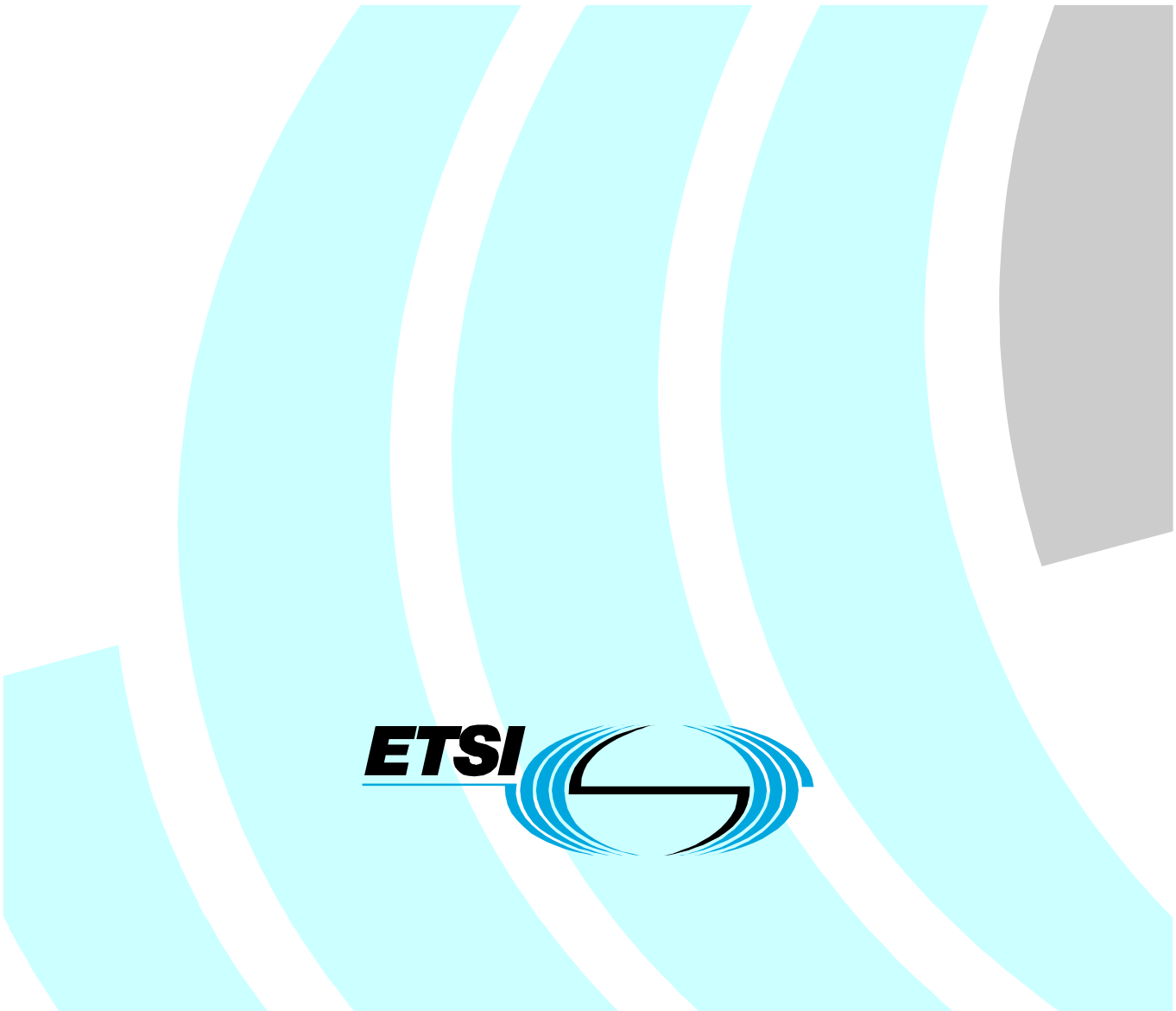
# ETSI TS 102 250-4 V1.1.1 (2003-10)

*Technical Specification*

# Speech Processing, Transmission and Quality Aspects (STQ); QoS aspects for popular services in GSM and 3G networks; Part 4: Requirements for Quality of Service measurement equipment



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# Contents

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# Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Speech Processing, Transmission and Quality Aspects (STQ).

The present document is part 4 of a multi-part deliverable covering the QoS aspects for popular services in GSM and 3G networks, as identified below:

Part 1: "Identification of Quality of Service aspects";

Part 2: "Definition of Quality of Service parameters and their computation";

Part 3: "Typical procedures for Quality of Service measurement equipment";

**Part 4: "Requirements for Quality of Service measurement equipment";**

Part 5: "Definition of typical measurement profiles";

Part 6: "Post processing and statistical methods".

