

Consultix PathFinder CW Receiver

User Manual





Copyright©2022 Consultix

All Rights Reserved

No part of this manual may be produced or transmitted in any form or by any means without prior written consent of Consultix.

Trademarks

Consultix is a trademark of Consultix Company. All other trademarks mentioned in this manual are the property of their respective holders.

Notice

The information in this manual is subjected to be changed without notice. Every effort has been made in the preparation of this manual to ensure the accuracy of the contents, but all statements, information and recommendations in this manual do not constitute the warranty of any kind, expressed or implied.

Building 57, Zone 2, District 6, El-Teseen St.,11835, New Cairo City, Cairo, Egypt.
☎ +20 225647370 info@consultix-egypt.com

w w w . c o n s u l t i x - e g y p t . c o m

Table of Contents

Table of Contents	3
Introduction	4
Overview	4
Key Features.....	4
Safety Compliances & Precautions	5
Getting Started.....	6
Package contents.....	6
PathFinder Front Panel	7
Technical Background	8
Lee Criteria Theory.....	8
Device Configuration	9
Configuration	9
Steps of Operation	10
WalkView™ Averaging Process	11
Examples.....	11
Guidelines for CW Measurement Surveys.....	12
Odometer interface option (PIN assignment)	12

Introduction

Overview

The PathFinder™ is Consultix supreme receiver which presents unparalleled performance when it comes to outdoor measurements.

The compact battery-operated device is engineered particularly for outdoor CW drive-test applications and RF environment scanning. Hence, the instrument is designed to deliver very high sampling speeds with superior immunity to interference in crowded RF ambiance.

The receiver is supported by the company's WALKVIEW™ data collection applications to automatically test & scan multiple CW signals. Its sampling speed allows scanning multiple bands in parallel while coping with the $40\text{-}\lambda$ Lee Criteria.

The test results including RSSI levels & location information are mapped on the software and can be archived or exported into a variety of radio planning software tools.

This instrument comes in 2 variances; either multi-band single-port or multi-band dual-port. And both versions have optional odometer interface for the utmost distance sampling accuracy.

You no longer have to bring a complex scanner with a bulky setup on-site when performing outdoor CW testing.

The Pathfinder together with its WalkView™ android App allow you to view live measurements, plot RSSI levels on google maps or export all data samples with geo-tags to your radio planning software of choice... all from the comfort of your tablet.

Alternatively, you can use the Walkview Windows version when performing multi-band scanning for higher efficiency.

Key Features

- Frequency Range: 200 MHz to 3900 MHz
- Amplitude Accuracy: ± 1.5 dB
- $40\text{-}\lambda$ Lee Criteria Conformance: Up to 550 samples/second
- Multi-Channel Scanning up to 12 Channels
- Distance Sampling Mode with Wheel Trigger Support
- Extreme rejection of interference



Safety Compliances & Precautions

In order to avoid damage to your receiver and to ensure efficient operation of your test receiver, please make sure to follow the following recommendations and best practices:

- A. To avoid hazard or damage, only use original accessories with the receiver.
- B. Don't touch the antenna during operation as it may alter the radiation pattern.
- C. Do not operate in Wet/Very Damp Conditions.
- D. Do not operate near **flammable** or explosive materials.
- E. If you suspect there is damage to this product, have it inspected only by **authorized** service personnel or service centers.
- F. For best accuracy,
 - Warm up the unit for 20 minutes prior to use
 - Having the battery always full gives the best performance. So, try to keep the device usually connected to the car charger.

Getting Started

Package contents

Please unpack and inspect the shipping package to make sure that you have received all the parts without damage; the shipping package is shown in **table 1**.





<p>Receiver</p>	
<p>12 VDC Power Adapter</p>	
<p>Documentation CD</p>	
<p>USB mini-B Cable</p>	

Table 1: PathFinder Receiver Packing List

For any issue regarding the shipment package, please contact your nearest Consultix distributor or contact us directly at support@consultixwireless.com

PathFinder Front Panel



Technical Background

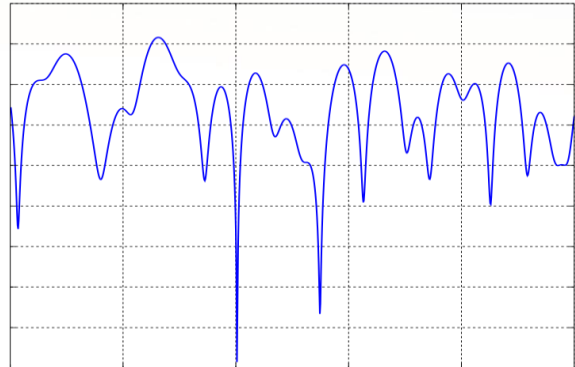
Consultix Pathfinder captures and samples at 550 Samples/Second which is more than enough to satisfy Lee's Criteria (Minimum 36 samples/distance of 40 Lambda) for any practical frequency and vehicle speed Combination in single channel mode. In this document, we will outline the sampling & averaging mechanism of Consultix WalkView™ SW along with CW Receiver

