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X RUSSIAN-GERMAN CONFERENCE ON BIOMDICAL ENGINEERING

第十屆俄德生物醫學工程會議

EVALUATION OF THE EFFECTIVENESS OF USING AIRES SHIELD ELECTRONIC ANOMALY NEUTRALIZERS TO REDUCE THE NEGATIVE INFLUENCE OF A CELLULAR PHONE'S ELECTROMAGNETIC FIELD

使用 Aires Shield 電子異常中和器以降低行動電話電磁場負面影響之效能評估

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Abstract **摘要**

Research was conducted to evaluate the effectiveness of using Aires Shield electromagnetic anomaly neutralizers to reduce the negative influence of the electromagnetic field caused by the operation of a cellular phone, on the brain's bioelectrical activity. 11 human subjects were tested, each of which participated in two experiments: a baseline study (using a mobile phone without an Aires Shield) and the main study (using a mobile phone with an Aires Shield). A mobile phone operating on the GSM-900 standard was used. In order to record the brain's bioelectric activity, a Mizar 19-channel computerized electroencephalogram machine using 16 monopole electrodes in accordance with the internationally-recognized 10-20 system The behavior of the relative strength of the rhythms of the brain's bioelectric activity with and without an Aires Shield was compared. The research has demonstrated that the elevation of the relative strength of theta and alpha rhythms, which are manifest when using a mobile phone on the side exposed to the mobile phone, without using an Aires Shield are virtually absent when it is used. Therefore, using an Aires Shield when working with mobile phones operating on the GSM-900 standard inhibits electromagnetic radiation from interacting with the brain's own bioelectric activity on the frequencies of the alpha- and delta rhythms, which may be regarded as a protective effect.

本研究旨在評估使用 Aires Shield 電磁異常中和器，是否能減少行動電話運作所產生之電磁場對大腦生物電活動的負面影響。共對 11 位受試者進行測試，每位受試者參與兩項實驗：基準研究（使用未裝置 Aires Shield 的行動電話）與主要研究（使用裝置 Aires Shield 的行動電話）。所使用之行動電話為採用 GSM-900 標準之機種。為記錄大腦之生物電活動，使用一部 Mizar 19 通道電腦化腦電圖機，依國際公認之 10-20 系統安置 16 個單極電極。比較了在有無 Aires Shield 情況下，大腦生物電活動節律之相對強度表現。研究顯示，在未使用 Aires Shield 時，靠近行動電話一側會出現相對強度上升的 theta 與 alpha 節律；而在使用 Aires Shield 時，該現象幾乎不復存在。 因此，在使用採用 GSM-900 標準的行動電話時，使用 Aires Shield 可抑制電磁輻射與大腦自身在 α 波與 δ 波頻率上的生物電活動相互作用，這可視為一種保護性效果。

Keywords: bioelectric activity of the brain, mobile phone, electroencephalography, Aires Shield neutralizers, electromagnetic radiation.

關鍵詞：大腦生物電活動、行動電話、腦電圖、Aires Shield 中和器、電磁輻射。

Introduction. In Europe and the United States, the adopted standards for determining SAR (Specific Absorption Rate) levels from cellular phone radiation are based solely on the thermal effect, which is only associated with the heating of the tissues of the human body. However, a number of works have discussed the presence of an informational effect [1, 2, 4]. The GSM-900 mobile phone standard transmits information using impulses that are joined into blocks. The duration of a single block is 4.616 ms , which establishes the frequency of the mobile phone's impulses at approximately 217 Hz (1/4.616). Blocks of impulses between a mobile phone and a base station are grouped into multiblocks, consisting of 26 repetitions. Thus, the second frequency emitted by a mobile phone is 8.35 Hz (217/62). Certain types of cellular phones operating in an energy-conserving mode may also generate a third frequency: 2 Hz [3, 5].

