



# Aries

TETRA Network Performance Monitoring

# RSi



*Autonomous real-time network performance data collection using small low-cost probes – analyse and display the results on any internet browser*

*Powerful, easy-to-use, affordable*

*Ideal for large users and network operators needing independent performance verification*



## Key features

- ▶ autonomous monitoring of TETRA network performance
- ▶ measurement of speech quality to ITU-T Rec. P.862 'PESQ'
- ▶ layer 2/3 logging & analysis, recording Motorola Scout file for further analysis
- ▶ all functionality is controlled from the server – no need for any engineering expertise in the survey vehicle
- ▶ low-cost, small, robust probes can be fitted in any vehicle
- ▶ compatible with Sepura/Teltronic and Motorola TETRA and Tait DMR radio terminals
- ▶ all results and analysis presented in real-time on secure web pages accessible from any browser
- ▶ built-in powerful analysis functions for calculating high-level key performance indicators (KPI)
- ▶ inherently scalable design can easily manage 1000's of probes

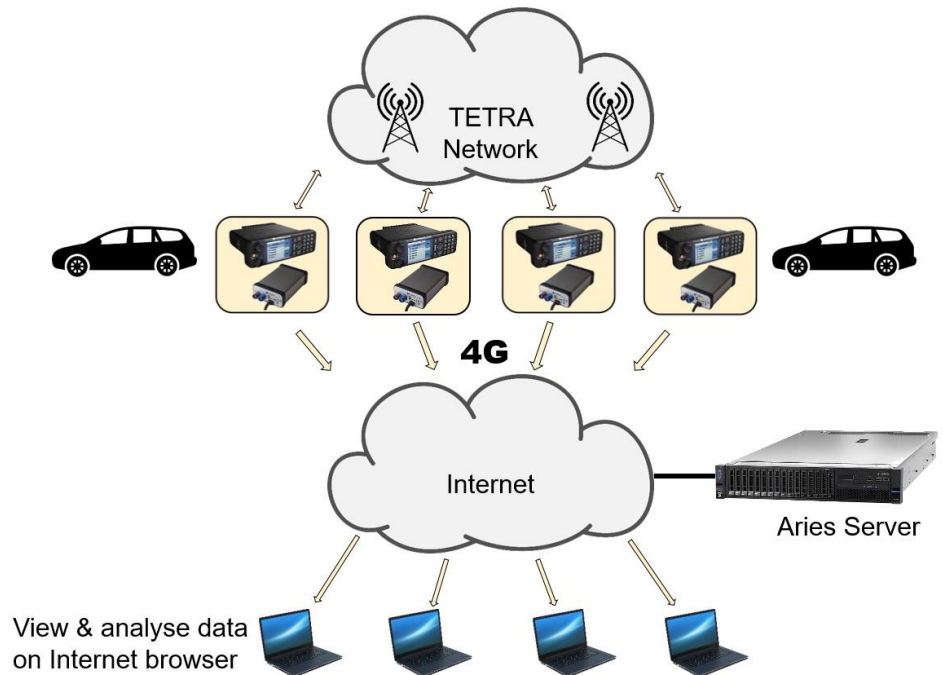
## What is Aries?

Aries is an autonomous TETRA radio network monitoring tool that provides real-time performance statistics. It consists of many small probes that connect to the back of existing radio terminals as well as software that runs on a web server. As the vehicles with the radios and probes travel across the network, data is sent from the probes back to a central web server so that a picture of network performance builds up. Results may be viewed in real-time as maps, graphs, tables and warnings using a secure password-protected web site available on any Internet connected PC using a standard browser.

Aries provides first-line radio network monitoring of faults and problems with the facility to send warning SMS to service engineers when key metrics are exceeded. Problems can then be investigated further with the detailed technical data and powerful analysis functionality.

Aries provides a picture of the network performance that is not available from the standard network call logging as it takes into account all of the failed calls and poor coverage areas and it provides a true and independent measure of grade-of-service as perceived by the user

Aries monitoring probes are ideal for fitting in any vehicle that regularly travels across the service area such as public transport - once installed they can be forgotten about. In addition Aries probes may be used for fixed monitoring of individual base sites.



