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Quality of Service Report:

Free State Province

2017/2018 Quarter 2

Contents

List of Abbreviations

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 Free State Province. The measurements were carried out in the period of 28th August 2017 to 11th October 2017. The total distance covered was over 2300 kilometers.

The purpose of performing QoS measurements was to monitor and analyse 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 Botshabelo, Bethlehem, Ladybrand, Kroonstad and Sasolburg.

A vehicle equipped with TEMS Symphony measurement tool and Sony Experia V LT25i backpack were 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 in terms of overall Call Setup Success Ratio, MTN met the Accessibility target with a CSSR of above 98%, whereas Vodacom, Telkom and Cell C failed to meet the Accessibility target with the CSSR values below 98% target. In terms of overall Drop Call Ratio, Cell C and Telkom did not meet the DCR target of less than 3%; while Vodacom and MTN met the DCR target thus meeting 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 prices[1]. 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 Free State Province of South Africa.

The Free State is in the geographical centre of South Africa, bordered by the Northern Cape, Eastern Cape, North West, Mpumalanga, KwaZulu-Natal and Gauteng provinces, as well as Lesotho. The Free State is a rural province of farmland, mountains, goldfields and widely dispersed towns. Although the Free State is the third largest province in South Africa, it has the second smallest population and the second lowest population density. It covers an area of 129 825 km² and has a population of 2 834 714 – 5.1% of the national population. Its capital is Bloemfontein, which is South Africa's judicial capital. Other important towns include Welkom, Kroonstad, Sasolburg and Bethlehem[2].

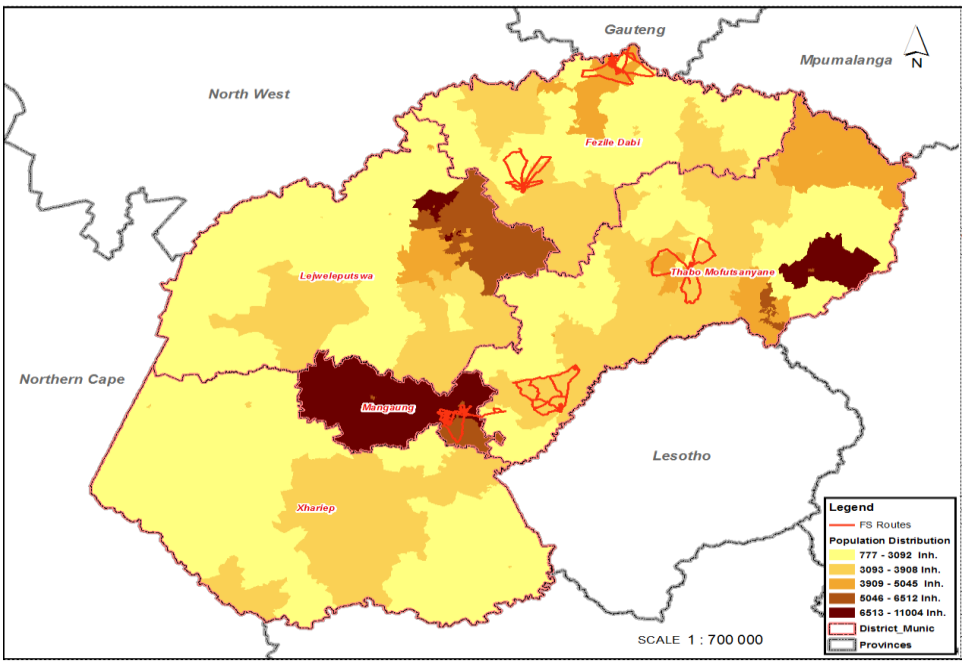


Figure 1: Free State Province Route Map

[1]ICASA Strategic Plan 2016/17-2021
[2]https://www.localgovernment.co.za/provinces/view/2/free-state

The QoS monitoring was conducted in the areas within Mangaung Metropolitan Municipality, Fezile Dabi District Municipality and Thabo Mofutsanyana District Municipality. The selected areas include Botshabelo, Bethlehem, Ladybrand, Kroonstad and Sasolburg. 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 caries the call[3]. It is measured using Drop Call Rate (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 Rate (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 a snapshot of an operator's network performance selected routes and particular time of the day. It is therefore 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 and hardware, eight Samsung Galaxy Note 4 (SM-N910F) mobile devices, a laptop computer and a TEMS Probe Controller 1.9. The mobile devices

[3] Annexure B.2 of ETSI EG 202 057-3

were configured to automatically select mobile network and radio access technology.

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 Table 1 below:

Table 1: Selected routes and dates

Test Type	Municipality	Route Name	Dates
Accessibility and Retainability	Mangaung Metropolitan Municipality	Botshabelo and Thaba-Nchu	28/08/2017 11/09/2017 11/10/2017
	Mantsopa Local Municipality	Ladybrand	29/08/2017 12/09/2017
	Dihlabeng Local Municipality	Bethlehem	30/08/2017 13/09/2017
	Moqhaka Local Municipality	Kroonstad	31/08/2017 14/09/2017
	Metsimaholo Local Municipality	Sasolburg	01/09/2017 15/09/2017

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. A minimum distance between antennas is maintained to contain RF influence to an acceptable level. The coupling loss between two mobile handsets was a minimum of 40.5 dB[4].
Band	The bands tested for voice were GSM (900 and 1800 MHz) and WCDMA (900 and 2100 MHz). The bands scanned were GSM (900 and 1800 MHz) and WCDMA 2100 MHz.
Call Samples	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. The drive test was designed to be representative of the population relative to the traffic of the network. Measurements were scheduled to reflect accurately the traffic variations over the hours of a day, and user's behavior[5].
Call Type and Window Call	Long calls and short calls were used. Voice telephony was tested in the Mobile Originating Call (MOC) direction. The following call durations were used: • CD1: 10 seconds for call setup testing; • CD2: 120 seconds for typical tests, default call duration;

[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)

	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].
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 TEMS Probe Controller 1.9.2.
KPI[7]	The measurements focused on the following network parameters: (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 locations 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	A Toyota Hilux Double Cab van equipped with drive-test equipment was used. All the road traffic rules were observed during the drive test. The speed was maintained to an average of 60km/h in town and built-up areas, and an average of 100km/h on highways.

