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# BAB 5

## EEG PATTERN FOR STRESS CONDITION DURING LISTENING ROCK MUSIC AND BINAURAL BEAT SOUND

**N.A.N.Mohamed[1], N.Fuad[2,4], M.E.Marwan[3], Norazlin[3]**

[1]Faculty of Electrical and Electronic Engineering,
Universiti Tun Hussein Onn Malaysia, 86400 Johore, MALAYSIA.
[2]Embadded Computer Systems (EmbCoS), Faculty of Electrical and Electronic Engineering
Universiti Tun Hussein Onn Malaysia, 86400 Johore, MALAYSIA.
[3]Department of Computer Science, Kolej Poly-Tech MARA Batu Pahat, Sri Gading, 83300 Johore, MALAYSIA
[4]Mentor Solution, Taman Koperasi Bahagia, Batu Pahat, 83000 Johore, MALAYSIA (JR0041306-H)
[norfaiza@uthm.edu.my, myrandir276@gmail.com]

**ABSTRACT**

Music has a great effect on human brain and brainwaves. It is already proven that listening to music such as binaural beat sound and rock music increases the beta band power that is associated to increase the stress condition during listening. This research were conducted to determine the EEG pattern for stress condition during listening binaural beat sound and rock music. The research were conducted due to there is no previous research that conduct an experiment related binaural beat during listening. The previous researcher only focus on the effect of binaural beat after the listening. Experiment were conducted on 5 subjects which are 3 female and 2 male and the data of brainwaves of the samples were collected. The data collected were focused only on Alpha band and Beta band which only exist when someone are in awake state. The data were collected by using Emotiv Insight 5-Channel EEG Mobile set which consist of the Emotiv Insight headset, the Universal USB Receiver and the Emotiv Pure EEG software. The data were in power spectral density (PSD) form and it were analyzed by using SPSS software. In SPSS software, the data were analyzed to find the mean, standard deviation and the distribution. From the analysis and discussion, the hypothesis of this research are proven as the beta band are increasing and higher than alpha band. As for the recommendation, the next researcher could increase the number of subject for experimental and the songs also recommended to be divided based on subject song preferences.

**KEY WORDS:** Electroencephalogram (EEG), Stress, Binaural Beat, Rock Music, Power Spectrum Density (PSD).

### 1.0 INTRODUCTION

Human brain is a electrochemical organ which made up of billions of brain cells called neurons, which use electricity to communicate with each other. The billions of neurons which are combined

and interact with each other and sending signals at once, produces an significant amount of electrical activity in the brain, which can be detected using sensitive medical equipment such as an electroencephalogram (EEG) [6].

This electrical actions of the brain is regularly known as a brainwave pattern during the brain activity. The electrical actions produces waves pattern which have frequency range of 1 to 100 Hz [2]. Brainwaves have several frequency bands in which electroencephalogram (EEG) equipment can be used measured it. The electroencephalogram (EEG) equipment records four simple frequency bands of brainwaves which is Alpha, Beta, Delta, Theta identified by frequency and amplitudes [1-3].

In this study, the frequency bands that will be investigate are Alpha and Beta bands only. Alpha bands commonly have low frequencies and high amplitudes compared to beta bands when human is in relaxation mode. Meanwhile, beta waves generally have high frequencies and low amplitudes compared to alpha waves when human performs an action that increased the mental activity such as thinking and studying or when the human in stress mode [1,2].

Stress can be categorized as the response of the human body towards mental, emotional and physical distress [1-4]. It is also can classified as unwanted response of human body. Therefore, various method can be implement to relief the stress and anxiety from human mental such as music therapy. There are many type of music that exist in the world which some of them can be used as the therapy. For example, instrumental music, ballad or pop music, "nasyid" music, binaural beat sound. As for this research, the binaural beat sound and rock music were selected to be the material to determine either the stress will be exist or not while listening to them.

## 2.0 PROBLEM STATEMENT

Nowadays, the study of the effect of music towards the brain has been one of interesting subject for many researcher. For example, a study concluded that music therapy may have beneficial effects for people experiencing depression, anxiety or stress. Music is one of a small set of human cultural universals, evoking a wide range of emotions, from exhilaration to relaxation, joy to sadness, fear to comfort, and even combinations of these. There are many type of music such as pop, ballad, classical music, binaural beat and rock music. The meditation is one of the common ways to relief stress that people usually do in their everyday life. The binaural beats which is one type of brainwave entrainment can be a substitute way to replace meditation process but gain the same effect [5].

Some from previous research concluded that rock music also has benefit which is can boost someone brain power. While a number of researchers have associated rock music with depression or stress, these effects will not occur when rock is the listener's musical preference [7]. However, scientific and specific evidence on the comparison between listening to rock music and binaural beats sound that lead stress to the brainwaves signals using EEG was not found yet. This research is to investigate and to compare the brainwave patterns for subjects while listening to binaural beat sound and rock music. This is because the previous research only focus on the effect of the songs after the listening not while the listening. However, this investigation concentrates on alpha and beta band only.

## 3.0 METHODOLOGY

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Flowchart in Figure 1 shows the research development from the beginning and followed by several steps that are crucial until the final phase of the research. As a result, it is important to follow all the steps that have been set. The methodology seeks to understand more about the development of the project. There are many things that must be implemented during completed this study. The first phase are understanding on theory, search information and make literature review from the previous research related to this research. All information was gathered together in order to make the process of extracting the information become easy. This phase are very important for better understanding about the research. The second phase is finding 5 healthy subjects which will provide EEG sample while listening binaural beat sound and rock music. The third phase are recording the EEG sample from subject while listening binaural beat sound and rock music. The final phase are analyze and evaluate the data recoded by using suitable software and make the conclusion for this research and recommendation for future research.

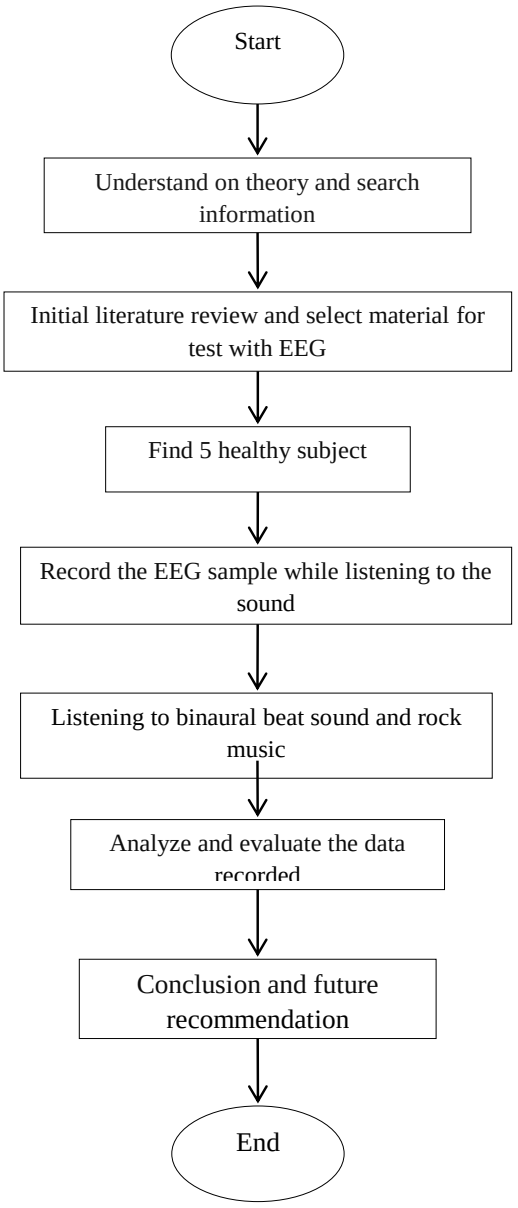

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Figure 1. Flow diagram of methodology

a) Subjects for Data Collection

For the data collection, the subject participated in this research are 5 subjects which are 3 females and 2 males. Before the experiment, the subject were asked about their physical and health condition in order to ensure that they were in general good health, have normal hearing and vision, and free from drugs or alcohol and neurological symptoms. After the experiment, the subjects were given some small gift as appreciation in participating this research.

b) Data Collection Process

This part involves the collection of EEG raw data. The data will collected from 5 healthy subjects among UTHM students. The subject will collected by using Emotiv Insight 5-Channel Mobile EEG. Firstly, the subjects will be asked to answer a questionnaire that related to this research which is about human stress. After that, they were calm themselves and sit on the chair provided comfortably. The Emotiv Insight 5-Channel Mobile EEG will be placed on the top of their head and they will listening to the binaural beat sound which Alpha Binaural Beat of 10 Hz and then rock music which is "Psychosocial" by Slipknot in mp3 format via headphone.

