ellisys
Better Analysis

Bluetooth Explorer™

All-in-One Dual-Mode Bluetooth® Protocol Analysis System

Powerful ▪ Advanced ▪ Integrated

Sales Contact:

☎ USA: +1.866.724.9185
Asia: +852 2272 2626
Europe: +41 22 777 77 89

@ sales@ellisys.com

www.ellisys.com/bex400

Wideband BR/EDR and Low Energy sniffer with concurrent capture of Wi-Fi® 2x2 802.11 a/b/g/n, 2.4 GHz spectrum, HCI (USB, UART, SPI), WCI-2, logic signals, generic I2C/UART/SPI/SWD, and Audio I2S.

Innovative Tool for Demanding Users

Traffic analysis is one of the key day-to-day activities for Bluetooth engineers looking to rapidly test and debug their prototypes and products. Unfortunately, Bluetooth over-the-air sniffing has always been difficult to perfect. **Legacy sniffing methods suffered from major technological drawbacks,** making them unreliable and even unusable in several circumstances, making Bluetooth engineers' tasks much more difficult.

With its **revolutionary wideband Digital Radio**, Ellisys lifts protocol capture and analysis to new heights, radically overcoming the drawbacks of those legacy approaches to Bluetooth sniffing. The Ellisys all-in-one whole-band sniffer robustly records any packet, at any time, from any neighboring piconet, with zero-configuration and without being intrusive.

Bluetooth Wideband Capture

Bluetooth wireless technology was originally designed to be robustly impervious to interference on the much-used 2.4 GHz ISM band. It was also designed to be difficult to sniff, for security reasons. To meet these criteria, a Bluetooth radio uses from 40 (low energy) to 79 (classic) channels pseudo-randomly according to a hopping sequence defined at the piconet's connection time. A hopping sniffer tries to actively synchronize on a specific hopping sequence, and captures the packets only after a successful synchronization. This kind of sniffer has several inherent limitations, making it more difficult to use, less reliable, and usable only in a limited set of scenarios.

Ellisys revolutionized Bluetooth sniffing with the release of the industry's first wideband sniffer. This approach overcomes all of these drawbacks and adds innovative and ground-breaking features, opening new horizons for Bluetooth debugging and interoperability testing. The wideband capture approach is as simple as it is powerful: instead of listening to just a few channels, the sniffer captures all channels concurrently. The sniffer thus does not need to synchronize to a piconet; it will listen passively to all nearby Bluetooth piconets, scatternets, and other topologies such as mesh, without any required configuration.

Reconfigurable Bluetooth Digital Radio

With its innovative reconfigurable radio, the Ellisys sniffer can uniquely be updated by software to support changes in the specification, without any change to the hardware, and even without any interaction from the user.

For instance, this flexibility allowed for the addition of next generation Bluetooth baseband features (such as enhanced AES security, Connectionless Broadcast, and more recent features like Bluetooth LE Coded PHY and 2Mbps support) several months before these features were officially released in an updated specification. Additionally, the Bluetooth Explorer comes with free lifetime software updates, so all customers can benefit from these great additions free-of-charge!

LC3 Auto-Detect

The Low Complexity Communications Codec, or LC3, is particularly ideal for Bluetooth Low Energy as it provides a high degree of quality, even at its lowest data rates. This architectural flexibility, which includes a wide selection of bit rates, allows developers to easily manage trade-offs between audio quality and power consumption, enabling extensions to battery life or even smaller battery sizes. Ellisys Bluetooth Analyzers include detailed decoding for LC3 traffic.

An innovative feature, based on an Ellisys-designed, test equipment-grade LC3 codec, allows for automatic determination of LC3 configuration parameters. Historically, test equipment implementations have required a complete and error-free capture of (wirelessly transmitted) audio codec configuration parameters to properly capture, characterize, and replay audio.

With this auto-detect innovation, even with otherwise critical configuration packets corrupted by interferences or low signal strength, LC3 audio is still recognized, understood, captured, and available for further analysis. Even incorrect configuration implementations will not prevent LC3 capture.

Powerful Ellisys Features

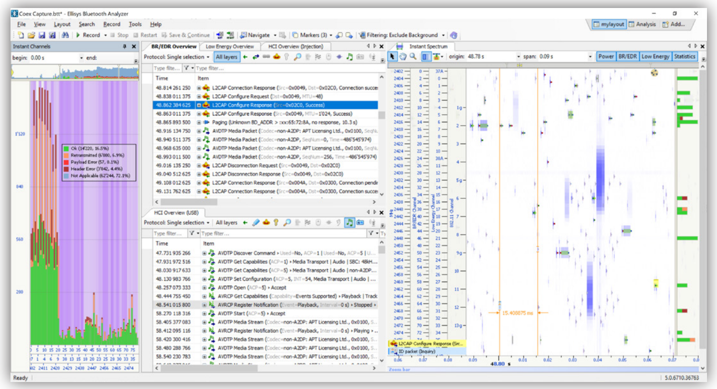
- **All-in-One:** Fully hardware-integrated, time-synchronized, and truly one-click concurrent capture of BR/EDR, Bluetooth Low Energy, Wi-Fi, raw RF spectrum, HCI, logic/GPIO, generic I2C, UART, SWD, and SPI, Audio I2S, and WCI-2
- **Widely Acclaimed Software:** The Ellisys software application provides intuitive understandings of complex protocol and RF behaviors, and flexible configuration and control to give engineers the insights they need
- **Bluetooth Wideband Capture:** Easy and rock-solid capture of any traffic on all channels, including discovery/connection traffic and complex topologies
- **Wi-Fi 802.11 a/b/g/n (2x2) Capture:** Extremely accurate and perfectly synchronized Wi-Fi capture accelerated by Ellisys hardware protocol engine for best-in-class performance
- **LC3 Auto-Detect:** Proprietary technology to detect and decode LC3 traffic even without capture of configuration parameters
- **Emerging Features Support:** Benefit from early implementation of pre-specification feature additions
- **Mesh Support:** Includes full support for Bluetooth Mesh network topologies
- **Reprogrammable Bluetooth Digital Radio:** Evolvable by software to protect your investment
- **Multi-Piconet Support:** Visualize all topologies, including multiple piconets and scatternets
- **All Protocols and Profiles:** Best-of-breed protocol decoding
- **Integrated Audio Analysis:** Listen to captured over-the-air audio, including audio over HCI and I2S, within the software, in sync with all other traffic
- **Raw RF Spectrum Display:** Characterize the raw wireless environment and visualize co-ex issues
- **Automation:** Ellisys provides an automation API, a CLI, and an Injection API to allow for advanced capture control and data insertion/extraction tasks
- **Free Maintenance:** Hassle-free, no-cost lifetime software updates

