# SwiftBroadband
# User Manual

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REFERENCE

## NOTICE



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## DOCUMENT APPROVAL AND VALIDATION

| | NAME | SIGN | DATE |
|---|---|---|---|
| **EDITED** | V Hartman | | |
| **APPROVED AUTHOR** | V Hartman | Sagrestano | - 7 JUL 2021 |
| **APPROVED SYSTEM ENGINEER** | H Dreyer | Sagrestano | - 7 JUL 2021 |
| **APPROVED SYSTEMS ENGINEERING MANAGER** | D Howie | Sagrestano | - 7 JUL 2021 |
| **APPROVED MARKETING AND SALES** | C Lombaard | Sagrestano | - 7 JUL 2021 |
| **APPROVED QA** | A Jacobs | Sagrestano | - 7 JUL 2021 |

*Approvals obtained via email during lockdown and signatories working from home in RSA, as a result of COVID-19.*
*R Sagrestano (Configuration Manager)*

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# ACRONYMS AND ABBREVIATIONS

| *Acronym or Abbreviation* | *Definition* |
|---|---|
| 3GPP | 3rd Generation Partnership Project |
| AES | Aeronautical Earth Station |
| AT | Attention (used to start a command line in an emulated terminal) |
| BGAN | Broadband Global Area Network |
| CS | Circuit-Switched |
| DHCP | Dynamic Host Configuration Protocol |
| DNS | Domain Name Server |
| DP | Distribution Partner |
| EMEA | Europe, Middle East and Africa |
| FTP | File Transfer Protocol |
| HTTP | Hyper-Text Transfer Protocol |
| IE | Internet Explorer |
| IMEI | International Mobile Equipment Identifier |
| IMSI | International Mobile Subscriber Identifier |
| IP | Internet Protocol |
| ISDN | Integrated Services Digital Network |
| ITU | International Telecommunications Union |
| LAN | Local Area Network |
| MSISDN | Mobile Station International Subscriber Directory Number |
| MSN | Multiple Subscriber Number |
| NAT | Network Address Translation |
| PAP | Password Authentication Protocol |
| PC | Personal Computer |
| PDA | Personal Digital Assistant |
| PDP | Packet Data Protocol |
| PEP | Performance Enhancing Proxy |
| PoE | Power-over-Ethernet |
| POTS | Plain Old Telephone Service |
| PPP | Point to Point Protocol |
| PPPoE | Point-to-Point Protocol over Ethernet |

| *Acronym or Abbreviation* | *Definition* |
|---|---|
| PS | Packet-Switched |
| PSTN | Public Switched Telephone Network |
| QoS | Quality of Service |
| RAN | Radio Access Network |
| RDI | Restricted Digital Information |
| SBB | SwiftBroadband |
| SATCOM | Satellite Communication |
| SDU | Satellite Data Unit |
| SP | Service Provider |
| STE | Secure Terminal Equipment |
| TA | Terminal Adapter |
| TCP | Transmission Control Protocol |
| TE | Terminal Equipment |
| UDI | Unrestricted Digital Interface |
| UDP | User Datagram Protocol |
| UMTS | Universal Mobile Telecommunications System |
| URL | Uniform Resource Locator |
| USIM | Universal Subscriber Identity Module |
| VoIP | Voice over IP |
| WAN | Wide Area Network |

# 1. INTRODUCTION

Browsing the Internet at Mobile Broadband speeds or making a telephone call onboard an aircraft (whilst in mid-flight) can easily and seamlessly be accomplished using the SATCOM System with the Inmarsat SwiftBroadband network service.

This document provides a guide for users intending to connect to the Internet, or to make telephone calls via the SATCOM System. It contains the steps the user should follow to successfully connect to the Internet or to make calls.

The use of basic Circuit Switched (CS) and Packet Switched (PS) services as well as the use of advanced PS features is demonstrated by means of examples.

An installed and configured Cobham SwiftBroadband (SBB) Aeronautical Earth Station (AES) is assumed throughout.

## 1.1 User Documents

Figure 1-1 indicates the relationship of this document with respect to the other documents required to install, configure and use the SATCOM System.

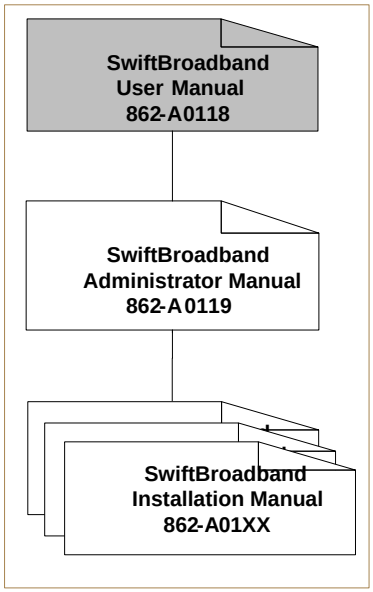


Figure 1-1: User Documents

- The **SwiftBroadband User Manual** (this document) contains procedural detail for end users to connect to the Internet and international telephone network via the Inmarsat SBB network.
- The **SwiftBroadband Administrator Manual** [1] contains procedural detail for Administrators to configure and customise the system.
- The **SwiftBroadband Installation Manual** [2] contains technical detail to install and maintain the SATCOM System.

This document is applicable after the SATCOM System installation and configuration have been successfully completed.

# 2. REFERENCES

[1] SwiftBroadband Administrator Manual, 862-A0119_AM

[2] SwiftBroadband Installation Manual, 862-A0101_IM

[3] Digital cellular telecommunications system (Phase 2), UMTS AT command set for User Equipment, 3GPP TS 27.007, V4.5.0 (2002-12), Release 4

[4] SwiftBroadband and IP data connections, Version 01 (available at https://www.airsatone.com/static-documents/inmarsat/swiftbroadband_and_ip_data_connections.pdf), URL accessed on 30/6/2021

[5] Using TFTs on BGAN, Version 02 (available at "http://inmarsat-russia.ru/files2/Using_TFTs_on_BGAN_EN.pdf"), URL accessed on 30/6/2021

# 3. QUICK START GUIDE

## Connect to the Internet via a shared connection

1. Connect your laptop/handheld device to the aircraft LAN. Refer to section [6.3;6.4]
2. Open your favourite Browser and start surfing the web.

## Connect to the Internet via a dedicated connection

1. Connect your laptop/handheld device to the aircraft LAN. Refer to section [7.3.1;7.3.3;8.4]
2. For PPPoE access, configure a broadband connection refer to section [7.3.1]. For Single User NAT-free mode refer to section [8.4.]
3. Open your favourite Browser and start surfing the web.

## Call a land-based subscriber from the aircraft

1. Dial "00" followed by the country code (e.g. "44" for the UK) followed by the telephone number you of the subscriber you wish to speak to. Refer to section [15.2.1.1;15.2.1.2;15.2.1.3]

## Call the aircraft from a land-based telephone

1. The calling party can dial "+870" followed by the number provided by the Administrator for the handset near you to ring. Refer to section [15.3.1;15.3.2]

## Call another passenger

1. Dial the passenger's four digit extension. Refer to section [15.4]

## Configure your SIP enabled device and make calls

1. Configure your SIP application. Refer to section 15.6. When successfully configuring the application displays 'online'.
2. In the SIP application keypad, compose "00" followed by the country code (e.g. "44" for the UK) followed by the telephone number of the subscriber you wish to speak to. Press the SIP client dial/call button. Refer to section [15.6;15.2.1.2]

# 4. SWIFTBROADBAND SYSTEM DESCRIPTION

## 4.1 Inmarsat Network Services

The Inmarsat BGAN system is a satellite-based packet radio network, offering both PS and CS services to mobile terminals. The service available to aeronautical users is called SwiftBroadband (SBB), and this term will be used throughout this document. Examples of PS services are user client PC connections to the Internet, while examples of CS services are Public-Switched Telephone Network (PSTN) voice calls and Integrated Services Digital Network (ISDN) connections. More detail on the SBB network can be found in Section 16.

The SATCOM System can simultaneously provide the following services via the Inmarsat network (per modem for a multi-modem SATCOM System):

- PS data connections for multiple users.
- A single external CS call[1]

## 4.2 SATCOM Systems User Basic Services Matrix

The various user services that can be accessed via the SATCOM System product range are shown in Table 4-1.

Table 4-1: SATCOM System basic user services matrix

| Product | User Services | Description |
|---|---|---|
| **SDU 7320/7330** | ISDN | ISDN S/T Bus (Euro or NT1 protocols) for up to a total of 5 powered or 8 self-powered ISDN Terminals |
| | Internet | 10BaseT Ethernet ports (10 Mbps twisted pair) with Group-1 Power over Ethernet (PoE), limited to a total power of 16W. |
| | POTS | Two-wire phone interfaces (POTS), maximum 2 phones per port. |
| **SDU 7310/7315** | Internet | 10BaseT Ethernet ports (10 Mbps twisted pair) with Group-1 Power over Ethernet (PoE). |
| | POTS | Two-wire phone interfaces (POTS), maximum 2 phones per port. |

## 4.3 Inmarsat Data Services

### 4.3.1 Classes of service

The Inmarsat network can provide two classes of service for each Packet Switched (PS) data connection also known as "Packet Data Protocol (PDP) context":

- Background Class or "Standard IP" - This service accesses capacity that is shared amongst a number of users of the SBB network, providing a non-guaranteed rate of up to [2]432 kbps service. This type of connection is ideal for internet browsing, sending email and transferring files. Billing is done per amount of data transferred.

[1] Future changes to the SBB network architecture may allow additional simultaneous services.
[2] Depends on high-gain antenna class of operation, limited number of users in same spot beam, satellite elevation, Inmarsat network bearer assignment.

- Streaming Class or "Streaming IP" - This service provides guaranteed, symmetrical data rates from 8 kbps to 128kbps. The X-Stream service can achieve more than 250 kbps (see 16.2.2.) This mode of connection is typically used for time critical applications such as live audio or video, where users require dedicated connections with exclusive bandwidth. Connection is charged per minute.

The two different PDP context types are distinguished by different Quality of Service (QoS) characteristics. The key distinctions between Background and Streaming Class services are summarised in Table 4-2.

Table 4-2: Data Connection Features

| Feature | Background Class | Streaming Class |
|---|---|---|
| Bandwidth | Contended | Guaranteed QoS |
| Data transfer reliability | Automatic retransmissions | No automatic retransmissions (by default) |
| Charging (subject to particular service provider agreement) | Per Mbyte of data transferred | Per minute of connection |

More information on the features and characteristics of the different PS data connection types can be found in Section 16.

### 4.3.2 SATCOM System Access Modes

Users may access the SATCOM System via the Ethernet user ports in in the following three modes:

- Office network or LAN service, also termed the **Shared Internet Connection** or "Router" access mode, resembling normal office or residential broadband Internet access via a private LAN.

  In this mode of operation, the SATCOM System can be seen as a NAT/DHCP router, and operation over the satellite is configured and controlled as described in Section 6. When using a Shared Internet Connection, all connected users simply have to open an Internet browser to connect to the Internet.

  A variant of the Shared Internet Connection exists and consists of more than one modem (in a multi-modem system) bonded together to increase the effective throughput (see section 6.2.2 for further detail).

- PPPoE-based broadband connection service, also termed **PPPoE** access mode, resembling residential broadband Internet access via a USB-connected modem. The connection receives a unique global [3]accessible IP address.

  In this mode of operation, the SATCOM System fulfils the role of the dial-up modem, and default operation over the satellite is configured and controlled as described in Section 7. The 'user' in this mode is typically an external router or server using PPPoE on its WAN link, but may also be an individual user PC.

- **Single User NAT-free** mode. This mode of access shares some characteristics with the Shared Internet Connection (simple method of connection) and the PPPoE access type (NAT-free, dedicated global IP address). More details of this mode can be found in Section 8.

The first two access methods can be used simultaneously, and can employ a mix of both Background and Streaming PDP contexts. The third method cannot co-exist with any of the first two on a particular modem.

[3] If provisioned as such by the Inmarsat Distribution Partner (see [1]).

## 4.4 Inmarsat CS Services

The Inmarsat network provides the following Circuit Switched (CS) services:

- Voice - 4kbps compressed voice (low cost, low bandwidth, used for Voice only)
- Voice - 3.1 kHz Audio (high quality, used for Premium Voice, analogue modems or G3 Facsimile)
- Data - 64 kbps UDI (high quality data connection)
- Data - 56 kbps RDI (high quality data connection)

The Inmarsat CS service support of the various SATCOM products is outlined in Table 4-3:

Table 4-3: SATCOM Systems CS user services matrix

| Product | User Services | Network services included |
|---|---|---|
| **SDU 7320/7330** | ISDN | • Voice - 4kbps compressed voice (low cost, low bandwidth, used for Voice only)<br>• Voice - 3.1 kHz Audio (high quality, used for Premium Voice, analogue modems or G3 Facsimile)<br>• Data - 64 kbps UDI (high quality data connection)<br>• Data - 56 kbps RDI (high quality data connection) |
| | POTS | • Voice - 4kbps compressed voice (low cost, low bandwidth, used for Voice only)<br>• Voice - 3.1 kHz Audio (high quality, used for Premium Voice, analogue modems or G3 Facsimile) |
| | [4]SIP | • Voice - 4kbps compressed voice (low cost, low bandwidth, used for Voice only)<br>• Voice - 3.1 kHz Audio |
| **SDU 7310/7315** | ISDN | Not Supported |
| | POTS | • Voice - 4kbps compressed voice (low cost, low bandwidth, used for Voice only)<br>• [5]Voice - 3.1 kHz Audio (high quality, used for Premium Voice, analogue modems or G3 Facsimile) |
| | SIP | • Voice - 4kbps compressed voice (low cost, low bandwidth, used for Voice only)<br>• [6]Voice - 3.1 kHz Audio |

### 4.4.1 SATCOM System CS Access Methods

#### 4.4.1.1 POTS access

Calls can be made with any POTS device (telephone) plugged into a POTS socket wired to the SATCOM System.

[4] Both the Inmarsat Network services are accessed via the PCMA 8000 codec on the SIP phone
[5] The 3.1kHz Audio bearer service is not available for class 15 mode of operation, therefore is only applicable to the SDU7315.
[6] The 3.1kHz Audio bearer service is not available for class 15 mode of operation, therefore is only applicable to the SDU7315.

