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Distribution of Electromagnetic Radiation on Television

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Electromagnetic radiation; Tube television; LED television; Isodose contour; Scilab.

Abstract
Electromagnetic radiation on television has been analyzed. The aim is to create a radiation distribution pattern and compare the electromagnetic radiation of Tube television and LED television. In this study, radiation measurements using an electromagnetic radiation sensor. Radiation exposure dose measurements were carried out at 25 measurement points in the television room, namely 5 points each on the track and 1 point in the center of the radiation source. The data processing method uses Scilab to create radiation distribution patterns. The results of data processing showed that the largest radiation exposure dose was on line C (in front of television) for 60 minutes. The radiation value of Tube television is greater than the radiation value of LED television. The isodose contour shows the radiation exposure dose value of 0 at a distance of 2.5 m from the TV, which is the safe limit for watching.

INTRODUCTION

Radiation is the propagation of energy in the form of particles or waves through space or matter (Nanda et al., 2021) . Radiation can be classified into ionizing radiation and non-ionizing radiation based on the ability to ionize the material through which it passes (Peter, 2020) . Radiation cannot be separated in our lives because radiation is all around us at home, office, or in public places that can come from electronic devices. These electronic devices use electromagnetic radiation as an information carrier to transmit and receive signals (Yamin, 2019) . Electromagnetic radiation is a wave that propagates through space or matter, and has electrical and magnetic components that oscillate in a 90° phase angle (Kemal et al., 2019).

Electromagnetic wavelengths are at risk of causing health problems in the population, namely several symptoms of hypersensitivity known as electrical sensitivity, namely in the form of complaints of headaches and chronic fatigue (M Niki, 2022).

As a TV information medium has positive and negative impacts, impacts the positive result is that TV is able to become a learning place to get the latest information. Change or Technological advances in TV can result in electromagnetic radiation that can interfere with other existing electronic devices. Apart from having an impact on the devices surrounding electronics, electromagnetic radiation can also have an impact on creatures' lives and can cause radiation pollution (Agung et al., 2020). Sitting too close to the TV causes tension and fatigue in the eyes due to incorrect lighting which can damage the eyes audience's eyes. Meanwhile, exposure to magnetic electric field radiation is received by the audience that

exceeds the threshold of 2 tesla can cause cancer (Johan et al., 2020).

Vision should be maintained as early as possible. The easiest thing is not to look at the television too closely. Concerns about this began in the years before 1960, when the televisions that are made still use convex screens that can emit radiation rays up to 10,000 times the normal limit, so that if left untreated the eyes can experience eye problems for example minus, tired eyes, narrowing of blood vessels (Andy Nugroho, 2021) . Therefore, through this study, the authors are interested in researching and analyzing the distribution of electromagnetic radiation on television so that a safe distance will be obtained for watching television.

METHOD

The tools and materials used in this research are Tube television and LED television as radiation sources, and the electromagnetic radiation tester GM 3120 as a measuring instrument for electromagnetic radiation.

