Communications Regulatory Authority | هيئة تنظيم الاتصالات

Quality of Service Measurements- Mobile Services Network Audit

2013

Quality of Service REPORT

The purpose of the study is to evaluate and benchmark Quality Levels offered by Mobile Network Operators, Ooredoo and Vodafone, in the state of Qatar. The independent study was conducted with an objective End-user perspective by Directique and does not represent any views of CRA.

This study is the property of CRA. Any effort to use this Study for any purpose is permitted only upon CRA's written consent.

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1 Reader's Advice

For a proper understanding of this report, readers are advised to take into account the following key elements:

Quality of Mobile Services Audit is a snapshot of the observed quality and performance offered by Mobile Operators at the time of the measurements campaign.

Mobile Operators are continuously performing modifications and upgrades (including during the audit). Performance at the time of reading the report may be different.

TRA deliberately chose to assess quality from the end user perspective, which involves for example carrying out measurements with mobile devices which are available in Mobile Operator shops, behaving like the user on the field and cross network testing. Please read section 4 carefully for a full understanding of the test protocol and measurement conditions.

As with any quality audit or survey, the statistical accuracy is systematically presented in the results tables. Accuracy is the error margin to the actual values, so any comparison between results should take this "confidence interval" into account.

To be consistent with this level of accuracy, results have been rounded up or down to the nearest tenth of a unit. It is reminded that:

- The sum of two rounded results can be different from the rounding of their sum,
- Multiplying one rounded result by another is different than rounding the result of their multiplication.

Other statistical aggregates used in the report are:

- **Standard Deviation** shows how much variation there is from the average. A low standard deviation indicates that the data points tend to be very close to the mean, whereas high standard deviation indicates that the data are spread out over a large range of values.
- **Min** and **Max** show the worse and best results (such as delay, throughput) obtained during successful measurements.
- **Average** is always the arithmetic mean of the referred sample.

2 Methodology

This audit was conducted from 11th November 2013 to 5th January 2014, except 18th December 2013 (Qatar National day).

2.1 Team and Equipment

2.1.1 Team

The project was managed with the following project team on the ground:

- A dedicated project manager present in Doha during audit launch phase.
- A field supervisor based in Doha for the whole audit duration.
- One team performing Coverage measurements.
- 2 teams performing Voice and SMS measurements:
  - 2 Engineers and a driver on the field.
  - 2 Engineers in an office located in Doha.
- 3 teams performing Data measurements.

2.1.2 Equipment

The following mobile devices have been selected, in agreement with Mobile Operators:

Voice / SMS / MMS	Data Dongles	Data Smartphone
Samsung Galaxy S4	**VODAFONE** : USB Stick K4305	Samsung Galaxy S4
IPhone 5	**OOREDOO** : 100 Mbps 4G USB modem	

All devices were compatible with voice, SMS and MMS technologies and were recommended or sold by Mobile Operators for 2G and 3G technologies.

Land lines were equipped with a standard fixed phone.

During Incar measurements, mobile phones were used without external antenna. For all voice measurements, a hands-free kit was used with mobile phones.

2.1.3 Prepaid plans

100% of the QoS measurements were done with prepaid plans.

	Ooredoo	VODAFONE
VOICE/SMS/BBM	HALA QR 500	Pre-paid QR 500
DATA	Hala Mobile Broadband Unlimited	Internet Monthly Pack 200

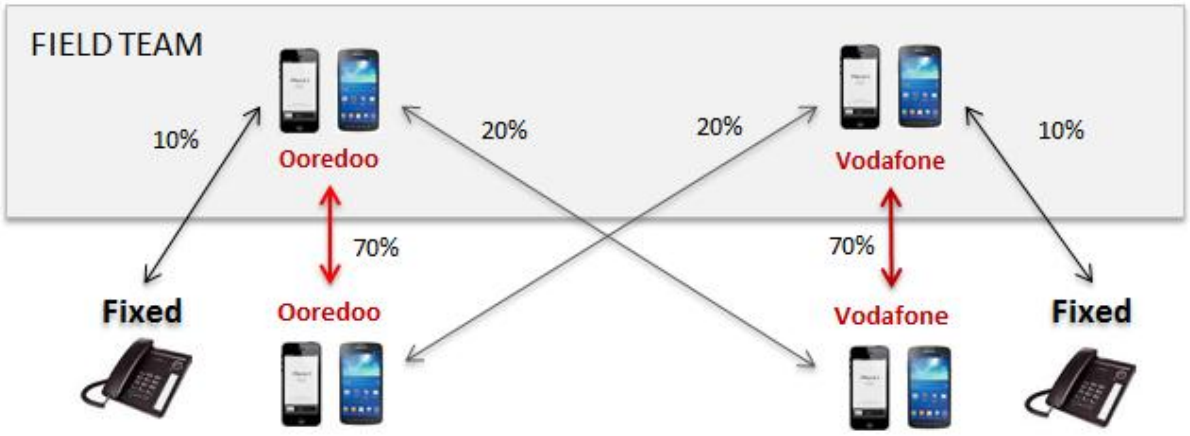
2.2 Voice Service Quality Testing

2.2.1 Measurement

A voice measurement was a call attempt followed by a 2 minutes conversation. Calls were placed on all networks simultaneously from the same physical location. A measurement was therefore a set of two calls, one per Mobile Operator.

A field tester was conversing over his mobile phone with a tester in Doha office. The tester in the office was using either a fixed-line phone for 10% of the calls or a mobile phone.

Each field team had 2 types of phone for each mobile network: one Samsung Galaxy S4 and one iPhone 5. Either side could initiate the call following pre-defined call sample objectives.



Voice Service Levels:

Voice measurements were performed in three configurations:

- **Indoor** Pedestrian Indoor in public and private buildings
- **Outdoor** Pedestrian Outdoor in the busiest outdoor places. 1/3 of the measurements were dynamic, walking from one point to another and 2/3 were static.
- **Incar** On road links (Incar Road) and within Town borders (Incar Town)

Calls included 70% Mobile to Mobile (MTM) own network, 20% MTM cross networks and 10% Mobile to land line.

- **Audio Quality Marking:**

Failed and dropped calls were registered in the database. The audio quality was evaluated for calls established and maintained for 2 minutes. Once a call was established, Engineers followed a speech guideline, simulating an average conversation and audio quality was marked on a scale of 1 to 4 as follow:

Level 4 **- Perfect**	Engineer doesn't notice any defect
Level 3 **- Fair**	One defect occurs while the conversation goes on uninterrupted
Level 2 **- Poor**	The natural flow of the conversation is altered and the Engineer has to repeat himself
Level 1 **- Bad**	The defect is so strong that conversation cannot proceed.

As the call went on, each Engineer took note of the identified defects such as: metallic noises, voice distortion, echo. At the end of the call the fixed located Engineer collected both marks on a scale of 1 to 4, did input results in the database, along with standard description of specific defect(s), if any. In the case field and fixed-end Engineers had different evaluation for the call, the worst mark was retained.

2.2.2 Testing Area and Sample Size

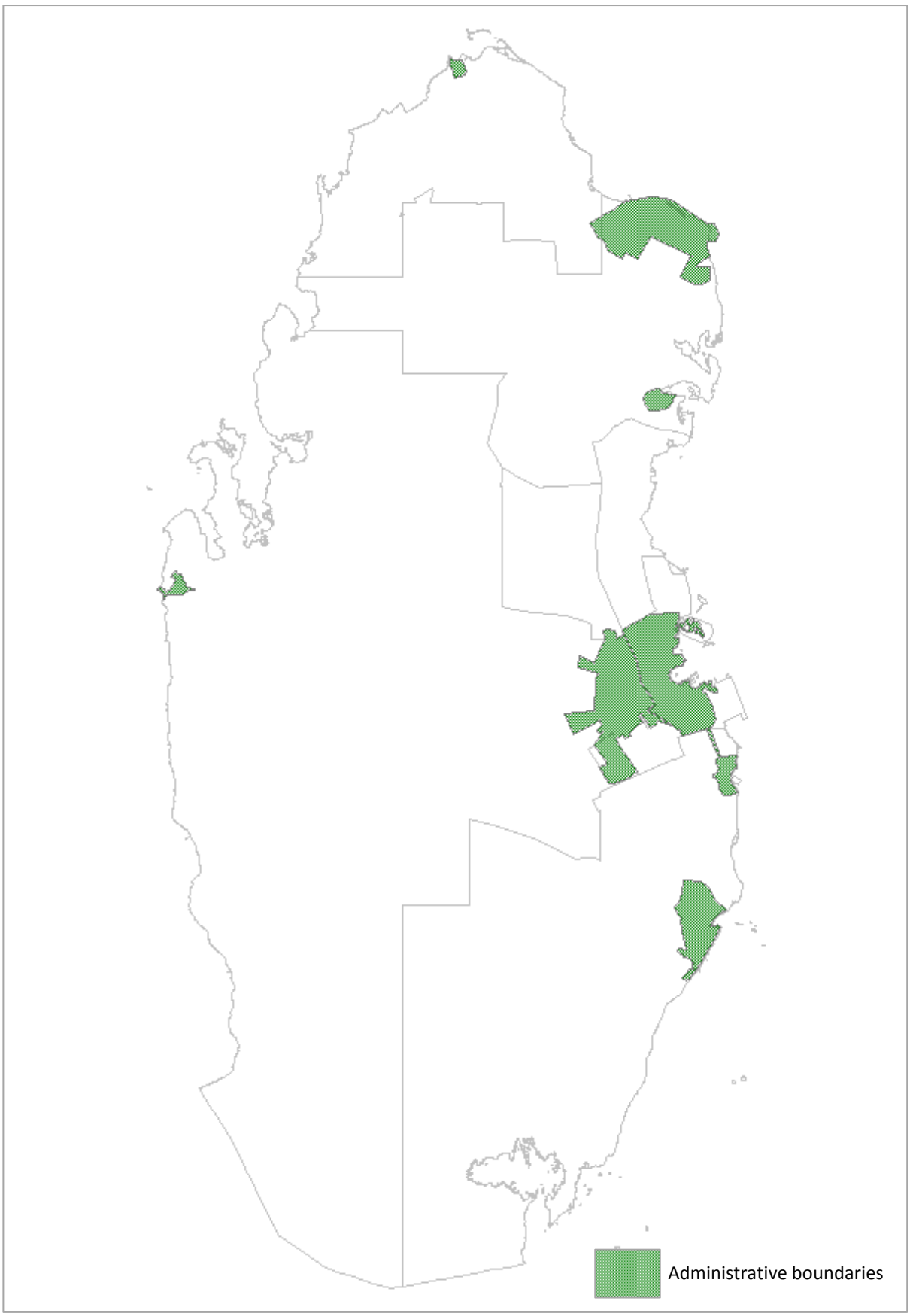
Sampling distribution between towns was based on population data and organised as follow:

Cities	Population	% pop	% mes. *	Incar	Indoor	Oudoor	Total
DOHA	796947	47%	30.5%	457	457	457	1 372
AL RAYYAN	455623	27%	23.1%	346	346	346	1 038
AL KHOR and AL THAKHIRA	193983	11%	15.0%	226	226	226	677
AL WAKRA	141222	8%	12.8%	193	193	193	578
UMM SLAL	60509	4%	8.4%	126	126	126	378
AL DAAYEN	43176	3%	7.1%	106	106	106	319
MADINAT AL SHAMAL	7975	0%	3.1%	46	46	46	137
Total	**1 699 435**	100%	**100%**	**1500**	**1500**	**1500**	**4 500**

Test Calls Repartition

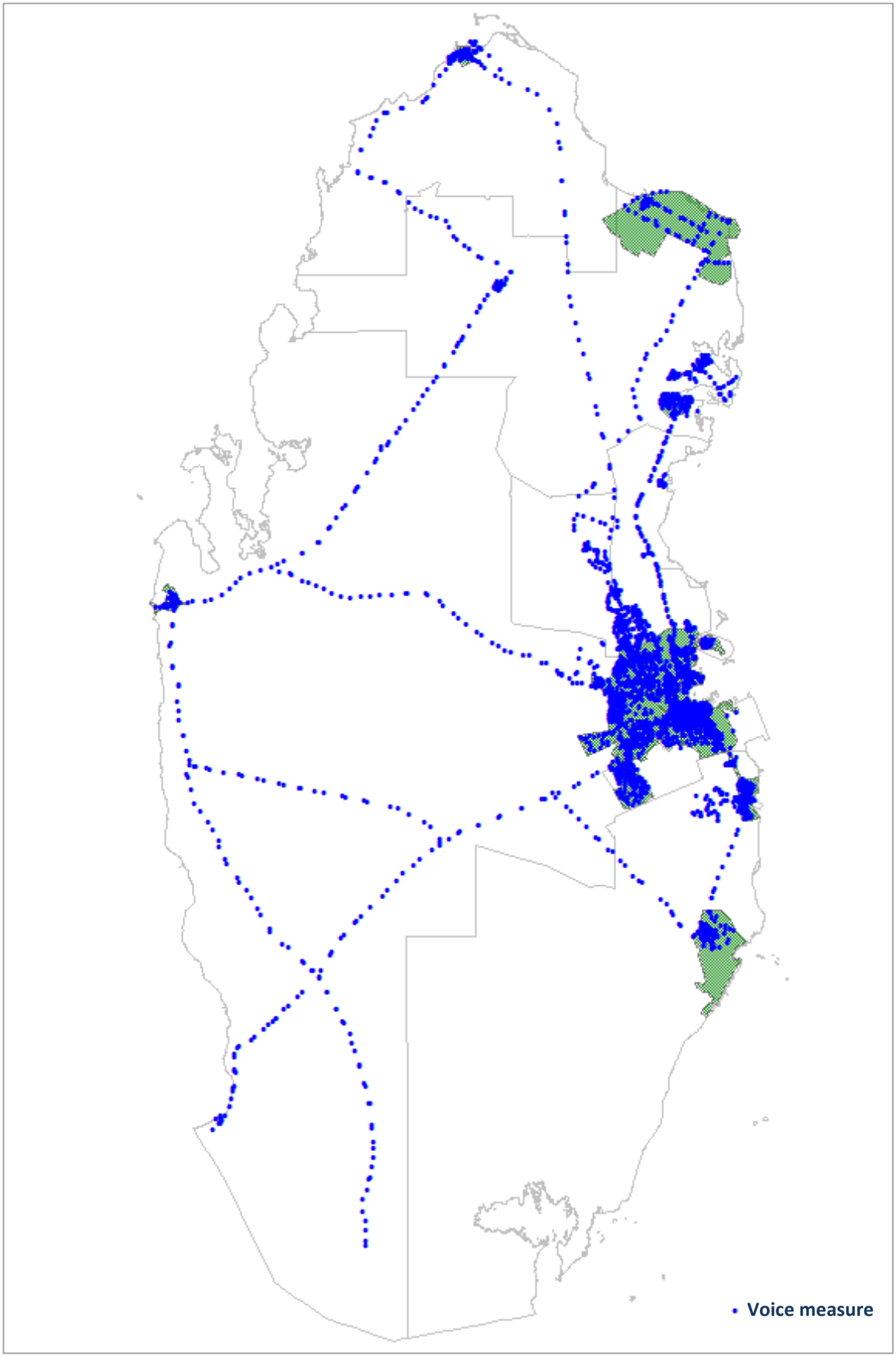
The total number of voice test calls performed was almost 5,000, including also about 500 incar measurements on road links between cities.

Cities Populated Zones



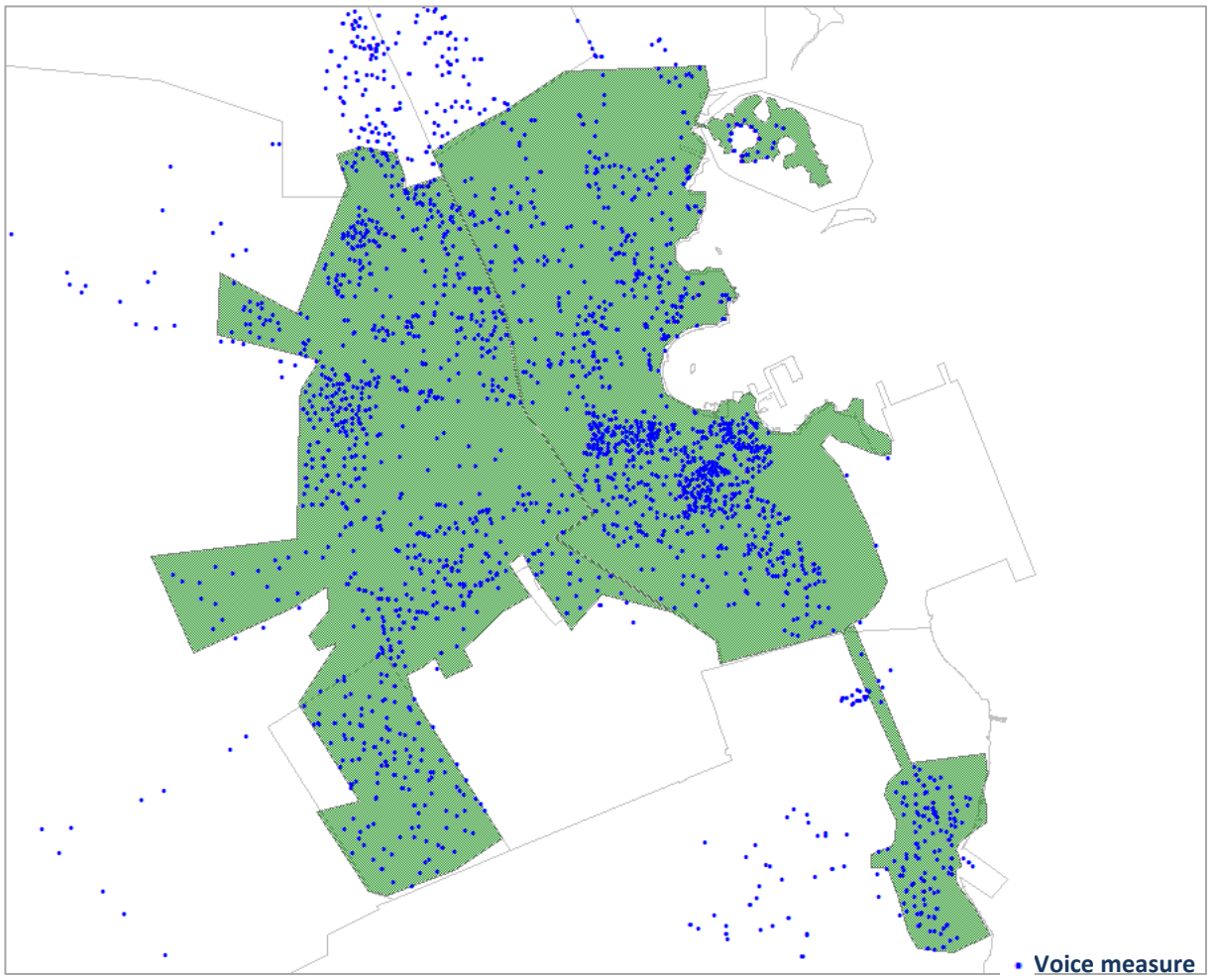
Map of VOICE Measurements

Global



Map of VOICE Measurements

Zoom on DOHA



2.2.3 Measurements Specifications - Towns

- ***Incar Measurements***

Measurements were performed on paths that included major roads and constructed zones (Downtown, malls, stations, touristic places and business centres).

- ***Pedestrian Measurements***

Pedestrian measurements were equally distributed over an area to ensure good test coverage.

Pedestrian Outdoor Measurements

1/3 of measurements were dynamic (from a point to another) and 2/3 were static. A single test was performed for each location, to always ensure best repartition over the tested zone. Locations were selected among high-attendance pedestrian places (buildings, parks, malls, etc…).

Pedestrian Indoor Measurements

Calls were placed preferably on daylight indoor (less than 3 meters from a window) or on deep indoor. Any floor in a particular building was tested, except basement and above 12th floor.

Measurements were adapted by building type:

- 56% in the public places
- 22% in offices
- 22% in residential areas

Number of measurements depended on the size of the building:

- Large places : 3 to 4 measurements
- Small places : 1 to 2 measurements

- **Voice Sample - Cities**

	INCAR cities	INDOOR	OUTDOOR dynamic	OUTDOOR Static
DOHA	552	618	307	213
AL RAYYAN	401	385	313	150
AL KHOR	60	42	26	15
MADINAT AL SHAMAL	45	13	13	6
AL WAKRAH - AL WAKAIR	91	66	58	28
DUKHAN	17	20	14	6
MESSAIED	51	16	13	7
RAS LAFFAN	66	10	13	3
OTHER TOWNS AND VILLAGES	129	187	203	56
TOTAL	**1 412**	**1 357**	**960**	**484**

2.2.4 Measurements Specifications - Road Links

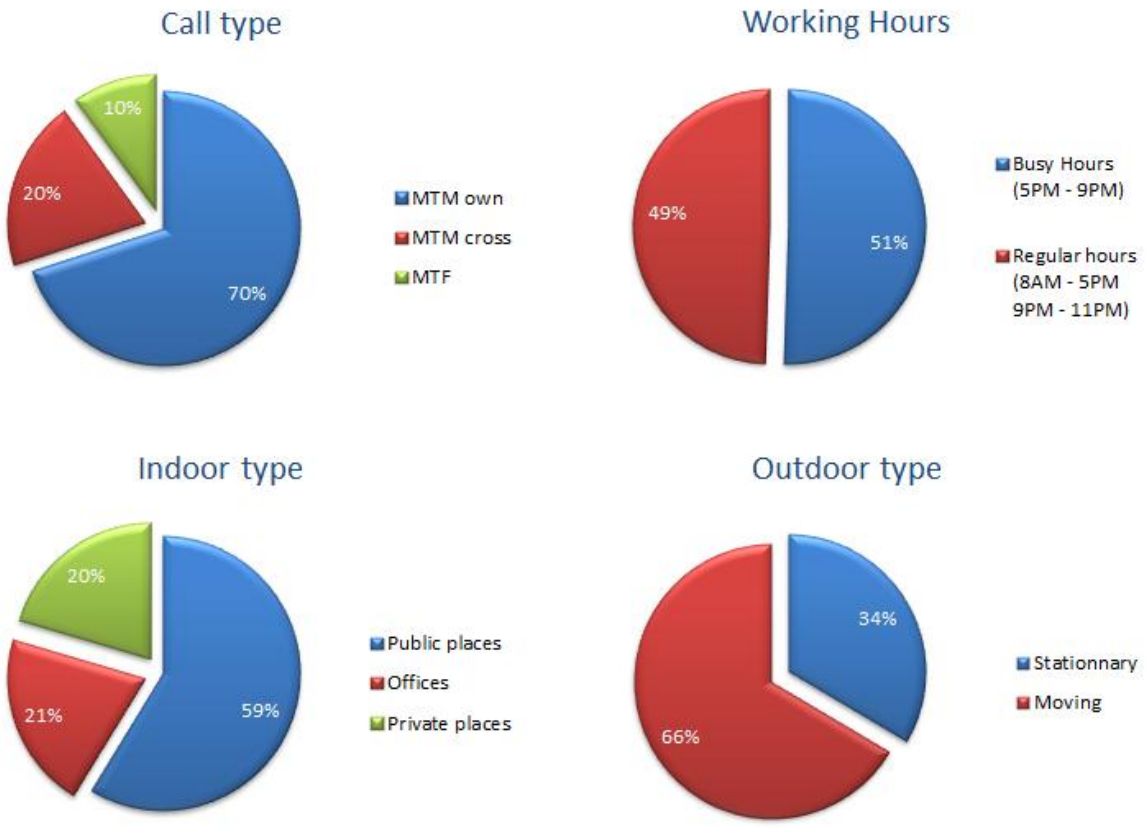
- **Road links Measurements**

Measurements were performed on major links (primary and secondary roads) between the main cities of Qatar and also to the borders with Saudi Arabia and UAE.

- **Voice Sample – Road links**

	INCAR Roads
AL GHUWAYRIYAH - DUHKAN	49
AL-RUWAIS - AL GHUWAYRIYAH	45
DOHA - AL KHOR	72
DOHA - AL RUWAIS	45
DOHA - AS SALWA (Saudi Border)	73
DOHA - DUHKAN	73
DOHA - MESSAIED	22
DOHA - RAS LAFFAN	24
MESSAIED - Salwa Road	30
SALWA ROAD - Saudi Border	31
UMM BAB - DUHKAN	18
UMM BAB - QATAR Saudi Road	25
UMM BAB - Salwa Road	27
TOTAL	**534**

2.2.5 Global Voice Measurements Distribution



2.2.6 Method

Test methodology followed ITU ref P.800 Mean Opinion Score for voice specification.

The corner stone of Directique test methodology is based on a training method performed on a specifically developed software **FormaTest** ©.This training method allows for a clear and faithful marking system of audio and video quality problems. Directique guarantee consistency across Engineers, and a minimum standard deviation of the marks.

All tests were timed stamped and GPS tagged, in order to ensure full traceability of each measurement.

Test phones were verified on a daily basis, and when allocated for field testing, handsets were rotated between teams regularly to avoid bias due potential to small differences between same model phones in radio frequency sensitivity and processor performance.

Measurements software assisted by **ChronoTest** ©, were started simultaneously by the mobile and the fixed operators to synchronize call start. The software provided Engineers with all necessary information related to a test call, when a call had to be placed (either mobile originated or mobile terminated) and ended, in order to guarantee a strict adherence to test protocol. **ChronoTest** © was combined with a GPS receiver recording the location of the mobile team every second.

All information concerning test location and call marks were recorded by the Engineer at the fixed-end location in a database who ran live coherence checks to guarantee error free recording.

Hands-free kits were used on mobile phones in order to minimizes ambient noise and provide a better environment to the field Engineer to measure quality of the voice service.

Outdoor, the phone was either held by hand, or placed in a pocket in areas where discretion was required.

2.2.7 No Default Procedure

In order to guarantee the same level of assessment for all Mobile Operators, engineers were regularly switched from one operator to another.

In order to prevent a faulty phone polluting measurement samples, phones used for the test were new and tested prior the start of measurements campaign.

Any abnormal behaviour of a handset was recorded and the phone was removed from the test pool.

Every week, test results were computed in a way that singled out any problem that could be related to a test phone.

Test phones were rotated between Mobile Networks every half day.

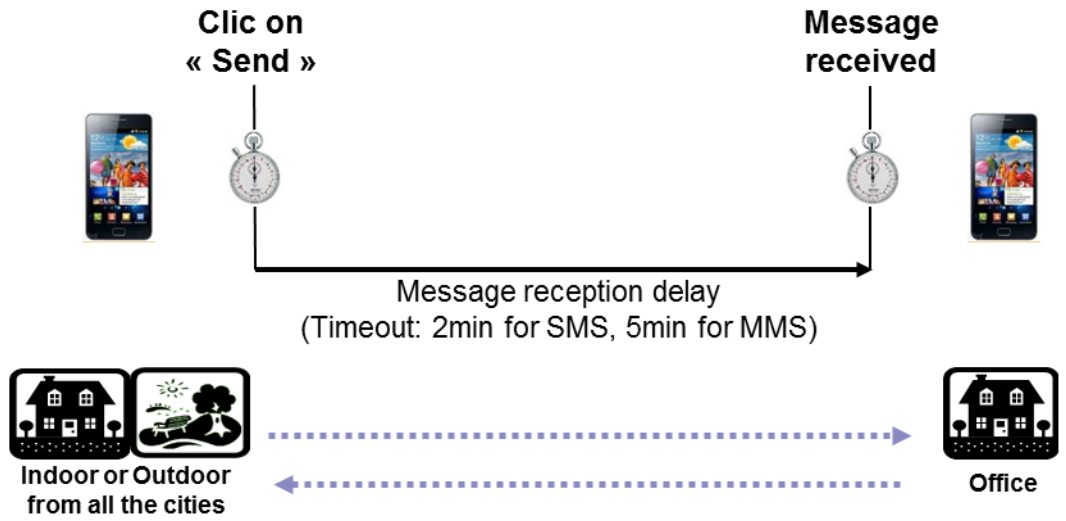
2.3 SMS, MMS and BBM Measurements

2.3.1 SMS Measurements

The mobile phones used to receive SMS were at a fixed location in an area served by a strong radio signal from the Mobile Operators. The mobile phones transmitting the SMS were in the field with the testing team. SMS were sent from indoor and outdoor locations used for voice testing or from the fixed location in Doha. During a test both phones stayed still.

A measurement, made simultaneously on all Mobile Networks, consisted of:

- Sending a 26 characters message including an index, and recording time.
- Observing when transmission was acknowledged on the phone and taking note of the time.
- Observing reception of the message on the other phone and taking note of the time; a message not received after 2 minutes and that has elapse time was marked as failed.
- Opening and checking integrity of the received message and index matching.



SMS test areas excluded road links, SMS testing schedule was the same as for voice testing.

SMS test sample distribution:

	INDOOR	OUTDOOR
DOHA	303	256
AL RAYYAN	197	234
AL KHOR	18	22
MADINAT AL SHAMAL	8	8
AL WAKRAH - AL WAKAIR	33	42
DUKHAN	10	10
MESSAIED	8	10
RAS LAFFAN	5	8
OTHER TOWNS AND VILLAGES	87	130
TOAL	**669**	**720**

2.3.2 MMS Measurements

MMS measurements were performed in a similar manner to the SMS, with the addition MMS were made of 26 characters, an index, plus a 50 KB picture attachment; receiving phone parameters were set to automatic reception.

Testing MMS area excluded road links and small towns, MMS testing schedule was the same as for voice testing.

MMS test sample distribution:

	INDOOR	OUTDOOR
DOHA	311	258
AL RAYYAN	192	231
AL KHOR	21	21
MADINAT AL SHAMAL	6	10
AL WAKRAH - AL WAKAIR	33	44
DUKHAN	10	10
MESSAIED	8	10
RAS LAFFAN	5	8
OTHER TOWNS AND VILLAGES	93	129
TOTAL	**679**	**721**

2.3.3 BBM Measurements

	INDOOR	OUTDOOR
DOHA	92	816
AL RAYYAN	30	436
AL KHOR	8	20
MADINAT AL SHAMAL	4	6
Wakrah	0	62
DUKHAN	2	14
MASAIEED	0	16
RAS LAFFAN	0	6
OTHER TOWNS AND VILLAGES	2	72
TOTAL	**138**	**1 448**

2.4 Data Service Testing

2.4.1 FTP Measurements

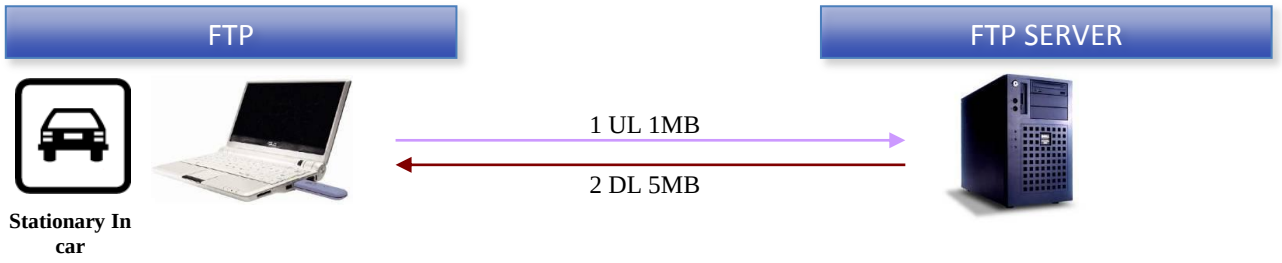
Data measurements were carried out automatically via **Mobi.Net** ©, Directique's software data test.

