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March 30, 2015

*Via Electronic Filing*

Marlene H. Dortch, Secretary
Federal Communications Commission
445 Twelfth Street, SW
Washington, DC 20554

Re: *Ex Parte* Notice: *Terrestrial Use of the 2473-2495 MHz Band for Low-Power Mobile Broadband Networks* – IB Docket No. 13-213

Dear Ms. Dortch:

On March 27, 2015, L. Barbee Ponder IV, General Counsel & Vice President, Regulatory Affairs, for Globalstar, Inc. ("Globalstar"), Steve Berman of Lawler, Metzger, Keeney & Logan, LLC, and I had separate meetings with Louis Peraertz, Senior Legal Advisor to Commissioner Mignon Clyburn; Erin McGrath, Legal Advisor to Commissioner Michael O'Rielly; and Jose Albuquerque of the International Bureau. At these meetings, we expressed support for the rules the Commission proposed in November 2013 to allow Globalstar to provide low-power terrestrial mobile broadband service (Terrestrial Low Power Service or "TLPS") in its own licensed spectrum at 2483.5-2495 MHz and adjacent, unlicensed spectrum at 2473-2483.5 MHz.[1] We urged the Commission to adopt its proposed rules expeditiously to add 22 megahertz to the nation's wireless broadband spectrum inventory and ease the congestion that is diminishing the quality of Wi-Fi service at high-traffic 802.11 hotspots and other locations.

At these meetings, we also discussed the recently completed TLPS demonstration held at the Commission's Technology Experience Center ("TEC"), including Globalstar's results previously filed into the record of this proceeding.[2] These demonstrations included numerous operational scenarios within the TEC, which was determined to be a "quiet" environment from an RF perspective. As described more fully in Globalstar's reports, the demonstrations confirm

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[1] *Terrestrial Use of the 2473-2495 MHz Band for Low-Power Mobile Broadband Networks; Amendments to Rules for the Ancillary Terrestrial Component of Mobile Satellite Service Systems*, Notice of Proposed Rulemaking, 28 FCC Rcd 15351 (2013).

[2] *See* Letter from Regina M. Keeney, Counsel to Globalstar, Inc., to Marlene H. Dortch, Secretary, FCC, IB Docket No. 13-213 (Mar. 10, 2015) (attaching report of AT4 wireless, Inc. and Roberson and Associates, LLC, *Globalstar TLPS Operation Demonstration* (Mar. 6 and 9, 2015), and report of Michael Needham and Dr. Kenneth Zdunek, Roberson and Associates, LLC, *Bluetooth – TLPS Demonstrations at the FCC Technology Experience Center* (Mar. 10, 2015)).

that TLPS is a good neighbor to (i) Wi-Fi operations on IEEE 802.11 Channel 11 and other channels and (ii) Bluetooth device operations within the unlicensed ISM band at 2400-2483.5 MHz. (We provided a copy of the attached report, *TLPS Operation Demonstration*, at our meetings with Mr. Peraertz and Ms. McGrath.) We also noted that although Commission staff invited all participants in the TEC demonstration to attend subsequent testing of the TLPS access points at the FCC Laboratory, the only outside attendees for this testing were representatives of Globalstar.[3]

As to the TLPS/Bluetooth capability demonstrations, we explained that Globalstar and the Bluetooth Special Interest Group ("Bluetooth SIG") representatives mutually agreed on the operational parameters for the Bluetooth demonstrations, including the number of devices, power levels, and streaming speeds.[4] As we described in these meetings, Globalstar's demonstration showed that Bluetooth-enabled devices, including a heart rate monitor, wireless speaker, and various computer mouses, worked without any service impact in the presence of TLPS. We showed both Mr. Peraertz and Ms. McGrath a video of a TLPS/Bluetooth demonstration at the TEC confirming that these various Bluetooth operations were unaffected by the activation of a TLPS access point (this recording is available at http://www.globalstar.com/en/index.php?cid=6202&from=sidenav).

We also explained that the Bluetooth SIG's representatives chose to demonstrate only two devices – a hearing aid and prototypes of a meshed automated lighting network – despite having additional devices at the TEC. Contrary to recent claims by the Bluetooth SIG, "significant audio disruption" did not occur.[5] Indeed, the Bluetooth SIG representative performing the hearing aid demonstration indicated his agreement with those in the room that there was no perceptible degradation in audio quality when TLPS on Channel 14 was activated simultaneously with the three public Wi-Fi channels. The Bluetooth SIG has not yet responded to Globalstar's request for data from its demonstrations.

Regarding the TLPS/Wi-Fi compatibility demonstration, we explained that, across various operational scenarios, TLPS was shown to have no negative impact on existing Wi-Fi operations in other channels. As described in the attached report, even when three access points were activated on Channel 14 within the confined TEC environment, there was no reduction in

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[3] *See* Letter from Regina M. Keeney, outside counsel to Globalstar, Inc., to Marlene Dortch, Secretary, FCC, IB Docket No. 13-213, at 1 (Mar. 27, 2015).

[4] *See also* Letter from Regina M. Keeney, outside counsel to Globalstar, Inc., to Marlene Dortch, Secretary, FCC, IB Docket No. 13-213, at 2 (Mar. 27, 2015) ("Globalstar March 27 *Ex Parte*") (attaching Kenneth J. Zdunek, Michael Needham, Nat Natarajan, Edward Porrett, Roberson and Associates, LLC, *Review of Bluetooth SIG Ex Parte Filing of March 20, 2015 Titled: "Further Comments and Detailed Report from TLPS & Bluetooth Demonstrations FCC Technology Center - March 6, 2015*" (Mar. 27, 2015)).

[5] *See* Globalstar March 27 *Ex Parte* at 1; *Ex Parte* Notice for TLPS & Bluetooth Demonstrations, Bluetooth SIG, IB Docket No 13-213, at 1 (Mar. 12, 2015); *see also TLPS and Bluetooth Demonstrations FCC Technology Center – March 06, 2015,* attached to *ex parte* filing of Bluetooth SIG, IB Docket No. 13-213 (Mar. 20, 2015).

data throughput from a fourth access point operating on Wi-Fi Channel 11. Moreover, Globalstar demonstrated not only a lack of impact on the adjacent Wi-Fi channels, but also a material increase in the aggregate data throughput across the 2.4 GHz 802.11-capable spectrum. With three access points already operating on Channels 1, 6, and 11, respectively, the activation of TLPS on non-overlapping Channel 14, even in a quiet RF environment, yielded an approximately forty percent increase in aggregate data throughput. In contrast, in a scenario where a fourth access point operated on Wi-Fi Channel 6 rather than on Channel 14, there was no increase in aggregate data throughput. As these results demonstrate, American consumers will benefit significantly from the provision of TLPS across 22 megahertz of additional broadband spectrum in the 2.4 GHz band.

We further pointed out that CableLabs' TLPS/Wi-Fi demonstration set-up was in no sense representative of a real-world deployment, and that any results provided by CableLabs in this proceeding should be entirely discounted. CableLabs requested that Globalstar take down its network of access points in the TEC in order to "sandwich" an inexpensive Belkin access point operating on Channel 11 between multiple Channel 6 access points and multiple TLPS-enabled access points, all within a few feet of one another. The Commission should disregard this contrived attempt to force a negative impact on Wi-Fi Channel 11.