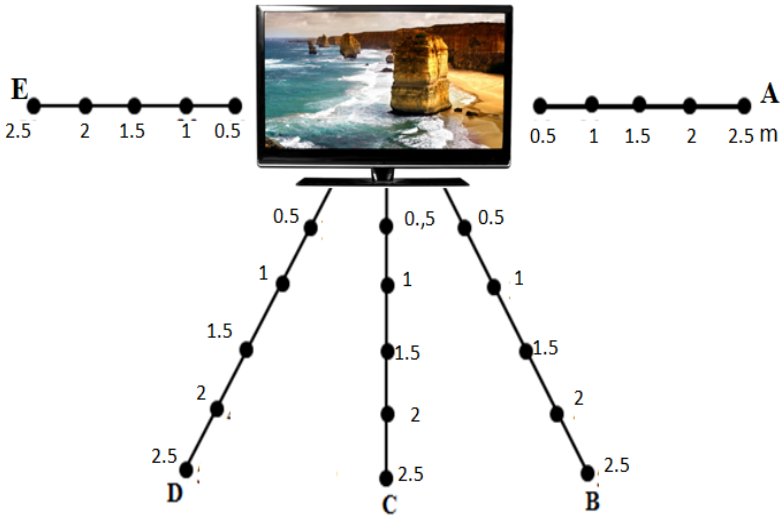

Figure 1. Indoor measurement point design

There are 25 measurement points divided into five paths, namely A, B, C, D and E (see Figure 1). Each path has a distance variation of 0.5 m, 1 m, 1.5 m, 2 m and 2.5 m. Each measurement point is measured by electromagnetic radiation with time variations, namely 0 minutes, 15 minutes, 30 minutes, 45 minutes, and 60 minutes.

After obtaining electromagnetic radiation at each measurement point, then make a distribution pattern of electromagnetic radiation using the Scilab program. After that, the value of radiation produced by Tube television and LED television is compared. And obtained a safe distance to watch television, namely the minimum radiation value.

RESULT AND DISCUSSION

In this study, the results of measurements of television radiation carried out with the Electromagnetic Radiation Tester GM-3120 sensor with two televisions, namely Tube television and LED television, produced different distributions of electromagnetic radiation.

From the data obtained, the radiation value of Tube television is greater than the radiation value of LED television. Electromagnetic radiation exposure for Tube television is 735 V/m, 8.73 µT (see Figure 2 and Figure 4). While electromagnetic radiation exposure for LED television is 131 V/m, 0.09 µT for 60 minutes (see Figure 6 and Figure 8). The data obtained by (Johan et al., 2020) stated

that the radiation produced by Tube television is greater than LED television, because Tube television requires greater electrical power than LED television.

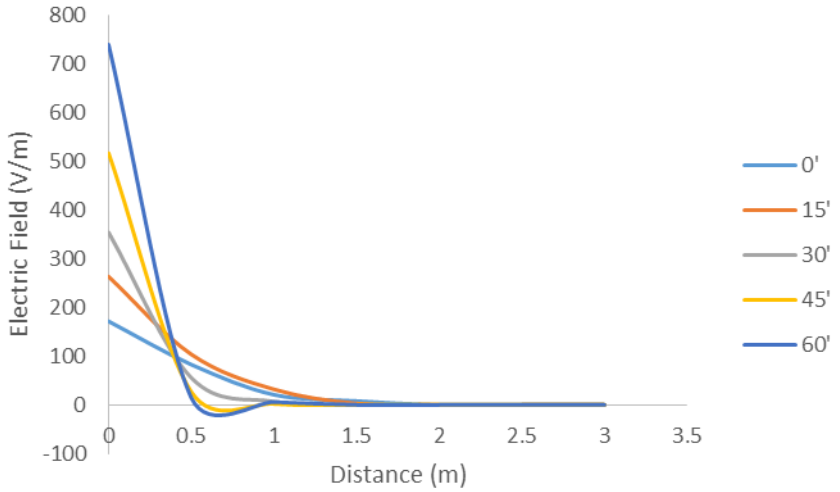

Figure 2. Tube Television Electric Field on Path C in Five Variation Time: a. 0 minute, b. 15 minute, c. 30 minute, d. 45 minute and e. 60 minute

