Agenda Item: 7

Source: ETSI SMG2 UTRAN Architecture Expert Group

Title: Manifestations of Handover and Streamlining (SRNS Relocation) v8

Document for:

_____

–

0. Preface

This paper has evolved from Tdoc SMG2 UMTS 70/98, and Tdoc SMG2 UMTS-ARC 71/98, following discussions at SMG2 UMTS #5 and in the SMG2 Architecture Expert Group.

The paper currently reflects the scenarios viewed from the perspective of the UTRAN.

1. Introduction

This paper attempts to map the various manifestations of handover in UMTS 23.10 (version 0.6.0) onto the proposed UTRAN architecture. There are several reasons for doing this:

- to ensure that all scenarios have been captured and can be developed
- so that the requirements for the UTRAN/CN entities and interfaces can be defined
- to raise and discuss issues concerning the architecture

Some of the scenarios from 23.10 have been split to provide more detail.

The scenarios show the relationship between radio interface mobility with Iu interface mobility.

It should be noted that in all scenarios where the UE is connected to UTRAN, the connection can use Dedicated or Common channels, in either FDD or TDD mode. In CCH state, only hard handover is possible, while in DCH state both hard and soft handover may be possible (depending on scenario).

Throughout the paper handovers are shown in both directions (i.e. the scenarios are symmetric); it is for further study whether this is desirable and/or practical.

It is assumed that support of inter-operator soft handover is not required.

For the purposes of this paper, **handover** is taken to mean the transfer of a user's connection from one radio channel to another (can be same or different cell). **SRNS Relocation** is the change of Iu instance. It should be noted that SRNS Relocation was previously known as Streamlining.
[editor's note: an improved definition of handover is for further study, and the document's title may need to change to reflect this]

[editor's notes: UMTS 23.10 also classifies handovers in terms of where the decision is taken, whether the target cell has prior knowledge and whether there is an anchor point. Clearly, these concepts and the requirements imposed by macrodiversity/soft handover also need to be included in the discussions.

Handover and SRNS relocation discussions should not only consider the radio aspects, but also related issues such as transcoder location, handover of both stream and packet data services, fax services,

QoS requirements, resource availability/negotiation, group calls, local services and VHE. In addition, backward compatibility with GSM should be considered.]

2. Manifestations of Handover

Scenario 1a covers the case where the mobile does not change cell, but changes frequency/code. This scenario shall be supported by the UTRAN. Steps (i) & (ii) show the situation before and after.
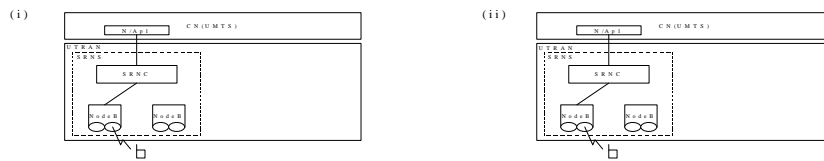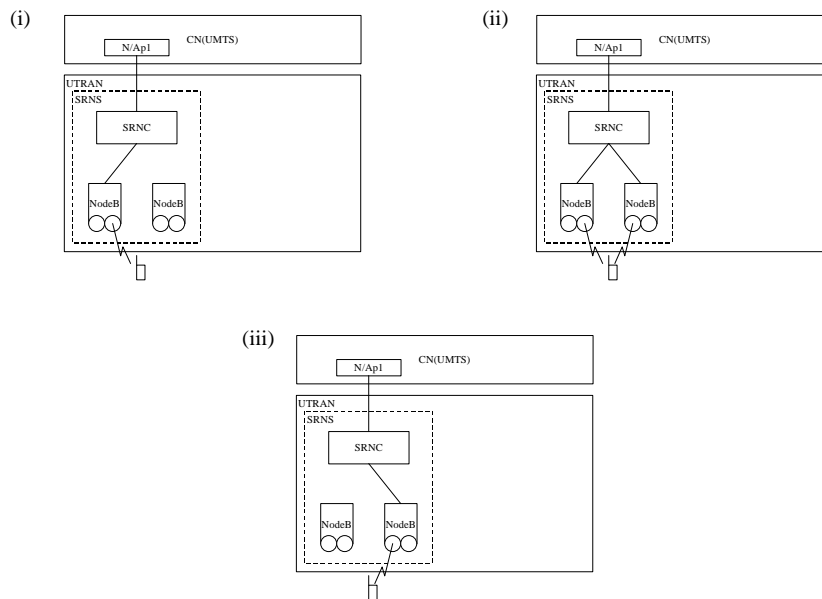

