4.9 INTERFERENCE TESTING

Airborne 4.9 Wireless

The purpose of this document is to demonstrate different interference cases between ground and airborne 4.9Ghz users. Proxim, working with the City of LA, GMS (Global Microwave Systems) & MRC (Microwave Radio Communications), has demonstrated successful interoperability between functional 4.9 Wireless systems and frequencies.

Interference Testing between Airborne & Ground systems.

The following sequence of tests were conducted using the following equipment;

Interference Tests

4.9Ghz Spectrum validation

Each test case was conducted in 2 locations. The first location was approximately 100' away, with an elevation of between 100-150' airborne. The second location was approximately 4/10s mile away, with an elevation of 100-150'.

- Test Case #1, Baseline 4.9Ghz throughput and stability
- Test Case #2, Determine throughput & stability using non-adjacent channels
- Test Case #3, Determine throughput & stability using overlapping channels

Location

Test were conducted at the Long Beach Emergency Operations Center (EOC). Each helicopter hovered in designated locations for a period of up to 5 minutes during each test.

Equipment Setup & Software

Proxim

Access Point - 4.9Ghz, Public Safety AP, operating at 10Mhz, channels 4950 & 4985Mhz.

Roof Antenna - WISPerformance 4.9 – 6Ghz Adjustable Sector Panel Antenna, 60°, 15dB gain

Ground Antenna – Maxrad, 4.9, 7dB Omni antenna.

Ixia, Chariot Endpoint Performance Suite

GMS

Helicopter Transmitter

GMS model MHPT, Messenger High power w/ int. Pads and Coax., operating at 6Mhz, on channel 4950Mhz.

GMS 800-RCU remote control unit

Antenna – GMS model A0C6A06N360XG, 6db Omni 4-6Ghz

Ground station receiver

GMS model 565-042, Consumer DVB-T receiver, single channel w/ MPEG 420 decoding

GMS model BDC (block down converter) (0.9-2.7Ghz

Antenna – GMS model A0C6A06N360XG, 6db Omni 4-6Ghz

MRC

Helicopter Transmitter

Strata 4.9Ghz Transmitter, operating at 6Mhz, on channel 4949Mhz

GMS 800-RCU remote control unit

Antenna – MRC, 4.9Ghz Sectorscan, 16dBi directional, 90°, *vertically polarized antenna.*

Ground station receiver

Video Distribution amplifier

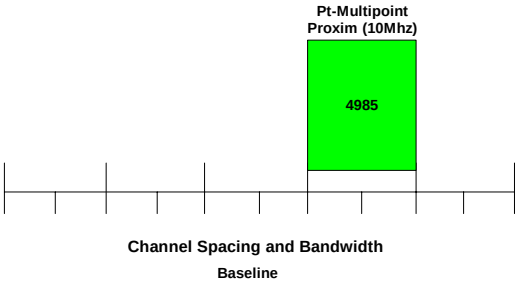
Troll System TS940 slave controller

Master controller located on laptop with Troll's Touchstar NT control & monitoring software

The TS940's function is to steer the antenna both manually & through automatic tracking (Navtrac), control the feed assembly of the antenna, and control and monitor of the MRC CR.4 & MRC RXL.

