Terms of Reference

The Republic of the Union of Myanmar

Provision of Consulting Services to Verify the Network Performance of the Mobile Operators' Networks

(C 1.1.25)

Date: 1st December 2018

Background

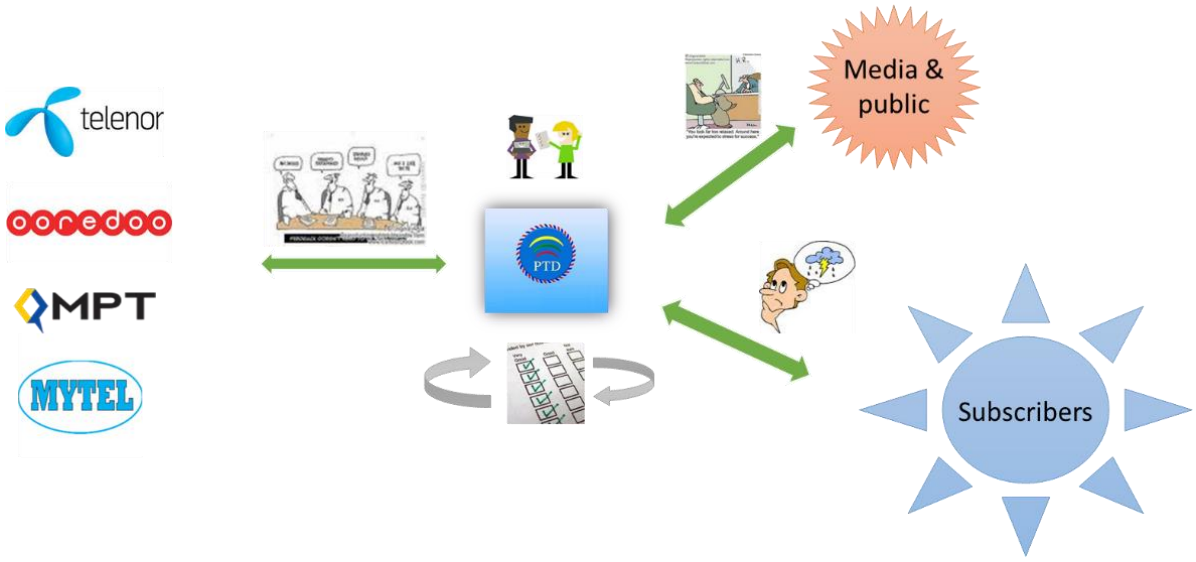
The Government of the Republic of the Union of Myanmar (Government) has undertaken telecommunications sector reforms in order to:

(i) increase by tenfold access to quality telecommunication services;
(ii) make services affordable for its citizens; and
(iii) develop the required ICT infrastructure in Myanmar that will facilitate inclusive growth and poverty reduction.

With the reform process undertaken in the Telecom Sector, Myanmar Post Telecommunication (MPT)'s long lasting monopoly is being replaced by a competitive market structure consisting of multiple operators. Telenor Myanmar Limited and Ooredoo Myanmar Limited and Telecom International Myanmar co., Ltd (MyTel) were awarded Nationwide Telecommunications Services Licenses. The Nationwide Telecommunications Services License holders shall fulfill the Minimum Geographic Coverage Commitments, Minimum Population Coverage Commitments for mobile Voice and mobile Data as well as the Quality of Service (QoS) Commitment contained in their License nationwide basic based on random check.

Given that the Regulator needs to ensure that the Licensees (four operators) have fulfilled the commitments of their licenses, with the assistance of consultant, there is a need to do the drive test for coverage and QoS measurement as the Regulator itself cannot do to get the result in time.

The Government has received support under the World Bank financed Telecommunications Sector Reform Project to hire the consultants for the drive test and QoS measurement. The activity described in these Terms of Reference is to support and advise PTD to do drive test and QoS measurement and to analyze whether the licensees meet their Geographic Coverage commitment and QoS commitment based on results that has got from drive test and QoS measurement.



One of key role of PTD make sure Operators provide right commitment about network quality, network coverage and reduce complaint from subscribers

Objective

The main objective of this assignment is to provide support and advise to Posts and Telecommunications Department (PTD)to:

(i) Consolidate the coverage map for each region of Myanmar in consultation with operators.

