

CatchAll-SE Ultrafast Wideband Receiver

Overview

The CatchAll-SE receiver is a sophisticated measurement tool for the verification and optimisation of wireless networks, such as TETRA, Tetrapol and GSM both in walk-test and drive-test modes. As a standard offering it is a feature packed drive-test tool.

Unlike conventional scanning receivers the CatchAll-SE receiver uses an instantaneous sampling technique to yield a detailed picture of the radio frequency activity over a wide frequency band. This, in combination with the positional information from the integrated GPS receiver and wheel-pulse inputs makes the CatchAll-SE receiver a powerful network analysis tool.

Furthermore, the CatchAll-SE receiver can be upgraded in the field to support new features, as and when they become available or can be integrated directly into the CRIBSTM walk-test turnkey solution complete with a dedicated tablet PC, power source and rucksack for ease of carrying.

As standard, CatchAll-SE receiver is controlled by a laptop PC (not supplied) via a universal serial bus (USB) link. It is supplied complete with all the software needed to control the receiver and capture the data in GPS mode. An optional upgrade enables the import of building plans, the use of waypoints and the in-built accelerometer to provide better data when the unit is used for walk-testing.

No Scan List Required

Conventional scanning receivers operate by tuning a narrowband receiver to each carrier frequency in turn to measure the signal strength on a selected list of carriers. This re-tuning typically limits the rate at which channels can be scanned to less than 100 channels per second, and if fast fading is averaged, to less than five channels per second. This means that the scan list must be chosen carefully, and it may be necessary to update this list during a measurement run.

Furthermore, if it becomes apparent that measurements are required on additional frequencies that were not included in the initial scan list, then new measurement runs will be required.

MAC Ltd's CatchAll-SE receiver uses a wideband receiver and a state-of-the-art analogue-to-digital converter (ADC) to capture an instantaneous bandwidth of 5 MHz.