2.4 Statistical significance

The purpose 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

[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

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:

$$DCR = D/S*100$$

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:

$$CSSR = Y/X *100$$

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

[8] End-User and Subscriber Service Charter Regulations of 2016
[9] End-User and Subscriber Service Charter Regulations of 2016

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: Botshabelo, Bethlehem, Ladybrand, Kroonstad and Sasolburg.

3.1 Accessibility and Retainability measurements

Table 3: Summary of results

Route Name	Operator	CSSR (%)	DCR (%)
Botshabelo	Telkom	99.30%	1.92%
	Cell C	97.26%	2.98%
	VodaCom-SA	97.41%	1.62%
	MTN-SA	98.96%	2.11%
Bethlehem	Telkom	96.21%	3.17%
	Cell C	96.41%	11.11%
	Vodacom	94.92%	4.03%
	MTN	98.01%	1.53%
Ladybrand	Telkom	92.37%	6.56%
	Cell C	86.16%	9.89%
	Vodacom	92.48%	3.71%
	MTN	96.92%	4.09%
Kroonstad	Telkom	96.30%	0.71%
	Cell C	99.45%	2.19%
	Vodacom	93.22%	0.36%
	MTN	98.64%	0.38%
Sasolburg	Telkom	97.15%	2.62%
	Cell C	95.60%	5.88%
	Vodacom	98.08%	2.27%
	MTN	97.87%	3.19%
Overall results for the above 5 areas	Telkom	96.21%	3.02%
	Cell C	94.55%	6.25%
	Vodacom	95.22%	2.40%
	MTN	98.07%	2.41%

Table 3 above shows voice call measurement results in each route and as an overall for all areas for all the operators. Detailed results are presented in the Appendix 6.

3.1.1 Call Setup Success Ratio (CSSR)

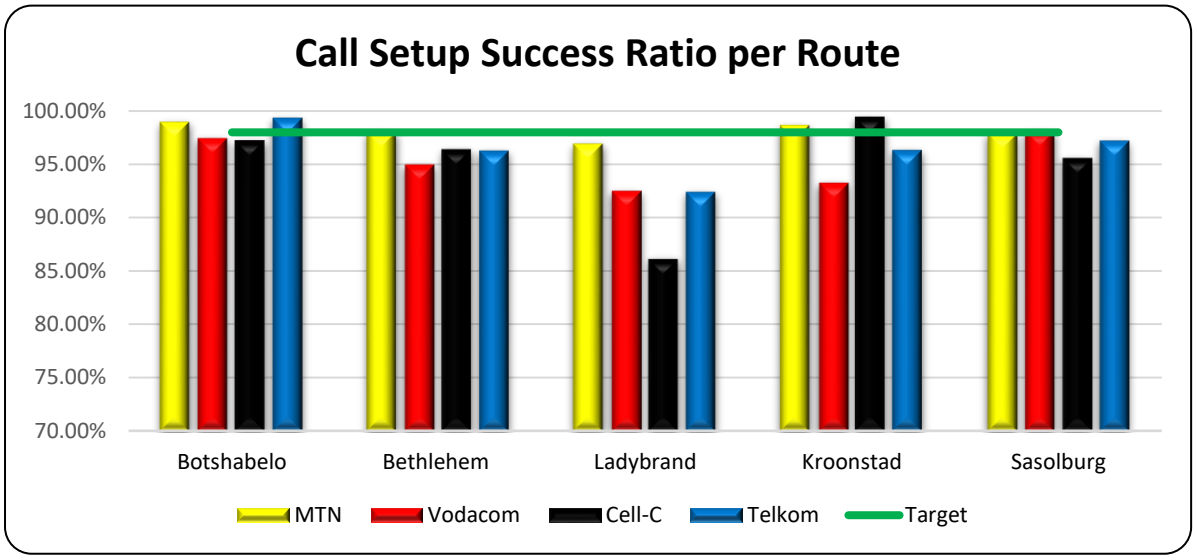


Figure 2: Call Setup Success Ratio (CSSR) per Route

Figure 2 above shows that MTN met the 98% CSSR target in Botshabelo, Bethlehem and Kroonstad. Vodacom met the CSSR target only in Sasolburg, Cell C only in Kroonstad and Telkom only in Botshabelo. Cell C, Vodacom, and Telkom achieved less than 98% CSSR in four areas and MTN achieved a CSSR value above 98% in three areas.

