Acoustic spectra for radio signal DAB and FM

Measurement of Spectra a signal using a Fast Fourier Transform FFT in the domain of time are performed in a finite time. In other words, the measured are portions of a waveform of the signal of the specified length. Fragments extracted cyclically subjected are to the FFT. Fragments the waveform on shores contains discontinuities because are collected at intervals. Discontinuities cause blurring to spectra. The spectra of the downloaded portions of the waveform are different from the spectra of the whole continuous the signal subjected to measurement. To reduce blur spectra signal is passed the signal through a time window. The Time window reduced spillage of energy in the domain of frequency. Measurements were made for spectra of acoustic signals DAB and FM. The signal was passed through a time window. Used were of the time window: Rectangular, Bartlett, Hanning, Hamming, Blackman, Blackman-Harris, Flat-Top. The time window it is function shaping the signal measured undergone FFT. In the domain of time, signal is the function of time and was multiplying with the function describing by the time window. In the domain of frequency occurs weave these functions. The result of the signal is subjected to FFT.

Measurement 1. Broadcast DAB

Following are the results of the measurements of the spectra acoustic signal DAB radio with using different of time windows. Selected is the cut-off point which is a point in which the low-pass filter cut off higher frequencies of the transmitted signal from the Studio. This point determines the bandwidth sound. In this case, there has been a cut of around 15 kHz. Radio band acoustic signal MPX is 15 kHz. You can see that the sender does not prepare a dedicated DAB signal, which allows you to upload a better quality acoustic signals a broader band only broadcast signal for FM broadcast.

The charts are done in linear scale in the frequency domain.

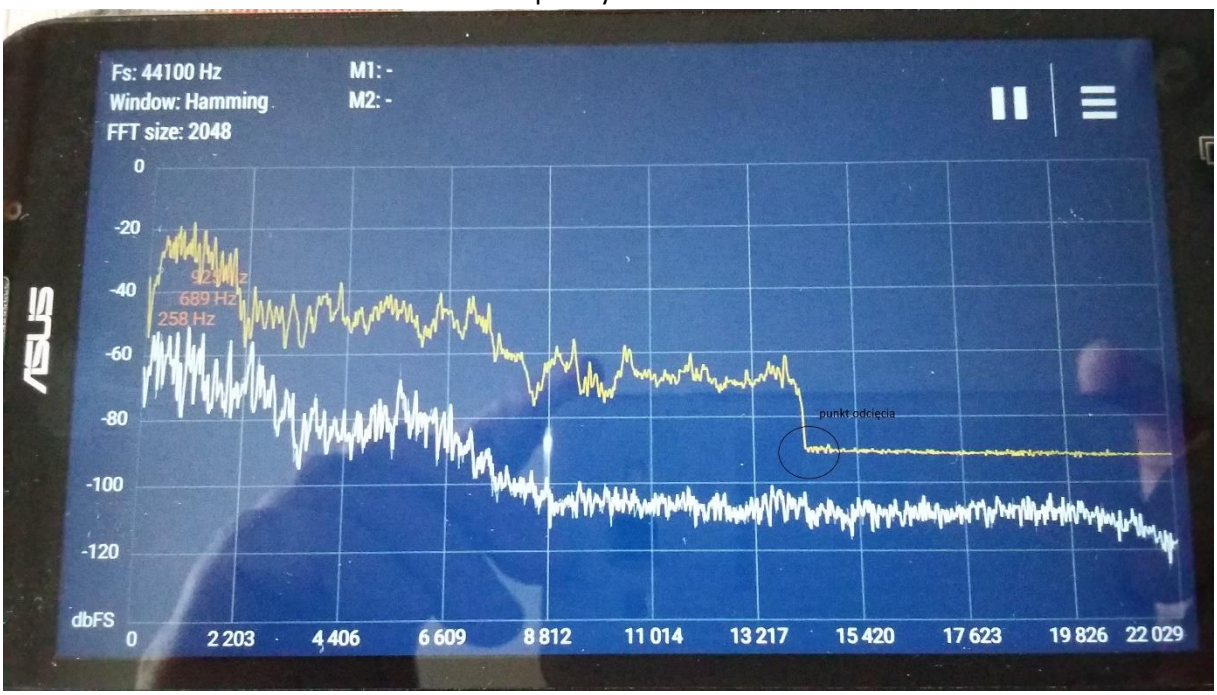

Figure 1. The time window: Hamming Window

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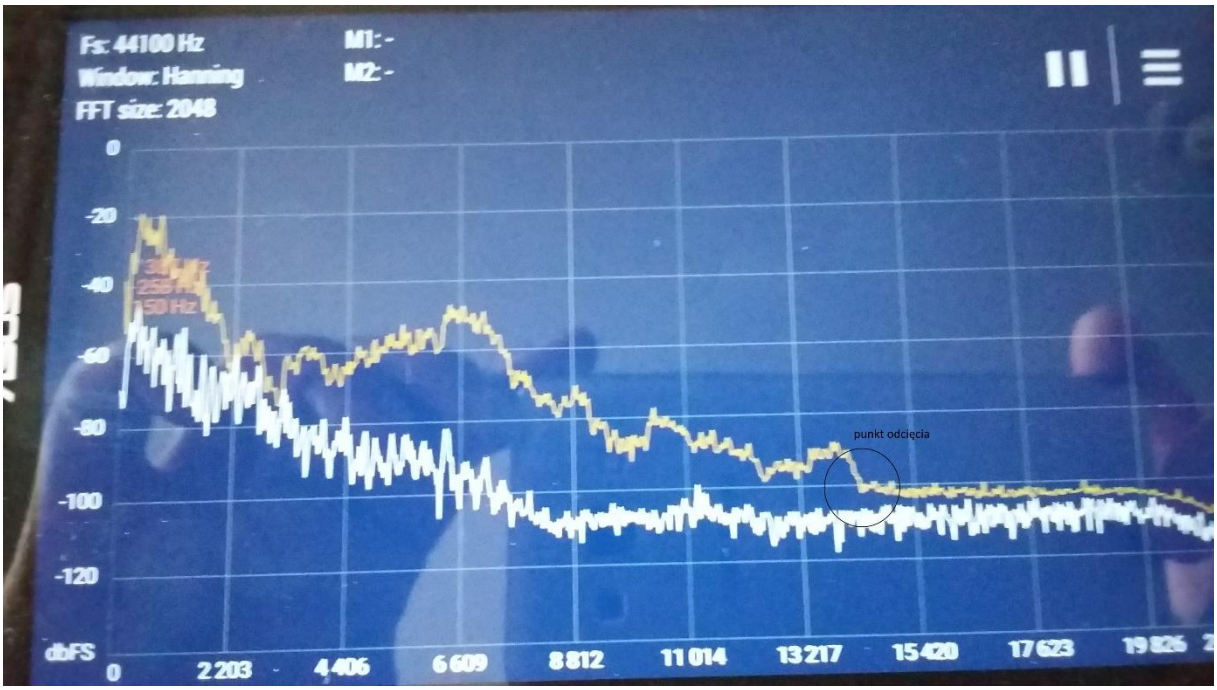

