Datasheet

Split Cylinder Resonators

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General:

EM labs' Split Cylinder Resonators with a Keysight Technologies' network analyzer provide the capability of measuring the complex relative permittivity of low-loss dielectric materials. With Keysight' N1500A-007 software, you can efficiently capture accurate permittivity values of your samples with ease of use.

Models:

Nine models of Split Cylinder Resonators are available, covering the frequency range from 10GHz to 80GHz. A single resonator is designed to operate at one specific frequency.

The TE011 resonance mode is used for all the models, with the electric field oriented parallel to the sample plane.

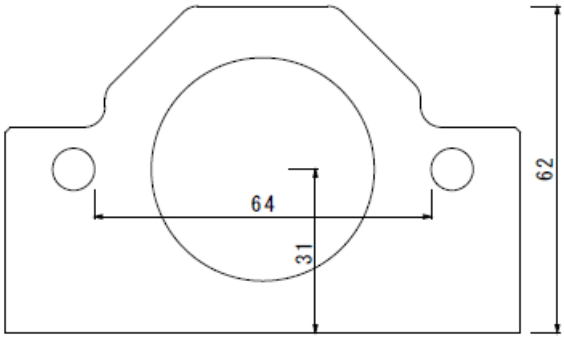
Moder number	description	Frequency	unloaded Q	Connector
N1501AKEAD-710	SCR-10	10GHz	＞20,000	2.92mm(f)
N1501AKEAD-720	SCR-20	20GHz	＞14,000	2.92mm(f)
N1501AKEAD-724	SCR-24	24GHz	＞14,000	2.92mm(f)
N1501AKEAD-728	SCR-28	28GHz	＞14,000	2.92mm(f)
N1501AKEAD-735	SCR-35	35GHz	＞10,000	2.92mm(f)
N1501AKEAD-740	SCR-40	40GHz	＞10,000	2.92mm(f)
N1501AKEAD-750	SCR-50	50GHz	＞7,000	2.4mm(f)
N1501AKEAD-760	SCR-60	60GHz	＞6,000	1.85mm(f)
N1501AKEAD-780	SCR-80	80GHz	＞6,000	1mm(f)

Sample shape and size:

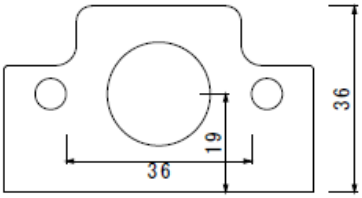
Recommended samples shape is rectangular with the sizes listed on this table.

Frequency	Easy-to-use size
SCR-10 (10GHz)	63mm x 75mm
SCR-20,24,28,35,40,50,60,80	34mm x 45mm

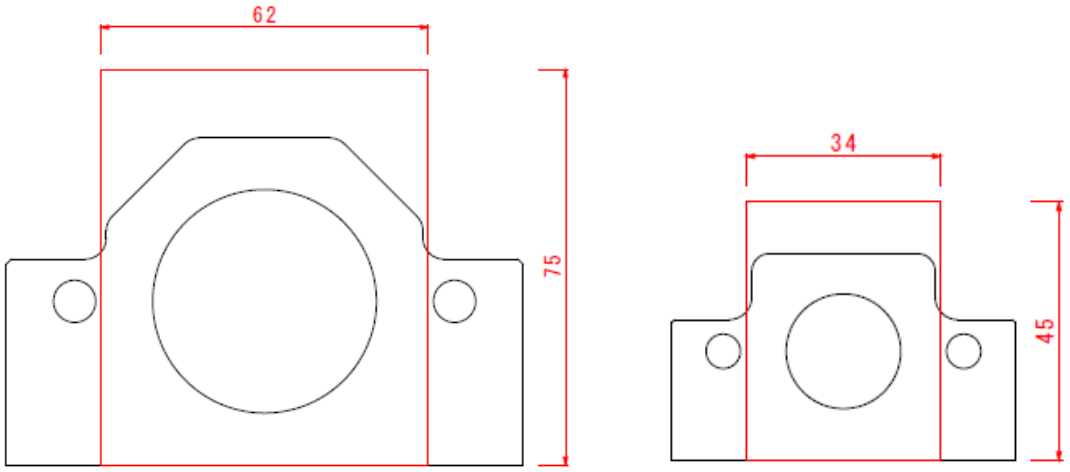
The shapes and the sizes of the Split Cylinder Resonators are shown below.
The circles represent the portion of the resonant cavity where the actual measurement takes place. A sample needs to cover the whole area of the cavity circle for accurate measurement. Diameters of the cavities are approximately 40, 20, 16, 15, 12, 10, 8, 7, 5mm correspondingly to 10, 20, 24, 28, 35, 40, 50, 60 and 80GHz.