## Use Cases

### End Users

- ▶ contractual acceptance verification
- ▶ identify any network weaknesses before mission critical communications
- ▶ monitor ongoing performance for Service Level Agreement
- ▶ spot trends in performance, identifying problems before users do
- ▶ high-level KPI reporting for management

### Network Operators

- ▶ collect network engineering data for troubleshooting and optimisation
- ▶ collect coverage data for feeding back into the network planning process
- ▶ early warning of faults and performance issues
- ▶ high-level KPI reporting for management
- ▶ identify performance bottleneck areas of weak coverage or capacity
- ▶ benchmark before and after performance when changes are made
- ▶ gain a better view of your network with continuous, real-time QoS data

## How does Aries work?

Aries probes are deployed in vehicles across the radio network service area ensuring that each base site is monitored at least once a day and preferably much more frequently for critical base sites. Each probe records the basic site parameters such as RSSI and Site LAC as well as neighbour cell info typically every 60 seconds and initiates a test call typically every 3-5 minutes to avoid generating excessive traffic.

Results are sent back immediately from the probe to the central server using GPRS packet data. If the GPRS service is not available then up to 6 days of data is stored in the probe until it can be sent back.

All of the probe parameters are configured by the system administrator and updated over-the-air from the central server. All over-the-air data both to and from the probes is encrypted for the highest level of security and a separate Talk Group is assigned for Aries so that the test calls do not disturb or interfere with users.

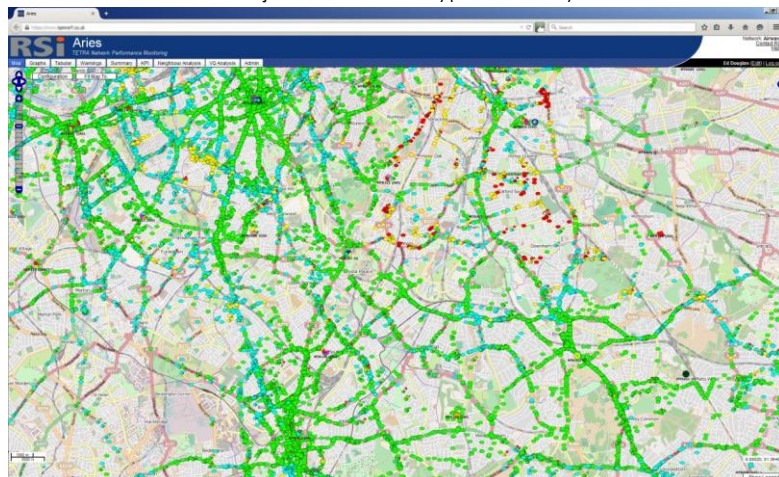
To measure speech quality, Aries uses two probes working together to play short samples of human speech to each other in both the uplink and downlink. The samples are typically 4 sec long and in any language. Speech quality is measured using the industry standard PESQ algorithm meeting ITU-T Rec. P.862, often known as 'PESQ', which compares the received audio with a copy of the original speech to determine the Mean Opinion Score (known as MOS and measured on a scale of 1 to 5).

MOS is an excellent indicator of the quality perceived by end-users and is now generally regarded by TETRA network operators and users as the key parameter for network acceptance and testing.

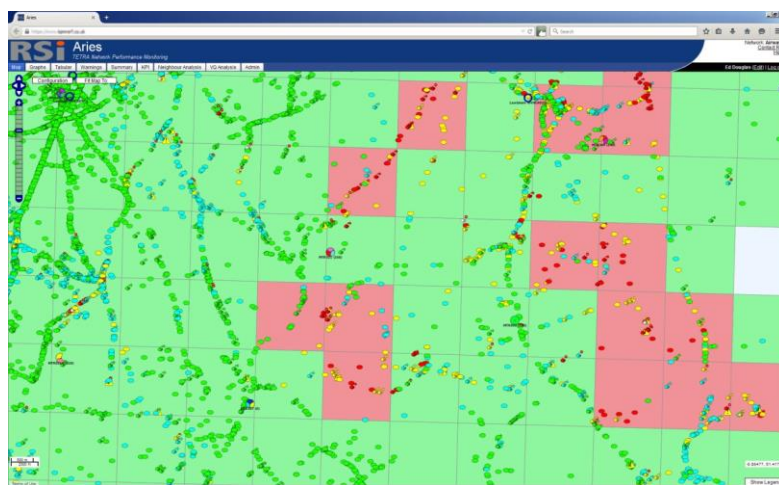
Users may run the Aries web server application on their existing server or on dedicated server hardware supplied by RSI or may purchase access as a service from RSI's own secure server.

