Terms of Reference
The Republic of the Union of Myanmar
Provision of Consulting Services to Verify the Network Performance of the Mobile Operators' Networks
(C1.1.22)

Background

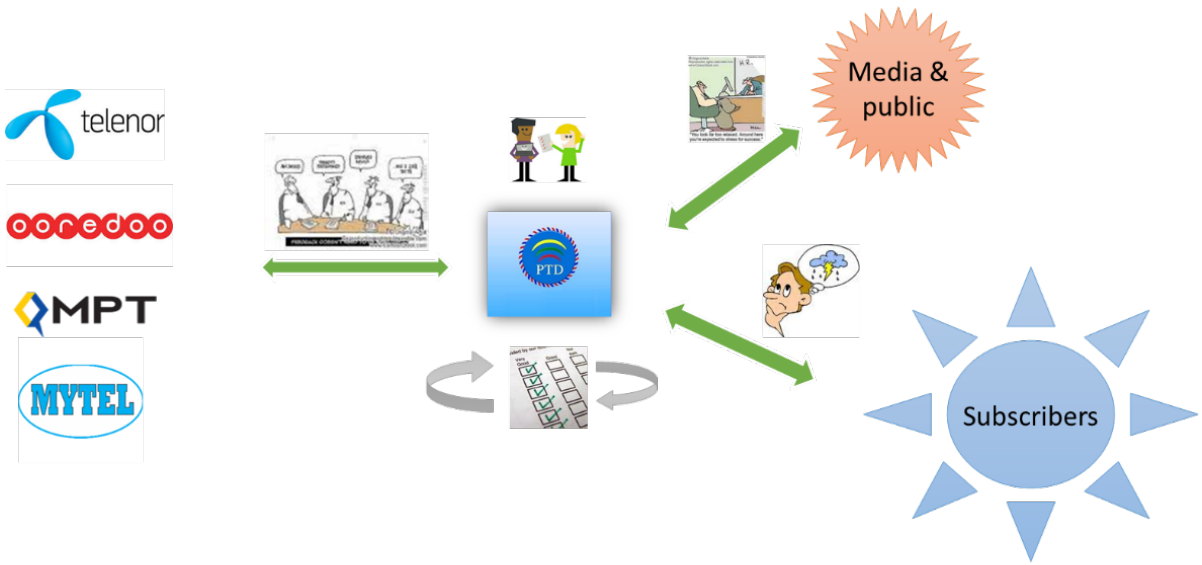
The Government of the Republic of the Union of Myanmar (Government) has undertaken telecommunications sector reforms in order to:

(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, Myanma Post Telecommunications (MPT)'s long lasting monopoly is being replaced by a competitive market structure consisting of multiple operators. Telenor Myanmar Limited, Ooredoo Myanmar Limited and Telecom International Myanmar co., Ltd (MyTel) were awarded Nationwide Telecommunications Services Licenses. The Nationwide Telecommunications Services License holder shall fulfill the Minimum Geographic Coverage Commitments for mobile Voice and mobile Data as well as the Quality of Service (QoS) Commitment.

Given that the regulator needs to ensure that the Licensees (four operators) have fulfilled the commitments of their licensees, there is need to do the drive test and QoS measurement.

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 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 to Posts and Telecommunications Department (PTD)to:

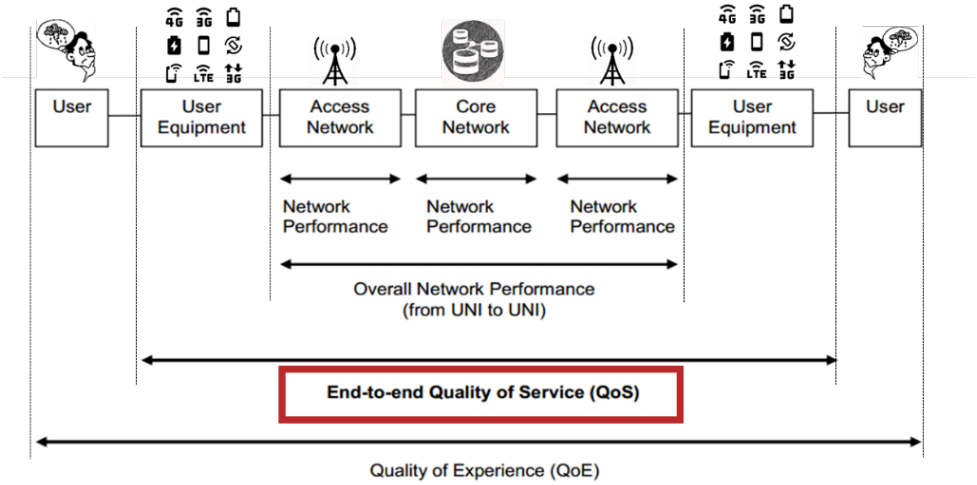
(i) Consolidate the coverage map for each region of Myanmar in consultation with operators.
(ii) Conduct the drive test to verify the coverage commitment and QoS commitments on a sample basis.

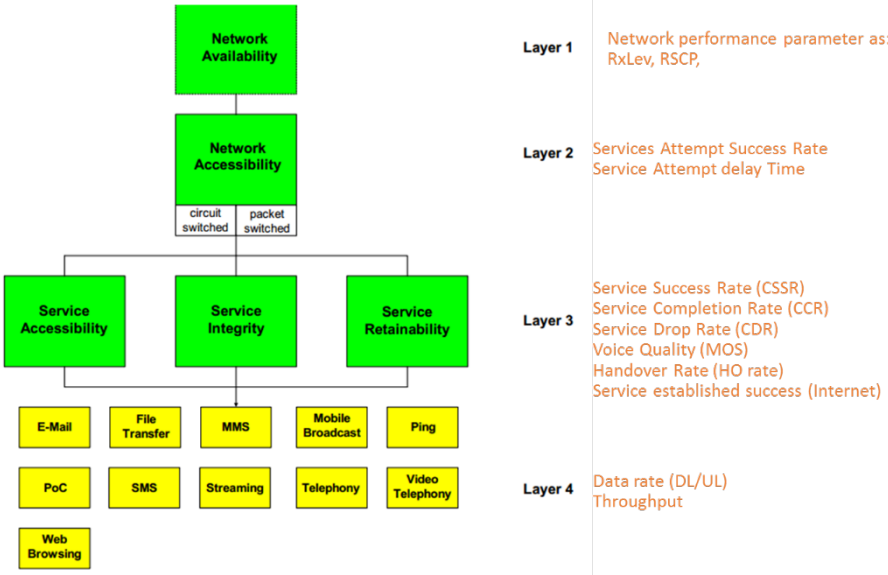
(iii) Check the Population Coverage commitment by Telenor and Ooredoo operators with the appropriate RF planning & optimization software and/or through operators' own software. In doing this task, the consultant's team shall have ability to use 2014 Census report of Myanmar together with RF planning 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 PTD and recommend necessary measures to PTD if the operators have not met their coverage and quality of services commitments.

(vi) Train at least 5 staff 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 dataover 2G/3G 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.

Activity (C):
Conduct the Drive Test in selected areas across the country (not more than 40 cities or towns and 5 major highways between states and regions) to verify the geographic coverage commitment for both voice and data networks of the operators (2G/3G) 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 themself.

Activity (D):
QoS Measurements for 2G/3G Network in cities and major highways as indicated in Annex 1.