10GHz Split Cylinder Resonator

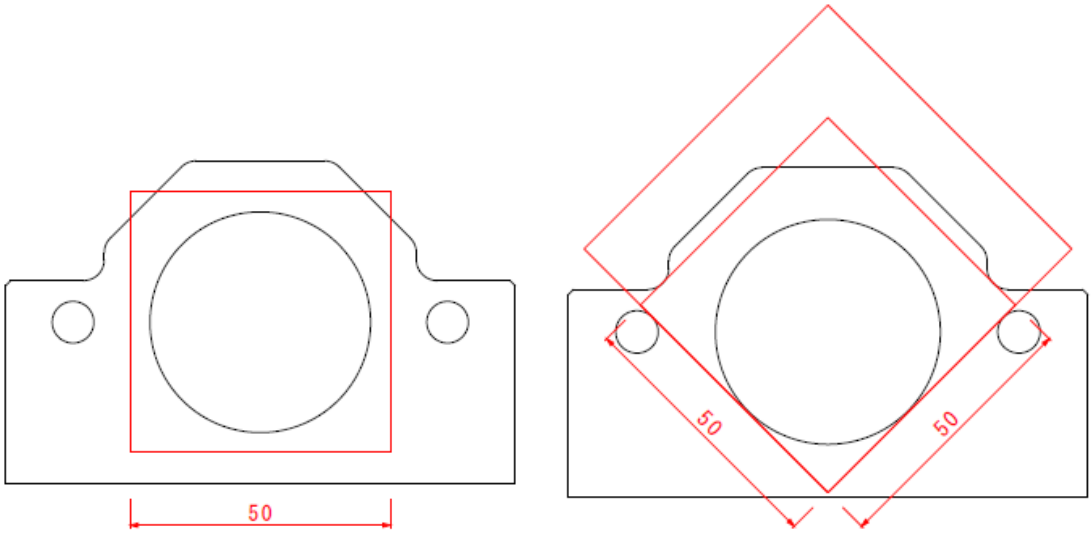


20~80GHz Split Cylinder Resonators

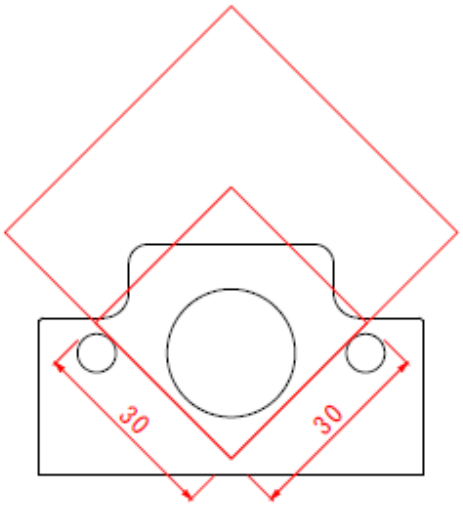


Recommended "easy to use" sample sizes

Even if the sample size does not satisfy the "ease of use" size, other sample sizes and shapes can be measured as long as the sample covers the cavity circle and can be inserted and taken out without trouble.



