

中国认可
国际互认
校准
CALIBRATION
CNAS L0502

校准证书

Calibration Certificate

证书编号
Certificate No.客户名称
Client器具名称
Instrument型号/规格
Type/Model出厂编号
Serial No.生产厂商
Manufacturer联络信息
Contact Information校准日期
Date of Calibration接收日期
Date of Receiving

批准人:

Approved by

发布日期: 2024 年 01 月 31 日
Date of Issue地址: 中国北京北三环东路 18 号
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中国计量科学研究院



证书编号
Certificate No.

中国计量科学研究院(NIM)是国家最高的计量科学研究中心和国家级法定计量技术机构。1999年授权签署了国际计量委员会(CIPM)《国家计量基(标)准和国家计量院签发的校准与测量证书互认协议》(CIPM MRA)。The National Institute of Metrology (NIM) is China's national metrology institute (NMI) and a state-level legal metrology institute. NIM is China's signatory to the Mutual Recognition of National Measurement Standards and of Calibration and Measurement Certificates Issued by National Metrology Institutes (CIPM MRA) which is arranged by the International Committee of Weights and Measures (CIPM).

质量管理体系符合 ISO/IEC17025 标准,通过中国合格评定国家认可委员会(CNAS)和亚太计量规划组织(APMP)联合评审的校准和测量能力(CMCs)在国际计量局(BIPM)关键比对数据库中公布。NIM's quality management system meets requirements of the ISO/IEC 17025. Its Calibration and Measurement Capabilities (CMCs) that are peer reviewed both by China National Accreditation Service for Conformity Assessment (CNAS) and the Asia Pacific Metrology Programme (APMP) are published in the International Bureau of Weights and Measures (BIPM) Key Comparison Database (KCDB).

2020年,NIM和CNAS就认可领域的技术评价活动签署了谅解备忘录,承认NIM的计量支撑作用和出具的校准/检测结果的溯源效力。NIM and CNAS signed a Memorandum of Understanding (MOU) for Recognition of Technical Assessment in Laboratory Accreditation Field in 2020, in which CNAS recognizing the technical supporting role of NIM in laboratory accreditation and the traceability of NIM's calibration / test results.

校准结果不确定度的评估和表述均符合 JJF1059 系列标准的要求。The evaluation and expression of uncertainty of the calibration results are in line with the requirements of JJF1059 series standards.

校准所依据/参照的技术文件(代号、名称) Reference documents (Code,Name)

JJF 1897-2021 30MHz-1GHz 测量天线校准规范;

NIM-ZY-XD-DJ-002 鞭状、双锥、对数周期、复合及微波喇叭天线校准作业指导书。

校准环境条件及地点 Calibration place and environment

温度 Temperature: 3°C 地点 Location: 昌平 Changping 开阔场 OATS

湿度 Humidity: 38% RH 其它 Others: /

校准使用的计量基(标)准装置(含标准物质)/主要仪器

Reference Standards (Including the Reference Material) / Instruments used

名称 Name	测量范围 Measurement Range	不确定度/ 准确度等级 Uncertainty/Accuracy	证书编号 Certificate No.	证书有效期至 Due Date (YYYY-MM-DD)
矢量网络分析仪 Vector Network Analyzer	100kHz~ 8.5GHz	(0.1~0.3)dB (k=2)	XDgp2023-01941	2024/06/30
地面反射场法 天线测量标准装置 Metrology Standard of Antenna Measurement Based on Ground-Reflection Range	30MHz~ 1GHz	(0.4~1.0)dB (k=2)	[2014]国量标计证 字第 278 号	2027/07/28

校准结果 Calibration Results

1. 校准参考文件 Calibration Reference Standard Documents

- (1) JJF 1897-2021 《30MHz~1GHz 测量天线校准规范》
JJF 1897-2021 Calibration Specification for Measurement Antennas from 30MHz to 1GHz
- (2) NIM-ZY-XD-DJ-002 鞭状、双锥、对数周期、复合及微波喇叭天线校准作业指导书

上述标准包含以下文件

The above standards contain the following documents:

- (1) GB/T 6113.106-2018 《无线电骚扰和抗扰度测量设备和测量方法规范第 1-6 部分：无线电骚扰和抗扰度测量设备 EMC 天线校准》
GB/T 6113.106-2018 Specification for radio disturbance and immunity measuring apparatus and methods-Part 1-6: Radio disturbance and immunity measuring apparatus — EMC antenna calibration
- (2) ANSI C63.5-2017 American National Standard for Electromagnetic Compatibility- Radiated Emission Measurements in Electromagnetic Interference (EMI) Control- Calibration and Qualification of Antennas (9 kHz to 40 GHz)
- (3) CISPR 16-1-6-2022 Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods-Part 1-6: Radio Disturbance and Immunity Measuring Apparatus — EMC Antenna Calibration.

