Operation Description

GERNERAL

This product is a Bluetooth device. The product operates in 2402 to 2480 MHz band.
The channel is represented by a pseudo-random hopping sequence through the 79 channels.
The channel is divided into time slots, with a nominal slot length of 625μs, where each slot corresponds to different RF hop frequencies. The nominal hop rate is 1600 hops/s.
The control signals and data in the Bluetooth Chipset are modulated and processed
and then pass the PA in it. They will be transmitted from ANT through the MATCHING UNIT
to another Bluetooth device. The RF signal from other Bluetooth devices is received via ANT.
And they go through internal MATCHING UNIT into the chip
They are magnified by internal LNA in the chip.
The power settings and crystal trim are stored in internal flash.
The product is powered from a Li-ion battery and uses an integral chip antenna.
No external ground is required.

POWER PART ;

Lithum-ion Battery supplies power(3.7Vdc, >4000mAh) to the circuit when the user press the switch button. The blue LED will be on. It is output(1.8 V dc) by an internal DC-DC converter. This product is able to charge the battery via MicroUSB type cable.

CPU / RF PART ;

CSR8645(U2)

CSR Rise core is supplied 26MHz clock through X-TAL and using the RF reference clock , RF Part is consisted of one-chip, it is with other electronics components performs on oscillating modulation and amplifying . In this way, the transmitter, generation, multiple and amplification, turning

MEMORY PART ;

EEPROM(U3) : record the using parameter

Frequency Hopping

The frequency hopping is fully controlled by the module. The two frequencies being used when a call is successfully cleared is stored in EEPROM and will be used as start frequencies at the next call. The module is monitoring the packet error rate at both the TX and RX module receiver and maintains a 'Packet Loss' quantity for each frequency. The calculation is based on incrementing a number if the packet was lost on one or both sides and decrementing a number if the packet was successfully received at both sides. By weighting the increment and decrement numbers, the 'Packet Loss' quantity is either an increasing or decreasing number at a given bit error rate. If the number increases to a given threshold, the frequency is considered to be disturbed and the module starts using another frequency.

Co-ordination of the hopping sequence in data mode to avoid simultaneous occupancy by multiple transmitters:

Bluetooth units which want to communicate with other units must be organized in a structure called piconet. This piconet consist of max. 8 Bluetooth units. One unit is the master the other seven are the slaves. The master co-ordinates frequency occupation in this piconet for all units. As the master hop sequence is derived from it's BD address which is unique for every Bluetooth device, additional masters intending to establish new piconets will always use different hop sequences.

Example of a hopping sequence in data mode:

Example of a 79 hopping sequence in data mode:

40, 21, 44, 23, 42, 53, 46, 55, 48, 33, 52, 35, 50, 65, 54, 67, 56, 37, 60, 39, 58, 69, 62, 71, 64, 25, 68, 27, 66, 57, 70, 59, 72, 29, 76, 31, 74, 61, 78, 63, 01, 41, 05, 43, 03, 73, 07, 75, 09, 45, 13, 47, 11, 77, 15, 00, 64, 49, 66, 53, 68, 02, 70, 06, 01, 51, 03, 55, 05, 04

Equally average use of frequencies in data mode and short transmissions:

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 synchronization with other units, only the offsets 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 (23h30). 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.

Regarding short transmissions, the Bluetooth system has the following behavior: The first connection between the two devices is established, a hopping sequence is generated. For transmitting the wanted data, the complete hopping sequence is not used and the connection ends. The second connection will be 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 (and it cannot be shorter) than the minimum resolution of the clock (312.5 µs). The hopping sequence will always differ from the first one.

Receiver input bandwidth, synchronization and repeated single or multiple packets:

The input bandwidth of the receiver is 1 MHz. In every connection, one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence. The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally the type of connection (e.g. single or multi-slot packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing is according to the packet type of the connection. Also, the slave of the connection uses these settings. Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.

RF Packet

Preamble	Address	Packet Control Field	Payload	CRC

- Preamble : The preamble is a bit sequence used to detect 0 and 1 levels in the receiver.
- Address : This is the address for the receiver. An address ensures that the correct packets are detected by the receiver.
- Packet Control Field : The packet control field contains a 6 bit payload length field
- Payload : The payload is the user defined content of the packet.
- CRC : The CRC is the error detection mechanism in the packet.