Prepared (also subject responsible if other)		No.		
Anish PK				
Approved	Checked	Date	Rev	Reference
		25-01-2020	Ver1.0	

MOP of TWAMP Analysis for Nokia Site

Table of Contents

Prepared (also subject responsible if other)		No.		
Anish PK				
Approved	Checked	Date	Rev	Reference
		25-01-2020	Ver1.0	

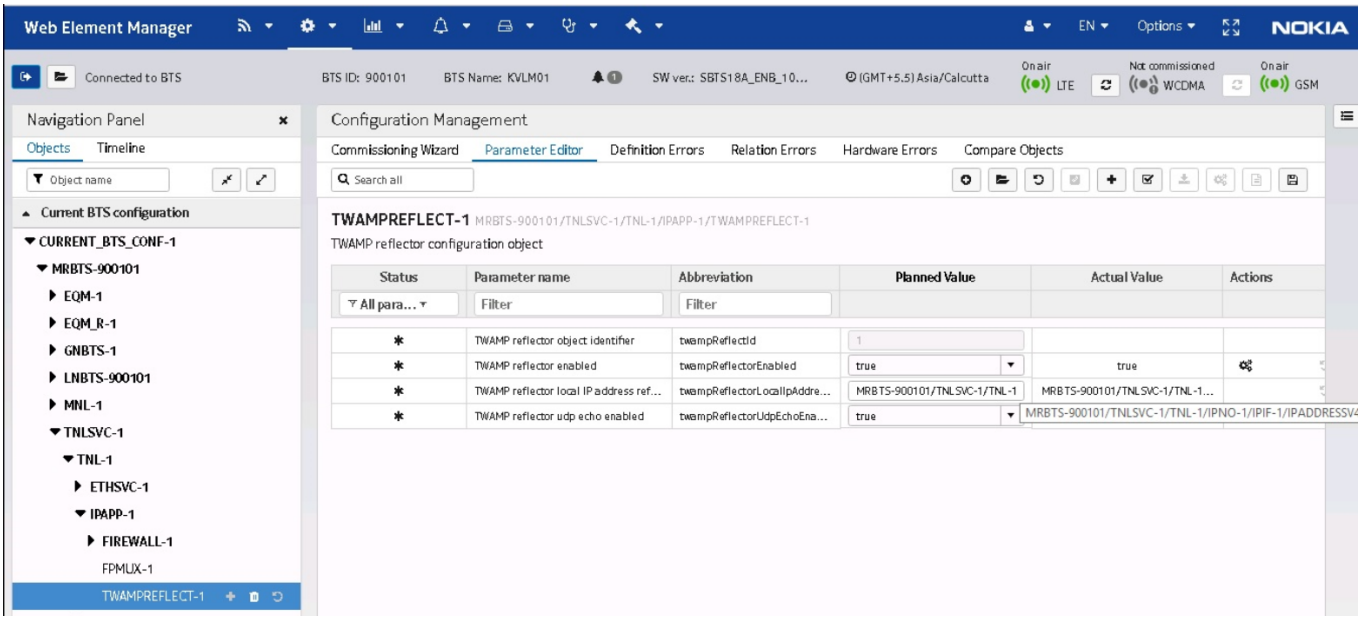
TWAMP Overview

Two-Way Active Measurement Protocol (TWAMP) defines a standard for measuring round-trip network performance between any two devices that support the TWAMP protocols.

For monitoring the packet loss/latency issues in LTE network, TWAMP reflector configurations are updated in each of the EnodeBs against User plane VLAN/IP and the corresponding reflector port is enabled at the server end also.