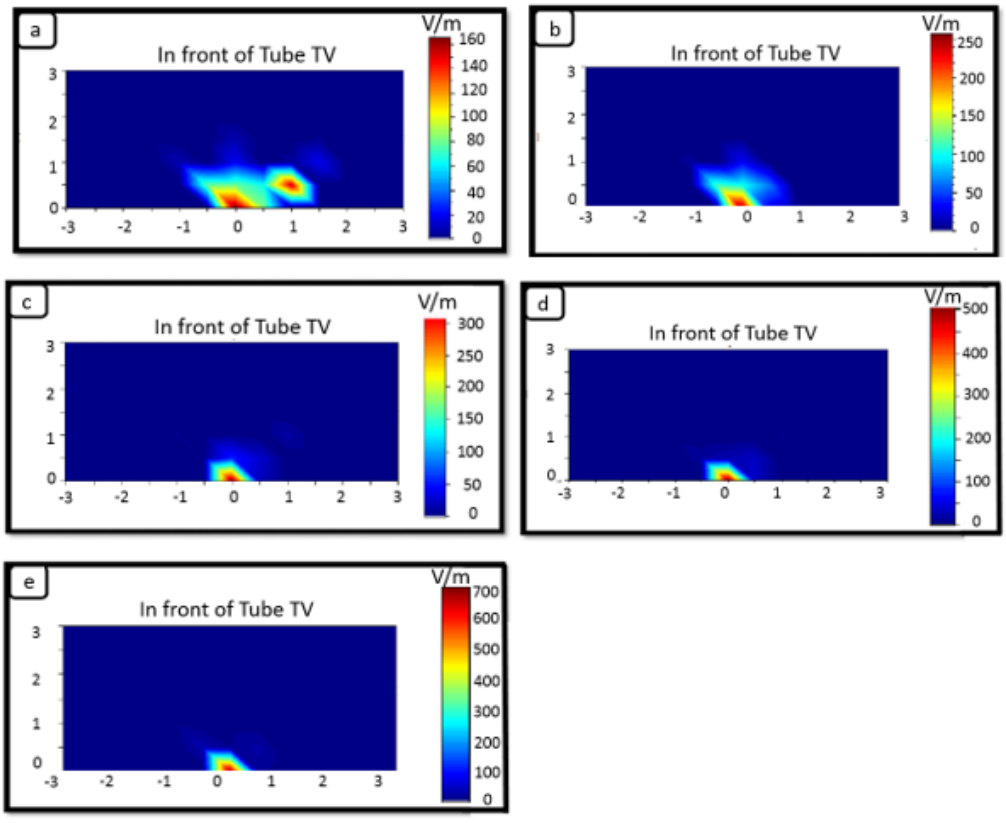

Figure 3. Isodose Contour Tube Television Radiation Exposure Electric Field in Five Variation Time: a. 0 minute, b. 15 minute, c. 30 minute, d. 45 minute and e. 60 minute

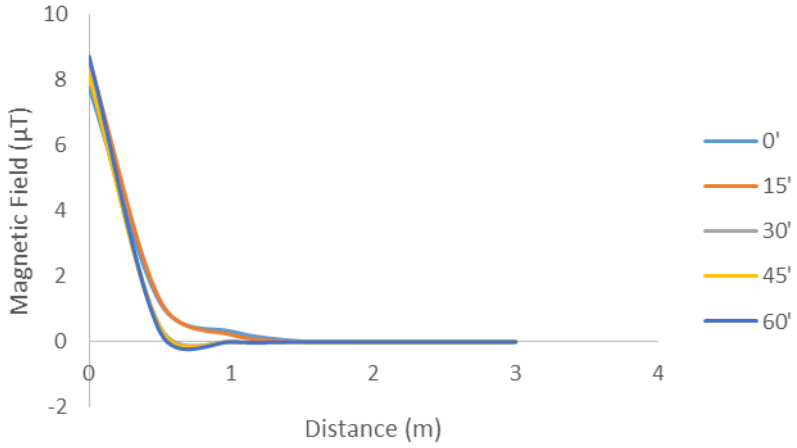

Figure 4. Tube Television Magnetic Field on path C in Five Variation Time: a. 0 minute, b. 15 minute, c. 30 minute, d. 45 minute and e. 60 minute

