EIN

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Theory of Operation / Technical Description of

Barber 2 Zigbee Radio Module

FCC ID: X5C-BARBER-2; Industry Canada REL 8815A-BARBER2

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The Barber 2 is a 2.4-GHz 802.15.4 ZigBee transceiver module designed for use in OEM products, where the designers desire a pre-certified Zigbee wireless solution. It operates under FCC 47 CFR Part 15.247, and Industry Canada specifications RSS-210 and RSS-GEN.

The Barber 2 radio module contains its own voltage regulation, requiring only a 2.8V – 3.6V DC input at a maximum of 160 mA. It also contains its own frequency standard (a 16 MHz quartz crystal) and shield can over the entire module.

The Barber 2 contains an integral microprocessor which can process baseband data transmitted and received by the radio section. The radio section contains hardware buffers that limit data rate to 250 kBits/sec, and limit transmitted signal bandwidth. Transmit/receive data I/O to the user is by asynchronous serial or discrete I/O. No user data can cause overmodulation or overdeviation.

Refer to the block diagram for the following.

The microprocessor, transmitter and receiver are contained in one system-on-a-chip (SOC) integrated circuit (IC). On a separate Front-End Module (FEM) IC contains the transmit power amplifier, and low-noise receive amplifier, and a transmit/receive switch. All voltage and RF power regulation is contained within these two ICs.

The transmitter of the Barber 2, per IEEE 802.15.4, uses Direct Sequence Spread Spectrum. It uses Offset Quadrature Phase Shift Keying (O-QPSK) modulation with half-sine pulse shaping to modulate the RF carrier to a bandwidth of about 2 MHz. There is no IF frequency, as the carrier is directly phase-shift keyed.

The radio transmitter and receiver cannot operate at the same time (half-duplex).

The transmitter RF power level is set to a fixed level in a calibration step during manufacturing, and cannot be changed by the user. Specified maximum conducted power is +19 dBm into 50 ohms.

The receiver section of the Barber 2 converts the 5-MHz channel bandwidth at RF directly to baseband using zero-IF techniques. There is no discernible IF frequency.

The Barber2 module may be fitted with one of four antennas in manufacturing: 1) a "chip" ceramic antenna on the circuit board (< 0 dBi); 2) a quarter-wave monopole (about 2.2 dBi); 3) a PCB antenna separate from the module, via the on-board U.FL connector (about 2 dBi), and 4) a half-wave monopole antenna separate from the module, via the on-board U.FL antenna (< 3 dBi). All four antennas have been tested for emissions along with the module.