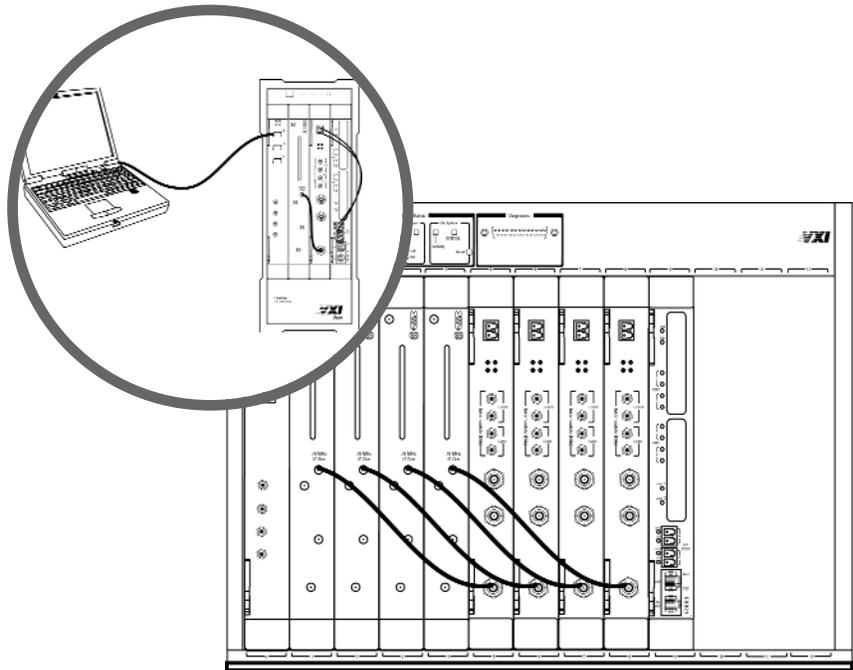# Agilent E3238S/35688E Signal Intercept and Collection System

Configuration and Performance Reference

Introduction

The Agilent E3238 series is a family of modular Signal Intercept and Collection solutions. The systems are based upon COTS industry standards for both hardware and software components. To meet your specific solution needs, numerous system components can be selected and configured. The modular and scalable architecture makes it possible to build small footprint intercept and collection solutions, or grow the system into fully programmable signals development workstations.

This configuration and performance reference guide will describe:

- Basic Application Software for an E3238 System
- Examples of several fully configured solutions
- Typical search and collection subsystems
- Foundation components
- Acquisition and processing performance attributes of the system
- Standard characteristics for systems including size, weight, power and cooling requirements

Agilent Technologies

1 E3238 Signal Intercept and Collection Solutions

Since the RF spectrum and your acquisition requirements are rapidly changing, the system is designed to be modular so as your mission changes, the system hardware and software can be easily updated to meet new requirements.

All of the solutions in the E3238 family are built around the core 35688E application software. This software provides the cockpit controls for the user, control of all the acquisition hardware in the E3238 system, and more. This software runs on Microsoft® Windows® XP and 2000.

35688E Option 103 – Standard Application Software

Currently many users tasked with signal survey are buying many individual pieces of test equipment, including spectrum analyzers and other devices. Often, customers end up writing custom software and struggling to create databases for their collected signals. It is a turnkey software solution for unknown wireless emitter identification. The software provides an extremely powerful, high speed portable, HF or V/UHF signal survey and database collection and creation tool. It speeds results by supplying all the necessary software to control measurement acquisition hardware and provide automated signal processing tools in one complete portable solution.

Option 103 provides the ability to add any or all optional application packages to a single system. Often customers purchase a single seat of Option 103 with the open programming environment option, and multiple seats of Option 103 with the run time enabler options. This makes it possible to develop your own solutions and then deploy them for less than buying full development seats for each system.

35688E-103 Runtime and Development Features

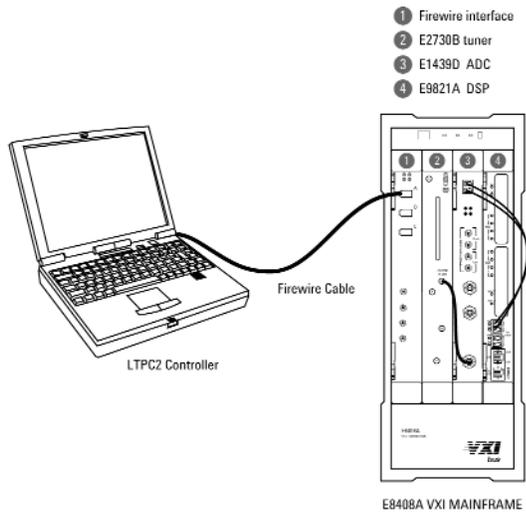| Primary System Application	Runtime System For signal survey and signal collection	Development Seat Enables user programming of system and DSP
Multiple search modes	■	■
Thresholds (level, noise following, environmental)	■	■
Frequency list function	■	■
Alarms function - (to trigger action)	■	■
Energy history database	■	■
Mission state save/recall	■	■
Hardware handoff receivers supported (18 models)	■	■
Signal specific marker functions	■	■
Time and Frequency snapshot functions	■	■
Data compatibility to Agilent 89600 VSA	■	■
Remote control and data export capability	■	■
DDC channels supported	■	■
Signal database - MR1	■	■
Software subscription service available (1RU or 2RU)	●	●
Signal analysis and classification Tools		
Universal Signal Detection - USD	●	●
Modulation Recognizer - MR1	●	●
Audio Player for Snapshot Files - N6829A	●	●
Pager Intercept solution - PG1	●	●
Voice Activity Detection solution - VA2	●	●
HF ALE Intercept solution - AL9	●	●
Narrowband Recorder - NBR	●	●
Realtime Audio - AU1	●	●
FM signal - FMR	●	●
DTMF Signal Recognizer - DTM	●	●
CTCSS signal - PLR	●	●
User programming capability		
Direction Finding subsystems - EDF	●	●
User defined energy features - ASD	Runtime	●
User defined feature filters - ASD	Runtime	●
User defined alarm tasks - ASD	Runtime	●
User defined menus/panes & interface controls - ASD	Runtime	●
User Programming for new hardware handoff receivers - ASD	Runtime	●
User defined signal processing - E9051A-121, 35688E-ESX	●	✚
User-defined handoff receiver drivers - ASD	Runtime	●
Multi-channel system	✚	✚
Multi system synchronization	✚	✚
Enable Channelized Data - ECH	✚	✚

KEY

■ Standard in this version   ● Orderable as an option   ✚ Special option upon request

Examples of Fully Configured Systems

1 Firewire interface
2 E2730B tuner
3 E1439D ADC
4 E9821A DSP

Firewire Cable

LTPC2 Controller

E8408A VXI MAINFRAME

HF Signal Survey

1 Firewire interface
2 WJC9119M tuner LO
3 WJC9119S tuner RF
4 E1437A ADC
5 E9821A DSP

Firewire Cable

LTPC2 Controller

MFRAME1 VXI MAINFRAME

V/UHF Signal Survey

This is the smallest form factor search system available. It uses the portable 4-slot E8408A VXI mainframe with the enhanced current option 001.

