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TEMS™ POCKET 12.4

implemented on Sony/Sony Ericsson, Samsung, and HTC devices

User's Manual

Document number: NT12-13421 ver 1.0

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1. Introduction

Welcome to TEMS Pocket.

TEMS Pocket is an advanced cellular network diagnostics tool built into a mobile phone. TEMS Pocket is suitable for day-to-day verification, maintenance and troubleshooting of cellular networks but is also handy for many cell planning tasks.

This document describes TEMS Pocket 12.4 as implemented on the following devices:

Phones

- Sony Ericsson Xperia arc (WCDMA/GSM)
- Sony Ericsson Xperia arc S (WCDMA/GSM)
- Sony Ericsson Xperia T LT30a (LTE/WCDMA/GSM)
- Samsung Galaxy S 4G (WCDMA/GSM)
- Samsung Galaxy S II LTE (LTE/WCDMA/GSM)
- Samsung Galaxy S III GT-I9305 (LTE/WCDMA/GSM)
- Samsung Galaxy S III SGH-I747 (LTE/WCDMA/GSM)
- Samsung Infuse 4G (WCDMA/GSM)
- HTC Rezound (LTE/CDMA/EV-DO)
- HTC Vivid (LTE/WCDMA/GSM)

Tablets

- Samsung Galaxy Note 10.1 LTE GT-N8020 (LTE/WCDMA/GSM)

2. Recently Introduced Features in TEMS Pocket

2.1. What's New in TEMS Pocket 12.4

2.1.1. New Phone: Samsung Galaxy S III (GT-I9305)

This is an Android smartphone operating on LTE, WCDMA, and GSM networks.

- Frequency bands:
  - LTE 800 (Band 20), 1800 (Band 3), 2600 (Band 7)
  - WCDMA 850 (Band V), 900 (Band VIII), 2100 (Band I)
  - GSM 850, 900, 1800, 1900
- Throughput categories:
  - LTE Category 3 (100/50 Mbit/s)
  - HSDPA Category 24 (42 Mbit/s)
  - HSUPA Category 6 (5.8 Mbit/s)
  - GPRS/EDGE Class 12
- Control capabilities:
  - TEMS GSM, WCDMA, LTE RAT lock
  - TEMS GSM, WCDMA, LTE band lock
  - Both RAT and band lock are real-time control functions. No reboot of the phone is required.
- IP logging
- Google Android 4.0
- Wi-Fi: 802.11 a/b/g/n
- Integrated GPS with A-GPS support

- Chipset: Qualcomm MSM9615
- CPU: Quad-core 1.4 GHz

2.1.2. New Phone: Sony Xperia T (LT30a)

This is an Android smartphone operating on LTE, WCDMA, and GSM networks.

- Frequency bands:
  - LTE 700 (Band 17), 850 (Band 5), 1700 (Band 4), 1900 (Band 2)
  - WCDMA 850 (Band V), 1900 (Band II), 2100 (Band I)
  - GSM 850, 900, 1800, 1900
- Throughput categories:
  - LTE Category 3 (100/50 Mbit/s)
  - HSDPA Category 24 (42 Mbit/s)
  - HSUPA Category 6 (5.8 Mbit/s)
- GPRS/EDGE Class 12
- Control capabilities:
  - TEMS GSM, WCDMA, LTE RAT lock
  - TEMS GSM, WCDMA, LTE band lock
  - TEMS GSM cell lock
  - All control capabilities are real-time control functions. No reboot of the phone is required.
- Google Android 4.0
- Wi-Fi: 802.11 a/b/g/n
- Integrated GPS with A-GPS support
- Chipset: Qualcomm MSM8960
- CPU: Dual-core 1.5 GHz

2.1.3. TEMS Pocket on Tablet

As operators around the world introduce the **latest LTE tablet** from Samsung, so does Ascom Network Testing. TEMS Pocket is now available

on the brand new Samsung Galaxy S III Note 10 LTE, offering excellent screen real estate for in-building testers.

User familiar with TEMS Pocket smartphones will recognize themselves immediately as features and functions are similar but **designed with a tablet screen in mind**. A few examples of tablet-specific features are that the pinpointing and logfile replay controls have been moved to the right-hand side for easy access when holding the tablet. Layer 3 full-text decoding is also more intuitive with message sequences and detailed contents available side by side.

TEMS Pocket also introduces **real-time** GSM, WCDMA and LTE **control capabilities** in the form of RAT and band lock on this tablet. Real-time control capabilities provide a non-intrusive way to test specific technologies or frequency bands, enabling users to work more efficiently than ever.

2.1.4. Supported Tablet: Samsung Galaxy Note 10.1 LTE (GT-N8020)

This is an Android 10-inch tablet operating on LTE, WCDMA, and GSM networks.

- Frequency bands:
  - LTE 800 (Band 20), 1800 (Band 3), 2600 (Band 7)
  - WCDMA 850 (Band V), 1900 (Band II), 2100 (Band I)
  - GSM 850, 900, 1800, 1900
- Throughput categories:
  - LTE Category 3 (100/50 Mbit/s)
  - HSDPA Category 24 (42 Mbit/s)
  - HSUPA Category 6 (5.8 Mbit/s)
  - GPRS/EDGE Class 12
- Control capabilities:
  - TEMS GSM, WCDMA, LTE RAT lock
  - TEMS GSM, WCDMA, LTE band lock
  - Both RAT and band lock are real-time control functions. No reboot of the is tablet required.
- Google Android 4.1

- Wi-Fi: 802.11 a/b/g/n
- Integrated GPS with A-GPS support
- Chipset: Qualcomm MSM9615
- CPU: Quad-core 1.6 GHz

2.1.5. Real-time RAT/Band Lock for Samsung Devices

This release adds **real-time** RAT and band lock for GSM, WCDMA and LTE to a range of selected non-Sony devices. These capabilities, which until the release of HTC Vivid in 2012 have been exclusive to certain TEMS Sony devices, are now added to the following devices:

- Samsung Galaxy Note 10 LTE (GT-N8020)
- Samsung Galaxy S III LTE (GT-I9305)
- Samsung Galaxy S III LTE (SGH-I747)

While some other solutions might require the device to be rebooted each time a control function is used, the capabilities introduced in this release are real-time. Practically this means that the control functions can be applied either manually by the user, or automatically through TEMS Pocket scripts, perhaps interleaved with other testing or use of other TEMS Pocket features, **without having to reboot the phone** each time a function is to be used.

Having to reboot the device for each application of a control function means several lost minutes for the user: waiting for the phone to reboot, starting the test application and resuming tests. It also prevents scripting of control functions so that they can be executed in the background without user supervision.

RAT and band lock, like many of the popular, **non-intrusive**, TEMS control capabilities reduce error-prone tasks which would otherwise take hours or even days, by changing settings on the network side, to mere minutes and without the risk of affecting commercial users or introducing errors in the network configuration. This greatly **increases efficiency** for TEMS Pocket users.

2.1.6. Logfile Upload via HTTP

It is now possible to upload logfiles also via HTTP. It offers an alternative upload mechanism to the previously supported FTP logfile upload. This is

useful for cases where FTP access is not readily available, for example due to company IT policies, or simply not preferred.

As there is no clear standardized way of performing file upload via HTTP, TEMS Pocket offers a very flexible configuration of the upload in order to support a wide variety of user preferences. As an example, the user can set a number of custom key/value pairs which can be sent as arguments to the web client accepting the upload.

Note that HTTP logfile upload is not guaranteed to work with all websites or servers accepting file uploads, due to the unspecified nature of HTTP uploads in general.

Important: HTTP logfile upload using a secure connection through SSL requires a separate SSL license option in TEMS Pocket. The SSL license option is under *embargo restrictions* and can only be sold to certain countries. Without the SSL license option, HTTP uploads will be unencrypted. This is the same license as used to enable encryption of email for email testing which was introduced in TEMS Pocket 12.3.

Note that this is unrelated to user authentication, which does not require the SSL license option and is always supported by TEMS Pocket.

2.1.7. Full-text Layer 3 Decoding

The capability to show the complete contents of Layer 3 messages was until recently limited to more powerful laptop or desktop solutions, but is now available directly in TEMS Pocket. Much as in TEMS Investigation, the user can select a message from the Layer 3 Messages window and immediately see the full contents of the message in human-readable format.

By displaying the full message contents the user can troubleshoot signaling issues directly in the field, for example by viewing MIB or SIB configurations, or get detailed information on things like RRC procedures for the GSM, WCDMA, CDMA and LTE technologies.

Full-text message display is available both in real time and when replaying TEMS Pocket logfiles.

2.1.8. SMS Service Testing

Users can now perform testing and service assurance of SMS sending for GSM, WCDMA and LTE networks. Success ratio, send and ack time KPIs are displayed directly in the handset.

TEMS Pocket offers a number of parameters to facilitate efficient SMS testing:

- Custom text contents.
- Optional random text of user-configurable size for easy testing of specific message sizes and message fragmentation.
- Custom SMS center.
- Sending of multiple SMS messages, each tagged with a sequence number for easy detection of lost messages.

2.1.9. External GPS Support

It is now possible to connect an **external location receiver** to TEMS Pocket for positioning outdoor where GPS satellite coverage is available.

An external GPS has the advantage of reduced power consumption in the mobile device, and it is more easily installed in a position with better satellite coverage. The user can for example place the GPS on the car dashboard, with better satellite line of sight, and use the mobile device inside the car where GPS coverage might be less accurate or even unavailable.

On the other hand, it should be noted that the internal GPS units in today's smartphones have improved significantly in accuracy and acquisition rate compared to older devices, so that they deserve consideration as a convenient alternative to an external GPS.

Should the external GPS be accidentally disconnected or run out of battery, TEMS Pocket will automatically switch to the internal GPS as a fallback. This safeguards the continuity of positioning data.

Note that only approved location receivers should be used with TEMS products for best user experience. See section 2.1.10.

2.1.10. Supported External GPS: GlobalSat BT-359

GlobalSat BT-359 is a GPS receiver with wireless Bluetooth 2.0 connectivity and 1 Hz positioning update rate, supporting up to 11 hours of continuous use.

BT-359 package contents:

- BT-359 Bluetooth GPS receiver
- 110/240 V AC wall charger

- Euro AC wall plug adapter
- 12 V DC car charger
- USB charger cable

2.1.11. Cell Barred Control

TEMS Pocket adds another popular control capability to Sony Xperia arc S LT18i/a devices: cell barred control. This capability is useful for testing sites that are in operation in commercial live networks, keeping the impact on network subscribers to a minimum.

By barring access to a specific cell, the operator can prevent commercial handsets from camping on that cell. However, applying the cell barred control function, the TEMS Pocket user can bypass the access restrictions and still use the cell to conduct tests uninterrupted and in a more controlled environment. This increases the reliability of tests and promotes user efficiency, as the alternatives can be costly and error-prone.

The cell barred control function offers three different settings for GSM:

- **Normal:** Only non-barred cells can be used by the phone. This is how commercial devices normally behave.
- **All:** All cells, including barred ones, can be used by the phone.
- **Only barred:** Only barred cells can be used by the phone.

For WCDMA, additional options involving *reserved* cells are provided.

2.1.12. Settings Export

TEMS Pocket users can now export their event settings and custom events, storing them in a format suitable for import by other TEMS Pocket phones or storing multiple settings. This enables users to distribute their created custom events, share best practises and align towards common ways of working, further increasing reliability and efficiency in their daily work.

TEMS Pocket now also retains custom events and event settings when upgraded to newer software versions.

2.1.13. IP Capture on Additional Devices

IP logging capabilities have been added to the following devices:

- Samsung Galaxy S III LTE GT-I9305

- Samsung Galaxy S III LTE SGH-I747
- Sony Xperia T LTE LT30a

2.2. What Was New in TEMS Pocket 12.3

2.2.1. New Phone: Samsung Galaxy S III (SGH-I747)

This is an Android smartphone operating on LTE, WCDMA, and GSM networks.

- Frequency bands:
  - LTE 700 (Band 17), 1700/2100 (Band 4)
  - WCDMA 850 (Band V), 1900 (Band II), 2100 (Band I)
  - GSM 850, 900, 1800, 1900
- Throughput categories:
  - LTE Category 3 (100/50 Mbit/s)
  - HSDPA Category 14 (21 Mbit/s)
  - HSUPA Category 6 (5.8 Mbit/s)
  - GPRS/EDGE Class 12
- Google Android 4.0
- Wi-Fi: 802.11 a/b/g/n
- Integrated GPS with A-GPS support
- Chipset: Qualcomm MSM8960
- CPU: Dual-core 1.5 GHz
- AT&T branded

Please note that if the user switches Google accounts, resets the device or otherwise removes the TEMS Pocket application, the user should contact Customer Care in order to receive the TEMS Pocket PC installer for re-installation of TEMS Pocket.

2.2.2. Audio Quality Measurement Using POLQA

By introducing **POLQA**, Perceptual Objective Listening Quality Analysis, this release offers a method of **audio quality measurement** that is up to the task

of assessing today's complex and heterogeneous networks. POLQA, codified in ITU-T Rec. P.863, has been designed to address and eliminate a range of known weaknesses in the older PESQ algorithm.

TEMS Pocket provides a unique, best-in-class POLQA solution with two distinct advantages:

- The ability to control **device-specific audio-enhancing** functions such as noise suppression, audio stretch, comfort noise and gain control enables TEMS Pocket to measure true network quality, without characteristics of individual devices impacting the results. By uniforming such settings, MOS scores are made device-independent so as to convey a consistent and unbiased picture of the actual network quality.
- The user can prescribe which **voice codec** should be used by the phone. Normally, voice codec selection is mandated by the network and is beyond the user's control, unless changes are made to the network configuration. Such operations can be error-prone and might not even be feasible if the user is not in control of the network, as will often be the case when doing benchmarking.

POLQA as offered in TEMS Pocket 12.3 has the following features:

- Measurement conducted during mobile-to-fixed calls, from a Sony Ericsson Xperia arc S LT18i/a device to a TEMS Call Generator.
- Downlink MOS score obtained for circuit-switched audio.
- Narrowband voice codecs supported.
- Use of POLQA is optional. A POLQA license option is required for TEMS Pocket itself, and the TEMS Call Generator needs to have a POLQA and CS voice license.

Coming releases will expand this functionality further.

Note: It is possible to measure POLQA on wideband codecs, such as AMR-WB (16 kHz sample rate), but the score will not be accurate as the current POLQA implementation only supports sample rates up to 8 kHz.

2.2.3. Voice Codec Control

Voice codec control, mentioned in the POLQA section above, is another control function that is unique to Ascom. This function allows the TEMS Pocket user to select which **voice codecs the phone should report as supported** to the network. The network will then pick a codec to use for CS

voice encoding from this subset alone. Each codec provides a different trade-off between audio quality and robustness to channel errors.

The alternative to this non-intrusive solution is to change the configuration in the mobile network. This procedure is both time-consuming and costly, and moreover it may introduce errors in the network or in measurement results.

Voice codec selection in TEMS Pocket can be **controlled in real time** before setting up each voice call. The function is easily accessible manually and can be automated via TEMS Pocket test scripts. It can be combined with other control functions such as RAT, band, cell or channel lock to form powerful test sequences suitable for multi-technology networks.

Voice codec control, as supported by TEMS Pocket, is **the only practical way** to test individual voice codecs.

2.2.4. Outdoor Maps

When testing in locations with GPS coverage, the **outdoor map view** can be used to display measurements, events and cell sites.

This allows the user to easily locate network trouble spots and visualize network performance geographically, something which previously was exclusive to PC-based test solutions.

The same range of value elements can be displayed on the outdoor map as in the indoor map view.

To allow for hands-off operation, the map can be set to automatically center on the user's position when traveling. If preferred, this behavior can be switched to freestyle zooming and panning at the touch of a button.

The map content is taken from Google Maps, and all of the following map types are available for display in TEMS Pocket: roadmap, satellite, terrain, and hybrid (satellite image with roadmap overlay). It is possible to inhibit download of new map tiles during measurement to prevent such activity detracting from data throughput performance. Tiles already downloaded will continue to be displayed.

2.2.5. Cell Site Display

Cell site information provided by external cell files can be displayed graphically on outdoor maps. In order to work efficiently with multi-technology networks, the user can display layers of cell site information selectively:

- Toggle the **map layer off** to focus on cells and measurements.

- Toggle **cell sites** on and off **by technology** (GSM, WCDMA, LTE, CDMA) to keep clutter to a minimum.
- Turn on the **serving cell tracker** to point to the cell currently serving the TEMS Pocket device.

Cell sectors are displayed according to their antenna direction and beam width, with a technology label (G, W, L, C) indicating the radio access technology.

To ensure good performance, the display of sites is governed by the map zoom level, but is independent of the TEMS Pocket user location. This has the advantage that users can load and view cell location data anywhere, regardless of their current position and GPS coverage.

The cell presentation is conditioned by the map zoom level to keep it from becoming too cluttered. If the map is zoomed out far enough, no cells will be shown, and the user is prompted to increase the zoom level. When this is done, cell sites are first displayed as simple black squares without sector information. After the map is zoomed in further, the full range of cell information appears.

2.2.6. Parallel Service Testing

To simulate more complex user behavior, TEMS Pocket 12.3 made it possible to combine a wider range of **data actions to run in parallel with voice** sessions. Testing of Ping and email was added to FTP, HTTP and voice parallel test actions. One instance of each data service can be scheduled in parallel, and break conditions are user-customizable.

2.2.7. Progress Tracking

TEMS Pocket 12.3 enhanced users' ability to track the **expected remaining time** of data transfers: FTP, email and logfile upload. Each data service view in the Test Status category sports a progress bar with an estimate of the remaining transfer time based on file size and current throughput.

2.2.8. Easy "Go/No-go" Testing

To better reflect the more concurrent behavior of today's mobile services, the Test Status category of data views was expanded. Each testable service type in TEMS Pocket has its **own progress view**, while a general Script Progress view tells of the overall test progress.

The Script Progress view has **status indicators** for each service type, color-coded to indicate their current status (inactive, active, running, or error). Each status indicator is linked to the corresponding service-specific progress view, which in turn has a link leading back to the general script progress view.

The service test indicators enable users to assess test progress at a glance. This can be especially handy in use cases such as site commissioning or service accessibility assurance, where a simple “green-for-go” analysis is often sufficient.

2.2.9. Manual GPS Control

The phone’s GPS can be **manually enabled** and disabled from the TEMS Pocket Action menu. This allows users to verify their location also when not running a script, and to plot measurements or important events on the outdoor map whenever desired.

2.2.10. Alerts and Notifications for Events and Layer 3 Messages

The amount of diagnostics data generated by a single device running multiple services can sometimes be overwhelming for a user to monitor. Important network, service and application events, as well as Layer 3 messages, can be brought to the TEMS Pocket user’s attention through highly customizable alerts and notifications.

Each event and message supported in TEMS Pocket can be announced by any combination of the following:

- **Audio alerts**, allowing the user to direct their focus away from the handset and still be able to react to what is happening.
- **Popup messages**, providing a visual, silent notification when an event or message occurs.
- **Markers** in line charts and on indoor/outdoor maps, highlighting the “when and where” of an event or message.

2.2.11. TEMS Pocket Status Icons on Android Status Bar

The TEMS Pocket data view header carries a column of status icons showing the current overall status of scripting, logfile recording, GPS, and control function usage. To allow the user to track this status **at all times**, and not only

when a TEMS Pocket data view is on display, the status icons also appear on the Android status bar and its associated drop-down menu.

2.2.12. New Events: Radio Events, Device Events

TEMS Pocket 12.3 added a wide range of new events, some radio-related, others device-related, and still others pertaining to new services introduced such as email testing. All of these events are there to help the user focus on the right information at the right time:

Radio Events for GSM and WCDMA

- Call Attempt, Call Established, Call End
- Blocked Call, Dropped Call

General Events for GSM, WCDMA, CDMA, and LTE

- Cell Change, Channel Change, System Change

Device-related Events

- GPS Position Lost/Found
- Battery Low
- Low Disk Space

2.2.13. Customizable Events

Over and above the predefined events, users can also create their own **custom events** based on measurements reaching or crossing preset **thresholds**. A hysteresis parameter can be configured, ensuring that the event is triggered once when a condition sets in, but avoiding a profusion of generated events ("ping-pong" effect) in case of rapidly fluctuating measurement values.

The measurements available for use as event triggers are the same as those displayable on the indoor and outdoor maps.

2.2.14. Email Service Testing

Scripted testing of **email (SMTP)** enables the user to perform service assurance for email services, recording KPIs such as data transfer cut-off and success ratios.

TEMS Pocket supports a number of features to facilitate efficient email testing:

- Automatic generation of contents according to custom size enables precise testing of email size thresholds
- Custom sender and receiver information
- HTML or plain-text format
- File or custom-sized attachments (example files included)

Important: Email testing using a secure connection through SSL requires a separate SSL license option in TEMS Pocket. The SSL license option is under *embargo restrictions* and can only be sold to certain countries. Without the SSL license option, all email testing will be unencrypted. Note that most commercial email services such as Gmail require some form of encryption; there are however some servers that do not require encrypted communication. Corporate email servers are almost guaranteed to require encryption of data.

Note that this is not related to user authentication, which does not require the SSL license option and is always supported by TEMS Pocket.

2.2.15. IP Packet Capture

With the onslaught of OTT (over-the-top) services and migration of CS voice to packet-based VoIP, capturing application data is becoming increasingly important in order to understand subscriber experience.

Using TEMS solutions for packet capture, as opposed to using dedicated IP tracing applications, brings the major benefit of having the IP data **positioned** according to the user location, even in-building, and provided **together with radio** environment and radio bearer QoS data.

The user can choose to record IP data to an external file in .pcap format for easy IP-layer post-processing in Wireshark, and/or to a TEMS-internal format for comprehensive service KPI analysis (for example, SIP statistics) in TEMS post-processing solutions such as TEMS Discovery.

2.2.16. Mobile-friendly User's Manual

The TEMS Pocket 12.3 application incorporates the User's Manual in a **mobile-friendly HTML format** that is easy to read on a small screen. The manual is accessed from the TEMS Pocket Help menu.

The new user manual format comes with a powerful search function as well as a comprehensive table of contents and index, all providing immediate access to the information sought.

2.2.17. Screenshots of All Data Views

The screenshot function in TEMS Pocket 12.3 **captures all data views**, storing them either directly in a folder on the phone or in the logfile if one is being recorded.

This ability is particularly useful in TEMS Pocket Standard, since it allows the user to visually capture network and service information even without the ability to record logfiles.

2.2.18. New Logfile Format

With the release of version 12.3, TEMS Pocket adopted the new TEMS **common logfile format, TRP** (TEMS Route Persistence). This format has previously been adopted by TEMS Investigation and TEMS Discovery.

The TRP format is designed with three main objectives in mind:

- To provide a flexible and versatile framework for recording data, that is, to store a wider range of data categories and store the data more efficiently.
- To facilitate future development efforts, shortening time-to-market for new features that impact the logfile format.
- To increase usability and performance for TEMS product users.

For TEMS Pocket users, the most immediate benefit of TRP is that they no longer need to convert TEMS Pocket logfiles to a different format before post-processing them in other TEMS products, such as TEMS Investigation or TEMS Discovery. This can save the user minutes every time a TEMS Pocket logfile needs post-processing.

2.3. What Was New in TEMS Pocket 12.2

2.3.1. New Phone: Samsung Galaxy S II LTE (GT-I9210)

This is an Android smartphone operating on WCDMA, GSM and LTE networks. Its combination of supported frequencies makes it an ideal device for both EMEA and APAC operators.

- Frequency bands:
  - GSM 850, 900, 1800, 1900
  - WCDMA 900 (Band VIII), 2100 (Band I)
  - LTE 800 (Band 20), 1800 (Band 3), 2600 (Band 7)
- Throughput categories:
  - HSDPA Category 24 (42 Mbit/s)
  - HSUPA Category 6 (5.8 Mbit/s)
  - GPRS/EDGE Class 12
  - LTE Category 3 (100/50 Mbit/s)
- Google Android 2.3
- Wi-Fi: 802.11 a/b/g/n
- Integrated GPS with A-GPS support
- Chipset: Qualcomm MSM8260 and Qualcomm MDM9200
- CPU: Dual-core 1.5 GHz Scorpion

Please note that the Samsung Galaxy S II LTE firmware shall not be updated by the user either via Samsung Kies or over-the-air. If a firmware update is made available by Ascom, the device must be sent back to Ascom to have the update installed. This does not however apply to the TEMS Pocket application, which can be updated using the TEMS Pocket PC installer.

2.3.2. RAT Lock and Band Lock Support in HTC Vivid

TEMS Pocket control functionality was introduced on the HTC Vivid smartphone. The device can be locked to RAT and band for LTE, WCDMA, and GSM. These control functions are seamlessly integrated into the device and are applied from within TEMS Pocket, either manually or automatically using a script.

The locking functions enable reliable and cost-efficient testing of all technologies and frequency bands in multi-technology networks. One highly relevant application today is to testing new LTE bands as they are introduced in networks to increase capacity.

Without non-intrusive control functions like these at their disposal, operators can accomplish this kind of testing only by cumbersome means, such as altering network or cell site configurations. These procedures may disturb commercial users; they could also introduce errors in the network, and they certainly take considerable time. Below are a few examples of how TEMS Pocket allows a tester to perform these tasks much more simply and incomparably faster:

Task	Time Taken	
	By traditional methods	With TEMS Pocket
Lock on band	~30 min (requires network reconfiguration)	~1 min
Lock on RAT	several days (requires multiple, pre-ordered SIMs with distinct PLMN settings)	~1 min

Network reconfiguration is not really an option in the RAT case, since shutting down commercial network components (even briefly) would have an intolerable impact on subscribers. For band lock, on the other hand, network reconfiguration is the only "traditional" method available.

With its ability to lock phones to RAT and band, TEMS Pocket saves engineers all of the hassle just described, thus also eliminating the risk of network changes being made incorrectly or remaining by accident after the testing is done.

2.3.3. ICMP Ping for Round-trip Latency Testing

Network latency is a critical parameter for real-time, delay-sensitive services such as VoIP, live video, and gaming. The LTE technology is capable of

bringing latency down to about 50 ms, which is about one quarter that of HSPA networks and an even greater improvement on GSM, which has a delay of approximately 500 ms.

TEMS Pocket 12.2 added ICMP Ping to its network testing toolkit to enable engineers to test and verify network latency characteristics – something which in the past was possible only with traditional drive test solutions.

Just like other network testing actions in TEMS Pocket, Ping tests are scripted, which ensures speedy and reliable execution. Live results as well as summary statistics are presented in real time in the handset.

2.3.4. Real-time Display of Layer 3 Signaling

In TEMS Pocket 12.2 it became possible to study Layer 3 signaling flows directly in the TEMS Pocket user interface. Layer 3 messages from GSM, WCDMA, LTE, and CDMA/EV-DO are presented in a new data view. This capability was previously exclusive to PC-based drive test tools and required the user to transfer logfiles to a PC for analysis.

The ability to analyze Layer 3 signaling in real time allows TEMS Pocket users to capture signaling issues immediately in the field, potentially saving them an entire round-trip to and from the office to run the data through PC-based post-processing tools.

For each message, TEMS Pocket displays its name, direction, timestamp, and originating protocol, as well as (if applicable) its associated channel. The user can freeze the data view to scroll through and scrutinize the message list at leisure, and can then return to the real-time presentation mode at the tap of a finger.

2.3.5. Charting of Important GSM, WCDMA and LTE Measurements

Understanding how and why measurements change over time as one traverse the network is vital to efficient troubleshooting. To address this need, TEMS Pocket 12.2 significantly expanded its array of line charts tracking key quantities and parameters:

- Serving and neighbor signal conditions: separate charts for LTE, WCDMA, and GSM
- Distribution of HSDPA modulation scheme usage (the choice of modulation scheme impacts the maximum throughput)

- LTE cyclic prefix and resource block allocation, likewise affecting maximum throughput
- Comparison of throughput at multiple protocol levels, including MAC-hs

2.3.6. Improved Line Chart Legends

Line chart legends were augmented with the numeric values of the latest data points plotted. The entire legend can also optionally be hidden in order to make more room for the charts. All of this helps make the charts even more lucid and informative, conveying essential data more effectively and saving the tester valuable time in the field.

2.3.7. Grid Indicators for Easy Navigation Among Data Views

Finding the right data view in TEMS Pocket became even more intuitive with the addition of the screen grid indicators. These indicators consist of colored bars located along the top and left-hand edges of the data view, showing which category the current data view belongs to and what position it occupies within that category.

As the user becomes familiar with the organization of the data views, the grid indicators provide an increasingly useful frame of reference, speedily guiding the user to the data view sought for.

2.3.8. Planning In-building Routes Directly in the Handset

Save up to 10 minutes per route by creating pre-planned routes in the built-in TEMS Pocket route editor rather than designing them in some external utility and importing them from there.

Multiple routes for the same floor can be created on the fly and saved to the map set: that is, to an iBwave Collection file (*.ibwc).

2.3.9. Enhanced Usability of In-building Maps

The usability of TEMS Pocket indoor navigation was enhanced with the ability to freely pan the map also when a pre-planned route is loaded. This allows users to freely look ahead and preview the remainder of the planned route, or conversely to backtrack and re-examine previous measurements.

2.3.10. Predefined Scripts and Maps

The TEMS Pocket installation package was supplemented with an example map set with a suite of predefined routes, as well as example scripts for HTTP and FTP. This material helps get new users started working with in-building maps and creating scripts of their own without having to consult the documentation at every step.

2.3.11. New Measurements Displayed

The following new measurements were added in the TEMS Pocket user interface. As a result, the total number of unique displayable measurements was raised to more than 160 for all technologies taken together.

- HSPA
  - MAC-hs throughput, UL/DL: Useful for troubleshooting packet data performance by comparing throughput across multiple protocol layers.
  - Distribution of HSDPA modulation scheme usage (%): The choice of modulation determines the maximum achievable throughput.
  - BLER: Block Error Rate on downlink, combined value for all transport channels.
  - HSPA TB size: Size of downlink transport blocks, correlated with the quality of the radio environment (CQI).
- PDP context information: Data on currently assigned IP connections.
  - PDP address
  - APN, Access Point Name
  - NSAPI, Network Service Access Point Identifier
  - State: Active/inactive
- LTE
  - Cyclic prefix usage, UL/DL (normal/extended): The cyclic prefix length governs cell performance in the presence of inter-symbol interference (ISI). The extended cyclic prefix is more ISI tolerant, but adds signaling overhead and reduces throughput.
  - LTE modulation scheme usage (%): The modulation used governs the maximum throughput. Modulation schemes that enable higher throughput also require a cleaner RF environment, and vice versa.

2.4. What Was New in TEMS Pocket 12.1

2.4.1. New Phone: Samsung Infuse 4G (WCDMA/GSM)

This is an Android phone operating on WCDMA and GSM networks. Its model designation is SGH-I997.