Part 1 identifies QoS aspects for popular services in GSM and 3G networks. For each service chosen QoS indicators are listed. They are considered to be suitable for the quantitatively characterization of the dominant technical QoS aspects as experienced from the end-customer perspective.

Part 2 defines QoS parameters and their computation for popular services in GSM and 3G networks. The technical QoS indicators, listed in part 1, are the basis for the parameter set chosen. The parameter definition is split into two parts: the abstract definition and the generic description of the measurement method with the respective trigger points. Only measurement methods not dependent on any infrastructure provided are described in the present document. The harmonized definitions given in the present document are considered as the prerequisites for comparison of QoS measurements and measurement results.

Part 3 describes typical procedures used for QoS measurements over GSM, along with settings and parameters for such measurements.

Part 4 defines the minimum requirements of QoS measurement equipment for GSM and 3G networks in the way that the values and trigger-points needed to compute the QoS parameter as defined in part 2 can be measured following the procedures defined in part 3. Test-equipment fulfilling the specified minimum requirements, will allow to perform the proposed measurements in a reliable and reproducible way.

Part 5 specifies test profiles which are required to enable benchmarking of different GSM or 3G networks both within and outside national boundaries. It is necessary to have these profiles so that when a specific set of tests are carried out then customers are comparing "like for like" performance.

Part 6 describes procedures to be used for statistical calculations in the field of QoS measurement of GSM and 3G networks using probing systems.

# Introduction

All the defined quality of service parameters and their computations are based on field measurements. That indicates that the measurements were made from customers point of view (full End-to-end perspective, taking into account the needs of testing).

It is assumed that the end customer can handle his mobile and the services he wants to use (operability is not evaluated at this time). For the purpose of measurement it is assumed that:

- the service is available and not barred for any reason;
- routing is defined correctly without errors; and
- the target subscriber equipment is ready to answer the call.

Voice quality values measured should only be employed by calls ended successfully for statistical analysis.

However, measured values from calls ended unsuccessfully (e.g. dropped) should be available for additional evaluations and therefore, must be stored.

Further preconditions may apply when reasonable.

# 1 Scope

The present document defines the minimum requirements of QoS measurement equipment for GSM and 3G networks in the way that the values and trigger-points needed to compute the QoS parameter as defined in TS 102 250-2 [2] can be measured following the procedures defined in TS 102 250-3 [3].

Test-equipment fulfilling the specified minimum requirements, will allow to perform the proposed measurements in a reliable and reproducible way.

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

[1] ETSI TS 100 910: "Digital cellular telecommunications system (Phase 2+); Radio transmission and reception (3GPP TS 05.05)".

[2] ETSI TS 102 250-2: "Speech Processing, Transmission and Quality Aspects (STQ); QoS aspects for popular services in GSM and 3G networks; Part 2: Definition of Quality of Service parameters and their computation".

[3] ETSI TS 102 250-3: "Speech processing, Transmission and Quality Aspects (STQ); QoS aspects for popular services in GSM and 3G networks; Part 3: Typical procedures for Quality of Service measurement equipment".

# 3 Abbreviations

For the purposes of the present document the following abbreviations apply:

| | |
|---|---|
| 3GPP | 3rd Generation Partnership Project |
| AD | Access Delay |
| DQ | Data Quality |
| FQT | Fixed QoS Test equipment |
| GPS | General Positioning System |
| GSM | Global System for Mobile communication |
| ISDN | International Subscriber Digital Network |
| LAC | Location Area Code |
| MCC | Mobile Country Code |
| MM | Mobile Mobile call |
| MMI | Man Machine Interface |
| MNC | Mobile Network Code |
| MQT-LC | Mobile QoS Testequipment Local Control |
| MQT-RC | Mobile QoS Testequipment Remote Control |
| MS | Mobile Station |
| MSC | Mobile Switching Centre |
| PDN | Packet Data Network |
| PMN | Public Mobile Network |
| PSTN | Public Switching Telephone Network |

| | |
|---|---|
| PSD | Packet Switched |
| PWR | PoWser Supply |
| QoS | Quality of Service |
| RF | Radio Frequency |
| SA | Service Access |
| SMS | Short Message Service |
| SMSC | Short Message Service Center |
| SpQ | Speech Quality |
| ST | Setup Time |
| TS | Timeslot |
| WGS-84 | World Geodetic System 1984 |

# 4 Overview

All tests are based on emulation of a typical customer using services provided in a public mobile network (PMN). All of the services to be tested (see TS 102 250-2 [2]) can be emulated by the Mobile QoS Test-equipment (MQT) which can be installed in a vehicle, can be carried around by a pedestrian or is installed for semi-stationary use (e.g office environment).

