J4212A GSM Signaling Advisor

Product note

GSM Base Station Optimisation and Quality of Service Analysis

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Effects of Continuous Change

Continuing growth in demand (and increasing competitive pressures) for mobile radio services requires GSM operators to manage a perpetual state of change. The necessary modifications to the RF configuration, along with the changes in the wider environment, cause a bewildering diversity of interactions, some of which can seriously effect the perceived quality of service enjoyed by the network's customers.

To be successful in the increasingly competitive personal communications market place, operators must continue to provide the highest quality of service to their customers at the same time as making optimum use of facilities. To achieve the required level of service requires continuous insights into the operational interaction and performance of the RF network. Unfortunately, achieving such insights can require time-consuming investigation by experienced personnel. Any modifications to the network then require similarly time-consuming analysis to verify that the desired improvement has been achieved.

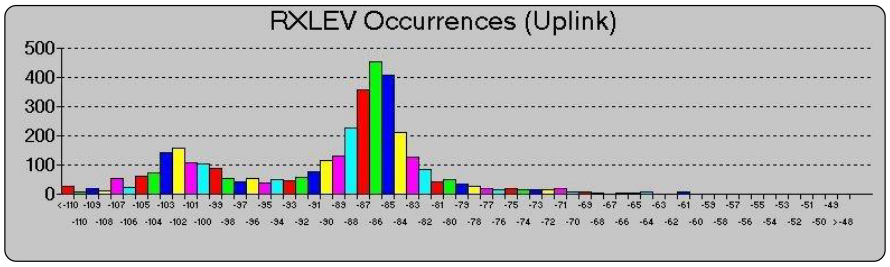
The cost effectiveness of network maintenance operations can be much increased by utilizing the considerable quantity of network performance information carried over the GSM Abis interface between the Base Station Controller (BSC) and Base Transceiver Station (BTS). However, making effective use of this valuable source of information can be difficult.

Statistical Analysis using the GSM Signaling Advisor

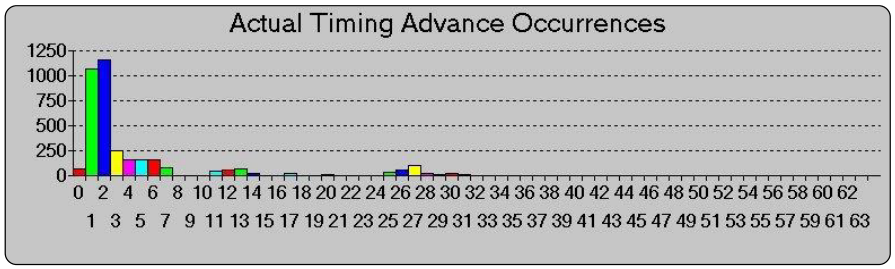
To assist the RF engineers in understanding the performance of their GSM network, the GSM Signaling Advisor not only provides comprehensive traffic capture with real-time decode and call trace capabilities, but also provides a range of prepackaged statistical analyses methods for the Abis interface.

With the GSM Signaling Advisor connected to the appropriate links, Abis traffic can be captured and analyzed. Analysis can be either real-time or post-capture, and by utilizing the powerful filter capabilities, can be based on link, cell or TRX as required.

The parametric information contained in the MEASurement RESult messages is often pointed to as a source of useful RF performance information. The GSM Signaling Advisor makes it simple to extract and view the distributions of this Level, Quality and Timing information, even in the presence of discontinuous transmission.

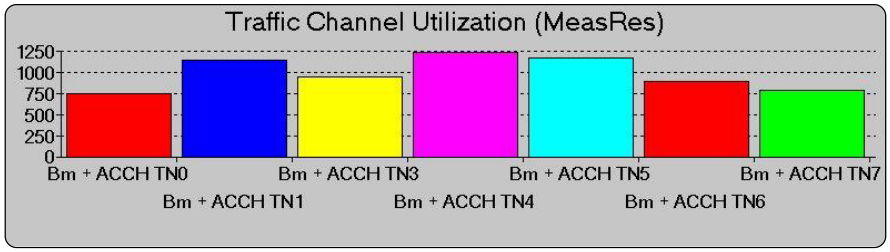


The comprehensive and flexible filtering capability of the GSM Signaling Advisor provides for a further level of investigation. For example, in the plot above of RXLEV distribution, there is a secondary peak around -102dBm. Plotting the Timing Advance distribution for just the messages forming this secondary peak shows that they mostly originate from relatively close to the TRX (see below). Thus it may be realized that there is a specific area with poor reception, possibly a shopping mall, and that it may be appropriate to provide a micro-cell to enhance service to customers there.