Finally, we reiterated Globalstar's support for the Commission's "all of the above" approach to increasing the nation's supply of broadband spectrum and promoting more intensive use of both unlicensed and licensed frequencies. The Commission should not consider TLPS a substitute for additional action at 5 GHz or any other band. Globalstar continues to support rapid progress not only in the instant proceeding, but also in the 3.5 GHz band, 5 GHz band, and 600 MHz broadcast spectrum. At the same time, TLPS represents a unique opportunity, since Commission adoption of its proposed rules would enable Globalstar to implement TLPS almost immediately and provide consumers with additional wireless broadband capacity throughout the United States without delay.

Pursuant to section 1.1206(b)(2) of the Commission's rules, 47 C.F.R. § 1.1206(b)(2), this *ex parte* notification and a copy of the attached report are being filed electronically for inclusion in the public record of the above-referenced proceeding.

Respectfully submitted,

/s/ *Regina M. Keeney*
Regina M. Keeney

Attachment

cc: Louis Peraertz
Erin McGrath
Jose Albuquerque

Roberson and Associates, LLC
Technology and Management Consultants

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# TLPS Operation Demonstration

TLPS Operation Demo – March 6th and 9th, 2015

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# Demo Setup Diagram

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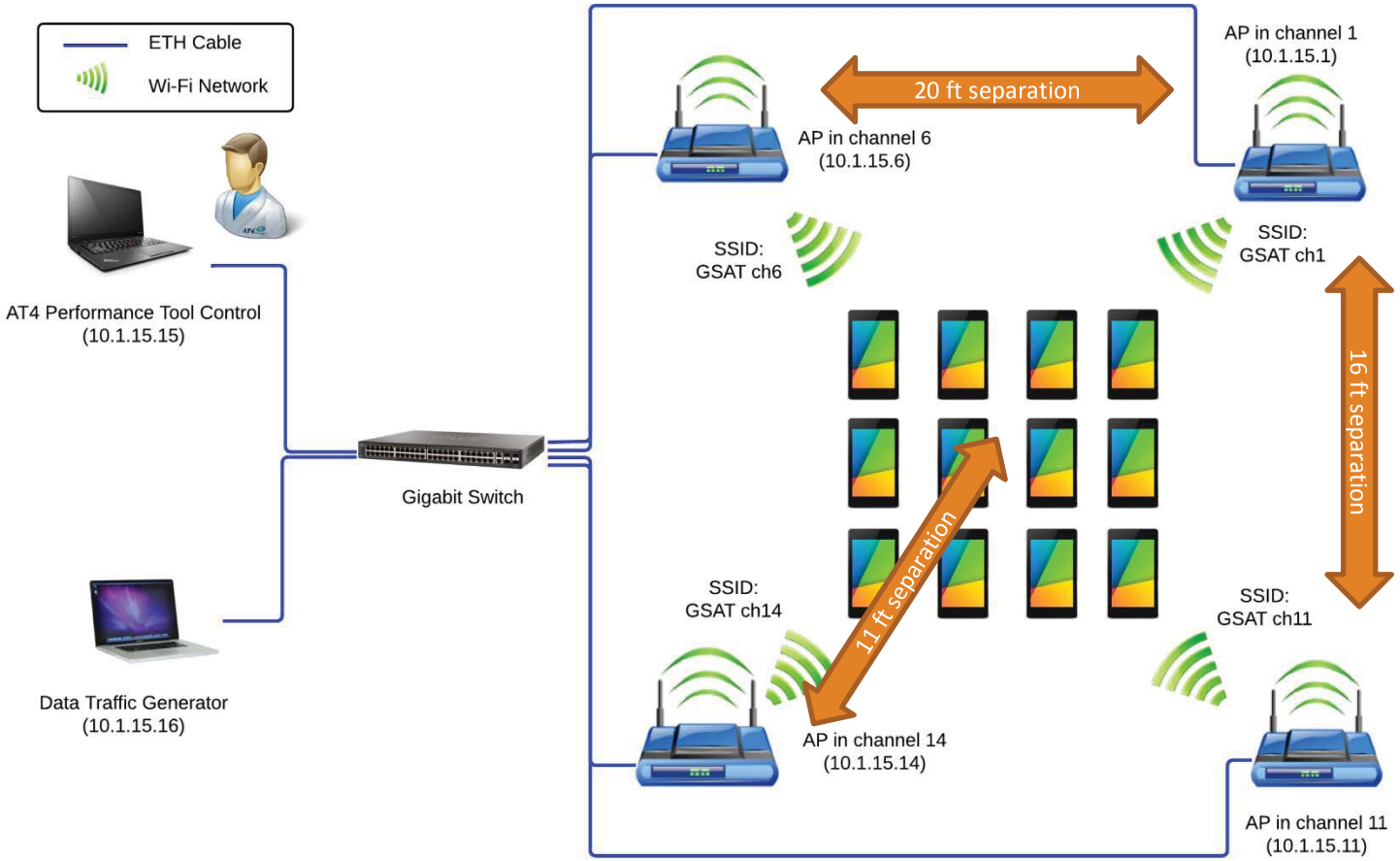



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# Demo Setup

Roberson and Associates, LLC
Technology and Management Consultants

Wi-Fi Clients Setup

Wi-Fi AP Setup

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# Wi-Fi Scenarios Performed

Roberson and Associates, LLC
Technology and Management Consultants

- The following scenarios were tested as part of this demonstration:
  1. Scenario #1: Baseline: 3 APs no TLPS
     - **3** APs operating in **3** different channels
     - **12** active users in the network
  2. Scenario #2: 4 APs with TLPS
     - **4** APs operating in **4** different channels
     - **12** active users in the network
  3. Scenario #3: 4 APs without TLPS
     - **4** APs operating in **3** different channels
     - **12** active users in the network
  4. Scenario #4: TLPS on multiple APs
     - **4** APs operating in **2** different channels
     - **12** active users in the network


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# Wi-Fi Scenario #1: Baseline: 3 APs. No TLPS

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- Purpose: *Demonstrate Baseline Performance on IEEE 802.11n Channels 1,6,11. Very High Channel Traffic.*
- Environment:
  - 4 Wi-Fi clients per AP (12 Wi-Fi clients Aggregated)
  - **3** APs operating in **3** channels
- Steps:
  1. Channel 1 Only
  2. Channel 6 Only
  3. Channel 11 Only
  4. Channel 1+6+11 Simultaneously
- Results:
  - Aggregated downlink data throughput per channel for each step

Note: Above steps were executed 3 times. Values obtained in each iteration were then averaged.

