ZebraII Manual Table of Contents

Zebra II

manual version 1.0

Introduction

Zebra is a CDMA source with higher dynamic range than specified in CDMA test standards. Zebra is an inexpensive, baseband CDMA source. This instrument can be coupled to laboratory RF modulators to obtain greater out-of-band rejection than specified as per IS-97 and J-STD-019 standard for testing cellular and PCS CDMA systems. Zebra helps engineers to characterize the performance of CDMA power amps and to measure CDMA receiver sensitivity with Walsh and data encoded CDMA signals. ZebraII Controller, the software shipped with your unit, enables you to customize Zebra for your application. The ZebraII Controller can dynamically switch between eight waveforms to simulate loading on base stations.
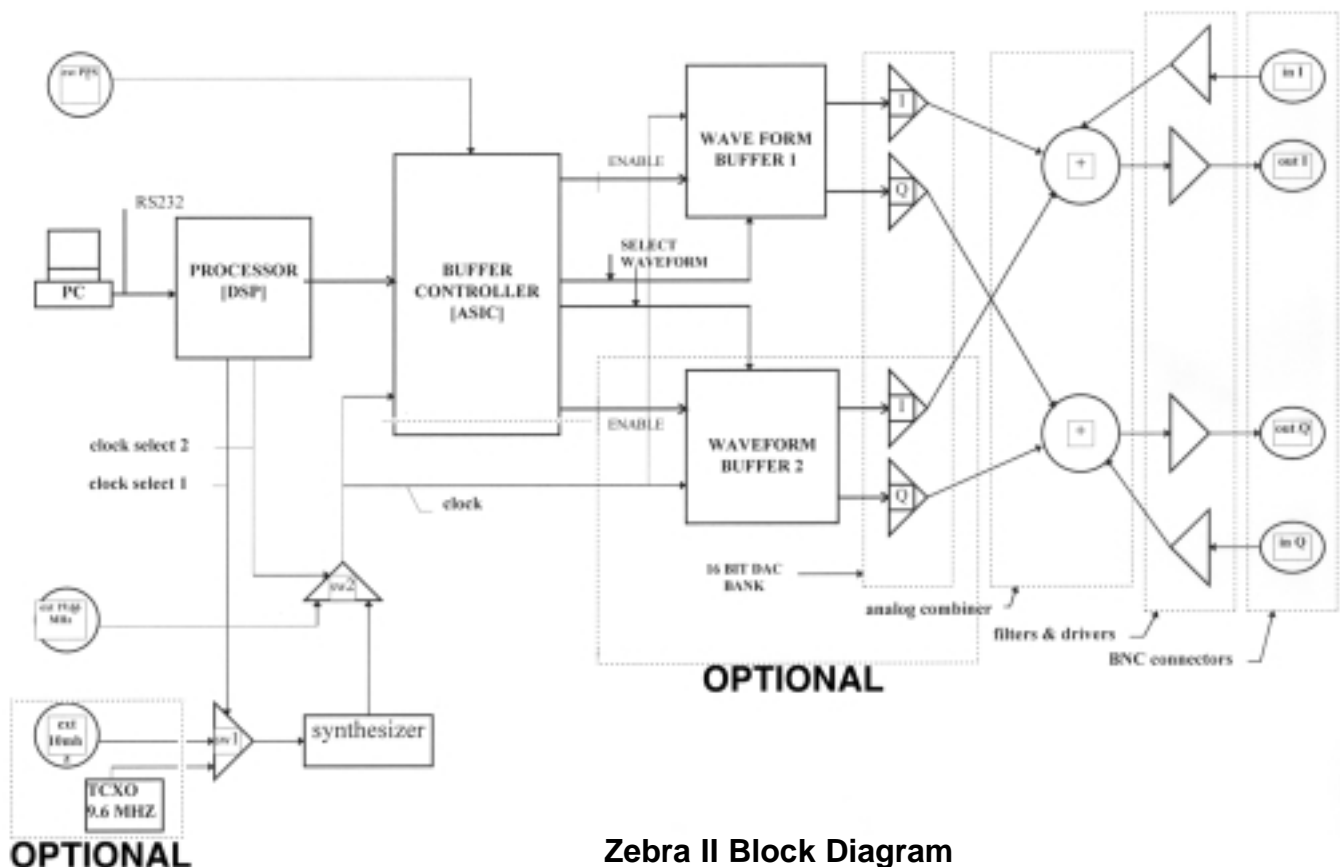
Zebra II Block Diagram

