Quality of service Regulation and Monitoring in Thailand

- Types of QoS Key Performance Indexes (KPI Parameters) regulated by NBTC

- Characteristics of QoS data

- NBTC's regulations relating to QoS

  – NBTC Notification Re: Quality of Service standard for voice services

  – NTBC Notification Re: Quality of Service standard for mobile Data services

- Policy Framework, Enforcement problems/obstacles
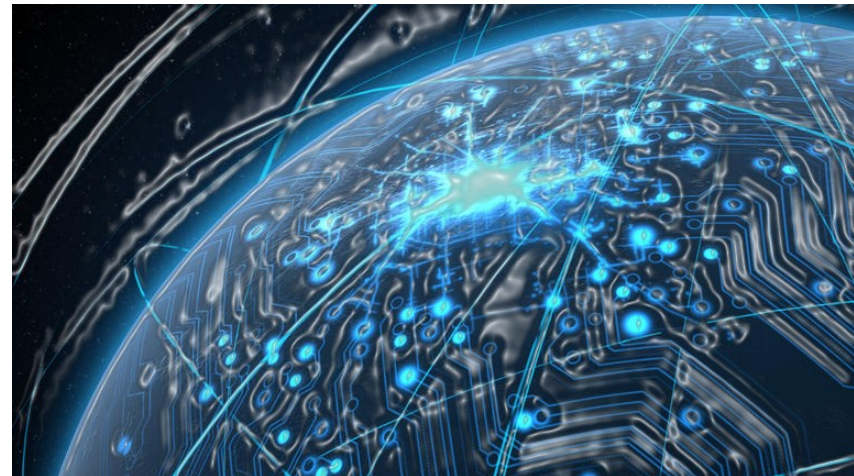
- Non-Technical QoS parameters

  - Quality of Customer Services

  - Example of KPI parameters

    - Service activation time

    - Billing accuracy

    - Complaint resolves times

  - Voice services & Data services

    - share similar parameters

- Technical QoS parameters: Infrastructure availability

  - related to the availability and integrity of the network

  - Example KPI parameters

    - Network Coverage

    - Service outage time, duration & ratio

  - Voice services & Data services

    - can share similar parameters

      – (in case of mobile services)

- Technical QoS parameters: Network Quality

    - Related to the quality of the network

  - Example KPI parameters

    - Voices

        - Call successful ratio, Drop call rate, etc.

    - Data

        - FTP speed, Round trip delay, etc.

Characteristics of technical QoS data

Real Statistic Data	Data from Measurement
- obtained by Network Monitoring System - Applicable mostly to voice service parameters - Drop call rate, call successful rate, etc - Non-intrusive - Flexibility - Can reflect real performance of whole network or at specific time & place - Must be obtained by operators - Regulators has no means to collect or double check authenticity of the data	- obtained by conducting test and measurement in network - Required mostly to data service parameters - Round trip time, FTD speed, etc. - Intrusive - Flexibility - statistic from only specific time & place - cannot reflect real performance of the whole network - can be done by both operators and regulators

NBTC's regulations relating to QoS

NBTC Notification Re: Quality of Service standard for voice services	NTBC Notification Re: Quality of Service standard for mobile Data services
came into force in June 2017 Scope: Voice services 　　　Fixed Personal Landline 　　　Mobile Phone	came into force in May 2018 Scope: Mobile Data services

NBTC's regulations relating to QoS

NBTC Notification Re: Quality of Service standard for voice services

came into force in June 2017

Scope:

Voice services

Fixed Personal Landline

Mobile Phone

NTBC Notification Re: Quality of Service standard for mobile Data services

came into force in May 2018

Scope:

Mobile Data services

NBTC Notification Re: Quality of Service standard for voice services

Enforced Parameters (KPIs): Fixed Personal landline

KPI	Target value
Non-Technical QoS parameters	
Supply time for initial connection	< 10 working days
Service installation completed within confirmed date	> 90%
Billing inaccuracy	< 1%
Response time for accessing customer-service call center	< 60 sec.
Technical QoS parameters: Infrastructure availability	
Number of reported faults (over 3 months)	< 5 times per 100 customers
Fault repair time	< 24 hours
Technical QoS parameters: Network Quality	
Successful call ratio (within network)	Not less than 90%
Successful call ratio (across different networks)	Not less than 85%