Scenario 1a: Intra Node B (Intra Cell)

Scenario 1b is the other case of the intra Node B handover, where the radio session is handed from one cell to another, both within the same Node B. This scenario shall be supported by the UTRAN, for both hard and soft handover. For hard handover, step (ii) is omitted.
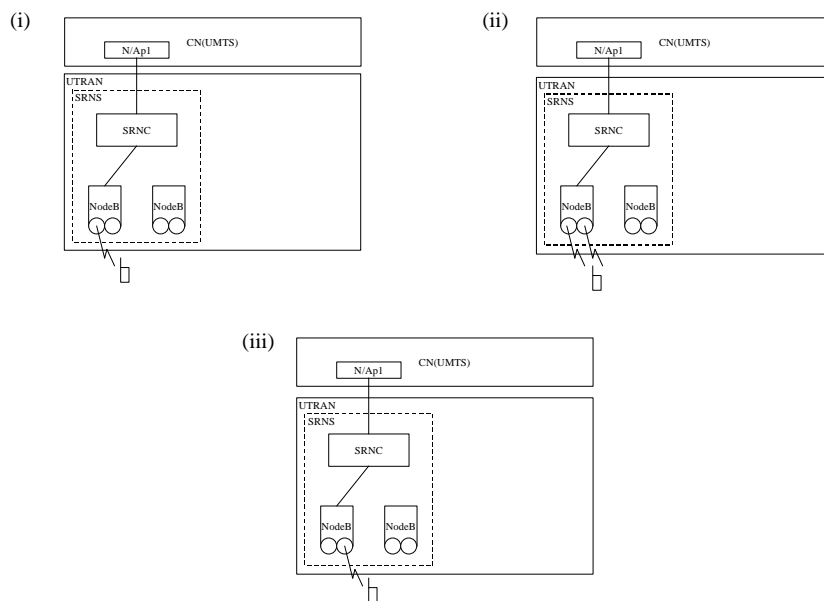
Scenario 1b: Intra Node B (Inter Cell)

Scenario 2a involves a change of Node B, so in a soft handover situation the uplink "combining" (or selection) occurs at the RNC. Again, this shall be supported by the UTRAN for both soft and hard handover cases. For hard handover, step (ii) is omitted.


Scenario 2a: Inter Node B (Intra RNS)

In Scenario 2b, the handover still occurs within the UTRAN, but is now between cells under the control of different RNCs; it is for further study (in SMG12) what the implications of the access points (N/Ap) being in the same or different core network nodes are. The scenario can be split into two phases – handover and SRNS relocation. For a particular UE, the SRNS Relocation phase is optional. It may be executed at any time by UTRAN (SRNC) in the case of a UE moving to a cell which belongs to a different RNC from the current SRNC.

This scenario will be supported by the UTRAN as both soft and hard handover.
In the first set of figures (soft handover), steps (i) & (ii) show the UE entering the macrodiversity state; step (iii) shows the UE connected to a DRNC only. Either step (ii) or step (iii) can be the starting point for SRNS relocation (see below).

(i)

(ii)

(iii)
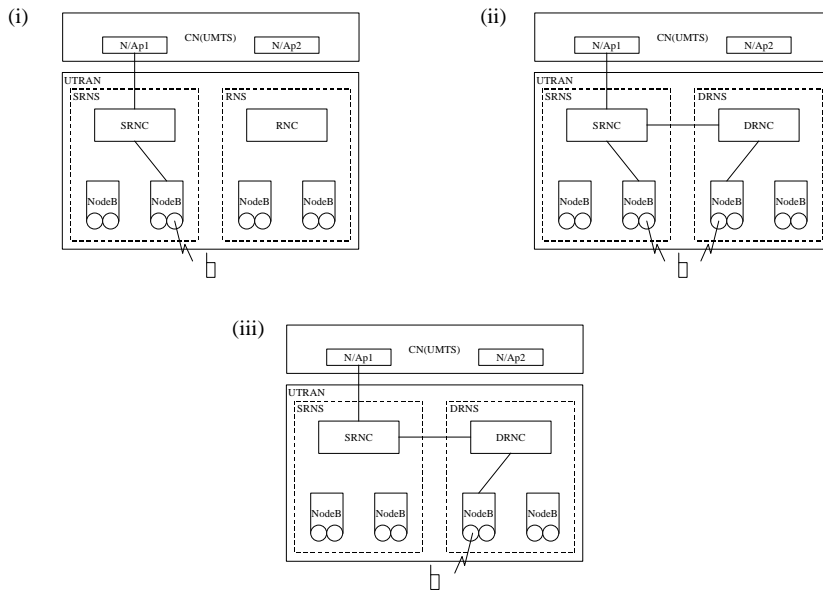
Scenario 2b: Inter RNS
Soft Handover

