HP E1439A

95 MSa/s Digitizer with DSP, Memory and 70MHz IF Input

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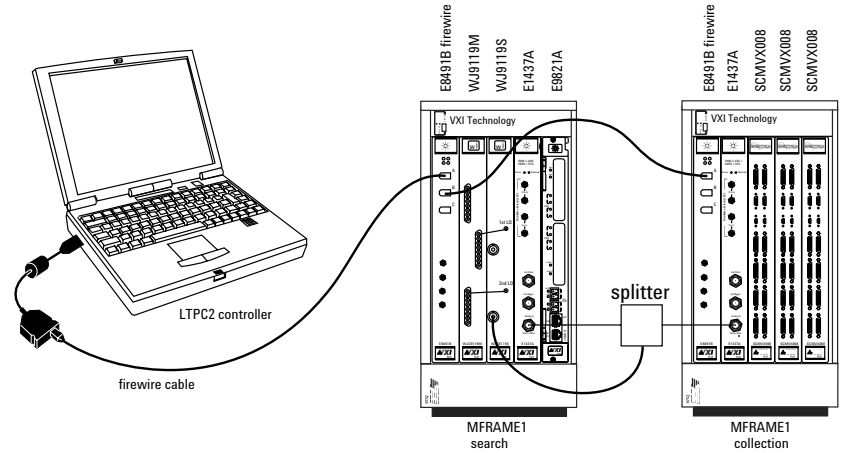
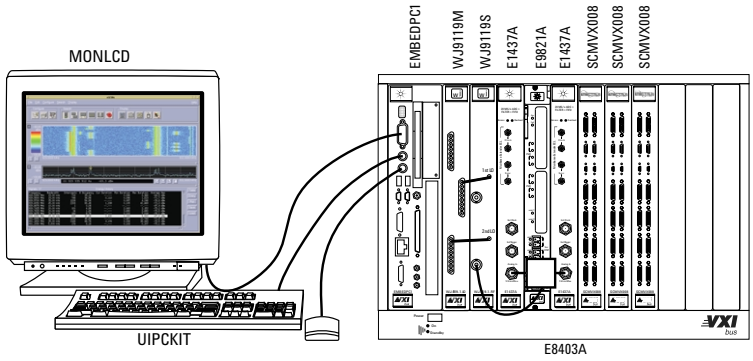
Agilent E3238
Signals Development System

Configuration Guide





Laptop and embedded configurations

Any system can be configured with either a laptop or embedded controller. Additionally, search and collection subsystems can be housed in a single mainframe or split between two mainframes. These two search and collection systems are the same, differing only in form-factor and controller. In the laptop-based configuration shown, search and collection subsystems are housed in separate mainframes to create a more easily transported system. The search mainframe can be used by itself, and the collection mainframe can be added when required. The single-mainframe configuration with an embedded controller is more self-contained, and for remote applications, the monitor, mouse and keyboard are not required.

Modular Configurations

The E3238 Signals Development System can be configured, and re-configured, as your missions change. Its modular commercial-off-the-shelf (COTS) hardware and software allow it to be configured as a portable search system, or a multi-mainframe, 100+ channel search and collection system. Systems can support HF, VHF/UHF, or µWave just by changing the tuner and ADC – other system hardware and software stays the same.

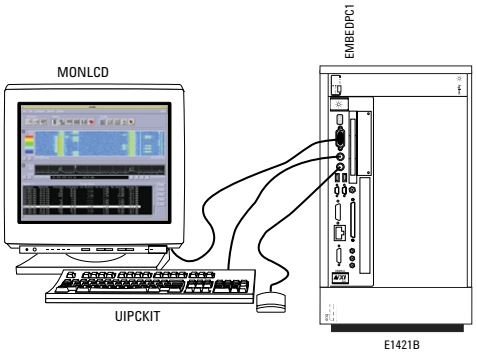
The E3238 modular hardware design can be upgraded by Agilent with new modules as advanced technology becomes available, protecting your hardware investment and allowing easy migration to new capabilities or performance. Modular hardware design extends to the internal design of the E9821A and SCMVX008 DSP modules, where daughter-cards are used to implement digital signal processing and digital-down-convertor (DDC) requirements. The daughter cards use the latest DSP chips and custom FPGA technology, and can easily be replaced as new technology becomes available from Agilent.

