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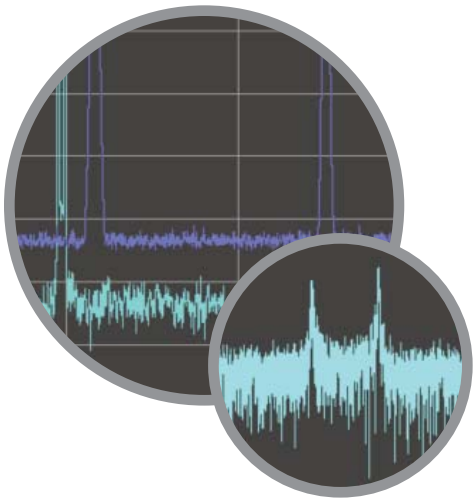
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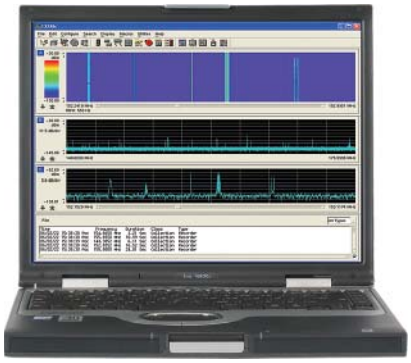


Agilent E3238S/35688E Signal Intercept and Collection System

Product Overview

Deploy Quicker, Produce Faster

- Increase the probability of intercept for off-the-air RF signals
- Re-configure signal detection without programming to increase probability of intercept
- Quickly categorize and select target signals using visual, audible, and analytic tools
- Improve mission productivity by automating common processing tasks and mission setups
- Complete solutions to support tactical operations including demodulation and decoding of device-specific signals
- Increase interoperability and re-use through integration with legacy systems and open programming capability
- Scalable performance from simple survey solutions to completely integrated intercept and collection solutions
- Rapidly deployable solution based upon industry-standard off-the-shelf components





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Operator Tools for Investigating the RF Spectrum

The tools you require depend on the amount of knowledge you have about the target. The E3238S/35688E supports missions from the simple, such as cataloging the signal environment, to the complex such as interception and collection of information from specific devices and users.

Survey

Initially, the operator must survey RF spectrum for signal energy. Since the number and variety of signals is so large, and the spectrum so vast, efficiency is critical. The hardware must be able to search for new signals as they appear, and the operator must have the tools to quickly determine the kinds of signals that are present.

Collection

Once the types of signals of interest are known, a system can be put in place to collect them, usually by recording them for later analysis. To increase mission efficiency, the system must be able to differentiate between modulation types, and collect signals of the target types only. Even then, the task of sorting through the recorded signals can be time consuming. Analysts may need to determine how to demodulate the signals, or linguists may need to listen to each signal to determine if it is important. The goal is to rapidly identify the specific devices and users so that no critical signal will be missed.

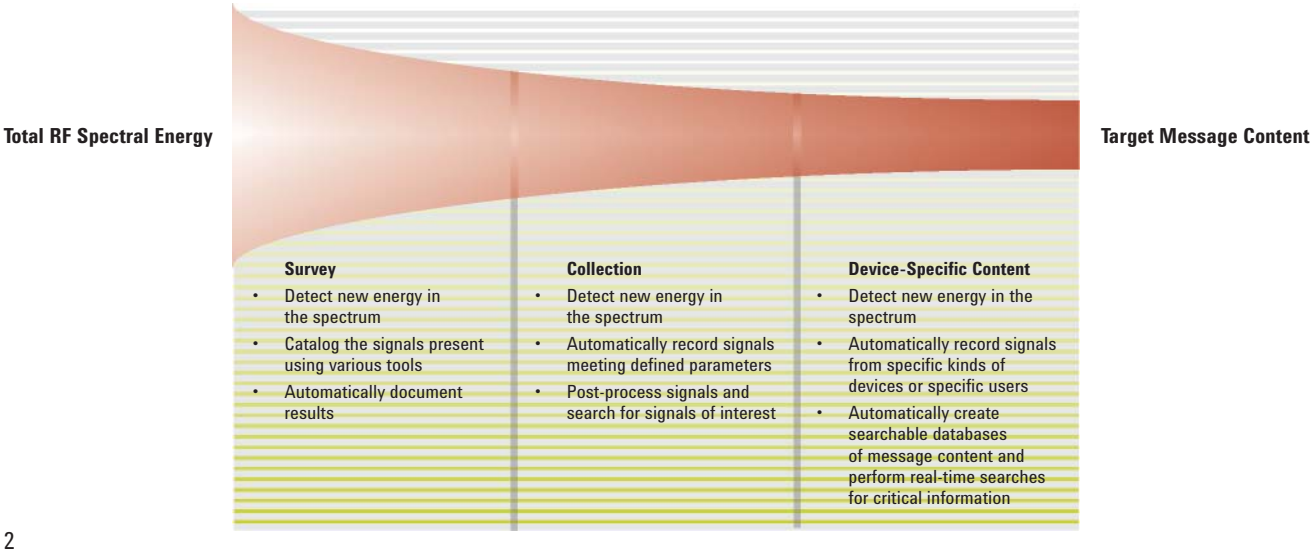
Universal signal detection

The universal signal detection option spans both survey and collection. A universal signal detector automatically identifies signals of interest by operating on the characteristics of RF transmissions. Agilent's universal signal detection (Option USD) includes bandwidth filters, frequency plans, wideband detectors, and narrowband confirmers. These wideband and narrowband technologies are combined to efficiently sift through the crowded spectrum and significantly increase the probability of intercept.

As signals of interest are detected, simultaneous gap-free recordings (or data streams) are easily handled by the multiple digital down converters (DDC) and parallel DSPs in the E3238S system. When a new threat emerges you can quickly build a detector from a recording of a new signal without programming.

Device-specific applications

Once specific devices have been identified, and critical identifying information such as pager capcodes, phone numbers, and communication frequencies and times have been extracted, then device-specific demodulators and decoders can be put in place to capture signals of interest as they occur. For data transmissions, the message content can be put in a searchable database, real-time searches can be performed and reports generated. For voice transmissions, operators can listen to the communications as they occur to support tactical operations.



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Wideband Search Increases Probability of Intercept

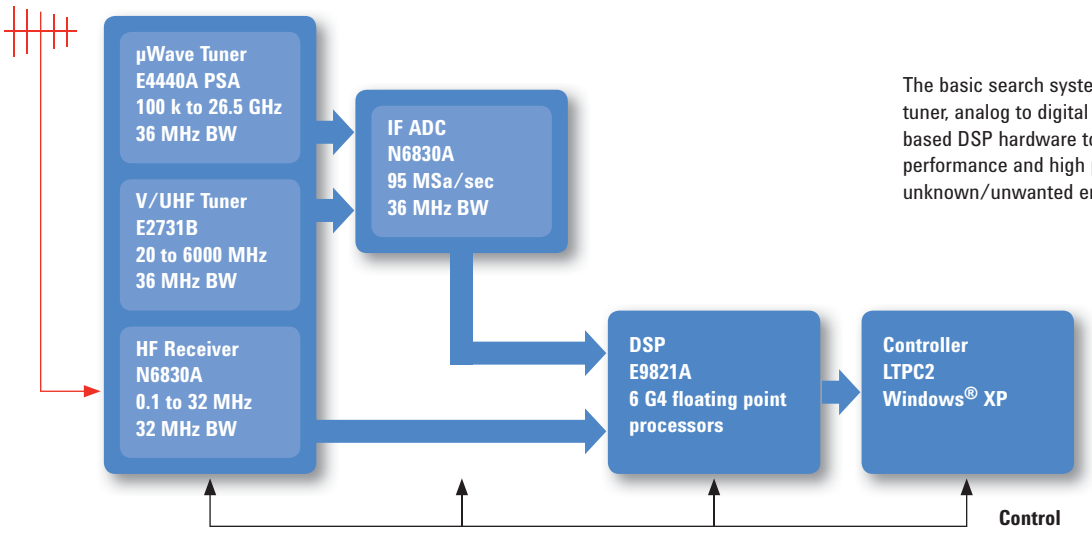
The E3238S uses a wide-band stepped FFT technique to achieve exceptionally fast sweep rates while maintaining high resolution and wide dynamic range. Unlike swept analyzers, the E3238S concatenates several FFTs so you can zoom in closer and still resolve spectral detail. Up to six Motorola G4 processors compute FFTs, allowing 10 GHz/sec sweep rates. Broad expanses of spectrum are covered quickly, and frequencies of interest are revisited often to intercept short signals. The E3238S hardware has the dynamic range to dig signals out of noise, the frequency resolution to isolate small signals hiding next to large ones, and fast sweep rates to capture signals just fractions of a second long.

Mission-specific hardware configurations

The E3238S hardware can be configured to target specific frequency ranges and missions, then reconfigured as needs change. HF, VHF/UHF, and Microwave (µWave) systems are possible – only the tuners need to be changed to target a different frequency range. The rest of the system stays the same. The new Agilent N6830A is a dual channel HF receiver and 70 MHz IF ADC configured for monitoring HF signals from 100 kHz to 32 MHz, as the IF ADC for V/UHF or microwave tuners, or for dual channel applications. Systems can be easily upgraded as new hardware becomes available, saving hardware and training expense. Agilent can support new technologies faster, since the entire system does not need to be redesigned.

