ICG-9 Meeting, Prague, Session 3, 11th Nov. 2014

Spectrum Monitoring applied to the Detection and Geolocation of GPS Jammers

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Radio Monitoring

Spectrum Management Systems

Strategic Consulting

Training Academy

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Detection & Geolocation of GPS Jammers

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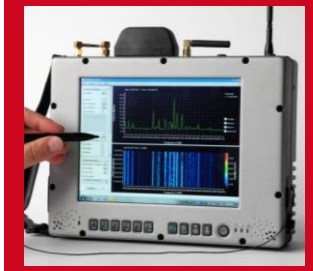
Monitoring Hardware

Fixed

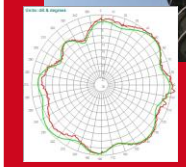
Portable



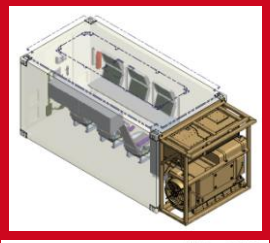
Transportable

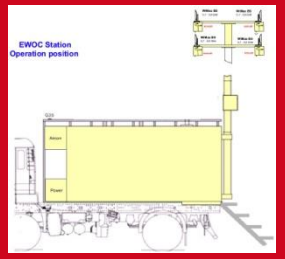
Mobile

Flying



Custom





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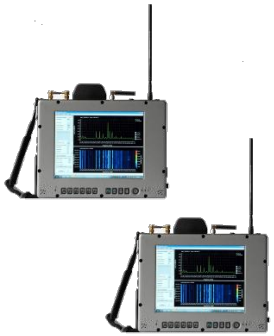
Typical System Configuration

