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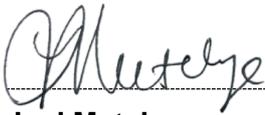
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## **Executive Summary**

The Multi-Service Access Platform (MSAP) is regarded an intermediate solution for Operation Technology (OT) services while Eskom is investigating migration of these services to the Internet Protocol/Multiprotocol Label Switching (IP/MPLS) platform, since the Bandwidth Management Equipment (BME) has reached its end of life. The MSAP must be compatible with the existing network infrastructure within the Eskom Telecommunication (ET).

This document outlines the test cases that must be performed to ensure that the selected MSAP equipment is compatible with the existing ET network infrastructure.

## **1. Introduction**

This document serves as an input to the technical evaluation criteria for the Operational Technologies (OT) over Multi-Service Access Platform (MSAP). It must be noted that the usage of "MSAP" in this document is reserved for the new multiplexers that will be proposed. The existing equipment/multiplexers such as "ABB FOX 615/12 and Newbridge/Alcatel 3600/30" will specifically be referred to with their model numbers.

## **2. Supporting clauses**

### **2.1 Scope**

This document contains test cases to be used as input to the technical evaluation criteria for evaluating the MSAP enquiry. The test cases consist of MSAP and BME Interoperability, and mission critical Operational Technology services over MSAP.

#### **2.1.1 Purpose**

The purpose of this document is to outline test cases that must be satisfied to comply with 240-170000907 Technical Evaluation Criteria for Multi-Service Access Platform (MSAP). These test cases will form part of evaluating Request for Proposal/Request or Quotation (RFP/RFQ) submissions for the MSAP enquiry.

Eskom reserves the right to ask the supplier to demonstrate any other feature which is not mentioned in this document but is specified in [2].

#### **2.1.2 Applicability**

This document shall apply throughout the tender enquiry, submissions, evaluations, and selection processes for the OT over MSAP solution in Eskom Holdings Limited Divisions.

## **2.2 Normative/informative references**

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

### **2.2.1 Normative**

- [1] ISO 9001 Quality Management Systems.
- [2] 240-128505297 Multi-Service Access Network Equipment Specification
- [3] 240-170000907 Technical Evaluation Criteria for Multi-Service Access Platform (MSAP)

### **2.2.2 Informative**

- [4] 240-145585933 BME to MSAP Interoperability (E&M)
- [5] 240-140849036 MSAP Multi-dropping for Distribution and Transmission Test Report
- [6] 240-128587097 Test Cases for Operational Technologies Over IP/MPLS
- [7] 240-70732272 MSAP Design Guideline
- [8] 240-145285823 Multiple-Service Access Platform Data Terminal Unit Test

## 2.3 Definitions

### 2.3.1 General

| Definition     | Description  |
|----------------|--|
| <b>FXO</b>     | <b>Foreign eXchange Office</b> interface is the port that receives the analogue line. It is the plug on the phone or fax machine, or the plug(s) on your analogue phone system. It delivers an on-hook/off-hook indication (loop closure). Since the FXO port is attached to a device, such as a fax or phone, the device is often called the "FXO device".  |
| <b>FXS</b>     | <b>Foreign eXchange Subscriber</b> interface is the port that delivers the analogue line to the subscriber. In other words, it is the "plug on the wall" that delivers a dial tone, battery current and ring voltage.  |
| <b>FXS/FXO</b> | Are the names of the ports used by analogue phone lines (also known as POTS – Plain Old Telephone Service) or phones.  |
| <b>RS232</b>   | An RS-232 serial port was once a standard feature of a personal computer, used for connections to modems, printers, mice, data storage, uninterruptible power supplies, and other peripheral devices. However, RS-232 is hampered by low transmission speed, large voltage swing, and large standard connectors.   |
| <b>X.21</b>    | It's an interface specification for differential communications introduced in the mid-1970s by the ITU-T. X.21 was first introduced as a means to provide a digital signalling interface for telecommunications between carriers and customers' equipment. This includes specifications for DTE/DCE physical interface elements, alignment of call control characters and error checking, elements of the call control phase for circuit switching services, and test loops. |

### 2.3.2 Disclosure classification

**Controlled disclosure:** controlled disclosure to external parties (either enforced by law, or discretionary).

## 2.4 Abbreviations

| Abbreviation   | Description   |
|----------------|---|
| <b>BME</b>     | Bandwidth Management Equipment                          |
| <b>E&amp;M</b> | Ear and Mouth   |
| <b>ET</b>      | Eskom Telecommunications                                |
| <b>FXS/FXO</b> | Foreign eXchange Subscriber / - Foreign eXchange Office |
| <b>IP</b>      | Internet Protocol                                       |
| <b>IP/MPLS</b> | Internet Protocol / Multi-Protocol Labelling Switching  |
| <b>OT</b>      | Operational Technology                                  |
| <b>PABX</b>    | Private Automatic Branch Exchange                       |
| <b>SCADA</b>   | Supervisory Control And Data Acquisition                |
| <b>SCOT</b>    | SCOT – Steering Committee Of Technologies               |
| <b>UHF</b>     | Ultra-High Frequency                                    |
| <b>VHF</b>     | Very High Frequency                                     |

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## 2.5 Roles and responsibilities

Not applicable

## 2.6 Process for monitoring

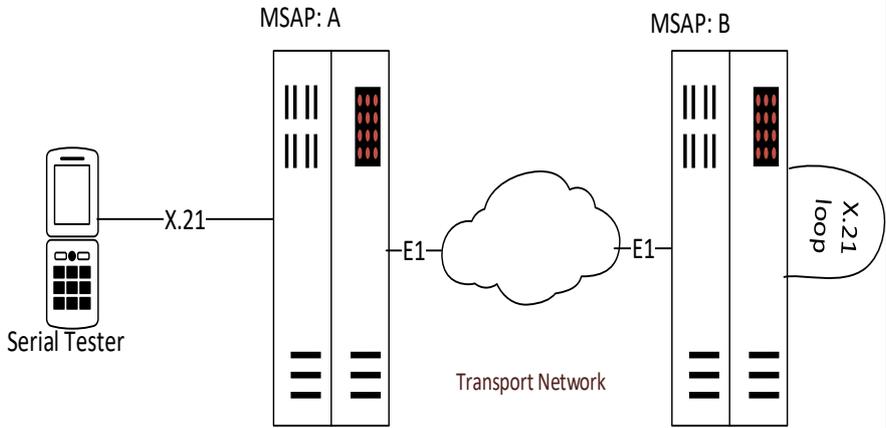
Multiplexer transport must strictly be PDH and SDH (TDM) will all services transported over TDM. Ethernet and IP circuits must be transported over TDM not in the other way round. Because of this requirement, testing of Ethernet bus/transport is not important.

