

# Sound Hazard Survey of Telecommunication Mast in Port Harcourt Metropolis Nigeria

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*Abstract -- The communication industry has helped to boost the economy of most nation as well as improve on the standard of living but the hazards are still frightening to many. This paper looks at the sound related hazards by taking the noise survey and comparing with the health hazards. Four base stations were selected for the study and these include Mile 1, Mile 3, Garrison and Rumuokoro. The noise source was traceable to the generators, transformers, traffic, flux, sparks and electromagnetic sources. The peak noise level was found to be 76.8dBA for mile 1, 80.0dBA for mile 3, 79.7dBA for Garrison and 79.9dBA for Rumuokoro. Statistically, there is no significant difference in the noise level of the four base stations, aggravated by motor traffic, commercial and cottage industries noise sources. The Health index from WHO is that the noise level is at a hazardous spectrum and will require community protection from the low frequencies, noise source. On the compliment, some rural communication mask shows average noise level of 65dBA +2 which implies improved technology. This study recommends the use of fuse lightening arresters, Earthing, protectective relay, sound proof and circuit breakers where applicable to enhance safety.*

## I. INTRODUCTION

Noise survey of telecommunication mast was carried out. The study area is Port Harcourt and is situated between Latitude 43 north and 4.45 north and Longitude 7.00, east and 7.15 east in the geographical Map (fig 1) with a population of 1,000,908 persons and an area of four hundred and seventy square kilometers 470.00sq km of land (Hart et al., 2012). In this area, four clusters were identified which was used for the study. The identified clusters that were used for the evaluation are in Rumokoro, Mile 3, Mile 1 and Garrison base.

Each of the clusters contains at least two masts within a distance less than 200m. The details of the clusters are given below.

1. Rumuokoro: The Rumuokoro cluster contains two mast; Airtel and 9Mobile network. The two Masts are about 30m apart. The area is majorly residential but also contains companies, schools, hotels e.t.c.
2. Mile 3: This cluster contains 2 masts which house MTN and Glo network. The Glo mast is located inside a police station while the MTN mast is near a filling station. The masts are about 100m apart. Mile 3 is mainly a business area with few residential settlements. It contains about the biggest market in Rivers State.
3. Mile 1: Mile 1 contains 5 masts which are Mtn, Glo, Airtel and 9Mobile. All the masts are contained inside a police station and are about 10m from the building. Mile 1 is made up of residential and business premises.
4. Garrison: The cluster in Garrison contains four masts which is for MTN, Glo, 9Mobile and Airtel network. The masts are 100m to 200m apart. The area is also made up of residential and business offices.

## II. STUDIES ON COMMUNICATION BASE MAST AND NOISE

A lot of studies have been conducted on mobile phone radiation and health impact, electromagnetic fields from base mast, micro waves associated with base mast, vector and climatic impact on base mast and other physical related parameters.

These scholars include:

Babisch et al (2005), Banjo et al (2008), Barnes and Greenbaum (2007), Belojevic et al (2008), Bodin et al (2009), Broste et al (1989), Chagnaud et al (1999), Cherry (2000), De-luliis et al (2013), Eger et al (2004), Enyinna and Onwuka (2014), Femie and Reynolds (2005), Hart et al (2012), Heikkinen et al (2011), Hutter et al (2006), Navaro et al (2003),

Nylund and Leszynski (2006), Panagopoulos et al (2008), Santini et al (2003), Wolf and Wolf (2004).

The focus of this paper is on noise survey of multiple clusters, covering four regions in the Port Harcourt metropolis of Nigeria. These base cluster include; Mile1, Mile 3, Garison and Rumuokoro. Effort is made to establish the co-ordinates of sample sites and the respective noise level by taking an average of the minimum and maximum noise level to plot a contour map of the noise spread including the critical noise areas. The noise level exceeded the World Health Organization standards of 55dBA for on the critical health index and need some modification.