Due to power limitations in the mainframe, the E9821A DSP processor in this system is populated with one option 101 Dual G4 processor. For full sweep rate performance, use a MFRAME1, 5 slot mainframe which will enable full performance with three option 101 Dual G4 processors.

By moving up to the 5 slot mainframe, you also have room for an optional VXI handoff receiver from among those supported for the standard signal survey solution. The VXI cards shown, E2730B and E1439D, survey V/UHF signals.

The 5-slot VXI mainframe shown is an example of an HF signal survey system. It uses the WJC9119 tuners and the E1437A ADC. The E9821A DSP shown can have up to three option 101 Dual G4 processors.
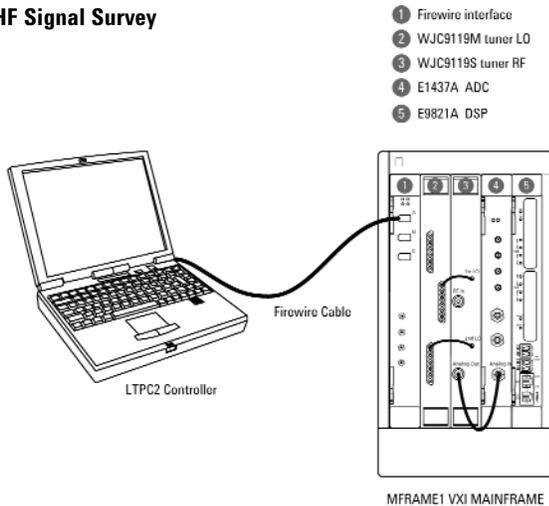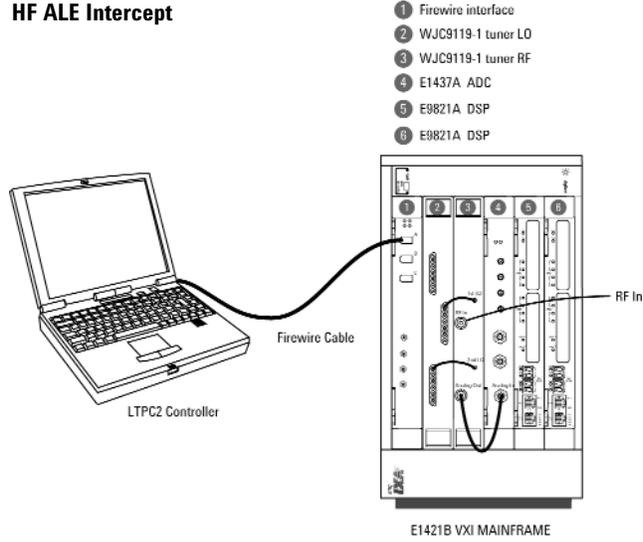
VHF/UHF Voice Activity Detection System

A compact, high performance V/UHF Voice Activity Detection System (VADS) consists of the V/UHF survey solution above, plus a DDC plug-in in a 5-slot VXI mainframe. With the new DDC plug-in, the E9821A can perform search and collection in a single DSP module. This produces a smaller, less conspicuous system. Previous Voice Activity Detection Systems were over twice this size. When used with an external laptop PC, this is very portable and can scale from 32 channels up to a full 96 channels in only 5 VXI slots.

HF ALE Intercept Solution

Typical multi-channel systems are for V/UHF signals, so multiple sets of E273xB tuners and E1439D ADC hardware is configured. In HF Systems, the HF tuner, WJC9119 requires two VXI slots. In the past this meant using a much larger VXI mainframe. The high density signal processing capabilities of the G4 processor, coupled with our newest 32 channel DDC makes our 32 channel HF ALE intercept solutions fit in a 5 slot mainframe, or scale up to a 128 channel system as shown in a 6 slot E1421B mainframe.
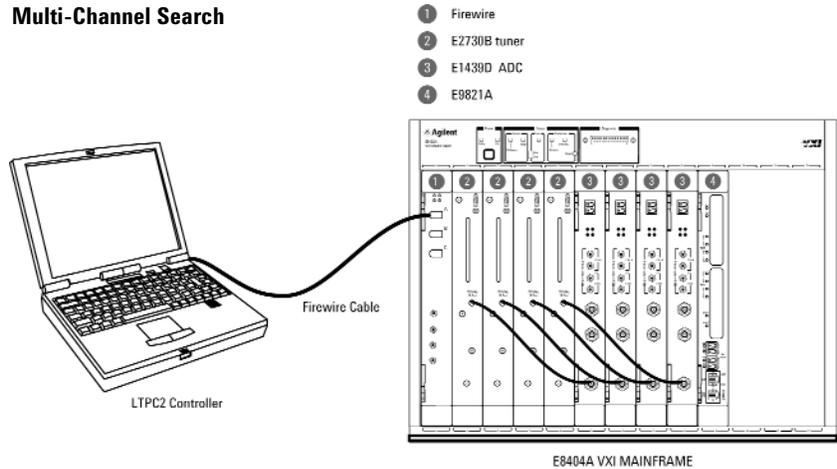
HF ALE Intercept

1 Firewire interface
2 WJC9119-1 tuner LO
3 WJC9119-1 tuner RF
4 E1437A ADC
5 E9821A DSP
6 E9821A DSP

Firewire Cable

RF In

LTPC2 Controller

E1421B VXI MAINFRAME

Multi Channel Search Subsystem

35688E option EMC allows up to four tuner/ADC search channels. Using 35688E option ASD a programmer can write programs that compare the power of the four input channels to see which antenna has the greatest signal strength. A hidden emitter is most likely physically located nearest the antenna with the greatest signal strength. Due to the complexity of EMC configurations, customers should work with an Agilent sales person to configure any system with multi-channel search capability. Option EMC requires option ASD in software configurations.

Multi-Channel Search

1 Firewire
2 E2730B tuner
3 E1439D ADC
4 E9821A

Firewire Cable

LTPC2 Controller

E8404A VXI MAINFRAME

HF through Microwave Subsystem

The Agilent E4440A PSA can be used as a tuner for a very broad search of the RF spectrum to include microwave frequencies. The E1439D ADC's 36 MHz bandwidth matches the bandwidth of the PSA with special option HY7 IF output. The PSA is controlled via LAN to allow survey from 100 kHz to 26.5 GHz.

Microwave Search and Collection

IEEE 1394

H7x Output

LAN

RF in

Network Hub or Switch

5
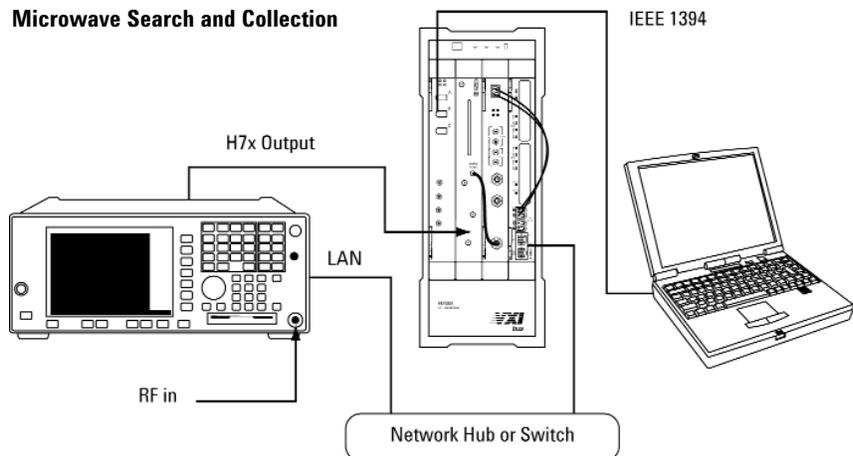
Typical Subsystem Configurations

Search Subsystems

Every E3238 system must have at least one search subsystem. The E9821A DSP module is used for all signal search subsystems, but the tuners and digitizers are selected depending upon the frequency range of interest.

