

# TRANSIENT LIMITER

## 1 Introduction

The TBFL1 is a combined transient limiter / attenuator / high pass filter, designed to provide optimum protection of spectrum analyser or measurement receiver inputs when carrying out conducted noise measurements or other measurements where the input levels cannot be predicted with certainty or where accidental overloads may occur.

Pin- and Schottky diodes combined with a multi-stage 10dB attenuator result in a device which can withstand a continuous RF input level of up to 5W (37 dBm). A gas discharge tube provides additional protection against high voltage transients. Furthermore, a 9 kHz high pass filter suppresses harmonics of the mains supply voltage. With a limiting threshold of +11dBm and a flat frequency response from 9 kHz to 600 MHz, the TBFL1 limiter can be used as protective device for the complete range of conducted noise measurements and in many other applications.



Picture 1 – TBFL1 transient limiter

### **Application:**

general purpose RF transient limiter

limiter for conducted noise measurement set ups

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## 2 Electrical Specifications

### Technical Data:

Frequency range: 9 kHz – 600 MHz

Attenuation: 10 dB – 0.7/+1.6 dB in-band (9 kHz to 600 MHz)

Attenuation HP-filter: > 30 dB @ 2kHz

Maximum continuous RF input power: 5W (+37 dBm) in-band

Maximum DC input voltage: ± 20V

Input matching, linear operating range: 9 kHz - 600 MHz < - 16 dB

Output matching, linear operating range: 9 kHz - 600 MHz < - 23 dB

Linear operating range: up to 0 dBm input level, in-band

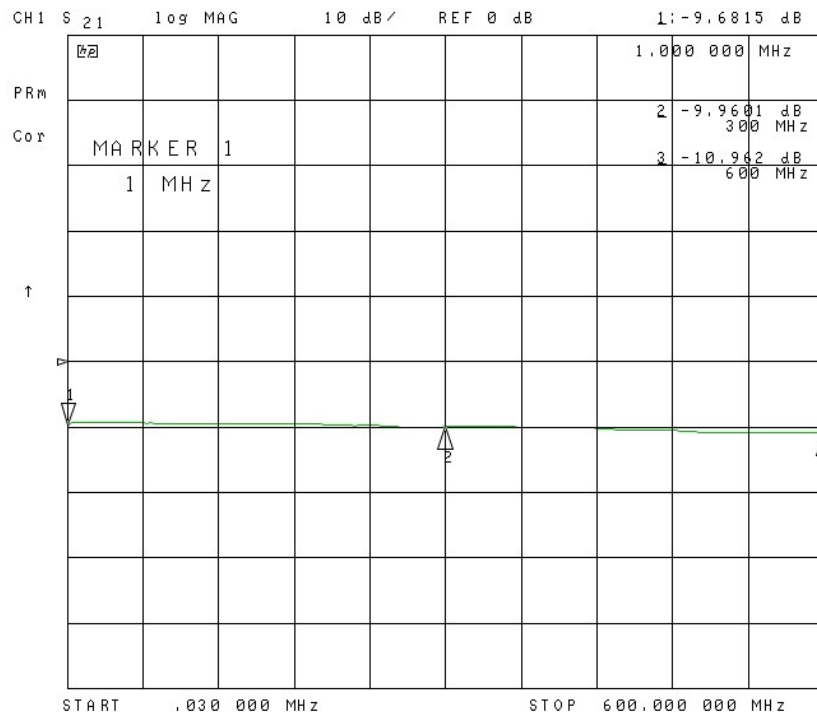
Limiting threshold: +11 dBm (@ 37dBm input level)