The subjects will be asked to close their eyes by wearing eye patch during the whole data collection process to avoid disturbance because the EEG sample might be affected by the disturbance and make the data become invalid. For each session, before listening to the song the subjects need to seat in silence for 1 minute. Then subjects need to listen to Alpha Binaural Beat of 10 Hz with closed eye for 4 minutes and EEG is recorded simultaneously. Consequently, the subjects repeat the procedure in the next session by listening rock music for 4 minutes after remain resting in 1 minute. The signal of the brainwaves sample that has been captured by the headset were transmitted to the software through the dongle which is Emotiv Universal USB Receiver. The results which is the wave pattern graph of each sub-bans were displayed and recorded simultaneously by Emotiv Pure EEG software. The flow of the whole data collection phase are shown in Figure 2.

c) Analysis And Evaluation Of Data

This phase are very important phase to get the results. In this phase, the data EEG sample that has been collected and recorded using Emotiv Insight 5-Channel Mobile EEG headset and Emotiv Pure EEG software on subjects which are among UTHM students will analyze using SPSS software. The data recorded which are the value of Power Spectral Density (PSD) of each sub-bands were saved in Microsoft Excel file. The data were transferred in SPSS Software for analyzing process.

In the SPSS software, the recorded data that has been transferred were undergo the spectral plots procedure which are the power spectral density graph for each sub-bands of each subject by using the spectral analysis function to find the pattern of the power spectral density. Next, for analyzing

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process, the data were evaluated and analyzed to find the mean and standard deviation for each bands.

Besides, this process also involve the analysis on descriptive statistics analysis of the Alpha and Beta sub bands in EEG that gained from the subjects while listening to binaural beat sound. From the mean and standard deviation that we get in descriptive statistics analysis in the SPSS software, we create the bar graph of the mean and standard deviation to observe the relationship between the mean of each sub-bands of each samples. From the analysis, the conclusion and recommendation were easy to make.

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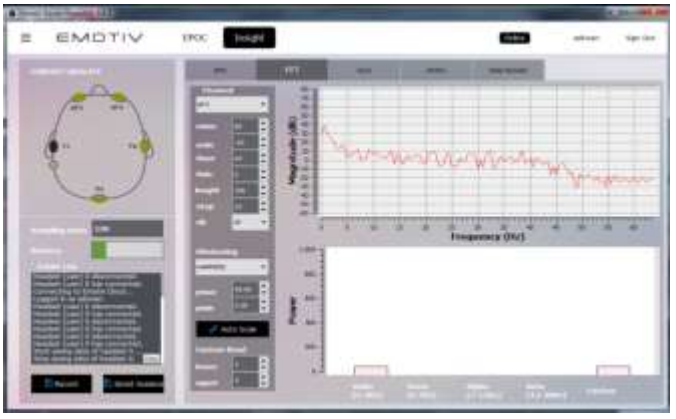
Subject wearing sleeping eye patch, Emotiv Insight and headphone

The Emotiv Universal USB Receiver




The Emotiv Pure EEG software

Figure 2: The flowchart of the data collection process [8].

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a) *Spectral Analysis*

In the spectral analysis, the spectral plots procedure is used to identify periodic behavior in time series. Instead of analyzing the variation from one time point to the next, it analyzes the variation of the series as a whole into periodic components of different frequencies. Smooth series have stronger periodic components at low frequencies while the random variation spreads the component strength over all frequencies. Series that include missing data cannot be analyzed with this procedure.

b) *Statistical Analysis*

Statistics is a branch of mathematics dealing with the collection, analysis, interpretation, presentation, and organization of data. In applying statistics to a scientific, industrial, or social problem, it is conventional to begin with a statistical population or a statistical model process to be studied. Statistics deals with all aspects of data including the planning of data collection in terms of the design of surveys and experiments.

Two main statistical methods are used in data analysis are descriptive statistics, which summarize data from a subjects using indexes such as the mean or standard deviation which draw conclusions from data that are subject to random variation. Descriptive statistics are most often concerned with two sets of properties of a distribution central tendency seeks to characterize the distribution's central or typical value, while dispersion characterizes the extent to which members of the distribution depart from its center and each other.

c) *Descriptive Statistic Analysis*

In SPSS software, the descriptive statistics analysis is the summarization of the data set which can represent the whole data. There several parameter that usually been summarize form the set of data based on what have been chose on the SPSS software. It were summarize the minimum and maximum value of the data set. It also can calculate the mean or the average value of the data. In addition, the standard deviation and variance of the data also can be summarize. This descriptive analysis on SPSS were helps the user to minimize the calculation error if doing the calculation manually in their analysis of data since the data are usually large. The standard deviation, σ and variance, σ2 can be find manually by using formula in Equation 3.1 and Equation 3.2

$$\sigma = \frac{\sqrt{\Sigma(x-x\prime)^2}}{(n-1)} \quad (3.1)$$

$$\sigma^2 = \frac{\Sigma(x-x\prime)^2}{(n-1)} \quad (3.2)$$

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## 4.0 RESULTS, ANALYSIS AND DISCUSSION

1. Result from Questionnaire

In this research, 5 subjects which are 2 male and 3 female were participate in the data collection process. A set of questionnaire that related to human stress and music were given to each subject in order to investigate the EEG pattern of stress condition during listening binaural beat sound and rock music. The questionnaire are generally asked about their feelings and thoughts related to stress in their daily life.

*Question 1 : How often have you been upset because of something that happened unexpectedly?*

The findings from Figure 3 shows the scale on how often have the sample been upset because of something that happened unexpectedly. In this figure, generally all of the sample were upset because of something that happened unexpectedly. At least 20% sample were upset fairly often while the 40% of the sample were upset very often and the rest were upset in sometimes.

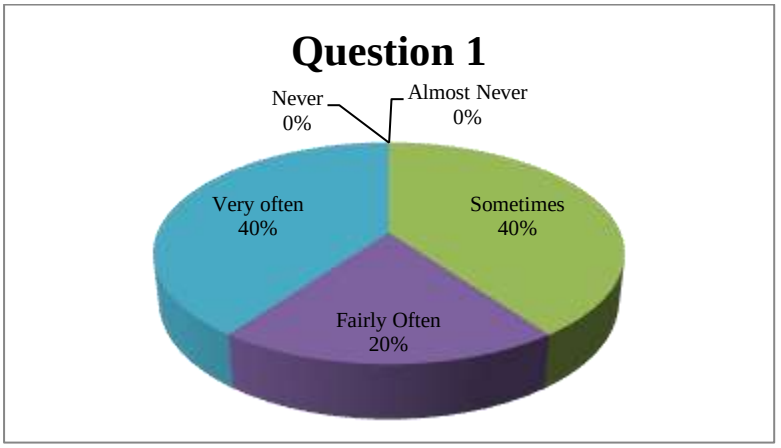


Figure 3: How often have you been upset because of something that happened unexpectedly?

*Question 2: How often have you felt that you were unable to control the important things in your life?*

Figure 4 shows pie chart of the scale on how often have the sample felt that they were unable to control the important things in their life. In this figure, at least 20% sample were felt that they were unable to control the important things in their life very often. Meanwhile, the 40% of other sample were felt sometimes and fairly often respectively that they unable to control the important thing in their life. This is maybe because of the problem or the important things that they had to face in their life are so heavy.

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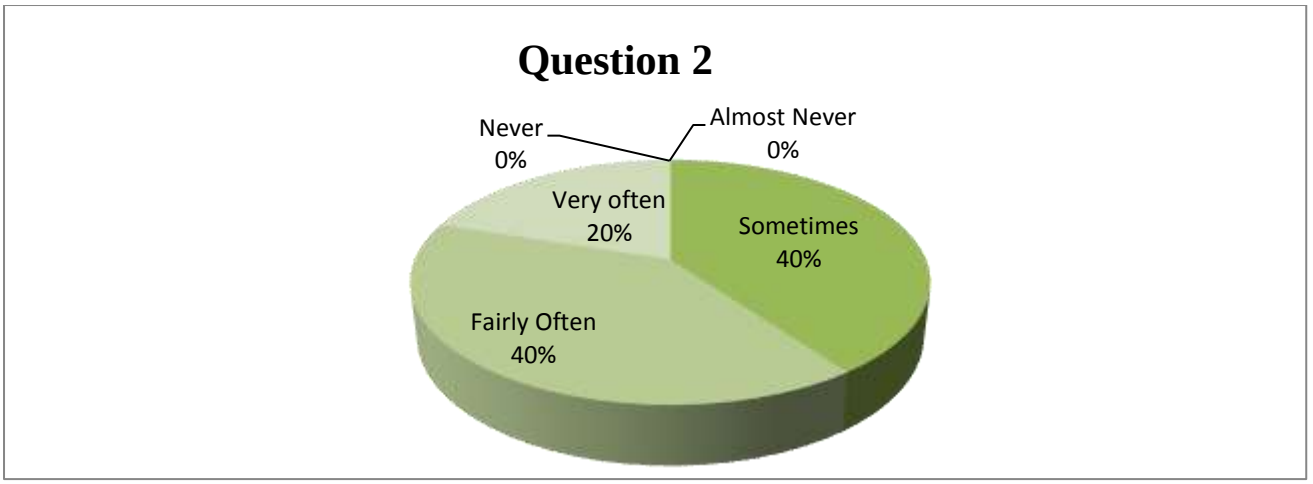


Figure 4 : How often have you felt that you were unable to control the important things in your life?