Note:
Systems using an E1421B 6-slot mainframe are limited to a maximum temperature of 40° Celsius. Sysems using the LTPC2 laptop PC have a maximum temperature of 35° Celsius

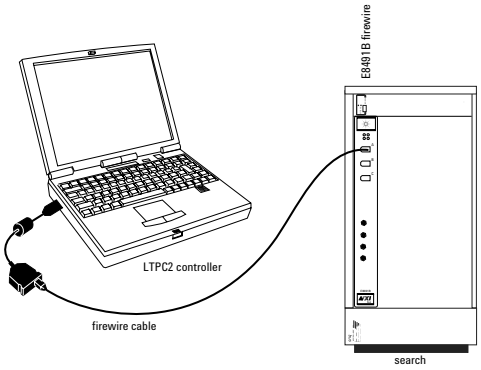
Agilent Technologies

Controller and Interface Configurations

The controller and interface combinations shown use small mainframes for portability, but any mainframe can be used. The maximum configuration a mainframe can support is determined by the power it can deliver and the power required by the modules.



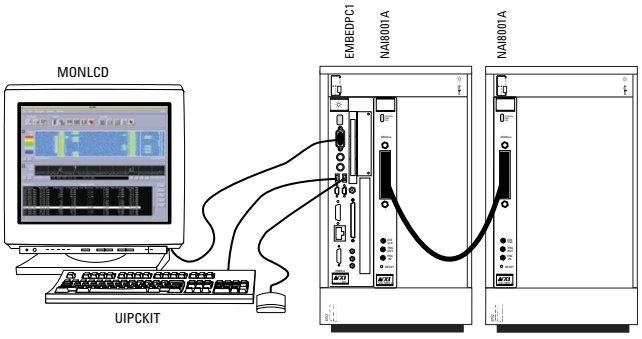
Embedded controller



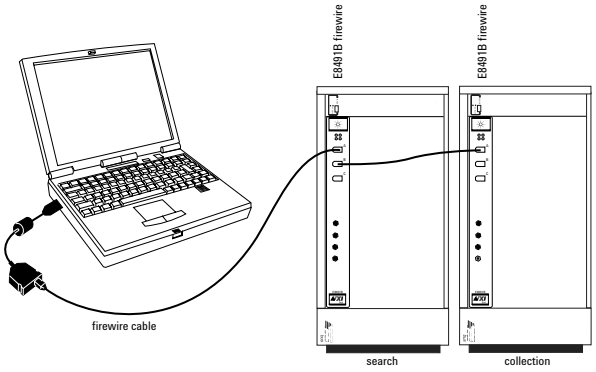
Laptop controller

Embedded and laptop controllers

The E3238 supports both embedded and external laptop controllers, both running Windows® 2000. The laptop controller, a 2.2 GHz Pentium® IV, comes with a Cardbus (PCMCIA) Firewire interface that connects to the E8941B VXI Firewire interface in the VXI mainframe. It has a 60 GByte harddisk, CD-RW, and 512 MB RAM. The embedded controller is a 1.26 GHz Pentium III with a 20 GByte harddisk and 384 MB RAM.



Embedded controller



Laptop controller

Multi-mainframe systems

Large search and collection systems can be configured in a single 13-slot mainframe or can be contained in two smaller, more portable mainframes. The drawings show how multi-mainframe systems are configured. Multi-mainframe systems based on the laptop controller use Firewire to connect mainframes, while systems based on an embedded controller use an NAI8001A MXI II interface in each mainframe to connect the mainframes.

Note: Multi-mainframe systems with an embedded controller require three slots in the search mainframe for the controller and NAI8001A interface. Because of this, all embedded controller systems other than VHF/UHF, with its single-slot tuner, require a 13-slot search mainframe for multi-mainframe search and collection systems.

Search Subsystems

Search Configurations

An E3238 system must have one search subsystem. The new E9821A DSP module is used for all search systems, but the tuners and ADCs are different depending on the frequency range of interest.

HF, VHF/UHF, and µWave

To change the search frequency coverage, just change the E3238's tuner and ADC. The other measurement hardware is the same for all systems. Several tuners are available, from HF to µWave. See the available tuner and ADC combinations below.

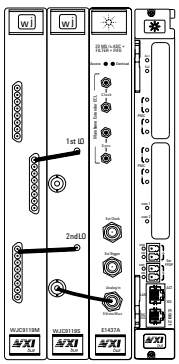
Optimizing the ADC

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.