Test handset were connected to a laptop and **Mobi.Net** © was launched on each selected test point.

On each network, a measurement consisted of:

- Attempting to set up a radio connection before a 1 minute timeout. Connection time was recorded.
- Downloading 5MB file via FTP. Download time of the entire file was recorded (Test of integrity).
- Uploading 1MB file via FTP. Uploading time of the entire file was recorded

In case of error, the software did record the error type based on pre-defined error codes such as: FTP server connection error, radio signal drop, data transfer timed out set at 10 minutes etc.,



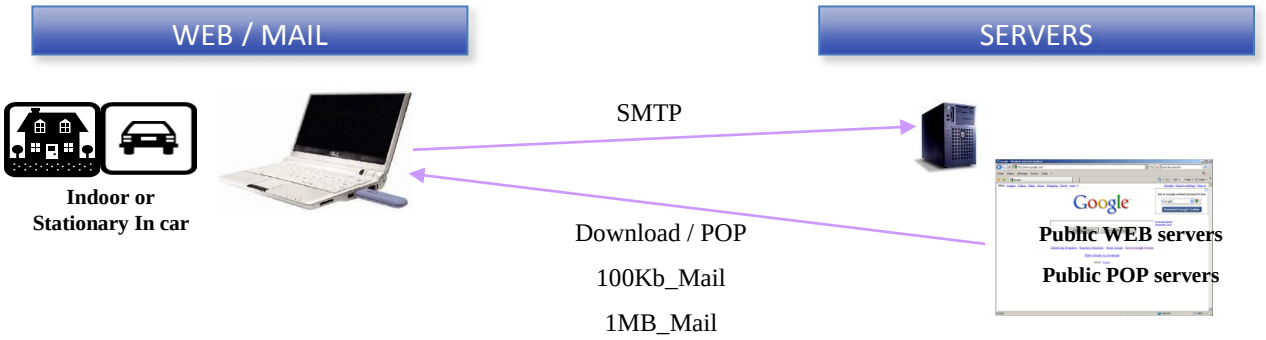
Quality of Service assessment offered by the access network with FTP Download and Upload tests was distributed over main Cities of Qatar.

	Connection	*FTP DL 5MB*	*FTP UL 1MB*
DOHA	1 803 mes	1 801 mes	1 801 mes
AL RAYYAN	929 mes	921 mes	921 mes
AL KHOR	56 mes	56 mes	56 mes
MADINAT AL SHAMAL	20 mes	20 mes	20 mes
Wakrah	124 mes	125 mes	125 mes
DUKHAN	30 mes	30 mes	30 mes
MASAIEED	30 mes	31 mes	31 mes
RAS LAFFAN	12 mes	12 mes	12 mes
OTHER TOWNS AND VILLAGES	150 mes	141 mes	141 mes
TOTAL	**3 154 mes**	**3 137 mes**	**3 137 mes**

FTP Test Samples Repartition

2.4.2 Web Browsing and Email Measurement

Web and Mail measurements were carried out automatically with **Mobi.Net** © (introduced earlier).



The test 3G+ USB dongle was connected to a laptop and **Mobi.Net** © was launched on each selected test point.

On each network, a measurement consisted of:

- Attempting to set up a radio connection before timeout set to 1 minute. Record connection time.
- For Web : downloading the homepage of the operator and 4 of the most visited public homepages, taking note of completion time, errors on page if any, with a 2 minutes timeout.

HTTP Tested Webpages:

http://www.facebook.com
http://www.google.com
http://www.ooredoo.qa
http://www.vodafone.qa
http://www.yahoo.com
http://www.youtube.com

	FACEBOOK	*GOOGLE*	*QTEL*	*VODAFONE*	*YAHOO*	*YOUTUBE*
DOHA	2 654 mes	4 217 mes	2 431 mes	1 493 mes	3 119 mes	2 860 mes
AL RAYYAN	1 347 mes	2 131 mes	1 176 mes	815 mes	1 637 mes	1 493 mes
AL KHOR	77 mes	128 mes	66 mes	48 mes	93 mes	81 mes
MADINAT AL SHAMAL	26 mes	44 mes	25 mes	15 mes	34 mes	27 mes
Wakrah	180 mes	293 mes	164 mes	105 mes	214 mes	192 mes
DUKHAN	40 mes	67 mes	34 mes	18 mes	45 mes	41 mes
MASAIEED	40 mes	65 mes	36 mes	28 mes	58 mes	46 mes
RAS LAFFAN	18 mes	26 mes	15 mes	7 mes	18 mes	18 mes
OTHER TOWNS AND VILLAGES	199 mes	311 mes	170 mes	118 mes	233 mes	215 mes
TOTAL	**4 581 mes**	**7 282 mes**	**4 117 mes**	**2 647 mes**	**5 451 mes**	**4 973 mes**

WEB Test Samples Repartition

Email Testing:

- For Mail (SMTP/POP): sending and receiving an e-mail, with an attached document 100Kb or 1MB.

	100Kb File	*1Mb File*
DOHA	1 807 mes	1 807 mes
AL RAYYAN	922 mes	922 mes
AL KHOR	56 mes	56 mes
MADINAT AL SHAMAL	20 mes	20 mes
Wakrah	121 mes	121 mes
DUKHAN	30 mes	30 mes
MASAIEED	32 mes	31 mes
RAS LAFFAN	12 mes	12 mes
OTHER TOWNS AND VILLAGES	141 mes	140 mes
TOTAL	**3 141 mes**	**3 139 mes**

MAIL Test Samples Repartition

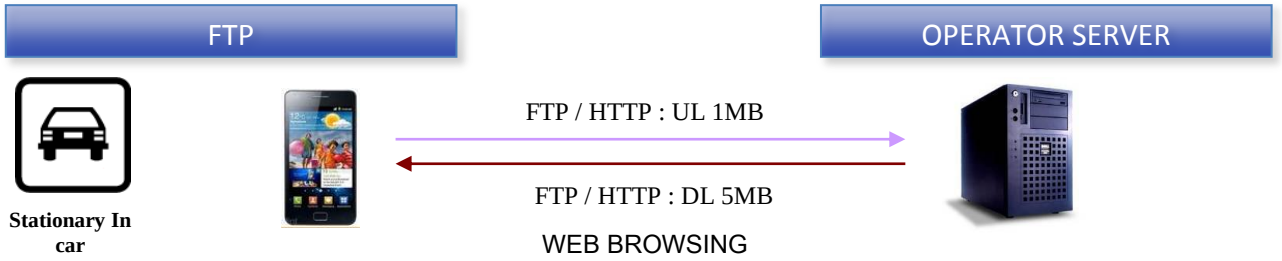
2.4.3 Smartphone Measurement

The test was launched automatically by the android App **MobiSpeed** ©.

On each network, a measurement consisted of:

- Downloading 5MB file via FTP. Download time of the entire file was recorded (Test of integrity).
- Uploading 1MB file via FTP. Uploading time of the entire file was recorded. For LTE, size were changed from 1M to 10M in upload
- Downloading 5MB file via HTTP. Download time of the entire file was recorded (Test of integrity). For LTE, size were changed from 5M to 20M. in download
- Uploading 1MB file via HTTP. Uploading time of the entire file was recorded.
- WEB: Downloading the homepage of the operator and 4 of the most visited public homepages, taking note of completion time, errors on page if any, with a 2 minutes timeout.

In cases of error, the software did record the error type based on pre-defined error codes such as: FTP server connection error, radio signal drop, data transfer timed out set at 10 minutes etc.,



	WEB	*HTTP*	*FTP*
DOHA	8 330 mes	3 342 mes	3 337 mes
AL RAYYAN	4 118 mes	1 652 mes	1 651 mes
AL KHOR	230 mes	92 mes	92 mes
MADINAT AL SHAMAL	85 mes	34 mes	34 mes
Wakrah	574 mes	230 mes	230 mes
DUKHAN	120 mes	48 mes	48 mes
MASAIEED	120 mes	48 mes	48 mes
RAS LAFFAN	45 mes	18 mes	18 mes
OTHER TOWNS AND VILLAGES	665 mes	265 mes	266 mes
TOTAL	**14 287 mes**	**5 729 mes**	**5 724 mes**

Smartphone Test Sample Repartition

2.4.4 Video Streaming (Smartphones and Dongles)

Objectives: Assess the quality of a popular YouTube video

Protocol:

- The evaluation lasts 2 minutes.
- Each video and audio defect is categorized and its duration is collected in order to determine if the viewing is perfect, fair, poor or bad.
- Once the sequence has been completed, a grade is given to describe 3 global appraisal criteria (sharpness, audio/video synchronization and sound quality)

Testers trained with Golden eyes : computerized training system based on several hundreds of video samples representative of all characteristics defects associated with mobile networks.

The reference video for this audit is a popular YouTube video tested in guaranteed throughput conditions prior to the audit.

Defects correspond to damages occurring during the assessment and detailed hereafter:

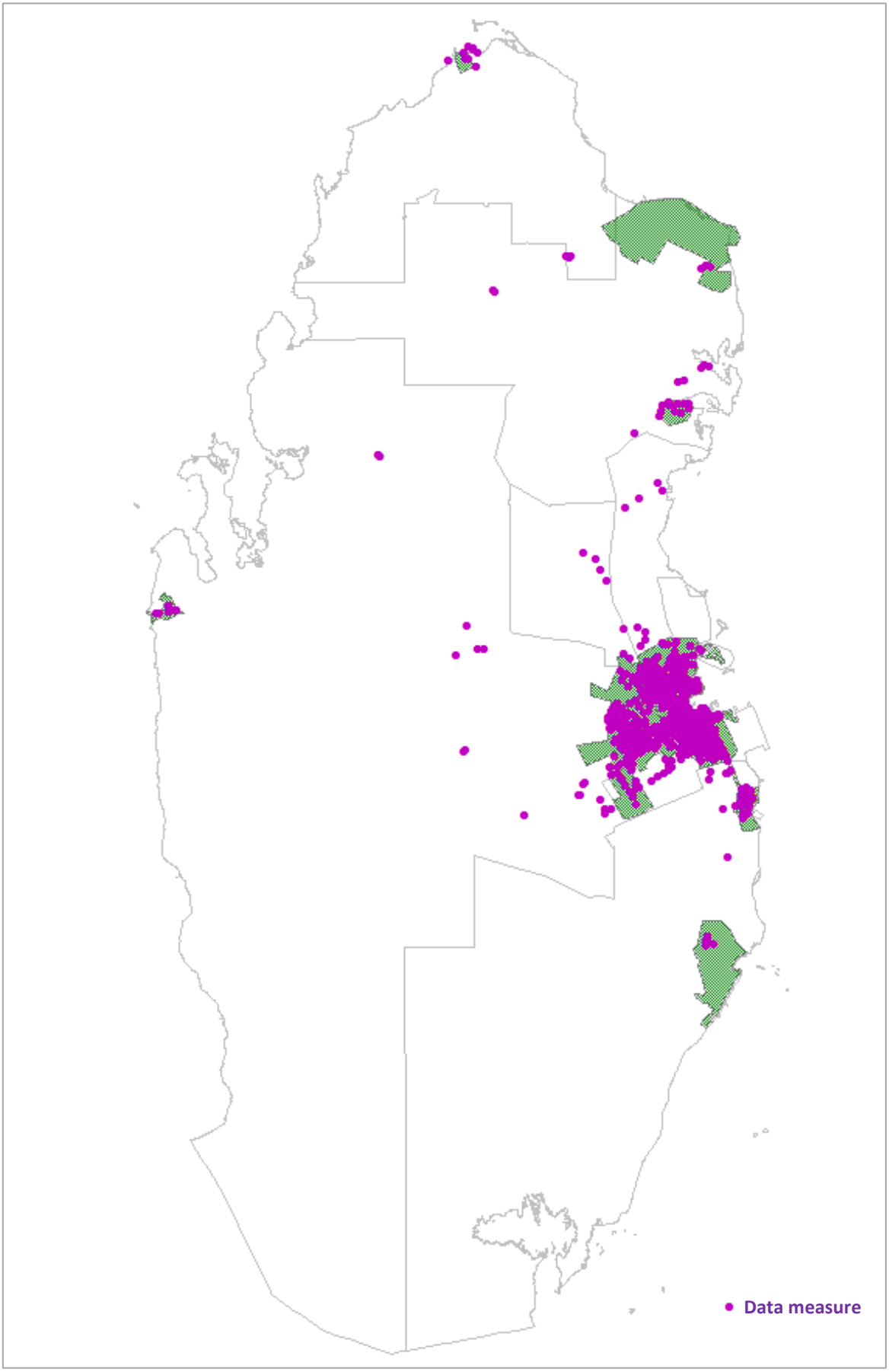
Video appraisal criteria	
SUPERIMPOSITION	Bad transition between frames triggering superimposition or interlaced images
PIXELATION	Single-colored square display elements that comprise the bitmap are visible.
BUFFERING	The sequence stops, a message showing the buffering percentage appears.
JERKINESS	When the frame rate is not fast enough, individual still images may be perceived by the viewer.
FREEZE	A Freeze occurs when the sequence shows a still image during a few seconds

Audio appraisal criteria	
AUDIO INTERRUPTIONS	Silences are categorized as furtive (< 1s), short (< 3s) or long (> 3s)
AUDIO DEFECTS	Punctual audio defects perceived by the user including distortions, crackling, metallic sounds and echoes.

	Smartphone	Dongle
DOHA	912 mes	912 mes
AL RAYYAN	463 mes	464 mes
AL KHOR	28 mes	28 mes
MADINAT AL SHAMAL	10 mes	10 mes
Wakrah	66 mes	66 mes
DUKHAN	16 mes	16 mes
MASAIEED	16 mes	16 mes
RAS LAFFAN	6 mes	6 mes
OTHER TOWNS AND VILLAGES	74 mes	74 mes
TOAL	**1 591 mes**	**1 592 mes**

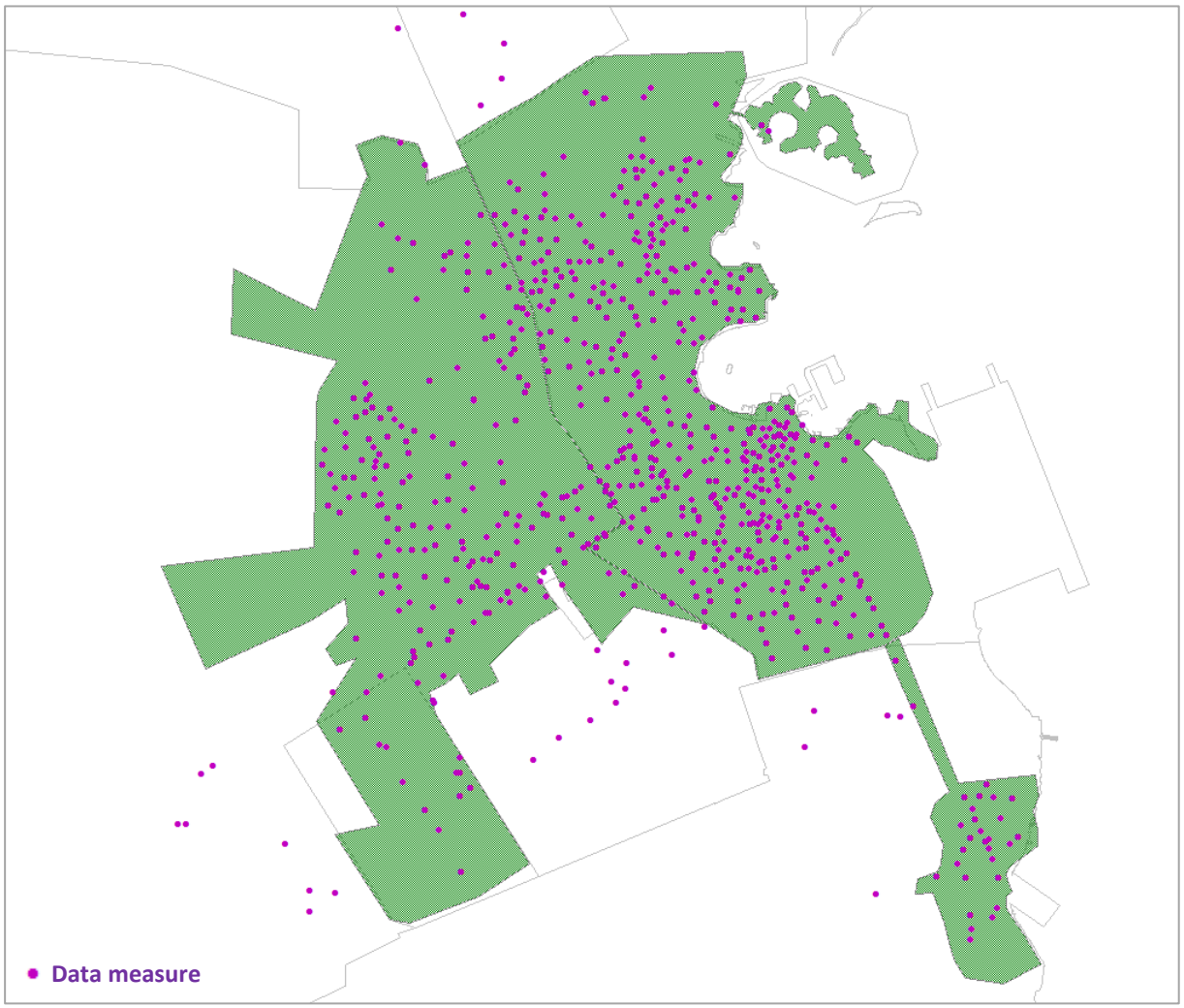
Streaming Sample Repartition

Map of DATA Measurements



Map of DATA Measurements

Zoom on DOHA



2.5 Key Performance Indicators

2.5.1 Voice KPIs

A voice measurement is a successful call attempt followed by a 2 minutes conversation, with an assessment of the audio voice quality for each operator service.

KPIs	Definition
SHC (Set-up and held for 2 min calls)	% of calls set-up and held for 2 min. Call set-up on first attempt and held for 2 min without drop. Rate is based on the total sample
PQR (Perfect quality rate)	% of calls set-up held for 2 min and marked 4. Calls excluded = failed on first attempt, dropped before 2 min, or been marked 3 or lower Rate is based on the total sample
CQR (Correct quality rate)	% of calls set-up held for 2 min and marked 3 or 4 Calls excluded = failed on first attempt, dropped before 2 min, or been marked 2 or lower Rate is based on the total sample

2.5.2 BBM KPIs

KPIs	Definition
RS2 (% of received BBM within 2 minutes)	BBM not refused when sent out and received within 2 minutes without being altered Rate is based on the total number of SMS send attempts.
RS30 (% of received BBM within 30 sec)	BBM not refused when sent out and received within 30 seconds without being altered.

2.5.3 SMS KPIs

KPIs	Definition
RS2 (% of received SMS within 2 minutes)	SMS not refused when sent out and received within 2 minutes without being altered Rate is based on the total number of SMS send attempts.
RS30 (% of received SMS within 30 sec)	SMS not refused when sent out and received within 30 seconds without being altered.

2.5.4 MMS KPIs

KPIs	Definition
RM5 (% of received MMS within 5 minutes)	MMS not refused when sent out and received within 5 minutes without being altered Rate is based on the total number of MMS send attempts.
RM2 (% of received MMS within 2 min)	MMS not refused when sent out and received within 2 minutes without being altered.

2.5.5 FTP, HTTP, Web and Mail KPIs

KPIs	Definition
% of **successful radio connections** within 1 minute	Connection within 1 minute timeframe. The indicator is based on the total number of connection attempts.
% of successful radio connections **within 10 seconds**	Same as above but within 10 seconds timeframe.
% of successful **data transfers**	Successful data file when received in full and without radio drop, within 10 minutes (FTP) or 2 minutes (Web & eMails) once connected. Indicator is based on the total number of connection attempts.
Average **download time** once connected	Average download time once connected applied only to successful data transfers.
Standard download time deviation	Standard download time deviation applied only to successful data transfers.

2.5.6 Video Streaming

KPIs	Definition
LHV % of video set-up and held for 2 min	Video set-up on first attempt and held for 2 min without drop. Rate is based on the total sample.
VPQR % of calls set-up, held for 2 min, and marked 4	Video excluded = failed on first attempt, dropped before 2 min, or been marked 3 or lower Rate is based on the total sample.
VCQR % of calls set-up, held for 2 min, and marked 3 or 4	Video excluded = failed on first attempt, dropped before 2 min, or been marked 2 or lower Rate is based on the total sample.

3 Industry results and international benchmark

3.1 Introduction

The availability and quality of modern telecommunications services are critical elements for the success of the state of Qatar. Mobile telecommunications services are heavily used by consumers and businesses, either located in Qatar or visiting the country.

In releasing this study, CRA aimed at evaluating and benchmarking quality levels offered by Mobile Network Operators in the state, Ooredoo and Vodafone from an end-user perspective, for the following set of services:

- Voice
- Short Message Services (SMS)
- Multi Media Messaging Services (MMS)
- BlackBerry Messenger (BBM)
- Video Streaming
- Web Surfing
- File Transfer (FTP and HTTP)
- Emails

The Authority selected Directique, an international consulting firm to conduct the assessment using a test method designed to gather a faithful qualitative record from an end-users' point of view, avoiding assessing quality through a pure technical angle as this is performed by Mobile Operators themselves on a regular basis.

This audit was conducted from 11th November 2013 to 5th January 2014, except 18th December 2013 (Qatar National day).

Measurements were performed between 8:00 am and 11:00 pm every day except Saturdays.

3.2 Industry Results

The following tables show the average combined results achieved by the two Mobile Operators for all measurements.

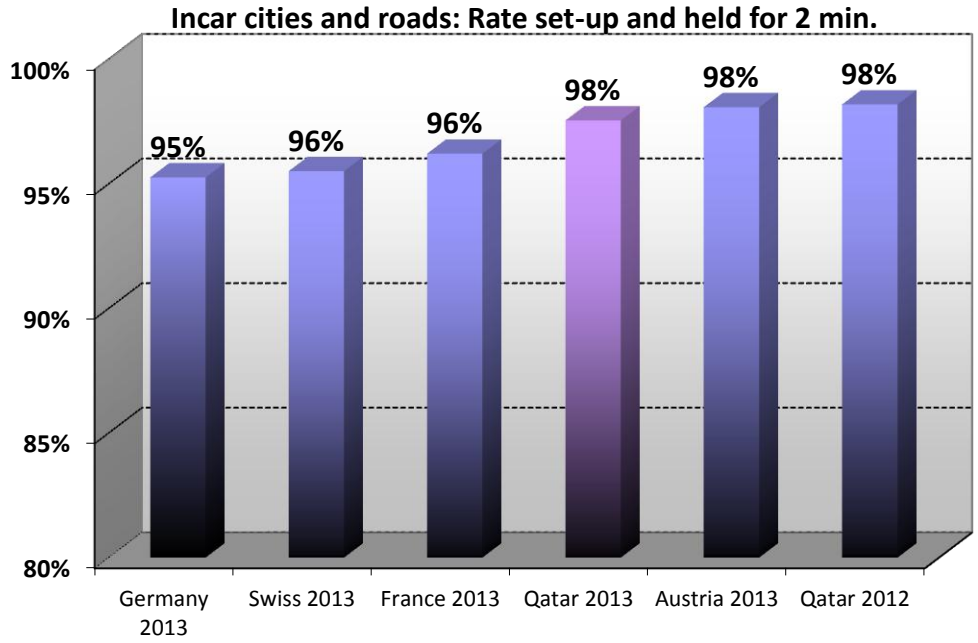
3.2.1 Voice and Messaging Services

	Sample	*9 494 mes*
Rate of calls set-up and held for 2 min		**98.1%**
	Statistic accuracy	*+/-0.3%*
and marked	4-perfect (PQR)	**97.0%**
	Statistical accuracy	*± 0.3%*
	4-perfect or 3-fair (CQR)	**97.7%**
	Statistical accuracy	*± 0.3%*

INCAR (Cities and roads) Voice Service

	Sample	*3 892 mes*
Rate of calls set-up and held for 2 min		**97.5%**
	Statistic accuracy	*+/-0.5%*

International benchmark:

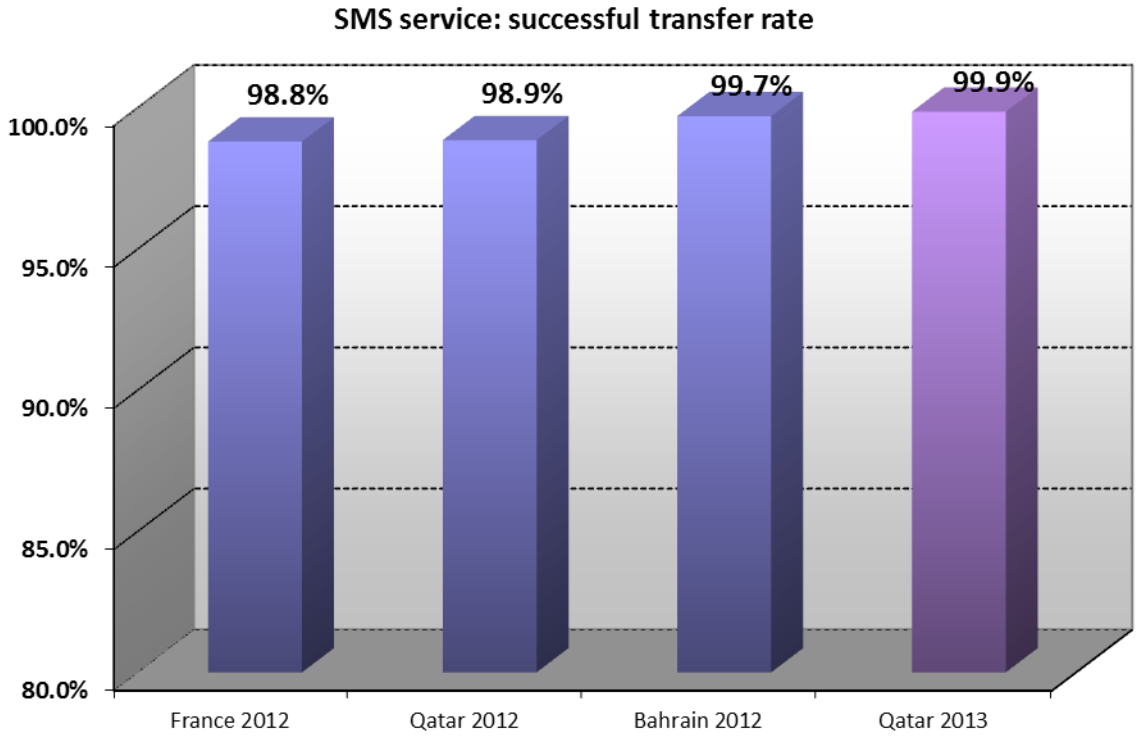


Note: only the failure and drop calls rate can be compared. The voice quality of the calls is assessed, in some countries, with automatic tools, like Swissqual. Therefore, the quality of the conversation cannot be evaluated for these countries.

SMS Service

	Sample	*2 778*
Rate of received SMS within 2 minutes (RS2)		**99.9%**
	Statistical accuracy	*+/-0.1%*
Rate of received SMS within 30 seconds (RS30)		**98.7%**
	Statistical accuracy	*+/-0.4%*
Rate of received SMS within 15 seconds (RS15)		**97.7%**
	Statistical accuracy	*+/-0.6%*
Average time reception		**5.1 s**

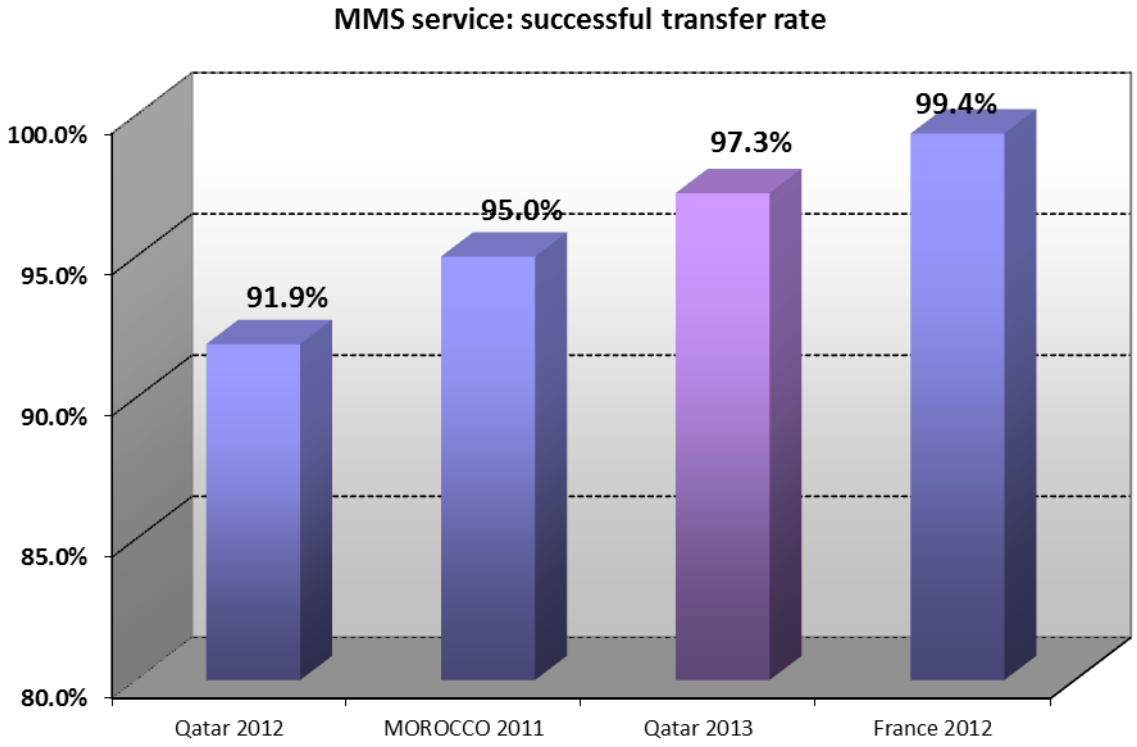
International benchmark:



MMS Service

	Sample	*2 800*
Rate of received MMS within 5 minutes (RM5)		**97.3%**
	Statistical accuracy	*+/-0.6%*
Rate of received MMS within 2 minutes (RM2)		**94.7%**
	Statistical accuracy	*+/-0.8%*
Average time reception		**34.7 s**

International benchmark:



BBM Service

	Sample	*1 586*
Rate of received SMS within 2 minutes (RS2)		**97.4%**
	Statistical accuracy	*+/-0.6%*
Rate of received SMS within 30 seconds (RS30)		**96.8%**
	Statistical accuracy	*+/-0.6%*
Rate of received SMS within 15 seconds (RS15)		**95.5%**
	Statistical accuracy	*+/-0.8%*
Average time reception		**4.5 s**

3.2.2 Video Streaming

Video Streaming

		Smartphone	Dongle
	Sample	*1 700*	*1 703*
END to END Quality rate		**92.8%**	**92.0%**
	Statistic accuracy	*+/-1.2%*	*+/-1.3%*
Rate of successful access to the video		93.3%	92.4%
	Statistic accuracy	*+/-1.2%*	*+/-1.3%*
Dropped sequences		0.0%	0.0%
	Statistic accuracy	*+/-0.0%*	*+/-0.0%*
Non Quality sequences		0.6%	0.4%
	Statistic accuracy	*+/-0.4%*	*+/-0.3%*

Results are similar between tests on Smartphone and tests on PC with dongle.

