A Comprehensive Satellite Spectrum Management

or the technical state of the art satellite spectrum management tools

Jérôme Duboé

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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.
Efficient Functional Diagram

Step 1: Spectrum Detection and Characterization

Step 2: Satellite Geolocation

Step 3: Last Mile Geolocation in the survey
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.
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 Geolocatation

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

Different path lengths give Differential Time Offset (DTO).

Different satellite velocities give Differential Frequency Offset (DFO).

Actually calculates error ellipse directly from measurements.
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 (satirg.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.

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

- Spectrum Monitoring & Scanning
- Equipment Control
- Transmitter Geolocation
- Central Database & Tools
- External Interface
- Customer Application
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

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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

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an ARD Telecom Partner

www.integ-europe.com