1. An introduction to the technology

Bluetooth is the name given for short range wireless communications using the 2.4 GHz ISM (Industrial, Scientific and Medical) frequency band. The band was selected as it is available world-wide and license free. The availability of such a band allows equipment to be produced for a true global market, and there are no barriers to the movement of such equipment. The license free nature of the band means that it is an R.F. 'free for all' and by virtue of that, the band cannot be guaranteed to be free from interference. To counter this, Bluetooth has adopted a frequency hopping implementation of the defined ISM radio interface to provide some resilience from interference.

The Bluetooth device may be considered as an 'add-on' to an existing host system. Within the Bluetooth specification the terms 'host', for the existing host, and 'host controller', for the 'add-on' Bluetooth device are in common use. Formally, the specification defines a Host Controller Interface (HCI) as an interface between host and host controller, in addition to the radio air interface.

Robust operation
- Bluetooth divides the allocated frequency band into 79 different frequencies spaces 1 MHz apart. During transmission and reception all devices which are linked hop, in sync, around these frequencies, changing every 625us. This allows them to avoid narrow band interference from other devices or minimize its effect.
- Every data packet transmitted in a 625us slot is immediately acknowledged in the next slot so any errors can be quickly detected and the data re-transmitted.
- Cyclic Redundancy Checks are used to detect5 errors. There is also the option, in noisy environments, to use some of the available bandwidth (usually $1/3^{rd}$) for Forward Error Correction – allowing errors to be detected and corrected without the need for retransmission.

Interoperable
- The Bluetooth Core specification describes, in detail, how the technology works.
- The Bluetooth Profile specification describes, in detail, how the technology is used.
- Every Bluetooth module must achieve qualification. This allows it to use the Bluetooth logo, and various intellectual property owned by Ericsson and intrinsic to Blutooth's operation.

2. Why ISM at 2.4 GHz

The overriding reason for the selection of the 2.4 GHz banc is that it is one of the few bandx that are truly available globally in the some minor variations,

Country Band RF channels

USA 2.400-2.4835 GHz f=2402 +k MHz, k=0,….,78

Europe (not France)

2.400-2.4835 GHz f=2402+k MHz, k=0,…..,78

France 2.4465-2.4835 GHz f=2454+k MHz, k=0,…..,22

Bluetooth implements a frequency hopping scheme to minimize the effects of interference

- 1600 hops per second
- 79 (or23) 1 MHz channels
- 220 us guard time
- ARQ and FEC schemes are part of the atandard

The receiver characteristics are very relaxed:

- RX sensitivity – 70 dBm
- C/I co-channel 11 dB, After transition period
- C/I f 1 MHz 0 dB, After transition period. An introduction to Bluetooth Why ISM at 2.4 GHz? P

The modulation is Gaussian filtered Frequency Shift Keying (GFSK) where a positive frequency deviation is represented by a 1 and a negative deviation by a zero. Procides a raw bit rate of 1 Mbit/s

- maximum instantaneous data rate of 723 kbit/s
- modulation scheme is GFSK with BT=0.5
- modulation index of 0.28-0.35
- Min (Fmin+, Fmin-)/Fd>0.8,
- Min (Fmin-, Fmin+)/115 kHz