Lee Criteria Theory

Fading is a natural phenomenon that causes variations in received signal level, fading occurs due to changes in the transmission channel or propagation paths.

There are two types of fading:

- Slow fading (also called large scale fading or terrain based fading) which is due to path-loss and shadowing effects. This is the parameter that we're ultimately looking to characterize here.
- Fast fading (or Rayleigh fading) which causes rapid (hence fast) variations of the received signal strength over short distance and short time periods (this is the component that we seek to filter out in order to accurately measure the path loss)



To avoid the effects of fast fading, William C. Lee proposed a method for obtaining the local mean values of the received signal along a route, this method has since been recommended and adopted by ITU and CEPT among others. It is based on an averaging process (commonly referred to as 40 Lambda averaging) applied to the envelope of the received signal.

Simply put, a number of samples (N) collected along the route over a certain distance (L) are all averaged together to produce a single point. The number of samples (N) and the distance (L) are essential parameters to ensure that the averaged value:

- Filters out fast fading effects
- Remain, representative of the real signal / within acceptable error limits

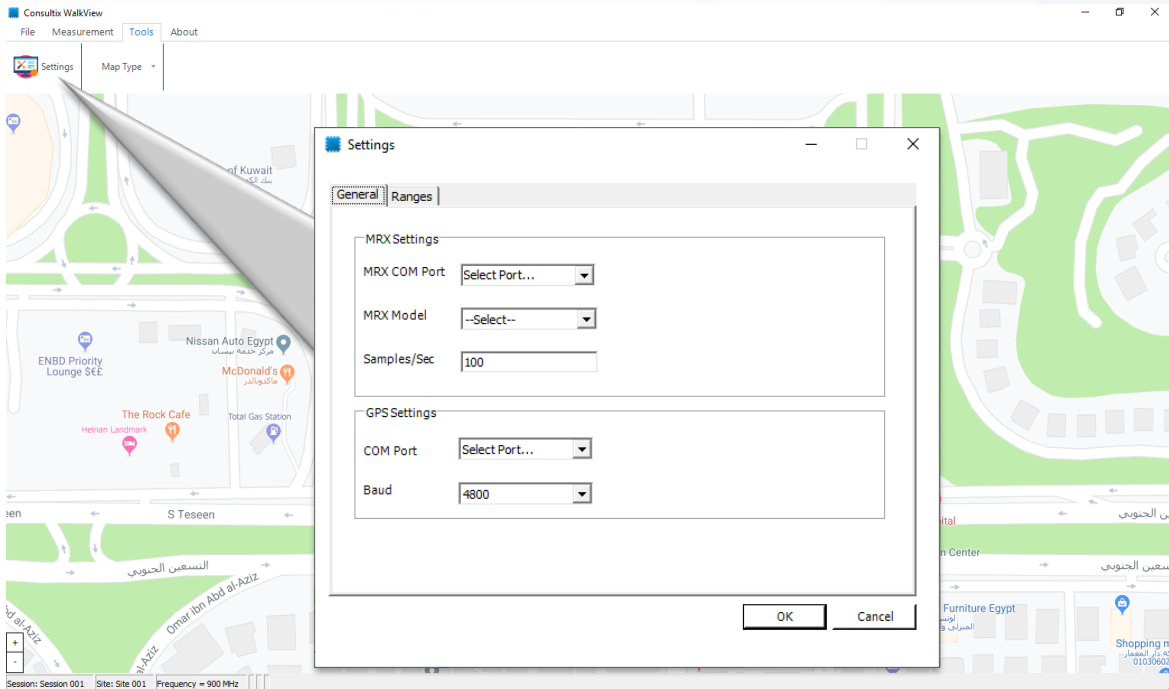
Lee obtained the values of the parameters as follows:

- Distance $L = 40 \times \text{Wavelengths (40 Lambdas)}$
- $N = 36\text{-}50$ points

In other words, in order to remove the effects of fast fading in compliance with Lee's criteria your receiver must be capable of collecting a minimum of 36-50 points in the time, it takes the test car to cover a distance of 40 lambdas. Then, all the samples belonging to this 40 lambda distance are averaged together to produce a single point.