> “*Test and characterization of new Bluetooth silicon and end-products is a comprehensive process requiring a diverse set of engineering expertise and an array of specialized, analytical tools,* ***said Muthu Kumar, Wireless Firmware Engineer, Intel Corporation.*** *The Ellisys Bluetooth Explorer plays an important role in this process by delivering a clear and complete understanding of the behavior of the ever-evolving Bluetooth technology from both hardware and software perspectives, all while providing exceptional ease of use.*”

Visualizing Coexistence Issues

In addition to Bluetooth Classic and Bluetooth Low Energy, Bluetooth Explorer supports capture of Wi-Fi 802.11a/b/g/n 2x2 and raw RF spectrum - **in precise synchronization with each other and all supported wired transmissions.** These technologies are frequently sources of interference and contention with Bluetooth communications, as they share the 2.4 GHz ISM spectrum used by Bluetooth. Increasingly, these technologies are co-resident on the same SoC.

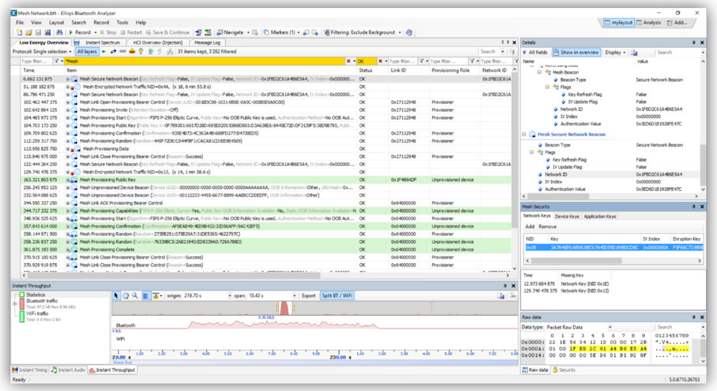
To fully characterize coexistence issues, Explorer delivers a variety of features that make this task easier. The user is provided a precise understanding of RF signatures, sources, and power, various timings, device performance indications, and other related metrics.



Bluetooth Mesh Networking

The Bluetooth Mesh Networking specifications define a broad spectrum of device and system requirements for a large-scale many-to-many network using Bluetooth Low Energy wireless technology. Bluetooth mesh networks can greatly increase the range of Bluetooth communications by using a message relay approach and are inherently uncomplicated and inexpensive to deploy, as there are no requirements for a central router or computer.

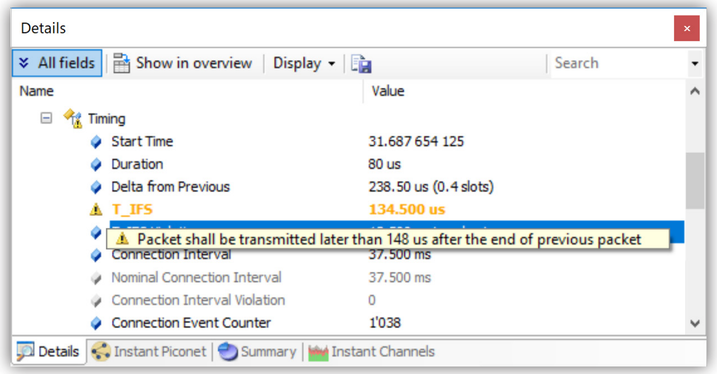
Bluetooth Explorer provides **comprehensive support for capture of mesh network protocol,** related packet and transactional decodes, encryption and key management features, and error detections. Mesh traffic is captured concurrently and in precise synchronization with all other supported traffic streams.



Automated Error Detections

The analyzer software alerts the user to a variety of errors detected for both wired and wireless captures. Physical, protocol, and profile layer errors, including packet and transactional errors, are **automatically highlighted without any need to search through the capture.**

Errors are highlighted on a color-coded system to indicate the relative severity of the errors, summarized in a dedicated status column in each protocol overview, and described in the Details view or with pop-up messages on fly-over in the Overviews. Incomplete payloads, missing or incorrect field values, center frequency violations, timing violations, missing responses, and CRC errors are among the errors indicated.



