

Microphone Testing with Inverse Equalizer Toolkit

Abstract: In this example, we will illustrate how MatDeck can be used in audio equipment testing. In this particular case, we test the quality of a given microphone by recording a test sound. The test sound is a chirp signal whose frequency is swept through the hearing range from 20Hz up to 20000Hz. The recorded sound signal is corrected by using the Inverse Equalizer which is adjusted to reverse the frequency response of the microphone. MatDeck components which are used in this example are: Chirp Signal Generator Toolkit, Signal Frequency Analysis Toolkit and Inverse Equalizer Toolkit.

1. Chirp Signal Generation

For the testing proposed, the chirp audio signal is generated with frequency sweeping in the range from 20Hz up to 20000Hz. The frequency is swept in a logarithmic manner across the frequency range. The sampling frequency is set to 44100Hz, with 16 bits per sample. The total signal length is 2 seconds, or 88200 samples. The audio signal explained above is generated using Chirp Signal Generator Form which allows the users to set all the parameters mentioned. We also set a short delay, in order to enable the recording function to grasp all the signal components. The audio chirp signal is played on system speakers, and recorded by using a microphone.

```
ff1 := chsiggenform(0, "Gen011")
```

Chirp Signal Generator Form

Frequency Range (Hz)

20 10000

Sampling Rate (Hz)

44100

Frequency Sweap

logarithmic

Signal Lenght (samples)

44100

Bits Per Sample

16

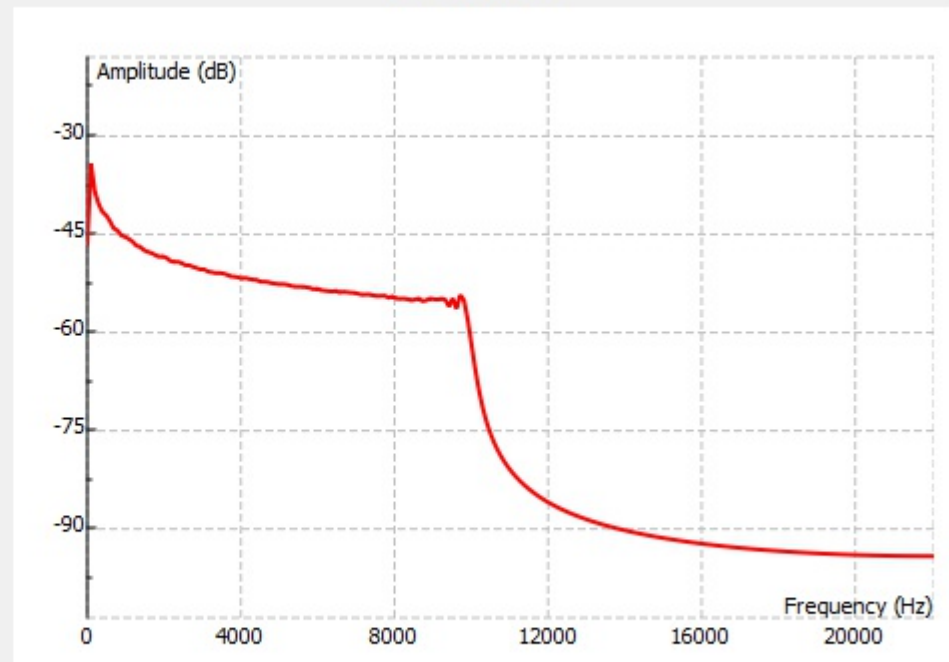
Delay (samples)

