

GAZELLE

User's manual version 1.7



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INTRODUCTION

The Gazelle ships standard with the items shown and listed below. Check for each item as you unpack.



Figure 1. Unpacking your Gazelle

Items Supplied

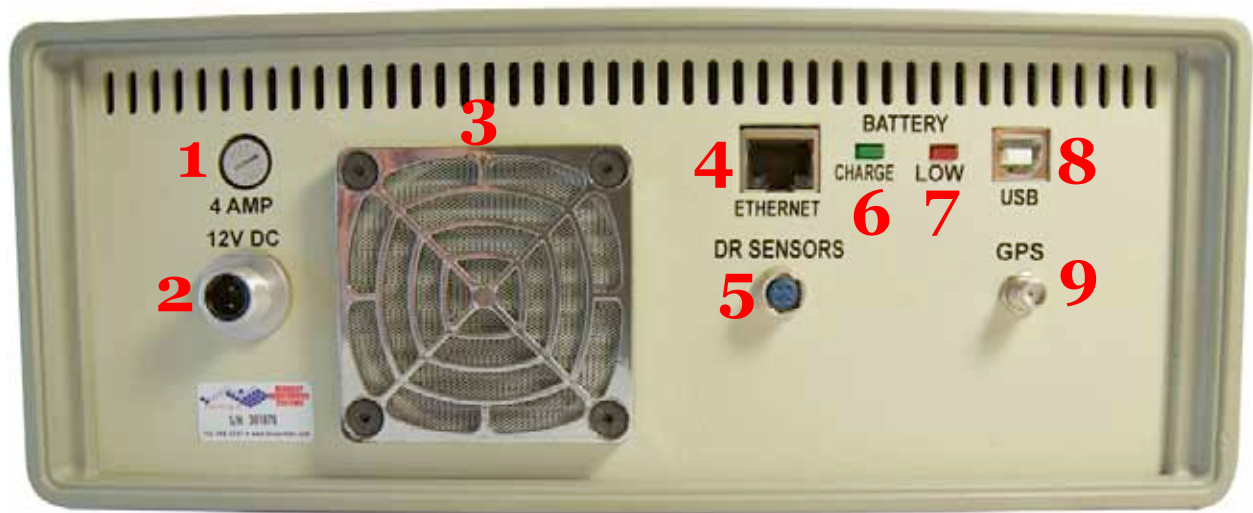
The Gazelle ships with the following items:

1. Receiver chassis
2. Removable receiver module(s) (installed in chassis) (frequencies must be specified by customer before shipping)
3. Power cable
4. AC power transformer
5. Antenna(s) (frequencies must be specified by customer before shipping)
6. USB flash drive with software and user's manual
7. Gazelle software (API OEM reference or BVS Gazelle Drive-Study Software)



Gazelle Front Panel

1. STBY (orange) LED
2. ON (green) LED
3. Power ON/OFF switch
4. REF OUT (not enabled)
5. Module Knob
6. Module SMA Antenna Connection Port
7. Module LED (red) Power Indicator



Gazelle Rear Panel

1. 4 AMP fuse
2. 12VDC power input
3. Exhaust fan
4. Ethernet connection port
5. DR Sensors
6. Battery Charging LED (green) indicator
7. Battery Low LED (red) indicator
8. USB port
9. GPS Antenna Input

POWERING UP GAZELLE

The Gazelle unit is powered via the DC input jack with the supplied DC power cable and transformer. ON/OFF switch powers up the chassis. Power to the chassis is indicated by the orange STBY LED on the left side. This means that continuous power is being fed to the chassis and the ON/OFF switch is ON. Only when there is a communication between the receiver module(s) and the PC software, does the green ON LED light. This green LED indicates communication to the receiver and must be lit in order to take measurements and log any data.



Receiver Modules

Gazelle allows for up to four removable receiver modules that may be swapped in and out at anytime by the user. Simply turn the silver knob to loosen the receiver module. Be sure to only pull on the handle at the bottom when removing or replacing the receiver module into the Gazelle.



Loosen knob before removing



Pull on handle to remove or replace module

Gazelle PC & OEM Software

If your Gazelle included BVS PC software on the included SD card, you can install that application and follow the directions in that installer from there.