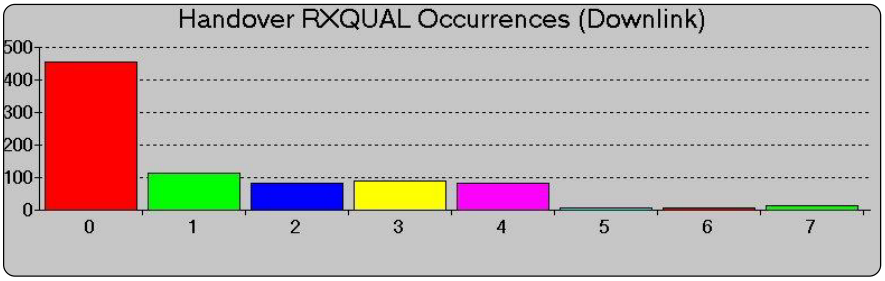
Sleeping Timeslots

Under some operating circumstances it is possible for timeslots to go unused for long periods. The result of such non-optimal operation is an increase in loading on the remaining timeslots, with the possibility of overload and loss of service to customers. Such sleeping timeslots can be difficult to detect since they may be overlooked by the O&M systems. However, with the GSM Signaling Advisor connected to the appropriate Abis links, Channel Utilization can be monitored directly, rapidly highlighting sleeping timeslots or other imbalance in channel utilization. In the Channel Utilization plot below, the traffic channel usage is roughly even except that Timeslot Number 2 shows no usage at all.

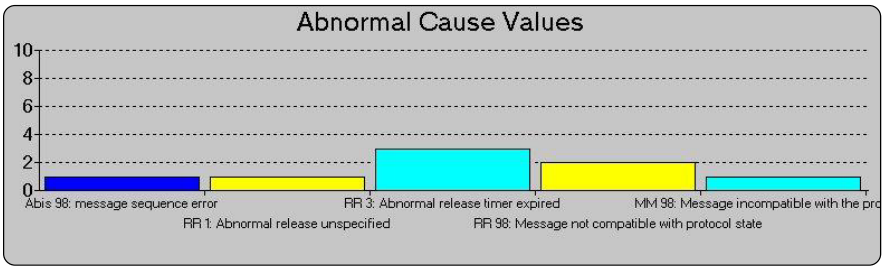


Call Failure Analysis

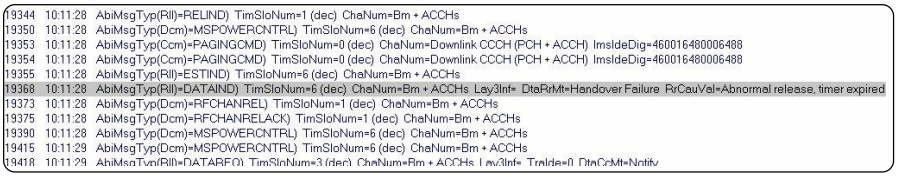
Discovering why unexpected handovers occur can tax the understanding of the best technician. In situations such as this, good information is particularly important. The GSM Signaling Advisor provides a statistical analysis package to assist in identifying aberrations in handover performance. It may be possible to identify the problem from the RF characteristics of the links when handover occurs. For this application, a specially tailored set of statistics is provided to show the statistical distribution of the RF parameters at handover:



In some circumstances handovers can fail completely and calls may be dropped. In this situation the ability to readily identify the failure Cause Value is invaluable. The GSM Signaling Advisor allows the operator to monitor for any abnormal cause value by simply selecting the statistics profile to monitor the Abis traffic, either real-time or post capture:



However, knowing that a failure has occurred is just the beginning. What the GSM Signaling Advisor provides is the ability to drill-down (from any statistics display) to the last message underlying any statistic. In this case, drilling down takes us to the message that contains the Cause Value field. From that message it is possible to view all the messages associated with the call in question at the click of a mouse. When the above plot was generated the operator could have double clicked on the 'RR3: Abnormal release timer expired' column and obtained the following traffic view:



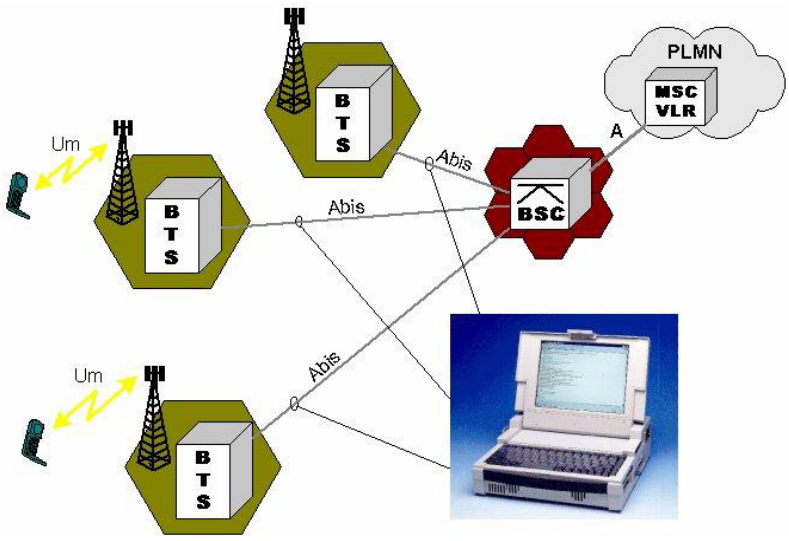
Here the particular message that contained the selected Cause Value is highlighted along with the other messages on the link (the filter capability has been used to remove MeasRes messages for clarity). In this instance it was a Handover Failure message. This message contains little additional information except that it does identify the channel as a traffic channel and the timeslot as timeslot 6. However, if a call trace has also been run, then it is possible to display all the messages in the call associated with this Handover Failure message by clicking the Group button  :

```
19044  10:11:24  AbiMsgTyp(Dcm)=CHANACTIV) TimSloNum=2 (dec) ChaNum=SDCCH/8 + ACCH Sub-Channel 1 Spe/Ind=Signaling ChaTypAndTdmOff=SDCCH/8 + SACCH/C8 (sub 1) AbsRfChaNum=104
19045  10:11:24  AbiMsgTyp(Dcm)=CHANACTIVACK) TimSloNum=2 (dec) ChaNum=SDCCH/8 + ACCH Sub-Channel 1
19062  10:11:24  AbiMsgTyp(Rill)=ESTIND) TimSloNum=2 (dec) ChaNum=SDCCH/8 + ACCH Sub-Channel 1 Lay3Inf= DteMmMt=CM Service Request ImsIdeDig=
19068  10:11:24  AbiMsgTyp(Rill)=DATAREQ) TimSloNum=2 (dec) ChaNum=SDCCH/8 + ACCH Sub-Channel 1 Lay3Inf= DteMmMt=Authentication Request
19119  10:11:25  AbiMsgTyp(Rill)=DATAIND) TimSloNum=2 (dec) ChaNum=SDCCH/8 + ACCH Sub-Channel 1 Lay3Inf= DteMmMt=Authentication Response
19121  10:11:25  AbiMsgTyp(Dcm)=ENCRCMD) TimSloNum=2 (dec) ChaNum=SDCCH/8 + ACCH Sub-Channel 1 Lay3Inf= DteRrMt=Ciphering Mode Command
19140  10:11:25  AbiMsgTyp(Rill)=DATAIND) TimSloNum=2 (dec) ChaNum=SDCCH/8 + ACCH Sub-Channel 1 Lay3Inf= DteRrMt=Ciphering Mode Complete
19151  10:11:25  AbiMsgTyp(Rill)=DATAIND) TimSloNum=2 (dec) ChaNum=SDCCH/8 + ACCH Sub-Channel 1 Lay3Inf= TraIde=0 DteCcMt=Setup CalParBcdNum=
19155  10:11:25  AbiMsgTyp(Rill)=DATAREQ) TimSloNum=2 (dec) ChaNum=SDCCH/8 + ACCH Sub-Channel 1 Lay3Inf= TraIde=0 DteCcMt=Call Proceeding
19165  10:11:25  AbiMsgTyp(Rill)=DATAREQ) TimSloNum=2 (dec) ChaNum=SDCCH/8 + ACCH Sub-Channel 1 Lay3Inf= DteRrMt=Assignment Command ChaDesTimNum=6 ChaTypAndTdmOff=Bm + ACCH's AbsRfChaNum=104
19183  10:11:25  AbiMsgTyp(Dcm)=MSPOWERCNTRL) TimSloNum=6 (dec) ChaNum=Bm + ACCHs
19184  10:11:26  AbiMsgTyp(Rill)=ESTIND) TimSloNum=6 (dec) ChaNum=Bm + ACCHs
19193  10:11:26  AbiMsgTyp(Rill)=DATAIND) TimSloNum=6 (dec) ChaNum=Bm + ACCHs Lay3Inf= DteRrMt=Assignment Complete FrCauVal=Normal event
19198  10:11:26  AbiMsgTyp(Dcm)=RFCHANREL) TimSloNum=2 (dec) ChaNum=SDCCH/8 + ACCH Sub-Channel 1
19200  10:11:26  AbiMsgTyp(Dcm)=RFCHANRELACK) TimSloNum=2 (dec) ChaNum=SDCCH/8 + ACCH Sub-Channel 1
19259  10:11:26  AbiMsgTyp(Dcm)=BSPOWERCNTRL) TimSloNum=6 (dec) ChaNum=Bm + ACCHs PowLev=Pn - 0 dB
19318  10:11:27  AbiMsgTyp(Rill)=DATAREQ) TimSloNum=6 (dec) ChaNum=Bm + ACCHs Lay3Inf= DteRrMt=Handover Command ChaDesTimNum=1 ChaTypAndTdmOff=Bm + ACCH's AbsRfChaNum=106
19350  10:11:28  AbiMsgTyp(Dcm)=MSPOWERCNTRL) TimSloNum=6 (dec) ChaNum=Bm + ACCHs
19355  10:11:28  AbiMsgTyp(Rill)=ESTIND) TimSloNum=6 (dec) ChaNum=Bm + ACCHs
19368  10:11:28  AbiMsgTyp(Rill)=DATAIND) TimSloNum=6 (dec) ChaNum=Bm + ACCHs Lay3Inf= DteRrMt=Handover Failure FrCauVal=Abnormal release, timer expired
19390  10:11:28  AbiMsgTyp(Dcm)=MSPOWERCNTRL) TimSloNum=6 (dec) ChaNum=Bm + ACCHs
19415  10:11:29  AbiMsgTyp(Dcm)=MSPOWERCNTRL) TimSloNum=6 (dec) ChaNum=Bm + ACCHs
19511  10:11:30  AbiMsgTyp(Dcm)=MSPOWERCNTRL) TimSloNum=6 (dec) ChaNum=Bm + ACCHs
19548  10:11:31  AbiMsgTyp(Rill)=DATAREQ) TimSloNum=6 (dec) ChaNum=Bm + ACCHs Lay3Inf= DteRrMt=Handover Command ChaDesTimNum=3 ChaTypAndTdmOff=Bm + ACCH's AbsRfChaNum=118
19591  10:11:31  AbiMsgTyp(Dcm)=RFCHANREL) TimSloNum=6 (dec) ChaNum=Bm + ACCHs
19593  10:11:31  AbiMsgTyp(Dcm)=RFCHANRELACK) TimSloNum=6 (dec) ChaNum=Bm + ACCHs
```