引言。在歐洲和美國，用來評估行動電話輻射之比吸收率（SAR）標準僅以熱效應為依據，亦即只考量對人體組織的加熱作用。然而，已有多項研究討論資訊效應的存在[1, 2, 4]。GSM-900 行動電話標準以脈衝傳輸資訊，脈衝被合併成區塊。單一區塊的持續時間為 4.616 毫秒，這確定了行動電話脈衝的頻率約為 217 赫茲（1/4.616）。行動電話與基地台之間的脈衝區塊被分組為多區塊（multiblocks），由 26 次重複組成。因此，行動電話發射的第二個頻率為 8.35 赫茲（217/26）。某些在省電模式下運作的特定型號行動電話，還可能產生第三個頻率：2 赫茲[3, 5]。

The danger of such an informational effect from mobile phones is that the frequencies mentioned above can interact with the brain's own electroencephalographic activity. The frequency 217 Hz may resonate with the brain's gamma rhythm, the frequency 8.35 Hz - with the alpha rhythm, and 2 Hz - with the delta rhythm. Thus, when using a mobile phone, signals are transmitted into the human brain, which are capable of interacting with the brain's own

行動電話這類資訊性效應的危險在於，上述頻率可能與大腦自身的腦電活動產生交互作用。頻率 217 Hz 可能與大腦的伽瑪節律產生共振，頻率 8.35 Hz 與阿爾法節律共振，而 2 Hz 則與德耳塔節律共振。因此，使用行動電話時，會有訊號傳入人腦，能夠與大腦自身的

bioelectric activity, thereby disrupting its function. This makes it important to protect the human brain when using a mobile phone.

生物電活動互相作用，從而干擾其功能。這也使得在使用行動電話時保護人腦變得重要。

Aires Shield electromagnetic anomaly neutralizers may be considered one form of protection. They are a universal three-dimensional Fourier filter. As a result of an electromagnetic field interacting with the Aires Shield, the field undergoes a structural transformation that may cancel out the influence of the frequencies that resonate with the human brain (217 Hz, 8.35 Hz, and 2 Hz), which occur when using a cellular phone.

Aires Shield 電磁異常中和器可被視為一種保護形式。它們是一種通用的三維傅立葉濾波器。當電磁場與 Aires Shield 作用時，該場會經歷結構性的轉變，可能抵消在使用行動電話時出現、與人腦產生共振的那些頻率（ 217 Hz, 8.35 Hz ，以及 2 Hz）所造成的影響。

Research objective. To evaluate the effectiveness of using Aires Shield electromagnetic anomaly neutralizers to reduce the negative influence of the electromagnetic field caused by the operation of a cellular phone, on the brain's bioelectrical activity.

研究目的。評估使用 Aires Shield 電磁異常中和器，是否能降低行動電話運作所產生之電磁場對大腦生物電活動的負面影響。

Methodology. 11 men (ages 18 to 22 years) participated in the study. Each subject participated in two experiments: a baseline study (using a mobile phone without an Aires Shield) and the main study (using a mobile phone with an Aires Shield).

方法。研究參與者為 11 名男性（年齡 18 至 22 歲）。每位受試者皆參與兩項實驗：基線研究（使用未裝置 Aires Shield 的手機）與主要研究（使用裝置 Aires Shield 的手機）。

The research was conducted in the morning in a room with an air temperature of 20°C. The recording procedure was an uninterrupted 40 minutes long and included the following stages:

研究在上午於室內進行，室內空氣溫度為 20°C 。記錄程序為連續 40 分鐘，包含以下階段：

Recording a baseline EEG at rest (a state of calm wakefulness).

記錄安靜休息（平靜清醒狀態）下的基線腦電圖。

Recording an EEG with a mobile phone in standby mode held next to the ear (3 minutes).

以待機模式将手機貼在耳邊錄製腦電圖（3 分鐘）。

Recording an EEG with a mobile phone in call mode held next to the ear (no audio, 3 minutes).

以通話模式將手機貼在耳邊錄製腦電圖（無音訊，3 分鐘）。

Recording an EEG with a mobile phone in talk mode held next to the ear (no audio, 5 minutes).

以講話模式將手機貼在耳邊錄製腦電圖（無音訊，5 分鐘）。

Recording an EEG 3, 5, and 10 minutes after turning off the phone.

關機後 3、5 及 10 分鐘錄製腦電圖。

The subjects were sitting in a darkened, soundproof room while the EEGs were recorded.

受試者坐在昏暗且隔音的房間內，並在此環境中進行腦電圖（EEG）記錄。

A mobile phone operating on the GSM-900 standard was used.

