WIND Measurement System

Wireless Interference Detection
For GSM Telephone Networks

WIND Catcher
User Manual

May 2009
Revision 2.0

Important Information

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Conventions and Definitions

The following conventions and definitions are used in this guide:

< >	Angle brackets contain numbers that represent a range of values. For example, BCCH<128-889>
|	The | symbol leads you through nested menu items and dialog box options to a final action. The sequence File|Page Setup|Options directs you to pull down the File menu, select the Page Setup item, and select Options from the last dialog box.
Bold	Bold text denotes items that you must select or click on in the software, such as menu items and dialog box options.
Italic	Italic text denotes variables, emphasis, a cross reference, or an introduction to a key concept. This font also denotes text that is a placeholder for a word or value that you must supply.
Downconverter	The WIND RF downconverter module. A downconverter "zooms in" on a narrow frequency component of a signal and shifts it to center around a lower frequency, 4 MHz in the case of the WIND.
IF	Intermediate Frequency—The intermediate signal to which an RF signal is converted in order to be demodulated, displayed, or processed. For instance, the WIND downconverter will convert RF signals to a 15 MHz IF signal that can be digitized.

1 Set Up and Configuration

1.1 Required Equipment

Set-up and use of the Wider Networks WIND Measurement Systems requires the following items:

- WIND Catcher hardware subsystem:
  - WIND wideband RF digital receiver module
  - WIND automobile power adapter
  - USB cable (less than 2 meters in length)
  - RF antenna (PCS, cellular, or dual-band) with SMA connector
  - GPS antenna with BNC connector

- Notebook/laptop computer for measurement collection and control:
  - Windows 2000 or Windows XP (Service Pack 2 or later) recommended
  - One available USB (1.1 or 2.0) input per each WIND Catcher unit to be controlled
  - Minimum of 256MB memory
  - 10 MB available disk space for application installation
  - Available disk space for data collection (approximately 20-30 MB per hour of collection)

- WIND Catcher software installation CD
  - Installation application
  - WIND Catcher USB drivers
  - Documentation

1.2 Installation

1.2.1 Software Installation

The WIND Catcher application should be installed on the control PC before connecting the hardware so that correct operation may be verified. Currently WIND is supported on Windows 2000 and Windows XP operating systems.

Windows 2000 and Windows XP
Run the "setup.exe" program on the WIND Install CD, and installation will proceed automatically. Setup.exe copies the WIND Catcher software into the proper location in the directory structure and installs the USB drivers for the WIND hardware.

1.2.2 Hardware Installation

The WIND Catcher hardware is designed to be used in an automobile and can be powered by 12VDC from a cigarette-lighter socket in the vehicle. An optional AC/DC transformer is available should it be necessary to obtain power from a 120V AC supply.

Before following the steps below to connect and power-up the WIND Catcher hardware, ensure that the:

- ✓ WIND Catcher module is not connected to the power supply
- ✓ WIND Catcher power switch is in the OFF position
- ✓ vehicle engine is running

NOTE: In order to avoid equipment damage, DO NOT TURN THE ENGINE ON OR OFF WHILE THE WIND CATCHER HARDWARE IS POWERED ON!

1) Connect the RF antenna to the threaded, female, SMA connector on the back of the WIND Catcher. Mount the RF antenna outside on the roof of the vehicle.

2) Connect the GPS antenna to the BNC connector on the back of the WIND Catcher module. Mount the GPS antenna outside on the roof of the vehicle. *Note: For best results, the GPS antenna should be located on top of the vehicle in a position such that it remains parallel to the earth's surface, and as far as possible from any transmit antennas.*

3) Connect the WIND Catcher to the control PC using a standard USB cable that is not more than 2 meters in length.

4) Make sure the power switch on the WIND Catcher is in the OFF position.

5) Plug the small, female connector of the car power adapter cable into the WIND Catcher hardware. IT IS IMPORTANT THAT THIS END BE PLUGGED IN BEFORE THE POWER CABLE IS "LIVE" IN ORDER TO AVOID SHORTING THE CONNECTOR AND BLOWING THE POWER ADAPTER FUSE!

6) Plug the large, male end of the car power adapter cable into the power (cigarette lighter) socket in the vehicle. At this point, only the yellow standby power LED should light.