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2. 校准说明 Notes for the calibration details

- (1) 自由空间或准自由空间天线系数是当前有效版本 (包括 CISPR 16-1-6-2022 和 ANSI C63.5-2017)标准中用于产品电磁辐射发射测量的默认天线系数。

The free-space or near free-space antenna factor is the default parameter used for measuring the electric field strength radiated from a device under test, according to the present standard for EMC antenna calibrations, CISPR 16-1-6-2022 and ANSI C63.5-2017.

- (2) 本报告中的天线系数为准自由空间天线系数,是依据 CISPR 16-1-6-2022 第 8.4 节和 ANSI C63.5-2017 第 5 章中的标准场地法在以下特定条件下测量得到的:

- 1) 收、发天线参考点的水平投影之间距离为 10m;
- 2) 收、发天线均为水平极化;
- 3) 发射天线离地面高度 2m;
- 4) 接收天线在 1m ~ 4m 高度范围内垂直扫描寻找最大场强。

The antenna factor in this certificate is near free-space antenna factor, which is measured according to the Standard Site Method in Clause 8.4 of CISPR 16-1-6-2022 and Clause 5 ANSI C63.5-2017 under the following specific conditions:

- 1) The separation between the reference points projected horizontally on the ground is 10m;
- 2) Both the transmit antenna and receive antenna are set up horizontally polarized;
- 3) The transmit antenna is 2m in height;
- 4) Receive antenna is scanning between 1m to 4m vertically to measure the maximum field strength.

- (3) 开阔试验场金属反射面尺寸为 60m×40m, 四周铺设底边长 5m 高为 10m 的等腰三角形金属网; 98%的点的平整度位于±6mm 以内。

The dimension of the metal ground plane is 60m×40m. An isosceles triangular metal mesh with a base length of 5 m and a height of 10 m is laid all around. The flatness is within ±6mm for the 98% sampling points at the metal ground plane.

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3. 校准数据 Calibration Data

频率 Frequency (MHz)	天线系数 F_a (dB(m ⁻¹))	增益 Gain (dBi)
30	27.0	-27.2
31	26.7	-26.6
32	26.3	-26.0
33	26.0	-25.4
34	25.7	-24.8
35	25.0	-23.9
36	24.8	-23.5
37	24.7	-23.1
38	24.1	-22.3
39	23.5	-21.5
40	23.0	-20.8
41	22.7	-20.2
42	22.4	-19.7
43	21.8	-18.9
44	21.0	-17.9
45	20.7	-17.4
46	20.3	-16.9
47	19.8	-16.1
48	19.1	-15.3
49	18.6	-14.5
50	18.2	-14.0
51	17.8	-13.4
52	17.2	-12.7
53	16.5	-11.8
54	16.0	-11.2
55	15.6	-10.6
56	15.2	-10.0

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3. 校准数据 Calibration Data (续)

频率 Frequency (MHz)	天线系数 F_a (dB(m ⁻¹))	增益 Gain (dBi)
57	14.4	-9.1
58	13.9	-8.4
59	13.4	-7.8
60	13.0	-7.2
61	12.3	-6.4
62	11.7	-5.7
63	11.2	-5.0
64	10.8	-4.4
65	10.3	-3.8
66	9.7	-3.1
67	9.2	-2.5
68	8.8	-2.0
69	8.4	-1.4
70	8.0	-0.9
71	7.6	-0.4
72	7.3	0.0
73	7.1	0.4
74	6.9	0.7
75	6.8	0.9
76	6.8	1.1
77	6.7	1.2
78	6.7	1.3
79	6.8	1.3
80	6.9	1.4
81	6.9	1.4
82	6.9	1.5
83	7.1	1.5

