

2 1

3a 3b

4a (PPG)

4b

5a 2 3 (ECG)

5b 5d R-peak

6 Burg

7a (EDA)

7b (EDA)
(SCR)

8

9a (ICA)

9b ICA

10a (EGG)

10b (time-varying spectrum)

11

12

2000 가 가 200 가

가

2000-041437

2001-28961

(RF tag)

2001-3479 'Animal's intention translational method'

,가

가

가

가

가

, US 5046453, 'Animal training apparatus'

가
(cold fluid)가

US 5054428, 'Method and apparatus for remote conditioned cue control of animal training stimulus'
가 가 (duration)

가

가

, WO99/42968 'Pet locator system'

(Pet)

(movable

object)

WO96/30882 'Wireless pet containment system'

가

가

가

, (a)

; (b)

; (c)

(a)

; (b)

; (c)

(SVM)

1

ography, ECG), (photoplethysmography, PPG), (skin temperature, SKT), (electrocardi
lectromyogram, EMG) (electrogastrogram, EGG) (electrodermal activity, EDA), (e
(110), (100),

(120).

(130).

가
120 가
가

100

2 1

(200)

(200),

(210)

(220),

(230),

(240)

(230)

(240)

(250)

(250)

(260)

(260)

(200)

(250)

1

2

가

(Human-computer interaction, HCI)

가

가
(Heart rate variability),

(
(electrodermal activity),

)
(skin temperature)

(intenti

on)

3a

3b
, 3b

3a

가

(200)

3b

3a

가

가

PPG),

(EDA),

(EMG)

(200)

(EGG)

(SKT),

(ECG),
(100).

(

RF

, A/D
(210)

(220)
(signal recovery)

(210)

RF

(200)

(230)

(230)

(add-on)

(230)

(pacemaker)

sinoatrial node(SA node)

가

가

(electrocardiography, ECG),

(phonocardiography),

(photoplethysmography, PPG)

가

가

3a (200)

Medical instrumentation (J. G. Webster, 1999)

3b 2 3

(PPG) 가 4a

4b

PPG (lowpass filter, 400) (median filter)(410) (matched filter)(420) (peak) (baseline movement)

5a 2 3 (ECG) , 5b 5d
R-peak

5b

5a (bandpass filter)(500) QRS complex (510) 5c
(510)

(Teager's energy operator, TEO)(520) : Kyung Hwan Kim et al., 'Neural spike sorting under nearly 0 dB signal-to-noise ratio using nonlinear energy operator and artificial neural network classifier, IEEE Transactions on biomedical engineering, 2000) 가 R-peak R-R (time series)

5d (520)

g) (smoothing), 가 (downsampling)
'An efficient algorithm for spectral analysis of heart rate variability,' IEEE Trans. Biomed. Eng., vol. 33, 1986 (R. D. Berger et. al)

6 Burg

Burg (autoregressive modeling)
0.0043-0.04 Hz (, very low frequency, VLF), 0.04-0.15 Hz (, low frequency, LF) 0.15-0.4 Hz (, high frequency, HF) 3 . Burg
Statistical digital signal processing and modeling (: M. Hayes), Wiley, 1996

R-peak , 10 %

7a 3a, 3b (EDA) 3a
3b (electrodermal activity, EDA)

7a EDA (level) (skin conduc
 tance response, SCR) (SCR) (duration),
 SCR

7b (EDA) (SCR)

EDA 256 Hz (700) 10
 -12 1 (710) (720)
 , 20 Bartlett window(: Statistical digital signal processing and modeling (
 : M. Hayes), Wiley, 1996) (convolution) (smoothing) SCR (730)
 (threshold) 2 SCR

(SKT) , (thermistor)

가

(230)

, , , EDA SCR , SCR , SKT (10%), SKT 9

(250)

(230)

가 가 가

(240)

(240)

(250)

, Wiley) Bayes' rule (Pattern classification, 2nd ed., (: R. O. Duda, P. E. Hart, D. G. Stock), 2000

s' rule 가 Baye
 Parzen window classifier, multilayer perceptron

가
 (generalization)

(Linear projection)