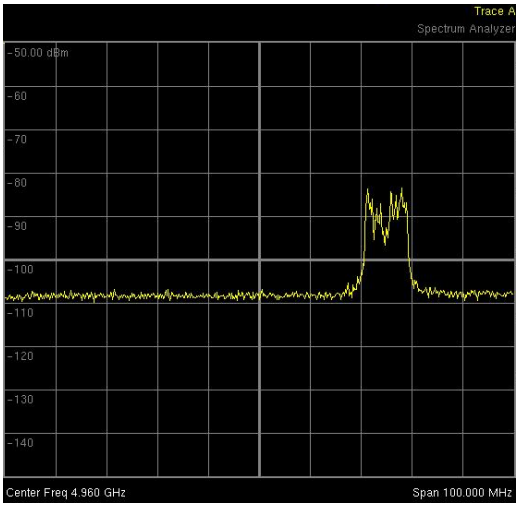
Test Case #1, Baseline Throughput & SNR

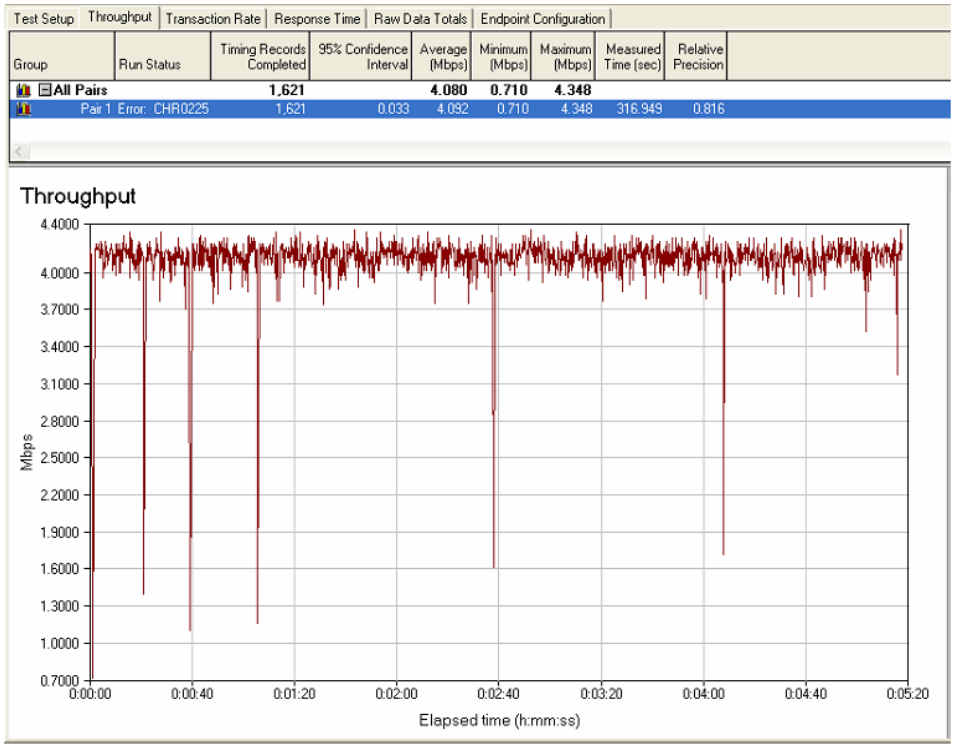
Proxim Channel: 4985Mhz, 10Mhz
Throughput avg.: 4 Mbps
Throughput max: 4.3Mbps
SNR Baseline: 25



Channel Spacing and Bandwidth

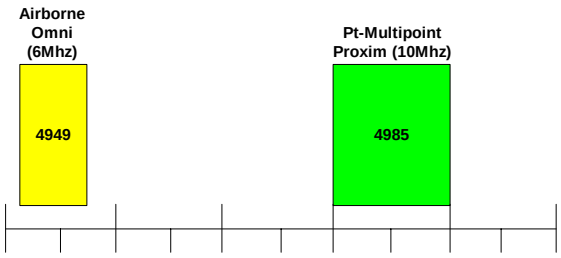
Baseline





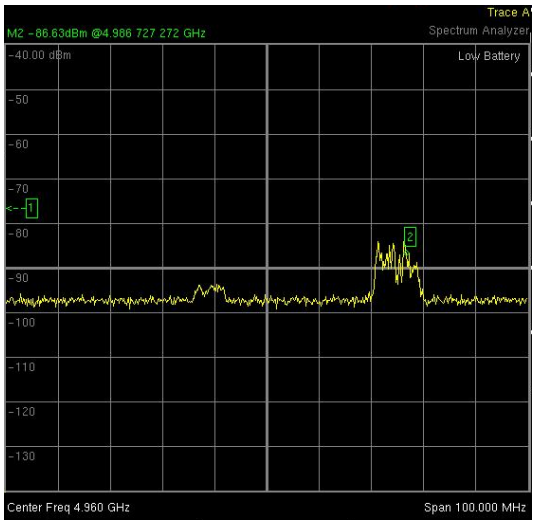
Test Case #2, MRC - Test interference running non-overlapping channels.