使用一支採用 GSM-900 標準的行動電話。

When performing the electrophysiological exam, the brain's bioelectric activity was recorded by a Mizar 19-channel computerized electroencephalogram machine using 16 monopole electrodes in accordance with the internationally-recognized 10-20 system in the 0-70 Hz transmission band with 250 Hz frequency discretization. Unpolarized silver chloride electrodes were placed symmetrically in the areas of the prefrontal (Fp1, Fp2), postfrontal (F3, F4), inferior (F7, F8), central (C3, C4), middle temporal (T3, T4), posttemporal (T5, T6), parietal (P3, P4), and occipital (O1, O2), areas, with joined reference electrodes being placed on the earlobes. The electrodes were fastened under the bands of a special headpiece. To improve their impedance, the electrodes were soaked in a saline solution and the attachment sites were treated

在進行電生理檢查時，腦的生物電活動由一台 Mizar 19 通道電腦化腦電圖機記錄，採用 16 個單極電極，依國際公認的 10-20 系統配置，傳輸頻帶為 0–70 Hz，取樣頻率為 250 Hz。未極化的氯化銀電極對稱地置於前額（Fp1、Fp2）、前額後部（F3、F4）、下側（F7、F8）、中央（C3、C4）、中顳（T3、T4）、顳後（T5、T6）、頂葉（P3、P4）與枕葉（O1、O2）等部位，參考電極合併置於耳垂。電極固定於特殊頭套的帶子下。為改善接觸阻抗，電極先浸泡於生理鹽水中，貼附部位則以酒精處理。

with alcohol. A 50 Hz band-stop filter with a 0.1 Hz stop band was used during the processing of the recordings.

在記錄處理過程中，使用了一個 50 Hz 的帶阻濾波器，阻帶寬度為 0.1 Hz。

The software program Win EEG was used to analyze the artifact-free portions of the EEGs. The multi-channel EEG pattern was analyzed using rhythm topography (color mapping), the numeric values of which were determined using a table of indices (the indices of the EEG's main rhythms were determined as the ratio of the time a particular rhythm was present to the entire EEG recording time, expressed as a percentage) and the top frequency in each of the main EEG ranges across the 16 leads. The following frequency ranges were examined: the delta rhythm ($0.5-3$ Hz), Θ (4-7 Hz), $\alpha(8-13\ \text{Hz}), \beta_1(14-25\ \text{Hz}), \beta_2(26-35\ \text{Hz}), \gamma(36-50\ \text{Hz})$.

使用 Win EEG 軟體分析無雜訊的腦電圖片段。多通道腦電圖模式採用節律拓撲（色彩映射）分析，其數值由指數表決定（腦電圖主要節律的指數以該節律出現時間與整段腦電圖記錄時間之比表示，為百分比），並測定 16 個導聯中各主要腦電圖頻段的最高頻率。檢視的頻率範圍如下：delta 節律（ $0.5-3$ Hz ）、Θ（4-7 Hz）、$\alpha(8-13\ \text{Hz}), \beta_1(14-25\ \text{Hz}), \beta_2(26-35\ \text{Hz}), \gamma(36-50\ \text{Hz})$ 。

A qualified visual analysis of the EEG was employed to isolate the analysis period with a duration from 0.2-1 second. The periods free from oculogyric and muscular artifacts were sampled at random over the entire duration of the EEG recording.

採用合格的目視分析來擷取持續時間為 0.2–1 秒的分析時段。隨機抽樣整段腦電圖記錄中不含眼球旋轉及肌肉雜訊的時段。

80-100 EEG fragments were analyzed at all of the stages of measurement in each EEG recording.