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# Wi-Fi Scenario #1: Baseline: 3 APs. No TLPS

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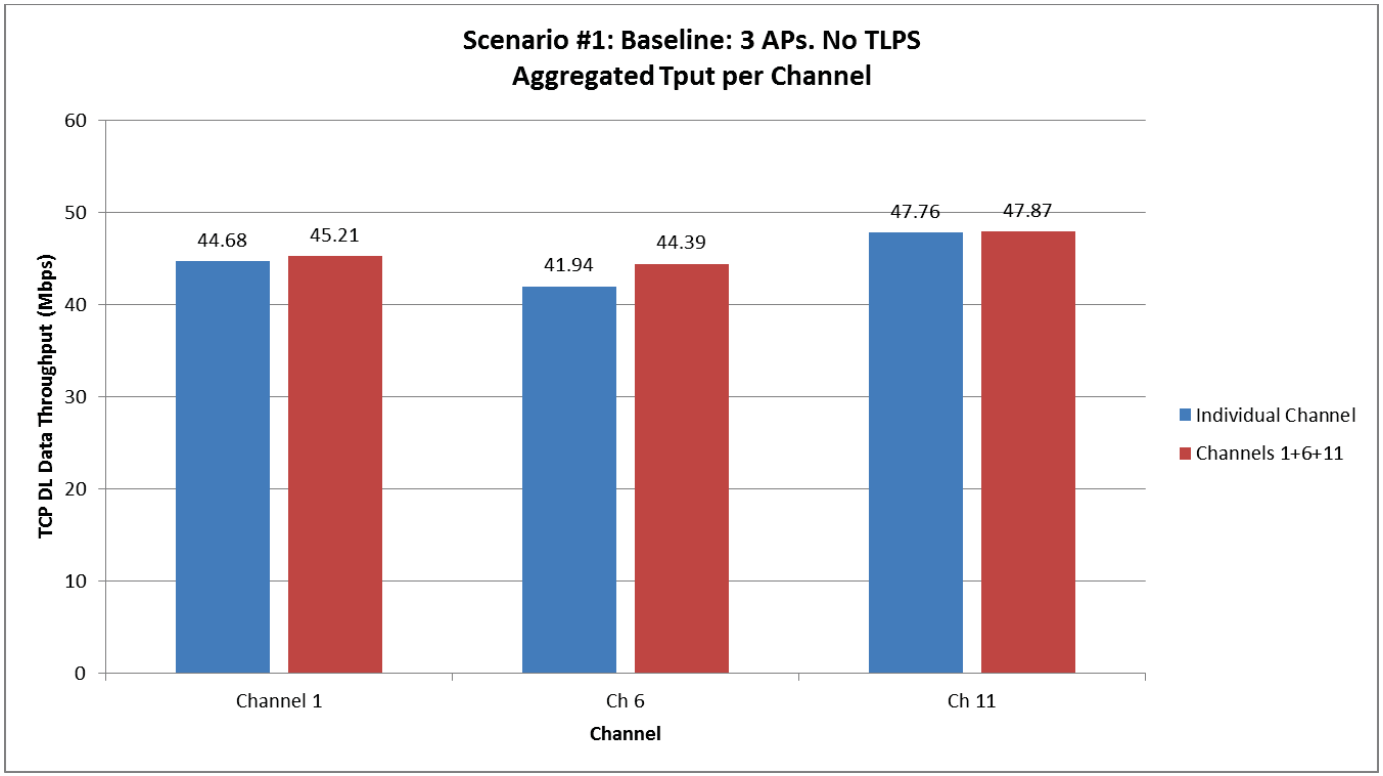


- Blue bars above indicate measured downlink data throughput when each channel was measured in isolation. Red bars indicate throughput levels when channels 1, 6 and 11 were running concurrently.
- **Similar** aggregated downlink data throughput per channel in all test conditions.

*Note: Slight variations in the data presented are due to ambient conditions within the demonstration environment.*


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# Wi-Fi Scenario #2: 4 APs with TLPS

Roberson and Associates, LLC
Technology and Management Consultants

- Purpose: *Demonstrate Effect of Channel 14 on Performance of IEEE 802.11n Channels 1,6,11. Very High Channel Traffic.*
- Environment:
  - 3 Wi-Fi clients per AP (12 Wi-Fi clients Aggregated)
  - 4 APs operating in 4 channels
- Steps:
  - Channel 1 Only
  - Channel 6 Only
  - Channel 11 Only
  - Channel 14 Only
  - Channel 1+6+11 Simultaneously
  - Channel 1+6+11+14 Simultaneously
- Results:
  - Aggregated downlink data throughput per channel for each step

Note: Above steps were executed 3 times. Values obtained in each iteration were then averaged.

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# Wi-Fi Scenario #2: 4 APs with TLPS

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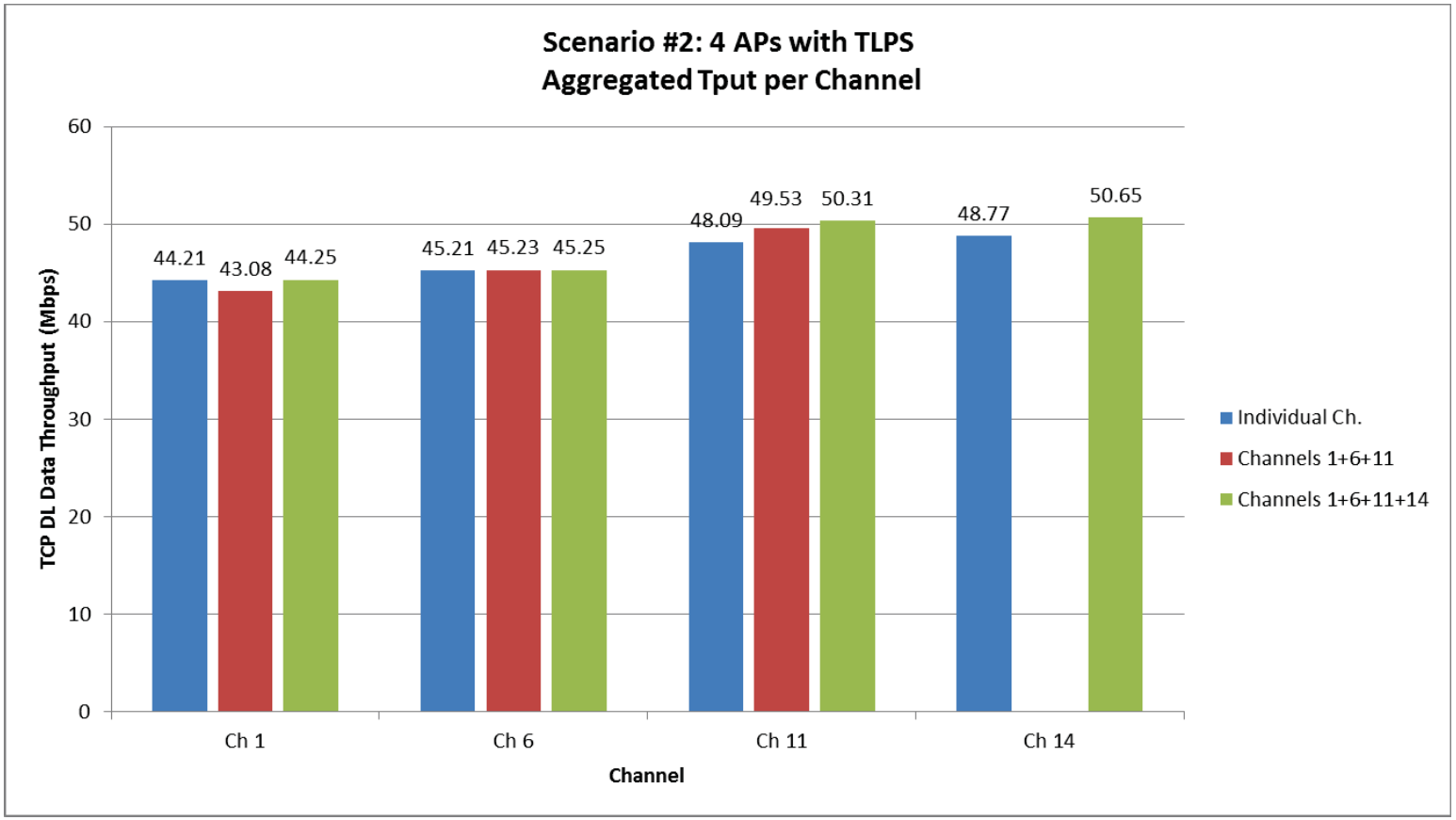