## 2.7 Related/supporting documents

240-128505297 Multi-Service Access Network Equipment Specification

# 3. Test Cases: Operational Technology (OT) services over Multi-Service Access Protocol (MSAP)

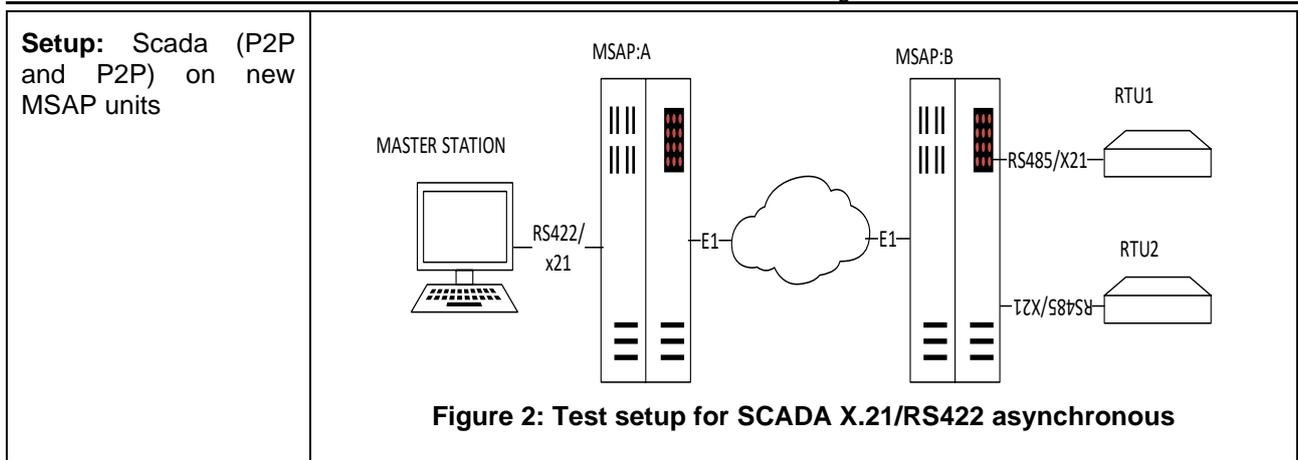
## 3.1 Test Case 1: Network latency tests using a portable tester

| SCENARIO   | TEST SETUP AND EXPECTED RESULTS   |                      |  |                      |                     |                        |
|--|---|----------------------|--|----------------------|---------------------|------------------------|
| <p><b>DESCRIPTION</b></p>  | <ol style="list-style-type: none"> <li>The serial portable tester must establish communication and measure the roundtrip delay.</li> <li>The circuits are expected to meet the 20ms latency one way for SCADA and 5ms for teleprotection.</li> <li>Circuits must be created using NMS.</li> </ol> |                      |  |                      |                     |                        |
| <p><b>Test Case 1:</b> Using a tester and physical loop to test serial circuits.</p> |  <p style="text-align: center;"><b>Figure 1: Test setup for X.21 loop</b></p>   |                      |  |                      |                     |                        |
| <p><b>Scenario</b></p>   | <p><b>Expected Results</b></p>  |                      | <p><b>Recorded Results</b></p>         |                      | <p><b>Score</b></p> | <p><b>Comments</b></p> |
| <p><b>Parameters</b></p>   | <p><b>Round Trip delay @64kpbs</b></p>  | <p><b>Errors</b></p> | <p><b>Round Trip delay @64kpbs</b></p> | <p><b>Errors</b></p> |                     |                        |

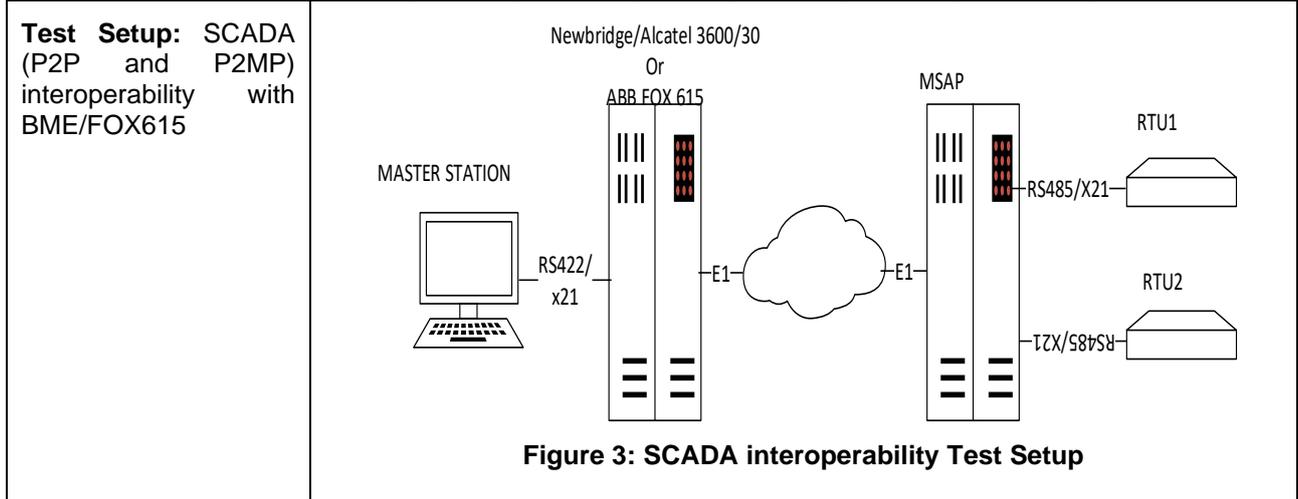
|  |                    |                |                    |                         |                  |                |  |
|--|--------------------|----------------|--------------------|-------------------------|------------------|----------------|--|
| <b>Scenario 1:</b> X.21 Synchronous Round-Trip Test (P2P)  | =<5ms              |                | No                 |                         |                  |                |  |
| <b>Parameters</b>  | <b>Round delay</b> | <b>Trip</b>    | <b>Errors</b>      | <b>Round Trip delay</b> |                  |                |  |
|  | @96 kbps           | @19.2 kbps     |                    | @96 kbps                | @19.2 kbps       |                |  |
| <b>Scenario 2:</b> X.21 Asynchronous Round-Trip Test (P2P) | =<20 ms            | =<20 ms        | No                 |                         |                  |                |  |
| <b>X.21 Asynchronous Round-Trip Test (P2MP)</b>            |                    |                |                    |                         |                  |                |  |
| <b>Scenario 3:</b> 2 Circuits                              | =<20 ms            | =<20 ms        | No                 |                         |                  |                |  |
| <b>Scenario 4:</b> 5 circuits                              | =<20 ms            | =<20 ms        | No                 |                         |                  |                |  |
| <b>Scenario 5:</b> 10 Circuits                             | =<20 ms            | =<20 ms        | No                 |                         |                  |                |  |
| <b>Name</b>  | <b>Surname</b>     | <b>Company</b> | <b>Designation</b> | <b>Date</b>             | <b>Signature</b> | <b>Comment</b> |  |
|  |                    |                |                    |                         |                  |                |  |
|  |                    |                |                    |                         |                  |                |  |

### 3.2 Test Case 2: SCADA and Teleprotection Tests

| SCENARIO           | TEST SETUP AND EXPECTED RESULTS  |
|--------------------|--|
| <b>DESCRIPTION</b> | <ol style="list-style-type: none"> <li>1. The SCADA masters must establish communication with the RTUs without errors.</li> <li>2. Teleprotection units must establish communication without errors.</li> <li>3. Record SCADA and TPE latency</li> </ol> |



| Scenario  | Expected Results |            |        | Recorded Results |            |        | Score | Comment |
|---|------------------|------------|--------|------------------|------------|--------|-------|---------|
| Parameters  | Round Delay      | Trip       | Errors | Round Delays     | Trip       | Errors |       |         |
|   | @96k bps         | @19.2 kbps |        | @96 kps          | @19.2 kpbs |        |       |         |
| <b>Scenario 1:</b> X.21 Asynchronous Round-Trip Test (P2P) - SCADA                | ≤20 ms           | ≤20 ms     | No     |                  |            |        |       |         |
| <b>Scenario 2:</b> X.21 Asynchronous Round-Trip Test (P2MP) - SCADA Multidropping | ≤20 ms           | ≤20 ms     | No     |                  |            |        |       |         |