#### 4.4.1.2 ISDN access

Calls can be made with any ISDN handset connected to an ISDN socket [7] wired to the SATCOM System.

#### 4.4.1.3 VoIP (SIP) access

Version 5.12 of the SATCOM System incorporates a SIP proxy server. SIP handsets or SIP phone applications running on the user's mobile phone, laptop etc., connected the SATCOM System SIP proxy server, can be used to make internal or external (over the SwiftBroadband network) calls.

[7] ISDN service is not available for SATCOM Systems operating in aeronautical terminal Class 15 mode.

# 5. NAVIGATE THIS DOCUMENT

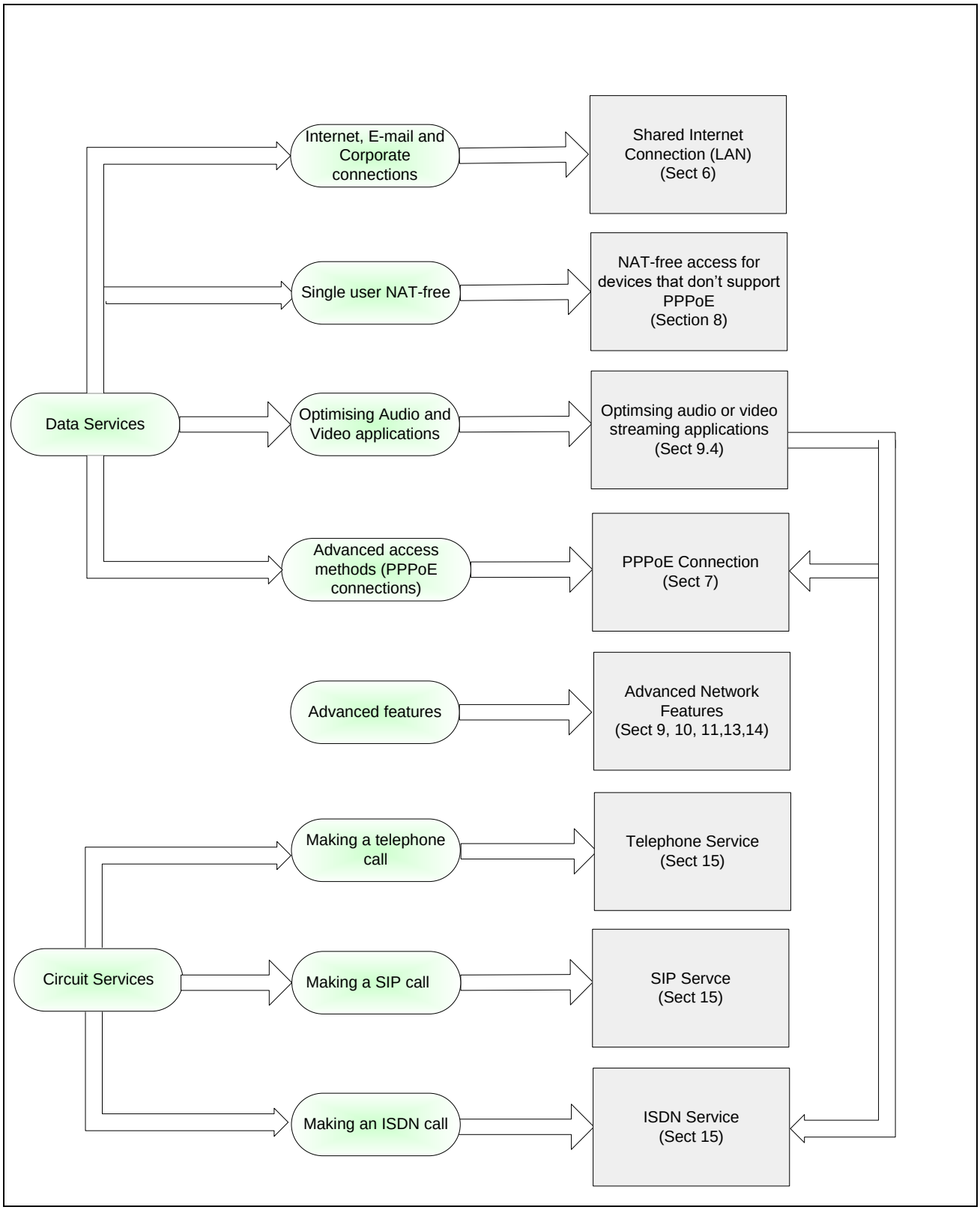


Figure 5-1: Quick Start Guide

# 6. SHARED INTERNET DATA CONNECTIONS

## 6.1 Introduction

This standard form of network access operates in exactly the same way as an office environment or using a broadband router at home, allowing you to browse the Internet, send and receive e-mails, and connect to corporate servers while away from the office.

All users of the Shared Internet Connection will share the capacity of the connection. It is strongly recommended that the user PC's firewall functionality remains enabled.

## 6.2 SATCOM System-side Control

After start-up, the Shared Internet Connection has successfully been established, the Connection Monitor page will display "Status: Connected" inside the Shared Internet Connection control pane. The 'connect' button will be greyed out.

If the "connect" button is not greyed out, to activate the Shared Internet Connection the user can click on the 'connect' button.

### 6.2.1 Non-Bonded Shared Internet Connection

The SATCOM System is typically be configured by the System Administrator to automatically start a Background PDP Context for the Shared Internet Connection. As billing of this type of PDP context is based on the volume of data transferred it is recommended that automatic updates for applications such as virus checkers be disabled on your PC while using the system. The Shared Internet Connection can also be configured to use a Streaming PDP Context.

It is possible to operate audio and video applications over this standard access method – see the use of optimised connection types as outlined in Section 6.5.6.

### 6.2.2 Bonded Shared Internet Connection

As stated in [2], the Bonded Shared Internet Connection can be used for Video broadcast traffic (UDP). It is not advisable to use Bonded Shared Internet Connections for Web browsing and file transfer (FTP) applications.

For the Bonded Shared Internet Connection to work the Bonded Shared Internet Connection checkbox (SATCOM Console *[Packet Switching – Configuration])* must be enabled. The Bonded Shared Internet Connection will automatically activate at system start-up. Billing of the Bonded Shared Internet Connection is time-based, as currently only Streaming PDP Contexts can be bonded.

An additional status entry in the Shared Internet Connection control pane indicates the result of the Bond. If the Bonded Shared Internet Connection was successfully created, the following status will be displayed inside the Connection control pane:

Bond Result: "Bonded connection successfully created"

The Bond Result will be displayed in addition to the Status field as described in section 6.2. An exhaustive list of Bond Result status codes can be found on the Connection Monitor *[help]* page.

## 6.3 How users can connect to the SATCOM System Shared Internet Connection

The following items are required to gain access to the Shared Internet connection:

- A network-enabled device with a wired Ethernet connector or Wi-Fi access (if the aircraft is suitably equipped) e.g. a laptop PC or PDA. The network adaptor must be enabled with the appropriate drivers installed.

- Access to one of the Ethernet user ports of the SATCOM System, either directly or via an external Ethernet switch or Wi-Fi router.

- Appropriate applications software e.g. MS Internet Explorer, MS Outlook.

Power-over-Ethernet (PoE) may be available via the wired Ethernet connections if enabled by the SATCOM System installer.

## 6.4 How to connect to the Internet

The following steps are required to connect to the Internet:

- Connect the network-enabled device to an available Ethernet port or Wi-Fi access point (if the aircraft is suitably equipped).

- Configure the TCP/IP protocol to enable dynamic IP addressing (DHCP) on the PC LAN adaptor. (This is the default setting for Windows, see Section 6.5.2.) The SATCOM System will then automatically allocate a private IP address to the device.

- Start the application(s) that access the Internet.

To ensure optimum data throughput, TCP window sizes MUST be configured on the network-enabled device to be compatible with the long latency of the satellite link, as described in Section 17.

## 6.5 Troubleshooting (Connection/Performance Issues)

The user instructions provided in the following sections are based on Microsoft Windows 7.

### 6.5.1 Limited network connectivity displayed for user PC Internet connection

If the network-enabled device is correctly configured for dynamic IP addressing, but started up before the SATCOM System was ready, then the device's operating system may have allocated a default address to its network connection and marked it as having "Limited network connectivity". In this case, the network connection needs to be "repaired", to request a new IP address from the SATCOM System.

Click on the Start button, and then select Control Panel as shown in Figure 7-1.

The Network Sharing Center will open as shown in Figure 7-2.

Click on “Change Adaptor Settings” in the left pane. A window displaying the list of available network connections will be shown. Right-click on the appropriate network connection, and if this indicates that the Ethernet adaptor is currently disabled, then select “Enable”. If the connection is still not successful, select the "Diagnose" option as shown in Figure 6-1.

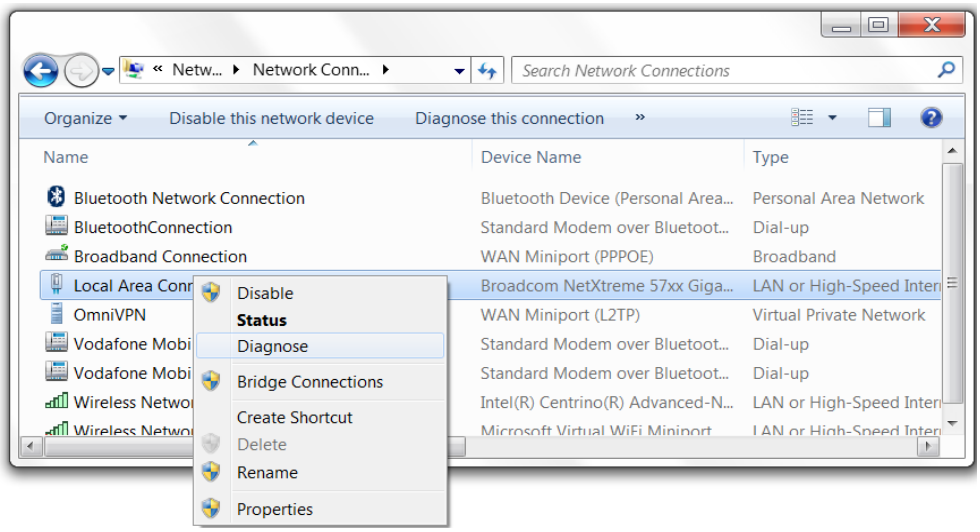


Figure 6-1: Network Diagnose Option

### 6.5.2 User PC not connected to Internet despite active Shared Internet Connection

Cause: The user PC may not be configured for dynamic IP addressing.

**Remedy**: Click on the Start button, and select Control Panel as shown in Figure 7-1.The Control Panel window will open as shown in Figure 7-2.

Double-click on the Network Connections icon. A window displaying the list of available network connections will be shown. Right-click on the appropriate network connection, and select "Properties" as shown in Figure 6-2.

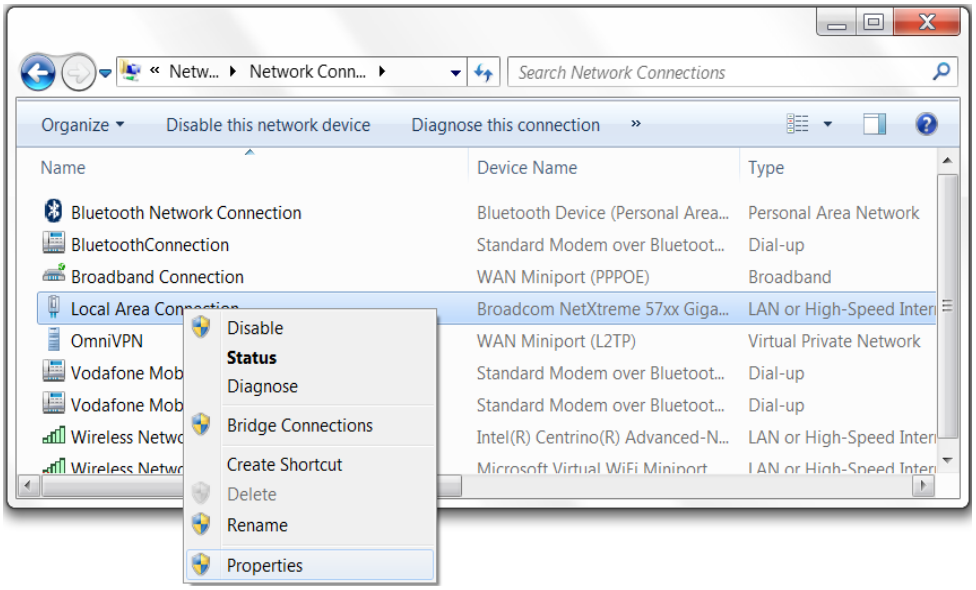


Figure 6-2: Windows Network Connections

Under the "Networking" tab, select "Internet Protocol (TCP/IP)" in the scrolling window, and then click on the Properties button as shown in Figure 6-3.

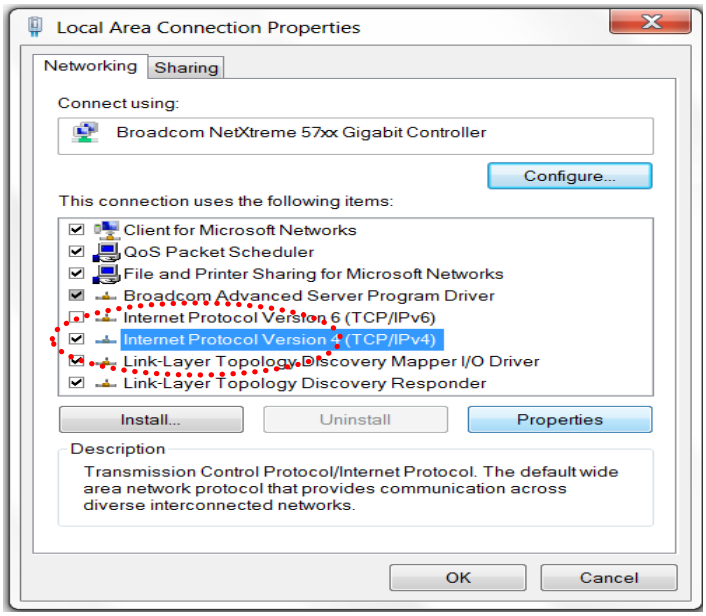


Figure 6-3: Windows LAN Properties

Ensure that both "Obtain an IP Address automatically" and "Obtain DNS server address automatically" are selected as shown in Figure 6-4.