Test scenarios need to distinguish the following principal user cases.

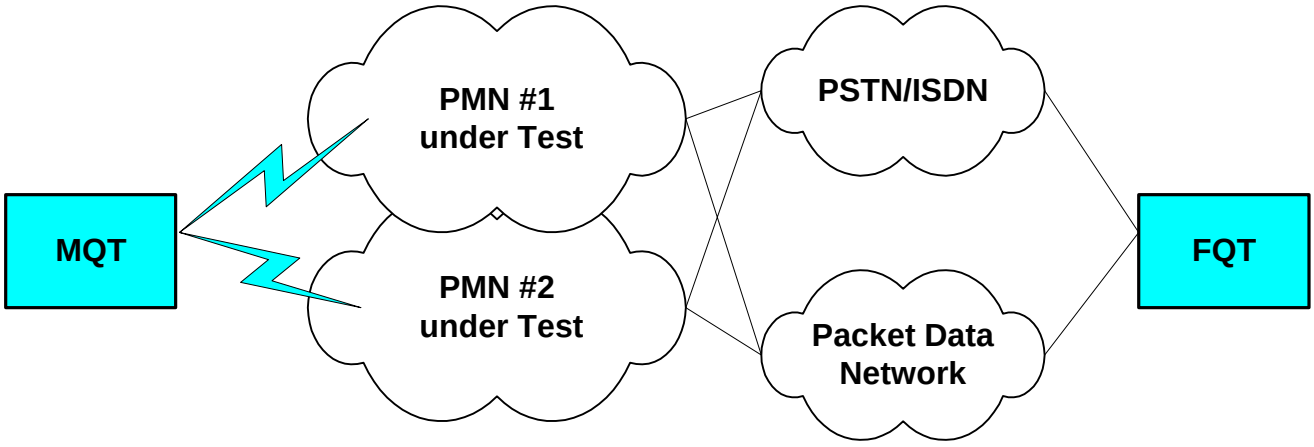



**Figure 1**

(1) User-to-user services (typically telephony);

(2) Store-and-forward services (e.g. SMS);

(3) Information (down-load) services (e.g. accessing the internet);

(4) Push services.

Some of the services require test-equipment connected to a non-mobile network (PSTN, ISDN, PDN) emulating the counterpart of the typical mobile customer or the host offering the service. This part will be called Fixed QoS Test-equipment (FQT). The FQT for type (3) and (4) services could be composed as a (virtual) Internet Service Provider.

Below, requirements will be described on a per scenario basis. Those requirements not belonging to a specific scenario, e.g. antenna requirements, will be grouped together.

Depending on how far the MQT can be automated or not, we can distinguish between:

- MQT-LC: local control and operation; or
- MQT-RC: remote control and operation.

Although the same type of classification (-LC or -RC) can be made for FQT, most of the FQT are remote controlled.

# 5 General requirements

## 5.1 General requirement for data logging

The measurement system must provide means to collect all relevant measurement data and other information related to the measurement in one place.

Also, the system should provide means to make sure that logged information is usable and meaningful.

## 5.2 Required information for logging

Measurement results need to be reproduced if necessary. This requires that the conditions under which the measurement has been done need to be recorded.

The following list is considered to be minimum required.

Type of mobile, firmware version:

- Antenna type, including any extra attenuation;
- Timestamp for each data item;
- Network ID (MCC, MNC, CI, LAC), respective data items with a rate sufficient to track the mobile's behavior;
- All other information on test case control parameters required to re-run the test case under the same conditions;
- Additional set-up information depending on the particular type of test.

