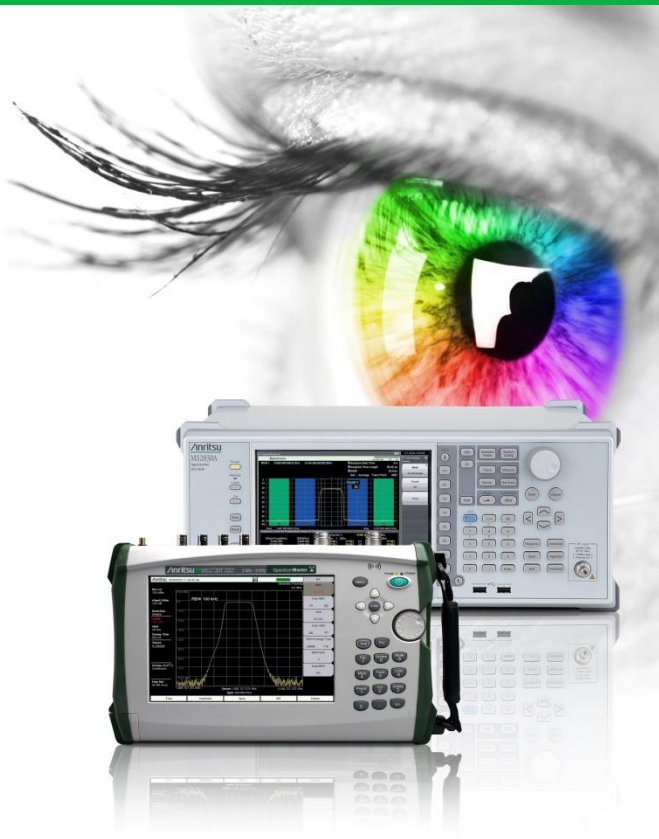
RF Interferences Hunting and Over the Air measurei



Ferdinand Gerhardes

EMEA Business Development Manager

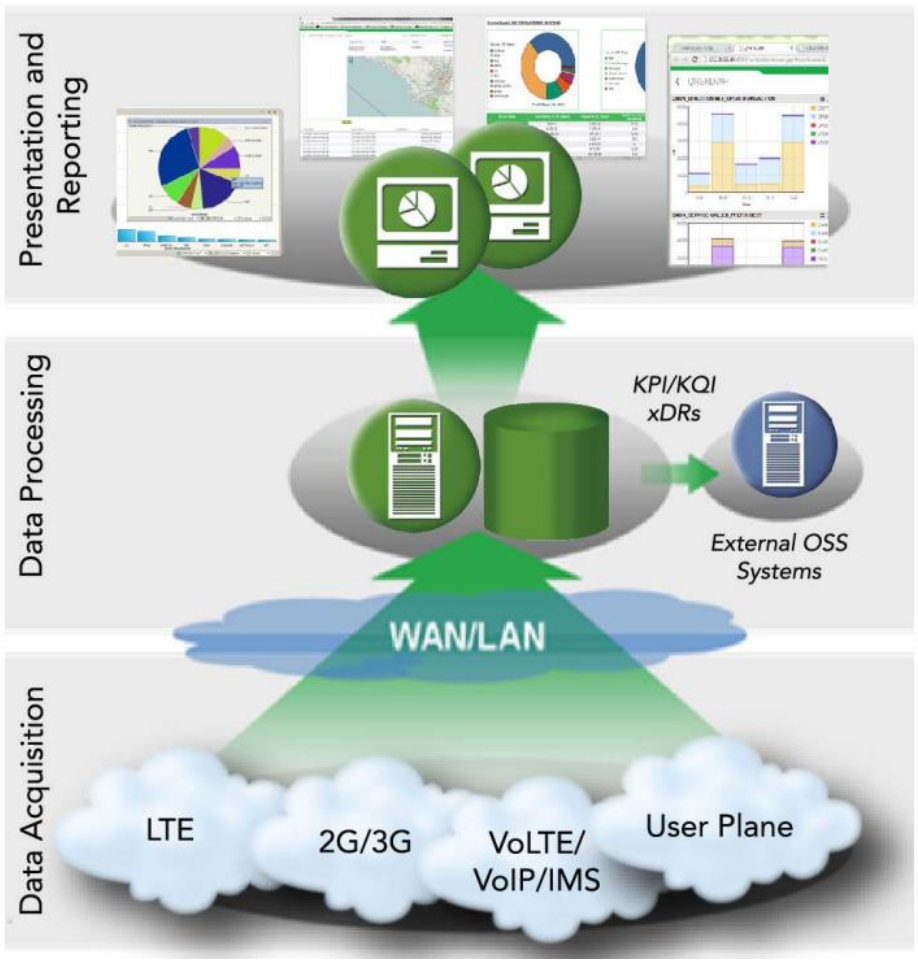
April 2018

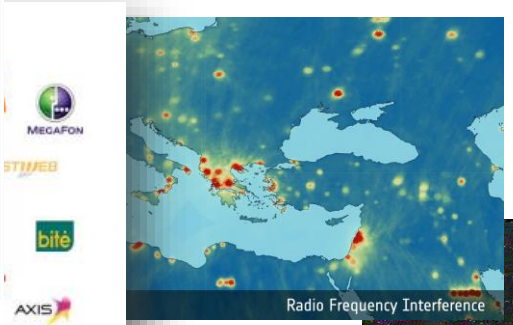
The Wireless Challenge

- More transmitters
  - spectrum is becoming more and more crowded.
- More mobile devices
  - stationary TRX are no longer the norm
- New modulation types
  - analog signals becoming less common than digital signals.
- More complex modulation
  - higher order modulation requires a better RF environment.
- Spectrum refarming
  - moving services to different frequencies requires spectrum clearing and involves different propagation and interference types.
- Wireless connectivity
  - from “nice to have” to “must have.”

The Wireless Challenge

Indicators - or know that you have a problem





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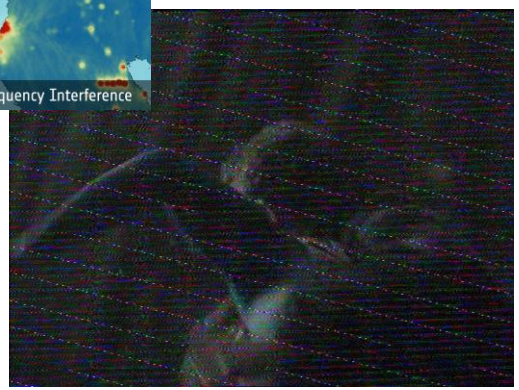
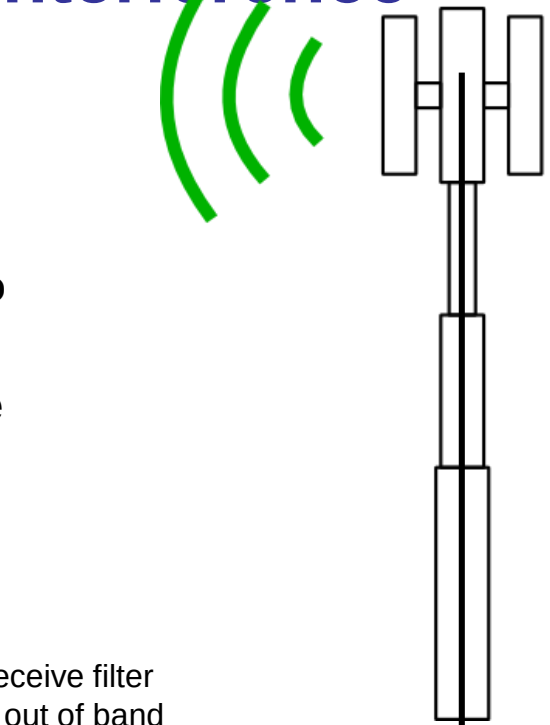


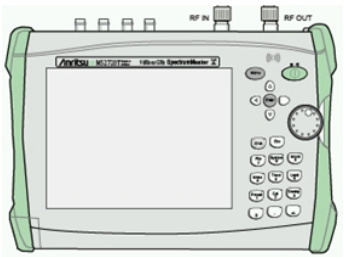
Spotting and characterization of Interference

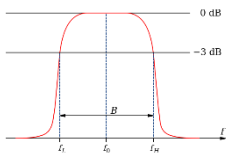
What and how to look for?