- **Similar** aggregated downlink data throughput per channel in all test conditions

*Note: Slight variations in the data presented are due to ambient conditions within the demonstration environment.*


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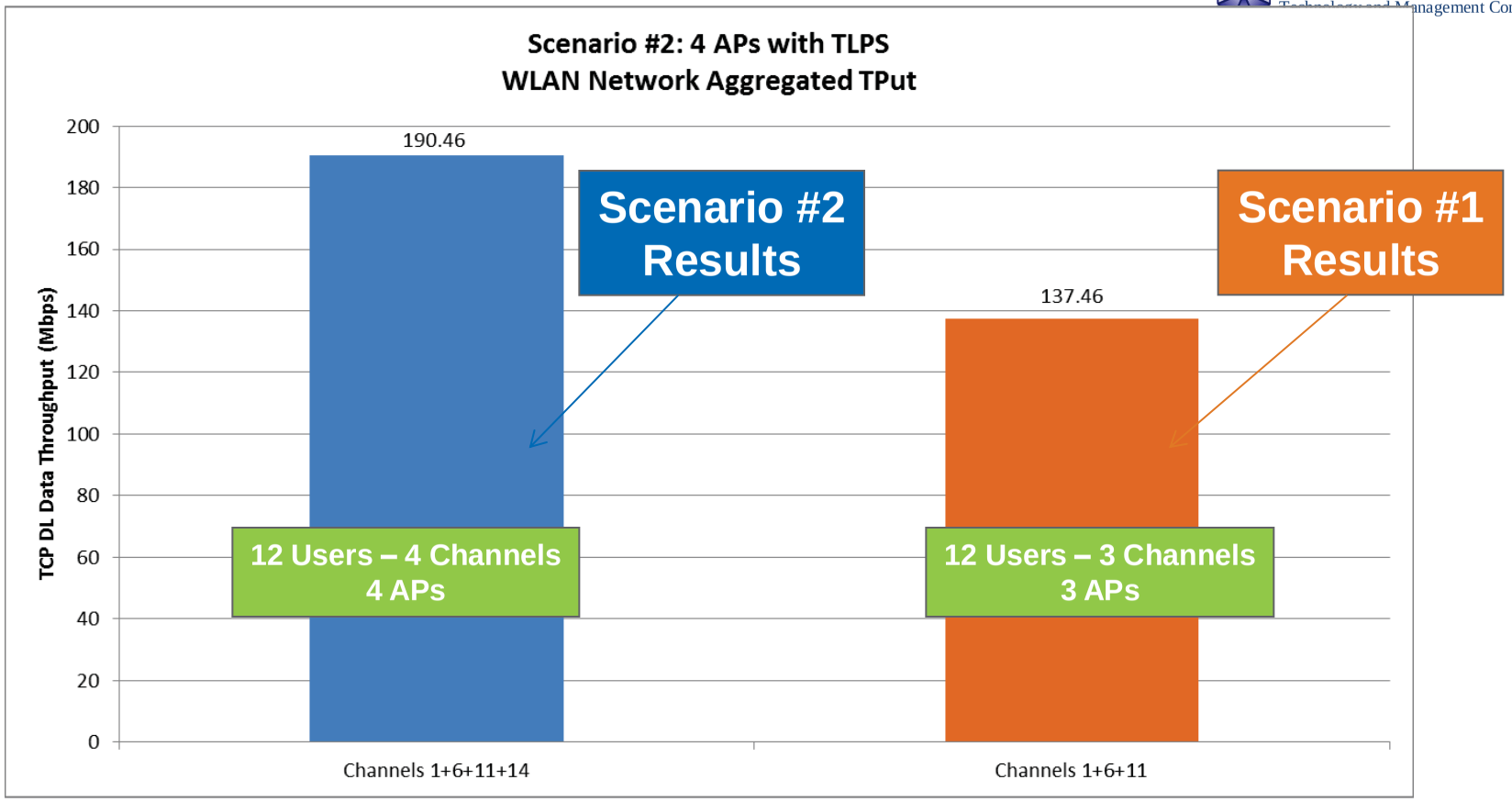
# Wi-Fi Scenario #2: 4 APs with TLPS (II) and Comparison to Scenario #1 3 APs with No TLPS




Even in very quiet RF environment (all surrounding APs near demonstration environment were turned off), there was an **approximately 40%** aggregated network capacity increase, for the same number of active users, when TLPS was enabled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# Wi-Fi Scenario #2: 4 APs with TLPS (Overtime)