Input connector: N-female

Output connector: N-male

Dimensions: 156 mm x 26 mm x 26mm

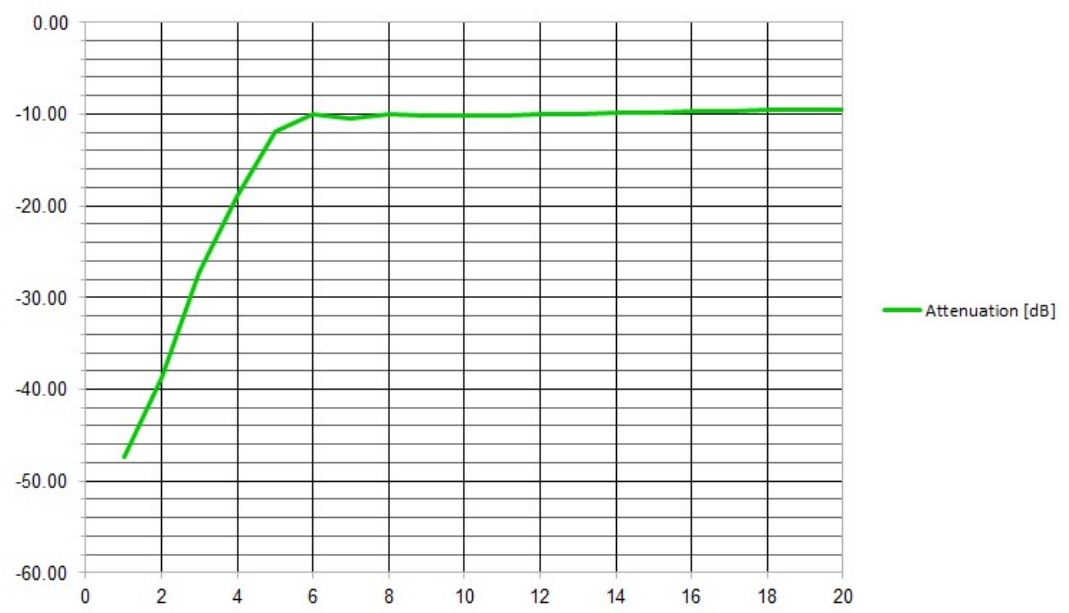
Weight: 170 g



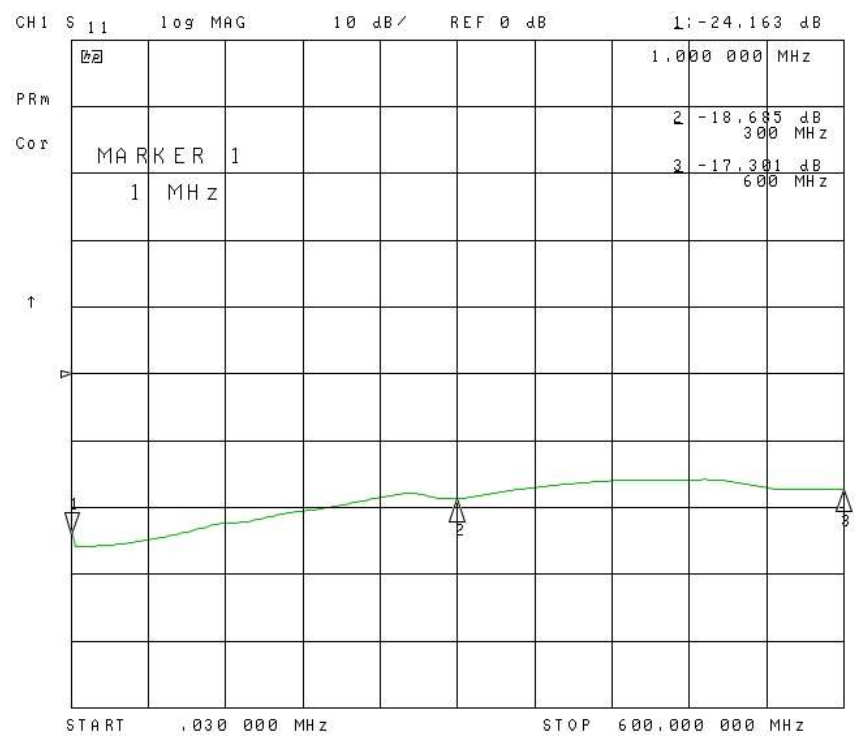
Picture 3 – TBFL1, attenuation, 9 kHz – 600 MHz



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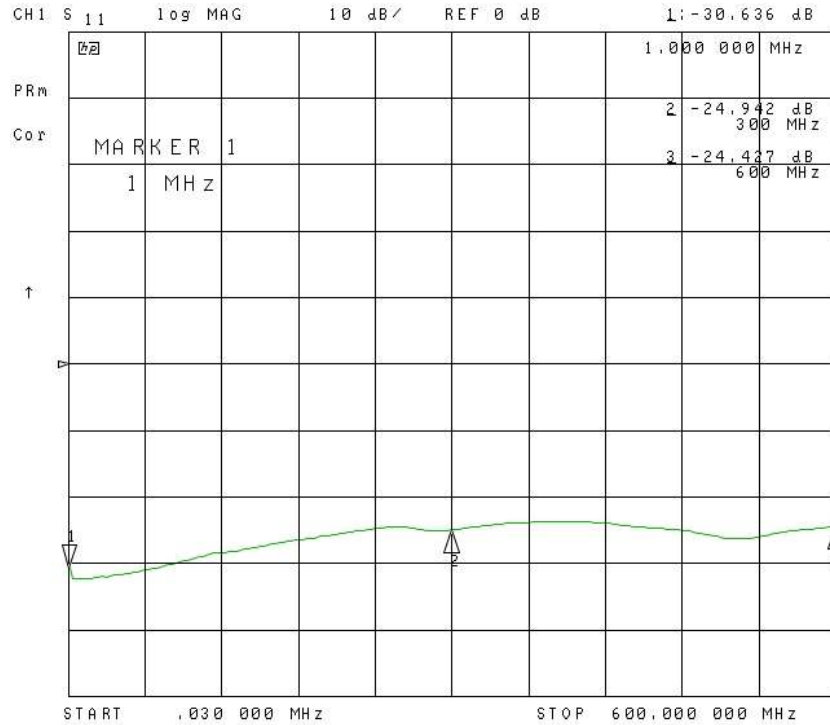


