

Measurement Result of Processing Gain for 27700GEx-A DSST Basic Phone

1. Introduction

1.1 Scope

These documents are a telian engineering test report for model 27700GEx-A basic cordless phone, which contains the results of measurement of the processing gain of Dsst phone.

1.2 Reference documents

This section lists documents that are referenced or are materially relevant to these documents.

Code of federal regulations, Title 47, Chapter 1, Part 15 Radio frequency device (FCC)

1.3 Definitions

1	FCC	Federal Communication Commission
2	SNR	Signal to Noise Ratio
3	JSR	Jammer to Signal Ratio
4	CW	Continuous Wave (Jammer)
5	HS	Handset
6	BS	Base station
7	DBPSK	Differential Binary Phase Shift Keying

Table 1: Definitions & Abbreviations

2. An overview of the FCC method for measuring processing gain

Two methods are specified for measuring the 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 and the signal to noise ratio (SNR) with the spreading code switched off.

The difference between two methods is called as the processing gain. The SNR is measured at the demodulated output of the receiver. In principle this is an acceptable 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 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 (e)(1). This involves transmitting a CW jammer in the RF pass-band 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 (BER) is left up to the tester. The jammer is stepped in 50KHz increments across the entire pass-band 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 are discarded. The processing gain can then be calculated as follows;

$$Gp = (S/N)_{theory} + (J/S)_{measured} + L_{system}$$

Where Gp is the processing gain, the SNR is the 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_{sys} adjusts for non-ideal system losses. L_{sys} can not be greater than 2dB.

3. Processing gain

The following parameters were used in the test set-up.

1	HS TX Power(dBm)	-3.6	
2	BS LNA Gain(dB)	0	
3	Test system losses (Signal) (dB)	-14.5	-4.0dB(system),-3.0dB(signal combiner) -7.5dB(cable loss)
4	Test system losses (Jammer) (dB)	-5.6	-3.0 dB (signal combiner) -2.6 dB (cable loss)

Table 2: Test set-up parameter

The following measurement results were taken at the base station.
The desired bit error rate was set at e^{-3}

Jammer Freq. (MHz)	BER(BS)	Received jammer Power(dBm)	Received signal Power (dBm)	Jammer/Signal Ratio(dB)
2404.8 MHz	1.14 x e-3	-16.5	-18.6	2.1
2406.8 MHz	9.74 x e-4	-16.0	-18.2	2.2
2408.4 MHz	1.14 x e-3	-17.2	-19.3	2.1
2410.2 MHz	9.6 x e-3	-16.1	-18.6	2.5
2412.0 MHz	9.7 x e-4	-17.4	-19.6	2.2
2413.8 MHz	1.1 x e-3	-16.0	-18.2	2.2
2415.6 MHz	1.2 x e-3	-17.5	-19.6	2.1
2417.4 MHz	1.6 x e-4	-16.0	-18.5	2.5
2419.2 MHz	1.3 x e-3	-17.5	-19.6	2.1
2421.0MHz	9.2 x e-4	-16.9	-19.2	2.3
2422.8 MHz	1.4 x e-3	-16.6	-19.6	3.0
2424.6 MHz	1.1 x e-3	-17.0	-18.1	1.1
2426.4 MHz	1.0 x e-3	-17.5	-18.6	1.1
2428.2 MHz	9.2 x e-4	-17.0	-19.2	2.2
2430.0 MHz	1.1 x e-3	-16.0	-19.2	3.2
2431.8 MHz	1.2 x e-3	-17.4	-19.6	2.2
2433.6 MHz	9.7 x e-4	-16.5	-18.1	1.5
2435.4 MHz	9.1 x e-4	-17.0	-18.5	1.5
2437.2 MHz	1.2 x e-3	-17.2	-19.2	2.0
2430.0 MHz	1.1 x e-3	-17.4	-19.6	2.2
2440.8 MHz	1.2 x e-4	-17.0	-18.1	2.1
2442.6 MHz	1.2 x e-3	-16.0	-19.2	3.2
2444.4 MHz	1.0 x e-3	-16.0	-18.1	2.1
2446.2 MHz	9.2 x e-4	-17.1	-18.1	1.0
2448.0 MHz	1.2 x e-3	-17.0	-19.6	2.6
2449.8 MHz	9.2 x e-4	-17.3	-19.3	2.0
2451.6 MHz	9.1 x e-4	-17.0	-18.4	1.4
2453.4 MHz	1.0 x e-3	-18.0	-19.6	1.6
2455.2 MHz	1.2 x e-3	-17.0	-19.5	2.5
2457.0 MHz	1.0 x e-3	-17.6	-18.6	2.0
2458.8 MHz	1.3 x e-3	-17.0	-19.5	2.5
2460.6 MHz	9.2 x e-4	-17.0	-19.1	2.1
2462.4 MHz	1.4 x e-3	-16.7	-18.6	1.9
2464.2 MHz	1.2 x e-3	-17.0	-19.1	2.1
2466.0 MHz	9.4 x e-4	-16.7	-19.5	2.3
2467.8 MHz	9.2 x e-4	-16.0	-18.6	2.6
2469.6 MHz	9.2 x e-3	-17.3	-19.5	2.2
2471.4 MHz	9.2 x e-4	-17.0	-19.6	2.6
2473.2 MHz	9.2 x e-3	-16.0	-18.1	2.1
2475.0 MHz	9.4 x e-4	-17.0	-19.2	2.2