500

Generate

Play audio

Generated Signal



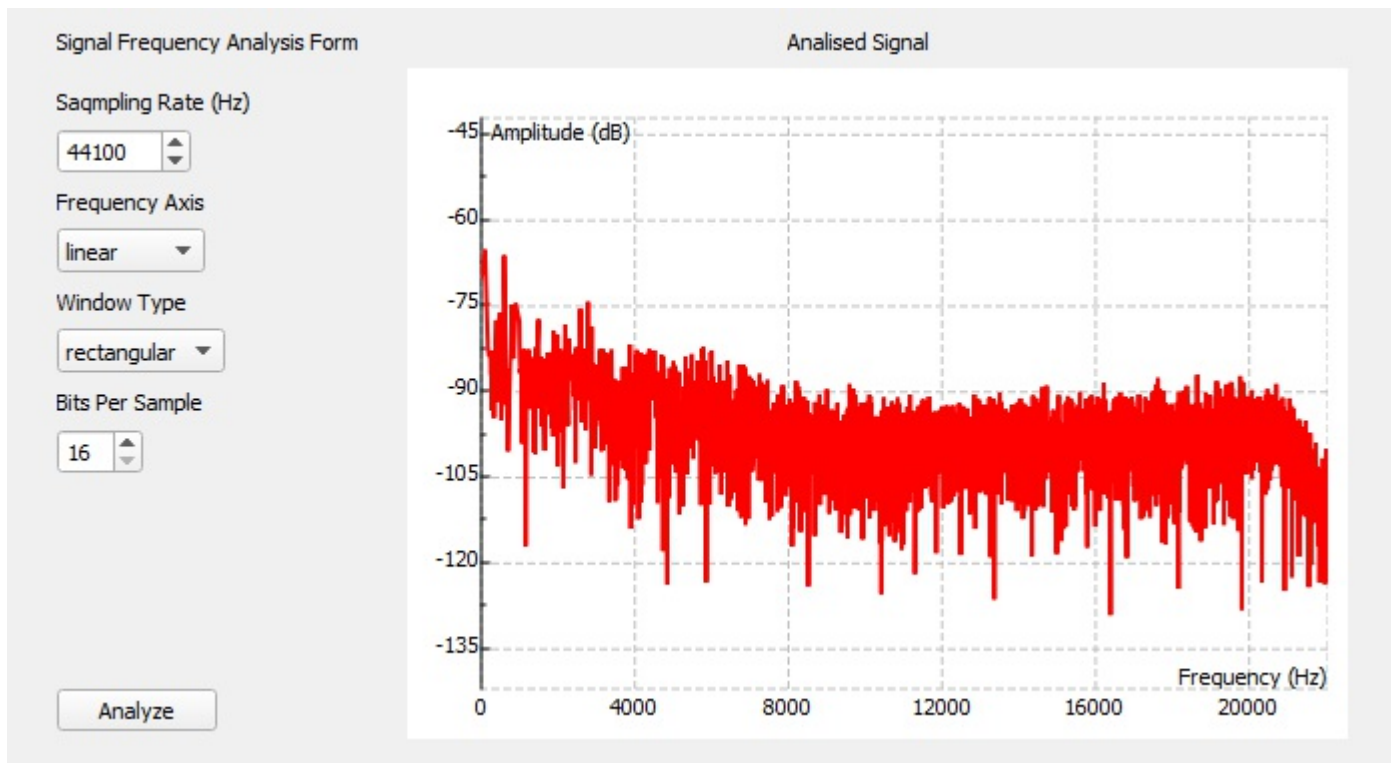
The testing scenario with a single microphone is given in Figure above.

```
Xchirp := chsiggenresult(ff1)
Xrec := audio record(44100 , 16 , 8000) Record test signal
```

