



# **Intel® PROSet/Wireless WiFi Software Production Version v13.3 Performance Data TRWFW1355**

PCCG Wireless Marketing

WW32 2010

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HW: Intel® PRO/Wireless 3945ABG Network Connection (3945ABG)  
HW: Intel® WiFi Link 4965AGN (4965ABGN)  
HW: Intel® WiFi Link 5000 Series (Shirley Peak)  
HW: Intel® WiMAX/WiFi Link 5050 Series (Echo Peak)  
HW: Intel® Centrino® 6000 Series (Puma Peak)  
HW: Intel® Centrino® Advanced N + WiMAX (Kilmer Peak)  
HW: Intel® Wireless-N 1000 (Condor Peak)

OS: Microsoft® Windows Vista\* (Vista32, Vista64,...)  
OS: Microsoft® Windows XP\* (XP32, XP64,...)  
OS: Microsoft® Windows 7

# Performance Data

## 13.3 PV Release

**VIP Kit: # 26578**

**Build: TRFW1355**

**Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of products as measured by those tests. Any difference in system hardware, software design, configuration, or test environment may affect actual performance.**

# OTA Performance Data

# Throughput Test Cases

## Non Line Of Sight (NLOS) Test – Enterprise Environment

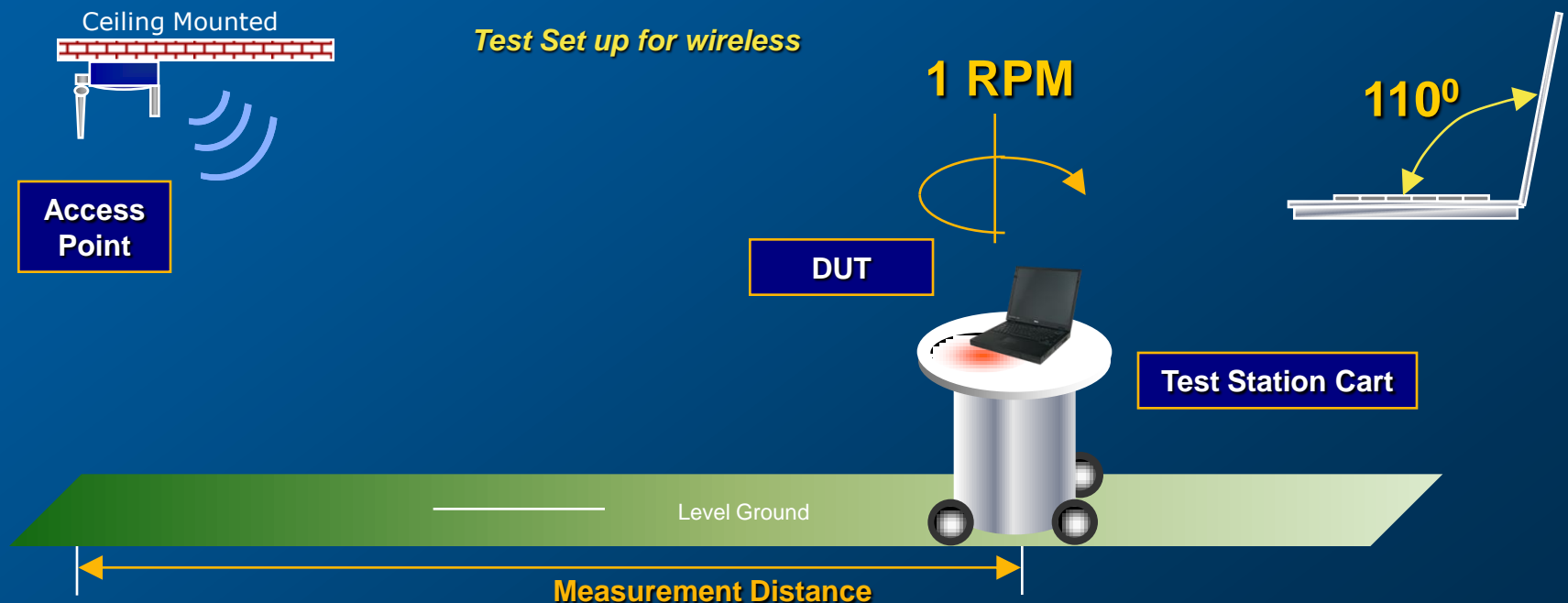
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- Validates the product meets throughput targets when placed in an environment that eliminates line of sight connection between the access point (AP) and client (DUT)
- Three locations on the OTA Range (CAS1) for DUT (refer to “Floor Plan” foil)
  - Stations: 40, 42, 48, and 50
  - 2.4GHz channels: 1, 6, and 11
  - 5.2GHz channels: 36, 48, and 149
- Two iterations per channel and throughput is average across two iterations
- IxChariot TCP Traffic used for throughput measurements
  - Legacy: 1MB file for 802.11a/b/g mode using “throughput.scr” script, set to run for 2 minutes with 1 pair.
  - 802.11n HT: 10MB file using “High\_Performance\_Throughput.scr” script set to run for 2 minutes with 4 pairs.
- No encryption
- DUT screen angle open to 110° from closed position
- DUT rotating at 1 RPM
- DUT on AC power and in Constant Awake Mode (CAM)
- Spectrum Analyzer used to verify quiet range in 2.4GHz and 5.2GHz 802.11 spectrum range prior to testing

# Set Up for Wireless Testing

## Test Environment and Methodology

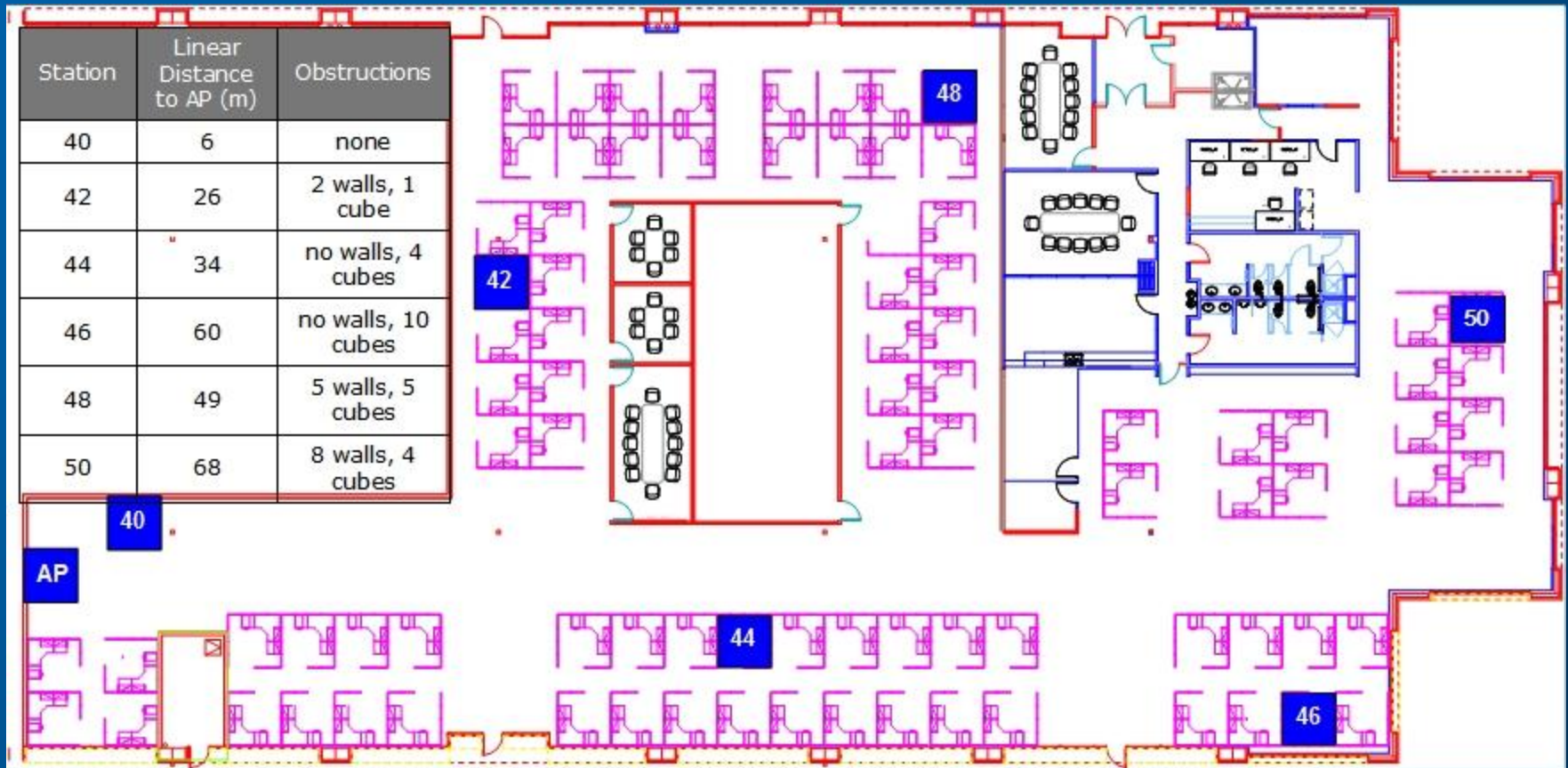
- **Platform:** tested with the “lid” open to 110°
- **Access Point:** ceiling mounted
- **Test Stations:** vary in physical environment characteristics such as: distance from AP and walls or cubes between client and AP
- **All tests start with the DUT at the same angular position relative to the range**





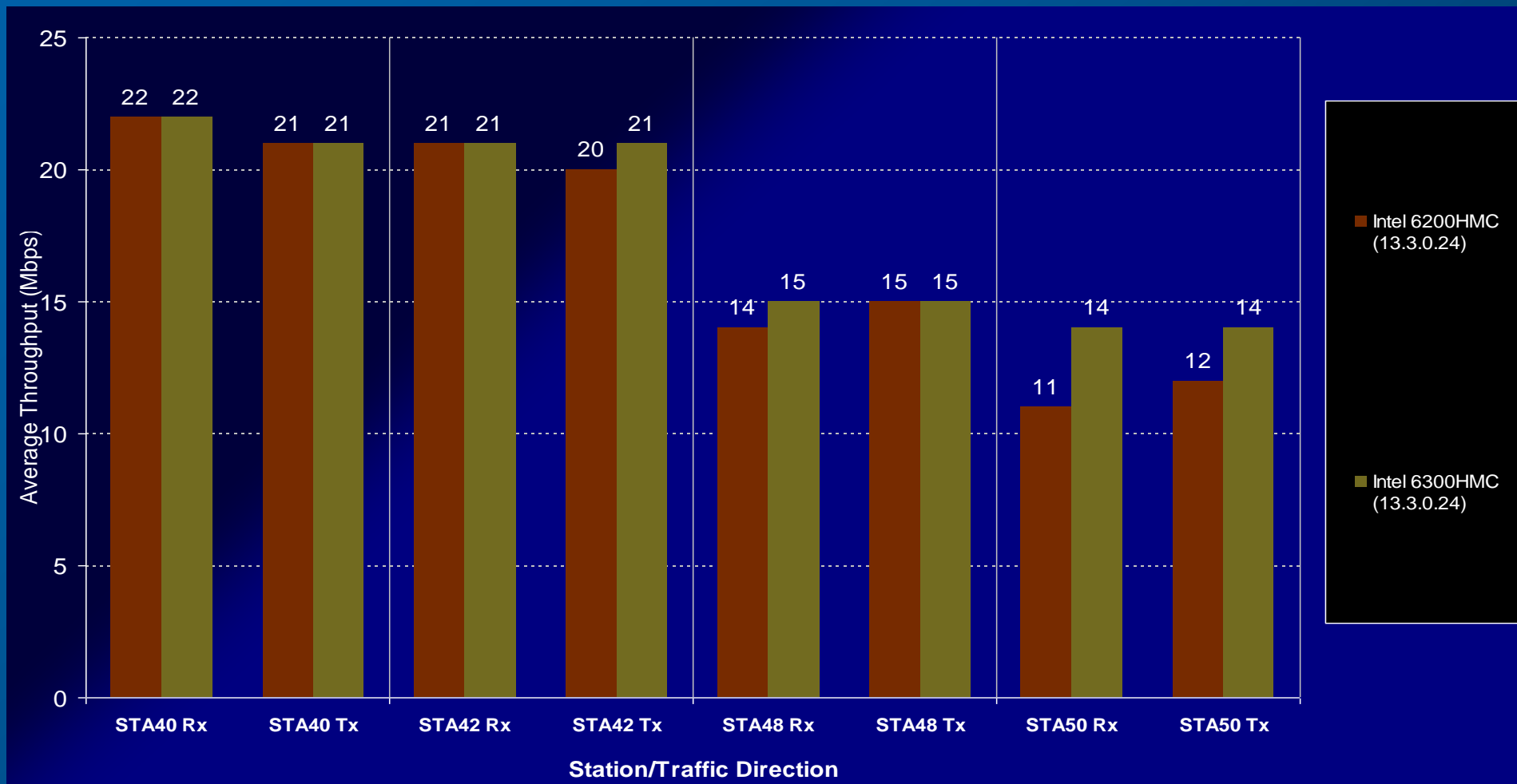
# Non Line Of Sight (NLOS) Station Locations at CAS1

## Floor Plan



# NLOS Performance - 5.2GHz Legacy (802.11a)

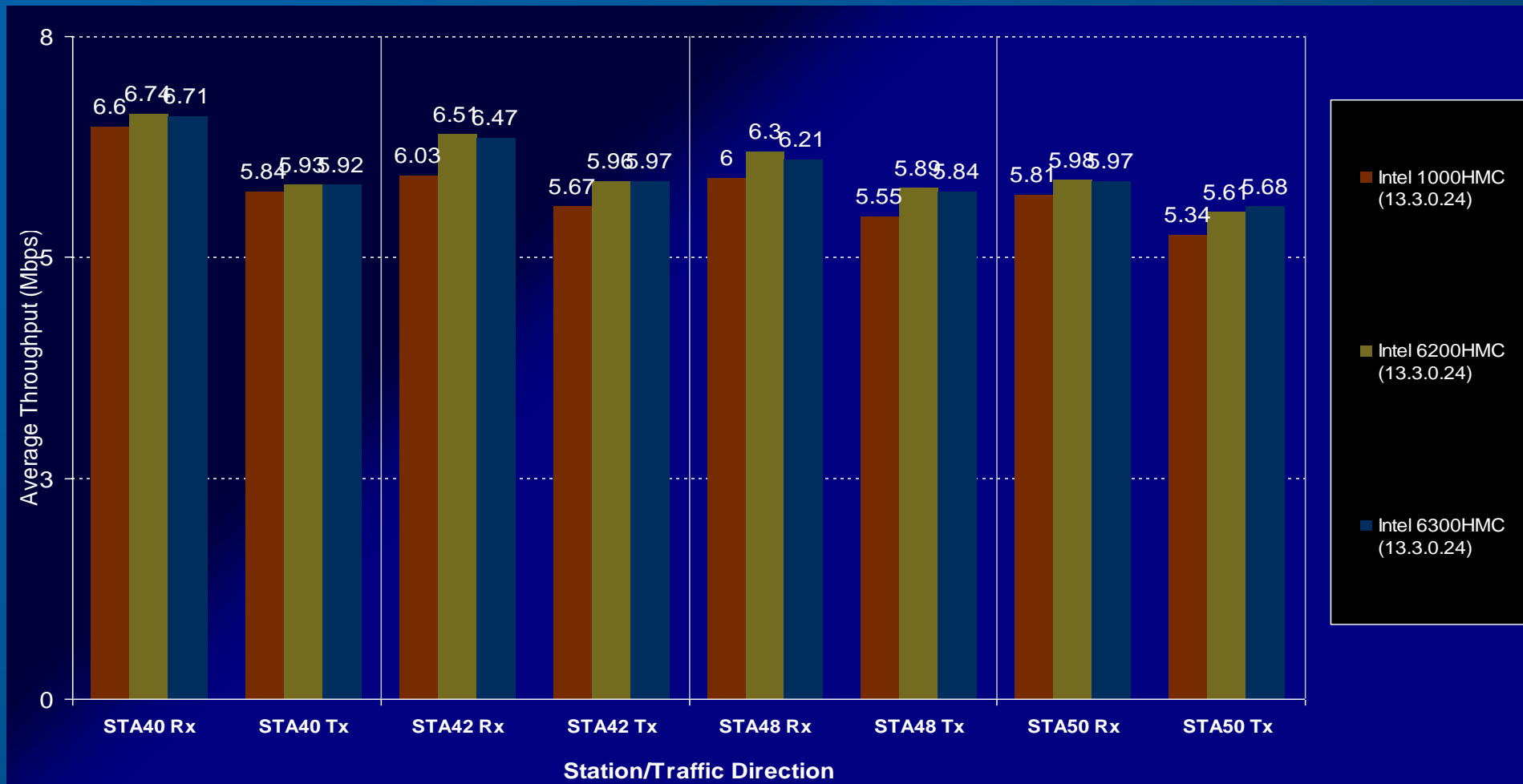
Cisco 1250 LWAPP; 20Mhz; Enterprise Range; Multiple channels





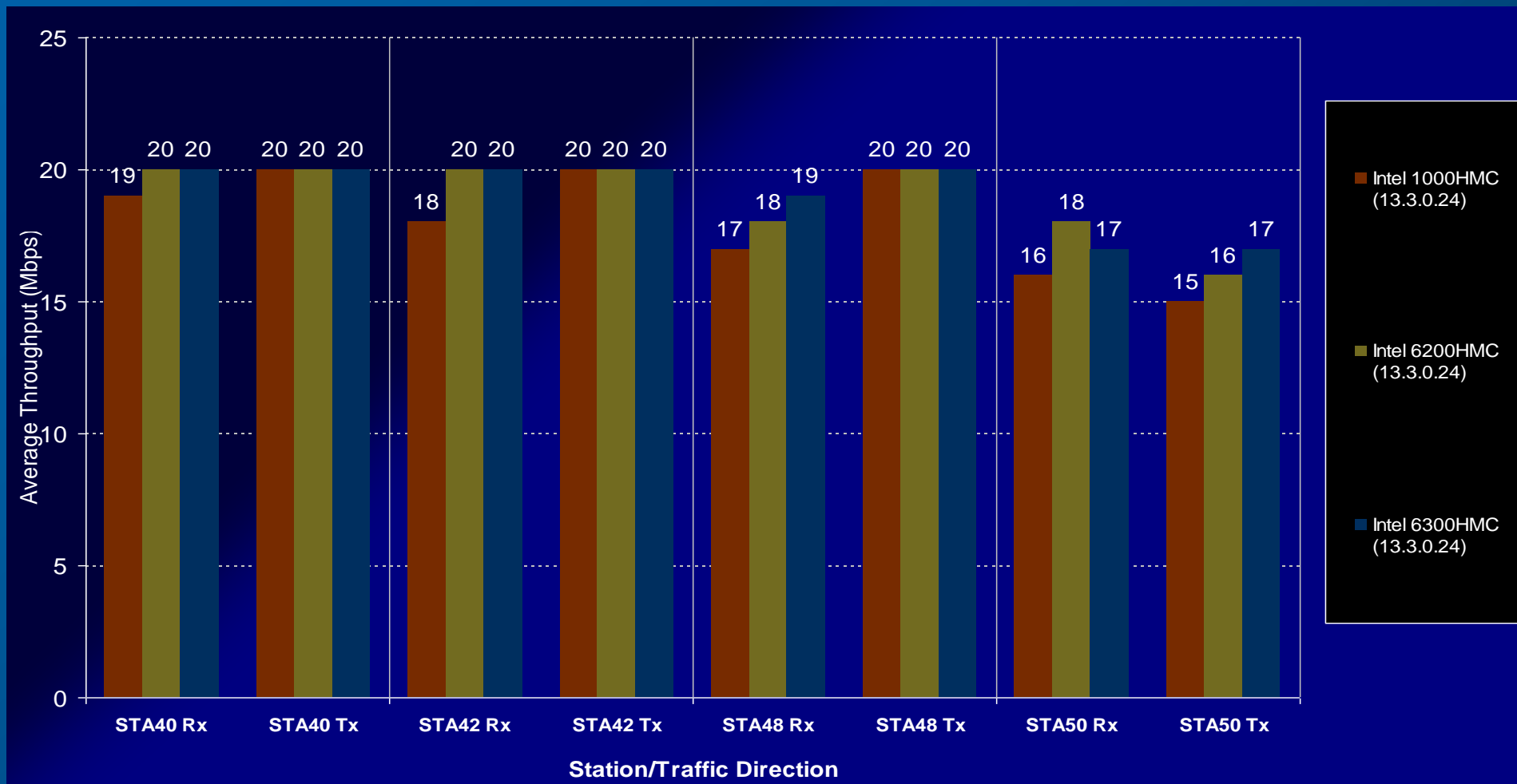
# NLOS Performance - 2.4GHz Legacy (802.11b)