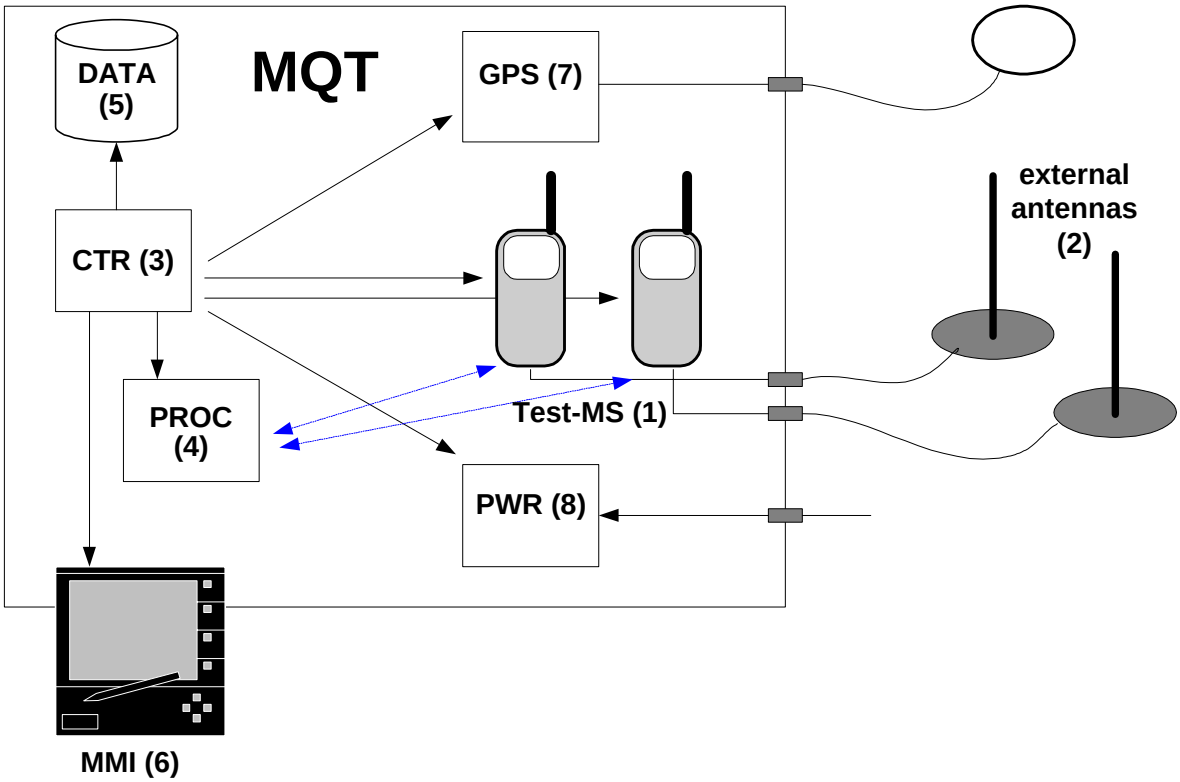
Additionally, the following information should be recorded whenever possible:

- Geographical information (position, speed, heading).

# 6 Mobile QoS Test-equipment (MQT)

## 6.1 Overview

The typical components of the Mobile QoS Test-equipment (MQT) will be as illustrated in figure 2.




| | | |
|---|---|---|
| (1) | Test-MS: | Mobile Station emulating the typical customer MS (1…n). |
| (2) | Antenna: | Test-MS antenna or external antenna. |
| (3) | Controller: | Controls all the active parts in MQT. |
| (4) | Processor: | Preprocessing of measurement data. |
| (5) | Storage: | Storage of measurement data and programs. |
| (6) | MMI: | Man Machine Interface for control of a MQT-LC or for diagnostics in case of a MQT-RC. |
| (7) | GPS: | Geographical Positioning System. |
| (8) | PWR: | Power Supply. |

**Figure 2**

## 6.2 Test-MS

Basic requirements on the Test-MS:

- Compliant to 3GPP specifications.
- It is worthwhile to apply additional quality assurance measures to ensure that the Test-MS satisfies the requirements for the tests.
- Remote controllable to initiate the QoS tests with required parameter settings.
- Delivering all data required for QoS tests.
- Allowing to reach the best configuration provided by the network (e.g. max. number of TS allowed, best type of speech codec, …).
- Switching between the MS own antenna and an external antenna.
- Electrical interface for audio input and output.
- External control of power supply.

## 6.3 Antennas

Depending on the customer, the Test-MS' own antennas or external antennas have to be used.

The used antenna configuration (MS own/external antenna with attenuation) is logged in the measurement data file.

The MS own antennas are typically used for pedestrian in- and out-door or stationary measurements in office environment.

The antennas have to be arranged in a well defined fixed way with a minimum distance to each other reducing RF-influence on an acceptable level in an equal radio environment. The coupling loss between 2 MS should be min. 40,5 dB (as specified in clause 2 of TS 100 910 [1]).

External antennas are typically used for measurements in vehicles (car, train, ship):

- Recommended antenna types for typical customer profile:
  - Car mounted: external antenna, no extra attenuation;
  - In-car use: external antenna with extra attenuation;
- Cable loss;
- Antenna gain;
- RF-combiners.