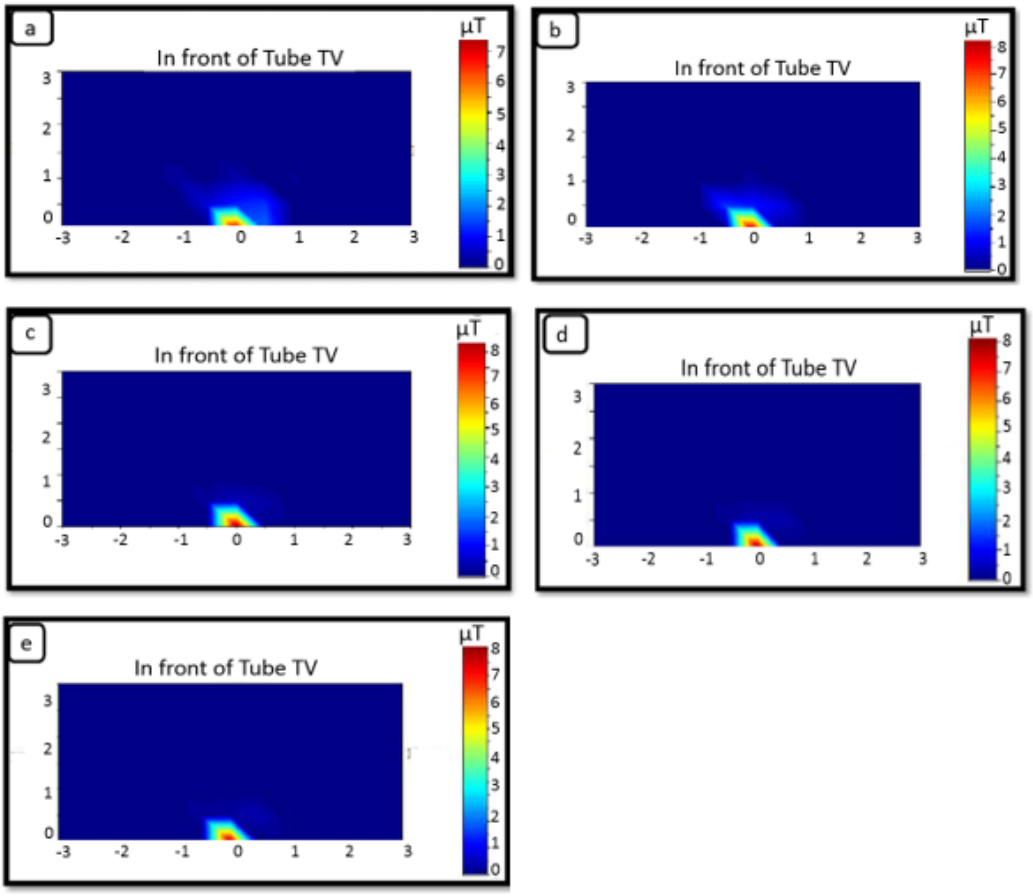

Figure 5. Isodose Contour Tube Television Radiation Exposure Magnetic Field in Five Variation Time: a. 0 minute, b. 15 minute, c. 30 minute, d. 45 minute and e. 60 minute

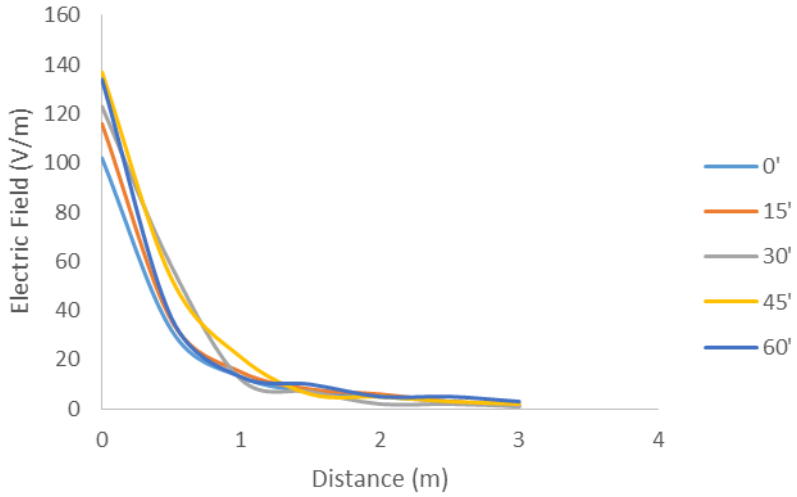

Figure 6. LED Television Electric Field on path C in Five Variation Time: a. 0 minute, b. 15 minute, c. 30 minute, d. 45 minute and e. 60 minute