Cisco 1250 LWAPP; 20Mhz; Enterprise Range; Multiple channels



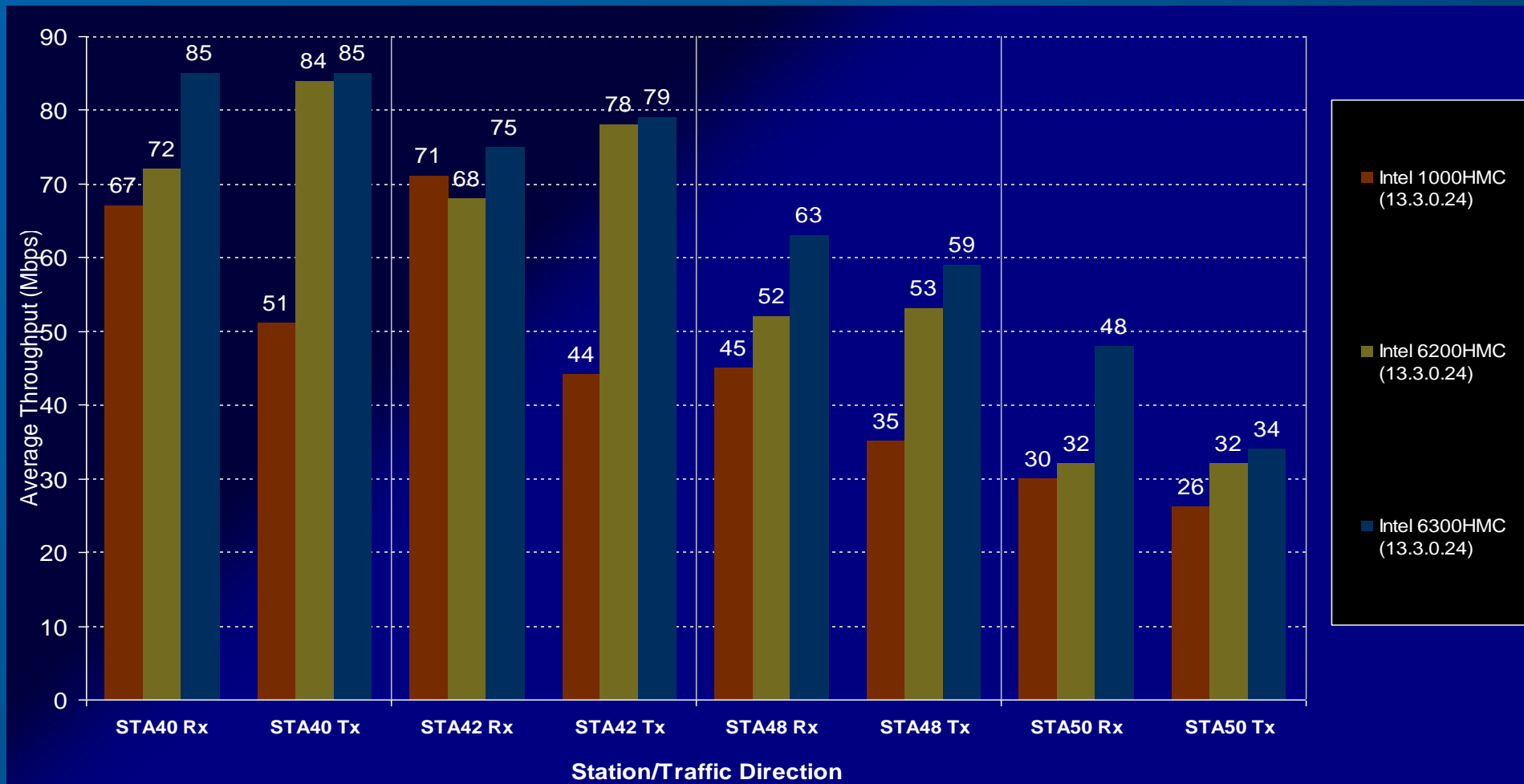
# NLOS Performance - 2.4GHz Legacy (802.11g)

Cisco 1250 LWAPP; 20Mhz; Enterprise Range; Multiple channels



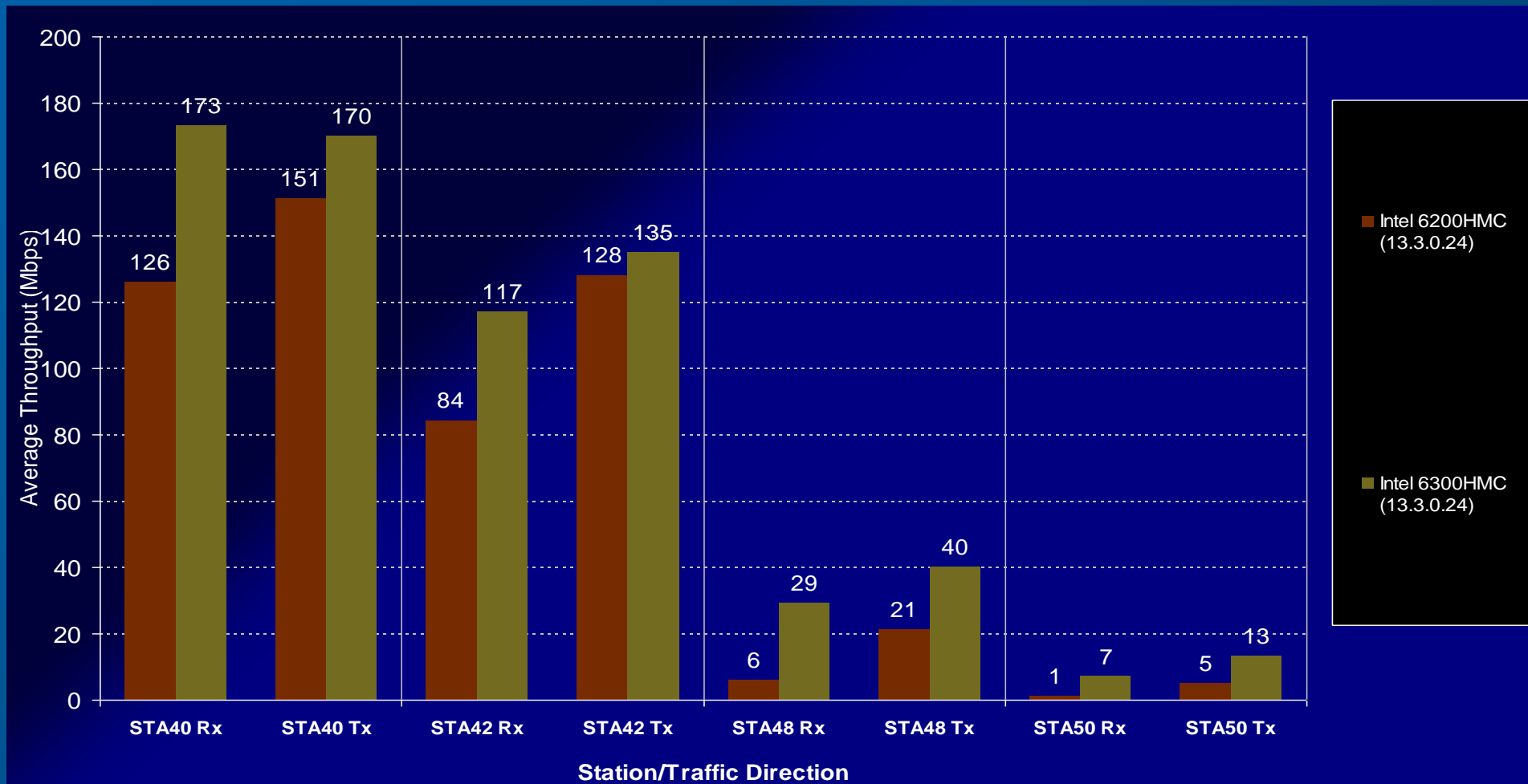
# NLOS Performance - 2.4GHz High Throughput (802.11n)

Cisco 1250 LWAPP; 20Mhz; Enterprise Range; Multiple channels



# NLOS Performance - 5.2GHz High Throughput (802.11n)

Cisco 1250 LWAPP; 40Mhz; Enterprise Range; Multiple channels



# **OTA Performance Data Intel® My WiFi Technology**

# Summary

## Configurations

- SW Driver – 13.3.0.22
- HW - Intel® Wireless WiFi Link 1000, 6200, 6300 on Dell E6400, Win7-64
- HW - Intel® Wireless WiFi Link 4965 on Dell D830, XP32
- HW - Intel® Wireless WiFi Link 4965 on Dell D820, XP32
- AP 1 - D-Link DIR-855A2 AP
- AP 2 - Linksys E3000

## Test Cases

- WiFi PAN (Intel My WiFi technology)

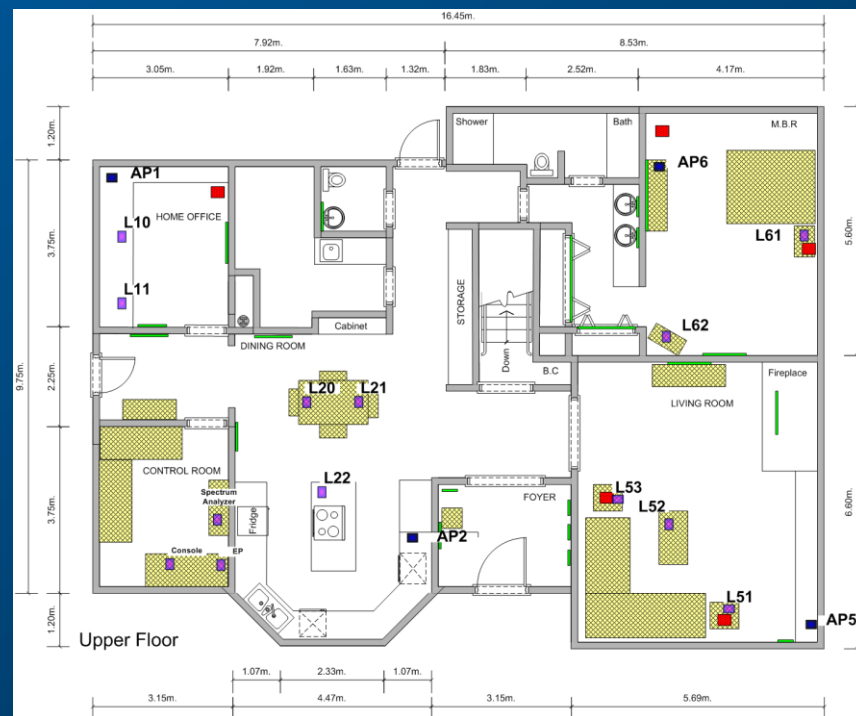
# Test Configuration

- Four locations on the OTA Range for DUT (refer to the floor plan)
- 2.4GHz channel – 6; 5GHz channel – 36. For each channel, at least two iterations of testing was carried and reported throughput is average across 2 iterations
- TCP only
- No encryption
- DUT Screen angle open to 110 degrees from closed position
- DUT rotates at the rate of 1 rpm
- Chariot\* file size
  - Legacy: 1MB file for a/b/g mode using Chariot\* “throughput.scr” script, set to run for 2 minutes. 1 Chariot\* pair used
  - HT: 10MB file using Chariot\* “High\_Performance\_Throughput.scr” script set to run for 6 minutes. 2 Chariot\* pairs used
- Spectrum Analyzer used to verify quiet range in the 2.4GHz and the 5.0-6.0GHz band prior to testing



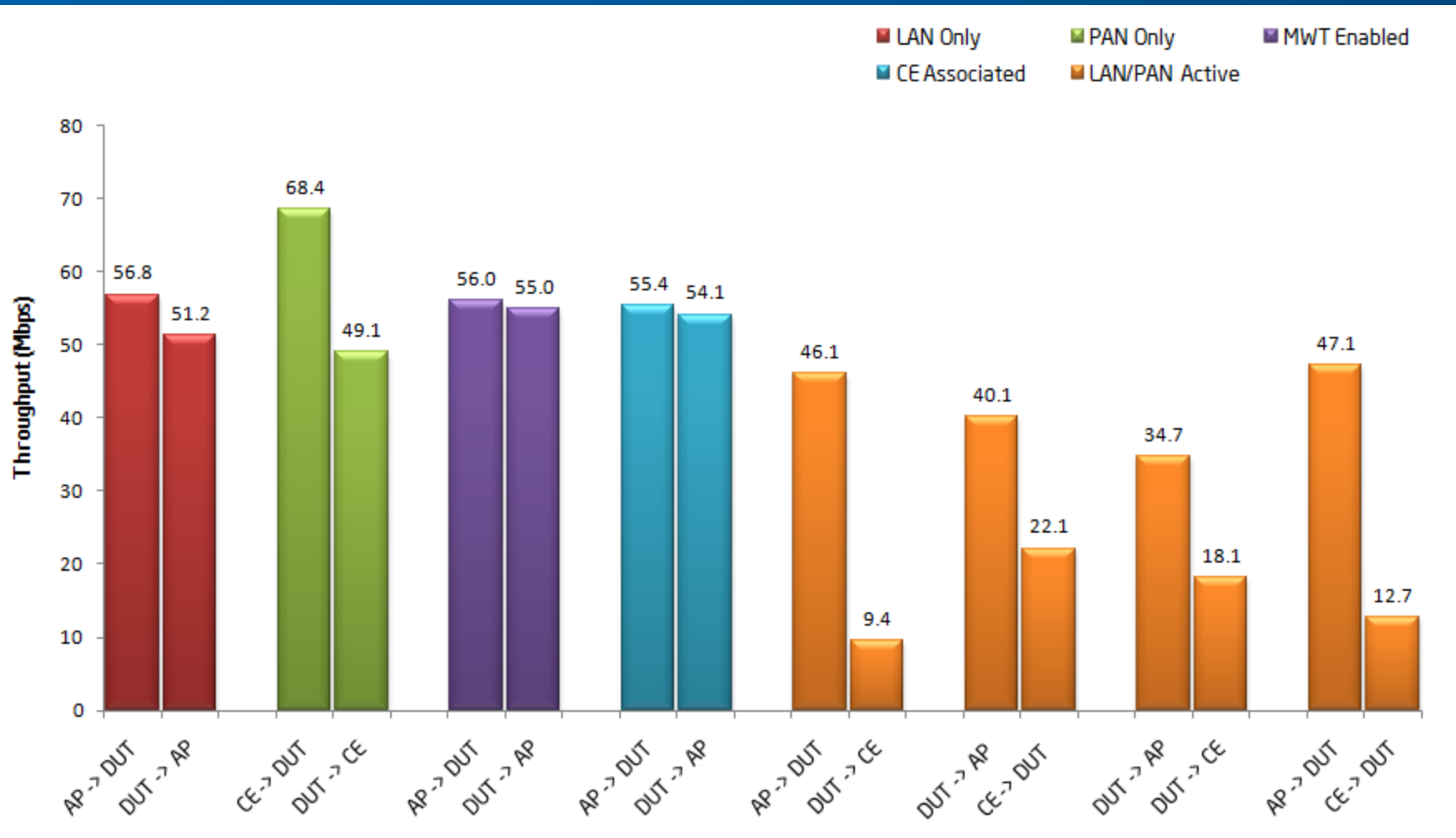
# Test Case Overview

- LAN Only
  - Baseline test case
  - My WiFi (MWT/PAN) disabled
- PAN only
  - LAN off, only PAN traffic
- MWT Enabled
  - MWT enabled but no CE devices attached
- CE Associated
  - One CE device associated but no PAN traffic
- LAN/PAN active
  - BSS and PAN passing traffic simultaneously
  - CE device LOS to Cliffside
- Test Locations
  - AP: AP1
  - DUT: L10; CE: L11



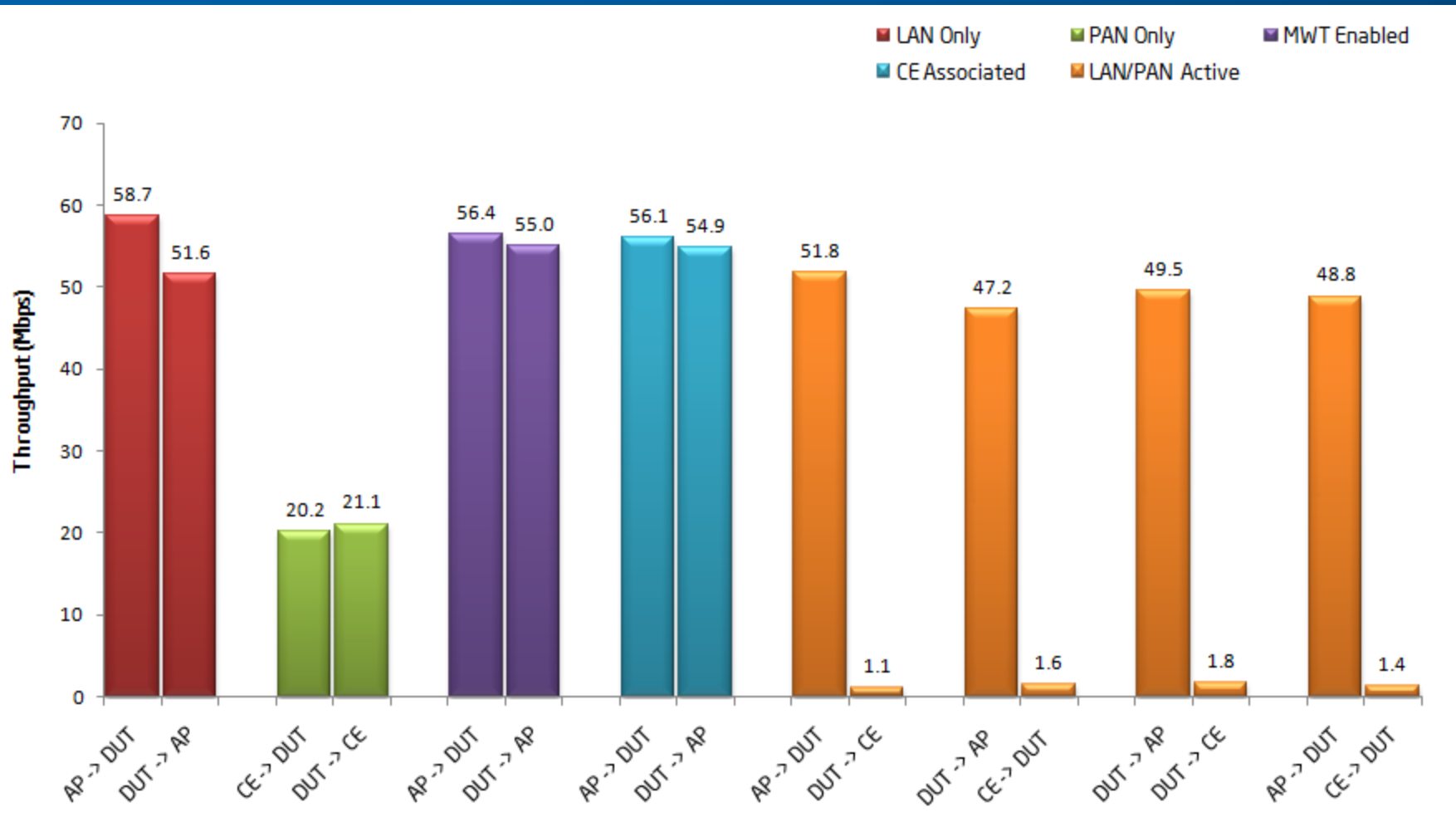
# Intel® 1000 My WiFi Technology OTA Performance

