

**RADIO FREQUENCY INTERFERENCE (RFI) ANALYSIS
ON DYNAMIC SPECTRUM AT SELECTED GALILEO
STATIONS USING KURTOSIS ANALYSIS.**

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**SCHOOL OF OCEAN ENGINEERING
UNIVERSITI MALAYSIA TERENGGANU
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RADIO FREQUENCY INTERFERENCE (RFI) ANALYSIS ON DYNAMIC
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By
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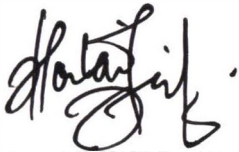
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THESIS CONFIRMATION AND APPROVAL

This is acknowledged and confirmed that thesis entitled: RADIO FREQUENCY INTERFERENCE (RFI) ANALYSIS ON DYNAMIC SPECTRUM AT SELECTED CALLISTO STATIONS USING KURTOSIS ANALYSIS by ZAIDATUL NABILAH BINTI ZAINUD-DIN Matric No.: S39254 have been checked and all the suggested corrections have been done. The thesis is submitted to School of Ocean Engineering, Universiti Malaysia Terengganu in partial fulfillment of the requirements for the award of the degree of Bachelor of Applied Science (Electronics and Instrumentation Physics).

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I hereby declare that this thesis is the result of my own research except as cited in the references.

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RADIO FREQUENCY INTERFERENCE (RFI) ANALYSIS ON DYNAMIC SPECTRUM AT SELECTED CALLISTO STATIONS USING KURTOSIS ANALYSIS.

ABSTRACT

The Radio Frequency Interference (RFI) nowadays becomes a serious problem and crucial issue in the radio astronomy observation. Compact Astronomical Low-Cost Instrument for Spectroscopy in Transportable Observatories (CALLISTO) is a worldwide network of spectrometer system for the solar activity monitoring. The detection of solar radio bursts are being interrupted due to RFI as which these stations are held on the ground. Since RFI signals are being detected from surrounding, this gives inaccurate data for ground base station observations. RFI sources are mostly come from man-made devices. This research is about the analysis of RFI level at selected CALLISTO stations using Kurtosis Analysis. Data from Banting, Sumedang, Ooty and Daejeon stations for two months (45-870MHz) that contain solar burst and no solar burst had been selected. The data obtained, one per 15 minutes of observation with the total 11520 data have been analysed for all stations. The kurtosis value is then compared with the population density to get the relationship between the population density and the RFI level. The RFI will affect the solar burst appearance in the dynamic spectrum. The highest average of kurtosis values indicates the lowest of radio frequency interference at these sites. From obtained results, the highest kurtosis value in January obtained at 'Ooty' which 2.0092 and in the Deuterium line was found at 'Sumedang' with a value of 4.3874. In July, the highest kurtosis value obtained at 'Sumedang' with a value of 64.774 and in the Deuterium line was also found at 'Sumedang' with a value of 4.4893. 'Banting' was found as the second lowest of kurtosis value for both January and July with a value of 0.3983 and 0.8523. In the Deuterium line, 'Banting' was in a second highest of kurtosis value for both months with a value of 2.7544 and 3.2347. MATLAB software was used in this study for data analysis and Microsoft Excel for RFI profiling graphing. It is important to have the

RFI analysis to determine the noise level at the stations to plan for further action. This study will benefit radio astronomy research especially in solar monitoring.

RADIO FREQUENCY INTERFERENCE (RFI) ANALYSIS ON DYNAMIC SPECTRUM AT SELECTED CALLISTO STATIONS USING KURTOSIS ANALYSIS.

ABSTRAK

Gangguan Frekuensi Radio (RFI) saat ini menjadi satu masalah serius dan merupakan satu isu penting dalam pemerhatian radio astronomi. Alatan CALLISTO (Compact Low-Frequency, Low-cost Instrument for Spectroscopy in Transportable Observatories) adalah rangkaian sistem spektrometer seluruh dunia yang digunakan untuk pemantauan aktiviti suria. Pengesanan letusan suria terganggu disebabkan oleh RFI yang mana stesen-stesen ini terletak di atas tanah. Oleh kerana isyarat RFI dikesan dari sekitarnya, ini memberikan data yang tidak tepat untuk pemerhatian stesen pangkalan tanah. Sumber RFI kebanyakannya berasal dari alatan buatan manusia. Kajian ini adalah mengenai analisis tahap RFI di stesen CALLISTO yang dipilih dengan menggunakan Analisis Kurtosis. Data dari stesen Banting, Sumedang, Ooty dan Daejeon selama dua bulan (45-870MHz) yang mengandungi letusan suria dan tidak mengandungi letusan suria telah dipilih. Data yang diperolehi adalah satu dari 15 minit pemerhatian dengan jumlah 11520 data telah dianalisis untuk kesemua stesen. Nilai kurtosis kemudiannya dibandingkan dengan kepadatan populasi untuk mendapatkan hubungan di antara kepadatan penduduk dengan tahap RFI. RFI ini akan menjejaskan penampakan letusan suria di dalam spektrum dinamik. Purata nilai kurtosis tertinggi menunjukkan gangguan frekuensi radio rendah di tempat terbabit. Dari hasil yang diperolehi, nilai kurtosis tertinggi pada bulan Januari dilihat di 'Ooty' di mana nilainya adalah 2.0092 dan di garisan Deuterium, 'Sumedang' dengan nilai 4.3874. Pada bulan Julai, nilai kurtosis tertinggi diperolehi di 'Sumedang' dengan nilai 64.774 dan di garisan Deuterium nilai kurtosis tertinggi juga dilihat di 'Sumedang' dengan nilai 4.4893. 'Banting' memperolehi nilai kurtosis kedua terendah bagi kedua-dua bulan Januari dan Julai dengan nilai 0.3983 dan 0.8523. Di garisan Deuterium, 'Banting' memperolehi nilai kedua tertinggi kurtosis untuk kedua-dua bulan dengan nilai 2.7544 dan 3.2347. Perisian MATLAB telah digunakan dalam

kajian ini untuk tujuan menganalisis data dan Microsoft Excel untuk membuat grafik bagi RFI profil. Analisis RFI sangat penting untuk menentukan tahap gangguan di sesuatu stesen sebelum tindakan selanjutnya diambil. Kajian ini akan memberi manfaat kepada penyelidikan radio astronomi terutamanya di dalam pemantauan suria.