Directique
Customer Quality Perspectives

هيئة تنظيم الاتصالات
Telecommunications Regulatory Authority

Mobile Networks Coverage Audit

Kingdom of Bahrain - 2014

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1 EXECUTIVE SUMMARY

Mobile Network Operators are under a coverage obligation as a condition of their Individual Mobile Telecommunications license (IMTL), and it is the responsibility of TRA to verify and validate that each operator is meeting its obligation.

The license obligation based on the modified IMTL issued on 19 September 2013 requires operators to, using their own mobile telecommunications network, offer licensed services with a coverage of at least 99% of the population in the Kingdom of Bahrain on or before the 19 June 2014.

The license obligation defines the minimum expected population coverage for each Mobile Operator's own telecommunications network. The coverage is independent of the technology deployed, however in order to determine coverage, measurements have been performed for the following technologies:

2G, 3G and 4G.

It is important to point out that some areas were not accessible to the audit team, being either private land or reserved for government, which explains why the maps do not show any measurements in those areas of the Kingdom. However those areas are not open to general public. With this in mind, results are very good and show that there is no significant coverage difference from one operator to the other.

Directique was also required to audit Mobile Network Operators coverage prediction maps with the actual coverage observed. The maps included in this report contain two layers: a first layer showing the coverage predictions provided by the operators themselves, on top of which, a second layer superimposed is showing results of the coverage measurements.

2 OBJECTIVE

The objective of this audit was to:

- Measure the outdoor coverage of the 3 Mobile Operators; Batelco, Viva and Zain, via an accessibility test
- 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 observed during the audit

3 METHODOLOGY

The audit was conducted from the 29 June to the 7 July 2014 cross the Kingdom's 5 Governorates.

Audit results have been weighted with the population percentage living in each Governorate[1]. The tables in Annex 6 present the detailed coverage per Governorate as measured for each operator.

Coverage, from a end-user perspective, cannot be measured based on signal level. A scanner cannot discern the difference between the live cells and the other emitting cells and the result would give an over optimistic coverage measurement.
Beside such tools would measure reception levels in dB, and this cannot be interpreted or be easily 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, and completed with signal levels.

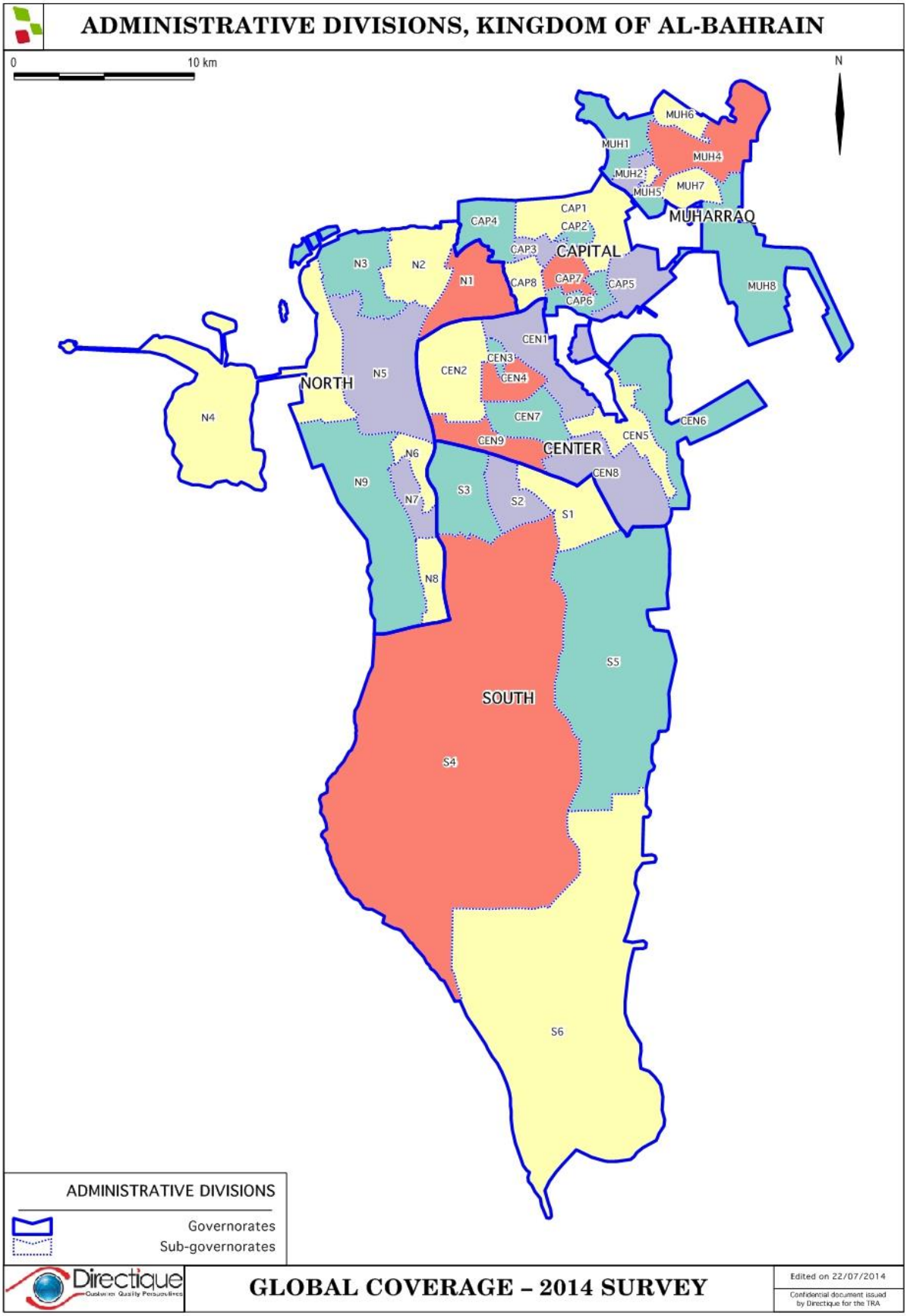
Measurements have been performed with the following platform:

- a set of smartphones LTE enabled
- a set of smartphones in 3G only
- a set of smartphones in idle mode running proprietary software ***MobiTrace*** .

The vehicle equipped with to the test platfrom followed a pre-determined route which was selected to ensure that it covered the 5 Governorates of the Kingdom. Test were conducted automaticaly.

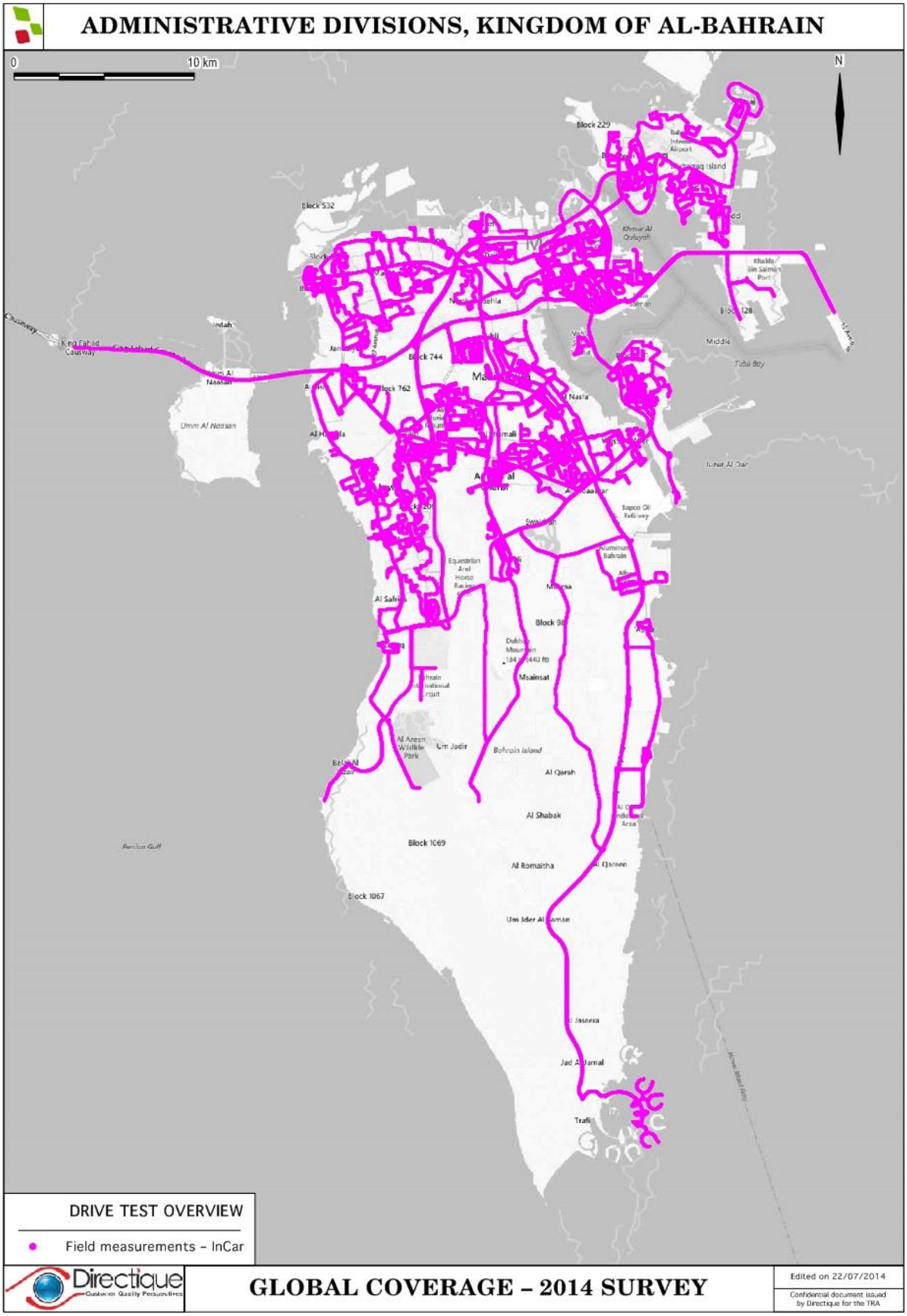
[1] Population data based on CIO latest census

3.1.1 **Administrative divisions**



3.1.2 Drive test

Routes followed by the vehicle performing measurements.



3.1.3 Equipment

Audit measurements were performed using standard mobile phones.

Data coverage

Device:

Samsung Note3

Protocol: All devices were set in automatic mode, which means that each data measurement was launched on the best technology offered by the network at the time of the test.

In order to have a representative experience of 2 types of services, those with 4G and those restricted to 3G, devices were set differently:

- One set of smartphones, network modes were: **LTE/WCDMA/GSM (auto connect**).
- On the other set of smartphones, LTE was not disabled; network modes were: **WCDMA/GSM (auto connect)**.

IDLE coverage:

Devices:

Samsung Wave 2 for 2G and 3G.

- Samsung S3 4G for 4G.

Protocol: 3 mobile phones were used for each network, for this specific test one mobile phone locked in 2G, one mobile phone locked in 3G mode and one mobile phone in 4G mode.

The same setup was repeated to cover all 3 mobile networks, i.e. Batelco, Viva and Zain.

Rooftop box and mobile phones

For outdoor test conditions mobile phones were positioned in a plastic rooftop box. The rooftop box was tested in measuring using a reference signal, attenuation outside and then inside the rooftop box, 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 computer based software recording test results. The set-up was completed with a GPS receiver, which recorded the exact location of each test.

3.1.4 Coverage rate

The geographical coverage rate for each technology is computed using the number of successful measurements on this technology by the total number of measurements.

