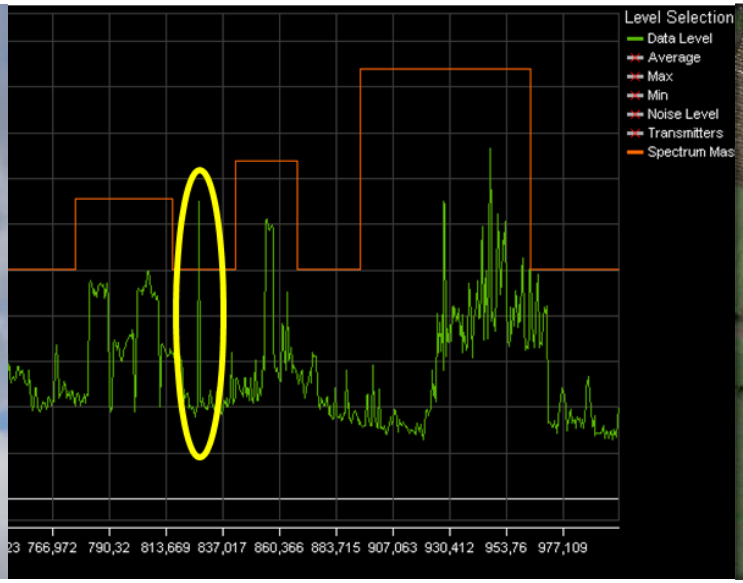
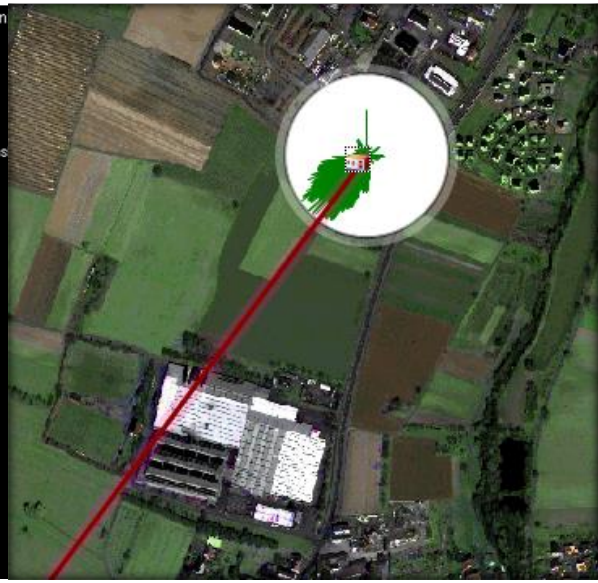
Colibrex
Member of the LS telcom Group

DRONE ASIA CONFERENCE @ MILIPOL ASIA-PACIFIC 2017

Singapore, 5th April 2017

Drone as a Flying Spectrum Monitoring Unit for Public & Homeland Security Purposes

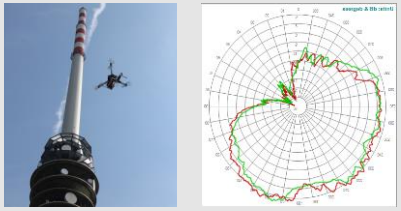




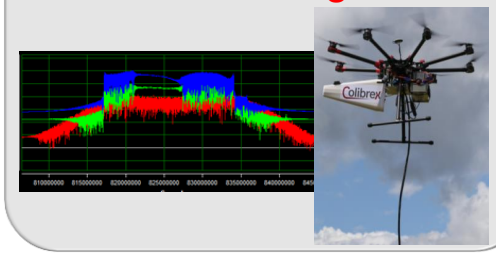
About Colibrex

- 100% subsidiary of LS telcom AG specifically dedicated to new fields of activities around UAS
- LS telcom, as global leader in spectrum efficiency, offers spectrum management and RF monitoring tools to a large scope of institutional, military and commercial organizations
- Colibrex is a pioneer in RF airborne measurement using UAS and offers the measurement services worldwide
- Based on its background as professional UAS operator and on the competencies and experience of LS telcom towards dynamic databases and licensing processes, Colibrex is also extending its activities with drone regulatory and safety solutions