If your Gazelle included an OEM API reference for developing custom Gazelle software, you should refer to that software on the SD card and the OEM user's manual (separate from this one) included with your Gazelle.

Typical Drive Study Setup

Gazelle is designed with mobile site surveys and drive study engineers in mind. Always follow local speed limits and be sure to bring along a passenger to operate the laptop while driving.



Connect to Gazelle via USB with any laptop.



Be sure not to crimp your antenna cables.



Always space your antennae away from each other.



Keep Gazelle on the floor of your vehicle.

GAZELLE Quad Modular Drive-Study Receiver System

SPECIFICATIONS:

Frequency Range:	120Mhz - 6000Mhz (CW only) Stock Sub Bands Receivers: 120-180Mhz, 12/6Khz IF BW 400-500Mhz, 12/6kHz IF BW 690-810Mhz, 12/6kHz IF BW 810-960Mhz, 12/6kHz IF BW
Frequency resolution:	250Hz
Frequency Accuracy:	±1.5ppm internal reference, Aging : ±1ppm per year
Dual Conversion	433Mhz first IF, 455kHz second IF
IF Bandwidth:	6Khz, 7.5Khz,10Khz, 12kHz, 15kHz, 20kHz, 25kHz, 30khz. Each Receiver has two IF filters, selectable
Sensitivity:	-120dBm for SNR 5dB and 12Khz IF BW
Phase Noise :	10Khz offset - 89dBc Typical 100kHz offset -115dBc Typical 1Mhz offset -125dBc Typical
Noise Figure:	7dB Typical for 12Khz IF BW and 5dB SNR
Image Rejection:	80dB Typical, 50dB min
Adj. Chan. Rejection:	50dB Typical, 40db min
Measurement Range:	-120dBm to -30dBm, 0.1dB Resolution
Accuracy:	± 1dB, -30dBm to -105dBm ± 1.5dB, -106dBm to -120dBm

RF Input:	SMA 50 Ohms, 1.8:1 VSWR max.
Maximum RF Input without Damage:	+13dBm
LO level at RF Input:	-70dBm maximum
Operating Temperature:	-5°C to 45°C
Relative Humidity:	Up to 90%, Non Condensing
Remote Interface:	USB Port, RJ-45
GPS Receiver:	Internal 12-Channels
Power:	External 12-16 VDC@5000mA
Weight:	9lbs. fully loaded
Dimensions:	4"H x 10" W x 12" L

INCLUDES

Antenna:	SMA (50 Ohms)
DC Power Supply:	12VDC@5A
PC Software:	Gazelle Control PC Software

GAZELLE PC SOFTWARE

Introduction

The BVS Gazelle is a continuous wave receiver. The Gazelle can scan up to 4 channels at high speed per receiver module. Up to 4 receiver modules can be installed in the Gazelle hardware.

The Gazelle is controlled by remote application software running on a computer with Windows Vista or 7 as the operating system. This connection is made via USB.

Minimum Software Requirements

Operating System:	Windows Vista / Windows 7
RAM:	3 GB
Processor:	Core 2 Duo
Processor Speed:	2.2 GHz
Hard Drive Space:	256 MB for application installation
Monitor Resolution:	1680 x 1050 (recommended)

Installation

The Gazelle application software is shipped on a secure digital (SD) card. Simply run the “.msi” file in the root directory of the SD card to begin installation.

Once installation is complete, there will be a shortcut to the Gazelle application on the Windows desktop.