In the hard handover figures, steps (i) & (ii) show the handover Step (ii) is the starting point for any subsequent SRNS relocation (see below).

(i)

(ii)
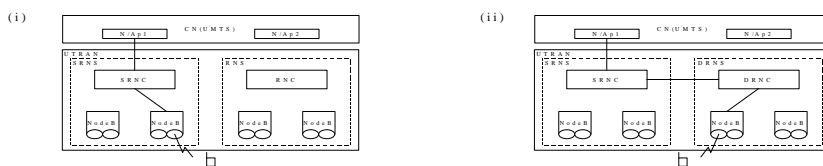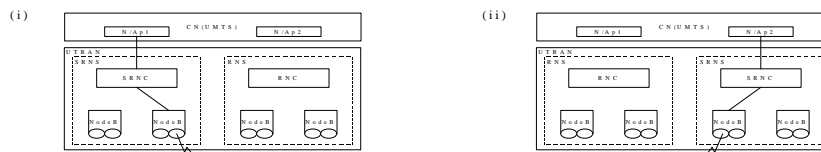
Scenario 2b: Inter RNS
Hard Handover

The SRNS relocation phase can either be initiated when the UE is only connected through one or more drift RNCs (i), or when the connection is also using radio resources directly controlled by the Serving RNC (iii). Steps (ii) and (iv) show the situation after the SRNS Relocation has occurred.

[Editor's note – short term transient states are not shown]
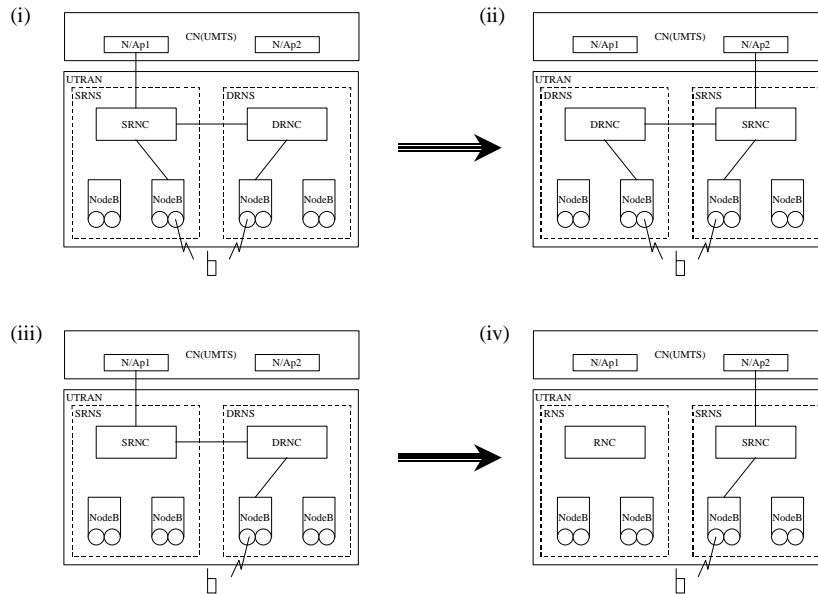
Scenario 2b: Inter RNS
SRNS Relocation