Narrowband collection

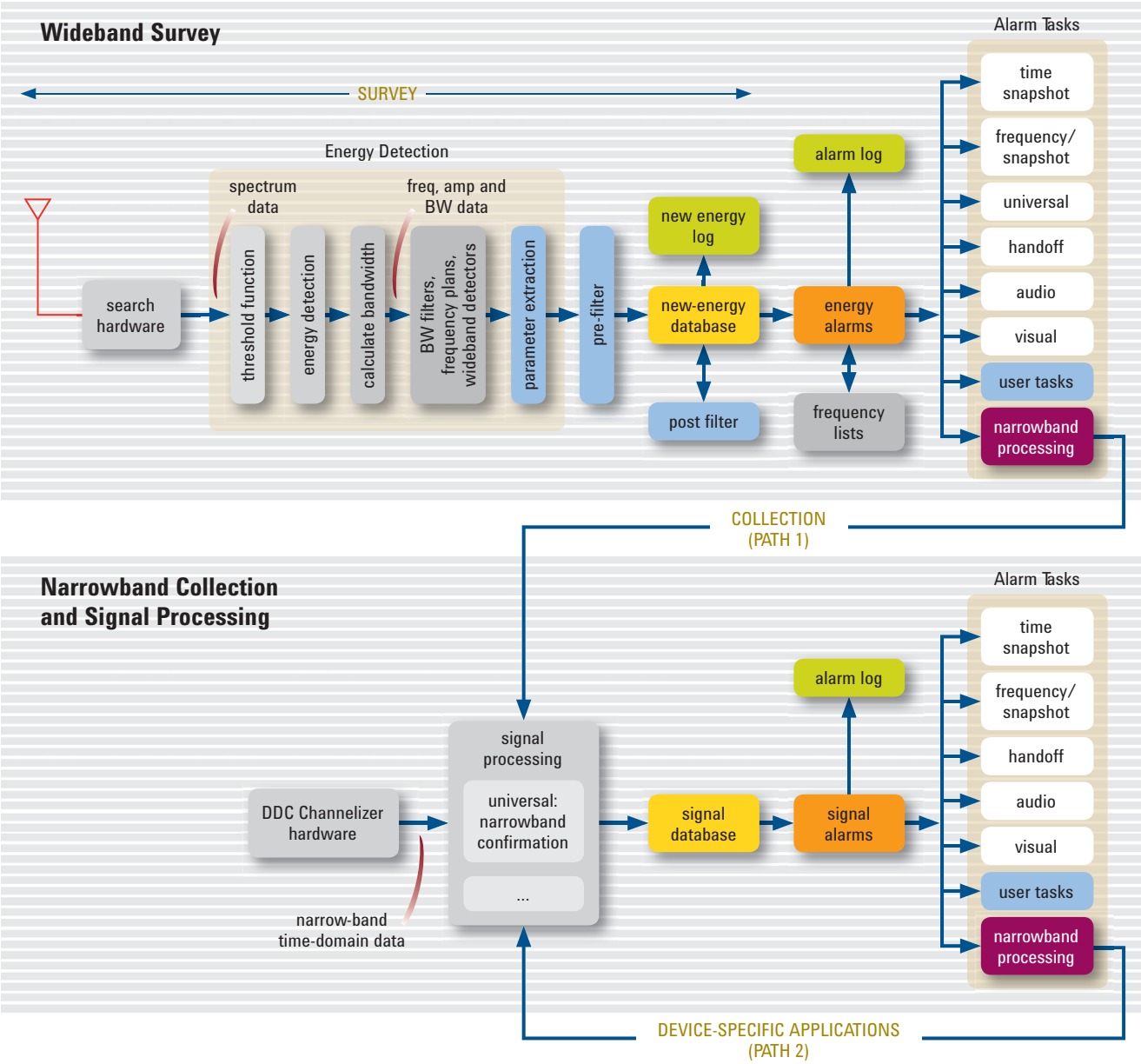
E3238S systems can be configured with hundreds of narrowband channels, each with independently programmable center frequencies and bandwidths. Several signal processing algorithms can run simultaneously, targeting multiple signal types. Information extracted from signals goes into a searchable Signal Database where it is logged and user-defined alarms can be generated, allowing alarming on specific message content.



The basic search system controls the system tuner, analog to digital convertor (ADC) and G4 based DSP hardware to provide industry leading performance and high probability of intercept of unknown/unwanted emitters.

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Process Flow Diagram



The blue blocks show the elements in the processing stream where user programming is available:

Option USD automatically identifies signals of interest by using the characteristics of the RF transmission. USD adds bandwidth filters, frequency plans, wideband detectors and narrowband confirmers to the block diagram.

Option ASD adds eight different shared library entry points to make it possible to dynamically link new functions and capabilities into the E3238S. The option adds parameter extraction and pre- and post-filters to the energy detection stage. These blocks create new calculated parameters for inclusion in the new energy database, or to create user defined alarm tasks. In addition ASD enables customization of the graphical interface to create mission specific views into the system and the ability to write drivers and external links to other processing systems.

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Processing Flow Overview

The purpose of the E3238S is to detect, identify and collect signals of interest (SOI) in the RF spectrum.

The system is connected to an antenna or other energy source for signal acquisition. The energy presented at the input to the system is the wideband RF spectrum.

The search hardware acquires the signal and converts it into spectrum data.

The spectrum data is processed in two ways:

1. As wideband data in the WIDEBAND Search mode of operation

2. Broken out into narrowband data for the NARROWBAND collection and signal processing

The Narrowband Signal Processing chain is generally used to do one of three things to the energy detected at the end of the processing chain.

- Identify (type of signal)
- Locate (direction finding)
- Collect (record and demodulate)

As an example, consider the need to search, detect and collect a specific FSK signal from the RF Spectrum, and then determine signal location.

Wideband Search:
Energy Detection to Alarm Tasking

This section performs wide-band processing of all the signals in the RF environment and filters out all but the most likely signals of interest. The RF energy that makes it through this filtering process is entered into the energy history along with their continuously-updated statistics. If the energy matches the criteria for the target RF energy, an Energy Alarm is triggered which will cause an Alarm Task to execute. There are many different types of Alarm Tasks that can be executed as result of an Energy Alarm. One of the most powerful Alarm Tasks is to execute further Narrowband Processing to extract signal content.

Narrowband Collection and Signal Processing:
Extracting Signal Content

The next section of processing operates on narrow-band time domain data that is extracted from the wideband data stream via the Digital Down Convertor Channelizer hardware.

As an example, assume that an energy alarm from the wideband search detected energy of interest that looks like an FSK signal in the wideband data stream. The parameters about this energy like frequency and bandwidth is passed to the narrowband collection and processing chain (see page 4, Processing Flow diagram, PATH 1).

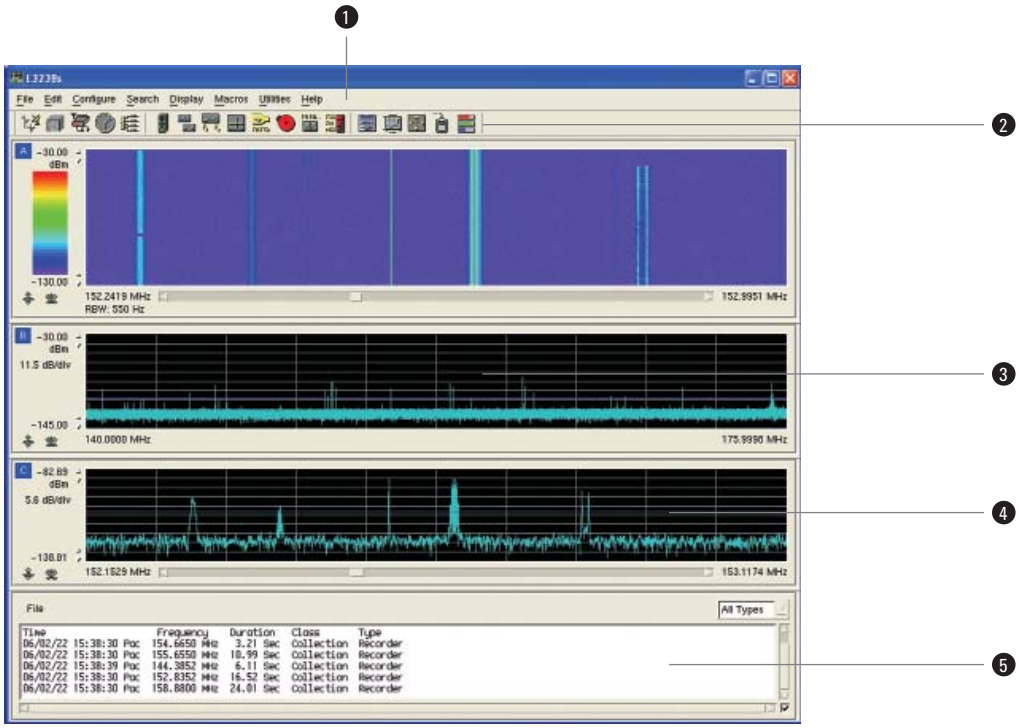
The narrowband data is further processed into signal specific information and entered into the Signal Database. At this point we know we have a potential FSK Signal Of Interest, but we don't yet have actual demodulated information content from the signal.