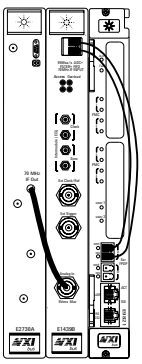
New E9821A DSP Performance

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.

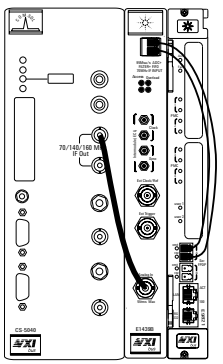
The recently-introduced E9821A DSP module uses Motorola® G4 DSPs to provide new levels of performance, FFT'ing time-domain data, processing the results, and transferring results to the host computer. For maximum performance, six G4 processors are used to parallel-process the time-domain data. Alternatively, 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. See drawings of system configurations on pages 5-7.



HF search subsystem



VHF-UHF search subsystem



µWave search subsystem

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 E2730A 20-2700 MHz tuner and the new E2731A 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 ComSol 5040 0.5-20 GHz VXI tuner. The E1439D's 36 MHz stare bandwidth and exceptional sweep rates also apply when using the ComSol 5040 tuners. Options to the 5040 allow it frequency coverage to 100 GHz. The ComSol tuner must be ordered separately from ComSol, or ordered as a special option from Agilent.

Collection Subsystems

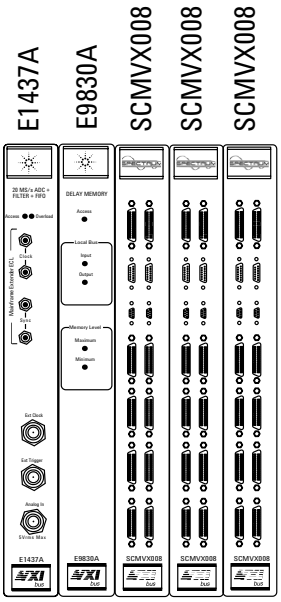
Collection Subsystems

A collection subsystem is typically "tipped" by the search subsystem to tune one of its DDC channels to the center frequency and bandwidth of the narrowband signal. It can then demodulate the signal and decode the signal content. Alternatively, it may perform further analysis of the signal to determine its internal characteristics, and then may pass the information to an additional collection subsystem to demodulate and decode the signal. Other operations are possible, determined by the collection algorithms created with 35688D option ASH software for creating signal algorithms that run on SCMVX008 modules.

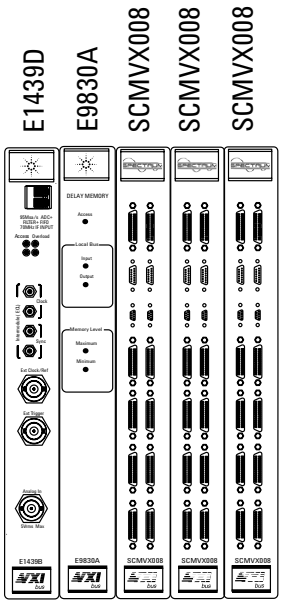
Up to two collection subsystems can be used in an E3238. They can be housed in the search mainframe or be in a separate mainframe. For sample configurations see pages 6-7.

The number of SCMVX008 DSP modules determines the number of collection channels that can be processed. Common SCMVX008 configurations have 16 DDC channels per SCMVX008, but other SCMVX008 configurations are possible. In addition to the DDCs, there are Texas Instrument TMS320C40 DSP processors to process the narrowband signals. For more information on configurations of the E9821A and SCMVX008 DSP modules, see page 8.

Note: In collection subsystems the ADC is often optional. Including one has the benefit of allowing time domain snapshots, and its ADC RAM can be used for delay, often removing the requirement for an E9830A to implement delay. An ADC is always required if the collection subsystem is housed in a separate mainframe. If an ADC is included it must be the same as in the search subsystem and shares the search system's tuner.



HF collection subsystem



VHF-UHF or µWave collection subsystem

HF collection subsystem

This common HF collection subsystem has 48 channels, 16 per SCMVX008. Configurations as small as a single SCMVX008, or up to five SCMVX008s, are possible, with the mainframe's power capabilities being the limiting factor. One or two collection subsystems are possible in the E3238. If the collection subsystem is housed in a separate mainframe it must contain an E1437A ADC.

The optional E9830A delay module provides up to 2 GBytes of DRAM so that the digitized signals can be delayed, allowing the SCMVX008s to access the important first bit of the detected message. One or more E9830As can be used.

