Joint Working Manual
Grenada

Reference Interconnection Offer v 1.0

Table of Contents

1 Chapter 1 – Technical Specification

1.1 Introduction

1.1.1.1 This chapter describes the technical specifications applicable to the Services as described in the Service Descriptions. The specifications in this chapter are applicable to both Parties.

1.2 Technical characteristics for the Optical In-Span Joining Service

1.2.1 Principles

1.2.1.1 The Optical In-Span Joining Service is based upon the principle of one Telco IPOP to one LIME ISL.

1.2.1.2 As described in the Optical In-Span Joining Service Service Description, the service will comprise:

- One Optical Fibre cable run (which may consist of two or more Optical Fibre strands) from the Telco IPOP to the LIME ISL (referred to as the route).

1.2.1.3 As described in the Optical In-Span Joining Service Service Description, a Carrier System comprises a Service Taker CTU, the matching Service Supplier CTU for the route, and the point to point Optical Fibre cable.

1.2.1.4 Carrier Systems based on Synchronous Optical Network (SONET) 155.52 Mbit/s (OC-3) will be used. All SONET systems should conform to SONET Transport Systems standards: Bellcore GR-253 section 3.1. The basic sub-rate of all the systems is 1.544 Mbit/s.

1.2.1.5 The 155.52 Mbit/s Carrier Systems specified are capable of supporting up to eighty-four 1.544Mbit/s Network Links. Figure 1 represents a functional overview of the service.

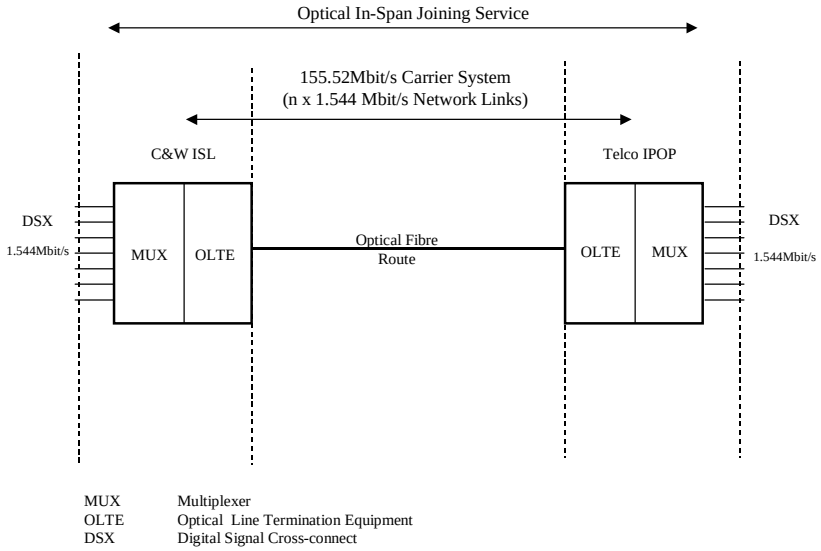

Figure 1: The Carrier System.

1.2.1.6 Single mode optical fibre cable is specified utilising 1330nm short haul interface conforming to G.957.

1.2.2 Cable Routing & Resiliency

1.2.2.1 No physical route diversity is provided as part of the Optical In-Span Joining Service. However, an additional route can be added if technical issues or traffic volumes warrant.

1.2.2.2 Carrier System equipment resiliency may be provided upon request whereby a working fibre pair and a protecting fibre pair are provided on the same fibre route. Protection switching is facilitated by the CTU of each party in accordance with Uni-directional Path Switched Ring (UPSR) protection standards specified in T1.105.01.

1.2.2.3 Cables that enter and traverse cable vaults will be protected by concrete (outside building) and mechanical armour (within building).

1.2.2.4 The physical interface between the Telco System and the LIME System will be the OC-3 optical fibre interface. For the avoidance of doubt, the physical interface is not the same as the Point of Connection.