Device Configuration

1. Connect the PathFinder receiver with a Mini USB-B cable
2. Click on the desktop shortcut Consultix WalkView
3. Connect the GPS receiver
4. Navigate to the **Tools** menu and press **Settings** menu



5. Under **General** submenu adjust the following:
 - a- Select MRX-Pro COM Port according to your computer device manager
 - b- Select the hardware model to be PathFinder
 - c- Set device sampling speed to any value between 100 to 600 Samples/Second according to your operating frequency and driving speed
Note: the sampling speed should be calculated carefully to match Lee criteria. you may set this value to 250 Sample/Second, this will comply with Lee criteria with a car speed up to 90Kmph and up to 3GHz
 - d- Select GPS COM port and Baud Rate
Note: that WalkView is compatible with GPS receivers operating with NMEA standard only.

Configuration

The PathFinder receives these configurations from the WalkView software before session start

- Operating Frequency
- Sampling rate
- No f channels
- Operating port for each channel

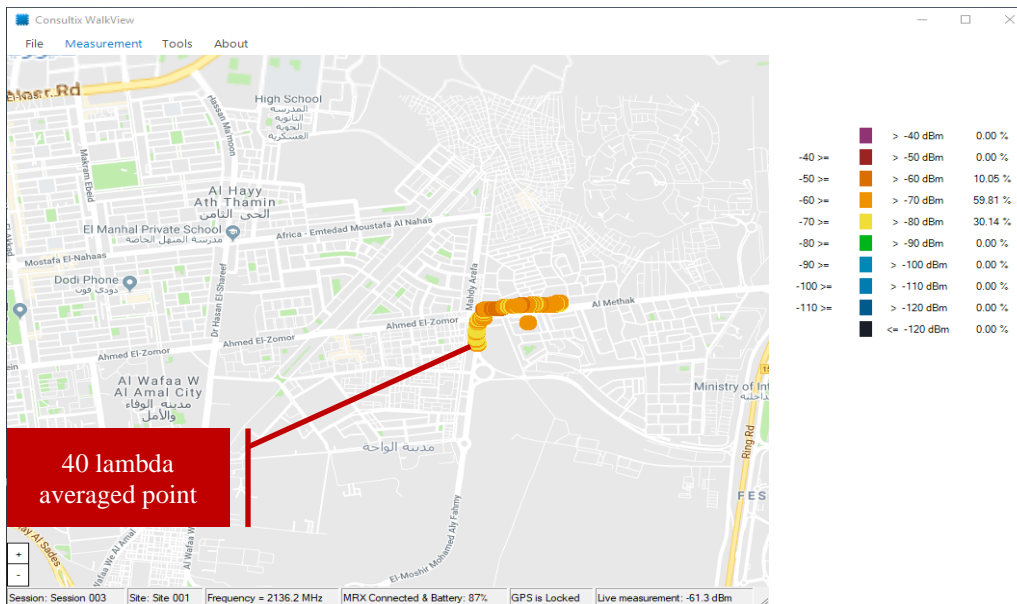
The MRX includes high speed core that can duel between all configured channels while conserving the configured sampling rate, configured sampling rate is divided equally on selected channels, i.e. when the MRX is working with 600 samples/second on two channels then every channel will be sampled with 300 samples/second.

Steps of Operation

Once Consultix receiver is commanded by the WalkView application to start operation, the receiver autonomously collects and sends samples to the software. All collected samples are stored along with GPS coordinates and timestamp in a raw data file. If the car stopped moving (Speed = 0) anytime, the SW would command the receiver to stop measurements, this guarantee that your raw data file size is not filled with static useless measurements.

According to Lee Criteria, every 40 wavelengths, WalkView SW plots one point on the map with the average of all samples collected within this distance and stores the original (raw) RF samples to the raw datafile.

RAW data files are saved automatically to the Android device, while the user still can export average points plotted on the map to an average data file with different file format such as a CSV format, ASSET format, or Planet format.