## 6.4 Controller/processor/storage

The performance of the unit should be high enough and have no impact on the correctness of the data collection.

## 6.5 Man Machine Interface (MMI)

### 6.5.1 MQT-LC

The MMI has to be user-friendly and allow full operation of the MQT by the operator. The main functionalities can be monitored and the operator is alerted in case of main failures. Some basic failure diagnostic is possible.

### 6.5.2 MQT-RC

An MMI can be connected to perform basic tests and some failure diagnostics. Unattended systems should provide means to generate alarms upon operational faults in the system.

## 6.6 Geographical positioning

For outdoor measurements the use of the Navstar Global Positioning System (GPS) is common standard. Depending on the required accuracy the GPS-receiver has to be supported with data of a differential GPS (DGPS) or by a dead-reckoning system.

### 6.6.1 Format of geographical co-ordinates

- Out-door: WGS-84.
- In-door: Fixed reference points.

### 6.6.2 Accuracy

The accuracy of the geographical positioning must be high enough for all outdoor measurements i.e. for drive test and pedestrian walk tests.

## 6.7 Time sources

- Accuracy and stability of time sources should be high enough to reach the equired accuracy of computed parameter (e.g. set-up time in [ms]).
- In case of a computation based on trigger points in MQT and FQT, the abslute timestamp values have to reach the required accuracy or a synchronization procedure has to be performed between the MQT and FQT time sources.

## 6.8 Environnemental conditions

The equipment should be supplied with sufficient information that the user canoperate the equipment within the operating parameters ensuring accurate measurements.

# 7 Fixed QoS Test-equipment (FQT)

## 7.1 General

Depending on the test-scenarios defined in clause 4 of the present document, there will be different requiements for the FQT.

## 7.2 FQT for user-to-user services

Telephony:

- dedicated equipment which can be a simulation of end-user equipment (e.g. PC-module with audio interface);
- answering machine.

Type of equipment and interfaces (e.g. ISDN-So, PSTN-ab, MSC build-in ) has to be specified in the profile.

## 7.3 FQT for store-and-forward services

SMS:

- mobile to mobile, no interface in the storing element (SMSC).

## 7.4 FQT for information (download) services

Server to be specified for every service.

## 7.5 FQT for push services

Server to be specified for every service.

## 7.6 Controller

The performance of the unit should be high enough and have no impact on the correctness of the data collection.

## 7.7 Time-sources

Accuracy and stability of time sources should be high enough to reach therequired accuracy of computed parameter (e.g. set-up time in [ms]).

In case of a computation based on trigger points in MQT and FQT, the absolute timestamp values have to reach the required accuracy or a synchronization procedure has to be performed between the MQT and FQT time sources.

## 7.8 Environmental conditions

The equipment should be supplied with sufficient information that the user can operate the equipment within the operating parameters ensuring accurate measurements.

# 8 QoS parameter export

## 8.1 Overview

Goal of this interface format is to have a flexible means to adapt the measurement data related to QoS events of different vendors to the requirements of the user for further processing.

For every QoS event you need a parameter set for the export. The parameter set can be configured by the user. The order of the parameter is selectable. The configuration of the parameter set can be saved in a text file. The extension of the file is PAR.

The export file is selectable as ASCII-file, excel-sheet etc. The content and the format of the export file is given by a defined parameter set.

The information of the parameter set is in respect to the QoS event.

## 8.2 Description of standard parameter set

The following information must be available at a minimum parameter set. All datas shall have the highest possible precision.

### 8.2.1 Geo data

Date, time, longitude, latitude.

### 8.2.2 QoS data

All QoS parameters defined in TS 102 250-2 [2] are selectable. In all cases where a ratio is defined in the table will occur Res (result) instead of R (ratio).

#### 8.2.2.1 Telephony

SA-T, ST-T, SpQ (dl-ul), CCRes CS.

#### 8.2.2.2 SMS

SA SMS MO, AD SMS MO, DT SMS, CRes SMS CS.

#### 8.2.2.3 CSD

SA-CSD, AD-CSD, DQ, CCRes-CSD.

#### 8.2.2.4 PSD

SA-PSD, AD-PSD, DQ, SeCRes-PSD.