Thus the operator may determine the detailed sequence of signaling messages that led up to (and followed) the specific occurrence.

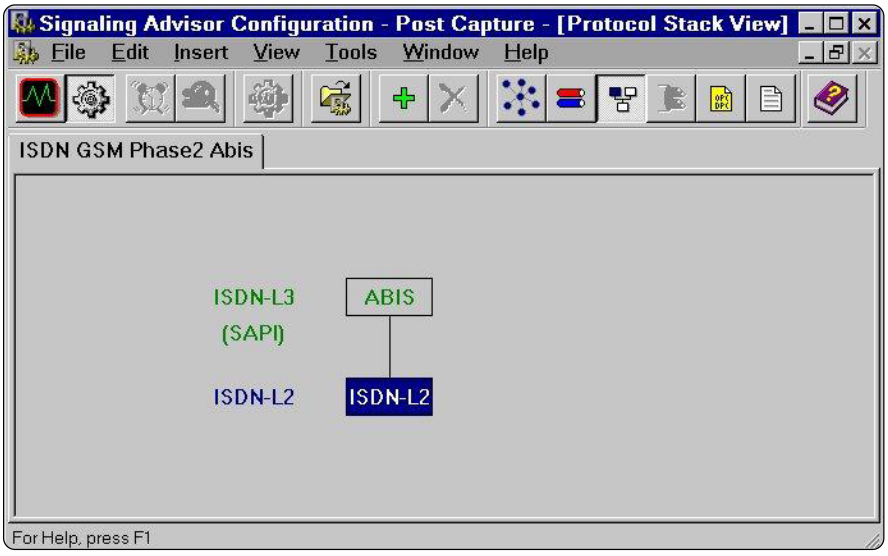
Performing the Analysis

In order to capture the Abis signaling traffic required for analysis, the GSM Signaling Advisor may be connected to monitor the Abis bearers at suitable monitor points, either at the BTS or BSC.

