



Independent Communications Authority of South Africa

Pinmill Farm, 164 Katherine Street, Sandton

Private Bag X10002, Sandton, 2146

Quality of Service Report:

Eastern Cape Province

2016/2017 Quarter 3

23 March 2017

Contents

EXECUTIVE SUMMARY.....	3
1 Introduction.....	5
2 Methodology.....	6
2.1 Drive Test Equipment.....	6
2.2 Route Selection.....	7
2.3 Equipment test setup and configuration	7
2.4 Statistical Significance	9
2.5 Measurement Parameters and Targets.....	9
2.5.1 Parameter Targets.....	9
2.5.2 Drop-Call Ratio.....	10
2.5.3 The Call Setup Success Ratio	10
3 Results and Analysis.....	10
3.1 Accessibility and Retainability Measurements.....	11
3.1.1 Call Setup Success Ratio (CSSR).....	12
3.1.2 Drop Call Ratio (DCR).....	13
3.2 Serving Technology Analysis	14
4 Conclusion.....	15
5 Appendixes	16
5.1 Appendix A: Drive Test Results KPI's.....	16
5.2 Appendix B: Coverage Maps.....	18
5.2.1 Scanner Measurements	18
5.2.1.1 Vodacom.....	18
5.2.1.2 MTN	18
5.2.1.3 Cell-C.....	19
5.2.1.4 Telkom.....	19
5.2.2 Serving Technology Details.....	20

List of Acronyms

ACSSR	Average Call Setup Success Ratio
ADCR	Average Drop Call Ratio
CD	Call Duration
CSSR	Call Setup Success Ratio
DCR	Drop Call Ratio
GSM	Global System for Mobile Communications
IVR	Interactive Voice Response
WCDMA	Wideband Code Division Multiple Access
MOC	Mobile Originating Call
KPI	Key Performance Indicator

EXECUTIVE SUMMARY

The Authority conducted Quality of Service (QoS) measurements on the networks of mobile operators: Cell C, MTN, Telkom, and Vodacom. The measurements were performed to monitor performance of voice services being offered by the operators in Eastern Cape Province. The measurements were carried out in the period of 31 October 2016 to 19 November 2016 and covered a total distance of over 3500 kilometers.

The purpose of performing QoS measurements was to monitor and analyze the quality of mobile voice service as experienced by the end user. The results are later benchmarked against the QoS standard set by the Authority. The measurements were conducted in areas and in circumstances where mobile voice service is likely to be accessed. These areas include major towns, townships, farm areas, rural areas, major road arteries, economic activity nodes and areas of previous complaints. The sampled areas include Bizana, Mthatha, Tsolo, Mount Fletcher and Sterkspruit.

A vehicle equipped with TEMS Symphony measurement tool was used to collect data by driving through areas of interest. The two Key Performance Indicators (KPIs) used to assess QoS are Retainability and Accessibility. The Drop Call Ratio (DCR) parameter is used to measure Retainability and Call Setup Success Ratio (CSSR) parameter measures Accessibility.

According to the End-User and Subscriber Service Charter regulations of 2016, DCR should be less than 3% and CSSR should be greater than 98%.

The results show that only MTN met the Accessibility target in two areas but failed to meet the target in Bizana, Mthatha and Mount Fletcher. The CSSR for Cell C, Telkom and Vodacom was less than 98% in all areas, thus these operators failed the Accessibility target in all the areas of interest. Cell C's Accessibility was the lowest in Mthatha which showed a CSSR of 75.3%.

All operators did not meet the Retainability target in Bizana and Sterkspruit as the DCR was more than 3%. MTN met the target in Mthatha, Tsolo and Mount Fletcher, whereas Vodacom met the target only in Tsolo. Cell C and Telkom did not meet the target in all areas of interest, and both operators show high Retainability

failure in Mthatha with DCR of between 14% and 20%. Telkom's DCR is above 10% in all areas of interest.

In terms of the average results of the areas covered in Eastern Cape, all the operators' CSSR values were less than 98% and therefore they did not meet the Accessibility target. MTN is the only operator that met the Retainability target. Cell C, Vodacom and Telkom did not meet the Retainability target.

1 Introduction

ICASA's mission is to ensure that all South Africans have access to a wide range of high quality communication services at affordable prices¹. The Authority ensures the quality of service through its Quality of Service (QoS) monitoring activities. The Authority conducted QoS monitoring of the GSM voice telephony service being offered by Cell-C, MTN, Vodacom and Telkom within Eastern Cape Province of South Africa.

Eastern Cape Province is located on the east coast of South Africa between the Western Cape and KwaZulu-Natal provinces. Inland, it borders the Northern Cape and Free State provinces, as well as Lesotho. The province covers an area of 168 966km² and has a population of 6 996 976. It is the second-largest province in South Africa by surface area and has the third-largest population. The capital is Bhisho. Other major cities and towns include Port Elizabeth, East London, Grahamstown, Mthatha (previously Umtata), Graaf Reinet, Cradock and Port St Johns.²