- Networks:
  - GSM 850, 900, 1800, 1900
  - WCDMA 850 (Band V), 1900 (Band II), 2100 (Band I)
- Throughput categories:
  - HSDPA Category 14 (21 Mbit/s)
  - HSUPA Category 6 (5.8 Mbit/s)
  - GPRS/EDGE Class 10
- Google Android 2.3
- Wi-Fi: 802.11 b/g/n
- Integrated GPS with A-GPS support
- Chipset: ST Ericsson 1.2 GHz Hummingbird
- Advanced control functions:
  - Lock to RAT, band
  - Lock to cell, channel

Please note that Samsung Galaxy S 4G and Samsung Infuse 4G can currently be offered only to T-Mobile US, AT&T, and network vendors such as Ericsson, NSN, and ALU. To receive a quote for these devices, please contact TEMS Customer Care (customercare.tems@ascom.com).

2.4.2. New Phone: HTC Rezound (LTE/CDMA/EV-DO)

HTC Rezound replaced HTC ThunderBolt in TEMS Pocket 12.1. Like its predecessor, HTC Rezound is an Android phone operating on LTE, CDMA, and EV-DO networks. It is equipped with two radio chipsets, one dedicated to CDMA (1x), and one that can alternate between EV-DO and LTE operation. The device is therefore able to camp on CDMA + EV-DO or CDMA + LTE simultaneously.

- Networks: LTE 700 MHz, CDMA EV-DO Rev. A

- Google Android 2.3.4 with HTC Sense 3.5
- Display: 4.3 inch S-LCD capacitive multi-touch screen
- 8 megapixel camera with autofocus and dual LED flash; 2 megapixel front-facing camera
- Wi-Fi: 802.11 a/b/g/n
- Integrated GPS with A-GPS support
- Chipsets: Qualcomm MSM8660 Snapdragon and Qualcomm MDM9600
- CPU: Dual-core 1.5 GHz Scorpion

2.4.3. Withdrawal of HTC ThunderBolt Support

Because it was replaced by HTC Rezound, HTC ThunderBolt was withdrawn from the set of supported TEMS Pocket devices.

2.5. What Was New in TEMS Pocket 12.0

2.5.1. New Phone: Sony Ericsson Xperia arc S (WCDMA/GSM)

This is an Android phone operating on WCDMA and GSM networks.

The phone is available in two models, each supporting a different set of WCDMA frequency bands.

- Networks:
  - GSM 850, 900, 1800, 1900
  - LT18i: WCDMA 900 (Band VIII), 2100 (Band I)
  - LT18a: WCDMA 800 (Band VI), 850 (Band V), 1900 (Band II), 2100 (Band I)
- Throughput categories:
  - HSDPA Category 10 (14.4 Mbit/s)
  - HSUPA Category 6 (5.8 Mbit/s)
  - GPRS/EDGE Class 12
- Google Android 2.3
- Wi-Fi: 802.11 b/g/n

- Integrated GPS with A-GPS support
- Chipset: Qualcomm MSM8255
- Advanced control functions:
  - Lock to RAT, band
  - Lock to cell, channel
  - Cell multi-lock/prevention

2.5.2. Global Availability of Control Functions

TEMS Pocket as implemented on the Sony Ericsson Xperia arc S offers control functions similar to those found on the Samsung Galaxy S 4G: lock on RAT, lock on band, lock on channel/cell. Since the Xperia arc S device can be purchased globally without any restrictions, it makes the TEMS Pocket control functionality universally available.

2.5.3. Now Even More Cost-efficient

With the introduction of the world's first Android phone with control functions, the Xperia arc S LT18i/a, prices were reduced for the Xperia arc LT15i/a phone. While the Xperia arc LT15i/a does not support control functions, it otherwise offers the same software features as the Xperia arc S LT18i/a and is a valuable tool for optimization, troubleshooting and indoor measurements. This pricing scheme provides even greater flexibility in terms of finding the right tool at the right cost, matching user requirements.

2.5.4. Cell Multi-lock and Cell Prevention

TEMS Pocket 12.0 added the option to lock to multiple cells at once. While previously a lock could only be applied to one cell at a time, the TEMS Pocket 12.0 user was enabled to specify a list of cells on which to lock. Alternatively, cells to lock on can be picked among the ones appearing in cell list views.

It is also possible to do the opposite: *prevent* the use of a cell or a set of cells. In essence, this is equivalent to locking the phone to all other relevant cells, but as the operation of excluding one cell will often be quicker and easier, it helps save time in the field.

Cell multi-lock is especially handy when working in an indoor environment, where the feature allows locking to all of the indoor cell sites while filtering out the outdoor macro sites. This helps engineers validate indoor coverage

without the outdoor sites interfering with the cell selection behavior of the phone.

The alternative to these non-intrusive control functions is to physically shut down cell sites or otherwise change RAN configurations, procedures which inevitably impinge on network operation and affect subscribers. Cell multi-lock also allows testing with greater accuracy and reliability, since each locking procedure can be configured in advance and readily shared amongst engineers.

The ability to lock on multiple cells/technologies at the same time is a TEMS unique feature, currently available in no other network testing solution. Other solutions rely on single lock-to-carrier operations, which do not bring the same efficiency and accuracy to ways of working.

2.5.5. Withdrawal of Xperia Play Support

Because of the introduction of newer CDMA devices, the Sony Ericsson Xperia Play CDMA was withdrawn from the set of supported TEMS Pocket phones.

3. Overview of TEMS Pocket

3.1. Prerequisites for Running TEMS Pocket

The phone must have a memory card and (where applicable) a SIM or CSIM card installed.

> **Note:** After running the update service/firmware update, you need to ensure that the phone has a valid data connection. If no data connection is established, TEMS Pocket will fail in downloading the license and refuse to start up. If this occurs, you will be notified by a popup message.

3.2. TEMS Pocket 12.4 Product Packages

TEMS Pocket 12.4 is available in two different packages, Professional and Standard.

- The **Professional** package encompasses the full set of product features, and it is the package covered in this User's Manual.
- The **Standard** package does not include logfile recording, nor can it be combined with the indoor pinpointing option. In other respects, the Standard package is identical with Professional. A Standard package can be upgraded to a Professional package.

3.3. License Options in TEMS Pocket

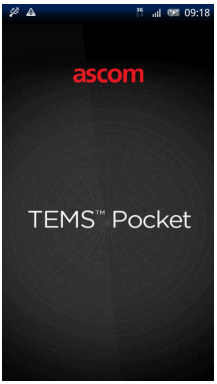
A number of functions in TEMS Pocket require special license options to be enabled in the application.

- The **Indoor Map** view and the **pinpointing** function require a special TEMS Pocket license option.
- For **AQM**, an AQM license option is required for TEMS Pocket itself, and the TEMS Call Generator needs to have an AQM and CS voice license.

- **Email** testing using a **secure connection** through SSL requires a separate SSL license option in TEMS Pocket. The SSL license option is under embargo restrictions and can only be sold to certain countries.

3.4. Launching the TEMS Pocket Application

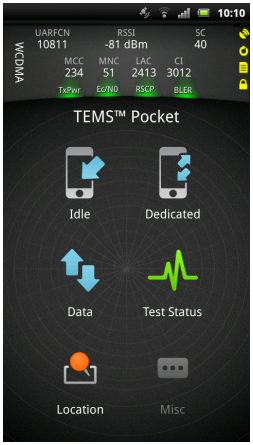
- Launch TEMS Pocket by tapping the TEMS Pocket icon in the phone's application launcher.



This screen appears while TEMS Pocket is starting up.

3.5. TEMS Pocket User Interface

3.5.1. Top-level TEMS Pocket Screen

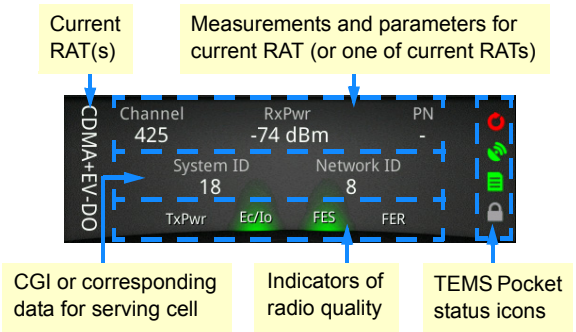


Once TEMS Pocket has initialized, it will display a screen that holds the top-level data view categories.

Everything about the data views is covered in chapter 4.

3.5.2. Data View Header

In the topmost part of the data view is always shown a set of general data related to the cellular technology currently in use, as well as a column of icons reflecting the current status of TEMS Pocket.



See also section 4.5.

The indicators and symbols at the very top of the screen are the same as in the commercial phone.

3.5.2.1. Status Icons

A column of icons appears on the far right in the data view header. These icons give a quick overview of:

- script execution
- GPS status
- logfile recording
- control functions applied.

Generally speaking, the icons give an indication of *what last happened*. They do not provide comprehensive information but should be seen as a complement to the data views.

Script Icon

Symbol	Meaning
 green	A script is running, and the last action completed normally.
 red	A script is running, but the last action failed.
 yellow	No script is running.

GPS Icon

Symbol	Meaning
 green	The GPS selected for use with TEMS Pocket (internal or external) is delivering valid coordinates.
 red	The GPS selected for use with TEMS Pocket is currently not delivering valid coordinates.
 yellow	No GPS selected for use with TEMS Pocket.

Logfile Recording Icon

Symbol	Meaning
green	Logfile recording is in progress and proceeding normally.
red	Logfile recording is in progress, but the free space on the memory card is running low (< 20 MB left).
yellow	No logfile being recorded.

Control Icon

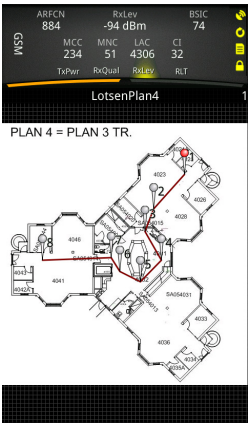
This icon appears only on phones where TEMS Pocket offers control functions.

Symbol	Meaning
green	The control function last invoked was successfully applied, and at least one control function is currently applied.
red	The control function last invoked was not successfully applied. (Other control functions that were previously applied with success may still be active.)
yellow	No control functions currently applied.

When no TEMS Pocket data view is being displayed, those icons that are red or green will instead appear on the status bar at the top of the screen. When you swipe down from the status bar, a drop-down notification (reading simply "TEMS Pocket") appears for each icon.

3.5.3. Indoor Map: Positioning by Pinpointing

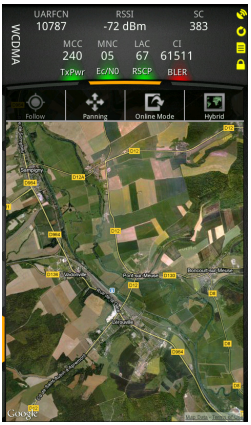
In an indoor environment or other location without GPS coverage, you can use the Indoor Map view (see chapter 6) to pinpoint your test route. You load a floor plan or other image of your testing area into the Indoor Map view, then indicate your route by marking waypoints on that map. The map image can also be assigned a geographical position.



Indoor Map view

3.5.4. Outdoor Map View

When testing in locations with GPS coverage, the Outdoor Map view (see chapter 7) can be used to display measurements, events and cell sites. This view allows you to easily locate network trouble spots and visualize network performance geographically.



Outdoor Map view

3.5.5. Scripts

TEMS Pocket offers the use of *scripts* for automated testing of various services. See chapter 8.

3.5.6. Events

When you run a script in TEMS Pocket, events are generated pertaining to radio (Layer 3 signaling), device operation, script progress, and more. See chapter 5.

3.5.7. Logfiles

3.5.7.1. Logfile Recording

You can record data collected by TEMS Pocket in *logfiles* and replay these files in TEMS Pocket itself or in TEMS Investigation or TEMS Discovery. See chapter 9.

3.5.7.2. GPS Positioning

TEMS Pocket supports positioning of data in logfiles using either the phone's built-in GPS or an external GPS.

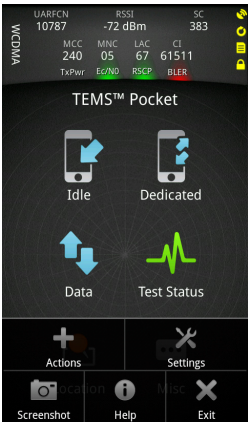
3.5.8. Cell Files

You can import a cell file into TEMS Pocket in order to display cells by name (rather than by CGI) in data views as well as in the Outdoor Map view. See chapter 10.

3.5.9. Control Functions

TEMS Pocket as implemented on some of the supported phones has a number of *control* functions modifying the phone's behavior in the cellular network. These include locking the phone to a RAT, band, cell, or channel. See chapter 11 for full details.

3.5.10. TEMS Pocket Menus



If you press the **Menu** button on the phone (the button on the right) while a data view or the overview screen is displayed, a menu with TEMS Pocket commands appears at the bottom.

From here you can perform all of the actions and configuration tasks referred to in section 3.5 and also inspect some categories of data.

3.5.11. Tablet User Interface

TEMS Pocket as implemented on the Samsung Galaxy Note 10.1 LTE (GT-N8020) tablet has the same functionality as the mobile phone based TEMS Pocket applications. However, to make good use of the larger screen, the tablet user interface is organized differently in some respects. Please turn to chapter 16 for details.

3.6. TEMS Pocket File Storage Locations

TEMS Pocket related files are stored on the phone's memory card in the following locations:

- **Cell files:** /sdcard/pocket/private/cellfiles/
- **Email attachments:** /sdcard/pocket/private/attachments/
- **Exported settings:** /sdcard/pocket/exportsettings/
- **Logfiles:** /sdcard/pocket/logfiles/ (*.pcap files with IP capture data are also stored here)
- **Indoor map sets:** /sdcard/pocket/private/mapsets/ (*.ibwc files)
- **Routes:** /sdcard/pocket/private/waypoints/
- **Screenshots:** /sdcard/pocket/screenshots/ (when saved separately and not in a logfile)

- **Scripts:** /sdcard/pocket/private/scripts/

Please note that these locations are not accessible through the TEMS Pocket user interface (nor from the phone's standard user interface; a third-party Android app is required). Naturally you can always view the memory card directory structure by connecting the phone to a PC.

If you replace the memory card, you need to copy the /sdcard/pocket/ directory to the new card. For Sony Ericsson Xperia arc and arc S phones, see also section 3.8.3.

3.7. Language Support

The TEMS Pocket 12.4 phones support languages as follows:

- Regular phone user interface: Same as in the commercial phone release.
- TEMS Pocket user interface
  - Text display: English
  - User input: English

Note: There is no support for inputting non-ASCII characters. When entering text strings, only use characters from the ASCII set.

3.8. General Advice on Using TEMS Pocket

3.8.1. Configuring Phone Settings

- For the phone's internal GPS to be available to TEMS Pocket, it must be enabled in the phone. The name of the option that must be checked and its position in the menu system may vary between Android versions; for example, it may read **Settings** → **Location & security** → **Use GPS satellites**. This setting does not have any bearing on an external GPS.
- Also make sure that data traffic is enabled: Under **Settings** → **Wireless & networks** → **Mobile networks**, the **Data enabled** checkbox must be checked. (This is the default setting.)
- You may need to enable data roaming. This is done under **Settings** → **Wireless & networks** → **Mobile networks**, by checking the **Data roaming** checkbox.

- On Samsung devices, the option **Settings** → **Location and security** → **Use sensor aiding** must be turned off.

3.8.2. TEMS Pocket vs. TEMS Investigation

When a phone possesses a license for both TEMS Pocket and TEMS Investigation, the two applications cannot coexist on the device. For the Sony Ericsson phones, this means that:

- If the TEMS Pocket phone is connected to a PC and you start TEMS Investigation on that PC, the TEMS Pocket application will shut down.
- If you connect your TEMS Pocket phone to a PC where TEMS Investigation is running, you cannot start the TEMS Pocket application.

3.8.3. License Handling

This section applies to Sony Ericsson Xperia arc and arc S only. For these devices, a TEMS Pocket license file resides on the phone's memory card. The file is named TEMS_v1.lic and stored in the root. Therefore, if you want to replace the memory card with a different one, you must copy the license file to that card.

For non-Sony Ericsson phones, the memory card is unrelated to license handling.

3.8.4. External Antennas

An external antenna is available as an accessory for the Sony Ericsson Xperia arc S phone.

> **WARNING:** To ensure personal safety and to limit the exposure to electromagnetic fields, always keep a minimum distance of 20 cm from an external antenna.

3.9. Exiting TEMS Pocket

You exit the TEMS Pocket application by pressing the Menu button and then tapping **Exit**. See section 3.5.10.

4. Data Views

4.1. General Data View Properties

Many data views in TEMS Pocket are RAT-specific; there exist, for example, separate cell list data views for each supported RAT. Which views can appear is of course dependent on the range of technologies supported by the phone; which view is shown at a given instant is governed by the RAT the phone is currently using. The switching between views is automatic.

All data views have the same general structure in idle mode and dedicated/ active mode. The presentation combines textual and graphical elements.

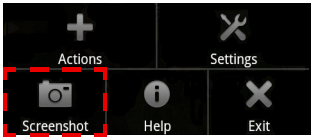
Whenever a parameter is currently not valid, this is indicated in the data view by a dash "–".

In all graphs containing a legend, you can tap anywhere in the graph to hide the legend. Tap once more to make the legend visible again. When you swipe to a graph view, the legend is always visible, even if you have previously hidden it.

4.2. The Screenshot Capture Function

You can take screenshots of the data views using the built-in screen capture function. Whenever you use this function, snapshots are taken of *all* data views as well as the currently shown data view header.

Press the Menu button and tap **Screenshot**.



Screenshots are transparent, that is, they do not include the on-screen "spider web" background. This is in order to minimize the size of the image files.

Please note that screenshots are always stored on the memory card (see section 3.6), so the phone must have one inserted.

Screenshot image files are named according to the pattern yyyy-mm-dd_hh.mm.ss_<data view category><sequence no.>_screenshot.png, for example 2012-10-18_13.23.09_Data1_screenshot.png.

If you take screenshots while a logfile is being recorded, you can opt to save the screenshots in the logfile (*.trp) along with its other contents. You are asked on each occasion whether to do that or save the images in the screenshot folder.

4.3. Other Data View Actions

In some data views you can perform an action relating to a piece of data shown in the view. For example, in data views listing cells, you can lock on one of the cells.

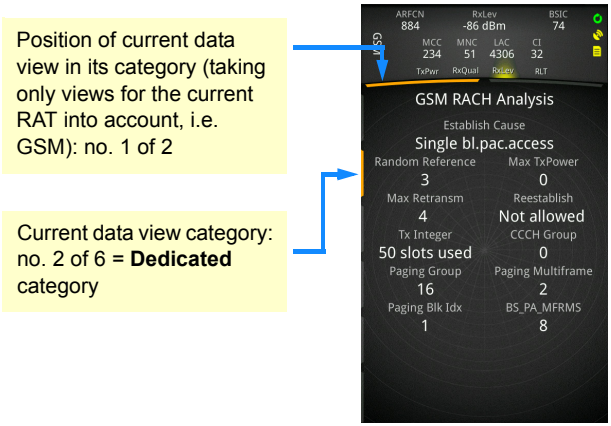
Specifics on data view actions are found in sections 4.7–4.12.

4.4. Survey of Data Views

The data views are divided into the categories found on the overview page (section 3.5.1). On entering a data view, you can browse the data views within the same category by swiping left and right. You can also browse to an adjacent data view category by swiping up or down; the name of the target category then appears briefly at the bottom of the screen. TEMS Pocket remembers which data view was last displayed in each category; when you return to a category, that view is shown.

There is no wraparound when browsing through data views and data view categories (i.e. neither horizontally nor vertically).

The arrays of indicators along the top and left-hand edges of the data view are used to show the position of the current view in the category structure just explained. The vertical indicator shows what data view category you are currently in, and the horizontal indicator shows the position of the current data view within that category, counting only views that belong to the cellular technology the phone is currently using. See the example below.



The list the follows covers all TEMS Pocket 12.4 data views that exist; please note that none of the phones displays all of these, since no phone supports all of the technologies involved. Refer to section 4.4.1 for details.

Data View Name	Displayed Contents	Ref.
Idle category		
GSM Cell List	ARFCN, BSIC, RxLev, C1, and C2 for GSM serving cell and neighbors.	4.7.1
GSM Cell Line Chart	RxLev and RxQual for serving cell; RxLev for two strongest neighbors; device TxPower.	4.7.2
WCDMA Cell List	UARFCN, scrambling code, E_c/N_0, and RSCP for WCDMA serving cell/active set and neighbors.	4.7.3
WCDMA Cell Line Chart	UTRA Carrier RSSI; RSCP for serving cell; BLER; RSCP for two strongest neighbors; device TxPower.	4.7.4
LTE Cell List	EARFCN, PCI, RSRP, and RSRQ for LTE serving cell and neighbors.	4.7.5

Data View Name	Displayed Contents	Ref.
LTE Cell Line Chart	E-UTRA Carrier RSSI; RSRP and CINR for serving cell; RSRP for two strongest neighbors; device PUSCH TxPower.	4.7.6
LTE Cell Configuration	E-UTRA band, MME, and Physical Cell parameters for LTE serving cell.	4.7.7
CDMA Cell List	RF channel number, PN offset, E_c/I_0, and E_c for CDMA (1x) active, candidate, and neighbor sets.	4.7.8
EV-DO Cell List	RF channel number, PN offset, E_c/I_0, and E_c for EV-DO active, candidate, and neighbor sets.	4.7.9
Dedicated category		
GSM RACH Analysis	Parameters and data related to RACH signaling in GSM.	4.8.1
GSM Dedicated Mode	GSM dedicated mode radio parameters.	4.8.2
WCDMA RACH Analysis	Parameters and data related to RACH signaling in WCDMA.	4.8.3
WCDMA Dedicated Mode	WCDMA dedicated (connected) mode radio parameters.	4.8.4
LTE Dedicated Mode	LTE dedicated mode radio parameters.	4.8.5
CDMA Perform	CDMA (1x) active mode radio parameters.	4.8.6
EV-DO Perform	EV-DO active mode radio parameters.	4.8.7
CDMA/EV-DO Perform	Composite view showing both CDMA (1x) and EV-DO active mode radio parameters.	4.8.8

Data View Name	Displayed Contents	Ref.
Data category		
GPRS/EDGE Data	Parameters and data related to GPRS/ EDGE.	4.9.1
GPRS/EDGE RLC Throughput	RLC/MAC throughput charts for GPRS/ EDGE.	4.9.2
HSPA Data	Parameters and data related to HSPA.	4.9.3
HSPA RLC Throughput	RLC throughput charts for HSPA.	4.9.4
LTE Data	Parameters and data related to LTE data transfer.	4.9.5
LTE PHY Throughput	Physical layer throughput charts for LTE.	4.9.6
HSDPA Modulation/ Packet Data Performance	HSDPA modulation scheme usage; MAC-HS uplink/downlink throughput; downlink TB size; downlink BLER.	4.9.7
PDP Context Information	Information on current PDP contexts.	4.9.8
RLP Throughput	RLP throughput charts for EV-DO.	4.9.9
Test Status category		
Script Progress	General progress of a script that is being executed.	4.10.1
AQM Progress	Progress of scripted AQM testing.	4.10.2
Email Progress	Progress of scripted email testing.	4.10.3
FTP Progress	Progress of scripted FTP testing.	4.10.4
HTTP Progress	Progress of scripted HTTP testing.	4.10.5

Data View Name	Displayed Contents	Ref.
Logfile Upload Progress	Progress of scripted logfile upload.	4.10.6
Ping Progress	Progress of scripted Ping testing.	4.10.7
Voice Progress	Progress of scripted voice testing.	4.10.9
Location category		
Indoor Map	See chapter 6.	
Outdoor Map	See chapter 7.	
GPS	GPS positioning data.	4.11.3
Misc category		
Layer 3 Messages	Listing of transmitted and received Layer 3 messages.	4.12.1
Wi-Fi Spectrum	Signal strength and bandwidth of Wi-Fi networks detected.	4.12.2
Wi-Fi Cell List	Strongest Wi-Fi access points detected.	4.12.3

4.4.1. Data Views by Phone

The Samsung Galaxy tablet supports the same data views as Samsung Galaxy S III.

Data View Name	Sony Ericsson			Samsung				HTC	
	Xperia arc	Xperia arc S	Xperia T	Galaxy S 4G	Galaxy S II LTE	Galaxy S III	Infuse 4G	Rezound	Vivid
Idle category									
GSM Cell List	✓	✓	✓	✓	✓	✓	✓		✓
GSM Cell Line Chart	✓	✓	✓	✓	✓	✓	✓		✓
WCDMA Cell List	✓	✓	✓	✓	✓	✓	✓		✓
WCDMA Cell Line Chart	✓	✓	✓	✓	✓	✓	✓		✓
LTE Cell List			✓		✓	✓		✓	✓
LTE Cell Configuration			✓		✓	✓		✓	✓
LTE Cell Line Chart			✓		✓	✓		✓	✓
CDMA Cell List								✓	
EV-DO Cell List								✓	
Dedicated category									
GSM RACH Analysis	✓	✓	✓	✓	✓	✓	✓		✓
GSM Dedicated Mode	✓	✓	✓	✓	✓	✓	✓		✓
WCDMA RACH Analysis	✓	✓	✓	✓	✓	✓	✓		✓
WCDMA Dedicated Mode	✓	✓	✓	✓	✓	✓	✓		✓
LTE Dedicated Mode			✓		✓	✓		✓	✓
CDMA Perform								✓	
EV-DO Perform								✓	
CDMA/EV-DO Perform								✓	
Data category									
GPRS/EDGE Data	✓	✓	✓	✓	✓	✓	✓		✓

Data View Name	Sony Ericsson			Samsung				HTC	
	Xperia arc	Xperia arc S	Xperia T	Galaxy S 4G	Galaxy S II LTE	Galaxy S III	Infuse 4G	Rezound	Vivid
GPRS/EDGE RLC Throughput	✓	✓	✓	✓	✓	✓	✓		✓
HSPA Data	✓	✓	✓	✓	✓	✓	✓		✓
HSPA RLC Throughput	✓	✓	✓	✓	✓	✓	✓		✓
LTE Data			✓		✓	✓		✓	✓
LTE PHY Throughput			✓		✓	✓		✓	✓
HSDPA Modulation/ Packet Data Performance			✓		✓	✓			✓
PDP Context Information			✓		✓	✓		✓	✓
RLP Throughput								✓	
Test Status category									
All views supported by all phones.									
Location category									
All views supported by all phones.									
Misc category									
All views supported by all phones.									

4.5. Data View Header

In the topmost part of the data view is always shown a set of general data related to the cellular technology currently in use.

4.5.1. Data View Header for GSM

No cell file loaded

Cell file loaded

All data shown in the header pertains to the current serving cell.

- **ARFCN:** Absolute Radio Frequency Channel Number
- **RxLev:** Received Signal Level (dBm)
- **BSIC:** Base Station Identity Code

CGI data (shown if no cell file is loaded)

- **MCC:** Serving cell Mobile Country Code
- **MNC:** Serving cell Mobile Network Code
- **LAC:** Serving cell Location Area Code
- **CI:** Serving cell Cell Identity, 16 bits, decimal (= C-Id: ▶ 3GPP 25.401, section 6.1.5)

If a cell file is loaded, the CGI parameters are replaced by the cell name. You can then tap and hold this section of the screen (or, better, to the left or right of it to avoid obstructing the view) in order to display CGI instead. The presentation reverts to cell name once you release your finger.

Indicators (see also color key below)

- **TxPwr:** UE Transmit Power
- **RxQual:** Received Signal Quality
- **RxLev:** Received Signal Level
- **RLT:** Radio Link Timeout, Current/Max ratio

Indicator Color Key

Measurement	Green	Yellow	Red
TxPower (dBm)	0 ... 9	10 ... 19	20 ... 31

Measurement	Green	Yellow	Red
RxQual	0	1 ... 4	5 ... 7
RxLev (dBm)	–75 ... –10	–94 ... –76	–120 ... –95
RLT Curr/Max (%)	100	91 ... 99	0 ... 90

4.5.2. Data View Header for WCDMA

No cell file loaded

Cell file loaded

All data shown in the header pertains to the current serving cell or active set.

- **UARFCN:** UARFCN, UMTS Absolute Radio Frequency Channel Number
- **RSSI:** Received Signal Strength, equal to UTRA Carrier RSSI
- **SC:** Scrambling Code of serving cell (idle mode) or strongest active set member (connected mode)

CGI data (shown if no cell file is loaded)

- **MCC:** Serving cell Mobile Country Code
- **MNC:** Serving cell Mobile Network Code
- **LAC:** Serving cell Location Area Code
- **CI:** Serving cell Cell Identity, 16 bits, decimal (= C-Id: ▶ 3GPP 25.401, section 6.1.5)

If a cell file is loaded, the CGI parameters are replaced by the cell name. You can then tap and hold this section of the screen in order to display CGI instead. The presentation reverts to cell name once you release your finger.

Indicators (see also color key below)

- **TxPwr:** UE Transmit Power
- **Ec/N0:** Carrier-to-noise ratio, E_c/N_0
- **RSCP:** Received Signal Code Power

- **BLER:** Block Error Rate in percent, average taken over all downlink transport channels (DCH only)

Indicator Color Key

Measurement	Green	Yellow	Red
TxPower (dBm)	–31 ... 0	1 ... 9	10 ... 50
E_c/N_0 (dB)	–10 ... 0	–15 ... –11	–34 ... –16
RSCP (dBm)	–85 ... –15	–99 ... –86	–140 ... –100
BLER (%)	0 ... 20	21 ... 49	50 ... 100

4.5.3. Data View Header for LTE

No cell file loaded

Cell file loaded

All data shown in the header pertains to the current serving cell.

- **EARFCN:** E-UTRA ARFCN (Absolute Radio Frequency Channel Number)
- **RSSI:** E-UTRA Carrier RSSI (Received Signal Strength Indicator)
- **Phy Cell ID:** Physical layer Cell Identity

CGI data (shown if no cell file is loaded)

- **MCC:** Serving cell Mobile Country Code
- **MNC:** Serving cell Mobile Network Code
- **TAC:** Serving cell Tracking Area Code
- **CI:** Serving cell Cell Identity, 28 bits, decimal (= UC-Id: ▶ 3GPP 25.401, section 6.1.5)

If a cell file is loaded, the CGI parameters are replaced by the cell name. You can then tap and hold this section of the screen in order to display CGI instead. The presentation reverts to cell name once you release your finger.

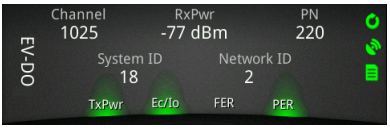
Indicators (see also color key below)

- **PUSCH:** PUSCH Tx Power
- **PUCCH:** PUCCH Tx Power
- **RSRQ:** Reference Signal Received Quality
- **RSRP:** Reference Signal Received Power
- **BLER DL:** Block Error Rate on PDSCH (Physical Downlink Shared Channel)

Indicator Color Key

Measurement	Green	Yellow	Red
PUSCH Tx Power (dBm)	–30 ... –10	–9 ... 14	15 ... 30
PUCCH Tx Power (dBm)	–30 ... –10	–9 ... 14	15 ... 30
RSRQ (dB)	–9 ... 0	–23 ... –10	–30 ... –24
RSRP (dBm)	–70 ... –40	–99 ... –71	–140 ... –100
BLER DL (%)	0 ... 20	21 ... 49	50 ... 100

4.5.4. Data View Header for CDMA/EV-DO



No cell file loaded

Cell file loaded

All data shown in the header pertains to the current active set.