2.4GHz/CH6/20MHz, LAN 802.11n/PAN 802.11n, Linksys E3000, Win7 64



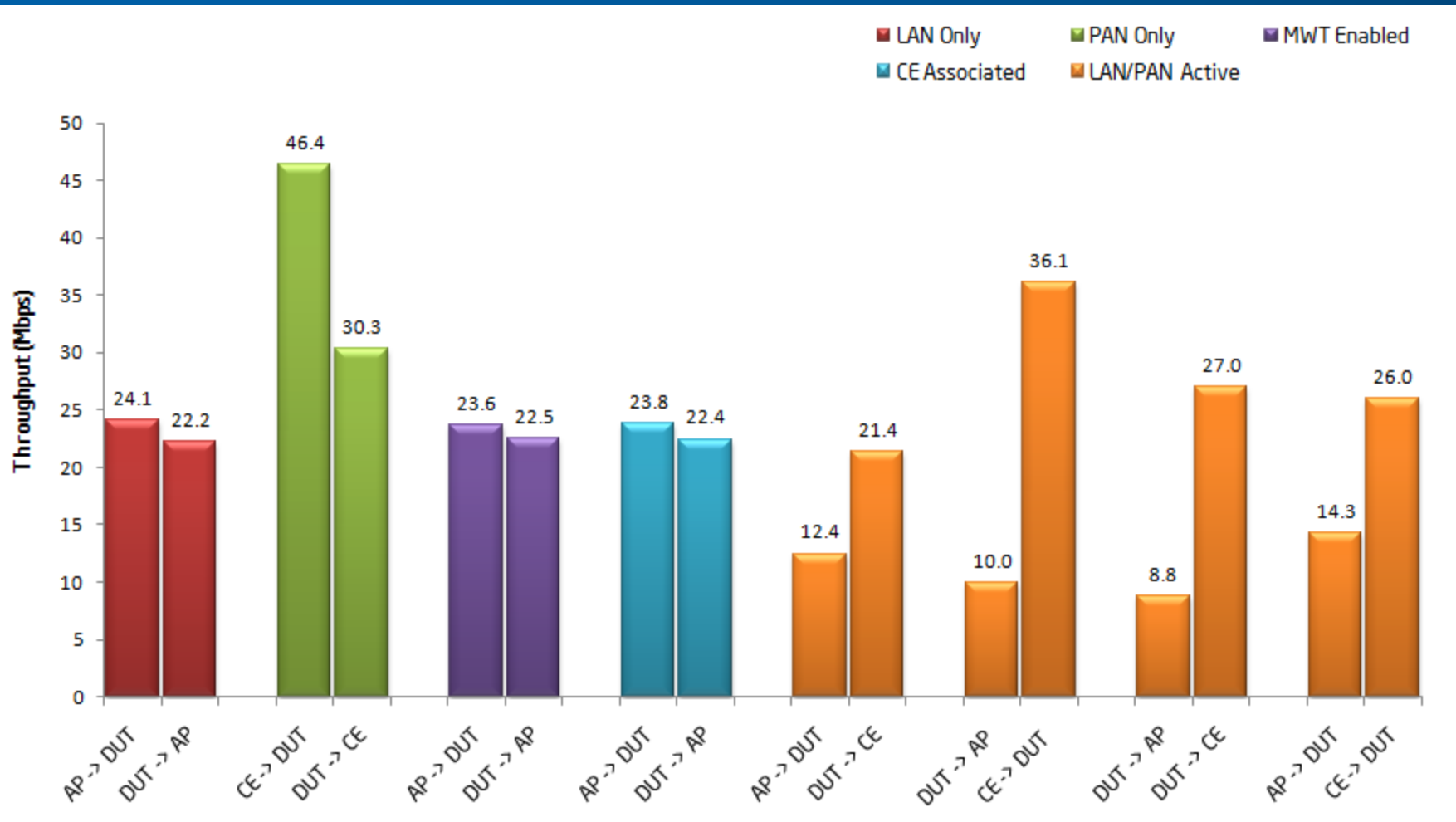
# Intel® 1000 My WiFi Technology OTA Performance

2.4GHz/CH6/20MHz, LAN 802.11n/PAN 802.11g, Linksys E3000, Win7 64



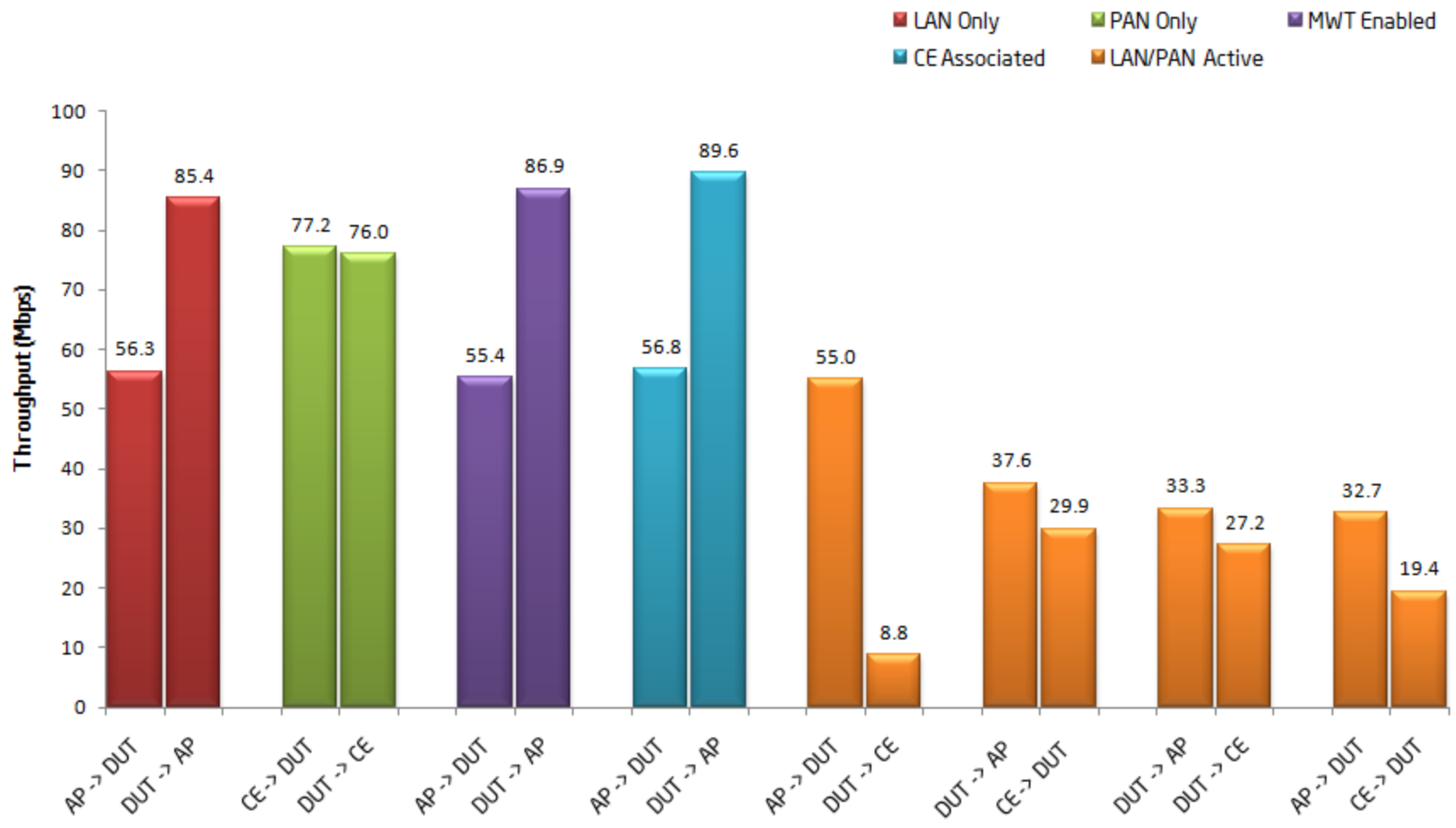
# Intel® 1000 My WiFi Technology OTA Performance

2.4GHz/CH6/20MHz, LAN 802.11g/PAN 802.11n, Linksys E3000, Win7 64



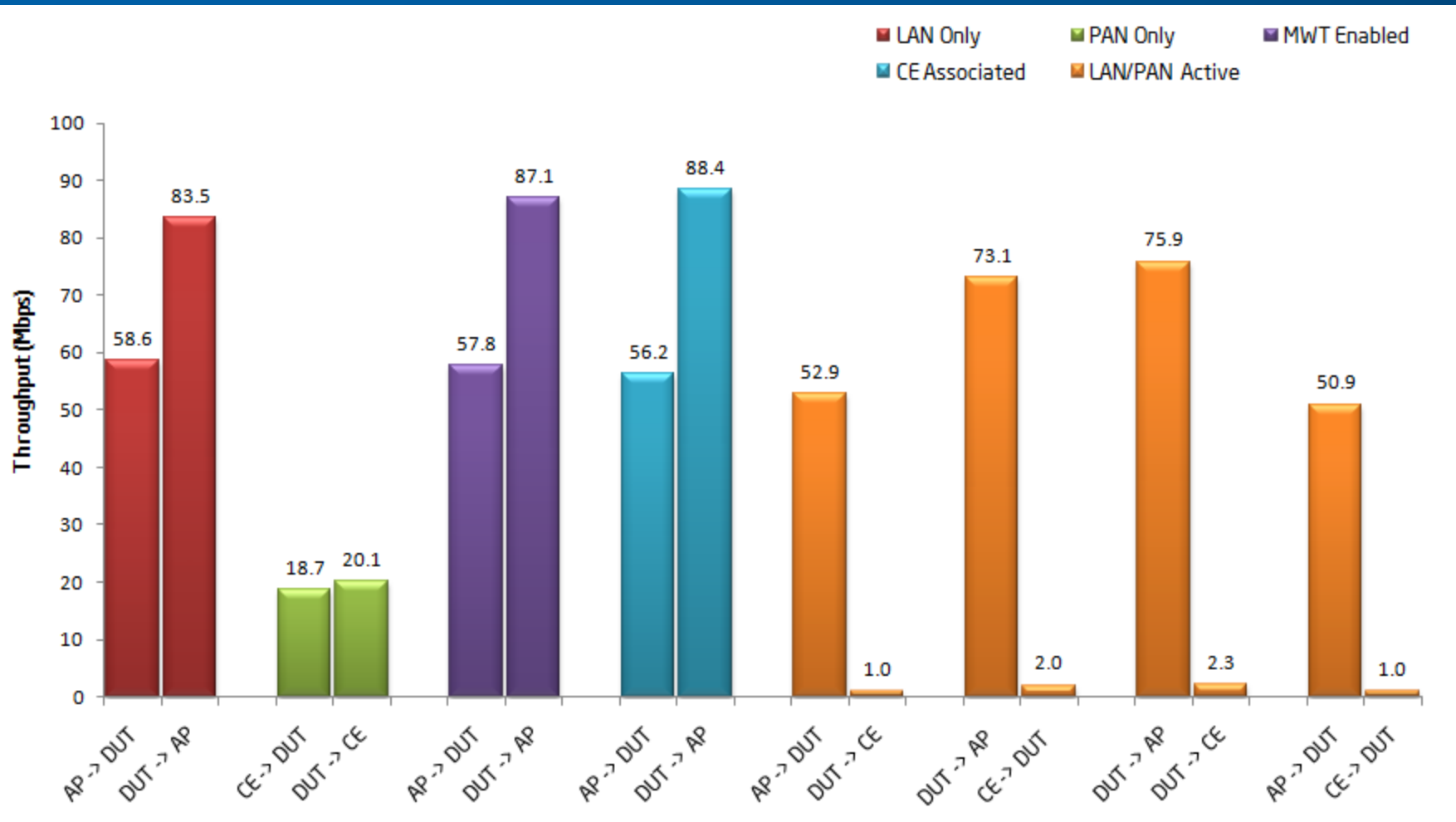
# Intel® 6200 My WiFi Technology OTA Performance

2.4GHz/CH6/20MHz, LAN 802.11n/PAN 802.11n, Linksys E3000, Win7 64



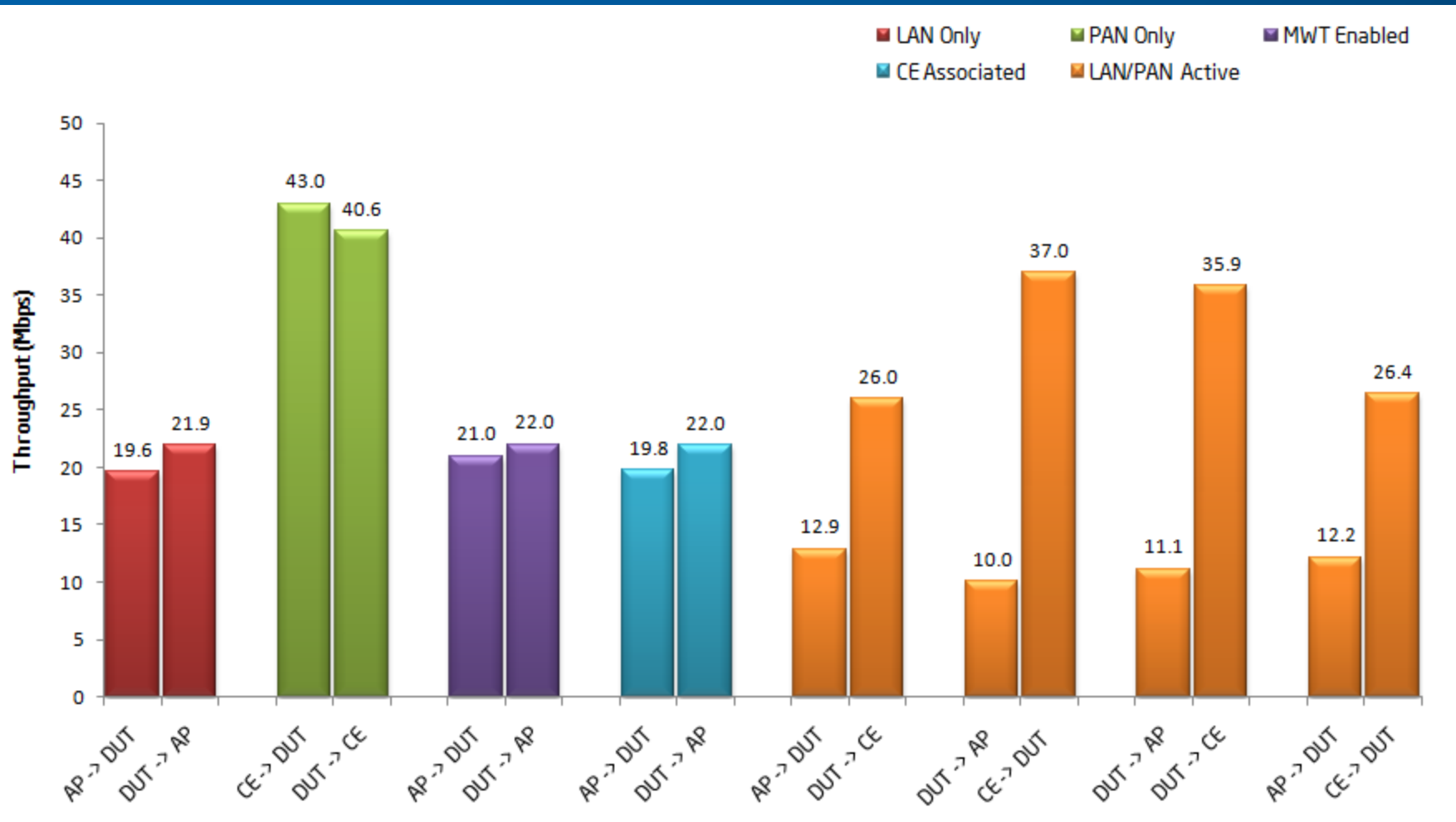
# Intel® 6200 My WiFi Technology OTA Performance

2.4GHz/CH6/20MHz, LAN 802.11n/PAN 802.11g, Linksys E3000, Win7 64



# Intel® 6200 My WiFi Technology OTA Performance

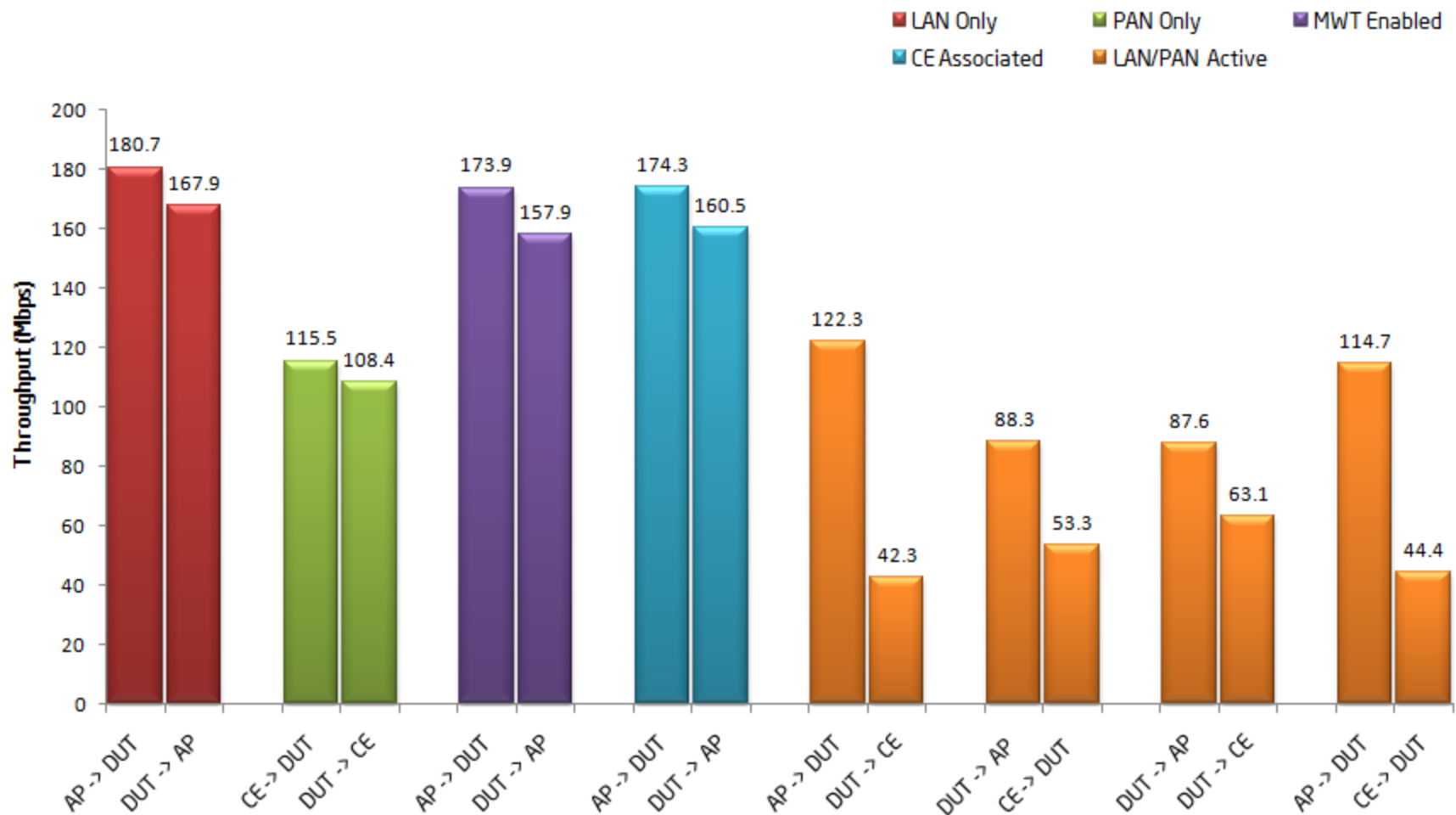
2.4GHz/CH6/20MHz, LAN 802.11g/PAN 802.11n, Linksys E3000, Win7 64