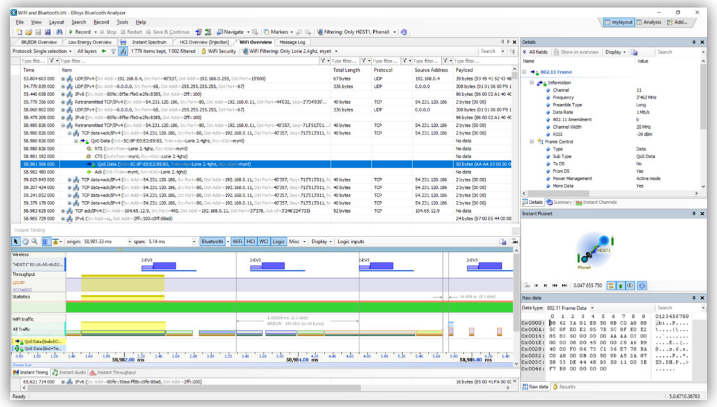
Name	Value
⊟ Timing	
Start Time	31.687 654 125
Duration	80 us
Delta from Previous	238.50 us (0.4 slots)
⚠ T_IFS	134.500 us
Connection Interval	37.500 ms
Nominal Connection Interval	37.500 ms
Connection Interval Violation	0
Connection Event Counter	1'038

⚠ Packet shall be transmitted later than 148 us after the end of previous packet

Wi-Fi Capture

With Explorer, **Wi-Fi traffic is captured using an innovative, Ellisys-designed hardware-accelerated protocol engine.** With lower-performance Wi-Fi capture tools that use a software-based capture approach, the capture process is done with a processor involved. This approach can limit the speed and timing accuracy of the capture – packets can be missed when the processor is outmatched by the incoming streams.

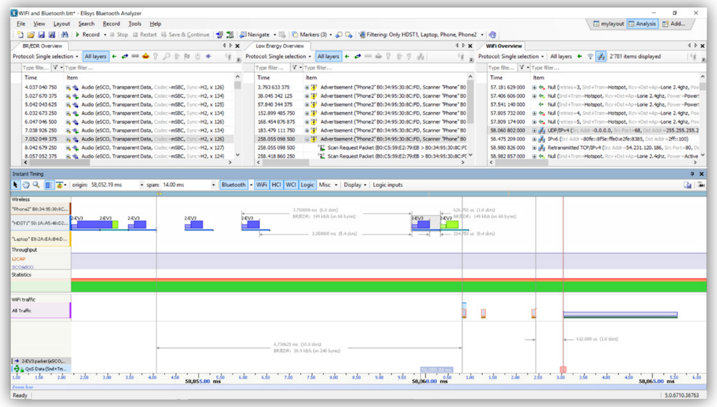
With Explorer's specially designed protocol engine, the Wi-Fi capture is driven directly and without processor dependence to guarantee throughput and minimize latency. Importantly, the Wi-Fi traffic is captured concurrently and in precise synchronization with all other supported wired and wireless capture streams.



Instant Timing

Timing is everything as they say, and with Bluetooth, it's always an important focus. Multitudes of timing parameters defined by the Bluetooth specification are system-critical. It is understandably important to characterize these timings efficiently and accurately. Hardware and software timing issues are often the source of interoperability and performance issues that can challenge Bluetooth engineers.

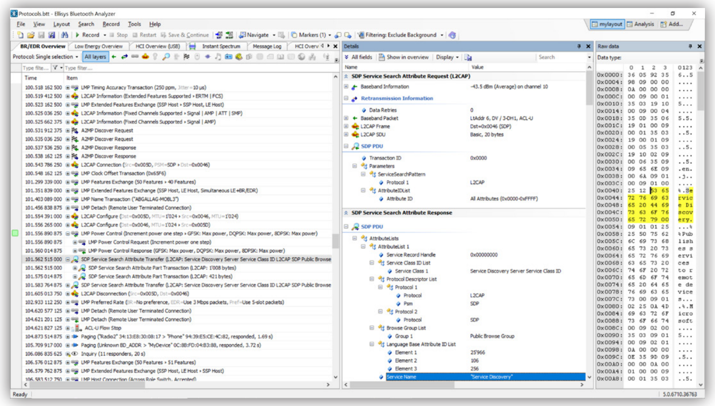
The Instant Timing view displays various information along a common timestamp, including visualized Bluetooth and Wi-Fi packets, HCI traffic (UART, SPI, and USB), generic communications (SWD, I2C, UART, and SPI), and logic signals. Data throughput and packet transmission statistics are included to complete the approach.



Protocol & Profiles Analysis

Bluetooth protocols and profiles are displayed in an **easy-to-understand, high-level procedures-oriented chronological format** in the Overview windows and fully detailed to the lowest bit/byte level in the linked Details view. All supported traffic streams are displayed in designated Overviews real-time, as the capture progresses.

The user is provided various controls to easily customize any Overview, including powerful filtering and coloring capabilities designed to quickly isolate specific protocols, profiles, or communications of interest. Traffic can be presented at the highest level of abstraction and the user can drill down to show all intermediate levels, down to the most basic elements, such as packet-only views.



