



Application Note 24

**Making and receiving GSM
Circuit-Switched Data Calls (CSD).
Applies to routers with
Siemens wireless WAN modules only.**

UK Support

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1 INTRODUCTION

1.1 Outline

This document contains information regarding GSM/GPRS models from Digi Transport to allow for GSM Circuit-Switched Data Calls (CSD or “data” calls) to be both made and received.

1.2 Assumptions

This guide has been written for use by technically competent personnel with a good understanding of the communications technologies used in the product, and of the requirements for their specific application.

Configuration: This application note assumes that the router will be connecting to a cellular network.

This application note applies to;

Models shown: Digi Transport DR64 router with Siemens EDGE module.

Other Compatible Models: All Digi Transport products with Siemens EDGE module.

Firmware versions: 5.162 and above.

Configuration: This Application Note assumes the devices are set to their factory default configurations. Most configuration commands are only shown if they differ from the factory default.

1.3 Important note

In order for the Digi Transport to **place** GSM CSD calls **to** ISDN/POTS your SIM **must** be enabled for data services by your network operator.

In order for the Digi Transport to **receive** GSM CSD calls **from** ISDN/POTS your SIM **must also** be enabled to accept **incoming data services** on a data number by your network operator.

Most normal GSM SIM's are not enabled for receiving data services by default. Please check with your network operator before attempting to configure devices.

1.4 Corrections

Requests for corrections or amendments to this application note are welcome and should be addressed to: uksupport@digi.com

Requests for new application notes can be sent to the same address.

1.5 Version

Version Number	Status
1.0	Published
1.1	Re-branded to Digi Transport
1.2	Updated to new GUI

2 HOW DO CSD CALLS WORK?

2.1 Technical Information

From <http://mobileinternetguide.org/html/ch01s01s02.html>

The usually referred GSM CSD bearer service is the most widely used data service providing a non-transparent data rate of 9.6 kbit/s. It provides error correction and flow control, which is what the "non-transparent" means in this context. Due to the special technologies employed for error protection and correction (FEC, ARQ, interleaving) on the air interface (physical layer) the measurable two way round trip time (RTT) is typically around 1 second for a GSM network operating in the 900 MHz frequency band and 500 ms for a GSM network operating in the 1800 MHz frequency band. This RTT can in general be measured when a mobile host (laptop connected to a GSM mobile phone via the infrared port or a serial cable) is connected to a fixed host in the Internet via the GSM non-transparent bearer service, by pinging the fixed host. The reason for the lower RTT in the 1800 MHz GSM network is the smaller interleaving depth, which becomes possible due to the usually half sized cell sizes compared to the 900 MHz cells. This 9.6 kbit/s service is what is most often used to connect laptop computers, PDA and WAP phones to the services they use.

Commonly, GSM network operators support the non-transparent CSD bearer service through a modem interworking function. This means that a mobile station (mobile phone) initiates a data call and the network routes the call to the modem interworking function, which is located at the Mobile Switching Centre (MSC) of the GSM network, which then dials the number supplied by the mobile station. This is different from voice calls, where the GSM network routes the call itself, often to another mobile station on the same network. The GSM network doesn't route data calls; it dials the requested number on behalf of the mobile station and leaves the routing to the external wireline telephone network. The main reason for this is that the GSM network has information about what the user wants to do with the data call. Maybe the user is contacting his Internet Service Provider (ISP) to send email or maybe he is dialling his corporate intranet to set up a virtual private network (VPN) connection to retrieve confidential customer information from a company database. The GSM network also does not know what speeds and compression are supported by the connection it dials. It has to take a "lowest common denominator" approach, just like a wireline modem does when it dials an ISP. Like a wireline modem, it has to conduct a complex conversation modem-to-modem, to configure speeds and compression, every time it dials. This modem-to-modem conversation accounts for most of the delay when a call from a laptop or WAP phone is established.

In addition to modem-to-modem calls most of the GSM networks today can also use ISDN to set-up calls from the MSC interworking function. In this case, there is no need for the long CSD call set-up. The selection whether an ISDN or a modem-to-modem call is established is done by adding a special AT command set in the dial-up networking settings. The details about the AT command settings for the mobile station in use calls can be found on the web pages of the mobile phone vendors.

2.2 Technical Summary

CSD data calls differ significantly from normal point-to-point ISDN or POTS calls as they rely on using equipment at the network operator to provide access to the services.