VHF/UHF or µWave collection subsystem

Both VHF/UHF and µWave systems commonly use the E1439D ADC because of its 36 MHz stare bandwidth and industry standard 70 MHz IF input.

This VHF/UHF collection subsystem has 48 channels, 16 per SCMVX008. Configurations as small as a single SCMVX008, or up to five SCMVX008s, are possible, with the mainframe's power capabilities being the limiting factor. One or two collection subsystems are possible in the E3238.

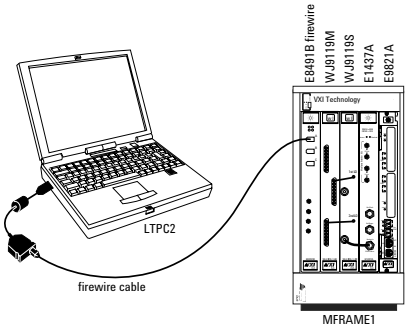
For VHF/UHF and µWave collection subsystems, the optional E9830A may not be required for delay since the E1439D can be configured with up to 1.2 GBytes of delay RAM. This provides the amount of delay that is commonly required to catch the first bit of a signal, and it saves a valuable VXI slot. For more delay, one or more E9830As can be used.

Search-Only Configurations

To configure a system to be used only for search, add a search subsystem to any controller/interface and mainframe combination. The number of slots used by the search subsystem system plus the chosen controller and interface determine which size mainframe is appropriate.

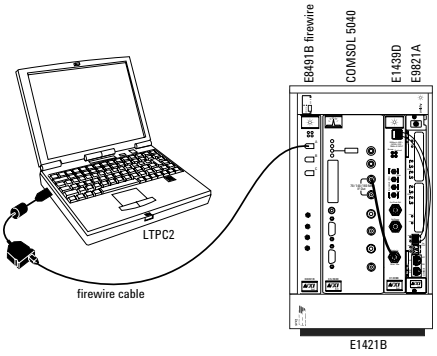
Power is also a consideration, but is not generally an issue for search-only systems, except in the case of the very-portable E8408A 4-slot mainframe, which requires a specific configuration of the E9821A. See page 8 for more information.

All configurations shown use the smallest mainframe possible and an external laptop controller to minimize physical size. A larger mainframe can be used instead, and an embedded controller can be used, but the mainframe must be at least one slot larger than those shown since the embedded controller requires two slots.



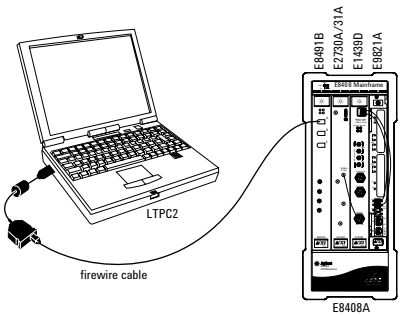
HF search

This search system uses the portable 5-slot MFRAME1 VXI mainframe. If an EMBEDPC1 embedded controller is used, an E1421B 6-slot mainframe is required. Note: If an HF search system with an EMBEDPC1 embedded controller is planned to be used with a collection subsystem housed in a separate mainframe, a 13-slot search mainframe is required because of the extra slot needed for the NAI8001A MXI II interface.



µWave search

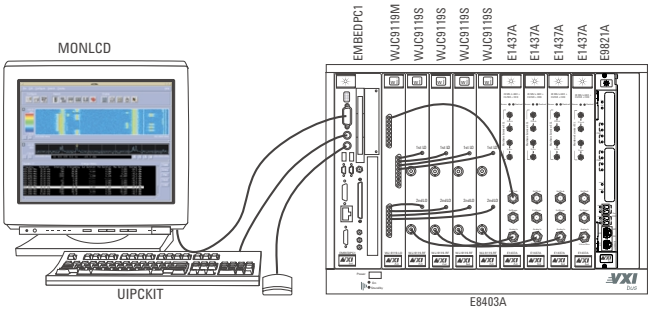
The ComSol tuner shown in this configuration must be purchased from ComSol, or ordered as a special product from Agilent Technologies. If an EMBEDPC1 embedded controller is chosen instead, an E8403A or E8404A 13-slot mainframe is required.



VHF/UHF search

This is the smallest search system possible, and uses the portable 4-slot E8408A VXI mainframe. Due to power limitations of the E8408A, the E9821A DSP processor in this system must be configured with a single option 100 Dual G4 DSP. Sweep rate will be decreased, but still exceeds the E1485C, which the new E9821A replaces. (See page 8 for more information.) For full sweep rate performance, use an MFRAME1 5-slot mainframe which allows the full-performance E9821A with three option 100s to be used.

