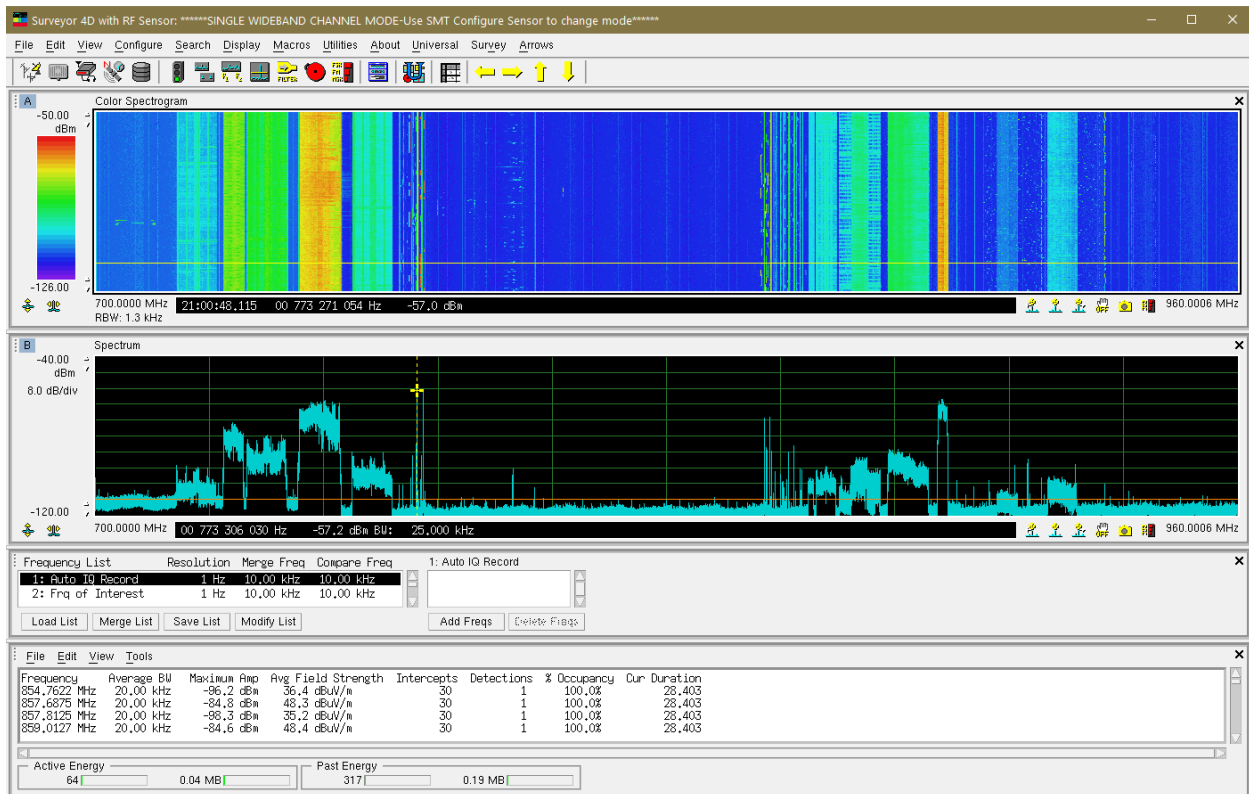


N6820114E Core Capabilities

N6820ES Surveyor 4D software

The Keysight Technologies N6820114E Surveyor 4D software is a spectrum monitoring tool, capable of automating signal search and survey functions. It tasks internal or external processes to capture and analyze spectrum events or conduct comprehensive surveys of the RF environment. Its powerful detection, triggering, and alarm functions are unrivaled in the commercial spectrum monitoring industry. Additionally, the Surveyor 4D software can be used manually as a high-speed spectrum display to task handoff receivers, modulation recognition, recording, direction-finding, and emitter location measurements.



Applications

- Spectrum monitoring and logging
- Spectrum management
- Interference detection and location
- Band clearing
- Signal development
- RF Survey
- Special signal intercept and collection
- Satellite downlink monitoring

