Bluetooth® Seminar Series

Tools, Techniques, and Trends

Bluetooth Protocol Analysis

Improving Quality and Efficiency

Chuck Trefts | General Manager | Ellisys

Overview

- General Analyzer Capabilities
- Typical Markets/Users
- Updates for Bluetooth 5.2
- Typical Use Cases and Captures
- Newest Features

Technology Common to All Ellisys Sniffers

Wireless

- Ellisys revolutionary wideband radio
- Radio baseband reconfigurability
- Additional co-ex capture capabilities
  - Wi-Fi, 802.15.4, Raw Spectrum

Integration

- Common software platform
- Purpose-built and fully integrated
  - **Better Design = Better Analysis™**
- Diverse set of wired capture features

Ellisys Bluetooth Qualifier™ (EBQ)

Dual-Mode Test System for LL/BB/LMP/HCI

Highlights

- 1300+ tests
- Test-equipment grade, purpose-built
- Proprietary, flexible, reconfigurable radio
- Qualification, development, validation, and non-regression capabilities
- Used by developers and labs
- Powerful, home-grown RF, baseband, stack, software, and test architecture

Flexibility Needed to Address Many Markets/Usages

- Radio controllers
- Stack developers
- Mobile phones, PCs, tablets
- Automotive
- Audio and entertainment
- Location & positioning services
- Home automation
- Qualification test labs
- Medical devices
- Sports and fitness
- IoT sensors, gateways
- Building automation
- Retail - beacons, point of service
- Aerospace
- Government & defense agencies
- Universities and other non-profits

Flexibility to Address Many Use Cases

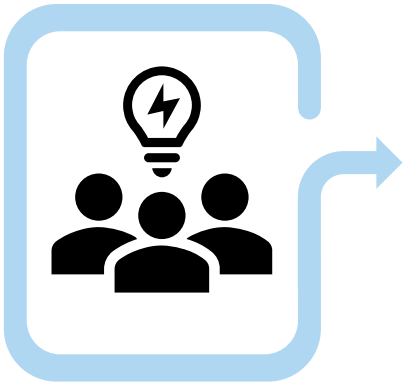
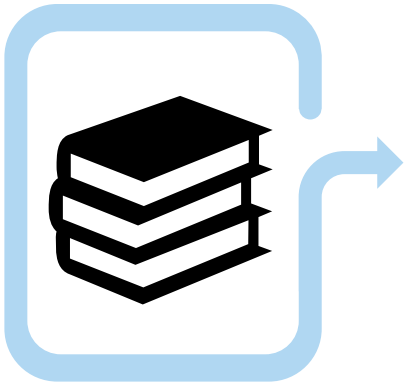
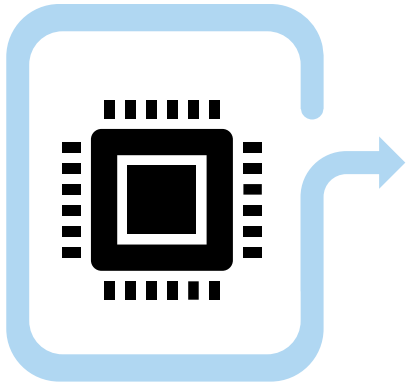
- Typical use cases can vary widely depending on the application
- The tool must be flexible enough to seamlessly move across various use case profiles, including automation

Bluetooth 5.2 Update

Tools Should *Lead* Specs and Products

ECOSYSTEM

ELLISYS

Membership & WGs	Core, test, marketing specs, drafts	Controllers, stacks	End products
			
We begin our involvement	We attend interop events & collaborate with early adopters	Reconfigurability allows us to test early with analyzers and qualification tools	Features matured, we're ready when you are

Reconfigurability – Today's Features Yesterday

EBQ (tester) and analyzer support delivered to developers early 2019

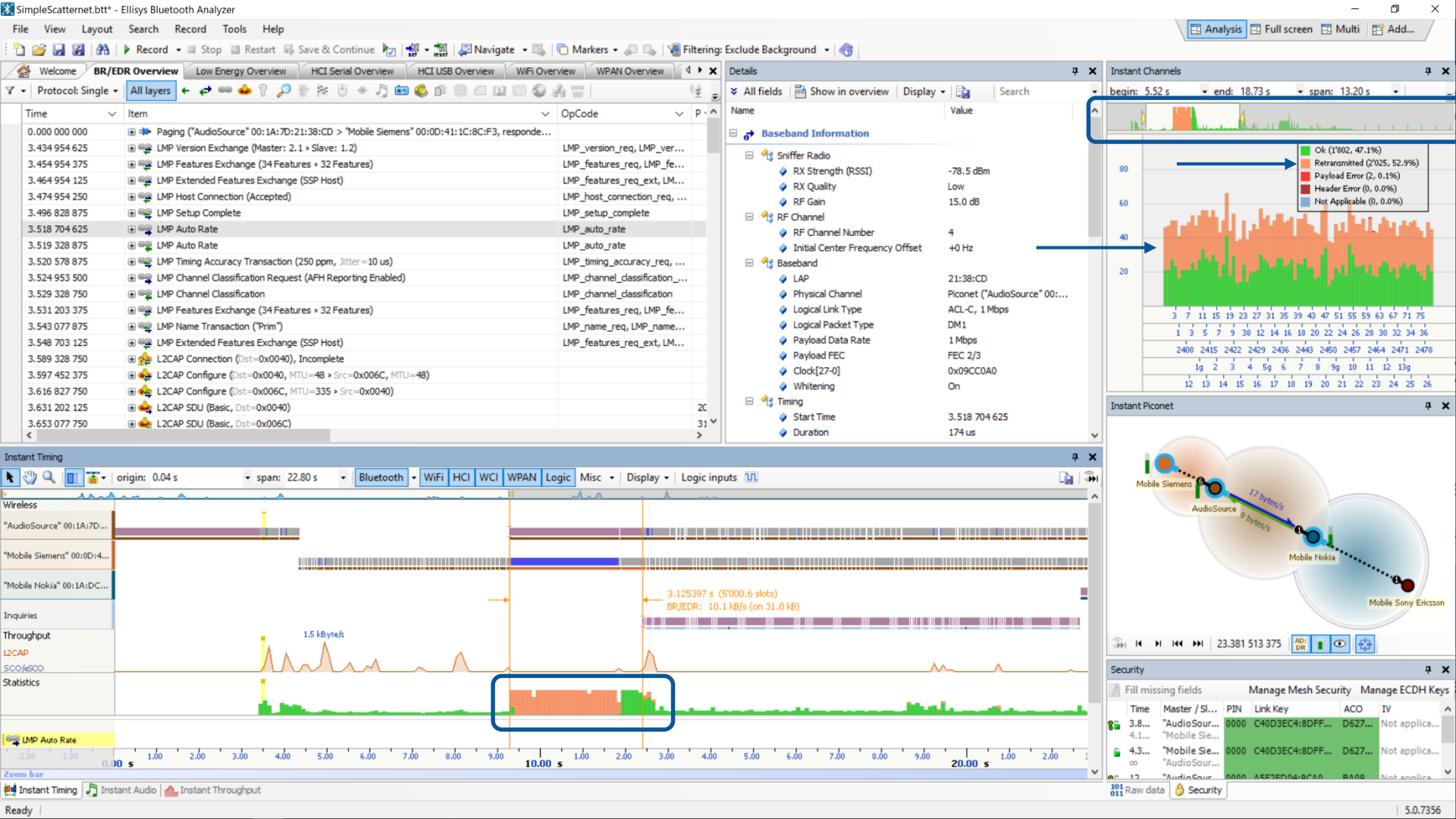
Ellisys Ready on Day One of Highly Anticipated Bluetooth® 5.2 Roll-Out

Company's Qualification and Analysis Platforms Enabling Development
of Next-Generation Bluetooth Audio

Geneva, Switzerland — January 16, 2020 — Ellisys, a leading worldwide provider of test and analysis solutions for Bluetooth, Wi-Fi®, Universal Serial Bus (USB), and other wired and wireless communications technologies, today announced the availability of qualification testing and protocol analyzer features supporting the latest version of the Bluetooth Core Specification.