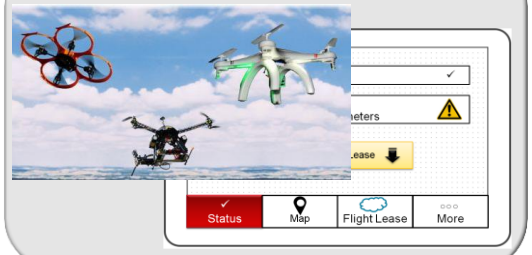
Airborne Measurement Services



RF Monitoring UAS

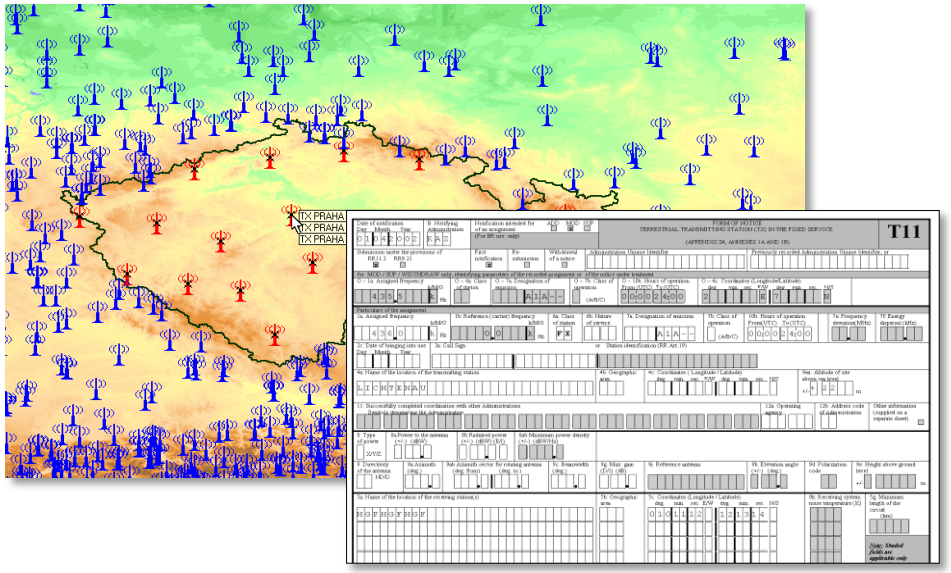


Drone-Flight-Check

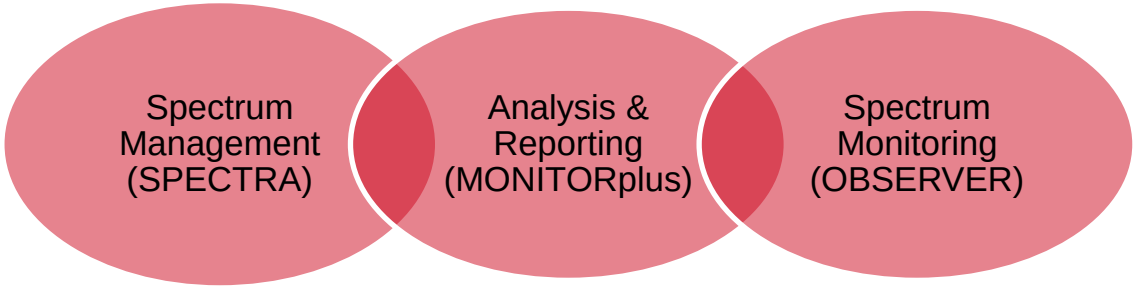


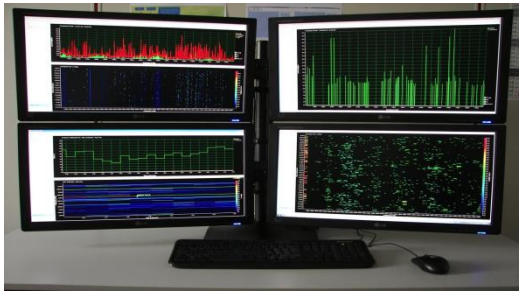
Spectrum Management and Monitoring

- Spectrum is a limited resource that is heavily occupied with more and more wireless applications everywhere. It must be well managed and monitored.
- Breaches of regulations, wrong calibration/settings of transmitting equipments, illegal transmitters and jammers can create problems going from interferences up to interruption of communication services
- Looking at homeland and military security, detecting transmitting sources is crucial
- All in all efficient and flexible spectrum monitoring is a key in national security operations



