



Electronic stethoscope assist iOS app **Bodyphone**

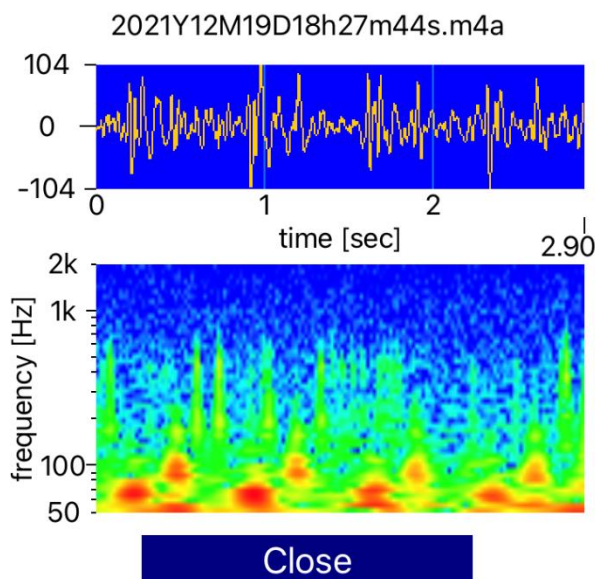
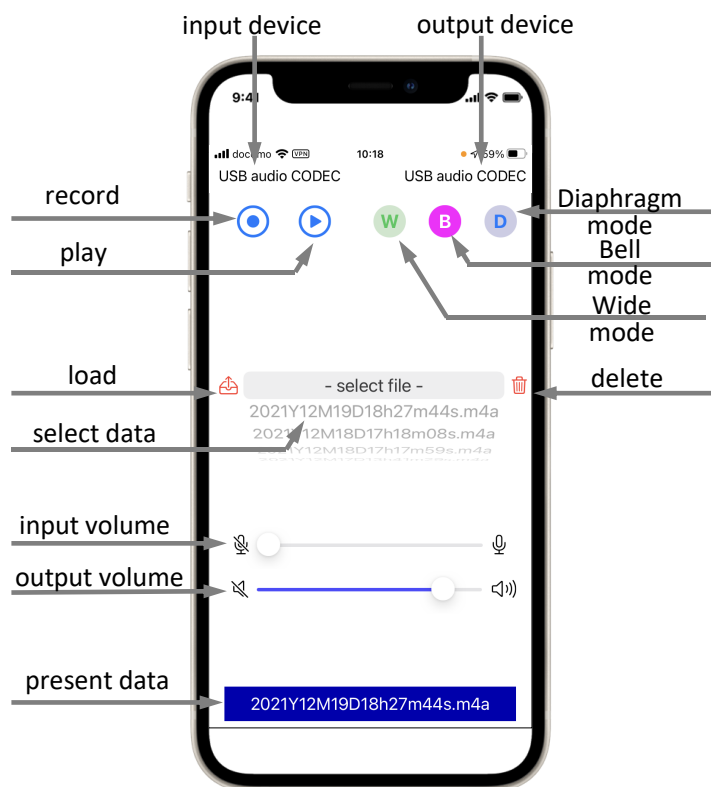
Bodyphone, available from App Store, assists electronic stethoscope.

Bodyphone has ability of recording, playing, filtering in 4 modes (wide, bell, diaphragm, and non-filter), and visualizing sound as a scalogram based on Gabor continuous wavelet transform.