*Question 3:How often have you felt nervous and "stressed"?*

The findings from Figure 5 shows on how often have the sample felt nervous and "stressed". From the observation, generally all of the sample have felt nervous and stressed. There are 2 sample were felt nervous and stressed very often while the other sample were felt nervous and stressed in sometimes and fairly often. There is no sample that never felt nervous or stressed. The reason of they felt nervous or stressed maybe because of lack of confidence or they have low self-esteem when facing something important.

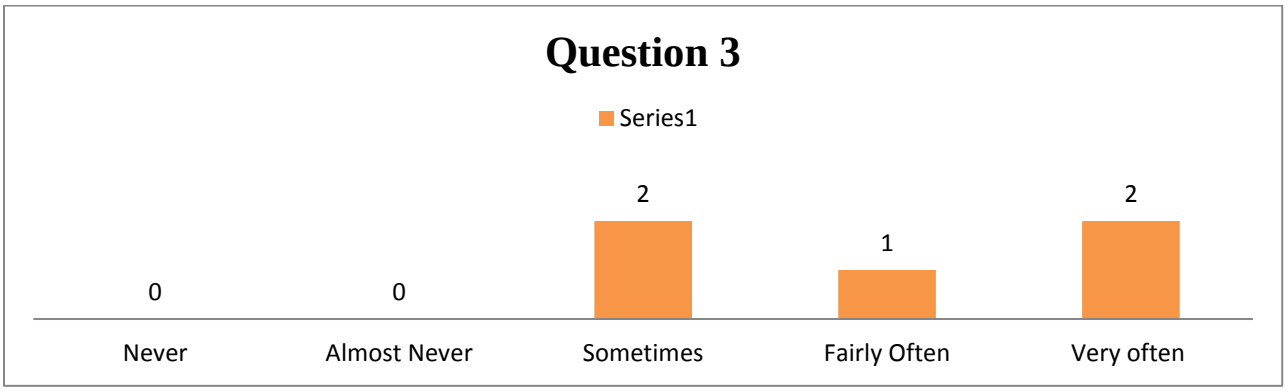


Figure 5: How often have you felt nervous and "stressed"?

*Question 4: How often have you found that you could not cope with all the things that you had to do?*

Based on observations, Figure 4.4 shows the scale on how often have the sample find that they could not cope with all the thing that they had to do. Most of the sample which are 4 sample were sometimes find that they could not cope with the thing they had to do. This is maybe because they faced too much pressure or problem related to their studies, financial or personal life.

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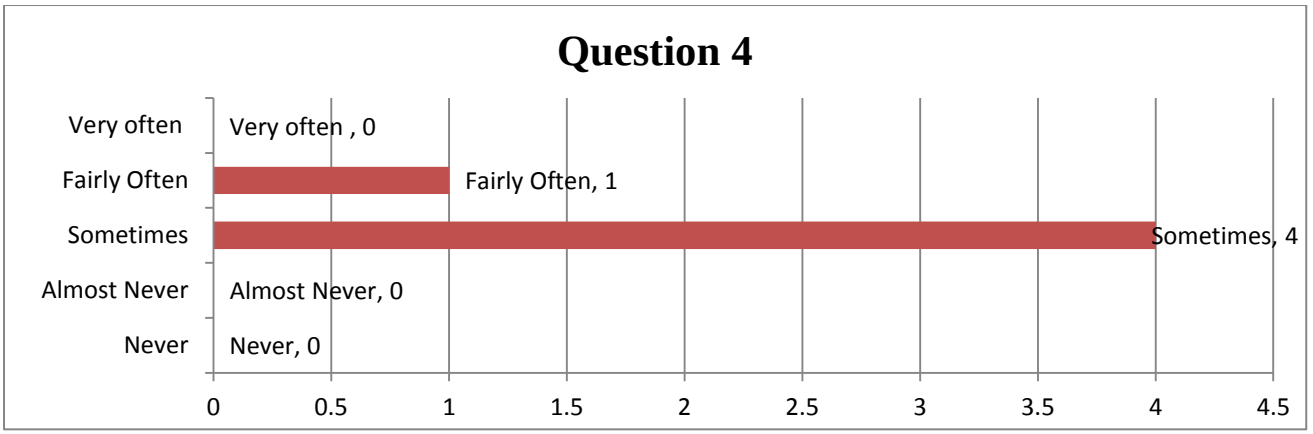


Figure 6: How often have you found that you could not cope with all the things that you had to do?

*Question 5: How often have you been angered because of things that were outside of your control?*

The findings from Figure 6 shows the scale on how often have the sample been angered because of things that were outside of their control. From the observation, 60% of the sample were fairly often been angered meanwhile the 40% were sometimes been angered because of things that were outside of their control.

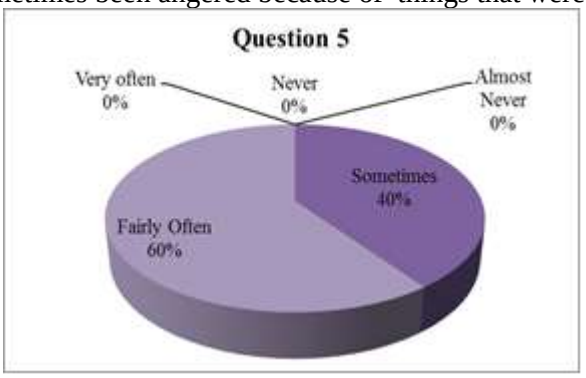


Figure 7: How often have you been angered because of things that were outside of your control?

*Question 6: How often have you felt difficulties were piling up so high that you could not overcome them?*

From the observation of Figure 7, the pie chart shows the scale on how often have the sample felt difficulties were piling up so high that they could not overcome them. 60% of the samples fairly often felt difficulties were piling up so high while the rest were sometimes felt the difficulties. There is no sample that never felt difficulties were piling up so high that they could not overcome them.

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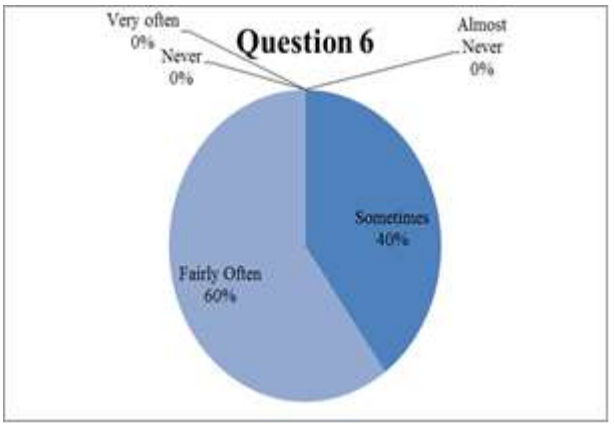


Figure 8: How often have you felt difficulties were piling up so high that you could not overcome them?

*Question 7: Do you think that music can reduce stressed?*
*Question 8 : If yes, please choose the type of music you preferred to reduce stresses.*

Based on observations, all of the sample agree that the music can reduce stressed as shown in Figure 9. Meanwhile, the Figure 10 shows the percentage on different type of music that they preferred as a music that could reduce stress. The instrumental music held the highest percentages which is 28% and binaural beat held the lowest percentages which is 9%. The other music which nasyid, rock music and ballad/pop held 27%, 18% and 18% respectively. This happen because maybe certain music are the samples favorites music and their preferences.

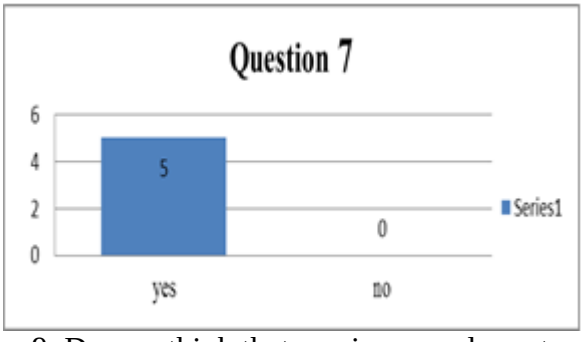


Figure 9: Do you think that music can reduce stressed?

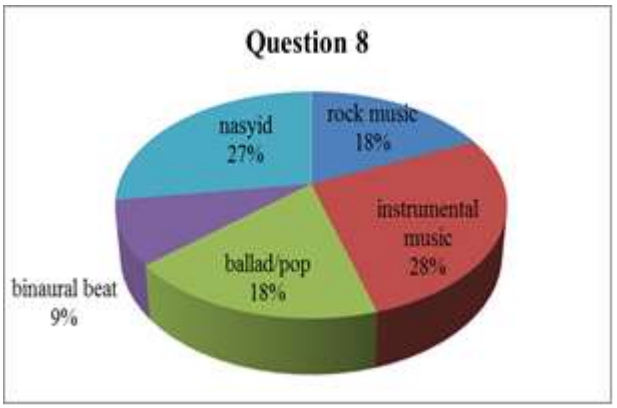


Figure 10: If yes, please choose the type of music you preferred to reduce stresses.

