SERVICE SCHEDULE –
INTEROPERABILITY TESTING SERVICE (IOT SERVICE)

NUCLEUS CONNECT PTE. LTD.

INTERCONNECTION OFFER (ICO) AGREEMENT

SERVICE SCHEDULE – INTEROPERABILITY TESTING SERVICE (IOT SERVICE)

CONTENT PAGE

1. **INTRODUCTION**

1.1 This Service Schedule sets out the terms and conditions under which Nucleus Connect will provide testing services based on the Basic Mandated Service(s) subscribed by the Contracting QP (the "**IOT Services**").

1.2 This Service Schedule comprises the following:

(a) the provisions herein; and
(b) Orders submitted by the Contracting QP in relation to this Service Schedule.

1.3 In the event of any inconsistency or conflict between the provisions herein and Orders submitted by the Contracting QP in relation to this Service Schedule, the provisions herein shall prevail.

1.4 The Master ICO Agreement, including the Annexes, shall apply unless and to the extent amended or supplemented by the provisions of this Service Schedule.

1.5 In this Service Schedule, a reference to a paragraph, unless stated otherwise, is to a paragraph of this Service Schedule.

2. **DEFINITIONS AND INTERPRETATION**

2.1 Unless otherwise defined herein this Service Schedule, all terms and expressions used herein will be construed to have the same meanings as found in the Master ICO Agreement. Where a term or expression is defined specifically in this Service Schedule herein, the provisions herein shall prevail.

2.2 In this Service Schedule:

Approved Project Schedule	has the meaning ascribed to it in paragraph 6.2 or 6.4, as the case may be;
IOT Services	has the meaning ascribed to it in paragraph 1.1;
Order	means an order for the IOT Service(s) necessary for the relevant Basic Mandated Service(s) that the Contracting QP intends to subscribe for; and
Project Schedule	has the meaning ascribed to it in paragraph 6.1.

2.3 In this Service Schedule, the reference to "third party" shall not include Nucleus Connect's contractors and/or suppliers.

3. **COMMENCEMENT**

This Service Schedule shall commence with effect from the date that the Contracting QP first places an Order for an IOT Service, in accordance with paragraph 5 below.

4. **SERVICE REQUIREMENTS**

4.1 The IOT Services comprise the following types of tests:

(a) Connectivity Tests

(i)   QP-EVPL Interface Test;
(ii)   User Network Interface (UNI) test;
(iii)   EVC Configuration and Testing;
(iv)   Class of Service (COS) Verification;
(v)   Bandwidth Profiles;
(vi)   OAM pass through; and
(vii)   Remote Management;

(b)   Throughput and End to End Performance Testing;

(c)   Service Functionality Test; and

(d)   Failover mechanism and protocol.

The test cases, technical specifications and acceptance criteria in respect of each of the abovementioned tests are described in Appendix A annexed hereto.

4.2   Each Basic Mandated Service is prescribed a combination of the abovementioned tests, as set out in Appendix B annexed hereto.

5.   **ORDER HANDLING**

5.1   The Contracting QP must place any Order in accordance with paragraph 5.2.

5.2   The Contracting QP shall use the Platform to place Orders, or (only if the Platform is not in operation) shall send Orders using the application form attached to this Service Schedule by email to orderdesk@nucleusconnect.com (and/or such other email address as Nucleus Connect may notify the Contracting QP from time to time) in the first instance or if email is not available for any reason by facsimile to (65) 6808 2820 (and/or such other facsimile number as Nucleus Connect may notify the Contracting QP from time to time) (the latter method shall hereinafter be referred to as the "**Manual Process**").

5.3   The Contracting QP is responsible for the acts and omissions of its Authorised Users in connection with the Platform and the Manual Process.

5.4   All Orders received by Nucleus Connect will be processed by Nucleus Connect in the order in which they are received. For Orders received via the Platform or via email, Nucleus Connect shall notify and send to the Contracting QP an acknowledgement that the Orders have been received.

5.5   Nucleus Connect shall use the Platform to notify the Contracting QP if Nucleus Connect rejects any Order submitted by the Contracting QP pursuant to paragraph 5.6, or (only if the Platform is not in operation) shall send such notification by email in the first instance or if email is not available for any reason by facsimile, to the email address or facsimile number of the "Primary contact person" specified in Annex 5 of the Master ICO Agreement. Any such rejection, and the reasons therefor, shall be notified to the Contracting QP as aforesaid within two (2) Business Days after Nucleus Connect's receipt of such Order.