TWAMP report gives insight into the packet loss issues in 4G network. It captures all PL issues >0.5% with a measurement granularity of 1min & the counter is incremented whenever PL goes beyond 0.5%

TWAMP configuration snapshot from BTS



Prepared (also subject responsible if other)		No.		
Anish PK				
Approved	Checked	Date	Rev	Reference
		25-01-2020	Ver1.0	

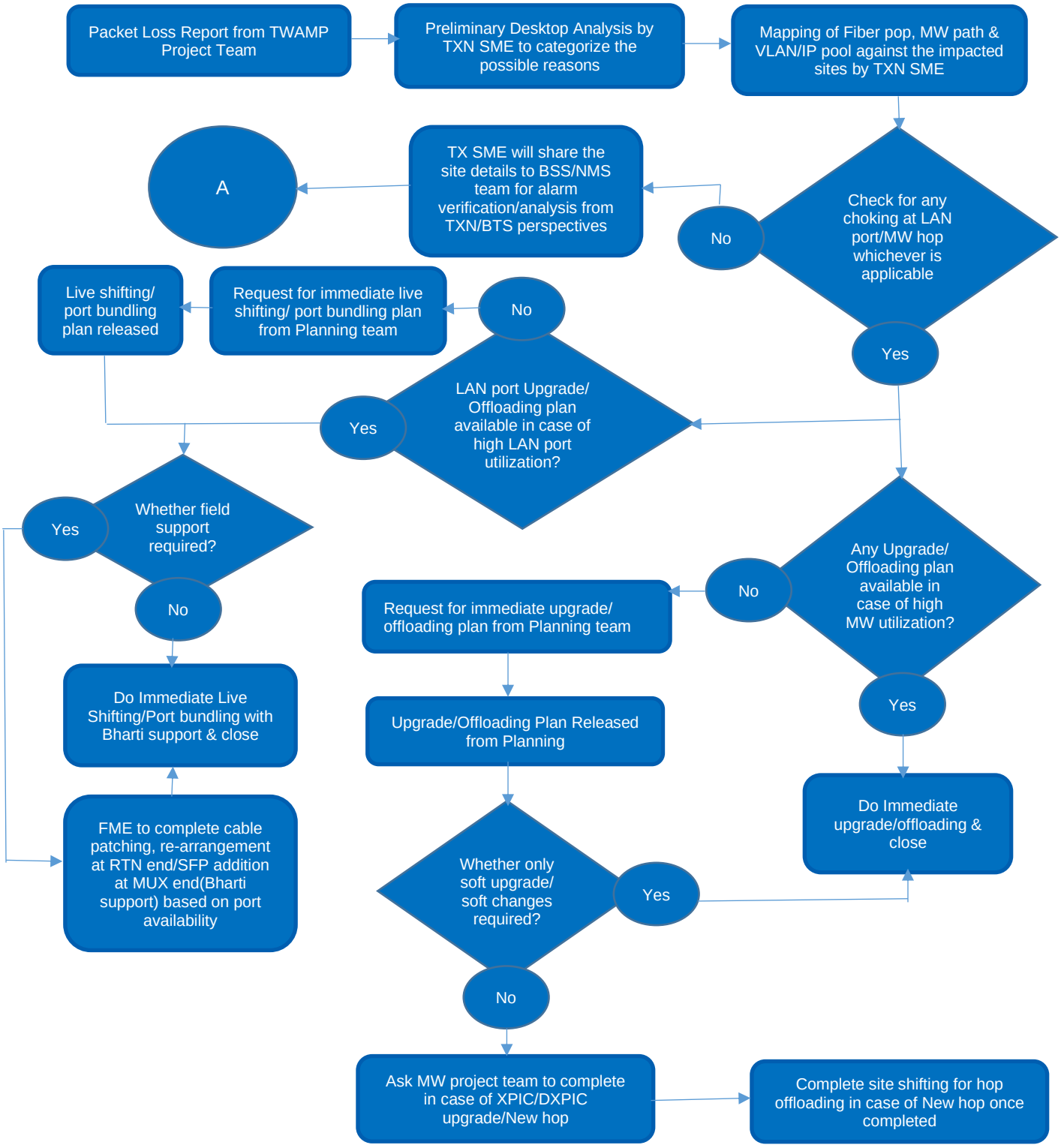
Analysis Checkpoints

This document explains E2E troubleshooting steps for analysing & addressing the TWAMP/Packet loss issues in LTE network.
Below points to be covered while analysing impacted sites.