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*Question 9: Do you know the 'Binaural Beat'? If yes, explain it.*

Based on Figure 11, 60% of the sample said that they know about the binaural beat sound while the rest are no know about the binaural beat. The sample said that the binaural beat sound are the song that simulate the brain and also could release the stressed.

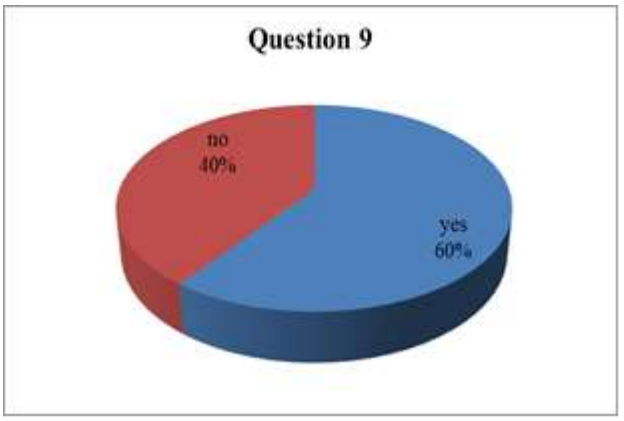


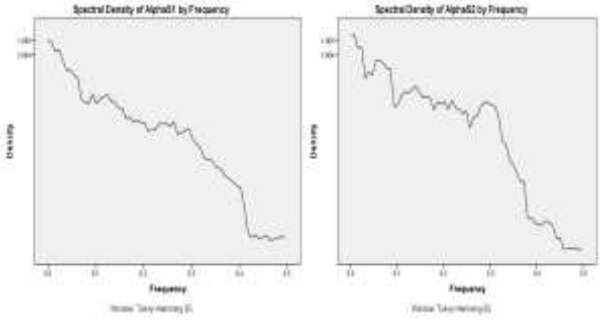

Figure 11: Do you know the 'Binaural Beat' ?

2. Result from experimental

In order to obtain an accurate conclusion for this research, the value of PSD for alpha and beta of binaural beat sound and rock music obtained from the data collection process were undergo spectral plots procedure in SPSS software by using spectral analysis option to see the pattern of the power spectral density either it is tally with the hypothesis or not.

i. *Power Spectral Density of Alpha for Binaural* Beat

Figure 12 shows the graph of the power spectral density of Alpha band versus frequency for binaural beat sound for each subject which is subject 1 until subject 5. The graphs shows the fluctuation pattern due to different value of power spectral density (PSD) in 129 brainwave samples.



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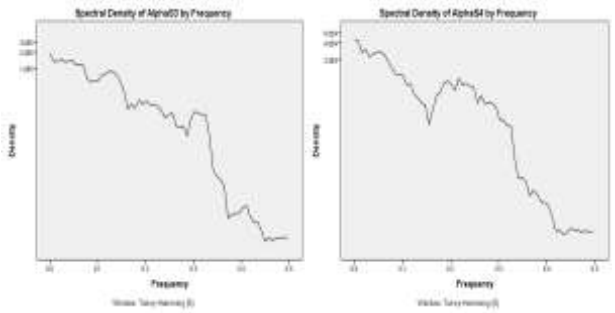

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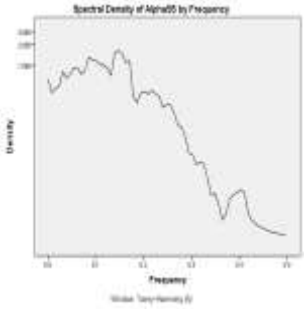
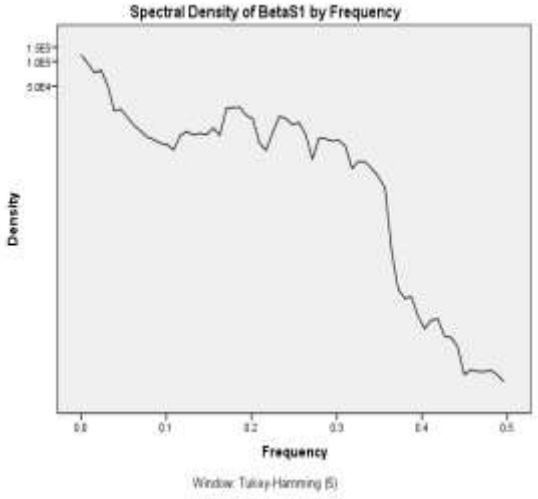


(e)

Figure 12: The PSD graph of alpha binaural beat (a) subject 1 (b) subject 2 (c) subject 3 (d) subject 4 (e) subject 5

*ii. Power Spectral Density of Beta for Binaural Beat*

Figure 13 shows the graph of the power spectral density of Beta band versus frequency for binaural beat sound for each subject which is subject 1 until subject 5. The graphs shows the fluctuation pattern due to different value of power spectral density (PSD) in 129 brainwave samples.

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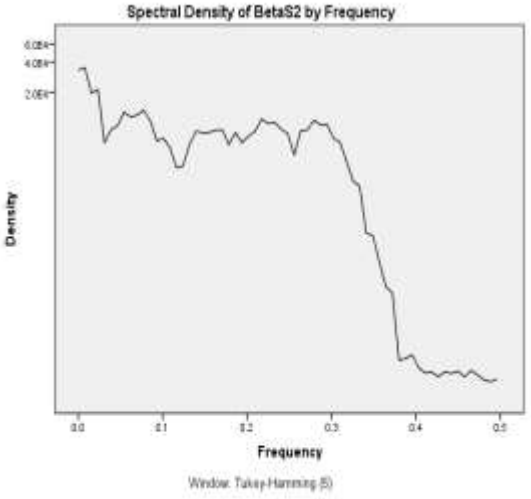


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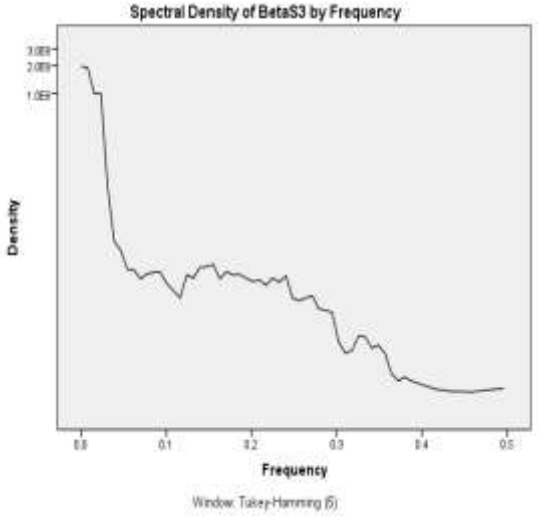


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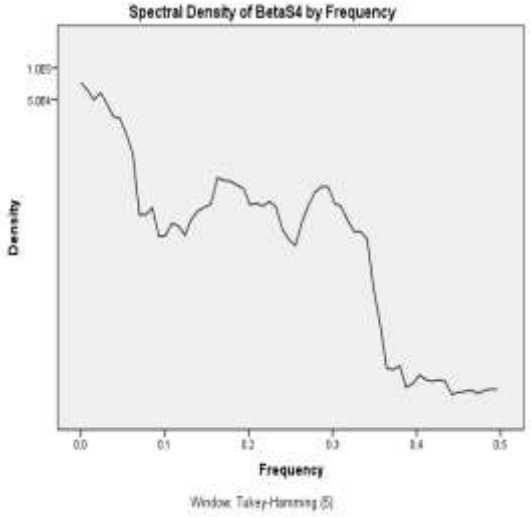


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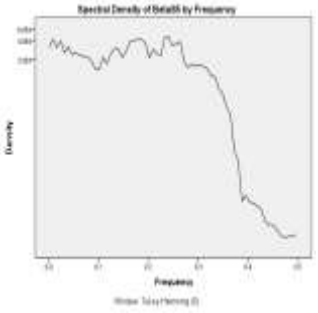

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Figure 13: The PSD graph of beta binaural beat (a) subject 1 (b) subject 2 (c) subject 3 (d) subject 4 (e) subject 5

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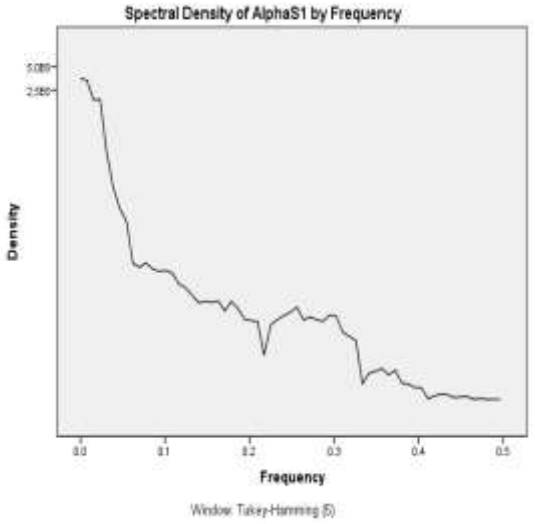
*iii. Power Spectral Density of Alpha for Rock Music*

Figure 14 shows the graph of the power spectral density of Alpha band versus frequency for rock music for each subject which is subject 1 until subject 5. The graphs shows the fluctuation pattern due to different value of power spectral density (PSD) in 129 brainwave samples.

