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Wi-Fi 7 – Lessons from the field

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Agenda

- MLO Station Modes
- SSID deployment strategy
- Demo1 – iPhone 16 MLO behavior
- Demo2 – Google Pixel 8 – Spectrum view of EMLSR during interference.
- Demo 3 – MS Team call between MLO and Non-MLO—Induce interference on one channel and highlight how MLO dynamically switches between bands and maintains good voice quality compared to the Non-MLO client.
- Wi-Fi 7 Design Considerations

MLO STA Modes

802.11be defines following different operational modes for MLDs

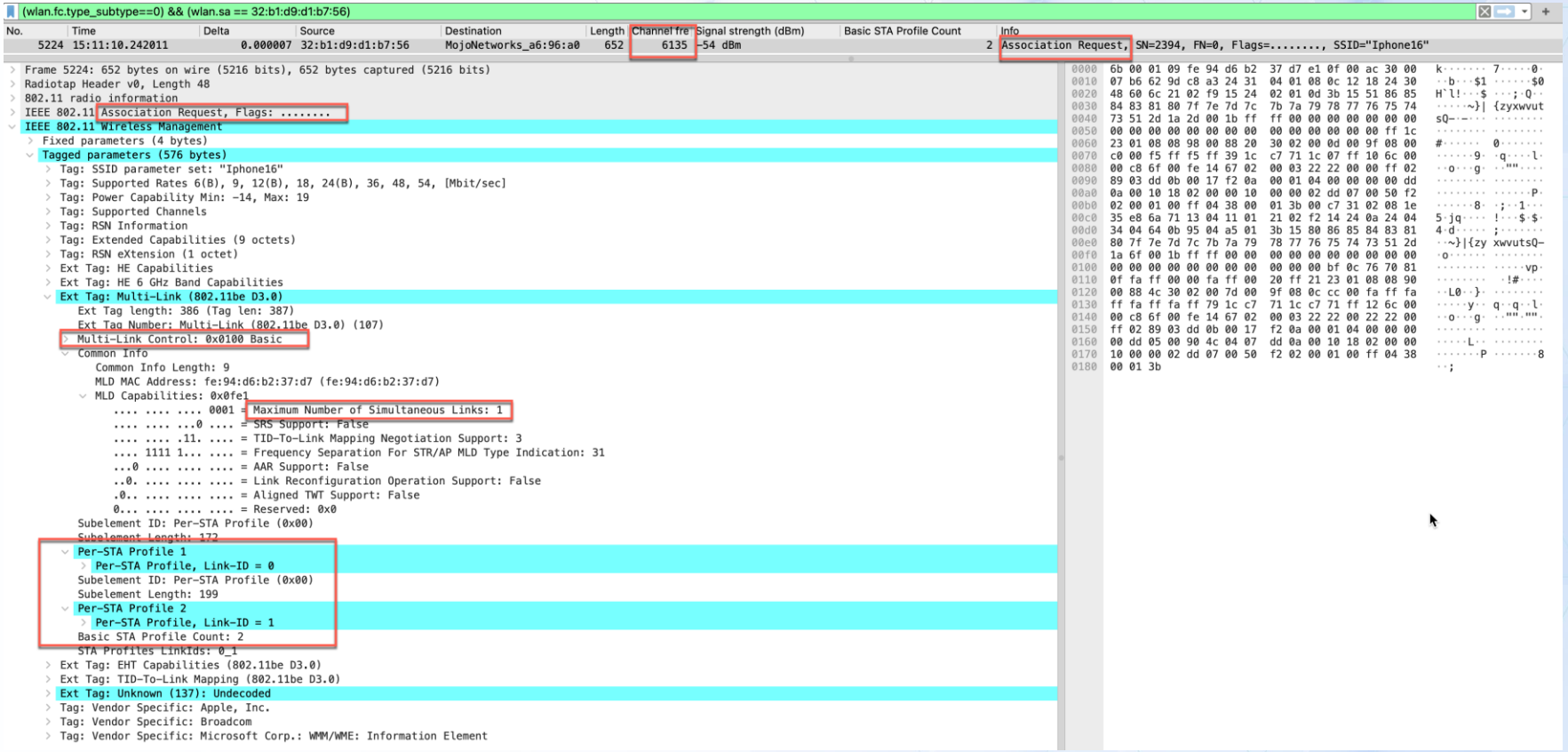
Single Radio	**Single link eMLSR** Single link enhanced multi link single radio	Able to Tx and Rx over only one radio at a time
	Multi Link eMLSR Enhanced Multiple Link Single Radio	Enhanced MLSR with additional capability to listen on two links simultaneously
Multi Radio	**STR-MLMR** Simultaneous Transmit & Receive Multiple Link Multiple Radio	Simultaneous Tx / Tx, Rx / Rx and Tx / Rx over multiple links
	NSTR-MLMR Non-Simultaneous Transmit & Receive Multiple Link Single Radio	Simultaneous Tx/Tx and Rx/Rx over multiple links
	eMLMR Enhanced Multi Link Multi Radio	Capabilities to dynamically reconfigure links

