



NATIONAL COMMUNICATIONS AUTHORITY

Quality of Service (QoS) Monitoring of Cellular Mobile Voice Services- EASTERN REGION

[August 2015]

[Communications for Development]

**QUALITY OF SERVICE (QoS) MONITORING OF CELLULAR MOBILE VOICE SERVICES IN EASTERN
REGION, AUGUST 2015**

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Background

In pursuance of Annexure D1 and D2 of the Cellular Mobile Licence of Telecommunication Operators, the consumer perspective of the quality of voice services are tested to ensure the compliance of Operators to the obligations on service quality to the user.

The report is based on findings on quality of service in Eastern region from August 2015 for all Operators except for Espresso due to their technical challenges. Tigo and Airtel networks could not be measured in Begoro due to an unstable network. Glo was not available at Nkawkaw, Kade, Begoro, Akosombo and Yilo Krobo.

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What we measure

The Quality of Service monitoring system measures many parameters including coverage signal strength and voice quality. These parameters are in the 3G licence, a complementary licence to the Cellular Mobile Licence. The Voice Quality is measured by an ITU standard P.863 fondly called (POLQA) Perceptual Objective Listening Quality Assessment.

As per the Cellular Mobile licence obligations, the QoS indicators and their respective threshold for compliance under assessment considering the user's perspective are as below;

- **Stand-alone Dedicated Control Channel (SDCCH) Congestion Rate**
- **Call Setup Time (CST)**
- **Call Congestion Rate**
- **Call Drop Rate (CDR)**
- **Voice Call Audio Quality**
- **Coverage Signal Strength**

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Findings

The results for the cities and towns tested during the period are as below:

a) Stand-alone Dedicated Control Channel (SDCCH) Congestion Rate

SDCCH Congestion Rate should be equal or less than one per cent (1%).

SDCCH Congestion is defined as the probability of failure of accessing a stand-alone dedicated control channel during call set up.

For analysis and calculations,

$$\text{SDCCH Congestion}[\%] = \frac{\text{Number of connect fails due to Immediate Assignment Failures}}{\text{MOC call attempts}} \times 100\%$$

Table 1. Signalling Congestion Rate Cellular Mobile Voice Service, August 2015

Month	Town	MTN	Vodafone	Tigo	Airtel	Glo
August	Nkawkaw	0	0	0	0	No Network
August	Kade	0	0	0	0	No Network
August	Akim- Oda	0	0	0	0	0
August	Asamankese	0	0	0	0	0
August	Nsawam	0	0	0	0	0
August	Koforidua	0	0	0	0	0
August	Begoro	0	0	No Network	No Network	No Network
August	Akosombo	0	0	0	0	No Network
August	Yilo Krobo	0	0	0	0	No Network

REMARK:

- ❖ All Operators were in compliance in tested towns with the signalling congestion threshold of less than 1 percent (1%).

b) Call Setup Time (CST)

CST should be less than ten seconds (<10secs) in 95% of cases.

Call Setup Time is the period of time elapsing from the sending of a complete destination address (target telephone number) to the setting up of a call to the receiving terminal;

$$\text{Call set - up time [s]} = t_{\text{alerting-signal}} - t_{\text{address-sending}}$$

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$t_{alerting\ signal}$ – Moment when an alerting signal is sent to the called terminal

$t_{address\ sending}$ – Moment user presses the SEND button on the calling terminal

Table 2. Call Setup Time of Cellular Mobile Voice Service, August 2015

Month	Town	MTN	Vodafone	Tigo	Airtel	Glo
August	Nkawkaw	7.73	11.33	9.75	16.4	No Network
August	Kade	7.23	6.04	6.59	6.33	No Network
August	Akim- Oda	7.725	8.44	6.41	6.83	4.13
August	Asamankese	7.147	5.35	7.08	5.53	3.99
August	Nsawam	5.23	9.38	6.59	15.5	10.38
August	Koforidua	9.95	11.915	6.58	16.6	5.9
August	Begoro	4.08	4.62	No Network	No Network	No Network
August	Akosombo	9.65	13.22		15.94	No Network
August	Yilo Krobo	8.47	8.45	8.91	16.1	No Network

REMARKS:

- ❖ MTN and Tigo met the licence condition for Call Setup Time in all the localities.
- ❖ Vodafone had Call Setup time delays in Nkawkaw, Koforidua and Akosombo.
- ❖ Airtel had Call Setup time delays in Nkawkaw, Nsawam, Koforidua, Akosombo and Yilo Krobo.
- ❖ Glo had Call Setup time delays at Nsawam.

c) Call Congestion Rate

Traffic Channel Congestion should be equal or less than one per cent (1%).

Call Congestion Rate is the probability of failure of accessing a traffic channel during call setup;

$$\text{Call Congestion } [\%] = \frac{\text{Number of Connect failed calls}}{\text{Total number of call attempts}} \times 100\%$$

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Table 3. Call Congestion Rate Cellular Mobile Voice Service, August 2015

Month	Town	MTN	Vodafone	Tigo	Airtel	Glo
August	Nkawkaw	0	0	0	0	No Network
August	Kade	0	0	0	0	No Network
August	Akim- Oda	0	0	0	0	0
August	Asamankese	0	0	0	0	0
August	Nsawam	0	0	0	0	0
August	Koforidua	0.4	0	1.27	0	0
August	Begoro	0	0	No Network	No Network	No Network
August	Akosombo	0	0	0	0	No Network
August	Yilo Krobo	0	0	0	0	No Network

REMARKS:

- ❖ All Operators except Tigo complied with the licence threshold of less than one percent (1%) in all the tested locations.
- ❖ Tigo has excessive congestion at Koforidua.

d) Call Drop Rate (CDR)

Call drop rate should be equal or less than three per cent (3%).

Voice Call Drop Rate is the probability of a call terminating without any of the users' will;

$$\text{Drop Rate } [\%] = \frac{\text{Number of calls terminated unwillingly}}{\text{Total number of call attempts}} \times 100\%$$

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Table 4. Call Drop Rate Cellular Mobile Voice Service, August 2015

Month	Town	MTN	Vodafone	Tigo	Airtel	Glo
August	Nkawkaw	0	0	0	0	No Network
August	Kade	0	0	0	0	No Network
August	Akim- Oda	0	0	0	0	0
August	Asamankese	0	0	0	0	0
August	Nsawam	0	0	0	0	0
August	Koforidua	0	0	0	0	0
August	Begoro	0	0	No Network	No Network	No Network
August	Akosombo	0	0	0	0	No Network
August	Yilo Krobo	0	0	0	0	No Network

REMARK:

- ❖ All operators were in compliance with the Call Drop Rate licence threshold of less than three percent (3%) in all localities tested.

Voice Call Audio Quality

- perceptibility of the conversation during a call. Voice Call Audio Quality is measured using a parameter called the Mean Opinion Score (MOS) which categorizes speech samples in ranges from 1 to 5. See legend below. This parameter is machine measured.

Range	Rating
(Min,1)	Very bad
(1,2)	Bad
(2, 3.2)	Poor
(3.2, 3.5)	Fair
(3.5, 3.9)	Good
(3.9, 5.01)	Very good
(5.01, Max)	Excellent

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Table 5. Speech Quality Mean Opinion Score Eastern Region, August 2015

Central Region	MTN	Vodafone	Tigo	Airtel	Glo
MOS	3.76	3.49	2.65	3.02	3.71

REMARK:

- ❖ MTN and Glo were assessed to give ‘GOOD’ speech quality.
- ❖ Vodafone and Airtel were assessed to give ‘FAIR’ speech quality.
- ❖ Tigo was assessed to give “POOR” speech quality.

REMEDIES

- ❖ The NCA has notified Operators of publication of these findings and has directed all Operators to improve their coverage in some localities by December 2015.
- ❖ Vodafone Ghana has been sanctioned for failing Call Setup Time in the region.




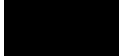
COVERAGE SIGNAL STRENGTH

COVERAGE AND SPEECH MAPS

The Maps below show the coverage level and speech quality in various towns where monitoring was performed. The coverage map is a combination of both 2G and 3G network signal strength. In each plot is a legend to indicate definitions of signal strength and quality range attain by operators during measurement.

Coverage levels in green falls in the rage of -85dBm and above are considered good. Those between -85 and -95dBm are considered fair and are indicated in yellow. The red samples represent poor coverage in the range of -95 to -110dBm. The black samples represent areas with no coverage. The speech quality was assessed with Mean Opinion Score (MOS) which ranges from 5 to 1.

Coverage Legend

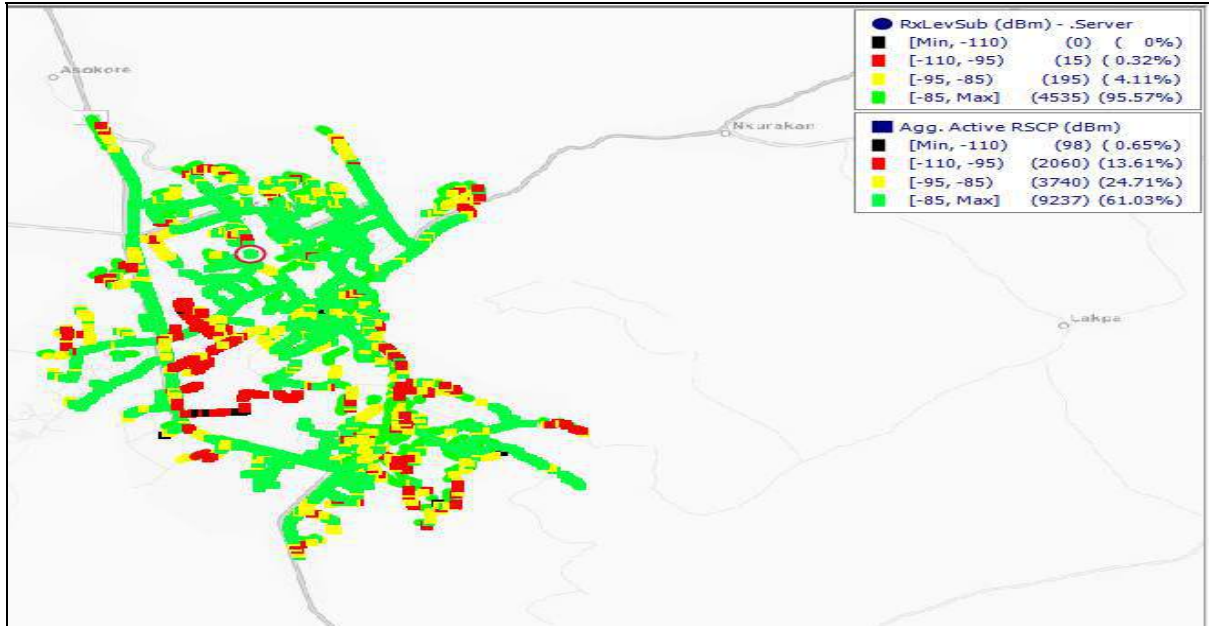
<i>Colour</i>	<i>Area Coverage Rating</i>
	Good Coverage Areas
	Fair Coverage Areas
	Poor Coverage Areas
	None Existent Coverage Areas

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APPENDIX I

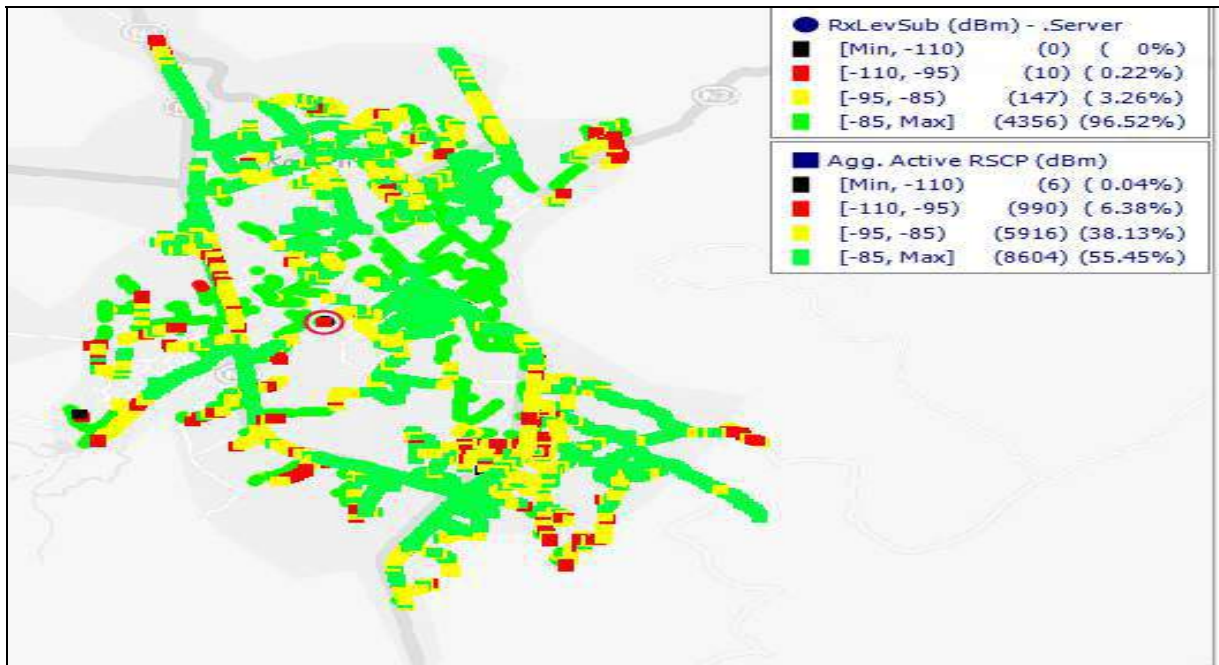
COVERAGE AT KOFORIDUA

Figure 1 – MTN Coverage, Koforidua metropolis – August 2015



Remarks: Good coverage yet requires improvement at Effiduase and surrounding areas.

