250MHz – 1300 MHz Log Periodic Measurement Antenna

1 Introduction

CISPR 16 divides the frequency range into several bands and defines specific antennas for each of these bands. For the frequency range above 300 MHz up to 1 GHz, CISPR 16 specifies using logarithmic periodic antennas (log-periodic antennas) for radiated noise measurements.

The TBMA3 is an affordable logarithmic periodic measurement antenna, targeting radiated noise EMC pre-compliance testing.
The TBMA3 is characterized from 250 MHz to 1.3 GHz and has VSWR and antenna factor values typical for log-periodic measurement antennas.



2 Product overview

The TBMA3 is an average sized log-periodic antenna, with its radiating elements and supporting booms made from powder coated aluminum alloy. It is equipped with a standard female N-connector and comes together with an antenna bracket and a mounting adapter. A standard ¼" thread on the bottom of the mounting adapter makes it easy to connect it to most standard tripods.

The TBMDA3 is shipped in a robust carrying case, as pictured above.

3 Technical specifications

- Type: logarithmic periodic	- Voltage Standing Wave Ratio (VSWR): < 1.95:1 over the entire frequency range ; 1.35:1 average
- Frequency range: 250 MHz– 1300 MHz	- Width: 749 mm (29.49")
- Nominal impedance: 50 Ω	- Height (With the mounting adapter): 170.23 mm (6.70")
- Connector: N type female	- Height (Without the mounting adapter): 79.5 mm (3.13")
- Maximum continuous input RF power: 100 W	- Depth: 863 mm (33.98")
- Isotropic gain: 6 dBi ± 1.5 dB	- Weight: 1.78 kg (3.92 lbs)
- Antenna factor: 14.2 … 27.5 dB/m	- Tripod Adapter Thread Size: ¼"

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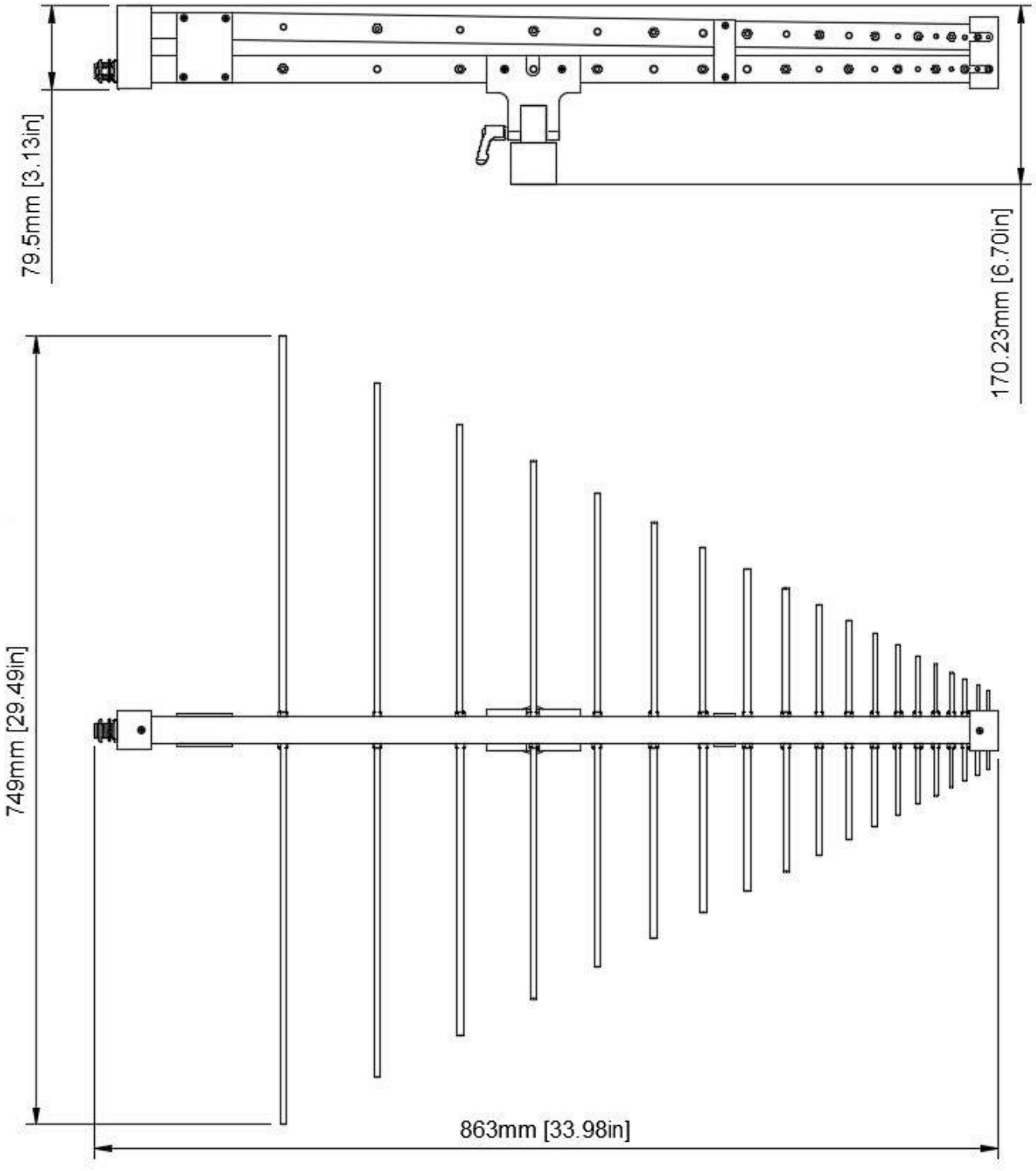