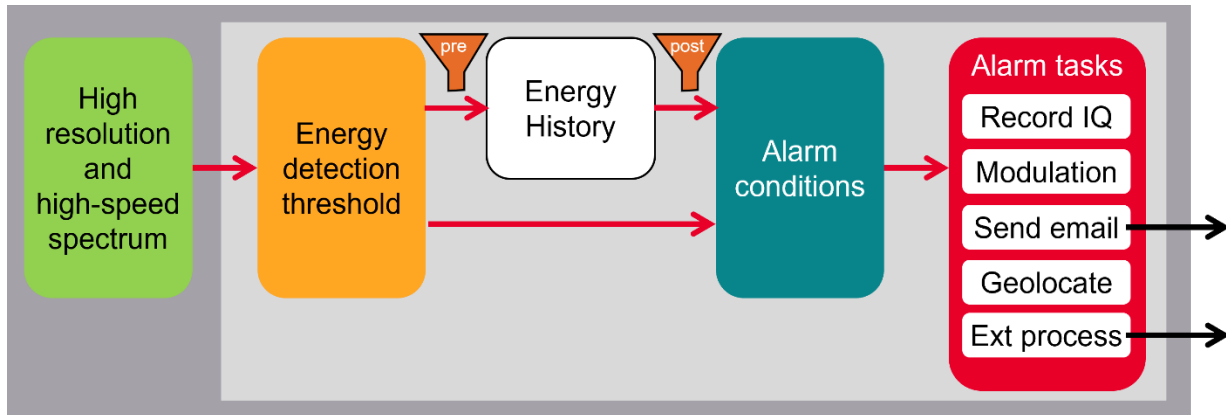
Customers

- Telecommunications regulatory authorities
- Mobile service providers
- Government range frequency managers
- Corporate spectrum/frequency managers
- RF test managers
- Military and intelligence agencies
- Satellite system operators

Key features

- High-speed, high-resolution spectrum search
- Automated signal survey and classification tools
- Powerful triggering and masking functions
- Configurable alarm functions and flexible tasking of resources
- SQL database for long-term logging and big data analysis
- Built-in spectrum recorder
- Flexible multi-band search modes
- Automatic tasking of RF emitter location or direction-finding sub-systems
- ITU-RSM.1600 Technical identification compliance
- IQ capture and recording of RF signals

The diagram below shows how Surveyor 4D works by first receiving high-resolution, high-speed spectral data from the hardware. Configurable energy detection and thresholds enable the separation of RF signals from the noise. The parametric data of the detected RF energy is measured and stored in the energy history database. Combinations of the parametric information trigger alarms resulting in automated tasks.



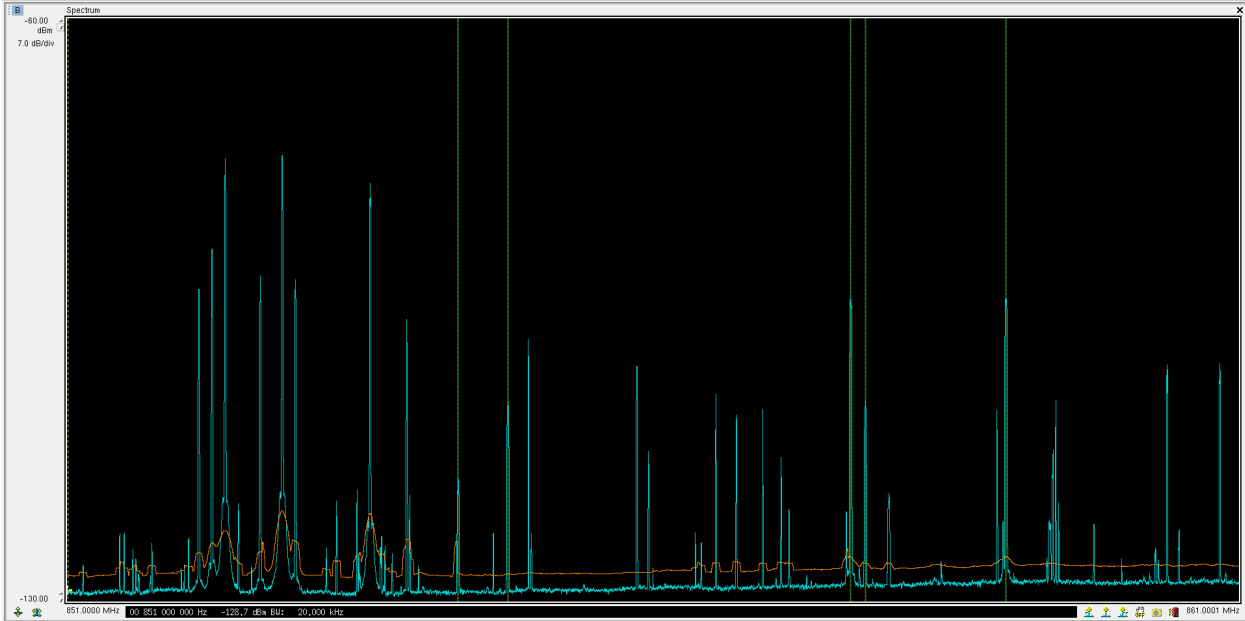
Surveyor 4D Software Description

Hardware options

The N6820114E Surveyor 4D core software includes hardware drivers for connection to Keysight N6841A RF Sensors and the FieldFox analyzers. One software license can be installed and run on one PC at a time. Up to six independent instances of Surveyor 4D can be run simultaneously on one PC. Each instance of the software can connect to up to four devices (either N6841A or FieldFox analyzers). Surveyor 4D can connect to the M9391A and M9393A PXIe receivers when the N6820MTPE feature is purchased. It can also connect to the N6831A HF wideband receiver when the N6820HFPE feature is purchased. For more information, refer to their respective technical overviews. Additional tools are provided with the Surveyor 4D core software that are described at the end of this document.

Energy detection

Detecting energy is a core feature of the Surveyor 4D software. Surveyor 4D conducts high-speed, high-resolution RF searches across single or multiple radio bands processing energy that meets the detection criteria. Energy detection requires a spectral threshold and Surveyor 4D offers many different types including Level, Auto, Environmental, and user-defined files. Having a variety of energy thresholds is extremely valuable for addressing different situations encountered in real-world spectral events since one technology does not fit every circumstance. The noise-riding threshold (orange trace) is used in the setup shown below.