### III. METHODS

A CEL 231 and CEL 254 digital noise level meter with A,B,C,D, weighting corresponding to low, medium, high and impulsive noise respectively was used. The sound signal or wave strikes the microphone and is converted into a corresponding electrical signal. This is usually small and has to be amplified before it is sent to the meter for reading. Between the input terminals is a weighing network and rectifier for necessary filtering and determination of an acceptable average.

The electrical signal is converted to the power equivalent which is interpreted as decibel in display screen. The measurements were taking from diffuse source within the near and free field, which gives us an approximate distance of 1-3 meters from sound source, depending on convenience and at a height of about 1.2meters.

### IV. RESULTS

The results of noise levels measured within the surveyed area have been presented in table 1-8 and illustrated in figure 1,2,3 with corresponding table 9 on health index of WHO to compliment. The noise contour and hazard spread is shown on fig. 5 and 6 respectively.

Table 1: Noise evaluation location, Rumuokoro East

| Distance | Location                       | MAX  | MIN  | MEAN  |
|----------|--------------------------------|------|------|-------|
| 10       | N04°52'03.4''<br>E006°59'34.2' | 86.2 | 73.5 | 79.85 |
| 50       | N04°52'03.5''<br>E006°59'35.9' | 80.3 | 71.5 | 75.9  |
| 100      | N04°52'03.2''<br>E006°59'38.2' | 79.1 | 72.3 | 75.7  |
| 150      | N04°52'03.1''<br>E006°59'42.7' | 71.5 | 61.5 | 66.5  |

Table 2: Results of Noise Level Measurements In Rumuokoro West

| Distance | Location                        | MAX  | MIN  | MEAN  |
|----------|---------------------------------|------|------|-------|
| 10       | N04°52'03.7''<br>E006°59'33.4'' | 79.2 | 57.5 | 68.35 |
| 50       | N04°52'04.0''<br>E006°59'31.0'' | 75.6 | 54.5 | 65.05 |
| 100      | N04°52'04.4''<br>E006°59'26.0'' | 60.1 | 48.5 | 54.3  |
| 150      | N04°52'04.8''<br>E006°59'26.0'' | 80.5 | 61.5 | 71    |
| 200      | N04°52'05.1''<br>E006°59'23.4'' | 78.5 | 69.5 | 74    |

TABLE 3: Results of Noise Level Measurements In Rumuokoro South

| Distance | Location                      | MAX  | MIN  | MEAN  |
|----------|-------------------------------|------|------|-------|
| 5        | N04°52'0.22"<br>E006°59'33.8" | 76.2 | 59.8 | 68    |
| 10       | N04°52'02.3"<br>E006°59'33.6" | 79.4 | 60.1 | 69.75 |
| 20       | N04°52'01.6"<br>E006°59'33.3" | 51.8 | 46.3 | 49.05 |

Table 4: noise evaluation location 4, Rumuokoro North.

| Distance | Location                      | MAX  | MIN  | MEAN  |
|----------|-------------------------------|------|------|-------|
| 10       | N04°52'04.5"<br>E006°59'34.2" | 78.2 | 69.1 | 73.65 |
| 50       | N04°52'05.1"<br>E006°59'36.3" | 87.5 | 62.5 | 75    |
| 100      | N04°52'05.5"<br>E006°59'26.3" | 81.1 | 70.2 | 75.65 |
| 150      | N04°52'03.9"<br>E006°59'31.8" | 78.9 | 61.5 | 70.2  |
| 200      | N04°52'06.4"<br>E006°59'28.5" | 89.3 | 70.1 | 79.7  |

Table 5: noise evaluation location 5, Garrison North.