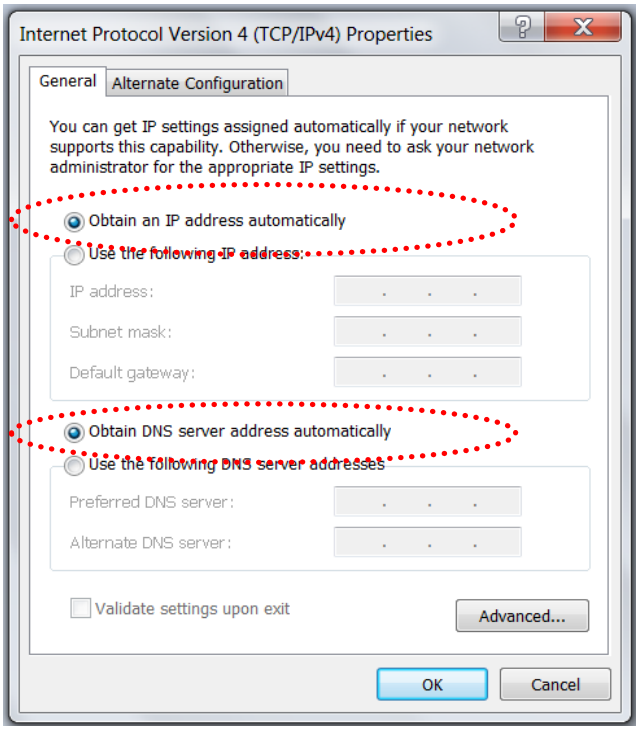


Figure 6-4: Internet Protocol Properties

Click on the OK button to return to the network connection properties, and click on the OK button again to return to the Network Connections window.

If the Network Connections window indicates that the Ethernet adaptor is currently disabled, right-click on the connection and select "Enable".

### 6.5.3 Browser unable to find a proxy server

Use of a proxy server, if configured on the browser being used, needs to be disabled as follows:

- Start the browser.
- In the Tools menu, click Internet Options.
- Click on the Connections page tab.
- Click on LAN Settings.
- Ensure the box marked "Use a proxy server..." is cleared.
- Click OK, and again click OK to close the Internet Options boxes.

### 6.5.4 Shared Internet Connection in state "Disconnected" on SATCOM Console.

If the SATCOM System has not been configured by the System Administrator to auto-activate a Shared Internet Connection at start-up, and user control has been enabled instead, then the SATCOM Console must be accessed to manually initiate a connection once the SATCOM System has started up. The SATCOM Console is a Web-based Application Server embedded in the SATCOM System, which can be accessed via the existing Ethernet connection using any Web Browser.

Enter the IP address of the SATCOM Console in a browser. The default address is http://172.18.0.250. (Consult the System Administrator if the browser cannot connect.) The Connection Monitor Page of the SATCOM Console will be displayed as shown in Figure 6-5. Click the "Connect" button to start a Shared Internet Connection. The connection can be stopped at a later time if desired, by clicking the "Disconnect" button.

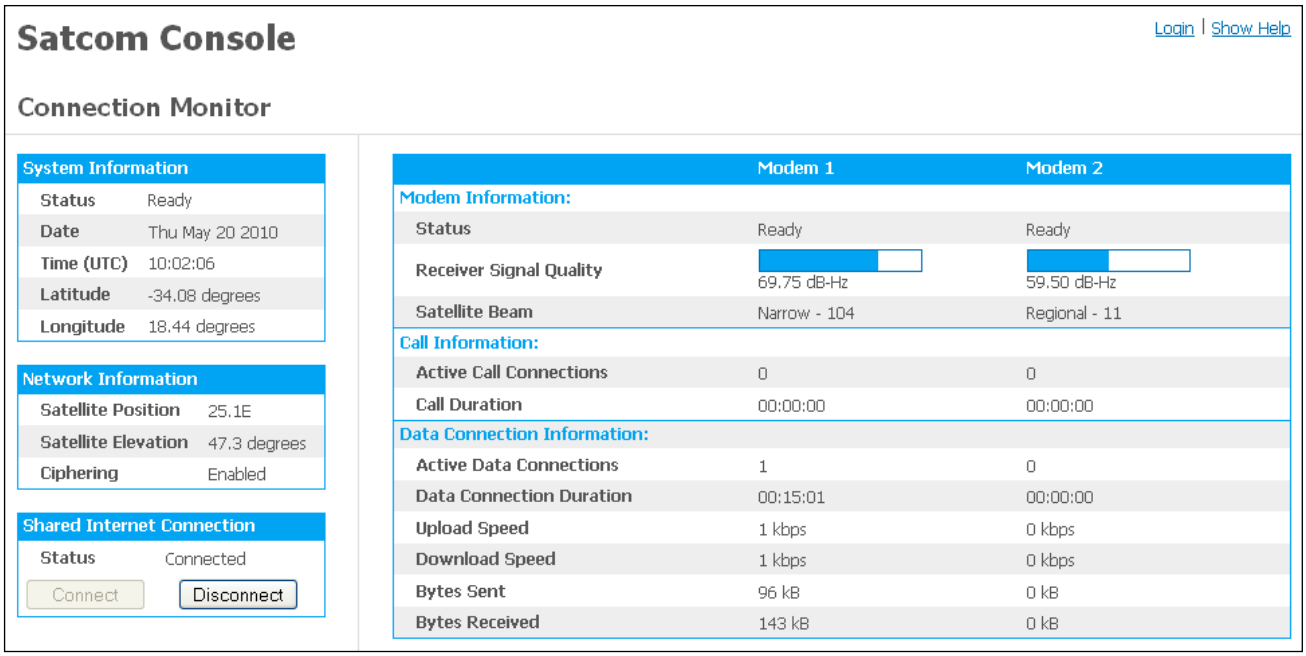


Figure 6-5: SATCOM Console - Connection Monitor Page

**NOTE:** The *Shared Internet Connection* control feature connects or disconnects the Shared Internet Connection for ALL users of the shared connection.

If the "Connect" button is greyed-out, or becomes active again after some period but there is still no Internet access, then there may be a problem accessing the Inmarsat SBB network. The SATCOM System status can be found at any time as outlined in Section 19. Consult the System Administrator for further details.

### 6.5.5 Internet access is available, but some applications fail to connect or operate correctly

The SATCOM System implements a NAT router for Shared Internet Connection access, and this can interfere with some specialised applications, including some VPNs. Please consult the system administrator to configure port forwarding rules as required.

### 6.5.6 Low audio or video quality

If you have problems establishing audio or video applications, such as VoIP, conferencing or streaming, or the content is intermittent, then it is possible that bandwidth constraints on the Shared Internet Connection are affecting the performance. This may be addressed in one of several ways:

- If possible, configure the application for a lower resolution mode of operation. For video broadcast this may require a different video codec or changing of a codec setting to lower the transmitted bit rate.
- Modify the Shared Internet Connection to use a Streaming Class PDP Context - This network service provides a guaranteed bandwidth at a rate that can be selected to accommodate your application. Charging is per minute connected, regardless of whether there is any user data or not. Please consult your System Administrator to configure this mode of operation.
- Make use of the Bonded Shared Internet Connection variant. Please consult your System Administrator to configure this mode of operation.
- Use the PPPoE access method to obtain a Streaming Class PDP Context - This will provide a guaranteed bandwidth dedicated to your network-enabled device, and may be used in parallel with other users using the Shared Internet Connection. However, a single PC cannot use both methods at the same time. Refer to Section 7 for further details.

### 6.5.7 Slow browsing response, slow file and email transfer

Operation over a satellite link introduces an extra delay which can affect the throughput of TCP-based applications such as web browsing, e-mail and file transfer.
It is very important that TCP window sizes be adjusted on your PC to allow for the latency of the satellite link, as described in Section 17.

The Inmarsat PEP application may be installed on your PC to further improve TCP performance, as described in Section 17.2.

# 7. PPPOE DATA CONNECTIONS

## 7.1 Introduction

PPPoE Access allows a user (or a pre-configured server) to obtain one or more dedicated data connections, not shared by other users on the aircraft, with direct control over the key characteristics of each connection. This method of access allows the user to:

- Choose the Class (Background or Streaming Class) of every connection, and the required bit rate for each Streaming Class PDP context.
- Associate and direct the data for a particular application to go over a specific connection. Individual connections may then be optimised for their intended use, for example by setting up one Background Class connection for browsing and e-mail and another simultaneous Streaming Class connection for audio or video applications.
- Select a specific network Access Point Name (APN) specified by the Service Provider, as opposed to the default configured by the System Administrator. (APNs are the gateways available to access the Internet, and a Service Provider may allocate these depending on specific service or performance requirements. Consult the System Administrator for more details.)
- Access services which require authentication by the Service Provider. (Consult the System Administrator for more details.)
- Change or modify the connection type and bandwidths as required.
- Create Secondary PDP contexts and Traffic Flow Templates (TFT).
- Select the SATCOM System modem (in a multi-modem system) over which the connection will be established.

It is assumed that the user is familiar with the concepts outlined in [3], and has a working knowledge of the Hayes AT command set.

There is a one-to-one mapping between each PPPoE connection and each primary PDP context activated by the SATCOM System. For aeronautical classes 6 and 7, a maximum of 11 PDP contexts are supported per modem, comprising of both primary and secondary contexts. For the aeronautical terminal class 15 a maximum of 3 PDP contexts (one background PDP context together with a maximum of 2 streaming PDP contexts) are supported by the Inmarsat network per modem.

Consider the following scenario as an example for class 6 and class 7 aeronautical terminals:
If one PDP context is used by the Shared Internet Connection, then the SDU could support up to ten PDP Contexts that may be created via the PPPoE interface. If there are any secondary PDP contexts associated with a primary, then proportionally fewer primary PDP Contexts (PPPoE connections) can be created.

Multiple independent users may connect via PPPoE connections simultaneously, up to the limit described above for the particular aeronautical class. Each user will create his/her own PPPoE connection and related PDP context, and obtain their own IP address.

While a data connection may be dedicated to a particular user employing this access mode, it should be noted that bandwidth provided to the terrestrial networks will still be subject to overall SATCOM System and Inmarsat SBB network capacity constraints. Only a Streaming Class PDP context, accessed via a PPPoE connection, will provide guaranteed bandwidth dedicated to a single user of the SATCOM System.

## 7.2 What you require to connect

The following items are required for modem (PPPoE) access:

- A network-enabled device with a wired Ethernet connector or Wi-Fi access (if the aircraft is suitably equipped) e.g. a laptop PC or PDA. (The network adaptor must be enabled, with the appropriate drivers installed.)

- Access to an Ethernet user port of the SATCOM System, either directly or via a cabin switch or Wi-Fi access point.

- Appropriate applications software e.g. MS Internet Explorer, MS Outlook.

Power-over-Ethernet (PoE) may be available via the wired Ethernet connections if enabled by the SATCOM System installer.

## 7.3 How to connect to the Internet

To ensure optimum data throughput, TCP window sizes MUST be configured on the network-enabled device to be compatible with the long latency of the satellite link, as described in Section 17.1.

The following steps are required to connect to the Internet:

- Connect the network-enabled device to an available Ethernet port or WI-FI access point (if the aircraft is suitably equipped).

- Define a broadband (PPPoE) connection on the device, and then configure the appropriate service or command strings for the desired connection type(s).

- Once the SATCOM System has started-up, the broadband (PPPoE) connection may be started. The SATCOM System will establish a primary PDP context (and any pre-configured, associated secondary PDP contexts), and pass the IP address assigned by the Inmarsat SBB network back to the network-enabled device.

- When the connection is established, it can provide application(s) with access to the Internet.

The user instructions provided in the following sections are based on MS Windows XP. Please note that MS Windows allows only one active PPPoE connection at a time on a particular PC.

### 7.3.1 Defining a broadband (PPPoE) connection

Click on the Start button, and then select Control Panel as shown in Figure 7-1.

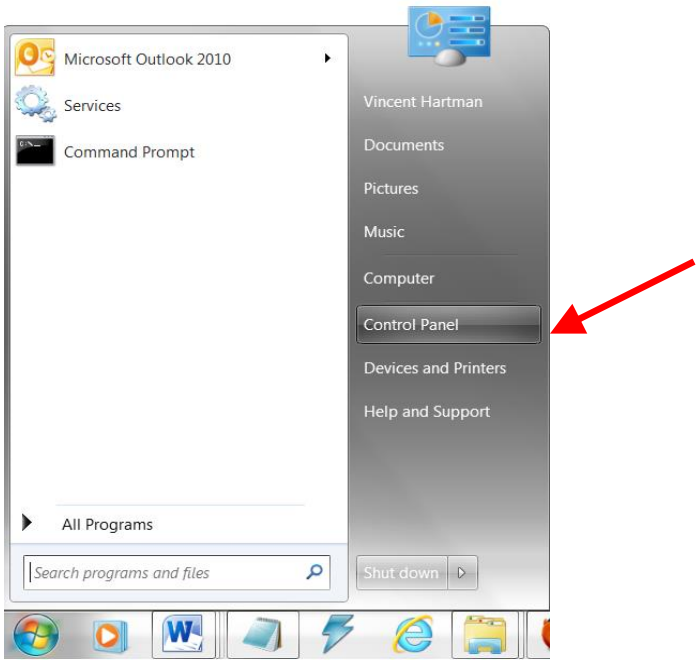


Figure 7-1: Windows Start Menu

The Control Panel window will open as shown in Figure 7-2.

