Webinar Series by DASpedia

The Value of CPRI Testing

By Cher Henton/Ubeity

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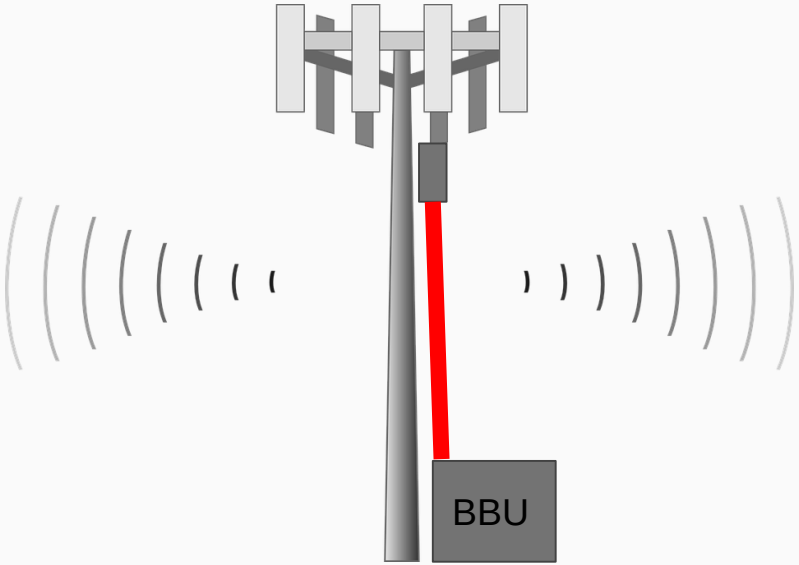
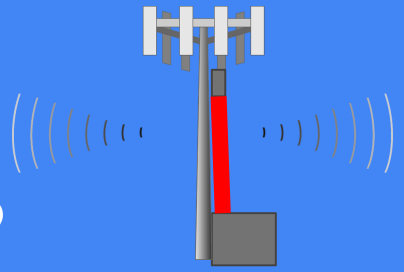
The RRH to BBU CPRI Link

Complete RF I/Q Data is loaded on the fiber from RRU to BBU encoded with CPRI - Common Public Radio Interface protocol.

RF Analysis over CPRI is valid for CRAN configurations as well.



What can you do with CPRI Analysis?



You can see the RF Spectrum with CPRI Analysis to troubleshoot ***interference and PIM*** problems.

Who cares about testing RF over the CPRI link and why?

Uptime ↑

Performance team

How bad does a problem sector need to be to justify a maintenance window troubleshooting session or to take the site down for testing?

CPRI Test Panels help reduce the number of bad sectors in your network.

MTTR ↓

Ops team

How many more sectors can Ops test/optimize if a test port allows easy access anytime with no performance impact?

Without a CPRI Panel/Analyzer, how will carriers optimize overall network performance?

Save $$$

Corporate level

How many less bucket truck/tower climbs and radio swaps will be necessary?

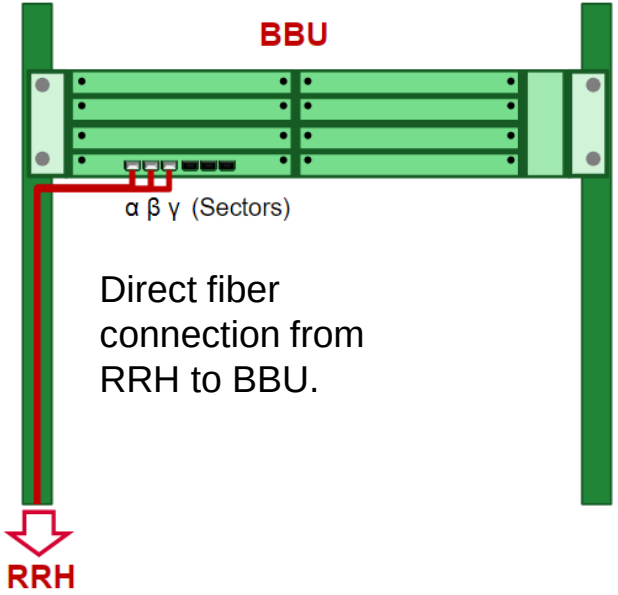
How much can we improve market level KPIs?