The CatchAll-SE receiver

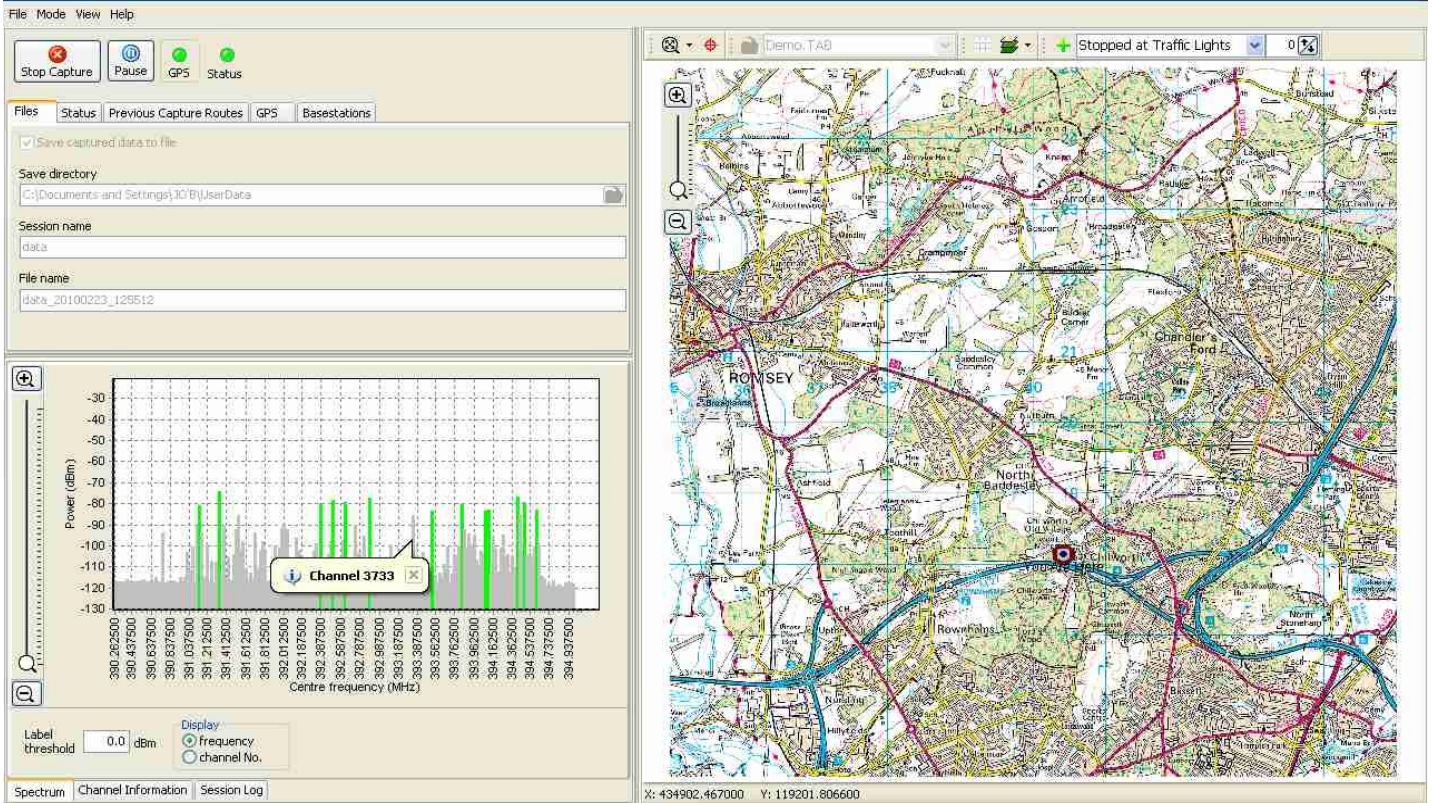


Depending upon the mode of operation, this band can be sampled at up to 125 times per second, and with this sampling rate the CatchAll-SE receiver can accommodate an effective scan list size of 200 TETRA or 400 Tetrapol carriers, thereby eliminating the need to carefully design the scan list prior to each measurement run and also removing any requirement to update the scan list during a measurement run.

Features

- Ultrafast sampling
- Captures up to 5 MHz instantaneously (20 MHz on request only)
- Frequency ranges: 380 - 480 MHz
805 - 860 MHz
Other ranges available
- Integrated GPS receiver
- Lee Criterion scanning
- Drive-test and optional walk-test modes
- Data captured for analysis by TRAMPSTM or suitable data-base programs
- Wheel-pulse input to measure distance travelled without GPS
- 3-axis accelerometer for use in walk-test/waypoint mode

