

中国计量科学研究院

National Institute of Metrology, China



中国认可
国际互认
校准
CALIBRATION
CNAS L0502

校准证书

Calibration Certificate

证书编号 XDdj2025-01622
Certificate No.

客户名称 Client	KMUTT, Faculty of Engineering, Department of Electrical Engineering
器具名称 Instrument	三环天线 Three Loop Antenna
型号/规格 Type/Model	VVLA-30M
出厂编号 Serial No.	SOLS20250157
生产厂商 Manufacturer	力汕电子科技 (上海) 有限公司 LISUN ELECTRONICS (SHANGHAI) CO., LTD
联络信息 Contact Information	126 Pracha Uthit Rd., Bang Mod, Thung Khru, Bangkok 10140, Thailand
校准日期 Date of Calibration	2025 年 3 月 28 日 2025-03-28
接收日期 Date of Receiving	2025 年 3 月 28 日 2025-03-28

批准人:

黄璿

Approved by



发布日期: 2025 年 04 月 03 日
Date of Issue

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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)

参照 NIM-ZY-XD-DJ-028 大三环磁场天线自编校准规范

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

温度 Temperature: 23 °C 地点 Location: 北京市海淀区安宁庄村南北方
湿度 Humidity: 37% RH 其它 Others: / 丝绸厂 5 幢平房 123

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

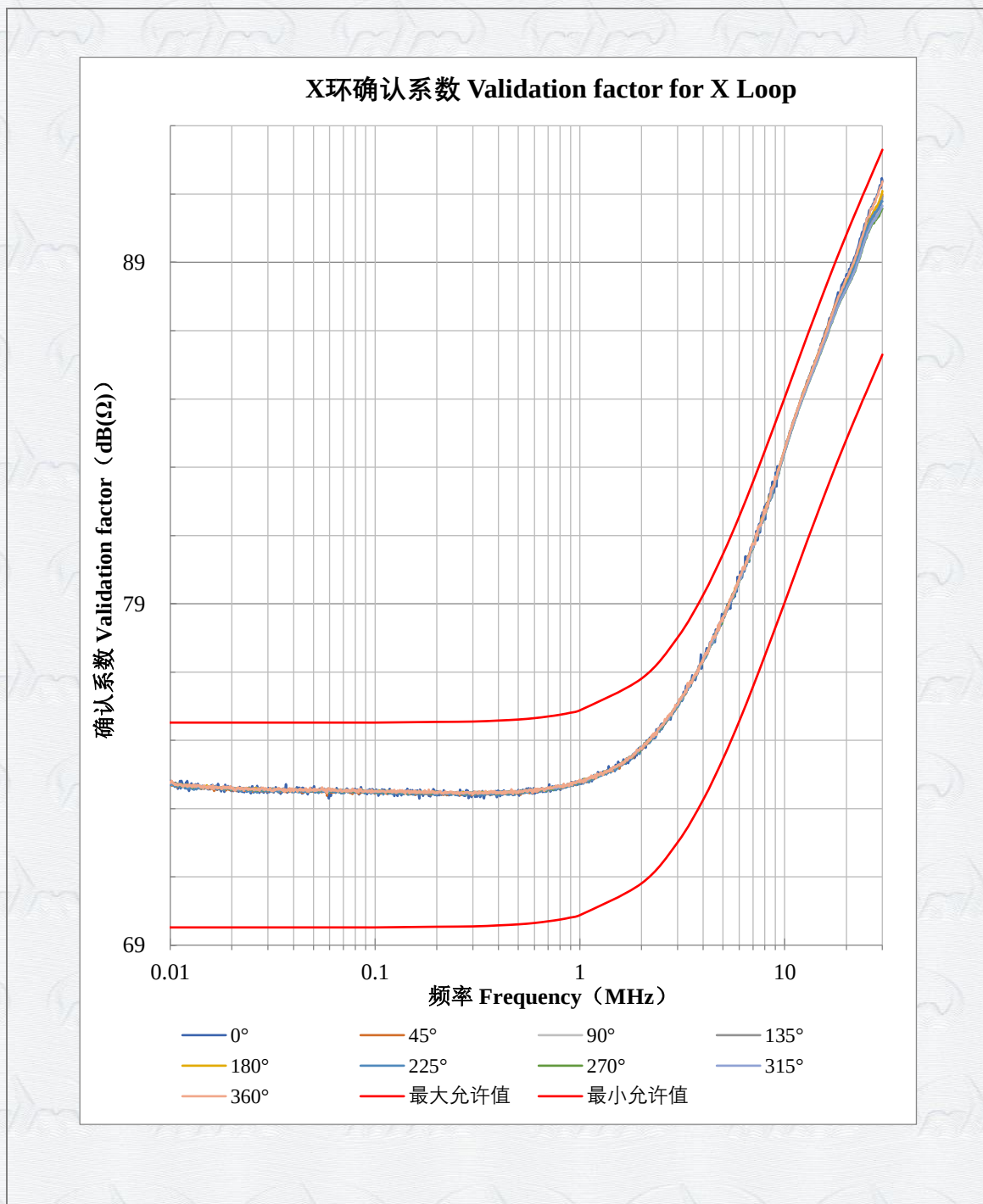
名称 Name	测量范围 Measurement Range	不确定度/ 准确度等级 Uncertainty/Accuracy	证书编号 Certificate No.	证书有效期至 Due Date (YYYY-MM-DD)
网络分析仪 Network Analyzer	9kHz~8.5GHz	MPE: $\pm 0.1\text{dB}$	XDgp2024- 03069	2025-07-01