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 to get agreement on necessary measures which must be taken actions by the operators based on their licence commitments.
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 within 3 and ½ months 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 + 1 weeks	1	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. If it is necessary, 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 equipment's and which standards will be used etc.
A	Contract signing + 2 weeks	2	Consolidate Detailed Coverage map of each state and region for each operator in consultation with operators (subject to operator data availability) Check the Population Coverage Commitment by operators with the appropriate RF Planning & Optimization software.
C +D	Contract Signing + 6 weeks.	3	Check the Population Coverage commitment by operators with the appropriate RF Planning & Optimization software (if it is not finished in 'A'). Conduct drive test and provide reports on the Drive Test and QoS measurement to PTD. Provide reports on the results of checking Population Coverage Commitment of the operators to PTD.
C+D	Contract signing + 12 weeks		Final Reports and recommended necessary measures for all test and measurements including results for checking of Population Coverage with analysis.
E	Contract signing +	4	Sign off with operators and PTD on the drive test and

	20 weeks		all measurements including remedial measures and all kinds of discussion relating to this project.

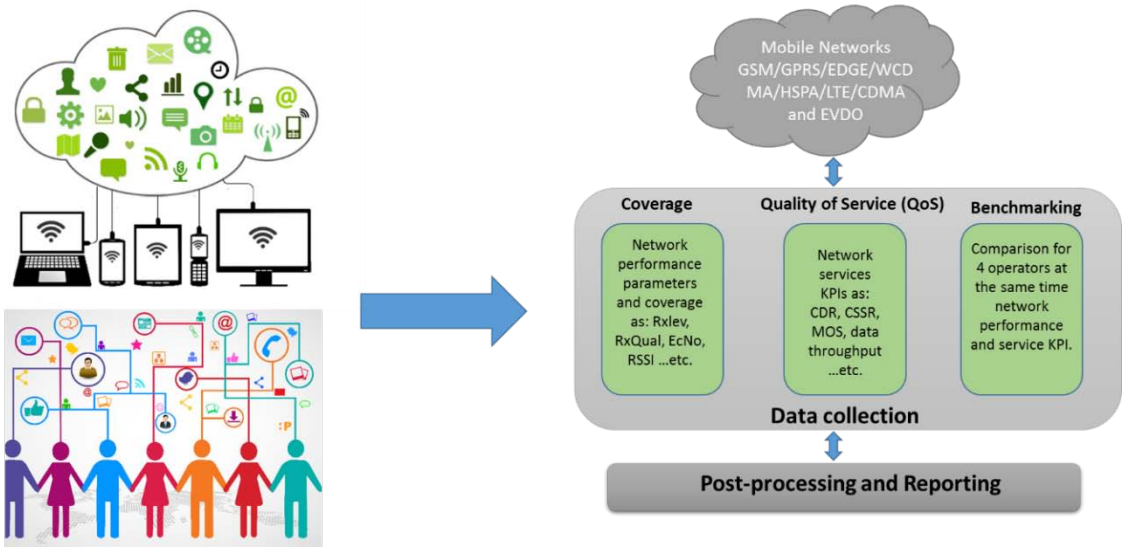
All deliverables will be sent to the PTD. Electronic copies will suffice. All deliverables must be in English. Final approval of all outputs and deliverables, linked to payments to the consultant, is the responsibility of MoTC.

Minimum Qualifications Requirements of the Consulting firm:

- The Consultant shall be a firm or a consortium or joint venture of firms or companies and will be selected based on its experience and capacity in carrying out this type of work in Myanmar. Its knowledge of, and experience in, Benchmarking of the Mobile Networks, particularly with the use of Nemo Outdoor and Nemo Invex II Drive Test Tool and related software .
- The Consultant shall have valid ISO 9000 quality management certificate or demonstrate having comparable quality management system implemented.
- 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 6 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 two (2) 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 Myanmar(Burmese) language.
- The consultant's team shall take responsibility of the test's result and shall reach to resolution with the operator if there are any disputes from operators with the result.
- The consultant's team shall use its own, commercially licensed and up to date versions of Nemo Outdoor equipment with scanner and MOS capability. As PTD has a set of Nemo Invex II equipment, based on workload and if it is required by the Consultant' team, PTD can provide the equipment to the Consultant team to be used in the project.
- The consultant's team shall arrange all transportation, accommodation and logistics and shall bear all costs and expenses arising including the travel, accommodation and food for PTD staffs assigned for field works in this project.

