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January 2015

Suppliers' Information Note

For The BT Network

Synchronisation – Recommended Settings for Customer Premises Equipment

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Registered Office 81 Newgate Street LONDON EC1A 7AJ
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1. Introduction

This Suppliers' Information Note (SIN) describes the recommended synchronisation configurations for Customers Premises Equipment (CPE) when utilising the BT fixed network, i.e. via the metallic or optical local loop. These recommendations apply specifically within the UK, but the same synchronisation principles apply worldwide. This document provides information for customers, terminal equipment manufacturers, suppliers and developers. This document covers in life and obsolete services.

The consequence of inappropriate synchronisation settings of customer equipment may result in errored data, poor quality of voice, through to network failures. Hence it is important that customers, their supplier and/or installer understand the synchronisation requirements and configure their equipment correctly. In particular, past experience has shown that there has been confusion over sub interface synchronisation settings, particularly with regard to SDH delivered services.

The following are the present fundamental delivery systems in place within BT:

SDH – Synchronous Digital Hierarchy

For STM-1 circuits (VC4 circuit) and STM-n aggregate Interface (where n can be 1, 4, or 16), the synchronisation of the SDH element, i.e. the BT component of any connection, is derived according to ITU-T-G781 for network quality clocks. Customer's SDH interface terminal equipment should never be configured to deviate from the derived settings, as this could result in pointer justification events within the circuit's routing. The important point to remember is that SDH technology carries PDH elements and it is these elements that this document is interested in. The synchronised SDH platform does not synchronise the PDH elements of that platform therefore they are plesiochronous, see PDH below.

PDH – Plesiochronous Digital Hierarchy

For PDH circuits, because these are plesiochronous services, there is no default synchronisation within the BT network; the connections are effectively free running. Therefore the services that are routed over these connections all have to be synchronised. If a synchronous service is purchased from BT, such as KiloStream, ISDN30, ATM, FrameStream, MPLS then these services provide the synchronisation. If a service such as G703 [1] MegaStream is utilised the terminal equipment is responsible for synchronisation.

Irrespective of the service delivery both SDH and PDH services consist of plesiochronous elements.

Section 2 lists examples of BT products and services where synchronisation of CPE will need to be considered together with the recommended synchronisation settings. Please note that this list is not exhaustive, however the principles are common to any service delivered via BT delivery systems, whether BT supplied or not.

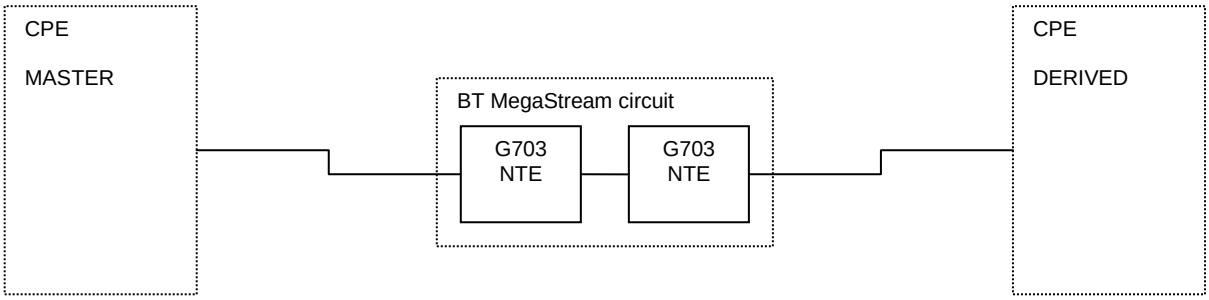
2. Recommended Synchronisation Configurations

The following recommendations are for the configuration of synchronisation for Customer Premises Equipment (CPE) when utilising the various BT delivered communications services. Synchronisation must be considered during equipment and network design and problem solving. These recommendations are particularly for BT's UK services, but the same principles apply worldwide.

