Note

A Collection of EEG Data

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Abstract: In this note EEG (electroencepharogram) data are shown, which were recorded from two persons. The data are six kinds of EEG as follows: states of resting (or relaxing), α blocking by a clap, blinking eyes, and looking at 3 D graphics, two colored quadrilaterals giving rise to a complementary color, and a picture (an old woman and girl). These collections of EEG data imply that individuarity of EEG brings some difficulties to investigate brain functions from EEG data.

Introduction

Electroencepharogram(EEG) is a record of electric potential changes on the surface of head caused by the mass action of nerve cells (or neurons) in the brain. The amplitude of these potential changes is in the ragne of several deca-microvolts. It will become useful to analyze them, if we can see mental processes from EEG data. For this purpose, we began the study how we can trace neuronal process in the brain by EEG. As the primary stage of study we choose a strategy to investigate the EEG change by visual stimulations or visulal inputs. We recorded the EEG data with task to look at pictures (3-d graphics, two colored quadrilaterals, and a girl hidden in an old woman), and also recorded EEG data of resting sate, α-blocking (or blocking of α rhythm) by a clap, and blinking of eyes to compare with EEG for tasks. The obtained EEG data are depicted in an appendix.

Method

EEG data are recorded by a personal computer (PC-386LSR, EPSON) through an 16 bits A/D converter (ADM-5698BPC, Microscience). The electric potential changes are measured setting four small plate electrodes (Ag-AgCl) on the surface of head and by amplifying the potential with two amplifiers for living bodies (MEG-2100$\times$2, Nihon Kohden). The degree of amplification is 50 μV to 1 V. The measured electric potential is filtered off with low cut filter (lower than 0.5 Hz), high cut filter (higher than 100 Hz), and hum cut filter for 50 Hz. The amplified potential differences are converted to digital data by A/D converter (sampling interval is 1 msec), and then they are recoded as mentioned above. The amplified

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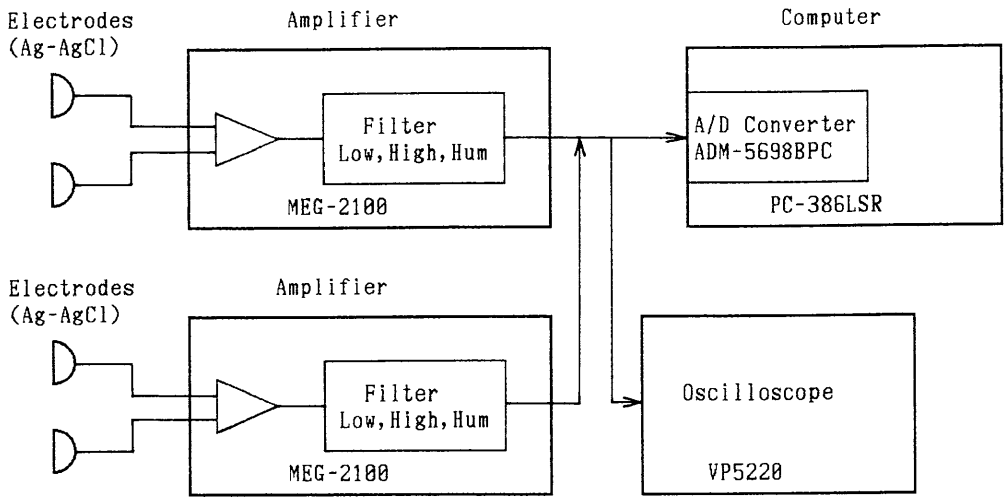


Fig. 1 The arrangement of experimental instruments.

potential is monitored by a oscilloscope (VP-5220A, National). The arrangement of experimental system is shown in Fig.1.

At four positions on the surface of head, EEG potential was recorded. We call the data induced from these four positions as ch1, ch2, ch3, and ch4. The four channels denote potential difference between an ear and a position of head listed in Table I.

The numbers appeared in Table I are the same ones as shown in Fig.2. These four channels data were recorded for a given task.

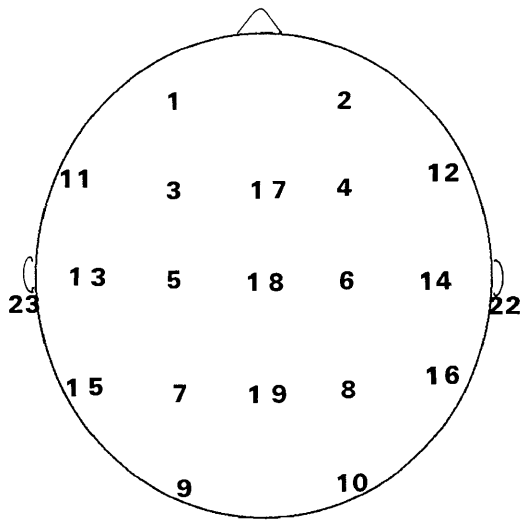


Fig. 2 Electrodes positions to put on human head for EEG recording.
(from "A new introduction to electroencepharogram" by T. Tokizane *et al.*)

Table I Channels for recorded positions

head location	right	left
back	ch1: 22–10	ch2: 23 9
side	ch3: 22–14	ch4: 23–13

Result and Discussion

We recorded EEG data of four channels for relaxing state, α blocking by a clap, blinkin eyes, and three kinds of tasks for looking at pictures. These are arranged as follows:

record 1 : EEG of resting (or relaxing) state with α rhythm,
record 2 : EEG of α-blocking by a clap,
record 3 : EEG of blinking eyes,
record 4 : EEG of looking at 3-D graphics,
record 5 : EEG of looking at two colored quadrilaterals which give rise to a complementary color,
record 6 : EEG of looking at the picture of an old woman and a girl (a girl hidden in an old woman).

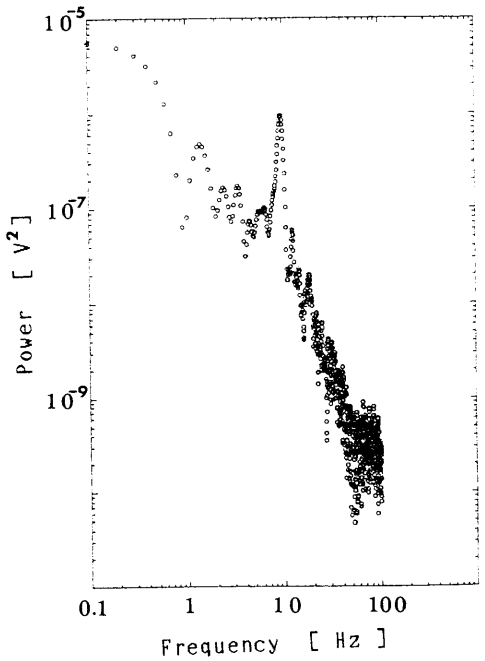


Fig. 3a Power spectrum of ch1 of record 1 for person A. The depicted power spectrum is obtained by averaging five spectra. Each of five is calculated for thousand data points (1 sec).

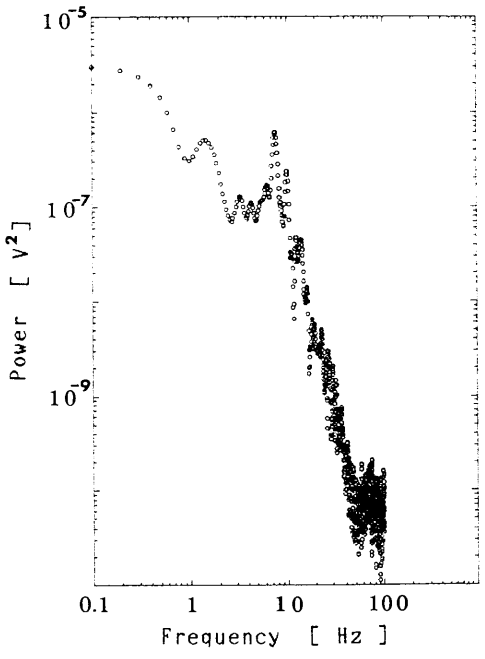


Fig. 3b The same as Fig. 3a but for person M.

These recordings were carried out for two persons of female (persons are named as A and M in the present note).

The recorded EEG data are shown in the appendix below. The records of EEG shown in the appendix are for these two persons. As seen from the recorded EEG data, α-thythm is observed in the resting state with closed eyes in a dark room. There exist somewhat difference between two persons. Power spectra of α-thythm for two persons A and M are shown in Figs. 3a and 3b, respectively. The α-thythm of person A shows a typical one while that of person M shows splitting of frequency. For person A, frequency of α-thythm is about 9.5 Hz, and for person M that is about 8 Hz and side splitting frequency is about 10 Hz. Shapes of α-thythm quitely depend on persons.

Blinking of eyes causes slow swells of EEG potential on the right and left side of head as shown in recorded EEG (record 3). Power spectra of this case for persons A and M are shown in Figs. 4a and 4b, respectively. For person A, frequency of slow swells is about 1 Hz, while person M has double peaked swells with frequencies about 1.5 Hz and 2.8 Hz.

As seen EEG data of record 6, EEG figures of ch1 of persons A and M are entirely different. This may imply that information process of this kind of visual task depends on the fact how brain organize its structure in surrounding circumstance.

There exist some difficulties to understand brain functions through EEG data, because

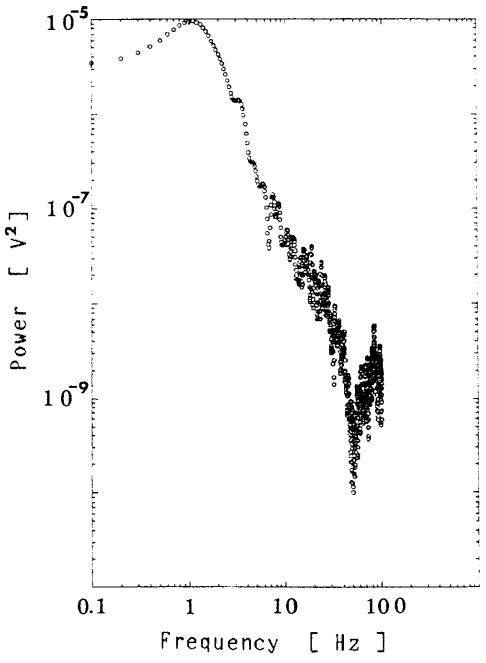


Fig. 4a Power spectrum of ch2 of record 3 for person A. This spectrum is obtained the same manner mentioned in Fig. 3.

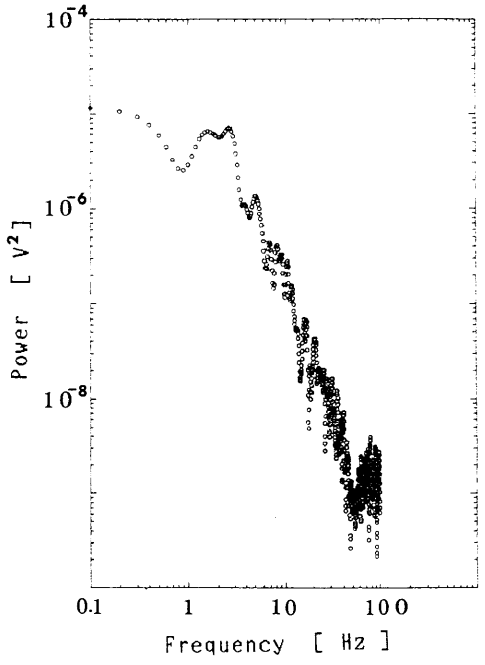


Fig. 4b The same as Fig. 4a but for person M.

of individuality of EEG. The studies will be devoted to see how EEG data tell the function of human brain. This note is the first step of our work to understand the brain functions through EEG data.

References

T. Tokizane, B. Fujimori, Y. Shimazono and K. Sano, "A New Introduction to Electroencepharogram" in Japanese, 1969, Nanzando, Tokyo.
D. Marr, "Vision", 1982, W. H. Freeman and Company, New York.
M. Marois(ed.) "From Theoretical Physics to Biology", 1973, S. Karger AG, Basel.

Appendix

In this appendix, we show the collected data of EEG. The collected data are six kinds of records for two persons. The collected data are labeled as record 1, record 2, record 3, record 4, record 5, and record 6 (what kind of record of EEG was understood to see the text). Each record is consist of the data of four channels, i.e., ch1, ch2, ch3, and ch4. Six kinds of records of ch1, ch2, ch3, and ch4 are shown for two persons A and M. For person A, depicted length of data is 28 sec for each channel while for person B 14 sec. In the experiments, EEG data were recorded with the length 32 sec and time intervals to sample the data (sampling interval) was 1 msec.

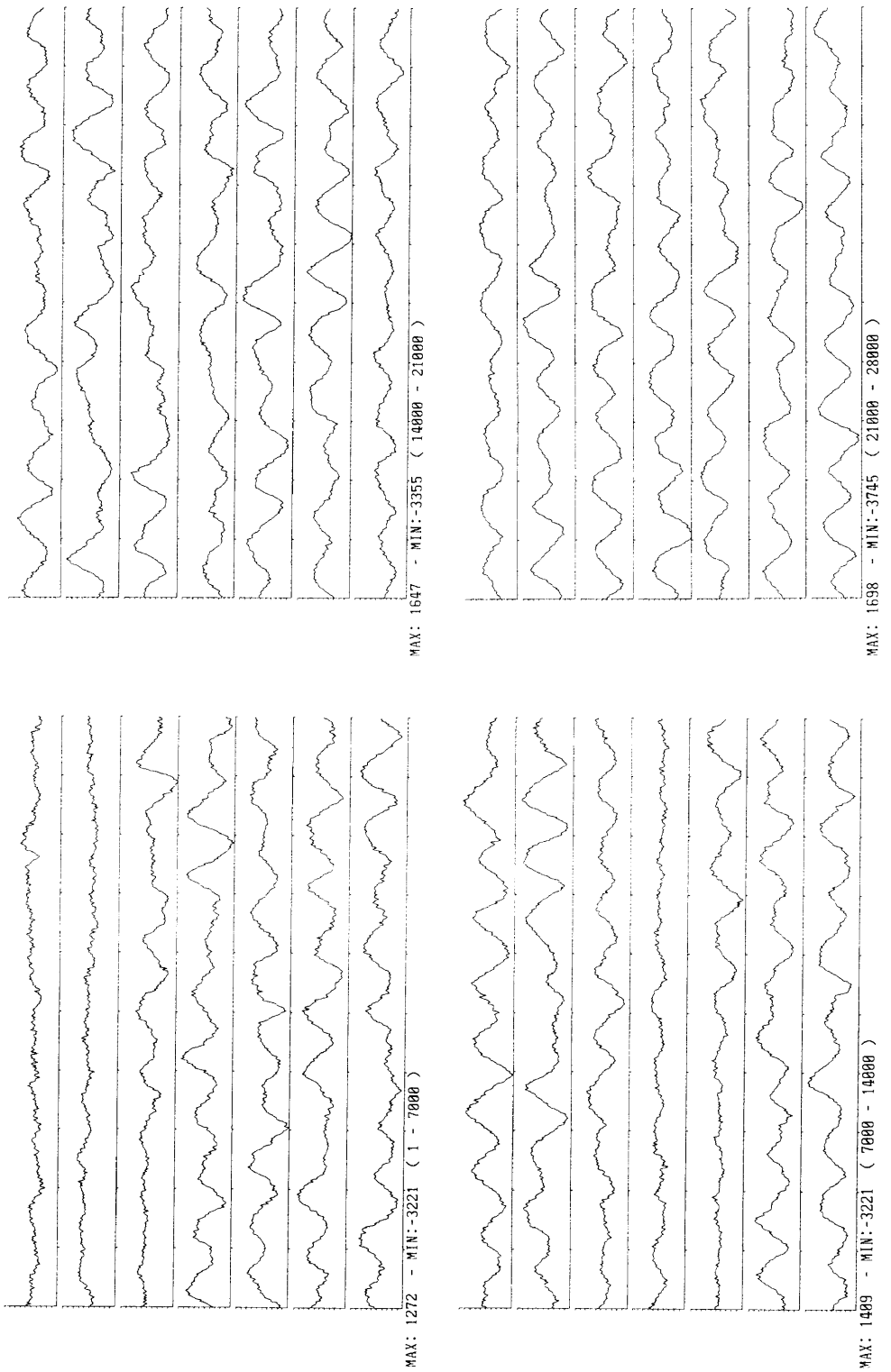
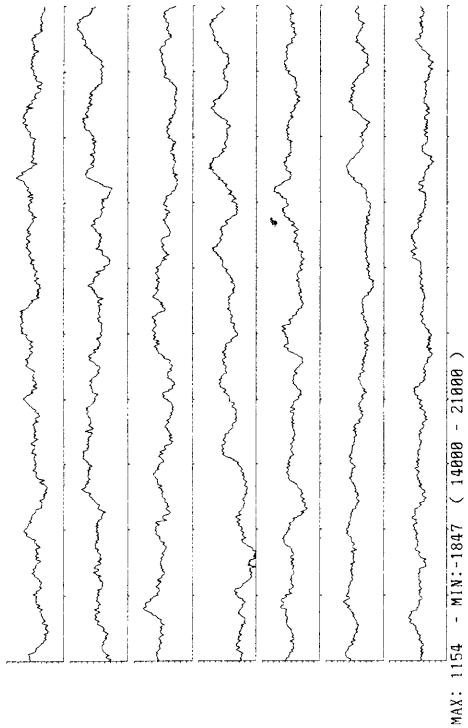
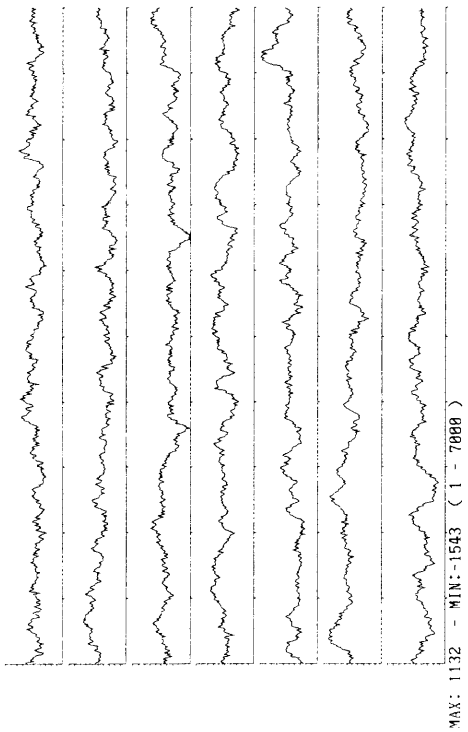
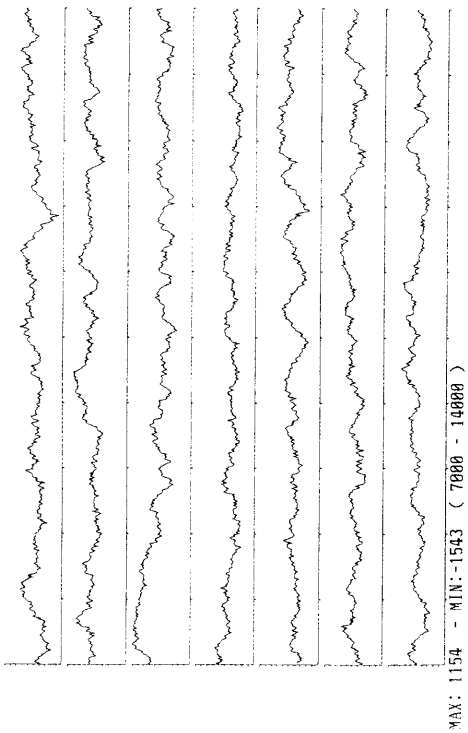


Fig. A1-1 EEG data of ch1 of record 1 for person A.







