



A red swoosh graphic above the text.  
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# A Comprehensive Satellite Spectrum Management

or the technical state of the art satellite spectrum management tools

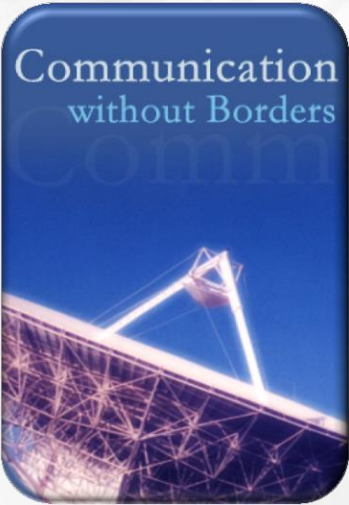


Jérôme Duboé  
ITU Regional Seminar for CIS and Europe Kyiv,  
Ukraine, 10-12 July 2013

# Presentation Agenda

- Satellite Spectrum Management Introduction.
- State of the Art Spectrum Tools.
- Emerging New Capabilities.
- Conclusion.

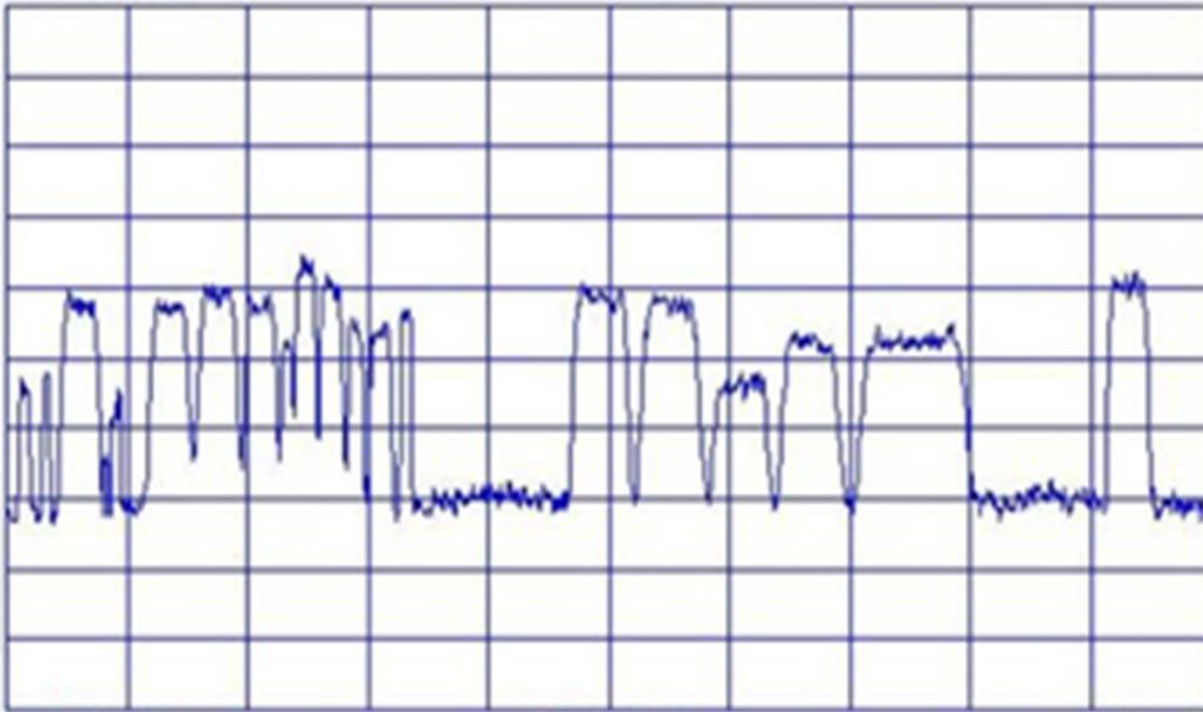




# Satellite Spectrum Management Introduction

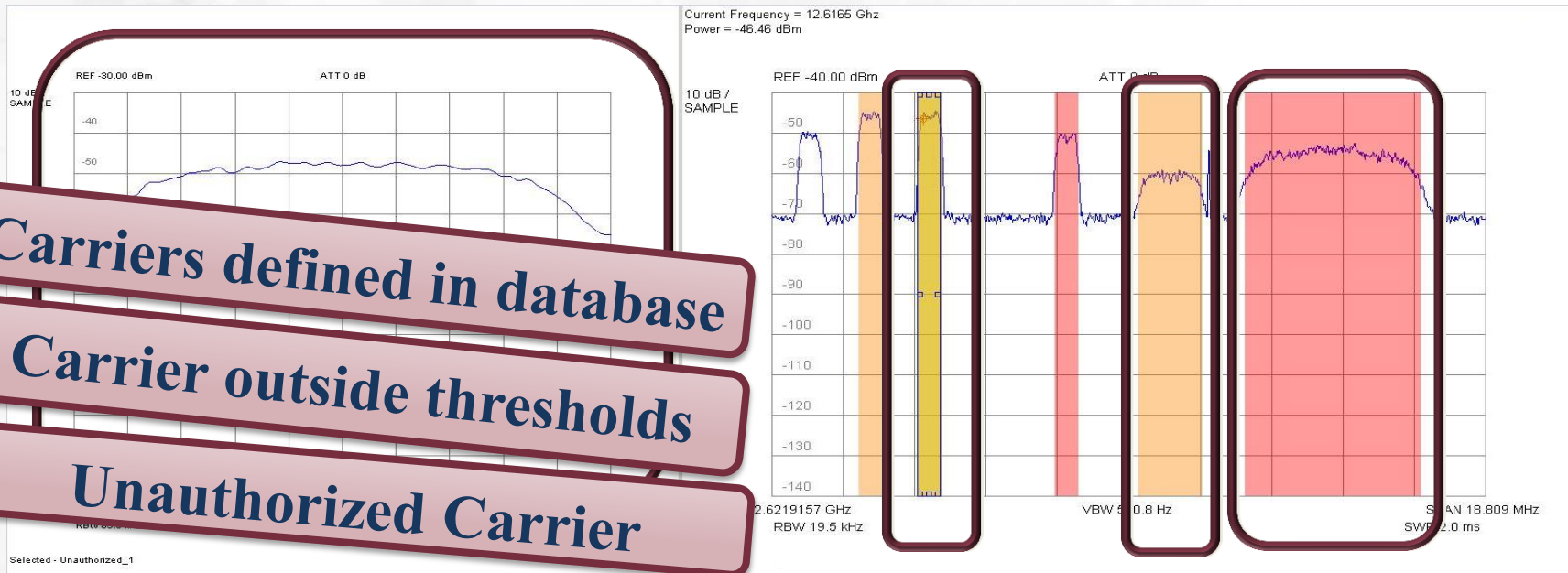
# ...yesterday a difficult scenario

- Antennas were pointed toward satellite on demand.
- Using Spectrum Analyzers, operators had spectrum ...



# ...today, advanced and easy solution

- Configurations are stored in server databases.
- Spectrum management becomes automatic and easier.



