May1, 2000

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Attention: Mr. Dichoso

Re: Answers to questions from E-mail of 04/05/00
Correspondence Reference Number: 13606
FCC ID: H25DSS950TX
731 Confirmation Number EA96934
Equipment Class: DSS-Part 15 Spread Spectrum Transmitter
Applicant: DTC

DTC has collected additional data on H25DSS950TX in order to satisfy the two questions on the referenced E-mail.

1. The SAR report has been uploaded to the RF Exposure info folder.

2. The receiver BER measurements made by Digital Wireless Corp (DWC) indicate a S/N of 12 to 14 dB for a BER of .0001. The referenced 9.6 dB was not a measurement. It was simply a comment on the theoretical S/N for a BER of .0001 for coherent BPSK. Coherent BPSK is not employed.

   The DWC receiver is inferior to theoretical coherent BPSK this in two ways:

   First of all it employs DBPSK demodulation which has a theoretical S/N for a BER of .0001 of 10.6 dB; 1 dB worse than coherent BPSK, as shown in the S/N curve graph I have submitted. This curve is from RF and Microwave Circuit Design for Wireless Communications, Artech House, Lawrence E. Larson, Editor, 1996. Also see Digital Communications by Bernard Sklar, Prentice Hall, 1988.

   Second of all, the receiver is not capable of achieving this theoretical number (10.6 dB), because of practical design considerations. DWC quotes 12 to 14dB for this receiver in the Data EXHIBIT.
   Using the worst case number and the equation: Gp =S/N + Lsys + (J/S); Gp = 12 + 2 + (-2.9) = 11.1 dB, which is compliant.

Best Regards,

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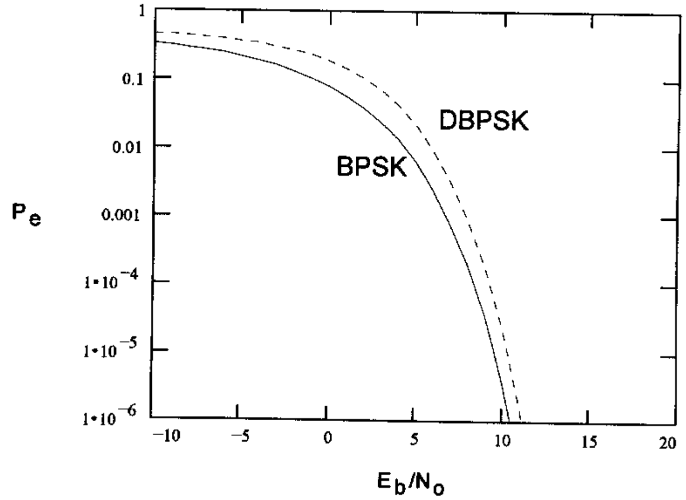

Figure 4.11 BPSK probability of bit error.

$$\frac{E_b}{N_0} = \frac{S \cdot T_b}{N/B_n} = \frac{S}{N} \cdot B_n T_b = \frac{S}{N} \cdot \frac{B_n}{f_b} \tag{4.20}$$

where f_b is the bit rate of the data. As (4.20) shows, E_b/N_0 is equal to S/N, or SNR, *when the noise bandwidth of the receiver is equal to the data rate.* This is a theoretical result, since the noise bandwidth of the receiver needs to be somewhat wider than the bit rate to avoid ISI in the received waveform. A practical rule of thumb is that a BPSK signal can fit into a bandwidth equal to 1.4 times the bit rate by using special filtering techniques. This is significantly narrower than the spectrum of the BPSK signal shown in Figure 4.8. These filtering techniques will be discussed in more detail in Section 4.2.5.

E_b/N_0 is often used to relate probability of bit error because it is a dimensionless quantity. By using (4.20), we can relate this quantity back to SNR. Two curves are shown in Figure 4.11. The curve labeled BPSK is the P_e for coherently demodulated BPSK. The curve labeled DBPSK is for differentially encoded/decoded BPSK. In DBPSK, we compare the received signal with a delayed version of itself. This is shown in Figure 4.12, where both the DBPSK modulator and DBPSK demodulator are shown. Notice that the data must be differentially encoded prior to modulation. If the original NRZ data stream is

$$0, 1, 1, 0, 1, 1, 1, 0, 0 \ldots \tag{4.21}$$

then the encoded NRZ data signal (assuming the initial bit was a 0) is

From: Lawrence Larson, "RF and Microwave Circuit Design for Wireless Communications"; Artech House 1996