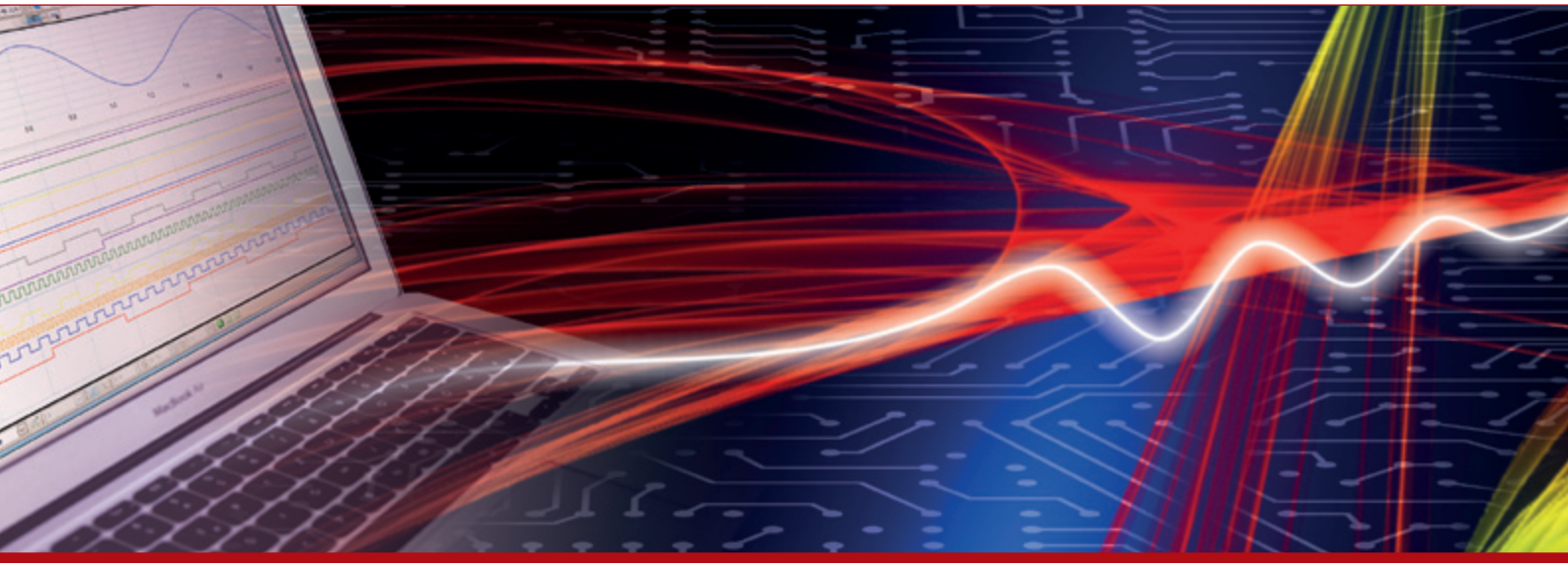
Product Datasheet - Technical Specifications



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Modulated Wideband Driver Amplifier

1 Introduction

The TBMDA7 modulated wideband driver amplifier is designed to provide an inexpensive signal source for immunity testing of electronic building blocks and products. It operates in the frequency range from 1 GHz to 3 GHz and is designed to be driven by the tracking generator output of spectrum analyzers. With a 1dB compression point of 350 mW avg. and a saturated output power of 500 mW avg., it can boost the output power of a tracking generator to drive Tekbox near field probes in order to find the sensitive spot of an electronic circuit or to create electric fields up to 150V/m CW, 80V/m AM when driving the Tekbox TEM Cell TBTC0, 80V/m CW, 45V/m AM when driving the TBTC1, 40V/m CW, 25 V/M AM when driving the TBTC2 or 27V/m CW, 15V/m AM when driving the TBTC3. Test signals for immunity testing can be CW, AM or PM. The TBMDA7 provides built in modulation capability to generate 1 kHz AM or PM signals. In PM mode, the TBMDA7 can also generate a 217 Hz Signal with 12.5% duty cycle in order to simulate mobile phone TDMA noise.