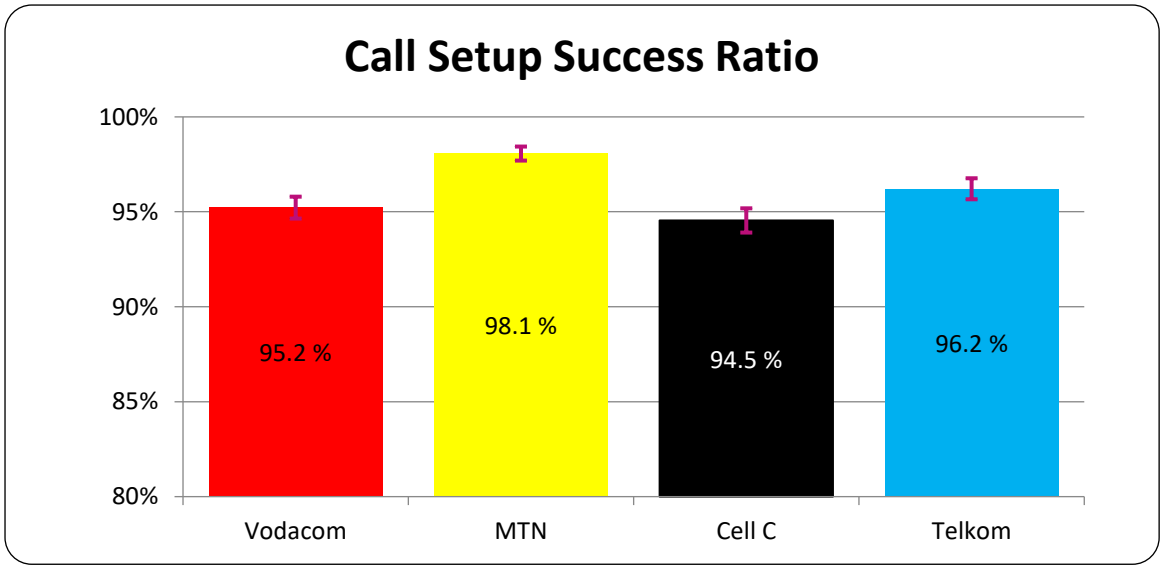


Figure 3: Overall Call Setup Success Ratio with Statistical Significance

Figure 3 shows that MTN's CSSR is the highest, followed by Telkom, Vodacom and Cell C in their respective descending order. MTN is the only operator that met the ICASA's CSSR target of above 98% as per "End-User and Subscribers Service

charter regulations of 2016". MTN's results show statistically significance difference in relation to other operators results. There is no statistically significance difference between Vodacom and Cell C results and between Vodacom and Telkom results. Cell C and Telkom results are statistically different.

3.1.2 Drop Call Ratio (DCR)

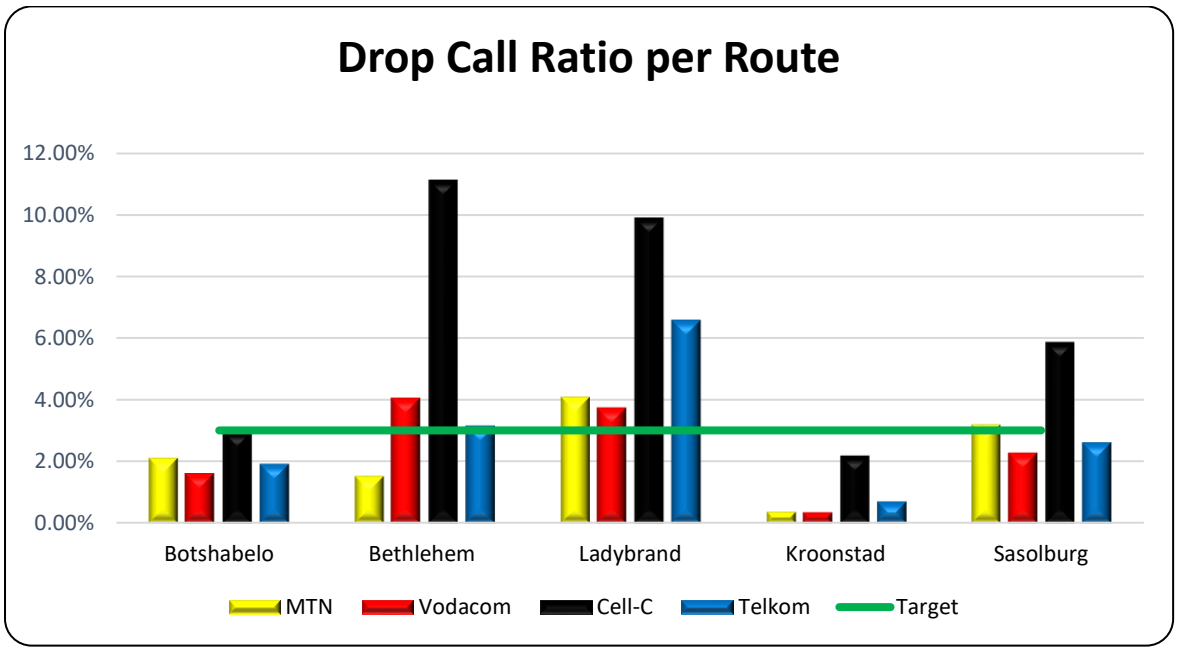


Figure 4: Drop Call Ratio (DCR) per Route

Figure 4 above shows that all operators met the 3% DCR target in Botshabelo and Kroonstad. All operators failed to meet the target in Ladybrand. MTN failed to meet the target in Ladybrand and Sasolburg. Telkom and Vodacom failed to meet the target in Ladybrand and Bethlehem. Cell C failed to meet the target in Ladybrand, Bethlehem and Sasolburg.