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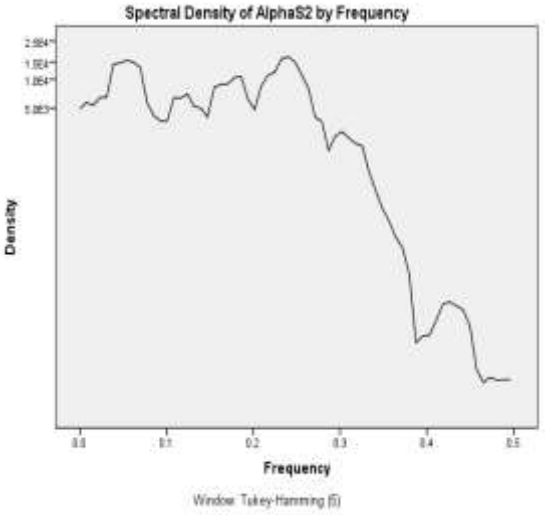


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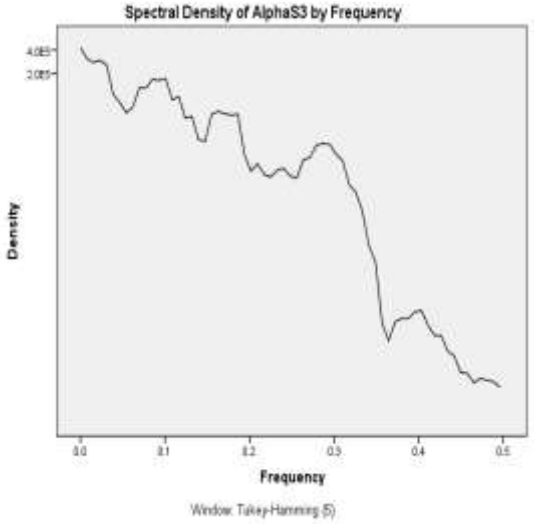


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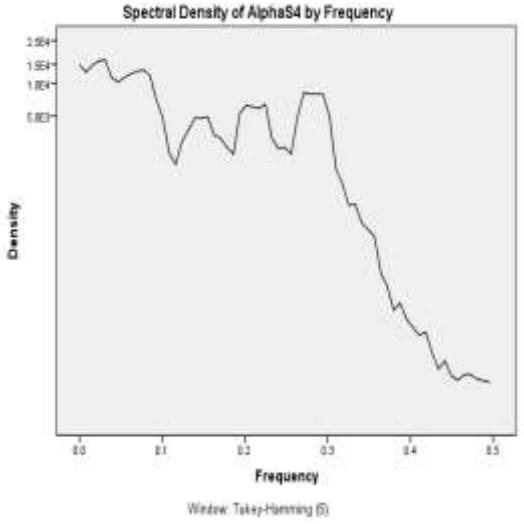


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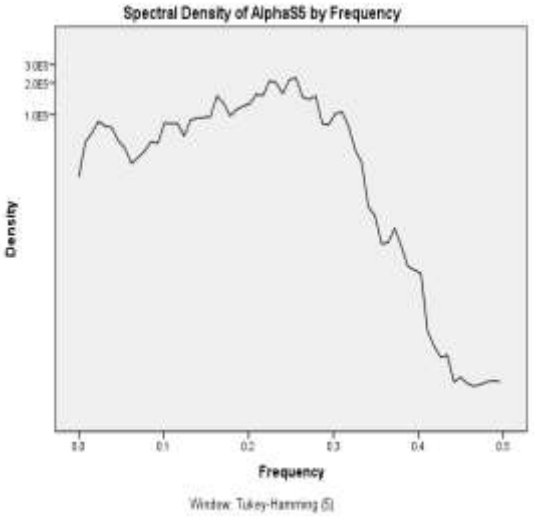
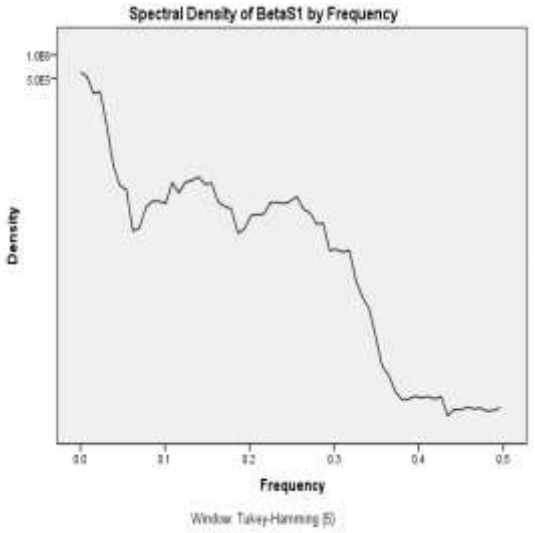



(e)

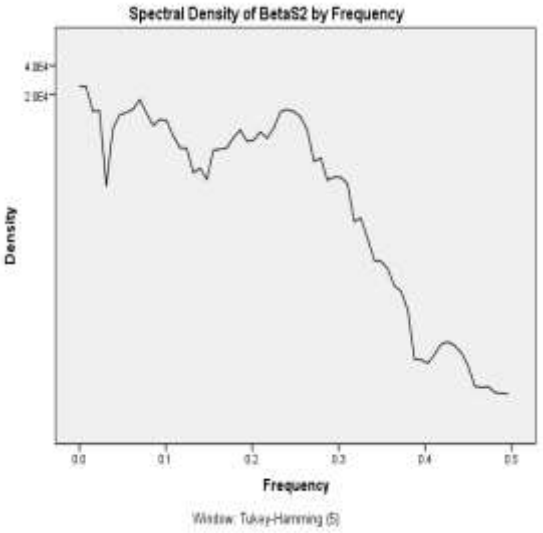
Figure 14: The PSD graph of alpha rock music (a) subject 1 (b) subject 2 (c) subject 3 (d) subject 4 (e) subject 5

*iv. Power Spectral Density of Beta for Rock Music*

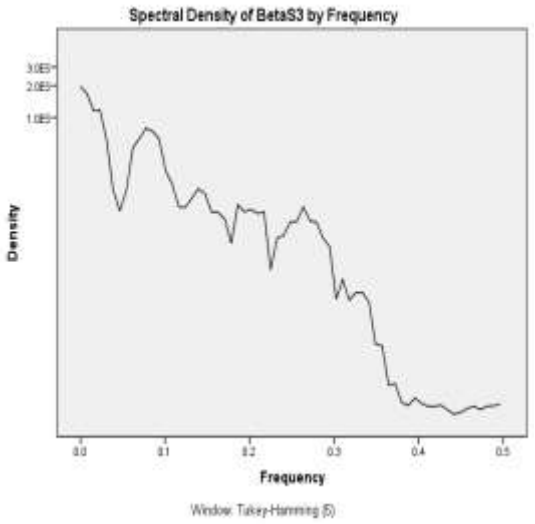
Figure 15 shows the graph of the spectral density of Beta band versus frequency for rock music for each subject which is subject 1 until subject 5. The graphs shows the fluctuation pattern due to different value of power spectral density (PSD) in 129 brainwave samples.


Spectral Density of BetaS1 by Frequency
Density
Frequency
Window: Tukey-Hamming (5)

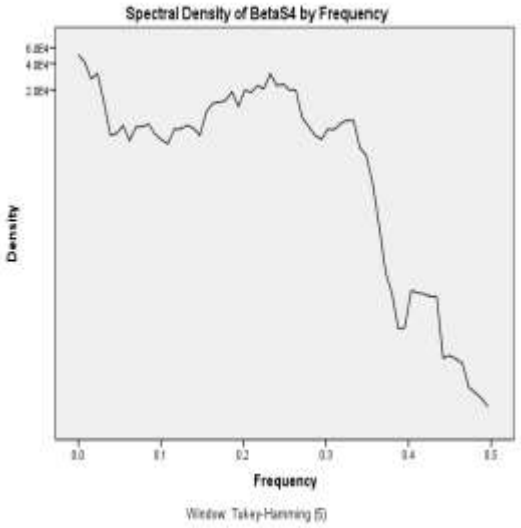
(a)


Spectral Density of BetaS2 by Frequency
Density
Frequency
Window: Tukey-Hamming (5)

(b)


Spectral Density of BetaS3 by Frequency
Density
Frequency
Window: Tukey-Hamming (5)

(c)


Spectral Density of BetaS4 by Frequency
Density
Frequency
Window: Tukey-Hamming (5)

(d)

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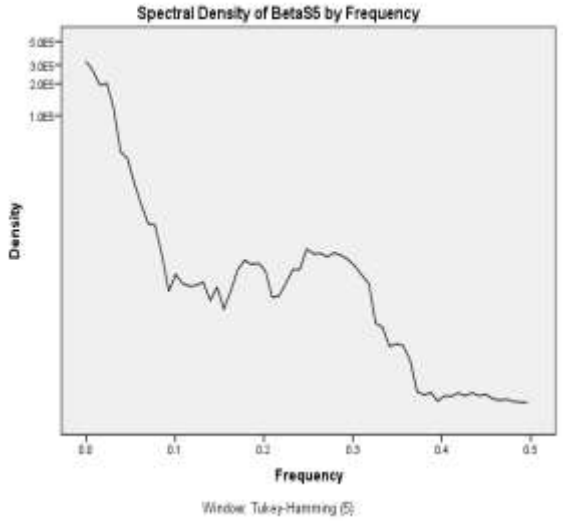


(e)

Figure 15: The PSD graph of beta rock music (a) subject 1 (b) subject 2 (c) subject 3 (d) subject 4 (e) subject 5

d) Analysis and Discussion

In this research, the analysis and discussion part are plays important roles in order to achieve the main objective which are determining the EEG pattern for stress condition during listening binaural beat sound and rock music. The analysis and discussion are contain the descriptive statistics which are the analysis about the mean and the standard deviation for the each sub-bands in binaural beat sound and rock music and also the comparison for mean between binaural beat and rock music.