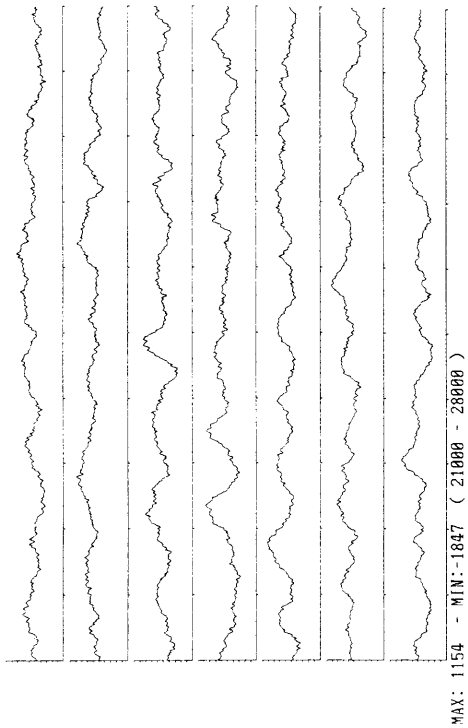


Fig. A1–2 EEG data of ch2 of record 1 for person A.

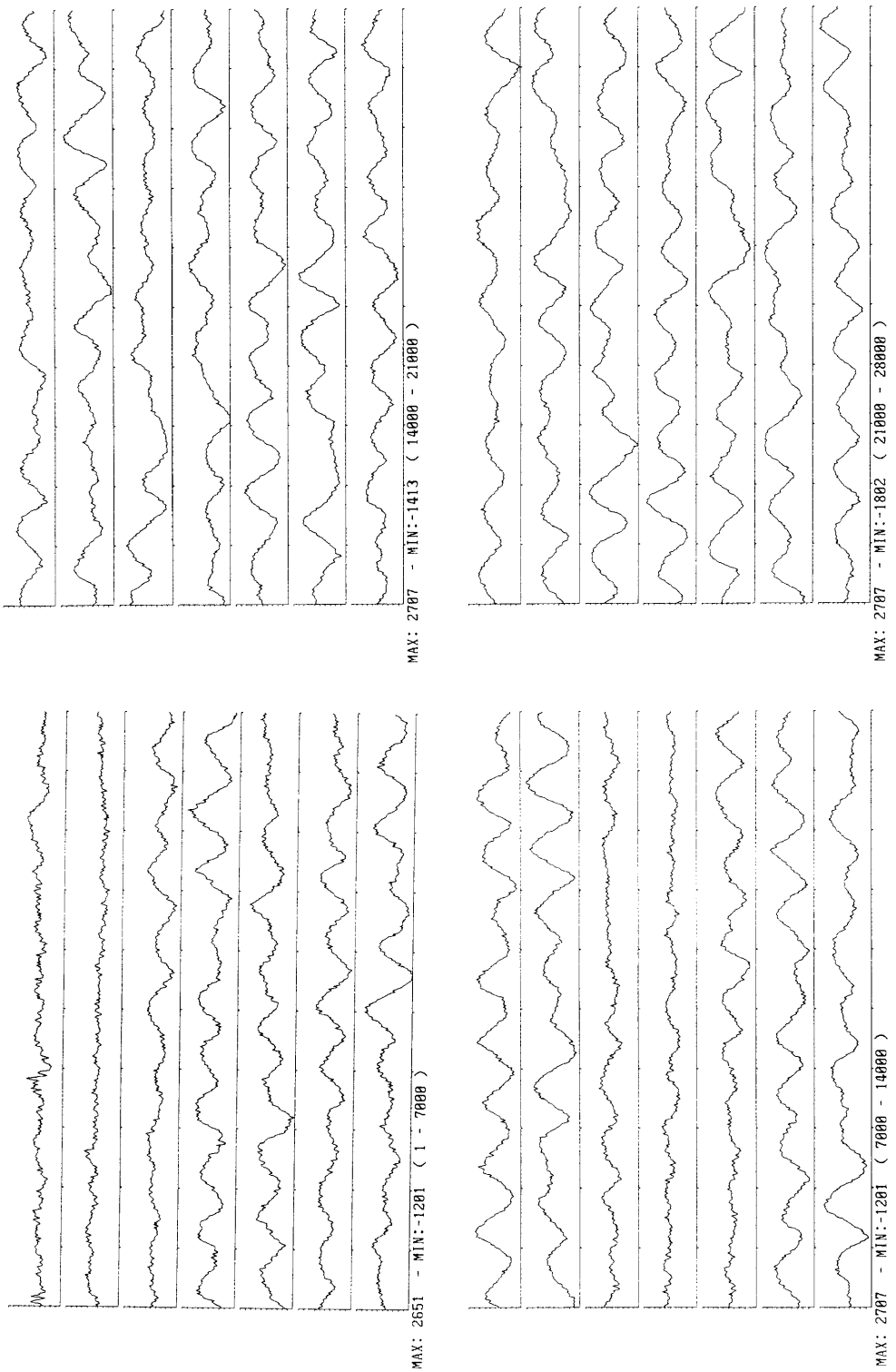


Fig. A1-3 EEG data of ch3 of record 1 for person A.

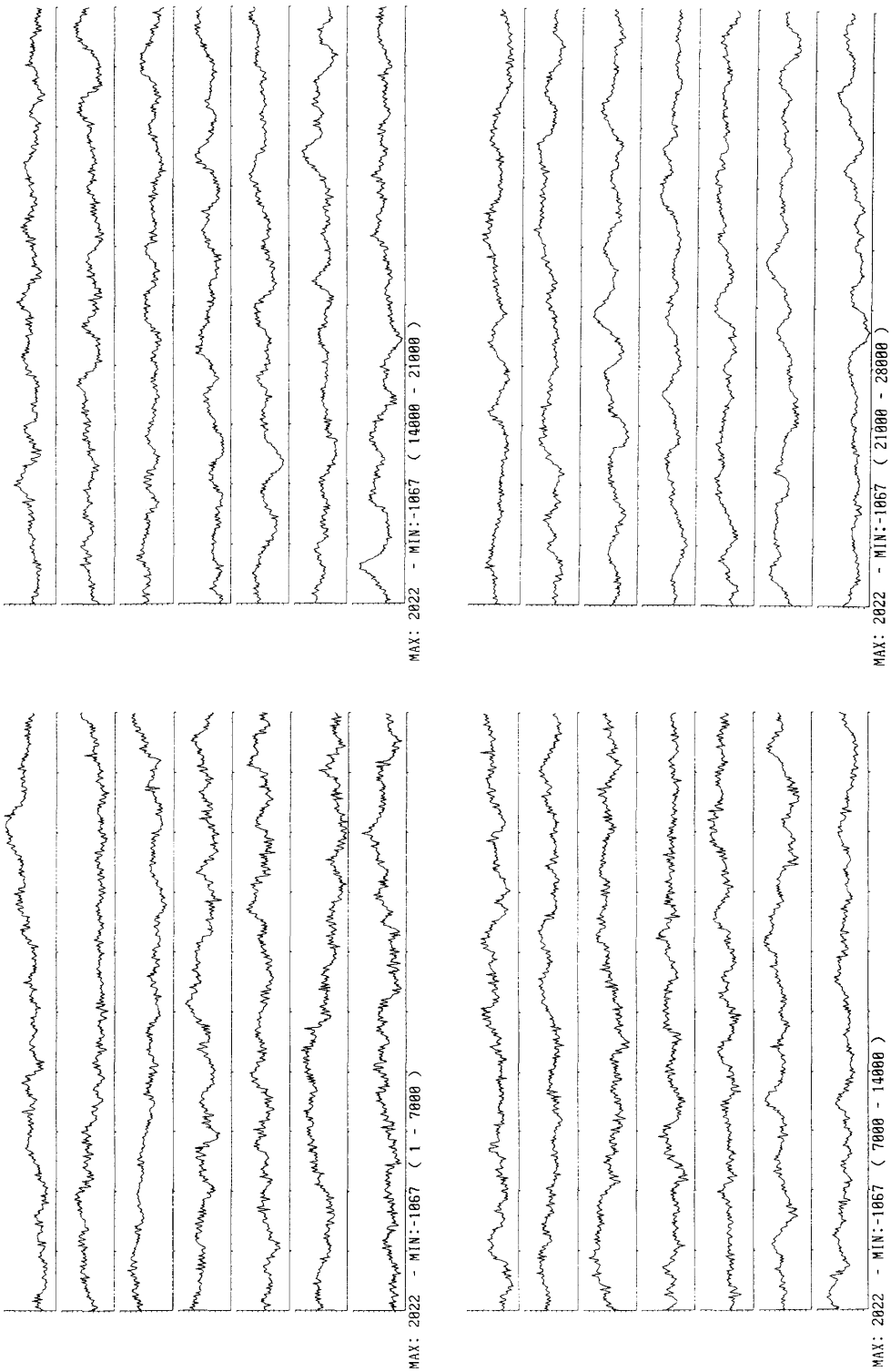


Fig. A1-4 EEG data of ch4 of record 1 for person A.

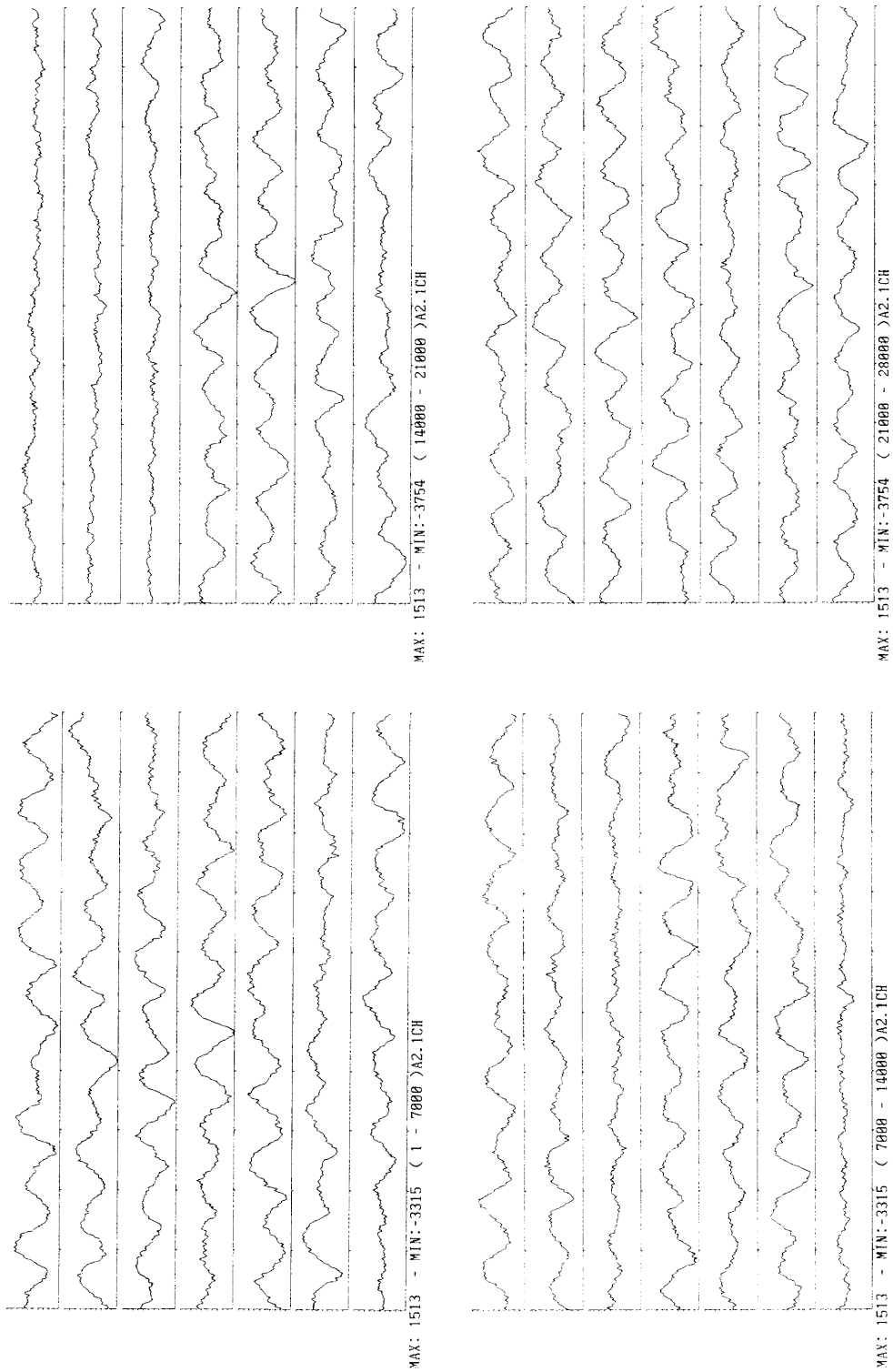


Fig. A2-1 EEG data of ch1 of record 2 for person A.

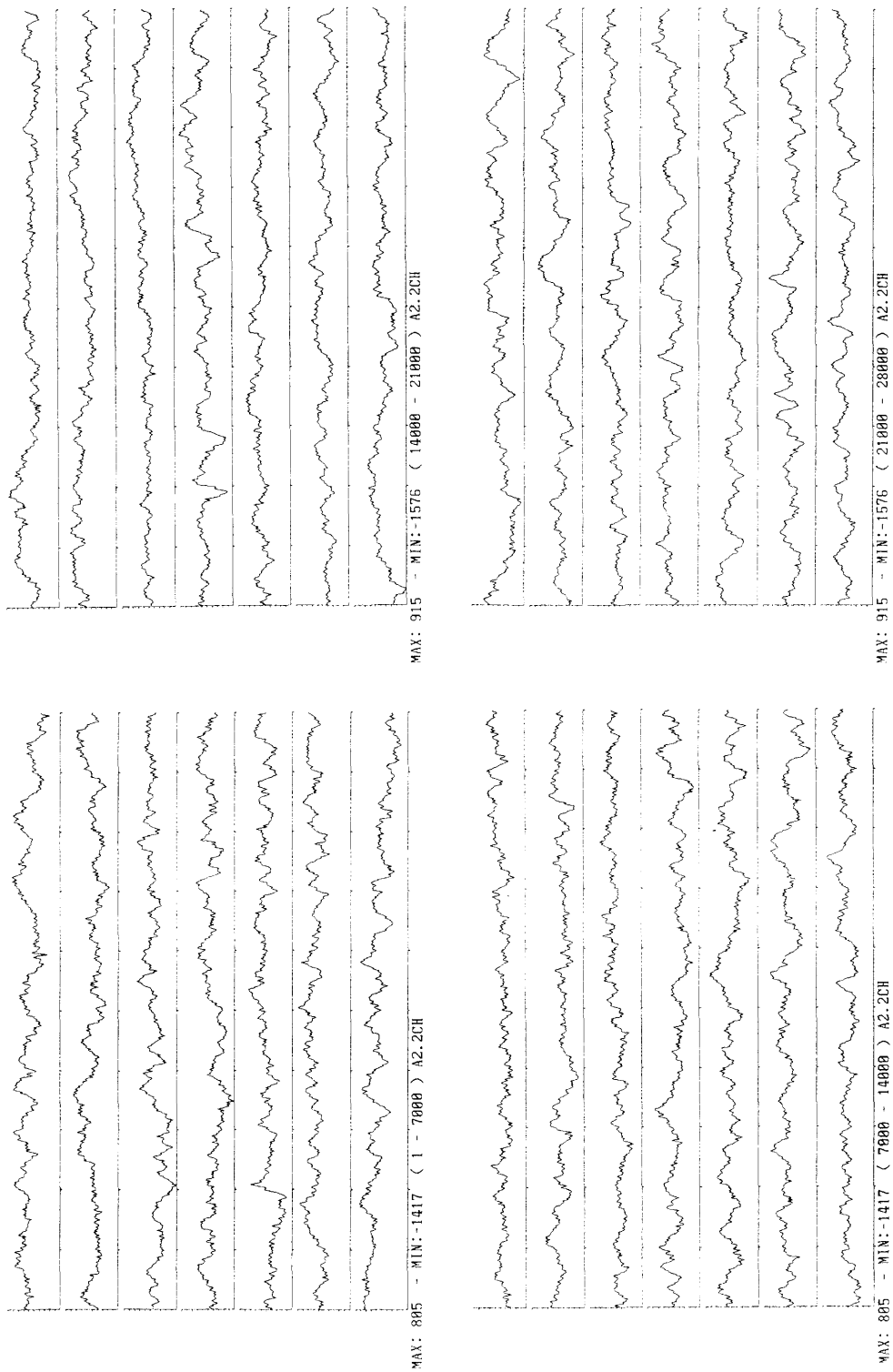


Fig. A2-2 EEG data of ch2 of record 2 for person A.