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4 TBMA3 Antenna characterization

4.1 Gain & Antenna Factor versus frequency

Frequency	Wavelength	Gain (Isotropic)	Gain (Dipole)	Antenna Factor
MHz	m	dBi	dBd	dB/m
250	1.20	0.41	-1.74	17.77
255	1.18	2.62	0.47	15.74
260	1.15	4.18	2.03	14.34
265	1.13	4.46	2.31	14.23
270	1.11	4.58	2.43	14.27
275	1.09	4.70	2.55	14.31
280	1.07	4.79	2.64	14.37
285	1.05	4.10	1.95	15.22
290	1.03	4.81	2.66	14.66
295	1.02	5.25	3.10	14.37
300	1.00	5.32	3.17	14.44
310	0.97	5.35	3.20	14.70
320	0.94	5.65	3.50	14.67
325	0.92	5.79	3.64	14.67
330	0.91	5.90	3.75	14.69
340	0.88	6.02	3.87	14.83
350	0.86	5.96	3.81	15.14
360	0.83	5.98	3.83	15.37
370	0.81	6.02	3.87	15.56
375	0.80	5.96	3.81	15.75
380	0.79	5.99	3.84	15.83
390	0.77	6.04	3.89	16.00
400	0.75	6.02	3.87	16.24
425	0.71	5.40	3.25	17.39
435	0.69	4.15	2.00	18.84
450	0.67	6.07	3.92	17.21
475	0.63	6.30	4.15	17.46
500	0.60	6.14	3.99	18.06
520	0.58	6.02	3.87	18.52
550	0.55	6.42	4.27	18.61
580	0.52	6.73	4.58	18.76
600	0.50	6.73	4.58	19.05
620	0.48	6.75	4.60	19.32
650	0.46	6.74	4.59	19.74
680	0.44	6.24	4.09	20.63
700	0.43	6.54	4.39	20.58
750	0.40	6.58	4.43	21.14
800	0.38	6.59	4.44	21.69
850	0.35	6.69	4.54	22.12
900	0.33	6.32	4.17	22.98
950	0.32	6.13	3.98	23.64
1000	0.30	6.36	4.21	23.86
1050	0.29	5.98	3.83	24.66
1100	0.27	5.49	3.34	25.56
1150	0.26	5.14	2.99	26.29
1200	0.25	4.37	2.22	27.43
1300	0.23	4.96	2.81	27.54

