

REPORT ON ELECTROMAGNETIC FIELD (EMF) MEASUREMENTS

MARCH 2021

This report is publicised for public educational awareness.

1. **INTRODUCTION**

- 1.1 Pursuant to the BOCRA mandate, the Department of Technical Services continues to make efforts by undertaking measures to protect the consumers as provided for in the CRA Act Section 6 (1) and (2) that safe and quality services must be provided in the Botswana market. These measures include but not limited to taking the Electromagnetic Fields (EMF) radiation measurements on the Mobile Network Operators (MNOs) base stations. The measures are conducted against the set standards for compliance purposes.
- 1.2 The measurement of the EMF exposure to the human body is important for analyzing the effects on health. Some studies have reported that the EMF has adverse effects on human body while some have denied those hypotheses.
- 1.3 In carrying out this exercise, BOCRA used the International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines which sets out the human safety threshold standard for the EMF radiation.

2. BACKGROUND

2.1 In the past, there had been expressions of public fears and perceptions locally relating to effects of exposure to EMF from the public mobile base stations. These fears have been exacerbated by the Conspiracy theories around Corona Virus and 5G. The Authority has since embarked on measuring the EMF radiation in an ad-hoc manner in sampled places around the country. These efforts were to manage the public perceptions and consequently protect the consumers. Accordingly, the measurement results have always indicated that EMF radiation emitted by the mobile base stations were below the human safety thresholds and therefore harmless to the public.

2.2 In a bid to continue with EMF radiation measurements thence forth, the DTS carried out measurements at some sampled areas around the country from November 2020 to March 2021.

3. OBJECTIVES

3.1 The objective of this report is to show the outcome the EMF exposure measurements in selected mobile base stations across the country.

4. **DISCUSSIONS**

- 4.1 Noting since market liberalization, operators compete amongst themselves to offer the best service to their customers. This is evidenced by the several installations that emerge in the cities, towns and village. However, these installations are not laid arbitrarily but in accordance with the regulations and/or license conditions showing the antenna heights and locations/areas.
- 4.2 The EMF measurements exercise therefore was carried out in some strategically selected areas where a sample of mobile

base stations per operator per area were measured countrywide. The sites of interest were identified before measurements were carried out to establish whether the site was active (operational or not). Only operational sites were measured. In accordance with the EMF Plan, there were five selected areas namely: Jwaneng, Palapye, Ghanzi, Maun, and Kasane.

- 4.3 Within an area, the sites were identified targeting the locations and coverage areas which are regularly accessed by the public, such locations of interests included among others: clinics, schools, playgrounds/parks, malls, industrial areas, churches and others. These targeted areas were assumed to be the red zones with the potential to pose detrimental human health and safety risks should the levels exceed the set EMF thresholds for human safety standards.
- 4.4 BOCRA used the ICNIRP Guidelines to Identify the lowest exposure level that can cause harm to humans in the general public area. The human safety threshold standard for the EMF radiation. – e.g. 4 W/kg causes 1°C body core temperature rise.

Apply reduction factors to that exposure level to obtain safety restrictions– e.g. reduce 4 W/kg by a factor of 50 and set general public exposure restriction to **0.08 W/kg** – this is too low to cause detectable increase in body core temperature.

5 MEASURED OUTPUT RESULTS

5.1 For this measurements exercise, at-least the four (4) measured points were undertaken at different positions per site, this is in accordance with the CENELEC (European Committee for Electrotechnical Standardization) measurement methodology. Reference is made to Figure 1 showing the pictorial view map and Figure 2: photos of the positions per site.



Figure 1: Pictorial view (map) for Palapye Site 1



Figure 2: Measurements taken at several positions (7) per site.

- 5.2 Overall, the results that follow below show that for the five (5) areas, a total of 30 base stations were measured and that at these base stations, a corresponding total of 190 measured points were conducted. Reference is made to **Table 1**.
- 5.3 The best practice is that the measurements must be undertaken from the ground level of radius of 100m from the site, this are the points of expected maximum exposure. The total measured points gave an aggregated total exposure level per site. It is worth noting that, during these measurements, field engineers' cell phones were switched off as they could contribute to the total exposure levels as other distant base stations already do by default.
- 5.4 For the human exposure, the radiofrequency electromagnetic fields (RF) measurements were carried out in the range 9KHz to 6GHz for the 2G-4G technologies.
- 5.5 The measured outputs were then downloaded to a computer loaded with the Software and ICNIRP Guidelines standards.