Picture 4 – TBFL1, high pass filter response 1 – 20 kHz

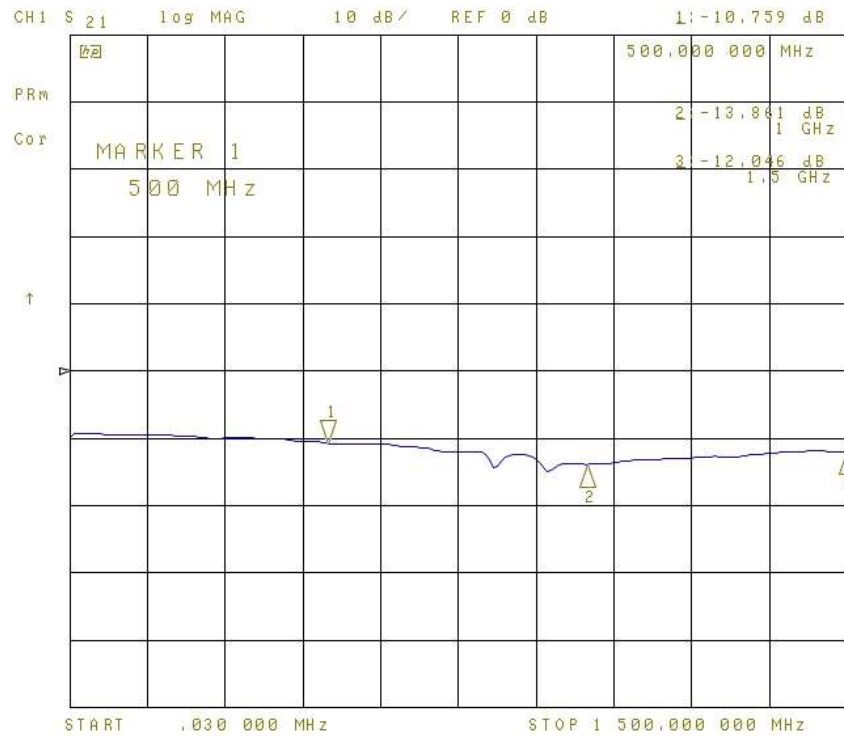


Picture 5 – TBFL1, input return loss, IS11,, 30 kHz – 600 MHz

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Picture 6 – TBFL1, output return loss, IS111, 30 kHz – 1.5 GHz



Picture 7 – TBFL1, attenuation, IS211, 30 kHz – 1.5 GHz

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### 3. Typical insertion loss

The table below shows typical insertion loss of a TBFL1.

Frequency [MHz]	S21 [dB]	Frequency [MHz]	S21 [dB]
0.01	-9.53	50	-9.34
0.02	-9.48	60	-9.37
0.03	-9.80	70	-9.39
0.04	-9.58	80	-9.40
0.05	-9.48	90	-9.39
0.06	-9.43	100	-9.39
0.07	-9.38	110	-9.45
0.08	-9.36	120	-9.54
0.09	-9.36	130	-9.55
0.1	-9.39	140	-9.51
0.2	-9.33	150	-9.50
0.3	-9.31	160	-9.50
0.4	-9.32	170	-9.51
0.5	-9.31	180	-9.50
0.6	-9.31	190	-9.54
0.7	-9.30	200	-9.62
0.8	-9.30	210	-9.74
0.9	-9.31	220	-9.74
1	-9.30	230	-9.69
2	-9.32	240	-9.65
3	-9.31	250	-9.73
4	-9.31	260	-9.85
5	-9.31	280	-9.94
6	-9.31	300	-9.95
7	-9.32	350	-9.97
8	-9.31	400	-10.10
9	-9.32	450	-10.56
10	-9.31	500	-10.47
20	-9.34	550	-10.74
30	-9.34	600	-11.57
40	-9.34		

Table1: Insertion loss: 10 kHz to 600 MHz

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### 4. Caution

When using the limiter in a conducted noise set up, it is recommended to keep the RF path disconnected while powering ON or OFF the DUT. This can be done either by engaging the “OFF” position of a corresponding switch at the LISN, if available, or by disconnecting the coaxial cable at the RF connector of the LISN. DUTs representing an inductive load such as motors or switched mode power supplies can generate very powerful, high voltage transients, exceeding the ratings of the limiter or reducing the life time of the limiter. The failure mode is short circuit of the limiter Pin-diode, resulting in increased attenuation. Nevertheless, even in case of a disastrous high voltage transient, the RF input of the analyzer will remain protected by the Schottky limiter in the second attenuator stage.

### 5. Ordering Information

Part Number	Description
TBFL1	9 kHz – 600 MHz transient limiter / attenuator / high pass filter, beech-wood box

*Table 1 – Ordering Information*

### 6. History

Version	Date	Author	Changes
V1.0	30.8.2017	Mayerhofer	Creation of the document
V1.1	18.12.2017	Mayerhofer	Chapter 2 updated
V1.2	03.05.2019	Mayerhofer	Chapter 3 added
V1.3	09.03.2020	Mayerhofer	Added chapter 3 typical insertion loss Change old chapter 3 to Chapter 4
V1.4	26.05.2020	Mayerhofer	Update new product picture

*Table 2 – History*