Acceptable sample example for 10GHz SCR

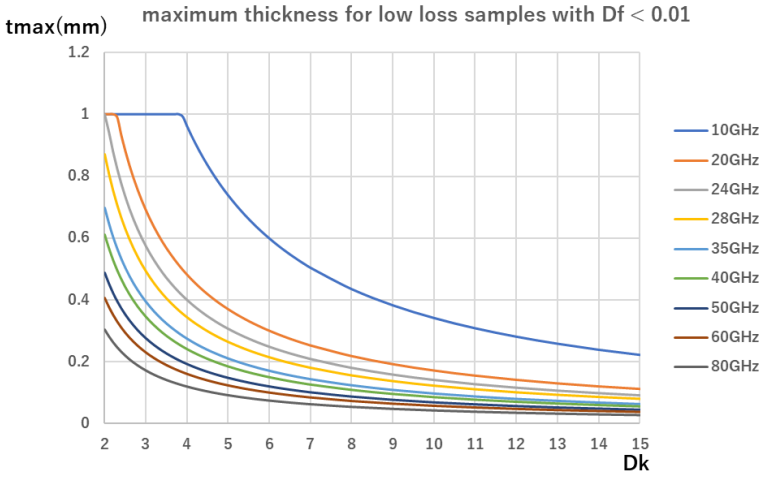


Acceptable sample example for 20~80GHz SCRs
(the circle size of 20GHz is shown in the drawing)

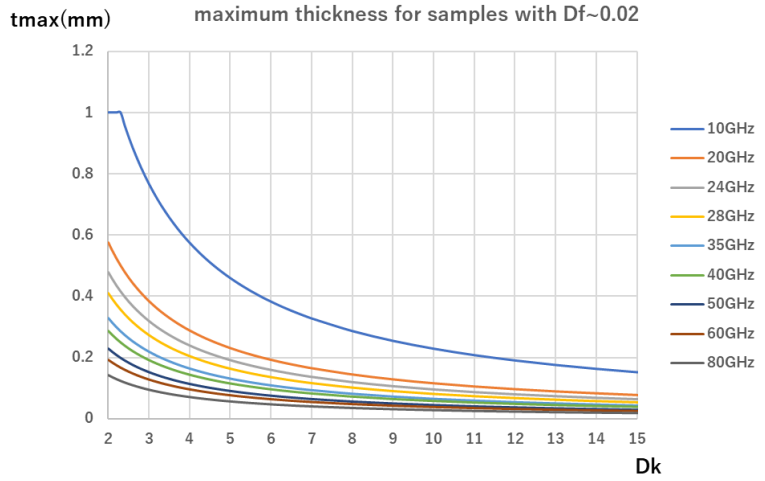
Sample thickness:

The upper limit of the sample thickness is determined by the frequency, as well as the sample's Dk and Df values. For low-loss samples with Df < 0.01, the upper graph applies. For Df ~ 0.02, the lower graph applies. For samples with Df > 0.02, Split Cylinder Resonator may not be a good fit.

The lower thickness limit of a sample is determined by its ease of handling. As long as the sample can be properly inserted into the resonator, it can be measured.



Maximum measurable thickness for low loss samples (Df < 0.01)



Maximum measurable thickness for samples with Df ~ 0.02

The CR-MA-BU option enables measurement of samples thicker than those shown in these graphs. This option supports materials with Dk < 50 at frequencies up to 40 GHz, or Dk < 12 at 60 GHz, and thicknesses of less than 800 µm. It is applicable to resonators operating at 60 GHz or below.

Reference sample:

A reference COP(cyclo-olefin polymer) sheet(~187um) with pre-measured permittivity values is provided for verification and maintenance purposes.

Reference COP has Dk of approximately 2.37 and Df of approximately 0.0007.

Note: COP is chosen for its stable permittivity over temperature and humidity; however, its permittivity is still affected by the environment, with variations of approximately 0.001 for Dk and 0.00001 for Df.

Measurement accuracy (normal indoor environment):

- Dk error < 0.005 (0.2%)
- Df error < 0.00005

Measurement accuracy is defined only as the deviation from the specified values of the reference COP (including the variation of COP itself, stated above).

Note: Absolute accuracy cannot be specified due to the absence of an absolute standard.

Repeatability:

- Dk standard deviation < 0.1%
- Df standard deviation < 0.00002

Repeatability is defined as the standard deviation of ten measurements of the reference COP sheet, with the sheet being removed, flipped, and reinserted into the resonator before each measurement.

Operating temperature:

- 10 to 40℃（no condensation）

Size/Weight:

- SCR-10: 100mmW x 130mmD x 68mmH / 2.4kg
- SCR-20,24,28,35,40,50,60,80: 76mmW x 100mmD x 42mmH / 0.8kg