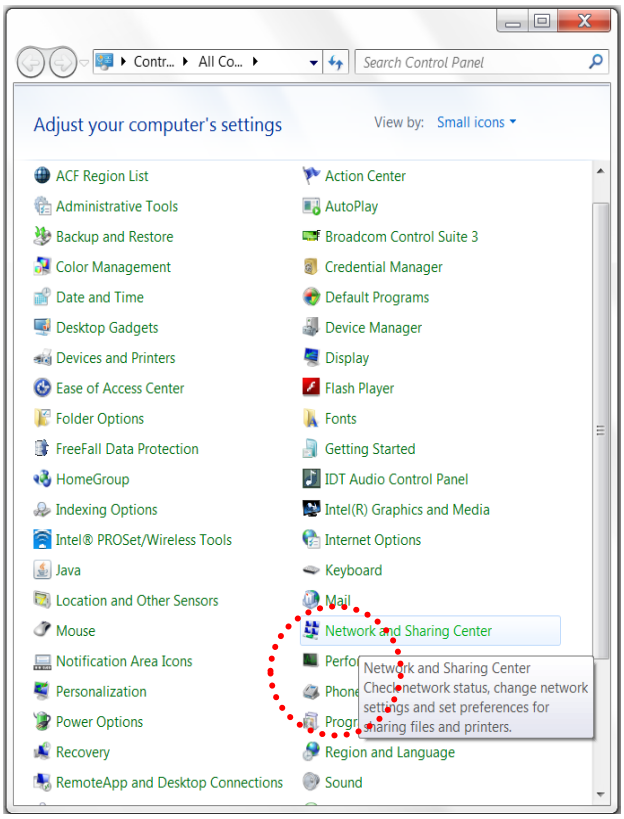


Figure 7-2: Windows Control Panel

Double-click on the Network Connections icon. A window displaying the list of available network connections will be shown. Scroll down and select the "Set up a new connection or network" hyperlink", under the "Change your network settings", pane as shown in Figure 7-3.

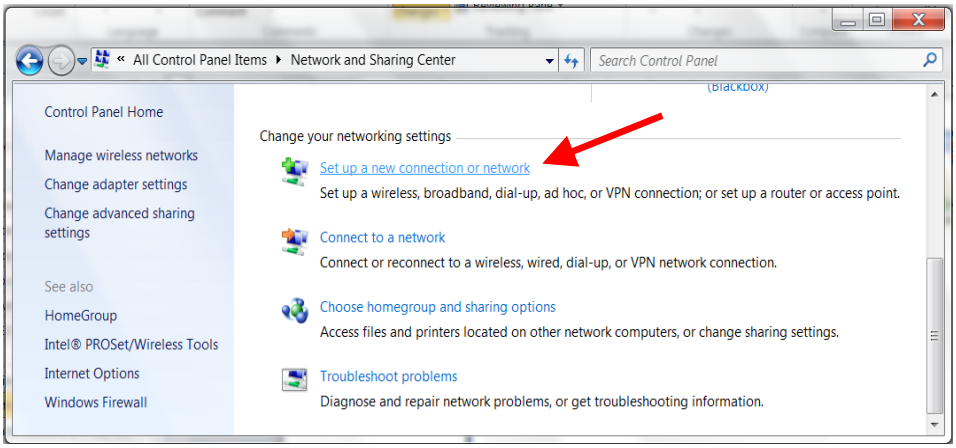


Figure 7-3: Network Connections Window

Select "Connect to the Internet" and click "Next" as shown in Figure 7-4.

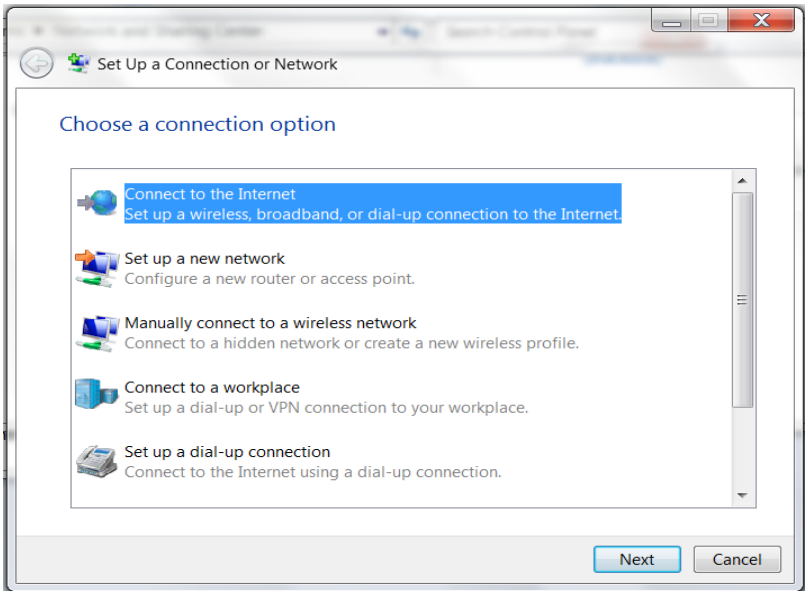


Figure 7-4: New Connection Wizard

Select "Set up a new connection anyway" as shown in Figure 7-5.

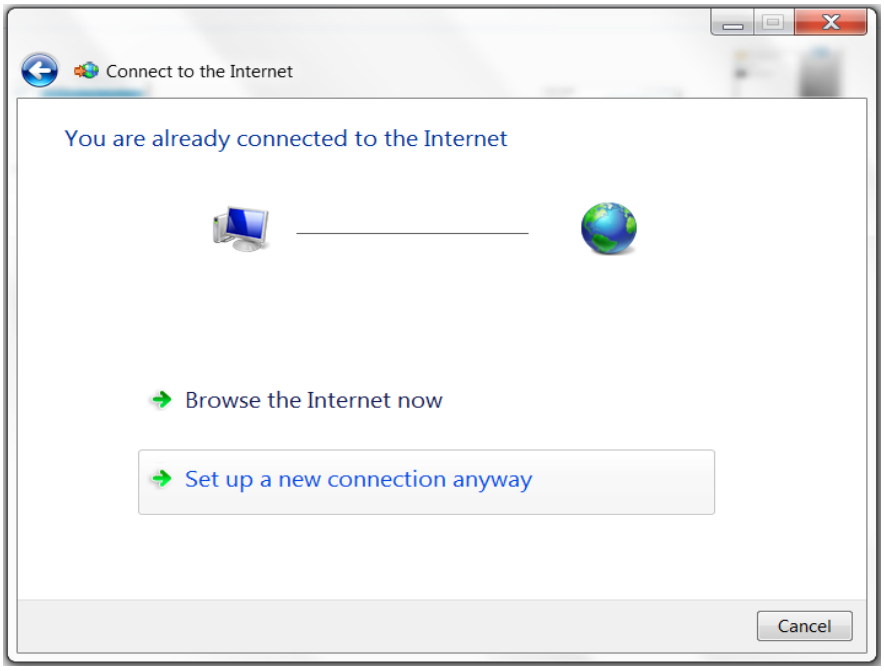


Figure 7-5: Getting Ready Page

Assuming that an active Internet connection exists, select "No create a new connection", and click "Next" as shown in Figure 7-6.

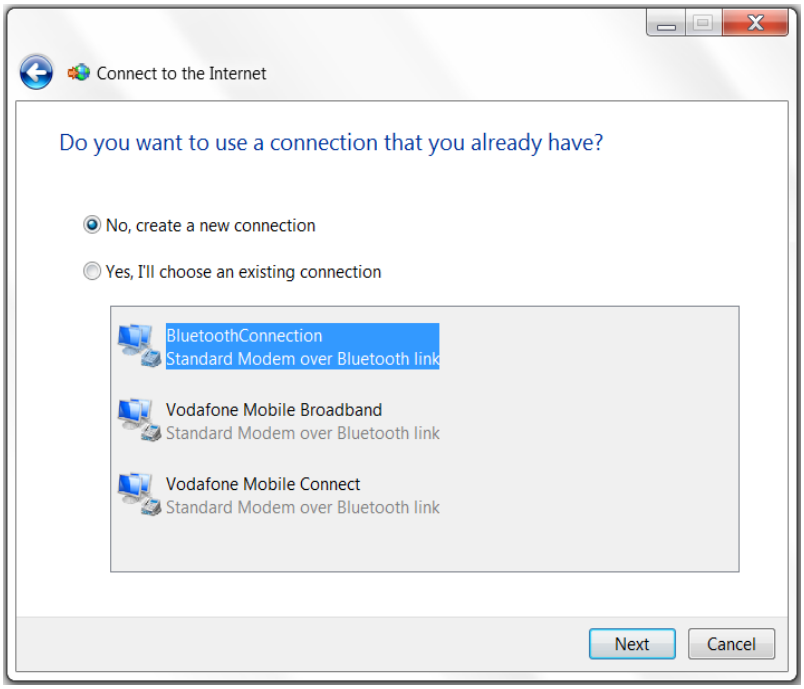


Figure 7-6: Internet Connection Page

Select "Broadband PPPoE" as shown in Figure 7-7.

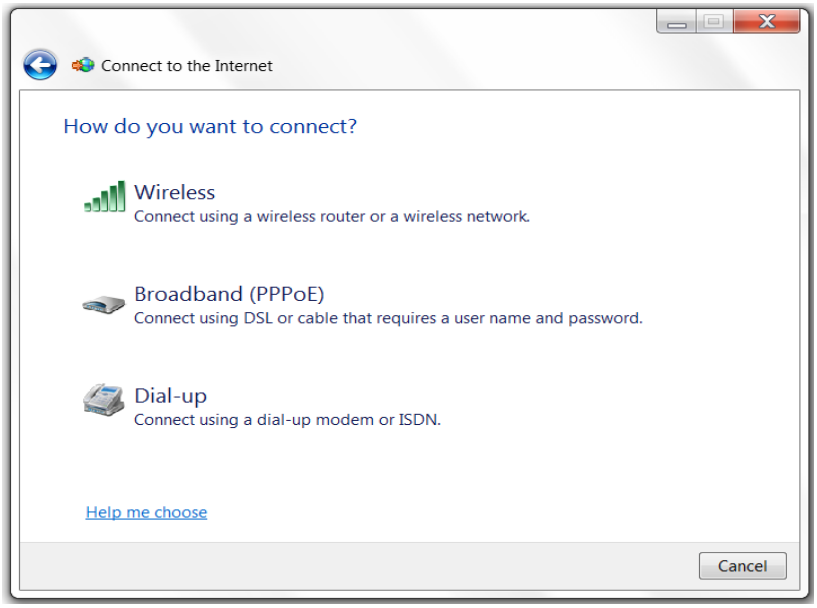


Figure 7-7: Connection Name

Leave the user name and password blank, unless these are required to access a particular service (such as a static IP) as advised by your Service Provider (refer to Section 12 for additional details).

Select "Connect" as shown in Figure 7-8.

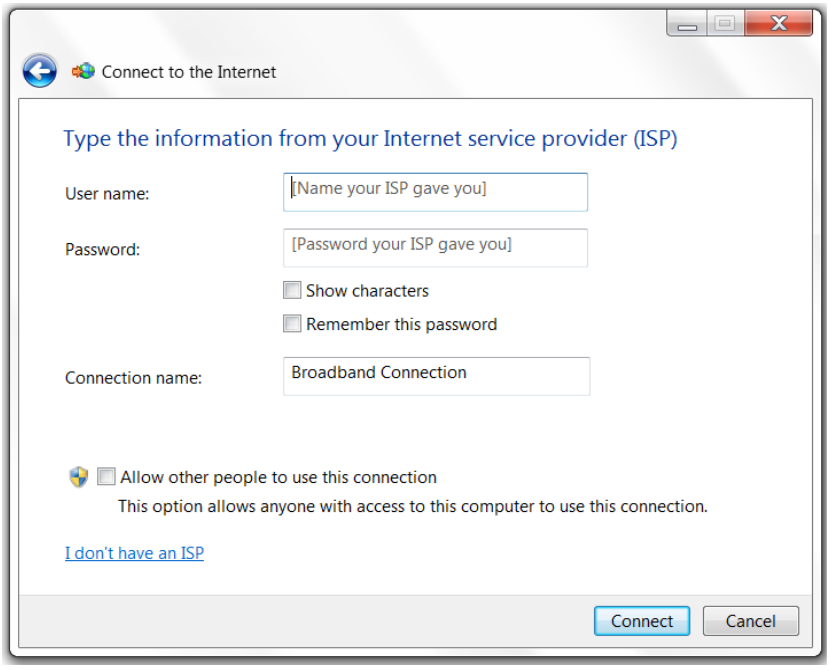


Figure 7-8: Connection Availability Page

The following dialogue (see Figure 7-9) appears indicating that the PPPoE connection is in progress.

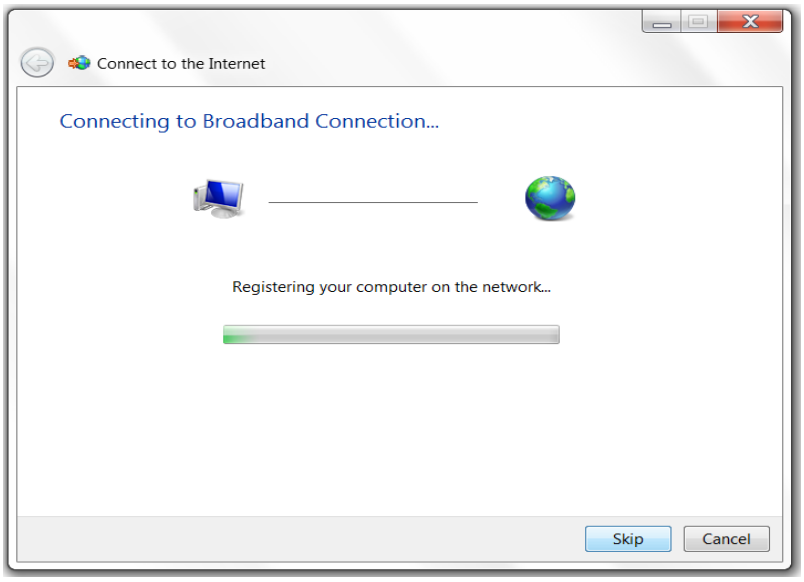


Figure 7-9: Registering dialogue

After the connection was completed the dialogue shown in Figure 7-10 appears.