KPI	Target value
Non-Technical QoS parameters	
Billing complaints	< 0.3%
Response time for accessing customer-service call center	< 60 sec.
Technical QoS parameters : Infrastructure availability	
times that cell outages continuously over 4 hours in a month	< 15 times / 100 cells
Percentage of cell outages continuously over 24 hours in a month	< 3%
Percentage of cumulative cell outage time in a month	< 1%
Technical QoS parameters : Network Quality	
Successful call ratio (10.00 AM-13.00 PM, 16.00 -19.00 PM)	> 90%
Drop call rate (20.00-21.00 PM)	< 2%
Mean Opinion Score (MOS) (for 90% of measurements)	> 2.5

NTBC Notification Re: Quality of Service standard for Mobile Data services

Enforced Parameters (KPIs)

KPI	Target value
Non-Technical QoS parameters	
Service activation time	Pre-paid : 90% Less than 3 hours Post-paid : 90% Less than 5 hours
customer-service call center response time	< 60 seconds
Percentage of Billing inaccuracy	< 0.3%
Technical QoS parameters : Infrastructure availability	
times that cell outages continuously over 4 hours in a month	<15 times / 100 cells
percentage of cell outages continuously over 24 hours in a month	< 3%
cumulative cell outage time in a month	< 1%

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Enforced Parameters (KPIs)

KPI	Target value	
Technical QoS parameters: Network Quality		
Round trip time	2G: 1 sec | 3G: 500 msec | 4G: 150 msec	
FTP Success ratio	Download: 80% | Upload: 70%	
FTP mean data rate (For 75% of all FTP sessions)	Download - 4G: 2.5 Mbps - 3G: 750 kbps - 2G: 48 kbps	Upload - 4G: 500 kbps - 3G: 300 kbps - 2G: 20 kbps
HTTP success ratio	3G: 90% | 2G: 80%	
SMS end-to-end delivery time	90 seconds	
SMS completion success ratio	90%	
MMS end-to-end delivery time	5 minutes	
MMS completion success ratio	80%	

- KPIs are required to be met anywhere/anytime within service area

- KPIs serve as reference QoS criteria to resolve dispute between customer and operator

- Operators conducted QoS measurement according to KPIs

- Quarterly reports by operators

  - Submit to Office of NBTC

  - Publishing in operator's website

    - Timing limit of the quarterly report submission and website publishing

- Conduct parallel QoS testing and monitoring by office of NBTC

  - Only for mobile parameters

- Authenticity of the QoS reports

  - Statistical data collected by operators

  - No means to double check authenticity of the data

- Low consumer awareness of the QoS reports

  - QoS reports is not easily accessible in the operators website

- Report publishing is delayed and outdated

- Dispute about coverage and service areas

Objective

        To assessing the network performance that delivered to user

        To ensure that network services available all 24 hour a day

        To ensure operator follow by NBTC Notification Voice & Data for Mobile

Test Cases -> Stationary & Drive test

        Voice: both On-net and Off-net

                   Call setup success   and Call drop rate

                   Voice quality POLQA by ITU-T P.863

        Data: Round Trip Time   HTTP success rate

                   FTP upload & download success rate

                   FTP upload & download throughput average rate

                   (Testing File size 2 - 5MB)

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Mobile services QOS Monitoring

Key performance indicator Parameter for QOS

Voice call On-Net / Off-Net Testing	KPI
1. Call setup success rate (%)	> 90%
2. Call drop rate (%)	< 2%

Data Testing	2G KPI	3G KPI	Up 4G KPI
1. Round Trip Time	< 1,000 ms	< 500 ms	< 150 ms
2. HTTP Success Rate	> 80 %	> 90 %	> 90 %
3. FTP Download Success Rate	> 75 %	> 75 %	> 75 %
4. FTP Upload Success Rate	> 75 %	> 75 %	> 75 %
5. Average Throughput download rate	> 48 kbps	> 750 kbps	> 2.5 Mbps
6. Average Throughput upload rate	> 20 kbps	> 300 kbps	> 500 kbps