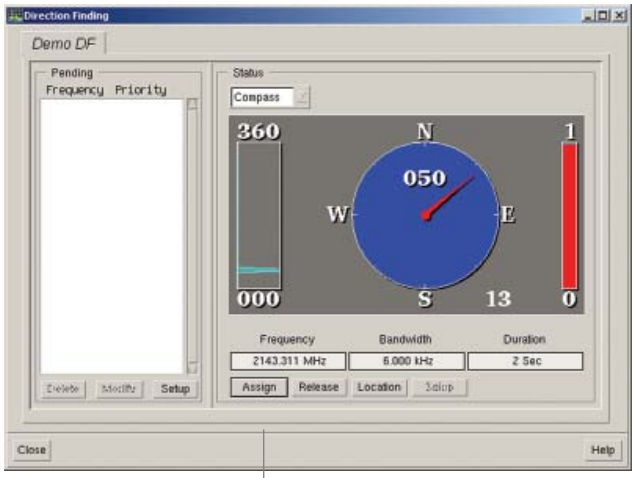
A Signal Alarm is established that tests for a specific FSK signal to appear at a certain time of day at a given frequency assignment. When that signal is detected, another narrowband processing task is executed (Processing Flow diagram, PATH 2) to record the signal to disk and also to apply further narrowband demodulation processing to extract the actual information content from the signal.

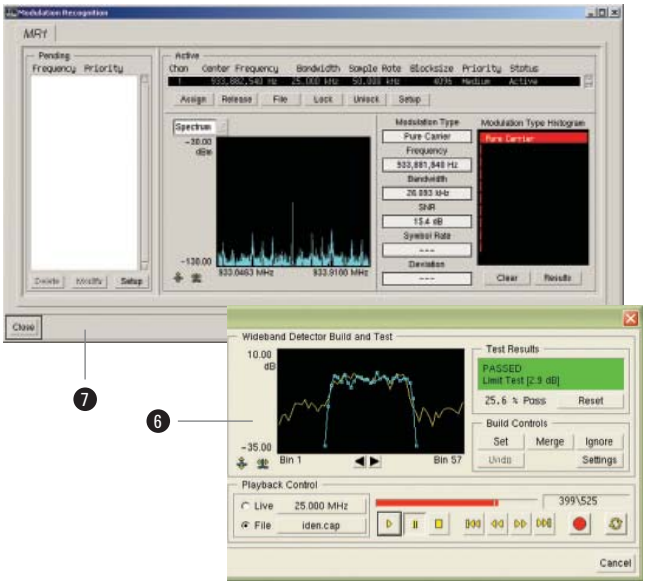
Integrating with Legacy Datastreams

Since the E3238S is defined with socket protocols, connection and integration with legacy sub-systems make the E3238S the ideal operator control center for signal identification and collection missions. Consider the FSK detected in the example. With a connection between the E3238S and a legacy Direction Finding system, data from the E3238S is used to "tip off" the Direction Finding system as to the presence of energy, and then receive back the line of bearing and other geolocation parameters for entry into the signal database. Now we have a complete solution to identify, locate, and collect the specific FSK signals coming from a specific line of bearing or location.

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Designed to speed Intercept and Collection tasks and increase probability of intercept (POI):

1 Cockpit control of all systems assets from antennas to digital receivers via the system icon bar

2 A variety of signal visualization tools speed analysis

3 Operators eyes never leave the signal of interest while they interact directly with trace data to control assets like drop receivers, Modulation Recognition, and Direction Finding systems

4 Automated alarms, thresholding and alerts automate the task of keeping track of incoming signals

5 Signals Database automatically logs all signals of interest for historical use

6 Wideband detector technologies in the universal signal detection option use shape, peaks, or limit lines to quickly identify signals of interest

7 Quickly identify unknown emitters with the Modulation Recognition option

8 Integration with legacy systems completes the solution, shown here with Direction Finding results

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Versatile tools for the survey task

Everything within the E3238S user interface is designed to increase an operator's efficiency during a mission. The key to efficiently surveying and collecting signals is to provide the operator with an integrated suite of tools for controlling the system.

Optimized graphical user interface

The E3238S's easy-to-use graphical user interface is designed to speed signal detection in dense signal environments. Simple toolbars are used to configure the system hardware, setup and control the search and collection subsystem, and finally to present various user displays and visualization tools.

High-speed visual displays

Display types with very high update rates show how signals change over time. Multiple displays can reveal broad and close-up view of signals simultaneously. Whether the signals are stationary or moving, burst or continuous, low-level or high-power, the E3238S's spectrum and spectrogram displays have the speed and resolution needed to resolve fine details.

Audible tools to classify signals

The E3238S can easily hand-off signals to traditional single channel hand-off receivers, or transfer them to the 35688E-AU1 software-based AM/FM handoff receiver. Voice signals can be listened to directly. Many digital signals have distinctive sounds that reveal the signal type to an experienced operator. Manual or automatic modes let the operator assign monitoring and collection assets to signals of interest. Software drivers are provided for handoff receivers from companies such as Cubic Communications, ICOM, and others.

Reconfigure without programming

Universal signal detection and modulation recognition technologies are powerful tools that can easily be adapted for various missions. When a new threat emerges you can quickly build a detector from a recording of the new signal without programming.

Capturing direction information

Signal parameters can also be passed to a direction finding sub-system. The returned geolocation information like azimuth and elevation is integrated in the marker display and saved in the Signal Database.

Tying it all together with markers

Markers and the mouse work together to increase efficiency. Direction finding, handoff receivers, and modulation recognition can all be linked to markers. A click of the mouse steps the marker from peak to peak, automatically passing center frequency and bandwidth to the DF subsystem, modulation recognition algorithm, or handoff receiver. The operator can listen to the signal while the DF and modulation type information update in the marker display area.

Record a signal for later analysis

During a mission, signals can be recorded for later analysis. The ADC zooms its center frequency and bandwidth to slice the signal of interest out of the spectrum. Its time data is recorded and sent to the host computer where analysts can evaluate it later.

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Automate Survey Missions to Increase Productivity

Automation is the key to increasing signal detection intercept and collection productivity. The E3238S automatically detects and logs energy events into an energy history. Tools to filter energy into and out of the energy history are key to reducing operator workload and increasing Probability of Intercept.

Automatic new-energy detection

Automatic signal classification starts with isolating potential signal energy from noise energy. To determine when new energy appears in the spectrum, an energy threshold is established. The E3238S offers three standard energy thresholds.

The first threshold that operators can select is the level threshold. The level threshold is most effective when the noise floor is flat and reasonably constant. It can be visually adjusted to a position as close to the noise floor as the task demands.

The next threshold that operators may choose is the noise-riding auto threshold. The auto threshold is best for HF missions, or anytime the noise floor is contoured or changing. This noise-riding threshold automatically shapes itself to the noise floor and is recalculated for each new sweep. The auto threshold dramatically increases POI in HF search.

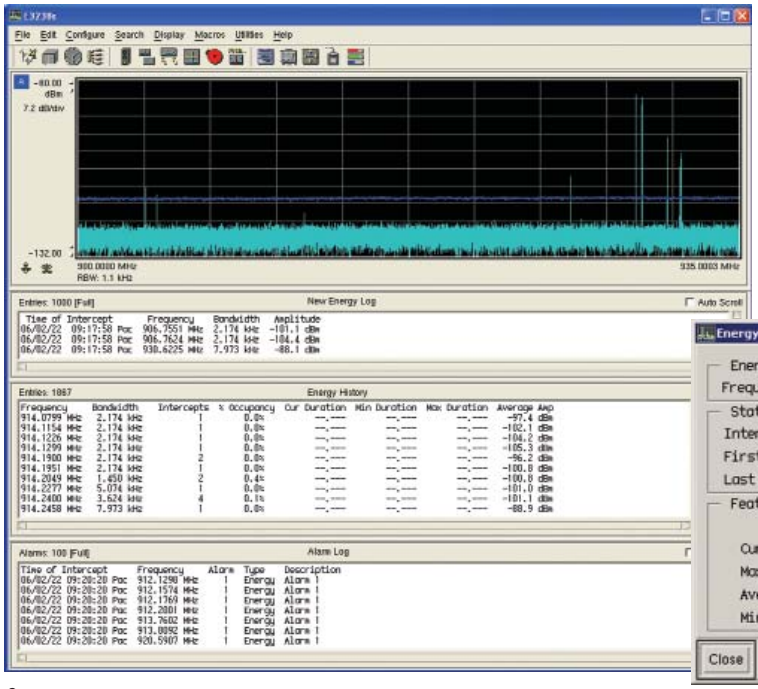
The third and last standard threshold is called the environment threshold which can reveal changes to the signal environment from one time period to another. The environment threshold memorizes the environment on command and then subtracts it from the spectrum display. The operator only has to monitor signals not previously present. The environment threshold can be saved and used at a later time to see if new signals are present.

Custom environment thresholds can also be built with a text editor or a spreadsheet program.