3.2.3 Computer Dongle Services

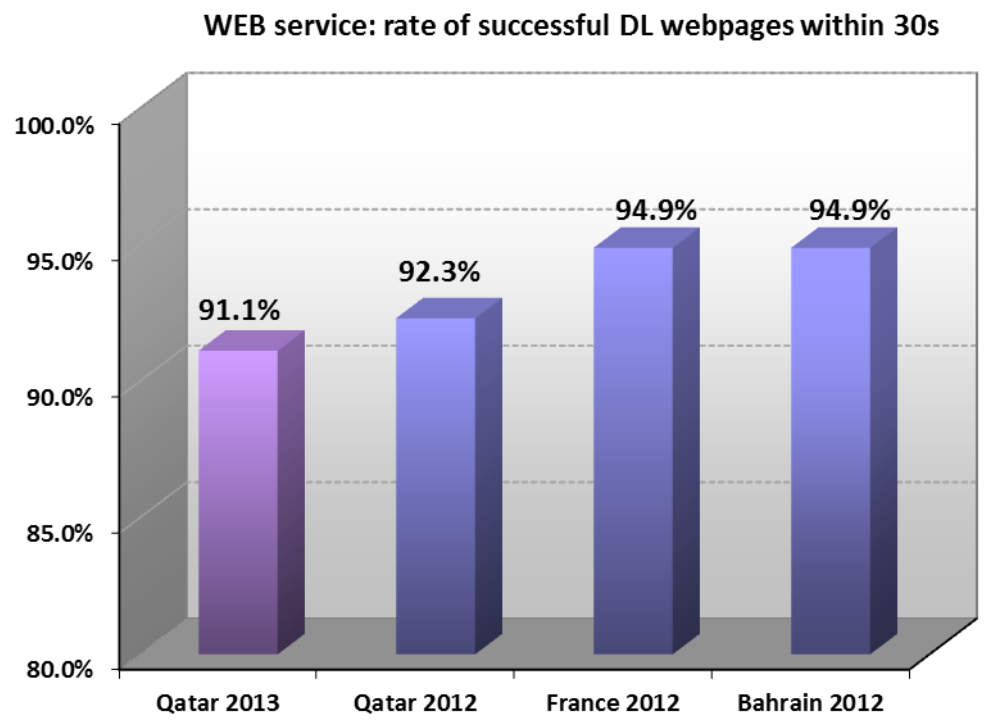
Radio Connection

	Sample	*3 148*
Rate of succesfull radio connections to network		**99.3%**
	Statistical accuracy	*+/-0.3%*
Rate of succesfull radio connections within 10 sec		**98.7%**
	Statistical accuracy	*+/-0.4%*

Web Browsing

	Sample	*15 643*
Rate of successful DL webpages within 30s		**91.1%**
	Statistical accuracy	*+/-0.4%*

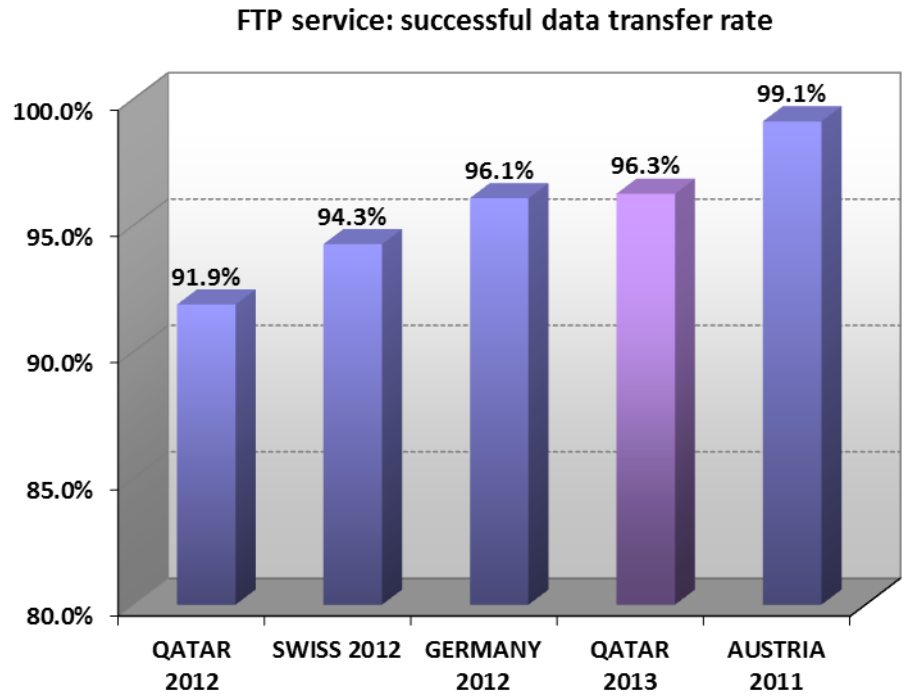
International benchmark:



FTP Download & Upload

		Global	Download	Upload
	Sample	***6 293***	*3 156*	*3 137*
Rate of succesfull data transfers		**96.3%**	**99.2%**	**93.3%**
	Statistical accuracy	*+/-0.5%*	*+/-0.3%*	*+/-0.9%*
Average Throughput			4754 kbps	1986 kbps
Max Throughput			15281 kbps	4947 kbps

International Benchmark:



No measures were done with dongles since 2012 in Austria, Germany and Swiss.

Mail

		SMTP	**POP**
	Sample	*6 280*	*5 577*
Rate of succesfull data transfers		**94.5%**	**95.2%**
	Statistical accuracy	*+/-0.6%*	*+/-0.6%*

3.2.4 Smartphone Services

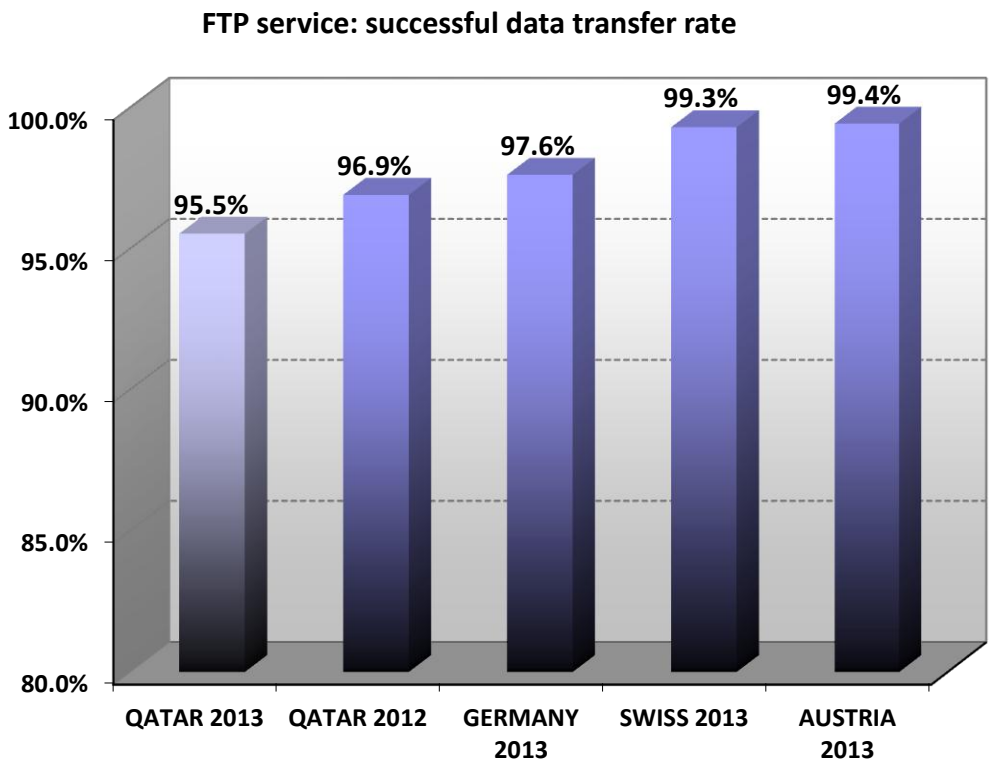
Web Browsing

	Sample	*13 882*
Rate of successful DL webpages within 30s		**86.8%**
	Statistical accuracy	*+/-0.6%*

FTP Download & Upload

		Global	Download	Upload
	Sample	***5 562***	*2 782*	*2 780*
Rate of succesfull data transfers		**95.5%**	**97.6%**	**93.4%**
	Statistical accuracy	*+/-0.5%*	*+/-0.6%*	*+/-0.9%*
Average Throughput			4 137 kbps	1 831 kbps
Max Throughput			24 139 kbps	8 700 kbps

International benchmark:



HTTP Download & Upload

	Global	Download	Upload
Sample	***5 567***	*2 783*	*2 784*
Rate of succesfull data transfers	**95.4%**	**97.3%**	**93.5%**
Statistical accuracy	*+/-0.6%*	*+/-0.6%*	*+/-0.9%*
Average Throughput		7 616 kbps	3 019 kbps
Max Throughput		49 737 kbps	29 199 kbps

4 AUDIT RESULTS

4.1 OOREDOO Results

4.1.1 Global Voice Results (Towns & Roads)

Global Voice Service		**Ooredoo**
	Sample	*4 747 mes*
Rate of calls set-up and held for 2 min		**98.9%**
	Statistical accuracy	*± 0.3%*
and marked	4-perfect (PQR)	**97.6%**
	Statistical accuracy	*± 0.4%*
	4-perfect or 3-fair (CQR)	**98.5%**
	Statistical accuracy	*± 0.3%*

4.1.1.1 Cities Voice Results (In car-Indoor-Outdoor)

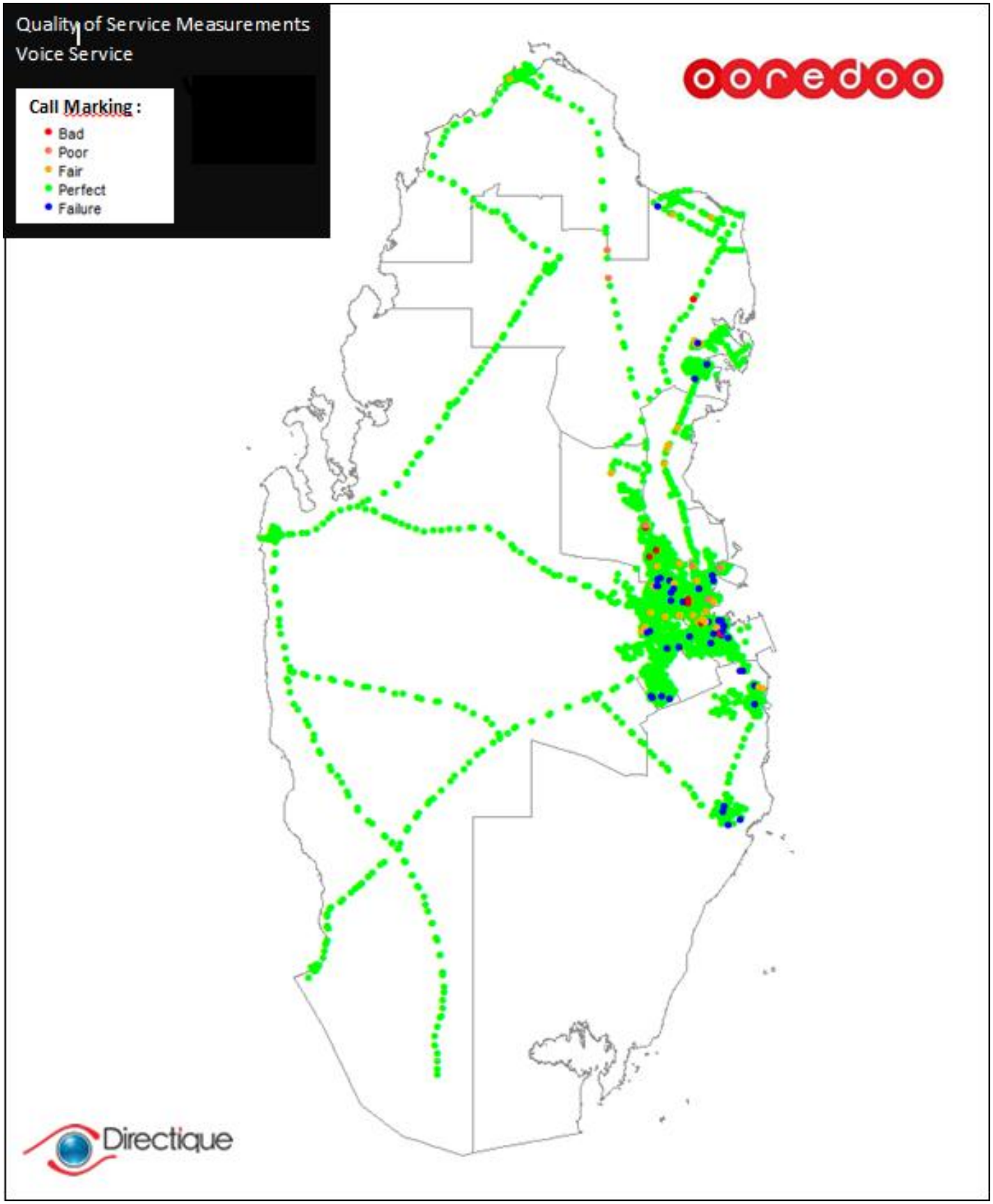
CITIES VOICE SERVICE		**Ooredoo**
		4 213 mes
Rate of calls set-up and held for 2 min		**98.8%**
	Statistical accuracy	*± 0.3%*
and marked	4-perfect (PQR)	**97.6%**
	Statistical accuracy	*± 0.5%*
	4-perfect or 3-fair (CQR)	**98.5%**
	Statistical accuracy	*± 0.4%*

Cities INCAR Voice Service		**Ooredoo**
		1 412 mes
Rate of calls set-up and held for 2 min		**98.0%**
	Statistical accuracy	*± 0.7%*
and marked	4-perfect (PQR)	**97.6%**
	Statistical accuracy	*± 0.8%*
	4-perfect or 3-fair (CQR)	**98.5%**
	Statistical accuracy	*± 0.6%*

4.1.1.2 Roads Links Voice Results

Road Links Voice Service		**Ooredoo**
		534 mes
Rate of calls set-up and held for 2 min		**99.8%**
	Statistical accuracy	*± 0.4%*
and marked	4-perfect (PQR)	**98.1%**
	Statistical accuracy	*± 1.1%*
	4-perfect or 3-fair (CQR)	**98.9%**
	Statistical accuracy	*± 0.9%*

Map – **Voice** Call Results



4.1.2 Services Results

4.1.2.1 SMS Results

SMS Service	Ooredoo
Sample	*1 389*
Rate of received SMS within 2 minutes (RS2)	**99.9%**
Statistical accuracy	*+/-0.1%*
Rate of received SMS within 30 seconds (RS30)	**99.5%**
Statistical accuracy	*+/-0.4%*
Average time reception	4.5 s

4.1.2.2 BBM Results

BBM Service	Ooredoo
Sample	*798*
Rate of received BBM within 2 minutes (RS2)	**99.4%**
Statistical accuracy	*+/-0.5%*
Rate of received BBM within 30 seconds (RS30)	**99.0%**
Statistical accuracy	*+/-0.7%*
Average time reception	4.6 s

4.1.2.3 MMS Results

	Ooredoo
Sample	*1 400*
Rate of received MMS within 5 minutes (RM5)	**98.4%**
Statistical accuracy	*+/-0.7%*
Rate of received MMS within 2 minutes (RM2)	**95.4%**
Statistical accuracy	*+/-1.1%*
Average time reception	35.9 s

4.1.3 Data Dongle Results

4.1.3.1 Data Accessibility Results

Radio Connection	Ooredoo
Sample	*1 584 mes*
Rate of succesfull radio connections to network (within 60 seconds)	**99.6%**
Statistical accuracy	*+/-0.3%*
Rate of succesfull radio connections within 10 sec	**99.6%**
Statistical accuracy	*+/-0.4%*

4.1.3.2 WEB Service Results

WEB BROWSING	Ooredoo
Sample	*7 916 mes*
Rate of succesfull downloaded webpages (within 30 seconds)	**96.5%**
Average download time once connected	**4.2 s**
Min download time once connected	0.7 s
Max download time once connected	30 s
Standard deviation of download time once connected	2.9 s

4.1.3.3 FTP Results

Download FTP	Ooredoo
Sample	*1 578*
Rate of succesfull data transfer	**99.9%**
Statistical accuracy	*+/-0.2%*
Average Throughput	**8 173 kbps**
THROUGHPUT - min	197 kbps
THROUGHPUT - max	15 281 kbps
THROUGHPUT - standard deviation	2 583 kbps

Upload FTP	Ooredoo
Sample	*1 578*
Rate of succesfull data transfer	**98.6%**
Statistical accuracy	*+/-0.6%*
Average Throughput	**3 242 kbps**
THROUGHPUT - min	82 kbps
THROUGHPUT - max	4 947 kbps
THROUGHPUT - standard deviation	1 052 kbps

4.1.3.4 Mail Results

	Email 100Kb		*Email 1Mb*	
Mail Service **OOREDOO**	**SMTP**	**POP**	**SMTP**	**POP**
Sample	*1 579*	*1 396*	*1 578*	*1 318*
Rate of succesfull data transfer	**99.6%**	**99.4%**	**97.5%**	**100.0%**
Statistical accuracy	*+/-0.3%*	*+/-0.4%*	*+/-0.8%*	*+/-0.0%*
Average Sending/Receiving Time once connected	**6.0 s**	**3.3 s**	**8.5 s**	**5.1 s**
Min Sending/Receiving Time once connected	3.7 s	2.4 s	5.0 s	3.5 s
Max Sending/Receiving Time once connected	60 s	20 s	57 s	49 s
Standard deviation Sending/Receiving Time once connected	4.0 s	1.0 s	4.6 s	2.7 s

4.1.4 Smartphone Results

4.1.4.1 WEB Service Results

WEB BROWSING	Ooredoo	Ooredoo 3G	Ooredoo LTE
Sample	*6 038*	*3 199*	*2 839*
Rate of succesfull downloaded webpages (within 30 seconds)	**97.3%**	**96.1%**	**98.6%**
Statistical accuracy	*+/-0.4%*	*+/-0.7%*	*+/-0.4%*
Average download time once connected	**5.3 s**	**6.8 s**	**3.6 s**
Min download time once connected	0.9 s	1.5 s	0.9 s
Max download time once connected	29.0 s	29.0 s	28.3 s
Standard deviation of download time once connected	3.5 s	4.3 s	2.6 s

4.1.4.2 FTP Results

Download FTP	Ooredoo	Ooredoo 3G	Ooredoo LTE
Sample	*1 208*	*640*	*568*
Rate of succesfull data transfers	**99.2%**	**99.1%**	**99.3%**
Statistical accuracy	*+/-0.5%*	*+/-0.7%*	*+/-0.7%*
Average Throughput	**5 575 kbps**	**2 406 kbps**	**8 745 kbps**
THROUGHPUT - min	160 kbps	185 kbps	160 kbps
THROUGHPUT - max	24 139 kbps	8 177 kbps	24 139 kbps
THROUGHPUT - standard deviation	2 727 kbps	1 279 kbps	4 175 kbps

Upload FTP	Ooredoo	Ooredoo 3G	Ooredoo LTE
Sample	*1 208*	*640*	*568*
Rate of succesfull data transfers	**98.8%**	**98.8%**	**98.9%**
Statistical accuracy	*+/-0.6%*	*+/-0.9%*	*+/-0.8%*
Average Throughput	**2 453 kbps**	**878 kbps**	**4 029 kbps**
THROUGHPUT - min	86 kbps	86 kbps	96 kbps
THROUGHPUT - max	8 700 kbps	3 167 kbps	8 700 kbps
THROUGHPUT - standard deviation	1 094 kbps	337 kbps	1 850 kbps

4.1.4.3 HTTP Results

Download HTTP	Ooredoo	Ooredoo 3G	Ooredoo LTE
Sample	*1 208*	*640*	*568*
Rate of succesfull data transfers	**99.1%**	**99.1%**	**99.1%**
Statistical accuracy	*+/-0.5%*	*+/-0.7%*	*+/-0.8%*
Average Throughput	**10 203 kbps**	**2 920 kbps**	**17 485 kbps**
THROUGHPUT - min	151 kbps	151 kbps	731 kbps
THROUGHPUT - max	49 737 kbps	10 734 kbps	49 737 kbps
THROUGHPUT - standard deviation	5 691 kbps	1 832 kbps	9 550 kbps

Upload HTTP	Ooredoo	Ooredoo 3G	Ooredoo LTE
Sample	*1 208*	*640*	*568*
Rate of succesfull data transfers	**98.2%**	**98.6%**	**97.7%**
Statistical accuracy	*+/-0.8%*	*+/-0.9%*	*+/-1.2%*
Average Throughput	**4 042 kbps**	**1 222 kbps**	**6 861 kbps**
THROUGHPUT - min	77 kbps	77 kbps	91 kbps
THROUGHPUT - max	29 199 kbps	3 764 kbps	29 199 kbps
THROUGHPUT - standard deviation	2 633 kbps	449 kbps	4 818 kbps

4.1.5 Video Streaming Results

	Ooredoo	
VIDEO STREAMING	**Smartphone**	**Dongle**
Sample	*796*	*796*
END to END non-Quality rate	**2.8%**	**0.5%**
Statistic accuracy	*+/-1.1%*	*+/-0.5%*
TNQ - Acess to the video	2.5%	0.5%
Youtube sequences dropped	0.0%	0.0%
Youtube sequences with quality defaults	0.3%	0.0%
(more than 2 major defaults and/or more than 6 minor defaults)		

4.2 VODAFONE Results

4.2.1Global Voice Results (Towns & Roads)

Global Voice Service		**Vodafone**
		4 747 mes
Rate of calls set-up and held for 2 min		**97.3%**
	Statistical accuracy	*± 0.5%*
and marked	4-perfect (PQR)	**96.4%**
	Statistical accuracy	*± 0.5%*
	4-perfect or 3-fair (CQR)	**96.8%**
	Statistical accuracy	*± 0.5%*

4.2.1.1 Towns Voice Results (In car-Indoor-Outdoor)

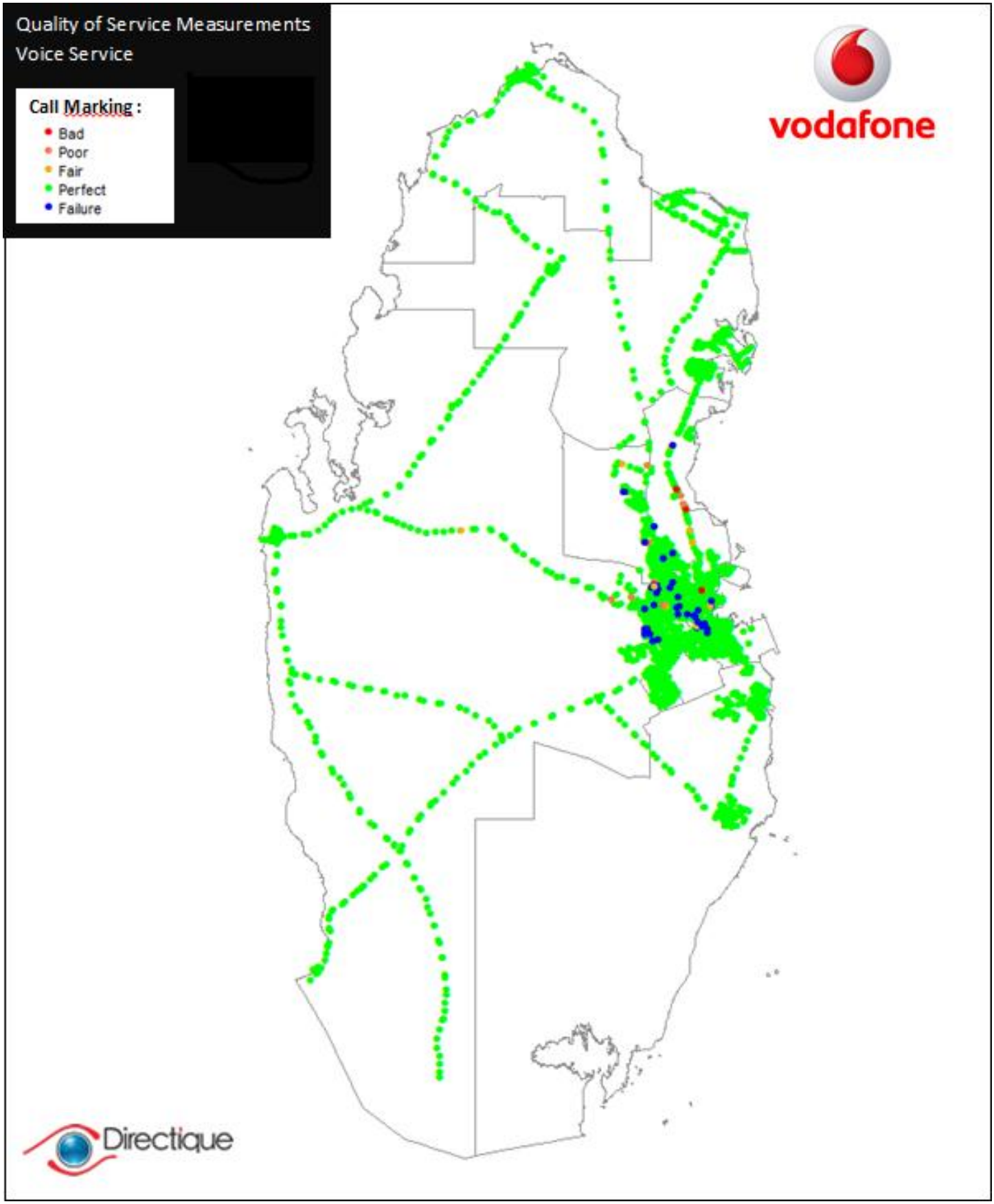
CITIES VOICE SERVICE		**Vodafone**
		4 213 mes
Rate of calls set-up and held for 2 min		**97.7%**
	Statistical accuracy	*± 0.5%*
and marked	4-perfect (PQR)	**97.1%**
	Statistical accuracy	*± 0.5%*
	4-perfect or 3-fair (CQR)	**97.3%**
	Statistical accuracy	*± 0.5%*

Cities INCAR Voice Service		**Vodafone**
		1 412 mes
Rate of calls set-up and held for 2 min		**97.4%**
	Statistical accuracy	*± 0.8%*
and marked	4-perfect (PQR)	**96.4%**
	Statistical accuracy	*± 1.0%*
	4-perfect or 3-fair (CQR)	**96.8%**
	Statistical accuracy	*± 0.9%*

4.2.1.2 Roads Links Voice Results

Road Links Voice Service		**Vodafone**
		534 mes
Rate of calls set-up and held for 2 min		**94.4%**
	Statistical accuracy	*± 2.0%*
and marked	4-perfect (PQR)	**91.4%**
	Statistical accuracy	*± 2.4%*
	4-perfect or 3-fair (CQR)	**92.9%**
	Statistical accuracy	*± 2.2%*

Map - **Voice** Call Results



4.2.2Service Results

4.2.2.1 SMS Results

SMS Service	Vodafone
Sample	*1 389*
Rate of received SMS within 2 minutes (RS2)	**99.8%**
Statistical accuracy	*+/-0.2%*
Rate of received SMS within 30 seconds (RS30)	**97.8%**
Statistical accuracy	*+/-0.8%*
Average time reception	5.7 s

4.2.2.2 BBM Results

BBM Service	Vodafone
Sample	*788*
Rate of received BBM within 2 minutes (RS2)	**95.3%**
Statistical accuracy	*+/-1.5%*
Rate of received BBM within 30 seconds (RS30)	**94.7%**
Statistical accuracy	*+/-1.6%*
Average time reception	4.5 s

4.2.2.3 MMS Results

	Vodafone
Sample	*1 400*
Rate of received MMS within 5 minutes (RM5)	**96.1%**
Statistical accuracy	*+/-1.0%*
Rate of received MMS within 2 minutes (RM2)	**94.1%**
Statistical accuracy	*+/-1.2%*
Average time reception	33.6 s

4.2.3Data Dongle Results

4.2.3.1 Data Accessibility Results

Radio Connection	Vodafone
Sample	*1 564 mes*
Rate of succesfull radio connections to network (within 60 seconds)	**99.0%**
Statistical accuracy	*+/-0.6%*
Rate of succesfull radio connections within 10 sec	**97.8%**
Statistical accuracy	*+/-0.8%*

4.2.3.2 WEB Service Results

WEB BROWSING	Vodafone
Sample	*7 727 mes*
Rate of succesfull downloaded webpages (within 30 seconds)	**85.6%**
Average download time once connected	**9.3 s**
Min download time once connected	1.5 s
Max download time once connected	30 s
Standard deviation of download time once connected	6.5 s

4.2.3.3 FTP Results

Download FTP	Vodafone
Sample	*1 559*
Rate of succesfull data transfer	**95.3%**
Statistical accuracy	*+/-1.0%*
Average Throughput	**1 335 kbps**
THROUGHPUT - min	143 kbps
THROUGHPUT - max	6 155 kbps
THROUGHPUT - standard deviation	899 kbps

Upload FTP	Vodafone
Sample	*1 559*
Rate of succesfull data transfer	**87.9%**
Statistical accuracy	*+/-1.6%*
Average Throughput	**729 kbps**
THROUGHPUT - min	82 kbps
THROUGHPUT - max	3 604 kbps
THROUGHPUT - standard deviation	437 kbps

4.2.3.4 Mail Results

	Email 100Kb		*Email 1Mb*	
Mail Service **VODAFONE**	**SMTP**	**POP**	**SMTP**	**POP**
Sample	*1 562*	*1 553*	*1 561*	*1 310*
Rate of succesfull data transfer	**97.7%**	**97.1%**	**83.3%**	**83.0%**
Statistical accuracy	*+/-0.7%*	*+/-0.8%*	*+/-1.8%*	*+/-2.0%*
Average Sending/Receiving Time once connected	**16.4 s**	**13.4 s**	**29.4 s**	**66.3 s**
Min Sending/Receiving Time once connected	5.7 s	4.9 s	12.4 s	12.1 s
Max Sending/Receiving Time once connected	60 s	59 s	60 s	120 s
Standard deviation Sending/Receiving Time once connected	10.4 s	7.6 s	9.6 s	23.6 s

4.2.4 Smartphone Results

4.2.4.1 WEB Results

WEB BROWSING	Vodafone
Sample	*7 844*
Rate of succesfull downloaded webpages (within 30 seconds)	**78.7%**
Statistical accuracy	*+/-0.9%*
Average download time once connected	**9.2 s**
Min download time once connected	2.5 s
Max download time once connected	30.0 s
Standard deviation of download time once connected	6.2 s

4.2.4.2 FTP Results

Download FTP	Vodafone
Sample	*1 574*
Rate of succesfull data transfers	**96.4%**
Statistical accuracy	*+/-0.9%*
Average Throughput	**1 262 kbps**
THROUGHPUT - min	145 kbps
THROUGHPUT - max	8 104 kbps
THROUGHPUT - standard deviation	809 kbps

Upload FTP	Vodafone
Sample	*1 572*
Rate of succesfull data transfers	**89.2%**
Statistical accuracy	*+/-1.5%*
Average Throughput	**585 kbps**
THROUGHPUT - min	70 kbps
THROUGHPUT - max	2 620 kbps
THROUGHPUT - standard deviation	288 kbps

4.2.4.3 HTTP Results

Download HTTP	Vodafone
Sample	*1 575*
Rate of succesfull data transfers	**96.0%**
Statistical accuracy	*+/-1.0%*
Average Throughput	**2 442 kbps**
THROUGHPUT - min	141 kbps
THROUGHPUT - max	14 109 kbps
THROUGHPUT - standard deviation	1 942 kbps

Upload HTTP	Vodafone
Sample	*1 576*
Rate of succesfull data transfers	**89.8%**
Statistical accuracy	*+/-1.5%*
Average Throughput	**975 kbps**
THROUGHPUT - min	72 kbps
THROUGHPUT - max	3 693 kbps
THROUGHPUT - standard deviation	468 kbps

4.2.5 Video Streaming Results

	Vodafone	
VIDEO STREAMING	**Smartphone**	**Dongle**
Sample	*795*	*796*
END to END non-Quality rate	**11.7%**	**18.8%**
Statistic accuracy	*+/-2.2%*	*+/-2.7%*
TNQ - Acess to the video	10.8%	14.7%
Youtube sequences dropped	0.0%	0.1%
Youtube sequences with quality defaults	0.9%	4.0%
(more than 2 major defaults and/or more than 6 minor defaults)		

5 Conclusions

KPI's synthesis. Objectives for the next 2 years will be defined after public consultation

Protocol	KPI	Operator	Rate
VOICE	Rate of calls set-up and held for 2 min (SHC)	**Ooredoo**	98.9%
		Vodafone	97.3%
SMS	Rate of received SMS within 2 minutes (RS2)	**Ooredoo**	99.9%
		Vodafone	99.8%
BBM	Rate of received BBM within 2 minutes (RS2)	**Ooredoo**	99.4%
		Vodafone	95.3%
MMS	Rate of received MMS within 5 minutes (RM5)	**Ooredoo**	98.4%
		Vodafone	96.1%
DATA			
STREAMING VIDEO	END to END non-Quality rate	**Ooredoo**	1.5%
		Vodafone	12.8%
WEB Dongle	Rate of successfully downloaded webpages	**Ooredoo**	96.5%
		Vodafone	85.6%
WEB Smartphone	Rate of successfully downloaded webpages	**Ooredoo**	97.3%
		Vodafone	78.7%
FTP Dongle	Rate of successful data transfers	**Ooredoo**	99.2%
		Vodafone	91.6%
FTP Smartphone	Rate of successful data transfers	**Ooredoo**	99.0%
		Vodafone	92.8%
HTTP Smartphone	Rate of successful data transfers	**Ooredoo**	98.6%
		Vodafone	92.9%
MAIL SMTP Dongle	Rate of successfully sent messages	**Ooredoo**	98.5%
		Vodafone	90.5%
MAIL POP Dongle	Rate of successfully received messages	**Ooredoo**	99.7%
		Vodafone	90.6%

6 Appendix: Compliance with Annexure E of Operator's Licence

As stated in the annexure E of their licenses (here below), stating the obligations relating to provision and QoS to retail customer, operators have an obligation on the network call set-up success rate CSSR and the network dropped call rate DCR.