5.6   Subject to paragraph 5.7, where the Contracting QP submits an Order, the Contracting QP acknowledges and agrees that Nucleus Connect shall be entitled to reject such Order in the following circumstances:

(a)   where such Order is not in the prescribed form;
(b)   where the information in such Order is illegible, inaccurate, incomplete or incorrect; or

(c)   where the Contracting QP has committed a material breach of the ICO Agreement.

5.7   Where the Platform is in operation, the grounds in paragraphs 5.6(a) and 5.6(b) shall not automatically entitle Nucleus Connect to reject an Order. In the event such grounds materialise, Nucleus Connect shall grant to the Contracting QP the opportunity to make the necessary corrections in real time via the Platform, without the need to re-enter all of the other correct information. If the Contracting QP does not make such correction as aforesaid, or the ground in paragraph 5.6(c) materialises, Nucleus Connect shall be entitled to reject such Order in which case this Service Schedule shall lapse, unless Nucleus Connect is separately providing IOT Service(s) to the Contracting QP at the time, in which case this Service Schedule shall remain in force.

6.   **TAKING UP THE SERVICE**

6.1   If an Order is not rejected by Nucleus Connect, Nucleus Connect will provide a project schedule (the "**Project Schedule**") to the Contracting QP within ten (10) Business Days after Nucleus Connect's receipt of such Order, stating:

(a)   the scope of work involved;

(b)   the proposed date of commencement of testing, which date shall be no later than the date falling twenty (20) Business Days after the date that Nucleus Connect provides such Project Schedule;

(c)   the number of man-days required, which shall be based on the duration prescribed for the relevant tests in Appendix A provided that Nucleus Connect shall be entitled to vary such duration where there are extraordinary situations or strong justifications to deviate, in which case Nucleus Connect shall inform the Contracting QP the reasons for such deviation;

(d)   an estimation of Nucleus Connect's charges (based on the NC Charges set out in paragraph 8); provided that in the case of the Escort Charge specified in paragraph 8.2, it shall be waived by Nucleus Connect so long as access to Nucleus Connect's test lab is during office hours;

(e)   an estimation of OpenNet's charges and any third party charges involved. In addition, in situations where OpenNet requires Nucleus Connect to agree to certain ON Charges and Nucleus Connect intends to on-pass such ON Charges to the Contracting QP, Nucleus Connect shall also use its best endeavours to include such ON Charges in the Project Schedule. To the extent that such ON Charges are made known to Nucleus Connect only after the date of NC's said provision of the Project Schedule to the Contracting QP (the "**Post-Project Schedule ON Charges**"), Nucleus Connect shall be entitled to on-pass the Post-Project Schedule ON Charges to the Contracting QP; Provided that for the avoidance of doubt, where OpenNet requires Nucleus Connect to agree to the Post-Project Schedule ON Charges, Nucleus Connect shall obtain the Contracting QP's prior agreement for the Post-Project Schedule ON Charges before on-passing the same to the Contracting QP. If the Contracting QP fails or refuses to give such agreement to the Post-Project Schedule ON Charges:

(i)   the Order which is the subject of such Project Schedule shall be deemed to be cancelled whereupon paragraph 8.3 shall apply mutatis mutandis;

(ii)   the following Charges shall be imposed on the Contracting QP:

          (1)   all ON Charges (except those ON Charges which would be subject to the Contracting QP's agreement) which have been incurred by Nucleus Connect or which Nucleus Connect has committed to incur, at the time of such deemed cancellation of the Order;

          (2)   all Third Party Charges which have been incurred by Nucleus Connect or which Nucleus Connect has committed to incur, at the time of such deemed cancellation of the Order; and

          (3)   any other third party charges, OpenNet's charges and/or ON Charges which the Contracting QP has agreed to, which have been incurred by Nucleus Connect or which Nucleus Connect has committed to incur, at the time of such deemed cancellation of the Order; and

    (iii)   the said Project Schedule and this Service Schedule shall lapse, unless Nucleus Connect is separately providing IOT Service(s) to the Contracting QP at the time, in which case this Service Schedule shall remain in force; and

(f)   such other terms and conditions relating to the provision of the IOT Service(s) as Nucleus Connect may specify.