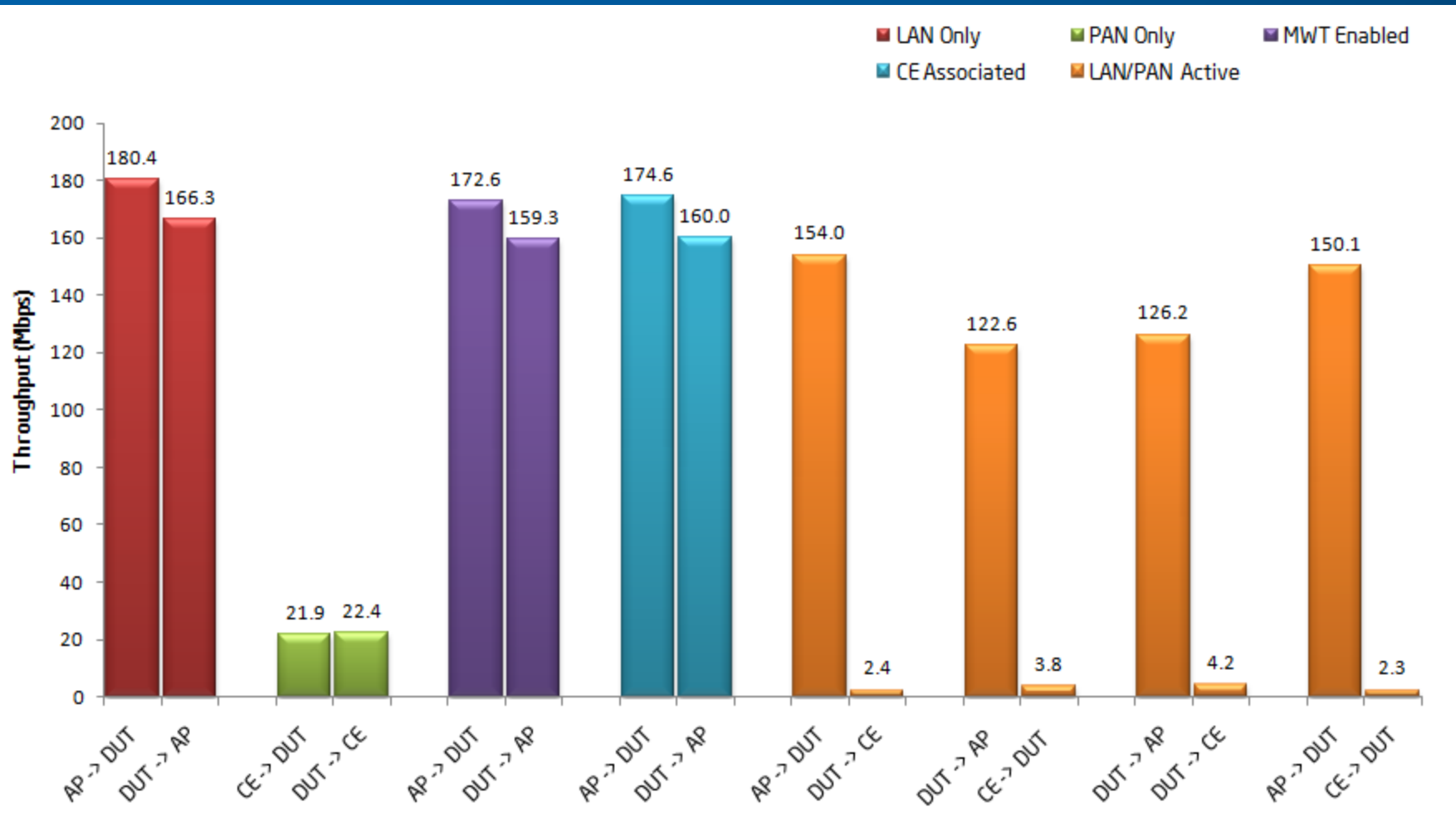
# Intel® 6200 My WiFi Technology OTA Performance

5GHz/CH36/40MHz, LAN 802.11n/PAN 802.11n, Linksys E3000, Win7 64



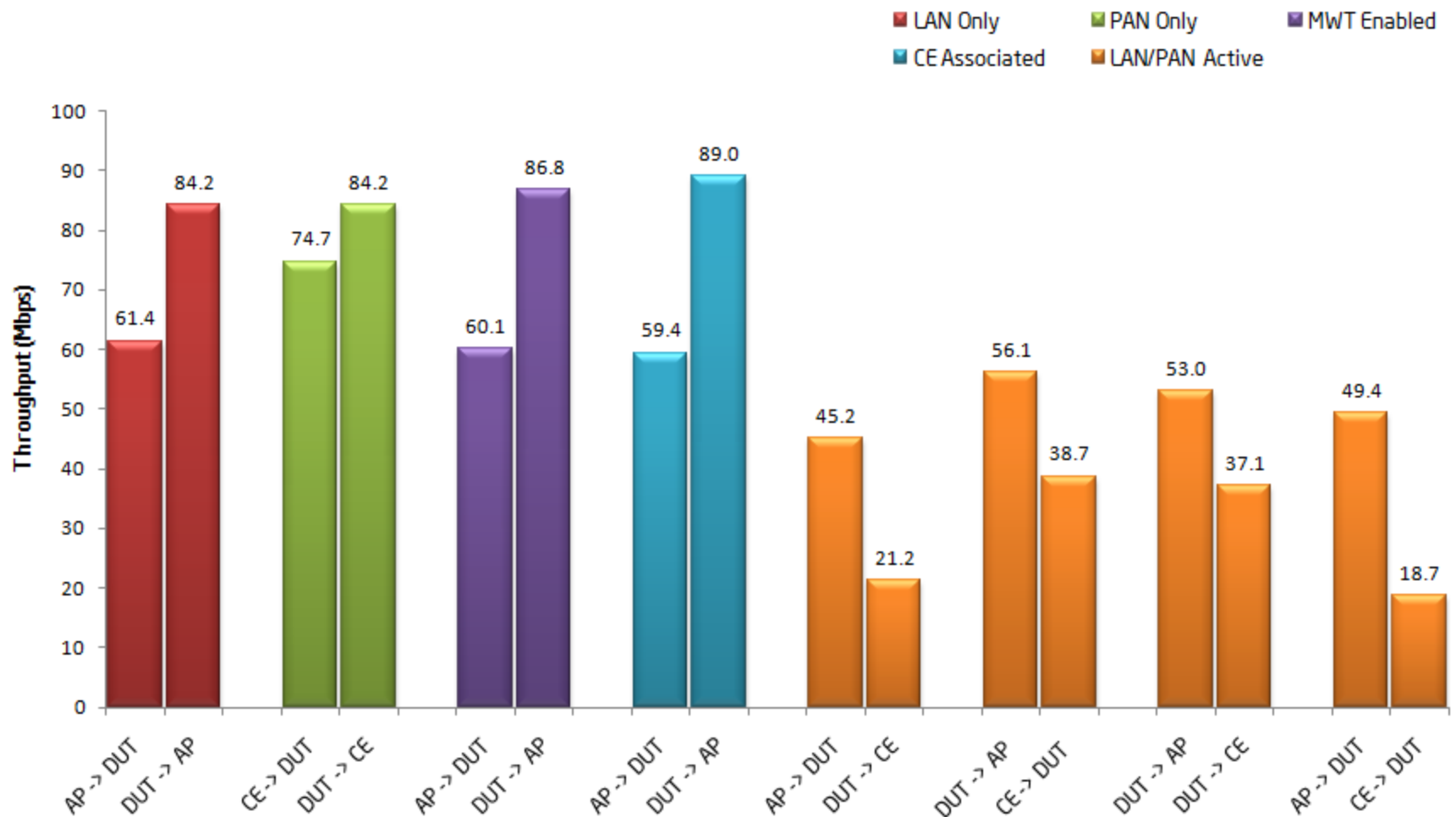
# Intel® 6200 My WiFi Technology OTA Performance

5GHz/CH36/40MHz, LAN 802.11n/PAN 802.11a, Linksys E3000, Win7 64



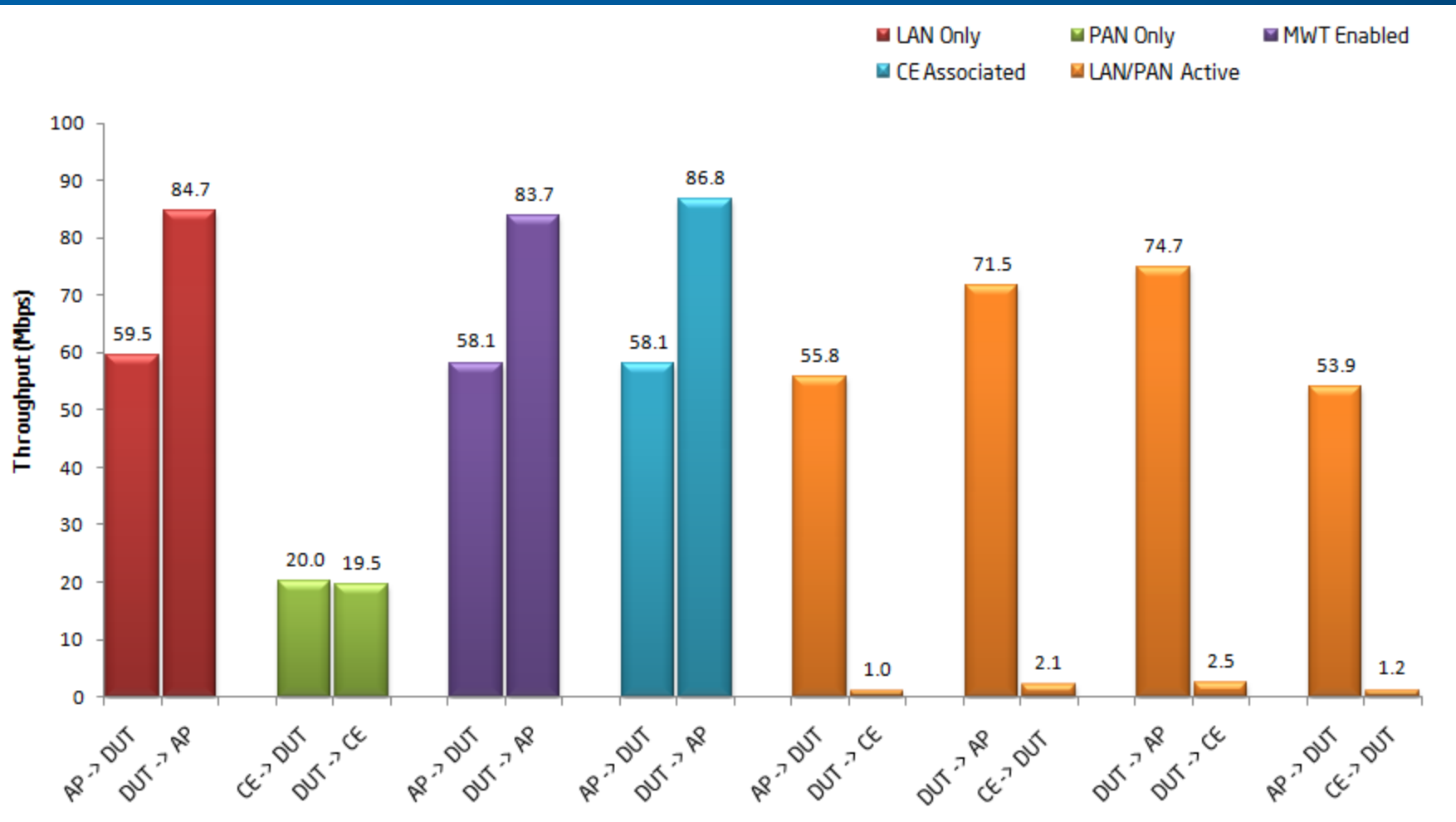
# Intel® 6300 My WiFi Technology OTA Performance

2.4GHz/CH6/20MHz, LAN 802.11n/PAN 802.11n, Linksys E3000, Win7 64



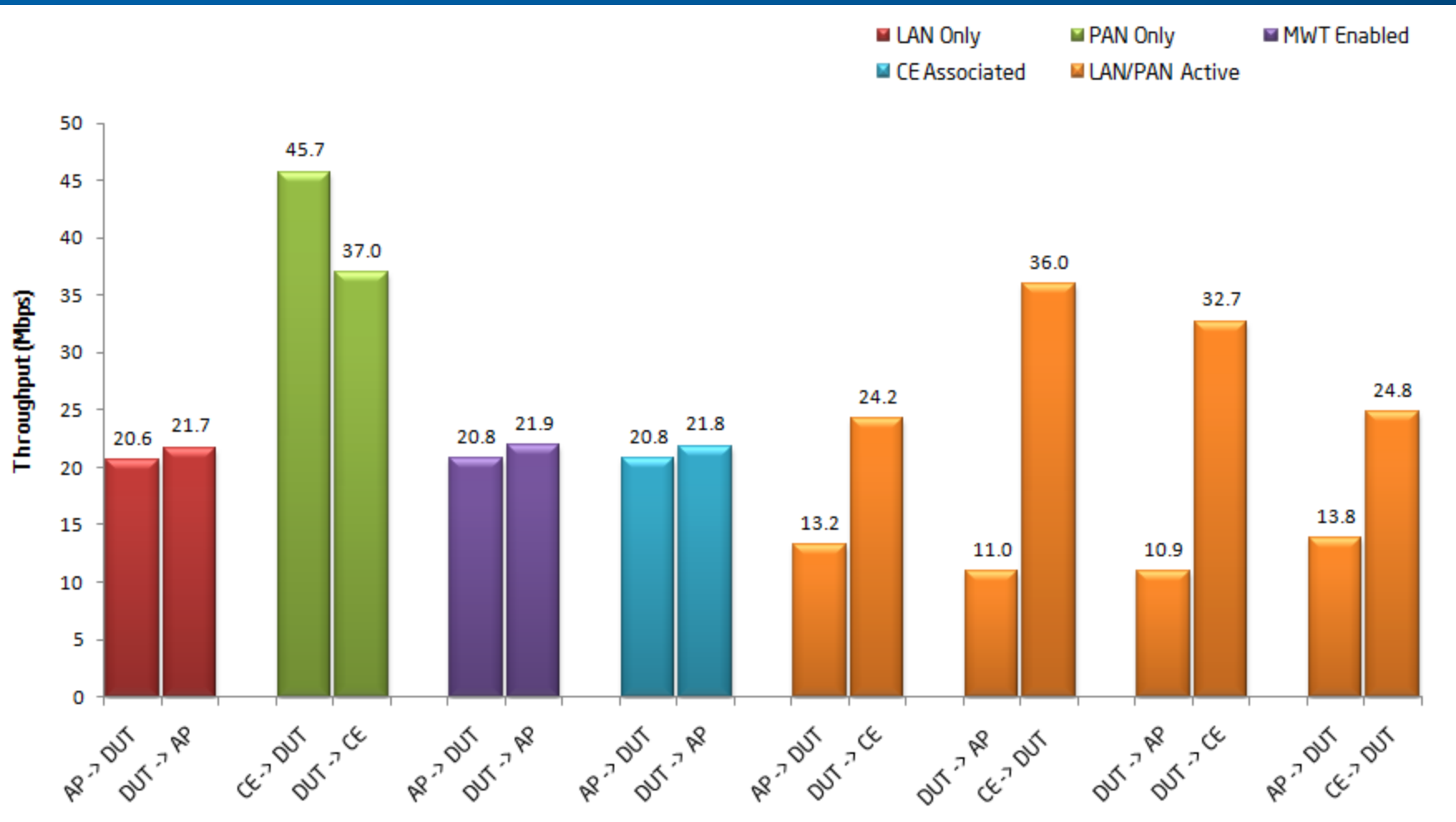
# Intel® 6300 My WiFi Technology OTA Performance

2.4GHz/CH6/20MHz, LAN 802.11n/PAN 802.11g, Linksys E3000, Win7 64



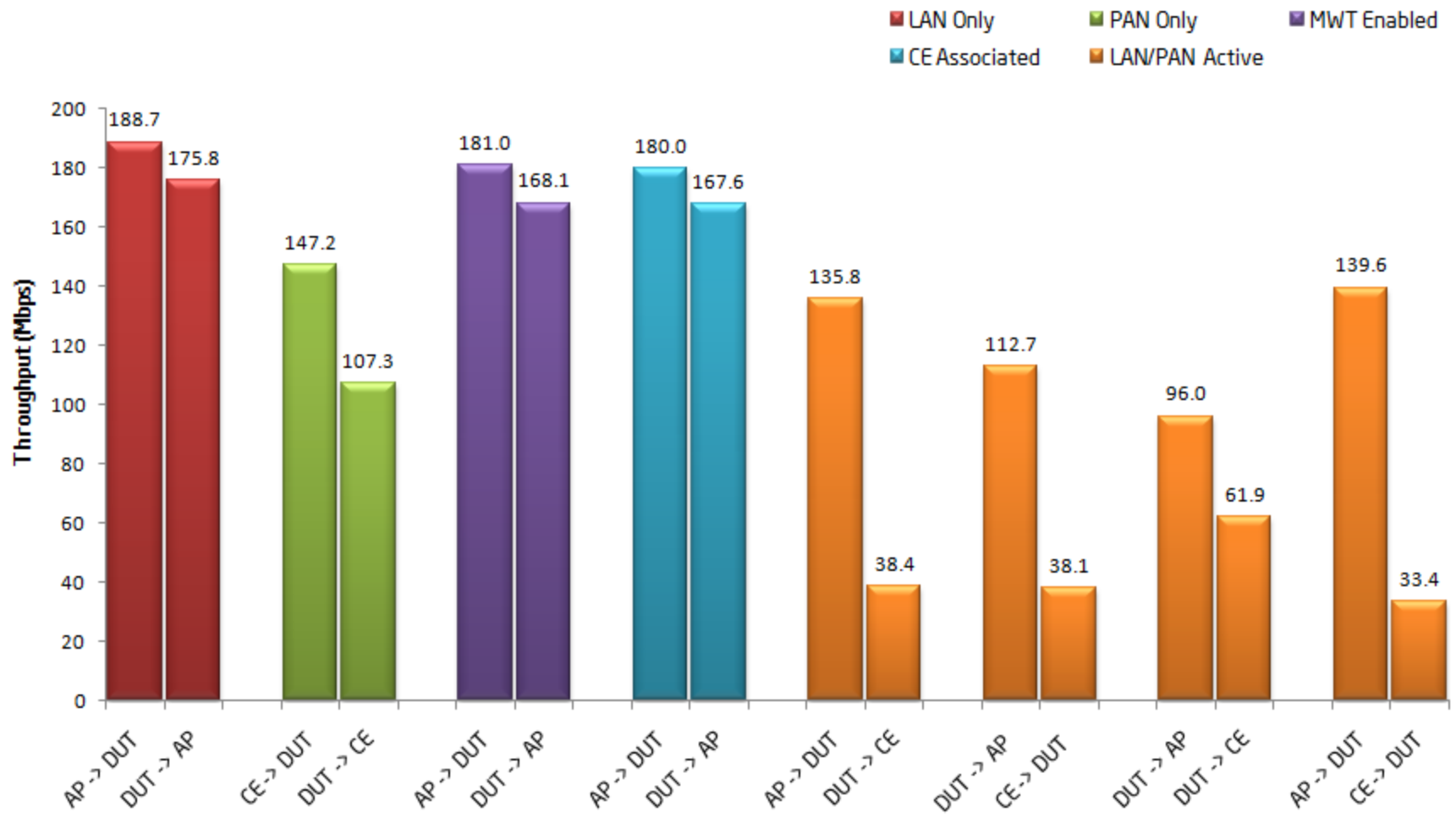
# Intel® 6300 My WiFi Technology OTA Performance