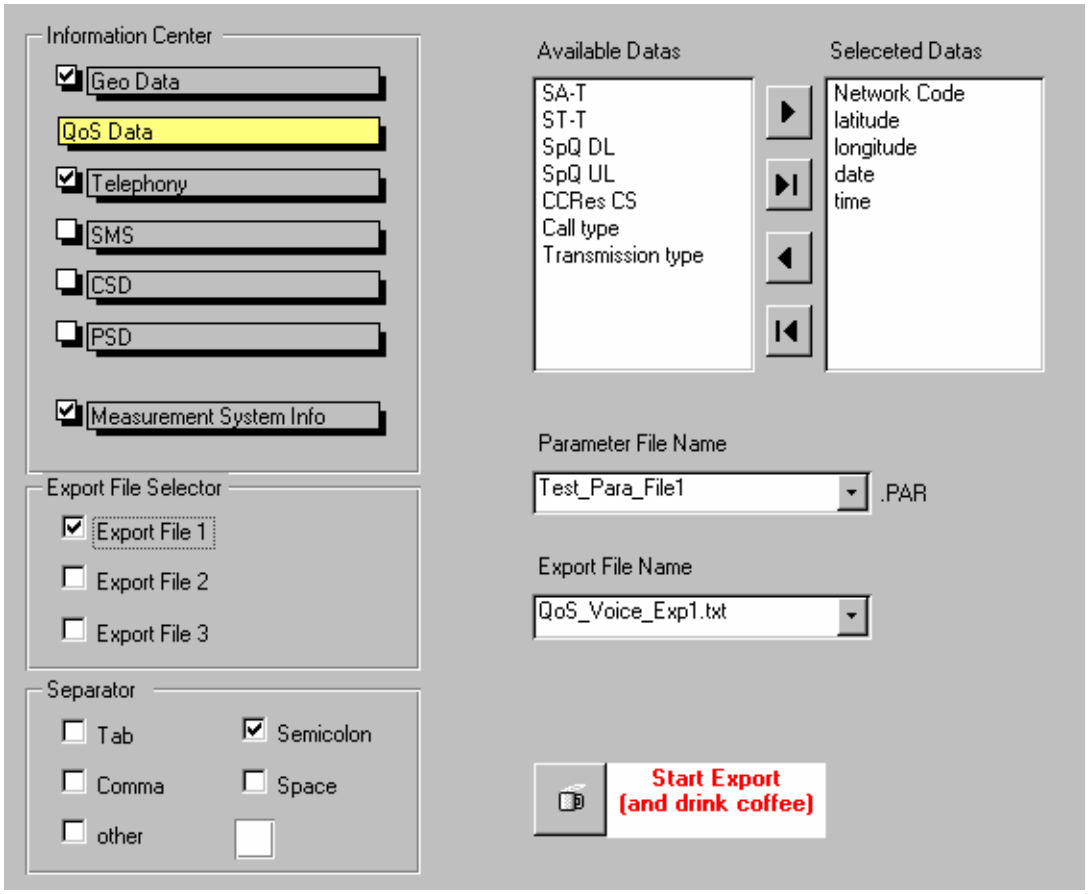
### 8.2.3 Measurement system info

- Call type: MO, MT, MM.
- Transmission type: down, up, half duplex, duplex.
- Mobile or channel: 1 to x.

## 8.3 Data selection and file format

The data selection box and the different export files are defined in clauses 8.3.1 to 8.3.4.

### 8.3.1 Data selection box




In the **Information Center** you select the data groups.

The export file is selected in **Export File Selector** box.

In the **Separator** box you define the separator for the file export.

In the **Available Data** box are shown all parameters from the selected data groups. With the arrows you can select or deselect the wanted parameters into the **Selected Data** box.

To save the selected parameter set you enter a file name in the **Parameter File Name** box. The standard extension is PAR.

The name for the export file is entered into the **Export File Name** box (with an extension).

After hitting the **Start** button the parameter set and the selected data will be saved under the given names.

