Gemini

TETRA network performance measurement tool

RSi

Key features

- **independent and objective TETRA network performance measurement tool**
- **measurement of speech quality to ITU-T Rec. P.862**
- **use for network acceptance tests and ongoing performance checks**
- **scalable design: from walk-testing to multiple vehicle drive-testing**
- **survey using up to 4 radios simultaneously**
- **available in 19" rack, robust carry-case or hand-held options**

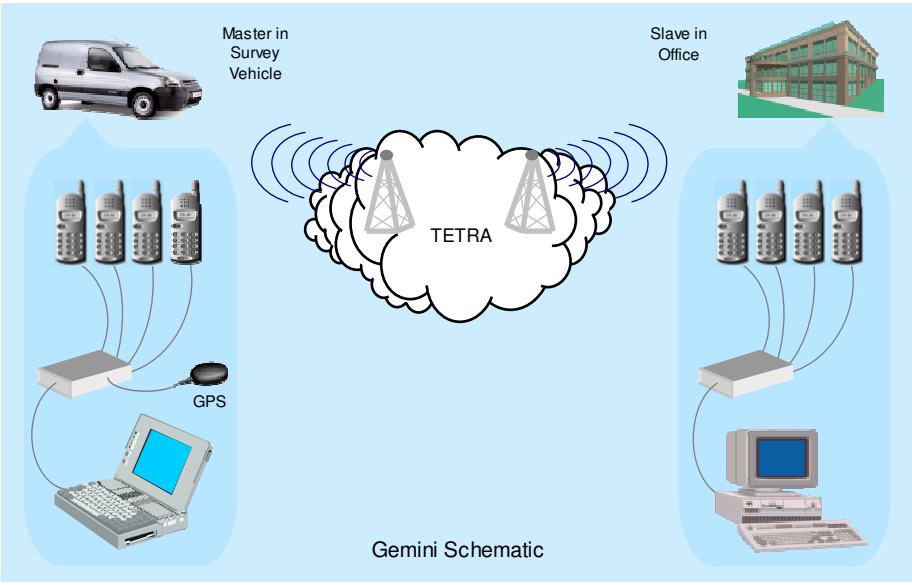
What is Gemini?

Gemini is a survey tool that measures radio network performance as perceived by a user, whether it is affected by coverage problems, system overloading or equipment failure.

Gemini measures the critical parameters associated with coverage and grade of service and provides sophisticated analysis to display the results as maps, graphs or tables. Standard radio terminals are used so that results truly match what the end-user perceives.

Gemini is intended to be used for initial network acceptance testing and then for regular performance checking against Service Level Agreement criteria. Gemini is essentially technology independent although it has been developed with the requirements of the TETRA market particularly in mind.

Gemini is available in robust carry-case or 19" rack options or, if only using one radio terminal, as a hand-held unit.



Gemini Schematic

How does Gemini work?

Gemini consists of two parts, the master in the survey vehicle and the slave at a fixed location with good coverage. Both parts may control up to 4 radios, with each master radio initiating calls to its corresponding slave radio over the radio network. Calls are made continuously and entirely automatically with attempts being made to re-establish the call should it be lost. Each master-slave pair of radios works independently so that in total, there may be up to 4 simultaneous test calls at any time - useful for comparison of different networks or different radios on the same network, or for testing the network under load.

During each test call all the results including any failures are logged together with speech quality measurements of both the uplink and downlink and GPS coordinates.

Post-survey, the slave uplink results are merged and synchronised with the master downlink results to produce a single database with all data for further analysis. Data from other survey vehicles can also be imported to a single database thereby giving the option for centralised data analysis when using a fleet of survey vehicles.

How does Gemini assess call quality?

Once a call has been successfully set up, Gemini plays short samples of human speech, typically 4 sec and in any language, at one end and records the received audio at the other end. Speech quality is measured using the industry standard PESQ algorithm meeting ITU-T Rec. P.862 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.

Other parameters are measured and include the following:

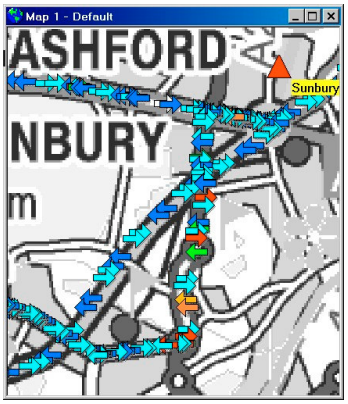
Call set-up time - an indicator for the loading of the network and usually expressed as a Grade of Service, e.g. 90% of calls to be set up in 5 sec or less.