Implementation of CPRI Test Panels for access to CPRI Analysis

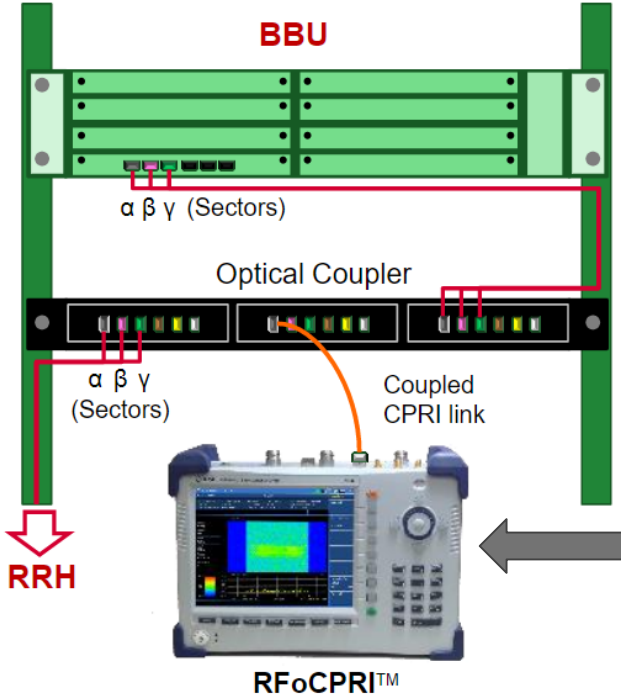
RFoCPRI™ Technology

CPRI Monitoring

Standard Cell Site Deployment



Cell Site with CPRI Monitoring



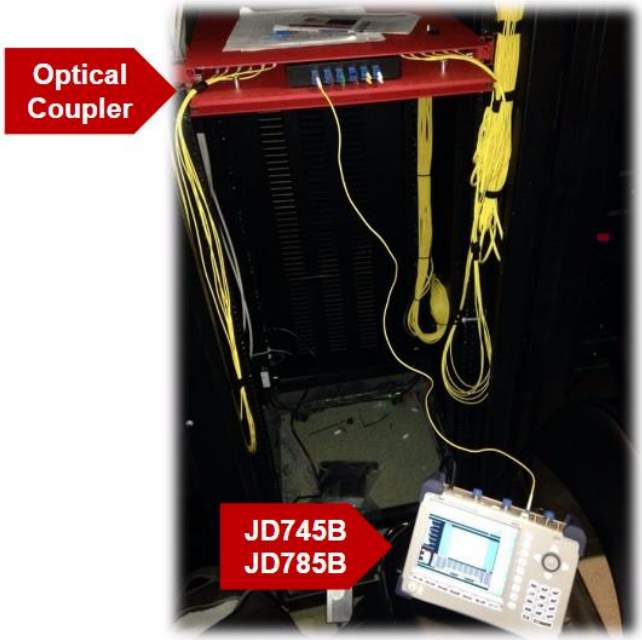
CPRI Panel

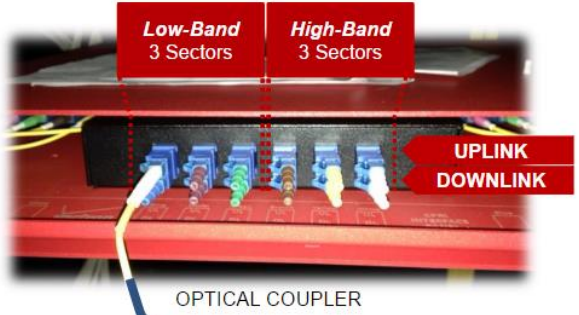
CPRI Analysis

RFoCPRI™ Setup

CPRI Test Points

- **CPRI Measurement Points**

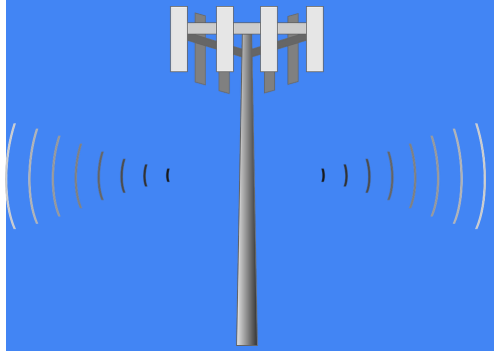




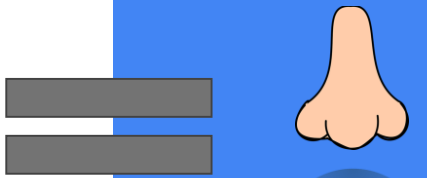
OPTICAL COUPLER

Temporary fiber jumper.

JD745B or JD785B



Site is up and running during testing.