7) Turn on the power switch of the WIND Catcher module. The green power supply status LED should now light.

8) If the control PC is not already powered on, boot it up and start the WIND Catcher application.

9) You will see the "Found New Hardware" dialog box, and Windows will automatically install the correct driver for that particular WIND Catcher unit. Note that each WIND Catcher unit will require a separate driver install.

2 Making Measurements

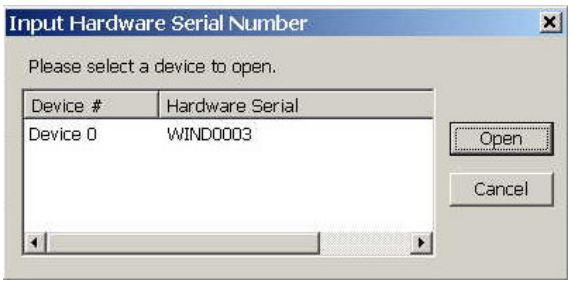
Wider Networks' WIND System is specially designed to identify and quantify the sources of interference that reduce quality and capacity of a wireless telephone network. Armed with WIND data, which shows interference sources as low as 21dB C/I, an operator can EFFECTIVELY analyze and re-configure the network to unlock previously "hidden" capacity while simultaneously improving the overall quality the subscribers enjoy.

The WIND Catcher measurement system, configured as specified in Section 1, allows for the control of measurement collection and status display functions during a drive-test through the WIND Catcher software application.

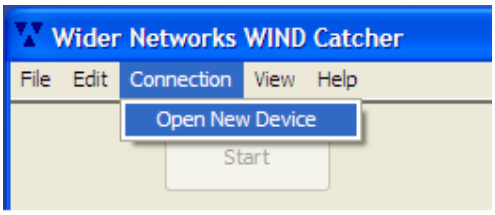
2.1 Configure the collection system

Make a connection to the WIND Catcher hardware by starting a WIND Catcher application (click on the icon ).

The application will find all connected WIND Catcher modules and present a selection box. From this box, choose the particular WIND Catcher device to be configured. Keep in mind that each WIND Catcher module must be configured and used from a distinct and separate instance of a WIND Catcher application.



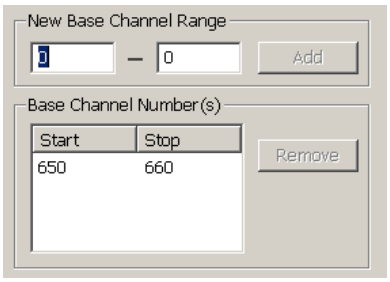
If the selection box above does not appear, click on the menu item **Connection | Open New Device**.



Select the ID string that corresponds to the particular WIND device that will be configured and click the **Open** button.

2.2 Select Channels

Channel numbers on which to collect are added from the two boxes inside the New Base Channel Range dialog box. All entries are made as a range of GSM Absolute Radio Frequency Channel Numbers. If only a single channel needs to be collected enter that same channel number in both ends of the range.



Click the **Add** button to transfer the input of the New Base Channel Range into the Base Channel Number(s) box.

To remove a channel range from being collected, select the range in the Base Channel Number(s) box and then click the **Remove** button.

When the WIND Catcher application is started, the channel list will be filled in with the most recently used ranges selected.

Each range consists of a start channel number and end channel number. WIND will control any frequency retunes needed to capture the entire channel range. Each range is treated independently, and multiple, overlapping ranges are allowed. This overlap may be used to capture a particular channel (or range of channels) more often than other channels.

As each WIND Catcher "snapshot" scans 4 channels, full capture of one channel range may require multiple snapshots, with a frequency re-tune occurring in between each snapshot. For example, if the selected channel range is 800-805, WIND will capture all the data for these 6 channels over two snapshots.

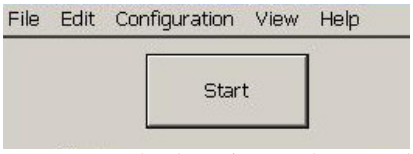
If there is one frequency range that should be collected more often than the others, you can input that range multiple times. The ranges are measured in the order that they are listed in the "Base Channel Number(s)" box.