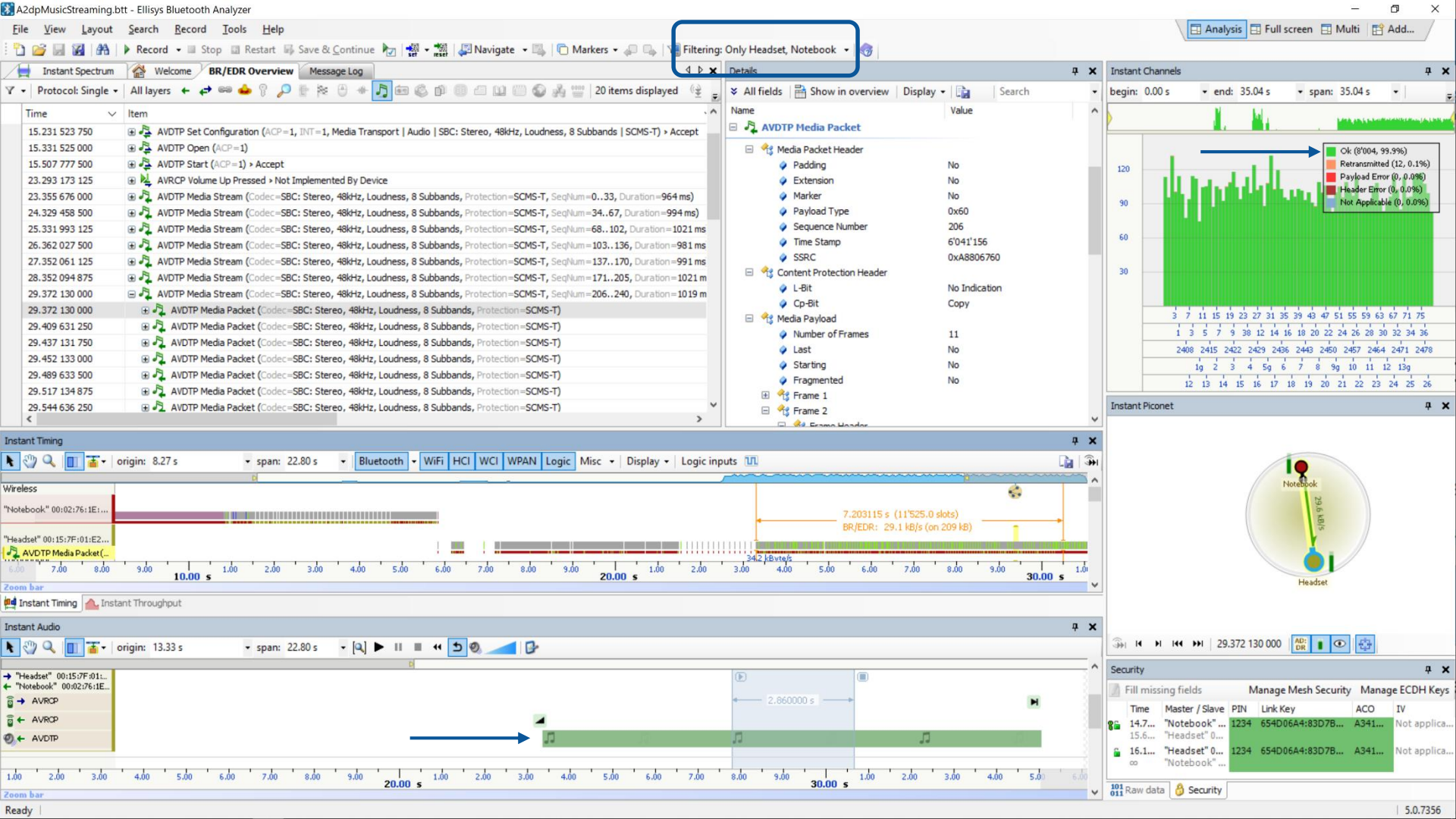
Typical Cases/Captures

Retransmissions


SimpleScatternet.btt* - Ellisys Bluetooth Analyzer
File View Layout Search Record Tools Help
Analysis Full screen Multi Add...
Record Stop Restart Save & Continue Navigate Markers Filtering: Exclude Background
Welcome BR/EDR Overview Low Energy Overview HCI Serial Overview HCI USB Overview WiFi Overview WPAN Overview
Protocol: Single All layers
Time Item OpCode
0.000 000 000 Paging ("AudioSource" 00:1A:7D:21:38:CD > "Mobile Siemens" 00:0D:41:1C:8C:F3, responde...
3.434 954 625 LMP Version Exchange (Master: 2.1 › Slave: 1.2) LMP_version_req, LMP_ver...
3.454 954 375 LMP Features Exchange (34 Features › 32 Features) LMP_features_req, LMP_fe...
3.464 954 125 LMP Extended Features Exchange (SSP Host) LMP_features_req_ext, LM...
3.474 954 250 LMP Host Connection (Accepted) LMP_host_connection_req, ...
3.496 828 875 LMP Setup Complete LMP_setup_complete
3.518 704 625 LMP Auto Rate LMP_auto_rate
3.519 328 875 LMP Auto Rate LMP_auto_rate
3.520 578 875 LMP Timing Accuracy Transaction (250 ppm, Jitter=10 us) LMP_timing_accuracy_req, ...
3.524 953 500 LMP Channel Classification Request (AFH Reporting Enabled) LMP_channel_classification_...
3.529 328 750 LMP Channel Classification LMP_channel_classification
3.531 203 375 LMP Features Exchange (34 Features › 32 Features) LMP_features_req, LMP_fe...
3.543 077 875 LMP Name Transaction ("Prim") LMP_name_req, LMP_name...
3.548 703 125 LMP Extended Features Exchange (SSP Host) LMP_features_req_ext, LM...
3.589 328 750 L2CAP Connection (Dst=0x0040), Incomplete
3.597 452 375 L2CAP Configure (Dst=0x0040, MTU=48 › Src=0x006C, MTU=48)
3.616 827 750 L2CAP Configure (Dst=0x006C, MTU=335 › Src=0x0040)
3.631 202 125 L2CAP SDU (Basic, Dst=0x0040)
3.653 077 750 L2CAP SDU (Basic, Dst=0x006C)
Details
All fields Show in overview Display Search
Name Value
Baseband Information
Sniffer Radio
RX Strength (RSSI) -78.5 dBm
RX Quality Low
RF Gain 15.0 dB
RF Channel
RF Channel Number 4
Initial Center Frequency Offset +0 Hz
Baseband
LAP 21:38:CD
Physical Channel Piconet ("AudioSource" 00:...
Logical Link Type ACL-C, 1 Mbps
Logical Packet Type DM1
Payload Data Rate 1 Mbps
Payload FEC FEC 2/3
Clock[27-0] 0x09CC0A0
Whitening On
Timing
Start Time 3.518 704 625
Duration 174 us
Instant Channels
begin: 5.52 s end: 18.73 s span: 13.20 s
Ok (1'802, 47.1%)
Retransmitted (2'025, 52.9%)
Payload Error (2, 0.1%)
Header Error (0, 0.0%)
Not Applicable (0, 0.0%)
Instant Piconet
Mobile Siemens
AudioSource
17 bytes/s
9 bytes/s
Mobile Nokia
Mobile Sony Ericsson
23.381 513 375
Instant Timing
origin: 0.04 s span: 22.80 s
Bluetooth WiFi HCI WCI WPAN Logic Misc Display Logic inputs
Wireless
"AudioSource" 00:1A:7D...
"Mobile Siemens" 00:0D:4...
"Mobile Nokia" 00:1A:DC...
Inquiries
Throughput
L2CAP
SCO/eSCO
Statistics
LMP Auto Rate
3.125397 s (5'000.6 slots)
BR/EDR: 10.1 kB/s (on 31.0 kB)
1.5 kByte/s
10.00 s
20.00 s
Zoom bar
Security
Fill missing fields Manage Mesh Security Manage ECDH Keys
Time Master / Sl... PIN Link Key ACO IV
3.8... "AudioSour... 0000 C40D3EC4:8DFF... D627... Not applica...
4.1... "Mobile Sie...
4.3... "Mobile Sie... 0000 C40D3EC4:8DFF... D627... Not applica...
"AudioSour...
Instant Timing Instant Audio Instant Throughput
Raw data Security
Ready
5.0.7356

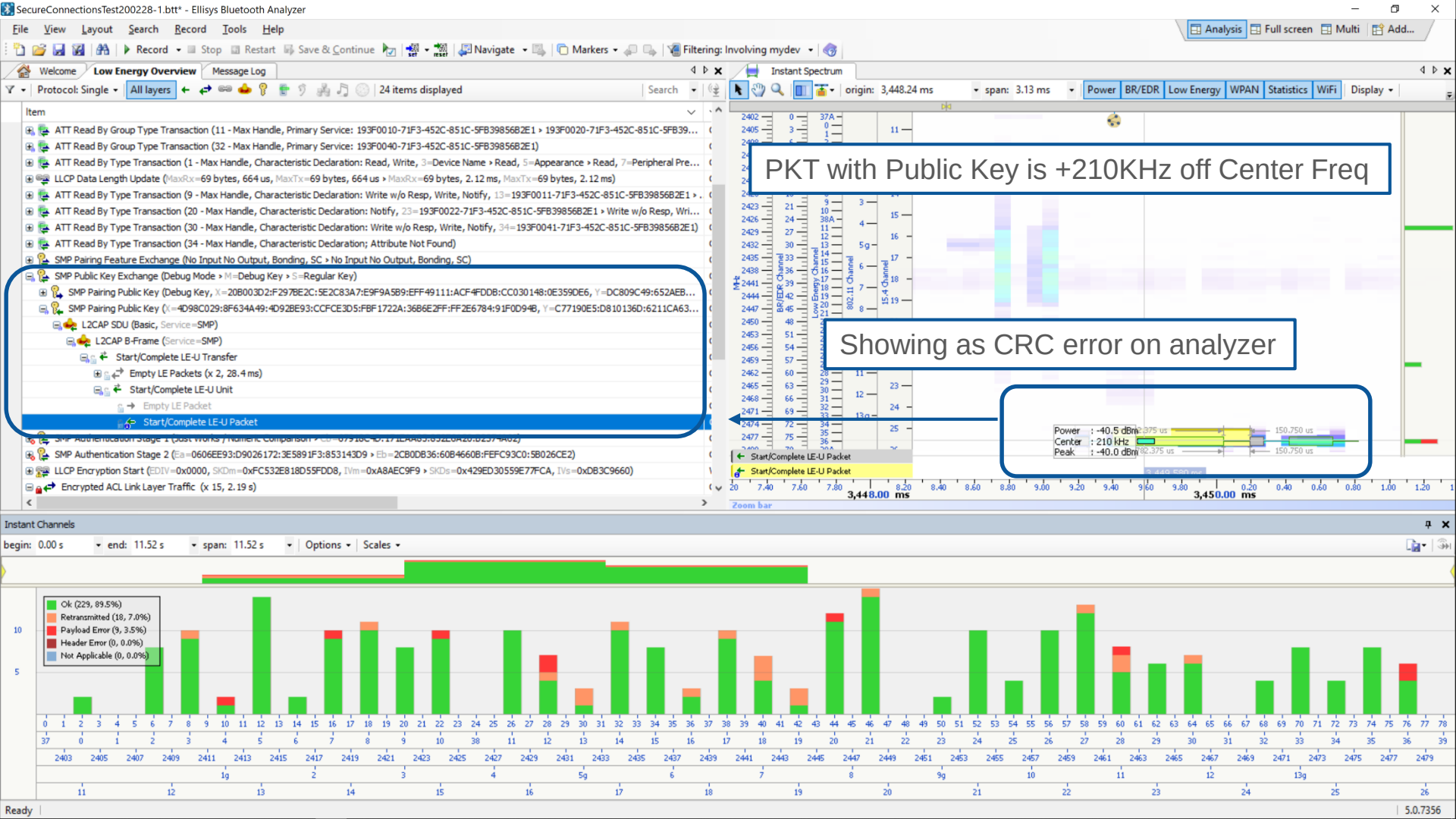
Typical Cases/Captures

Audio Analysis


A2dpMusicStreaming.btt - Ellisys Bluetooth Analyzer
File View Layout Search Record Tools Help
Analysis Full screen Multi Add...
Record Stop Restart Save & Continue Navigate Markers
Filtering: Only Headset, Notebook
Instant Spectrum Welcome BR/EDR Overview Message Log
Protocol: Single All layers 20 items displayed
Time Item
15.231 523 750 AVDTP Set Configuration (ACP=1, INT=1, Media Transport | Audio | SBC: Stereo, 48kHz, Loudness, 8 Subbands | SCMS-T) › Accept
15.331 525 000 AVDTP Open (ACP=1)
15.507 777 500 AVDTP Start (ACP=1) › Accept
23.293 173 125 AVRCP Volume Up Pressed › Not Implemented By Device
23.355 676 000 AVDTP Media Stream (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, Protection=SCMS-T, SeqNum=0..33, Duration=964 ms)
24.329 458 500 AVDTP Media Stream (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, Protection=SCMS-T, SeqNum=34..67, Duration=994 ms)
25.331 993 125 AVDTP Media Stream (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, Protection=SCMS-T, SeqNum=68..102, Duration=1021 ms
26.362 027 500 AVDTP Media Stream (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, Protection=SCMS-T, SeqNum=103..136, Duration=981 ms
27.352 061 125 AVDTP Media Stream (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, Protection=SCMS-T, SeqNum=137..170, Duration=991 ms
28.352 094 875 AVDTP Media Stream (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, Protection=SCMS-T, SeqNum=171..205, Duration=1021 m
29.372 130 000 AVDTP Media Stream (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, Protection=SCMS-T, SeqNum=206..240, Duration=1019 m
29.372 130 000 AVDTP Media Packet (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, Protection=SCMS-T)
29.409 631 250 AVDTP Media Packet (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, Protection=SCMS-T)
29.437 131 750 AVDTP Media Packet (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, Protection=SCMS-T)
29.452 133 000 AVDTP Media Packet (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, Protection=SCMS-T)
29.489 633 500 AVDTP Media Packet (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, Protection=SCMS-T)
29.517 134 875 AVDTP Media Packet (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, Protection=SCMS-T)
29.544 636 250 AVDTP Media Packet (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, Protection=SCMS-T)
Details
All fields Show in overview Display Search
Name Value
AVDTP Media Packet
Media Packet Header
Padding No
Extension No
Marker No
Payload Type 0x60
Sequence Number 206
Time Stamp 6'041'156
SSRC 0xA8806760
Content Protection Header
L-Bit No Indication
Cp-Bit Copy
Media Payload
Number of Frames 11
Last No
Starting No
Fragmented No
Frame 1
Frame 2
Instant Channels
begin: 0.00 s end: 35.04 s span: 35.04 s
Ok (8'004, 99.9%)
Retransmitted (12, 0.1%)
Payload Error (0, 0.0%)
Header Error (0, 0.0%)
Not Applicable (0, 0.0%)
Instant Piconet
Notebook
29.6 kB/s
Headset
Instant Timing
origin: 8.27 s span: 22.80 s
Bluetooth WiFi HCI WCI WPAN Logic Misc Display Logic inputs
Wireless
"Notebook" 00:02:76:1E:...
"Headset" 00:15:7F:01:E2:...
AVDTP Media Packet (...
7.203115 s (11'525.0 slots)
BR/EDR: 29.1 kB/s (on 209 kB)
34.2 kBytes/s
10.00 s 20.00 s 30.00 s
Zoom bar
Instant Timing Instant Throughput
Instant Audio
origin: 13.33 s span: 22.80 s
"Headset" 00:15:7F:01:...
"Notebook" 00:02:76:1E...
AVRCP
AVRCP
AVDTP
2.860000 s
20.00 s 30.00 s
Zoom bar
29.372 130 000
Security
Fill missing fields Manage Mesh Security Manage ECDH Keys
Time Master / Slave PIN Link Key ACO IV
14.7... "Notebook" ... 1234 654D06A4:83D7B... A341... Not applica...
15.6... "Headset" 0...
16.1... "Headset" 0... 1234 654D06A4:83D7B... A341... Not applica...
∞ "Notebook" ...
Raw data Security
Ready
5.0.7356