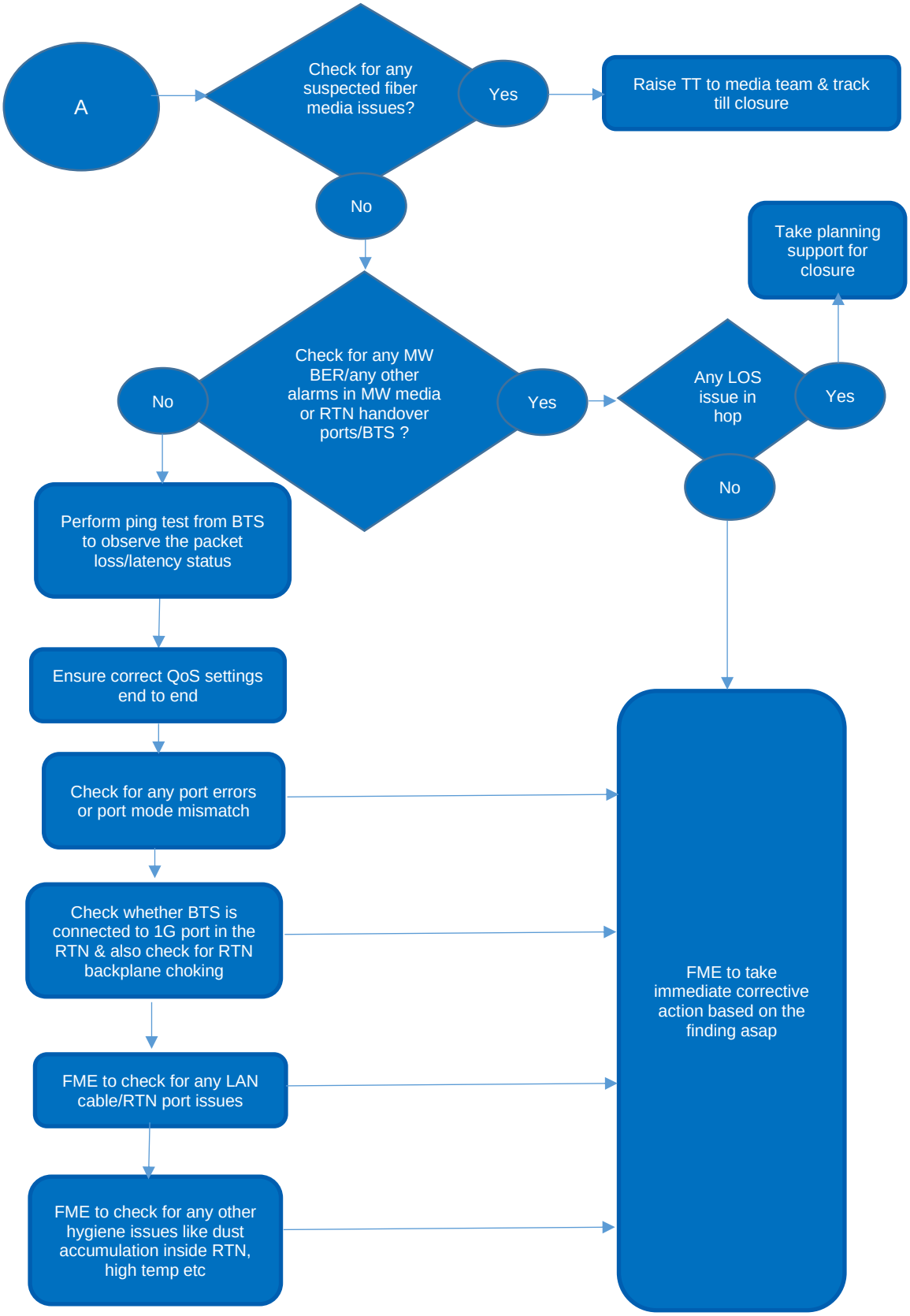
- End-to-End Utilization in the Transmission Path
- Alarms in TXN media as well as BTS
- Site Hygiene
- QoS Settings
- Other Learnings