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

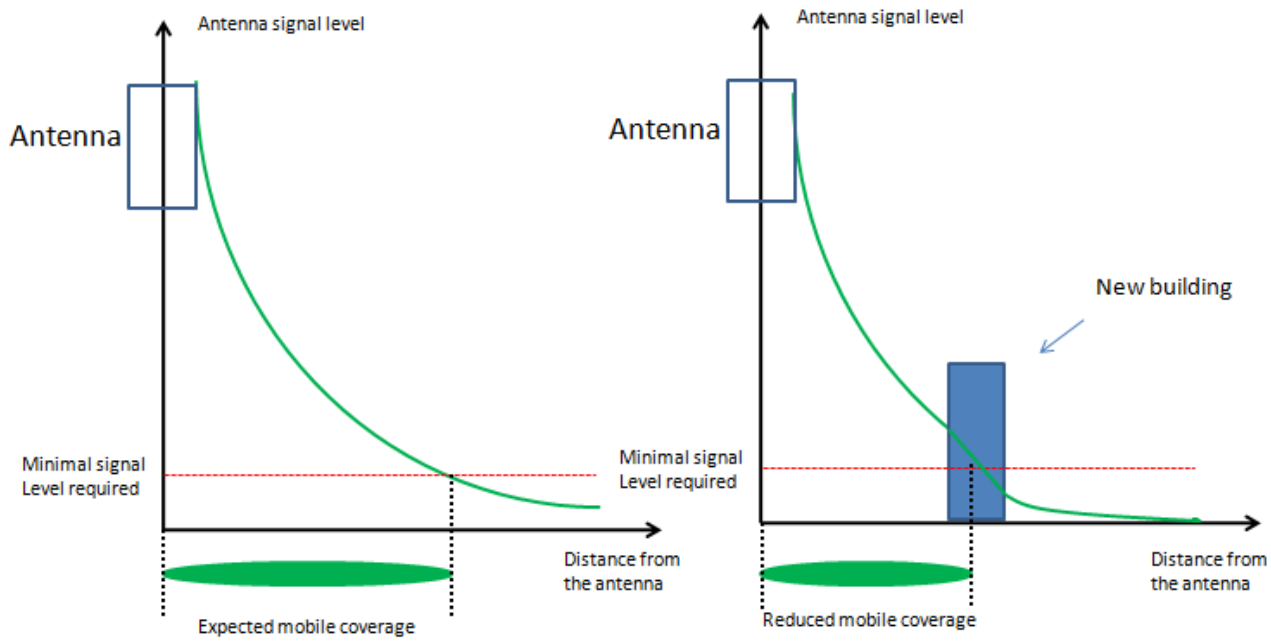
Population coverage is then calculated by weighting these results with the population percentage living in each Governorate, using latest available Central Informatics Organisation (CIO) census statistics for the Kingdom.

3.1.5 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.

In some instances such as malls and large shopping centres, hotels and airports, Mobile Operators implement additional base stations to ensure adequate indoor coverage, however the assessment of indoor coverage was not in the scope of this audit.



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 Population coverage – LTE's users

4.1.1 LTE's population Coverage for a 4G user

			4G					
			Batelco		Viva		Zain	
Governorate	Code	% Pop	Nb	Coverage	Nb	Coverage	Nb	Coverage
Capital	CAP	27%	1 096	100%	1 113	100%	1 103	99.5%
								0.4%
Central	CEN	27%	1 244	88%	1 291	99.9%	1 302	97%
				1.8%		*0.2%*		*0.9%*
Muharraq	MUH	15%	591	100%	625	100%	608	91%
								2.2%
Northern	N	23%	1 459	90%	1 550	99.2%	1 524	96%
				1.5%		*0.5%*		*1.0%*
Southern	S	8%	765	62%	853	99%	820	91%
				3.4%		*0.7%*		*2.0%*
Total		100%	5 155	91%	5 432	99.7%	5 357	96.2%
				0.8%		*0.1%*		*0.5%*

The rate represents the % of locations where 4G was available for the user.

4.1.2 LTE + 3G population Coverage for a 4G user

			4G + 3G					
			Batelco		Viva		Zain	
Governorate	Code	% Pop	Nb	Coverage	Nb	Coverage	Nb	Coverage
Capital	CAP	27%	1 096	99.8%	1 113	100%	1 103	100%
				0.2%				
Central	CEN	27%	1 244	98.7%	1 291	100%	1 302	100%
				0.6%				
Muharraq	MUH	15%	591	99.8%	625	100%	608	100%
				0.4%				
Northern	N	23%	1 459	99.4%	1 550	99.7%	1 524	100%
				0.4%		*0.3%*		
Southern	S	8%	765	94%	853	100%	820	99.8%
				1.7%				*0.3%*
Total		100%	5 155	98.9%	5 432	100%	5 357	100%
				0.3%		*0.1%*		*0.0%*

The rate represents the % of locations where 4G or 3G was available for the user.

Legend:

Governorate: Governorate name
Code: Governorate area in administrative division map
% Pop: Population percentage in the specific area

Nb:Number of measurements
Coverage:Resulting computed population coverage in %

4.1.3 LTE + 3G +2G population Coverage for a 4G user

			4G + 3G + 2G					
			Batelco		Viva		Zain	
Governorate	Code	% Pop	Nb	Coverage	Nb	Coverage	Nb	Coverage
Capital	CAP	27%	1 096	100%	1 113	100%	1 103	100%
Central	CEN	27%	1 244	99.6%	1 291	100%	1 302	100%
				0.3%				
Muharraq	MUH	15%	591	100%	625	100%	608	100%
Northern	N	23%	1 459	99.8%	1 550	99.7%	1 524	100%
				0.2%		0.3%		
Southern	S	8%	765	99.3%	853	100%	820	100%
				0.6%				
Total		100%	5 155	99.8%	5 432	100%	5 357	100%
				0.1%		0.1%		

The rate represents the % of locations where any technology was available for the user.

4.2 Population coverage – 3G users

4.2.1 3G population Coverage for a 3G user

			3G					
			Batelco		Viva		Zain	
Governorate	Code	% Pop	Nb	Coverage	Nb	Coverage	Nb	Coverage
Capital	CAP	27%	984	96%	836	99.9%	981	99.8%
				1.2%		0.2%		0.3%
Central	CEN	27%	1 151	92%	955	99.7%	1 176	99.5%
				1.6%		0.3%		0.4%
Muharraq	MUH	15%	546	94%	509	100%	539	99.9%
				2.0%				0.3%
Northern	N	23%	1 360	95%	1 116	100%	1 349	99.7%
				1.2%				0.3%
Southern	S	8%	721	89%	613	99.7%	742	100%
				2.3%		0.4%		0.5%
Total		100%	4 762	93.8%	4 029	100%	4 787	100%
				0.7%		0.1%		0.2%

The rate represents the % of locations where 3G was available for the user.

Legend:

Governorate: Governorate name
Code: Governorate area in administrative division map
% Pop: Population percentage in the specific area

Nb:Number of measurements
Coverage:Resulting computed population coverage in %

4.2.2 3G + 2G population Coverage for a 3G user

			3G + 2G					
			Batelco		Viva		Zain	
Governorate	Code	% Pop	Nb	Coverage	Nb	Coverage	Nb	Coverage
Capital	CAP	27%	984	100%	836	100%	981	100%
Central	CEN	27%	1 151	100%	955	100%	1 176	100%
Muharraq	MUH	15%	546	100%	509	100%	539	100%
Northern	N	23%	1 360	100%	1 116	100%	1 349	100%
Southern	S	8%	721	100%	613	100%	742	100%
Total		100%	4 762	100%	4 029	100%	4 787	100%

The rate represents the % of locations where 3G was available for the user.

Legend:

Governorate: Governorate name
Code: Governorate area in administrative division map
% Pop: Population percentage in the specific area

Nb:Number of measurements
Coverage:Resulting computed population coverage in %

4.3 Technology distribution

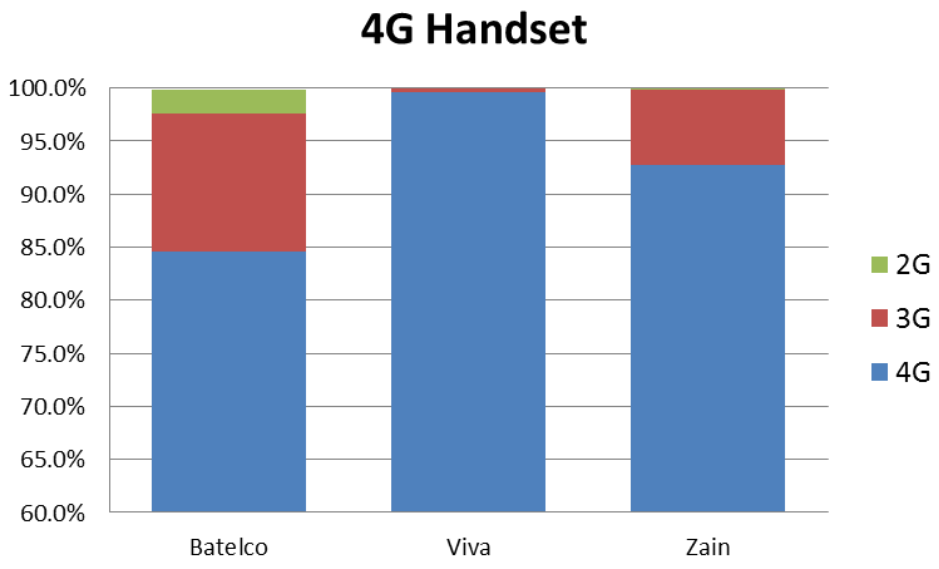
Figures here below show the exact distribution of the data coverage measurements.
First, the rate of successful HTTP PING (latency test), as a location were the latency was NOK is considered as not covered.
Then, graph show the percentages of those successful tests on each technology used by the mobile.
3G = HSDPA + UMTS
2G = EDGE + GPRS

4.3.1 4G handset

	Batelco	Viva	Zain
Rate of successfull HTTP PING	99.8%	99.9%	100.0%

On technology:

LTE	84.6%	99.6%	92.7%
HSPDA	11.2%	0.3%	7.1%
UMTS	1.9%		
EDGE	2.2%		0.1%
GPRS			

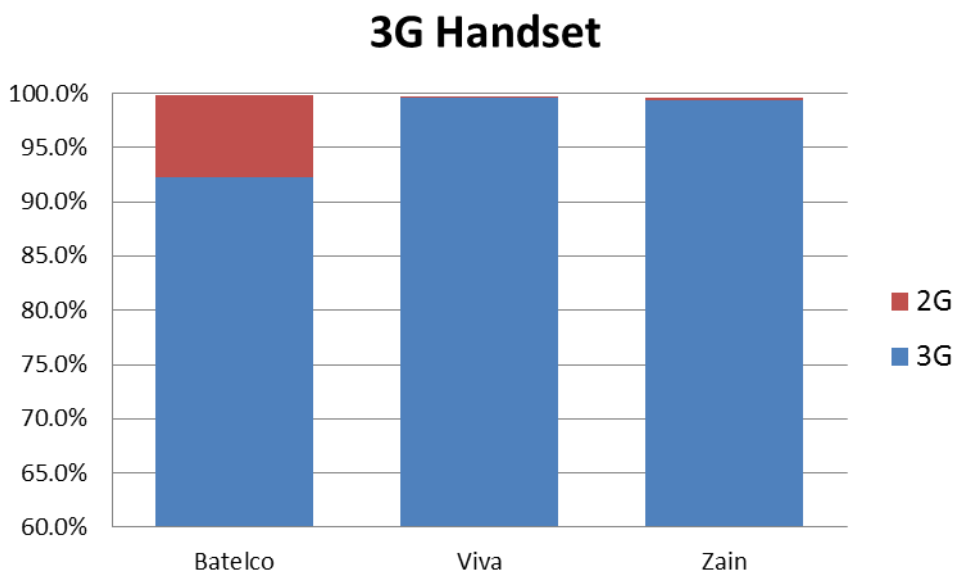


4.3.1 3G handset

	Batelco	Viva	Zain
Rate of successfull HTTP PING	99.9%	99.8%	99.6%

On technology:

HSPDA	84.6%	99.6%	99.3%
UMTS	7.6%		
EDGE	7.6%	0.2%	0.3%
GPRS	0.0%		0.0%



4.4 Audit of Operators' Coverage Maps

Another objective of this audit was to verify operator's coverage maps reliability.