Surveillance and Data Collection

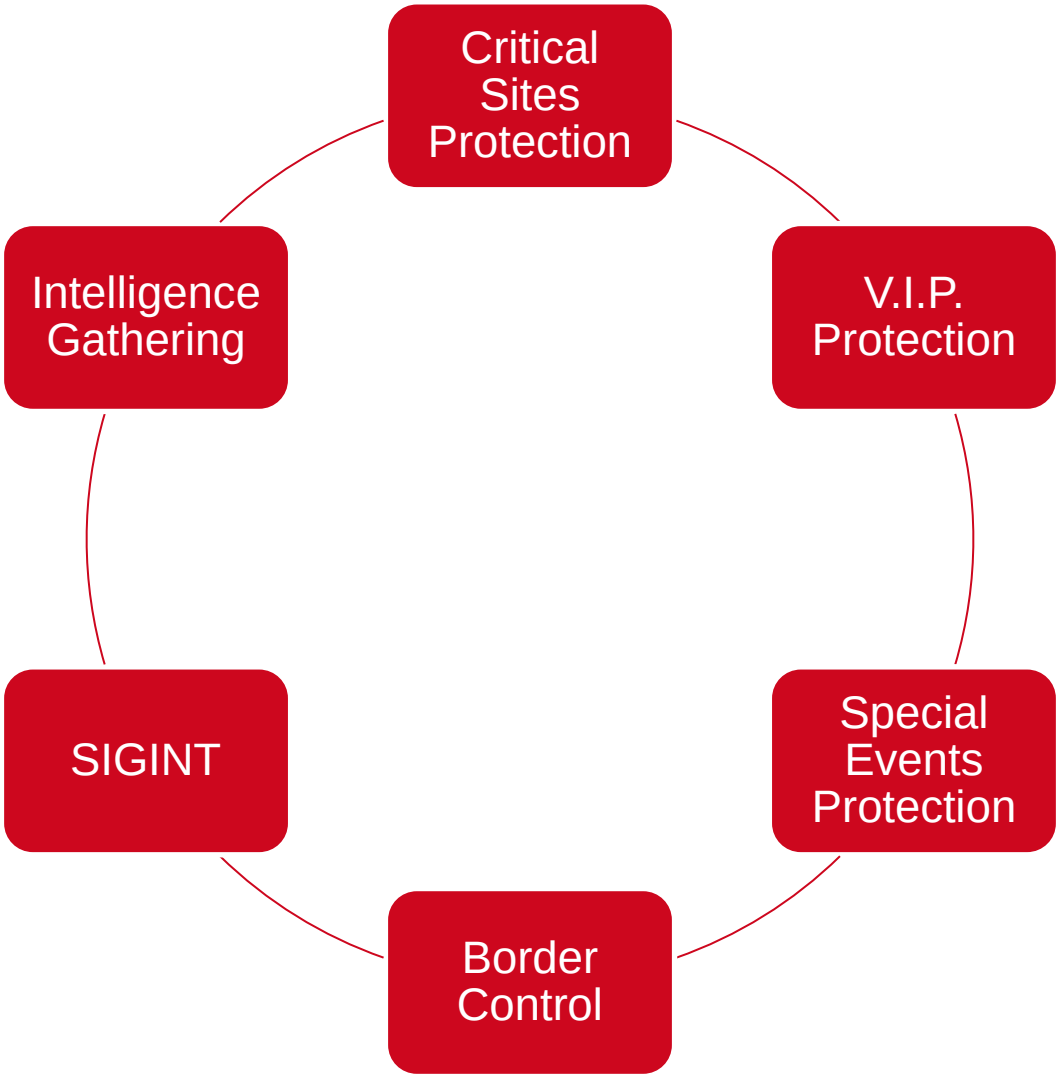




Surveillance of the Electro-Magnetic Spectrum

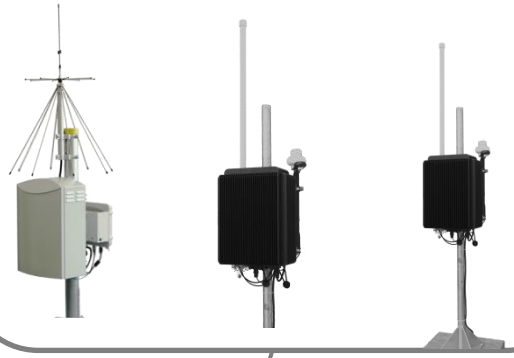
- Observes the entire RF-Spectrum to detect:
  - Suspicious or illegal activity
  - Potential Threats
  - Unwanted Emissions (Jamming)
- Permanently or on special occasions
- Data analysis on-the-fly, Automated processes
- Direction finding or geolocation of potential threats

Target Groups / Applications

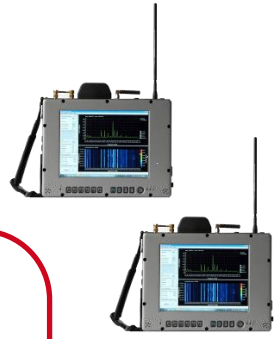


Typical Monitoring System Configuration

Continuous Monitoring



Transportable Monitoring



Portable Monitoring

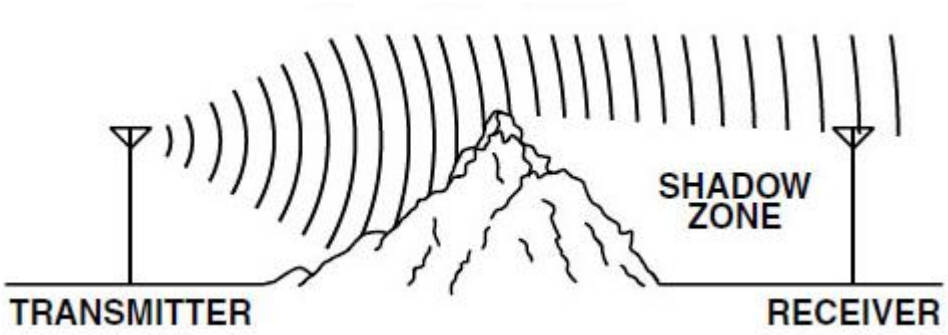
Airborne Monitoring

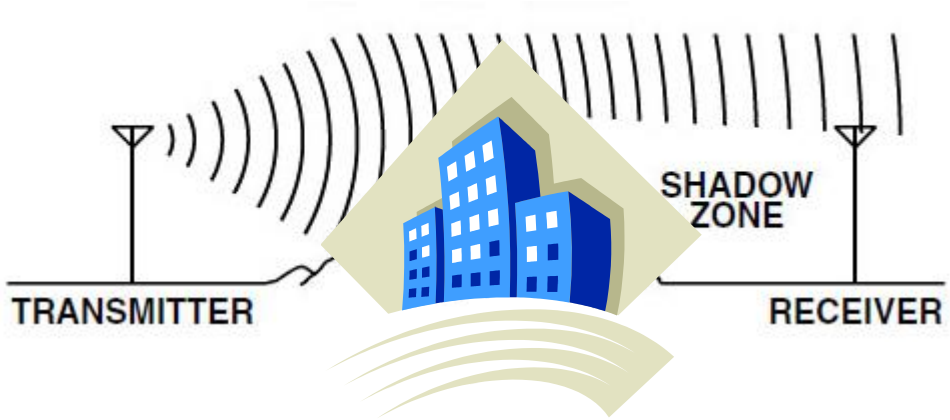
Control & Operating Centre

Mobile Monitoring

Primary Advantages of Measuring “in the air”

