Monitoring: Produits & services

Markets:
- Satellite Operators
- Regulatory Bodies
- Defense Agencies
- System Integrators

Services
- Ephemeris and TDOA services
- Geolocation services

Systèmes & Projets
- Satellite Ephemeris Estimation
- Geolocation systems
- Monitoring systems
- Defense projects

Products & Solutions
- IFoIP
- CSA/Lib Diapason analysis
- Acquisition services and signal processing
- Diapason
- RF2P
Monitoring solutions
Satellite monitoring
by ZODIAC DATA SYSTEMS
Monitoring system – Architecture synopsis
Carrier & Signal Monitoring
Satellite analysis and monitoring
by ZODIAC DATA SYSTEMS
Carrier & Signal Monitoring - CSM

Focus: Satellite Arabsat4B(29526) on matrix input 12, Polar vertical (as superuser)

<table>
<thead>
<tr>
<th>Title</th>
<th>Central freq [MHz]</th>
<th>Bandwidth [MHz]</th>
<th>Min Range [dBm/Hz]</th>
<th>Max Range [dBm/Hz]</th>
<th>Mean [dBm/Hz]</th>
<th>Freq Min [MHz]</th>
<th>Freq Max [MHz]</th>
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<tbody>
<tr>
<td>08:21:36: PSD Arabsat4B29...</td>
<td>12723</td>
<td>43.9927</td>
<td>-138.454</td>
<td>-121.304</td>
<td>-130.631</td>
<td>12701</td>
<td>12745</td>
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<tr>
<td>08:23:36: Noise Arabsat4B2...</td>
<td>12723</td>
<td>43.9927</td>
<td>-137.841</td>
<td>-135.114</td>
<td>-135.862</td>
<td>12701</td>
<td>12745</td>
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</tbody>
</table>

Search ...

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Satellite analysis and monitoring
by ZODIAC DATA SYSTEMS
Carrier & Signal Monitoring - CSM

• Background survey of any available Satellite RF Source
• Automatic scheduling and acquisition resource management
• Multi-User, Multi-Mission
• Automatic population of database with historical data:
  o Spectrum PSD
  o Carrier RF Parameters
  o Carrier Digital Parameters
• Integration of CSA, CID, libDiapason and Recorder capabilities
Triggered operations include:

- Logging of an event
- Analysis of a carrier to get advanced parameters
- Binary signal recording
- Signal Geolocation
Carrier & Signal Analysis

Option to CSM

or

Standalone system
Satellite analysis and monitoring by ZODIAC DATA SYSTEMS
Carrier & Signal Analyzer - CSA

Blind recognition of carrier parameters

Databases of:
- Satellites
- Communications

Carrier under Carrier:
- Carrier cancellation
- CuC analysis

Display of:
- Spectrum
- Characteristics
- Spectrogram
- Constellation

Analysis of:
- RF parameters
- 24 modulations
- FEC
- Communication std
Satellite analysis and monitoring
by ZODIAC DATA SYSTEMS
Carrier & Signal Analyzer - CSA

Blind recognition of burst signal

- Spectrum & Spectrum Waterfall Display
- Power vs. Time of the carrier of interest
- Detailed carrier Analysis
- Burst series
- VSAT/ TDMA Analysis
  - Burst Analysis
  - User separation
  - Access type
  - Classification

Detected bursts
One color per detected user

Satellite analysis and monitoring by ZODIAC DATA SYSTEMS
Carrier & Signal Analyzer - CSA

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Carrier & Signal Analyzer - CSA

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Detected bursts
One color per detected user
Satellite analysis and monitoring
by ZODIAC DATA SYSTEMS
Carrier & Signal Analyzer - CSA
DVB-S2 compliant ACM/VCM

TDM Stream detected

Retrieved Constellation Statistics

Frames analysis

DVB-S2 compliant ACM/VCM

Stream source: multiple
Source type: continuous
Transmission mode: ACM
Null packet deletion: 0
ISID indicator: 0
fc: 3740.91 MHz
B: 1.403 Mbps
SNR: 28.75 dB

<table>
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<tr>
<th>Frames</th>
<th>Rate</th>
<th>Constellation</th>
<th>Rate</th>
<th>eSNR</th>
<th>E/N0</th>
<th>Data rate</th>
<th>G/C check</th>
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<td>short</td>
<td>True</td>
<td>32APSK 3/4</td>
<td>1/4</td>
<td>0.0 dB</td>
<td>23.0 dB</td>
<td>35.0 kbps</td>
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<td>short</td>
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<td>32APSK 3/4</td>
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<td>QPSK 1/2</td>
<td>1/2</td>
<td>0.0 dB</td>
<td>23.5 dB</td>
<td>22.4 kbps</td>
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Carrier ID

Option to CSM
or
Standalone system
Carrier ID

The Carrier ID is transmitted using spread spectrum technique.

