



Customer Document

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ip.access
nanoBTS Installation and Test Manual
CENG0336

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The information contained in this document is commercially confidential and must not be disclosed to third parties without prior consent.

Revision History

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1 Introduction

1.1 Purpose and Scope

This document provides the reader with all the necessary information required to install the ip.access nanoBTS. The document provides step-by-step instructions for the hardware installation, PSU Installation and BTS Installation and configuration steps of required to bring the BTS into service.

1.2 Related Documents

This document comprises:

Reference Number	Document Title	Description
1	CENG0133	Customer Safety and Regulatory Information
2	CENG0210	Hardware Installation – BTS
3	CENG0033	PSU Installation Guide
4	CENG0048	BTS Installation User Guide

2 Overview

This document takes the user from unpacking a BTS from it's box, installing the BTS onto a wall/ceiling then using BTS Installer to configure the BTS to communicate with the BSC.

3 Customer safety and regulatory information (CENG0133)

3.1 Introduction

3.1.1 Purpose and Scope

This document provides the customer with safety and regulatory warnings, cautions and information for the IP Access range of products.

Products covered are the model 108, 110, 139, 140, 165 and 178 range of nanoBTSs, model 109 and 126 power supplies, model 129 4U circuit switched BSC.

3.1.2 Related Documents

This document shall be referenced by the individual product's user guides.

3.1.3 Terminology

UL Underwriters Laboratories
FCC Federal Communications Commission
ICE Industry Canada
CE European Union

3.1.4 Change Control

Changes to this document shall be agreed and implemented according to the ECN procedures described within QS019, Approvals Liaison Engineer signature is required in all cases.

3.1.5 Document Organisation

This document is divided into sections by product type.

3.2 Model 109 Power Supply

3.2.1 109 - Handbook - Warnings and Cautions



This document is written in English, please request a copy in your local language if required.



This product is only intended to power products approved by IP Access. Ensure that only IP Access products are connected to an Ethernet circuit enabled for 48V operation, this also applies to outlets remote from the unit.



For indoor use only, output cabling is SELV / LAN for indoor routing only.



Do not cover casing or otherwise impede cooling.



Do not apply power to unit if there is any evidence of condensation.



Do not open casing as mains voltages may be present within the unit.



90 to 264VAC input is via a 2 pin IEC C7 (figure 8) connector. Inlet cable assembly must carry a suitable local approval (e.g. UL marked for US and Canadian markets).

PSU109 – Environmental Specification

- -10 to +45 degrees Centigrade ambient operating temperature.
- This product has been Listed by UL for use in a 25 degree C ambient.
- -20 to +80 degrees C ambient storage temperature.
- 5 to 95% RH non condensing humidity.

3.2.2 109 - Handbook - FCC Text

WARNING

This is a class B product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Federal Communications Commission

Note: This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

3.2.3 109 – Handbook - Industry Canada text

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numérisé de la classe B est conforme à la norme NMB-003 du Canada.

3.2.4 109 – Handbook - Regulatory Compliance Statement

EMC Standards

- EN 55022 and EN55024 (CE marked)
- FCC Part 15 class B
- ICES-003

Safety Standards

- EN60950 (CE marked)
- UL60950 Listed (File number E231617) (USA and Canada)

This product is intended for use in all
Member States of the European Union

“Hereby, ip.access declares that this Ethernet Power Inserter is in compliance with the essential requirements and other relevant provisions of Directives 73/23/EEC and 89/336/EEC.”

The PSU109 is supplied by Poly-Products Industries, model number ILA1711112.

A copy of regulatory compliance documentation may be obtained in writing from

“IP access Ltd, Building 2020, Cambourne Business Park, Cambourne, Cambridge, CB23 6DW, UK”.

3.3 Model 126 Ethernet Switch and Power Inserter

3.3.1 126 - Handbook - Warnings and Cautions



This document is written in English, please request a copy in your local language if required.



This product is only intended to power products approved by IP Access.



Ensure that only IP Access approved products are connected to an Ethernet circuit enabled for 48V operation, this also applies to outlets remote from the unit.



To be located in a restricted access location only (accessible to maintenance personnel only).



For indoor use only, output cabling is SELV / LAN for indoor routing only.



Do not block ventilation holes or otherwise impede cooling.



Refer to National Engineering Code (USA). Wiring methods must be in accordance with NEC Article 300.



When rack mounting, secure via front panel plate with 4 bolts and ensure that no additional load is placed upon the caseworks (e.g. heavy objects on top).



When rack mounting, ensure that the internal rack temperature does not exceed the rating of this product.



Do not apply power to unit if there is any evidence of condensation.



Do not open casing as mains voltages may be present within the unit.



AC inlet cable must carry suitable local approval (e.g. UL marking for US and Canadian markets).

126 - Input Power Source Specification

- Unit may be powered via AC or DC (not both).

- 90 to 132 and 180 to 264VAC (auto-ranging) via an IEC C13 connector. 135W, 2A rating.
- 47 to 57V DC via screw terminals on the front panel. 115W 3A rating. The installer must ensure that this supply connection is fused externally at 5A and provision is made for an external disconnection device.
- Appliance must be earthed, either via the mains connector (mains operation) or screw terminal on the front panel (DC operation).

126 – Environmental Specification

- -5 to +45 degrees C ambient operating
- -20 to +80 degrees C ambient storage
- 5 to 95% RH non condensing

3.3.2 126 – Handbook - FCC Text

WARNING

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Federal Communications Commission

Note: This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

3.3.3 126 – Handbook - Industry Canada text

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérisé de la classe A est conforme à la norme NMB-003 du Canada.

3.3.4 126 – Handbook - Regulatory Compliance Statement

The nanoBTS conforms to the following regulatory standards.

EMC Standards

- EN 55022 and EN55024 (CE marked)
- FCC Part 15 class A
- ICES-003

Safety Standards

- EN60950 (CE marked)
- IEC 60950
- UL60950 Listed (File number E230296) (USA and Canada)

- CB certificate (DK-7033)

This product is intended for use in all Member States of the European Union
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“Hereby, ip.access declares that this Ethernet Switch / Power Inserter is in compliance with the essential requirements and other relevant provisions of Directives 73/23/EEC and 89/336/EEC.”

A copy of regulatory compliance documentation may be obtained in writing from

“IP access Ltd, Building 2020, Cambourne Business Park, Cambourne, Cambridge, CB23 6DW, UK”.

3.4 NANO BTS Products

3.4.1 NanoBTS - Handbook - Warnings and Cautions



This system is designed to be operated indoors as a fixed system device and must be located either on or near the ceiling away from the user. It must be mounted in a manner to ensure that all users and bystanders are kept a minimum of 20cm away from the integral antennas at all times.



Do not touch or move the antenna(s) while the unit is transmitting or receiving.



Do not hold any component containing a radio such that the antenna is very close to or touching any exposed parts of the body, especially the face or eyes while transmitting.



In most parts of the world, regulatory approval(s) are needed before the nanoBTS is operated.



Do not connect any device other than the nanoBTS to any RJ45 socket that has been enabled for nanoBTS connection (i.e. 48Vdc operation).



The nanoBTS is intended for dry indoor applications only. If evidence of condensation is present do not apply power to the nanoBTS.



The nanoBTS must only be powered using an ip.access model 109 PSU (PPI part number ILA1711112) or ip.access model 126 Ethernet switch and power inserter (unless prior written approval is obtained from IP Access). Model 165 BTS's may also be powered by a direct 48V connection using a PSU specified in writing by IP Access Ltd.



PSU's supplied by ip.access must not be used for powering any other equipment (unless carried out in a manner having prior written approval from IP Access).



TIB ports on the NanoBTS may only be connected with ip.access supplied cables with part numbers 139-040, 139-041, 139-042, 139-043 or 165-076.



Fitting external antenna or antenna cabling to the BTS invalidates the type approval, CE marking and UL listing referred to herein (unless carried out in a manner having prior written approval from IP Access).



Maximum cable length from the Ethernet Hub, Switch or PSU is limited to 100m.

3.4.2 NanoBTS - Handbook - Parts required for each nanoBTS

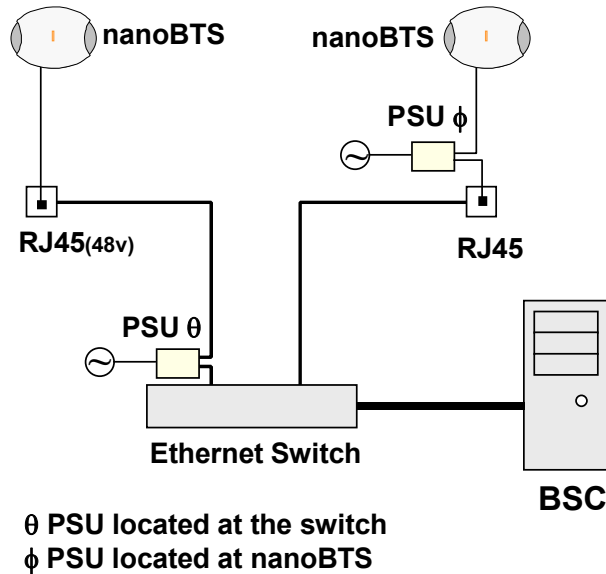
- WALL FIXINGS: These are not normally provided as part of the NanoBTS but should be suitable for the wall material and weight of the NanoBTS (2.7kg).

Suggested materials are 4 x 30mm no.10 woodscrews or M5 bolts and wall plugs (if required).

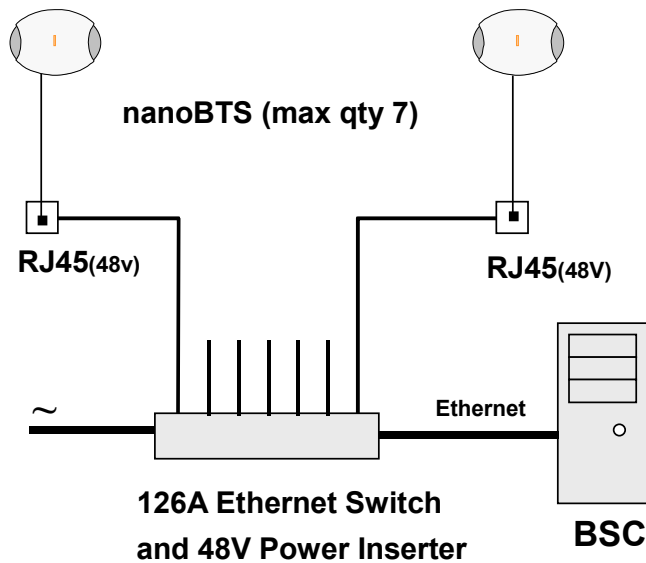
- PSU.
- NanoBTS complete with mounting bracket.
- RJ45-RJ45 connecting leads

3.4.3 NanoBTS - Handbook - Provision of Power to the nanoBTS

Power for the NanoBTS may be inserted at either the RJ45 outlet or at the output of the last Ethernet switch/hub/router etc. see figure below.

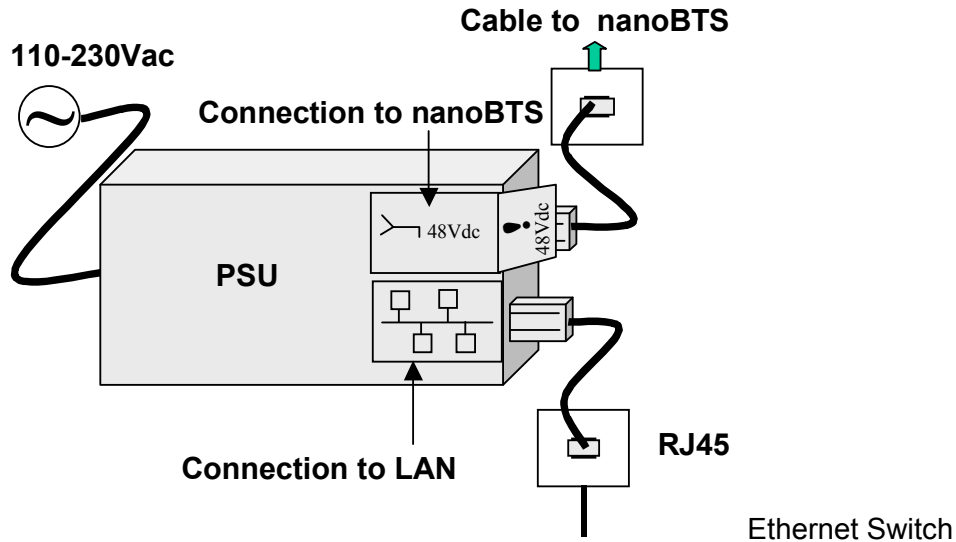


When using the ip.access model 126A Ethernet Switch and Power Inserter, external PSU's are not required, the NanoBTS is connected locally or via site cabling to the powered ports of the 126.



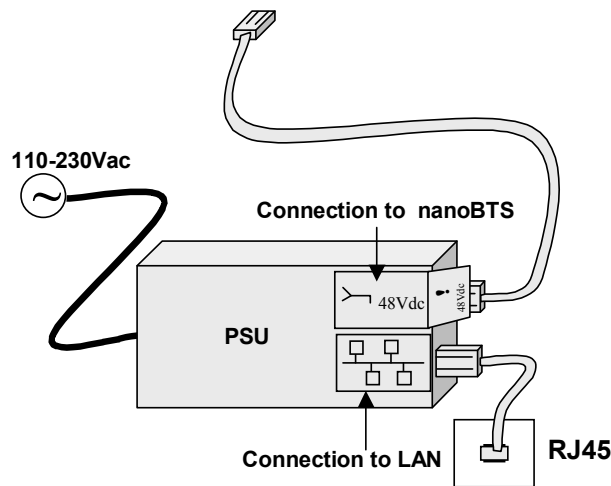
3.4.3.1 NanoBTS - Handbook - Installing the PSU at the Ethernet switch.

If the 109 PSU is located at the patch panel /output port of the Ethernet switch, it is important that the 109 PSU is connected exactly as illustrated below (failure to do so may cause damage to the switch). Ensure that the 109 PSU is placed in a location that is ventilated and that the connection leads provide no safety hazard.



3.4.3.2 Nano - BTS Handbook - Installing the PSU at the nanoBTS.

Ensure that the 109 PSU is placed in a location that is ventilated and that the connection leads provide no safety hazard.



3.4.4 NanoBTS - Handbook – FCC Text

Standards

- FCC Rule 47 Parts 2, 15, 24

NOTE: Changes or modifications not expressly approved by the party responsible for compliance may void the user's authority to operate this equipment.

Model 110 NanoBTS has FCC ID QGGM180TVX

Model 140 NanoBTS has FCC ID QGGKU02ZZT
Model 165B NanoBTS has FCC ID QGGKU02ZZP
Model 165D NanoBTS has FCC ID QGGKU02ZZR

Federal Communications Commission

Note: This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

3.4.5 NanoBTS - Handbook – IC Text

Standards

- RSS133 issue 2

NOTE: Changes or modifications not expressly approved by the party responsible for compliance may void the user's authority to operate this equipment.

Model 110 NanoBTS has IC (Industry Canada) ID 4644A-M180TVX
Model 140 NanoBTS has IC (Industry Canada) ID 4644A-KU02ZZT
Model 165B NanoBTS has IC (Industry Canada) ID 4644A-KU02ZZP
Model 165D NanoBTS has IC (Industry Canada) ID 4644A-KU02ZZR

3.4.6 NanoBTS – Handbook - Regulatory Compliance Statement

The nanoBTS conforms to the following regulatory standards.

Type Approvals

- GSM essential requirements under article 3.2 of the R&TTE directive ETSI EN 301 502. CE Marking (CE0168).
- FCC - see above.
- ICE – see above.

EMC Standards

- ETSI EN 301 489-1 and –8, ETSI EN 301 502.
- FCC - see above.
- ICE – see above.

Environmental Standards

- ETS 300 019.

Safety Standards

- EN60950 (CE Marking)
- IEC 60950
- UL60950 Listed (file number E230296, USA and Canada)
- CB Certificate

This product is intended for use in all
Member States of the European Union

“Hereby, ip.access declares that this NanoBTS is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.”

A copy of regulatory compliance documentation may be obtained in writing from
“IP access Ltd, Building 2020, Cambourne Business Park, Cambourne, Cambridge,
CB23 6DW, UK”.

3.5 Model 129 BSC (Base Station Controller)

3.5.1 BSC – Handbook – Warnings and Cautions



This document is written in English, please request a copy in your local language if required.



To be located in a restricted access location (accessible to maintenance personnel only).



For indoor use only, Ethernet and E1/T1 cabling is LAN / SELV for indoor routing and termination only.



Do not block ventilation holes or otherwise impede cooling.



Refer to National Engineering Code (USA). Wiring methods must be in accordance with NEC Article 300.



When rack mounting, ensure that no additional load is placed upon the caseworks (e.g. heavy objects on top).



Unit Weight is 13Kg (29lbs). When rack mounting use 4 off M6 bolts (or equivalent) to secure the BSC chassis to the rack rails.



When rack mounting, ensure that the internal rack temperature does not exceed the rating of this product.



Do not apply power to unit if there is any evidence of condensation.



Do not open casing as mains voltages may be present within the unit.



Casing is to be operated with all covers (including slot covers) in place for safe operation and to ensure correct cooling airflow.



AC inlet cables must carry suitable local approval (e.g. UL marking for US and Canadian markets).



Connection points are provided at the front and rear of the BSC for personal electrostatic discharge wrist straps, these should be used when servicing the BSC to prevent damage to cards.



The processor card utilises a clock backup battery. CAUTION, Risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to the suppliers instructions.



To avoid electric shock, do not connect safety extra low voltage (SELV) circuits to telephone network voltage (TNV) circuits. LAN ports contain SELV circuits, and WAN ports contain TNV circuits. Some LAN and WAN ports use RJ45 connectors, Use caution when connecting cables.

BSC - Input Power Source Specification

- There are two variants of the 4U chassis, AC powered or DC powered.
- 90 to 264VAC via three IEC-C13 connectors. 300W, 4A rating (per input).
- The AC variant has three independent inlets for the purposes of power source migration and redundancy, at least two of these require power for operation, all three require power for normal redundant operation.
- -38 to -75V (-48V nominal) DC via two sets of screw terminals. 500W 10A rating. The installer must ensure that each DC supply connection is fused externally at 5A and provision is made for an external disconnection device. Plastic covers (supplied) are to be fitted over -48V BSC connections.
- The DC variant has two inlets for the purposes of power source migration, these are internally diode combined, the external -48V supplies must therefore share a common reference.
- Appliance must be earthed, either via the mains connectors (AC mains operation) or screw terminal on the rear panel (DC operation). Earth cable to be minimum 0.75mm² section.

BSC – Environmental Specification

- 0 to +45 degrees C ambient operating
- -20 to +80 degrees C ambient storage
- 10 to 90% RH non condensing
- -100m to +3050m altitude

3.5.2 BSC – Handbook - FCC Text

WARNING

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Federal Communications Commission

Note: This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

3.5.3 BSC - Handbook - Industry Canada text

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérisé de la classe A est conforme à la norme NMB-003 du Canada.

3.5.4 BSC - Handbook - Regulatory Compliance Statement

The model 129 4U Circuit BSC carries CE and cTUVus markings, it conforms to the following regulatory standards.

EMC Standards

- ETSI EN 301 489-1 and ETSI EN 301 489-8 (CE Marking)
- ETSI EN 300 386 (CE Marking)
- FCC Part 15 class A (USA)
- ICES-003 (Canada)

Safety Standards

- EN60950 (CE Marking)
- IEC60950 (international)
- cTUVus – the BSC 4U chassis (including backplane, power supplies and cooling fan tray) is a TUV Rheinland Listed product for USA and Canadian markets.

This product is intended for use in all Member States of the European Union
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“Hereby, ip.access declares that model 129 4U CircuitBSC is in compliance with the essential requirements and other relevant provisions of Directives 1999/5/EC, 73/23/EEC and 89/336/EEC .”

A copy of regulatory compliance documentation may be obtained in writing from “IP access Ltd, Building 2020, Cambourne Business Park, Cambourne, Cambridge, CB23 6DW, UK”.

4 BTS Hardware Installation (CENG0210)

4.1 Introduction

4.1.1 Purpose and Scope

This documents the procedure used to install the nanoBTS hardware and physical connections together with applying the base software configuration.

4.2 Warnings

Please refer to the appropriate section of CENG0133 [1].

4.3 Regulatory Information

For all regulatory information please see CENG0133 [1].

4.4 Unpacking

Unpack nanoBTS and check to see that the unit has not been damaged in transit. Any damaged units should be returned to your supplier.



Figure 1 - Unpacking the nanoBTS

4.5 Fitting the External Antenna Kit (optional)

4.5.1 139/140 Hardware

NOTE: When looking at the nanoBTS with the connections facing down and the LED visible the antenna on the left is the Transmit antenna and the antenna on the right hand side is the Receive antenna.

NOTE: The RF feeder cable must not be bent sharply as this may result in a degraded performance.

Remove the plastic covers by removing the top and bottom plates from both ends of the nanoBTS. Lever gently apart with screwdriver in notch.

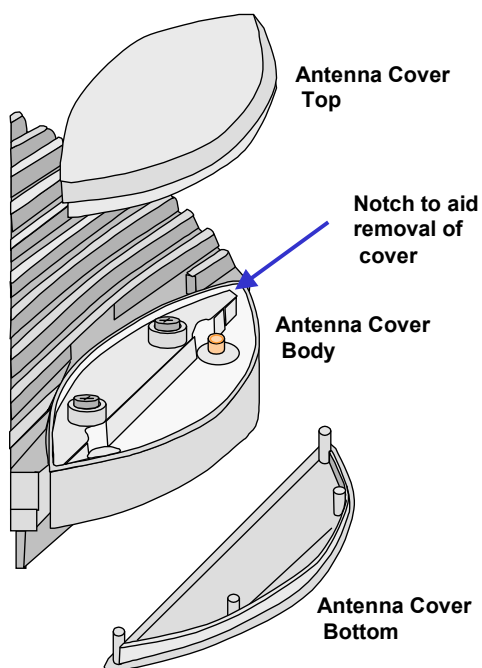


Figure 2 - Removal of antenna covers

Remove the antenna cover body, by unscrewing the two Torx T20 screws retaining

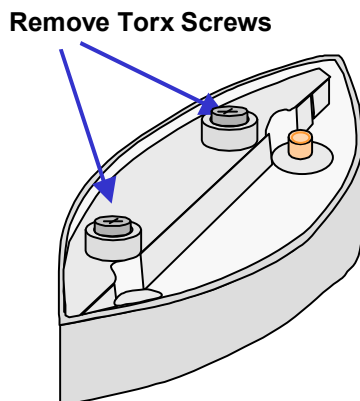


Figure 3 - Removal of antenna cover body

Fit the replacement antenna cover body ensuring that the feeder cable connector fits into the antenna. Note that one cover only fits the receiver whilst the other fits the transmitter.

Fit the clamp as shown below and second Torx screw, then replace top and bottom covers.

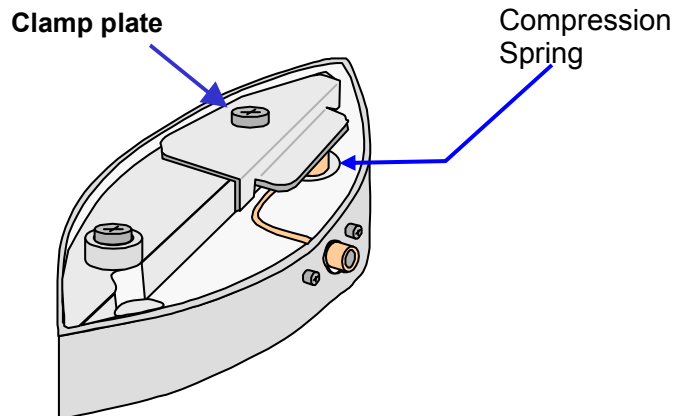


Figure 4 - Fit clamp plate

Repeat the process for the other end of nanoBTS

4.5.2 165 Hardware

NOTE: When looking at the front of 165 nanoBTS with the Ethernet and TIB connectors facing downwards, the TX antenna is bottom left, the RX antenna is bottom right and the Network Listen (NWL) antenna is top right.

To fit external antennas, remove the plastic cover from the unit and unscrew the the antennas to expose the SMA connectors. Connect directly to these connectors.

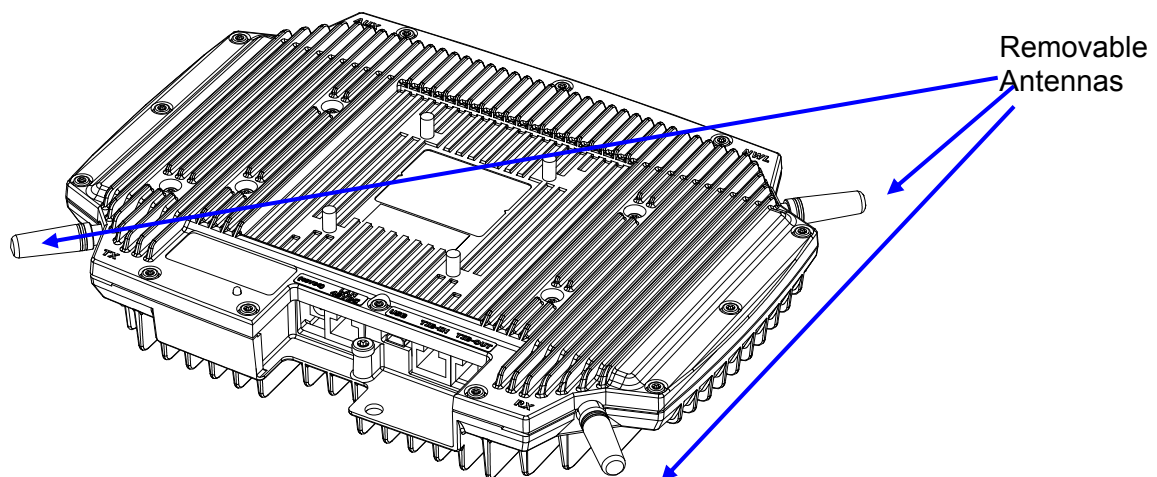


Figure 5 - 165 nanoBTS Removable Antennas

4.6 Cabling the nanoBTS

4.6.1 139/140 Hardware

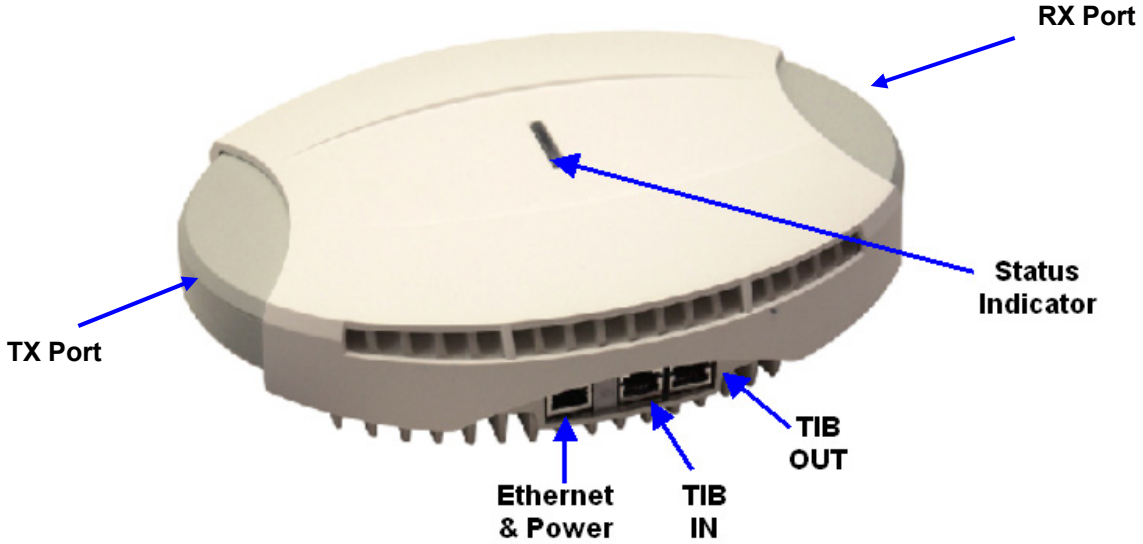


Figure 6 – 139/140 nanoBTS Connections

4.6.2 165 Hardware

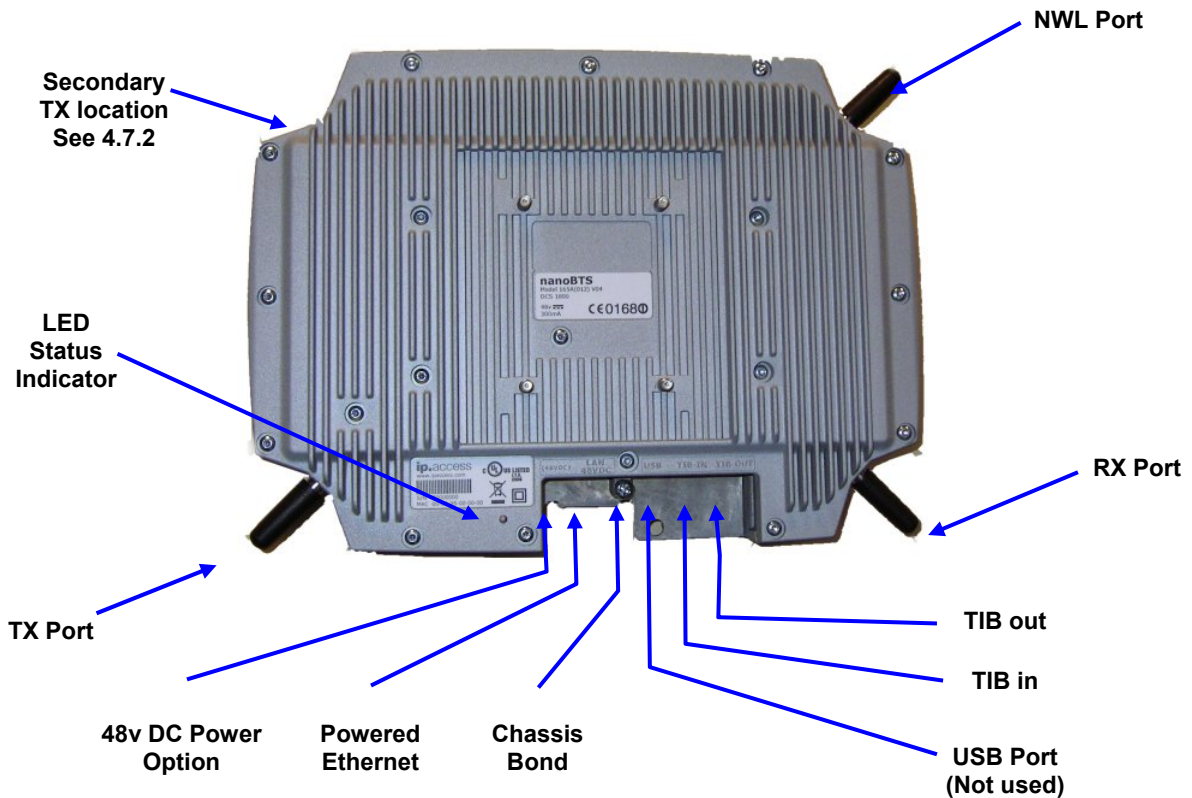


Figure 7 – 165 nanoBTS Connections

Figure 8 below illustrates the correct cabling of the Ethernet and TIB cables:

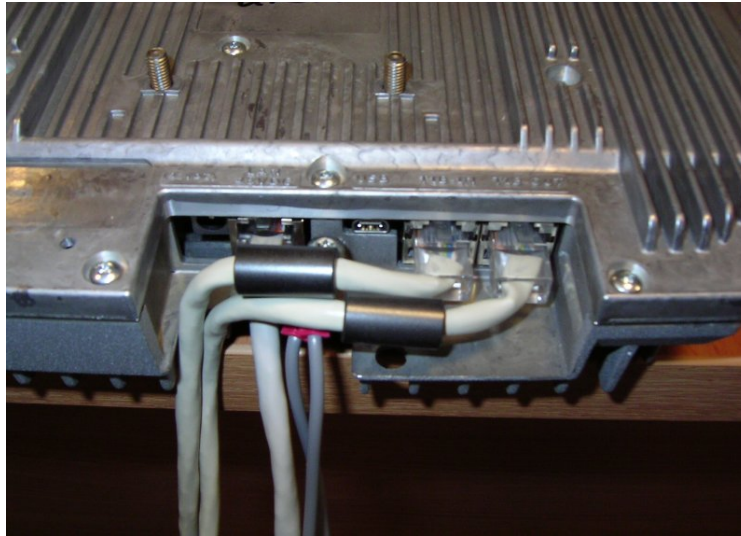


Figure 8 - Ethernet and TIB cabling

4.6.3 Ethernet

Each 139/140/178 nanoBTS must be connected to an Ethernet switch or hub via either a 109 ip.access single power inserter or 126 ip.access Powered Ethernet Switch. Refer to CENG0033 for details of the power supply connections. The 165 EDGE nanoBTS may use either the above power options or a separate 48V DC power supply available from ip.access.