## Results and Analysis

All data collected from the probes is viewed and analysed from a standard web browser with secure login to the Aries LTE server. The screenshots below show just some of the types of analysis available:



◀ Aries coverage map showing samples coloured by received signal strength. Base station sites are clearly displayed. Data samples may be coloured by many other measured parameters.

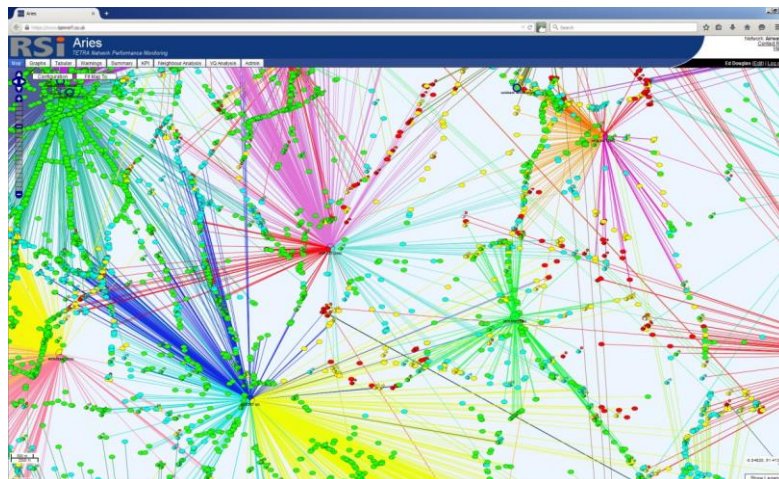


KPI Analysis

Date Range: 01/01/2013 00:00:00 => now

Pass	Event count:	137767
Pass	RSSI:	97.7% greater than -90dBm
Pass	Call Success:	99.5%
Pass	Call Setup Time:	99.6% less than 800msec
Pass	Handover Count:	2.5%
Pass	Handover Failure Rate:	5.8%
Pass	Handover Time:	91.6% less than 500msec
Fail	No Service Count:	1.6%
Pass	50% value PESQ MOS-LOO (P862.1)	2.7 (20464 samples)
Pass	95% value Audio level	-21.53 (20376 samples)
Fail	Square km RSSI:	17.7% failed squares having 80% RSSI greater than -90dBm
Pass	Square km Call Setup Time:	0% failed squares having 90% Call Setup Time less than 800msec
Fail	Square km Handover:	34.9% failed squares having Handovers less than 10%
Fail	Square km Handover Failure Rate:	56.3% failed squares having Handover Failure Rate less than 8%
Fail	Square km Handover Time:	59.6% failed squares having 90% Handover Time less than 500msec

◀ Aries map showing the square km analysis option – in this case each square km is coloured green for 'Pass' or red for 'Fail' based on whether the data meets the test criteria. This provides a higher level of statistical analysis and is ideal for performance acceptance testing.



▲ Aries map showing the base site affiliation lines. The coverage areas of the sectored base sites can be clearly seen together with a small number of samples using what appear to be obviously wrong base sites – this is one of the ways that Aries helps to identify problems with handover and coverage leading to improved network performance for users.

