



# Bluetooth® Vanguard<sup>™</sup>

**Advanced Wireless Protocol Analysis System** 

# Innovative • Cutting-Edge • Integrated

# Sales Contact:



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www.ellisys.com/bv1

and Audio I2S



# **Powerful Ellisys Features**

- generic I2C, UART, SWD, and SPI, Audio I2S, and WCI-2
- insights they need
- discovery/connection traffic and complex topologies
- capture accelerated by Ellisys hardware protocol engine for best-in-class performance
- unmatched coexistence analysis capability
- Connection / Power Flexibility: Connect, control, and power the system locally or remotely Deliverv)
- 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: Support for new specifications without hardware changes
- Multi-Piconet Support: Visualize all topologies, including multiple piconets and scatternets
- All Protocols and Profiles: Best-of-breed protocol decoding
- I2S, within the software, in sync with all other traffic
- issues
- Free Maintenance: Free lifetime updates as well as free fully-featured viewer software with unlocked hardware that can be used on any computer

# **Innovative Tool for Demanding Users**

Wideband BR/EDR and Low Energy sniffer, with concurrent capture of Wi-Fi, WPAN IEEE

802.15.4, spectrum, HCI (USB, UART, SPI), Generic UART, SPI, SWD, I2C, WCI-2, logic signals,

The most advanced, most comprehensive Bluetooth protocol analyzer ever made. Building on a legacy of innovation, the Bluetooth Vanguard All-In-One Wireless Protocol Analysis System delivers new advances designed to ease the increasingly complex tasks of Bluetooth developers.

With its revolutionary wideband Digital Radio and integrated All-in-One hardware approach, Ellisys has changed the way Bluetooth protocol capture and analysis is done, by radically overcoming the drawbacks of legacy approaches. The Ellisys whole-band capture approach robustly records any packet, at any time, from any neighboring piconet, with zero-configuration and without being intrusive.

## **Reconfigurable Bluetooth Digital Radio**

The reconfigurable radio concept for Bluetooth analyzers is another innovation from Ellisys engineering. With the Bluetooth Vanguard, this cost-saving feature remains a core user benefit. Reconfigurability means that the analyzer can be updated by software to support new features, without any change to the hardware. For instance, this flexibility allowed for the addition of Bluetooth features such as enhanced AES Security, Connectionless Broadcast, and more recent features, like Coded PHY and the 2Mbps BLE speed enhancement many months before these features were released in an updated specification.

Additionally, Ellisys analyzers come with free lifetime software updates and no restrictions on sharing the application software with co-workers, so our customers can benefit from these great additions hassle-free.



## **Industry's First 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 to 79 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 created the industry's first wideband sniffer in 2010, which overcame these drawbacks, adding revolutionary features which opened 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 without any required configuration.

## The All-in-One Sniffer Concept — **Another Ellisys Innovation**

Capturing wireless traffic is a very important aspect of Bluetooth debugging, but other information is equally important for understanding the big picture. This is another aspect where Ellisys sniffers excel.

The Bluetooth Vanguard supports one-click concurrent and tightly synchronized capture of:

#### **Wireless Capture**

- Bluetooth Low Energy
- Bluetooth Classic (BR/EDR)
- Wi-Fi IEEE 802.11a/b/g/n/ac (3x3) [ENT]
- WPAN IEEE 802.15.4 [ENT]
- 2.4 GHz Raw Spectrum Energy [PRO]

#### Wired Capture

- Bluetooth HCI (UART x2, USB x1, SPI x2) [PRO]
- General Purpose Logic Signals [PRO]
- Audio I2S [PRO]
- Wireless Coexistence Interface 2 [PRO]
- Generic Communications –UART, SPI, I2C, SWD [PRO]



• All-in-One: Fully hardware-integrated, time-synchronized, and truly one-click concurrent capture of BR/EDR, Bluetooth Low Energy, Wi-Fi, WPAN (IEEE 802.15.4), raw RF spectrum, HCI, logic/GPIO,

 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

Bluetooth Wideband Capture: Easy and rock-solid capture of any traffic on all channels, including

• Wi-Fi 802.11 a/b/g/n/ac (3x3) Capture: Extremely accurate and perfectly synchronized Wi-Fi