MLO Mode Selection by MLO Capable Clients

iPhone 16 – Client behavior

   2.4 GHz 5 GHz	   2.4 GHz 6 GHz	   5 GHz 6 GHz	    2.4 GHz 5 GHz 6 GHz
STR-MLMR	STR-MLMR	NSTR MLMR	Supported link =2 (5GHz + 6GHz) ; NSTR MLMR
			
Data Transfer only on one band	Data Transfer only on one band	Data Transfer only on one band.	Data Transfer only on one band

iPhone 16 – SSID on 2.4 + 5.0 + 6.0 GHz band



iPhone 16 – SSID on 2.4 + 5.0 + 6.0 GHz band

```
Per-STA Profile 1
  Per-STA Profile, Link-ID = 0
    STA Control: 0x0030, Complete Profile, MAC Address Present
        .... .... .... 0000 = Link ID: 0x0
        .... .... ...1 .... = Complete Profile: True
        .... .... ..1. .... = MAC Address Present: True
        .... .... .0.. .... = Beacon Interval Present: False
        .... .... 0... .... = TSF Offset Present: False
        .... ...0 .... .... = DTIM Info Present: False
        .... ..0. .... .... = NSTR Link Pair Present: False
        .... .0.. .... .... = NSTR Bitmap Size: 0
        .... 0... .... .... = BSS Parameters Change Count Present: False
        0000 .... .... .... = Reserved: 0x0