Maps have been provided by each operator at the beginning of this audit.

The documents presented hereafter show each operator's coverage maps with a superimposed layer showing results of the coverage measurements performed by Directique, using the following colour code:

If the spot is grey, the test was outside the coverage zone of the operator.

If the spot is red, the test was inside the coverage zone of the operator but the device used a different technology.

If the spot is green, the test was inside the coverage zone of the operator and the expected technology was used by the device.

For 3G, 2 different maps are presented: the first one represents the spots where a LTE user could reach 3G or 4G. The second shows the spots where a user with a 3G handset is in 3G.

It is interesting to notice that for every operator, the chance to reach at least 3G is higher for a 4G handset user than for a 3G handset user.

For each map provided by operators themselves, the rate of reliability is calculated, for each technology, following this formula:

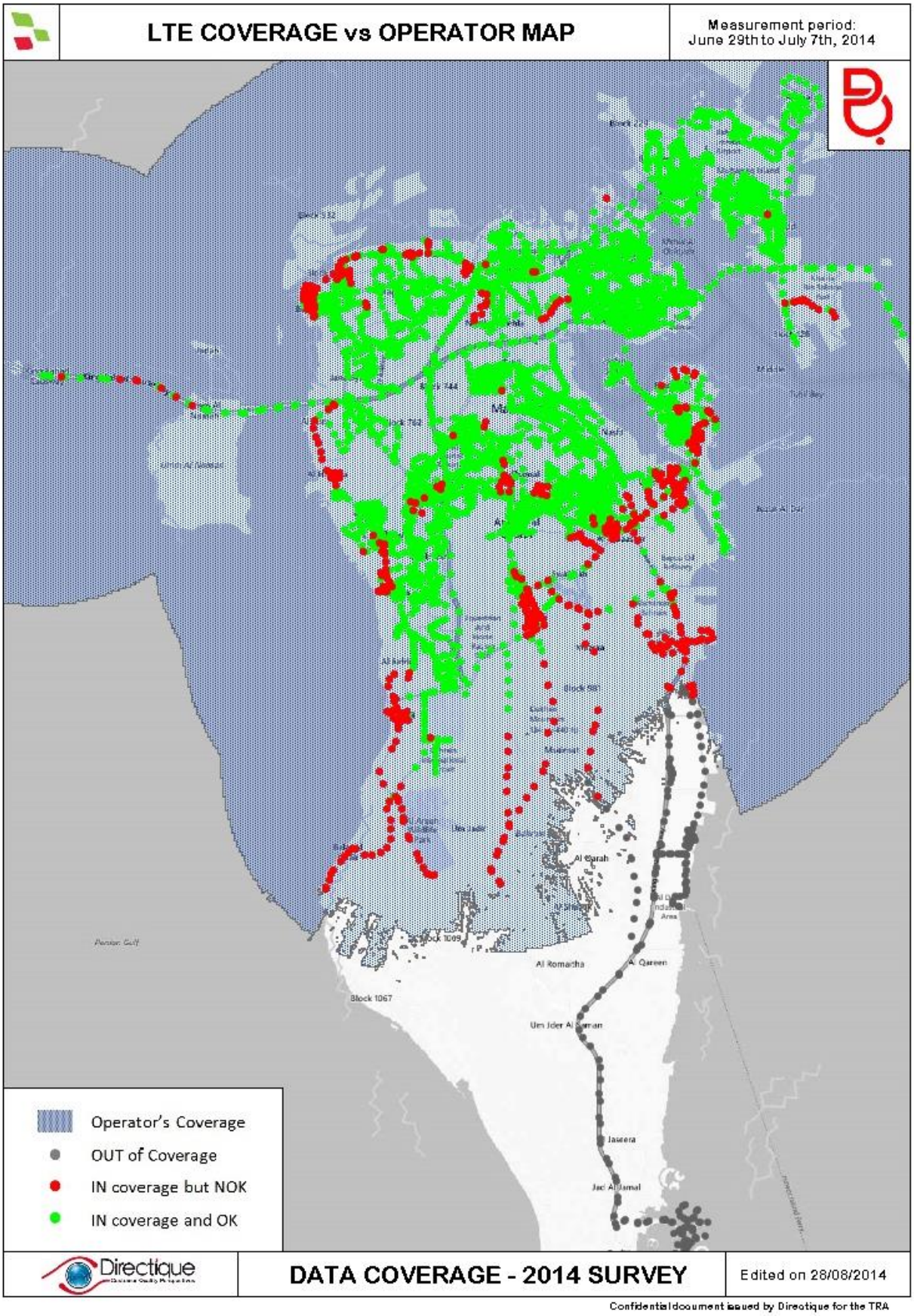
$$\frac{\textit{Number of tests inside coverage zone where the device has reached the technology}}{\textit{Total sample inside technology coverage zone}}$$

4G	Batelco 4G	Viva 4G	Zain 4G
Total sample inside coverage zone	4 936 tests	5 432 tests	5 357 tests
Reliability of Operator's maps	**88.5%**	**99.6%**	**92.7%**
statistical accuracy	0.9%	0.2%	0.7%

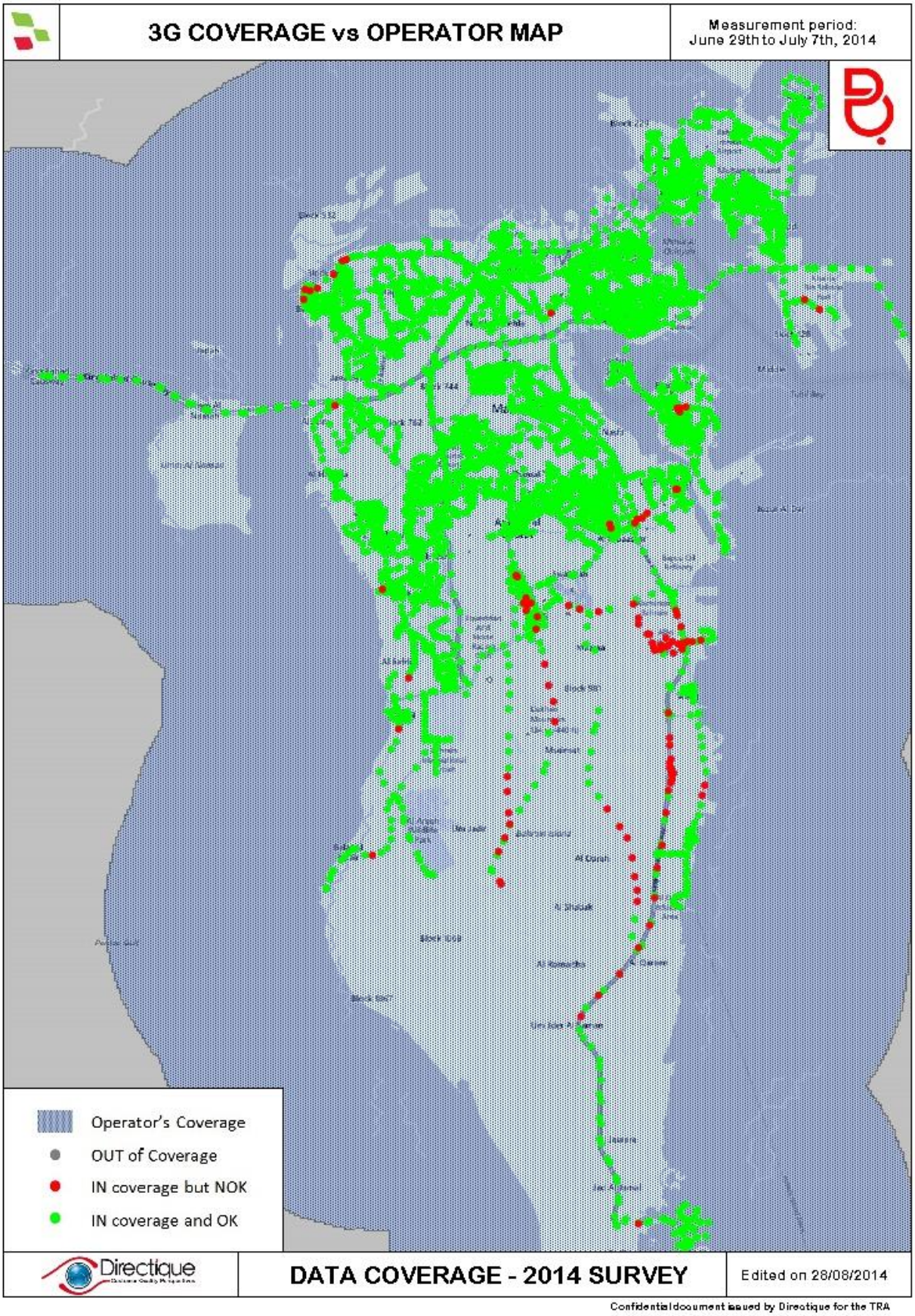
3G - For a LTE user	Batelco 3G	Viva 3G	Zain 3G
Total sample inside coverage zone	4 936 tests	5 432 tests	5 235 tests
Reliability of Operator's maps	**98.4%**	**99.9%**	**100.0%**
statistical accuracy	0.3%	0.1%	0.0%

3G - For a 3G user (no LTE)	Batelco 3G	Viva 3G	Zain 3G
Total sample inside coverage zone	4 397 tests	4 029 tests	4 669 tests
Reliability of Operator's maps	**92.3%**	**99.8%**	**99.6%**
statistical accuracy	0.8%	0.1%	0.2%