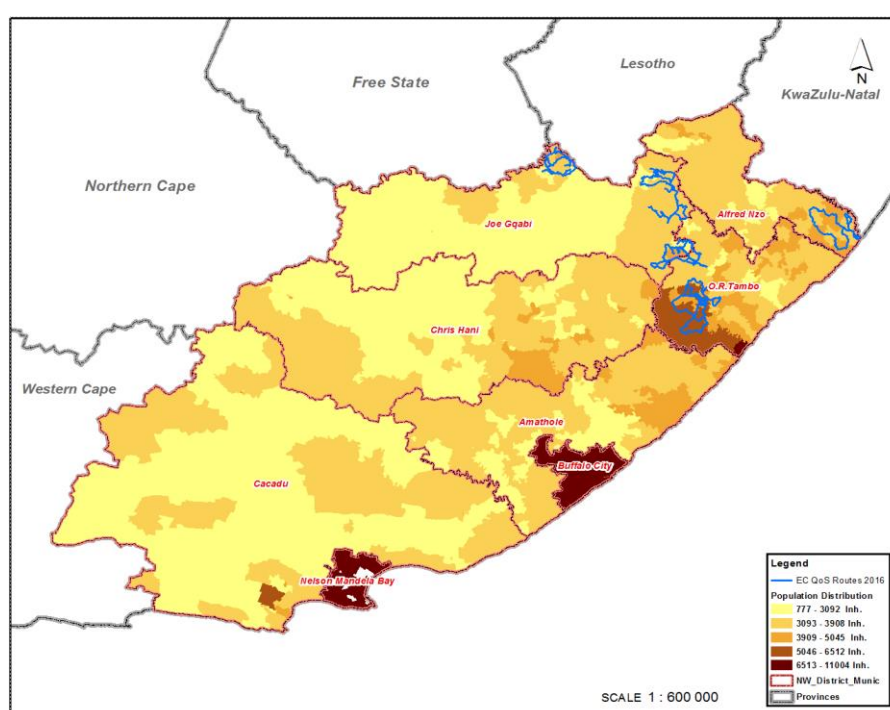


Figure 1: Eastern Cape Province Route Map

¹ ICASA Strategic Plan 2016/17-2021

² <http://www.localgovernment.co.za/provinces/view/1/eastern-cape>

The QoS monitoring was conducted in the areas within O.R. Tambo, Alfred Nzo and Joe Gqabi district municipalities. The selected areas include Mthatha, Tsolo, Bizana, Mount Fletcher and Sterkspruit. The areas consist of major towns, townships, farm areas, rural areas, major road arteries, economic activity nodes and areas of previous complaints.

QoS is defined as the collective effect of service performance that determines the degree of satisfaction a user derives from a service. It provides an indication of what a customer experiences when using a mobile network and is evaluated in terms of Retainability and Accessibility parameters.

- a) Retainability is defined as the ability for a call to stay connected through to a normal call tear-down process, without abnormally disconnecting from the cell site that carries the call³. It is measured using Drop Call Ratio (DCR).
- b) Accessibility is defined as the percentage of the number of times a user is rejected due to the unavailability of system resources when attempting to place a call. It is measured using Call Setup Success Ratio (CSSR).

2 Methodology

A drive test sampling methodology which provides a snapshot view of the mobile operator's quality of service was adopted. It provides a realistic picture of network performance from a user's point of view. The method adopted provides an external indicative snapshot of an operator's network performance from the user's point of view on the selected routes and particular time of the day, which is not a true representation of the mobile service provider's overall network performance.

2.1 Drive Test Equipment

The drive test was carried out using a test kit comprised of TEMS Symphony 7.7 software, a Samsung Galaxy Note 4 (SM-N910F) mobile device, a laptop computer and a Probe Controller 1.9. The mobile devices were configured to automatically select mobile network and radio access technology.

³ Annexure B.2 of ETSI EG 202 057-3

2.2 Route Selection

Measurement routes were selected so that they would reflect end-user distribution at different geographical locations in areas where people live and use mobile phones (e.g. urban, suburban, major towns, rural towns, township, farm areas, highways, tourism areas and major roads).

The selected five areas in which the QoS measurements were conducted are within the district municipalities as indicated in the Table 1 below:

Table 1: Selected Routes and Date

Test Type	District	Route Name	Dates
Accessibility and Retainability	Alfred Nzo	Bizana	31/10/2016 19/11/2016
		Mthatha	01/11/2016 17/11/2016
	O.R Tambo	Tsolo	02/11/2016 18/11/2016
		Mount Fletcher	03/11/2016 15-16/11/2016
	Joe Gqabi	Sterkspruit	04/11/2016 14/11/2016

2.3 Equipment test setup and configuration

Table 2 below shows the test plan and configurations of the drive test equipment.

Table 2: Test plan and configurations

Configuration	Explanation
Antennas	Tests were carried out from a moving vehicle with roof mounted antennas. The antennas were arranged in a well-defined fixed way with a minimum distance to each other,

	reducing RF-influence to an acceptable level in an equal radio environment. The coupling loss between two mobile handsets was min 40.5 dB ⁴ .
Band	The bands tested were GSM (900 and 1800 MHz) and WCDMA (900 and 2100 MHz).
Call Samples	<p>A minimum of 120 test samples per network operator were collected except in the areas where services were limited on most part of the drive test route. Test drives were planned to ensure, as far as practicable, that the results adequately reflect the QoS perceived by customers for the period under review.</p> <p>The drive test was designed to be representative of the population relative to the traffic of the network. Measurements were scheduled so as to reflect accurately the traffic variations over the hours of a day, and user's behaviour.⁵</p>
Call Type and Window Call	<p>Long calls and Short calls were used.</p> <p>Voice Telephony was tested in Mobile Originating Call (MOC) direction. The following call durations were used:</p> <ul style="list-style-type: none"> • CD1: 10 seconds for call setup testing; • CD2: 120 seconds for typical tests, default call duration; <p>Call Window: Call Duration + 30 seconds, (for the setup and release phases) + 30 seconds (for the minimum pause. Interval), for the default call duration this results in 180 seconds.⁶</p>
Equipment	The equipment used for testing was the TEMS Symphony 7.7 equipped with Samsung Galaxy Note S4 (SM-N910F), PCTEL EXFlex Scanner and Dell Latitude with Probe Controller 1.9.2.
KPI ⁷	The measurements focused on the following network parameters:

⁴ Section 6.3 of ETSI TS 102 250-4 V.1.1.2 (2003-10)

⁵ Section 4.8 of ETSI EG 202 057-3 V1.1.1 (2005-04)

⁶ Section 4.2.1 of ETSI TS 102 250-5 V1.2.1 (2005-05)

⁷ End-User and Subscriber Service Charter Regulations of 2016

	(i) Dropped Call Ratio (DCR); (ii) Call Set-up Success Ratio (CSSR)
Log files	The log files for each test case were stored in different location with different names. The log files were recorded per network operator.
Mobile terminal used	The test calls were terminated on each operator's test platform or IVR system.
Network tested	Cell-C, MTN, Vodacom and Telkom.
SIM cards	Test SIM cards provided by each operator were used during the drive test
Vehicle used	Toyota Hilux Double Cab equipped with drive test equipment was used. All the road traffic rules were observed during the drive test. The speed was maintained to average of 60km in town and built-up areas, and an average of 100km/h on highways.