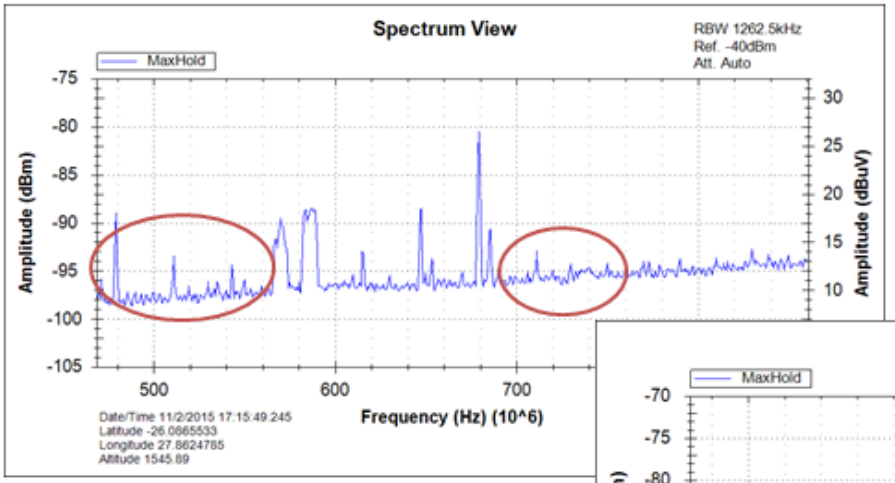
1) To capture signals only available at a certain height





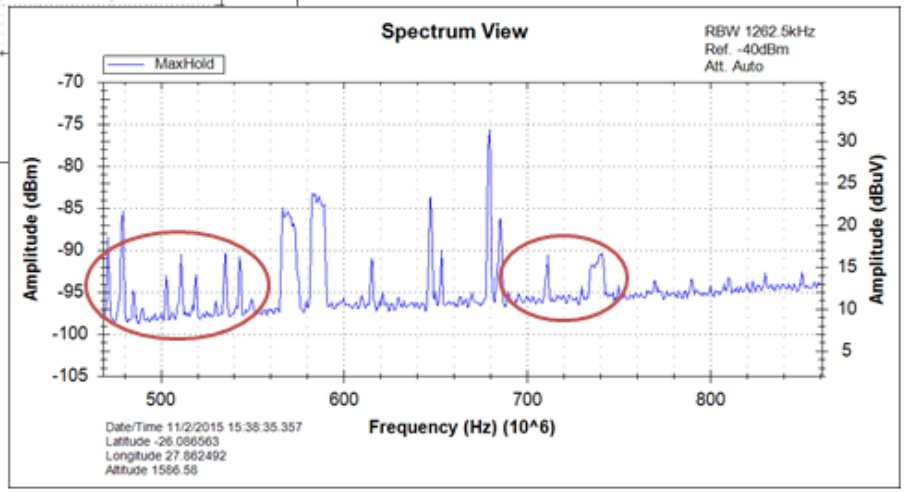
Primary Advantages of Measuring "in the air"

- Example: comparison of spectrum view between a test point on the ground and a test point in the air (at 50m height)



Measurement on ground (2m)

Airborne measurement
With RPA system (50m)

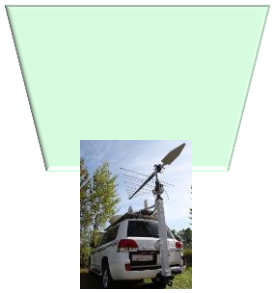


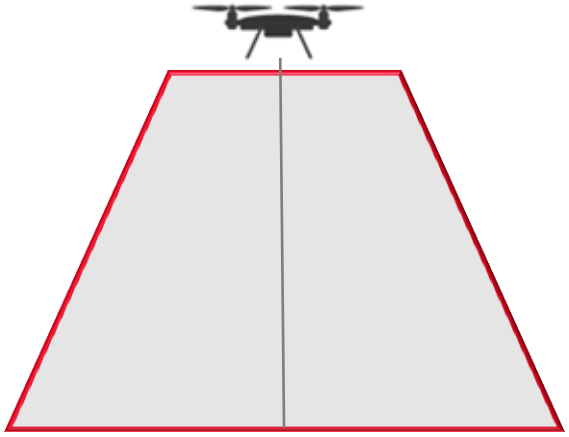
Primary Advantages of Measuring “in the air”