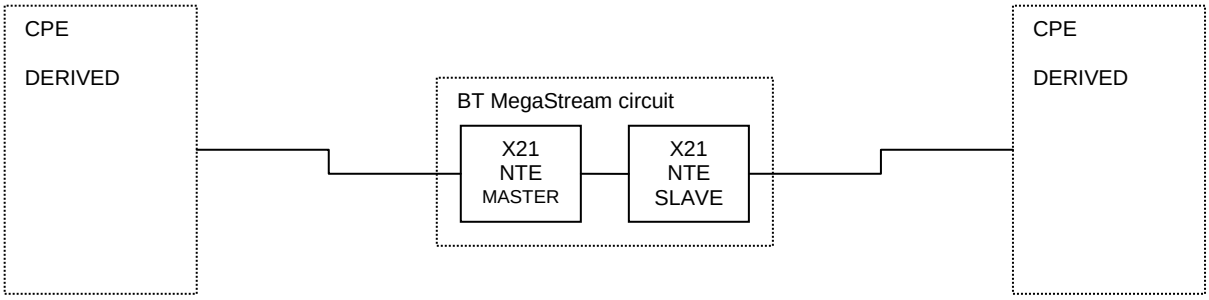
2.1 MegaStream 1 (ref SIN 223)

BT provides a 1Mbit/s (1,024kbit/s) MegaStream service - either as a structured G704 framed (1.024Kbps) service with customers data in timeslots 1 to 16 and presented on a G703 75/120 ohm interface or; as serial unstructured data from 320 Kbps to 1.024 Kbps, (in multiples of 64Kbps) this is presented on an X21 interface.

If the MegaStream 1 service is terminated as G703 [1] at both BT points of presentation, it is the customer's responsibility to provide a suitable synchronisation signal to stabilise the overall circuit.

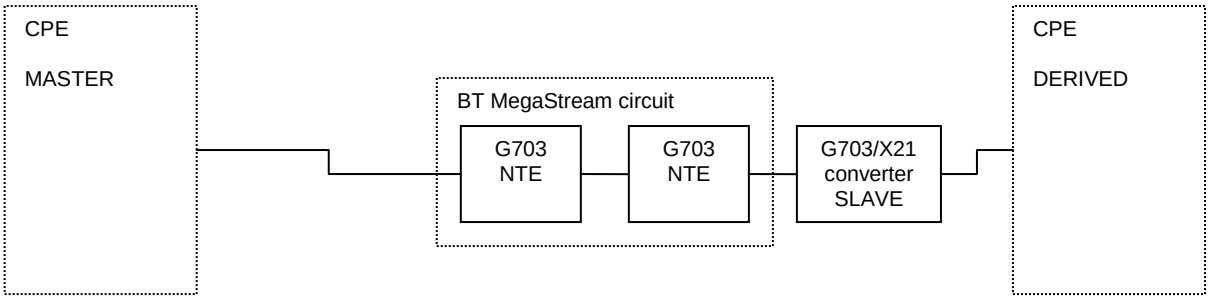


Where BT terminates the service as X21 at both BT points of presentation on that individual service, then a clock synchronisation will be applied by the BT network in accordance with G823 [5] ITU specifications.