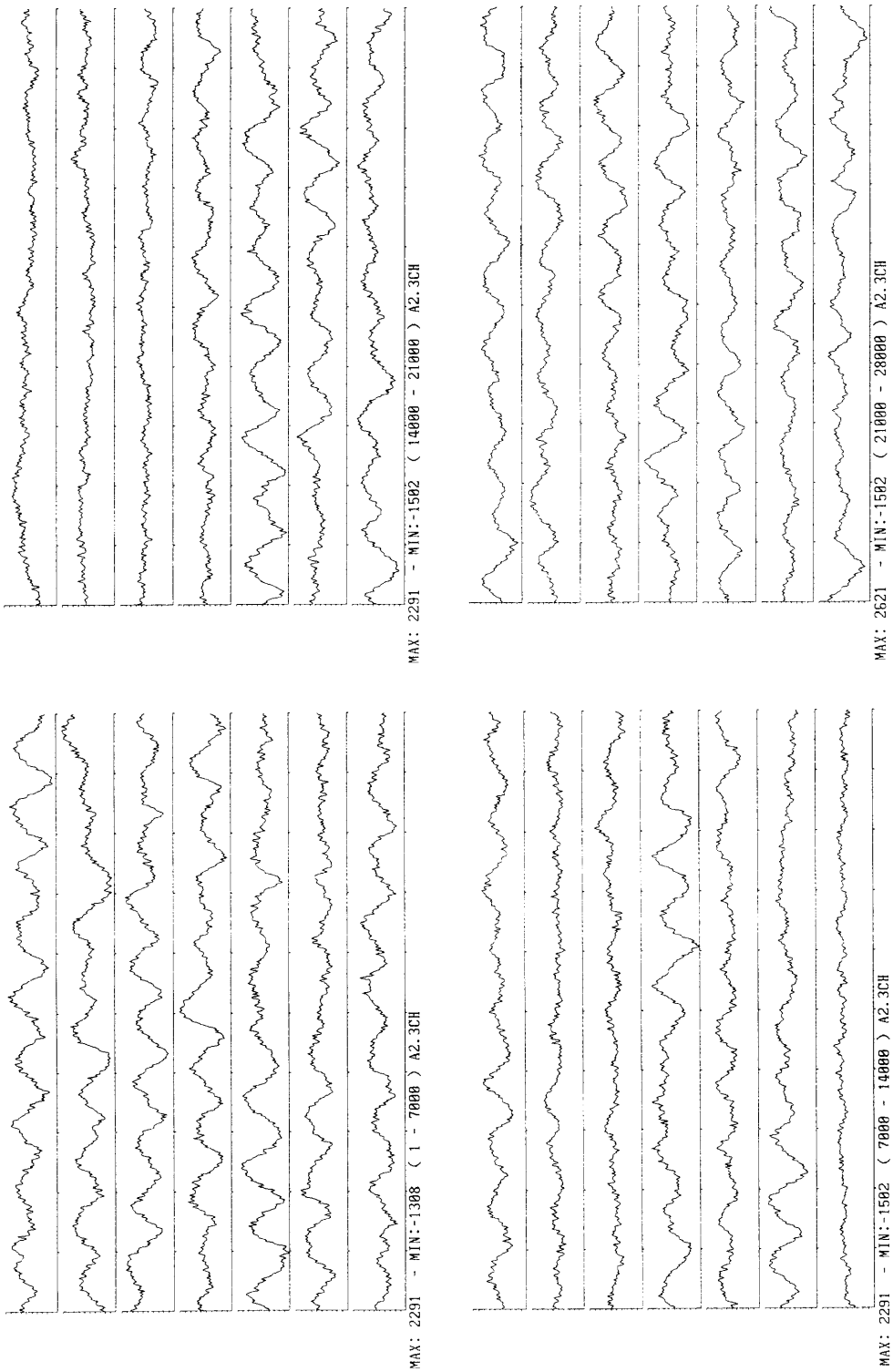


Fig. A2-3 EEG data of ch3 of record 2 for person A.

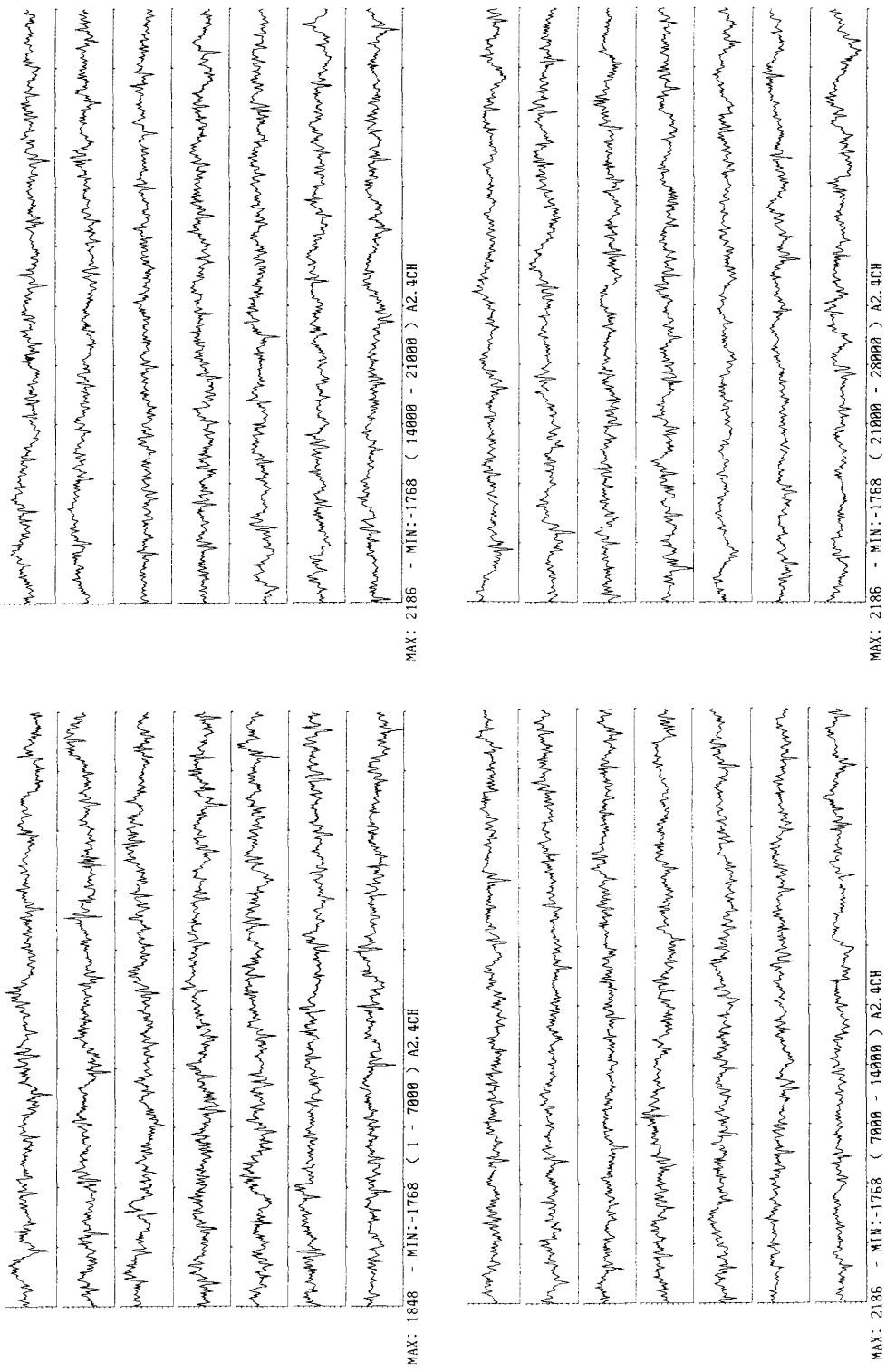


Fig. A2-4 EEG data of ch4 of record 2 for person A.

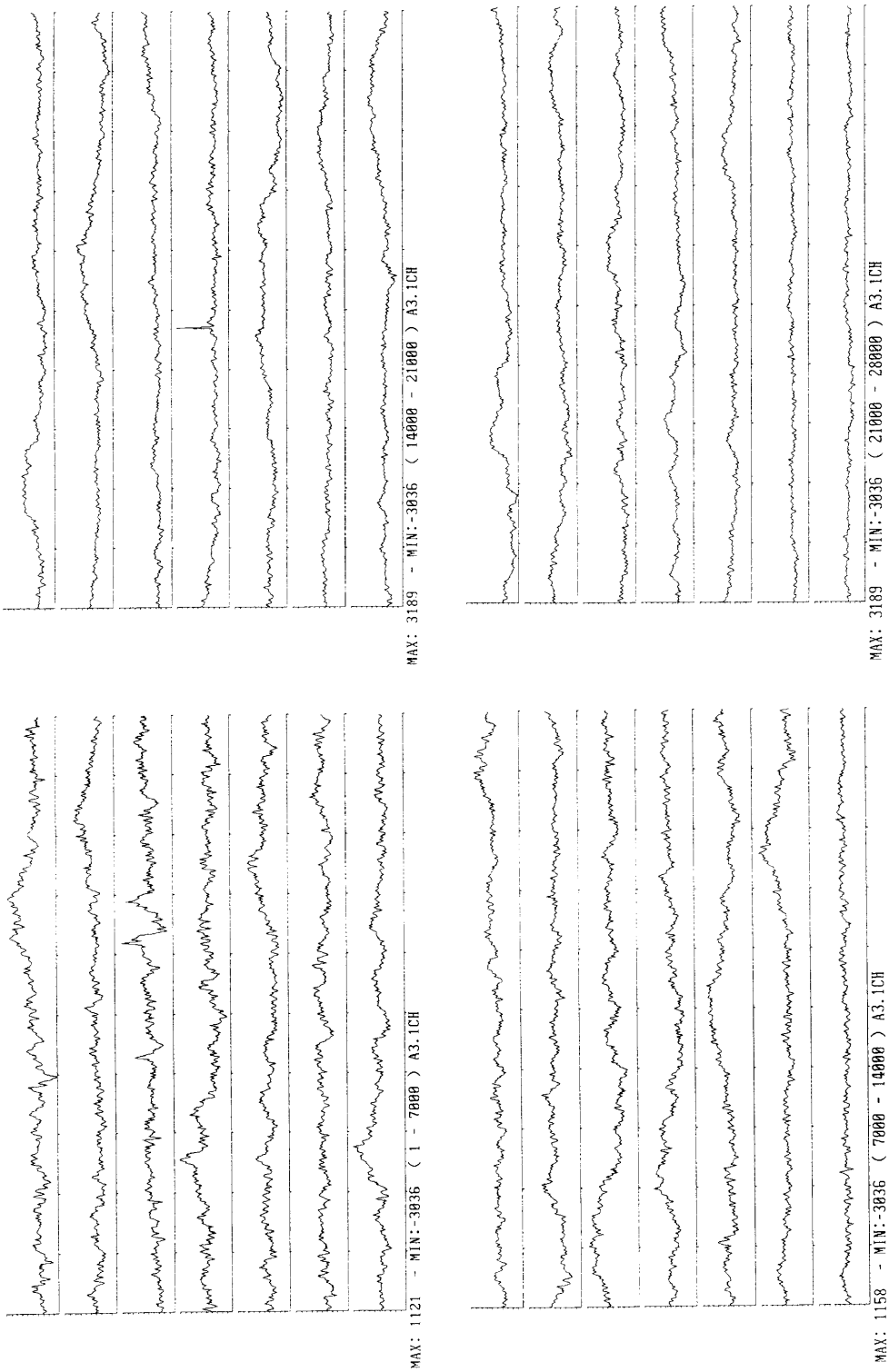


Fig. A3-1 EEG data of ch1 of record 3 for person A.

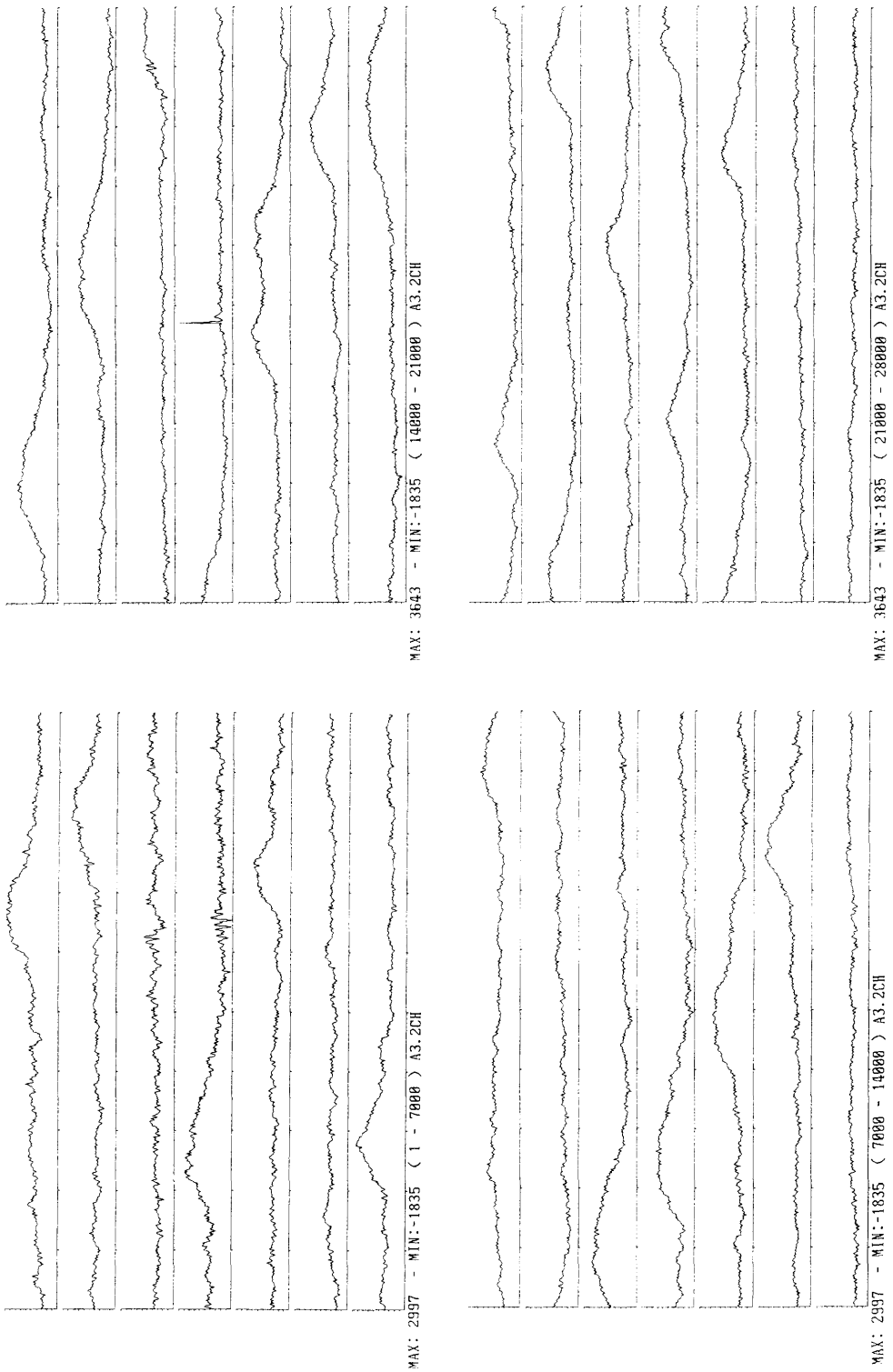


Fig. A3-2 EEG data of ch2 of record 3 for person A.

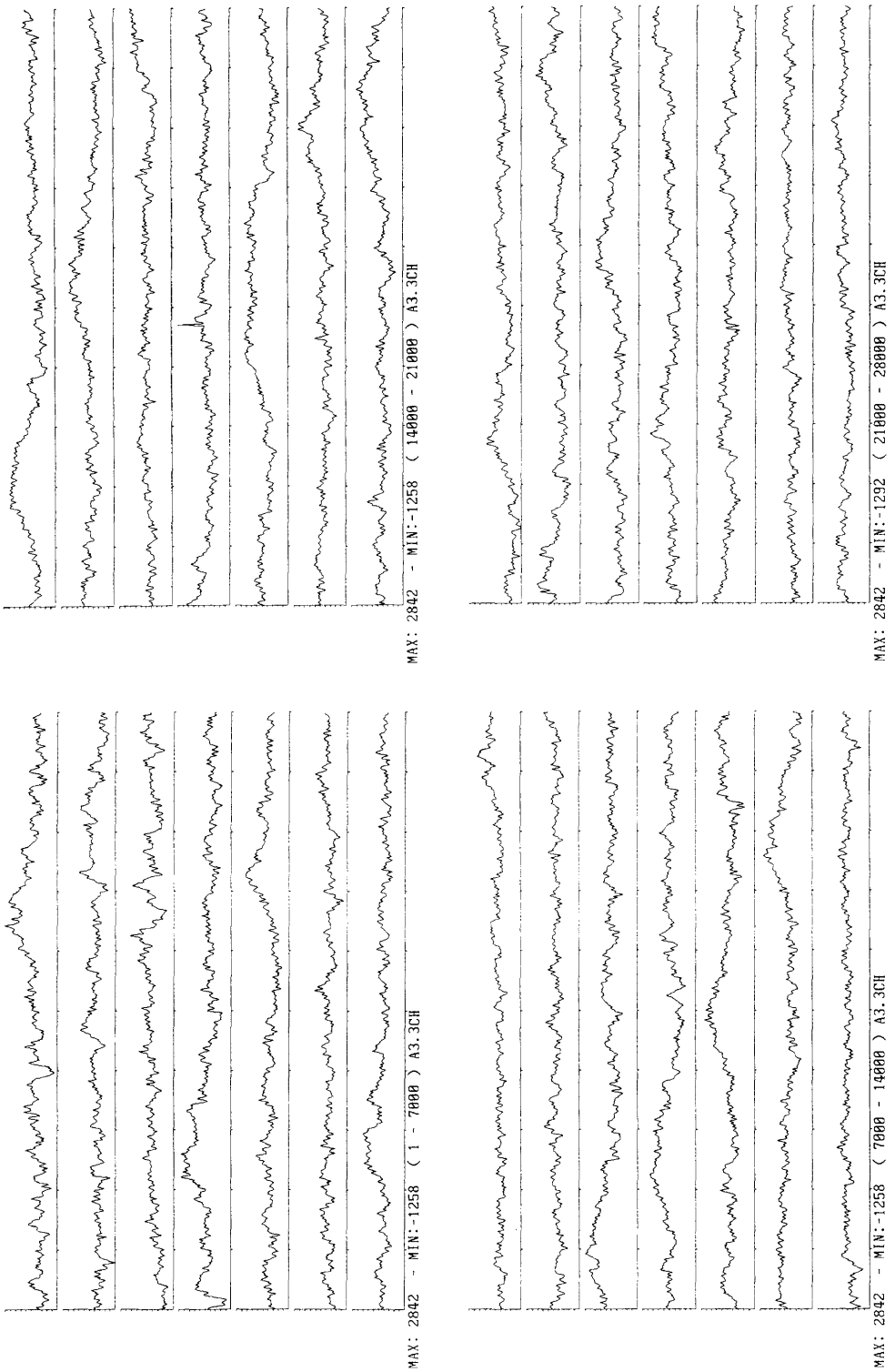


Fig. A3-3 EEG data of ch3 of record 3 for person A.