Prepared (also subject responsible if other)		No.		
Anish PK				
Approved	Checked	Date	Rev	Reference
		25-01-2020	Ver1.0	

Flow Chart



Prepared (also subject responsible if other)		No.		
Anish PK				
Approved	Checked	Date	Rev	Reference
		25-01-2020	Ver1.0	



Prepared (also subject responsible if other)		No.		
Anish PK				
Approved	Checked	Date	Rev	Reference
		25-01-2020	Ver1.0	

Activity Details

Preliminary Analysis

1. Map the fiber pop, MW path, VLAN/IP pool against the impacted sites
2. See whether all sites in the fiber pop are impacted to isolate the common point
3. See whether all sites in common MW Path are impacted
4. Raise TT to TNG/ANG/MPLS as per the circuit details in case fiber media issue is suspected

High Utilization

1. Check for any High LAN port Utilization at the UNI port in case of bulk impact for all sites in the handover
2. Perform Live Shifting of part of the sites to a different port or do Port bundling based on feasibility & plan available
3. Check for high MW utilization if all sites in a common MW path are impacted
4. Check for any RTN backplane choking scenario incase of any bulk impact

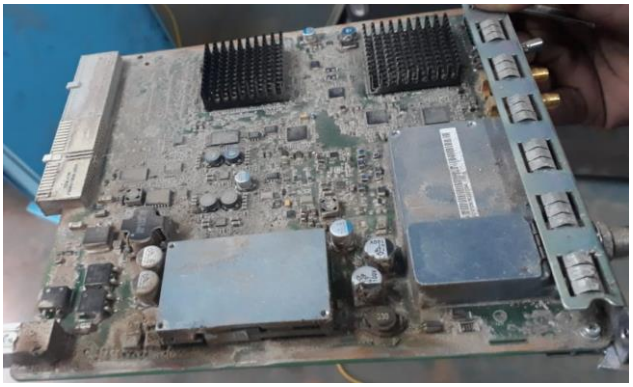
Alarms & Site Hygiene

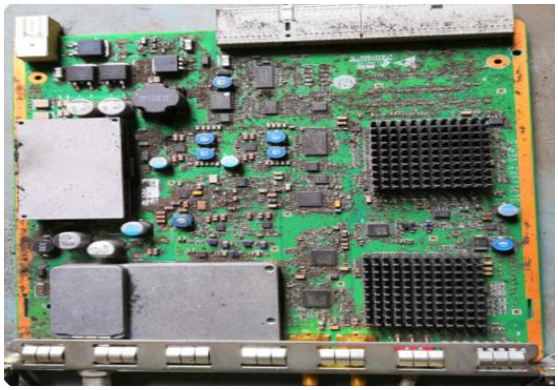
1. Check for any alarms in the MW media or Mux handover port/ BTS handover port
2. Ensure no MW BER, HW alarms, errors at connected ports
3. Check for any related alarms at BTS end as well
4. Check for any port mode/auto-negotiation mismatch alarms
5. Check for any drop ratio over alarm in enodeB connected ports which are mostly due to LAN cable issues or sometimes due to System Module port issues.
6. Inspect for any RTN or BTS port level issues
7. Check for any LAN cable damage - mostly due to routing cables outdoor in the absence of Armored cables.
8. Ensure that the LAN cables in use are not having any losses & also should be CAT5e or higher.
9. Ensure to connect BTS to 1G port in the RTN & also check for any RTN backplane choking scenario.
10. Check for any dust accumulation inside RTN.
11. Check for any high temperature issues that can impact the performance

Dust Accumulation in RTN FAN:-

Prepared (also subject responsible if other)		No.		
Anish PK				
Approved	Checked	Date	Rev	Reference
		25-01-2020	Ver1.0	

