

**PROTOCOL**to exercise

***Standing Waves***

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| ***Standing Waves*** | | |
| **Used Devices**   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Nr. | Device | Manufacturer | Type |  | | 1. | **Oscilloscope** | **-** |  |  | | 2. | **Function generator** | **-** |  |  | | 3. | **Spectrum Analyser** |  |  |  | | | |

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# Tasks

## General Information

A configuration with two parallel lines to measure standing waves and their wavelength is also called lecher-line. At one end of the lecher-line a high frequency signal is feed into the line. On the other End of the lecher-line a short circuit was made.

The maximas of the current are always located at the distance of and , measured from the short circuited lecher-line end. In addition a current maxima is also located at each end of the lecher-line.

This effect causes the possibility to measure the wavelength of a periodic signal with a lecher-line.

The practical uses of this is to measure propagation speeds of electromagnetic signals.

## Given Exercises

* Measuring of the wavelength of a radio signal using the lecher-line.
* Measuring of the frequency of the radio signal.
* Calculating of the propagation speed of the signal on the lecher-line.
* Comparison with the measured propagation speed and the speed of light in vacuum.
* Calculating of the shortening factor ().

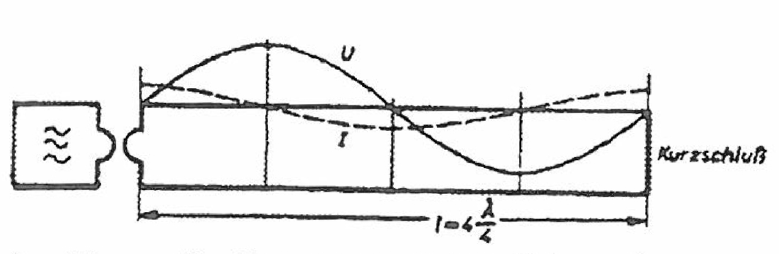


Figure 1. – Idea of the lecher-line

The given lecher-line was driven by a generator und built up on a wood-bar. Therefore the propagation speed is way smaller as the one from light.

# Measuring of the frequency

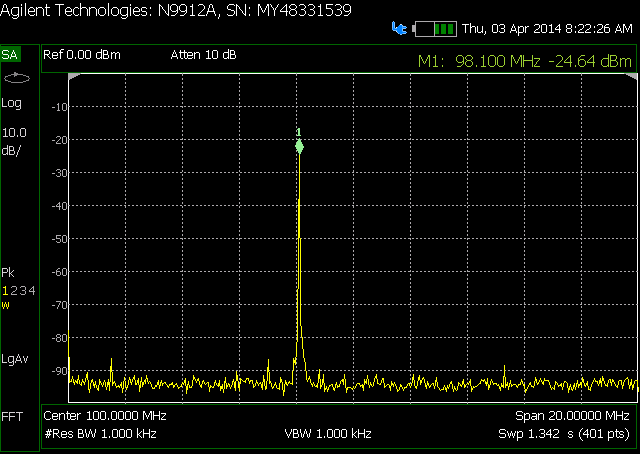


Figure 2. – Measured spectrum of the generator

The generated signal was measured on a Spectrum RF Analyser. Based on aboves spectrum it is shown that the generator has an output of about 100 MHz (exactly 98 MHz).

Measuring the signal with an oscilloscope was logically resulting in the same frequency value.

# Measuring of the wavelength

The distance between the maxima was 2,55 m. This value was measured with a light bulb connected to both lines of the lecher-line which indicated the maxima.

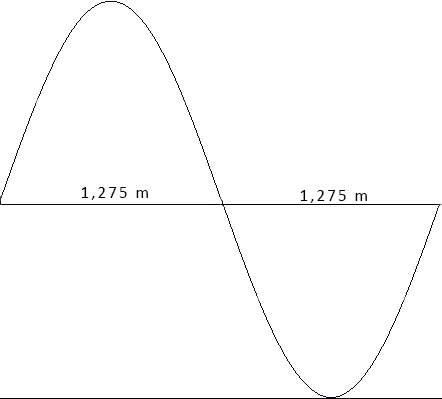


Figure 3. – Signal wavelength

# Propagation Speed

Based on both aboves measured values the propagation speed () was calculated.

# Comparison with the speed of light

The speed of light is about the measured speed with was therefore only 85 % of the speed of light.

## Shortening factor

Based on the measured propagation speed and the speed of the light the following calculation was made.

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