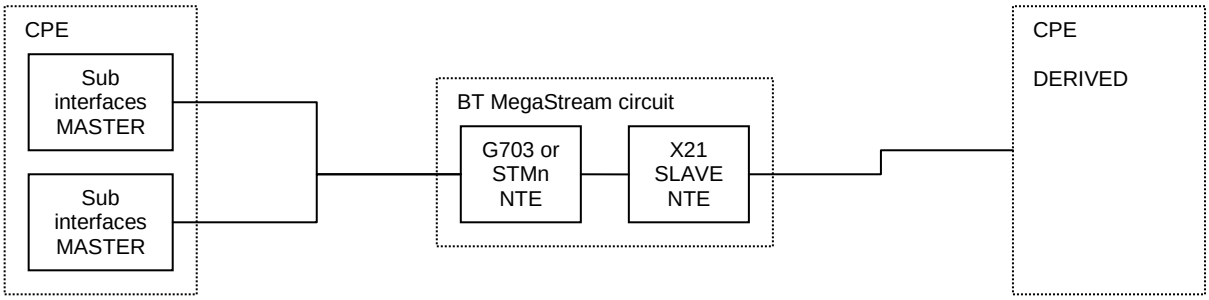
NB. Although individual X21 MegaStream with X21 at both ends has timing (synchronisation) provided, normally by the A-end NTE, networks with multiple X21 MegaStream circuits will NOT be in synchronisation with each other, only the individual connections will be synchronised. X21 MegaStream circuits are normally used as point to point connections only.

Customers will utilise interface converters if the MegaStream 1 service is provided G703 [1] at one end to provide CPE with an X21 interface. The converters can be configured for various timing modes; however the recommendation is that the interface converter should be set to slave timing mode, meaning that it will take its synchronisation from the G703 end of the connection where the customer's CPE would provide the synchronisation, e.g. set to master.



In situations for Partial Private Circuits (PPCs), whereby one end is an X21 interface, (normally provided at the B end of the circuit) and the other end is a point of handover, e.g. a G703 or a STMn aggregate delivery, then the B end NTE will be set as the "X21 slave". The A end will be the G703 or Aggregate Interface. Timing

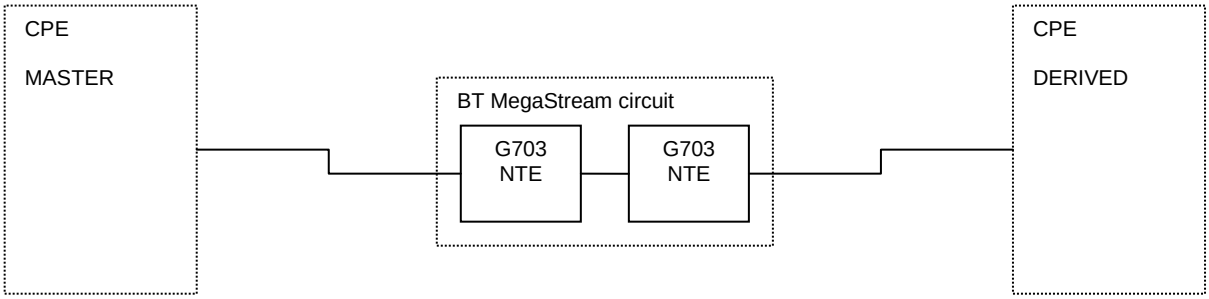
will therefore be provided by the A end CPE on each sub interface. Customers are to be aware that it is their responsibility to provide the X21 timing. This differs from the standard MegaStream circuit with X21 at both ends where the A end will have its NTE set as “X21 Master". It must be noted that X21, by its very nature, is a synchronised connection, it can not be synchronised from the CPE it is directly connected to, it is therefore necessary for the synchronisation to be introduced within the connection.



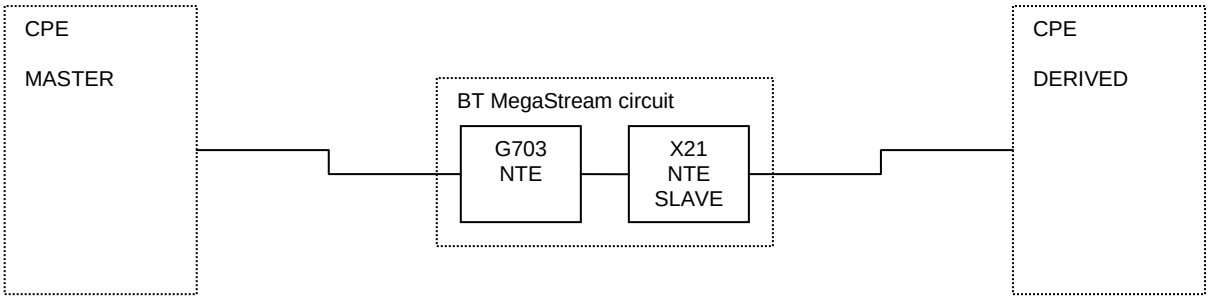
2.2 MegaStream 2 (ref. SINs 169 and 223)