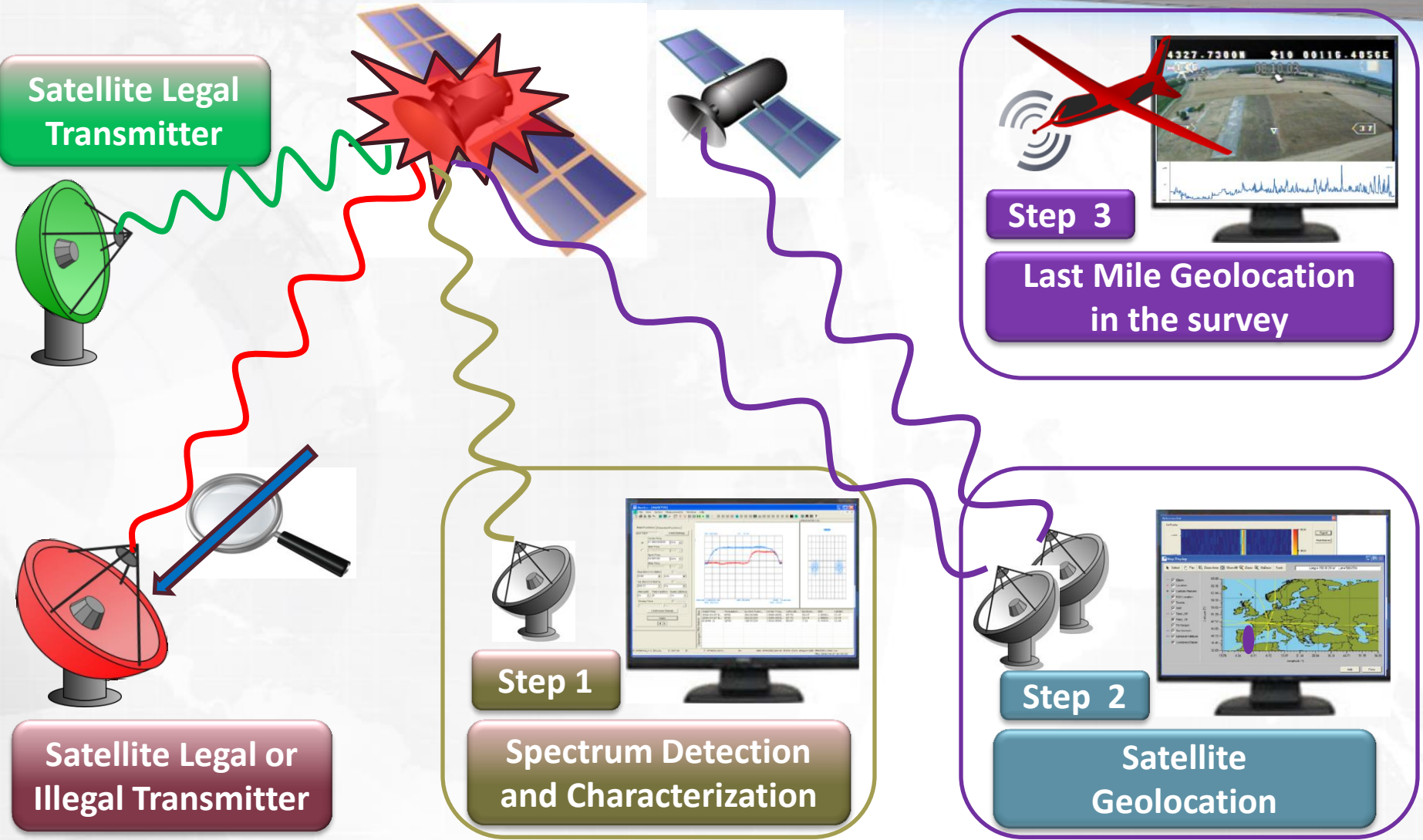
**Carriers defined in database**

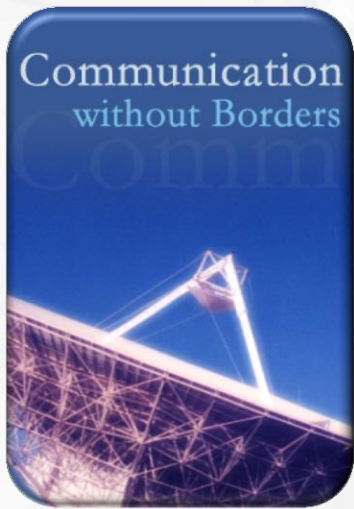
**Carrier outside thresholds**

**Unauthorized Carrier**

Carriers	Nom Center Frequency (MHz)	Measured Center Frequency	Alloc BandWidth (KHz)	Nom Occ BandWidth (KHz)	Measured Occ BandWidth (KHz)	Nom EIRP (dBW)	Measured EIRP (dBW)	Nom Es/No (dB)	Measured Es/No (dB)	Nom C/No (dB/Hz)	Measured C/No (dB/Hz)	Modulation Type	Missing Alarm	Foreign Alarm	Interfer Alarm
ATO_05	12,613.51	12,613.50	836.12	627.90	620.01	19.08	19.07	18.97	19.25	78.18	77.16	8PSK	No	No	No
t	12,615.10	12,615.09	683.59	683.59	622.52	24.44	24.29	1.1	22.42	1.1	82.44	8PSK	No	No	No
tt	12,616.69	12,616.67	683.59	683.59	618.99	24.38	24.24	1.1	12.04	1.1	82.98	8PSK	No	No	No
ttt	12,623.01	12,622.99	1,816.41	1,816.41	1,683.12	14.04	13.32	1.1	9.97	1.1	71.05	8PSK	No	Yes	No
Unauthorized_1	12,627.27	12,627.27	4,628.87	4,628.87	4,628.87	23.87	23.87	7.58	7.58	1.1	82.91	QPSK	No	No	No

# Efficient Functional Diagram





# **Sate Of The Art Spectrum Tools**

# Automatic Satellite Spectrum Monitoring

- Distributed system: Monitor thousands of carriers from multiple site monitoring plans into a centralized database.