For example, when a GSM data call is going out to a POTS/ISDN device the GSM device does not actually dial this number, this is done by the modem interworking function at the Mobile Switching Centre (MSC) of the network operator and the data is then relayed over the GSM network back to the device.

These connections are called non-transparent i.e. the link is not a dedicated tunnel and utilises a special GSM error correction/flow control facility called Radio Link Protocol (RLP).

RLP does add an amount of overhead but it ensures successful data delivery over the GSM parts of the link.

For example, the order of the call from a GSM device to a POTS would be something like:

GSM Device	Network Operator	POTS Device
Dial Number →	Makes Call →	→ Number rings
		← Answers
	Modem Speed Negotiation →	← Modem Speed Negotiation
	Connect Indication ←	← Connect Indication
Connect RLP →	← Connect Indication	
Data →	Data Converted and relayed →	→ Data
Data ←	← Data Converted and relayed	← Data

As can be seen there are actually two sets of connections – the GSM to the Network Operator and the Network Operator to the POTS device with the data being relayed between the GSM RLP link and the normal POTS analogue link.

Note that the speed at which the Network Operator connects to the POTS device will normally be at whatever is set from the GSM device data bearer i.e. 9600/14400bps, however the Network Operator is able to convert between speeds if the POTS device runs at a higher data rate than the GSM device can support.

Also if the POTS device cannot answer then a BUSY/NO CARRIER indication will be relayed back to the GSM device and the call terminated.

For a GSM device to an ISDN device would be similar but with the benefit of faster call setup from ISDN.

GSM Device	Network Operator	ISDN Device
Call Setup →	Call Setup →	→ Call Indication
	Connect Indication ←	Connect Indication ←
Connect RLP ←	← Connect Indication	
Data →	Data converted and relayed →	→ Data
Data ←	← Data converted and relayed	← Data

3 CONFIGURATION

3.1 Making outgoing calls from the Digi Transport

A Digi Transport can make calls to GSM, POTS and ISDN using V.110 rate adaptation or PPP over V.110, PPP is most common and is discussed here.

GSM to GSM

This should be supported by default when Data Services are enabled.

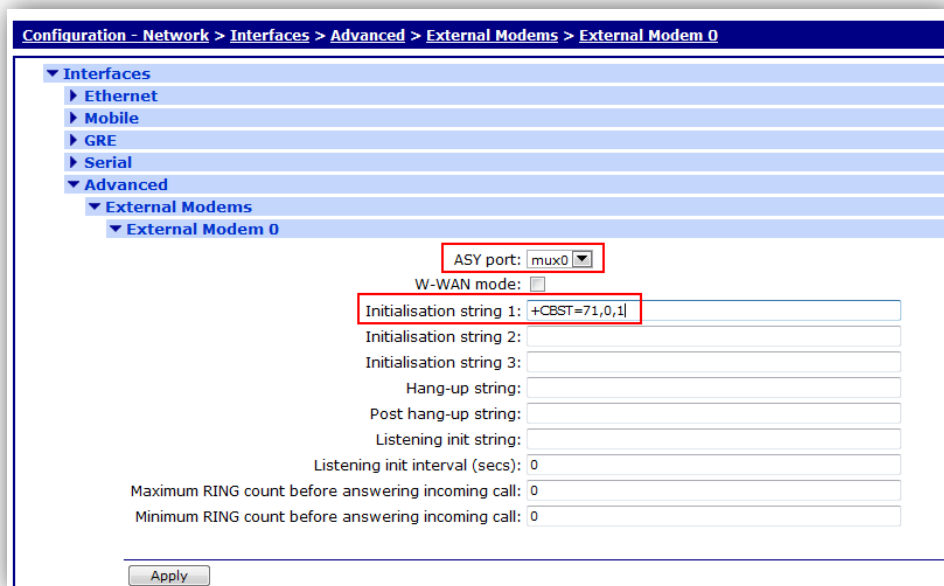
GSM Dial Out to ISDN & POTS

With Data Services enabled you will be able to call ISDN and POTS numbers but your network operator may require you to set the 'Bearer Service' on the Digi Transport to use.

Add the following into the Initialisation String 1 in **Configuration - Network > Interfaces > Advanced > External Modems > External Modem 0**

+CBST=71,0,1	For 9600bps ISDN services.
+CBST=75,0,1	For 14400bps ISDN services.
+CBST=7,0,1	For 9600bps Analogue Services
+CBST=14,0,1	For 14400bps Analogue Services

Also change the ASY port to "mux0" in the drop down list.