BT provides a 2Mbit/s (2,048kbit/s) MegaStream service. This can be presented to the customer via various interfaces: X21, G703 [1] (75ohm and 120ohm), or a mixture of X21 and G703 [1]. The following are the recommended synchronisation configurations for the various provided presentations.

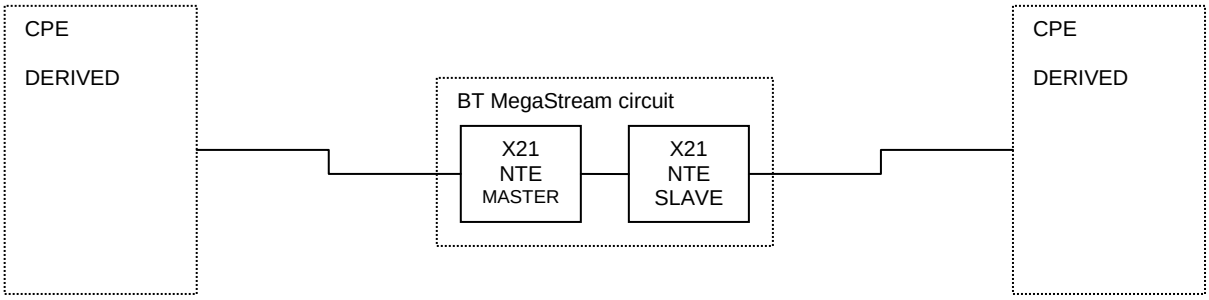
Where circuits have a G703 [1] interface provided both ends, it is the responsibility of the customer's terminating equipment to provide the synchronisation and any structure (e.g. G704) to the 2Mbit/s signal.



Where one end of a circuit is provided X21, it is still the customer's responsibility to provide timing, the NTE will be set for X21 slave (loop timing or recovered clocking) and will synchronise to the customer's signal from the G703 [1] end.



Where both ends are X21, the BT network will provide the timing. Normally the A-end NTE will be set for X21 master (local timing) and the B-end NTE X21, slave (loop timing). The customer's equipment both ends should then be set to loop timing.



NB. Although individual X21 MegaStream with X21 at both ends has timing (synchronisation) provided, normally by the A-end NTE, networks with multiple X21 MegaStream circuits will NOT be in synchronisation with each other, only the individual connections will be synchronised. X21 MegaStream circuits are normally used as point to point connections only.

2.3 MegaStream 8 (ref. SIN 223)

As from 2002, MegaStream 8 is no longer available for new supply. Existing MegaStream 8 Customers can continue to rent current circuits, no new circuits can be provided. The presentation for MegaStream 8 is G703 [1] interface; therefore it is the responsibility of the customer's equipment to provide the timing / synchronisation, as for MegaStream 2 above.

2.4 MegaStream 34 (ref. SINs 218 and 260)

BT provides a 34Mbit/s (34,368kbit/s) MegaStream. The service will support either a frame structure in accordance with ITU-T Recommendation G.751 [2] or an unstructured signal and can be point to point or aggregate (MegaStream Aggregate). The presentation for MegaStream 34 is G703 [1] interface; therefore it is the responsibility of the customer's terminating equipment to provide the timing / synchronisation. A master slave configuration is recommended, as for MegaStream 2 above.