Automated energy history

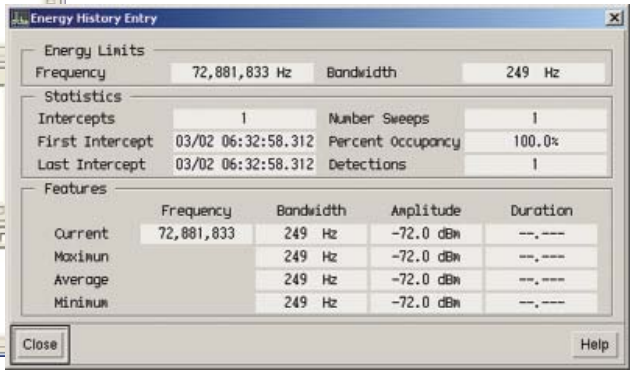
When any energy exceeds the threshold it is automatically characterized and its parameters are entered in the energy history. The energy history records frequency, bandwidth, amplitude and duration of all energy above the threshold. It also calculates the minimum, maximum, and average values of the amplitude, bandwidth and duration of each signal, the percent occupancy, and the date and time of the first and last intercept.

The energy history is critical in documenting the survey of a signal environment, but plays an even more critical role for collection, where parameters are used to create alarms.

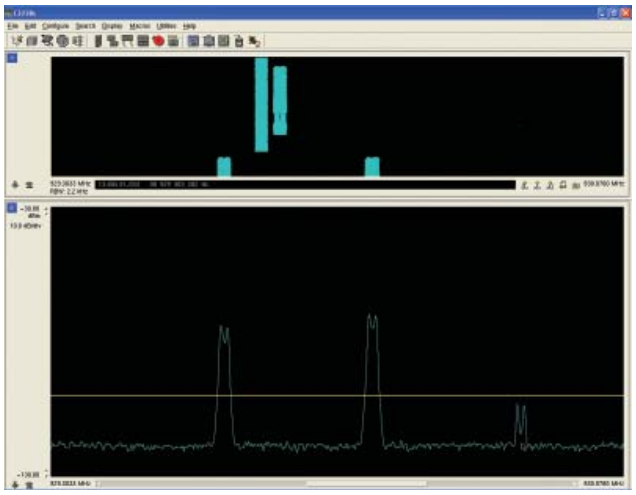


Automatic documentation

The energy history display shows a summary of information in the energy history for all signals that exceed the threshold. Clicking on a line of the Energy History opens the dialog box (bottom right), which shows all information for the energy at that frequency. The handoff log saves all information about the use of handoff receivers, and the alarm log records any alarm that has triggered. In this display, alarms have triggered to task the direction finding system, and to call the UHF/VHF voice activity detection algorithm (see page 21 for more information).

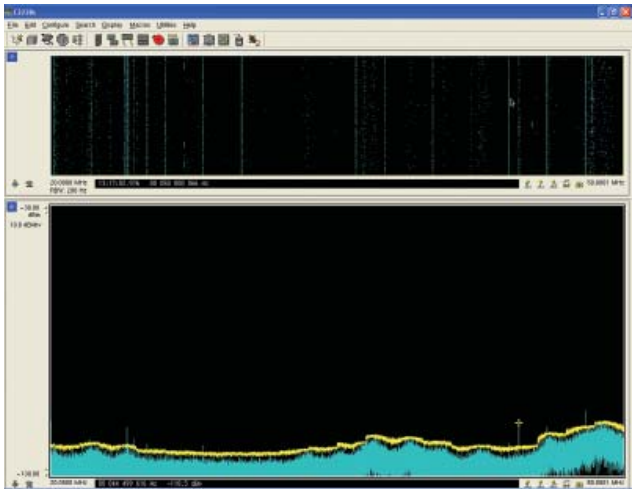


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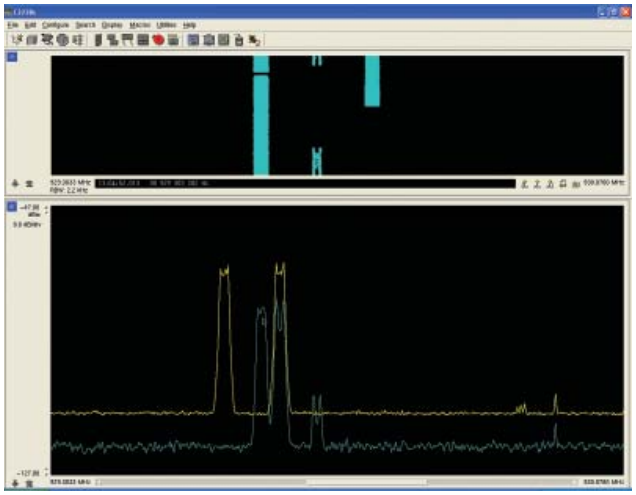
Level threshold

This threshold works well when the noise floor is flat and unchanging, as it often is in VHF/UHF and µWave Spectrum.



Auto-threshold

Auto-threshold shapes itself to the noise floor. This is especially important in HF, where the noise floor is not flat, and changes with the time of day and year. Since the auto-threshold is automatically recalculated with each new sweep, it can adapt to changes, which significantly increase the probability of intercepting HF signals.



Environmental threshold

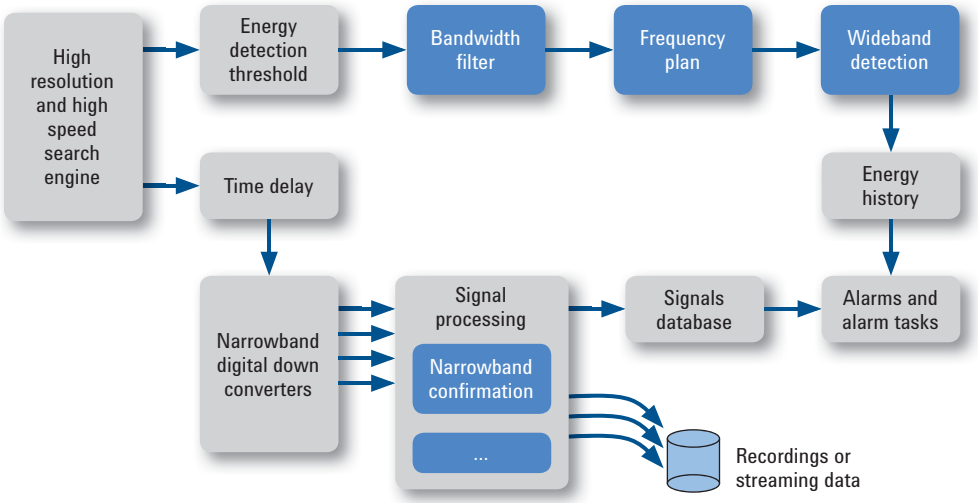
This threshold takes a snapshot of the spectrum and creates a threshold that matches the spectral shape at that time. It can be used at a later time to see if new signals are present. In this case there are three new signals that were not present when the original threshold was created, and two signals are not present now. Notice that only the new signals appear in the spectrogram display.

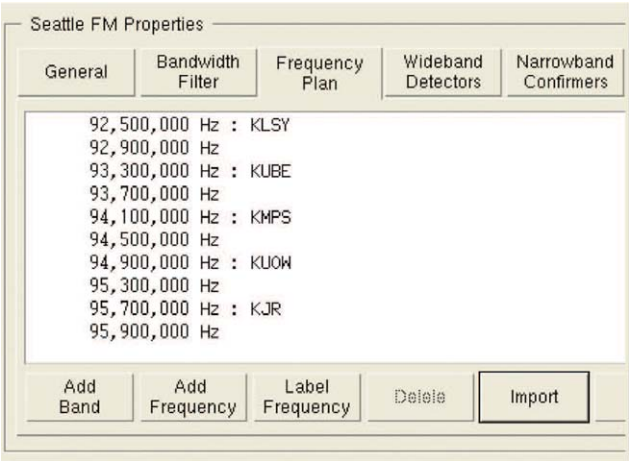
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Universal Signal Detection (Option USD)

A universal signal detector automatically identifies signals of interest by operating on the characteristics of RF transmissions. Agilent's Universal Signal Detection option includes a bandwidth filter, a frequency plan, wideband detectors, and narrowband confirmers.

These wideband and narrowband technologies are combined to create universal signal detectors that efficiently sift through the crowded spectrum and significantly increase the probability of intercept. As signals of interest are detected, simultaneous gapfree recordings (or data streams) are easily handled by the multiple digital down converters (DDC) and parallel DSPs in the E3238S system. When a new threat emerges you can quickly build a detector from a recording of a new signal without programming.

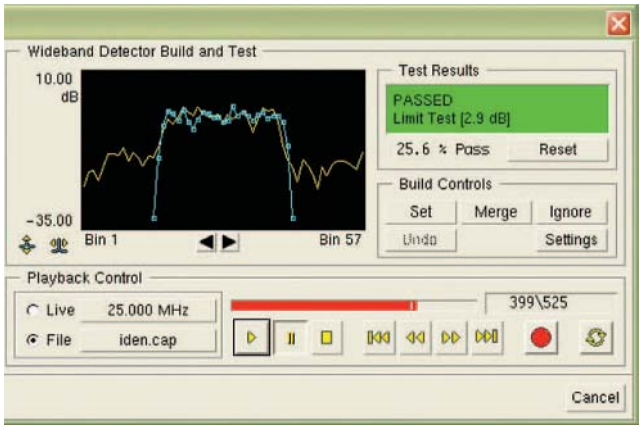




Bandwidth filter and frequency plan

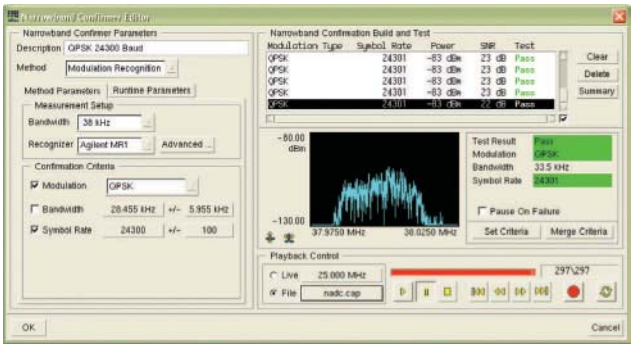
For energy that appears above a threshold, a signal detector's bandwidth filter and frequency plan will remove signals that don't meet the criteria for the signal of interest. The frequency plan can include individual frequencies, bands of frequencies, or the channelized bands.