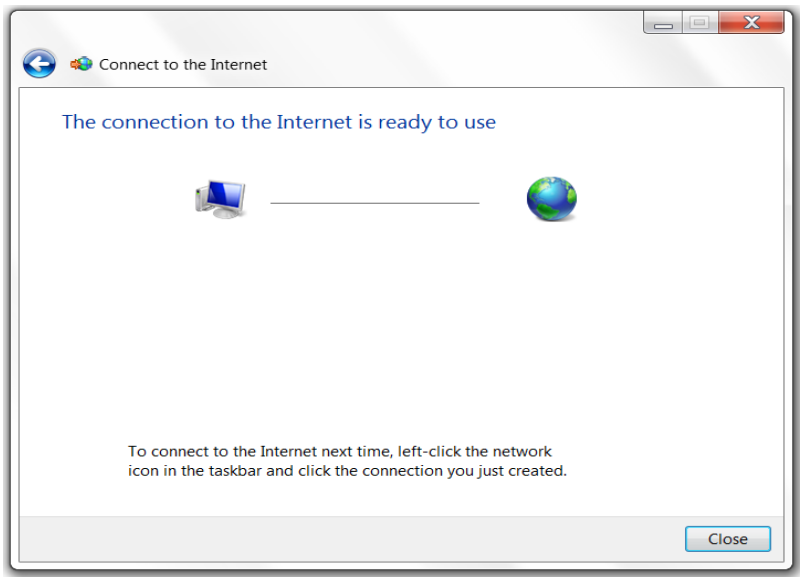


Figure 7-10: Connection final status

### 7.3.2 Using the Service Name field

The use of the Service Name field is optional. The user may customize the connection type, modem used, and connection quality by specifying a series of strings in the Service Name field. If left empty, a connection will be assigned to the default modem using the default PPPoE settings (as configured by the System Administrator) provided that no active rules exist for the Service Name String override facility. For a description of the Service Name String Override facility - see [1].

### 7.3.2.1 Configuring the Service Name field on a Windows 7 machine

Follow the following steps to configure the Service Name field:

- Open the broadband connection in the" Network Sharing Center" page available via Control Panel (see Figure 7-2). The dialogue shown in Figure 7-3 appears.
- Select "Change Adaptor Settings". A list of Network connections appear (see Figure 7-11).

The following dialogue appears (see Figure 7-11). Note the newly added broadband connection appears as "Broadband Connection" in the left pane):

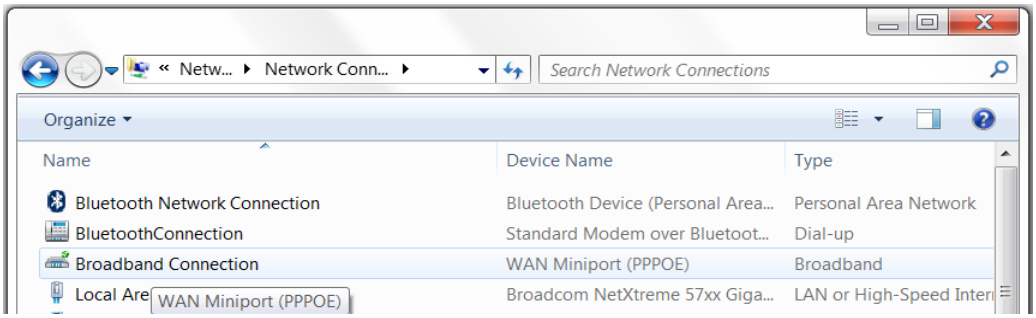


Figure 7-11: Change Adaptor settings

- Right click on the "Broadband Connection" and select the "Properties" item. The properties dialogue opens with the "Service Name" field accessible under the "General" (see Figure 7-12). A service string and/or AT command string can be entered to configure the broadband connection, as shown in Section 7.3.2.2.
- Follow the conventions used in Section 7.3.2.2 to create the text string that will set up the required service.
- Click *OK.*
- The string inside the Service Name field will be applied to all subsequent connections.

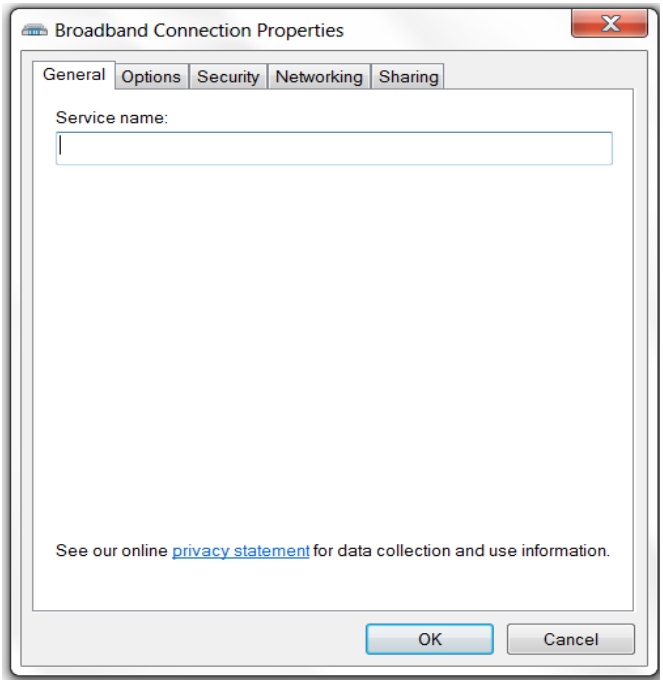


Figure 7-12: Connection Properties Dialogue

### 7.3.2.2 Service Name Field Input Format

The service name field may be populated by a series of text strings (delimited by the keyboard space character).

They are:

**[Service([:])[(-Modem)]] [Service String] ([AT Command String])**, where the strings are defined as follows:

Table 7-1: Service Name configurable options

| Field | Mandatory/ Optional | Possible Values | Meanings |
|---|---|---|---|
| [Service-Modem] | Optional else default Modem will be used | SBB: | SwiftBB on default modem |
| | | SBB-1 | SwiftBB service on Modem 1 |
| | | SBB-2 | SwiftBB service on Modem 2 (multi-modem system) |
| | | SBB-3 | SwiftBB service on Modem 3 (multi-modem system) |
| | | SBB-4 | SwiftBB service on Modem 4 (multi-modem system) |
| [Service String] | Optional (except "" is required to enter an AT command string on its own) | BACKGROUND | Background Class PDP context. |
| | | STREAM<rate>K<br>With <rate> = (8 to 64) in increments of 1 OR (64 to 128) in increments of 8.<br>OR 512 (X-Stream) | Streaming Class PDP context<br>(If not supplied, administrator defaults will be applied.) |
| | | USER[8] | USER: Specifies that the [Command String] will be used. |
| [Command String] | Optional<br><br>Mandatory only for the [Service String] = USER | AT command string (see paragraphs below)[8]. | The following substitution characters can be used in place of the standard Context ID parameter inside the AT command string:<br>• ^ Current context number<br>• & Current context number + 1<br>• - Current context number + 2<br>• % Current context number - 1 |

[8] Not applicable if "Non ARINC-781 PPPoE Connection Identifiers" was disabled.

The [Service String] field specifies the primary PDP context type to be established for the connection. If accepted by the SATCOM System, the SATCOM System will attempt to activate it by sending the appropriate request to the network. Any associated secondary PDP contexts will need to be defined and activated via the appropriate AT command strings.

When a [Service String] value other than USER is used, then any AT commands in [Command String] will be appended to the connection request sent to the network by the SATCOM System. Also see footnote 8.

With the [Service String] value of USER, only the user-supplied AT commands in [Command String] are applied.

Service Name Examples:

*SBB-1*
A primary PDP context corresponding to the default PDP connection Class (as configured by the System Administrator) will be defined and activated on modem 1.

*SBB-1 STREAM128K*
A Streaming Class 128 kbps primary PDP context will be defined and activated on modem 1.

*SBB-2 BACKGROUND AT+CGDSCONT=&,^;+CGEQREQ=&,1,32,32,32,32;+CGTFT=&,1,1,,17;+CGACT=1,&*
A Background Class primary PDP context is defined and activated, followed by a Streaming Class 32 kbps secondary PDP context with a UDP-based TFT filter, all on modem 2. This filter will pass all UDP traffic directed to the SDU from the Internet over the Secondary PDP Context. The Primary PDP Context will carry all the UDP traffic destined towards the Internet. For more information on creating secondary contexts and TFT's please see [5].

*SBB-2 USER AT+CGDCONT=^,"IP","bgan.inmarsat.com";+CGEQREQ=^,3;+CGACT=1,^*

A Background Class primary PDP is defined and explicitly activated to APN "bgan.inmarsat.com" on modem 2.

There should be no spaces in [Command String], and only the first command in a concatenated string should have the "AT" prefix. Any default parameters in a trailing position at the end of a command can optionally be omitted.

A primary PDP context initiated via [Service String] is automatically activated. Primary and any Secondary PDP contexts activated via a [Command String] must be explicitly activated with the +CGACT command.

Certain client applications have limited effective input length fields. It appears that the MS Windows 7 PPPoE client application accepts more than one hundred characters (one hundred and twenty nine) in the Service Name field, but only transmits the first hundred characters to the PPPoE server.

#### 7.3.2.3 PDP Context parameters

The parameters in Table 7-2 can be specified in a PDP context definition.

Table 7-2: PDP Context Parameters

| Parameter | Possible Values |
|---|---|
| Context Identifier (CID) | Context IDs can range from 1 to 35 for each modem (in a dual-modem system), with only a subset (corresponding to the maximum number of active PDP contexts) active at any one time |
| APN | Text string. If omitted, the default bgan.inmarsat.com is used |
| IP Address | IPv4 format. If omitted, a dynamic IP address is provided by the Inmarsat SBB network. If specified, a static IP address will be requested, and a subscription is required with the Service Provider. A specific APN will also typically need to be specified |
| Connection Class | Background (3) or Streaming (1) |
| Maximum Bit rate Upload/Download (kbps) | Background: N/A (so either omit, or specify 0 or 512)<br><br>Streaming: 8,9..64 (any 1kbps step) or 64,72..128 (any 8 kbps step). Also see 16.2.3 |
| Guaranteed Bit rate Upload/Download (kbps) | Background: N/A (so either omit, or specify 0 or 512)<br><br>Streaming: 8,9..64 (any 1kbps step) or 64,72..128 (any 8 kbps step). Also see 16.2.3 |
| Transfer Delay (ms) | Background: N/A (so either omit, or specify 0)<br><br>Streaming: 0-4000<br>• >1000 (acknowledged mode streaming)<br>• =0 (unacknowledged mode streaming) |

### 7.3.3 Starting a broadband (PPPoE) connection

- Double-click on the icon created for the new connection in the Network Connections window.
- Click on "Connect" to establish the PPPoE connection as shown in Figure 7-13. This will cause the SATCOM System to activate a single primary PDP Context and any pre-configured, associated secondary PDP Contexts (see Section 7.3.2). Further secondary PDP Contexts can be defined and activated after connection, as outlined in Section 14.1.1 (for better understanding of secondary Contexts see Section 16.2.3).


Figure 7-13: Connection Dialogue

**NOTE:** If your PC was previously connected to the Internet via a Shared Internet Connection before the broadband connection was created, then data will now start to pass over the broadband (PPPoE) connection. To resume operation over the Shared Internet Connection, simply stop the broadband connection as described below.

**NOTE:** All IP traffic will pass over the single broadband connection. If defined, filters in the SATCOM System will then segregate different traffic types over the primary PDP context and any associated secondary PDP contexts, with recombination performed at the terrestrial end.

### 7.3.4 Stopping a broadband (PPPoE) connection

Go to the "Network and Sharing Center" window within the Control Panel. Select the Broadband Connection and click "Disconnect this connection" in the strip above the list of connections (see Figure 7-14). Alternatively right click the Broadband Connection and select "Disconnect" from the menu.

This will cause the SATCOM System to deactivate the single primary PDP context and any pre-configured, associated secondary PDP contexts.

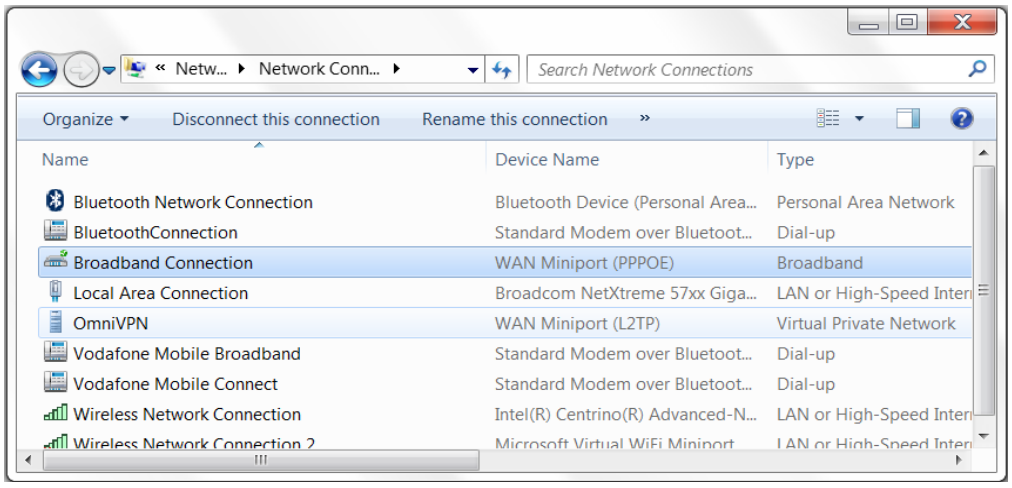


Figure 7-14: Stopping Broadband Connection

# 8. SINGLE USER NAT-FREE DATA CONNECTION

## 8.1 Introduction

Therefore no NAT translation is performed in the SATCOM System on the data traffic to/from the user's PC. This mode of access is typically used when only a single device is connected to the SATCOM System and the device, e.g. an encryption device, requires a fixed, globally available IP address. If such a device has the capability to dial up via a PPPoE link, the PPPoE access method (see section 7) is preferred.

## 8.2 SATCOM System Configuration

It is assumed that the SATCOM System has been configured by the System Administrator to automatically activate the Single User Nat Free Mode at start-up as well as enable DHCP in the SATCOM System.

The Single User Nat Free access mode inherits all the Shared Internet Connection configuration settings previously configured by the System Administrator. If the Shared Internet Connection was configured to automatically start a Background PDP Context, the Single User Nat Free Mode will also start a Background PDP Context. In multi-channel systems, the default modem for the Shared Internet Connection will be the modem used for the Single User NAT Free mode connection.