An intuitive user interface makes the CatchAll receiver straightforward to use



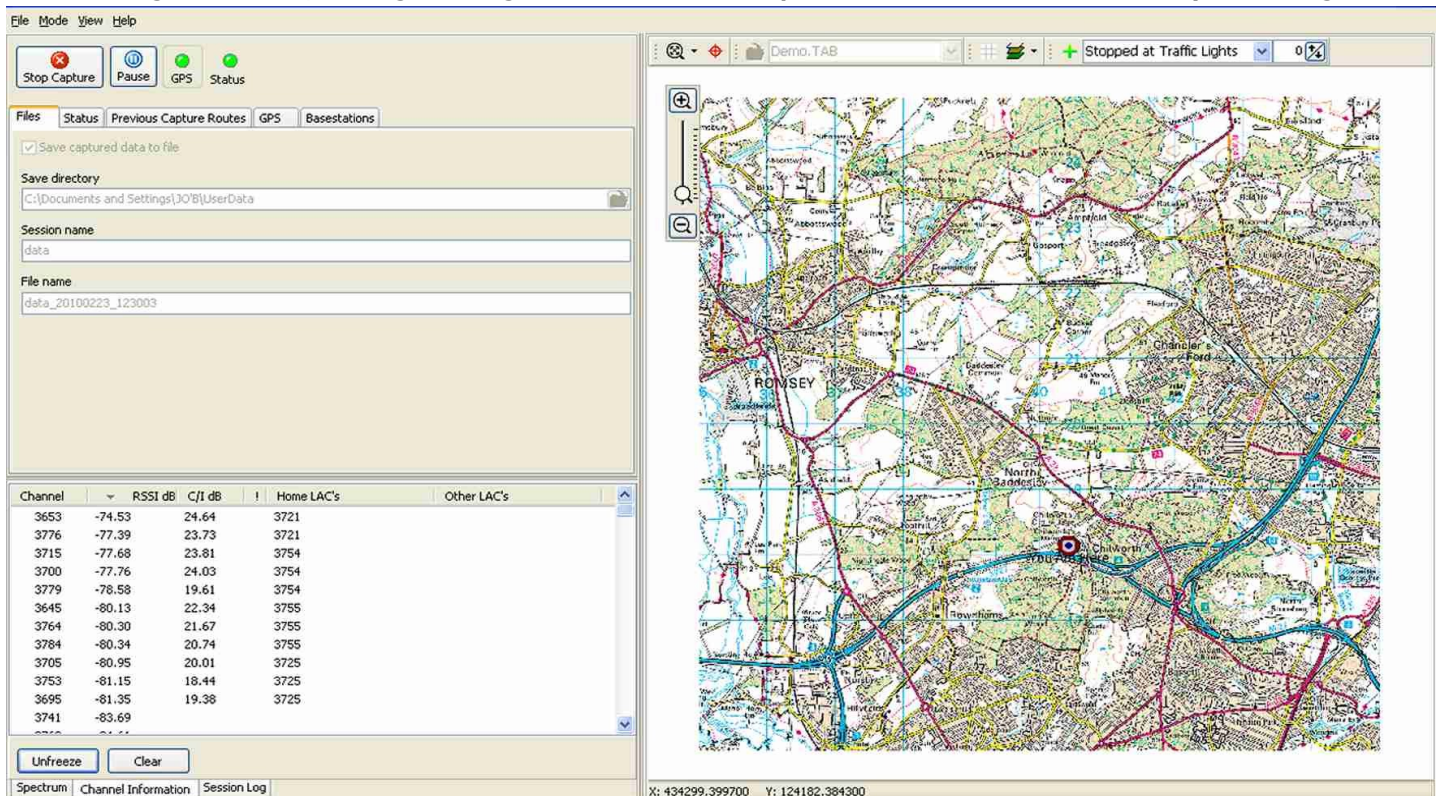
Spectrum and Selected Channel Displays

The CatchAll-SE receiver requires no user operation while it is gathering data, although the PC collecting the data samples provides a "spectrum analyser" type display in real-time and a channel information display. If the CatchAll receiver is operational but data are not being stored, the spectrum analyser-type information is displayed in red. The PC can only commence storing the data to its hard disk when the GPS is

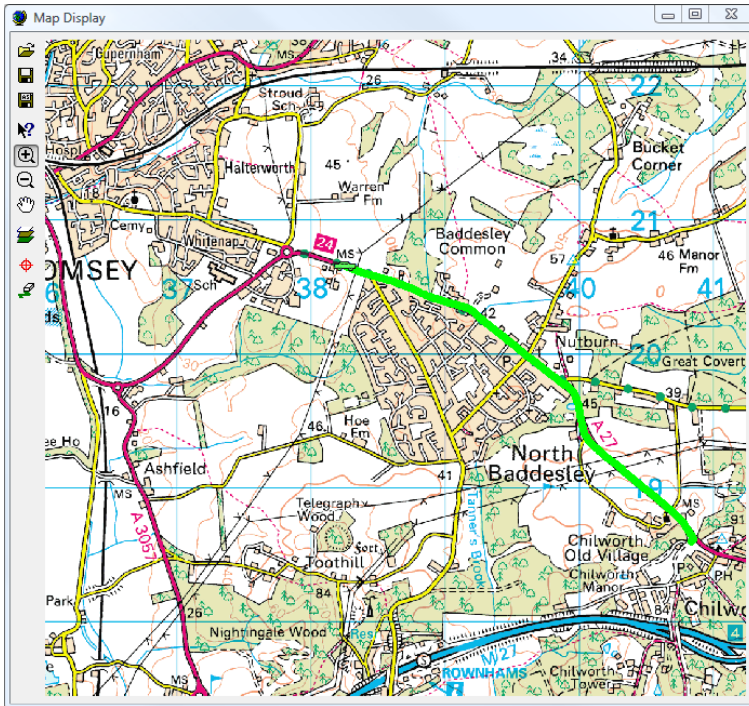
locked, this is indicated by the green button.