Scenario 2c shows the case where there is no Iur interface between the RNSs. This scenario will be supported by UTRAN as hard handover only. Steps (i) & (ii) show the situation before and after.
[editor's notes: 1) Whether this may also represent public/private handover is for further study.
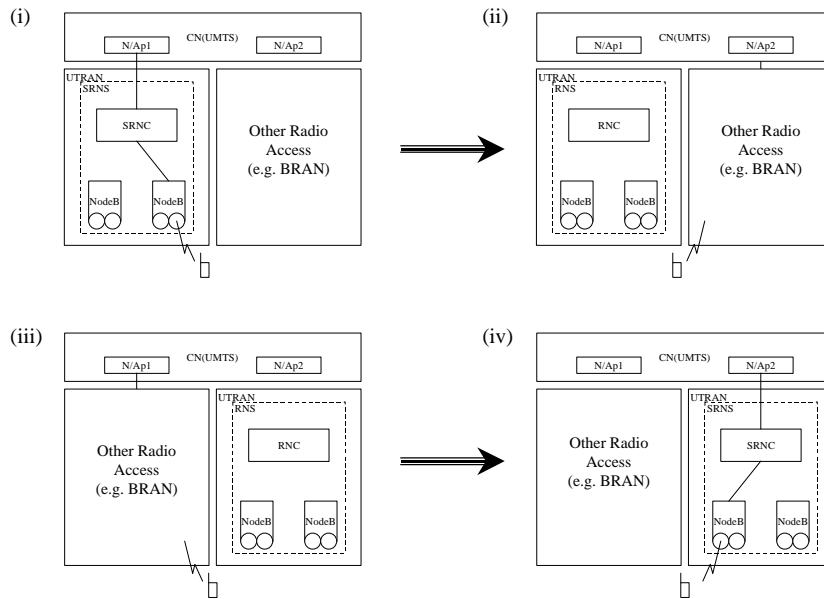*   ]*

Scenario 2c: Inter RNS (Intra UTRAN)
No Iur

Scenarios 3 and 4 in 23:10 are defined as follows:

> *3) inter-URAN handover (without change of CN access point)*
> *4) intra-CN handover with same URAN type*

As there is currently no requirement for the support of multiple access networks (of the same type) from one core network, these scenarios are inconsistent with the UMTS requirements and so have been omitted. If the connection of 2 UTRANs to one CN becomes a requirement, then these scenarios may need to be included.

Scenario 5 is for handover between a UTRAN and another type of radio access (e.g. BRAN) both connected to a UMTS core network. This scenario is FFS; it is FFS whether it will be supported by UTRAN in UMTS Phase 1. If supported, it will be as a hard handover. Steps (i) & (ii) show handover from UTRAN. Steps (iii) & (iv) show handover to UTRAN.

(i) CN(UMTS) N/Ap1 N/Ap2

UTRAN /SRNS

SRNC

Other Radio
Access
(e.g. BRAN)

NodeB NodeB

(ii) CN(UMTS) N/Ap1 N/Ap2

UTRAN /RNS

RNC

Other Radio
Access
(e.g. BRAN)

NodeB NodeB

(iii) CN(UMTS) N/Ap1 N/Ap2

Other Radio
Access
(e.g. BRAN)

UTRAN /RNS

RNC

NodeB NodeB

(iv) CN(UMTS) N/Ap1 N/Ap2

Other Radio
Access
(e.g. BRAN)

UTRAN /SRNS

SRNC

NodeB NodeB

Scenario 5: Inter URAN
Different URAN Types

Scenario 6 shows the case where the handover is between two UTRANs that are connected to different UMTS core networks. An example of this would be inter-operator handover. This scenario will be supported by UTRAN as hard handover only. Steps (i) & (ii) show the situation before and after. *[editor's note: the interface between the CNs is outside the scope of SMG2-ARC, and is only included for completeness].*

(i) CN (UMTS) 1 N/Ap1   CN (UMTS) 2 N/Ap1

UTRAN /SRNS

SRNC

NodeB NodeB

UTRAN /RNS

RNC

NodeB NodeB

(ii) CN (UMTS) 1 N/Ap1   CN (UMTS) 2 N/Ap1

UTRAN /RNS

RNC

NodeB NodeB

UTRAN /SRNS

SRNC

NodeB NodeB
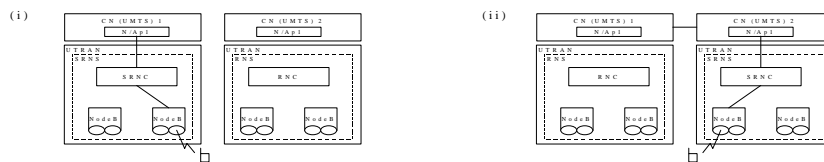
Scenario 6: Inter CN
Same URAN/CN Types