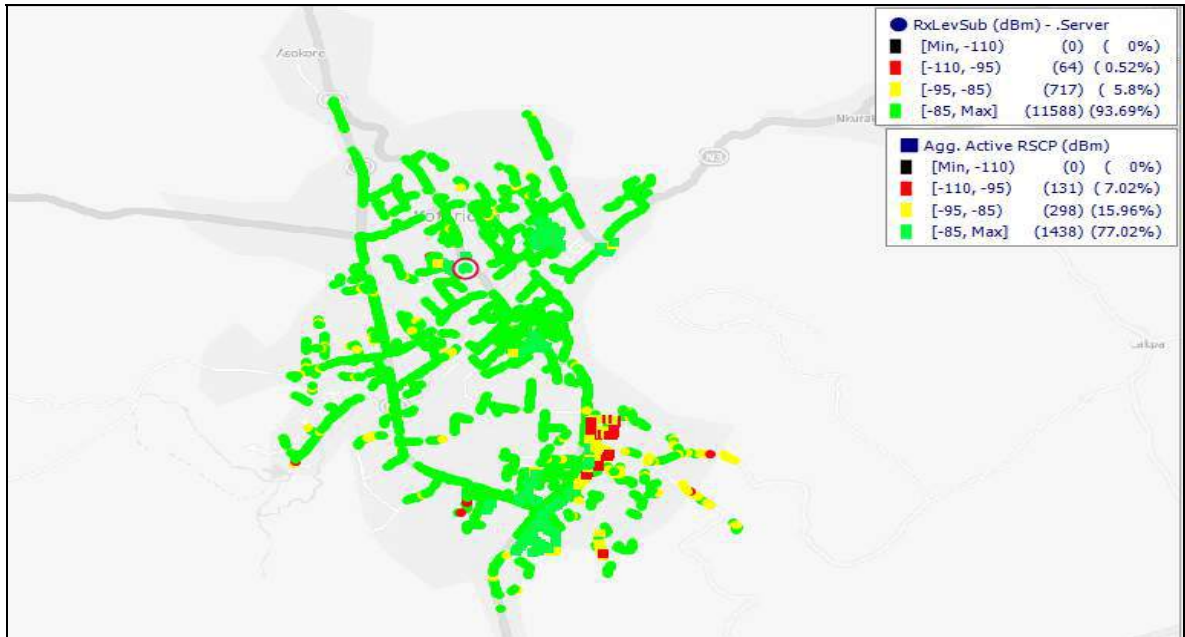
Figure 2 – Vodafone Coverage, Koforidua metropolis, August 2015



Remarks: Good network coverage with few scattered spots of poor coverage in the Koforidua metropolis.

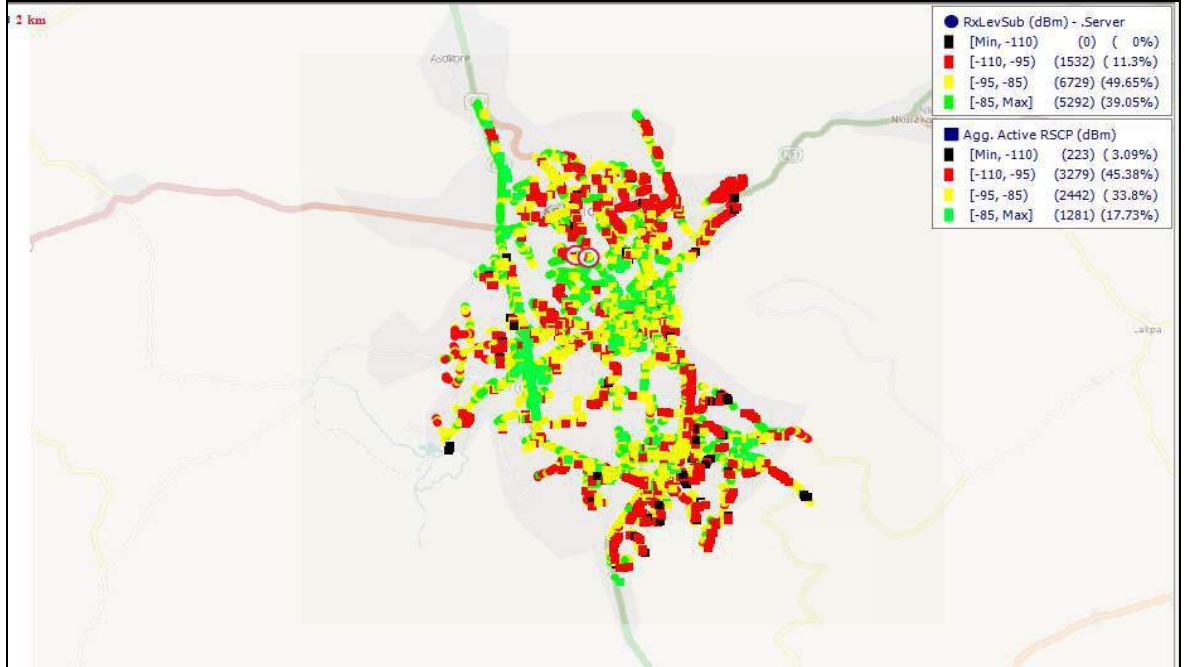
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Figure 3 – Tigo Coverage, Koforidua – August 2015



Remarks: Good network coverage.

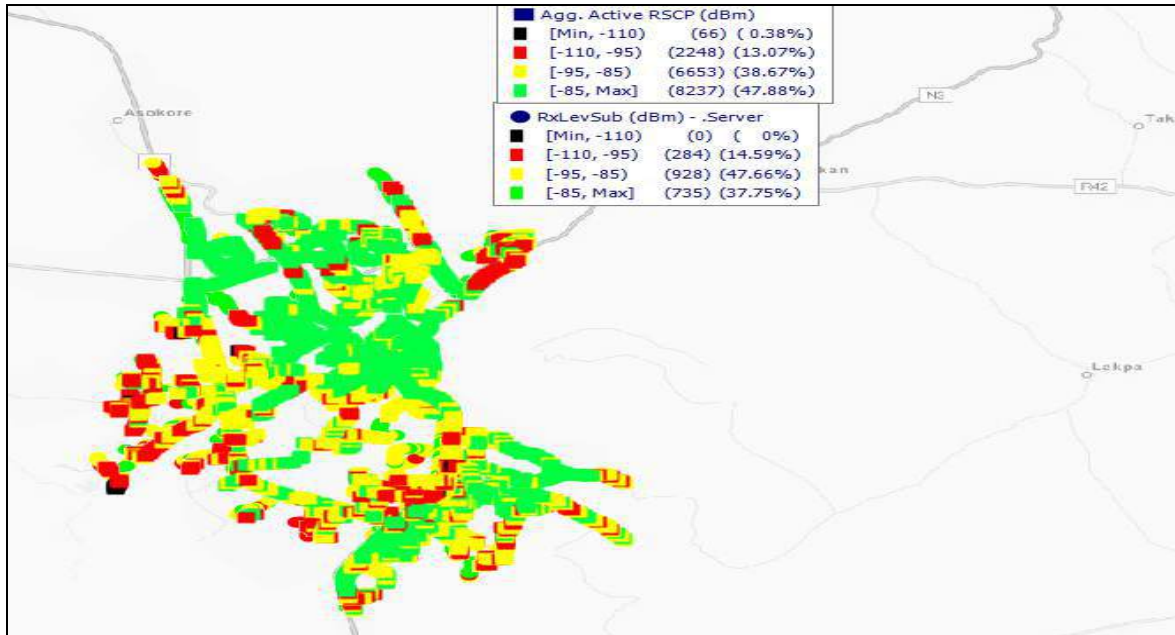
Figure 4- Airtel Coverage, Koforidua- August 2015



Remarks: Poor network coverage across. Major improvement is needed especially around Koforidua new town, Adweso and Asokore areas.

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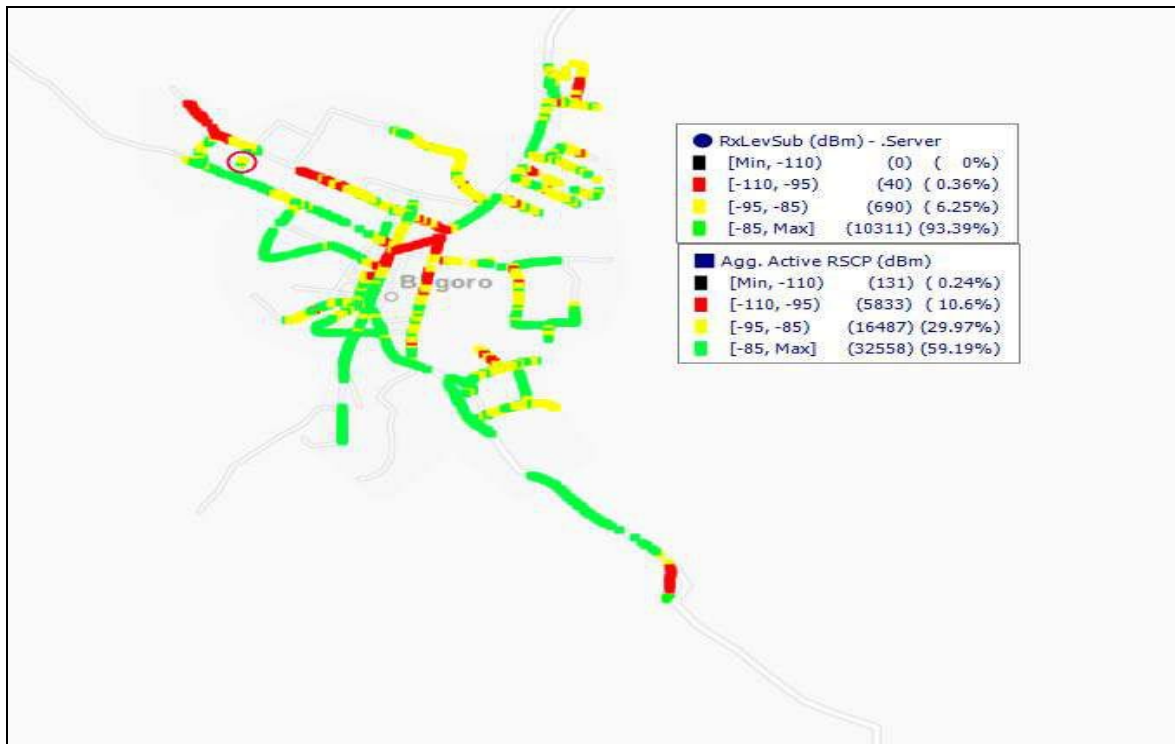
Figure 5 – Glo coverage, Koforidua metropolis –August 2015



Remark: Good coverage yet improvement is needed at Asokore, Mile 50 and Effiduase areas.

COVERAGE AT BEGORO

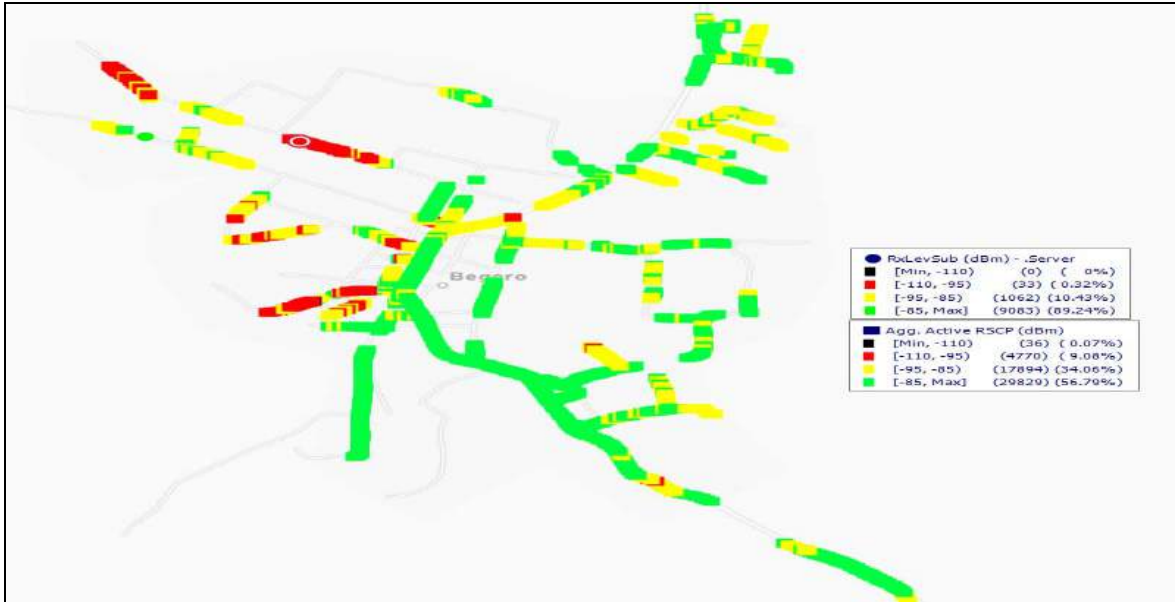
Figure 6 – MTN Coverage, Begoro -August 2105



Remarks: Good coverage but needs improvement at Begoro Goil Station

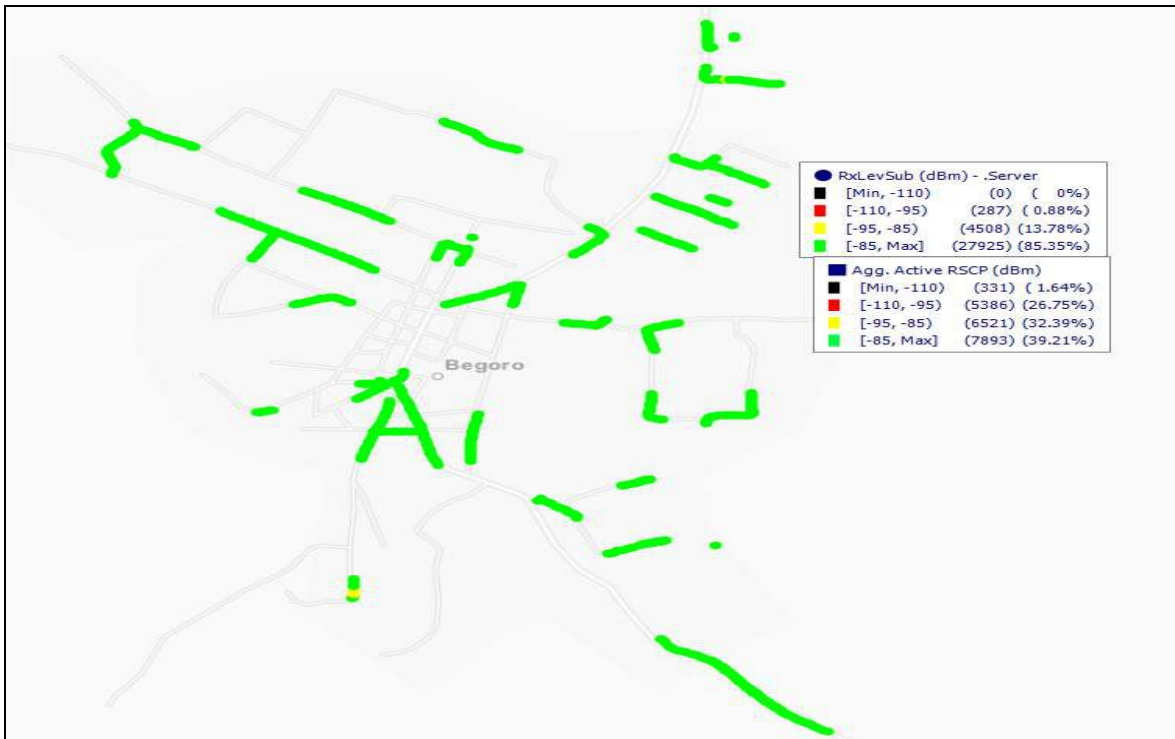
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Figure 7 – Vodafone Coverage, Begoro August 2015



