CETECOM ICT Services GmbH

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Laboratory for aeronautical radio , microwave radio and radar

Accredited by the
German Accreditation
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

2. Technical test

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		

[X]	Appendix 1	Photographs	8 pages
[X]	Appendix 2	Test equipment	8 pages
[X]	Appendix 3	Plots, data sheets	16 pages
[X]	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	

1.2 Testing laboratory

CETECOM ICT Services GmbH
P.O. Box 100445, 66004 Saarbrücken
Untertürkheimer Str. 6 - 10, 66117 Saarbrücken
Germany
Telephone : + 49 681 5 98 - 84 32
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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

[X] **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

[X] **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:

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

Test results in details:

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

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

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

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

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

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

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

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

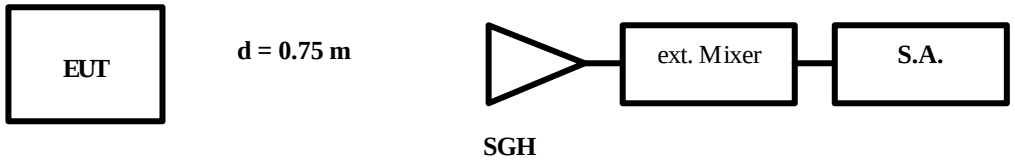
15.253 (e)	**Fundamental emissions under normal and extreme conditions**
applicable	**15.253(b.1); 15.253(b.2)**

15.253 (a)	Operation within the frequency band 76.0 to 77.0 GHz

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	V DC
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

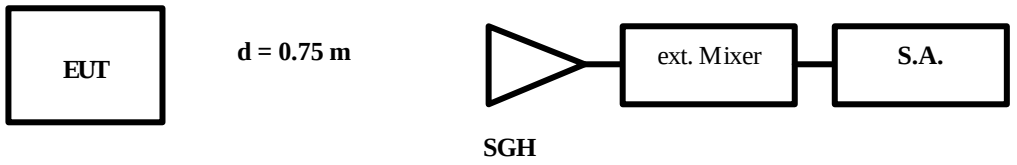
Test standards passed: **Yes** [X] **No** [ ]

15.253 (b.1)	Radiated emission limits within the band if the vehicle is standing

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 ^{2})	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^2**

Measurements at 3.0 m distance:

Measured frequency (GHz)	p (SA) (dBm)	Res.-BW (MHz)	EIRP (nW)	PD nW/cm^2	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.

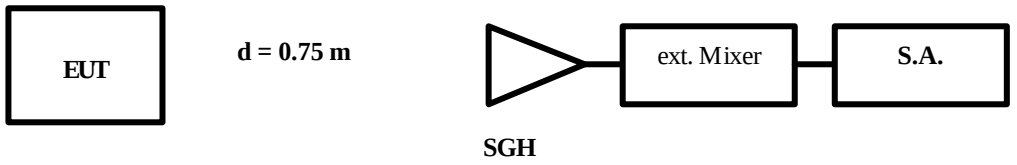
Test standards passed: **Yes** [X] **No** [ ]

15.253 (b.2)	Radiated emission limits within the band if the vehicle is moving

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:



SGH

Limits:

Power density (µW/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^2**

Measurements at 0.75 m distance:

Measured frequency (GHz)	p (SA) (dBm)	Res.-BW (MHz)	EIRP (µW)	PD (µW/cm^2)	t (°C)	Plot no.:
76.500 (± 272 MHz)	-6.8	3.0	**208**	**38.5**	+ 23	1
76.500 (± 250 MHz)	-6.8	3.0	**208**	**38.5**	+ 55	4
76.500 (± 250 MHz)	-7.5	3.0	**178**	**32.9**	-20	3

Measurements at 3.00 m distance:

Measured frequency (GHz)	p (SA) (dBm)	Res.-BW (MHz)	EIRP (µW)	PD (µW/cm^2)	t (°C)	Plot no.:
76.500 (± 272 MHz)	-18.8	3.0	**13.183**	**2.441**	+ 23	-
76.500 (± 250 MHz)	-18.8	3.0	**13.183**	**2.441**	+ 55	-
76.500 (± 250 MHz)	-19.5	3.0	**11.220**	**2.078**	-20	-

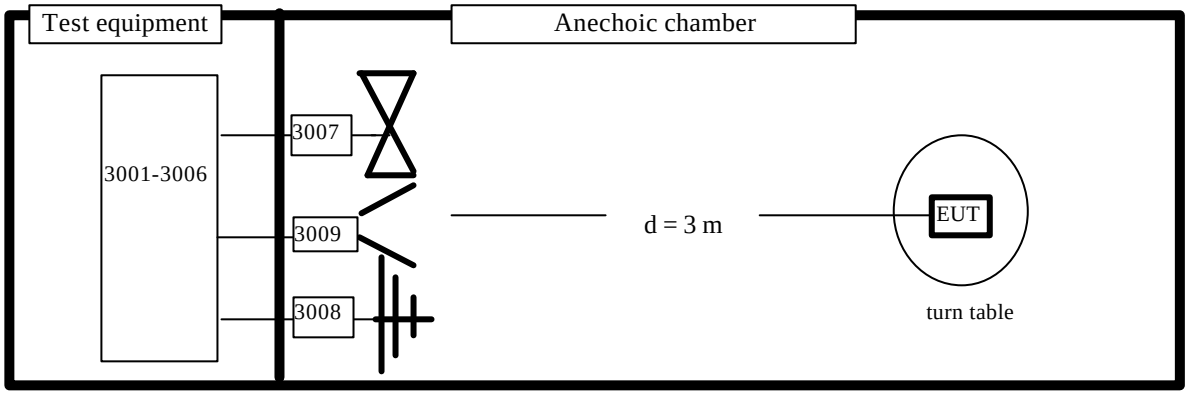
Test standards passed: **Yes** [X] **No** [ ]

15.253 (c.1) 15.209 (a)	**Radiated emission limits outside the band below 40 GHz General requirements**

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: Varation 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

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

Test standards passed: **Yes** [X] **No** [ ]

15.253 (c.2/c4)	Radiated emission limits outside the band above 40 GHz to 231 GHz

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^2)	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^2)**	**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 [X] No [ ]