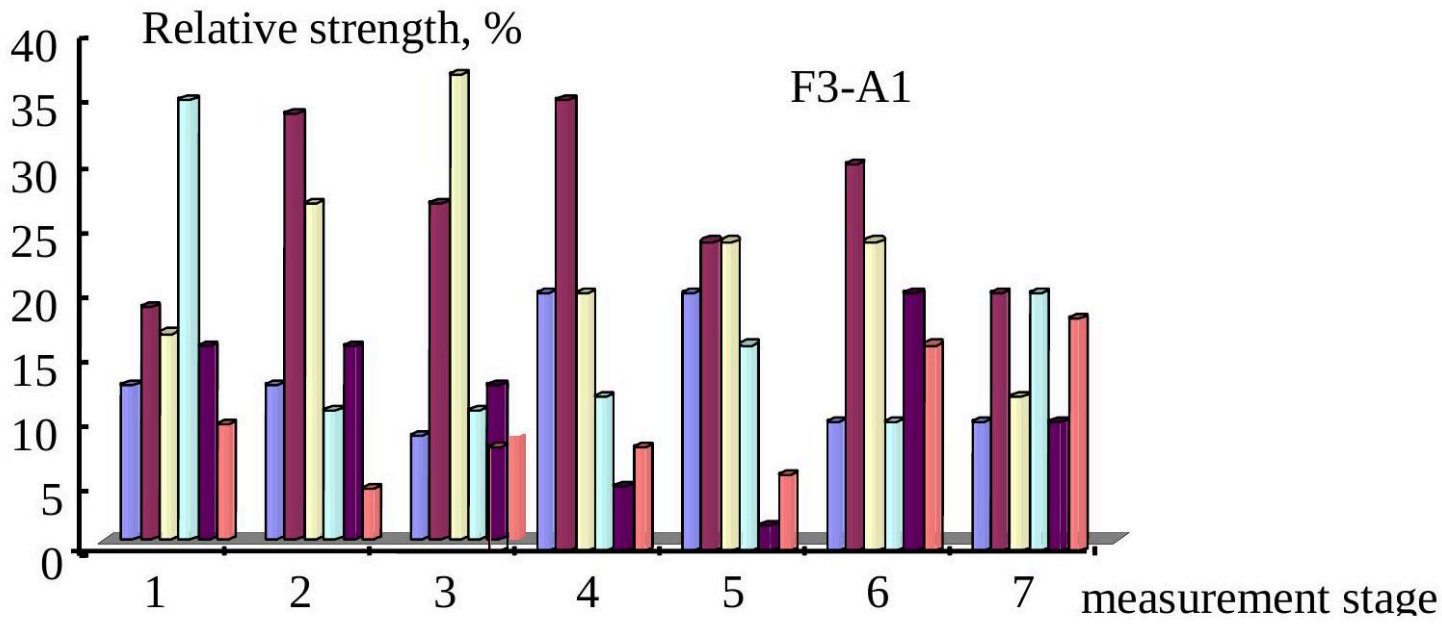
在每次腦電圖記錄的所有測量階段均分析 80–100 個腦電圖片段。

Results. The distribution of the relative strength of the delta, $\theta, \alpha, \beta_1, \beta_2$, and γ rhythms was determined for the EEG in the frontal, temporal, central, parietal, and occipital leads.

結果。測定額葉、顳葉、中央、頂葉及枕葉導聯中 delta、 $\theta, \alpha, \beta_1, \beta_2$ 及 γ 節律相對強度的分佈。

The substantial change of the spectral characteristics of the EEG rhythms is conspicuous under the influence of a mobile phone in virtually all of the left leads examined. The most typical was the increase of the relative strength of the delta and alpha rhythms, especially the increase observed in the third and fourth stages of measurement, which confirms the data obtained by other experiments. When using the electromagnetic anomaly neutralizers, no increase in the relative strength of the rhythms was detected. Figures 1 and 2 illustrate this pattern in the EEG's frontal lead.

在幾乎所有檢查的左側導聯中，行動電話影響下腦電波頻譜特性的顯著變化非常明顯。最典型的是 delta 和 alpha 節律相對強度的增加，尤其是在第三與第四次測量階段所觀察到的增加，這也印證了其他實驗所得的數據。使用電磁異常中和器時，未檢測到節律相對強度的增加。圖 1 與圖 2 在腦電的額葉導聯中說明了此一模式。