Ellisys Bluetooth Explorer™

All-in-One Dual-Mode Bluetooth Protocol Analysis System

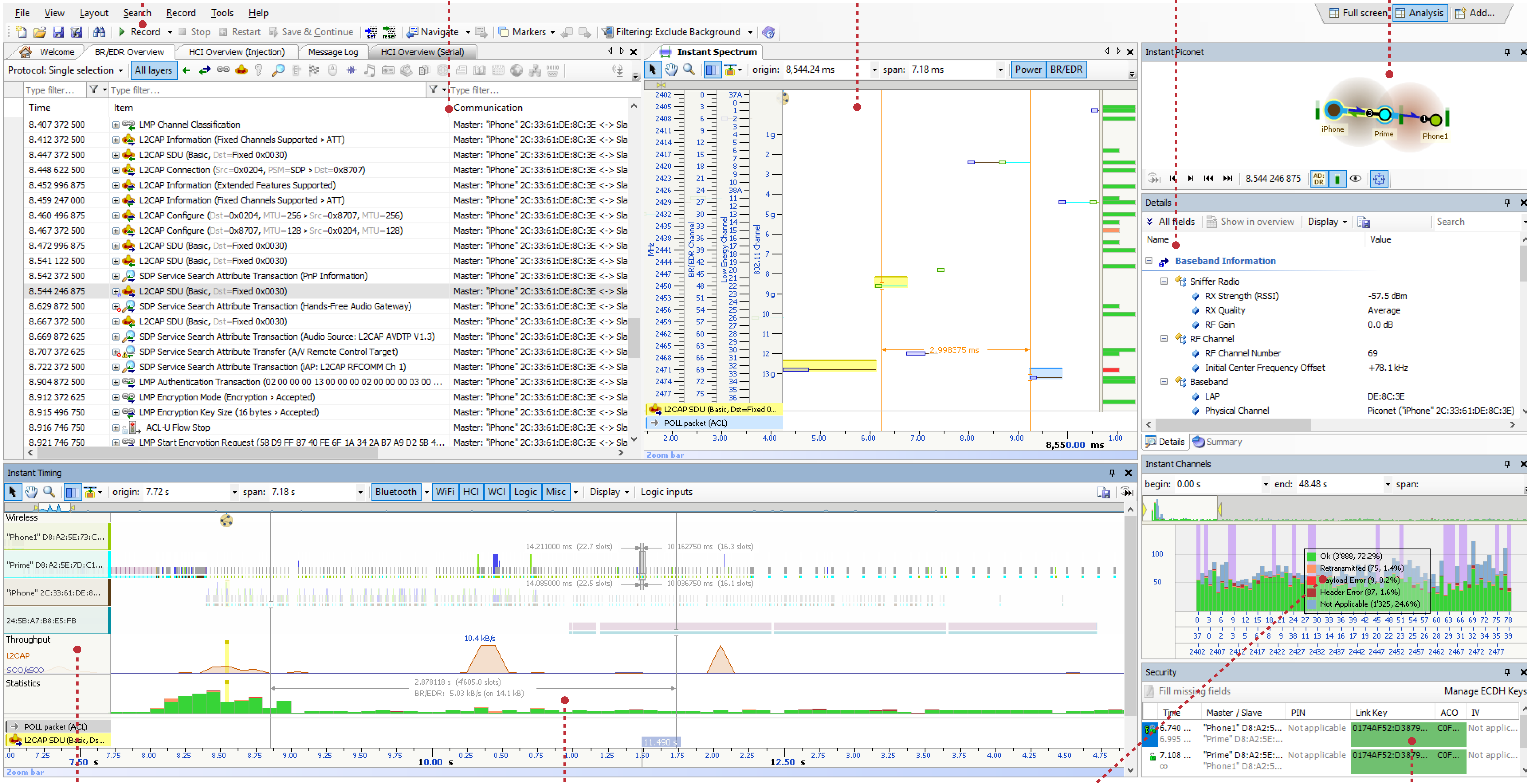
One-Click Record
Capture starts instantly without any configuration. Devices under test are automatically detected.

Protocol Overview
Low-level and stack protocol elements are hierarchically displayed in easily configurable views.

Instant Spectrum
Visualize hopping sequences, AFH dynamics, statistical per-channel error characteristics, timings, and RF characteristics.

In-Depth Data Mining
Detailed meta-data and protocol fields are clearly displayed and linked to the selected item in the overview.

Instant Piconet
Actual piconet and scatternet topology is shown with throughput and other various hints. Works in Live or Replay mode.



Time	Item	Communication
8.407 372 500	LMP Channel Classification	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.412 372 500	L2CAP Information (Fixed Channels Supported › ATT)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.447 372 500	L2CAP SDU (Basic, Dst=Fixed 0x0030)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.448 622 500	L2CAP Connection (Src=0x0204, PSM=SDP › Dst=0x8707)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.452 996 875	L2CAP Information (Extended Features Supported)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.459 247 000	L2CAP Information (Fixed Channels Supported › ATT)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.460 496 875	L2CAP Configure (Dst=0x0204, MTU=256 › Src=0x8707, MTU=256)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.467 372 500	L2CAP Configure (Dst=0x8707, MTU=128 › Src=0x0204, MTU=128)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.472 996 875	L2CAP SDU (Basic, Dst=Fixed 0x0030)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.541 122 500	L2CAP SDU (Basic, Dst=Fixed 0x0030)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.542 372 500	SDP Service Search Attribute Transaction (PnP Information)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.544 246 875	L2CAP SDU (Basic, Dst=Fixed 0x0030)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.629 872 500	SDP Service Search Attribute Transaction (Hands-Free Audio Gateway)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.667 372 500	L2CAP SDU (Basic, Dst=Fixed 0x0030)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.669 872 625	SDP Service Search Attribute Transaction (Audio Source: L2CAP AVDTP V1.3)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.707 372 625	SDP Service Search Attribute Transfer (A/V Remote Control Target)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.722 372 500	SDP Service Search Attribute Transaction (iAP: L2CAP RFCOMM Ch 1)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.904 872 500	LMP Authentication Transaction (02 00 00 00 13 00 00 00 02 00 00 00 03 00 …	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.912 372 625	LMP Encryption Mode (Encryption › Accepted)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.915 496 750	LMP Encryption Key Size (16 bytes › Accepted)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.916 746 750	ACL-U Flow Stop	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla
8.921 746 750	LMP Start Encryption Request (58 D9 FF 87 40 FE 6F 1A 34 2A B7 A9 D2 5B 4…	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla

Details

All fields | Show in overview | Display | Search

Name	Value
Baseband Information	
Sniffer Radio	
RX Strength (RSSI)	-57.5 dBm
RX Quality	Average
RF Gain	0.0 dB
RF Channel	
RF Channel Number	69
Initial Center Frequency Offset	+78.1 kHz
Baseband	
LAP	DE:8C:3E
Physical Channel	Piconet ("iPhone" 2C:33:61:DE:8C:3E)

Security

Fill missing fields | Manage ECDH Keys

Time	Master / Slave	PIN	Link Key	ACO	IV
6.740 ... 6.995 ...	"Phone1" D8:A2:5... "Prime" D8:A2:5E:...	Notapplicable	0174AF52:D3879...	C0F...	Not applic...
7.108 ... ∞	"Prime" D8:A2:5E:... "Phone1" D8:A2:5...	Notapplicable	0174AF52:D3879...	C0F...	Not applic...

Innovative Data Groups
Relationships between packets are made clear, by assembling data per piconet's master device, slave, channel and more.

Instant Timing
Time-ordered, color-coded display of air and HCI traffic, statistics, data throughput and logic signals, with precision timing measurements.

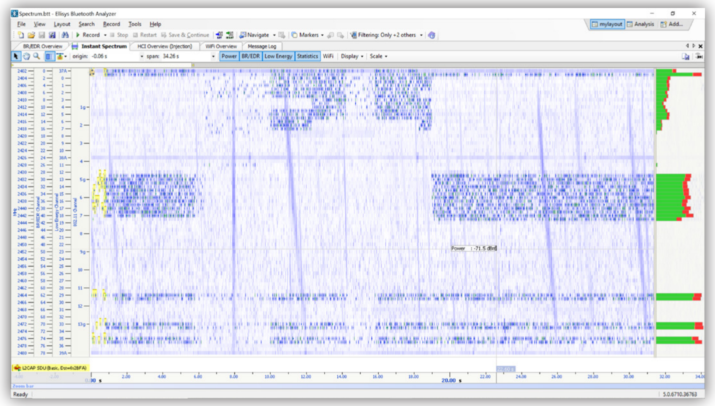
Instant Channels
Understand per-channel transmission quality with a variety of statistics, over a user-specified time range.

Security Management
Manage addition of link keys here. See when a Start Encryption exchange happens and navigate there with a single click.

Spectrum Analysis

The Instant Spectrum feature displays packets by channel, over time and can also **synchronously display raw RF spectrum information in the busy and unlicensed 2.4GHz ISM band** in which Bluetooth operates. Other users of this band include Wi-Fi, LTE, ZigBee, ANT, microwave ovens, and other products and technologies. These users can and do interfere with each other, and it is often necessary to gain a precise understanding of the wireless environment.

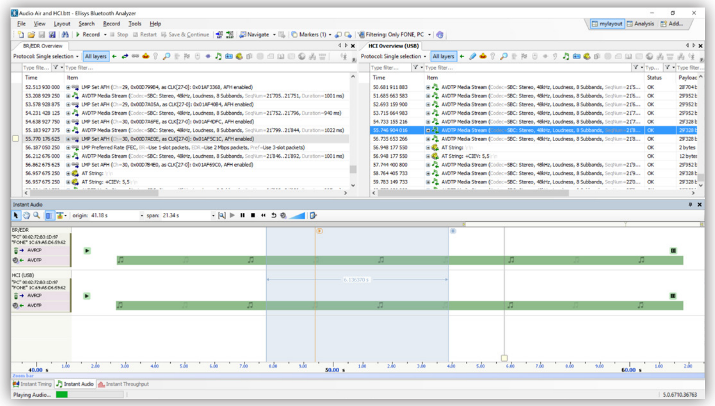
The signal strength of all emitters (RSSI) is displayed. Adaptive Frequency Hopping (AFH) behaviors are overlaid, enabling a keen understanding of the complexities of the dynamic RF challenges encountered by any given Bluetooth link.



Integrated Audio Analysis

Captured audio streams can be easily played back, even during capture. LC3 traffic is **automatically detected** using a test equipment-grade LC3 codec, even without capture of LC3 configuration traffic.

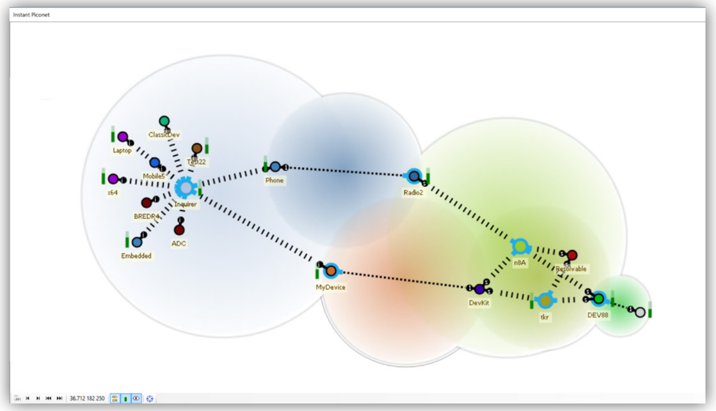
Finding packets carrying specific audio portions or at specific events is easily done. Audio captured over HCI or from an Audio I2S input [PRO] can be played back. This enables characterization of the complete audio chain, including the uncompressed audio provided to the source, the audio transmitted wirelessly, and the decoded audio at the receiver device. Audio streams are exportable to WAV format.