Getting Started

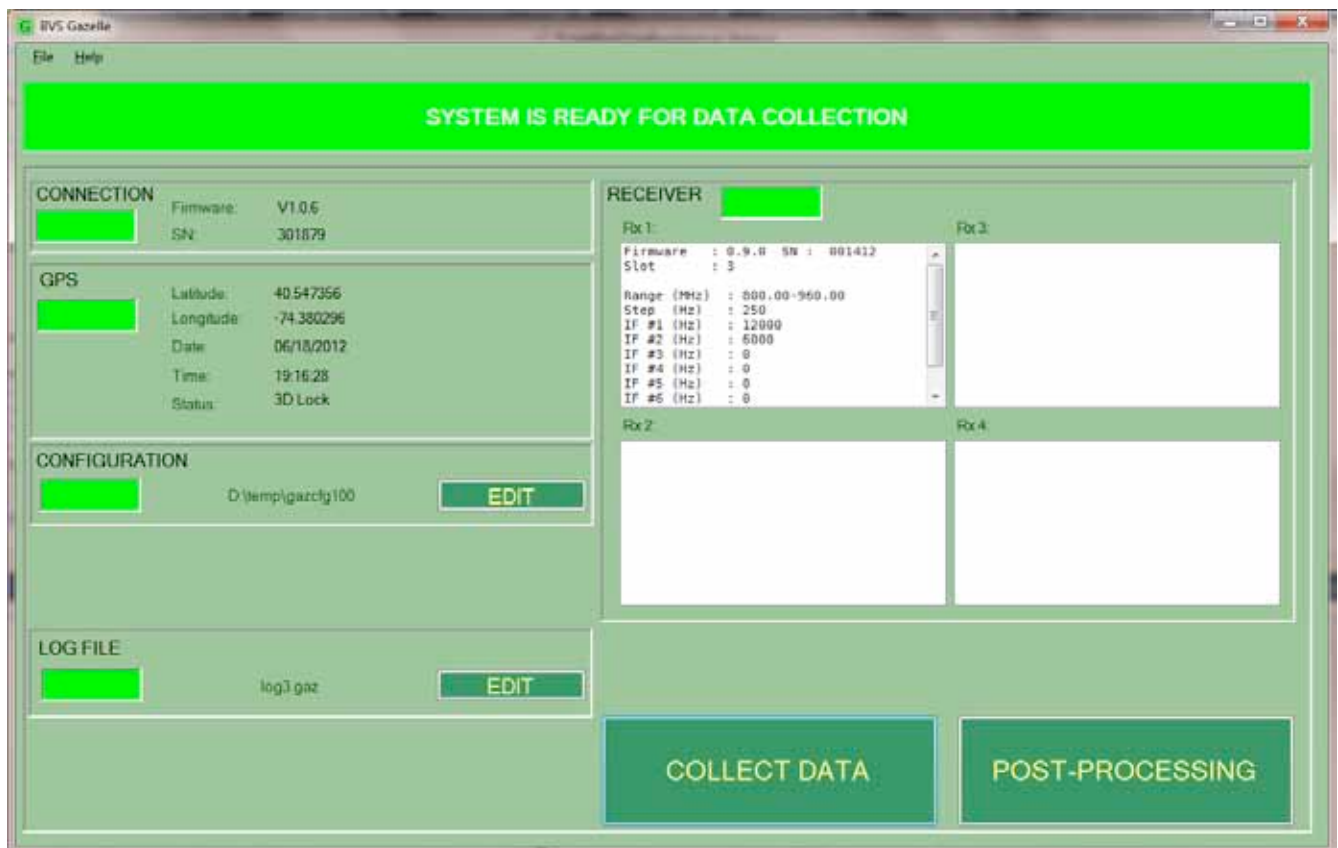
Before using the Gazelle PC software, ensure that the device is connected properly. The Gazelle is connected to the PC via a USB cable. The power cable should be fastened and plugged into a wall outlet. The GPS antenna which came with the Gazelle should be connected and placed in an area which will be able to see a good portion of the sky. This will enable the GPS receiver built in to the unit to receive data from the greatest number of GPS satellites.

Finally, the RF antenna to be used for measurements should be connected to the appropriate connector on the Gazelle for each receiver.

When everything is connected, turn on the Gazelle. The PC will ask for a USB driver. Use the one provided on the SD card.

After the driver has been installed, start the Gazelle application. The main screen should be displayed along with information on the Gazelle hardware and receivers installed.

As can be seen from the figure below, the information for each receiver installed appears in its own list box on the right-hand side. Information such as the frequency range, step size and available IF bandwidths will be shown.



GAZELLE MAIN SCREEN

There will be a message at the top of the screen that display whether or not the system is ready for data collection. The system is not ready unless:

- A valid connection to the device is made.
- A scan configuration has been chosen to load into the receivers.
- GPS position lock has been obtained.
- A log file has been chosen to store the scan data.

Post-processing of data already collected does not require the system to be ready for data collection and can be accessed at any time.