Energy history database

When any RF energy exceeds the threshold and meets the detection criteria, an entry is made into the Energy History Database (EHD). Each entry contains over 20 precisely measured signal parameters associated with the detected energy. The EHD is used as an interim repository where intercept data is further processed and refined through filtering and alarms.

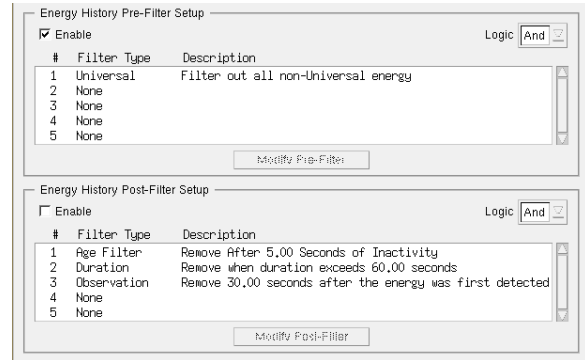
EHD Parameters include, but are not limited to center frequency, bandwidth, amplitude, power, field strength, duration, and occupancy. This data and associated statistics can be logged over long periods of time and used to develop insights on the use of spectrum in a specific location or along a route.

Energy Limits				
Frequency	857,687,500 Hz	Bandwidth	20,00 kHz	
Location				
Latitude	39,941867633°	Altitude	-44,22 m	
Longitude	-105,951491467°	Heading	---,--°	
Statistics				
Intercepts	964	Number Sweeps	964	
First Intercept	04/27 20:49:25,347	Percent Occupancy	100,0%	
Last Intercept	04/27 20:50:01,411	Detections	1	
Detection Channel	1			
Features				
	Frequency	Bandwidth	Amplitude	Duration
Current	857,687,500	20,00 kHz	-95,2 dBm	36,064
Maximum		20,00 kHz	-92,8 dBm	36,064
Average		20,00 kHz	-95,7 dBm	36,064
Minimum		20,00 kHz	-100,4 dBm	---,---
Field Strength				
Current	40,7 dBW/m			
Maximum	43,1 dBW/m			
Average	40,2 dBW/m			
Minimum	35,5 dBW/m			
Universal Mod Rec Ready Universal Ready Signal A Ready				
State	True	-	-	-
% True	100,0 %	---, - %	---, - %	---, - %
Signal B Ready				
State	-			
% True	---, - %			

Energy History filters

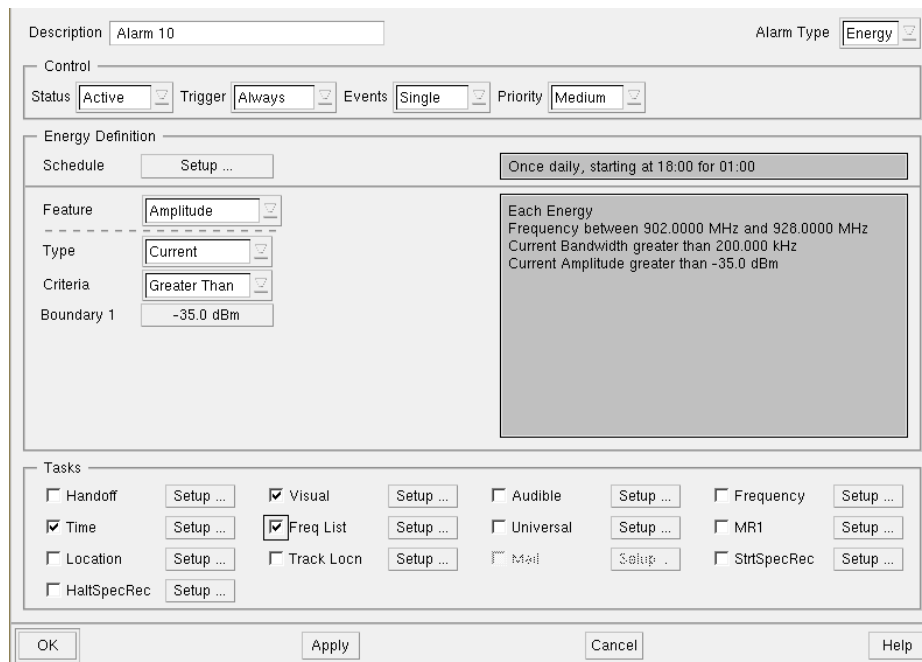
Surveyor 4D can apply Energy History Pre- and Post-Filters designed to restrict or open the flow of detected energy data into, or out of, the Energy History Database. For example, the Post-Filter “Age” removes entries after the energy drops below the threshold for a user-defined number of seconds.

The most commonly used Pre-Filter is the Universal Signal Detector (USD) A detailed description of the USD feature is in the N6820USDE technical overview.