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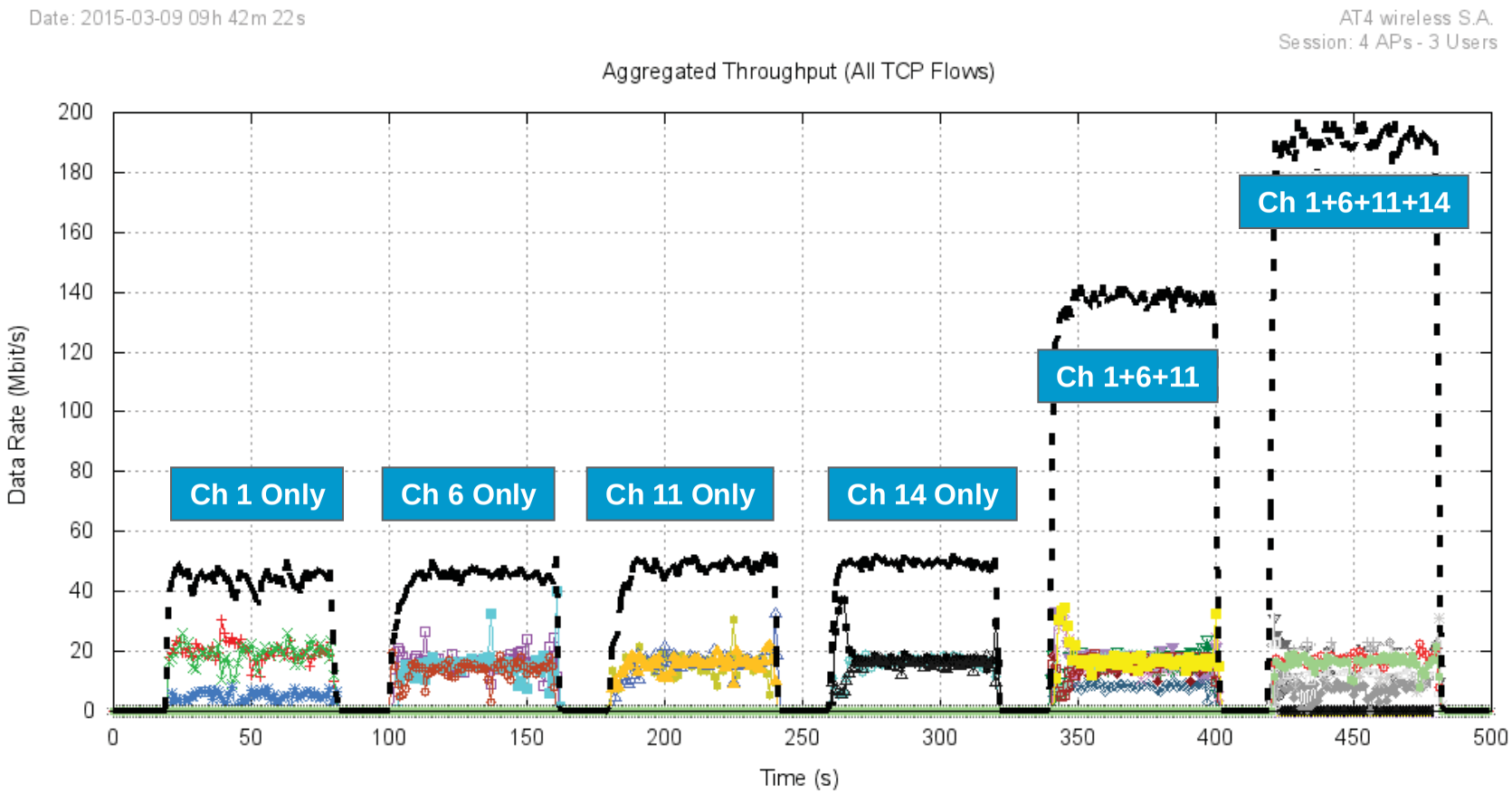


- In time domain above, the addition of Channel 14 materially increased total aggregated throughput

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# Wi-Fi Scenario #3: 4 APs without TLPS

Roberson and Associates, LLC
Technology and Management Consultants

- Purpose: *Demonstrate Performance of 4 APs on Channels 1,6,6,11. (Channel 14 Not Available.) Very High Channel Traffic conditions*
- Environment:
  - 3 Wi-Fi clients per AP (12 Wi-Fi clients Aggregated)
  - **4** APs operating in **3** channels
- Steps:
  1. Channel 1 Only
  2. Channel 6 Only
  3. Channel 11 Only
  4. Channel 6 Only (2nd channel AP)
  5. Channel 1+6+11 Simultaneously
  6. Channel 1+6+11+ 6 2nd AP Simultaneously
- Results:
  - Aggregated downlink data throughput per channel for each step

Note: Above steps were executed 3 times. Values obtained in each iteration were then averaged.

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# Wi-Fi Scenario #3: 4 APs without TLPS

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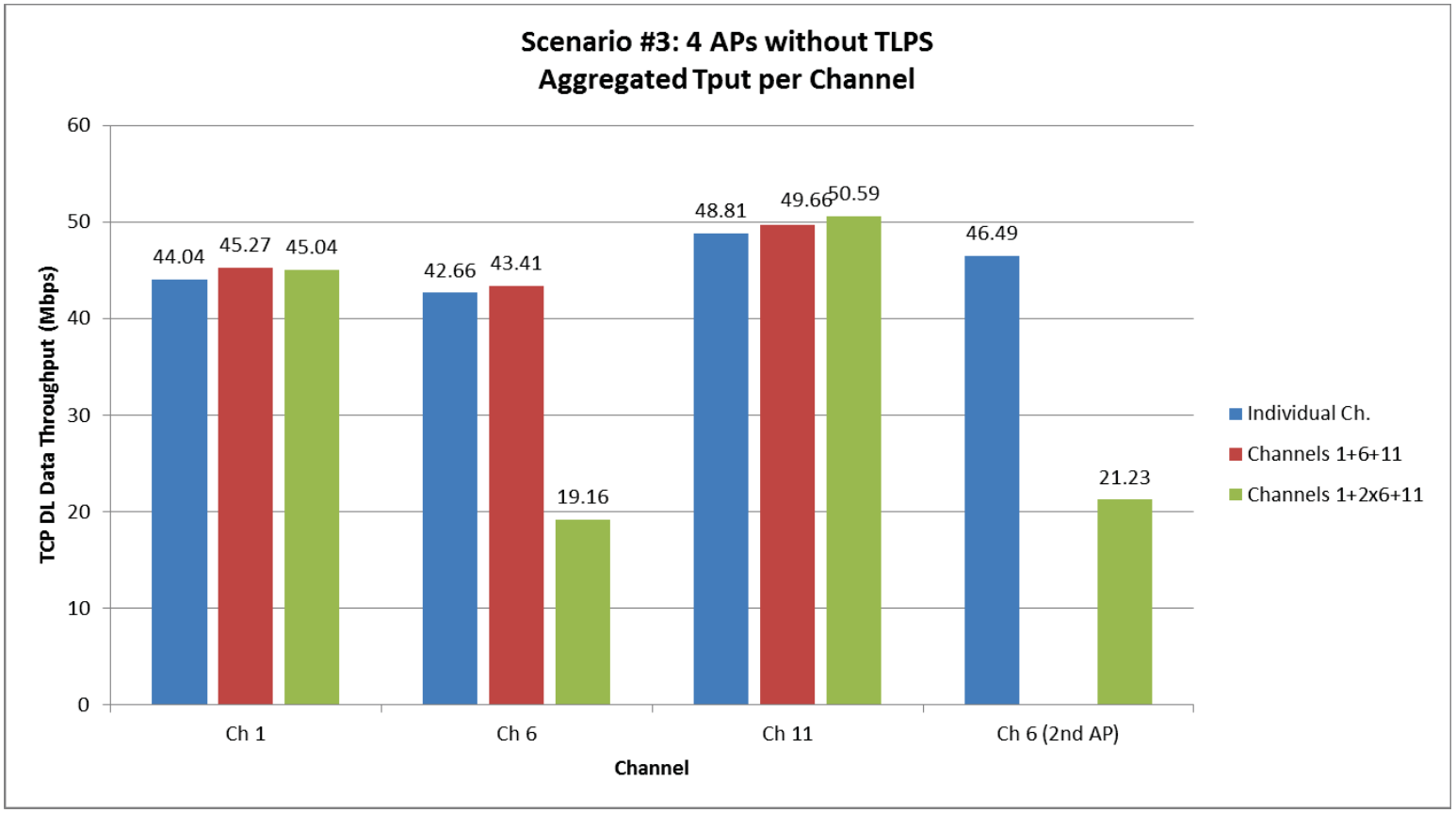