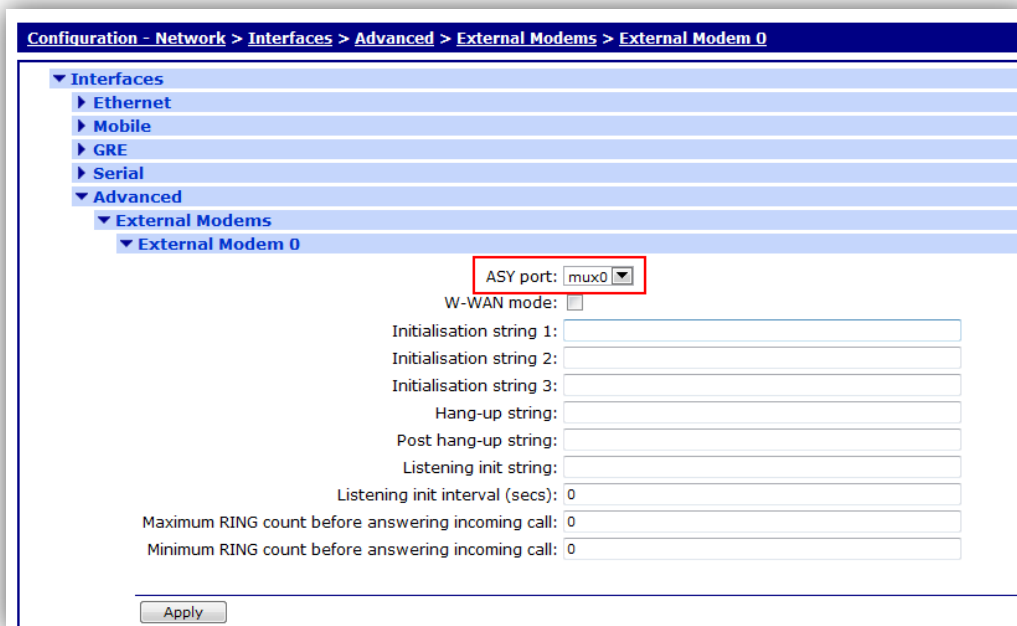


3.2 Accepting incoming calls on the Digi Transport

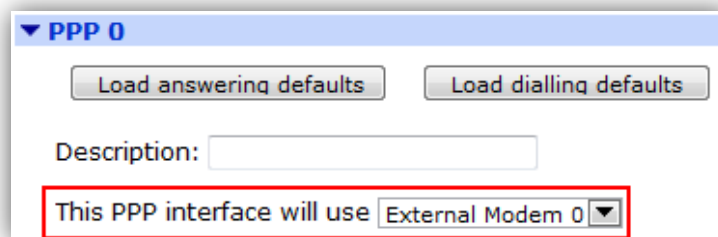
A Digi Transport will accept calls from POTS or ISDN with V.110 rate adaptation or PPP over V.110, PPP is most common and is discussed here.

The factory configuration of the Digi Transport will allow incoming PPP calls but PPP 0 (the accepting PPP interface) must be configured to accept calls from the GSM module.

1. Check that External Modem 0 is configured to use ASY port MUX0 (the GSM modem module) in **Configuration - Network > Interfaces > Advanced > External Modems > External Modem 0**



2. Configure PPP 0 so that External Modem 0 is used in **Configuration - Network > Interfaces > Advanced > PPP 0**



3. Turn OFF the cell monitor by setting the monitoring interval to 0 via CLI :

```
ss65000>cellmon 0 mon_int 0
OK
```

You will now be able to accept incoming PPP calls and be assigned an address in accordance with the parameters on PPP 0, this will typically be an address of 10.10.10.0 and the Digi Transport will have an address of 1.2.3.4.

POTS to CSD calls

No extra settings are required; the modem bank at the network operator will accept the call and pass it via RLP to the Digi Transport.

Note: Before the Modem bank can pick up the call the Digi Transport itself must answer the incoming call – if it cannot accept the call (e.g. if the number is busy or SIM is not ready) then the modem bank will not pick up the call.

ISDN to CSD calls

Note: The dialling ISDN device **must** support a transparent V.110 Mode i.e. PPP data from a Windows Dial-Up Networking session must be allowed out in a ‘raw’ state by the device– many other TA’s only support V.120 or basic V.110.