2.4 Statistical Significance

The meaning of statistical analysis is to present the statistical accuracy of reported KPIs. This means that one can be "relatively sure" that the results represent the reality (true population mean) and that they did not occur by chance. Statistical theory provides tools to assess the statistical significance of measurement observations with a given sample count and standard deviation.

2.5 Measurement Parameters and Targets

2.5.1 Parameter Targets

The Average Drop Call Ratio should be less than 3% over 6 months' period and Average Call Setup Success Ratio must be greater than 98% over six months' period as per the "End-User and Subscriber Service Charter Regulations of 2016".

2.5.2 Drop-Call Ratio

Dropped Call Ratio (DCR) is the proportion of incoming and outgoing calls, which, once correctly established and therefore having been assigned a traffic channel, is dropped or interrupted prior to the deliberate completion by the user.⁸

The formula to calculate DCR is shown below:

$$\text{DCR} = D/S \times 100$$

where D represents the number of dropped calls and S is the number of successful call attempts

2.5.3 The Call Setup Success Ratio

The Call Setup Success Ratio (CSSR) is the percentage of calls that are successfully set up as a percentage of the total call attempts.⁹

The formula to calculate CSSR is shown below:

$$\text{CSSR} = Y/X \times 100$$

where Y represents the calls that are call established and X is the total call attempts.

3 Results and Analysis

This section provides a summary of the mobile operator's performance results based on the drive test route in the following test areas: Bizana, Mthatha, Tsolo, Mount Fletcher and Sterkspruit.

⁸ End-User and Subscriber Service Charter Regulations of 2016

⁹ End-User and Subscriber Service Charter Regulations of 2016

3.1 Accessibility and Retainability Measurements

Table 3: Summary of Results

Route Name	Operator	CSSR (%)	DCR (%)
Bizana	MTN	97.82%	3.48%
	Vodacom	93.16%	4.86%
	Cell C	89.08%	5.69%
	Telkom	94.72%	15.68%
Mthatha	MTN	97.68%	2.02%
	Vodacom	93.46%	3.17%
	Cell C	75.43%	19.18%
	Telkom	97.41%	14.83%
Tsolo	MTN	99.18%	1.56%
	Vodacom	96.45%	2.85%
	Cell C	88.41%	7.43%
	Telkom	97.29%	14.07%
Mount Fletcher	MTN	94.61%	2.82%
	Vodacom	83.68%	4.45%
	Cell C	88.39%	5.54%
	Telkom	93.89%	17.19%
Sterkspruit	MTN	99.45%	3.27%
	Vodacom	97.20%	3.46%
	Cell C	96.57%	4.27%
	Telkom	96.77%	10.37%
Average for the above 5 areas	MTN	97.42%	2.62%
	Vodacom	91.39%	3.78%
	Cell C	88.01%	8.26%
	Telkom	96.02%	14.52%

Table 3 above shows Voice Call measurement results in each route and on average level for all the operators. Additional KPIs are presented in the Appendix 5.

3.1.1 Call Setup Success Ratio (CSSR)

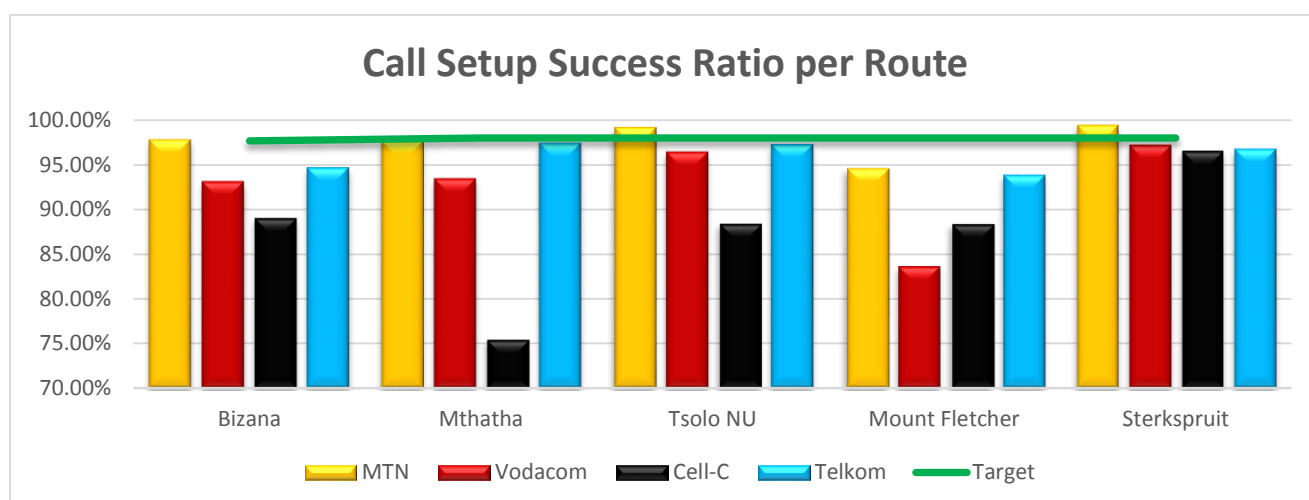


Figure 2: Call Setup Success Ratio (CSSR) per Route

Figure 2 above shows that MTN met the 98% CSSR target in Tsolo and Sterkspruit but failed to meet the target in Bizana, Mthatha and Mount Fletcher. The CSSR for Cell C, Telkom and Vodacom was less than 98% in all areas, thus these operators failed the Accessibility target in all the areas of interest. Cell C's Accessibility was the lowest in Mthatha which showed a CSSR of 75.3%.