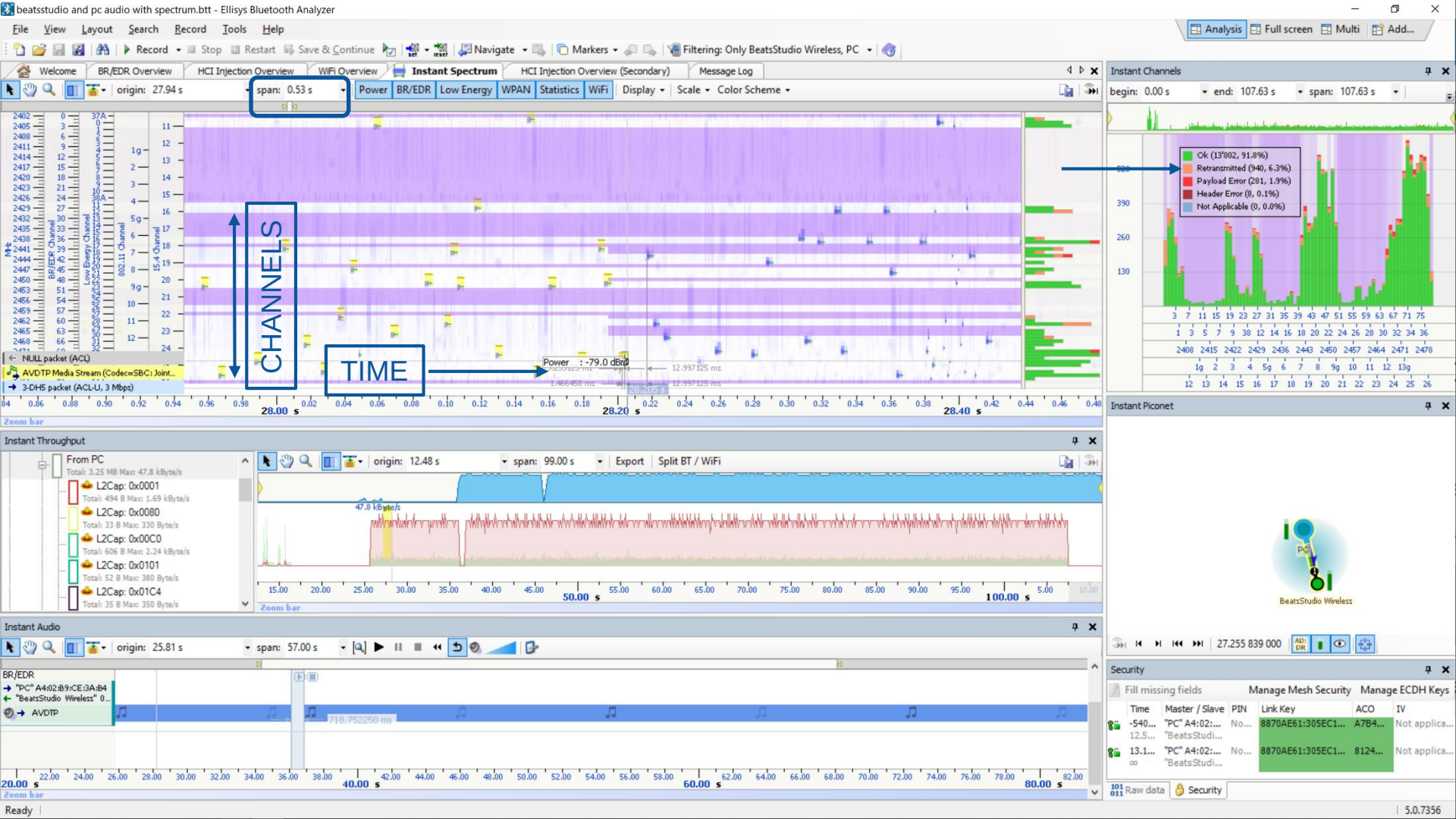
Typical Cases/Captures

Frequency Offset Issue


SecureConnectionsTest200228-1.btt* - Ellisys Bluetooth Analyzer
File View Layout Search Record Tools Help
Analysis Full screen Multi Add...
Record Stop Restart Save & Continue Navigate Markers Filtering: Involving mydev
Welcome Low Energy Overview Message Log
Protocol: Single All layers 24 items displayed Search
Item
ATT Read By Group Type Transaction (11 - Max Handle, Primary Service: 193F0010-71F3-452C-851C-5FB39856B2E1 › 193F0020-71F3-452C-851C-5FB39...
ATT Read By Group Type Transaction (32 - Max Handle, Primary Service: 193F0040-71F3-452C-851C-5FB39856B2E1)
ATT Read By Type Transaction (1 - Max Handle, Characteristic Declaration: Read, Write, 3=Device Name › Read, 5=Appearance › Read, 7=Peripheral Pre...
LLCP Data Length Update (MaxRx=69 bytes, 664 us, MaxTx=69 bytes, 664 us › MaxRx=69 bytes, 2.12 ms, MaxTx=69 bytes, 2.12 ms)
ATT Read By Type Transaction (9 - Max Handle, Characteristic Declaration: Write w/o Resp, Write, Notify, 13=193F0011-71F3-452C-851C-5FB39856B2E1 › ...
ATT Read By Type Transaction (20 - Max Handle, Characteristic Declaration: Notify, 23=193F0022-71F3-452C-851C-5FB39856B2E1 › Write w/o Resp, Wri...
ATT Read By Type Transaction (30 - Max Handle, Characteristic Declaration: Write w/o Resp, Write, Notify, 34=193F0041-71F3-452C-851C-5FB39856B2E1)
ATT Read By Type Transaction (34 - Max Handle, Characteristic Declaration; Attribute Not Found)
SMP Pairing Feature Exchange (No Input No Output, Bonding, SC › No Input No Output, Bonding, SC)
SMP Public Key Exchange (Debug Mode › M=Debug Key › S=Regular Key)
SMP Pairing Public Key (Debug Key, X=20B003D2:F297BE2C:5E2C83A7:E9F9A5B9:EFF49111:ACF4FDDB:CC030148:0E359DE6, Y=DC809C49:652AEB...
SMP Pairing Public Key (X=4D98C029:8F634A49:4D92BE93:CCFCE3D5:FBF1722A:36B6E2FF:FF2E6784:91F0D94B, Y=C77190E5:D810136D:6211CA63...
L2CAP SDU (Basic, Service=SMP)
L2CAP B-Frame (Service=SMP)
Start/Complete LE-U Transfer
Empty LE Packets (x 2, 28.4 ms)
Start/Complete LE-U Unit
Empty LE Packet
Start/Complete LE-U Packet
SMP Authentication Stage 2 (Ea=0606EE93:D9026172:3E5891F3:853143D9 › Eb=2CB0DB36:60B4660B:FEFC93C0:5B026CE2)
LLCP Encryption Start (EDIV=0x0000, SKDm=0xFC532E818D55FDD8, IVm=0xA8AEC9F9 › SKDs=0x429ED30559E77FCA, IVs=0xDB3C9660)
Encrypted ACL Link Layer Traffic (x 15, 2.19 s)
Instant Spectrum
origin: 3,448.24 ms span: 3.13 ms
Power BR/EDR Low Energy WPAN Statistics WiFi Display
PKT with Public Key is +210KHz off Center Freq
Showing as CRC error on analyzer
Power : -40.5 dBm
Center : 210 kHz
Peak : -40.0 dBm
Start/Complete LE-U Packet
Start/Complete LE-U Packet
3,448.00 ms
3,450.00 ms
Zoom bar
Instant Channels
begin: 0.00 s end: 11.52 s span: 11.52 s Options Scales
Ok (229, 89.5%)
Retransmitted (18, 7.0%)
Payload Error (9, 3.5%)
Header Error (0, 0.0%)
Not Applicable (0, 0.0%)
Ready
5.0.7356