Energy alarms

An Energy Alarm is a system-level trigger. The alarm criteria are based on one or more of the parametric data elements collected and stored in the EHD. An Alarm can use these parameters independently or combined to isolate a spectral event of interest. For example, you can create an Energy Alarm to take an action on energy seen occasionally between 902 MHz and 928 MHz, between 6:25 p.m. and 7:25 p.m., with a bandwidth greater than 200 kHz and amplitude greater than -35 dBm. The Energy Alarm setup for this example is shown below:



When the Alarm triggers, one or more actions (referred to as “Tasks”) are executed. These tasks can include:

- Handoff to an external receiver for demodulation of the signal and to play/record the audio
- Take a frequency snapshot of the spectral trace data
- Send an IQ time-series sample to the Modulation Recognition algorithm (MR1)
- Illuminate a visual tripped alarm indicator
- Take an IQ time-series recording
- Task a network of RF sensors to locate the emitter
- Sound an audible alert
- Add/Remove the frequency to/from one of ten configurable frequency lists
- Custom, user-defined alarms, created by Keysight or a Solution Partner
- Send an email message to one or more recipients

Signal Database and Reporting

Surveyor 4D maintains two internal databases – the energy history and signal database. Some alarm tasks will result in a new entry in the signal database (SDB). The SDB contains information from signal processing tasks such as:

- Universal Signal Detection (USD) classifications
- Modulation recognition (MR1) process results
- Direction-Finding (DF) results
- Emitter Location (GEO) results
- Time or Frequency recordings

Time	Frequency	Duration	Bandwidth	Class	Type	Description
22/04/27 22:23:48	Eas 859.0094 MHz	17.08 Sec	42.725 kHz	Collection	Recorder	Filename: \snapshot\AUTO_IQCF_859.009_MH
22/04/27 22:24:18	Eas 859.0125 MHz	8.59 Sec	20.267 kHz	Signal Id	Mod Rec	PI/4 QPSK
22/04/27 22:25:33	Eas 858.7562 MHz	1 mSec	4.488 MHz	Collection	Recorder	Filename: \snapshot\Surveyor_4D_22_04_27
22/04/27 22:27:22	Eas 852.3125 MHz	--- Sec	20.000 kHz	Signal Id	Universal	TETRA

Signal alarms

Signal Alarms operate on data found in the Signal Database. For example, a signal alarm is triggered when a signal classification is present with a specific modulation format or symbol rate. When used with the N6854A geolocation server software, a signal alarm is triggered when a location measurement result falls into a specified geographic zone.

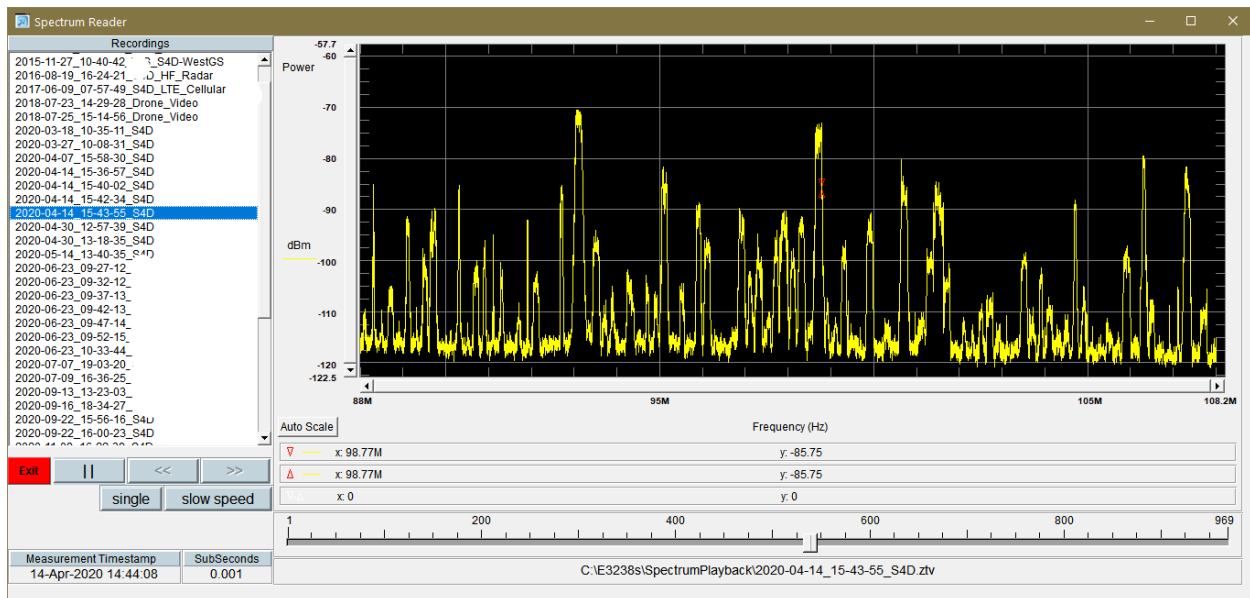
N6854A Geolocation Server Software Integration

The N6854A Geo server software is embedded in the RF Sensor Management Tool software (SMT) and is tightly integrated with Surveyor 4D. It synchronizes a group of RF sensors to locate RF emitters using Time Difference of Arrival (TDOA), Received Signal Strength (RSS), or a Keysight Hybrid algorithm. The software uses time and power-based geolocation algorithms and is ideal for determining the location of modern signals either for indoor or outdoor applications. Time-based or RF power triggering can be used for high or low-duty cycle signals.