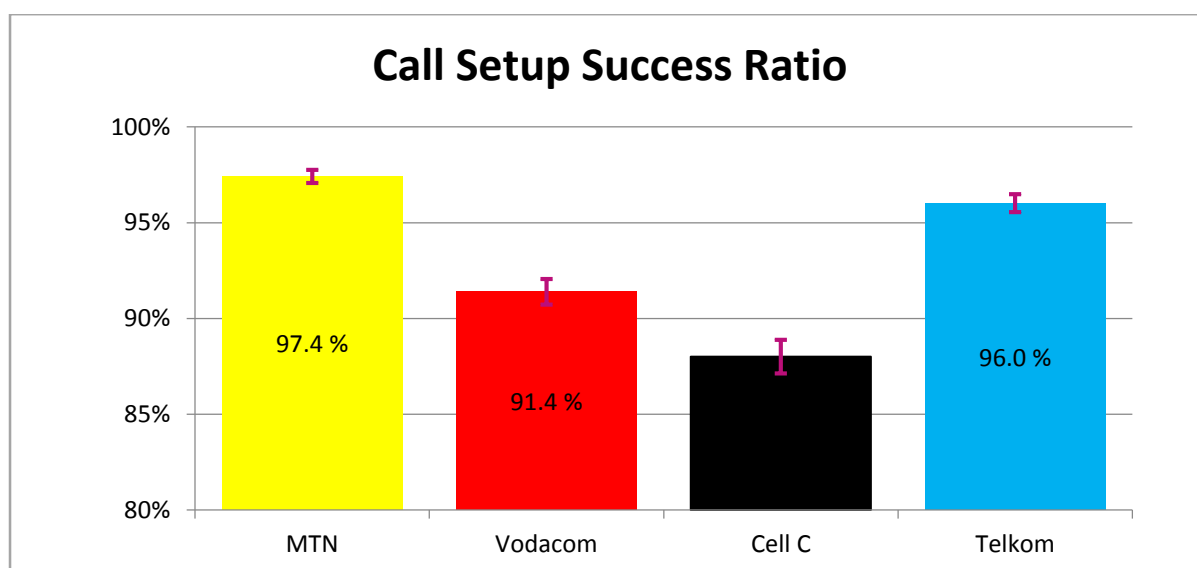


Figure 3: Overall Call Setup Success Ratio with Statistical Significance

Figure 3 above shows that MTN's average CSSR is the highest, followed by Telkom, Vodacom and Cell C in descending order. None of the operators met ICASA's CSSR target of above 98% as per "End-User and Subscribers Service

charter regulations of 2016". All operators' results are statistically significantly different from each other.

3.1.2 Drop Call Ratio (DCR)

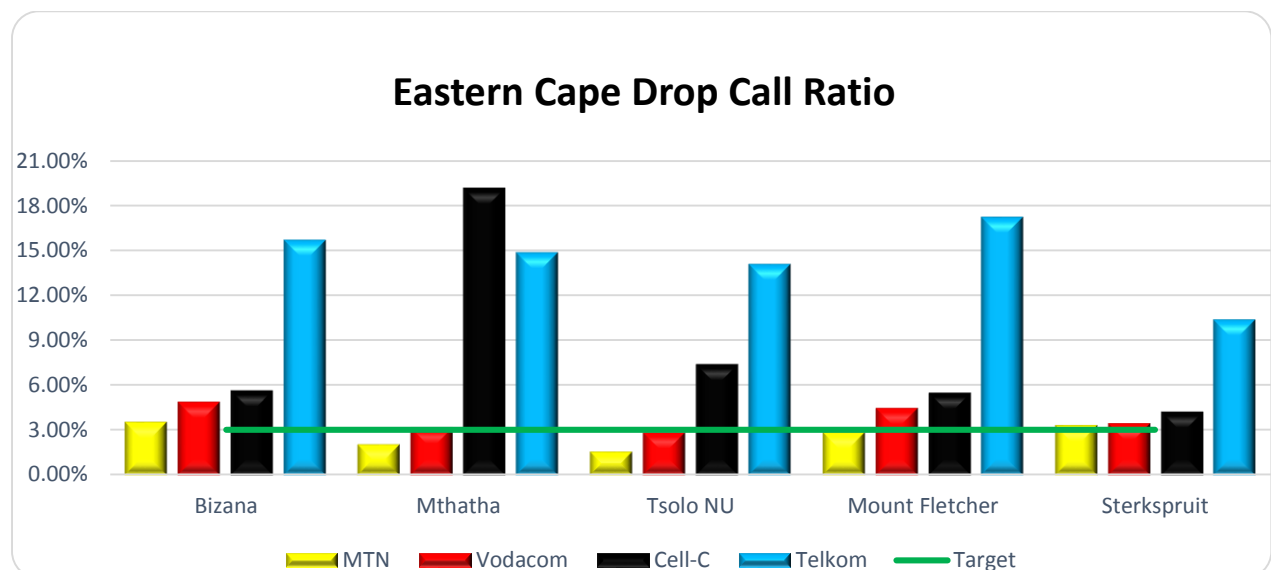


Figure 4: Drop Call Ratio (DCR) per Route

Figure 4 above shows that MTN met the below 3% DCR target in Mthatha, Tsolo and Mount Fletcher, and failed the target in Bizana and Sterkspruit. Vodacom met the target in Tsolo and failed the target on the four other areas (Bizana, Mthatha, Mount Fletcher and Sterkspruit). Cell C and Telkom failed the target in all five target areas.

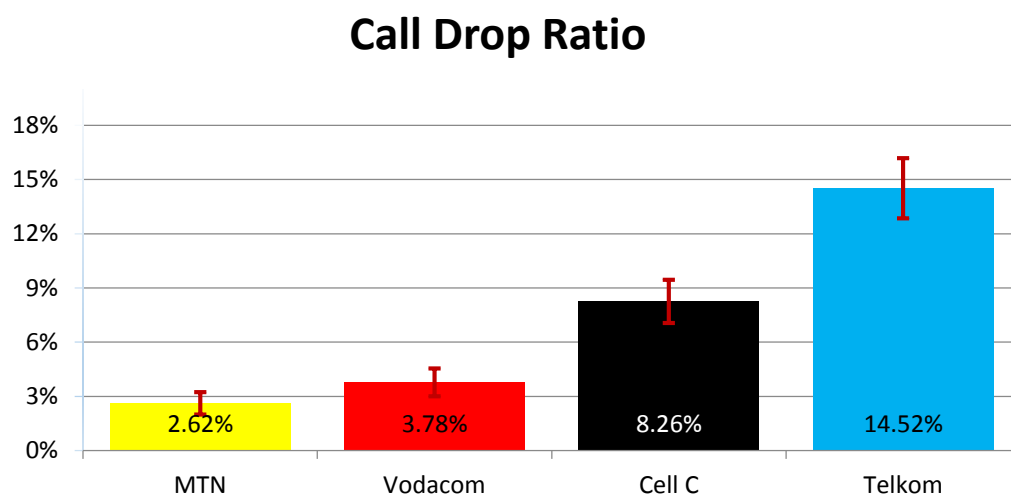


Figure 5: Total Call Drop Ratio with Statistical Significance

Figure 5 above shows that MTN's average DCR is the lowest followed by Vodacom, Cell C and Telkom in the respective descending order. MTN met ICASA's 3% DCR target. Vodacom, Cell C and Telkom did not meet the DCR target as their DCR values were above 3%. There was no statistical significant difference recorded between MTN and Vodacom results. There is a statistical significant difference between Cell C and other operators (Vodacom, MTN, and Telkom). There was also a big statistical significant difference between Telkom and other operators (Vodacom, MTN, and Cell C).

