Zebra

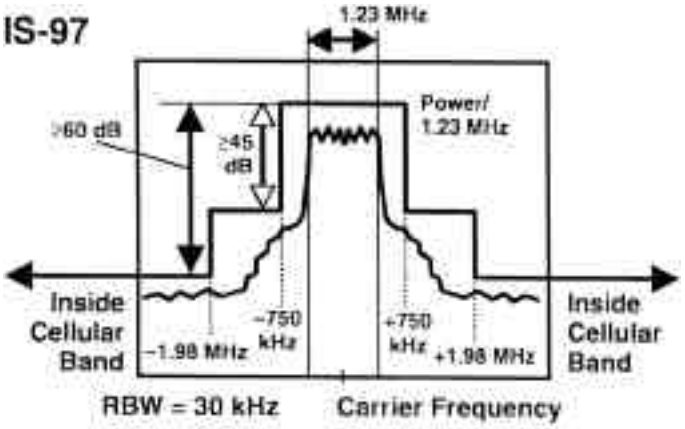
IS-95 CDMA SOURCE

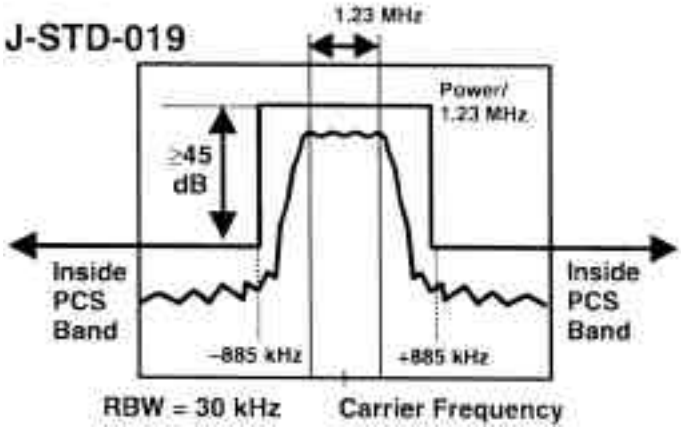
Manual Version 1.3

Zebra Manual Table of Contents

Introduction

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





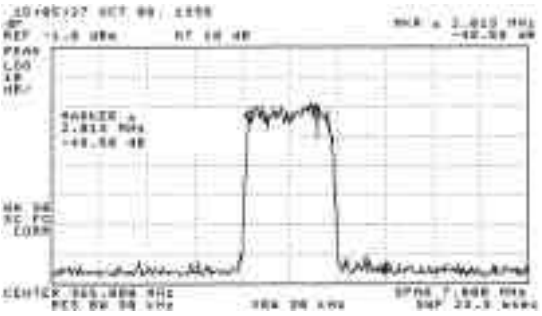


Figure 1 - Single IS-95 Carrier

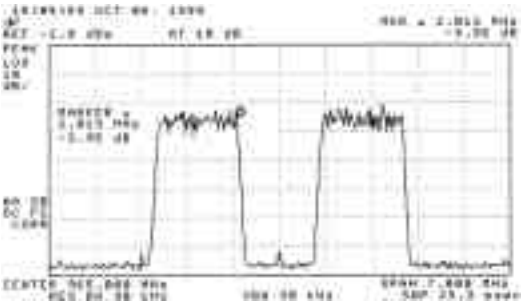


Figure 2 - Multicarrier (2 carriers)

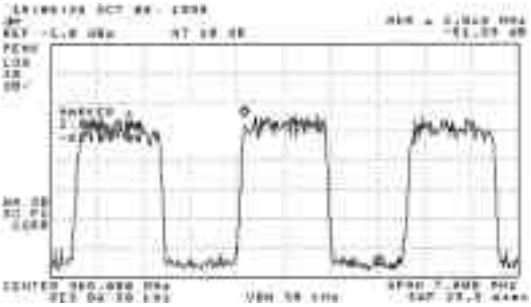


Figure 3 - Multicarrier (3 carriers)

