15.247 (g) Statement – Bluetooth devices

Date: 27/01/2003

According to Bluetooth specifications the channel hopping sequence which has a very long period length (23h 30') does not show repetitive patterns over a short time interval, but distributes the hop frequencies equally over the 79 hopping channels during a short time interval.

The generation of the hopping sequence in connection mode depends essentially on two input values:

1. LAP/UAP of the master of the connection
2. Internal master clock

The LAP (lower address part) are the 24 LSB's of the 48 BD_ADDRESS. The BD_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP (upper address part) are the 24 MSB's of the 48 BD_ADDRESS.

The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For synchronisation with other units only offset are used. It has no relation to the time of the day. Its resolution is at least half the RX/TX slot length of 312.5 µs. The clock has a cycle of about one day (23h 30'). In most case it is implemented as 28 bit counter. For the deriving of the hopping sequence the entire LAP (24 bits), 4 LSB's (4 bits) (Input 1) and the 27 MSB's of the clock (Input 2) are used.

With this input values different mathematical procedures (permutations, additions, XOR-operations) are performed to generate the sequence. This will be done at the beginning of every new transmission. The output constitutes a pseudorandom sequence covering 79 hop channels.

For short transmissions the Bluetooth systems have the following behaviour:

When the first connection between two devices is established, a hopping sequence is generated. If for transmitting the wanted data the complete hopping sequence is not used, the connection is ended.

When a second connection is established. A new hopping sequence is generated. Due to the fact that the Bluetooth clock has a different value, because the period between the two transmission is longer (it cannot be shorter) than the minimum resolution of the clock (312,5 µs). The hopping sequence will always differ from the first one.