Distributed Multi-Layer Spectrum Monitoring Systems

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Snapshot

- Entrepreneurial company, based in Cambridge UK, and California
- Team with track record in wireless telecoms
- World class RF and applications team
- Outstanding RFeye® products and value for money
- Hardware, software and integrated solutions
- IP67 rated, CE and FCC certified and approved
- High quality manufacturing base
- Worldwide sales and support channels
  - LS Telcom Value Added Reseller
- Worldwide operational deployments
Distributed spectrum monitoring systems

- Distributed networks of fixed and mobile nodes
  - Distributed over any size area, infinitely scalable

- Software applications to drive networks in real time
  - Multi-user and simultaneous multi-mission capability

- Multiple users running multiple tasks
  - Each node can support multiple users running multiple tasks priority based

- Nodes directly addressable
  - Web portals, direct access and M2M capability between nodes

- On-board processing power creates truly distributed intelligence
  - Each network node capable of autonomous decision-making and coordination with other nodes

- Integrated database applications
  - Database for data storage with powerful analysis tools
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Network architecture – Multi User and Multi Mission

- Mobile
- Fixed
- Direction Finding
- Geo-location
- Database
- Database Access
- Local Storage Standalone
- Real Time Access
- Database Analyser
- Web Portal
Applications

NATIONAL MONITORING AND SPECTRUM INVENTORIES

DIRECTION FINDING & ENFORCEMENT

DYNAMIC SPECTRUM SHARING

POLICE & EMERGENCY SERVICES MONITORING

PRISONS, HOSPITALS & AIRPORT MONITORING

BOARD ROOM SECURITY

STADIUM MONITORING
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National monitoring and spectrum inventories

- Inform spectrum planning with real measurement data
- Enable agile spectrum management decision-making
- Track and analyse spectrum usage and improve efficiency
- Identify and reassign under-utilized spectrum
- Monitor and police spectrum usage and compliance
- Resolve spectrum conflicts

Fixed and mobile spectrum data collection for cities, regions or whole countries
National regulators and spectrum agencies, commercial operators and spectrum stakeholders
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Network architecture – Multi User and Multi Mission

Mobile

Fixed

Direction Finding

Internet

Local Storage Standalone

Web Portal

Geo-location

Database

Database Analyser

Real Time Access

Database Access
Mobile data analysis

Database analysis of multi terabyte database

Zoom In

Spectrogram from all nodes

KML Output
Radiocommunications Agency of the Netherlands

- Fleet of mobile RFeye nodes in operation since 2010
- No additional cost of journeys (“anyway kms”)
- All logged data stored in multi-terabyte RFeye DAS database
- RFeye data and DAS report generation is basis of much of annual report
- Information shared widely across the Agency
- Improved understanding of spectrum usage across the Netherlands
- Database also used by enforcement group to aid visits
- Year on year data trends are informing spectrum policy
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Network architecture – Multi User and Multi Mission

Mobile

Fixed

Direction Finding

Internet

Local Storage

Standalone

Web Portal

Geo-location

Database

Database Analyser

Real Time Access

Database Access
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- WEB based portal into live database
- Up to the minute data collected from RFeye network
- Data can be analysed by area, frequency and time
- Scalable architecture
Detect and investigate interference

Identify and track jammers and rogue transmitters

Overlay techniques for high probability of geo-location

Improve efficiency by pre-visit database research

Compare spectrum usage with licence database

Direction finding and geo-location of nuisance or rogue transmitters

National regulators and spectrum agencies, spectrum managers, network operators
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Geo-location

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Real Time Access

Database Access
Geo-location overlay (TDOA, AOA and POA)

- TDOA using deployed network of fixed nodes
- Two frequencies selected in different areas
- Nodes can be tasked to do multiple frequencies per capture
- Multiple computation areas can be created
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In-place monitoring

- Detect and locate unauthorised transmissions
- Protect critical systems from interference
- Monitor buildings for rogue or nuisance interference
- Detect security risks and threats to public safety
- Locate any type of signal regardless of modulation

In-place monitoring of prisons, hospitals, airports, sensitive public buildings

Prisons, hospitals, civil airports, corporate premises, national security
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In-building monitoring

- **POA (power on arrival)** used with frequency locked and synchronous captures
- Receivers placed around the building and time synchronised
- Software scans and looks for any power transmissions and geo locate within building
- Signal analysis techniques used to identify modulation and signal type
Summary

Flexible hardware/software with multi-layer multi-user capabilities
• the key to cost-effective spectrum monitoring

Networks of “intelligent” nodes capable of multi-tasking
• autonomous decision-making

Ability to talk to any network node directly via IP address
• fast real-time network with nodes sharing information between nodes

Databases and servers provide additional resources

TDOA/POA/AOA overlay techniques
• high probability of locating any given transmitter

Distributed intelligence is the future of spectrum monitoring
Thank you!

CRFS spectrum intelligence systems

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