Topology Analysis

Bluetooth technology has become very popular among consumers and continues to evolve into new applications and markets, leading to more complex use cases. The only way to support these new use cases is to create more complex topologies, for example, Mesh Networking.

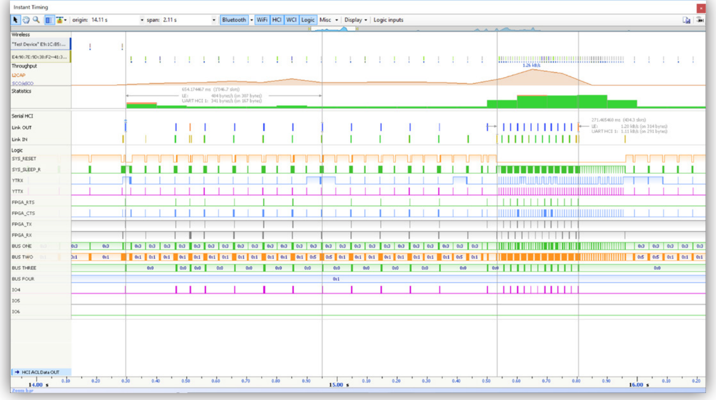
Debugging complex topologies has always been a difficult task, but Bluetooth Vanguard is up to the task with its **powerful wideband radio capable of capturing any traffic from any device,** including the most complex topologies. The Instant Piconet view helps developers visualize their topologies live while capturing, and also provides a play-back feature showing step-by-step evolution of topology changes.



Logic Analysis

The logic analysis feature allows for synchronous capture of external logic signals. Any digital signal is supported, including general-purpose inputs/outputs (GPIOs) or dedicated pins such as TX/RX Active, CTS, RTS, etc. A convenient color-coded probe is supplied.

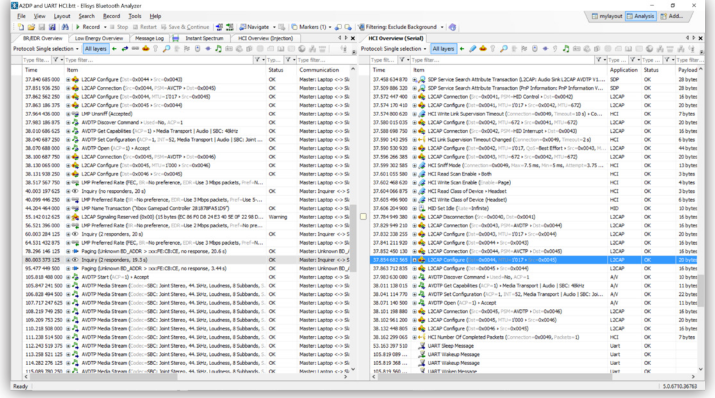
These **signals are visualized with 5-nanosecond precision** and displayed in the Instant Timing view with all over-the-air and wired traffic streams. Signals can be assigned custom names and colors for easy identification. Custom signal groups can be created and displayed as buses, in addition to the display of discrete signals. Users can create simple external comparators and observe thresholds being crossed for various metrics, such a power consumption.



HCI Analysis

Wireless traffic is the primary element of debug information for Bluetooth engineers, but Host Controller Interface (HCI) traffic can be an equally important complement of information for getting a clear and complete picture of a given situation. Bluetooth Vanguard supports capture of HCI transports over USB, UART, and SPI.

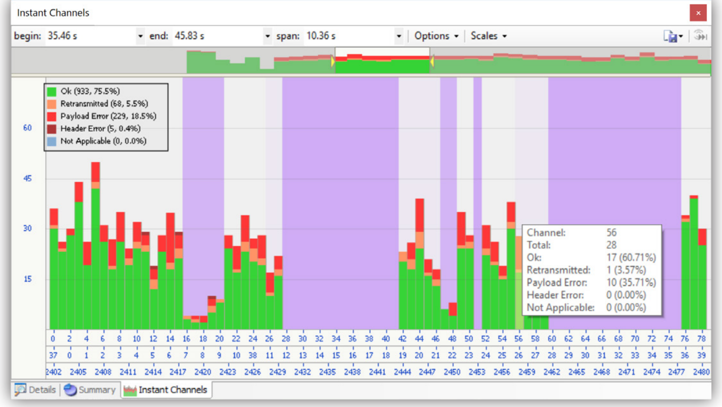
HCI traffic is captured concurrently with the wireless traffic and other wired streams using the same precision clock for perfect synchronization and timing analysis and is decoded and displayed in various formats. Conveniently, the Ellisys software **automatically extracts any Link Key exchanged over HCI** and uses it to decrypt the wireless traffic, all without any user interaction.



Channels View

The Channels View feature provides **easy-to-understand visual and statistical analyses on various per-channel transmission characteristics,** including packet retransmissions, header errors, and payload errors. This information can be useful in understanding where in the Bluetooth spectrum all devices, or specific devices, are communicating and the spectral areas (channels) they are avoiding, generally due to external interferences.

Visual cues are provided to give the user an understanding of the propensity of a given device, or aggregate devices, to avoid particular channels. This information is provided for the duration of an entire capture and can be configured to characterize all devices in the vicinity or specific devices.