3.2 Serving Technology Analysis

Figure 6 below shows the statistical distribution of the serving technology during the drive test. The serving technology distribution were based on the device used and the network parameter configuration which varies with the mobile operators. Cell C serving technology distribution was mainly on WCDMA while other operators GSM was a dominant technology.

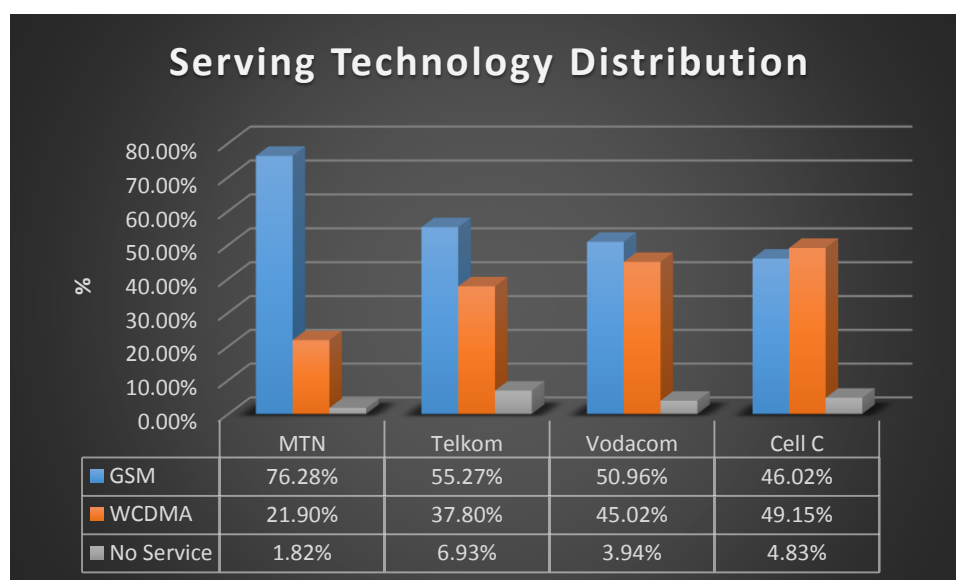


Figure 6: Technology Distribution

4 Conclusion

This section provides the summary and key findings of all measurements. The obtained results illustrate a snapshot of the mobile network performance and customer experience within the measured time and location context.

The results indicate that the End-Users Quality of Service and operators' network performance varies significantly on per location basis.

The results show that in terms of Average Call Setup Success Ratio, all operators results were below the target of 98%. In terms of Average Drop Call Ratio, only MTN met the DCR target of less than 3%, while Vodacom, Cell C and Telkom did not meet the target. There was no statistically significant difference between MTN's and Vodacom's DCR results.

5 Appendixes

5.1 Appendix A: Drive Test Results KPI's

Table 4: Drop call ratio (DCR) per Route

Route Name	Operator	Phase 1			Phase 2			TOTAL		
		Call Established	Call Dropped	DCR (%)	Call Established	Call Dropped	DCR (%)	Call Established	Call Dropped	DCR (%)
Bizana	MTN	247	10	4.05	127	3	2.36%	374	13	3.48%
	Vodacom	219	7	3.20	151	11	7.28%	370	18	4.86%
	Cell C	132	9	6.82	114	5	4.39%	246	14	5.69%
	Telkom	184	22	11.96	103	23	22.33%	287	45	15.68%
Mthatha	MTN	211	6	2.84	283	4	1.41%	494	10	2.02%
	Vodacom	190	5	2.63	251	9	3.59%	441	14	3.17%
	Cell C	135	28	20.74%	183	33	18.03%	318	61	19.18%
	Telkom	165	30	18.18%	280	36	12.86%	445	66	14.83%
Tsolo	MTN	246	5	2.03%	204	2	0.98%	450	7	1.56%
	Vodacom	232	7	3.02%	189	5	2.65%	421	12	2.85%
	Cell C	133	7	5.26%	136	13	9.56%	269	20	7.43%
	Telkom	145	18	12.41%	125	20	16.00%	270	38	14.07%
Mount Fletcher	MTN	307	10	3.26%	332	8	2.41%	639	18	2.82%
	Vodacom	238	9	3.78%	301	15	4.98%	539	24	4.45%
	Cell C	164	10	6.10%	287	15	5.23%	451	25	5.54%
	Telkom	130	21	16.15%	155	28	18.06%	285	49	17.19%
Sterkspruit	MTN	235	9	3.83%	254	7	2.76%	489	16	3.27%
	Vodacom	186	5	2.69%	161	7	4.35%	347	12	3.46%
	Cell C	194	7	3.61%	157	8	5.10%	351	15	4.27%
	Telkom	155	16	10.32%	115	12	10.43%	270	28	10.37%