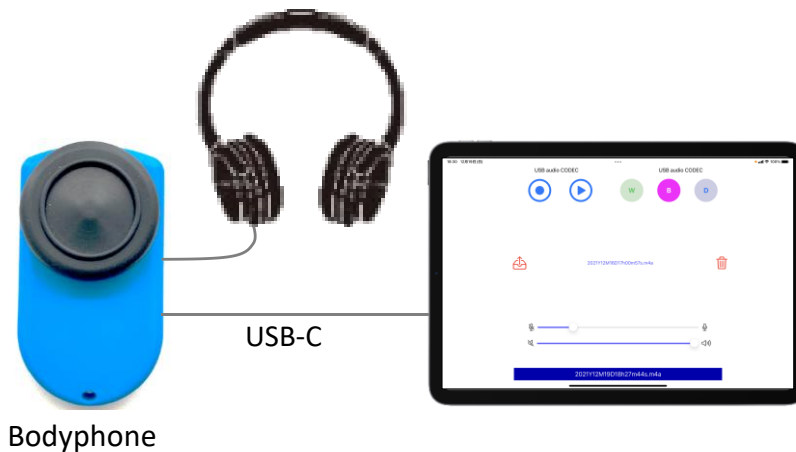
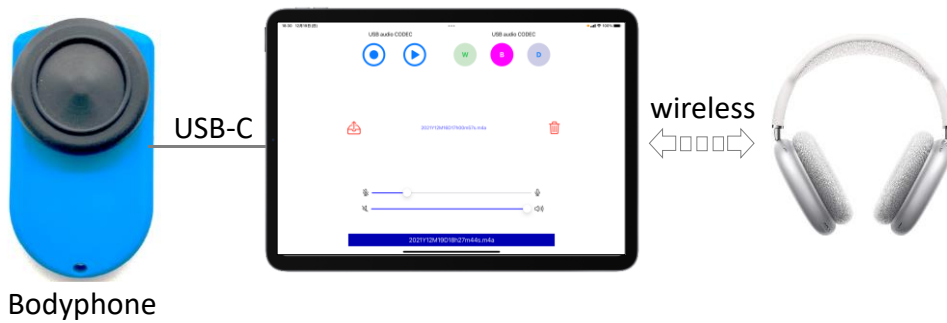
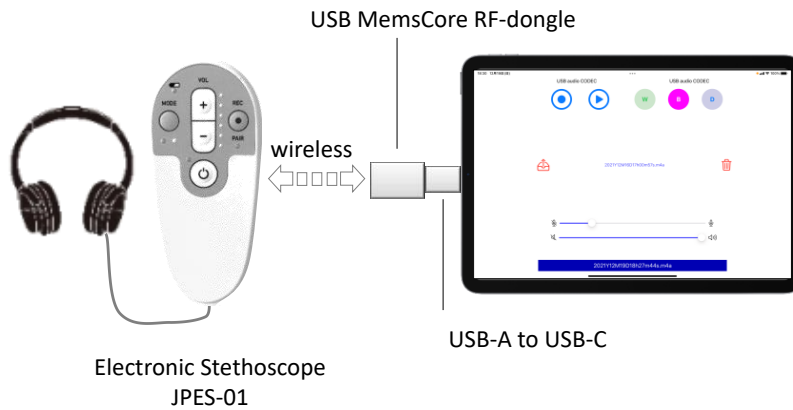
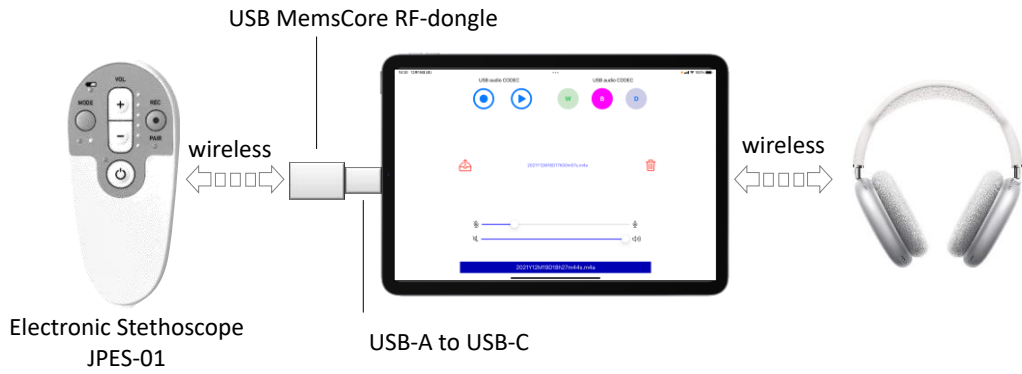
Output device can be switched, so stethoscope sound can be heard by wireless headphone.