2. Frequency domain analysis of the recorded signal.

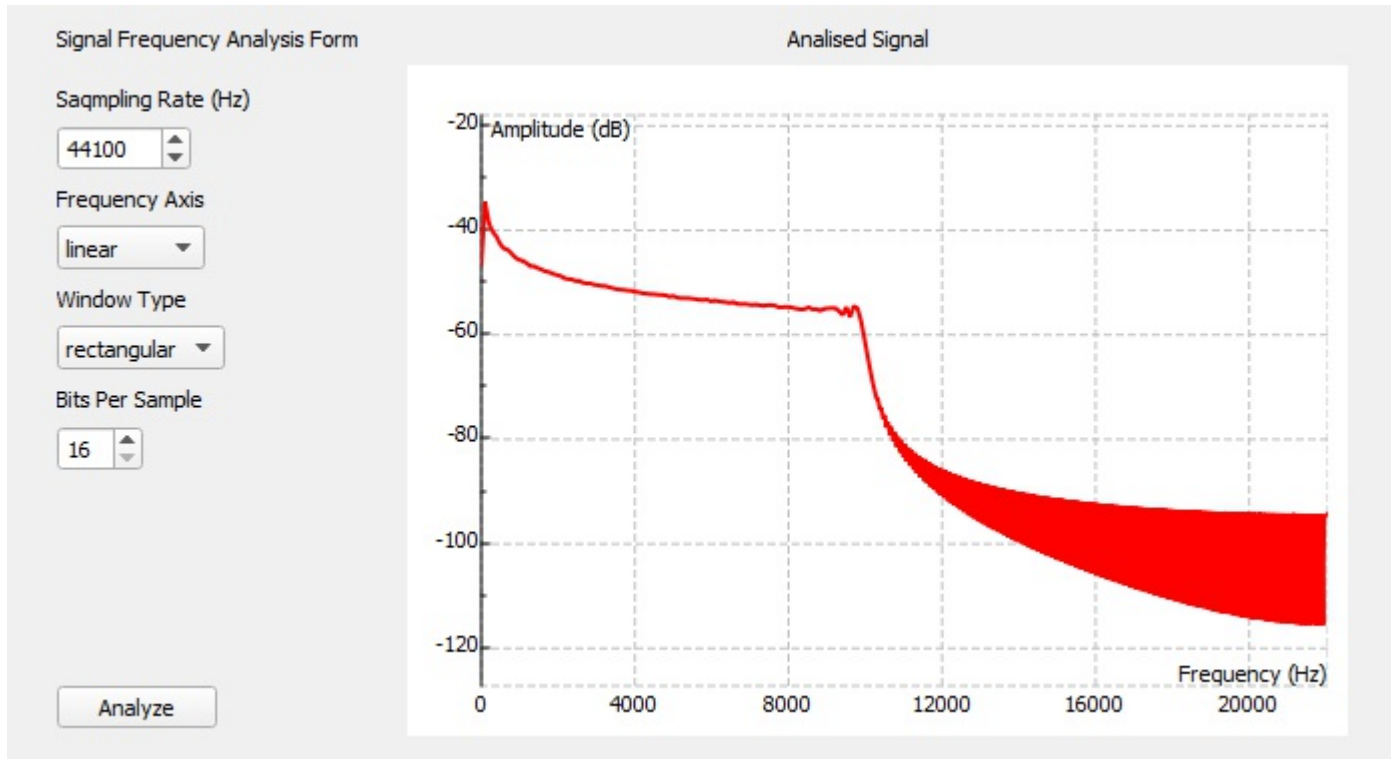
The recorded test signal is analyzed in the frequency domain and compared to the original signal. For that purpose we use Signal Frequency Analysis Form.

```
ff2 := sigfreanaform(0 , "Analysis011")
```



```
Xrecspectar := sigfreanaresult(ff2 , Xrec)
```

```
ff3 := sigfreanaform(0, "Analysis022")
```



```
Xchirppectar := sigfreanaresult(ff3, Xchirp)
```

3. Inverse Equalizer

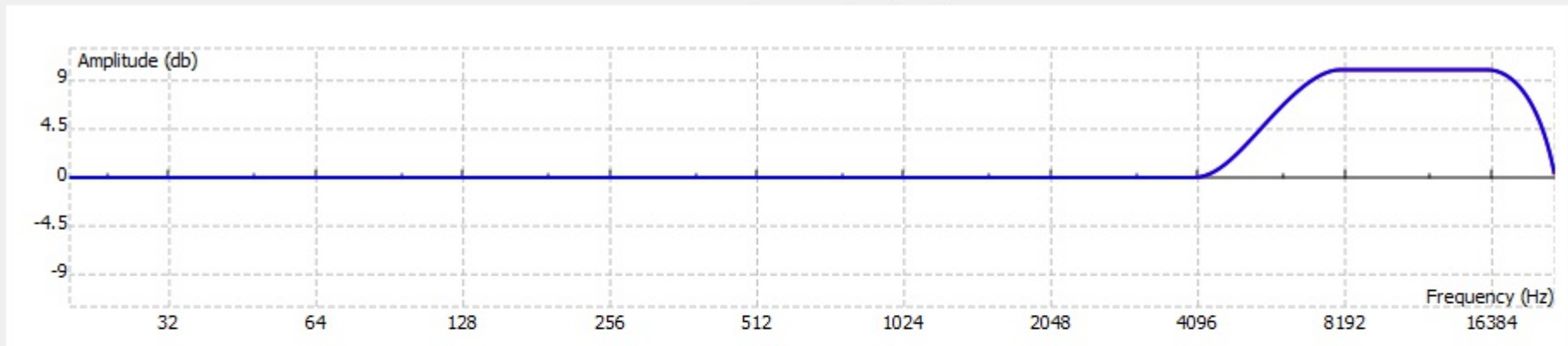
The Inverse Equalizer is used to correct the recorded signal in order to reverse the influence of the microphone. What is left, is to check the corrected audio signal after the equalizer. The corrected audio signal can be inspected by listening and by checking its frequency spectrum.

```
ff4 := equalizerinverseform(0, "Equalizer11")
```

```
Result := equalizerinverseresult(ff4, Xrec)
```

Inverse Equalizer Form

Equalizer Frequency Response



Number of points to specify response:

Frequency Points (Hz)

Desired Amplitude (db)

Sampling Rate (Hz)

Filter Length

Window Type

Frequency Axis

Interpolation

```
audio play(44100 , 16 , Result)
```

```
ff5 := sigfreanaform(0 , "Analysis033")
```

```
ResSpect := sigfreanareult(ff5 , Result)
```