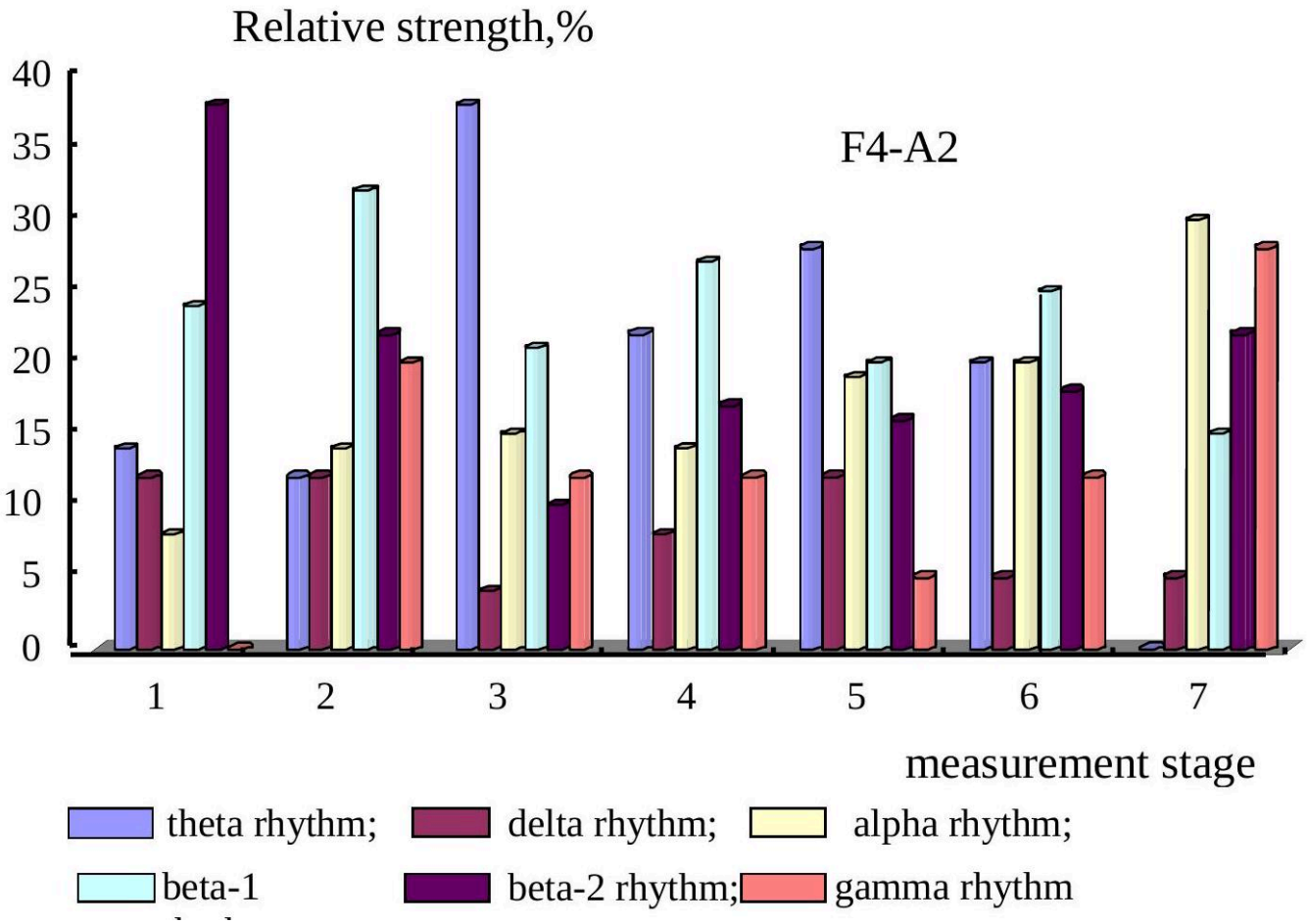


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Figure 1: Key: **圖 1：說明：**

Recording of a baseline EEG at rest. 2. Recording an EEG with a mobile phone in standby mode held next to the ear. 3. Recording an EEG with a mobile phone in call mode held next to the ear (no audio). 4. Recording an EEG with a mobile phone in talk mode held next to the ear (no audio). 5.-7. Recording of an EEG 3, 5, and 10 minutes after turning the phone off.

1. 於靜息狀態下記錄的基線腦電圖。2. 將待命中的行動電話貼耳時記錄的腦電圖。3. 將通話模式（無聲音）下的行動電話貼耳時記錄的腦電圖。4. 將通話中（無聲音）的行動電話貼耳時記錄的腦電圖。5.-7. 關機後 3、5 及 10 分鐘記錄的腦電圖。

Figure 1. Relative strength of the EEG rhythms in the frontal leads when under the influence of a mobile phone's electromagnetic field during the stages of measurement.