If an EMBEDPC1 embedded controller is chosen instead, an MFRAME1 5-slot mainframe is required for search only systems. An E1421B 6-slot would be required for a multi-mainframe VHF/UHF system using an embedded controller.



Multi-channel search with AS4

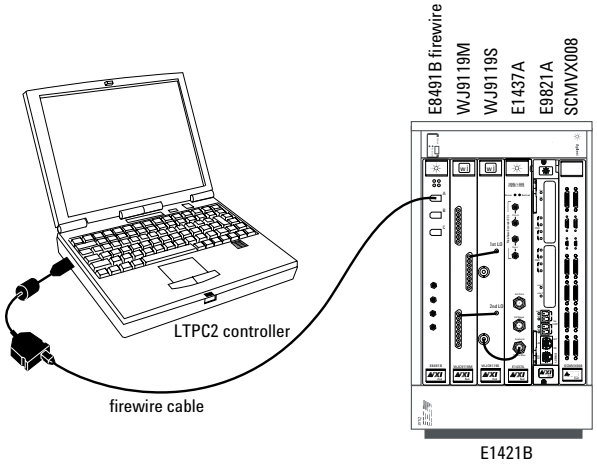
35688D option AS4 allows up to four tuner/ADC search channels. Only the master search channel is used to detect if a signal level exceeds the user-set threshold. Using 35688D option AS9 a programmer can write programs that compare the power of the four input channels to see which antenna has the greatest signal strength. A hidden emitter is probably physically located nearest the antenna with the greatest signal strength. This HF configuration uses a single WJC9119M local oscillator distribution module with four WJC9119S RF tuners.

Due to the complexity of AS4 configurations, customers should work with an Agilent sales person to configure any system with multi-channel search capability. Option AS4 requires option AS9.

Search and Collection Configurations

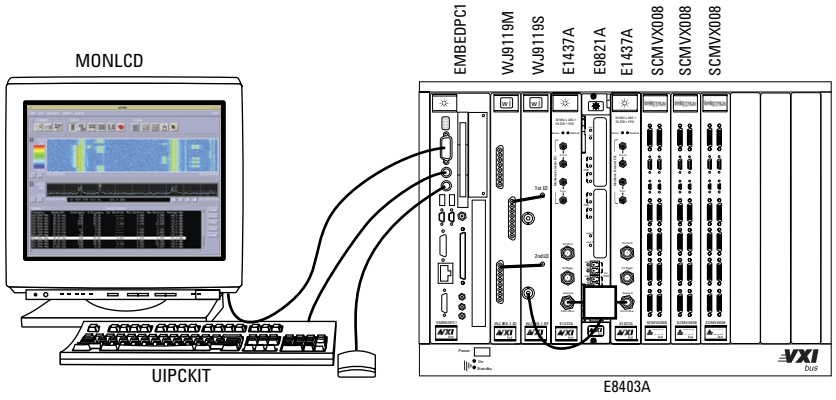
Multi-mainframe HF with laptop

For maximum portability, use a laptop computer — it saves a critical mainframe slot. This is the most portable HF search and collection system, containing 16 collection channels. It represents the first time that both HF search and collection can be housed in a 6-slot mainframe. If more channels are required, more SCMVX008s can be added by increasing the size of the mainframe to 13 slots, or by using two 5-slot mainframes. See page 7 for examples of multi-mainframe configurations. Up to two collection subsystems can be used for more complex systems with multi-stage algorithms for detecting signal types and demodulating them. Each collection subsystem can have its own delay, allowing complete signals to be detected, identified, demodulated, and decoded.



Single-mainframe HF with embedded controller

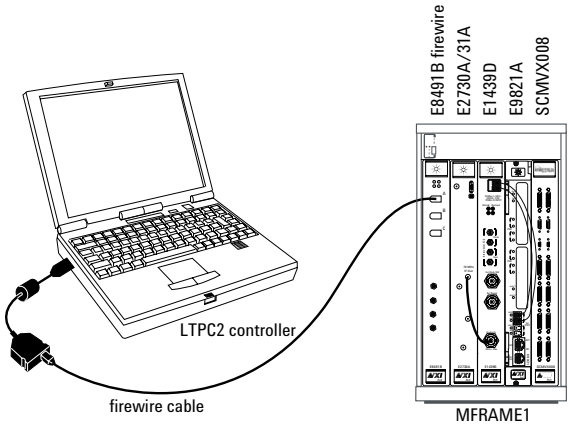
This 48 channel HF system is self-contained and physically robust in a 13-slot mainframe. For remote operation, the monitor, keyboard, and mouse are not required. The E1437A is optional (see note on page 4). If delay is required, add an E9830A delay module between the collection E1437A and the first SCMVX008. As with the laptop-based system above, an additional collection subsystem can be added for multi-stage collection algorithms, and each can contain one or more E9830A delay modules. The mainframe's maximum power capability sets the maximum configuration.



