT:

- The EUT is accordant with the technical documentation
- The technical documentation consists of 1 Technical Manual.
- 1 Technical Customer Documentation (TCD) Y203K60028
- 2
- The EUT was compared with the relevant parts of these documents
- The EUT is not accordant with the technical documentation

### Test results in details:

<b>15.253 (a)</b>	<b>Operation within the frequency band 76.0 to 77.0 GHz</b>
	<b>Test standards passed:</b>
<b>X</b>	<b>Yes</b>
	No
	No measurement

<b>15.253 (b.1)</b>	<b>Radiated emission limits within the band if the vehicle is standing</b>
	<b>Test standards passed:</b>
<b>X</b>	<b>Yes</b>
	No
	No measurement

<b>15.253 (b.2)</b>	<b>Radiated emission limits within the band if the vehicle is moving</b>
	<b>Test standards passed:</b>
<b>X</b>	<b>Yes</b>
	No
	No measurement

<b>15.253 (b.3)</b>	<b>Radiated emission limits for side-looking sensors</b>
	<b>Test standards passed:</b>
	Yes
	No
<b>X</b>	<b>Not applicable</b>

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<b>15.253 (c.1) 15.209 (a)</b>	<b>Radiated emission limits outside the band below 40 GHz Test standards passed:</b>
<b>X</b>	<b>Yes</b>
	No
	No measurement

<b>15.253 (c.2)</b>	<b>Radiated emission limits outside the band (40 GHz to 200 GHz) Test standards passed:</b>
<b>X</b>	<b>Yes</b>
	No
	No measurement

<b>15.253 (c.3+4)</b>	<b>Radiated emission limits outside the band (200 GHz to 231 GHz) Test standards passed:</b>
<b>X</b>	<b>Yes</b>
	No
	No measurement

<b>15.253 (d) 15.35</b>	<b>Measurement detector functions and bandwidths</b>
<b>applicable</b>	<b>15.253(b.1); 15.253(b.2); 15.253(c.1); 15.253(c.2); 15.253(c.3+4)</b>

<b>15.253 (e)</b>	<b>Fundamental emissions under normal and extreme conditions</b>
<b>applicable</b>	<b>15.253(b.1); 15.253(b.2)</b>



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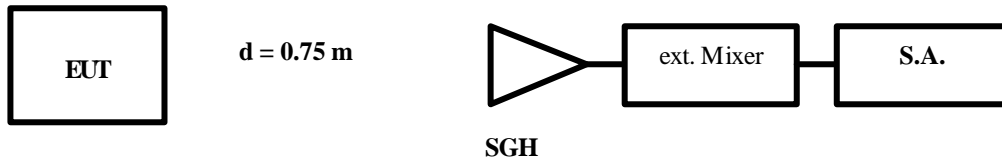
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<b>15.253 (a)</b>	<b>Operation within the frequency band 76.0 to 77.0 GHz</b>
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**Test conditions:**

Frequency band	f	=	76.000 – 77.000 GHz
Designation of emission	m	=	544M0F0N (FMCW)
Power supply	U	=	9.0 / 12.0 / 16.0 VDC
Temperature	t	=	-20.0 / +23.0 / +55.0 °C

**Test set - up:**



**Test measurement:**

Frequency band (GHz)	Measured centre frequency (GHz)	U (V DC)	t (°C)	Deviation (MHz)	Plot No.
76.000 – 77.000	76.520	9.0 – 16.0	+ 23.0	± 272	1
76.000 – 77.000	76.584	9.0 – 16.0	- 20.0	± 250	3
76.000 – 77.000	76.500	9.0 – 16.0	55.0	± 250	2

The maximum wanted frequency deviation is 544 MHz

**Test standards passed:**      Yes       No

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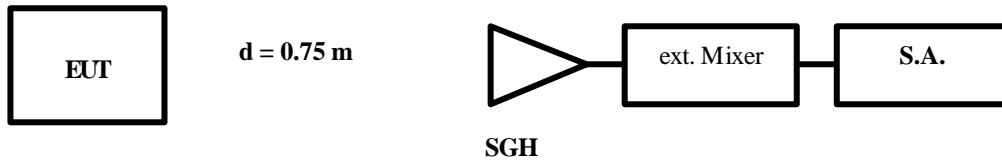
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<b>15.253 (b.1)</b>	<b>Radiated emission limits within the band if the vehicle is standing</b>
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**Test conditions:**