| Distance | Location                      | MAX  | MIN  | MEAN  |
|----------|-------------------------------|------|------|-------|
| 10       | N04°48'23.4"<br>E007°00'22.3" | 74.6 | 65.4 | 70    |
| 50       | N04°48'25.6"<br>E007°00'15.7" | 71.2 | 63.2 | 67.2  |
| 100      | N04°48'30.2"<br>E007°00'09.3" | 76.3 | 61.2 | 68.75 |
| 150      | N04°48'27.0"<br>E007°00'10.9" | 78.2 | 59.6 | 79.7  |

Table 6: noise evaluation location 6, Garrison south.

| Distance | Location                      | MAX  | MIN  | MEAN  |
|----------|-------------------------------|------|------|-------|
| 10       | N04°48'20.5"<br>E007°00'25.0" | 67.9 | 48.9 | 58.4  |
| 20       | N04°48'19.0"<br>E007°00'27.8" | 68.3 | 52.1 | 60.2  |
| 30       | N04°48'18.3"<br>E007°00'28.1" | 69.2 | 55.1 | 62.15 |
| 60       | N04°48'15.8"                  | 70.4 | 58.2 | 64.3  |

|     |                                       |      |      |      |
|-----|---------------------------------------|------|------|------|
|     | E007°00'31.<br>3"                     |      |      |      |
| 150 | N04°48'16.<br>4"<br>E007°00'32.<br>3" | 62.4 | 40.2 | 51.3 |

Table 7: noise evaluation location 7, Garrison East.

| Distance | Location                              | MAX  | MIN  | MEAN |
|----------|---------------------------------------|------|------|------|
| 10       | N04°48'24<br>.4"<br>E007°00'2<br>1.3" | 63.2 | 44.2 | 53.7 |
| 50       | N04°48'33<br>.1"<br>E007°00'2<br>7.7" | 66.4 | 49.8 | 58.1 |
| 100      | N04°48'24<br>.7"<br>E007°00'2<br>6.0" | 67.1 | 51.3 | 59.2 |
| 150      | N04°48'23<br>.0"<br>E007°00'2<br>4.8" | 69.4 | 52.8 | 61.1 |
| 200      | N04°48'26<br>.9"<br>E007°00'2<br>7.3" | 71.1 | 54.1 | 62.6 |

Table 8: noise evaluation location 8, Garrison west.

| Distance | Location                              | MAX  | MIN  | MEAN  |
|----------|---------------------------------------|------|------|-------|
| 10       | N04°48'1<br>7.0"<br>E007°00'<br>15.6" | 72.4 | 62.5 | 67.45 |
| 50       | N04°48'1<br>3.6"<br>E007°00'<br>13.2" | 76.8 | 64.8 | 70.8  |
| 100      | N04°48'0<br>5.7"<br>E007°00'<br>07.8" | 77.8 | 65.2 | 71.5  |
| 150      | N04°48'0<br>7.6"<br>E007°00'<br>09.0" | 78.9 | 66.4 | 72.65 |
| 200      | N04°48'0<br>2.6"<br>E007°00'<br>05.2" | 74.8 | 68.2 | 71.5  |

Table 9: Noise health index by WHO (WHO, 2014).  
To guide fig1, 2,3 results

| ENVIRONMENT          | CRITICAL HEALTH EFFECT       | SOUND LEVEL dB(A) | TIME (HOURS) |
|----------------------|------------------------------|-------------------|--------------|
| Outdoor living areas | Annoyance                    | 50-55             | 16           |
| Indoor dwellings     | Speech intelligibility       | 35                | 16           |
| Bed rooms            | Sleep disturbance            | 30                | 8            |
| School classrooms    | Disturbance of communication | 35                | During class |

|  |                    |     |    |
|--|--------------------|-----|----|
| Industrial, commercial and traffic areas | Hearing impairment | 70  | 24 |
| Music through ear phones                 | Hearing impairment | 85  | 1  |
| Ceremonies and entertainments            | Hearing impairment | 100 | 4  |

Source: world health organization (WHO), 2014.