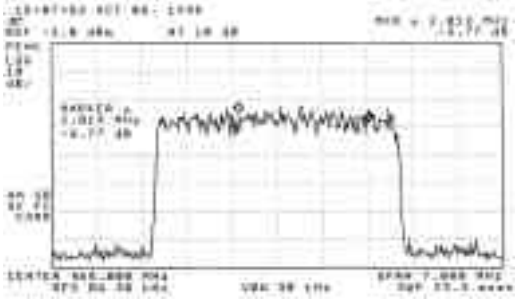


Figure 4 - Wideband CDMA (bandwidth up to 10 MHz)

Zebra Setup to Conduct In-Band Spurious Emission

1. Configure Zebra from Zebra Eye to transmit IS-97 model CDMA waveform

2. Connect the Zebra output to spectrum analyzer and check that the dynamic ra of the BERT waveform is >60dB

3. Connect Zebra Q and I output to a signal generator

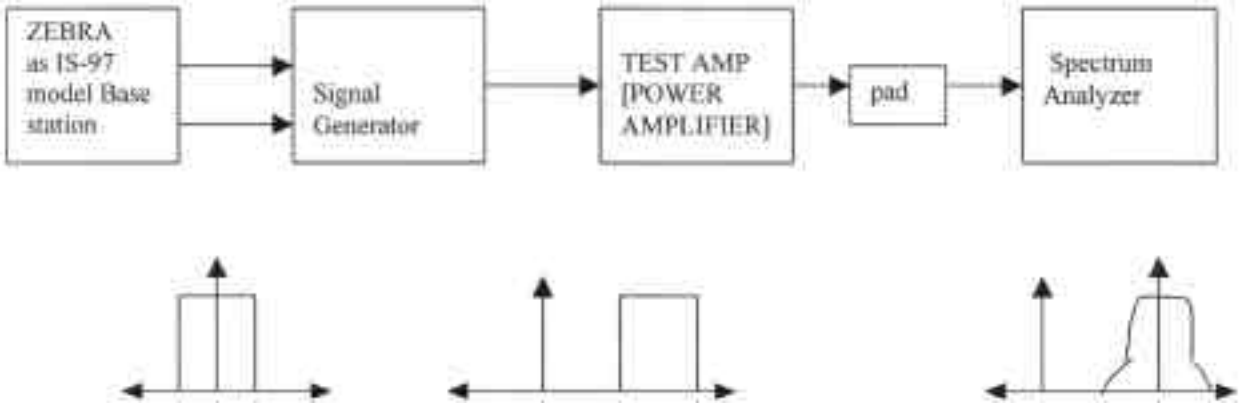
4. Set the signal generator to base station frequency (869 to 894 MHz)

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 60 turn of 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



Before you power up

The Zebra is shipped with all the accessories to automatically generate CDM signals as specified in IS-97 after power-up. Your shipment should include t following:

1. **Zebra unit**
2. **Power cord**
3. **Serial cable**
4. **Zebra Eye software (3.5" diskette)**
5. **This manual**

Power up

Connect the power cable to the back of Zebra and plug to a 120 VAC or 220 V power outlet. The green power LED will blink after switching the unit on. The u is loading the default CDMA signal, and this takes about 2 minutes. The u automatically starts generating the baseband CDMA waveform when the green L stops blinking. Your unit is shipped with a default setting to generate the CD signal as per Table 1.