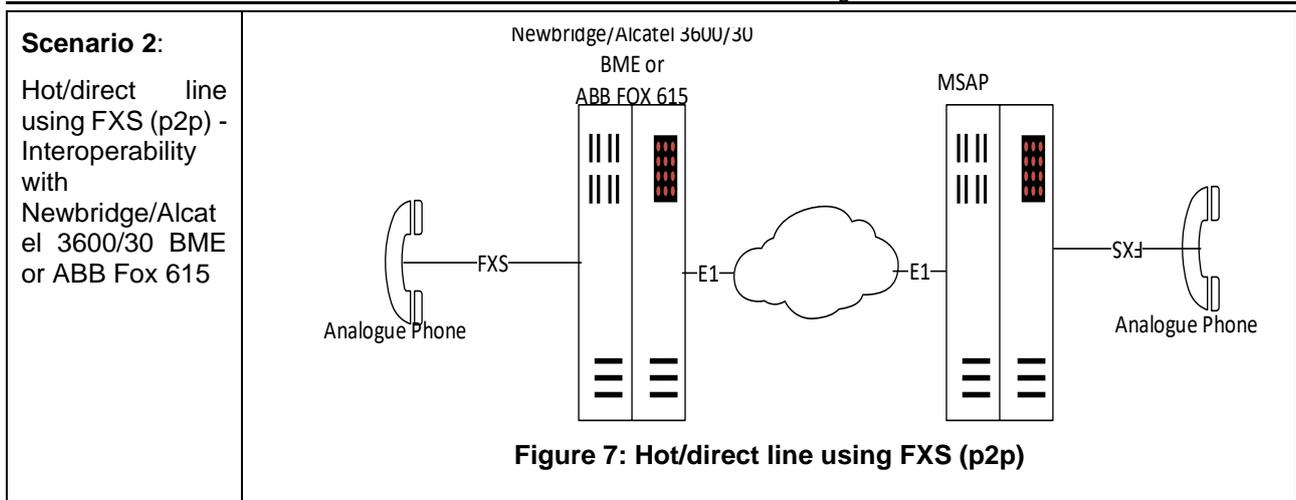
| Scenario   | Expected Results |      |        | Recorded Results |      |        | Score | Comment |
|------------|------------------|------|--------|------------------|------|--------|-------|---------|
| Parameters | Round Delay      | Trip | Errors | Round Delay      | Trip | Errors |       |         |
|            |                  |      |        |                  |      |        |       |         |

|   |   |               |                                    |                         |              |                |                |  |
|---|---|---------------|------------------------------------|-------------------------|--------------|----------------|----------------|--|
|   | @96k pbs  | @19.2 kbps    |                                    | @96 kbps                | @19.2 kbps   |                |                |  |
| <b>Scenario 3:</b> X.21 Asynchronous Round-Trip Test (P2P) - SCADA  | =<20 ms   | =<20 ms       | No                                 |                         |              |                |                |  |
| <b>Scenario 4:</b> X.21 Asynchronous Round-Trip Test (P2MP) - SCADA Multidropping   | =<20 ms   | =<20 ms       | No                                 |                         |              |                |                |  |
| <b>Scenario 5:</b> X.21 Synchronous Round-Trip Test (P2P) – Teleprotection – on MSAP Units  | <p style="text-align: center;"><b>Figure 4: Test setup for X.21 synchronous using NSD570/DIP5000 teleprotection devices</b></p> |               |                                    |                         |              |                |                |  |
| Parameters  | <b>Round Trip Delay at 64 kbps</b>  | <b>Errors</b> | <b>Round Trip Delay at 64 kbps</b> | <b>Errors</b>           | <b>Score</b> | <b>Comment</b> |                |  |
| <b>Results</b><br>Teleprotection  | =<5ms   | No            |                                    |                         |              |                |                |  |
| <b>Scenario 6:</b> X.21 Synchronous Round-Trip Test (P2P) – Teleprotection – Interoperability with Newbridge/Alcatel 3600/30 or ABB FOX 615 | <p style="text-align: center;"><b>Figure 5: Test setup for X.21 synchronous using NSD570/DIP5000 teleprotection devices</b></p> |               |                                    |                         |              |                |                |  |
| <b>Scenario</b>   | <b>Expected Results</b>   |               |                                    | <b>Recorded Results</b> |              | <b>Score</b>   | <b>Comment</b> |  |
| <b>Parameters</b>   | <b>Round Trip Delay at 64 kbps</b>  | <b>Errors</b> | <b>Round Trip Delay at 64 kbps</b> | <b>Errors</b>           |              |                |                |  |

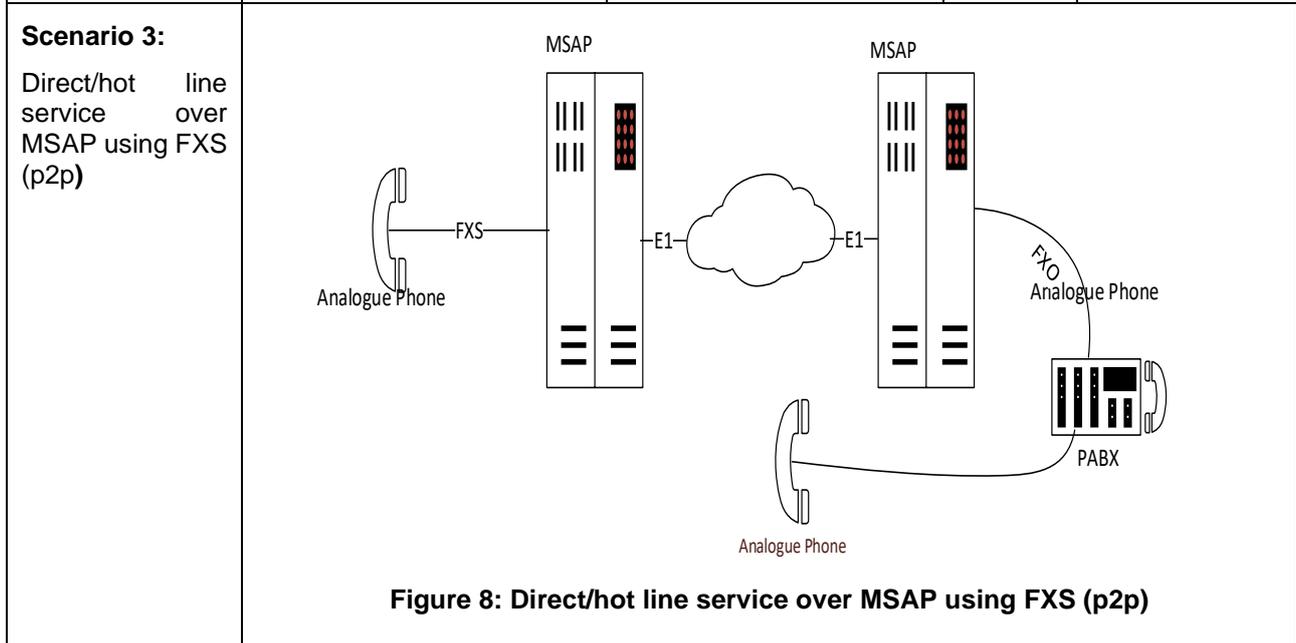
|                                   |                |                 |                    |             |                   |                |  |
|-----------------------------------|----------------|-----------------|--------------------|-------------|-------------------|----------------|--|
| <b>Results:</b><br>Teleprotection | -              | =<5ms           | No                 |             |                   |                |  |
| <b>Name</b>                       | <b>Surname</b> | <b>Comp any</b> | <b>Designation</b> | <b>Date</b> | <b>Signatu re</b> | <b>Comment</b> |  |
|                                   |                |                 |                    |             |                   |                |  |
|                                   |                |                 |                    |             |                   |                |  |