Surveyor 4D Tools

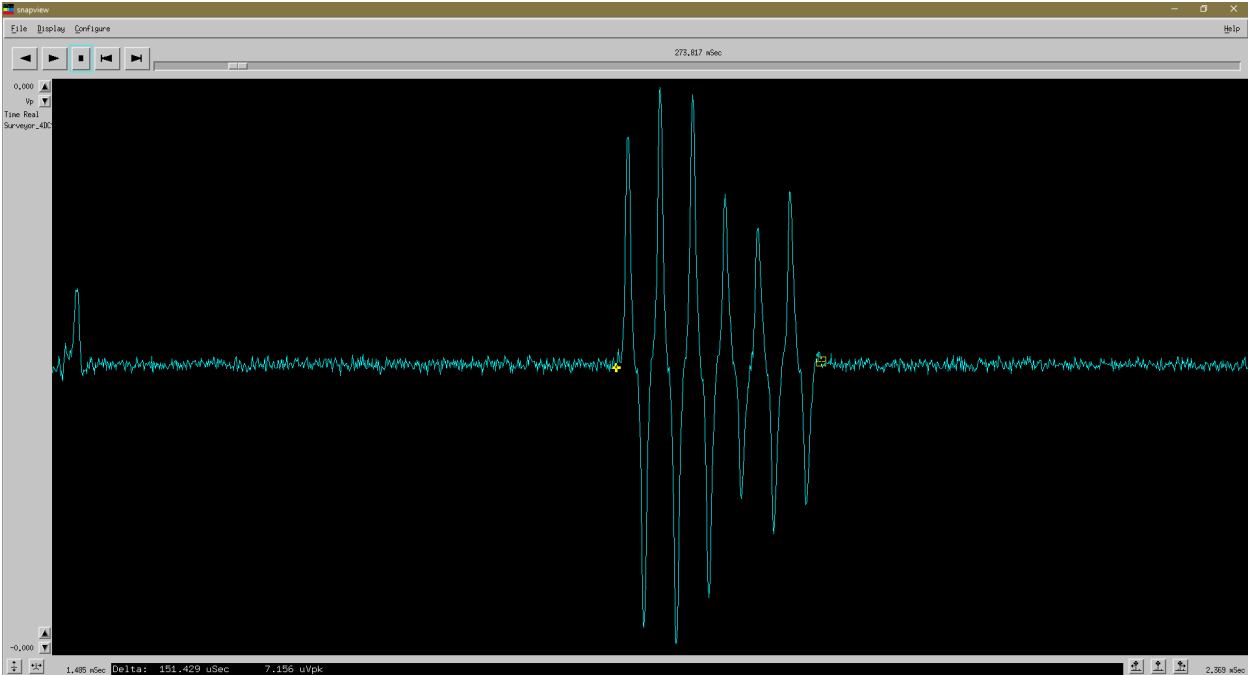
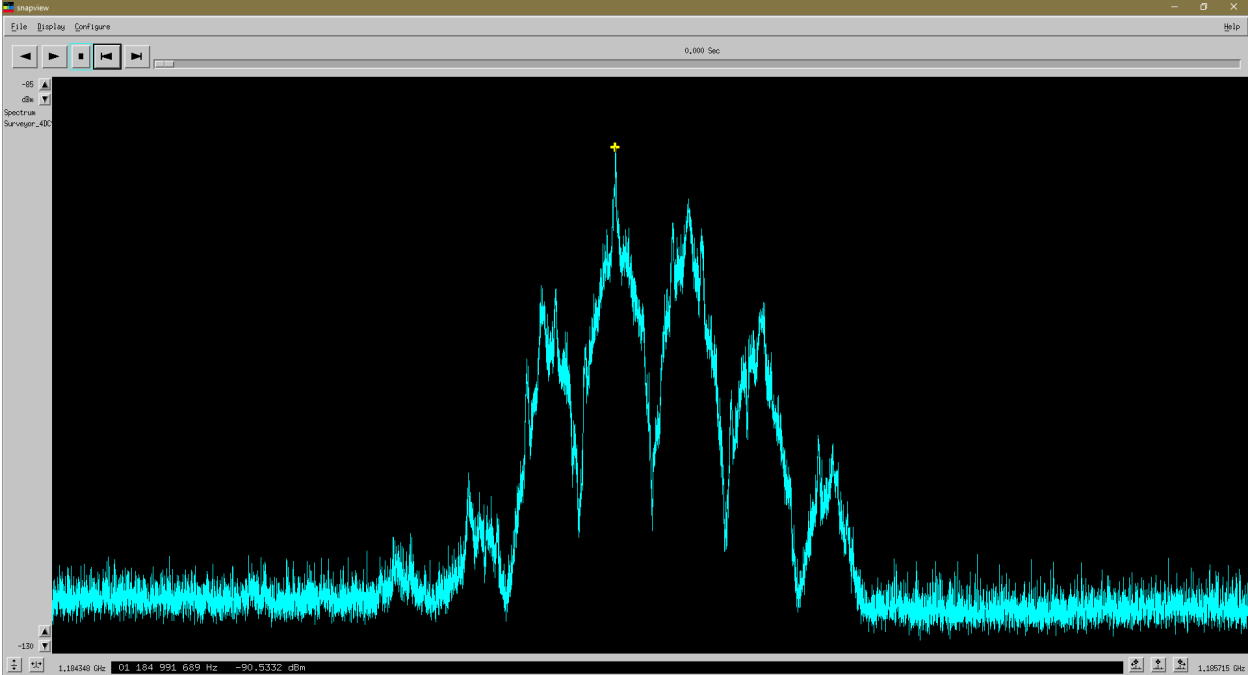
Surveyor 4D Spectrum record and playback tool

