The development of the medical world is increasingly rapid to help diagnose diseases, one of which is the CT Scan modality used in Radiology Installation as one form of X-ray utilization in the medical field. Especially radio diagnostic [1]. CT Scan is able to provide information or image data onto body organs that can be seen from various different angles, namely axial, coronal and sagittal. This information can also be stored and processed using a program in a computer to then be displayed in the form of cross-sectional variations on certain desired organs [2].

Early diagnostic development in 1972, Godfrey N. Hounsfield and J. Ambrose who worked at the Central Research Lab of EMI, in the UK produced the first clinical picture with CT-Scan (Computed Tomography Scan). Two years later, sixty CT units installed were only limited to head CT examinations, but in 1975 they were able to be used for CT-Scan all organs or WholeBody scanners for the first time, so in 1979 Hounsfield and Cormack were awarded the Nobel prize. Ten years later, W. A Calendar and P. Vock conducted the first clinical examination using Spiral CT and in early 1998 CT began to be developed so that CT Scan performed better and is now known as Multi Slice CT (MSCT) [3].

With the progress and development of technology, the division of CT is based on the number of detectors and light sources. Generation I with a small X-ray Source with one detector, Generation II with X-ray File rather wide, and has several detectors, Generation III wide X-ray beam (fan) and has several detectors, Generation IV Detector arranged as a circle, and X-ray tube spinning. In its use Generation I and II are not produced anymore, and only Generation III and IV or often known as dual slice CT Scan and Multi Slice CT Scan [4]. In this study, we will discuss the evaluation of dual slice CT image quality testing.

2. Material and Method
In this study using Dual Slice CT and Phantom ACR modalities.

2.1 Dual Slice CT Scan
The CT scan has the main components, namely: Computer, gantry and couch table. Gantry and couch are inside the examination room while the computer is placed separately in the control room [5].
1. The computer provides a link between the operator with other components of the image system. Computers in CT Scan have 4 basic functions, namely: as a control of data acquisition, image reconstruction, image data storage, and displaying scanning images.

2. Gantry is a CT device that is circular as a home of x-ray tubes and detectors, Data Acquisition System (DAS) and array detectors. The Gantry component in a CT scan dual slice has two X-ray tubes and a detector that is parallel and intersects each other [6].

![Figure 1. Tubes and dual slice CT scan detectors](image1)

Figure 1 shows red ed and green images indicated two tubes and a detector that is parallel to each other and rotates when scanning, which is the basic principle of dual slice CT Scan modalities. The latest CT units also contain continuous slip rings and high-voltage generators inside the gantry. The structure of the gantry collects attenuation measurements needed to be sent to the computer for image reconstruction. Gantry can be angled for and backward to 30 ° to adjust body parts.

3. A table is a place to position patients, usually connected automatically with computers and gantry. This table is made of carbon fiber which can be used to support inspection but does not cause artifacts on the scanning image. Most of the examination tables can be programmed to move in and out of the gantry, depending on the patient and the inspection protocol used.

2.2 Phantom ACR
Phantom ACR CT accreditation (phantom Gammex 464) is a solid phantom containing four modules, and is made of materials that are equivalent to water [7]. There are external x, y and z axis alignment marks that are line and painted white (to reflect the straightening light) at each slice to allow reflection of the phantom on the axial axis (z axis, cranial/caudal), sagittal (x axis, left/right) direction and coronal (y axis, anterior/posterior) as show in figure 2[8].

![Figure 2. Phantom ACR](image2)

There are 4 ACR CT phantom modules, namely as follows:
1. Slice an is used to assess CT number accuracy and slice thickness, position and alignment.
2. Slice b is used to assess low contrast resolution. This image consists of a series of cylinders of different diameters, all of which have a difference between \( / \) in 0.6\% (6 HU) from background material which has an average CT value of about 90 HU.

3. Slice c to assess the uniformity of CT numbers consisting of uniform materials equivalent of tissue.

4. Slice d is used to assess high contrast (spatial) resolution. It contains eight bars. Resolution patterns: 4, 5, 6, 7, 8, 9, 10 and 12 lp/cm, with a 15 mm x 15 mm square area, as shown in figure 3.

![Figure 3. Phantom ACR Slice Structure](image)

In the head regulation of BAPETEN No. 2 of 2018 Quality Test Image CT Scan modalities can be assessed with several parameters using phantom, namely: Accuracy of CT number, Uniformity of CT Number, Uniformity of CT Noise, Linearity of CT Number [9]. Phantom ACR is placed on the inspection table and x-ray irradiation is carried out, some of the parameters can be calculated, namely:

a. **Accuracy of CT Number**

CT Number values are affected by X-ray tube voltage, X-ray filtration and object thickness. The Number water CT value is 0 HU, while the average CT Number value of the phantom centered ranges of ±4HU.

b. **Uniformity of CT Number and Noise**

Uniformity is related to the average value of CT Number of water in a homogeneous 20 cm diameter phantom object of a narrow area. The average difference in CT Number on the edge and center of homogeneous phantom 18 are less than 8 HU.

c. **CT Number linearity**

Place the ROI pointed on: air, polyethylene, water, archils and bone. Record each value of the CT numbers on the worksheet. Then make a curve to get a correlation value of the value of electron density of the value of the CT number.
3. Results and Discussion
In some parameters the vulnerability of 2016 to 2018 has different standard deviation values.

