



Barbados Spread Spectrum Policy

Policy in accordance with sections 4 (2)(b) and 4 (2)(f) of the Telecommunications Act 2001-36.

This document explains the terms and outlines the techniques involved in Spread Spectrum. The conditions of appropriate Spread Spectrum use in Barbados as set by The Telecommunications Unit in The Ministry Of Energy and Public Utilities are also clearly defined.

1. INTRODUCTION

- 1.1 Conventional wireless communication consist of a transmitter, transmitting information at a frequency which remains constant with time, as constant as technology permits, thus the bandwidth is kept within certain limits. With conditions such as these it leaves the transmitted signal very susceptible to interception and interference.
- 1.2 In order to circumvent such disastrous outcomes that could arise from such vulnerabilities, the theory of spread spectrum was introduced. Spread spectrum involves the deliberate variations in frequency of the transmitted signal over a comparatively large segment of the electromagnetic spectrum. This variation is done in accordance with a specific, complicated mathematical function. This frequency-versus-time function must be 'known' by both sender and receiver to ensure synchronisation. Spread Spectrum uses wide band, noise-like signals. Because Spread Spectrum signals are noise-like, they are hard to detect. Spread Spectrum signals are also hard to Intercept or demodulate. Further, Spread Spectrum signals are harder to jam (interfere with) than narrowband signals. Because Spread Spectrum signals are so wide, they transmit at a much lower spectral power density, measured in Watts per Hertz, than narrowband transmitters.

- 1.3 For a signal transmitted in such a manner to be intercepted, a receiver must be tuned to frequencies that vary precisely according to this frequency-versus-time function, and must also have knowledge of the starting point at which the function begins. It is imperative for the spread spectrum function be kept very confidential and out of the hands of unauthorised persons.

2. SPREAD SPECTRUM TECHNOLOGIES

2. There are two main types of spread spectrum techniques that are employed. These are Direct Sequence Spread Spectrum (DSSS) and Frequency Hopping Spread Spectrum (FHSS).

Direct Sequence Spread Spectrum:

- 2.1 Direct Sequence Spread Spectrum also known as Direct Sequence Code Division Multiple Access (DS-SS) entails the division of the stream of information into small pieces, each of which is allocated to a frequency channel across the spectrum. A data signal at the point of transmission is combined with a higher data-rate bit sequence, also known as the 'chipping code', which divides the data according to a spreading ratio. The redundant chipping code helps the signal resist interference and enables the original data to be recovered if data bits are damaged during transmission.
- 2.2 For a more practical example of the techniques employed by DSSS, consider a direct sequence spread spectrum radio. A DSSS radio works by mixing a Pseudorandom Noise (PN) sequence with the data. This mixing is done either by generating a wideband signal which, in turn, is used to modulate the Radio Frequency (RF) carrier, or by modulating the carrier source with the data and then spreading the signal prior to transmission. On the receiving end, the incoming Direct Sequence (DS) signal is reconstructed by generating local replica of the transmitter's PN code, and synchronising the signal with this local PN sequence.
- 2.3 By removing the effects of the spreading sequence through the remodulation of the incoming signal by the local PN sequence, the spread signal collapses into a data-modulated carrier. Using correlation techniques the identity of a signal that has been spread with a particular PN sequence can be discovered.

Frequency Hopping Spread Spectrum:

- 2.4 Frequency Hopping Spread Spectrum (FHSS) also known as Frequency Hopping Code Division Multiple Access (FH-CDMA) involves a signal being transmitted across a frequency band that is much wider than the minimum bandwidth required by the information signal.
- 2.5 The transmitter 'spreads' the signal originally in the narrowband, across a number of frequency band channels on a wider electromagnetic spectrum.
- 2.6 In a FHSS system, a transmitter 'hops' between available frequencies according to a spreading algorithm. The transmitter operates in synchronisation with the receiver, which remains tuned to the same center frequency as the transmitter. The transmitter is therefore capable of hopping its frequency over a given bandwidth several times a second, transmitting on one frequency for a certain period of time known as the 'dwell time', then hopping to another frequency in the same spreading bandwidth and transmitting again. Ideally each frequency should be occupied with equal probability, and the probability of hopping from one channel to any other channel should also be equal.

3. UTILISATION OF SPREAD SPECTRUM

- 3.1 Spread Spectrum systems will only be allowed to operate in Barbados in the three (3) Industrial, Scientific and Medical (ISM) Bands as follows:
 - ◆ 902.000-928.000 MHz
 - ◆ 2.400-2.4835 GHz
 - ◆ 5.725-5.850 GHzAnd in the Band 5.15- 5.35 GHz
- 3.2 Operators in these Bands must acknowledge the following stipulations:
 - ◆ There will be no Interference Mitigation
 - ◆ Users who cause Interference would have to shutdown forthwith
 - ◆ Users who receive Interference must either accept it or shutdown

- ◆ The Telecommunications Unit is not responsible for the investigation, or rectification of Interference in these 3 ISM Bands.

3.3 The use of the mentioned three (3) ISM Bands must be in direct accordance with the Federal Communication Commission (FCC) Code of Federal Regulations (CFR) Part 15.247.

4. LICENCES

4.1 Licences for the use of spectrum other than unlicensed applications, are renewable annually and expire on the anniversary of the issued date of each year. Failure to comply with the regulations set out in The Telecommunications (Licence Fees) Regulations 2003, will result in action being taken by the Chief Telecommunications Officer in accordance with section 13 of The Telecommunications Act 2001-36.

Fees:

4.2 The fees allocated to the above mentioned ISM Bands are determined as a result of their associated bandwidths and are as follows:

- (a) 20 MHz or less... .. \$100.00
- (b) More than 20 MHz but not exceeding 50MHz... .. \$200.00
- (c) More than 50 MHz \$300.00

4.3 There are no associated application fees.

5. UNLICENSED APPLICATIONS

5.1 Wireless Fidelity (Wi-Fi), Bluetooth, Wireless Local Area Networks (W LANs) in building networks, Metropolitan Area Networks (MANs), and other low power spread spectrum devices are not required to obtain a licence for operating in the bands mentioned in this policy.

6. DEFINITIONS

Spectrum

6.1 The range of frequencies of electromagnetic radiation from zero to infinity. The International Telecommunications Union (ITU) formally recognizes 12 bands, from 30 Hz to 3000 GHz. These

Bands are from Very Low Frequency (VLF) to Extremely High Frequency (EHF).

- 6.2 New bands, from 3 THz to 3000 THz, are under active consideration for recognition.

N.B: **Tera Hertz (THz):** A unit denoting one trillion (10^{12}) hertz.

Code Division Multiple Access (CDMA)

- 6.3 A form of multiplexing where the transmitter encodes the signal using a pseudo-random sequence which the receiver also knows and can use to decode the received signal. Each different random sequence corresponds to a different communication channel.

Pseudorandom Noise (PN)

- 6.4 This is a noise that satisfies one or more of the standard tests for statistical randomness