HF, VHF/UHF, and Microwave Coverage

Since the system is built using modular hardware, it is easy to reconfigure a system for different missions. To change the coverage of search frequencies, simply change the E3238's tuner and digitizer combination. The other measurement hardware is the same for all systems. Several tuners are available, from HF to microwave. Here are the most common combinations of Tuner and Digitizer selected by customers.

Optimizing the ADC

The E1437A 20 MSample/sec ADC provides high dynamic range that is critical for the crowded HF spectrum. For VHF/UHF and µWave, the E1439D's 36 MHz stare bandwidth lets you continuously search wide frequency ranges or sweep at rates up to 10 GHz/sec. This minimizes revisit times and maximizes probability of intercept.
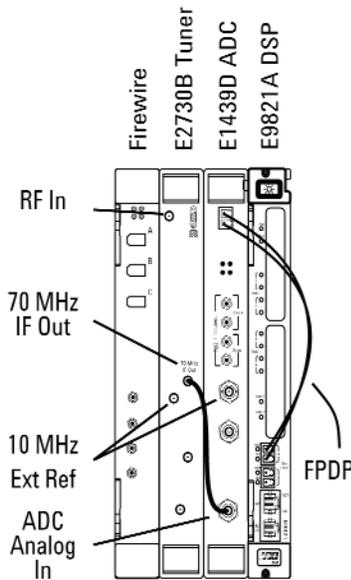
E9821A DSP Performance

Search is performed by detecting new energy in the frequency domain, as new signals briefly appear and disappear. To do this in real-time at the extremely high sweep rates attainable with the E3238, extensive DSP capabilities are required.
The E9821A DSP module uses Motorola® G4 DSP's with altivec vector processing to provide new levels of performance, FFT'ing time-domain data, processing the results, and transferring results to the host computer. For maximum performance, six G4 processors are used to parallel-process the time-domain data. Alternatively, a version of the E9821A is available with two G4 processors to decrease cost and provide a lower-power solution that allows a VHF/UHF search system to be used in the very portable E8408A 4-slot mainframe.
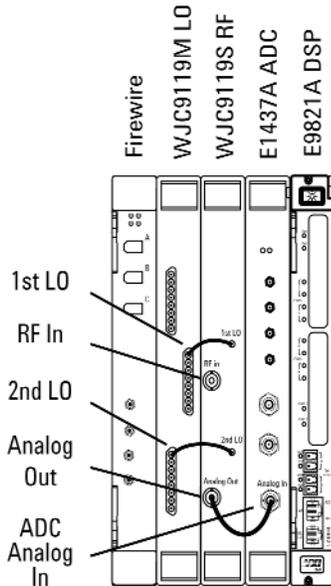
**1 -32 MHz HF VXI Tuner
with Exceptional Dynamic Range**

**20 MHz - 2.7 GHz VHF/UHF VXI Tuner
with 36 MHz Bandwidth**

**500 MHz - 20 GHz µWave VXI Tuner
for Coverage to Greater than 60 GHz**

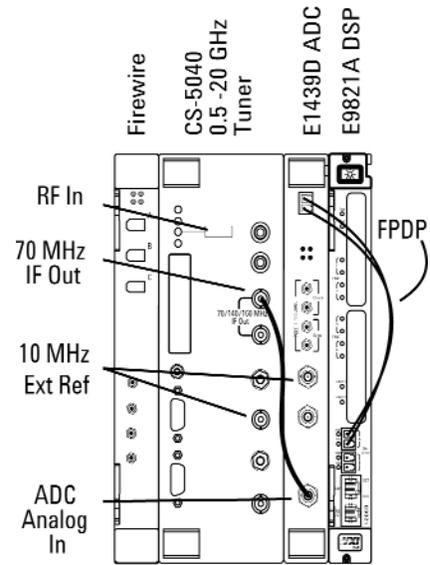### HF with exceptional dynamic range

The E1437A 20 MSample/sec ADC provides unmatched dynamic range. When coupled with the WJC9119M/S 0.1-30 MHz tuner, it can find small signals hiding near big ones, or pull signals out of the noise floor. Its 6.75 MHz stare bandwidth supports wideband search, maximizing probability of intercept.

VHF/UHF with 36 MHz bandwidth

The E1439D ADC's 36 MHz bandwidth matches the bandwidth of the E2730B 20-2700 MHz tuner and the new E2731B 20-6000 MHz tuner, allowing you to stare at wide frequency regions. For covering the full frequency range of these tuners, the E3238 with the new E9821A DSP can sweep at rates up to 10 GHz/sec, dramatically decreasing revisit times.

µWave coverage to greater than 60 GHz

The E1439D ADC's 70 MHz IF input is an industry standard, making it compatible with the CS 5040 0.5-20 GHz VXI tuner. The E1439D's 36 MHz stare bandwidth and exceptional sweep rates also apply when using the CS 5040 tuners. Options to the 5040 allow it frequency coverage to 100 GHz. The CS tuner must be ordered separately from Rockwell Collins.

Collection Subsystems

In the simplest form of intercept and collection system, a single E9821A serves as both the Search Signal Processing controller AND as the Collection Processing Controller.

To add more collection signal processing into the system, additional E9821A DSP modules are added into the VXI mainframe.

Each of the E9821A modules has four internal mezzanine card slots for insertion of either dual G4 DSP modules or 32 channel DDC modules. A multi-channel narrowband processing hardware subsystem (software defined receiver) is created when a DDC module and dual G4 DSP module are combined inside the E9821A.

One example of a collection subsystem is the implementation of a bank of narrowband receivers. The receivers are normally "tipped" by the search subsystem to tune one of its many Digital Down Converter (DDC) channels to the center frequency and bandwidth of the target narrowband energy.

The system can then record the signals to disc or perform further analysis of the energy to determine its internal signal characteristics. If the energy and signal characteristics match those in the search criteria, the system will pass information to other internal collection and processing components to demodulate and decode the signal. Other operations beside demodulation are possible. The processing actions of a collection system are determined by the collection algorithms created with 35688E optional programming software E9051A-121 used to create signal algorithms that run inside the E9821A G4 based DSP modules.

Agilent has created a variety of software defined collection systems, including a Pager Intercept System, Voice Activity Detection System, ALE Intercept System and others.

Contact your Agilent Sales Engineer to help you configure a system for your specific processing requirements.