2.5 MegaStream 45 (ref. SINs 247 and 292)

BT provides a 45Mbit/s (44,736kbit/s) MegaStream. The service is an inland unstructured point to point leased high speed digital service. The service presentation for MegaStream 45 is G703 [1] interface; therefore it is the responsibility of the customer's terminating equipment to provide the timing / synchronisation. A master slave configuration is recommended, as for MegaStream 2 above.

2.6 MegaStream 155* (ref. SINs 326 and 289)

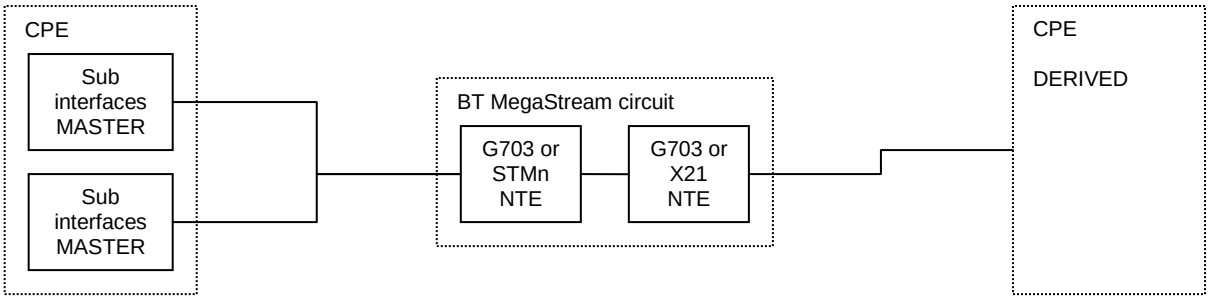
BT provides a 155Mbit/s (155,520kbit/s) MegaStream. The service is an inland Synchronous Digital Hierarchy (SDH) point to point or aggregate (MegaStream Aggregate) leased high speed digital service. The service presentation for MegaStream 155 is via an FC type optical connector conforming to BS EN 186110:1994 [3]. As specified in ITU-T Recommendation G.957 [4]; therefore it is the responsibility of the customer's terminating equipment to provide the timing / synchronisation of the sub SDH channels (TUGs). A master slave configuration of CPE is recommended as for MegaStream 2 above.

It is important to remember that although the SDH takes timing from the BT network’s master clock the individual circuit elements should be treated in the same way as PDH delivered services.

2.7 MegaStream 622** (ref. SIN 337)

BT provides a 622Mbit/s MegaStream. The service is an inland Synchronous Digital Hierarchy (SDH) point to point or aggregate (MegaStream Aggregate) leased high speed digital service. The service presentation for MegaStream 622 is via an optical Single Mode fibre connection conforming to ITU-T Recommendation G.957 [4]; therefore it is the responsibility of the customer's terminating equipment to provide the timing / synchronisation of the sub SDH channels (TUGs), the SDH takes timing from the BT network. A master slave configuration is recommended.

In situations for Partial Private Circuits (PPCs), whereby the remote ends are sub interfaces, (normally provided at the B end of the circuit) and the other end is a point of handover, e.g. a G703 or a STMn aggregate delivery. The “A” end will be the G703 or Aggregate Interface. Timing will therefore be provided by the A end CPE on each sub interface. Customers are to be aware that it is their responsibility to provide the synchronisation. This differs from the standard MegaStream circuit with X21 at both ends where the A end will have its NTE set as “X21 Master". It must be noted that X21, by its very nature, is a synchronised connection, it can not be synchronised from the CPE it is directly connected to, it is therefore necessary for the synchronisation to be introduced within the connection at the customer’s aggregate end.



Note:

* 155.520Mbit/s service delivered from an Add Drop Multiplexor can be presented as either G703 (electrical) or G957 (Optical).