圖 1。測量各階段中，額葉導聯在行動電話電磁場影響下腦電波節律的相對強度。

Figure 2: Relative strength, %

圖 2：相對強度，%

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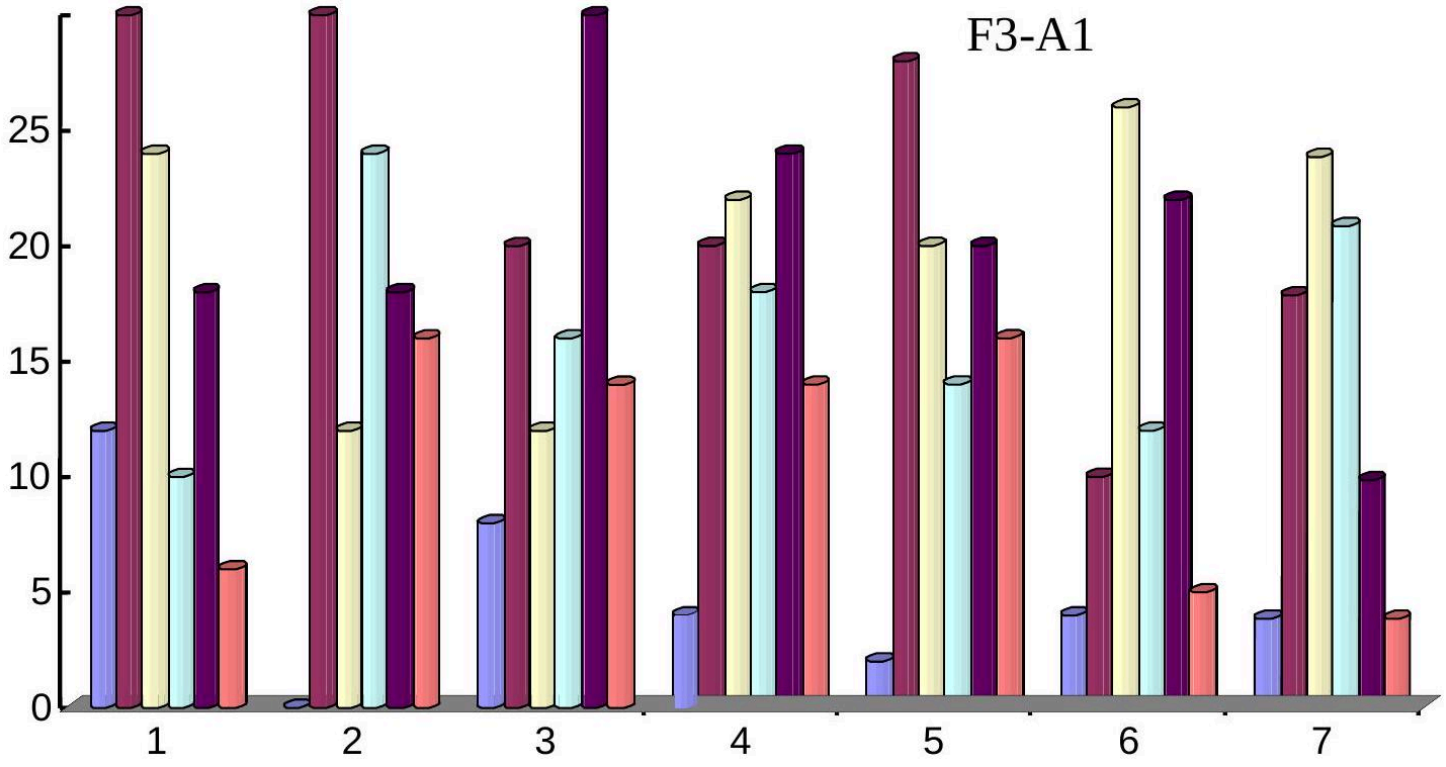

