CETECOM ICT Services GmbH

Radio Satellite Communication
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Accredited Testing Laboratory

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

Test report no.: 2_2590-A/01
FCC Part 15.247 (f)
DCR-IP7

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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

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

1.3 Details of applicant

Name : Sony Corporation Mobile Network Company, Personal Video Company
Street : Shinagawa INTERCITY C-Tower Shinagawa Tec.
City : 2-15-3 konan, Minato-Ku, Tokyo 108-6201
Country : Japan
Telephone : +81 3 5769 5595
Telefax : +81 3 5769 5946
Contact : Mr. Seiichi Morikawa
Telephone : +81 3 5769 5599

1.4 Application details

Date of receipt of application : 02.07.01
Date of receipt of test item : 13.07.01
Date of test : 13.07.01

1.5 Test item

Type of equipment	:	**Buildin Bluetooth transceiver**
Type designation	:	**DCR-IP7**
Manufacturer	:	applicant
Street	:	
City	:	
Country	:	
Serial number	:	HW:1.1.0 SW: 1.0.0
Additional informations: :		
Frequency	:	2400 – 2483.5 MHz
Type of modulation	:	1M00FXD / 79M8FXD (FHSS)
Number of channels	:	79
Antenna	:	integral antenna
Power supply	:	7,2 V DC Lithium accu
Output power	:	-5,1 dBm / 0,31 mW EIRP/Powerdensity max : -7,28 dBm / 0,187mW
Type of equipment	:	Temperature range : 0°C - +40°C

1.6 Test standards: FCC Part 15 §15.247 (f)

2 Technical test

2.1 Summary of test results

The test results fulfils all the requirements of the FCC Part 15.247 (f) (processing gain).

Final verdict : PASS

Technical responsibility for area of testing :

Date	Section	Name	Signature
18.07.01	RSC 8411	Berg M.	

Technical responsibility for area of testing :

Date	Section	Name	Signature
18.07.01	RSC8414	Ames H.	

2.2 Testreport

TEST REPORT

Testreport no. : 2_2590-A/01

TEST REPORT REFERENCE

LIST OF MEASUREMENTS

Introduction

This report describes the results of the processing gain measurement for the SONY DCR-IP7 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.

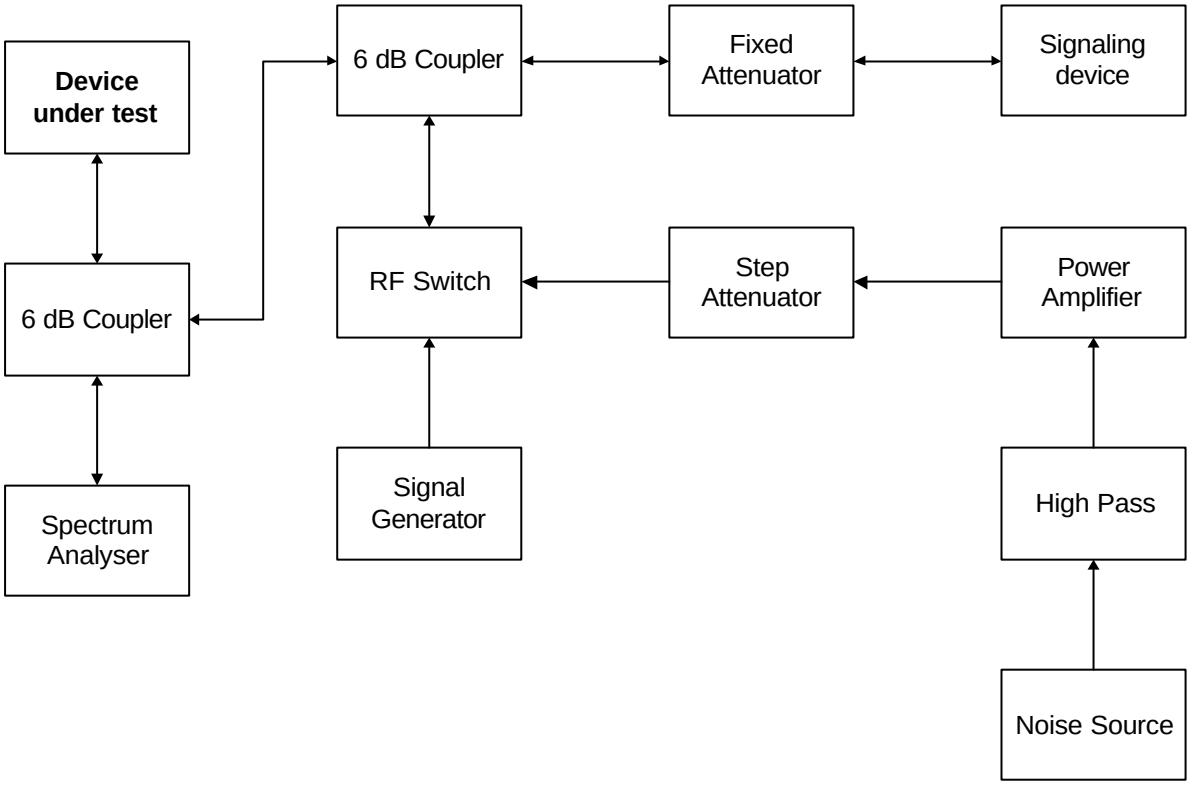
Although this two points produce a system loss which will be much greater than 2 dB, we calculated with this value, because this is the maximum that will be accepted by FCC.