Instant Channels

begin: 35.46 s end: 45.83 s span: 10.36 s

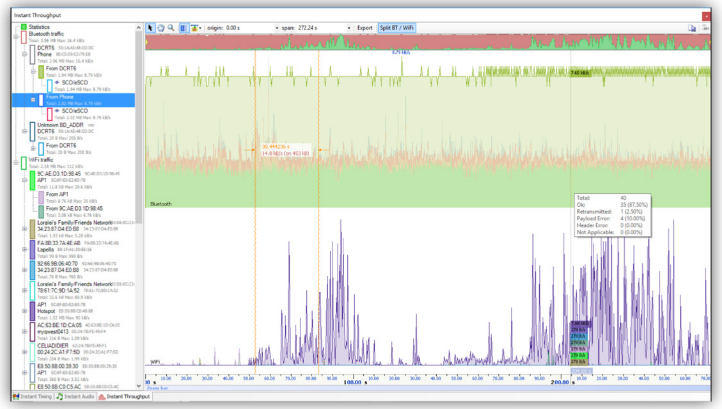
🟩	Ok (933, 75.5%)
🟧	Retransmitted (68, 5.5%)
🟥	Payload Error (229, 18.5%)
🟫	Header Error (5, 0.4%)
🟦	Not Applicable (0, 0.0%)

Channel:	56
Total:	28
Ok:	17 (60.71%)
Retransmitted:	1 (3.57%)
Payload Error:	10 (35.71%)
Header Error:	0 (0.00%)
Not Applicable:	0 (0.00%)

Throughput and Airtime

Understanding device data throughout and airtime utilization are common tasks for wireless engineers. **These characterizations are managed by the Throughput and Airtime views.** A statistical analysis overlays graphics in both views to provide information on how various transmission inefficiencies relate to performance.

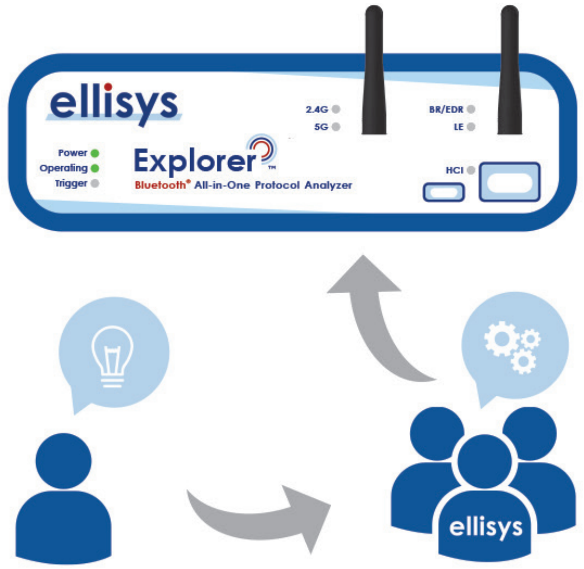
A navigation bar is provided to allow the user to select a time range to pan through the entire capture to see trends, including high and low peaks on data throughput or airtime utilization. **Various controls are available to drill down to device connections**, individual transmitters, L2CAP channels, and audio channels. A synchronization feature allows for precise tracking with other views.



Emerging Features Support

All Ellisys Bluetooth analyzer systems are reconfigurable with software updates – another Ellisys innovation. Ellisys maintains close relationships with radio developers worldwide and with various technical groups involved in outlining new Bluetooth specifications.

This approach allows new features to be added even in the conceptual stages, long before they become standardized in a public release of the Bluetooth specification. This is a huge advantage to Bluetooth radio developers, and to the Bluetooth developer ecosystem in general, as radio developers can test new features well before they are committed to silicon, greatly reducing chances of re-spins or discoveries of issues in the marketplace, post-spin.



> *The new advanced features provided by Ellisys provide our teams with tools that substantially increase visibility into the workings of Bluetooth technology,* ***said Miles Louis Smith, Senior R&D Engineer, Test Group, Nordic Semiconductor.*** *We use the sniffer to diagnose complex timing issues that other sniffers might not be able to capture. Due to the unique radio architecture of the Ellisys sniffer we can capture all packets regardless of the timing. The reconfigurable hardware is very flexible, and the Ellisys team provides great support to help us get products to market sooner.*

Configurations and Purchase Information

Radio Configuration	EDR	LE	DUAL
BR/EDR Capture	x		x
Low Energy Capture		x	x

Editions	Standard	Pro	Enterprise
Wideband Bluetooth Capture	x	x	x
HCI Capture		x	x
Logic Capture		x	x
I2C, UART, SPI, SWD Capture		x	x
Spectrum Capture		x	x
Audio I2S Capture		x	x
WCI-2 Capture		x	x
Wi-Fi 802.11 a/b/g/n Capture			x
Warranty	2 years	2 years	3 years

Description	Code
Ellisys Bluetooth Explorer 400 Standard BR/EDR	**BEX400-STD-EDR**
Ellisys Bluetooth Explorer 400 Low Energy	**BEX400-STD-LE**
Ellisys Bluetooth Explorer 400 Dual Mode	**BEX400-STD-DUAL**
Ellisys Bluetooth Explorer 400 Pro BR/EDR	**BEX400-PRO-EDR**
Ellisys Bluetooth Explorer 400 Pro Low Energy	**BEX400-PRO-LE**
Ellisys Bluetooth Explorer 400 Pro Dual Mode	**BEX400-PRO-DUAL**
Ellisys Bluetooth Explorer 400 Enterprise BR/EDR	**BEX400-ENT-EDR**
Ellisys Bluetooth Explorer 400 Enterprise Low Energy	**BEX400-ENT-LE**
Ellisys Bluetooth Explorer 400 Enterprise Dual Mode	**BEX400-ENT-DUAL**
Ellisys Bluetooth Explorer 400 Pro Upgrade	**BEX400-PRO/UPG**
Ellisys Bluetooth Explorer 400 Enterprise Upgrade	**BEX400-ENT/UPG**
Ellisys Bluetooth Explorer 400 Dual Mode Upgrade	**BEX400-DUAL/UPG**