Figure 3: Relative strength, %

圖 3：相對強度，%

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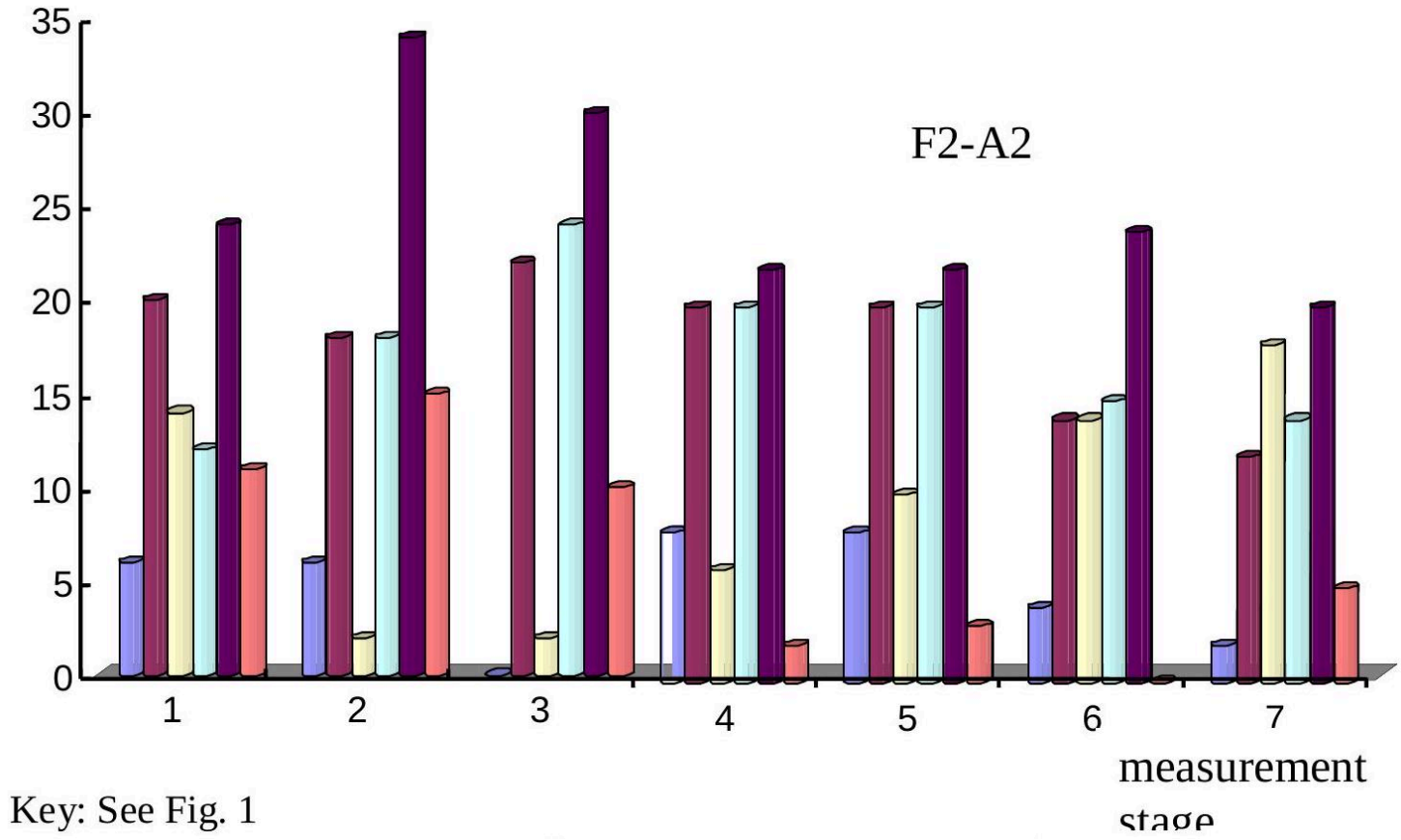

Figure 2. Relative strength of the EEG rhythms in the frontal leads when under the influence of a mobile phone's electromagnetic field while using electromagnetic radiation neutralizers during the stages of measurement.

圖 2. 在使用電磁輻射中和器於測量各階段時，行動電話電磁場影響下額葉導聯中腦電節律相對強度的變化。

In the leads located on the side of the head opposite the mobile phone, no pattern was identified in the changes of the relative strength of the rhythms.

在位於與行動電話相對側頭部的導聯中，節律相對強度的變化未發現特定模式。

A comparison of the behavior of the relative strength of the rhythms of the brain's total bioelectric activity with and without an Aires Shield made it possible to detect statistically significant ($p < 0.5$) differences in its properties. Figure 3 shows the behavior of the relative strength of the delta and alpha rhythms of the EEG during all stages of measurement. It has been

比較在有無 Aires Shield 情況下整體腦生物電活動節律相對強度的行為，使得能夠檢測出其性質上的統計顯著差異（$p < 0.5$）。圖 3 顯示了在所有測量階段中腦電圖的 delta 與 alpha 節律相對強度的變化情形。它已被

established that the elevation of the relative strength of these rhythms, which are manifest when using a mobile phone on the side exposed to the mobile phone, without using an Aires Shield, are virtually absent when it is used.

已經證實，當使用未裝設 Aires Shield 的手機於靠近一側時，該側腦部出現的這些節律相對強度升高；而當使用 Aires Shield 時，這種現象幾乎消失。