Modification of measurement method

Despreading is accomplished by correlating the received bit stream with the bit pattern of the access code. Then with the value of the correlator output will be decided if the access code is valid or not. That means if the access code is not valid a “bit error” occurs for the Bluetooth device.
For this reason in CW jamming margin method the ratio of invalid access codes (IACR) is used to instead of the BER.

Another reason to use this criteria is the fact, that the Bluetooth technology uses the access code to find the correct sampling point. That means if the access code cannot be found, all other bits in the transmission cannot be sampled successfully.

Test setup:



Remark: not all measuring equipment were used

In the result the number of invalid access codes for a packet of 255 transmissions is given. For this test 200 packets (51000 bursts) were measured.

For the selected IACR of 0.1 %, this means that 51 access codes are not valid.

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 IACR reached 0.1 %.

With this measurement configuration the S/N ratio was 16.7 dB.

The jammer signal was stepped in 50 kHz steps over the receiving channel.
For every step the jammer level was adjusted until the IACR 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	-60.3	-14.3	0.1%
-450	**-60.0**	**-14.0**	0.1%
-400	-60.0	-14.0	0.1%
-350	-59.2	-13.2	0.1%
-300	-57.2	-11.2	0.1%
-250	-55.5	-9.5	0.1%
-200	-54.8	-8.8	0.1%
-150	-54.6	-8.6	0.1%
-100	-52.5	-6.5	0.1%
-50	-49.6	-3.6	0.1%
0	-46.9	-0.9	0.1%
+50	-47.0	-1.0	0.1%
+100	-49.8	-3.8	0.1%
+150	-53.2	-7.2	0.1%
+200	-54.4	-8.4	0.1%
+250	-56.7	-12.7	0.1%
+300	-59.0	-13.0	0.1%
+350	-58.9	-12.9	0.1%
+400	-60.8	-14.8	0.1%
+450	-60.4	-14.4	0.1%
+500	-60.8	-14.8	0.1%

Wanted signal : -46.0 dBm

Signal/Noise : 16.7 dBm

Disregarding the marked data points (-500, +400, +450,+500 kHz) the worst data point is at -450 kHz with a Jammer / Signal value of -14.0 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 = 16.7 –14.0 + 2.0 = 4.7 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 + 4.7 dB = 19.7 dB

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

The device passes the requirement of this clause.

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	Signal Analyzer	FSIQ 26	Rohde & Schwarz	835540/01B
02	Power Splitter	11667B	Hewlett Packard	00616
03	Micro Systems Amplifier	83017A	Hewlett Packard	3123A00105
04	RF-Step Attenuator	DPSP	Rohde & Schwarz	334.6010.02
05	Signal Generator	SMIQ 03B	Rohde & Schwarz	835541/055
06	Signal Generator	SMIQ 03B	Rohde & Schwarz	835541/056
07	Protocol Tester	PTW 60	Rohde & Schwarz	838312/011
08	Industrial Controller	PSM 12	Rohde & Schwarz	835259/007
09	Noise Source	BAT 31	-	-
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