RF CURRENT MONITORING PROBE

1 Introduction

The TBCP5-150K400 is a snap-on RF current monitoring probe, expanding the Tekbox product range of affordable test equipment.
The probe has a flat response from 150 kHz to 400 MHz and is characterized over the frequency range from 10 Hz to 500 MHz. The TBCP5-150K400 is designed for RF current monitoring applications, which need very high magnetic saturation. The TBCP5-150K400 transimpedance characteristic is not influenced by bias currents as high as 200Ampere.

Picture 1: TBCP5-150K400 RF current monitoring probe

The aperture of the RF current monitoring probe is 46 mm. The transfer impedance is 11 dB Ohm with a 3dB bandwidth from 150kHz to 400 MHz.

	Switching high bias currents can create transients at the output of the probe, potentially damaging connected equipment. To protect your equipment, read the necessary information from the datasheet.

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2 Specification

Characterized frequency range:	10 Hz to 500 MHz
3 dB bandwidth:	150 kHz to 400 MHz, typ.
Transfer impedance:	11 dBΩ (3.5 Ω) in the flat region, typ. (50 Ω load impedance)
Insertion impedance:	<400mΩ up to 400 MHz (series measurement method)
Shunt capacitance:	<1 pF (concentric cable with ⌀ 10 mm)
Output impedance:	50 Ω (resistive matching)
Max. bias current (DC - 400 Hz):	200 A (no influence on transimpedance)
Max. primary current (RF):	2 A
Max. core temperature:	125 °C
Connector type:	N female
Aperture diameter:	46 mm
Outside diameter:	124 mm
Height:	36 mm
Weight:	320 g