Frequency band	f	=	76.000 – 77.000	GHz
Designation of emission	m	=	TX off	
Power supply	U	=	9.0 / 12.0 / 16.0	V DC
Temperature	t	=	-20.0 / +23.0 / +55.0	° C

**Test set - up:**



**Limits:**

Power density (nW/cm <sup>2</sup> )	Distance (m)
200 (-37.0 dBm)	3.0

**RX antenna:** Standard gain horn gain = 23 dBi aperture = 2.0 cm \* 2.7 cm = 5.4 cm<sup>2</sup>

**Measurements at 3.0 m distance:**

Measured frequency (GHz)	p (SA) (dBm)	Res.-BW (MHz)	EIRP (nW)	PD nW/cm <sup>2</sup>	Remarks
76.500 (± 272 MHz)	<-45.0	3.0	<31.622	<5.856	noise

EUT does not show unwanted emissions in the frequency range 76.000 GHz to 77.000 GHz in stand by.

**Test standards passed:**

Yes

No

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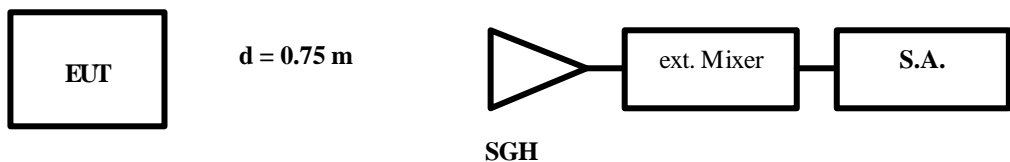
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<b>15.253 (b.2)</b>	<b>Radiated emission limits within the band if the vehicle is moving</b>
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**Test conditions:**

TX-frequency band	f	=	76.000 – 77.000	GHz
Designation of emission	m	=	544M0F0N	
Power supply	U	=	9.0 / 12.0 / 16.0	V DC
Temperature	t	=	-20.0 / +23.0 / +55.0	° C

**Test set - up:**



**Limits:**

Power density ( $\mu\text{W}/\text{cm}^2$ )	Distance (m)
60 (-12.2 dBm)	3.0
955 (-0.2 dBm)	0.75

**RX antenna:** Standard gain horn gain = 23 dBi aperture = 2.0 cm \* 2.7 cm = 5.4 cm<sup>2</sup>

**Measurements at 0.75 m distance:**

Measured frequency (GHz)	p (SA) (dBm)	Res.-BW (MHz)	EIRP ( $\mu\text{W}$ )	PD ( $\mu\text{W}/\text{cm}^2$ )	t (°C)	Plot no.:
76.500 ( $\pm$ 272 MHz)	-6.8	3.0	<b>208</b>	<b>38.5</b>	+ 23	1
76.500 ( $\pm$ 250 MHz)	-6.8	3.0	<b>208</b>	<b>38.5</b>	+ 55	4
76.500 ( $\pm$ 250 MHz)	-7.5	3.0	<b>178</b>	<b>32.9</b>	-20	3

**Measurements at 3.00 m distance:**

Measured frequency (GHz)	p (SA) (dBm)	Res.-BW (MHz)	EIRP ( $\mu\text{W}$ )	PD ( $\mu\text{W}/\text{cm}^2$ )	t (°C)	Plot no.:
76.500 ( $\pm$ 272 MHz)	-18.8	3.0	<b>13.183</b>	<b>2.441</b>	+ 23	-
76.500 ( $\pm$ 250 MHz)	-18.8	3.0	<b>13.183</b>	<b>2.441</b>	+ 55	-
76.500 ( $\pm$ 250 MHz)	-19.5	3.0	<b>11.220</b>	<b>2.078</b>	-20	-