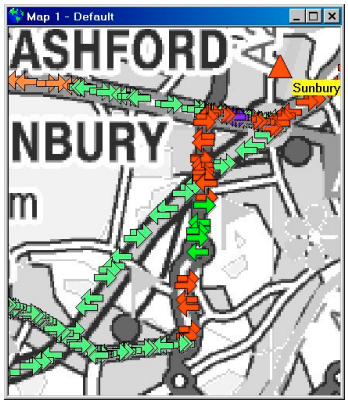
Call set-up failures, calls dropped, No Service, Network busy - all of these are possible call failure reasons that are logged and are available for further analysis.

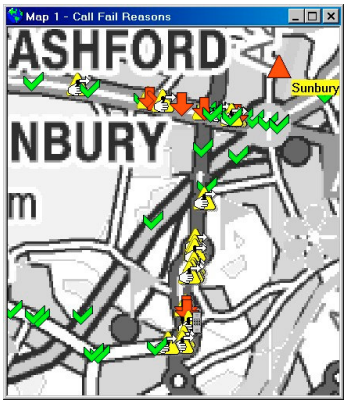
RSSI, Site ID, C1, adjacent Site ID & C2, handovers - all are engineering parameters used for more detailed analysis of the network performance.

How does Gemini analyse and present the survey data?

Gemini includes built-in powerful and flexible analysis functionality to process the raw survey data and present it in many different ways on maps, graphs and tables or for export to external applications. The following screenshots show some examples:





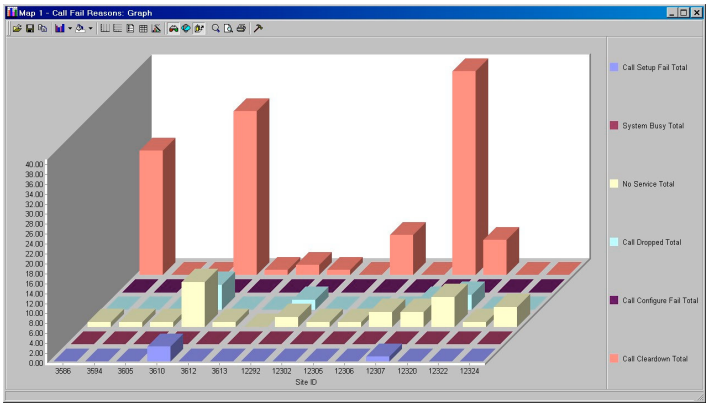


◄ These maps illustrate just 3 of the options for viewing results - many more are possible. Note how in this example, poor speech quality can be traced to the handovers and coverage problems from the local base site.

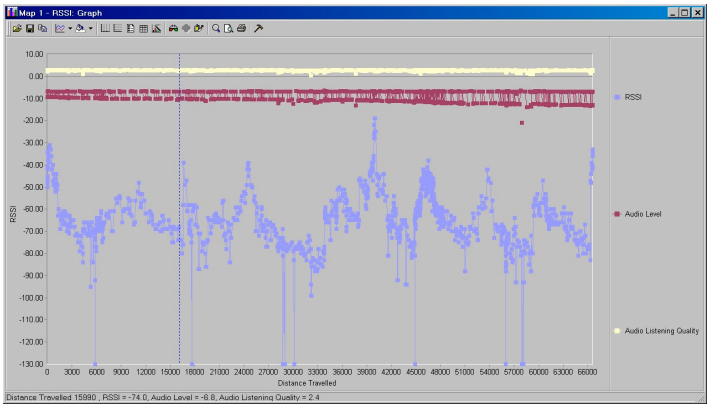
left: speech sample icons coloured by MOS