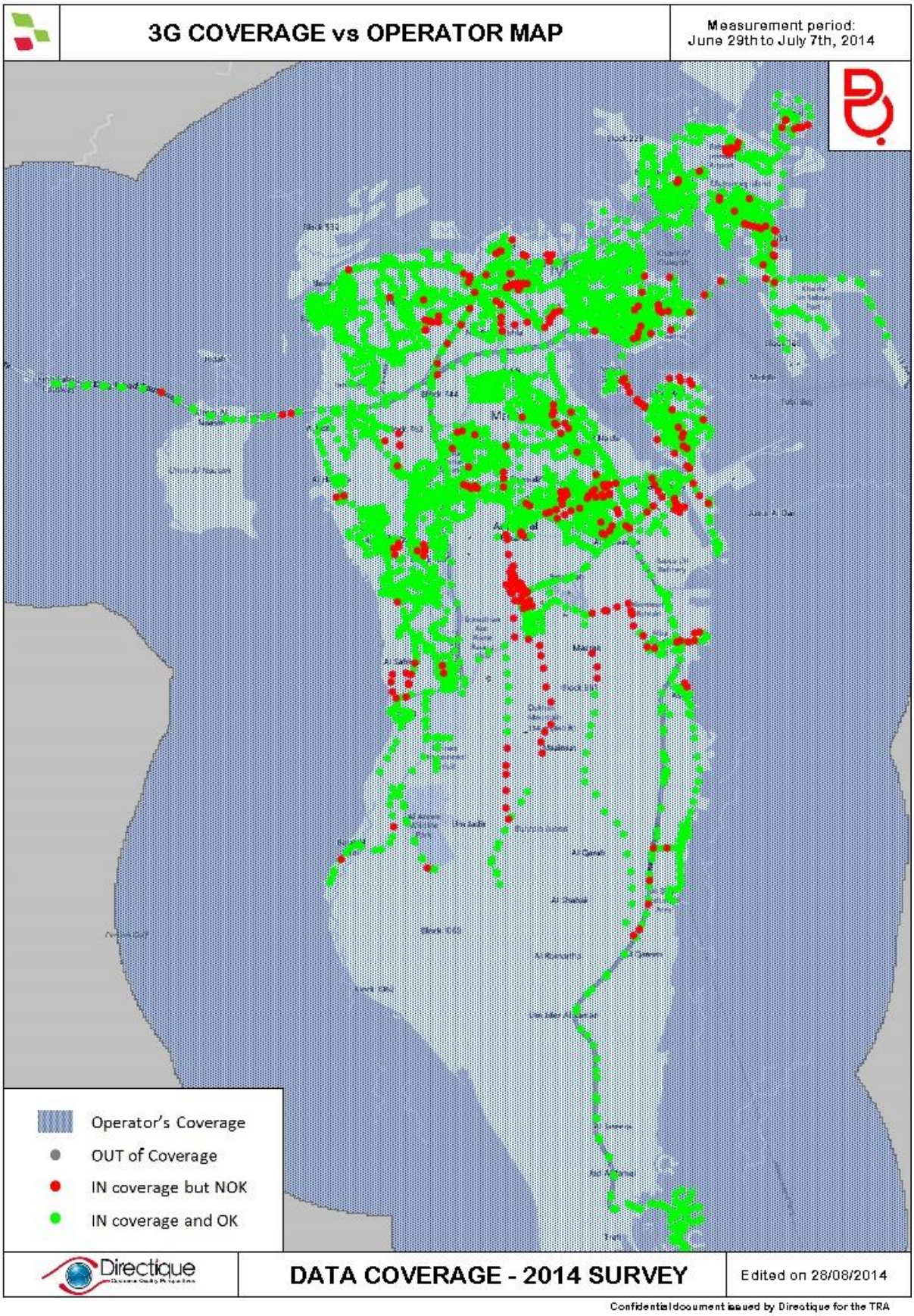
4.4.1 **Batelco 4G**



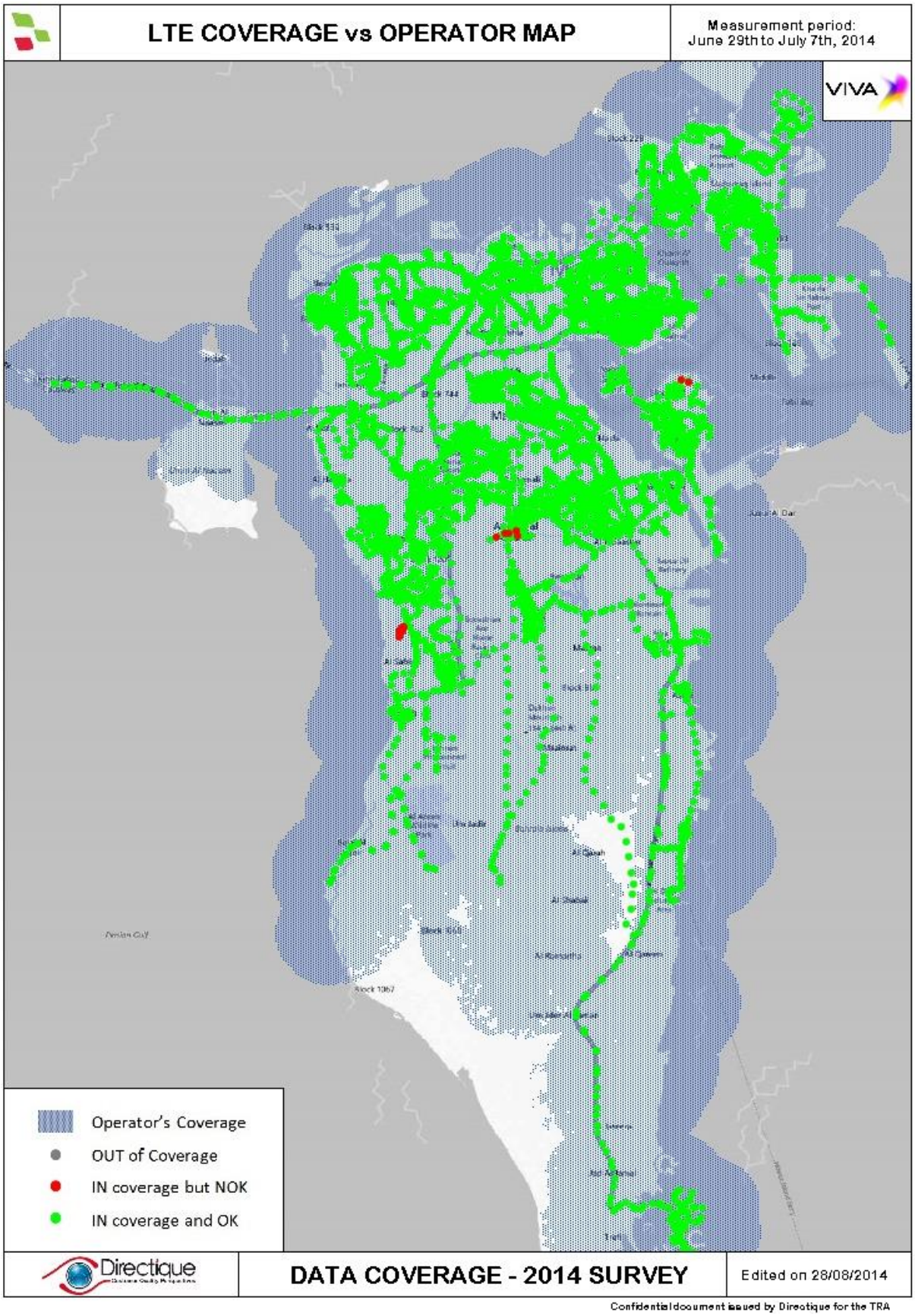
4.4.2 Batelco 3G – for a LTE user



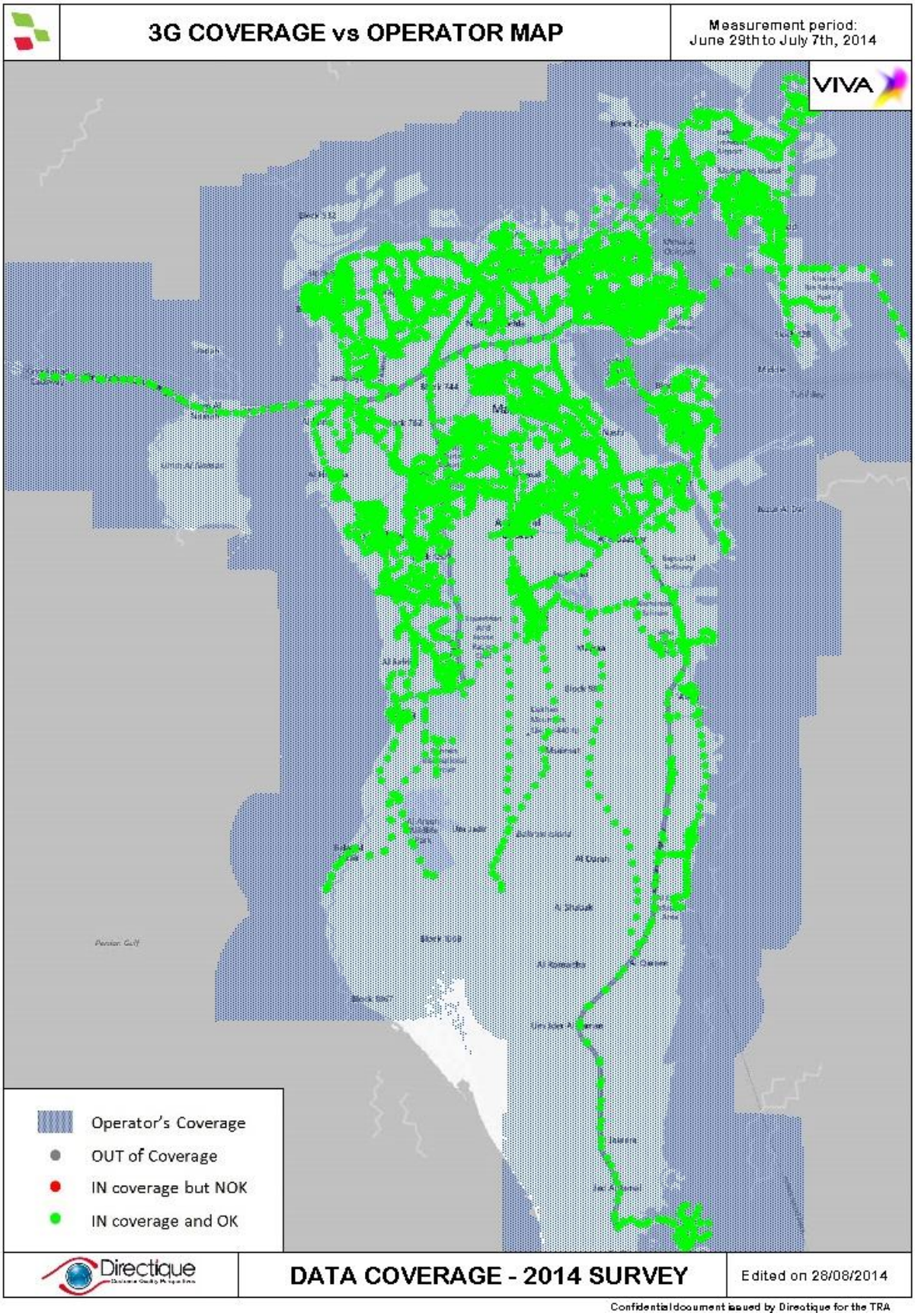
4.4.3 Batelco 3G – for a 3G user



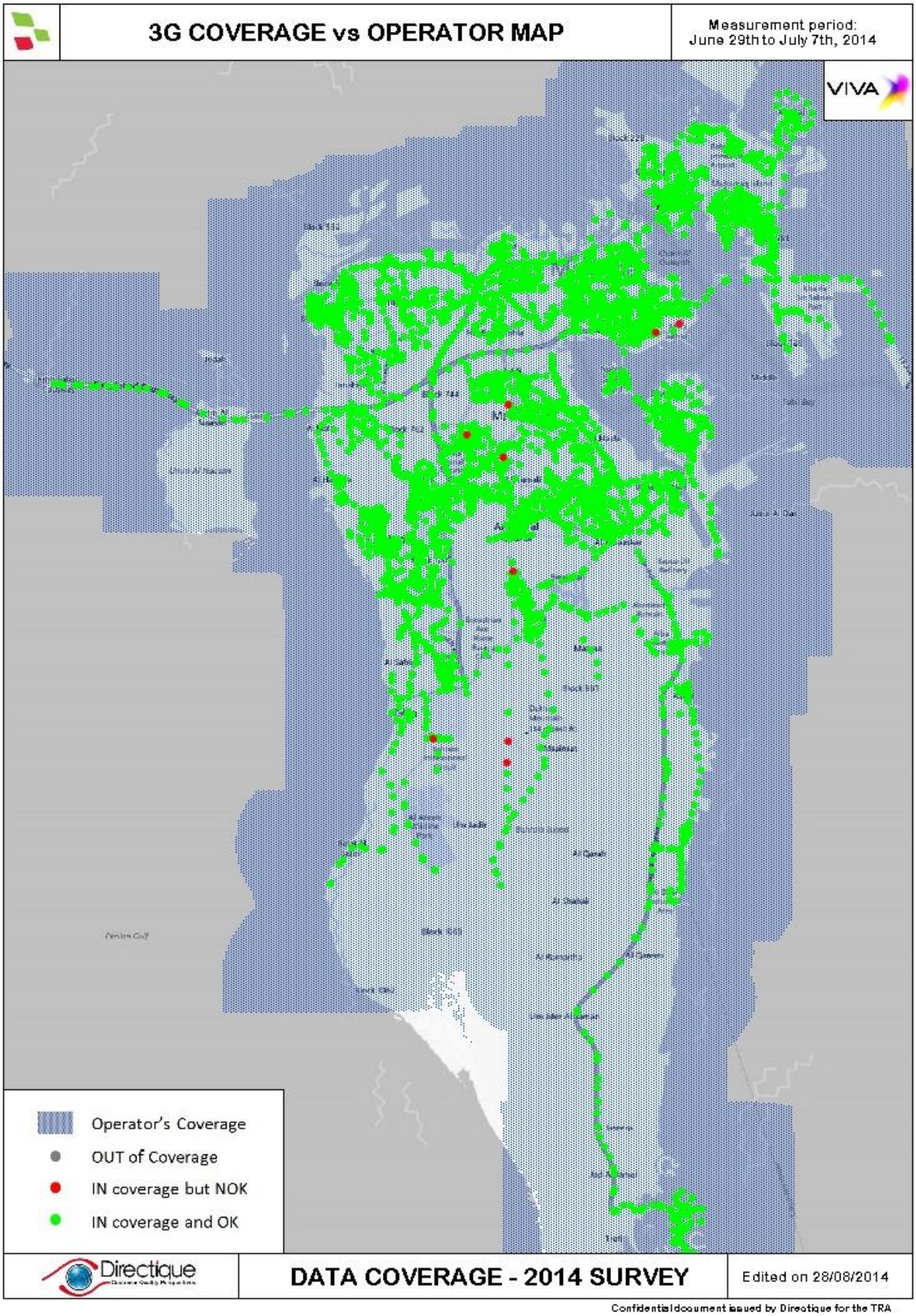
4.4.4 Viva 4G – for a LTE user



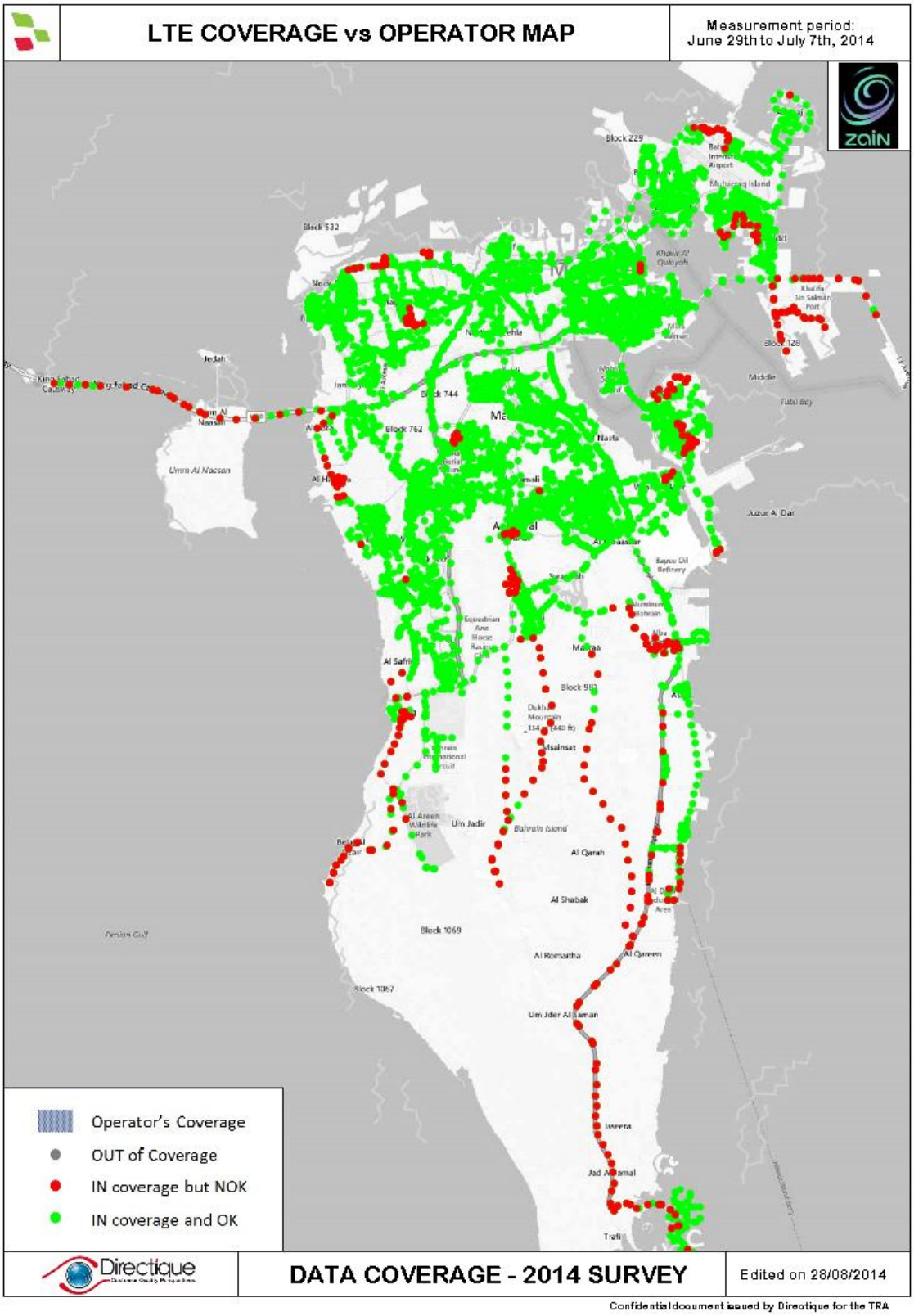
4.4.5 Viva 3G – for a LTE user



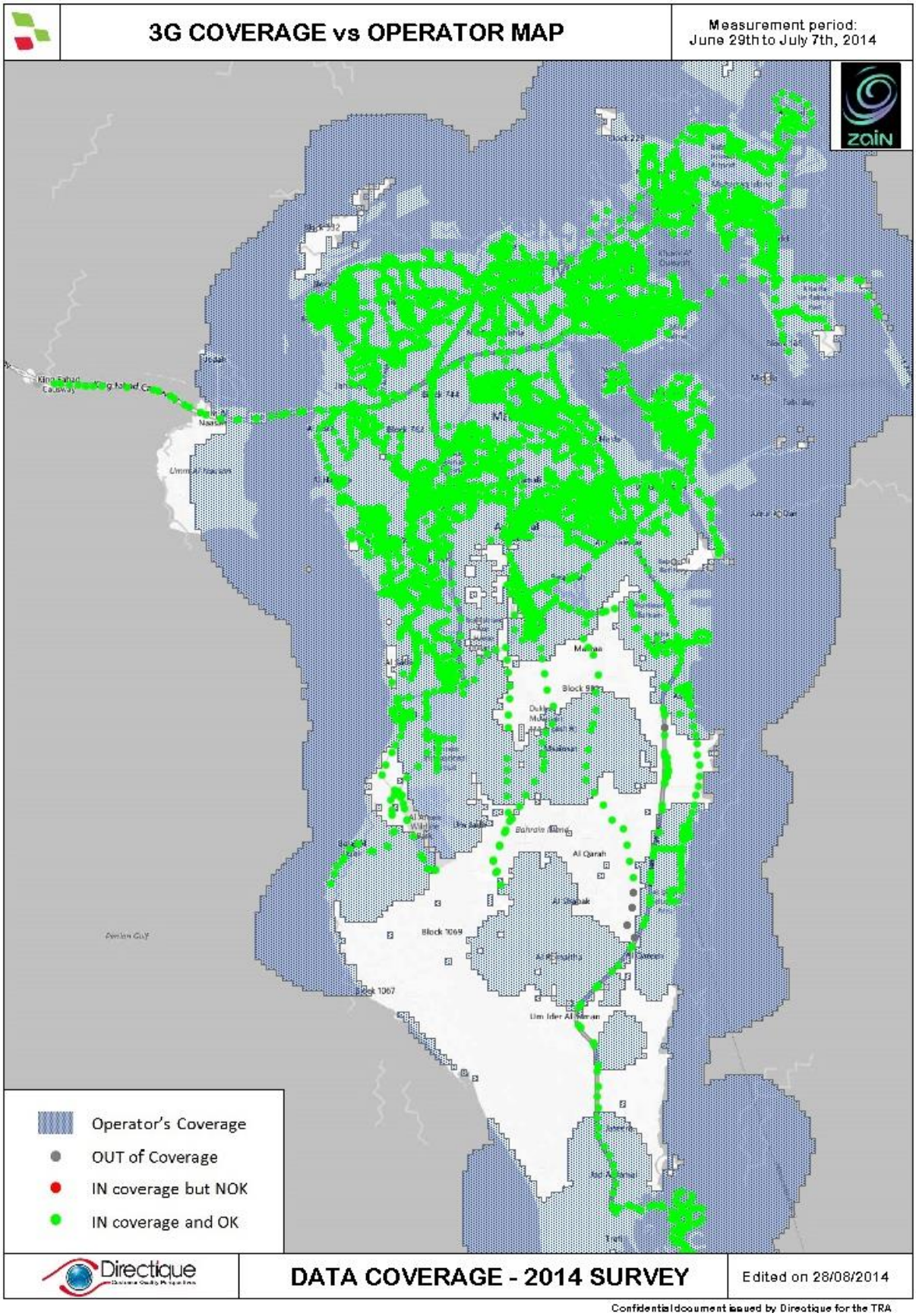
4.4.6 Viva 3G – for a 3G user



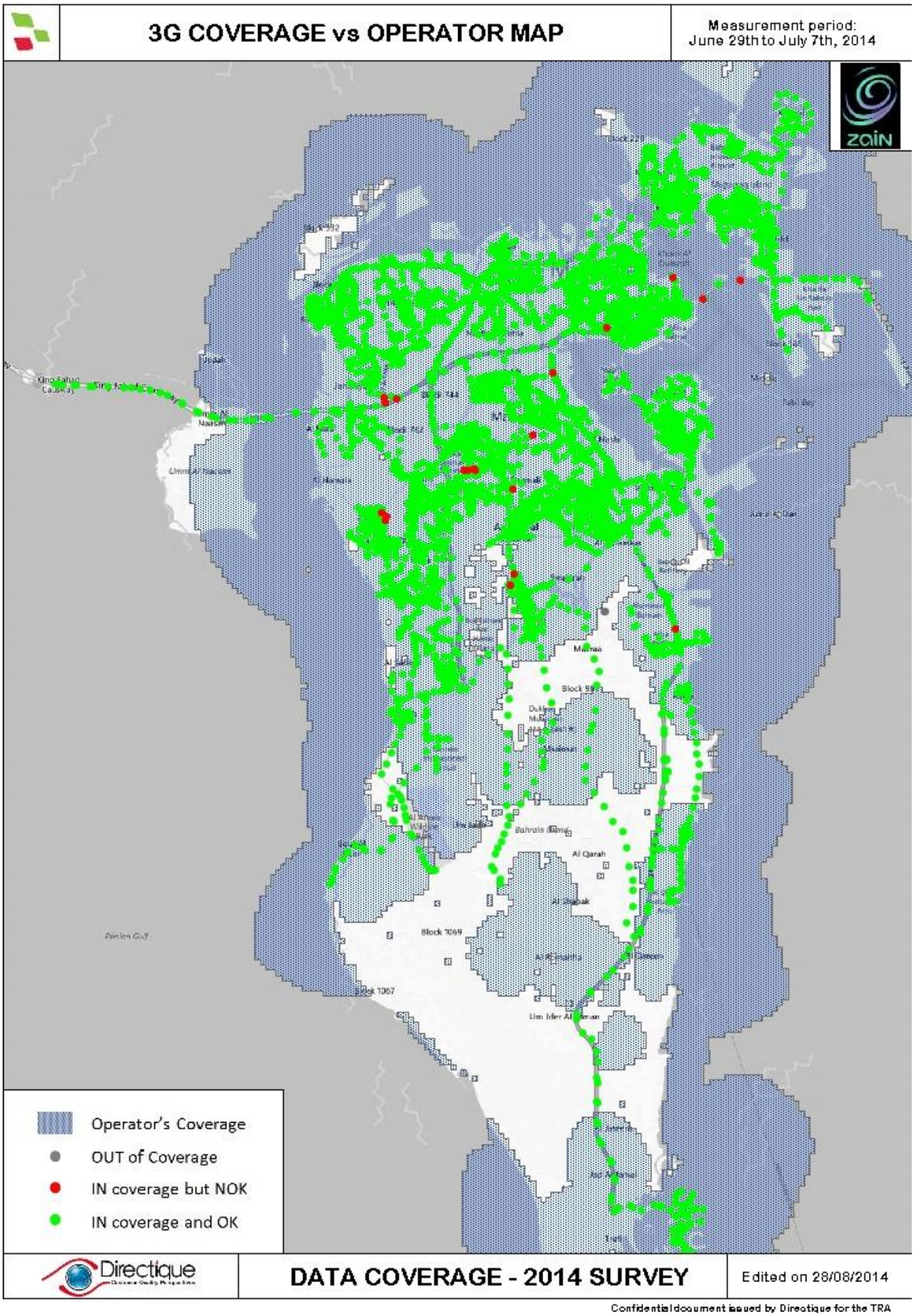
4.4.1 Zain 4G – for a LTE user



4.4.2 Zain 3G – for a LTE user



4.4.3 Zain 3G – for a 3G user