- **Channel:** RF channel number
- **RxPwr:** Receive Power (dBm)

- **PN:** PN Offset of serving cell (idle mode) or strongest active set member (active mode)

SID and NID (shown if no cell file is loaded)

- **System ID:** System Identification (SID)
- **Network ID:** Network Identification (NID)

If a cell file is loaded, the SID and NID parameters are replaced by the cell name. You can then tap and hold this section of the screen in order to display SID/NID instead. The presentation reverts to cell name once you release your finger.

Indicators (see also color key below)

- **TxPwr:** Transmit Power
- **Ec/Io:** Signal-to-noise ratio for strongest active set member
- **FES:** Finger Energy Sum
- **FER:** Frame Erasure Rate (shown for CDMA); alternates with **PER:** Packet Error Rate (shown for EV-DO)

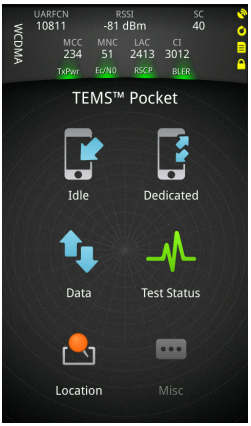
Indicator Color Key

Measurement	Green	Yellow	Red
TxPwr (dBm)	–31 ... 0	1 ... 9	10 ... 50
E_c/I_o (dB)	–9 ... 0	–23 ... –10	–32 ... –24
FES (dBm)	–15 ... 10	–24 ... –16	–64 ... –25
FER (%)	0 ... 2	3 ... 5	6 ... 100
PER (%)	0 ... 2	3 ... 5	6 ... 100

4.5.5. Header Display for HTC Rezound

When the HTC Rezound is camping on both CDMA and LTE at the same time, either the CDMA or the LTE header is shown. Which one appears depends on which technology the phone first started camping on. You can switch to the other header by tapping the RAT indicator ("CDMA+LTE") on the far left.

4.6. Top-level Data View Categories



On startup, TEMS Pocket displays a screen holding the top-level data view categories:

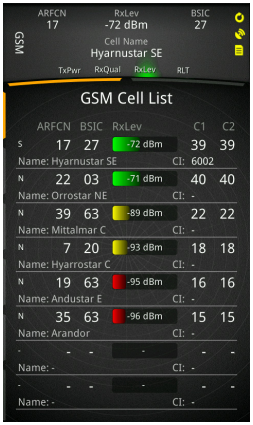
- Idle
- Dedicated
- Data
- Test Status
- Location
- Misc

They are gone through in the subsections that follow.

You can always return to this screen by pressing the **Back** button (possibly several times if you are navigating the menu system).

4.7. "Idle" Data View Category

4.7.1. GSM Cell List Data View



For the header, see section 4.5.1.

The view displays the serving cell (always on top) and up to seven neighbors (in order of descending signal strength).

- **S:** Serving cell
- **N:** Neighbor cell.

ARFCN: ARFCN, Absolute Radio Frequency Channel Number.

BSIC: BSIC, Base Station Identity Code.

RxLev: Received Signal Level.

C1: Pathloss Criterion C1. ▶ 3GPP 45.008, section 6.4

C2: Cell Reselection Criterion C2. ▶ 3GPP 45.008, section 6.4

If a cell file is loaded, a string with the following information appears on a separate line below each line of cell data:

Name: Cell name according to cell file.

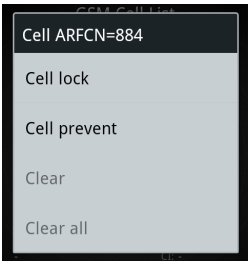
CI: Cell identity according to cell file.

Data View Actions

You can do one of the following (not both at the same time):

- *Lock* on one or several cells listed in this view. The phone is then restricted to camping on these cells alone.
- *Prevent* one or several cells listed in this view. The phone is then prevented from camping on these cells.

Tap and hold a cell to bring up a context menu with data view actions.



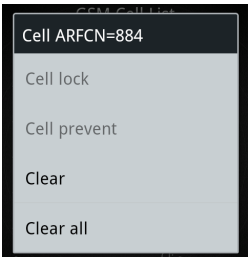
- Tap **Cell lock** to apply a lock to this cell.
- Tap **Cell prevent** to prevent use of this cell.

The ARFCN is highlighted in the list:

- in *green* if locked on (shown here)
- in *red* if prevented.

You can add more cells to the set locked on or prevented. Just tap and hold any cell in the list as shown above.

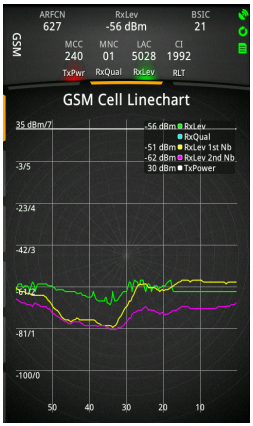
Any actions applied in this way are also immediately reflected in the control function settings, described in chapter 11.



- To undo a lock or prevent action, long-tap the relevant cell and choose **Clear**.
- To undo all lock or prevent actions at once, long-tap any cell in the list and choose **Clear all**.

If a cell you have locked on disappears from the GSM Cell List view, and you want to release that lock, you can always do this from the Control Functions menu as described in section 11.5.2.

4.7.2. GSM Cell Line Chart Data View



For the header, see section 4.5.1.

The chart shows the latest 60 seconds. Each label "<n>" on the x-axis means "*n* seconds ago".

The y-axis has both dBm and RxQual unit scale marks.

RxLev: Received Signal Level of serving cell in dBm.

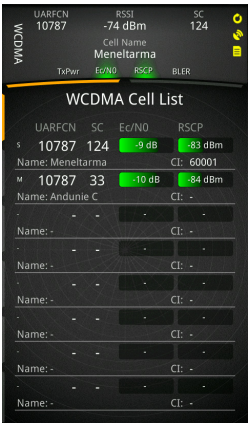
RxQual: Receive Bit Error Rate, RxQual, of serving cell; scale defined in ▶ 3GPP 45.008, section 8.2.

RxLev 1st Nb: RxLev of strongest neighbor (dBm).

RxLev 2nd Nb: RxLev of second strongest neighbor (dBm).

TxPower: UE Transmit Power (dBm).

4.7.3. WCDMA Cell List Data View



For the header, see section 4.5.2.

Up to eight cells are displayed, each belonging to one of the following categories:

- **S:** Serving cell (idle mode)
- **A:** Active set member (connected mode)
- **M:** Monitored neighbor
- **D:** Detected neighbor.

The categories are prioritized as listed above, cells from lower-ranking categories being displayed as far as space allows. Within each category, cells are sorted by descending E_c/N_0.

UARFCN: UARFCN, UMTS Absolute Radio Frequency Channel Number.

SC: Scrambling Code.

Ec/No: E_c/N_0 (dB), signal-to-noise ratio measured according to ▶ 3GPP 25.215, section 5.1.5.

RSCP: Received Signal Code Power (dBm).

If a cell file is loaded, a string with the following information appears on a separate line below each line of cell data:

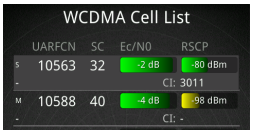
Name: Cell name according to cell file.

CI: Cell identity according to cell file.

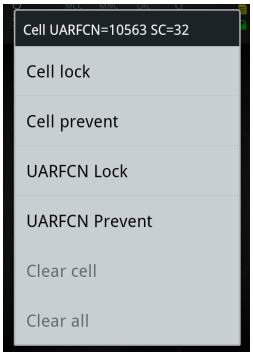
Data View Actions

You can do one of the following (not both at the same time):

- *Lock* on one or several cells and/or UARFCNs listed in this view. The phone is then restricted to camping on these cells/UARFCNs.
- *Prevent* one or several cells and/or UARFCNs listed in this view. The phone is then prevented from camping on these cells/UARFCNs.



Tap and hold a cell to bring up a context menu with data view actions.

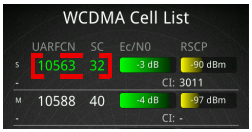


Locking actions:

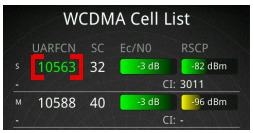
- Tap **Cell lock** to apply a lock to this cell (i.e. this UARFCN + SC combination).
- Tap **UARFCN lock** to apply a lock to this UARFCN, without specifying a SC. That is, the whole UARFCN is allowed.

Prevent actions:

- Tap **Cell prevent** to prevent use of this cell (UARFCN + SC combination).
- Tap **UARFCN prevent** to prevent use of this UARFCN. That is, the entire UARFCN is disallowed.



Cell lock (UARFCN + SC)



UARFCN lock

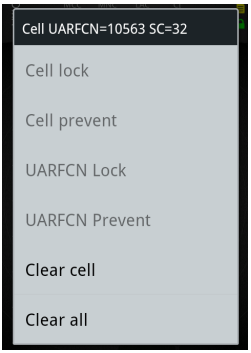
The cell/UARFCN is highlighted in the list:

- in *green* if locked on (shown here)
- in *red* if prevented.

For a cell lock, both UARFCN and SC are highlighted. For an UARFCN lock, only the UARFCN is highlighted.

You can add more cells and/or UARFCNs to the set locked on or prevented. Just tap and hold any cell in the list as shown above.

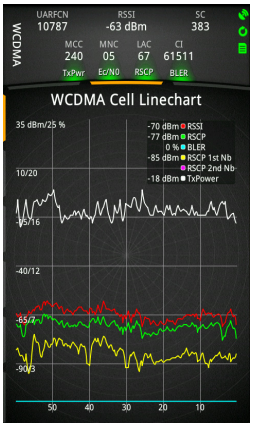
Any actions applied in this way are also immediately reflected in the control function settings, described in chapter 11.



- To undo a lock or prevent action, long-tap the relevant cell and choose **Clear**.
- To undo all lock or prevent actions at once, long-tap any cell in the list and choose **Clear all**.

If a cell you have locked on disappears from the WCDMA Cell List view, and you want to release that lock, you can always do this from the Control Functions menu as described in section 11.4.2.

4.7.4. WCDMA Cell Line Chart Data View



For the header, see section 4.5.2.

The chart shows the latest 60 seconds. Each label "<n>" on the x-axis means "*n* seconds ago".

The y-axis has both dBm and percent scale marks.

RSSI: Received Signal Strength, equal to UTRA Carrier RSSI.

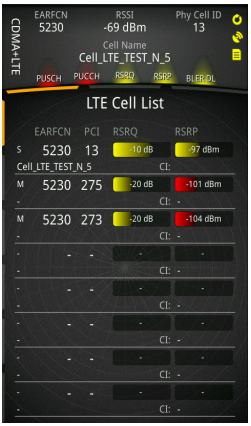
RSCP: Received Signal Code Power (dBm) of serving cell.

BLER: Block Error Rate in percent, average taken over all downlink transport channels (DCH only).

RSCP 1st Nb: RSCP of strongest neighbor (dBm).

RSCP 2nd Nb: RSCP of second strongest neighbor (dBm).

4.7.5. LTE Cell List Data View



For the header, see section 4.5.3.

Up to eight cells are displayed, each belonging to one of the following categories:

- **S:** Serving cell
- **M:** Measured neighbor.

The categories are prioritized as listed above, cells from lower-ranking categories being displayed as far as space allows. Within each category, cells are sorted by descending RSRP.

EARFCN: E-UTRA ARFCN (Absolute Radio Frequency Channel Number).

PCI: Physical layer Cell Identity.

RSRQ: Reference Signal Received Quality (dB).

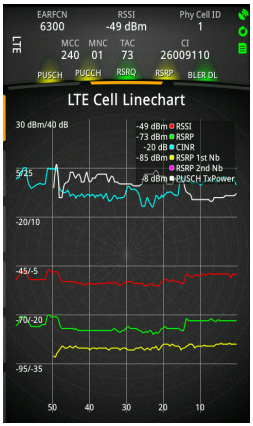
RSRP: Reference Signal Received Power (dBm).

If a cell file is loaded, a string with the following information appears on a separate line below each line of cell data:

Name: Cell name according to cell file.

CI: Cell identity according to cell file.

4.7.6. LTE Cell Line Chart Data View



For the header, see section 4.5.3.

The chart shows the latest 60 seconds. Each label "<n>" on the x-axis means "*n* seconds ago".

The y-axis has both dBm and dB scale marks.

RSSI: E-UTRA Carrier RSSI (Received Signal Strength Indicator) in dBm.

RSRP: RSRP of serving cell (dBm).

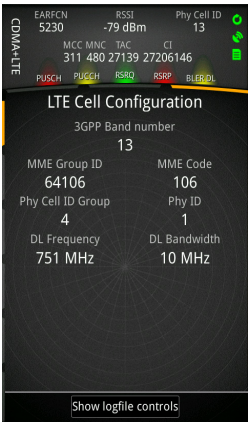
CINR: CINR of serving cell (dB).

RSRP 1st Nb: RSRP of strongest neighbor (dBm).

RSRP 2nd Nb: RSRP of second strongest neighbor (dBm).

PUSCH TxPower: Transmit power on PUSCH.

4.7.7. LTE Cell Configuration Data View



For the header, see section 4.5.3.

This view deals with the LTE serving cell.

3GPP Band Number: Number of E-UTRA band as laid down in ▶ 3GPP 36.101, table 5.5-1 “E-UTRA Operating Bands”.

MME Group ID: Mobility Management Entity Group ID. ▶ 3GPP 23.003, section 2.8.1

MME Code: Mobility Management Entity Code. ▶ 3GPP 23.003, section 2.8.1

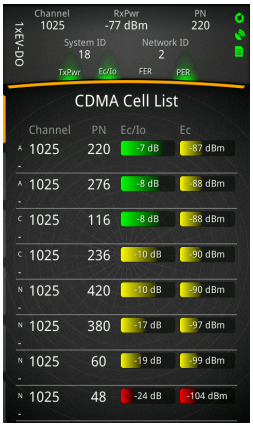
Phy Cell ID Group: Physical layer Cell Identity Group, PCIG.

Phy ID: Physical layer Identity = “PI” in the relationship PCI = PCIG + PI; value range = {0, 1, 2}.

DL Frequency: Downlink frequency used in serving cell.

DL Bandwidth: Downlink bandwidth of serving cell in MHz, one of: {1.4, 3, 5, 10, 15, 20}.

4.7.8. CDMA Cell List Data View



For the header, see section 4.5.4.

Up to eight cells are displayed, each belonging to one of the following categories:

- **A:** Active set
- **C:** Candidate set
- **N:** Neighbor set.

The categories are prioritized as listed above, cells from lower-ranking categories being displayed as far as space allows. Within each category, cells are sorted by descending E_c/I_0.

Channel: RF channel number.

PN: PN offset.

Ec/Io: E_c/I_0 (dB), signal-to-noise ratio.

Ec: Received signal code power (dBm).

If a cell file is loaded, a string with the following information appears on a separate line below each line of cell data:

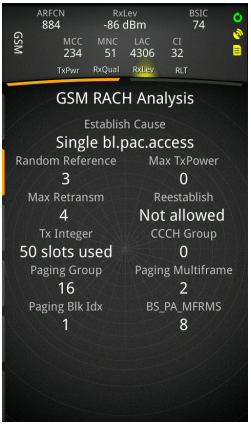
Name: Name of cell according to cell file.

4.7.9. EV-DO Cell List Data View

This view has exactly the same contents as the CDMA Cell List view (see section 4.7.8) but for EV-DO cells.

4.8. “Dedicated” Data View Category

4.8.1. GSM RACH Analysis Data View



For the header, see section 4.5.1.

The view displays parameters and data related to RACH signaling and paging in GSM.

Establish Cause: Establishment cause in Channel Request message. ▶ 3GPP 44.018, section 9.1.8

Random Reference: Random Reference in Channel Request message. ▶ 3GPP 44.018, section 9.1.8

Max TxPower: The maximum TX power level an MS may use when accessing on a Control Channel, CCH. ▶ 3GPP 44.018, table 10.5.2.4.1, MS-TXPWR-MAX-CCH

Max Retransm: Maximum number of retransmissions. ▶ 3GPP 44.018, table 10.5.2.29.1

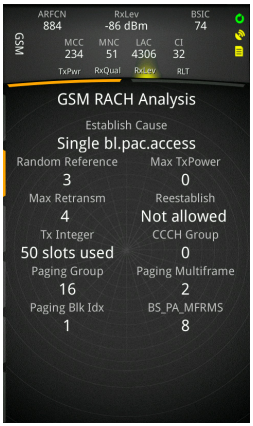
Reestablish: Call reestablishment allowed/not allowed in the cell. ▶ 3GPP 44.018, table 10.5.2.29.1

Tx Integer: Number of slots used to spread the transmission. ▶ 3GPP 44.018, table 10.5.2.29.1

CCCH Group / PCCCH Group: The former of these appears for CS and the latter for PS data.

- *CS data:* Mobiles in a specific CCCH group will listen for paging messages and make random accesses only on the specific CCCH to which the CCCH group belongs. ▶ 3GPP 45.002, section 6.5.2, CCCH_GROUP
- *PS data:* Same mechanism, but with “CCCH” replaced by “PCCCH”. ▶ 3GPP 45.002, section 6.5.6, PCCCH_GROUP

(continued on next page)



(continued)

Paging Group: The mobile's paging group. ▶ 3GPP 45.002, sections 6.5.2, 6.5.6, PAGING_GROUP

Paging Multiframe: Paging multiframe: ▶ 3GPP 45.002, section 6.5.3

Paging Blk Idx: Paging block index: ▶ 3GPP 45.002, section 6.5.3

BS_PA_MFRMS: Number of 51-multiframes between transmission of paging messages to mobiles of the same paging group {2 ... 9}. ▶ 3GPP 45.002, section 3.3.2.3, BS_PA_MFRMS

4.8.2. GSM Dedicated Mode Data View

For the header, see section 4.5.1.

Channel Mode: GSM channel mode, one of:

- FR = Voice, Full Rate
- EFR = Voice, Enhanced Full Rate
- HR = Voice, Half Rate
- AFR = Voice, AMR Full Rate
- AHR = Voice, AMR Half Rate
- CSD = Circuit-switched data
- SIG = Signaling only

TCH ARFCN: Traffic Channel (TCH ARFCN) or Stand-alone Dedicated Control Channel (SDCCH ARFCN) or Packet Dedicated Traffic Channel (PDTCH ARFCN). Hopping channels are shown one at a time.

RLT Ratio: Radio Link Timeout, ratio of current value to maximum (= start) value, expressed in percent. ▶ 3GPP 45.008, section 5.2

RxQual: Receive Bit Error Rate, RxQual; scale defined in ▶ 3GPP 45.008, section 8.2.

Timeslots: List of timeslots in use, e.g. “157” meaning timeslots 1, 5, and 7.

Timing Adv: Timing Advance.

TxPower: UE Transmit Power (dBm).

Channel Type: Channel type, one of {BCCH, PBCCH, PDTCH, SDCCH, TCH/F, TCH/H}.

Subchannel: Subchannel Number {0 ... 7}.

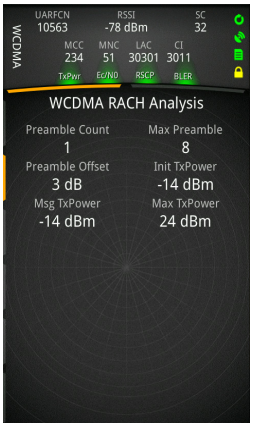
Ciphering: Ciphering Mode, one of {A5/1, A5/2, A5/3, GEA/1, GEA/2}. ▶ 3GPP 43.020

Hopping: Use of frequency hopping: On/Off.

HSN: Hopping Sequence Number {0 ... 63}.

MAIO: MAIO, Mobile Allocation Index Offset {0 ... 63}. ▶ 3GPP 45.002

4.8.3. WCDMA RACH Analysis Data View



For the header, see section 4.5.2.

The view displays parameters and data related to RACH signaling in WCDMA.

The WCDMA random access procedure is comprehensively described in ▶ 3GPP 25.214, section 6.1.

Preamble Count: Number of preambles used in this preamble ramping cycle.

Max Preamble: Preamble Retrans Max, maximum number of preambles in one preamble ramping cycle.

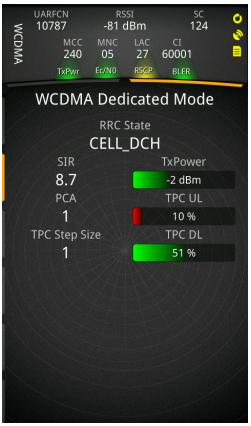
Preamble Offset: Power Ramp Step, power increase between consecutive preambles (dB).

Init Tx Power: Preamble_Initial_Power, transmit power of first RACH preamble (dBm).

Msg Tx Power: Transmit power of RACH preamble to which a response was obtained (dBm).

Max Tx Power: Maximum allowed transmit power of RACH preamble (as well as overall; dBm).

4.8.4. WCDMA Dedicated Mode Data View



For the header, see section 4.5.2.

RRC State: RRC State, one of {CELL_DCH, CELL_FACH, CELL_PCH, URA_PCH, Idle}.

SIR: Signal-to-Interference Ratio (dB).

TxPower: UE Transmit Power (dBm).

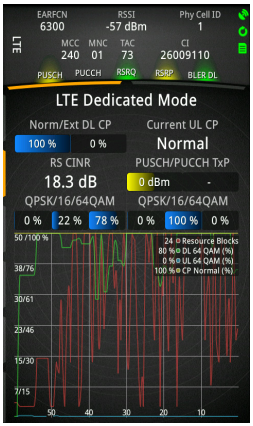
PCA: Power Control Algorithm: ▶ 3GPP 25.331

TPC UL: Transmit Power Control on uplink over the last 0.5 seconds: percentage of power control commands that were “increase” commands.

TPC Step Size: Transmit Power Control Step Size (dB). ▶ 3GPP 25.331

TPC DL: Transmit Power Control on downlink over the last 0.5 seconds: percentage of power control commands that were “increase” commands.

4.8.5. LTE Dedicated Mode Data View



For the header, see section 4.5.3.

Left-hand column: Downlink

Norm/Ext DL CP: Percentage distribution of downlink cyclic prefix usage: Normal (left) vs. Extended (right). Updated once every second.

RS CINR: Reference Signal CINR in dB.

QPSK/16/64QAM: Percentage distribution of downlink modulation scheme usage: QPSK (left), 16-QAM (center), 64-QAM (right). Updated once every second.

Right-hand column: Uplink

Current UL CP: Type of cyclic prefix currently used on uplink: Normal or Extended.

PUSCH/PUCCH TxP: Transmit powers on PUSCH and PUCCH respectively: maximum value during the past second.

QPSK/16/64QAM: Percentage distribution of uplink modulation scheme usage: QPSK (left), 16-QAM (center), 64-QAM (right). Updated once every second.

Graph

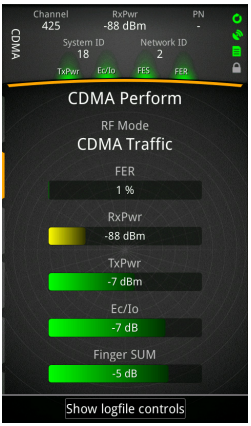
The line chart shows the latest 60 seconds. Each label "<n>" on the x-axis means "*n* seconds ago". The y-axis has two sets of scale marks: "number of" (left) and "percent" (right).

Resource Blocks: PDSCH resource block allocation, also presented numerically in the "LTE Data" view (see section 4.9.5).

DL 64 QAM, UL 64 QAM: 64-QAM usage rate (in %) on downlink and uplink, respectively.

CP Normal: "Normal" cyclic prefix usage rate (in %) on downlink.

4.8.6. CDMA Perform Data View



For the header, see section 4.5.4.

RF Mode: "<technology> <phone state>", where

- <technology> = "CDMA"
- <phone state> = one of "Init", "Idle", "Access", "Traffic".

FER: Frame Erasure Rate (%).

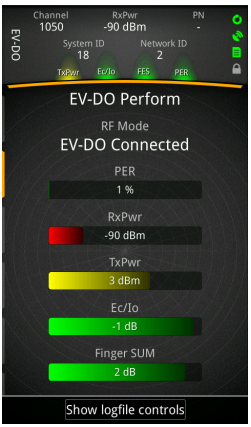
RxPwr: Receive Power (dBm).

TxPwr: Transmit Power (dBm).

Ec/Io: E_c/I_o, signal-to-noise ratio for strongest active set member (= topmost PN in CDMA Cell List data view, section 4.7.8; unit dB).

Finger SUM: Finger Sum, total signal-to-noise ratio (E_c/I_o) for all Rake fingers (dB).

4.8.7. EV-DO Perform Data View



For the header, see section 4.5.4.

RF Mode: "<technology> <AT state>", where

- <technology> = "EV-DO"
- <AT state> = one of "Inactive", "Acquisition", "Sync", "Idle", "Access", "Connected".

PER: Packet Error Rate (%).

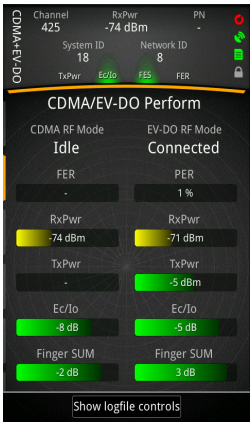
RxPwr: Receive Power (dBm).

TxPwr: Transmit Power (dBm).

Ec/Io: E_c/I_o, signal-to-noise ratio for strongest active set member (= topmost PN in CDMA Cell List data view, section 4.7.8; unit dB).

Finger SUM: Finger Sum, total signal-to-noise ratio (E_c/I_o) for all Rake fingers (dB).

4.8.8. CDMA/EV-DO Perform Data View



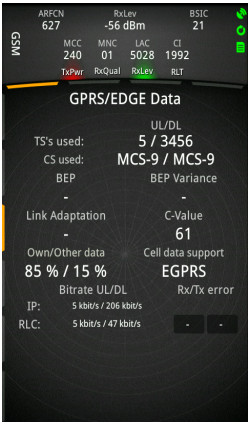
For the header, see section 4.5.4.

This is a composite of the CDMA Perform and EV-DO Perform views, arranged side by side in separate columns. The composite view appears when the phone is camping on both CDMA and EV-DO simultaneously (possible only for dual-chip devices with such capability).

For the contents, refer to sections 4.8.6 and 4.8.7.

4.9. “Data” Data View Category

4.9.1. “GPRS/EDGE Data” Data View



For the header, see section 4.5.1.

All data shown here pertains to the phone’s latest reporting period, unless otherwise noted.

TS’s used: Timeslots used on uplink/downlink.

CS used: *(updated for each multiframe)*

- *GPRS:* Channel coding scheme on downlink/uplink {CS1 ... CS4}.
- *EDGE:* Modulation coding scheme on downlink/uplink {MCS1 ... MCS9}.

BEP: EDGE mean bit error probability.

BEP Variance: EDGE bit error probability variance.

Link Adaptation: Automatic Repeat Request Mode {ARQ1, ARQ2}. ▶ 3GPP 44.060, section 9.2.3.1

C-Value: EDGE C Value {0 ... 63}.

Own/Other data: Own data/Other data ratio during last multiframe.

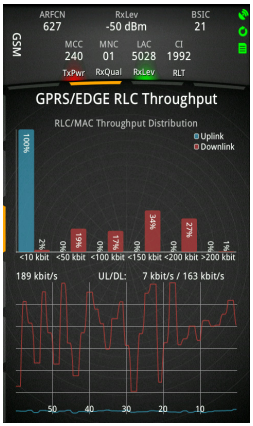
Cell data support: Technology supported in cell: GPRS or EGPRS.

Bitrate UL/DL: IP and RLC/MAC level throughputs on uplink and downlink. All of these figures are updated once every second.

Rx/Tx error: RLC/MAC level only. Updated once every second. Obtained only with the Samsung phones.

- **Rx error:** Percentage of data blocks erroneously decoded on downlink.
- **Tx error:** Percentage of data blocks retransmitted on uplink.

4.9.2. GPRS/EDGE RLC Throughput Data View



For the header, see section 4.5.1.

This view presents RLC/MAC throughput for GPRS/EDGE data transfer.

Bar chart "RLC/MAC Throughput Distribution"

This histogram shows the distribution of RLC/MAC-level data throughput on uplink (blue) and downlink (red).

To reset the statistics:

Press the Menu button and select **Actions** → **Clear History**.

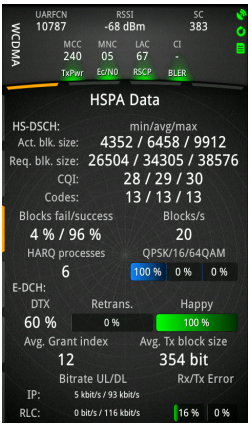
The histogram is cleared automatically when you start a script, as well as when you load and unload a logfile.

Line chart

This line chart tracks RLC/MAC-level data throughput over the past 60 seconds: uplink (blue), downlink (red).

The value on the far left indicates the maximum value on the y-axis. The values on the right are those of the latest data points plotted.

4.9.3. “HSPA Data” Data View



For the header, see section 4.5.2.

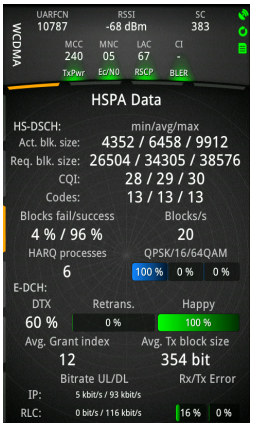
All data shown here pertains to the phone’s latest reporting period, unless otherwise noted.

HS-DSCH:

- **Act. blk. size:** Actual HS-DSCH transport block size in bits: minimum/average/maximum.
- **Req. blk. size:** Requested transport block size in bits (corresponding to minimum CQI): minimum/average/maximum.
- **CQI:** Minimum/average/maximum value of CQI (Channel Quality Indicator). CQI values are defined in ▶ 3GPP 25.214, section 6A.2.
- **Codes:** Number of channelization codes used on the HS-DSCH: minimum/average/maximum. Obtained with HSPA+ enabled phones.
- **Blocks fail:** Block error rate on HS-DSCH for first retransmission. Updated once every second.
- **Blocks success:** Percentage of blocks on HS-DSCH that were transmitted successfully on first attempt (zero retransmissions). Updated once every second.
- **Blocks/s:** Total number of blocks to be received on the HS-DSCH during the latest one-second period.

HARQ processes: Number of active HARQ (Hybrid Automatic Repeat Request) processes on the HS-DSCH.

(continued on next page)



(continued)

QPSK/16/64QAM: Percentage distribution of downlink modulation scheme usage: QPSK (left), 16-QAM (center), 64-QAM (right). Updated once every second.