Channel	Walsh	Power 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

Table 1 - IS-97 Base Station

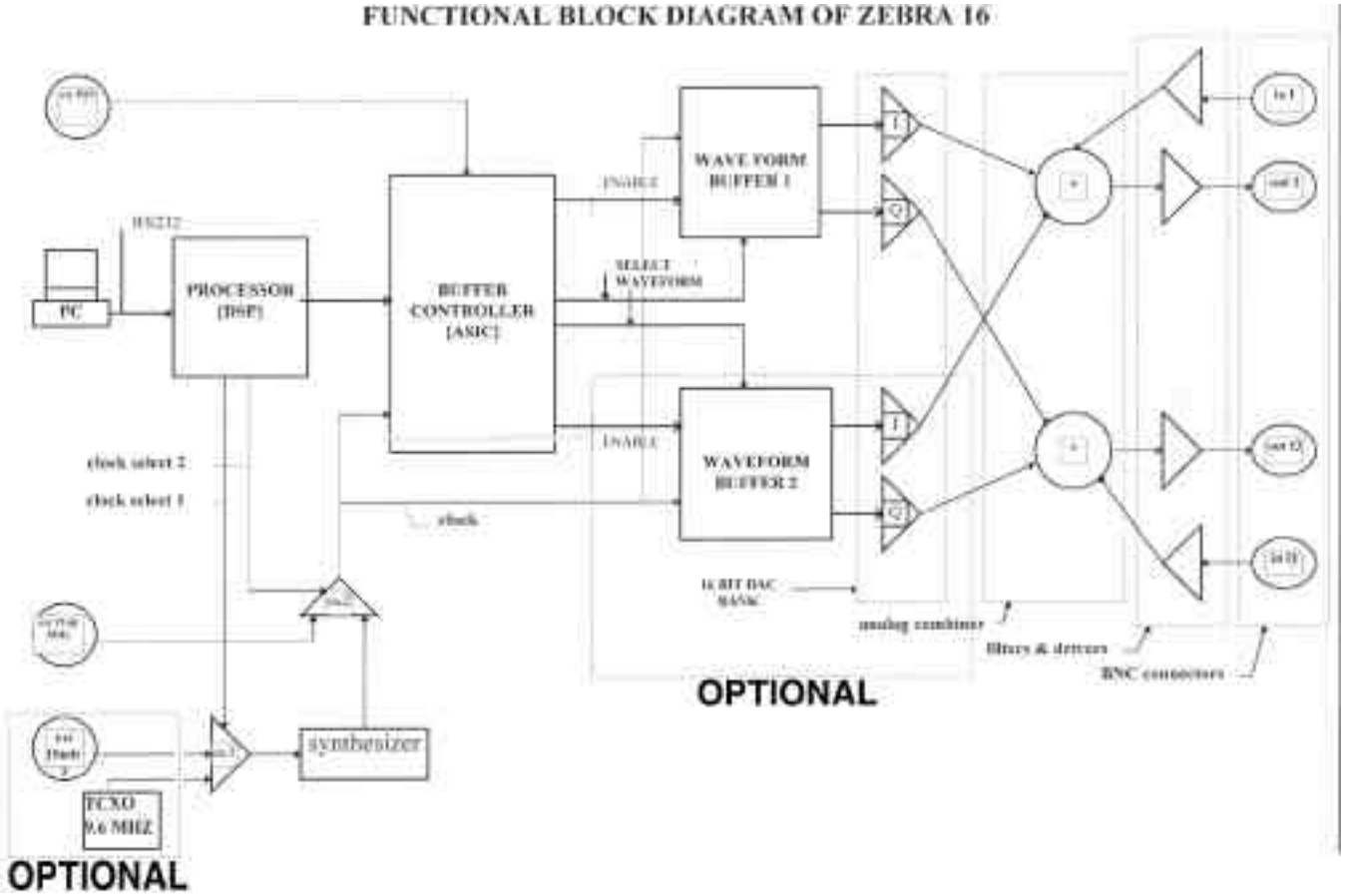


Figure 5 - Zebra Block Diagram

About your unit

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

Zebra complete with accessories

Zebra Rear Panel

Zebra Front Panel

Zebra Power & LED Indicator

Specification

- **Chip rate** 1.2288 Mbps
- **Pilot** IS-95
- **Orthogonal Channels** 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** Maximum -10 dBm, unfiltered, attenuation of 20 dB and mixed with the internal CDMA signal
- **Clock Inputs** 19.6608 MHz, 50%, 50Ω, 1 VPP
- **Power** External AC power 110/220, 50/60 Hz, 1A