2.4GHz/CH6/20MHz, LAN 802.11g/PAN 802.11n, Linksys E3000, Win7 64



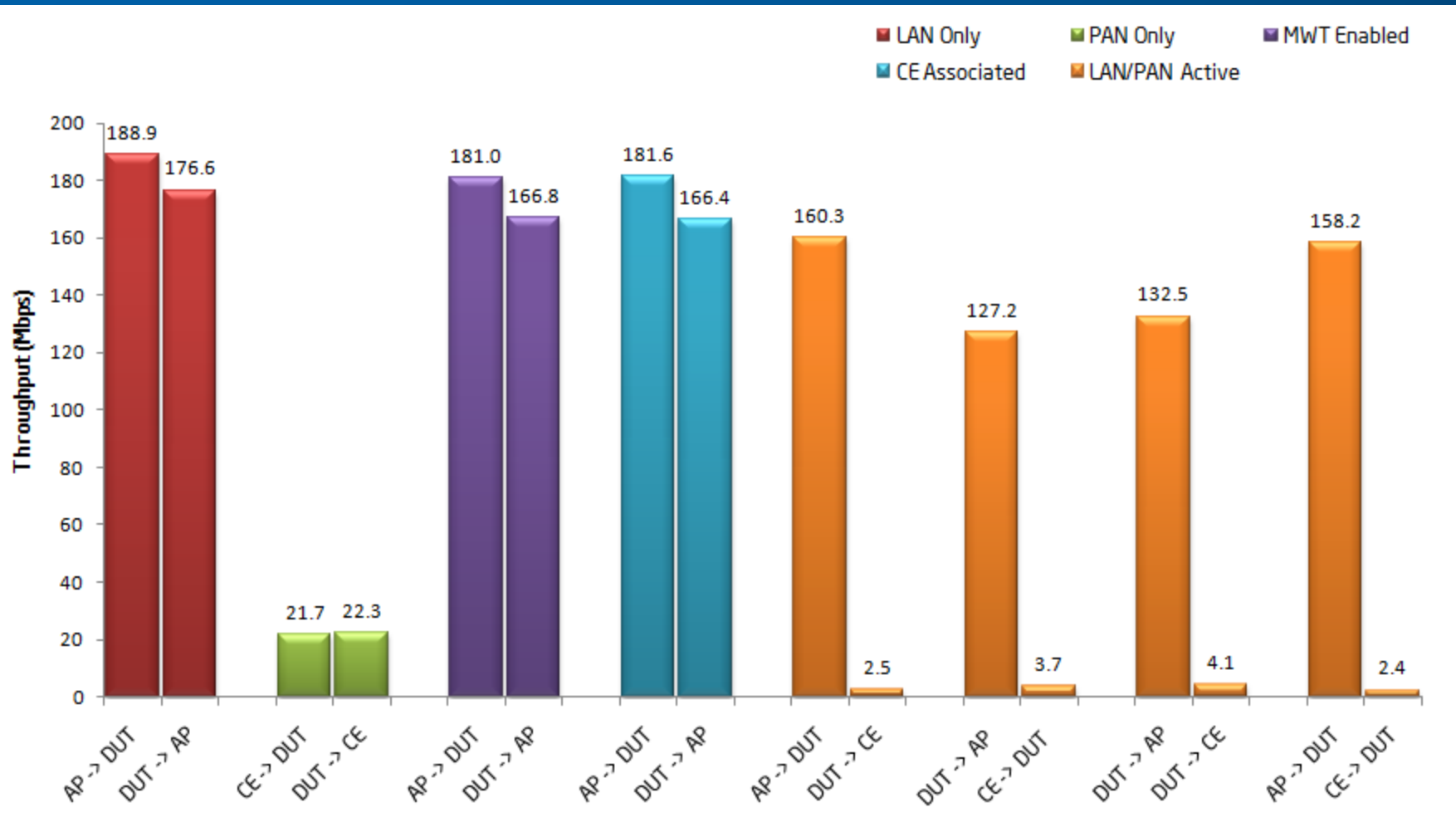
# Intel® 6300 My WiFi Technology OTA Performance

5GHz/CH36/40MHz, LAN 802.11n/PAN 802.11n, Linksys E3000, Win7 64



# Intel® 6300 My WiFi Technology OTA Performance

5GHz/CH36/40MHz, LAN 802.11n/PAN 802.11a, Linksys E3000, Win7 64





# Conductive Performance Data

# Test Case Summary

## Throughput vs. Attenuation (RvR)

Execution falls on the following channels: **11a**; 36 **11b**; 1, **11g**; 6, **11n 2/20**; 11, **11n 5/40**;(44,1).

HT tests are done on 20 MHz and 40 MHz channels

Samples are taken for Unicast (TCP), in 20 second samples every 3 dB until the end of the range when stepping then drops to 1 dB until disconnect

Power scheme set to "Max Performance"(Vista/Win7) or "Always On"(XP)

Points on the X axis are cases in which TCP cannot be passed, but association is still alive

BT adapter disabled

## CPU Utilization

Execution falls on the following channels: **11a**; 36 **11b**; 1, **11g**; 6, **11n 2/20**; 11, **11n 5/40**;(44,1).

Samples are taken for TCP and UDP traffic.

Uplink, downlink and bi-directional traffic are sampled in optimal conditions for 100 seconds.

Measurements are recorded for throughput as well as CPU Utilization with Ixia Chariot.

Power scheme set to "Max Performance"(Vista/Win7)

BT adapter disabled



# Conductive Setup Details

## **Access point used:**

All tests done on Cisco® 1252(2x3) Firmware: 12.4(10b)JDA

## **Device under test:**

Intel Centrino® Ultimate-N 6300

Intel Centrino® Advanced-N 6200

Intel Centrino® Advanced-N + WiMAX 6250

Intel® WiFi Link 1000

Driver: 13.3.0.24

## **Platform:**

Calpella B3 CRB

Processor: Intel® Core™ i5 540 @ 2534 MHz, 2 Cores, 4 Logical Processors

Total Physical Memory: 2 GB

OS: Microsoft® Win7™ (64-bit)