Mobile services QOS Monitoring (Stationary)
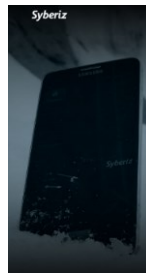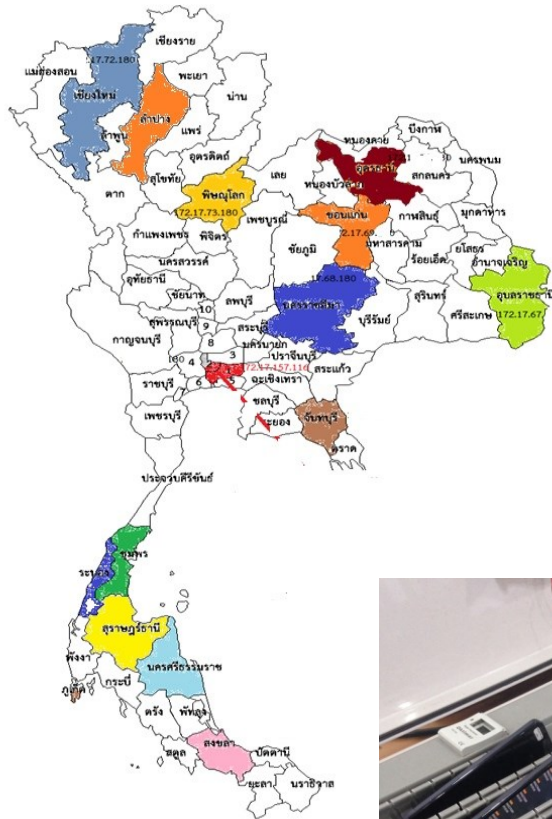
Testing Location

Located at NBTC head office and

Located at District office of NBTC

1.BANGKOK	2.CHANTHABURI
3.UBON RACHATHANI	4.KHONKAEN
5.NAKORN RATCHASIMA	6.UDON THANI
7.LAMPANG	8.CHIANGMAI
9.PHITSANULOK	10.SONGKHLA
11.PHUKET	12.RANONG
13.SURAT THANI	14.AYUTHATYA
15.NAKHON SI THAMMARAT	

Mobile services QOS Monitoring (Stationary)

Benchmarking Result Of 5 Operators

Voice call

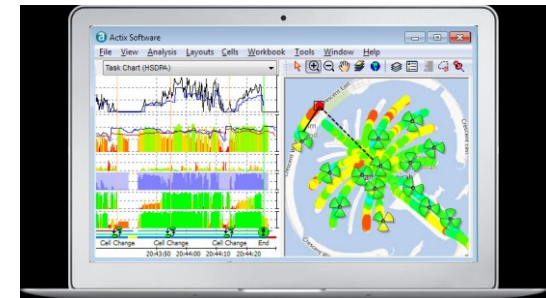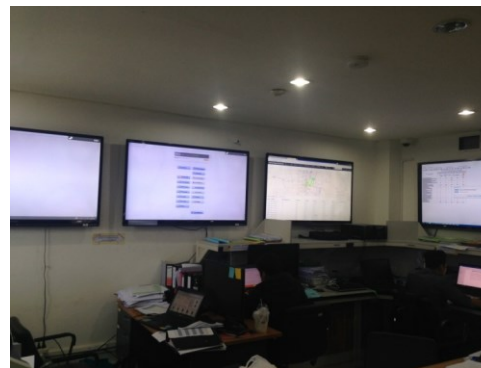| Measured parameter ค่าที่ทำการวัด	Mobile Network Performance Result (Voice call) ผลการตรวจวัดเครือข่ายโทรศัพท์เคลื่อนที่ด้าน Voice Call				
	AWN	DTN	TUC	TOT	CAT
Call Complete Rate (CCR) (%) % ของจำนวนครั้งที่โทรสำเร็จ	100	98.276	98.291	99.145	97.087
Drop Call Rate (DCR)(%) % ของจำนวนครั้งที่สายหลุด	0	0.862	0.855	0.855	0.971
Call Origination Failure (COF)(%) % ของจำนวนครั้งที่ไม่สามารถโทรออกได้	0	0.862	0.855	0	1.942
Number of total call attempts	117	116	117	117	103
Number of PASS sample	117	114	115	116	100
Number of dropped call sample	0	1	1	1	1
Number of call blocked sample	0	1	1	0	2