4.6.4 Timing Interface Bus (TIB) – Multi-TRX only

The Timing Interface Bus (TIB) is used to provide clock and signaling between the nanoBTS when operating in a Multi-TRX configuration.

The TIB OUT from the Master TRX must be connected to the TIB IN of the slave TRX. This in turn has its TIB OUT connected to the next TRX in the chain. See Figure 9.

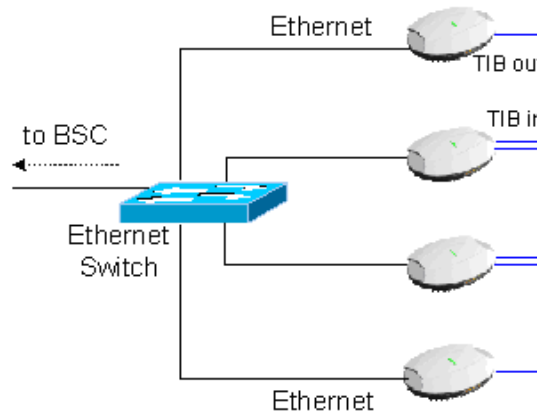


Figure 9 - TIB Connections

4.6.5 Chassis Bond Strap – Multi-TRX only

When the nanoBTS is operated in a Multi-TRX configuration, each of the nanoBTS must be connected together using the supplied chassis bond kit.

To fit the chassis bond strap, remove the nanoBTS from the mounting plate

Using the screw provided, screw the Chassis Bond Strap to the screw on the rear of the nanoBTS, see Figure 10 or Figure 11.

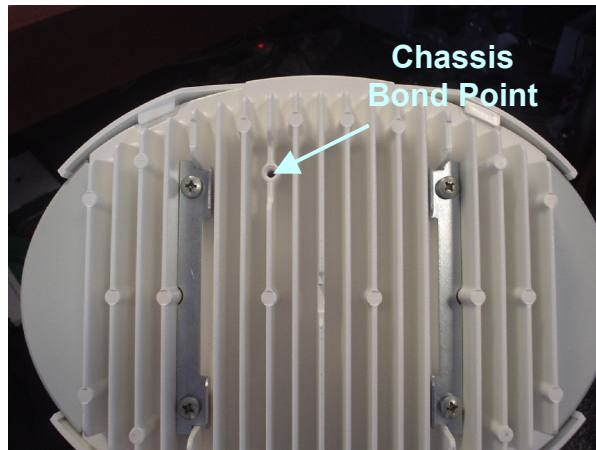


Figure 10 – Chassis Bond Screw Location – 139/140 BTS

Connect the other end of the Chassis Bond lead to the next nanoBTS chassis bond point in the chain.

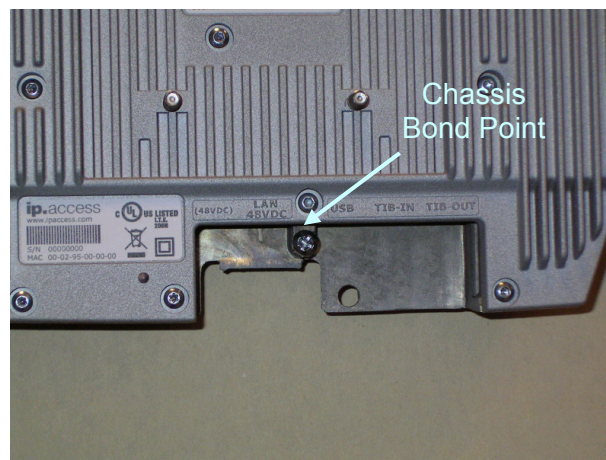


Figure 11 – Chassis Bond Screw Location – 165 BTS

4.7 Mounting the nanoBTS

The location of each nanoBTS is shown on the installation floor plan produced at the network planning stage. The network wiring must be complete before the nanoBTS can be installed and commissioned. The nanoBTS should be placed on a wall at or above head height or on a ceiling. Unless explicitly stated otherwise, the following procedure is common for both 139/140 and 165 hardware variants.

Remove the nanoBTS from the bracket by sliding the removal tool over the central fin between the bracket and the body of the unit to disengage the locking spring, slide bracket to separate it from the main body of the unit. The tool may be inserted from the top or bottom of the nanoBTS

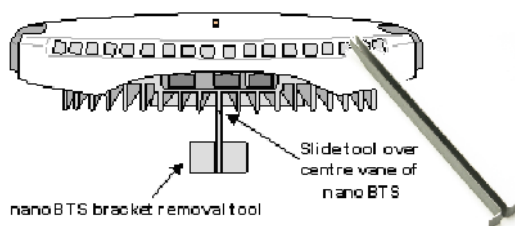


Figure 12 - nanoBTS Bracket Removal

Position the bracket on the wall and mark the position of the four screw holes. The top of the bracket **MUST** be positioned uppermost. Ensure that the bracket is level and sufficient clearance is maintained to allow the unit to be located on the bracket (at least 80mm from the bracket to the top of wall and 120mm from the side of the bracket to a side wall). See the diagram below, Figure 13 - Fixing the wall bracket.

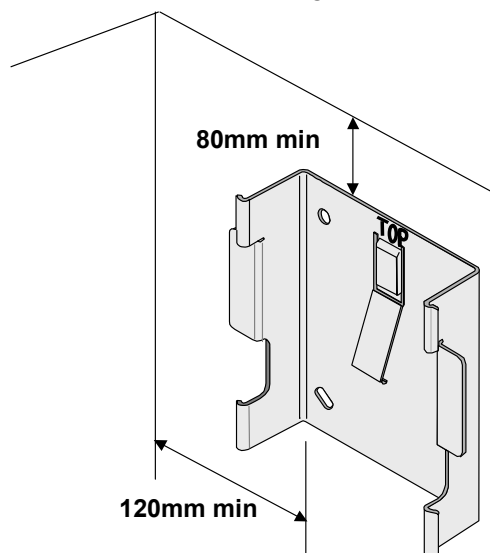


Figure 13 - Fixing the wall bracket

Drill the four holes in the positions marked previously and insert wall plugs (if required) and fix the mounting bracket securely to the wall. The bracket is designed to allow the nanoBTS unit to be mounted with the connections at the bottom of the unit. Slide the nanoBTS onto the bracket and ensure that the retaining spring engages into the indent at the rear of the unit.

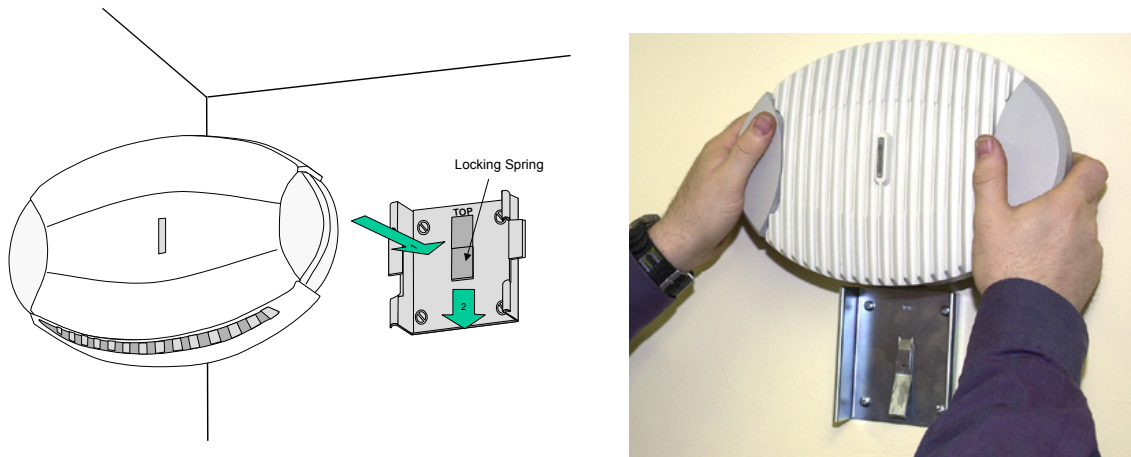


Figure 14 - Mounting the nanoBTS

When fixing to a ceiling or a sloping wall the same fixing process and clearances should be observed as for fixing to a wall (at least 80mm from the bracket to the top of wall and 120mm from the side of the bracket to a side wall). On a sloping surface the top of the bracket **MUST** be uppermost. Once the unit has been attached to the bracket the outer cover **MUST** be removed to expose the cooling vanes, as shown in Figure 15 - Ceiling Mounted nanoBTS



Figure 15 - Ceiling Mounted nanoBTS

4.7.1 Mounting Multi-TRX nanoBTS

When the nanoBTS are to be installed in a Multi-TRX configuration, then each TRX should be installed in a similar orientation but not closer than 30cm to each other.

A further specific constraint is that the TIB cables must be <1.5m and a 1.5mm² Chassis Bond cable must also be connected between each TRX with a length not exceeding that of the TIB cable.

4.7.2 Mounting Multi-TRX 165 nanoBTS

The 165 (EDGE) BTS may be installed in a stacked two-TRX configuration. See Annex A - Drawing 165#018 for details. The procedure for mounting a stacked two-TRX configuration is as follows:

- Fit the first wall bracket to the wall in the desired position

- Remove the plastic cover from the bottom unit
- Relocate the TX antenna as illustrated in Annex A
- Fit the antenna cable (part number 165_072) as illustrated in Annex A
- Fit the second wall bracket to the bottom unit as illustrated in Annex A
- Mount the bottom unit on the wall
- Fit the Ethernet and TIB cables to the bottom unit
- Fit the skirt (part number 165_028) to the bottom unit
- Remove the plastic cover from the top unit and attach it to the bottom unit
- Attach the Ethernet and TIB cables to the top unit
- Replace the plastic cover on the top unit

4.8 Initial Frequency Calibration

NOTE: The nanoBTS must be powered on for a minimum of 24 hours prior to final frequency calibration. It is recommended that during installation an initial, local calibration is made following a powered on time of > 10 minutes followed by a final operational calibration after 24 hours power on time.

NOTE: If the nanoBTS is used in a Multi-TRX configuration, then the TIB OUT must be disconnected from each nanoBTS in the chain prior to calibration and reconnected afterwards. Only the Master TRX should be calibrated.

- Using BTSInstaller, select the nanoBTS that is to be calibrated and then click on the “Listen” button in the “BTS Status” pane.
- Select the frequency band to match that of the nanoBTS to be installed.
- Click on the “Connect” button, this will cause the nanoBTS TRX to power up. The status LED will flash green when completed.
- Click on the “Channel Usage” tab and then click on the “Start Test” button.
- When completed click on the “BCCH Channel Usage” tab and then click on the “Start Test” button.
- When completed, click on the “Frequency Synchronisation” tab.
- Select “Configure Test”
- Select the “Freq Sync Options” tab and then click on the “Apply Frequency Synch Options” and change the Option to “Adjust The Clock To Correct The Reported Errors” then click “OK”
- Click on the “Start Test” button.

Once the test completes then the calibration is completed and the procedure should be repeated for all installed nanoBTS before reconnecting the TIB cables.

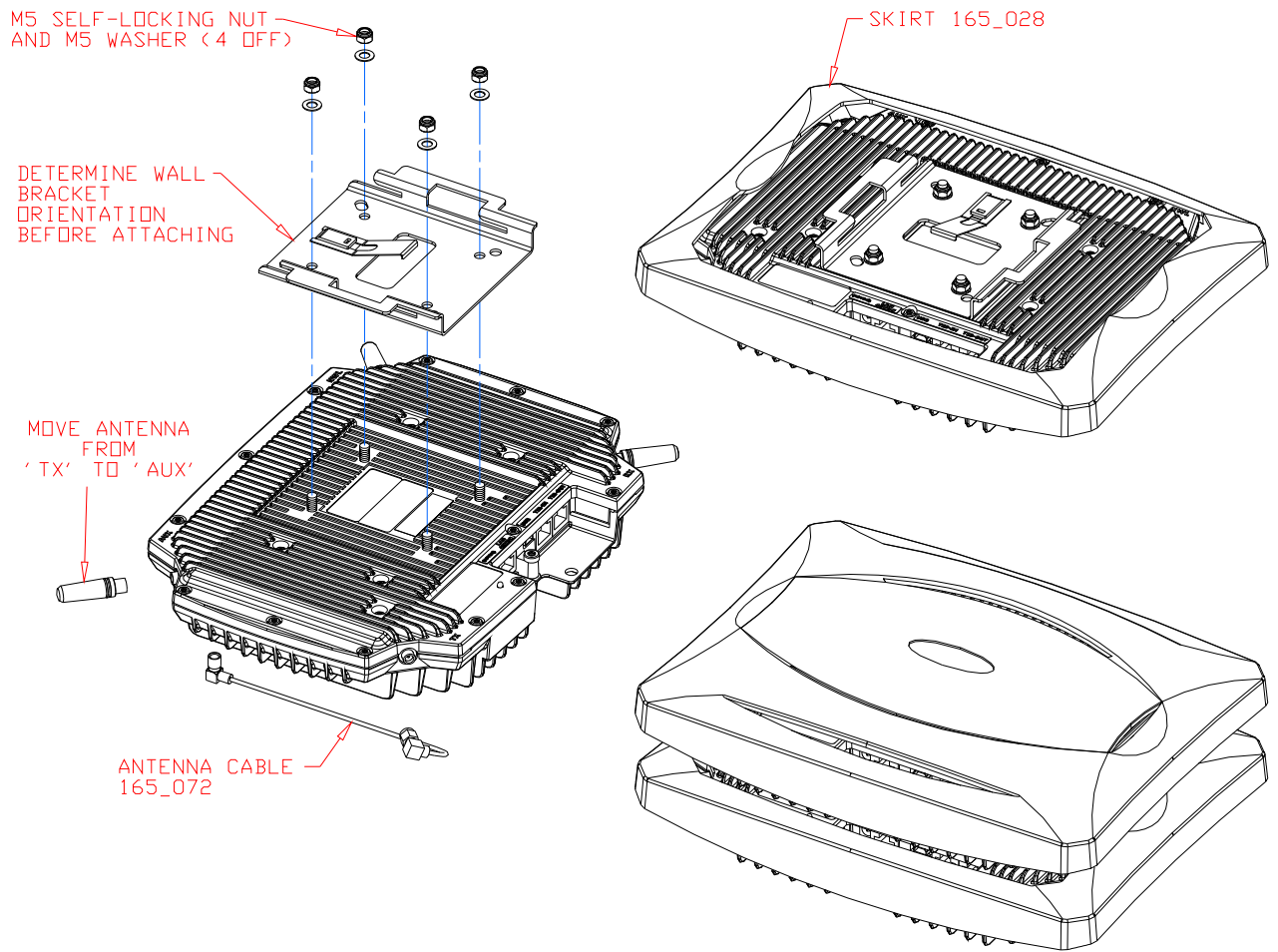
Following the 24-hour period, the Frequency Calibration procedure should be performed as per the Operations procedure – Ref {2}

4.9 LED Status Indicators

The following table shows the meaning of the state LED under normal and fault conditions.

State	Pattern	When	Precedence
LED_SELF_TEST_FAILURE	Red Steady	In boot or application code when a power on self-test fails.	1 (High)
LED_UNSPECIFIED_FAILURE	Red Steady	On s/w fatal errors.	2
LED_NO_ETHERNET	Orange Slow Flash	Ethernet disconnected.	3
LED_FACTORY_RESET	Red Fast Blink	Dongle detected at start up and the factory defaults have been applied.	4
LED_NOT_CONFIGURED	Alternating Red/Green Fast Flash	The unit has not been configured.	5
LED_DOWNLOADING_CODE	Orange Fast Flash	Code download procedure is in progress.	6
LED_ESTABLISHING_XML	Orange Slow Blink	A management link has not yet been established but is needed for the TRX to become operational. Specifically: for a master a Primary OML or Secondary OML is not yet established; for a slave an IML to its master or a Secondary OML is not yet established.	7
LED_SELF_TEST	Orange Steady	From power on until end of backhaul power on self-test	8
LED_NWL_TEST	Green Fast Flash	OML established, NWL test in progress	9
LED_OCXO_CALIBRATION	Alternating Green/Orange Slow Blink	The unit is in the fast calibrating state [SYNC].	10
LED_NOT_TRANSMITTING	Green Slow Flash	The radio carrier is not being transmitted.	11
LED_OPERATIONAL	Green Steady	Default condition if none of the above apply.	12 (Low)

4.10 Annex A – Drawing 165#018



5 PSU Installation Guide (CENG0033)

5.1 Introduction

5.1.1 Purpose and Scope

The purpose of this document is to provide an overview of the installation procedure for the range of ip.access Power Over Ethernet power supplies.

5.1.2 Related Documents

None

5.1.3 Warnings



Do not connect any device other than a nanoBTS to any RJ45 socket that is enabled for nanoBTS connection (i.e. 48V DC operation).



Ensure that the connection to the main LAN (Server) is only made to the UPLINK (i.e. 48V DC operation).

5.2 Overview

Two power supply modules are available from ip.access, designed for use with the ip.access nanoBTS product range.



Figure 16 - Single Power Supply Unit

The single output power supply, shown in Figure 16 is commonly used for single site installations, whereas the powered Ethernet switch shown in Figure 17 is generally used at sites where multiple nanoBTS installations exist.



Figure 17 - 8 Port Powered Ethernet Switch

5.3 Installation

5.3.1 Single Power Supply Unit

The single power supply unit is supplied as standard with each nanoBTS. The power supply has two Ethernet connections, one for connection to the main LAN, the other for connection to the nanoBTS. Figure 18 shows the network connections for two possible installation options.

The mains input is provided via a figure 8 mains lead connected to the mains supply of either

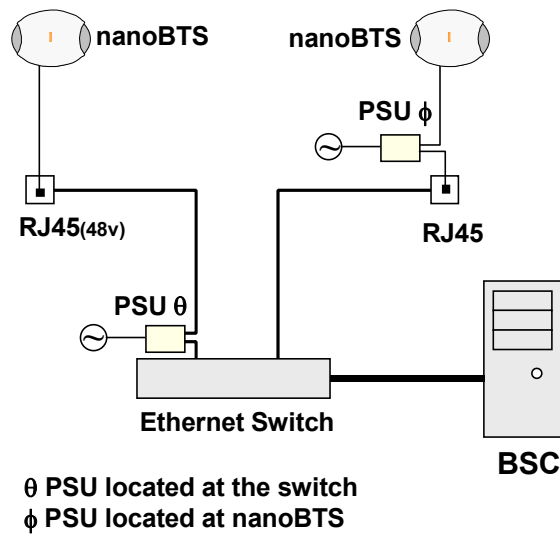


Figure 18 - Locating the PSU

The power supply can be either located locally at the nanoBTS, as shown in Figure 19, or remotely at the network switch, as long as no other network elements are installed between the two points, as shown in Figure 20.

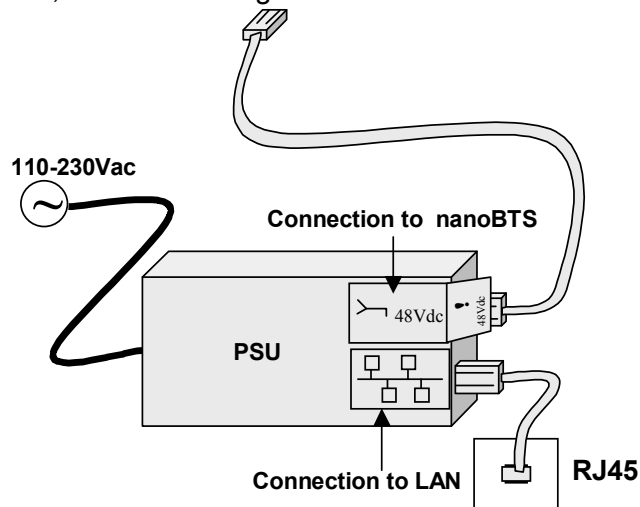


Figure 19 - PSU located at the nanoBTS

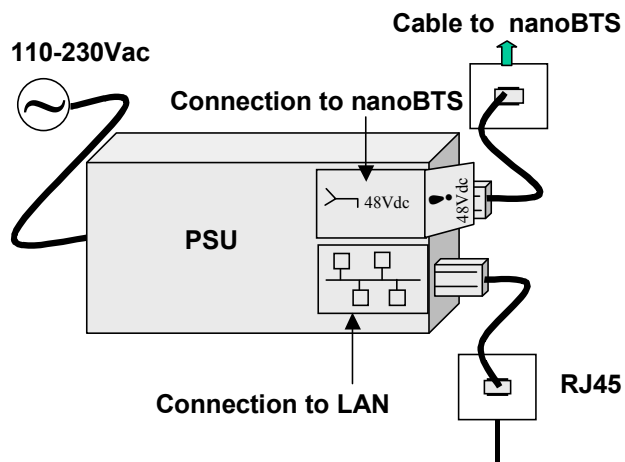


Figure 20 - PSU Installation At The Switch



Do not connect any device other than a nanoBTS to any RJ45 socket that is enabled for nanoBTS connection (i.e. 48Vdc operation).

5.3.2 8 Port Powered Ethernet Switch

The 8 port powered Ethernet switch, is a combined power inserter, for use with the ip.access range of products and a fully functional 10/100 Ethernet switch.



Figure 21 – The 8 Port Powered Ethernet Switch

Power to the unit is provided via a 110 – 240 volt ac mains plug or via a 48-volt dc plug and housed in a 1U 19” rack mount case.

5.3.2.1 Mounting The 8 Port Powered Ethernet Switch

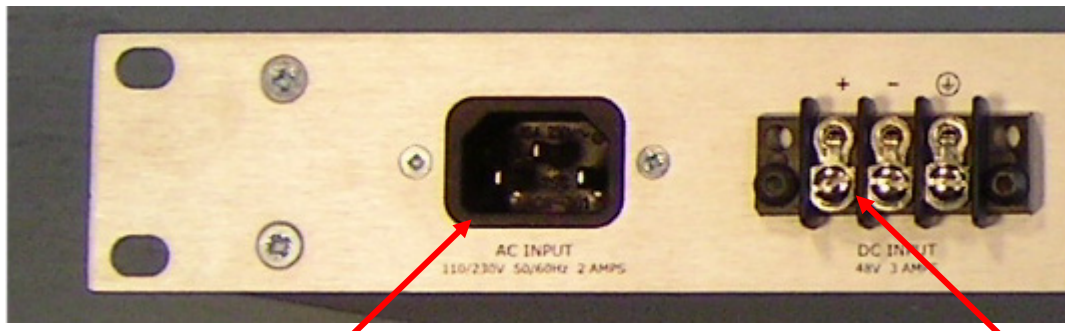
The unit is designed to be mounted within a standard 19” rack, and occupies just 1U height, with all connections accessible from the front panel.

Insert 4 cage nuts in the 19” equipment rack at the height and location that the 8 Port Powered Ethernet Switch is to be positioned.

Taking care, slide the 8 Port Powered Ethernet Switch into location, holding the switch steady, then with 4 mounting screws, secure the 8 Port Powered Ethernet Switch into the rack.

5.3.2.2 Connecting The 8 Port Powered Ethernet Switch

Connect “ONE” of the required power input connectors to the 8 Port Powered Ethernet Switch, either mains 110/240V ac or 48V DC.



Mains 110 – 240 V AC

48Volt dc

Figure 22 - Supply Connections

Once the 8 Port Powered Ethernet Switch is mounted and the mains / DC supply is connected, the main network can be connected, as shown in Figure 23. When powered from the AC mains, ensure the unit is earthed via the IEC power cord. When powered from a 48VDC supply, ensure the unit is earthed via a cable to the screw terminal.

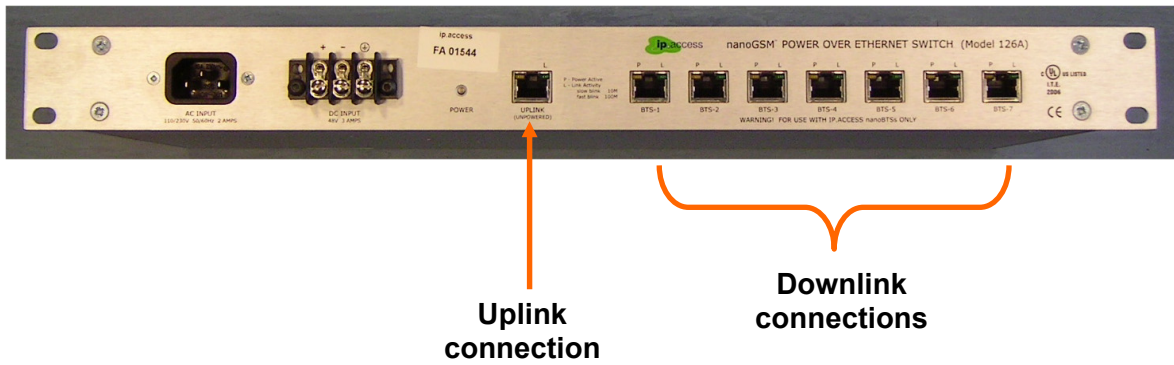



Figure 23 - Ethernet Connections

 **Ensure that the connection to the main LAN (Server) is only made to the UPLINK (i.e. 48Vdc operation).**

Connect each nanoBTS to the powered output of the power inserted as shown in Figure 23, ensuring that the connection is made only to an ip.access nanoBTS.

6 BTS Installer User Guide (CENG0048)

6.1 Introduction

6.1.1 Purpose and Scope

The purpose of this document is to provide the user of the ip.access software package, “BTS Installer”, with the knowledge to use the application to its full potential.

Using BTS Installer, the user is able to configure (and reconfigure) nanoBTS™ installation parameters, download new software to nanoBTSs and perform Network Listen tests.

This document covers only those aspects of nanoBTS installation that involve using BTS Installer. For full details of how to install a nanoBTS, please refer to [CENG0336].

6.1.2 Related Documents

[CENG0336] CENG0336, “nanoBTS Installation and Test Manual”, ip.access (latest issue)

6.2 Capabilities

BTS Installer contains a collection of related tools that enable you to:

- Perform initial installation and manual configuration of nanoBTSs.
- Upgrade and reconfigure nanoBTSs.
- Perform Network Listen tests.

These include all the operations necessary to install and configure a nanoBTS to the stage where it will connect correctly to a BSC, from which point its telecommunications behaviour can be configured using management software.

Before a nanoBTS can connect to a BSC:

- It must have an IP address, and other IP configuration parameters must be set.
- It must have a Unit ID, as this is what it uses to identify itself to the BSC.
- It must have various non-volatile attributes configured; as a minimum it must know where to find the BSC before it can connect to it.

At various times, either during initial installation of a nanoBTS or after it has already been operational for a while, it may be necessary to:

- Change the nanoBTS’ IP configuration, Unit ID or non-volatile attributes.
- Download a new version of software to the nanoBTS.
- Perform various diagnostic operations on the nanoBTS, such as querying its current configuration.

A nanoBTS can optionally communicate with the BSC via a secure SSL link. To configure it to do so it is necessary to:

- Download a certificate to the nanoBTS

- Download certificate revocation lists to the nanoBTS from time to time

BTS Installer contains tools to carry out all these actions. It can do so

- To one nanoBTS at a time or several nanoBTSs at once.
- Automatically or manually.
- According to information either loaded from a configuration file or entered via the graphical user interface.

To allocate IP addresses and other IP configuration to nanoBTSs, BTS Installer contains a built-in DHCP server. This will respond to requests from nanoBTSs only, so should co-exist with any other DHCP servers that are present on the same network.

In addition BTS Installer contains a Network Listen tool that enables you to control a nanoBTS to:

- Listen to its GSM band and report on received signal strength and BCCH details for each ARFCN.
- Correct its clock by reference to the signals from other cells.
- Transmit a beacon signal that can be listened to and measured by other nanoBTSs, which can be useful in ensuring adequate coverage of an area.

6.3 Concepts

This section describes some basic concepts behind the operation of BTS Installer; without an understanding of these it will be difficult to make sense of instructions for using the tool. Figure 24 is an illustration of BTS Installer's user interface, and this is referred to when explaining some of these concepts. Detailed explanations of all aspects of the user interface will be found in later sections.

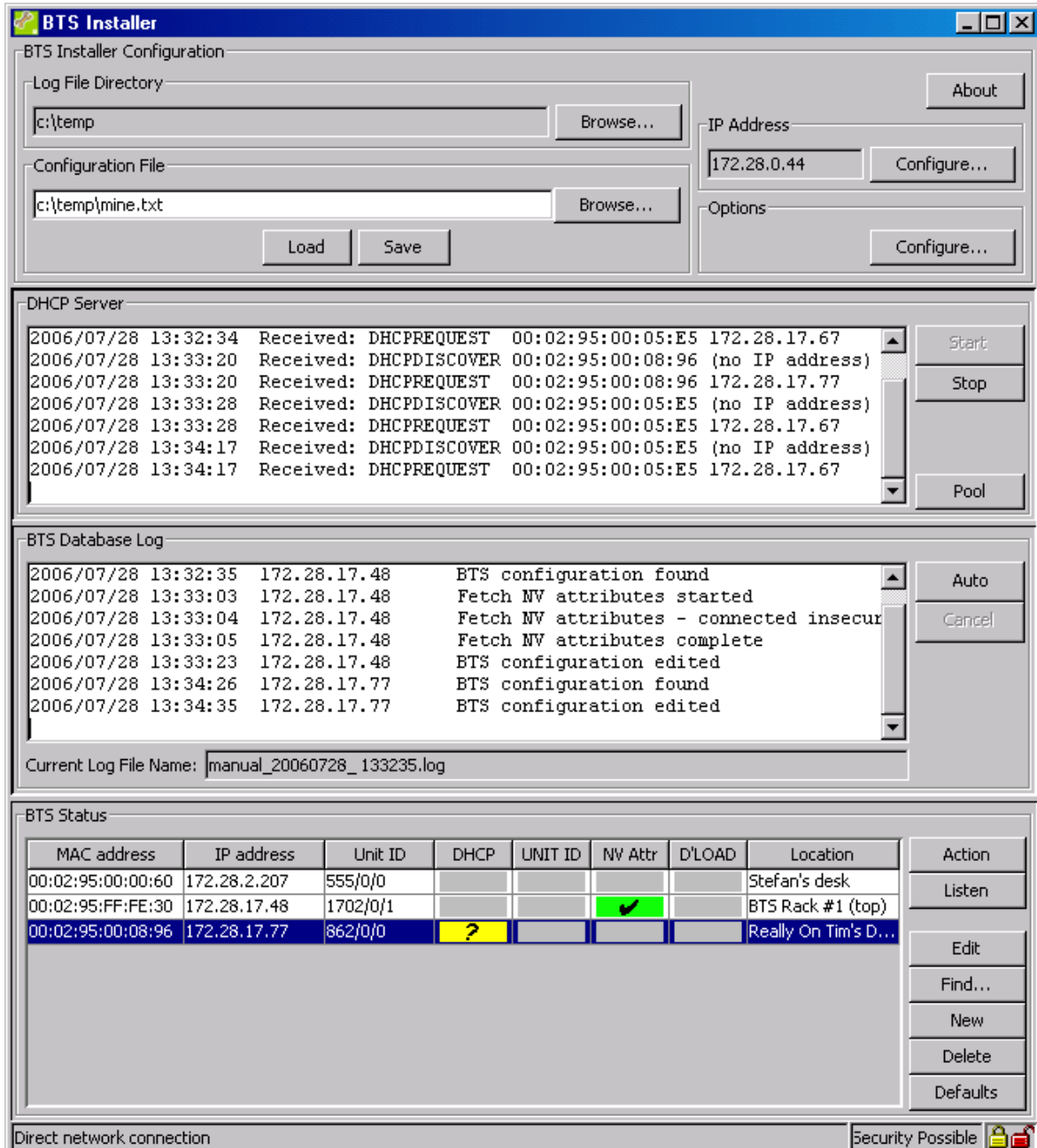


Figure 24 - Main Display

6.3.1 The BTS Database

BTS Installer will only operate on a nanoBTS that it knows about.

The collection of nanoBTSs that BTS Installer knows about is called the **BTS Database**.

The BTS Status section at the bottom of the graphical user interface is a display of the current status of each entry in the BTS Database – each row in this table represents one nanoBTS that BTS Installer knows about.