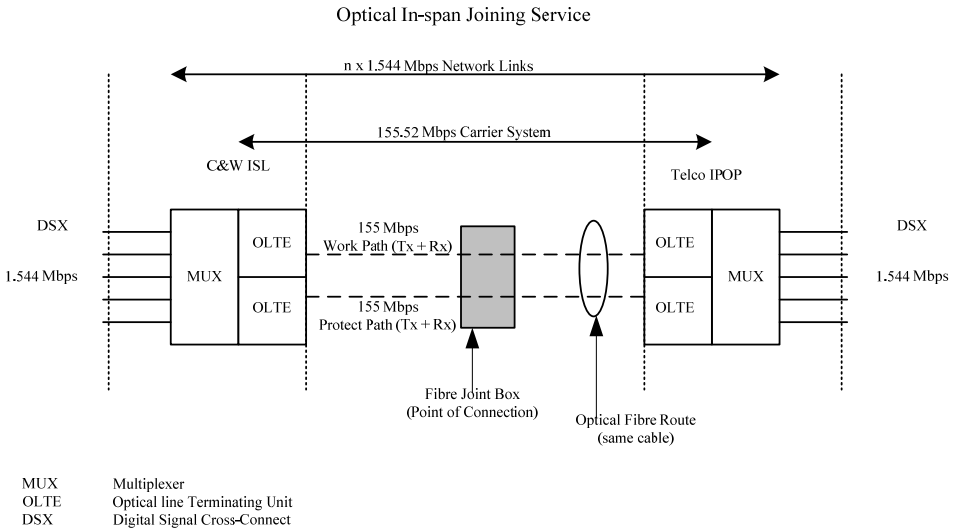

Figure 2: Carrier System resiliency

1.2.3 Circuit Termination Unit Specification

1.2.3.1 LIME approved suppliers, following testing:

Manufacturer	**Product**
Nortel Networks Corporation	OME6110, OM3500, OM3300

1.2.4 Process for accreditation of alternative CTU

1.2.4.1 All CTU equipment must conform to SONET standards and any additional standards specified in this technical chapter.

1.2.4.2 In advance of ordering, the alternative CTU manufacturer equipment specification shall be sent to the LIME Liaison Manager for technical evaluation. Further to this evaluation, some specific inter-operability testing may need to be planned and conducted. For the avoidance of doubt, interoperability testing will not be required where alternative CTU equipment is designed with identical interface specifications as equipment defined in Paragraph 1.2.3.1.

1.2.5 Joint Box engineering drawing

1.2.5.1 The specification of the Joint Box will be provided in the form of an engineering drawing blue print.

1.3 1.544 Mbit/s Network Link Characteristics

1.3.1 Electrical characteristics

1.3.1.1 The output jitter shall not exceed 5 UI under worst case operating conditions when measured in the frequency range 10 Hz to 40 KHz, as defined in ANSI T1.102 (Table 9).

1.3.1.2 The tolerance of both the LIME and the Telco input ports to jitter should be as defined in ITU-T Recommendation G.823.

1.3.1.3 A jitter measuring set conforming to the requirements of ITU-T Recommendation O.171 (Timing Jitter Measuring Equipment for Digital Systems) shall be used to measure jitter.

LIME and the Telco shall co-operate in the application of testing methods as described in ITU-T Recommendation G.823.

1.3.1.4 The wander specification is set out in ITU-T recommendation G.823. The maximum values of wander at input ports must conform to section 3.1.1 of ITU-T Recommendation G.823.

1.3.2 Functional characteristics

1.3.2.1 Each 1.544Mbit/s Network Link shall be transparent and independent of any traffic stream passed across it.

1.3.2.2 For the D-type channel bank application, eight bits are available for payload in 5/6 of the DS1 frames. In every sixth frame, bit position eight (# 8) is a payload overhead channel, used for signalling. In the super frame format, two distinct channels are available; A and B as presented in ANSI T1.107 figure 7, while four distinct channels, A, B, C, and D are available in the extended superframe format as presented in figure 10 of ANSI T1.107.

1.3.2.3 1.544Mbit/s interfaces shall conform to ANSI T1.107 for generation of Alarm Identification Signal (AIS) and RAI alarms and with G.824 for slipping conditions. RAI timing requirements shall comply with ANSI T1.231.