Search with Collection   +   Additional Collection
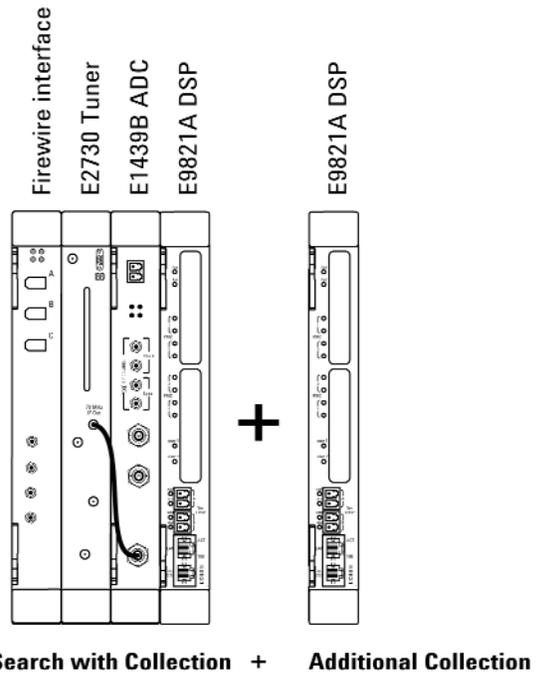
4   Building an E3238S from Foundation Components

The E3238 has two basic configurations, E3238S and E3238SU

- E3238S is a factory integrated system of computer, hardware and software, with pre-defined configuration requirements.

- E3238SU is used to order non-standard system configurations, upgrading existing systems or buying spare equipment as standalone components. The E3238SU requires the further selection of one of two options :

  - E3238SU-001   Integrated special or non-standard system, requires statement of work

  - E3238SU-002   Standalone items for system upgrade or spares

Since the E3238SU does not have pre-determined configuration requirements, purchase of an E3238SU system requires configuration advice from a factory expert.

The E3238S and E3238SU both contain the same system components. To minimize duplication only the E3238S components and configuration requirements are described in this configuration guide.

Step 1
Choose the frequency range for the signals of interest by selecting the combination of tuner and ADC.

The E3238S can monitor HF, VHF/UHF, or µWave signals. The ADC and tuner are configured as a combination for the specific signal monitoring task. All search systems or search + collection systems require at least one pair of an ADC and downconverter/tuner.

Signal	Tuner	ADC
HF	WJC9119M and WJC9119S	E1437A
U/VHF	E2730B or E2731B	E1439D
HF to Microwave	E4440A with HY7	E1439D
Microwave	See list below	E1439D

One ADC must be chosen for the E3238S system to operate. Up to four each of the same ADC model number is available. More than one ADC requires the 35688E-EMC for multiple search channels. The E1437A is used for measuring HF signals and the E1439D is used for measuring VHF/UHF and µWave Signals. The E1437A and E1439D are single slot VXI modules that plug into the VXI mainframe.

HF Frequency Range Tuner and Digitizer
The WJC9119M/S (2 VXI slots required) for signals from 0.1 to 32 MHz is only used with the E1437A. The WJC9119M is the LO section and WJC9119S is the RF section. One WJC9119M will interface with up to four WJC9119S modules for more channels. Each WJC9119S requires a dedicated E1437A. *(Export of the WJC9119M/S modules is subject to U.S. export control laws. WJC9119M/S can not be sold in Australia.)*

WJC9119M	VXI HF Tuner (LO section)
WJC9119S	HF Tuner (RF section)

E1437A single slot VXI digitizer requires option ANE for 64 MB RAM

E1437A	20MS/s, 23 bit, ADC with Filter and FIFO (Form Factor: C-1, VXI)
E1437A-ANE	64 MB total RAM
E1437A-0B2	Standard manuals included

V/UHF Frequency Range Tuner and Digitizer
The E273xB V/UHF tuners require one VXI slot each.

E3238S-030	E2730B--20 MHz to 2.7 GHz RF Tuner, including cable kit
E3238S-031	20 MHz to 6.0 GHz RF Tuner, including cable kit

The E1439D (single-slot VXI digitizer) requires 144 MB RAM. Additional RAM improves performance.

E1439D	70MHz IF ADC with filters and memory for E3238 systems
E1439D-144	144 MB total RAM
E1439D-288	288 MB total RAM
E1439D-001	1.2 GB total RAM
E1439A-0B2	Standard manuals included

Microwave Frequency Range Tuner and Digitizer

For survey of microwave frequencies, use the E1439D configured above, the E3238S-040 Cable Kit, and the E4440A PSA configured with option HY7. The E4440A PSA must be ordered separately from the E3238S system configuration.

E3238S-040	PSA as tuner cable kit

Option 510 is available for using a customer-supplier tuner. The 35688E supports the following customer-supplied tuners:

CS-5020/40	500MHz to 20 GHz (60 GHz with options)
SI-9136	20 MHz to 3 GHz
3000T	20 MHz to 3 GHz

The following combinations of block downconverters and tuners are supported:

SI-9250 and E273X	20 MHz to 18 GHz
SI-9250 and 3000T	20 MHz to 18 GHz
SI-9250 and SI9136	20 MHz to 18 GHz
CS-5320	2 GHz to 18 GHz

CS-xxxx models provided by Rockwell Collins.
SI-9xxx models provided by DRS Technologies.
3000T provided by Mercury Computer Systems.

These customer-supplied tuners and downconverters require the E1439D as the ADC.

E3238S-510	No downconverter, downconverter supplied by user or outside this configuration

Step 2
Must choose 35688E software (required)

Every E3238 system must have one copy of 35688E application software to run the hardware. 35688E-103 core software provides cockpit control of all the systems assets from antennas to digital receivers.

The software includes:
- A variety of signal visualization tools
- A powerful automatic energy detection and threshold detection system.
- A database for logging energy and signals.
- An automated alarm engine that makes it possible to run an unattended system and still get great results.

35688E	E3238S Intercept and Collection software
35688E-1RU/2RU	One-year or two-year Software update service
35688E-103	Standard E3238 software on Windows

Software Update Service – 35688-1RU or 2RU
Options 1RU and 2RU provide intermediate software updates and enhancements.

2.1   Choose Signal Applications
The 35688E software provides the application modules for monitoring various signal types. These software options provide the signal processing in the E3238S system.

35688E-AL9	Automatic link establishment MIL-STD-188-141
35688E-AU1	Real-time audio
35688E-FMR	FM signal recognizer/recorder
35688E-NBR	Narrowband recorder
35688E-PG1	Pager intercept
35688E-PLR	CTCSS signal/recorder
35688E-DTM	DTMF Signal Recognizer
35688E-USD	Universal Signal Detection
35688E-VA2	VHF/UHF voice activity detection/recorder

AL9 *– Auto link establishment MIL-STD-188-141
The 35688E-AL9 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.

AU1* – Real-time audio
Real-time audio makes it possible to use the narrowband DDC assets in a system as a virtual realtime handoff receiver. It is of value for customers who are already buying other options such as NBR, VA1 or other backend processing signal options.

DTM* - DTMF Signal Recognizer
The 35688E-DTM software 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. Multiple narrowband channels are recorded simultaneously using the E9821A-200.