Picture 1 – TBMDA7 modulated wideband driver amplifier, front view

Picture 2 – TBMDA7 modulated wideband driver amplifier, rear view

Modulated Wideband Driver Amplifier

Application:

General-purpose gain block

Signal source for immunity testing, driving near field probes

Signal source for immunity testing, driving TEM Cells

Features:

CW amplifier (modulation off)

1 kHz, 80% AM modulation

1 kHz, 50% duty cycle pulse modulation

217 Hz, 12.5% duty cycle pulse modulation

2 Electrical Specifications

Technical Data:

Frequency range: 1 GHz – 3 GHz

RF Input / Output: 50 Ohm, SMA female; DC supply: Mini-USB-C connector

Nominal supply Voltage: 5V, typ. 800mA; maximum supply voltage 5.5V.

Nominal input power: -10 dBm to – 8 dBm; maximum input power: -5 dBm continuous, -3 dBm max.

Operating temperature range: -20°C to 50°C

Harmonics: < -10 dBc typ. @ 1.5 GHz

Harmonics: < -15 dBc typ. @ 1.5 GHz

Internal modulation frequency AM: 1 kHz ±10%

Internal modulation frequencies PM: 1 kHz ±10%, 217 Hz ±20%

Duty cycle, PM: 50% ±10% @ 1 kHz; 12.5% ±20% @ 217 Hz

Output Power, Saturated; measured with -8 dBm input power					
Frequency [MHz]	1000	1500	2000	2500	3000
Saturated Output Power [dBm]	24,35	26,3	28	29,3	27,3
Saturated Output Power [W]	0,272	0,427	0,631	0,851	0,537

Table 1 – TBMDA7 saturated output power

Output Power, P1dB; measured with -10 dBm input power					
Frequency [MHz]	1000	1500	2000	2500	3000
P1dB [dBm]	22,1	25	27,1	27,3	26,4
P1dB [W]	0,162	0,316	0,513	0,537	0,437

Table 2 – TBMDA7 saturated output power

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Input power: -8/-10/-12/-15 dBm									
Frequency [MHz]	1000	1250	1500	1750	2000	2250	2500	2750	3000
Gain @ -15dBm [dB]	36,7	39,5	40,7	41,3	41,9	42,6	42,1	40,1	38,4
Gain @ -12dBm [dB]	36,1	38,6	39,7	40,6	41,4	42,1	41,8	39,9	38,2
Gain @ -10dBm [dB]	35,3	37	38,1	39,4	40,3	40,9	40,9	39,5	38
Gain @ -8dBm [dB]	33,9	35,2	36,4	37,7	38,7	39,5	39,6	39,3	37,9