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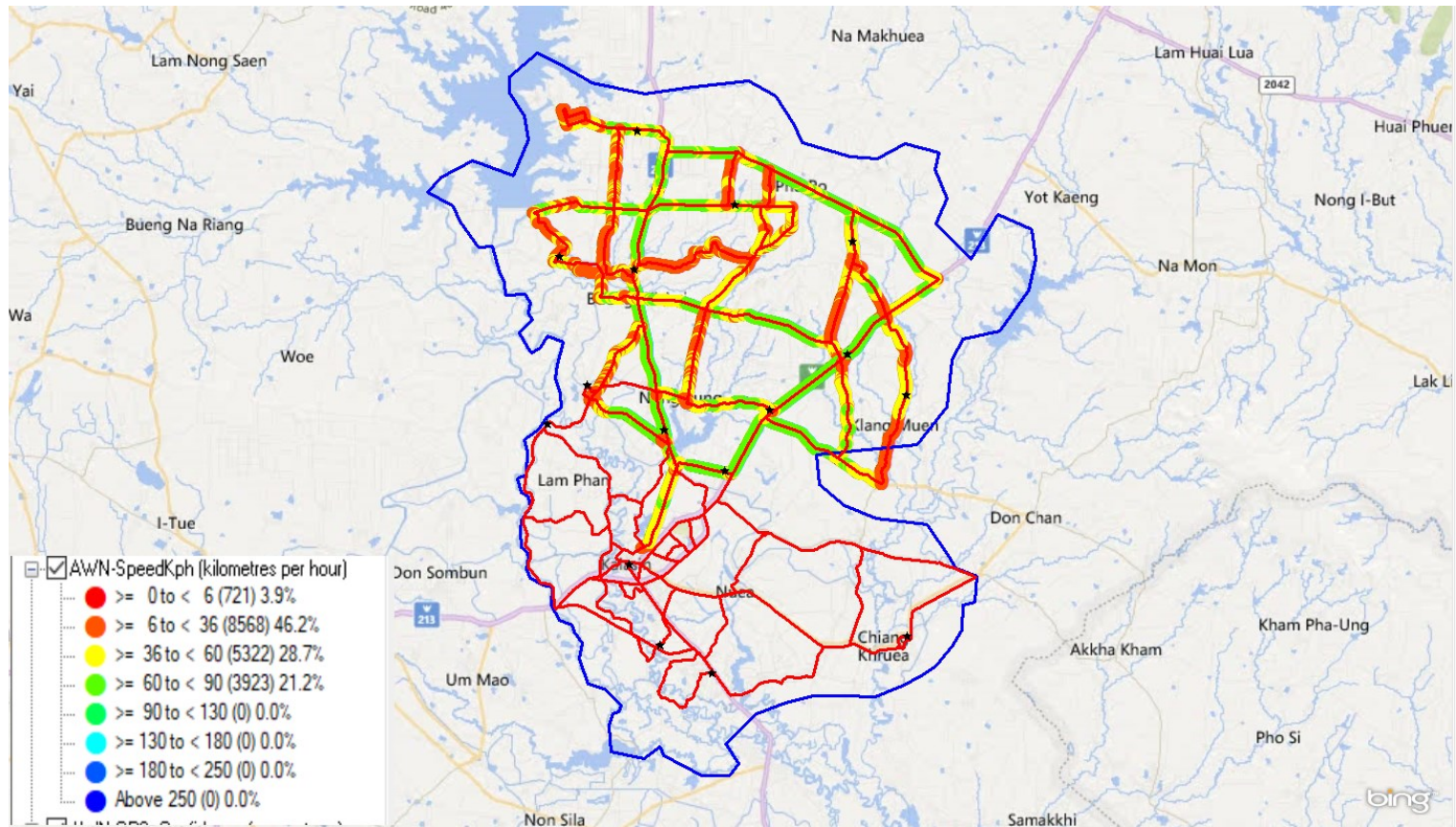# Mobile services QOS Monitoring (Stationary)

Benchmarking Result Of 5 Operators

Data

Measured parameter	Mobile Network Performance Result (FTP Upload) ผลการตรวจวัดเครือข่ายโทรศัพท์เคลื่อนที่ FTP Download				
	AWN	DTN	truemove H Universal Communication	TOT 3G	my
Data Call IP Accessibility (%) % ของจำนวนครั้งที่สามารถใช้งาน data service ได้	100	100	100	89.13	100
Data Call IP Drop session (%) % ของจำนวนครั้งที่ data service หลุดขณะใช้งาน	0	1.818	1.892	4.348	0
Data Throughput (> 384kbps) จำนวนการทดสอบที่ความเร็วการใช้งาน data service สูงกว่า 384 kbps	55	54	52	37	51
Average Data Throughput (Mbps) ความเร็วเฉลี่ยของ data service (Mbps)	8.567	7.689	10.345	5.636	4.576
Number of sample จำนวนการทดสอบทั้งหมด (Attempt)	55	55	55	46	54
Number of Setup Fail sample (F1. No IP Address)	0	0	0	4	0
Number of Data drop sample (F2. Has IP address but Failed with error cause)	0	1	1	2	0
Fail as incompleted download sample (F3. Fail but data size > 0 byte and timeout before completion)	0	0	0	0	0
Fail as no data traffic sample (F4. Fail with 0 downloaded data byte until session timeout reached)	0	0	2	2	2
Number of Fail sample (F1 + F2 + F3 + F4)	0	1	3	9	2
Network availaibility (%)	100	100	100	100	100