6.2   The Contracting QP will be able to raise to Nucleus Connect any terms that are not acceptable to it in the Project Schedule within five (5) Business Days from its receipt thereof, failing which the Contracting QP shall be deemed to have accepted and agreed to the terms in the Project Schedule in its entirety and such Project Schedule shall constitute an Approved Project Schedule.

6.3   If the Contracting QP and Nucleus Connect are unable to reach a mutual agreement on the terms of a Project Schedule within ten (10) Business Days after such Project Schedule is made available to the Contracting QP:

(a)   the Order which is the subject of such Project Schedule shall be deemed to be cancelled whereupon paragraph 8.3 shall apply; and

(b)   such Project Schedule and this Service Schedule shall lapse, unless Nucleus Connect is separately providing IOT Service(s) to the Contracting QP at the time, in which case this Service Schedule shall remain in force.

Nucleus Connect shall not unreasonably reject the Contracting QP's request for extension of the said ten (10) Business Days timeframe to reach a mutual agreement on the terms of the Project Schedule.

6.4   As soon as practicable after the mutual agreement of the Contracting QP and Nucleus Connect to the terms of a Project Schedule (as modified or with such additional terms as the Contracting QP and Nucleus Connect may require), the Contracting QP shall confirm in writing to Nucleus Connect that the Contracting QP agrees to the terms of such Project Schedule in their entirety (and such agreed Project Schedule shall hereinafter be referred to as an "**Approved Project Schedule**") within the ten (10) Business Days timeframe (or as the case may be, the agreed extended timeframe) referred to in paragraph 6.3, whereupon the Approved Project Schedule shall be binding on Nucleus Connect and the Contracting QP.

6.5   If the Contracting QP subsequently does not wish to proceed with an Approved Project Schedule, that shall be deemed to be a cancellation of such Approved Project Schedule whereupon paragraph 8 shall apply.

7.   **PROVISIONING THE SERVICE**

7.1   Nucleus Connect shall provide the IOT Service(s) to the Contracting QP pursuant to and in accordance with the Approved Project Schedule.

7.2   The Contracting QP acknowledges and agrees that:

(a)   it must procure and maintain, at its own cost, any equipment or software needed to receive or use the IOT Service(s);

(b)   it shall be responsible for delivering its equipment and/or test traffic to Nucleus Connect's test lab for the purpose of the IOT Service(s) at its own cost, one (1) Business Day before the commencement date of testing as stated in the Approved Project Schedule. For the avoidance of doubt, where the Contracting QP intends to deliver such test traffic remotely to Nucleus Connect, the Contracting QP shall be responsible for procuring the transmission link for the delivery of such test traffic; and

(c)   Nucleus Connect will not be responsible for any equipment and/or software used by the Contracting QP for the purpose of the IOT Service(s), including any loss or damage caused by or as a result of the use of such equipment and/or software whether in conjunction with the IOT Service(s) or not, except that Nucleus Connect will use its reasonable efforts to prevent loss or damage to such equipment or software.

7.3   Nucleus Connect agrees to use its best endeavours to ensure that:

(a)   the test results from the IOT Service(s) provided to the Contracting QP are not shared with any other Contracting QPs, unless otherwise required or disclosed by the Authority; and

(b)   the Contracting QP's equipment used for the purpose of the IOT Service(s) is not shared with or accessed by other Contracting QPs.

7.4   In relation to an Approved Project Schedule, if Nucleus Connect does not complete the IOT Service(s) by the completion date as stated in such Approved Project Schedule and such delay is caused by:

(a)   the fault of Nucleus Connect, its contractors and/or suppliers, Nucleus Connect shall waive the Charges applicable to the portion of the IOT Service(s) conducted after such completion date and the Contracting QP shall not be liable to pay to Nucleus Connect such Charges; Provided That if such delay is caused by the fault of OpenNet and Nucleus Connect is not entitled to make a claim therefor against OpenNet, Nucleus Connect shall not be obliged to waive such Charges and the Contracting QP shall remain liable to pay such Charges to Nucleus Connect; or

(b)   the fault of the Contracting QP, its contractors and/or suppliers, the Contracting QP may request Nucleus Connect for an extension of time to complete the IOT Service(s). The Contracting QP acknowledges and agrees that Nucleus Connect may not be able to accede to such request if Nucleus Connect's test lab is not available to support such extension, in which case Nucleus Connect reserves the right to fail all uncompleted test cases under such IOT Service(s). If Nucleus Connect agrees to such extension, the Contracting QP shall be liable to pay Nucleus Connect an additional $2,000 for each day of extension or part thereof.