The spectrum record and playback tool is provided as part of the N6820114E core software and requires no option or additional license. The tool is loaded from the N6820ES_Extensions installer. It provides a basic spectrum record and playback feature for Surveyor 4D's high-speed spectrum trace data. Recorded files include sequential, time-stamped spectrum traces acquired in either general search, directed search or tuner-locked modes. The record and playback feature is ideal for interference and survey applications involving short-duration transmissions. Alarm tasks can be used to start and/or stop the spectrum recording.



SnapView software

The SnapView software is provided as part of the N6820114E core software and requires no option or additional license. It enables playback of IQ (*.cap) and Frequency (*.fss) snapshot recordings. SnapView provides a quick and easy way to evaluate the time-varying characteristics of a signal, with the spectrum, or real/imaginary time-series views as shown below.

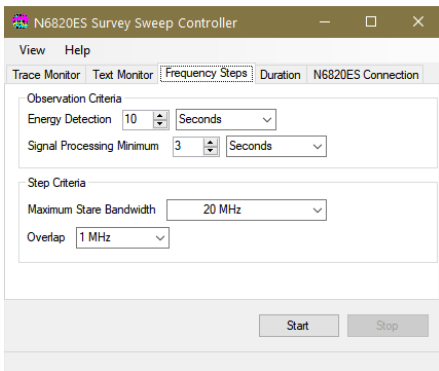


Spectrum Survey tool

The Survey feature collects and exports a summary of all system results including Energy History and Signal Databases to a format readable by Microsoft Excel®. Spectral data can then be sorted and filtered to prepare reports. After setup, the survey tool can be used with one click of the toolbar icon. A sample report is shown below.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
	Frequency (MHz)	Bandwidth (kHz)	Amp (dBm)	First Intercept	Last Intercept	First Longitude	Intercepts	Duration (s)	Occupancy (%)	Alarms	Symbol Rate	Freq Spacing	Summary	APCCO 3600FSK	APCCO 4800FSK	TETRA	TMR 4.8Kbaud	
1																		
2	851.362486	11.13	-70.7	4/22/22 13:37:28	4/22/22 13:45:47	38.931965	-74.919463	603	1.3	17.7	3	4801	1806 APCCO 4800FSK					
3	851.650006	9.50	-90.3	4/22/22 13:37:42	4/22/22 13:45:51	38.931965	-74.919463	654	0.5	19.2	88	4801	1760 APCCO 4800FSK				9	
4	851.674980	8.96	-92.3	4/22/22 13:38:09	4/22/22 13:45:31	38.931965	-74.919463	525	0.6	15.4	152	4801	1772 APCCO 4800FSK				13	
5	852.088308	10.40	-73.6	4/22/22 13:37:28	4/22/22 13:45:54	38.931965	-74.919463	648	1.1	19.0	23	4801	1760 APCCO 4800FSK/TMR 4				5	
6	852.125532	9.50	-91.7	4/22/22 13:37:32	4/22/22 13:45:43	38.931965	-74.919463	688	1.2	20.2	12	4801	1783 APCCO 4800FSK/TMR 4			3	2	
7	852.237566	8.65	-88.6	4/22/22 13:37:28	4/22/22 13:45:30	38.931965	-74.919463	3211	60.1	94.3	8	3602	5280 APCCO 3600FSK	5				
8	852.350686	9.56	-70.8	4/22/22 13:37:36	4/22/22 13:44:56	38.931965	-74.919463	466	0.7	13.7	9	4800	1793 APCCO 4800FSK/TMR 4			1	1	
9	852.600403	9.81	-72.8	4/22/22 13:37:34	4/22/22 13:45:33	38.931965	-74.919463	723	1.9	21.2	8	4801	1793 APCCO 4800FSK/TMR 4			3	3	
10	852.851053	9.38	-89.7	4/22/22 13:37:40	4/22/22 13:45:41	38.931965	-74.919463	785	0.9	23.1	10	4801	1780 APCCO 4800FSK/TMR 4			1	1	
11	852.675041	9.75	-90.9	4/22/22 13:37:28	4/22/22 13:45:35	38.931965	-74.919463	1084	1.4	31.8	13	4801	1724 APCCO 4800FSK			1		
12	852.838070	10.06	-70.5	4/22/22 13:37:32	4/22/22 13:45:51	38.931965	-74.919463	511	1.7	15.0	10	4800	1827 APCCO 4800FSK/TMR 4			1	1	
13	852.950031	9.19	-92.3	4/22/22 13:38:01	4/22/22 13:45:54	38.931965	-74.919463	1111	1.3	32.6	12	4801	1787 APCCO 4800FSK			2		
14	853.088745	7.75	-74.6	4/22/22 13:37:29	4/22/22 13:45:43	38.931965	-74.919463	725	0.8	21.3	25	4796	TMR 4.8Kbaud				2	
15	855.063477	10.25	-84.6	4/22/22 13:38:35	4/22/22 13:41:32	38.931965	-74.919463	12		0.4	12							
16	855.164307	11.95	-83.6	4/22/22 13:40:34	4/22/22 13:40:34	38.931965	-74.919463	1		0.0	1							
17	857.687500	18.75	-85.3	4/22/22 13:37:28	4/22/22 13:45:30	38.931965	-74.919463	3211	60.1	94.3	8	18000	TETRA			1		
18	859.012000	20.00	-85.0	4/22/22 13:37:28	4/22/22 13:44:30	38.931965	-74.919463	2809	60.1	82.5	7							
19	860.838135	10.25	-96.9	4/22/22 13:37:30	4/22/22 13:45:53	38.931965	-74.919463	751	0.4	22.1	375							