    STA Info
    Capabilities Information: 0x0431
    Tag: Supported Rates 6, 9, 12, 18, 24, 36, 48, 54, [Mbit/sec]
    Tag: Power Capability Min: -7, Max: 21
    Tag: Supported Channels
    Tag: Supported Operating Classes
    Tag: HT Capabilities (802.11n D1.10)
    Ext Tag: HE Capabilities
    Ext Tag: EHT Capabilities (802.11be D3.0)
    Ext Tag: Unknown (137): Undecoded
    Tag: Vendor Specific: Apple, Inc.
    Tag: Vendor Specific: Broadcom
    Tag: Vendor Specific: Microsoft Corp.: WMM/WME: Information Element
    Ext Tag: Non-Inheritance
  Subelement ID: Per-STA Profile (0x00)
  Subelement Length: 199
```

```
Per-STA Profile 2
  Per-STA Profile, Link-ID = 1
    STA Control: 0x0231, Complete Profile, MAC Address Present, NSTR Link P
        .... .... .... 0001 = Link ID: 0x1
        .... .... ...1 .... = Complete Profile: True
        .... .... ..1. .... = MAC Address Present: True
        .... .... .0.. .... = Beacon Interval Present: False
        .... .... 0... .... = TSF Offset Present: False
        .... ...0 .... .... = DTIM Info Present: False