Continuous Monitoring

Ethernet, LTE /UMTS, WiMax

3G-UMTS, 4G-LTE

WiMax, 3G-UMTS, 4G-LTE



Portable Monitoring

Control & Operating Centre

Mobile Monitoring

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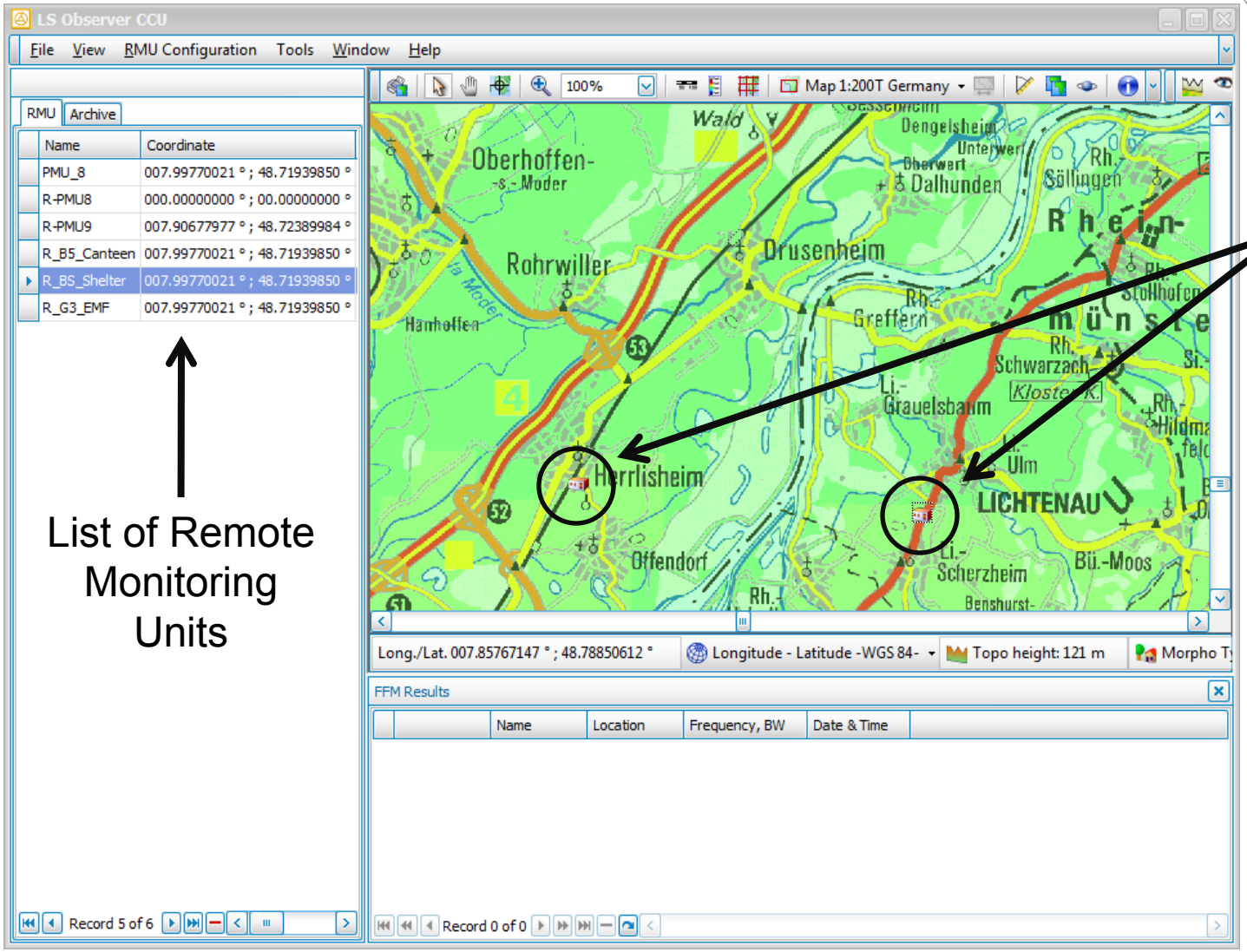
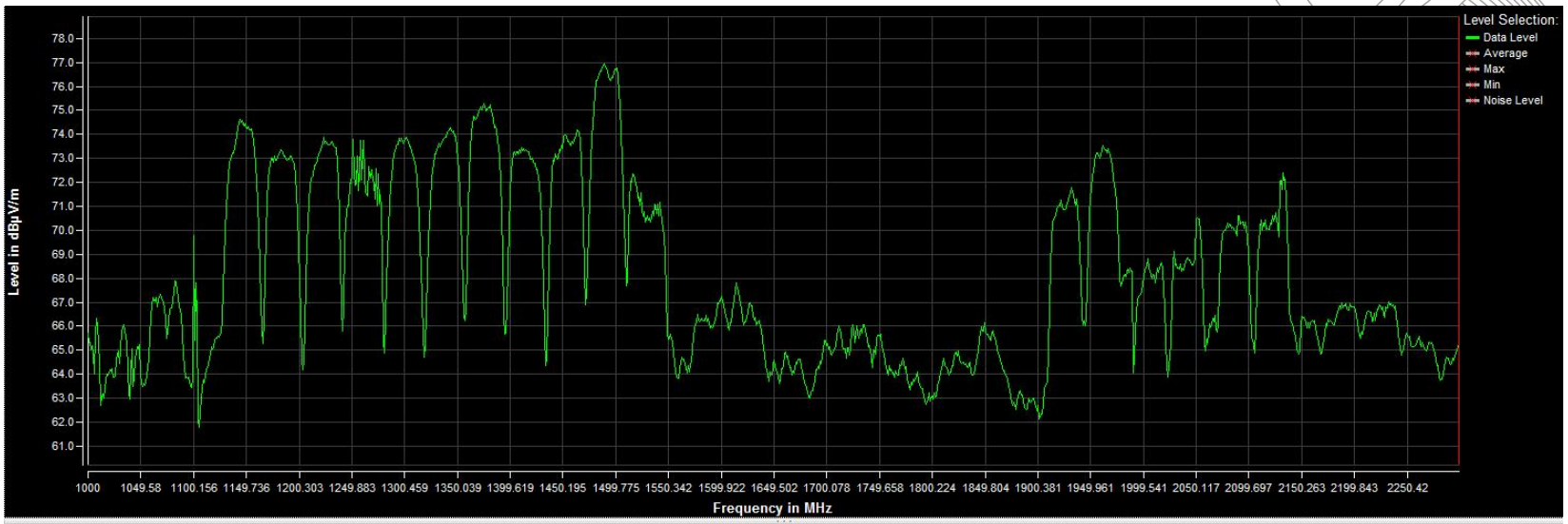
Full Remote Control