Table 3 – TBMDA7 gain

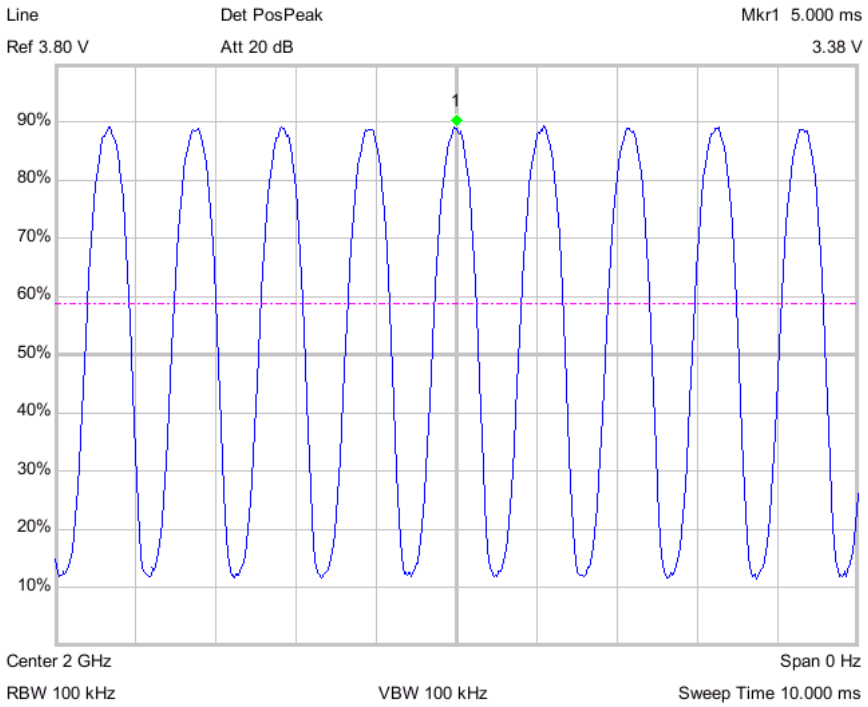

Figure 2 – 1 kHz, 80 % AM envelope, applying the drive levels given in table 3, 2 GHz