Table 1. Parameters of 2016 quality test for dual slice CT Scan A, B and C are the Value Results Test the dual slice CT Scan modality of each hospital

| No. | Parameter                    | 2016 Average | Standard deviation | SNI |
|-----|------------------------------|--------------|--------------------|-----|
| 1.  | Accuracy of CT Number        | 1.8          | 1.89               | ≤±4 |
| 2.  | Uniformity of CT Number      | 1.3          | 0.75               | ≤±2 |
| 3.  | Uniformity of noise          | 0.8          | 0.29               | ≤±2 |
| 4.  | CT Number linearity          | 0.994        | 0.002              | ≥0.99 |

Table 1 shows the Deviation Value of the Accuracy of CT Number 1.89 parameters, Uniformity of CT Number 0.75. Uniformity of Noise 0.29 and CT Number Linearity 0.002.

Table 2. Parameters of 2017 quality testing for dual slice CT scan A, B and C are the Value Results Test the dual slice CT Scan modality of each hospital

| No. | Parameter                    | 2017 Average | Standard deviation | SNI |
|-----|------------------------------|--------------|--------------------|-----|
| 1.  | Accuracy of CT Number        | 2.2          | 2.02               | ≤±4 |
| 2.  | Uniformity of CT Number      | 1.3          | 0.71               | ≤±2 |
| 3.  | Uniformity of noise          | 0.8          | 0.16               | ≤±2 |
| 4.  | CT Number linearity          | 0.995        | 0.002              | ≥0.99 |

Table 2 shows the Deviation Value of the Accuracy parameter of CT Number 2.02, Uniformity of CT Number 0.71, Uniformity of Noise 0.16 and CT Number Linearity 0.002.

Table 3. Parameters for testing the quality of dual slice CT Scan in 2018 A, B and C are the Value Results Test the dual slice CT Scan modality of each hospital

| No. | Parameter                    | 2018 Average | Standard deviation | SNI |
|-----|------------------------------|--------------|--------------------|-----|
| 1.  | Accuracy of CT Number        | 2.4          | 1.55               | ≤±4 |
| 2.  | Uniformity of CT Number      | 1.5          | 0.16               | ≤±2 |
| 3.  | Uniformity of noise          | 0.9          | 0.27               | ≤±2 |
| 4.  | CT Number linearity          | 0.994        | 0.002              | ≥0.99 |

Table 3 shows the Deviation Value of the Accuracy of CT Number 1.55 parameters, Uniformity of CT Number 0.16, Uniformity of Noise 0.27 and CT Number Linearity 0.002.
Figure 1 Show that several image quality test parameters from 2016 to 2018 in the value pass the CT Number Accuracy tested $\pm 4$, Uniformity Noise $\pm 2$, Linearity CT Number $\leq 2$ and Uniformity CT Number $\geq 0.99$. The average value of each CT Number Accuracy parameter in 2016; 0.73, 2017; 0.83, and 2018; 1.32. CT Number Uniformity Parameters in 2016; 1.04, 2017; 1.07, and 2018; 1.43. Noise Uniformity Parameters in 2016; 0.55, 2017 has increased by 0.64, and in 2018 has decreased by 0.58. While the CT Number Linearity parameter in 2016; 0.995, 2017; 0.998 and 2018; 0.995. While the standard deviation value of the CT Number Accuracy parameter in 2016; 1.89, 2017; 2.02, and 2018; 1.55. CT Number Uniformity Parameters in 2016; 0.75, 2017; 0.71 and 2018; 0.16. Noise Uniformity Parameter; 0.29, 2017; 0.16 and in 2018; 0.27. And CT Number Linearity Parameters in 2016; 0.002, 2017; 0.002 and 2018; 0.002. From the parameter of image quality assessment which refers to BAPETEN Regulation Number 2 of 2018 the CT scan condition is stated to be reliable, if it meets the image quality parameter value. The double slice CT scan condition is declared reliable with improvement if several tests have passed other parameter tests. The condition of a double slice CT scan is stated to be unreliable, if it does not have the value.

4. Conclusion
The analysis shows that the CT Number and CT Number Uniformity parameters has increased from year to year. CT Number Accuracy parameters in 2016 is 0.73, 2017 is 0.83, and for year 2018 is 1.32. CT Number Uniformity parameters in 2016 is 1.04, 2017 is 1.07, and for year 2018 is 1.43. Whereas the Noise Uniformity parameter in 2016 is 0.55, In 2017 there was an increase of 0.64, then in 2018 it decreased by 0.58.

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