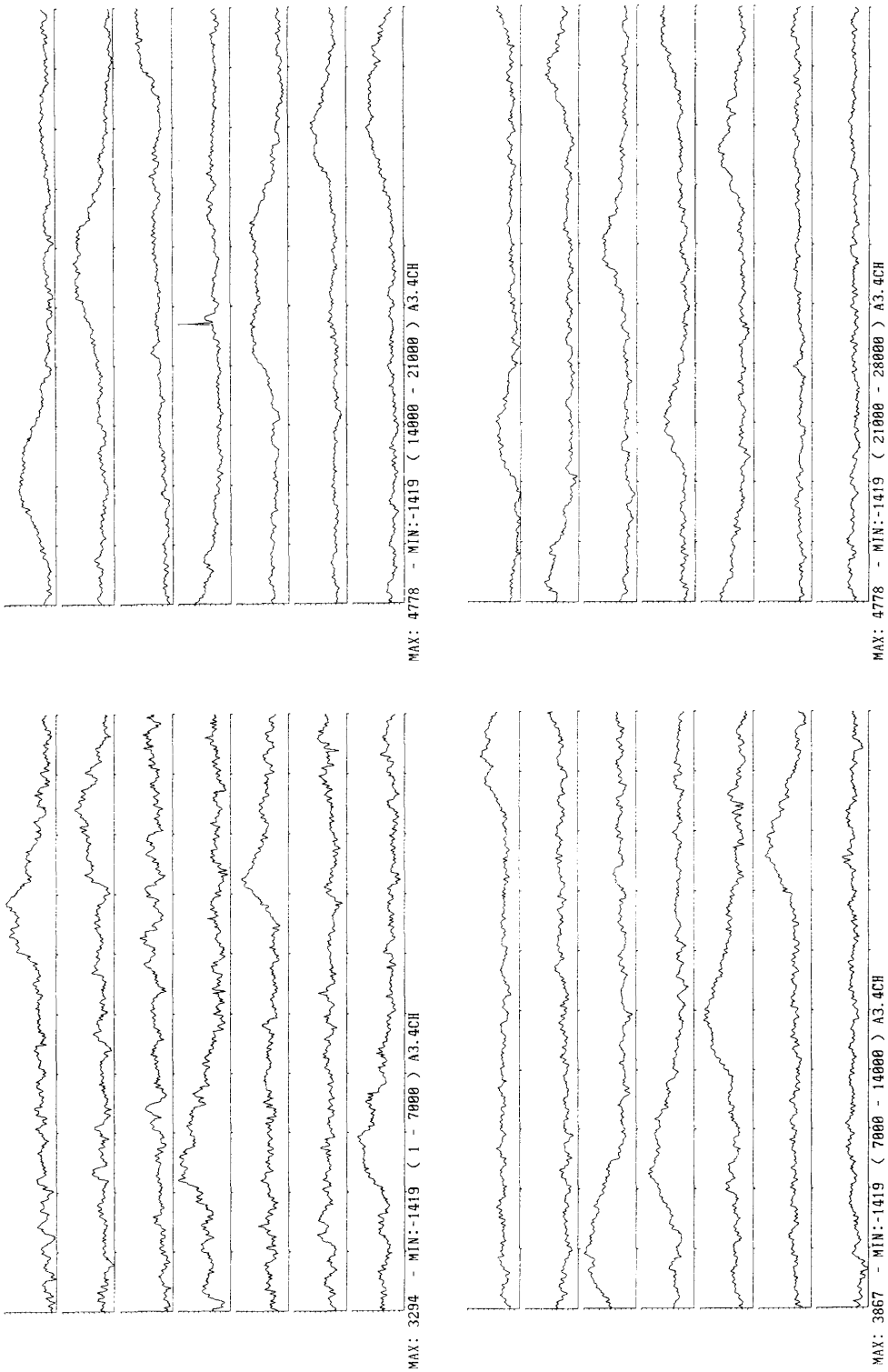


Fig. A3-4 EEG data of ch4 of record 3 for person A.

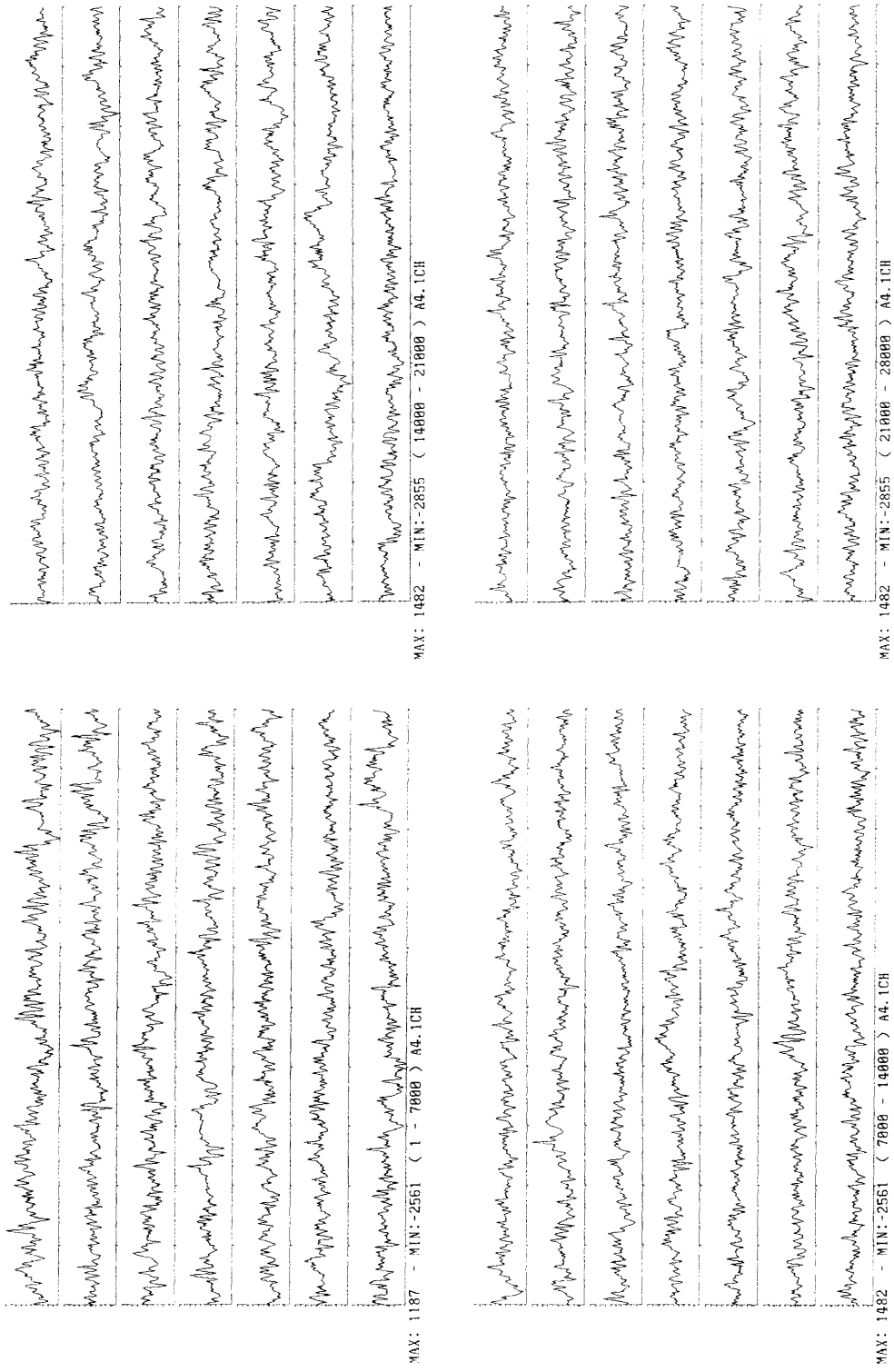


Fig. A4-1 EEG data of ch1 of record 4 for person A.

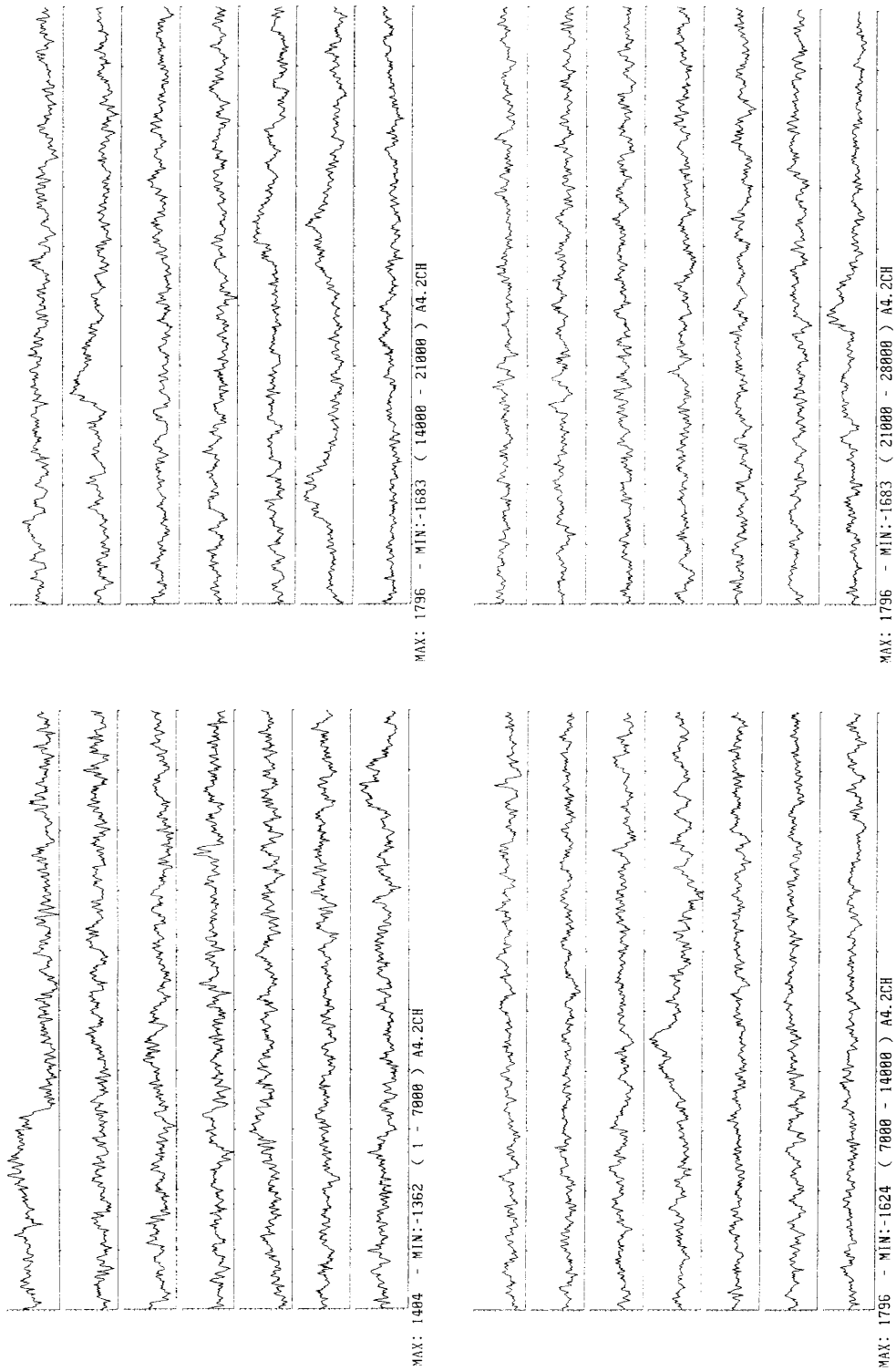


Fig. A4-2 EEG data of ch2 of record 4 for person A.

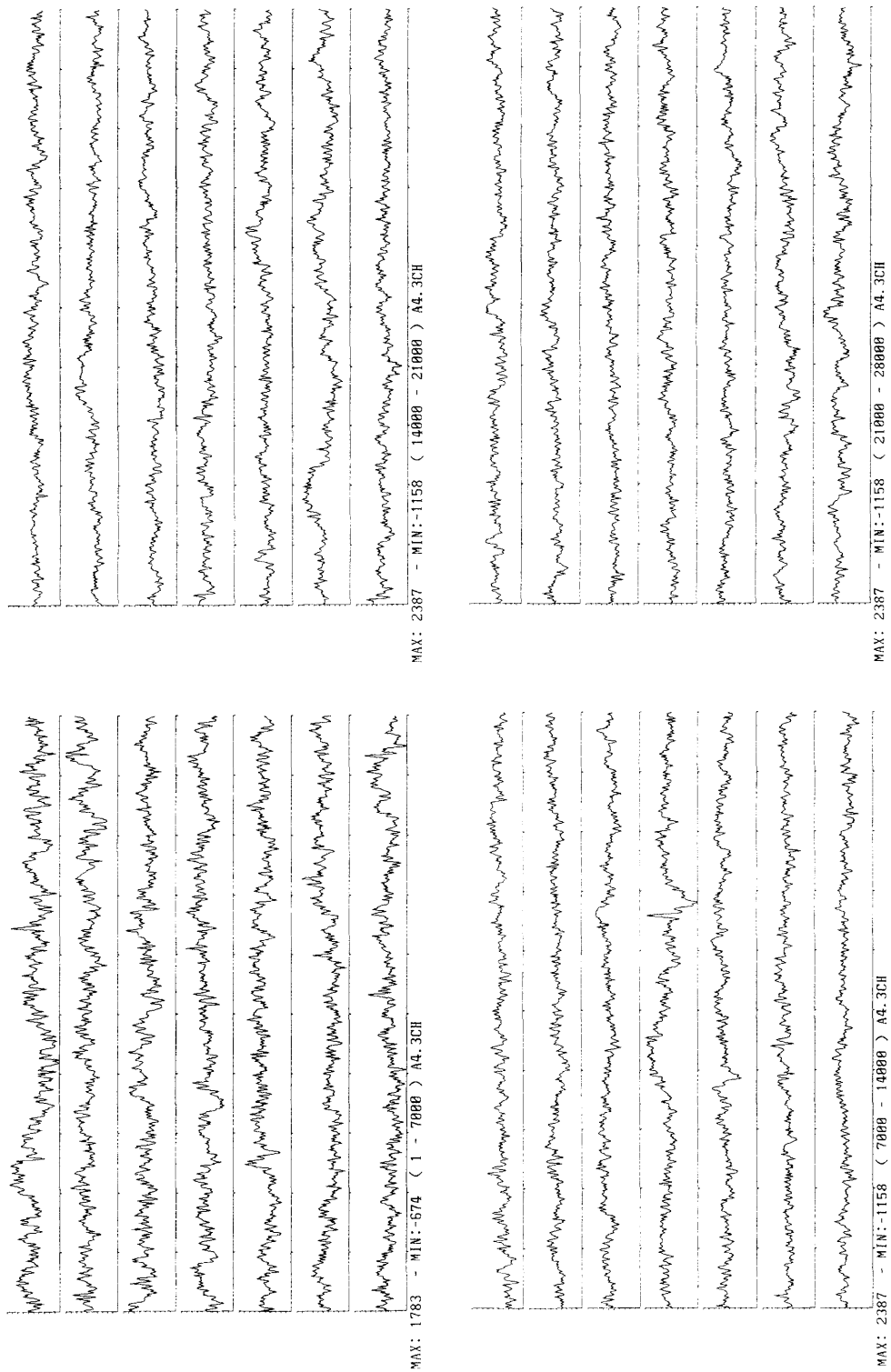


Fig. A4-3 EEG data of ch3 of record 4 for person A.

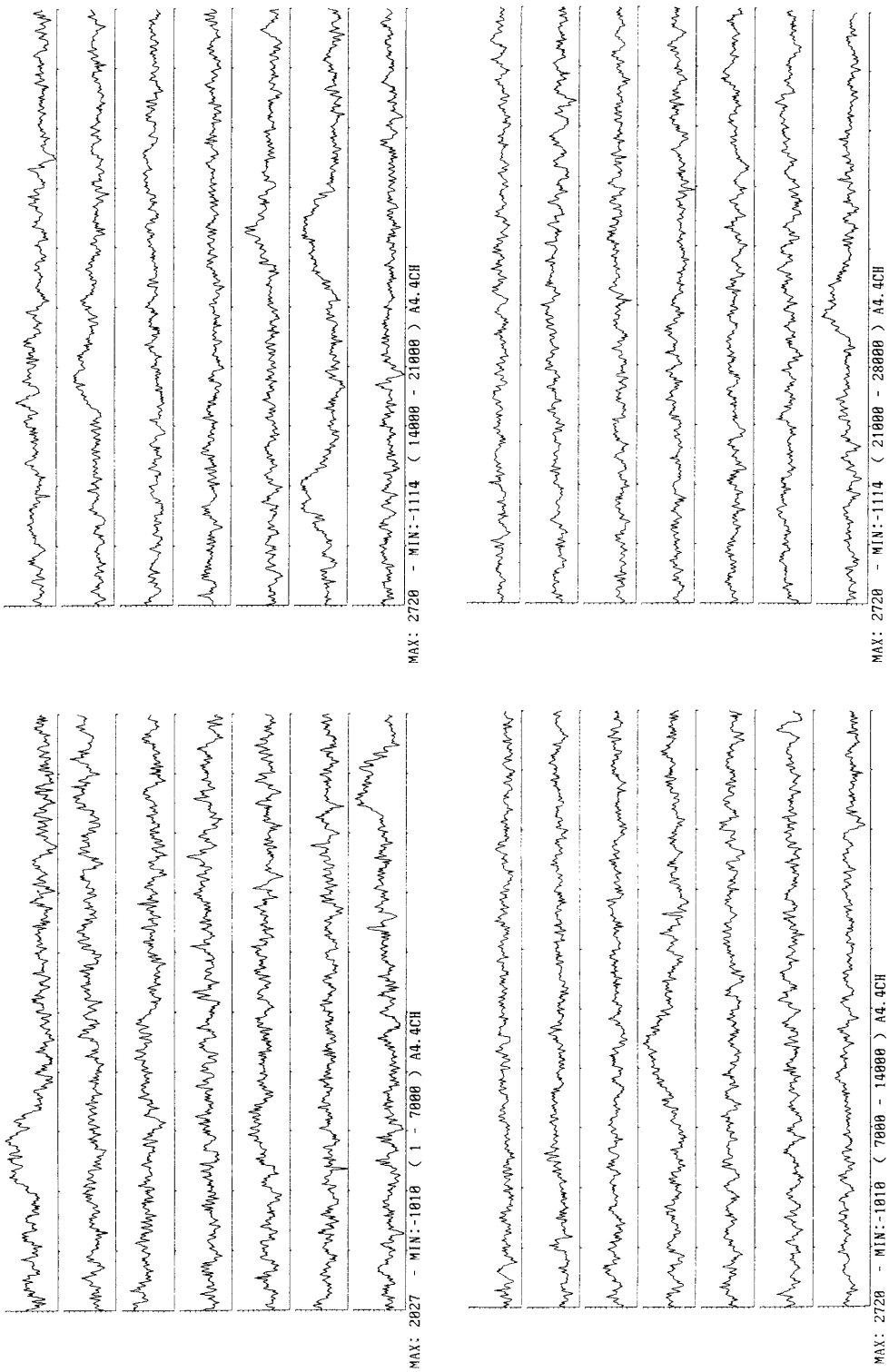


Fig. A4–4 EEG data of ch4 of record 4 for person A.