Before you power up
The Zebra is shipped with all the accessories to automatically generate CDMA signals as specified in IS-97 after power-up. Your shipment should include the following:
1. Zebra unit
2. Power cord
3. Serial cable
4. Zebra Eye software (CD-ROM)
5. This manual

Power up
Connect the power cable to the back of Zebra and plug to a 120 VAC or 220 VAC, power outlet. Zebra II can store up to 8 waveforms. All waveforms are setup to output IS-97 single carrier test waveforms. Press the ENTER key to load the waveform. It takes 2 minutes to generate and load the waveform. While loading, the progress bar indicates status of loading. Your unit is shipped with a default setting to generate the CDMA signal as per **Table 1**.

Table 1

Channel	Walsh#	dBm	Data
pilot	00	-7.0	0
sync	32	-13.3	PRBS
paging	01	-7.3	PRBS
traffic	11	-10.3	PRBS
traffic	12	-10.3	PRBS
traffic	13	-10.3	PRBS
traffic	14	-10.3	PRBS
traffic	15	-10.3	PRBS
traffic	16	-10.3	PRBS

About Your Unit
Figure 1 shows the block diagram of your Zebra unit. The pilot channel is mixed with sync, page and six traffic channels. The pilot channel is spread with Walsh 0 in-phase and quadrature phase PN. The sync channel is encoded with pseudo-random sync data frames and with Walsh32 and separately spread with in-phase and quadrature phase PN. The page channel is encoded with pseudo-random data with pre-assigned Walsh and spread with in-phase and quadrature phase PN. The traffic channel is encoded with pseudo-random data and encoded with pre-assigned Walsh and spread with in-phase and quadrature phase PN. Finally, the combined output signal is filtered by an FIR filter and band limited before outputting to the test device. The external IF modulator and clock source are optional.

Specifications
- Chip rate   1.2288 Mbps
- Pilot   IS-95
- Orthogonal Channel   Selectable Walsh [0-63]
- Data   Pseudo-random Binary Data [PRBS], Zero's, One's
- Clock stability   TCXO 2.5 ppm from 10 to 50 deg C
- I & Q Outputs   Baseband [I and Q] - 1VPP, 50Ω
- I & Q Inputs   1 VPP, 50 Ω
- Clock Inputs   10 MHz, 19.6608 MHz, 50%, 50 Ω, 1 VPP
- PPS Input   Maximum 6V
- Power   External AC power 110/220, 50/60 Hz, 1A
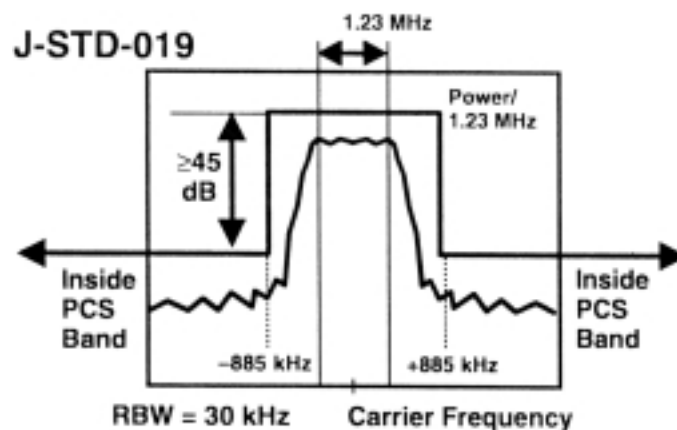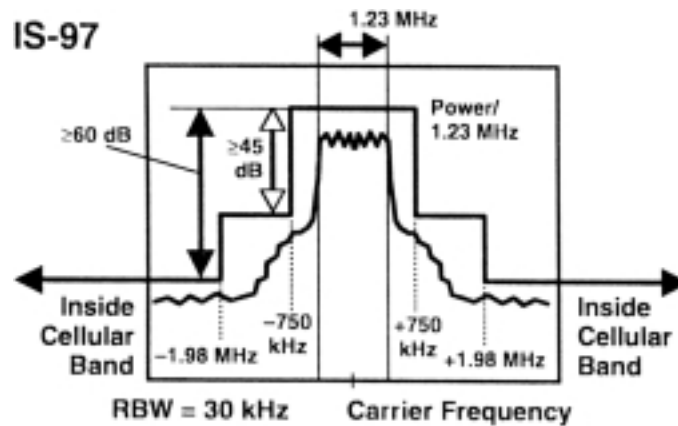
Zebra Setup to Conduct In-Band Spurious Emission
1. Configure Zebra from ZebraII Controller to transmit single carrier IS-97 model CDMA waveform
2. Connect the Zebra output to spectrum analyzer and check that the dynamic range of the BERT waveform is >60dB
3. Connect Zebra Q and I output to a signal generator
4. Set the signal generator to base station frequency (869 to 894 MHz)
5. Connect the RF output of the signal generator to the spectrum analyzer
6. If the dynamic range of the output from the signal generator is less than 60dB, turn off ALC
7. Connect the RF output of the signal generator to the power amp to be tested
8. Connect the output of the power amp spectrum analyzer through a 30dB pad