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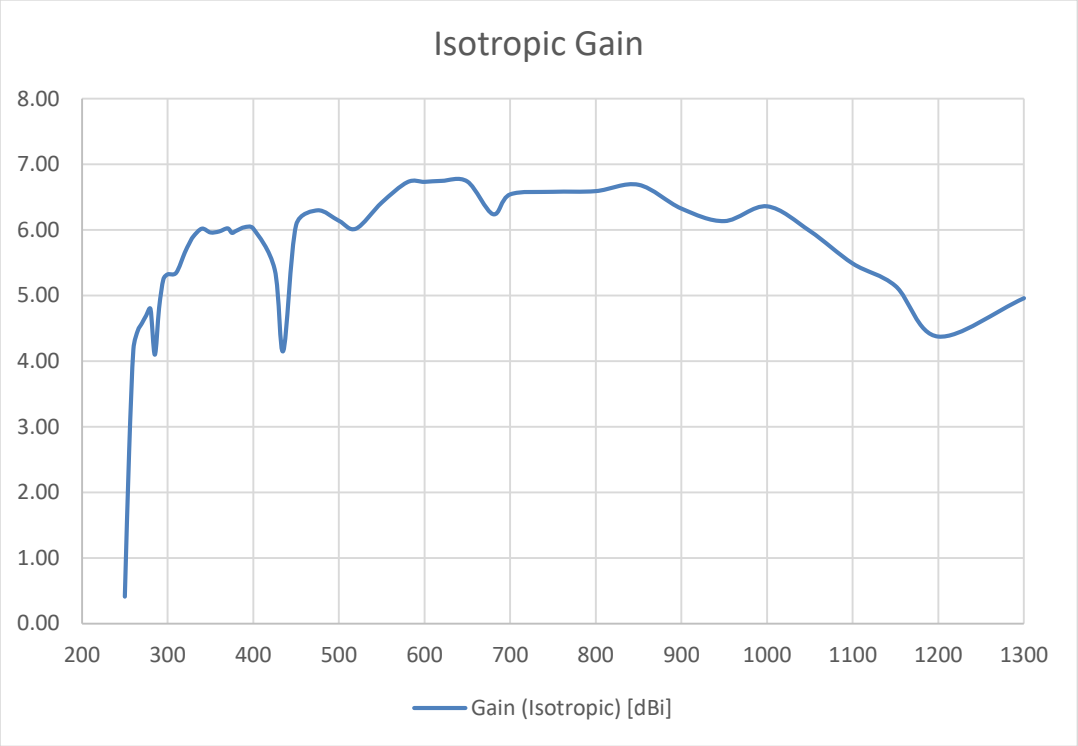
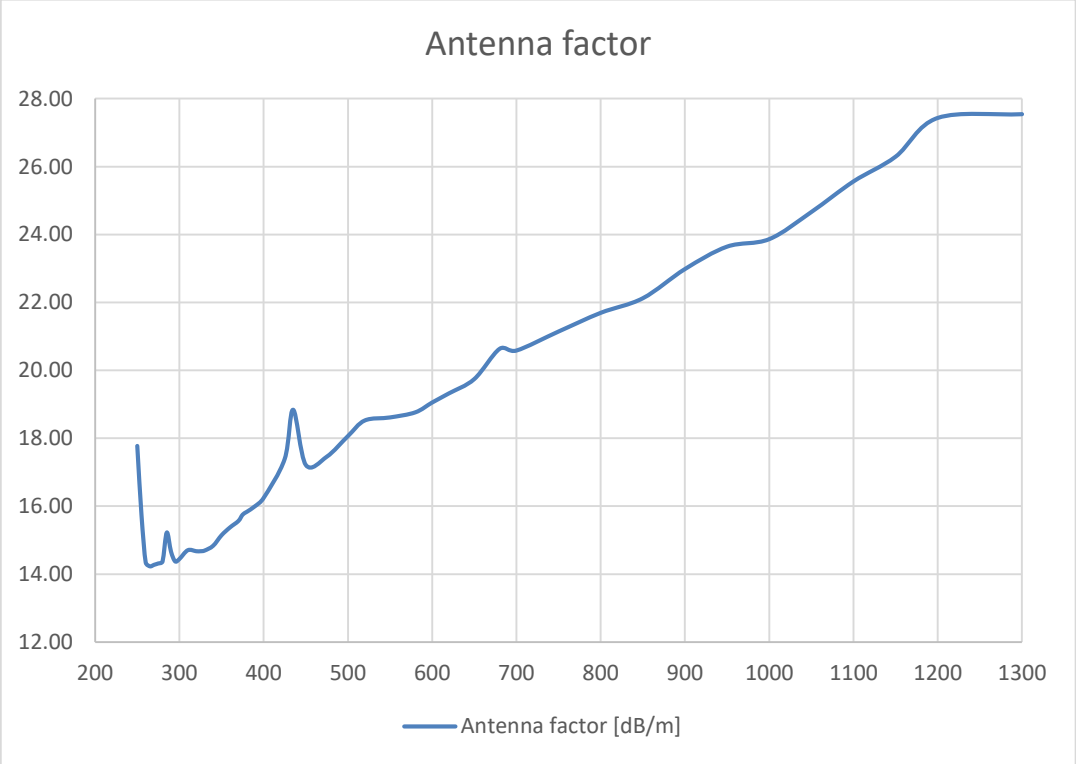


