Technical Description

The BLUETOOTH iPhone/iPad SPEAKER is a speaker for mp3 player, CD player, iPhone, iPAD, or any smartphone devices that supports either 1/8" Aux input or A2DP Bluetooth technology. In general, the audio input signal is sent from an audio source such as mp3 player, or iPAD through Aux connection, or Bluetooth pairing to the speaker amplifier.

The speaker is working through Bluetooth chip provided by CSR BC05 Chip(BC57F687A). It includes the Bluetooth chip, crystal, memory, printed antenna and speaker. Audio is amplified by with Class D amplifier(TAS5711)

Remark :

A : Modulation format : GFSK，π/4-DQPSK，8DPSK

B: Ant type : Integral antenna.

C: Frequency list :

2402	2403	2404	2405	2406	2407	2408	2409	2410
2411	2412	2413	2414	2415	2416	2417	2418	2419
2420	2421	2422	2423	2424	2425	2426	2427	2428
2429	2430	2431	2432	2433	2434	2435	2436	2437
2438	2439	2440	2441	2442	2443	2444	2445	2446
2447	2448	2449	2450	2451	2452	2453	2454	2455
2456	2457	2458	2459	2460	2461	2462	2463	2464
2465	2466	2467	2468	2469	2470	2471	2472	2473
2474	2475	2476	2477	2478	2479	2480		

■ BC57F687A Characteristics

Radio

■ Common TX/RX terminal simplifies external matching; eliminates external antenna switch

■ BIST minimises production test time

■ Bluetooth v2.1 + EDR specification compliant Transmitter

■ 8dBm RF transmit power with level control from onchip 6-bit DAC over a dynamic range >30dB

■ Class 2 and Class 3 support without the need for an external power amplifier or TX/RX switch

Receiver

■ Receiver sensitivity of -92dBm

■ Integrated channel filters

■ Digital demodulator for improved sensitivity and cochannel rejection

■ Real-time digitised RSSI available on HCI interface

■ Fast AGC for enhanced dynamic range

Synthesiser

■ Fully integrated synthesiser requires no external VCO, varactor diode, resonator or loop filter

■ Compatible with crystals 16MHz to 26MHz or an external clock 12MHz to 52MHz

Physical Interfaces

■ Synchronous serial interface for system debugging

■ I²C compatible interface to external EEPROM containing device configuration data (PS Key)

■ UART interface

■ 2 LED drivers with faders

Auxiliary Features

■ Crystal oscillator with built-in digital trimming

■ Power management includes digital shutdown and wake-up commands with an integrated low-power oscillator for ultra-low power Park/Sniff/Hold mode

■ Clock request output to control external clock

■ 2 integrated linear regulators: 1.5V output from 1.7V to 1.95V input

■ Integrated high-efficiency switch-mode regulator: 1.8V output from 2.5V to 4.4V input

■ Power-on-reset cell detects low-supply voltage

■ 10-bit ADC available to applications

■ Integrated charger for lithium ion/polymer batteries

Kalimba DSP

■ Very low-power Kalimba DSP coprocessor, 64MIPS, 24-bit fixed point core

■ Support for SBC and MP3 codec for improved audio quality (MP3 decode functionality requires an appropriate licence from Thomson.

■ Single-cycle MAC; 24 x 24-bit multiply and 56-bit accumulator

■ 32-bit instruction word, dual 24-bit data memory

■ 6K x 32-bit program RAM, 8K x 24-bit + 8K x 24-bit data RAM

■ 64 x 32-bit program memory cache when executing from ROM

Audio Codec

■ 16-bit internal codec

■ DAC for stereo audio

■ ADC dual channel mono voice band audio

■ Integrated amplifiers for driving 16Ω speakers; no need for external components

■ Support for single-ended speaker termination and line output

■ Integrated low-noise microphone bias

Baseband and Software

■ Internal ROM

■ 48KB of internal RAM, allows full-speed data transfer, mixed voice/data and full piconet support

■ Logic for FEC, HEC, access code correlation, CRC, demodulation, encryption bit stream generation, whitening and transmit pulse shaping