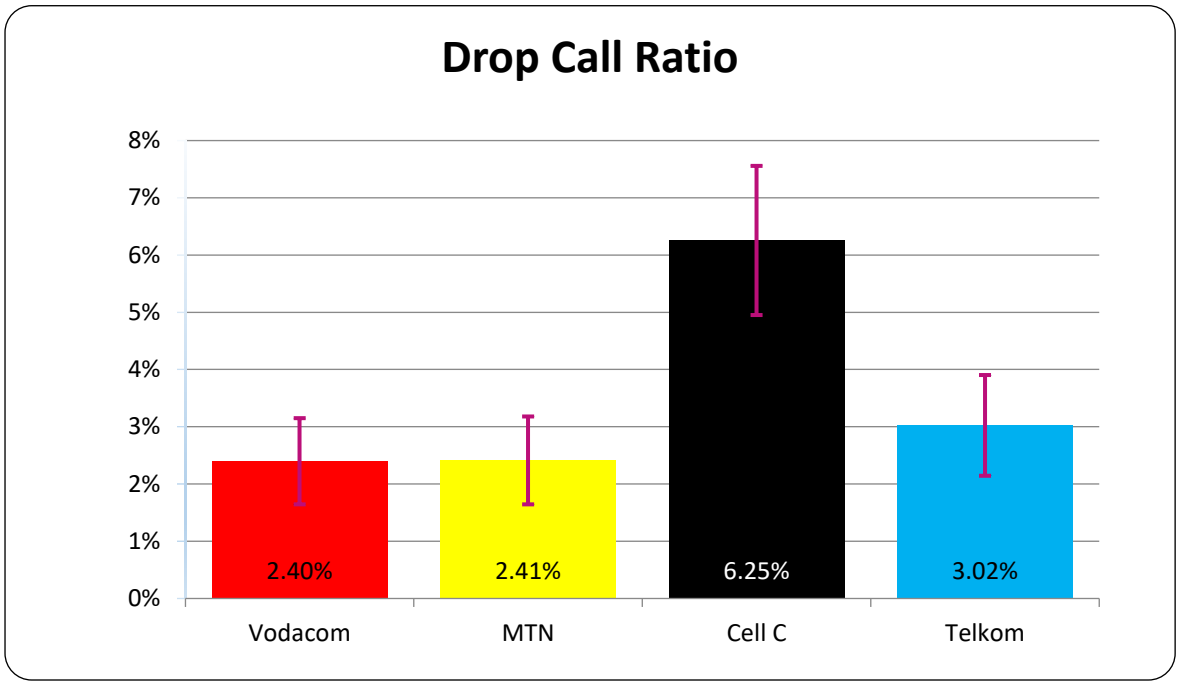
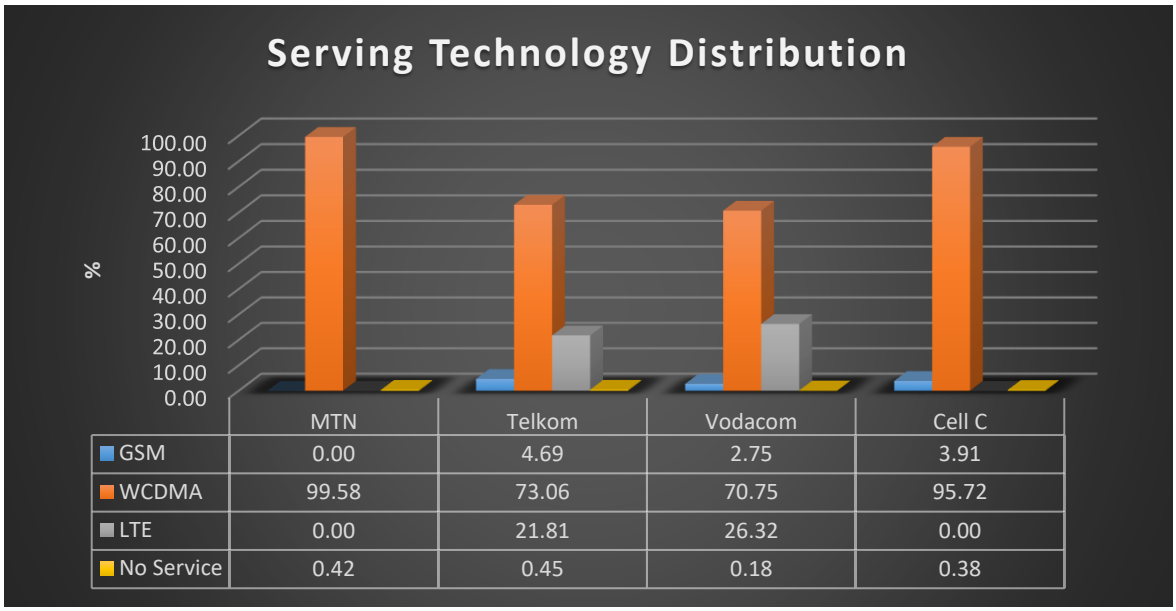


Figure 5: Total Drop Call Ratio with Statistical Significance

Figure 5 shows that Vodacom's DCR is the lowest followed by MTN, Telkom and Cell C in the respective ascending order. MTN and Vodacom met ICASA's 3% DCR target, while Cell C and Telkom did not meet the DCR target. There was no statistically significant difference in results between MTN, Telkom and Vodacom. Cell C's results show statistically significance difference in relation to other operators' results. The highest recorded DCR was Cell C with 6.25% and Vodacom was the lowest with 2.40%.

3.2 Analysis of the serving technology

Figure 6 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 and MTN serving technology distribution was mainly on WCDMA technologies, while Vodacom and Telkom distribution was on both WCDMA and LTE technologies.