Wiley) 'Fisher projection Pattern classification, 2nd ed.'(: R. O. Duda, P. E. Hart, D. G. Stock, 2000,
 2 (projection)

가

가

ne, SVM) (support vector machi

SVM (mapping) 가 Vapnik
 (statistical learning theory) (generalization performance)

(classification error)

(mapping)

SVM V. Vapnik, 'An overview of statistical learning theory,' IEEE Transactions on neural network, vol. 10, no. 5, pp. 988-999, 1999

8 (252) SVM (230)
(degree of happiness), (degree of sadness), (degree of stress), (degree of anger), (240)
(254)

가
9a (independent component analysis, ICA) (post-processing) 9b ICA
(200)

(electrogastrogram, EGG) 3b

(200) (200) (motion artifact) ICA (blind source separation) (instrumentation noise) ICA
, Aapo Hyvarinen, EGG (post-processing) Independent component analysis, Wiley, 2001

10a (EGG) 10b
(time-varying spectrum) 9
, 50 , 10 가 10a 10b

Burg (autoregressive model)

J. Chen IEEE Transactions on Biomedical Engineering 1993 "Spectral analysis of episodic rhythmic variations in the cutaneous electrogastrogram"
가

(230) (peak)
(spectral width) 2 (spectral width) 10b
(peak)
(250) (240)

11

가

()

가

tection) (zero-clipping) (smoothing) (envelope de
 가
 , (heart rate variability), (EDA), (SKT)
 가 ,
) (250) (130) (260)
 (260) 100 가 120

가
 12
 (200) (1200)
 (photodiode) LED(light emitting diode)
 2
 ()
 , RS-232C 가

(240), (250) (230),
 PDA (icon) / 가
 가
 가 가 가 (200) (1210) 가 ,
 가
 가

가
 가
 , HDD, 가
 가
 가 ROM, RAM, CD-ROM, CD-RW,
 (

(PPG), (EDA), (EMG) (EGG) (SKT), (ECG),
 가 가 가 가 가 가
 가 가 가 가 가 가 가
 가 가 가 가 가 가 가 (PDA)

(57)

1.

- (a) ;
- (b) ;
- (c)

2.

- (a) ;
- (b) ;
- (c) (SVM) ;

3.

- 1 2 ,
- (b) , (a)
- (b1) ;
- (b2) ;
- (b3) (b1) ; (b2) ,
- (b4) (b3) (peak)

4.

1 2 ,

(b) , (a) ,

(b1') ;

(b2') ;

(b3') (b1) ; (b2)

(b4') (b3') 가 가 (R-peak) (Teager's energy operator, TEO) ;

(b5') ;

(b6') deling) (Burg algorithm) (autoregressive mo

5.

4 ,

(b)

6.

1 2 ,

(b) , (a) ,

(b1'') ;

(b2'') (b1) ;

(b3'') (b2) (smoothing) ; (Bartlett window) (convolution)

(b4'') (threshold) 가 2

7.

1 2 , (c) (a)

8.

7 ,

(b) , (a) (independent component analysis)
(blind source separation)

(autoregressive modeling) (Burg algorithm)
(time-varying spectrum)

(c) , (b)

(support vector machine)²

1 **9.** 2 , (c)
(a) ,

1 **10.** 2 , (c) (a)

1 **11.** 2 ,
(d) (c)

1 **12.** 2 ,
(e) (a) (c)
;

