

# **Description of Frequency Hopping Spread Spectrum**

(in accordance with requirement of FCC 15.247 (a), (g) and (h))

## **1. Bluetooth system**

The Equipment Under Test (EUT) is the Digital Video Camera Recorder, which has a *Bluetooth* communication module internally. *Bluetooth* is the one of the short-range wireless communication system with frequency hopping spread spectrum (FHSS). *Bluetooth Specification* is standardized by and published by *Bluetooth Special Interest Group (SIG)*. This EUT is completely applied to *The Bluetooth Specification ver. 1.1* released in February 22nd, 2001.

## **2. Hopping Frequency**

The frequency range is 2402 MHz to 2480 MHz with spanning 79MHz. Hopping frequencies (channels) are separated by 1MHz within 20 dB bandwidth. Therefore there are 79 hopping frequencies. These hopping frequencies are selected by pseudo random sequence so that each frequency must be used equally on the average. The slot length of *Bluetooth* is separated by 625 microsecond and *Bluetooth* specifications allow a multi slots packet using these slots, up to five slots without an interval. A hopping frequency occupies over this multi slots packet and the longest occupancy is 3.125 millisecond, in case of a five-slot packet.

## **3. Hopping Sequence**

The hopping frequencies are selected derived from the *Bluetooth* clock and the *Bluetooth BD\_Address*, which is a unique ID for unit by unit.

In case of channel hopping sequence, 79 Hop frequencies distributed equally over the 79MHz.

\* Sequence example 1:

8, 66, 10, 70, 12, 19, 14, 23, 16, 1, 18, 5, 20, 33, 22, 37, 24, 3, 26, 7, 28, 35, 30, 39, 32, 72, 34, 76, 36, 25, 38, 29, 40, 74, 42, 78, 44, 27, 46, 31, 48, 9, 50, 13, 52, 41, 54, 45

\* Sequence example 2:

55, 26, 19, 20, 23, 22, 53, 40, 57, 42, 21, 36, 25, 38, 27, 63, 31, 65, 74, 59, 78, 61, 29, 0, 33, 02, 76, 75, 01, 77, 35, 71, 39, 73, 3, 67, 7, 69, 37, 8, 41, 10, 5, 4, 9, 6, 43, 16

In case of inquiry/page mode, 32 hop frequencies distributed equally over the 79MHz.

\* Sequence example 1:

48, 50, 09, 13, 52, 54, 41, 45, 56, 58, 11, 15, 60, 62, 43, 47, 00, 02, 64, 68, 04, 06, 17, 21, 08, 10, 66, 70, 12, 14, 19, 23, 48, 50, 09, 13, 52, 54, 41, 45, 56, 58, 11, 15, 60, 62, 43, 47

\* Sequence example 2:

41, 05, 10, 04, 09, 43, 06, 16, 47, 11, 18, 12, 15, 45, 14, 32, 49, 13, 34, 28, 17, 51, 30, 24, 55, 19, 26, 20, 23, 53, 22, 40, 41, 05, 10, 04, 09, 43, 06, 16, 47, 11, 18, 12, 15, 45, 14, 32

Where, 0 - 78 is 2402MHz - 2480MHz.

In the Both modes, selected 32/79 hop frequencies are changed by pseudo random sequence one after another. And cycling time is so long, because the code length is  $2^{27}-1$ .

## **4. Creating connection**

Short-range wireless communication network of *Bluetooth*, called piconet, is established as following. One

“Master” unit searches for other “Slave” units in surrounding area, which is called “Inquiry”. If at least one “Slave” is found, “Master” can try to create connection with it, which is called “Page”. After the connection is established, “Master” unit controls the hopping sequence in the piconet. In this case, “Master” unit’s BD\_Address is used to generate hopping sequence.