

## THEORY OF OPERATION

This part is to describe the operation theory of our handsfree device. Basically, our handsfree device can be divided into four sub-systems:

- 1) RF transceiver unit.
- 2) Baseband and digital control unit.
- 3) Audio unit.
- 4) Power management unit

### RF TRANSCEIVER UNIT

This unit is used to convert the RF signal from/to the digital or audio signal at the baseband side. The RF unit is composed of a antenna, duplexer, LNA and a RADIA01 RFIC and to perform true full duplex operation.

The duplexer in the RF unit is used to isolate the transmitting and receiving path to improve overall performance.

- Incoming signal goes through duplexer that increase isolation from TX noise and get amplified by LNA before going through receiver section of Radia01 via a quadrature mixer in a direct-conversion, zero-intermediate frequency (zero-IF) approach. After quadrature down-conversion and baseband filtering, a quadrature mixer up-converts the complex baseband signal to an intermediate frequency (IF) for demodulation. There is no image frequencies as the IF is zero.
- Radia01 transmitter section is comprised of a modulation-input circuit, a PLL synthesizer /VCO and a RF power amplifier providing a maximum of +3.0 dBm into a 50-Ohm load. It directly modulate the digital data or audio signal from the baseband part - such modulated signal will then be power amplified and transmitted through the duplexer and antenna.
- The RFIC have also a built-in RSSI function (Receiving Signal Strength Indication) to indicate the existing noise level in order to achieve auto channel scanning and out-of-range detection features.
- The existing antenna is a quarter wavelength AWG wire matched to the front end.

## BASEBAND, AUDIO & DIGITAL CONTROL UNIT

- This baseband and digital control unit is a central controller of the handsfree device. The audio circuit including microphone input amplifier and ID active filter and modulation input parts, receive audio filter amplifier, audio and ID code split circuit, and audio power amplifier circuit as well as a data slicer.
- The main functions of the baseband and digital control unit include to control the operation mode and channel of the RFIC and all features of the handsfree device, such as ON/OFF control, out-of-range detection, battery-low alarm, etc.. are also controlled by this control unit.
- MCU is also used as the data IN/OUT to the RFIC to make a connection between the Earset and Phoneset.
- The audio unit is mainly used to amplify the audio from the mic. IN / to the speaker out for the earset and the audio IN/OUT from the mobile phone for phoneset. The audio unit can also provide the filter function to band limit the audio signal in order to improve the sound quality.

## POWER MANAGEMENT UNIT

The power management unit comprises of 2 sub-systems:

- 2 voltage regulating circuits supplying power to relevant RF block and rest of the device – these are controlled by the MCU for power conservation in different mode of operation i.e. Sleep Mode, Standby Mode & Active Mode;
- A battery charging & discharging protection circuit as well as charging status indication.