- **Similar** aggregated downlink data throughput for Channel 11 in all test conditions
- Channel 6 aggregated downlink data throughput per AP decreased by approximately 50%

*Note: Slight variations in the data presented are due to ambient conditions within the demonstration environment.*


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# Wi-Fi Scenario #3: 4 APs without TLPS (II) and Comparison to 3 APs Baseline and 4 APs with TLPS

Roberson and Associates, LLC
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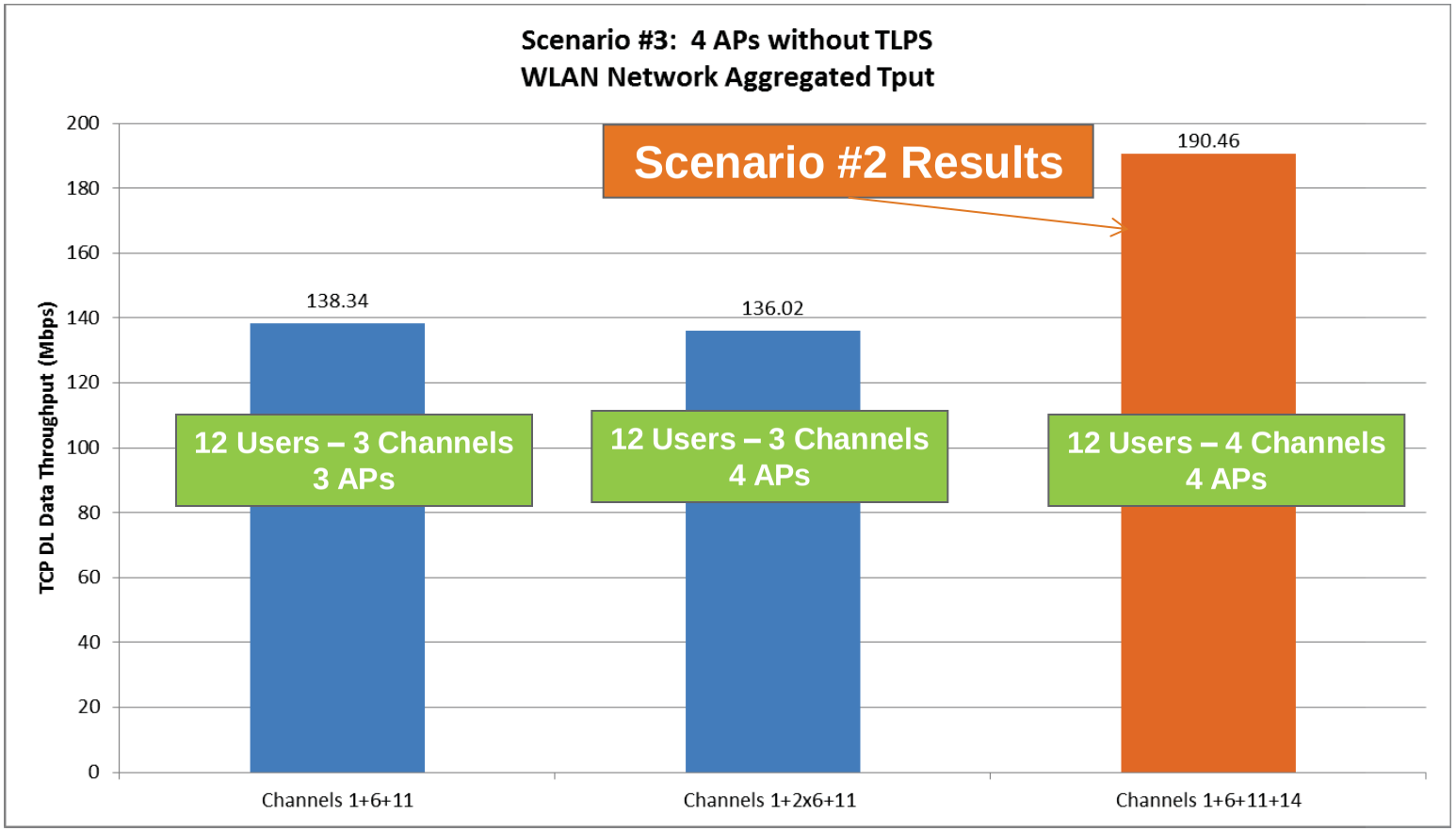


- Additional AP in Channel 6 did not translate into additional network capacity

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# Wi-Fi Scenario #3: 4 APs without TLPS (Overtime)

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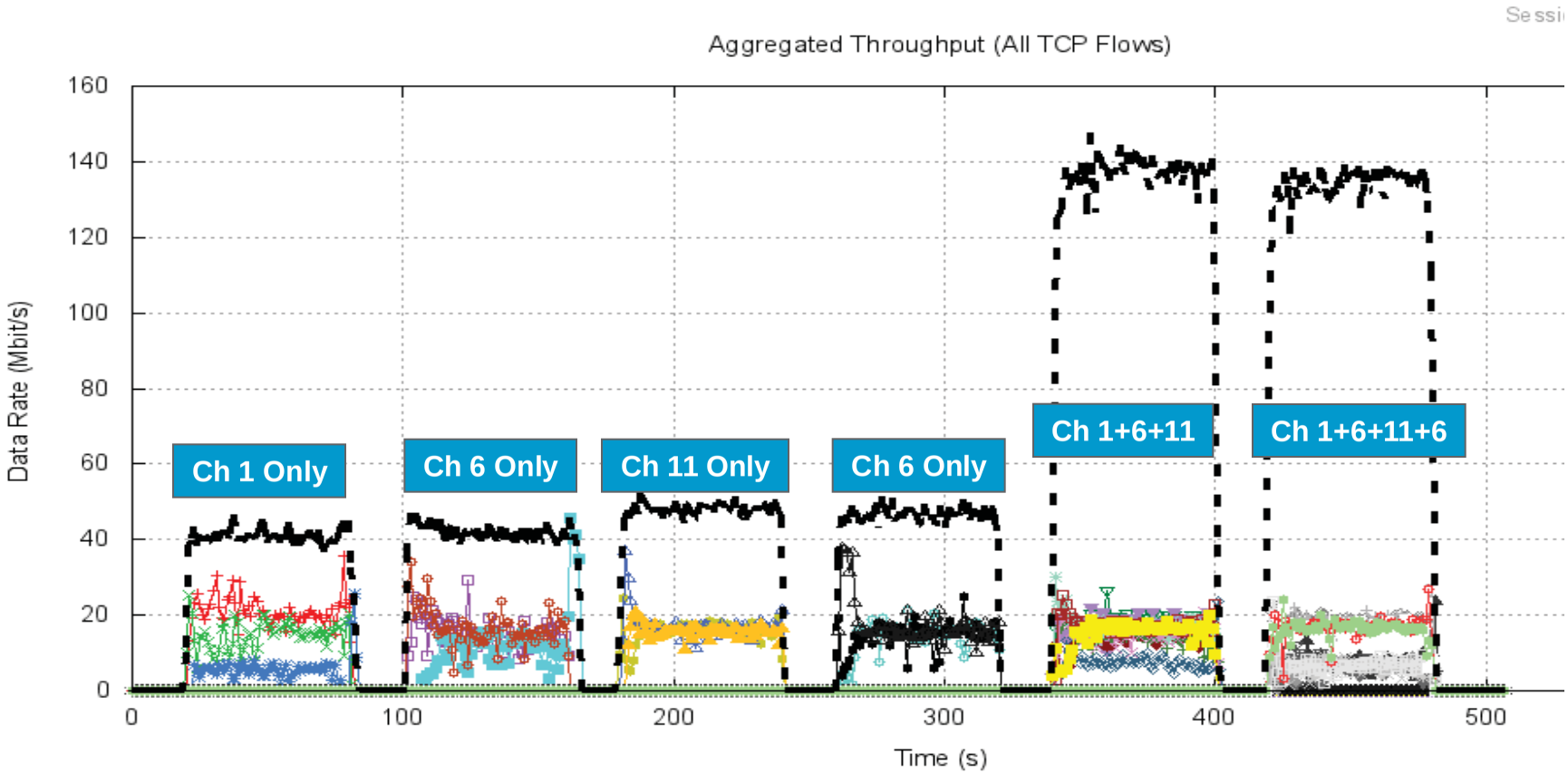


