The CatchAllHSE 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 CatchAllHSE 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 CatchAllHSE receiver a powerful network analysis tool.

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

As standard, the CatchAllHSE 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 position data when the unit is used for walk-testing.

**Overview**

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**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.

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 MHz to 480 MHz
  805 MHz to 860 MHz
  Other ranges available
- Integrated GPS receiver
- Lee Criterion scanning
- Drive-test and optional walk-test modes
- Data captured for analysis by TRAMPS™ or suitable database programs
- Wheel-pulse input to measure distance travelled without GPS
- 3-axis accelerometer for use in walk-test/waypoint mode
The CatchAllHSE 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 CatchAllHSE 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 a 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. Routes driven previously can be “saved” and re-displayed by means of the “Previous Capture Routes” tab to assist in identifying routes that are still to be driven.

**Spectrum and Selected Channel Displays**

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**An example of the channel information displayed while the CatchAll-SE receiver is capturing data**
Software

The data-logging software provides the user interface to the CatchAllSE 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 receiver, the CatchAll-SE receiver case includes the accelerometers required to measure the moving or stopped states during waypoint-based surveys.

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

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.

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

Prior to data capture the CatchAll-SE is set up in an intuitive way via the Settings tab.

Optional Features

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 to indicate the QoS by calculating the constellation distance between the actual received signal and an artificial but perfect signal (a white paper is available to describe the method used). 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, which is 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 QoS and RSSI information superimposed on a map or building plan of the drive-test or walk-test route.

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