        .... ..1. .... .... = NSTR Link Pair Present: True
        .... .0.. .... .... = NSTR Bitmap Size: 0
        .... 0... .... .... = BSS Parameters Change Count Present: False
        0000 .... .... .... = Reserved: 0x0
    STA Info
    Capabilities Information: 0x0111
    Tag: Power Capability Min: -14, Max: 20
    Tag: Supported Channels
    Tag: Supported Operating Classes
    Tag: HT Capabilities (802.11n D1.10)
    Tag: VHT Capabilities
    Ext Tag: HE Capabilities
    Ext Tag: EHT Capabilities (802.11be D3.0)
    Ext Tag: Unknown (137): Undecoded
    Tag: Vendor Specific: Apple, Inc.
    Tag: Vendor Specific: Epigram, Inc.
    Tag: Vendor Specific: Broadcom
    Tag: Vendor Specific: Microsoft Corp.: WMM/WME: Information Element
    Ext Tag: Non-Inheritance
  Basic STA Profile Count: 2
  STA Profiles LinkIds: 0_1
```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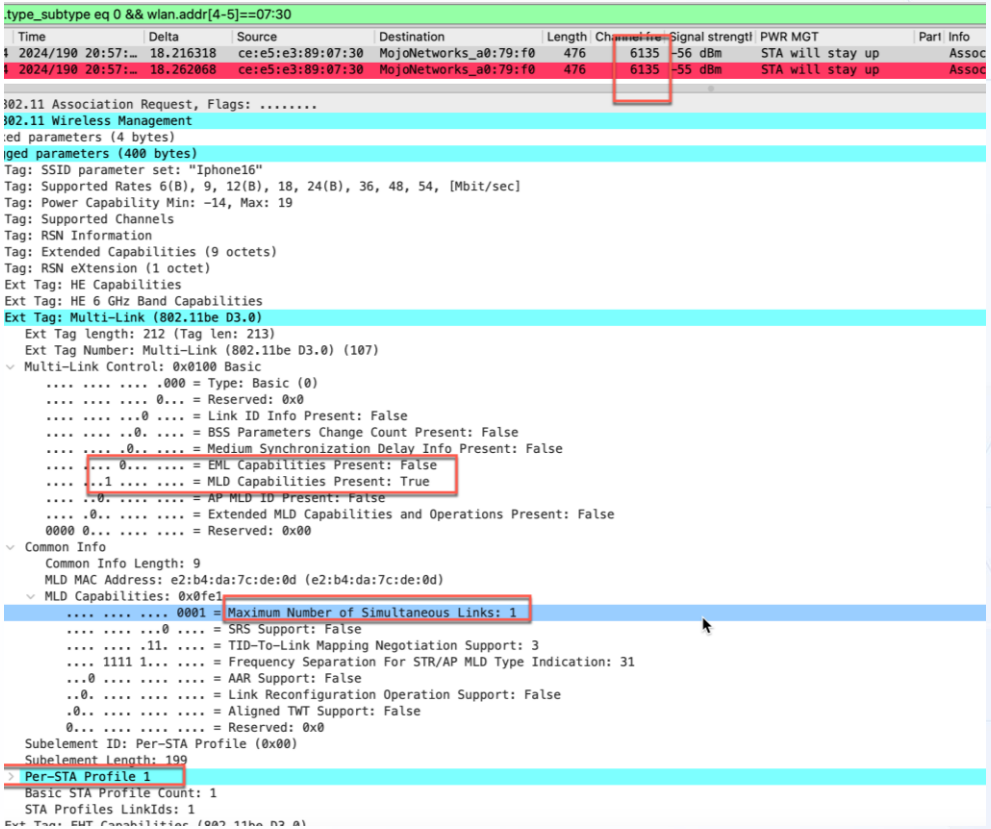
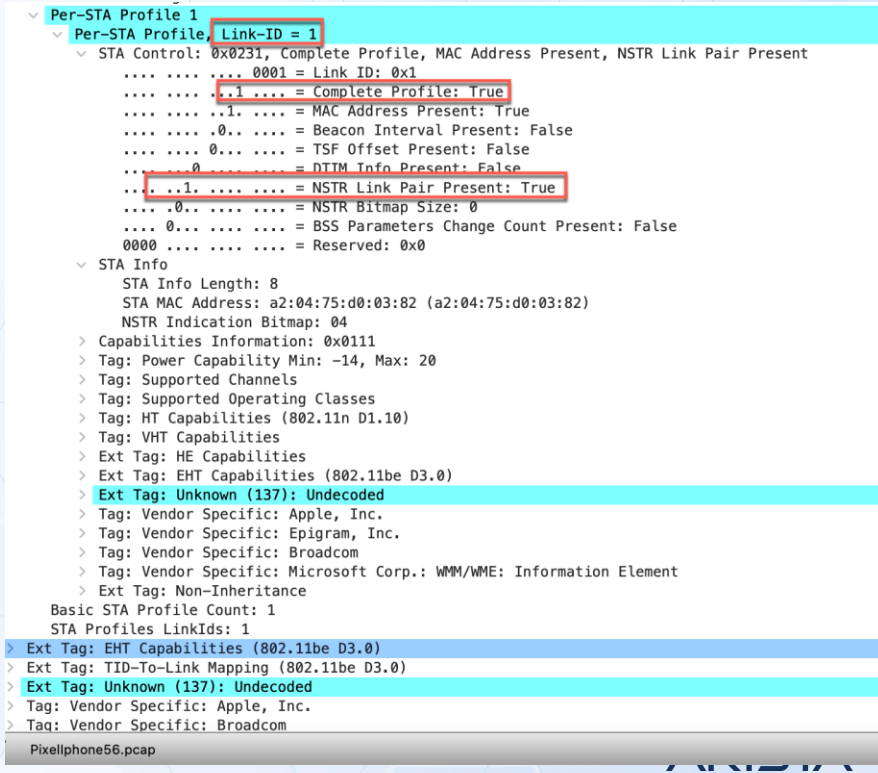
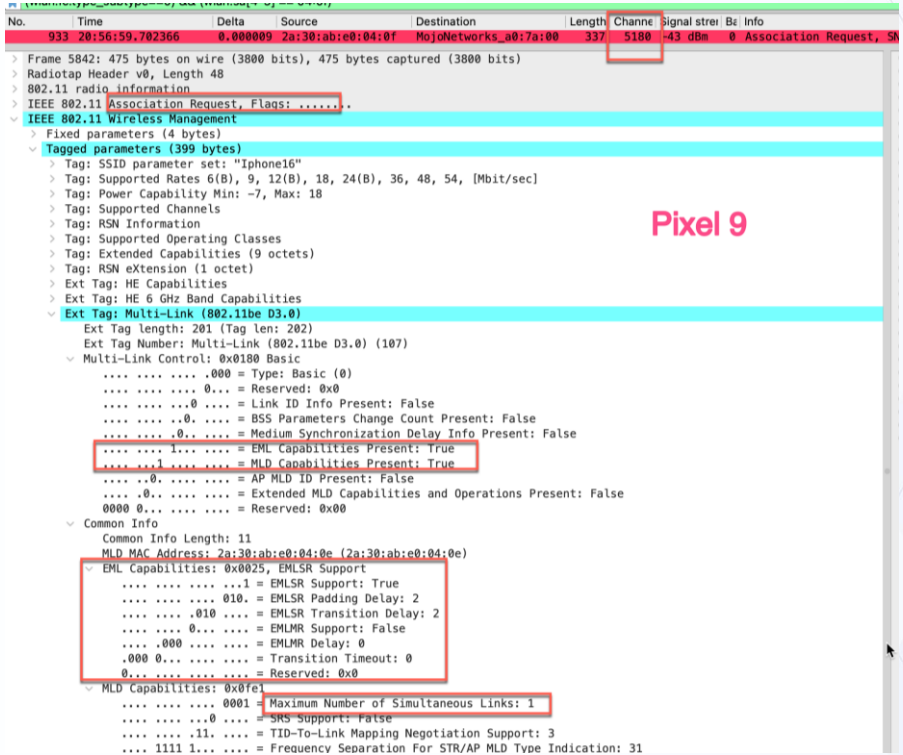
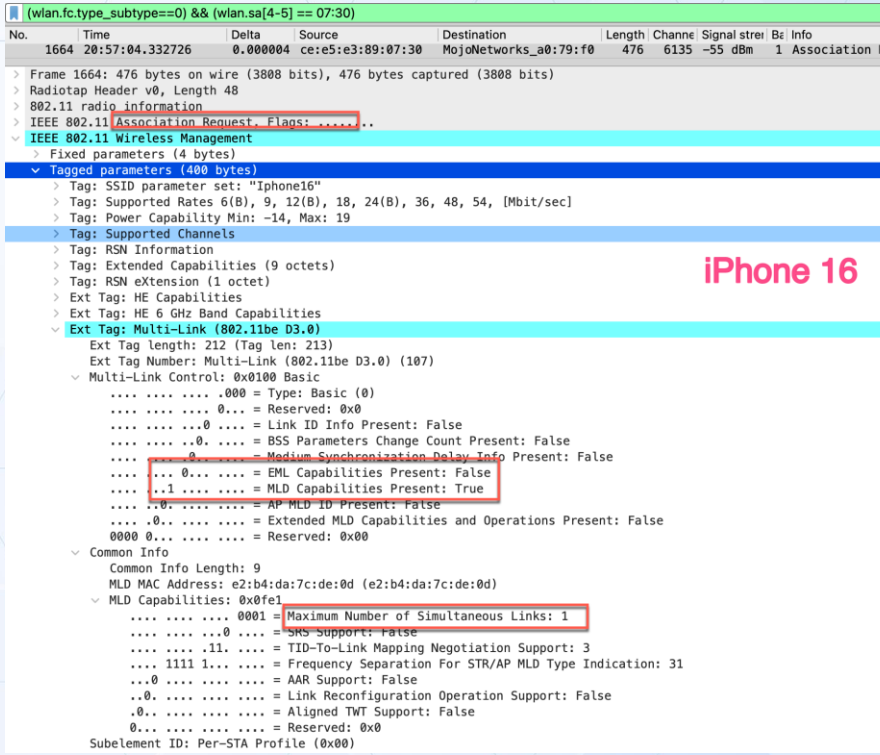
iPhone 16 – SSID on 5.0 + 6.0 GHz band