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频率 Frequency (MHz)	X 环确认系数 Validation factor for X Loop (dB(Ω))									
	标称值 Nominal	0°	45°	90°	135°	180°	225°	270°	315°	360°
0.009	72.52	73.74	73.83	73.83	73.83	73.82	73.80	73.82	73.82	73.82
0.010	72.52	73.82	73.75	73.76	73.76	73.75	73.75	73.77	73.77	73.76
0.020	72.52	73.51	73.55	73.58	73.58	73.58	73.54	73.56	73.59	73.59
0.030	72.52	73.52	73.50	73.54	73.54	73.55	73.54	73.56	73.57	73.54
0.040	72.52	73.51	73.52	73.54	73.55	73.55	73.53	73.56	73.55	73.51
0.050	72.52	73.57	73.49	73.52	73.53	73.53	73.52	73.55	73.55	73.53
0.060	72.52	73.46	73.50	73.52	73.53	73.53	73.55	73.54	73.55	73.56
0.070	72.52	73.51	73.45	73.51	73.54	73.53	73.51	73.55	73.55	73.51
0.080	72.52	73.58	73.51	73.50	73.52	73.51	73.48	73.51	73.51	73.55
0.090	72.52	73.52	73.51	73.51	73.52	73.52	73.46	73.51	73.52	73.51
0.100	72.52	73.52	73.44	73.49	73.50	73.51	73.46	73.48	73.49	73.51
0.200	72.54	73.51	73.44	73.47	73.46	73.46	73.40	73.46	73.47	73.46
0.300	72.55	73.42	73.43	73.46	73.47	73.47	73.43	73.46	73.46	73.40
0.400	72.58	73.53	73.45	73.47	73.48	73.48	73.46	73.48	73.49	73.46
0.500	72.61	73.44	73.44	73.48	73.50	73.48	73.51	73.50	73.50	73.47
0.600	72.65	73.52	73.52	73.54	73.54	73.54	73.57	73.56	73.57	73.51
0.700	72.70	73.59	73.59	73.58	73.58	73.57	73.56	73.60	73.60	73.62
0.800	72.75	73.60	73.59	73.62	73.63	73.66	73.63	73.65	73.66	73.66
0.900	72.81	73.70	73.68	73.69	73.71	73.71	73.67	73.67	73.69	73.74
1.000	72.88	73.83	73.78	73.79	73.81	73.80	73.72	73.76	73.78	73.85
2.000	73.81	74.77	74.72	74.75	74.77	74.78	74.75	74.79	74.79	74.76
3.000	75.01	76.07	76.05	76.04	76.04	76.04	76.00	76.01	76.02	76.04
4.000	76.26	77.30	77.38	77.34	77.34	77.35	77.38	77.36	77.35	77.30
5.000	77.46	78.51	78.53	78.55	78.57	78.56	78.49	78.52	78.53	78.50