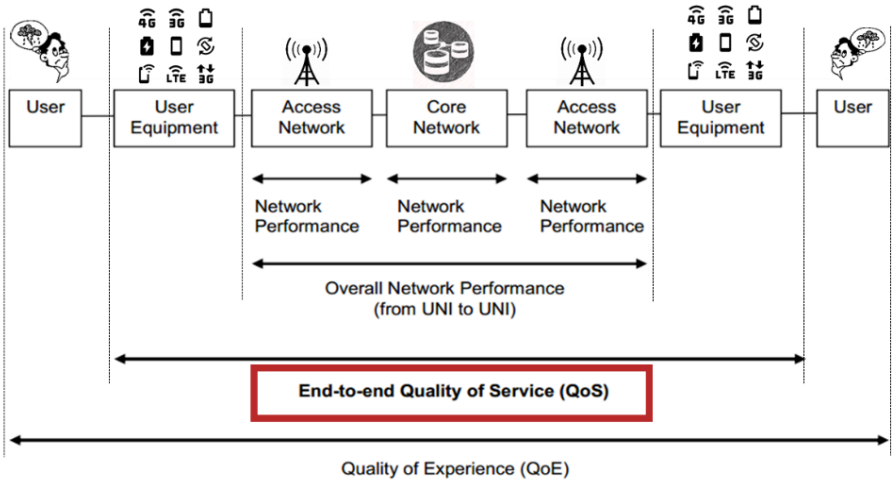
(ii) Conduct the drive test to verify the coverage commitment and QoS commitments on a sample basis. Consultant team shall be proposed 3-4 teams for Drive test to do in parallel and 1 team for post processing & analysis and Coverage map consolidation together with the necessary measuring/test equipment.

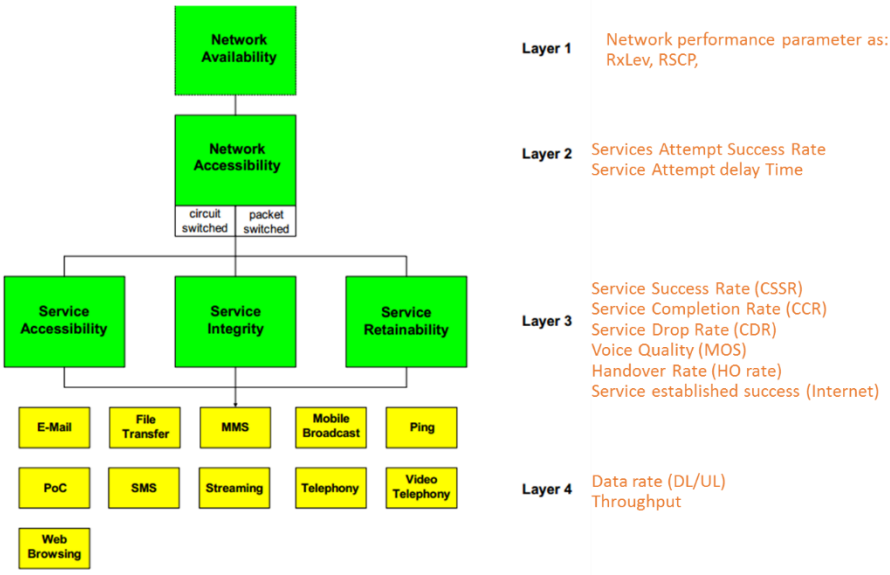
(iii) Check the Population Coverage commitment by MPT, MyTel, Telenor and Ooredoo operators with the appropriate RF planning & optimization software and through operators' own software as well. In doing this task, the consultant's team shall have ability to use 2014 Census report of Myanmar together with RF planning software to check Population Coverage commitments of Operators.

(iv) Analyze the test results to PTD and advise PTD officials on how to mainstream such enforcement in their work.

(v) Present the test results to the operators and recommend remedial measures if the operators have not met their coverage and quality of services commitments.

(vi) Train at least (5) staff staffs from PTD.





Summary of Tasks

The consultant will support PTD to undertake the following tasks as part of the engagement:

Activity (A):
Prepare a detailed coverage map of each operator's mobile network (both voice and data over 2G/3G/4G technologies) based on the data acquired from the operators. Check the Population Coverage Commitment by operators with the appropriate RF Planning & Optimization software.

Activity (B):
Prepare a training program for PTD staff for them to become fully competent in monitoring and enforcing coverage and QoS commitment of licensees. Inception Report that includes approach for assignment + preparation of detailed training plan and advise to PTD that which data or parameters are needed to require from Operators for Coverage map and to calculate Population coverage. Before starting any drive test, a meeting will be held between PTD and operators and the consultant firm will involve in the discussion and must be able to have knowledge and to discuss all details including methodologies how to test(measure) the networks, which equipments and which standards will be used etc.