With the map display enabled the position of the equipment can be tracked along the test route. If no map is available a simple substitute grid enables the route to be traced. Previously driven routes can be "saved" and re-displayed by means of the "Previous Capture Routes" tab to assist in identifying routes which are still to be driven.

An example of the channel information display produced while the CatchAll receiver is capturing data. The display is showing the channels, their signal strength, C/I and identifiers captured while the vehicle was stationary at traffic lights.



Map view showing where data has been captured



Lee Criterion Compliance

The CatchAll-SE receiver is intended for use as part of a drive test system for radio-based networks, especially those constructed in a cellular-type arrangement. When a mobile moves, its receiver will encounter a rapidly changing signal strength due to the changing environment around the receiver. Reflections from objects between the transmitter and receiver cause multi-path signals, which interfere with and reinforce each other depending upon their relative phase. This is known as fast fading.

To measure the local mean signal strength as the receiver moves requires a certain degree of averaging of the received signal strength measurements. Too short an averaging period would produce rapid and unrepresentative changes in measured signal strength, and too long a period would average out the genuine changes in signal strength that the measurement system is trying to capture.

W. C. Y. Lee[†] determined, and it is widely accepted, that the best averaging distance is between 20 and 40 wavelengths of the signal being measured and that using between 36 and 50 samples in this interval provides for sufficient averaging. This sampling rate is known as the Lee Criterion. For narrowband signals, such as TETRA and Tetrapol, by limiting the instantaneous bandwidth to 5 MHz, the CatchAll is capable of a sampling rate of 125 samples/s. This is sufficient to provide enough samples that the Lee Criterion can be met on all 200 25 kHz carriers, within a contiguous 5 MHz band, whilst the drive test vehicle is travelling at up to 180 kph and is equivalent to a scanning rate of 25,000 channels per second.

For wideband signals such as GSM, the CatchAll-SE can, on request, be made to provide the full 20 MHz band at a reduced sampling rate of 50 times a second.

[†] W.C.Y. Lee, *Mobile Cellular Telecommunications Systems*, McGraw-Hill Book Co., 1989 p. 13–14.

Software

The data-logging software provides the user interface to the CatchAll-SE receiver. Through the user interface the drive test parameters, such as frequency bands and sampling rate, can be set. During a drive test the data-logging software stores the captured data along with a GPS position and time stamp information for subsequent processing.

The CatchAll-SE processes the captured data on-the-fly, therefore no post-processing of the data is necessary and analysis can quickly follow the capture stage. In TETRA systems an RSSI (signal strength) and QOS (Quality Of downlink Service) are produced for all signals measured during the drive test. The exported data files are in a .csv text format, suitable for subsequent analysis by tools such as TRAMPS, MapInfo Professional® or Microsoft® Excel®.

In addition to the in-built GPS, the CatchAll-SE receiver case includes the accelerometers required to measure the moving or stopped states during waypoint based surveys.

The unit can be order with either only walk-test enabled, only GPS mode enabled or both options enabled. Options not enabled are greyed in the GUI.