Bodyphone runs under background, so stethoscope sound can be shared with other apps. It can be used in web meeting If iPad with USB-C is used.

Sound data and scalogram image can be accessed by File app, so they can be copied to USB memory, sent by email, and uploaded to cloud computing service.



Connection to electronic stethoscope



For iPhone, iPad, iPod touch with Lightning connector, use Lightning camera adapter.

Filter modes

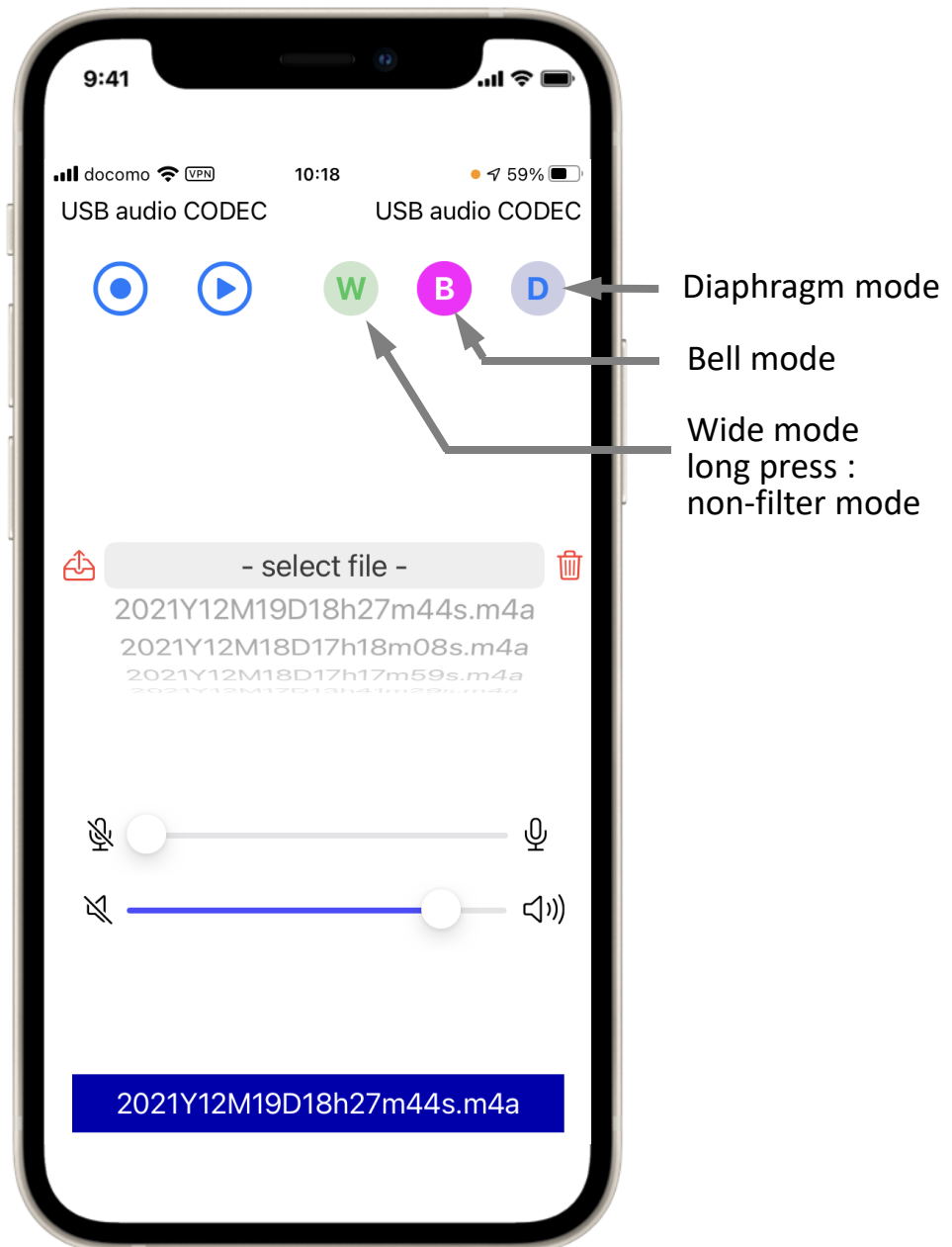
Wide mode (green button) : frequency range 20 ~ 2000Hz is enhanced