Typical test values

1. Output power measured with HP spectrum analyzer with following settings:

VBW :1 kHz,

START FREQ :0 MHz,

STOP FREQ :3 MHz

MARKER :307 kHz and 750 kHz

2. Input and Output signal level measured with HP oscilloscope with 50 Ω termination

Config.	I-CHANNEL			Q-CHANNEL		
	Signal (2) (mV)	Power (1) (dBm)		Signal (2) (mV)	Power (1) (dBm)	
		307 kHz	750 kHz		307 kHz	750 kHz
IS-97	450	-35	-99	450	-35	-99
Only Pilot-0 dB	320	-36	-100	320	-38	-99
Only Pilot-6 dB	165	-43	-101.5	165	-43	-100

Table 2 - Output levels with no inputs

External INPUT [dBm]		External OUTPUT [dBm] 1	
Channel	Power	I Channel	Q Channel
I	-20	-40.50	-98.5
Q	-20	-95	-38.50

Table 3 - Input levels without internal waveform signals

Sample Test setup

Many CDMA sources that exist on the market are an integrated part of expens phone testing equipment or tied as an option to an expensive AWGN sign generator. In most of the phone testing equipment there is no access to baseba and Q signals. Figure 5 shows an inexpensive way of configuring a test setup us

Zebra and available RF modulators. Zebra is a simple multiple CDMA channel sou with a built-in IS-95 filter. The CDMA channels are precisely combined using digital combiner. The Zebra is available with up to 16 code channels. Zeb provides independent control of the gain and Walsh code spreading for each chan The channels are digitally combined and well defined RF envelopes per IS-97 can generated. In addition, the output of Zebra can be combined with an external no signal. This allows greater system loading simulation while respecting worse ca modulation peaks by choosing adverse Walsh mixing with AGWN. Zebra has optio to modulate actual data packets