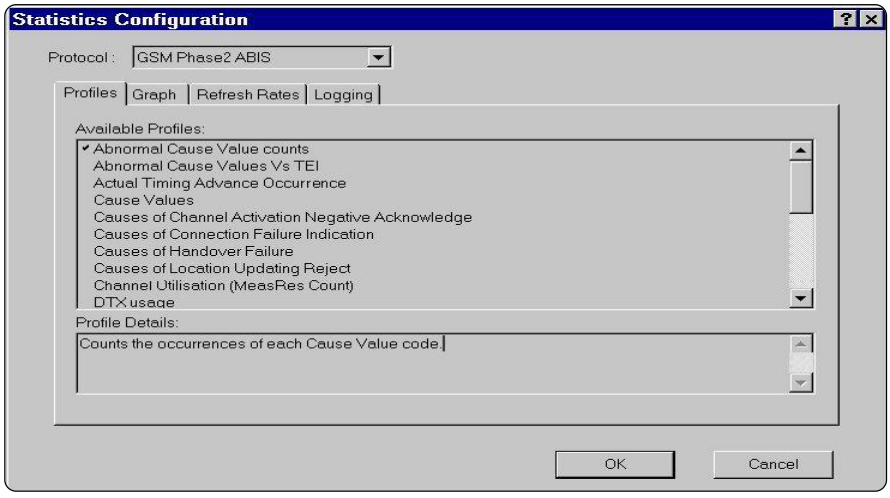


BTS – Base Transceiver Station **BSC** – Base Station Controller
MSC – Mobile Switching Center **VLR** – Visitor Location Register
PLMN – Public Land Mobile Network

To configure the GSM Signaling Advisor the ISDN GSM Phase2 Abis stack should be used:



The various GSM statistics are selected by entering the Monitor application and clicking on the Statistics button,  . A configuration dialog is then displayed.
The protocol of interest may be selected using the drop down list at the top of the dialog. A list of the available statistics profiles for the selected protocol is offered. Selecting a statistics profile brings up a short description in the lower part of the dialog. Other options (such as graph type) can be altered using the Graph, Refresh Rate and Logging tabs. Clicking OK enables the statistics profile.



Available Statistics (GSM Phase2 Abis)

LAPD TEI Usage

Abnormal Cause Values
Abnormal Cause Values Vs TEI

Actual Timing Advance

Causes of Channel Activation Negative Acknowledge
Causes of Connection Fail Indication
Causes of Handover Failure
Causes of Location Updating Reject
Causes of Overload

Channel Activation Channel Occurrence
Channel Connection Failure Channel Occurrence
Channel Utilization

Handover Access Delay
Handover Received Level Occurrence (Downlink)
Handover Received Level Occurrence (Uplink)
Handover Received Quality Occurrence (Downlink)
Handover Received Quality Occurrence (Uplink)
Handover Received Timing Advance Occurrence

Path Level Imbalance – DCS1800
Path Level Imbalance – GSM900
Path Level Imbalance – PCS1900
Path Quality Imbalance

Power Level Occurrence

Power Control Level Occurrence – DCS1800
Power Control Level Occurrence – GSM900
Power Control Level Occurrence – GSM900

Receive Level Occurrence (Downlink)
Receive Level Occurrence (Uplink)
Receive Level Average Vs Timing Advance
Receive Quality Occurrence (Downlink)
Receive Quality Occurrence (Uplink)

Measurement Summary – DCS1800
Measurement Summary – GSM900
Measurement Summary – PCS1900

Transmission Loss Occurrence (Downlink)
Transmission Loss Occurrence (Uplink) – DCS1800
Transmission Loss Occurrence (Uplink) – GSM900
Transmission Loss Occurrence (Uplink) – PCS1900

NOTE - implementations of the Abis interface vary, and with some implementations some of the statistics may be ineffective.

Ordering Information

The GSM Basestation Optimisation Monitor statistics application is delivered in the following configuration:

37907A: Signaling Advisor Mainframe
E757xA: Interface Module + cables
J4212A: GSM Signaling Advisor

References

5968-8013E – Signaling Advisor Family Brochure
5968-8594E – J4212A GSM Signaling Advisor Technical Specifications
5968-8593E – J4212A GSM Signaling Advisor Configuration Guide

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