Sample Test Setup
Many CDMA sources that exist on the market are an integrated part of expensive phone testing equipment or tied as an option to an expensive AWGN signal generator. In most of the phone test-ing equipment there is no access to baseband I and Q signals. Zebra is a simple multiple CDMA channel source with a built-in IS-95 filter. The CDMA channels are precisely combined using a dig-ital combiner. The Zebra is available with up to 16 code channels. Zebra provides independent control of the gain and Walsh code spreading for each channel. The channels are digitally com-bined and well defined RF envelopes as per IS-97 can be generated. In addition, the output of Zebra can be combined with an external noise signal. This allows greater system loading simula-tion while respecting worse case modulation peaks by choosing adverse Walsh mixing with AGWN. Zebra has options to modulate with pseudorandom data.

1 RF modulator
2 Power supply for amplifier
3 Amplifier being tested
4 ZebraII CDMA Baseband Source unit
5 Power attenuator
6 Spectrum analyzer showing clean CDMA power output
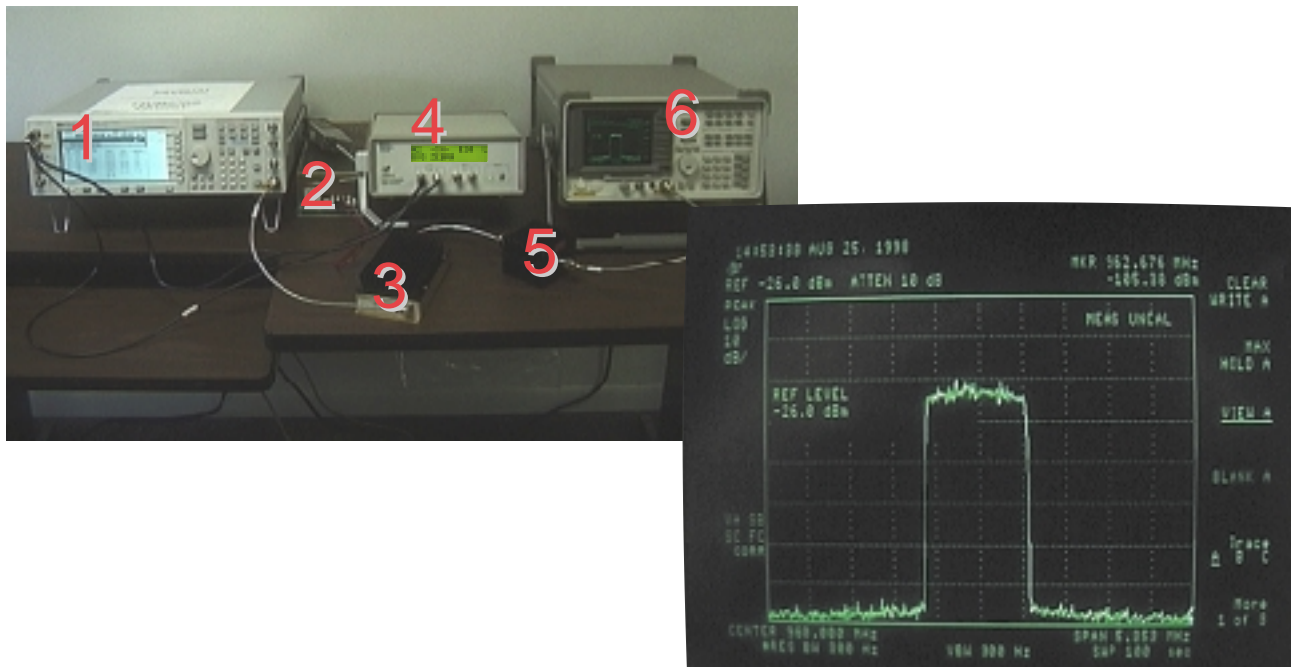
Actual screen shot from spectrum analzyer showing a CDMA signal fed through a power amplifier.
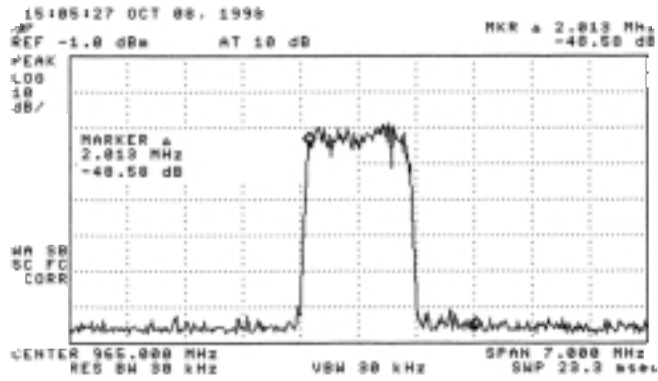
Single IS-95 Carrier
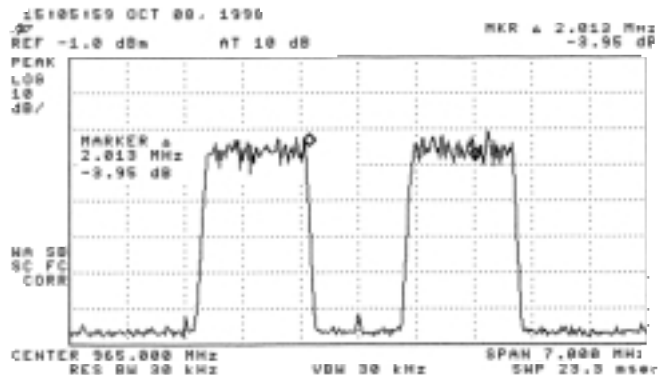
Multicarrier (2 carriers)
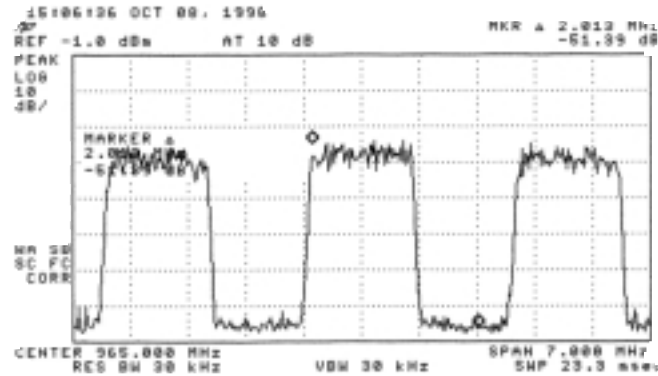
Multicarrier (3 carriers)
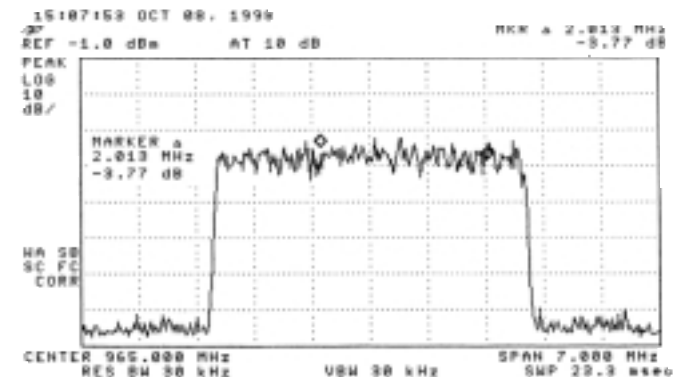
Wideband CDMA (bandwidth up to 10 MHz)

Zebra LCD Screens

#2   waveform number loaded from PC (up to 8 may be saved and loaded from PC)
-ON-   status of waveform output
E10   external reference input (10 Mhz shown)
L   indicates it was a loaded waveform
BVS ZEBRA custom label assigned (in PC) to waveform