There are several ways in which BTS Installer can get to know about a nanoBTS, ie ways in which a nanoBTS can be added to the BTS Database:

- Information about the nanoBTS can be loaded from a **configuration file** (see section 6.3.4).
- The **Find** command will create BTS Database entries for one or more nanoBTSs that BTS Installer was able to locate on the local LAN (these nanoBTSs must already have valid IP configurations for the Find command to work).
- The **New** command will create a BTS Database entry full of default values; the user must edit some values in this entry before it is useful, and in particular must enter either a MAC address or an IP address or a Unit ID before BTS Installer will be able to identify the nanoBTS to which the entry relates.
- The IP address and optionally the Unit ID of the nanoBTS can be specified on the command line when BTS Installer is started.

BTS Database entries are deleted:

- When the **Delete** command is used.
- When a new configuration file is loaded.
- When BTS Installer is shut down.

A BTS Database entry can be edited:

- Using the **Edit** command.
- Indirectly using the **Defaults** command, which affects all BTS Database entries that don't have more specific values.

None of BTS Installer's tools, including the DHCP server, will operate on a nanoBTS for which there is no BTS Database entry.

6.3.2 Configuration Phases

Configuration of a nanoBTS takes place in a number of phases. In automatic mode (see section 6.3.3.1) all enabled phases are run automatically one after another in a fixed order; in manual mode the user chooses which phase to run, one at a time, and can also perform other actions which are not equivalent to automatic configuration phases.

The configuration phases are, in the order in which they are run in automatic mode:

- Setting the nanoBTS' IP configuration using the built-in DHCP server.
- Setting the nanoBTS' Unit ID.
- Setting the nanoBTS' non-volatile attributes.
- Downloading a file to the nanoBTS.

Each phase can be enabled or disabled separately for each nanoBTS. The download file can download any one of: software; a certificate; a certificate revocation list, but can only download one file at a time.

The BTS Status section of the user interface gives a quick reference to which phases are enabled for which nanoBTSs: this is indicated by the colour code in the columns headed respectively DHCP, UNIT Id, NV Attr, D'LOAD – grey indicates that this phase is disabled for this nanoBTS, any other colour indicates that this phase is enabled for this nanoBTS. Status colours other than grey are accompanied either by explanatory text, or by a symbol (Grey = no symbol, Red = cross, Yellow = question mark, Red = tick).

6.3.3 Modes of Operation

BTS Installer has a variety of different modes of operation, to suit different circumstances and requirements.

6.3.3.1 Manual and Automatic Operation

BTS Installer has an **automatic** mode of operation, in which it will apply all enabled phases of configuration to all known nanoBTSs in parallel, and when it has finished it will produce a summary in the log window and log file and will display in the BTS Status window which phases of configuration for which nanoBTSs have succeeded and which have failed.

This automatic mode of operation is initiated by pressing the Auto button in the BTS Database Log section of the user interface.

BTS Installer also has a **manual** mode of operation, in which the user performs just one operation at a time on just one nanoBTS at a time, and has immediate feedback as to the success or failure of the operation.

The various manual operations are available from pressing the Action button in the BTS Status section of the user interface.

Some example scenarios are:

- A number of operating nanoBTSs are to have their software upgraded. Automatic mode is used to download the new version of software to all of them at once.

- A particular nanoBTS is not operating correctly. Manual mode is used to investigate its configuration and diagnose and fix the problem.

6.3.3.2 The Unknown BTS Mode

Normally the BTS Database contains entries for specific nanoBTSs. In particular the DHCP server will only normally only supply an IP configuration to a nanoBTS whose MAC address matches that explicitly specified in the BTS Database entry.

There is a special “Unknown BTS” mode of operation in which the BTS Database contains just one special entry. This special entry acts as if it had a wildcard MAC address, and the DHCP server will recognise **any** nanoBTS that asks for an IP configuration.



IN THIS MODE THERE IS NOTHING IN BTS Installer TO STOP THE CONFIGURATION OF ANY nanoBTS THAT IS CONNECTED TO THE NETWORK FROM BEING CHANGED.

This special mode of operation is designed to be used when only one nanoBTS at a time is connected to the computer running BTS Installer, usually on a tiny private network, perhaps just a crossover cable. It bypasses the normal safeguards that BTS Installer uses to ensure that it makes configuration changes only to BTSs that are identified as those that the user has specified.

There is no way to create this special BTS Database entry from the graphical user interface; it must be loaded from a configuration file. There is no particular indication to the user that BTS Installer is in Unknown BTS Mode, except that the Find and New buttons in the BTS Status section of the user interface are disabled.

6.3.3.3 Proxy and Direct Operation

There are various network configurations in which BTS Installer may be used, and the general design of the IP network configuration is outside the scope of this document.

In some network configurations BTS Installer is on the same network as the nanoBTSs, in that there is an IP route from BTS Installer to the nanoBTSs. In such configurations BTS Installer can communicate directly with the nanoBTSs in **direct connection** mode.

There are two different types of direct connection that BTS Installer can make to a nanoBTS: a normal TCP connection or a secure SSL connection.

In other network configurations BTS Installer and the nanoBTSs are on different networks, and there is no IP routing between the two. Typically in this scenario the BSC will be multihomed, and will have an interface to each network but will not route IP packets between the two networks. An optional system component, the BTS Installer Proxy, can be installed as part of the BSC, and will forward requests from BTS Installer to the nanoBTSs and return the replies. In such configurations BTS Installer communicates with the nanoBTSs in **proxy mode**.

There are two different types of proxy that might be present on a BSC: a Primary OML Proxy and a Secondary OML Proxy. Which can be used depends on the network configuration.

Direct connection or proxy mode is indicated to the user in the status bar at the bottom of the user interface. A later section explains how to start BTS Installer in proxy mode, and lists the limitations of BTS Installer whilst in proxy mode.

6.3.4 The Configuration File

BTS Installer can be given the information it needs

- in a configuration file, or
- via the graphical user interface, or
- via some combination of both.

The configuration file is a text file which can be created with any text editor and which contains definitions for:

- default values for BTS attributes
- the nanoBTSs to be operated on
- attributes to be set for the BTSs
- the DHCP server's IP address pool.

It is not necessary to create a configuration file for most uses of BTS Installer, as almost all necessary information can be entered via the graphical user interface. The only exception is that a BTS Database entry for the "Unknown BTS" cannot be entered via the GUI and can only be entered via the configuration file.

At any point it is possible to save the current state of the BTS Database and IP address pool to a configuration file; this can be done even if no configuration file has been loaded and all data has been entered via the GUI. This allows you to

- enter configuration information via the GUI
- save this to a new configuration file
- load the configuration file in a later run of BTS Installer.

In other words, you can use BTS Installer itself to create a configuration file for later use, instead of using a text editor.

Section 6.10 gives details of the syntax of the configuration file.

6.4 Getting Started

This section contains information about installing BTS Installer, preparing it for use, and performing an operation on a nanoBTS.

6.4.1 Installing BTS Installer

BTS Installer is a Java application. It requires that the Sun J2SE Java Runtime Environment be installed: version 1.5 is required (there is no particular requirement as to which subversion of 1.5 is used). The J2SE Java Runtime Environment is available, with installation instructions, from Sun's Java web-site (<http://www.java.sun.com>).

6.4.1.1 Microsoft Windows

To install BTS Installer run the supplied .msi file and follow the instructions on screen. If it is desired to use BTS Installer to make secure (SSL) connections to nanoBTSs then

- the Aladdin eToken run time environment must be installed, which in turn requires that the computer is running either Windows 2000 SP4 or Windows XP or later
- the eToken, which is a hardware device which contains a certificate and private key for BTS Installer, must be plugged into a USB port.

6.4.1.2 Other Platforms

Details of installing BTS Installer on platforms other than Microsoft Windows are beyond the scope of this document. However in most cases copying the file BtsInstaller.jar to a suitable directory will be adequate. On platforms other than Windows there is no support for making SSL connections to the nanoBTS.

6.4.2 Starting BTS Installer

6.4.2.1 From Config Manager

BTS Installer can be started from Config Manager, in which case it will be pre-populated with some nanoBTSs selected in Config Manager and will operate in proxy mode. See section 6.9.2 for details.

6.4.2.2 Microsoft Windows

BTS Installer can be started by double clicking the desktop item or by selecting the menu entry in the normal way.

6.4.2.3 Other Platforms

Details of starting BTS Installer on platforms other than Microsoft Windows are beyond the scope of this document. However on platforms with a command line interface a command like:

```
java -jar BtsInstaller.jar
```

is likely to be useful.

6.4.2.4 Command Line Arguments

On all platforms, additional command line arguments can be used to specify that BTS Installer should run in proxy mode, and/or to specify the IP addresses and optionally Unit IDs of some nanoBTSs for which BTS Installer should create BTS Database entries.

See section 6.9.3 for details of these command line arguments.

At the end of the command line the following arguments may be present:

/AUTO filename

If these are present BTS Installer will

- (a) load the specified file as a configuration file
- (b) perform an automatic run
- (c) shut itself down

thus providing an unattended mode in which BTS Installer may be run entirely from the command line.

Depending on the platform, it will be possible to set up a shortcut or a script to run BTS Installer with any desired set of command line arguments.

6.4.3 Entering the password

When BTS Installer starts, if an eToken containing a certificate and private key is found it will prompt the user for the password for the eToken. The password should be entered if it is desired to make secure (SSL) connections to nanoBTSs; if only insecure connections are wanted then the password request may be cancelled. See section 6.10 for further details.

6.4.4 Setting Up BTS Installer

The BTS Installer Configuration section of the user interface (Figure 25) contains some settings that tell BTS Installer how it is to operate. Until some of these settings have been made most of the buttons on the user interface will be disabled and most of BTS Installer's functionality will be unavailable.

Once these settings have been made they are remembered and will not normally need to be made again on later runs of BTS Installer on the same computer.

The items that can be set up are:

- Log file directory – see section 6.5.1.1 – this **must** be set up, but it can alternatively be done as a by-product of choosing a configuration file (see section 6.5.1.3)
- IP Address – see section 6.5.1.2 – this does not need setting if you are not going to use BTS Installer's built-in DHCP server, but if you are going to use the DHCP server then this **must** be set up

- Configuration file – see section 6.5.1.3 – this need not be set up unless and until you wish to use a configuration file
- Options – see section 6.5.1.4 – these usually do not **need** to be set up as the default values are usually adequate.

6.4.5 Creating a BTS Database Entry

BTS Installer will not operate on any nanoBTS that it doesn't know about; in order to do anything to a nanoBTS it must have a BTS Database entry for that nanoBTS (see section 6.3.1 and section 6.5.4.2).

A BTS Database entry can be created by any of the following methods as desired:

- create a new blank BTS Database entry – see section 6.5.4.2.2
- finding a nanoBTS on the local area network – see section 6.5.4.2.1
- load a configuration file – see section 6.5.1.3

6.4.6 Assigning an IP address

For most operations (other than when operating via a Primary OML Proxy) the nanoBTS must have an IP address assigned, and BTS Installer must know the IP address.

If the nanoBTS on which you wish to operate already has an IP address:

- ensure that the BTS Database entry for that nanoBTS has the correct IP address; if not use the **Edit** button to fill in the IP address on the BTS tab of the BTS Configuration dialog box.

If the nanoBTS on which you wish to operate does not already have an IP address then you may use BTS Installer's built-in DHCP server to assign one:

- consult the network administrator for the network on which the nanoBTS is installed and ask for an IP address that can be used for the nanoBTS
- use the **Edit** button to fill in this IP address on the BTS tab of the BTS Configuration dialog box
- go to the DHCP tab on the same dialog box, (and if not already done) tick the Enable DHCP Configuration check box, and enter the correct Subnet Mask (and Router address, if needed)
- ensure that the DHCP server is running
- wait until the DHCP server assigns the address to the nanoBTS.

For more information about editing the nanoBTS' attributes using the BTS Configuration dialog box see section 6.7. For more information about the DHCP server, particularly for conditions that must be satisfied before it will work and assign an IP address to a nanoBTS, see section 6.6.

6.4.7 Setting desired nanoBTS attributes

For many, but not all, operations it is necessary to specify some attributes that you wish to be configured on the nanoBTS.

Use the **Edit** button to pop up the BTS Configuration dialog box on which desired attributes may be entered. See section 6.7 for complete details of the BTS Configuration dialog box.

6.4.8 Perform desired operations

At this point any desired operation may be performed on the nanoBTS:

- automatic configuration – use the **Auto** button
- manual configuration – use the **Action** button
- network listen functions – use the **Listen** button.

Section 6.5 is a reference for the user interface and gives details of all these operations.

6.5 User Interface Reference

BTS Installer's user interface is divided into four areas, as shown in Figure 24. Each area is described in detail in this section.

6.5.1 BTS Installer Configuration section

The first section of the user interface contains settings concerned with the operation of BTS Installer itself.

The user **must** set up a Log File Directory – there are two ways of doing this, see section 6.5.1.1 or section 6.5.1.3. Until a Log File Directory has been specified most of BTS Installer's buttons will be disabled and most functionality will be unavailable.

If BTS Installer's built-in DHCP server is to be used the user **must** set up BTS Installer's IP address – see section 6.5.1.2. If this is not done the DHCP server will terminate with an error message.

The Configuration File and Options may be configured as the user desires.

Most of the settings in this section of the user interface are remembered for future runs of BTS Installer, so they don't need to be entered each time BTS Installer is used.

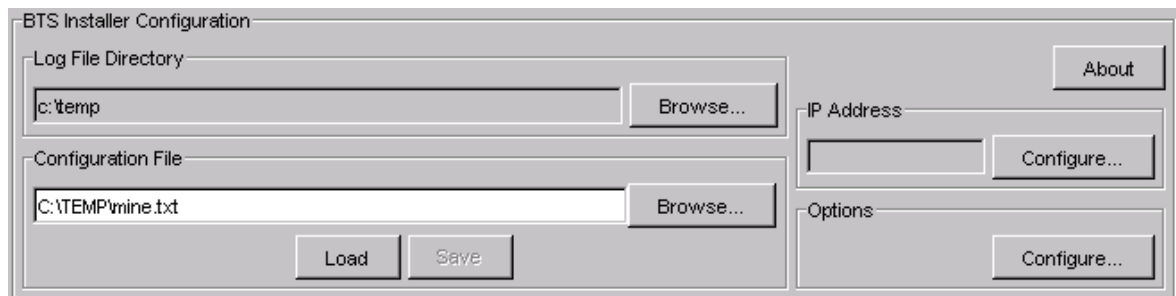


Figure 25 - BTS Installer Configuration section

6.5.1.1 Log file directory selection

BTS Installer insists on logging everything interesting it does. So it won't do anything much, and most functions will be disabled, until a log directory has been specified in which it can create log files.

There are two ways to specify the log file directory:

If a "Configuration File Name" is specified (it doesn't have to be actually loaded) and the directory containing the configuration file also contains a subdirectory called "log" then this "log" directory will be used for log files (see section 6.5.1.3).

The user can specify a log file directory explicitly, using the "Browse" button in the "Log File Directory section" section of BTS Installer's main window (see Figure 26).

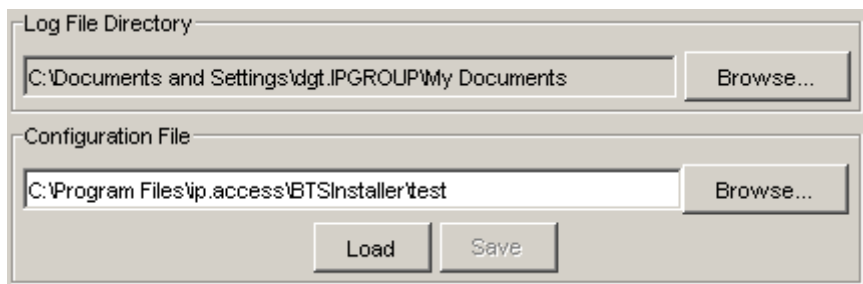


Figure 26 - File Selections

This will bring up the Log File Directory selection window as shown in Figure 27.

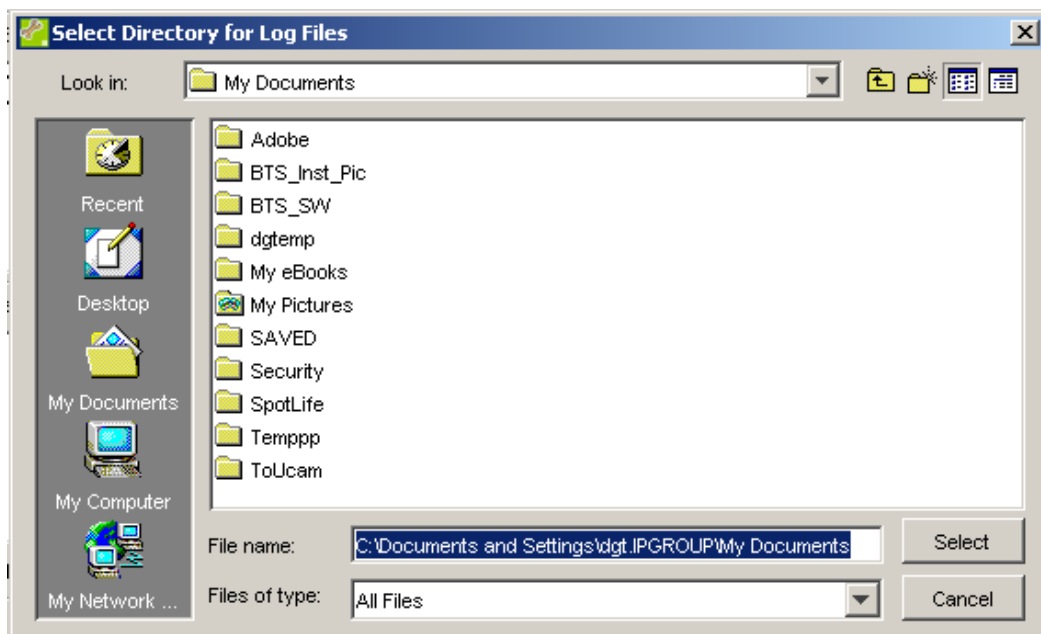


Figure 27 - Setting Log File Directory

Using the window shown above browse to the selected location for log files to be stored in and click on select.

Once a log file directory has been specified it is stored persistently so is remembered next time BTS Installer is run.

6.5.1.2 IP address selection

Some operations of BTS Installer require it to know its own IP address and/or subnet mask. Where the application is running on a computer with more than one Ethernet adapter there is no way that the tool can know which of its multiple IP addresses it should be using.

To tell BTS Installer which IP address and subnet mask it should be using, use the “Configure” button in the “BTS Installer Configuration” panel (see Figure 28).

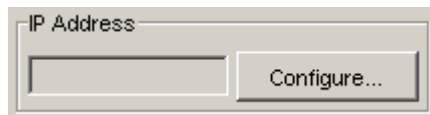


Figure 28 - Configure BTS Installer IP Address

This should pop up a dialog box containing a list of the network adapters found:

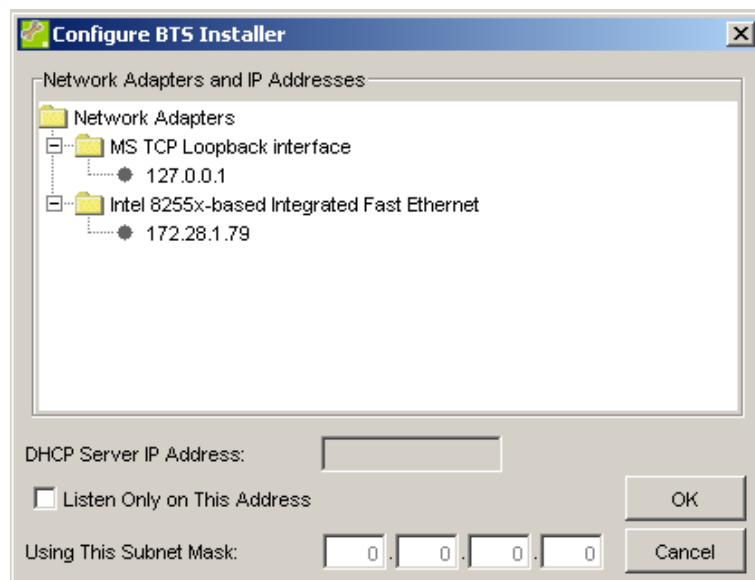


Figure 29 - Selecting BTS Installer IP Address

Expand these nodes as necessary to find the IP address you want to use and then select it, causing it to be copied to the “DHCP Server IP Address” field.

The “Listen Only On This Address” option, if selected, will cause both the DHCP server and the Find feature to ignore incoming messages on other network adapters; this is only an issue if the machine running BTS Installer has multiple network adapters *and* there are BTSs on more than one subnet which are known to BTS Installer – in most circumstances this option can be left unchecked.

If the “Listen Only On This Address” option is selected then BTS Installer needs to know its subnet mask: check the “subnet mask” field; this is *not* necessarily the correct subnet mask for the selected interface, as the BTS Installer application is written in Java and there is no portable way to obtain this information – the suggested value in this field is calculated from the class of the IP address, and this may or may not be correct for the particular network in use.

These options are stored persistently so are remembered next time BTS Installer is run.

Whenever these options are changed **the DHCP server will need to be stopped and restarted** in order to notice the new values.

6.5.1.3 Configuration file

Once the IP address has been selected and the log file directory has been specified most functions of BTS Installer are available and can be used without loading a "configuration file".

The configuration file can be used to automatically configure 1 or more nanoBTS from a preset configuration. This can be particularly useful when deploying a number of nanoBTS at the same time such as may happen during an office application deployment.

To use a configuration file BTS Installer must first know where to find the configuration file.

The user can specify a configuration file in the "Configuration File" section of BTS Installer's main window; either by entering the full pathname of the file in the text box or by using the "Browse" button which pops up a standard file selection dialog box.

6.5.1.4 Options

The user selects the Bts Installer Options using the Configure button in the Options panel.

This should pop-up an Options dialog box that gives access to a number of settings.

The Options dialog box (Figure 30) allows the user to change the default timers, the reconnection attempts and also the window size used during software download. The default values are chosen so as to work with current versions of nanoBTS software under normal local area network conditions whilst minimising waits and delays. Under some circumstances some operations might result in error messages, usually about things timing out, in which case you may wish to change some of the default values.

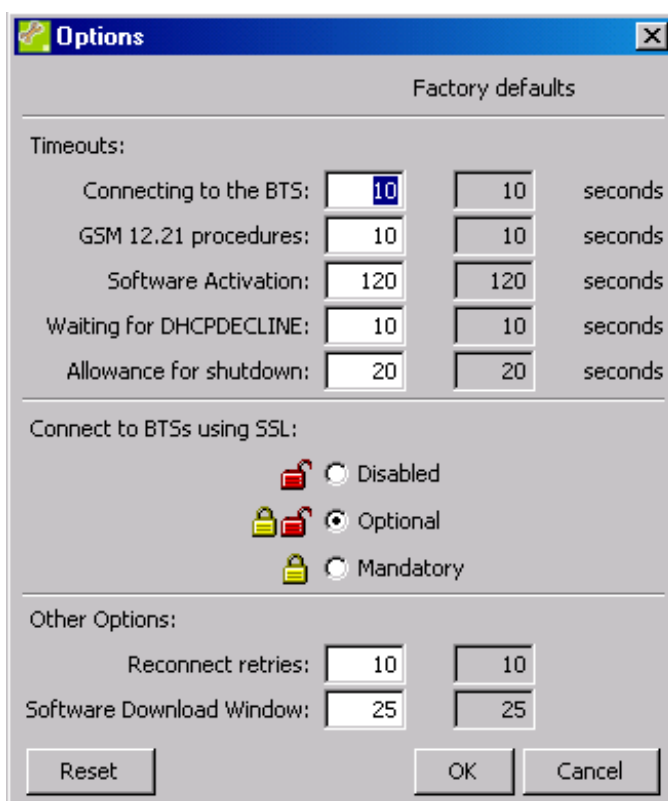


Figure 30 - Options dialog box

Here are some example circumstances in which you may wish to try values other than the defaults:

- If the download is found to be unreliable due to poor network performance then it is likely to be helpful to change some of these settings. For example, if problems are encountered when trying to download software to many nanoBTSs at once via a BTS Installer Proxy you might try increasing the GSM 12.21 procedures timeout, say to 30 seconds, and reducing the Software Download Window, say to 5.
- The Software Activation timeout is reasonable for current versions of nanoBTS software. If later versions of nanoBTS software need longer to complete software activation this timeout will need to be increased, otherwise Network Listen tests will not be possible.
- The Allowance for Shutdown timeout is reasonable for current versions of nanoBTS software. If later versions of nanoBTS software need longer to complete shutting down this timeout will need to be increased; conversely if

later versions of nanoBTS software shut down more quickly than this delay could be reduced to speed up operation.

- After performing an operation in which BTS Installer resets the nanoBTS and then has to reconnect to it, it attempts reconnection the number of times specified by Reconnect retries, and gives up on each connection attempt after the time specified by Connecting to the BTS. These numbers are reasonable for current versions of nanoBTS software, but if later versions take longer to restart after being reset then one or both of these numbers may need to be increased.

For an explanation of the SSL options see section 6.10.

6.5.2 DHCP Server section

This section of the user interface, shown in Figure 31, allows you to control BTS Installer's built-in DHCP server, and contains a scrolling log of DHCP server activity.

For a more detailed description of what the DHCP server is, how it works, and how to use it, see section 6.6.

The DHCP server provides IP address information and some basic configuration information to the nanoBTS.

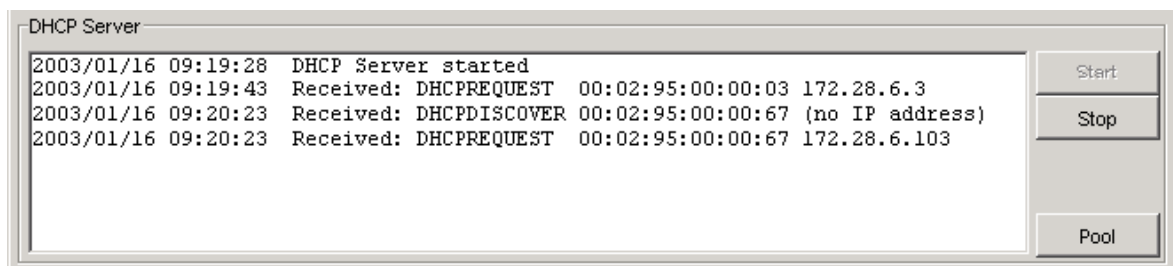


Figure 31 - DHCP Window

6.5.2.1 Starting and stopping

The DHCP server can be started with the **Start** button and stopped with the **Stop** button. When BTS Installer is started in direct connection mode the DHCP server is running by default; when BTS Installer is started in proxy mode the DHCP server is stopped by default.

6.5.2.2 The IP address pool

The DHCP server can have a pool of IP addresses that it will hand out to nanoBTSs that request IP addresses. See section 6.6.3 for information about how this works, when the IP address pool is used and whether you need to create an IP address pool.

The **Pool** button will display the IP address pool as shown in Figure 32. There is a row for each IP address in the pool, with a colour code (and symbol) indicating the status of each address as follows:

Colour	Symbol	Meaning
Grey	none	This IP address is not in use, and is available for allocation

Colour	Symbol	Meaning
Yellow	question mark	This IP address has been offered to a nanoBTS which has not yet accepted or rejected it
Green	tick	This IP address is allocated to a nanoBTS
Red	cross	This IP address has been offered but the nanoBTS has rejected it

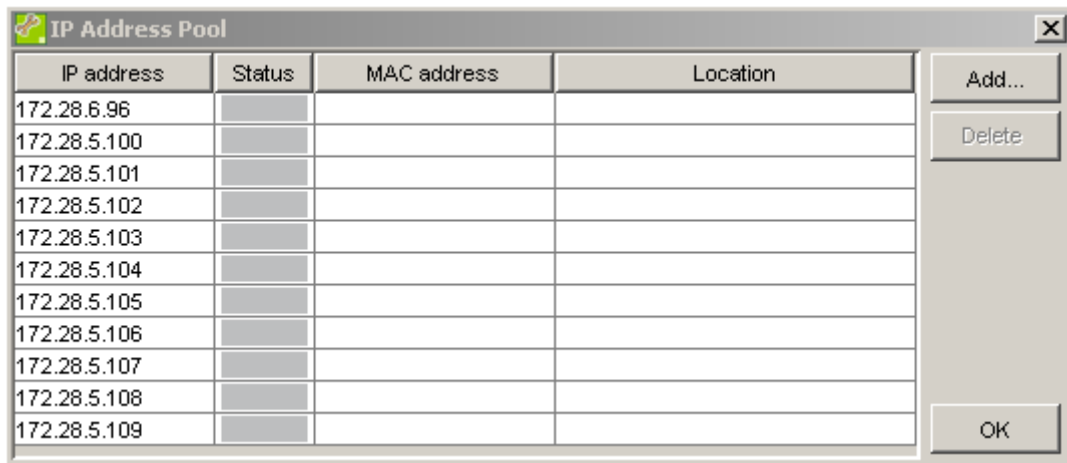


Figure 32 - IP Address Pool

Clicking on column headings will sort the display.

The **Add** button allows one or more IP addresses to be added to the pool. The example in Figure 33 will add the addresses 192.168.0.200, 192.168.0.201, 192.168.0.202, 192.168.0.203, and 192.168.0.204.

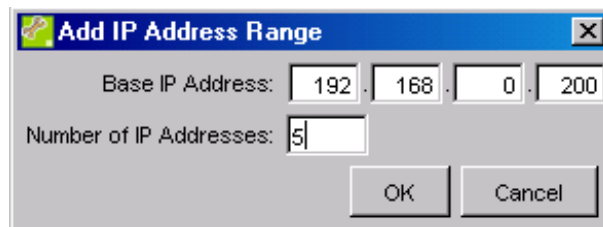


Figure 33 - Adding IP addresses to the pool

To delete one or more addresses from the pool, select them in the table and press the **Delete** button.

6.5.2.3 DHCP server log

The DHCP server's log window shows an entry for every DHCP message that the server receives or sends, and an entry for each operation on the IP address pool.

```

2004/02/20 11:19:12 Received: DHCPDISCOVER 00:02:95:00:00:1F (no IP address)
2004/02/20 11:19:12 Pool offer: 00:02:95:00:00:1F 192.168.0.100
2004/02/20 11:19:12 Sent: DHCP OFFER 00:02:95:00:00:1F 192.168.0.100
2004/02/20 11:19:12 Received: DHCPREQUEST 00:02:95:00:00:1F 192.168.0.100
2004/02/20 11:19:12 Pool assign: 00:02:95:00:00:1F 192.168.0.100
2004/02/20 11:19:12 Sent: DHCPACK 00:02:95:00:00:1F 192.168.0.100

```

Figure 34 - DHCP server log

The sequence of log entries shown in Figure 34 is a typical sequence showing the DHCP server receiving a request from a nanoBTS and allocating it an IP address from the IP address pool.

You may see other “Received:” messages which are nothing to do with nanoBTSs: the DHCP server will not respond to these.

If you see “Received:” messages which you believe are from nanoBTSs and to which you expect the DHCP server to reply, but you don’t see replies from the DHCP server, please review section 6.6.2 which explains the conditions under which the DHCP server will respond to requests.

6.5.3 BTS Database Log section

This section of the user interface, shown in Figure 35, has two functions:

- it contains a log of all BTS Installer’s activity
- it allows starting and control of the automatic configuration mode.

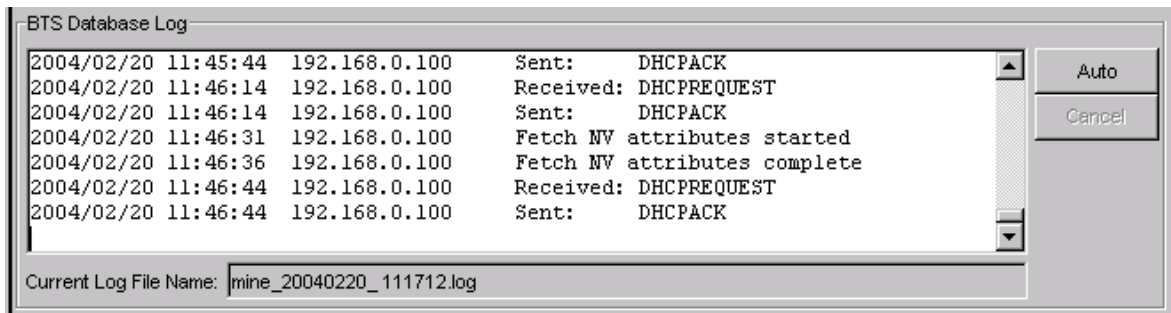


Figure 35 - BTS Database Log section

6.5.3.1 Log

The log window displays a message for each action taken by the user or BTS Installer that could affect one of the nanoBTSs in the BTS Database (see section 6.3.1).

As well as being displayed in the window, messages are written to a log file. The name of the current log file is displayed beneath the log messages; this file name is constructed from the name of the current configuration file, if any (see section 6.5.1.3), and a timestamp.

The directory to which the log file is written is chosen by the user as described in section 6.5.1.1.

