

EUROMET PROJECT FINAL REPORT*)

1. Ref No.: 340	2. Field: PHOTO LENGTH
3. Type of collaboration: Co-operation in research	
4. Partners: FI (HUT) NO (National Measurement Service)	
5. Subject: Research of precision measurements of laser wavelength	
6. Progress:	
<p>Co-operation in the precision measurement of laser wavelengths at 543 nm was arranged at the Helsinki University of Technology.</p> <p>The stabilized laser wavelength was measured with the Fourier Transform (FT-) wavemeter in comparison with the wavelength of $^{127}\text{I}_2$ stabilized HeNe laser (633 nm) at transition 11-5, component f. Five sets of measurements were performed on separate days and each set included six to twelve measurements. The results were compensated for the refractive index of air according to the corrected Edlen equation. For the compensation the environmental temperature, air pressure and humidity were measured.</p> <p>In the measurements with the FT - wavemeter the standard deviation of the measured laser wavelength was less than 1 MHz in each set of measurements, which is comparable to the calibration measurements of the laser done before delivery (output frequency varied within ± 1 MHz during several hours of operation). The linewidth in the measurements (full width at half maximum, FWHM) was 238.9 MHz. The signal-to-noise ratio ranged from 65 dB to 55 dB and, correspondingly, the line position uncertainty varied from 130 kHz to 410 kHz. The average laser wavelength varied from 543.5151785 nm to 543.5151880 nm. The calibrated average vacuum wavelength of the laser had been 543.515180 nm. The variation of the measured wavelength, compensated for the refractive index of air, seems to follow the change of the air pressure. At the air pressure of 112440 Pa, temperature of 20 °C and relative humidity of 21 % the measured wavelength was 543.5151803 nm \pm 0.0000005 nm with the line position uncertainty of 130 kHz..</p>	
7 Coordinator's name: Address: Telephone: + 358 0 451 2281	8. Completion date: 1995 12 31
MarjaLeena Junntila Faculty of Electrical Engineering, HUT Telefax: + 358 0 460 224	9. Date: 1995 12 31
9. Coordinator's signature: <i>M. Junntila</i>	10. Date: 1995 12 31

Notes for the completion of the form overleaf