Table 5: Call Setup Success Ratio (CSSR) per Route

Route Name	Operator	PHASE 1			PHASE 1			TOTAL		
		Call Attempt	Call Setup	CSSR (%)	Call Attempt	Call Setup	CSSR (%)	Call Attempt	Call Setup	CSSR (%)
Bizana	MTN	487	475	97.94%	574	557	97.72%	1061	1032	97.82%
	Vodacom	479	423	88.68%	548	531	97.07%	1027	954	93.16%
	Cell C	510	449	88.56%	299	269	89.97%	809	718	89.08%
	Telkom	438	411	94.70%	551	503	94.73%	989	914	94.72%
Mthatha	MTN	757	746	98.68%	841	814	96.79%	1598	1560	97.68%
	Vodacom	347	332	96.79%	557	483	91.30%	904	815	93.46%
	Cell C	432	322	76.67%	465	341	74.29%	897	663	75.43%
	Telkom	643	622	97.19%	951	920	97.56%	1594	1542	97.41%
Tsolo	MTN	658	657	99.85%	561	550	98.39%	1219	1207	99.18%
	Vodacom	647	617	95.36%	704	686	97.44%	1351	1303	96.45%
	Cell C	456	381	85.43%	450	405	91.42%	906	786	88.41%
	Telkom	712	681	97.56%	645	609	96.97%	1357	1290	97.29%
Mount Fletcher	MTN	1148	1060	92.82%	1238	1186	96.27%	2386	2246	94.61%
	Vodacom	1042	876	84.31%	1292	1068	83.18%	2334	1944	83.68%
	Cell C	628	535	85.46%	997	889	90.25%	1625	1424	88.39%
	Telkom	741	604	88.18%	995	932	98.00%	1736	1536	93.89%
Sterkfontein	MTN	865	858	99.19%	949	946	99.68%	1814	1804	99.45%
	Vodacom	652	619	96.12%	649	631	98.29%	1301	1250	97.20%
	Cell C	614	577	95.85%	488	465	97.48%	1102	1042	96.57%
	Telkom	598	579	96.98%	554	528	96.53%	1152	1107	96.77%