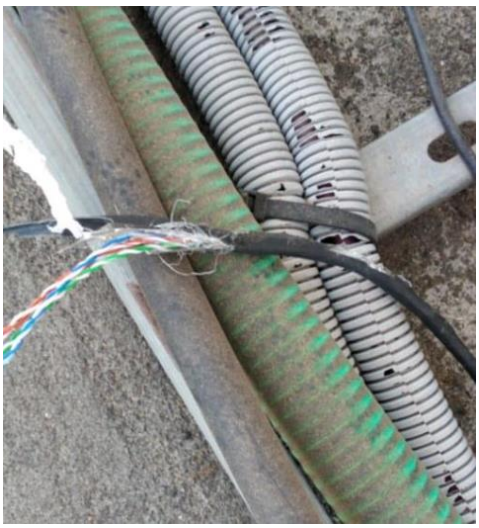
Dust Accumulation in RTN HW:-





Dust Cleaning from RTN HW: -

LAN cable Damage in outdoor installations:-



Prepared (also subject responsible if other)		No.		
Anish PK				
Approved	Checked	Date	Rev	Reference
		25-01-2020	Ver1.0	

MW Waveguide Damage :-

Prepared (also subject responsible if other)		No.		
Anish PK				
Approved	Checked	Date	Rev	Reference
		25-01-2020	Ver1.0	

Action Point Summary

Utilization: -

Below points to be considered. Ensure that utilization is within limits end-to-end

- MPLS NNI Utilization
- Fiber ring utilization
- Fiber pop LAN port utilization
- MW hop utilization
- RTN backplane utilization

Alarms: -

- End to end MW/RTN path from MUX handover port till the drop port at BTS end should be alarm (SA/SD) free
- System Module port issues can also lead to PL
- Complete alarm history to be verified from both TXN & BTS perspective as any intermittent alarms also may be there

Site Hygiene: -

- RTN or BTS port level issues
- LAN cable connectivity from RTN to BTS
- Dust accumulation in RTN
- Any high temperature issues that can impact the performance

QoS Settings: -

- Proper QoS configuration as per recommendation end-to-end

Other Inputs: -

- Ensure no capping on MUX end handover UNI ports
- Ensure that port bundling is done properly both at RTN & MUX ends wherever 1G+1G port aggregation is done and that both the bundled ports are error free & sharing equal traffic
- Ensure to remove capping if any on both the bundled ports
- Verify for any bandwidth limitation in RTN 980 & 950 with specific CSH board and contributing PKT LOSS (TWAMP) in UNI BUNDLED POP
- Ensure that MUX handovers are taken either to RTN controller card or to the EG4/EG6 cards in the initial slots itself that provide max backplane capacity to avoid any chances of RTN backplane choking which will be very difficult to identify
- Always consider the backplane capacity of each RTN card for all handovers & accordingly limit the number of MUX UNI handovers to same RTN card
- Ensure 1000Mbps connectivity for all enodeBs & avoid any port mode/port speed/auto-negotiation mismatch between the connected ports. Settings should be 1000Mb full duplex with auto negotiation enabled or equivalent.
- Make sure that the LAN cables in use are not having any losses & also should be CAT5e or higher.

Learnings

Prepared (also subject responsible if other)		No.		
Anish PK				
Approved	Checked	Date	Rev	Reference
		25-01-2020	Ver1.0	

1) RTN Backplane Choking:

Apart from RTN port capacity, backplane switching capacity also should be tracked to improve end user experience and resolve TWAMP packet loss issues. Since it does not generate any alarms/events, manual calculation required to identify the backplane chocking in the network.
Ensure that MUX handovers are taken either to RTN controller card or to the EG4/EG6 cards in the initial slots that provide max backplane switching capacity to avoid any chances of backplane choking which will be very difficult to identify.