(f) 가

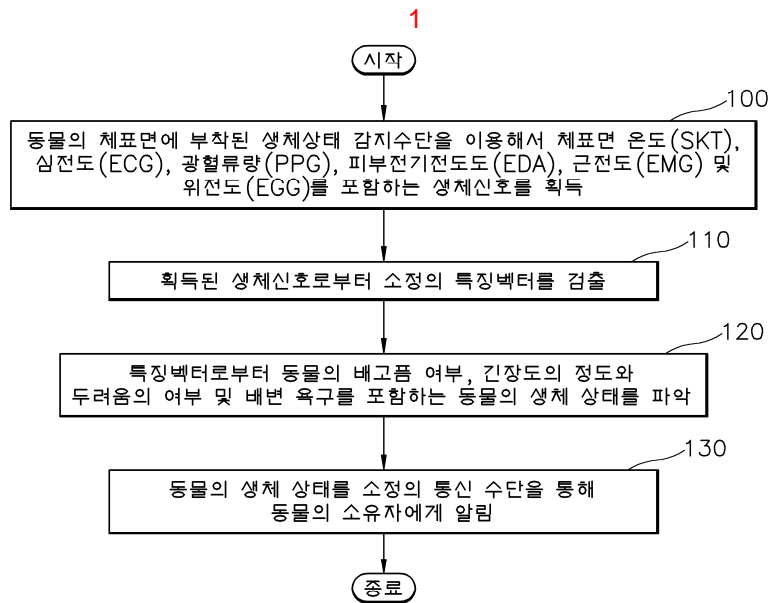
13.
;
;
;
;

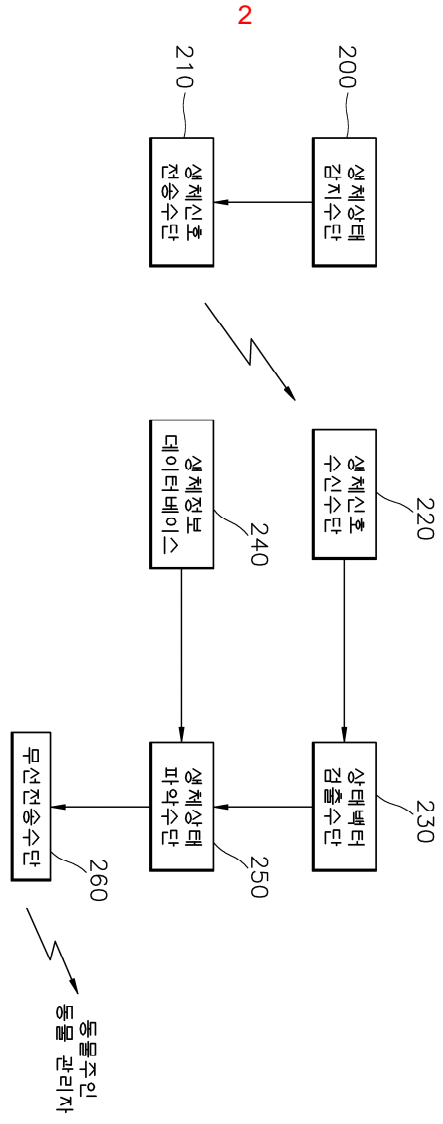
14.
;
;
;
;
;
;
;
;
;

13 15. 14

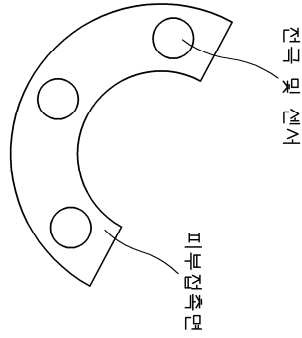
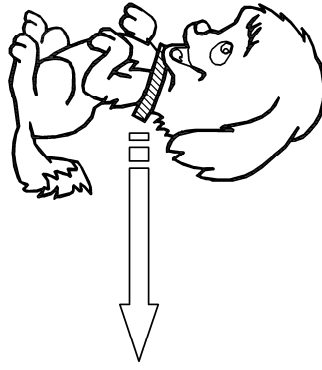
13 16. 14

가

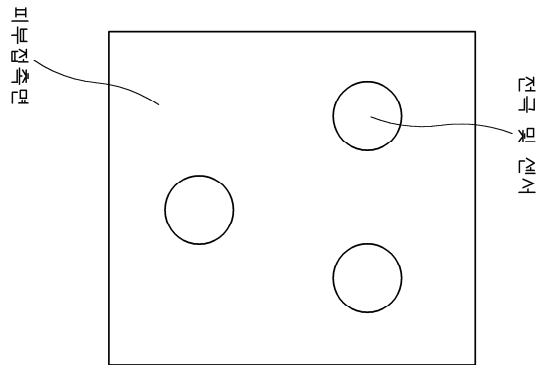
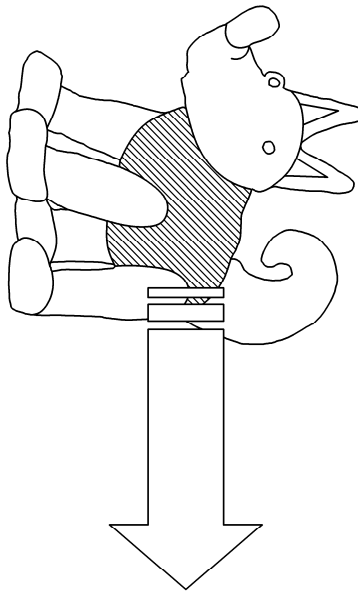