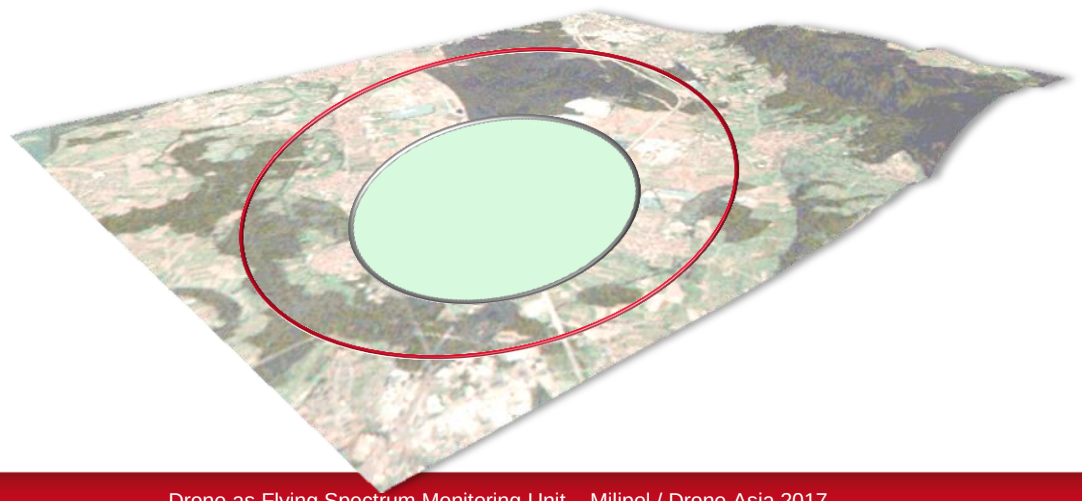
2) To enlarge the captured area

70 m

10 m

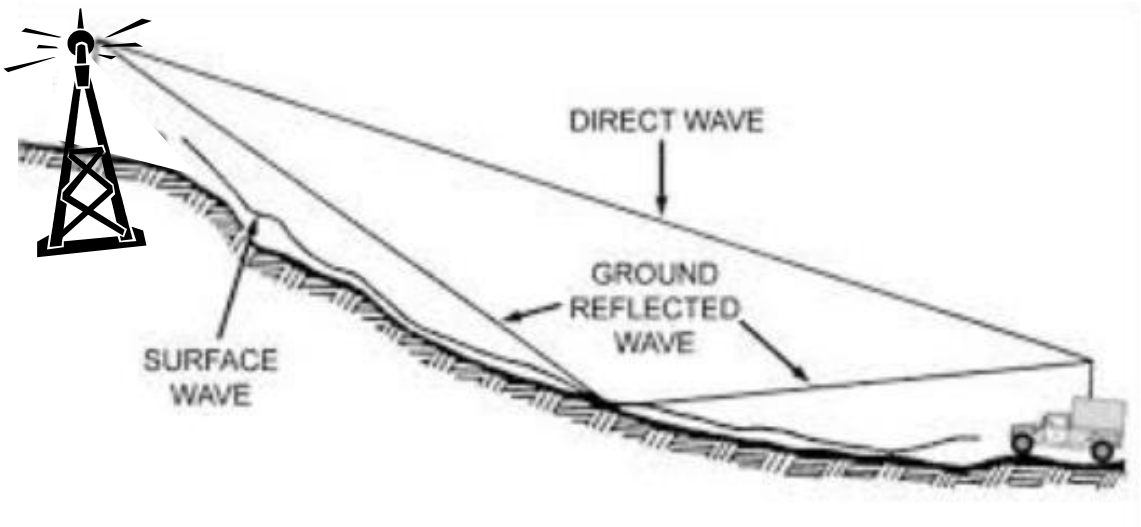






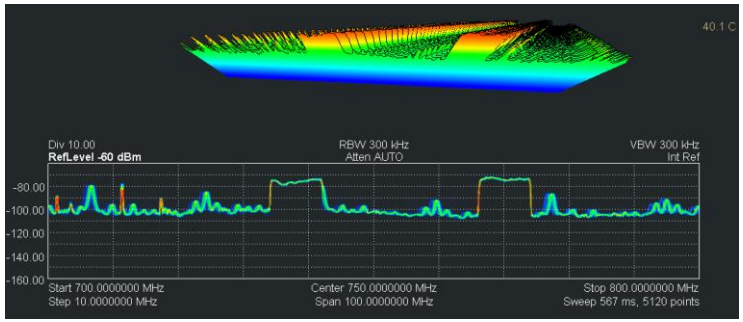
Primary Advantages of Measuring “in the air”

3) To avoid / reduce ground reflections



Principles and Challenges Using a UAS for Monitoring Applications

- Size and Weight of the Payload ⇨ dedicated measurement sensor & data processor
- Real-time communication / data transfer
- High resolution flight positioning and orientation
- Selection of suitable antennas (compromise between size / weight and frequency bands / directivity)
- Limitation of flight time due to battery capacity



Use of Tethered UAS for Long-time Monitoring

Benefits of using a tethered system:

- No flight time limitation anymore
- Secured / stable downlink communication (Ethernet cable)
- Up to 100m flight height
- System can be mounted on a pick-up for easy transport and quick deployment

Technical characteristics:

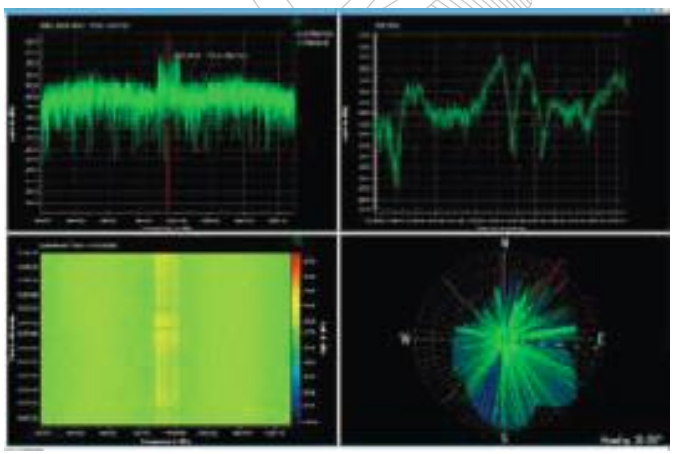
- ✓ Ground converter AC/DC (2400W)
- ✓ Power monitoring with acoustic alarm, automatic short term LiPo Backup Circuit on the UAS
- ✓ High voltage power cord and CAT-6 Ethernet cable