	MTN	Telkom	Vodacom	Cell C
GSM	0.00	4.69	2.75	3.91
WCDMA	99.58	73.06	70.75	95.72
LTE	0.00	21.81	26.32	0.00
No Service	0.42	0.45	0.18	0.38

Figure 6: Technology Distribution

The maps in Appendix 6.3.1 show the geographic areas where the radio access technology was selected by the mobile device.

4 RESPONSES TO MEASUREMENT RESULTS FROM OPERATORS

A draft report similar to section 1, 2, 3, 5 and 6 of this report, was provided to operators for their comments. Also provided were the log files with all measurement results. The information enables operators to critically review the Authority's measurements and provide comment, as well as provide a network improvement plan. The responses from the operators are summarised in Appendix 6.2.

5 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.

As we benchmark the operators, the results show that in terms of overall Call Setup Success Ratio, MTN met the Accessibility target with a CSSR of above 98%, whereas Vodacom, Telkom and Cell C failed to meet the Accessibility target with the CSSR values below 98% target. In terms of the overall Drop Call Ratio, Cell C

and Telkom did not meet the DCR target of less than 3%, while Vodacom and MTN met the DCR target, thus meeting the Retainability target.

6 APPENDICES

6.1 Appendix A: Detailed test results

Table 4: Drop call ratio (DCR) per Route

		Phase 1			Phase 2			Total		
Route Name	Operator	Call Established	Call Dropped	DCR (%)	Call Established	Call Dropped	DCR (%)	Call Established	Call Dropped	DCR (%)
Botshabelo	Telkom	189	2	1.06%	175	5	2.86%	364	7	1.92%
	Cell C	170	5	2.94%	166	5	3.01%	336	10	2.98%
	Vodacom	187	4	2.14%	184	2	1.09%	371	6	1.62%
	MTN	196	6	3.06%	135	1	0.74%	331	7	2.11%
Bethlehem	Telkom	92	3	3.26%	129	4	3.10%	221	7	3.17%
	Cell C	101	10	9.90%	124	15	12.10%	225	25	11.11%
	Vodacom	107	6	5.61%	141	4	2.84%	248	10	4.03%
	MTN	115	1	0.87%	146	3	2.05%	261	4	1.53%
Ladybrand	Telkom	165	7	4.24%	155	14	9.03%	320	21	6.56%
	Cell C	148	14	9.46%	135	14	10.37%	283	28	9.89%
	Vodacom	192	5	2.60%	185	9	4.86%	377	14	3.71%
	MTN	182	7	3.85%	185	8	4.32%	367	15	4.09%
Kroonstad	Telkom	143	0	0.00%	140	2	1.43%	283	2	0.71%
	Cell C	100	1	1.00%	128	4	3.13%	228	5	2.19%
	Vodacom	136	1	0.74%	145	0	0.00%	281	1	0.36%
	MTN	139	0	0.00%	123	1	0.81%	262	1	0.38%
Sasolburg	Telkom	130	2	1.54%	137	5	3.65%	267	7	2.62%
	Cell C	118	4	3.39%	137	11	8.03%	255	15	5.88%
	Vodacom	149	4	2.68%	159	3	1.89%	308	7	2.27%
	MTN	153	3	1.96%	160	7	4.38%	313	10	3.19%

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

		PHASE 1				PHASE 2				TOTAL			
Route Name	Operator	Call Attempt	Call Setup	User Busy	CSSR (%)	Call Attempt	Call Setup	User Busy	CSSR (%)	Call Attempt	Call Setup	User Busy	CSSR (%)
Botshabelo	Telkom	525	522	0	99.43%	478	474	0	99.16%	1003	996	0	99.30%
	Cell C	549	530	0	96.54%	508	498	0	98.03%	1057	1028	0	97.26%
	Vodacom	610	597	0	97.87%	547	530	0	96.89%	1157	1127	0	97.41%
	MTN	608	601	0	98.85%	546	541	0	99.08%	1154	1142	0	98.96%
Bethlehem	Telkom	394	380	0	96.45%	319	306	0	95.92%	713	686	0	96.21%
	Cell C	454	434	0	95.59%	438	426	0	97.26%	892	860	0	96.41%
	Vodacom	512	493	0	96.29%	473	442	0	93.45%	985	935	0	94.92%
	MTN	553	543	0	98.19%	501	490	0	97.80%	1054	1033	0	98.01%
Ladybrand	Telkom	498	459	0	92.17%	551	510	0	92.56%	1049	969	0	92.37%
	Cell C	619	597	1	96.60%	560	418	0	74.64%	1179	1015	1	86.16%
	Vodacom	476	424	0	89.08%	627	596	0	95.06%	1103	1020	0	92.48%
	MTN	656	637	0	97.10%	545	527	0	96.70%	1201	1164	0	96.92%
Kroonstad	Telkom	412	385	0	93.45%	479	473	0	98.75%	891	858	0	96.30%
	Cell C	464	462	0	99.57%	448	445	0	99.33%	912	907	0	99.45%
	Vodacom	507	482	0	95.07%	511	467	0	91.39%	1018	949	0	93.22%
	MTN	517	508	0	98.26%	516	511	0	99.03%	1033	1019	0	98.64%
Sasolburg	Telkom	436	427	0	97.94%	477	460	0	96.44%	913	887	0	97.15%
	Cell C	447	422	0	94.41%	372	361	0	97.04%	819	783	0	95.60%
	Vodacom	478	466	0	97.49%	511	504	0	98.63%	989	970	0	98.08%
	MTN	410	404	0	98.54%	480	467	0	97.29%	890	871	0	97.87%

6.2 Appendix B: Summary of operators' responses

A summary of the response received from operators is provided below.