Scenario 7 is a combination of the previous two, with the handover between a UTRAN (connected to one UMTS CN) and another radio access (connected to a different UMTS CN; the interface is FFS in SMG12). This scenario is FFS; it is FFS whether it will be supported by UTRAN in UMTS Phase 1. If supported, it will be as a hard handover only. Steps (i) & (ii) show handover from UTRAN. Steps (iii) & (iv) show handover to UTRAN.
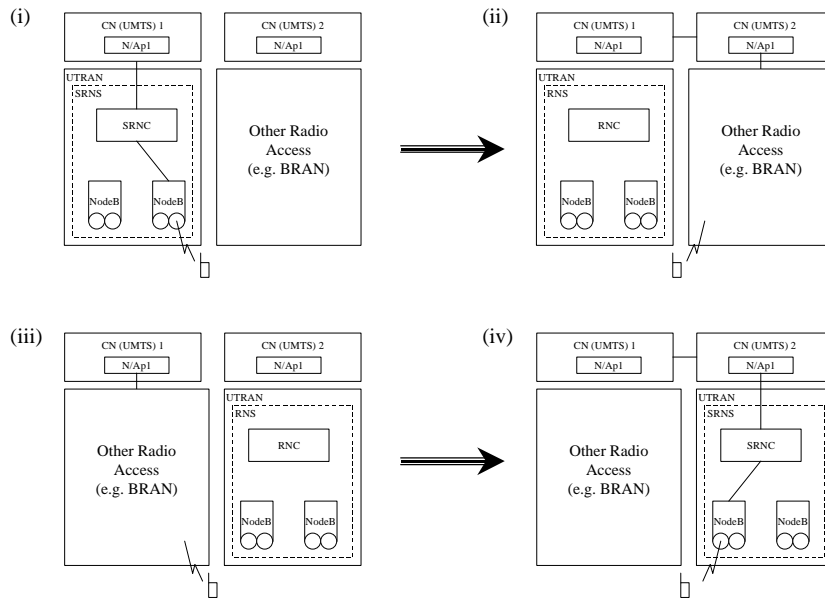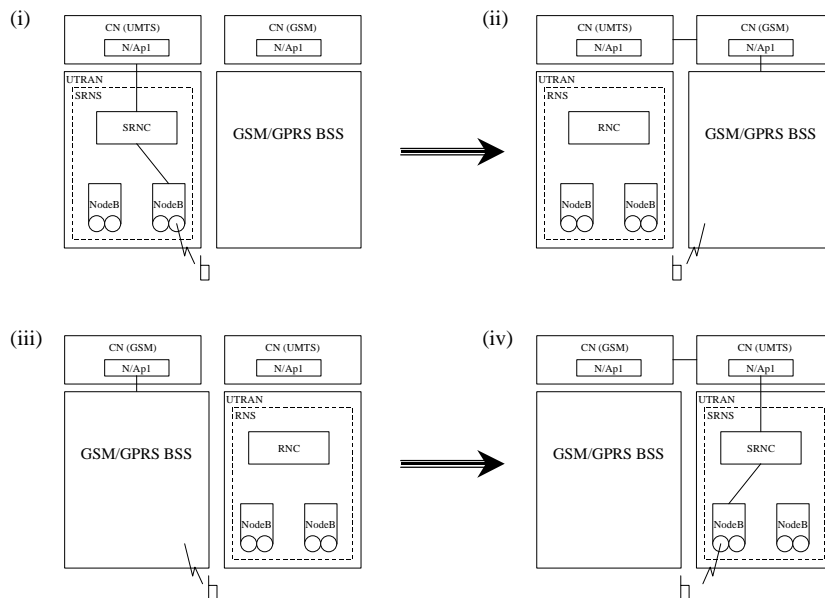
Scenario 7: Inter CN
Different URAN Types

Scenario 9 (8 and 10 are for further study) shows the case of UMTS-GSM handover. More generally this scenario is for inter core network handover with different URAN types. It will be supported by UTRAN as a hard handover only. It is assumed that there will be no direct UTRAN-BSS interface. Steps (i) & (ii) show handover from UTRAN. Steps (iii) & (iv) show handover to UTRAN.