iPhone 16 vs Pixel 9 – SSID on 5.0 + 6.0 GHz band





Device MLO Mode Selection

Client	Chipset	EMLSR	STR-MLMR	NSTR-MLMR
Google Pixel 8	Broadcom	5 + 6	2.4 + 5, 2.4 + 6	Not supported
Google Pixel 8 Pro	Broadcom	5 + 6	2.4 + 5, 2.4 + 6	Not supported
Google Pixel 9	Broadcom	5 + 6	2.4 + 5, 2.4 + 6	5 + 6 Advertised, not supported
iPhone 16	Broadcom	Data transfer only on one link either 5 or 6 GHz based on association	2.4 + 5 Advertised, Data transfer only on one link. 2.5 + 6 Advertised, Data transfer only on one link	5 + 6 Advertised, not supported
iPhone 16 Pro	Broadcom	Data transfer only on one link either 5 or 6 GHz based on association	2.4 + 5 Advertised, Data transfer only on one link. 2.5 + 6 Advertised, Data transfer only on one link	5 + 6 Advertised, not supported
OnePlus 11	Qualcomm	Not supported	2.4 + 5, 2.4 + 6	Not supported
Samsung S24	Qualcomm	Not supported	2.4 + 5, 2.4 + 6	Not supported
Intel BE200	Intel	2.4 + 5, 2.4 + 6, 5+ 6	Not supported	Not supported
QC Fast Connect 7800	Qualcomm	5 + 6 GHz STR-MLMR	2.4 + 5, 2.4 + 6, 5 + 6	Not supported

