CETECOM ICT Services GmbH

Radio Satellite Communication
Untertürkheimer Straße 6-10 . D-66117 Saarbrücken Telefon: +49 (0)681 598-9100 Telefax: -9075

Accredited Testing Laboratory

DAR-Registration number:
TTI-P-G 166/98-20

Test report no.: 5_2973-H/00
FCC Part 15.247
AXIS 9010

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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.

1.2 Testing laboratory

CETECOM ICT Services GmbH
Untertürkheimer Straße 6 - 10
66117 Saarbrücken
Germany
Telefone : + 49 681 598 - 9100
Telefax : + 49 681 598 - 9075
E-mail : Michael.Berg@ict.cetecom.de
Internet : www.cetecom.de

Accredited testing laboratory
DAR-registration number : TTI-P-G 166/98-20

1.3 Details of applicant

Name : AXIS Communications AB
Street : Scheelevägen 34
City : SE-22363 Lund
Country : Sweden
Telephone : +46 46 2721 899
Telefax : +46 46 13 6130
Contact : Mr. Nils Olsson
Telephone : +46 46 2721 899

1.4 Application details

Date of receipt of application : 28.03.01
Date of receipt of test item : 28.03.01
Date of test : 05.07.01

1.5 Test item

Type of equipment	:	**Radio LAN Access Point for Bluetooth**
Type designation	:	**AXIS 9010/ALPS**
Manufacturer	:	applicant
Street	:	
City	:	
Country	:	
Serial number	:	-.-
Additional informations: :		
Frequency	:	2400 – 2483.5 MHz
Type of modulation	:	1M00FXD / 79M8FXD (FHSS)
Number of channels	:	79
Antenna	:	integral antenna
Power supply	:	12V AC/DC Adaptor
Output power	:	EIRP: 10.0 mW
Type of equipment	:	Temperature range : -10°C - +55°C

1.6 Test standards: FCC Part 15 §15.247

2 Technical test

2.1 Summary of test results

Technical responsibility for area of testing :

Date	Section	Name	Signature
05.07.01	RSC 8411	Berg M.	

Technical responsibility for area of testing :

Date	Section	Name	Signature
05.07.01	RSC8414	Ames H.	

2.2 Testreport

TEST REPORT

Testreport no. : 5_2973-H/00

TEST REPORT REFERENCE

LIST OF MEASUREMENTS

Introduction

This report describes the results of the processing gain measurement for the AXIS 9010/ALPS using the FCC CW jamming margin method.

Requirement

Hybrid systems that employ a combination of both direct sequence and frequency hopping modulation techniques shall achieve a processing gain of at least 17 dB from the combined technique.