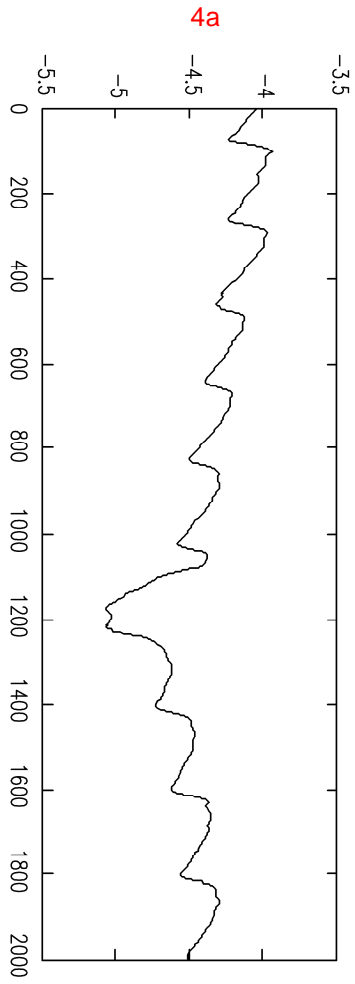


3a

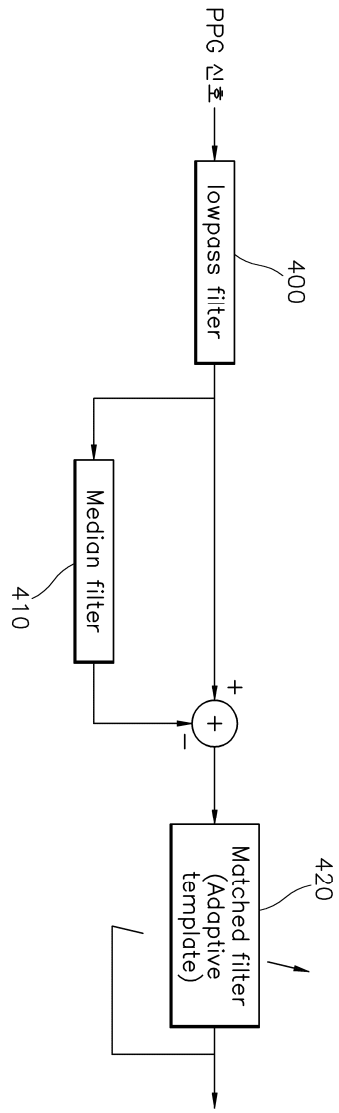


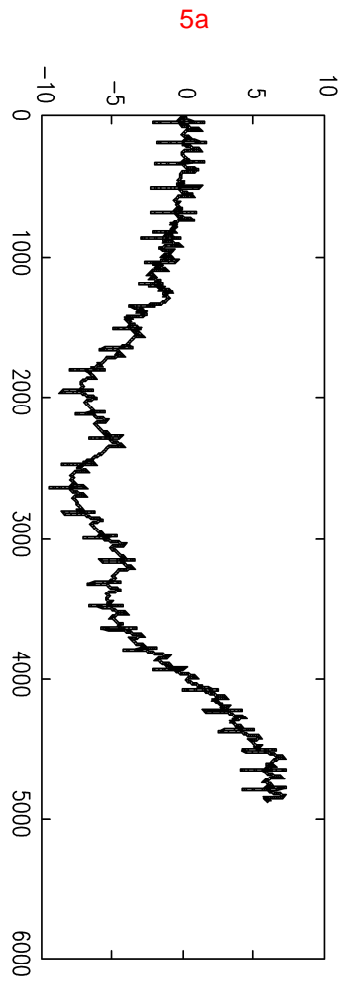
3b



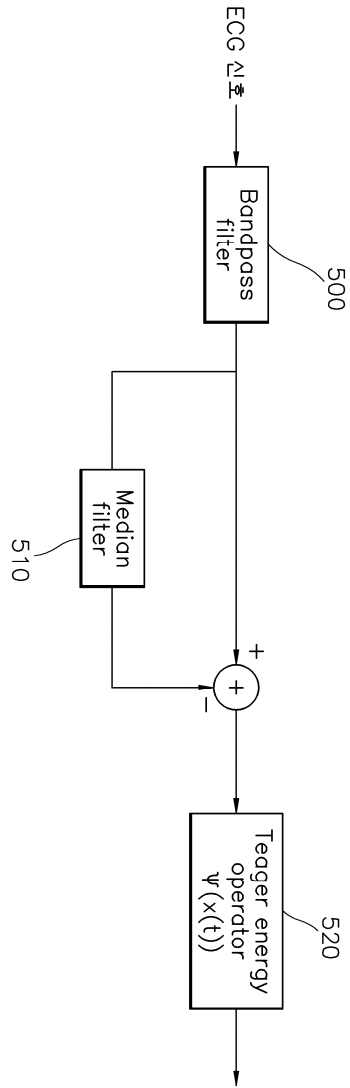