Scenario 9: Inter CN
Different CN/URAN Types

Scenario 11 shows handover between UTRAN and a GSM BSS. This will be supported by the UTRAN as hard handover only. It is assumed that there will be no direct UTRAN-BSS interface, so handover

between GSM BSS and UTRAN is supported by switching in the core network. Steps (i) & (ii) show handover from UTRAN. Steps (iii) & (iv) show handover to UTRAN.
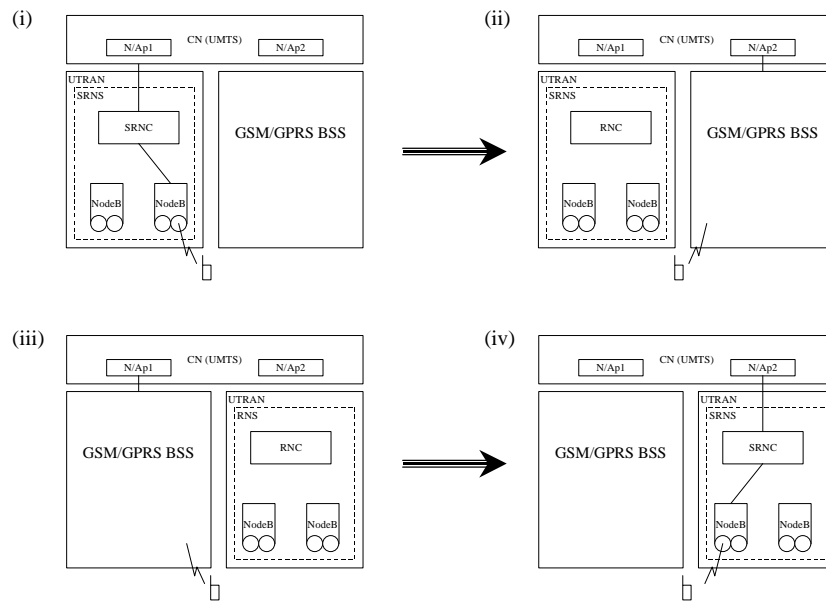
Scenario 11: Intra CN
UTRAN/GSM

3. TDD/FDD Mode

While it is clear that handover between FDD mode and TDD mode is a requirement, it is not yet clear how the two modes will fit into the architecture. However, once this has been determined, additional scenarios may be required to cover handover between the two modes. It has been agreed that, for inter-mode handover, there will be two options – either for the handover to be handled within the UTRAN or to be at the core network level.

Similarly, the mapping of public and private domains onto the scenarios is for further study.

History

<table>
<tr><td colspan="3" align="center">Document history</td></tr>
<tr><td>Date</td><td>Version</td><td>Comment</td></tr>
<tr><td>14 December</td><td>8</td><td>Editorial correction.</td></tr>
<tr><td>13 November 1998</td><td>7</td><td>Separated 2b into HO and SRNS Relocation. Modified text around 2b. Added clarification to Sc11 as agreed in Chicago.</td></tr>
<tr><td>28 October 1998</td><td>6</td><td>New diagrams. Textual changes in intro according to Tdoc 197/98. Scenarios 5 & 7 marked as FFS for phase 1.</td></tr>
<tr><td>8 October 1998</td><td>5</td><td>Editorial Changes following ARC#6 – conclusions removed/changed to comments in intro. Sc5a becomes Sc11 as BSS is not a URAN.</td></tr>
<tr><td>1 September 1998</td><td>4</td><td>Changes according to SMG2ARC #5 (Kista) – Section 1 from Tdoc 164 added to scenario 2b (with editorial changes). 2c shown as hard HO only.</td></tr>
<tr><td>24 July 1998</td><td>3</td><td>Changes according to SMG2 UMTS Ad Hoc #6 – removed example from scenario 2c. Also some minor editorial changes.</td></tr>
<tr><td>3 July, 1998</td><td>2</td><td>Changes according to SMG2ARC #4 (Helsinki) – added scenario 2c, and a number of notes. Also, added change history, and version number for 23.10.</td></tr>
<tr><td>20 May, 1998</td><td>1</td><td>First "official" version. Based on Tdoc SMG2 UMTS-ARC 71/98, and decisions made at SMG2 ARC #3 (Turin)</td></tr>
<tr><td colspan="3">Editor:

Richard Townend
BT

Tel: + 44 1473 605 429
Fax: + 44 1473 623 683
Email: Error! Bookmark not defined.~~richard.townend@bt.com~~</td></tr>
<tr><td colspan="3"></td></tr>
</table>