Bell mode (pink button) : frequency range 20 ~ 100Hz is enhanced

Diaphragm mode (blue button): frequency range 200 ~ 2000Hz is enhanced

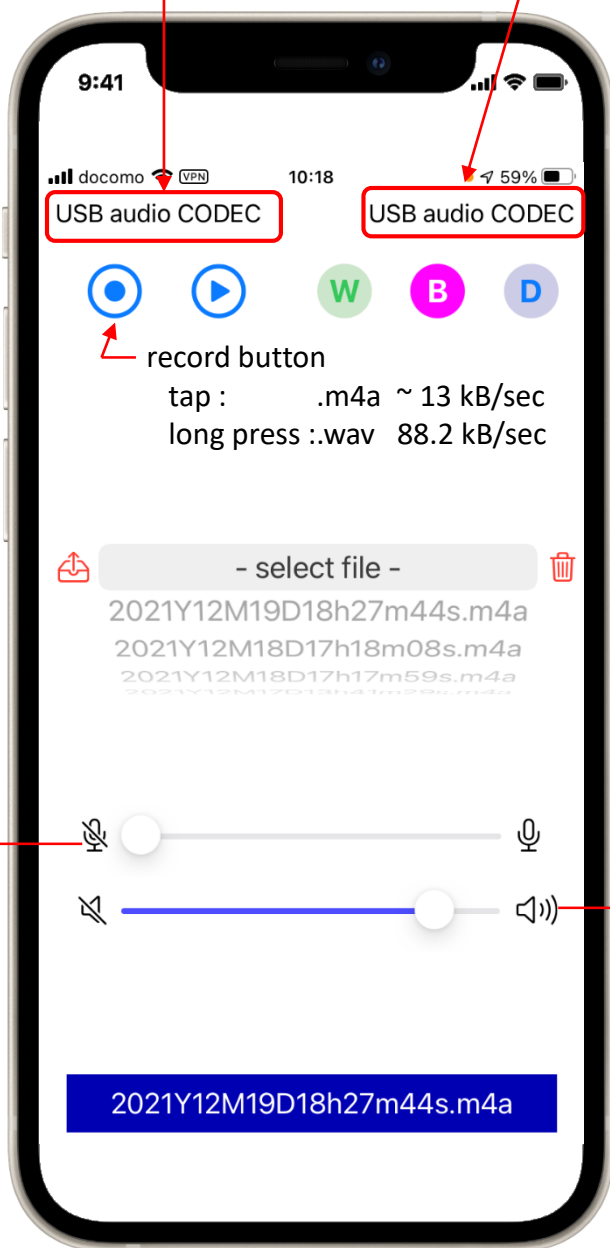
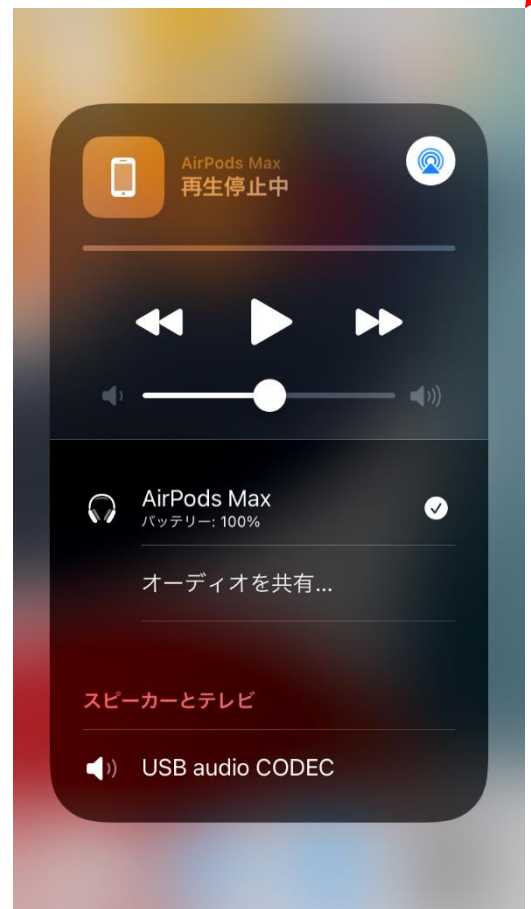
non-filter mode (green button long press) :