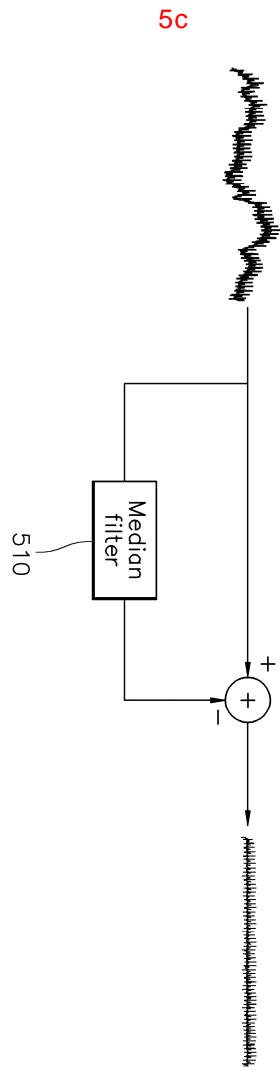
4b



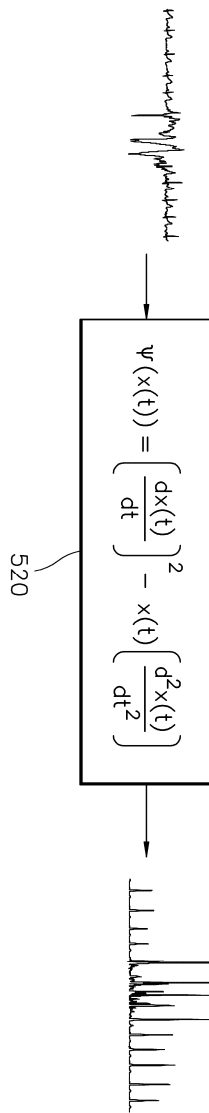


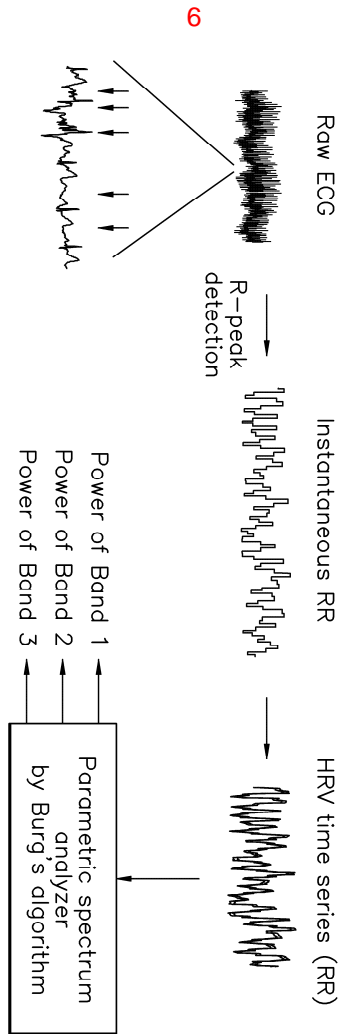
5b