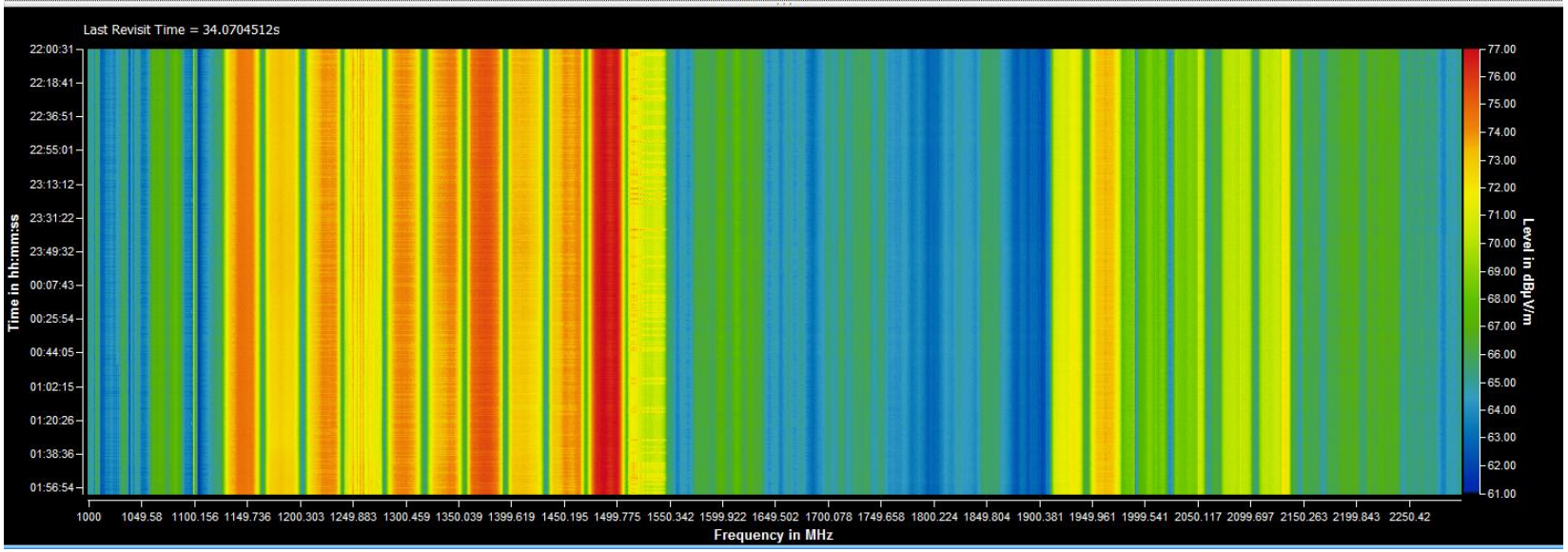


List of Remote Monitoring Units

Position of the units shown on the map

Wideband Spectrum Monitoring





Continuous Spectrum Monitoring

- Principles of operation
  - Wideband monitoring
  - Monitor radio-frequencies 24/7
  - Record measurement results

- Benefits
  - Monitor several frequency bands
  - Quick identification of anomalies
  - Allow quick geolocation
  - Automated monitoring system
  - Look back in the past

Fixed Monitoring Stations

- Installed at fixed sites
- Remotely controled
- Wideband MHz – GHz ranges
- Measuring RF continuously
- Automatically looking for unwanted emissions
- Raising alerts

Transportable Monitoring Stations

- Same features as FMS
- Easily transportable
- Installation within minutes
- Temporary measurements

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Portable Monitoring Units

- Mainly handheld usage for in field measurements but also applicable as mobile and portable unit
- Manual or remote controlled operations
- Display of measurement result files
- Geolocation of using PDoA
- Direction Finding: sequential AoA/LoB
- Useful in dense populated areas, like big towns, where fixed stations can't hear between the buildings
- Like fixed stations, recording Raw Data for later processing

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Off-the-shelf Configuration Options