E-DCH:

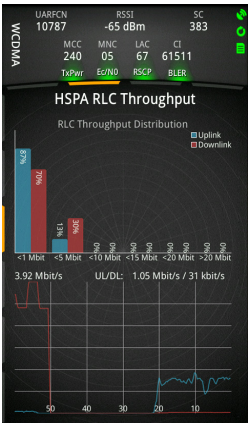
- **DTX:** DTX rate (%) on uplink.
- **Retrans.:** Number of retransmissions on E-DPCCH/E-DPDCH divided by the number of TTIs.
- **Happy:** Happy rate (%), i.e. the percentage of TTIs where the UE was happy, as defined in ▶ 3GPP 25.321, section 11.8.1.5.
- **Avg. Grant index:** Average value of Serving Grant Index.
- **Avg. Tx block size:** Average transport block size in bits on E-DCH.

Bitrate UL/DL: IP- and RLC-level throughputs on uplink and downlink. All of these figures are updated once every second.

Rx/Tx Error: (RLC level only; updated once every second)

- **Rx Error:** Percentage of data blocks erroneously decoded on downlink.
- **Tx Error:** Percentage of data blocks retransmitted on uplink.

4.9.4. HSPA RLC Throughput Data View



For the header, see section 4.5.2.

This view presents RLC throughput for HSPA data transfer.

Bar chart "RLC Throughput Distribution"

This histogram shows the distribution of RLC-level data throughput on uplink (blue) and downlink (red).

To reset the statistics:

Press the Menu button and select **Actions** → **Clear History**.

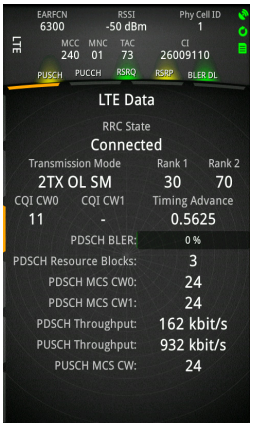
The histogram is cleared automatically when you start a script, as well as when you load and unload a logfile.

Line chart

This line chart tracks RLC-level data throughput over the past 60 seconds: uplink (blue), downlink (red).

The value on the far left indicates the maximum value on the y-axis. The values on the right are those of the latest data points plotted.

4.9.5. "LTE Data" Data View



For the header, see section 4.5.3.

Quantities shown here are updated when the value changes, unless otherwise noted. All quantities except Timing Advance are invalid in RRC state "Idle".

RRC State: "Idle" or "Connected".

Transmission Mode: Downlink transmission mode, one of:

- SISO: Single-input single-output
- Port5 SISO
- 2TX SFBC: Two Tx antennas, space-frequency block coding
- 2TX OL SM: Two Tx antennas, open-loop spatial multiplexing
- 2TX CL SM Rank(1): Two Tx antennas, closed-loop spatial multiplexing, Rank = 1
- 2TX CL SM Rank(2): Same as preceding but with Rank = 2
- 2TX MU MIMO: Two Tx antennas, multi-user multiple-input multiple-output.

Rank 1: Percentage of time Rank Indication (RI) has had the value 1. ▶ 3GPP 36.212

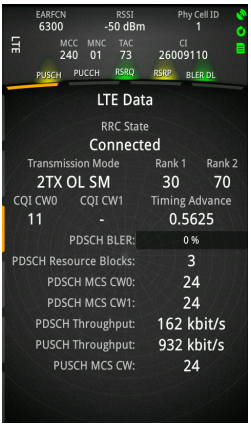
Rank 2: Percentage of time Rank Indication (RI) has had the value 2.

CQI CW 0: Best value of Channel Quality Indicator for code word 0 during the past second. Updated once every second. ▶ 3GPP 25.214, section 6A.2

CQI CW 1: Best value of Channel Quality Indicator for code word 1 during the past second. Updated once every second.

Timing Advance: Timing Advance; ▶ 3GPP 36.321, section 5.2. For the representation of values, see ▶ 3GPP 36.213, section 4.2.3.

(continued on next page)



(continued)

PDSCH BLER: Block error rate on Physical Downlink Shared Channel.

PDSCH Resource Blocks: Number of resource blocks on PDSCH.

PDSCH MCS CW 0: Modulation Coding Scheme for code word 0 on PDSCH.

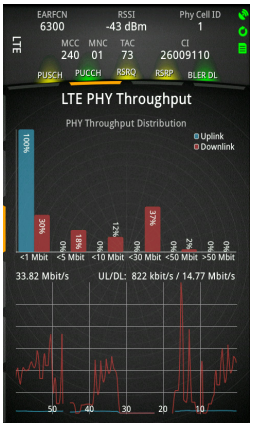
PDSCH MCS CW 1: Modulation Coding Scheme for code word 1 on PDSCH.

PDSCH Throughput: Throughput on Physical Downlink Shared Channel. Updated once every second.

PUSCH Throughput: Throughput on Physical Uplink Shared Channel. Updated once every second.

PUSCH MCS CW: Modulation Coding Scheme on PUSCH.

4.9.6. LTE PHY Throughput Data View



For the header, see section 4.5.3.

This view presents physical layer throughput for LTE data transfer.

Bar chart "PHY Throughput Distribution"

This histogram shows the distribution of PUSCH throughput (blue) and PDSCH throughput (red).

To reset the statistics:

Press the Menu button and select **Actions** → **Clear History**.

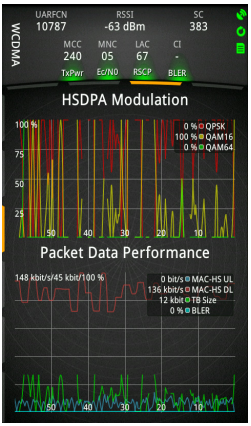
The histogram is cleared automatically when you start a script, as well as when you load and unload a logfile.

Line chart

This line chart tracks PUSCH throughput (blue) and PDSCH throughput (red) over the past 60 seconds.

The value on the far left indicates the maximum value on the y-axis. The values on the right are those of the latest data points plotted.

4.9.7. HSDPA Modulation/Packet Data Performance Data View



For the header, see sections 4.5.1–4.5.3.

These line charts track various HSDPA and other packet data related quantities over the past 60 seconds.

HSDPA Modulation part (top)

QPSK: The percentage of time QPSK was used as modulation method.

QAM16: The percentage of time 16-QAM was used as modulation method.

QAM64: The percentage of time 64-QAM was used as modulation method.

Packet Data Performance part (bottom)

MAC-HS UL: MAC-hs throughput on uplink.

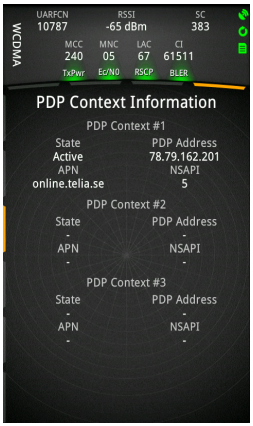
MAC-HS DL: MAC-hs throughput on downlink.

TB Size: Average transport block size on HS-DSCH.

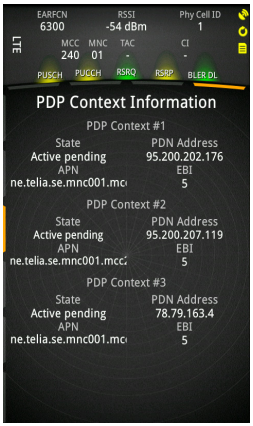
BLER: Block Error Rate in percent, average taken over all downlink transport channels (DCH only).

The value on the far left indicates the maximum value on the y-axis. The values on the right are those of the latest data points plotted.

4.9.8. PDP Context Information Data View



GSM/WCDMA



LTE

For the header, see sections 4.5.1–4.5.3.

The view displays information on up to three PDP contexts.

State: PDP context state. One of: "Active", "Active pending", "Inactive", "Inactive pending", "Modification pending".

PDP Address/PDN Address:

- *GSM, WCDMA:* IPv4 PDP address. ▶ 3GPP 24.008, section 10.5.6.4
- *LTE:* IPv4/IPv6 PDN address. ▶ 3GPP 23.402, section 4.7

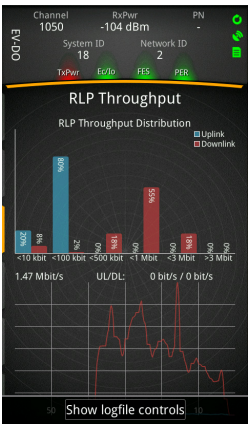
APN: Access Point Name (shown as scrolling text).

NSAPI/EBI:

- *GSM, WCDMA:* NSAPI, Network Service Access Point Identifier. ▶ 3GPP 24.008, section 10.5.6.2
- *LTE:* EBI, EPS Bearer ID. ▶ 3GPP 24.007, section 11.2.3.1.5

Note: PDP context data is not reported on a regular basis, but only in connection with PS attach. Since the phone performs this attach at power-on whenever possible, it will already have taken place when TEMS Pocket is launched, and the above data view will then not display any information. However, one way to elicit PDP context data in this view is to switch the phone to flight mode and then back.

4.9.9. RLP Throughput Data View



For the header, see section 4.5.4.

This view presents RLP throughput for EV-DO data transfer. Please note that data transfer over CDMA (1x) does *not* appear in this view.

Top chart: "RLP Throughput Distribution"

This histogram shows the distribution of RLP-level data throughput on uplink (blue) and downlink (red).

To reset the statistics:

Press the Menu button and select **Actions** → **Clear History**.

The histogram is cleared automatically when you start a script, as well as when you load and unload a logfile.

Bottom chart

This line chart tracks RLP-level data throughput over the past 60 seconds: uplink (blue), downlink (red).

The value on the far left indicates the maximum value on the y-axis. The values on the right are those of the latest data points plotted.

4.10. "Test Status" Data View Category

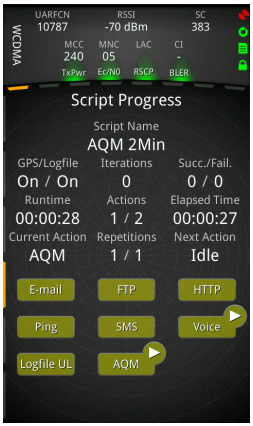
This data view shows the progress of the script that is currently running, if any. When you stop the script, this view is cleared, and all counters are reset.

- The **Script Progress** data view gives general information on script progress, independent of what types of action are being run.
- The other data views in this category contain action-specific progress and service performance data. For certain action types, a graph is plotted which scrolls from right to left in real time.

Line charts always show the latest 60 seconds of execution time for the action type in question.

How to compose scripts is explained in chapter 8.

4.10.1. Script Progress Data View



For the header, see sections 4.5.1–4.5.4.

Script Name: The name of the script that is currently running.

GPS/Logfile: Use of GPS / Use of logfile recording.

Iterations: Total number of completed script iterations.

Succ./Fail.: Total number of successfully completed script actions (all iterations) / Total number of failed script actions (all iterations).

Runtime: Total elapsed script execution time (all iterations).

Actions: Index of current action in list of actions / Total number of actions in script.

Elapsed Time: Elapsed execution time for current action (reset at start of new action).

Current Action: Type of current action: FTP, HTTP, Voice, etc.

(continued on next page)

(continued)

Repetitions: Index of current repetition of action / Total number of repetitions to perform (**Repeat action** parameter in script setup).

Next Action: Next action in script (no wraparound: “-” is shown while last action is executed).

Script action type buttons

Tap one of these buttons to jump to an action-specific progress view (they are described in sections 4.10.2–4.10.9). When an action of a particular type is executing, the corresponding button is tagged with a “play” symbol.

Furthermore, the buttons are color-coded in a similar way as the status icons (described in section 3.5.2.1):

- *Yellow/Olive green:* No action of this type has been run yet.
- *Green:* The last action of this type completed with success.
- *Red:* The last action of this type failed.

Regarding script setup, see chapter 8.

4.10.2. AQM Progress Data View

Mode: Equal to the AQM mode chosen in the action settings.

Min / Avg / Max: Minimum, average, and maximum AQM score for the current repetition of the AQM action.

Current: Current AQM score. The update interval may vary slightly since the AQM computation time is noticeably dependent on processor load, but is generally around 6 s.

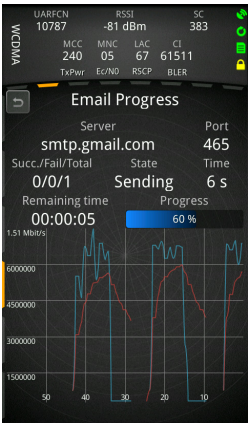
Count: Number of AQM scores computed during the current repetition of the AQM action.

Graph

Histogram showing AQM score distribution for the current repetition of the AQM action.

For the script setup, see section 8.3.7. Regarding audio quality measurement with TEMS Pocket in general, see chapter 12.

4.10.3. Email Progress Data View



Server: IP address or host name of SMTP server.

Port: The port on which the SMTP server listens for requests.

Succ./Fail/Total: Number of emails successfully delivered/Number of emails whose delivery failed/Total number of emails to send.

State: State of SMTP client. The values that will normally be visible in the user interface are:

- Inactive
- Preparing
- Connecting
- Logging In
- Sending
- Quitting
- Finished
- Aborting

Time: Time elapsed for the email that is currently being sent. Given in seconds.

Remaining Time: Estimated remaining time of the email session.

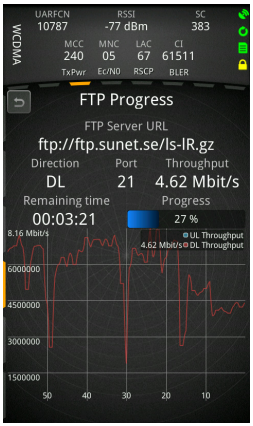
Progress: Percentage of the email data transfer that has been completed.

Graph

Line chart of current and average application-level email throughput. This throughput is shown only during the email transfer as such and not during host lookup, login/logout, or other steps of setting up and taking down the email session.

For the script setup, see section 8.3.1.

4.10.4. FTP Progress Data View



FTP Server URL: Name and full path of file being uploaded/downloaded over FTP. The server can be specified by an IPv4 address (12-digit number) or a plain-text name.

Direction: FTP session type (UL or DL).

Port: The FTP server port used.

Throughput: Current uplink/downlink application-level FTP throughput.

Remaining Time: Estimated remaining time of the FTP session.

Progress: Percentage of the FTP data transfer that has been completed.

Graph

Line chart of uplink/downlink application-level FTP throughput.

For the script setup, see section 8.3.2.

4.10.5. HTTP Progress Data View

HTTP URL: The URL of the web page being downloaded.

Transfer Time: Duration of the current HTTP session in seconds.

Throughput: Current downlink application-level HTTP throughput.

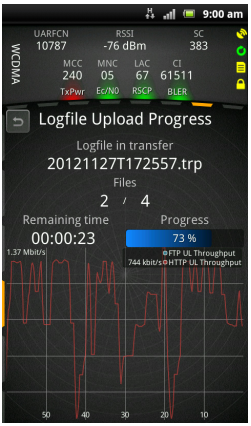
Graph

Line chart of downlink application-level HTTP throughput.

For the script setup, see section 8.3.3.

4.10.6. Logfile Upload Progress Data View

Logfile upload can be performed via FTP or HTTP(S).



Logfile in transfer: Name of logfile currently being uploaded.

Files: Number of logfiles uploaded / Total number of logfiles to be uploaded.

Remaining Time: Estimated remaining time of the Logfile Upload action.

Progress: Upload progress, stated as the percentage of logfiles in the current batch that have been uploaded.

Graph

Line chart showing application-level FTP or HTTP(S) throughput for the logfile upload.

For the script setup, see section 8.5.4.

4.10.7. Ping Progress Data View

Host: The URL of the host being pinged.

Min / Avg / Max (ms): Minimum/average/ maximum ping round-trip time for the current repetition of the Ping action. Timeouts and errors are left out of account in these statistics.

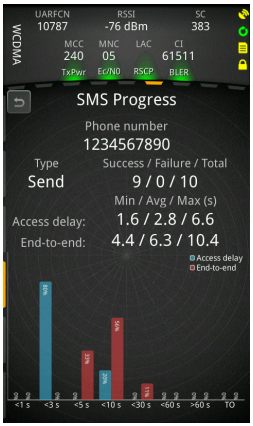
Finished / Total: Number of finished pings/ Total number of pings to be sent in the action.

Graph

Histogram of ping round-trip times for the current repetition of the Ping action. The “TO” bin on the far right represents timeouts (no response within the specified maximum time to wait).

For the script setup, see section 8.3.4.

4.10.8. SMS Progress Data View



Phone number: Number of SMS recipient.

Type: Always "Send" in this TEMS Pocket version.

Success / Failure / Total: Number of successfully sent SMS messages / Number of failed SMS messages / Total number of SMS messages to be sent in the current repetition of the SMS action.

Access delay: Time from SMS send start until RP-ACK is received from the network: minimum/average/maximum.

End-to-end: Time from SMS send start until a delivery report (RP-DATA with SMS Status Report) is received from the network: minimum/average/maximum.

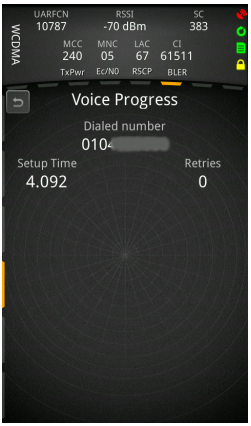
Timeouts and failures are left out of account in the Access delay and End-to-end statistics. Values are given in seconds, rounded off to one decimal place.

Graph

Histogram of access delay and end-to-end times for the current repetition of the Ping action. The "TO" bin on the far right represents timeouts and failures.

For the script setup, see section 8.3.5.

4.10.9. Voice Progress Data View



Dialed number: The number called.

Setup Time: Call setup time in seconds. The call setup time is calculated at the application layer, so it can differ slightly from the call setup time indicated when replaying the file in TEMS Investigation.

Retries: Total number of retries made during the current call.

For the script setup, see section 8.3.6.

4.10.10. Other Actions

The **Control Function**, **Idle**, **Wait**, and **Wi-Fi** actions do not have a progress screen.

4.11. "Location" Data View Category

4.11.1. Indoor Map View

This view is not a regular data view, but it is included in the Location category.

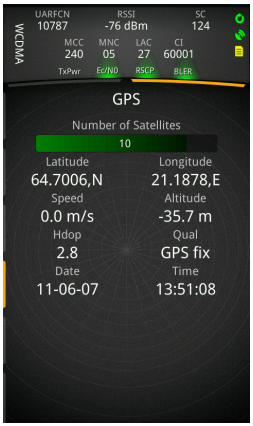
See chapter 6.

4.11.2. Outdoor Map View

This view is not a regular data view, but it is included in the Location category.

See chapter 7.

4.11.3. GPS Data View



For the header, see sections 4.5.1–4.5.4.

This view always presents data either from the phone's internal GPS or from an external GPS that is currently connected. How to select a GPS for use with TEMS Pocket is explained in section 14.3.

Number of Satellites: The number of satellites the GPS currently sees.

Latitude, Longitude: Latitude and longitude given in decimal degrees.

Speed: Speed in meters per second.

Altitude: Height above sea level in meters.

Hdop: Horizontal dilution of precision, HDOP.

Qual: Reads "GPS fix" if GPS fix obtained, otherwise left blank ("-").

Date: Date ("yy-mm-dd").

Time: Time of day ("hh:mm:ss", UTC).

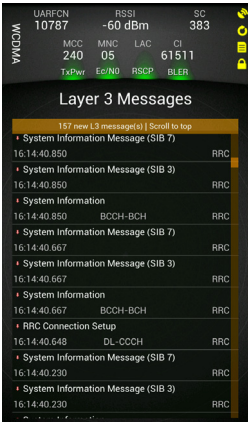
In a script, the use or non-use of GPS data is set in the general script properties; see section 8.2.1.

Manually, you can turn the GPS on and off by pressing the Menu button and selecting **Actions** → **Turn On GPS** or **Turn Off GPS**.

Regarding GPS use with TEMS Pocket generally, see chapter 14.

4.12. “Misc” Data View Category

4.12.1. Layer 3 Messages Data View



For the header, see sections 4.5.1–4.5.4.

This data view lists Layer 3 messages transmitted and received by the phone. All technologies are covered; that is, whatever subset of GSM, WCDMA, LTE, CDMA, and EV-DO the phone supports.

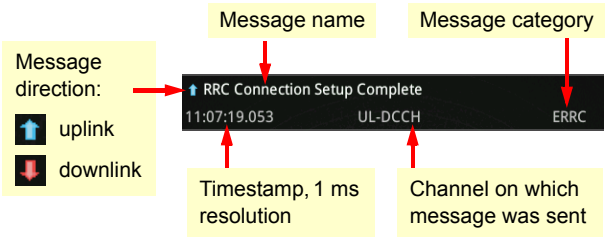
By default this view is automatically refreshed, with each new message appearing at the top of the list. However, to be able to study the message flow at your leisure, you can freeze the data view by *dragging* the message list gently *downward*. (A more forceful swipe gesture has the usual effect of taking you to a different data view.) While the view is frozen, further dragging actions cause the message list to scroll. The scrolling bar on the far right shows your current position in the list.

While the view is frozen, the notification bar (yellow) at the top of the list indicates the number of new messages that have been sent and received after you froze the view. In a logfile, these messages are recorded normally, independently of the data view state.

To return the data view to live mode, tap the **Scroll to top** link on the notification bar, or scroll manually all the way to the top of the message list. The view is then updated with all messages that were queued while the view was frozen.

You can view the full plain-text decoding of a message by tapping it. See section 4.12.1.2.

For each message, the following information is provided:



4.12.1.1. Layer 3 Message Categories

Each Layer 3 message belongs to one of the following categories:

GSM/WCDMA

- **CBS**, Cell Broadcast Service
- **CC**, Call Control
- **GMM**, GPRS Mobility Management
- **LLC**, Logical Link Control
- **MM**, Mobility Management
- **RLC/MAC**, Radio Link Control/Medium Access Control
- **RR**, Radio Resource (Management)
- **RRC**, Radio Resource Control
- **SM**, Session Management
- **SMS**, Short Message Service
- **SS**, Supplementary Services

LTE

- **EMM**, EPS (Evolved Packet System) Mobility Management
- **ERRC**, EPS Radio Resource Control
- **ESM**, EPS Session Management

CDMA

> **Note:** These designations are channel types, but are displayed on the far right as message categories. The channel field in the middle is empty for CDMA.

- **ACH**, Access Channel
- **FTCH**, Forward Traffic Channel
- **PCH**, Paging Channel
- **RTCH**, Reverse Traffic Channel
- **SCH**, Supplemental Channel

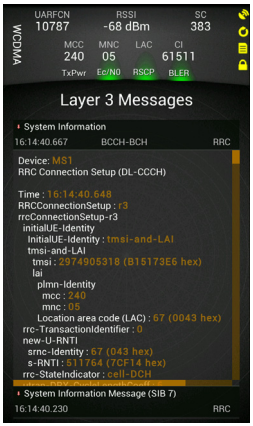
EV-DO

- **ACH MAC**, Access Channel MAC
- **Addr. Mgmt**, Address Management
- **Air Link Mgmt**, Air Link Management
- **Authentication**
- **CCH MAC**, Control Channel MAC
- **Conn. State**, Connected State
- **Encryption**
- **FTCH MAC**, Forward Traffic Channel MAC
- **Idle State**
- **Init. State**, Initialization State
- **Key Exchange**
- **MM Cap. Disc.**, Multimode Capability Discovery
- **Overhead Msgs**, Overhead Messages
- **Packet Cons.**, Packet Consolidation
- **Physical Layer**
- **Route Update**
- **Security**
- **Session Cfg**, Session Configuration

- **Stream**
- **Stream0**
- **Stream1**
- **Stream2**
- **Stream3**
- **Virtual Stream**

4.12.1.2. Plain-text Decoding of Layer 3 Messages

When you tap a Layer 3 message, its contents are displayed in plain-text decoded format.



In all mobile phone implementations of TEMS Pocket, the plain-text decoding is displayed inline as an expansion of the Layer 3 message list item. On tablets, however, the plain-text decoding is displayed separately to the right of the message list (see chapter 16).

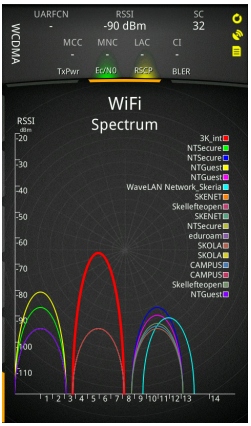
- *Double-tap* the plain-text decoding field to hide it again. Alternatively, you can press the Back button.

4.12.1.3. Clearing the Layer 3 Messages Data View

To clear the message list, press the Menu button and select **Actions** → **Clear History**.

The message list can hold up to 1,000 messages. After this number is exceeded, the oldest message drops out as a new one enters. While the view is frozen, up to 999 messages can be buffered for later presentation. Any messages in excess of that number will not appear when the view is released (but in a logfile, all messages are always recorded).

4.12.2. Wi-Fi Spectrum Data View



The header shown is that belonging to the cellular technology last used. See sections 4.5.1–4.5.4.

This data view shows the result of Wi-Fi scanning. Each detected Wi-Fi network is visualized as a lobe, associated in the legend with the network name (SS ID). The network the phone is currently connected to is drawn with a thicker line (red lobe in screenshot).

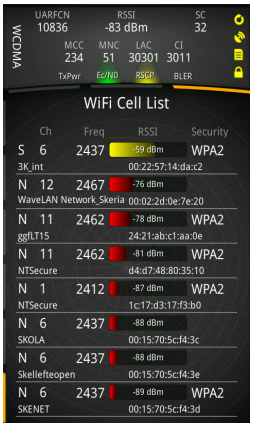
The height of a lobe indicates the RSSI (dBm) of that Wi-Fi network.

The width of a lobe represents the network's allotted transmission bandwidth (fixed at 20 MHz in ▶ IEEE 802.11a/b/g; variable in ▶ IEEE 802.11n). The numbers {1 ... 14} labeling the x-axis are the channel numbers defined in that standard.

Along the x-dimension is thus also visualized the overlap between Wi-Fi networks.

Please note that Wi-Fi access points with hidden SS ID cannot be detected by TEMS Pocket.

4.12.3. Wi-Fi Cell List Data View



The header shown is that belonging to the cellular technology last used. See sections 4.5.1–4.5.4.

This data view shows Wi-Fi access points detected by Wi-Fi scanning. Up to eight access points are displayed, each belonging to one of the following categories:

- **S:** Serving
- **N:** Neighbor.

The categories are prioritized as listed above, neighbors being displayed as far as space allows. Within each category, cells are sorted by descending RSSI.

Ch: Channel number according to ▶ IEEE 802.11b/g/n.

Freq: Channel center frequency in MHz.

RSSI: Received Signal Strength (dBm).

Security: Wi-Fi security protocol: one of {WPA2, WPA, WEP} or none.

A string with the following information about each Wi-Fi access point appears on a separate line:

SS ID: Name of Wi-Fi network.

BSS ID: MAC address of Wi-Fi access point, given in hexadecimal format: "12:34:56:78:90:ab".

The cell file format (see appendix D) currently does not extend to Wi-Fi access points.

5. Events

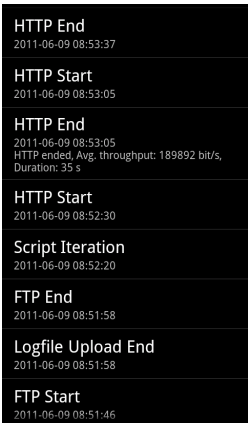
TEMS Pocket displays *events* to indicate a variety of occurrences that are worthy of note. A large number of events are predefined; you can also define custom events of your own.

Events in TEMS Pocket 12.4 subdivide into the following categories:

- Radio events
- Session events (also includes logfile recording events)
- System events (related to device operation)
- Custom events

5.1. Event Log

To view events that have occurred, press the Menu button and select **Settings** → **Event Log**.



Events are listed in chronological order with the most recent event on top.

To view details of an event, tap it in the event log. The log item is then expanded to also display event parameters: see the “HTTP End” event in the screenshot.

You refresh the event log manually as described in section 5.1.1. There is no automatic refresh.

The event log can hold a maximum of 500 events. After this number has been reached, the oldest event is deleted from the log whenever a new event occurs.

The event log is cleared automatically every time you start TEMS Pocket. You can also clear the event log manually at any time: see section 5.1.2.

5.1.1. Refreshing the Event Log

To refresh the event log, press the Menu button and select **Refresh**.

5.1.2. Clearing the Event Log

To clear the event log, press the Menu button and select **Clear**.

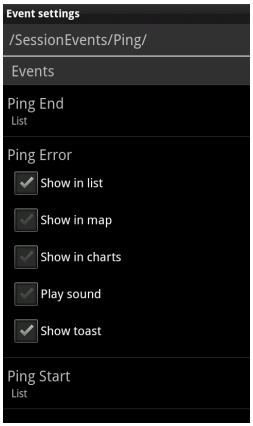
5.2. Presentation Options for Events (and Layer 3 Messages)

Besides being listed in the event log, events can be presented in a number of other ways. This is configured in the Event Settings menu.

The same range of additional presentation options are in fact also available for Layer 3 messages (that is, besides listing them in the Layer 3 Messages data view).

Press the Menu button and select **Settings** → **Event Settings**.

- Navigate the hierarchy of events and Layer 3 messages to locate the individual item or group of items you want to change settings for. The following options exist:



Show in list: List occurrences of this event/message in the event log/in the Layer 3 Messages data view.

Show in map: Plot this event along routes in map views. For events to appear in a map view, the "Events" layer must be selected for displaying there: see sections 6.4 and 7.5.

Show in charts: Indicate this event in data view line charts.

Play sound: Play an audio alert when this event occurs.

Show toast: Briefly display a notification ("toast" in Android parlance) at the bottom of the screen when this event occurs.

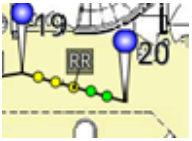
Each of these presentation options (other than the event log) is exemplified in the subsections that follow.

To revert to the default settings for all events, do the following at the top level in the Event Settings menu:

Press the Menu button and tap the **Reset** button.

5.2.1. Presentation in Map Views

A mnemonic is displayed as a framed text label pointing to the route marker where the event or message occurred. The example below shows a Layer 3 message belonging to the RR category.



5.2.2. Presentation in Data View Line Charts

A horizontal line in the chart, accompanied by a descriptive text label below the x-axis, indicates the precise time when an event or message occurred.

5.2.3. Presentation by Audio Alerts

Events and messages can also be announced by means of spoken audio alerts. Speech synthesis is used to produce this audio.

5.2.4. Presentation in Notification Boxes

Finally, events and messages can be presented as notifications (“toasts”) appearing briefly at the bottom of screen.

5.3. List of Predefined Events

This section lists all events that are predefined in TEMS Pocket, along with their parameters where applicable. More detailed descriptions are provided for call events and other events that require it.

5.3.1. Radio Events

5.3.1.1. Call Events

The call events pertain to GSM and WCDMA.

All call events have Call Control id as parameter. This is usually zero, but may take a value between 1 and 6 in case of multiple concurrent voice calls. Call Control id is omitted from the table below.