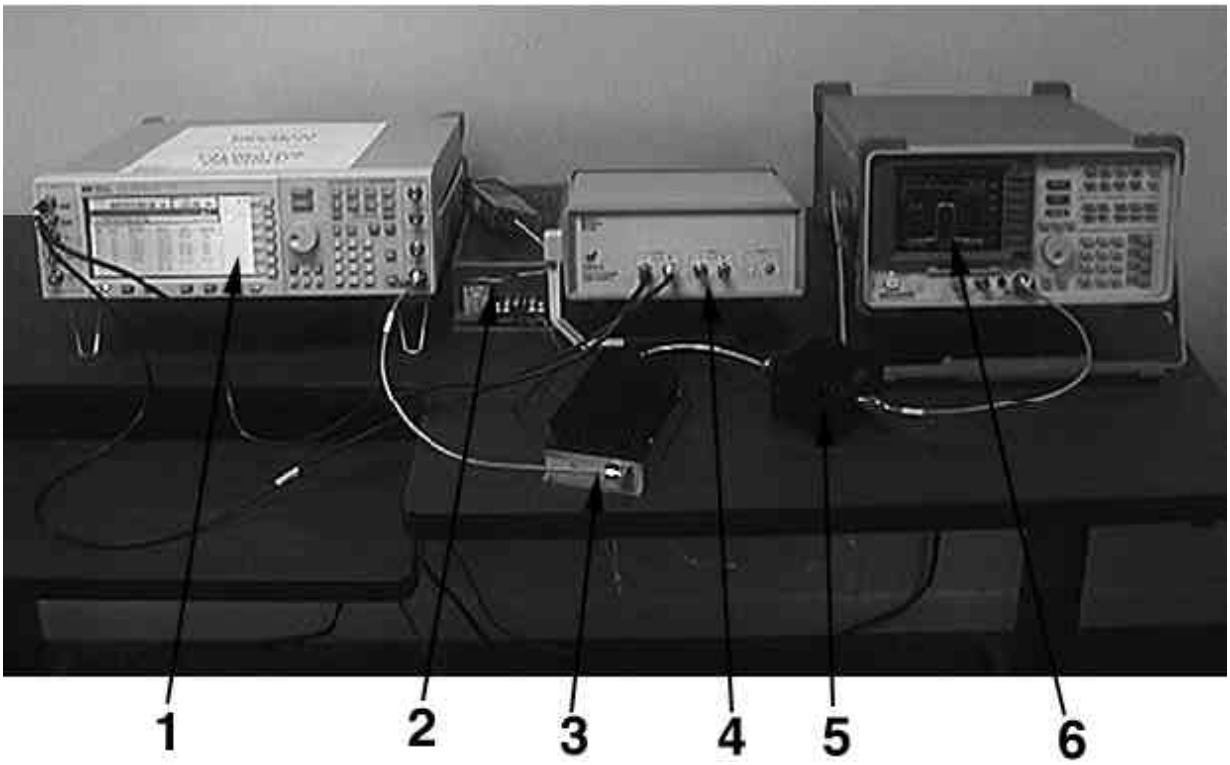


Figure 6 - CDMA Amplifier test setup with the Zebra

1. RF modulator

2. Power supply for amplifier

3. Amplifier being tested

4. Zebra CDMA Baseband Source unit