OpticalRF™
RF Spectrum Analysis over CPRI

FTTA Cell Site Installation

RRH

BBU

α β γ
(Sectors)

FTTA Cell Site Installation with CPRI Access Panel

RRH

BBU

α β γ (Sectors)

Optical Splitter

α β γ
(Sectors)

OpticalRF™

CPRI Access Panel

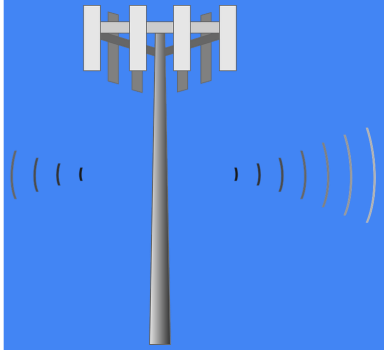
RF Spectrum Analysis over CPRI

EXFO

OpticalRF™ Setup

From RRH

To BBU



Site is up and running during testing.

EXFO

Test Procedure for RF Testing over CPRI with/without CPRI splitter panels

RF Analysis over CPRI for site with **CPRI splitter panels** *Just plug in!*

Diversity Imbalance Alarm

First Domino

Problem with a sector is identified by RSSI/Diversity Imbalance Alarm

>6dB difference for xx minutes/hours

Tech inspection

Tap into….

If Radio is accessible and has a sniffer port, use traditional RF Spectrum Analysis: no need for CPRI Analysis.

If RRH has fiber link to BBU (encoded with CPRI,) must use CPRI Analysis. ***Just plug in!***

Identify

Cause

Use RF over CPRI Analysis to look for:

- PIM
- Interference

CPRI Panels allow testing any time of day.

Troubleshooting **without** CPRI Panels for CPRI Analysis

MTTR ↑ **Uptime** ↓

Diversity Imbalance Alarm

First Domino

Problem with a sector is identified by RSSI/Diversity Imbalance Alarm

>6dB difference for xx minutes/hours

Consider taking site down to test

Break RRH/BBU Connection

For each link/sector under consideration, insert temporary fiber splitter after disconnecting, cleaning and reconnecting fibers.

Connect fiber jumper to CPRI Analyzer and BBU.

Returning site to service

Remove temp Splitter

After testing each link, remove the splitter, clean each fiber, and reconnect the RRH to the BBU.

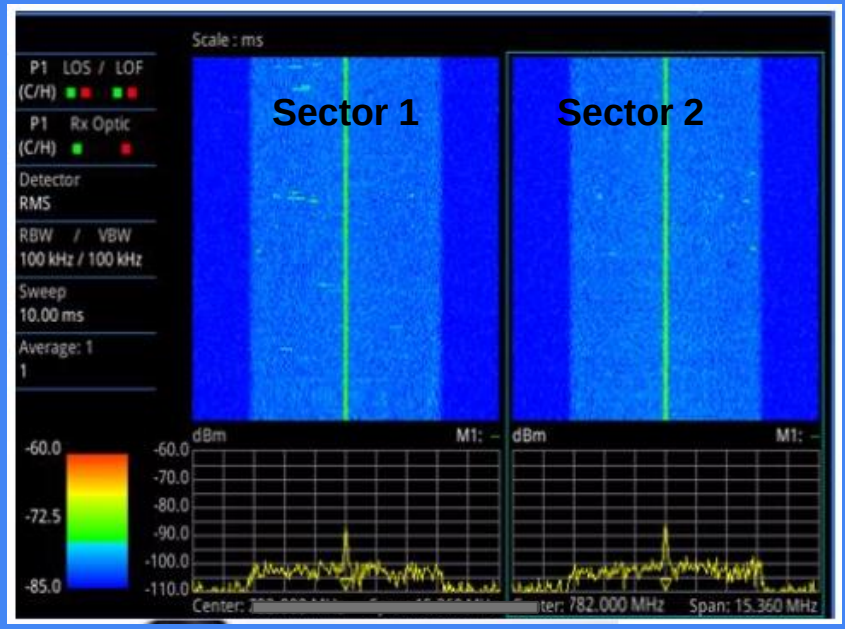
This may be necessary on multiple links for each site which means taking multiple sectors down.

Troubleshooting with CPRI Analysis

Catch an Interferer

RF Spectrum Analysis over CPRI allows you to do interference analysis and have the proof you need to go to the authorities…. Spectrum printouts.

Inspecting multiple sectors at a site can help determine if you have an **internal or external** problem.