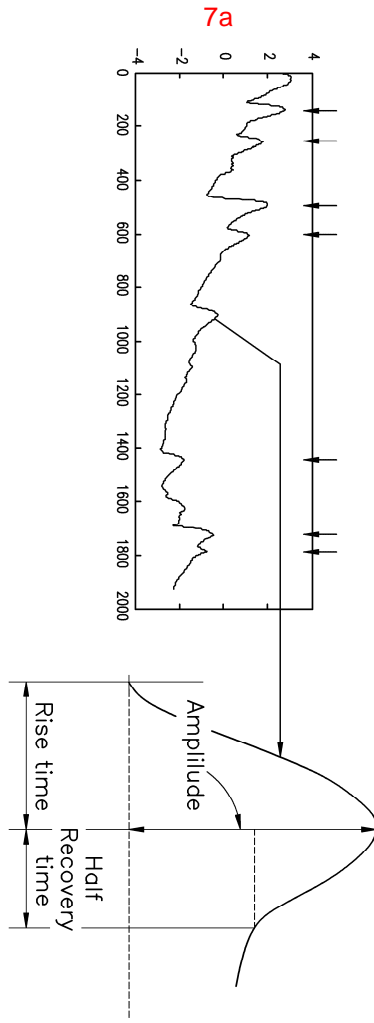


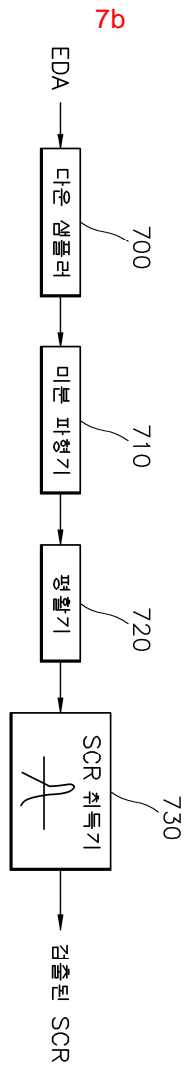


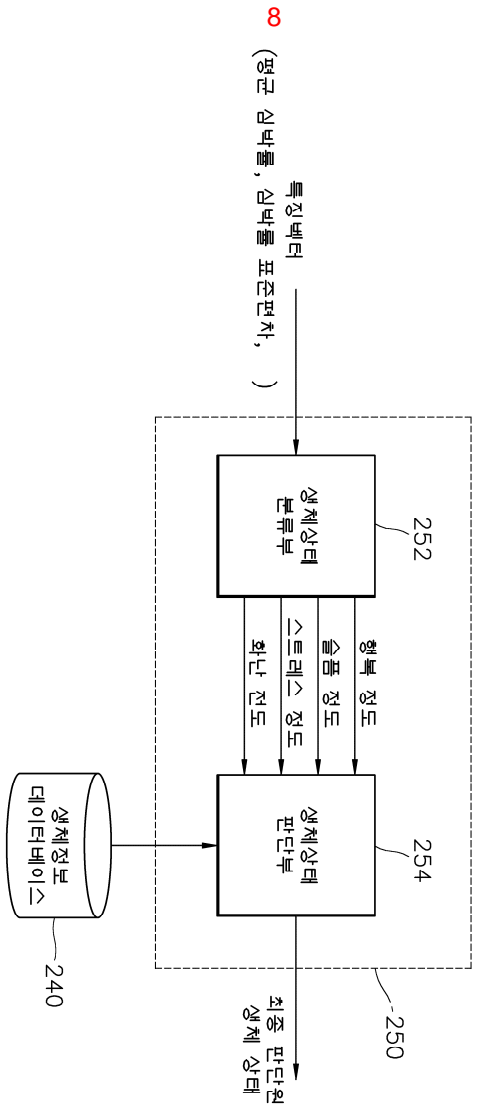
5d



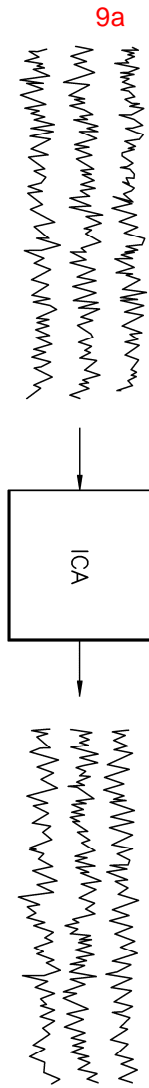