The following sections describe setting up a configuration, logging a file, collecting the data, and post-processing the data.

Configuration

Each receiver must be configured prior to initiating a scanning session. Each receiver may have up to 4 channels configured at any time.

DEVICE CONFIGURATION

To load or create a configuration, press EDIT from the configuration box on the main screen. The device configuration box screen appears with information on

the currently selected configuration and all of the parameters for each channel on each receiver.

The configuration shown is the last configuration work on while in the application. A configuration can be saved or loaded using the SAVE/LOAD buttons on this screen.

G Device Configuration

GAZELLE SCAN CONFIGURATION

Firmware : 0.9.0 SN: 001412
Slot : 3

Maximum Vehicle Speed = 60 MPH
Effective Sampling Rate = 1000 samples/second
Channel 1 : 800.0000 MHz Temporal Sampling Req: 250samples/sec
Channel 2 : 800.0000 MHz Temporal Sampling Req: 250samples/sec
Channel 3 : 800.0000 MHz Temporal Sampling Req: 250samples/sec
Channel 4 : 800.0000 MHz Temporal Sampling Req: 250samples/sec

Range (MHz) : 800.00-960.00
Step (Hz) : 250

EDIT

Configuration Title : Gazelle |

LOAD

SAVE

DONE

DEVICE CONFIGURATION SCREEN

The title of the configuration is shown on the bottom of the screen. In each receiver panel, the channels selected are shown along with the scan type and requested samples/second. The maximum speed and IF bandwidth for the receiver is shown. The calculated scan rate for the receiver is also shown based on the requested rates for each of the channels.

To edit the configuration for any receiver, choose the EDIT button in the appropriate receiver panel.

RECEIVER CONFIGURATION

The receiver configuration screen again shows all of the channels currently selected. If less than four channels are selected the remaining channels are blanked out. In this screen, the maximum speed that the vehicle will be driving during this session is to be entered. This number is used in calculations for the sampling rate needed for spatial sampling.

The IF bandwidth for the receiver is also selected and will be used for every channel being scanned. The effective sampling rate is the calculated rate needed to meet the requirements of each channel. If the requirements exceed the capabilities of the receiver, the number will be reduced.

Receiver Configuration

Rx # 1 , Slot # 1 , Range : 800.00-960.00 MHz

	Frequency (MHz)	Processing Type	Rate Requested samples/sec	
1	850.0000	Temporal Sampling	250	Add Edit Clear
2	800.0000	Uniform Spatial Sampling	54	Add Edit Clear
3				Add Edit Clear
4				Add Edit Clear

Maximum Vehicle Speed ☒ MPH ☐ KM/H

Effective Sampling Rate samples / sec / channel

IF Bandwidth - Hz

RECEIVER CONFIGURATION SCREEN

Choose the ADD button on a channel line to add a channel to the configuration. Choose DELETE to remove a channel from the configuration. Choose EDIT to edit the existing channel configuration.