- **CSSR** : Call set-up on first attempt. Rate is based on the total sample.
- **DCR** : Rate of calls dropped before 2 minutes. Rate is based on the total sample.

Those KPI are, as stated in the license methodology, considering busy hours of the networks (17pm – 21pm)

The drive tests done in the state of Qatar as part of the audit are only indicative but not sufficient to assess this parameter.

QoS Voice - busy Hours		**Ooredoo**	**Vodafone**
	Sample	*2 398*	*2 398*
CSSR : Call set-up Success Rate		**99.2%**	**98.3%**
	Statistical accuracy	*+/-0.3%*	*+/-0.5%*
DCR : Dropped Call Rate		**0.4%**	**1.4%**
	Statistical accuracy	*+/-0.2%*	*+/-0.5%*

Annexure E of Operator's License:

Parameter	Measure	Measurement Method	Obligation during First Year following the Effective Date	Obligation during Second Year following the Effective Date	Ongoing obligation after Second Year following the Effective Date
Network call set-up success rate	These measures the call set up success rate over the busiest part of the network. The call setup success rate is defined as (successful seizures for TCH/ seizure attempts for TCH) multiplied by (successful SDCCH requests for call set-up / SDCCH requests for call set-up).	The 10% of cells which have the highest levels of carried traffic during their busy hour during the measurement period are identified. The call set up success rate is calculated for each cell during the identified busy hour[1]. The network call set up success rate is the average across the individual success rates for each cell.	≥ 95%	≥ 97%	≥ 98%
Network dropped call rate	This measures the dropped call rate over the busiest part of the network. The network dropped call rate is defined as the proportion of calls successfully set up which terminate for any reason other than termination by either the calling or called parties.	The dropped call rate is calculated during the busy hour[1] for each of the 10% of busiest cells (as for the call success rate). The network dropped call rate is the average over the dropped call rates for each cell.	≤ 3.5%	≤ 2.0%	≤ 1.5%

7 ANNEXURES

a. Annexure 1 - Voice Results by Municipality

OOREDOO:

SHC (Set-up and held for 2 min calls)

ID	Municipality	Sample	Ooredoo
1	AL DAAYEN MUNICIPALITY	200	100.0%
2	UMM SLAL MUNICIPALITY	249	100.0%
3	AL WAKRA MUNICIPALITY	373	97.9%
4	AL RAYYAN MUNICIPALITY	1449	99.1%
5	DOHA MUNICIPALITY	1843	98.6%
6	AL KHOR MUNICIPALITY	496	99.2%
7	AL SHAMAL MUNICIPALITY	137	100.0%
	TOTAL	**4 747**	**98.9%**

VODAFONE:

SHC (Set-up and held for 2 min calls)

ID	Municipality	Sample	Vodafone
1	AL DAAYEN MUNICIPALITY	200	95.5%
2	UMM SLAL MUNICIPALITY	249	98.8%
3	AL WAKRA MUNICIPALITY	373	97.3%
4	AL RAYYAN MUNICIPALITY	1449	96.4%
5	DOHA MUNICIPALITY	1843	97.3%
6	AL KHOR MUNICIPALITY	496	99.0%
7	AL SHAMAL MUNICIPALITY	137	100.0%
	TOTAL	**4 747**	**97.3%**

b. Annexure 2 - Voice Results by Zones

SHC (Set-up and held for 2 min calls)

ID	Municipality	Sample	Ooredoo
1	AL JASRA	19	100.0%
2	AL BIDDA	2	100.0%
3	FEREEJ MOHAMMED BIN JASIM / MUSHAIREB	11	100.0%
4	MUSHAIREB	9	100.0%
5	AL NAJADA / BRAHAT AL JUFAIRY / FEREEJ AL ASMAKH	3	100.0%
6	OLD AL GHANIM	13	100.0%
7	AL SOUQ	41	95.1%
10	WADI AL SAIL	8	100.0%
11	RUMAILA	1	100.0%
12	AL BIDDA	4	100.0%
13	MUSHAIREB	37	97.3%
14	FEREEJ ABDEL AZIZ	13	100.0%
15	AL DOHA AL JADEEDA	63	100.0%
16	OLD AL GHANIM	13	92.3%
17	AL RUFAA / OLD AL HITMI	24	100.0%
18	SLATA / AL MIRQAB	28	96.4%
19	DOHA PORT	1	100.0%
20	WADI AL SAIL	12	100.0%
21	RUMAILA	9	100.0%
22	FEREEJ BIN MAHMOUD	63	98.4%
23	FEREEJ BIN MAHMOUD	34	100.0%
24	RAWDAT AL KHAIL	56	100.0%
25	AL MANSOURA / FEREEJ BIN DIRHAM	96	99.0%
26	NAJMA	50	94.0%
27	UMM GHUWAILINA	58	96.6%
28	AL KHULAIFAT / RAS BU ABBOUD		
29	RAS BU ABBOUD	1	100.0%
30	DUHAIL	34	100.0%
31	UMM LEKHBA	30	96.7%
32	MADINAT KHALIFA NORTH / DAHL AL HAMAM	9	100.0%
33	AL MARKHIYA	13	100.0%
34	MADINAT KHALIFA SOUTH	10	90.0%
35	FEREEJ KULAIB	12	100.0%
36	AL MESSILA	12	100.0%
37	FEREEJ BIN OMRAN / NEW AL HITMI / HAMAD MEDICAL CITY	49	100.0%
38	AL SADD	103	100.0%
39	AL SADD / NEW AL MIRQAB / FEREEJ AL NASR	33	100.0%
40	NEW SLATA	47	100.0%
41	NUAIJA	10	100.0%
42	AL HILAL	41	97.6%
43	NUAIJA	4	100.0%
44	NUAIJA	20	90.0%
45	OLD AIRPORT	91	100.0%
46	AL THUMAMA		
47	AL THUMAMA	16	100.0%

c.

ID	Municipality	Sample	Ooredoo
48	DOHA INTERNATIONAL AIRPORT	7	100.0%
49	DOHA INTERNATIONAL AIRPORT	1	100.0%
51	AL GHARRAFA / GHARRAFAT AL RAYYAN / IZGHAWA / BANI HAJ	315	97.8%
52	AL LUQTA / LEBDAY / OLD AL RAYYAN / AL SHAGUB / FEREEJ AL Z	202	99.5%
53	NEW AL RAYYAN / AL WAJBA / MUAITHER	240	99.2%
54	FEREEJ AL AMIR / LUAIB / MURAIKH / BAAYA / MEHAIRJA / FERE	47	100.0%
55	FEREEJ AL SOUDAN / AL WAAB / AL AZIZIYA / NEW FEREEJ AL GH	250	98.8%
56	FEREEJ AL ASIRI / NEW FEREEJ AL KHULAIFAT / BU SAMRA / AL	91	100.0%
57	INDUSTRIAL AREA	166	97.6%
60	AL DAFNA	22	100.0%
61	AL DAFNA / AL QASSAR	62	98.4%
62	LEKHWAIR	12	100.0%
63	ONAIZA	72	100.0%
64	LEJBAILAT	26	100.0%
65	ONAIZA	33	100.0%
66	ONAIZA / LEQTAIFIYA / AL QASSAR	145	99.3%
67	HAZM AL MARKHIYA	26	92.3%
68	JELAIAH / AL TARFA / JERYAN NEJAIMA	30	100.0%
69	JABAL THUAILEB / AL KHARAYEJ / LUSAIL / AL EGLA / WADI AL BA	27	100.0%
70	LEABAIB / AL EBB / JERYAN JENAIHAT / AL KHEESA / RAWDAT AL	184	100.0%
71	AL KHARAITIYAT / IZGHAWA / UMM SLAL MOHAMMED / BU FE	249	100.0%
72	AL UTOURIYA	22	100.0%
73	LIJMILIYA	16	100.0%
74	SIMAISMA / AL JERYAN / AL KHOR	266	98.9%
75	AL THAKHIRA/RASS LAFFAN/UMM BIRKA	195	99.5%
76	AL GHUWAIRIYA	60	100.0%
77	FUWAIRIT/AIN SINAN/MADINAT AL KAABAN	9	100.0%
78	ABU DHALOUF/AL ZUBARA	46	100.0%
79	AL RUWAIS/MADINAT AL SHAMAL	82	100.0%
80	AL SHEEHANIYA	15	100.0%
81	MEBAIREEK	13	100.0%
82	RAWDAT RASHED	12	100.0%
83	AL KARAANA	30	100.0%
84	UMM BAB	31	100.0%
85	AL NASRANIYA	10	100.0%
86	DUKHAN	81	100.0%
90	AL WAKRA	192	99.0%
91	AL THUMAMA / AL WUKAIR/AL MASHAF	71	97.2%
92	MESAIEED	104	96.2%
93	MESAIEED INDUSTRIAL AREA		
94	SHAGRA	6	100.0%
95	AL KHARRARA		
96	ABU SAMRA	64	100.0%
97	SAWDA NATHEEL	12	100.0%
98	AL ADAID		
	TOTAL	**4 747**	**98.9%**

SHC (Set-up and held for 2 min calls)

ID	Municipality	Sample	Vodafone
1	AL JASRA	19	100.0%
2	AL BIDDA	2	100.0%
3	FEREEJ MOHAMMED BIN JASIM / MUSHAIREB	11	100.0%
4	MUSHAIREB	9	100.0%
5	AL NAJADA / BRAHAT AL JUFAIRY / FEREEJ AL ASMAKH	3	100.0%
6	OLD AL GHANIM	13	100.0%
7	AL SOUQ	41	97.6%
10	WADI AL SAIL	8	100.0%
11	RUMAILA	1	100.0%
12	AL BIDDA	4	100.0%
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16	OLD AL GHANIM	13	100.0%
17	AL RUFAA / OLD AL HITMI	24	100.0%
18	SLATA / AL MIRQAB	28	100.0%
19	DOHA PORT	1	100.0%
20	WADI AL SAIL	12	100.0%
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22	FEREEJ BIN MAHMOUD	63	98.4%
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46	AL THUMAMA		
47	AL THUMAMA	16	81.3%

ID	Municipality	Sample	Vodafone
48	DOHA INTERNATIONAL AIRPORT	7	85.7%
49	DOHA INTERNATIONAL AIRPORT	1	100.0%
51	AL GHARRAFA / GHARRAFAT AL RAYYAN / IZGHAWA / BANI HAJE	315	97.5%
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55	FEREEJ AL SOUDAN / AL WAAB / AL AZIZIYA / NEW FEREEJ AL GH	250	97.6%
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83	AL KARAANA	30	96.7%
84	UMM BAB	31	54.8%
85	AL NASRANIYA	10	100.0%
86	DUKHAN	81	96.3%
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93	MESAIEED INDUSTRIAL AREA		
94	SHAGRA	6	100.0%
95	AL KHARRARA		
96	ABU SAMRA	64	96.9%
97	SAWDA NATHEEL	12	100.0%
98	AL ADAID		
	TOTAL	**4 747**	**97.3%**

Communications Regulatory Authority | هيئة تنظيم الاتصالات

Quality of Service Measurements- Mobile Services Network Audit 2013

COVERAGE REPORT

TABLE OF CONTENTS

1 Executive Summary

Mobile Operators are under a coverage obligation as a condition of their mobile license, and it is the responsibility of CRA to verify and validate that each operator is meeting its obligation.

Verification of Coverage and Technology Commitment:

- Ooredoo and Vodafone are to provide 2G to 100% of the State of Qatar. Vodafone is however obliged to provide 3G and 3.5G services to 90% of Qatar's population.
- Although Ooredoo has no technology commitments mentioned in its license, the test developed to verify Vodafone Qatar's compliance with technology roll-out shall be carried out for both operators.
- Public Mobile Telecommunications Services are considered to be available in a geographic area if a voice call can be successfully commenced and completed and the minimum signal strength obligations are met.
- The minimum signal strength required to qualify for achieving coverage is -85 dBm at ≥ 95% of the locations within any outdoor area of 100m x100m at a height of 1.5m above ground level. (Please see Annexure G of the licenses)
- 100% of the State of Qatar is defined as the primary physical landmass of the State of Qatar. For the avoidance of doubt, this does not include Qatari territorial waters or offshore islands.
- Population coverage shall be defined as the percentage of the total number of inhabitants of the State of Qatar who permanently reside, in accordance with the then most recent official statistics available from The General Secretariat of the Planning Council for the State of Qatar (http://www.qsa.gov.qa) in the area where the Public Mobile Telecommunications Services are available at the minimum signal strength.

Coverage Obligation:

- Geography: 100% of the State of Qatar for **both** service providers.
- Population: 100% of the population for Vodafone. No obligation for Ooredoo.

Vodafone Technology Commitments:

Mobile Technology	Population Coverage
2G (GSM)	100%
2.5G (GPRS/EDGE)	100%
3G (UMTS)	90%
3.5G (HSDPA)	90%

It is important to point out that several areas were not accessible to the test team, being either private land or reserved for government, which explains why the maps do not show any measurements in some area of the Country. However those areas are not open to general public.
Directique was also required to compare Mobile Operators coverage prediction maps with the actual coverage measured. The maps included in this report contain two layers: a first layer showing the coverage predictions provided by the operators themselves, and a second layer illustrating the results of the coverage measurements.

2 Objective

The objective of this audit was to:

- Measure the outdoor coverage of the 2 Mobile Operators Ooredoo and Vodafone, on both 2G and 3G technologies with mobiles in IDLE recording the signal strength.
- With mobiles launching Accessibility tests every 30 seconds, establish for each operator a direct correlation between the number of households covered and the percentage of the population, resulting directly from such coverage.
- Validate the coverage maps of each Mobile Operator against the outdoor coverage measured during the audit.
- Conduct a DATA coverage audit with Smartphones.

3 Methodology

The audit was conducted between November 11th 2013 and February 15th 2014 and across the entire State of Qatar.

Coverage results have been weighted by the population percentage living in each Zone. The tables presented in Annex show the detailed coverage as measured for each operator.

Measurements have been performed in three ways, a set of mobile equipment set in 2G only and a set of mobile equipment set in 3G only.

Coverage, from a end-user perspective, cannot be measured with a scanner or by tracing reception level. A scanner cannot discern the difference between the live cells and the other emitting cells and would give an over optimistic coverage measurement. Further, measuring reception levels would also not be appropriate as having a signal is not a guarantee that a call would be successful.

For example in the case of an unbalanced cell between receive and transmit signal levels, it is possible for a mobile phone to receive a good signal but be unable to support a call due to the distance to the base station. Furthermore, such tools would measure reception levels in dB, and this cannot be interpreted or even understood by the end user.

It is for these reasons that the coverage has been audited using tools which are fully representative of how a subscriber would access a mobile service – the audit therefore if fully representive of the subscriber experience.

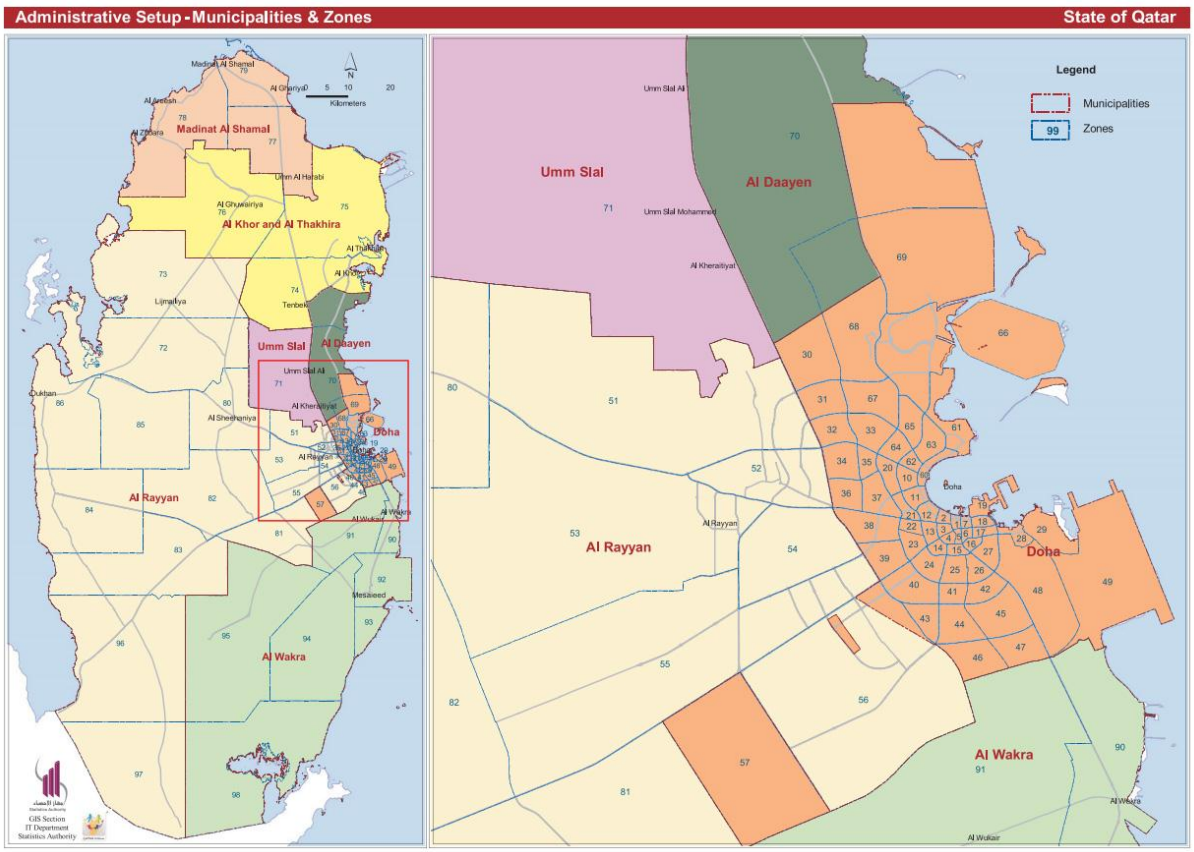
A vehicle equipped with standard mobile phones an placing calls following an automatic test script driven by a software called ***MobiTrace,*** was used perform tests on all streets (paved roads of Qatar along a length of approximately 11 000km approx.), pedestrian areas and through desert (off) roads (a length of approximately 500 km).

Accessibility Measurements : The software performed repeated call attempts to pre-defined number (111), until a ring-back tone or a specific audio recording (voicemail message) was received. The software also performed a measure of the field strength for every call.

IDLE Measurements : a full radio trace is recorded every second, indicating the signal strengh in 2G (RxLev) and 3G (RSCP). Then, in order to establish a coverage KPI corresponding to the license's obligation, a specific method of calculation has been set:

- The State of Qatar has been divided into 100m*100m areas
- For each 100m*100m area, the rate of locations where signal strength is greater than -85dBM is calculated
- The KPI shows the proportion of areas where this rate is over 95%

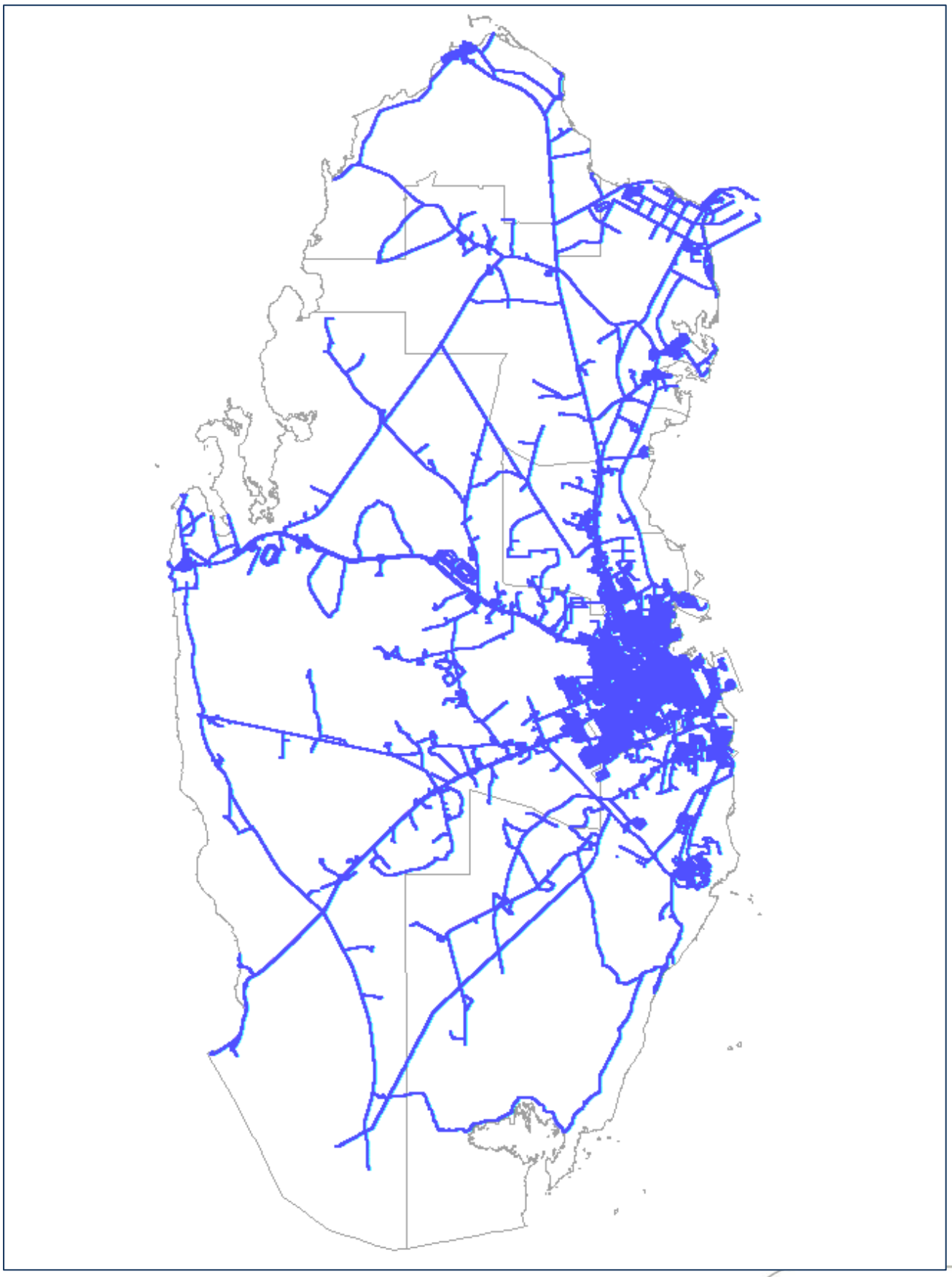
Administrative Divisions



Qatar is divided into 7 Municipalities, including 90 administrative zones.

3.1 Drive Test

Routes followed by the vehicle performing measurements, including off roads.



3.2 Equipment

Audit measurements were performed using standard mobile phones.

The mark and model of the mobile phone used is Samsung GT-S8530 for 2G and 3G.

For each type of tests (accessibility and Idle), two mobile phones were used per network. One was locked in 2G mode and the other one was locked in 3G mode.

Rooftop Box and Mobile Phones

For outdoor test conditions mobile phones were positioned in a plastic rooftop box. The rooftop box was tested by measuring a reference signal, both outside and inside the rooftop box; this is to validate the absence of significant radio signal attenuation. Similarly the test platform was calibrated using a reference signal to identify and correct any significant difference between mobile phones sensibility.

Inside the rooftop box, mobile phones were positioned vertically on a stable, specifically adapted base, to provide the best possible radio conditions. Electrical supply of each mobile phone was continuously guaranteed to ensure autonomy of the device and optimal radio conditions.

The platform was connected to a computer based software running the automated test script and recording test results. The set-up was completed with a GPS receiver, one for each Mobile Operator, which recorded the exact location of each test.

3.3 Data Coverage

Accessibility Data tests are fully automated with the following method:

- A latency measurement of a 32-byte file download.

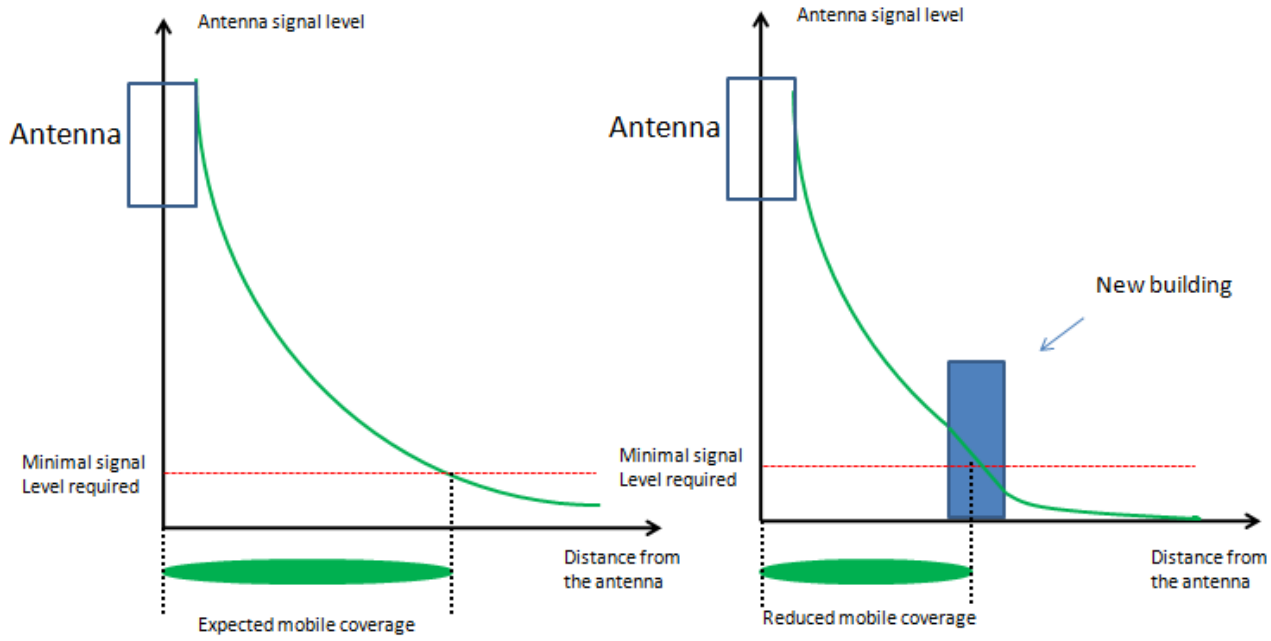
This enables the detection of networks, their availability and their technology.

Data coverage measurements are carried out using android smartphones and Directique's tool Mobispeed. Smartphones are installed inside the vehicle used for Coverage measurements and tests are reiterated every minute automatically. This method makes it possible to carry out 10 000 measurements each week.

3.4 Additional Elements

It is important to understand that outdoor coverage is usually better than indoor coverage, because the base station providing the mobile signal is usually located outside, typically on a building roof or a telecommunications mast.