Event Name	Description/Parameters
Blocked Call	Call abnormally ended prior to Call Established event (for example because all traffic channels were busy). **Parameters:** CC cause
Call Attempt	Setup message received in state NULL. **Parameters:** Call direction (MO/MT)
Call End	A call has been terminated. This event is normally triggered by the CC message Release. **Parameters:** Call end cause, Call duration
Call Established	A call has been established. The event is triggered by the Layer 3 message Connect (MO call) or Connect Acknowledge (MT call). **Parameters:** Call direction (MO/MT)
Call Setup	A call has been set up by the phone. The event is triggered by one of the Layer 3 messages Alerting or Connect. **Parameters:** Call direction (MO/MT)

Event Name	Description/Parameters
Dropped Call	Call ended abnormally after Call Established event. **Parameters:** Cause

5.3.1.2. Other Radio Events

Event Name	Description/Parameters
Cell Changed	The phone changed to a different cell within the same RAT and on the same channel. **Parameters:** • *GSM:* ARFCN, Old BSIC, New BSIC • *WCDMA:* UARFCN, Old SC, New SC • *LTE:* EARFCN, Old PCI, New PCI • *CDMA/EV-DO:* RF Channel, Old PN, New PN
Channel Changed	The phone changed to a different channel within the same RAT. **Parameters:** • *GSM:* Old ARFCN, New ARFCN • *WCDMA:* Old UARFCN, New UARFCN • *LTE:* Old EARFCN, New EARFCN • *CDMA/EV-DO:* Old RF channel, New RF channel
System Changed	The phone changed to a different RAT. **Parameters:** Old RAT, New RAT (each being one of “GSM”, “WCDMA”, “LTE”, “CDMA”, “EV-DO”)

5.3.2. Session Events

Among these events, all "End" events imply successful completion of the session.

Event Name	Parameters/Notes
AQM Start	Dialed number, AQM mode, Duration
AQM End	AQM mode, AQM samples, AQM score: min./ avg./max.
AQM Error	Cause
Email Start	Recipient, SMTP server address and port, Security, Number of emails
Email End	Avg. throughput, Avg. transfer time
Email Error	Successes, Success ratio, Failures, Failure ratio, Cutoff ratio, Avg. throughput, Avg. transfer time
Email Send Success	Avg. throughput, Message size, Transfer time
Email Send Failure	Cause, Avg. throughput, Transfer time
FTP events: These are triggered both by FTP service testing and by logfile upload over FTP.	
FTP Start	Direction (UL/DL), FTP server host name, File name, FTP port, User name on FTP server
FTP End	Direction (UL/DL), Avg. throughput, Duration of session
FTP Error	Direction (UL/DL), Cause **Note:** This event is also generated during a Voice + Data action when an FTP session is terminated on voice call end.
HTTP Start	URL
HTTP End	Avg. throughput, Duration of session

Event Name	Parameters/Notes
HTTP Error	Cause **Note:** This event is also generated during a Voice + Data action when an HTTP session is terminated on voice call end.
HTTP Upload Start	Method (only Post), URL, authentication (Yes/No), user name
HTTP Upload End	Throughput and transfer time for the upload
HTTP Upload Error	Error message, throughput and transfer time for the upload
Idle Start	Configured session duration
Idle End	(No parameters)
Idle Error	Time remaining of configured duration when error occurred
IP Capture Start	(No parameters)
IP Capture End	Number of packets captured
Logfile Start	(No parameters) Generated for all types of logfile recording.
Logfile Stop	(No parameters) Generated for all types of logfile recording.
Parallel Execution Start	(Parameter set dependent on constituent actions)
Parallel Execution End	(Parameter set dependent on constituent actions)
Parallel Execution Error	(Parameter set dependent on constituent actions)
Ping Start	Host, Number of pings
Ping End	Round-trip time statistics (min./avg./max.)

Event Name	Parameters/Notes
Ping Error	Latest error cause *or* indication of timeout(s), Ping statistics (success/timeout/error), Round-trip time statistics (min./avg./max.)
Script Start	Script name
Script Iteration	Sequence number of the iteration started
Script End	Script execution time, Number of iterations, Number of successful actions, Number of failed actions
SMS Start	Sequence number of SMS, Phone number, Number of SMS messages to send, Text size, Delivery report flag, Delivery timeout, Send timeout
SMS End	Access delay (min./avg./max.), End-to-end time (min./avg./max.)
SMS Error	Failure ratio, Access delay (min./avg./max.), End-to-end time (min./avg./max.)
SMS Send Start	Sequence number of SMS
SMS Send Success	Access delay, End-to-end time
SMS Send Failure	Cause
Upload Start	Number of logfiles to be uploaded
Upload End	(No parameters)
Upload Error	Number of logfiles uploaded when error occurred
Voice Start	Dialed number
Voice End	(No parameters)
Voice Error	Cause
VoiceData Start	(No parameters)

Event Name	Parameters/Notes
VoiceData End	(No parameters) Success criteria for the Voice + Data action are given in section 5.3.2.2 below.
VoiceData Error	Cause **Note:** This event is (of course) *not* generated when **Stop at voice end** is set and the data session terminates prematurely – although the latter occurrence does trigger an FTP Error/HTTP Error event. See also the table in section 5.3.2.2.
Wi-Fi Enable	(No parameters)
Wi-Fi Disable	(No parameters)

5.3.2.1. Success Criteria for "Parallel" Action

The outcome of the Parallel action depends on how the **Abort condition** parameter is set (see section 8.4.2) and on the outcomes of the individual services run:

Abort Condition	Service Result	Parallel Result
Stop at all done	No failures	Success
	At least one failure	Failure
Stop at first done	First service succeeded	Success
	First service failed	Failure
Stop at first success	No service failed before first service finished with success	Success
	At least one service failed before first service finished with success	Failure
	No service succeeded	Failure
Stop at first error	No failures	Success
	At least one failure	Failure

5.3.2.2. Success Criteria for "Voice + Data" Action

The outcome of the Voice + Data action depends crucially on how the **Stop at voice end** flag (see section 8.4.1) is set:

Stop at Voice End	Voice Result	Data Result	Voice + Data Result	
On	Success	Success	Success	after voice finished
		Running[1]	Success	
		Failure	Failure	
	Failure	Don't care	Failure	
Off	Success	Success	Success	after both finished
	Failure	Don't care	Failure	
	Don't care	Failure	Failure	

1. That is, the data session is still running when the voice call completes.

5.3.3. System Events

These events relate to the operation of the TEMS Pocket device.

Event Name	Description/Parameters
Battery Low	The battery level has dropped below 10%.
Low Disk Space	There is less than 20 MB disk space remaining.
GPS Connected	An external GPS has been Bluetooth paired and connected in Android.
GPS Disconnected	An external GPS has been disconnected in Android.
GPS Position Found	The GPS currently in use has started reporting valid positions.
GPS Position Lost	The GPS currently in use has stopped reporting valid positions.

5.4. Custom Events

Besides the predefined events, you can create your own custom-made events which are based on TEMS Pocket value elements reaching or crossing preset thresholds.

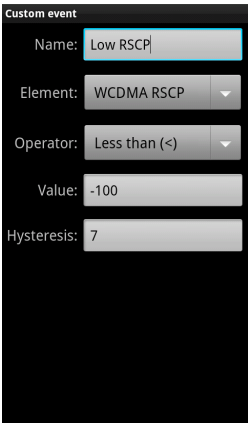
Predefine events have a hysteresis parameter. The function of the hysteresis is to introduce a degree of “inertia” into the event generation, avoiding a profusion of generated events (“ping-pong” effect) in case of rapidly fluctuating measurement values. A precise description of the mechanism is given in section 5.4.1.

5.4.1. Creating Custom Events

To create a custom event:

Press the Menu button and select **Settings** → **Custom Events**.

Press the Menu button and select **Add custom event**.



Name: Enter a name for the custom event.

Element: Select the value element on the basis of which the event should be triggered.

Operator: Select a boolean operator, one of: <, <=, >, >=, =, or !=.

Value: Threshold to which the value element should be compared.

Hysteresis: This parameter applies to conditions containing one of the operators <, <=, >, or >=. It has the following effect:

- After an expression *x* > *y* or *x* >= *y* has evaluated to true and triggered the event, the event cannot be triggered again until after the following condition has been true at some point: *x* < *y* – *Hyst*.
- After an expression *x* < *y* or *x* <= *y* has evaluated to true and triggered the event, the event cannot be triggered again until after the following condition has been true at some point: *x* > *y* + *Hyst*.

The hysteresis mechanism can be described more informally as follows: When the value element is fluctuating near the threshold, the event will be triggered only once at the beginning. Event generation is re-enabled when the value element retreats sufficiently far from the threshold, as specified by the **Hysteresis** parameter.

5.4.2. Presentation of Custom Events

The same range of presentation options exist for custom events as for predefined events. See section 5.2.

5.4.3. Removing Custom Events

To remove a custom event:

- Select the event in the Custom Events list.

Press the Menu button and select **Remove**.

To remove all custom events:

Press the Menu button and select **Settings** → **Custom Events**.

Press the Menu button and select **Remove all**.

5.5. Exporting and Importing Event (and Layer 3 Message) Settings

You can export the current presentation settings (covered in section 5.2) for events and Layer 3 messages. The export also includes the definitions of any custom events currently defined (see section 5.4).

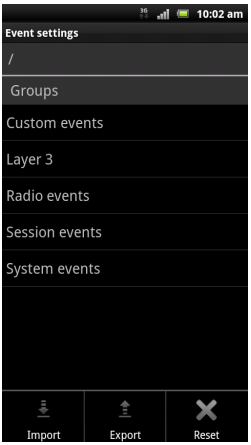
The export always encompasses all events and messages; it cannot be done selectively.

When TEMS Pocket is upgraded, a settings export is done automatically before the old version is uninstalled. After installation of the new version, the settings are imported back into the application.

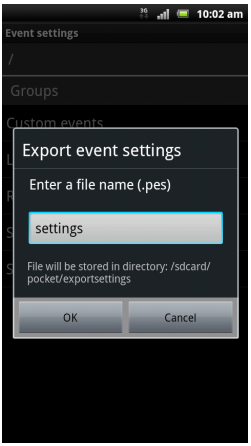
5.5.1. Exporting Settings

To perform the export:

Press the Menu button and select **Settings** → **Event Settings**.



Press the Menu button and tap the **Export** button.



You are invited to name the export file. It has extension .pes and is stored on the memory card in the directory indicated in section 3.6. The file name must be distinct from those of existing *.pes files.

5.5.2. Importing Settings

Note: When you import settings, all of the old settings are overwritten. You are warned about this by an on-screen message. Note especially that any existing custom events are *deleted* and replaced by those present in the .pes file (if any).

To perform the import:

- Press the Menu button and select **Settings** → **Event Settings**.
- Press the Menu button and tap the **Import** button.

The event settings files stored on the memory card are listed and you select one of them for import.

6. The Indoor Map View

Note: The Indoor Map view and the pinpointing function require a special license option. The Indoor Map icon on the top-level screen (see section 3.5.1) is grayed if no such license is present.

The **Indoor Map** function enables import of maps and positioning of measurements in indoor locations and other places where GPS coverage is lacking. The positioning is done by pinpointing the test route in the Indoor Map view.

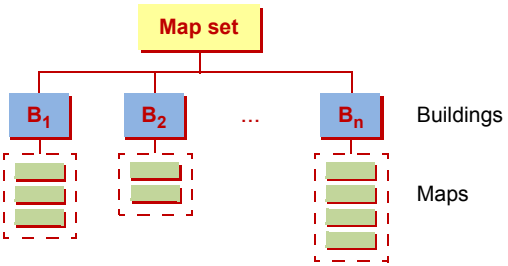
TEMS Pocket map sets are created in *.ibwc format, which is the container format used in the iBwave Design indoor radio planning software tool.

6.1. The Map Editor

You use the **Map Editor** to create and configure TEMS Pocket map sets.

6.1.1. Map Set Structure

A map set covers a number of buildings, each of which contains a collection of maps. Below is a hierarchical diagram showing the map set structure.



6.1.2. Obtaining Map Images

First you need to obtain images of the environment that is going to be covered during measurement. For example, use the phone's camera to photograph the emergency or evacuation plan for the relevant floor(s) of the building. The best image quality is obtained if the camera is set in black-and-white mode. Also avoid using the flash. If you are using an image from a different source, it must be in JPEG, PNG, or BMP format.

6.1.3. Creating Map Sets

Press the Menu button and select **Settings** → **Map Editor**.

Press the Menu button and select **New Map Set**.

- Tap **Name** and enter a name for the new map set.

Now for each building to be covered by the map set, do the following:

- Tap **Buildings**.

Press the Menu button and select **Add Building**.

- Tap **Name** and enter a name for the building.
- Then tap **Maps**.

Press the Menu button and select **Add Indoor Map**.

- You are now invited to pick an image to use as a map. Select your floor plans or other background images that you want to use. The selected image files are added to the map set. A map set can contain up to 99 images.

Map sets are saved in the iBwave container format (extension .ibwc). These files are self-contained and can easily be transferred to other devices. Map sets are saved to the phone's memory card as specified in section 3.6.

It is also possible to store a logfile (*.trp) containing a map set in the map set directory, and then load it into the Indoor Map view just like a map set (*.ibwc), as described in section 6.2.

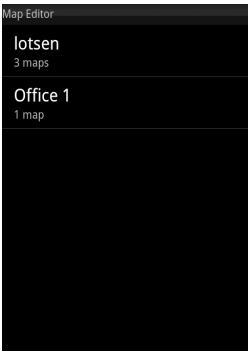
6.1.4. Specifying Map Set Properties

You can set some position properties and other metadata for the map set.

If you are not already in the Map Editor:

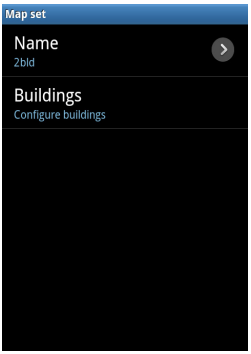
Press the Menu button and select **Settings** → **Map Editor**.

A list of the map sets you have already created appears.

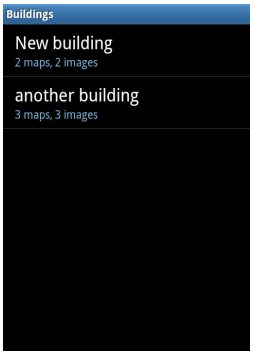


- Tap the map set you want to define properties for.

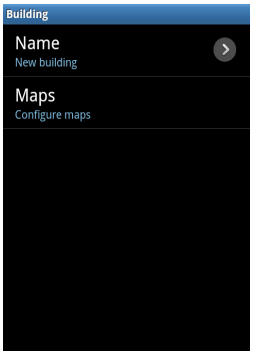
- Tap **Indoor Maps**.



- Here you can edit the map set name by tapping it.
- Tap **Buildings** to access a list of the buildings defined in the map set.

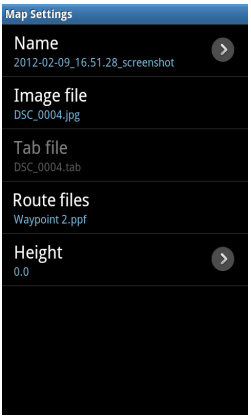


- Tap an individual building to access its constituent parts (maps).



- You can edit the building name by tapping it.
- Tap **Maps** to access a list of the maps defined for this building.
- Then tap an individual map to access its properties.

The map properties are as follows:



- **Name:** Name assigned to the map.
- **Image file:** Name of the map image file.
- **Tab file:** TAB file associated with the map image, if any. A TAB file present in the same directory as the map image and identically named will appear automatically in this field. Section 3.6 gives the path to the map set directory.
- **Route files:** Planned routes associated with this map image, if any. See section 6.3.5. Tap this field to select from a list of available route files. Note that several route files can be associated with the same map.
- **Height:** Height above sea level of the floor depicted in the map image.

6.1.5. Managing Maps in a Map Set

If you tap and hold a map in a map set, a menu with the choices **Move up**, **Move down**, and **Delete** appears.

- Use the move commands to move the map one step up or down in the map set.
- Use the **Delete** command to delete this map from the map set.

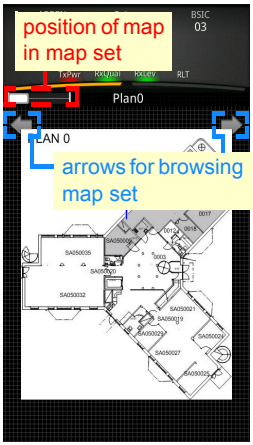
6.2. Loading a Map Set into the Indoor Map View

At the outset the Indoor Map view is empty. A grid is drawn in the view when no map set is loaded.

Here is how to load a map set into the Indoor Map view:

Press the Menu button and select **Actions** → **Load Map Set**.

- Select the desired map set and tap **Load**. The map set now loads in the Indoor Map view.



If the map set contains several images, the first is shown. If there are several buildings in the map set, the whole map set structure is flattened into a single sequence of maps when viewed here.

You flip through the maps by tapping the arrows that appear in the top left and right corners of the Indoor Map view. The map sequence wraps around after you browse to the first or last map. The bar indicator in the top left portion of the view indicates the position of the currently displayed map in the map set sequence.

When the Indoor Map view is zoomed in (zoom level > 1.0), any dragging action results in panning the currently visible map. When the view is zoomed out (zoom level = 1.0), swiping right will take you to the next view in the Location group, i.e. the Outdoor Map view (section 4.11.2), and swiping up or down will take you to a different data view group.

Note: Map sets from TEMS Pocket 11.2 and older versions cannot be loaded in TEMS Pocket 12.4.

6.3. Pinpointing Your Test Route

6.3.1. Fundamentals of Pinpointing

You can perform pinpointing in either of two ways:

- **Manually**, marking waypoints freely on the map. See section 6.3.4.
- According to a predetermined **planned route**. See section 6.3.5.

Your route will be recorded in a logfile. Logfile recording starts automatically when you start pinpointing and is ended when you stop pinpointing.

6.3.2. Coexistence with Other TEMS Pocket Functions

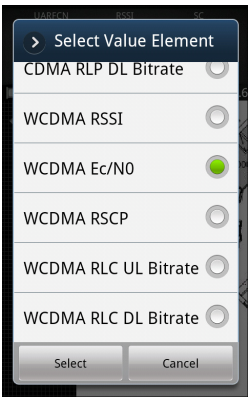
- While a script is running, pinpointing is disabled. You must stop the script first. (On the other hand, you *can* start a script while the pinpointing function is active; however, the logfile recording normally triggered by the script is then suppressed. Only the pinpointing function will produce a logfile in this case.)
- While you are recording a logfile manually, pinpointing is disabled.
- While pinpointing is active, you cannot swap maps; that is, you cannot move from one image in the map set to another.

6.3.3. Plotting Route Markers with RF Data

You can optionally have markers plotted along your route which are color-coded according to a selected piece of RF data ("value element"). The color coding of the markers is the same as that used for the value element in data views; it is explained in appendix A.

By default, no value element markers are plotted. The feature is activated and customized as follows: .

Press the Menu button and select **Actions** → **Select Value Element**.



- From the list that appears, pick the value element you want to show. The full list is also given in appendix B.
- Tap **OK**.

From now on, all pinpointed routes will be traced by dot-shaped markers whose color encodes the value element as measured at each point.

If you want to plot a different value element, simply make a new selection as described above. Note, however, that if you do this in the middle of pinpointing a route, the value element markers already plotted will be erased.

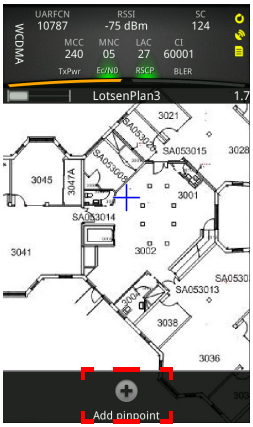
The waypoints that you mark on the map are always indicated by pin symbols colored blue, and the straight-line segments connecting them are drawn in

black. Neither of these colors is affected by the **Select Value Element** command.

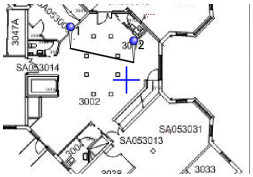
Route markers are plotted also during logfile replay (covered in section 9.4).

6.3.4. Manual Pinpointing

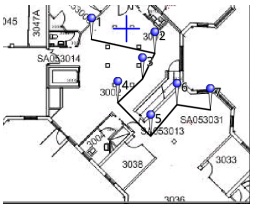
Press the Menu button and select **Actions** → **Start Pinpoint**.



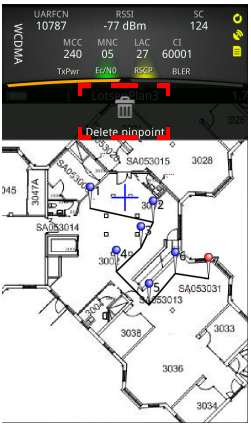
- Pan the map to position the crosshairs correctly. It may also be helpful to use the zoom function; pinch and spread to zoom the map image in and out. Alternatively, you can double-tap to zoom out to normal. The current magnification is indicated numerically in the top right corner.
- Tap **Add pinpoint** to place a waypoint at the spot marked by the crosshairs. The waypoint is marked by a pin symbol and labeled with a sequence number.



- Pan the map to position it for the next waypoint, then tap **Add pinpoint** again. A new pin is drawn and joined to the previous one by a connecting line. (No value element is plotted in the example shown here.)



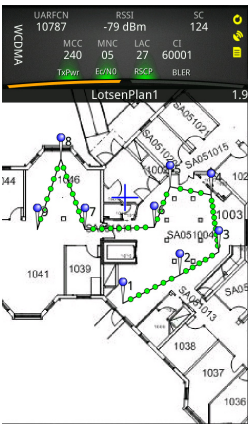
- Continue pinpointing at regular intervals along the route, and whenever you change direction. If you stop along the way, pinpoint when you stop and again when you resume your walk.



- If you want to undo a pinpointing action, tap the relevant pin. The pin turns red, and the map is re-centered around it. Confirm by tapping **Delete pinpoint** at the top of the view. Connecting lines are redrawn and the numbering is adjusted automatically.

To cancel the delete action, just tap the pin once more. Its color then reverts to blue.

Below is an example of value element plotting (see section 6.3.3):



Route markers are drawn along each route segment as soon as it has been completed, that is, when you mark a new waypoint ending the segment. A maximum of 10 route markers are drawn between two waypoints.

When you have completed your route:

Press the Menu button and select **Actions** → **Stop Pinpoint**.

After you stop pinpointing, a TEMS Pocket logfile with extension .trp is created and stored in the location stated in section 3.6.

Logfiles can be replayed in TEMS Pocket itself, as detailed in section 9.4. You can also transfer the logfiles to a PC and open them in TEMS Investigation or TEMS Discovery.

6.3.5. Pinpointing According to Planned Route

6.3.5.1. Creating Planned Routes

Here is how to design planned routes in TEMS Pocket.

If you are not already in the Map Editor:

Press the Menu button and select **Settings** → **Map Editor**.

- Load the map set you are going to use, if it is not loaded already.
- Navigate to the map on which you want to trace the route.
- Tap the map's **Route files** property. (Compare section 6.1.4.)

Now press the Menu button and select **Create route file**.

- Enter a name for the route file.
- A dialog appears with the message "Save all mapset changes and start route editor?". Tap **Yes**.

The user interface now switches to the Indoor Map view, and you proceed to create your planned route by placing waypoints exactly as when doing manual pinpointing (see section 6.3.4). The only difference consists in how the task is concluded:

When you have completed your route, press the Menu button and select **Actions** → **Save Route Changes**.

The new route is now stored with the map as a file with extension *.ppf. (Selecting **Discard Route Changes** instead will discard all the route waypoints that you have just defined. The route itself remains, but it will contain no waypoints.)

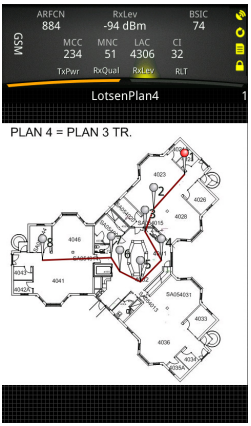
- The new route appears in the list of route files associated with the map.

6.3.5.2. Loading a Planned Route and Using It for Pinpointing

Press the Menu button and select **Actions** → **Load Route**.

- Select the desired route file from the list that appears, and tap **Load**.

Pinpointing Procedure



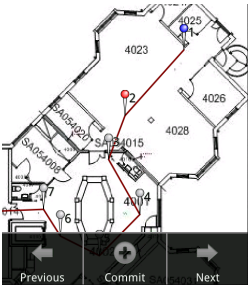
Regardless of which method you used to load your planned route, the route is drawn in dark red on the map. Waypoints are marked by pin symbols.

To pinpoint according to this route, do as follows:

- Go to the physical location marked by the first waypoint (highlighted in red).

Press the Menu button and select **Actions** → **Start Pinpoint**.

- A panel with three buttons appears, and the map is centered around the first waypoint. Tap the **Commit** button to indicate that you are currently in that location.
- Tap **Next** to proceed to the next waypoint. The highlighting in red then switches to that waypoint, and the map is re-centered around it.



- Walk in a straight line and at a steady pace towards the spot marked by the highlighted waypoint. When you have reached it, tap **Commit**. The route segment just completed is retraced in black.

- Continue in this fashion until you have finished the route.

(It is possible to move backwards along the route by tapping the **Previous** button.)

When you have completed the route:

Press the Menu button and select **Actions** → **Stop Pinpoint**.

You can unload the route file as follows:

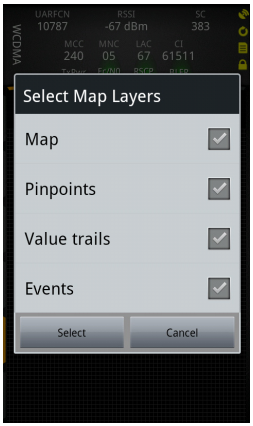
Press the Menu button and select **Actions** → **Unload Route**.

The route is removed from the Indoor Map view.

6.4. Showing and Hiding Indoor Map Layers

You can turn the visibility on and off for various map layers individually.

Press the Menu button and select **Actions** → **Select Map Layers**.



- **Map:** Google Maps imagery.
- **Pinpoints:** Routes made up of pin symbols and connecting lines.
- **Value trails:** Route markers encoding a value element.
- **Events:** Event presentation. If this is unchecked, no events will appear in the Indoor Map view regardless of the **Show in map** setting for individual events (see section 5.2).

Check a layer to show it; uncheck to hide it.

6.5. Unloading a Map Set

To unload the currently loaded map set:

Press the Menu button and select **Actions** → **Unload Map Set**.

7. The Outdoor Map View

The Outdoor Map view is intended for outdoor drive testing with access to GPS coverage. The view uses Google Maps imagery in the form of roadmaps and/or satellite images.

Routes can be plotted in live mode as well as in replay mode.

When a cell file is loaded, cell sites can be displayed from that file, and cells currently being used can be pointed out.

In live mode, for obvious reasons, all plotting that relates to the device's current position is possible only when GPS data is available.

The Outdoor Map view does not require any special license option.

7.1. Supported Google Maps Content

The map content supported is limited to the basics, and most options found in Google Maps are disabled. For example, StreetView is not supported. You can however switch between map types, as described in section 7.6.4.

7.2. Plotting Your Route on the Outdoor Map

The device's current position is always marked by a white dot.

Along your test route you can leave a trail of markers whose color encodes a piece of RF data. To select this value element:

Press the Menu button and select **Actions** → **Select Value Element**.

The same value elements are selectable as in the Indoor Map view. See appendix B, and compare what is said in section 6.3.3. At the outset no value element is chosen.

Up to 10,000 route markers can be plotted in the Outdoor Map view.

To clear all route markers from the Outdoor Map view:

Press the Menu button and select **Actions** → **Clear History**.

7.3. Displaying Events on the Outdoor Map

Events are displayed in the Outdoor Map view as text labels pointing to a route marker. See section 5.2.1.

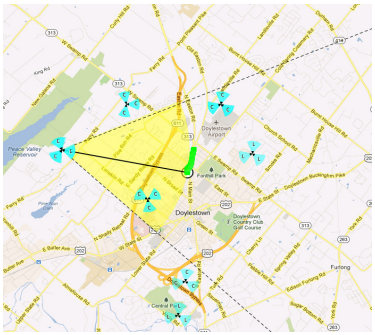
7.4. Displaying Cell Sites on the Outdoor Map

Cell sites can be displayed in the Outdoor Map view according to a cell file that you have loaded into TEMS Pocket. See chapter 10.

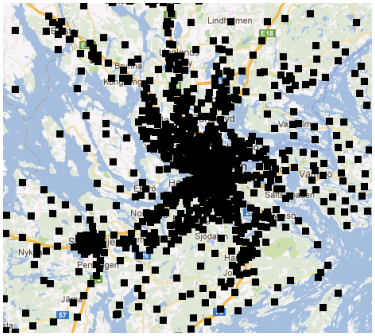
Each cell of a site is visualized as a cyan-colored sector extending from the site's position and covering an angle that corresponds to the cell beam width as indicated in the cell file. The innermost part of a site is drawn in black to indicate the site position more distinctly.

Cells are marked with a letter representing the radio access technology: **G** = GSM, **W** = WCDMA, **L** = LTE, **C** = CDMA.

When the TEMS Pocket device has an active network connection, a line is drawn from the device's current position to the serving cell or to each cell in the active set. An extension of the cell sector, reaching out to the device's position, is drawn as an overlay in a semi-transparent yellow color. The radii of the sector are further extended by means of dashed lines all the way out to the edge of the map view. The purpose of these lines are to indicate the angle within which it is reasonable for a device to be served by this cell.



A maximum of 1,000 cells (not sites, please note) will be plotted in the Outdoor Map view. If you zoom out so far as to view an area comprising more than 1,000 cells, all sites are replaced by small black squares in the presentation. If the number of in-view cells exceeds 10,000, all presentation of cells is disabled. These limits are imposed for readability and performance reasons.



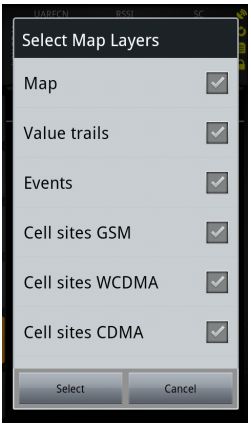
Cells drawn as black squares

No cells plotted when map is zoomed out far enough

7.5. Showing and Hiding Outdoor Map Layers

You can turn the visibility on and off for various map layers individually.

Press the Menu button and select **Actions** → **Select Map Layers**.



- **Map:** Google Maps imagery.
- **Value trails:** Route markers encoding a value element.
- **Events:** Event presentation. If this is unchecked, no events will appear in the Outdoor Map view regardless of the **Show in map** setting for individual events (see section 5.2).
- **Cell sites GSM:** GSM cell site data from cell file.
- **Cell sites WCDMA:** WCDMA cell site data from cell file.
- **Cell sites CDMA:** CDMA/EV-DO cell site data from cell file.
- **Cell sites LTE:** LTE cell site data from cell file.
- **Serving cell tracker:** Line(s) from device position to serving cell/active set.

Check a layer to show it; uncheck to hide it.

7.6. Map Controls

This section deals with the buttons located at the top of the Outdoor Map view.