suitable for JPES-01 since above filter modes are implemented in circuit level



input device :
 Memscore RF dongle (JPES-01) or
 USB audio CODEC (Bodyphone)

output device:
 can be selected by
 Control Center

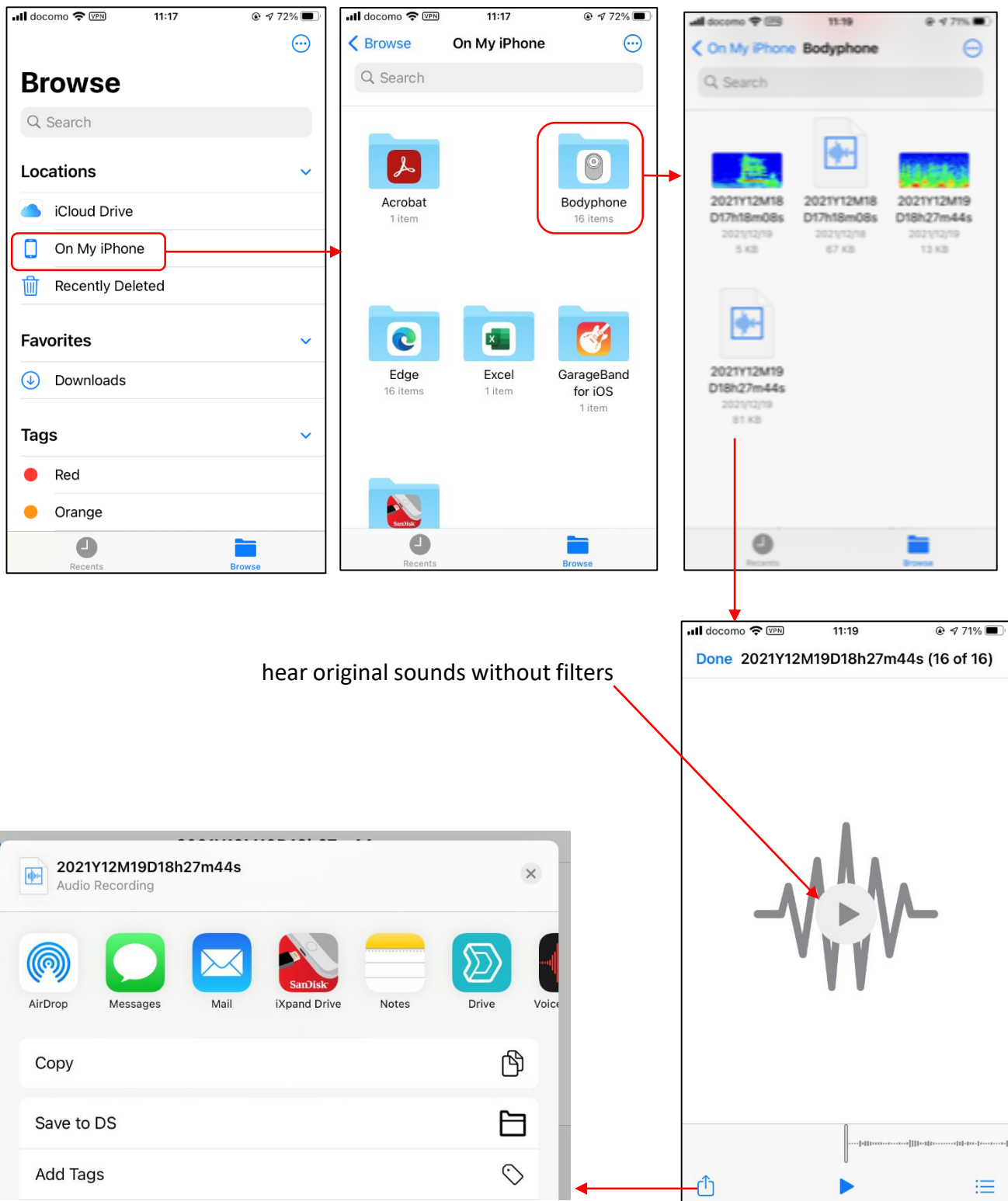
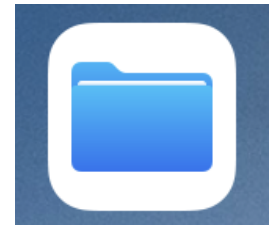