The mobile signal is attenuated when it penetrates a building structure, affected by the thickness of concrete wall and metallic elements used in the construction, thus resulting in lower signal strength inside the building.



Coverage Evolution Following a New Construction

Readers shall understand that mobile coverage can also vary with the evolution of the landscape, the diagram above showing the impact of a new building in a previously fully covered area, and illustrate the need for Mobile Operators to continuously monitor the coverage of their mobile network and take action when necessary to maintain the appropriate coverage level.

4 Results

4.1 Geographical Coverage: (IDLE Measurements)

The minimum signal strength required to qualify for achieving coverage is -85 dBm at ≥ 95% of the locations within any outdoor area of 100m x100m at a height of 1.5m above ground level. (Please see Annexure G of the licenses).

	OOREDOO 2G	OOREDOO 3G
Total areas	*66 125*	*65 871*
% of areas where maximum signal is -85 dBm or higher	99.9%	94.7%
Statistical accuracy	*+/-0.0%*	*+/-0.2%*

	VODAFONE 2G	VODAFONE 3G
Total areas	*65 865*	*65 764*
% of areas where maximum signal is -85 dBm or higher	98.8%	88.7%
Statistical accuracy	*+/-0.1%*	*+/-0.2%*

Geographical Coverage by Municipality:

	OOREDOO 2G		OOREDOO 3G	
Municipality	Sample	Coverage	Sample	Coverage
AL DAAYEN MUNICIPALITY	*2 477*	99.8%	*2 478*	97.7%
AL KHOR MUNICIPALITY	*7 977*	100.0%	*7 981*	92.5%
AL RAYYAN MUNICIPALITY	*30 038*	99.9%	*29 751*	95.0%
AL SHAMAL MUNICIPALITY	*2 579*	100%	*2 601*	93.6%
AL WAKRA MUNICIPALITY	*8 686*	99.9%	*8 689*	91.0%
DOHA MUNICIPALITY	*11 781*	100.0%	*11 785*	99.0%
UMM SLAL MUNICIPALITY	*2 587*	100.0%	*2 586*	89.0%
TOTAL	***66 125***	**99.9%**	***65 871***	**94.7%**

	VODAFONE 2G		VODAFONE 3G	
Municipality	Sample	Coverage	Sample	Coverage
AL DAAYEN MUNICIPALITY	*2 475*	98.7%	*2 478*	96.9%
AL KHOR MUNICIPALITY	*7 978*	99.1%	*7 979*	86.0%
AL RAYYAN MUNICIPALITY	*29 760*	99.1%	*29 648*	88.4%
AL SHAMAL MUNICIPALITY	*2 599*	97%	*2 602*	85.0%
AL WAKRA MUNICIPALITY	*8 685*	97.0%	*8 692*	75.8%
DOHA MUNICIPALITY	*11 783*	100.0%	*11 782*	99.6%
UMM SLAL MUNICIPALITY	*2 585*	97.5%	*2 583*	89.8%
TOTAL	***65 865***	**98.8%**	***65 764***	**88.7%**

Comment: for all the tables regarding IDLE measurements: the sample represents the total number of 100mX100m areas where measurements have been conducted

Geographical Coverage by Zone:

		OOREDOO 2G		OOREDOO 3G	
ID_Zone	Zone	Sample	Coverage	Sample	Coverage
1	AL JASRA	24	100%	24	100.0%
2	AL BIDDA	24	100.0%	24	100.0%
3	FEREEJ MOHAMMED BIN JASIM / MUSHAIREB	18	100.0%	18	100.0%
4	MUSHAIREB	33	100%	33	100.0%
5	AL NAJADA / BRAHAT AL JUFAIRY / FEREEJ AL ASMAKH	24	100%	24	100.0%
6	OLD AL GHANIM	30	100%	30	100.0%
7	AL SOUQ	27	100%	27	100.0%
10	WADI AL SAIL	28	100.0%	28	100.0%
11	RUMAILA	58	100.0%	59	100.0%
12	AL BIDDA	65	100%	65	98.5%
13	MUSHAIREB	60	100%	60	100.0%
14	FEREEJ ABDEL AZIZ	55	100.0%	55	100.0%
15	AL DOHA AL JADEEDA	40	100.0%	40	100.0%
16	OLD AL GHANIM	39	100.0%	39	100.0%
17	AL RUFAA / OLD AL HITMI	45	100.0%	45	100.0%
18	SLATA / AL MIRQAB	52	100%	52	100.0%
19	DOHA PORT	34	100%	34	97.1%
20	WADI AL SAIL	72	100%	72	100.0%
21	RUMAILA	61	100%	62	100.0%
22	FEREEJ BIN MAHMOUD	54	100%	54	96.3%
23	FEREEJ BIN MAHMOUD	106	100.0%	106	100.0%
24	RAWDAT AL KHAIL	146	100.0%	146	100.0%
25	AL MANSOURA / FEREEJ BIN DIRHAM	142	100.0%	142	99.3%
26	NAJMA	111	100%	111	99.1%
27	UMM GHUWAILINA	115	100%	115	100.0%
28	AL KHULAIFAT / RAS BU ABBOUD	88	100.0%	88	98.9%
29	RAS BU ABBOUD	106	100%	106	100.0%
30	DUHAIL	250	100.0%	250	100.0%
31	UMM LEKHBA	301	100%	301	99.7%
32	MADINAT KHALIFA NORTH / DAHL AL HAMAM	221	100.0%	221	100.0%
33	AL MARKHIYA	169	100.0%	169	100.0%
34	MADINAT KHALIFA SOUTH	260	100.0%	260	99.6%
35	FEREEJ KULAIB	96	100.0%	96	99.0%
36	AL MESSILA	111	100%	111	98.2%
37	FEREEJ BIN OMRAN / NEW AL HITMI / HAMAD MEDICAL CITY	219	100%	219	97.7%
38	AL SADD	200	100.0%	200	100.0%
39	AL SADD / NEW AL MIRQAB / FEREEJ AL NASR	255	100%	255	100.0%
40	NEW SLATA	337	100%	337	99.4%
41	NUAIJA	116	100.0%	116	100.0%
42	AL HILAL	176	100.0%	176	98.9%
43	NUAIJA	185	100.0%	185	100.0%
44	NUAIJA	279	100.0%	279	98.9%
45	OLD AIRPORT	461	100.0%	461	99.6%
46	AL THUMAMA	296	100.0%	296	98.3%
47	AL THUMAMA	307	100.0%	307	99.0%

		OOREDOO 2G		OOREDOO 3G	
ID_Zone	Zone	Sample	Coverage	Sample	Coverage
48	DOHA INTERNATIONAL AIRPORT	*200*	100.0%	*200*	99.0%
49	DOHA INTERNATIONAL AIRPORT	*586*	100%	*586*	99.1%
51	AL GHARRAFA / GHARRAFAT AL RAYYAN / IZGHAWA / BANI HAJER / AL SEEJ / RAWDAT EGDAIM / AL THEMAID	*2 186*	100%	*1 973*	94.5%
52	AL LUQTA / LEBDAY / OLD AL RAYYAN / AL SHAGUB / FEREEJ AL ZAEEM	*753*	100%	*687*	99.3%
53	NEW AL RAYYAN / AL WAJBA / MUAITHER	*1 487*	100%	*1 484*	99.9%
54	FEREEJ AL AMIR / LUAIB / MURAIKH / BAAYA / MEHAIRJA / FEREEJ AL SOUDAN	*1 161*	100%	*1 161*	99.2%
55	FEREEJ AL SOUDAN / AL WAAB / AL AZIZIYA / NEW FEREEJ AL GHANIM / FEREEJ AL MURRA / FEREEJ AL MANASEER / BU SIDRA / MUAITHER / AL	*4 037*	100%	*4 037*	99.8%
56	FEREEJ AL ASIRI / NEW FEREEJ AL KHULAIFAT / BU SAMRA / AL MAAMOURA / BU HAMOUR / MESAIMEER / AIN KHALED	*3 923*	100%	*3 923*	99.0%
57	INDUSTERIAL AREA	*2 051*	100.0%	*2 052*	99.2%
60	AL DAFNA	*87*	100%	*87*	97.7%
61	AL DAFNA / AL QASSAR	*226*	100.0%	*226*	98.2%
62	LEKHWAIR	*48*	100%	*48*	100.0%
63	ONAIZA	*162*	100%	*162*	98.8%
64	LEJBAILAT	*138*	100%	*138*	98.6%
65	ONAIZA	*179*	100%	*179*	97.2%
66	ONAIZA / LEQTAIFIYA / AL QASSAR	*1 101*	100%	*1 101*	97.5%
67	HAZM AL MARKHIYA	*313*	100.0%	*313*	99.7%
68	JELAIAH / AL TARFA / JERYAN NEJAIMA	*187*	100.0%	*187*	93.6%
69	JABAL THUAILEB / AL KHARAYEJ / LUSAIL / AL EGLA / WADI AL BANAT	*293*	100%	*293*	98.6%
70	LEABAIB / AL EBB / JERYAN JENAIHAT / AL KHEESA / RAWDAT AL HAMAMA / WADI AL WASAAH / AL SAKHAMA / AL MASROUHIYA / WADI LUSAIL / LUSAIL	*1 771*	100%	*1 773*	98.4%
71	AL KHARAITIYAT / IZGHAWA / UMM SLAL MOHAMMED / BU FESSEELA / UMM SLAL ALI / UMM AL AMAD / UMM OBAIRIYA / LEKHSHAINA / SUNAY	*2 587*	100%	*2 586*	89.0%
72	AL UTOURIYA	*1 643*	99.9%	*1 646*	81.5%
73	LIJMILIYA	*913*	100%	*913*	83.2%
74	SIMAISMA / AL JERYAN / AL KHOR	*2 922*	100%	*2 921*	95.9%
75	AL THAKHIRA/RASS LAFFAN/UMM BIRKA	*4 227*	100%	*4 231*	96.7%
76	AL GHUWAIRIYA	*1 516*	100%	*1 517*	75.9%
77	FUWAIRIT/AIN SINAN/MADINAT AL KAABAN	*790*	100.0%	*798*	93.2%
78	ABU DHALOUF/AL ZUBARA	*717*	100.0%	*730*	92.9%
79	AL RUWAIS/MADINAT AL SHAMAL	*1 072*	100%	*1 073*	94.4%
80	AL SHEEHANIYA	*2 440*	100%	*2 440*	92.3%
81	MEBAIREEK	*1 977*	99.9%	*1 977*	97.1%
82	RAWDAT RASHED	*2 260*	100%	*2 261*	95.8%
83	AL KARAANA	*1 710*	100.0%	*1 709*	92.0%
84	UMM BAB	*901*	97.8%	*901*	88.5%
85	AL NASRANIYA	*1 208*	100.0%	*1 203*	87.9%
86	DUKHAN	*1 823*	100.0%	*1 823*	96.7%
90	AL WAKRA	*1 279*	99.8%	*1 279*	99.8%
91	AL THUMAMA / AL WUKAIR/AL MASHAF	*1 734*	99.9%	*1 729*	96.6%
92	MESAIEED	*1 650*	100.0%	*1 650*	97.8%
93	MESAIEED INDUSTRIAL AREA	*247*	100.0%	*247*	93.9%
94	SHAGRA	*721*	100%	*720*	85.3%
95	AL KHARRARA	*2 418*	99.9%	*2 426*	83.8%
96	ABU SAMRA	*1 488*	100%	*1 488*	95.8%
97	SAWDA NATHEEL	*460*	100%	*457*	95.2%
98	AL ADAID	*637*	99%	*638*	73.2%
	TOTAL	***66 125***	**99.9%**	***65 871***	**94.7%**

		VODAFONE 2G		VODAFONE 3G	
ID_Zone	Zone	Sample	Coverage	Sample	Coverage
1	AL JASRA	*24*	100.0%	*24*	100.0%
2	AL BIDDA	*24*	100.0%	*24*	100.0%
3	FEREEJ MOHAMMED BIN JASIM / MUSHAIREB	*18*	100.0%	*18*	100.0%
4	MUSHAIREB	*33*	100%	*33*	100.0%
5	AL NAJADA / BRAHAT AL JUFAIRY / FEREEJ AL ASMAKH	*24*	100%	*24*	100.0%
6	OLD AL GHANIM	*30*	100%	*30*	100.0%
7	AL SOUQ	*27*	100%	*27*	100.0%
10	WADI AL SAIL	*28*	100.0%	*28*	100.0%
11	RUMAILA	*58*	98.3%	*59*	100.0%
12	AL BIDDA	*65*	100.0%	*65*	100.0%
13	MUSHAIREB	*60*	100%	*60*	100%
14	FEREEJ ABDEL AZIZ	*55*	100.0%	*55*	100.0%
15	AL DOHA AL JADEEDA	*40*	100.0%	*40*	100.0%
16	OLD AL GHANIM	*39*	100.0%	*39*	100.0%
17	AL RUFAA / OLD AL HITMI	*45*	100.0%	*45*	100.0%
18	SLATA / AL MIRQAB	*52*	100%	*52*	100.0%
19	DOHA PORT	*34*	100%	*34*	100.0%
20	WADI AL SAIL	*72*	100.0%	*72*	100.0%
21	RUMAILA	*62*	100.0%	*62*	100.0%
22	FEREEJ BIN MAHMOUD	*54*	100%	*54*	100%
23	FEREEJ BIN MAHMOUD	*106*	99.1%	*106*	100.0%
24	RAWDAT AL KHAIL	*146*	100%	*146*	100.0%
25	AL MANSOURA / FEREEJ BIN DIRHAM	*142*	100.0%	*142*	100.0%
26	NAJMA	*111*	100.0%	*111*	99.1%
27	UMM GHUWAILINA	*115*	100.0%	*115*	100.0%
28	AL KHULAIFAT / RAS BU ABBOUD	*88*	100.0%	*88*	96.6%
29	RAS BU ABBOUD	*106*	100%	*106*	99.1%
30	DUHAIL	*250*	100.0%	*250*	99.6%
31	UMM LEKHBA	*301*	100.0%	*301*	100.0%
32	MADINAT KHALIFA NORTH / DAHL AL HAMAM	*221*	100.0%	*221*	100.0%
33	AL MARKHIYA	*169*	99.4%	*169*	98.8%
34	MADINAT KHALIFA SOUTH	*260*	100.0%	*260*	100.0%
35	FEREEJ KULAIB	*96*	100.0%	*96*	100.0%
36	AL MESSILA	*111*	99%	*111*	100%
37	FEREEJ BIN OMRAN / NEW AL HITMI / HAMAD MEDICAL CITY	*219*	100%	*219*	100.0%
38	AL SADD	*200*	100.0%	*200*	100.0%
39	AL SADD / NEW AL MIRQAB / FEREEJ AL NASR	*255*	100%	*255*	100.0%
40	NEW SLATA	*337*	100.0%	*337*	100.0%
41	NUAIJA	*116*	100.0%	*116*	100.0%
42	AL HILAL	*176*	100.0%	*176*	100.0%
43	NUAIJA	*185*	100.0%	*185*	100.0%
44	NUAIJA	*279*	100.0%	*279*	100.0%
45	OLD AIRPORT	*461*	100.0%	*461*	100.0%
46	AL THUMAMA	*296*	99.7%	*296*	100.0%
47	AL THUMAMA	*307*	100.0%	*307*	99.0%

		VODAFONE 2G		VODAFONE 3G	
ID_Zone	Zone	Sample	Coverage	Sample	Coverage
48	DOHA INTERNATIONAL AIRPORT	*200*	100.0%	*200*	99.0%
49	DOHA INTERNATIONAL AIRPORT	*586*	100.0%	*586*	97.8%
51	AL GHARRAFA / GHARRAFAT AL RAYYAN / IZGHAWA / BANI HAJER / AL SEEJ / RAWDAT EGDAIM / AL THEMAID	*1 981*	99.1%	*1 984*	99.1%
52	AL LUQTA / LEBDAY / OLD AL RAYYAN / AL SHAGUB / FEREEJ AL ZAEEM	*687*	100.0%	*688*	99.7%
53	NEW AL RAYYAN / AL WAJBA / MUAITHER	*1 487*	100%	*1 486*	97%
54	FEREEJ AL AMIR / LUAIB / MURAIKH / BAAYA / MEHAIRJA / FEREEJ AL SOUDAN	*1 161*	100.0%	*1 161*	99.8%
55	FEREEJ AL SOUDAN / AL WAAB / AL AZIZIYA / NEW FEREEJ AL GHANIM / FEREEJ AL MURRA / FEREEJ AL MANASEER / BU SIDRA / MUAITHER / AL	*4 036*	99.7%	*4 037*	99.5%
56	FEREEJ AL ASIRI / NEW FEREEJ AL KHULAIFAT / BU SAMRA / AL MAAMOURA / BU HAMOUR / MESAIMEER / AIN KHALED	*3 923*	100.0%	*3 815*	99.3%
57	INDUSTERIAL AREA	*2 051*	100.0%	*2 049*	99.7%
60	AL DAFNA	*87*	100.0%	*87*	100.0%
61	AL DAFNA / AL QASSAR	*226*	100.0%	*226*	100.0%
62	LEKHWAIR	*48*	100.0%	*48*	100.0%
63	ONAIZA	*162*	100%	*162*	99.4%
64	LEJBAILAT	*138*	100.0%	*138*	100.0%
65	ONAIZA	*179*	100.0%	*179*	97.2%
66	ONAIZA / LEQTAIFIYA / AL QASSAR	*1 101*	100.0%	*1 101*	99.6%
67	HAZM AL MARKHIYA	*313*	100.0%	*313*	100.0%
68	JELAIAH / AL TARFA / JERYAN NEJAIMA	*187*	100.0%	*187*	98.4%
69	JABAL THUAILEB / AL KHARAYEJ / LUSAIL / AL EGLA / WADI AL BANAT	*293*	100.0%	*293*	99.0%
70	LEABAIB / AL EBB / JERYAN JENAIHAT / AL KHEESA / RAWDAT AL HAMAMA / WADI AL WASAAH / AL SAKHAMA / AL MASROUHIYA / WADI LUSAIL / LUSAIL	*1 772*	99%	*1 773*	97.0%
71	AL KHARAITIYAT / IZGHAWA / UMM SLAL MOHAMMED / BU FESSEELA / UMM SLAL ALI / UMM AL AMAD / UMM OBAIRIYA / LEKHSHAINA / SUNAY	*2 585*	97.5%	*2 583*	89.8%
72	AL UTOURIYA	*1 647*	98.4%	*1 645*	80.8%
73	LIJMILIYA	*913*	100%	*913*	97.2%
74	SIMAISMA / AL JERYAN / AL KHOR	*2 920*	99.3%	*2 919*	90.2%
75	AL THAKHIRA/RASS LAFFAN/UMM BIRKA	*4 229*	99.1%	*4 230*	90.5%
76	AL GHUWAIRIYA	*1 515*	99%	*1 518*	70.5%
77	FUWAIRIT/AIN SINAN/MADINAT AL KAABAN	*798*	92.0%	*798*	96.9%
78	ABU DHALOUF/AL ZUBARA	*728*	99.6%	*731*	55.3%
79	AL RUWAIS/MADINAT AL SHAMAL	*1 073*	99.1%	*1 073*	96.5%
80	AL SHEEHANIYA	*2 440*	100%	*2 440*	96.4%
81	MEBAIREEK	*1 977*	97.3%	*1 974*	88.5%
82	RAWDAT RASHED	*2 261*	96.6%	*2 261*	62.0%
83	AL KARAANA	*1 709*	99.1%	*1 705*	78.7%
84	UMM BAB	*901*	99.0%	*901*	28.3%
85	AL NASRANIYA	*1 206*	99.8%	*1 205*	70.7%
86	DUKHAN	*1 823*	98.8%	*1 823*	86.5%
90	AL WAKRA	*1 278*	99.7%	*1 279*	99.5%
91	AL THUMAMA / AL WUKAIR/AL MASHAF	*1 734*	99.5%	*1 734*	91.0%
92	MESAIEED	*1 650*	99.7%	*1 650*	98.9%
93	MESAIEED INDUSTRIAL AREA	*247*	100.0%	*247*	98.4%
94	SHAGRA	*723*	93%	*719*	55.6%
95	AL KHARRARA	*2 415*	93.6%	*2 427*	43.9%
96	ABU SAMRA	*1 488*	99.7%	*1 488*	90.1%
97	SAWDA NATHEEL	*452*	100.0%	*454*	92.5%
98	AL ADAID	*638*	94%	*636*	62.9%
	TOTAL	***65 865***	**98.8%**	***65 764***	**88.7%**

4.2 Population Coverage: (IDLE Measurements)

Population coverage is then calculated by weighting results with the population percentage living in each Zone, using most recent official statistics available from The General Secretariat of the Planning Council for the State of Qatar.

By Municipality:

	OOREDOO 2G	OOREDOO 3G
Total areas	*66 125*	*65 871*
% of areas where maximum signal is -85 dBm or higher	100.0%	96.1%
Statistical accuracy	*+/-0.0%*	*+/-0.1%*

	VODAFONE 2G	VODAFONE 3G
Total areas	*65 865*	*65 764*
% of areas where maximum signal is -85 dBm or higher	99.3%	92.6%
Statistical accuracy	*+/-0.1%*	*+/-0.2%*

By Zone:

	OOREDOO 2G	OOREDOO 3G
Total areas	*66 125*	*65 871*
% of areas where maximum signal is -85 dBm or higher	100.0%	95.9%
Statistical accuracy	*+/-0.0%*	*+/-0.2%*

	VODAFONE 2G	VODAFONE 3G
Total areas	*65 865*	*65 764*
% of areas where maximum signal is -85 dBm or higher	99.6%	94.8%
Statistical accuracy	*+/-0.0%*	*+/-0.2%*

Population Coverage by municipality:

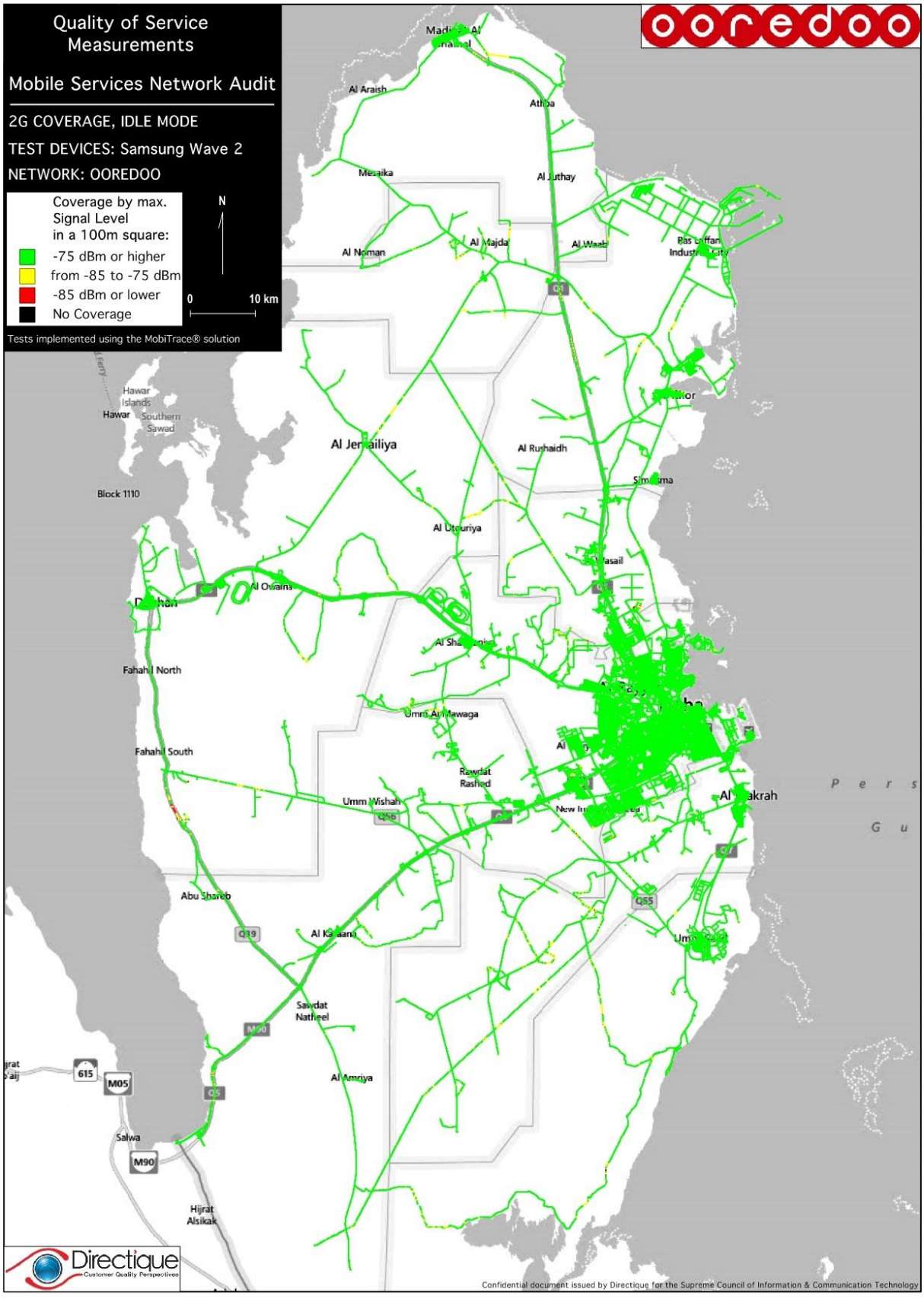
			OOREDOO 2G		OOREDOO 3G	
Municipality	Pop.	% Pop	Sample	Coverage	Sample	Coverage
AL DAAYEN MUNICIPALITY	43 176	2.5%	*2 477*	99.8%	*2 478*	97.7%
AL KHOR MUNICIPALITY	193 983	11.4%	*7 977*	100.0%	*7 981*	92.5%
AL RAYYAN MUNICIPALITY	455 623	26.8%	*30 038*	99.9%	*29 751*	95.0%
AL SHAMAL MUNICIPALITY	7 975	0.5%	*2 579*	100%	*2 601*	94%
AL WAKRA MUNICIPALITY	141 222	8.3%	*8 686*	99.9%	*8 689*	91.0%
DOHA MUNICIPALITY	796 947	46.9%	*11 781*	100.0%	*11 785*	99.0%
UMM SLAL MUNICIPALITY	60 509	3.6%	*2 587*	100.0%	*2 586*	89.0%
TOTAL	**1 699 435**		***66 125***	**100.0%**	***65 871***	**96.1%**

			VODAFONE 2G		VODAFONE 3G	
Municipality	Pop.	% Pop	Sample	Coverage	Sample	Coverage
AL DAAYEN MUNICIPALITY	43 176	2.5%	*2 475*	98.7%	*2 478*	96.9%
AL KHOR MUNICIPALITY	193 983	11.4%	*7 978*	99.1%	*7 979*	86.0%
AL RAYYAN MUNICIPALITY	455 623	26.8%	*29 760*	99.1%	*29 648*	88.4%
AL SHAMAL MUNICIPALITY	7 975	0.5%	*2 599*	97.0%	*2 602*	85.0%
AL WAKRA MUNICIPALITY	141 222	8.3%	*8 685*	97.0%	*8 692*	75.8%
DOHA MUNICIPALITY	796 947	46.9%	*11 783*	100.0%	*11 782*	99.6%
UMM SLAL MUNICIPALITY	60 509	3.6%	*2 585*	97.5%	*2 583*	89.8%
TOTAL	**1 699 435**		***65 865***	**99.3%**	***65 764***	**92.6%**

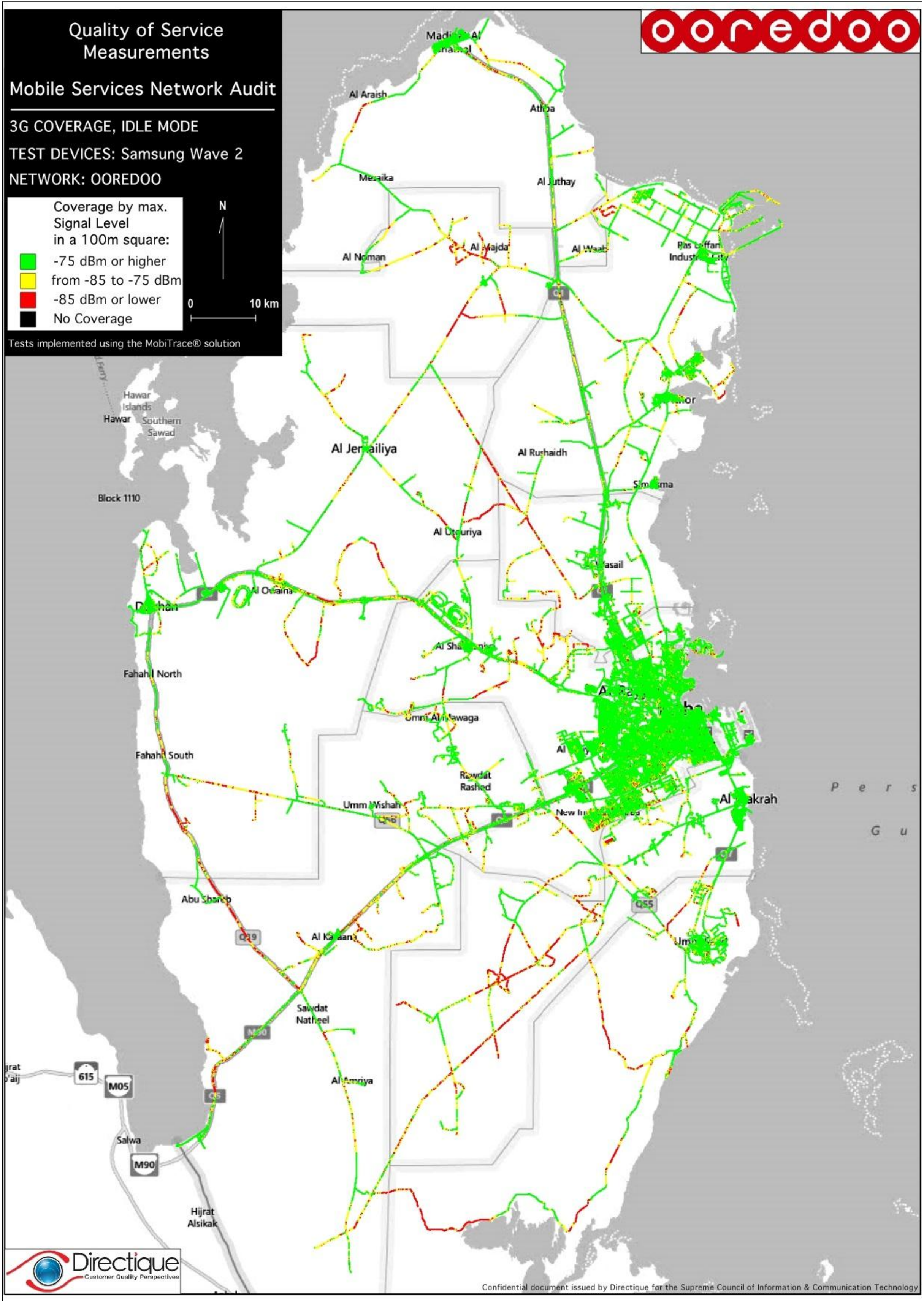
Population Coverage by Zone in annexure 1