FMR* – FM Signal Recognizer/Recorder
The 35688E-FMR software for the E3238 detects VHF/UHF frequency modulated signals and records both the demodulated and un-demodulated narrowband time data and the demodulated voice or data to the E3238S system disc. To use the FM Recognizer software, an operator creates an energy alarm that identifies energy with the bandwidth of the signals of interest. 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 extracts that channel from the wideband data, and passes it to the G4 processors, which test to see if it is an FM signal. If it is, the signal is recorded to the system disc in a variety of demodulated and un-modulated file formats..

NBR* – Narrowband Signal Recorder
The E3238 Narrowband Recorder (NBR) extends the functionality of the E3238 system to include multi-channel recording of narrowband signals up to 350 kHz bandwidth per channel. It is a general-purpose recorder that is called as an alarm task. Unlike 35688E-FMR and PLR, NBR does not perform any tests on the signal. It simply records the time data from the DDC's output to the system disk. The center frequency and bandwidth of the recording can be passed from the energy alarm, a signal alarm, or be selected by the operator. Option USD includes the functionality of NBR. *(A E9821 "collection" module can contain up to three 32-channel DDC daughtercards providing a maximum of 96 channels of simultaneous NBR recording channels per E9821 VXI module. Multiple E9821A modules can be added for higher channel counts.)*

PG1*– Pager Intercept
Pager signals are automatically intercepted, demodulated, decoded, and recorded by the Pager Intercept System. Over 100,000 pages per hour can be recorded. User-defined alarms search new pager messages for capcodes and pager parameters, as well as words and numbers contained in ASCII messages. A display shows the alarms as they occur, allowing you to click on them to read the messages immediately. Powerful find capabilities allow you to search the entire database for words, capcodes, or protocol parameters. Reports summarize the results of the find operation in a concise chronological report.

PLR*– CTCSS Signal Recognizer
The E3238 Continuous Tone Coded Squelch System (CTCSS) Detector software extends the E3238's functionality to provide detection of signals using CTCSS in their transmissions. A CTCSS transmitter uses a sub-audible tone that is sent along with the transmission, A CTCSS receiver or repeater will detect this sub-audible tone and allow the reception or transmission to happen. The main benefit is the rejection of all other transmissions that do not contain the sub-audible tone. This is particularly helpful for repeater stations and to minimize interference in crowded RF environments.

USD* - Universal Signal Detection

Option USD is a very flexible and powerful tool for signal detection and classification. Without programming, you can quickly change the USD settings and parameters to detect new signals. USD works with the DSP's narrowband DDC for multichannel gap-free recordings. It can also learn from sample recordings to create a new signal detector.

USD efficiently processes only signals of interest by setting up a frequency plan, signal detectors and narrowband confirmers. This option's signal processing starts with bandwidth filters and a frequency plan of individual frequencies or bands. Up to 23 universal wideband detectors are created or used from a library to look at the shape of the power spectrum and limit the signals of interest. Once a signal is detected using the detectors, narrowband confirmers can be used to look at the modulation format and parameters, such as symbol rate, bw, and deviation. The MR1 modulation recognition option's capability can be easily integrated for narrowband confirmation.

VA2*– V/UHF Voice Activity Detection/Recorder

The E3238s VHF/UHF Voice Activity Detector (UVAD) software extends the E3238s functionality to provide multi-channel automated detection of FM modulated voice signals within the VHF/UHF frequency spectrum. The UVAD software includes a built-in recording capability, allowing the user to optionally record detected voice signals. Voice recordings can be saved in a variety of formats, including .AU, .WAV, and E3238s .CAP files.

* Note 1: AL9, AU1, FMR, NBR, PG1, PLR, VA2, DTM, and USD require at least one E9821A DSP with one or more DDC daughter cards.

* Note 2: The AL9, AU1, FMR, NBR, PG1, PLR, VA2, DTM, and USD signal detectors consist of host software (the interface to the E3238 signal processing system, alarming, and signal database), plus DSP code which implements the specialized voice signal processing in the embedded E9821A DSP's G4 processors. E9821A-101 DSP processing power is required to run any of these signal detectors. Refer to the load factor tables for the amount of processing power recommended for each signal processing option and number of channels. Each additional E9821A VXI module provides additional channels and processing.

2.2 Modulation Recognition
MR1 – Modulation Recognition Software

35688E-MR1 adds wideband modulation recognition capability or narrowband confirmation to an E3238 system. Twenty-five analog and digital modulation formats are supported. Wideband modulation recognition runs on the search system's host CPU, it does not require collection hardware; therefore systems are physically smaller and less expensive. Narrowband confirmation runs in conjunction with option USD and requires narrowband collection hardware.

Key features:
- Modulation recognition user interface integrates into the E3238 interface
- Signals are tested for all modulation types, and the most likely are displayed graphically with additional pertinent information
- Integrates with Universal Signal Detection
- A histogram shows the relative probability of the modulation types

Modulation types supported:

FSK	256 QAM
3-level FSK	AM
4-level FSK	AM DSBSC
8-level FSK	LSB
Analog FM (includes multi-level FSK not shown above)	USB
MSK (includes GMSK and Offset (aka Staggered) QPSK)	OOK (aka ASK)
	4PAM (aka 4-level ASK)
BPSK	Manual Morse
QPSK (includes DQPSK)	Machine Morse
p/4 QPSK (incl. p/4 DQPSK)	Unknown Digital (reports symbol rate of other digital modulation formats)
8 PSK	
16 PSK	Unknown
16 QAM	Pure Carrier
32 QAM	Noise
64 QAM	V.29 Modem

Modulation attributes displayed:

Confidence

Frequency

Bandwidth

Signal to noise ratio (SNR)

Symbol rate

Frequency Deviation
Confidence

35688E-MR1	Basic modulation recognition application

2.3 Software Enablers

The 35688E software enablers are used for runtime or development. Some software enablers, e.g. ESX are required to run customer-developed software.

EDF – Enable direction finding systems

This option is required for an E3238 system that will be inter-connected with a supported external direction-finding system.

These DF sub-systems are supported with a software driver:

- Titan/L-3 Comm PRD-13

- Cubic VXI 4400 (uses Cubic VXI-3570 handoff receiver)

EMC – Enable multiple 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. This option requires additional system hardware and project consultation from Agilent for successful implementation.

EMS – Enable multi-system synchronization

This option makes it possible to accurately synchronize the timing of multiple E3238 based systems. This option requires additional system hardware and project consultation from Agilent for successful implementation.

ESX – Enable all signal processing applications

Each customer-developed signal processing application connects to this runtime enabler module. Only one option ESX is required per system.

35688E-EDF	Enable direction finding applications
35688E-EMC	Enable multiple search channel applications
35688E-EMS	Enable multi-system synchronization applications
35688E-ESX	Enable customer-developed signal processing applications

ECH – Enable channelized data

Option ECH delivers multiple channels of narrowband time data to an external processing workstation. The time data can be delivered to the host processing workstation via LAN for convenience and low cost, or via a serial Front Panel Data Port (sFPDP or FPDP) for higher throughput. The multiple channels of data can be set up from the E3238S user interface, using an alarm, or by sending a command string.

