

#### **2.4.1 Circuit Description - per 2.1033(b)4**

The E-Zone Tower Unit consists of several integrated components:

##### **LCD color display:**

The display is a standard commercially available LCD color display unit that is used to display NTSC TV video information. This display is connected electrically to the Video interface board by a thin ribbon cable.

##### **Video interface board:**

This interface board provides all of the drive circuitry needed to interface to the LCD color display. This board also contains circuitry needed to convert the incoming cable TV signal into the signal required to drive the LCD color display. This board contains an off-shelf Phillips TV tuner module. This tuner module is used to select the received TV station signal (utilizing I2C interface command sequence) and down-convert it to a NTSC standard base-band video signal. This base-band signal is then in-turn converted to the RGB and sync signals, which are used to drive the LCD.

##### **Control board:**

This board contains the majority of the digital circuitry. This board contains the master microprocessor that is used to control the other boards and processors within the tower unit. All the control needed to communicate with other processors and devices on this board and other boards are accomplished through the I2C command bus. This board also contains a clock circuit, which is based on a 12.288 MHz crystal all of the clocks on this board are derived from this clock frequency.

This board contains the DSP and audio processing circuitry.

This circuitry has several functions:

- It allows the selection of several audio sources such as the CD, Tape, or TV.
- It provides the capability to adjust the frequency response of the audio signal using a 10 band digitally controlled equalizer.
- The DSP contains a proprietary 3D audio processing algorithm that provides the listener with an increased audio depth of field when using headphones.

This board also contains 2 other slave Microchip PIC slave processors. These processors receiver all of their commands from the main processor on this board through the I2C interface command bus. These processors provide the following functions:

- One processor provides the necessary logic to scan the front panel keyboard and provide support glue logic required in the DSP audio processing section.
- The second processor provides the necessary logic required for IR communication to the headphone unit and also provides circuitry needed for the Ultrasound location detection. The ultrasound is used to enable the tower when a new individual is detected in front of the tower. This processor also provides the glue logic needed to program the 900 MHz-transmitter module PLL to select the transmitter frequencies.

##### **Transmitter Module:**

This module is the 900 MHz ISM band transmitter used to transmit the audio signal to the headphone receiver device. This device is an integrated module that contains all of

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the circuitry needed to create the carrier and modulate the carrier from the base-band stereo audio signal. The 900 MHz carrier is developed from a 14.4 MHz TCXO oscillator on the board. This 14.4 MHz oscillator is multiplied to the desired frequency using the LMX2332 PLL and VCO. The loop response of the VCO/PLL is set slow enough that the VCO can be modulated with an MPX type FM stereo signal. This MPX type stereo signal is created using a separate analog base-band processor section on the transmitter module board. This circuit limits the modulation signal if the input signal exceeds the recommended input signal range of the transmitter module. This circuit also provides the necessary 19 KHz pilot tone required in the base-band MPX signal. The power supply within the transmitter module is regulated using a linear regulator. This allows the power supply to vary between 9V DC 18V DC without affecting output power or modulation.

**Tape mechanism and Tape control board:**

The Tape mechanism is a standard off-the-shelf mechanism. This mechanism is controlled with the tape controller board. This board is a custom board created by E-Zone. This board consists of a PIC microcontroller; a 4.00 MHz crystal and 5V & 8V power supply regulators. The PIC receives commands from the main control board (described above) through the I2C Command Bus.

**CD mechanism and CD control board:**

The CD mechanism is a standard off-the-shelf mechanism. This mechanism is controlled with the CD controller board. This board is a custom board created by E-Zone. This board consists of a PIC microcontroller; a 4.00 MHz crystal and 5V & 8V power supply regulators. This PIC receives commands from the main control board (described above) through the I2C command bus.

**Power supply:**

The power supply provides power to all of the boards and circuits in the tower. This power supply is an off-the-shelf commercially available off-line switch mode power supply. It provides 100-240 VAC to 12 VDC step down in a small self-contained unit.