Fig. A5-1 EEG data of ch1 of record 5 for person A.

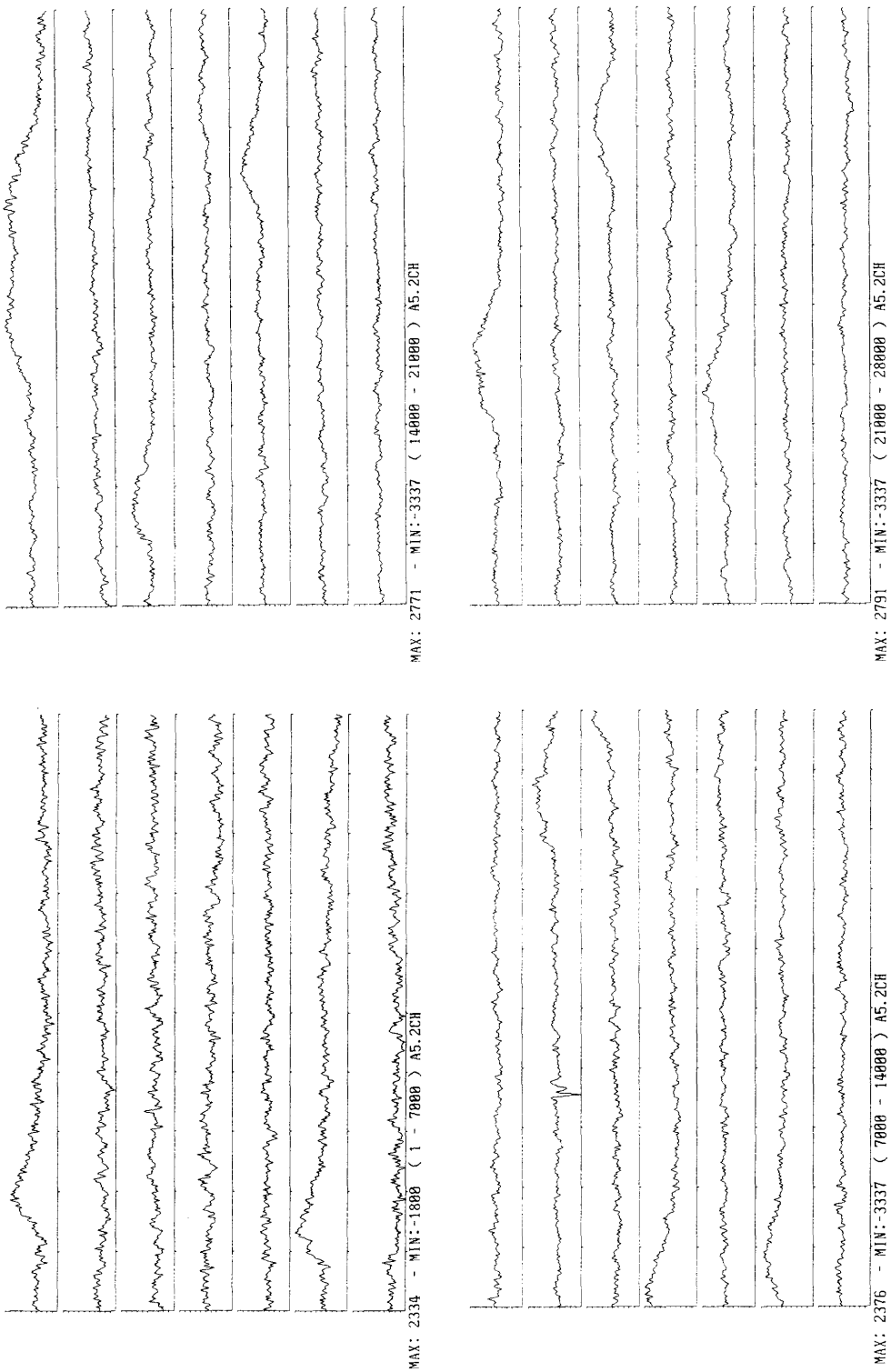


Fig. A5-2 EEG data of ch2 of record 5 for person A.

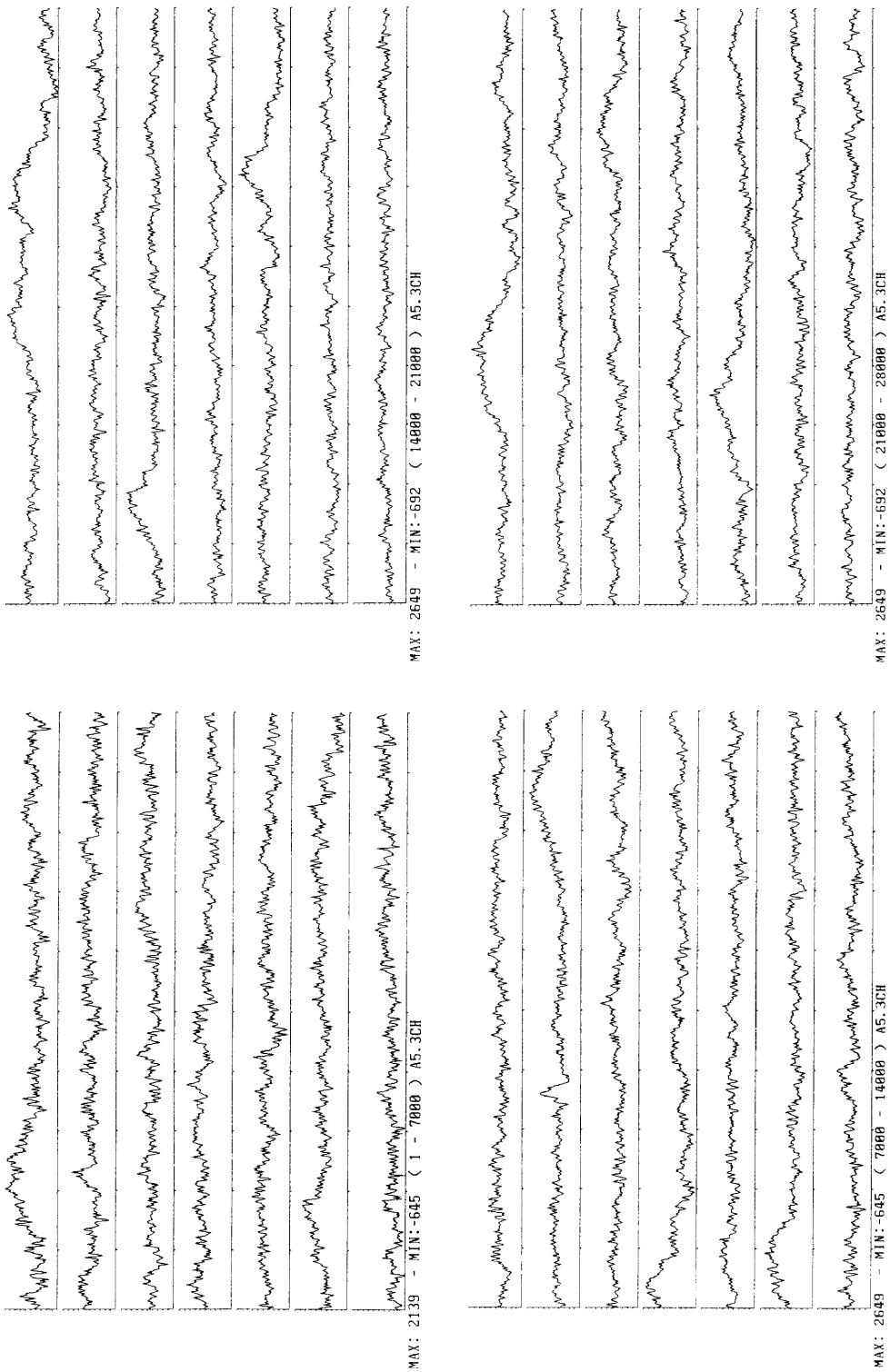


Fig. A5-3 EEG data of ch3 of record 5 for person A.

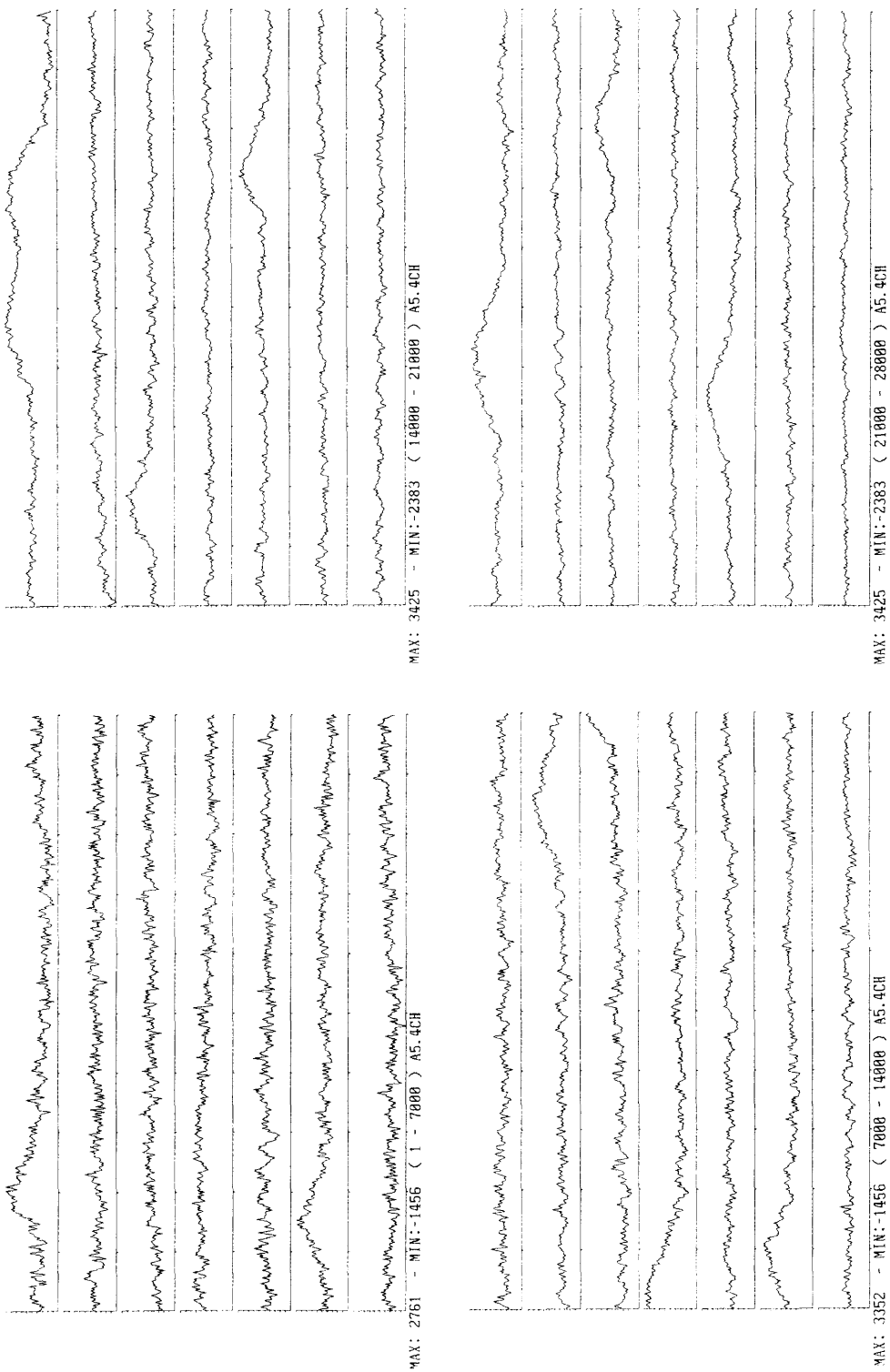


Fig. A5-4 EEG data of ch4 of record 5 for person A.

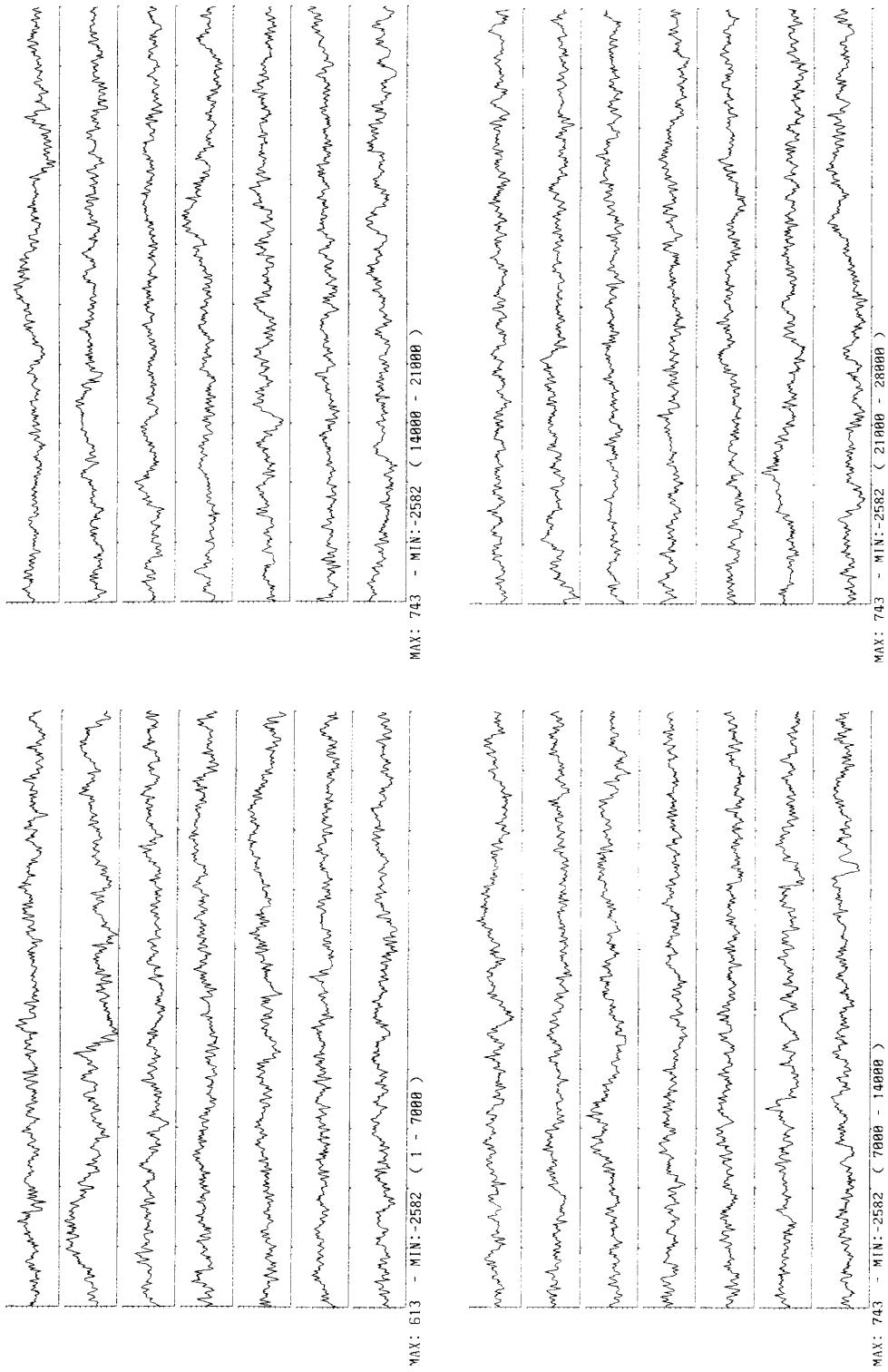


Fig. A6-1 EEG data of ch1 of record 6 for person A.

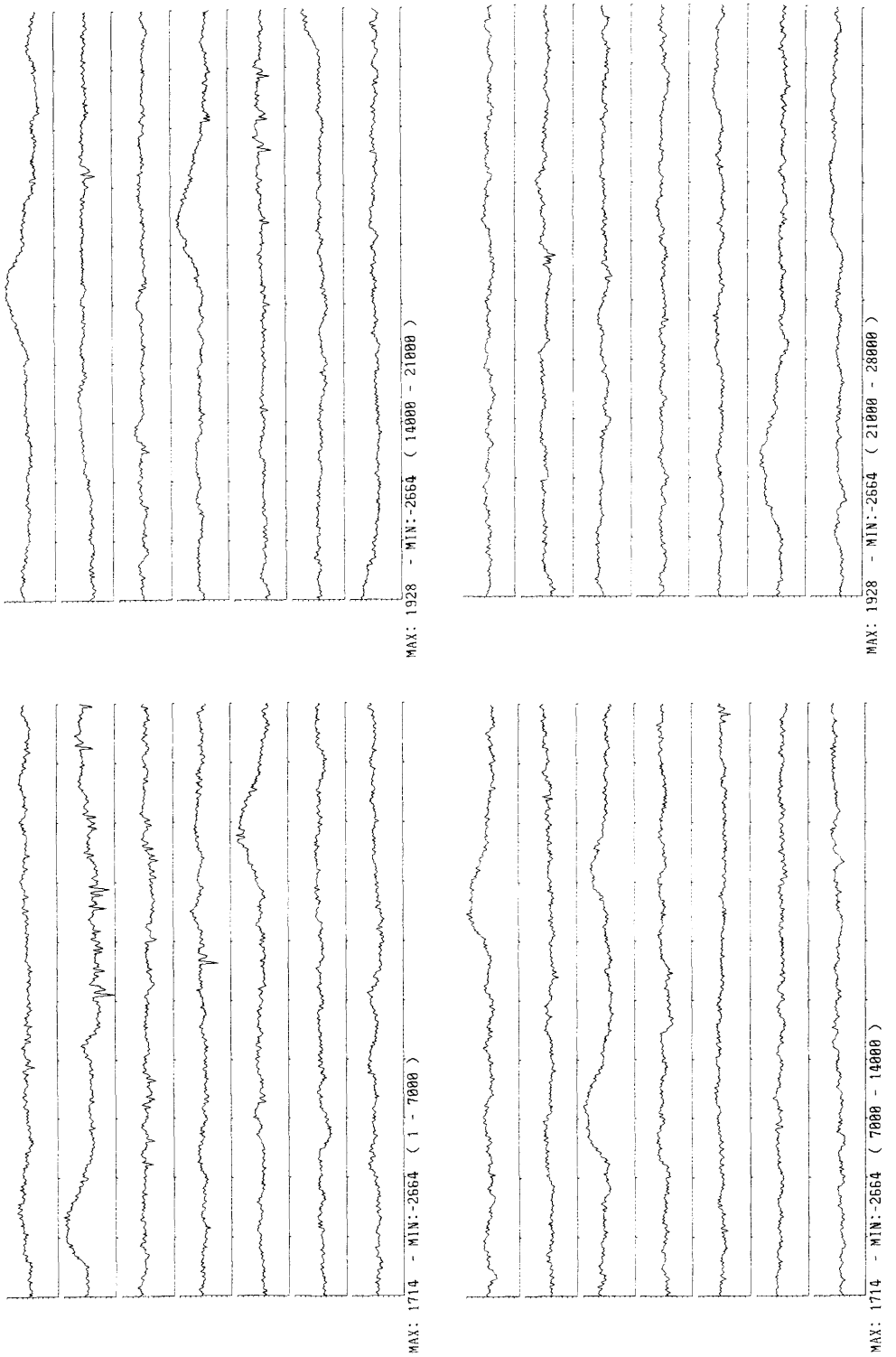


Fig. A6–2 EEG data of ch2 of record 6 for person A.