35688E-ECH	Enable Channelized Data

2.4 Additional Software

N6829A Audio Player

Audio Player is a separate software tool that allows linguists using independent PC's on a system LAN to manage files, demodulate, and listen to voice channels saved by the E3238 system or the 89600 Vector Signal Analyzer. One copy of Audio Player is required for each PC.

N6829A	Audio Player Software

2.5 Development Software

ASD* – User Programming Libraries and documentation

Option ASD makes it possible for users and other system integrators to dynamically link new functions and capabilities into the E3238 such as:

- Custom energy classification functions
- Database filtering functions
- Custom alarm functions
- Tuning the user interface
- Control for new or special receivers

ASM* – Feature studio

Option 35688E-ASM Feature Studio is a legacy program with a graphical user interface that automatically generates C code to create limit lines. Option USD has more capability and has superceded the functionality of ASM.

Note 3: To make and save programming changes with Options ASD and ASM users must own and have installed a copy of Microsoft Visual Studio .NET

Signal Survey and Collection System (35688E-103)									Development Options	
Band	AL9	AU1	FMR	NBR	PG1	PLR	VA2	DTM	USD	ASD	E9051A-121
HF	■	■		■				■	■	■	■
VHF/UHF		■	■	■	■	■	■	■	■	■	■
Microwave		■	■	■	■	■	■	■	■	■	■

35688E Signal Compatibility - Various 35688E signal options and developer options are compatible with the signal ranges of interest.

35688E-ASD	User programming libraries and documentation
35688E-ASM	Feature studio

E9051A-121 Signal Processing Libraries

This product is only available as special order. It provides special programming libraries for self-integrators. Contact your Agilent Sales Engineer for ordering and availability.

User software created with development options can run in the E3238S without licensing or restrictions. Depending on the user software created, 35688E enabling options may need to be included in the runtime system.

2.6 License Key Choices

The 35688E software can be tied to a USB key or the hostID of the PC. Your license file can be encoded specifically for a removable USB hostID device (USB Key) by selecting LK1 option. This is the best choice if you prefer to work on multiple computers. Alternatively, your license file can be keyed to a specific computer as option LK2. A unique hostID is derived from your computer's components. This is the best choice if you need operational simplicity on one machine.

You should have a failure recovery plan for the complete system hardware, including the computer. To recover from a computer failure, the software may need to be re-installed and properly configured on a back-up computer. To activate the license on the option LK1, simply move the USB key to the back-up computer and continue operation of the system. To operate a back-up computer with LK2, you must contact the Agilent E3238S Software Licensing Administration team for a new computer-keyed license file. In emergency situations where these remedies are not possible, an option LKB is provided as a quick, fail-safe recovery of software operation. This single-use, emergency back-up key will enable the operation of the E3238S for a few days from when it is activated. The back-up key is only for temporary license recovery when you are unable to contact the Agilent E3238S License Administration team.

35688E-LK1	Standard USB license key
35688E-LK2	License key tied to hostID
35688E-LKB	Back-up License Key

Step 3
Must select a DSP (required)

At least one E9821A DSP module must be included in the VXI mainframe. Up to four E9821A DSP modules may be chosen. Each DSP module has four sites to attach a combination of up to 3 dual G4 processors and/or three multi-channel digital

down converters (DDC). Additional E9821A DSP modules may be added for more processing power and/or more channels. Delay memory can be created by using two E9821A modules.

E9821A	Signal processor module for E3238 system
E9821A-101	Add dual G4 processor card with extended RAM
E9821A-200	Multi-channel digital downconverter card
E9821A-0B2	Standard manuals included

Two of the 9045A Fiber Optic cables must be used to connect each E1439D to each E9821A. Multiple E9821A's require one fiber optic cable between each module. Spares of this cable are recommended.

E9045A	Fiber-optic 16-inch simplex cable

DSP processors will be positioned in the mainframe with the first DSP on the left and the second to the right of the first. The first DSP will always be the search DSP, and may also have 32 channels of collection. The second through fourth additional E9821A VXI signal processor main boards are added for collection use only.

In a "search only" system configuration, the E9821A should be configured with 3 each option 101's to provide the most processing power. In a search and 32 channel collection system, the E9821A should be configured with 3 each option 101 and one each option 200. In system configurations with more than 32 channels, the configurations of the DSP's depend on the type of signals and the processing load factor. As an example, an ALE signal is simple to process, so it can be processed effectively in a 1 Dual G4 with 3 channelizer card configuration. A U/VHF VAD signal is more complex and requires a 2x2 configuration of 2 DSPs /2 channelizer cards. Use the DSP G4 processor and/or DDC channels load factor table in section 5 of this document to determine the configuration of the E9821A DSP for specific signals.

Step 4
Must Choose System Controller (required)

The E3238S system requires a PC to control the instrumentation via the software. The LTPC2 is a laptop PC with the features from the "required" column on the following page.

Model	Description
LTPC2	Laptop PC with Windows
E3238S-500	No Controller, controller supplied by user or outside this configuration

The minimum PC requirements for installing the 35688E software on a user-supplied PC are:

Features	Minimum Required	Recommended
CPU		
Processor	1.5 GHz Pentium P4	Dual 3 GHz Pentium
Memory	512 MB	2 GB
Operating System:	Microsoft® Windows® XP with Service Pack 2 (also supports Windows 2000)	Microsoft Windows XP with Service Pack 2
Drives		
Hard Drive	20 GB	120 GB
CD / DVD Drives	CD/DVD Combo Drive	16x DVD+RW
Graphics		
Display	15" Display	24" WidescreenLCD Display
Graphic Card	True 1024x1280 (on-screen resolution)	True 1600x1600 (on-screen resolution)
	16 Bit True Color	32 bit True Color
	On-board Video Memory (8 Mbyte minimum)	Video Card with 128 Mbyte memory
Communication (I/O)		
Sound Card (Audio)	Required only for AU1 and E9051A-430	32 bit Stereo Audio Card (with Line in/out).
	Required for E3238S training classes	Required for E3238S training classes
Serial Ports	not required	1-port (used for each serial handoff receiver)
USB	1-port required for License Key	4-ports
Firewire	1 port (must meet OHCI standard)	2-ports (must meet OHCI standard)
GP-IB	not required, unless using GP-IB handoff receiver	1-port - (May use Lan to GPIB converter)
Networking	not required, unless using multiple system synchronization, remote audio, or socket connection to other systems on the network)	100/1000 Mbit/sec Network Interface card (NIC)
PCI Expansion Slots	May be required for the above items	One open PCI slot required for (MMS)

Optional PC Accessories

The LTPC2 includes IEEE-1394-1995 connectivity. The E8491B IEEE-1394 PC Link to VXI includes the cable and VXI card to connect to the VXI Mainframe.

LTPC2 includes a mouse.

If a customer-supplied desktop PC does not have IEEE-1394 interface, then include E8491A-001 with the configuration. Customer-supplied laptop PC must have a compatible IEEE-1394 interface.