6.5.3.2 Automatic configuration

Pressing the **Auto** button will start automatic configuration mode.

BTS Installer will then run all enabled configuration phases (see section 6.3.2) for all nanoBTSs in the BTS Database (see section 6.3.1).

During automatic configuration, messages will be written to the log window and the log file indicating each stage of processing for each nanoBTS. Any error messages relating to any configuration failures will also be logged.

As automatic configuration proceeds the various colour codes shown in the BTS Status window will be updated.

When configuration of all nanoBTSs is complete a summary will be written to the log window and log file listing all the nanoBTSs and saying whether configuration succeeded or failed for each one.

During automatic configuration the **Auto** button will be disabled and the **Cancel** button will be enabled. Pressing the **Cancel** button will abandon automatic configuration; as for normal completion of automatic configuration a summary is written to the log, and each nanoBTS whose configuration did not complete is listed as having failed.

6.5.4 BTS Status section

This section of the user interface, shown in Figure 36, has the following functions:

- it displays the current status of the contents of the BTS Database
- it allows nanoBTSs to be added to the BTS Database – New and Find buttons
- it allows nanoBTSs to be deleted from the BTS Database – Delete button
- it allows editing of the parameters and attributes of the nanoBTS in the BTS Database – Edit and Default buttons
- it gives access to the various manual configuration commands – Action button
- it gives access to the Network Listen feature – Listen button

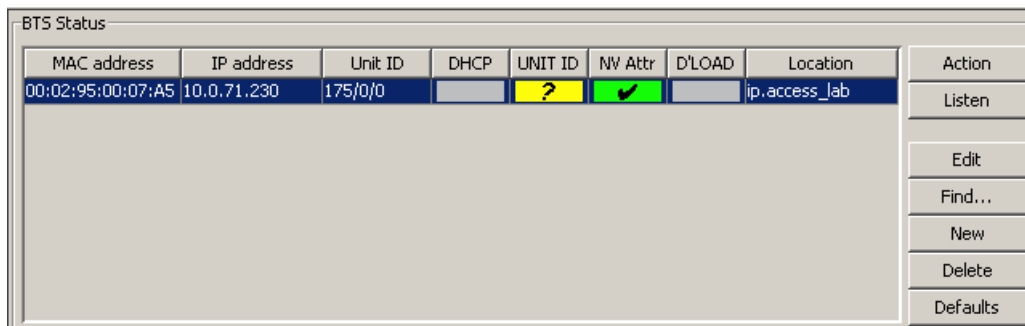


Figure 36 - BTS Status section

6.5.4.1 BTS Database Display

The main part of the display contains a table with a row for each nanoBTS known to BTS Installer, ie each nanoBTS in the BTS Database (see section 6.3.1). The table has 3 data columns and 4 status columns.

The data columns show the MAC Address, IP Address, Unit ID and Location of the nanoBTS.

The four status columns show the following information:

DHCP	What BTS Installer thinks about the current state of the DHCP configuration for this nanoBTS
------	--

UNIT ID	What BTS Installer thinks about the current state of the UNIT ID set for this nanoBTS
NV Attr	What BTS Installer thinks about the current state of the non-volatile attributes for this nanoBTS
D'LOAD	What BTS Installer thinks about the firmware currently loaded on this nanoBTS

The coloured indicators have the following meanings:

Colour	Symbol	Meaning
Grey	none	The configuration phase is disabled for the nanoBTS, and BTS Installer is making no statement as to the status of this aspect of the nanoBTS's configuration.
Green	tick	The configuration phase is enabled for the nanoBTS and as far as BTS Installer knows, this aspect of the nanoBTS is configured as required. This usually indicates either that BTS Installer has configured it correctly, or that it has detected that the nanoBTS is already configured as required.
Yellow	question mark	The configuration phase is enabled for the nanoBTS but BTS Installer doesn't know whether this aspect of the nanoBTS is currently correctly configured. This is usually because BTS Installer has not read the current values from the nanoBTS and this configuration phase is enabled but has not yet been carried out.
Red	cross	The configuration phase is enabled for the nanoBTS and as far as BTS Installer knows, this aspect of the nanoBTS is not configured as required. This usually indicates either that an error occurred when BTS Installer tried to apply the required values, or that BTS Installer knows that the user has entered new values and the configuration phase has not yet been run.

In Figure 36 above, DHCP and D'LOAD are enabled for the first BTS, and DHCP succeeded, while the software download failed. Just DHCP is turned on for the other BTSs but has not yet been carried out.

Similar coloured status indicators for nanoBTS configuration phases also appear elsewhere in the user interface, with the same meanings.

Note that the red and green indicators can become out of date as a result of changes to the nanoBTS that are not made using BTS Installer.

6.5.4.2 Creating BTS Database entries

There are three ways to make a nanoBTS known to BTS Installer, ie to create an entry in the BTS Database and add a line to the BTS Status display:

- load a configuration file (see section 6.5.1.3)
- **Find** one or more nanoBTSs
- make a **New** BTS Database entry.

6.5.4.2.1 Finding nanoBTSs

The **Find** button allows BTSs on the local network to be located and added to the BTS Database for later configuration.

Pressing the **Find** button causes BTS Installer to look for nanoBTSs on the local area network and display the results as shown in Figure 37. The display can be sorted on any column by clicking on the column heading.

If BTS Installer is running on a computer that has more than one network adapter installed and enabled, **Find** will look for nanoBTSs on all of the connected local area networks unless the **Listen Only on This Address** option is ticked on the Configure BTS Installer dialog box (see section 6.4.6) in which case it will only look for nanoBTSs on the local area network connected to the adapter which has the specified IP address.

Note that BTS Installer looks for nanoBTSs using UDP broadcasts. In typical network configurations this means that BTS Installer can only find nanoBTSs that are present on the same local area network. In particular if the network configuration is such that BTS Installer needs to run in proxy mode then it is unlikely that the Find command will locate the nanoBTSs, and they will need to be added to the BTS Database by one of the other means available.

IP Address	MAC Address	Unit ID	Location
172.20.7.200	00:02:95:00:04:00	909/0/1	Daves Bench 21...
172.28.6.35	00:02:95:00:00:23	99/0/0	
172.28.6.0	00:02:95:00:00:00	44/0/0	Lab - EDGE (1900)
172.28.6.125	00:02:95:00:00:7D	19/0/0	Daves Bench
172.28.6.18	00:02:95:00:00:12	55/0/0	BTS 55 for CS-B...
172.28.2.165	00:02:95:00:00:6C	1/0/0	Jonathan's desk...
172.28.1.168	00:02:95:00:05:C9	654/0/1	
172.28.1.196	00:02:95:00:01:5E	707/0/0	craigs desk
172.28.3.236	00:02:95:FF:FF:EA	65535/255/255	
172.28.7.176	00:02:95:00:02:6F	57/0/0	BTS 57 for CS-B...
172.28.6.23	00:02:95:00:00:17	409/0/0	ds2's wonde...
172.28.2.140	00:02:95:55:55:50	65535/0/0	Craig's Desk

Figure 37 - "Find" Results

Once the **Find** operation is complete it is possible to select either the nanoBTS that requires configuration alone or a number of nanoBTSs for multiple site configurations. Simply select a nanoBTS with the left mouse button (or a number of contiguous nanoBTSs by holding down the shift key + pressing left click on the mouse, or a number of non-contiguous nanoBTSs by ctrl + click) and then click **Select**.

The **Refresh** button will repeat the search for nanoBTSs. If you have just powered up a nanoBTS you may have to repeat **Refresh** several times before the nanoBTS has booted up and reached the stage where it can be found and will appear in the list.

Pressing the **Cancel** button removes the Select nanoBTS dialog box.

6.5.4.2.2 Creating a New BTS Database entry

The **New** button will create a new blank BTS Database entry. It will pop up a BTS Configuration dialog box to allow you to edit the attributes of the BTS. See section 6.7 for a complete reference to all the attributes.

6.5.4.3 Deleting BTS Database entries

To delete one or more BTS Database entries, select them in the BTS Status window and press the **Delete** button.

6.5.4.4 Editing nanoBTS attributes

To edit the attributes for a particular nanoBTS, select the relevant entry in the BTS Status window and press the **Edit** button. A BTS Configuration dialog box for this nanoBTS will appear. See section 6.7 for a complete reference for this dialog box.

To edit default values that BTS Installer will use for *all* nanoBTSs that do not have explicit values specified press the **Defaults** button. A BTS Configuration dialog box for the default values will appear. See section 6.7 for a complete reference for this dialog box and a description of how the default system operates.

6.5.4.5 Manual configuration

To perform various manual configuration operations on a nanoBTS, select the relevant entry in the BTS Status window and press the **Action** button. The Configure BTS dialog box will appear. See section 6.5.5 below for a full description of the various operations available from this dialog box.

6.5.4.6 Network Listen

To perform various Network Listen tests on a nanoBTS, select the relevant entry in the BTS Status window and press the **Listen** button. The Network Listen window will appear. See section 6.8 for a full description of the Network Listen tests.

6.5.5 Manual configuration operations

The Configure BTS dialog box (see Figure 38) gives access to a number of manual BTS configuration operations.

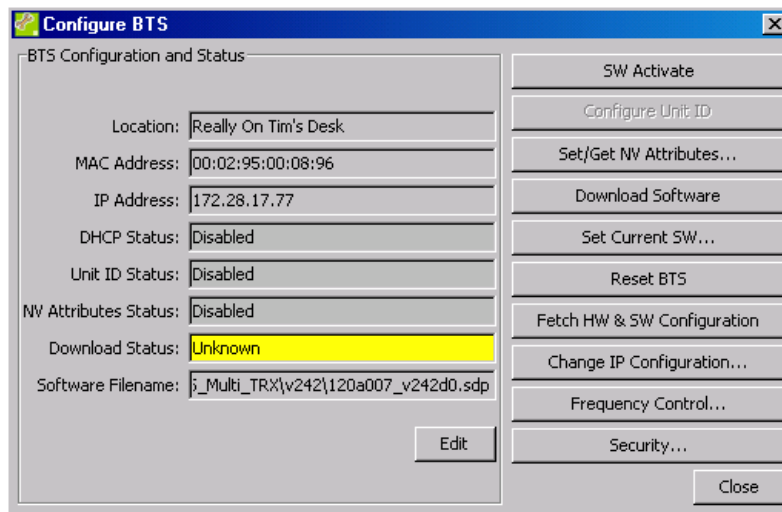


Figure 38 - Configure BTS dialog box

The status displays show the same information as in the relevant row in the BTS Status window, with the addition of the filename of any software configured for downloading. The **Edit** button is an alternative means of opening the BTS Configuration dialog box to edit this nanoBTS' attributes.

The buttons down the right hand side give access to the various manual configuration options. The **Close** button removes the Configure BTS dialog box.

6.5.5.1 The Progress Dialog box

Most of the manual operations involve BTS Installer establishing a connection with the nanoBTS, and then carrying out a transaction involving a number of messages backwards and forwards. During such processes a progress dialog box is displayed as shown in Figure 39.

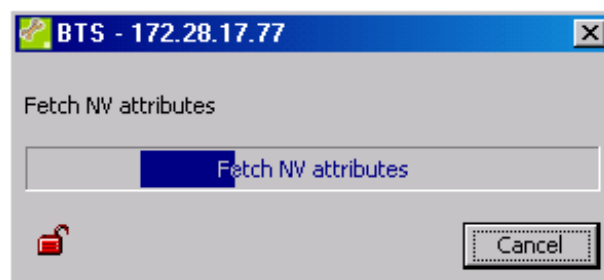


Figure 39 - Progress Dialog box

The progress dialog box indicates how the operation is progressing, and how it finished. On successful completion it will usually display something like “Get Attributes complete”, except where the operation involves resetting the nanoBTS in which case the final message on success will be “Reinitialise requested” at which point the nanoBTS shuts down and restarts.

If the operation fails then an error message will be displayed in the progress dialog box and you will need to use this message to diagnose and correct the problem.

The **Cancel** button on a progress dialog box can be used at any time to abandon the operation. This changes to a **Close** button when the operation has completed, whether successfully or not.

An open or closed padlock is displayed to indicate whether the connection is insecure or secure (SSL) – see section 6.10 for more information about SSL connections to nanoBTSs.

6.5.5.2 SW Activate

For some diagnostic engineering procedures outside the scope of this User Guide it may be necessary to activate the software in the nanoBTS. If so then press the **SW Activate** button.

The only function of BTS Installer that requires Software Activation is the Network Listen feature, and this does its own software activation automatically. In normal use of BTS Installer there will never be any requirement to use the SW Activate button.

This function does not work if the connection to the nanoBTS is via a Primary OML Proxy. See section 6.9 for more information.

6.5.5.3 Configure Unit ID

The **Configure Unit ID** button is used to change the nanoBTS' Unit ID, which is what the nanoBTS uses to identify itself to the BSC and to the user via management software.

This button is only enabled if the Unit ID configuration phase is enabled.

See section 6.7.8 for details of how to enable the Unit ID configuration phase and how to specify the nanoBTS' Unit ID.

When the Configure Unit ID button is pressed the Unit ID specified on the Unit ID tab of the BTS Configuration dialog box is sent to the nanoBTS, which is then optionally reset. A progress dialog box (see section 6.5.5.1) is displayed during this process and will indicate whether the operation succeeded.

6.5.5.4 Set/Get NV Attributes

The **Set/Get NV Attributes** button is used to perform some or all of

- Set new values for some or all non-volatile attributes in the nanoBTS
- Fetch some or all of the values of non-volatile attributes from the nanoBTS
- Fetch some or all of the current values of attributes from the nanoBTS

The “NV” value of an attribute can differ from the “current” value of an attribute in some cases because some changes to some non-volatile attributes do not take effect immediately. Some, for example, only take effect the next time the nanoBTS is restarted; in such cases the values fetched for “NV Attributes” will be those that are stored in non-volatile memory and that will be used next time the nanoBTS is restarted, and the values fetched for “Current Attributes” are the values that the nanoBTS is using at the moment.

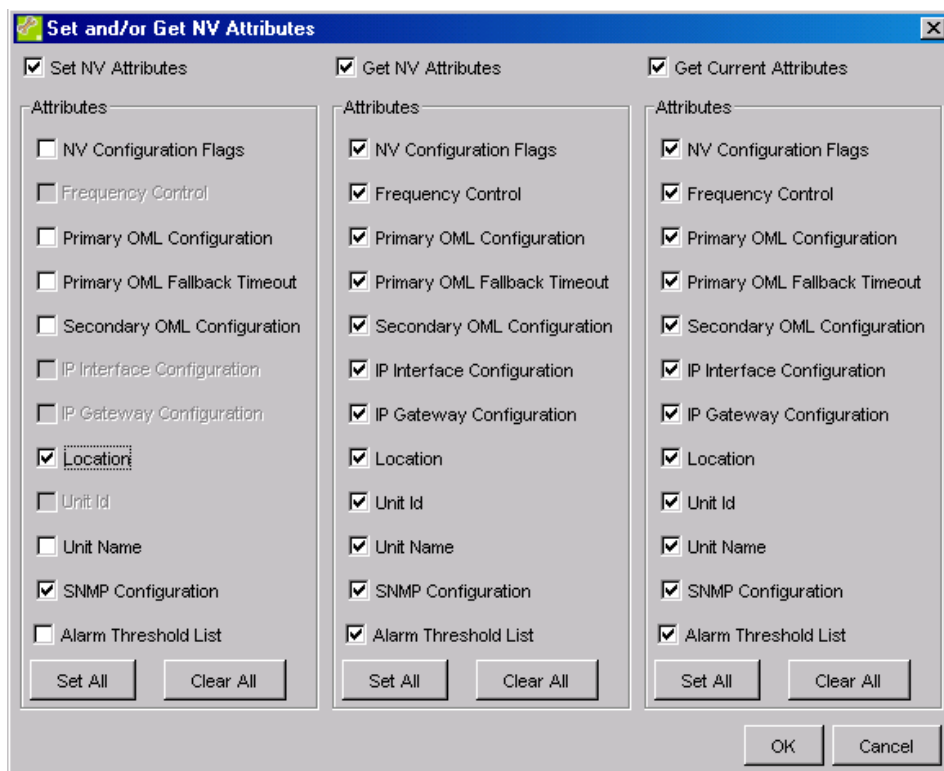


Figure 40 - Set and/or Get NV Attributes dialog box

The **Set/Get NV Attributes** button will produce the dialog box show in Figure 40. This allows the user to choose which attributes are set, then which have their NV values fetched and which have their current values fetched. The initial state of this dialog box is BTS Installer’s best guess as to what the user is likely to want.

Note that there are some NV attributes that cannot be set in this way, although their values can be fetched. These are:

- Frequency Control – use the **Frequency Control** command instead.
- IP Interface Configuration and IP Gateway Configuration – use the **Change IP Configuration** command instead.
- Unit ID – use the **Configure Unit ID** command instead.

In addition there are some NV attributes that cannot be fetched in this way either. These are:

- Current SW Configuration – use the **Set Current SW** and **Fetch HW & SW Configuration** commands to examine and change the current software configuration.

When the Set/Get NV Attributes command has completed the BTS Configuration dialog box is displayed showing any values fetched. See section 6.7 for a full description of that dialog box.

6.5.5.5 Download Software

The **Download Software** button is enabled only if the software download configuration phase is enabled.

It will cause new software to be downloaded to the nanoBTS as specified in the Download tab of the BTS Configuration dialog box (see section 6.7.13). Use the **Edit** button to open the BTS Configuration dialog box if necessary.

Note that this button **always** attempts to download new software, **regardless** of the type of download (software, certificate or CRL) that is selected on the Download tab of the BTS Configuration dialog box. To download a certificate or certificate revocation list to the nanoBTS use the **Security...** button rather than the **Download Software** button.

6.5.5.6 Set Current SW

The **Set Current SW** button fetches information about the current software configuration from the nanoBTS, and allows the user to change the software configuration, ie specify which software will run next time the nanoBTS is restarted. There is also an option to restart the nanoBTS.

First this command fetches the current software configuration and displays it in the dialog box show in Figure 41.



Figure 41 - Current SW Configuration dialog box

There will always be one version of Boot Code software displayed; there will be up to two versions of each of Backhaul software and TRX software, depending on what has been downloaded to the nanoBTS. The current software versions will be selected; these are the versions that will be run the next time the nanoBTS is restarted, and may not be the versions that are currently running in the nanoBTS.

If you select a different version of software using the radio buttons, the OK button will be enabled, as will the Reinitialize check box, allowing you to specify that a different versions of software be loaded next time the nanoBTS restarts, and also allowing you to restart the nanoBTS immediately to use these different versions.

6.5.5.7 Reset BTS

The **Reset BTS** button instructs the nanoBTS to reset itself. After using this command you will be unable to contact the nanoBTS using BTS Installer for a while.

6.5.5.8 Fetch HW & SW Configuration

The **Fetch HW & SW Configuration** button fetches

- software configuration information
- hardware configuration information
- in service time, the cumulative number of hours for which the nanoBTS has operated
- up time, the number of hours, minutes and seconds the unit has been operating since the nanoBTS was last (re-)started¹

and displays them in a dialog box as show in Figure 42.

The dialog box, titled "BTS - 172.28.7.200", is divided into two main sections: software configuration on the left and hardware description on the right. The software section includes categories for Boot Code, Backhaul, and TRX software, each with radio buttons for different versions. It also displays "In Service Time" as 7014 hours and "Up Time" as 198:29:43 hh:mm:ss. The hardware section lists various identifiers: Equipment Id (nbts-00-02-95-00-04-8D), Equipment Type (nanoBTS), Equipment Version (140_029), Location (Daves Bench 2TRX), MAC Address (00:02:95:00:04:8D), HW/SW Compatibility Number (02), Manufacturer Serial Number (00060031), OEM Id, Date and Time of Manufacture (2004/03/15 17:36:46), Date and Time of Calibration (2005/02/16 14:04:57), Factory Id, and Factory Serial Number. An "OK" button is located at the bottom right.

Figure 42 - HW & SW Configuration Dialog box

¹ The Up Time attribute is only supported from System Release 2.0 onwards. For nanoBTSs running software from releases prior to SR2.0, the Up Time field will be blank

6.5.5.9 Change IP Configuration

The **Change IP Configuration** button pops up the dialog box shown in Figure 43 which displays the nanoBTS' current IP address and allows the user to change the IP address, subnet mask and default gateway.

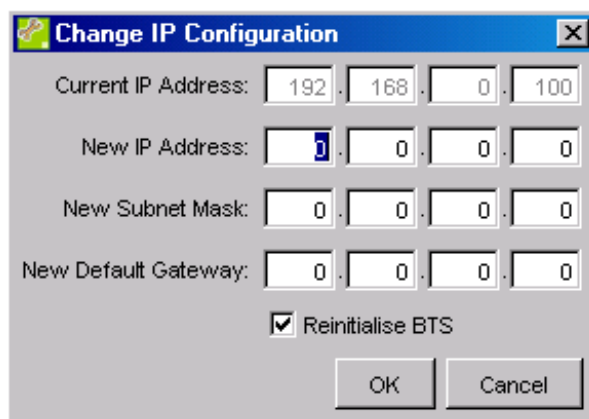


Figure 43 - Change IP Configuration dialog box

The nanoBTS may be optionally restarted after setting these attributes; the nanoBTS will not use the new values of these attributes until it is restarted, and if you don't restart it at this stage BTS Installer will probably try to contact it in future using the new IP address and will probably fail.

This is one of two methods of changing the IP configuration provided by BTS Installer, and is the method to use if you are not using BTS Installer's built-in DHCP server to provide this information to the nanoBTS.

NOTE: User has to enter values for all the three new parameters (i.e. New IP Address, New Subnet Mask and New Default Gateway). If any one value missed to enter then default value (0.0.0.0) will be configured which may lead incorrect IP configuration to BTS.

6.5.5.10 Frequency Control

[See the ip.access document, "nanoBTS Synchronisation Feature Definition", for a description of how the GSM frequency accuracy requirements are met in the nanoGSM™ system.]

The **Frequency Control** button allows the user to make manual adjustments to the nanoBTS' clock frequency, via the Frequency Control attribute, which is represented as a number of ppb (parts per billion) from a nominal value.^{2,3} It also allows the user to view the Timing Bus status, which is of interest in the case of multi-TRX capable nanoBTSs.⁴

² It is generally easier to adjust a nanoBTS's clock frequency using the Network Listen Frequency Synchronisation Test (see section 6.8.7) or - for multi-TRX capable nanoBTS models - an accurate 10 MHz clock source. See [CENG0336] for details.

³ Note that in a multi-TRX BTS (available in SR2.0 onwards), only the master unit can be adjusted by this means; slaves automatically adjust their clocks to the master.

⁴ You can use BTS Installer to determine whether a nanoBTS is multi-TRX capable or not using the Fetch HW & SW Configuration button: if the nanoBTS is not multi-TRX capable, the Equipment Version will be 108_029 or 110_029; all other values of Equipment Version are multi-TRX capable.

The normal process for manual frequency adjustment is for the user to:

- connect external frequency measuring equipment to the nanoBTS TIB out port using the correct type of cable
- use the Frequency Control command to change the Frequency Control attribute whilst observing the effects using the external measuring equipment
- stop when the nanoBTS is set to the required frequency (26MHz for nanoBTS models that are not multi-TRX capable, 1.625 MHz for nanoBTS models that are multi-TRX capable) within the required tolerance.

Selection, connection, calibration and use of external frequency measuring equipment is beyond the scope of this User Guide. The external Frequency Counter should, however, be referenced to an accurate and stable source such as a Rubidium or GPS reference.



PRIOR TO CALIBRATION THE nanoBTS SHOULD BE POWERED UP FOR A MINIMUM OF 10 MINUTES TO ALLOW IT TO STABILISE

When the Frequency Control button is clicked, BTS Installer first checks the unit's Up Time.

If the unit's Up Time cannot be determined (for example if the BTS is running pre-SR2.0 software), BTS Installer displays a warning message, "The nanoBTS's Up Time could not be determined. The nanoBTS's internal oscillator may not have settled sufficiently for frequency adjustment to be sufficiently accurate. It is recommended that frequency adjustment be carried out only after the nanoBTS has been running for at least 24 hours. Do you wish to continue?" with an OK button and a Cancel button.

If the unit's Up Time is less than 10 minutes, BTS Installer displays a warning message, "Up Time is less than 10 minutes. The nanoBTS's internal oscillator is very unlikely to have settled sufficiently for frequency adjustment to be sufficiently accurate. It is recommended that frequency adjustment be carried out only after the nanoBTS has been running for at least 24 hours. Do you wish to continue?" with an OK button and a Cancel button.

If the unit's Up Time is equal to or greater than 10 minutes but less than 24 hours, BTS Installer displays a warning message, "Up Time is less than 24 hours. The nanoBTS's internal oscillator may not have settled sufficiently for frequency adjustment to be sufficiently accurate. It is recommended that frequency adjustment be carried out only after the nanoBTS has been running for at least 24 hours. Do you wish to continue?" with an OK button and a Cancel button.

If the unit's Up Time is equal to or greater than 24 hours, or if a warning message has been displayed and the user has selected the OK button, the Frequency Control dialog box is displayed, as shown in Figure 44 below.

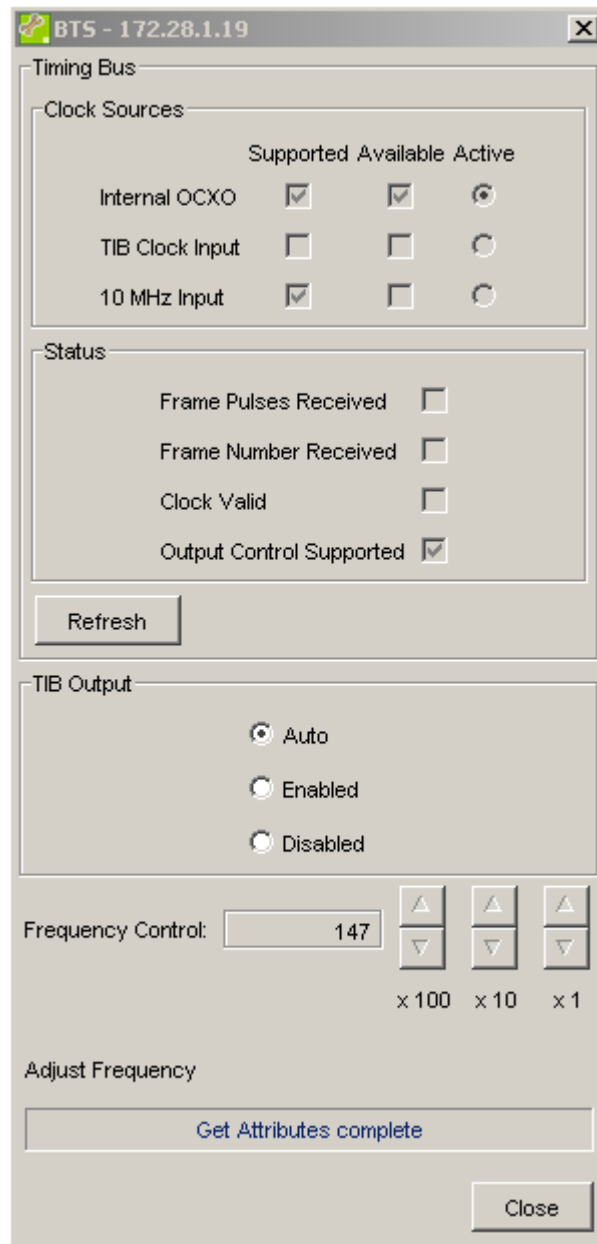


Figure 44 - Frequency Control dialog box

BTS Installer automatically reads from the BTS all of the values for this dialog box when it is first displayed.

The Timing Bus group box contains read-only information about clock sources and the status of the timing bus. It contains a Refresh button, which when clicked causes BTS Installer to fetch the latest values for clock sources and status from the nanoBTS and update the display as necessary.

The Clock Sources group box lists the possible clock sources and indicates for each one:

- whether it is supported on the nanoBTS unit in question
- whether it is currently available (ie. whether a clock source is present)
- whether it is currently the active clock source (ie. the one that the unit is taking its timing from)

On nanoBTS models that are not multi-TRX capable, the Internal OCXO is always supported, available and active, and neither TIB Clock Input nor 10 MHz Input are supported. On other nanoBTS models, all three sources are supported.

The Status group box indicates, for the currently active clock source:

- whether GSM frame pulses are being received (these are only expected if the active clock source is TIB Clock Input)
- whether GSM frame numbers are being received (again, only expected if the active clock source is TIB Clock Input)
- whether the external clock input is valid (this applies only if the active clock source is either TIB Clock Input or 10 MHz Input)

The Status group box also indicates whether timing bus output control is supported. On nanoBTS models that are not multi-TRX capable, it is never supported. On other nanoBTS models, it is supported on a master, but not on a slave.

The TIB Output group box contains a set of three radio buttons that allow the user to choose between automatic, enabled and disabled. These buttons are only enabled if timing bus output control is supported.

Clicking the spin controls (the buttons with up and down arrows) on this dialog box adjusts the OCXO frequency up or down by 100, 10 or 1 ppb. These spin controls are only enabled if the TIB Output is set to enabled. Each change is sent to the nanoBTS immediately, so the user can see the effect on the nanoBTS' frequency immediately using the external frequency measuring equipment. When the desired frequency has been reached press the Close button; a note of the starting and ending values of the Frequency Control is made in the log.

A nanoBTS's frequency can only be adjusted manually if Internal OCXO is the active clock source. If the Internal OCXO is not the active clock source and the nanoBTS being adjusted is a master, remove its 10 MHz input.

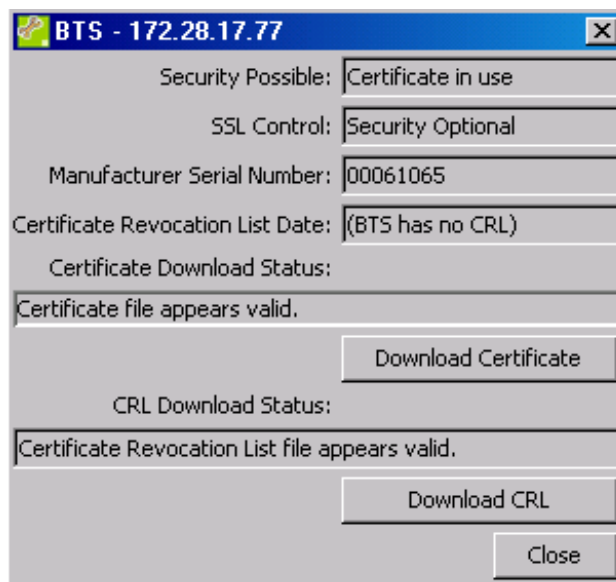
If the active clock source shown in the Clock Sources group box is not Internal OCXO, BTS Installer disables the Frequency Control spin controls. However, since this display is only refreshed by user action, it can be out of date. If the user attempts to use the spin controls to adjust the frequency of a nanoBTS that has an active external clock source, the nanoBTS rejects the update and BTS Installer displays an error message indicating "resource not available" in the progress bar on the Frequency Control dialog box.

In order to be able to monitor the frequency of a master's TIB Out signal while making adjustments, the user may have to change the TIB Output setting to Enabled. It is the user's responsibility to ensure that the TIB Output setting is restored to the previous value (if that is what is required) when adjustment is complete. If when the user closes the Frequency Control dialog box, the TIB Output setting is different from when the dialog box was opened, BTS Installer displays a warning to that effect and gives the user the option to confirm or cancel.

6.5.5.11 Security

The **Security** button allows the user to view certain attributes of the nanoBTS relating to whether and how the nanoBTS uses secure SSL connections, and allows the downloading of certificates and certificate revocation lists to the nanoBTS.

When the button is pressed, BTS Installer fetches some attributes from the nanoBTS and then displays this dialog:



The Security Possible attribute is a read-only attribute which indicates whether the nanoBTS is capable of making secure connections. If the nanoBTS is not capable of making secure connections because it is running a version of software which does not have this feature then "(not present)" will be displayed. If the nanoBTS does have security capable software running then the value will be one of:

- **No certificate** – no certificate has been downloaded to the nanoBTS and it is unable to make secure connections.
- **Certificate available** – a certificate has been downloaded to the nanoBTS, but the nanoBTS has not been reset since the download of the certificate. The nanoBTS is unable to make secure connections but should become able to make secure connections if it is reset.
- **Certificate in use** – a certificate has been downloaded to the nanoBTS and is in use. The nanoBTS is able to make secure connections.

The SSL Control attribute is a configurable attribute which instructs the nanoBTS how it is allowed to make connections. This attribute cannot be configured from BTS Installer; ways to configure it include using Config Manager. If the nanoBTS is running a version of software which is capable of making secure connections the value displayed will be one of:

- **Security Disabled** – the nanoBTS will not make secure connections
- **Security Optional** – the nanoBTS will make secure (SSL) connections if possible, or insecure connections if secure connections cannot be made
- **Security Mandatory** – the nanoBTS will only make secure (SSL) connections; if it cannot make secure connections it will refuse to make insecure connections.

