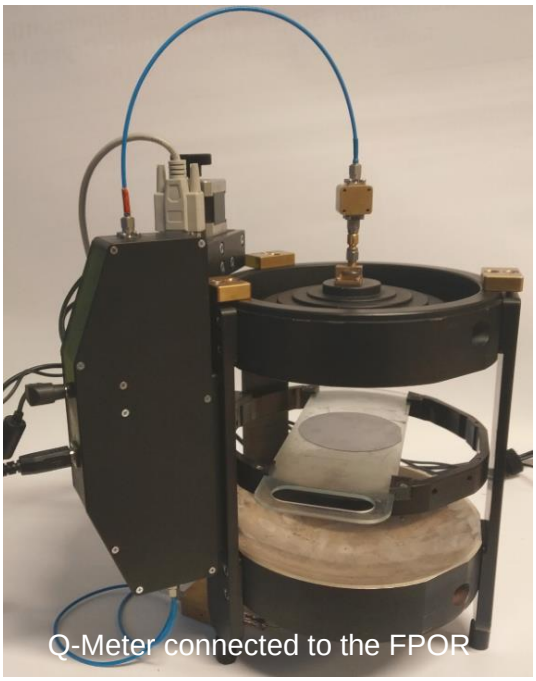
MICROWAVE Q-METER 20-40 GHz

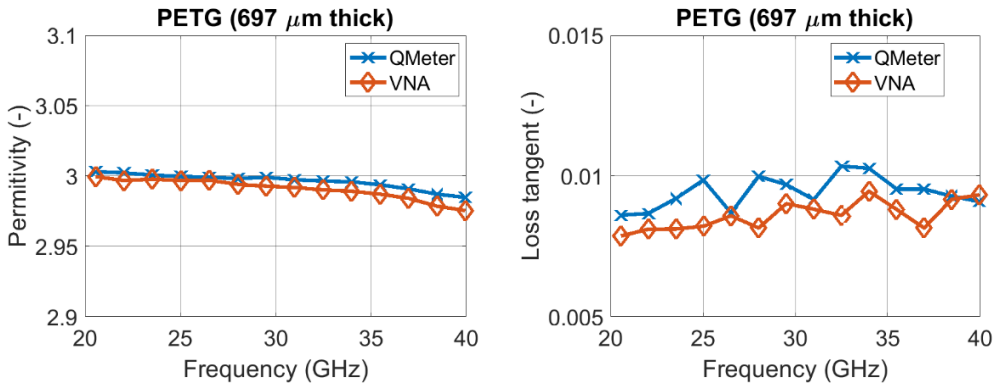
emArges

We manufacture a new model of **Microwave Q-Meter** dedicated to the measurement of dielectric properties of low-loss dielectrics with the aid of a **Fabry-Perot Open Resonator** (FPOR) in the frequency band of **20-40 GHz**. The Q-Meter can replace a laboratory-grade vector network analyzer (VNA) that is usually employed to measure the resonant frequency and the quality factor of the FPOR. It allows one to perform automated broadband and precise room temperature scalar measurements of the properties of high-Q resonators loaded with material samples in this frequency range. It is controlled with a specialized **software** that oversees the measurement process and extracts complex permittivity of the material under test based on the measured properties of the cavity.