RoHS

3 Transfer impedance

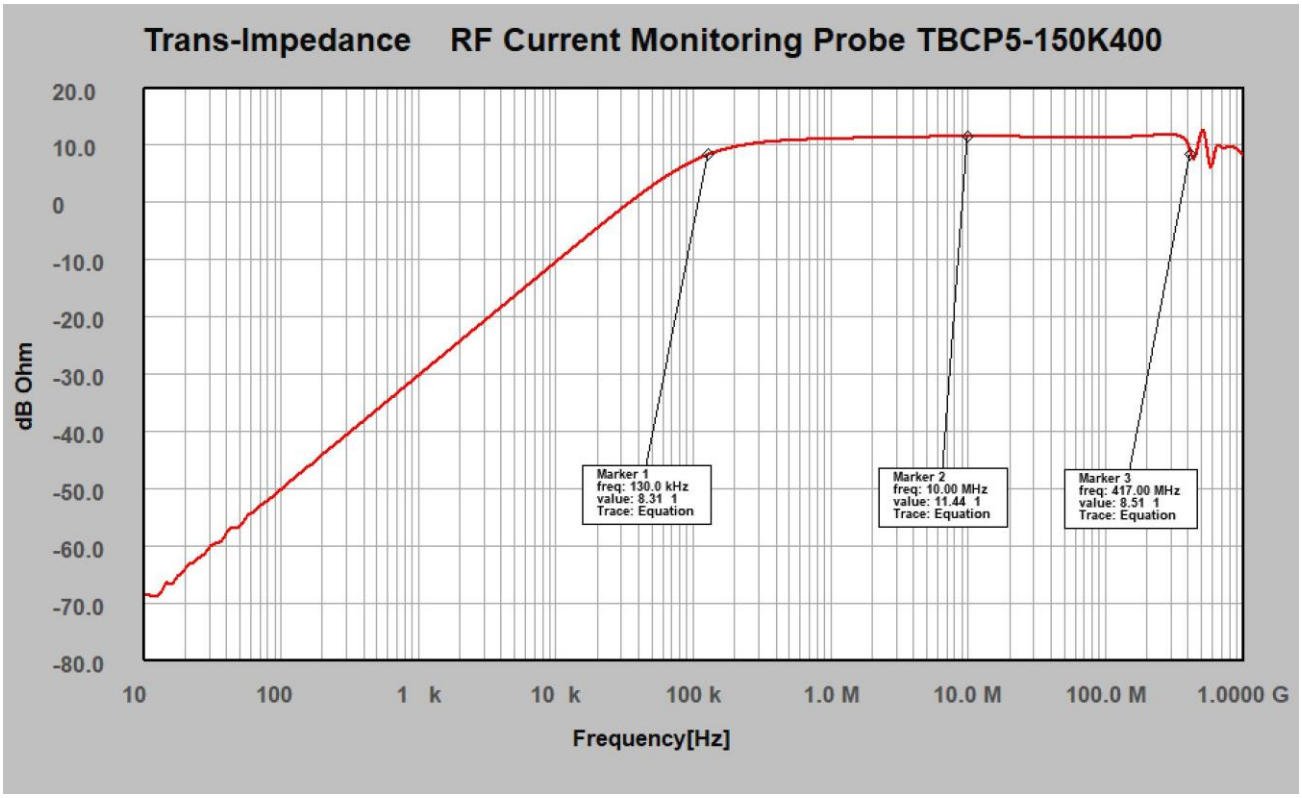


Figure 1: typical transfer impedance

4 Typical transfer impedance table

The table below shows typical transfer impedance data of a TBCP2-150K400 current probe. Each current probe is delivered with its corresponding measurement protocol. This data can be used for the creation of a correction file for EMCview or similar EMC measurement software. The transfer impedance in dBΩ subtracted from the analyzer reading in dBµV gives the corrected reading in dBµA.
Refer to the application notes of EMCview on how to create a current probe correction file.

Frequency [MHz]	Transfer impedance [dBΩ]	Frequency [MHz]	Transfer impedance [dBΩ]
0.00001	-68,56	150	11,39
0.000025	-62,27	175	11,47
0.00005	-56,69	200	11,57
0.000075	-52,62	225	11,65
0.0001	-50,25	250	11,73
0.00025	-42,31	260	11,75
0.0005	-36,33	270	11,77
0.00075	-32,80	280	11,78
0.001	-30,33	290	11,79
0.0025	-22,42	300	11,79
0.005	-16,46	310	11,77
0.0075	-12,96	320	11,72
0.01	-10,48	330	11,65
0.025	-2,70	340	11,54
0.05	2,78	350	11,42
0.075	5,52	360	11,28
0.1	7,13	370	11,14
0.15	8,82	380	10,93
0.25	10,07	390	10,58
0.5	10,79	400	9,97
0.75	10,97	410	9,13
1	11,07	420	8,26
2.5	11,29	430	7,64
5	11,40	440	7,51
7.5	11,43	450	7,96
10	11,44	460	8,80
25	11,40	470	9,84
50	11,35	480	10,87
75	11,28	490	11,72
100	11,31	500	12,28
125	11,34		

Table 1: Transfer impedance: 10 Hz to 500 MHz, typical data

5 Insertion impedance

The insertion impedance was measured using a VNA, applying the series impedance method:

$Z_{Series} = 50 * 2 * (1-S21)/S21$

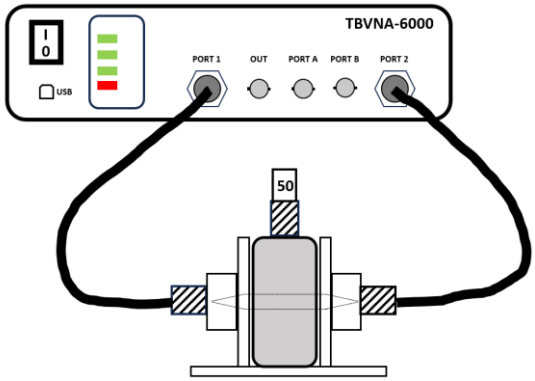


Figure 2: measurement setup

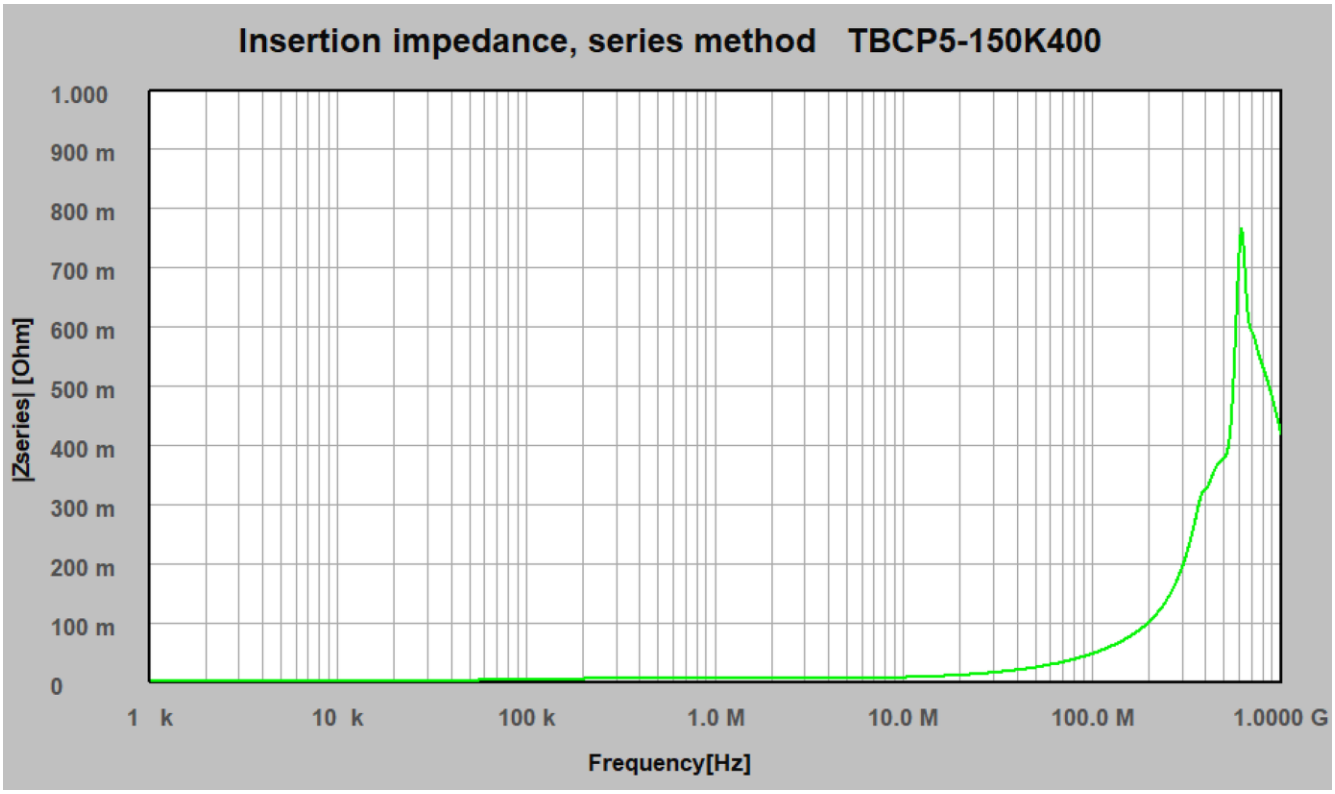


Figure 3: insertion impedance < 1Ω

6 Bias current behavior

In most applications, RF current monitoring probes are used to measure common mode emissions. Saturation is not an issue since forward and return supply currents are routed through the probe's aperture, and the magnetic fields produced cancel each other out.

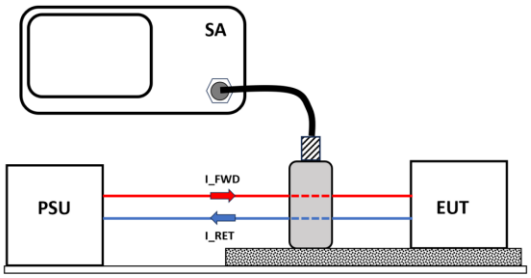


Figure 4: simplified setup for common mode emission measurement

In case of differential mode measurements, where one of the current paths is routed outside the aperture or where wires are routed through the aperture in opposite direction, the TBCP5-150K400 can handle the magnetic field of the resulting bias currents without being saturated up to 200A.