6.2.1 Vodacom

- Vodacom acknowledged the existence of issues in the low performing areas and shared the following remedial actions:

- Ladybrand route – Issues in the Ladybrand area are associated with poor coverage. On the other hand, spectrum utilisation is a challenge since this area borders Lesotho. New sites have been planned to resolve coverage related areas. 2G to 3G (U900) refarming is also planned in the area to extend 3G coverage and improve performance however the operator expects GSM quality to degrade after this exercise. New sites and refarming projected on air date is June 2018.

- Botshabelo route – An interim solution which was to adjust cell range parameters in the cells serving the area was implemented in November 2017. A permanent solution is to add a new site with projected on-air date of September 2018.

- Kroonstad route – There were issues with database settings of the cells serving the area and the settings were adjusted. Addition of a new site and of U900 refarming have projected on-air dates of September 2018 and June 2018 respectively.

- Bethlehem route – Failures occurred due to poor 3G coverage in the area. Challenges exist due to terrain and poor propagation properties of the 2100 MHz spectrum. 900 MHz spectrum refarming is planned for June 2017.

- Failures were found to be due to poor 3G coverage, new sites have been planned in these areas but 2100 MHz 3G will not be able to provide contiguous coverage due to the amount of capital expenditure involved due limited coverage footprint in this spectrum.

- The operator also highlighted that the test areas could be better served by the release of 800 MHz spectrum.

- In the interim U900 refarming will be done, but it should be noted that this exercise will compromise, in turn, 2G quality.

6.2.2 MTN

MTN submitted that it has reviewed the Authority's draft report and noted that out of five areas measured it only failed the CSSR target in Ladybrand and Sasolburg. The remedial actions to improve quality of service include:

- Botshabelo route – Down-tilting has been conducted in five sites to provide quality and coverage improvements. Two additional sites will be deployed in 2018.

- Bethlehem route – MTN recognises that some calls could not be set up due to poor coverage and has scheduled optimisation on three sites.

- Sasolburg route – Lack of coverage in the area was identified and two additional sites will be integrated during the course of 2018. Three sectors were optimised to improve capacity and coverage.

- Ladybrand route – MTN acknowledges that it experienced network issues resulting in one site being down during the Authority's drive-test. Thus the unavailability of the base station had an adverse effect on the overall network performance in the area. MTN has identified four sites that require optimisation and has scheduled tilt changes to improve quality and coverage in the area.

- Kroonstad route – One site was down during the drive-test. Two new sites will be integrated in the network during the course of 2018 and three sites will be optimised.

MTN highlighted that it had the highest call setup success rate of all operators, which was 2% higher than any other operator and 0.01% below the best dropped call rate. Since the time the Authority conducted the drive-tests, MTN has initiated optimisation of several sites to address coverage and quality aspects. A total of six additional sites will be built and integrated into MTN's network during the course of 2018.

6.2.3 Cell C

Cell C highlighted the lack of its own network coverage in some of the areas tested. In these areas Cell C relies on national roaming arrangements with Vodacom's network. Cell C's plans and remedies in the low performance areas include the following:

- Cell C has project plans for the future to have site roll-out, capacity and transmission routes improved and optimised in the low performing areas.
- Cell C is further testing seamless handover with its roaming partner Vodacom.
- Optimisation and capacity initiatives are taking place in the regions to complement the existing coverage.
- New sites are planned to be built in poor performing areas.

6.2.4 Telkom

Telkom gave the following response to the Authority's draft report:

- ICASA's drive tests give a snapshot of network performance on the specific day and time and is not a true representation of the overall network performance. Nevertheless, Telkom views the test results as very significant and use them as additional input to further improve the quality of the mobile network.
- Telkom, as the fourth entrant in the mobile market, depends on a national roaming agreement with roaming partner MTN, to cater for areas with limited or no Telkom coverage. Having a roaming agreement is particularly important to Telkom as they don't have access to the 900 MHz frequency band, which is a crucial requirement for the cost-effective deployment of national coverage, specifically in rural areas. Nevertheless, Telkom continues to extend its network coverage including in rural areas, to the extent possible.
- Telkom acknowledges that poor network coverage contributed to not meeting all performance objectives in some of the areas tested. However, Telkom is in

a process of planning and building additional sites that are aimed at mitigating the poor coverage in the areas in question, the operator acknowledges that it is facing site acquisition challenges, which hamper these efforts.

- Regarding the Call Setup Success Ratio (CSSR) results in the test area, Telkom made the following comments:

    (i) Telkom is pleased that the Call Setup Success Rate (CSSR) was above the Authority's target threshold in the Botshabelo area.

    (ii) Telkom noted that it did not meet the CSSR target in Bethlehem, Kroonstad and Sasolburg by a small margin.

    (iii) Most of the failed CSSR in Ladybrand occurred on the roaming partner's network. Telkom currently does not have additional sites planned for the Ladybrand area and will continue to depend on the roaming partner.

    (iv) Telkom is planning additional sites in the Kroonstad area and 80% of these are currently in the Site Acquisition and Integration phase. These additional sites will further improve coverage and quality in this area.

    (v) The CSSR failures experienced on the Telkom network were mainly caused by poor coverage and network optimisation related issues, which are being addressed. From the network optimisation perspective, Telkom is engaging with the national roaming partner in an endeavour to improve the network.