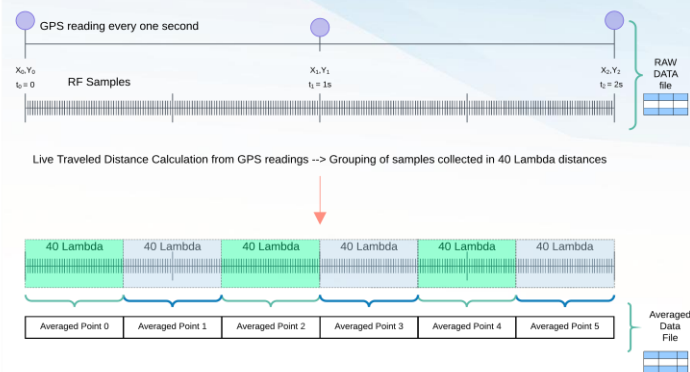
Averaged data file



RAW data file

WalkView™ Averaging Process

The GPS Receiver reports the location every 1 second, then the application records RF samples with GPS Readings and stores it in the raw data file, the WalkView™ SW performs live distance calculation from the GPS readings then groups the collected RF samples into blocks corresponding to 40 lambda distances



The block size and number of samples in each block, will vary depending on the sampling rate and driving speed, also number of blocks vary with the distance traveled during every GPS report, Samples corresponding to each 40 Lambda distance is then averaged to one point then presented as one point on the map, Optionally the user can export presented points to averaged data file

Examples

Assuming a CW drive test with the following configuration,

RX Frequency = 2140 MHz

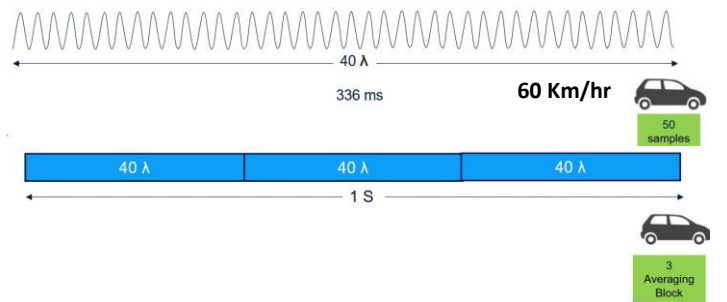
Lambda = 14 cm

40 Lambda = 5.6m

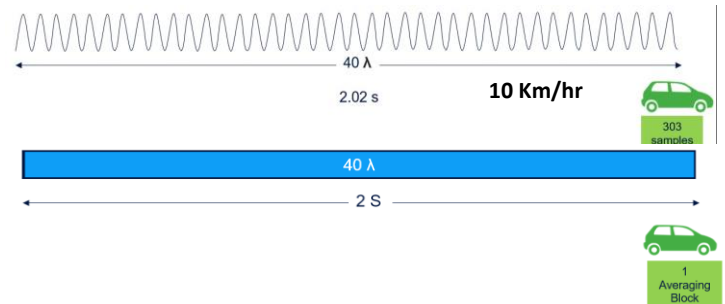
RF Sampling Rate = 150 samples/second

Ex. 1: with a car speed of 60 Km/hr, the car will finish a distance of 40 lambda (5.6 m) in 336 ms and WalkView™ SW gets 50 samples.

The application then will have 3 x (40 lambda) blocks between every 2 GPS reports (1 second). Samples corresponding to each block will be averaged and presented as one point on the map - this is done assuming a constant velocity during the one second GPS reporting interval.



Ex. 2: with a car speed of 10 Km/hr, the car will finish a distance of 40 lambda (5.6 m) in 2.02 s and WalkView™ SW gets 303 samples, this happens after 2 GPS reports, and after this period the WalkView™ SW will average all samples corresponding to this block (2.02 seconds and 303 samples) as one point presented on the map



Guidelines for CW Measurement Surveys

- Inaccurate measurements → inaccurate calibration → inaccurate model
- The area under test must be scanned against interference exists
- Selected frequency must have a clearance of 400kHz from radio interference
- Measurement surveys should be obtained for distances up to 10km (or until the noise floor of the receiver has been reached).
- Equal number of samples should be conducted near as well as far from the transmitter
- CW measurement surveys should be well documented with a 'Station Measurement Form' (position, antenna height, transmit power, gains and losses)

Odometer interface option (PIN assignment)

Pin 1 Red =====> +5V VCC

Pin 2 Black =====> Ground

Pin 3 Green =====> Data



Further Help

- For any support inquiry, kindly contact:

Support: support@consultixwireless.com

Or contact our distributor covering your region (check www.consultixwireless.com)

- For any information about prices, specifications, future developments, recommendations, customizations, or general question, kindly contact:

Sales: sales@consultixwireless.com



Building 57, Zone 2, District 6, El-Teseen St.,11835, New Cairo City, Cairo, Egypt.
☎ +20 225647370 info@consultix-egypt.com