■ Transcoders for A-law, µ-law and linear voice from host and A-law, µ-law and CVSD voice over air

■ FastStream, CSR low latency codec significantly reduces the latency of the audio link, from source to sink, avoiding lip-sync issues when simultaneously listening to audio and watching video images

■ Configurable stereo headset ROM software to setup headset features and user interface

■ HFP 1.5 (including 3-way calling) and HSP 1.0 support

■ Bluetooth v2.1 + EDR specification Secure Simple Pairing support

■ BlueTunes ROM QFN supports as standard a new high-performance DSP based dual-microphone noise reduction

■ BlueTunes ROM QFN also supports a DSP based single-microphone cVc echo and noise reduction

Package Option

■ QFN 68-lead, 8 x 8 x0.9mm, 0.4mm pitch

■ Bluetooth operation description

I. Hopping sequence

Frequency 2.402GHz to 2.480GHz

□ hopping rate 1600 hops per second, T=625µs

□ TDD (Time Division Duplex)

□ 79 channels

□ 1MHz frequency separation

Regulatory Range RF Channel

2400~2483.5 MHz f = 2402+k MHz, k=0, …, 78

In total, six types of hopping sequence are defined − five for the basic hop system and one for an adapted set of hop locations used by adaptive frequency hopping (AFH). For example

- A page hopping sequence with 32 wake-up frequencies distributed equally over the 79 MHz, with a period length of 32;
- A page response hopping sequence covering 32 response frequencies that are in a one-to-one correspondence to the current page hopping frequency. The master and slave use different rules to obtain the same sequence.

1. How the hopping sequence is generated?

BH-111 is a FHSS system, which uses adaptive frequency hopping, which is Bluetooth 2.4GHz system. The basic piconet physical channel is characterized by a pseudo-random hopping through all 79 RF channels. The frequency hopping in the piconet physical channel is determined by the Bluetooth clock and BD_ADDR of the master. When the piconet is established, the master clock is communicated to the slaves. Each slave shall add an offset to its native clock to synchronize with the master clock. Since the clocks are independent, the offsets must be updated regularly. All devices participating in the piconet are time-synchronized and hop-synchronized to the channel.

2. How each individual EUT meets the requirement that each of its hopping channels is used equally on average?

In total, six types of hopping sequence are defined − five for the basic hop system and one for an adapted set of hop locations used by adaptive frequency hopping (AFH). These sequences are:

- A page hopping sequence with 32 wake-up frequencies distributed equally over the 79 MHz, with a period length of 32;
- A page response hopping sequence covering 32 response frequencies that are in a one-to-one correspondence to the current page hopping sequence. The master and slave use different rules to obtain the same sequence;
- An inquiry hopping sequence with 32 wake-up frequencies distributed equally over the 79 MHz, with a period length of 32;
- An inquiry response hopping sequence covering 32 response frequencies that are in a one-to-one correspondence to the current inquiry hopping sequence.
- A basic channel hopping sequence which has a very long period length, which does not show repetitive patterns over a short time interval, and which distributes the hop frequencies equally over the 79 MHz during a short time interval.

- An adapted channel hopping sequence derived from the basic channel hopping sequence which uses the same channel mechanism and may use fewer than 79 frequencies. The adapted channel hopping sequence is only used in place of the basic channel hopping sequence. All other hopping sequences are not affected by hop sequence adaptation.

3. How the associated receiver(s) complies with the requirement that its input bandwidth matches the bandwidth of the transmitted signal?

The RF section uses an integrated circuit for the transceiver and receiver. For full duplex transmission, a Time-Division Duplex (TDD) scheme is used. On the channel, information is exchanged through packets. Each packet is transmitted on a different hop frequency. A packet nominally covers a single slot, but can be extended to cover up to five slots. There is a balanced filter used in the transceiver, whose frequency range is 2450 ± 50 MHz, in order to balance the signal transmitted or received.

4. How the associated receiver(s) has the ability to shift frequencies in synchronization with the transmitted signals?

Adapted piconet physical channels can be used for connected devices that have adaptive frequency hopping (AFH) enabled. There are two distinctions between basic and adapted piconet physical channels. The first is the same channel mechanism that makes the slave frequency the same as the preceding master transmission. The second aspect is that the adapted piconet physical channel may be based on less than the full 79 frequencies of the basic piconet physical channel.