** MegaStream 622Mbit/s service was officially withdrawn from new sales on the 5th of May 2008.

2.8 MegaStream Aggregate

The MegaStream Aggregate service can be delivered via different bearer circuit technologies, i.e. SDH and PDH. The service presentation for each bearer is detailed above, however the customer should also ensure that each 2Mbit/s circuit within the aggregate bearer is synchronised correctly i.e. a master slave configuration is recommended for each 2Mbit/s circuit within the aggregate bearer. Therefore it is the responsibility of the customer's terminating equipment to provide the timing / synchronisation for the PDH bearer and the individual circuits aggregated within the bearer. With SDH delivered circuits the SDH bearer is synchronised to the BT network, with the individual sub circuits (TUGs) being synchronised by the customer’s terminating equipment.

2.9 MegaStream Partial Private Services

CPs (Communication Providers) may use BT circuits to provide the transmission path at one or both ends of their service offering. It is the responsibility of the CP to ensure suitable synchronisation arrangements are set-up to maintain the overall stability of their service.

If BT circuits are utilised either side of a CP’s own SDH transmission network, then it will be the responsibility of the CP to ensure that a suitable synchronisation source to G703 [1] and G823 [5] ITU specifications is applied by either themselves or their customer to stabilise the overall 2Mbit/s Layer 1 transport path.

2.10 BT ISDN30e Service (ref. SIN 261)

The BT ISDN30e Service can be delivered via different delivery mechanisms e.g. copper or fibre optical. In either case the service presentation is provided via an RJ45 interface. As the ISDN network will provide the timing, it is the recommendation that the customer's terminating equipment recovers the timing / synchronisation from the network. The customer's terminating equipment should be configured for recovered timing.

2.11 BT ISDN DASS2 Service (ref. SIN 222)

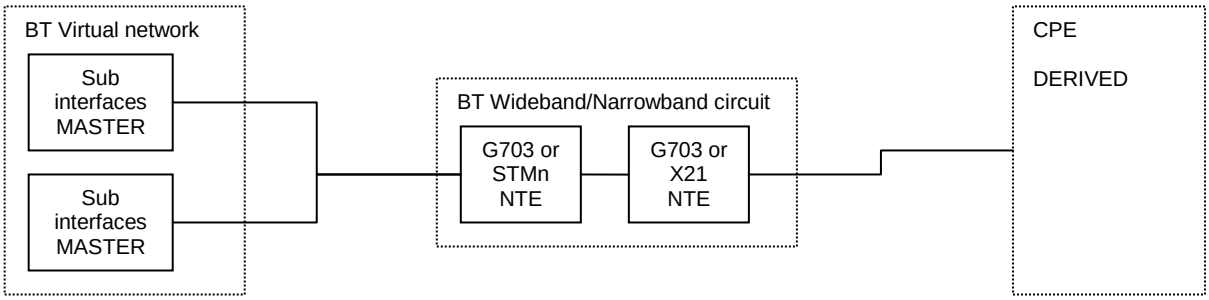
The BT DASS2 Service can be delivered via different delivery mechanisms e.g. copper or fibre optical. In either case the service presentation is provided via a BNC coax 75 Ohm interface. The ISDN network will provide the timing therefore it is the recommendation that the customer's terminating equipment to recover the timing / synchronisation from the network. The customer's terminating equipment should be configured for recovered timing.

2.12 BT FeatureNet 1000 Service (ref. SINs 324, 357)

The BT FeatureNet1000 Service can be delivered via different delivery mechanisms e.g. copper or fibre optical. The service presentation is provided via a 75ohm BNC interface for the service. The FeatureNet network will provide the timing, therefore it is the recommendation that the customer's terminating equipment to either recover the timing / synchronisation from the network or to use another network source which is in synchronisation with the FeatureNet network, such as BT's ISDN30 service. The customer's terminating equipment should be configured for recovered timing.

2.13 BT Virtual Networks

When connected to a virtual or real network, e.g. BT's IPClear, MPLS, ISDN, Kilostream, ATM, FrameStream, etc. it is imperative that synchronisation is taken from that network. Therefore all CPE would be set for derived timing and any interface converter would be configured as slave.