- **Check for interference at receiver**
  - **At the tower for Cellular or complaint area for Two Way or in the complaint area for Broadcast**
  - **Allow the RX pre-filter to eliminate the strong side emissions**
  - **Measure noise floor from a receive antenna**
    - **Same receive pattern as the radio**
  - **Get a visual ID on the interfering signal**
    - **Characterize signal so you will know it later**



Receive filter for out of band signal suppression

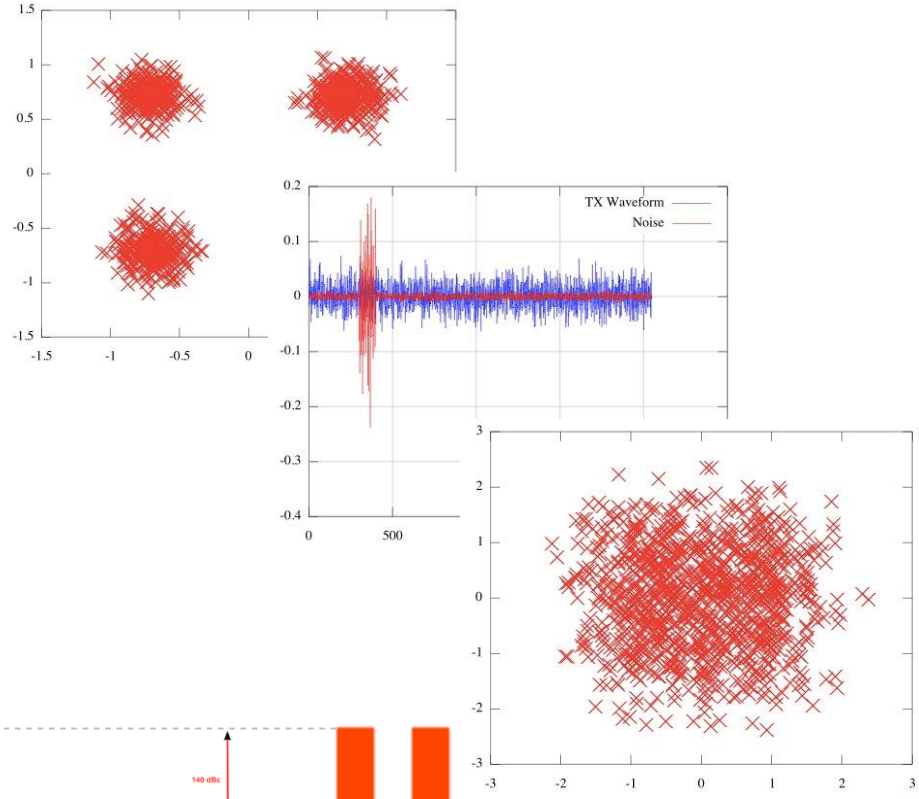


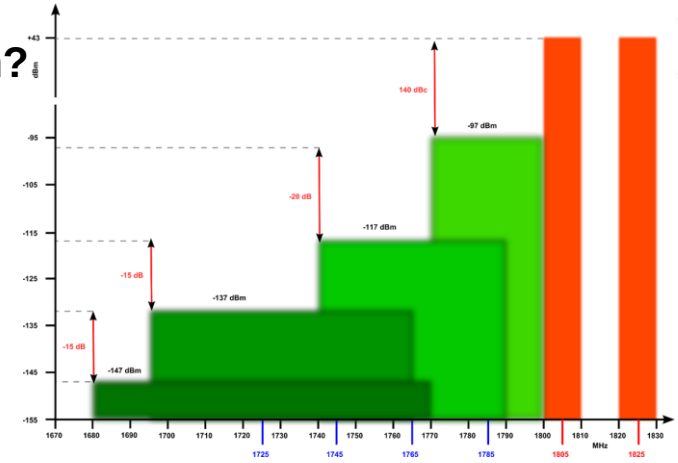


Spotting and characterization of Interference

Interference Mechanisms

- **A series of questions to be answered:**
  - **Is it On-Channel interference?**
  - **Is it In-band interference?**
  - **Is it Impulse Noise?**
  - **Is it Harmonics?**
  - **Is it Passive Intermodulation?**
  - **Is it a Near-Far Problem?**
  - **Is it intentional?**





Spotting and characterization of Interference

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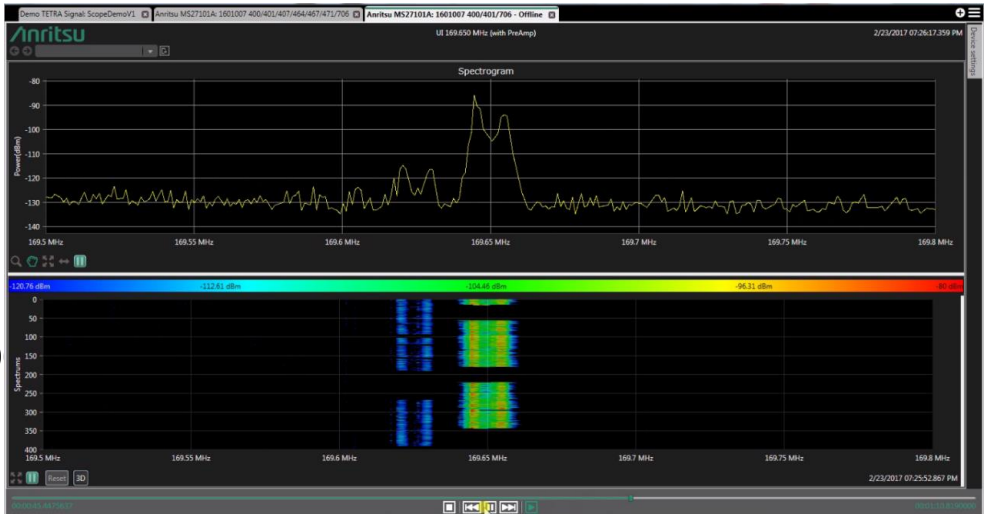
Spotting and characterization of Interference

Documentation of all measurable signal parameters

- **Signal parameters**
  - Center Frequency
  - Occupied Bandwidth
  - Channel Power
  - Transmission shape / envelop
  - Time based characteristics
    - Puls Duration (PD)
    - Pulse Repetition Frequency (PRF)
  - Location based parameters
    - Time
    - GPS location
  - Weather conditions
  - Propagation environment
    - Rural
    - Suburban
    - Urban



- **Signals may be linked to other signals**
  - Look for a trace that turns on and off
  - Look for carriers that turn on and off when your interference turns on and off