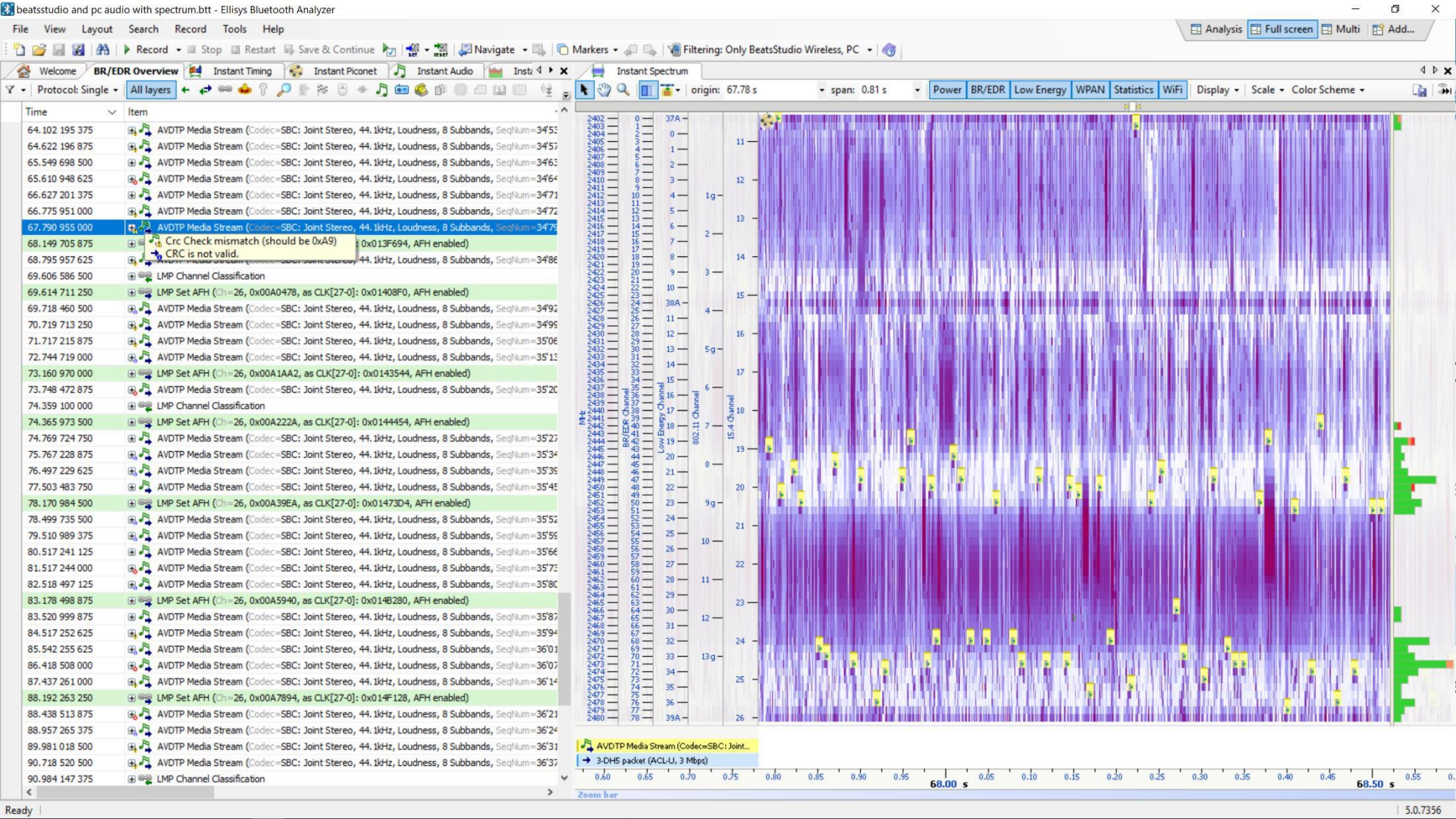
Typical Cases/Captures

Audio with Adaptive Frequency Hopping


beatsstudio and pc audio with spectrum.btt - Ellisys Bluetooth Analyzer
File View Layout Search Record Tools Help
Analysis Full screen Multi Add...
Record Stop Restart Save & Continue Navigate Markers Filtering: Only BeatsStudio Wireless, PC
Welcome BR/EDR Overview HCI Injection Overview WiFi Overview Instant Spectrum HCI Injection Overview (Secondary) Message Log
origin: 27.94 s span: 0.53 s Power BR/EDR Low Energy WPAN Statistics WiFi Display Scale Color Scheme
CHANNELS
TIME
Power : -79.0 dBm
NULL packet (ACL)
AVDTP Media Stream (Codec=SBC: Joint...
3-DH5 packet (ACL-U, 3 Mbps)
28.00 s
28.20 s
28.40 s
Zoom bar
Instant Channels
begin: 0.00 s end: 107.63 s span: 107.63 s
Ok (13'802, 91.8%)
Retransmitted (940, 6.3%)
Payload Error (281, 1.9%)
Header Error (8, 0.1%)
Not Applicable (0, 0.0%)
Instant Throughput
From PC
Total: 3.25 MB Max: 47.8 kByte/s
L2Cap: 0x0001
L2Cap: 0x0080
L2Cap: 0x00C0
L2Cap: 0x0101
L2Cap: 0x01C4
origin: 12.48 s span: 99.00 s Export Split BT / WiFi
47.8 kByte/s
50.00 s
100.00 s
Instant Piconet
PC
BeatsStudio Wireless
Instant Audio
origin: 25.81 s span: 57.00 s
BR/EDR
"PC" A4:02:B9:CE:3A:B4
"BeatsStudio Wireless" 0...
AVDTP
718.752250 ms
20.00 s
40.00 s
60.00 s
80.00 s
Security
Fill missing fields Manage Mesh Security Manage ECDH Keys
Time Master / Slave PIN Link Key ACO IV
8870AE61:305EC1... A7B4... Not applica...
8870AE61:305EC1... 8124... Not applica...
Raw data Security
Ready
5.0.7356

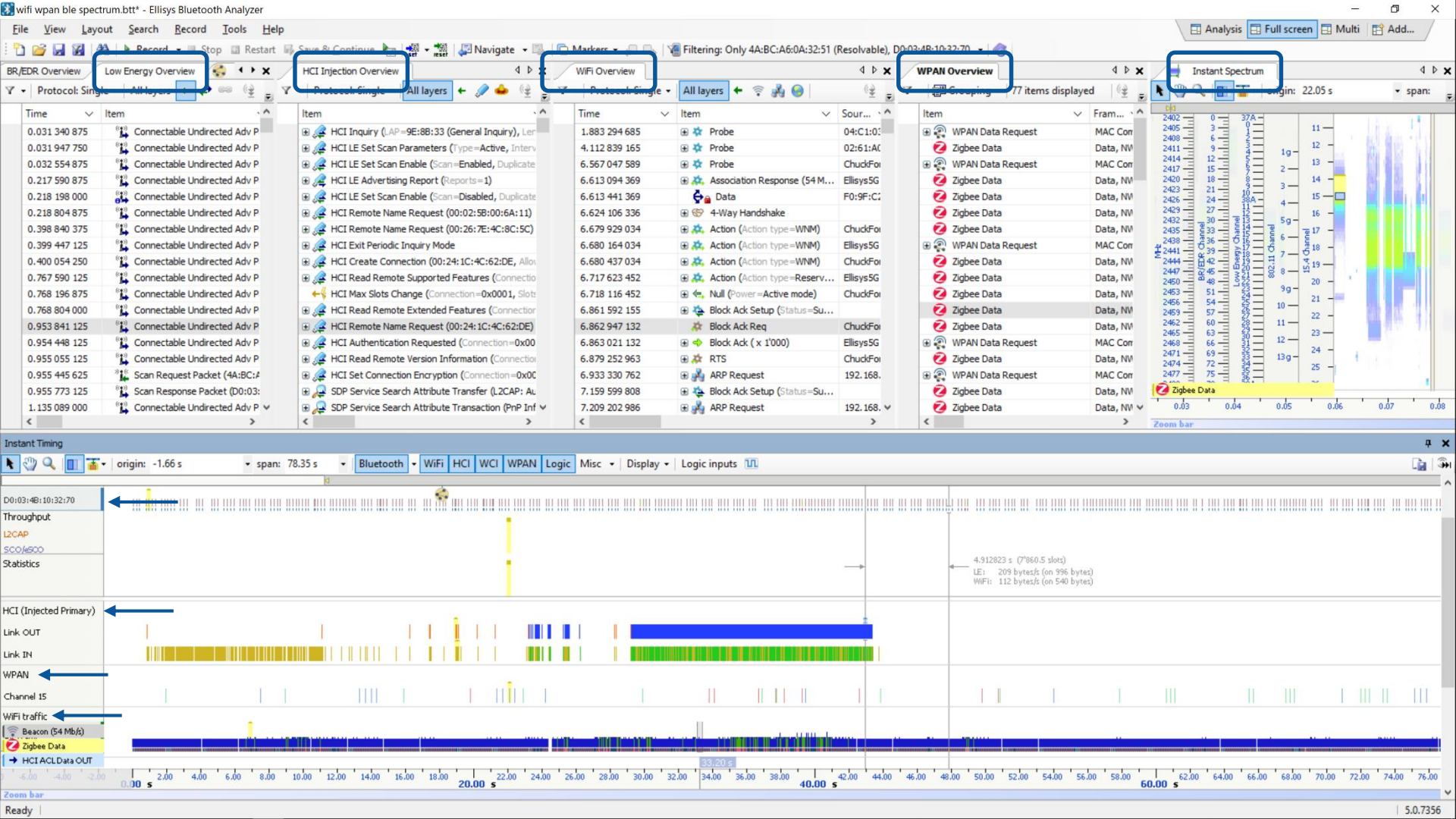
Typical Cases/Captures

Seeking the best channels on which to talk


beatsstudio and pc audio with spectrum.btt - Ellisys Bluetooth Analyzer
File View Layout Search Record Tools Help
Analysis Full screen Multi Add...
Record Stop Restart Save & Continue Navigate Markers Filtering: Only BeatsStudio Wireless, PC
Welcome BR/EDR Overview Instant Timing Instant Piconet Instant Audio Instant Spectrum
Protocol: Single All layers origin: 67.78 s span: 0.81 s Power BR/EDR Low Energy WPAN Statistics WiFi Display Scale Color Scheme
Time Item
64.102 195 375 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=34'53
64.622 196 875 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=34'57
65.549 698 500 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=34'63
65.610 948 625 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=34'64
66.627 201 375 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=34'71
66.775 951 000 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=34'72
67.790 955 000 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=34'79
Crc Check mismatch (should be 0xA9)
CRC is not valid.
68.149 705 875 0x013F694, AFH enabled)
68.795 957 625 44.1kHz, Loudness, 8 Subbands, SeqNum=34'86
69.606 586 500 LMP Channel Classification
69.614 711 250 LMP Set AFH (Ch=26, 0x00A0478, as CLK[27-0]: 0x01408F0, AFH enabled)
69.718 460 500 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=34'92
70.719 713 250 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=34'99
71.717 215 875 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=35'06
72.744 719 000 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=35'13
73.160 970 000 LMP Set AFH (Ch=26, 0x00A1AA2, as CLK[27-0]: 0x0143544, AFH enabled)
73.748 472 875 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=35'20
74.359 100 000 LMP Channel Classification
74.365 973 500 LMP Set AFH (Ch=26, 0x00A222A, as CLK[27-0]: 0x0144454, AFH enabled)
74.769 724 750 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=35'27
75.767 228 875 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=35'34
76.497 229 625 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=35'39
77.503 483 750 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=35'45
78.170 984 500 LMP Set AFH (Ch=26, 0x00A39EA, as CLK[27-0]: 0x01473D4, AFH enabled)
78.499 735 500 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=35'52
79.510 989 375 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=35'59
80.517 241 125 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=35'66
81.517 244 000 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=35'73
82.518 497 125 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=35'80
83.178 498 875 LMP Set AFH (Ch=26, 0x00A5940, as CLK[27-0]: 0x014B280, AFH enabled)
83.520 999 875 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=35'87
84.517 252 625 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=35'94
85.542 255 625 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=36'01
86.418 508 000 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=36'07
87.437 261 000 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=36'14
88.192 263 250 LMP Set AFH (Ch=26, 0x00A7894, as CLK[27-0]: 0x014F128, AFH enabled)
88.438 513 875 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=36'21
88.957 265 375 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=36'24
89.981 018 500 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=36'31
90.718 520 500 AVDTP Media Stream (Codec=SBC: Joint Stereo, 44.1kHz, Loudness, 8 Subbands, SeqNum=36'37
90.984 147 375 LMP Channel Classification
BR/EDR Channel
Low Energy Channel
802.11 Channel
15.4 Channel
AVDTP Media Stream (Codec=SBC: Joint...
3-DH5 packet (ACL-U, 3 Mbps)
68.00 s
68.50 s
Zoom bar
Ready
5.0.7356

Typical Cases/Captures

Coexistence in action


wifi wpan ble spectrum.btt* - Ellisys Bluetooth Analyzer
File View Layout Search Record Tools Help
Analysis Full screen Multi Add...
BR/EDR Overview
Low Energy Overview
HCI Injection Overview
WiFi Overview
WPAN Overview
Instant Spectrum
Time Item
Item
Time Item Sour...
Item Fram...
Instant Timing
origin: -1.66 s
span: 78.35 s
Bluetooth WiFi HCI WCI WPAN Logic Misc Display Logic inputs
D0:03:4B:10:32:70
Throughput
L2CAP
SCO/eSCO
Statistics
HCI (Injected Primary)
Link OUT
Link IN
WPAN
Channel 15
WiFi traffic
Beacon (54 Mb/s)
Zigbee Data
HCI ACL Data OUT
Zoom bar
Ready
5.0.7356