7.6.1. Follow

When the Follow function is **on**, the map will autopan as you move around, so that it is always centered around your current position. You can zoom the map by pinching and spreading.

As soon as you activate the Follow function, **Panning** is automatically turned off if it was active. (Automatic panning and manual panning obviously cannot coexist.) However, the previous Panning setting is remembered and is restored when you turn Follow off again.

When the Follow function is **off**, there is no automatic panning of the map, even if the device moves out of the area displayed. You need to pan manually using the **Panning** function.

7.6.2. Panning

When this function is **on**, swiping actions in the map view will pan the map. Pinching and spreading will zoom the map.

When this function is **off**, swiping in the map view does not affect the map but takes you to a different data view, as described in section 4.4. Furthermore, the map cannot be zoomed by pinching and spreading in this state.

Panning is disabled when the **Follow** function is on (see section 7.6.1).

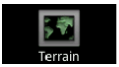
7.6.3. Online Mode/Offline Mode

Online Mode: Download map imagery from Google whenever an Internet connection is available.

Offline Mode: Use cached Google Maps imagery. This mode is useful if problems can be expected with the internet connection in the field. You can then download Google Maps content for your testing area by other means (for example, in advance while still in the office), and then put the Outdoor Map view in offline mode so that it relies on that cached content rather than a live connection to Google Maps. Map tiles other than those downloaded will then be black and empty apart from the message “Sorry, we have no imagery here.”.

7.6.4. Map Type

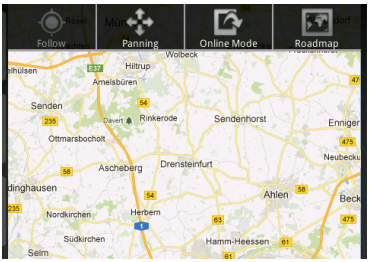
Roadmap: Displays the default road map view.



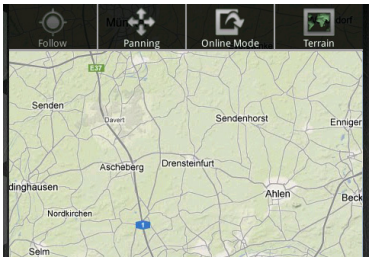
Terrain: Displays a physical map based on terrain data.

Satellite: Displays Google Earth satellite images.

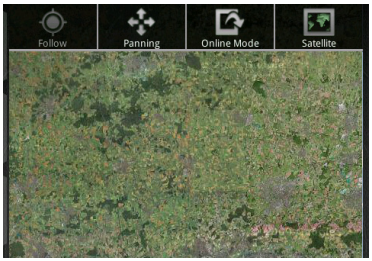
Hybrid: Displays a mixture of roadmap and satellite views.



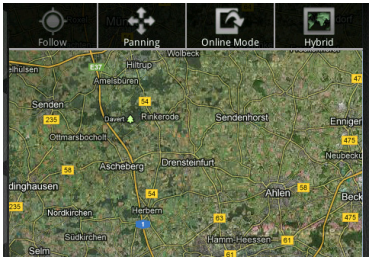
Roadmap



Terrain



Satellite



Hybrid

8. Scripts

8.1. Introduction to Scripts

Scripts are used to **automate testing of services**. The following services and tasks are supported by the script function:

Actions Running a Single Service

- Email
- FTP
- HTTP
- Ping
- SMS
- Voice (mobile-originated calls)
- AQM

Actions Running Multiple Concurrent Services

- Voice + Data (concurrent CS and PS sessions: multi-RAB)
- Parallel

Other Actions

- Control Function
- Idle
- IP Capture
- Logfile Upload
- Wait
- Wi-Fi Scanning

You can have the execution of a script **recorded** automatically in a logfile. It is also possible to have that logfile **uploaded** automatically to an FTP or HTTP server. The upload is accomplished with the script action Logfile upload.

You **start and stop** a script with menu commands: see section 8.7. When a script is executed, its actions are performed one after another in the order they come in the script definition. Once started, the script repeats until you stop it, or until the memory card fills up.

> **Note:** Running a script for extended periods of time places a high load on the phone battery. See chapter 17 for advice on how to ensure that the battery is not drained.

Script **setups** are stored on file, as detailed in section 3.6. Such files can be transferred to other TEMS Pocket units.

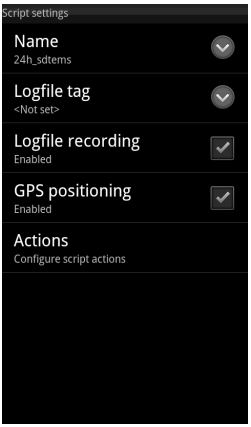
8.2. Basics of Composing Scripts

To access the script editing function, press the Menu button and select **Settings** → **Script Editor**.

Any scripts already defined are listed here.

To define a new script, press the Menu button and tap **New Script**.

8.2.1. General Script Settings



Here you define general script settings.

Name: Enter a name for the script here.

Logfile tag: Here you can define a tag that will be added to the name of each logfile. By default, logfile names consist only of script name, date, and time, as described in section 9.2.

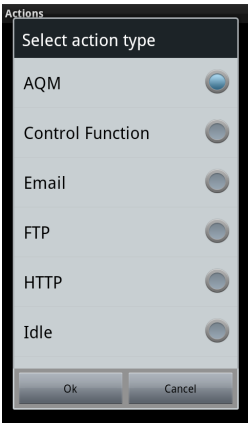
Logfile recording: Governs whether to record logfiles during script execution. Please note, however, that while a logfile is being recorded manually, all script-controlled logfile recording is inhibited.

GPS positioning: Governs whether or not to make use of the currently selected GPS (see section 14.3) during script execution.

After editing these settings, tap **Actions** to define the actions the script should perform.

8.2.2. Adding an Action to a Script

To add an action to the script, press the Menu button and select **New Action**.

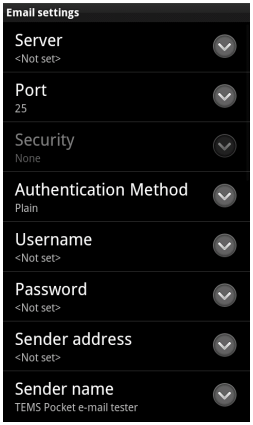


- Select an action type, then tap **OK**.

The action types are gone through one by one in the subsections that follow.

8.3. Script Actions Running a Single Service

8.3.1. "Email" Action Settings



(Only a subset of the settings is shown in the screenshot)

Server: IP address or host name of the SMTP server.

Port: The port on which the SMTP server listens for requests.

Security:

- *None:* No security is applied.
- *SSL:* The SSL (Secure Sockets Layer) cryptographic protocol is used throughout the email session. **Note** that this requires a special TEMS Pocket license option.

Authentication Method:

- *Plain:* The normal method today, specified in IETF RFC 4616.
- *Login:* SMTP AUTH login, a Microsoft proprietary method.

Username: User name of email account.

Password: Password for email account.

Sender address: Email address of sender.

Sender name: Name of email sender.

Receiver address: Email address of recipient.

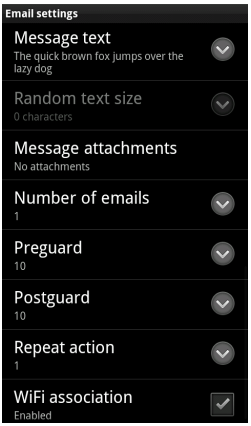
Message type: Plain text or HTML. Images in HTML will be inlined.

Message subject: Content of email Subject field.

Message text type:

- *Custom text:* String entered by user.
- *Random text:* String of random alphanumeric ASCII characters generated by TEMS Pocket.

(continued on next page)



(continued)

Message text: This field is enabled if **Message text type** is set to “Custom text”. Enter the email message body text here.

Random text length: This field is enabled if **Message text type** is set to “Random text” and specifies the length of the generated text.

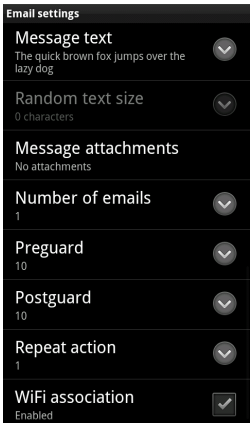
Message attachments: You can add one or several attachments to the email message. Each attachment can be either a file stored on the phone (see section 3.6) or a randomly generated file. In the latter case, you are prompted for the desired file size. **Note** that binary files are base 64 encoded, which means that the volume of data actually transmitted will be larger than the total file size of the attachments.

Number of emails: The number of emails to send (all identical and defined by the above parameters). The maximum is 99.

Preguard, Postguard: Guard periods automatically inserted before and after the measurement task, respectively. The purpose of the guard periods is to ensure that the signaling setting up and taking down the service session is recorded to the logfile and made available for post-processing. For this reason, they should not be set too short; the default for both is 10 s (see appendix C.5).

Repeat action: Total number of times to execute the action before the script proceeds to the next action. The maximum is 99. All repetitions are recorded in the same logfile.

(continued on next page)



(continued)

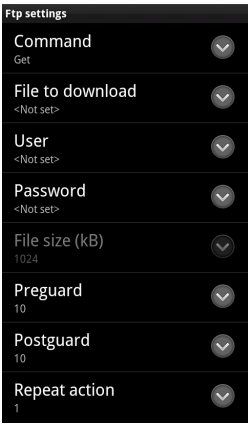
WiFi association: By setting this to Disabled, you prevent the phone from connecting to a Wi-Fi access point (even if a Wi-Fi network is available) and force it to run the session over a cellular network instead. Note that the default Android behavior is always to use Wi-Fi if it is the best available bearer. The option provided here eliminates the need to deactivate Wi-Fi manually in the phone's regular settings to achieve the same effect.

Advice on Email Size

Please bear in mind that most SMTP servers have an email message size limit, typically on the order of 10 MB.

Note also that for TEMS Pocket to be able to send an email, there must be sufficient free space on the memory card for the temporary file that is created in the process.

8.3.2. “FTP” Action Settings



Command: Get or Put.

Upload to file/File to download: Name and full path of file to be uploaded/downloaded over FTP. The server can be specified by an IPv4 address (12-digit number) or a plain-text name. A port number can optionally be added to the server name (“:<port number>”); if no port number is specified, port 21 is used.

User: User name on the FTP server.

Password: Password on the FTP server.

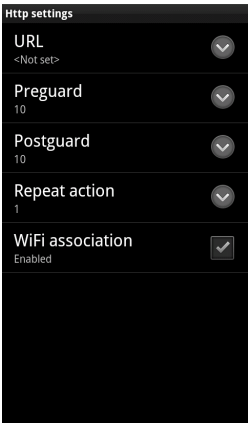
File size (kB): *(Applicable to uploads only)* Size of file to upload. This is a generated file containing random data.

Preguard, Postguard: See section 8.3.1.

Repeat action: Total number of times to execute the action before the script proceeds to the next action. The maximum is 99. All repetitions are recorded in the same logfile.

WiFi association: See section 8.3.1.

8.3.3. “HTTP” Action Settings



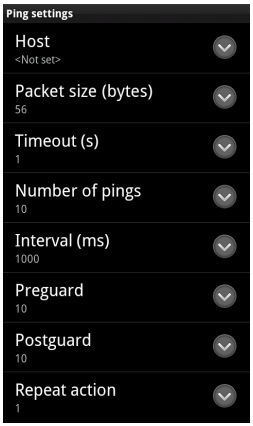
URL: The URL of the web page to be downloaded.

Preguard, Postguard: See section 8.3.1.

Repeat action: Total number of times to execute the action before the script proceeds to the next action. The maximum is 99. All repetitions are recorded in the same logfile.

WiFi association: See section 8.3.1.

8.3.4. "Ping" Action Settings



Host: The IP address or host name of the server to be pinged.

Packet size (bytes): Size in bytes of the ping packet. The maximum size is 65,500 bytes. To this an 8-byte ICMP header and a 20-byte IP header are added prior to transmission.

Timeout (s): Maximum time to wait for each ping response.

Number of pings: The number of pings to send. The maximum is 999.

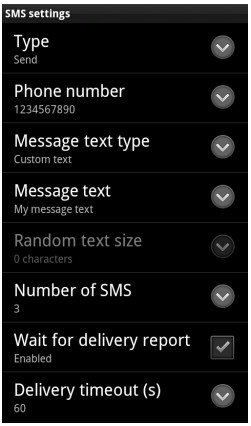
Interval (ms): Time between consecutive pings.

Preguard, Postguard: See section 8.3.1.

Repeat action: Total number of times to execute the action before the script proceeds to the next action. The maximum is 99. All repetitions are recorded in the same logfile.

WiFi association: See section 8.3.1.

8.3.5. “SMS” Action Settings



Type: Always “Send” in this version of TEMS Pocket.

Phone number: Number of SMS recipient.

Message text type:

- *Custom text:* String entered by user.
- *Random text:* String of random alphanumeric ASCII characters generated by TEMS Pocket.

Message text: This field is enabled if **Message text type** is set to “Custom text”. Enter the SMS message body text here.

Random text size: This field is enabled if **Message text type** is set to “Random text” and specifies the length of the generated text.

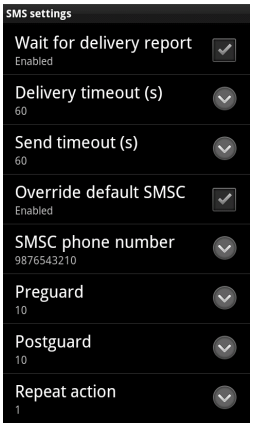
Number of SMS: The number of SMS messages to send (all identical and defined by the above parameters). The maximum is 99. If more than one SMS are sent, a sequence number is appended to each SMS (#01, #02, etc.).

Wait for delivery report: Governs whether or not TEMS Pocket will wait for SMS delivery reports. This is a prerequisite for computing the end-to-end statistics shown in the SMS Progress data view (see section 4.10.8).

Delivery timeout: The time in seconds to wait for a delivery report. The timer starts ticking when the send ACK is received. If **Wait for delivery report** is set to Disabled, this field is grayed out.

Send timeout: The time in seconds to wait for a send ACK (“RP-ACK”).

(continued on next page)



(continued)

Override default SMSC: Governs whether to override the default SMS center (entered as a setting in Android) and send messages to a different SMS center.

SMSC phone number: This field becomes editable when **Override default SMSC** is set to Enabled. Enter the phone number to your custom SMSC here. If the field is left empty, the default SMSC number will be used anyway.

Preguard, Postguard: See section 8.3.1.

Repeat action: Total number of times to execute the action before the script proceeds to the next action. The maximum is 99. All repetitions are recorded in the same logfile.

8.3.5.1. Technical Notes on SMS Composition, Encoding, and Transfer

Long SMS messages (more than 160 characters) are supported, up to a maximum of 9,999 characters. The same limit applies for both custom and random text. Please note that Android may issue warnings about messages smaller than this; specifics are vendor and device dependent.

TEMS Pocket prepends a five-digit internal reference number abcde to each SMS and sometimes also tacks on a sequence number nn at the end of the message (see Number of SMS above). The full syntax is: abcde:<message text>#nn. In consequence, up to 9 characters of each SMS are taken up by this tagging.

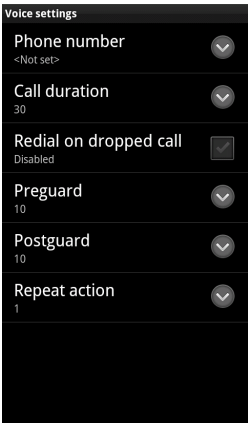
Whenver possible, the 7-bit default encoding is used. If characters outside of that range occur, TEMS Pocket switches to a different encoding (8-bit or UCS2). The choice of encoding cannot be controlled by the TEMS Pocket user, except indirectly by including characters that will require 8-bit or UCS2.

Once sent, SMS messages cannot be recalled by TEMS Pocket. This means that if you stop an SMS action, an interrupted SMS transfer may give rise to signaling during subsequent actions and may delay their execution.

If you do not specify an SMSC in the action, a default SMSC must be set in the device. How to do this varies from one device to another.

The SMS technical specifications are found in ▶ 3GPP 23.040.

8.3.6. “Voice” Action Settings



Phone number: The phone number to be dialed. Any characters available in the phone interface can be used.

Call duration: Duration of the voice call in seconds.

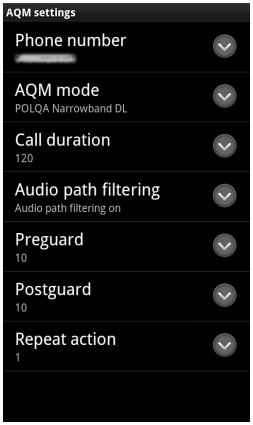
Redial on dropped call: If set to Enabled, the phone will automatically redial the call if it is blocked or dropped. A maximum of three redials are made on each occasion; that is, if the call is successfully redialed and then dropped again, up to three new retries are made.

Preguard, Postguard: See section 8.3.1.

Repeat action: Total number of times to execute the action before the script proceeds to the next action. The maximum is 99. Note that for the Voice action, a separate logfile is created for each repetition.

8.3.7. "AQM" Action Settings

This action is supported with the subset of TEMS Pocket phones listed in section 12.2.



Phone number: AQM voice calls are always placed to a TEMS Call Generator, as explained in chapter 12. Here you enter the Call Generator phone number. Any characters available in the TEMS Pocket phone interface can be used.

AQM mode: This refers to the AQM algorithm used and to the bandwidth of the transmitted speech: narrowband, wideband, or super-wideband. What options are available here depends on what the phone supports. The AQM algorithm currently supported is POLQA, which is described briefly in section 12.1.

Call duration: Duration of the AQM voice call in seconds. The maximum is 600 s.

Audio path filtering: Use of device-specific audio-enhancing functions such as noise suppression, audio stretch, comfort noise, and gain control. By turning this off, you enable TEMS Pocket to measure network audio quality in a more unbiased way, without device-specific audio processing impacting the results.

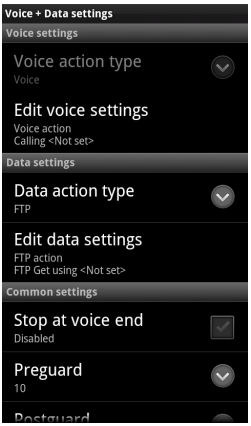
Preguard, Postguard: See section 8.3.1.

Repeat action: Total number of times to execute the action before the script proceeds to the next action. The maximum is 99. Note that for the AQM action, a separate logfile is created for each repetition.

8.4. Script Actions Running Multiple Concurrent Services

These actions enable concurrent testing of multiple services.

8.4.1. “Voice + Data” Action Settings



This action type defines simultaneous (multi-RAB) voice and data sessions:

- 1 CS session (voice) *plus*
- 1 PS session (FTP *or* HTTP)

Voice settings

Voice action type: Currently always “Voice”.

Edit voice settings: Same settings as for the Voice action: see section 8.3.6.

Data settings

Data action type: FTP or HTTP.

Edit data settings: Same settings as for the chosen data action type: see sections 8.3.2 (FTP), 8.3.3 (HTTP).

Common settings

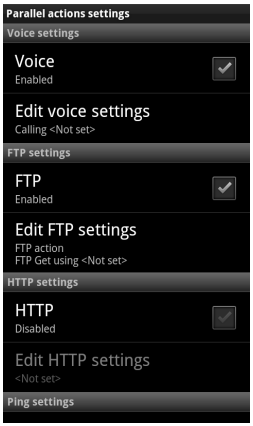
Stop at voice end: If enabled, the data action will be aborted when the voice action ends. If disabled, the data action will be unaffected by the voice action terminating.

Preguard, Postguard: See section 8.3.1.

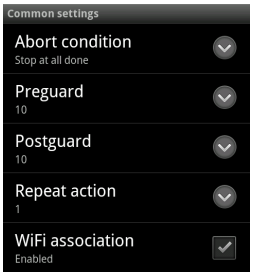
Repeat action: Total number of times to execute the action before the script proceeds to the next action. The maximum is 99. Note that this setting refers to repetition of the Voice + Data action as a whole; the Data part has its own Repeat setting and can therefore be repeated independently of what is selected here. The Voice part, however, is always run only once for each repetition of the Voice + Data action.

The total number of separate logfiles created by the Voice + Data action type is equal to its **Repeat action** setting.

8.4.2. "Parallel" Action Settings



Service settings (only top part shown)



Common settings

The Parallel action is used to run multiple services concurrently. You can run one session of each of the following types: Voice, AQM, FTP, HTTP, Ping, Email, and SMS.

In the dialog, each of these service types has a separate settings section. A checkbox governs whether or not to include this service in the action. Below the checkbox is an item **Edit** <service type> **settings**, which opens a settings dialog similar to that found in the corresponding single-service action, except that certain general parameters are not present. These are instead found under **Common settings** and are defined only once for the Parallel action as a whole: **Preguard**, **Postguard**, **Repeat action**, and **WiFi association**.

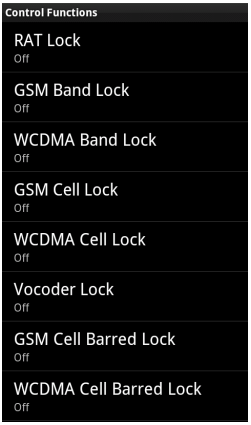
Under Common settings is also found an **Abort condition** parameter, which determines when the Parallel action should stop executing. The following options are provided:

- **Stop at all done:** Stop only after all services have finished (either succeeded or failed).
- **Stop when first done:** Stop as soon as one service has finished (succeeded or failed).
- **Stop at first success:** Stop when one service has finished with success.
- **Stop at first error:** Stop when one service has finished with error.

For details on the outcome of a Parallel action as a function of the outcomes of the service sessions and the chosen Abort condition setting, see section 5.3.2.1.

8.5. Other Script Actions

8.5.1. “Control Function” Action Settings

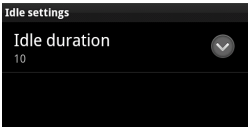


The settings for this action are exactly the same as when applying control functions manually, as described in chapter 11 (which see).

Note that a Control Function action always sets *all* control functions anew. (There is no “as-is” option that leaves a particular previous setting unchanged.)

During script execution, the settings specified by a Control Function action remain in force until the next time a Control Function action is executed, or else until the script terminates.

8.5.2. “Idle” Action Settings

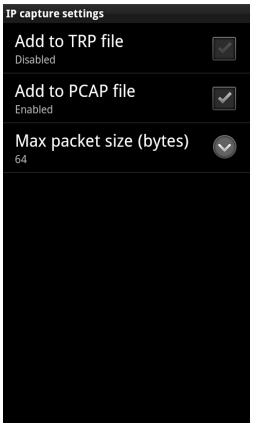


Idle duration: The length of time (in seconds) the phone should spend in idle mode.

8.5.3. “IP Capture” Action Settings

This action is supported on the following TEMS Pocket phones:

- Samsung Galaxy S III LTE GT-I9305
- Samsung Galaxy S III LTE SGH-I747
- Sony Xperia T LTE LT30a
- Sony Ericsson Xperia arc S
- HTC Rezound



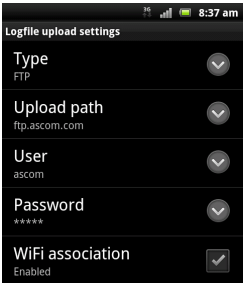
The IP Capture action enables or disables packet capture. Note that this action does *not* in itself start logfile recording; rather, that must be initiated in one of the ways mentioned in section 9.1. Note also that a PCAP file is created only in connection with TRP logfile recording; it is not possible to record PCAP files independently.

- **Add to TRP file:** If checked, packet capture data is saved to a regular TEMS Pocket logfile (*.trp) alongside other data logged to that file.
- **Add to PCAP file:** If checked, packet capture data is saved to a PCAP file, which can be read for example by Wireshark. The PCAP file is named identically to the TRP logfile (as described in section 9.2), except that the extension is replaced by .pcap. PCAP files are stored in the same directory as TRP logfiles: see section 3.6.
- **Max packet size (bytes):** The maximum number of bytes of each packet that will be captured. Any further bytes in the packet will be truncated.

8.5.4. “Logfile Upload” Action Settings

Logfiles can be uploaded via either FTP or HTTP(S).

8.5.4.1. Logfile Upload via FTP



Whenever this action executes, TEMS Pocket tries to upload all logfiles found in the folder specified in section 3.6, and then deletes all files successfully uploaded. However, no more than 500 logfiles will be uploaded at a time. If there are files left after this action terminates, they will be taken care of the next time a Logfile Upload action is executed.

Type: Type of upload: FTP or HTTP. Which parameters that appear below depends on the selected type. Selecting **FTP** here displays the following parameters:

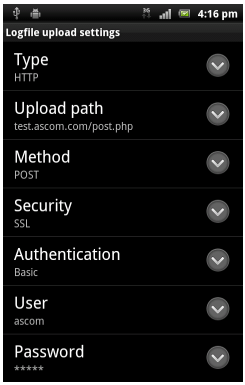
Upload path: Path to an FTP server directory where the logfiles should be uploaded, e.g. ftp://ftp.myserver.com/tems/pocketlogfiles.

User: User name on the FTP server, if required.

Password: User password on the FTP server, if required.

WiFi association: See section 8.3.1. Note that you can use this flag to divert logfile uploads to a different bearer from that used for testing.

8.5.4.2. Logfile Upload via HTTP(S)



Logfile upload settings: Top part

Whenever this action executes, TEMS Pocket tries to upload all logfiles found in the folder specified in section 3.6, and then deletes all files successfully uploaded. However, no more than 500 logfiles will be uploaded at a time. If there are files left after this action terminates, they will be taken care of the next time a Logfile Upload action is executed.

Type: Type of upload: FTP or HTTP. Which parameters that appear below depends on the selected type. Selecting **HTTP** here displays the following parameters:

Upload path: Path to an upload script in an HTTP server directory. This script (*.php) takes care of the uploaded logfiles, e.g. test.myserver.com/post.php. The path can be entered without the protocol prefix "http://" or "https://" since the parameter **Security** controls which protocol is used.

Method: Only POST available. See IETF RFC 2616.

Security: None or SSL. Only applicable if a valid security (SSL) license is available. If SSL is selected, the HTTPS protocol is used (see **Upload path**).

Authentication: None or Basic. The latter is according to IETF RFC 2617. Note that if Basic is used without SSL (see **Security**), the **Password** will be sent as plain text.

User: User name on the HTTP server, if required. Only applicable if **Authentication** is set to Basic.

Password: User password on the HTTP server, if required. Only applicable if **Authentication** is set to Basic.

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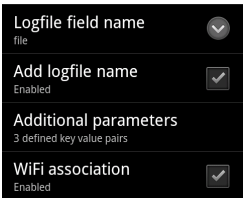
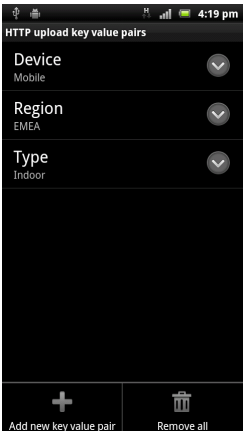
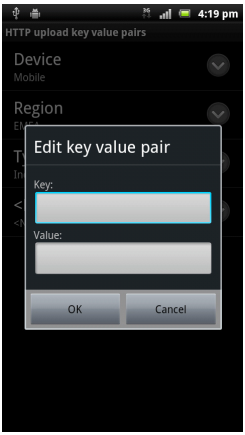


Logfile upload settings: Bottom part



Additional parameters: Key value pairs displayed



Add/edit key value pair

(continued)

Logfile field name: The name of the field in the Content-Disposition header for the file to be uploaded (containing the actual logfile). See IETF RFC 2388. The script mentioned under **Upload path** expects a file with this name, containing a logfile.

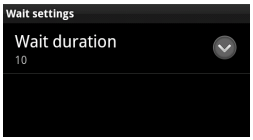
Add logfile name: Enabled or Disabled. If Enabled is selected, the name of the actual logfile is also added in the Content-Disposition header for the file to be uploaded. See IETF RFC 2388.

Additional parameters: Here it is possible to add or edit key value pairs, providing additional assistance to the script in sorting the uploaded logfiles. Tapping this field takes you to the list of existing key value pairs.

- Tapping the button **Add new key value pair** displays the dialog where you enter a name of the key (mandatory) and the name of the value (optional).
- Tapping **Remove all** removes all key value pairs from the list.
- Tapping an existing key value pair displays the same dialog as when adding a new one. You can edit the key and/or the value.
- Long-pressing a key value pair displays a context menu from which you can move the pair to a different position in the list, or remove the pair.

WiFi association: See section 8.3.1. Note that you can use this flag to divert logfile uploads to a different bearer from that used for testing.

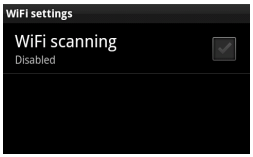
8.5.5. "Wait" Action Settings



You can use the Wait action to insert a guard time between other actions. The Wait action itself does nothing, and no logfile is recorded during the wait even if logfile recording is enabled in the general script settings (see section 8.2, introduction).

Wait duration: The length of time (in seconds) the phone should spend in idle mode.

8.5.6. "Wi-Fi" Action Settings



WiFi scanning: Enables or disables scanning for Wi-Fi networks. Enabling has the same effect as starting Wi-Fi scanning manually as described in chapter 13.

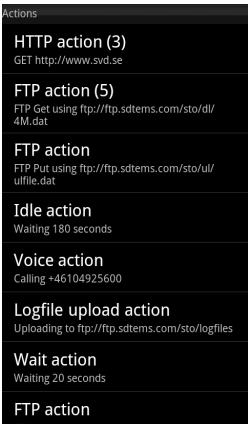
The output from Wi-Fi scanning is presented in the data views described in sections 4.12.2 and 4.12.3.

For clarity, it may be remarked that this action is unrelated to the **WiFi association** setting in data service actions (about which see section 8.3.1).

8.6. Editing a Script

8.6.1. The Assembled Script

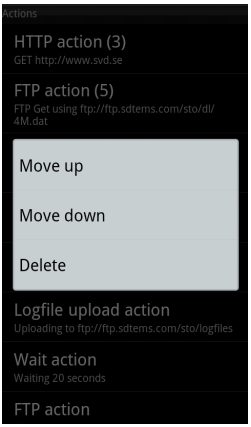
Once you are done setting up an action, simply press the Back button to return to the list of actions in the script.



In this list the new action appears on top of those previously defined. Here is an example where multiple actions have been set up. The addition “(3)” after “HTTP action” means that this action is executed three times back-to-back (**Repeat action** parameter, see section 8.3.3).

You can add one more action to the script by again pressing the Menu button, tapping **New Action**, and proceeding as described above.

8.6.2. Rearranging and Deleting Actions in a Script



- To move an action to a different position in the script, long-press the action in the list of actions and select **Move up**/**Move down** as appropriate from the menu that pops up.
- To delete an action from a script, long-press the action and select **Delete**.

You can also delete an action while editing it, by pressing the Menu button and then tapping **Delete** on the screen.

8.7. Starting and Stopping a Script

To run a script:

Press the Menu button and select **Actions** → **Execute Script**.