Figure 2. The time window: Hanning Window

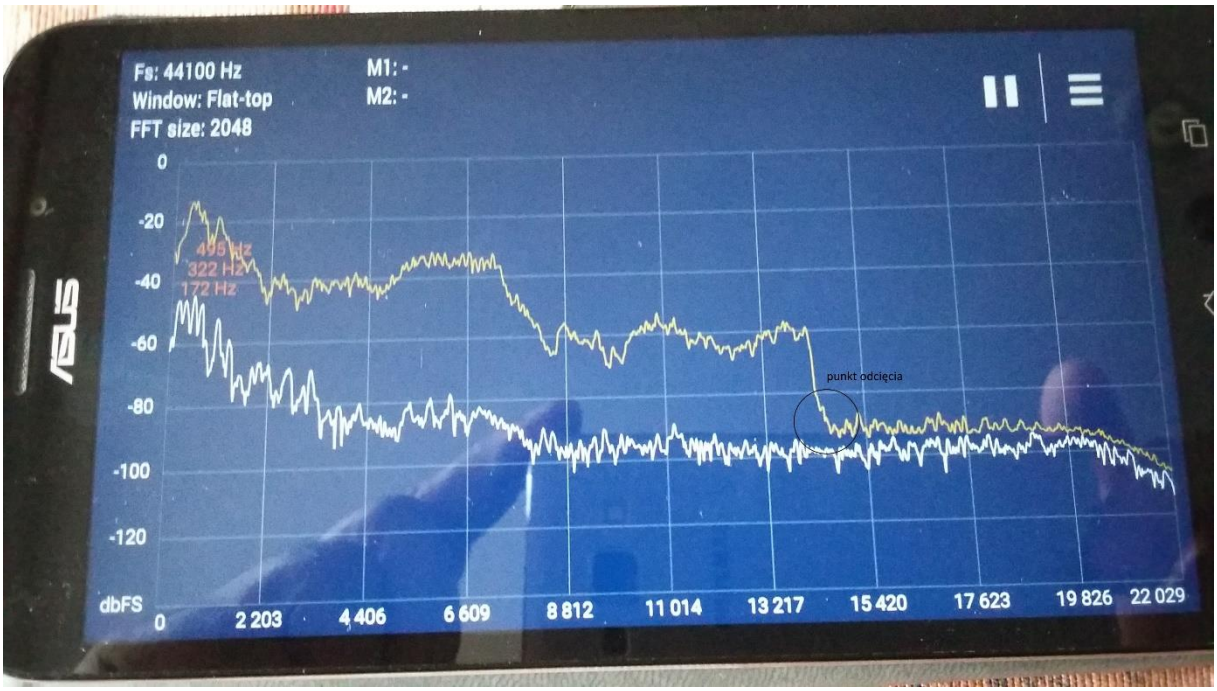

Figure 3. The time window: Flat-Top Window

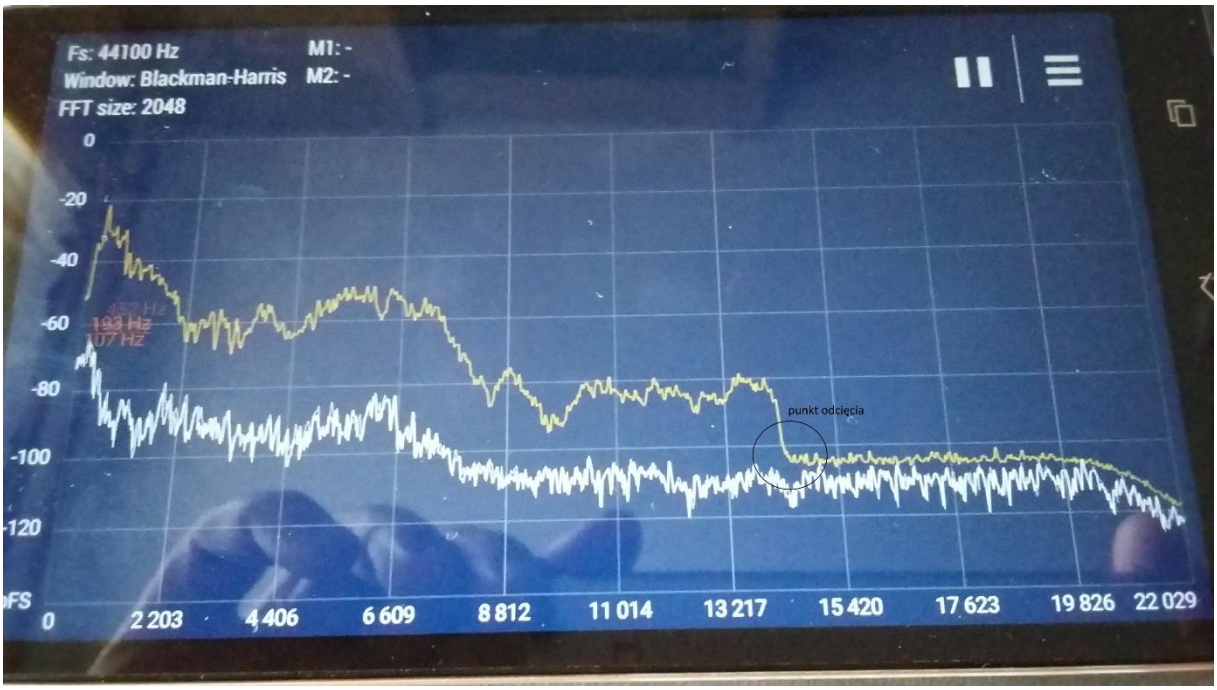

Figure 4. The time window: Blackman-Harris Window

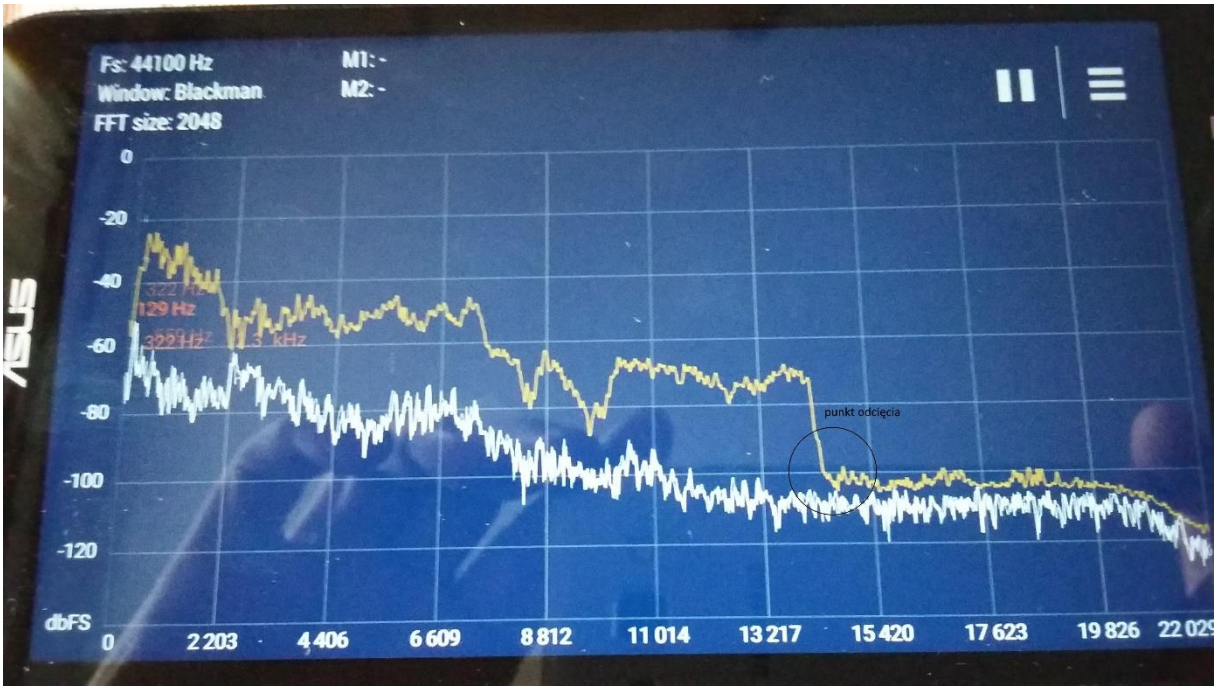

Figure 5. The time window: Blackman Window

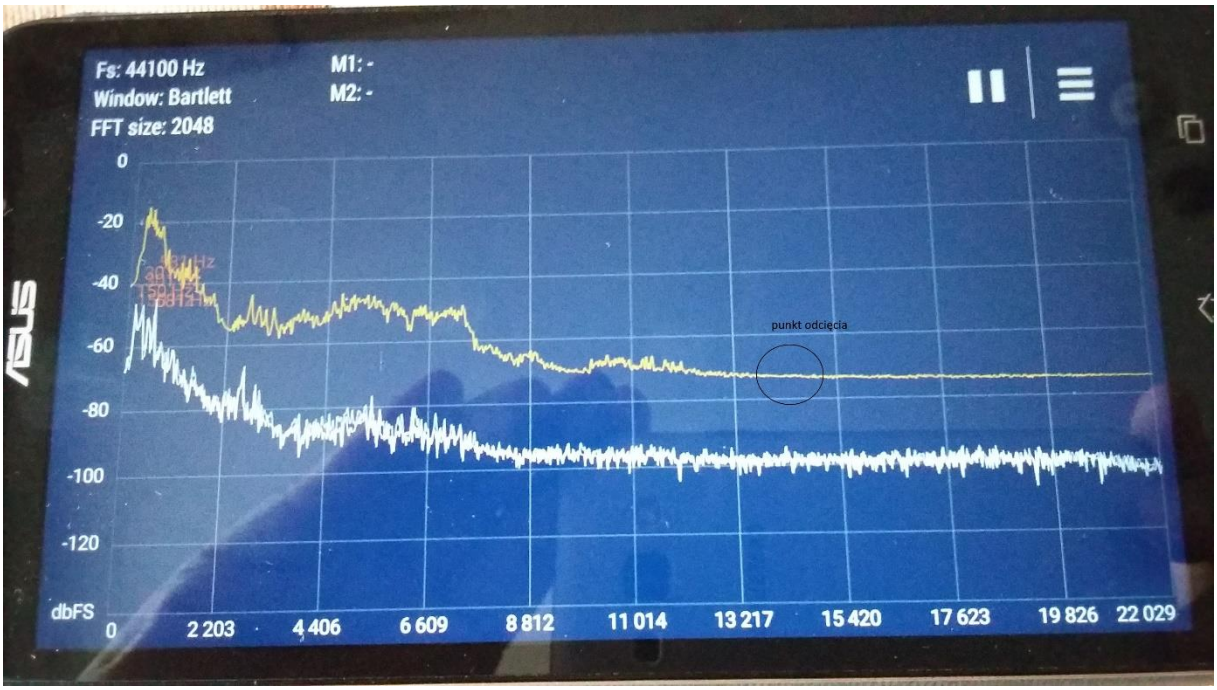

Figure 6. The time window: Bartlett Window

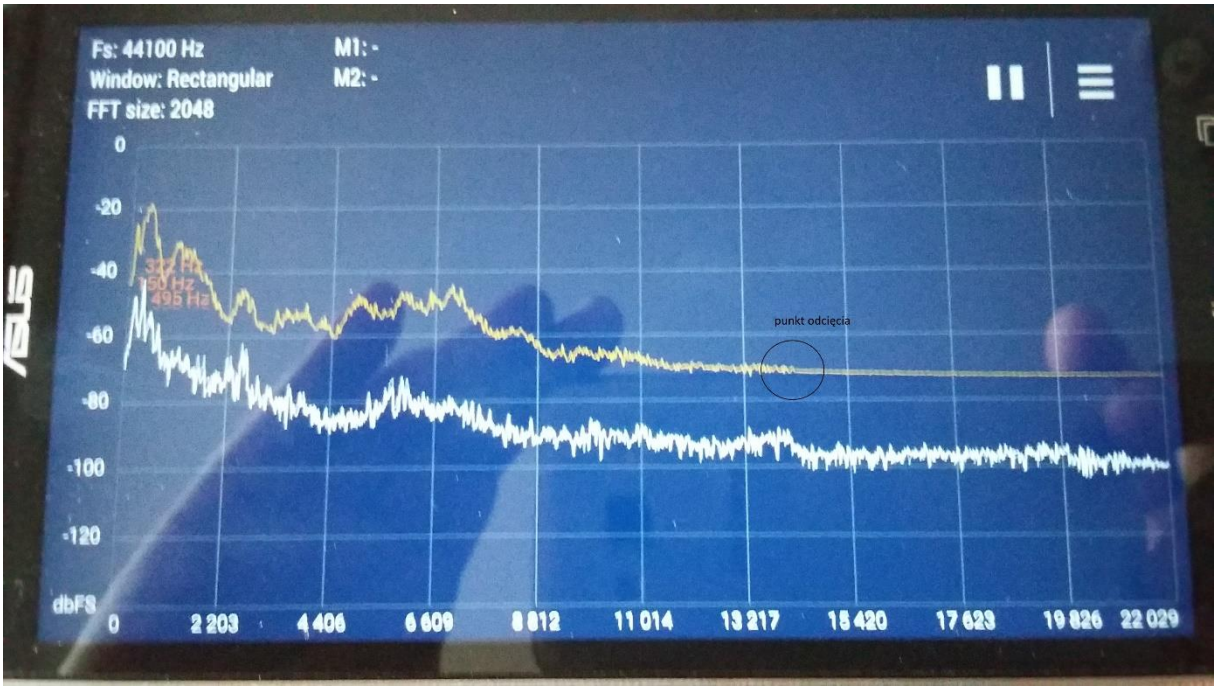

Figure 7. The time window: Rectangual Window

Measurement 2. Broadcast DAB

The following drawings show the results of the measurements of the spectra acoustic signal DAB radio emitted by another radio station. The sender, in this case, did not limit bandwidth sound. It was of high quality. Measurements were taken also for different of time windows. Selected is the cut-off point which is a point in which the acoustic track cut off higher frequency of the transmitted signal from the Studio. This point determines the bandwidth sound. In this case, there has been a cut of around 20 kHz.

The charts are done in linear scale in the frequency domain.