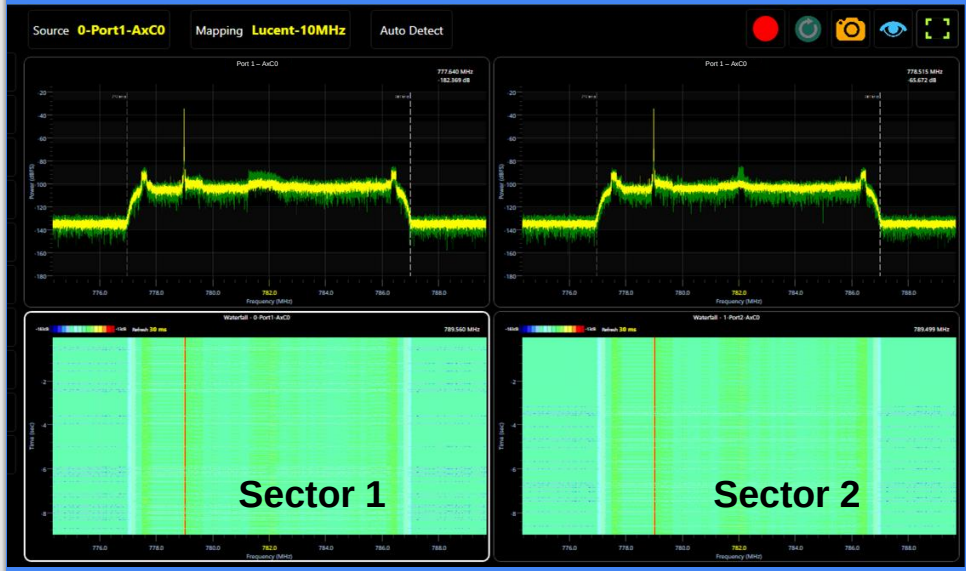
Interference that shows up clearly on 2 sectors is probably an external problem.

For external interferers you still need to drive and detect with a Yaggi antenna.

Catch an Interferer

CPRI splitter panels allow you to test when the interferer is active.

If you can see 2 sectors of a site at the same time, dual sector analysis, you can identify interferers that are external to the site.



What could this interferer be??????

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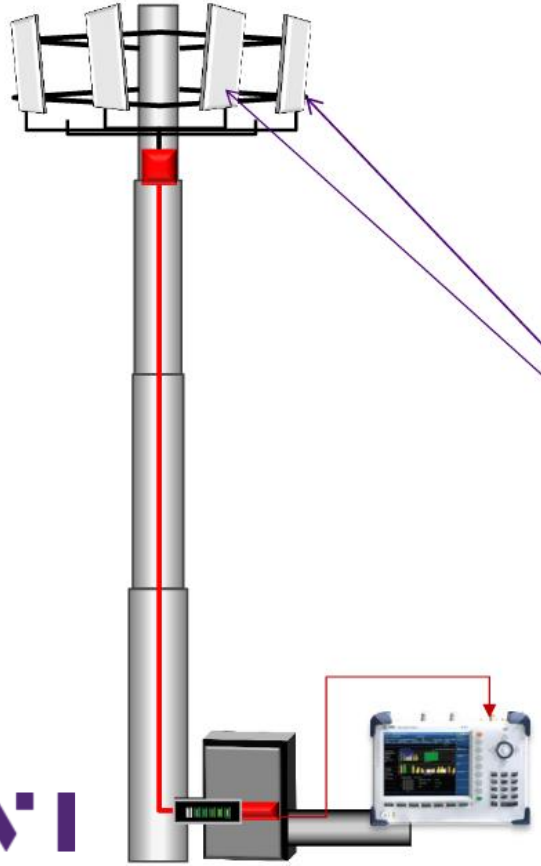
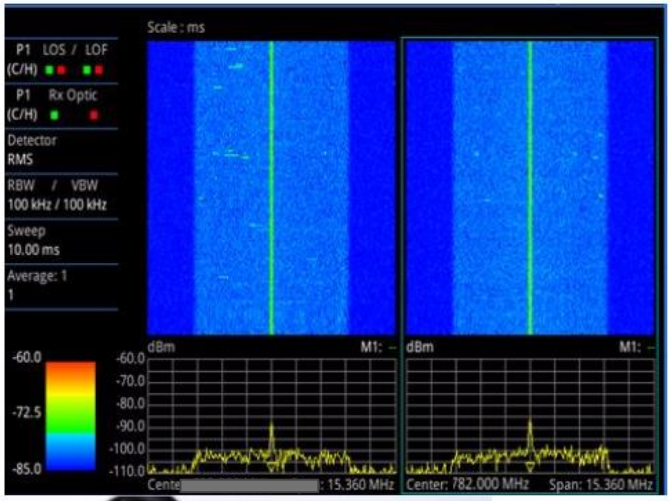
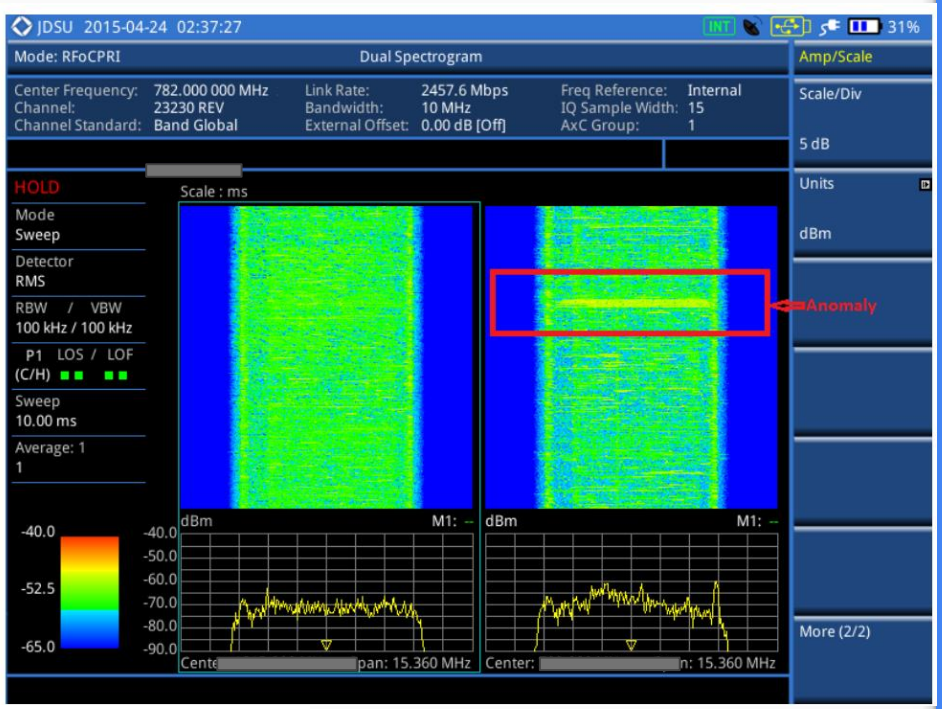
MIMO External Interference RX1 and RX2