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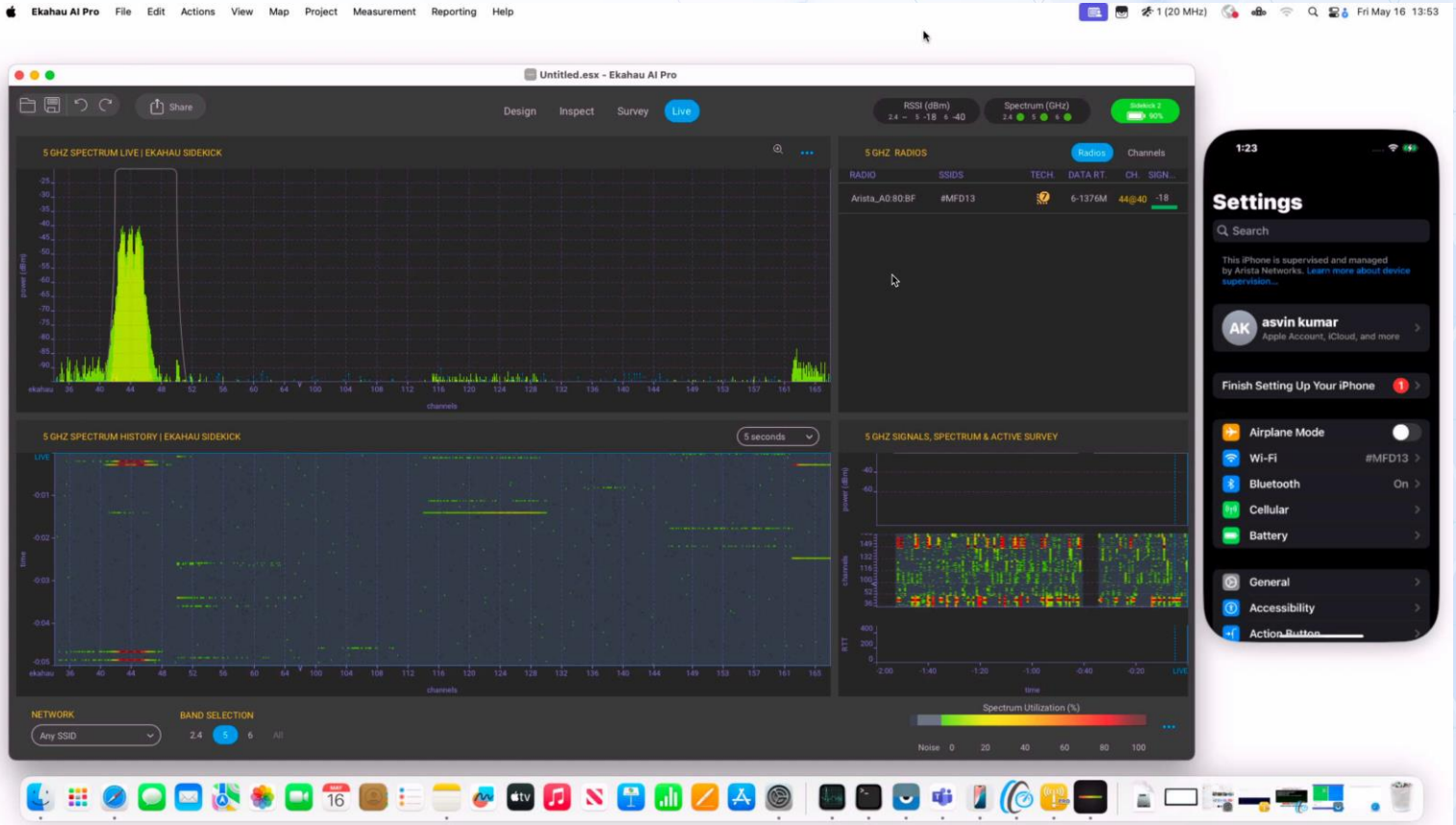
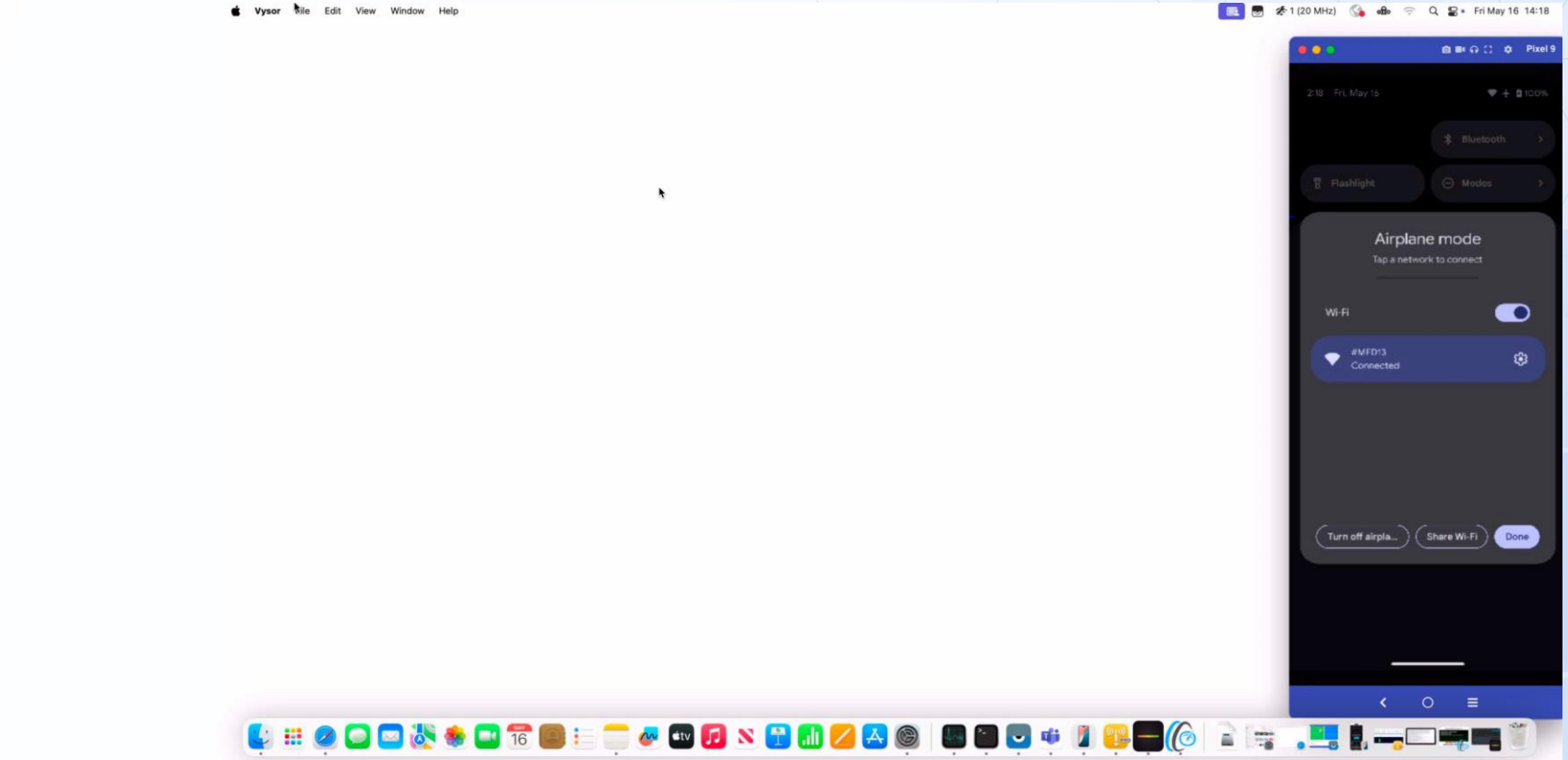
Demos