1.3.2.4 At the digital interface the analogue information shall be encoded using the 8bit, μ-law characteristic in accordance with ITU-T Recommendation G.711 such that a 64kbit/s time slot at the switch connection can be decoded using an 8-bit, μ-law decoder. The bit pattern of a free channel shall be in conformity with ITU-T recommendation Q.522, section 2.1.2.

1.3.3 Synchronisation

1.3.3.1 The Telco shall synchronise on the LIME System.

1.3.3.2 The Telco shall synchronise on the LIME System via nominated Network Links when using the OC-3 Carrier System.

1.3.3.3 LIME will provide the 1.544Mbit/s interface for synchronisation on the ISL. Inputs will have a minimum accuracy of Stratum 2 (Accuracy of 1.6x10-8 and stability of 1x10-10/day).

1.3.3.4 The nominated synchronisation channels will be agreed as part of the order process.

1.3.3.5 The maximum wander shall conform to ITU-T G.811 and G.812. The synchronisation provided by LIME meets the requirements of ITU-T G.703 and is traceable to Stratum 1 source (minimum accuracy of ±1x10-11).

1.3.4 Safety and protection

1.3.4.1 All equipment will comply with UL 1950 and/or national safety standards whichever is the most stringent.

1.3.4.2 For high voltages, equipment will comply with ITU-T K.11.

1.3.4.3 If radio equipment is used, it will comply with the International standard ITU-T K.37 to protect employees from electromagnetic radiation with a power in excess of 1 milliwatt per centimetre.

1.3.4.4 The screen of the cable at an output port must be connected to the metal cabinet, which holds the equipment. The screen of the cable at an input port must be earthed.

1.3.5 Electromagnetic Compatibility

1.3.5.1 All link equipment must comply with ITU-T K.43 for network equipment Electromagnetic Compatibility (EMC) requirements and must comply with any national regulations relating to electromagnetic and electrostatic compatibility.

1.3.5.2 All link equipment must comply with ITU-T K.42 for immunity to radiated electromagnetic energy.

1.3.5.3 All link equipment must comply with ANSI T1.308 and/or ITU-T K.32 for electrostatic discharge.

1.3.5.4 All link equipment must comply with EN 55022 class B or FCC Part 15 for radiated and conducted emissions.

1.3.5.5 All link equipment must comply with any national regulations relating to electromagnetic and electrostatic compatibility.

1.3.5.6 The link equipment must be immune to radiated electromagnetic field of up to 3V/m.

1.4 Network Link Quality of Service

1.4.1 Definitions

1.4.1.1 Network Link Availability, Errored Seconds and Severely Errored Seconds are the parameters used to measure the service quality of the Network Link. These quality of service parameters are applicable to all Network Links that are delivered by LIME as well as to all Network Links that are delivered by the Telco. Measurements of these service quality parameters will be specified in minutes per calendar months and will be on a per link basis.

1.4.1.2 The definition of Network Link Availability (%) for a Party is

$$100 * \frac{\text{(total time – time allocated to Planned Maintenance – time link not available for traffic due to Carrier System Faults)}}{\text{(total time – time allocated for Planned Maintenance)}}$$

where the unit of time is minutes and total time is calculated as the number of days in the month multiplied by 1440 minutes.

1.4.1.3 The definition of Errored Second is a one second interval with one or more bit errors.

1.4.1.4 The definition of Severely Errored Second is a one-second period, which has a bit error ratio greater than or equal to 10^{-3}.

1.4.2 Quality of Service levels

1.4.2.1 The following Quality of Service level is applicable to the Network Links.

1.	Network Link Availability	> 99.9%
2.	Percentage of Severely Errored Seconds	≤ 0.055%
3.	Error Free Seconds	> 99.0%

1.5 Signalling

1.5.1 Signalling Principles

1.5.1.1 Signalling applied shall be Signalling System No. 7 which conforms to ETSI standards. Operator dependent implementations of the signalling protocol at the network interconnection interface will not be supported.

1.5.1.2 In principle LIME will transfer signalling messages transparently through its network. However, LIME cannot guarantee proper end-to-end inter-working of services originating or terminating outside the LIME network.