### 8.3.2 Export File 1

| date | time | Network Code | long | lat | qos_param | qos_value | explanation |
|---|---|---|---|---|---|---|---|
| 30.07.2001 | 10:20:30.40 | 1 | 7.543423 | 54.543423 | SA-T | >0 | Service Accessibility Telephony |
| 30.07.2001 | 10:20:40.50 | 1 | 7.543425 | 54.543425 | ST-T | 10,05 | Setup Time Telephony |
| 30.07.2001 | 10:22:30.55 | 1 | 7.543426 | 54.543426 | SpQ | 2,54 | Speech Quality |
| 30.07.2001 | 10:22:35.70 | 1 | 7.543429 | 54.543429 | CCRes CS | OK | Call Completion Rate Circuit Switched |
| 30.07.2001 | 10:20:30.40 | 1 | 7.543423 | 54.543423 | SA-T | >0 | Service Accessibility Telephony |
| 30.07.2001 | 10:20:40.50 | 1 | 7.543425 | 54.543425 | ST-T | 9,81 | Setup Time Telephony |
| 30.07.2001 | 10:22:30.55 | 1 | 7.543426 | 54.543426 | CCRes CS | NO | Call Completion Rate Circuit Switched |
| 30.07.2001 | 10:20:30.40 | 1 | 7.543423 | 54.543423 | SA-T | >0 | Service Accessibility Telephony |
| 30.07.2001 | 10:20:40.50 | 1 | 7.543425 | 54.543425 | ST-T | 0,00 | Setup Time Telephony (=> setup failure?) |
| 30.07.2001 | 10:22:30.55 | 1 | 7.543426 | 54.543426 | CCRes CS | NO | Call Completion Rate Circuit Switched |
| 30.07.2001 | 10:20:30.40 | 1 | 7.543423 | 54.543423 | SA SMS MO | OK | Service Accessibility SMS mobile originated |
| 30.07.2001 | 10:20:37.50 | 1 | 7.543425 | 54.543425 | AD SMS MO | 4,56 | Access Delay SMS MO |
| 30.07.2001 | 10:20:39.45 | 1 | 7.543426 | 54.543426 | DT SMS | 11,55 | End-to-End Delivery Time SMS |
| 30.07.2001 | 10:20:40.00 | 1 | 7.543426 | 54.543426 | CRes SMS CS | OK | Completion Rate SMS Circuit Switched |
| 30.07.2001 | 10:20:30.40 | 1 | 7.543423 | 54.543423 | SA SMS MO | OK | Service Accessibility SMS mobile originated |
| 30.07.2001 | 10:20:37.50 | 1 | 7.543425 | 54.543425 | AD SMS MO | 4,56 | Access Delay SMS MO |
| 30.07.2001 | 10:21:09.45 | 1 | 7.543426 | 54.543426 | DT SMS | 31,55 | End-to-End Delivery Time SMS |
| 30.07.2001 | 10:21:10.00 | 1 | 7.543426 | 54.543426 | CRes SMS CS | DUP | Completion Rate SMS Circuit Switched |
| 30.07.2001 | 10:20:30.40 | 1 | 7.543423 | 54.543423 | SA SMS MO | OK | Service Accessibility SMS mobile originated |
| 30.07.2001 | 10:20:37.50 | 1 | 7.543425 | 54.543425 | AD SMS MO | 4,56 | Access Delay SMS MO |
| 30.07.2001 | 10:20:39.45 | 1 | 7.543426 | 54.543426 | DT SMS | 11,55 | End-to-End Delivery Time SMS |
| 30.07.2001 | 10:20:40.00 | 1 | 7.543426 | 54.543426 | CRes SMS CS | DAM | Completion Rate SMS Circuit Switched |
| 30.07.2001 | 10:20:30.40 | 1 | 7.543423 | 54.543423 | SA SMS MO | OK | Service Accessibility SMS mobile originated |
| 30.07.2001 | 10:20:37.50 | 1 | 7.543425 | 54.543425 | AD SMS MO | 4,56 | Access Delay SMS MO |
| 30.07.2001 | 10:20:39.45 | 1 | 7.543426 | 54.543426 | DT SMS | 0 | End-to-End Delivery Time SMS |
| 30.07.2001 | 10:20:40.00 | 1 | 7.543426 | 54.543426 | CRes SMS CS | NO | Completion Rate SMS Circuit Switched |

This file type shows a sequential parameter flow. All QoS parameters occurs in a chronological way.

### 8.3.3 Export File 2

This file type shows a parallel parameter flow. All parameters for one service (e.g. telephony or SMS) are in one line. Start and end time as well as start and end position is available.

| Network Code | service | SA-T | ST-T | SpQ DL | SpQ UL | CCRes CS | SA SMS MO | AD SMS MO | DT SMS | CRes SMS CS | time end | long end | lat end |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | telephony | >0 | 10,05 | 2,54 | 2,45 | ok | | | | | 10:22:35.70 | 7.543429 | 54.543429 |
| 1 | telephony | >0 | 9,81 | | | no | | | | | 10:22:30.55 | 7.543426 | 54.543426 |
| 1 | telephony | >0 | 0 | | | no | | | | | 10:22:30.55 | 7.543426 | 54.543426 |
| 1 | SMS | | | | | | ok | 4,56 | 11,55 | ok | 10:20:40.00 | 7.543426 | 54.543426 |
| 1 | SMS | | | | | | ok | 4,56 | 31,55 | dup | 10:21:10.00 | 7.543426 | 54.543426 |
| 1 | SMS | | | | | | ok | 4,56 | 11,55 | dam | 10:20:40.00 | 7.543426 | 54.543426 |
| 1 | SMS | | | | | | ok | 4,56 | 0 | no | 10:20:40.00 | 7.543426 | 54.543426 |