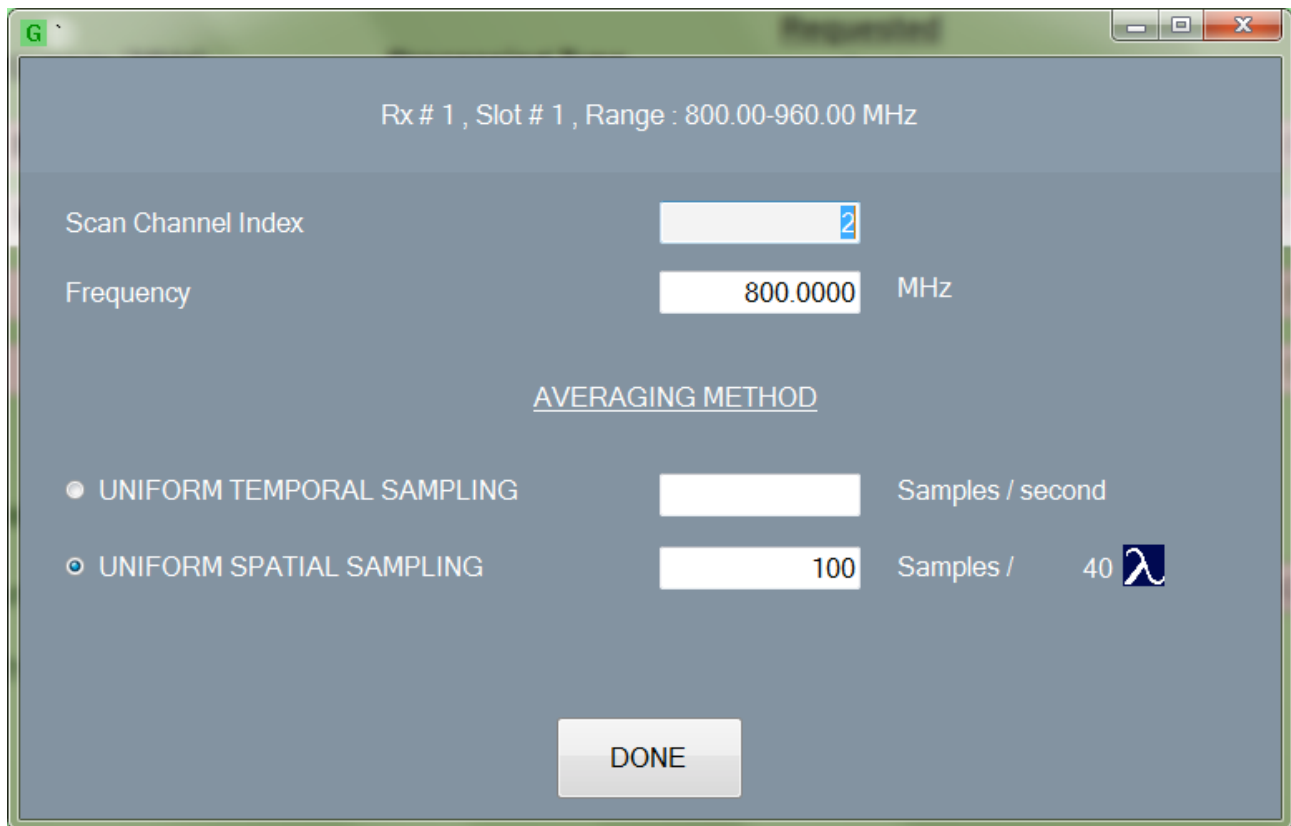
CHANNEL CONFIGURATION

The channel configuration screen allows the user to select parameters for a particular channel on the selected receiver. These parameters include the frequency of the channel in MHz (within range of receiver).

Also, the averaging method may be selected. There are two types of averaging available. With uniform temporal sampling, the samples are distributed evenly over time. Simply choose the number of samples/second desired. This rate will be used if it is below the maximum sampling rate for the receiver.

Uniform spatial sampling will provide a certain number of samples over a given distance. This distance is based on the frequency of the channel. The distance is the number of wavelength (λ s) requested.

The various options are shown in the following snapshot.



Rx # 1 , Slot # 1 , Range : 800.00-960.00 MHz

Scan Channel Index

Frequency MHz

AVERAGING METHOD

☐ UNIFORM TEMPORAL SAMPLING Samples / second

☒ UNIFORM SPATIAL SAMPLING Samples / 40 

CHANNEL CONFIGURATION SCREEN

After these parameters have been entered, pressing DONE saves the settings and returns to the receiver configuration screen.

Log File

A log file is chosen by simply choosing the EDIT button in the log file section of the main screen. This file will be created if it does not exist and appended to if it does exist.

All information needed for later processing of the data will be contained in this file.

Data Collection

When the main screen says that the system is ready for data collection, press on the COLLECT DATA button to get to the collection screen.

The collection screen has “LED” indicators for the connection, GPS lock, reception of packets from the CW receivers, and entry of data into the log file.

To start data collection, press the START button. You will see the CW and LOG LED's begin to blink after a few seconds. This indicates the reception of packets and the logging of data into the selected file.

There will be up to 4 display windows shown (one for every receiver installed). To zoom in on a particular receiver, double-click on the window for that receiver. To zoom back out to all receivers, simply double-click again.