1.5.2 Circuit related signalling

1.5.2.1 3.1KHz audio and speech bearer services are supported.

1.5.3 Protocols

1.5.3.1 The MTP (ANSI T1.111) and ISUP V2 (ANSI T1.113) protocols are supported.

1.5.3.2 The signalling mode is quasi associated. This means that at least one pair of Signalling Transfer Points is involved i.e. the access Signalling Transfer Points of LIME. It is preferred that the signalling transfer function is also applied by the Telco in order to maximise efficiency regarding the number of Signalling Links.

1.5.4 Parameter fields

1.5.4.1 Network indicator 11 (binary notation) and National Transit Domain point-codes shall be used. The CLI represents the national significant number or international number depending on the source of the call. The nature of address indicator shall be set accordingly. The address presentation restriction indicator shall not contain the values “spare” or “address not available”.

1.5.5 Signalling procedure

1.5.5.1 All calls to national significant numbers shall use en-bloc-signalling mode of operation.

1.5.5.2 In case of overlap signalling mode of operation the Address Complete Message shall be sent as soon as all digits necessary to complete the call are received.

1.5.5.3 Stop digits for indicating that the full number is transmitted shall not be used.

1.5.5.4 The required called party number format, nature of address, number length (range) and signalling mode of operation as passed between the networks is specified in the Parameter Schedule.

1.6 Traffic Handling of Services

1.6.1 Trunk Groups

1.6.1.1 Separate Trunk Groups per Service or for a group of services will be agreed.

1.6.1.2 All trunk groups will be uni-directional.

1.6.1.3 The separate Trunk Groups between the Telco IPOP and the LIME ISL are specified in the Parameter Schedule.

1.6.2 Signalling Links

1.6.2.1 A minimum of two Signalling Links will be provided between the LIME System and the Telco System.

1.6.2.2 LIME and the Telco will maintain equal loading of the Signalling Links.

1.6.2.3 The Signalling Links will be designed for a normal load of 0.2E and a maximum load of 0.4E following the guidelines of ETS 300 008.

1.6.2.4 The dimensioning of Signalling Links will be determined by the number of Call attempts using Erlangs formula.

1.6.2.5 This formula is applicable when Signalling Links are used for circuit related signalling and the number of links will be subsequently monitored, and adjusted, should this be necessary, according to specific traffic type.

1.6.2.6 The Signalling Links shall be used exclusively for the exchange of signalling messages.

1.6.3 Quality of Service for Termination Services, Special Access Services, Transit Services and International Call Origination Service

1.6.3.1 The Quality of Call related Termination Services, Special Access Services, Transit Services, and International Call Origination Services are represented by the parameters Call Availability, Dial Set-up Delay and Propagation Delay.

1.6.3.2 Depending on the Service offered the Service Supplier has a role as:

- **originating party.** In this role the Service Supplier handles calls from the Subscriber Connection of the calling party in the originating network to the Point of Connection .
- **transit party.** In this role the Service Supplier handles calls from the Point of Connection or Point of Handover as the case may be via the national transit network to the Point of Handover or Point of Connection as the case may be.
- **terminating party.** In this role the Service Supplier handles calls from the Point of Connection to the called Subscriber Connection of the called party in the terminating network.

1.6.3.3 For each Quality of Service parameter a value is defined.

1.6.4 Call Availability

1.6.4.1 The definition of Call Availability (%) is

$$100 * \frac{\text{(total call attempts – total call releases with causes marked as network fault)}}{\text{(total call attempts)}}$$

during a specified calendar month.

Release causes marked as network faults are the following causes specified in ITU-T rec. Q.850:

* no circuit/channel available
* network out of order
* temporary failure
* switching equipment congestion
* access information discarded
* requested circuit/channel not available
* resource unavailable, unspecified
* bearer capability not presently available
* protocol error, unspecified

- interworking, unspecified.