- In time domain above, the addition of a Channel 6 AP did not increase network capacity

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# Wi-Fi Scenario #4: TLPS on Multiple APs

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Technology and Management Consultants

- Purpose: *Demonstrate Effect of Multiple APs on Channel 14 on Channel 11 Performance. Very High Channel Traffic.*
- Environment:
  - 3 Wi-Fi clients per channel (12 Wi-Fi clients Aggregated)
  - **4** APs operating in **2** channels
- Steps:
  1. Channel 11 Only
  2. Channel 11 + 14 + $14^{2nd\ AP}$ +$14^{3rd\ AP}$ Simultaneously
- Results:
  - Aggregated downlink data throughput per channel for each step

Note: Above steps were executed 3 times. Values obtained in each iteration were then averaged.


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# Wi-Fi Scenario #4: TLPS on Multiple APs

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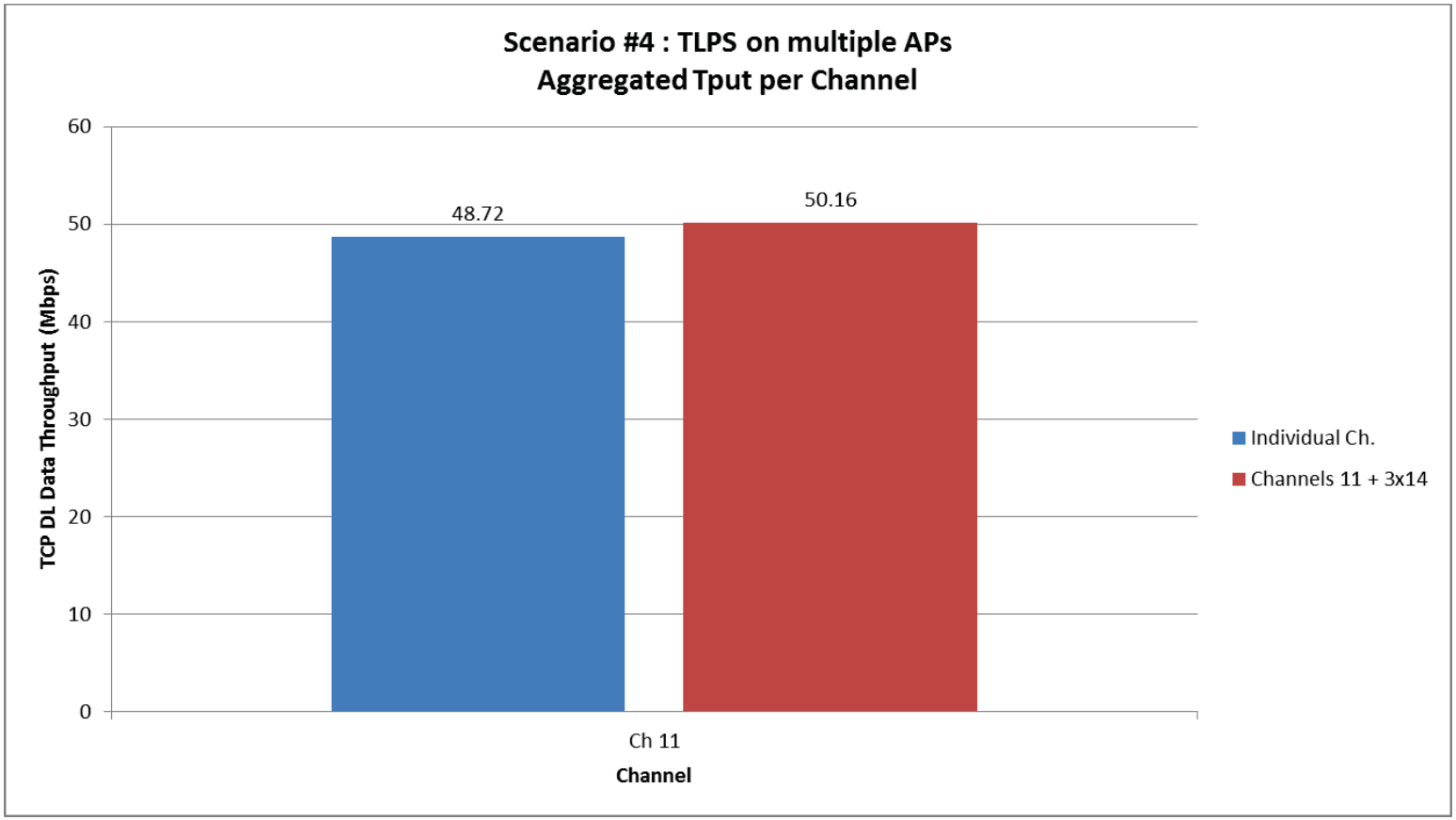


- **Similar** aggregated downlink data throughput in Channel 11 in presence of 3 APs operating in Channel 14

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# Summary Slides:

# Comparison of Scenarios


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# Summary: Channel 11 Throughput Comparison of Scenarios