### 3.3 Test Case 3: Hotline/ Direct line service (Analogue)

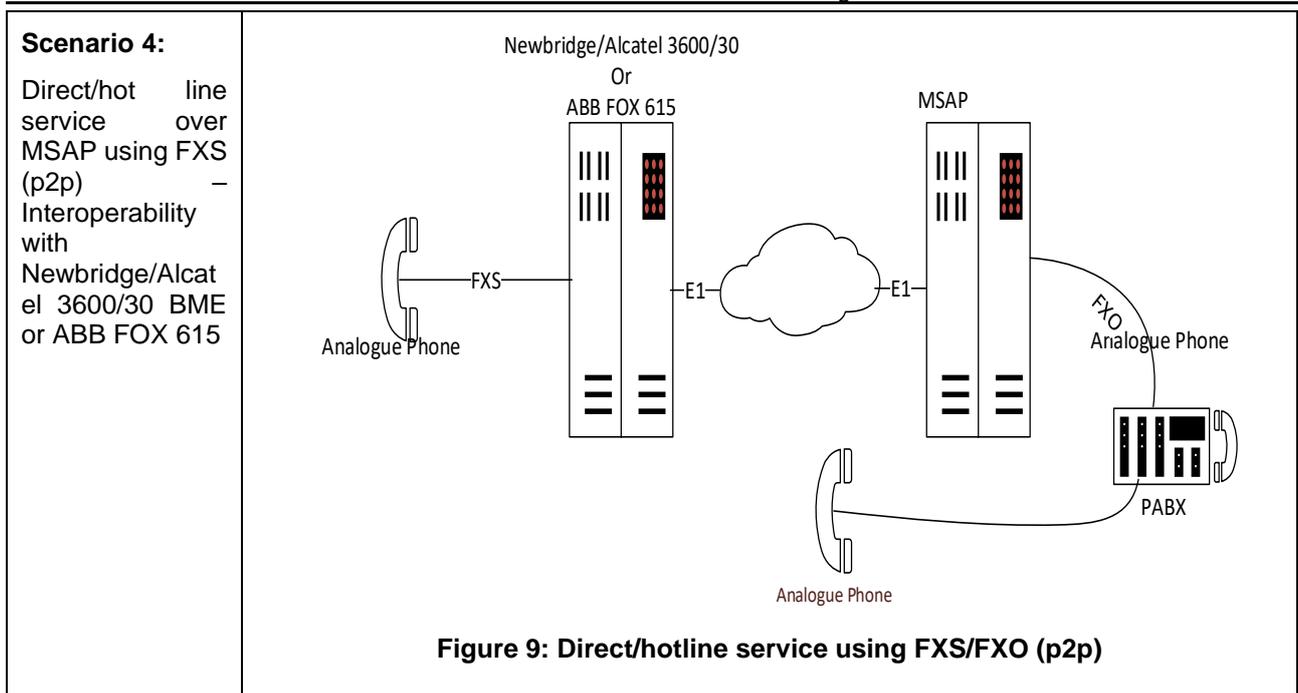
| SCENARIO  | TEST SETUP AND EXPECTED RESULTS   |                             |              |                 |
|---|---|-----------------------------|--------------|-----------------|
| <b>DESCRIPTION</b>                                    | <ol style="list-style-type: none"> <li>In this test, communication between two telephone devices must be established using the setup below.</li> <li>In this test, communication between two telephone devices must be established using the FXS and FXO setup below.</li> <li>Record the used codecs if any</li> </ol> |                             |              |                 |
| <b>Scenario 1:</b><br>Hot/direct line using FXS (p2p) | <p style="text-align: center;"><b>Figure 6: Hot/direct line using FXS (p2p)</b></p>   |                             |              |                 |
| <b>Actions</b>  | <b>Expected Results</b>   | <b>Used codecs (If any)</b> | <b>Score</b> | <b>Comments</b> |
| Pick up phone 1                                       | Phone 2 rings (without dialling) (Private Line Automatic Ringdown [PLAR])   |                             |              |                 |
| Pick up phone 2                                       | Phone 1 rings (without dialling) (PLAR)   |                             |              |                 |



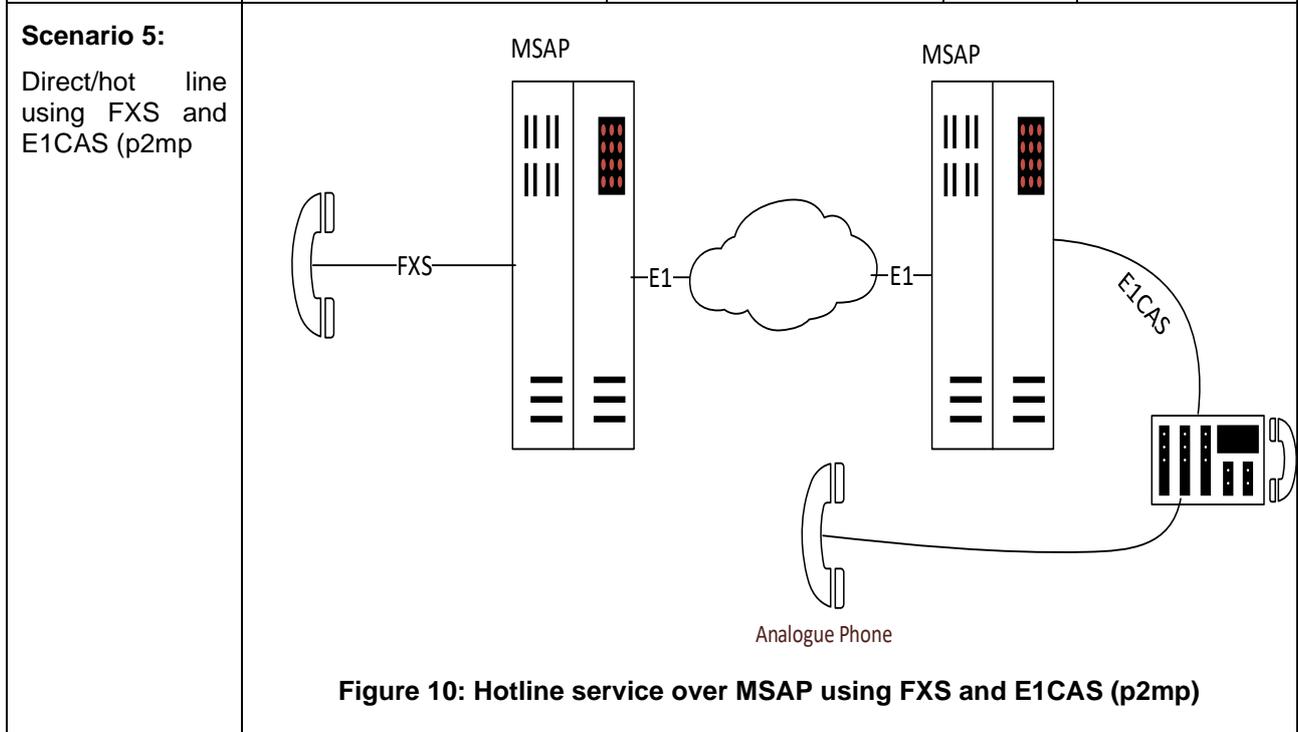
| Actions         | Expected Results  | Used codecs (If any) | Score | Comments |
|-----------------|---|----------------------|-------|----------|
| Pick up phone 1 | Phone 2 rings (without dialling) (Private Line Automatic Ringdown [PLAR]) |                      |       |          |
| Pick up phone 2 | Phone 1 rings (without dialling) (PLAR)                                   |                      |       |          |