input volume : Be careful that sound is
 distorted when this volume is too high,.

output volume: maximum is iOS volume
 To increase sound volume, increase iOS volume.

File

Recorded sounds and scalogram images can be obtained by iOS standard app **File**.



hear original sounds without filters

Share with other apps

Closing Bodyphone, the following message appears on top, which means Bodyphone runs in underground mode.

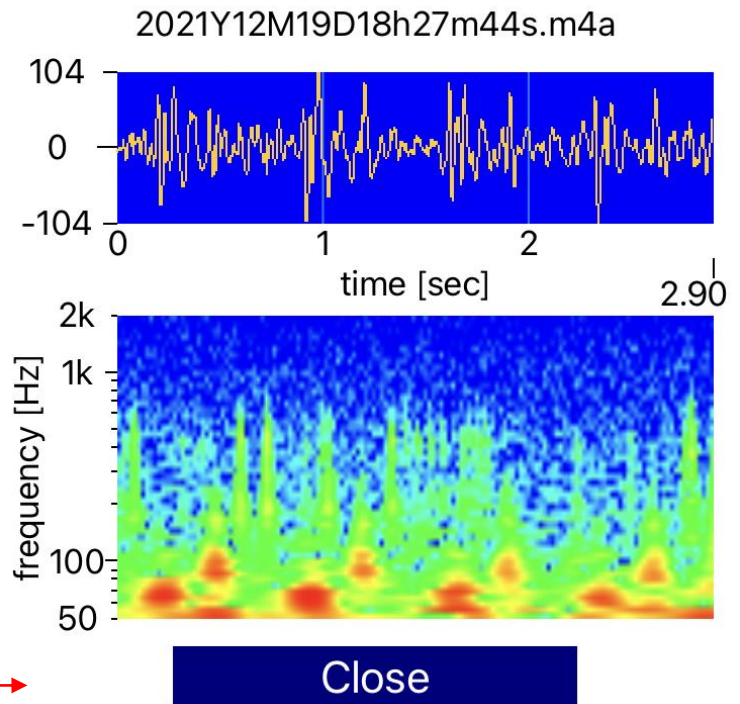
 Touch to return to Bodyphone

Electronic stethoscope sound can be shared with other apps.