Ellisys Bluetooth Explorer™

All-in-One Dual-Mode Bluetooth Protocol Analysis System

Technical Specifications

Bluetooth Capture Characteristics

- Ellisys Rainbow™: Industry's first wideband concurrent capture of all Bluetooth channels
- Frequency band: 2.402-2.480 GHz
- Sensitivity range: From -90 to +15 dBm
- Gain: Programmable from -30 to +15 dB
- Modulations: All BR/EDR/LE modulations(GFSK 1/2Mbps, p/4-DQPSK, 8-DPSK)
- Baseband: Support of Bluetooth 5.x, upgradeable by software.

Wi-Fi Capture Characteristics

- 802.11 2x2 a/b/g/n (2 streams)
- Channel width 2.4GHz: 20MHz or 40MHz, configurable
- Channel width 5GHz: 20MHz or 40MHz
- 11n MCS 2.4GHz 20MHz channel: 0 to 15
- 11n MCS 2.4GHz 40MHz channel: 0 to 7
- 11n MCS 5GHz 20MHz channel: 0 to 7
- Guard Interval: 800ns and 400ns GI
- Frame encoding: BCC (LDPC not supported)
- Max AMPDU size: 16,384 bytes

Logic Capture Characteristics

- Maximum bandwidth: 20 MHz
- Sampling precision: 5 ns
- Supported input voltage: 1.8 to 7V

HCI Capture Characteristics

- USB HCI transport: Low, Full, and High Speed, with automatic detection
- UART HCI transport: Up to 8 Mbit/s, automatic detection of all parameters
- SPI HCI transport: Up to 8 Mbit/s, automatic detection of all parameters

Embedded Memory

- 512 MB of FIFO memory
- Data is stored in highly optimized format
- Analyzed data is uploaded in real time

Low-speed Serial Capture Characteristics

- UART: Up to 8 Mbit/s automatic detection of all parameters
- SPI: Up to 8 Mbit/s, automatic detection of all parameters
- I2C: Up to 1 Mb/s
- SWD: Up to 8 Mb/s

Timing

- Clock: ±10ppm frequency accuracy over -10 to +60 degrees Celsius range
- BR/EDR/LE timestamp accuracy: ±125ns
- Wi-Fi timestamp accuracy: ±1us
- USB HCI timestamp accuracy: ±16.7ns
- Logic timestamp accuracy: ±5ns

Enclosure

- 180 x 170 x 58 mm (7.1 x 6.7 x 2.3'')
- 1.0 kg (2.0 lbs)

Power Input

- DC input (12-24 V)

Power Adapter

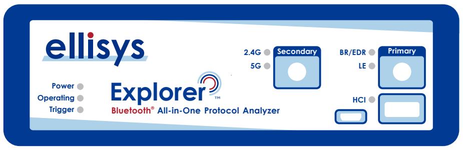
- Input: 100-240 VAC
- Output: 24 VDC
- Power: 40 W
- Plug: 5.5 x 2.1 x 12 mm barrel straight
- Safety: CB, TUV, UL, CCC, PSE
- EMI: CE, FCC, VCCI, RCM

Hardware Upgrade

- The Ellisys Rainbow™ engine is automatically updated with each software release (no user intervention required)

Maintenance and Licensing

- Free lifetime software updates – no maintenance fees
- Free full-featured viewer software – easily share annotated traces between computers and colleagues
- Use Ellisys hardware on any computer – no additional licenses needed

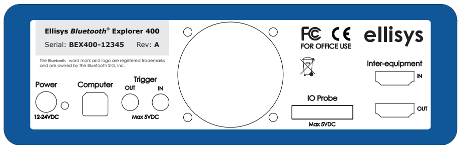


Front-Panel Indicators

- Power: unit powered on
- Operating: unit performing requested task
- Trigger: trigger event detected
- Capture: BR/EDR and/or LE packet captured
- HCI: HCI packet captured

Front-Panel Connectors

- Capture: Standard SMA female
- HCI: USB 2.0 Standard-A and Micro-B


Ellisys Bluetooth® Explorer 400
Serial: BEX400-12345 Rev: A
The Bluetooth word mark and logo are registered trademarks and are owned by the Bluetooth SIG, Inc.
Power
12-24VDC
Computer
Trigger
OUT
IN
Max 5VDC
FC CE
FOR OFFICE USE
ellisys
Inter-equipment
IN
OUT
IO Probe
Max 5VDC

Rear-Panel Connectors

- Computer: USB 2.0 Standard-B
- Power: 12-24 VDC, max 18 W
- Trigger: SMA in and out, 50 Ω, max 5VDC
- IO Probe: supports UART/SPI HCI, WCI-2 and logic analysis
- Inter-equipment: in and out, supports connection of several units

Warranty

- Two-year limited warranty [STD and PRO]
- Three-year limited warranty [ENT]

Minimum Requirements

- Intel Core, 2 GHz or compatible processor
- 4 GBytes of RAM
- 1280 x 1024 display resolution with at least 65,536 colors
- USB 2.0 EHCI host controller
- Windows® 7 or higher .net framework 4.6.1

More information at: www.ellisys.com/bex400