Modulated Wideband Driver Amplifier

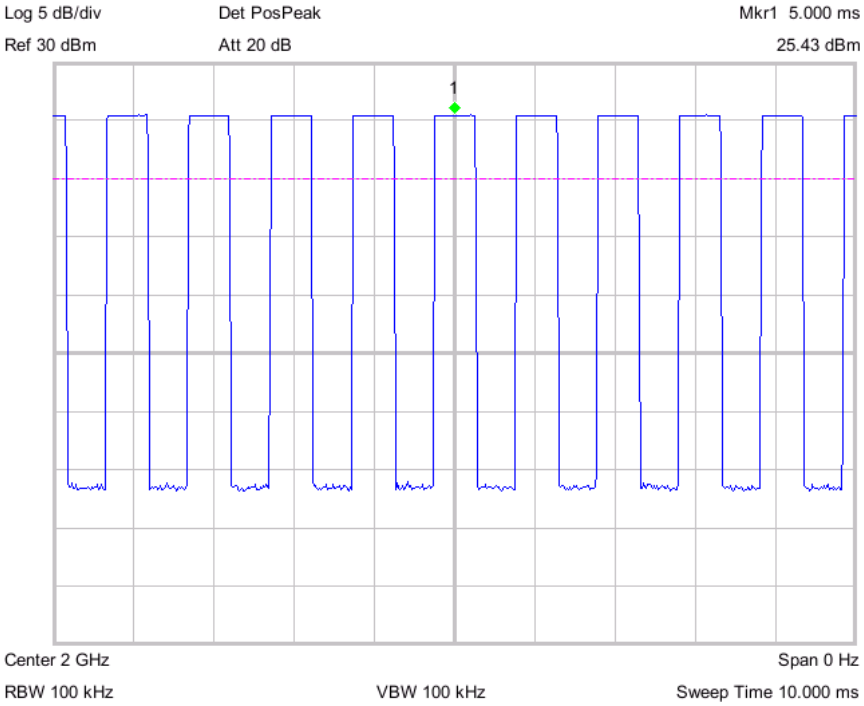

Figure 3 – 1 kHz, 50 % PM envelope, 2 GHz

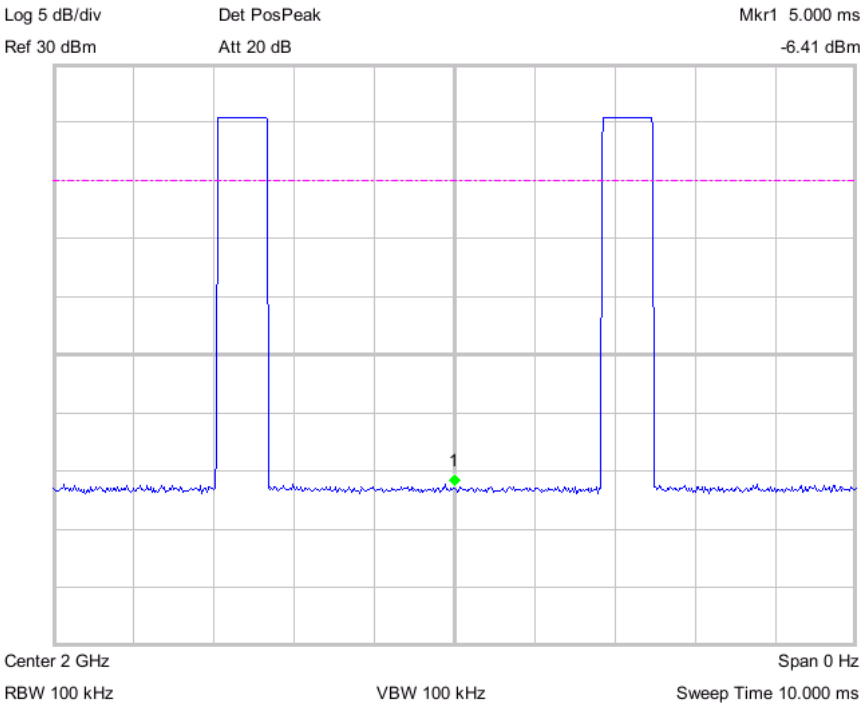

Figure 4 – 217 Hz, 12.5 % PM envelope, 2 GHz

Modulated Wideband Driver Amplifier

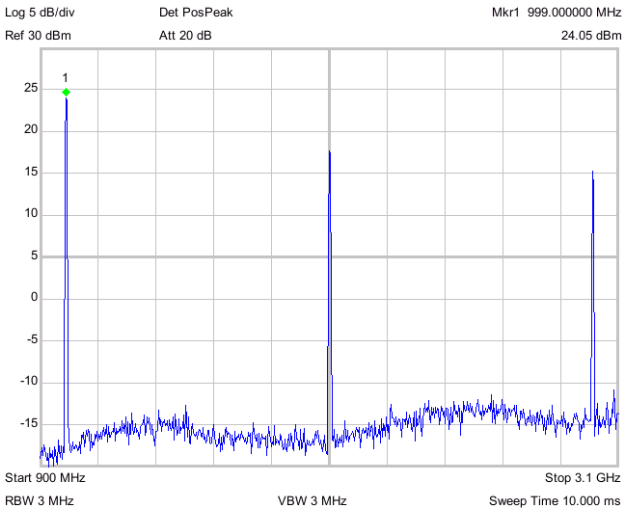

Figure 5 – CW, harmonics, saturated output power, 1 GHz

3 Power supply

The current consumption of the TBMDA7 is 800mA. Supply the TBMDA7 through a USB 3.0 port or a mobile phone charger with an output current capability of 1A or higher.