Mobile services QOS Monitoring (Drive test)

AWN-SpeedKph (kilometres per hour)
- 🔴 >= 0 to < 6 (721) 3.9%
- 🟠 >= 6 to < 36 (8568) 46.2%
- 🟡 >= 36 to < 60 (5322) 28.7%
- 🟢 >= 60 to < 90 (3923) 21.2%
- 🟢 >= 90 to < 130 (0) 0.0%
- 🔵 >= 130 to < 180 (0) 0.0%
- 🔵 >= 180 to < 250 (0) 0.0%
- 🔵 Above 250 (0) 0.0%

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Mobile services QOS Monitoring (Drive test)

รายงานผลการทดสอบคุณภาพการให้บริการโทรศัพท์เคลื่อนที่ (QOE)   ประจำวันที่ 9 กุมภาพันธ์ 2561   ตั้งแต่เวลา 09:10 น. ถึง 18:00 น.

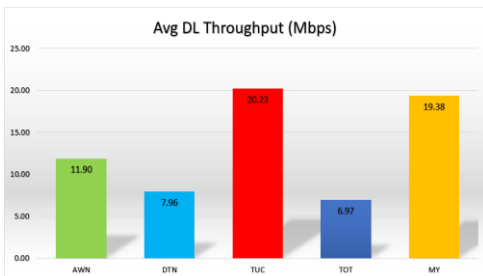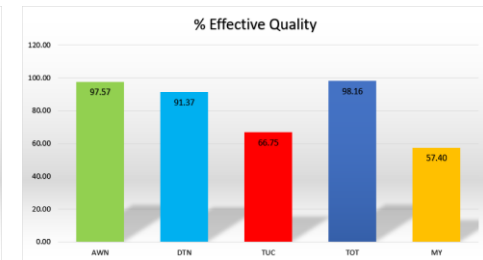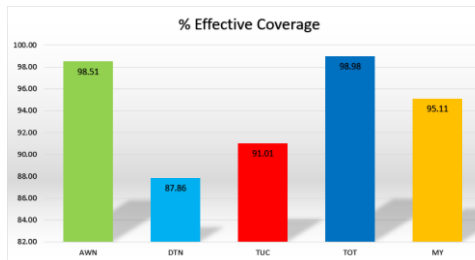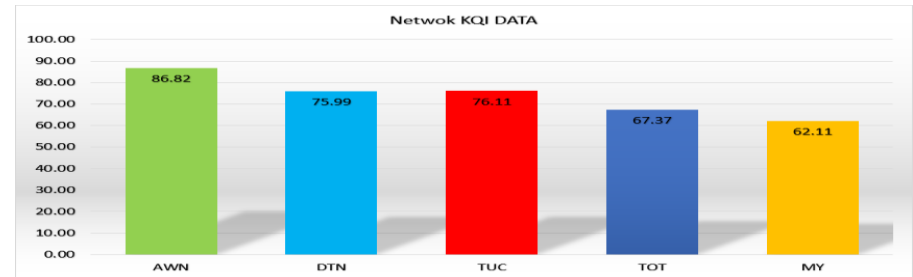| การทดสอบ/เครื่องมือทดสอบ	รายการทดสอบ	พื้นที่/เส้นทางการตรวจสอบ อำเภอเมือง จังหวัดกาฬสินธุ์									
		ผลการทดสอบแต่ละผู้ให้บริการ									
		AWN		DTN		TUC		TOT		MY	
คุณภาพการให้บริการ ประเภทเสียง (Syberiz)	**Voice Calls**										
	Call Attempts (Samples)	174		170		165		168		171	
	Successes Call (Samples)	173		164		153		162		169	
	Call Setup Success Rate (%)	99.43%		98.82%		96.36%		96.43%		99.42%	
	Blocked Call (Samples)	1		2		6		6		1	
	Dropped Call (Samples)	**0**		**4**		**6**		**0**		**1**	
	Call Drop Rate (%)	0.00%		2.44%		3.92%		0.00%		0.59%	
คุณภาพการให้บริการ ประเภทข้อมูล (Tems version:16)	**Round Trip Time (Ping)**										
	Ping Start (Samples)	96		81		116		86		124	
	Ping Success (Samples)	96		81		116		86		124	
	Ping Fail (Samples)	0		0		0		0		0	
	Ping RTT (ms)	116.31		176.93		67.30		91.99		133.28	
	Ping Success Rate (%)	100.00%		100.00%		100.00%		100.00%		100.00%	
	Web Browsing										
	HTTP Start (Samples)	277		243		336		256		364	
	HTTP Success (Samples)	267		225		331		225		332	
	HTTP Fail (Samples)	10		18		5		31		32	
	Average HTTP TranfersTime (s)	16.116		8.261		7.740		5.854		5.755	
	Average HTTP Throughput (Mbps)	1.384		1.304		1.703		1.722		2.352	
	HTTP Success Rate (%)	96.39%		92.59%		98.51%		87.89%		91.21%	
	Data Transfers (FTP)	DL	UL	DL	UL	DL	UL	DL	UL	DL	UL
	FTP Start (Samples)	90	86	80	72	109	108	83	78	119	116
	FTP Success (Samples)	53	76	61	62	101	100	67	61	67	69
	FTP Fail (Samples)	37	10	19	10	8	8	16	17	52	47
	FTP Success Rate (%)	58.89%	88.37%	76.25%	86.11%	92.66%	92.59%	80.72%	78.21%	56.30%	59.48%
	Throughput Min (Mbps)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Average Throughput (Mbps)	8.876	6.835	6.606	2.147	10.355	4.432	6.270	1.654	9.476	3.214
	Throughput Max (Mbps)	45.521	30.729	33.798	43.377	51.047	22.603	9.296	3.855	731.970	22.561
	อัตราการใช้เทคโนโลยีในการให้บริการ (Technology Serving Dedicated Mode)										
	LTE	85.29%		34.11%		84.94%		0.89%		54.26%	
	UMTS	14.71%		64.09%		15.06%		98.39%		45.74%	
	GSM	0.00%		1.80%		0.00%		0.72%		0.00%	