5.2 Appendix B: Coverage Maps

5.2.1 Scanner Measurements

5.2.1.1 Vodacom

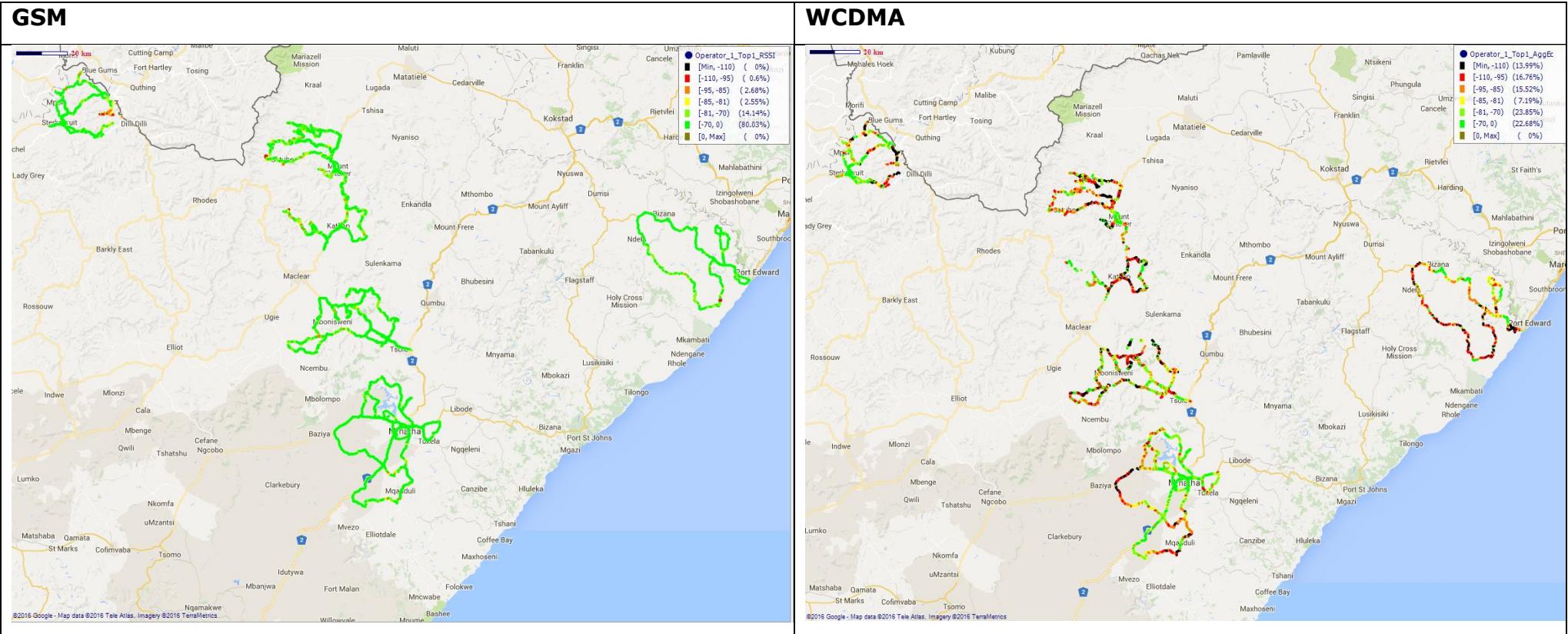


Figure 7: Eastern Cape Province - Vodacom GSM and WCDMA Signal Levels

5.2.1.2 MTN

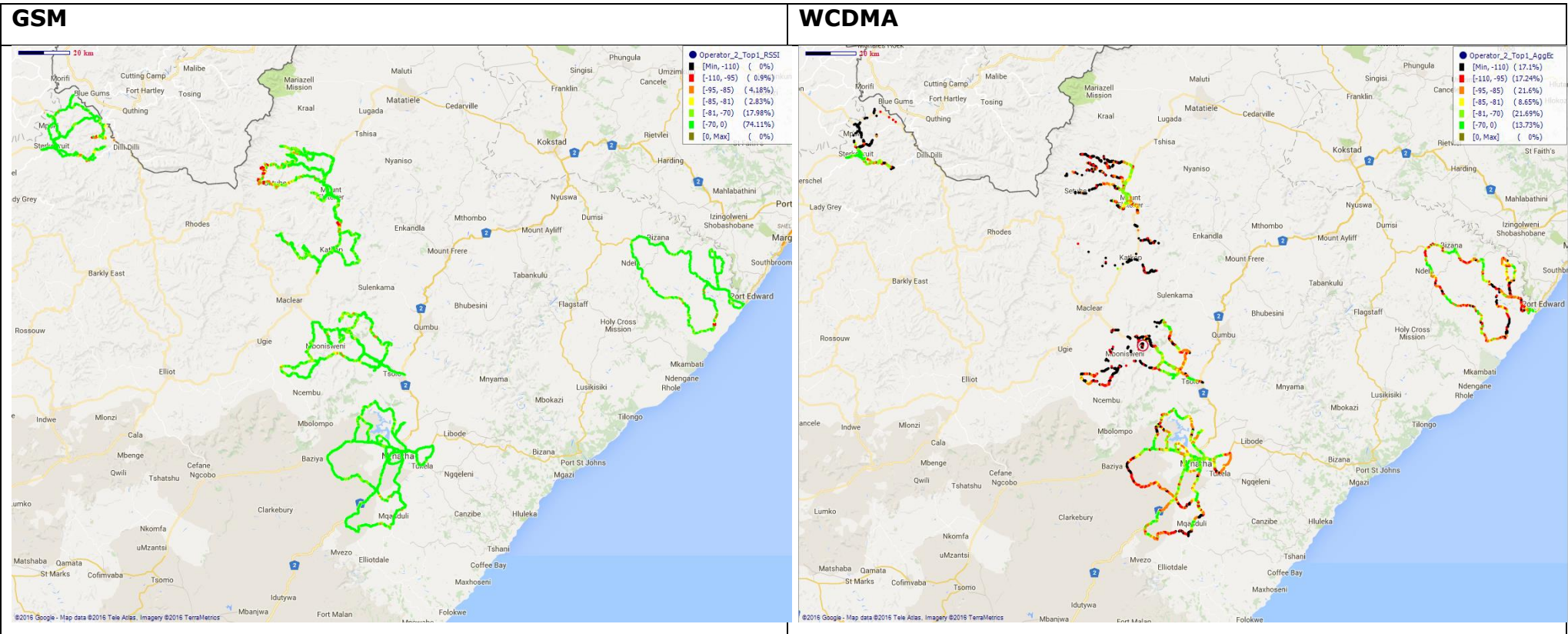


Figure 8: Eastern Cape Province - MTN GSM and WCDMA Signal Levels

5.2.1.3 Cell-C

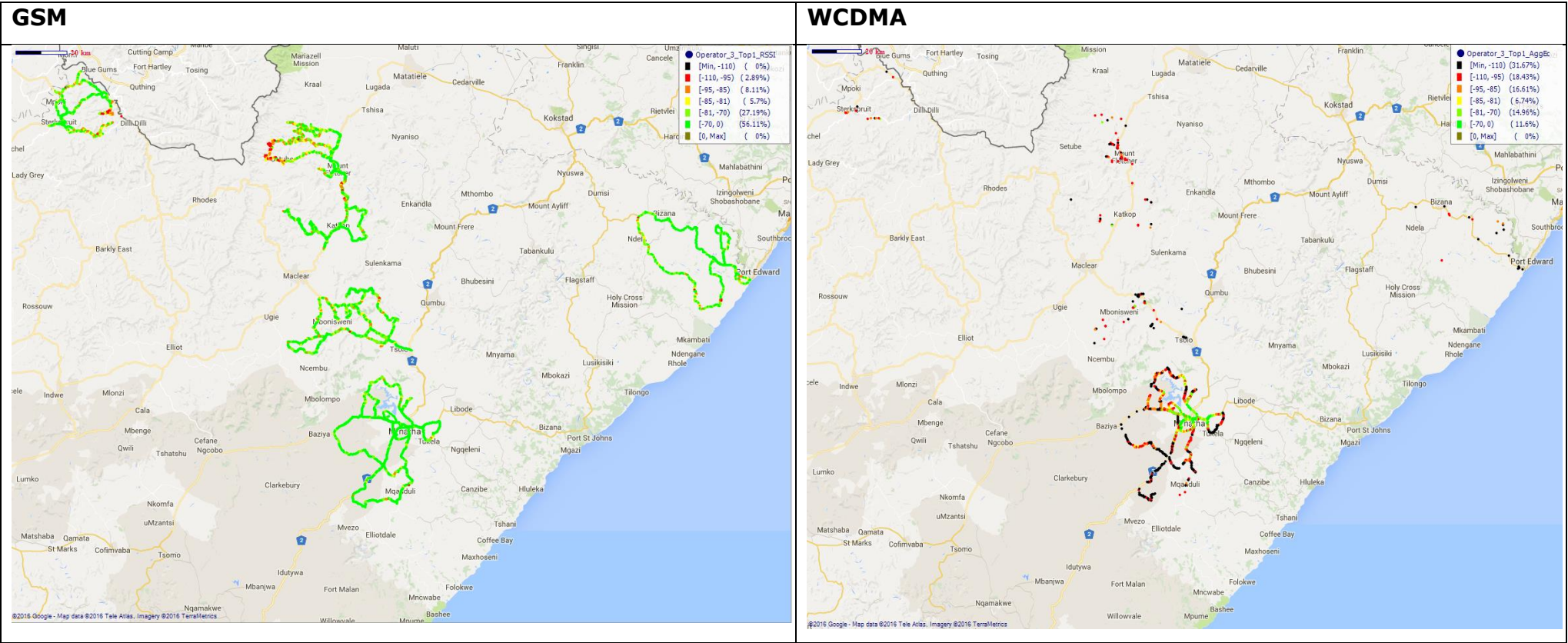