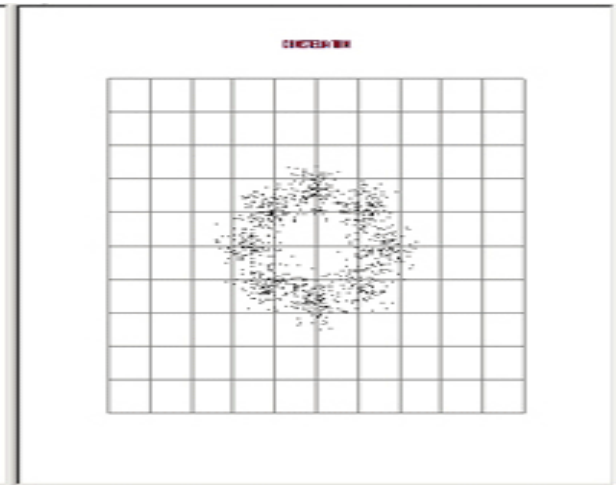
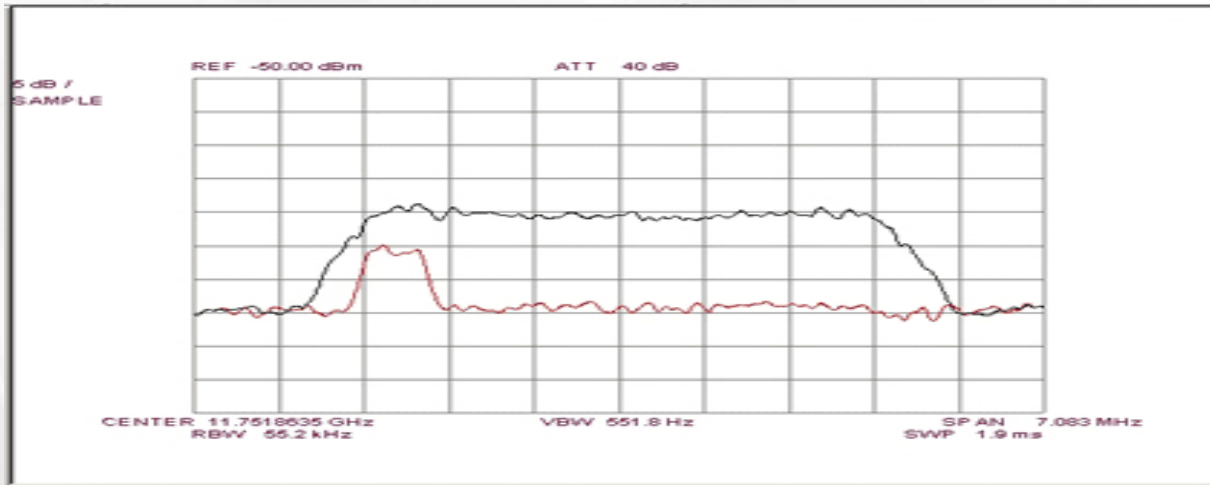
- Automatically trigger alarms on anomalous signal conditions.
- Automatic storage of trace and measurement results.
- Carrier blind search capability: automatic database population.
- Report templates to allow to quickly analyses issues .
  - EIRP fluctuations due to inclined orbit.
  - Carrier Central frequency fluctuations : sweeping carriers.



# Signal Characterization

Digital Spectrum Processing analysis detects multiple carriers.