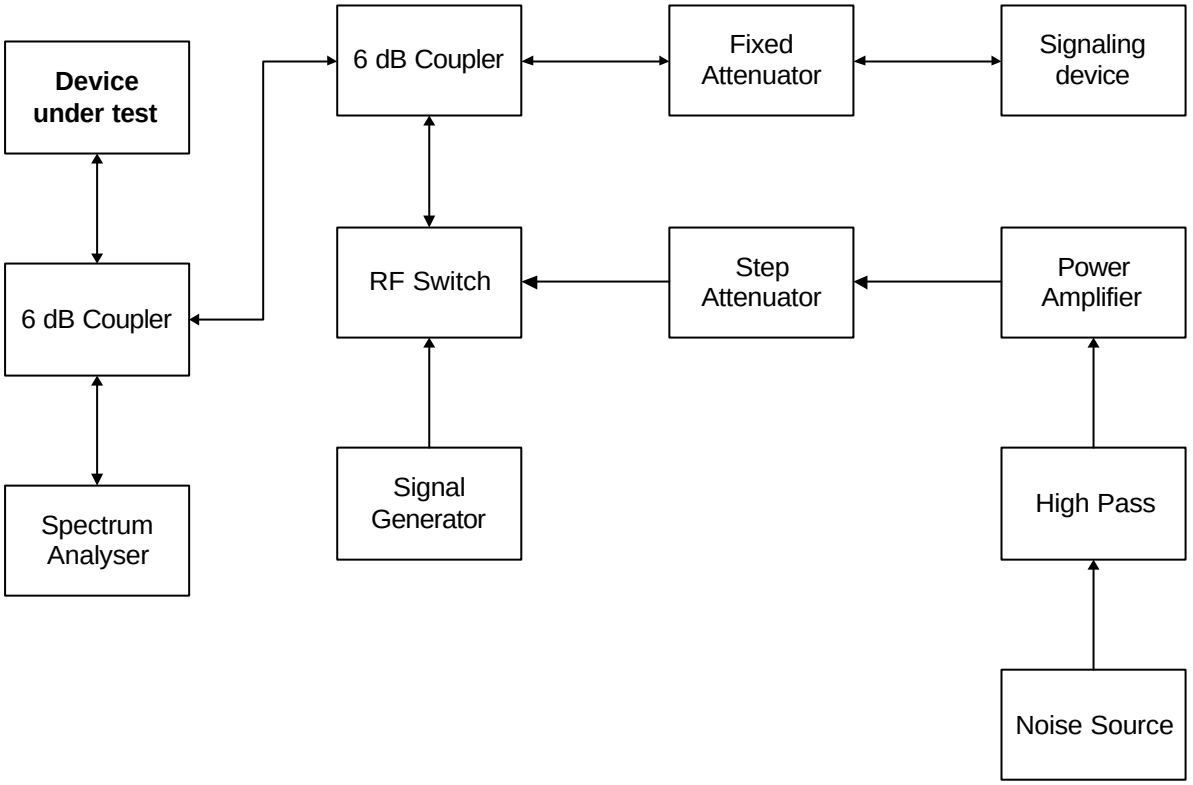
System losses

In the formula for calculation the processing gain appears the term system losses. In Bluetooth there are two major causes for the system loss:

1. The non optimal sampling time. The CW jamming method assures that the optimal sampling time as determined before, in fact, as described above, it will be determined via the access code.
2. Losses due to attenuation in the RF part.

Although this two points produce a system loss which will be much greater than 2 dB, we calculated with this value, because this is the maximum that will be accepted by FCC.

Test setup:



To set-up the connection a special test program was used. It is installed on the laptop and communicates with the **AXIS 9010/ALPS**.

The BER was determined with a special test software over 1600000 Bits .

Measurement Results :

S/N Measurement :

The measurement for S/N was performed by adding noise to the wanted signal. The noise level was adjusted until the BER reached 0.1 %.

With this measurement configuration the S/N ratio was 13.6 dB.

The jammer signal was stepped in 50 kHz steps over the receiving channel.
For every step the jammer level was adjusted until the BER was 0.1 %. The ratio between wanted signal power and the jammer power at the RF input of the device is the required Jammer to Signal ratio.

With this measurement configuration the JSR has the following results:

Jammer Offset(KHz)	Jammer-Signal	Jammer/Signal ratio	BER
-500	-61.3	-12,8	0.1%
-450	-62.3	-13.8	0.1%
-400	-62.0	-13.5	0.1%
-350	-60.5	-12.0	0.1%
-300	-59.9	-11.1	0.1%
-250	-58.0	-9.5	0.1%
-200	-58.1	-9.6	0.1%
-150	-54.7	-6.2	0.1%
-100	-52.6	-4.1	0.1%
-50	-50.8	-2.3	0.1%
0	-50.9	-2.4	0.1%
+50	-50.9	-2.4	0.1%
+100	-52.4	-3.9	0.1%
+150	-54.4	-5.9	0.1%
+200	-57.1	-8.6	0.1%
+250	-57.1	-8.6	0.1%
+300	-57.7	-9.2	0.1%
+350	-59.1	-10.6	0.1%
+400	-59.7	-11.2	0.1%
+450	**-60.5**	**-12.0**	0.1%
+500	-61.3	-12.8	0.1%

Wanted signal : -48.5 dBm

Signal/Noise : 13.6 dBm

Disregarding the marked data points (-500, -450, -400, -350, +500 kHz) the worst data point is at +450 kHz with a Jammer / Signal value of -12.0 dB.

Processing gain calculation

With these values the processing gain for the DSS part of the system is calculated to:
Mj = JSR
Gp = S/N + Mj + Lsys = 13.6 -12 + 2.0) = 3.6 dB

The processing gain for FHSS part is calculated as:

10 * log 32 = 15 dB (32 hopping channels in hybrid mode)

This means for the total processing gain of the hybrid system:

15 dB + 2.6 dB = 18.6 dB

This is above the minimum value of 17 dB stated in FCC rules.

The device passes the requirement of this clause.