Automatic Spectrum

Monitoring

MS2710xA

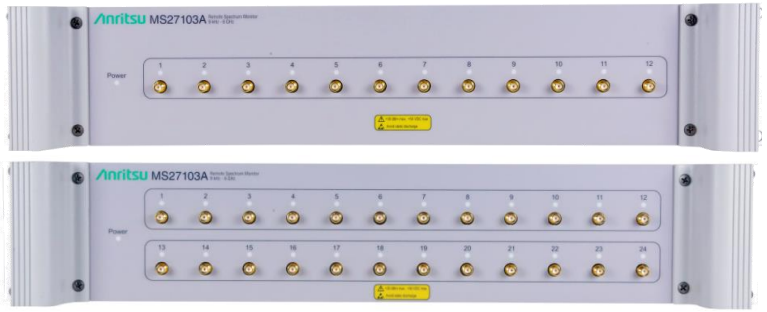
VISION MX28001A

SpectraVision MX28010A

Automatic Spectrum Monitoring

MS2710xA Remote Spectrum Monitors - A family of platforms to meet y

MS27101A
Half Rack x 1U Single Input



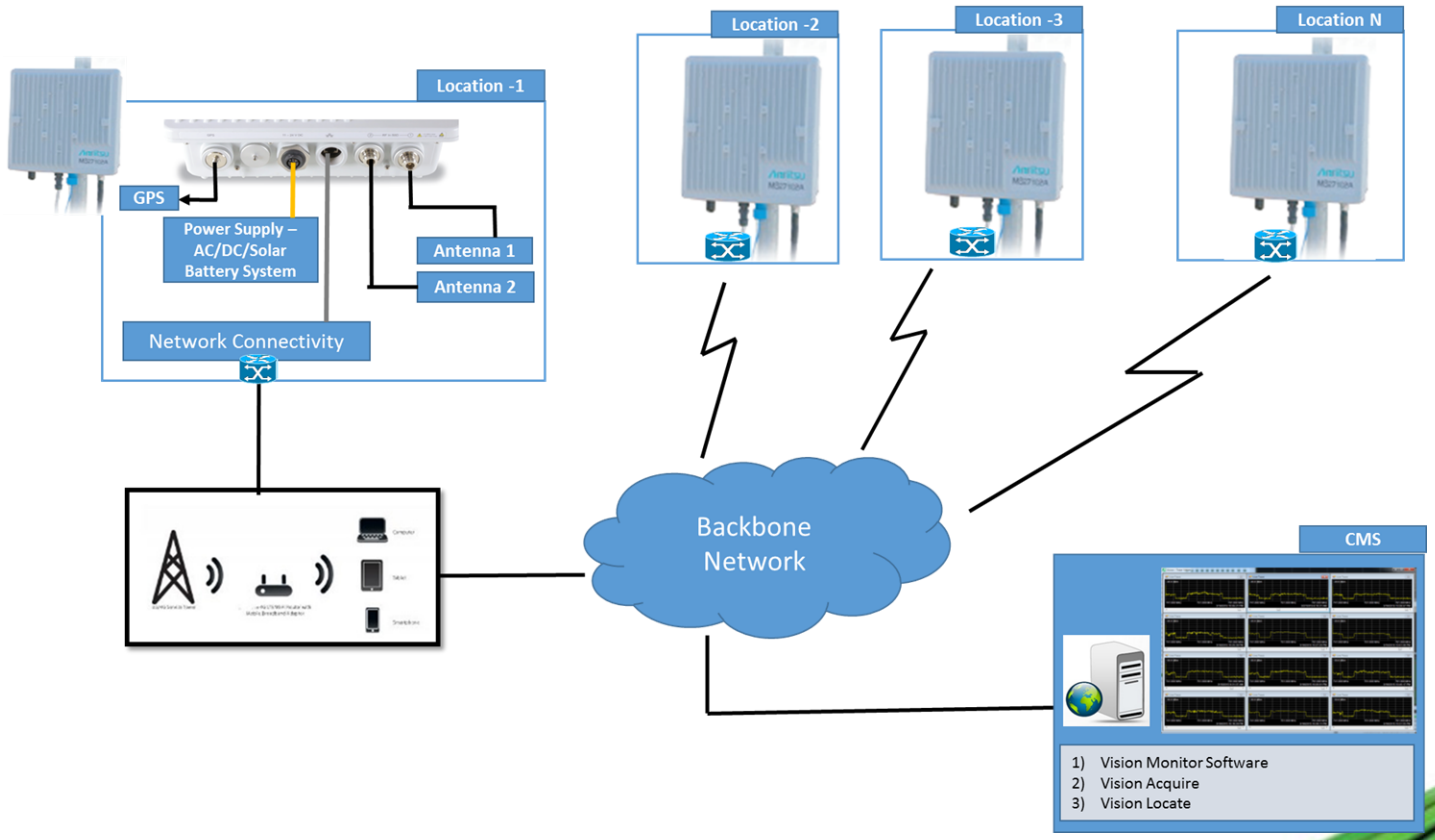
MS27103A Full Rack x 2U 12 / 24 input ports

MS27102A
IP67 Outdoor rated 1 or 2 input ports

MS27100A OEM PCA Only

Automatic Spectrum Monitoring

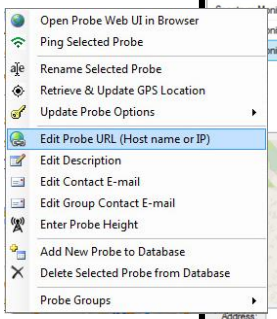
MS2710xA Operating Modes

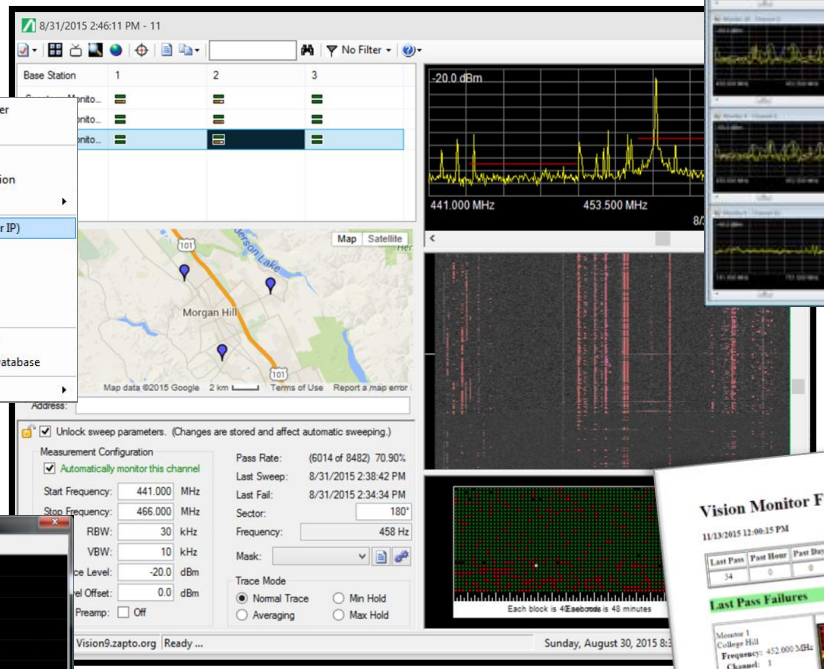


Automatic Spectrum Monitoring

VISION Monitor Functions

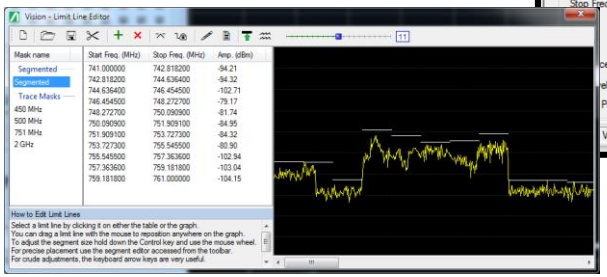
Edit probe information and scan settings





View synchronized historical or live data from numerous probes

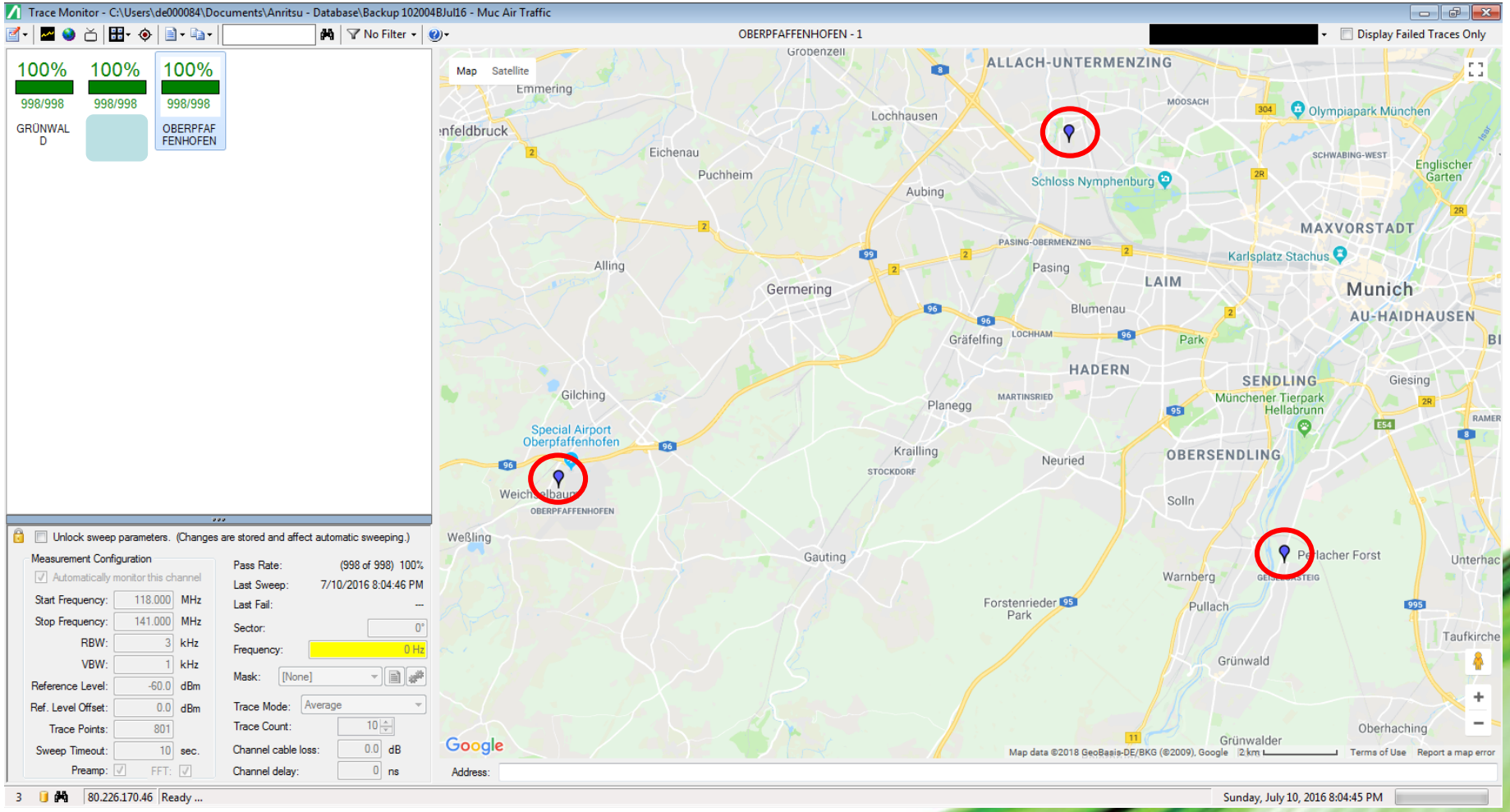
Edit limit lines and apply retroactively to historical trace data