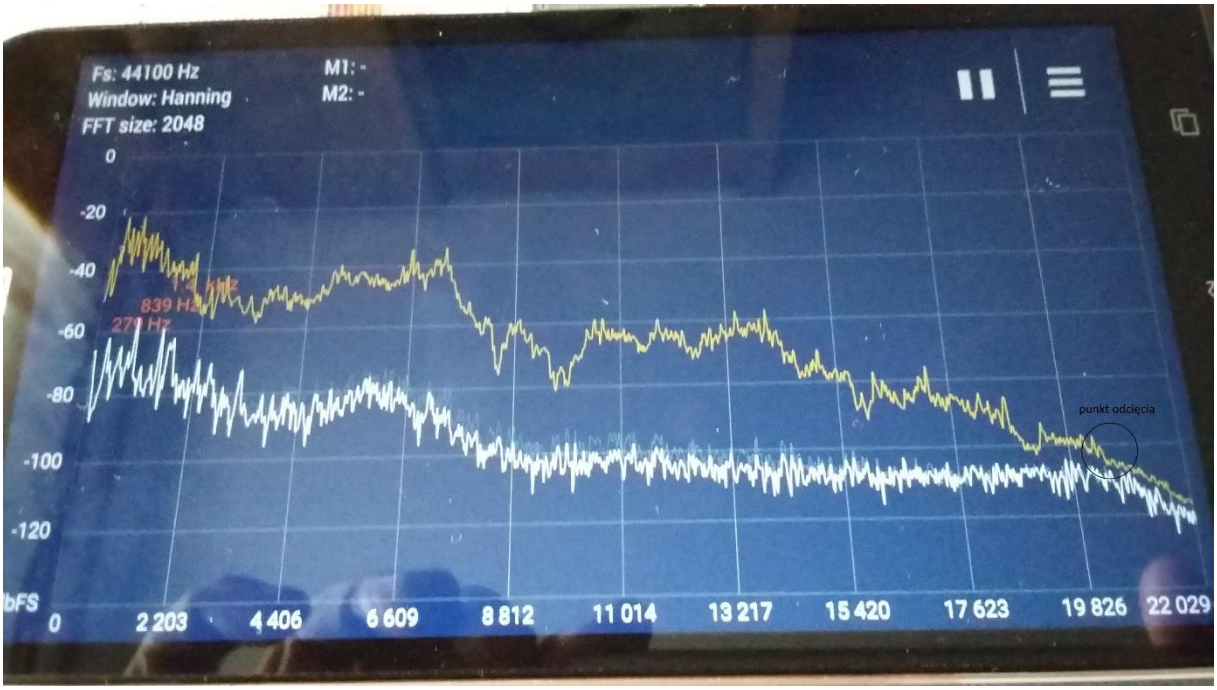

Figure 8. The time window Hanning Window

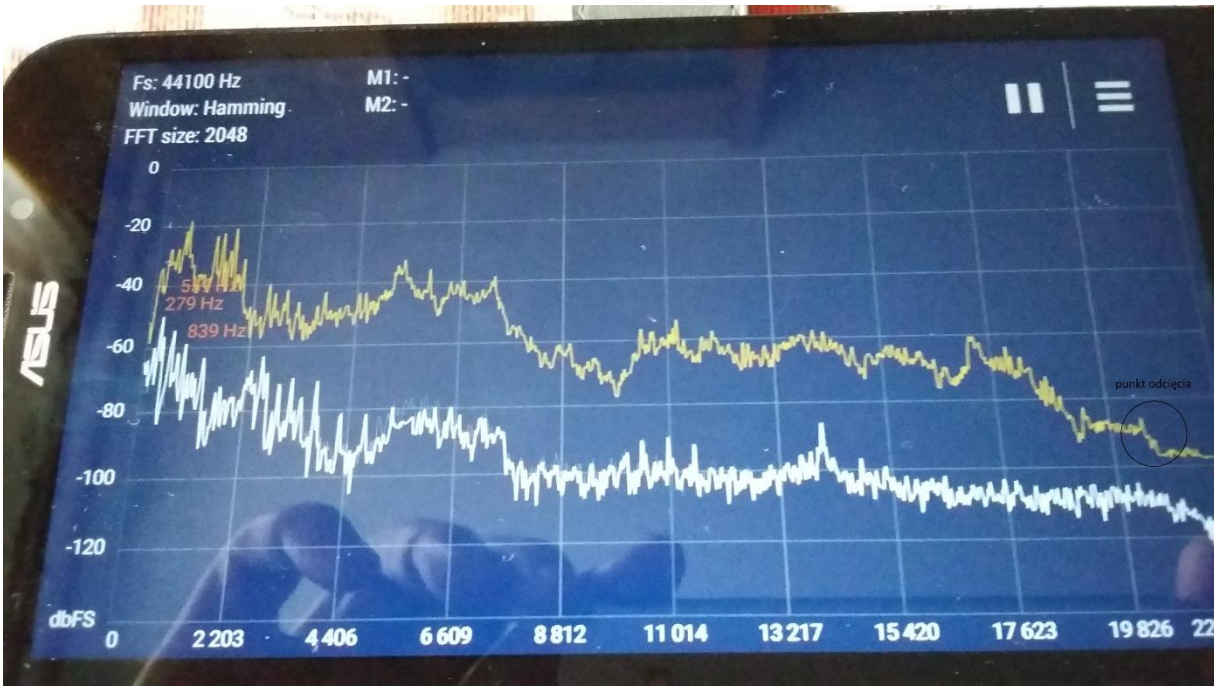

Figure 9. The time window Hamming Window

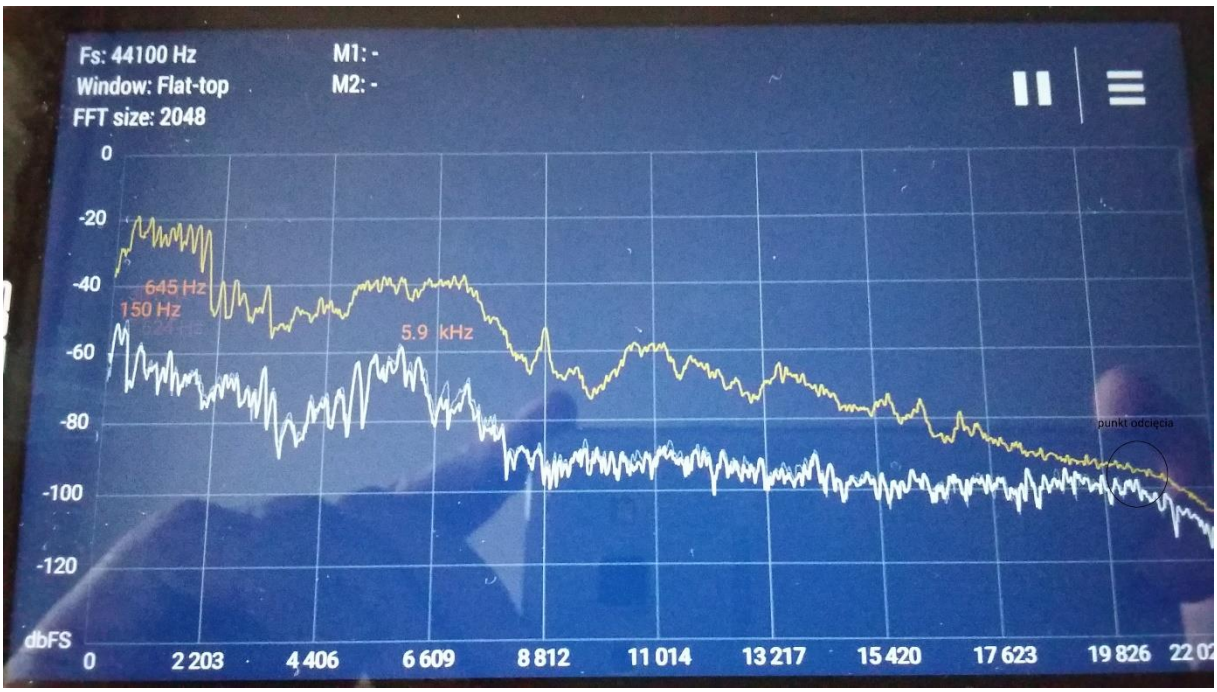

Figure 10. The time window Flat-Top Window

Figure 11. The time window Blackman-Harris

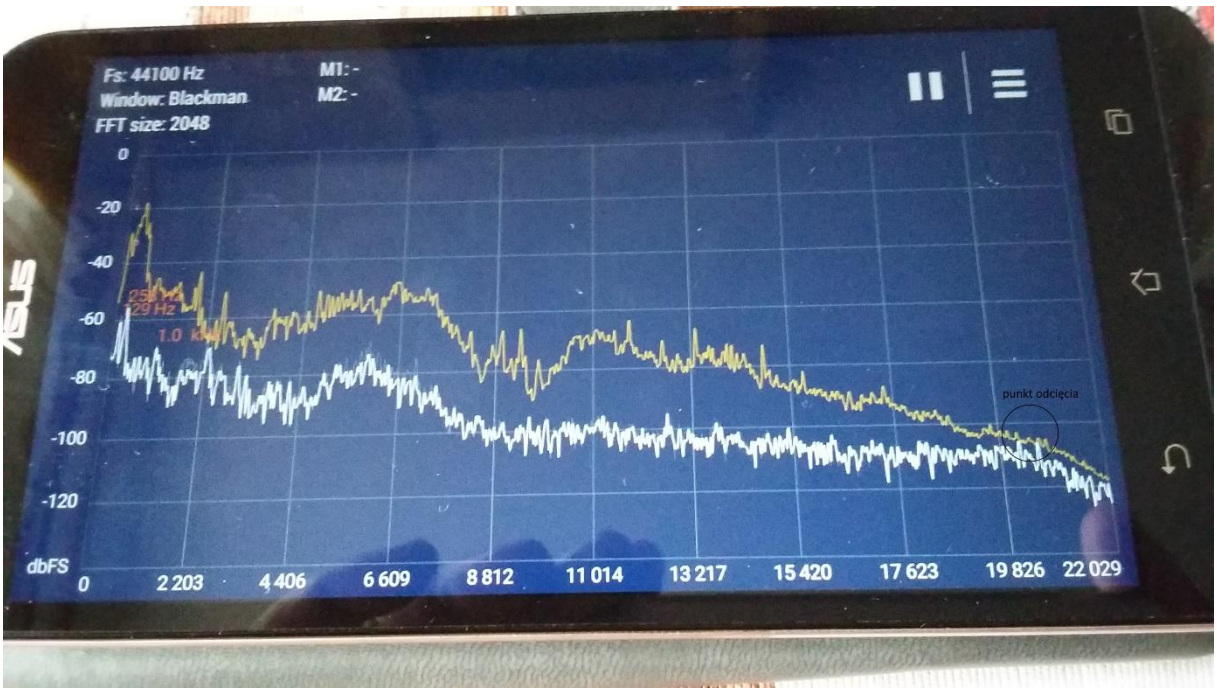

Figure 12. The time window Blackman Window

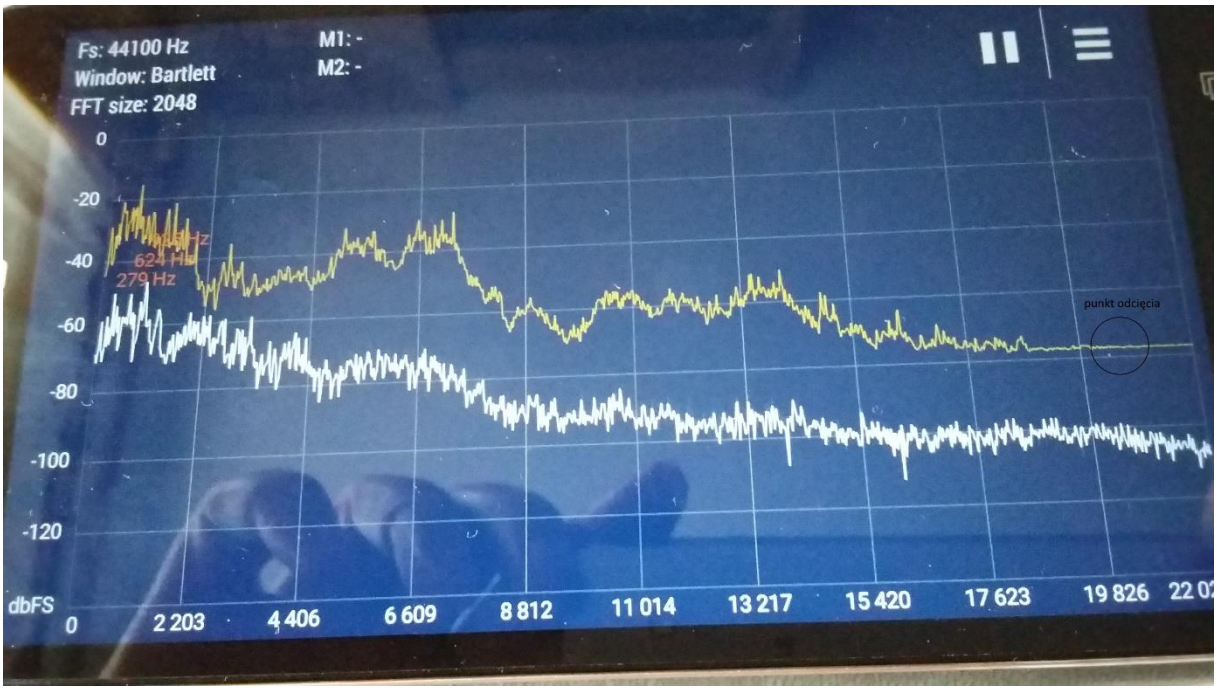

Figure 13. The time window Bartlett Window

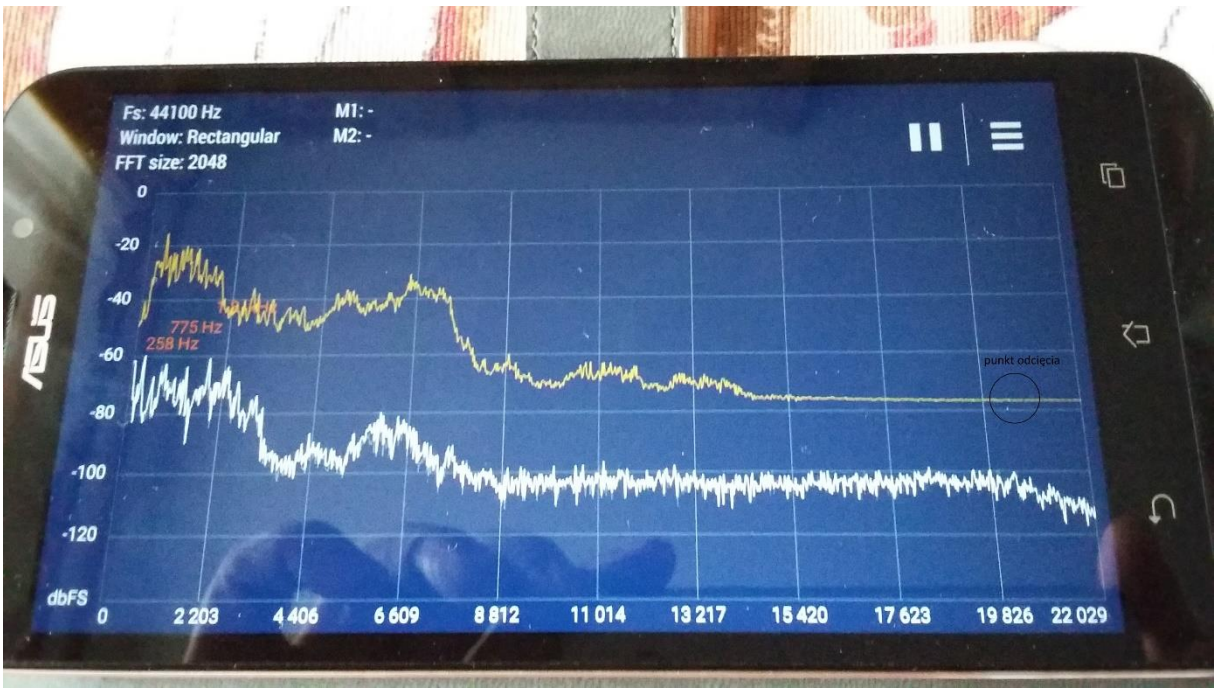

Figure 14. The time window Rectangual Window

Measurement 3. Broadcast FM

Next are the results of the measurements of the spectra acoustic signal FM radio with using different of time windows. Selected is the cut-off point which is a point in which the low-pass filter cut off higher frequencies of the transmitted signal from the Studio. This point determines the bandwidth sound. In this case, there has been a cut of around 15 kHz. Bandwidth acoustic signal MPX is 15 kHz.

The charts are done in logarithmic scale in the frequency domain.