Proxim Channel: 4985Mhz, 10Mhz
MRC Channel: 4949Mhz, 6Mhz
Throughput avg.: 2.4Mbps
Throughput max: 3.7
SNR Location 1: 17
SNR Location 2: 19

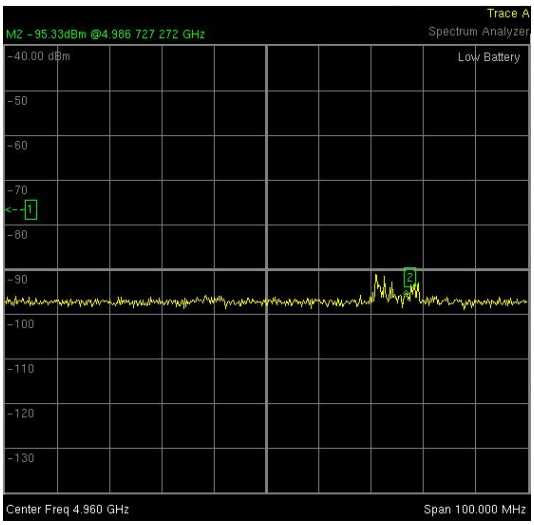


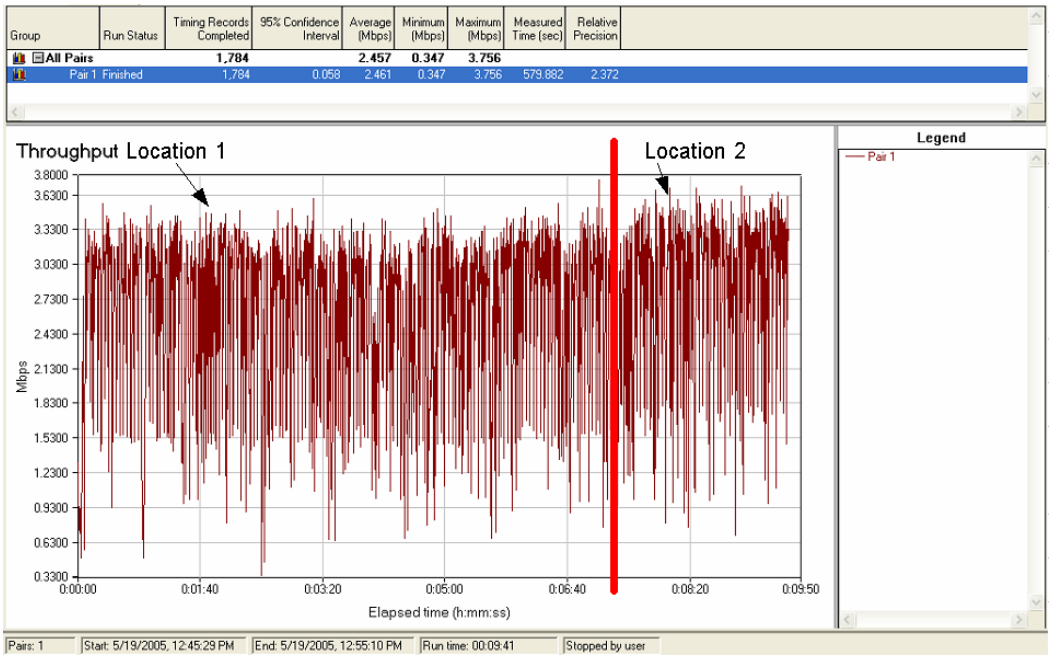
Channel Spacing and Bandwidth
MRC, Location 1, 2

Location 1



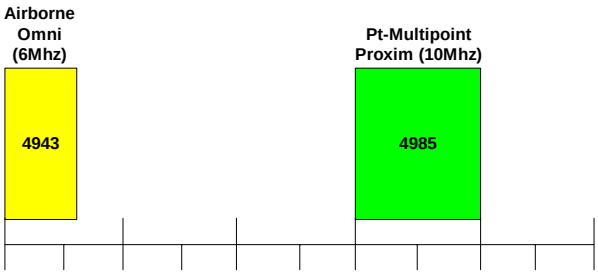
Location 2





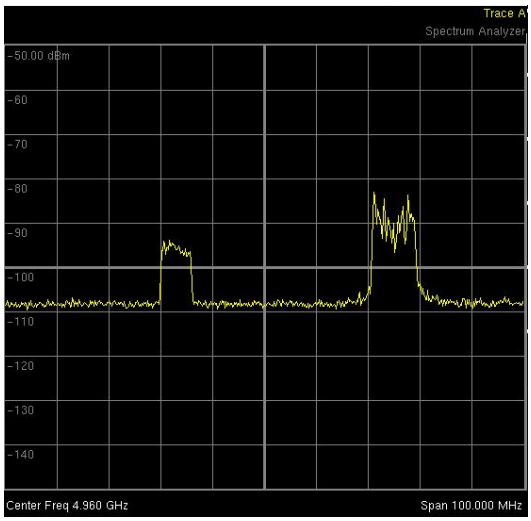
Test Case #2, GMS - Test interference running non-overlapping channels.