2.3 Starting and stopping the collection system

Before starting to collect data ensure that:

- ✓ **"Receiver Status" is green and "Ready"**
- ✓ **Either the "GPS Status" or "Dead Reckoning Status" is green and "Locked"**
- ✓ **"UTC Time" is either yellow or green and indicates the correct UTC Time (also known as Greenwich Mean Time).**

Click on the "Start" button. Enter the filename in which the measurements will be saved. For user



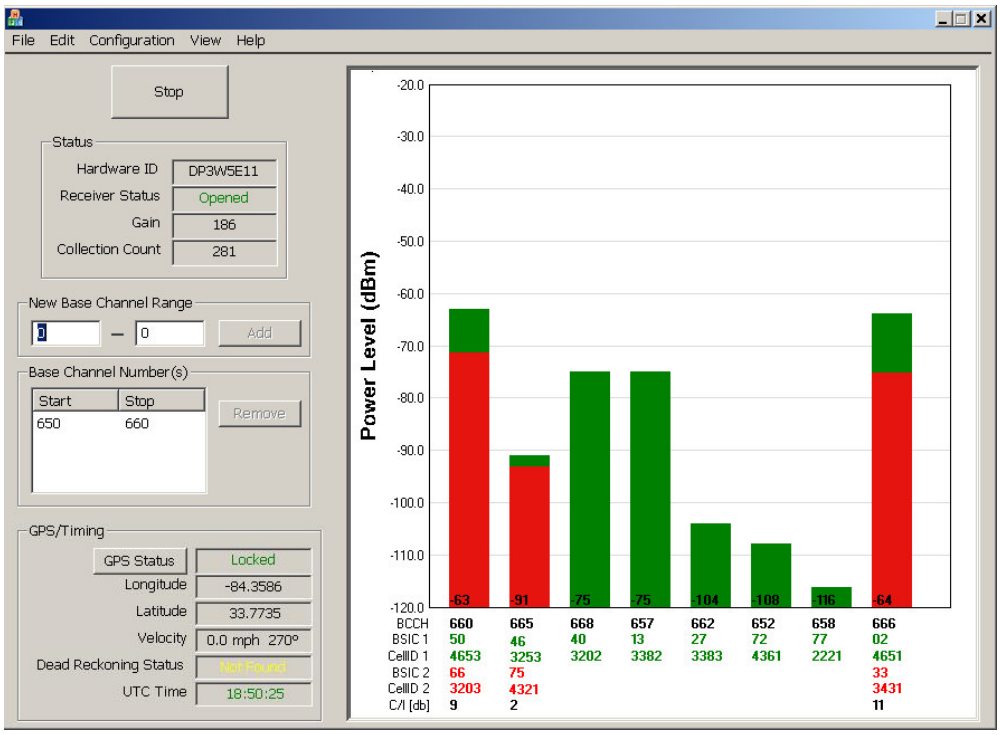
convenience, a filename that represents the date, time, and HWID (hardware ID number of the WIND Catcher unit) is presented as a default. However, any different filename may be entered manually.

While the system is collecting data the "Start" button becomes the "Stop" button. Press the "Stop" button and the system will stop collecting data.

There is no "Pause" feature. Once you press the "Start" button again you will begin collection in a new file.

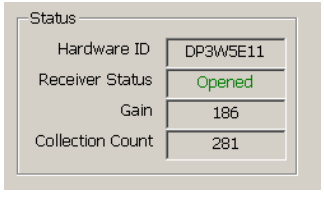
3 Real-Time Information

The WIND Catcher Software has a number of interface elements that provide real-time feedback during data collection on the performance of both the WIND hardware and the RF network that is being measured.



3.1 Status Display

The "Status" display provides 4 pieces of information about the state of the receiver.



Hardware ID: Reports the unique ID of the Wind Catcher hardware being used.

Receiver Status: Reports whether the WIND Catcher software is able to communicate with the WIND Catcher hardware. It has only three values "Found", "Not Found", or "Opened". "Found" means that the WIND Catcher is attached to the data collection computer and is communicating normally. "Not Found" means that no WIND Catcher is attached or that the communications is not working. The most common cause of a "Not Found" is the USB cable coming loose during drive testing. "Opened" means that the WIND Catcher is collecting data and reporting to the computer.