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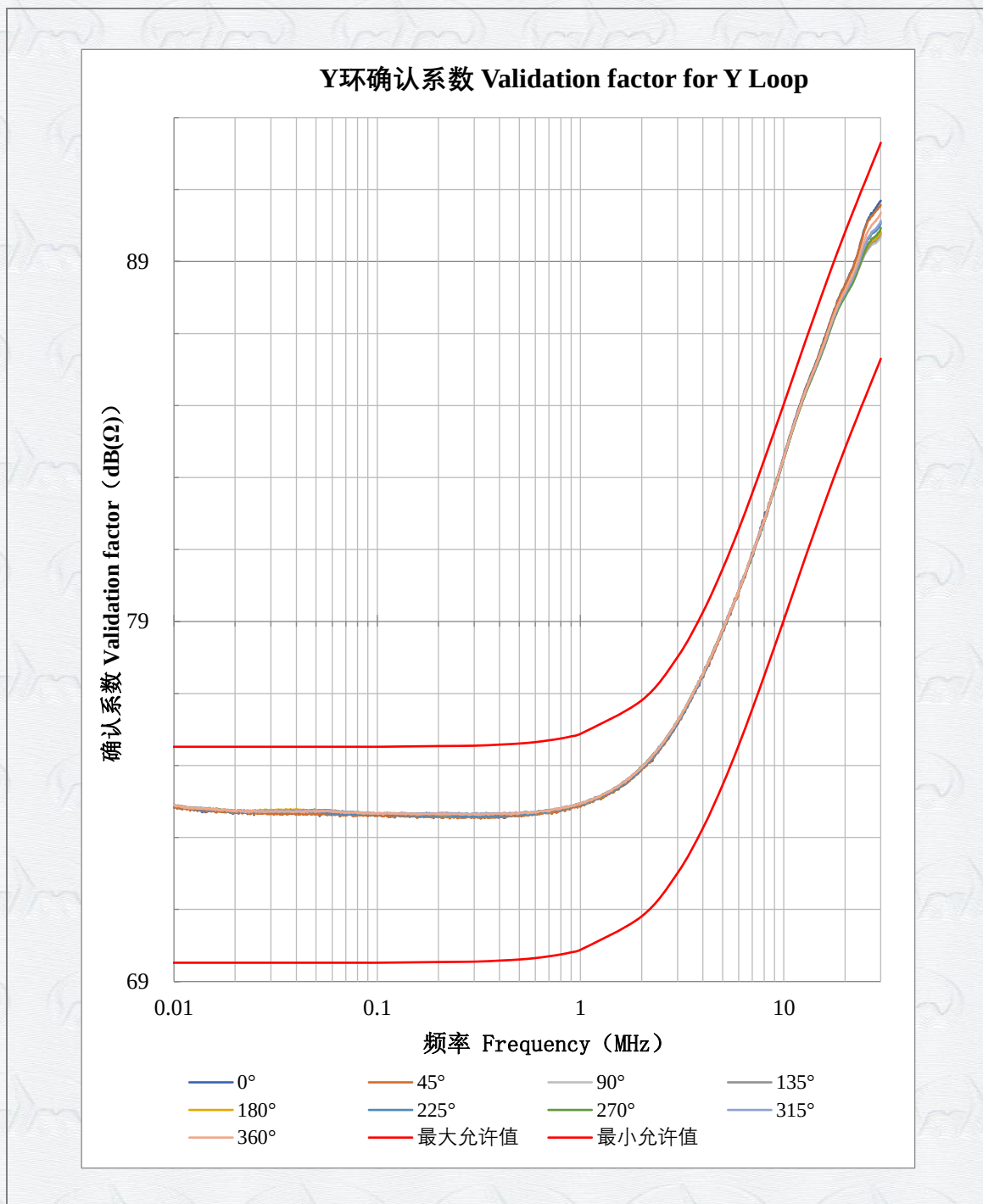
频率 Frequency (MHz)	X 环确认系数 Validation factor for X Loop (dB(Ω))									
	标称值 Nominal	0°	45°	90°	135°	180°	225°	270°	315°	360°
6.000	78.56	79.75	79.67	79.67	79.65	79.65	79.64	79.63	79.65	79.66
7.000	79.57	80.68	80.72	80.69	80.72	80.74	80.60	80.63	80.64	80.77
8.000	80.48	81.85	81.58	81.65	81.64	81.63	81.69	81.61	81.61	81.63
9.000	81.30	82.52	82.58	82.60	82.58	82.59	82.51	82.50	82.53	82.72
10.000	82.04	83.53	83.51	83.48	83.50	83.51	83.44	83.44	83.45	83.52
11.000	82.72	84.31	84.28	84.23	84.25	84.25	84.20	84.19	84.20	84.25
12.000	83.34	84.97	84.96	84.92	84.93	84.95	84.86	84.85	84.86	84.98
13.000	83.91	85.56	85.53	85.47	85.48	85.50	85.43	85.40	85.41	85.49
14.000	84.42	85.98	86.00	85.95	85.97	85.99	85.92	85.87	85.88	86.00
15.000	84.90	86.50	86.48	86.40	86.43	86.46	86.38	86.31	86.33	86.52
16.000	85.34	87.05	86.99	86.90	86.92	86.96	86.85	86.77	86.80	86.97
17.000	85.75	87.41	87.42	87.30	87.33	87.37	87.29	87.20	87.22	87.41
18.000	86.13	87.95	87.85	87.73	87.77	87.81	87.71	87.60	87.62	87.84
19.000	86.48	88.35	88.19	88.08	88.11	88.16	88.04	87.94	87.95	88.19
20.000	86.81	88.56	88.46	88.32	88.36	88.41	88.31	88.18	88.19	88.53
21.000	87.12	88.81	88.67	88.55	88.61	88.68	88.60	88.45	88.47	88.76
22.000	87.41	89.14	88.96	88.83	88.87	88.94	88.84	88.70	88.73	89.06
23.000	87.68	89.48	89.20	89.09	89.16	89.27	89.22	89.03	89.04	89.41
24.000	87.95	89.89	89.60	89.47	89.54	89.63	89.62	89.40	89.43	89.76
25.000	88.19	90.17	89.93	89.81	89.88	89.98	89.90	89.70	89.74	90.21
26.000	88.43	90.52	90.09	89.99	90.09	90.22	90.15	89.93	89.96	90.37
27.000	88.66	90.69	90.29	90.21	90.29	90.43	90.37	90.14	90.17	90.56
28.000	88.88	90.89	90.51	90.41	90.48	90.63	90.48	90.24	90.28	90.87
29.000	89.09	91.18	90.68	90.57	90.65	90.79	90.62	90.36	90.46	91.11
30.000	89.30	91.36	90.99	90.87	90.94	91.09	90.78	90.57	90.66	91.38