1.6.4.2 The Call Availability is > 99%. The apportionment for the Call Availability budget for Service Supplier and Service Taker is as follows:

Originating party	Transit party	Terminating party
≥99.6 %	≥99.8 %	≥99.6 %

1.6.5 Dial Setup Delay

1.6.5.1 Dial Setup Delay is defined as the interval from the moment that the last digit of the called party number is keyed by the calling party to the time a relevant tone (ring tone/busy/information tone/message) is received by the calling party.

1.6.5.2 Dial Setup Delay Quality of Service parameter shall be no more than 2350 ms for a national Call.

1.6.5.3 The apportionment for the Dial Setup Delay value for Service Supplier and Service Taker is as follows:

Originating party	Transit party	Terminating party	Database access if applicable
575 ms	700 ms	575 ms	500 ms

1.6.6 Propagation Delay

1.6.6.1 Propagation Delay is defined as the round trip delay between the received signal and the transmitted signal.

1.6.6.2 The Propagation Delay Quality of Service parameter shall be no more than 22ms. Both Parties will take appropriate actions (e.g. echo cancellation) if this Propagation Delay is exceeded.

1.6.6.3 The apportionment for the Propagation Delay budget for Service Supplier and Service Taker is as follows:

Originating PBX network if applicable	Originating party	Transit party	Terminating party	Terminating PBX network
5 ms	4.5 ms	3 ms	4.5 ms	5 ms

1.6.7 Calling Line Identity

1.6.7.1 All interconnect trunks will utilise Q.731 signalling through which CLI shall be passed transparently.

1.6.7.2 All numbers with CLI are transparent between networks. Calling Number Delivery Blocking (CNDB) shall be applied to all private numbers within the LIME System and the Telco System. LIME and the Telco should ensure that CLI associated with numbers with the CNDB feature is blocked from Subscriber Connections.

1.7 References

ITU-T Recommendation	
G.703	"Physical/electrical characteristics of hierarchical digital interfaces"
G.711	"Pulse code modulation (PCM) of voice frequencies"
G.821	"Error performance of an international digital connection forming part of an integrated services digital network"
G.824	"The control of Jitter and wander within digital networks which are based on the 1.544 Mbit/s hierarchy".
O.171	"Timing Jitter measuring equipment for digital systems"
K.11	"Principles of protection against over voltage and over current"
K.42	"Preparation of emission and immunity requirements for telecommunications equipment"
K.43	"Immunity requirements for telecommunications equipment"
K.37	"Public Telecommunications network equipment EMC requirements Part I: Product family overview, compliance criteria and test levels"
UL 1950	"Standard for Safety for Information Technology Equipment, 3rd Edition"
T1.102-1993	Digital Hierarchy – Electrical Interfaces
T1.105-1995	Synchronous Optical Network (SONET) - Basic Description including Multiplex Structure, Rates and Formats
T1.105.01-1998	Synchronous Optical Network (SONET) - Automatic Protection
T1.105.02-2000	Synchronous Optical Network (SONET) - Payload Mappings
T1.105.03-1994	Synchronous Optical Network (SONET) - Jitter at Network Interfaces
T1.105.04-1995	Synchronous Optical Network (SONET) - Data Communication Channel Protocol and Architectures
T1.105.05-1994	Synchronous Optical Network (SONET) - Tandem Connection Maintenance
T1.105.06-1996	Synchronous Optical Network (SONET) - Physical Layer Specifications
T1.105.07-1996	Synchronous Optical Network (SONET) - Sub-STS-1 Interface Rates and Formats Specification
T1.105.09-1996	Synchronous Optical Network (SONET) - Network Element Timing and Synchronization
T1.105.06-1996	Synchronous Optical Network (SONET) - Digital Hierarchy Optical Interface Specification: Single-Mode
T1.107-1995	Digital Hierarchy – Formats Specifications
T1.110-1992	Signalling System No. 7, General Information
T1.111-1996	Signalling System No. 7, Message Transfer Part
T1.112-1996	Signalling System No. 7, Signalling Connection Control Part Functional Description
T1.231-	Digital hierarchy-Layer 1 in-Service Digital Transmission Performance Monitoring

T1.304-1997	Ambient Temperature and Humidity Requirements for Network Equipment in Controlled Environments