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3. 校准数据 Calibration Data (续)

频率 Frequency (MHz)	天线系数 F_a (dB(m ⁻¹))	增益 Gain (dBi)
84	7.2	1.5
85	7.4	1.4
86	7.5	1.4
87	7.6	1.4
88	7.8	1.3
89	7.9	1.3
90	8.1	1.2
91	8.2	1.2
92	8.3	1.2
93	8.5	1.1
94	8.6	1.1
95	8.7	1.1
96	8.9	1.0
97	9.0	1.0
98	9.1	1.0
99	9.2	1.0
100	9.3	0.9
101	9.5	0.8
102	9.5	0.8
103	9.6	0.8
104	9.8	0.8
105	9.9	0.8
106	9.9	0.8
107	9.9	0.9
108	9.9	1.0
109	9.9	1.0
110	9.9	1.1

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3. 校准数据 Calibration Data (续)

频率 Frequency (MHz)	天线系数 F_a (dB(m ⁻¹))	增益 Gain (dBi)
111	9.8	1.3
112	9.8	1.4
113	9.9	1.4
114	10.0	1.4
115	10.0	1.5
116	9.9	1.6
117	9.9	1.7
118	10.1	1.6
119	10.2	1.5
120	10.4	1.4
121	10.4	1.5
122	10.4	1.5
123	10.5	1.5
124	10.6	1.4
125	10.6	1.5
126	10.6	1.6
127	10.6	1.7
128	10.5	1.8
129	10.4	2.0
130	10.2	2.3
131	10.1	2.4
132	10.1	2.5
133	10.1	2.6
134	9.9	2.8
135	9.8	3.0
136	9.8	3.1
137	9.8	3.2

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3. 校准数据 Calibration Data (续)

频率 Frequency (MHz)	天线系数 F_a (dB(m ⁻¹))	增益 Gain (dBi)
138	9.7	3.3
139	9.6	3.5
140	9.5	3.7
141	9.4	3.8
142	9.4	3.9
143	9.2	4.1
144	9.1	4.3
145	9.0	4.4
146	9.0	4.5
147	8.9	4.6
148	8.8	4.8
149	8.7	5.0
150	8.7	5.1
151	8.7	5.1
152	8.7	5.2
153	8.6	5.3
154	8.6	5.4
155	8.6	5.4
156	8.6	5.5
157	8.5	5.6
158	8.3	5.9
159	8.2	6.0
160	8.2	6.1
161	8.2	6.2
162	8.1	6.3
163	8.0	6.4
164	8.0	6.5

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3. 校准数据 Calibration Data (续)

频率 Frequency (MHz)	天线系数 F_a (dB(m ⁻¹))	增益 Gain (dBi)
165	8.0	6.5
166	8.0	6.6
167	8.0	6.7
168	8.0	6.7
169	8.0	6.8
170	7.9	6.9
171	7.9	6.9
172	7.9	7.0
173	7.9	7.0
174	7.9	7.1
175	7.9	7.2
176	7.9	7.2
177	7.9	7.2
178	8.0	7.3
179	8.0	7.3
180	8.0	7.3
181	8.0	7.4
182	8.0	7.4
183	8.1	7.4
184	8.1	7.4
185	8.2	7.4
186	8.2	7.4
187	8.3	7.4
188	8.4	7.2
189	8.7	7.1
190	9.0	6.8
191	9.3	6.6

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3. 校准数据 Calibration Data (续)

频率 Frequency (MHz)	天线系数 F_a (dB(m ⁻¹))	增益 Gain (dBi)
192	9.5	6.4
193	9.4	6.5
194	9.3	6.7
195	9.1	7.0
196	8.9	7.1
197	8.8	7.3
198	8.8	7.4
199	8.7	7.5
200	8.7	7.6
205	8.6	7.9
210	8.8	7.9
215	8.9	7.9
220	9.2	7.9
225	9.3	8.0
230	9.5	7.9
235	9.8	7.9
240	10.0	7.9
245	10.1	7.9
250	10.3	7.9
255	10.5	7.9
260	10.6	7.9
265	10.7	8.0
270	10.9	7.9
275	11.0	8.0
280	11.2	8.0
285	11.4	7.9
290	11.6	7.9