This shows a typical info form for a TETRA Base Site. It includes frequencies planned and frequencies actually used, cell parameters for each base site, indicating values that do not match the expected value, Cell Broadcast Information, list of Neighbour Cells including the % of handovers to each neighbour, PESQ Voice Quality results, broken down by uplink / downlink and for each channel in use at the base site

**BaseSite:** Base Site 0123

Frequencies Planned: 3654  
Frequencies Used: 3684 3654  
Reference: City Centre

Failure Simulation Mode

Show Event Count

[Hide Base Site details](#)

Fast reselect threshold:	26 dB	✓
Slow reselect threshold:	14 dB	✓
Fast reselect hysteresis:	8 dB	✓
Slow reselect hysteresis:	8 dB	✓
Min Rx access level:	-110 dBm	✓
Max Tx Power:	35 dBm	✓
Access Parameter:	-39 dBm	✓
Colour Code:	34	✓
Subscriber Class:	14, 16	✓
Security Class:	3	✓
Mobile Country Code:	234	✓
Mobile Network Code:	78	✓
Encryption Air/TOH:	0	✓

BS service:

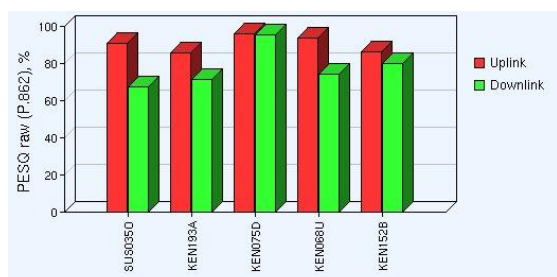
Registration:	1
De-registration:	1
Priority Cell:	0
Minimum mode:	1
Migration:	0
System Wide Service:	1
TETRA Voice Service:	1
Circuit mode data Service:	0
SNDP Service:	1
AI Encryption Service:	1
Advanced Link Supported:	1

[Hide neighbour details](#)

Neighbours	LAC	Frequency	Handover All (Failed)
Base 025	1234	391.1575	9.1% (1.7%)
Base 027	1245	391.2125	4.1% (0%)
Base 721	1428	392.2375	—
Base 664	1299	391.8125	—
Base 711	1375	393.1575	1.2% (0%)
Base 593	1660	391.2000	26.1% (2.1%)
Base 448	1145	391.9875	15.4% (3.7%)
Base 735	1899	393.4125	8.3% (0.8%)
Base 749	1288	391.5875	14.9% (4.1%)
Base 662	1132	394.1000	—
Base 891	1574	391.8000	0.4% (0.4%)
Base 227	1377	392.4525	11.2% (3.3%)
Base 503	1045	393.6825	8.7% (0.4%)
Base 411	1664	392.9875	—
Handovers to other Base Sites			0.4%

[Hide VQ details](#)

Uplink		Downlink		Overall		Combined
Used Frequency	VQ Score	Used Frequency	VQ Score	Uplink	Downlink	
3654	2.85	3654	2.83	2.90	2.90	2.90
3684	2.90	3684	2.90			



◀ Aries graph showing PESQ Voice Quality Grade of Service for uplink and downlink: % of samples with score better than 2.7, grouped by base site