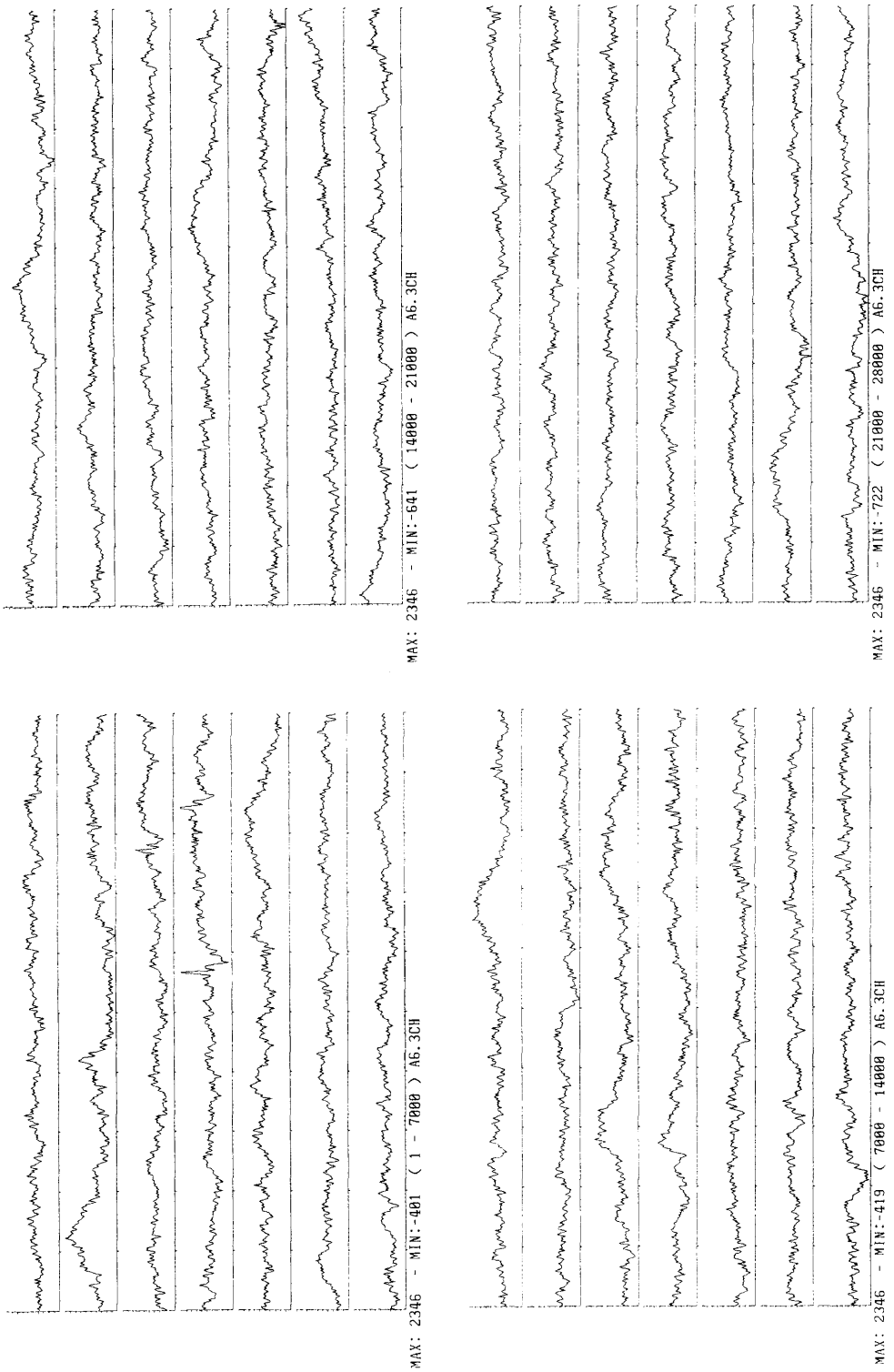


Fig. A6-3 EEG data of ch3 of record 6 for person A.

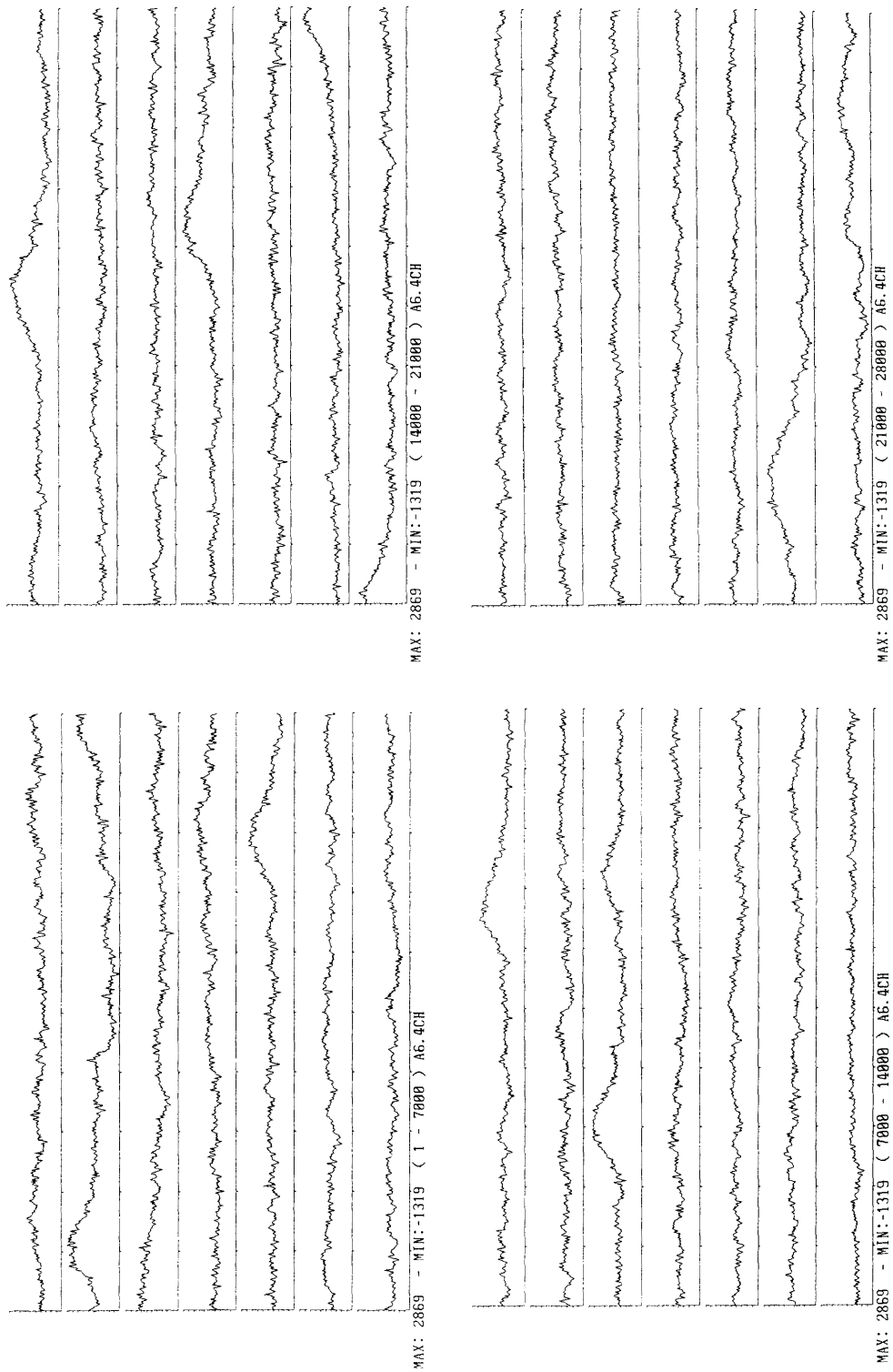


Fig. A6-4 EEG data of ch4 of record 6 for person A.

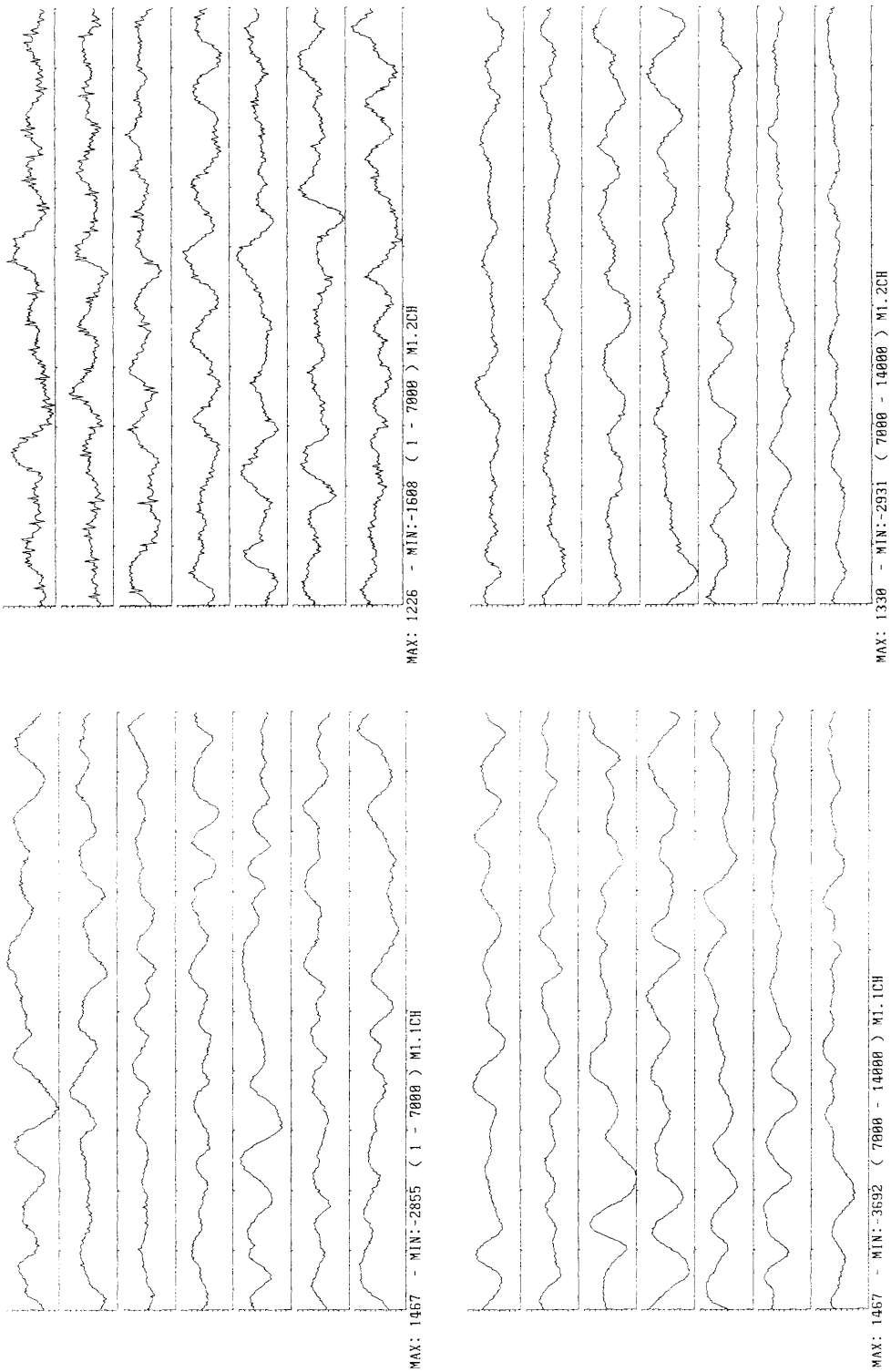


Fig. M1-1 EEG data of ch1 and ch2 of record 1 for person M.

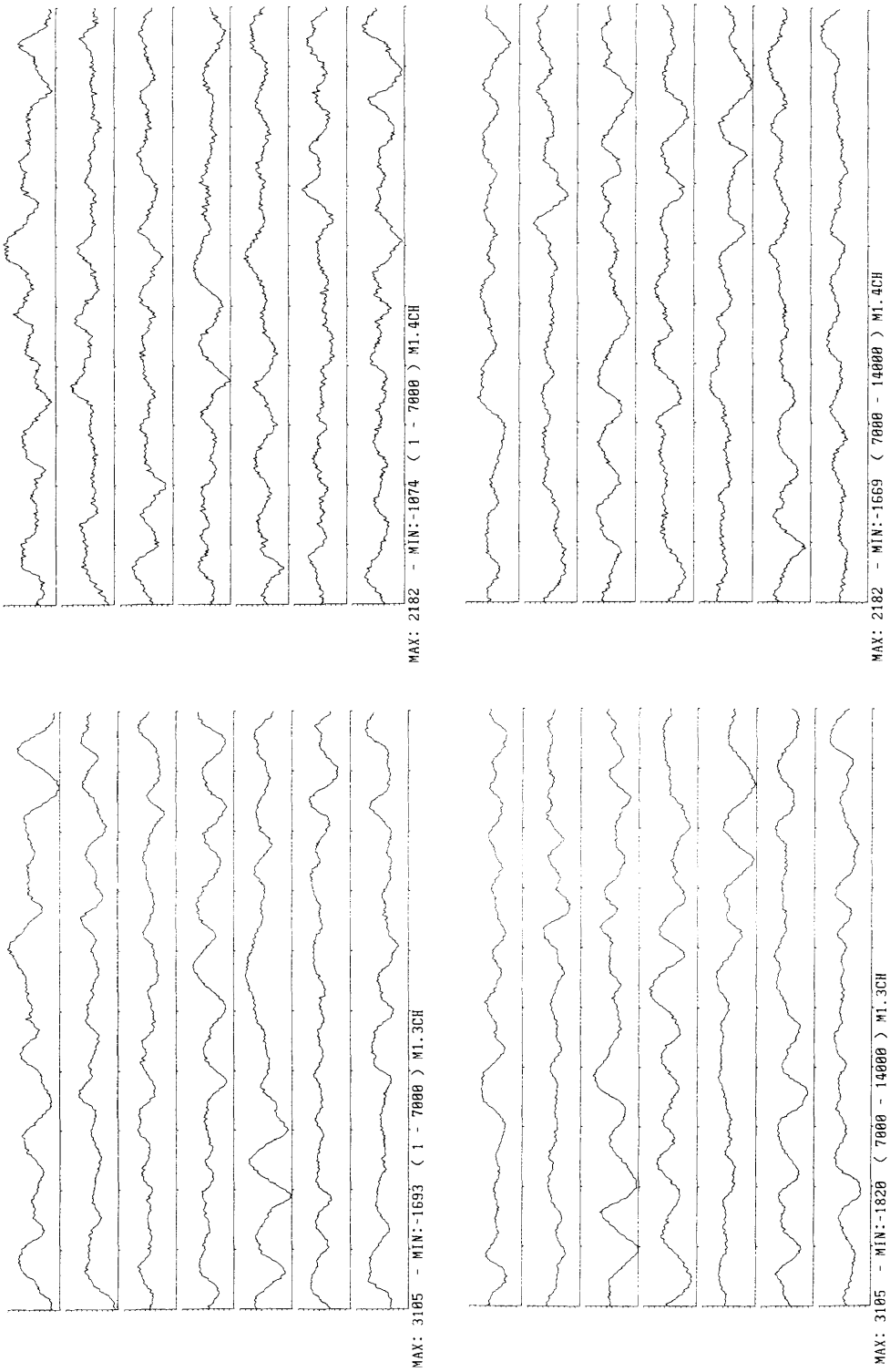


Fig. M1-2 EEG data of ch3 and ch4 of record 1 for person M.