| Actions         | Expected Results                 | Used Codecs (If any) | Score | Comments |
|-----------------|----------------------------------|----------------------|-------|----------|
| Pick up phone 1 | Phone 2 rings (without dialling) |                      |       |          |
| Pick up phone 2 | Phone 1 rings (without dialling) |                      |       |          |



| Actions         | Expected Results                 | Used Codecs (If any) | Score | Comments |
|-----------------|----------------------------------|----------------------|-------|----------|
| Pick up phone 1 | Phone 2 rings (without dialling) |                      |       |          |
| Pick up phone 2 | Phone 1 rings (without dialling) |                      |       |          |



| Actions | Expected Results | Used Codecs (If any) | Score | Comments |
|---------|------------------|----------------------|-------|----------|
|---------|------------------|----------------------|-------|----------|

|                 |                                  |  |  |
|-----------------|----------------------------------|--|--|
| Pick up phone 1 | Phone 2 rings (without dialling) |  |  |
| Pick up phone 2 | Phone 1 rings (without dialling) |  |  |

**Scenario 6:**  
Direct/hot line using FXS and E1CAS (p2mp) – Interoperability with Newbridge/Alcatel 3600/30 BME or ABB FOX 615

**Figure 11: Hotline service over MSAP using FXS and E1CAS (p2mp)**

| Actions         | Expected Results                 | Used Codecs (If any) | Score | Comments |
|-----------------|----------------------------------|----------------------|-------|----------|
| Pick up phone 1 | Phone 2 rings (without dialling) |                      |       |          |
| Pick up phone 2 | Phone 1 rings (without dialling) |                      |       |          |

| Name | Surname | Company | Designation | Date | Signature | Comments |
|------|---------|---------|-------------|------|-----------|----------|
|      |         |         |             |      |           |          |
|      |         |         |             |      |           |          |

**3.4 Test Case 4: VoIP Services**

| SCENARIO           | TEST SETUP AND EXPECTED RESULTS   |
|--------------------|---|
| <b>DESCRIPTION</b> | <ol style="list-style-type: none"> <li>In this test, communication between two telephone devices must be established using the setup below.</li> <li>In this test, communication between two telephone devices must be established using the PoE.</li> <li>Record the used codecs if any</li> </ol> |

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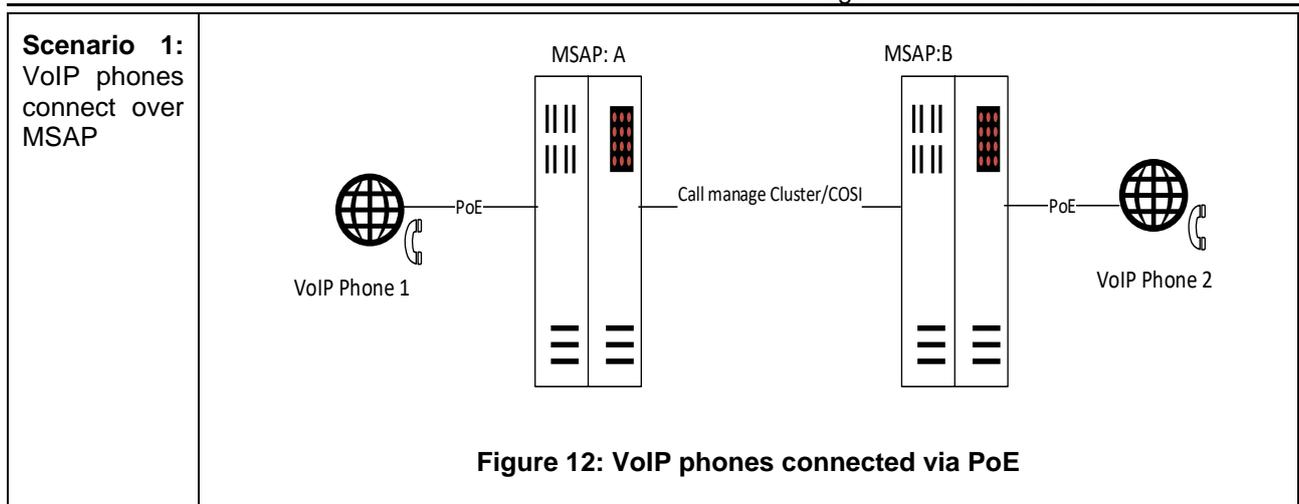


Figure 12: VoIP phones connected via PoE

| Actions             | Expected Results | Used Codecs (If any) | Score | Comments |
|---------------------|------------------|----------------------|-------|----------|
| Phone1 dials Phone2 | Phone 2 rings    |                      |       |          |
| Phone2 dials Phone1 | Phone 1 rings    |                      |       |          |