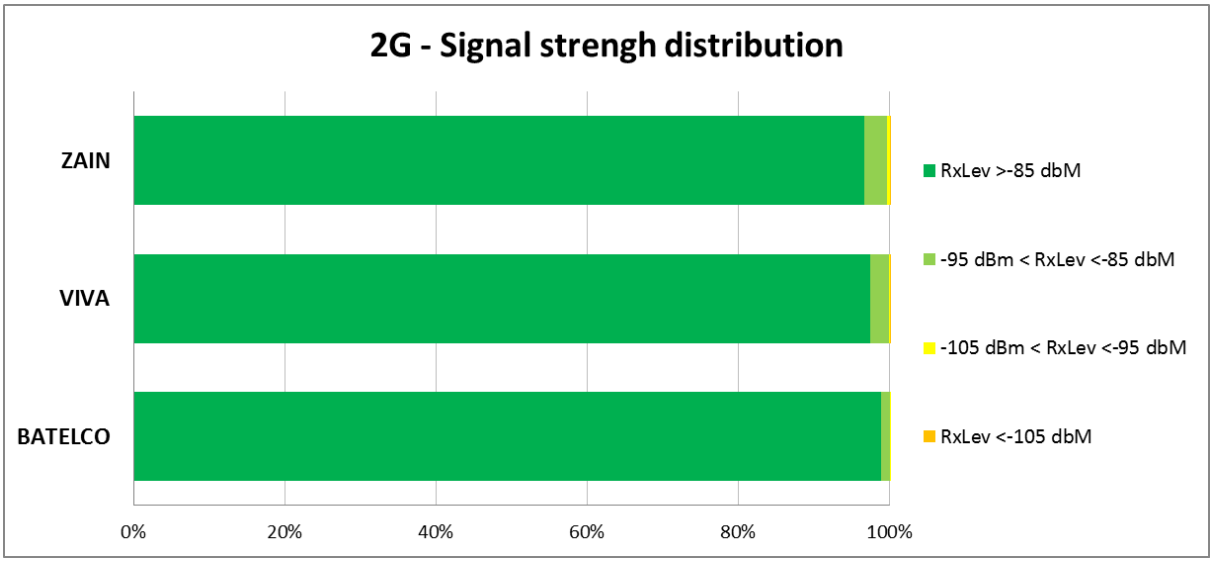


4.5 IDLE Coverage – signal strength distribution

All devices were in IDLE, blocked on their respective technology.

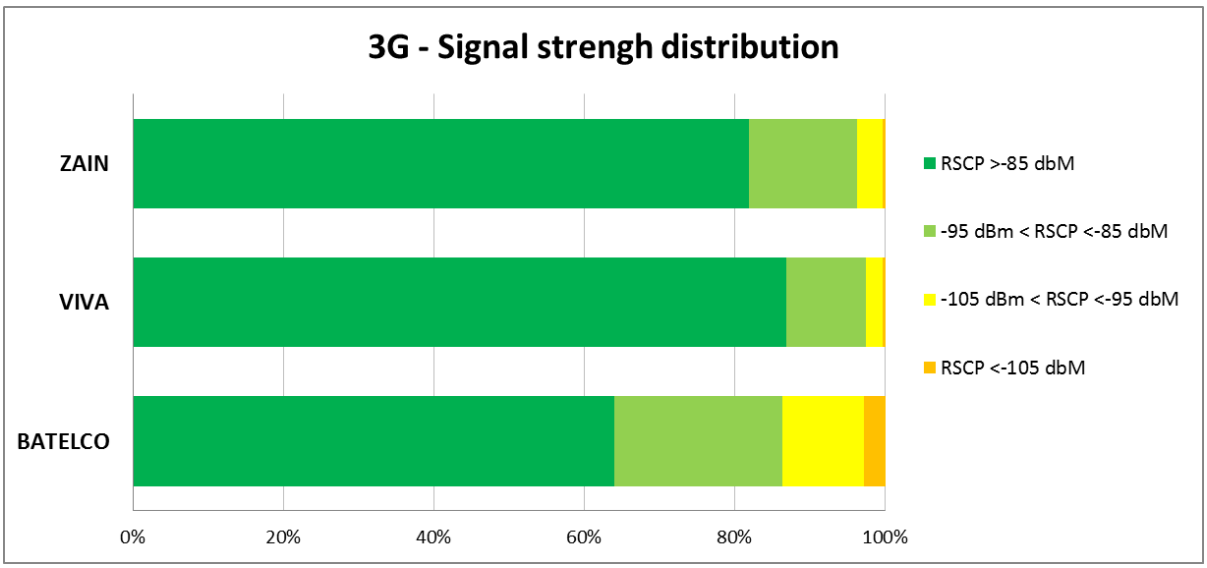
4.5.1 2G handsets

	BATELCO	VIVA	ZAIN
RxLev >-85 dbM	99%	97%	97%
-95 dBm < RxLev <-85 dbM	1%	2%	3%
-105 dBm < RxLev <-95 dbM	0%	0%	0%
RxLev <-105 dbM	0%	0%	0%



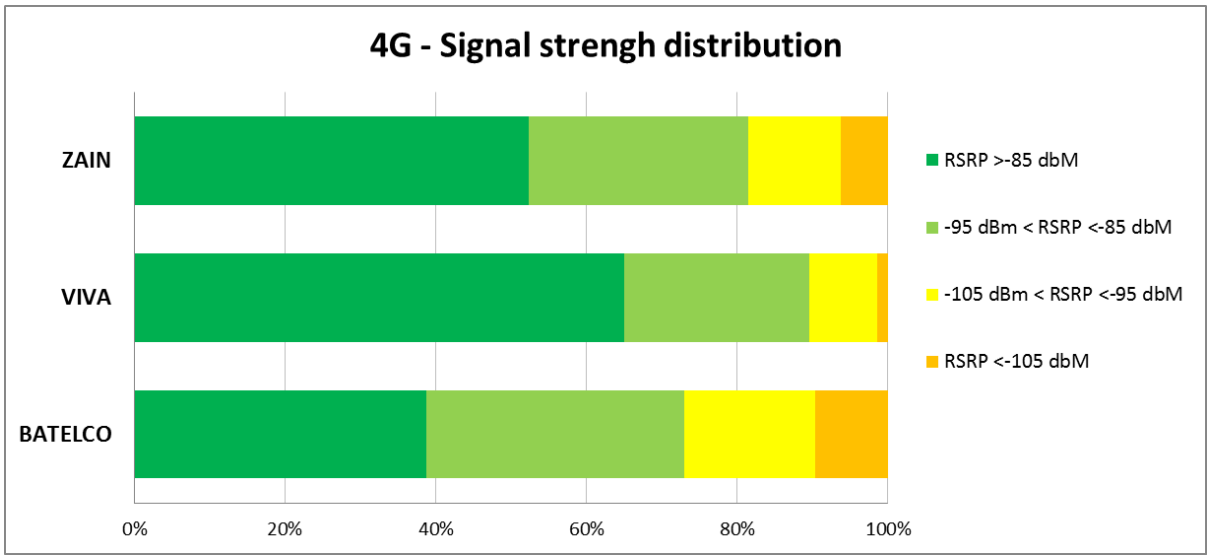
4.5.2 3G handsets

	BATELCO	VIVA	ZAIN
RSCP >-85 dbM	64%	87%	82%
-95 dBm < RSCP <-85 dbM	22%	11%	14%
-105 dBm < RSCP <-95 dbM	11%	2%	3%
RSCP <-105 dbM	3%	0%	0%



4.5.3 4G handsets

	BATELCO	VIVA	ZAIN
RSRP >-85 dbM	39%	65%	52%
-95 dBm < RSRP <-85 dbM	34%	25%	29%
-105 dBm < RSRP <-95 dbM	17%	9%	12%
RSRP <-105 dbM	10%	1%	6%



5 ANNEX

The following pages contain detailed coverage results tables for the three Mobile Operators.

Legend:

2G:	Mobile in 2G, 3G or 4G during the test
3G:	Mobile in 3G or 4G during the test
4G:	Mobile in 3G or 4G during the test
Governorate:	Governorate name
Code:	Governorate area as defined in administrative division map page 8
Nb:	Number of measurements
Coverage:	Resulting computed population coverage in percent