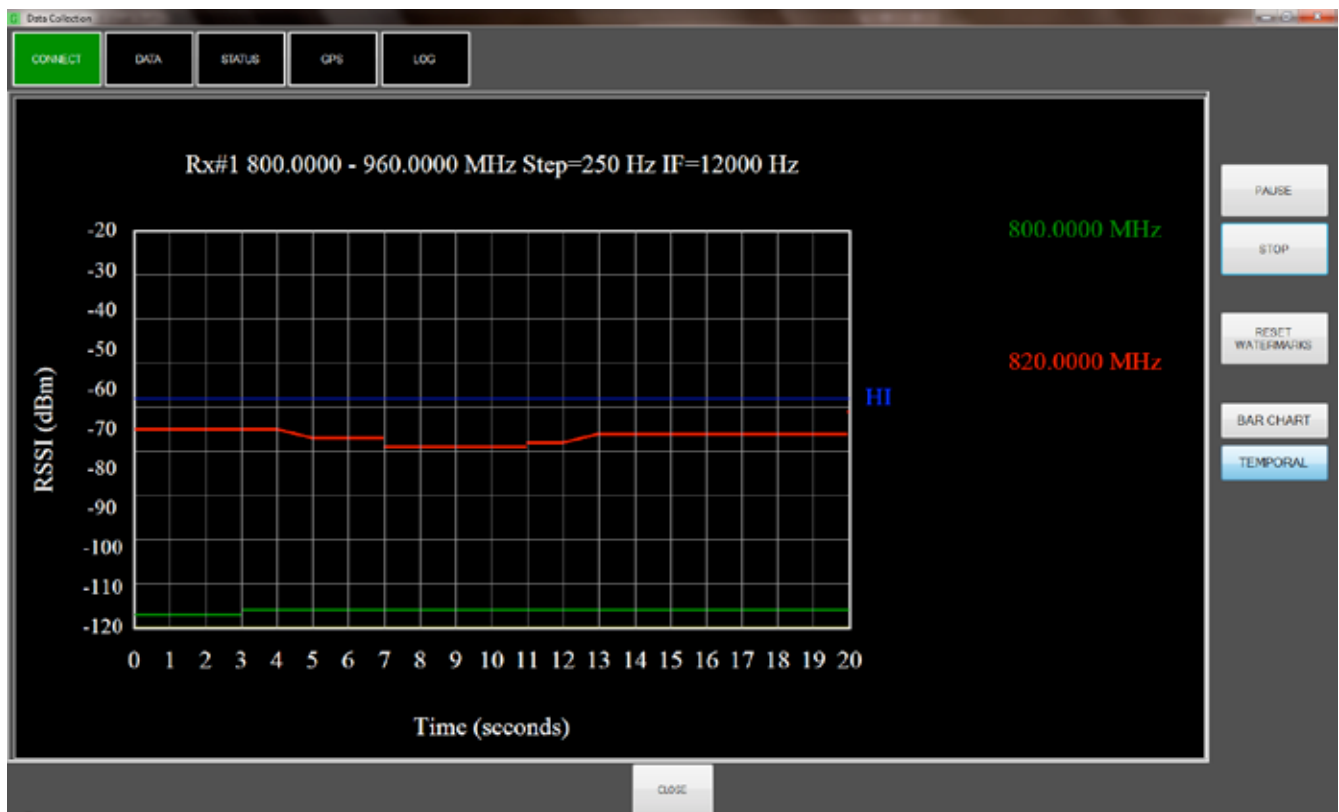
There will be an individual bar for every channel configured. The value of the bar will fluctuate depending on incoming RSSI values. The samples received in a packet are averaged together for display purposes so there should appear to be one update per second or two.

There will be a watermark marker which shows the highest reading shown since the last reset. To reset the watermarks, press the RESET WATERMARK button.

To pause the data collection press PAUSE. To stop the data collection press STOP. Pausing the data means that the configuration information will not be re-sent when resuming the collection of data.



DATA COLLECTION SCREEN



DATA COLLECTION TEMPORAL DISPLAY

Data Processing

To process data collected during a scan session, choose the post-processing button from the main screen. Here there is a straightforward dump to ASCII. Simply choose the log file to convert, choose the fields to convert, choose the receiver data to convert, choose the delimiter, and choose whether certain fields will use English or Metric units.

Also choose whether the output will be standard ASCII or a custom format such as EDX, iBwave, or BVS Forecaster.

Then hit the convert button and the data will be outputted to the output file chosen.