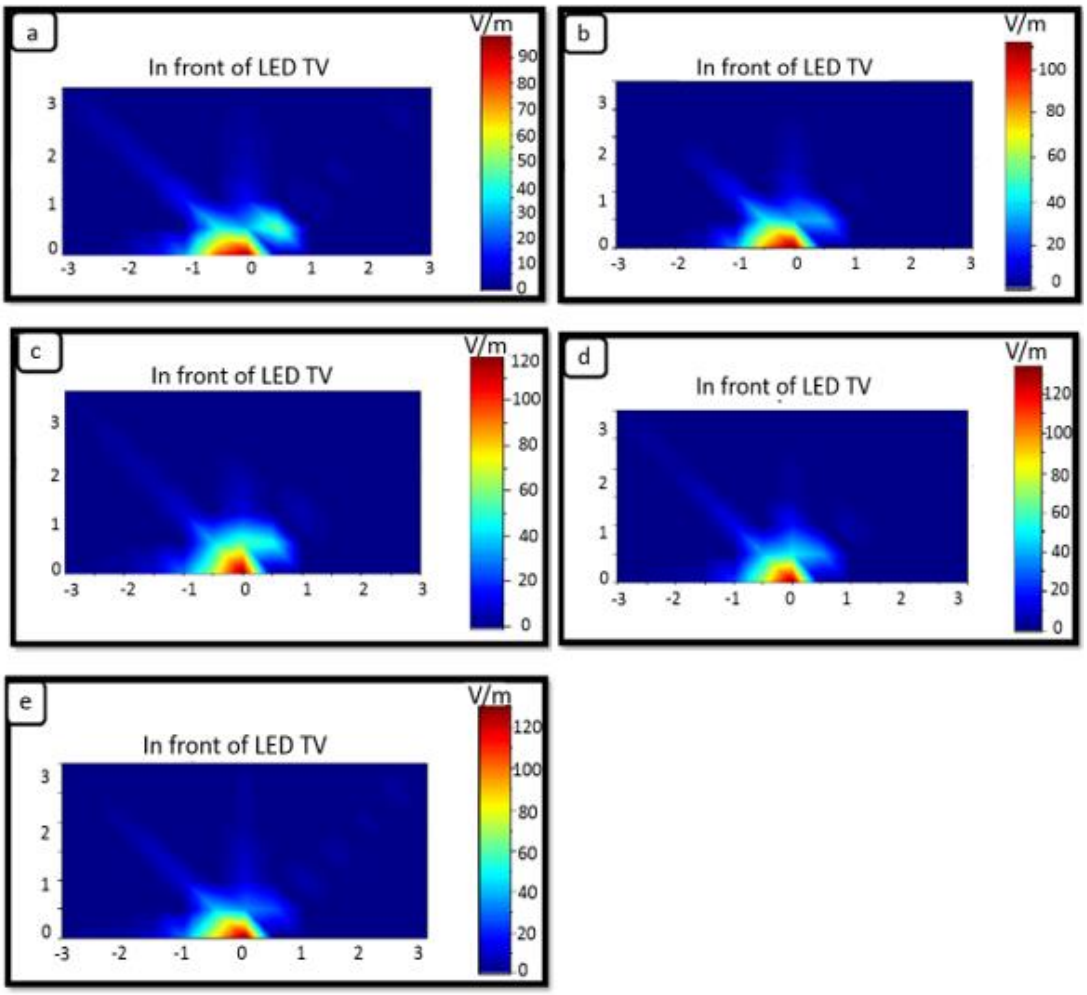

Figure 7. Isodose Contour LED Television Radiation Exposure Electric Field in Five Variation Time: a. 0 minute, b. 15 minute, c. 30 minute, d. 45 minute and e. 60 minute