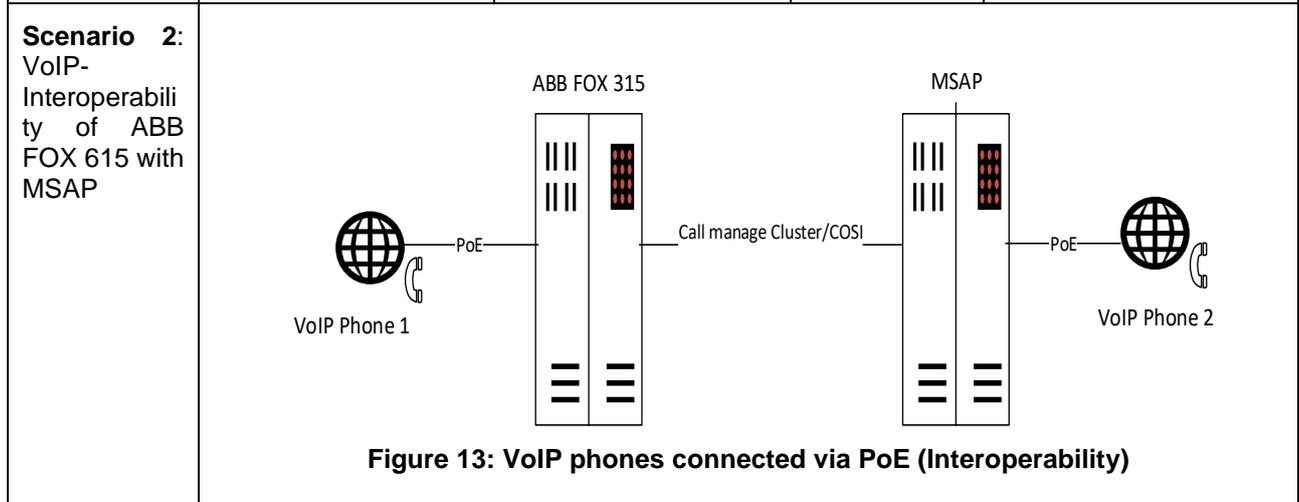
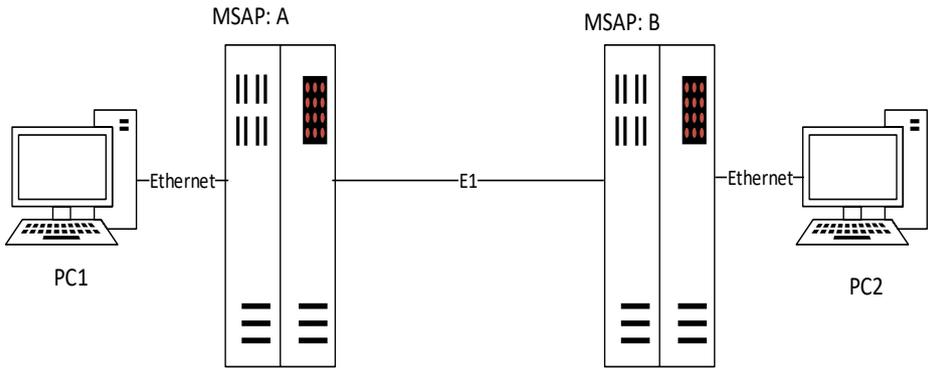
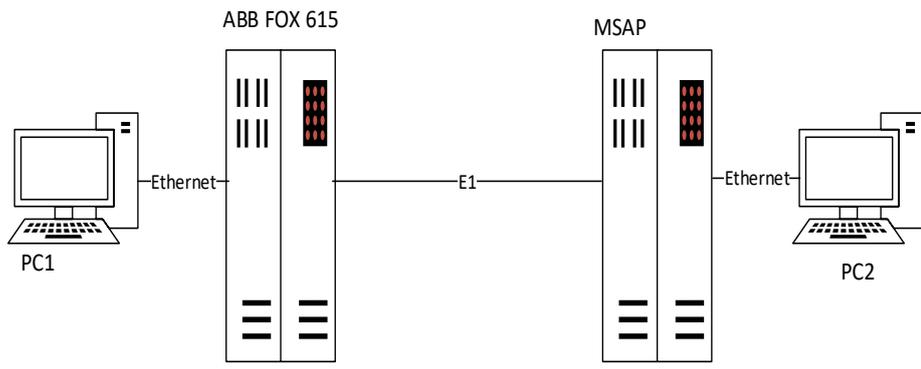


Figure 13: VoIP phones connected via PoE (Interoperability)

| Actions             | Expected Results | Used Codecs (If any) | Score | Comments |
|---------------------|------------------|----------------------|-------|----------|
| Phone1 dials Phone2 | Phone 2 rings    |                      |       |          |
| Phone2 dials Phone1 | Phone 1 rings    |                      |       |          |

| Name | Surname | Company | Designation | Date | Signature | Comments |
|------|---------|---------|-------------|------|-----------|----------|
|      |         |         |             |      |           |          |
|      |         |         |             |      |           |          |

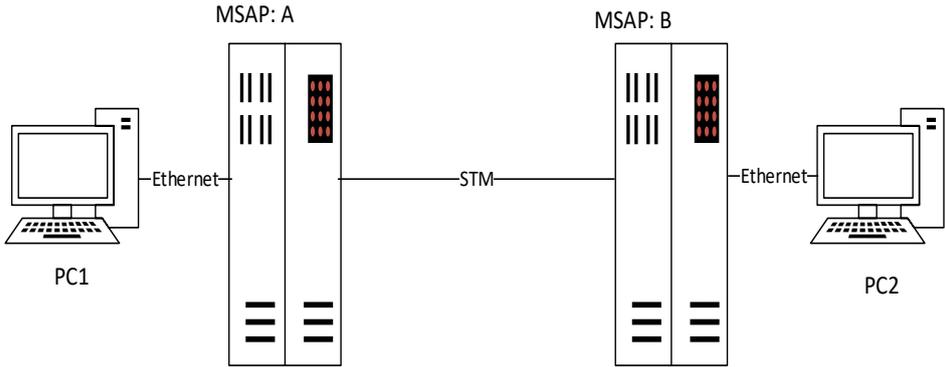
### 3.5 Test Case 5: Ethernet over PDH

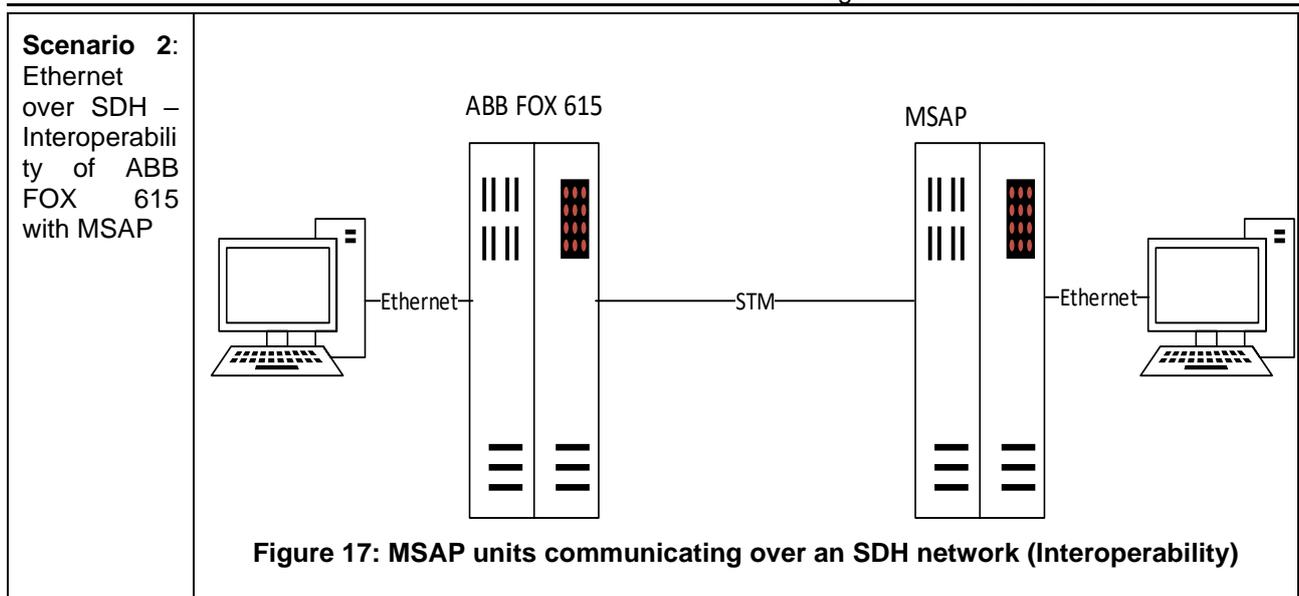
| SCENARIO  | TEST SETUP AND EXPECTED RESULTS   |                  |         |
|---|---|------------------|---------|
| DESCRIPTION   | The purpose of this test is to establish communication between two MSAP units over a PDH network.   |                  |         |
| <p><b>Scenario 1:</b><br/>Ethernet over PDH via MSAP</p>                                    |  <p style="text-align: center;"><b>Figure 14: PDH Network (MSAP)</b></p>                 |                  |         |
| Action  | Expect Results  | Recorded Results | Comment |
| PC1 ping PC2  | Successful ping, no packet loss   |                  |         |
| PC2 Ping PC1  | Successful ping, no packet loss   |                  |         |
| <p><b>Scenario 2:</b><br/>Ethernet over PDH – Interoperability of ABB FOX 615 with MSAP</p> |  <p style="text-align: center;"><b>Figure 15:PDH network- Interoperability Test</b></p> |                  |         |
| Action  | Expect Results  | Recorded Results | Comment |
| PC1 ping PC2  | Successful ping, no packet loss   |                  |         |