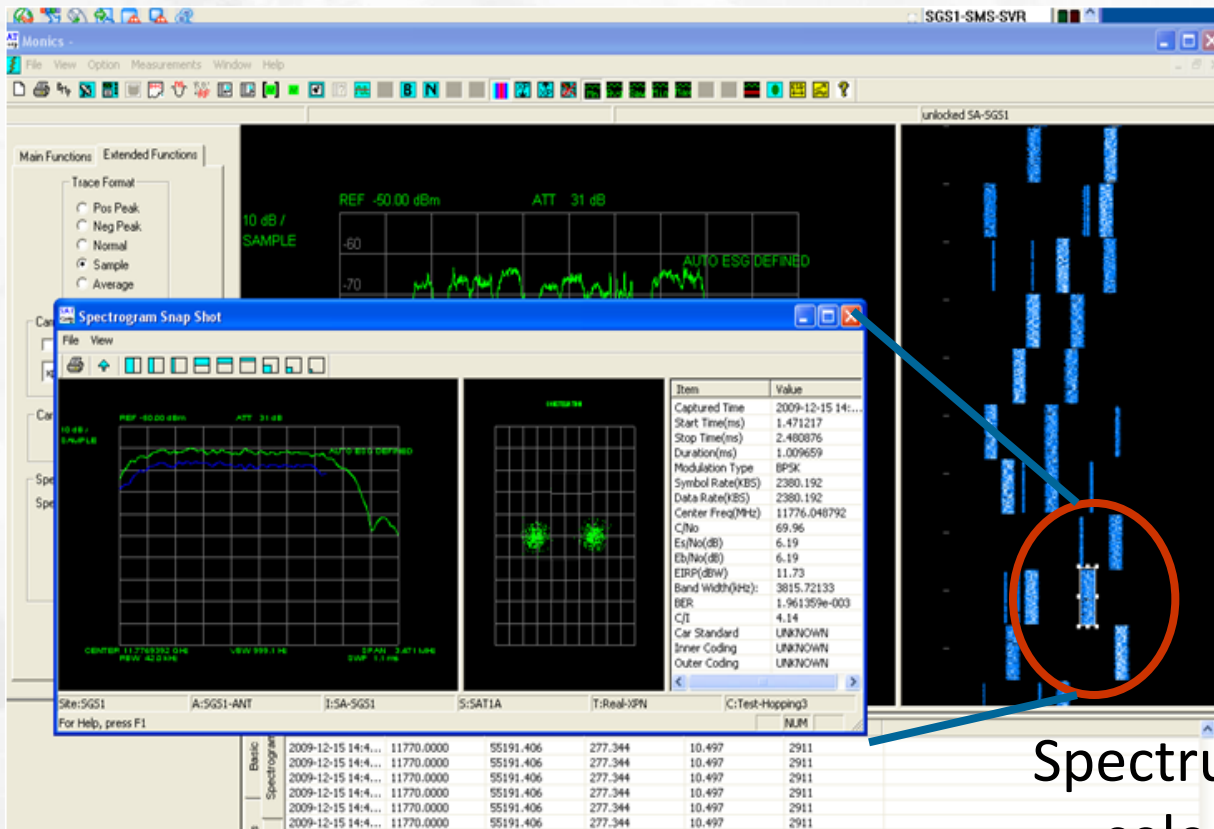
- carrier under carrier analysis with modulation analysis (including FEC).
- Carrier ID (upcoming new capabilities).
- I/Q constellation diagrams with vector signal processing for both signals.



Date/Time	Modulation Type	Symbol Rate(Ksps)	Center Freq(MHz)	BER	Carrier Standard	Inner Coding	Outer Coding	C/No(dB/Hz)
2008-04-09 11:25:04	8PSK	4495.617	11751.930803	6.041545e...	DESS-310	2/3	(201,219)	78.49
(Carrier 1)	QPSK	520.606	11750.000047	5.193933e...	DVB-S	UNKNOWN	UNKNOWN	61.39