Demo 1 – Spectrum view of iPhone 16

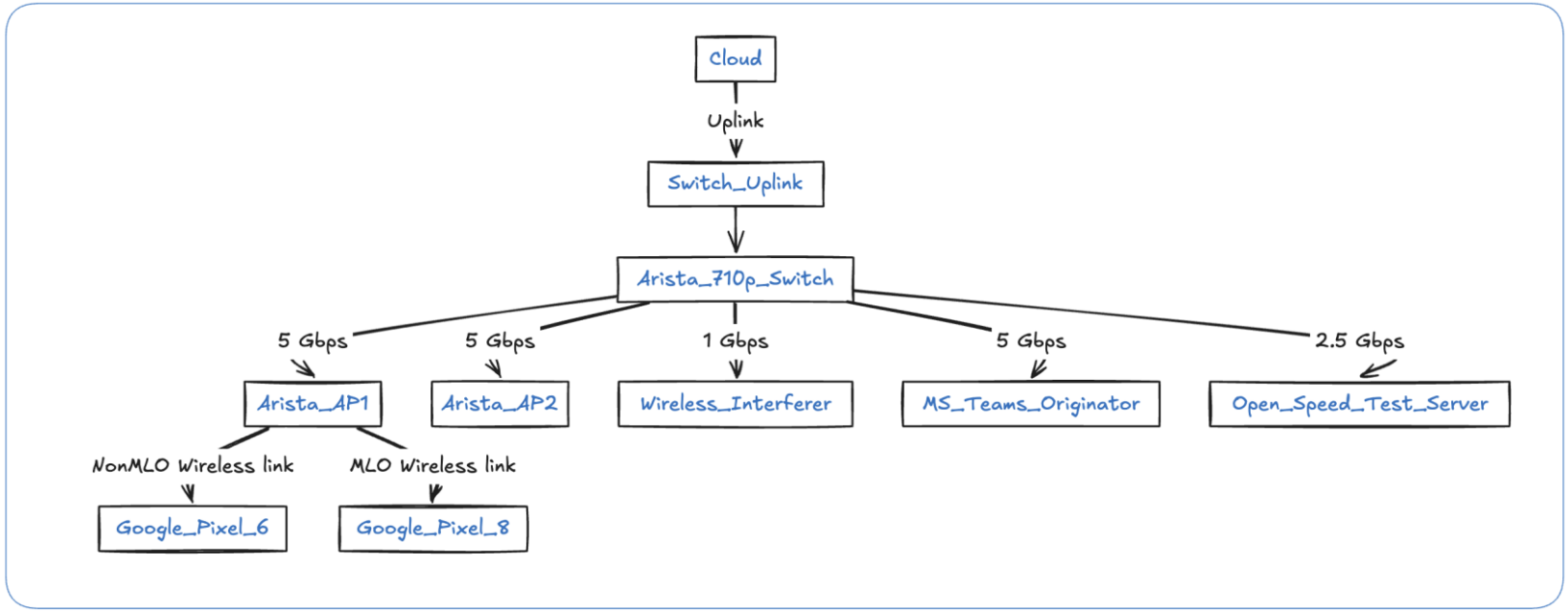


Demo 2 – Spectrum view of Google Pixel 9 during Interference



Demo 3 – MLO Vs Non-MLO during active MS-Teams voice calls in congested environment.

Topology



Demo 3 – MLO Vs Non-MLO during active voice calls in congested environment.

Demo 3 - Key Takeaway

- Voice call quality is good for MLO clients compared to Non-MLO clients. MLO clients took advantage of dynamic steering and doesn't break the connection
- For the bad calls – Admin get a live feed via slack or google meet thru webhooks indicating the location of the client
- MLO + QOS Telemetry come together to support Day2 operation helping admin to understand and act on the issues in real time.

Wi-Fi 7 Deployment Guidelines/Design Considerations

SSID Configuration

For Enterprise (dot1x) SSIDs, use WPA3 Transition mode with PMF optional
- MLO clients will connect with WPA3 in MLO mode.
- Non-MLO clients will connect with WPA3/WPA2 in Non-MLO mode based on their capabilities

For Personal (PSK/SAE) SSIDs, use WPA3 Transition mode with PMF optional
- MLO clients will connect with WPA3 in MLO mode.
- Non-MLO clients will connect with WPA3/WPA2 in Non-MLO mode based on their capabilities

For IoT SSIDs, MLO may not be applicable and better to turn off MLO

AP Deployment

Replace Wi-Fi 6E APs with Wi-Fi 7 APs directly if the RF design and planning are already optimized.

Network

High-end Wi-Fi 7 APs require BT power (802.3bt) to operate at full performance.
Mid-range and entry-level Wi-Fi 7 APs may function with AT power (802.3at), but with limited capabilities.
For optimal throughput, connect APs to multi-Gigabit switch ports (2.5G / 5G / 10G) or use link aggregation where supported.
Use Cat6a or higher cabling for 10G uplinks, especially for runs up to 100 meters.

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Thank You

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