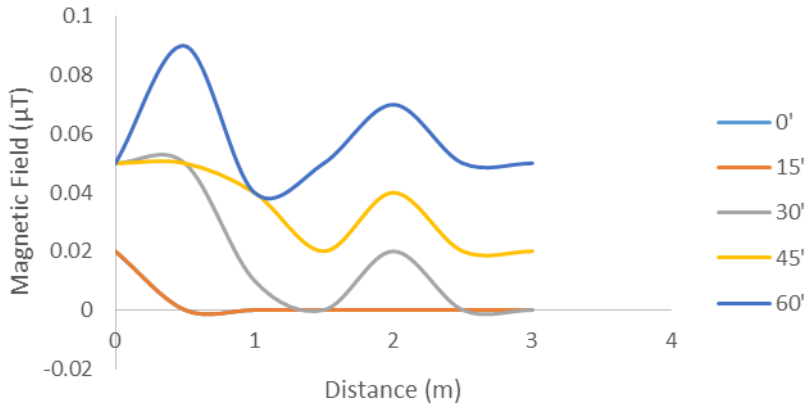

Figure 8. LED Television Electric Field on path C in Five Variation Time: a. 0 minute, b. 15 minute, c. 30 minute, d. 45 minute and e. 60 minute

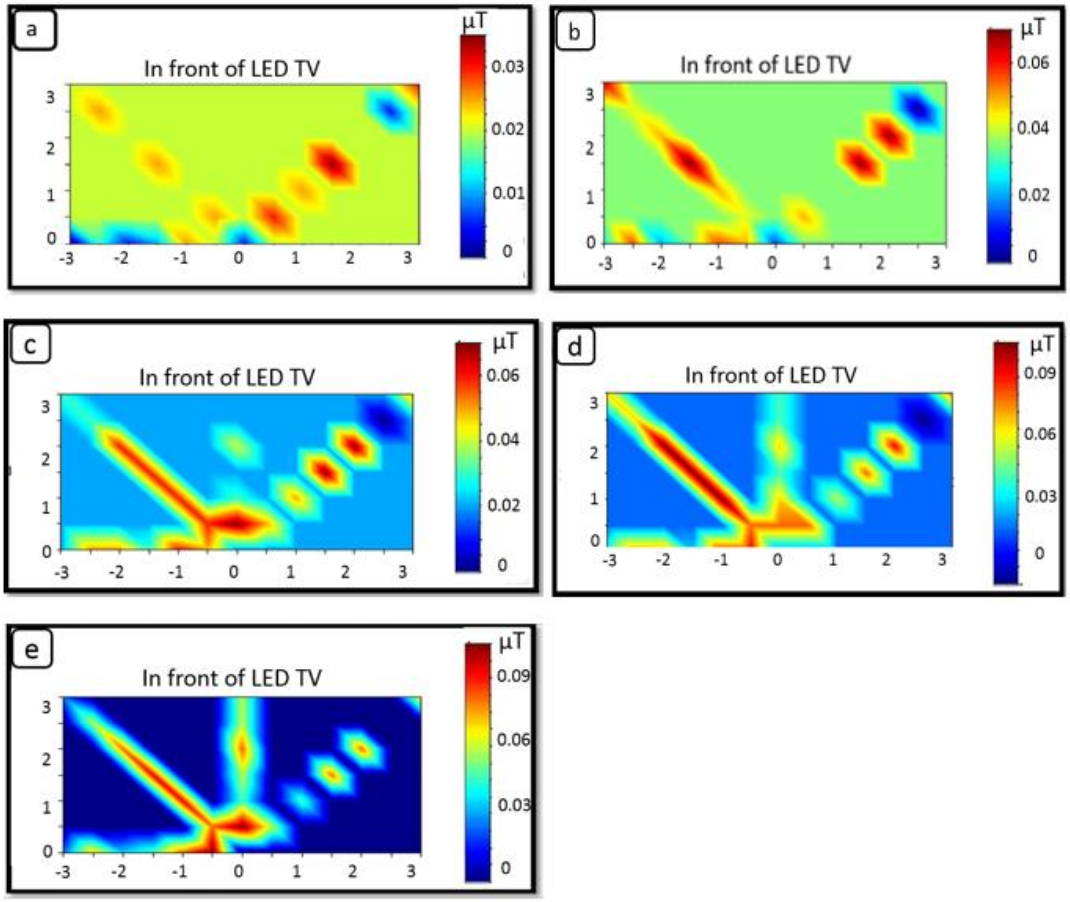

Figure 9. Isodose Contour LED Television Radiation Exposure Magnetic Field in Five Variation Time: a. 0 minute, b. 15 minute, c. 30 minute, d. 45 minute and e. 60 minute

Based on the contour display (see Figure 3, Figure 5, Figure 7 and Figure 9), there are several quantities of different tracks and colors on each track. The red color shows an electric field or magnetic field with the greatest value. While the color blue shows the electric fields or magnetic fields of the smallest value.