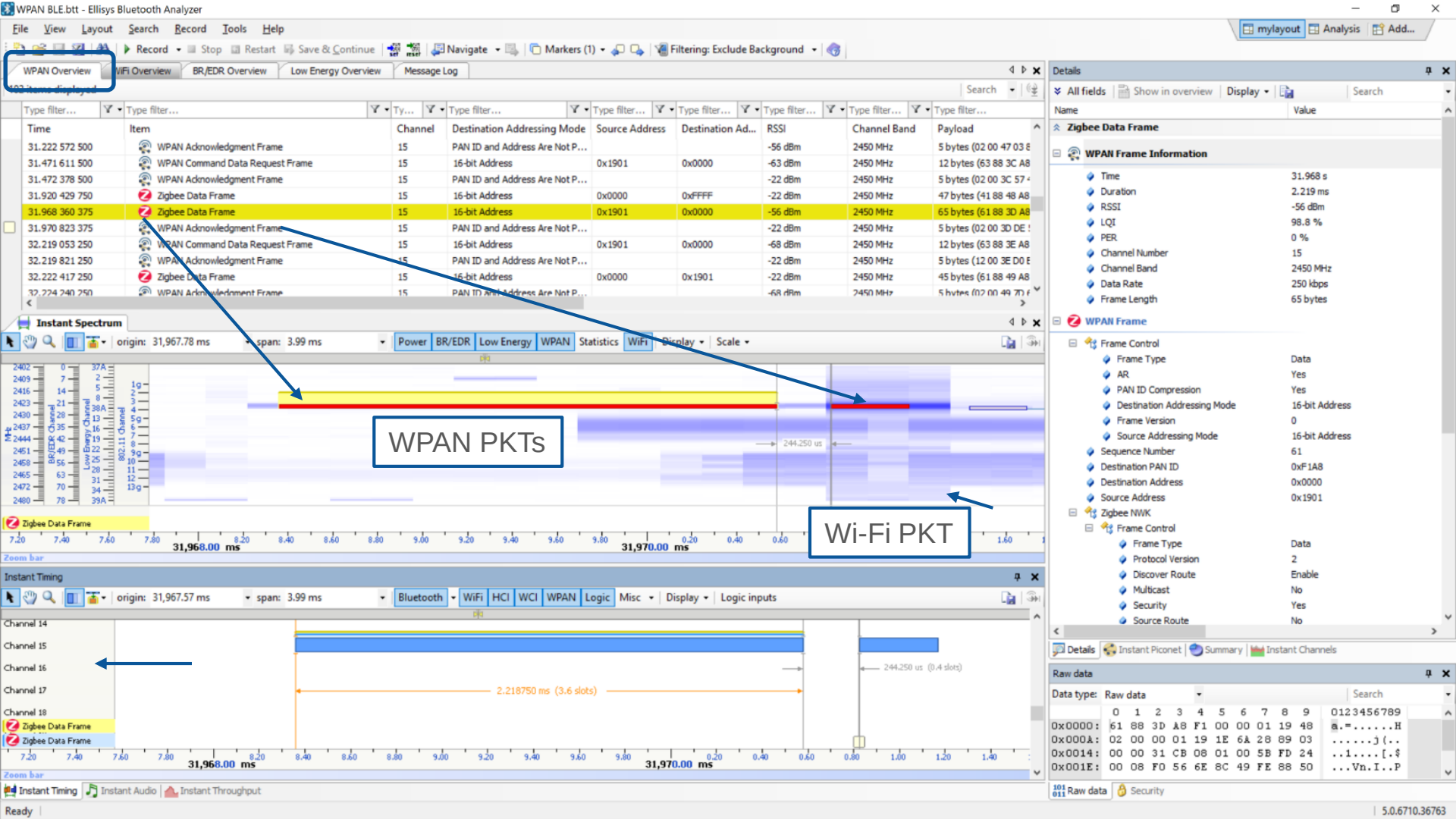
Typical Cases/Captures

Logic (GPIO) x16


logic capture.btt - Ellisys Bluetooth Analyzer
File View Layout Search Record Tools Help
Full screen Analysis Add...
Record Stop Restart Save & Continue Navigate Markers (1) Filtering: Involving Test Device
BR/EDR Overview Low Energy Overview HCI Overview (USB) Instant Timing Instant Piconet Instant Channels Instant Throughput HCI Overview (Injection)
origin: 11.17 s span: 21.60 s Bluetooth WiFi HCI WCI Logic Display Logic inputs
Wireless
"Test Device" E9:1C:B5:...
E4:90:7E:9D:38:F2~41:3...
Throughput
L2CAP
SCO/eSCO
Statistics
1.26 kB/s
9.985028 s (15'976.0 slots)
LE: 155 bytes/s (on 1.37 kB)
UART HCI 1: 373 bytes/s (on 2.08 kB)
Serial HCI
Link OUT
Link IN
Logic
SYS_RESET
SYS_SLEEP_R
ICYTRX_RX
ICYTRX_TX
FPGA_RTS
FPGA_CTS
FPGA_TX
FPGA_RX
BUS ONE
BUS TWO
Empty LE Packet
29.30 s
10.00 s
20.00 s
30.00 s
Zoom bar
Ready
5.0.6429

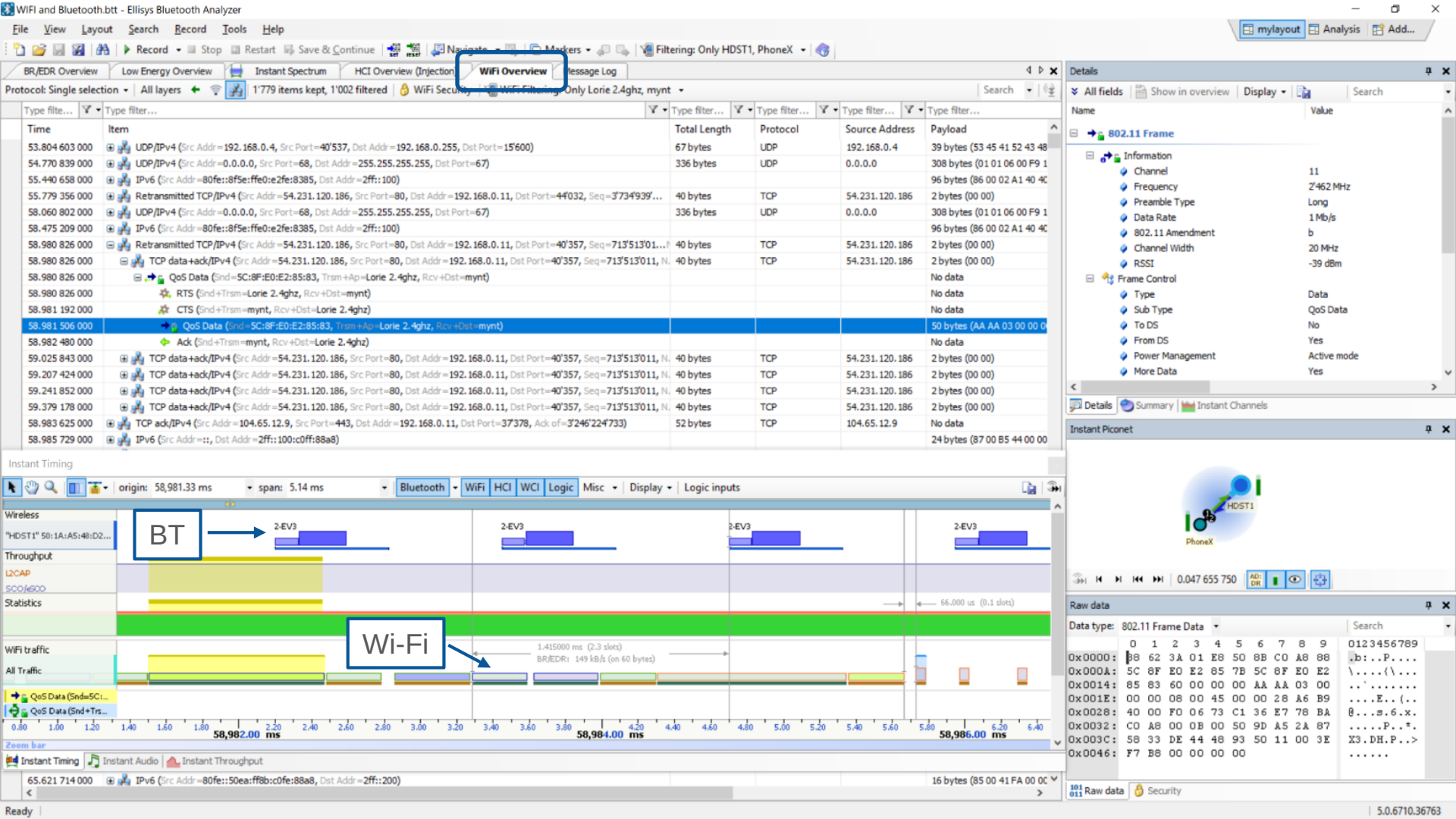
Typical Cases/Captures

A closer look at 802.15.4 (Zigbee in this case)


WPAN BLE.btt - Ellisys Bluetooth Analyzer
File View Layout Search Record Tools Help
mylayout Analysis Add...
Record Stop Restart Save & Continue Navigate Markers (1) Filtering: Exclude Background
WPAN Overview
WiFi Overview
BR/EDR Overview
Low Energy Overview
Message Log
Time Item Channel Destination Addressing Mode Source Address Destination Ad... RSSI Channel Band Payload
31.222 572 500 WPAN Acknowledgment Frame 15 PAN ID and Address Are Not P... -56 dBm 2450 MHz 5 bytes (02 00 47 03 8
31.471 611 500 WPAN Command Data Request Frame 15 16-bit Address 0x1901 0x0000 -63 dBm 2450 MHz 12 bytes (63 88 3C A8
31.472 378 500 WPAN Acknowledgment Frame 15 PAN ID and Address Are Not P... -22 dBm 2450 MHz 5 bytes (02 00 3C 57
31.920 429 750 Zigbee Data Frame 15 16-bit Address 0x0000 0xFFFF -22 dBm 2450 MHz 47 bytes (41 88 48 A8
31.968 360 375 Zigbee Data Frame 15 16-bit Address 0x1901 0x0000 -56 dBm 2450 MHz 65 bytes (61 88 3D A8
31.970 823 375 WPAN Acknowledgment Frame 15 PAN ID and Address Are Not P... -22 dBm 2450 MHz 5 bytes (02 00 3D DE
32.219 053 250 WPAN Command Data Request Frame 15 16-bit Address 0x1901 0x0000 -68 dBm 2450 MHz 12 bytes (63 88 3E A8
32.219 821 250 WPAN Acknowledgment Frame 15 PAN ID and Address Are Not P... -22 dBm 2450 MHz 5 bytes (12 00 3E D0
32.222 417 250 Zigbee Data Frame 15 16-bit Address 0x0000 0x1901 -22 dBm 2450 MHz 45 bytes (61 88 49 A8
Instant Spectrum
origin: 31,967.78 ms span: 3.99 ms
Power BR/EDR Low Energy WPAN Statistics WiFi Display Scale
WPAN PKTs
244.250 us
Wi-Fi PKT
Zigbee Data Frame
31,968.00 ms
31,970.00 ms
Instant Timing
origin: 31,967.57 ms span: 3.99 ms
Bluetooth WiFi HCI WCI WPAN Logic Misc Display Logic inputs
Channel 14
Channel 15
Channel 16
Channel 17
Channel 18
2.218750 ms (3.6 slots)
244.250 us (0.4 slots)
Zigbee Data Frame
Zigbee Data Frame
31,968.00 ms
31,970.00 ms
Instant Timing Instant Audio Instant Throughput
Details
All fields Show in overview Display
Name Value
Zigbee Data Frame
WPAN Frame Information
Time 31.968 s
Duration 2.219 ms
RSSI -56 dBm
LQI 98.8 %
PER 0 %
Channel Number 15
Channel Band 2450 MHz
Data Rate 250 kbps
Frame Length 65 bytes
WPAN Frame
Frame Control
Frame Type Data
AR Yes
PAN ID Compression Yes
Destination Addressing Mode 16-bit Address
Frame Version 0
Source Addressing Mode 16-bit Address
Sequence Number 61
Destination PAN ID 0xF1A8
Destination Address 0x0000
Source Address 0x1901
Zigbee NWK
Frame Control
Frame Type Data
Protocol Version 2
Discover Route Enable
Multicast No
Security Yes
Source Route No
Details Instant Piconet Summary Instant Channels
Raw data
Data type: Raw data
0 1 2 3 4 5 6 7 8 9 0123456789
0x0000: 61 88 3D A8 F1 00 00 01 19 48 a.=.....H
0x000A: 02 00 00 01 19 1E 6A 28 89 03 ......j(..
0x0014: 00 00 31 CB 08 01 00 5B FD 24 ..1....[.$
0x001E: 00 08 F0 56 6E 8C 49 FE 88 50 ...Vn.I..P
Raw data Security
Ready
5.0.6710.36763