Frequency range

- 12.4 GHz
- 4.4 GHz
- 100 kHz
- 9 kHz

Storage

- up to 2 years monitoring data

Environmental parameters

- Ruggedised

Geolocation

- PDoA
- Direction Finding Software

Connectivity

- 3G-UMTS
- WiFi
- Bluetooth
- Ethernet
- Remote Control

Accessories

- Monitoring Antenna
- Battery
- Directionnal -Antenna
- Bag
- Case
- ...

standard | SW Option | HW Option

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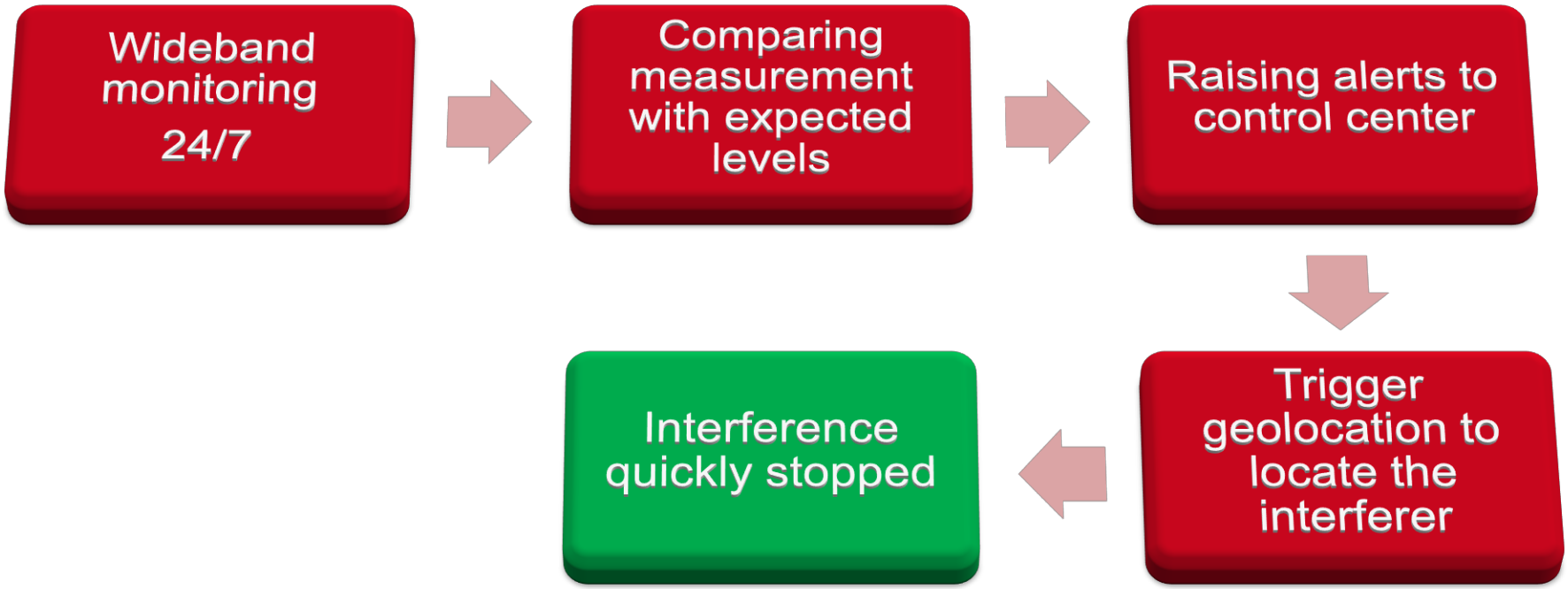
Automated Continuous Monitoring