Table 3: Test results

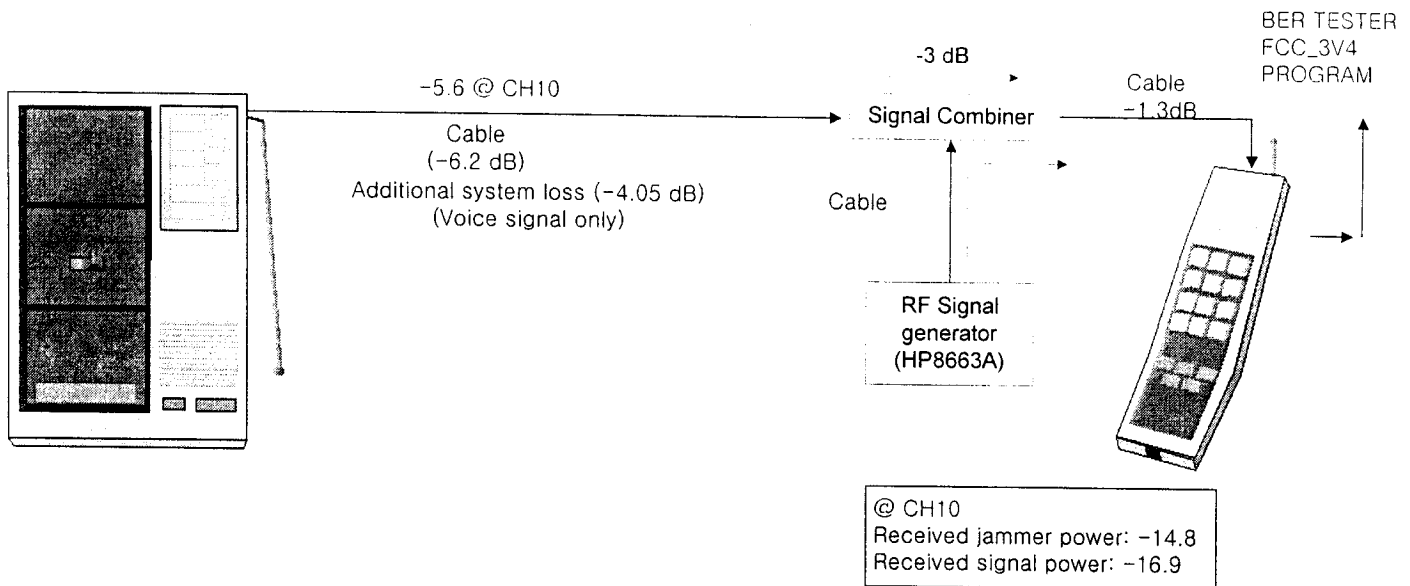


Figure 1: Test set-up

For DBPSK @ e-3 bit error rate the required SNR is 8.0dB. Using the results above and the data in the table below the processing gain is calculated to be 12.0dB.

Required SNR (dB)	8.0
System losses (dB)	2.0
J/S ratio @ 80% point (dB)	2.0
FCC processing gain (dB)	12.0

4. Conclusions

The result measured for processing gain of 12.0 dB is close to the actual processing gain due to a 12 chip spreading code of

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

FEDERAL COMMUNICATIONS COMMISSION
Laboratory Division
7435 Oakland Mills Road
Columbia, MD. 21046

December 29, 1999

Registration Number: 95517

Timco Engineering, Inc.
P.O. BOX 370
849 N.W. State Road 45
Newberry, FL 32669

Attention: S Sanders

Re: Measurement facility located at Newberry
3 meter site
Date of Listing: December 22, 1999

Gentlemen:

Your submission of the description of the subject measurement facility has been reviewed and found to be in compliance with the requirements of Section 2.948 of the FCC Rules. The description has, therefore, been placed on file and the name of your organization added to the Commission's list of facilities whose measurement data will be accepted in conjunction with applications for Certification under Parts 15 or 18 of the Commission's Rules. Please note that this filing must be updated for any changes made to the facility, and at least every three years from the date of listing the data on file must be certified as current.

If requested, the above mentioned facility has been added to our list of those who perform these measurement services for the public on a fee basis. An up-to-date list of such public test facilities is available on the Internet on the FCC Website at WWW.FCC.GOV, E-Filing, OET Equipment Authorization Electronic Filing.

Sincerely,



Thomas W Phillips
Electronics Engineer