Activity (C):
Conduct the Drive Test in selected areas across the country (not more than 60 cities or towns and 5 major highways and SEZ between states and regions) to verify the geographic coverage commitment for both voice and data networks of the operators (2G/3G/4G) networks. When the drive tests and QoS tests are being conducted, at least 5 staff from PTD will accompany the consultants and will be fully involved in the testing.
The consultant will provide on the job training and will also be responsible for the costs of travel, accommodation and food for PTD staff.
All drive tests will be conducted in coordination with the operators and/or consultant team and PTD themselves.

Activity (D):
QoSMeasurements for 2G/3G/4GNetwork in citiesand major highwaysas indicated in Annex 3.

Activity (E):
Conduct Analysis and prepare a detailed report of the Drive Test and QoS measurement. Conduct a discussion with each operator on the findings of the test and agree on remedial measures so that operators can take necessary steps to meet their obligations within a given time frame.
The detail requirement (Test scenarios and KPI for QoS and Parameters) for the drive test is mentioned in Annex 2.

Deliverables and Proposed Payment Schedule

This consultancy is scheduled to be completed within6months from the date of signing the agreement between PTD and the Consultant. The following table provides a summary of the main deliverables required and estimated timing:

Activity	**Date**	**Deliverable**	
		#	**Description**
B	Contract signing + 1weeks	1	Prepare a training program for PTD staff for them to become fully competent in monitoring and enforcing coverage and QoS commitment of licensees. Inception Report that includes approach for assignment + preparation of detailed training plan and advise to PTD

			that which data or parameters are needed to require from Operators for Coverage map and to calculate Population coverage. Before starting any drive test, a meeting will be held between PTD and operators and the consultant firm will involve in the discussion and must be able to have knowledge and to discuss all details including methodologies how to test(measure) the networks, which equipments and which standards will be used etc.
A	Contract signing + 2weeks	2	Consolidate Detailed Coverage map of each state and region for each operator in consultation with operators (subject to operator data availability)
C +D	Contract Signing + 8 weeks	3	Conduct drive test and provide reports on the Drive Test and QoS measurement to PTD. Check the Population Coverage commitment by operators with the appropriate RF Planning & Optimization software. (Note: Final report for MyTel must be finished.)
C+D	Contract signing + 12weeks & 18weeks	4	Final Reports for all test and measurements including results for checking of Population Coverage with analysis(Note: Final report for Telenor and Ooredoo must be finished within Contract signing + 12 weeks and for MPT within 18 weeks)(Note also C+D)
E	Contract signing + 32 weeks	5	Sign off with all operators and PTD on the drive test and all measurements including remedial measures

All deliverables will be sent to the PTD. Electronic copies will suffice. All deliverables must be in English. Final approval of all outputs and deliverables, linked to payments to the consultant, is the responsibility of MoTC.

Minimum Qualifications Requirements of the Consulting firm:

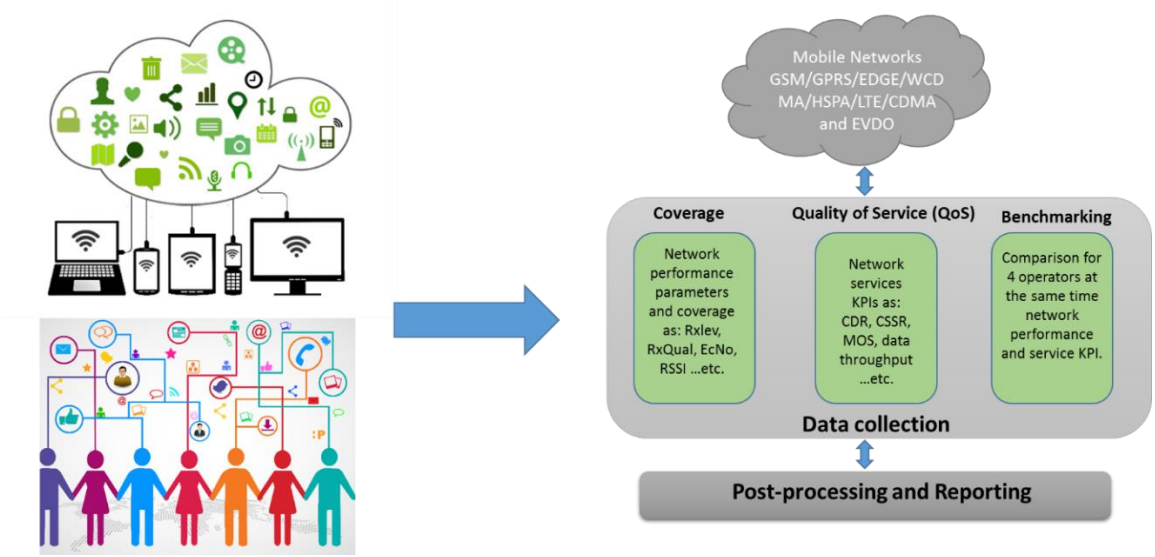
- The Consultant is preferred to be a company registered in Myanmar not less than (1) year and which has internal experience (or) is a member of multinational company (or) will establish a consortium with an international company to demonstrate it's strong experience and capability in Network Coverage and Performance Verification and Benchmarking test in abroad and as well as in Myanmar, particularly with the use of Nemo Outdoor and Nemo Invex II Drive Test Tool and related software as PTD engineers are also familiar with these equipment.
- The Consultant (or) it's Consortium shall have valid ISO 9000 quality management certificate or demonstrate having comparable quality management system implemented and documented.
- The Consultant shall have licensed and up to date versions of internationally accepted RF planning tool, and optimization software, with access to high resolution digital maps in order to perform assigned tasks under this ToR.
- The Consultant's team at least should consist of 7 personnel with skills and experience. (Lead Consultant should have at least 10 years of international experience, three (3) engineers should have at least 5 years experiences and three (3) engineers should have at least 2 years' experience) in this type of work (CV's shall be provided as part of the Consultant's offer). The consultant's team shall perform the test together with at least, five engineers and staffs from PTD,and shall provide on job training to them in local Burmese language. The consultant's team shall take all responsibilities of the test's result and shall reach to resolution with the operator if there are any disputes arising from operators with the result.
- The consultant's team will use at least two to three sets of its own, commercially licensed and up to date versions of Nemo equipment with scanners and MOS capability. As PTD has Nemo Invex II

equipment, based on workload and timeline if it is required by the Consultant' team, PTD can provide that equipment for the project purpose.

- The Consultant's team shall arrange all transportation, accommodation and logistics and shall bear all costs and expenses arising including the travel, accommodation and daily allowance cost of PTD staffs assigned for field works. Those cost shall be factored in the price proposals.

Annex -1: Methodology

The selected consulting firm shall perform the following test cases to simulate the real communication environtment.



Required Test cases are made to cover all used technologies in Myanmar operators network and might vary depending availability of each technology Operator by operator.

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Test Case 1:	- "**Voice 2G/3G**" using mobile devices that are freely selecting between 2G and 3G networks in order to monitor voice and SMS QoS of those mobile users, who have a 2G/3G mobile phone
Test Case 2	- "**Packet Switched Data, 4G**" using mobile devices locked to 4G networks in order to monitor PS data QoS as perceived by those users who have a modern 4G mobile device.
Test Case 3	- "**Packet Switched Data, 2G/3G**" using mobile devices freely selecting between to 2G and 3G networks in order to monitor PS data QoS as perceived by those users who have a 3G mobile device.
Test Case 4	- "**Network Coverage and Quality**" using a scanner to measure coverage and

	quality of all frequency bands independently and separately.

Table 1. Requseted Test cases

Test Case 1: Voice 2G/3G	
Purpose	Test circuit switched call service QoS as perceived by end-users with 2G/3G terminals.
Band lock	Freely selecting serving system from 2G/3G as per NW parameterisation
Test cycle	Hold time: 60 s for short call, continuous for long call Waiting time: 10 s
Timeout	Telephony Service Non-Accessibility Timeout: 20 seconds; Telephony Setup Time Timeout: 20 seconds.
Note	Voice Quality (MOS) Measurement, POLQA, ITU P.863
Reference point	Mobile to mobile VQ measurements are used, the reference point is the terminating mobile terminal in a fixed location.