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Wideband detection

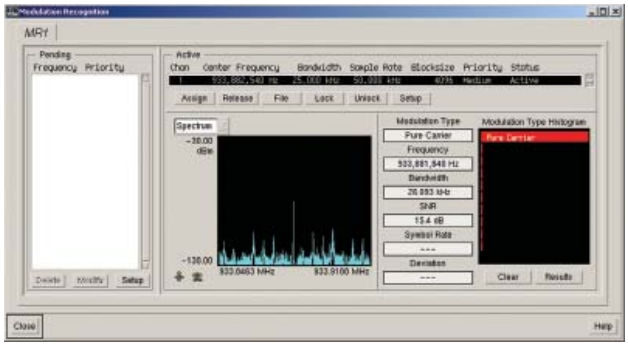
USD's wideband detection operates on the frequency-domain results of each sweep. When energy is detected in the frequency spectrum, that portion of the frequency spectrum is processed by one or more wideband detectors. The wideband detectors quickly determine if the energy is a potential signal of interest by comparing its magnitude spectrum to the wideband detectors you created. It passes signals programmatically as opposed to a human viewing the spectrum data. The wideband detector techniques that are supported in USD are shape, peaks and limit lines.



Narrowband confirmation

USD's narrowband confirmation operates on the complex time-domain data from signals that meet the bandwidth, frequency, and spectral shape criteria. When used with Agilent's modulation recognition option MR1, the modulation format, symbol rate, (and frequency spacing for FSK) are compared to criteria for the signal of interest. Agilent's narrowband confirmation takes full advantage of the E3238S system's DDCs and parallel DSPs.

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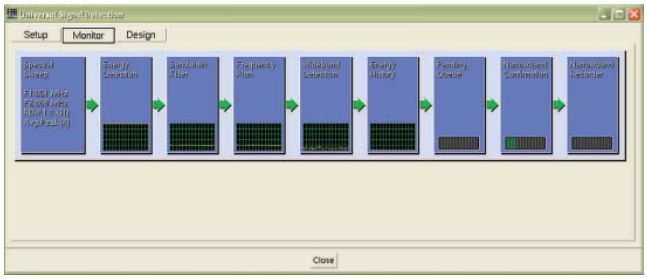


Automated modulation recognition

Modulation Recognition (Option MR1) is used to identify modulation types on signals of interest. Option MR1 provides a library of analog and digital modulation recognizers. Option MR1, when coupled with option USD, allows the Modulation Recognition application to run on all active narrowband channels at the same time.

Popular modulation types supported with Option MR1:

- Noise
- Unknown digital
- MSK
- FM MSK
- FSK
- 3 level FSK
- 4 level FSK
- 8 level FSK
- BPSK
- QPSK
- PI/4 QPSK
- 8 Level PSK
- 16 Level PSK
- 16 QAM
- 32 QAM
- 64 QAM
- 128 QAM
- 256 QAM
- AM
- AM DSBSC
- LSB
- USB
- Analog FM
- Pure Carrier
- Manual Morse
- Machine Morse
- OOK
- FM OOK
- 4 PAM
- V.29
- Any



Design, monitor and run universal signal detectors

Universal Signal Detection has separate development and run modes for maximizing efficiency for the developer and the operator. In the design environment, you create and test signal detectors. Because you make inputs into dialog boxes, pull-down menus, and check boxes, programming is not needed to detect and capture signals of interest. There's a straightforward design flow that helps you create signal detectors. Once the signal detector is designed, it is stored in a library. There is no limit to the number of detectors stored in the library. Up to 23 signal detectors can be running at one time. In run or monitor mode, operators can add signal detectors "on-the-fly" from the library that was previously created. A mission set up can load numerous detectors and automatically begin the search for specific signals.

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Collection Using Alarming and Narrowband Processing

After surveying the RF spectrum for energy that matches target criteria, the next step is to determine which of the signals are "Signals of Interest." Additional processing is applied to the narrower bandwidth data streams starting with alarm determination and subsequent narrowband signal processing.

Energy alarms trigger collection

Automated alarms are the foundation of the E3238S's signal detection and collection capabilities.

The energy history is used for documenting the parameters of signals that exceed the threshold and for testing against Energy Alarm criteria.

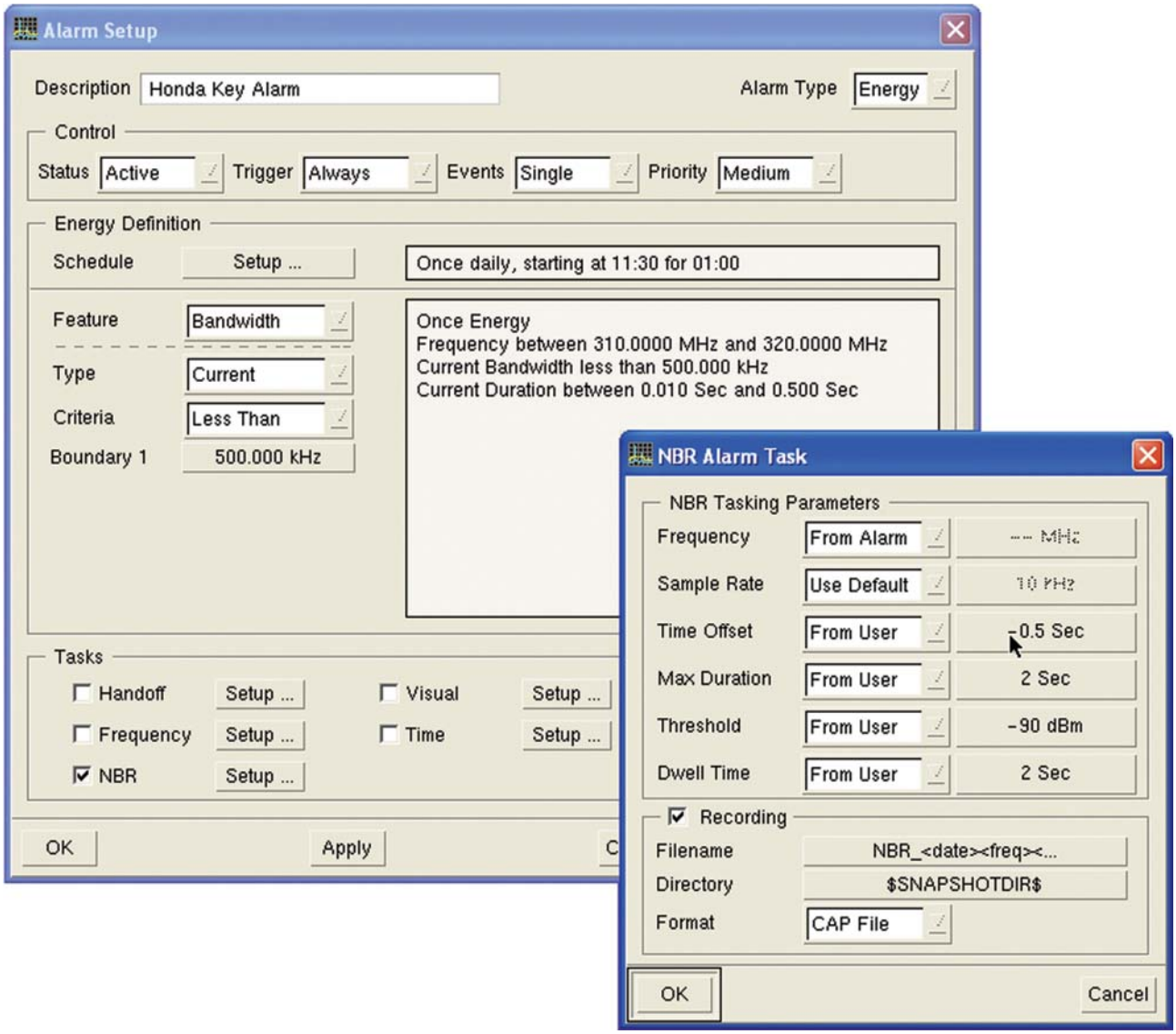
Any combination of the energy parameters in the energy history can be used as alarm criteria. Without writing any software, an operator can create an alarm that is a logical expression of the Alarm Criteria parameters in the energy history. If the logical expression is true, operatorselected alarm tasks are automatically executed. The task or tasks to be executed are chosen by the operator when the energy alarm is created.