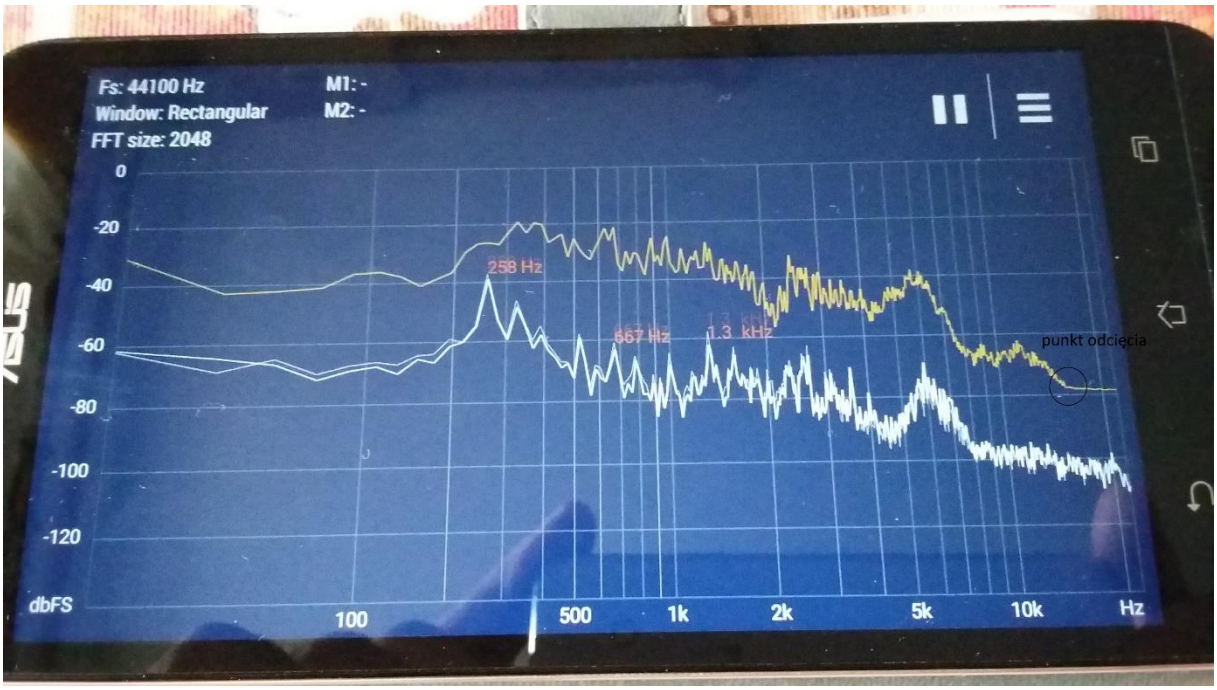

Figure 15. The time window Rectangual Window

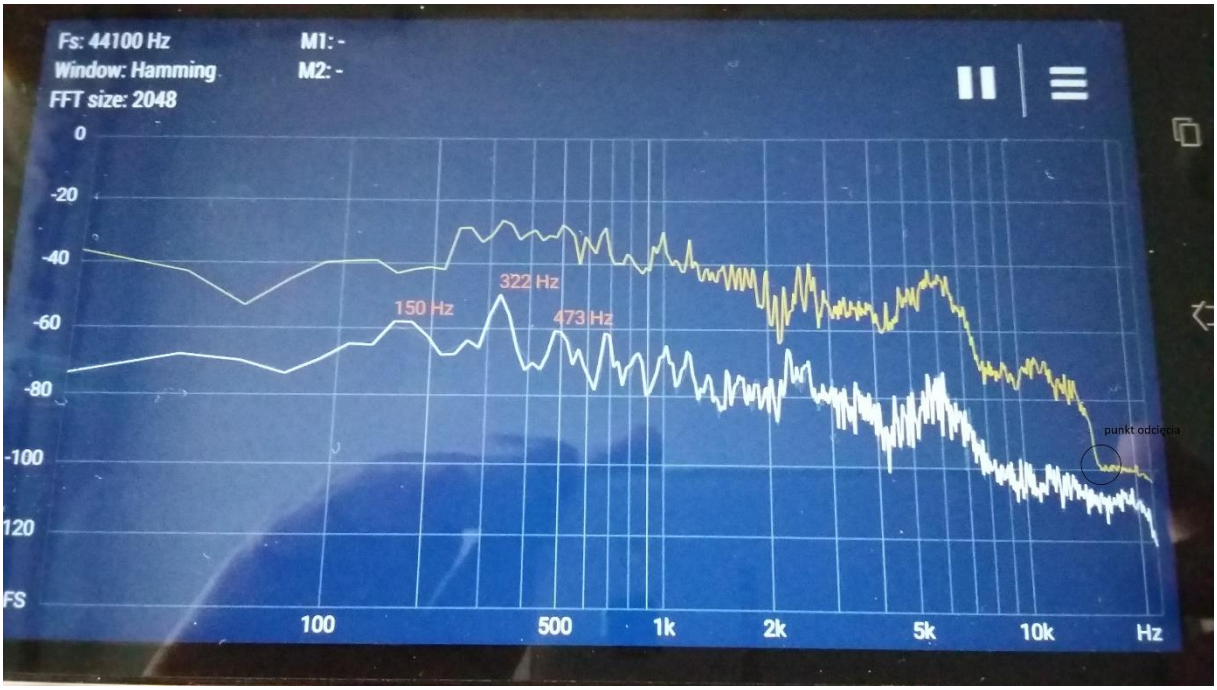

Figure 16. The time window Hamming Window

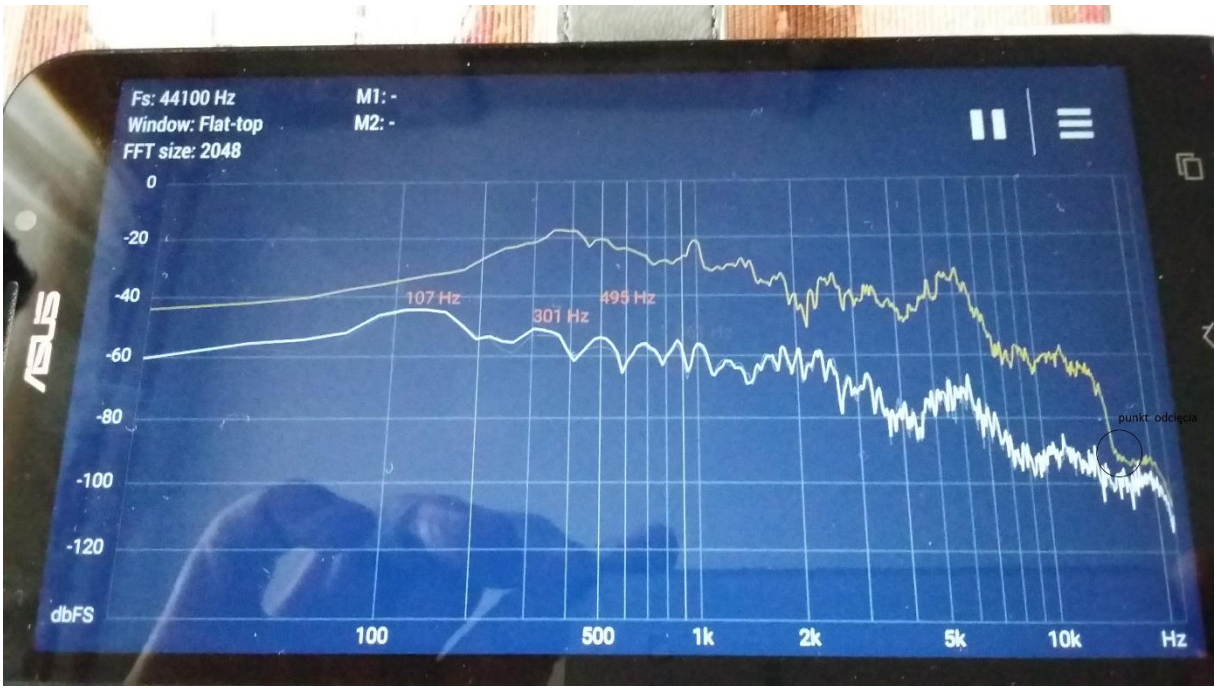

Figure 17. The time window Flat-Top Window

The use of a logarithmic scale makes it easier to find the cutoff point. This point is more clearly visible.

The following charts are done in linear scale in the frequency domain.