middle: speech sample icons coloured by Site ID

right: call pass/failure icons with default colours

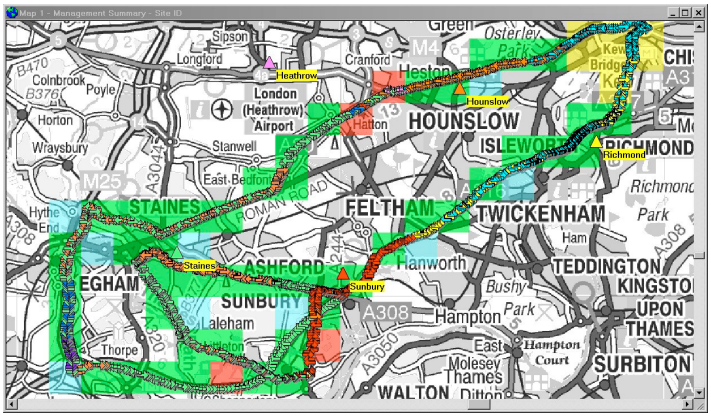


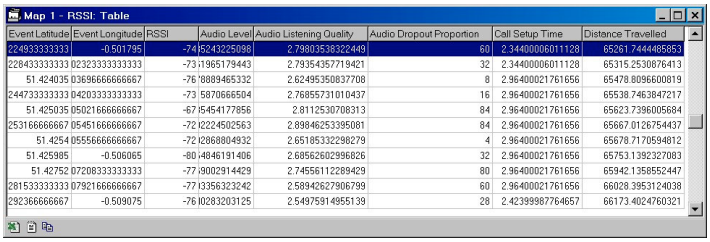
▲ This graph shows a breakdown of call pass/fail reasons grouped against Site ID. The relative performance of base sites can be seen clearly with some sites having many more call set-up fails than others indicating a possible problem for further investigation.



▲ This graph shows RSSI, Audio Level & MOS against distance. The graph and map are synchronised to help identify problem areas.

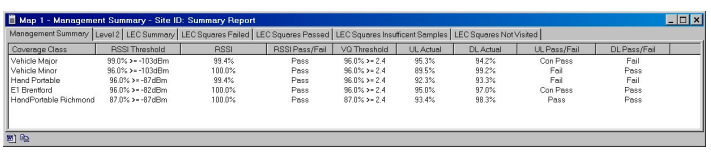
▼ This table shows a typical listing of raw survey data that is synchronised to the map and may be exported for further analysis.




Map 1 - RSSI: Table

Event Latitude	Event Longitude	RSSI	Audio Level	Audio Listening Quality	Audio Dropout Proportion	Call Setup Time	Distance Travelled
224933333333	-0.501795	-74	5243225098	2.798035383224 49	60	2.34400006011128	65261.7444485853
2284333333333	02323333333333	-73	1965179443	2.79354357719421	32	2.34400006011128	65315.2530876413
51.424035	0.369666666667	-76	8889465332	2.624953508377 08	8	2.96400021761656	65478.8096600819
2447333333333	0.420333333333	-73	5870666504	2.76855731010437	16	2.96400021761656	65538.7463847217
51.425035	0.502166666667	-67	5451777856	2.8112530708313	84	2.96400021761656	65623.7396005684
2531666666667	0.545166666667	-72	2224502563	2.89846253395081	84	2.96400021761656	65667.0126754437
51.4254	0.555666666667	-72	2868804932	2.651853322982 79	4	2.96400021761656	65678.7170594812
51.425985	-0.506065	-80	4846191406	2.685626029968 26	32	2.96400021761656	65753.1392327083
51.42752	0.720833333333	-77	9002914429	2.74556112289429	80	2.96400021761656	65942.1358552447
2815333333333	0.792166666667	-77	3563232422	2.58942627906799	60	2.96400021761656	66028.3953124038
292366666667	-0.509075	-76	0283203125	2.54975914955139	28	2.42399987764657	66173.4024760321

◄ This map and table show the results from the management summary analysis - this is intended for network acceptance testing where an overall Pass / Fail result is needed. The pass criteria consist of a set of thresholds for RSSI and MOS that are applied to different coverage classes, e.g. major roads, rural, urban, city, within each 1 km square and on a global basis. This provides a comprehensive set of coverage statistics that ensure there are no localised coverage black-spots when calculating the overall coverage. Individual 1km squares are coloured for Pass / Fail or not enough data.


Map 1 - Management Summary - Site ID: Summary Report

Management Summary | Level 2 | LEC Summary | LEC Squares Failed | LEC Squares Passed | LEC Squares Insufficient Samples | LEC Squares Not Visited

Coverage Class	RSSI Threshold	RSSI	RSSI Pass/Fail	VQ Threshold	UL Actual	DL Actual	UL Pass/Fail	DL Pass/Fail
Vehicle Major	99.0% >= -103dBm	99.4%	Pass	96.0% >= 2.4	95.3%	94.2%	Con Pass	Fail
Vehicle Minor	96.0% >= -103dBm	100.0%	Pass	96.0% >= 2.4	89.5%	99.2%	Fail	Pass
Hand Portable	96.0% >= -87dBm	99.4%	Pass	96.0% >= 2.4	92.3%	93.3%	Fail	Fail
E1 Brentford	96.0% >= -82dBm	100.0%	Pass	96.0% >= 2.4	95.0%	97.0%	Con Pass	Pass
HandPortable Richmond	87.0% >= -87dBm	100.0%	Pass	87.0% >= 2.4	93.4%	98.3%	Pass	Pass

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