- Regarding the Drop Call Ratio (DCR) results in the tested areas, Telkom made the following specific comments:

    (i) Telkom is pleased that in terms of the Drop Call Ratio (DCR), out of all the areas tested, the operator met the mandated threshold of 3% in the Botshabelo, Kroonstad and Sasolburg areas. Telkom has already planned additional sites in the Kroonstad area, out of which 80% are in the Site Acquisition and Integration phase. These additional sites will further improve coverage and quality of services in this area, even

though the network performance was already meeting the stipulated performance standards.

(ii) Telkom will continue to rely on the roaming partner for network coverage in areas such as Ladybrand as there are currently no sites planned. The operator will continue to engage MTN with a view of improving the customer's network experience.

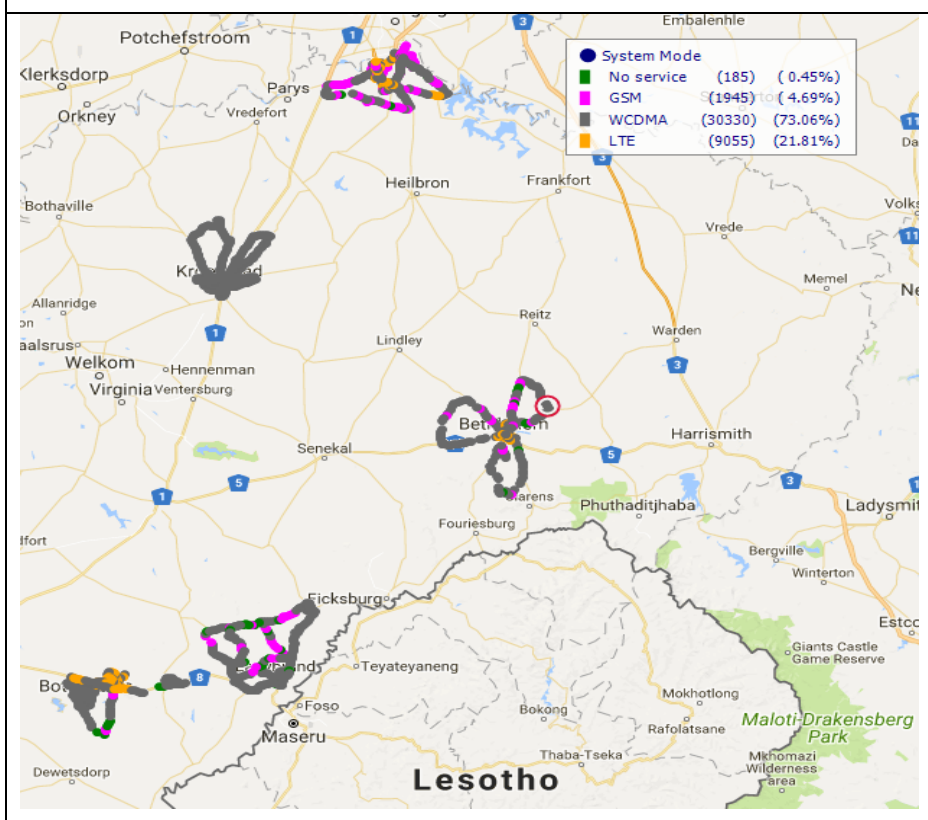
(iii) It is noted through the log files that UMTS was used mostly during the drive tests. However, most of the dropped calls emanated on GSM, which could be a result of the refarming of the GSM spectrum. The refarming of the 1800 MHz spectrum was done to improve national data connectivity. The impact of refarming the 1800 MHz spectrum on GSM is being monitored to mitigate the impact on GSM quality of service.

(iv) Telkom reiterates that the current service level agreement with the roaming partner does not discriminate between Telkom and MTN customers in terms of the quality of service provisioning and applies on a national basis. Therefore, the operator expects customers to enjoy a similar QoS as experienced by MTN customers.