1. Descriptive Statistic Analysis

i) Mean and Standard Deviation for Alpha Binaural Beat

Table 1 shows the descriptive statistics value for alpha binaural beat which consist of the minimum and maximum value, mean value and standard deviation value for each subject in 129 signal samples. Meanwhile, Figure 16 shows the bar graph of mean for alpha binaural beat and the Figure 17 shows the line graph of standard deviation binaural beat for each subject. From the observation, the mean for AlphaS3 are the highest with 4185.62 while the lowest mean are AlphaS4 with 4043.22. This show that the binaural beat could lead to stress condition during listening because the alpha value of each subject seem decreasing.

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Table 1: Descriptive Statistics for Alpha Binaural Beat

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| AlphaS1 | 129 | 4069.74 | 4168.21 | 4129.48 | 18.392 |
| AlphaS2 | 129 | 4116.41 | 4213.33 | 4174.18 | 22.174 |
| AlphaS3 | 129 | 4096.92 | 4272.82 | 4185.62 | 40.955 |
| AlphaS4 | 129 | 4003.08 | 4081.54 | 4043.22 | 17.833 |
| AlphaS5 | 129 | 3935.90 | 4381.03 | 4160.30 | 136.206 |
| Valid N (listwise) | 129 | | | | |

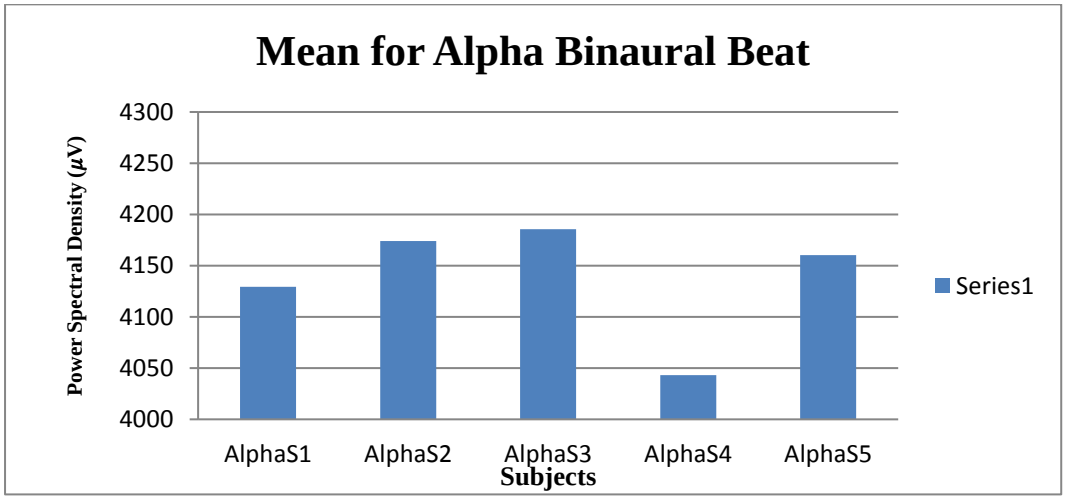


Figure 16: Mean for alpha binaural beat

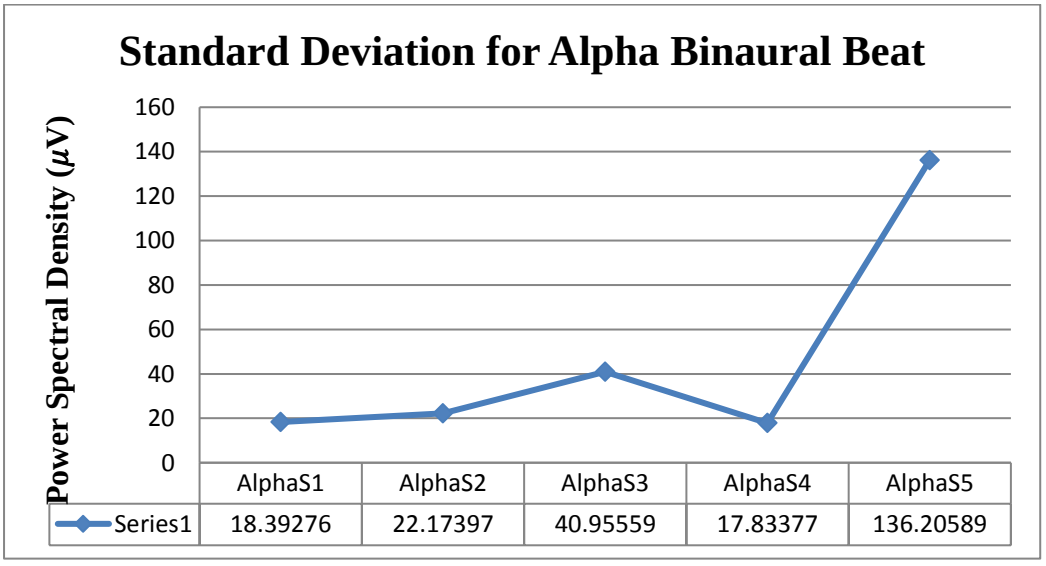


Figure 17: Standard deviation for alpha binaural beat

ii) Mean and Standard Deviation for Beta Binaural Beat

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The descriptive statistics value for beta binaural beat as shown in Table 2 above shows which consist of the minimum and maximum value, mean value and standard deviation value for each subject in 129 signal samples. Meanwhile, Figure 18 shows the bar graph of mean for beta binaural beat and the Figure 19 shows the line graph of standard deviation beta binaural beat for each subject. From the observation, the mean for BetaS3 are the highest with 4270.87 while the lowest mean are BetaS1 with 4139.87. This show that the binaural beat could lead to stress condition during listening because the beta value of each subject seem increasing.

Table 2: Descriptive Statistics for Beta Binaural Beat

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Betas1 | 129 | 4064.10 | 4198.97 | 4139.86 | 25.699 |
| Betas2 | 129 | 4147.69 | 4230.77 | 4184.36 | 16.984 |
| Betas3 | 129 | 4161.54 | 4385.64 | 4270.87 | 61.194 |
| Betas4 | 129 | 4109.23 | 4201.03 | 4162.45 | 19.433 |
| Betas5 | 129 | 4136.41 | 4292.82 | 4208.76 | 28.829 |
| Valid N (listwise) | 129 | | | | |

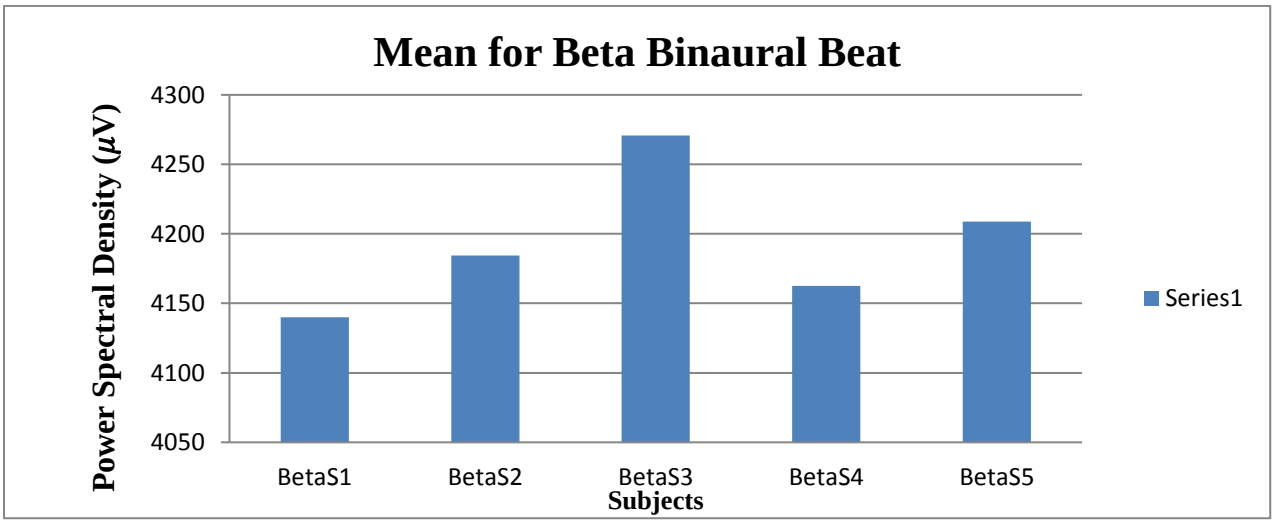


Figure 18: Mean for beta binaural beat.