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频率 Frequency (MHz)	Y 环确认系数 Validation factor for Y Loop (dB(Ω))									
	标称值 Nominal	0°	45°	90°	135°	180°	225°	270°	315°	360°
0.009	72.52	73.91	73.92	73.98	73.97	73.98	73.95	73.97	73.98	73.98
0.010	72.52	73.84	73.85	73.90	73.92	73.89	73.86	73.89	73.90	73.89
0.020	72.52	73.71	73.69	73.74	73.74	73.74	73.73	73.75	73.75	73.74
0.030	72.52	73.66	73.65	73.72	73.72	73.77	73.74	73.74	73.73	73.72
0.040	72.52	73.64	73.64	73.74	73.74	73.78	73.73	73.74	73.75	73.74
0.050	72.52	73.70	73.67	73.72	73.72	73.74	73.71	73.74	73.74	73.72
0.060	72.52	73.64	73.62	73.69	73.69	73.69	73.66	73.74	73.74	73.72
0.070	72.52	73.66	73.64	73.68	73.67	73.66	73.66	73.71	73.70	73.68
0.080	72.52	73.63	73.62	73.66	73.67	73.67	73.66	73.69	73.68	73.67
0.090	72.52	73.60	73.59	73.65	73.65	73.67	73.64	73.69	73.69	73.67
0.100	72.52	73.61	73.59	73.64	73.64	73.65	73.63	73.66	73.67	73.66
0.200	72.54	73.60	73.57	73.62	73.62	73.62	73.62	73.66	73.66	73.64
0.300	72.55	73.56	73.54	73.60	73.60	73.60	73.60	73.65	73.66	73.65
0.400	72.58	73.60	73.58	73.64	73.63	73.63	73.62	73.66	73.65	73.65
0.500	72.61	73.62	73.59	73.64	73.63	73.62	73.63	73.67	73.67	73.66
0.600	72.65	73.67	73.64	73.67	73.66	73.67	73.67	73.70	73.71	73.70
0.700	72.70	73.68	73.68	73.75	73.75	73.72	73.72	73.75	73.74	73.74
0.800	72.75	73.79	73.77	73.77	73.78	73.77	73.76	73.80	73.80	73.80
0.900	72.81	73.80	73.79	73.85	73.83	73.83	73.83	73.86	73.87	73.87
1.000	72.88	73.86	73.85	73.94	73.94	73.93	73.91	73.94	73.94	73.94
2.000	73.81	74.88	74.87	74.89	74.90	74.91	74.90	74.94	74.95	74.93
3.000	75.01	76.15	76.16	76.19	76.18	76.18	76.17	76.23	76.23	76.21
4.000	76.26	77.50	77.48	77.52	77.52	77.49	77.48	77.53	77.52	77.51
5.000	77.46	78.73	78.71	78.75	78.77	78.74	78.72	78.73	78.76	78.75