**Environment:** 9-Port Attenuator (Multipath Configuration), Ramsey® isolation chamber

Traffic: Ixia® Chariot™ Console version 6.2 with Chariot Endpoint version 7

## **Power Consumption Equipment:**

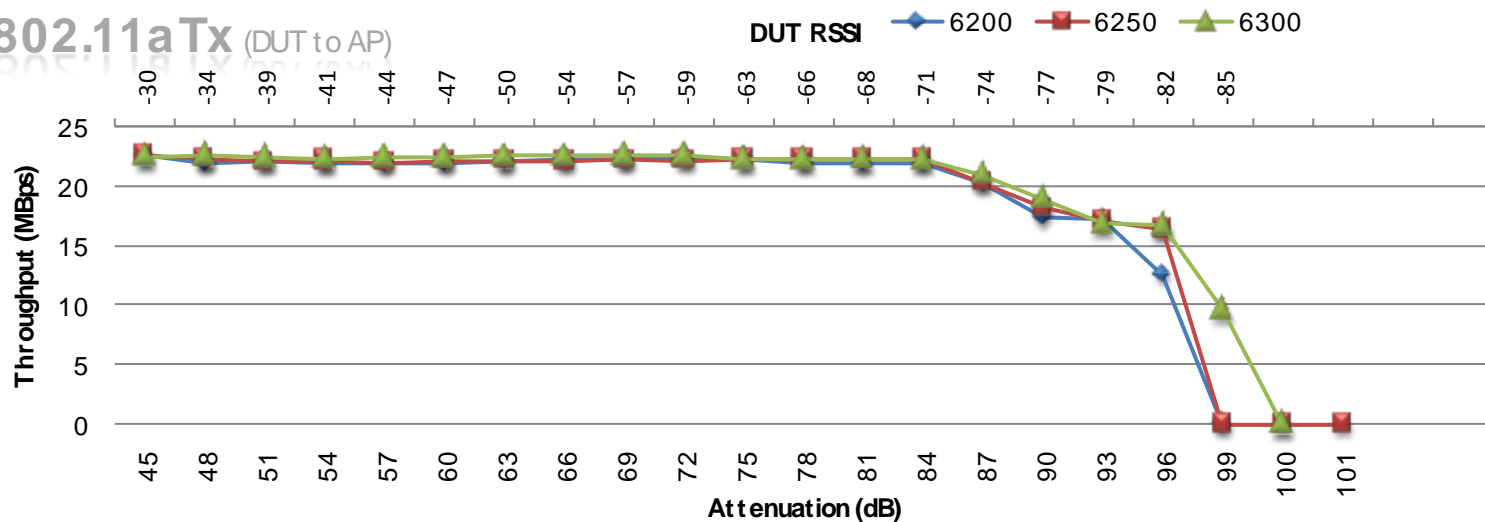
Digital Oscilloscope DPO4054

Current Probes TCP312

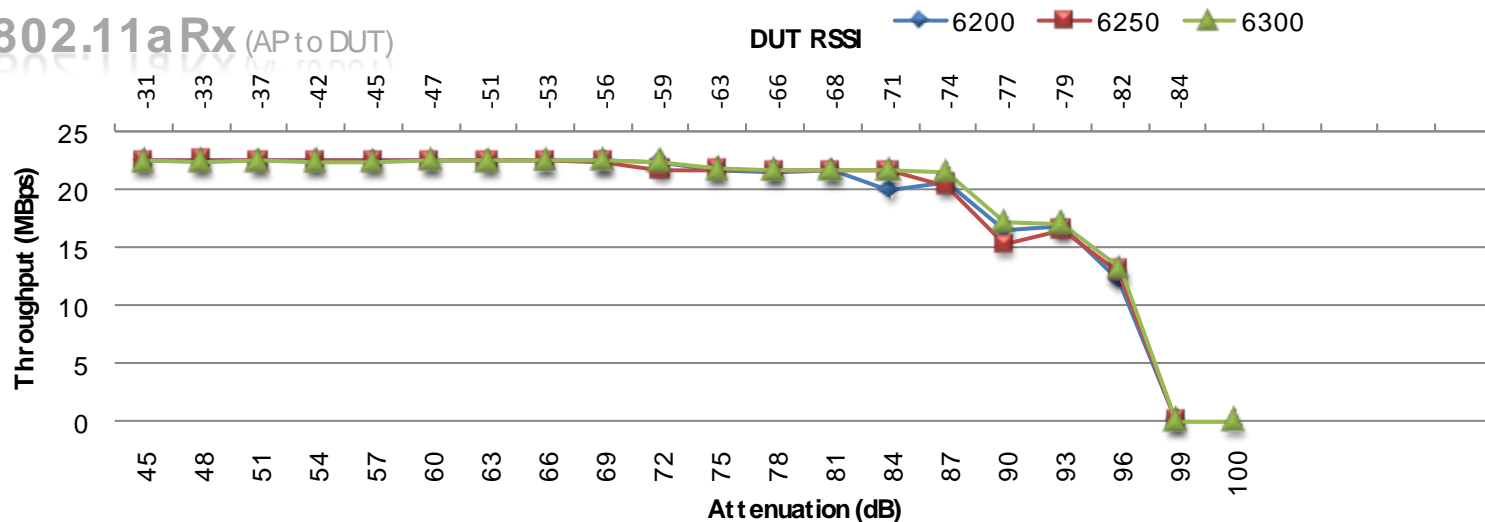
Current Probe Amplifier TCPA300

# 802.11a

## 802.11aTx (DUT to AP)

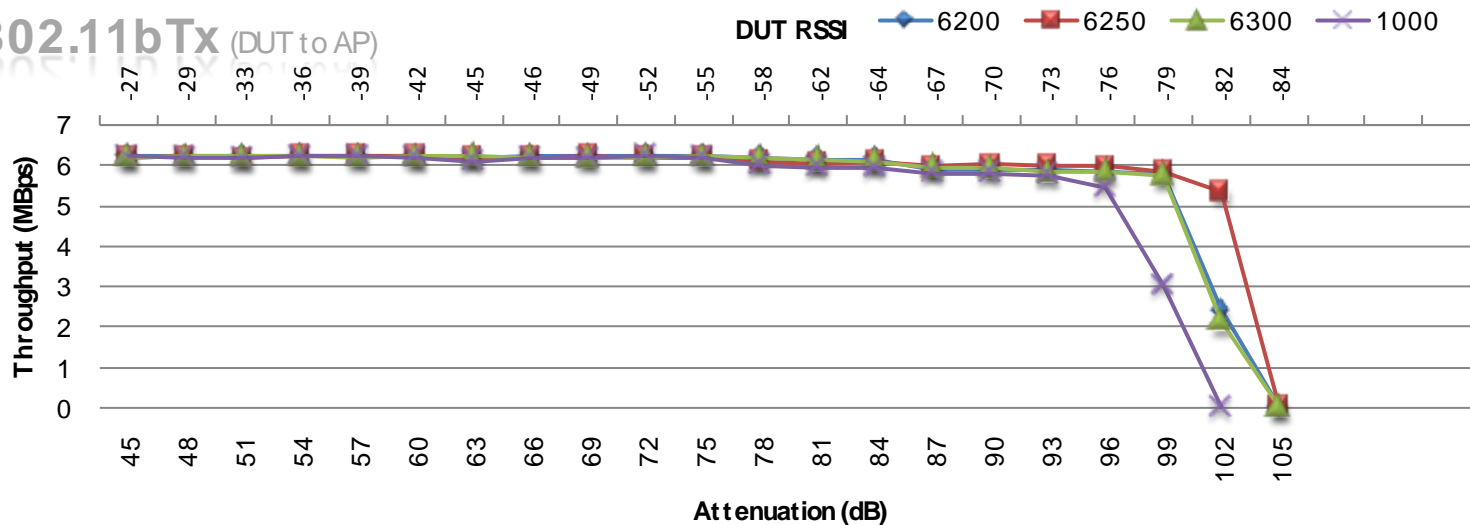


## 802.11aRx (AP to DUT)

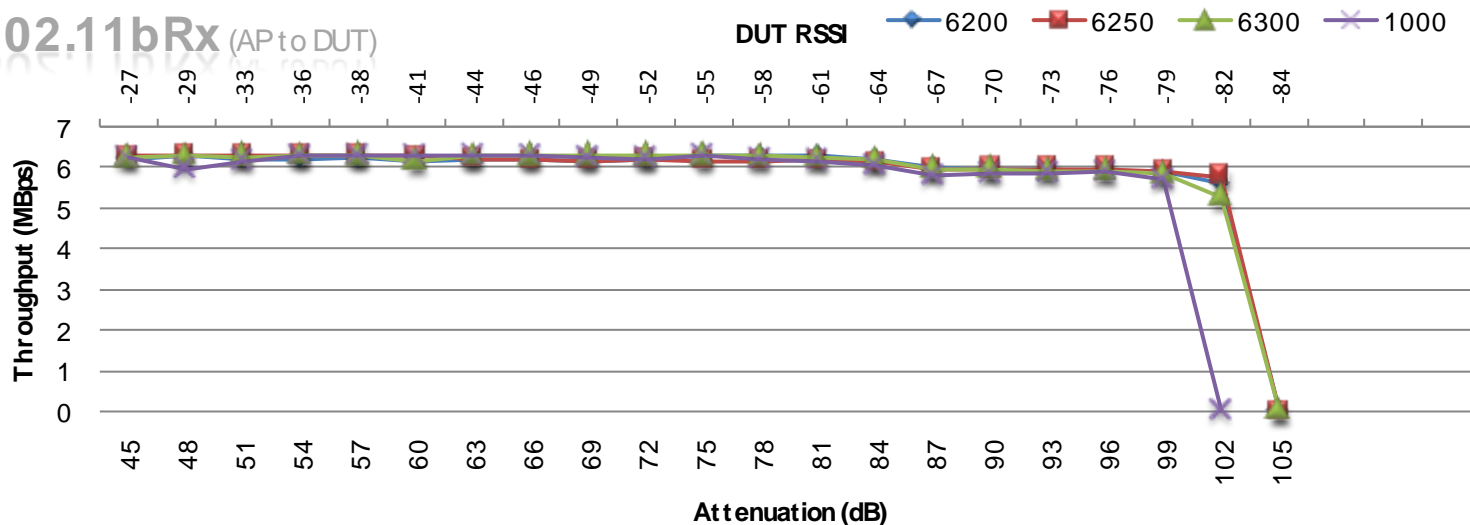


# 802.11b

## 802.11bTx (DUT to AP)

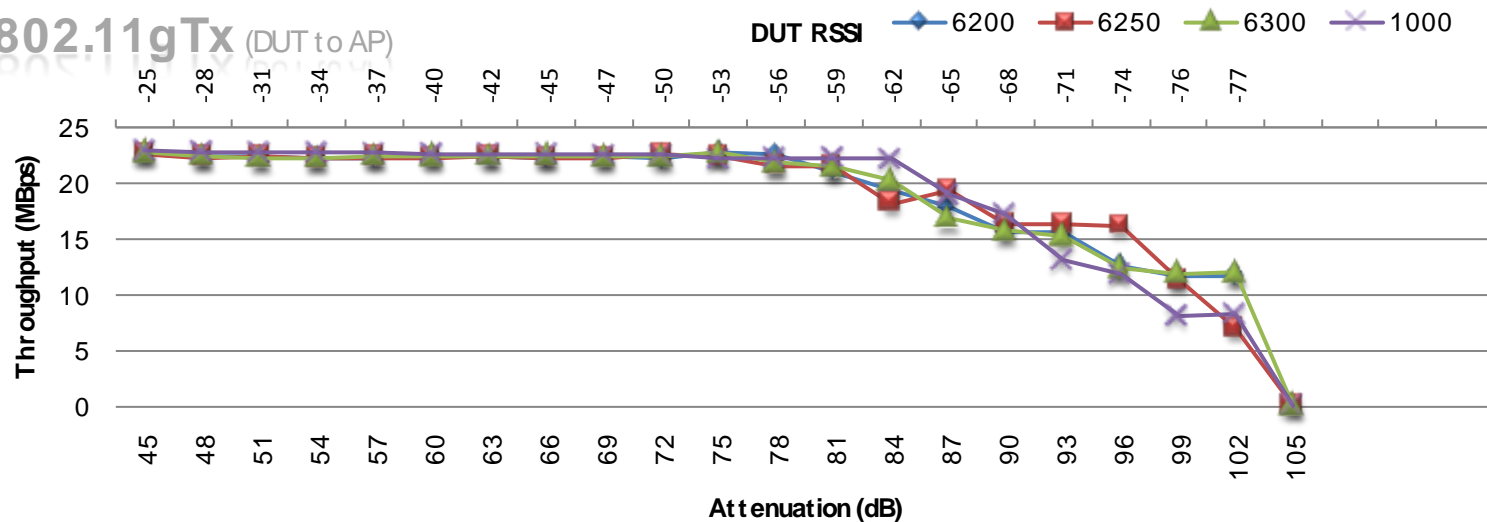


## 802.11bRx (AP to DUT)

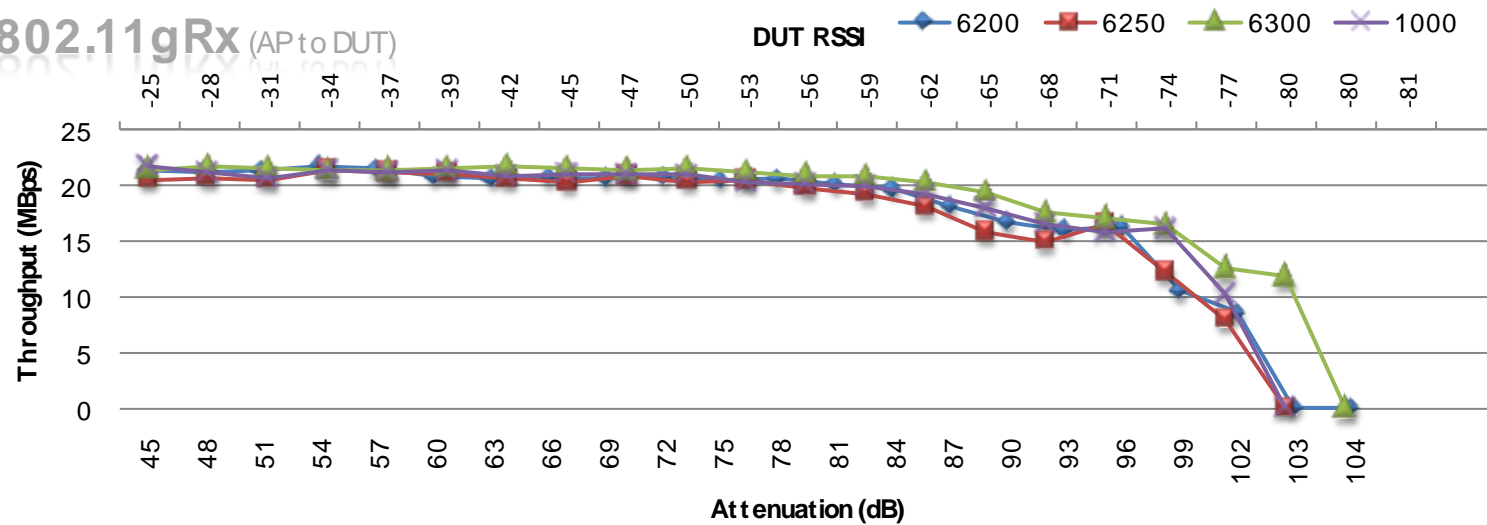


# 802.11g

## 802.11gTx (DUT to AP)

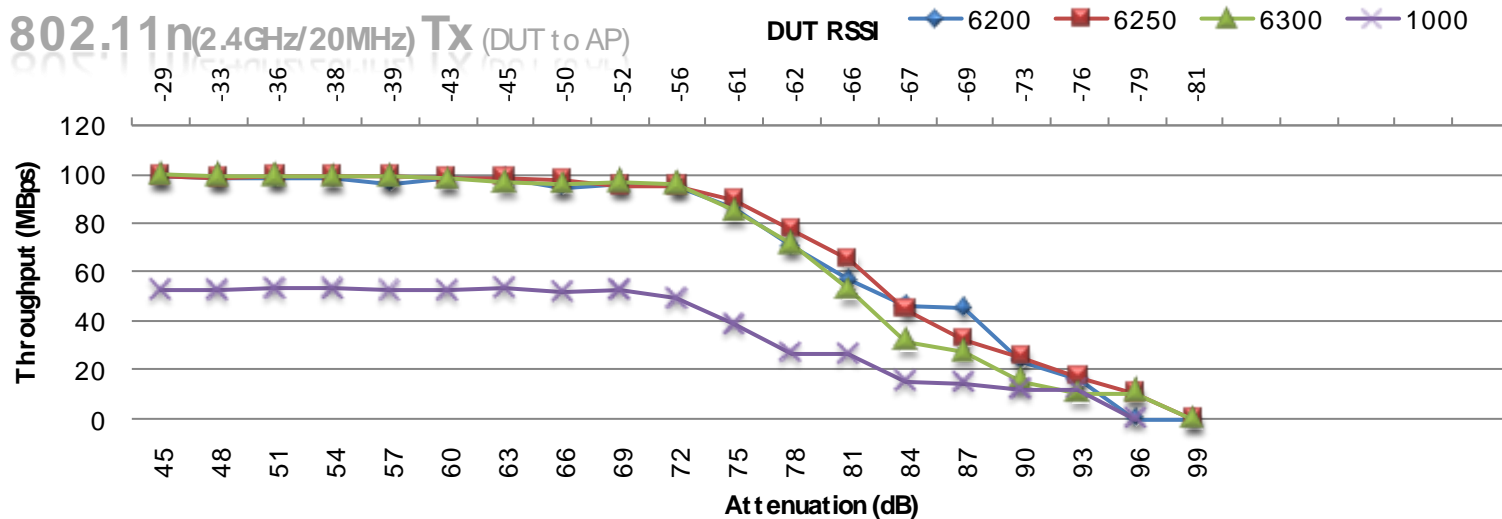


## 802.11gRx (AP to DUT)

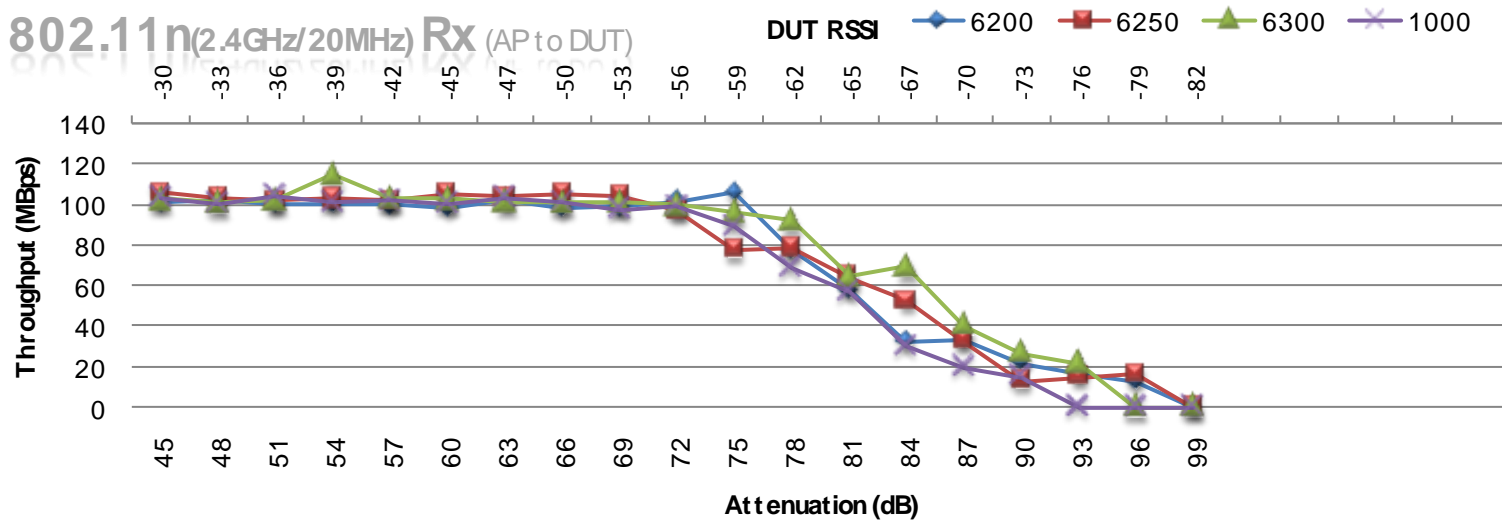


# 802.11n 2.4 GHz/20 MHz

## 802.11n(2.4GHz/20MHz) Tx (DUT to AP)



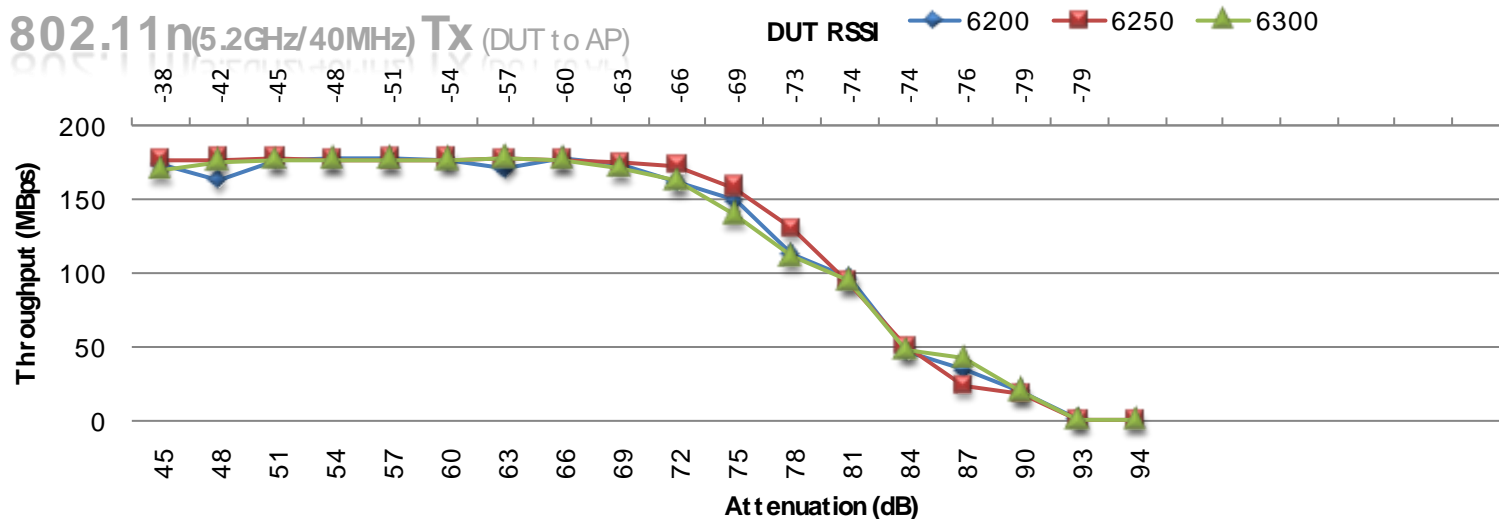
## 802.11n(2.4GHz/20MHz) Rx (AP to DUT)



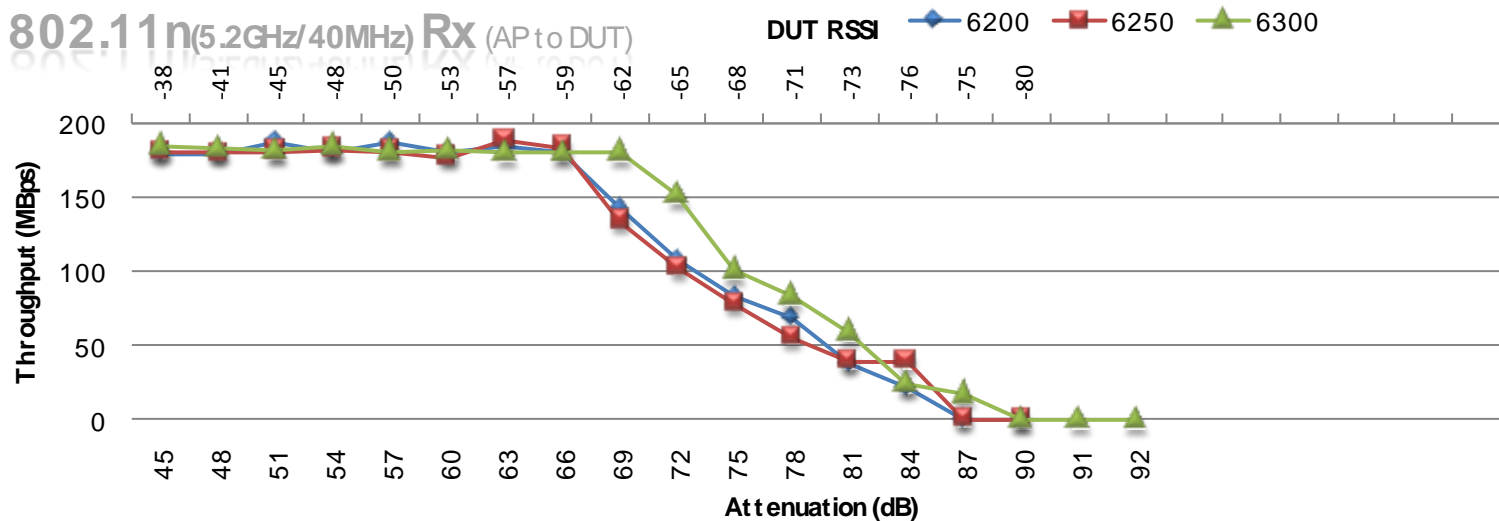


# 802.11n 5.2 GHz/40 MHz

802.11n(5.2GHz/40MHz) Tx (DUT to AP)



802.11n(5.2GHz/40MHz) Rx (AP to DUT)



# WiFi Power Consumption Performance Data

# WiFi Power Consumption Test Environment

## Test environment: Conductive

- AP configuration: DTIM = 3 and beacon interval = 100mS
- Tests are performed at 3.3V and 25°C for all wireless bands
- Margin of error: Tx/Rx states  $\approx 5\%$ , low power states  $\approx 9$  mW
- 8 mW overage of POR allowed due to probe drift
- PSP5 Max Power Savings for all measurements

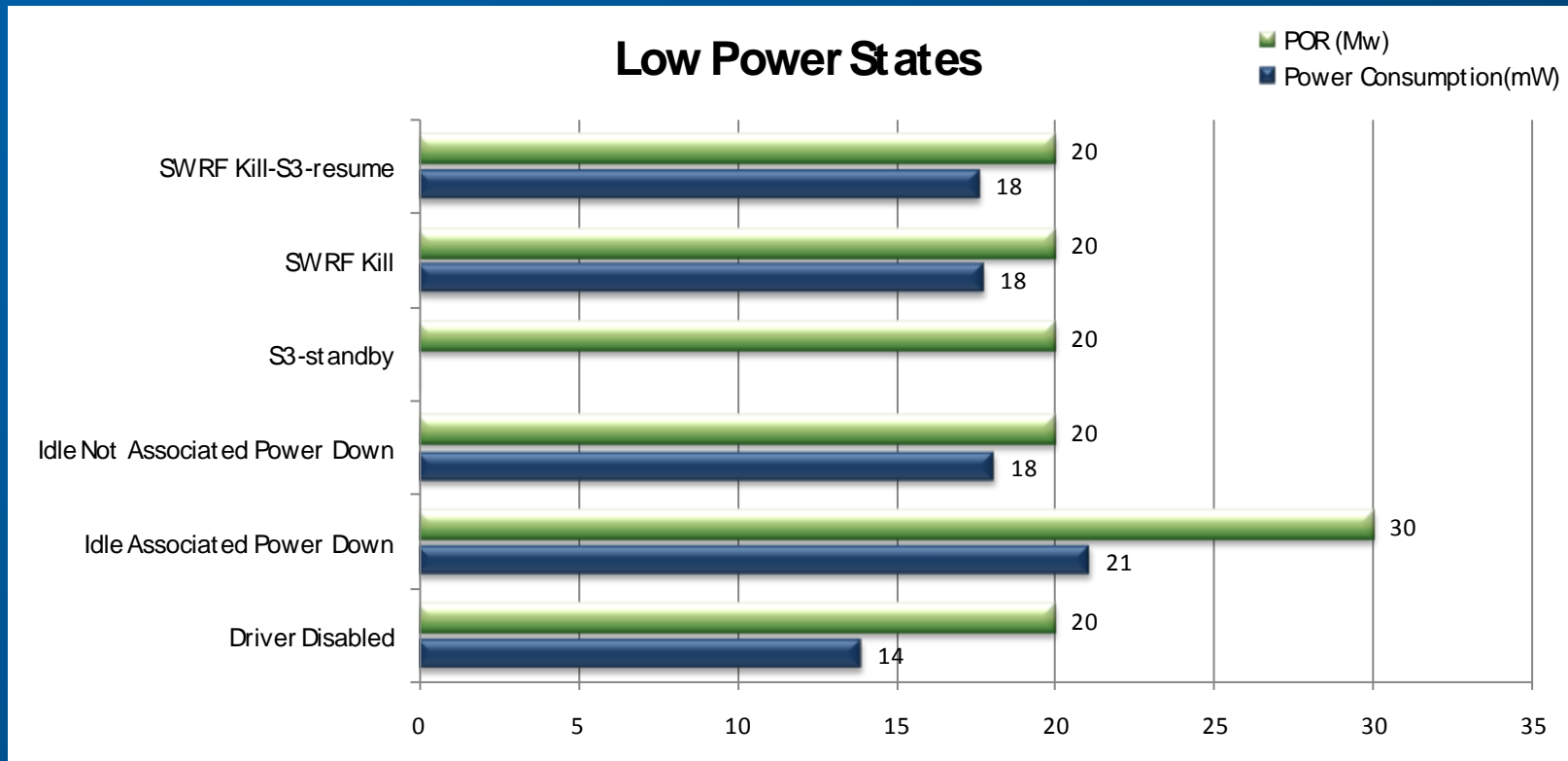
# WiFi Power Consumption Idle States

<i>State</i>	<i>Description</i>
<b>Idle Associated</b>	Average power consumption DUT is idle, associated and scanning periodically. There is no network traffic and the station is not busy. The station wakes up once in a while to check if any data is waiting. Power level = PSP5 DTIM = 3 Measurements completed with 11n AP.
<b>Idle Not Associated</b>	Average power consumption while station is idle, not associated and scanning periodically. Power level = PSP5 DTIM = 3.
<b>Mobile Mark 2005 Wireless Web Browsing</b>	Average power consumption while station is associated, scanning periodically and downloading 150 KB web pages every 15 seconds. Power level = PSP5. DTIM = 3. Measurements completed with 11n AP.
<b>Wireless Disabled (RF-Kill)</b>	The average power consumption after RF Kill HW/SW is enabled to disable the radio (turn the radio off).