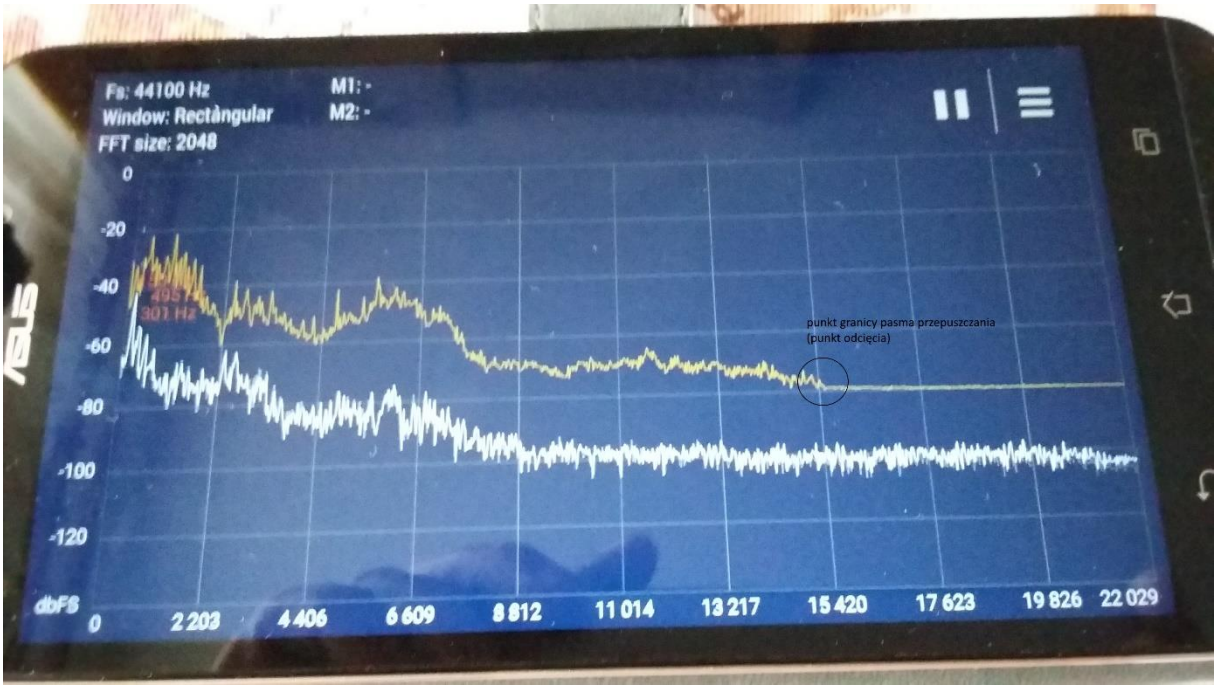

Figure 18. The time window Rectangual Window

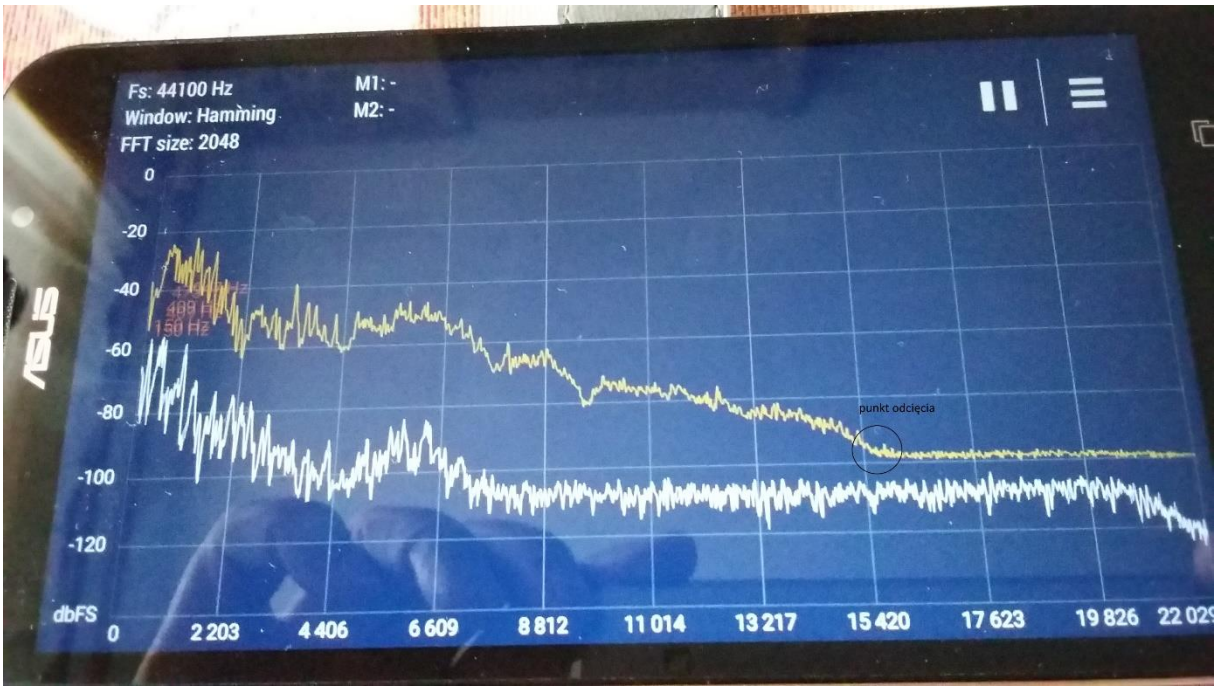

Figure 19. The time window Hamming Window

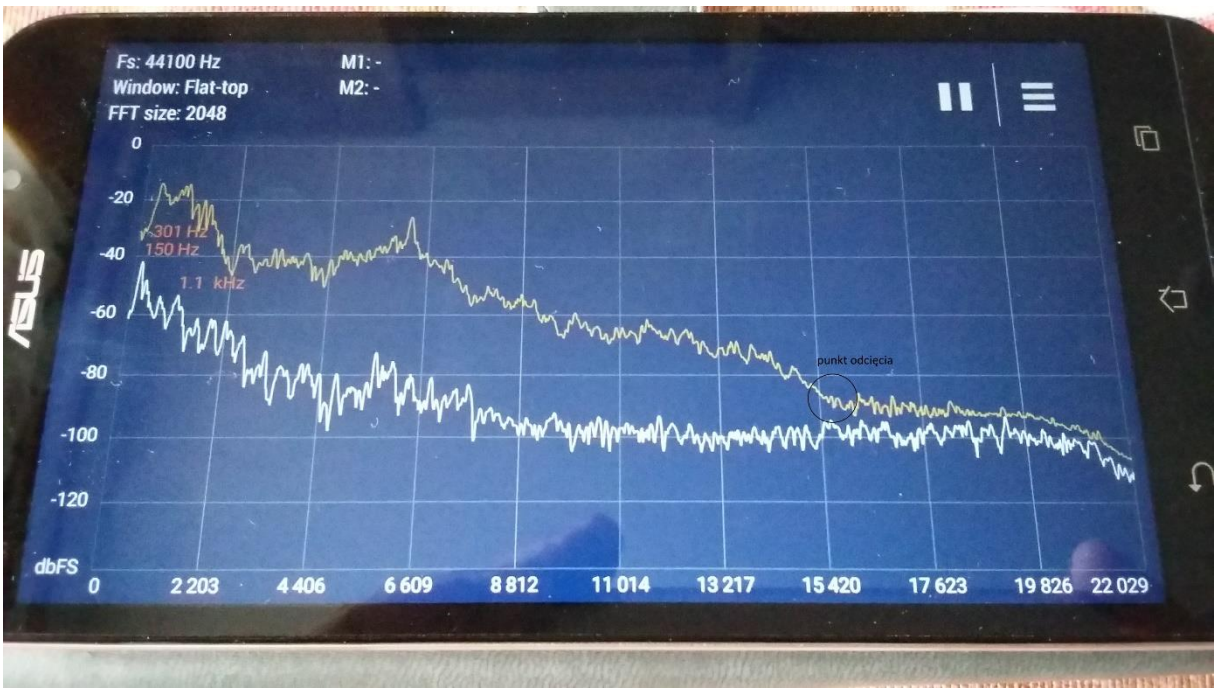

Figure 20. The time window Flat-Top Window

Measurement 4. Broadcast FM

The following are the results of the measurements of the spectra acoustic signal FM radio with using different of time windows. Selected is the cutoff point which is a point in which the low-pass filter cut off higher frequencies of the transmitted signal from the Studio. This point determines the

bandwidth sound. In this case, there has been a cut of around 15 kHz. Bandwidth acoustic signal MPX is 15 kHz. Also visible is signal pilot 19 kHz stereo.

The charts are done in logarithmic scale in the frequency domain.

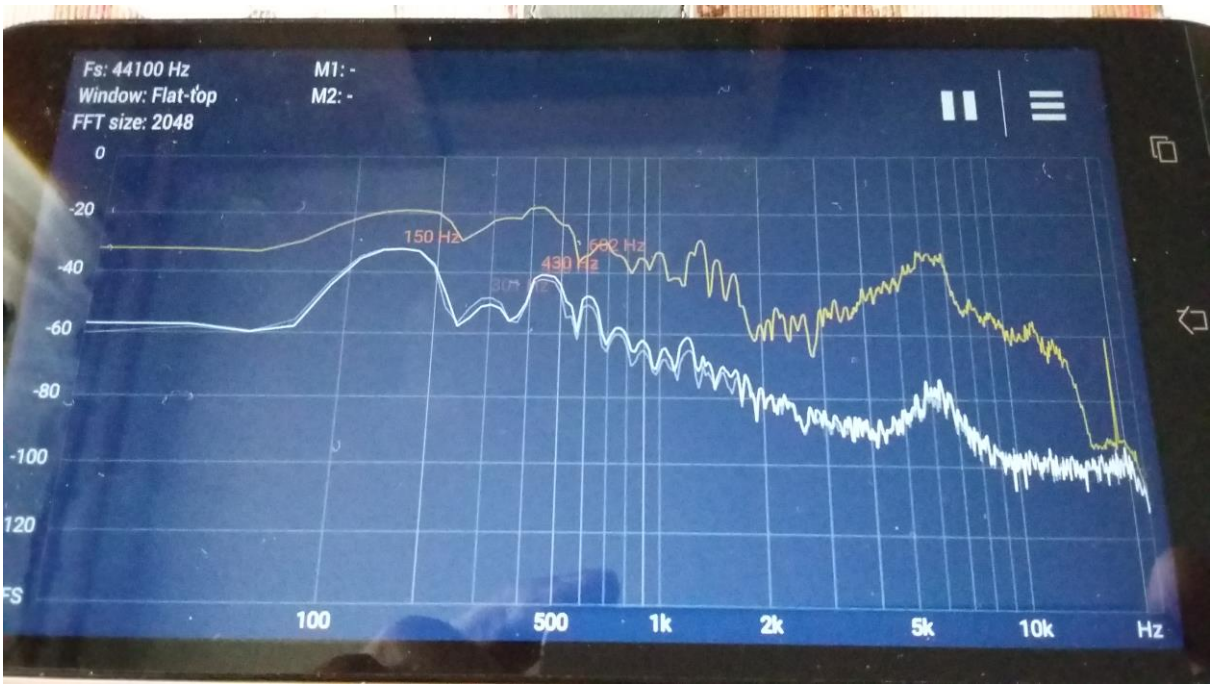

Figure 21. The time window Flat-Top Window. Visible is signal pilot 19 kHz stereo

Next the charts are done in linear scale in the frequency domain.