# TDMA Analysis on Burst

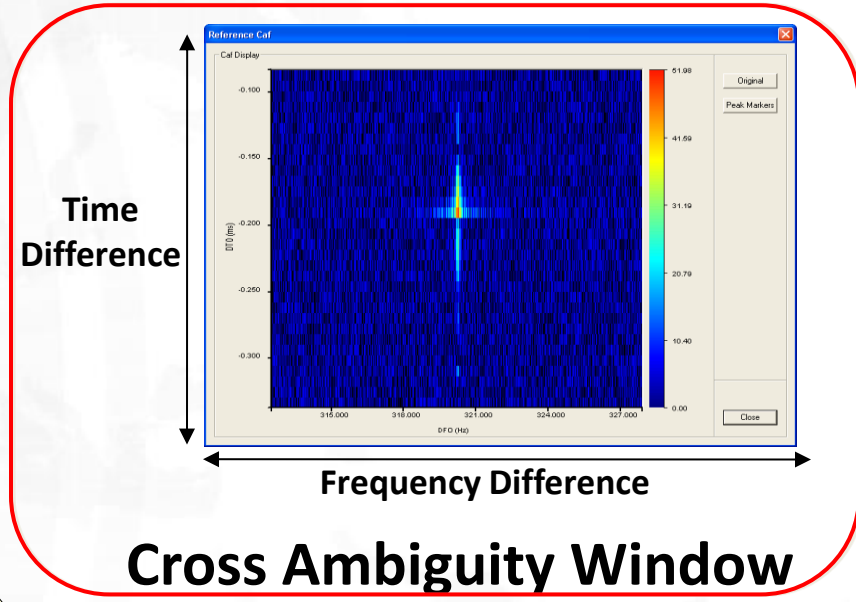
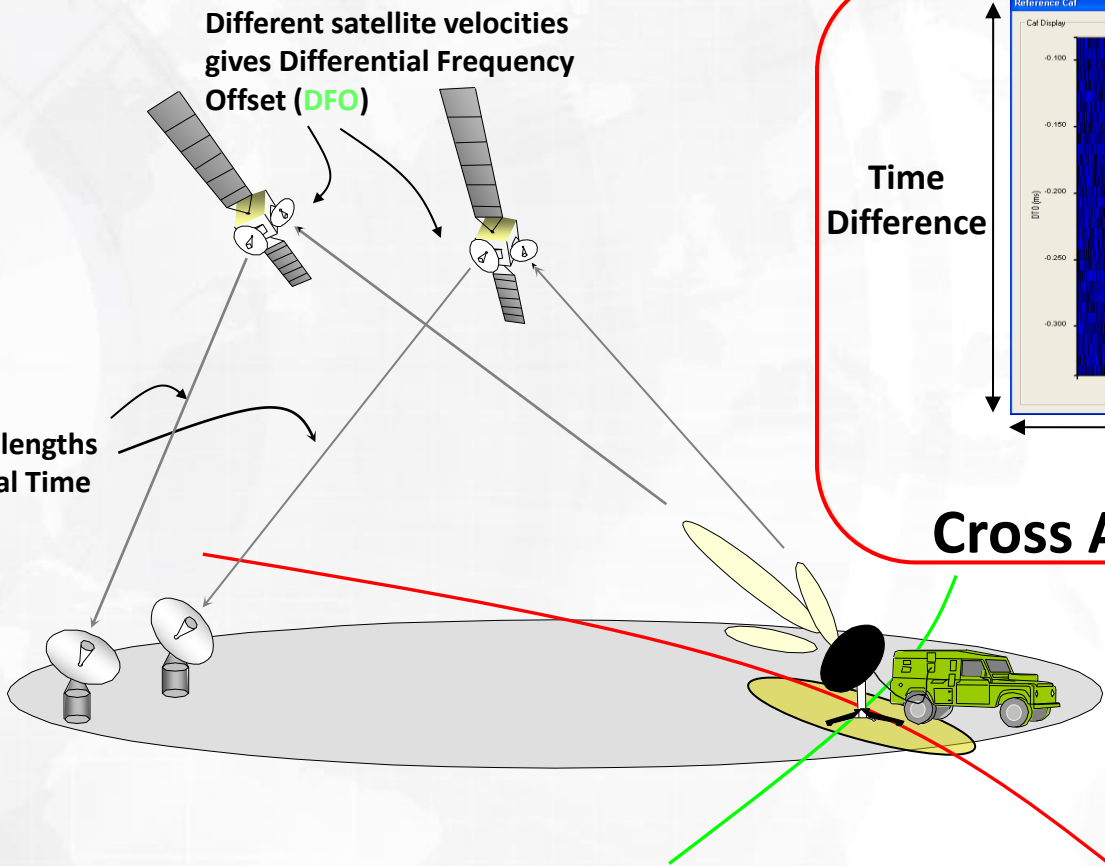
- TDMA Spectrogram to gain more in-site into your TDMA network.
- Individual burst can be identified and information returned.



Spectrum Analysis for selected time period

# Satellite Down Link Geolocation

- Technics mature on two satellite configuration (TDOA FDAO).
- Scenarios possible with sweeping carriers or TDMA signals.



