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HBLP-Uxxx-xx Technical Description

The transmitter is power by four 1,5V AAA (LR03) batteries.

During standby (no buttons pressed) the PIC18F u-controller (A) will be in sleep (completely static operation – no clocks running). All other circuitry will also be powered down by the u-controller. When a button is pressed the u-controller wakes up and starts running on an internal RC-oscillator. The key (or keys) pressed is detected by a scanning process. The keyboard interface has been omitted from the Block Diagram for reason of clarity.

RF-Transmitter:

The modulation scheme is ASK. The data bit rate is 4 kbit/s (each bit having a length of 250 us). The coding scheme is Manchester so each bit consist of a high period of 125 us and a low period of 125 us. Thus the signal will always have a duty cycle of 50% (constant DC component) regardless of the data content. Data is transmitted in packets. For a more detailed description of the coding and data scheme refer to the “RF-protocol description”.


The u-controller (A) generates a “Hold” signal which enables the “SAW Oscillator”. The “Hold” signal will be enabled for the whole duration of the data packet (regardless of the data contents). The low frequency ASK data signal is present at an output pin of the u-controller. This signal is fed directly to the “ASK-modulator and Gain” (C)

The oscillator (B) is a common collector Colpitt configuration. The induction element is constituted by the SAW resonator. The oscillator will be running whenever the “Hold” signal is active. The signal generated by the oscillator is a 433.92MHz which is the constant carrier used by the transmitter. This carrier will thus be present for the whole duration of the data packet.

The carrier signal is feed to the “ASK-modulator and Gain” stage (C). The modulator combines the carrier signal and the “LF ASK data Signal” thus creating the RF-signal (433.92MHz ASK Modulated Signal). Modulator and gain stage is made up by a dual gate MOS-FET.

The RF-signal is feed through a resonant LC band pass filter (D) which will remove any harmonic components from the signal.

The Antenna is made up by a small current loop on the PCB board itself (E). The inductance of the loop is tuned in resonance with capacitors.

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Transmitter LED

The circuitry for the Transmitter LED (F) is a constant current generator that ensures that the voltage for the LED is stable. The circuit is controlled by the u-controller and is turned on only when the handset is transmitting. The “on” signal from the u-controller is a 100KHz PWM signal with 50% duty-cycle

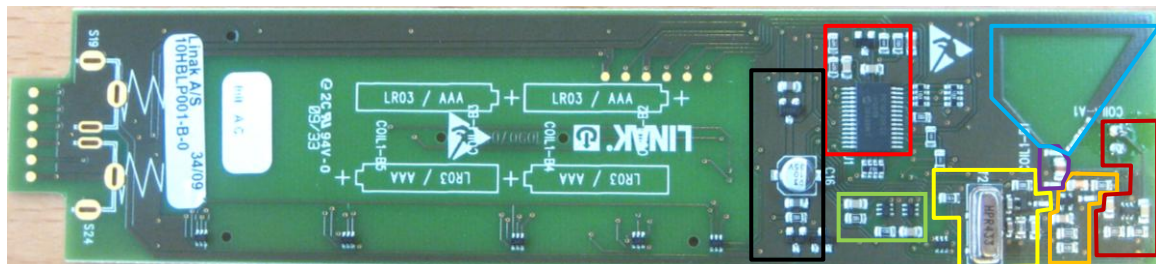
Backlight LEDs

The circuitry for the backlight LEDs (G) are also a constant current generator. It is controlled by the u-controller that generates a 100kHz PWM signal with 80% duty-cycle. The backlight are turned on when a button is pressed and turns off 5 seconds after the button is released.

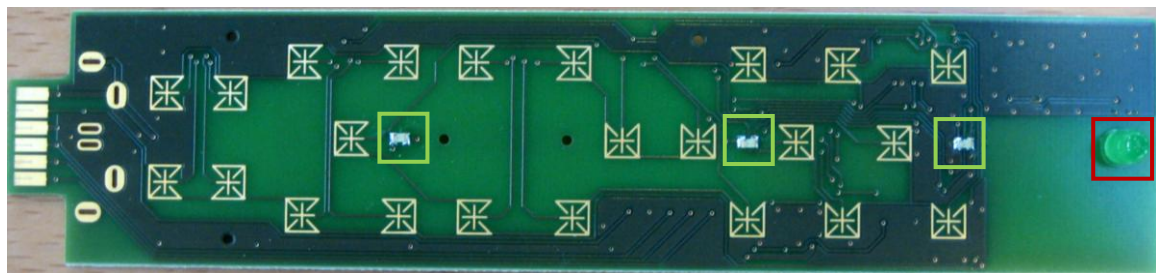
Battery management

The battery management circuit converts the 6V from the AAA cells to 3.3V for the u-controller.

HBLP-Uxxx-xx Physical Layout




Bottom side



Top side

- A** – PIC18F u-controller with passives for reset and voltage reference
- B** - SAW Oscillator
- C** - ASK-modulator and Gain Stage
- D** - Resonant BP Filter
- E** - Small Current Loop PCB Antenna
- F** – Transmitter LED circuit
- G** – Backlight LED circuit
- H** – Battery management

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Schematics references

A – PIC18F u-controller

The u-controller is an PIC18F2xK20 designated U1 in the schematics (summary datasheet attached). Reset circuit are made from R4, R5, C5 and Z1. Voltage reference are established by R9, R10 and C2.

B - SAW Oscillator

Main components of the oscillator are the SAW resonator designated T2 in the schematics (HR433.92TS - datasheet attached) and RF NPN transistor designated Q5 in the schematics (BFR181W - datasheet attached). Additional components are R6, C26 and C27.

C - ASK-modulator and Gain Stage

The ASK-modulator and Gain Stage is made up of a dual gate N-channel MOS-FET. Designator Q6 in the schematics (BF1201W – datasheet attached). Additional components are L2, R19, R22, C10 and C23.

D - Resonant BP Filter

The Band pass filter is made up of inductor L1 and capacitor C25 together with the output capacitance of Q6 parallel with C24.

E - Small Current Loop PCB Antenna

The tuning capacitors are C6 and C9. The inductive loop antenna is embedded in the PCB layout.

F - Transmitter LED circuit

The transistors are a double package Q7 with passives R12, R13, C3 and C11 attached. LED D13 is mounted on the top side of the PCBA.

G – Backlight LED circuit

The transistors are a double package Q2 with passives R115, R16, C12 and C13 attached. LEDs D8, D9 and D10 are SMD diodes mounted on the top side of the PCBA.

H – Battery management

The main part of the battery management are the MCP1702T converter designated U2 and the passives C4, C7 and C16.

The FET transistor 2N7002 and the passives R8 and Z2 protects the circuit from wrongly mounted batteries.