5. Power attenuator

6. Spectrum analyzer showing clean CDMA power output

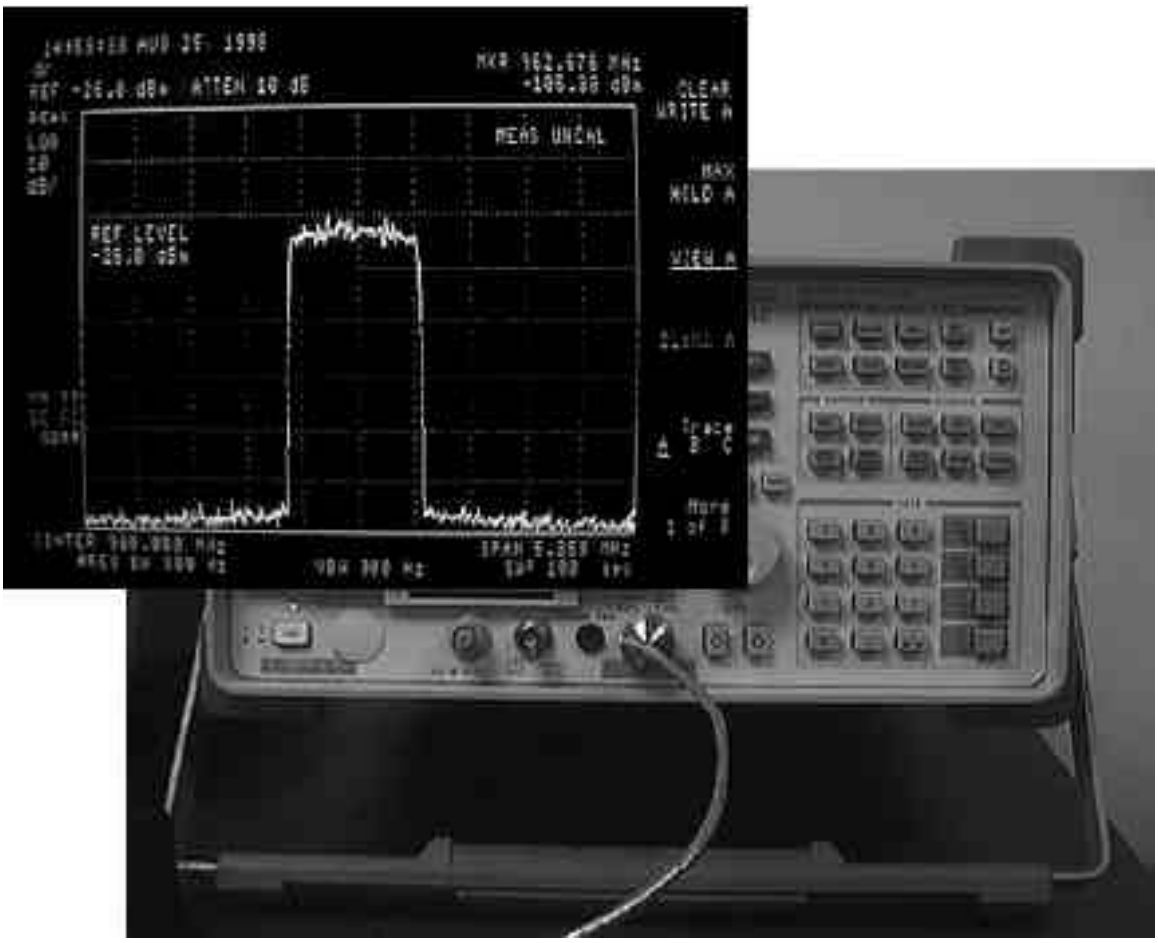


Figure 7 - Actual screen shot from spectrum analzyer showing a CDMA signal fed through a power amplifier