Connector: Mini-USB-C

4 Applications

Immunity testing using a TEM cell

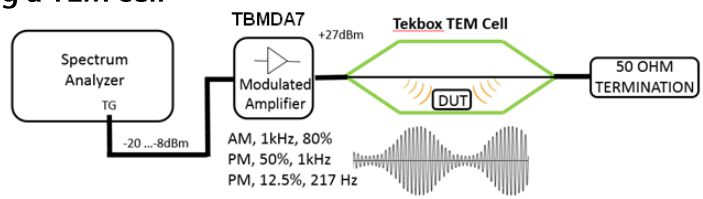

Figure 6 – immunity testing setup

Immunity testing using near field probes

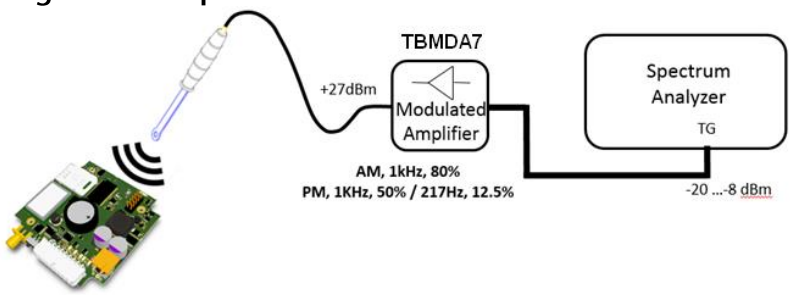

Figure 7 – immunity testing setup

Modulated Wideband Driver Amplifier

5 TEM Cell field strength

A typical pre compliance set up for immunity testing is typically not sophisticated enough to measure the real field strength inside the TEM cell. However, the field strength can be approximated mathematically.

The E-field (V/m) between septum and lower (upper) wall of a TEM cell is E = V/d where V is the RMS voltage of the applied signal and d is the distance between septum and lower (upper) wall. This is based on the simplified assumption that the E field would be perfectly homogenous/evenly distributed. A more practical formula is E = V*Cor/d where Cor is a correction factor for the average field strength over the volume of the DUT derived from the analysis of the field distribution over the cross section of the cell.

Assuming the DUT is placed in the center of the cell and in the middle between bottom wall and septum, we can however use the simplified formula with sufficient accuracy.

TBTC0: d = 2.8 cm -> $E_{[V/m]} = (\sqrt{(P*50\Omega)})*35.7$

TBTC1: d = 5 cm -> $E_{[V/m]} = (\sqrt{(P*50\Omega)})*20$

TBTC2: d = 10 cm -> $E_{[V/m]} = (\sqrt{(P*50\Omega)})*10$

TBTC3: d = 15 cm -> $E_{[V/m]} = (\sqrt{(P*50\Omega)})*6.66$

The power P in the formulas above hast to be entered in [Watt]

$P_{[W]} = 0.001*(10^{\wedge} (P_{[dBm]}/10))$

Frequency [MHz]	Input power [dBm]	Output power [dBm]	Field strength TBTC0 [V/m]	Field strength TBTC1 [V/m]	Field strength TBTC2 [V/m]	Field strength TBTC3 [V/m]
1000	-10	23	112	63	31	n.a
1100	-10	24.3	131	73	37	n.a
1200	-10	24.7	137	77	38	n.a
1300	-10	24.6	135	76	n.a	n.a
1400	-10	25.3	146	82	n.a	n.a
1500	-10	25.3	147	83	n.a	n.a
1600	-10	26.2	163	91	n.a	n.a
1700	-10	26.3	164	92	n.a	n.a
1800	-10	26.4	168	94	n.a	n.a
1900	-10	26.9	176	99	n.a	n.a
2000	-10	27.5	189	106	n.a	n.a
2100	-10	27.8	196	110	n.a	n.a
2200	-10	28.1	202	n.a	n.a	n.a
2300	-10	28.3	206	n.a	n.a	n.a
2400	-10	28.7	216	n.a	n.a	n.a
2500	-10	28.4	210	n.a	n.a	n.a
2600	-10	28.3	208	n.a	n.a	n.a
2700	-10	27.6	192	n.a	n.a	n.a
2800	-10	27.5	190	n.a	n.a	n.a
2900	-10	26.9	176	n.a	n.a	n.a
3000	-10	26.5	168	n.a	n.a	n.a

Table 4 – calculated field strength for TBMDA7 driving Tekbox TEM cells

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The calculations above refer to a CW signal.

To achieve the same RMS fieldstrength with an AM signal, 5.1 dB higher peak power is required.

To achieve the same RMS power with 50% duty cycle pulse modulation, 3 dB higher peak power is required.

6 PC Software for immunity testing

The Tekbox EMCview SW supports immunity pre-compliance testing with a feature for automated tracking generator control. This significantly simplifies immunity testing, especially in case of repeated testing during debugging and validation of DUT modifications/improvements.

Tekbox EMCview currently supports Rigol, Siglent, Owon, UNI-T, Teledyne, BK-Precision, R&S FPC and FPH series spectrum analyzers.