The Survey feature is often used with the Survey Sweep Controller tool (shown below) enables the search to step through pre-configured bands on a regular interval and extract both external and internal signal parameters for the survey report.



PostgreSQL database and SQL visualizer tool

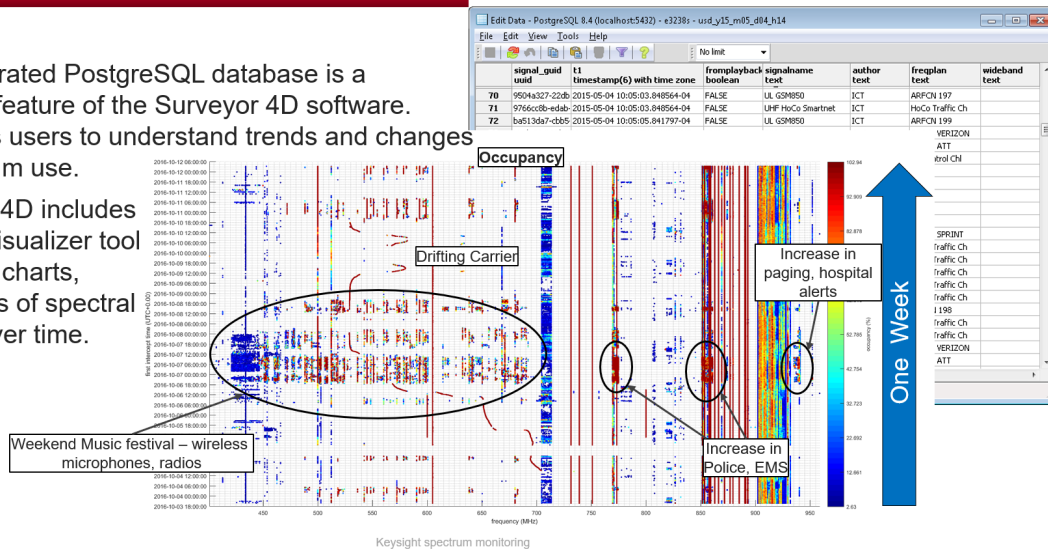
Surveyor 4D's integrated PostgreSQL database enables users to save all signal parametric data, and all other signal processing results over extended periods of time limited only by the size of the hard drive and associated SQL database. The parametric data is saved whenever the user-defined observation interval is met. The interval will determine the time resolution of the spectral data and statistics for key data (such as minimum, maximum, and average) will be determined over the time interval. The data and the associated reports provide insights to the user to understand trends and changes in spectrum use over time. The SQL visualizer tool is provided as part of the N6820114E core software and requires no option or additional license. It enables the creation of plots, charts, graphs, and tables from collected spectrum metadata. An example of an occupancy spectrogram is shown in the figure below.

Spectrum Data & Report Generation



SURVEYOR 4D SQL SPECTRUM VISUALIZER

- The integrated PostgreSQL database is a powerful feature of the Surveyor 4D software. It enables users to understand trends and changes in spectrum use.
- Surveyor 4D includes an SQL visualizer tool providing charts, and tables of spectral activity over time.



Surveyor 4D recording capabilities

While any of the hardware connected to Surveyor 4D can make pre-detected IQ recordings, the maximum acquisition bandwidth and time of recordings is dependent on the type of hardware as indicated below:

	N6841A	M9391A/M9393A	FieldFox "A"	FieldFox "B"	N6831A
Hardware	20 MHz to 6 GHz	1 MHz to 50 GHz	5 kHz to 50 GHz	5 kHz to 54 GHz	9 kHz to 32 MHz
Max snapshot	4.5 sec @ 20 MHz	2.5 sec @ 160 MHz	0.32 sec @ 10 MHz	1 sec @ 100 MHz	3.28 sec @ 5.12 MHz
Streaming	Up to 1.5 MHz	No	No	No	Up to 1 MHz

In addition to IQ recording, Surveyor 4D offers spectrum snapshots, high-speed spectrum recording, and AM or FM-detected audio recordings. Conversion utilities are supplied in the event the files need to be loaded into other software applications.