4.3 Idle Coverage Maps

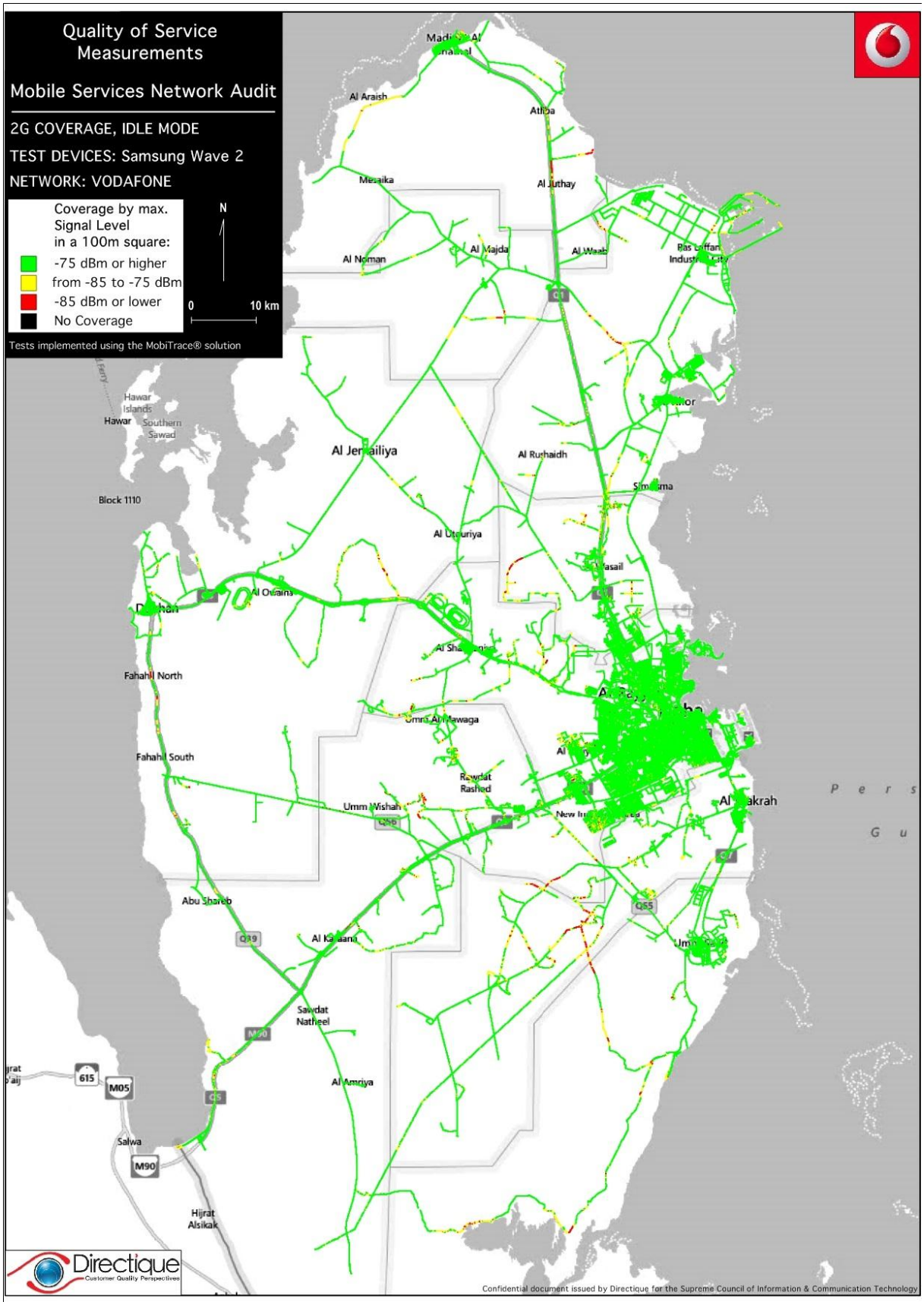
OOREDOO **2G**



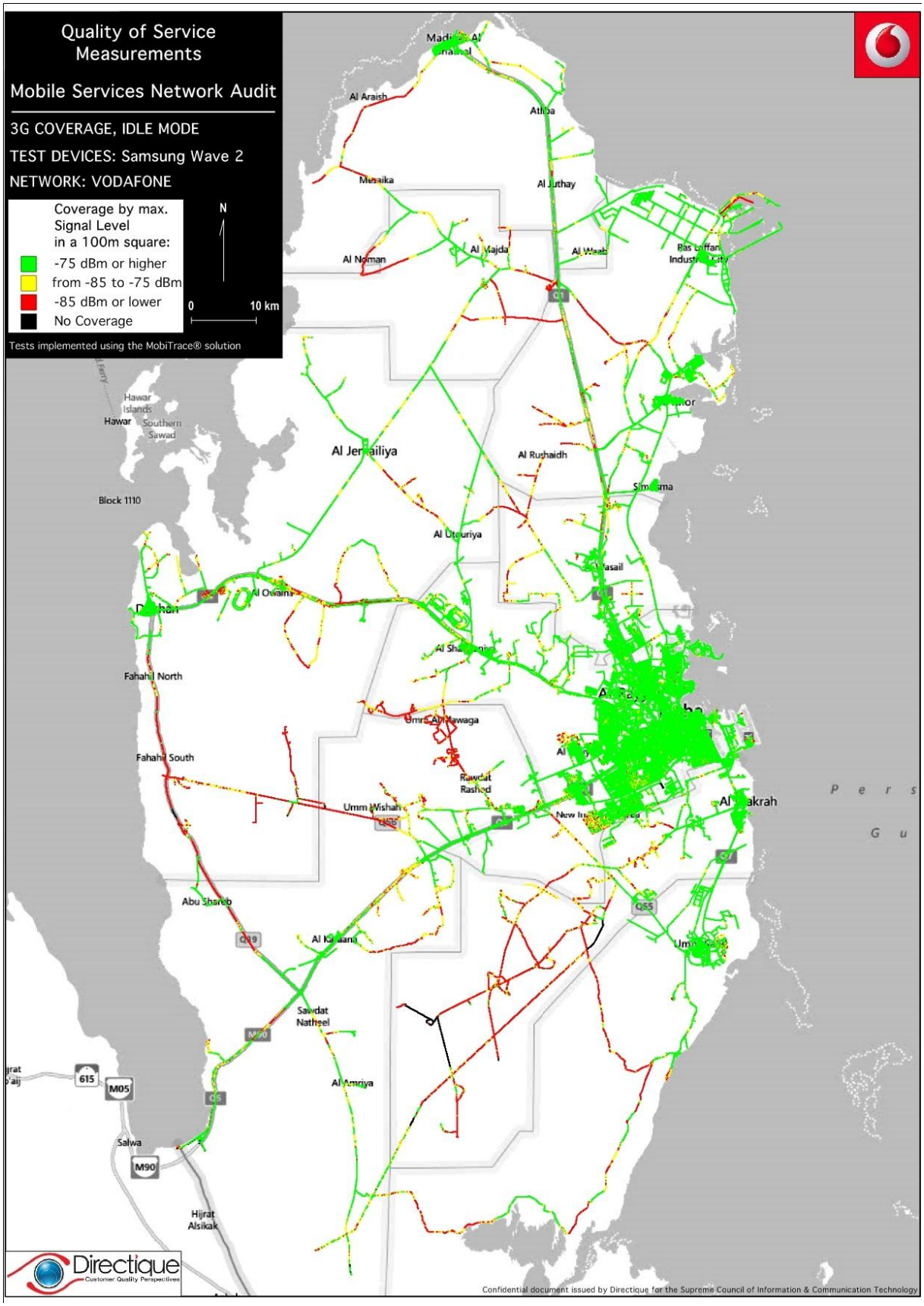
OOREDOO **3G**


Quality of Service Measurements
Mobile Services Network Audit
3G COVERAGE, IDLE MODE
TEST DEVICES: Samsung Wave 2
NETWORK: OOREDOO
Coverage by max. Signal Level in a 100m square:
-75 dBm or higher
from -85 to -75 dBm
-85 dBm or lower
No Coverage
N
0
10 km
Tests implemented using the MobiTrace® solution
ooredoo
Directique
Confidential document issued by Directique for the Supreme Council of Information & Communication Technology

VODAFONE **2G**


Quality of Service Measurements
Mobile Services Network Audit
2G COVERAGE, IDLE MODE
TEST DEVICES: Samsung Wave 2
NETWORK: VODAFONE
Coverage by max. Signal Level in a 100m square:
-75 dBm or higher
from -85 to -75 dBm
-85 dBm or lower
No Coverage
N
0
10 km
Tests implemented using the MobiTrace® solution
Al Araish
Al Noman
Al Majda
Al Waab
Hawar Islands
Hawar
Southern Sawad
Block 1110
Al Ruthaidh
Al Uqairiya
Al Ovaina
Fahahil North
Fahahil South
Umm Al Mawaqa
Rawdat Rashed
Umm Wishah
Abu Shareb
Sawdat Natheel
Al Amriya
Salwa
Hijrat Alsikak
Directique
Customer Quality Perspectives
Confidential document issued by Directique for the Supreme Council of Information & Communication Technology

VODAFONE **3G**


Quality of Service Measurements
Mobile Services Network Audit
3G COVERAGE, IDLE MODE
TEST DEVICES: Samsung Wave 2
NETWORK: VODAFONE
Coverage by max. Signal Level in a 100m square:
-75 dBm or higher
from -85 to -75 dBm
-85 dBm or lower
No Coverage
N
0
10 km
Tests implemented using the MobiTrace® solution
Al Araish
Al Noman
Al Rushaidh
Block 1110
Fahahil North
Fahahil South
Abu Shareb
Salwa
Hijrat Alsikak
Directique
Customer Quality Perspectives
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4.4 Data Coverage

- **Latency Success Rate**: Number of successful latency tests divided by the number of attempts.

		Ooredoo	Vodafone
	Sample	*111 075 mes*	*108 431 mes*
Latency Success Rate		**99.9%**	**99.1%**
	Statistical accuracy	*+/-0.0%*	*+/-0.1%*
Average latency time		363 ms	587 ms

- **Technology Distribution (Successful Latency Tests)**:

		Ooredoo	Vodafone
GPRS		**0.0%**	**0.0%**
	Statistical accuracy	*+/-0.0%*	*+/-0.0%*
EDGE		**0.1%**	**6.1%**
	Statistical accuracy	*+/-0.0%*	*+/-0.1%*
UMTS		**0.0%**	**0.4%**
	Statistical accuracy	*+/-0.0%*	*+/-0.0%*
HSDPA		**13.2%**	**93.5%**
	Statistical accuracy	*+/-0.2%*	*+/-0.1%*
LTE		**86.7%**	**na**
	Statistical accuracy	*+/-0.2%*	

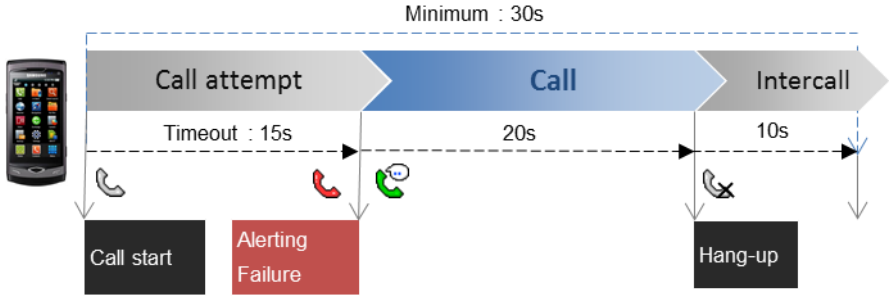
This table provides the technology breakdown used by Mobile Operators as recorded during all measurements. Every minute, the mobile is recording the observed technology. They are shown as contextual information at the time of the audit.

4.5 Accessibility Test

Accessibility Test Scenario

The vehicle equiped with the on board test platform was following pre-defined routes across the state. The computer based software automaticaly initiated tests and recorded results following a pre-defined test cycle based on the following parameters:

- An individual test duration set to a minimum of 30 seconds and up to a maximum of 35 seconds - “Call cycle”
- A call attempt window of up to 15 seconds - “Timeout”
- A call maintained 20 seconds.
- A minimum time before a new call takes place set to 10 seconds - “Intercall”



Accessibility Test Scenario

Coverage measurement for the 2 Mobile Operators’ networks was launched at the same time, the software triggering the start of a call cycle for the 2 Operators simultaneously.

The timeout was set to 15 seconds to allow for different dial delay scenario.

The Inter call time was set to 10 seconds.

Calls failed due to genuine network problems as identified by mobile protocol and not related to network coverage, such as for example network congestion, were extracted and not taken into consideration in the final results.

Accessibility Test

The geographical coverage rate is computed using the number of successful accessibility tests divided by the number of test attempts, after removal of congestion attempts, if any.

Accessibility	Call N	Call N+1	Call N+3	Call N+4	Call N+5	...
Result	OK	OK	OK	NOK	OK	

$$\text{Coverage rate} = \frac{\sum \text{OK}}{\sum \text{OK+NOK}}$$

Population coverage is then calculated by weighting these results with the population percentage living in each Zone, using most recent official statistics available from The General Secretariat of the Planning Council for the State of Qatar.

Accessibility Rate

The accessibility rate is computed using the number of successful accessibility tests divided by the number of test attempts, after removal of congestion attempts, if any:

		Ooredoo 2G	Ooredoo 3G
	Sample	*33 703 mes*	*34 327 mes*
Accessibility rate		**96.0%**	**96.1%**
	Statistical accuracy	*+/-0.2%*	*+/-0.2%*
Average access time		9.5 s	7.2 s

		Vodafone 2G	Vodafone 3G
	Sample	*32 545 mes*	*31 810 mes*
Accessibility rate		**86.8%**	**92.3%**
	Statistical accuracy	*+/-0.4%*	*+/-0.3%*
Average access time		11.1 s	10.8 s

Accessibility Rate by Municipality:

	Ooredoo 2G		Ooredoo 3G	
	Sample	Accessibility	Sample	Accessibility
AL DAAYEN MUNICIPALITY	805	99.3%	860	99.3%
AL KHOR MUNICIPALITY	2 618	94.1%	2 594	93.6%
AL RAYYAN MUNICIPALITY	14 659	94.5%	14 500	94.8%
AL SHAMAL MUNICIPALITY	725	100.0%	715	99.9%
AL WAKRA MUNICIPALITY	3 541	97.9%	3 629	97.3%
DOHA MUNICIPALITY	10 303	97.3%	10 869	97.2%
UMM SLAL MUNICIPALITY	1 052	98.2%	1 160	98.6%
GLOBAL	**33 703**	**96.0%**	**34 327**	**96.1%**

	Vodafone 2G		Vodafone 3G	
	Sample	Accessibility	Sample	Accessibility
AL DAAYEN MUNICIPALITY	824	87.1%	785	98.9%
AL KHOR MUNICIPALITY	2 402	93.6%	2 489	98.3%
AL RAYYAN MUNICIPALITY	14 295	86.7%	13 569	91.7%
AL SHAMAL MUNICIPALITY	519	90.0%	687	99.1%
AL WAKRA MUNICIPALITY	3 373	87.7%	3 386	72.1%
DOHA MUNICIPALITY	10 167	84.7%	9 882	96.9%
UMM SLAL MUNICIPALITY	965	86.7%	1 012	98.6%
GLOBAL	**32 545**	**86.8%**	**31 810**	**92.3%**

5 Conclusion

1 Geographical Coverage:

	OOREDOO 2G	OOREDOO 3G
Total areas	*66 125*	*65 871*
% of areas where maximum signal is -85 dBm or higher	99.9%	94.7%
Statistical accuracy	*+/-0.0%*	*+/-0.2%*

	VODAFONE 2G	VODAFONE 3G
Total areas	*65 865*	*65 764*
% of areas where maximum signal is -85 dBm or higher	98.8%	88.7%
Statistical accuracy	*+/-0.1%*	*+/-0.2%*

Ooredoo and Vodafone are not in compliance with the annexure G of their license (100%)

*A**nnexure G**: the minimum signal strength required to qualify for achieving coverage is -85 dBm at ≥ 95% of the locations within any outdoor area of 100m x100m at a height of 1.5m above ground level.

2 Population Coverage:

% of areas where maximum signal is -85 dBm or higher	VODAFONE 2G	VODAFONE 3G
Total areas	*65 865*	*65 764*
By Municipality	99.3%	92.6%
Statistical accuracy	*+/-0.1%*	*+/-0.2%*
By Zone	99.6%	94.8%
Statistical accuracy	*+/-0.0%*	*+/-0.2%*

VODAFONE is not in compliance with the annexure G of its license, where 100% of the population should be covered.

3 Data Coverage:

		Ooredoo
EDGE		**100.0%**
	Statistical accuracy	*+/-0.0%*
UMTS		**99.9%**
	Statistical accuracy	*+/-0.0%*
HSDPA		**99.9%**
	Statistical accuracy	*+/-0.0%*
LTE		**86.7%**
	Statistical accuracy	*+/-0.2%*

		Vodafone	License's obligation
EDGE		**100.0%**	100.0%
	Statistical accuracy	*+/-0.1%*	
UMTS		**93.9%**	90.0%
	Statistical accuracy	*+/-0.0%*	
HSDPA		**93.5%**	90.0%
	Statistical accuracy	*+/-0.1%*	

Vodafone is in compliance with the technology commitment mentioned in the Annexure G of the Vodafone license.

Note: Ooredoo has no technology commitments mentioned in its license.

6 ANNEXURES

a. Annexure 1 - Population Coverage by Zone

Population Coverage				OOREDOO 2G		OOREDOO 3G	
ID_Zone	Zone	Pop.	% Pop	Sample	Coverage	Sample	Coverage
1	AL JASRA	240	0.0%	*24*	100%	*24*	100.0%
2	AL BIDDA	35	0.0%	*24*	100.0%	*24*	100.0%
3	FEREEJ MOHAMMED BIN JASIM / MUSHAIREB	4 886	0.3%	*18*	100.0%	*18*	100.0%
4	MUSHAIREB	14 063	0.8%	*33*	100.0%	*33*	100.0%
5	AL NAJADA / BRAHAT AL JUFAIRY / FEREEJ AL ASMAKH	4 138	0.2%	*24*	100.0%	*24*	100.0%
6	OLD AL GHANIM	3 462	0.2%	*30*	100.0%	*30*	100.0%
7	AL SOUQ	679	0.0%	*27*	100.0%	*27*	100.0%
10	WADI AL SAIL	8	0.0%	*28*	100.0%	*28*	100.0%
11	RUMAILA	63	0.0%	*58*	100.0%	*59*	100.0%
12	AL BIDDA	1 067	0.1%	*65*	100.0%	*65*	98.5%
13	MUSHAIREB	8 648	0.5%	*60*	100.0%	*60*	100.0%
14	FEREEJ ABDEL AZIZ	10 808	0.6%	*55*	100.0%	*55*	100.0%
15	AL DOHA AL JADEEDA	13 059	0.8%	*40*	100.0%	*40*	100.0%
16	OLD AL GHANIM	14 230	0.8%	*39*	100.0%	*39*	100.0%
17	AL RUFAA / OLD AL HITMI	7 125	0.4%	*45*	100.0%	*45*	100.0%
18	SLATA / AL MIRQAB	741	0.0%	*52*	100.0%	*52*	100.0%
19	DOHA PORT	6	0.0%	*34*	100.0%	*34*	97.1%
20	WADI AL SAIL	539	0.0%	*72*	100.0%	*72*	100.0%
21	RUMAILA	1 532	0.1%	*61*	100.0%	*62*	100.0%
22	FEREEJ BIN MAHMOUD	10 590	0.6%	*54*	100.0%	*54*	96.3%
23	FEREEJ BIN MAHMOUD	13 582	0.8%	*106*	100.0%	*106*	100.0%
24	RAWDAT AL KHAIL	17 219	1.0%	*146*	100.0%	*146*	100.0%
25	AL MANSOURA / FEREEJ BIN DIRHAM	31 573	1.9%	*142*	100.0%	*142*	99.3%
26	NAJMA	24 763	1.5%	*111*	100.0%	*111*	99.1%
27	UMM GHUWAILINA	26 069	1.5%	*115*	100.0%	*115*	100.0%
28	AL KHULAIFAT / RAS BU ABBOUD	1 868	0.1%	*88*	100.0%	*88*	98.9%
29	RAS BU ABBOUD	0	0.0%	*106*	100.0%	*106*	100.0%
30	DUHAIL	7 059	0.4%	*250*	100.0%	*250*	100.0%
31	UMM LEKHBA	9 871	0.6%	*301*	100.0%	*301*	99.7%
32	MADINAT KHALIFA NORTH / DAHL AL HAMAM	14 725	0.9%	*221*	100.0%	*221*	100.0%
33	AL MARKHIYA	5 197	0.3%	*169*	100.0%	*169*	100.0%
34	MADINAT KHALIFA SOUTH	35 125	2.1%	*260*	100.0%	*260*	99.6%
35	FEREEJ KULAIB	7 702	0.5%	*96*	100.0%	*96*	99.0%
36	AL MESSILA	4 716	0.3%	*111*	100.0%	*111*	98.2%
37	FEREEJ BIN OMRAN / NEW AL HITMI / HAMAD MEDICAL CITY	21 066	1.2%	*219*	100.0%	*219*	97.7%
38	AL SADD	14 113	0.8%	*200*	100.0%	*200*	100.0%
39	AL SADD / NEW AL MIRQAB / FEREEJ AL NASR	15 184	0.9%	*255*	100.0%	*255*	100.0%
40	NEW SLATA	15 114	0.9%	*337*	100.0%	*337*	99.4%
41	NUAIJA	5 604	0.3%	*116*	100.0%	*116*	100.0%
42	AL HILAL	11 257	0.7%	*176*	100.0%	*176*	98.9%
43	NUAIJA	10 742	0.6%	*185*	100.0%	*185*	100.0%
44	NUAIJA	13 357	0.8%	*279*	100.0%	*279*	98.9%
45	OLD AIRPORT	44 275	2.6%	*461*	100.0%	*461*	99.6%
46	AL THUMAMA	4 417	0.3%	*296*	100.0%	*296*	98.3%
47	AL THUMAMA	12 179	0.7%	*307*	100.0%	*307*	99.0%

Population Coverage				OOREDOO 2G		OOREDOO 3G	
ID_Zone	Zone	Pop.	% Pop	Sample	Coverage	Sample	Coverage
48	DOHA INTERNATIONAL AIRPORT	1 354	0.1%	*200*	100%	*200*	99.0%
49	DOHA INTERNATIONAL AIRPORT	0	0.0%	*586*	100%	*586*	99.1%
51	AL GHARRAFA / GHARRAFAT AL RAYYAN / IZGHAWA / BANI HAJER / AL SEEJ / RAWDAT EGDAIM / AL THEMAID	46 976	2.8%	*753*	100%	*687*	99.3%
52	AL LUQTA / LEBDAY / OLD AL RAYYAN / AL SHAGUB / FEREEJ AL ZAEEM	20 416	1.2%	*1 487*	100%	*1 484*	99.9%
53	NEW AL RAYYAN / AL WAJBA / MUAITHER	76 966	4.5%	*1 161*	100%	*1 161*	99.2%
54	FEREEJ AL AMIR / LUAIB / MURAIKH / BAAYA / MEHAIRJA / FEREEJ AL SOUDAN	23 591	1.4%	*4 037*	100%	*4 037*	99.8%
55	FEREEJ AL SOUDAN / AL WAAB / AL AZIZIYA / NEW FEREEJ AL GHANIM / FEREEJ AL MURRA / FEREEJ AL MANASEER / BU SIDRA / MUAITHER / AL	138 573	8.2%	*3 923*	100%	*3 923*	99.0%
56	FEREEJ AL ASIRI / NEW FEREEJ AL KHULAIFAT / BU SAMRA / AL MAAMOURA / BU HAMOUR / MESAIMEER / AIN KHALED	85 906	5.1%	*2 051*	100%	*2 052*	99.2%
57	INDUSTERIAL AREA	260 726	15.3%	*87*	100%	*87*	97.7%
60	AL DAFNA	19	0.0%	*226*	100%	*226*	98.2%
61	AL DAFNA / AL QASSAR	2 782	0.2%	*48*	100%	*48*	100.0%
62	LEKHWAIR	3	0.0%	*162*	100%	*162*	98.8%
63	ONAIZA	5 170	0.3%	*138*	100%	*138*	98.6%
64	LEJBAILAT	4 024	0.2%	*179*	100%	*179*	97.2%
65	ONAIZA	7 710	0.5%	*1 101*	100%	*1 101*	97.5%
66	ONAIZA / LEQTAIFIYA / AL QASSAR	22 168	1.3%	*313*	100%	*313*	99.7%
67	HAZM AL MARKHIYA	8 586	0.5%	*187*	100%	*187*	93.6%
68	JELAIAH / AL TARFA / JERYAN NEJAIMA	5 558	0.3%	*293*	100%	*293*	98.6%
69	JABAL THUAILEB / AL KHARAYEJ / LUSAIL / AL EGLA / WADI AL BANAT	1 213	0.1%	*1 771*	100%	*1 773*	98.4%
70	LEABAIB / AL EBB / JERYAN JENAIHAT / AL KHEESA / RAWDAT AL HAMAMA / WADI AL WASAAH / AL SAKHAMA / AL MASROUHIYA / WADI LUSAIL / LUSAIL	24 722	1.5%	*2 587*	100%	*2 586*	89.0%
71	AL KHARAITIYAT / IZGHAWA / UMM SLAL MOHAMMED / BU FESSEELA / UMM SLAL ALI / UMM AL AMAD / UMM OBAIRIYA / LEKHSHAINA / SUNAY	60 509	3.6%	*1 643*	100%	*1 646*	81.5%
72	AL UTOURIYA	1 060	0.1%	*913*	100%	*913*	83.2%
73	LIJMILIYA	1 706	0.1%	*2 922*	100%	*2 921*	95.9%
74	SIMAISMA / AL JERYAN / AL KHOR	80 220	4.7%	*4 227*	100%	*4 231*	96.7%
75	AL THAKHIRA/RASS LAFFAN/UMM BIRKA	128 574	7.6%	*1 516*	100%	*1 517*	75.9%
76	AL GHUWAIRIYA	4 834	0.3%	*790*	100%	*798*	93.2%
77	FUWAIRIT/AIN SINAN/MADINAT AL KAABAN	1 970	0.1%	*717*	100%	*730*	92.9%
78	ABU DHALOUF/AL ZUBARA	1 009	0.1%	*1 072*	100%	*1 073*	94.4%
79	AL RUWAIS/MADINAT AL SHAMAL	4 996	0.3%	*2 440*	100%	*2 440*	92.3%
80	AL SHEEHANIYA	35 393	2.1%	*1 977*	100%	*1 977*	97.1%
81	MEBAIREEK	11 333	0.7%	*2 260*	100%	*2 261*	95.8%
82	RAWDAT RASHED	6 046	0.4%	*1 710*	100%	*1 709*	92.0%
83	AL KARAANA	1 567	0.1%	*901*	98%	*901*	88.5%
84	UMM BAB	6 194	0.4%	*1 208*	100%	*1 203*	87.9%
85	AL NASRANIYA	1 043	0.1%	*1 823*	100%	*1 823*	96.7%
86	DUKHAN	11 520	0.7%	*1 279*	100%	*1 279*	99.8%
90	AL WAKRA	79 457	4.7%	*1 734*	100%	*1 729*	96.6%
91	AL THUMAMA / AL WUKAIR/AL MASHAF	22 459	1.3%	*1 650*	100%	*1 650*	97.8%
92	MESAIEED	35 150	2.1%	*247*	100%	*247*	93.9%
93	MESAIEED INDUSTRIAL AREA	123	0.0%	*721*	100%	*720*	85.3%
94	SHAGRA	3 874	0.2%	*721*	100%	*720*	85.3%
95	AL KHARRARA	117	0.0%	*2 418*	100%	*2 426*	83.8%
96	ABU SAMRA	1 065	0.1%	*1 488*	100%	*1 488*	95.8%
97	SAWDA NATHEEL	15	0.0%	*460*	100%	*457*	95.2%
98	AL ADAID	42	0.0%	*637*	99%	*638*	73.2%
	TOTAL	**1 699 435**		***66 125***	**100.0%**	***65 871***	**95.9%**