7.5   If the Contracting QP wishes to carry out any testing using OpenNet's fibre, Nucleus Connect agrees to use its reasonable efforts to procure such fibre on a temporary basis from OpenNet to facilitate such testing, provided that Nucleus Connect shall not

be liable to the Contracting QP if OpenNet does not accept Nucleus Connect's order for such fibre for any reason whatsoever. For the avoidance of doubt, the Contracting QP acknowledges and agrees that Nucleus Connect shall not be obliged to accept terms and conditions imposed by OpenNet in respect of such order for OpenNet's fibre, if such terms and conditions are not reasonably satisfactory to Nucleus Connect. The Contracting QP shall bear all ON Charges imposed by OpenNet in connection with such testing. In situations where OpenNet requires Nucleus Connect to agree to certain ON Charges and Nucleus Connect intends to on-pass such ON Charges to the Contracting QP, Nucleus Connect and the Contracting QP shall also agree on such ON Charges before Nucleus Connect proceeds to incur such ON Charges.

7.6   The Contracting QP may request that Nucleus Connect carry out tests in addition to the IOT Service(s) set out in an Approved Project Schedule, or to re-test cases which did not pass the relevant tests prescribed under the IOT Service(s) specified in Approved Project Schedule. The process for submitting such request shall follow that of submitting an Order in accordance with paragraph 5. It is hereby acknowledged and agreed that (without prejudice to Nucleus Connect's right to reject the Order by virtue of any of the grounds of rejection under paragraph 5):

(a)   where the Order comprises additional tests which fall outside the scope of the tests prescribed for the relevant Basic Mandated Service as set out in Appendix A, Nucleus Connect shall be entitled to reject the Order; and

(b)   (subject to sub-paragraph (a) above) where the Order comprises (i) additional tests which fall outside the scope of the Approved Project Schedule but do not fall outside the scope of the tests prescribed for the relevant Basic Mandated Service as set out in Appendix A or (ii) re-testing of cases which did not pass the relevant tests prescribed under the IOT Service(s) specified in the Approved Project Schedule, Nucleus Connect will provide to the Contracting QP a revised Project Schedule setting out the matters referred to in paragraph 6.1 and the process for reaching an agreement on such Project Schedule shall follow that as set out in paragraphs 6.1 to 6.4. If an agreement on such revised Project Schedule is reached, Nucleus Connect and the Contracting QP agree that such Project Schedule shall be deemed to be a revised Approved Project Schedule which shall supersede the previously agreed Approved Project Schedule in its entirety.

7.7   After the completion of the IOT Service(s), the Contracting QP shall be required to disconnect and/or remove, at its own cost, all of its equipment and other property used for the purpose of such IOT Service(s) located on Nucleus Connect's premises. Notwithstanding any provision to the contrary in the Master ICO Agreement, the Contracting QP shall effect such disconnection and/or removal by the Business Day immediately following completion of such IOT Service(s), failing which Nucleus Connect may (but shall not be obliged to) effect such disconnection and/or removal and shall be entitled to charge the Contracting QP for the reasonable costs incurred thereby.

8.   **CHARGES**

8.1   The Charges set out below are the rates which will be used by Nucleus Connect to compute the cost chargeable to the Contracting QP in a Project Schedule. In addition, depending on when the relevant action is preferred by the Contracting QP to be undertaken by Nucleus Connect, the following multiplier factor will be applied to the NC Charges set out below. For the avoidance of doubt, the multiplier factor to be applied shall be one (1) unless the Contracting QP requests that the relevant action be undertaken by Nucleus Connect on off-working hours during Business Day(s) or on non Business Day(s).

	Period	Time	Multiplier

				Factor
Business Day	Monday to Friday	Working Hours	9.00am to 5.00pm	1
	Monday to Friday	Off-working hours	Before 9am and after 5.00pm	1.5
Non-Business day	Saturday, Sundays and Public Holidays	Throughout		2

8.2   The NC Charges in relation to the provision of the IOT Service are as follows:

Description	One-Time Charges
IOT Service Charge	Based on number of man-days required (minimum of 0.75 man-day) at the rate of $2,000 per man-day
Escort Charge in respect of access to Nucleus Connect's test lab	Non-office hours (being any time other than between 9 am to 5 pm from Mondays to Fridays which are not public holidays): $120/hr (For the avoidance of doubt, the multiplier factor of 1.5 or 2 shall not apply to the Escort Charge in respect of access to Nucleus Connect's test lab)