It is important to note that only one user at any particular time can connect to the Internet using this method of access. The Single User NAT-free mode cannot co-exist with the Shared Internet Connection or the PPPoE access methods on a particular modem. In NAT-free mode, a second PC can be configured with a static IP address to connect to the SDU Console. The Static IP address of this PC must be x.x.x.y where x.x.x are the upper (most significant) three octets of the Inmarsat Network-assigned IP address that was assigned to the first PC in Single User Nat Free mode. The host part (least significant octet) of the IP address, y, can be any number except 250 or the host part of the IP address assigned to the first PC. The Console can then be accessed at x.x.x.250.

## 8.3 What you require to connect to the SATCOM System

See section 6.3. Additionally your PC network adaptor must be configured to enable DHCP.

## 8.4 How to connect to the Internet

See section 6.3.

# 9. TROUBLE SHOOTING (CONNECTION/PERFORMANCE ISSUES)

## 9.1 Broadband connection fails to connect

This may occur due to several reasons:

- Invalid service string or AT command string - This should be checked for correctness against the format outlined in Section 7.3.2.2.
- Capacity is unavailable on the SATCOM System or the system is not operating correctly - If a Background PDP does not connect successfully, these are some of the likely causes. The system status can be determined as described in Section .
- SATCOM System located near the edge of satellite coverage, capacity is unavailable in the SwiftBroadband network (the network will refuse a request for a streaming connection if the available network capacity is considered to be insufficient.) or sub-optimal network conditions exist. If a Background PDP Context connects successfully, but a Streaming PDP Context is unsuccessful, then these are some of the likely causes. Use a lower Streaming rate or a Background PDP Context only.

## 9.2 Internet access is available, but some applications fail to connect or operate correctly

Inward connections from terrestrial PCs to airborne PCs will possibly be subject to any firewalls implemented by the Service Provider or the user terminals in the aircraft.

## 9.3 Connections over the second modem drop (in a multi-modem system)

If SATCOM System propagation conditions are unfavourable, the connections on one modem (the most recent one to be used) may be disconnected. Once propagation conditions improve, it should be possible to reconnect all services over the second modem.

## 9.4 Optimising performance of audio or video applications

If you have problems establishing audio or video applications, such as VoIP, conferencing or streaming, or the content is intermittent, then it is possible that bandwidth constraints on the modem (PPPoE) connection are affecting the performance. This may be addressed in one of several ways:

- If possible, configure the application for a lower resolution mode of operation.
- Modify the PDP type to be a Streaming Class PDP, with sufficient bandwidth to accommodate your application.
- If secondary PDPs are in use, ensure that the TFT filters are correctly defined to appropriately direct the traffic for the particular application.
- Use a circuit-mode data connection over ISDN - The rate will be limited to 56kbps or 64kbps, and an ISDN card will be required for your PC. Refer to Section 15 for further details.

## 9.5 Optimising throughput of TCP-based applications

Low TCP data throughput may be a result of sub-optimal user PC TCP configuration. Some applications running on the user's PC make use of TCP to transfer data (for example file transfer using FTP). The satellite link adds a significant amount of link delay that may or may not have been automatically compensated for by your PC's operating platform. Refer to Section 6.5.7 in this regard.

### 9.6 GPS time is not accurate after SDU start-up

After an SDU start up the Time Source i.e. internal GPS time could be inaccurate by up to 15 seconds until the internal GNSS acquires the satellites. The Time Source will be updated within 13 minutes.

# 10. HEADER COMPRESSION

Header compression is a process whereby redundant data in TCP, UDP and IP protocol headers are compressed before packets are exchanged over the satellite link, and then decompressed before onward transmission over the external IP network at each end.

This compression is separate from any data compression, TCP performance enhancement (such as by a Performance Enhancing Proxy (PEP)) or HTTP acceleration that may be applied externally to the SATCOM System.

If header compression was enabled by the Administrator, header compression will be applied to all PDP Contexts and therefore no user-enable compression will be required for new PDP Contexts.

# 11. CIPHERING

Ciphering is a process whereby user signalling and data are encrypted over the satellite link to prevent unauthorised interception of information. The functionality is enabled by default, and should only be disabled for diagnostic purposes when investigating connection problems, as described in the SwiftBroadband Administrator manual [1].

If enabled, the terminal's capability to use ciphering is signalled to the Inmarsat SBB network by the SATCOM System during registration, and applies to every PDP context. It should also be noted that ciphering is only applicable to data transmitted inside the Inmarsat network. Once data packets leave the Radio Access Network (RAN) the content is no longer protected, and if security is important, it is strongly recommended that the user employs end-to-end encryption.

# 12. CONNECTION AUTHENTICATION

User Authentication may be required for some connections. In such cases a user name and password may be supplied in the PPPoE connection instance. Before attempting such connections, the user should verify with the Service Provider whether authentication is required for any required service or IP address type.

The SATCOM System supports PAP authentication which may be used for the Shared Internet connection mode or PPPoE access mode. For the Shared Internet access mode the user name and password must be configured by the SATCOM System Administrator.

# 13. ARINC-781 OUT OF BAND CONTROL USING TELNET

Secondary PDP Contexts can be created, modified, activated and de-activated using ARINC-781 TELNET control. Refer to the disabling of "Non ARINC-781 PPPoE Connection Identifiers" in [1] for a detail description and examples. This method simplifies PDP Context management especially in multi-modem systems and hence is preferred over the raw TCP method described in section 14.

# 14. PDP CONTEXT CONTROL USING RAW TCP CONNECTIONS

RAW vs TELNET: A typical TELNET client listens for control messages and responds to them to negotiate line buffering, character echo etc. This is all done to 'prepare' for the data connection which will follow. Control can also be sent interspersed in the data. TELNET clients would then, in the absence of these control messages revert to a RAW pipe. The character echo, line buffering must in the case be handled by the server connection peer entity in the SATCOM System.

### 14.1.1 Modem Control Port

AT-command functionality (defined in Section 14.1.2 to 14.1.8) is available to any installed modem through a unique port *(Modem Control port)* in an established RAW TCP connection.

Only Primary PDP contexts created via PPPoE clients, that exist on the modem associated with the Control Port, can be modified. The Primary PDP Context associated with the Shared Internet Connection must not be modified in this way. The creation of Primary PDP Contexts may be allowed by the SATCOM System, but must not be done, as it will not be possible to pass data over such PDP Contexts. Secondary Contexts (tied to PPPoE Primary Contexts) can be created and modified.

A RAW connection via the Maintenance or User Ethernet interface is used to access the *Control Port* (one RAW connection per *Control Port*). The session may be created using any terminal emulator.

An example is shown in Figure 14-1 using PuTTY. To initiate a connection, enter the IP address of the SATCOM System in the terminal emulator, along with the appropriate RAW port number. The standard Linux and Windows-based TELNET clients can also be used to connect to the Modem Control ports.

Maintenance Port:

- IP Address: 10.0.1.100
- Modem 1: 9876
- Modem 2: 9877
- Modem 3: 9878
- Modem 4: 9879

User Ports

- IP Address: LAN Settings Gateway Address (default: 172.18.0.250)
- Modem 1: 9876
- Modem 2 9877
- Modem 3: 9878
- Modem 4: 9879

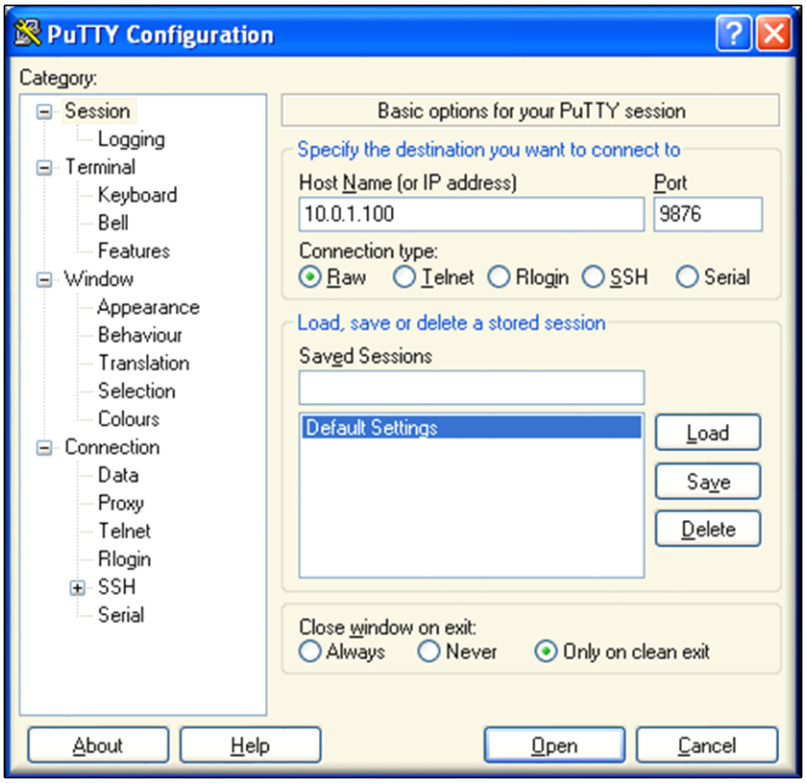


Figure 14-1: PuTTY Raw TCP Connection

### 14.1.2 Creating Secondary PDP Contexts

Primary contexts ***must*** be created via the SATCOM Console configured Shared Internet Connection or via the user PC initiated PPPoE access method.

Secondary contexts may be created via the Modem Control Port method shown in Section 14.1.1.

### 14.1.3 Managing Context IDs

When performing advanced functions such as scaling of PDP contexts, context IDs for each PDP context must be co-ordinated and tracked as specific context ID (CID) referencing is required.

This will avoid inadvertent modification of the incorrect context, or loss of connection due to incorrect context termination.

Context IDs are managed by the SDU and are linked to the modem/USIM. The first context defined on each modem will always be created with CID 1. The CID will be incremented with every new context defined on the same modem. Thus the SDU may have duplicate CIDs in use but on separate modems/USIM pairs.

If a context is deactivated, the CID becomes available and will be used for the next context that is defined on the same modem.

### 14.1.4 Determining Active Context IDs

The Context ID is displayed on the SATCOM Console Connection Monitor screen under the "Show Detailed Data Connection Information". The CID for the defined contexts may also be requested using AT-commands.

The command sequence is as follows:

AT-command: AT+CGCMOD=?

AT-response: +CGCMOD: (x,y,z...) Where x,y,z is the list of CIDs for defined PDP contexts

OK

See the example in Figure 14-2 using the Control Port; there are 2 active contexts: CID 1 and CID 2.


Figure 14-2: List of Active Contexts

### 14.1.5 Determining Active Context Connection Information

To verify CIDs connection information (Class of service and negotiated rate if applicable), the following AT-command should be used:

AT-command: AT+CGEQNEG=<CID#>

AT-response: +CGEQREQ=<CID#>,<Connection_Class>,<Max_Bitrate_Up>,<Max_Bitrate_Down>, <Guaranteed_Bitrate_Up>,<Guaranteed_Bitrate_Down>,<N/A>,<N/A>,<N/A>,<N/A>, <N/A>,<N/A>,<N/A>

Where <Connection_Class> is defined by:

1 = Streaming Class,
3 = Background Class

The bitrates shown are those negotiated with the network in kbps.

Additional information marked as not applicable (<N/A>) in the response is not relevant to this document.

**NOTE:** Due to network loading the negotiated rates may be lower than those requested.

See Streaming Class example in Figure 14-3 and Background Class example Figure 14-4, both using the Control Port.

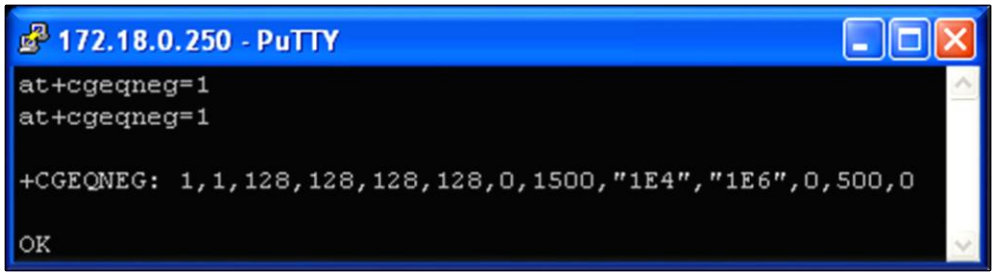


Figure 14-3: Active context connection information – Streaming Class


Figure 14-4: Active context connection information – Background Class

### 14.1.6 Modifying/Scaling of PDP Contexts

Certain characteristics of an active PDP context can be modified, while the context remains active.

#### 14.1.6.1 Scaling Streaming Class Contexts "On-the-fly"

The negotiated bit rate of an active Streaming Class context may be renegotiated, while the context remains active.

The CID for the connection ***must*** be known in order to modify the correct context. Refer to Sections 14.1.2, 14.1.4 & 14.1.5 for assistance in determining the CID if it is not known.

When configuring a Streaming Class connection, the Maximum Bitrate Up/Down and the Guaranteed Bitrate Up/Down must be specified. The network will attempt to reserve the Maximum Bitrate requested. If this is not available, the network will revert to the Guaranteed Bitrate, and signal this "negotiated" rate to the SATCOM System.

If the context was assigned the Maximum Bitrate and network loading increases, the network may reduce the bitrate from the Maximum Bitrate to the Guaranteed Bitrate to accommodate more users.

The Inmarsat network currently only supports symetrical up and down bitrates. This implies that the requested up and down bitrates must be identical, even though they are requested separately.

To renegotiate a specific context the following AT-command is used:

AT-command: AT+CGEQREQ=<CID#>, <Connection_Class>, <Max_Bitrate_Up>, <Max_Bitrate_Down>, <Guaranteed_Bitrate_Up>, <Guaranteed_Bitrate_Down>

AT-response: <echo response of command>
OK

Where:
<Connection_Class> is defined by:

1 = Streaming Class,
3 = Background Class

<Max_Bitrate_Up> and <Max_Bitrate_Down> specify the requested Maximum Bitrate (the preferred bitrate). The Maximum Bitrate up and down must be identical as described above.

<Guaranteed_Bitrate_Up> and <Guaranteed_Bitrate_Down> specify the requested Guaranteed Bitrate (acceptable bitrate). The Guaranteed Bitrate up and down must be identical as described above.

See example in Figure 14-5 showing modification of CID 1 (Streaming Class) to a Maximum Bitrate of 64 kbps and a Guaranteed Bitrate of 32 kbps.

