

ISCO INTERNATIONAL

LINK CONDITIONING® For the RF Uplink

SINR Optimization with Proteus® and Proteus1AIR™



ISCO International is focused on the evolution of wireless networks to enable more connections as demand continues to grow throughout the world. When wireless carriers can carry more traffic on the spectrum they already own, the cost of providing service goes down. ISCO's Link Conditioning network function reduces this cost by maximizing spectral efficiency.

The Value of Link Conditioning

Link Conditioning is a software network function running on ISCO's Proteus hardware platforms to measure and optimize Signal to Interference and Noise Ratio (SINR) for each RF link. It allows wireless operators to maximize available capacity by improving spectral efficiency while providing visibility into a unique set of signal quality measures.

User density, location in the sector, applications used, external conditions (e.g., weather, time of day, automobile traffic) and other factors combine to create a dynamic environment that cannot be compensated through network design. Link Conditioning is a closed-loop set of adaptive algorithms that can free up capacity to carry more traffic, increase LTE data rates on both the uplink and downlink, and serve more users by improving cell edge performance.

Key Benefits of Link Conditioning

- Carry More Traffic Over Existing Spectrum
Achieving better spectral efficiency by optimizing SINR drives more UL and DL traffic
- Increase Uplink and Downlink LTE Data Rates
Improving the condition of the uplink allows the radio to increase data rates
- Provide Better Cell Edge Performance
Automatically sculpting the RF link helps reach devices at the cell edge
- Reduce Cost to Deliver Data
Serve more users and deliver more traffic using existing spectrum and RAN equipment
- Broaden Your Spectral View
Understand out-of-band and in-band interference to complement the view provided by the eNodeB
- Deliver A High Quality User Experience
Link Conditioning is like fine tuning, keeping service quality high to satisfy the growing demands of wireless users

Common Applications

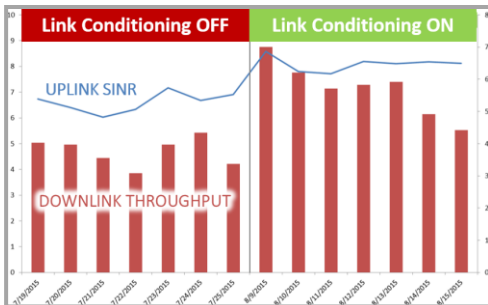
- Extend the life of existing carriers
- Underperforming cell sites
- Locations that are starved for spectrum
- Poor performance at the cell edge
- High density areas
- Sites with ICI challenges

Optimal SINR is essential to network performance. ISCO's Link Conditioning can help you achieve it.

Requirements and Sample Reports

ISCO Product Requirements

Link Conditioning works on LTE paths on Proteus, Proteus1, Proteus1AIR
 Proteus/Proteus1 Software Release 6.1 or later (Release 6.1.5 for PCS)
 Proteus1AIR Software Release 1.2 or later (Release 2.0 for PCS)



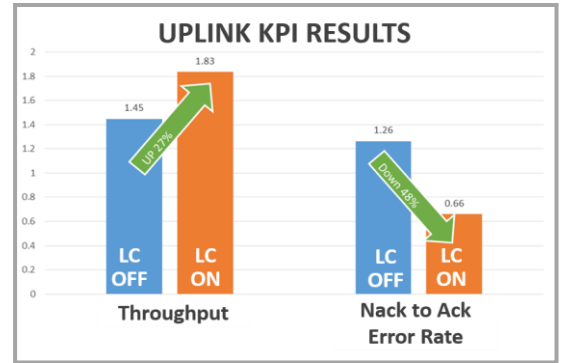
Throughput

A different cluster of sites showed 21% improvement in DL throughput and 13% improvement in UL throughput averaged across the cluster

Site Performance Improvements

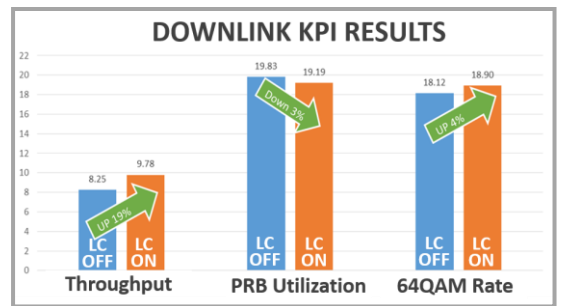
Uplink

Improvements in Nack/Ack Error Rate, PRB Utilization and data modulation rate combined to increase UL throughput 27%



Downlink

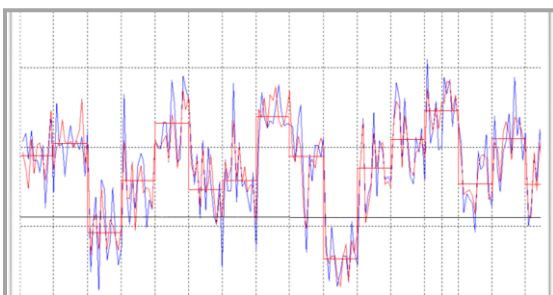
Increased DL throughput 19%, driven by reduction in PRB utilization and higher modulation rates



Link Conditioning Metrics

The Link Conditioning RF Conditioning Network Function continuously analyzes numerous aspects of the RF link's spectrum and SINR to determine optimization actions to invoke. These unique spectral KPIs, measurements and actions are available to access remotely and interface with OSS and service assurance systems.

ID	nAdj	nCmp	nOut	nCar	iCar	Signal	Noise	SINR	Temp
-0	-111.71	-130.00	-114.07	-109.59	-98.87	-99.02	-98.27	-0.75	50
-1	-111.63	-130.00	-114.45	-110.50	-104.86	-104.29	-103.45	-0.84	50
-0	-109.59	-130.00	-112.84	-109.79	-98.13	-97.92	-97.53	-0.40	49.5
-1	-109.65	-130.00	-112.35	-110.34	-102.44	-102.13	-101.47	-0.66	49.5



The Link Conditioning Closed Loop Process

1. Measure SINR and other spectral conditions of the link
2. Analyze the LTE signal with ISCO's PRB-aware algorithm
3. Depending on SINR, spectral conditions and the LTE signal, take action
4. Verify changes improved performance to close the loop

Result: Continuous optimization of SINR changing within minutes

We Care About The Connection™