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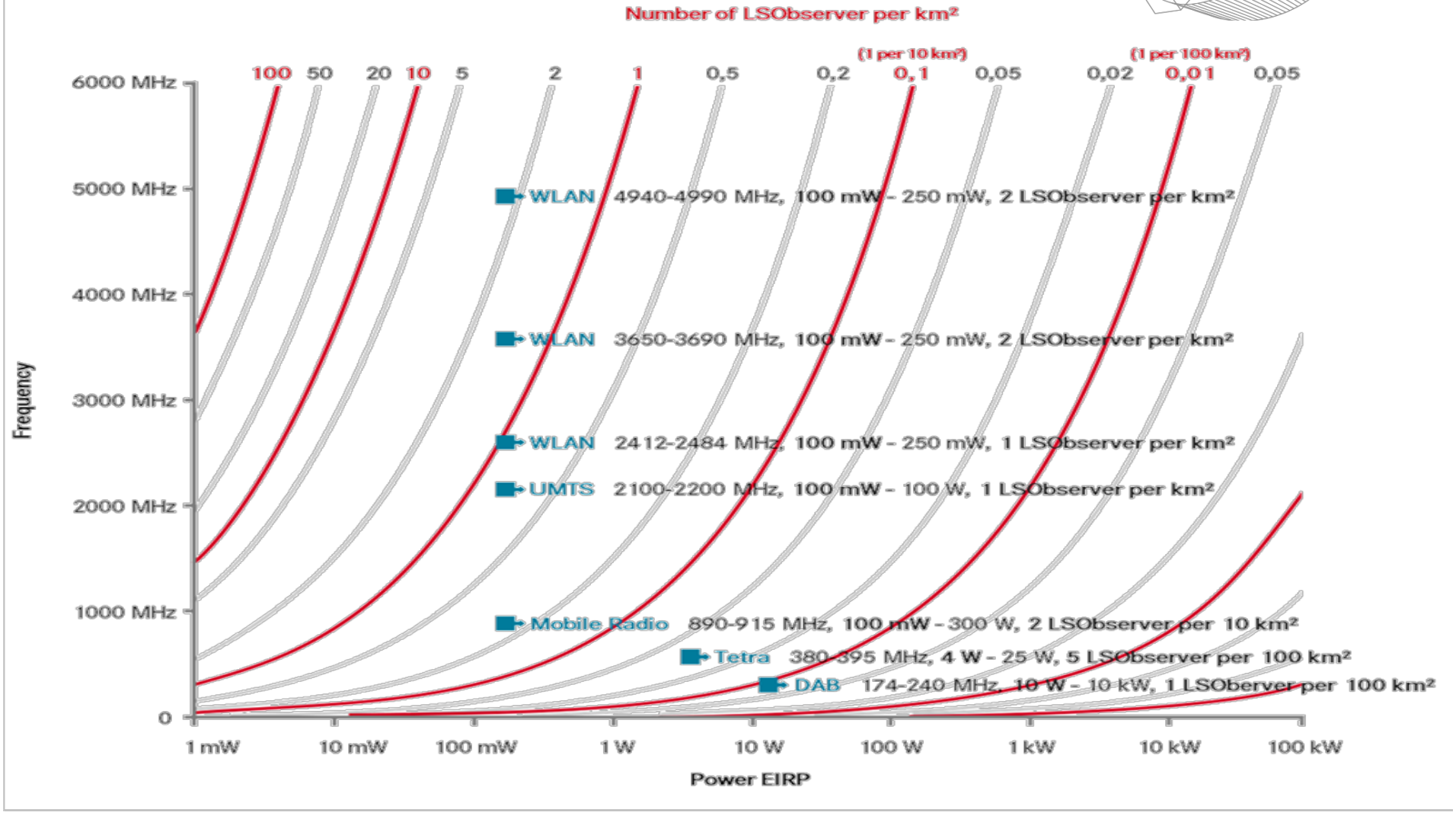