Remarks: Good coverage but needs improvement around Begoro Odumase area

Figure 8 – Tigo Coverage, Begoro –August 2015

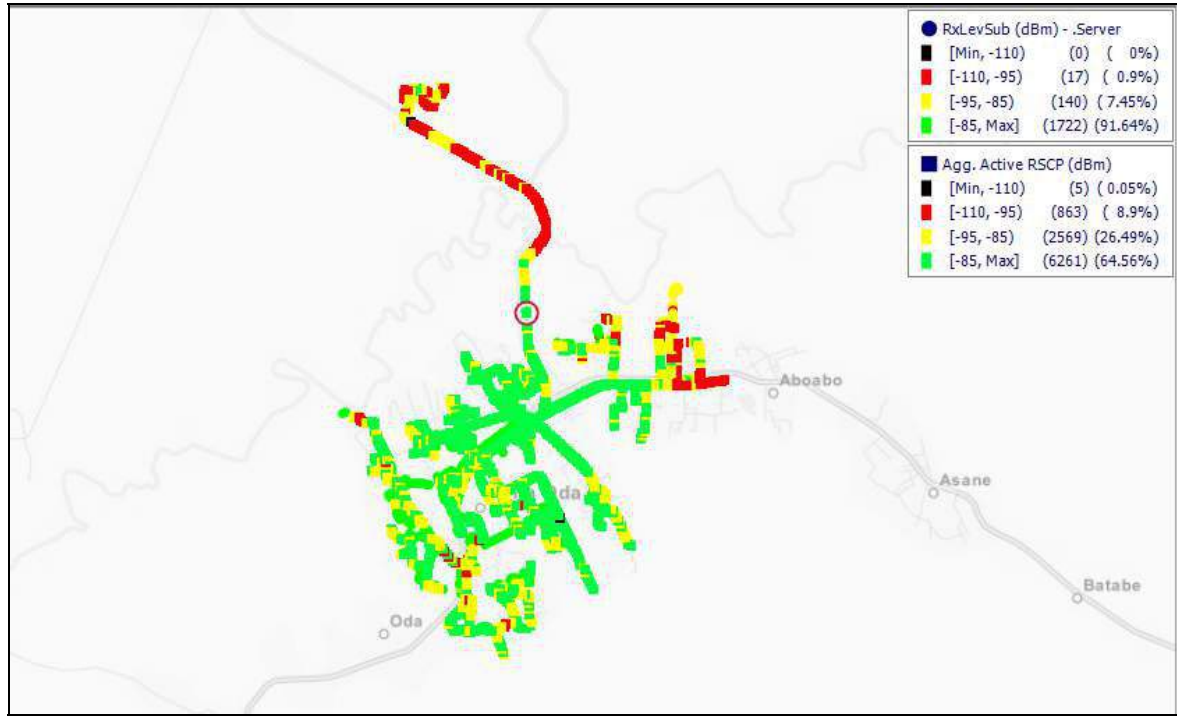


Remarks: Good 2G coverage

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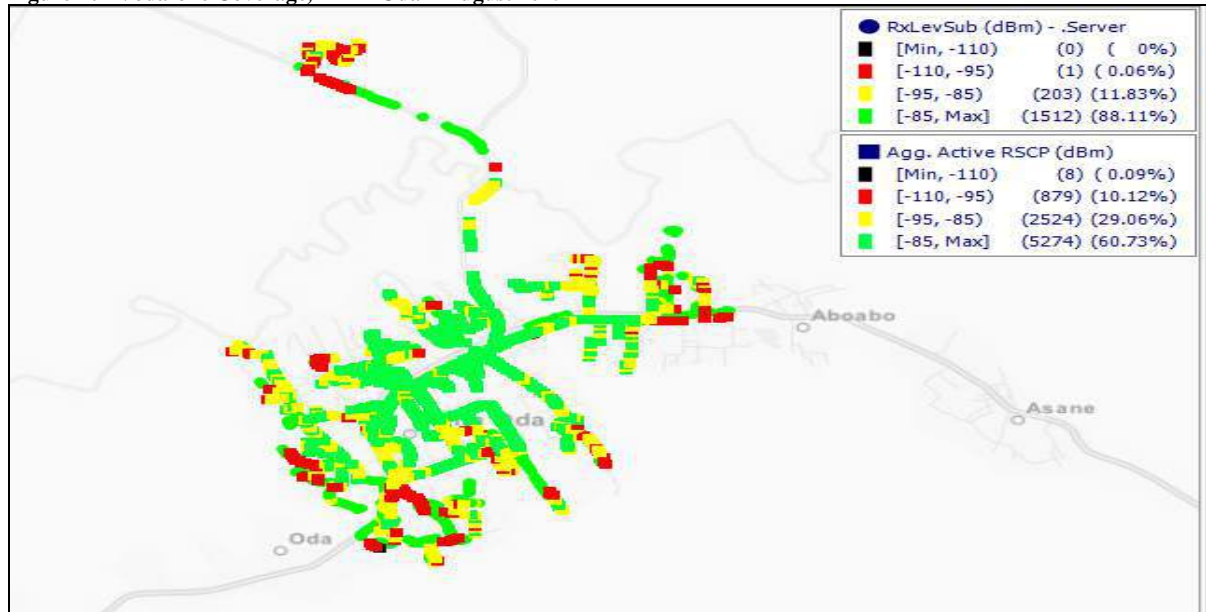
COVERAGE AT AKIM ODA

Figure 9 – MTN Coverage, Akim-Oda – August 2015



Remarks: Good coverage yet requires improvement towards Aboabo

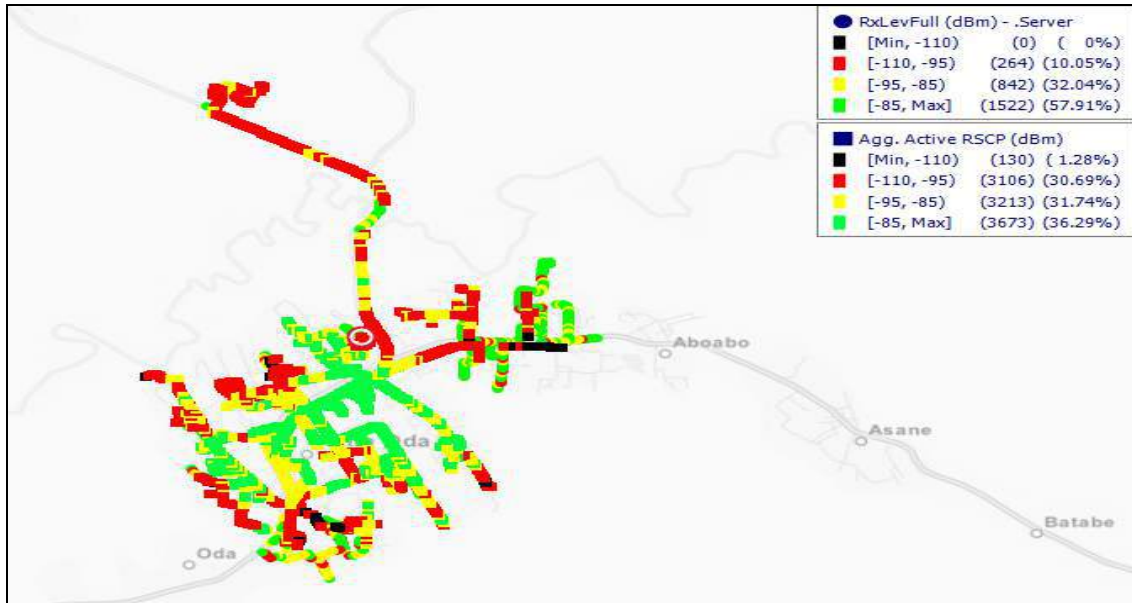
Figure 10– Vodafone Coverage, Akim-Oda – August 2015



Remarks: Good coverage yet improvement is needed at Oda-zongo community.

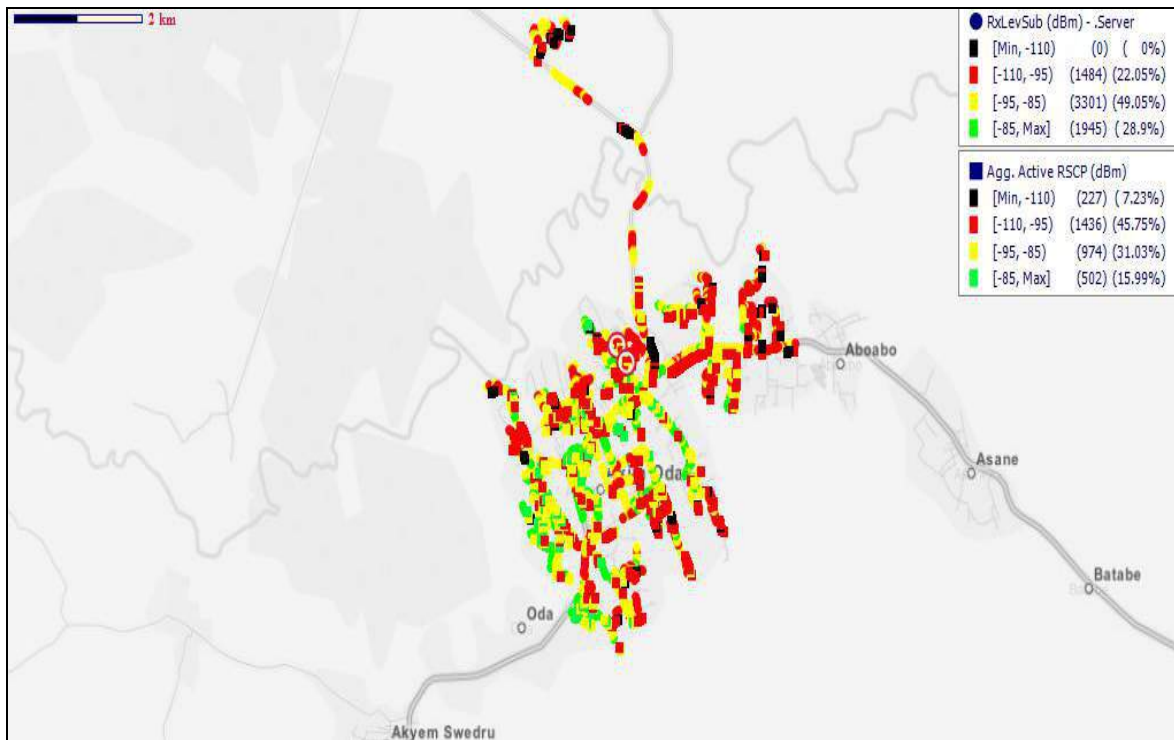
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Figure 11 – Tigo Coverage, Akim- Oda-August 2015



Remarks: Partly good coverage with equal percentage of poor coverage across Akim- Oda especially around the main station. Major improvement is needed.

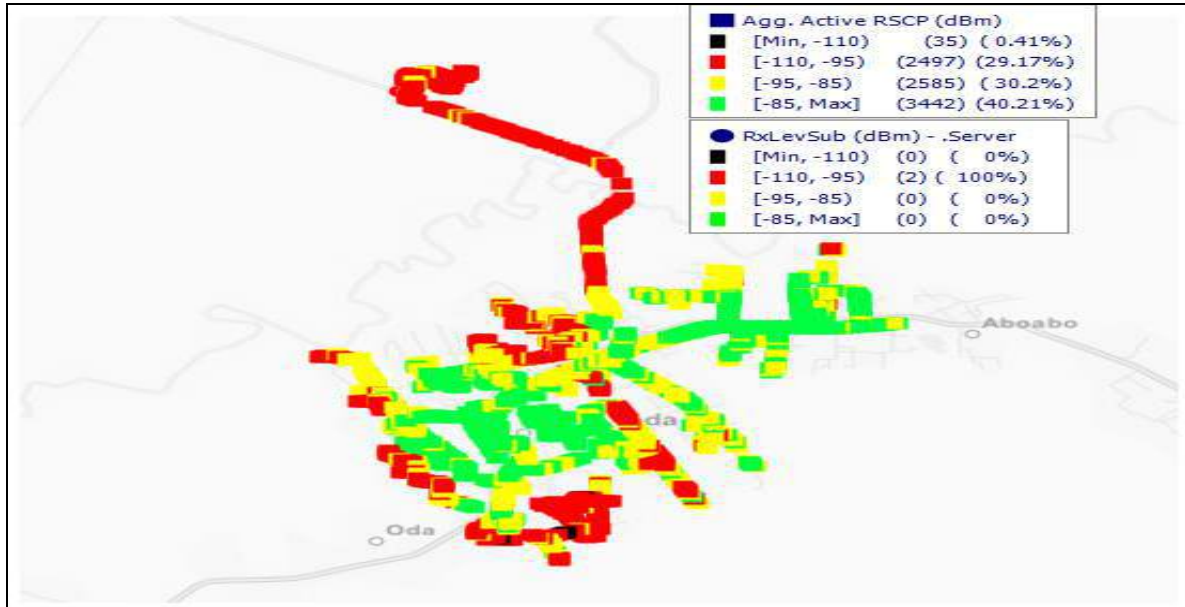
Figure 12 – Airtel Coverage, Akim Oda- August 2015.



Remarks: Poor network coverage across the township. Major Improvements needed in Akim-Oda locality especially the Asene-Aboabo community.

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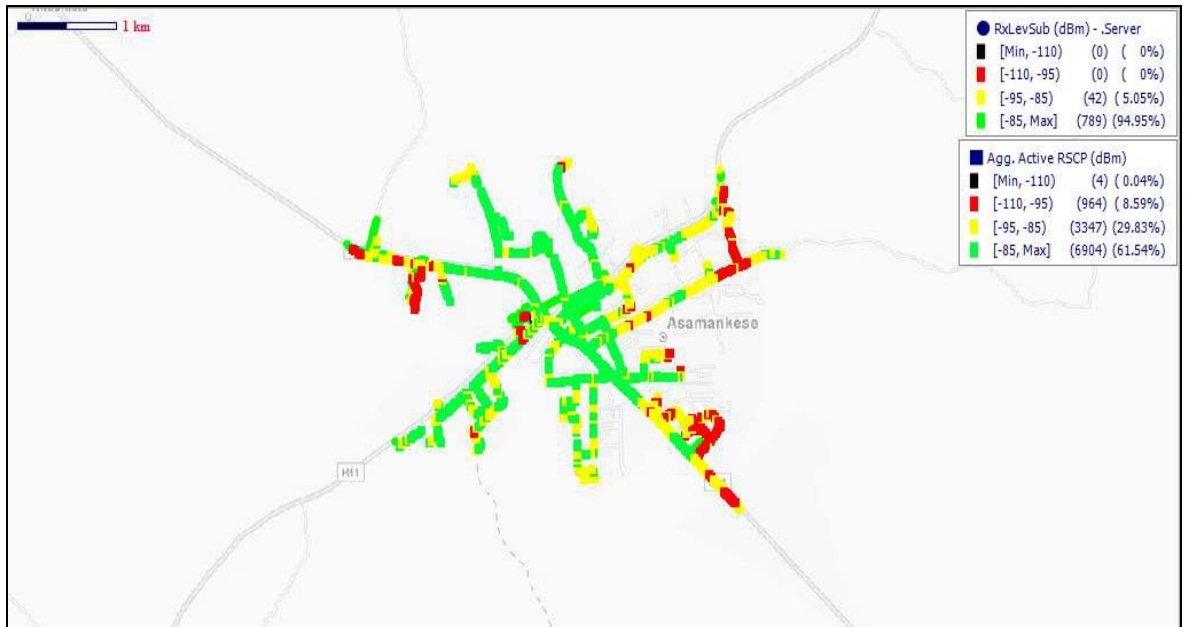
Figure 13 – Glo coverage, Akim-Oda - August 2015



Remarks: Poor coverage. Major improvement required.