Note that as for some other non-volatile (NV) attributes there are two versions of the SSL Control attribute on the nanoBTS – the “NV” version, which says what the nanoBTS will do next time it is reset, and the “current” version, which says what it is doing now. BTS Installer displays the current version. If the value of SSL Control is changed by some means, for example by using Config Manager, but the nanoBTS is not reset then there will be no change to the value of SSL Control displayed on this dialog until after the nanoBTS has been reset.

The Manufacturer Serial Number of the nanoBTS is displayed. This is used in working out the name of the certificate .sdp file which BTS Installer will attempt to locate in the .zip file which the user has specified on the Download tab of the BTS Configuration dialog. If the .zip file does not contain a certificate for this individual nanoBTS then it is this serial number that should be used, via whatever administrative procedures are in place, to locate or request the certificate for the nanoBTS.

If a Certificate Revocation List has ever been downloaded to the nanoBTS then its timestamp is displayed. BTS Installer will refuse to download a certificate revocation list to the nanoBTS unless it has a later timestamp than the one already in the nanoBTS.

The **Certificate Download Status** displays the results of several checks that BTS Installer has performed on the .zip file specified by the user on the Download tab of the BTS Configuration dialog. This includes checking that the .zip file does contain a certificate for the nanoBTS as determined by its Manufacturer Serial Number.

If the certificate file appears valid, the **Download Certificate** button is enabled. This will attempt to download the certificate to the nanoBTS. However this process is not guaranteed to succeed – one reason for failure would be if the Security Possible attribute’s value wasn’t “No Certificate”, as it is only possible to download a certificate to a nanoBTS which doesn’t already have one.

The **CRL Download Status** displays the results of several checks that BTS Installer has performed on the certificate revocation list .sdp file specified on the Download tab of the BTS Configuration dialog (or the most recent CRL found if no file name is specified).

If the CRL file appears valid, the **Download CRL** button is enabled. This will attempt to download the certificate revocation list to the nanoBTS.

6.6 The DHCP Server

6.6.1 Function of the DHCP server

The DHCP server can supply the following information to a nanoBTS which does not have an IP configuration:

- IP address
- subnet mask
- default gateway.

This information is necessary for the nanoBTS to be able to communicate with the other functions of BTS Installer and with the BSC.

Details of how to design an IP network for nanoBTSs are outside the scope of this User Guide.

6.6.2 Prerequisites for the DHCP server to work

The DHCP server will not offer IP addresses except where it is absolutely certain that you want it to do so – it is very careful to avoid disrupting the operation of other DHCP servers that may be on the local area network. At any stage, if BTS Installer's built-in DHCP server is at all unsure that it should be offering an IP address to a particular device, it will not offer any address.

Hint: If BTS Installer's DHCP server is not giving a BTS an IP address when you think it should be, first look in the BTS Database pane and check the indicator in the DHCP column for the BTS in question. If the indicator is grey (rather than yellow, red, or green), BTS Installer will not try to give out an IP address, because you haven't ticked the Enable DHCP Configuration check box on the DHCP tab of the BTS Configuration dialog box: click the Edit button to bring up the dialog box and then correct the problem.

In addition there are a number of network configuration issues that can stop the DHCP server from working. A complete discussion of DHCP network design is outside the scope of this User Guide, but some requirements and pitfalls are mentioned below.

In order for the DHCP server to succeed in allocating an IP address to a nanoBTS **all** the following conditions **must** be met:

- There must be an entry for the nanoBTS in the BTS Database – see section 6.3.1.
- The MAC address in the BTS Database entry must match the MAC address of the nanoBTS; normally this is as printed on the bar code label attached to the nanoBTS. (Alternatively, if BTS Installer is in Unknown BTS Mode – see section 6.3.3.2 – then a request from any nanoBTS will be accepted regardless of MAC addresses matching.)
- The nanoBTS must have its various flags correctly configured to use DHCP to acquire an IP address, see section 6.7.9.
- The DHCP configuration phase for this nanoBTS must be enabled – see the **Hint** above (and more details in sections 6.3.2 and 6.4.6)

- The DHCP server must have an IP address to offer to the nanoBTS, either configured explicitly or chosen from a pool, as described below, and the subnet mask and default gateway for the nanoBTS must be specified.
- The DHCP server must know the IP address of the interface on which it is to respond to requests – see section 6.5.1.2.
- The DHCP server must be running – when it is running the Start button will be disabled and the Stop button will be enabled.
- There must be a network connection between the nanoBTS and BTS Installer that allows the relevant broadcast UDP messages to be sent and received; typically this will be the case if they are both on the same local area network, or if all routers between them are running an appropriately configured BOOTP Relay Agent.
- There must be no software, for example a personal firewall, running on the machine with BTS Installer that blocks packets incoming to UDP port 67 (which the firewall might list as "DHCP server" or "BOOTP server") or packets outgoing from UDP port 68 (which the firewall might list as "DHCP client" or "BOOTP client").

Also under no circumstances will BTS Installer's built-in DHCP server offer an IP address to any device that doesn't appear to be a nanoBTS. This is achieved by checking that the device quotes a Vendor Class Identifier that matches a known string, all of which currently start with "com.ipaccess.nanobts".

6.6.3 Assigning an IP address to a nanoBTS

There are two ways in which you can tell the DHCP server which IP address to allocate to a nanoBTS:

- If there is an explicit IP address specified on the "BTS" tab of the "BTS Configuration" dialog box then the DHCP server will offer this IP address to the nanoBTS. Choose this option if it matters to you exactly which nanoBTS gets which IP address.
- Otherwise, if there are any unused addresses in its IP Address Pool, the DHCP server will choose one of these to offer to the nanoBTS. Choose this option if you don't mind which nanoBTS gets which IP address, within a particular set of addresses.

The IP Address Pool is a set of IP addresses which you specify as being available to the DHCP server for it to offer to nanoBTSs. (If you allocate an explicit IP address to all nanoBTS then the pool is not used and can be empty.)

There are two ways to get IP addresses into the IP Address Pool:

- From the configuration file.
- By editing the pool using the **Pool** button.

See section 6.5.2.2 for details on how to edit the IP address pool.

In the IP address pool display, a red colour, showing that a nanoBTS has rejected this IP address, might indicate a network configuration problem. The most likely reason for a nanoBTS to reject an IP address is that it has discovered that some other device on the network is already using this address; trying to use the same address twice suggests a network configuration error.

6.6.4 Other IP configuration parameters

In addition to giving each nanoBTS a unique IP address it is necessary to specify the **subnet mask** and **default gateway** that each nanoBTS will use.

Normally you will want to set the same values for these parameters for all the nanoBTSs on a particular network.

These parameters are set on the DHCP tab of the BTS Configuration dialog box, either for the particular nanoBTS or for all nanoBTSs using the **Defaults** button.

See section 6.7.7 for a description of the DHCP tab of the BTS Configuration dialog box, and section 6.7.4 for a description of how the system of default values works.

6.7 BTS Attribute Reference

This section gives a complete reference to the BTS Configuration dialog box (Figure 45) and to all the attributes that can be specified for a nanoBTS, or as default values for all nanoBTSs, whether via the BTS Configuration dialog box or via a configuration file.

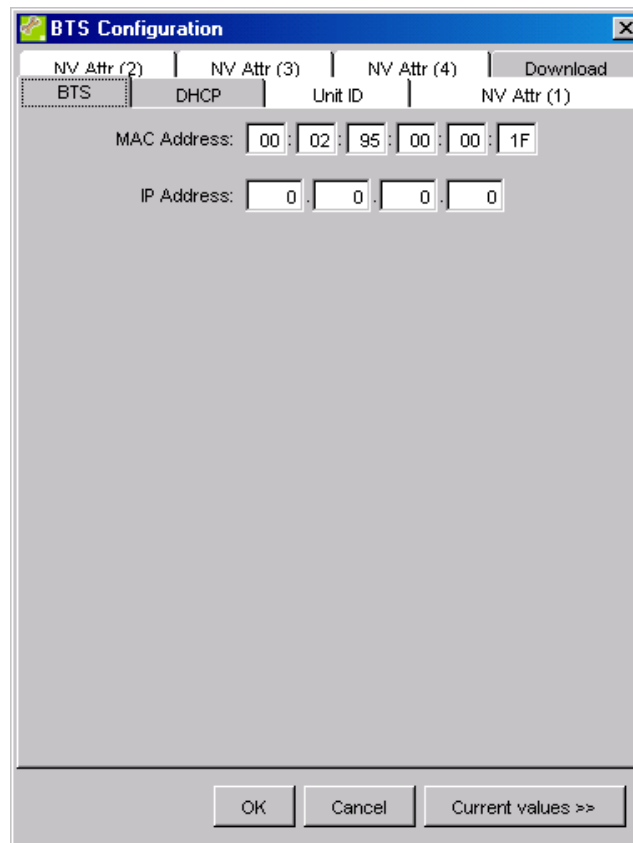


Figure 45 - BTS Configuration dialog box

6.7.1 The BTS Configuration Dialog box

The BTS Configuration dialog box can be displayed in any of the following ways:

- Select an entry for a nanoBTS in the BTS Status section of the user interface and press the **Edit** button – this produces a BTS Configuration dialog box that allows the attributes for that particular nanoBTS to be edited.
- Press the **Defaults** button – this produces a BTS Configuration dialog box that allows the user to edit default values that BTS Installer will use for all nanoBTSs that don't have specific settings.
- Press the **Edit** button from the Configure BTS dialog box (which in turn is produced by pressing the **Action** button) – this produces a BTS configuration dialog box that allows the attributes for the particular nanoBTS to be edited in exactly the same way as the **Edit** button in the main user interface.

There are various other occasions on which BTS Installer considers that the user is likely to want to edit or view nanoBTS attributes and it then pops up the BTS Configuration dialog box as part of a longer process. Examples include:

- When the user uses the **New** button to create a new BTS Database entry, the user will probably need to enter some attributes for this nanoBTS before the new BTS Database entry is useful for anything, so the BTS Configuration dialog box for the new BTS Database entry is displayed automatically.
- When the **Set/Get NV Attributes** button is used it is likely that the user will want to inspect the values fetched from the nanoBTS, so the BTS Configuration dialog box is displayed automatically.

The nanoBTS attributes are accessed from the BTS Configuration Dialog box and changes that have been made are saved by selecting the **OK** button. Selecting the **OK** button removes the BTS Configuration Dialog box.

The BTS Configuration Dialog box can also be removed by selecting the **Cancel** button. This will lose any changes that have been made to the nanoBTS attributes.

6.7.2 Current Values Display

The BTS Configuration dialog box can show just the attribute values that the user wants to configure on the nanoBTS, as in Figure 45, or it can be expanded by selecting the “Current values >>” button to also show the current values of the attributes in the nanoBTS, if these are known, as shown in Figure 46.

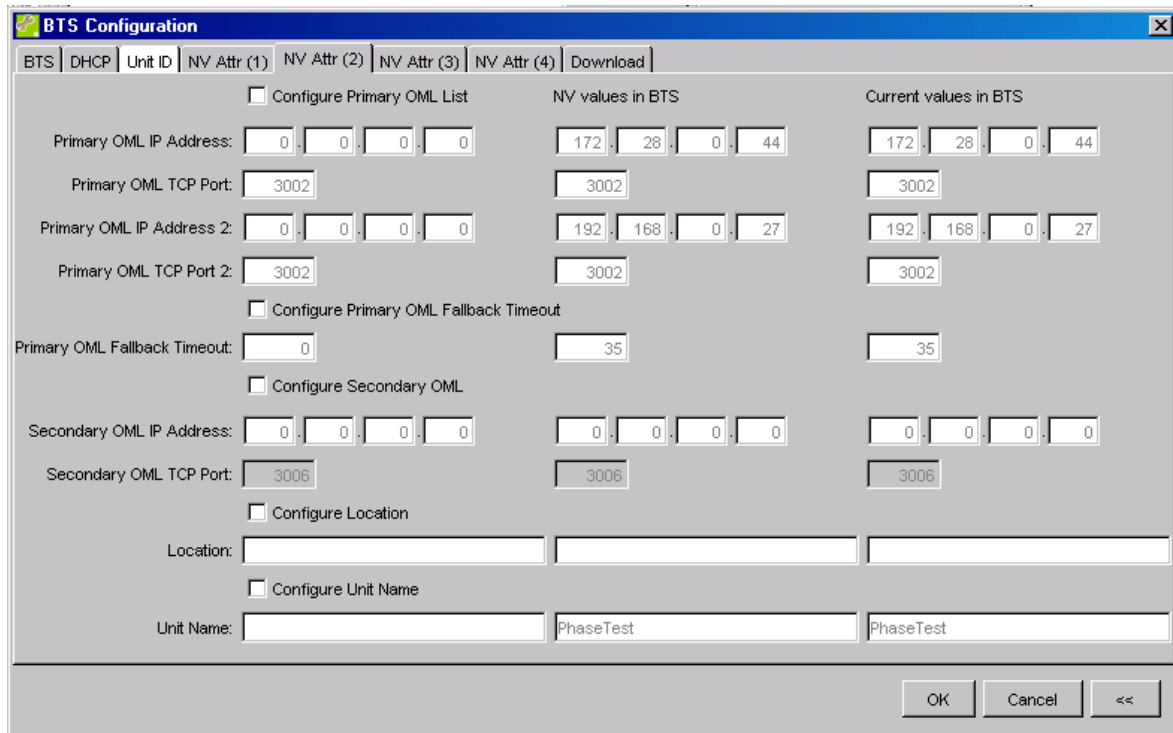


Figure 46 - Expanded BTS Configuration dialog box

BTS Installer may know about up to three possibly different values for each attribute, and these are displayed in three columns in the dialog box.

Left	Desired values	These are the values (specified by the user or by default) that will be configured in the nanoBTS next time a manual or automatic NV configuration phase is run.
Middle	NV values in BTS	These are the values held in non-volatile memory in the nanoBTS. These may not be the values currently in use, as for some attributes any new values are only used when the nanoBTS is restarted.
Right	Current values in BTS	These are the values currently being used by the nanoBTS.

The **Desired values** are as specified by the user, either in the BTS Configuration dialog box or in a configuration file, or may be default values. See section 6.7.4 for a description of how BTS Installer looks for default values for any attributes that have not been explicitly specified.

The **NV values in BTS** are only present if these have been fetched from the nanoBTS, and depending on when they were last fetched from the nanoBTS the values

displayed may or may not be up to date. These values are fetched from the nanoBTS as follows:

- When automatic configuration of the nanoBTS is performed, and the non-volatile attributes configuration phase is enabled, then any non-volatile attributes that are configured on the nanoBTS are read back. BTS Installer does this to check that the values set have been correctly stored by the nanoBTS. Attributes which are **not** being set are also **not** read back, so in a typical automatic configuration run **only some of the “NV values in BTS” are fetched**.
- When the manual **Set/Get NV Attributes** command is run some or all of the **NV values in BTS** will be fetched from the nanoBTS, as specified by the user (see section 6.5.5.4).

The **Current values in BTS** are only present if these have been fetched from the nanoBTS, and depending on when they were last fetched from the nanoBTS the values displayed may or may not be up to date. These values are fetched from the nanoBTS as follows:

- When the manual **Set/Get NV Attributes** command is run some or all of the **Current values in BTS** will be fetched from the nanoBTS, as specified by the user (see section 6.5.5.4).

Note that only the **Desired values** of attributes are ever read from or stored to configuration files. The **NV values in BTS** and **Current values in BTS** are never present in configuration files.

For some attributes there is no useful concept of any “current value” in which cases no current values are shown on the expanded dialog box.

The BTS Configuration Dialog box can be returned to displaying only the **Desired values** by selecting the << button.

6.7.3 Identifying a nanoBTS

There is no single nanoBTS parameter that can always be used to uniquely identify a nanoBTS' configuration data in the BTS Database, thus the most appropriate parameter to regard as the “identity” of the nanoBTS will vary depending on what the user is doing:

- During physical installation of nanoBTS, ie actually screwing them to the wall, the Location string is likely to be the most useful identifier, and if a configuration file is prepared in advance it will most likely identify the nanoBTS by the Location string. At this point the configuration file probably doesn't contain a MAC address for the nanoBTS, as this would unnecessarily constrain the installer to install specific units at specific locations.
- When a nanoBTS is physically installed the installer can make a note of the MAC address of the nanoBTS installed at each location, and can edit the configuration file or the BTS Database to add this information for each nanoBTS. The MAC address now becomes the most useful identifier for a nanoBTS, as it is the MAC address that the DHCP server component of BTS Installer uses to work out what data to send to which nanoBTS.
- Once the DHCP process has run, if desired, each nanoBTS will know its IP address. At this point the IP address becomes the most useful identifier for a

nanoBTS, as it is the IP address that BTS Installer will use to contact each nanoBTS for later configuration phases.

In addition, when BTS Installer connects to a BTS via a Primary OML Proxy, BTS Installer identifies the nanoBTS it wants to talk to by quoting the Unit ID to the proxy, so in this case it is the Unit ID that is the most useful identifier for the nanoBTS. See section 6.9 for more information about proxy mode.

BTS Installer does not therefore require that *any* of these parameters have unique values, as to do so would restrict the usefulness of the tool in some circumstances.

6.7.4 How Defaults Work

You do not need to enter a value for every parameter for every nanoBTS to be configured; most parameter values can be picked up using BTS Installer's system for handling default values.

When BTS Installer wants to know the value of a parameter to apply to a particular nanoBTS:

- First it will look in the BTS Database entry for that nanoBTS, to see whether a value has been specified explicitly for that nanoBTS, either in a [BTS:<location>] section in the configuration file or manually via the user interface;
- If it doesn't find an explicit value for that nanoBTS it will look at a special "default" BTS Database entry, which the user can set in the [Default] section in the configuration file or via the **Defaults** button on the user interface
- If the user hasn't specified a Default value then a built-in default value will be used.

The built-in default values are mostly things like zero, null strings, "off" or "don't". If the user specifies no parameters at all then BTS Installer will do nothing at all, and thus will do nothing harmful.

In a typical installation there will be several parameters which will have the same settings for all nanoBTS, for example the router (default gateway) DHCP parameter. The user is recommended to set these as default values using the [Default] section in the configuration file or the **Defaults** button on the user interface; it will not then be necessary to specify these values separately for each nanoBTS.

Note however that if you use the **Edit** button (or some other means) to edit the configuration for a nanoBTS what you will see in the dialog box is not just the parameters you have specified explicitly for this nanoBTS but the result of merging values from all three of the sources above. If you change a default value using the **Defaults** button then you will change what you see in the dialog box for those nanoBTSs that do not have an explicit setting for this parameter.

6.7.5 Enabling Configuration Phases

The various configuration phases can be enabled and disabled separately, and whether each phase is enabled or disabled is indicated by the various tabs of the BTS Configuration dialog box, which are grey if the relevant phase is enabled or white if the relevant phase is disabled.

Each phase is enabled or disabled by a check box which is the first item on the first tab for that phase.

Tab	Phase	Check box to enable this phase
BTS	None	N/A
DHCP	DHCP	Enable DHCP Configuration
Unit ID	Unit ID	Configure Unit ID
NV Attr (1)	Non-volatile attributes	Enable NV Attr Configuration
NV Attr (2)	Non-volatile attributes	(see NV Attr (1))
NV Attr (3)	Non-volatile attributes	(see NV Attr (1))
NV Attr (4)	Non-volatile attributes	(see NV Attr (1))
Download	Download	Enable Download

The BTS tab contains information to identify the nanoBTS and is not part of any configuration phase.

6.7.6 The BTS tab

The BTS tab, Figure 47, contains information to identify the nanoBTS.

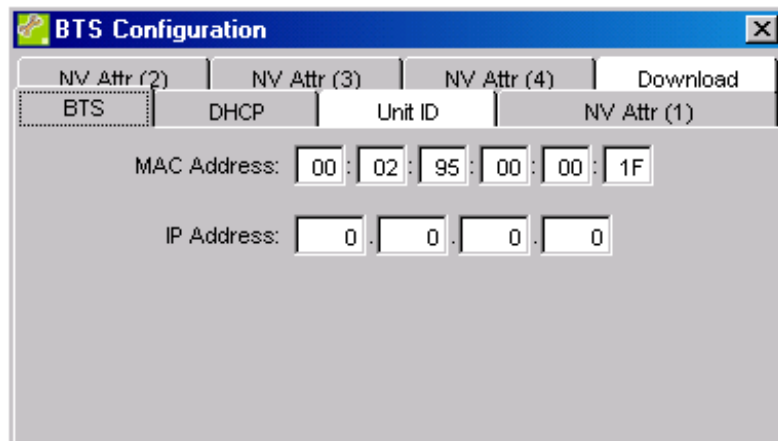


Figure 47 - BTS tab

Attribute	Description
MAC Address	The MAC address of the nanoBTS, if known
IP Address	The IP address of the nanoBTS, if explicitly specified

See also section 6.7.3 for a discussion of the various ways in which a nanoBTS can be identified at various stages of configuration.

The MAC address is displayed only if it is known to BTS Installer; otherwise a dummy default address is displayed. If BTS Installer does not have to give the nanoBTS an IP address using its built-in DHCP server then it never needs to know the nanoBTS' MAC address. So:

- If you want BTS Installer's DHCP server to allocate an IP address to this nanoBTS, fill in the MAC address of the nanoBTS here.
- If this BTS Database entry has been created by the **Find** command the MAC address will be filled in automatically for you.
- Otherwise ignore this attribute.

The IP address is displayed only if an IP address for this nanoBTS is known to BTS Installer *and* the IP address has not been allocated by BTS Installer's built-in DHCP server from the IP Address Pool. So:

- If you know the IP address of this nanoBTS, because it has already been allocated by some means external to BTS Installer, fill in the known IP address here.
- If you want BTS Installer to allocate a specific IP address to this nanoBTS using its DHCP server, fill in the desired IP address here.
- If you want BTS Installer to allocate an IP address from a pool to this nanoBTS, but don't care which particular IP address it gets, leave this set to 0.0.0.0.
- If this BTS Database entry has been created by the **Find** command the IP address will be filled in automatically for you.
- If this BTS Database entry has been created via an IP address on BTS Installer's command line, perhaps because BTS Installer has been run directly from Config Manager, the IP address will be filled in automatically for you.

Note that if you want to **change** the nanoBTS' IP address you can **not** do this simply by changing the IP address on this tab. If you enter a changed IP address here it *will* be used to reconfigure the nanoBTS' IP address but **only if and when** the nanoBTS tries to renew its IP address lease with BTS Installer's DHCP server. In most circumstances the **Change IP Configuration** command (see section 6.5.5.9) is a more appropriate way to try to change a nanoBTS' IP address – this will also change the IP address displayed in the BTS tab.

6.7.7 The DHCP tab

The DHCP tab, Figure 48, contains attributes to control the operation of the DHCP server with respect to this nanoBTS. In addition, if the DHCP configuration phase is enabled, the MAC address from the BTS tab is used by the DHCP server and the IP address from the BTS tab may be used by the DHCP server.

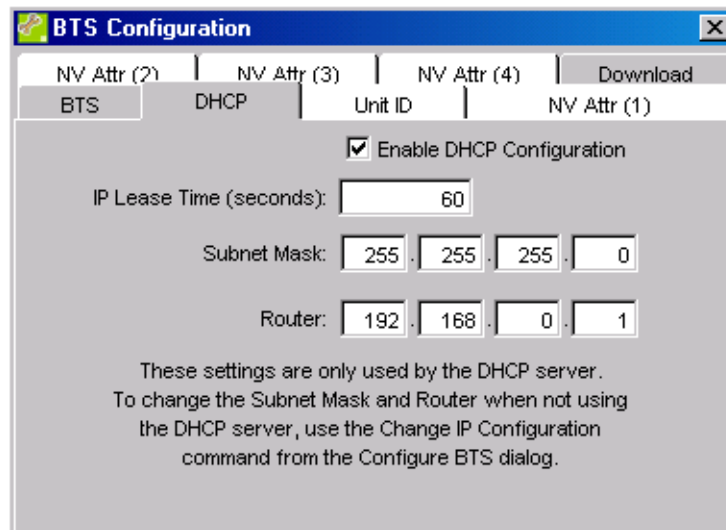


Figure 48 - DHCP tab

Attribute	Description
Enable DHCP Configuration	Enables or disables the DHCP configuration phase; when disabled the DHCP tab is white and the remaining attribute controls on this tab are disabled.
IP Lease Time	How long the IP address given to the nanoBTS by the DHCP server is valid. See discussion below.
Subnet Mask	The subnet mask that the nanoBTS uses as part of its IP configuration. This may be left at zero if it can be deduced from the class of the IP address. Details of the design of IP networks are outside the scope of this User Guide.
Router	The router, or default gateway, that the nanoBTS uses as part of its IP configuration. Details of the design of IP networks are outside the scope of this user guide.

The IP Lease Time specifies how long the IP configuration supplied to the nanoBTS by BTS Installer's DHCP server is to be valid. Before this period expires the nanoBTS will contact the DHCP server asking for the lease to be renewed; if the DHCP server doesn't reply, perhaps because BTS Installer isn't running any more, then when the period expires the nanoBTS will regard its IP configuration as invalid, will restart, and will try again to find a DHCP server willing to give it a valid IP configuration.

Whilst BTS Installer can be used as a permanently running (24/7) DHCP server to serve IP configurations to a network of nanoBTSs it is not designed or intended to be used in this way.

This means that it is only sensible to set a finite lease time in particular circumstances, for example:

- If BTS Installer is being used to connect to this nanoBTS in a temporary network configuration in order to perform some configuration of the nanoBTS before it is deployed to its final location then a finite lease is acceptable, as the nanoBTS does not need to continue to operate once BTS Installer has stopped running.
- If some other DHCP server is available on the network that will take over the job of BTS Installer's built-in DHCP server once BTS Installer has stopped running.

When the intention is to use BTS Installer's built-in DHCP server to give a nanoBTS a permanent IP address and IP configuration that it will remember across restarts, so that the nanoBTS will continue to operate correctly in the absence of any DHCP server on its network, it is necessary to:

- Set the lease time to infinite, by specifying a time of -1 seconds.
- Set flags F1, F2 and F3 to ON to ensure that the nanoBTS does not make more DHCP requests if and when it is restarted; see section 6.7.9 for details of these flags.

Note that if you want to **change** the nanoBTS' IP configuration you can **not** do this simply by changing the attributes on this tab. If you enter changed attributes here they *will* be used to reconfigure the nanoBTS' IP configuration but **only if and when** the nanoBTS tries to renew its IP address lease with BTS Installer's DHCP server. In most circumstances the **Change IP Configuration** command (see section 6.5.5.9) is a more appropriate way to try to change a nanoBTS' IP configuration – this will also change the attributes displayed in the BTS tab and the DHCP tab.

6.7.8 The Unit ID tab

The Unit ID tab, Figure 49, is used to control the Unit ID configuration phase.

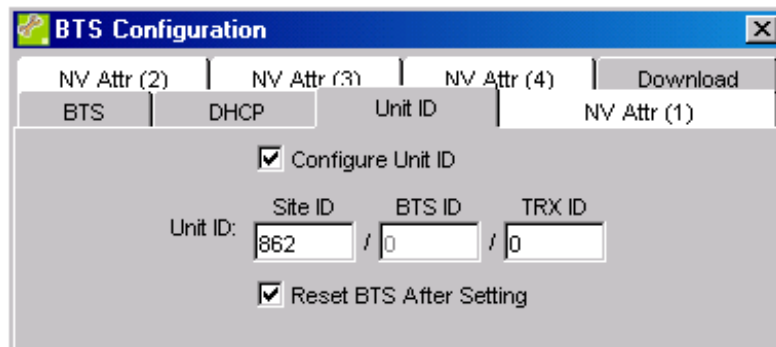


Figure 49 - Unit ID tab

Attribute	Description
Configure Unit ID	Enables or disables the Unit ID configuration phase; when disabled the Unit ID tab is white and the remaining attribute controls on this tab are disabled.
Unit ID	The Unit ID for the nanoBTS, see discussion below.
Reset BTS After Setting	Whether to restart the nanoBTS after setting its Unit ID. If this is checked, then during automatic configuration BTS Installer will reset the nanoBTS, will wait for it to restart, and will wait (if appropriate) for it to repeat its DHCP transaction before continuing with further configuration phases.

The Unit ID is used by the nanoBTS to identify its role in the system and to identify itself to the BSC. The desired Unit ID for each nanoBTS should be determined as part of the network design; this process is outside the scope of this User Guide.

Note that until a nanoBTS has a Unit ID configured it will not know its role in the network (whether it is a SITE manager, whether it contains a BTS object, whether it is a master TRX or a slave TRX) and many of its functions will be unavailable. From the point of view of BTS Installer, it will not be possible to software activate a nanoBTS that does not have a Unit ID configured, and hence it will not be possible to perform Network Listen operations.

6.7.9 The NV Attr (1) tab

The NV Attr (1) tab, Figure 50, enables or disables the entire non-volatile attribute setting configuration phase and contains the settings for the Non-volatile Configuration Flags.

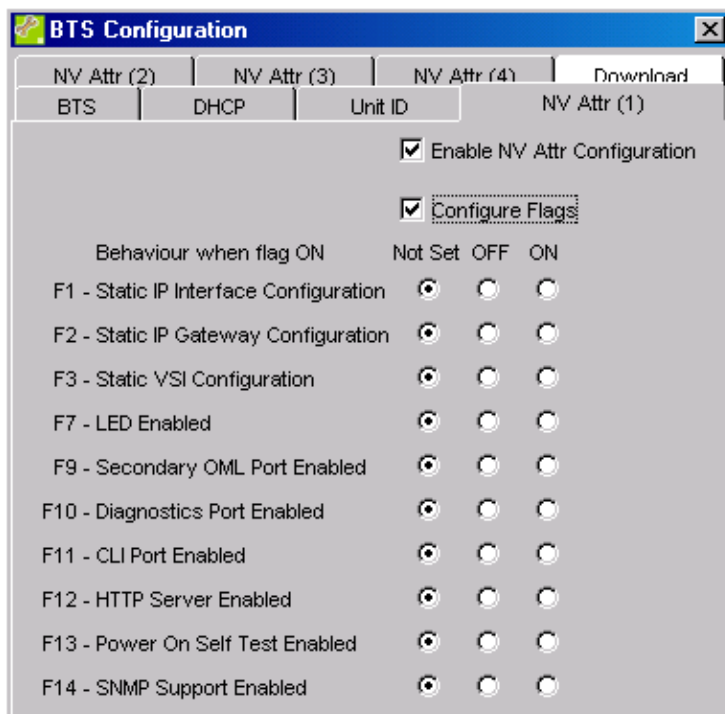


Figure 50 - NV Attr (1) tab

Attribute	Description
Enable NV Attr Configuration	Enables or disables the NV attribute configuration phase; when disabled all the NV Attr tabs are white and the remaining attribute controls on these tabs are disabled.
Configure Flags	Whether to send new values for the NV Configuration Flags to the nanoBTS
F1 to F14	For each flag the user can choose “Not Set”, in which case the value of this flag on the nanoBTS will be unchanged, or “OFF” to switch this flag off on the nanoBTS or “ON” to switch this flag on on the nanoBTS. See table below for the meaning of each flag.

Flags that are missing from the numerical sequence are not currently used, except for F4 which is automatically generated by BTS Installer for the benefit of older nanoBTS software that needs a value for this flag.

Flag	Name	Behaviour when Enabled	Behaviour when Disabled
F1	Static IP Interface Config	The current IP Interface config in NV cannot be altered by DHCP	The current IP Interface Config in NV may be altered by DHCP
F2	Static IP Gateway Config	The current IP Gateway config in NV cannot be altered by DHCP	The current IP Gateway config in NV may be altered by DHCP
F3	Static VSI Config	The current Config in NV cannot be altered by DHCP VSI	The current Config in NV may be altered by DHCP VSI
F7	LED	The LED indicates status of the BTS	The LED is disabled
F9	Secondary OML Enable	The BTS should allow connections to the secondary OML port.	The BTS should not allow connections to the secondary OML port.
F10	Diag Enable	The BTS should allow connections to the Diagnostics port	The BTS should not allow connections to the Diagnostics port
F11	CLI Enable	The BTS should allow connections to the CLI port	The BTS should not allow connections to the CLI port
F12	HTTP Enable	The BTS should enable the HTTP server	The BTS should disable the HTTP server
F13	POST Enable	The BTS should enable Power-On Self Test	The BTS should disable Power-On Self Test
F14	SNMP Enable	The BTS should enable SNMP support	The BTS should disable SNMP support

Notes:

- 1) The BTS may reject attempts to set flag values that would result in improper operation (e.g. disabling DHCP when there is no valid IP Interface Config and IP Gateway Config in the NVRAM), in which case BTS Installer will report that the configuration phase in question did not succeed.
- 2) Changes to flags F1-F3 only take effect at the next boot time, so after a successful change their NV values can differ from their current values. F7, F13 and F14 take immediate effect. Flags F9-F12 immediately affect the ability of the BTS to accept new connections for the specified services, but may not terminate any existing connections.