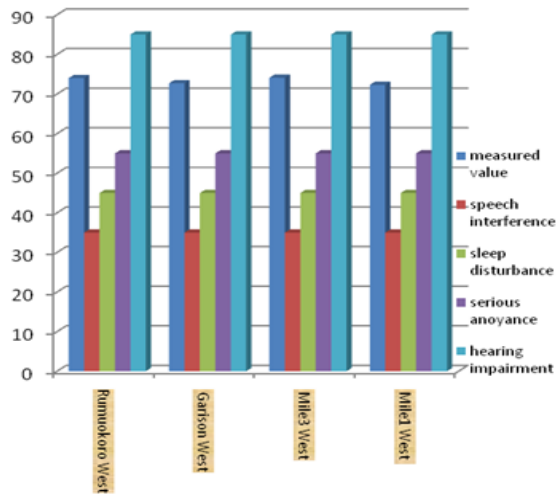


Figure 1: Bar Chart Comparing Maximum Noise Levels In The West Of Rumuokoro, Garrison, Mile 3 And Mile 1 With Permissible Standards

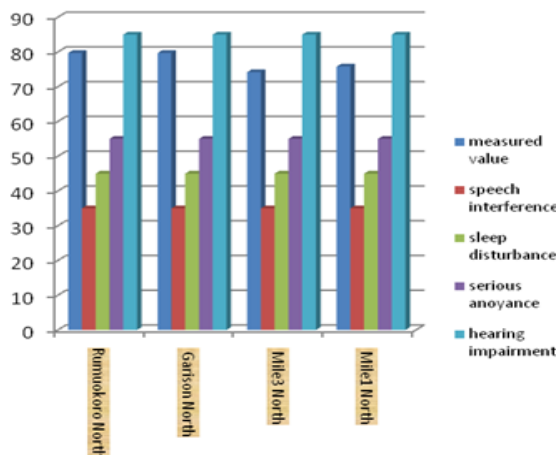


Figure 2: Bar Chart Comparing Maximum Noise Levels In The North Of Rumuokoro, Garrison, Mile 3 And Mile 1 With Permissible Standards

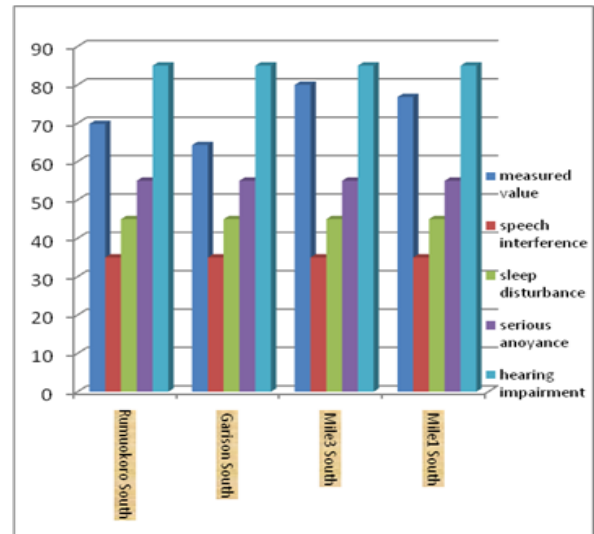


Figure 3: Bar Chart Comparing Maximum Noise Levels In The South Of Rumuokoro, Garrison, Mile 3 And Mile 1 With Permissible Standards