COVERAGE AT ASAMANKESE

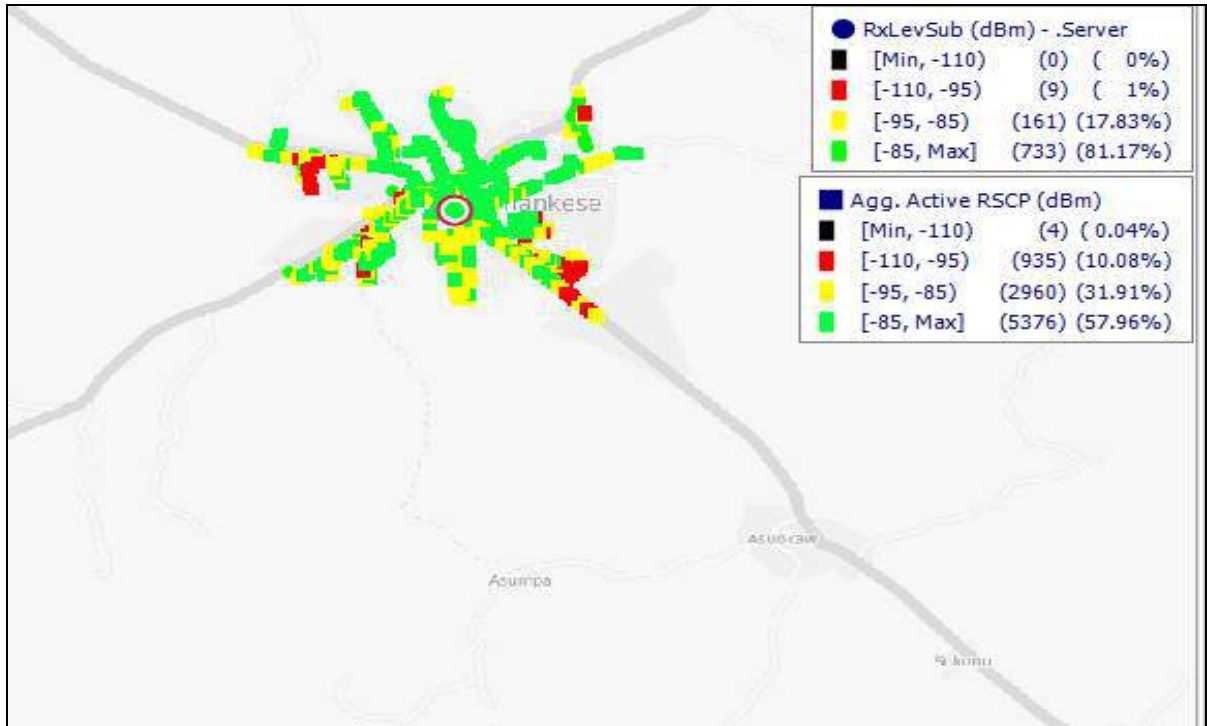
Figure 14 – MTN Coverage –August 2015



Remarks: Good coverage yet needs improvement around the main Lorry station and other areas at the outskirts.

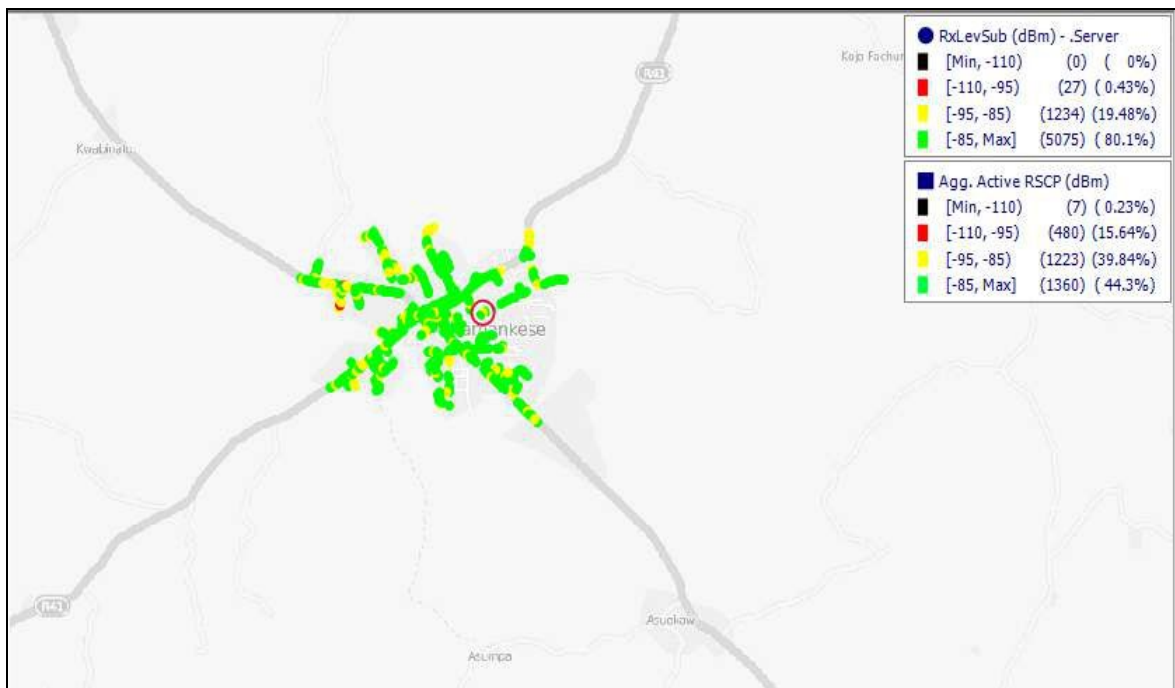
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Figure 15– Vodafone Coverage, Asamankese – August 2015



Remarks: Good coverage but requires improvements at the outskirts.

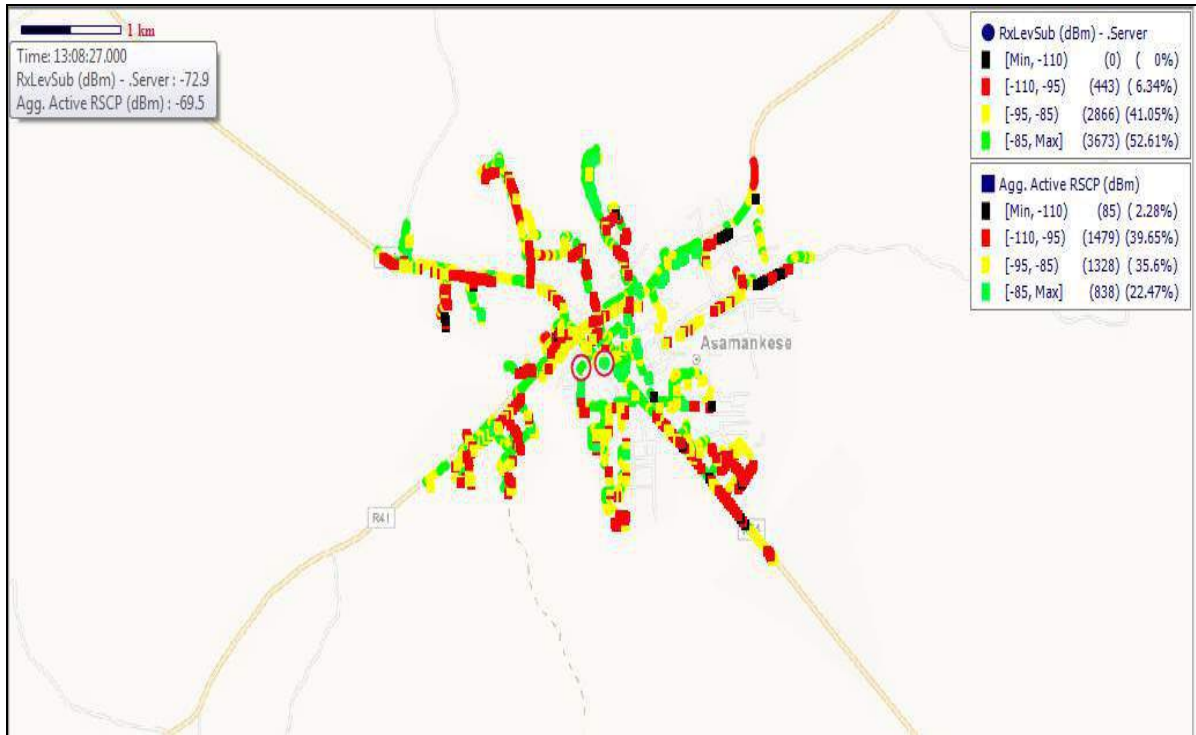
Figure 16 – Tigo Coverage, Asamankese – August 2015



Remarks: Good coverage.

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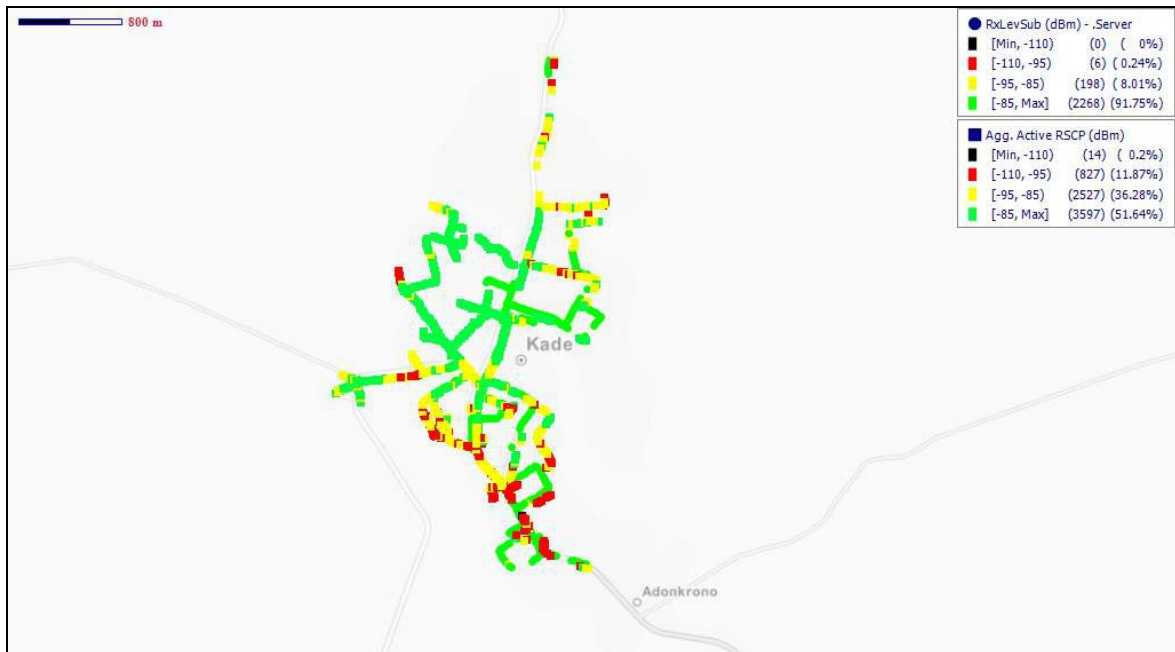
Figure 17 – Airtel Coverage, Asamankese-August 2015



Remarks: Over all fair coverage with patches of poor coverage scatted over the township. Improvement is needed.

COVERAGE AT KADE

Figure 18 – MTN Coverage, Kade – August 2015



Remarks: Good coverage yet requires improvement around the main station.

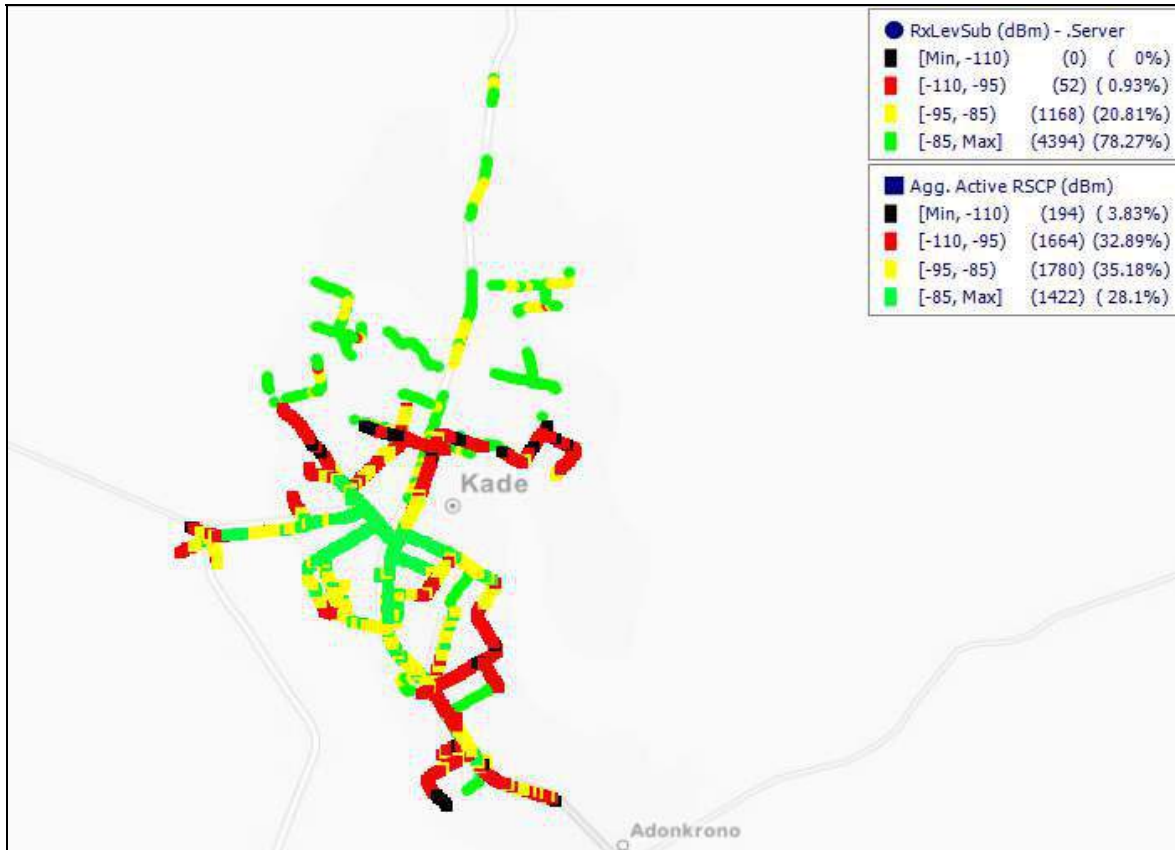
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Figure 19 –Vodafone Coverage, Kade – August 2015



Remarks: Good coverage.