3.3 Configuring a PC & Digi Transport to make PPP calls over ISDN

In order to configure a Digi Transport TA and Windows Dial Up Networking to call as CSD device over ISDN you must change the way the TA is configured as follows.

1. Set up an ADAPT instance e.g. ADAPT 0 in **Configuration - Network > Interfaces > Serial > Rate Adaption > Rate Adaption 0** to be **V110** with **V110 User Rate** 9600 and **Fixed Rate** on.

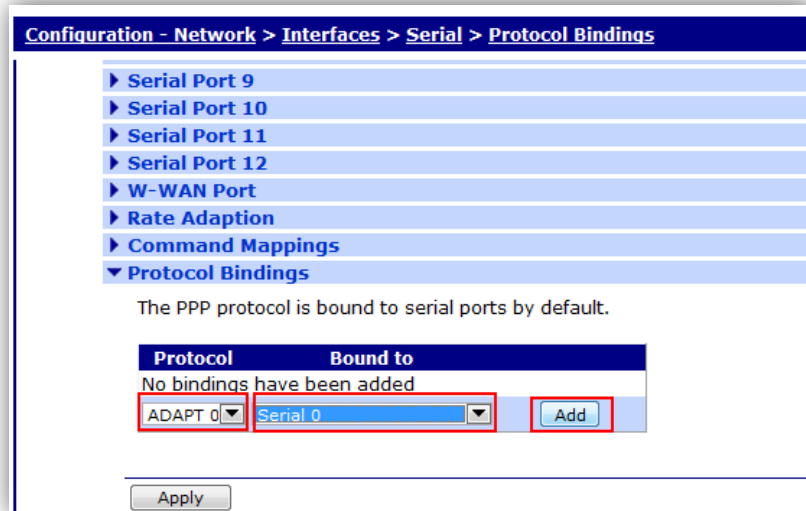
The screenshot shows the configuration window for 'Rate Adaption 0'. The breadcrumb path is 'Configuration - Network > Interfaces > Serial > Rate Adaption > Rate Adaption 0'. The window title is 'Rate Adaption' and the sub-title is 'Rate Adaption 0'. The settings are as follows:

- Attempt to redial the connection: 0 times if rate adaption has not been negotiated
- Drop the connection if it is idle for: 0 hrs 0 mins 0 secs
- Leased line mode
- Enable rate adaption on:
 - ISDN
 - Use protocol: V110
 - V110 rate: 9600
 - Fixed rate
 - Direct sync mode
- Only accept calls from:
 - MSN ending with: []
 - Sub-address ending with: []
 - CLI ending with: []
- TCP

At the bottom of the window is an 'Apply' button.

2. Bind ADAPT instance e.g. ADAPT 0 to the ASY port to which the PC making the Dial-Up Networking call from in **Configuration - Network > Interfaces > Serial > Protocol Bindings**.

Note: In 'normal' PPP configurations this would be bound to PPP but not in the case of ISDN -> GSM calls



3. Configure Dial-Up Networking on your computer to dial the data number you wish - there should be no need to deviate from the default settings.

4 TROUBLESHOOTING FAQ'S

Q: I can make GSM data calls but cannot receive them.

A: You will need to enable a data number on your SIM – this is rarely done automatically by your operator as when you make incoming data calls they are not sent to the device with the SIM but are handled by the MSC as detailed above. Contact your operator to confirm incoming GSM data capability.

Q: I have a data number but the Digi Transport is not accepting analogue (POTS) data calls.

A: Call the data number from a normal analogue land line and the Digi Transport should show an incoming call (the GSM light will illuminate steady) and you should hear the classic 'modem whistle' – if you do not then contact your network operator and make sure the data number is enabled.

Also check the analyser trace for an incoming "RING" message on the "external modem" ASY port.

Q: I can see in the analyser trace that a call is coming in and being answered but nothing happens after that.

A: This is most likely that you are not calling the data number or that your operator has not set up the data service for your SIM. Nb with Vodafone in the UK, once your SIM has been set up to receive data calls you actually call the normal SIM phone number not the data number.

Q: I have a data number but I cannot make ISDN calls.

A: If you are using a Digi Transport TA, make sure that the V.110 mode is set up as described, if you are using a different TA then check that it supports the correct mode of operation for connecting the GSM devices with your vendor and add the vendor-specific strings to your Dial-Up Networking Connection

Q: I am having trouble dialling the GSM module from an ISDN modem.

A. Your operator may require the GSM module to be set up with +CBST Init string as described for outgoing calls to accept an incoming ISDN calls.