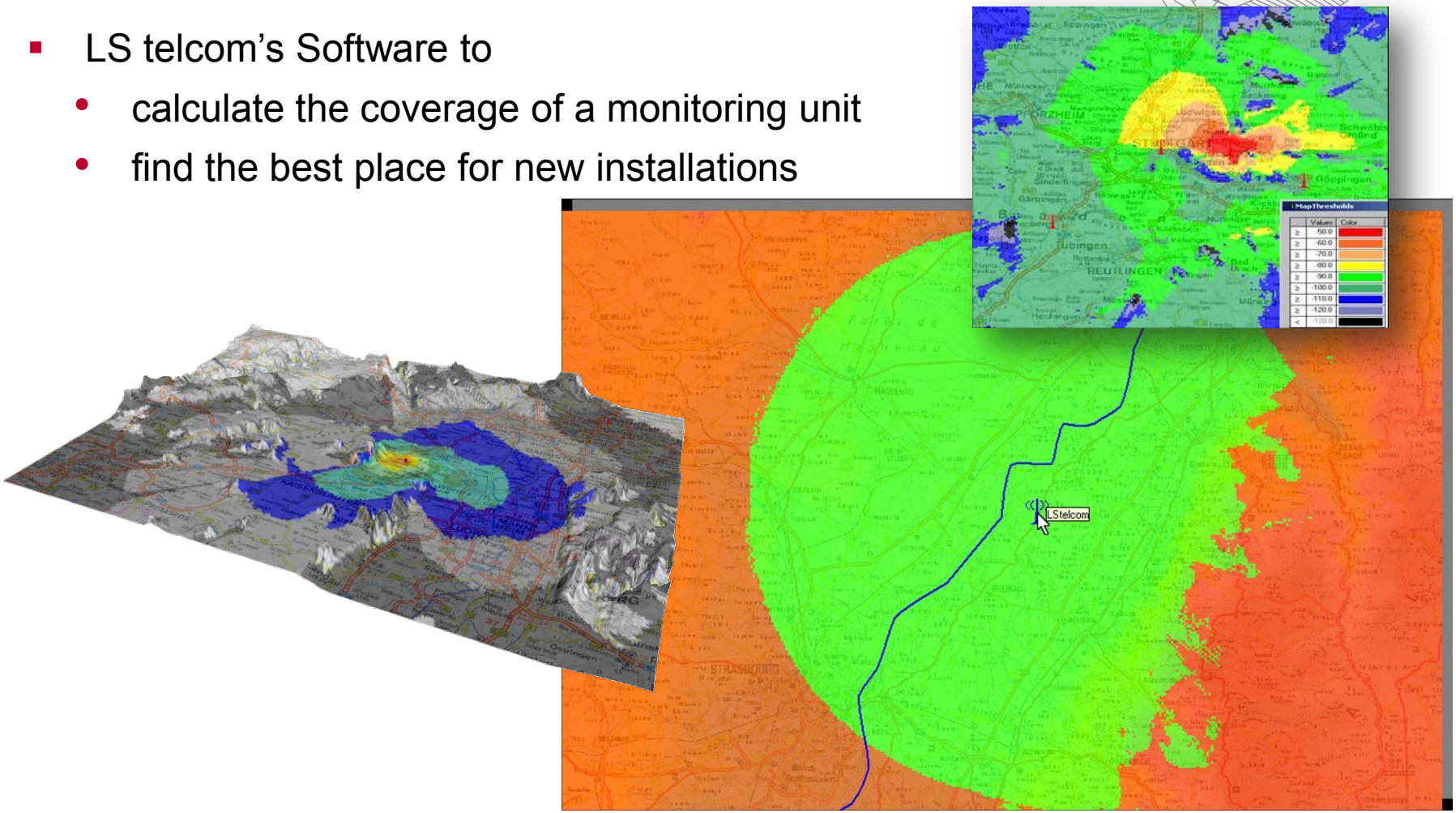
How many Monitoring Units?

