PROTOCOL

to exercise

Standing Waves

Class	Secretary	Signature
4BHELS	**HOFSTÄTTER A.**	
Exercise- / Delivery date 25th February 2015 4th March 2015	Employee	Signature
Teacher GRASINGER	Employee	Signature
Grade	**Employee**	Signature

Standing Waves

Used Devices

Nr.	Device	Manufacturer	Type	
1.	**Oscilloscope**	**-**		
2.	**Function generator**	**-**		
3.	**Spectrum Analyser**			

1 Inhalt

2 Tasks

2.1 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 $\lambda/2$ and λ, 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.

2.2 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 (k).

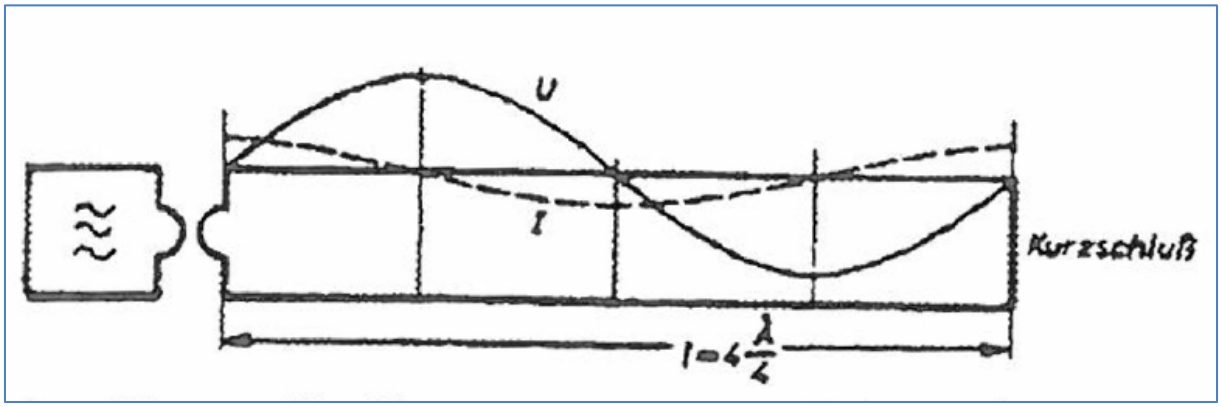

Figure 1. – Idea of the lecher-line

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.