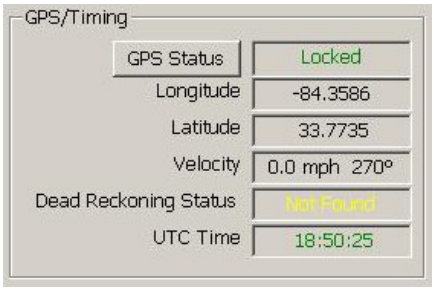
Gain: Reports the gain control setting that the pre-amplifier in the WIND Catcheris using for the current snapshot. The values range from 62 to 372 and are unitless. There is a linear relationship

between the gain setting and maximum power allowed before receiver saturation, with "62" representing the maximum gain (i.e. small amount of RF power present)

Collection Count: Reports the number of times that the WIND Catcher has taken snapshots of every frequency in all of the frequency ranges that are listed in the Base Channel Number(s) box. It will keep incrementing until the data collection is stopped.

3.2 GPS/Timing Display

Status information about the GPS module in the WIND Catcher as well as any attached dead reckoning unit is displayed in the GPS/Timing section of the GUI.



GPS Status: Reports the status of the GPS unit inside the WIND Catcher. There are only two values that will be displayed here: "Not Found" and "Locked". "Locked" means that the GPS has an accurate position because it has acquired a sufficient number of GPS satellites. When the status is "Not Found" the GPS does not have an accurate position. It is strongly recommended to wait until GPS is "Locked" before starting a data collection file. See "GPS Status Button" below for an explanation of the information in the window that appears when the "GPS Status" button is pressed.

Longitude: The current longitude reported by the WIND Catcher's internal GPS or by an externally attached dead reckoning unit.

Latitude: The current latitude reported by the WIND Catcher's internal GPS or by an externally attached dead reckoning unit.

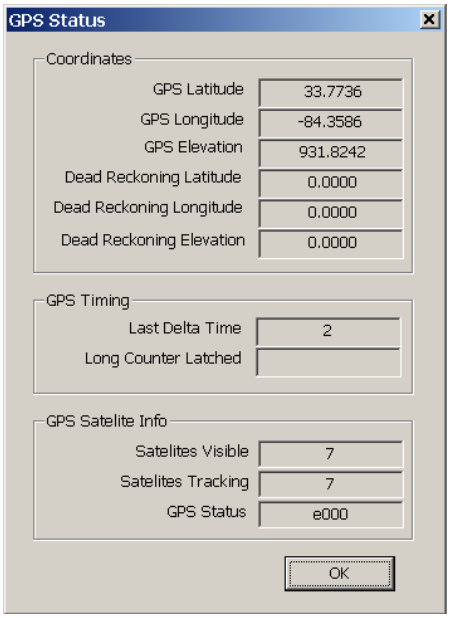
Velocity: The current velocity reported by the WIND Catcher's internal GPS or by an externally attached dead reckoning unit. The two values that represent the velocity are the speed in mph and the direction in degrees (0 represents true north, 90 is true east, etc).

Dead Reckoning Status: Reports the status of an externally attached dead reckoning unit. There are only two values that will be displayed here: "Not Locked" and "Locked". "Locked" indicates that the dead reckoning unit has an accurate position and is communicating with the data collection computer. When the status is "Not Locked" there is no dead reckoning unit attached or it is not recognized by the WIND Catcher software application.

UTC Time: Reports the current Greenwich Mean Time as measured by the internal clock. If the displayed time is in red, then the clock is not accurate. The WIND system relies on accurate timing to work correctly. **DO NOT START DATA COLLECTION UNTIL THE UTC TIME DISPLAY IS IN YELLOW OR GREEN.**

3.3 GPS Status Button

When the GPS Status button is pressed, the following popup window is displayed with additional detail about the GPS and the timing.



3.3.1.1.1 Coordinates

GPS Longitude: Longitude reported by the WIND internal GPS.

GPS Latitude: Latitude as reported by the WIND internal GPS.

GPS Elevation: Height[m] sbove sea level as reported by the WIND internal GPS.

Dead Reckoning Longitude: Longitude as reported by an externally attached dead reckoning unit.

Dead Reckoning Latitude: Latitude as reported by an externally attached dead reckoning unit.

Dead Reckoning Elevation: Elevation as reported by an externally attached dead reckoning unit.

3.4 GPS Timing

Last Delta Time: Internal hardware calibration value.
Long Counter Latched: Internal timing counter.