II. First addition operation

The first addition operation only adds a constant to the phase and applies a modulo 32 operation. For the page hopping sequence, the first addition is redundant since it only changes the phase within the segment. However, when different segments are concatenated (as in the basic channel hopping Sequence), the first addition operation will have an impact on the resulting sequence.

III. Synchronous connection-oriented (SCO)

The synchronous connection-oriented (SCO) logical transport is a symmetric, point-to-point channel between the master and a specific slave. The SCO logical transport reserves slots on the physical channel and can therefore be considered as a circuit-switched connection between the master and the slave.SCO logical transports carry 64 kb/s of information synchronized with the piconet clock. Typically this information is an encoded voice stream. Three different SCO configurations exist, offering a balance between robustness, delay and bandwidth consumption.

IV. Hopping spread spectrum system

The channel is represented by a pseudo-random hopping sequence hopping through the 79 or 23 RF channels. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master; the phase in the hopping sequence is determined by the Bluetooth clock of the master. The channel is divided into time slots where each slot corresponds to an RF hop frequency. Consecutive hops correspond to different RF hop frequencies. The nominal hop rate is 1600 hops/s. All Bluetooth units participating in the piconet are time and hop synchronized to the channel.

V. Hopping sequence is generated

A unit that wants to discover other Bluetooth units enters an inquiry substate. In this substate, it continuously transmits the inquiry message at different hop frequencies. The inquiry hop sequence is always derived from the LAP of the GIAC. Thus, even when DIACs are used, the applied hopping sequence is generated from the GIAC LAP. A unit that allows itself to be discovered, regularly enters the inquiry scan substate to respond to inquiry messages. The following sections describe the message exchange and contention resolution during inquiry response. The inquiry response is optional: a unit is not forced to respond to an inquiry message.

VI. In-band Spurious Emission

Within the ISM band the power spectral density of the transmitter shall comply with the following requirements when sending pseudo random data. All power measurements shall use a 100 kHz bandwidth with maximum hold. The power measurements between 1 MHz and 1.5 MHz from the carrier shall be at least 26 dB below the maximum power measurement up to 500 kHz from the carrier. The adjacent channel power for channels at least 2 MHz from the carrier is defined as the sum of the power measurements over a 1 MHz channel and shall not exceed -20 dBm for the second adjacent channels and -40 dBm for the third and subsequent adjacent channels. These requirements shall apply to the transmitted signal from the start of the guard time to the end of the power down ramp.

VII. Communion description

Bluetooth operates in the unlicensed ISM band at 2.4 GHz. A frequency hop transceiver is applied to combat interference and fading. A shaped, binary FM modulation is applied to minimize transceiver complexity. The symbol rate is 1 Ms/s. A slotted channel is applied with a nominal slot length of 625s. For full duplex transmission, a Time-Division Duplex (TDD) scheme is used. On the channel, information is exchanged through packets. Each packet is transmitted on a different hop frequency. A packet nominally covers a single slot, but can be extended to cover up to five slots.

The Bluetooth protocol uses a combination of circuit and packet switching. Slots can be reserved for synchronous packets. Bluetooth can support an asynchronous data channel, up to three simultaneous synchronous voice channels, or a channel which simultaneously supports asynchronous data and Synchronous voice. Each voice channel supports a 64 kb/s synchronous (voice) channel in each direction. The asynchronous channel can support maximal 721 kb/s asymmetric (and still up to 57.6 kb/s in the return direction), or 432.6 kb/s symmetric. The Bluetooth system consists of a radio unit, a link control unit, and a support unit for link management and host terminal interface functions, The current document describes the Specifications of the Bluetooth link controller which carries out the baseband protocols and other lowlevel link routines. Multiple piconets with overlapping coverage areas form a scattered. Each piconet can only have a single master. However, slaves can participate in different piconets on a time-division multiplex basis. In addition, a master in one piconet can be a slave in another piconet. The piconets shall not be time or frequency synchronized. Each piconet has its own hopping channel.