3 Measuring of the frequency

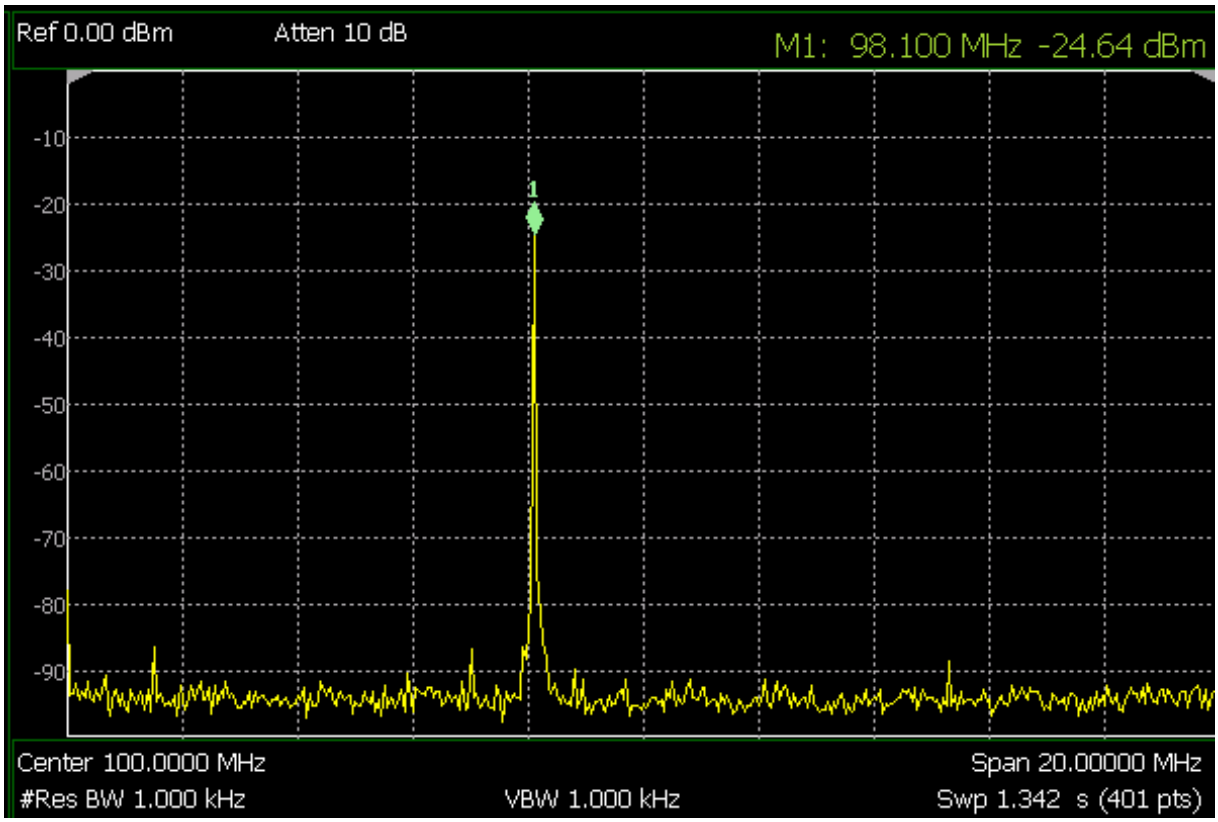

Figure 2. – Measured spectrum of the generator

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).

$$f = 98\ MHz$$

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

4 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.

$$\lambda/2 = 1{,}275\ m$$

$$\lambda = 2{,}55m$$

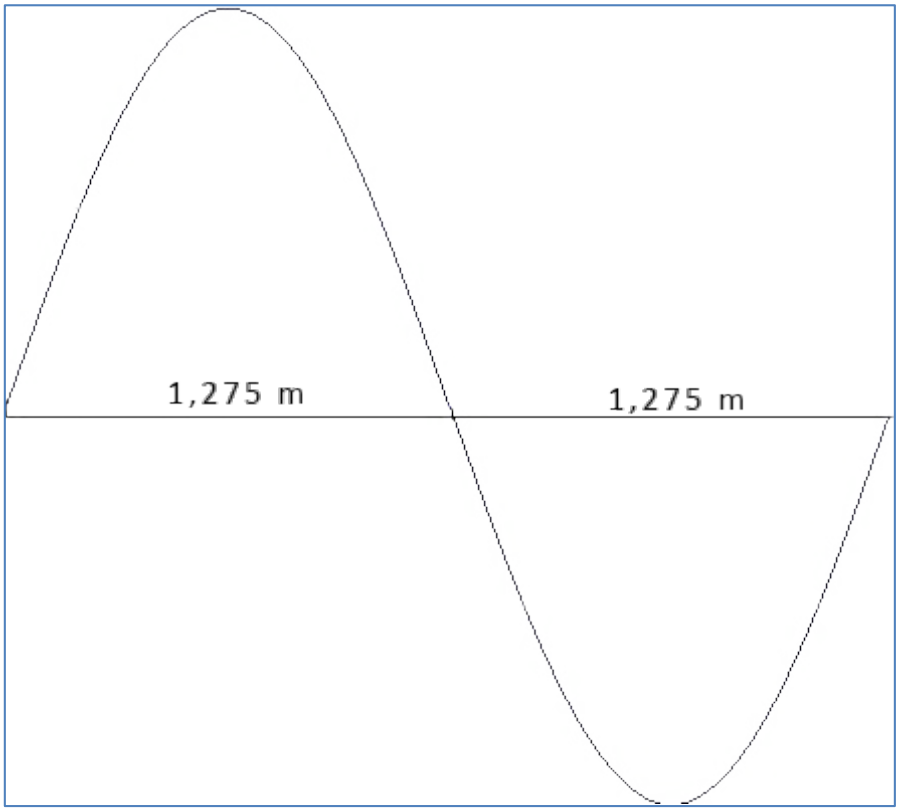

Figure 3. – Signal wavelength

5 Propagation Speed

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

$$v = \lambda * f = 2{,}55m * 98\ MHz$$

$$v = 255\ 000\ km/s$$

6 Comparison with the speed of light

The speed of light is about $3\ 000\ 000\ km/s$ the measured speed with $255\ 000\ km/s$ was therefore only 85 % of the speed of light.

6.1 Shortening factor

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

$$k = \frac{v}{c} = \frac{3\ 000\ 000\ km/s}{250\ 000\ km/s} = 0{,}85$$

7 List of figures