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频率 Frequency (MHz)	天线系数 F_a (dB(m ⁻¹))	增益 Gain (dBi)
295	11.6	8.0
300	11.8	8.0
305	11.9	8.0
310	12.0	8.1
315	12.2	8.0
320	12.3	8.0
325	12.4	8.1
330	12.5	8.1
335	12.7	8.0
340	12.7	8.1
345	12.8	8.1
350	13.0	8.1
355	13.2	8.0
360	13.4	8.0
365	13.4	8.0
370	13.7	7.9
375	13.8	7.9
380	13.9	7.9
385	13.9	8.0
390	14.0	8.1
395	14.0	8.1
400	14.0	8.2
405	14.2	8.2
410	14.4	8.1
415	14.5	8.1
420	14.6	8.1
425	14.8	8.0

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频率 Frequency (MHz)	天线系数 F_a (dB(m ⁻¹))	增益 Gain (dBi)
430	14.9	8.0
435	15.1	7.9
440	15.2	7.8
445	15.5	7.7
450	15.6	7.7
455	15.7	7.7
460	15.7	7.8
465	15.7	7.9
470	15.7	7.9
475	15.8	7.9
480	16.0	7.8
485	16.1	7.8
490	16.3	7.7
495	16.4	7.7
500	16.5	7.7
505	16.5	7.7
510	16.7	7.7
515	16.6	7.8
520	16.5	8.0
525	16.5	8.1
530	16.5	8.2
535	16.5	8.3
540	16.6	8.2
545	16.7	8.2
550	16.9	8.1
555	17.0	8.1
560	17.1	8.1

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频率 Frequency (MHz)	天线系数 F_a (dB(m ⁻¹))	增益 Gain (dBi)
565	17.0	8.2
570	17.2	8.2
575	17.3	8.1
580	17.3	8.2
585	17.3	8.3
590	17.4	8.3
595	17.4	8.3
600	17.5	8.3
605	17.5	8.3
610	17.6	8.3
615	17.7	8.3
620	17.7	8.3
625	17.7	8.4
630	17.8	8.4
635	17.8	8.4
640	17.9	8.5
645	18.1	8.3
650	18.2	8.2
655	18.4	8.2
660	18.4	8.2
665	18.3	8.3
670	18.3	8.4
675	18.4	8.4
680	18.5	8.4
685	18.6	8.3
690	18.7	8.3
695	18.8	8.3

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频率 Frequency (MHz)	天线系数 F_a (dB(m ⁻¹))	增益 Gain (dBi)
700	18.8	8.3
705	18.9	8.2
710	19.0	8.2
715	19.1	8.2
720	19.2	8.2
725	19.3	8.1
730	19.5	7.9
735	19.6	7.9
740	19.5	8.1
745	19.5	8.2
750	19.5	8.2
755	19.4	8.3
760	19.5	8.4
765	19.5	8.4
770	19.6	8.3
775	19.6	8.4
780	19.7	8.4
785	19.7	8.4
790	19.7	8.4
795	19.8	8.4
800	19.9	8.4
805	20.1	8.3
810	20.2	8.2
815	20.2	8.2
820	20.4	8.1
825	20.4	8.2
830	20.3	8.2

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频率 Frequency (MHz)	天线系数 F_a (dB(m ⁻¹))	增益 Gain (dBi)
835	20.4	8.3
840	20.3	8.4
845	20.3	8.4
850	20.3	8.5
855	20.3	8.5
860	20.4	8.5
865	20.6	8.3
870	20.7	8.3
875	20.7	8.3
880	20.8	8.4
885	20.8	8.3
890	20.8	8.4
895	20.9	8.3
900	21.0	8.3
905	21.1	8.3
910	21.2	8.2
915	21.3	8.1
920	21.4	8.1
925	21.4	8.1
930	21.3	8.3
935	21.2	8.4
940	21.2	8.5
945	21.1	8.6
950	21.2	8.6
955	21.2	8.6
960	21.2	8.6
965	21.2	8.7

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频率 Frequency (MHz)	天线系数 F_a (dB(m ⁻¹))	增益 Gain (dBi)
970	21.3	8.7
975	21.3	8.7
980	21.3	8.7
985	21.4	8.6
990	21.6	8.6
995	21.7	8.4
1000	21.8	8.4