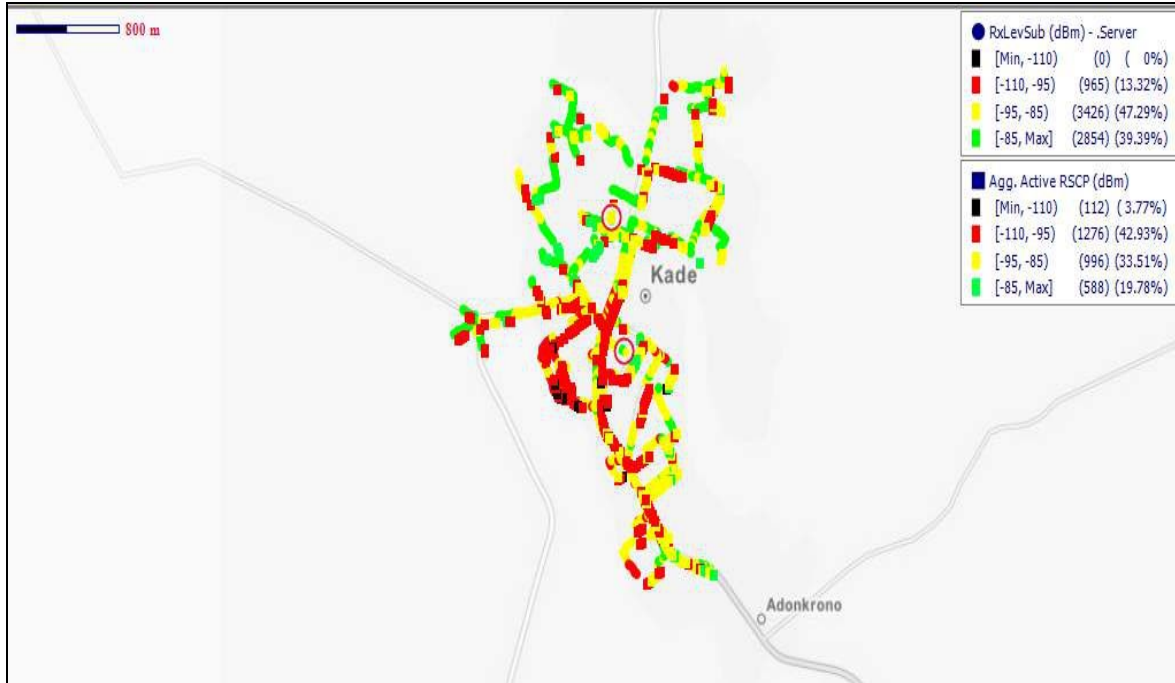
Figure 20 – Tigo Coverage, Kade –August 2015



Remarks: Partly poor coverage. Improvement is needed especially at the Kade main station and the Adonkrono area.

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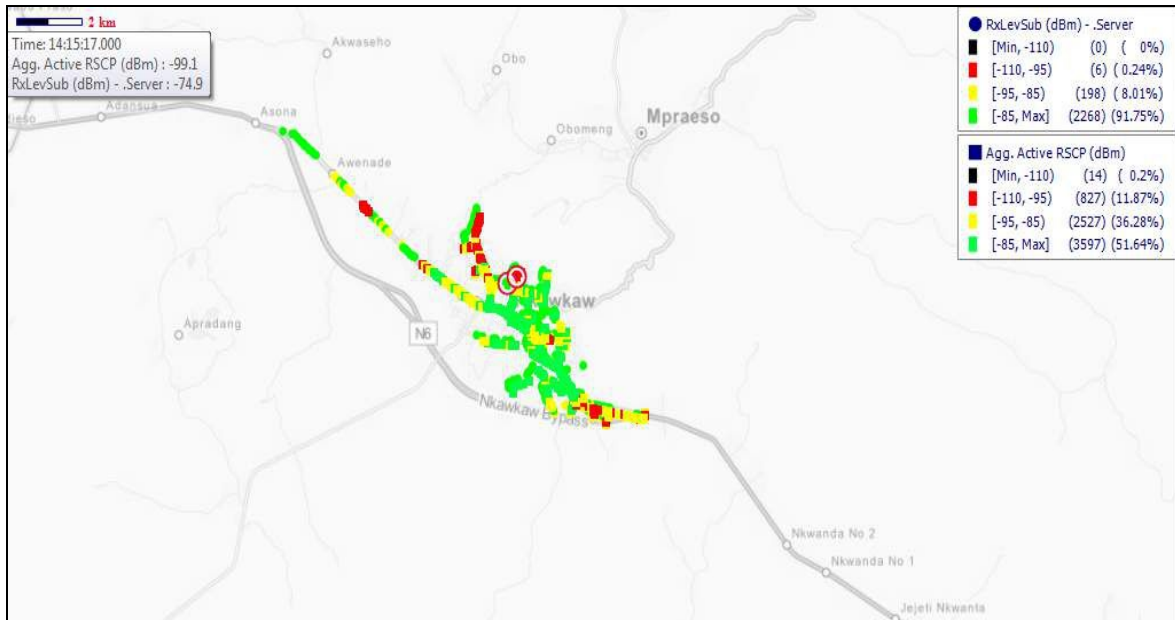
Figure 21 – Airtel Coverage, Kade- August 2015



Remarks: Poor network coverage across parts of Kade Township. Major improvement is needed.

COVERAGE AT NKAWKAW

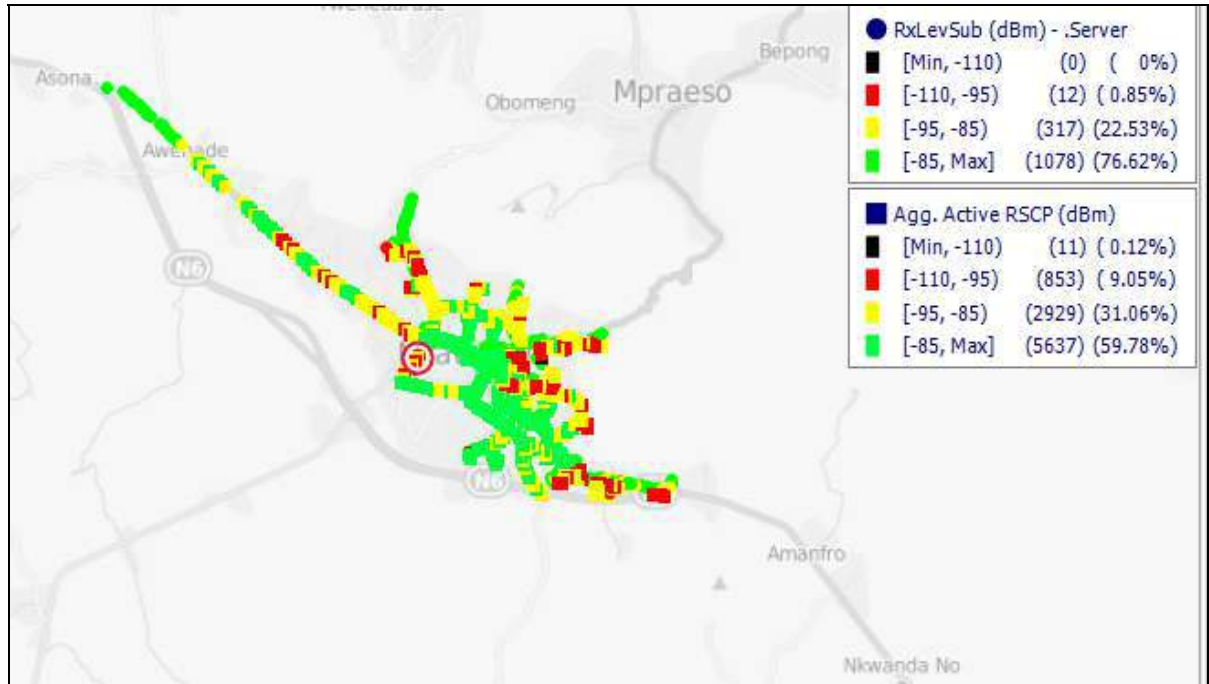
Figure 22 – MTN Nkawkaw -August 2015



Remarks: Good Coverage.

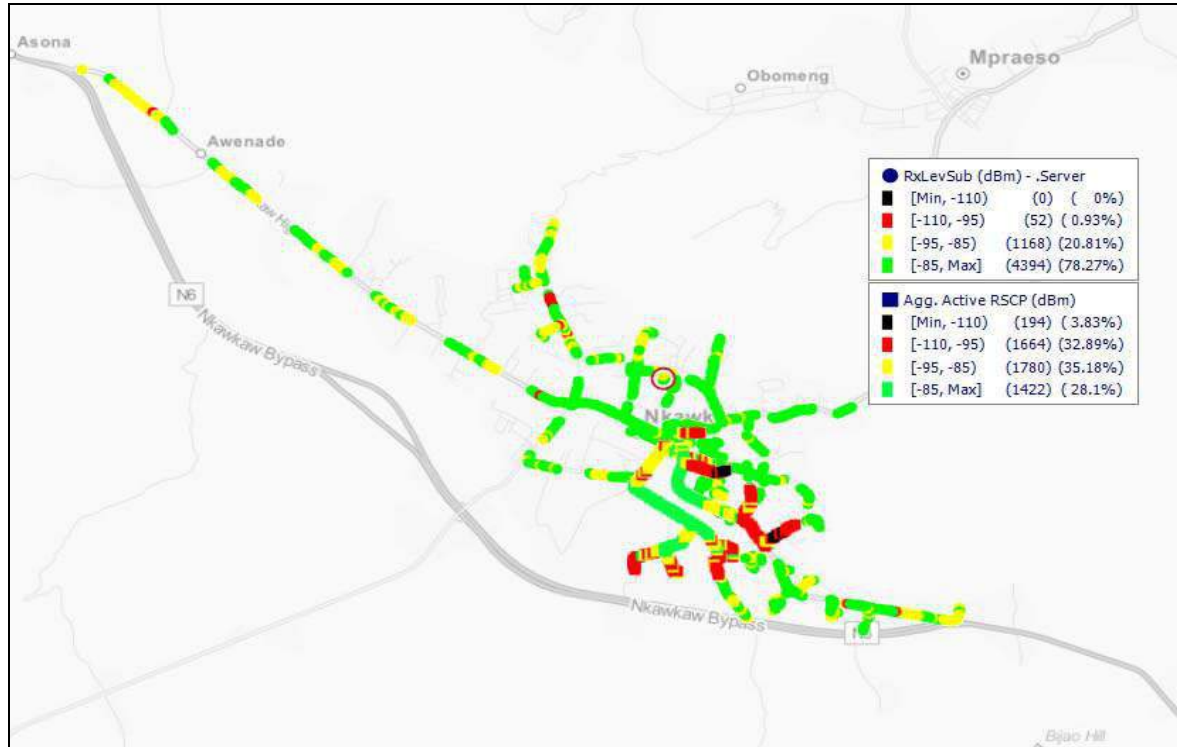
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Figure 23– Vodafone Coverage, Nkawkaw –August 2015



Remarks: Good Coverage yet improvement is needed at the eastern side of the township.

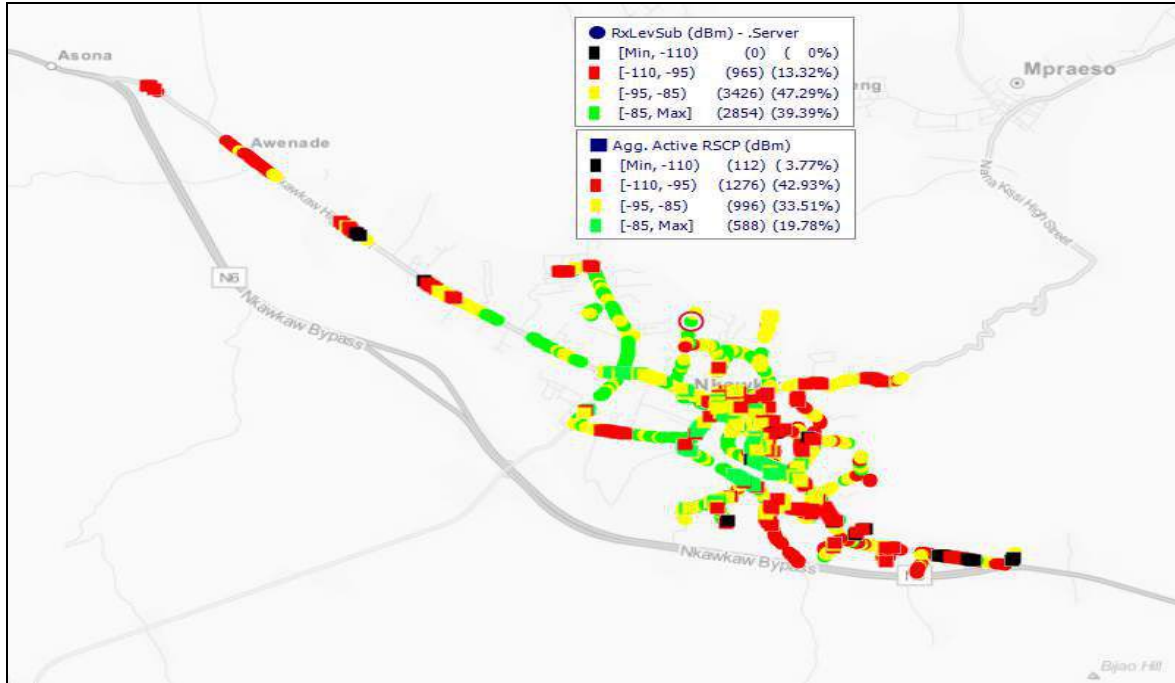
Figure 24 –Tigo Coverage, Nkawkaw –August 2015



Remarks: Good coverage but needs improvement on the Nkawkaw bypass road.