• WPAN 802.15.4 Wideband Capture: Concurrent capture of all 16 WPAN 2.4 GHz channels for an

via networkable GbE (with Power-over-Ethernet/PoE) or USB 3.1 over Type-C<sup>™</sup> (with USB Power

Integrated Audio Analysis: Listen to captured over-the-air audio, including audio over HCI and

• Raw RF Spectrum Display: Characterize the raw wireless environment and visualize coexistence



**Ellisys Bluetooth<sup>®</sup> Vanguard<sup>™</sup>** Advanced Wireless Protocol Analysis System

# All-Channels 802.15.4 WPAN

IEEE 802.15.4 is a technical standard that provides lower-layer support for higher-layer network specifications like Thread and Zigbee. Increasingly, this Low-Rate Wireless Personal Area Network (LR-WPAN) technology is being used on devices, modules, and SoC's that also employ Bluetooth and/or Wi-Fi communications, and in environments like Smart Home, smart cities, and industrial applications where Bluetooth and Wi-Fi are also present.

These circumstances present coexistence challenges. **Bluetooth Vanguard uses an innovative wideband approach to capture all 16 WPAN channels** that are used in the 2.4GHz band, including associated RF characteristics, in precise synchronization with all other traffic streams captured by the analyzer.



# **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.

# **Visualizing Coexistence Issues**

In addition to Bluetooth Classic and Bluetooth Low Energy, Vanguard supports capture of Wi-Fi 802.11a/b/g/n/AC 3x3, WPAN 802.15.4, 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, Vanguard 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.



# Wi-Fi Capture - Accelerated

With Vanguard, **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 Vanguard'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.

## **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 Vanguard 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.



# **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, Wi-Fi, and WPAN 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.



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Duration	80 us
Delta from Previous	238.50 us (0.4 slots)
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Nominal Connection Interval	37.500 ms
Connection Interval Violation	0
Connection Event Counter	1'038
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#### Ellisys Bluetooth<sup>®</sup> Vanguard<sup>™</sup>

Advanced Wireless Protocol Analysis System

#### **One-Click Record** Capture starts instantly without any configu-

ration. 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.

#### <u>File V</u>iew <u>L</u>ayout <u>S</u>ear<mark>c</mark>h <u>R</u>ecord <u>T</u>ools <u>H</u>elp

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8.472 996 875	🗉 🛶 L2CAP SDU (Basic, Dst=Fixed 0x0030)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla	$2438 - \frac{5}{2}36 - \frac{5}{2}16 - \frac{5}{2}8$	
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	2447 -= <sup>6</sup> 45 -= <sup>320</sup> -= <sup>8</sup> 8	
8.544 246 875	🖽 🛶 L2CAP SDU (Basic, Dst=Fixed 0x0030)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla	2450 - 48 - 22 - 2453 - 51 - 23 - 9g -	
8.629 872 500	$\mathbb{R}_{p}$ SDP Service Search Attribute Transaction (Hands-Free Audio Gateway)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla	2455 54 25 10	
8.667 372 500	🗄 🐟 L2CAP SDU (Basic, Dst=Fixed 0x0030)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla	2459 57 26 27 26	
8.669 872 625	🕀 🔎 SDP Service Search Attribute Transaction (Audio Source: L2CAP AVDTP V1.3)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla	2462 - 60 - 28 - 11 -	
8.707 372 625	🚓 🖉 SDP Service Search Attribute Transfer (A/V Remote Control Target)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla	2465 - 63 - 30 - 12 - 2468 - 66 - 31 - 12 -	←2,998375 ms
8.722 372 500	🕀 🔎 SDP Service Search Attribute Transaction (iAP: L2CAP RFCOMM Ch 1)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla	2471 69 32 139	
8.904 872 500	🕀 🚎 LMP Authentication Transaction (02 00 00 00 13 00 00 02 00 00 00 03 00	Master: "Phone" 2C:33:61:DE:8C:3E <-> Sla	2474 - 72 - 34 - 1	
8.912 372 625		Master: "Phone" 2C:33:61:DE:8C:3E <-> Sla	2477 75 75 36 7	
8.915 496 750	🕀 🚎 LMP Encryption Key Size (16 bytes > Accepted)	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla	e L2CAP SDU (Basic, Dst=Fixed 0	
8.916 746 750	🕀 🖀 🗓 🖕 ACL-U Flow Stop	Master: "iPhone" 2C:33:61:DE:8C:3E <-> Sla	→ POLL packet (ACL)	
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 💙	2,00 3,00 4,00 5,00	6.00 7.00 8.00 9.00 <b>8,550.00 m</b>