This is the loading screen on the ZebraII screen. The serial port from the ZebraII must be connected to a PC loaded with ZerbaII Controller software. Zebra can store up to 8 custom waveforms. It takes a few minutes and must be allowed to completely finish in order to produce the waveform.
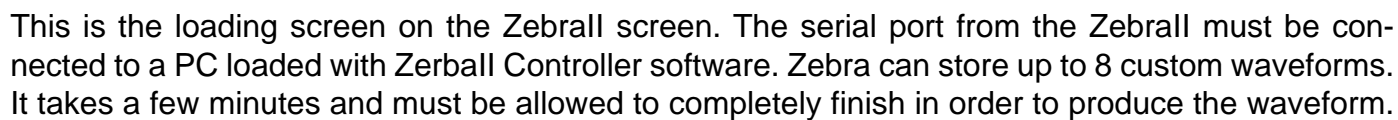
Zebra II Controller Software Operations Manual

Introduction

The Zebra II Controller application software is the PC interface that enables a user of the Zebra II CDMA Source to control and configure the unit for desired performance.

The Zebra II Controller (Z2C) allows the user to load either pre-defined or custom waveform parameters into the Zebra for transmission at the appropriate time. The Z2C also allows the user to mark a specific waveform as the default. This would allow the Zebra to operate individually without the PC by transmitting the waveform that has been marked as default.

Parameters for waveforms can be created in the Z2C and then saved to disk for use at a later time. These saved waveforms can then be read back into the application software for loading and playing on the Zebra.

The Z2C also allows the user to select a clock source. The Zebra can use its internal clock or either one of two distinct external clock sources.

The following sections outline the operation of the Z2C in greater detail.

Application Overview

The Z2C is designed to allow the user to quickly create or load a waveform and send it to the Zebra through a serial connection for transmission.

The main Z2C screen contains (from top to bottom), a main menu bar, a progress indicator, a bank selection control, a 16-channel configuration area, system control buttons, and the system status bar. The main screen can be seen in Figure 1.

The main menu contains three different submenus. The first submenu is FILE. Here you can load a pre-defined waveform such as the IS-97 standard, or load a waveform that had been previously configured by the user. The user can also save the current bank as shown in the configuration area. The user may also exit the application from this submenu.

The second submenu is COMMUNICATION. In this submenu, the user can select the port to which the Zebra is connected. This is the same screen that comes up upon launching the Z2C application.

The final submenu is HELP. In this submenu, this user manual can be brought up. The About box displaying version information is also available.

In between the main menu and the bank select control is the progress indicator. This area will only be visible when needed. It is used to display the progress of a bank that is being queued for transmission on the Zebra.

The bank selection control enables the user to switch between eight different selectable and configurable waveforms. Up to eight waveforms can be stored on the Zebra. When selecting different banks by clicking on the appropriate tab, the parameters that are stored on the Zebra for that particular bank will be loaded into the configuration area.

The configuration area is where the majority of the setup will be done. It contains fields for entering information for up to sixteen different channels to distinguish a waveform. Power values are automatically calculated for traffic channels.
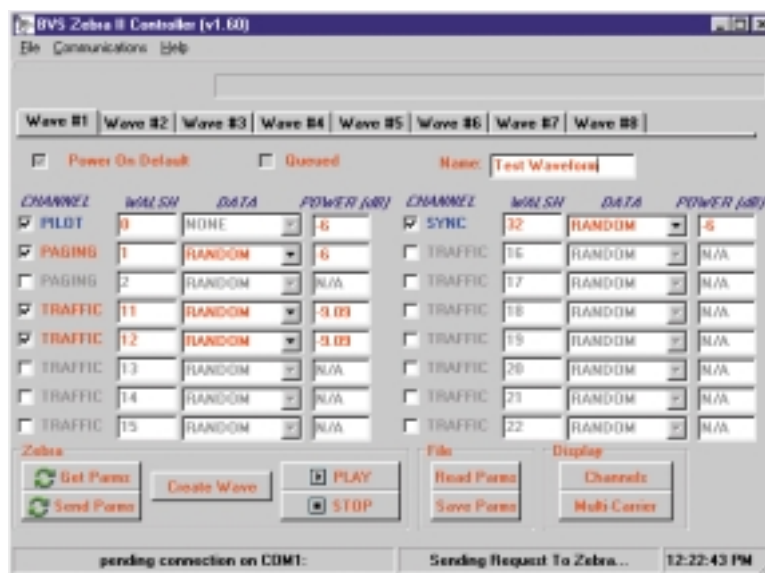

FIGURE 1 Z2C Main Screen

The system control buttons are broken up into two different sections, Zebra controls and file controls. The file controls work the same as the FILE submenu. Parameters for the currently selected bank can be loaded or saved from disk.