Smallest VHF/UHF search and collection

This is the most compact configuration of a complete 16-channel VHF/UHF search and collection system, housed in an MFRAME1 5-slot mainframe. The E2730A tuner provides coverage to 2.7 GHz, or an E2731A goes up to 6 GHz.

If more channels are required in a single-mainframe solution, use a 13-slot mainframe and add more SCMVX008s. E9830As can also be added to provide delay. Up to two VHF/UFHF collection subsystems can be used.



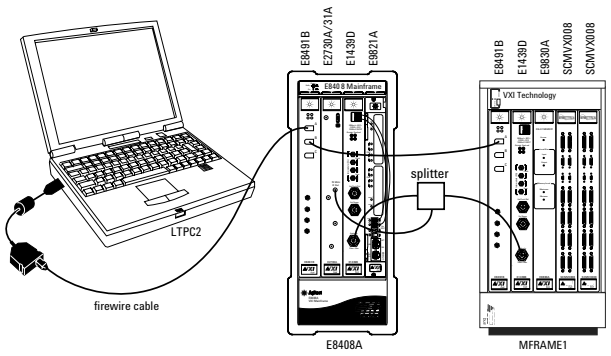
Search and Collection Configurations (continued)

Portable 32-channel VHF/UHF with delay

This small form-factor multi-mainframe VHF/UHF search and collection system uses an E8408A 4-slot mainframe for search and an MFRAME1 for collection. The search system can be used separately for survey applications, and the second mainframe can be added when needed. While search can run independently from collection, collection requires a search subsystem.

The collection subsystem can have up to 32 channels with an E9830A delay module, or can have up to 48 channels if no delay is required. For more channels, use a larger collection mainframe and more SCMVX008s.

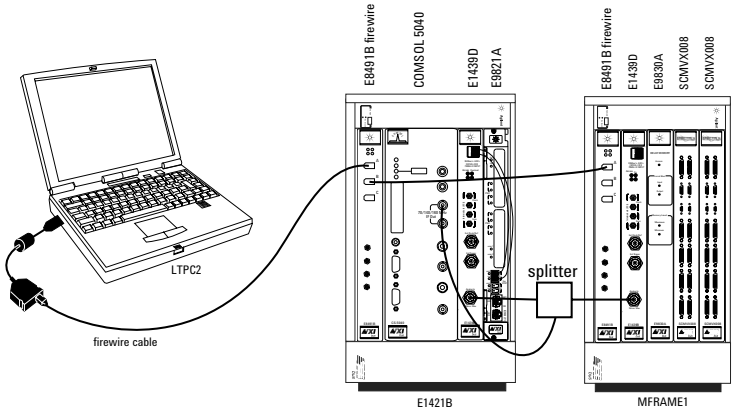
Due to power limitations of the E8408A, the E9821A DSP must be configured with two G4 processors instead of the more-common six, but search sweep speeds are still exceptionally high. For full sweep rate performance, replace the E8408A with the slightly larger MFRAME1 mainframe which has enough power for the full six G4 E9821A configuration. To use an EMBEDPC1 embedded controller, replace the E8408A with an E1421B 6-slot mainframe and use an NAI8001A MXI II interface in each mainframe.



Multi-mainframe µWave with delay

This is the most portable µWave search and collection configuration. It has 32 channels with an E9830A delay module, or up to 48 channels if no delay is required. Larger systems require a 6- or 13-slot collection mainframe, with more SCMVX008s and E9830As.