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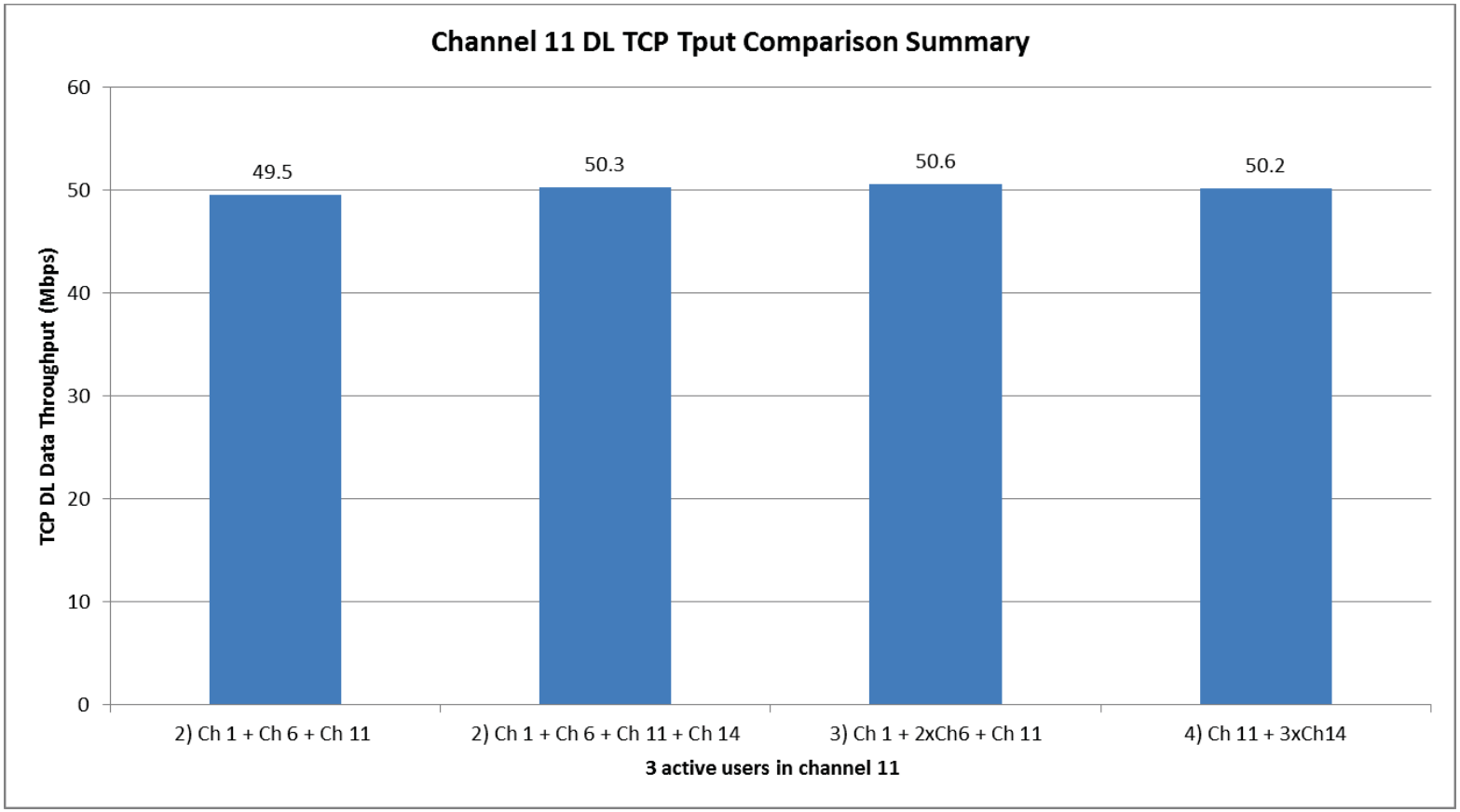


**Similar** aggregated downlink data throughput in Channel 11 for all the scenarios tested

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# Summary: Overall Capacity Comparison Across the Scenarios

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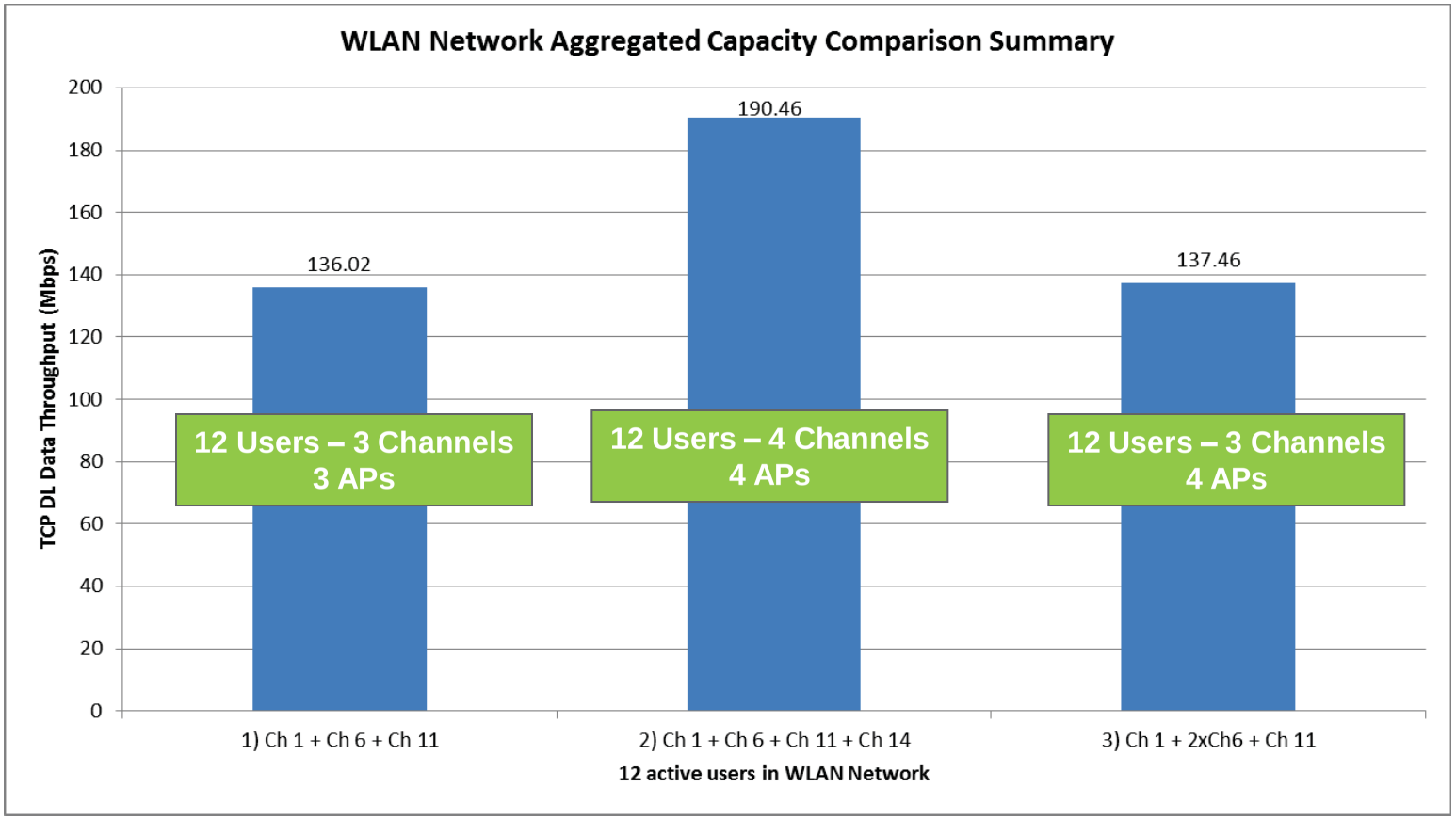


- Approximately 40% network capacity increase when TLPS is enabled
- Additional AP in Channel 6 did not increase network capacity

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