Generate pass/fail reports

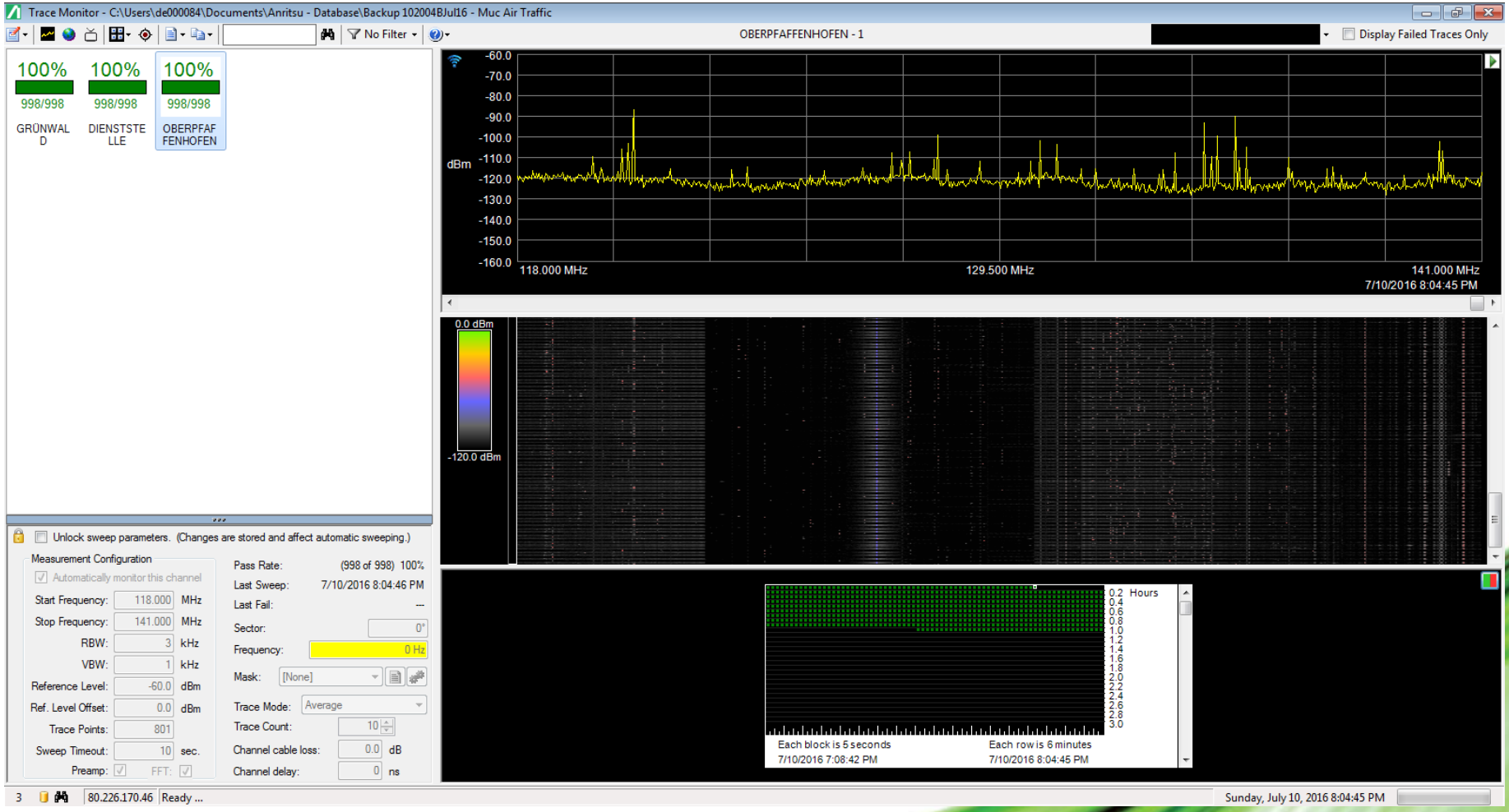
Automatic Spectrum Monitoring

VISION monitoring and multilateration – sensor deployment



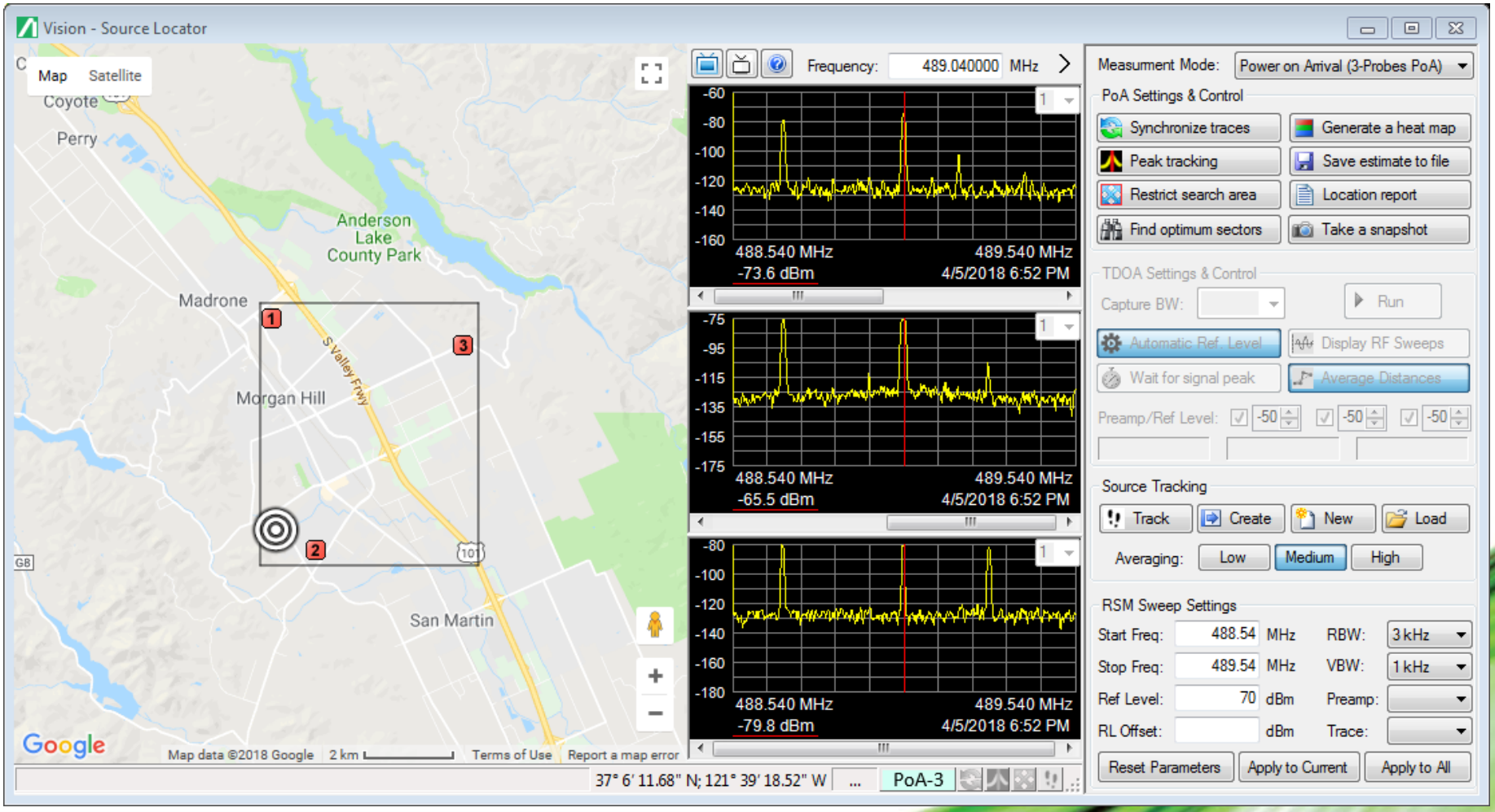
Automatic Spectrum Monitoring

VISION monitoring and multilateration - GUI



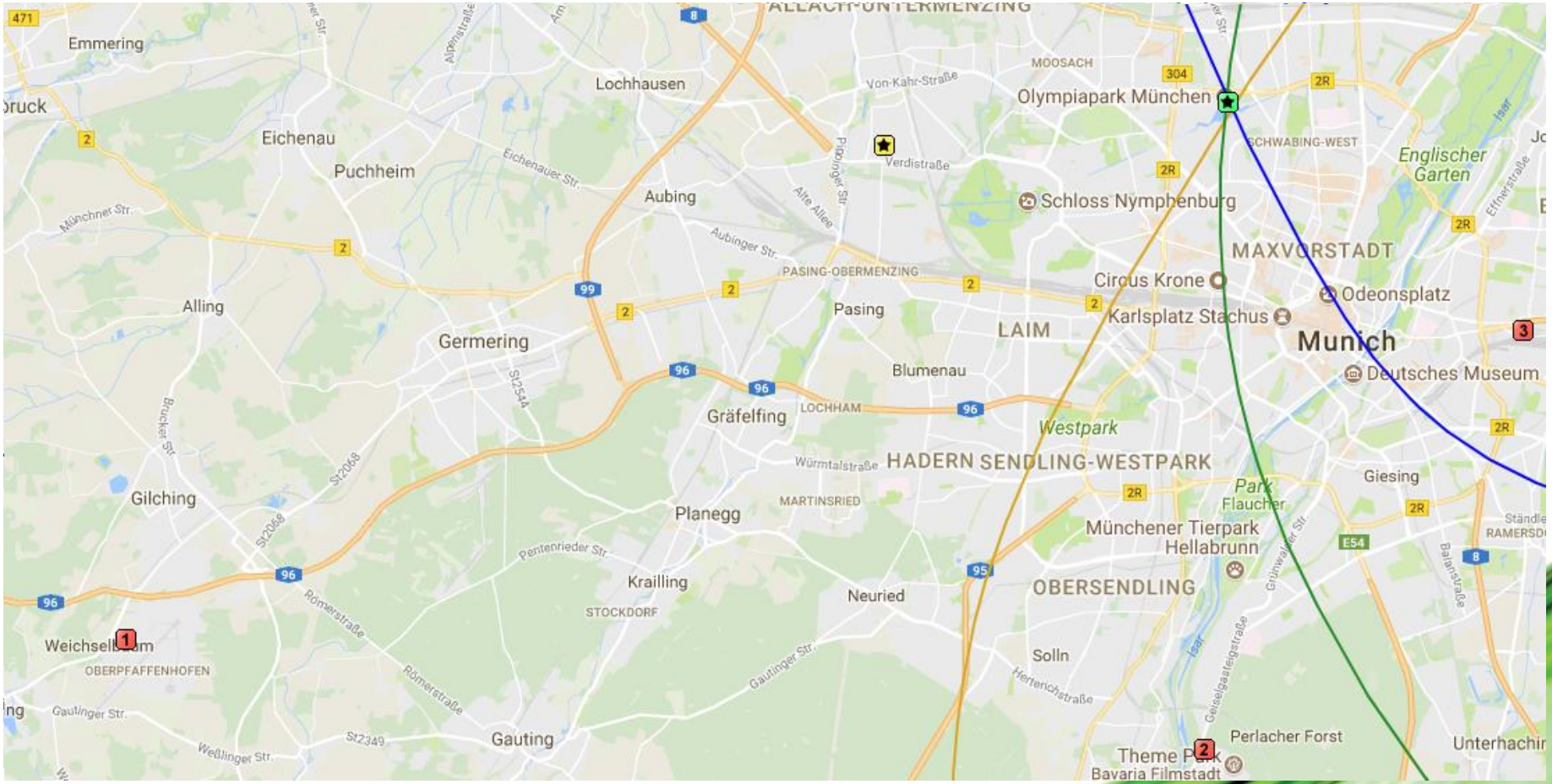
Automatic Spectrum Monitoring

VISION monitoring and multilateration – PDOA & TDOA GUI



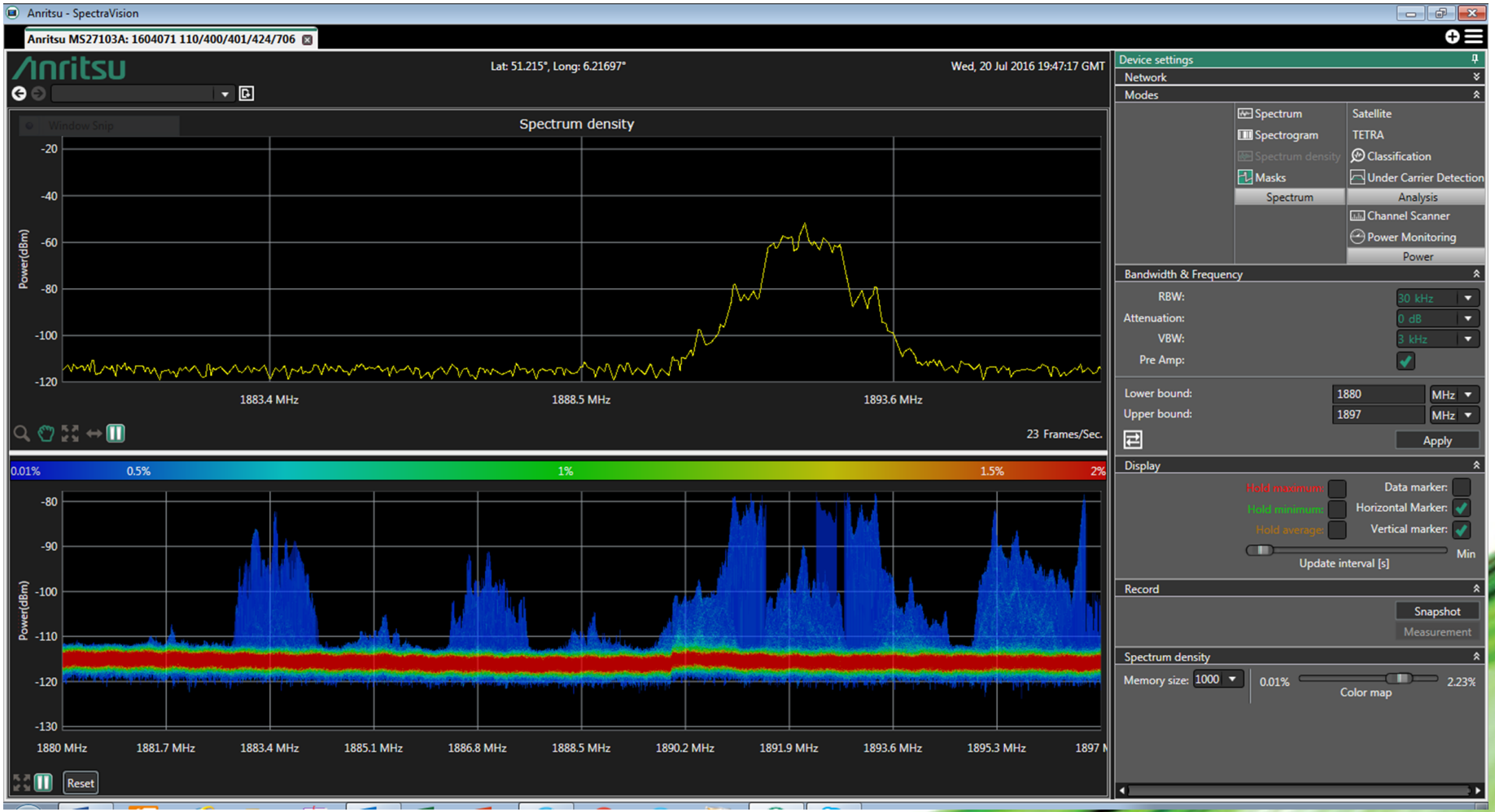
Automatic Spectrum Monitoring

VISION monitoring and multilateration – Typical TDOA result



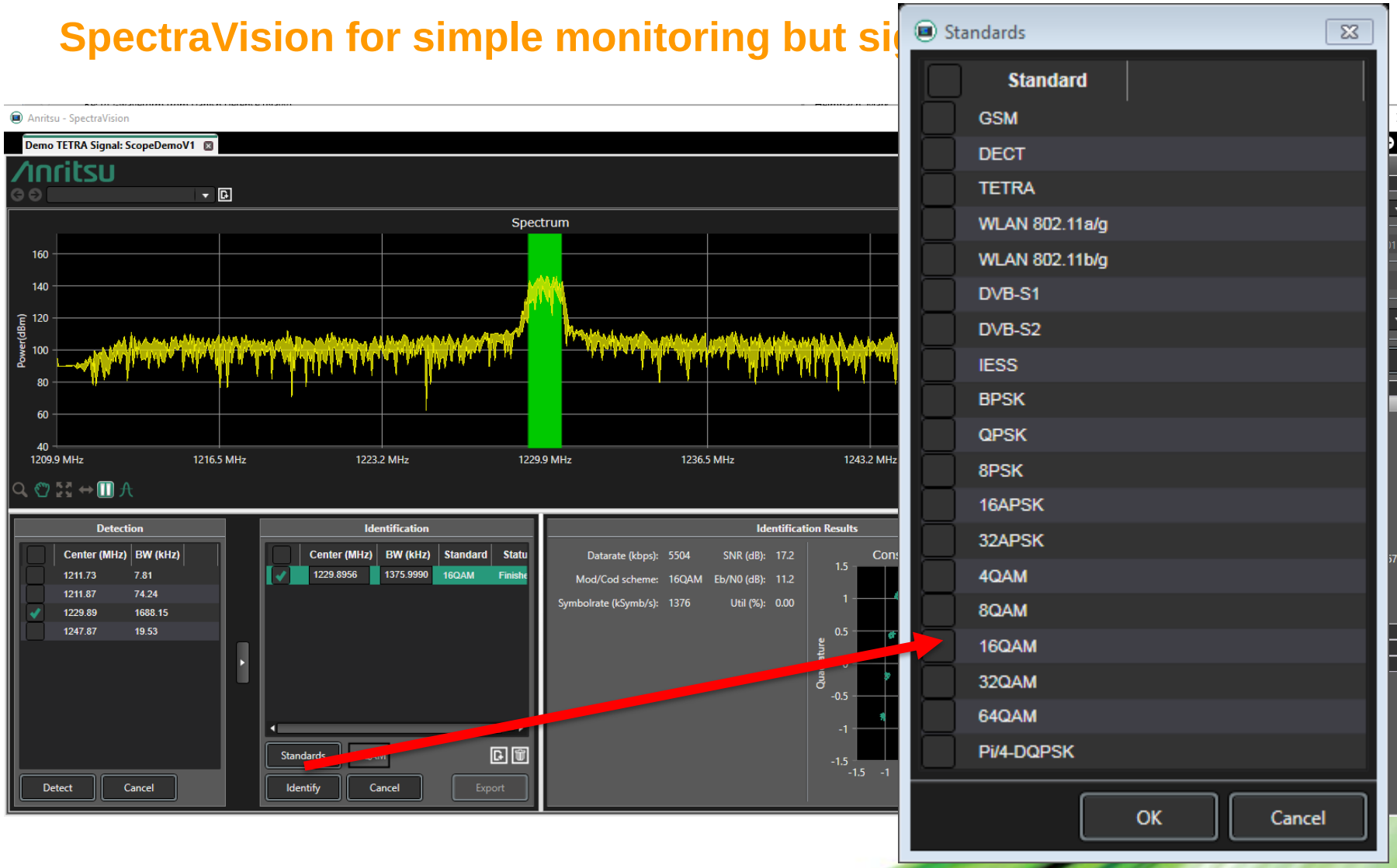
Automatic Spectrum Monitoring

SpectraVision for simple monitoring but signal analysis



Automatic Spectrum Monitoring

SpectraVision for simple monitoring but si



Automatic broadband Interference Locating system