6.7.10 The NV Attr (2) tab

The NV Attr (2) tab, Figure 51, contains additional non-volatile attribute settings. All the controls on this tab are disabled unless the **Enable NV Attr Configuration** check box on the NV Attr (1) tab is checked.

The screenshot shows the 'BTS Configuration' dialog box with the 'NV Attr (2)' tab selected. The dialog has a title bar with a close button. Below the title bar are tabs for 'BTS', 'DHCP', and 'Unit ID'. Under 'BTS', there are sub-tabs for 'NV Attr (1)', 'NV Attr (2)', 'NV Attr (3)', 'NV Attr (4)', and 'Download'. The 'NV Attr (2)' tab is active. The settings are as follows:

- Configure Primary OML List
- Number of Addresses in List: 1 (dropdown)
- Primary OML IP Address: 192 . 168 . 0 . 1
- Primary OML TCP Port (0 for default): 0
- Primary OML IP Address 2: 0 . 0 . 0 . 0
- Primary OML TCP Port 2 (0 for default): 0
- Configure Primary OML Fallback Timeout
- Primary OML Fallback Timeout: 0
- Configure Secondary OML
- Secondary OML IP Address: 0 . 0 . 0 . 0
- Secondary OML TCP Port: 3006
- Configure Location
- Location: [Empty text box]
- Configure Unit Name
- Unit Name: [Empty text box]

At the bottom are three buttons: 'OK', 'Cancel', and 'Current values >>'.

Figure 51 - NV Attr (2) tab

Each non-volatile attribute, or group of attributes, may be included or omitted when the non-volatile attribute configuration phase takes place. (This grouping of attributes is based on the grouping of attributes in the GSM 12.21 protocol used to communicate with the nanoBTS.) There is a check box to enable sending of each attribute or group of attributes: when this is not checked the controls for the corresponding attributes are disabled.

Attribute	Description
Configure Primary OML List	Whether to send new values for the Primary OML List to the nanoBTS.s
Number of Addresses in List	The Primary OML List contains up to two IP Addresses and Ports; this may be set to zero, one or two list entries. ⁵
Primary OML IP Address	The IP address to which the nanoBTS should try to connect to set up its primary OML connection, typically the address of the BSC. This control is only enabled if Number of Addresses in List is set to at least one.
Primary OML TCP Port	The TCP port that the nanoBTS should use when trying to connect to the above address. If this is set to 0, the nanoBTS will use its built in default value.
Primary OML IP Address 2	A fallback IP address to which the nanoBTS should try to connect to set up its primary OML connection if the attempt to connect to the Primary OML IP Address failed. This control is only enabled if Number of Addresses in List is set to 2.
Primary OML IP Port 2	The TCP port that the nanoBTS should used when trying to connect to the above address.
Configure Primary OML Fallback Timeout	Whether to send a new value for the Primary OML Fallback Timeout to the nanoBTS.
Primary OML Fallback Timeout	This is the number of seconds for which the nanoBTS should attempt to contact the Primary OML IP Address before giving up and trying to contact the Primary OML IP Address 2. If this value is zero the nanoBTS will only make one attempt to contact the first IP address before moving on to try the second.
Configure Secondary OML	Whether to send new values for the Secondary OML IP Address and Secondary OML TCP Port to the nanoBTS.
Secondary OML IP Address	If this address is set, it is the only IP address which the nanoBTS will allow to make secondary OML connections; if it is not set, ie if it is left at 0.0.0.0, incoming secondary OML connections will be allowed from any IP address. Note that BTS Installer uses the secondary OML connection to talk to the nanoBTS, so if this attribute is set to something other than the IP address of the BSC you may find that BTS Installer is not able to perform further operations on this nanoBTS.
Secondary OML TCP Port	This is the TCP port on which the nanoBTS listens for incoming secondary OML connections. BTS Installer does not provide any means for changing this attribute. If the port on which the nanoBTS listens for incoming secondary OML connections is changed using some other tool then BTS Installer will not be able to connect to that nanoBTS, as it always tries to connect to the default port.

⁵ When configuring the Primary OML List, the list of IP addresses (and optionally, ports) entered by the user will overwrite the BTS's existing list (rather than adding to the BTS's list). So, for example, to add a fallback OML IP address, the user must enter the existing Primary OML IP Address as well as a Primary OML IP Address 2. If you need to do this for several BTSs, you can do it in one go by using the Defaults facility (section 6.7.4 describes how this works).

Attribute	Description
Configure Location	Whether to send a new value for the Location to the nanoBTS.
Location	A text string that can be used to describe the physical location of the nanoBTS. This string will be recovered during the Find operation described in section 6.5.4.2.1.
Configure Unit Name	Whether to send a new value for the Unit Name to the nanoBTS.
Unit Name	A text string that is used as the nanoBTS' DNS host name.

6.7.11 The NV Attr (3) tab

The NV Attr (3) tab, Figure 52, contains additional non-volatile attribute settings. All the controls on this tab are disabled unless the **Enable NV Attr Configuration** check box on the NV Attr (1) tab is checked.

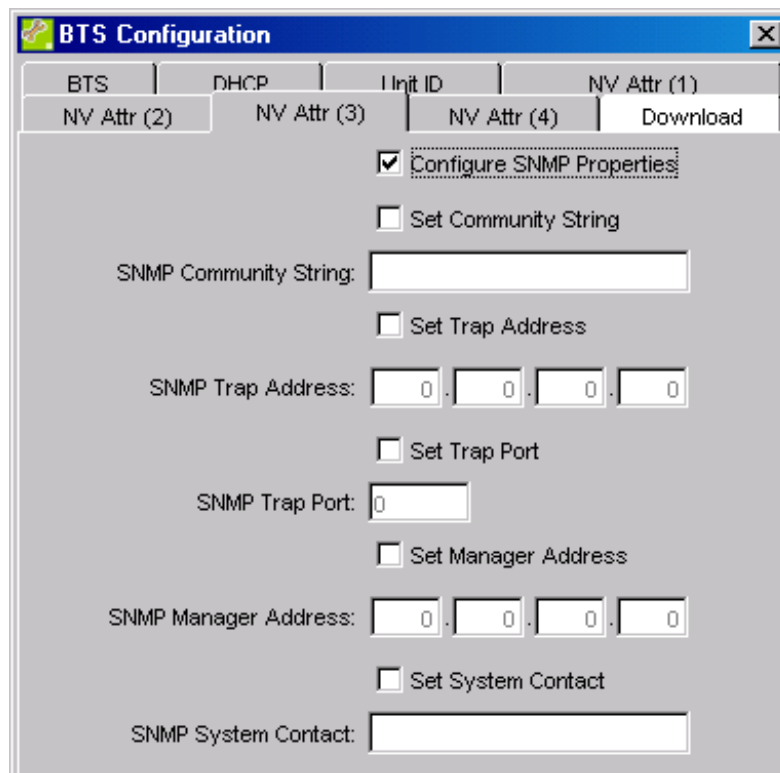


Figure 52 - NV Attr (3) tab

This tab contains the SNMP settings. There is an overall enabling check box, **Configure SNMP Properties**, to say whether any of the SNMP configuration should be sent to the nanoBTS, and if that is checked there are separate check boxes to control the sending of each individual part of the SNMP configuration. (Again, this reflects the options available in the underlying GSM 12.21 protocol.)

Attribute	Description
Configure SNMP Properties	Whether to send new values for any of the SNMP attributes to the nanoBTS. If this is not checked all the rest of the attributes on this tab are disabled.

Set Community String	Whether to send a new value for the SNMP Community String to the nanoBTS.
SNMP Community String	A text string. Meanings of the various SNMP configuration attributes are outside the scope of this User Guide.
Set Trap Address	Whether to send a new value of the SNMP Trap Address to the nanoBTS.
SNMP Trap Address	IP address
Set Trap Port	Whether to send a new value of the SNMP Trap Port to the nanoBTS
SNMP Trap Port	Port number
Set Manager Address	Whether to send a new value of the SNMP Manager Address to the nanoBTS.
SNMP Manager Address	IP address
Set System Contact	Whether to send a new value of the SNMP System Contact to the nanoBTS.
SNMP System Contact	Text string

6.7.12 The NV Attr (4) tab

The NV Attr (4) tab, Figure 53, contains additional non-volatile attribute settings. All the controls on this tab are disabled unless the **Enable NV Attr Configuration** check box on the NV Attr (1) tab is checked.

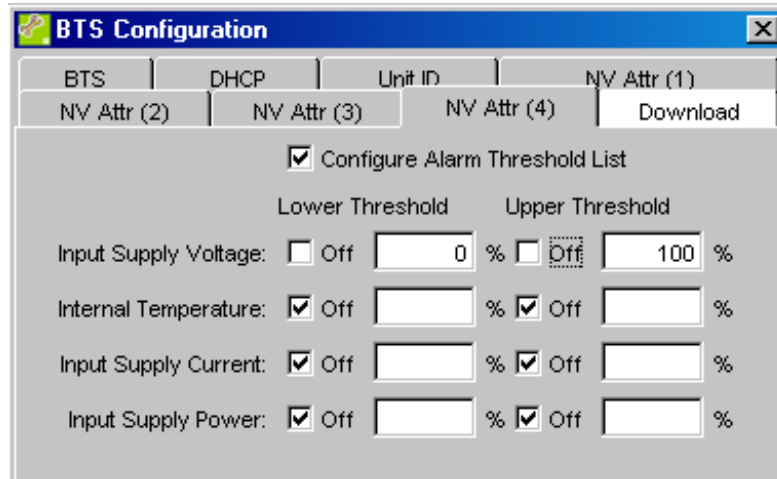


Figure 53 - NV Attr (4) tab

This tab contains thresholds for various alarms that the nanoBTS can raise.

Attribute	Description
Configure Alarm Threshold List	Whether to send a new value for the Alarm Threshold List to the nanoBTS.
Input Supply Voltage	Thresholds for the input supply voltage alarm
Internal Temperature	Thresholds for the internal temperature alarm
Input Supply Current	Thresholds for the input supply current alarm
Input Supply Power	Thresholds for the input supply power alarm

Each measured quantity can cause an alarm to be generated if it falls below the Lower Threshold or rises above the Upper Threshold. Any of these alarms can be turned off using the **Off** check box.

When the **Off** check box is not checked the threshold is entered as a percentage of the nominal working range of the value. For example, for a unit with a nominal input supply voltage range 40V – 56V, setting the input supply voltage upper threshold to 90% would give rise to an alarm when the voltage was above

$$40 + 0.9 * (56 - 40) = 54.4 \text{ V}$$

Each percentage value can be between –20% and 120%.

6.7.13 The Download tab

The Download tab, Figure 54, controls whether the download configuration phase is enabled, and if so provides the data necessary for the operation of that phase.

BTS Configuration

BTS	DHCP	Unit ID
NV Attr (1)	NV Attr (2)	NV Attr (3)
		NV Attr (4)

Enable Download

Only one type of file may be downloaded in a single operation

Download Software

File Name:

Make New Software the Default

Reset BTS After Download

Download Certificate

Specify the .zip file that contains the certificate for this BTS.

File Name:

Reset BTS After Download

Download Certificate Revocation List

Specify the .sdp file that contains the CRL; or leave blank to download the latest version (recommended).

File Name:

Latest CRL:

Reset BTS After Download

Switch Software Versions and/or Reset BTS only

Switch Backhaul Software Versions

Switch TRX Software Versions

Reset BTS

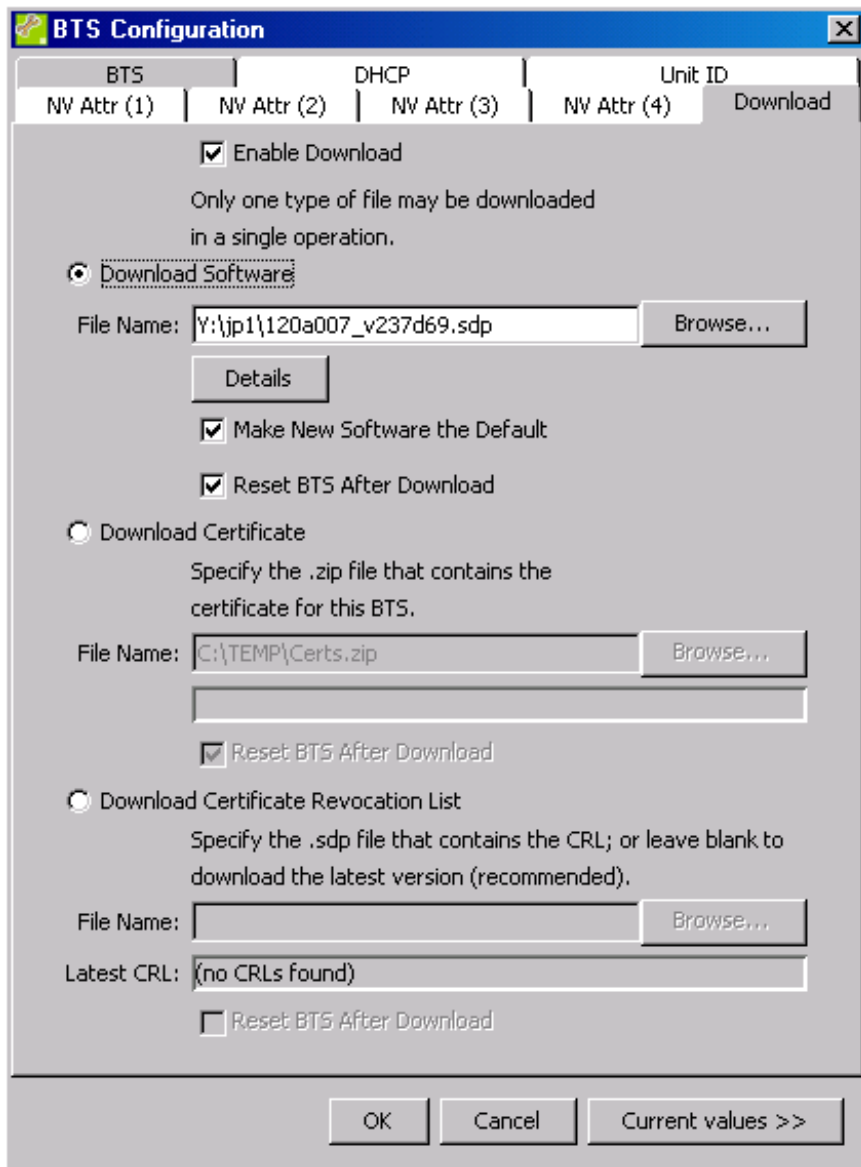


Figure 54 - Download tab

The download phase will perform one of three four actions, depending on which radio button is selected:

- download software
- download the nanoBTS' certificate
- download a certificate revocation list
- switch software versions and/or reset the BTS without downloading anything..

6.7.13.1 Download Software

Attribute	Description
Enable Download	Whether the download configuration phase is enabled.
Download Software	Specifies that it's software that is to be downloaded
File Name	The name of the file containing the software to be downloaded to the nanoBTS. The Browse button produces a standard file selection dialog box
(Status display)	The Details button will open a dialog box displaying the content of the selected file, see Figure 55 for an example.
Make New Software the Default	If this is checked then the new software will be made the default after downloading. This means that next time the BTS restarts it will load and run the newly downloaded software.
Reset BTS After Download	If this is checked then the nanoBTS will be reset after downloading the new software, and will load and run the new software.

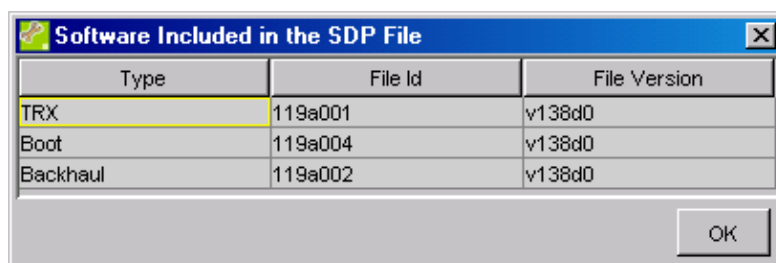


Figure 55 - Software details dialog box

6.7.13.2 Download Certificate

It is necessary to download a personalised certificate to each BTS that is going to communicate via a secure (SSL) connection to the BSC (and/or BTS Installer).

Field	Description
Enable Download	Whether the download configuration phase is enabled.
Download Certificate	Specifies that it's the nanoBTS' certificate that is to be downloaded
File Name	The name of the file containing the certificate to be downloaded to the nanoBTS. The Browse button produces a standard file selection dialog box
(Status field)	Displays a message if there is a problem with the selected file.
Reset BTS After Download	If this is checked then the nanoBTS will be reset after downloading the new software, and will load and run the new software.

Certificates for nanoBTSs are delivered in .zip files each of which may contain certificates for several BTSs. So, if certificates are to be downloaded to several BTSs, the .zip file may be set in the Defaults, and the correct certificate will be selected from the .zip file to download to each BTS.

6.7.13.3 Download Certificate Revocation List

From time to time some certificates may be revoked and Certificate Revocation Lists issued for downloading to nanoBTSs. This will prevent the nanoBTS communicating with anything that quotes the revoked certificate.

Field	Description
Enable Download	Whether the download configuration phase is enabled.
Download Certificate Revocation List	Specifies that it's a certificate revocation list that is to be downloaded
File Name	The name of the file containing the certificate to be downloaded to the nanoBTS. The Browse button produces a standard file selection dialog box
Latest CRL	Displays the name of the latest CRL found.
Reset BTS After Download	If this is checked then the nanoBTS will be reset after downloading the new software, and will load and run the new software.

A Certificate Revocation List is delivered as a .sdp file with a filename that includes a timestamp.

It is recommended that these file are installed to the same directory as the BtsInstaller.jar file; on a Windows system this might be somewhere like:

```
c:\program files\ip.access\BTSInstaller
```

If that is done then the "Latest CRL" field will show the file name of the latest CRL file in that directory, which will normally be the one that needs to be downloaded to the nanoBTSs. In this case there is no need to enter anything in the "File Name" field.

However if it is desired to download a specific CRL then its name may be specified in the "File Name" field.

To change the directory that BTS Installer searches for the latest CRL:

- put a CRL file in the desired directory
- type its name in the "File Name" field – at this point the "Latest CRL" field will be filled in automatically
- blank out the "File Name" field again.

From now on BTS Installer will look in that directory for certificate revocation list files.

6.7.13.4 Switch Software Versions and/or Reset BTS only

When this option is selected BTS Installer queries the BTS for its software configuration and includes a list of installed and active software versions in the log.

Field	Description
Switch Backhaul Software Versions	If this option is checked and the BTS contains two Backhaul software images then the current image is switched. This will take effect, ie the newly selected image will run, next time the BTS is reset.

Switch TRX Software Versions	If this option is checked and the BTS contains two TRX software images then the current image is switched. This will take effect, ie the newly selected image will run, next time the BTS is reset.
Reset BTS	If this option is checked the BTS will be reset after any requested software versions have been switched.

Note that the BTS will usually refuse to active incompatible versions of Backhaul and TRX software. So in normal use both the Backhaul and TRX options should be checked or they should both be unchecked.

The log will contain the versions of the newly activated software images.

6.8 Using Network Listen

6.8.1 Introduction to Network Listen

Network Listen is a feature implemented by the ip.access nanoBTS, and controlled by BTS Installer, that aids frequency planning. It puts the nanoBTS into a receive mode in which it can be used like a mobile to identify other base stations (which may be cells in the macro network or in the nanoGSM™ network), to monitor their power levels, frequency usage and BCCH information.

Network Listen includes the following tests:

Channel Usage	Measures and reports the received signal level on a set of RF channels, regardless of signal content.
BCCH Channel Usage	Measures and reports the received signal level on only those RF channels that are found to be transmitting a GSM Broadcast Control Channel.
BCCH Information	Extracts and reports information from BCCHs on a set of GSM RF channels.
Frequency Synchronisation	Monitors one or more RF channels, and if suitable BCCH carriers are found, measure the frequency error of the local oscillator relative to the received signal. The local oscillator may then be adjusted automatically to correct the error.
Transmit Beacon	Transmits a continuous beacon signal on a specified RF channel and at a specified power, conforming to the normal GSM slot, frame and multiframe structures, and carrying a full BCCH channel combination.

6.8.2 Starting Network Listen

To start Network Listen select a nanoBTS and then press the **Listen** button in the BTS Status part of BTS Installer's main window.

This will bring up the main window of the Network Listen function as shown in Figure 56.

For tests that return a set of received signal levels, the main part of the window defaults to a **Graph View** of RX Level against ARFCN, or by selecting the **List View** tab, a table of results can be displayed. The Graph View has two magnifying glasses that allow the user to zoom in and out of the ARFCN display. The List View can be sorted by clicking on the header of the column to be used as the sort key.

Along the top of the window there are a number of functions. **Frequency Band** allows the user to select the frequency band that the nanoBTS operates on: note that this must match the product's specified frequency band. The **Configure Test** button is used to configure individual parameters used during the various network listen tests. The **ARFCN**, **dBm** and **MCC/MNC** buttons are used to change the manner in which the decoded data is displayed in the main window.

Down the left hand side of the display, the Listen Tests may be selected and each of these will be discussed fully in the following sections.

At the bottom of the window there is a **Connect** button to control connection to the nanoBTS, **Start Test** and **Stop Test** buttons that control the running of the tests and an **OK** button that disconnects from a nanoBTS and then removes the Network Listen window.

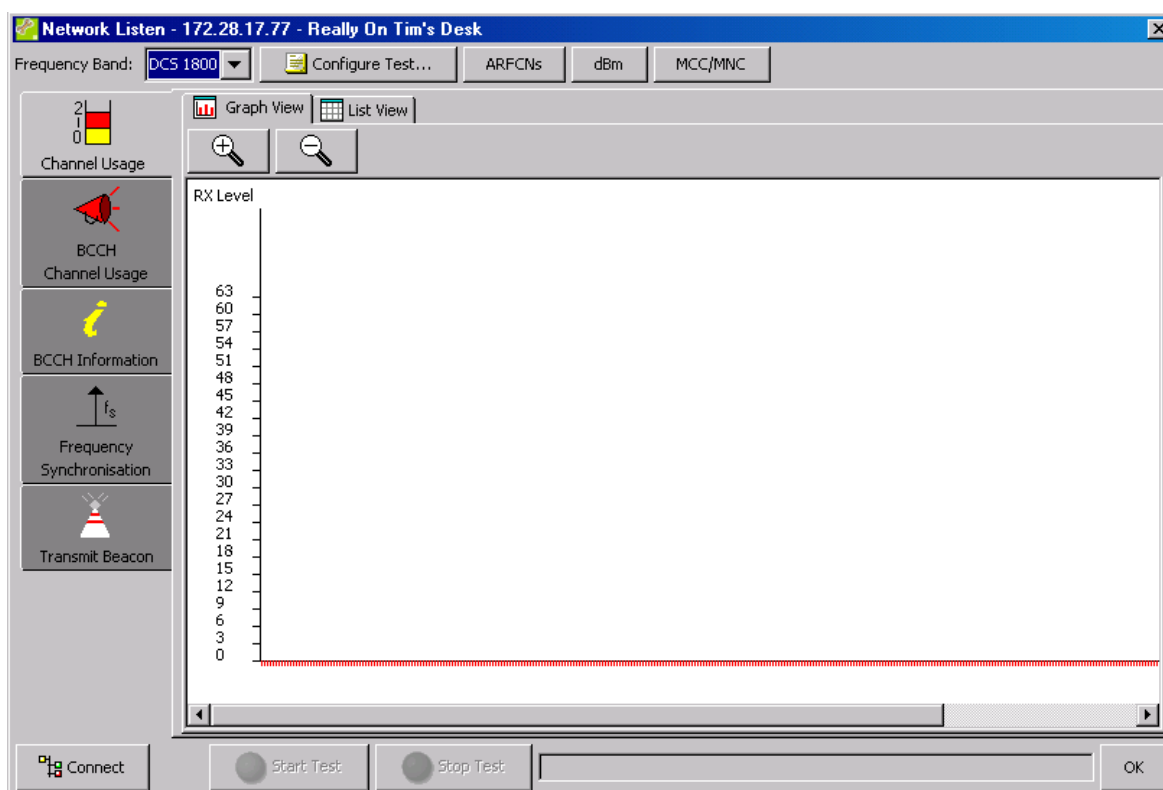


Figure 56 - Network Listen Main Display

Before it is possible to run any of the tests it is first necessary to select the **Connect** button to start a management connection between the nanoBTS and BTS Installer.

Once the connection is started the message pane in the bottom of the Network Listen window will display “SW Activating” for up to around 90 seconds (it will be quicker than that if the nanoBTS has already been software activated). It will then display “Ready to run test” to indicate that the nanoBTS has completed the boot of the TRX software and is ready to perform any of the tests listed down the left hand side of the main window.

When the connection to the BTS has been made a padlock will appear to the right of the Connect button. An open padlock indicates an insecure connection, and a closed padlock indicates a secure (SSL) connection.

6.8.3 Configuring a Network Listen Test

In order to configure a test, first select the required test from the tabs on the left hand side of the Network Listen window. Then select the **Configure Test** button on the toolbar:

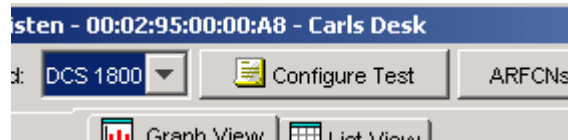


Figure 57 - Configure Test Button

which will bring up the Configure Test dialog box for the selected test.

All Network Listen tests other than the Transmit Beacon test have the following tabs on their Configure Test dialog boxes:

- Test Options
- ARFCN Lists
- RXLEV Threshold

All of the Network Listen tests, including the Transmit Beacon test, also have the following tab on their Configure Test dialog boxes:

- Advanced

Some tests have additional tabs for parameters that are specific to the test in question. These parameters are described in the same section as the test itself.

The common parameters are described in the following subsections.

6.8.3.1 Test Options

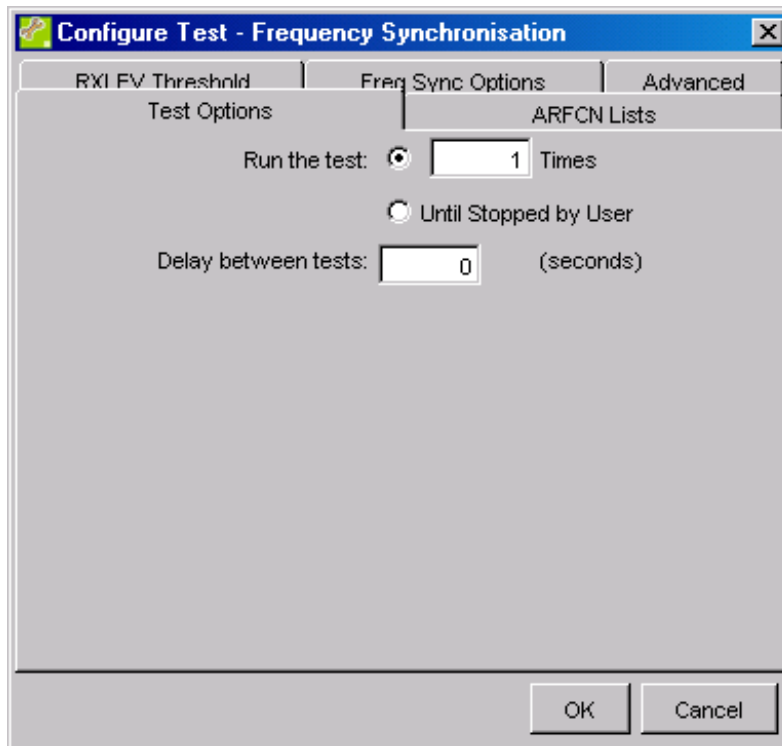


Figure 58 - Test Options

The “Test Options” tab allows the user to configure how many times the test runs and, if the test is to be run more than once, how long to delay between runs.

Control	Description
Run the test - Times	If selected, the test will be run the specified number of times. Default: 1. Note that if this is set to 0, BTS Installer will automatically switch to running the test until stopped by the user.
Run the test – Until stopped by user	If ticked, the test will be run repeatedly, until the user stops the test using the Stop Test button.
Delay between tests	The period, in seconds, for which BTS Installer should wait between the end of one test run and the start of the next.

6.8.3.2 ARFCN Lists

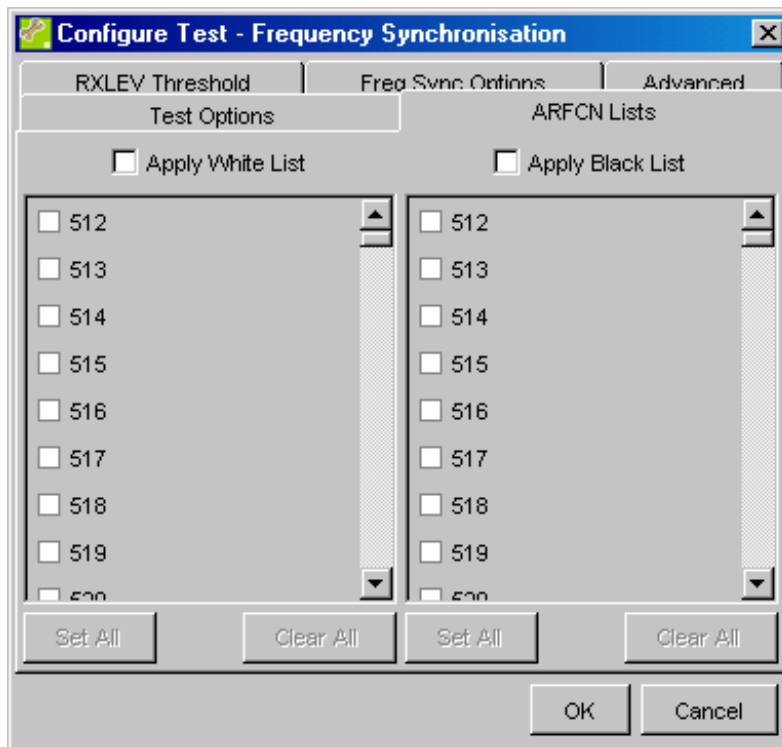


Figure 59 - ARFCN Lists

The ARFCN Lists tab allows the user to select channels to be either tested or not as required. To define a set of channels to test, select the **Apply White List** check box and then select the required ARFCNs from the list in the left hand panel. This will set Listen to test these ARFCNs only. To select ARFCNs to be explicitly ignored, select the **Apply Black List** check box and then select the required ARFCNs from the list in the right hand panel. These ARFCNs will then not be used in the test.

If neither the **Apply White List** nor the **Apply Black List** check boxes are selected, all RF channels in the relevant GSM band will be tested.

Note that for the BCCH Information test and the Frequency Synchronisation test, if a BCCH Channel Usage test has been run BTS Installer automatically uses its results to populate the ARFCN White List, but the user may override this.

6.8.3.3 RXLEV Threshold

Select the RXLEV Threshold tab and the window will show the selected properties for the receive level threshold (Figure 60).

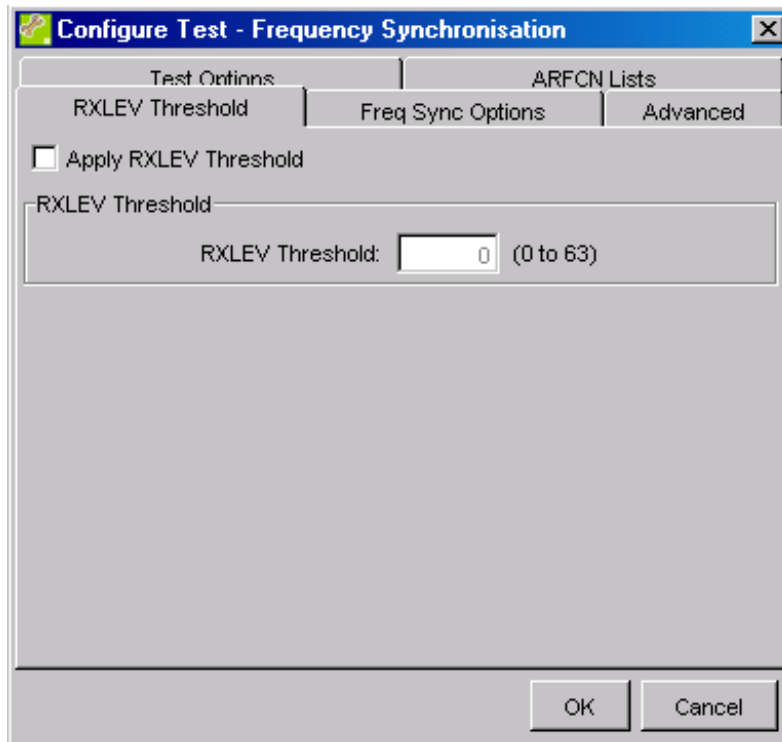


Figure 60 - RXLEV Threshold

Control	Description
Apply RXLEV Threshold	If ticked, the RXLEV threshold will be applied. If not ticked, no RXLEV threshold will be applied and no test results will be excluded on the basis of signal strength.
RXLEV Threshold	If an RXLEV Threshold is applied, only channels for which the measured RXLEV is at or above the value of RXLEV Threshold will be included in the results of the test.