Own X8-Copter designed by Colibrex

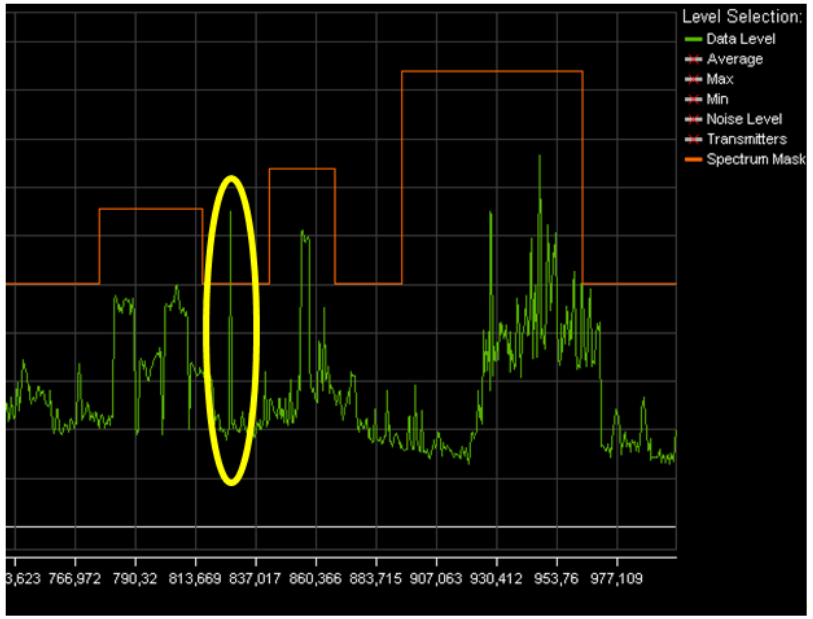
Typical Application (I): Detection of Illegal Signals / Frequency Violation

Observes the entire RF-Spectrum to detect:

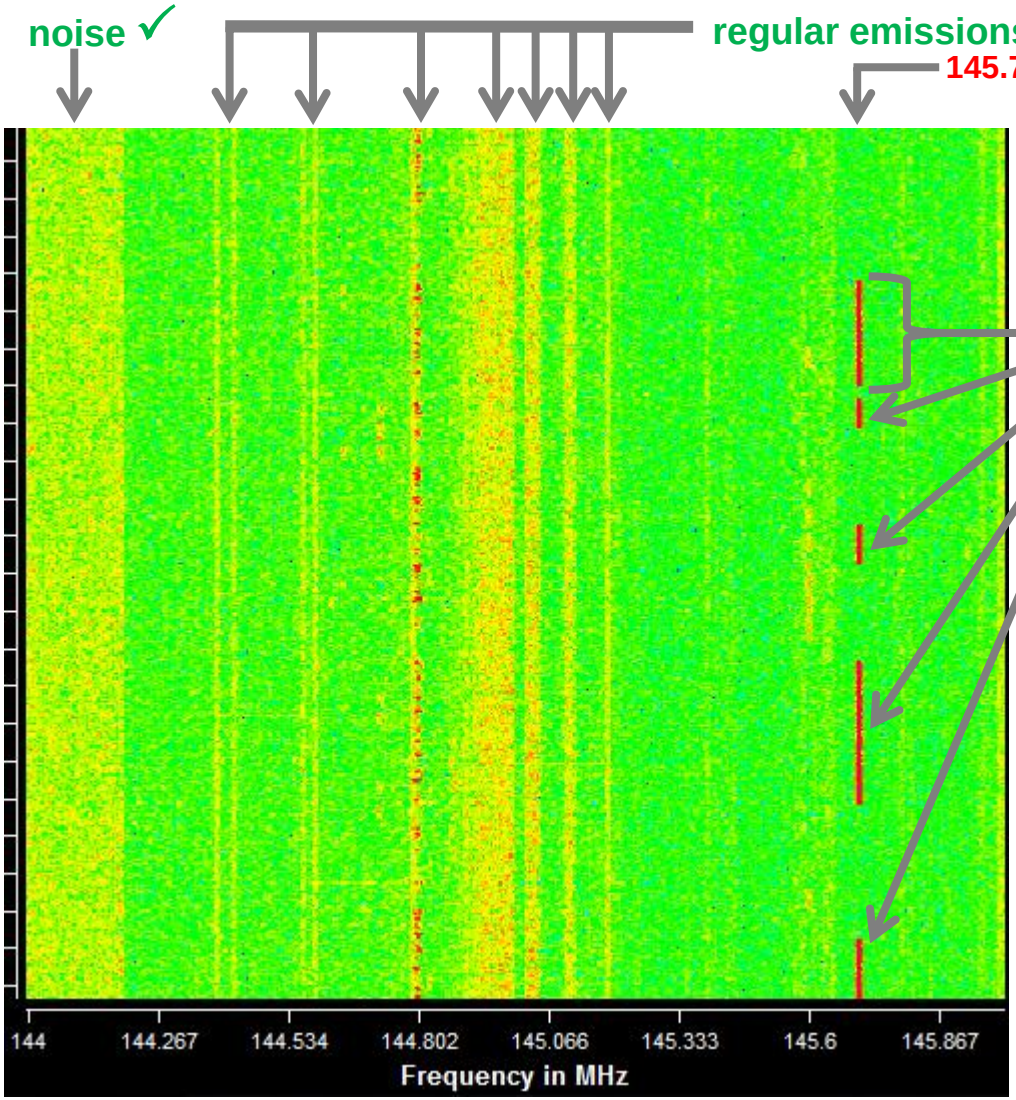
- Suspicious or illegal activity
- Potential Threats
- Unwanted Emissions (Jamming)
- Radio activity from neighboring countries