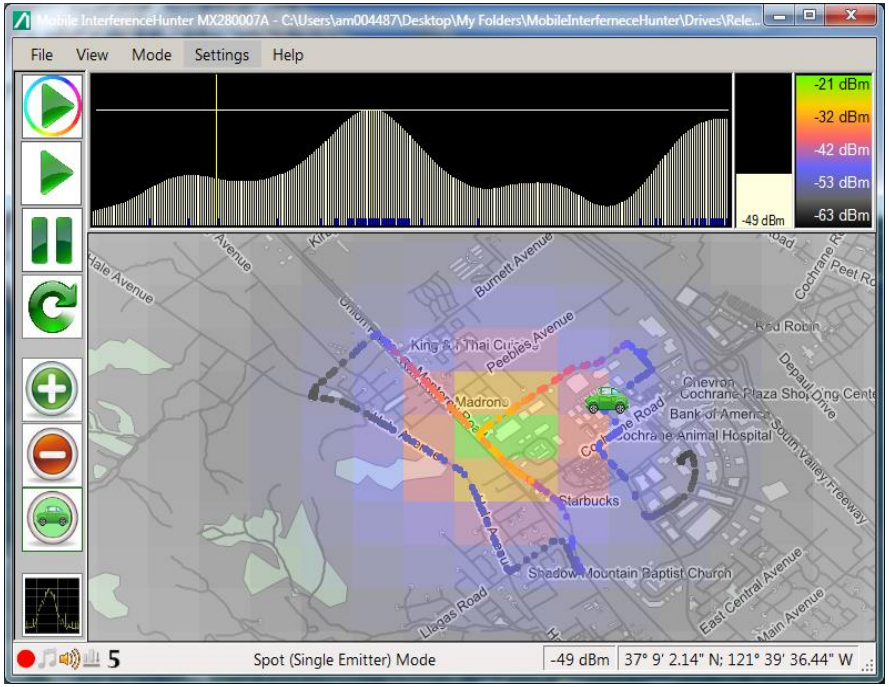
Mobile Interfrenece Hunter

MX28007A

Automatic broadband direction finding system

MX28007A – classical interference hunting role

- **Target application of Mobile InterferenceHunter™**
  - **Traditional Direction Finding**
    - **10 geo-located bearings per hour?**
  - **Mobile InterferenceHunter**
    - **100s of geo-located measurements per hour**
    - **While driving…**
    - **With patent pending driving direction guidance**
    - **With optional RSM handoffs**
    - **Works with pulsed or bursty signals**



Automatic broadband direction finding system

MX28007A

- **Single or multiple emitter detection mo**
  - **make it easy to use for any type of emitter detection application**
  - **e.g. multiple emitter mode is ideal for locating e.g. multiple cable TV interferers**