Annex -1: Methodology

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



Test ID	Test type	Test Scenario	Description	Criterias
TID1	Mobility	Coverage	2G Idle Mode	Lock to GSM
TID2	Mobility	Coverage	3G Idle Mode	Lock to WCDMA
TID3	Mobility	Data	GPRS Download	Lock to GSM, using HTTP, require to redial after data download finished every time, 5 multi thread File size >10MB
TID4	Mobility	Voice	2G Short Call	Short call: Call duration: 90s/ Call Wait: 10s
TID5	Mobility	Voice	2G Long Call	Continous call
TID6	Mobility	Voice	3G Short Call	Short call: Call duration: 90s/ Call Wait: 10s
TID7	Mobility	Voice	3G Long Call	Continous call
TID8	Mobility	Ping	3G Ping	PING global DNS www.google.com
TID9	Mobility	Ping	LTE Ping	PING global DNS www.google.com
TID10	Mobility	Voice	Automode MOS	MOS POLQA: Call duration: 90s/ Call Wait: 10s
TID11	Mobility	Data	Web Access	Automode, using popular web address
TID13	Mobility	Data	3G Download	Lock to WCDMA, using HTTP, require to redial after data download finished every time, 5 multi thread File size >10MB
TID14	Mobility	Data	3G Upload	Lock to WCDMA, using HTTP, require to redial after data download finished every time, 5 multi thread File size >10MB
TID15	Mobility	Data	LTE Download	Lock to LTE, using HTTP, require to redial after data download finished every time, 5 multi thread File size >10MB
TID16	Mobility	Data	LTE Upload	Lock to LTE, using HTTP, require to redial after data download finished every time, 5 multi thread File size >10MB
TID17	Stationery	Voice	LTE CSFB	
TID18	Mobility	Scanner	GSM 900, UMTS 900, UMTS 2100, LTE 1800, LTE 2100, LTE 2600, CDMA (450 & 800)	

Table 1. Required Drivetest Measurement Cases

All test devices and equipment shall support the following systems and related frequencies: GSM 900, UMTS 900, UMTS 2100, and scanning on CDMA 450 and CDMA 800.

KPI and Parameter	Mode	Duration	Note
RxLevel, RSCP, RSRP	Idle mode		Scanner can be used but just for optimization because sensitivity of scanner
RxQuality, EcIo	Dedicated mode – Short call		
CSSR	Short call	60-120s	Time out: 10s
CDR	Short call	60-120s	Time out: 10s
Call setup time	Short call	60-120s	Time out: 10s
MOS	Short call	60-120s	Time out: 10s
Throughput (UL/DL)	Session	100MB	Time out: 10s

Table 2. Definition for setting on Drivetest Cases

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 either with UE or Scanner**
  - **With UE: Not related to technologies (2G/3G) → Phones is in Idle mode, auto band**
  - **With Scanner: Scanner installation at the height of 1.5m above ground (antenna gain and feeder attenuation shall be applied)**

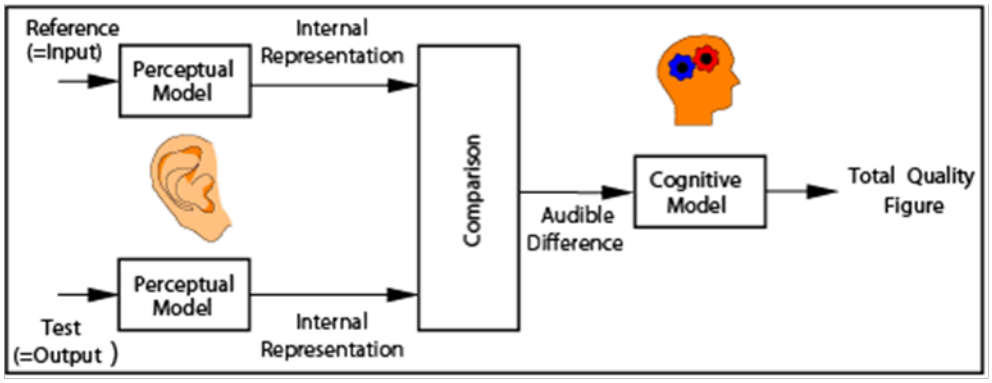
Quality of Service (QoS)