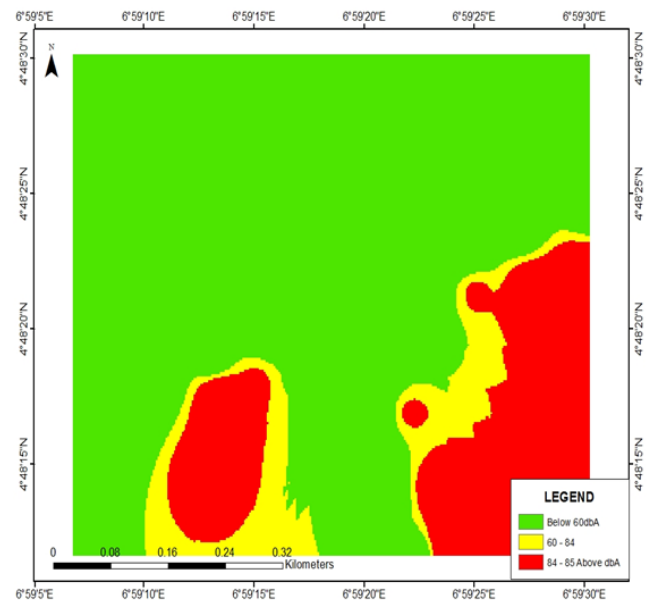


Figure 4: Geographical Preview Of Noise Level Distributions In Mile 1 Area Port-Harcourt As A Model

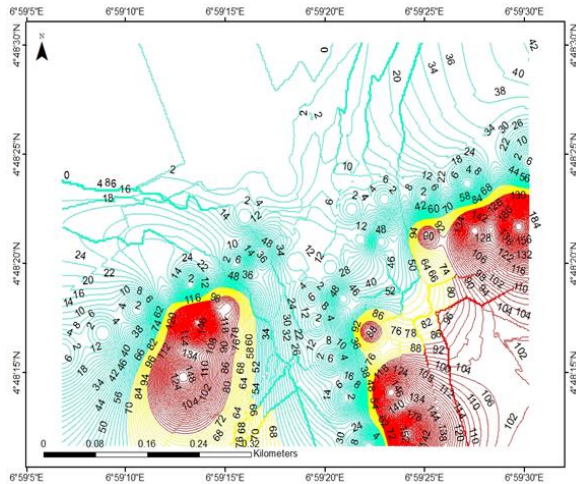


Figure 5: Contour Map of Mile 1 Showing Noise Level Distribution As A Model

## V. DISCUSSION

These results show that the noise exposure levels measured, ranged between 40.5dB and 89.3dB and with a minimum and maximum mean value of 51.3dB and 80dB respectively. These measured values as seen in (Enyinna, 2014) are high and could bring about speech interferences which could lead to a number of personal disabilities, and behavioural changes include problems with fatigue and irritation. These noise levels could equally bring about sleep disturbance and serious annoyance which can cause long-term effects on health. The highest noise levels were recorded in mile 3 east followed by mile 3 south then Rumuokoro north. The survey also reveals that the areas with the highest noise disturbances includes Mile 3 east, Mile 3 south, Rumuokoro north, Rumuokoro east and Garrison west; all in the range between 65dB to 80dB noise level mean. From figures 1,2,3, the noise levels recorded during the survey were higher than World Health Organization (WHO) limit set for speech interference, sleep disturbance and serious annoyance given as 35dB, 45dB and 55dB respectively. Though no measured value crossed the limit of 85dB for ear impairment, long term exposure to noise in; Rumuokoro North, Garrison North, Rumuokoro East, Mile 3 East and Mile 3 South can result in ear impairment.

## VI. SUMMARY OF FINDINGS

The following are the major findings of the study:

1. The maximum noise level measured in Rumuokoro is 79.85dB.
2. The maximum noise level measured in Mile1 is 76.8dB.
3. The highest noise level measured in Garrison is 79.7dB.
4. The maximum noise reading measured in Mile3 is 80dB.

## VII. CONCLUSION

The results of the noise exposure levels indicate high level of deviation in the negative sense from permissible standards by the World Health Organization (WHO) which are 35 dB, 45 dB and 55 dB for speech interference, sleep disturbance and serious annoyance. Exposure to this noise is capable of deteriorating both the psychological and health status of those who are occupationally affected and can cause hearing impairment for those exposed occasionally to noise in mile3.

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