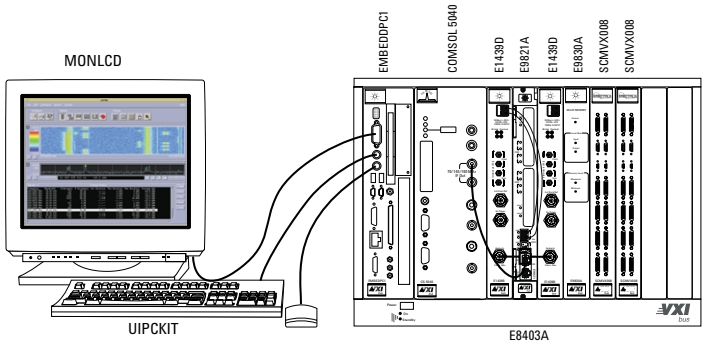
Since using an embedded controller requires a 13-slot search mainframe, there is little reason to use a multi-mainframe µWave configuration when using the embedded controller. The 13-slot search mainframe is probably large enough to accommodate the collection subsystem also.



Single-mainframe µWave with delay

This is the most portable µWave search and collection configuration. It has 32 channels with an E9830A delay module, or up to 48 channels if no delay is required. Larger systems require a 6- or 13-slot collection mainframe, with more SCMVX008s and E9830As.

Since using an embedded controller requires a 13-slot search mainframe, there is little reason to use a multi-mainframe µWave configuration when using the embedded controller. The 13-slot search mainframe is probably large enough to accommodate the collection subsystem also.



DSP Module Configurations

DSP Module Configurations

The E3238 uses the E9821A DSP module for search and the SCMVX008 DSP module for collection. While there are only three configurations of the E9821A, there are several configurations for the SCMVX008, and they are dependent on the custom software algorithms being run. It is therefore impossible to give simple advice for configuring an SCMVX008. Please contact the factory or an Agilent field salesperson for SCMVX008 configuration information.

E9821A Signal Processor Module for E3238 System
E9821A-100 - Add Dual G4 Processor Card

The highest performance configuration of the E9821A module, which has the fastest sweep rates, uses three option E9821A-100 for a total of six G4 processors. This is the configuration you should use unless you are using an E8408A 4-slot mainframe. With the E8408A you must configure the E9821A with one option E9821A-100 due to power limitations.

SCMVX008 TI-based DSP Module

SCMVX008-040	4-channel Tuner and DACs
SCMVX008-011	TMS32C40 TIM40 Module
SCMVX008-012	Dual TMS320C44 TIM40 Module
SCMVX008-002	Upgrade DSP SRAM with 8 MB
SCMVX008-082	4 MB DRAM Shared RAM
SCMVX008-083	8 MB DRAM Shared RAM
SCMVX008-085	32 MB DRAM Shared RAM
SCMVX008-086	64 MB DRAM Shared RAM

The most typical SCMVX008 configuration uses four option SCMVX008-040s and two option SCMVX008-011s but, since the required configuration is dependent of the custom software running in the SCMVX008, it is not possible in this document to tell you exactly what you need. Please contact your local Agilent salesperson or contact the factory for information on how to configure the SCMVX008.

Options

Software Options

35688D-AS9 User Programming

35688D-AS9 allows users to extend the functionality of the E3238 and connect it to legacy systems. AS9 extensions are written in C, and are dynamically linked into the E3238 as shared libraries. Software can be developed in Windows. Added functionality integrates seamlessly into the E3238 user-interface.

AS4 Multi-channel Search

The AS4 Multiple Channel option allows an AS9 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 AS4. A typical application for AS4 is searching for a hidden emitter and determining whether it is inside or outside a building.

35688D-ASM Feature Studio

35688D-ASM is a graphical program for creating complex-shaped upper and lower limit lines. ASM generates C code that is used with option AS9 to implement limit lines to use as pre-filters in the E3238.

35688D-ASH User Signal Processing

35688D-ASH is an integrated software development environment to create, test, and deploy new signal types. Using a Programming Wizard, you can easily generate a working signal framework, and then drop in your own custom signal algorithms. The resulting program runs on a multi-processor SCMVX008 DSP module, and is seamlessly integrated into the E3238 system. Using 35688D-ASH, you can develop their own sensitive signals quickly.