Single sector anomalies can be tricky



Some Interference may show up only on one sector, once in awhile.

This could easily look like a ***bad radio*** when it is not.

This historical view of the spectrum (AKA spectrogram/waterfall view) shows when (y-axis=time) and where (x-axis=frequency) the interferer occurs.

This sporadic, broadband problem was a faulty connector that caused problems during wind gusts.

Reducing no fault founds on RRHs

How could you distinguish this between a bad radio without CPRI Analysis?

Without CPRI Analysis, technicians may be left with replacing a radio in attempt to solve the problem.

Single sector anomalies, diagnosed on site with CPRI Analysis will reduce the number of radio swapped without cause.

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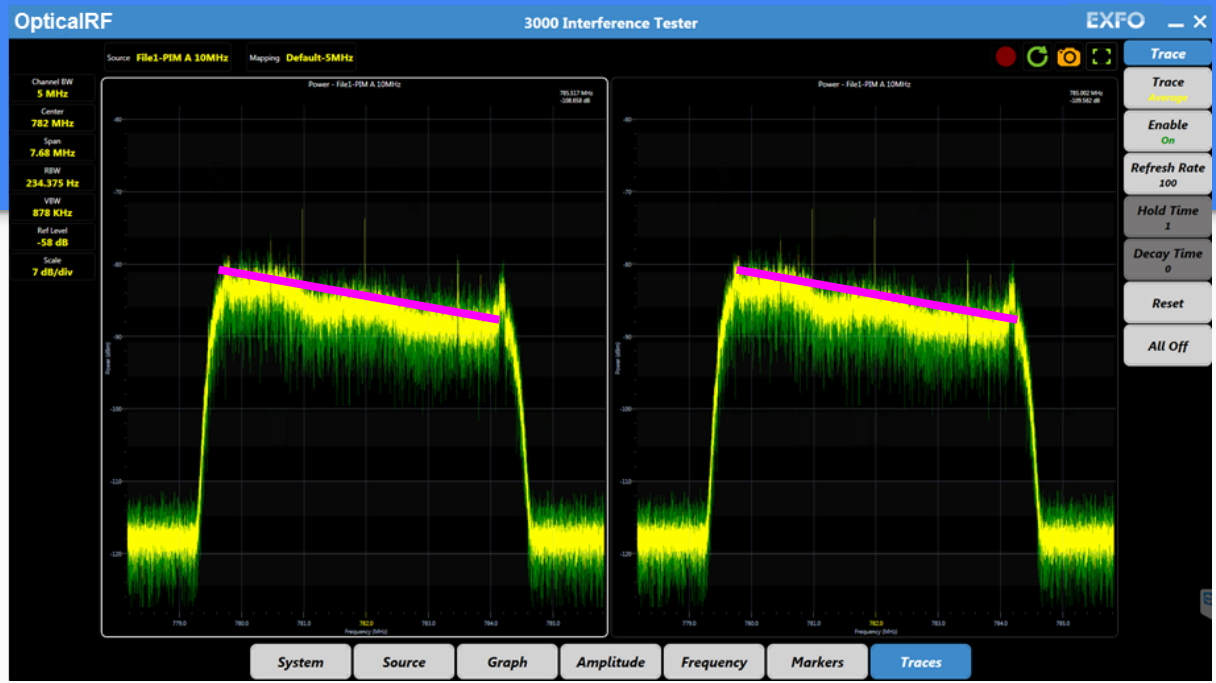
PIM & RFoCPRI