The Zebra controls allow the user to read and send parameter information to and from the Zebra, create data for the current bank for transmission, as well as start and stop transmission.

The system status bar displays connection and Zebra version information, as well as any pertinent statuses and the system clock.

The individual features of the application software are discussed in the following sections.

Starting the Application
Make sure that the Zebra unit is running and is connected to a serial port on the PC using the cable packed with the unit. Selecting the Z2C icon starts the Z2C application. When the PORT screen appears, choose the port to which the Zebra is connected. Leaving the choice as AUTOMATIC will put Z2C into search mode, and it will poll COM1 through COM4 in an attempt to find an operating Zebra.

When the main screen appears, check the status bar for verification that the connection was made to the Zebra. You are now ready to transfer information to the Zebra.

Waveform Transmission Procedure
In order to begin transmission of the default waveform, the user simply has to turn the Zebra unit on. No software assistance is needed. However, if the user wishes to play a different waveform, the following steps must be taken.

LOAD or CREATE parameters for the appropriate bank on the PC using the Z2C.
LOAD the parameters onto the ZEBRA.

CREATE the waveform on the ZEBRA.
PLAY the waveform on the ZEBRA.

It is also advisable to save any created waveforms for different banks to disk for later use.
Loading a Waveform from a File
To read a waveform for any one of the eight banks from a file, follow these instructions. First, choose the bank to read by selecting the appropriate tab from the bank selection control. Then, press the READ DATA button in the File control group.
Creating Parameters for a CDMA Waveform
Parameters for a new CDMA waveform may be created in the configuration area. Choose a desired combination of Pilot, Sync, Paging, and Traffic channels. The Pilot channel is always Walsh Code 0 and is always selected. The default parameters have all of the channels de-selected except for the Pilot channel. Follow these steps.

First, adjust the power level of the Pilot channel. If the power level is 0 dB, there will no power remaining to allocate to any other channels. This is why the other channels are de-selected. After adjusting the power level to some negative value, you will be allowed to activate other channels.

Placing a checkmark in the appropriate box activates channels. This will allow the user to adjust the remaining fields. The data for each channel except for the Pilot channel can be selected by choosing the pattern from the combination box for the channel.

The Sync channel is ALWAYS Walsh Code 32.

By choosing the Walsh Codes for the other channels, the field between the checkbox and Walsh Code will reflect what type of Walsh Code has been selected. If it is in the range of paging codes, the word PAGING will appear. If it is in the range of traffic codes, the word TRAFFIC will appear.

Power for Pilot, Sync, and Paging channels can be manually selected. Any remaining power will be distributed among the active traffic channels.

Warning messages will be displayed if the user tries to allocate too much power or tries to allocate the same Walsh Code to two different channels.

By default, Waveform #1 is considered the default waveform and will be transmitted upon startup of the Zebra unit. Also, Checkboxes above the configuration area will reflect queue (created waveform) status.