Typical Cases/Captures

A closer look at Wi-Fi

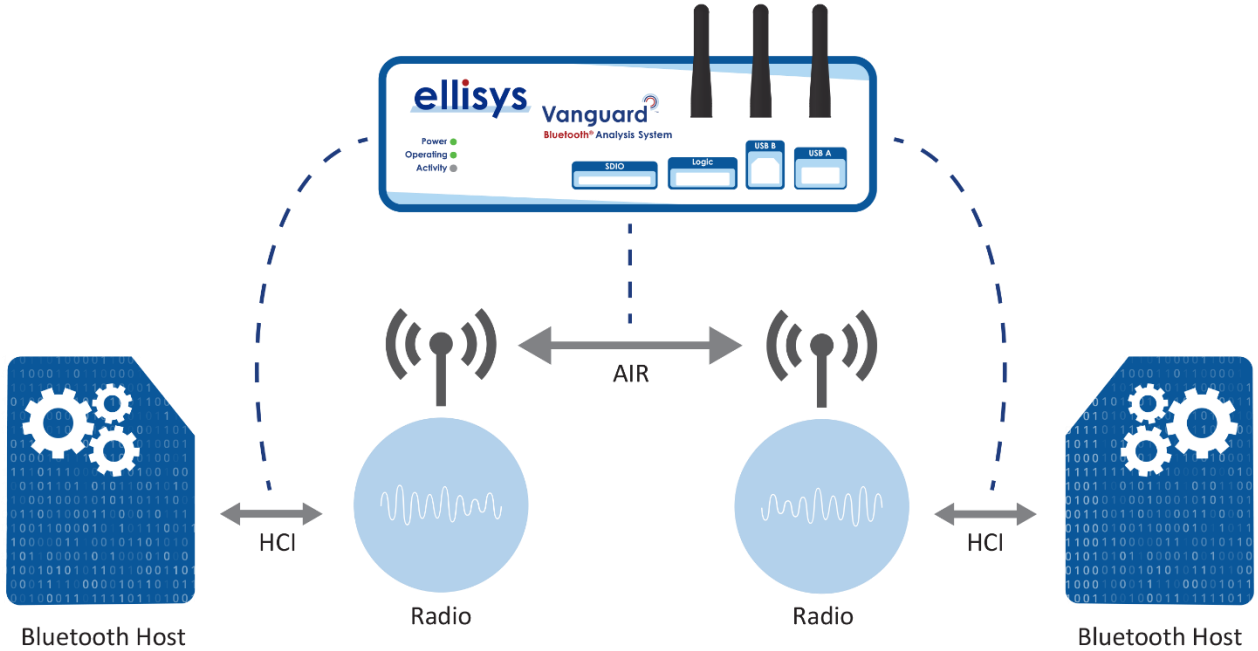

WIFI and Bluetooth.btt - Ellisys Bluetooth Analyzer
File View Layout Search Record Tools Help
mylayout Analysis Add...
Record Stop Restart Save & Continue Navigate Markers Filtering: Only HDST1, PhoneX
BR/EDR Overview
Low Energy Overview
Instant Spectrum
HCI Overview (Injection)
WiFi Overview
Message Log
Protocol: Single selection
All layers
1'779 items kept, 1'002 filtered
WiFi Security
WiFi Filtering: Only Lorie 2.4ghz, mynt
Search
Time
Item
Total Length
Protocol
Source Address
Payload
53.804 603 000 UDP/IPv4 (Src Addr=192.168.0.4, Src Port=40'537, Dst Addr=192.168.0.255, Dst Port=15'600) 67 bytes UDP 192.168.0.4 39 bytes (53 45 41 52 43 48
54.770 839 000 UDP/IPv4 (Src Addr=0.0.0.0, Src Port=68, Dst Addr=255.255.255.255, Dst Port=67) 336 bytes UDP 0.0.0.0 308 bytes (01 01 06 00 F9 1
55.440 658 000 IPv6 (Src Addr=80fe::8f5e:ffe0:e2fe:8385, Dst Addr=2fff::100) 96 bytes (86 00 02 A1 40 4C
55.779 356 000 Retransmitted TCP/IPv4 (Src Addr=54.231.120.186, Src Port=80, Dst Addr=192.168.0.11, Dst Port=44'032, Seq=3'734'939'... 40 bytes TCP 54.231.120.186 2 bytes (00 00)
58.060 802 000 UDP/IPv4 (Src Addr=0.0.0.0, Src Port=68, Dst Addr=255.255.255.255, Dst Port=67) 336 bytes UDP 0.0.0.0 308 bytes (01 01 06 00 F9 1
58.475 209 000 IPv6 (Src Addr=80fe::8f5e:ffe0:e2fe:8385, Dst Addr=2fff::100) 96 bytes (86 00 02 A1 40 4C
58.980 826 000 Retransmitted TCP/IPv4 (Src Addr=54.231.120.186, Src Port=80, Dst Addr=192.168.0.11, Dst Port=40'357, Seq=713'513'01... 40 bytes TCP 54.231.120.186 2 bytes (00 00)
58.980 826 000 TCP data+ack/IPv4 (Src Addr=54.231.120.186, Src Port=80, Dst Addr=192.168.0.11, Dst Port=40'357, Seq=713'513'011, N... 40 bytes TCP 54.231.120.186 2 bytes (00 00)
58.980 826 000 QoS Data (Snd=5C:8F:E0:E2:85:83, Trsm+Ap=Lorie 2.4ghz, Rcv+Dst=mynt) No data
58.980 826 000 RTS (Snd+Trsm=Lorie 2.4ghz, Rcv+Dst=mynt) No data
58.981 192 000 CTS (Snd+Trsm=mynt, Rcv+Dst=Lorie 2.4ghz) No data
58.981 506 000 QoS Data (Snd=5C:8F:E0:E2:85:83, Trsm+Ap=Lorie 2.4ghz, Rcv+Dst=mynt) 50 bytes (AA AA 03 00 00 0
58.982 480 000 Ack (Snd+Trsm=mynt, Rcv+Dst=Lorie 2.4ghz) No data
59.025 843 000 TCP data+ack/IPv4 (Src Addr=54.231.120.186, Src Port=80, Dst Addr=192.168.0.11, Dst Port=40'357, Seq=713'513'011, N... 40 bytes TCP 54.231.120.186 2 bytes (00 00)
59.207 424 000 TCP data+ack/IPv4 (Src Addr=54.231.120.186, Src Port=80, Dst Addr=192.168.0.11, Dst Port=40'357, Seq=713'513'011, N... 40 bytes TCP 54.231.120.186 2 bytes (00 00)
59.241 852 000 TCP data+ack/IPv4 (Src Addr=54.231.120.186, Src Port=80, Dst Addr=192.168.0.11, Dst Port=40'357, Seq=713'513'011, N... 40 bytes TCP 54.231.120.186 2 bytes (00 00)
59.379 178 000 TCP data+ack/IPv4 (Src Addr=54.231.120.186, Src Port=80, Dst Addr=192.168.0.11, Dst Port=40'357, Seq=713'513'011, N... 40 bytes TCP 54.231.120.186 2 bytes (00 00)
58.983 625 000 TCP ack/IPv4 (Src Addr=104.65.12.9, Src Port=443, Dst Addr=192.168.0.11, Dst Port=37'378, Ack of=3'246'224'733) 52 bytes TCP 104.65.12.9 No data
58.985 729 000 IPv6 (Src Addr=::, Dst Addr=2fff::100:c0ff:88a8) 24 bytes (87 00 B5 44 00 00
Instant Timing
origin: 58,981.33 ms
span: 5.14 ms
Bluetooth WiFi HCI WCI Logic Misc Display Logic inputs
Wireless
"HDST1" 50:1A:A5:48:D2...
BT
2-EV3
Throughput
L2CAP
SCO/eSCO
Statistics
66.000 us (0.1 slots)
WiFi traffic
All Traffic
Wi-Fi
1.415000 ms (2.3 slots)
BR/EDR: 149 kB/s (on 60 bytes)
QoS Data (Snd=5C:...
QoS Data (Snd+Trs...
58,982.00 ms
58,984.00 ms
58,986.00 ms
Zoom bar
Instant Timing
Instant Audio
Instant Throughput
65.621 714 000 IPv6 (Src Addr=80fe::50ea:ff8b:c0fe:88a8, Dst Addr=2fff::200) 16 bytes (85 00 41 FA 00 0C
Details
All fields
Show in overview
Display
Search
Name
Value
802.11 Frame
Information
Channel 11
Frequency 2'462 MHz
Preamble Type Long
Data Rate 1 Mb/s
802.11 Amendment b
Channel Width 20 MHz
RSSI -39 dBm
Frame Control
Type Data
Sub Type QoS Data
To DS No
From DS Yes
Power Management Active mode
More Data Yes
Details
Summary
Instant Channels
Instant Piconet
HDST1
PhoneX
0.047 655 750
Raw data
Data type: 802.11 Frame Data
Search
0 1 2 3 4 5 6 7 8 9 0123456789
0x0000: 88 62 3A 01 E8 50 8B C0 A8 88 .b:..P....
0x000A: 5C 8F E0 E2 85 7B 5C 8F E0 E2 \....{\...
0x0014: 85 83 60 00 00 00 AA AA 03 00 ..`.......
0x001E: 00 00 08 00 45 00 00 28 A6 B9 ....E..(..
0x0028: 40 00 F0 06 73 C1 36 E7 78 BA @...s.6.x.
0x0032: C0 A8 00 0B 00 50 9D A5 2A 87 .....P..*.
0x003C: 58 33 DE 44 48 93 50 11 00 3E X3.DH.P..>
0x0046: F7 B8 00 00 00 00 ......
Raw data
Security
Ready
5.0.6710.36763