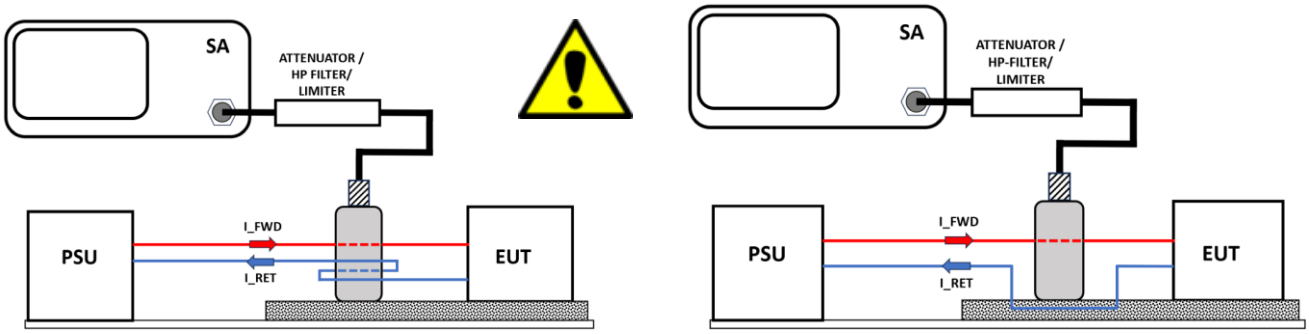
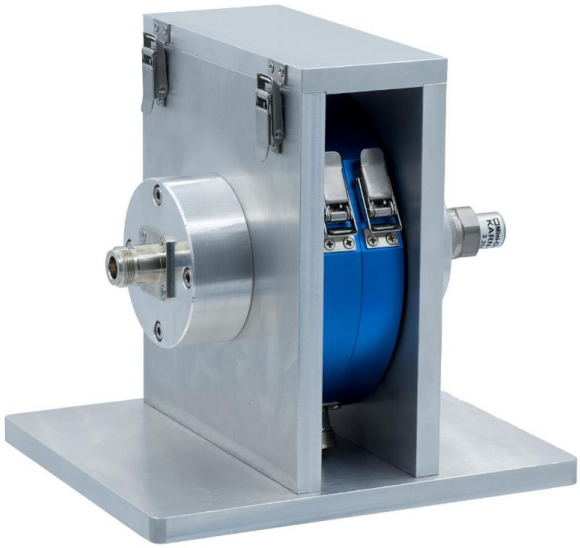


Figure 4: setups resulting in bias currents

However, such setups may potentially damage your connected equipment, if no precautions are taken:
Assume that power is applied to the setup. The probe has a transimpedance of 3.5 V/A. A 200 A power-on surge with short rise time can cause a 700-volt transient at the probe's output.
Disconnect the probe´s RF output during Power ON/OFF of the power supply or EUT. Protect the RF equipment with a transient limiter such as the Tekbox TBFL1. In case of very high currents, place an additional attenuator in front of the transient limiter.
Be aware that even if the EUT does not draw large currents in operation, it may draw a high inrush current, resulting in high voltage transients that might damage your equipment.

7 Accessories

Tekbox supplies a calibrator suitable for the TBCP5-150K400 current probe:



Picture 2: TBCP5-CAL RF current probe calibration fixture

8 Ordering Information

Part Number	Description
TBCP5-150K400	Snap on RF current monitoring probe, wooden box, calibration protocol 10 Hz – 500 MHz
TBCP5-CAL	Calibration fixture for TBCP5-150K400 current probe
TBFL1	Combined attenuator / high-pass filter / limiter
TBAS3	10W RF attenuator set

9 History

Version	Date	Author	Changes
V 1.0	8.2.2025	Mayerhofer	Creation

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