

Processing Gain Measurements for MH-9026 DCT TEST report

1. Introduction

1.1 Scope

This document is a GVC Engineering test report for MH-9026 basic DCT cordless phone.
This document details the results of measurement of the processing gain of a DCT phone.

1.2 Reference Documents

This section lists documents that are referenced within or are materially relevant to this document.
Code of Federal Regulations, Title 47, Chapter 1, Part 15 Radio Frequency Devices (FCC)

1.3 Definitions

FCC	Federal Communications Commission
SNR	Signal to Noise Ratio
JSR	Jammer to Signal Ratio
CW	Continuous wave (jammer)
HS	Handset
BS	Base station
DBPSK	Differential Binary Phase Shift Keying

Table 1: Definitions and Abbreviations

2. An Overview of the FCC Method for measuring Processing Gain

Two methods are specified for measuring processing gain by the FCC in 15.247 (e). The first method simply involves calculating the signal to noise ratio (SNR) with the spreading code switched on with the SNR when the spreading code is switched off. The difference between the two is the processing gain. The SNR is measured at the demodulated output of the receiver. In principle this is a reasonable method to measure the processing gain of any direct sequence spread spectrum communication system, however, it does not take into consideration that the non-spread spectrum portion of the system may operate under the assumption that the signal being transmitted is a spread spectrum signal and when the spreading code is switched off the system may fail to operate or operate at greatly reduced efficiency. In either case the measurement of processing gain will be meaningless.

The second method specified by the FCC to measure processing gain is detailed in 15.247 (a)(1). This involves transmitting a CW jammer in the RF passband of the system and measuring the jammer to signal ratio (JSR) required to achieve a certain bit error rate. The choice of the actual value of the bit error rate is left up to the tester. The jammer is stepped in 50 kHz increments across the entire passband and in each case the JSR to achieve the desired bit error rate is measured. The JSR is measured at the RF input to the system under test. The lowest 20% of the JSR data (in dB) is discarded. The processing gain can then be calculated as follows:

$$G_p = \left(\frac{S}{N} \right)_{theoretical} + \left(\frac{J}{S} \right)_{discarded} + L_{losses}$$

where G_p is the processing gain, the SNR is that theoretically predicted for the system under the test to achieve the desired bit error rate, the JSR is the lowest value (in dB) in the remaining data set and L_{losses} adjusts for non-ideal system losses. L_{losses} can not be greater than 2 dB.

3. Processing Gain Measurement Results

The following parameters were used in the test setup

HS Tx power (dBm)	-3.6	
BSU LNA gain (dB)	0	
Testsystem losses (signal) (dB)	-14.5	-4.0 dB (system), -3.0 dB (signal combiner)
Testsystem losses (jammer) (dB)		-7.5 dB (cables loss)
Test system losses (jammer) (dB)	-5.5	-3 dB (signal combiner), -2.5 dB (cables loss)

Table 2: Test Setup Parameters

The following measurement results were taken at the base station.

The desired bit error rate was set at 10^{-3} .

Jammer Frequency (MHz)	BER (dB)	Received jammer power (dBm)	Received signal power (dBm)	Jammer/Signal ratio (dB)
903.60	1.15×10^{-1}	-16.4	-18.2	1.8
904.80	9.78×10^{-1}	-16.3	-18.2	1.9
906.00	1.12×10^{-1}	-16.7	-18.4	1.7
907.20	1.23×10^{-1}	-16.1	-18.0	1.9
908.40	9.87×10^{-1}	-16.5	-18.8	2.3
909.60	9.94×10^{-1}	-16.2	-18.3	2.1
910.80	1.17×10^{-1}	-16.7	-18.7	2.0
912.00	9.69×10^{-1}	-16.8	-19.0	2.2
913.20	1.08×10^{-1}	-16.6	-18.4	1.8
914.40	1.25×10^{-1}	-17.0	-19.1	2.1
915.60	1.13×10^{-1}	-16.7	-19.0	2.3
916.80	9.91×10^{-1}	-17.5	-19.7	2.2
918.00	1.22×10^{-1}	-17.2	-18.9	1.7
919.20	9.60×10^{-1}	-17.5	-19.0	2.1
920.40	9.87×10^{-1}	-16.8	-19.2	2.4
921.60	1.38×10^{-1}	-17.6	-19.4	1.8
922.80	9.70×10^{-1}	-17.3	-19.5	2.2
924.00	1.43×10^{-1}	-17.0	-18.7	1.7
925.20	9.54×10^{-1}	-17.5	-19.6	2.1
926.40	1.36×10^{-1}	-17.7	-19.5	1.8

Table 3: Test Results

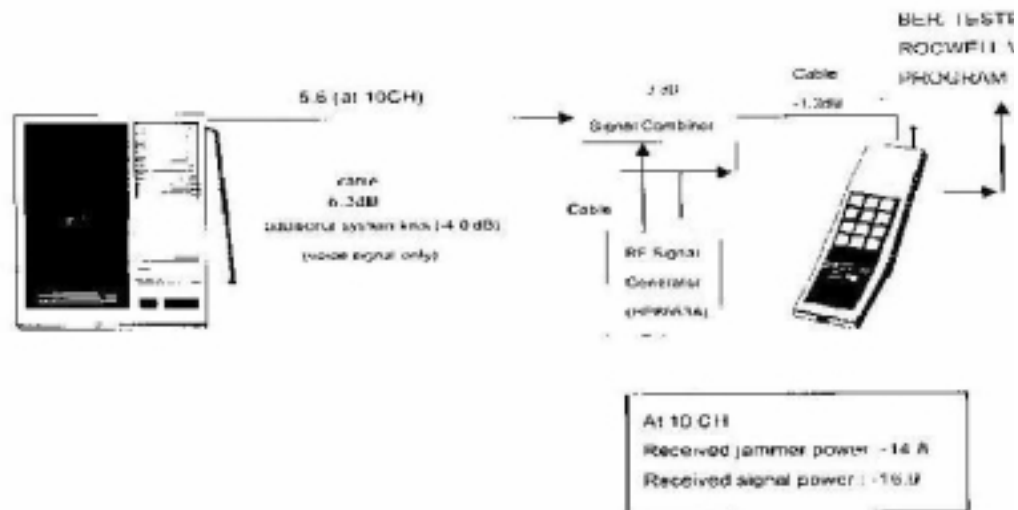


Figure 1 Test Setup

For DBPSK at 10^{-2} bit error rate the required SNR is 8.0 dB. Using the results above and the data in the table below the processing gain is calculated to be 12.1 dB.

required SNR (dB)	8.0
system losses (dB)	2.0
J/S ratio at 80% point (dB)	2.1
FCC Processing gain (dB)	12.1

Table 4. Processing Gain Calculation data

4. Conclusions

The result measured for processing gain of 12.1 dB is close to the actual processing gain due to a 12 chip spreading code of

$$10 \times \log_{10}(12) = 10.8 \text{ dB}$$

MH9026 FREQUENCY TABLE

CHANNEL	FREQUENCY (MHz)	CHANNEL	FREQUENCY (MHz)
1	903.600	11	915.600
2	904.800	12	916.800
3	906.000	13	918.000
4	907.200	14	919.200
5	908.400	15	920.400
6	909.600	16	921.600
7	910.800	17	922.800
8	912.000	18	924.000
9	913.200	19	925.200
10	914.400	20	926.400