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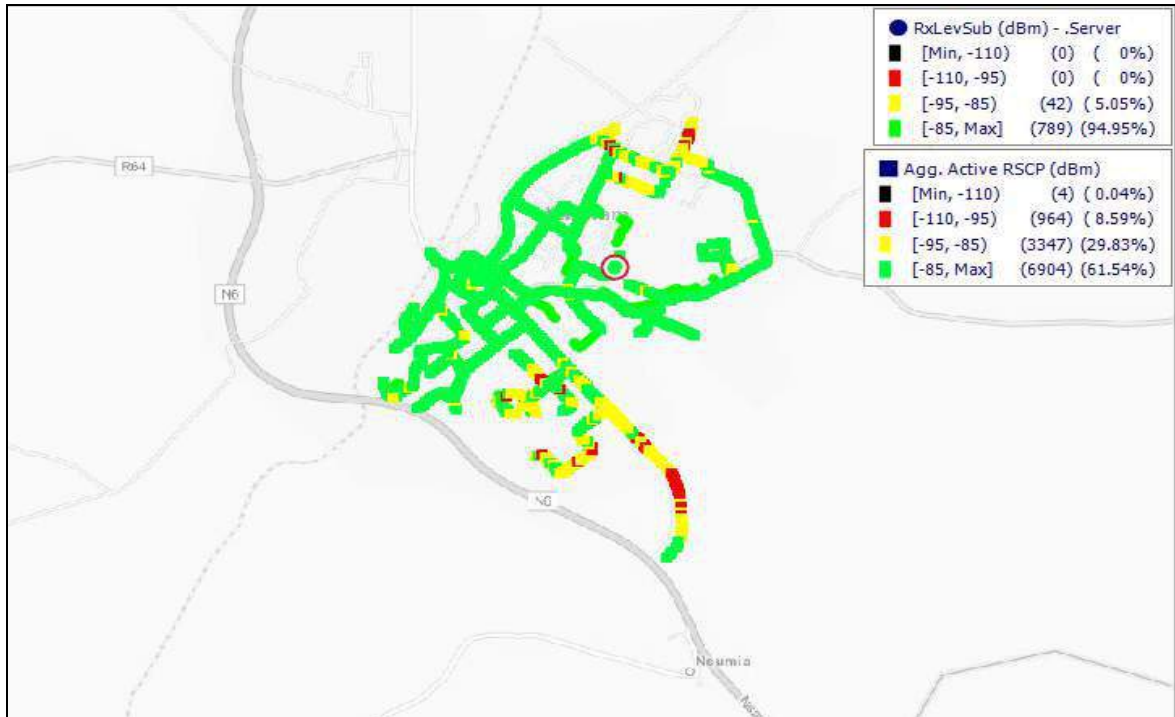
Figure 25 – Airtel Coverage, Nkawkaw – August 2015



Remarks: Poor network coverage in parts of Nkawkaw especially at sections of the Nkawkaw-Kumasi highway.

COVERAGE AT NSAWAM

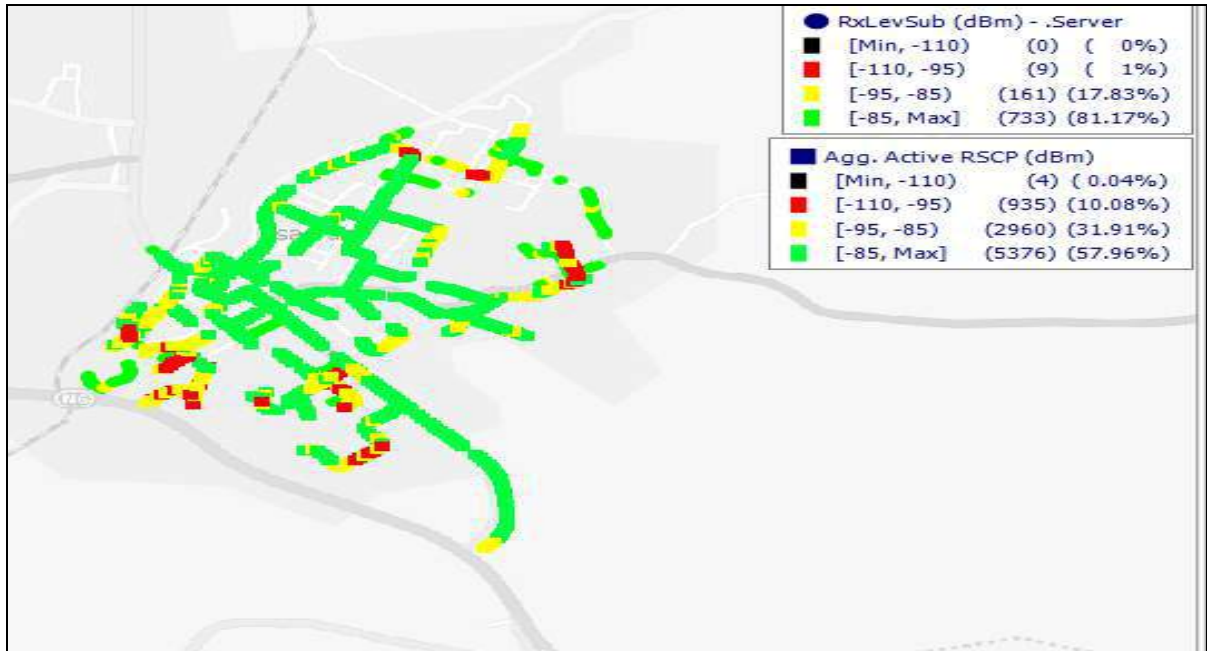
Figure 26 – MTN Coverage, Nsawam – August 2015



Remarks: Good coverage.

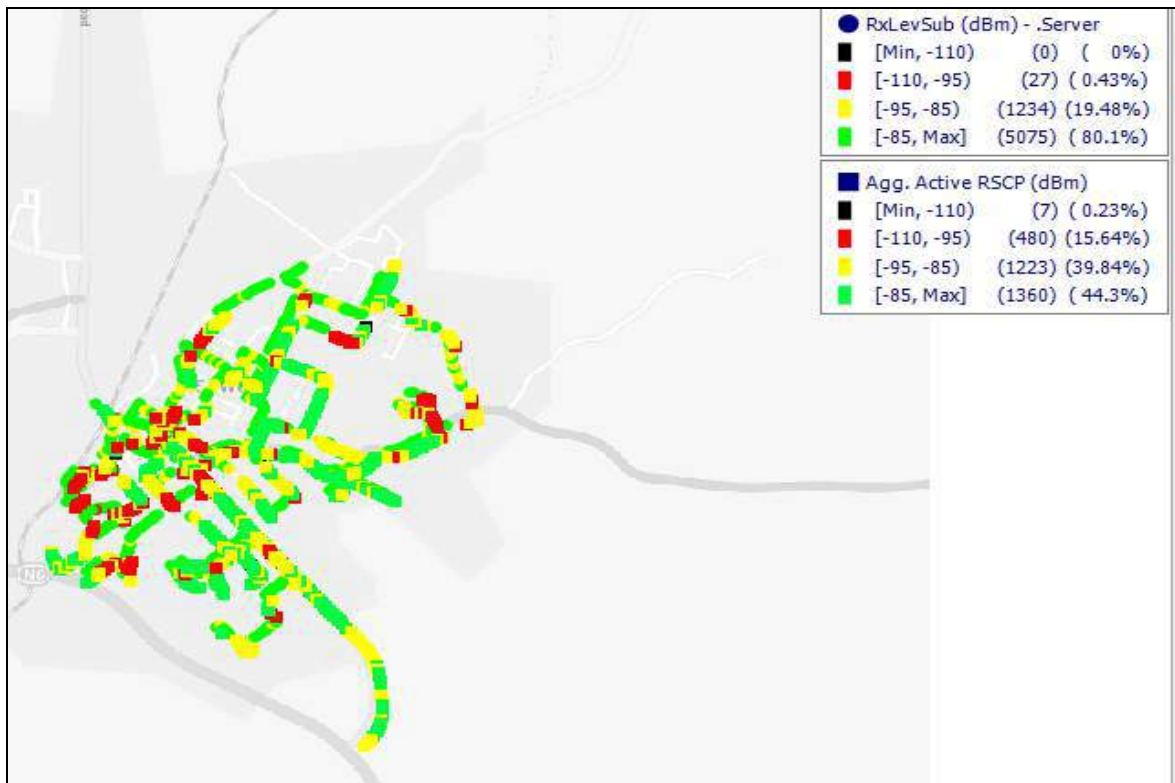
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Figure 27– Vodafone Coverage, Nsawam – August 2015



Remarks: Good coverage yet requires improvement around the Nsawam Medium Prison area.

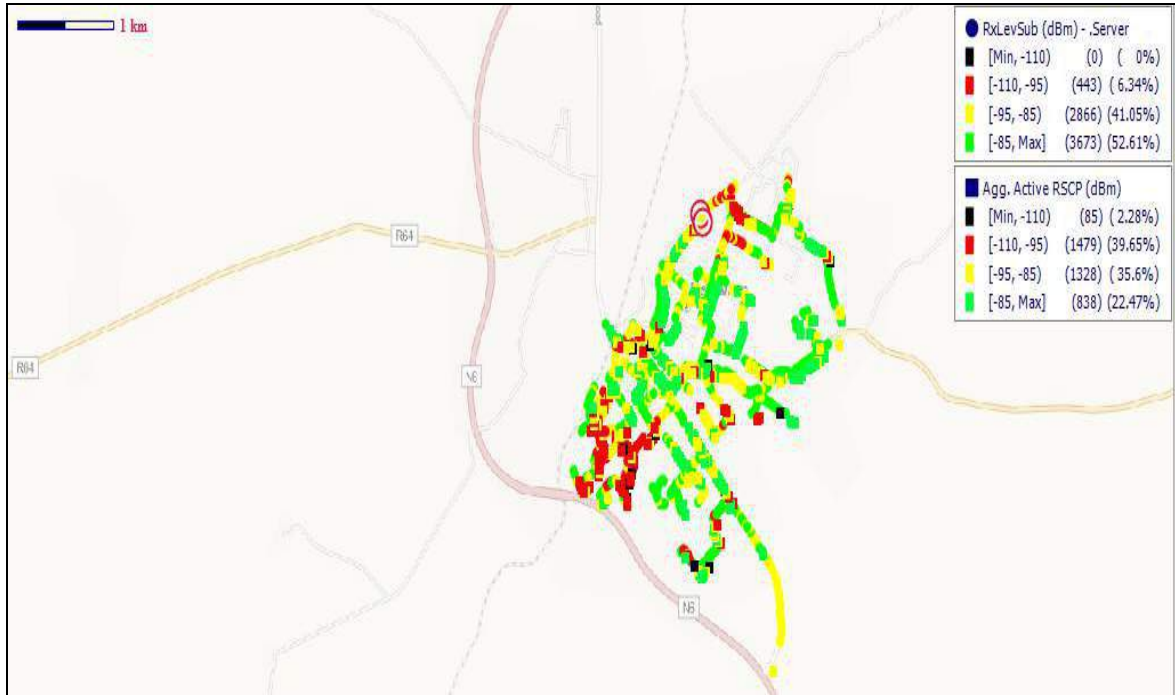
Figure 28 – Tigo Coverage Nsawam – August 2015



Remarks: Good coverage. However there were drops of poor coverage scattered around. Improvement is needed especially at the Nsawam station.

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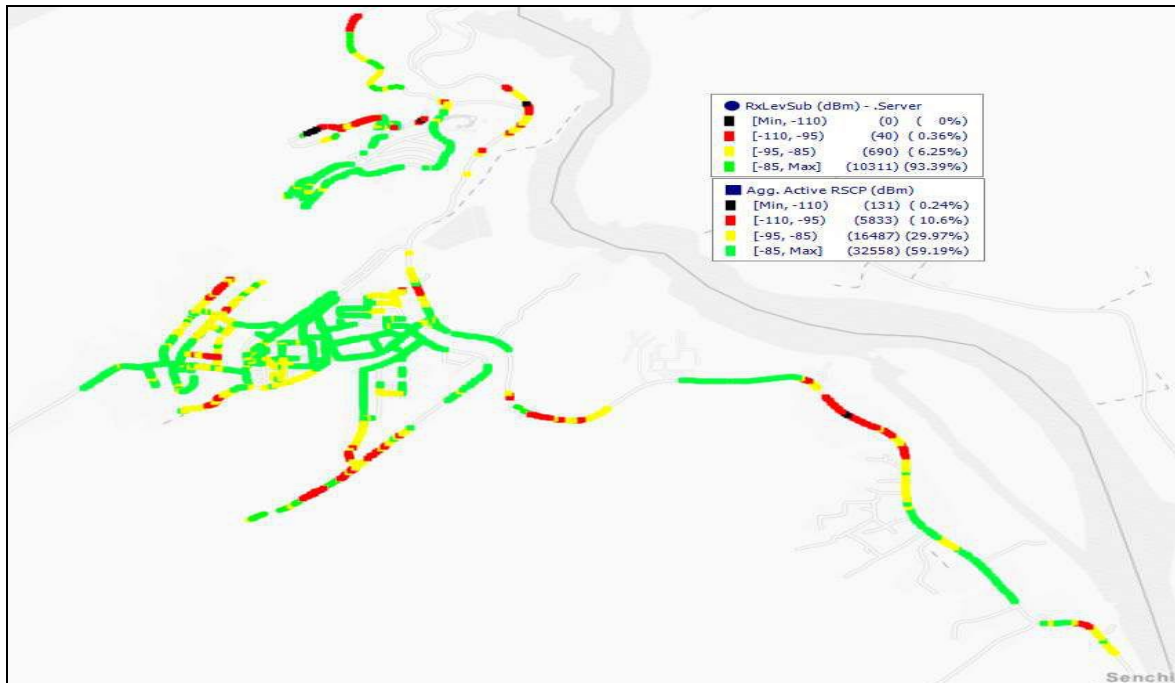
Figure 29 – Airtel Coverage, Nsawam August 2015



Remarks: Good network coverage yet improvement is required at Nsawam zongo community area