  - **Multiple TRX operating the same RF**
- **A spectrum clearing mode using channel power measurements that map signals above a certain power threshold**
- **Key capabilities**
  - **Guided area scan**
  - **Post-capture analysis**
  - **No special antenna requirement**

Anritsu Handheld Spectrum Analyzer with GPS Option

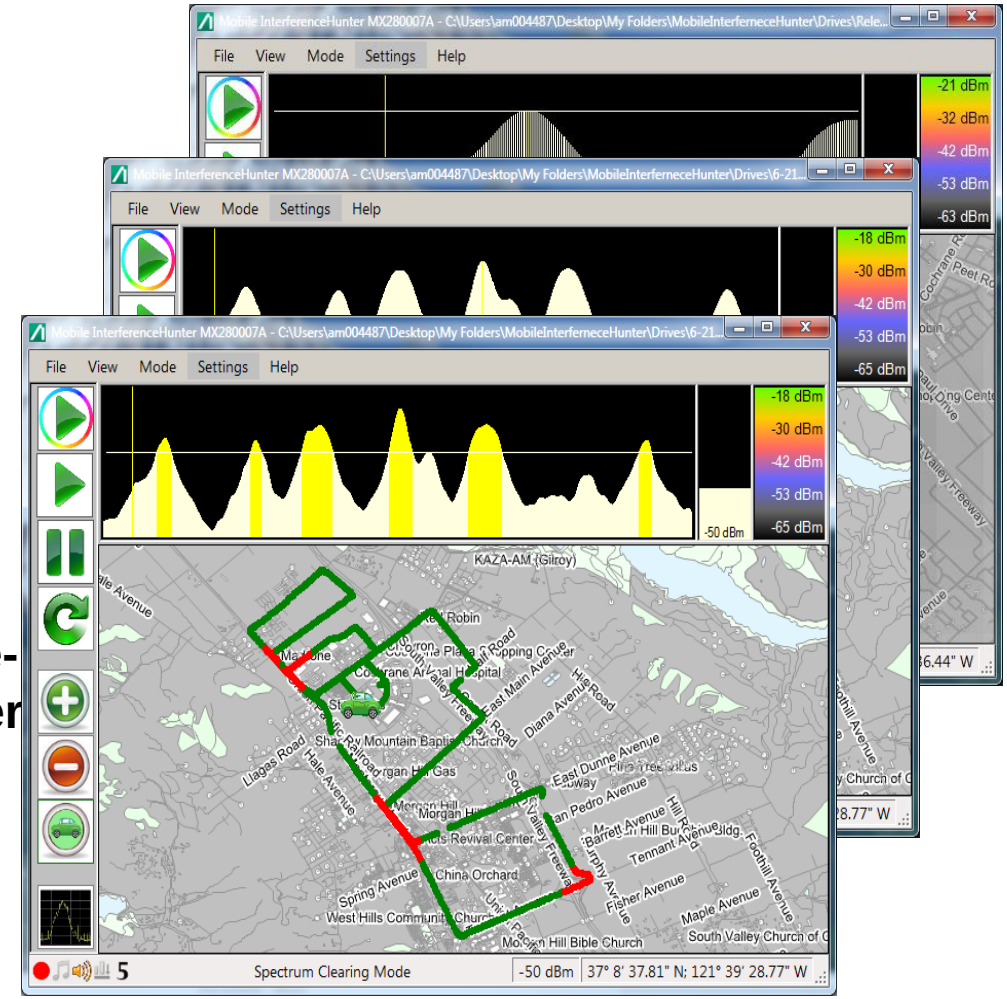
Dash-mounted Windows® PC Tablet with MX280007A Software and 2000-1801-R mounting hardware

2000-1647-R
Broadband Magnet Mount Omnidirectional Antenna
700 MHz to 6 GHz with GPS Antenna in one housing
(recommended antenna for users operating in this frequency range)

Automatic broadband direction finding system

MX28007A

- **Log files allow post-drive analysis**
  - **Many parameters may be changed**
  - **Allows expert assistance**