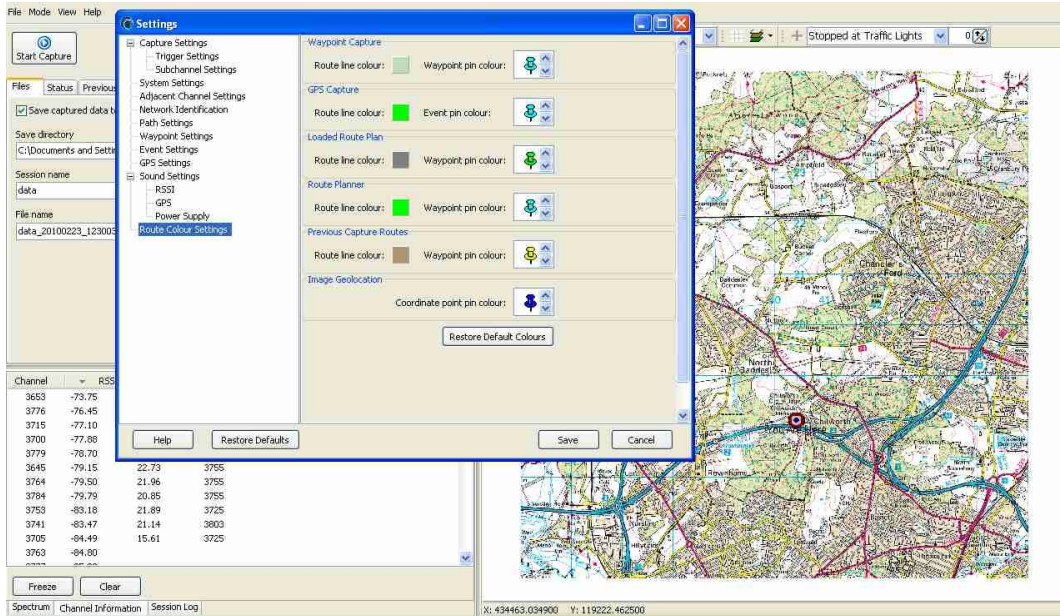
Optional Features

The reconfigurable nature of the CatchAll-SE receiver permits software upgrades to be added easily by the end user. As new functions are designed or refined, upgrades can be supplied electronically for installation via the PC interface. (Some new functions may require additional hardware modules.)

RSSI data in comma-separated variable (.csv) text format, suitable for import into many applications such as TRAMPS.

UTC Time	Timestamp	Longitude	Latitude	Ch3640	Ch3648	Ch3656
11:31:18	0045144541	4.34488	50.85959	-81.75	-66.86	-87.14
11:31:19	0045145041	4.34495	50.85938	-83.14	-67.48	-87.20
11:31:19	0045145541	4.34532	50.85918	-81.94	-67.18	-90.54
11:31:20	0045146041	4.34568	50.85899	-84.20	-67.90	-86.39
11:31:20	0045146541	4.34583	50.85889	-83.74	-68.51	-83.27
11:31:21	0045147041	4.34597	50.85880	-82.60	-68.82	-84.91
11:31:21	0045147541	4.34606	50.85880	-82.93	-68.45	-90.16
11:31:22	0045148041	4.34611	50.85877	-80.72	-67.40	-91.60
11:31:22	0045148541	4.34613	50.85872	-80.67	-67.23	-91.46
11:31:23	0045149041	4.34615	50.85870	-83.45	-66.44	-90.03
11:31:23	0045149541	4.34616	50.85870	-81.00	-66.53	-87.26
11:31:24	0045150041	4.34607	50.85874	-80.74	-66.67	-85.76
11:31:25	0045150541	4.34592	50.85880	-81.40	-66.84	-87.70
11:31:25	0045151041	4.34584	50.85885	-80.59	-66.66	-86.49
11:31:26	0045151541	4.34575	50.85891	-82.15	-67.72	-89.22
11:31:26	0045152041	4.34553	50.85901	-81.69	-67.03	-85.54
11:31:27	0045152541	4.34532	50.85910	-82.27	-68.13	-82.98
11:31:27	0045153041	4.34526	50.85910	-82.82	-68.06	-81.73
11:31:28	0045153541	4.34521	50.85910	-82.94	-68.18	-85.44
11:31:28	0045154041	4.34523	50.85910	-81.64	-67.34	-85.68
11:31:29	0045154541	4.34525	50.85910	-81.93	-67.64	-88.08
11:31:29	0045155041	4.34525	50.85910	-81.28	-67.27	-84.22
11:31:29	0045155541	4.34525	50.85910	-81.15	-68.15	-84.89
11:31:30	0045156041	4.34526	50.85910	-83.29	-68.10	-86.85
11:31:31	0045156541	4.34528	50.85910	-81.69	-67.20	-88.85
11:31:31	0045157041	4.34529	50.85910	-82.41	-67.74	-89.99
11:31:32	0045157541	4.34529	50.85910	-83.19	-66.79	-85.73
11:31:32	0045158041	4.34528	50.85910	-81.79	-66.87	-83.62
11:31:33	0045158541	4.34528	50.85910	-83.85	-68.37	-87.56
11:31:33	0045159041	4.34528	50.85910	-84.71	-68.17	-88.07
11:31:34	0045159541	4.34528	50.85910	-80.01	-67.70	-82.88
11:31:34	0045160041	4.34528	50.85910	-81.66	-68.16	-80.44
11:31:35	0045160541	4.34528	50.85910	-82.54	-67.15	-81.83
11:31:35	0045161041	4.34528	50.85910	-82.36	-67.08	-81.33
11:31:36	0045161541	4.34528	50.85910	-81.54	-67.55	-86.63
11:31:36	0045162041	4.34528	50.85910	-81.89	-67.45	-89.01
11:31:37	0045162541	4.34528	50.85910	-82.70	-68.80	-85.96