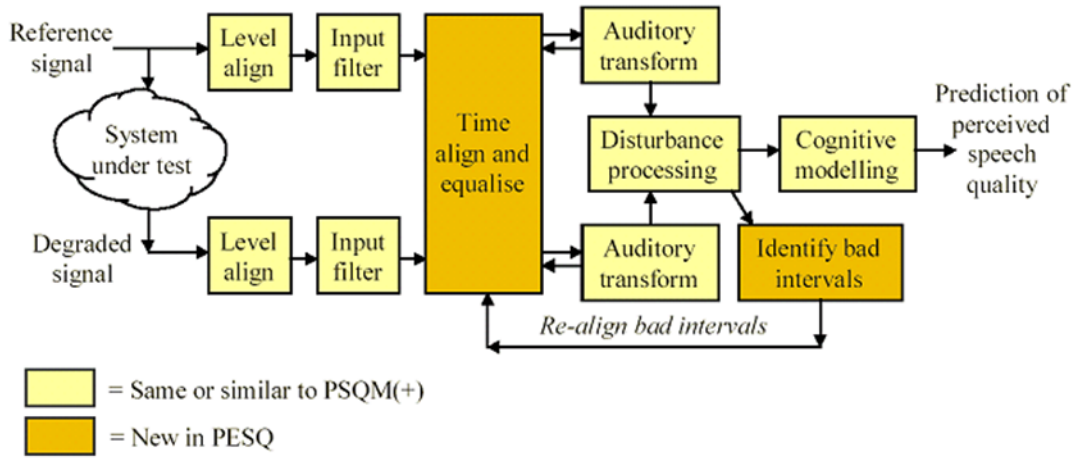
QoS test shall be carried out with UE for following parameters:

- **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 PESQ (for narrow band) and POLQA (for wideband)