Town/Village	Site No	Number of Points	
Kasane	6	38	
Maun	8	51	
Ghanzi	6	41	
Palapye	7	43	
Jwaneng	3	17	
TOTAL	30	190	

Table 1: Sites Measured Per Location

- 5.6 Table 2 below shows an example of Palapye area (Site 1) where the measurement of the RF radiation exposure levels in terms of a percentage as per the ICNIRP guidelines were conducted. According to the ICNIRP Guidelines, a 100% value indicates that the highest safe exposure limit for the General Public has been reached (meaning the values below 100% are safe) and that exceeding a 100% means the base station is no longer good for the human safety.
- 5.7 The results of the measurements were tabulated as below.

No. positions	Measured On	Position Comment	Total Exposure	Cellular Exposure
P1	16/12/2020 08:31	Palapye BTC (Base of Tower)	0.0298%	0.0268%
P2	16/12/2020 08:35	Palapye BTC (Sector 1- Position 1)	0.0315%	0.0280%
P3	16/12/2020 08:43	Palapye BTC (Sector 1- Position 2: Sefalana Shopers)	0.0328%	0.0291%
P4	16/12/2020 08:48	Palapye BTC (Sector 1- Position 3: Kombi Stop)	0.0135%	0.0116%
P5	16/12/2020 08:56	Palapye BTC (Sector 2- Position 4: Entrance of BTC HQ)	0.0376%	0.0311%
P6	16/12/2020 09:03	Palapye BTC (Sector 2- Position 5: Standard Charted Bank)	0.0109%	0.0085%
P7	16/12/2020 09:10	Palapye BTC (Sector 3- Position 6: Pink Houses Police Accom)	0.0770%	0.0577%
P8	16/12/2020 09:19	Palapye BTC(Sector 3- Position 7: Primary Hospital)	0.0272%	0.0186%

Table 2: RF Exposure at Measurement Positions (Palapye - Site 1)

5.8 **RESULT ANALYSIS**

- 5.8.1 Table 2 above shows typical measurement results from a Site (e.g., Palapye Site 1). The results show eight (8) measured positions with the **Total RF Exposure** at each position. The total exposure was calculated using the EMF Measurement Tool which is a the relative percentage of total exposure in reference to the ICNIRP guideline.
- 5.8.2 It is worth noting that even the distant Base Stations and Cellphones can **Influence** the RF Exposure measured.
- 5.8.3 The Measuring Tool with its intelligence, factors those influences to get the **Cell Exposure** for a given Site's as follows:

 $\label{eq:cellExposure} Cell Exposure + Exposure Influence = Total Exposure \\ 0.0268\% + 0.003\% = 0.0298\%$

5.9 Refer to **Figure 3** for the summary of the results of all the 190 measurement points around all the base stations measured.



Figure 3: Exposure Histogram

- 5.9.1 From the Figure 3 above, out of the 190 positions, the results showed that:
 - 5.9.1.1 Eleven (11) were a thousandth times below the guidelines levels;
 - 5.9.1.2 One Hundred Twenty-Eight (128) were ten thousandth times below the guidelines levels;
 - 5.9.1.3 Forty-Nine (49) were Hundred Thousandth times below; and
 - 5.9.1.4 Two (2) were Millionth times below the Guidelines levels.

6. CONCLUSIONS

- 6.1 The results showed the set threshold levels with the highest measurements reading a thousandth below the ICNIRP standard and therefore showed that the MNOs mobile base stations were compliant with the ICNIRP Guidelines. This in effect means that the base stations measured were safe for the public and may not pose any harm to them.
- 6.2 A conclusion was reached from the analysis that these were good results and that the sites were operating at conditions that were not harmful to the public.
- 6.3 The EMF radiation measurement are important for regulatory compliance purposes. This is also important for the consumer protection and goes a long way to improve consumer perceptions on communications services surveys.