Passive Intermodulation reduces a cell sites receive sensitivity and has numerous causes including loose connectors and bad radios.



PIM has a characteristic sloped pattern on an RF Spectrum as shown above on 2 sectors simultaneously.

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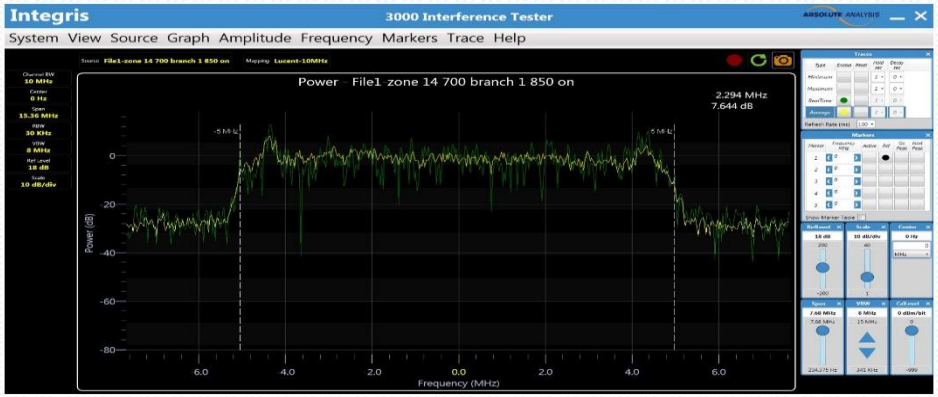
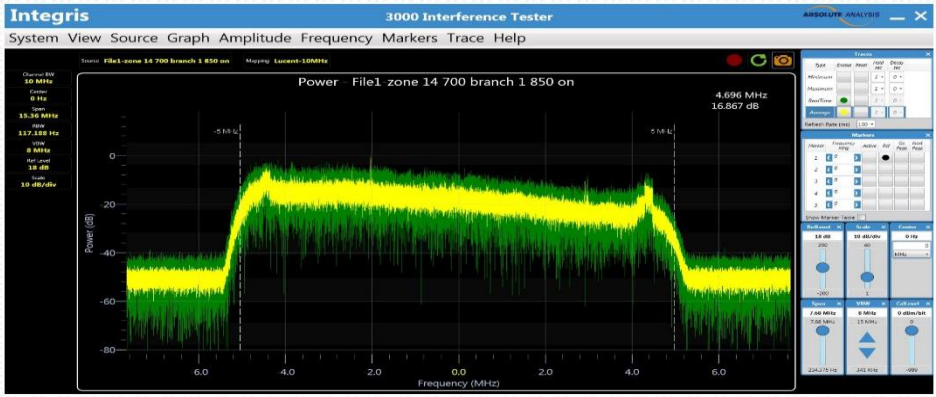
Non real-time vs. Real-Time PIM Display