8.3   Upon the cancellation of any Project Schedule or Approved Project Schedule, an NC Charge of $2,000 shall be imposed on the Contracting QP.
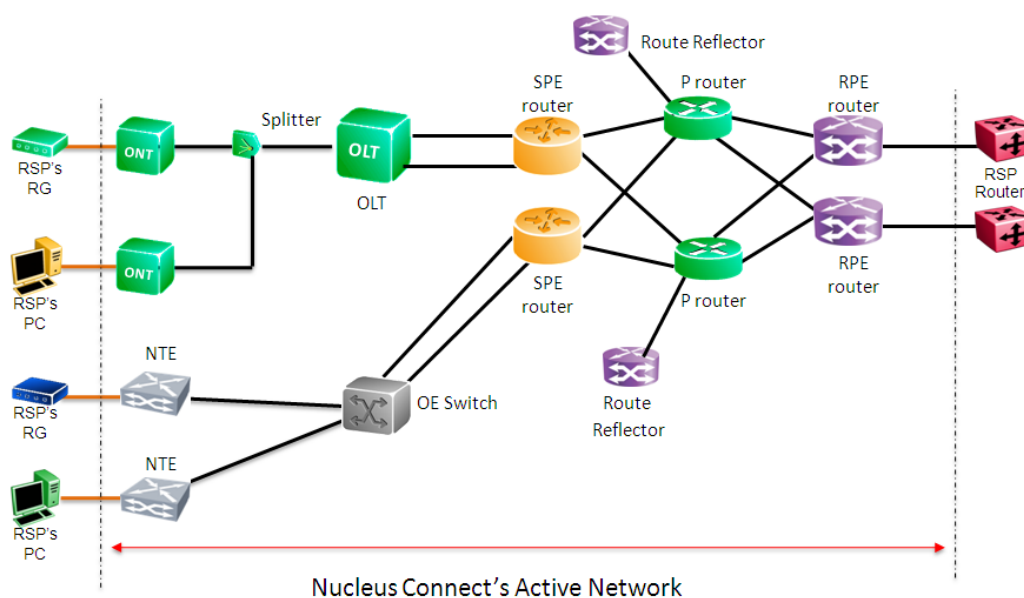
APPENDIX A

Note:

1. Nucleus Connect reserves the right, subject to the Authority's prior written approval, to add or remove test cases for the IOT.

2. Subject to paragraph 6.1(c), the number of "man-days" will be discussed and finalised with the Contracting QP and shall be reflected as such in the Project Schedule prior to actual IOT testing. Should actual testing be completed in less than the agreed number of man-days, the Contracting QP shall only be charged for the actual man-days.

3. Technical Setup of Testing

a) IP Address Usage:

   Nucleus Connect will use private IP addressing scheme for IOT testing. The Contracting QP can choose to use its own IP address via its own DHCP server or assign static IP address.

b) Schematic Example of Network Setup

4. The Contracting QP shall dedicate adequate technical expertise to conduct testing with Nucleus Connect.

Type of Tests	Test Items	Detailed Test Cases and Technical Specifications	Acceptance Criteria	Purpose	Estimated man days (MD)
Connectivity Test	QP-EVPL Interface test (Compulsory for	1. QP-EVPL Service Port type available:	Contracting QP router interfaces properly with Nucleus Connect's router	To verify interconnection between Contracting QP router and	0.5 MD/per QP-EVPL Service Port type.

Type of Tests	Test Items	Detailed Test Cases and Technical Specifications	Acceptance Criteria	Purpose	Estimated man days (MD)
	Contracting QP who order QP-EVPL Service Port)	• 1GE (IEEE 802.3 1000BASE-LX) • 10GE (IEEE 802.3 10GBASE-LR) 2. Layer 2 settings • IEEE 802.1Q • IEEE Q-in-Q • IEEE 802.1p 3. Layer 3 settings: • IP V4 • IP V6	and injects traffic via QP-EVPL Service Port into corresponding EVC. Contracting QP router receives traffic sent from corresponding EVC via Nucleus Connect's router at QP-EVPL Service Port.	Nucleus Connect's router at QP-EVPL Service Port to deliver traffic via PB-EVC or AG-EVC.	
	QP-EVPL Interface test (Compulsory for Contracting QP purchasing IP Multicast connection)	1. Test the IP Multicast Connection per QP-EVPL Service Port type with the following options: o IPv4 multicast address (RFC2780) 2. To test interworking for the following multicast protocols: o PIM-SM (BSR or Static RP)	Contracting QP router is able to inject multicast traffic into Nucleus Connect's network via QP-EVPL and IP Multicast connection. Multicast traffic sent by Contracting QP router is received properly at Nucleus Connect aggregation router.	To verify interconnection between Contracting QP router and Nucleus Connect's router at QP-EVPL Service Port for IP Multicast connection	0.5 MD/per QP-EVPL Service Port type