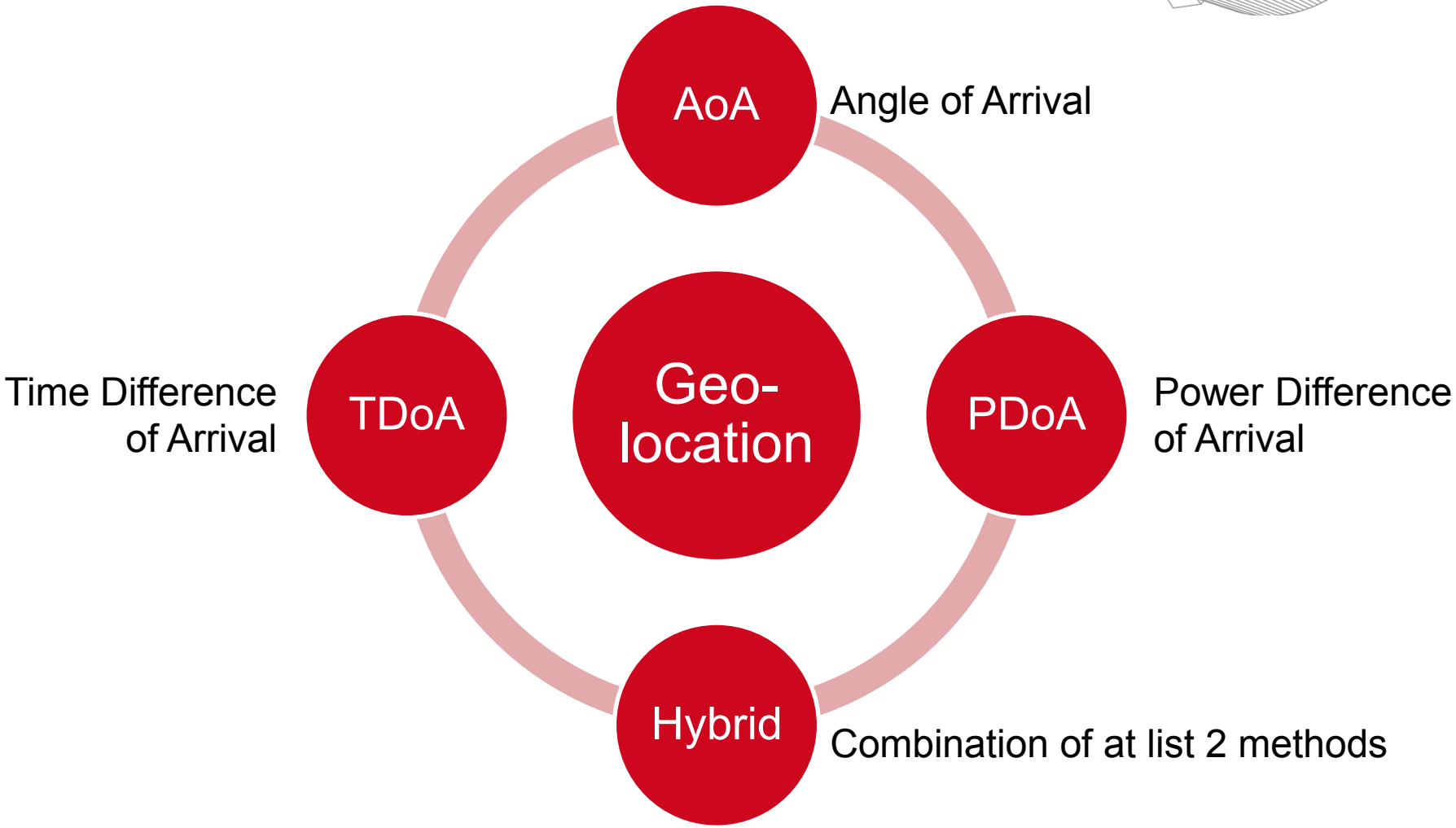


Where to place the monitoring units? Simulation & Planning

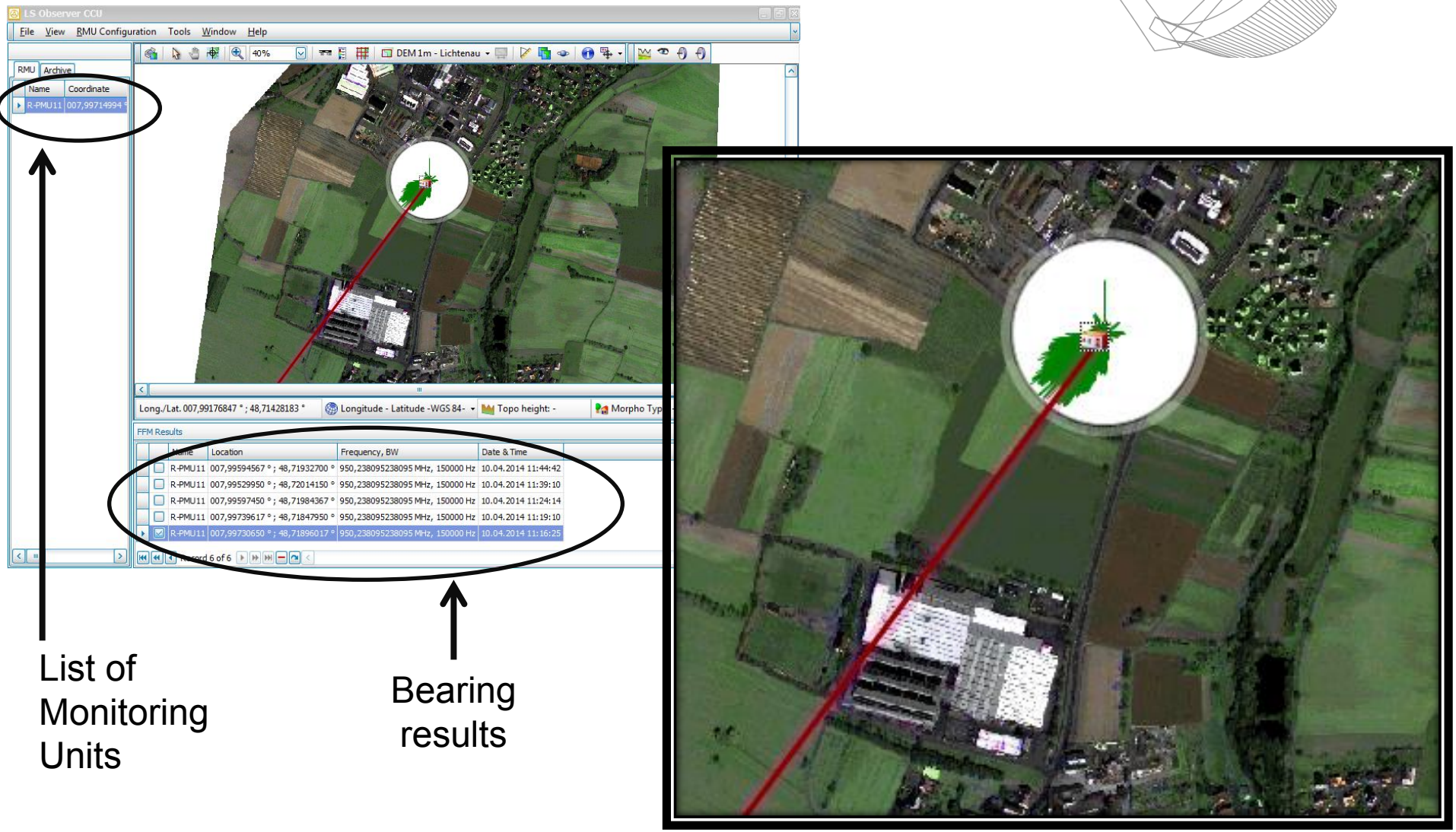
- LS telcom's Software to
  - calculate the coverage of a monitoring unit
  - find the best place for new installations



Geo-location methods



Geo-location with AoA



List of Monitoring Units

Bearing results

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What are PDoA and TDoA?

- PDoA is based on measuring the signal strength at different places and then computing the location using the different signal strengths that have been measured at different place

- PDoA can be computed live or at a later time using recorded data

- TDoA, like PDoA, is a computation based on a difference between measurement realised at different places but using time instead of signal strength. Each monitoring unit is equipped with a high precision GPS receiver that allows to exactly know when signals are received. Comparing the time when a same signal has been received by different monitoring stations allows to determine the area where the emitter is located with a good precision

- TDoA must be performed live. It can't be computed backwards

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Quick comparison of PDoA and TDoA

	PDoA	TDoA	Hybrid
Minimum number of units	3	3	3
Typical accuracy	200 m	45 m	45 m
Speed of geo-location	1 s	1 s	1 s
Minimum signal duration*	0.1 s	live signal	live signal
Minimum signal bandwidth	none	200 kHz	200 kHz
Maximum signal bandwidth	20 MHz	20 MHz	20 MHz
Can be computed live	yes	yes	yes
Can be computed on recorded data	yes	no	no

*: the signal must be in the air until three stations completed one scan

Geo-location with TDoA / PDoA

Monitoring of a wide area Coverage for Detection and Geolocation

Where to place the monitoring units?
Along roads, at „way points“

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Where to place the monitoring units?
Around particular sites

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Thank you for your attention

QUESTIONS ?

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