6.8.3.4 Advanced

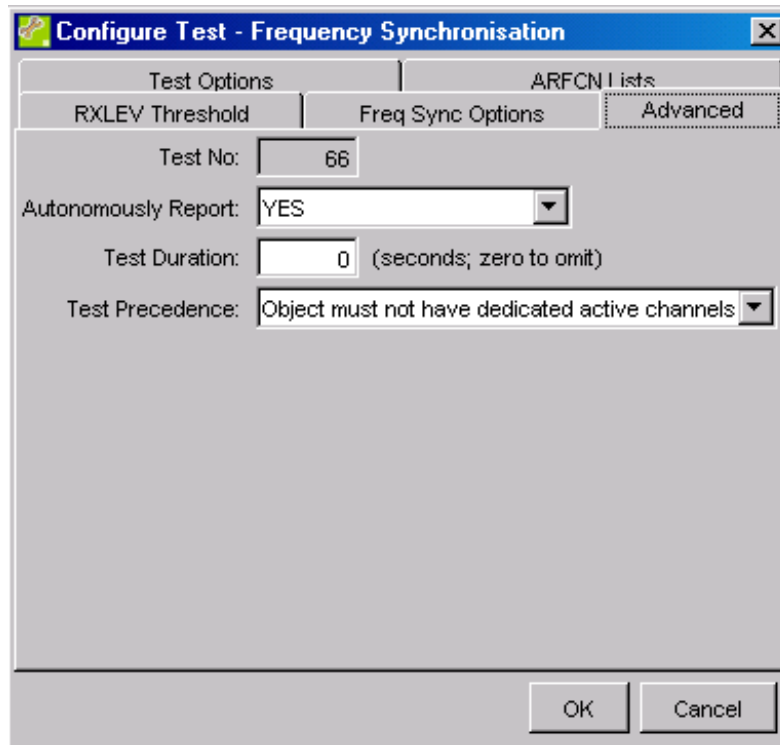


Figure 61 - Advanced Options

Control	Description
Test No	The number used internally to identify the type of test to be performed.
Autonomously Report	Not used.
Test Duration	The period, in seconds, after which the nanoBTS should autonomously terminate a not-yet-completed test. If a test is terminated in this way, BTS Installer will display any partial test results that are available. If Test Duration is set to 0, the nanoBTS will allow the test to continue indefinitely (but the test may still be stopped by the user selecting the Stop Test button).

Control	Description
Test Precedence	<p>Determines the conditions under which the nanoBTS will allow the test to be performed. The default is <i>Object must not have dedicated active channels</i>.</p> <p>If set to <i>Object must be Administratively Locked</i>, the nanoBTS will only carry out the test if the Administrative State of its radio carrier object is set to Locked or the radio carrier object has not yet been Op Started.</p> <p>If set to <i>Object must not have dedicated active channels</i>, the nanoBTS will only carry out the test if it has no active dedicated channels (such as SDCCH, TCH, PDCH).</p> <p>If set to <i>Object must be unconfigured</i>, the nanoBTS will only carry out the test if its radio carrier object has not yet been configured or Op Started.</p>

6.8.4 Channel Usage Test

This test is designed to perform a quick power scan across the selected band. As an example, it takes about 5 seconds for a full scan of the DCS 1800 band. It shows where there is activity in the band, but it doesn't tell you what is being transmitted on a given channel: there may be a BCCH, there may only be GSM traffic, there may be nothing but background noise, or in rare (we hope!) cases there may be some non-GSM signal. You need to use the BCCH Channel usage test to identify other BCCH carriers (see section 6.8.5).

To use this test select the Channel Usage tab on the left hand side of the Network Listen window. Then if you wish to view or change the configuration for the test, select the **Configure Test** button located at the top of the screen.

6.8.4.1 Test Configuration

All the tabs on the Configure Test dialog box for the Channel Usage test have been described already:

- Test Options – see section 6.8.3.1
- ARFCN Lists – see section 6.8.3.2
- RXLEV Threshold – see section 6.8.3.3
- Advanced – see section 6.8.3.4

6.8.4.2 Running The Test

Before running the test, ensure that a connection is established to the nanoBTS and that the configuration for the test has been completed.

To run the test, click on the “Start Test” button at the bottom of the main screen; note that the status bar at the bottom of the screen indicates that the test is running.

Following a short period of time, a graphical representation of the network band will be shown, as seen in Figure 62.

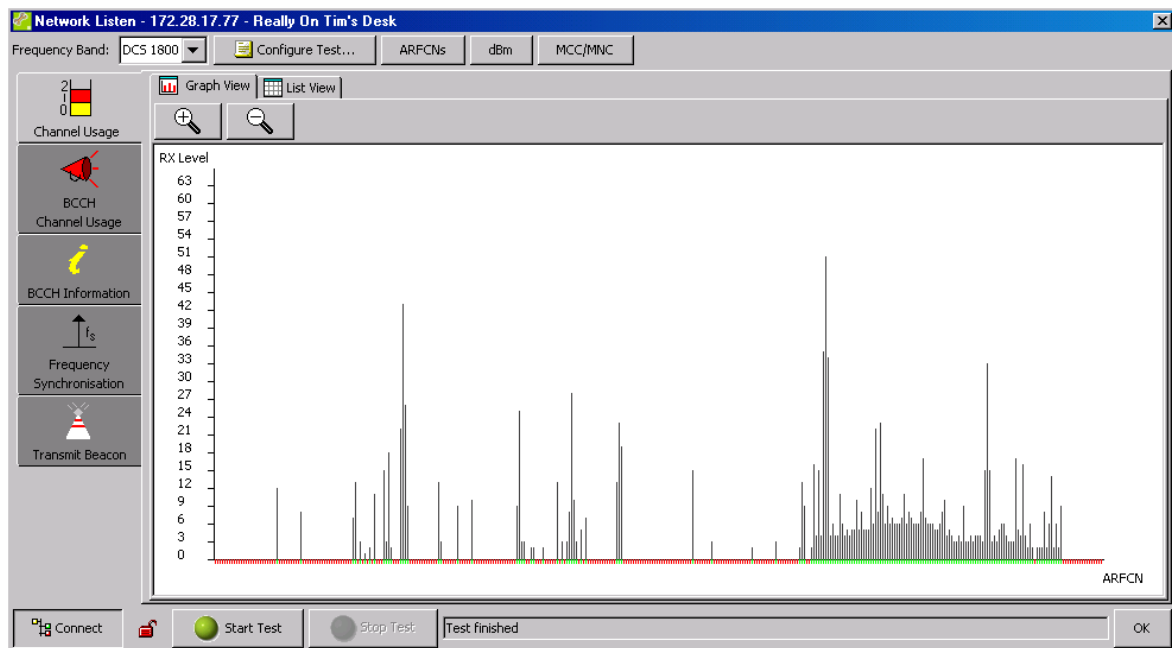


Figure 62 - Channel Usage Test Results

The resulting display is very similar to that which one would expect to see if the band was monitored using a spectrum analyser.

To examine the test results more closely click on the magnifying glass with the + sign in the upper left hand part of the display. This will zoom in on the display to show it in more detail. The magnifying glass with the – sign will zoom out from the display.

It is also possible to view the results as a list of frequencies with the signal level next to them by selecting the List tab from the top of the results screen.

It is also possible to switch between showing RXLEV and dBm using the button labelled dBm at the top of the window.

The ARFCN button switches between displaying only those ARFCNs that were included in the test, as specified by the white and black lists, which is the default display, or all ARFCNs.

6.8.5 BCCH Channel Usage Test

In this test the nanoBTS listens to each channel in turn and determines whether it is carrying a BCCH by looking for a GSM frequency correction burst and a synchronisation burst. It reports all channels where these are found, and omits all channels that are carrying only traffic or not carrying GSM signals at all. This test takes longer to run than the Channel Usage test - about 30 seconds for the full DCS 1800 band, for example.

To use this test select the BCCH Channel Usage tab on the left hand side of the Network Listen window. Then, if you wish to view or change the configuration for the test, select the **Configure Test** button located at the top of the screen.

6.8.5.1 Test Configuration

All the tabs on the Configure Test dialog box for the BCCH Channel Usage test have been described already:

Test Options – see section 6.8.3.1

ARFCN Lists – see section 6.8.3.2

RXLEV Threshold – see section 6.8.3.3

Advanced – see section 6.8.3.4

6.8.5.2 Running The Test

Before running the test, ensure that a connection is established to the nanoBTS and that the configuration for the tests has been completed.

To run the test, click on the “Start Test” button at the bottom of the main screen; note that the status bar at the bottom of the screen indicates that the test is running. Following a short period of time, a graphical representation of the network band will be shown, as seen in Figure 63.

To zoom in on a particular area of the frequency band, click on the magnifying glass +, or to zoom out select the – magnifying glass (see Figure 64 below).

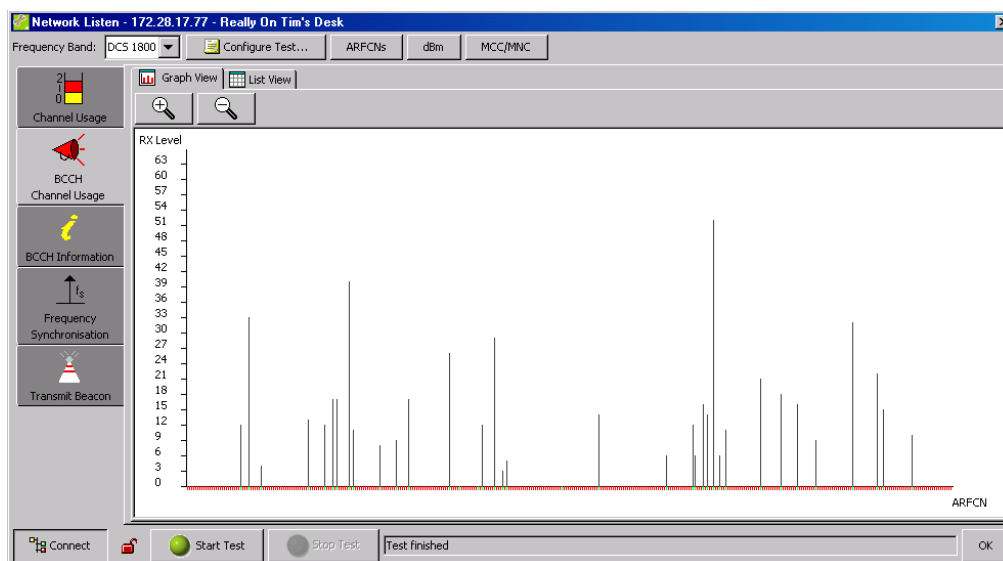


Figure 63 - BCCH Channel Usage Test Results

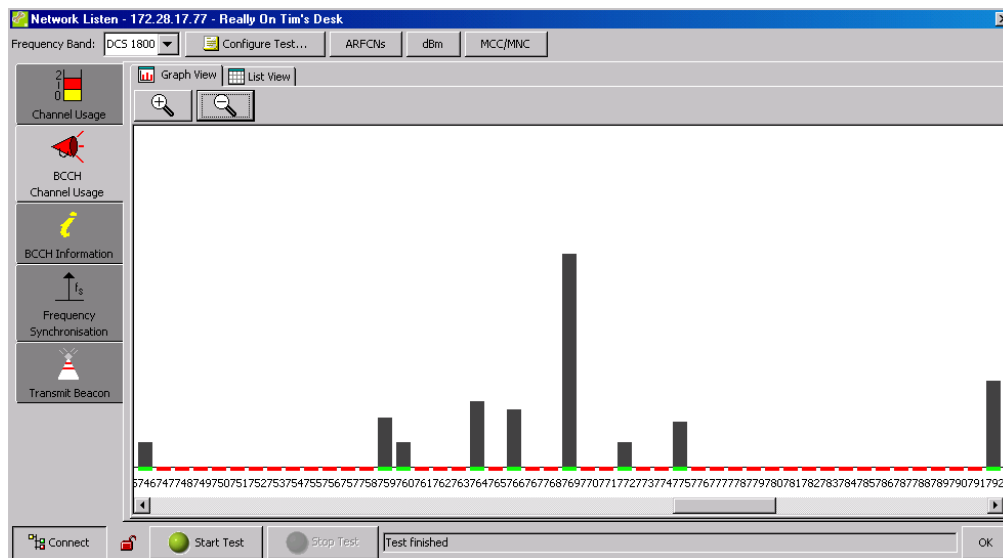


Figure 64 - BCCH Channel Usage Zoom

6.8.6 BCCH Information Test

In this test the nanoBTS decodes the system information messages that are being broadcast on a set of channels and reports the values of attributes such as location area code, cell id, and BSIC, as well as measuring RXLEV and RXQUAL. This takes about 15 seconds per channel, because of the repetition rate at which the relevant system information messages are transmitted.

If the BCCH Usage test has already been run, BTS Installer automatically uses the results of that test to populate the ARFCN White List for this test, so that time is not spent listening for system information messages that are not there. When viewing the configuration of the test, you will see that the ARFCN White list has automatically been selected as those detected with a BCCH. You can override this if you wish.

If you have not previously run the BCCH Channel Usage test, and you don't set up your own ARFCN White List, then all channels will be selected and the test will take a very long time to run. As usual, you can apply a RX LEV threshold that only selects ARFCN's to decode the BCCH on if the power level is above the threshold. In the event of accidentally starting a test that will run for too long, press the "Stop" button on the toolbar. This sends a message to the BTS requesting that it cease the test.

To use this test select the BCCH Information tab on the left hand side of the Network Listen window. Then, if you wish to view or change the configuration for the test, select the **Configure Test** button located at the top of the screen.

6.8.6.1 Test Configuration

Some of the tabs on the Configure Test dialog box for the BCCH Channel Usage test have been described already:

- Test Options – see section 6.8.3.1
- ARFCN Lists – see section 6.8.3.2
- RXLEV Threshold – see section 6.8.3.3
- Advanced – see section 6.8.3.4

The BCCH Information test can be tailored to provide only certain information from the BCCH decode (the default is to show all information). To do this, select the BCCH Information tab as shown in Figure 65.

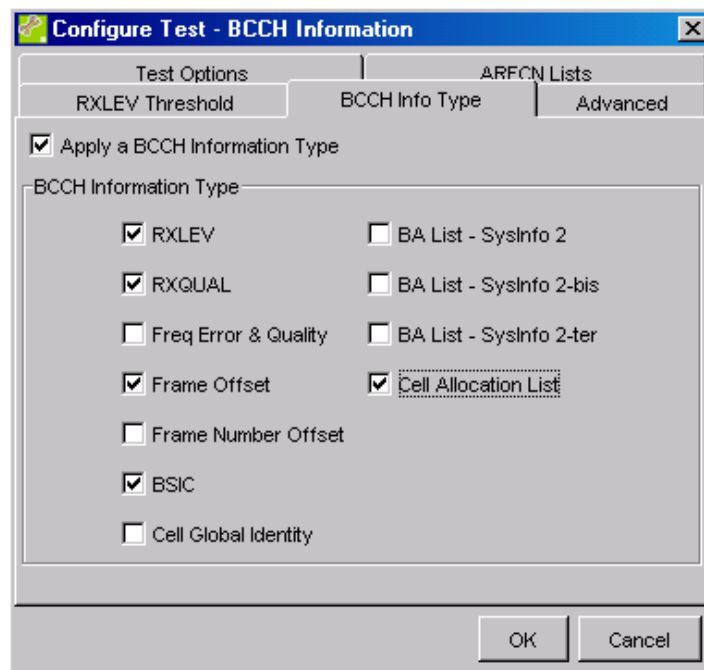


Figure 65 - BCCH Information, BCCH Info Type

Control	Description
Apply a BCCH Information Type	If ticked, the settings of the other controls will be used. If not ticked, all of the other controls will be treated as though they were ticked.
RXLEV	If ticked, the measured RXLEV will be reported.
RXQUAL	If ticked, the measured RXQUAL will be reported.
Freq Error & Quality	If ticked, the measured Frequency Error and Frequency Quality will be reported. The Frequency Error is a signed value measured in ppb. It is the amount by which the nanoBTS's timebase frequency exceeds the monitored channel's BTS timebase frequency. The Frequency Quality value is a monotonically increasing measure of quality of the estimate of frequency error derived by the BTS. The value zero is the lowest quality.
Frame Offset	If ticked, the measured Frame Offset will be reported. The Frame Offset is measured in units of quarter bits, and is an unsigned 16 bit integer, which shall not exceed 4999 (5000 being a complete frame offset). It is the amount by which the nanoBTS's frame timing is in advance of the monitored channel's frame timing.

Control	Description
Frame Number Offset	If ticked, the measured Frame Number Offset will be reported. The Frame Number Offset is measured in units of a whole GSM frame, and is an unsigned 32 bit integer, which does not exceed 2715647 (2715648 being the number of frames in a hyperframe 51*26*2048). It is the amount by which the nanoBTS Frame Number exceeds the monitored channel's Frame Number.
BSIC	If ticked, the decoded Base Station Identity Code will be reported. The BSIC has two components: the Network Colour Code (NCC) and the BTS Colour Code (BCC). BTS Installer displays the values of NCC and BCC separately.
Cell Global Identity	If ticked, the decoded Cell Global Identity (CGI) will be reported. The CGI has four components: Mobile Country Code (MCC), Mobile Network Code (MNC), Location Area Code (LAC), and Cell Identity (CI). BTS Installer displays the values of MCC, MNC, LAC, and CI separately.
BA List – SysInfo 2	If ticked, the BCCH Allocation List decoded from SysInfo 2 will be reported.
BA List – SysInfo 2-bis	If ticked, the BCCH Allocation List decoded from SysInfo 2-bis (if available) will be reported.
BA List – SysInfo 2-ter	If ticked, the BCCH Allocation List decoded from SysInfo 2-ter (if available) will be reported.
Cell Allocation List	If ticked, the Cell Allocation List decoded from SysInfo 1 (if available) will be reported.

6.8.6.2 Running The Test

To run the test, click on the “Start Test” button at the bottom of the main screen; note that the status bar at the bottom of the screen indicates that the test is running.

Following a short period of time, a graphical representation of the network band will be shown, as seen in Figure 66. By hovering the mouse icon over the top of a single ARFCN, decoded BCCH information will be displayed. The display can be switched to a table form by clicking on the “List View” tab, as shown in Figure 67.

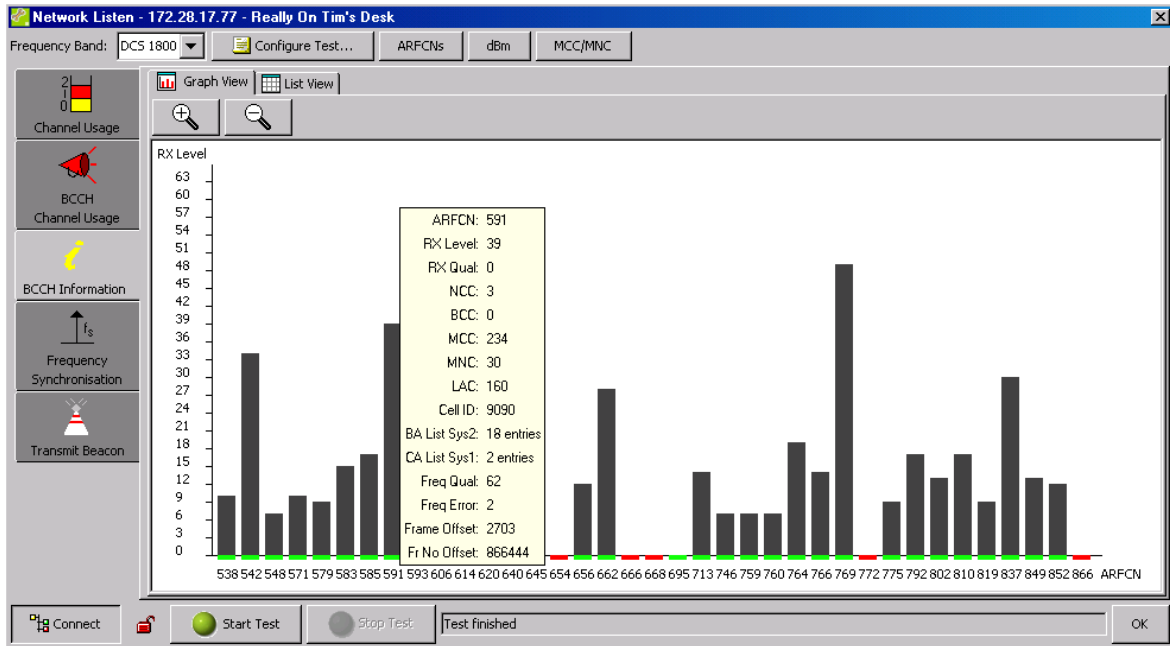


Figure 66 - BCCH Information, Graph View

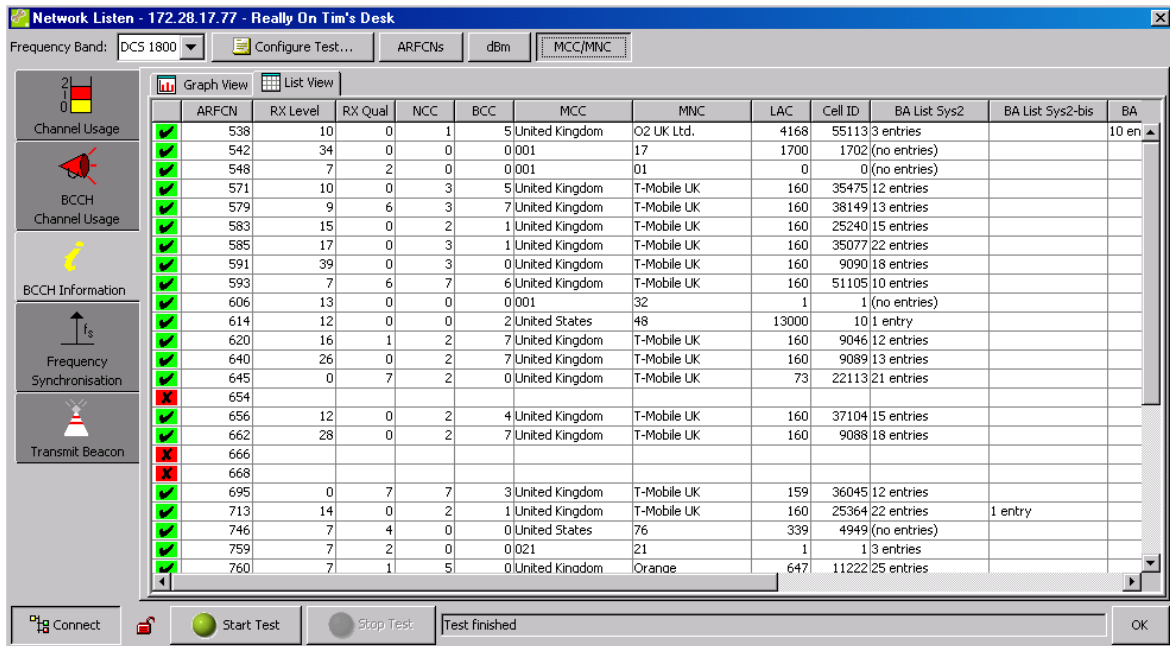


Figure 67 - BCCH Information, List View

6.8.7 Frequency Synchronisation Test

The Frequency Synchronisation test uses the nanoBTS's NWL downlink receiver to monitor one or more GSM RF channels, and if suitable BCCH carriers are found, measure the frequency error of the local oscillator relative to the measured references. The user can choose whether the frequency errors should be combined or reported separately in the event that more than one BCCH carrier is found. The user can also choose whether the nanoBTS should use the result of the test to adjust the local oscillator to correct the error.

Note that a nanoBTS can only adjust its clock using this test if the Internal OCXO is the active clock source. If the Internal OCXO is not the active clock source:

- If the nanoBTS being adjusted is a master, remove its 10 MHz input.
- If the nanoBTS being adjusted is a slave, either remove the cable from its TIB In port, or use BTS Installer to temporarily disable the TIB Out of its master.

If the user attempts to perform a Frequency Synchronisation test with the "Adjust the clock to correct the reported errors" option on nanoBTS that has an active external clock source, BTS Installer displays an error message indicating that in order to perform this test, the internal OCXO must be the active clock source.⁶



PRIOR TO CALIBRATION THE nanoBTS SHOULD BE POWERED UP FOR A MINIMUM OF 10 MINUTES TO ALLOW IT TO STABILISE

Note that the nanoBTS may not be able to correct the frequency error in one go, so you may need to re-run this test a few times to get the error down to a reasonable level.

For further information on using the Frequency Synchronisation test to calibrate a nanoBTS's local oscillator, please refer to [CENG0336]. Note that in the event that no BCCH carriers can be found, the nanoBTS's local oscillator can be adjusted manually, as described in section 6.5.5.10.

As with the BCCH Information test, if the BCCH Usage test has already been run, BTS Installer automatically uses the results of that test to populate the ARFCN White List for this test. When viewing the configuration of the test, you will see that the ARFCN White list has automatically been selected as those detected with a BCCH. You can override this if you wish.

To use this test select the Frequency Synchronisation tab on the left hand side of the Network Listen window. Then, if you wish to view or change the configuration for the test, select the **Configure Test** button located at the top of the screen.

⁶ If BTS Installer finds that the Internal OCXO is the active clock source and tries to initiate the test, but in the meantime an external clock source has become active, the nanoBTS rejects the test request and BTS Installer displays an error message indicating "resource not available".

6.8.7.1 Test Configuration

Some of the tabs on the Configure Test dialog box for the Frequency Synchronisation test have been described already:

Test Options – see section 6.8.3.1

ARFCN Lists – see section 6.8.3.2

RXLEV Threshold – see section 6.8.3.3

Advanced – see section 6.8.3.4

Selecting the Freq Sync Options tab allows you to view and change settings that are specific to the Frequency Synchronisation test, as shown in Figure 68 below.

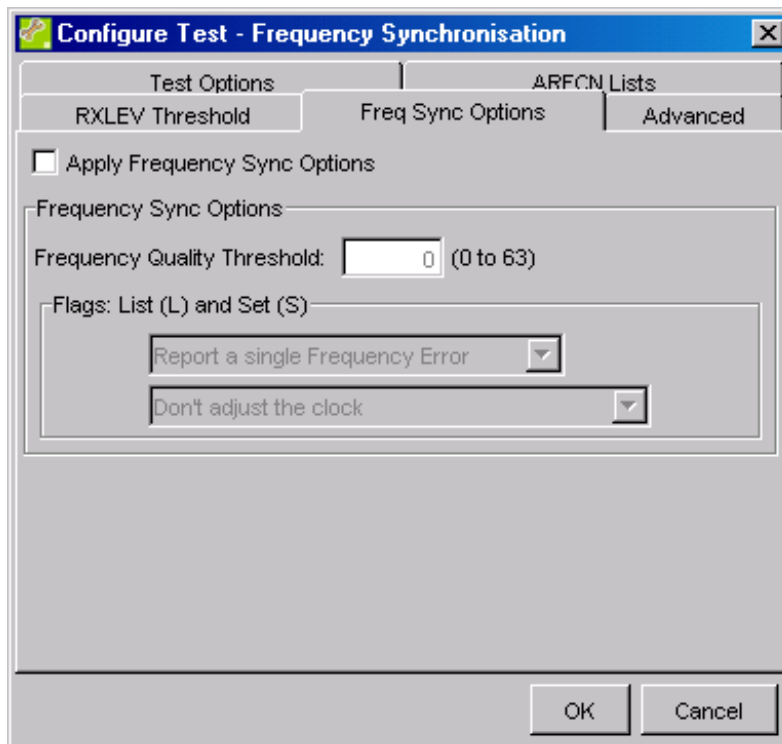


Figure 68 - Freq Sync Options properties window

Control	Description
Apply Frequency Sync Options	If ticked, the settings of the other controls will be used. If not ticked, the Frequency Quality Threshold will be set to 0, the List flag will be set to "Report a single Frequency Error", and the Set flag will be set to "Don't adjust the clock".
Frequency Quality Threshold	A threshold value for the measured Frequency Quality. Channels for which the measured Frequency Quality is below the set threshold shall not be included in the test results. Range: 0..31. Setting this control to 0 means that all results will be included regardless of measured Frequency Quality.
Flags - List	If set to "Report a single Frequency Error", a single Frequency Error value will be displayed, having been derived by combining the errors on all the measured channels. If set to "Report all individual Frequency Errors", the errors for the measured channels will be displayed separately.
Flags - Set	If set to "Don't adjust the clock", the measured Frequency Errors will be displayed, but the nanoBTS's clock will not be adjusted. If set to "Adjust the clock to correct the reported errors" the nanoBTS's clock will be adjusted as well as the error(s) being displayed.

6.8.7.2 Running The Test

To run the test, click on the **Start Test** button at the bottom of the main screen.

While the test is running the message pane in the lower part of the window will display “Test Running – Frequency Synchronisation”. While the nanoBTS is in this mode it is not possible to do anything else with it until the test is complete except end the test by selecting the **Stop Test** button.

Once the test is complete the message pane will display “Test finished”. An example of the results window is shown in Figure 69.

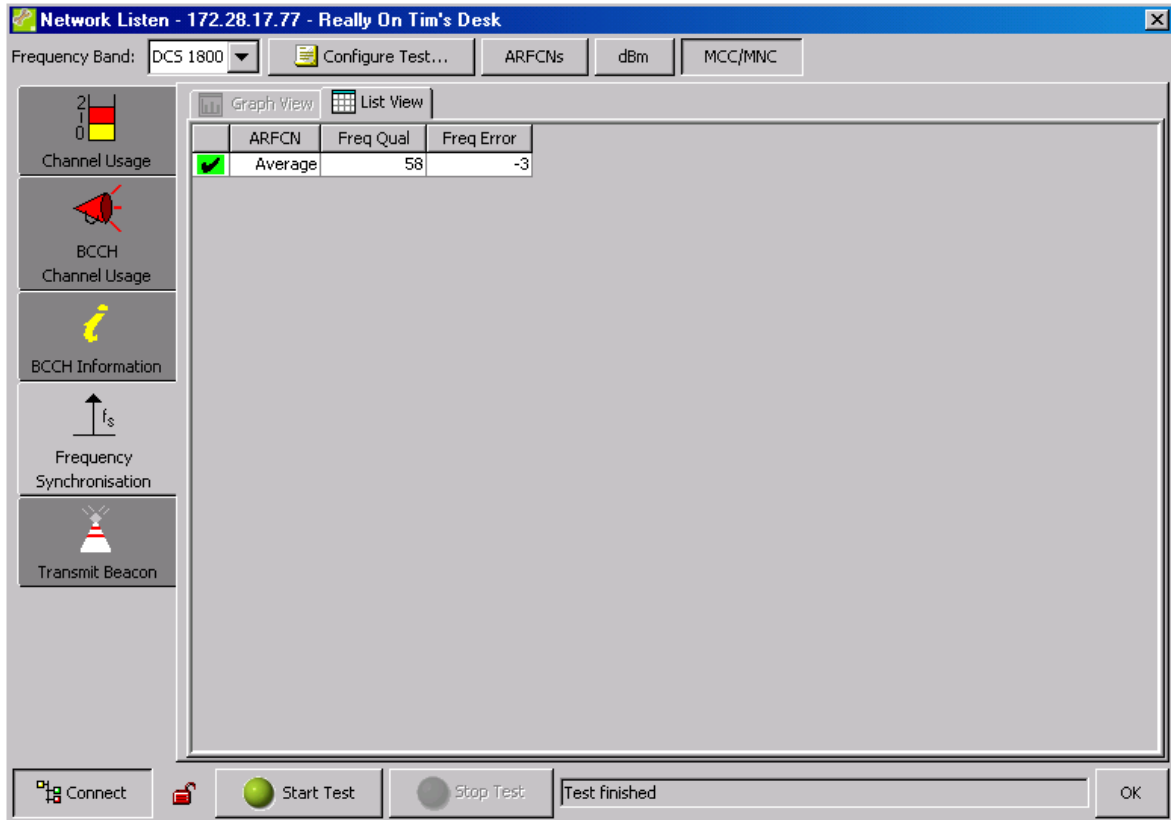


Figure 69 - Frequency Synchronisation Test Results

6.8.8 Beacon Transmit Test

The Beacon Transmit test is used so that the RF transmission from a nanoBTS can be measured without the nanoBTS having to be connected to a BSC. This is likely to be particularly useful during initial installation, when the BSC (or the communications link to the BSC) may not yet be available. It enables walk tests to be done using a test mobile to check coverage, and path loss between the transmitting nanoBTS and other nanoBTSs to be measured using the Network Listen Channel Usage test.