- Correlation of license data with measured data
- Automatic violation detection (AVD), possible detectors:
  - Illegal emitter
  - Extinction of an emitter
  - Modification of technical characteristics
  - Interference/Jammer
  - Customized



Detection of unknown RF Activity



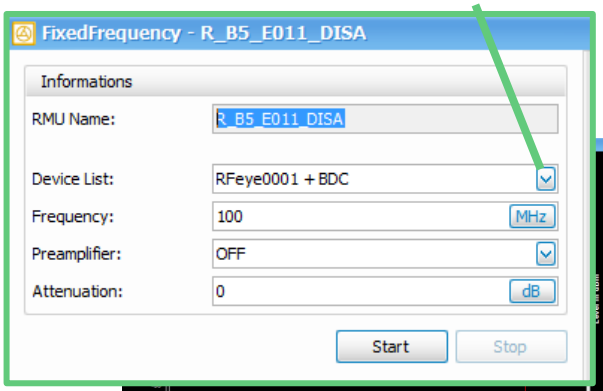
New Emitter
Single Frequency,
Strong Signal
⇒ Emitter is near
⇒ may be unlicensed activities

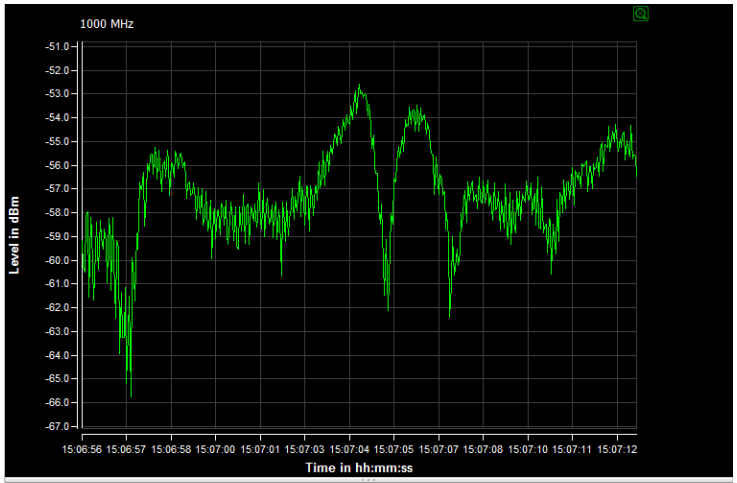
Typical Application (II): Direction Finding / Homing

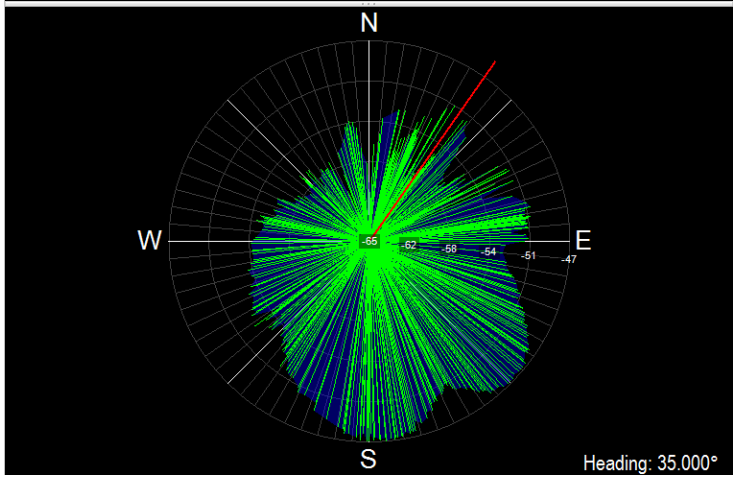
Use of AoA (Angle of Arrival) technology to determine the direction of the suspected emitter, using compass and a directive antenna and turning the UAS on its axis

Step 1
Set Frequency

Step 2
Start Tracking



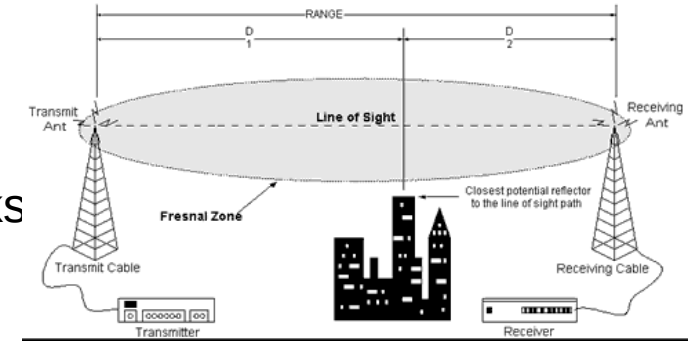




Further Applications

- Extension of an existing Monitoring Network with one AMU (Airborne Monitoring Unit) in addition to existing ground RMUs
  - ⇨ Enable pre-detection of signals not yet in the scope of the fixed monitoring units
  - ⇨ Mobile and flexible homing / geolocation operation
- Interference hunting
  (See Case Study from our US partner Cell Antenna)
  LTE networks can for ex. easily be disturbed
    - Cell phone boosters
    - Amplified TV Antennas
    - Metal Halide Lights
    - Electric Utility Poles
    - etc…
- Identification of VSAT / Microwave links