Zebra Controller (v1.3) Software Operations Manual

Introduction

The Zebra Controller application software is the PC interface that enables a u of the Zebra CDMA source to control and configure the unit for desire performance.

Zebra Eye allows the user to load either pre-defined or custom wavefor parameters into the Zebra for transmission at the appropriate time. Zeb Controller also allows the user to mark a specific waveform as the default. T allows the Zebra to operate individually without the PC by transmitting t waveform that has been marked as default.

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

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

The following sections outline the operation of Zebra Eye in greater detail.

Application Overview

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

The main Zebra Controller screen contains (from top to bottom), a main menu ba progress indicator, a bank selection control, a 16-channel configuration ar system control buttons, and the system status bar. The main screen can be seen Figure 8.

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

The second submenu is OPTIONS. Under this submenu, the user can change t setting for clock source. The third submenu is COMMUNICATION. In this subme the user can select the port to which the Zebra is connected. This is the sa screen that comes up upon launching the Zebra Controller application.

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

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

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

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

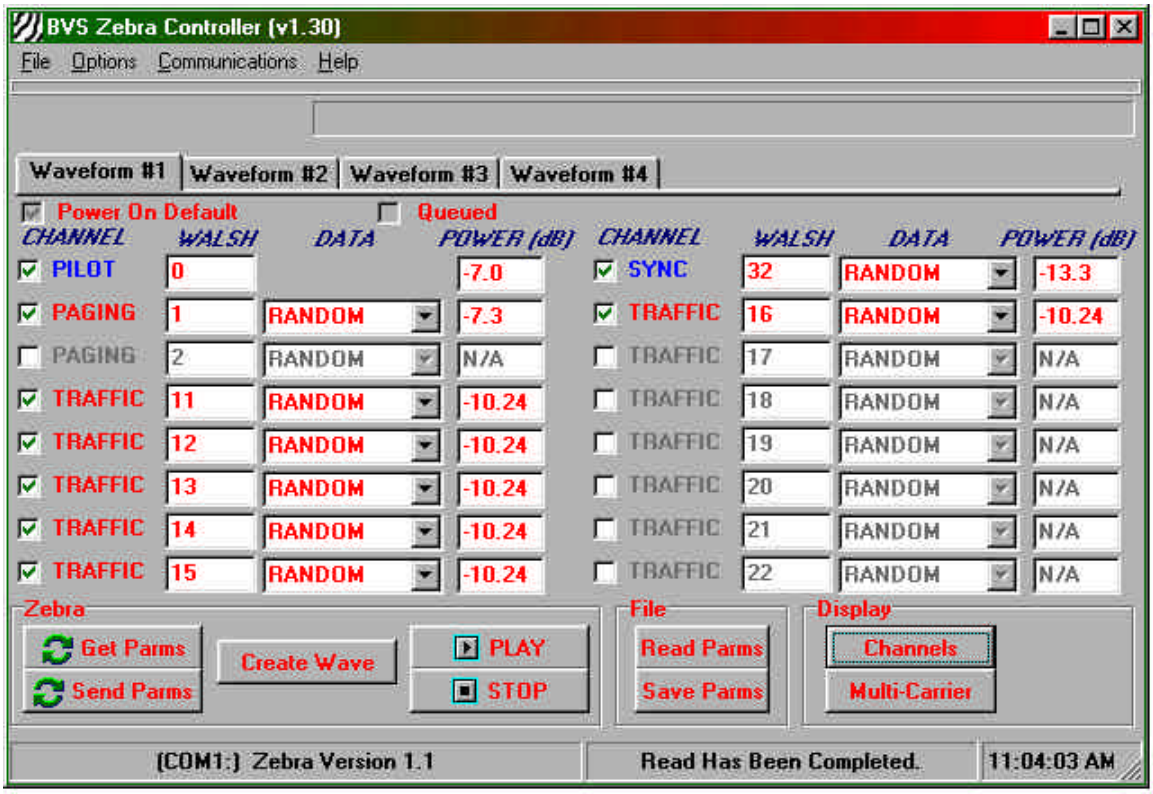


Figure 8 - Zebra Eye Screen 1 Defaults

The system control buttons are broken up into two different sections, Zeb controls and file controls. The file controls work the same as the FILE subme 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 a from the Zebra, create data for the current bank for transmission, as well as s and stop transmission.

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

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

Starting the Application

Make sure that the Zebra unit is running and is connected to a serial port on the using the cable packed with the unit. The Zebra Controller icon starts the Ze Controller application. When the PORT screen appears, choose the port to which Zebra is connected. Leaving the choice as AUTOMATIC will put Zebra Controller i search mode, and it will poll COM1 thru COM4 in an attempt to find an operat Zebra.

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

Waveform Transmission Procedure

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

1. LOAD or CREATE parameters for the appropriate bank on the PC using th Zebra Controller.
2. LOAD the waveform onto the ZEBRA.
3. CREATE the waveform on the ZEBRA.
4. PLAY the waveform on the ZEBRA.

It is also advisable to save any created waveforms for different banks to disk later use.

Loading a Waveform from a File

To read a waveform for any one of the four banks from a file, follow the instructions. First, choose the bank to read by selecting the appropriate tab fr the bank selection control. Then, press the READ DATA button in the File cont group.

Creating a CDMA Waveform

Parameters for a new CDMA waveform may be created in the configuration are Choose a desired combination of Pilot, Sync, Paging, and Traffic channels. The P channel is always Walsh Code 0 and is always selected. The default paramete have all of the channels de-selected except for the Pilot channel. Follow the steps.

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

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

The Sync channel is ALWAYS Walsh Code 32.

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

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

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

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

Activating Multiple Carriers (new in version 1.30)

Another feature of the Zebra Controller is its ability to activate multiple carri Choosing the "MultiCarrier" button will pop up the multi-carrier screen. To ret to the "Channels" information, simply select the "Channels" button. The "Mu Carrier" display is shown in Figure 9.