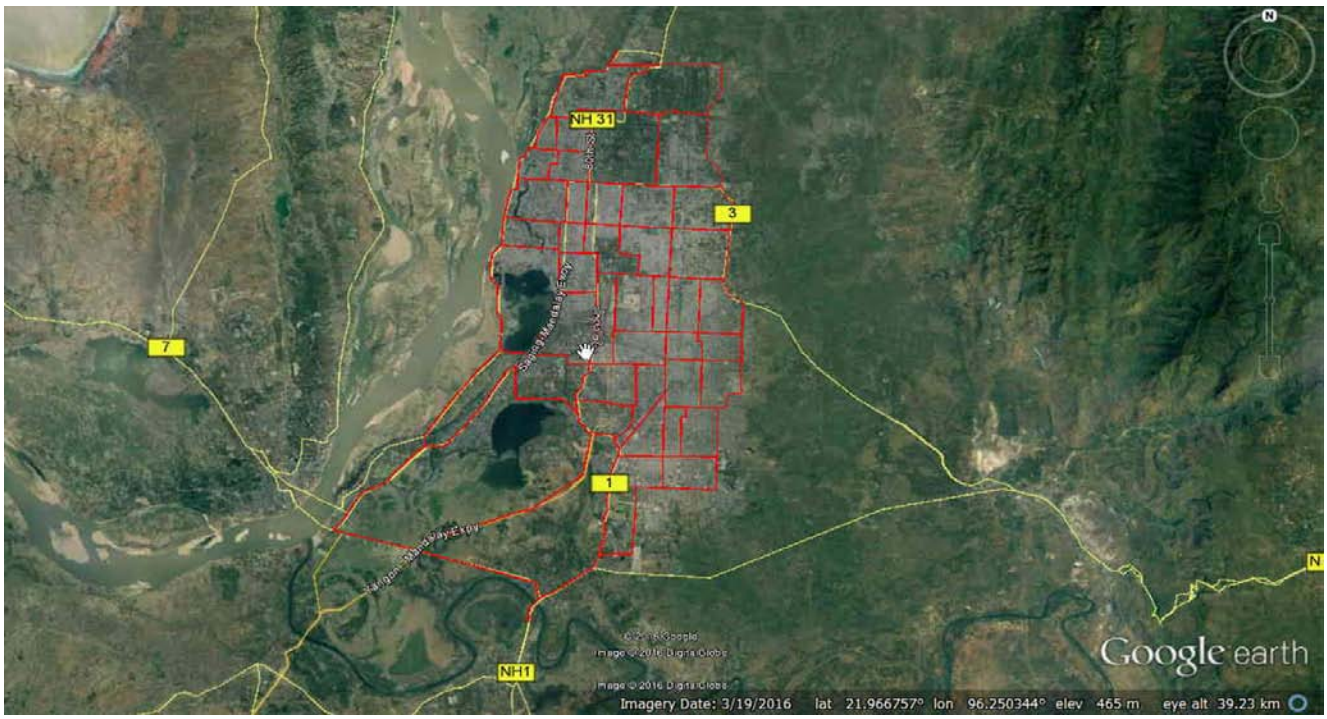




- Throughput
  - Download (DL): Mbps
  - Upload (UL): Mbps
  - Using phone and data card to test these parameters
  - Using FTP (but operators have to provide FTP IP and username/password for download)

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 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 Setup Time
SID2	Voice Retainability	Drop Call Rate, Handover Success Rate
SID3	Voice Quality	MOS, BER, BLER, ~~GSM SQI~~
SID4	Data Accessibility	PS Setup Success Rate, PDP Context Activation Time, Ping Time, **Web access time**
SID5	Data Quality	DL/UL Throughput (Peak and Average), DL BLER, ~~LTE MCS, LTE PRB~~
~~SID6~~	~~CSFB~~	~~LTE Circuit Switched Fall Back~~
SID7	IRAT	3G to 2G Redirection Success Rate
SID8	2G Coverage	RxLev: >= -75dBm, -75dbm to -90dBm, -90dBm to -100dBm, <-100dBm
SID9	2G Quality	RxQual: 0-2, 3-4, 5-7
SID10	3G Coverage	RSCP: >=-85dBm, -85dBm to -95dBm, -95dBm to -100dBm, <-100dBm
SID11	3G Quality	Ec/No: >=-7dB, -7dB to -12dB, <-12dB
~~SID12~~	~~LTE Coverage~~	~~RSRP: >= -80dBm, -80dBm to -90dBm, -90dBm to -100dBm, < 100dBm~~
~~SID13~~	~~LTE Quality~~	RSRQ: >=-10dB, -10dB to -15dB, <-15dB SNR: >=20dB, 13dB to 20dB, 0dB to 13db, <0dB
SID14	GSM C/I Index	GSM C/I: >12db, 9dB to 12dB, <9dB
SID15	UMTS CQI Index	UMTS CQI: 0-8, 9-19, 20-30
~~SID16~~	~~LTE CQI Index~~	~~LTE CQI: 0, 1-6, 7-9, 10-15~~
SID 17	**Benchmarking Score**	**Network Quality Index**

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)

Propose Network Quality Index (NQI)

Propose 36 KPIs for NQI calculation. They are grouped into main index as below

- Voice Accessibility
- Voice Retainability
- Data Accessibility
- Data Retainability
- Data Throughput
- IRAT
- Coverage and Quality
- NQI Method
- Choose 36 KPIs for NQI calculation
- Attribute a different weightage for each KPI
- Calculate ranking for each KPI
- Calculate score for each KPI based on ranking. First ranking is 10 score and second is 9 score and third is 8 score and fourth is 7 score
- NQI based on score of each KPI and weightage

Network Quality Index calculation results (excel format) will be submitted along with BMK Final report