2.14 Summary

Synchronisation should always be considered in any network. For every connection there has to be a synchronisation source and it is the customer's responsibility to ensure that synchronisation is considered. BT's managed core networks, e.g. ISDN, KiloStream, CellStream, FrameStream, etc. will provide a synchronisation source, the same applies to other CP's, however, full consideration still has to be given to the overall network synchronisation by the customer. Key points are:

- MegaStream circuits require the CPE to provide a synchronisation source (exception is X21 both ends).
- SDH does not provide a sub interface synchronisation source, therefore the customer has to provide the correct master/slave timing for each sub interface.

3. Further Information Contact Point

If you have enquiries relating to this document then please email us at: sinet.helpdesk@bt.com

There are consultants that can assist with CPE synchronisation, for example consultec@bt.com

4. Abbreviations

SIN	Suppliers Information Note
BS	British Standard
ITU-T	International Telecommunications Union – Telecommunications standardisation section
NTE	Network Terminating Equipment
ONP	Open Network Provision
CPE	Customer Premises Equipment
SDH	Synchronous Digital Hierarchy
PBX	Private Branch Exchange – Customers Telephony Equipment

5. References

No.	Title.
[1]	ITU-T Recommendation G703 – Physical/Electrical Characteristics of Hierarchical Digital Interfaces
[2]	ITU-T Recommendation G751 – Digital multiplex equipment operating at the third order bit rate of 34,368 kbit/s and the fourth order bit rate of 139,264 kbit/s and using positive justification.
[3]	BS EN 186110 – Sectional Specification. Connector sets for optical fibre cables Type FC
[4]	ITU-T Recommendation G.957 – Optical Interfaces for equipment and systems relating to the synchronous digital hierarchy.
[5]	ITU-T Recommendation G.823 – The control of jitter and wander within digital networks which are based on the 2048 kbit/s hierarchy.
[6]	SIN 169: Suppliers Information Note – International MegaStream (2Mbit/s) – Service Description
[7]	SIN 223: Suppliers Information Note – BT MegaStream 1, BT MegaStream 2 and BT MegaStream 8 Service Description
[8]	SIN 218: Suppliers Information Note – BT MegaStream 34 and BT MegaStream Aggregate Service Description
[9]	SIN 247: Suppliers Information Note – BT International MegaStream 45 – Service Description
[10]	SIN 292: Suppliers Information Note – BT National MegaStream 45 Service Description
[11]	SIN 246: Suppliers Information Note – BT MegaStream 140 Service Description

[12]	SIN 289: Suppliers Information Note – BT MegaStream 155 and BT MegaStream Aggregate Service Description
[13]	SIN 326: Suppliers Information Note – BT International MegaStream 155 – Service Description
[14]	SIN 337: Suppliers Information Note – BT MegaStream 622, BT MegaStream Aggregate (STM4) Service Description
[15]	SIN 260: Suppliers Information Note – BT International MegaStream 34 – Service Description
[16]	SIN 261: Suppliers Information Note - BT ISDN 2e and ISDN30e Services using full ETSI Call Control Service Description
[17]	SIN 222: Suppliers Information Note – BT ISDN30 (DASS) – Service Description
[18]	SIN 232: Suppliers Information Note – BT ISDN30 (I.421) Service – Service Description
[19]	SIN 324: Suppliers Information Note – FeatureNet Embark Service Description
[20]	SIN 357: Suppliers Information Note – BT FeatureNet™* Service: Technical Characteristics Of The Interfaces

6. History

Issue 1.0	October 2008
Review Issue 1.1	January 2012 – no changes
Review Issue 1.2	January 2015: • Introduction changed to incorporate obsolete and live services • Change SINet site references from http://www.sinet.bt.com to http://www.btplc.com/sinet/