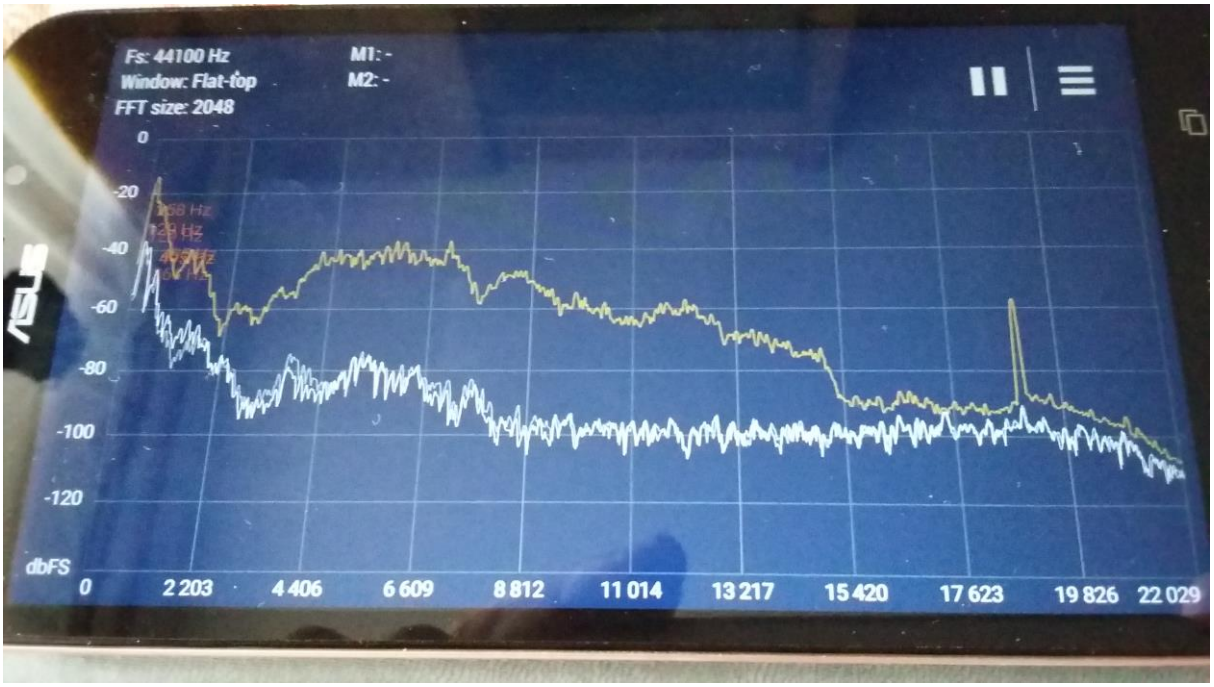

Figure 22. The time window Flat-Top Window. Visible is signal pilot 19 kHz stereo

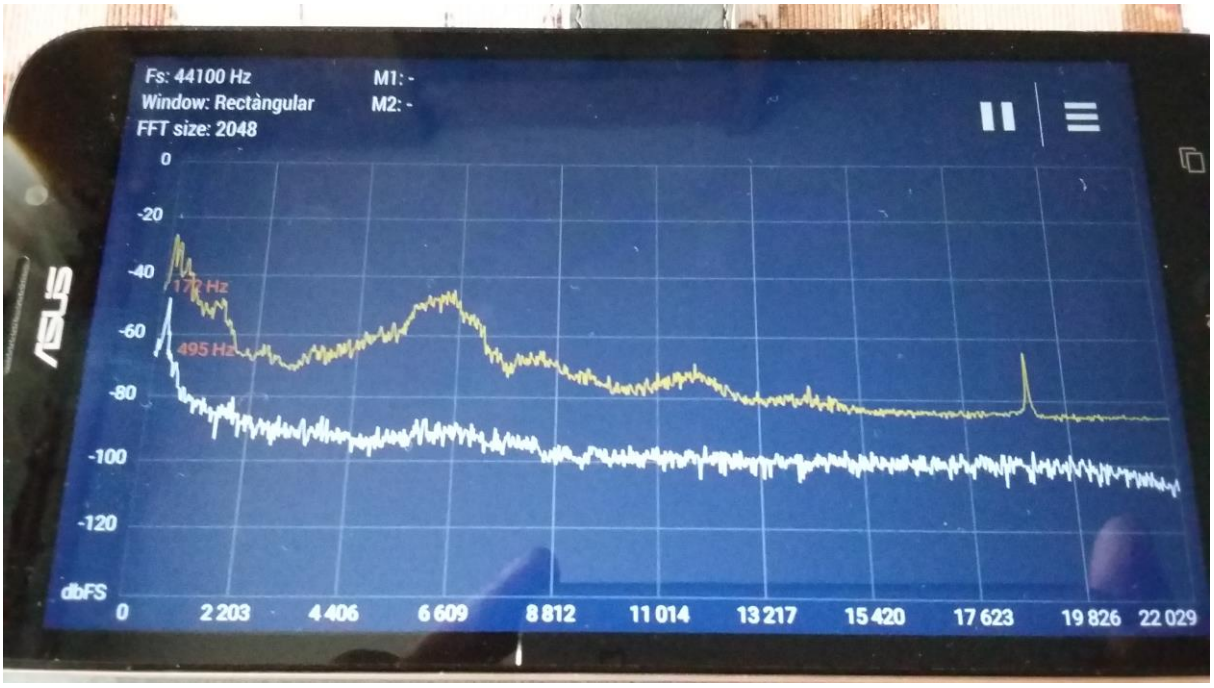

Figure 23. The time window Rectangular. Visible is signal pilot 19 kHz stereo

Comparison time windows.

Presented the result of the measurements spectra of the acoustic signal using by radio FM with couple time windows. Upper chart concerns time window Rectangular, lower Hamming. Selected is the cutoff point in which the low pass filter cut off higher frequencies of the transmitted the signal from the Studio.

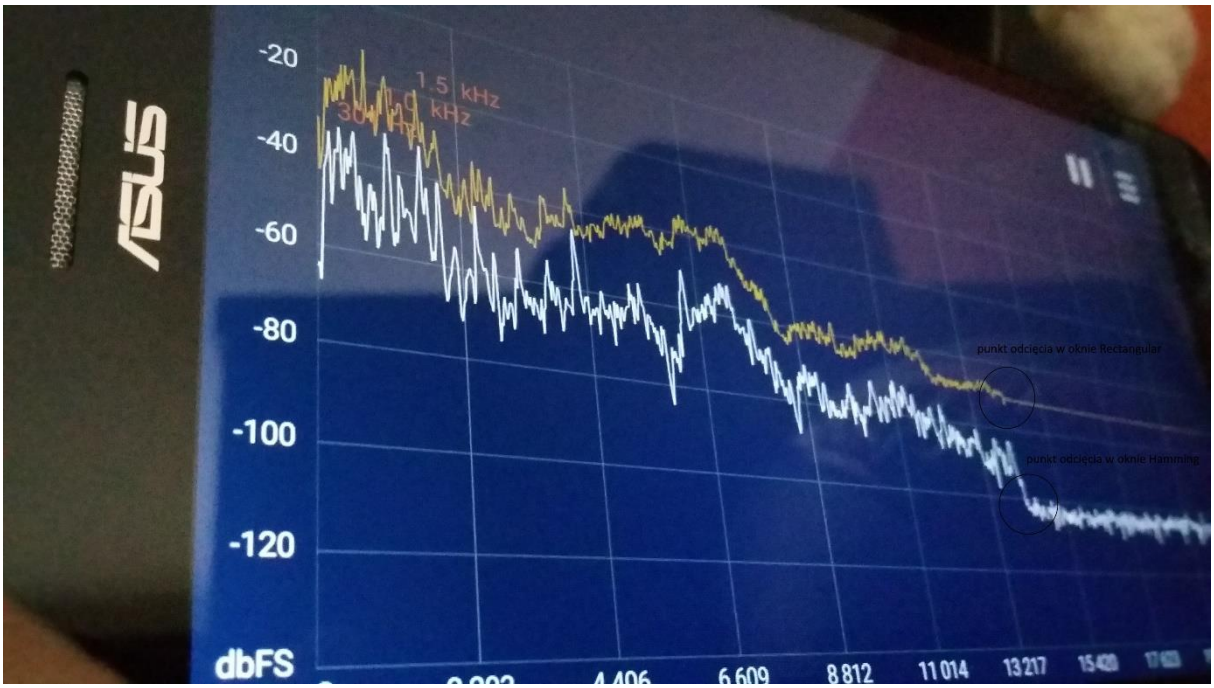

Figure 24. comparison time window Rectangual and Hamming

Comparison measurements.

Presented the results of the measurements of the spectrum of acoustic signal DAB and FM radio with using different time windows allow you to draw the following conclusions.

1. Hamming Window allows you to easily determine the cutoff point which is a point in the which applied to the track with an acoustic low-pass filter cut-off higher frequency of the transmitted the signal from the Studio.

2. You can also specify the sound transmission bandwidth when a filter is not applied.

3. Window Flat-Top better represents the amplitude of the test signals than other time windows.