Configuring the N6820ES Surveyor 4D software

Additional product features can be added to the core N6820114E software that extends its capabilities to handle different kinds of tasks or connect to different kinds of hardware. The additional features are listed below and are ordered and licensed separately. Support subscription is available for each feature and is ordered separately. Each feature is described in its own technical overview document.

Product number	Description
N6820114E	Core Surveyor 4D software
N6820EDFE	Enables DF interface drivers
N6820SSYE	Multi-system synchronous sweep service
N6820USDE	Universal Signal Detector
N6820MR1E	Modulation recognizer
N6820NBRE	Streaming narrowband recorder
N6820AL9E	MIL 188-141 ALE intercept feature *ITAR – export license required
N6820UTPE	V/UHF automated FM voice intercept feature *ITAR – export license required
N6820HFPE	N6831A HF wideband receiver driver
N6820MTPE	M9391A/M9393A PXIe receiver driver
N6820VRXE	N6820VRXE Virtual receiver driver

Application software licensing options

Flexible licensing options allow you to balance your project's requirements. Your application software may require consistent software operation over a full program lifecycle or may require frequent updates to maintain pace with fast-moving leading-edge applications. Keysight licensing has flexible license terms and types to address your application needs. KeysightCare provides selectable software support as well.

License term	Options
Perpetual	Use perpetual licenses indefinitely. KeysightCare Software Support is available for 1-, 2-, 3- or 5-year subscriptions, and is renewable.
Subscription	Use subscription licenses through the term of the subscription (6 months or 1-, 2-, or 3 years). KeysightCare Software Support is available through the license term.
License type	Descriptions
Node-locked	Use node-locked licenses on one specific instrument/computer.
Transportable	Use a transportable license with one instrument/computer at a time. Users can transfer the license to another instrument using Keysight Software Manager (internet connection required).
USB Portable	Use a USB portable license on one instrument/computer at a time. Users can transfer the license to another instrument using a certified USB dongle (available for additional purchase, Keysight part number E8900-D10).
Floating	Networked instruments/computers can access a license from a server one at a time. Purchase multiple licenses for concurrent usage. Three types of floating licenses are available: Single Site : 1-mile radius from the server; Single Region ¹ : Americas; Europe; Asia; Worldwide (export restriction identified in End User License Agreement (EULA))

1. Americas (North, Central, and South America, Canada); Europe (European Continent, Middle Eastern Europe, Africa, India); Asia (North and South Asia Pacific Countries, China, Taiwan, Japan)

For more information see the [Software Terms, Types, and KeysightCare Software Support Subscriptions flyer](#)

KeysightCare application software support

Ensure your software test and design tools are current and include the latest standards with KeysightCare Application Software Support which provides proactive notifications and software updates. Receive priority access, with a committed timeframe, to application experts who are familiar with Keysight software and the latest standards. Our experts can advise on techniques to help you stay within the most challenging emerging technology test limits.

Benefits summary:

- KeysightCare Technical Support
 - Online Knowledge Center
 - Self-Service Keysight Support Portal
- Technical support response within 4 business hours
- Software updates and enhancements
- Proactive software notifications

KeysightCare Software Support applies to the software with a 4-business hour response time, software updates and notifications, and access to the Keysight Support Portal. If both hardware and software are under technical support entitlement, the best service level will prevail, so in the case of KeysightCare Enhanced, this is the 2 business hours over the 4 business hours.

System requirements

Recommended computing resources

CPU	Minimum: 2 GHz Intel Core i5 4c/4t (libraries are optimized for Intel Processors) Recommended: 3 GHz Core i7 4c/8t
RAM	Minimum: 8GB Recommended: 16 GB or more (more is better)
Operating System	Windows® 10
Hard drive	Minimum: 40 GB SATA3 SSD (750 MB required for Surveyor 4D installation) Recommended: 512 GB PCIe NVMe (750 MB required for software and Snapshot files)
Display	Dual 24" or larger LCD display required to view spectral data points
Graphics card	Minimum: True 1280x1024 on-screen resolution, 16-bit True color, 8 Mbyte video memory Recommended: True 1920x1200 on-screen resolution, 32-bit True color, 2 Gbyte video memory
GPU (for N6820VRXE)	NVIDIA with CUDA compute capabilities 5.0 ("Maxwell") or higher
Software Training	(Delivered onsite or at a convenient Keysight office) PS-S20-100 Field application engineer training services, daily (3 days recommended) R2004A-007 Factory consulting services, hourly (24 hours recommended) R2004A-707 Travel expense for factory consulting (4 for U.S., contact Keysight for outside the U.S.)

For more information on Keysight Technologies' products, applications, or services, please visit: www.keysight.com



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