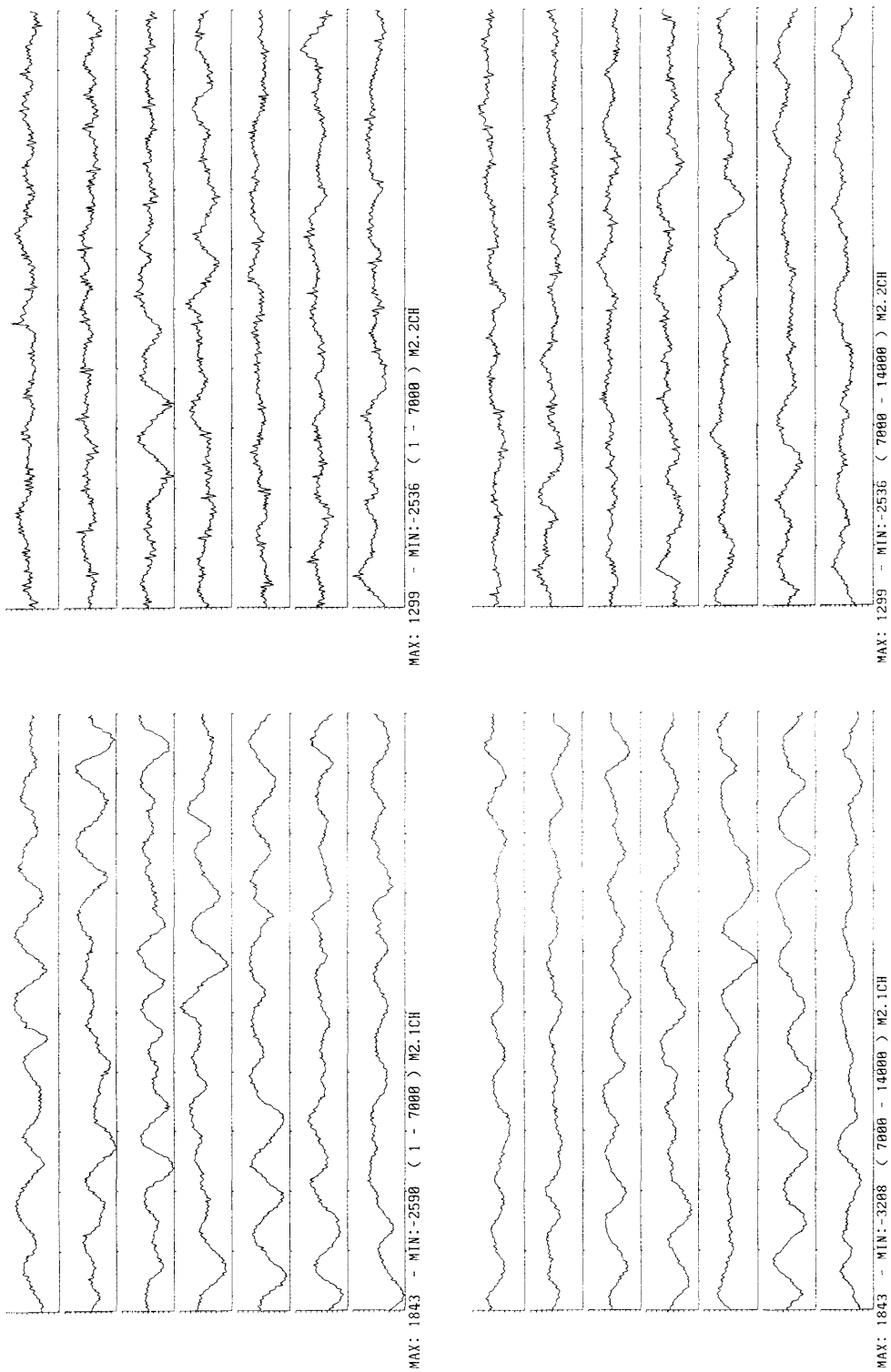


Fig. M2-1 EEG data of ch1 and ch2 of record 2 for person M.

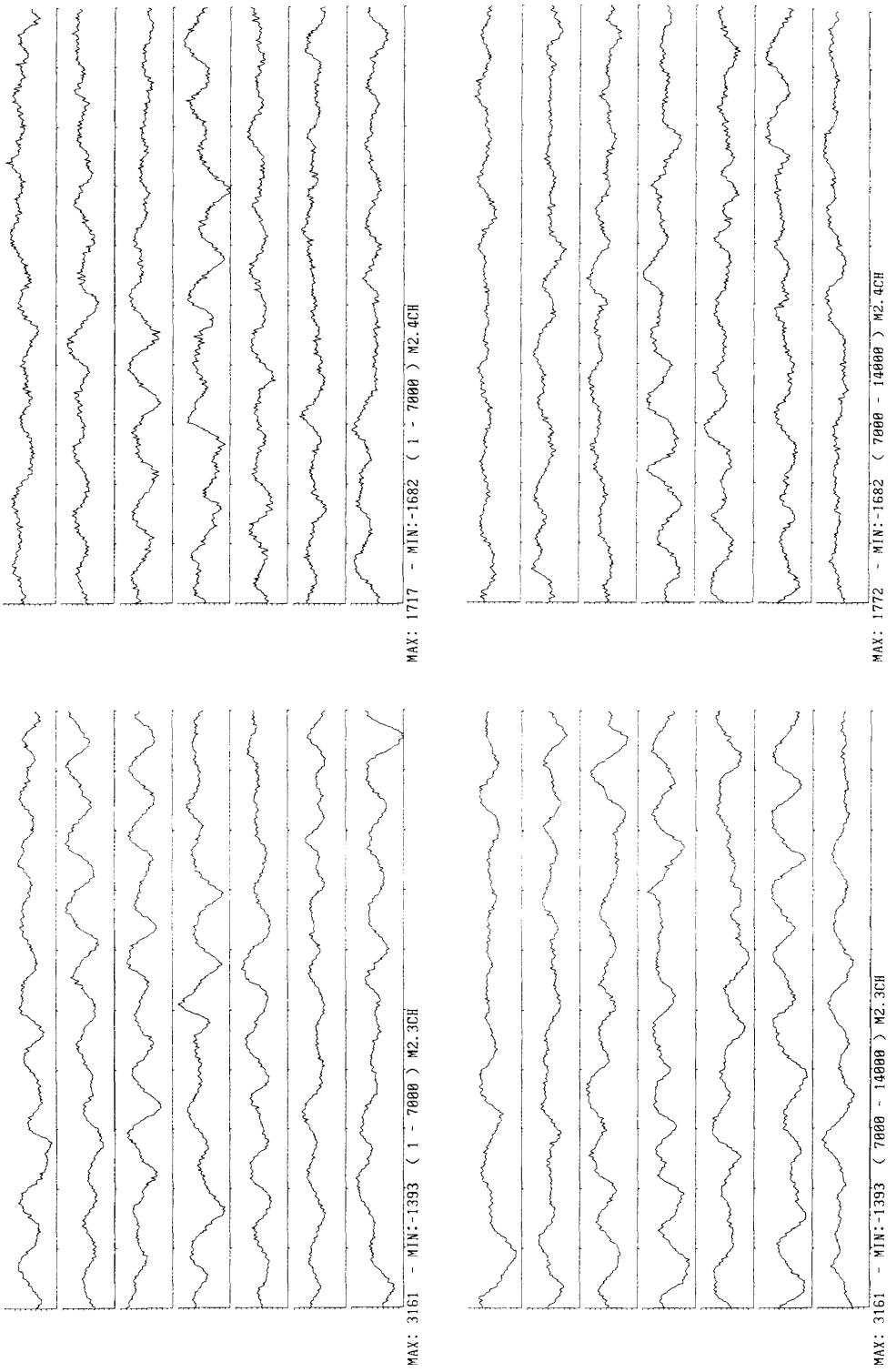


Fig. M2-2 EEG data of ch3 and ch4 of record 2 for person M.

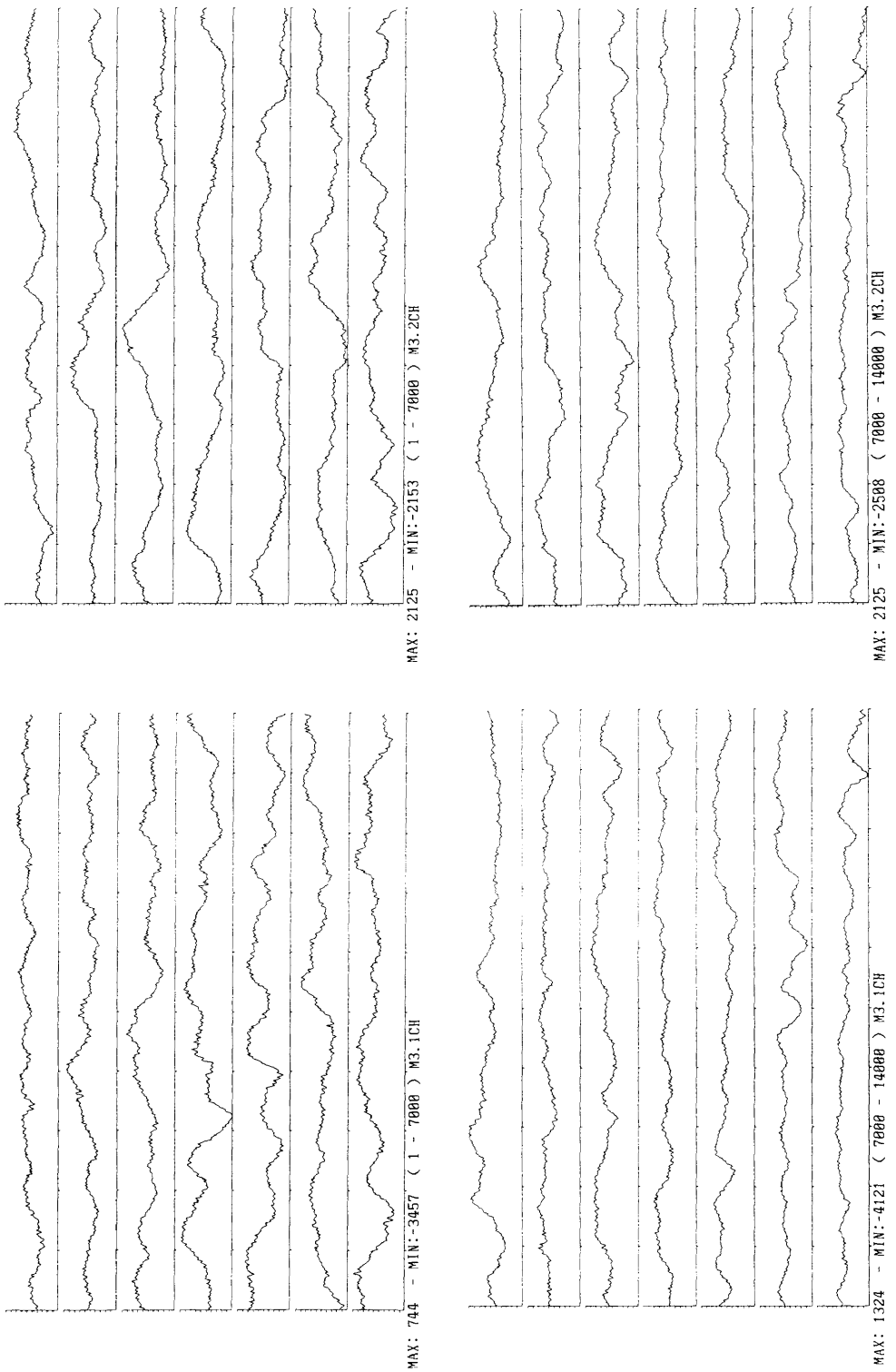


Fig. M3-1 EEG data of ch1 and ch2 of record 3 for person M.

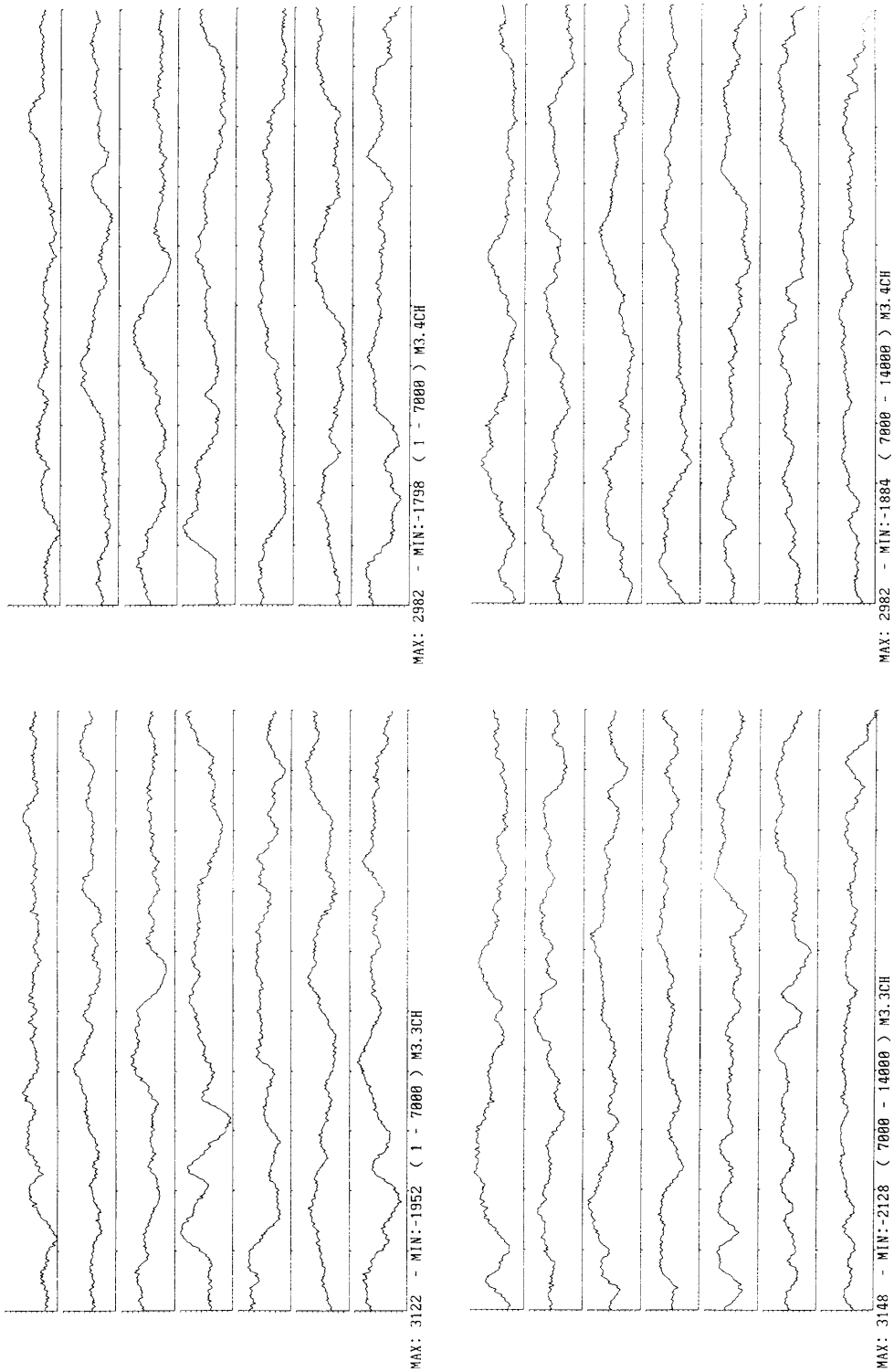


Fig. M3-2 EEG data of ch3 and ch4 of record 3 for person M.

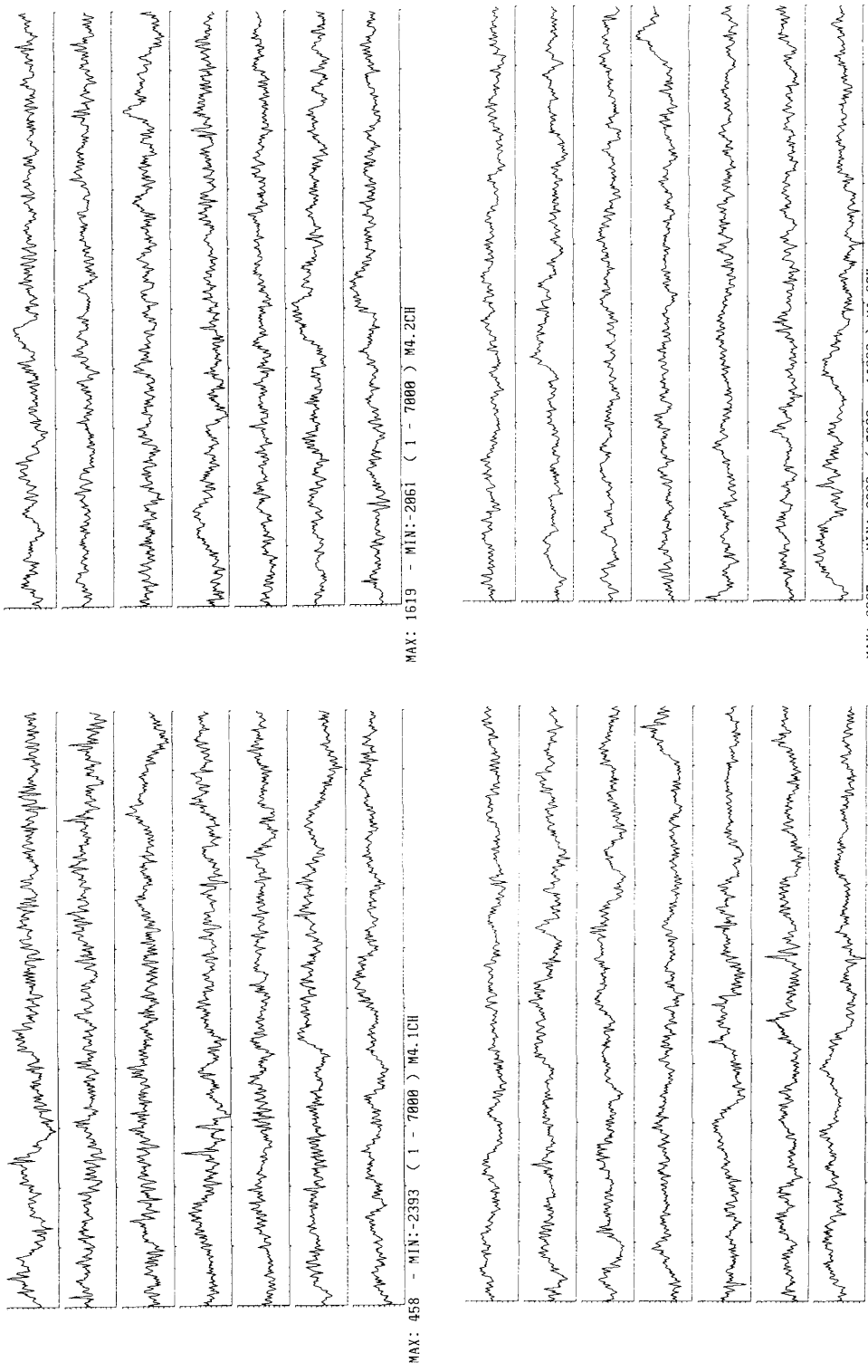


Fig. M4-1 EEG data of ch1 and ch2 of record 4 for person M.