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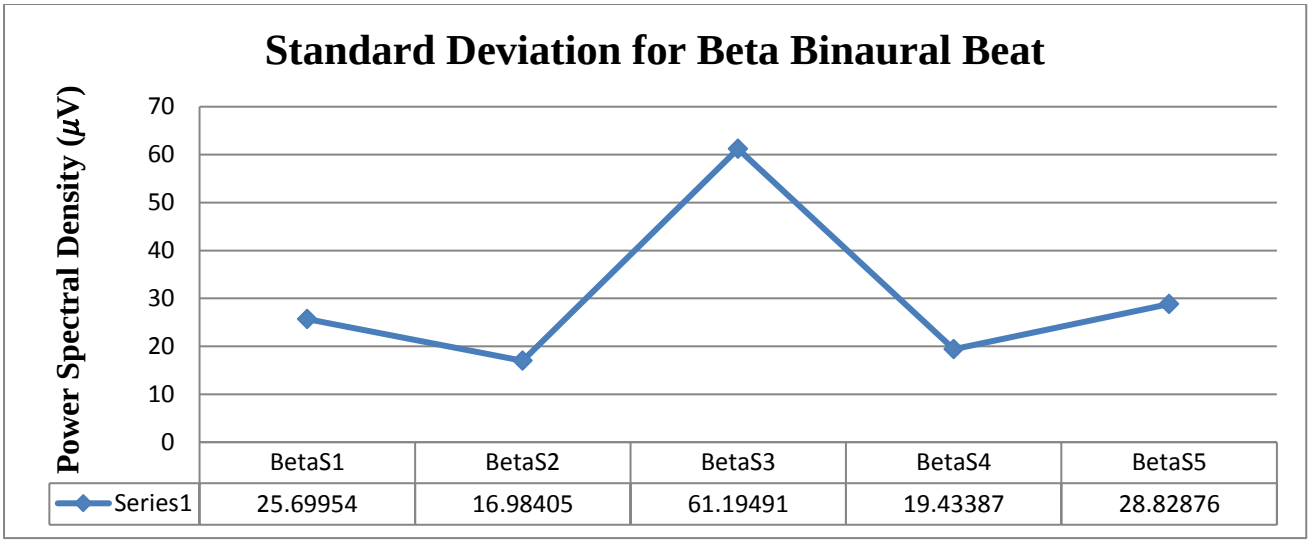


Figure 19: Standard deviation for beta binaural beat

iii) Mean comparison for alpha and beta Binaural Beat

Figure 20 shows the comparison of mean between alpha and beta binaural beat. From the observation, the mean value for beta band of each subject are higher than mean value for alpha band. In conclusion, this results were tally with the hypothesis which is the beta bands are higher than alpha band which means each subject are proven to be in stress condition during listening the binaural beat sound. In addition, AlphaS3 were held the highest value of alpha and beta which mean S3 are in the most stress condition during listening binaural beat compared to other subject.

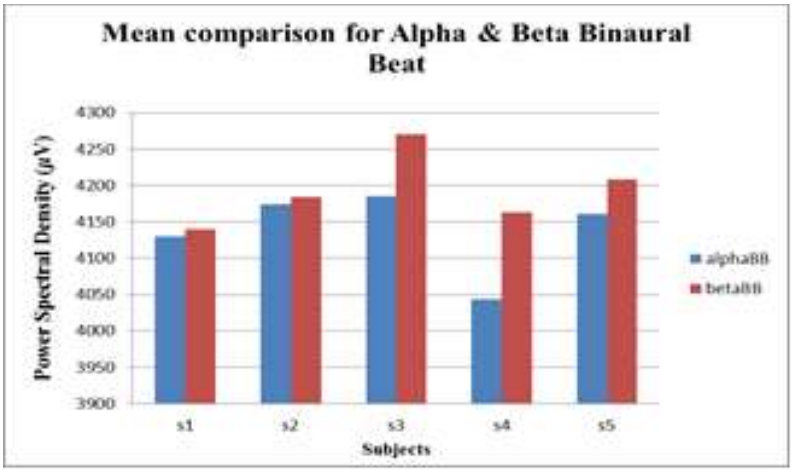


Figure 20: Mean for Alpha and Beta for Binaural Beat.

iv) Mean and Standard Deviation for Alpha Rock Music

Table 3 shows the descriptive statistics value for alpha rock music which consist of the minimum and maximum value, mean value and standard deviation value for each subject in 129 signal samples. Figure 21 shows the bar graph of mean for alpha rock music while the Figure 22

shows the line graph of standard deviation binaural beat for each subject. From the observation, the mean for AlphaS2 are the highest with 4185.62 while the lowest mean are AlphaS4 with 4033.11. This show that the rock music could lead to stress condition during listening because the alpha value of each subject seem decreasing.

Table 3: Descriptive Statistics for Alpha Rock Music

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Alphas1 | 129 | 3936.92 | 4228.72 | 4119.96 | 82.182 |
| Alphas2 | 129 | 4138.46 | 4220.00 | 4185.87 | 15.264 |
| Alphas3 | 129 | 4104.62 | 4306.67 | 4180.91 | 49.353 |
| Alphas4 | 129 | 3998.46 | 4076.41 | 4033.11 | 14.209 |
| Alphas5 | 129 | 4052.82 | 4304.10 | 4179.93 | 56.101 |
| Valid N (listwise) | 129 | | | | |

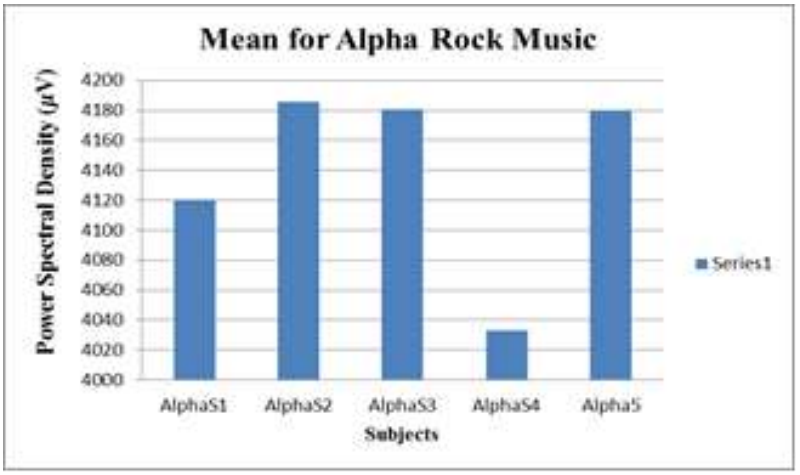


Figure 21: Mean for alpha rock music.

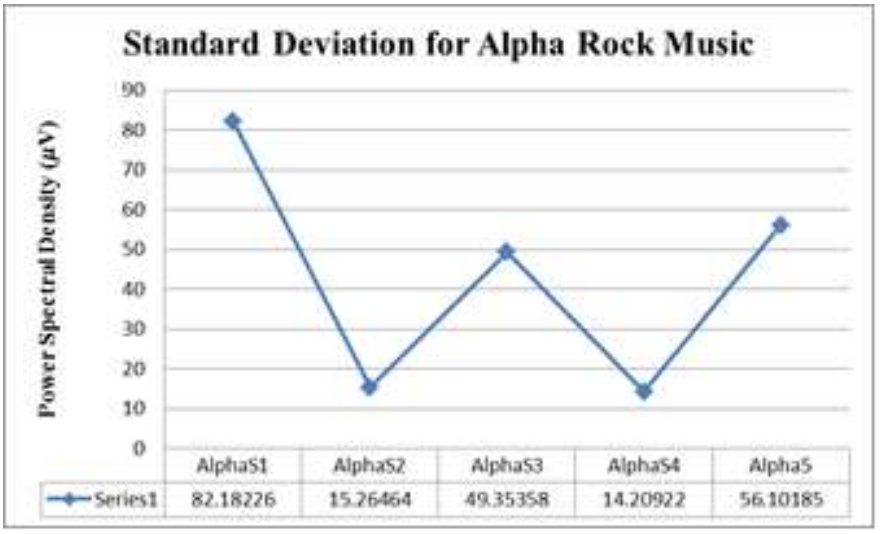


Figure 22: Standard deviation for alpha rock music.

v) Mean and Standard Deviation for Beta Rock Music

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The descriptive statistics value for beta binaural beat as shown in Table 4 above show which consist of the minimum and maximum value, mean value and standard deviation value for each subject in 129 signal samples. Meanwhile, Figure 23 shows the bar graph of mean for beta rock music and the Figure 24 shows the line graph of standard deviation beta binaural beat for each subject. From the observation, the mean for BetaS3 are the highest with 4192.37 while the lowest mean are BetaS1 with 4139.97. This can be conclude that the rock music could lead to stress condition during listening because the beta value of each subject seem increasing.