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| PC2<br>PC1 | Ping    | Successful ping, no packet loss |             |      |           |          |
|------------|---------|---------------------------------|-------------|------|-----------|----------|
| Name       | Surname | Company                         | Designation | Date | Signature | Comments |
|            |         |                                 |             |      |           |          |
|            |         |                                 |             |      |           |          |

### 3.6 Test Case 6: Ethernet over SDH

| SCENARIO                               | TEST SETUP AND EXPECTED RESULTS  |                  |         |
|--|--|------------------|---------|
| DESCRIPTION                            | The purpose of this test is to establish communication between two MSAP units over a SDH network.  |                  |         |
| Scenario 1: Ethernet over SDH via MSAP |  <p style="text-align: center;"><b>Figure 16: MSAP units communicating over an SDH network</b></p> |                  |         |
| Action                                 | Expect Results   | Recorded Results | Comment |
| PC1 ping PC2                           | Successful ping, no packet loss  |                  |         |
| PC2 Ping PC1                           | Successful ping, no packet loss  |                  |         |

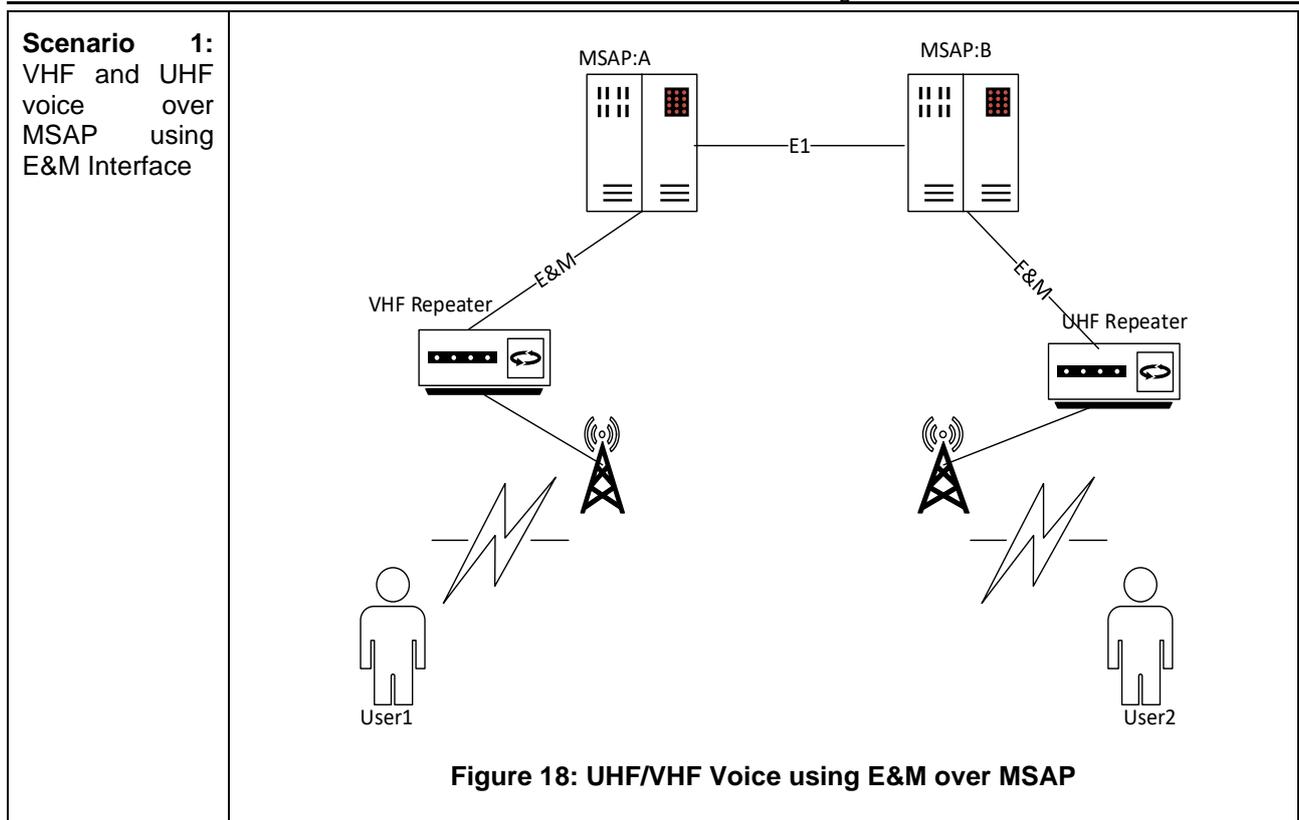


| Action          | Expect Results                  | Recorded Results | Comment     |      |           |          |
|-----------------|---------------------------------|------------------|-------------|------|-----------|----------|
| PC1 ping<br>PC2 | Successful ping, no packet loss |                  |             |      |           |          |
| PC2 Ping<br>PC1 | Successful ping, no packet loss |                  |             |      |           |          |
| Name            | Surname                         | Company          | Designation | Date | Signature | Comments |
|                 |                                 |                  |             |      |           |          |
|                 |                                 |                  |             |      |           |          |

