Uppgjord (även faktaansvarig om annan) -		Nr – *No*		
WSS Leif Björklund		WSS/D/R 01:036		
Dokansv/Godk - *Doc respons/Approved*	Kontr - *Checked*	Datum - *Date*	Rev	File
WSS Tomas Blom		2001-10-03	A	

Test Report
of
Processing Gain Measurement
for
Infineon PMB6754 + PMB6625
used in
Wireless Solutions LSE044

Uppgjord (även faktaansvarig om annan) -		Nr – *No*		
WSS Leif Björklund		WSS/D/R 01:036		
Dokansv/Godk - *Doc respons/Approved*	Kontr - *Checked*	Datum - *Date*	Rev	File
WSS Tomas Blom		2001-10-03	A	

1 General

1.1 Summary of Test Result

The device fulfils the requirements of FCC part 15, 247, processing gain.

1.2 Description of EUT

Device	Bluetooth Palm Adapter
Product type	LSE 044/..
S/N	LSE04401AB000001
HW status	R1A
Date of test started	2001-10-02
Date of test finished	2001-10-03
EUT comments	The LSE 044 has a built in antenna with 0dB gain.
Measurement comments	To make conducted measurements a semi-rigid cable with SMA connector was connected instead of the antenna.

Uppgjord (även faktaansvarig om annan) -		Nr – *No*		
WSS Leif Björklund		WSS/D/R 01:036		
Dokansv/Godk - *Doc respons/Approved*	Kontr - *Checked*	Datum - *Date*	Rev	File
WSS Tomas Blom		2001-10-03	A	

2 Introduction

This report describes the result from processing gain measurements for LSE044 Palm Adapter according to FCC part 15,247, with the CW jamming method.

3 Requirement

Hybrid systems that employ a combination of both DSSS and FHSS shall achieve at least 17dB from the combined techniques.

When the Bluetooth device is in page or inquiry mode, it is considered as a hybrid system. The processing gain from the frequency hopping is 15dB (32 channels). The direct sequence spreading should then be at least 2 dB according to the formula:

Gp = S/N + J/S + Lsys

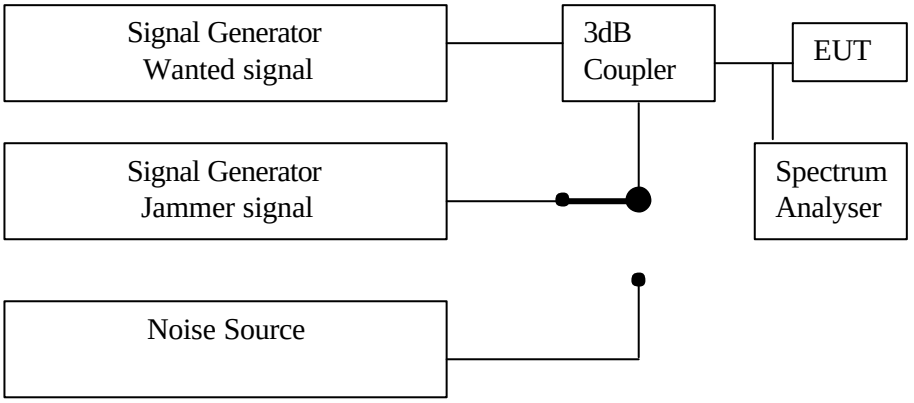
where
S/N is the required Signal to Noise ratio
J/S is the measured Jammer to Signal ratio
Lsys is defined as the system losses equal to 2dB

4 Modification of Measurement Method

De-spreading is accomplished by correlating the received bit stream with the bit pattern of the access code. If the access code is not valid it will be detected as an access code error.

For this reason will the Access Code Error Ratio (ACER) be used instead if the Bit Error Ratio (BER).

5 Measurement Set-up



For the test, 50 000 bursts were sent and the level of the Jammer Signal Generator was changed until an ACER level of 0.1% was reached. This was recorded as the J/S ratio.

To find the S/N ratio, the level of the noise source was changed until an ACER of 0.1% was reached. The noise level was checked with a spectrum analyser.

The wanted signal level was –60dBm.

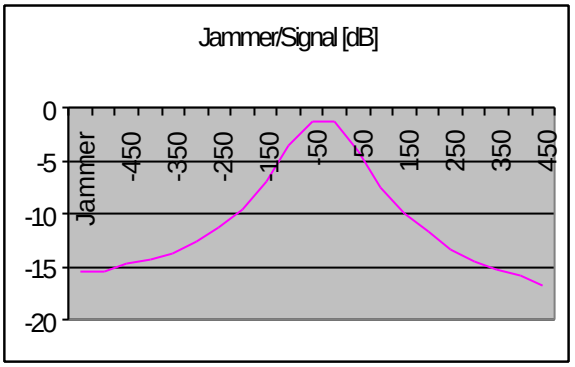
The Jammer was stepped in 50kHz steps +/- 500 kHz from the receiving channel.

6 Measurement result

The S/N ratio was found to be 18.6dB with the method according to above.

The J/S ratio was found to be –15.2dB discarding the worst 20% of the values according to the following table:

Jammer Offset [kHz]	Jammer/Signal [dB]	
-500	-15,5	Discard
-450	-15,5	Discard
-400	-14,7	
-350	-14,2	
-300	-13,7	
-250	-12,6	
-200	-11,3	
-150	-9,5	
-100	-6,9	
-50	-3,5	
0	-1,3	
50	-1,2	
100	-4,1	
150	-7,4	
200	-9,9	
250	-11,7	
300	-13,3	
350	-14,5	
400	-15,2	J/S ratio
450	-15,8	Discard
500	-16,7	Discard



The processing gain for the direct sequence will then be calculated as:

Gp = S/N + J/S + Lsys = 18.6 – 15.2 +2.0 = 5.4dB

The total processing gain will be:

Gp(DSSS) + Gp(FHSS) = 5.4 + 15 =20.4dB

According to FCC part 15.247, the processing gain of a hybrid system should be at least 17dB.

The device passes the requirement.

7 Test equipment and ancillaries used

Instrument	**Manufacturer**	**Type**	**S/N**	**Calibration due**
Signal Generator, Jammer Signal	Rohde & Schwarz	SMIQ03E	848948/005	September 2003
Signal Generator, Wanted Signal	Agilent	E4433B	GB39340649	October 2002
Spectrum Analyser	Rohde & Schwarz	FSEB	826079/019	October 2001
Noise Source	Agilent	33250A		
3dB Coupler	Mini-Circuits	ZFSC-2-2500		
Coaxial cable	Suhner	-	-	-
SMA connector	Male to Male	-	-	-