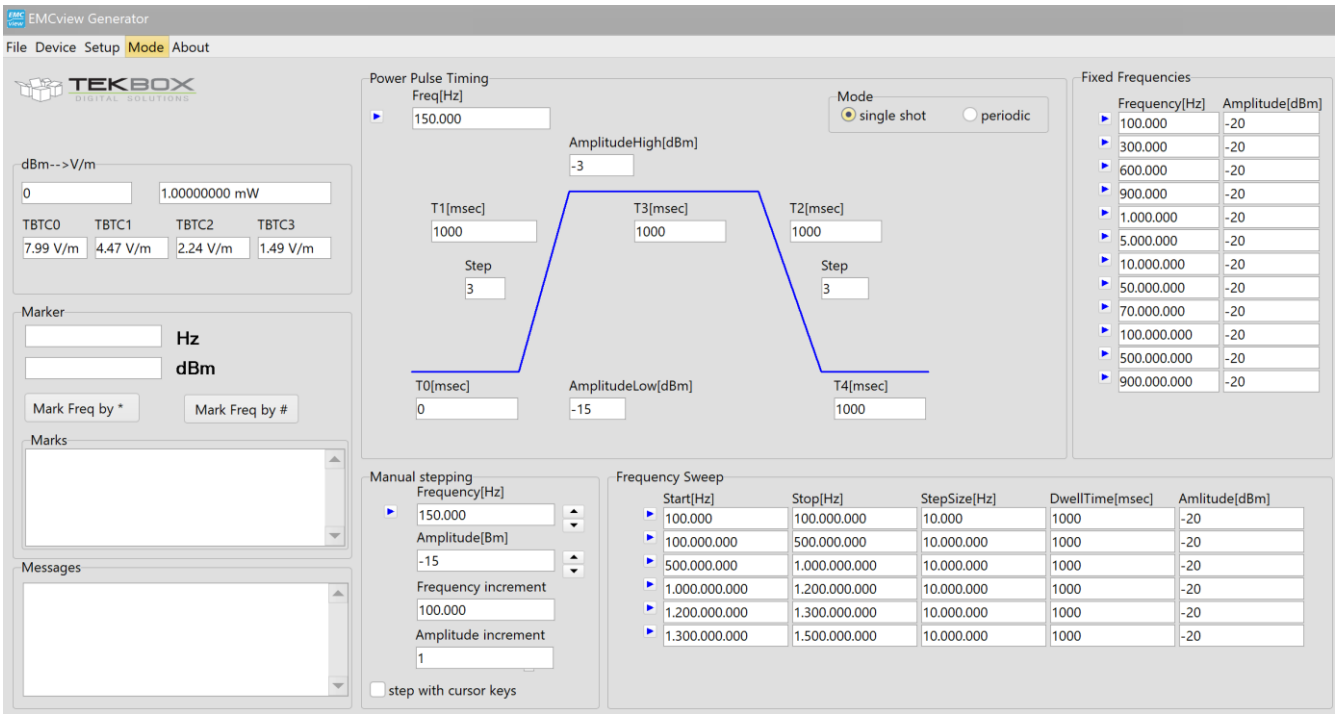

Figure 8 – screenshot of the tracking generator control feature of EMCview

WARNING:

Never connect the output of the TBMDA7 directly to the input of a spectrum analyzer. Check the maximum input ratings of the spectrum analyzer and protect it with an appropriate attenuator.

Example:

Rigol DSA815 – maximum input power rating: +20dBm

Modulated Wideband Driver Amplifier

7 Ordering Information

Part Number	Description
TBMDA7	modulated driver amplifier, 2 pcs 75cm SMA-male to N-male cables, 1 pc 20dB attenuator with N-connectors, USB cable,

Table 5 – Ordering Information

8 History

Version	Date	Author	Changes
V1.0	5.6.2024	Mayerhofer	Creation of the document

Table 6 – History