**Test standards passed:**

Yes

No

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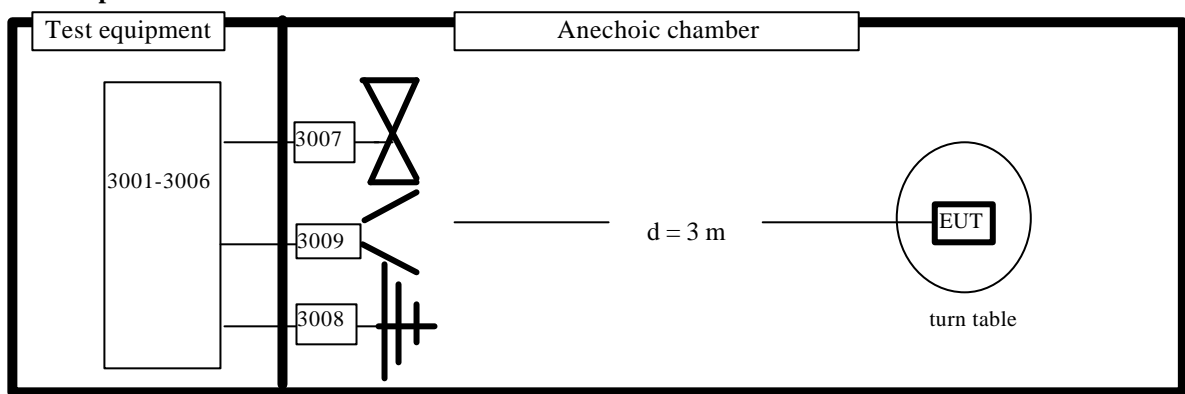
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<b>15.253</b> <b>(c.1)</b> <b>15.209 (a)</b>	<b>Radiated emission limits outside the band below 40 GHz</b> <b>General requirements</b>
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**Test conditions:**

TX-frequency band	f	=	76.000 – 77.000 GHz
Designation of emission	m	=	544M0F0N
Power supply	U	=	12.0 V DC
Temperature	t	=	+23.0 °C

**Test set-up**



**Limits**

Frequency (MHz)	Field strength E (µV/m)	Measurement dist. (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 - 88	100	3
88 – 216	150	3
216 - 960	200	3
above 960	500	3

Frequency band	Measured spurii (MHz)	p (dBm)	eirp (dBpW)	e (dBµV/m)	E (µV/m)	Plot No
0.009 ... 30.000 MHz	nothing found					15
30.000 ... 1000.000 MHz	n.f.	< - 54.0	< 36.0	< 43.5	< 153.1	5+6
1.0 – 4.0 GHz	n.f.	< - 60.0	< 30.0	< 37.5	< 75.0	7
1.0 – 5.0 GHz	n.f.	< - 80.0	< 10.0	< 17.5	< 7.5	8
5.0 – 18.0 GHz	12.684 GHz	-73.3	16.7	24.4	16.2	9
18.0– 40.0 GHz	n.f.				-	-

Remarks: Variation in power supply (9.0 ... 16.0 V DC) has no influence on spurious emissions level.

Conversion from radiated power [eirp (dBpW)] into field strength [e (dBµV/m)] at 3,0 m distance

$$e = \text{eirp} + 7,5 - g$$

Test standards passed:

Yes

No

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<b>15.253 (c.2/c4)</b>	<b>Radiated emission limits outside the band above 40 GHz to 231 GHz</b>
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**Test conditions:**

TX-frequency band	f	=	76.000 – 77.000 GHz
Designation of emission	m	=	544M0F0N
Power supply	U	=	12.0 V DC
Temperature	t	=	+23.0 °C

**Test set - up:**

**Limits**

Frequency (GHz)	Power density (pW/cm <sup>2</sup> )	Measurement dist. (m)
40 to 200	600	3
200 to 231	1000	3

**Test measurement at 3.00m distance :**

Frequency Range (GHz)	Spurious emissions p (dBm)	Res.-BW (MHz)	Spurious emissions P (pW)	Power density (pW/cm <sup>2</sup> )	See plot No.
40.000 – 60.000	n.f. (see note 1)	3.000	-	-	10
60.000 – 90.000	n.f.	3.000	-	-	-
90.000 – 140.000	n.f. (see note 1)	3.000	-	-	11
110.000 – 170.000	-33.2	3.000	478	172.08	12
156.717	-30.8	3.000	831	299.16	13
170.000 – 250.000	n.f.	3.000	-	-	

**n.f. = nothing found**

**Remarks: note 1: Spurious frequencies not from EUT (external mixer)**

**Test standards passed:**

Yes

No