**Protocol & Profiles Analysis** 

Bluetooth protocols and profiles are displayed in an easy-to-un-

derstand, high-level procedures-oriented chronological

format in the Overview windows and fully detailed to the low-

est bit/byte level in the linked Details view. All supported traffic

streams are displayed in designated Overviews real-time, as the

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 commu-

nications of interest. Traffic can be presented at the highest level

of abstraction and the user can drill down to show all intermedi-

ate levels, down to the most basic elements, such as packet-only



Analysis 2 Add.

**Ellisys Bluetooth<sup>®</sup> Vanguard<sup>™</sup>** Advanced Wireless Protocol Analysis System

# **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.

# Integrated Audio Analysis

The Ellisys analysis software includes integrated Audio analysis. **Any captured audio stream can be quickly and easily played back, even live, during capture.** Finding the packet carrying a specific audio portion or seeing event and topology changes at specific audio positions becomes child's play.

Audio captured over HCI or from an Audio I2S input [PRO] can be played back as well. This enables characterization of the complete audio chain, from the uncompressed audio provided to the source radio chip, to the audio transmitted wirelessly, and the decoded audio received by the receiver radio chip. The various audio streams are exportable to WAV format.

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# **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.



# Spectrum Analysis

capture progresses.

views.

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.

	e V • Type		A SDP Service Search Attribute Request (L2)	Value	0x0000 ;			3 0
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		UMP Timing Accuracy Transaction (250 ppm, 311er - 30 µs)	🗟 👉 Baseband Information	-43.5 dBm (Average) on channel 10	0×0008 :			
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200.54	8 162 125 8 9	LMP Clock Offset Transaction (Itv65F6)	🗟 🔩 ServiceSearchPattern		0x00341			
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121.45	6 838 875	UMP Detach (Remote User Terminated Connection)			0×0048 :			
101.55	4 391 000	L2CAP Configure (Dst-0x0050, MTU-1024 + Src-0x0046, MTU-1024)	SDP Service Search Attribute Response		0x004C1 0x00501			
101.55	6 265 000	L3CAP Configure (Dist=0x0046, MTU+1024 + Siz=0x0050)	B 🔍 SOP FOU		0x0054			
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101.56	2 515 000 @	SDP Service Search Attribute Transfer (L3CAP) Service Discovery Server Service Class ID L3CAP SDP Public Brows	Service Record Handle     Service Class ID List	0x0000000	0x0054 : 0x0058 :			
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		Paging (Unknown 8D, ACOR > "MyDevice" 0C(88)/FD/04(83)/88, responded, 3.72 s)	A Language Base Attribute ID List		0x0094:			
		D Inquiry (11 responders, 20 s)	@ Element 1	25'999	0×0098 :			
		UMP Features Exchange (50 Features + 51 Features)	@ Element 2	206	0×009C : 0×00A0 :			
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05.838 488 000 🛞 🦓 AVOTP Start (1 <p -="" 1)=""> Accept</p>	OK	Master: Laptop <-> Sk		37.983 630 080	a 4.	AIDTP Discover Command + Used=No, ACP+1	A/V	OK	20 b
05.847 241 500 🛞 🦓 AVOTP Media Stream (Codec-SBC: Joint Stareo, 44. Siriz, Loudness, 8 Subbands, 5		Master: Laptop <-> Sk				AVDTP Get Capabilities (ACP+1) + Media Transport   Audio   SBC: 48kHz	AN	OK	11 by
06.828 494 500 🏽 🖷 🐴 AVOTP Media Stream (Contec-SBC) Joint Stereo, 44.5Hz, Loudness, 8 Subbands, 5	OK	Mester: Laptop <>> Sk		38.041 114 770	a 4	AIDTP Set Configuration (10P-1, INT-52, Media Transport   Audio   SBCI Joi	A/V	OK	22.01
07.717 247 625 🛞 🦓 AUOTP Media Stream (Codec-SBC: Joint Stereo, 44. SHiz, Loudness, 8 Subbands, 5	OK .	Master: Laptop <-> Sk		38.071 140 500	- 4	AIDTP Open (I/CP = 1) > Accept	AN	OK	11 by
08.229 749 250 🌸 🐴 AVOTP Media Stream (Codec-58C: Joint Stereo, 44. SHz, Loudness, 8 Subbands, 5		Master: Laptop <> Sk				L3CAP Connection (Src=0x0045, PSH=AV07P + Dst=0x0046)	LICAP	OK	36 by
09.209 753 250 🛞 🐴 AUOTP Media Stream (Codec-SBC: Joint Stereo, 44. SHiz, Loudness, 8 Subbands, 5		Master: Laptop <-> Sk		38. 102 961 200	÷ 🔶	L2CAP Configure (Dist-0x0045, HTU+1000 + Src-0x0046)	LICAP	OK	20 by
10.238 508 000 🛞 🐴 AVOTP Media Stream (Codec-SBC: Joint Storeo, 44. Siriz, Loudness, 8 Subbands, 5		Master: Laptop <-> Sk				L2CAP Configure (Dist=0x0046 + Sirc=0x0045)	LOCAP	OK	35 by
11.238 514 500 🔹 🦓 AVOTP Media Stream (Codec-SBC: Joint Stereo, 44. SHrz, Loudness, 8 Subbands, 5	OK	Masteri Laptop <-> Sk		38. 162 299 065	8+6	HCI Number Of Completed Packets (Connection-0x0049, Packets-1)	HCI	OK	7641
12.243 519 375 🛞 🦓 AliOTP Media Stream (Codec-SBC: Joint Stareo, 44. Sirtz, Loudness, 8 Subbands, 5	OK .	Master: Laptop <-> Sk		53. 163 397 510		UART Sleep Message	Uart	OK	
13.258 521 125 🛞 🦓 AVOTP Media Stream (Codec-58C: Joint Stereo, 44. SHtz, Loudness, 8 Subbands, 5	ox	Master: Laptop <>> Sk		105.819.089	2	UART Wakeup Message	Uart	OK	
14.282 276 125 🛞 🖧 AUOTP Media Stream (Codec-SBC: Joint Stereo, 44. SHz, Loudness, 8 Subbands, 5	ox	Master: Laptop <-> Sk		105.819 368		UART Wakeup Message	Uart	OK	
15.089 780 750 (# 👌 AUTTP Media Steven Conferens/SEC: Selet Steven, 44. likter, Lewiness, & Subbards, S	ox	Master: Lanton <-> G V		105.819.560	Q.	LIAST Wolven Message	Lief	OK .	