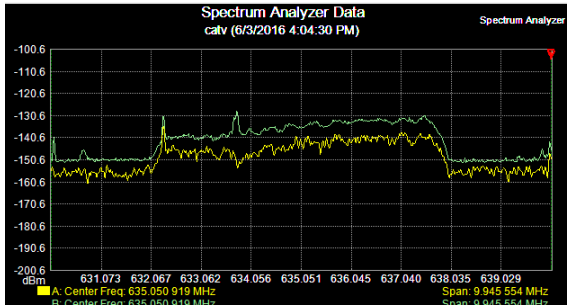


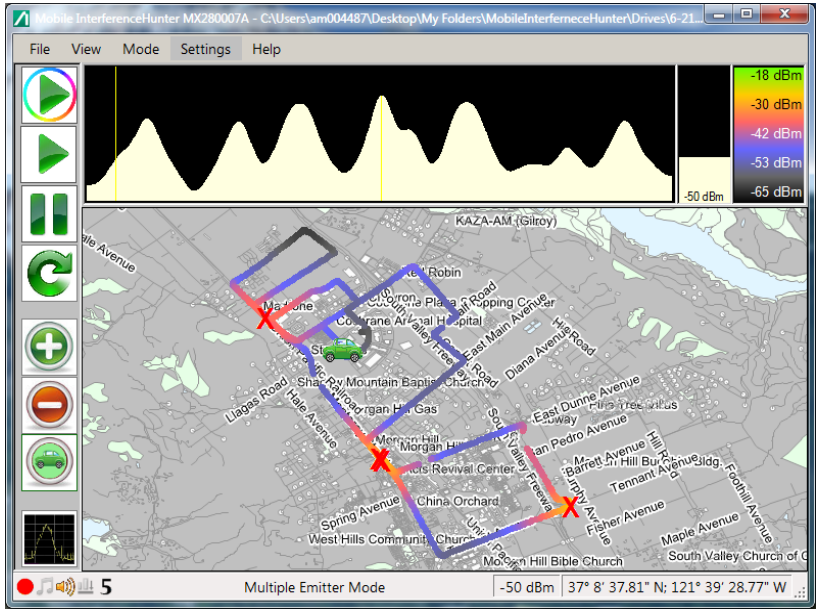
- **Single-Emitter**
- **Multi-Emitter**
- **Spectrum Cleaning**

Automatic broadband direction finding system

MX28007A – Hunting CATV egress

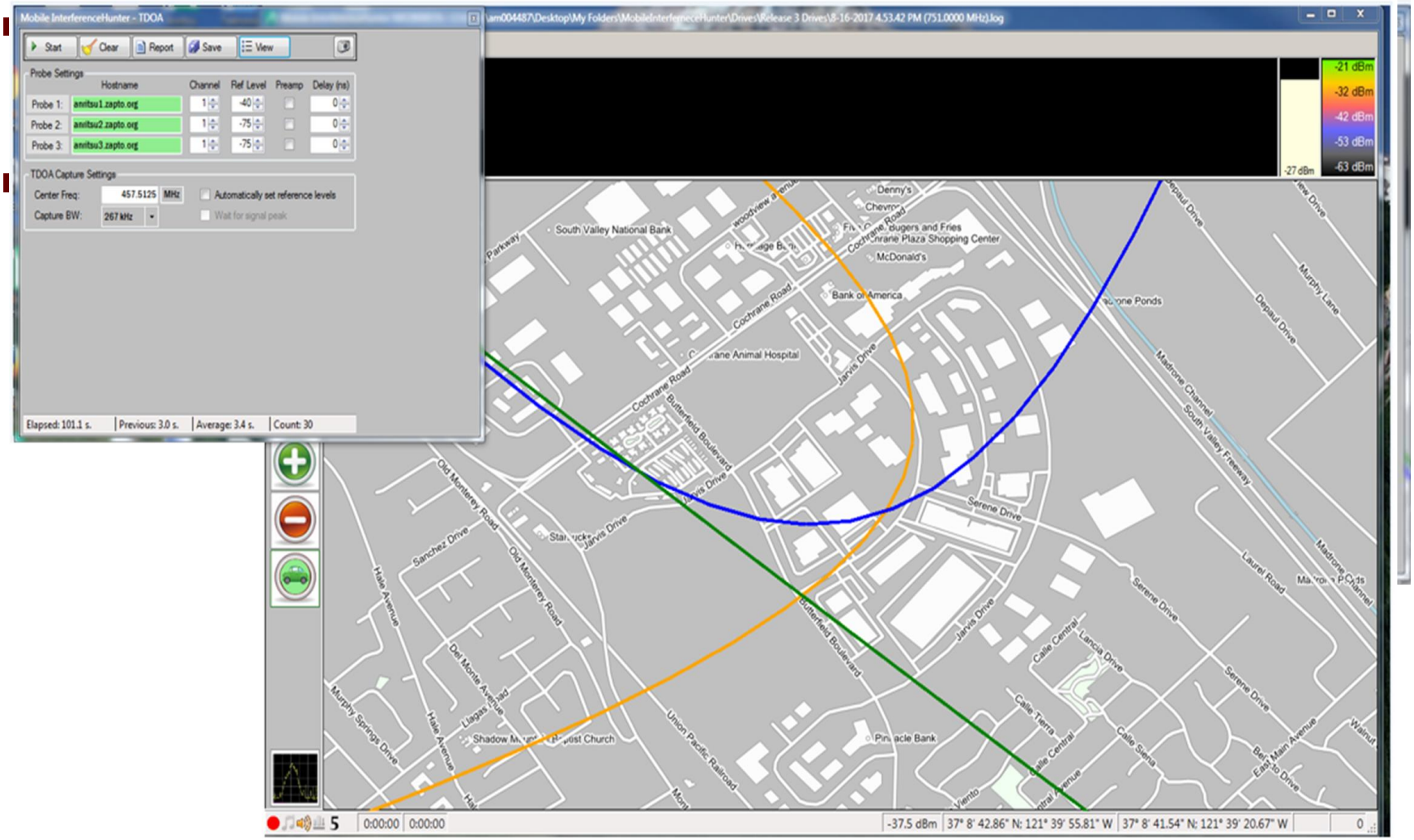
- Poorly maintained cable networks tend to leak
  - Squirrels and other rodents
  - CATV theft
  - Storm or traffic damage
- This leakage can:
  - Be in LTE uplink bands
  - Affect uplink quality
  - Have multiple sources
- The Problem
  - Locating 100s of emitters
  - By direction finding alone it's going to take a while
- Multi-Emitter mode
  - Locates channel power peaks
  - Shows power gradient
  - Can ignore LTE uplink signals
  - Can get to the nearest curb





Automatic broadband direction finding system

MX28007A – aided by VISION multilateration results



Automatic broadband direction finding system

MX28007A Compatibility

- All current HH SPAs
  - Required Options
    - GPS (Option 31)
    - Ethernet (Option 411)
  - Burst Detect
    - Spectrum Master MS2720T
    - BTS Master MT8220T
- Also works with
  - MS2760A, up to 110 GHz
  - MS27101A, headless