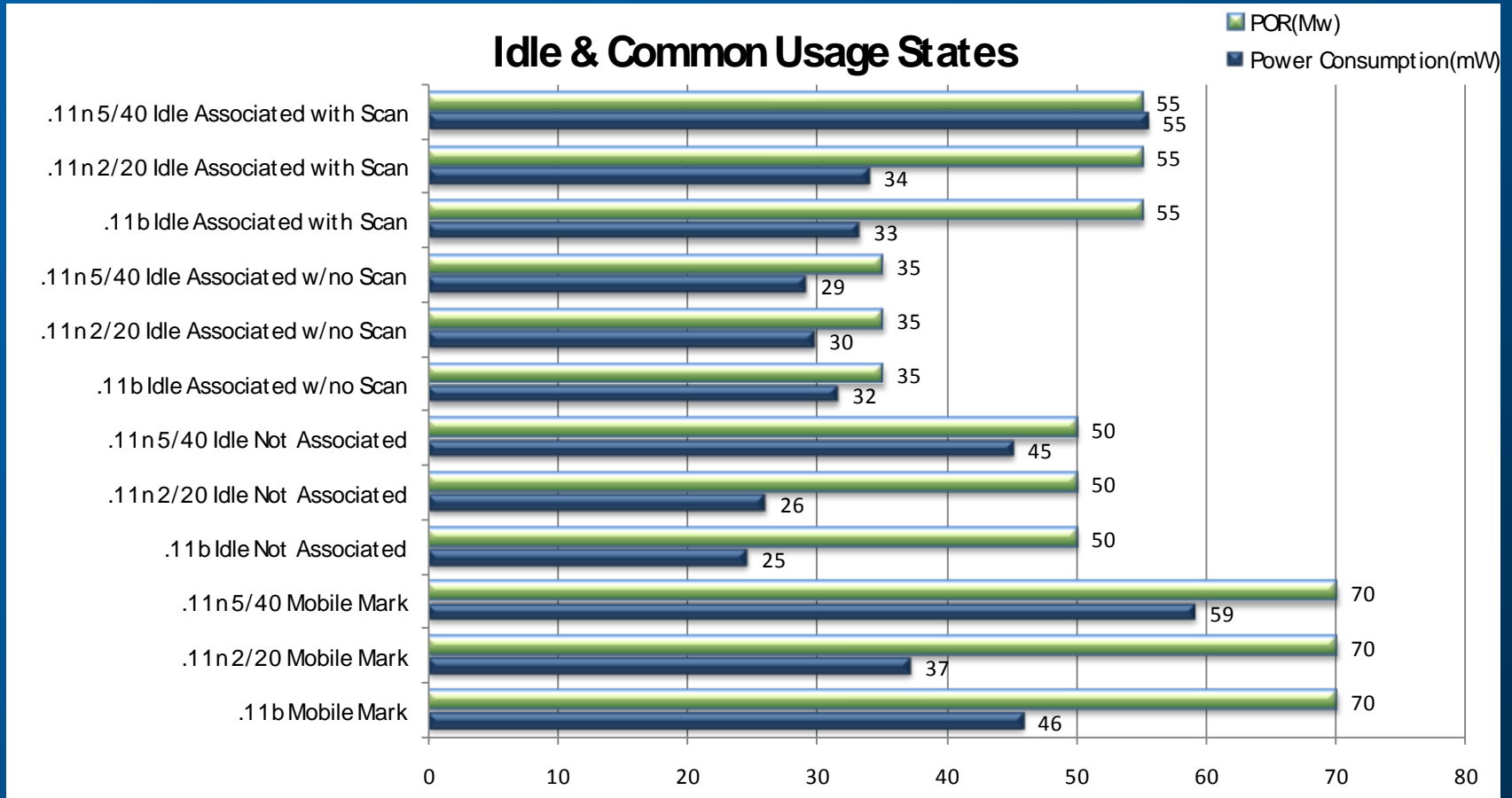
# WiFi Power Consumption Data Transfer States

<i>State</i>	<i>Description</i>
<b>Tx Average - Legacy</b>	Average power consumption while station is transmitting at the maximum throughput. The station is transmitting 1 spatial stream. This is measured using Chariot's throughput script (TCP/IP). Data rate = 48/54 Mbps.
<b>Rx Average - Legacy</b>	Average power consumption while station is receiving at the maximum throughput. The station has one Rx chain active. This is measured using Chariot's throughput script (TCP/IP). Data rate = 48/54 Mbps.
<b>11n Tx Average</b>	Average power consumption while station is transmitting at the maximum throughput in 11n mode. The station is transmitting Three/One spatial streams. This is measured using Chariot's throughput script (TCP/IP). MCS15. 20 & 40 Mhz channels for 2.4 Ghz. 40 Mhz channels for 5.2 Ghz.
<b>11n Rx Average</b>	Average power consumption while station is receiving at the maximum throughput in 11n mode. The station has three/two Rx chains active. This is measured using Chariot's throughput script (TCP/IP). MCS15. 20 & 40 Mhz channels for 2.4 Ghz. 40 Mhz channels for 5.2 Ghz.