Population Coverage

				VODAFONE 2G		VODAFONE 3G	
ID_Zone	Zone	Pop.	% Pop	Sample	Coverage	Sample	Coverage
1	AL JASRA	240	0.0%	*24*	100%	*24*	100.0%
2	AL BIDDA	35	0.0%	*24*	100.0%	*24*	100.0%
3	FEREEJ MOHAMMED BIN JASIM / MUSHAIREB	4 886	0.3%	*18*	100.0%	*18*	100.0%
4	MUSHAIREB	14 063	0.8%	*33*	100%	*33*	100.0%
5	AL NAJADA / BRAHAT AL JUFAIRY / FEREEJ AL ASMAKH	4 138	0.2%	*24*	100%	*24*	100.0%
6	OLD AL GHANIM	3 462	0.2%	*30*	100%	*30*	100.0%
7	AL SOUQ	679	0.0%	*27*	100%	*27*	100.0%
10	WADI AL SAIL	8	0.0%	*28*	100.0%	*28*	100.0%
11	RUMAILA	63	0.0%	*58*	98.3%	*59*	100.0%
12	AL BIDDA	1 067	0.1%	*65*	100%	*65*	100.0%
13	MUSHAIREB	8 648	0.5%	*60*	100%	*60*	100.0%
14	FEREEJ ABDEL AZIZ	10 808	0.6%	*55*	100.0%	*55*	100.0%
15	AL DOHA AL JADEEDA	13 059	0.8%	*40*	100.0%	*40*	100.0%
16	OLD AL GHANIM	14 230	0.8%	*39*	100.0%	*39*	100.0%
17	AL RUFAA / OLD AL HITMI	7 125	0.4%	*45*	100.0%	*45*	100.0%
18	SLATA / AL MIRQAB	741	0.0%	*52*	100%	*52*	100.0%
19	DOHA PORT	6	0.0%	*34*	100%	*34*	100.0%
20	WADI AL SAIL	539	0.0%	*72*	100%	*72*	100.0%
21	RUMAILA	1 532	0.1%	*62*	100%	*62*	100.0%
22	FEREEJ BIN MAHMOUD	10 590	0.6%	*54*	100%	*54*	100.0%
23	FEREEJ BIN MAHMOUD	13 582	0.8%	*106*	99.1%	*106*	100.0%
24	RAWDAT AL KHAIL	17 219	1.0%	*146*	100.0%	*146*	100.0%
25	AL MANSOURA / FEREEJ BIN DIRHAM	31 573	1.9%	*142*	100.0%	*142*	100.0%
26	NAJMA	24 763	1.5%	*111*	100%	*111*	99.1%
27	UMM GHUWAILINA	26 069	1.5%	*115*	100%	*115*	100.0%
28	AL KHULAIFAT / RAS BU ABBOUD	1 868	0.1%	*88*	100%	*88*	96.6%
29	RAS BU ABBOUD	0	0.0%	*106*	100%	*106*	99.1%
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31	UMM LEKHBA	9 871	0.6%	*301*	100%	*301*	100.0%
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34	MADINAT KHALIFA SOUTH	35 125	2.1%	*260*	100%	*260*	100.0%
35	FEREEJ KULAIB	7 702	0.5%	*96*	100%	*96*	100.0%
36	AL MESSILA	4 716	0.3%	*111*	99%	*111*	100.0%
37	FEREEJ BIN OMRAN / NEW AL HITMI / HAMAD MEDICAL CITY	21 066	1.2%	*219*	100%	*219*	100.0%
38	AL SADD	14 113	0.8%	*200*	100%	*200*	100.0%
39	AL SADD / NEW AL MIRQAB / FEREEJ AL NASR	15 184	0.9%	*255*	100%	*255*	100.0%
40	NEW SLATA	15 114	0.9%	*337*	100%	*337*	100.0%
41	NUAIJA	5 604	0.3%	*116*	100%	*116*	100.0%
42	AL HILAL	11 257	0.7%	*176*	100%	*176*	100.0%
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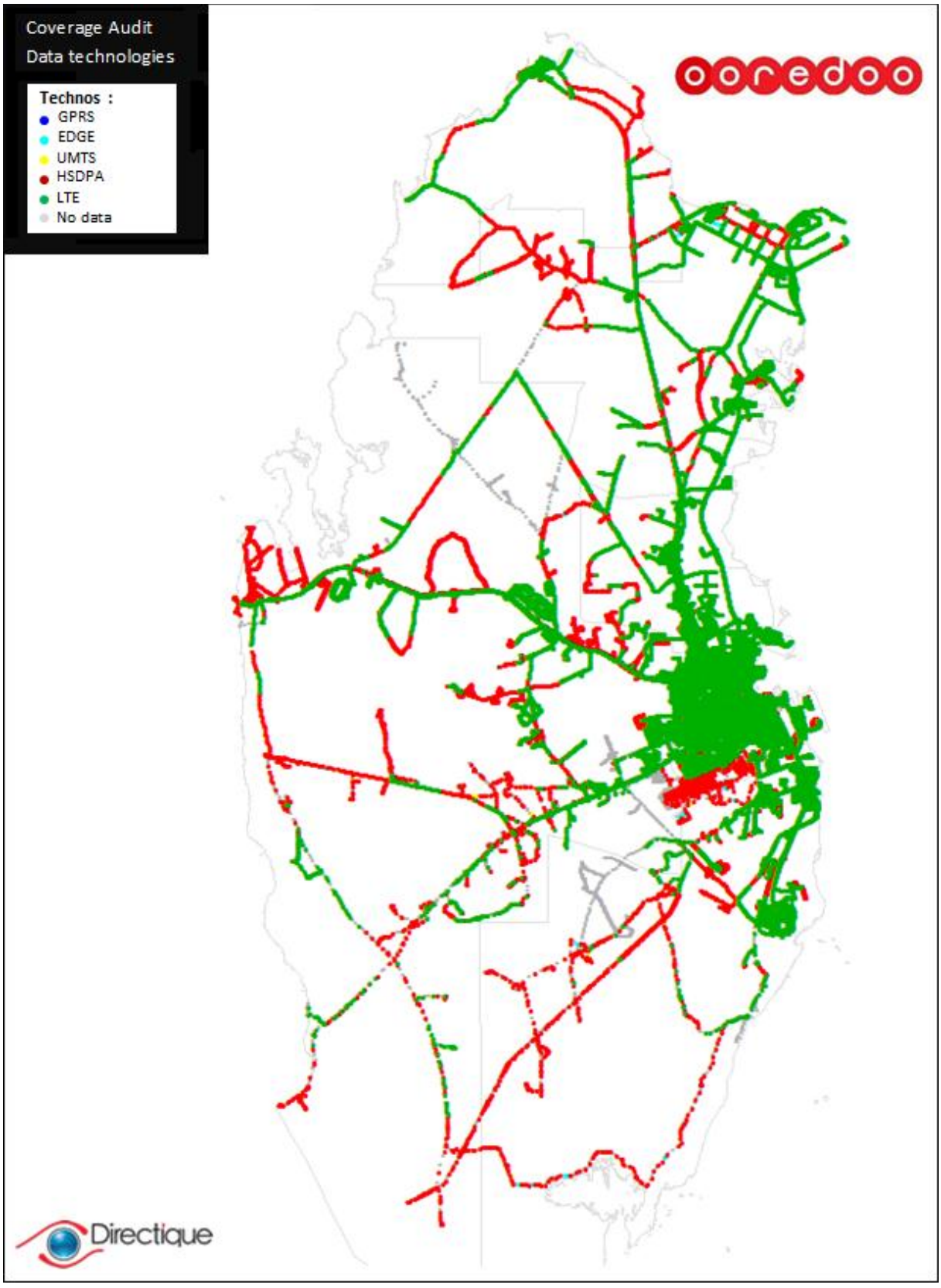
44	NUAIJA	13 357	0.8%	*279*	100%	*279*	100.0%
45	OLD AIRPORT	44 275	2.6%	*461*	100%	*461*	100.0%
46	AL THUMAMA	4 417	0.3%	*296*	100%	*296*	100.0%
47	AL THUMAMA	12 179	0.7%	*307*	100%	*307*	99.0%

Population Coverage

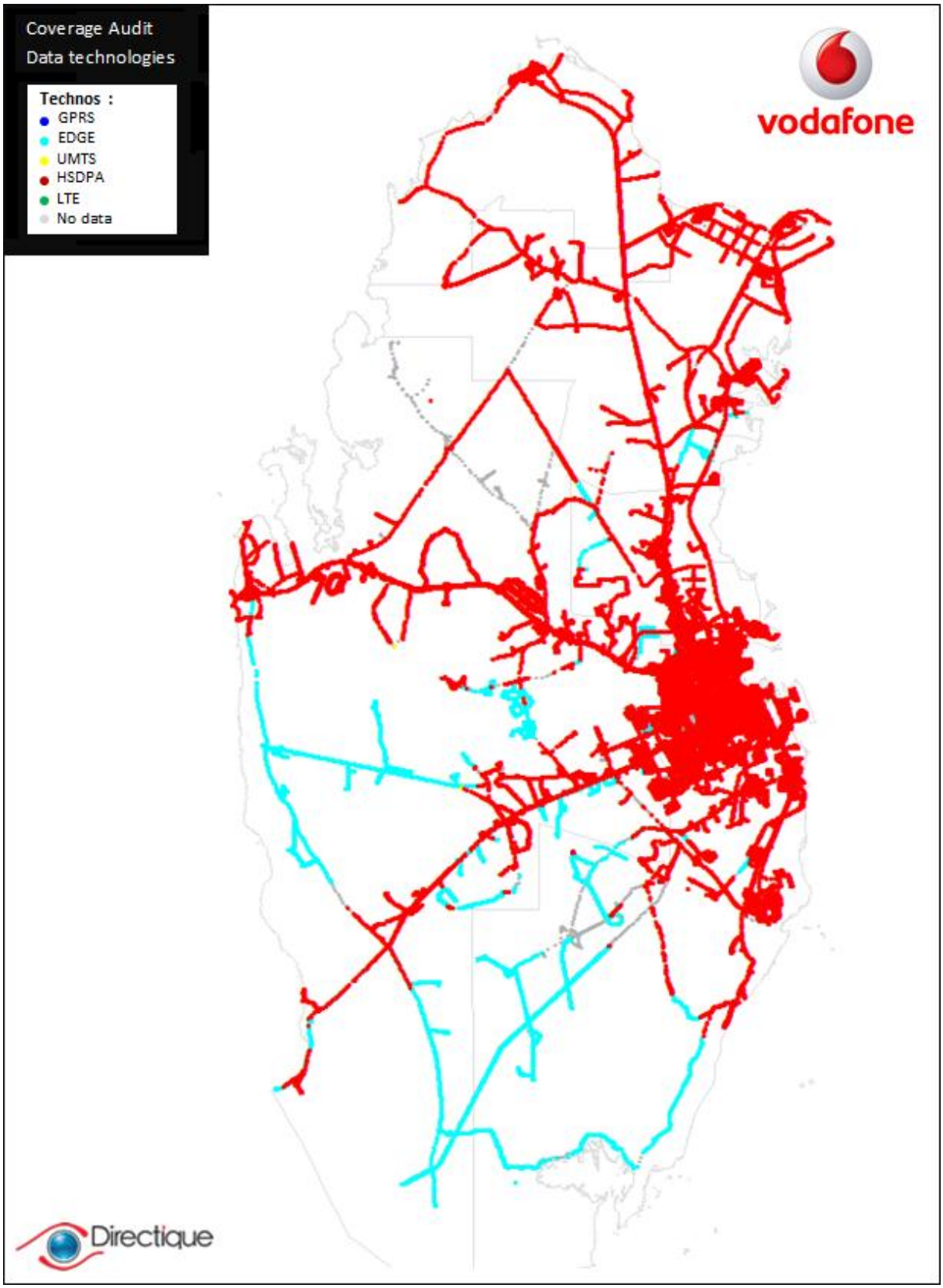
				VODAFONE 2G		VODAFONE 3G	
ID_Zone	Zone	Pop.	% Pop	Sample	Coverage	Sample	Coverage
48	DOHA INTERNATIONAL AIRPORT	1 354	0.1%	*200*	100%	*200*	99.0%
49	DOHA INTERNATIONAL AIRPORT	0	0.0%	*586*	100%	*586*	97.8%
51	AL GHARRAFA / GHARRAFAT AL RAYYAN / IZGHAWA / BANI HAJER / AL SEEJ / RAWDAT EGDAIM / AL THEMAID	46 976	2.8%	*687*	100%	*688*	99.7%
52	AL LUQTA / LEBDAY / OLD AL RAYYAN / AL SHAGUB / FEREEJ AL ZAEEM	20 416	1.2%	*1 487*	100%	*1 486*	96.6%
53	NEW AL RAYYAN / AL WAJBA / MUAITHER	76 966	4.5%	*1 161*	100%	*1 161*	99.8%
54	FEREEJ AL AMIR / LUAIB / MURAIKH / BAAYA / MEHAIRJA / FEREEJ AL SOUDAN	23 591	1.4%	*4 036*	100%	*4 037*	99.5%
55	FEREEJ AL SOUDAN / AL WAAB / AL AZIZIYA / NEW FEREEJ AL GHANIM / FEREEJ AL MURRA / FEREEJ AL MANASEER / BU SIDRA / MUAITHER / AL	138 573	8.2%	*3 923*	100%	*3 815*	99.3%
56	FEREEJ AL ASIRI / NEW FEREEJ AL KHULAIFAT / BU SAMRA / AL MAAMOURA / BU HAMOUR / MESAIMEER / AIN KHALED	85 906	5.1%	*2 051*	100%	*2 049*	99.7%
57	INDUSTERIAL AREA	260 726	15.3%	*87*	100%	*87*	100.0%
60	AL DAFNA	19	0.0%	*226*	100%	*226*	100.0%
61	AL DAFNA / AL QASSAR	2 782	0.2%	*48*	100%	*48*	100.0%
62	LEKHWAIR	3	0.0%	*162*	100%	*162*	99.4%
63	ONAIZA	5 170	0.3%	*138*	100%	*138*	100.0%
64	LEJBAILAT	4 024	0.2%	*179*	100%	*179*	97.2%
65	ONAIZA	7 710	0.5%	*1 101*	100%	*1 101*	99.6%
66	ONAIZA / LEQTAIFIYA / AL QASSAR	22 168	1.3%	*313*	100%	*313*	100.0%
67	HAZM AL MARKHIYA	8 586	0.5%	*187*	100%	*187*	98.4%
68	JELAIAH / AL TARFA / JERYAN NEJAIMA	5 558	0.3%	*293*	100%	*293*	99.0%
69	JABAL THUAILEB / AL KHARAYEJ / LUSAIL / AL EGLA / WADI AL BANAT	1 213	0.1%	*1 772*	99%	*1 773*	97.0%
70	LEABAIB / AL EBB / JERYAN JENAIHAT / AL KHEESA / RAWDAT AL HAMAMA / WADI AL WASAAH / AL SAKHAMA / AL MASROUHIYA / WADI LUSAIL / LUSAIL	24 722	1.5%	*2 585*	97%	*2 583*	89.8%
71	AL KHARAITIYAT / IZGHAWA / UMM SLAL MOHAMMED / BU FESSEELA / UMM SLAL ALI / UMM AL AMAD / UMM OBAIRIYA / LEKHSHAINA / SUNAY	60 509	3.6%	*1 647*	98%	*1 645*	80.8%
72	AL UTOURIYA	1 060	0.1%	*913*	100%	*913*	97.2%
73	LIJMILIYA	1 706	0.1%	*2 920*	99%	*2 919*	90.2%
74	SIMAISMA / AL JERYAN / AL KHOR	80 220	4.7%	*4 229*	99%	*4 230*	90.5%
75	AL THAKHIRA/RASS LAFFAN/UMM BIRKA	128 574	7.6%	*1 515*	99%	*1 518*	70.5%
76	AL GHUWAIRIYA	4 834	0.3%	*798*	92%	*798*	96.9%
77	FUWAIRIT/AIN SINAN/MADINAT AL KAABAN	1 970	0.1%	*728*	100%	*731*	55.3%
78	ABU DHALOUF/AL ZUBARA	1 009	0.1%	*1 073*	99%	*1 073*	96.5%
79	AL RUWAIS/MADINAT AL SHAMAL	4 996	0.3%	*2 440*	100%	*2 440*	96.4%
80	AL SHEEHANIYA	35 393	2.1%	*1 977*	97%	*1 974*	88.5%
81	MEBAIREEK	11 333	0.7%	*2 261*	97%	*2 261*	62.0%
82	RAWDAT RASHED	6 046	0.4%	*1 709*	99%	*1 705*	78.7%
83	AL KARAANA	1 567	0.1%	*901*	99%	*901*	28.3%
84	UMM BAB	6 194	0.4%	*1 206*	100%	*1 205*	70.7%
85	AL NASRANIYA	1 043	0.1%	*1 823*	99%	*1 823*	86.5%
86	DUKHAN	11 520	0.7%	*1 278*	100%	*1 279*	99.5%
90	AL WAKRA	79 457	4.7%	*1 734*	100%	*1 734*	91.0%
91	AL THUMAMA / AL WUKAIR/AL MASHAF	22 459	1.3%	*1 650*	100%	*1 650*	98.9%
92	MESAIEED	35 150	2.1%	*247*	100%	*247*	98.4%
93	MESAIEED INDUSTRIAL AREA	123	0.0%	*723*	93%	*719*	55.6%
94	SHAGRA	3 874	0.2%	*2 415*	94%	*2 427*	43.9%
95	AL KHARRARA	117	0.0%	*1 488*	100%	*1 488*	90.1%
96	ABU SAMRA	1 065	0.1%	*452*	100%	*454*	92.5%
97	SAWDA NATHEEL	15	0.0%	*452*	100%	*454*	92.5%
98	AL ADAID	42	0.0%	*638*	94%	*636*	62.9%
	TOTAL	**1 699 435**		***65 865***	**99.6%**	***65 764***	**94.8%**

b. Annexure 2 - Maps: Data Coverage

DATA COVERAGE – **OOREDOO**



DATA COVERAGE **- Vodafone**



c. Annexure 3 - Comparison with Operator's Maps

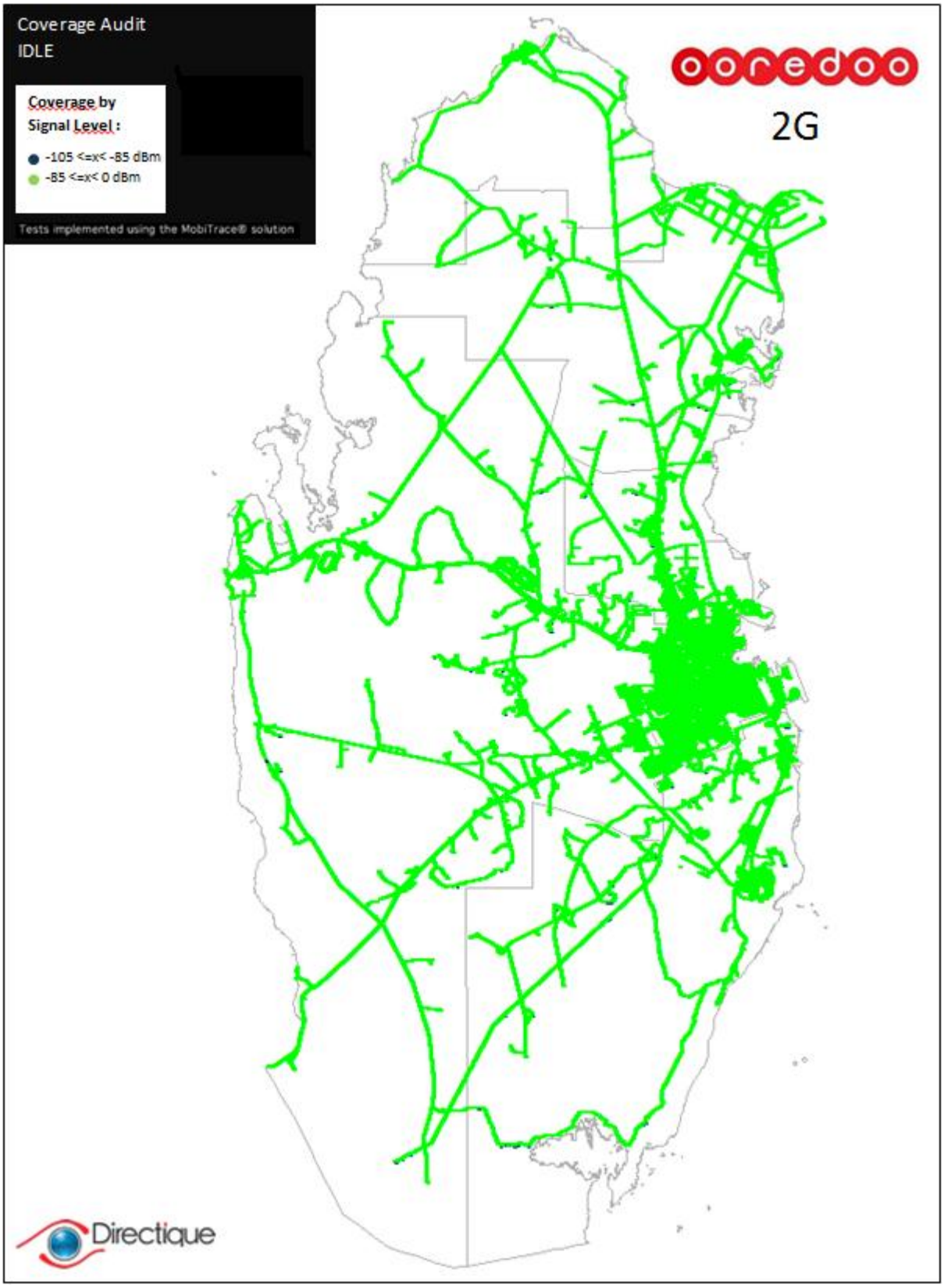
The idle coverage maps here after are showing the distribution of the signal strength of all the locations of the drive tests.

Also, they are compared to the coverage maps furnished by the operators themselves.

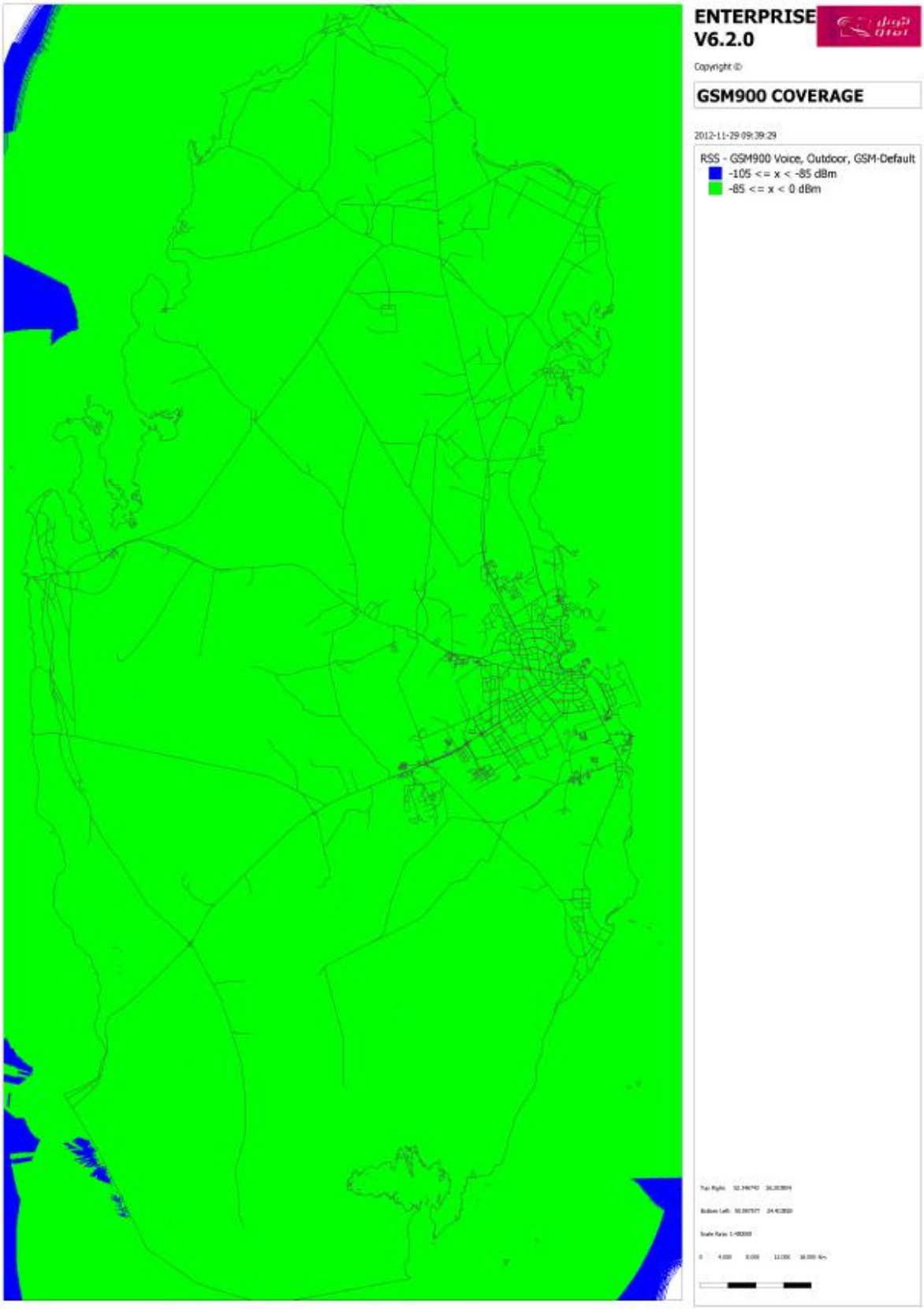
Compliance with operator's map:

OPERATOR	MAP COMPLIANCE	Comment
OOREDOO 2G	Yes	.
OOREDOO 3G	Comparison not available	Ooredoo's map is U900 only and shows signal strength under and above -95dBm. (not -85dBm)
VODAFONE 2G	Yes	
VODAFONE 3G	Yes	