Test Case 2: Packet Switched Data, 4G – DRIVE TESTING	
Purpose	Test packet switched data service QoS as perceived by end-users with 4G terminals.
Band lock	4G only
Test cycle	Waiting Time : 10 s HTTP/FTP download: File size (1000MB for 4G)
Timeout	Packet-Switched Service Non-Accessibility Timeout: 20 seconds; Packet-Switched Setup Time Timeout: 20 seconds.
Note	Access to local public FTP/HTTP server required.
Reference point	Mobile terminal

Test Case 3: Packet Switched Data, 2G/3G - DRIVE TESTING	
Purpose	Test packet switched data service QoS as perceived by end-users with 3G terminals.
Band lock	Freely selecting serving system from 2G/3G as per NW parameterisation
Test cycle	Waiting Time:10 s HTTP/FTP download: File Size (10MB for 2G, 100MB for 3G)
Timeout	Packet-Switched Service Non-Accessibility Timeout: 20 seconds; Packet-Switched Setup Time Timeout: 20 seconds.
Note	Access to local public FTP/HTTP server required.
Reference point	Mobile terminal

TC 4: Radio Network Coverage and Quality, 2G/3G/4G	
Purpose	Measure each MNO's radio network coverage and quality
Band lock	All frequency bands measured independently and separately
Test cycle	Not applicable
Timeout	Not applicable
Notes	Calibrated high precision measurement instruments. All MNO's in a given frequency band shall be measured with the same RF component chain.
Reference point	Not applicable

Table 2. Required Drivetest Measurement Cases

All test devices and equipment shall support the following systems and related frequencies: GSM 900, UMTS 900, UMTS 2100 and LTE2100,GSM 1800, UMTS 1800 and LTE 1800 .

Definition:

Coverage: RxLevel (dBm), RSCP (dBm), RSRP (dBm)

- To simulate customer behavior and collect exactly coverage level, we will collect coverage level based on devices (as: phone, data card),
- Coverage test shall be carried out by Scanner
    - Scanner installation at the height of 1.5m above ground (antenna gain and feeder attenuation shall be applied)

Quality of Service (QoS)

QoS test shall be carried out with UE for following parameters:

- CSSR:
    - Call Setup Success Rate = No. of Call setup Success / No. of Call x 100%
- CDR:

- Call Dropped Rate = No. of Call Dropped / No. of Call x 100%

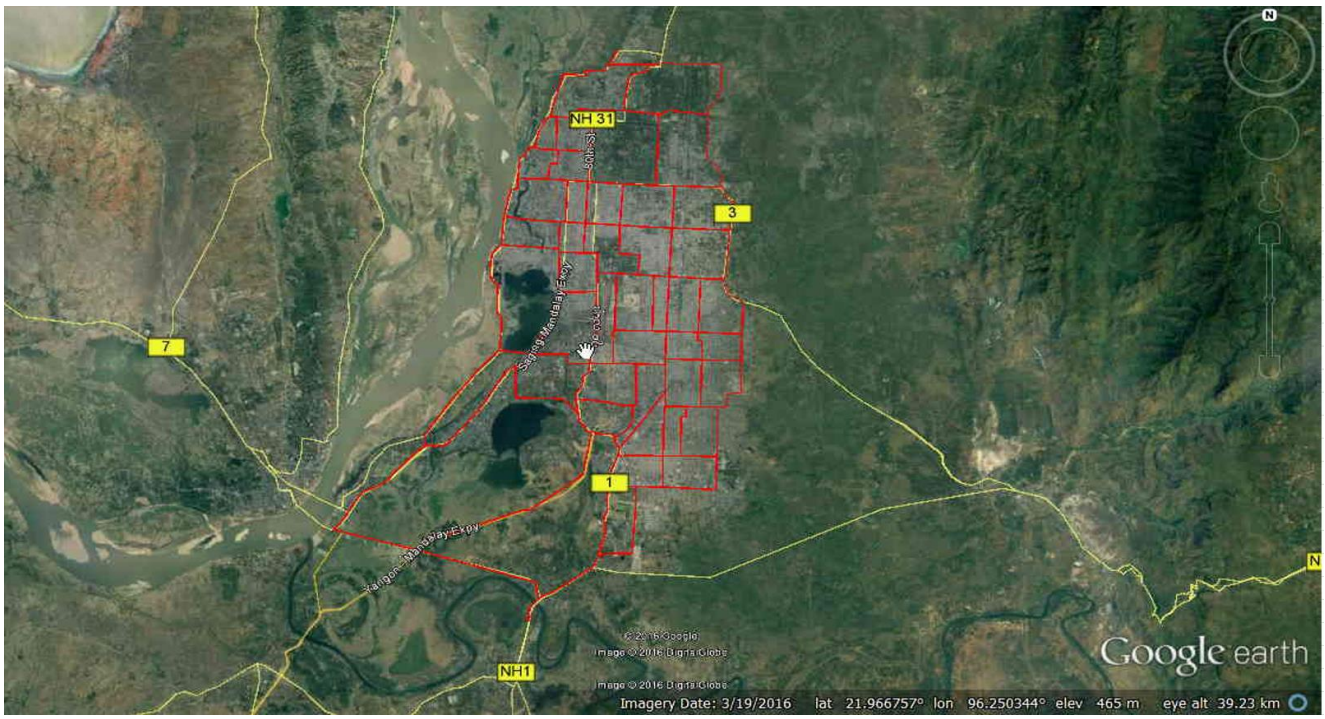
- CCSR
  - Call Completion Rate = Nr of successfully completed call/the total number of calls that are initiated and connected successfully(Successfully connected calls) within a specified time frame x 100%
- HOSR
  - Handover Success Rate (HOSR) = (Successful intercell handovers +Successful intracell handovers)/(Attempted intercell handovers+ Attempted intracell handovers) ×100%.
- Call setup time:
  - Call setup time(connection time) = Average of total call setup time (sec)
- MOS:
  - Mean Opinion Score (MOS) = 1 – 5 (poor, bad, normal, good, excellent)
  - MOS base on POLQA (for wideband) algorithm.
- SMS Send Success Rate:
  - SMS Send Success Rate = (Successful SMS serv attemp/Number of SMS attemp) ×100%.
- SMS Send Time:

  SMS Send Time = t2 – t1: t1 is time when “send” button is pushed in terminal (MO)
- Throughput
  - Download (DL): Mbps
  - Upload (UL): Mbps
  - Using phone and data card to test these parameters
  - Round Trip Time (RTT)
  - Using FTP (a local server where all operators measurements will be done)

All requested QoS test must follow ITU standards.

Follow the test cases and send the reports for regular checking. The Number of sample must be at least as required (higher is better).

The consultant is required to define and agreent with PTD the coverage routes to get signal of network as much as possible.



Example above, Mandalay Drive test roads

Annex - 2: KPI and Parameters

Consultant firm shall report the following KPIs and corresponding plots for quality benchmarking among all operators.

SID1	Voice Accessibility	Call Setup Success Rate, Call Success Rate, Call Setup Time
SID2	Voice Retainability	Drop Call Rate
SID3	Voice Quality	MOS, BER, BLER
SID4	Data Accessibility	PS Setup Success Rate, Ping Time, Web Access Time
SID5	Data Quality	DL/UL Throughput (Peak& Average), DL BLER, LTE MCS, LTE PRB
SID6	IRAT	3G to 2G Redirection Success Rate
SID7	2G Coverage	RXLev: >=-75dBm, -75dBm to -85dBm, -85dBm to -95dBm, <-95dBm
SID8	2G Quality	RXQual: 0-2, 3-4, 5-7
SID9	3G Coverage	RSCP: >=-80dBm, -80dBm to -90dBm, -90dBm to -100dBm, <-100dBm
SID10	3G Quality	Ec/No: -7dB, -7dB to -12dB, <-12dB
SID11	LTE Coverage	RSRP: >=-85dBm, -85dBm to -95dBm, -95dBm to -105dBm, <-105dBm
SID12	LTE Quality	RSRQ: >=-10dB, -10dB to -15dB, <-15dB
		SNR: <0dB, 0db to 13dB, 13dB to 20dB, >=20dB
SID13	2G C/I Index	C/I: >12dB, 9dB to12dB, <9dB
SID14	3G CQI Index	CQI: 0-8, 9-19, 20-30
SID15	LTE CQI Index	CQI: 0, 1-6, 7-9, 10-15

Table 3. Required KPIs

The consultant firm shall additionally provide the following plots.

- Scatter plots for signal coverage (Rxlev, RSCP, RSRP) vs. UL/DL throughput
- Scatter plots for signal quality (RxQual, Ec/Io, SINR) vs. UL/DL throughput
- Best Server Coverage
- Best Server Quality
- Pilot pollution plots
- Uplink UE Transmit Power (TX)
- BCCH Frequency, UARFCN distribution
- Plots for MOS
- PCI dominance
- Event plots (Drop, Setup fail, Handover fail, Re-direction fail, etc.)
- Serving Technology (GSM900, UMTS900, UMTS2100, LTE 1800, LTE2100)