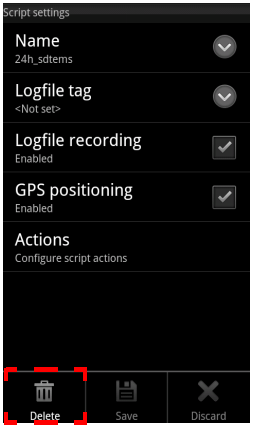
- Select the desired script from the list that appears and tap **Execute**.

The script will execute indefinitely unless you stop it. The **Test Status** data views detail the outcome of the execution: see section 4.10.

To stop a script that is running:

Press the Menu button and select **Actions** → **Stop Script**.

8.8. Deleting Scripts



To delete a script from the list of scripts:

- Tap the script.

Press the Menu button and select **Delete**.

Note: When you delete a script, the script file is permanently removed from the phone's file system.

9. Logfiles

9.1. Logfiles in TEMS Pocket: Overview

TEMS Pocket can record its measurements in logfiles, containing the same richness of detail as logfiles recorded with TEMS Automatic test units or with terminals connected to TEMS Investigation. The same TRP format is used as in these other TEMS products.

Logfiles are **stored** on the phone's memory card (see section 3.6). Logfiles are ordinary files in the phone file system.

You can **record** logfiles **manually** in the following ways:

- By giving the **Start Logfile Recording** command. See section 9.3.
- In connection with pinpointing in the Indoor Map view. See section 6.3.

You can also have logfiles recorded **automatically** during execution of scripts. See section 8.2.1.

Regarding logfile **naming**, see section 9.2.

TEMS Pocket has a logfile **replay** function, described in section 9.4. You can also study TEMS Pocket logfiles by transferring them to a PC and opening them in other TEMS products.

TEMS Pocket is capable of **uploading** logfiles over the cellular network to an FTP or HTTP server, using the built-in FTP or HTTP client. This is implemented as a special script action: see section 8.5.4. It is of course also possible to transfer logfiles via USB or Bluetooth, or to send them as attachments to email.[1]

1. The latter two methods require installation of a third-party Android app, since TEMS Pocket logfiles are not visible in the phone's standard user interface; see section 3.6.

9.2. Logfile Naming Format

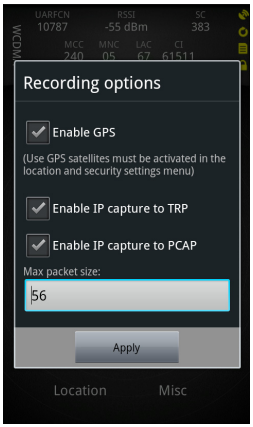
All logfiles recorded by TEMS Pocket are named according to the syntax [<script name>]yyyymmddThhmmss.trp, where the timestamp indicates at what time the recording started. In case of manual logfile recording, the <script name> part is absent.

9.3. Recording Logfiles Manually

You can initiate recording of a logfile manually, without running a script. (Logfile recording during pinpointing is covered in section 6.3.)

To start manual logfile recording:

Press the Menu button and select **Actions** → **Start Logfile Recording**.



A dialog with recording options appears.

Enable GPS: Check in order to record GPS positions in the logfile. Note that for this to be possible, the phone must have its built-in GPS enabled in the regular phone settings (as remarked in section 3.8.1) or an external GPS connected.

Enable IP capture to TRP: Check in order to capture packet data in the TRP logfile itself.

Enable IP capture to PCAP: Check in order to capture packet data in a PCAP file (which will receive the same file name as the TRP logfile but with extension .pcap).

Max packet size: The maximum number of bytes of each packet that will be captured.

The IP capture settings are the same as in the IP Capture script action: see section 8.5.3.

- Tap **Apply**. The logfile recording now starts.

The logfile is stored in the usual location indicated in section 3.6.

To stop the recording:

Press the Menu button and select **Actions** → **Stop Logfile Recording**.

9.3.1. Limitations of Manual Logfile Recording

You can only record one logfile manually at a time.

You cannot start manual logfile recording in the following situations:

- While a script is running. This applies generally, hence also during execution of **Idle**, **Wait**, and **Logfile Upload** actions.
- While pinpointing is active.
- While logfile replay is in progress.

9.4. Replaying Logfiles

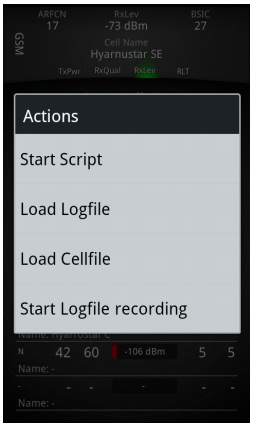
This function is used to replay TEMS Pocket logfiles in TEMS Pocket itself.[1] Note that you can also load logfiles into TEMS Investigation and TEMS Discovery and make use of the powerful presentation facilities in these tools.

During replay, the TEMS Pocket views are updated by the logfile content exactly as in live mode, that is, exactly as if the data were being received from the network.

To load a logfile:

Press the Menu button and select **Actions** → **Load Logfile**.

1. Please note that it is not possible to replay TRP logfiles from other TEMS products in TEMS Pocket. (For one thing, TEMS Investigation TRP logfiles may contain data from multiple devices, something which cannot be presented in TEMS Pocket.)



- A list appears of the TEMS Pocket logfiles found on the phone's memory card. Select the desired logfile from the list, and tap **Load**.

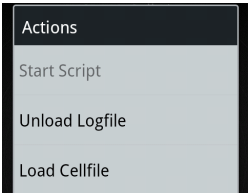
Once you have selected a logfile, the TEMS Pocket user interface (data views, event log) is cleared, and the logfile replay is put on standby. Furthermore, a panel with logfile replay controls appears at the bottom of the screen; see the next screenshot.

The timestamps on the left and right indicate the times of day when the logfile recording started and ended, respectively. The timestamp in the middle shows the point to which the replay has advanced, as also indicated graphically by the slider.

- To start the replay, tap the **Play** button. Its label changes to **Pause**. Tap the button once more to pause the replay.
- While the replay is paused, you can jump forwards or backwards in the logfile, one second or one minute at a time, using the buttons [**< 1m**], [**< 1s**], [**1s >**], [**1m >**] ("s" = second, "m" = minute). You can also jump to an arbitrary point in the logfile by dragging the slider.

In the Indoor Map view, if you skip past one or several route waypoints, value element markers will not be filled in for the whole of the skipped segment, but only from the last waypoint and up to the point you skipped to. (If no value element has been selected for plotting, the above is of course not applicable; see section 6.3.3.)

You may want to conceal the logfile controls to be able to inspect a data view more easily. To this end, tap **Hide logfile controls**. To show the controls again, just tap the button once more (**Show logfile controls**).



To close and unload the logfile that is currently loaded:

Press the Menu button and select **Actions** → **Unload Logfile**.

With this command you exit replay mode and return the application to “live” mode. The TEMS Pocket views are cleared, after which they will once again fill up with live data.

9.4.1. Coexistence with Other Phone and TEMS Pocket Functions

You can use any of the phone’s regular functions while replaying a logfile, for example take an incoming call or write an SMS. Such actions do not interfere with the replay in any way.

On the other hand, while at least one of the TEMS Pocket functions logfile recording, script execution, and pinpointing is active, logfile replay is disabled.

9.5. Compatibility with Other TEMS Products

- TEMS Pocket 12.4 logfiles can be post-processed in TEMS Discovery 4.0 (or later).
- TEMS Pocket 12.4 logfiles can be loaded in TEMS Investigation 14.5 (or later). Presentation of Wi-Fi scan data is currently not supported in TEMS Investigation.
- TEMS Pocket 12.4 phones other than HTC Rezound and HTC Vivid Release Key phones can also be used for data collection with TEMS Investigation 14.5 (or later).

10. Cell Files

You can import a **cell file** into TEMS Pocket in order to display cells by name (rather than by CGI) in data views. Cell files are in XML format, and relevant aspects of their syntax are described in appendix D.[1]

To import a cell file, do as follows:

Press the Menu button and select **Actions** → **Load Cellfile**.

- A list appears of the TEMS Pocket cell files found on the phone's memory card. Pick the desired cell file from the list, and tap the **Select** button.

Once you have imported a cell file, network cells will be presented by name in TEMS Pocket data views and in the Outdoor Map view (as detailed in sections 4.7–4.12 and chapter 7) whenever they can be matched with an entry in the cell file.

Each time you restart TEMS Pocket, the cell file last loaded in the application (if any) is automatically reloaded.

1. The file format is the same as in TEMS Investigation and contains a wide range of data, most of which is currently not used in TEMS Pocket.

11. Control Functions

Control functions are used to modify the phone's behavior in a cellular network.

Control functions can be applied either manually or automatically during execution of a script. For the latter, see section 8.5.1. This chapter deals with manual control functions.

11.1. Control Function Support in Devices

The following TEMS Pocket devices are equipped with control functions:

- Sony Ericsson Xperia arc S
- Sony Ericsson Xperia T (LT30a)
- Samsung Galaxy S 4G
- Samsung Galaxy S III GT-I9305
- Samsung Galaxy Note 10.1 LTE (GT-N8020)
- Samsung Infuse 4G
- HTC Vivid

What set of control functions is supported by each device is detailed in the table below. Please note that "cell lock" and "cell prevention" are applicable in both idle and dedicated/connected mode, that is, to both *cell selection* and *handover*.

Control Function/Device	Xperia arc S	Xperia T (LT30a)	Galaxy S 4G	Galaxy S III GT-I9305	Infuse 4G	Vivid	Section Ref.
WCDMA/GSM RAT lock	✓	✓	✓	✓	✓	✓	11.3
LTE RAT lock		✓		✓		✓	11.3
WCDMA cell lock/multi-lock, cell prevention	✓		✓		✓		11.4
WCDMA channel (UARFCN) lock	✓		✓		✓		11.4
GSM cell lock/multi-lock, cell prevention	✓	✓	✓		✓		11.5
WCDMA/GSM band lock	✓	✓	✓	✓	✓	✓	11.6
LTE band lock		✓		✓		✓	11.6
Vocoder selection	✓						11.7
Cell barred control	✓						11.8

The Samsung Galaxy Note 10.1 LTE (GT-N8020) tablet has the same control function support as Samsung Galaxy S III GT-I9305.

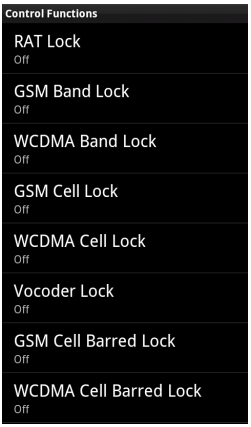
Regarding preparations that may be needed for HTC Vivid Test Key devices, see section 11.11.

11.2. Accessing Control Functions

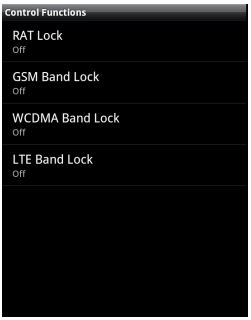
To access the control functions:

Press the Menu button and tap **Settings** → **Control Functions**.

A dialog appears listing the various control functions and their current states.



Dialog shown for Samsung and Sony Ericsson (Vocoder Lock and Cell Barred functions for Xperia arc S only)



Dialog shown for HTC Vivid

To apply a control function:

- Tap the desired function in this dialog.
- Make your selection according to the descriptions in sections 11.3–11.6 (which see).

Then press the Menu button and tap **Apply**.

To reset an individual control function:

- Tap that function in the dialog shown here.

Press the Menu button and select **Reset**.

To reset all control functions:

While in the dialog shown here, press the Menu button and select **Reset all control functions**.

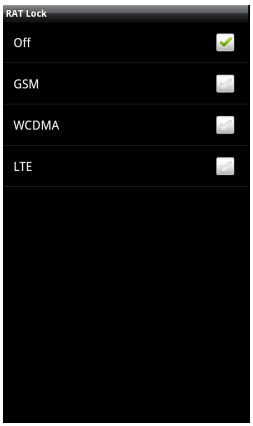
Regarding interplay between control functions, see section 11.9.

11.3. RAT Lock

This function locks the phone to one radio access technology in idle mode. It does not have any effect on RAT selection in dedicated mode.

When this function is activated, the phone detaches from the network it is currently attached to, as shown by the signal strength indicator in the phone display switching to "No network coverage". The phone then attaches to the selected network.

If the signal is too weak, the phone will go into no service mode.



Off: This means that TEMS Pocket does not influence the phone's network selection. Bear in mind that the phone can also be RAT locked from the phone's regular user interface; see note below.

GSM: The phone is forced to camp on a GSM network whenever one is available.

WCDMA: The phone is forced to camp on a WCDMA network whenever one is available.

LTE: The phone is forced to camp on an LTE network whenever one is available.

11.3.1. Note on Sony Ericsson and Samsung Phones

In the regular user interface of Sony Ericsson and Samsung phones, under **Settings** → **Wireless and networks** → **Mobile networks** → **Network mode**, it is possible to make a choice between "**GSM/WCDMA**", "**GSM only**", and "**WCDMA only**" (or similar; if the phone supports LTE, that technology is included in the first option). It is recommended *not* to use this function in conjunction with TEMS Pocket.

11.3.2. Note on HTC Vivid Test Key Devices

On HTC Vivid Test Key devices, a RAT lock alternatively can be applied from a special menu which is accessed by typing *#*#4636#*#* in the call dialer. This RAT lock should *not* be active when using TEMS Pocket, since it conflicts with the TEMS Pocket RAT lock function. Specifically, under **Testing**

→ **Phone info** in the special menu, **Set preferred network type** must be set to "**GSM/WCDMA/LTE auto**", meaning that no lock is applied.

11.4. WCDMA Cell Lock

You can do one of the following:

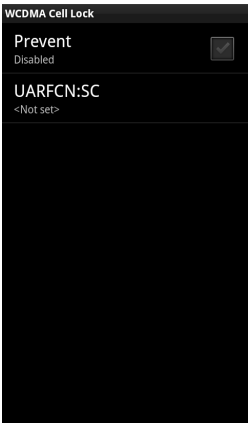
- *Lock* the phone to one or several cells and/or UARFCNs. The phone is then restricted to using these cells/UARFCNs.
- *Prevent* one or several cells and/or UARFCNs. The phone is then prevented from using these cells/UARFCNs.

It is not possible to apply both types of function at the same time. (This would be logically redundant anyway, since locking on one cell implicitly prevents all others, and vice versa.)

The WCDMA Cell Lock function has an effect in idle as well as connected mode. In other words, it can be used to control both cell selection and handover behavior.

If the signals from all allowed cells are too weak, the phone will go into no service mode.

11.4.1. Applying WCDMA Cell Lock Functions

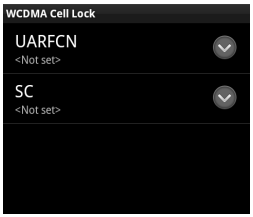


The **Prevent** flag governs which function is applied:

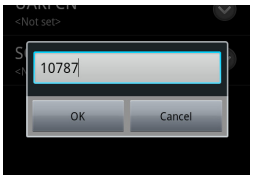
- For *locking*, uncheck Prevent.
- For *preventing*, check Prevent.

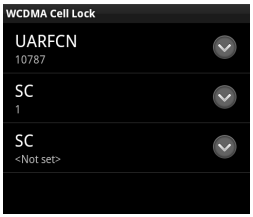
In either case, proceed to select the items the function should apply to. Below the procedure for locking is described; preventing is exactly analogous.

- Tap the **UARFCN:SC** item.

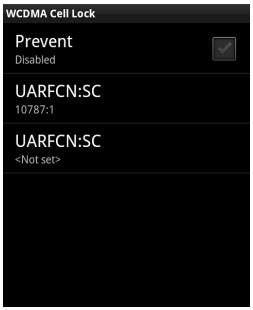


- Tap **UARFCN** to lock on a UARFCN. You will be asked to enter a channel number. Finish by tapping **OK**.
- Tap **SC** if you to want to lock on a cell (UARFCN + SC combination). Enter a number in the input field that appears, then tap **OK**.





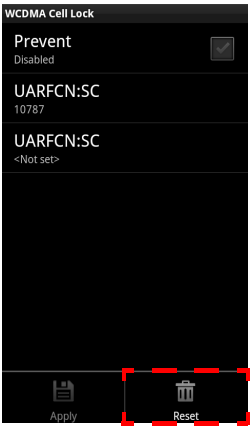
After you enter an SC, a further **SC** item appears. You can specify several SCs in order to allow all of them on the chosen UARFCN.



Back at the top level, you can add further **UARFCN:SC** items, each specifying either a whole UARFCN or a number of cells on that UARFCN.

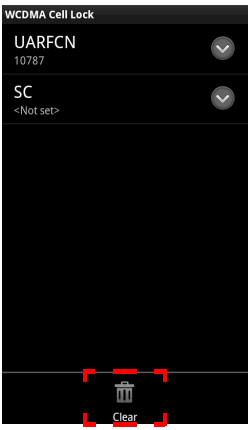
The same functions can alternatively be applied from the WCDMA Cell List data view to cells that appear there. Any actions that you perform from the Control Functions menu are also immediately reflected by means of highlighting (green/red) in the WCDMA Cell List data view. See section 4.7.3 for full details.

11.4.2. Releasing WCDMA Cell Lock Functions



To release all applied lock or prevent functions:

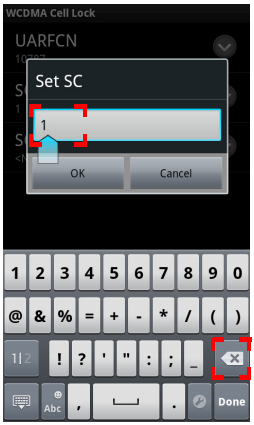
At the top level under WCDMA Cell Lock, press the Menu button and tap **Reset**.



To release a control function for an entire UARFCN (with or without SCs specified):

- Tap the relevant **UARFCN:SC** item at the top level.

Then press the Menu button and tap **Clear**.



To release a control function for one SC on one UARFCN:

- First open the relevant **UARFCN:SC** item at the top level.
- Tap the **SC** item you want to remove and erase the number from the input field. Click **OK** to confirm.

11.5. GSM Cell Lock

You can do one of the following:

- *Lock* on one or several cells. The phone is then restricted to using these cells alone.
- *Prevent* one or several cells. The phone is then prevented from using these cells.

It is not possible to apply both types of function at the same time. Compare section 11.4 on WCDMA.

The GSM Cell Lock function has an effect in idle as well as dedicated mode. In other words, it can be used to control both cell selection and handover behavior.

If the signals from all allowed cells are too weak, the phone will go into no service mode.

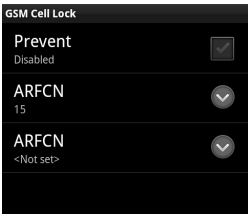
11.5.1. Applying GSM Cell Lock Functions

The **Prevent** flag governs what type of action is performed:

- For *locking*, uncheck the Prevent box.
- For *preventing*, check the Prevent box.

The procedures for locking and preventing are exactly analogous; in either case you simply define the set of ARFCNs the operation should apply to.

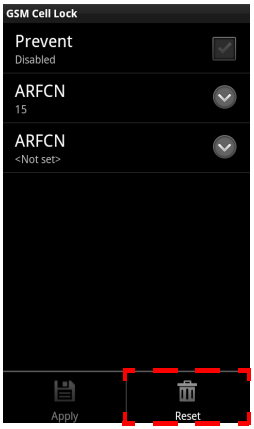
- Tap the **ARFCN** item. You are asked to enter a number. Finish by tapping **OK**.



After you enter an ARFCN, a further **ARFCN** item appears, enabling you to add one more ARFCN to the set if desired.

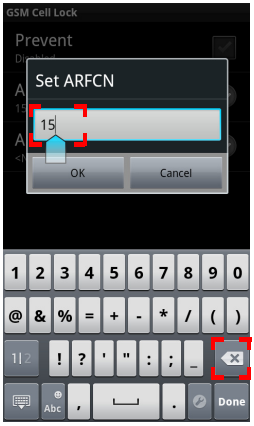
The same functions can alternatively be applied from the GSM Cell List data view to cells that appear there. Any actions that you perform from the Control Functions menu are also immediately reflected by means of highlighting (green/red) in the GSM Cell List data view. See section 4.7.1 for full details.

11.5.2. Releasing GSM Cell Lock Functions



To release all applied lock or prevent functions:

At the top level under GSM Cell Lock, press the Menu button and tap **Reset**.



To release a function for one cell:

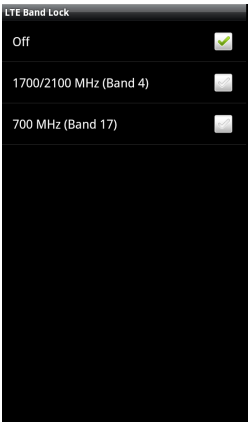
- Tap the **ARFCN** item you want to remove and erase the number from the input field. Click **OK** to confirm.

11.6. Band Lock: LTE/WCDMA/GSM

You can lock the phone to a particular frequency band on LTE, WCDMA, or GSM. Note that this operation will result in no service if you prevent the use of all bands that are available in the area.

The phone cannot be band-locked while a voice call is in progress.

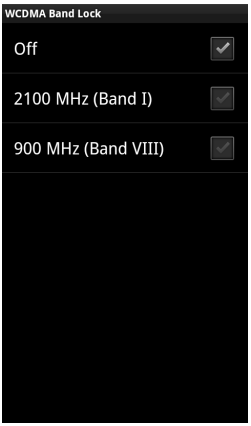
11.6.1. LTE Band Lock



Off: Function not applied.

1700/2100 MHz (Band 4), etc.: The phone will be locked to the indicated LTE band.

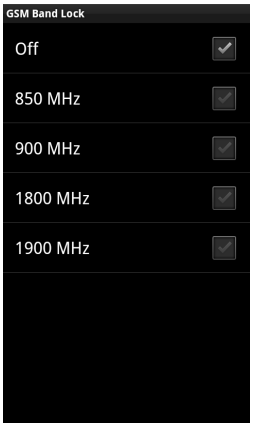
11.6.2. WCDMA Band Lock



Off: Function not applied.

2100 MHz (Band I), etc.: The phone will be locked to the indicated WCDMA band.

11.6.3. GSM Band Lock



Off: Function not applied.

850 MHz, etc.: The phone will be locked to the indicated GSM band.

11.7. Vocoder Lock

Off: Function not applied.

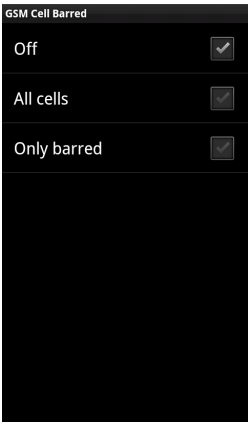
GSM codecs, UMTS codecs: Check the codecs that the phone should report as supported to the network:

- GSM Full Rate AMR
- GSM Enhanced Full Rate
- GSM Full Rate
- GSM Half Rate AMR
- GSM Half Rate
- UMTS AMR
- UMTS AMR2
- UMTS AMR Wideband

11.8. Cell Barred Control

This function lets you alter the phone's behavior with respect to barred, reserved, and other cells.

11.8.1. GSM Cell Barred

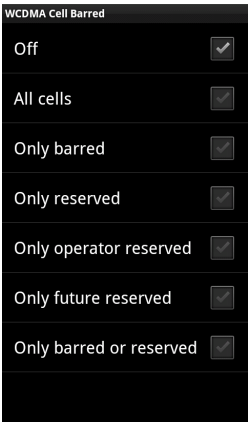


Off: The phone will not camp on barred cells.

All cells: The phone will camp on any cell, ignoring cell barring.

Only barred: The phone will camp only on barred cells.

11.8.2. WCDMA Cell Barred



Off: The phone will not access barred or reserved cells.

All cells: The phone will access any cell, also barred and reserved ones.

Only barred: The phone will only access barred cells.

Only reserved: The phone will only access reserved cells.

Only operator reserved: The phone will only access cells that are reserved for operator use.

Only future reserved: The phone will only access cells that are reserved for future use.

Only barred or reserved: The phone will only access cells that are barred or reserved.

Note: In WCDMA, it typically takes a while until this control function comes into effect. This is because cell barred/reserved settings are contained in System Information messages, which are sent only infrequently in WCDMA. TEMS Pocket cannot apply the control function until it has read System Information and found out about the cell's current status.

11.9. Interplay between Control Functions

This section describes the interdependencies among the various locking functions. For convenience, the cell lock, cell prevent, and band lock functions (sections 11.4, 11.5, 11.6) are referred to collectively below as "intra-technology" functions.

- While the phone is locked to a RAT, no control function associated with a different RAT can be applied (all such items are grayed out in the **Control Function Settings** dialog). The RAT lock must be released first.
- You can apply multiple intra-technology functions at the same time; for example, both a WCDMA band lock and a WCDMA cell lock.
- Applying an intra-technology function does *not* automatically lock the phone to the corresponding RAT.[1] If the phone is currently on a different RAT, then the intra-technology function will of course not have any immediate effect. It will take effect if and when the phone switches to the RAT associated with the intra-technology function.

11.10. Coexistence with Other TEMS Pocket Functions

Control functions cannot be applied during logfile replay.

Control functions cannot be applied manually while a script is running; but you can insert special actions in the script which apply control functions as part of the script execution. See section 8.5.1.

1. This is different from the behavior in TEMS Pocket 11.x, where an intra-technology lock triggered an automatic RAT lock.

11.11. Note on HTC Vivid Test Key Devices

HTC Vivid Test Key devices that have been configured for use with TEMS Investigation cannot respond to TEMS Pocket control functions while in that state. An error message will appear if you attempt to apply a control function. A message warning about the control functions being unavailable also appears when you start TEMS Pocket.

To be able to use the TEMS Pocket control functions, you must first disable external diagnostics for TEMS Investigation in the HTC SSD Test Tool which is installed on the phone:

- Under **All Tools**, select **Debug Tool**.
- When the phone is configured for TEMS Investigation connectivity, **Radio Flags** has the value 20000. This must be changed to zero (“0”).

- Press the Menu button and select **Write** to commit the change.
- Restart the phone.

12. Audio Quality Measurement

12.1. The POLQA Algorithm

POLQA (Perceptual Objective Listening Quality Analysis), defined in the ITU-T P.863 standard, is an algorithm which measures end-to-end speech quality by comparing one party's undistorted input signal (serving as reference) with the degraded version of the same signal received by the other party. The severity of the degradation as perceived by human listeners is assessed using highly refined models of the human ear and the brain's processing of auditory input.

POLQA is the successor of PESQ (ITU-T P.862) and has been specially developed for HD voice, 3G and 4G/LTE, and VoIP. The POLQA algorithm has been designed to eliminate known weaknesses of PESQ, particularly in these areas:

- Handling of new and complex types of distortions that arise from today's convergence and coexistence of voice, data, and multimedia application services. One example is the effects of packet loss and of packet loss concealment.
- Performance for higher-bandwidth audio signals (wideband, super-wideband).
- Performance for CDMA speech codecs and hence for CDMA networks in general.

More information about POLQA is available at ▶ www.itu.int/rec/T-REC-P.863/en.

12.2. POLQA in TEMS Pocket

POLQA is calculated in TEMS Pocket in mobile-originated voice calls made to a TEMS Call Generator. Such calls are set up in the "AQM" script action: see section 8.3.7.

POLQA requires a special TEMS Pocket license option.

In TEMS Pocket 12.4, POLQA is supported on Sony Ericsson Xperia arc S.

13. Wi-Fi Scanning

Wi-Fi scanning can be controlled from within TEMS Pocket. The effect of activating this scanning is exactly the same as when turning on Wi-Fi in the phone's regular user interface.

Wi-Fi scanning can be started manually as follows:

Press the Menu button and select **Actions** → **Turn On Wi-Fi**.

The function can also be activated in scripts by means of a special action; see section 8.5.6.

The output from Wi-Fi scanning is presented in the data views described in sections 4.12.2 and 4.12.3.

To stop Wi-Fi scanning manually:

Press the Menu button and select **Actions** → **Turn Off Wi-Fi**.

14. GPS Usage with TEMS Pocket

This chapter deals with using the device's built-in GPS or an external GPS with TEMS Pocket.

14.1. TEMS Pocket Functionality Requiring GPS Data

GPS data is required in TEMS Pocket in order to:

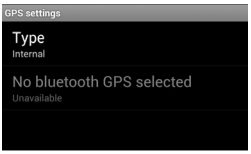
- Plot routes in the Outdoor Map view. See chapter 7.
- Make use of cell file look-up to present cells by name in data views and in the Outdoor Map view.
- Populate the GPS data view. See section 4.11.3.

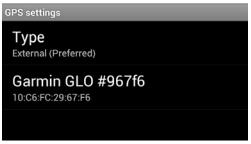
14.2. Supported External GPS Units

- GlobalSat BT-359

14.3. Selecting a GPS to Use with TEMS Pocket

Press the Menu button and select **Settings** → **General Settings** → **GPS**.





Type:

- **Internal:** Select this to always use the device's built-in GPS. Please note that the built-in GPS must be enabled in Android to be available to TEMS Pocket. See section 3.8.1.
- **External (Preferred):** Select this to make TEMS Pocket use an external GPS that has been Bluetooth paired with and connected to the TEMS Pocket device. The pairing and connect operations take place in Android and are not handled from within TEMS Pocket. Specifics differ between Android versions and are not described further here; but the operations are always done somewhere under the **Settings** menu.

Should the external GPS be accidentally disconnected or run out of battery, TEMS Pocket will automatically switch to the internal GPS as a fallback. This is why the string reads "(Preferred)". If and when the external GPS becomes available again (for example, when it has been recharged), TEMS Pocket will automatically revert to using the external GPS.

14.3.1. Built-in vs. External GPS: Pros and Cons

An external GPS has the advantage of reducing the power consumption in the mobile device. It is also easier to install in a position with good satellite coverage. For example, you might place the GPS on the car dashboard, where it has better satellite line of sight, and use the mobile device inside the car where GPS coverage might be less accurate or even unavailable.

On the other hand, it should be noted that the internal GPS units in today's smartphones have improved significantly in accuracy and acquisition rate compared to older devices, so that they deserve consideration as a convenient alternative to an external GPS. Using an external GPS also obviously means one more device to keep track of and to keep charged.

14.4. Controlling the GPS

Scripts in TEMS Pocket have a setting that governs GPS use, as explained in section 8.2.1.

When you record a logfile manually, you are prompted to decide whether to include GPS data in the logfile. See section 9.3.

TEMS Pocket also has commands for manually turning the GPS on and off. These commands are useful if you are doing tests without running a script.

- To turn on the GPS:

Press the Menu button and select **Actions** → **Turn On GPS**.

- To turn off the GPS:

Press the Menu button and select **Actions** → **Turn Off GPS**.

All of the operations mentioned in this section apply to any GPS, whether internal or external.

14.5. GPS Events

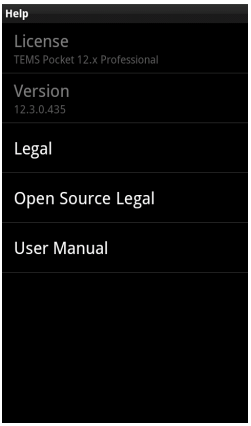
A number of events relating to GPS operation are generated by TEMS Pocket. Regarding these, turn to section 5.3.3.