Sharing Web meeting is possible if iPad with USB-C is used, but impossible if iPhone, iPad, or iPod touch with Lightning connector is used.

Sound visualization

Electronic stethoscope sound can be visualized by tapping bottom blue button.
For the first time, it takes long time to create image. The image is automatically stored.
Next time the stored image is used, so the graph appears in short time.

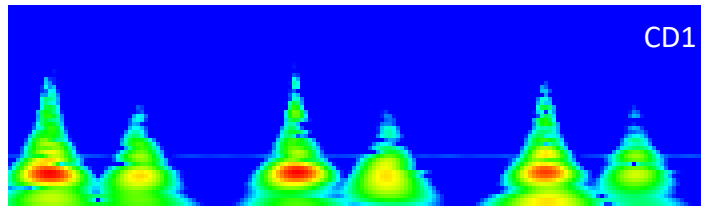


The above sound was obtained by Bodyphone from 69 years old man with high blood pressure. The next page reference is useful how to see the image. Be careful that environmental noise is usually added.

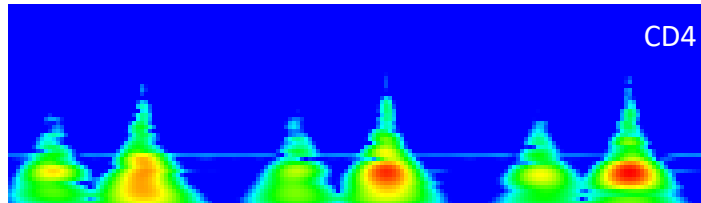
Reference of scalogram

Sound data (.wav) taken from book [1], not taken by electronic stethoscope.
Scalograms drawn by Bodyphone