250 MHz … 1.3 GHz, Isotropic Gain of TBMA3



250 MHz … 1.3 GHz, Antenna Factor of TBMA3

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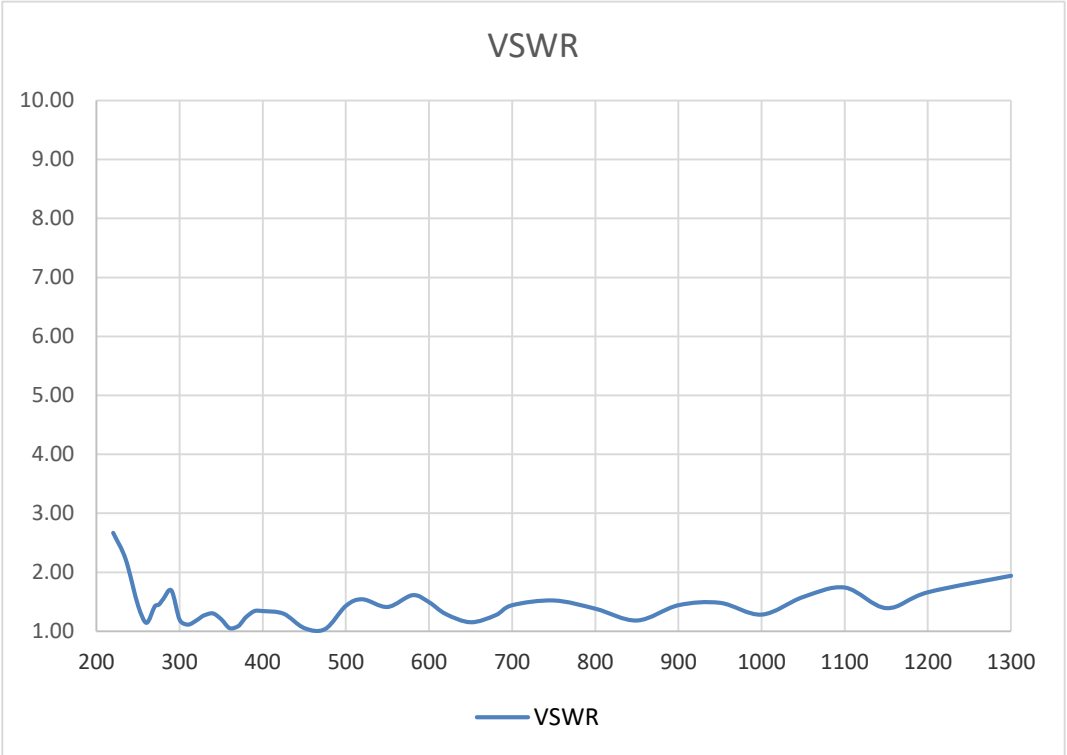
4.2 TBMA3 Return Loss / VSWR

TBMA3, S11, 250 MHz … 1.3 GHz



TBMA3, VSWR, 250 MHz … 1.3 GHz

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5 Application

The TBMA3 was designed, targeting radiated noise EMC pre-compliance measurement in the frequency range 250 MHz to 1300 MHz. In order to make optimum use of the TBMA3, a few details need to be considered:

The antenna factor has to be added to the measurement result in order to convert the level [dBm] into an equivalent electrical field strength [dBmV/m]. This conversion will also add to the base noise level of the spectrum analyzer which reduces the margin between base noise and limit lines.

If there is no risk of overloading the spectrum analyzer RF-input, decrease the internal attenuation to 0 dB and turn on the pre-amplifier to optimize the dynamic range of the measurement. Use a low loss coaxial cable to connect the antenna to the spectrum analyzer. CISPR 16 specifies a resolution bandwidth of 120 KHz for frequency ranges 300 MHz to 1 GHz. Consequently, lowering the RBW cannot be utilized to reduce the base noise level. However, in cases of standards with challenging limits with respect to the base noise level of pre-compliance spectrum analyzers, the antenna could be moved closer to the DUT and the limits converted accordingly. This will result in additional margin between base noise and limit levels. Since the TBMA3 is used for measurements above 250 MHz, 10m or 3m distance limits could be converted to 1m distance limits, resulting in 20dB or 10 dB additional margin to the base noise level. With 1m distance and measurement frequencies > 250 MHz, the antenna is already in the far field for any frequency.

Use the table below in order to convert limits to another measurement distance:

Conversion 3 m to 1 m	add 9.5 dB to the 3m limits
Conversion 10 m to 1 m	add 20 dB to the 10m limits
Conversion 10 m to 3 m	add 10.5 dB to the 10m limits

The table above is based on following formula:

$P_s = P_m + 20log\frac{D_m}{D_s}$ [dBm]

where D_m is the actual measurement distance and D_s is the specified distance in the relevant standard.

P_m is the RF power measured in the actual measurement distance.

P_s represents the calculated equivalent RF power in the distance specified in the relevant standard.

6 Ordering Information

Part Number	**Description**
TBMA3	250 – 1300 MHz log-periodic measurement antenna; mounting adapter, carrying case

7 History

Version	Date	Author	Changes
V1.0	5.21.2021	Mayerhofer	Creation of the document
V 1.1	6.16.2021	Gharachorloo	Updated in chapter 4