COVERAGE AT AKOSOMBO

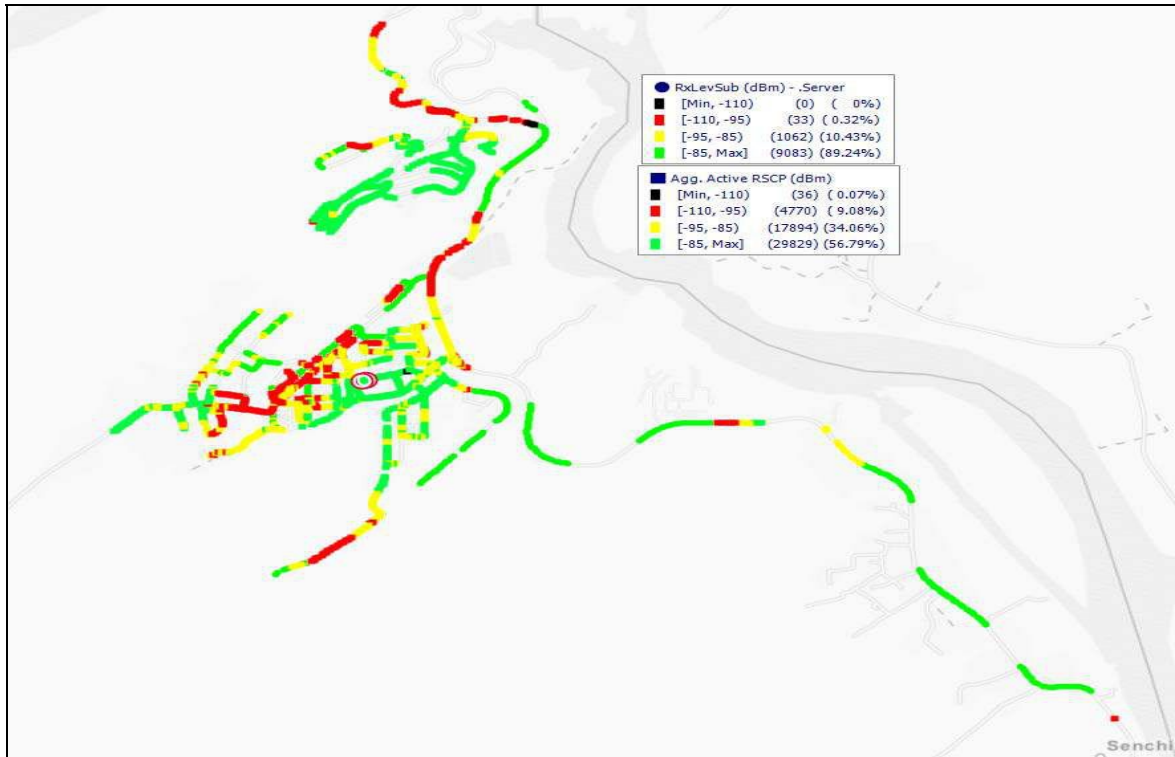
Figure 30 – MTN Coverage, Akosombo - August 2015



Remarks: Good coverage but needs improvement at VRA office and Volta hotel

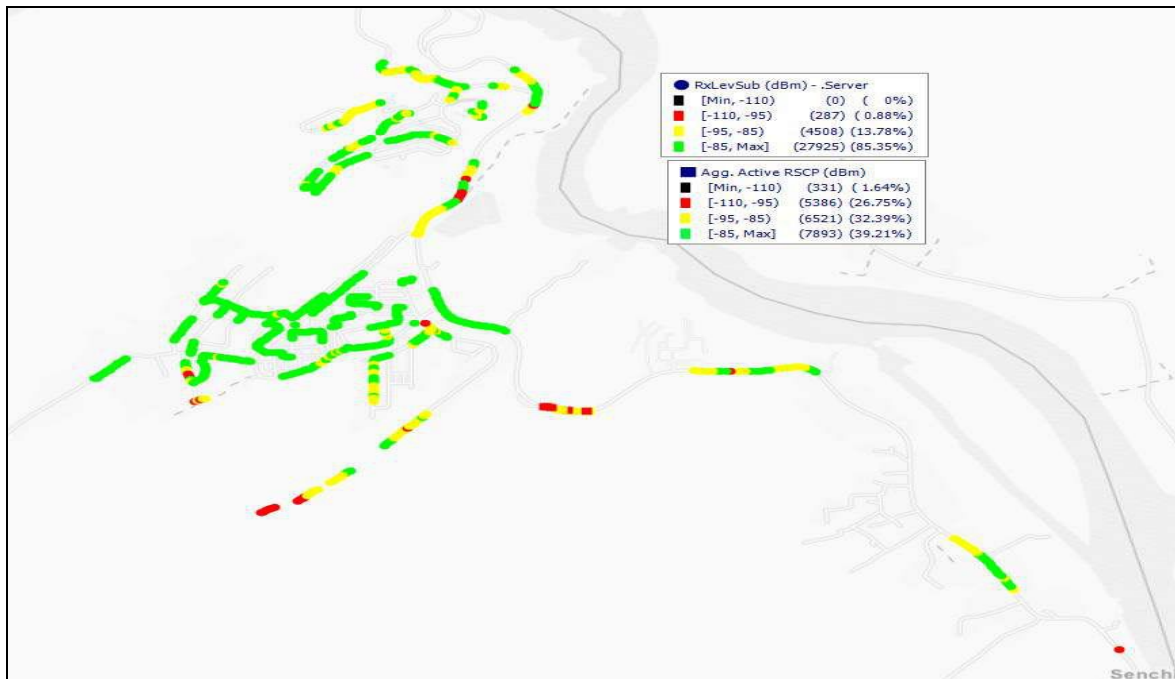
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Figure 31 –Vodafone Coverage, Akosombo –August 2105



Remarks: Good coverage yet requires improvement in Akosombo Township.

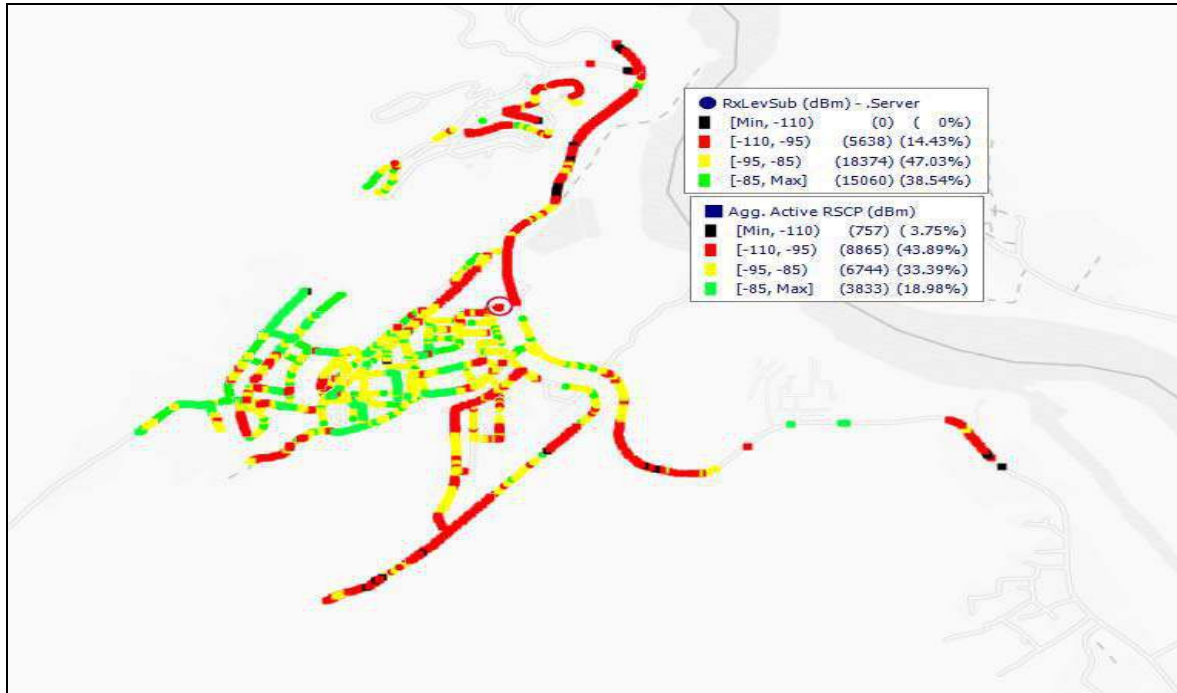
Figure 32 – Tigo Coverage, Akosombo –August 2015



Remarks: Good coverage but need to improve on coverage gaps

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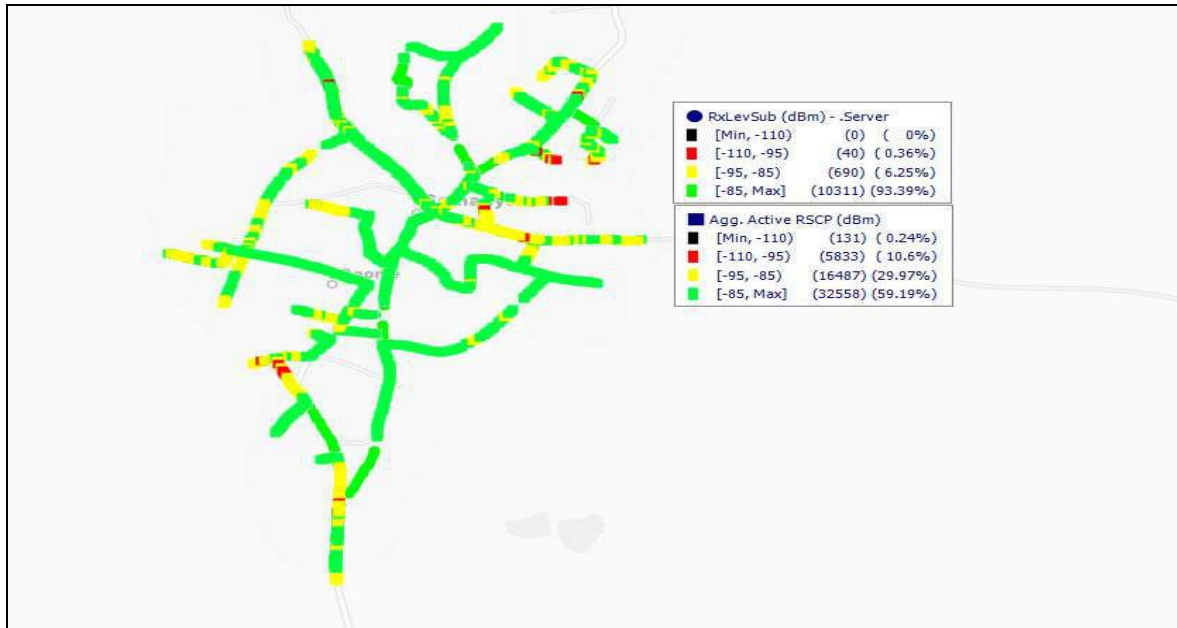
Figure 33 –Airtel Akosombo – August 2015



Remarks: Poor network coverage. Improvement is required especially around VRA and Volta hotel

COVERAGE AT YILO KROBO

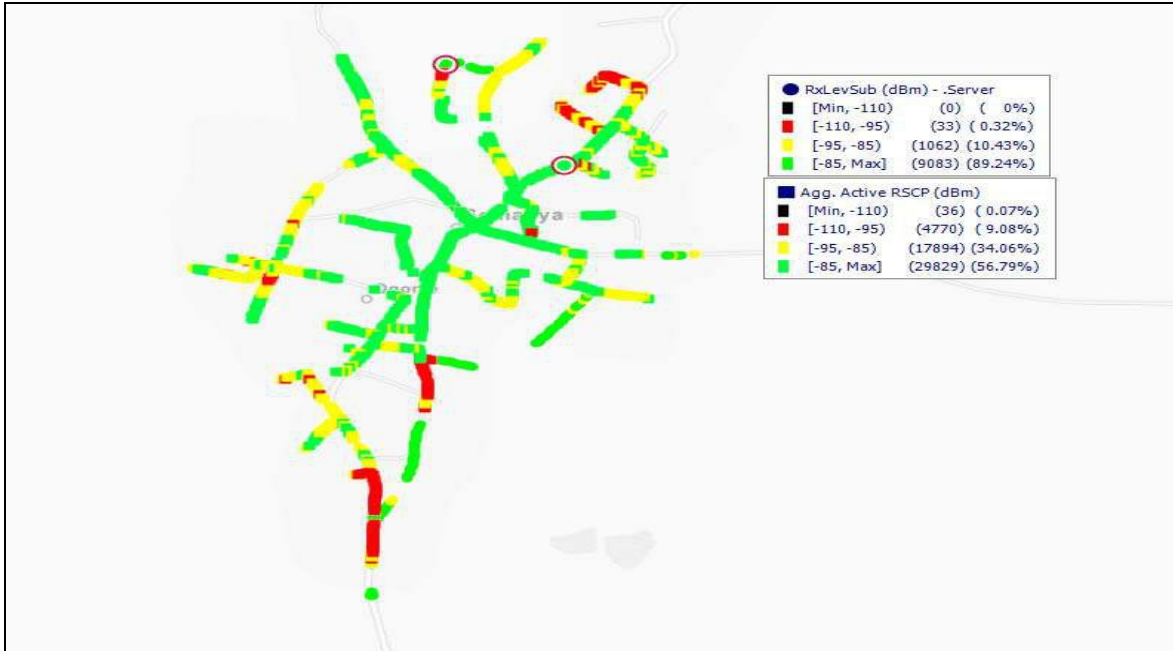
Figure 34 – MTN Coverage, Yilo Krobo/Somanya - August 2105



Remarks: Good coverage

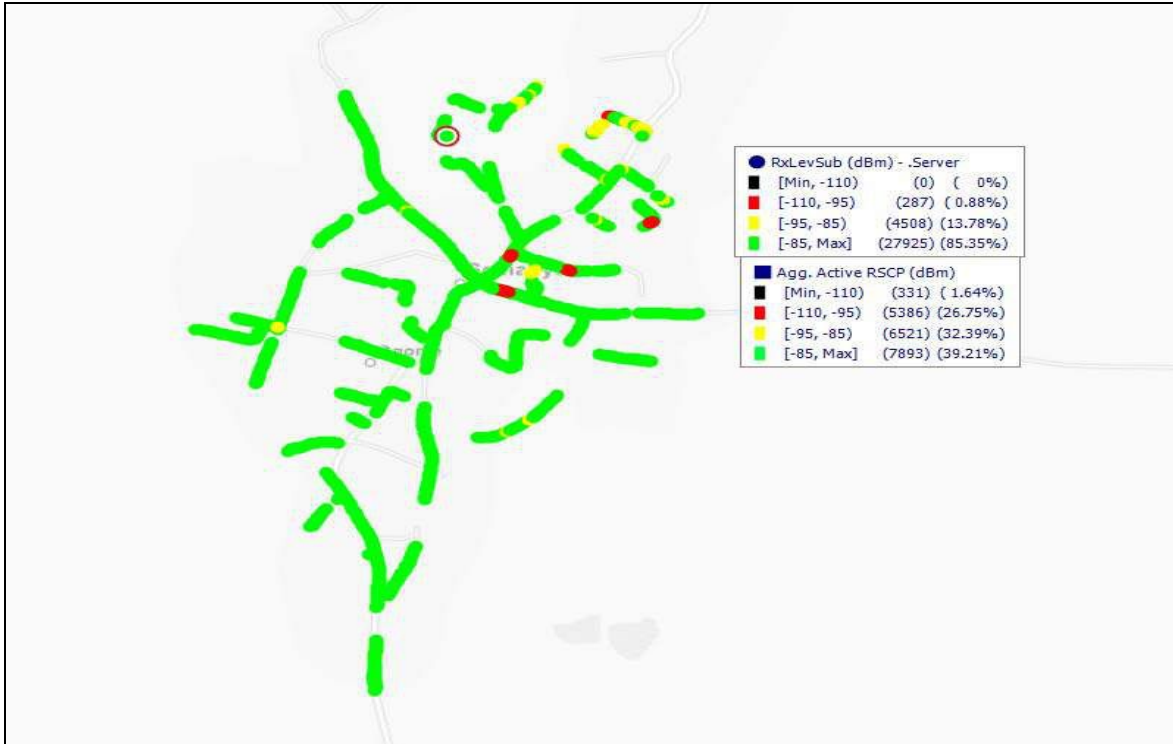
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Figure 35– Vodafone Coverage, Yilo Krobo -August 2105