Condition: Low Bandwidth non real-time display. PIM Difficult to



Condition: Real-time display makes PIM easy to detect



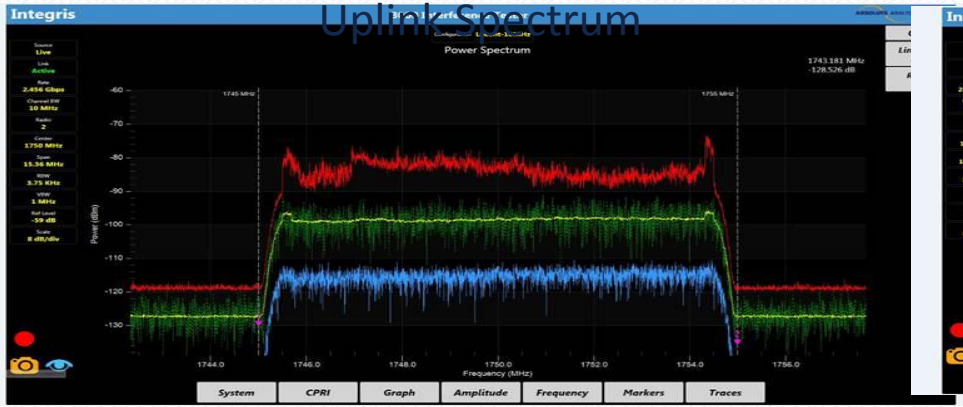
Conclusion: Using a real-time spectrum analyzer will allow to see PIM very clearly versus slower spectrum analyzers.

Internal PIM Issue

ABSOLUTE ANALYSIS

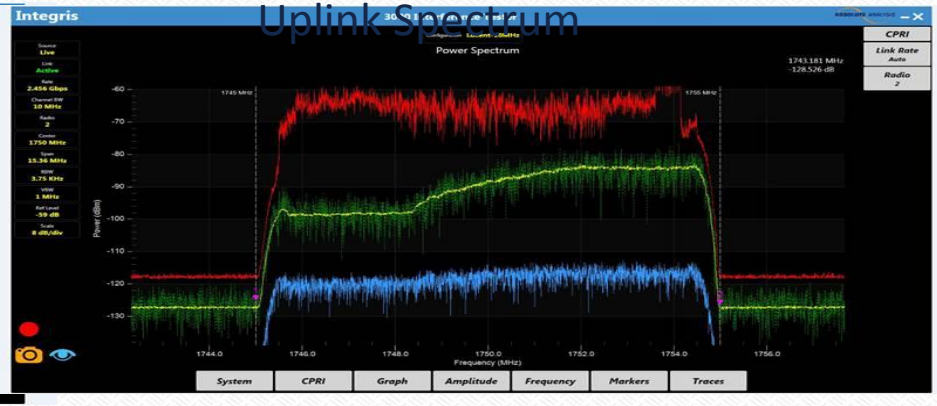
Condition: Downlink (Tx)
Low Power

Uplink Spectrum



Condition: Downlink (Tx)
High Power

Uplink Spectrum



Conclusion: The PIM was the result of a bad antenna that crashed the uplink signal when the downlink was turned to high power.

Special Thanks to Viavi

http://www.viavisolutions.com/en-us/products/celladvisor-base-station-analyzers-jd745b-jd785b

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- MTP/MPO Assemblies
- Mode Conditioning Patchcords
- Polarization Maintaining Patchcords
- Specialty Patchcords
- Pigtails
- Distribution Pigtails

Splicing

- Fusion Splicers
- Cleaver
- Cheetah Splice-On Connectors - 900µm
- Cheetah Splice-On Connectors - 3.0mm
- Cheetah Splice-On Connectors - Accessories
- Splice-On Connectors
- Mechanical-Splices
- Fusion-Protection Sleeves
- Protection Sleeve Oven
- Splicing Accessories

Cable

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- FIS Bobtail™ No-Polish Connectors
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- Tool Kits
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- Slitter/Removal Tools
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- Mid Access Tools
- Fish Tape & Poles
- Cable Pulling
- Cable Marking
- Tool Accessories

Enclosures

- Outside Splice Enclosures

Network Equipment

- Ethernet Switches
- Media Converters
- Harsh Environment Ethernet Switches
- Harsh Environment Media Converters
- Small Form Pluggable (SFP's)
- Ethernet & GPON Equipment
- Transmitters & Receivers

Training

- Fiber Optic Training Classes
- Training Videos

Special thanks to Exfo

Reducing operational expense and accelerating issue resolution in mobile networks

The new OpticalRF™ application reduces the costs of turning up and troubleshooting mobile networks by providing access to the RF signal through the digital CPRI link available at the base station, located at the bottom of the cell tower or kilometers away as in a centralized radio access network (C-RAN) architecture. This in turn eliminates unnecessary tower climbs and significantly reduces maintenance costs. In addition, EXFO's solution accelerates time to resolution of complex RF issues by enabling multiple users to connect, control and collaborate via remote access from any smart device or laptop directly to the OpticalRF™ application. With OpticalRF™, cell technicians can quickly and accurately identify critical interference issues such as external RF interference, and internal and external passive intermodulation (PIM).