Alarm criteria	
Energy parameters Amplitude Duration	Min Max Average Current
Number of intercepts	
Number of detections	
Occupancy %	
Intercept time	First Last
Number of sweeps since first intercept	

Alarm tasks
Handoff
Visual
Audible
Frequency snapshot
Time snapshot
Add to frequency list
Remove from frequency list
Universal Signal Detection

All information in the energy history can be used as an alarm criteria. The table shows the information in the energy history. The right side of the table shows the kinds of alarm tasks that can be initiated when the alarm criteria is met.

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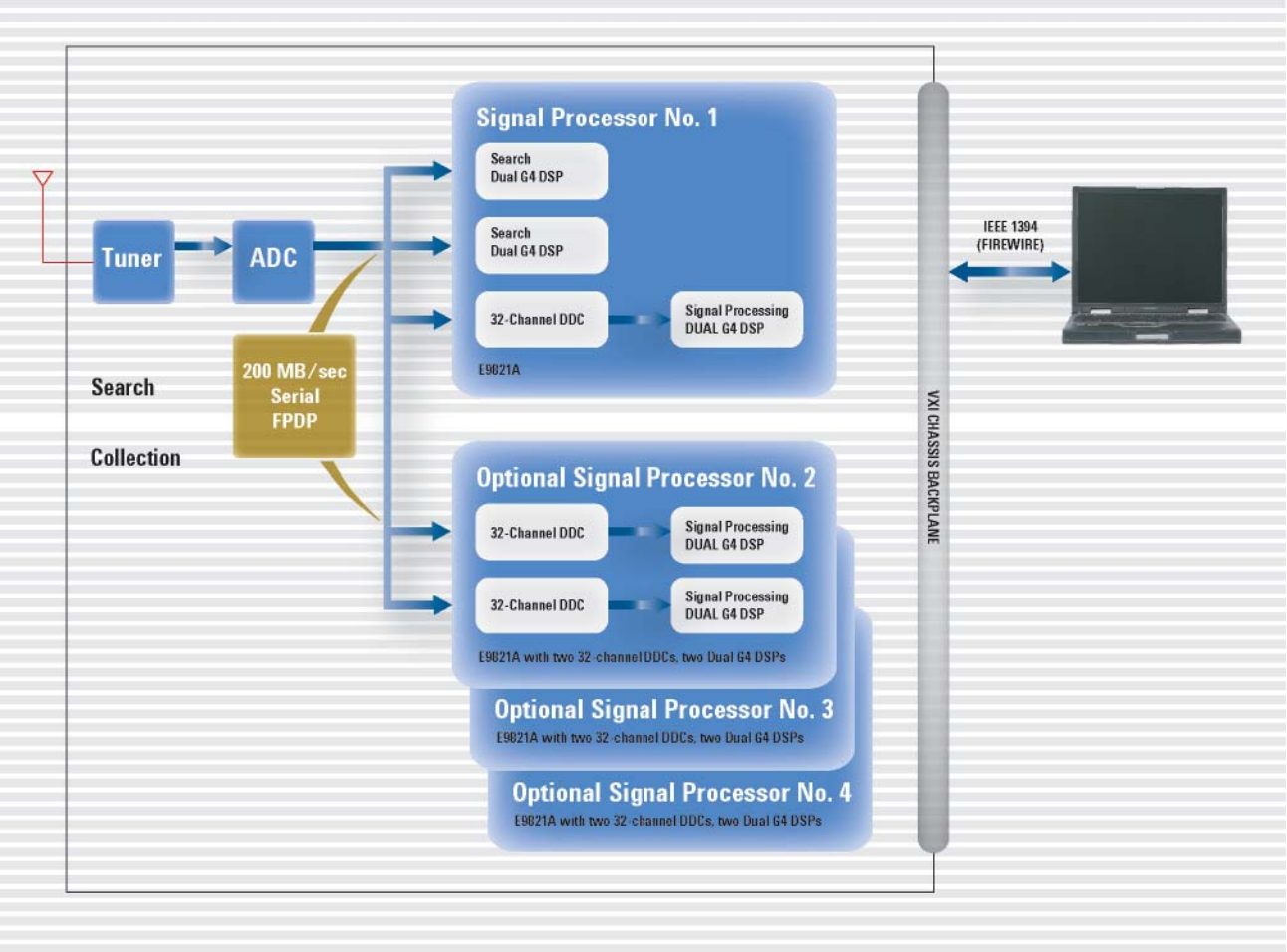


Energy alarm creation

Energy alarms are created using the dialog box shown above. For all energy that exceeds the threshold, the E3238S compares the information in the energy history to the conditions specified in the alarm. In this case the alarm is looking for energy starting at 11:30 for 1 hour with a bandwidth of less than 500 kHz, and a center frequency between 310 MHz and 320 MHz.

If any entry in the energy history meets these criteria, a new record is created in the alarm log and a narrowband recording is created.

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Scalable signal processing

The E3238S DSP hardware scales either by adding plug-in modules onto the E9821A signal processor mainboard, or adding additional complete E9821A modules to the system. The configuration above shows Signal Processor 1 performing search and 32 channels of collection using a combination of G4 DSP plug in modules and 32 Channel DDC modules. The optional Signal Processor 2 shows a second E9821A configured for an additional 64 channels of collection and/or device-specific signal demodulation and decoding. Additional E9821A Signal Processor boards are easily added if more channels or different types of signal processing are required.

Narrowband processing capabilities

Energy alarms are a critical tool in the survey application, automating handoff receivers, recording time and spectral snapshots, and creating critical frequency lists. But the real power of the E3238S is revealed when an energy alarm task hands off signals for narrowband processing in the E3238S's E9821A signal processor modules.

The E9821A signal processor's 32-channel digital downconvertors (DDCs) select narrowband channels out of the wideband data and pass their time data to G4 processors for further computations. E9821A's can be configured with hundreds of narrowband channels, and multiple E9821A's can be used to scale to even higher channel counts.

Hundreds of narrowband channels can be processed simultaneously, and numerous algorithms can be run on the narrowband channels. The algorithms can be selected depending on the energy alarm criteria, and be initiated as alarm tasks.

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Alarm Tasked Collection

Collection – recording signal information

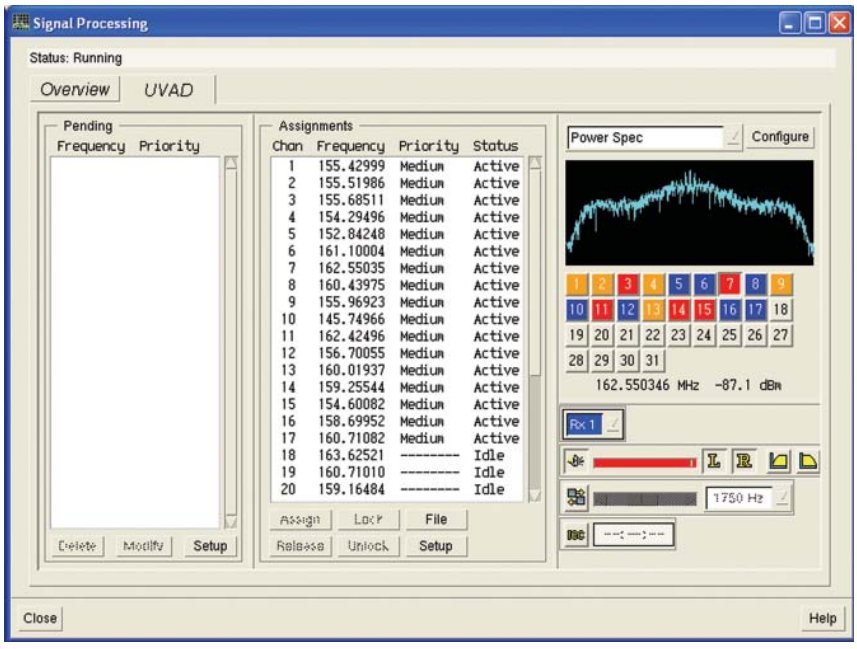
One simple example of narrowband processing is narrowband recording. In this process, narrowband time data is sent to the host and recorded to disk. The Digital Down Convertor (DDC) can be passed the center frequency and bandwidth by the energy alarm, and the recorded narrowband time data can be analyzed at a later time.

Another example of narrowband processing is FM detection and recording. In this process the G4 processors run an algorithm to determine if the signal has FM modulation, and only records those signals present with that modulation type. This type of automated processing dramatically reduces the number of signals to be recorded, and simplifies post analysis.

Getting at the message content

In some cases you may want to dig even further into the signal, demodulating and decoding it, then alarming on specific message content. This is possible in the E3238S by using signal alarms.

The alarm criteria for a signal alarm is information extracted from the message by a device-specific demodulation and decoding algorithm. Such information is saved in a dedicated Signal Database. If the signal information includes identifying information, such as telephone numbers, pager capcodes, or communication callsigns, these can be used as signal alarm criteria to identify communications from specific individuals. By intercepting the communications of specific individuals the E3238S can be used for both strategic information gathering and realtime tactical missions.