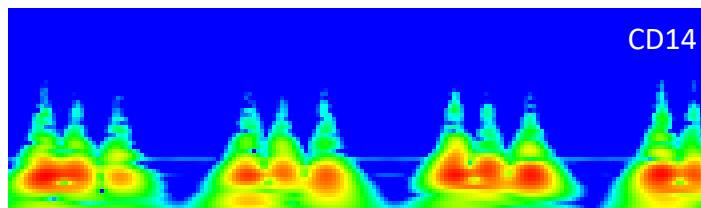
normal



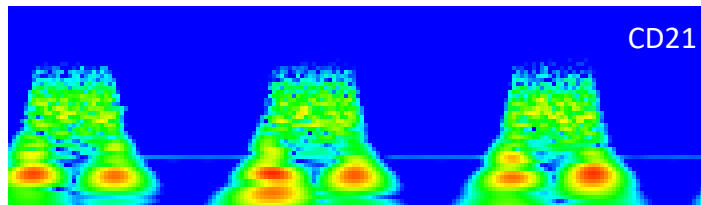
abnormal heart sounds



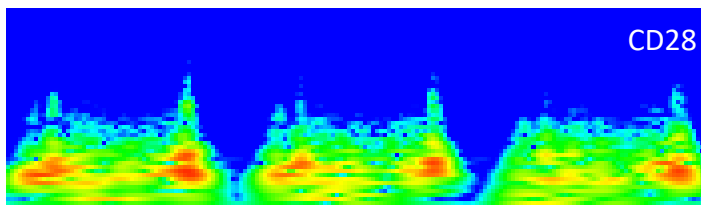
extra heart sounds



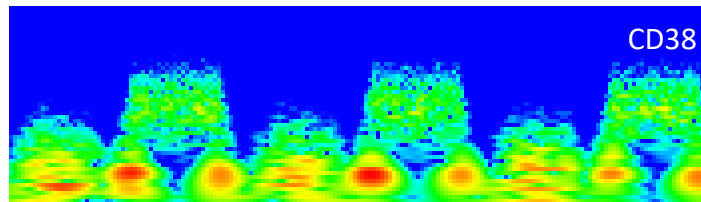
heart murmurs



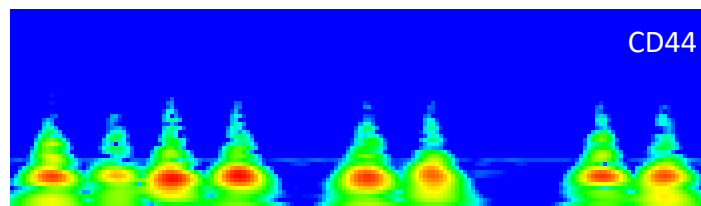
valvular disease



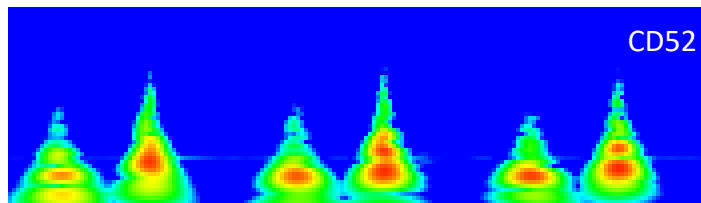
congenital heart disease



arrhythmias



high blood pressure

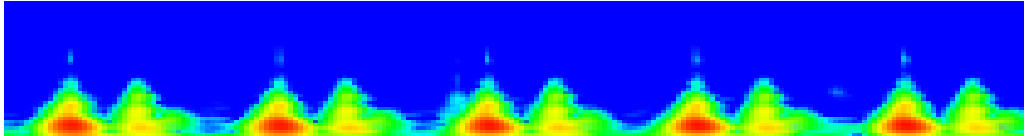


Example of sound scalogram taken by JPES-01

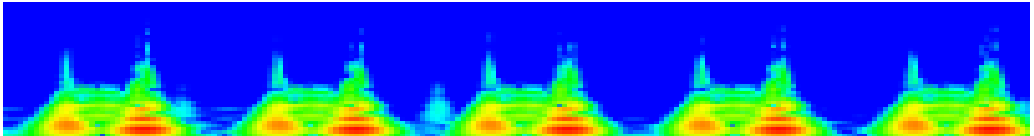
Sound data taken by electronic stethoscope JPES-01.
Scalograms drawn by Bodyphone

Heartbeat

normal

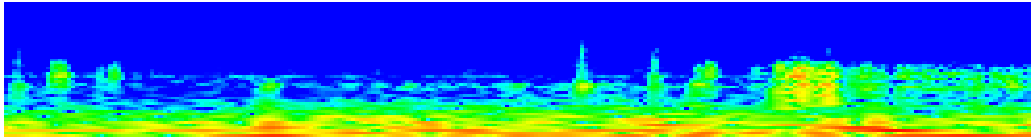


abnormal
(ASD-S2)

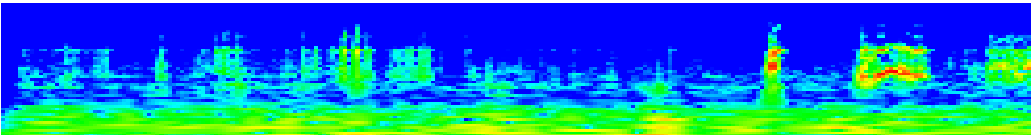


Intestinal sound

normal

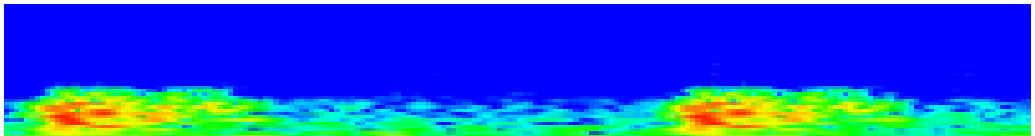


abnormal
(mechanical
intestinal
obstruction)



Lung sound

normal



abnormal
(Crepitus)