Type of Tests	Test Items	Detailed Test Cases and Technical Specifications	Acceptance Criteria	Purpose	Estimated man days (MD)
		(RFC4601)			
	EVC Configuration and testing (Compulsory for Contracting QP purchasing PB-EVC or AG-EVC)	1. Test one of the following options per EVC o Layer 2 settings • IEEE 802.1Q • IEEE Q-in-Q • IEEE 802.1p o Layer 3 settings: • IP V4 • IP V6 • Static routing • Dynamic routing (RIP, OSPF, IS-IS, BGP) o L3 Virtual Routing Domain setup	EVC is able to receive bidirectional traffic from/to Contracting QP router via corresponding QP-EVPL Service Port. Traffic contains proper information that Contracting QP router sends (e.g. VLAN tags, priority bit, IP address, etc…)	As part of End to End service delivery, this test is to verify the EVC option Contracting QP chooses is able to deliver the service over Nucleus Connect network.	0.5 MD/ per option per EVC type 0.2 MD per L3 Virtual Routing Domain setup.
	User Network Interface (UNI) of End User Connection (EUC) (Compulsory for Contracting QPs purchasing	1. UNI available o FE: IEEE 802.3 100Base-TX o GE: IEEE 802.3 1000Base-T 2. Test the	Contracting QP equipment sends traffic which: o is untagged, or o adheres to assigned C-VLAN tagging scheme, and	To verify Contracting QP service complies with VLAN schemes of Nucleus Connect If applicable, to verify the residential	0.5 MD/ per UNI type 0.2 MD per L3 Virtual Routing Domain setup.

Type of Tests	Test Items	Detailed Test Cases and Technical Specifications	Acceptance Criteria	Purpose	Estimated man days (MD)
	End-User Connections)	following options per UNI o C-VLAN tagging (IEEE802.1 Q IEEE Q-in-Q and 802.1p) o Untagged 3. Layer 3 settings: o IP V4 o IP V6 4. L3 Virtual Routing Domain setup for layer 3 options	o adheres to assigned IP address and routing protocols	gateway or end-user devices are able to work properly in different UNI options Separate tests required for GPON UNI and AE UNI	
	Class of Service Verification (Compulsory)	1. 802.1p bit tagging and pass through (applicable if Contracting QP chooses layer 2 option for QP-EVPL, EVC and EUC) (IEEE802.1 p 802.1Q) 2. Differentiate d Services Code Point (DSCP) pass through (applicable if Contracting QP	Contracting QP equipment tags p bit and/or DSCP values according to pre-agreed CoS. Transparently passing through priority bit as defined in IEEE802.1p and DSCP values as defined in RFC2474.	To verify Contracting QP service complies with corresponding CoS that Contracting QP intends to deploy To be tested for "segment-based" approach and end to end managed approach	1 MD/ per end to end connection comprising one QP-EVPL Service Port, one PB-EVC/AG-EVC and one End-User Connection 0.5 MD/ per pair of type of service ports