Table 4: Descriptive Statistics for Beta Rock Music.

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Betas1 | 129 | 4055.90 | 4209.74 | 4139.97 | 38.548 |
| Betas2 | 129 | 4135.90 | 4234.87 | 4192.37 | 15.892 |
| Betas3 | 129 | 4153.33 | 4292.31 | 4218.39 | 30.562 |
| Betas4 | 129 | 4125.64 | 4218.97 | 4171.37 | 20.567 |
| Betas5 | 129 | 4147.18 | 4281.54 | 4191.25 | 28.920 |
| Valid N (listwise) | 129 | | | | |

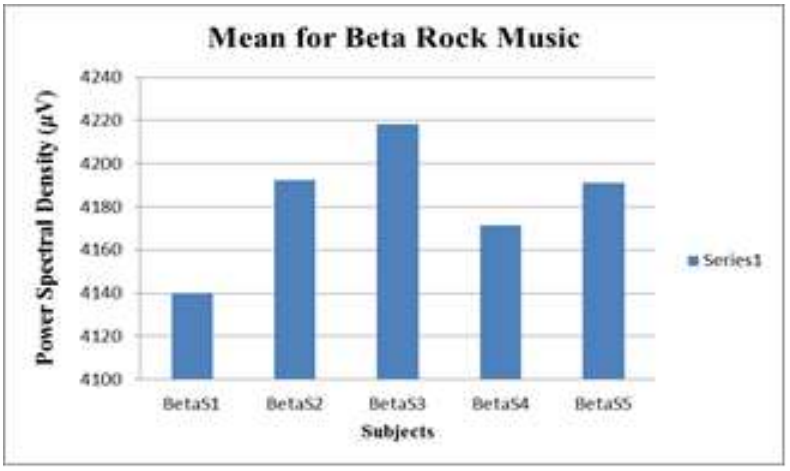


Figure 23: Mean for beta rock music

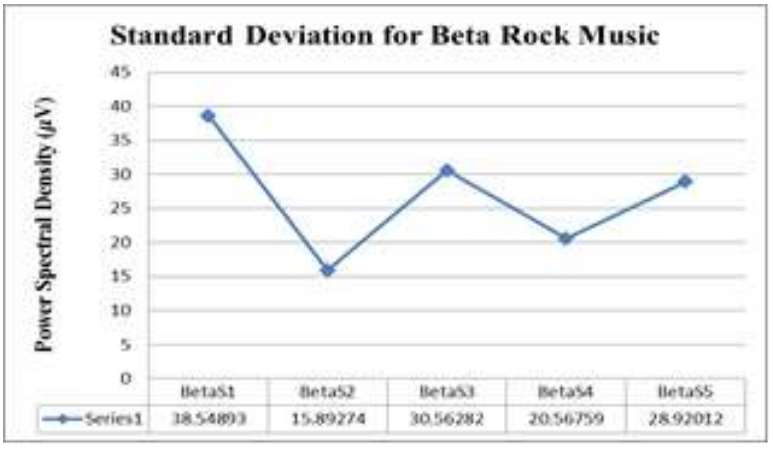


Figure 24: Standard deviation for beta rock music.

vi) Mean comparison for Alpha and Beta Rock Music

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Figure 25 shows the comparison of mean between alpha and beta rock music. From the observation, the mean value for beta band of each subject are higher than mean value for alpha band. In conclusion, this results were tally with the hypothesis which is the beta bands are higher than alpha band which means each samples are proven to be in stress condition during listening the rock music. In addition, S3 were held the highest value of alpha and beta which mean AlphaS3 are in the most stress condition during listening rock music compared to other subject.

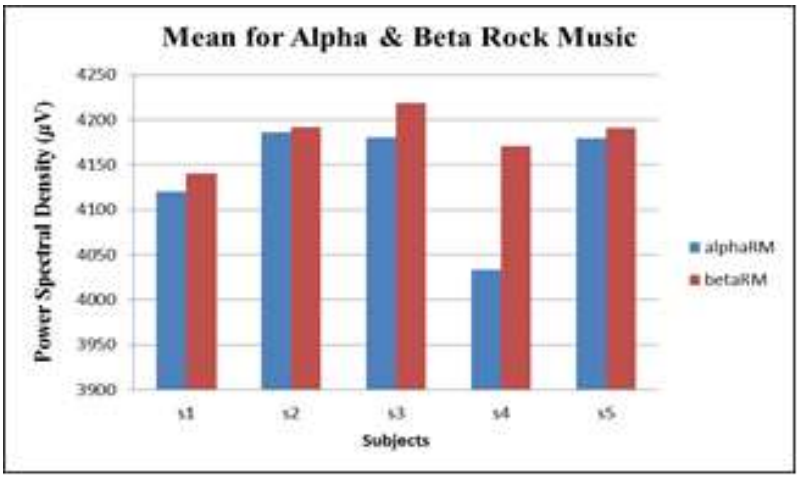


Figure 25: Mean for Alpha and Beta for Rock Music.

*i) Mean Comparison between Binaural Beat and Rock Music*

Figure 26 shows the mean comparison between alpha binaural beat and alpha rock music. From the observation, the samples S1,S3 and S4 were held the higher alpha binaural beat compared to the alpha rock music. So, it can be concluded that binaural beat were give more effect to alpha sub-band compared to rock music.

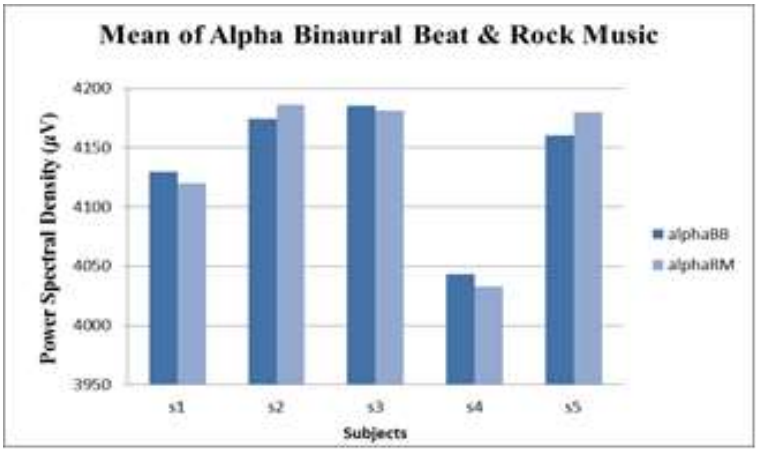


Figure 26: Mean for Alpha Binaural Beat Alpha Rock Music.

Figure 27 shows the mean comparison between beta binaural beat and beta rock music. From the observation, the samples S1,S3 and S5 were held the higher beta binaural beat compared to the beta rock music. It can be conclude that the binaural beat were give more effect that lead in stress condition.

So, from the analyze Figure 26 and Figure 27, it is proven that during listening, Binaural Beat

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can produce higher beta sub-band which lead to stress compared to alpha sub-band which lead to calmness. From the review, Binaural Beat can be used for therapy to calmness but during listening Binaural Beat, beta higher than alpha and after listening alpha supposedly higher than beta.

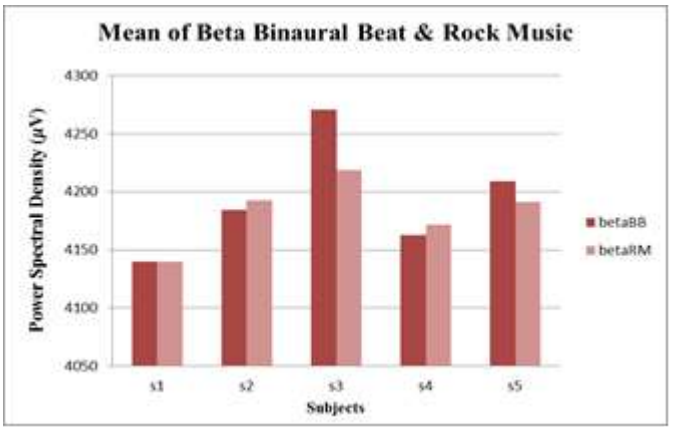


Figure 27: Mean for Beta Binaural Beat Alpha Rock Music.

## 5.0 CONCLUSION

Based on the analysis, this research find that the beta band were higher than the alpha band for each subjects for binaural beat and rock music. This prove that during the listening binaural beat and rock music were lead to stress condition. However, in comparison between listening binaural beat and rock music for each subjects, the 60% of subjects have higher beta band of binaural beat than the beta band of rock music. So, it can be concluded that binaural beat were more contribute in stress condition compared to rock music. Last but not least, it was clear that the research has achieve the main objective which are to determine the EEG pattern for stress during listening binaural beat sound and rock music.

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