## 8.3.4 Export File 3

This file type is a mixture from type 1 and 2.

| date | time start | long start | lat start | Network Code | service | SA-T | ST-T | SpQ DL | SpQ UL | CCRes CS | SA SMS MO | AD SMS MO | DT SMS | CRes SMS CS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 30.07.2001 | 10:20:30.40 | 7.543423 | 54.543423 | 1 | telephony | >0 | | | | | | | | |
| 30.07.2001 | 10:20:40.50 | 7.543425 | 54.543425 | 1 | telephony | | 10,05 | | | | | | | |
| 30.07.2001 | 10:22:30.55 | 7.543426 | 54.543426 | 1 | telephony | | | 2,54 | 2,45 | | | | | |
| 30.07.2001 | 10:22:35.70 | 7.543429 | 54.543429 | 1 | telephony | | | | | OK | | | | |
| 30.07.2001 | 10:20:30.40 | 7.543423 | 54.543423 | 1 | telephony | >0 | | | | | | | | |
| 30.07.2001 | 10:20:40.50 | 7.543425 | 54.543425 | 1 | telephony | | 9,81 | | | | | | | |
| 30.07.2001 | 10:22:30.55 | 7.543426 | 54.543426 | 1 | telephony | | | | | NO | | | | |
| 30.07.2001 | 10:20:30.40 | 7.543423 | 54.543423 | 1 | telephony | >0 | | | | | | | | |
| 30.07.2001 | 10:20:40.50 | 7.543425 | 54.543425 | 1 | telephony | | 0,00 | | | | | | | |
| 30.07.2001 | 10:22:30.55 | 7.543426 | 54.543426 | 1 | telephony | | | | | NO | | | | |
| 30.07.2001 | 10:20:30.40 | 7.543423 | 54.543423 | 1 | SMS CS | | | | | | OK | | | |
| 30.07.2001 | 10:20:37.50 | 7.543425 | 54.543425 | 1 | SMS CS | | | | | | | 4,56 | | |
| 30.07.2001 | 10:20:39.45 | 7.543426 | 54.543426 | 1 | SMS CS | | | | | | | | 11,55 | |
| 30.07.2001 | 10:20:40.00 | 7.543426 | 54.543426 | 1 | SMS CS | | | | | | | | | OK |
| 30.07.2001 | 10:20:30.40 | 7.543423 | 54.543423 | 1 | SMS CS | | | | | | OK | | | |
| 30.07.2001 | 10:20:37.50 | 7.543425 | 54.543425 | 1 | SMS CS | | | | | | | 4,56 | | |
| 30.07.2001 | 10:21:09.45 | 7.543426 | 54.543426 | 1 | SMS CS | | | | | | | | 31,55 | |
| 30.07.2001 | 10:21:10.00 | 7.543426 | 54.543426 | 1 | SMS CS | | | | | | | | | DUP |
| 30.07.2001 | 10:20:30.40 | 7.543423 | 54.543423 | 1 | SMS CS | | | | | | OK | | | |
| 30.07.2001 | 10:20:37.50 | 7.543425 | 54.543425 | 1 | SMS CS | | | | | | | 4,56 | | |
| 30.07.2001 | 10:20:39.45 | 7.543426 | 54.543426 | 1 | SMS CS | | | | | | | | 11,55 | |
| 30.07.2001 | 10:20:40.00 | 7.543426 | 54.543426 | 1 | SMS CS | | | | | | | | | DAM |
| 30.07.2001 | 10:20:30.40 | 7.543423 | 54.543423 | 1 | SMS CS | | | | | | OK | | | |
| 30.07.2001 | 10:20:37.50 | 7.543425 | 54.543425 | 1 | SMS CS | | | | | | | 4,56 | | |
| 30.07.2001 | 10:20:39.45 | 7.543426 | 54.543426 | 1 | SMS CS | | | | | | | | 0 | |
| 30.07.2001 | 10:20:40.00 | 7.543426 | 54.543426 | 1 | SMS CS | | | | | | | | | NO |

# History

| Document history | | |
|---|---|---|
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