Proxim Channel: 4985Mhz, 10Mhz
GMS Channel: 4943Mhz, 6Mhz
Throughput avg.: 2.1Mbps
Throughput max: 3.7
SNR Location 1: 15
SNR Location 2: 18

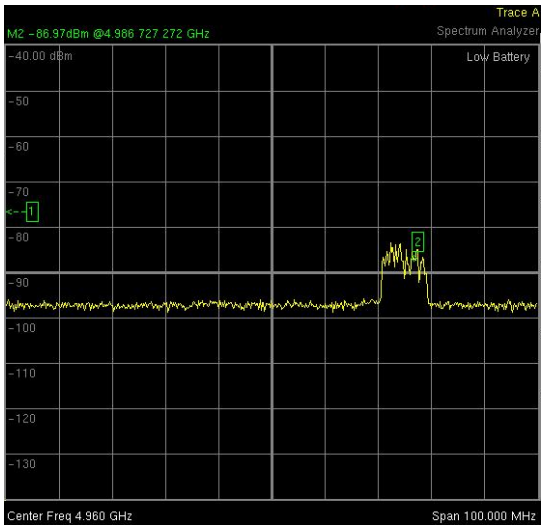


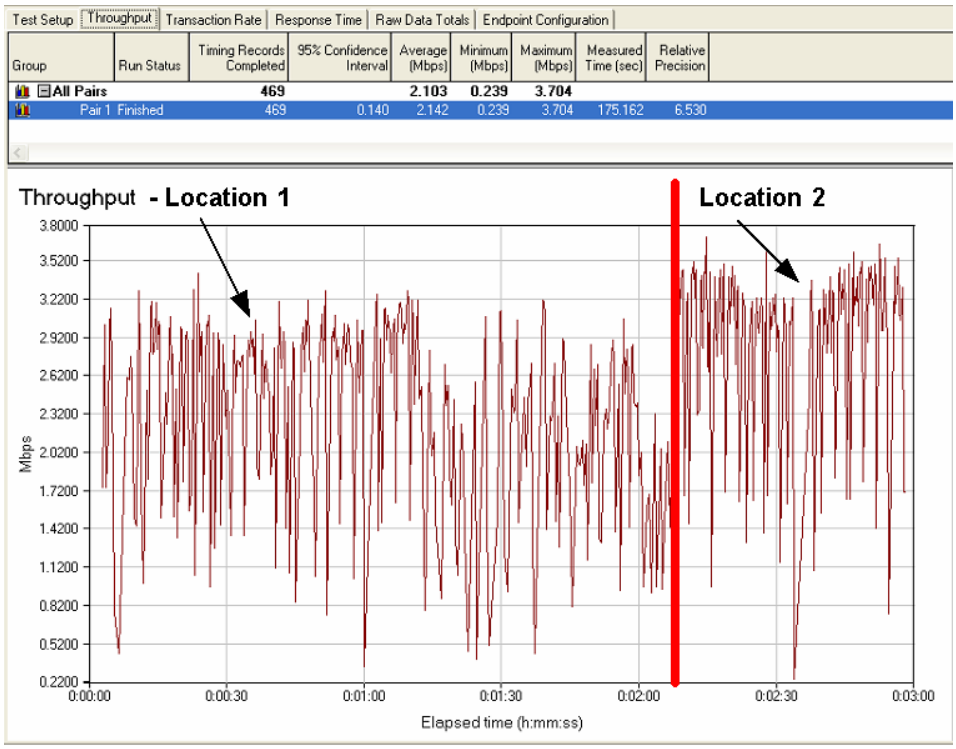
Channel Spacing and Bandwidth
Test 10 - GMS, Location 1, 2

Location 1



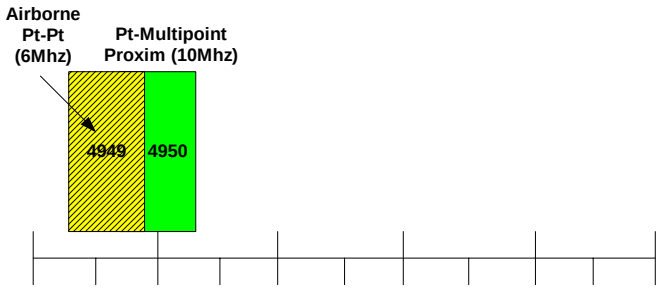
Location 2





Test Case #3, MRC - Test interference running overlapping channels.