Voice activity alarm collection task

In this example, an alarm task has called the VHF/UHF voice activity detection algorithm, 35688E-VA2, that executes in the G4 processors. If a signal appears to be human voice, then the signal is logged. The dialog box shows that 31 DDC channels have been dedicated to the voice detection algorithm, and seven of them are currently active, designated by the colored buttons. Channels 5, 6, 8, 10, 12, 16, and 17 are testing for voice. Channels 3, 7, 11, 14, and 15 have detected voice and are currently recording it. Channels 1, 2, 4, 9, and 13 have detected voice and are being recorded, but the signal has currently gone away. The spectrum of channel 7 is being displayed. Channels 18 through 31 are unassigned. Handoff receivers can be linked to the buttons so that pressing a button hands that channel to a handoff receiver so that it can be listened to in real-time.

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Collection Applications

The E3238S has several software options that recognize and record specific kinds of signals for later analysis.

FM Signal Recognizer

The 35688E-FMR software for the E3238S detects VHF/UHF frequency modulated signals and records the undemodulated narrowband time data to the E3238S system disk. It can record voice or data signals. There is a full solution for identifying and capturing voice signals, the 35688E-VA2 software. (See information on page 21.)

To use the FM Recognizer software, an operator creates an energy alarm that identifies energy with the bandwidth of the signals intercepted. The alarm task chosen for this alarm is FM Recognizer.

When energy of the correct bandwidth is detected, the center frequency is passed to an available DDC channel. It selects that channel from the wideband data, and passes it to the the G4 processors which test to see if it is an FM signal. If it is, the signal is recorded to the system disk.

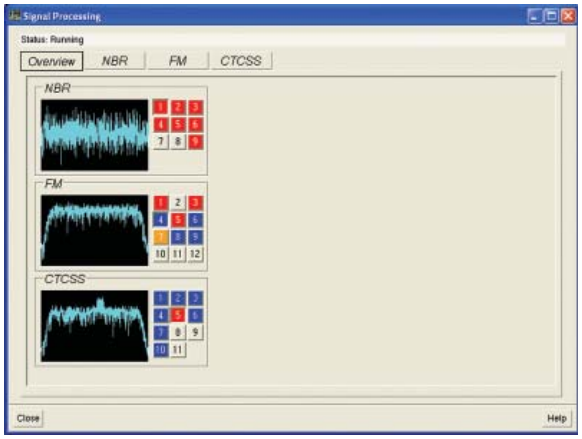
CTCSS Signal Recognizer

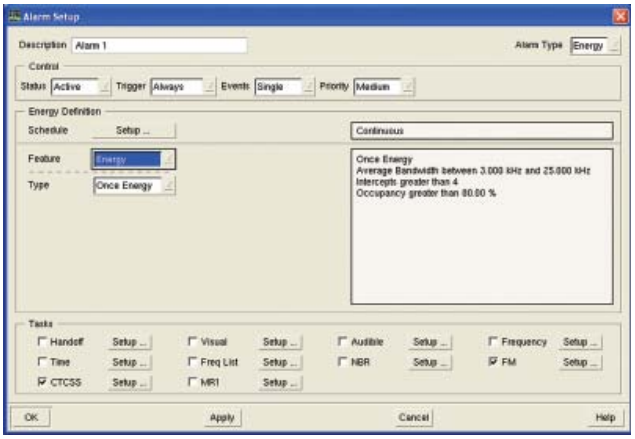
Some FM radios transmit a low frequency tone, commonly referred to as a CTCSS tone, along with the message. The receiving radio can then squelch any signals that do not have the correct low frequency tone, dramatically reducing the number of signals received, providing a more private communication link. Since there are several different low frequency tones, several different semiprivate links are available.

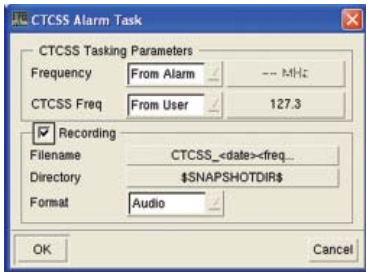
The 35688E-PLR CTCSS Signal Recognizer software is very similar to the FMR software, except it only records FM signals that have the target low frequency tone. If the CTCSS tone of the target user is known, recording signals with that tone allows the E3238S to intercept and record only those critical communications.

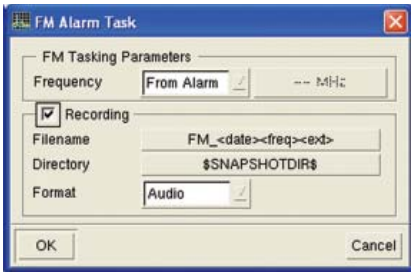
Dual-tone Multi-Frequency (DTMF) Signal Detection

The 35688E-DTM software option detects, decodes and records FM signals containing Dual-Tone Multi-Frequency dialing tones. With the DTM option, your signals of interest will be processed to include only signals with the familiar Touch-Tone keypad frequencies.









The Alarm Setup dialog box above shows a logical expression of new-energy parameters. The checkboxes in the Tasks section, indicate which alarm tasks are called, in this case the CTCSS Alarm Task and the FM Alarm Task. The dialog boxes to the left show the parameters of the alarm tasks. The "Signal Processing" dialog above left provides operators a real-time view into various narrowband processes and determine proper assignment of system resources.

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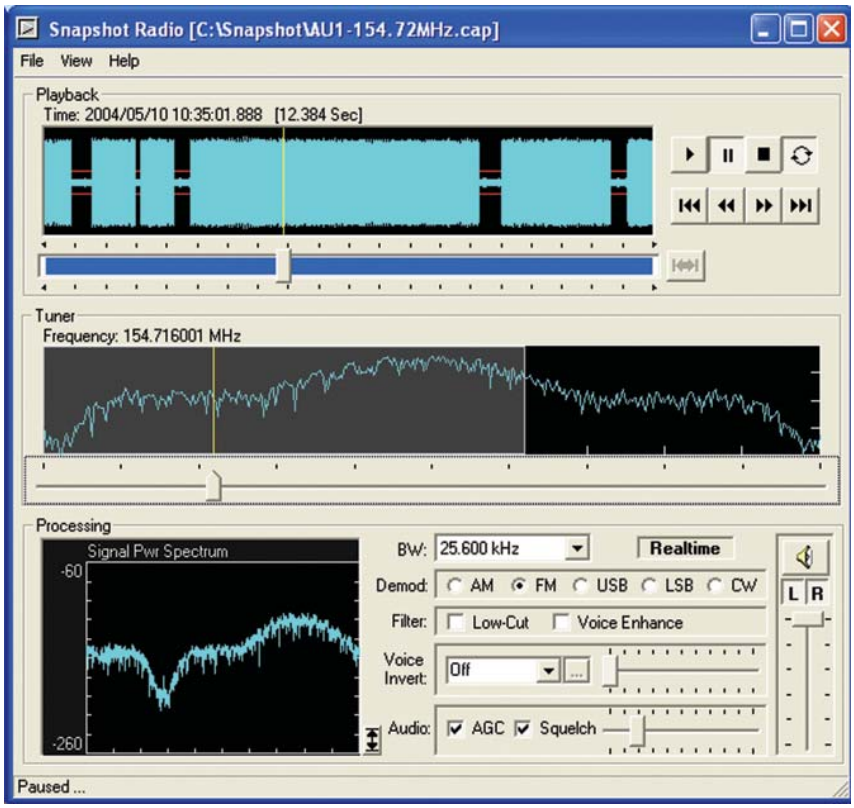
Audio Player

The N6829A Audio Player software is a completely separate software tool that can be used to play back files saved by the E3238S system.

Linguists using PCs on a system LAN can independently demodulate and listen to voice channel files saved from E3238S missions.

Audio Player works in a highly integrated way with 35688E-FMR, PLR, and the Voice Activity Detection System.

Audio Player provides AM, FM, uppersideband, and lower-sideband demodulation, gain, squelch and other audio processing controls. Using arrow keys to toggle through saved files makes it quick and easy to manage.



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Device-Specific Applications

E3238S software applications target specific communication devices. These applications also include tools specific to that type of communication. They may include special displays and automated report generation. Actual message information is stored in the Signal Database where it can be used as alarm criteria.

Automatic link establishment

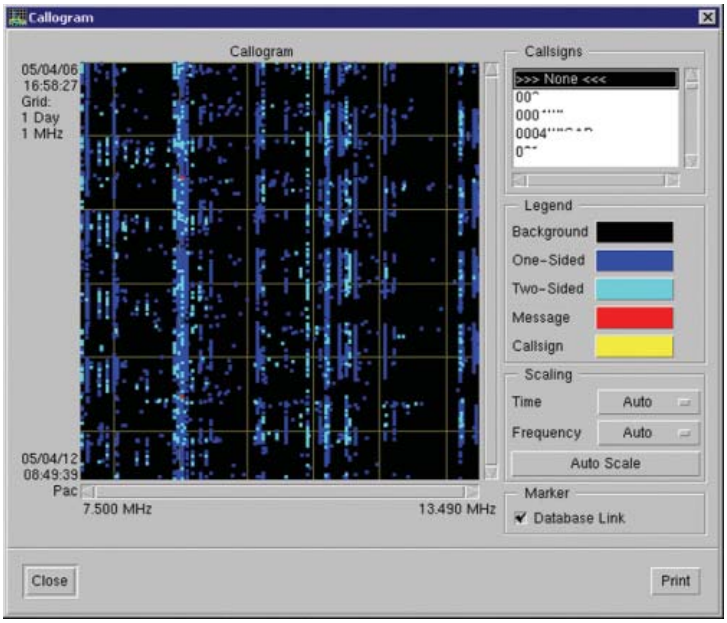
The 35688E-ALE software is targeted at a specific device: HF military radios that use automatic link establishment protocols, MIL-STD-188-141. It intercepts the link negotiations, and captures the callsigns of the radios establishing a link. The software includes extensive displays that allow operators to visualize the patterns of communication, including the time of day, frequencies used, the "to" and "from" callsigns, interconnection of callsigns, and other information such as LQA or AMD.