Figure 9: Eastern Cape Province - Cell C GSM and WCDMA Signal Levels

5.2.1.4 Telkom

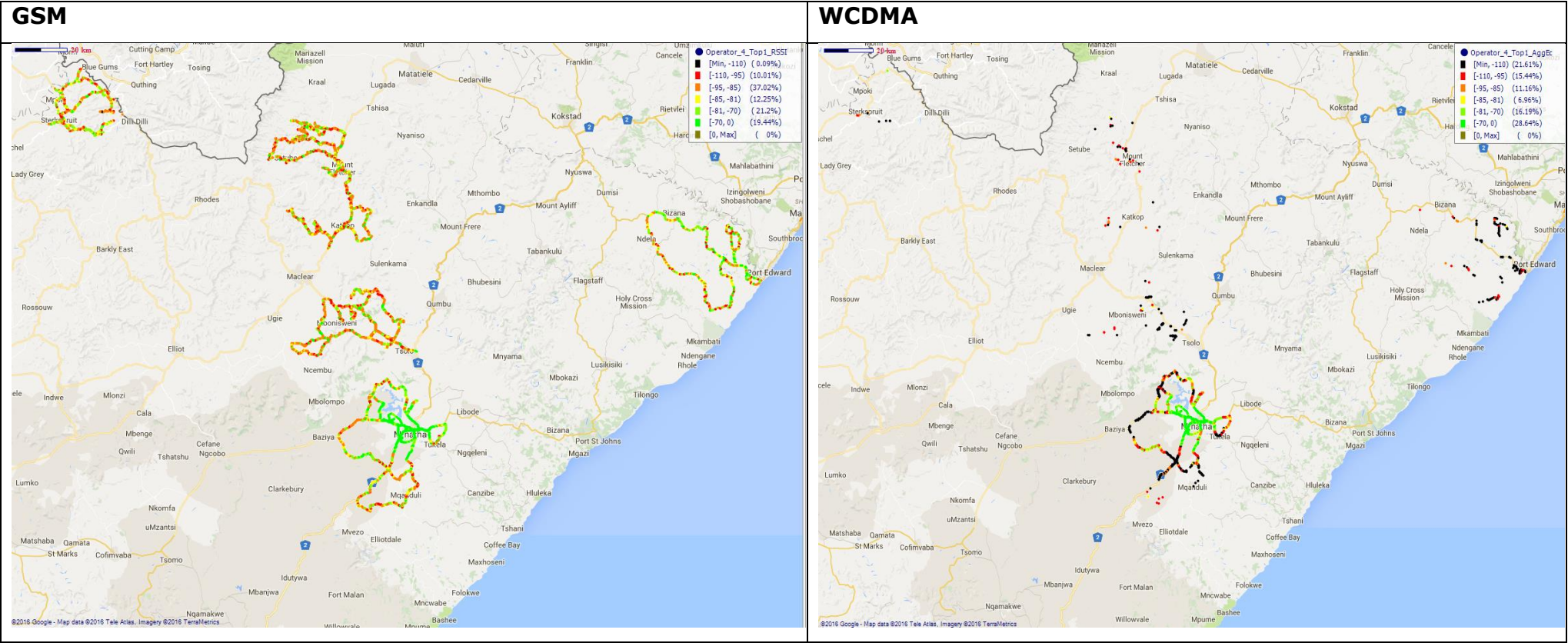


Figure 10: Eastern Cape Province - Telkom GSM and WCDMA Signal Levels

5.2.2 Serving Technology Details

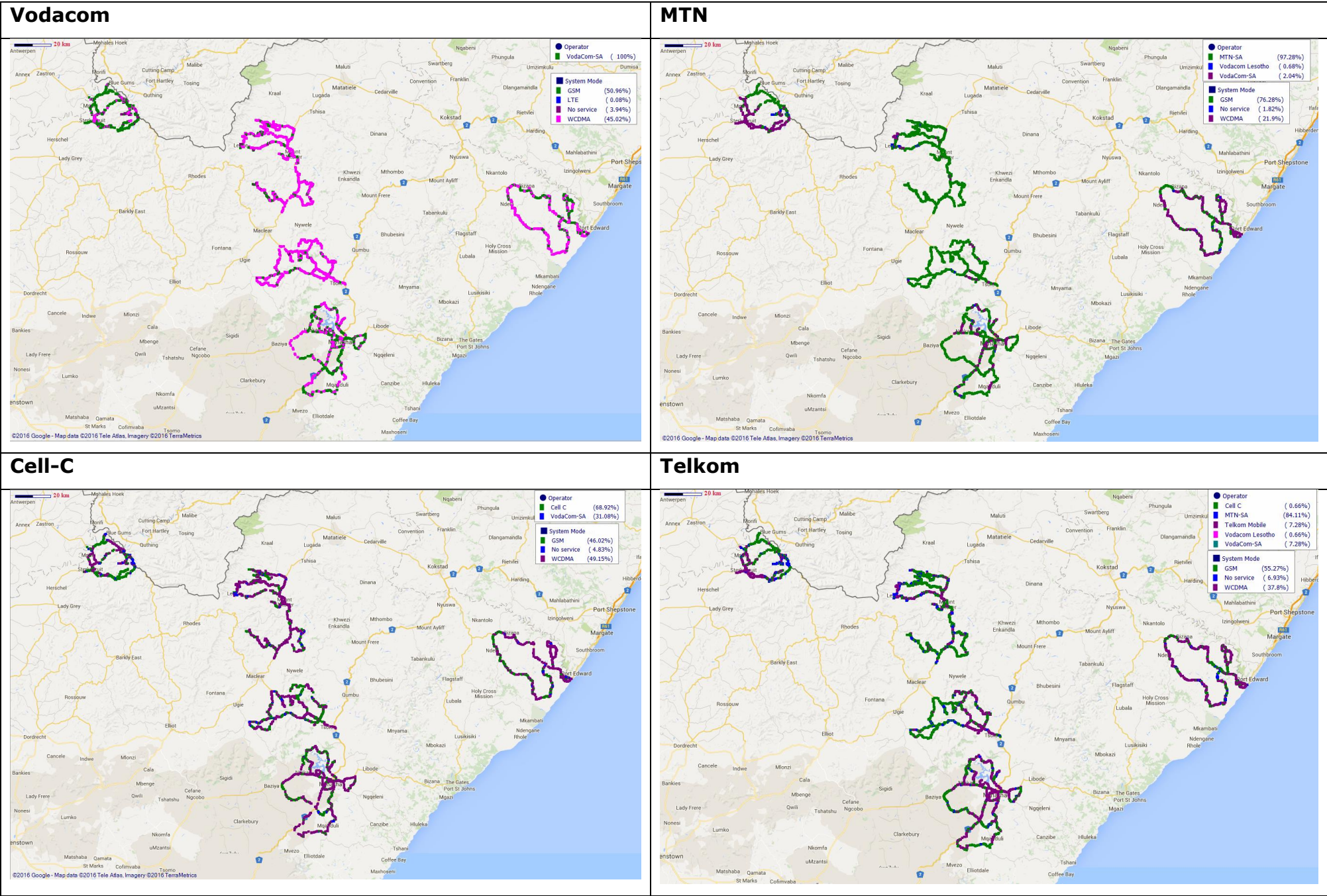


Figure 11: Eastern Cape Province Serving Technology Plots