VHF Range 29 MHz Push-to-Talk Radios – CB



Case Study: Interference Hunting

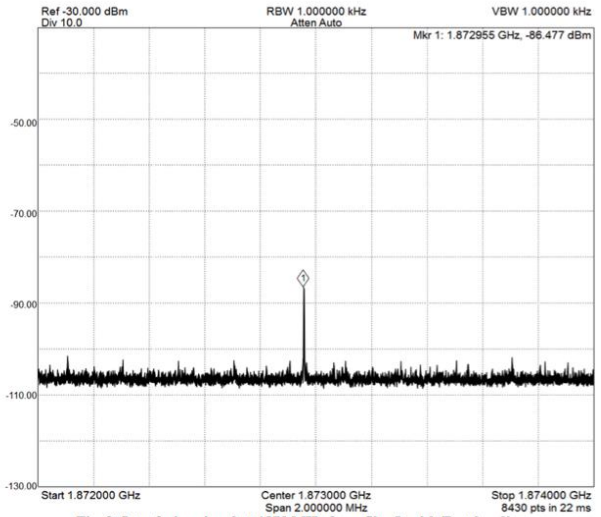
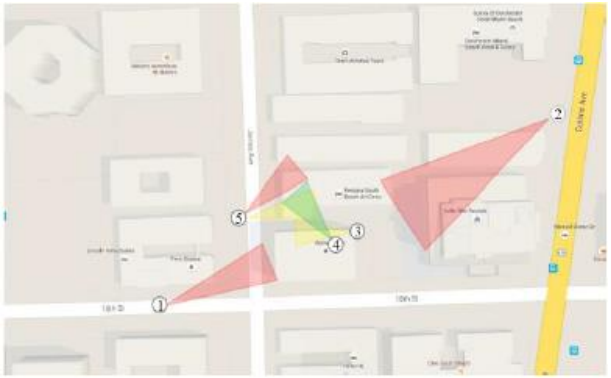


Fig. 9: Interfering signal at 1873 MHz from Site 5, with East heading

Signal Assessment:
Carrier Spent 4 months trying to find the source
1873 MHz – Narrow Band source

Methodology:
Tethered Drone
- First Reading at Tower
- Reset Reading downstream
- Reset Reading at street

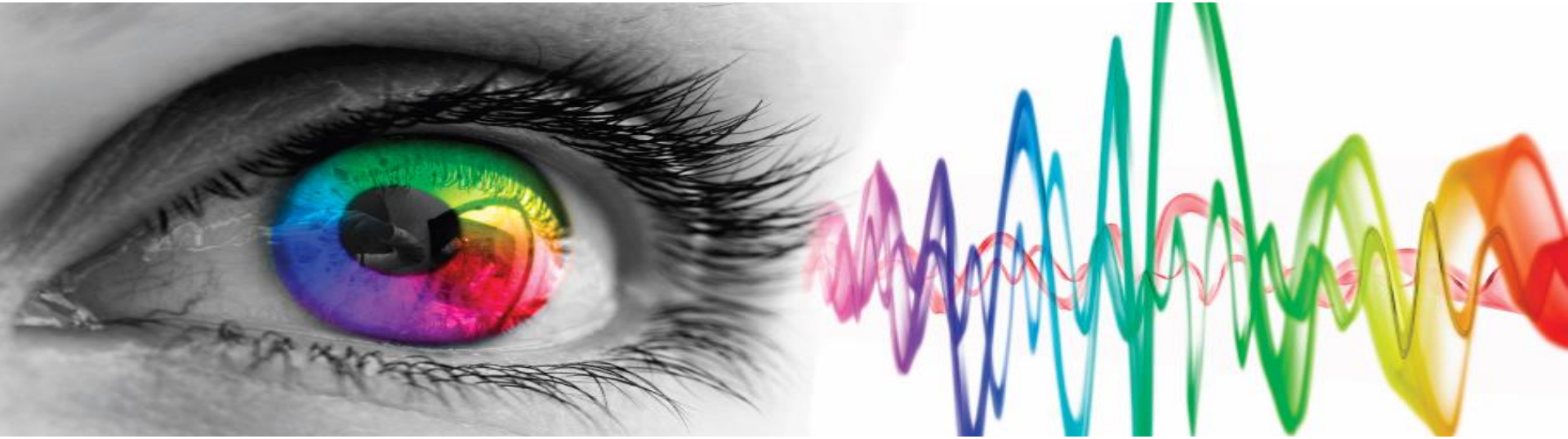
Interference source of -77dBm (BDA)
Window located on the third floor of the south-east corner of the Pestana South Beach Art Deco Hotel.



Project conducted by our US partner Cell Antenna

Conclusion

- In certain situations, „placing“ a spectrum monitoring sensor in the air is of huge benefit
- Having new generation, low weight receiving and monitoring equipment like LS Observer, an integration in a drone/UAS is possible, despite some technical and operational challenges
- Using a tethered system even enables long-time monitoring



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