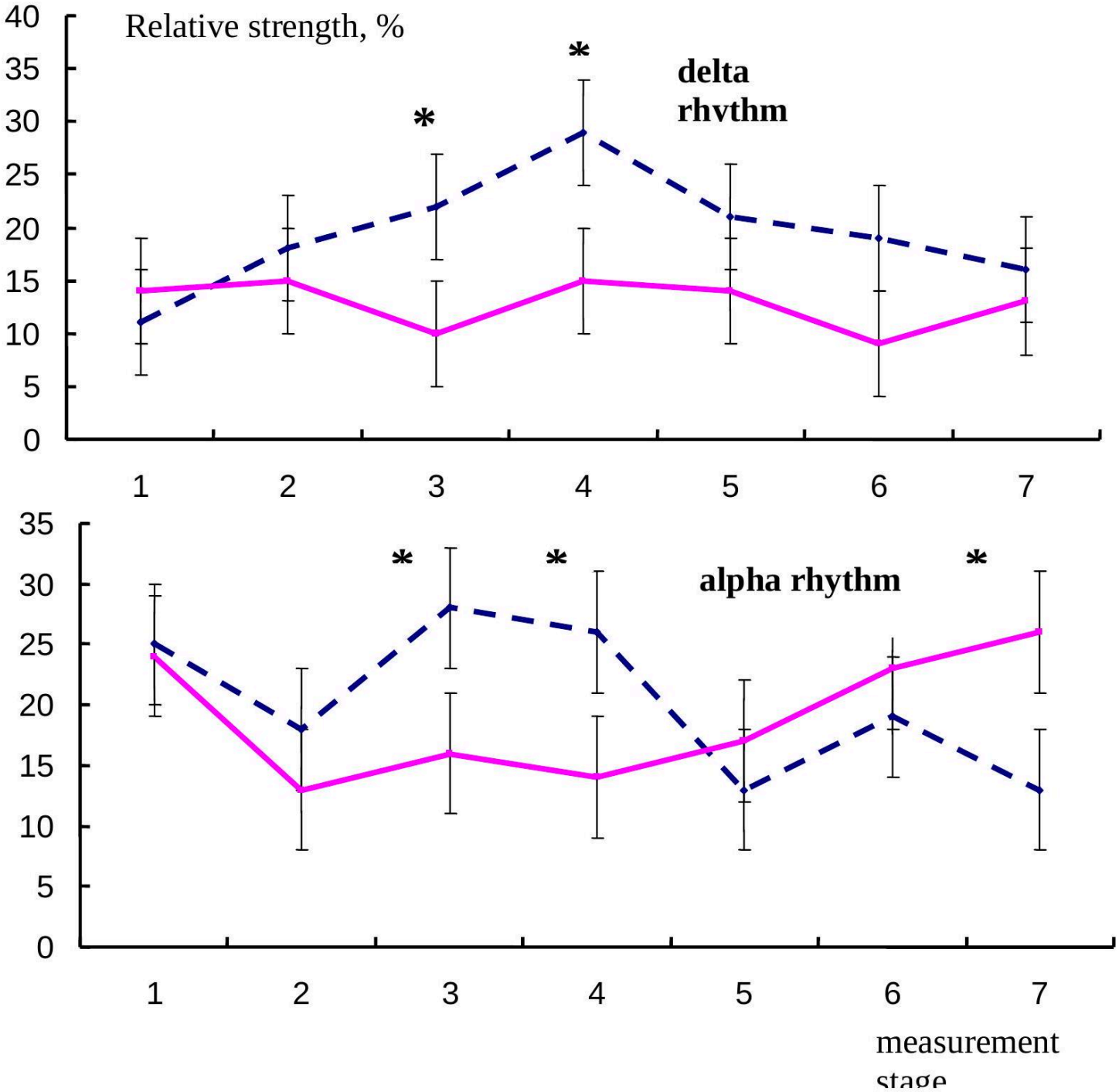

Figure 4: Key: **圖 4：說明：**
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control measurements;
main series of measurements (using the Aires Shield).

Statistically significant change ($p < 0.05$).

統計上顯著的變化（ $p < 0.05$ ）。

Figure 3. The comparative behavior of the relative strength of the EEG's rhythms under the influence of a mobile phone's electromagnetic field during the stages of the research in the main and control measurements (on the side of the head exposed to the field).

圖 3. 在研究各階段中主測與對照測量下（在暴露於場的一側頭部），行動電話電磁場影響下腦電圖節律相對強度的比較行為。

Conclusion. Using an Aires Shield electromagnetic oscillation neutralizer when working with mobile phones operating on the GSM-900 standard inhibits electromagnetic radiation from interacting with the brain's own bioelectric activity on the frequencies of the alpha- and delta rhythms, which may be regarded as a protective effect.

結論。 在使用符合 GSM-900 標準的行動電話時配戴 Aires Shield 電磁振盪中和器，會抑制電磁輻射與大腦自身在阿爾法波與德爾塔波頻率上的生物電活動互動，此效果可視為具有保護作用。

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