There are also choices for standard averaging and 40 lambda averaging. Standard averaging will average all of the samples per second into one output per second. The average fields such as mean and median are then available for output. The same is true with 40 lambda averaging. Here, if spatial mode was selected when starting a log session, data would be post-processed accordingly.

The average fields such as median and mean are not available when no averaging is selected.

Forty lambda processing is the standard for estimating the mean RF signal strength in the presence of Rayleigh fading. The Gazelle has a spacial sampling mode to support forty lambda processing and post-processing software to implement the forty lambda averaging.

In the spacial sampling mode, the user selects the number of samples required per forty wavelengths. This selection determines the confidence interval for the final forty lambda averages. The spacial sampling distance (d) is 40 wavelengths divided by N . For drive speeds greater than 1 m/s, the Gazelle records one sample every distance d . For speeds less than 1 m/s, the no data is output to prevent the GPS jitter from falsely accumulating as drive distance. These evenly spaced samples are then post-processed to provide data averaged over forty lambda.

Process Data

INPUT FILE:

OUTPUT FOLDER:

Available Fields ☒ Include a Header Record **Selected Fields**

Available Fields	Selected Fields
Record Number	Record Number
GPS Date (MM/DD/YYYY)	GPS Latitude (Decimal Degrees)
GPS Time (HH:MM:SS)	GPS Longitude (Decimal Degrees)
GPS Latitude (Decimal Degrees)	GPS Time (HH:MM:SS)
GPS Longitude (Decimal Degrees)	Receiver Number
GPS Altitude	Channel Index
GPS Lock Status	Distance
Receiver Number	Number of Samples
Channel Index	Median (dBm)
Number of Samples	Standard Deviation (dBm)
Processing Type	Mean (dBm)
Frequency (MHz)	dB Mean (dBm)
RSSI (dBm)	Minimum (dBm)
Median (dBm)	Maximum (dBm)

☐ File Split at records.

Output Format: ☒ Standard ASCII ☐ EDX

File Status: Input Bytes:

Averaging: ☐ None ☒ Standard ☐ 40 Lambda

Delimiter: ☐ Comma ☒ Tab ☐ Space ☐ Semicolon ☐ None

Units: ☒ English ☐ Metric

DATA PROCESSING SCREEN

Custom Gazelle RX 2300 - 2400 MHz Specifications (addendum)



SPECIFICATIONS:

- **Frequency Range:** 2300Mhz - 2400Mhz, 1650Mhz IF BW (CW only)
- **Frequency resolution:** 250Hz
- **Frequency Accuracy:** ± 1.5 ppm internal reference, Aging : ± 1 ppm per year
- **Dual Conversion** 465Mhz first IF, 70MHz second IF
- **IF Bandwidth:** 1650kHz
- **Sensitivity:** -100dBm for SNR 5dB and 1650Khz IF BW
- **Phase Noise :**
 - 10Khz offset - 82dBc Typical
 - 100kHz offset -110dBc Typical
 - 1Mhz offset -121dBc Typical

- **Noise Figure:** 7dB Typical for 1650Khz IF BW, 5dB SNR(CW only)
- **Image Rejection:** 80dB Typical, 50dB min
- **Adj. Chan. Rejection:** 40dB Typical, 35db min
- **Measurement Range:** -100dBm to -30dBm, 0.1dB Resolution
- **Accuracy:** $\pm 1\text{dB}$, -30dBm to -80dBm
 $\pm 1.5\text{dB}$, -81dBm to -100dBm
- **RF Input:** SMA 50 Ohms, 1.8:1 VSWR max.
- **Maximum RF Input without Damage:** +13dBm
- **LO level at RF Input:** -70dBm maximum
- **Operating Temperature:** -5°C to 45°C
- **Relative Humidity:** Up to 90%, Non Condensing
- **Remote Interface:** USB Port, RJ-45
- **GPS Receiver:** Internal 12-Channels
- **Power:** External 12-16 VDC@5000mA
- **Weight:** 9lbs. fully loaded
- **Dimensions:** 4"H x 10" W x 12" L

INCLUDES

- **Antenna:** SMA (50 Ohms)
- **DC Power Supply:** 12VDC@5A
- **PC Software:** Windows 7