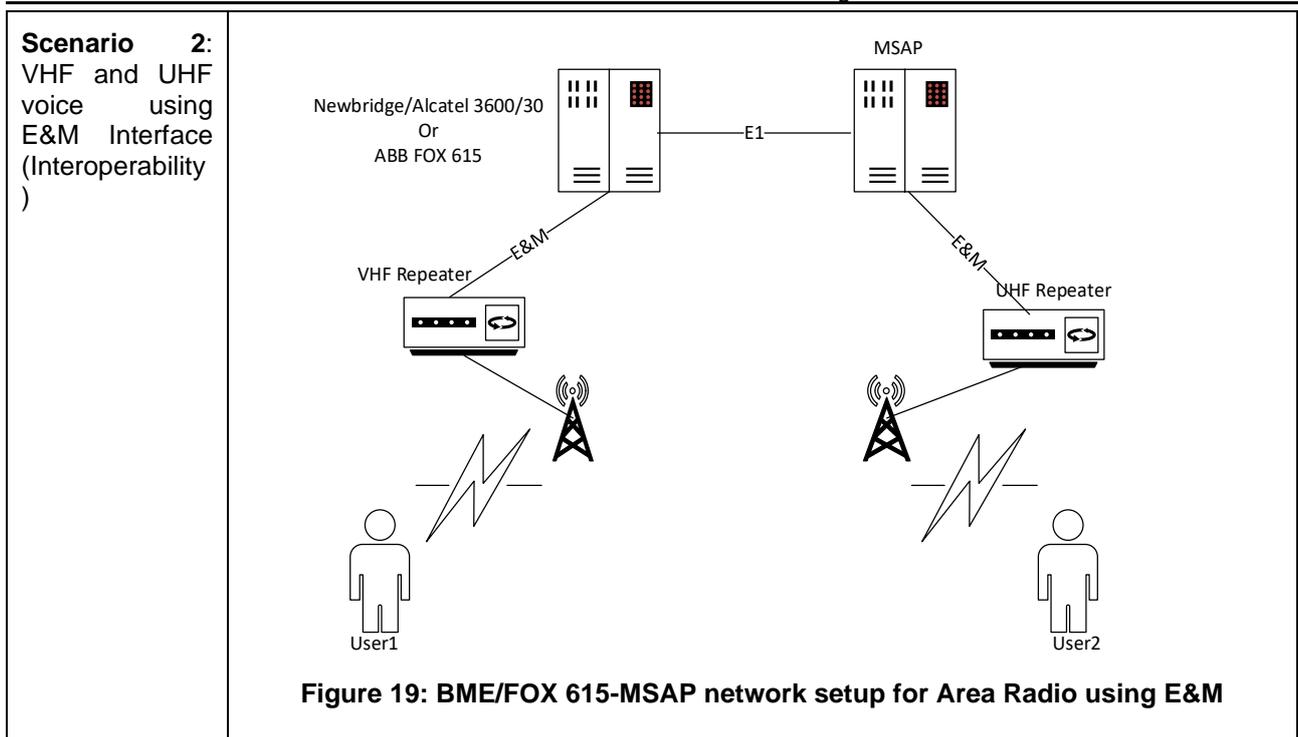
### 3.7 Test Case 7: Area Radio provisioned over MSAP

| SCENARIO           | TEST SETUP AND EXPECTED RESULTS  |
|--------------------|--|
| <b>DESCRIPTION</b> | This test measures the ability of the BME and MSAP to deliver VHF and UHF voice using E&M interface. E1 interface is used to connect the BME and MSAP. |

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| Actions            | Expected results  | Score | Comments |
|--------------------|---|-------|----------|
| User1 PTT<br>User2 | Voice communication sent from User1 to be heard clearly on User2. |       |          |
| User2 PTT<br>user1 | Voice communication sent from User2 to be heard clearly on User1. |       |          |



| Actions |         | Expected results  | Score       |      |           | Comments |  |
|---------|---------|---|-------------|------|-----------|----------|--|
| User1   | PTT     | Voice communication sent from User1 to be heard clearly on User2. |             |      |           |          |  |
| User2   | PTT     | Voice communication sent from User2 to be heard clearly on User1. |             |      |           |          |  |
| Name    | Surname | Company   | Designation | Date | Signature | Comment  |  |
|         |         |   |             |      |           |          |  |
|         |         |   |             |      |           |          |  |

Figure 20: VHF/UHF voice using E&N over MSAP

### 3.8 Test cases summary and scoring sheet

Below is the summary of the test cases to be conducted and the scoring sheet.

Table 1: Summary of test cases and scores

| Test Case | Designation                                   | Score |
|-----------|---|-------|
| 1         | Network latency tests using a portable tester |       |

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|             |   |  |
|-------------|---|--|
| Scenario: 1 | X.21 Synchronous Round-Trip Test (P2P)  |  |
| Scenario: 2 | X.21 Asynchronous Round-Trip Test (P2P)   |  |
| Scenario: 3 | X.21 Asynchronous Round-Trip Test (P2MP): 2 circuits  |  |
| Scenario: 4 | X.21 Asynchronous Round-Trip Test (P2MP): 5 Circuits  |  |
| Scenario: 5 | X.21 Asynchronous Round-Trip Test (P2MP): 10 Circuits   |  |
| <b>2</b>    | <b>SCADA and Teleprotection tests</b>   |  |
| Scenario: 1 | X.21 Asynchronous Round-Trip Test (P2P) - SCADA   |  |
| Scenario: 2 | X.21 Asynchronous Round-Trip Test (P2MP) - SCADA Multidropping  |  |
| Scenario: 3 | X.21 Asynchronous Round-Trip Test (P2P) - SCADA: Interoperability Test  |  |
| Scenario: 4 | X.21 Asynchronous Round-Trip Test (P2MP) - SCADA Multidropping: Interoperability Test                                   |  |
| Scenario: 5 | :X.21 Synchronous Round-Trip Test (P2P) – Teleprotection – on MSAP Units  |  |
| Scenario: 6 | X.21 Synchronous Round-Trip Test (P2P) – Teleprotection – Interoperability with Newbridge/Alcatel 3600/30 or ABB FOX615 |  |
| <b>3</b>    | <b>Hotline/ Direct line service (Analogue)</b>  |  |
| Scenario: 1 | Hot/direct line using FXS (p2p)   |  |
| Scenario: 2 | Hot/direct line using FXS (p2p) -Interoperability with Newbridge/Alcatel 3600/30 BME or ABB FOX 615                     |  |
| Scenario: 3 | Direct/hot line service over MSAP using FXS (p2p)   |  |
| Scenario: 4 | Direct/hot line service over MSAP using FXS (p2p) – Interoperability with Newbridge/Alcatel 3600/30 BME or ABB FOX 615  |  |
| Scenario: 5 | Direct/hot line using FXS and E1CAS (p2mp)  |  |
| Scenario: 6 | Direct/hot line using FXS and E1CAS (p2mp) – Interoperability with Newbridge/Alcatel 3600/30 BME or ABB FOX 615         |  |

|            |  |  |
|------------|--|--|
| <b>4</b>   | <b>VoIP Services</b>   |  |
| Scenario 1 | VoIP phones connect over MSAP  |  |
| Scenario 2 | VoIP- Interoperability of ABB FOX 615 with MSAP                                      |  |
| <b>5</b>   | <b>Ethernet over PDH</b>   |  |
| Scenario 1 | Ethernet over PDH via MSAP   |  |
| Scenario 2 | Ethernet over PDH – Interoperability of the ABB FOX 615 with MSAP                    |  |
| <b>6</b>   | <b>Ethernet over SDH</b>   |  |
| Scenario 1 | Ethernet over SDH via MSAP   |  |
| Scenario 2 | Ethernet over SDH – Interoperability of the ABB FOX 615 with MSAP                    |  |
| <b>7</b>   | <b>Area Radio provisioned over MSAP</b>  |  |
| Scenario 1 | VHF and UHF voice over MSAP using E&M Interface                                      |  |
| Scenario 2 | VHF and UHF voice using E&M Interface - Interoperability of the BME/FOX615 with MSAP |  |

#### 4. Authorization

This document has been seen and accepted by:

| Name and surname | Designation                 |
|------------------|-----------------------------|
| Zwelandile Mbebe | Chief Engineer PTM&C        |
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#### 5. Revisions

| Date      | Rev. | Compiler    | Remarks   |
|-----------|------|-------------|---|
| June 2022 | 1    | J. Mataboge | Input to technical evaluation of the MSAP enquiry |

#### 6. Development team

The following people were involved in the development of this document:

- Joel Mataboge
- Krupa Jose

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- Zwelandile Mbebe

## **7. Acknowledgements**

None