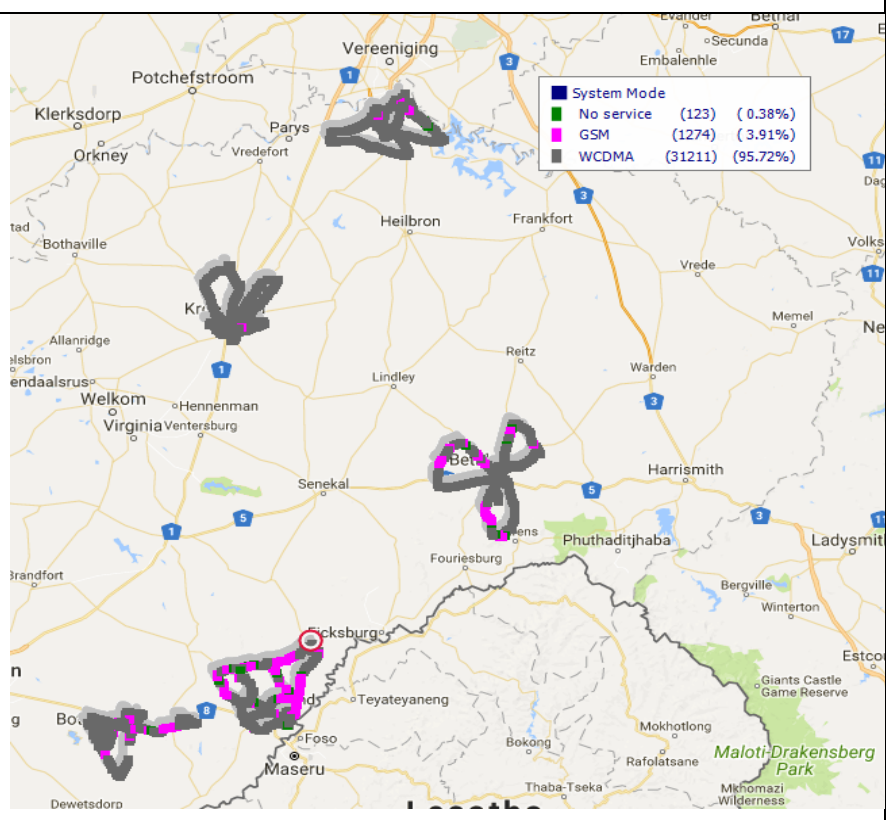
6.3 Appendix C: Coverage maps

6.3.1 Serving technology maps

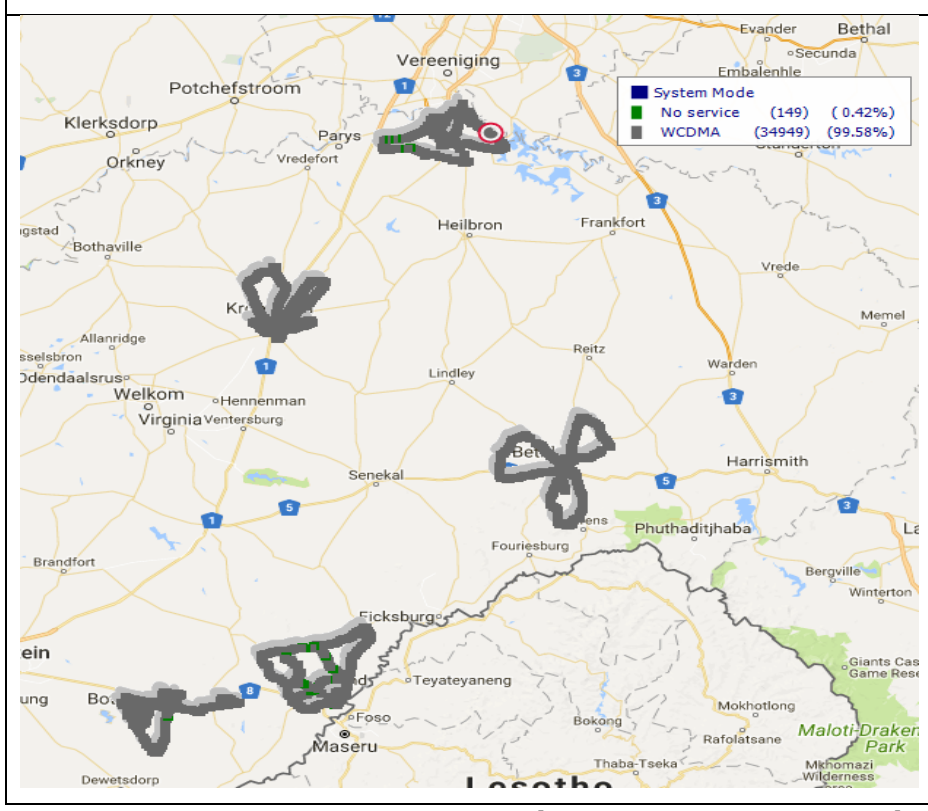
Telkom



Cell C



MTN



Vodacom

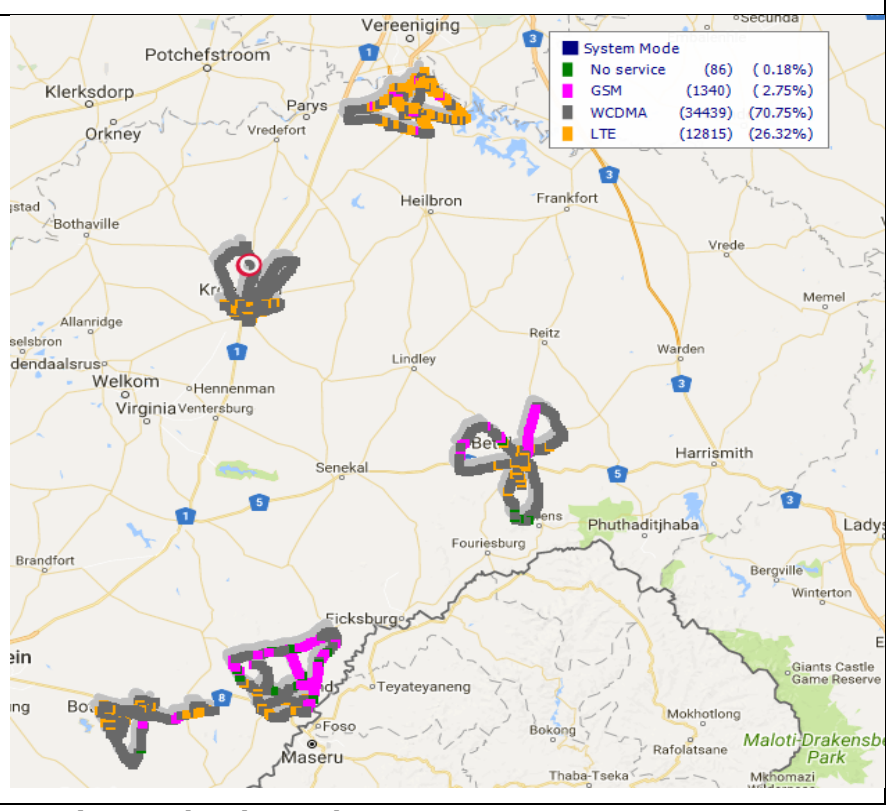


Figure 7: Free State Province Serving Technology Plot