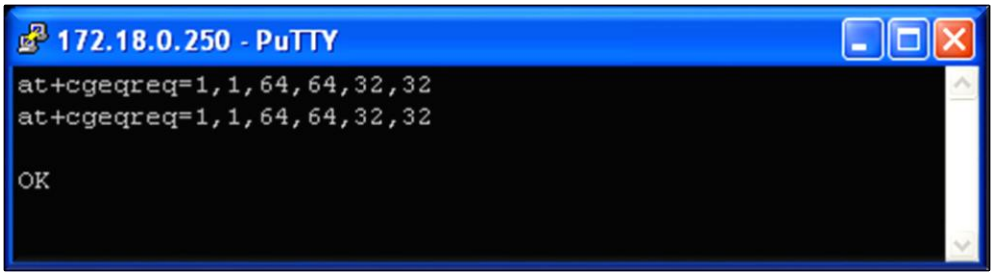


Figure 14-5: Streaming Class context modification – Renegotiate

After the AT+CGEQREQ command has been sent, the context will not yet use the new rates requested. An additional command is used to modify the context.

To modify a specific context the following AT-command must be used:

AT-command: AT+CGCMOD=<CID#>

AT-response: <echo response of command>
OK

At this point the renegotiation takes place and if successful the new Bitrates will be applied. See Figure 14-6.


Figure 14-6: Streaming Class context modification – Modify

Verify that the renegotiation was successful using the AT+CGEQNEG=<CID#> command as described in Section 14.1.5.

### 14.1.7 Modifying Background Class Contexts

The Inmarsat network does not allow the modification of Background Class contexts into Streaming Class contexts.

To change between Background and Streaming Class contexts the user must first deactivate the Background context manually, and then define and activate the Streaming context.

This modification cannot be performed with AT commands.

### 14.1.8 Deactivating PDP contexts

Deactivation of contexts may be performed using AT-commands.

**NOTE:** Great care should be taken when using this interface, since control of *all* modem connections is possible, including those in use by other users. You should be sure of your CID before deactivating any PDP.

The CID for the connection ***must*** be known in order to deactivate the correct context. Refer to Sections 14.1.2, 14.1.4 & 14.1.5 for assistance in determining the CID if it is not known.

To deactivate a specific context the following AT-command should be used:

AT-command: AT+CGACT=0,<CID#>

AT-response: <echo response of command>
OK


Figure 14-7: Deactivation of PDP Context

# 15. CS SERVICES

Please consult Table 4-3: for a comprehensive CS service list offered by the various SATCOM System terminals. These services are accessed via the following supported handset types: POTS devices, SIP handset/application and ISDN terminals.

The SATCOM System allows both incoming and outgoing Circuit Switched calls via all supported handsets.

Calls made to any number in the terrestrial ISDN or PSTN network from any supported handset, are termed outgoing calls. See Section 15.2 for more information on making outgoing calls.

Calls received by any supported handsets, connected to the SATCOM System, from the terrestrial PSTN or ISDN network are termed incoming calls. See Section 15.3 for more information on making incoming calls.

Internal calls may also be made between all supported handsets connected to the system. E.g. ISDN-to-POTS, POTS-to-POTS, ISDN-to-ISDN. SIP-POTS, SIP-SIP or SIP-ISDN. Internal calls are not billed.

The Inmarsat network provides ISDN Circuit Switched voice as well as circuit mode data services.

Each ISDN Interface of the SATCOM System allows users to connect standard ISDN user terminals conforming to the Euro-ISDN Basic Rate standard to make outgoing and receive incoming ISDN data or voice calls.
Voice calls are made by connecting an appropriate terminal device (for example an ISDN handset/telephone) to the SATCOM System ISDN socket.

Circuit mode data calls are typically made by connecting an internal/external Terminal Adapter (TA or ISDN Modem) between the users' PC and the ISDN port of the SATCOM System. This functionality is also offered by various ISDN handsets.

An MSN number matching the intended extension number of the terminal device must be configured in the terminal device before it can be used for Internal calls.

## 15.1 Service selection

CS calls can be made to use different service types provided they are offered by the specific SATCOM System terminal (see Table 4-3:). The service types that the Inmarsat core network supports are defined in Section 4.4.
No user control over service selection exists for incoming calls. The telephone number (MSISDN) dialled by the calling party will determine the service type used for incoming calls.

For outgoing calls, the user can select a specific service by using pre-fix dialling (see Section 15.1.1). Pre-fix dialling selects the service type on a call by call basis.

For ISDN handsets the service selection can additionally be done by selecting a different configured MSN corresponding to the required service type, prior to making the call. This is done by selecting a different active MSN in the handset configuration. All subsequent outgoing calls (on the particular handset) will use configured MSN.

The first option (4kps Voice), shown in Section 15.1.1, is the most cost effective way of voice calling. This service uses the lowest bandwidth over the satellite connection.

### 15.1.1 Pre-fix dialling

The following pre-fix dialling options are available. These options will override the administrator configured service on both POTS and ISDN ports.

The following pre-fixes may be used:

- "1*" followed by the destination number will establish a low cost voice call (4kbps).
- "2*" followed by the destination number will establish a high cost voice call (3.1kHz Audio).
- "3*" followed by the destination number will establish a 64kbps Data call.(ISDN handsets only)
- "4*" followed by the destination number will establish a 56kbps Data call.(ISDN handsets only)

## 15.2 Making outgoing calls

### 15.2.1.1 Making an outgoing call using a POTS handset

From a connected POTS handset dial the following using the handset keypad:

> "00" followed by the country code, e.g. "44" for the UK or "1" for the USA (or Canada) followed by the subscriber (called party) number.

**NOTE:** The "00" can be replaced with "+" if supported by the handset.

### 15.2.1.2 Making an outgoing call using a SIP handset or softphone

Configure your SIP client application as described in section 15.6.

From a SIP client registered with the SATCOM System SIP server, compose the number using the keypad or by selecting it from a preconfigured contact list.

> If keypad is used, dial "00" followed by the country code, e.g. "44" for the UK or "1" for the USA (or Canada) followed by the subscriber (called party) number. Press the SIP client dial/call button.

### 15.2.1.3 Making an outgoing call using an ISDN handset

The call is made the same way as indicated in 15.2.1.1.

Alternatively the call can be made by performing the following sequence:

> Press the 'Off Hook' button followed by *"00"* followed by the country code, e.g. *"44"* for the UK *or "1"* for the USA (or Canada) followed by the subscriber (called party) number followed by the *"#".*

## 15.3 Receiving incoming calls

## 15.3.1 Calling a handset connected to the SATCOM System (incoming calls):

The caller should dial the "telephone number" of the aircraft. More than one "telephone number" may be possible for the aircraft, as the "telephone number" is used to select the CS service type (either Voice or ISDN 3.1 kHz Audio) used when dialling the aircraft.

On the Inmarsat SwiftBroadband network, the aircrafts "telephone number" is termed the Mobile Station International Subscriber Directory Number (MSISDN).

The aircrafts "telephone number" is therefore: "+870" *followed by the* "MSISDN"

The SATCOM System incoming call numbering plan (See [1]) allows the System Administrator to select which handsets will ring for each MSISDN.

**NOTE:** For dual-modem systems there may be up to four MSISDN numbers available.

## 15.3.2 Receiving incoming calls:

Depending on the Incoming numbering plan configuration (see [1]) an incoming call will ring one, a group or all handsets connected to the SATCOM System.

## 15.4 Making internal calls

From a POTS handset, ISDN terminal or registered SIP phone/application:

Dial the four digit extension (see "Extension Number" on the SATCOM Console Outgoing Numbering Plan) corresponding to the Extension Port to which the destination handset is connected.

**NOTE:** An ISDN handset cannot receive internal calls if an Incoming MSN has not been configured in the handset.

## 15.5 ISDN terminal device Configuration

#### 15.5.1.1 Terminal Adaptor connection

Connect the ISDN cable between the TA and the provided SATCOM System ISDN socket. Connect the TA to the PC. Consult the particular TA manufacturer's guide for connection and configuration details.

#### 15.5.1.2 Terminal adaptor configuration for ISDN dial-up:

Most TA's require PC-side drivers to be installed. Refer to the TA installation guide for details. TA's enable PC applications such as Call or Fax Software to access the ISDN data network. Often TA's have a number of analogue ports built-in, enabling the user to connect analogue devices to the TA.

##### 15.5.1.2.1 Terminal Adaptor configuration for analogue modem dial-up

The TA must be connected to a ISDN socket on the SATCOM System configured with at least one extension number mapped to the 3.1kHz Audio Service (see the Configuration of Outgoing Call Routing Section in [1]).

Proceed as in 15.5.1.2, except for the dial string;

Use AT commands and configure the following:

- Error correction : LAPM
- Communications protocol V22bis (modulation method) and V42bis (compression)

## 15.6 SIP application Configuration

Connect your SIP application to the SATCOM System SIP Server. See the SIP section in the Administrator Manual [1] for more detail on how to connect to the SATCOM System.

Ask the Administrator to provide the following information:

| | |
|---|---|
| *SIP number* : | SATCOM System configured extension. Typically a four digit number "3000" |
| *Password* : | A Satom System preconfigured password corresponding to the SIP number. |
| *SIP proxy/registrar*: | The SATCOM System SIP server IP address. Typically "172.18.0.250". |

Configure your SIP application with the above data. The SIP application should automatically go online.

# 16. SBB NETWORK OVERVIEW

## 16.1 Introduction

The SBB system provides near-global coverage between +/-76 degrees latitude from three satellites in geostationary orbit. The satellites are 4th generation Inmarsat satellites, nominally located at longitudes 25 degrees East ("EMEA" satellite), 143.5 degrees East ("Asia-Pacific" satellite) and 98 degrees West ("Americas" satellite). A coverage map as well as a spot beam map is available at:
"http://www.inmarsat.com/services/swiftbroadband" (last access on 20/01/2015). Each satellite provides a large number of overlapping spot beams on the earth for users to access the network, similar in operation to any terrestrial cellular network.

The part of the earth's surface covered by each satellite is termed its "footprint". Within this footprint, a terminal should first be able to receive the satellite global beam in order to acquire system almanac data. Within the area covered by the global beam, there are a number of smaller beams called regional beams, each covering only a part of the footprint. Network registration and call announcements are performed in the regional beam covering the SATCOM System's geographical location, and the terminal stays "camped" in this beam whilst in idle mode. User services are provided in smaller spot beams, called narrow beams, which typically cover a few hundred kilometres across. The terminal moves to this beam only while user services are active.

In each spot beam, the network provides one or more bearers over which the signalling and data are transferred, and each modem in the SATCOM System is tuned to one forward link (satellite to user) and one return link (user to satellite) bearer at any given time. Note that each modem in a dual-modem system may be connected to the same or different bearers, at the discretion of the network.

The terrestrial connection point of the SBB system is called the Satellite Access Station (SAS). The SAS connects the satellite system with terrestrial networks like the global Internet and international PSTN. The same common infrastructure is accessible via every satellite region, and it is not possible to select SASs in SBB. Addressing for data traffic uses global IPv4 addressing, while PSTN calls are routed using standard international country codes in line with ITU-T E.164. All SBB calls must include international dialling prefixes, and the SBB system has the international dialling code +870 for incoming calls.

Three classes of aeronautical terminal are available: Class 6, Class 7 and Class 15. The Class type is set automatically by the type of antenna installed on the aircraft, with the larger antenna of the Class 6 terminal affording higher system data rates. For multi-modem SATCOM Systems, it should be noted that each modem appears as a completely independent terminal to the SBB network, but will have the same Class as determined by the antenna type.

Services will be lost whenever a user moves between different satellite regions, but the SATCOM System will automatically re-register with the network subject to being within coverage of the new satellite.

## 16.2 Packet Switched (PS) Data Services

### 16.2.1 Background Class connections

A Background Class connection uses bandwidth that is contended amongst multiple users occupying the same narrow spot beam and bearer. The maximum data rate is dependent on a number of factors, including the terminal class, the number of users actively passing traffic in the beam, the prevailing propagation conditions for the system, and the resources available in the network at any given time. The maximum data rate allocated over a single bearer is approximately 432 kbps under best case propagation conditions, shared amongst all users on the bearer at a given time.

Data transfer over the satellite link is reliable, with the system automatically resending any data that was previously received in error. As such, this sort of connection is most suitable for TCP-based applications which require end-to-end reliability e.g. WWW browsing, FTPs, E-mail, VPN.

As charging for a Background PDP is per Mbyte of data transferred, it may be desirable to disable automatic updates (e.g. Windows and applications such as virus checkers) on connected PCs. It should also be noted that VPNs maintain a continuous "keep alive" dialogue whilst connected, regardless of user activity.

### 16.2.2 Streaming Class connections

A Streaming class connection has a guaranteed and consistent data rate dedicated to the user. When configuring a Streaming class connection, the Maximum Bitrate Upload/Download and the Guaranteed Bitrate Upload/Download must be specified. The network will attempt to reserve the Maximum Bitrate Upload/Download requested. If this is not available, the network will revert to the Guaranteed Bitrate Upload/Download, and signal this "negotiated" rate back to the SATCOM System. If this is also not available, the creation of the context will be rejected. The maximum Streaming class bandwidth available to a single modem SBB terminal is 256 kbps, provided the associated USIM is provisioned accordingly. The SBB SB200 terminals are limited by the network to a maximum of 16 kbps.

By default, data transfer over the satellite link is not reliable for Streaming class connections. As such, this sort of connection is most suitable for UDP-based applications which do not require end-to-end reliability e.g. VoIP, Video Streaming. TCP-based applications will still run over such a connection, but error recovery for any dropped packets will take place at the end-to-end TCP level, which is less efficient than for Background class connections. To obtain a Streaming class connection with native data transfer reliability, a Transfer Delay value above 1 s should be specified.
As charging for a Streaming PDP is per minute connected, regardless of user activity, care should be taken to deactivate Streaming PDP contexts when not in use.

Streaming PDP contexts are available at rates from 8kbps to 64 kbps (depending on the terminal class of operation) in steps of 1 kbps; and from 64 kbps 8 kbps to 128kbps in steps of 8 kbps.

**NOTE:** The network may bill streaming connections in coarser steps (e.g. 8 kbps). For example, a 9 kbps connection may be billed as a 16 kbps connection.