15. Help Menu

On the Help menu you find the following:

- General information about the TEMS Pocket application.
- Legal information
- This user's manual in HTML format.

To access the Help menu, press the Menu button and tap **Help**.



License: The type of license purchased, e.g. "TEMS Pocket Professional".

Version: TEMS Pocket version, e.g. "12.4.0.<build number>".

Legal: Provides a link to the text of the TEMS Pocket software license agreement.

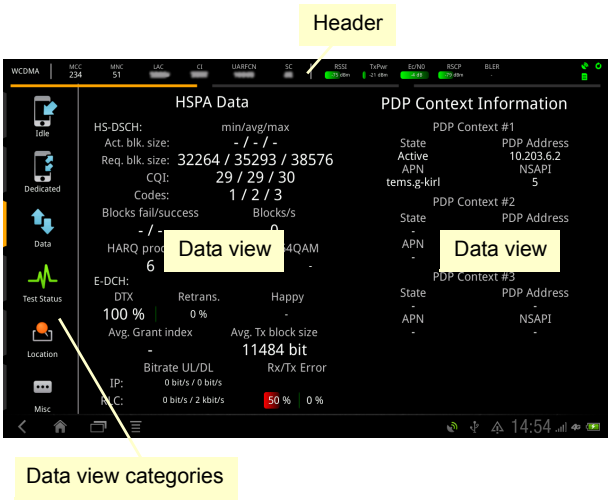
Open Source Legal: Provides a link to license agreements for open-source software components used in TEMS Pocket.

User Manual: Opens the present document in the phone's web browser. Document number: NT12-13421 ver 1.0

16. TEMS Pocket on Tablets

The TEMS Pocket user interface on tablets is generally similar to the mobile phone user interface. The differences that do exist are described in this chapter.

Below is a screenshot of the tablet user interface:

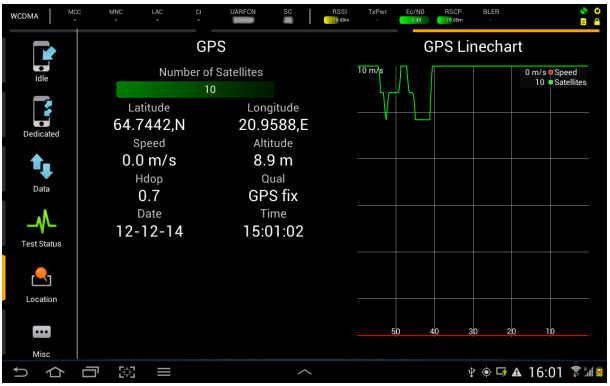


The following is worth noting:

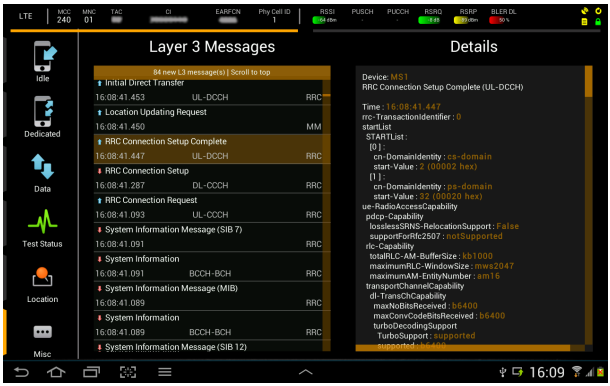
- In the header, the simple LED-style measurement value indicators shown on the phone screen are replaced by horizontal bars with the current numerical value displayed on top of them. Compare section 3.5.2.
- The data view category icons (found on the top-level screen on phones) are permanently visible on the tablet, in a column on the far left. Compare section 3.5.1.
- Data views are shown two at a time, side by side, in the main screen area. These are adjacent views in the currently selected data view category. Scrolling between data views is done in the usual manner.

- The pinpointing and logfile replay controls have been moved to the right-hand side of the screen for easy access when holding the tablet:

- The GPS data view is augmented with a graph (“GPS Line Chart”) showing the vehicle speed and the number of satellites seen:



- Plain-text decoded Layer 3 messages are not displayed inline in the message list but rather separately on the right:


LTE
MCC 240
MNC 01
TAC
CI
EARFCN
Phy Cell ID 1
RSSI
PUSCH
PUCCH
RSRQ
RSRP
BLER DL
Idle
Dedicated
Data
Test Status
Location
Misc
Layer 3 Messages
84 new L3 message(s) | Scroll to top
Initial Direct Transfer
16:08:41.453 UL-DCCH RRC
Location Updating Request
16:08:41.450 MM
RRC Connection Setup Complete
16:08:41.447 UL-DCCH RRC
RRC Connection Setup
16:08:41.287 DL-CCCH RRC
RRC Connection Request
16:08:41.093 UL-CCCH RRC
System Information Message (SIB 7)
16:08:41.091 RRC
System Information
16:08:41.091 BCCH-BCH RRC
System Information Message (MIB)
16:08:41.089 RRC
System Information
16:08:41.089 BCCH-BCH RRC
System Information Message (SIB 12)
Details
Device: MS1
RRC Connection Setup Complete (UL-DCCH)
Time : 16:08:41.447
rrc-TransactionIdentifier : 0
startList
START List :
[0] :
cn-DomainIdentity : cs-domain
start-Value : 2 (00002 hex)
[1] :
cn-DomainIdentity : ps-domain
start-Value : 32 (00020 hex)
ue-RadioAccessCapability
pdcp-Capability
losslessSRNS-RelocationSupport : False
supportForRfc2507 : notSupported
rlc-Capability
totalRLC-AM-BufferSize : kb1000
maximumRLC-WindowSize : mws2047
maximumAM-EntityNumber : am16
transportChannelCapability
dl-TransChCapability
maxNoBitsReceived : b6400
maxConvCodeBitsReceived : b6400
turboDecodingSupport
TurboSupport : supported
16:09

17. Battery Charging Considerations

Running several tasks in parallel on the Sony Ericsson Xperia arc or arc S phone places a heavy load on the phone battery. It may in fact happen that the battery charger cannot keep up with the power consumption, so that the battery eventually will be drained even if the charger is connected all the time. This situation may arise for example if the phone is more or less constantly using one service or another while at the same time having its display fully lit.

17.1. Choice of Phone Charger

When engaging the phone in highly power-consuming tasks, you should always use the regular phone charger. The USB charger, which is also provided with the phone, is only about one third as powerful, and this will often be vastly insufficient when running TEMS Pocket.

18. Configuration of DRT Transmitter

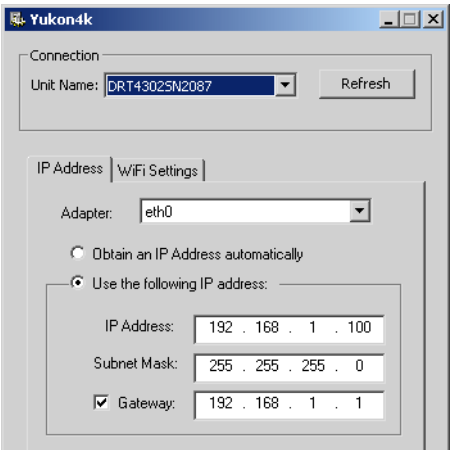
TEMS Pocket can be used in conjunction with a DRT4302A+ test transmitter. Such a transmitter can be included in the TEMS Pocket product package.

The DRT transmitter is controlled from a PC, to which it can be connected directly by means of a cable, over a local area network, or via Wi-Fi. The instructions that follow tell how to configure the transmitter and the PC in each case.

18.1. Setting Up the Transmitter

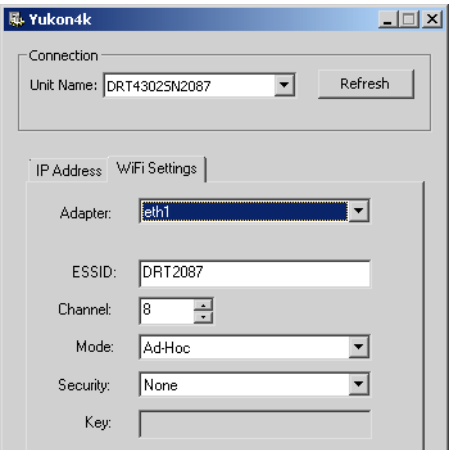
Before you begin, you need to install the **Nome** application, which functions as the transmitter's user interface, on the PC. Along with it, another application **Yukon4k** is installed which is used for configuring the transmitter's network connection.

1. After installing the above software, start Yukon4k. This application will find the DRT transmitter automatically and present its name as shown in the screenshot below.



2. On the **IP Address** tab you can set IP addresses for Ethernet and Wi-Fi. The adapter for Ethernet is “eth0” and by default uses the IP address 192.168.1.100. The Wi-Fi adapter is called “eth1” and uses the default IP address 192.168.2.100.
3. If you are going to connect to the transmitter via Ethernet, then for **Adapter** = “eth0” you need to select **Obtain an IP Address automatically** and click the **Set Unit IP Configuration** button. Compare section 18.3.
4. To be able to access the transmitter over Wi-Fi, enter appropriate settings on the **WiFi Settings** tab:
   - **ESSID:** Wi-Fi network name.
   - **Channel:** Select an unused channel in the range 1 ... 10.
   - **Mode:** Always **Ad-Hoc**. The transmitter’s Wi-Fi (802.11b/g) interface operates in an “ad-hoc” (peer-to-peer) configuration; the interface currently does not support the Wi-Fi “infrastructure” mode of operation. Control is determined when the unit is powered on. **Note** that any device that is going to receive signals from the DRT transmitter must support the “ad-hoc” mode of operation.
   - **Security:** “None” or WEP.
   - **Key:** If WEP is used, enter the WEP key here.

   When you are done entering the parameters, click the **Set Wireless Configuration** button.



5. If you want to change between Ethernet and Wi-Fi connection mode, you must reboot the transmitter. See section 18.1.1 below.

18.1.1. Changing between Ethernet and Wi-Fi Network Configuration Modes

On power-up or boot, the transmitter checks to see if there is an Ethernet cable connected to the DATA connector. If an Ethernet cable is present, the unit is configured to use that cable for control; if not, it selects Wi-Fi for communications.

To switch between these modes, it is necessary to turn off power to the transmitter and plug in or plug out the Ethernet cable as appropriate. Then power on the unit again, and the networking mode will be selected as just described.

18.2. Configuring the PC for Direct Connection

The DRT transmitter is shipped configured for a direct connection, with the static IP address 192.168.1.100 assigned to its Ethernet ("eth0") adapter. The PC's Ethernet adapter must likewise have its TCP/IP address configured as static and in the range 192.168.1.nnn, where nnn is any number between 1 and 255 except 100.

Follow these steps:

1. Access the Windows user interface showing your network connections:
   - (Windows 7) **Start** → **Control Panel** → **Network and Sharing Center** → **Change Adapter Settings**
   - (Windows Vista) **Start** → **Settings** → **Network Connections**
   - (Windows XP) **Start** → **Connect To** → **Show All Connections**.
2. Double-click **Local Area Connection**.
   - Click the **Properties** button. (Not applicable for Windows 7.)
3. In the box below "**This connection uses the following items:**", select:
   - (Windows 7/Vista) "Internet Protocol Version 4 (TCP/IPv4)"
   - (Windows XP) "Internet Protocol (TCP/IP)".
   - Then click the **Properties** button.
4. Select "**Use the following IP address**". Under **IP address**, enter 192.168.1.100. Under **Subnet mask**, enter 255.255.255.0. Then click OK.
5. Connect the transmitter to the PC's Ethernet port with a crossover 100Base-T cable.

18.3. Configuring the PC for LAN Connection

As explained in section 18.1, step 3, the Ethernet adapter of the DRT transmitter needs to be set to "obtain an IP address automatically". You need to change this setting on the PC as well.

Follow these steps:

1. Access the Windows user interface showing your network connections:
   - (Windows 7) **Start** → **Control Panel** → **Network and Sharing Center** → **Change Adapter Settings**
   - (Windows Vista) **Start** → **Settings** → **Network Connections**
   - (Windows XP) **Start** → **Connect To** → **Show All Connections**.
2. Double-click **Local Area Connection** and click the **Properties** button.
3. In the box below "**This connection uses the following items:**", select:
   - (Windows 7/Vista) "Internet Protocol Version 4 (TCP/IPv4)"
   - (Windows XP) "Internet Protocol (TCP/IP)".

4. Select "**Obtain an IP address automatically**".
5. Select "**Obtain DNS server address automatically**". Then click OK.
6. Connect the PC and the transmitter to available Ethernet ports on the same subnet of the LAN with normal (non-crossover) 100Base-T cables. If the remote location is not on the same subnet, then a VPN connection may be used to create an extended virtual subnet that can host the transmitter as if it were on a local subnet.

18.4. Verifying the Configuration

Here is how to confirm and troubleshoot the connection to the transmitter.

Before you begin, make sure your firewall is disabled.

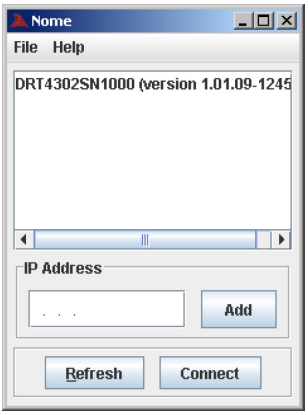
1. Connect the Ethernet cable or cables as described in sections 18.2 and 18.3.
2. Open a Windows command prompt (select **Start** → **Run**, enter cmd, and press Enter).
3. Ping the unit by typing the command ping drt4302snaaaa, where aaaa is the serial number of the device, and observe if responses are received.
4. If no response occurs, you may use Wireshark to capture the Ethernet traffic and determine the unit's current IP address. Enter the filter term nbns.flags == 0x2910 to isolate the Netbios Naming Service registration messages sent out by the transmitter. The IP address will be included in the message from the transmitter.

18.5. Configuring Transmitter Cell Information

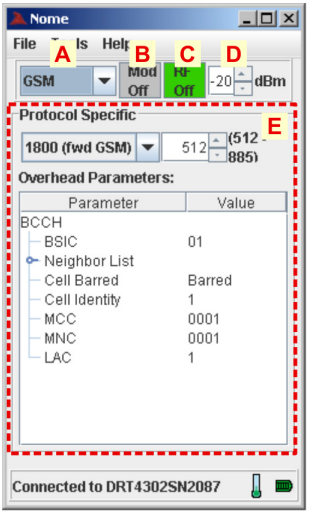
There are two ways to connect to the DRT transmitter and set up its cell information: through Nome or through a web interface.

18.5.1. Configuring the Transmitter Using Nome

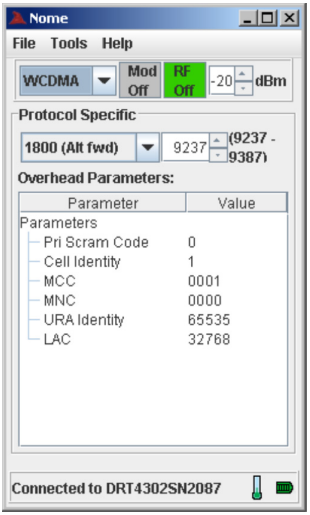
1. Start Nome and wait for the application to find the DRT transmitter. When found, it appears in the list box.



2. Select the DRT transmitter in the list, and click **Connect**. A new screen appears where you configure transmitter settings.



Technology = GSM



Technology = WCDMA

3. In the top section highlighted in the screenshot above, you can configure the following (letters refer to labels added in red):

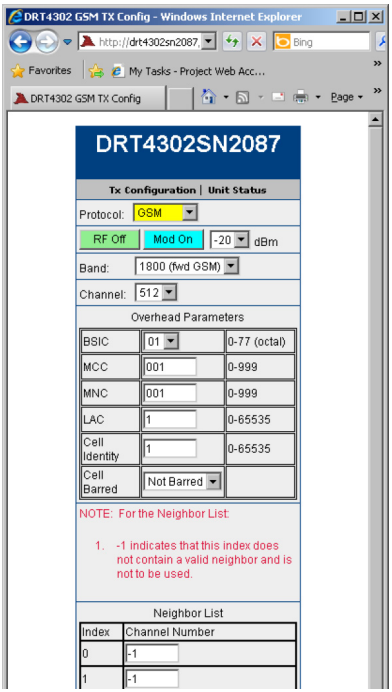
- **A:** Cellular technology, GSM or WCDMA.
- **B:** Modulation On or Off. **Mod On** means that the transmitter mimics a GSM or WCDMA downlink channel. **Mod Off** means that a CW signal is transmitted.
- **C:** **RF Off** = transmission turned off; **RF On** = transmission turned on.
- **D:** Output power, configurable in the range –20 ... +21 dBm.

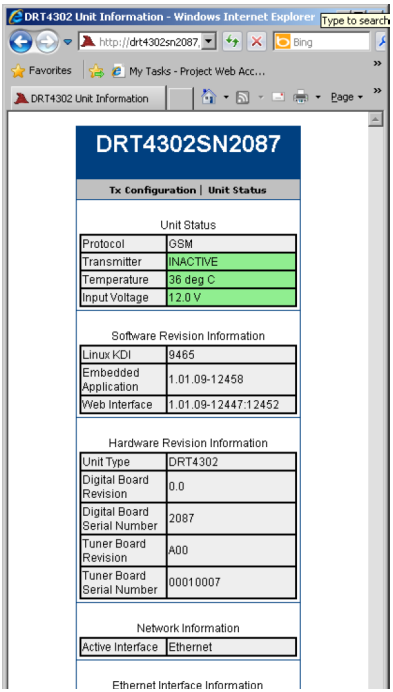
4. **Protocol Specific** section (**E**): Here you set what band and (U)ARFCN to use, along with other cell parameters.

18.5.2. Configuring the Transmitter Using Web Interface

The web browser used to access the DRT transmitter interface must support Ajax, for example: Internet Explorer 8 or later, Firefox 3.0.17, Firefox 3.6.3.

1. Connect to the transmitter with a web browser by entering the URL http://drt4302snaaaa, where aaaa is the serial number of the device. Alternatively, you can also enter the IP address for the transmitter: by default http://192.168.1.100 for Ethernet or http://192.168.2.100 for Wi-Fi.
2. The web browser interface looks somewhat different from the Nome application. Click the **Tx Configuration** link to set transmission parameters (left-hand screenshot below); compare section 18.5.1, step 3. Clicking the **Unit Status** link displays device status information, as shown in the screenshot on the right.


DRT4302 GSM TX Config - Windows Internet Explorer
http://drt4302sn2087
Favorites
My Tasks - Project Web Acc...
DRT4302 GSM TX Config
Page
DRT4302SN2087
Tx Configuration | Unit Status
Protocol: GSM
RF Off
Mod On
-20 dBm
Band: 1800 (fwd GSM)
Channel: 512
Overhead Parameters
BSIC 01 0-77 (octal)
MCC 001 0-999
MNC 001 0-999
LAC 1 0-65535
Cell Identity 1 0-65535
Cell Barred Not Barred
NOTE: For the Neighbor List:
1. -1 indicates that this index does not contain a valid neighbor and is not to be used.
Neighbor List
Index Channel Number
0 -1
1 -1


DRT4302 Unit Information - Windows Internet Explorer
Type to search
http://drt4302sn2087
Favorites
My Tasks - Project Web Acc...
DRT4302 Unit Information
Page
DRT4302SN2087
Tx Configuration | Unit Status
Unit Status
Protocol GSM
Transmitter INACTIVE
Temperature 36 deg C
Input Voltage 12.0 V
Software Revision Information
Linux KDI 9465
Embedded Application 1.01.09-12458
Web Interface 1.01.09-12447:12452
Hardware Revision Information
Unit Type DRT4302
Digital Board Revision 0.0
Digital Board Serial Number 2087
Tuner Board Revision A00
Tuner Board Serial Number 00010007
Network Information
Active Interface Ethernet
Ethernet Interface Information

19. Support Contact Information

19.1. Technical Support

If you have a question about TEMS Pocket which is not answered in any of the manuals nor in any of the other sources mentioned above, please contact technical support. Contact information is given at ▶ www.ascom.com/networktesting under the link "TEMS Support".

19.2. Follow Us

Our monthly newsletter TEMS News contains articles on new TEMS product releases and their features, general information about the TEMS portfolio, and much more. To sign up for this free service, go to ▶ www.ascom.com/nt/en/index-nt/nt-news.htm and click the "TEMS News" link. In this section of our website you can also read our press releases and find out about upcoming events where Ascom Network Testing will participate.

You can also follow Ascom Network Testing on Facebook, LinkedIn and YouTube, as well as subscribe to our RSS feed. Links are provided in the "Follow Us" section at ▶ www.ascom.com/networktesting.

Appendix A. Graphic Representation of Data

This appendix describes the color coding used to visualize value elements in data views.

A.1. GSM Data

Quantity	Green	Yellow	Red
RLC UL/DL bit rate (kbit/s)	100 ... 237	10 ... 99	0 ... 9
RLT Curr/Max (%)	100	91 ... 99	0 ... 90
RxLev (dBm)	–75 ... –10	–94 ... –76	–120 ... –95
RxQual	0	1 ... 4	5 ... 7
TxPower (dBm)	0 ... 9	10 ... 19	20 ... 31

A.2. WCDMA Data

Quantity	Green	Yellow	Red
BLER (%)	0 ... 20	21 ... 49	50 ... 100
E_c/N_0 (dB)	–10 ... 0	–15 ... –11	–34 ... –16
RLC UL/DL bit rate (kbit/s)	1000 ... 21100	100 ... 999	0 ... 99
RSCP (dBm)	–85 ... –15	–99 ... –86	–140 ... –100
RSSI (dBm)	–45 ... 0	–80 ... –46	–120 ... –81
TxPower (dBm)	–31 ... 0	1 ... 9	10 ... 50
TPC DL Increase command (%)	40 ... 60	not used	0 ... 39, 61 ... 100

Quantity	Green	Yellow	Red
TPC UL Increase command (%)	40 ... 60	not used	0 ... 39, 61 ... 100

A.2.1. HSPA Data

Quantity	Green	Yellow	Red
E-DCH Happy Rate (%)	50 ... 100	21 ... 49	0 ... 20
E-DCH Retransmission Rate (%)	50 ... 100	21 ... 49	0 ... 20

A.3. LTE Data

Quantity	Green	Yellow	Red
BLER DL (%)	0 ... 20	21 ... 49	50 ... 100
PUCCH Tx Power (dBm)	–30 ... –10	–9 ... 14	15 ... 30
PUSCH Tx Power (dBm)	–30 ... –10	–9 ... 14	15 ... 30
RSRP (dBm)	–70 ... –40	–99 ... –71	–140 ... –100
RSRQ (dB)	–9 ... 0	–23 ... –10	–30 ... –24

A.4. CDMA/EV-DO Data

Quantity	Green	Yellow	Red
RxPower (dBm)	–30 ... 0	–59 ... –31	–120 ... –60
TxPower (dBm)	–31 ... 0	1 ... 9	10 ... 50
E_c/I_0 (dB)	–9 ... 0	–23 ... –10	–32 ... –24
FER (%)	0 ... 2	3 ... 5	6 ... 100
FES (dBm)	–15 ... 10	–24 ... –16	–64 ... –25
PER (%)	0 ... 2	3 ... 5	6 ... 100

Quantity	Green	Yellow	Red
Finger Sum (dB)	–15 ... 10	–24 ... –16	–64 ... –25

A.5. POLQA

Quantity	Green	Yellow	Red
POLQA score	3.5 ... 5	2.5 ... 3.5	0 ... 2.5

A.6. GPS Data

Quantity	Green	Yellow	Red
Number of GPS satellites used in fix	4 ... 12	3	0 ... 2

Appendix B. Value Elements Presentable in Indoor Map View

This appendix lists the value elements that can be selected for route plotting in the Indoor Map view (see section 6.3.3) and Outdoor Map view (see section 7.2).

B.1. GSM Value Elements

- RLC DL bit rate
- RLC UL bit rate
- RxLev

B.2. WCDMA Value Elements

- E_c/N_0
- RLC DL bit rate
- RLC UL bit rate
- RSCP
- RSSI

B.3. LTE Value Elements

- RSRP
- RSRQ
- RSSI

B.4. CDMA/EV-DO Value Elements

- E_c

- E_c/I_o
- RLP DL bit rate
- RLP UL bit rate
- RxPwr

Appendix C. Default Settings in TEMS Pocket

This appendix lists default values for a selected editable settings in TEMS Pocket. Defaults that are not very interesting in themselves (such as the default body text in emails) are omitted.

C.1. Event and Layer 3 Message Settings

- All events listed in event log
- All messages listed in Layer 3 Messages data view
- Notification box shown for all error events
- Other presentation options turned off

C.2. GPS Settings

- Type: Internal

C.3. Indoor Map

- All layers visible

C.4. Outdoor Map

- All layers visible
- Map type: Roadmap

C.5. Script Editor

C.5.1. General Settings

- **Logfile recording:** Enabled
- **GPS positioning:** Enabled

These defaults are the same for all actions in which they occur:

- **Preguard:** 10 s
- **Postguard:** 10 s
- **WiFi association:** Enabled

C.5.2. AQM Action Settings

- **Call duration:** 600 s

C.5.3. Email Action Settings

- **Port:** 25
- **Security:** None
- **Authentication method:** Plain
- **Message type:** Custom text
- **Number of emails:** 1

C.5.4. FTP Action Settings

- **Command:** Get
- **File size:** 1024 kB

C.5.5. Idle Action Settings

- **Idle duration:** 10 s

C.5.6. Ping Action Settings

- **Packet size:** 56 bytes

- **Timeout:** 1 s
- **Number of pings:** 10
- **Interval:** 1000 ms

C.5.7. SMS Action Settings

- **Message type:** Custom text
- **Number of SMS:** 1
- **Wait for delivery report:** Enabled
- **Delivery timeout:** 60 s
- **Send timeout:** 60 s
- **Override default SMSC:** Disabled

C.5.8. Voice Action Settings

- **Call duration:** 30 s
- **Redial on dropped call:** Disabled

C.5.9. Voice + Data Action Settings

See sections C.5.4 and C.5.8.

C.5.10. Wait Action Settings

- **Wait duration:** 10 s

C.6. Control Functions

All control functions turned off.

Appendix D. Cell File Format

An XML cell file imported into TEMS Pocket must include the tags shown in the example below (except those identified as “optional content”). The tag names are all self-explanatory; in this example, one cell each is defined for GSM, WCDMA, LTE, and CDMA[1]. This data is a subset of the XML cell file format used in TEMS Investigation; see TEMS Investigation Technical Reference, chapter “Format of XML Cell File”.

Please note that TEMS Pocket can only display characters from the Extended ASCII set. Characters outside that set will appear as question marks “?” in the TEMS Pocket user interface.

Cell File Content

```
<TEMS_CELL_EXPORT>

  <GSM>
    <CELL_LIST>
      <GSM_CELL>
        <CELLNAME>My GSM Cell #1</CELLNAME>
        <CGI>
          <MCC>240</MCC>
          <MNC_LENGTH>2</MNC_LENGTH>
          <MNC>1</MNC>
          <LAC>5028</LAC>
          <CI>4362</CI>
        </CGI>
        <BSIC>
          <NCC>2</NCC>
          <BCC>2</BCC>
        </BSIC>
        <CHANNEL_INFO>
          <BCCH>
```

1. No EV-DO specific data is given in the cell file; the <CDMA> data serves for EV-DO as well.

```
            <ARFCN>19</ARFCN>
          </BCCH>
        </CHANNEL_INFO>
<!--  OPTIONAL CONTENT -->
        <POSITION>
          <GEODETIC_DATUM>WGS84</GEODETIC_DATUM>
          <LATITUDE>47.949722</LATITUDE>
          <LONGITUDE>-17.355278</LONGITUDE>
        </POSITION>
<!-- END OPTIONAL CONTENT -->
      </GSM_CELL>
    </CELL_LIST>
  </GSM>

  <WCDMA>
    <CELL_LIST>
      <WCDMA_CELL>
        <CELLNAME>My WCDMA Cell #1</CELLNAME>
        <UARFCN_DL>10787</UARFCN_DL>
        <SC>124</SC>
        <CGI>
          <MCC>240</MCC>
          <MNC_LENGTH>2</MNC_LENGTH>
          <MNC>5</MNC>
          <LAC>27</LAC>
          <CI>60001</CI>
        </CGI>
<!--  OPTIONAL CONTENT -->
        <POSITION>
          <GEODETIC_DATUM>WGS84</GEODETIC_DATUM>
          <LATITUDE>55.949722</LATITUDE>
          <LONGITUDE>-9.355278</LONGITUDE>
        </POSITION>
<!-- END OPTIONAL CONTENT -->
      </WCDMA_CELL>
    </CELL_LIST>
  </WCDMA>

  <LTE>
    <CELL_LIST>
      <LTE_CELL>
        <CELLNAME>My LTE Cell #1</CELLNAME>
```

```
        <EARFCN_DL>5206</EARFCN_DL>
        <POSITION>
          <GEODETIC_DATUM>WGS84</GEODETIC_DATUM>
          <LATITUDE>51.137990700</LATITUDE>
          <LONGITUDE>-9.943741439</LONGITUDE>
        </POSITION>
        <PCI>1</PCI>
        <PCIG>10</PCIG>
<!--  OPTIONAL CONTENT -->
        <LTE_CGI>
          <MCC>193</MCC>
          <MNC>11</MNC>
          <TAC>18</TAC>
          <CI>123456789</CI>
        </LTE_CGI>
<!-- END OPTIONAL CONTENT -->
      </LTE_CELL>
    </CELL_LIST>
  </LTE>

  <CDMA>
    <CELL_LIST>
      <CDMA_CELL>
        <CELLNAME>My CDMA Cell #1</CELLNAME>
        <PN_OFFSET>60</PN_OFFSET>
        <CDMA_CHANNEL_INFO>
          <BAND>CDMA 800</BAND>
          <CHANNEL>384</CHANNEL>
        </CDMA_CHANNEL_INFO>
<!--  OPTIONAL CONTENT -->
        <POSITION>
          <GEODETIC_DATUM>WGS84</GEODETIC_DATUM>
          <LATITUDE>46.949722</LATITUDE>
          <LONGITUDE>-17.355278</LONGITUDE>
        </POSITION>
<!-- END OPTIONAL CONTENT -->
      </CDMA_CELL>
    </CELL_LIST>
  </CDMA>

</TEMS_CELL_EXPORT>
```

Appendix E. Cell Identification

This appendix describes the algorithms used by TEMS Pocket to identify network cells with entries in a cell file. For the cell file format, see appendix D.

The following procedure is used to find a matching cell:

- Try to match cell parameters in the cell file, also considering the geographical position of the sample. Specifically:
  - For a GSM cell, ARFCN and BSIC.
  - For a WCDMA cell, UARFCN and SC.
  - For an LTE cell, EARFCN and PCI + PCIG.
  - For a CDMA cell, RF channel and PN offset.
- A position is considered valid if the distance to the cell is less than 100 km.
- If multiple matches are found within a 100 km radius, the closest cell is picked.
- If the position is invalid, no result is returned unless a unique match is found in the cell file.

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