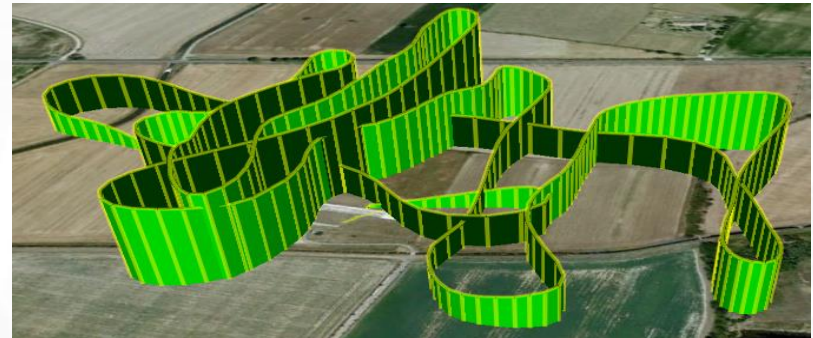
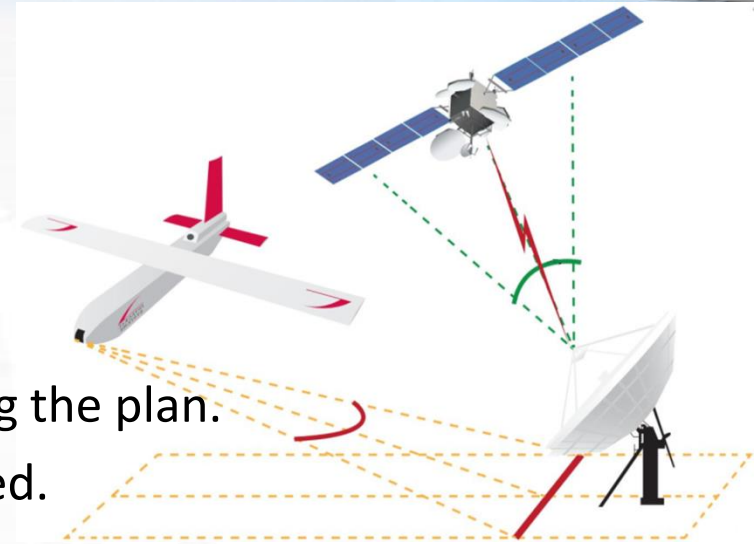
Actually calculates error ellipse directly from measurements

Communication  
without Borders

# Emerging New Capabilities

# Satellite Up Link Geolocation

- Mission prepared before take off,
  - Flight path based on geolocation results.
  - Spectrum payload configuration.
- During the flight (UAV or plane),
  - the pilot or autopilot drives vector according the plan.
  - GPS, video and spectrum power are recorded.
  - Operator receives live data.
  - If possible, operator updates the pilot on the flight.
- After landing,
  - Recorded data processing.
  - Precise interferer location computed.



# Carrier ID

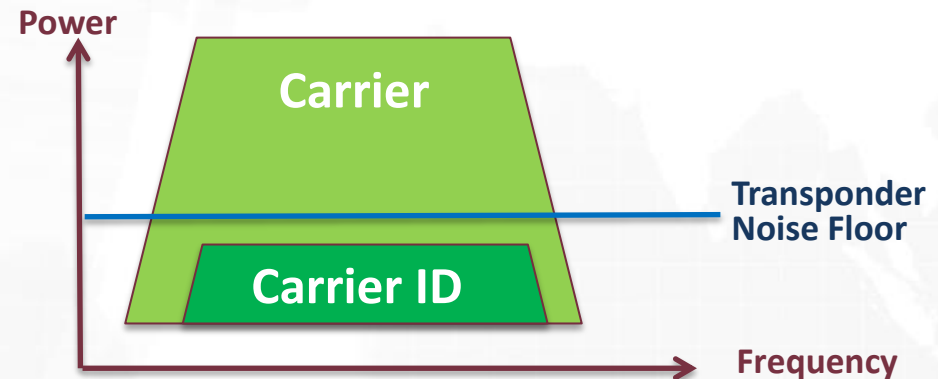
- Satellite Interference Reduction Group (sating.org) initiative for inclusion of a Carrier ID (CID) in carriers with MPEG transport streams has been standardised by the DVB organisation and ETSI.
- CID will reduce harmful interferences in broadcast scenarios.
- The CID Standard:
  - uses BPSK spread spectrum modulation, differential encoding ...
  - contains an Unique Identifier (64-bit), geographical coordinates and telephone number of the transmit station and a series of User Data.