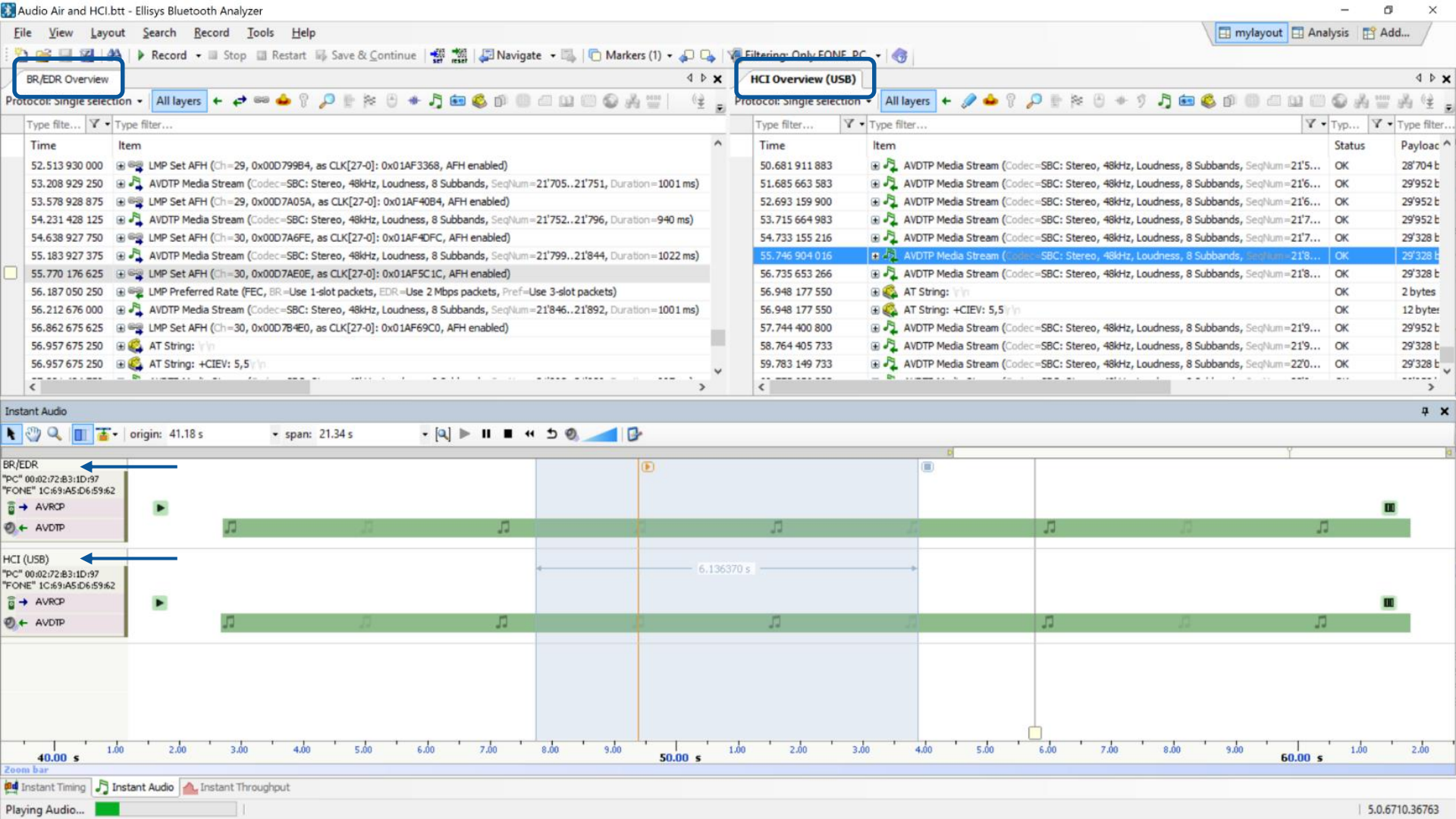
Typical Cases/Captures

HCI and OTA Concurrent

Understanding a System

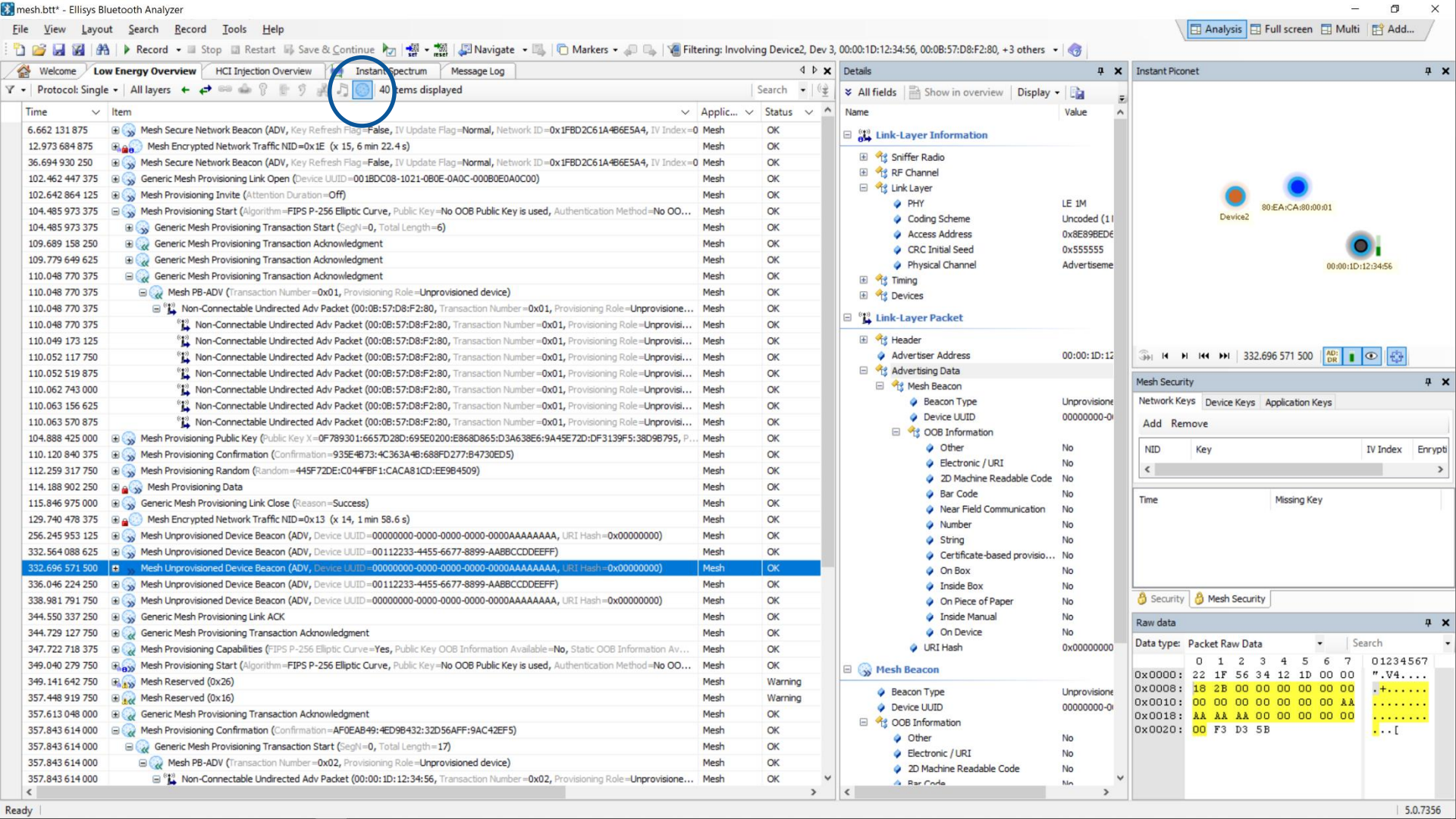
Precise capture of AIR and HCI on both sides of the connection




Audio Air and HCI.btt - Ellisys Bluetooth Analyzer
File View Layout Search Record Tools Help
mylayout Analysis Add...
Record Stop Restart Save & Continue Navigate Markers (1)
BR/EDR Overview
HCI Overview (USB)
Protocol: Single selection
All layers
Time
Item
Status
Payload
LMP Set AFH (Ch=29, 0x00D799B4, as CLK[27-0]: 0x01AF3368, AFH enabled)
AVDTP Media Stream (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, SeqNum=21'705..21'751, Duration=1001 ms)
LMP Set AFH (Ch=29, 0x00D7A05A, as CLK[27-0]: 0x01AF40B4, AFH enabled)
AVDTP Media Stream (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, SeqNum=21'752..21'796, Duration=940 ms)
LMP Set AFH (Ch=30, 0x00D7A6FE, as CLK[27-0]: 0x01AF4DFC, AFH enabled)
AVDTP Media Stream (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, SeqNum=21'799..21'844, Duration=1022 ms)
LMP Set AFH (Ch=30, 0x00D7AE0E, as CLK[27-0]: 0x01AF5C1C, AFH enabled)
LMP Preferred Rate (FEC, BR=Use 1-slot packets, EDR=Use 2 Mbps packets, Pref=Use 3-slot packets)
AVDTP Media Stream (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, SeqNum=21'846..21'892, Duration=1001 ms)
LMP Set AFH (Ch=30, 0x00D7B4E0, as CLK[27-0]: 0x01AF69C0, AFH enabled)
AT String:
AT String: +CIEV: 5,5
AVDTP Media Stream (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, SeqNum=21'5...
AVDTP Media Stream (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, SeqNum=21'6...
AVDTP Media Stream (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, SeqNum=21'7...
AVDTP Media Stream (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, SeqNum=21'8...
AVDTP Media Stream (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, SeqNum=21'9...
AVDTP Media Stream (Codec=SBC: Stereo, 48kHz, Loudness, 8 Subbands, SeqNum=22'0...
OK
2 bytes
12 bytes
Instant Audio
origin: 41.18 s
span: 21.34 s
BR/EDR
"PC" 00:02:72:B3:1D:97
"FONE" 1C:69:A5:D6:59:62
AVRCP
AVDTP
HCI (USB)
6.136370 s
40.00 s
50.00 s
60.00 s
Zoom bar
Instant Timing
Instant Audio
Instant Throughput
Playing Audio...
5.0.6710.36763