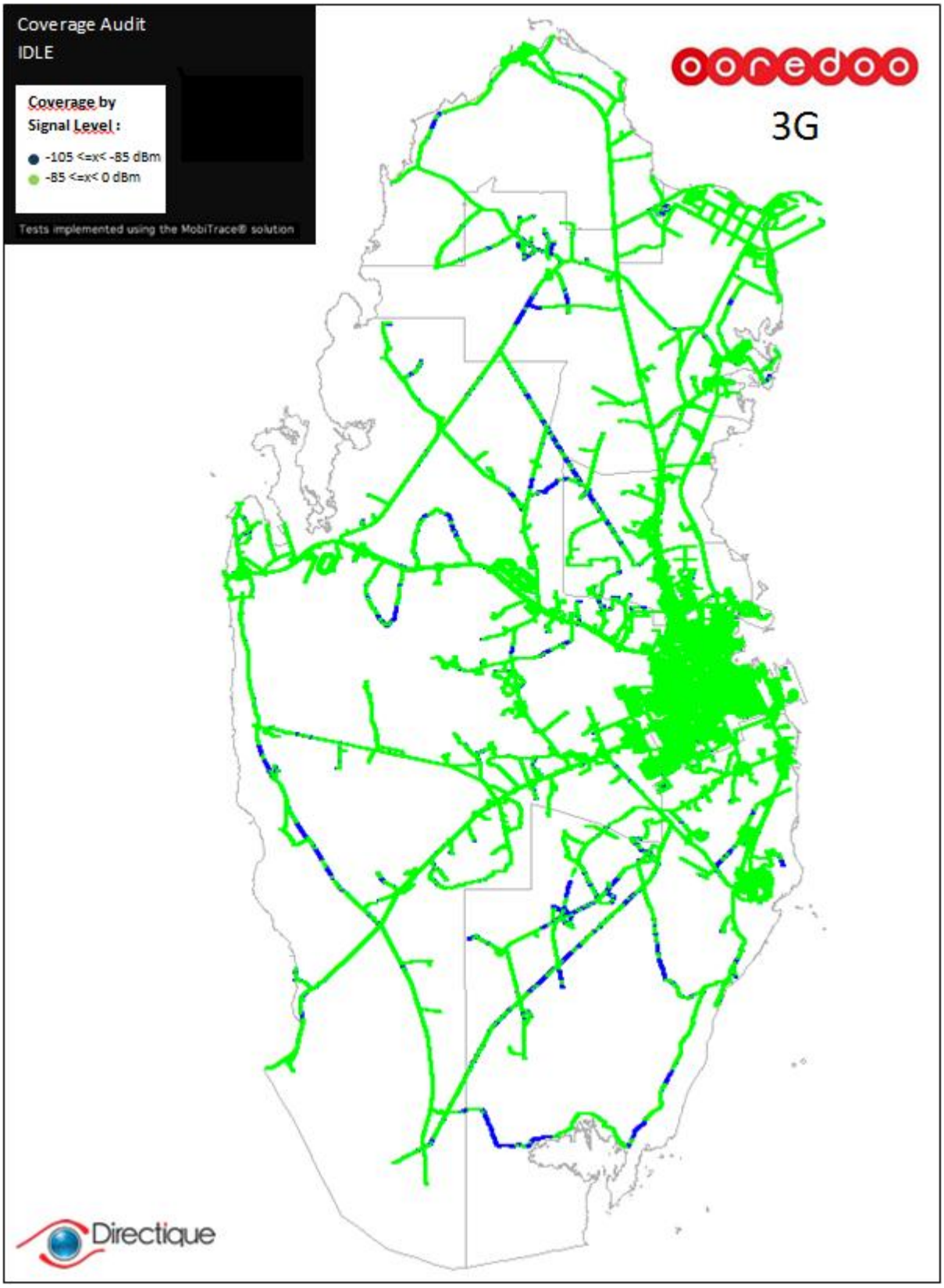
2G OOREDOO – Coverage Drive



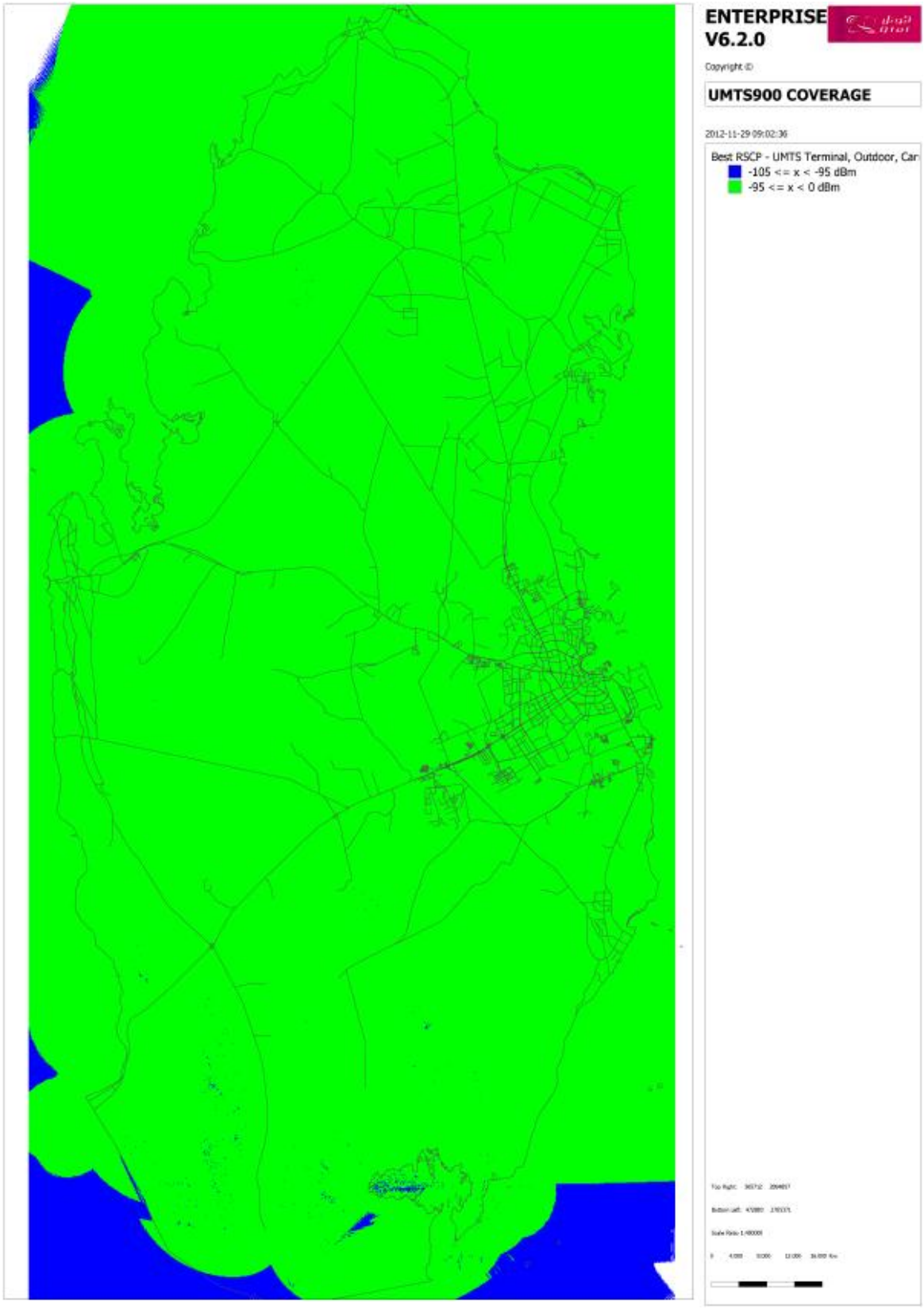
2G Coverage Map From OOREDOO



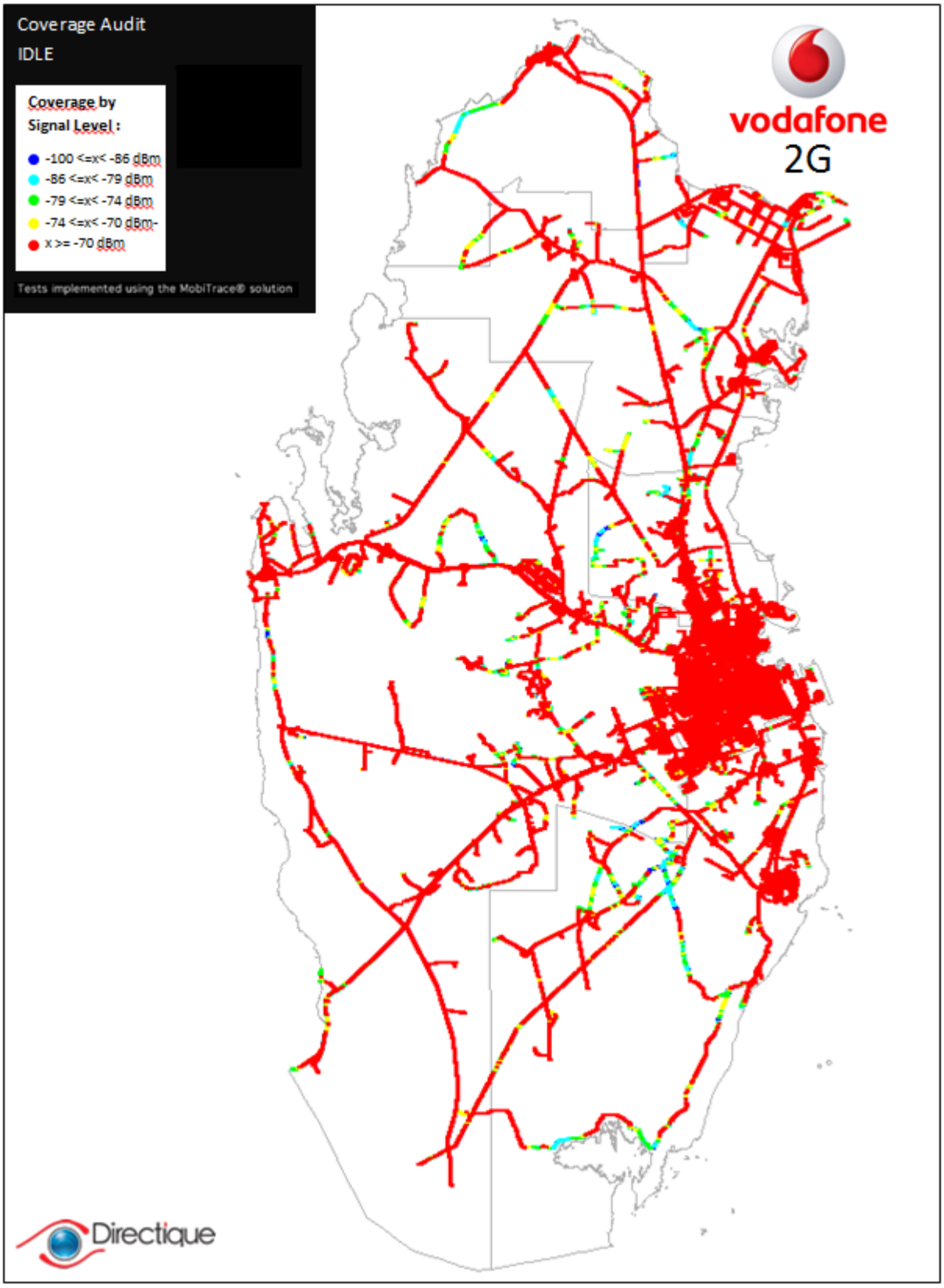
3G OOREDOO – Coverage Drive



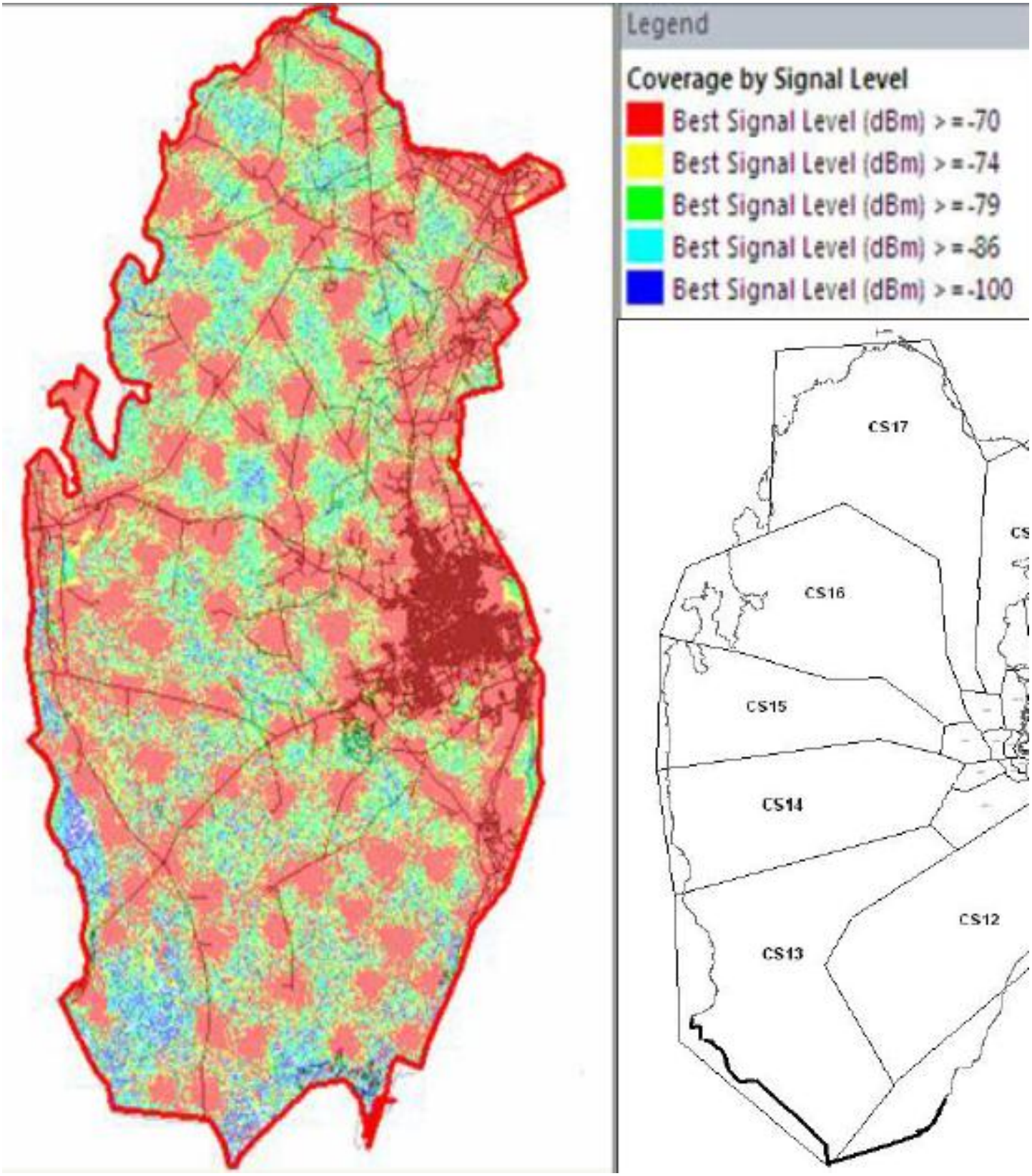
3G Coverage Map From OOREDOO



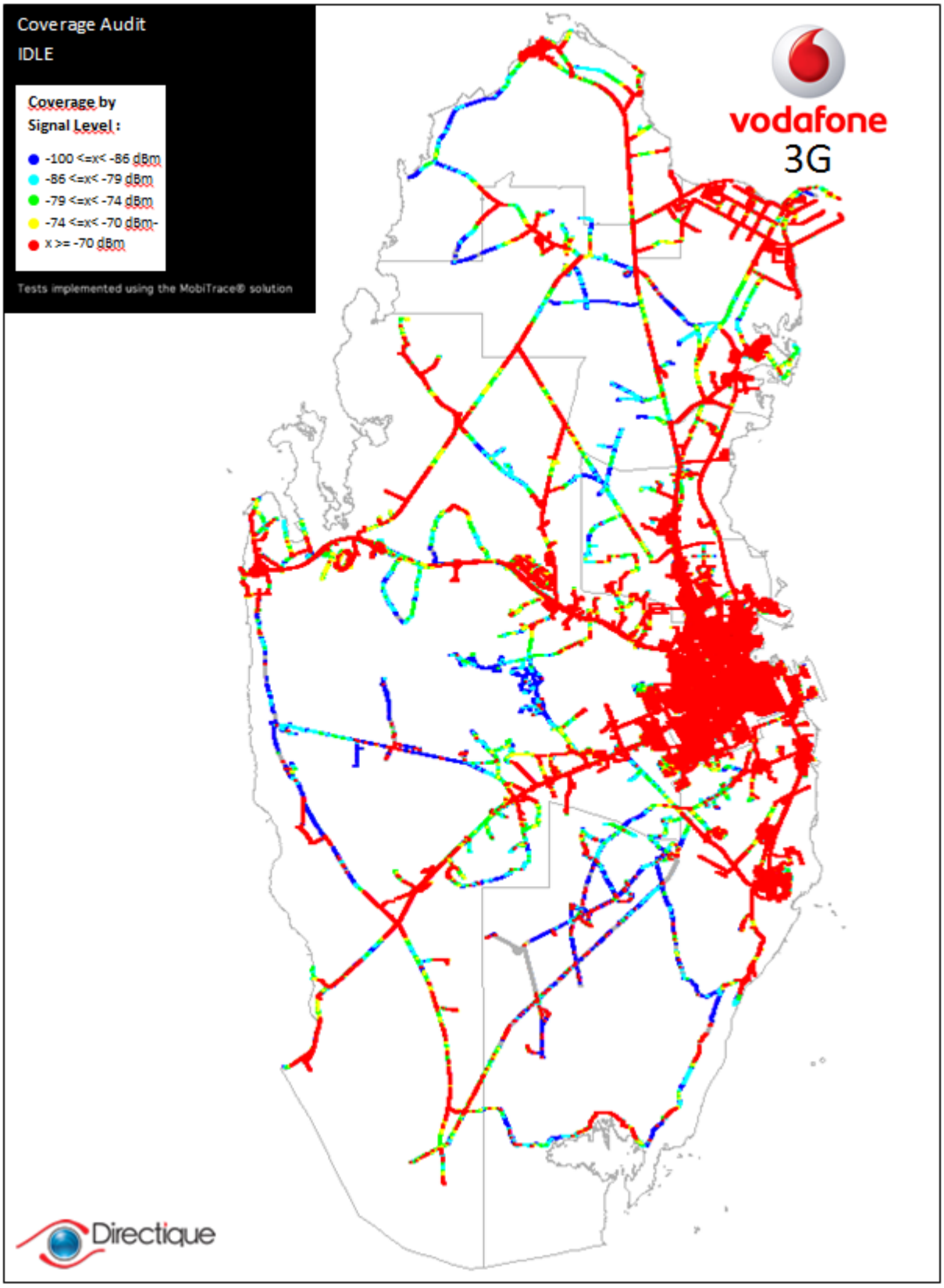
2G VODAFONE – Coverage Drive



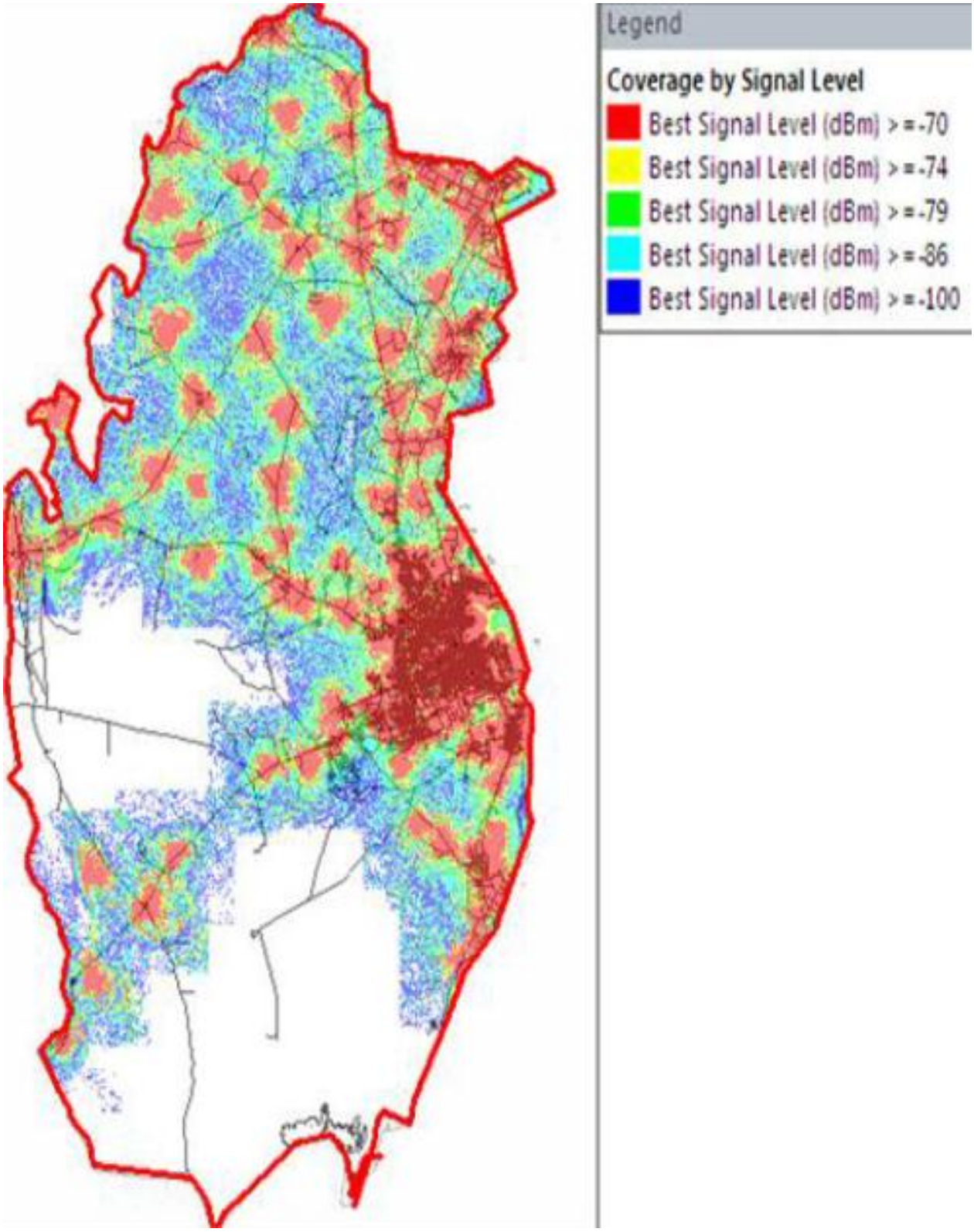
2G Coverage Map From VODAFONE



3G VODAFONE – Coverage Drive

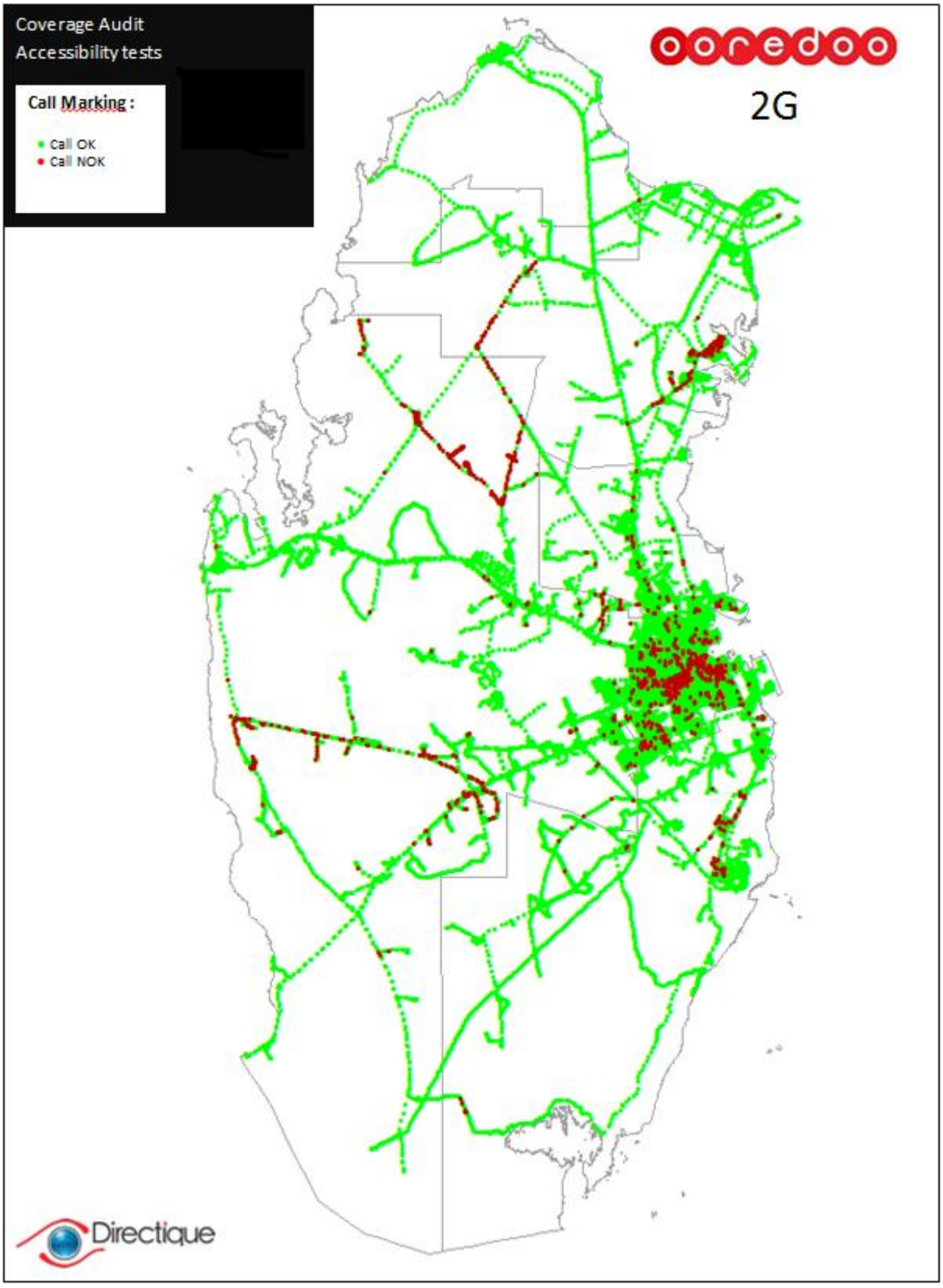


3G Coverage Map From VODAFONE

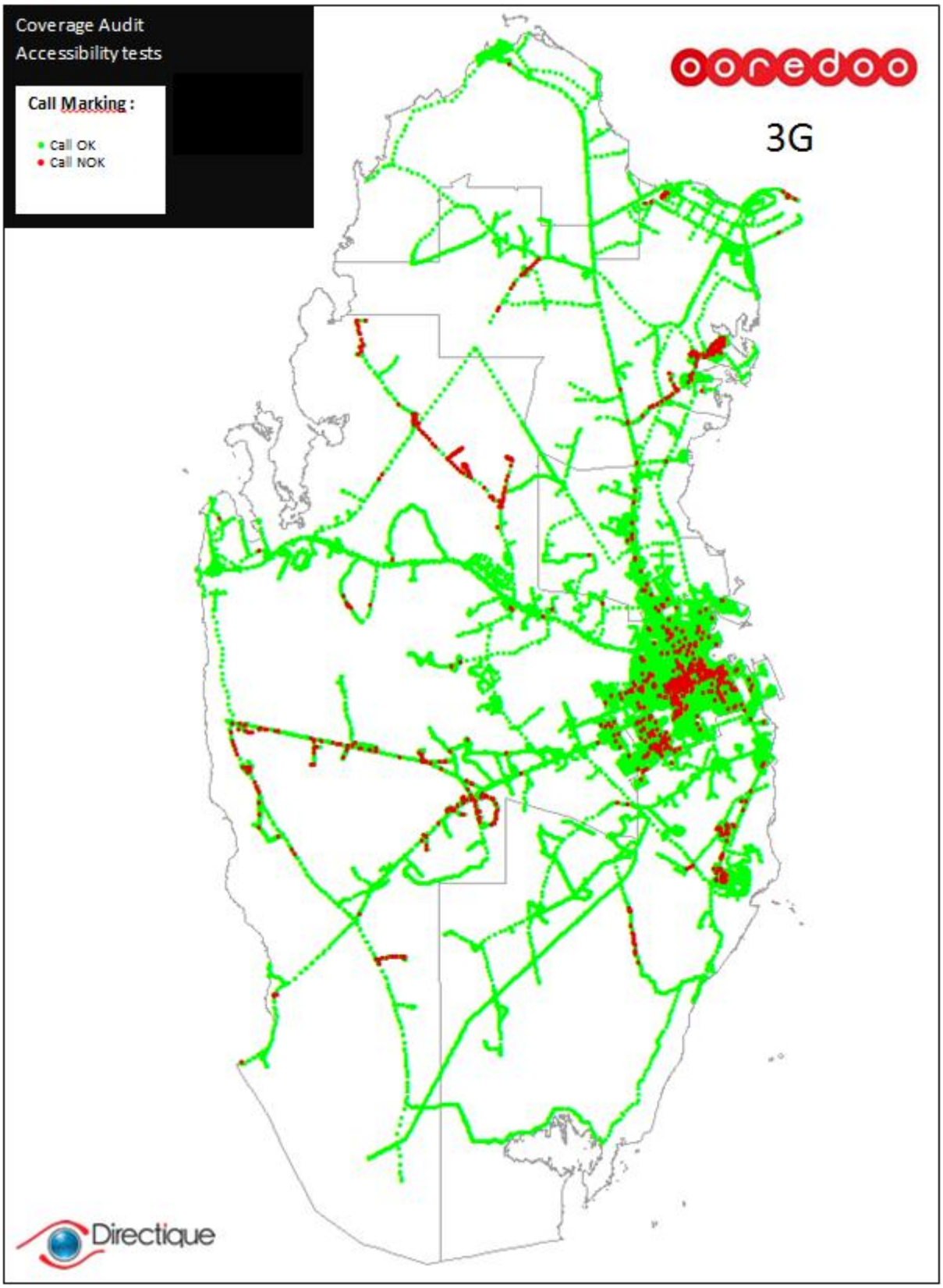


d. Annexure 4 - Maps: Coverage Accessibility

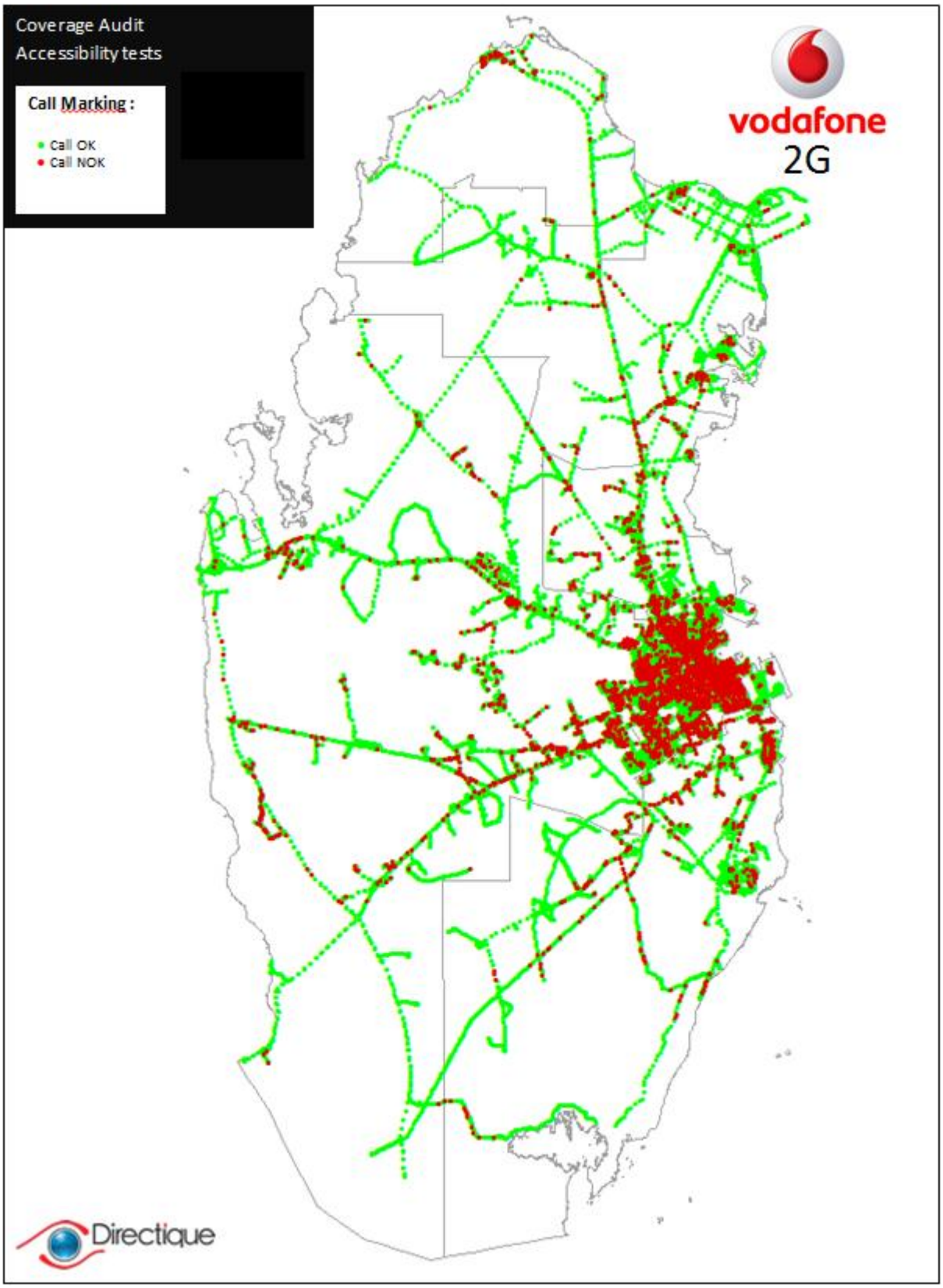
Coverage Accessibility – **OOREDOO 2G**



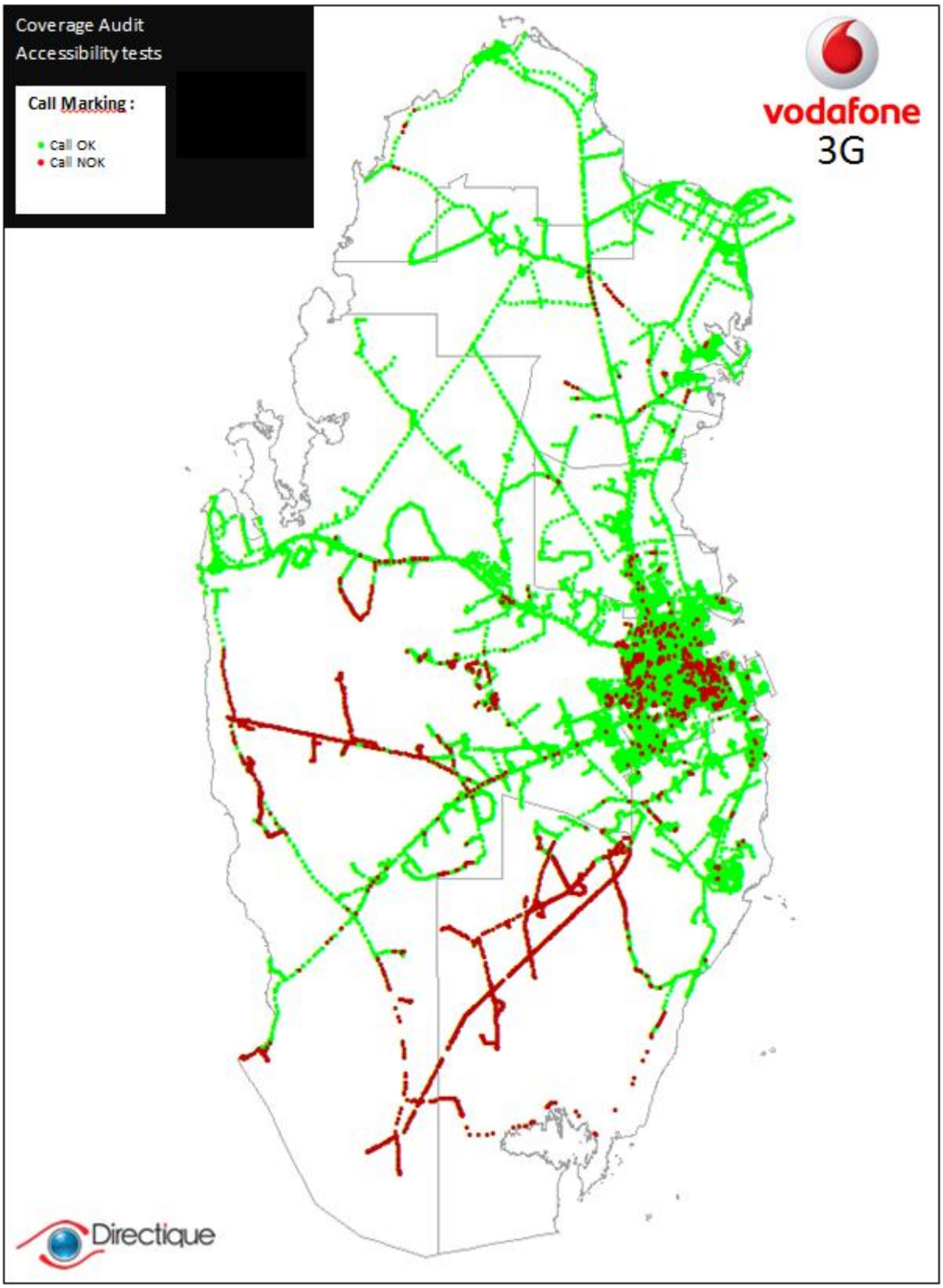
Coverage Accessibility – **OOREDOO 3G**



Coverage Accessibility – **Vodafone 2G**



Coverage Accessibility – **Vodafone 3G**



e. Annexure 5 - Raw Data

Excel Files