5.1 Population Coverage for a 4G user- by Sub-governorate

			Batelco 4G + 3G + 2G			Batelco 4G + 3G			Batelco 4G		
Governorate	*Code*	*% Pop*	*Nb*	*% Coverage*		*Nb*	*% Coverage*		*Nb*	*% Coverage*	
1	CAP1	6%	154	100.0%	± 0.0%	154	100.0%	± 0.0%	154	100.0%	± 0.0%
2	CAP2	6%	66	100.0%	± 0.0%	66	100.0%	± 0.0%	66	100.0%	± 0.0%
3	CAP3	5%	104	100.0%	± 0.0%	104	100.0%	± 0.0%	104	100.0%	± 0.0%
4	CAP4	2%	213	100.0%	± 0.0%	213	100.0%	± 0.0%	213	99.1%	± 1.3%
5	CAP5	2%	182	100.0%	± 0.0%	182	100.0%	± 0.0%	182	100.0%	± 0.0%
6	CAP6	3%	131	100.0%	± 0.0%	131	100.0%	± 0.0%	131	100.0%	± 0.0%
7	CAP7	3%	209	100.0%	± 0.0%	209	100.0%	± 0.0%	209	100.0%	± 0.0%
8	CAP8	2%	37	100.0%	± 0.0%	37	97.3%	± 5.2%	37	78.4%	± 13.3%
Capital	***CAP***	***27%***	***1096***	***100.0%***	*± 0.0%*	***1096***	***99.8%***	*± 0.2%*	***1096***	***100%***	*± 0.0%*
1	CEN1	4%	86	100%	± 0.0%	86	100%	± 0.0%	86	100%	± 0.0%
2	CEN2	4%	237	99%	± 1.4%	237	99%	± 1.4%	237	96%	± 2.4%
3	CEN3	1%	35	100%	± 0.0%	35	100%	± 0.0%	35	100%	± 0.0%
4	CEN4	2%	105	100%	± 0.0%	105	100%	± 0.0%	105	100%	± 0.0%
5	CEN5	4%	96	100%	± 0.0%	96	100%	± 0.0%	96	69%	± 9.3%
6	CEN6	3%	194	100%	± 0.0%	194	98%	± 2.0%	194	78%	± 5.8%
7	CEN7	2%	123	100%	± 0.0%	123	100%	± 0.0%	123	100%	± 0.0%
8	CEN8	4%	193	99%	± 1.4%	193	95%	± 3.1%	193	77%	± 6.0%
9	CEN9	2%	175	100%	± 0.0%	175	100%	± 0.0%	175	87%	± 4.9%
Central	***CEN***	***27%***	***1244***	***99.6%***	*± 0.3%*	***1244***	***98.7%***	*± 0.6%*	***1244***	***87.8%***	*± 1.8%*
1	MUH1	2%	54	100%	± 0.0%	54	100%	± 0.0%	54	100%	± 0.0%
2	MUH2	2%	79	100%	± 0.0%	79	100%	± 0.0%	79	100%	± 0.0%
3	MUH3	2%	16	100%	± 0.0%	16	100%	± 0.0%	16	100%	± 0.0%
4	MUH4	3%	89	100%	± 0.0%	89	100%	± 0.0%	89	100%	± 0.0%
5	MUH5	3%	25	100%	± 0.0%	25	100%	± 0.0%	25	100%	± 0.0%
6	MUH6	1%	43	100%	± 0.0%	43	100%	± 0.0%	43	100%	± 0.0%
7	MUH7	2%	156	100%	± 0.0%	156	100%	± 0.0%	156	100%	± 0.0%
8	MUH8	2%	129	100%	± 0.0%	129	98%	± 2.1%	129	90%	± 5.2%
Muharraq	***MUH***	***15%***	***591***	***100.0%***	*± 0.0%*	***591***	***99.8%***	*± 0.4%*	***591***	***100.0%***	*± 0.0%*
1	N1	4%	178	100%	± 0.0%	178	100%	± 0.0%	178	93%	± 3.7%
2	N2	2%	182	100%	± 0.0%	182	100%	± 0.0%	182	90%	± 4.3%
3	N3	3%	186	100%	± 0.0%	186	98%	± 1.8%	186	86%	± 5.0%
4	N4	1%	127	100%	± 0.0%	127	96%	± 3.4%	127	57%	± 8.6%
5	N5	2%	237	100%	± 0.0%	237	100%	± 0.0%	237	100%	± 0.8%
6	N6	2%	117	100%	± 0.0%	117	100%	± 0.0%	117	95%	± 4.0%
7	N7	2%	83	100%	± 0.0%	83	100%	± 0.0%	83	96%	± 4.0%
8	N8	3%	52	100%	± 0.0%	52	100%	± 0.0%	52	100%	± 0.0%
9	N9	3%	297	99%	± 1.3%	297	98%	± 1.5%	297	82%	± 4.3%
Northern	***N***	***23%***	***1459***	***99.8%***	*± 0.2%*	***1459***	***99.4%***	*± 0.4%*	***1459***	***90.4%***	*± 1.5%*
1	S1	3%	60	98%	± 3.2%	60	98%	± 3.2%	60	53%	± 12.6%
2	S2	2%	72	100%	± 0.0%	72	100%	± 0.0%	72	100%	± 0.0%
3	S3	1%	119	100%	± 0.0%	119	98%	± 2.3%	119	97%	± 3.2%
4	S4	1%	205	100%	± 0.0%	205	89%	± 4.3%	205	37%	± 6.6%
5	S5	1%	175	100%	± 0.0%	175	69%	± 6.9%	175	11%	± 4.6%
6	S6	0%	134	100%	± 0.0%	134	93%	± 4.2%	134	1%	± 2.1%
Southern	***S***	***8%***	***765***	***99.3%***	*± 0.6%*	***765***	***93.9%***	*± 1.7%*	***765***	***61.9%***	*± 3.4%*
Total		***100%***	***5155***	***99.8%***	*± 0.1%*	***5155***	***98.9%***	*± 0.3%*	***5155***	***91.4%***	*± 0.8%*

			Viva 2G			Viva 3G			Viva 4G		
Governorate	*Code*	*% Pop*	*Nb*	*% Coverage*		*Nb*	*% Coverage*		*Nb*	*% Coverage*	
1	CAP1	6%	157	100.0%	± 0.0%	157	100.0%	± 0.0%	157	100.0%	± 0.0%
2	CAP2	6%	68	100.0%	± 0.0%	68	100.0%	± 0.0%	68	100.0%	± 0.0%
3	CAP3	5%	106	100.0%	± 0.0%	106	100.0%	± 0.0%	106	100.0%	± 0.0%
4	CAP4	2%	215	100.0%	± 0.0%	215	100.0%	± 0.0%	215	100.0%	± 0.0%
5	CAP5	2%	192	100.0%	± 0.0%	192	100.0%	± 0.0%	192	100.0%	± 0.0%
6	CAP6	3%	133	100.0%	± 0.0%	133	100.0%	± 0.0%	133	100.0%	± 0.0%
7	CAP7	3%	206	100.0%	± 0.0%	206	100.0%	± 0.0%	206	100.0%	± 0.0%
8	CAP8	2%	36	100.0%	± 0.0%	36	100.0%	± 0.0%	36	100.0%	± 0.0%
Capital	***CAP***	***27%***	***1113***	***100.0%***	*± 0.0%*	***1113***	***100.0%***	*± 0.0%*	***1113***	***100%***	*± 0.0%*
1	CEN1	4%	88	100%	± 0.0%	88	100%	± 0.0%	88	100%	± 0.0%
2	CEN2	4%	239	100%	± 0.0%	239	100%	± 0.0%	239	100%	± 0.0%
3	CEN3	1%	38	100%	± 0.0%	38	100%	± 0.0%	38	100%	± 0.0%
4	CEN4	2%	113	100%	± 0.0%	113	100%	± 0.0%	113	100%	± 0.0%
5	CEN5	4%	112	100%	± 0.0%	112	100%	± 0.0%	112	100%	± 0.0%
6	CEN6	3%	185	100%	± 0.0%	185	100%	± 0.0%	185	99%	± 1.5%
7	CEN7	2%	121	100%	± 0.0%	121	100%	± 0.0%	121	100%	± 0.0%
8	CEN8	4%	218	100%	± 0.0%	218	100%	± 0.0%	218	100%	± 0.0%
9	CEN9	2%	177	100%	± 0.0%	177	100%	± 0.0%	177	100%	± 0.0%
Central	***CEN***	***27%***	***1291***	***100.0%***	*± 0.0%*	***1291***	***100.0%***	*± 0.0%*	***1291***	***99.9%***	*± 0.2%*
1	MUH1	2%	55	100%	± 0.0%	55	100%	± 0.0%	55	100%	± 0.0%
2	MUH2	2%	79	100%	± 0.0%	79	100%	± 0.0%	79	100%	± 0.0%
3	MUH3	2%	15	100%	± 0.0%	15	100%	± 0.0%	15	100%	± 0.0%
4	MUH4	3%	98	100%	± 0.0%	98	100%	± 0.0%	98	100%	± 0.0%
5	MUH5	3%	22	100%	± 0.0%	22	100%	± 0.0%	22	100%	± 0.0%
6	MUH6	1%	45	100%	± 0.0%	45	100%	± 0.0%	45	100%	± 0.0%
7	MUH7	2%	167	100%	± 0.0%	167	100%	± 0.0%	167	100%	± 0.0%
8	MUH8	2%	144	100%	± 0.0%	144	100%	± 0.0%	144	100%	± 0.0%
Muharraq	***MUH***	***15%***	***625***	***100.0%***	*± 0.0%*	***625***	***100.0%***	*± 0.0%*	***625***	***100.0%***	*± 0.0%*
1	N1	4%	190	100%	± 0.0%	190	100%	± 0.0%	190	100%	± 0.0%
2	N2	2%	184	100%	± 0.0%	184	100%	± 0.0%	184	100%	± 0.0%
3	N3	3%	193	100%	± 0.0%	193	100%	± 0.0%	193	100%	± 0.0%
4	N4	1%	139	100%	± 0.0%	139	100%	± 0.0%	139	100%	± 0.0%
5	N5	2%	263	100%	± 0.0%	263	100%	± 0.0%	263	100%	± 0.0%
6	N6	2%	118	100%	± 0.0%	118	100%	± 0.0%	118	100%	± 0.0%
7	N7	2%	85	94%	± 5.0%	85	94%	± 5.0%	85	94%	± 5.0%
8	N8	3%	52	100%	± 0.0%	52	100%	± 0.0%	52	100%	± 0.0%
9	N9	3%	326	100%	± 0.0%	326	100%	± 0.0%	326	98%	± 1.7%
Northern	***N***	***23%***	***1550***	***99.7%***	*± 0.3%*	***1550***	***99.7%***	*± 0.3%*	***1550***	***99.2%***	*± 0.5%*
1	S1	3%	66	100%	± 0.0%	66	100%	± 0.0%	66	100%	± 0.0%
2	S2	2%	77	100%	± 0.0%	77	100%	± 0.0%	77	96%	± 4.3%
3	S3	1%	128	100%	± 0.0%	128	100%	± 0.0%	128	98%	± 2.1%
4	S4	1%	230	100%	± 0.0%	230	100%	± 0.0%	230	100%	± 0.0%
5	S5	1%	200	100%	± 0.0%	200	100%	± 0.0%	200	100%	± 0.0%
6	S6	0%	152	100%	± 0.0%	152	100%	± 0.0%	152	100%	± 0.0%
Southern	***S***	***8%***	***853***	***100.0%***	*± 0.0%*	***853***	***100.0%***	*± 0.0%*	***853***	***99.0%***	*± 0.7%*
Total		***100%***	***5432***	***99.9%***	*± 0.1%*	***5432***	***99.9%***	*± 0.1%*	***5432***	***99.7%***	*± 0.1%*