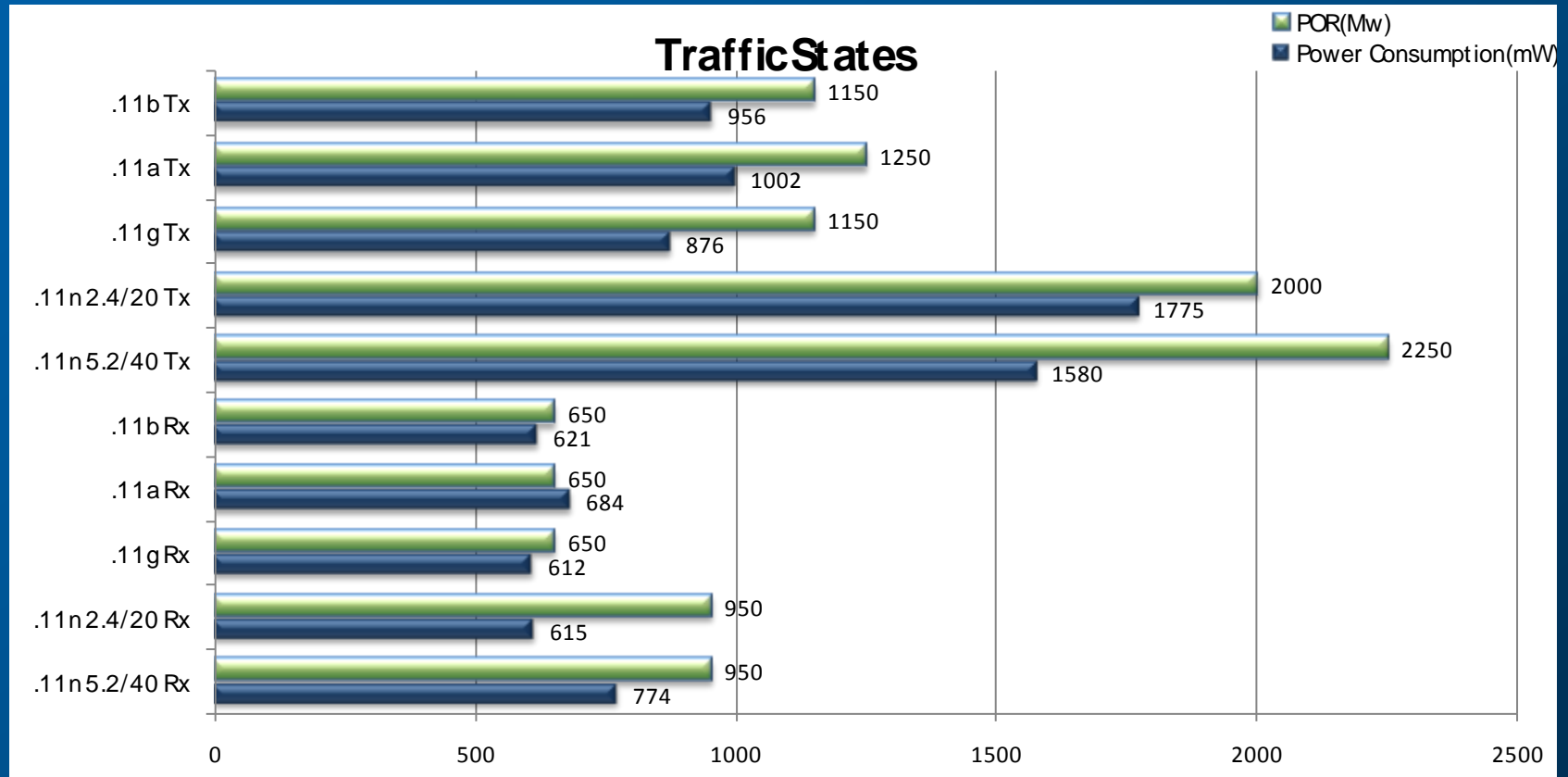
# PC Low Power States – 6200



# PC Idle & Common Usage – 6200

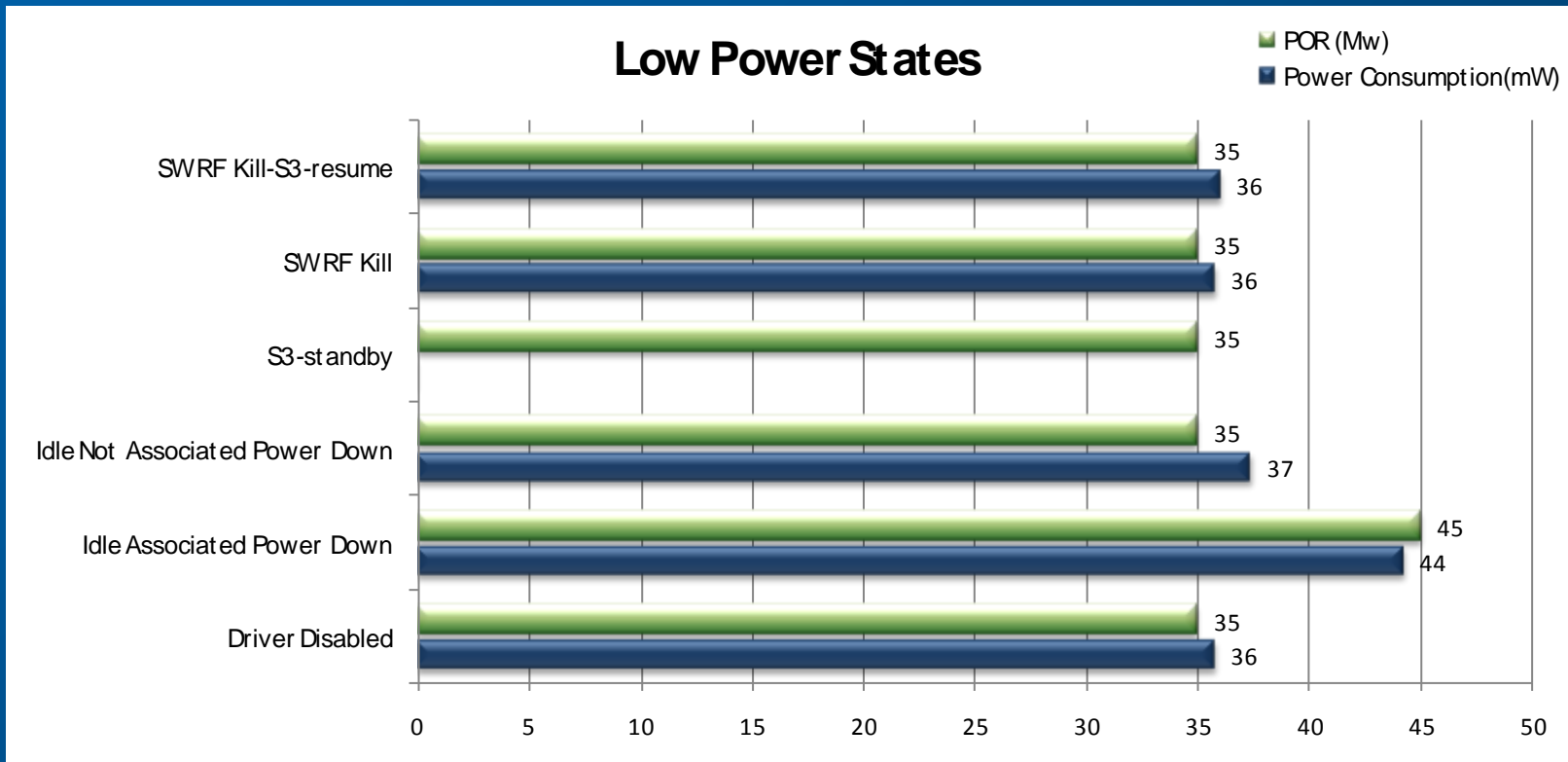


# PC Traffic States – 6200

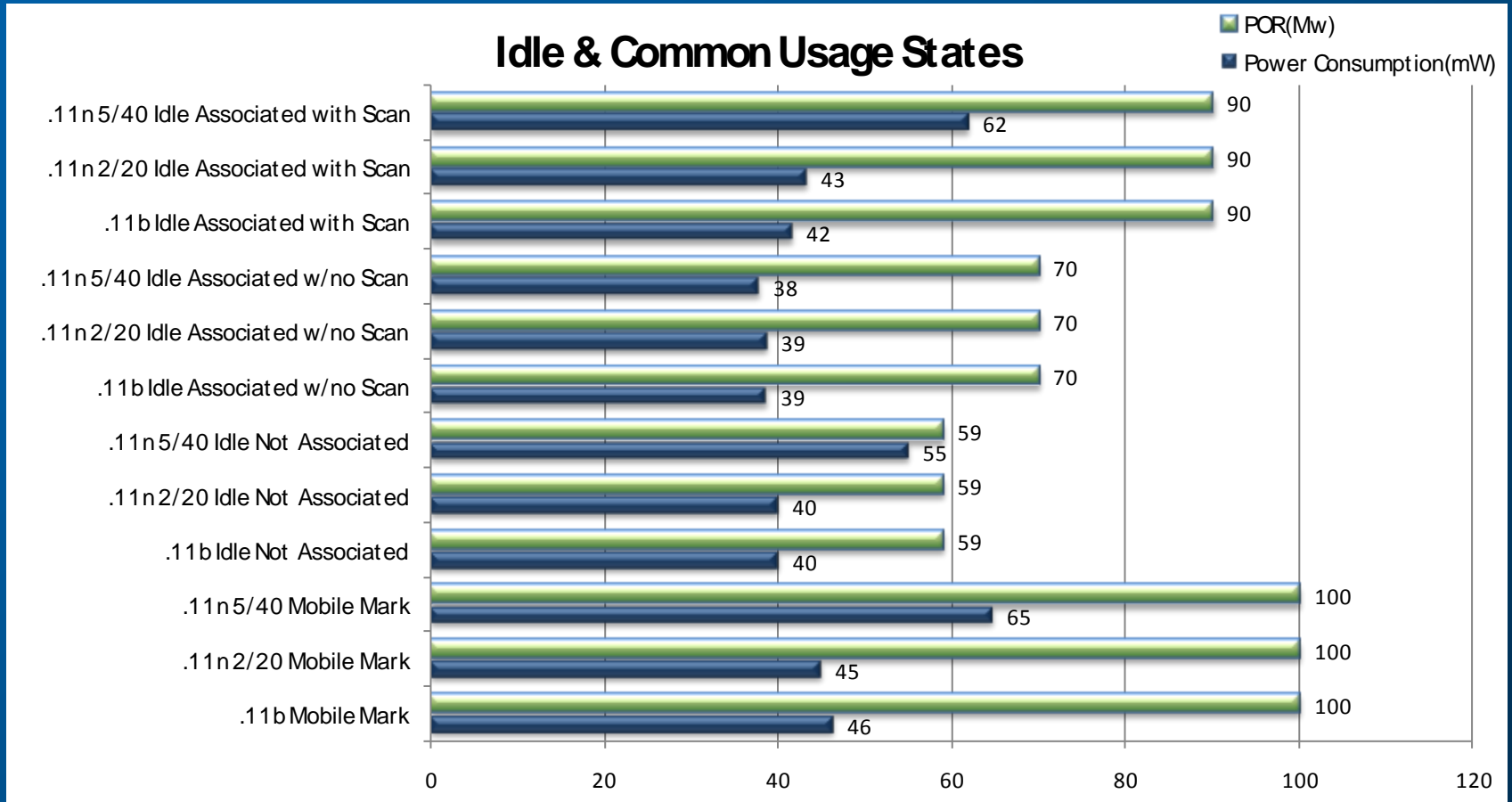




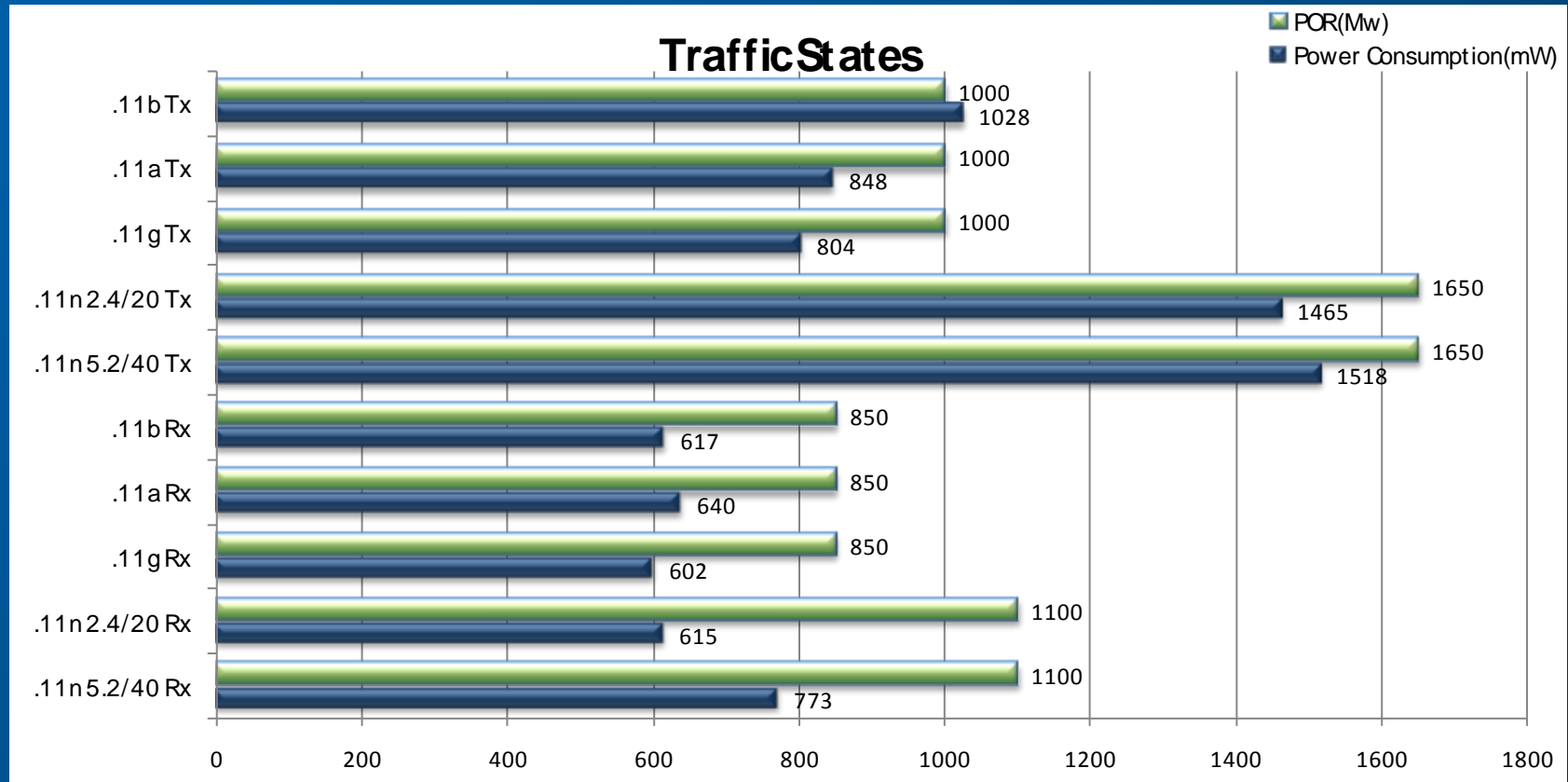
# PC Low Power States – 6250



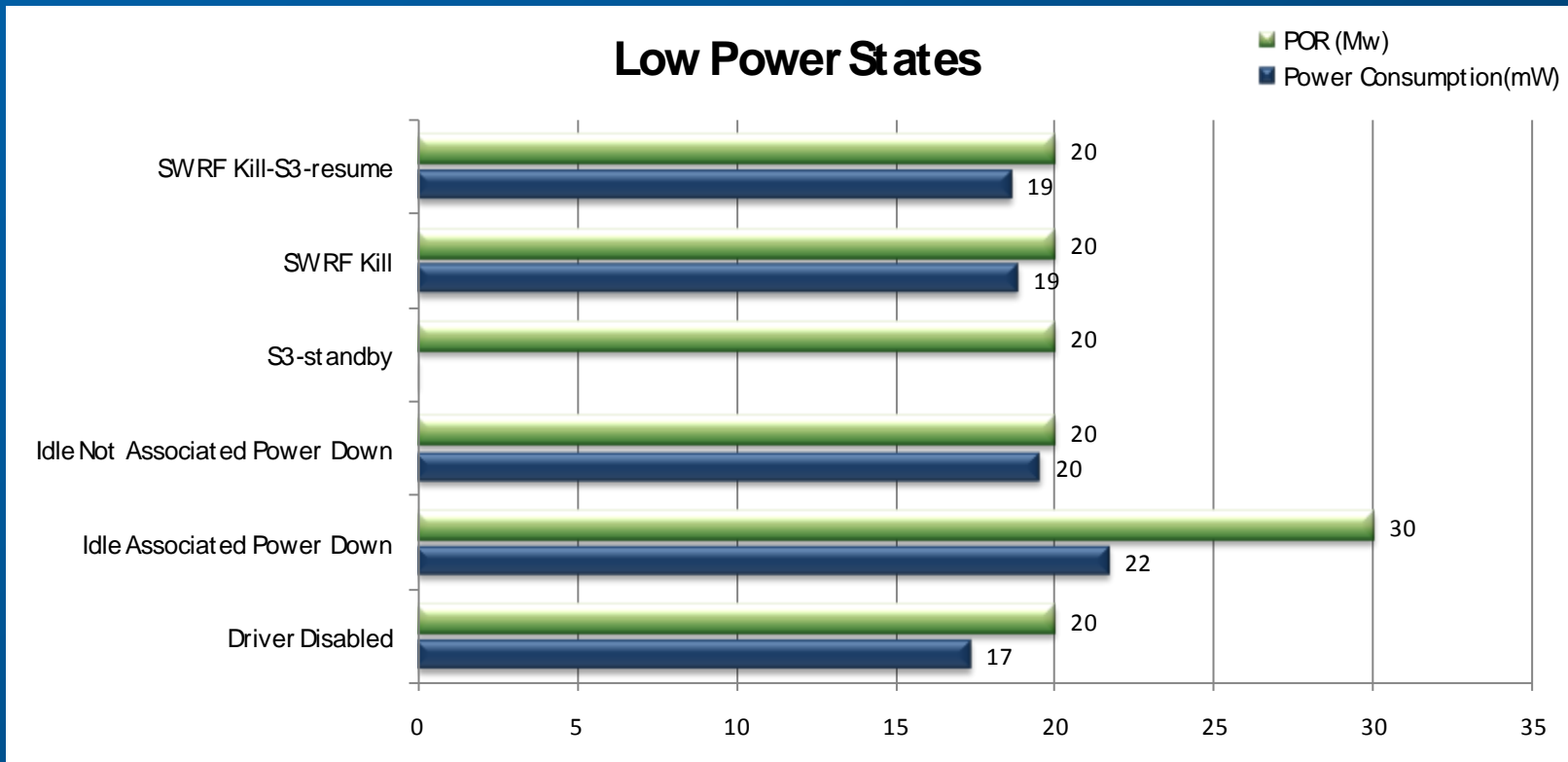
# PC Idle & Common Usage – 6250



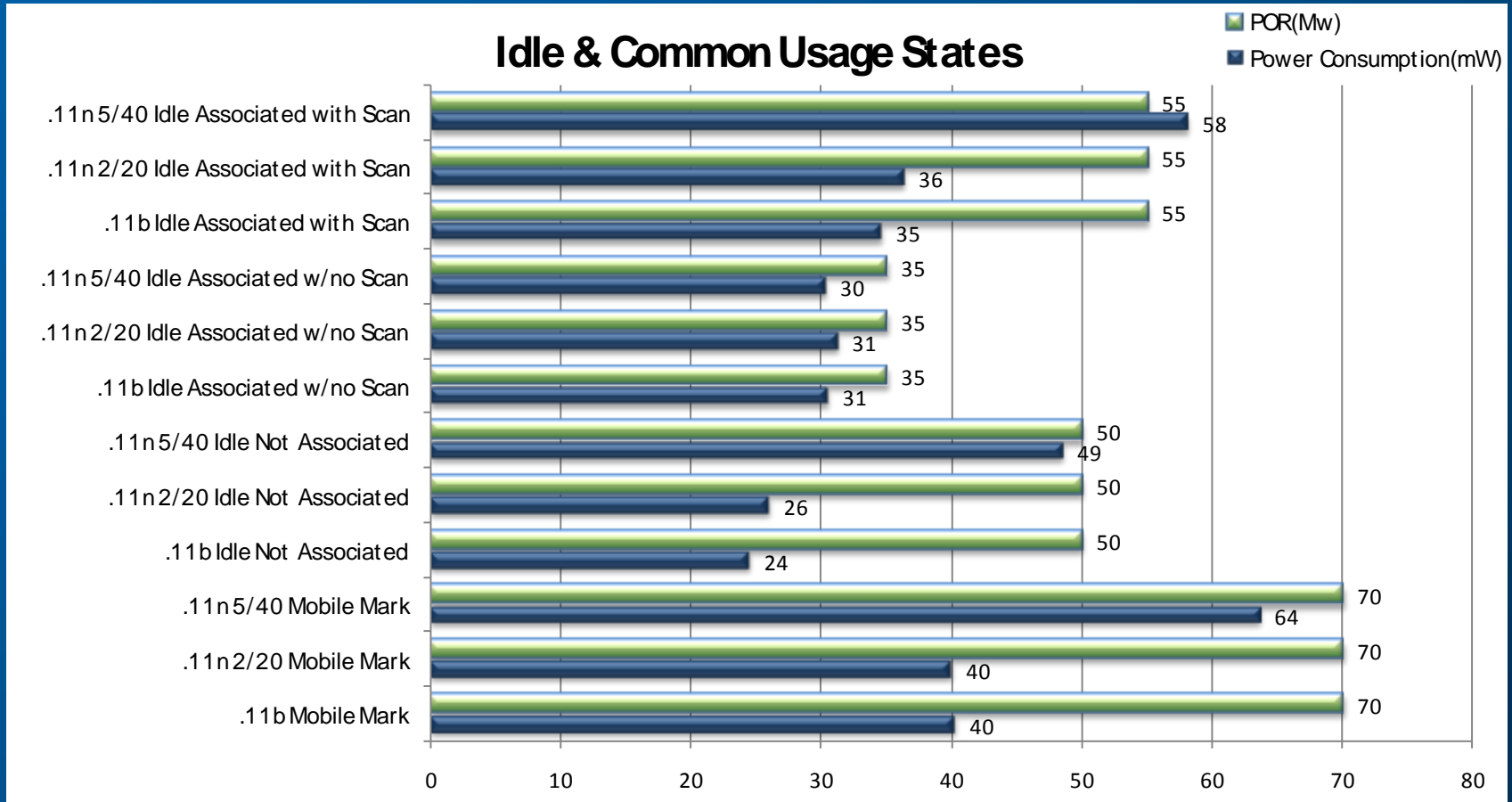
# PC Traffic States – 6250



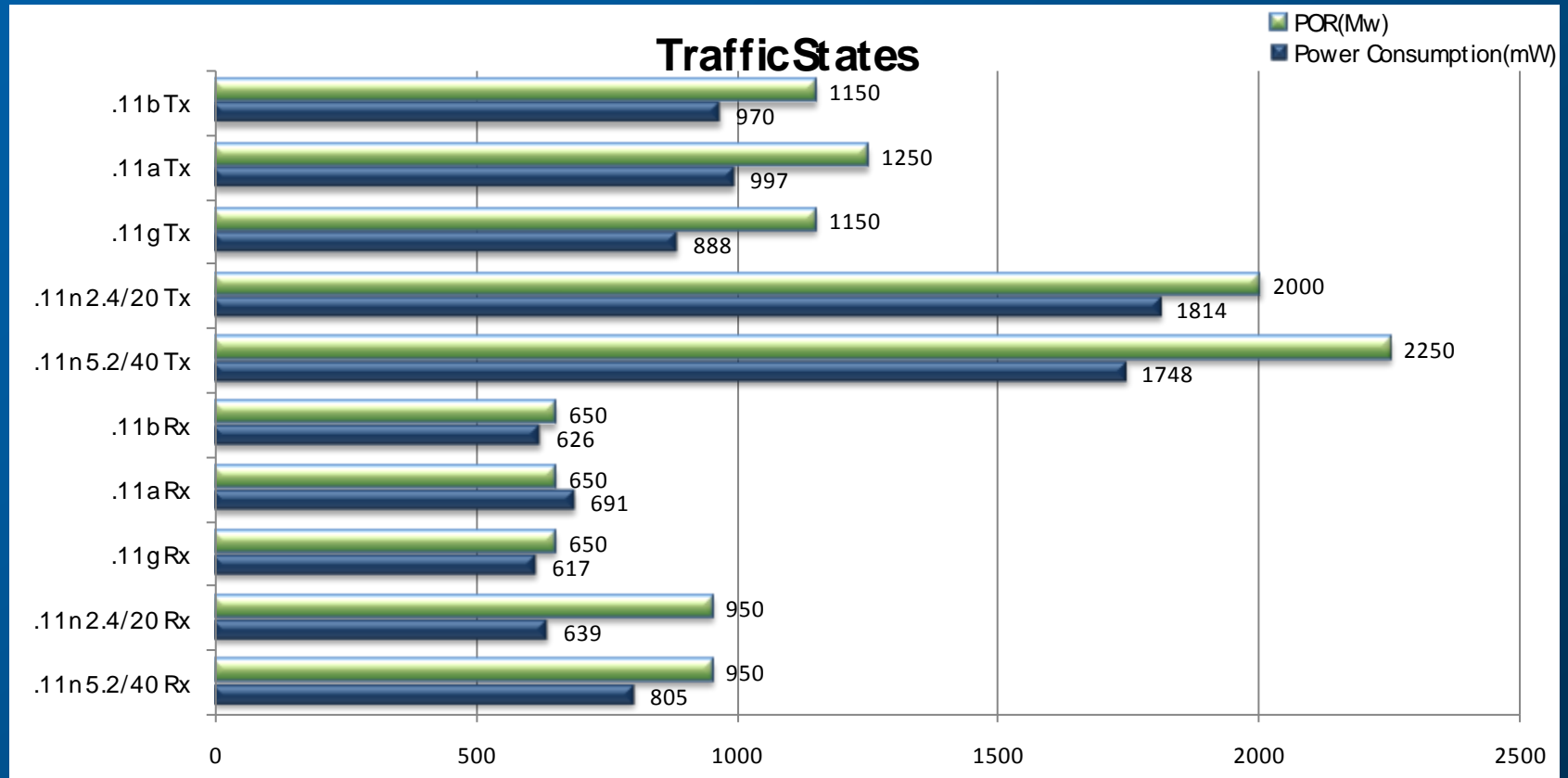
# PC Low Power States – 6300



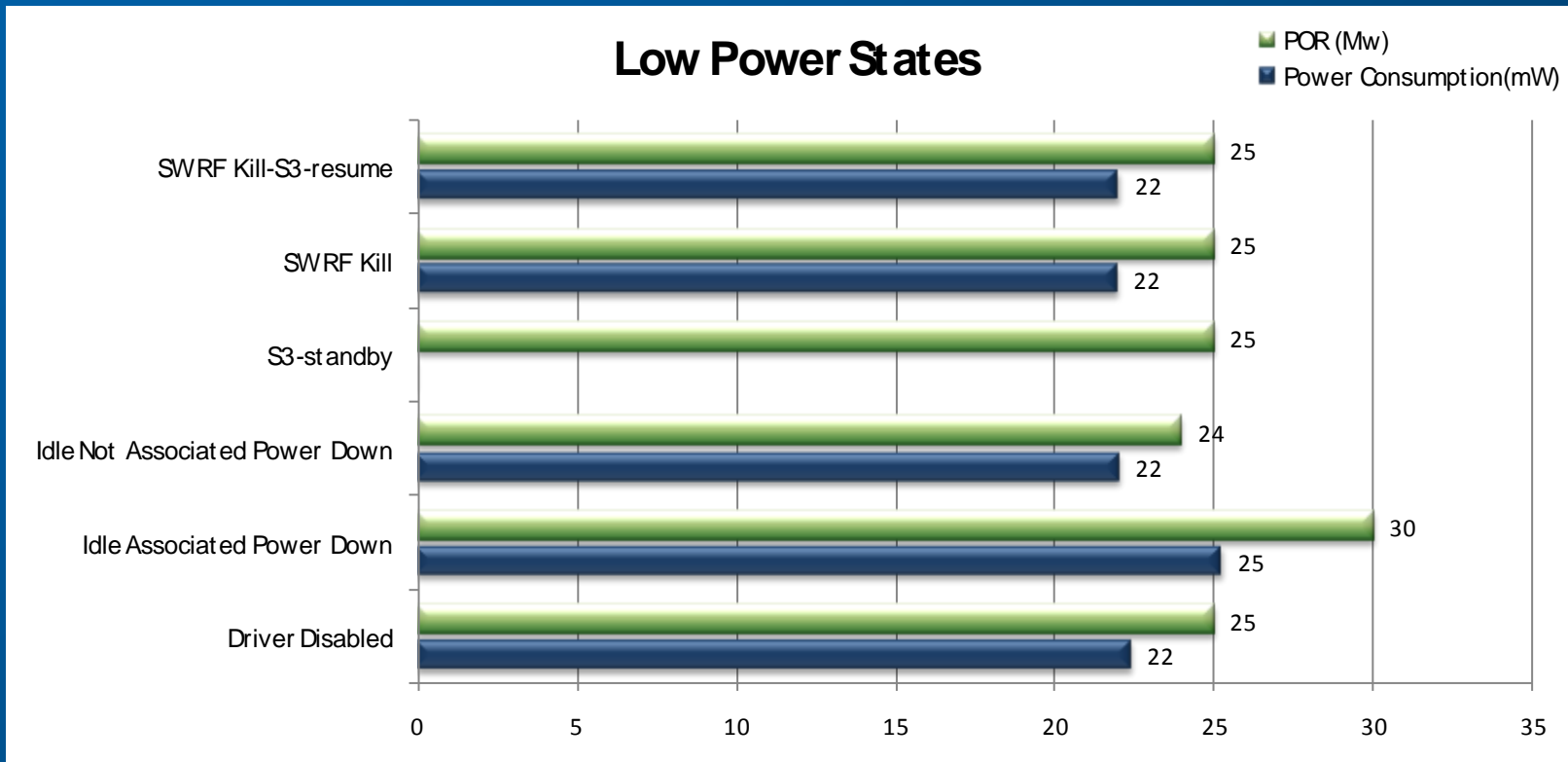
# PC Idle & Common Usage – 6300



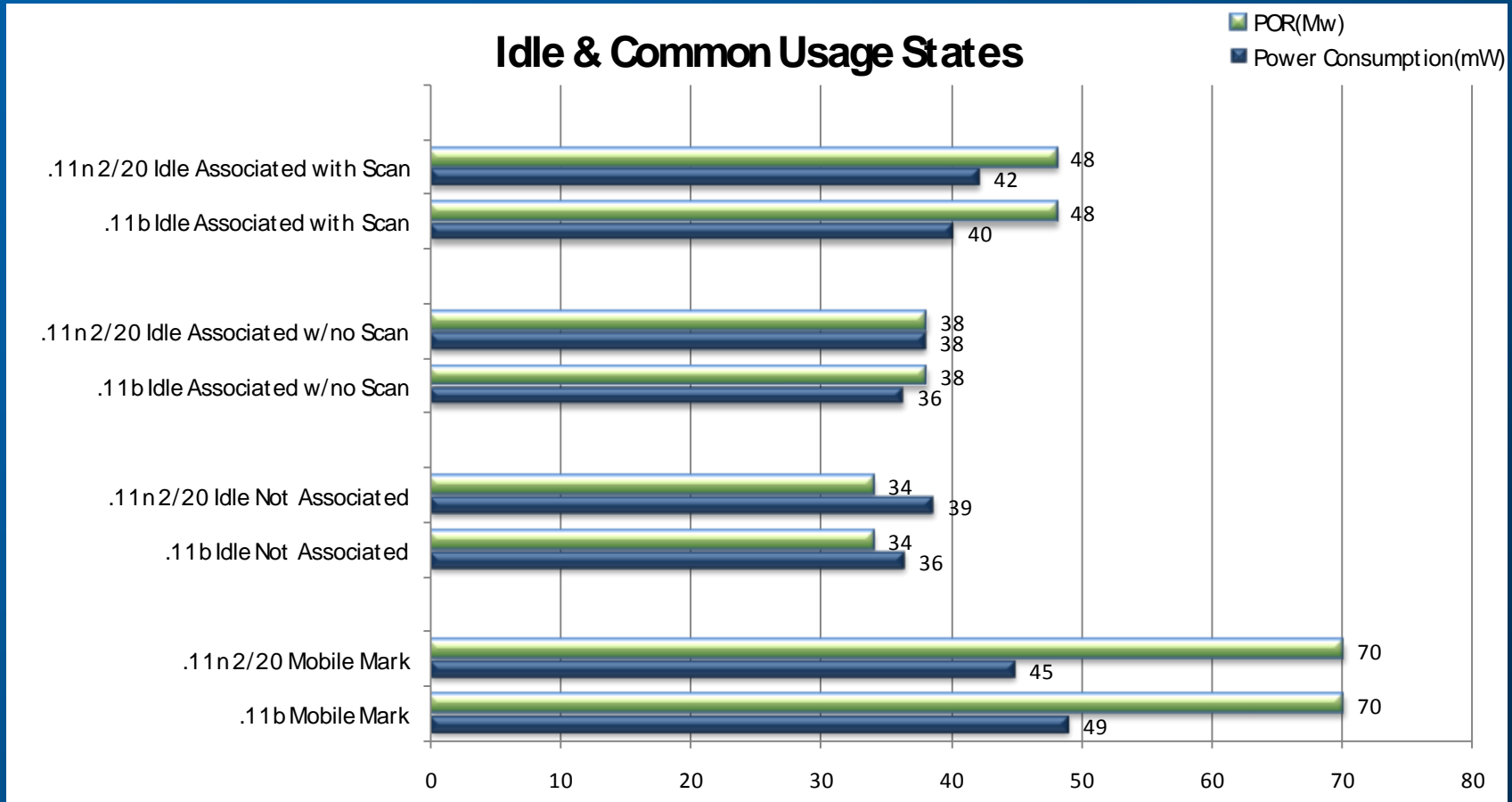
# PC Traffic States – 6300



# PC Low Power States – 1000



# PC Idle & Common Usage – 1000





# PC Traffic States – 1000