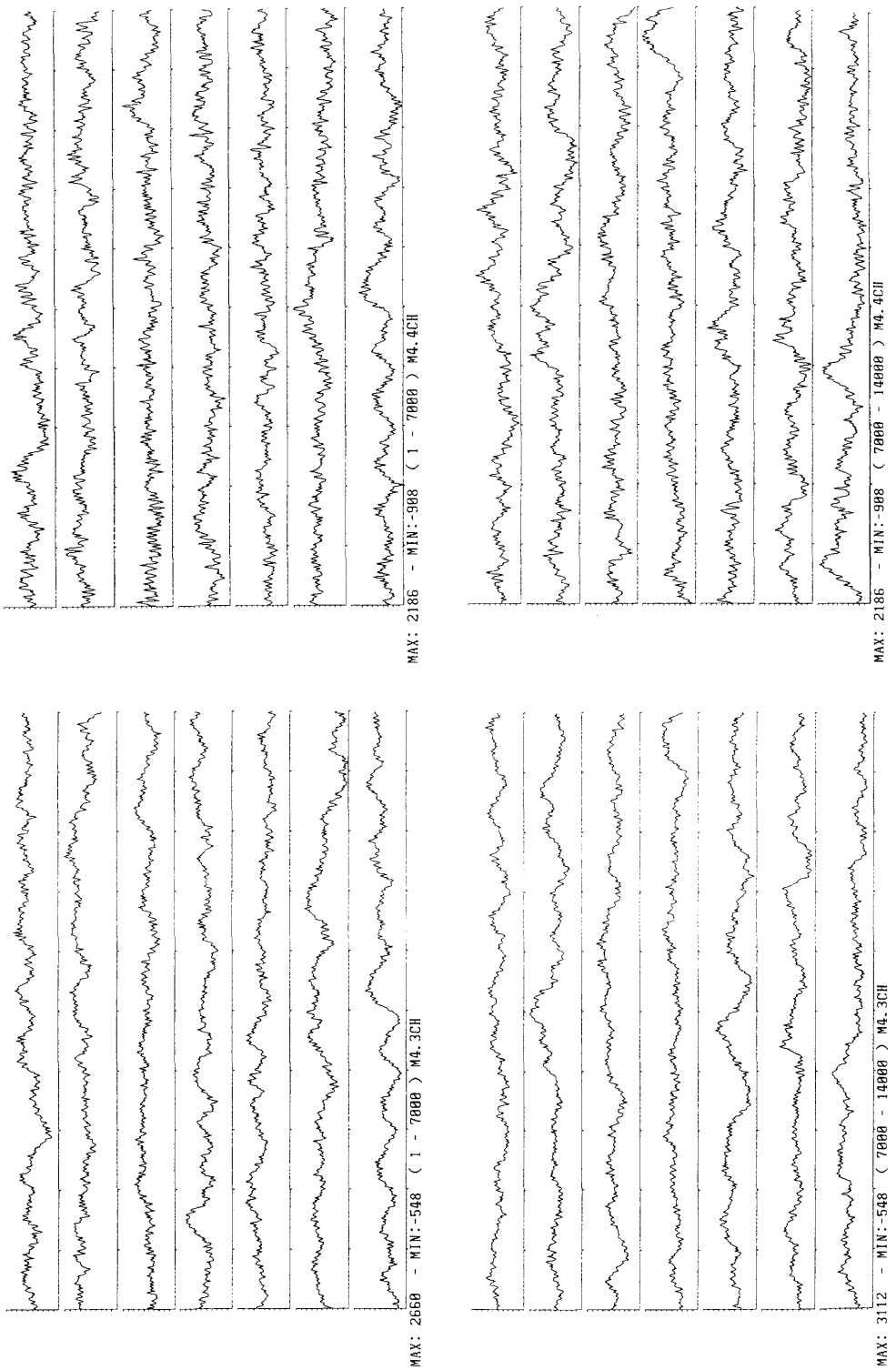


Fig. M4-2 EEG data of ch3 and ch4 of record 4 for person M.

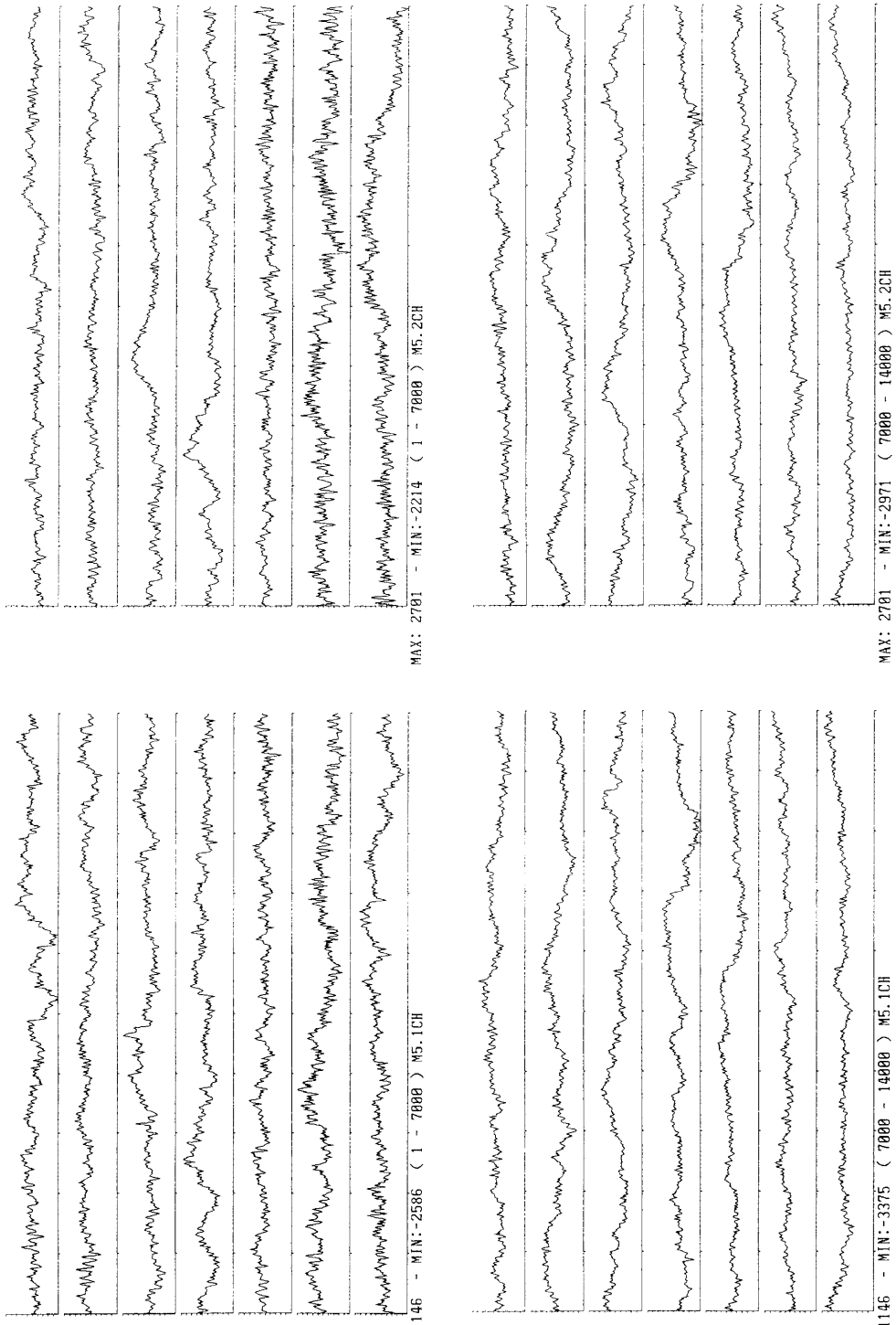


Fig. M5-1 EEG data of ch1 and ch2 of record 5 for person M.

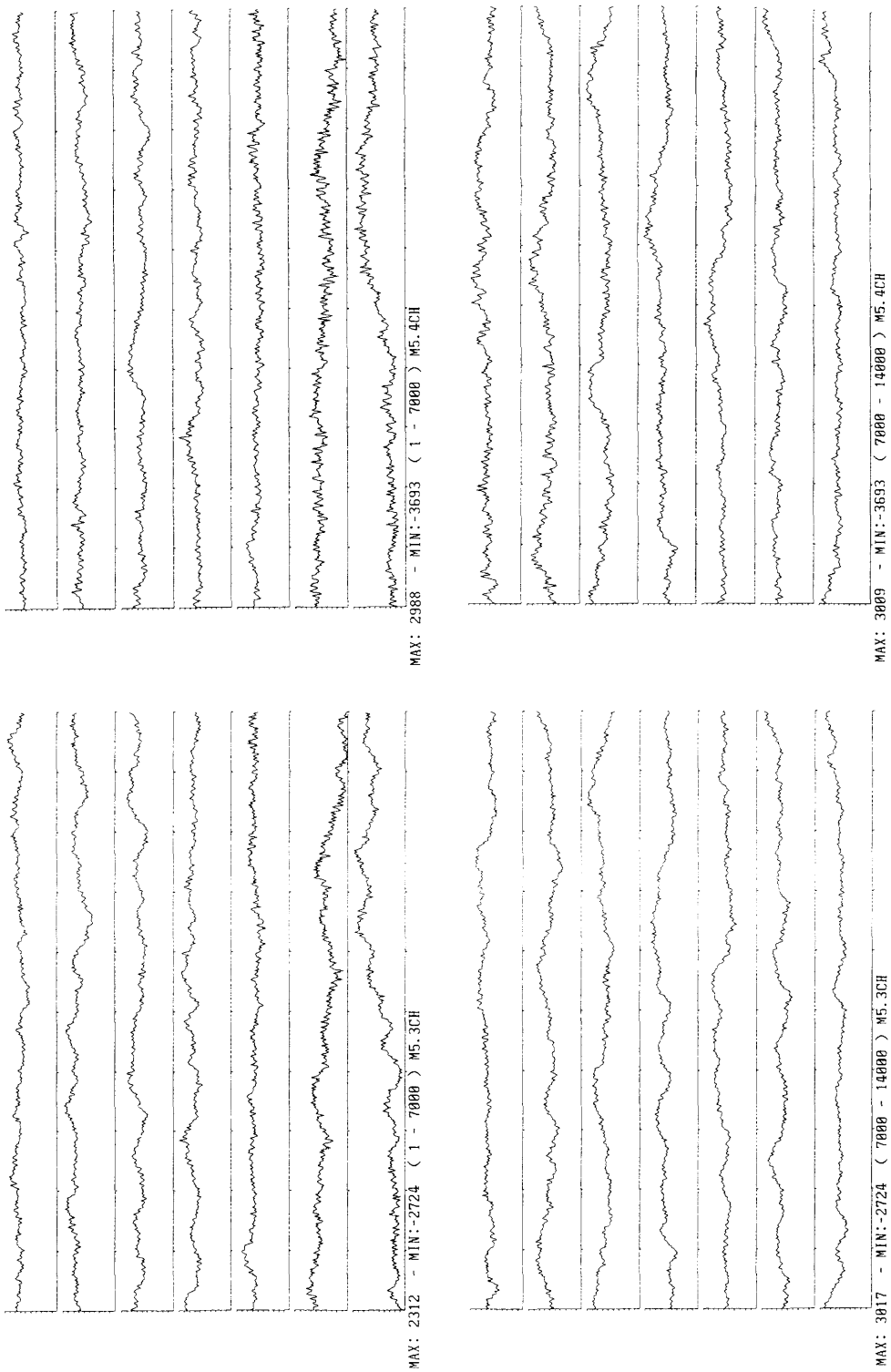


Fig. M5-2 EEG data of ch3 and ch4 of record 5 for person M.

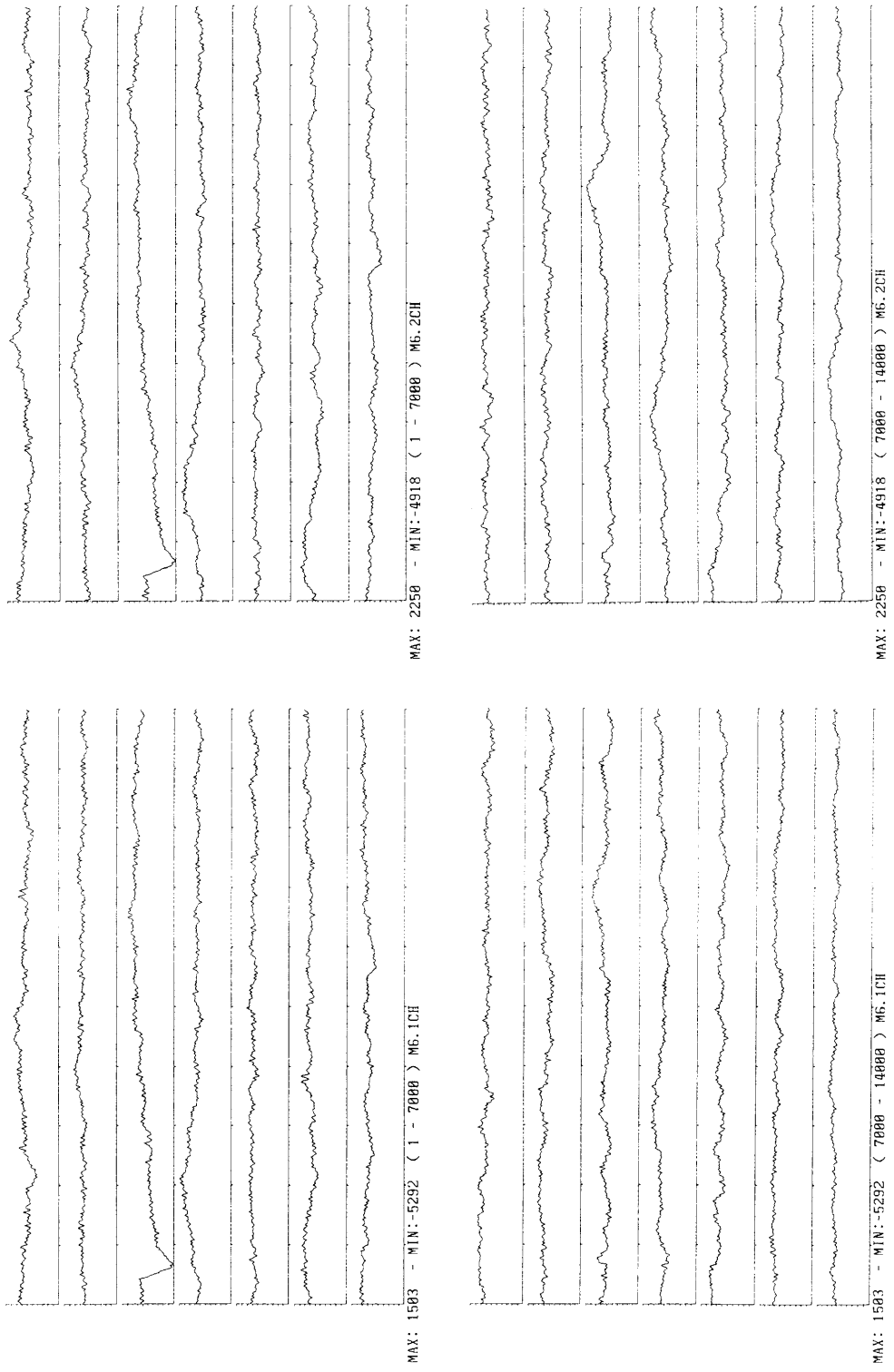


Fig. M6-1 EEG data of ch1 and ch2 of record 6 for person M.

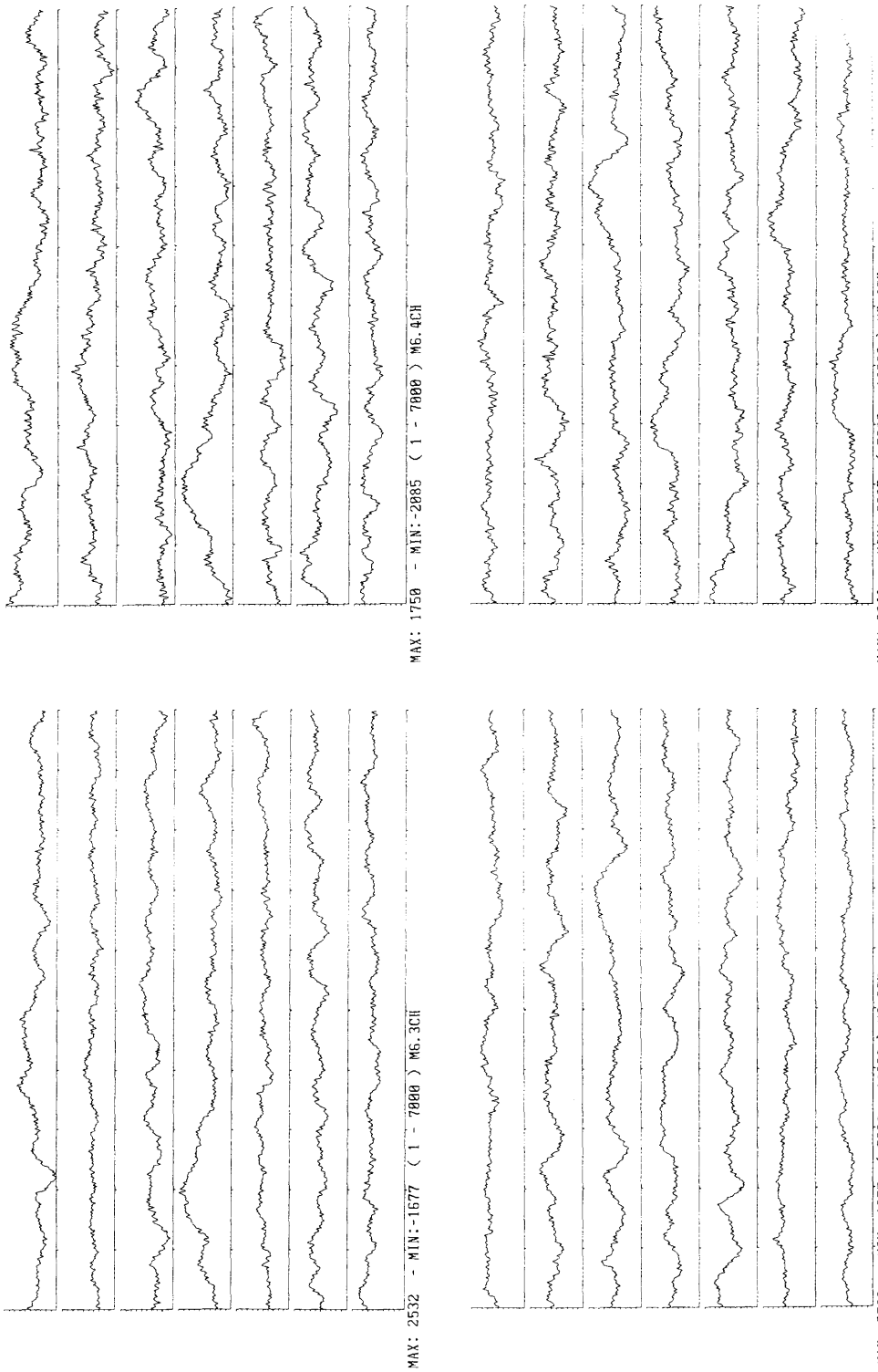


Fig. M6-2 EEG data of ch3 and ch4 of record 6 for person M.