			Zain 2G			Zain 3G			Zain 4G		
Governorate	***Code***	***% Pop***	***Nb***	***% Coverage***		***Nb***	***% Coverage***		***Nb***	***% Coverage***	
1	CAP1	6%	143	100%	± 0.0%	143	100%	± 0.0%	143	97.2%	± 2.7%
2	CAP2	6%	69	100%	± 0.0%	69	100%	± 0.0%	69	100.0%	± 0.0%
3	CAP3	5%	98	100%	± 0.0%	98	100%	± 0.0%	98	100.0%	± 0.0%
4	CAP4	2%	192	100%	± 0.0%	192	100%	± 0.0%	192	100.0%	± 0.0%
5	CAP5	2%	176	100%	± 0.0%	176	100%	± 0.0%	176	100.0%	± 0.0%
6	CAP6	3%	112	100%	± 0.0%	112	100%	± 0.0%	112	100.0%	± 0.0%
7	CAP7	3%	199	100%	± 0.0%	199	100%	± 0.0%	199	100.0%	± 0.0%
8	CAP8	2%	22	100%	± 0.0%	22	100%	± 0.0%	22	100.0%	± 0.0%
Capital	***CAP***	***27%***	***1011***	***100.0%***	*± 0.0%*	***1011***	***100.0%***	*± 0.0%*	***1011***	***100%***	*± 0.0%*
1	CEN1	4%	85	100%	± 0.0%	85	100%	± 0.0%	85	100.0%	± 0.0%
2	CEN2	4%	239	100%	± 0.0%	239	100%	± 0.0%	239	97.9%	± 1.8%
3	CEN3	1%	36	100%	± 0.0%	36	100%	± 0.0%	36	100.0%	± 0.0%
4	CEN4	2%	114	100%	± 0.0%	114	100%	± 0.0%	114	100.0%	± 0.0%
5	CEN5	4%	110	100%	± 0.0%	110	100%	± 0.0%	110	95.5%	± 3.9%
6	CEN6	3%	193	99%	± 1.0%	193	99%	± 1.0%	193	83.9%	± 5.2%
7	CEN7	2%	128	100%	± 0.0%	128	100%	± 0.0%	128	100.0%	± 0.0%
8	CEN8	4%	222	100%	± 0.0%	222	100%	± 0.0%	222	100.0%	± 0.0%
9	CEN9	2%	175	100%	± 0.0%	175	100%	± 0.0%	175	99.4%	± 1.1%
Central	***CEN***	***27%***	***1302***	***99.9%***	*± 0.1%*	***1302***	***99.9%***	*± 0.1%*	***1302***	***97.2%***	*± 0.9%*
1	MUH1	2%	55	100%	± 0.0%	55	100%	± 0.0%	55	100.0%	± 0.0%
2	MUH2	2%	78	100%	± 0.0%	78	100%	± 0.0%	78	100.0%	± 0.0%
3	MUH3	2%	15	100%	± 0.0%	15	100%	± 0.0%	15	100.0%	± 0.0%
4	MUH4	3%	96	100%	± 0.0%	96	100%	± 0.0%	96	97.9%	± 2.9%
5	MUH5	3%	23	100%	± 0.0%	23	100%	± 0.0%	23	100.0%	± 0.0%
6	MUH6	1%	41	100%	± 0.0%	41	100%	± 0.0%	41	65.9%	± 14.5%
7	MUH7	2%	169	100%	± 0.0%	169	100%	± 0.0%	169	95.3%	± 3.2%
8	MUH8	2%	78	100%	± 0.0%	78	100%	± 0.0%	78	89.7%	± 6.7%
Muharraq	***MUH***	***15%***	***555***	***100.0%***	*± 0.0%*	***555***	***100.0%***	*± 0.0%*	***555***	***100.0%***	*± 0.0%*
1	N1	4%	133	100%	± 0.0%	133	100%	± 0.0%	133	100.0%	± 0.0%
2	N2	2%	182	100%	± 0.0%	182	100%	± 0.0%	182	90.1%	± 4.3%
3	N3	3%	192	100%	± 0.0%	192	100%	± 0.0%	192	93.8%	± 3.4%
4	N4	1%	131	100%	± 0.0%	131	100%	± 0.0%	131	82.4%	± 6.5%
5	N5	2%	259	100%	± 0.0%	259	100%	± 0.0%	259	100.0%	± 0.0%
6	N6	2%	117	100%	± 0.0%	117	100%	± 0.0%	117	100.0%	± 0.0%
7	N7	2%	84	100%	± 0.0%	84	100%	± 0.0%	84	100.0%	± 0.0%
8	N8	3%	52	100%	± 0.0%	52	100%	± 0.0%	52	100.0%	± 0.0%
9	N9	3%	317	100%	± 0.0%	317	100%	± 0.0%	317	92.4%	± 2.9%
Northern	***N***	***23%***	***1467***	***100.0%***	*± 0.0%*	***1467***	***100.0%***	*± 0.0%*	***1467***	***96.2%***	*± 1.0%*
1	S1	3%	72	100%	± 0.0%	72	100%	± 0.0%	72	100.0%	± 0.0%
2	S2	2%	70	100%	± 0.0%	70	100%	± 0.0%	70	95.7%	± 4.7%
3	S3	1%	119	100%	± 0.0%	119	100%	± 0.0%	119	84.9%	± 6.4%
4	S4	1%	225	100%	± 0.9%	225	100%	± 0.9%	225	70.2%	± 6.0%
5	S5	1%	192	100%	± 0.0%	192	99%	± 1.4%	192	75.0%	± 6.1%
6	S6	0%	142	100%	± 0.0%	142	98%	± 2.4%	142	57.7%	± 8.1%
Southern	***S***	***8%***	***820***	***100.0%***	*± 0.1%*	***820***	***99.8%***	*± 0.3%*	***820***	***90.7%***	*± 2.0%*
Total		***100%***	***5155***	***100.0%***	*± 0.0%*	***5155***	***100.0%***	*± 0.0%*	***5155***	***97.6%***	*± 0.4%*

5.1 3G population Coverage for a 3G user- by Sub-governorate

			Batelco 3G		
Governorate	*Code*	*% Pop*	*Nb*	*% Coverage*	
1	CAP1	6%	138	96.4%	± 3.1%
2	CAP2	6%	62	100.0%	± 0.0%
3	CAP3	5%	93	100.0%	± 0.0%
4	CAP4	2%	194	89.2%	± 4.4%
5	CAP5	2%	162	92.0%	± 4.2%
6	CAP6	3%	113	93.8%	± 4.4%
7	CAP7	3%	191	100.0%	± 0.0%
8	CAP8	2%	31	80.6%	± 13.9%
Capital	***CAP***	***27%***	***984***	***96.3%***	*± 1.2%*
1	CEN1	4%	79	99%	± 2.5%
2	CEN2	4%	208	98%	± 2.1%
3	CEN3	1%	30	100%	± 0.0%
4	CEN4	2%	96	91%	± 5.8%
5	CEN5	4%	95	92%	± 5.6%
6	CEN6	3%	187	89%	± 4.4%
7	CEN7	2%	108	96%	± 3.6%
8	CEN8	4%	192	80%	± 5.6%
9	CEN9	2%	156	86%	± 5.5%
Central	***CEN***	***27%***	***1151***	***91.7%***	*± 1.6%*
1	MUH1	2%	49	100%	± 0.0%
2	MUH2	2%	69	96%	± 4.8%
3	MUH3	2%	13	100%	± 0.0%
4	MUH4	3%	83	84%	± 7.8%
5	MUH5	3%	17	100%	± 0.0%
6	MUH6	1%	39	90%	± 9.5%
7	MUH7	2%	150	96%	± 3.1%
8	MUH8	2%	126	90%	± 5.3%
Muharraq	***MUH***	***15%***	***546***	***94.2%***	*± 2.0%*
1	N1	4%	162	87%	± 5.2%
2	N2	2%	165	93%	± 3.8%
3	N3	3%	167	99%	± 1.2%
4	N4	1%	119	97%	± 2.8%
5	N5	2%	232	98%	± 1.9%
6	N6	2%	107	100%	± 0.0%
7	N7	2%	73	92%	± 6.3%
8	N8	3%	46	96%	± 5.9%
9	N9	3%	289	94%	± 2.7%
Northern	***N***	***23%***	***1360***	***94.7%***	*± 1.2%*
1	S1	3%	62	95%	± 5.3%
2	S2	2%	56	91%	± 7.5%
3	S3	1%	103	74%	± 8.5%
4	S4	1%	199	81%	± 5.5%
5	S5	1%	169	86%	± 5.3%
6	S6	0%	132	97%	± 2.9%
Southern	***S***	***8%***	***721***	***88.7%***	*± 2.3%*
Total		***100%***	***4762***	***93.8%***	*± 0.7%*

			Viva 3G		
Governorate	***Code***	***% Pop***	***Nb***	***% Coverage***	
1	CAP1	6%	109	100.0%	± 0.0%
2	CAP2	6%	54	100.0%	± 0.0%
3	CAP3	5%	91	100.0%	± 0.0%
4	CAP4	2%	177	100.0%	± 0.0%
5	CAP5	2%	129	98.4%	± 2.1%
6	CAP6	3%	87	100.0%	± 0.0%
7	CAP7	3%	156	100.0%	± 0.0%
8	CAP8	2%	33	100.0%	± 0.0%
Capital	***CAP***	***27%***	***836***	***99.9%***	*± 0.2%*
1	CEN1	4%	66	100%	± 0.0%
2	CEN2	4%	154	99%	± 1.8%
3	CEN3	1%	26	100%	± 0.0%
4	CEN4	2%	90	99%	± 2.2%
5	CEN5	4%	88	100%	± 0.0%
6	CEN6	3%	159	100%	± 0.0%
7	CEN7	2%	91	100%	± 0.0%
8	CEN8	4%	166	100%	± 0.0%
9	CEN9	2%	115	100%	± 0.0%
Central	***CEN***	***27%***	***955***	***99.7%***	*± 0.3%*
1	MUH1	2%	41	100%	± 0.0%
2	MUH2	2%	63	100%	± 0.0%
3	MUH3	2%	12	100%	± 0.0%
4	MUH4	3%	83	100%	± 0.0%
5	MUH5	3%	17	100%	± 0.0%
6	MUH6	1%	35	100%	± 0.0%
7	MUH7	2%	141	100%	± 0.0%
8	MUH8	2%	117	100%	± 0.0%
Muharraq	***MUH***	***15%***	***509***	***100.0%***	*± 0.0%*
1	N1	4%	134	100%	± 0.0%
2	N2	2%	124	100%	± 0.0%
3	N3	3%	141	100%	± 0.0%
4	N4	1%	100	100%	± 0.0%
5	N5	2%	167	100%	± 0.0%
6	N6	2%	93	100%	± 0.0%
7	N7	2%	63	100%	± 0.0%
8	N8	3%	36	100%	± 0.0%
9	N9	3%	258	100%	± 0.0%
Northern	***N***	***23%***	***1116***	***100.0%***	*± 0.0%*
1	S1	3%	46	100%	± 0.0%
2	S2	2%	57	100%	± 0.0%
3	S3	1%	103	99%	± 1.9%
4	S4	1%	159	98%	± 2.1%
5	S5	1%	125	100%	± 0.0%
6	S6	0%	123	100%	± 0.0%
Southern	***S***	***8%***	***613***	***99.7%***	*± 0.4%*
Total		***100%***	***4029***	***99.9%***	*± 0.1%*

			Zain 3G		
Governorate	***Code***	***% Pop***	***Nb***	***% Coverage***	
1	CAP1	6%	136	100%	± 0.0%
2	CAP2	6%	62	100%	± 0.0%
3	CAP3	5%	91	100%	± 0.0%
4	CAP4	2%	200	100%	± 0.0%
5	CAP5	2%	168	99%	± 1.6%
6	CAP6	3%	115	99%	± 1.7%
7	CAP7	3%	177	100%	± 0.0%
8	CAP8	2%	32	100%	± 0.0%
Capital	***CAP***	***27%***	***981***	***99.8%***	*± 0.3%*
1	CEN1	4%	76	99%	± 2.6%
2	CEN2	4%	219	100%	± 0.0%
3	CEN3	1%	33	100%	± 0.0%
4	CEN4	2%	100	99%	± 2.0%
5	CEN5	4%	98	100%	± 0.0%
6	CEN6	3%	182	100%	± 0.0%
7	CEN7	2%	100	100%	± 0.0%
8	CEN8	4%	196	100%	± 0.0%
9	CEN9	2%	172	97%	± 2.5%
Central	***CEN***	***27%***	***1176***	***99.5%***	*± 0.4%*
1	MUH1	2%	48	100%	± 0.0%
2	MUH2	2%	68	100%	± 0.0%
3	MUH3	2%	15	100%	± 0.0%
4	MUH4	3%	82	100%	± 0.0%
5	MUH5	3%	19	100%	± 0.0%
6	MUH6	1%	40	100%	± 0.0%
7	MUH7	2%	147	100%	± 0.0%
8	MUH8	2%	120	99%	± 1.6%
Muharraq	***MUH***	***15%***	***539***	***99.9%***	*± 0.3%*
1	N1	4%	161	100%	± 0.0%
2	N2	2%	168	100%	± 0.0%
3	N3	3%	173	100%	± 0.0%
4	N4	1%	124	100%	± 0.0%
5	N5	2%	229	99%	± 1.5%
6	N6	2%	103	100%	± 0.0%
7	N7	2%	75	100%	± 0.0%
8	N8	3%	48	100%	± 0.0%
9	N9	3%	268	99%	± 1.3%
Northern	***N***	***23%***	***1349***	***99.7%***	*± 0.3%*
1	S1	3%	58	100%	± 0.0%
2	S2	2%	65	100%	± 0.0%
3	S3	1%	110	98%	± 2.5%
4	S4	1%	198	100%	± 0.0%
5	S5	1%	178	98%	± 1.9%
6	S6	0%	133	100%	± 0.0%
Southern	***S***	***8%***	***742***	***99.5%***	*± 0.5%*
Total		***100%***	***4787***	***99.7%***	*± 0.2%*

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