Type of Tests	Test Items	Detailed Test Cases and Technical Specifications	Acceptance Criteria	Purpose	Estimated man days (MD)
		chooses layer 3 option for QP-EVPL, EVC and EUC) (RFC2474)			
	Bandwidth Profile (Non-Compulsory)	1. CIR and/or PIR in downlink and uplink 2. Changing of CIR (bandwidth top up) in downlink and uplink	Traffic sent by Contracting QP equipment conforms to pre-defined CIR and PIR.	To verify CIR and PIR subscribed conforms to what Contracting QP intends to purchase. To be tested for "segment-based" approach and end to end managed approach	0.5 MD / per EUC type or per EVC type 0.5 MD/ per pair of type of service port
	OAM Pass through (Compulsory only if Contracting QP intends to run Operations, Administration and Management (OAM) protocols over Nucleus Connect network.)	Test OAM protocols Contracting QP intends to deliver over Nucleus Connect Network. OAM protocol is Ethernet OAM (IEEE 802.1ag). Testing of additional OAM protocol can be considered upon request by Contracting QP.	OAM protocols are sent and received properly by Contracting QP equipment at both ends. Detailed acceptance criteria for additional OAM protocols shall be discuss and agreed prior to testing as they are different for various protocols.	To verify that Nucleus Connect Network is able to pass through OAM protocols that Contracting QP intends to deploy to their equipment.	0.5 MD/ per type of OAM protocol
	Remote Management (Compulsory only if	Remotely manage Contracting QP's residential gateways	Detailed acceptance criteria shall be discuss and agreed prior to testing as they	To verify that Contracting QP is able to remotely manage their residential	Depending on amount of days Contracting QP spends in the IOT lab.

Type of Tests	Test Items	Detailed Test Cases and Technical Specifications	Acceptance Criteria	Purpose	Estimated man days (MD)
	contracting QP intends to run Remote Management protocols over Nucleus Connect network.)	Remote Management protocols shall be agreed between Nucleus Connect and Contracting QP prior to testing.	are different for various protocols.	gateway via Nucleus Connect's Active Network	
Service functionality test (Non-Compulsory)		Test end to end delivery of Contracting QP service throughout Nucleus Connect network from residential gateway to Contracting QP router. Example of service such as High Speed Internet, Voice over IP, Gaming, etc…	In general, the passing criteria is Contracting QP service work properly over Nucleus Connect's Network. Detailed acceptance criteria shall be discuss and agreed prior to testing as it is different for various services.	To verify Contracting QP service work properly in Nucleus Connect's Active Network	Depending on amount of days Contracting QP spends in the IOT lab.
Throughput and End to End performance test (Non-Compulsory)		1. 12 hour throughput test and observe throughput results 2. Collect performance results from throughput test. Results include o Latency o Jitter o Packet loss	Results collected fall within expected throughput, which shall be discussed and agreed prior to testing. Performance parameters conform to those stated in ICO schedules	To verify Contracting QP equipment is able to sustain consistently high throughput over long duration in Nucleus Connect network. To verify performance of Contracting QP equipment and	1MD / per 12 hr throughput test

Type of Tests	Test Items	Detailed Test Cases and Technical Specifications	Acceptance Criteria	Purpose	Estimated man days (MD)
				Contracting QP service over long duration test	
Failover Mechanism and Protocol test at QP-EVPL port (Compulsory only if Contracting QP purchase above redundancy options at QP-EVPL Service Port.)		Test failover at connection from Contracting QP router to Contracting QP router via eBGP and IEEE802.3ad. For eBGP: active and backup link of Contracting QP routers may connect to different routers of Nucleus Connect. For IEEE802.3ad: active and backup link of Contracting QP router must connect to the same router of Nucleus Connect. QP-EVPL Service Port type available: 1GE (IEEE 802.3 1000BASE-LX) and/or 10GE (IEEE 802.3 10GBASE-LR)	Traffic from active link of Contracting QP router switches over to backup link of Contracting QP router should the active link be down. Switch over time shall be discussed and agreed prior to testing.	To verify the failover at layer 3 (eBGP) and/or layer 2 (802.3ad)	0.5MD/per type of pair of EVPL port per failover protocol (eBGP or 802.3ad).

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APPENDIX B

Types of Interoperability Tests	Connectivity Test							Throughput Test / End to End Performance Test	Service Functionality Test	Failover Mechanism and Protocol Test
	a) QP-EVPL Interface Test	b) User Network Interface (UNI) test;	c) EVC Configuration and Testing;	d) Class of Service (COS) Verification	e) Bandwidth Profiles	f) OAM pass through;	g) Remote Management			
Residential Per-End-User Connection		✓		✓	O	#	#	O	O	
Non-Residential Per-End-User Connection		✓		✓	O	#	#	O	O	
NBAP Per-End-User Connection		✓		✓	O	#	#	O	O	
QP Ethernet Virtual Private Line Service (QP-EVPL)	✓			✓	O	#	#	O	O	#
Provider Backbone Ethernet Virtual Connection Service (PB-EVC)			✓	✓	O	#	#	O	O	
Aggregation Ethernet Virtual Connection Service (AG-EVC)			✓	✓	O	#	#	O	O	
Layer 2 VPN Service		✓		✓	O	#	#	O	O	
Layer 2 Ethernet LAN Service		✓		✓	O	#	#	O	O	
Layer 3 VPN Service		✓		✓	O	#	#	O	O	
IP Multicast Connection Service	✓					#	#	O	O	#