Activating Multiple Carriers
Another feature of the Z2C is its ability to activate multiple carriers. Choosing the ìMulti-Carrierî button will pop up the multi-carrier screen. To return to the Channels information, simply select the Channels button. The Multi-Carrier display is shown in **Figure 2**.
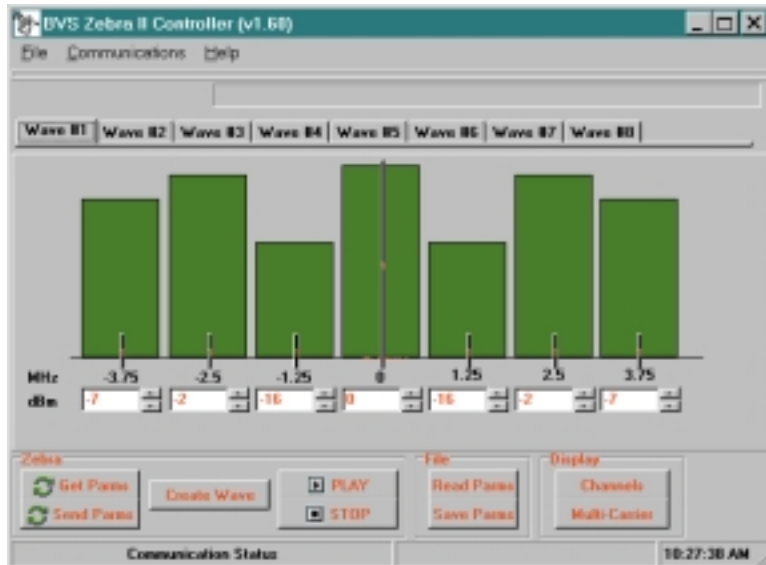
FIGURE 2 Multi-Carrier Display

Each waveform may have different carrier setups. The level of each of the carriers is between 0 and ñ40 dBm. If the particular carrier is active, it will show up as a solid green rectangle on the display. If the carrier is not active, it will show up as a hollow rectangle with a dashed outline.

Simply click on the appropriate rectangles to toggle the active state of the particular carrier. The height of each bar will vary based on the value chosen for the power beneath each bar.

Saving a Waveform to a File
To save parameters for a waveform for any one of the eight banks to a file, follow these instructions. First, choose the bank to read by selecting the appropriate tab from the bank selection control. Then, press the SAVE PARMS button in the File control group.

Reading a Waveform Bank from the Zebra
To read the waveform stored in any one of the eight banks on the Zebra, follow these instructions. First, choose the bank to read by selecting the appropriate tab from the bank selection control. Then, press the READ PARMS button in the Zebra control group.

!!!REMEMBER!!!   All data which is contained in the configuration area for this bank will be overwritten with data from the Zebra!!!

The status bar will notify the user as to whether the read operation was performed successfully.

Loading a Waveform Bank to the Zebra
To load one of the eight banks of waveforms on the Zebra, perform the following operations. Choose which bank to load by selecting the appropriate tab from the bank selection control. The press the SEND PARMS button in the Zebra control group. The status bar will display a message as to whether or not the bank has been loaded with parameters successfully.

Creating Waveform Data for Transmission
Before a waveform can be played, it must be queued into the transmission area of the Zebra. First, select the bank that is to be queued by adjusting the bank selection control to the appropriate tab. Next, press the CREATE WAVE button in the Zebra control button group.

A progress indicator will appear showing the status of the waveform creation. After the indicator announces that the waveform has been created, the banks selected is now ready for transmission.

Playing a Waveform on the Zebra
When the user is ready to play a waveform, he/she is to press the PLAY button in the Zebra button group on the main screen. At this time, the Zebra will begin transmission of the waveform which had been last queued by pressing the CREATE WAVE button.

To stop transmission, the user simply presses the STOP button in the Zebra control button group.

Glossary of Acronyms

AC	Alternating Current
A/D	Analog to Digital converter
AGC	Automatic Gain Control
Applet	a small application
BER	Bit Error Rate
BPSK	Binary Phase Shift Keying
BW	Band Width
CDMA	Code Division Multiple Access (spread spectrum modulation)
DC	Direct Current
D/A	Digital to Analog
dB	decibel
dBm	decibels referenced to 1 milliwatt
DOS	Digital Operating System
DSP	Digital Signal Processing
FIR	Finite Impulse Response
GHz	GigaHertz
GPS	Global Positioning System (satellite based)
GPS diff.	GPS error correction signal which enhances GPS accuracy
IF	intermediate frequency
I and Q	In phase and Quadrature
kHz	kiloHertz
LCD	Liquid Crystal Display
LO	Local Oscillator
Mbits	Megabits
MHz	MegaHertz
modem	modulator/demodulator
PC	Personal Computer
PCS	Personal Communications Service (1.8 to 2.1 GHz frequency band)
PN	Pseudo Noise
QPSK	Quaternary Phase Shift Keying, 4-level PSK
RF	Radio Frequency
RSSI	Receiver Signal Strength Indicator
UCT	Universal Coordinated Time
VAC	Volts Alternating Current
VGA	Video graphic

If you require technical assistance, or service to your Zebrall™ PN Scanner , please contact:

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