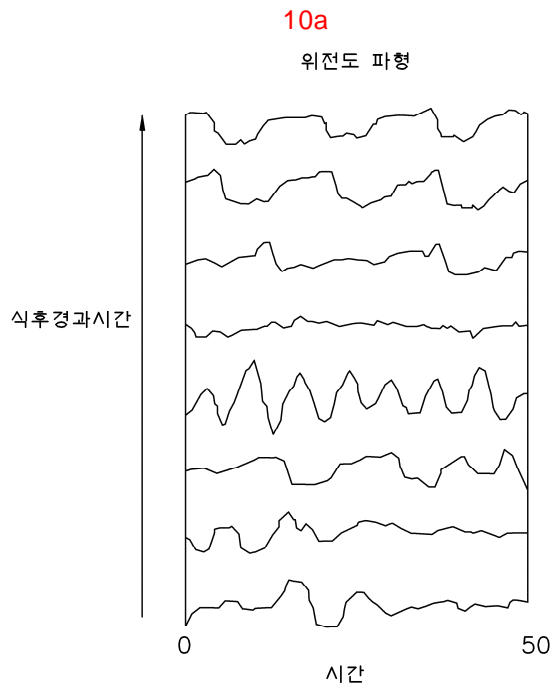
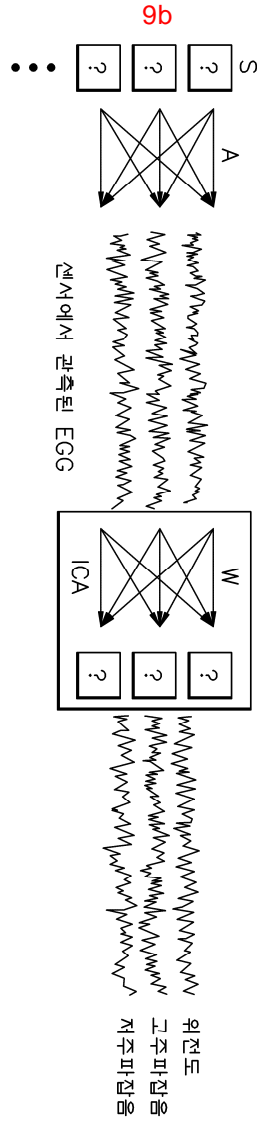






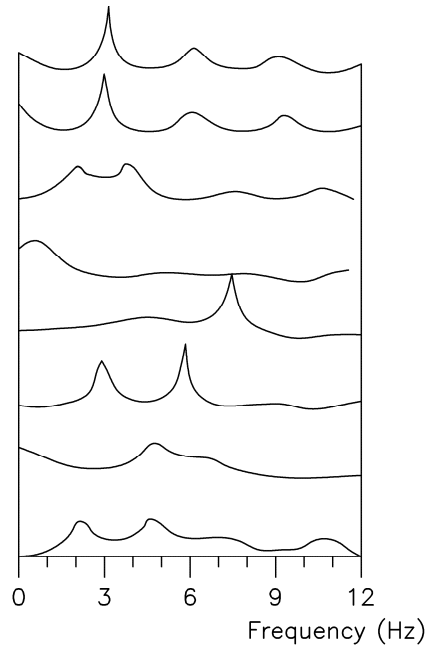
8 (평균 심박률, 심박률 표준편차,)





10b

스펙트럼



11