The maximum electric field on a Tube television at 0 minute is 172 V/m, at 15 minute is 264 V/m, at 30 minute is 355 V/m, at 45 minute is 518 V/m, at 60 minute is 735 V/m (see Figure 2 and Figure 3). While the maximum magnetic field on a Tube television at 0 minute is 7.7 μT, at 15 minute is 8 μT, at 30 minute is 8 μT, at 45 minute is 8 μT, at 60 minute is 8,73 μT (see Figure 4 and Figure 5).

The maximum electric field on LED television at 0 minute is 102 V/m, at 15 minute is 116 V/m, at 30 minute is 123 V/m, at 45 minute is 130 V/m, at 60 minute is 131 V/m (see Figure 6 and Figure 7). While the maximum electric field value at 0 minute is 102 V/m, at 15 minute is 116 V/m, at 30 minute is 123 V/m, at 45 minute is 130 V/m, at 60 minute is 131 V/m (see Figure 8 and Figure 9).

Based on Figure 2 to Figure 9 the farther measurement distance, the smaller the radiation electromagnetic exposure dose obtained. Conversely, the closer the measurement distance, the higher the radiation electromagnetic exposure dose obtained. This result is by Tulfala research (Tulfala et al., 2020) . So the safest distance for television viewers based on isodose contours is at a distance of more than 2.5 m where the radiation electromagnetic exposure dose produced is 0.

CONCLUSION

The conclusion obtained in this study is that the radiation exposure on Tube television is greater than radiation exposure on LED television, namely the electric field on the Tube television of *E max* = 735 V/m and the magnetic field *B max* = 8.73 μT while for the electric field on the LED television is *E max* = 131 V/m, and the magnetic field *B max* = 0.09 μT. The isodose contour can be used as a reference in making radiation protection efforts (knowing the safest distance) for television viewers. In this study, there are several trajectories and colors that indicate that the farther the measurement distance, the smaller the radiation exposure dose obtained.

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REFERENCES

Agung Yanuar Wirapraja, Ika Prawesty Wulandari and Mohamad marhaendra Ali, (2020). The effect of TV pattern test. on 30 MHz - 1 GHz Radiated Emission Characteristic of LED Television. Journal of Technology Process. 5(2).

Andy Nugroho Piro Utomo, (2021). The eye safety distance controller television monitor screen is based on microcontroller. Thesis of Muhammadiyah University Ponorogo.

Johan Aristo, Purnomosutji Dyah prinajati, and Nafsan Upara (2020). Analysis of the amount of TV electromagnetic radiation in the work environment. SEOI Journal. 2(1).

Kemal Dervić, Vladimir Šinik, Željko Despotović. (2019). Basic of electromagnetic radiation. IX International Conference Industrial Engineering and Environmental Protection. Zrenjanin, Serbia

Muhammad Niki Bagus Wahyune Sukma. (2022). Detection of electromagnetic wave radiation from television equipment in Sumbertebu village. Experiment : Journal of Science Education. 2(1) : 29-34.

Nanda, K., Kazi, M., Farhana, I., Marjanul, H., Razzak, Mollah, M., and Ruhul, A. (2021). Fundamental characteristics and application of radiation. GSC Advanced

Research and Review. 07(01): 064–072.

Peter Johnston. (2020). Making sense of radiation safety. Department of Nuclear Safety and Security.

Tulfala F, and Kasman. (2020). Analysis of Contour Isodosis of X-Ray Radiation Exposure at the Radiology Installation at the Madani Palu General Hospital. Gravitasi Journal 19-1: 20-23.

Yamin Sun, Zhiyong Yu, Chen Pang. (2019). Study on radiation characteristics of electromagnetic equipment. IOP Conf. Series, Journal of Physics: 1237-042073.