All ALE information is included in the Signal Database, so it is easy to create alarms when specific callsigns or combinations of callsigns occur. Callsign information can be linked with direction information from a direction finding subsystem to create alarms for tactical systems.

Pager intercept system

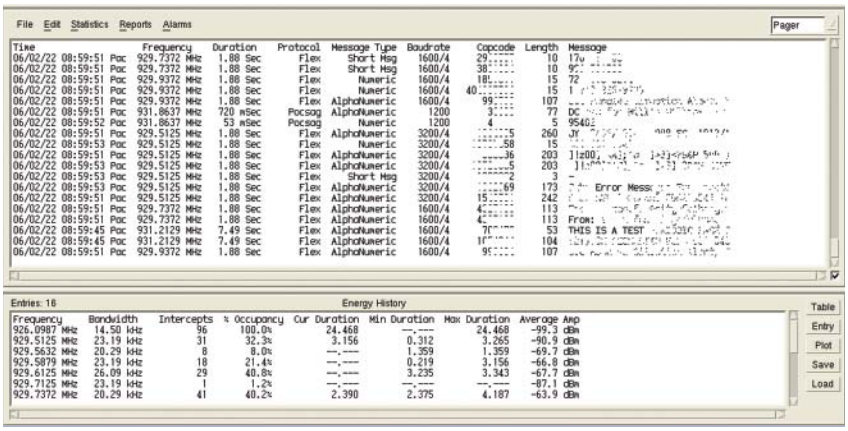
Pagers are a communication device that allows text communication at a very low cost. The 35688E-PG1 software targets POCSAG and FLEX format pagers specifically, intercepting the communications and decoding the text messages they contain. All text and device information, such as the unique pager capcode, is stored in the Signal Database. Alarms can be defined that trigger with specific capcodes, telephone numbers, or even words or phrases in the text message. Device-specific displays support automated report generation of messages based on the alarm criteria, and a real-time display supports tactical missions, with alarming and a simple interface that enables quick realtime access to messages.

The Callogram shows patterns of communication. It displays frequency across the x-axis and time across the y-axis. ALE links between callsigns are shown as dots, and a cursor can display the callsign or callsigns of a specific link. The dots are color coded with additional link information.

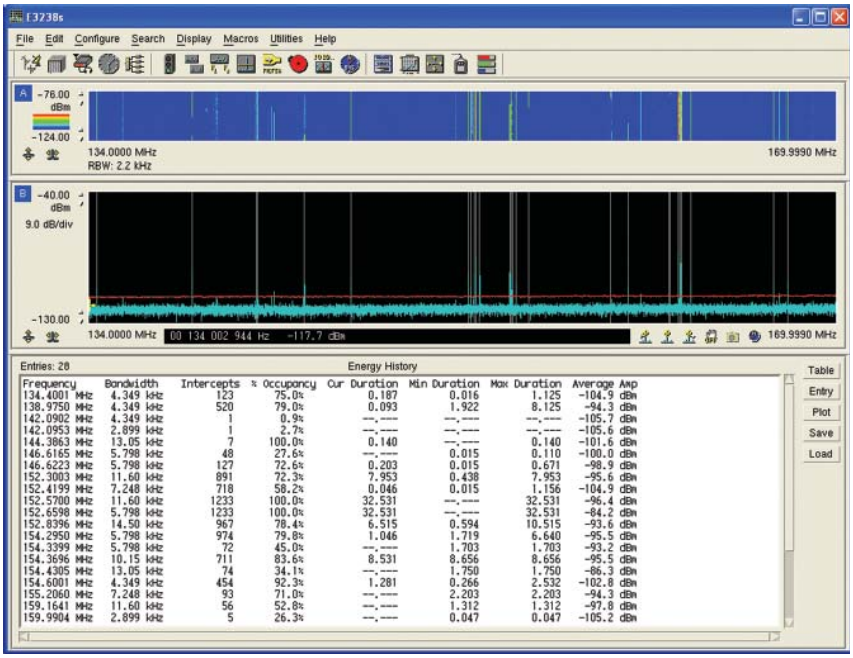


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The pager Signal Database can be displayed. It includes all information from intercepted signals, including the text and capcode of the specific pager.



This display shows the Signal Database, which includes entries for all recorded voice signals. The files can be automatically named, using a naming convention that includes critical signal information, such as time of day, center frequency, and bandwidth. To help the operator monitor activity, the spectrum display shows a vertical marker at all frequencies where voice signals have been intercepted and recorded.



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VHF/UHF voice activity detection

For customers who need to specifically intercept and collect push-to-talk voice communications in the VHF/UHF spectrum, the 35688E-VA2 Voice Detection software decreases the time required to locate specific messages of interest.

How voice activity detection works

An energy alarm uses the energy bandwidth to pass potential voice signals to the VA2 software running in the G4 processors. They perform FM demodulation, then test the resultant time data to see if it has the characteristics of spoken voice. If so, the undemodulated time data is recorded to the system disk where linguists can listen to it using the N6829A Audio Player software. Since Audio Player is a separate application, several linguists can simultaneously use its file management capabilities to efficiently sort through hundreds of signals as they occur.

The VHF/UHF voice activity detection software identifies CTCSS low frequency tones, if present, and includes their frequencies in the Signal Database. They can then be used as alarm criteria, allowing operators to focus their attention on communications with specific tones.

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35688E User Programming Option ASD

Option ASD makes it possible for users and other system integrators to dynamically link new functions and capabilities into the E3238S.

Custom energy classification functions

Using ASD, operators can create energy history entries computed from parameters already in the energy history. This provides enhanced automatic energy classification.

Energy history filtering functions

Option ASD enables user defined pre- and post-filtering of wideband data. Pre- and post-filtering are two ways to automatically limit the size of the energy history, speeding energy detection. A custom pre-filter prevents signals from being included in the energy history. For example, it is possible to compare the signal's frequency spectrum shape to user-defined upper and lower limit lines to determine if the modulation type has the same shape as the target signal. Post-filtering allows signals to be automatically removed from the energy history. For example, false hits generated by transient events can be automatically removed.

Custom alarm functions

Option ASD empowers users to add their own tasks to the E3238S alarm function task list. The E3238S will automatically execute the user-defined tasks when new energy meets the alarm criteria. Signals can be passed to a legacy system.

Tuning the user interface

Option ASD user programming features can be utilized to modify the E3238S's graphical user interface to more closely match operational needs. Increase operator efficiency and productivity with custom pull-down menus and display panes.

Control special receivers

The E3238S is supplied with drivers for a number of standard handoff receivers. Option ASD enables the creation and inclusion of new handoff receivers into the system. The new receivers must use either VXI, LAN, or RS-232C for their command interface. User-written drivers provide full mouse-driven drag-and-drop assignment and manual tuning control of the receivers. Complete compatibility with automatic signal assignment from the alarms feature is maintained as well as the handoff receiver log.

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Other Options for the E3238S

EMC multi-channel search

The 35688E-EMC Multiple Channel option allows an ASD programmer to compare the power spectrums of signals from up to four antennas to determine which antenna a specific emitter is nearer. Up to four tuner/ADC combinations are supported by ASD. A typical application for ASD is searching for a hidden emitter and determining whether it is inside or outside a building.

New signal threats...developed quickly

New signal types and new threats are constantly emerging. New programs may need to be created that execute on the E3238S's G4 processors. Agilent can create the software for you, or in special cases train you to create them yourself using open programming tools provided by Agilent. Contact your Agilent Field Engineer for more information.

Ordering Information

Model/Option No.	Core Application Platform Software
35688E	E3238SS Signals Development System Software
35688E-103	Standard E3238S software on Windows

Model/Option No.	Application and Tools Software
35688E-AL9	Auto link establishment MIL-STD-188-141 application
35688E-AU1	Real-time audio tool
35688E-FMR	FM signal recognizer tool
35688E-DTM	Dual-tone Multifrequency application
35688E-MR1	Basic modulation recognition tool
35688E-PG1	Pager intercept application
35688E-PLR	CTCSS signal tool
35688E-USD	Universal Signal Detection
35688E-VA2	VHF/UHF voice activity detection application
N6829A	Audio Player tool

Model/Option No.	Software Enablers (Used for Runtime and Development)
35688E-ASD	User programming libraries and documentation
35688E-EDF	Enable narrowband direction finding subsystems
35688E-EMC	Enable multiple search channel applications
35688E-EMS	Enable multi-system synchronization applications
35688E-ESX	Enable customer-developed signal processing applications
35688E-WDF	Enable wideband direction finding subsystems
35688E-WRP	Enable wideband record and playback subsystems
35688E-1RU	One-year software update service
35688E-2RU	Two-year software update service

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Revised: July 17, 2008

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Printed in USA, April 20, 2009
5989-1505EN

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