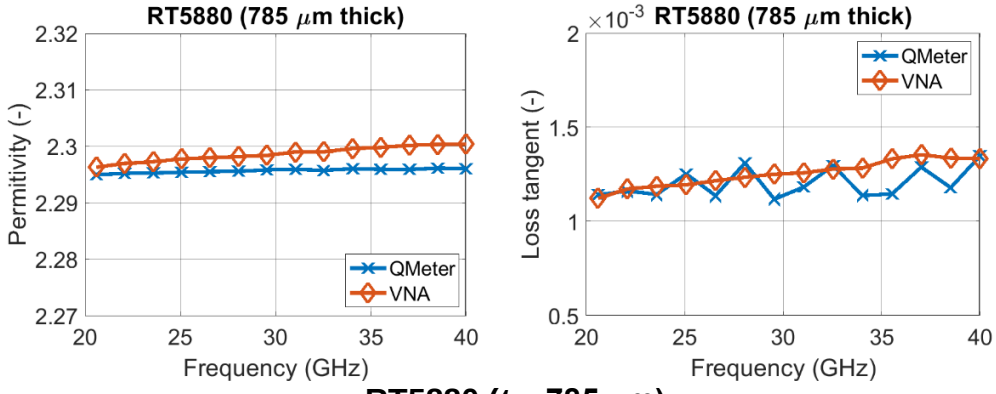

Q-Meter connected to the FPOR

The measurement setup consists of a computer, where the control software is installed, connected to the FPOR system and to the Q-Meter via an USB cable (or a VNA, if the Q-Meter is not used). The Q-Meter allows one to automatically extract material properties at ca. 14 frequency points corresponding to the consecutive $TEM_{0,0,q}$ odd modes spaced every 1.5 GHz. The measurements take about 20 seconds per frequency point.

Many samples of representative materials have been measured using a FPOR connected either to VNA or to the Q-Meter. Examples are given below:



PET (*t* = 697 μm)



RT5880 (*t* = 785 μm)

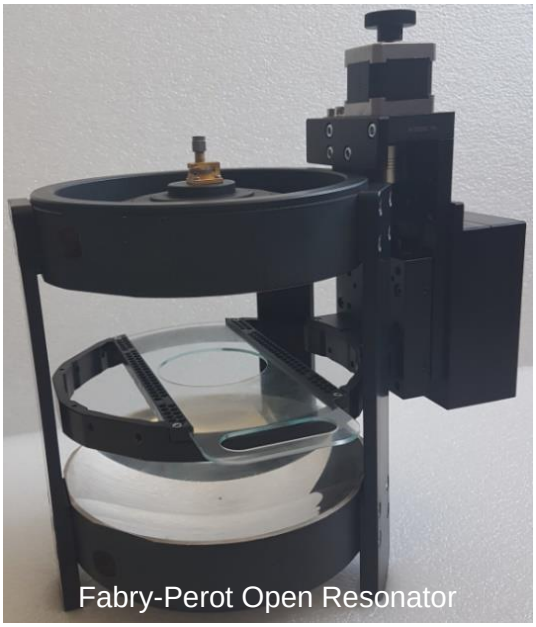
FABRY-PEROT OPEN RESONATOR 20-50 GHz

emArges

emArges manufactures a novel type of a **Fabry-Perot open resonator** (FPOR) with Gaussian mirrors for automated broadband and precise room temperature resonant measurements of electromagnetic properties of flat samples of low-loss dielectrics in the **20-50 GHz** frequency range. The FPOR system is equipped with a specialized **software** controlling the measurement process and extracting complex permittivity of the material under test from the measured frequency and quality factor.

The whole measurement setup consists of a computer, where the aforementioned control software is installed, connected to the FPOR and to measurement equipment (either VNA or **scalar Q-Meter**). The FPOR operates at consecutive $TEM_{0,0,q}$ Gaussian odd modes spaced every **1.5 GHz**.

Due to a sophisticated adaptive algorithm implemented in the control software dedicated to precise and robust tracking of the modes during the measurement, total measurement time usually does not exceed **10 minutes**.


Fabry-Perot Open Resonator

Parameters of a Fabry-Perot Open Resonator (FPOR)

Application	FPOR is intended for the measurements of the complex permittivity of low-loss laminar dielectric materials.
Accuracy of measurements	$\Delta\varepsilon/\varepsilon$ = ±0.5% for ε = 1…15 $\Delta\tan\delta/\tan\delta$ = ±2% for $\tan\delta \leq 2\%$
Operational frequency range	20-50 GHz FPOR uses consecutive $TEM_{0,0,q}$ Gaussian odd modes spaced every 1.5 GHz, 20 frequency points in the 20-50 GHz range.
Operational temperature range	Room temperature
Additional equipment needed to perform measurement	1. Vector Network Analyser (e.g. Keysight, N5245A) or scalar Q-Meter 2. National Instruments 488.2 GPIB controller or LAN
Measurement procedure	The whole measurement is automated and controlled via dedicated software installed on a PC computer. At first, resonant frequencies and Q-factors of $TEM_{0,0,q}$ odd modes of the empty resonator are measured. Afterwards, sample is inserted onto the holder and all the modes of interest are adaptively sought for and the changed resonant frequencies and Q-factors are measured in order to extract dielectric constant and loss tangent by comparing the results with a look-up table computed with a dedicated FPOR electromagnetic model.
Additional information	The thickness of the sample should be in the 50μm – 3mm range, while the diameter should exceed 75 mm.