Spectrum Master™ MS2760A


Remote Spectrum Monitor MS27101A


VNA Master MS2034B/35B


VNA Master MS20236C/37C/38C


Spectrum Master™ MS2720T


Spectrum Master MS2021B


Spectrum Master MS2722C/23C/24C/25C/26C


Spectrum Master MS2711E/12E/13E


BTS Master™ MT8220T


BTS Master MT8221B/22B


Cell Master™ MT8212E/13E


Site Master™ S332E/62E


LMR Master™ S412E

The last 100 m to the target

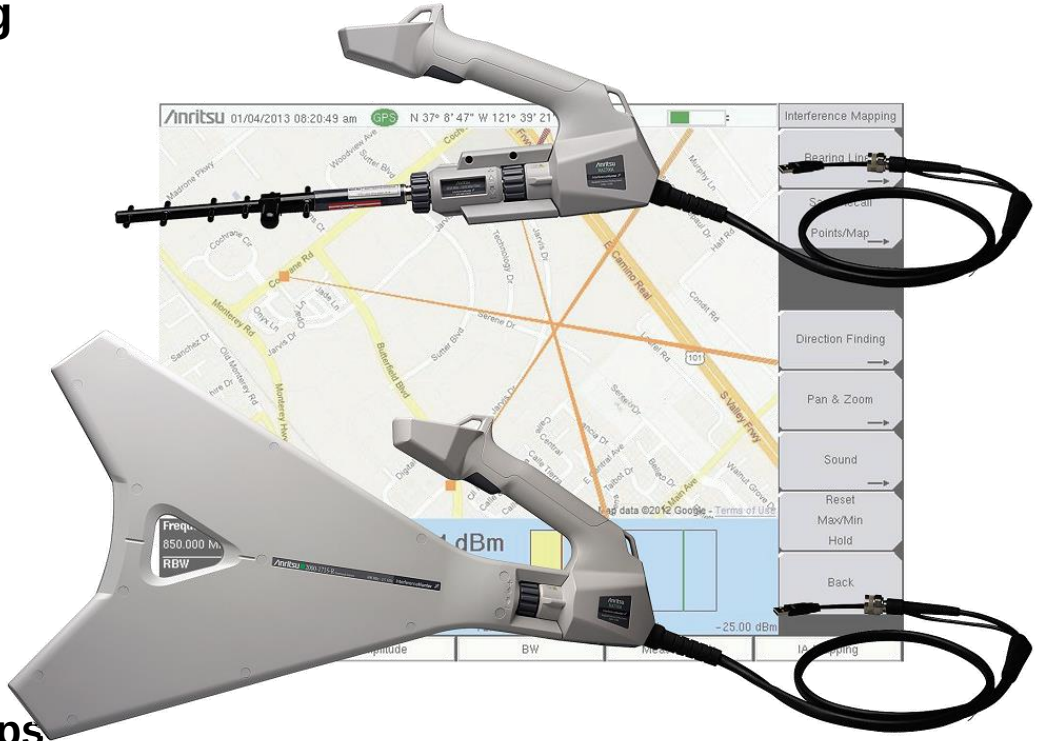
with

MS2700A

Handheld Emitter Location

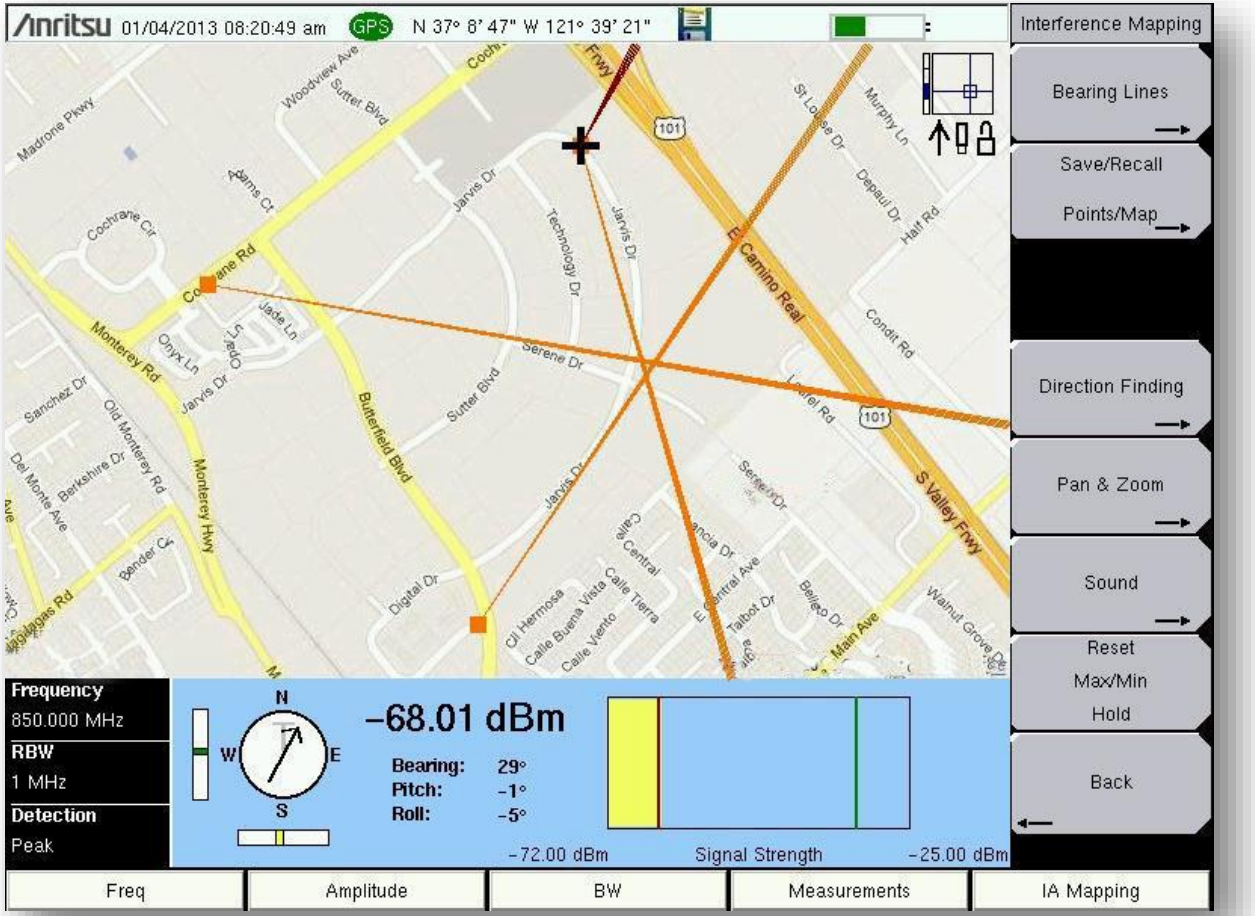
MA2700A

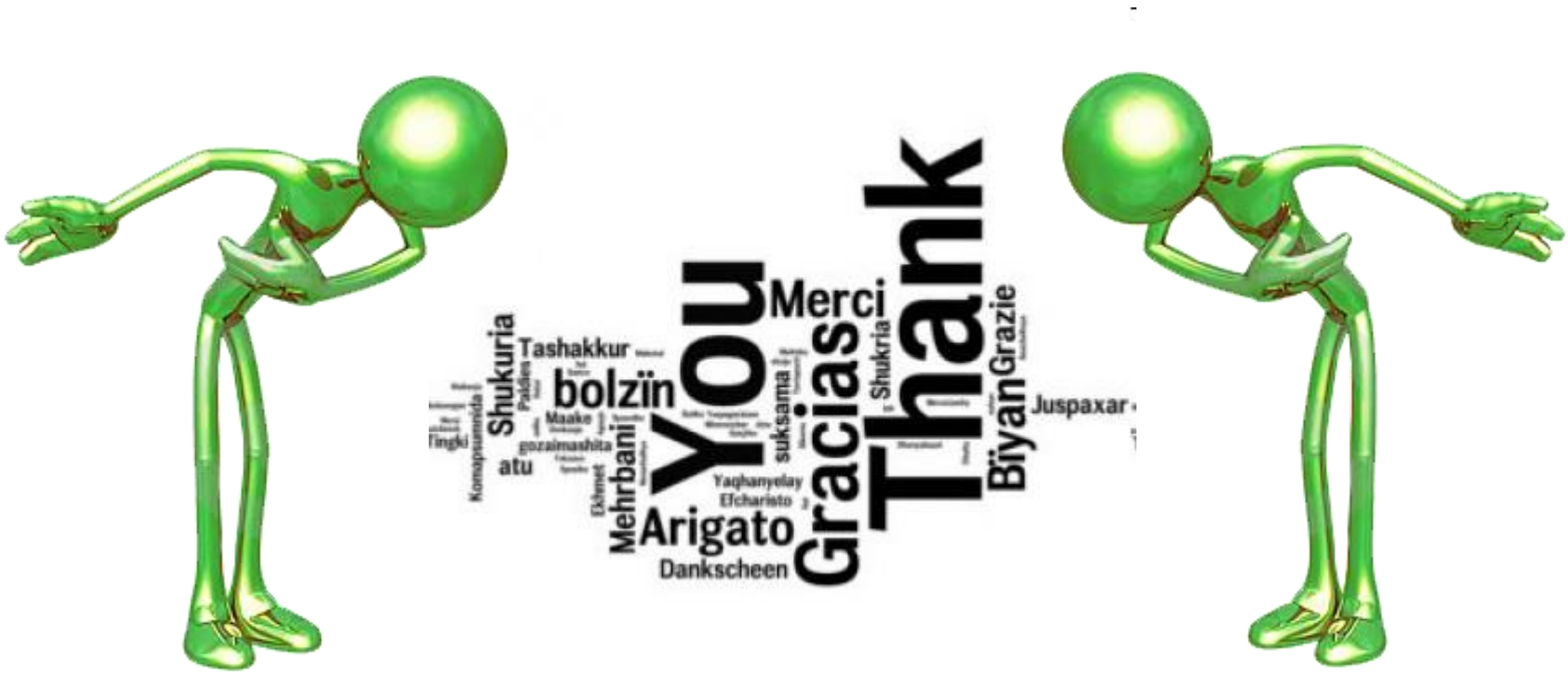
- **MA2700A for manual sniffing and taking bearings for locating purposes**
  - **Built-in electronic compass**
  - **Built-in GPS receiver**
  - **Built-in preamplifier**
  - **Trigger for saving vectors**
- **Easy no-tool attachment of antennas**
- **Ergonomic design**
  - **Instrument in front of the hips**
  - **Antenna operation by one hand**
- **Light weight**
- **Several available antennas**



MA2700A Handheld emitter localization

MS2700A – typical results




Thank
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Merci
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Arigato
Shukuria
Tashakkur
Mehrbani
Grazie
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Juspaxar
Shukria
suksama
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