The Beacon Transmit test uses the normal downlink transmitter to transmit a continuous beacon signal on a specified channel, with a specified Base Station Identity Code (BSIC) and at a specified power specified. The beacon transmission conforms to the normal GSM slot, frame and multiframe structures. Slot 0 carries a full BCCH channel combination, and all other slots carry idle TCH (i.e. contain Dummy Bursts). Slot 0 has the normal FCCH and SCH, which carries the specified BSIC. The BCCH carries SysInfo 2, SysInfo 3 and SysInfo 4, but the CCCH channels are empty and Dummy Bursts are transmitted as required. The SysInfo messages mark the cell as barred, with no neighbour lists or cell allocation lists. The PLMN is indicated as the well-known GSM Test PLMN, 001-01.

Hint: Before running the Beacon Transmit test, you might want to use the Channel Usage test to check that the ARFCN to be used is not already in use.

To use this test select the Transmit Beacon tab on the left hand side of the Network Listen window. Then, if you wish to view or change the configuration for the test, select the **Configure Test** button located at the top of the screen.

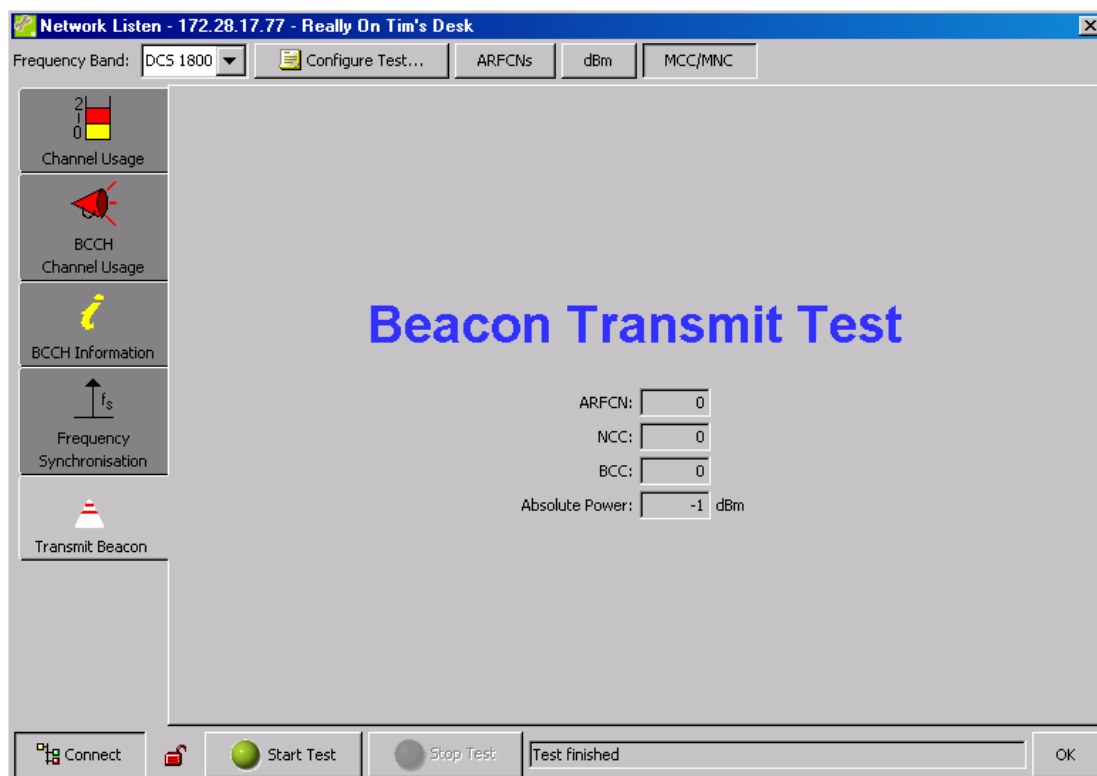


Figure 70 - Beacon Transmit Test Window

6.8.8.1 Test Settings

Selecting the Beacon Information tab allows you to view and change the settings shown in Figure 71.

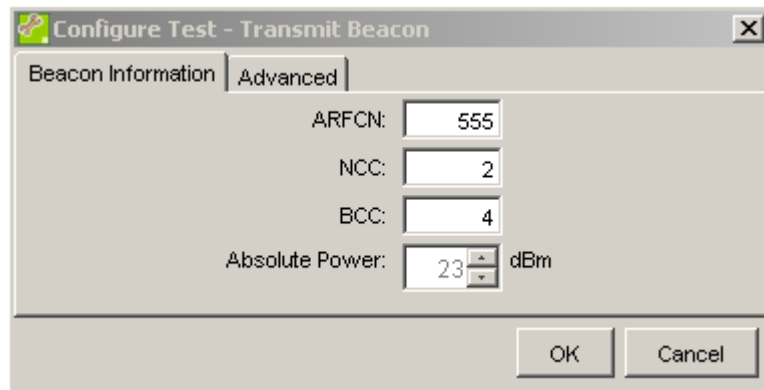


Figure 71 - Transmit Beacon Properties

Control	Description
ARFCN	Determines the RF channel on which the beacon is to be transmitted. This must be a valid ARFCN for the Frequency Band selected at the top of the Network Listen window.
NCC	The Network Colour Code which should be transmitted on the Synchronisation Channel. The valid range is 0..7.
BCC	The Base Station Colour Code which should be transmitted on the Synchronisation Channel. The valid range is 0..7.
Absolute Power	The power level, in dBm, at which the beacon signal is to be transmitted. In order to prevent invalid values from being entered, this field can only be changed using the spin controls.

The Advanced tab is described in section 6.8.3.4. For the Beacon Transmit test it might sometimes be useful to set the Test Duration on the Advanced tab to specify how long the test will run; otherwise the nanoBTS will transmit until you select the **Stop Test** button.

6.8.8.2 Running The Test

When all of the settings are completed start the test by clicking on the **Start Test** button. The main window will now show the Beacon Transmit Test display as shown in Figure 72.

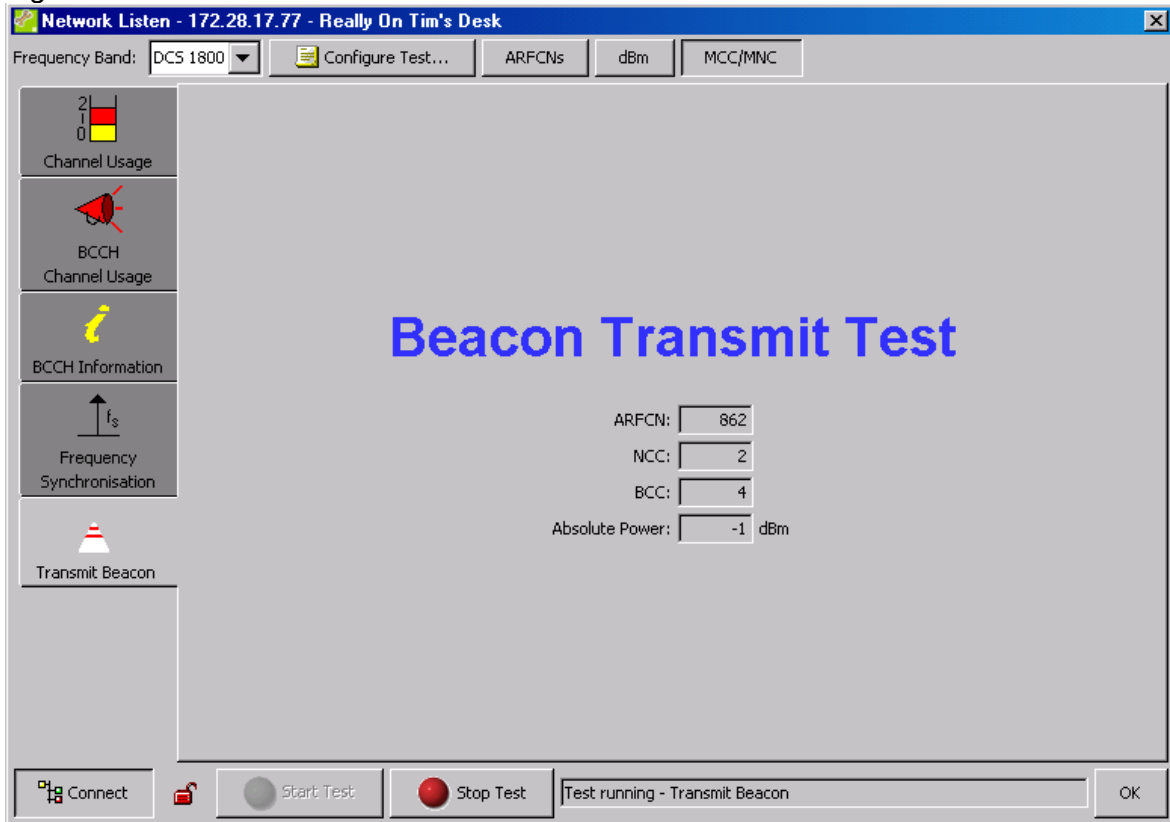


Figure 72 - Transmit Beacon Test Running Window

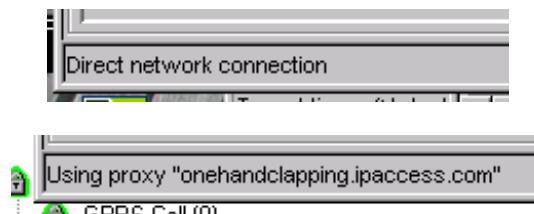
6.9 Using BTS Installer via a proxy

In some network configurations, BTS Installer is not on the same network as the nanoBTSs and is unable to access them directly.

There are two optional system components called the **Primary OML Proxy** and **Secondary OML Proxy** that may be run on the BSC platform, and in appropriate network configurations these will forward requests from BTS Installer to the nanoBTSs and route replies from the nanoBTSs to BTS Installer.

BTS Installer must be told to run in proxy mode, and must be told where the proxy is. This information is supplied in command line parameters when BTS Installer is started, and these parameters are supplied automatically whenever BTS Installer is started from Configuration Manager.

BTS Installer indicates whether or not it is running in proxy mode at the bottom of its main window:



6.9.1 The Two Types of Proxy

The Primary OML Proxy takes messages from BTS Installer and sends them down the Primary OML connection that the nanoBTS already has with the BSC.

BTS Installer identifies the nanoBTS to the Primary OML Proxy by quoting its Unit ID.

The Secondary OML Proxy takes messages from BTS Installer and sets up a new, separate connection from the proxy to the nanoBTS' secondary OML port.

BTS Installer identifies the nanoBTS to the Secondary OML Proxy by quoting its IP address.

There are various restrictions of BTS Installer functionality that apply depending on the type of proxy used. The following restrictions apply to both proxy types:

- BTS Installer's **Find command** will only find nanoBTS that are on the same network as BTS Installer, so in a network configuration where a BTS Installer Proxy is needed it is unlikely that the Find command will find any of the desired nanoBTS.
- BTS Installer's **DHCP server** will only provide a service to nanoBTS on the same network as BTS Installer (unless intervening router(s) are running BOOTP Relay Agents as necessary). This means that in a network configuration where a BTS Installer Proxy is needed it is unlikely that BTS Installer's DHCP server will be able to provide a service to the nanoBTS, and their IP configurations will need to be set by other means.

- When running **automatic configuration** via a BTS Installer Proxy, performance may be lower than that achieved with a direct connection between BTS Installer and the nanoBTS. The BTS Installer Proxy may be configured to allow only a limited number of simultaneous connections, in order to control the load on the BSC; if this is the case then automatic configuration will operate on only a limited number of nanoBTS at once, with others having to wait until the first batch have been configured (this is all handled automatically by BTS Installer). In addition, when configuring multiple nanoBTS via a BTS Installer Proxy, some of the default timeouts may prove to be inadequate – for example when downloading new software to many nanoBTS simultaneously via a BTS Installer Proxy it was found in one experiment that better results were achieved by setting the GSM 12.21 Procedures timeout to 30 seconds and the Software Download Window to 5.

The following additional restriction applies to the **Primary OML Proxy**:

- BTS Installer can only communicate via the Primary OML Proxy with a nanoBTS which is already configured to the point at which it has made an OML connection to the BSC. If there is a problem with the BTS such that it cannot set up a connection with the BSC, for example its primary OML addresses are set incorrectly, then BTS Installer will not be able to reach it using the Primary OML Proxy.
- The SW Activate feature on the Configure BTS dialog does not work when connected via a Primary OML Proxy.

The following additional restriction applies to the **Secondary OML Proxy**:

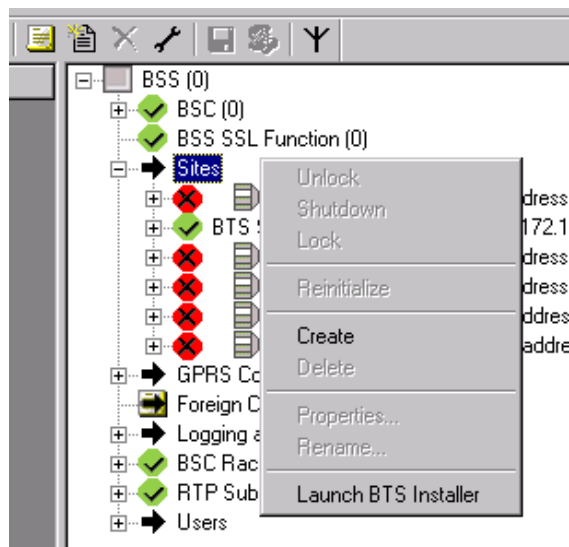
- If there is a NAT (network address translation) in the network between the nanoBTS and the BSC then the secondary OML proxy will not be able to contact the nanoBTS.

When BTS Installer starts in proxy mode it investigates whether a proxy of either or both types is running on the BSC platform. It will then use the proxies that it has detected when making any subsequent connection to a nanoBTS. If it can't find either proxy it will give up trying to run in proxy mode and will revert to direct mode.

If BTS Installer determined when starting up that both types of proxy were running, then it will first try to make a connection to a nanoBTS using the Primary OML Proxy, and if that fails it will try again using the Secondary OML Proxy.

6.9.2 Starting BTS Installer from Config Manager

To start BTS Installer from Config Manager, select a Baseband Transceiver, BTS, Site, the Sites collection, or the BSS, and then choose the Launch BTS Installer command either from the context menu as shown or from the toolbar button with the spanner icon.



BTS Installer will start in proxy mode, expecting that the one or both of the proxies is running on the BSC platform, and will be pre-loaded with all the nanoBTS at or beneath the selected managed object.

6.9.3 Command line parameters

The user will not normally enter BTS Installer's command line parameters directly, as these are normally created by Config Manager when it launches BTS Installer. This information is provided in case it is necessary to start BTS Installer in proxy mode other than via Config Manager.

Proxy mode is indicated by having "/proxy" as the first command line parameter followed by either the host name or IP address of the BTS Installer Proxy. Subsequent command line parameters are the IP addresses and optionally Unit IDs of nanoBTS to pre-load into BTS Installer.

For example if the command line parameters are:

```
/proxy bsc27.example.com 10.1.1.3|555/0/0 10.1.1.7|554/0/1 10.1.1.98|554/0/2
```

then

/proxy	indicates that BTS Installer is to run in proxy mode
bsc27.example.com	gives the location of the BTS Installer Proxy
10.1.1.3 555/0/0 etc	are the IP addresses and optionally Unit IDs by which the proxy can address the nanoBTS.

The Unit ID and the preceding vertical bar character ('|') are optional and are not needed for connections via the Secondary OML Proxy. However they are essential for connections via the Primary OML Proxy. Older versions of Config Manager do not

supply the Unit IDs and are not suitable for starting BTS Installer for use with a Primary OML Proxy.

Note that BTS Installer may also be started in direct (non-proxy) mode with some IP addresses and optionally Unit IDs of nanoBTS on the command line, and these will be pre-loaded and will appear in the BTS Status list.

6.10 Connecting to a nanoBTS via SSL

BTS Installer is capable, when not operating in proxy mode, of connecting to a nanoBTS using an authenticated encrypted SSL (secure sockets layer) connection.

6.10.1 Enabling secure connections

A number of conditions must be satisfied before an SSL connection can be set up. Firstly BTS Installer must be correctly installed:

- The user must be operating in a territory to which it is possible to export the cryptographic technology used.
- BTS Installer must be being used in a Windows environment, using Windows 2000 SP4 or Windows XP or later.
- The Aladdin eToken run time environment must be installed.
- The eToken must be plugged into a USB port.

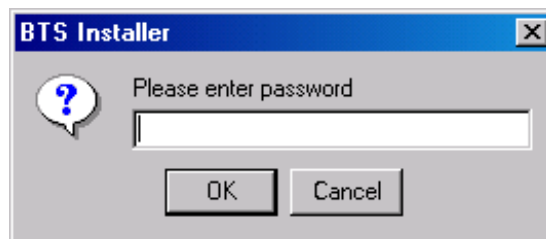


eToken

The first time the eToken is plugged into a USB port the new hardware wizard will appear and also the user will be prompted to allow the system to install a number of certificates:

- The user must permit the new hardware wizard to run normally.
- The user must permit the system to install these certificates.

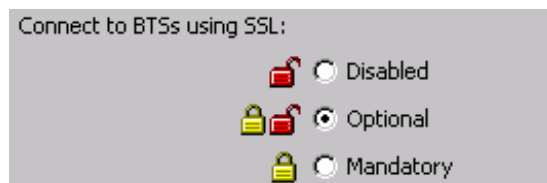
When BTS Installer is started and it successfully detects the eToken it will prompt the user for a password. The password is specific to the eToken.



- The user must enter the correct password.

If the user fails to enter the correct password then BTS Installer will continue to operate but will only make insecure (non-SSL) connections to nanoBTSs.

Then, BTS Installer will only attempt to make SSL connections if this is selected in the Options dialog:



- Optional or Mandatory must be selected.

If all is well with the installation and configuration of BTS Installer then the status bar will indicate that security is possible and will display a closed padlock:



depending on the “Connect to BTSs using SSL” option selected.

If there is a problem such that SSL connection is not possible something other than Security Possible will be shown along with an open padlock, for example if the user has failed to give the correct password for the eToken:



Next, BTS Installer will only succeed in making a secure connection to a nanoBTS if the nanoBTS is correctly configured.

- The nanoBTS must have had a certificate downloaded to it.
- The nanoBTS’ SSL Control attribute must have value Optional or Mandatory.

6.10.2 Connecting to a nanoBTS

When the user performs an operation that requires BTS Installer to connect to a nanoBTS, BTS Installer will then make a secure connection if it can, and if it can’t make a secure connection it will, if so allowed by the selected options, attempt to make an insecure connection. The nanoBTS may refuse either type of connection depending on the setting of its SSL Control attribute, which is initially set to Optional and may be viewed and changed using Config Manager or some other management tool.

The table shows the possible outcomes:

SSL Option (BTS Installer)	nanoBTS has certificate?	SSL Control attribute (nanoBTS)	Connection established
Disabled	No	Disabled	Insecure
		Optional	Insecure
		Mandatory	Can’t connect
Optional	Yes	Disabled	Insecure
		Optional	Insecure
		Mandatory	Can’t connect
Mandatory	No	Disabled	Insecure
		Optional	Insecure

		Mandatory	Can't connect
	Yes	Disabled	Insecure
		Optional	Secure (SSL)
		Mandatory	Secure (SSL)
Mandatory	No	Disabled	Can't connect
		Optional	Can't connect
		Mandatory	Can't connect
	Yes	Disabled	Can't connect
		Optional	Secure (SSL)
		Mandatory	Secure (SSL)

BTS Installer will indicate to the user the state of each connection it makes to a nanoBTS. In the case of a manual operation, either an open padlock will be displayed to indicate an insecure connection or a closed padlock will be displayed to indicate a secure (SSL) connection. This symbol will be displayed somewhere on the dialog that is performing the action, for example an insecure connection for Network Listen is indicated like this:



In addition the connection type will be recorded in the log:

```

BTS Database Log
2006/07/28 14:30:46 Configuration file c:\temp\mine.txt loaded
2006/07/28 14:30:50 172.28.17.77 Get Attributes started
2006/07/28 14:30:54 172.28.17.77 Get Attributes - connected secure
2006/07/28 14:30:55 172.28.17.77 Get Attributes complete
2006/07/28 14:31:15 172.28.17.77 Get Attributes started
2006/07/28 14:31:15 172.28.17.77 Get Attributes - connected insecure
2006/07/28 14:31:15 172.28.17.77 Get Attributes complete

```

In the case of automatic operation there is no graphical display of the security state of connections, but the state of each connection made is recorded in the log.

6.11 Configuration File Reference

This section defines the format and contents of the configuration file.

The configuration file is an ASCII text file that can be created with any text editor.

Whilst it is expected to be normal practice that a configuration file will be prepared in advance of an installation job, BTS Installer can carry out most of its functions without a configuration file, and can write out the contents of the BTS Database to a new configuration file (so you can use BTS Installer to create configuration files instead of a text editor).

6.11.1 File format

Comments start with ';' or '*'. You can't use these characters at all in parameter names or values - there is no escape mechanism. Spaces and case are not significant (apart from inside string values - whether string values themselves are case sensitive depends on what they're used for). Blank lines are ignored.

The format is a bit, but not quite, like .ini file format. Sections are introduced by a heading in square brackets; data items mostly consist of a name, an equals sign and a value.

A section called [Defaults] may be present and specifies default values for BTS configuration parameters; all BTSs will use these values unless otherwise specified.

To specify the parameters for a particular BTS use the section heading:

```
[BTS:<location>]
```

where <location> is the Location string as to be stored in the NVRAM, for example:

```
[ BTS : Room G47 ] ; where this BTS lives
```

Leading and trailing spaces and comments are ignored so that's the same as:

```
[BTS:Room G47]
```

The <location> may be blank but the colon must still be present, as in:

```
[BTS:]
```

(The location string can't contain a ']' - there is no escape mechanism.)

Within a section parameters are given like this:

```
[Defaults]
Router=192.168.0.1
SubnetMask = 255.255.255.0
PrimaryOmlTcpPort = 3002

[ BTS : Somewhere else ]

IPAddress = 192.168.0.2
```

```
BTSID = 123 ; comments are allowed after values
TRXID = 456
```

6.11.2 Data types

Parameters can be:

- **numbers** (positive or negative integers),
- **arbitrary strings** (except they can't contain ';' or '*' and can't have leading or trailing spaces); strings are not quoted
- **boolean values** ("yes", "true", "t", "1"; "no", "false", "f", "0") (without the quotes); if the value is omitted it's taken as true
- **flag values** - these are used for the non-volatile configuration flags and can have the same values as boolean values but also "on" or "set", "off" or "clear", or, to indicate that the flag value should not be sent to the BTS, "notset", "unknown" or "invalid"
- **IP address** - normal dotted quad notation (actually host names might work sometimes, but will get translated to numeric IP address which are what will get sent to the BTS)
- **MAC address** - six two digit hex numbers separated by colons
- **unit id** – three numbers separated by slashes, being <site id>/<BTS id>/<TRX id>, for example 862/0/0
- **percentage** – an alarm threshold percentage value, either a number from –20 to 120 or the string OFF indicating that this alarm is switched off

As a special case, in the [Pool] section only, single IP addresses or ranges of IP addresses can be given without any parameter name, eg:

```
1.2.3.4
1.2.4.1 - 1.2.4.254
```

6.11.3 Sections

Sections in the file can be in any order and the order is not significant. The following sections are allowed:

[Pool]	Values are IP addresses or ranges, in the format noted above, that the DHCP server will use as a pool from which to allocated addresses to any BTSs which do not have explicit IP addresses assigned
[Default]	Default parameters for BTS configuration
[BTS:<location>]	Parameters for a specific BTS as noted above

[UnknownBts] Parameters for any BTS which asks for an IP address; if this section is present no `BTS` sections may also be present. See section 6.3.3.2 for a description of BTS Installer's Unknown BTS Mode. **Warning:** use this mode with care!

6.11.4 BTS configuration parameters

Parameter names are case insensitive, so the following are all equivalent:

```
subnetmask = 255.255.255.0
SubnetMask = 255.255.255.0
Subnetmask = 255.255.255.0
```

The order in which parameters are specified within a section is not significant. If the same parameter is specified more than once in a section then which value BTS Installer will use is not defined.

The following boolean parameters control which configuration phases will run:

DHCP	The DHCP configuration phase will run to supply the IP address etc to this nanoBTS
ConfigureUnitId	The Unit ID configuration phase will run to set the nanoBTS' Unit ID.
NVRAM	The non-volatile attribute configuration phase will run (note that you will also need to set additional boolean parameters to indicate which NVRAM values should and should not be sent to the nanoBTS, see below)
Download	BTS Installer will download software to the nanoBTS

Example:

```
[Defaults]
dhcp = yes
configureunitid = yes
nvram = yes
download = yes ; do everything by default
.....

[ BTS: old one ]
dhcp = no ; just upgrade software on this one, it's
nvram = no ; already got the rest of its Config
configureunitid = no
.....
```

By default all these are off, ie BTS Installer will do nothing at all, and hence nothing harmful, unless you tell it to.

6.11.5 DHCP Configuration Phase

Here is the full list of parameters relating to the DHCP configuration phase:

Name	Type	What
DHCP	Boolean	whether to run the DHCP configuration phase
IpAddress	IP address	explicit IP address to assign
IpLeaseTime	number	length of IP lease in seconds
MacAddress	MAC address	MAC address of BTS
Router	IP address	IP address of default gateway
SubnetMask	IP address	subnet mask

6.11.6 Unit ID Configuration Phase

Here is the full list of parameters relating to the Unit ID configuration phase:

Name	Type	What
ConfigureUnitId	Boolean	whether to run the Unit ID configuration phase
NewUnitId	unit id	enter the new Unit ID value
ResetBtsUnitId	Boolean	whether to reset the nanoBTS after configuring the Unit ID

6.11.7 Non-volatile Attribute Configuration Phase

To cause a non-volatile attribute to be sent to the nanoBTS you need to switch on **both** the overall "nvram" boolean parameter **and** a specific boolean parameter which specifies a particular group of non-volatile attributes which are set as a unit. (These specific boolean control parameters correspond to the various check boxes on the NV Attr (n) tabs of the BTS Configuration dialog box, see section 6.7.)

Control parameter	Settings affected
SendNvConfigFlags	NV config flags F1 to F14
SendPrimaryOmlConfig	PrimaryOmlIpAddress, PrimaryOmlTcpPort, PrimaryOmlIpAddress2, PrimaryOmlTcpPort2
SendPrimaryOmlFbTimeout	PrimaryOmlFbTimeout
SendSecondaryOmlConfig	SecondaryOmlIpAddress
Sendlocation	The BTS' location string as specified in the [BTS] section header.
SendUnitName	UnitName
SendSnmpConfig	All Snmp* settings (ie. Settings that start with the characters Snmp, regardless of case)
SendAlarmThresholdList	InputVoltageLower, InputVoltageUpper, InternalTempLower, InternalTempUpper, InputCurrentLower, InputCurrentUpper, InputPowerLower, InputPowerUpper

So in order to persuade BTS Installer to send a unit name string to a BTS during automatic configuration you'll need all of:

```
[ BTS : somewhere ]
nvram                ; run the NVRAM setting procedure
sendunitname        ; send the unit name parameter
```

```
unitname = FredsBTS ; the unit name to be sent
```

and if you want the "somewhere" to be sent to the BTS as the location string during automatic configuration you'll also need:

```
sendlocation ; send the location string
```

You might want to put `nvramp`, `sendunitname` and `sendlocation` just once in the [default] section so only the unit name would need to be specified for each individual BTS.

The SNMP parameters are even more complicated, because to cause one of these to be sent to the nanoBTS you need to switch on the overall "nvramp" boolean parameter **and** the specific boolean parameter "sendsnmpconfig" which specifies that some of the SNMP configuration is to be send **and** another boolean parameter for each of the individual SNMP configuration sub-attributes that you wish to send.

Control parameter	SNMP sub-attribute affected
SendSnmpCommunityString	SnmpCommunityString
SendSnmpTrapAddress	SnmpTrapAddress
SendSnmpTrapPort	SnmpTrapPort
SendSnmpManagerAddress	SnmpManagerAddress
SendSnmpSystemContact	SnmpSystemContact

Here is the full list of parameters relating to the non-volatile attribute configuration phase:

Name	Type	What
Nvramp	Boolean	whether to run the non-volatile attribute setting configuration phase
SendNvConfigFlags	Boolean	whether to send the NV Configuration Flags
F1	Flag	NVRAM config flag (see section 6.7.9)
...
F14	Flag	NVRAM config flag (see section 6.7.9)
FstaticInterfaceIpConfig	Flag	Synonym for F1
FstaticIpGatewayConfig	Flag	Synonym for F2
FstaticVsiConfig	Flag	Synonym for F3
Fled	Flag	Synonym for F7
FsecondaryOmlEnable	Flag	Synonym for F9
FdiagEnable	Flag	Synonym for F10
FcliEnable	Flag	Synonym for F11
FhttpEnable	Flag	Synonym for F12
FpostEnable	Flag	Synonym for F13
FsnmpEnable	Flag	Synonym for F14
SendPrimaryOmlConfig	Boolean	Whether to send the next attributes
PrimaryOmlListLength	Number	How many (0, 1 or 2) sets of primary OML address and port to send
PrimaryOmlIpAddress	IP address	primary OML IP address
PrimaryOmlTcpPort	number	primary OML TCP port

PrimaryOmlIpAddress2	IP address	primary OML IP address 2
PrimaryOmlTcpPort2	number	primary OML TCP port 2
SendPrimaryOmlFbTimeout	Boolean	Whether to send PrimaryOmlFbTimeout
PrimaryOmlFbTimeout	number	Primary OML fallback timeout
SendSecondaryOmlConfig	Boolean	Whether to send SecondaryOmlIpAddress
SecondaryOmlIpAddress	IP address	secondary OML IP address
SendLocation	Boolean	Whether to send the location (which is in the BTS section header, not a separate parameter)
SendUnitName	Boolean	Whether to send the UnitName
UnitName	String	unit name
SendSnmpConfig	Boolean	Whether to send any of the SNMP configuration attributes
SendSnmpCommunityString	Boolean	Whether to send the SNMP community string
SnmpCommunity	String	SNMP community string
SendSnmpTrapAddress	Boolean	Whether to send the SNMP trap address
SnmpTrap	IP address	SNMP trap address
SendSnmpTrapPort	Boolean	Whether to send the SNMP trap port
SnmpTrapPort	Number	SNMP trap port
SendSnmpManagerAddress	Boolean	Whether to send the SNMP manager address
SnmpManagerAddress	IP address	SNMP manager address
SendSnmpSystemContact	Boolean	Whether to send the SNMP system contact
SnmpSystemContact	String	SNMP system contact
SendAlarmThresholdList	Boolean	Whether to send the alarm thresholds
InputVoltageLower	Percentage	Input voltage lower threshold
InputVoltageUpper	Percentage	Input voltage upper threshold
InternalTempLower	Percentage	Internal temperature lower threshold
InternalTempUpper	Percentage	Internal temperature upper threshold
InputCurrentLower	Percentage	Input current lower threshold
InputCurrentUpper	Percentage	Input current upper threshold
InputPowerLower	Percentage	Input power lower threshold
InputPowerUpper	Percentage	Input power upper threshold

6.11.8 Download Configuration Phase

Here is the full list of parameters relating to the download configuration phase:

Name	Type	What
Download	Boolean	whether to run the software download configuration phase
DownloadWhat	Number	Indicates what to download: 0 => download software 1 => download certificate 2 => download CRL 3 => switch software versions and/or reset BTS only
Filename	String	Name of file containing software to download
MakeDefault	Boolean	Whether to make the newly downloaded software the default
ResetBtsCode	Boolean	Whether to reset the nanoBTS after downloading software
CertFilename	String	Name of file containing certificate to download
ResetBtsCert	Boolean	Whether to reset the nanoBTS after downloading a certificate
CrlFilename	String	Name of file containing certificate revocation list to download
ResetBtsCrl	Boolean	Whether to reset the nanoBTS after downloading a certificate revocation list
SwitchBackhaul	Boolean	Whether to switch Backhaul software versions
SwitchTrx	Boolean	Whether to switch TRX software versions
ResetBtsSwitch	Boolean	Whether to reset the nanoBTS after switching any selected software versions