E8491B	IEEE-1394 PC Link to VXI
E8491B-001	OHCI based IEEE-1394/PCI card

Step 5
Additional capabilities (optional)

Switching
The E1472A 50 ohm single slot VXI RF multiplexer may be used in the E3238S system as an antenna switch. The E1472A is only appropriate for switching HF signals or the outputs of multiple tuners due to it's 1.3 GHz maximum frequency. The E1472A is only used with the WJC9119M/S tuners.

Be sure to include the VXI slot required in the VXI mainframe in step 6.

The E1368A 18 GHz microwave switch in single slot VXI with C-size VXI carrier module is available upon request. This microwave switch would be used with the E2730B or E2731B tuners and VHF/UHF signals.

E1472A	Six 1x4 50 Ohm RF Multiplexers
35688-88800	Cable kit

Hand-off Receivers
You may choose one of two types of handoff receivers. One type is a software handoff receiver, where the system actually passes data to a second software application, the 89600S family of Vector Signal Analysis software. One type of handoff receiver is where the system actually passes data to the 89600 Vector Signal Analyzer. Over 18 different receivers are supported and new drivers can be created if you have a different receiver. The 89600S is a very popular hand-off receiver. Signal Analysis Software is available with the E3238S as a convenience to the customer.

89601A	Vector Signal Analysis Software
89601A-200	Basic VSA, no hardware connectivity; includes free one year software update subscription service
89601A-300	Hardware connectivity
89601A-AYA	Vector modulation analysis
89601A-B7N	3G modulation analysis
89601A-B7R	WLAN modulation analysis
89601A-105	Dynamic link to EESof/ADS
89605B	RF Input and Calibration Module
89605B-611	Cable adapter kit

These are only a few of the options available. Every year more capability is added to the 89600S Vector Signal Analyzer.

Handoff receiver hardware can be provided separately or included by special request. Some handoff receiver hardware is in VXI format, so additional slots will be needed in the VXI mainframe.

Hardware Handoff Receiver

Handoff Receiver	Frequency Range	Interface Type
WJ-8607	VHF/UHF	RS232
WJ-8611	VHF/UHF	RS232
WJ-8615P	VHF/UHF	GPIB
WJ-8621	VHF/UHF	VXI
WJ-8629	VHF/UHF	VXI
WJ-8629/A	VHF/UHF	VXI
WJ-8634	VHF/UHF	VXI
WJ-8711	HF	RS232
WJ-8712	HF	RS232
WJ-8712A/P	HF	RS232
WJ-8721T	HF	VXI
WJ-8723	HF	RS232/GPIB
VXI-3250	HF	VXI
VXI-3550	VHF/UHF	VXI
VXI-3570	VHF/UHF	VXI
R-2411/U	MF/HF	GPIB
R-2412/U	VHF/UHF	GPIB
IC-R20	HF/VHF/UHF	RS232
IC-R8500	HF/VHF/UHF	RS232
IC-PCR1000	HF/VHF/UHF	RS232
EK-895	HF	RS232
RX-331	HF	RS232
Agilent 89400/600	VHF/UHF	GPIB

WJ-xxxx products provided by DRS Technologies

VXI-3xxx and R-24xx products provided by Cubic Communication

IC-xxxx products provided by ICOM

EK-895 provided by Rohde&Schwarz

RX-331 provided by Ten-Tech

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Step 6
Must Choose VXI Mainframe (required)

After selecting all the VXI Hardware in the system a total count of VXI modules is required before selecting the VXI mainframe. In addition, some combinations of VXI modules require higher VXI mainframe power.

One VXI mainframe is required for the installation of the VXI modules. Choices are 4-slot, 5-slot, 6-slot and 13 slot. The 13-slot VXI model numbers have a choice of vxi chassis monitoring. The E8404A with enhanced monitoring is recommended because the VXI modules in the E3238S system require significant cooling for optimum performance.

VXI backplane connector shields are required.

Enhanced current option for –5.2V supply is required with the E8408A.

Model	Description
E8408A	4-slot, C-size VXI mainframe.
E8408-80900	Installed backplane connector shields
E8408A-001	Enhanced current -5.2V sply (Max pk 5.8A; -24Vpk reduced to 0.5A, dyn to 0.25A)
MFRAME1	5-slot, C-size VXI Mainframe; includes backplane connector shields
E1421B	6-slot, C-size VXI mainframe Compact mainframe.
E1421-80921	Backplane connector shield
E8403A	13-slot, C-size, VXI Mainframe with 1000W power supply and basic monitoring.
E1401-80918	Backplane connector shield
E8404A	13-slot C-size VXI Mainframe, 1000W power supply, enhanced monitor, color graphic display
E1401-80918	Backplane connector shield

E8408A Accessories

E8397A	Rack Mount / Cable Adapter Kit
E3663AC	RAIL: STANDARD
1494-0015	Slide kit for support shelf

E1421B Accessories

E1421-80908	Flange Kit
E1421-80909	Handle Flange Kit
E1421-80905	Smoked Acrylic Door
E1421-80916	Recess Mounting Kit

E8403A or E8404A Accessories

E8400-60006	Cable tray kit
E8401-80938	Air Filter Accessory Kit, user installable
E8400-60003	Standard rack mount adapter kit. Use with support rail or rack slide kit.
E8400-60004	Flush mount adapter kit. Use with support rail kit to flush mount the mainframe.
E8400-60005	VXIplugplay (VPP-8) adapter for Agilent racks. For support rail or rack slide.
E8400-60008	VXI Plug-and-Play compliant adapter kit for non-Agilent racks
E8400-60006	Cable tray kit
E8400-69301	Tinted Acrylic Door. Mounts in front of the mainframe in a rack cabinet.
E3664AC	Solid (non-sliding) rack mount rail kit f or non-Agilent racks
E3663AC	RAIL: STANDARD
1494-0411	Rack Mount Sliding Rail Kit
1494-0064	Brackets for non Agilent racks

Step 7
Training, Warranty and Support

For most new installations and all new users, E3238 training is recommended or required using the following table.

Field AE-delivered	Factory-delivered	Description
PS-T10-35688	E3238E-001	Basic Operation class, 2 days at customer location in US, with customer-supplied equipment
PS-T11-35688	E3238E-002	User programming class, 3 days at customer location in US, with customer-supplied equipment
PS-X10	E3238E-003	Custom E3238S training

PS-X10 and E3238E-003 are quoted as special services, for situations involving a change in location, number of days, number of students, use of rented equipment or any modifications to the standard training materials and delivery. Training details are typically outlined in a statement of work.

Agilent provides customer assistance to ensure the use of the E3238S system is successful. There are numerous services provided via contract with Agilent.

E9050B	Hourly productivity assistance
E9050C	Specialist hourly productivity assistance
E9050E	Hourly Integration services and documentation

Standard warranty on the E3238S system is one year for the Agilent-labeled item numbers. Items with the OEM brand, e.g. PC and MFRAME1, have warranty of 90 days from Agilent. Software has a 90-day media replacement warranty. A warranty extension for the Agilent-labeled hardware is available. Agilent personnel can provide the system support.