校准结果不确定度的描述

Expanded Uncertainty of the measurement

(1) 天线系数 F_a Antenna factor F_a

复合天线 Hybrid antenna

 $U=1.0$ dB ($k=2$) (30MHz~200MHz) $U=0.7$ dB ($k=2$) (200MHz~1000MHz)(2) 天线增益 G Antenna gain G

复合天线 Hybrid antenna

 $U=1.0$ dB ($k=2$) (30MHz~200MHz) $U=0.7$ dB ($k=2$) (200MHz~1000MHz)

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校准结果

Calibration Results

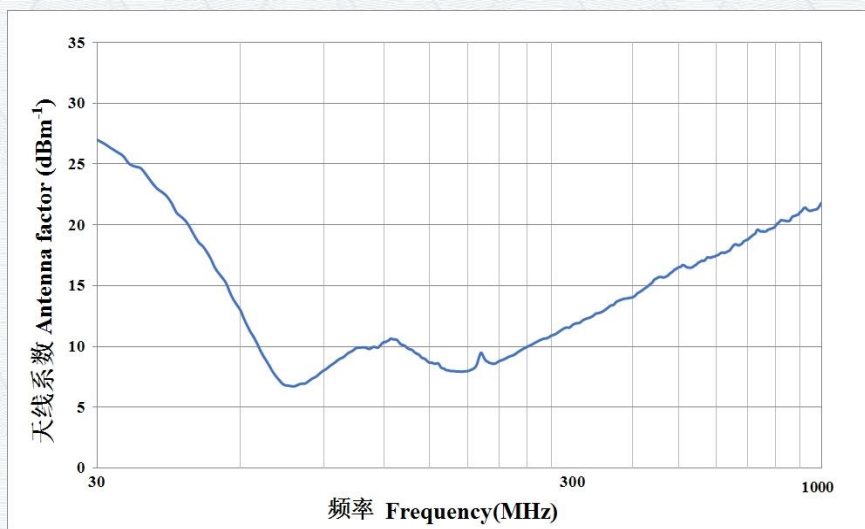


图 1 准自由空间天线系数
Fig.1 Near free-space antenna factor

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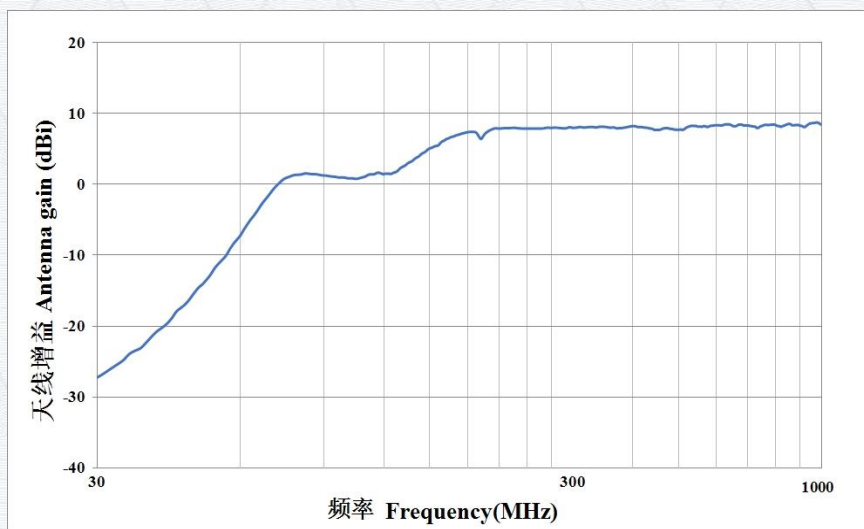


图2 天线增益
Fig.2 Antenna gain

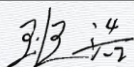
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建议 Suggestion:
/

声明 Statement:

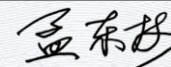
1. 我院仅对加盖“中国计量科学研究院校准专用章”的完整证书负责。
NIM is ONLY responsible for the complete certificate with the calibration stamp of NIM.
2. 本证书的校准结果仅对所校准的计量器具有效。
The certificate is ONLY valid for the calibrated instrument.
3. 本证书用中英文两种语言表达，准确含义以中文为准。
The certificate is reported in both English and Chinese, with the Chinese version as standard.

校准员:



Calibrated by

核验员:



Checked by