√ denotes mandatory Interoperability Test
O denotes Non-Compulsory test
# denotes compulsory test if Contracting QPs implement the feature/functionalities (e.g. OAM pass through, Remote Management and Failover Mechanism)

Application Form
Interoperability Testing (IOT) Service

nucleus connect

ATTN: NUCLEUS CONNECT, ORDER DESK
FACSIMILE NO.: (65) 6808 2820
EMAIL: orderdesk@nucleusconnect.com

Type of Order

☐ New Order   ☐ Modification   ☐ Disconnection

☐ Others (Please specify): _____

Existing Service ID (Mandatory field unless New Order): _____

Business Customer Information	
Company Details	**Authorised Officer Particulars**
Name of Firm/Company as in RCB:	Name of Authorised Officer as in NRIC/PASSPORT/FIN*. Please underline surname. (Dr/Mr/Miss/Mrs/Mdm):
Registered Address as in RCB:	NRIC/PASSPORT/FIN* No. of Authorised Officer (Dr/Mr/Miss/Mrs/Mdm):
	E-mail of Authorized Officer:
Main Office Contact No.:	Designation:
Main Office Fax No.:	Contact No. (Office):
Business Registration Number (BRN):	Contact No. (Fax):
Account Information (For New Accounts, please refer to www.nucleusconnect.com for instruction to sign up Nucleus Connect's Services)	Account Number:
Customer Reference ID : (This ID is issued by customer for their internal reference of the service that is set out in this application form)	

Billing Details (If different from Business Customer Information)	
Company Name:	Billing Address :
City & Postal Code:	Country:
Contact Person Name (Billing):	Customer Contact Number :
Customer Fax Number:	E-mail:

* Please select where appropriate

Customer Technical Contact	
Installation Contact (for service delivery)	**Operations/Technical Contact (after service delivery)**
Name:	Name:
Telephone (O):	Telephone (O):
Mobile:	Mobile:
Email:	Email:
Notification Mode: 24 Hours Daily ☐ Office Hours (9am-5pm, Mon-Fri) ☐	Notification Mode: 24 Hours Daily ☐ Office Hours (9am-5pm, Mon-Fri) ☐

Application Form
Interoperability Testing (IOT) Service

nucleus connect

Instruction

Basic Mandated Services

☐ Per-End-User Connection   ☐ PB-EVC   ☐ AG-EVC   ☐ QP-EVPL Service Port

☐ IP Multicast Connection Service   ☐ L2 VPN Service   ☐ L3 VPN Service   ☐ E-LAN Service

☐ Others: _____

Connectivity Tests

☐ QP-EVPL Interface Test   ☐ User Network Interface (UNI) test   ☐ EVC Configuration & testing   ☐ Class of Service Verification

☐ Bandwidth Profiles   ☐ OAM pass through   ☐ Remote Management   ☐ Others: _____

Throughput/Performance Test
☐ Throughput Test/ End to End Performance Testing

Fail over Mechanism and Protocol	
☐ IEEE 802.3ad	☐ eBGP

Contract Period	
Customer requested RFS date^	

Additional Information

^ Subject to agreement, resource availability and confirmation by Nucleus Connect. If the Order is accepted by Nucleus Connect, Nucleus Connect will provide a project schedule to the Contracting QP within ten (10) Business Days.

Customer Signature		
We hereby agree to subscribe to the abovementioned services on the terms and subject to the conditions contained in the Master ICO Agreement and the Service Schedule for the abovementioned services, which terms and conditions shall apply upon Nucleus Connect's acceptance of this application. We certify that all information provided by us herein are true, correct and complete. Further, we agree that any cancellation of the abovementioned services may result in a charge to us at Nucleus Connect's prevailing rates.		
Signature of Authorised Officer	Date	Company Stamp

For Nucleus Connect Use		
☐ Application Rejected:	Reason for rejection:	
☐ Application Accepted	Service ID/s:	Work Order No.:
No. of pages attached (Excluding application forms):	Approval code:	Processed by (Name, Contact, Signature and Date)