At Satellite Monitoring facilities, the carrier ID is demodulated to find the contact information and quickly point out the source of interference or to check transmitter compliance with CID regulation.
Carrier ID Scenario
by ZODIAC DATA SYSTEMS
Carrier ID - CID

Tests organized with the courtesy of Eutelsat and Work Microwave for the SIRG
Monitoring
Satellite Orbital position
Monitoring satellite orbital position

**Purposes:**

- To improve geolocation accuracy;
- To secure the satellite with the surrounding environment;
- To retrieve measurements quickly after maneuver;
- To ensure rational, equitable, efficient and economical use of the frequency and satellite orbit;
- To preserve performances, interoperability and quality of satellites communications…
Satellite Ephemeris Estimation
by ZODIAC DATA SYSTEMS

SEE provides TDOA measurements based on Passive Ranging

- **SEE concept:**
  - 3 Rx Stations minimum to receive Payload & GNSS signals
  - Payload signals are correlated to retrieve TDOA measurements between stations
  - TDOA delivery is done in less than 10 seconds.

(TDOA : Time Difference Of Arrival)
Satellite Ephemeris Estimation
by ZODIAC DATA SYSTEMS

SEE provides TDOA measurements based on Passive Ranging.

- SEE operations:
  - Automated and constant tracking of all visible geostationary satellites
Satellite Ephemeris Estimation
by ZODIAC DATA SYSTEMS

SEE provides TDOA measurements based on Passive Ranging

**SEE operations:**
- Automated and constant tracking of all visible geostationary satellites
Satellite Ephemeris Estimation
by ZODIAC DATA SYSTEMS

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  - Gather measurements from all stations and compute the TDOA
Satellite Ephemeris Estimation
by ZODIAC DATA SYSTEMS

SEE provides TDOA measurements based on Passive Ranging

- **SEE operations:**
  - Automated and constant tracking of all visible geostationary satellites
  - Gather measurements from all stations and compute the TDOA
  - Revisit each satellite every 20 minutes.

- **Data Delivery:**
  - Machine to machine Secured Measurement Network Transfer (Push or Pull mode)
  - Authenticated Web-based Access for customer specific measurements sent every 20 minutes to the user through FTPS
Satellite Ephemeris Estimation
by ZODIAC DATA SYSTEMS

SEE provides TDOA measurements based on Passive Ranging

- SEE system for EMEA region:
  - SEE system deployed on Zodiac Data Systems French premises
    - Four SEE stations in short baseline

- SEE service for EMEA region:
  - Coverage
    - 40deg West, 60deg East longitude
    - 84 satellites
  - Data delivery
    - 24/7
    - Every 20 mn (by default)
  - Measurement quality
    - < 5ns standard deviation
Satellite Ephemeris Estimation
by ZODIAC DATA SYSTEMS

SEE provides TDOA measurements based on Passive Ranging

SEE system for APAC region:
- SEE system will be deployed in Asia
  - Four SEE stations in short baseline

SEE service for APAC region:
- Coverage
  - 55deg East, 155deg East longitude
  - 65 satellites
- Data delivery
  - 24/7
  - Every 20 mn (by default)
- Measurement quality
  - < 5ns standard deviation
Satellite Ephemeris Estimation
by ZODIAC DATA SYSTEMS

SEE provides TDOA measurements based on Passive Ranging

- **SEE system for CONUS region:**
  - **SEE system will be deployed in USA**
    - Four SEE stations in short baseline

- **SEE service for CONUS region:**
  - **Coverage**
    - 40deg West, 140deg West longitude
    - 80 satellites
  - **Data delivery**
    - 24/7
    - Every 20 mn (by default)
  - **Measurement quality**
    - < 5ns standard deviation
Live demonstration

Satellite Ephemeris Estimation

SEE Demo
Standard Geolocation scenario
Geolocation Scenario
by ZODIAC DATA SYSTEMS
Geolocation Scenario
by ZODIAC DATA SYSTEMS
Standard scenario

Main satellite
Mirror satellite
Reference
Interference

National Area
Interference Source

Legit Transmitter for reference
Monitoring & Geolocation System

National Area
Geolocation Scenario
by ZODIAC DATA SYSTEMS
Geolocation using SEE ephemeris
Geolocation Scenario
by ZODIAC DATA SYSTEMS
Geolocation using SEE ephemeris
Complex Geolocation scenario

TDMA carrier under the main carrier with occupied mirror transponder
Geolocation Scenario
by ZODIAC DATA SYSTEMS
Geolocation Scenario
by ZODIAC DATA SYSTEMS
Geolocation of TDMA using SEE ephemeris
Geolocation Scenario
by ZODIAC DATA SYSTEMS
Geolocation of TDMA
Thanks you for your attention...