In addition a 256 kbps "X-Stream" streaming service is available on the Inmarsat network. This service differs from the other streaming class services in that a full bearer is allocated, and data rates well in excess of 256 kb/s are possible under good channel conditions[9]. Each USIM card must be specifically provisioned by the service provider to access this service.

To configure your X-Stream connection on the SATCOM System, please refer to Section 7.3.2.2.

[9] Applicable only to class 6 and class 7 type terminals

### 16.2.3 Primary and secondary PDP contexts

A PDP context may be a "primary context", in which case an IP address is assigned, or a "secondary context", in which case the PDP context is associated with (and dependent on) a separate primary PDP context.

A primary PDP context must be set up before any associated secondary contexts. Its connection or network access point to the Internet is specified by an Access Point Name (APN). The APN is provided beforehand by the service provider. The APN must then be used whenever the primary PDP context is set up.

**NOTE:** The end-to-end QoS for applications over an SBB terminal will be affected not only by the satellite link, but by the QoS of the service provider's interconnect to the Internet that is employed by the particular APN.

Secondary PDP contexts are used if different packet types (specific protocols, specific source or destination address parameters etc.) are required to be sent over selected satellite link QoS characteristics (link types – Streaming/Background or Streaming bandwidth for example) to and from the Internet. Although Secondary Contexts share the APN and IP address of the Primary PDP context to which they've been associated, each Secondary PDP context may be specified to have a different QoS.

In these cases, a Traffic Flow Template (TFT) must be specified for each secondary PDP context to inform both the network (CGTFT) and the SATCOM System (_ITFT) about the different types of traffic to filter along each PDP Context. All traffic that is not explicitly filtered onto a secondary PDP context is sent via the associated primary PDP context by default. The different traffic types are typically identified by application (strictly protocol type), although filtering by IP address and TCP/UDP port numbers is also possible.

PDP contexts are set up either automatically (in the case of the shared connection) or through the use of the PPPoE interface, as described in the next sections.

### 16.2.4 User access to each PDP context type

#### 16.2.4.1 Shared Connections

On behalf of all users employing the Shared Internet Connection or router access mode, the SATCOM System activates one primary PDP context on one modem only. The available bandwidth is therefore shared between the number of users connected to the Shared Internet Connection. The PDP context may be activated automatically on system start-up, or only when a user chooses to manually activate it via the SATCOM Console. Automatic activation based on user traffic is not supported in order to avoid inadvertent charges, for example due to automatic updates on the user client PCs. No secondary PDPs, or access to the second modem in a multi-modem system, are available via this access mode.

Another variant of the Shared Internet Connection is the Bonded Shared Internet Connection. The SATCOM System activates one primary PDP context each on more than one modem. The amount of modems to participate in the Bond is then pre-configured by the system Administrator. The available bandwidth is therefore shared between the number of users connected to the Shared Internet Connection as well as the number of modems configured for the Bond. No secondary PDPs are available via this access mode. Access to the bonded modems are still possible using PPPoE.

#### 16.2.4.2 PPPoE Connections

A primary PDP context is activated for every user connecting via the PPPoE access mode. After activation of the primary, the user may then activate secondary PDPs. Access to both modems in a dual-modem system is possible by specifying particular service strings or AT commands in the broadband connection setup. The advantage of using PPPoE is therefore that a user has complete control over the Internet connection link per device connected to the SATCOM System. The primary PDP context is only created when the demand exists.

The use of different PDP context types and access modes is summarised in Figure 16-1.

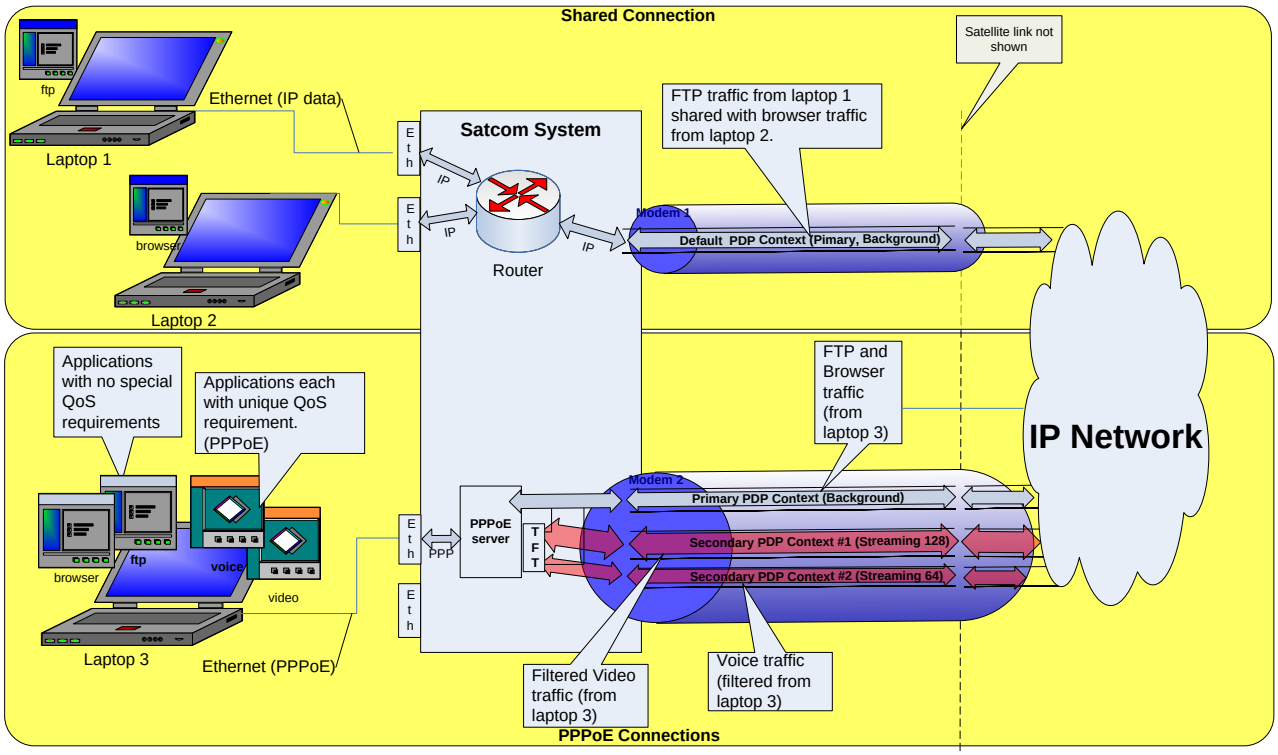


Figure 16-1: SATCOM System Packet Switched Services

Further information on BGAN and PS services can be found in [4].

# 17. OPTIMISING TCP FOR USE OVER SBB

Several methods are available to optimise TCP-based applications over SBB, including increasing the TCP receive window on the user PC to a value larger than the default set in some operating systems, and installing a Performance Enhancing Proxy (PEP) on the user PC. It is recommended that both of these methods be used to optimise throughput.

## 17.1 Increasing TCP Receive Window Size

The long latency typical of satellite communication links requires that certain user PC TCP settings be optimised before the full capacity of a satellite link can be utilised.

A TCP stack tuner utility (for example tcptune.exe freeware for MS Windows) can be used to do this. Recommended settings for TCP Tuner are shown in Figure 17-1.

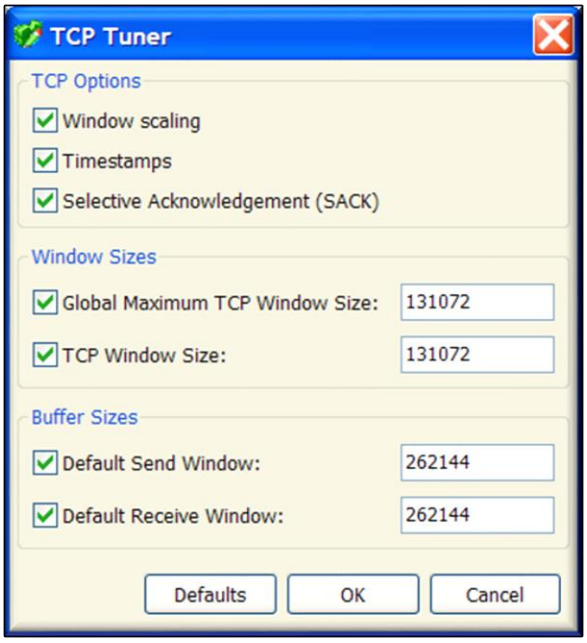


Figure 17-1: TCP Settings on Client PCs

## 17.2 Installing Inmarsat Performance Enhancing Proxy (PEP)

A PEP is an application that can enhance TCP traffic throughput in the 'send' direction over the satellite network. It is often called a TCP Accelerator.

PEP controls how packets are sent and acknowledged. Without PEP, the long transfer delays over a satellite network limit file transfer rates. With PEP, the ramp up time to reach the maximum transfer rate is reduced, resulting in faster file transfers. The increase in performance is most noticeable for smaller files and e-mail.

The Inmarsat SBB network incorporates a PEP for all traffic from the Internet to an airborne PC. For traffic from an airborne PC to the Internet, an Inmarsat-supplied PEP is available as a software application on PCs with the following operating systems:

- Windows 7 (32bit/64bit)
- Windows XP (32bit)
- Windows Vista (32bit)
- Mac OSX, Mac PowerPC

The Inmarsat TCP Accelerator application can be downloaded from the Inmarsat Support Website:

"https://www.inmarsat.com/en/support-and-info/support/bgan-firmware.html" (last accessed on 30/7/2021)

# 18. TESTED APPLICATIONS

The applications listed in Table 18-1 have been successfully tested over the SATCOM System.

Table 18-1: Tested Applications

| Application Type | Tested Applications |
|---|---|
| Instant Messaging | MSN 2008 Build 8.5<br>Oovoo V2<br>Pidgin 2.6.6<br>Skype V3.8,<br>Yahoo Messenger V8.1<br>BlackBerry Messenger |
| Video Calling | Oovoo V2<br>Skype V3.8 |
| VPN | OpenVPN |
| E-mail | Microsoft Exchange (2007) - VPN Mail<br>Microsoft Live Mail (2008) - Client Mail<br>Outlook (2007) - POP & SMTP |
| Web Video Conferencing | Oovoo V2 – 2 to 6 way video conference |
| Web Browsers | Chrome<br>Firefox<br>Safari<br>Internet Explorer<br>Opera |
| FTP | Dos FTP<br>Filezilla 3.1.1<br>IE7 Browser FTP<br>Total Commander 6 |
| Video Conference Hardware 2 | Polycom to Polycom<br>Polycom to Tandberg<br>Tandberg to Tandberg |
| Video Streaming | Streambox<br>Tandberg MXP |
| SIP handsets | Thrane & Thrane Aviator, Aircell Axxess, Snom, ICG ePhone |
| SIP applications/softphones | Linphone, Jitsi, BlackVoip, iPhone NetDial, Android CSipSimple. |

# 19. MONITORING SYSTEM STATUS

The status of the SATCOM System can be monitored with any standard web browser.

- Disable the web browser proxy (if currently selected).
- Enter the IP address of the SATCOM Console in the Browser address bar.

The default address is *http://172.18.0.250*. (Consult the System Administrator if the browser cannot connect.)

The Connection Monitor Page of the SATCOM Console is shown in Figure 19-1.

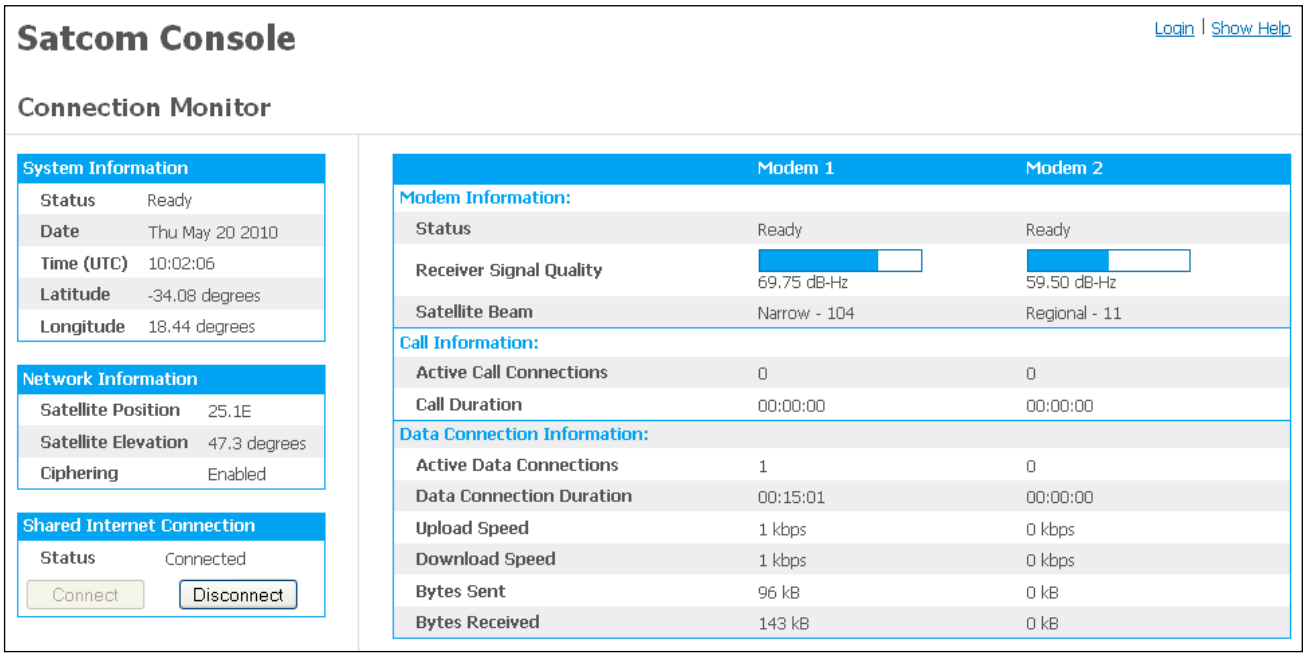


Figure 19-1: SATCOM Console - Connection Monitor Page

This Connection Monitor Help page (click on "Show Help") contains an exhaustive description of the Connection Monitor page's field descriptions together with possible states.