

EMC & OPTICS

Antenna Calibration NEWS

→ CISPR 16-1-6 – new calibration standard

→ ANSI C63.4 – new issue includes antenna calibration procedures

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New Calibration Standard and Changes in Current Standards

In the end of 2014 a new calibration standard was issued – the **CISPR 16-1-6**, dealing with EMC-Antenna Calibration. This standard describes several different calibration methods for EMC antennas (on open area test site or in free-space environment). The Free-Space Antenna Factor is determined using the

- *Three-Antenna-Method (TAM)*
- *Standard-Site-Method (SSM – three antenna method above groundplane)*
- *Standard-Antenna-Method (SAM)*

in different set ups. Table 1 in the CISPR 16-1-6 standard clearly states which method is applied for which type of antenna and for a certain frequency range. These specifications have an impact on future calibrations especially for log. periodic antennas (LPDA) and hybrid antennas due to their wide frequency range exceeding 1GHz. Calibrations need to be performed on an OATS (30 – 1000 MHz) and in free-space conditions (1000 MHz and above).

Also the revised calibration standard **ANSI C63.4** includes important information regarding antenna calibration procedures where similar statements are applicable on LPDA and hybrid antennas.

The following table should give an overview of calibration procedures applied to different antenna types. Specifications for antenna calibration according to CISPR 16-1-6, ANSI C63.4 and ANSI C63.5 are listed afterward. Accredited calibrations in accordance with the stated standards were adapted and can be provided by our laboratory. Different other antenna configurations are possible but may not be in accordance with a standard.

Antenna Type	Frequency Range	Test Site	Method	d [m]	h _{TX} [m]	h _{RX} [m]	ANSI C63.4 [2014]	ANSI C 63.5 [2006]	CISPR 16-1-6 [2014]
biconical antenna	30 - 1000 MHz	OATS	SSM	10	2	1-4	✓	✓	✓
log. periodic antenna	30 - 1000 MHz	OATS	SSM	10	2	1-4	✓	✓	✓
hybrid antenna	30 - 1000 MHz	OATS	SSM	10	2	1-4	✓	✓	✓
log. periodic antenna	> 1000 MHz	OATS	SSM	10	2	1-4	✗	✗	✗
hybrid antenna	> 1000 MHz	OATS	SSM	10	2	1-4	✗	✗	✗
log. periodic antenna	> 1000 MHz	FS	TAM	3	-	-	✓*	✓*	✓
hybrid antenna	> 1000 MHz	FS	TAM	3	-	-	✓*	✓*	✓
horn antenna	1 - 18 GHz	FS	TAM	3	-	-	-	-	✓
horn antenna	1 - 40 GHz	FS	SSM	3	-	-	✓*	✓*	-
biconical (+hybrid part)	30 - 300 MHz	FS	SAM	4	8	8	✗	✗	✓
log. Periodic (+hybrid part)	200 - 18000 MHz	FS	SAM	2.5	4	4	✗	✗	✓
log. Periodic (+hybrid part)	200 - 18000 MHz	FS (AC)	SAM	2.5	-	-	✗	✗	✓

* CISPR 16-1-6 uses two expressions TAM & SSM, ANSI C63.4 & C63.5 uses only the expression SSM.

The following table recommends the calibration procedures for the most common radiated emission test standards, this makes the choice easy.

Radiated Emission Test Standard	Calibration Standard (Recommended)
CISPR 11, 13, 14, 16-2-3, 22, 32	CISPR 16-1-6
ANSI C63.4	ANSI C63.5, ANSI C63.4
IEC 61000-6-3 IEC 61000-6-4	CISPR 16-1-6
Precompliance Testing	Individual calibration set up on OATS or Free-Space according to: Standard Site Method (SSM) Three Antenna Method (TAM) Standard Antenna Method (SAM)

Calibration of Broadband Antennas according to CISPR 16-1-6

Free space antenna factor calibration of a broadband antenna (biconical, log. periodic, hybrid antenna) according to CISPR 16-1-6.

No.	Standard and Frequency Range								
A1c1	CISPR 16-1-6 (up to 1 GHz):								
A1c2	CISPR 16-1-6 (> 1 GHz):								
A1c3	CISPR 16-1-6 (> 1 GHz)*: * results up to 1 GHz according to the standard; results > 1 GHz only for information								
A1c1	<p><u>Antenna Factor*</u>: Frequencyrange: up to 1 GHz Calibrationmethod: Standard Site Method (SSM) d=10m; h_{TX}=2m; h_{RX}=1-4m; horizontal; OATS</p>								
A1c2	<table border="0"> <tr> <td><u>Part A – Antenna Factor*</u>:</td> <td><u>Part B – Antenna Factor*</u>:</td> </tr> <tr> <td>Frequencyrange: 30 – 1000 MHz</td> <td>> 1 GHz</td> </tr> <tr> <td>Calibrationmethod: Standard Site Method (SSM)</td> <td>Three Antenna Method (TAM)</td> </tr> <tr> <td>d=10m; h_{TX}=2m; h_{RX}=1-4m; horizontal; OATS</td> <td>d=3m; vertical; Free-Space</td> </tr> </table>	<u>Part A – Antenna Factor*</u> :	<u>Part B – Antenna Factor*</u> :	Frequencyrange: 30 – 1000 MHz	> 1 GHz	Calibrationmethod: Standard Site Method (SSM)	Three Antenna Method (TAM)	d=10m; h _{TX} =2m; h _{RX} =1-4m; horizontal; OATS	d=3m; vertical; Free-Space
<u>Part A – Antenna Factor*</u> :	<u>Part B – Antenna Factor*</u> :								
Frequencyrange: 30 – 1000 MHz	> 1 GHz								
Calibrationmethod: Standard Site Method (SSM)	Three Antenna Method (TAM)								
d=10m; h _{TX} =2m; h _{RX} =1-4m; horizontal; OATS	d=3m; vertical; Free-Space								
A1c3	<p><u>Antenna Factor*</u>: Frequencyrange: whole frequency range results up to 1 GHz according to the standard; results > 1 GHz only for information Calibrationmethod: Standard Site Method (SSM) d=10m; h_{TX}=2m; h_{RX}=1-4m; horizontal; OATS</p>								
* AF in compliance with ANSI C63.5 & ANSI C63.4									
All options include VSWR and antenna balance									
<u>VSWR</u> :	h _{TX} =2m; horizontal; OATS								
<u>Antenna Balance</u> :	up to 300 MHz; d=10m; vertical; OATS h _{RX} =1.5m; h _{TX} = largest active antenna element 0.1 m above groundplane								

Additionally (not specified and required by the standards) we offer the evaluation of the polarization and distance dependence of the antenna factor up to 1 GHz:

- calibration in horizontal and vertical polarization
- calibration in 10 m and 3 m distance