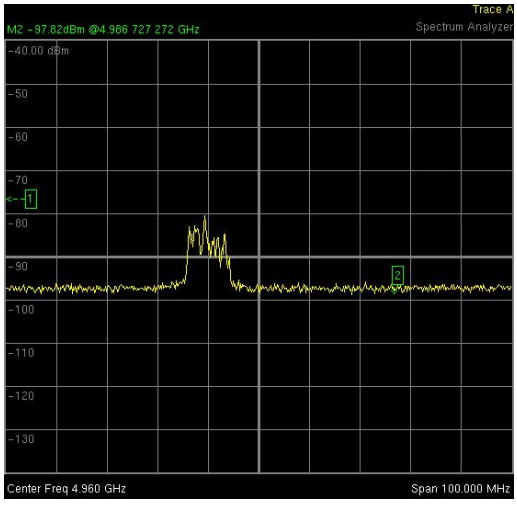
Proxim Channel: 4950Mhz, 10Mhz
MRC Channel: 4949Mhz, 6Mhz
Throughput avg.: 2.0Mbps
Throughput max: 3.6
SNR Location 1: 13
SNR Location 2: 16



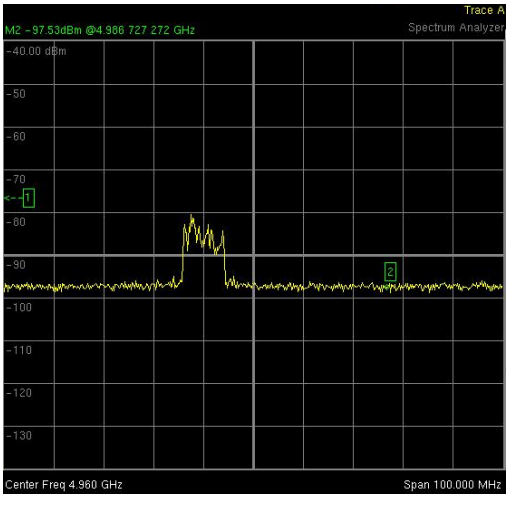
Channel Spacing and Bandwidth

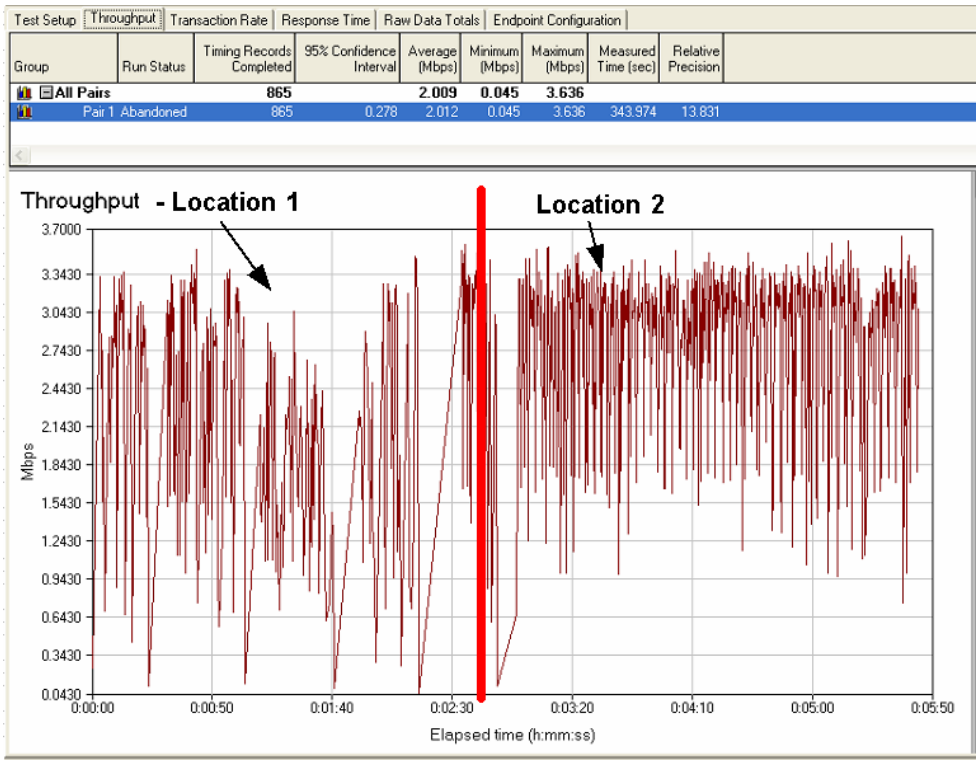
MRC, Location 1 & 2,
Channel Overlap

Location 1



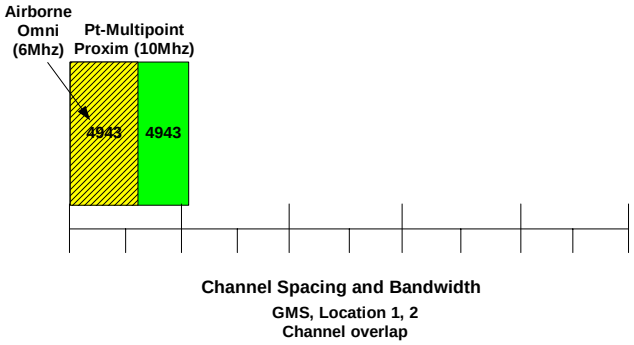
Location 2





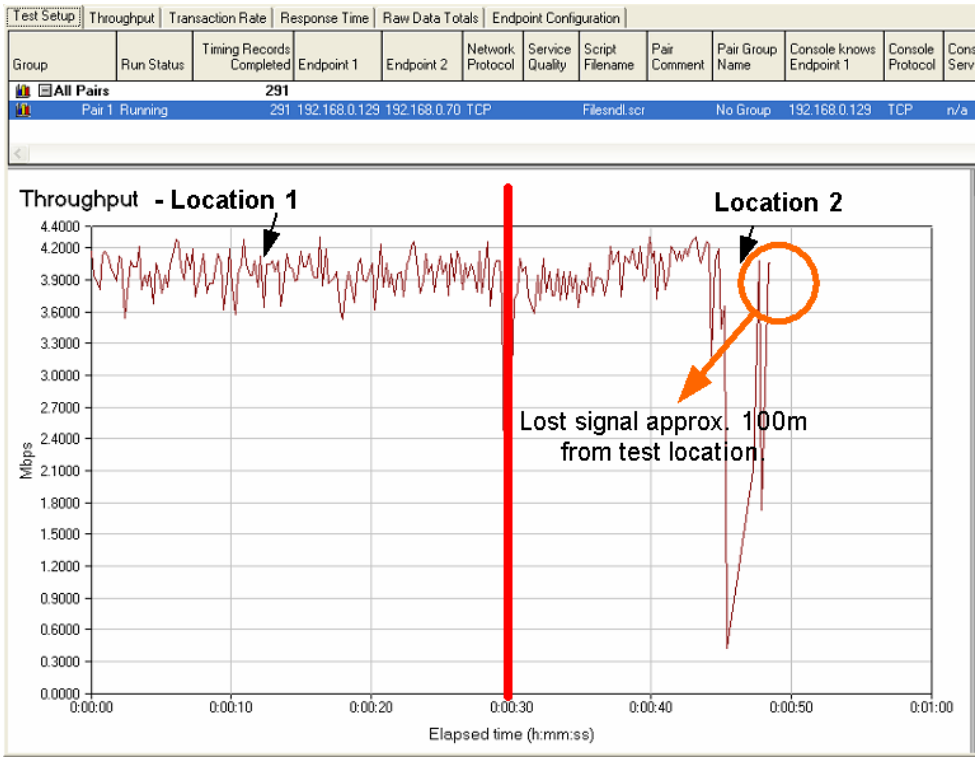
Test Case #3, GMS - Interference test, overlapping channels.

Proxim Channel: 4943Mhz, 10Mhz
GMS Channel: 4943Mhz, 6Mhz
Throughput avg.: 3.9Mbps
Throughput max: 4.3Mbps
SNR Location 1: 11
SNR Location 2: 19



Channel Spacing and Bandwidth
GMS, Location 1, 2
Channel overlap

- No Spectrum Analyzer trace available.



Summary:
In all test cases, there was minor degrade and expected reduction to signal and throughput. Overall, interference appeared to be acceptable in all cases, showing the great performance even in scenarios where frequencies overlap completely.