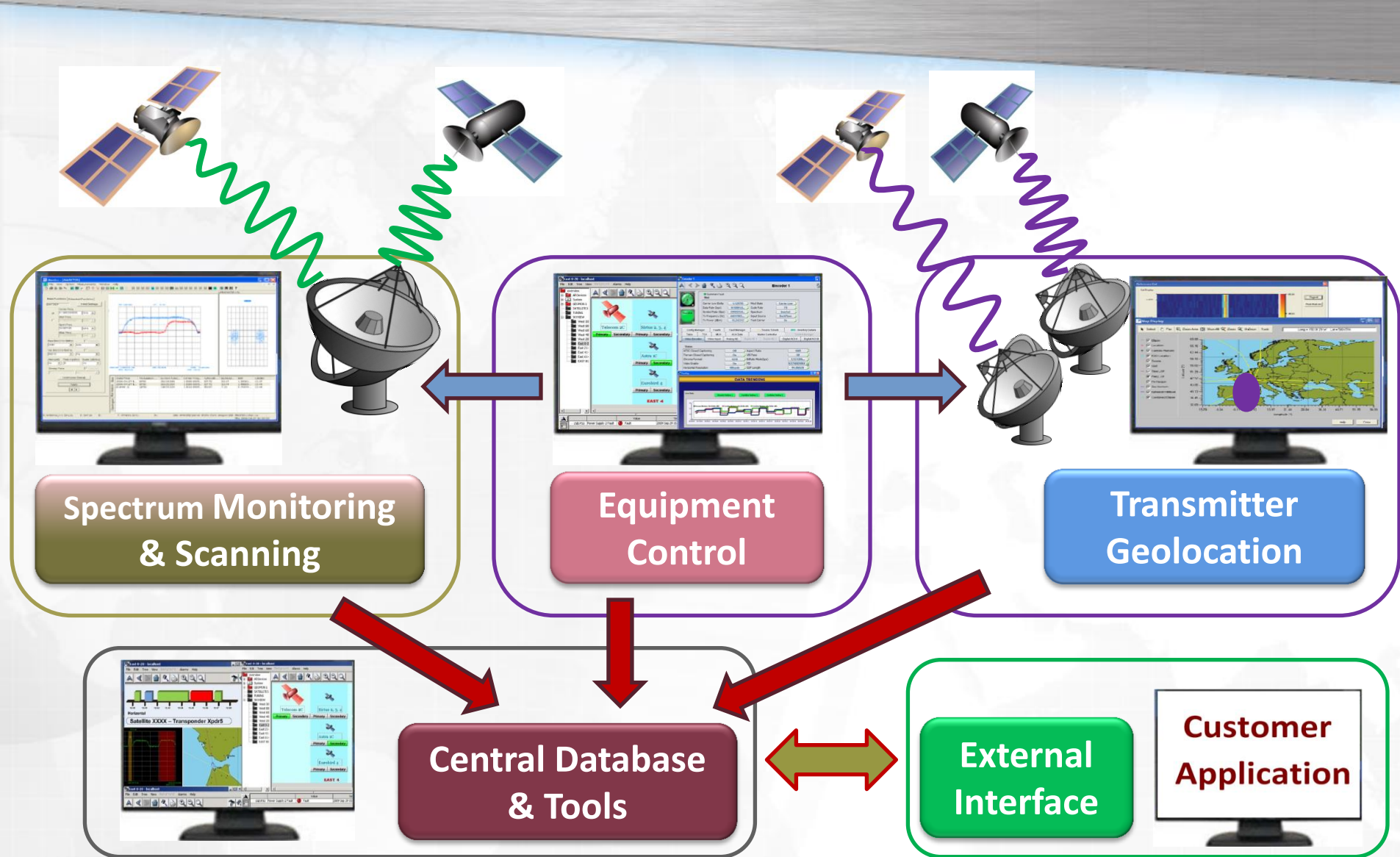
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ERICSSON

- Dedicated Carrier System Monitoring tools are used to decode and display the CID.



# Complete Efficient and Automated System



Communication  
without Borders



# Conclusion



# Conclusion

- **Satellite Spectrum Management.**
  - Yesterday Spectrum Analyzer Manual Check.
  - State of the art automated advanced Spectrum Management Systems.
- **State of the Art Spectrum Tools Overview.**
  - DSP Carrier Monitoring System : modulation type, FEC, carrier under carrier ...
  - Automated monitoring plans and blind scans.
  - TDMA Networks Monitoring tools.
  - Satellite Downlinks Geolocation system mature.
- **Emerging New Capabilities.**
  - Carrier ID analyzing system.
  - New Satellite Uplinks Geolocation Airborne Systems for UAV and planes.
  - New complete integrated system designed for regulators.

**SatCom Situational Awareness Over Any Country**

# Thank You

## A Comprehensive Satellite Spectrum Management

 **INTEGRAL SYSTEMS™**  
www.integ-europe.com

**Jérôme Duboé**  
System Engineer

INTEGRAL SYSTEMS EUROPE  
BuroParc III  
Rue de la Découverte, Voie no 2  
31675 Labège Cedex  
FRANCE

Tel: +33 5 61 00 17 17  
Fax: +33 5 61 00 22 13

[jduboe@integ.com](mailto:jduboe@integ.com)



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