Required information for Frequency Hopping

1. Pseudorandom hop sequence:

Hopping sequence selection for a system is controlled by the master unit within a specific system. The sequence is selected by a combination of address codes and master unit system clock. The pseudo-random sequence is generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage with the result fed back to the input of the first stage. This produces a pseudo-random sequence length of 511 bits.

The following are two examples of possible 79 channel hopping sequences with channels identified as 1 through 79. The channel numbering scheme starts with channel 2 at 2402 MHz with the 79th channel then appearing at 2480 MHz as channel 80.

Sequence a:

2,17,68,55,4,77,56,27,70,80,22,33,57,34,29,79,44,50,3,71,66,36,78,20,67,30,24,11,37,69,
23,7,41,38,63,14,31,59,40,13,6,25,65,15,61,73,58,47,19,28,54,76,74,48,52,75,5,42,64,72,
62,51,60,18,45,53,16,39,46,32,49,43,8,21,9,12,10,26,35

Sequence b:

50,6,41,57,64,14,42,33,79,3,20,38,56,69,75,21,80,23,31,40,45,68,32,28,4,15,34,59,71,61,
70,5,72,13,48,70,39,54,78,7,77,62,30,2,8,55,10,63,12,16,37,11,43,66,25,51,58,74,17,47,
9,29,65,19,53,18,52,36,27,26,44,22,49,24,35,60,73,76,67

2. Equally average use of frequencies in data mode and behavior for short transmissions:

In data mode the system goes into a pseudo-random 79 channel hopping sequence for data transmission. The master unit system clock selects the pseudo-random sequence and all units within a specific system are synchronized to the same sequence. Since data transmission is not synchronized to initiate on any specific frequency, the random occurrences of request for such transmission and the indeterminate length of such transmissions insure that, on average, each frequency within a hopping sequence is equally used.

3. Receiver matching bandwidth and synchronization

Receiver bandwidth:

The receiver bandwidth in hybrid mode (32 hopping channels) is equal to the receiver bandwidth in the 79 hopping channel mode that is 1 MHz.

Synchronization:

Synchronization within a piconet uses a system of beacon channels generated by the master unit with the remaining slave units periodically waking up and listening on a beacon channel. Beacon channels are designated by the master unit in page mode to identify channels for slave units to listen to. The beacon channel packet also contains the synchronization information

required for the slave to sync with the master unit. In page mode the same 32-hop segment is used all the time and the segment is selected by the address with different units having different paging segments. Although they are referred to as beacon channels, they are designated as beacons only for purpose of assisting the listening function for establishing a connection. The master unit is continually hopping through all 32 channels in the page mode. When two Bluetooth devices establish contact for the first time, one of the devices is sending out an inquiry access code, and the other party is scanning for this inquiry access code. If the two devices have been connected previously, and want to start a new session, a similar procedure takes place. The only difference being that instead of the inquiry access code, an access code derived from the paged unit's address is used. If the two Bluetooth devices have exchanged information during the last five hours, the typical time it takes to establish the connection is reduced considerably due to the ability of the paging unit to estimate at what frequency the other unit will perform the page scan. For further information see chapter 10 of the Bluetooth specification.

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4. Coordination requirement

The operation of a Bluetooth system is to allow inquiry by units to join a piconet communication system. Only after the system is established will the units within a piconet coordinate its hopping sequence. In the connection (link) mode the module uses a pseudo-random hopping sequence of 79 channels controlled by the master clock (see response 4B). The master unit within a specific system controls hopping sequence selection for a system. The sequence is selected by a combination of address codes and master unit system clock. There are no provisions for coordination between various systems. Occasional loss of data frames due to collisions on a channel is handled by a retransmission, but the hopping goes on.
Acknowledgement of received packets is used to support this feature.

5. Compliance with all rules when short bursts are sent

This is a repeat of the response in 4B. In data mode the system goes into a pseudo-random 79 channel hopping sequence for data transmission. The master unit system clock selects the pseudo-random sequence and all units within a specific system are synchronized to the same sequence. Since data transmission is not synchronized to initiate on any specific frequency, the random occurrences of request for such transmission and the indeterminate length of such transmissions insure that, on average, each frequency within a hopping sequence is equally used.