Remarks: Good coverage

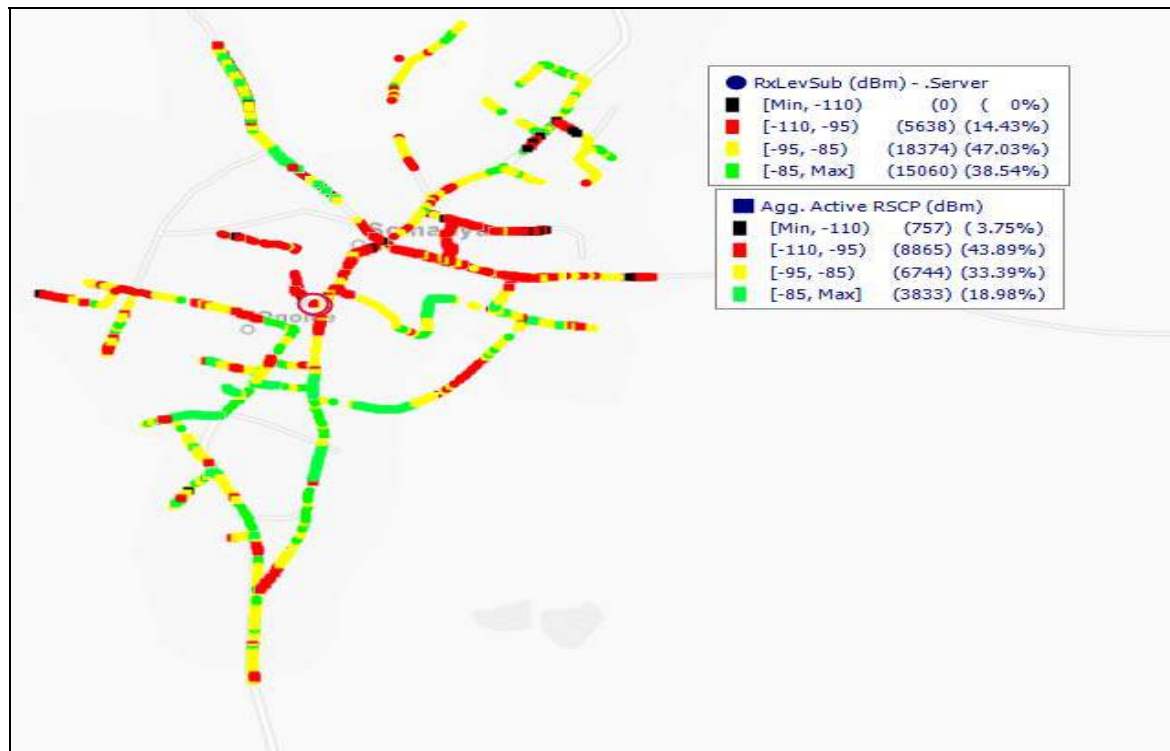
Figure 36 – Tigo Coverage, Yilo Krobo/Somanya –August 2015



Remarks: Good coverage

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Figure 37 – Airtel Coverage, Yilo Krobo – August 2015



Remarks: Poor network coverage especially around Somanya

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APPENDIX II

SPEECH QUALITY FOR OPERATORS

Figure 38 MTN Speech Quality report in Eastern Region

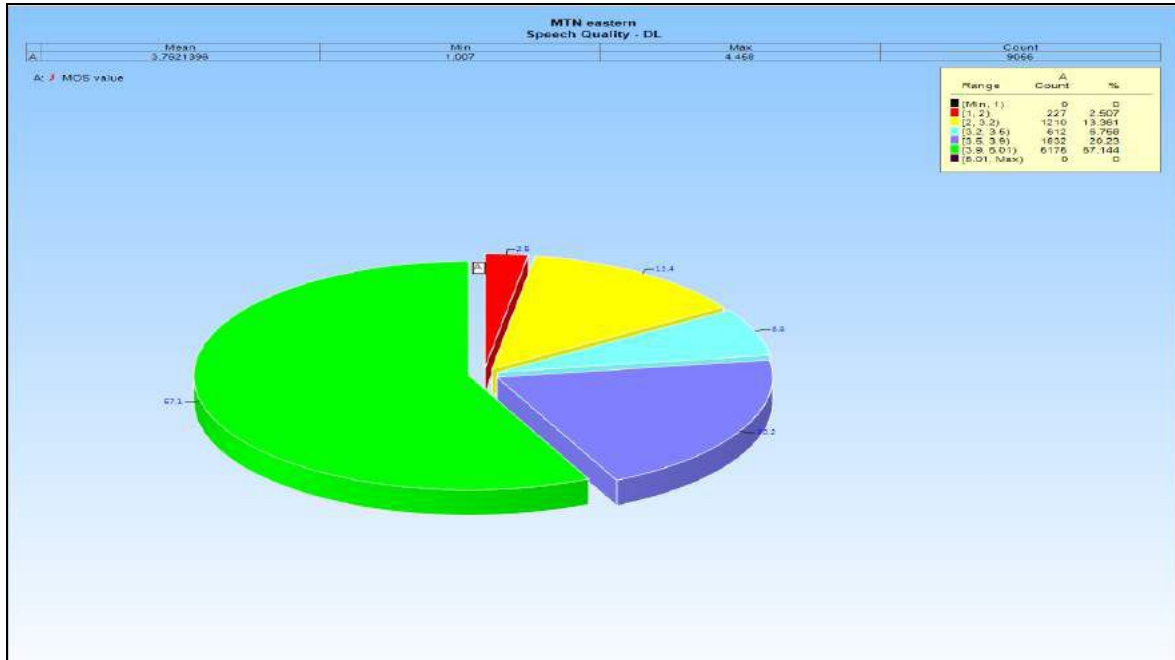
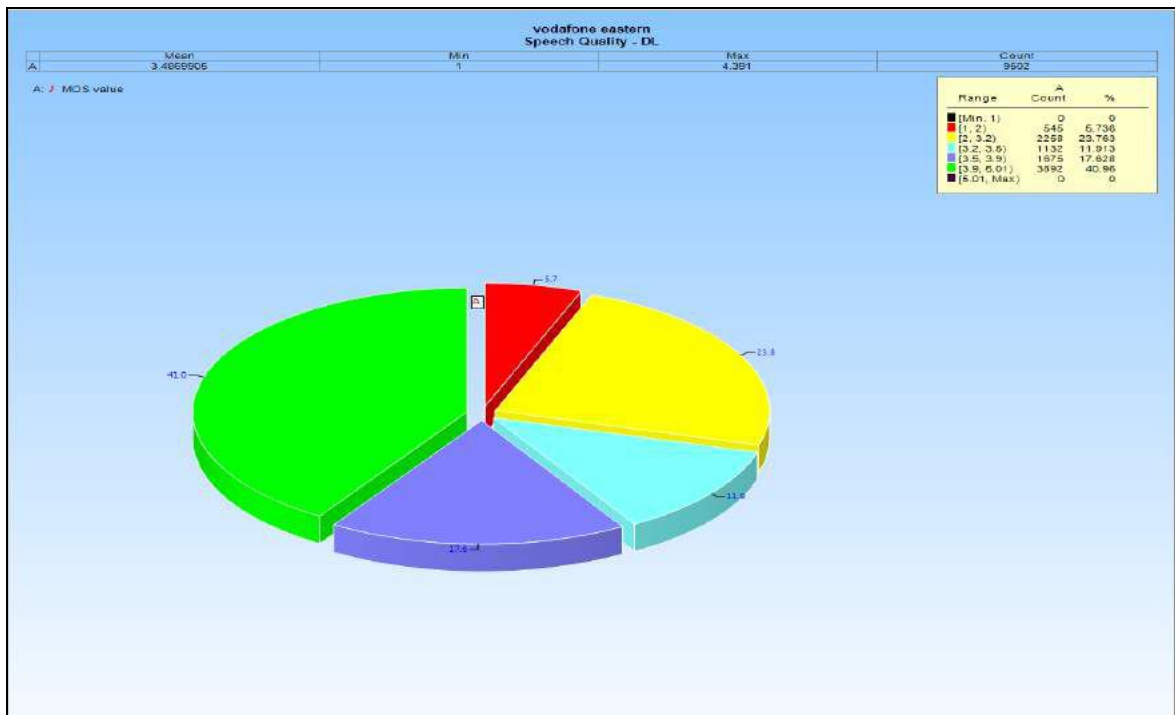


Figure 39 Vodafone Speech Quality report in Eastern Region



QUALITY OF SERVICE (QoS) MONITORING OF CELLULAR MOBILE VOICE SERVICES IN EASTERN REGION, AUGUST 2015

Figure 40 Tigo Speech Quality report in Eastern Region

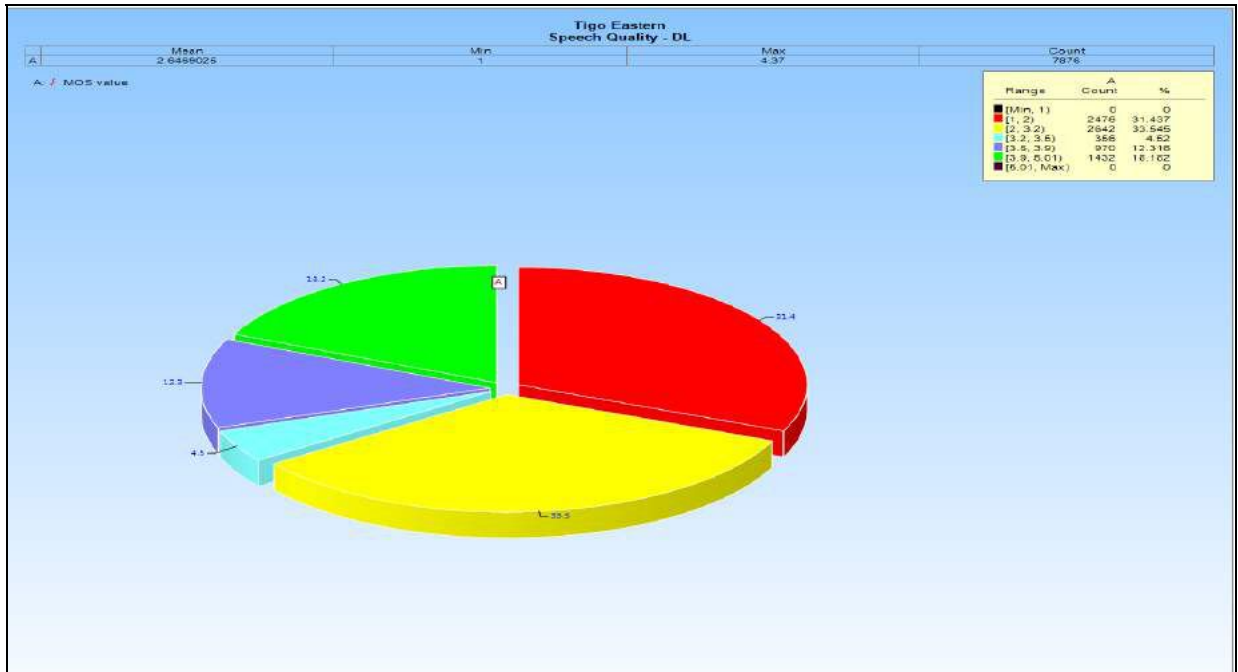
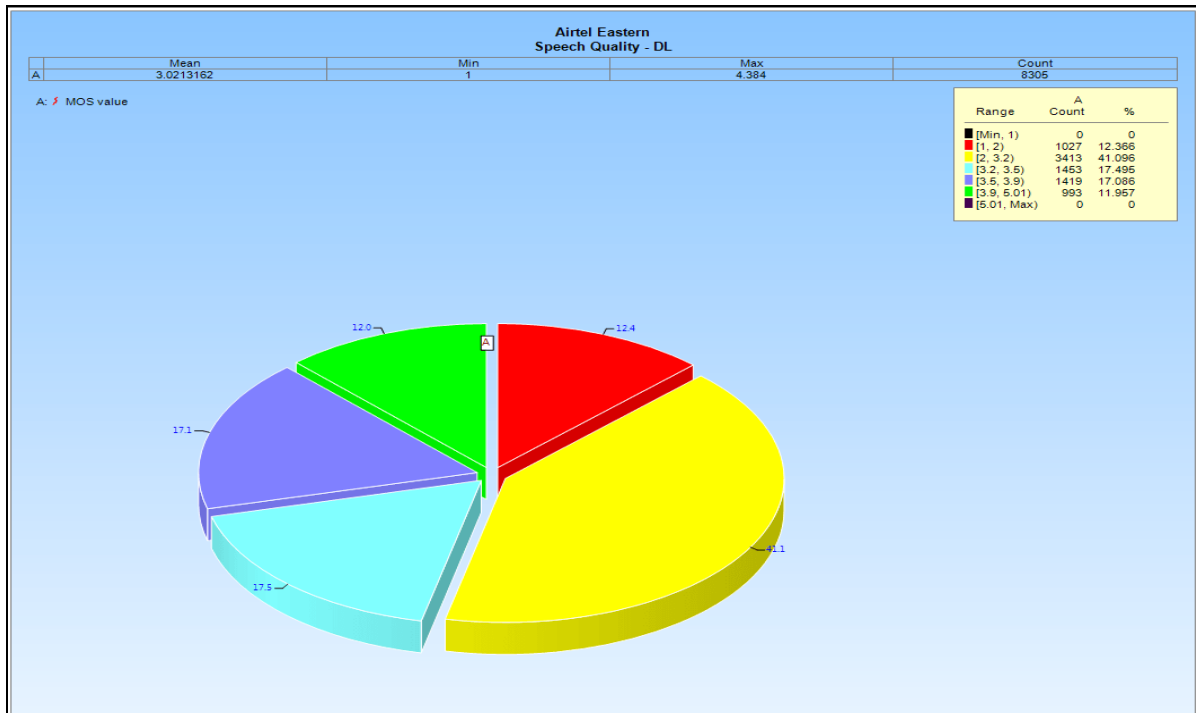


Figure 41 Airtel Speech Quality report in Eastern Region



QUALITY OF SERVICE (QoS) MONITORING OF CELLULAR MOBILE VOICE SERVICES IN EASTERN REGION, AUGUST 2015

Figure 42 Glo Speech Quality report in Eastern Region