## Specification



### Aries Probe

- Dimensions: 86mm x 56mm x 26mm excluding connectors
- Connectors: GSM – Fakra D, GPS – Fakra C, radio terminal – flying lead terminated in manufacturer specific connector
- Internal connectors: Micro USB (used for tech support), dual-SIM card holder, micro SD memory card holder, 2 x micro push-switch for manual On/Off/Reset
- GSM Modem: 2G: GPRS,EDGE; EMEA version: 3G HSPA+,UMTS on B1, B8 4G LTE on B1, B3, B7, B8, B20; Americas version: 3G HSPA+,UMTS on B2, B4, B5 4G LTE on B2, B4, B5, B12, B17, B25, B26
- Probe auto-starts when radio terminal powered up and remains powered on for 10mins by internal battery after radio power-down to send any remaining data
- Parameters logged:
  - o General: Time, Latitude, Longitude, Altitude, Speed, GSM RSSI
  - o Call Events: Monitor, Call Success, Call Fail, Uplink/Downlink Speech Sample, Call Completed Successfully, Call Dropped, Handover, Network Registration, Failed Handover, No Service, Airtracer atp file
  - o Motorola terminal (Airtracer mode): Serving Cell LAC/Frequency/RSSI/C1, Neighbour Cells LAC/Frequency/RSSI/C2, RDLC, MER, Slot No, Service Level, Fast Reselect Threshold, Slow Reselect Threshold, Fast Reselect Hysteresis, Slow Reselect Hysteresis, Min Rx Access level, Max Tx Power, Access Parameter, Colour Code, Subscriber Class, Security Class, MCC, MNC, Tx/Rx Modulation Mode/Rate/Bandwidth
  - o Motorola terminal (PEI mode): Serving Cell LAC/Frequency/RSSI/C1, Neighbour Cells LAC/Frequency/RSSI/C2
  - o Sepura/Teltronic terminal: Serving Cell LAC/Frequency/RSSI/C1, Neighbour Cells LAC/Frequency/RSSI/C2
  - o Tait DMR terminal: Serving Cell Frequency/RSSI
- PESQ Speech Quality testing requires a slave radio terminal and Aries probe to be paired with each main probe. Speech sample may be user supplied with configurable call length and format
- Samples reported back to the Aries server every 60secs (configurable)
- In the event of no network data service, samples are held in probe memory until they can be sent back
- Airtracer logging to atp file: probe may be instructed to log Motorola Airtracer data to Motorola Scout file format. File is uploaded to server for analysis using Motorola Scout software
- Android App 'Aries Probe Controller' available to control probe functionality by Bluetooth connection to Probe. Also allows probe to use phone internet connection for data transfer. For areas with no GPS, e.g. indoors or underground, the App allows the user to display a map or floor-plan of the area and click on the current location.

### Aries Server Application

- Runs on dedicated server at customer premises or secure and private access to RSI's servers is available
- Capable of supporting 1000's of probes limited by server resources
- Capable of supporting 100's of users logged in simultaneously limited by server resources
- Application enforces password complexity and expiry rules
- Different level of user account provide different levels of access and functionality
- All Data is logged in a MySQL database. A user-friendly interface is provided to allow the following methods of selecting data for analysis: Filter by Data, Filter by Probe, Filter by Base Site, Filter by Area, Filter by Event Type, Filter by parameter value
- Analysis may be done using maps, graphs, tables, KPI, Neighbour Analysis, Voice Quality Analysis
- A base site database is included allowing display of base site icons on the map
- Map icons may be coloured by: Speed, Altitude, Serving Cell RSSI, C1, LAC, Best Neighbour RSSI, C2, LAC, Call Setup Time, Handover Time, Network Registration Time, MER, RDLC, Slot No., Modulation, Number of Neighbour Cells, PESQ raw (P.862), PESQ MOS-LQO (P.862.1), Audio Level
- Map Square KM analysis mode, calculates performance statistics for each square km and colours them Pass/Fail
- Maps include support for data from Google Maps, Google Satellite, Google Terrain, Open Street Map
- Maps can be exported to kmz format for use in Google Earth
- Graph 'Values' and 'Summary' mode
- KPI Analysis: available KPI's: Signal Level, Call Success, Calls Blocked, Calls Dropped, SMS Success, No Service, Network Type, Data Mode, UL Data Rate, DL Data Rate, Data Fail
- Neighbour Analysis: Missing Neighbour Cells, Unplanned Frequencies, Unused Frequencies, Possible Duplicate LAC, Incorrect Neighbour Frequency, Asymmetric Neighbour Cells, Adjacent Channel Analysis, Co-Channel Analysis, Unplanned Neighbours, Unused Neighbours, Same Frequency Neighbours
- KML polygons may be uploaded to be used as Areas in the analysis
- Warnings are sent by SMS and email when key parameters or KPIs exceed preset thresholds
- Logging and Analysis of Airtracer data requires a license dongle to be purchased from RSI

Note: 'Scout' and 'Airtracer' are product names owned by Motorola Solutions (UK) Ltd

### Try Aries now

If you would like to try using Aries with some test data then go to [www.rsi-uk.com](http://www.rsi-uk.com) and select 'Contact RSI' to request a username and password.

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