Typical Cases/Captures

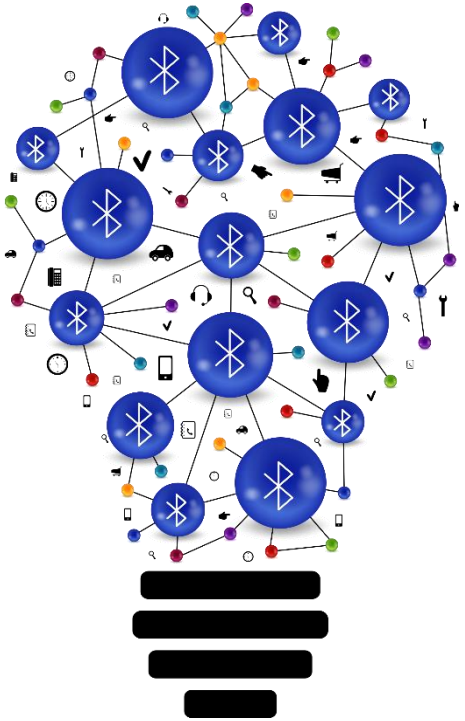
Bluetooth Mesh


mesh.btt* - Ellisys Bluetooth Analyzer
File View Layout Search Record Tools Help
Analysis Full screen Multi Add...
Record Stop Restart Save & Continue Navigate Markers
Filtering: Involving Device2, Dev 3, 00:00:1D:12:34:56, 00:0B:57:D8:F2:80, +3 others
Welcome
Low Energy Overview
HCI Injection Overview
Instant Spectrum
Message Log
Protocol: Single
All layers
40 items displayed
Search
Time
Item
Applic...
Status
6.662 131 875 Mesh Secure Network Beacon (ADV, Key Refresh Flag=False, IV Update Flag=Normal, Network ID=0x1FBD2C61A4B6E5A4, IV Index=0 Mesh OK
12.973 684 875 Mesh Encrypted Network Traffic NID=0x1E (x 15, 6 min 22.4 s) Mesh OK
36.694 930 250 Mesh Secure Network Beacon (ADV, Key Refresh Flag=False, IV Update Flag=Normal, Network ID=0x1FBD2C61A4B6E5A4, IV Index=0 Mesh OK
102.462 447 375 Generic Mesh Provisioning Link Open (Device UUID=001BDC08-1021-0B0E-0A0C-000B0E0A0C00) Mesh OK
102.642 864 125 Mesh Provisioning Invite (Attention Duration=Off) Mesh OK
104.485 973 375 Mesh Provisioning Start (Algorithm=FIPS P-256 Elliptic Curve, Public Key=No OOB Public Key is used, Authentication Method=No OO... Mesh OK
104.485 973 375 Generic Mesh Provisioning Transaction Start (SegN=0, Total Length=6) Mesh OK
109.689 158 250 Generic Mesh Provisioning Transaction Acknowledgment Mesh OK
109.779 649 625 Generic Mesh Provisioning Transaction Acknowledgment Mesh OK
110.048 770 375 Generic Mesh Provisioning Transaction Acknowledgment Mesh OK
110.048 770 375 Mesh PB-ADV (Transaction Number=0x01, Provisioning Role=Unprovisioned device) Mesh OK
110.048 770 375 Non-Connectable Undirected Adv Packet (00:0B:57:D8:F2:80, Transaction Number=0x01, Provisioning Role=Unprovisione... Mesh OK
110.048 770 375 Non-Connectable Undirected Adv Packet (00:0B:57:D8:F2:80, Transaction Number=0x01, Provisioning Role=Unprovisi... Mesh OK
110.049 173 125 Non-Connectable Undirected Adv Packet (00:0B:57:D8:F2:80, Transaction Number=0x01, Provisioning Role=Unprovisi... Mesh OK
110.052 117 750 Non-Connectable Undirected Adv Packet (00:0B:57:D8:F2:80, Transaction Number=0x01, Provisioning Role=Unprovisi... Mesh OK
110.052 519 875 Non-Connectable Undirected Adv Packet (00:0B:57:D8:F2:80, Transaction Number=0x01, Provisioning Role=Unprovisi... Mesh OK
110.062 743 000 Non-Connectable Undirected Adv Packet (00:0B:57:D8:F2:80, Transaction Number=0x01, Provisioning Role=Unprovisi... Mesh OK
110.063 156 625 Non-Connectable Undirected Adv Packet (00:0B:57:D8:F2:80, Transaction Number=0x01, Provisioning Role=Unprovisi... Mesh OK
110.063 570 875 Non-Connectable Undirected Adv Packet (00:0B:57:D8:F2:80, Transaction Number=0x01, Provisioning Role=Unprovisi... Mesh OK
104.888 425 000 Mesh Provisioning Public Key (Public Key X=0F789301:6657D28D:695E0200:E868D865:D3A638E6:9A45E72D:DF3139F5:38D9B795, P... Mesh OK
110.120 840 375 Mesh Provisioning Confirmation (Confirmation=935E4B73:4C363A4B:688FD277:B4730ED5) Mesh OK
112.259 317 750 Mesh Provisioning Random (Random=445F72DE:C044FBF1:CACA81CD:EE9B4509) Mesh OK
114.188 902 250 Mesh Provisioning Data Mesh OK
115.846 975 000 Generic Mesh Provisioning Link Close (Reason=Success) Mesh OK
129.740 478 375 Mesh Encrypted Network Traffic NID=0x13 (x 14, 1 min 58.6 s) Mesh OK
256.245 953 125 Mesh Unprovisioned Device Beacon (ADV, Device UUID=00000000-0000-0000-0000-0000AAAAAAAA, URI Hash=0x00000000) Mesh OK
332.564 088 625 Mesh Unprovisioned Device Beacon (ADV, Device UUID=00112233-4455-6677-8899-AABBCCDDEEFF) Mesh OK
332.696 571 500 Mesh Unprovisioned Device Beacon (ADV, Device UUID=00000000-0000-0000-0000-0000AAAAAAAA, URI Hash=0x00000000) Mesh OK
336.046 224 250 Mesh Unprovisioned Device Beacon (ADV, Device UUID=00112233-4455-6677-8899-AABBCCDDEEFF) Mesh OK
338.981 791 750 Mesh Unprovisioned Device Beacon (ADV, Device UUID=00000000-0000-0000-0000-0000AAAAAAAA, URI Hash=0x00000000) Mesh OK
344.550 337 250 Generic Mesh Provisioning Link ACK Mesh OK
344.729 127 750 Generic Mesh Provisioning Transaction Acknowledgment Mesh OK
347.722 718 375 Mesh Provisioning Capabilities (FIPS P-256 Elliptic Curve=Yes, Public Key OOB Information Available=No, Static OOB Information Av... Mesh OK
349.040 279 750 Mesh Provisioning Start (Algorithm=FIPS P-256 Elliptic Curve, Public Key=No OOB Public Key is used, Authentication Method=No OO... Mesh OK
349.141 642 750 Mesh Reserved (0x26) Mesh Warning
357.448 919 750 Mesh Reserved (0x16) Mesh Warning
357.613 048 000 Generic Mesh Provisioning Transaction Acknowledgment Mesh OK
357.843 614 000 Mesh Provisioning Confirmation (Confirmation=AF0EAB49:4ED9B432:32D56AFF:9AC42EF5) Mesh OK
357.843 614 000 Generic Mesh Provisioning Transaction Start (SegN=0, Total Length=17) Mesh OK
357.843 614 000 Mesh PB-ADV (Transaction Number=0x02, Provisioning Role=Unprovisioned device) Mesh OK
357.843 614 000 Non-Connectable Undirected Adv Packet (00:00:1D:12:34:56, Transaction Number=0x02, Provisioning Role=Unprovisione... Mesh OK
Details
All fields
Show in overview
Display
Name
Value
Link-Layer Information
Sniffer Radio
RF Channel
Link Layer
PHY LE 1M
Coding Scheme Uncoded (1
Access Address 0x8E89BED6
CRC Initial Seed 0x555555
Physical Channel Advertiseme
Timing
Devices
Link-Layer Packet
Header
Advertiser Address 00:00:1D:12
Advertising Data
Mesh Beacon
Beacon Type Unprovisione
Device UUID 00000000-0
OOB Information
Other No
Electronic / URI No
2D Machine Readable Code No
Bar Code No
Near Field Communication No
Number No
String No
Certificate-based provisio... No
On Box No
Inside Box No
On Piece of Paper No
Inside Manual No
On Device No
URI Hash 0x00000000
Mesh Beacon
Beacon Type Unprovisione
Device UUID 00000000-0
OOB Information
Other No
Electronic / URI No
2D Machine Readable Code No
Instant Piconet
Device2
80:EA:CA:80:00:01
00:00:1D:12:34:56
332.696 571 500
Mesh Security
Network Keys
Device Keys
Application Keys
Add
Remove
NID
Key
IV Index
Enrypti
Time
Missing Key
Security
Mesh Security
Raw data
Data type: Packet Raw Data
Search
0 1 2 3 4 5 6 7 01234567
0x0000: 22 1F 56 34 12 1D 00 00 ".V4....
0x0008: 18 2B 00 00 00 00 00 00 .+......
0x0010: 00 00 00 00 00 00 00 AA ....
0x0018: AA AA AA 00 00 00 00 00 ....
0x0020: 00 F3 D3 5B ...[
Ready
5.0.7356

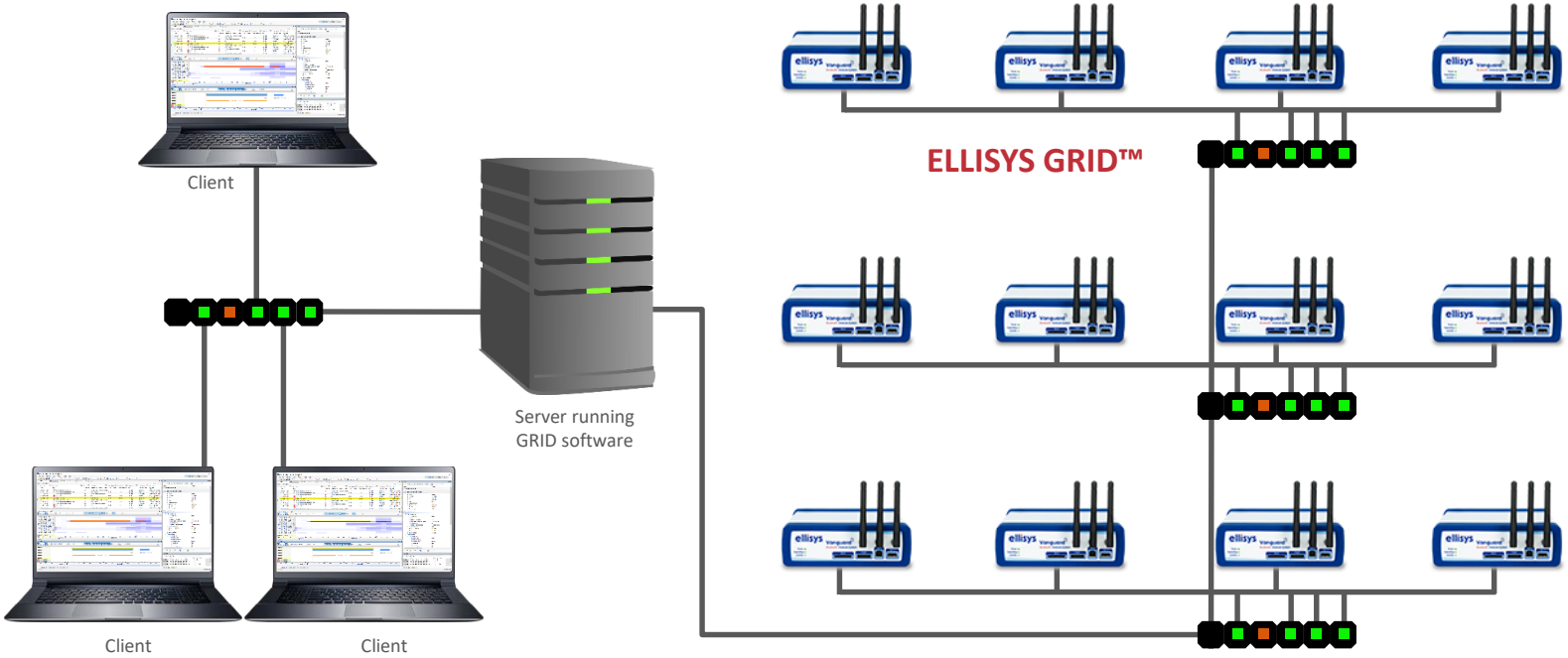
Innovation

Ellisys has a long history of delivering change and innovation to the Bluetooth ecosystem.

Let’s look at the two of our latest…

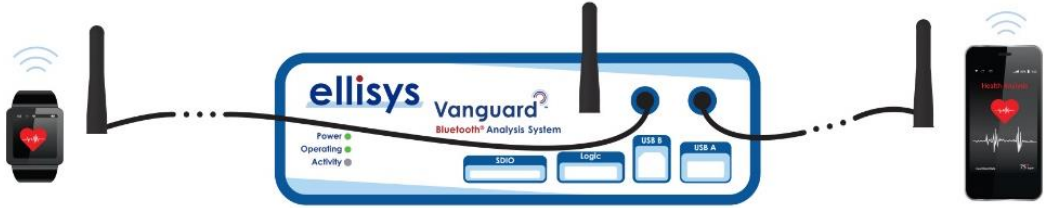


GRID - Many Analyzers Can Equal ONE Analyzer



Capture Diversity™

- Vanguard: this innovative technique involves a **co-operational (2x) replication of our whole-band capture engine**.
  - To improve packet reception:
    - Antennas can be *angularly displaced* on the analyzer unit
    - Antennas can be externally cabled and *placed nearer specific devices under test* to reduce error rate
  - To increase spatial volume of the reception:
    - Antennas can be *externally cabled* and placed at optimal locations



Online Bluetooth Technical Content

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Better Analysis

Thank you!

Questions?

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