Optional Agilent Hardware

VXI Mainframes

E8408A	4-slot VXI mainframe
MFRAME1	5-slot VXI mainframe
E1421B	6-slot VXI mainframe
E8403A	13-slot VXI high-power mainframe with basic monitoring
E8404A	13-slot VXI high-power mainframe with enhanced monitoring

Peripherals

UIKITPC	Windows PC user interface kit
EXTDVD	(EMBEDPC1 only) External desktop DVD drive
EXTDAT	External desktop DAT backup device
EXTHD	(EMBEDPC1 only) External desktop 9 GB hard disk
MON17	17 inch color monitor
MONLCD1	Color LCD monitor
MONRACK	Universal monitor rack mount kit

Controllers

EMBEDPC1	Embedded controller with Windows 2000
LTPC2	Laptop PC with Windows 2000

VXI Interfaces

E8491B	IEEE-1394 PC Link to VXI, C-sized
NAI8001A	VXI bus extender

Digitizers

E1437A	20 MS/s, 23 bit, ADC with filter and FIFO
E1438B	100 MSa/s VXI ADC with filters and memory
E1438D	100 MSa/s VXI ADC with filters and memory
E1439B	VXI 70 MHz IF ADC with filters and memory
E1439D	VXI 70 MHz IF ADC with filters and memory

DSP Processors

E9821A	Signal processor module for the E3238 system
SCMVX008	TI-based DSP module

Delay

E9830A	Delay memory module

Export of the product identified in this literature is subject to U.S. Export control laws. Export licenses are approved on a case-by-case basis and sale of any of these products is dependent on approval of the United States Government.

Supported Hardware

Compatible Tuners

Tuner	Frequency Range	E1437A	E1438A/B	E1439A/B	Interface Type
HP89431A	2.0 - 2650 MHz	√	√[2]		RS232
WJC9119L/R	0.5 - 32 MHz	√	√[2]		VXI
WJC9119M/S	0.5 - 32 MHz	√	√[2]		VXI
CS5040[1]	500 - 20000 MHz			√	VXI
E2730A	20 - 2700 MHz			√	VXI
E2731A	20 - 6000 MHz			√	VXI

1 Communications Solutions, Inc.
2 Not recommended due to lower dynamic range

Compatible Handoff Receivers

Handoff Receiver	Frequency Range	Interface Type
WJ-8607[1]	VHF/UHF	RS232
WJ-8611[1]	VHF/UHF	RS232/GPIB
WJ-8615P[1]	VHF/UHF	GPIB
WJ-8621	VHF/UHF	VXI
WJ-8629[1]	VHF/UHF	VXI
WJ-8629A[1]	VHF/UHF	VXI
WJ-8634[1]	VHF/UHF	VXI
WJ-8711[1]	HF	RS232/GPIB
WJ-8712[1]	HF	RS232
WJ-8712A[1]	HF	RS232
WJ-8721[1]	HF	VXI
Cubic VXI-3250[2]	HF	VXI
Cubic VXI-3550[2]	VHF/UHF	VXI
Cubic VXI-3570[2]	VHF/UHF	VXI
Cubic R-2411/U[2]	MF/HF	GPIB
Cubic R-2412/U[2]	VHF/UHF	GPIB
Agilent 89441	HF/VHF/UHF	GPIB

1 Signia-IDT, Inc.
2 Cubic Communications, Inc.

Compatible RF and µWave Switches

Switch	Frequency Range	Number of Switches	VXI Slots
E1472A (50 Ω)	RF	16:1	C-1
E1475A (75 Ω)	RF	16:1	C-1
E1368A (50 Ω)	µWave	4:1	C-1
E1369/E1370 (50 Ω)	µWave	user configurable	C-1

Compatible IRIG GPS Module

IRIG Module	Timestamp Accuracy
BC350VXI[1]	0.001 seconds

1 Datum, Inc.

E9830A Data Rates and Quantities

E9830A Specifications	Max Bandwidth	Max Data Rate	Max Samples (2 GB)	Max Samples (1 GB)
16 bit ADC data (recommended for VHF/UHF/µWave)	10.35 MHz	53 MB/sec	1,073,741,824	536,870,912
32 bit ADC data (recommended for HF)	5.17 MHz	53 MB/sec	536,870,912	268,435,456

Warranty

The hardware in the E3238 system is covered by three-year return to Agilent Technologies parts and labor warranty.The software is warranted for 90 days. Additional coverage may be purchased from Agilent.Contact you local Agilent representative.

Visit Our Websites

Agilent Communications Intelligence Information:
www.agilent.com/find/AD

Agilent VXI Product Information:
www.agilent.com/find/vxi

Related Literature

Publication Title	Publication Type	Publication Number
Agilent Communications Intelligence Solutions	Overview	5988-0633EN
E3238 Signals Development System	Product Overview	5968-2075E
E3238 Signals Development System	Technical Specifications	5963-6609E
Test Systems and VXI Products	Catalog	5980-0307E

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