Prior to data capture the CatchAll-SE must be set up. The Settings tab facilitates this in an intuitive and simple way



The CatchAll-SE now decodes the TETRA control channel as a standard feature. The control channels of TETRA base stations are decoded to provide more information about the received signal. In addition on-the-fly estimation of the carrier-to-interference ratio (C/I) is performed this indicates the quality of the downlink channels by calculating the constellation distance between the actual received and an artificial but perfect signal (white paper available). Other parameters such as Location Area Code (LAC) are also decoded directly from the control channel.

The spectrum view can be configured to indicate in a user-defined colour, those channels specific to a particular network and country, a useful feature when surveys are being conducted in territories bordering with other nations.

A complementary product designed to provide extensive diagnostic capability using the above information is MAC Ltd's TRAMPS™ TETRA measurement solution. TRAMPS consists of post-processing and data viewing software that enables the intuitive manipulation and display of quality of service (QoS) and RSSI information superimposed on a map or building plan of the drive-test or walk-test route.

The CatchAll-SE launched in May 2009 is in service in a number of TETRA countries and represents the an evolution of the successful CatchAll RF measurement receiver.

Technical Specification	
Receiver frequency ranges	380 MHz to 480 MHz 805 MHz to 860 MHz Other ranges available
Instantaneous scan bandwidth (BW)	5 MHz
Resolution BW (RBW)	25 kHz
Sampling rate (25 kHz RBW)	≤125 samples/s
RSSI accuracy	±1 dB
Input 1 dB compression point	-15 dBm
Dynamic range (25 kHz BW)	100 dB
Noise floor (25 kHz BW)	Better than -120 dBm
Operating temp range	0°C to +50°C
Power consumption	10 W
Power supply	12 volt (Lithium Ion battery option)
Accelerometer	3-axis
Configurable with	Windows XP, Vista or Windows 7
Gross weight	1.7kg
Dimensions	Height: 67.7 mm Width: 111.4 mm Depth: 253 mm
Wheel pulse input	
Pulse level	15 Volts maximum
Pulse rate	Up to 20 kHz

© MapInfo Professional is a registered trademark of Bowes MapInfo Corporation
 © Microsoft and Excel are registered trademarks of Microsoft Corporation
 ™ CatchAll and TRAMPS are trademarks of Multiple Access Communications Limited



www.mac ltd.com

Multiple Access Communications Limited
 Delta House, Southampton Science Park
 Southampton, SO16 7NS
 United Kingdom

Tel: +44 23 8076 7808
 Fax: +44 23 8076 0602
 Email: enquiries@mac ltd.com