# ellisys

**Ellisys Bluetooth® Vanguard**<sup>™</sup> **Advanced Wireless Protocol Analysis System** 

# **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/ac Capture			x
WPAN 15.4 Capture			x
Warranty	2 years	2 years	3 years

#### Description

Ellisys Bluetooth Vanguard Standard BR/EDR Ellisys Bluetooth Vanguard Standard Low Energy Ellisys Bluetooth Vanguard Standard Dual Mode Ellisys Bluetooth Vanguard Pro BR/EDR Ellisys Bluetooth Vanguard Pro Low Energy Ellisys Bluetooth Vanguard Pro Dual Mode Ellisys Bluetooth Vanguard Enterprise BR/EDR Ellisys Bluetooth Vanguard Enterprise Low Energy Ellisys Bluetooth Vanguard Enterprise Dual Mode Ellisys Bluetooth Vanguard Pro Upgrade Ellisys Bluetooth Vanguard Enterprise Upgrade Ellisys Bluetooth Vanguard Dual Mode Upgrade

# **Instant Channels**

The Instant Channels 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.



💽 😋 🔍 🔳 🚡 - I origin: 0.00 s

Total 1.55 MB Marc 16.4 MB DCRT6 S01A45/4800 Phone 80-C555M2279 Total 3.96 MB Marc 16.4 From DCRT6 Total 1.36 MB Marc 1

Test 205 8 Mer L 09 Mile CELMOIDER 42:04/06/ 00/24/2C/A1F7/50 00/2

- sparc 272.24 s

Funort Solt ET / Wi

# **Instant Throughput**

Understanding device data throughout performance is a common task for wireless engineers. These metrics are the domain of the Instant Throughput view, which provides throughput by device and by L2CAP or SCO/eSCO channel and Wi-Fi communications. A convenient statistical overlay provides information on how various transmission inefficiencies may be affecting throughput, such as packet retransmissions.