Mobile services QOS Monitoring (Drive test)

Cluster	Xway				
Operator	AWN	DTN	TUC	TOT	MY
Netwok KQI DATA	**86.82**	**75.99**	**76.11**	**67.37**	**62.11**
{10} Effective Coverage score	9.85	8.79	9.10	9.90	9.51
{15} Effective Quality score	13.79	10.68	0.00	14.08	0.00
{5} Latency < 110 ms score	3.90	0.00	3.75	4.70	2.11
{5} Web Browsing Success Rate score	5.00	5.00	5.00	4.62	4.75
{5} HandOver score	4.94	4.48	4.30	5.00	3.85
{15} FTP DL Completion score	14.40	14.29	14.40	13.81	6.92
{15} FTP UL Completion score	15.00	15.00	15.00	12.58	10.87
{15} FTP DL Throughput Avg score	4.95	2.76	9.57	2.20	9.10
{15} FTP UL Throughput Avg score	15.00	15.00	15.00	0.48	15.00
% Effective Coverage	98.51	87.86	91.01	98.98	95.11
% Effective Quality	97.57	91.37	66.75	98.16	57.40
% Latency < 110 ms	86.74	16.76	84.94	96.40	65.33
% Web Browsing Success Rate	100.00	100.00	100.00	98.46	98.98
% HandOver Success Rate	99.75	97.94	97.18	100.00	95.40
% FTP DL Completion Rate	99.21	99.05	99.20	98.41	89.23
% FTP UL Completion Rate	100.00	100.00	100.00	96.77	94.49
% FTP DL Throughput Avg	11.90	7.96	20.23	6.97	19.38
% FTP UL Throughput Avg	22.02	15.28	16.64	1.93	15.65

Netwok KQI DATA

Avg DL Throughput (Mbps)

Avg UL Throughput (Mbps)

% Effective Coverage

% Effective Quality

% FTP DL Completion Rate

% FTP UL Completion Rate

The
End