RTN Type	Controller Card	Switching Capacity Node/Controller Card	Switching Capacity - EG4 card	Switching Capacity-EM6T card
RTN905	CSHP(GEPort - 4 Nos (E) & 2 Nos (E/O)) - Slot 1	8Gbps	No Free Slots	Not Supported
RTN910A	CSHR(GEPort - 4 Nos (E) & 2 Nos (E/O)) - Slot1	10Gbps	2.5Gbps for Slots 3 &4	Not Supported
RTN950A	CSHO(GEPort - 4 Nos (E) & 2 Nos (E/O)) - Slot 7	10Gbps	2.5Gbps for Slots 1 to 6	Not Supported
RTN980	CSHN(GEPort - 2 Nos(E/O)) - Slot 15 & Slot20	22Gbps	2.5 Gbps for slots 1 to 6	1 Gbps
			1 Gbps for slots 7 to 14	1 Gbps
	CSHNA(GEPort - 2 Nos(E) & 2 Nos (E/O)) - Slot 15 & Slot20	43Gbps	2.5 Gbps for slots 1 to 2	1 Gbps
			1 Gbps for slots 3 to 14	1 Gbps
	CSHNU	120Gbps	2.5Gbps	1 Gbps

2) Bandwidth limitation in RTN 980 & 950 with specific CSH board and contributing Packet loss in UNI bundled pop

While UNI Port Bundling required on high dependent sites, we need to check SL91CSH & SLB1CSHNA HW installed in Optix RTN 950 & RTN980 respectively, Complete RTN box replacement will be required in case of Spare Controller board un-availability.
Manual calculation required to identify backplane chocking cases.

AT POP location where UNI port is Bundled

- Existing SL91CSH (Part no/BOM Code 03020RAR) required to replace with SL92CSH(Part no/BOM Code 03054170) RTN950
- SLB1CSHNA (Part no/BOM Code 3056502) required to replace with SLB1CSHN (Part no/BOM Code 03020VWW) or SLB2CSHN(Part no/BOM Code 3054169) in RTN980

Prepared (also subject responsible if other)		No.		
Anish PK				
Approved	Checked	Date	Rev	Reference
		25-01-2020	Ver1.0	

3) Port Mode Mismatch/Auto-negotiation Mismatch Alarms: -

Below are possible reasons for the port mode mismatch alarm

- Any mismatch in Port settings/port capability at BTS end & RTN end (1000Mb full duplex & auto negotiation enabled) can lead to this alarm
- LAN cable issues (cable should support the above speed) – It should be CAT5e or higher. Up to CAT5, it will support only 100Mbps theoretically & will also depend on cable length.

Below actions required for correcting the port capability/speed

- Make sure that the replaced LAN cable also is not having any issues & also should be CAT5e or higher.
- Change RTN port also incase alarm not getting cleared
- Cross check the port settings at RTN end as well as BTS end
- Try port reset from RTN & also recommission/reset the BTS if necessary
- If none of the above steps are successful, replace the System module as the port may be faulty at SM end.

4) Always maintain LAN port & MW Utilization within limits: -

MW Hop Utilization: -

- Regular tracking of MW hop utilization & close looping with Bharti planning & deployment teams for hop upgrades & new deployments
- Immediate QAM upgrade wherever feasible based on planning inputs
- DC Plan to be implemented wherever feasible based on planning inputs
- XPIC & D-XPIC upgrades in sync with Huawei deployment team
- TDM E1 deletion & re-arrangement on regular basis to free up ethernet BW in sync with project rollout/swap
- Fiber pop/Traffic shifting across all technologies for offloading of highly utilized hops
- Alternate frequency implementation for AMDS hops in sync with planning team to avoid hop congestion

LAN port Utilization: -

- Offloading plan/request to be initiated immediately to Bharti planning once the port utilization crosses 80%
- Plan implementation in sync with TNG/ANG teams
- 4G LAN port offloading through live shifting of VLANs to new port
- Port bundling at MUX & RTN end for doubling the BW from 1Gig to 2Gig
- Fiber pop/Traffic shifting across all technologies for offloading of highly utilized handovers