Each device and channel is color-coded and can be shown or not shown as the user may prefer. A navigation bar is provided to allow the user to select a time range to pan through the entire capture to see trends, as well as high and low peaks on data throughput.

# **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.





Code
BV1-STD-EDR
BV1-STD-LE
BV1-STD-DUAL
BV1-PRO-EDR
BV1-PRO-LE
BV1-PRO-DUAL
BV1-ENT-EDR
BV1-ENT-LE
<b>BV1-ENT-DUAL</b>
BV1-PRO/UPG
BV1-ENT/UPG
BV1-DUAL/UPG

#### Ellisys Bluetooth<sup>®</sup> Vanguard<sup>™</sup>

**Advanced Wireless Protocol Analysis System** 

#### ellisys Better Anglysis

# **Technical Specifications**

#### Bluetooth Capture Characteristics

- Ellisys Rainbow<sup>™</sup>: Industry's first wideband concurrent capture of all Bluetooth channels. Introduced in 2010.
- Frequency band: 2.402-2.480 GHz
- Sensitivity range: From -90 to +15 dBm
- Gain: Programmable from -30 to +30 dB
- Modulations: All BR/EDR/LE modulations (GFSK 1/2Mbps, p/4-DQPSK, 8-DPSK)
- Baseband: Support of Bluetooth 5, upgradeable by software. Preliminary support of non-released specifications available.

#### **Wi-Fi Capture Characteristics**

- IEEE 802.11 a/b/g/n/ac (3 streams)
- Channel width 2.4GHz: 20MHz, 40MHz
- Channel width 5GHz: 20MHz, 40MHz, 80MHz
- 11n MCS: 0 to 23 (up to 3 streams)
- 11ac MCS: 0 to 9 (up to 3 streams)
- Guard Interval: 800ns (long) and 400ns (short) GI
- Frame encoding: BCC, LDPC, STBC, Greenfield
- Max AMPDU size: 65,535 bytes
- Timing accuracy: 125 ns

#### **WPAN Capture Characteristics**

- IEEE 802.15.4-2011
- Channels: All 16 2.4 GHz channels (11 to 26)
- Data rate: 250 kbps
- Modulation: O-QPSK
- Timing accuracy: 125 ns

#### **Logic Capture Characteristics**

- Maximum bandwidth: 20 MHz
- Sampling precision: 5 ns
- Supported input voltage: 1.8 to 3.3V

#### **HCI Capture Characteristics**

- USB transport: Low, Full, and High Speed, with automatic detection
- UART transport: Up to 8 Mbit/s, automatic detection of all parameters
- SPI 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: ±125ns
- WPAN timestamp accuracy: ±125ns
- USB HCI timestamp accuracy: ±16.7ns
- Logic timestamp accuracy: ±5ns

#### **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

#### **Front-Panel Indicators**

- Power: unit powered on
- Operating: unit performing requested task
- Activity: blinks when wireless or wired activity detected

#### **Front-Panel Connectors**

- RF (x3): Shared between Bluetooth, Wi-Fi and WPAN
- USB HCI: USB 2.0 Standard-A and Standard-B
- Logic: supports UART/SPI HCI, WCI-2, generic I2C/UART/SPI/SWD and logic analysis
- SDIO: Optional, for external trace storage and unit recovery



#### **Rear-Panel Connectors**

- Computer: USB 3.1 Gen 1 Type-C
- Ethernet: 1GbE, PoE+
- Power: 12-24 VDC, max 36W
- Trigger: SMA in and out, 50  $\Omega,$  3.3VDC
- Clock IN: SMA, 50 Ω, 3.3VDC, 10MHz
- Clock OUT: SMA, 50 Ω, 3.3VDC, 10MHz
- Earth: Optional, to ground the unit



#### **Power Inputs**

- DC input (12-24 V)
- USB Type-C Power Delivery
- Power-over-Ethernet (PoE+)
- Backup Battery (22 Wh)

#### Enclosure

- 180 x 170 x 58 mm (7.1 x 6.7 x 2.3")
- 1.5 kg (3.3 lbs)

#### **Hardware Upgrade**

 The Ellisys Rainbow<sup>™</sup> 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 and replay captured traffic
- Use Ellisys hardware on any computer no additional licenses needed

#### 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 colorsUSB 2.0 EHCI host controller

DS4004-BV1-A

Windows® 7 or higher

# More information at: www.ellisys.com/bv1

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