3.5 GPS Satellite Info

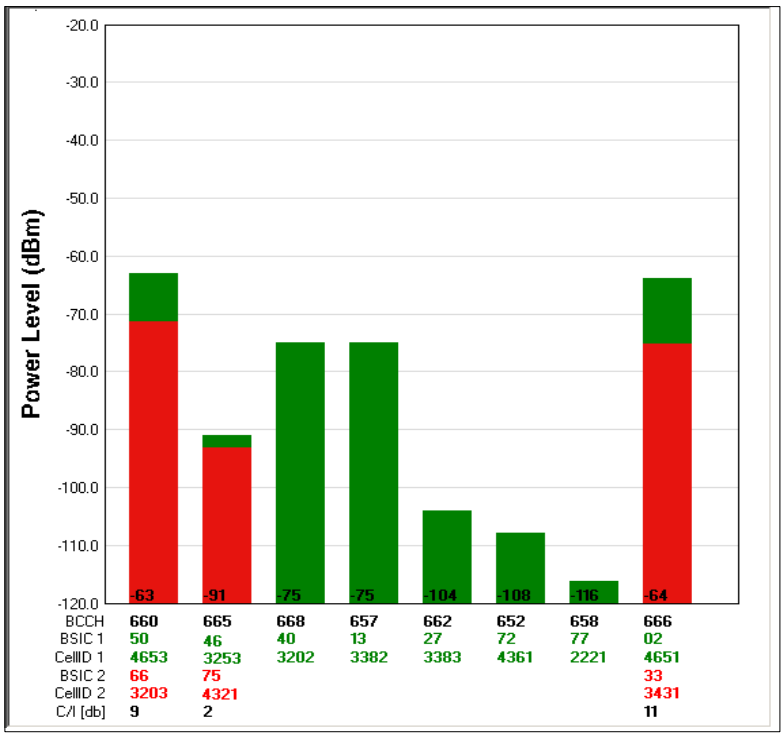
Satellites Visible: The number of satellites from which the WIND internal GPS is reading a signal.

Satellites Tracking: The number of satellites the WIND GPS is actively tracking to determine its position.

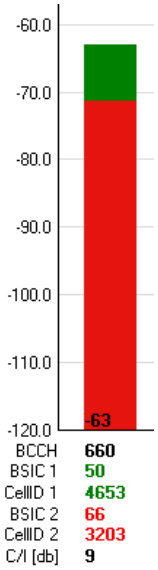
GPS Status: Reports the status of the GPS unit inside the WIND Catcher. There are only two values that will be displayed here "Not Locked" and "Locked". "Locked" means that the GPS has an accurate position because it has acquired a sufficient number of GPS satellites. When the status is "Not Locked" the GPS does not have an accurate position. It is strongly recommended to wait until GPS is "Locked" before starting a data collection file.

3.6 Real-Time Bar Graph

The Real-Time Bar Graph displays the power levels in dBm of the BCCH channels for the strongest eight sectors measured by the WIND Catcher.



The green bars show the power levels of each of the strongest sectors. If the WIND Catcher measures a second sector that reuses the same BCCH carrier frequency, then a red bar will show the power level of the interfering sector.



The number at the bottom of the column always displays the power level in dBm of the stronger of the two sectors (i.e. it refers to the power in the green column).

The WIND Catcher will often measure more than two cells using the same BCCH frequency, and that information is captured in the output file. However, the real-time display only shows the two strongest for each BCCH frequency.

Additional information for the measured sectoris available at the bottom of the graph. If the WIND Catcher decodes the BSIC or Cell ID for the strongest of the displayed sectors, that information is reported beneath the BCCH channel number as BSIC 1 and CellID 1.

BCCH	660	665	668	657	662
BSIC 1	50	46	40	13	27
CellID 1	4653	3253	3202	3382	3383
BSIC 2	66	75			
CellID 2	3203	4321			

If the WIND Catcher decodes the BSIC or Cell ID for an interfering sector, that information is reported as BSIC 2 and CellID 2.

For a displayed BCCH interferer, the difference in the power levels between it and the best server is reported in dB as the C/I.

C/I [db]	9	2

In order to ease visual inspection during drive-testing, the BCCH columns are not numerically sorted.