E3238 Training Requirements and Compatibility

Core Software Requirements	Basic Operation Class	User Programming Class
Signal Survey and Collection (35688E-103)	●	Depends on options
Development Seat	Prerequisite of User Programming Class	■
Training Hardware Requirements		
VXI Mainframe with Firewire	■	■
PC with Firewire	■	■
ADC with compatible tuner	■	■
DSP with search G4's (E9821A-101)	■	■
DSP with collection (E9821A-200)	●	■
Training Software Requirements		
35688E-ASD		■
35688E-ASM	●	●
Microsoft Visual Studio.NET		■
E9051A-121		■
WindRiver DIAB Compiler		■

■ Required   ● Highly Recommended

Performance Reference and Specifications

The E3238 system can support certain tuner and ADC combinations. Performance data is in the attached table.

Tuner/ADC Specifications	HF	VHF/UHF	VHF/UHF	µWave	HF to uWave
Tuner/Digitizer	WJC9119/E1437A	E2730B/E1439D	E2731B/E1439D	ComSol 5040/E1439D	E4440A with HY7/E1439D
Frequency range	0.1 - 32 MHz	20 - 2700 MHz	20 - 6000 MHz	0.5 - 20 GHz	100 kHz - 26.5 GHz
Useable IF bandwidth	6.75 MHz at 5.12 MHz IF	36 MHz at 70 MHz IF	36 MHz at 70 MHz IF	36 MHz at 70 MHz IF	36 MHz at 70 MHz IF
Tuner noise figure	13 dB, typical	11-12 dB, typical	16 dB typical	15 dB maximum	N/A
Tuner internally-generated spurious	-130 dBm, typical	-110 dBm, maximum	-110 dBm maximum	-100 dBm maximum	-100 dB maximum (option HY7)
RF input attenuation	0 - 47dB, i n 1 dB steps	0 - 30dB, in 2 dB steps	0 - 30 dB, in 2 dB steps	None	0 to 50 dB in 2 dB steps
Tuner pre-selection	Yes	No	No	No	No
Tuner form factor	2 VXI C-1 modules	1 VXI C-1 module	1 VXI C- module	1 VXI C-3 module	Standalone instrument, 7 in.
ADC residual spurious responses	- 110 dBfs	-90 dBfs	-90 dBfs	-90 dBfs	N/A
ADC harmonic distortion	- 75 dBc or - 110 dBfs	-70 dBc or -90 dBfs	-70 dBc or -90 dBfs	-70 dBc or -90 dBfs	-70 dBc or -90 dBfs
ADC form factor	1 VXI C-1 module	1 VXI C-1 module	1 VXI C-1 module	1 VXI C-1 module	1 VXI C-1 module

Physical Characteristics		E8404A 4-Slot		MFRAME1 5-Slot		Agilent E1421B 6-Slot		E8403A/E8404A 13-slot	
Dimensions		in.	mm	in.	mm	in.	mm	in.	mm
Width		5.25	133	6.96	176.78	9.19	233.4	16.7	424.5
Height		14.3	362	15	381	17.63	447.8	13.9	352
Depth		21.3	540	21.3	540	22	558.8	24.9	631
Weights		lbs	kg	lbs	kg	lbs	kg	lbs	kg
Mainframe Weight		20	9.1	22	10	30.6	19.9	55	25
Component Weights				lbs	kg				
E8491B Firewire Interface				2	0.91				
WJC9119 Tuner				10.9	4.95				
E2731B Tuner				7	3.18				
E9821A Search DSP				4	1.82				
E9821A Channelizer DSP				4	1.82				
E1437A Digitizer				4.5	2.04				
E1439D Digitizer				4.5	2.04				
Laptop PC				7	3.18				
Configured Systems	Total VXI Power	lbs.	kg	lbs.	kg	lbs.	kg	lbs.	kg
Signal Survey Only	155 watts	44	19.98						
VADS - 32 Channel	200 watts			47.5	21.57				
VADS - 96 Channel	285 watts			51.5	23.38				
Pager - 32 channel	230 watts			47.5	21.57				
HF ALE - 32 Channel	210 watts			51.4	23.34				
HF ALE - 96 Channel	260 watts					64	29.06		

E9821A DSP Loading Factor Tables

This table provides the number of G4 Processors required for different signal application software and increasing the number of DDC channels. Two G4 processors are provided with the option E9821A-101. Thirty-two channels are provided with one option E9821A-200. The first G4 processors configured as E9821A-101 are used for search, so these are additional G4 processors required for narrowband collection channels. Each E9821A may have a maximum of 6 G4's (or 3 each option 101).

Number of G4 Processors Required

	Signal Application Software								
	AL9	AU1	FMR	NBR	PG1	PLR	VA2	DTM	USD
(Loading Factor)	(96)	(16)	(32)	(48)	(24)	(32)	(16)	(32)	(8)
32 channels	1	2	1	1	1	1	2	1	4
64 channels	1	N/A	2	2	2	2	4	2	8
96 channels	1	N/A	3	2	3	3	6	3	N/A
128 channels	2	N/A	4	3	4	4	8	4	N/A

For example, if you are using the VA2 software, and you want 96 channels of collection, then you must have six G4 processors (or 3 each E9821A-101's) available for these 96 channels (provided as 3 each E9821A-200)

This table provides the maximum number of narrowband processing channels for different signal application software and increasing number of G4 processors. Two G4 processors are provided with each option E9821A-101. 32 channels are provided with one option E9821A-200.

Maximum Number of channels supported

	Signal Application Software								
	AL9	AU1	FMR	NBR	PG1	PLR	VA2	DTM	USD
(Loading Factor)	(96)	(16)	(32)	(48)	(24)	(32)	(16)	(32)	(8 to 16)
Two G4 processors	192	32	64	96	48	64	32	64	16
Four G4 processors	384	N/A	128	192	96	128	64	128	32
Six G4 processors	576	N/A	192	288	144	192	96	192	48
Eight G4 processors (requires two E9821As)	768	N/A	256	384	192	256	128	256	64

Performance Benchmarks

Data for a typically configured VHF/UHF or HF system are shown in the tables below. Holding all other processing factors constant, the sweep speed of the system increases in proportion to the number of G4 DSP processors. Adding Option 101 Dual G4 cards increases the sweep performance for those typical system communication bandwidths.

E2730B Tuner with E1439D ADC and 4 Averages

Sweep Rate in MHz/Second

RBW (Hz)	6 G4s	4 G4s	2 G4s
139160	10025.68	10131.93	10166.32
17395	9034.212	9119.06	9196.411
1087	2536.66	1830.013	893.142
136	146.651	97.739	47.442

WJC9119 Tuner with E1437A ADC and 4 Averages

Sweep Rate in MHz/Second

RBW (Hz)	6 G4s	4 G4s	2 G4s
120000	1795.511	1805.507	1822.145
15000	5055.375	4481.47	4844.549
938	872.934	875.2	610.722
117	119.478	119.533	69.853

System Component Operating Temperature Range

System Components	Temperature Range
E9821A	0 - 50 degrees C
E1437A	0 - 50 degrees C
E1439D	0 - 50 degrees C
LTPC2	5 - 35 degrees C
E2730B/E2731B	0 - 50 degrees C (20 - 30 degrees C guaranteed electricial specifications)
E1421B with E9821A	0 - 40 degrees C

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