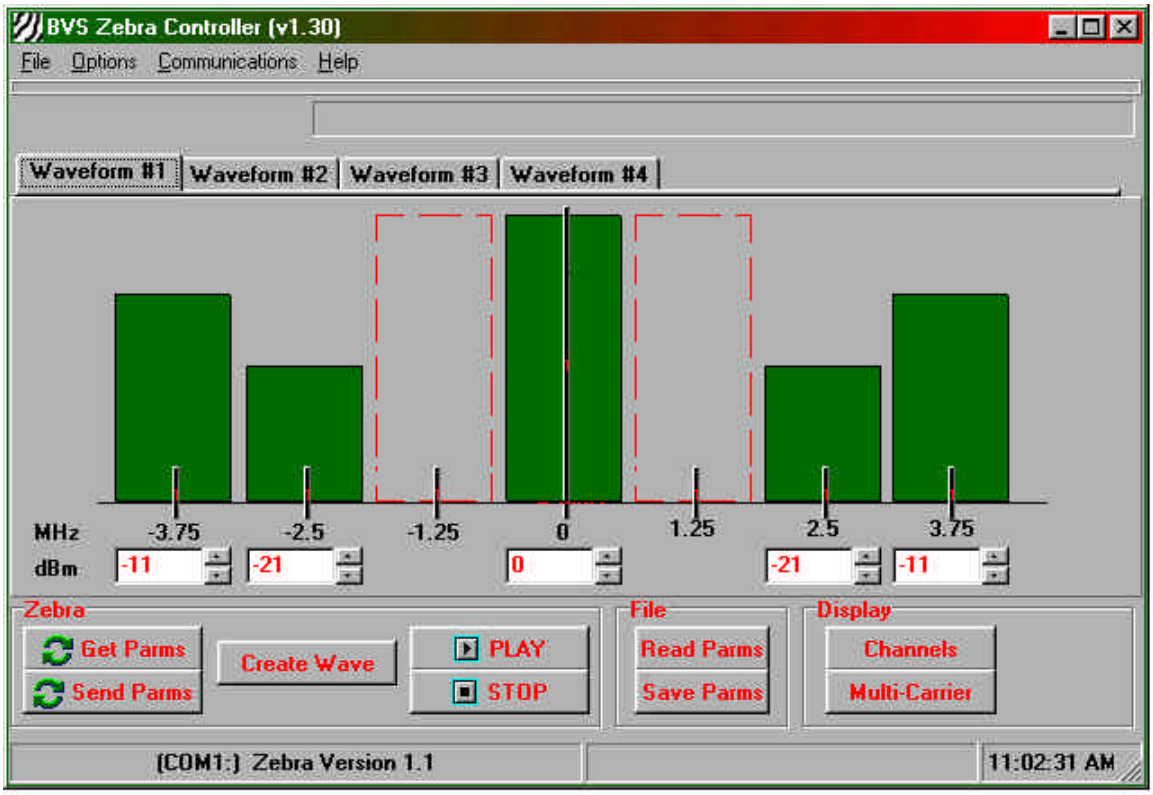


Figure 9 - Multi-carrier display

Each waveform may have different carrier setups. The level of each of the carri is between 0 and -40 dBm. If the particular carrier is active, it will show up a solid green rectangle on the display. If the carrier is not active, it will show up a hollow rectanglewith a dashed outline.

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

Saving a Waveform to a File

To save parameters for a waveform for any one of the four banks to a file, fol these instructions. First, choose the bank to read by selecting the appropriate from the bank selection control. Then, press the SAVE PARAMS button in the F control group.

Reading a Waveform Bank from the Zebra

To read the waveform stored in any one of the four banks on the Zebra, foll these instructions. First, choose the bank to read by selecting the appropriate from the bank selection control. Then, press the READ PARAMS button in the Ze 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 perfor successfully.

Loading Waveform Parameters of a Bank to the Zebra

To load one of the four banks of waveforms on the Zebra, perform the follow operations. Choose which bank to load by selecting the appropriate tab from bank selection control. Then press the SEND PARAMS button in the Zebra cont group. The status bar will display a message as to whether or not the ba parameter has been loaded successfully.

Creating a Waveform Bank for Transmission

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

A progress indicator will appear showing the status of the waveform creatio After the indicator announces that the wafeform has been created, the ban selected are 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 the Zebra button group on the main screen. At this time, the Zebra will beg transmission of the waveform which had been last queued by pressing the CREA WAVE button.

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

Setting the Clock Source [Optional]

The clock source may come from one of three different locations. The source m be the internal clock, an external 10MHz clock, or an external 19.66MHz clo External clock sources must be connected to the appropriate input on the Zebra.

The clock source may be selected by choosing CLOCK SOURCE under the OPTIO submenu. By choosing the source and clicking OK, the Zebra will be notified to the new source.

Glossary of Acronyms

AC	Alternating Current
A/D	Analog to Digital converter
AGC	Automatic Gain Control
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
PCMCIA	Personal Computer Memory Card International Association
PC	Personal Computer
PCS	Personal Communications Service (1.8 to 2.1 GHz)
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

Technical Support

- Up-to-date information is available on our web site at http://www.bvsystems.com
- The latest version of Zebra Eye is also available on our web site for download
- If you wish to contact technical support, e-mail to <info@bvsystems.com>

Acknowledgements

- Microsoft is a U.S. registered trademark of Microsoft Corporation.
- Windows is a trademark of Microsoft Corporation.

Notice

Information in this document is subject to change without notice.

If you require technical assistance, or service to your Zebra CDMA Baseband Source, contact:

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