Courtesy: http://www.exfo.com/corporate/news-events/news/2016/launching-most-powerful-rf-interference-analysis-solution-over-cpri

Special Thanks to Absolute Analysis

http://www.absoluteanalysis.com/

Anristu offers CPRI Analysis

Courtesty: https://www.anritsu.com/en-US/test-measurement/products/mt8220t

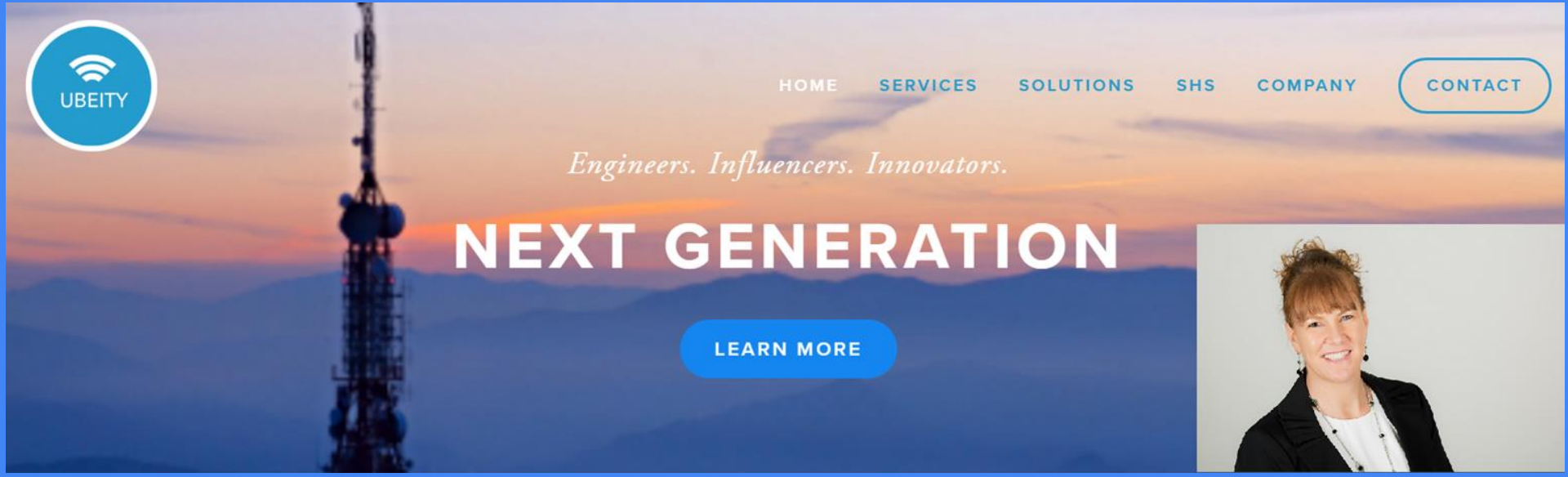
Conclusions/Benefits of non-intrusive CPRI Analysis using CPRI Panels

Operational improvements:

1. Address poorly performing sectors without impact to service.
2. Improve efficiency of technical team.
3. Reduce number of visits to problem sites by using traditional RF troubleshooting techniques with RF over CPRI Analysis.
4. Reduce Mean Time to Repairs
5. Reduce work during maintenance window.

Performance Improvements:

1. Improve overall network performance by reducing the number of bad sectors, increasing Uptime, and tightening KPIs.
2. KPIs can be tightened because problems can be addressed sooner without the consequence of impacting service.
3. Find interferers any time of day with no service impact and have proof (spectrum analysis) to involve authorities.



Cher Henton has worked in the RF/Wireless Test Industry for 20 years. After 10 years with HP/Agilent, Cher worked at T-Mobile and Anritsu before joining Ubeity as a West Region Manager in 2015. Cher earned a BS in Electrical Engineering from THE Ohio State University and later a Masters in Electrical Engineering from Stanford University… making her a Nut and Tree.

Her background includes Device Testing, RAN testing/deployment, RF PCB design, and extensive work with cellular simulation equipment used in the large US carriers.

Today, Cher will give an overview of enabling RF Analysis over the CPRI link. She will explain how to install necessary equipment and how to perform basic RF analysis over the CPRI link. Viavi, Exfo, and Absolute Analysis kindly contributed to this presentation.