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DESIGN A BELL 202 MODEM

BELL 202 MODEM USING Z02201/Z02922

INTRODUCTION

While the Z02201/Z02922 data pumps do not support the Bell 202 standard as one of its standard modes, it can be used to transmit and receive data using the Bell 202 standard. The reason behind this phenomemon is that the Bell 202 standard is very similar to the ITU V.23 standard; both are defined as half duplex 1200 bps FSK modems.

Consider these differences between V.23 and Bell 202:

1. V.23 provides for an optional 75 bps back channel. In the Z02201/Z02922, this back channel is used as the default condition and must be disabled in order to use in Bell 202 mode. For detailed information on how to disable this 75 bps back channel, refer to the Zilog Application Note, "Muting the V.23 Back Channel; Design a Half Duplex V.23 Modem with Z02201/Z02922."
2. The frequencies used to transmit marks and spaces differ between V.23 and Bell 202, are shown in Table 1.:

Table 1. Frequency Differences

	Mark	Space
V.23	1300 Hz	2100 Hz
Bell 202	1200 Hz	2200 Hz

The frequencies only differ by 100 Hz in both the marks and spaces. More importantly, the center frequency (the mid-point between the mark frequency and the space frequency) is the same in both cases. This makes it possible to use the V.23 mode to transmit and receive data using the Bell 202 standard in the Z02201/Z02922 data pump.

BELL 202 1200 BPS RECEIVE

Since the Bell 202 standard doesn't provide for the V.23 75 bps back channel, the same procedure is used to receive the Bell 202 signal as is used to receive a V.23 1200 bps signal with no back channel. In this configuration, the controller need only to set the TXSQLCH bit in the DPCTRL RAM location. This mutes the 75 bps back channel. The standard V.23 1200 bps receiver can be used "as is" to decode a Bell 202 signal.

BELL 202 1200 BPS TRANSMIT

Since the Bell 202 standard doesn't provide for an optional back channel, the same procedure used to transmit Bell 202 signals is used to transmit a V.23 1200 bps signal with no back channel. Since the transmit frequencies are different, one more step needs to be followed:

1. Set the CONFIG RAM location to 0413H (hex). This sets the data pump to the manual V.23 handshake mode transmitting at 1200 bps.
2. The DSP RAM locations that control the frequency generators are shown in Table 2. The space frequency RAM location should be programmed to 170AH (hex) and the mark frequency RAM location should be programmed to 0C91H (hex). In addition set DSP RAM location 0191H (hex) to 0C91H (hex). This instructs the data pump to transmit the Bell 202 mark frequency immediately.
3. Set TRNCTRL to 5. This forces datamode.
4. Reset DPCTRL bit 6. This forces the 1200 bps transmission to begin even though no back channel has been detected. You are now in datamode and can

transfer data. Make sure that the transmitter is unsquelched. This can be done by resetting the TXSQLCH bit in DPCTRL.

5. Wait for 50 ms for the other side to train up on the carrier. You may have to wait longer if the other side is doing an automode startup (i.e. cycling through different modes before settling).

The following controller code examples show how Bell 202 can be implemented on the Z02201/Z02922.

Table 2. Controller Codes

DSP Code Version/ ROM Code	Mark Frequency	Space Frequency
Z02201 031H/R3470	01CEH	01CDH

BELL 202 1200 BPS RECEIVE

```
#define DPCTRL 0x1FA
#define TXSQLCH 0x8000
#define MDMSTATUS 5                    // Modem status register (R5)
#define CDET 0x2
unsigned char T_ms                     // Millisecond countdown timer

/* do V.23 Rx 1200 */
void do_V23rx1200() {
    int ltemp;                         // 16 bit temporary variable.
    RTS_on ();                          //  Set reg4.rtsp = 1

    ltemp = read_DSP_RAM(DPCTRL);      // Squelch the transmitter.
    ltemp |= TXSQLCH;
    write_DSP_RAM(DPCTRL, ltemp);
    write_DSP_RAM(CONFIG, 0x4014);     // Set V.23 originate 1200 bps rx.
    while (!(inp(MDMSTATUS) & CDET));// Wait for carrier detect.
    return;
}
```

BELL 202 1200 BPS TRANSMIT

```
#define XFSKDATA 5
#define CONFIG 0x1FF
#define TRNCTRL 0x1FE
#define DPCTRL 0x1FA
#define TXSQLCH 0x8000
#define REG4 4
#define DATAP 3
#define CDET 0x2
unsigned char T_ms // Millisecond countdown timer

/* do V.23 Tx 1200 */
void do_V23tx1200() {
    int ltemp;                          // 16 bit temporary variable
```

```
    write_DSP_RAM(CONFIG, 0x413);       // Set for V.23 1200 Tx manual.
    write_DSP_RAM(0x1CD, 0x170A);       // Bell 202 workaround.
    write_DSP_RAM(0x1CE, 0xC91);
    write_DSP_RAM(0x191, 0xC91);
    write_DSP_RAM(TRNCTRL, XFSKDATA);   // Go into data mode.
    ltemp = read_DSP_RAM(DPCTRL);       // Tell the data pump NOT to
    ltemp &= ~0x40;                     // wait for a received tone.
    ltemp &= ~TXSQLCH;                  // Unsquelch the transmitter
    write_DSP_RAM(DPCTRL, ltemp);       // before going online.
    T_ms = 50;                          // Wait 50 ms for the
    while (T_ms);                       // other side to go online.
    return;                             // We can send data now.
}
```

CONCLUSION

Following these steps will enable your system to support the Bell 202 transmission standard using the Z02201/Z02922.

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