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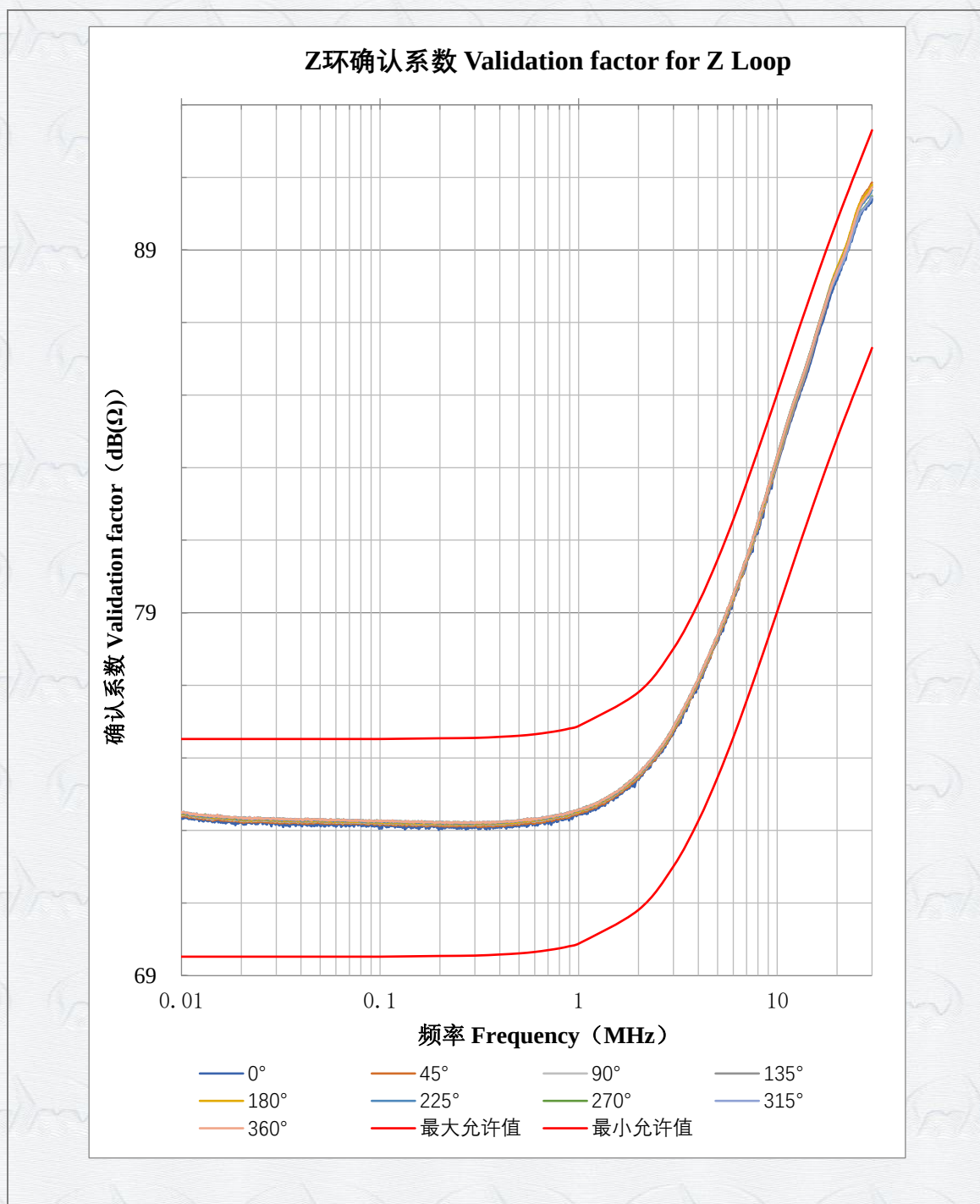
频率 Frequency (MHz)	Y 环确认系数 Validation factor for Y Loop (dB(Ω))									
	标称值 Nominal	0°	45°	90°	135°	180°	225°	270°	315°	360°
6.000	78.56	79.82	79.71	79.83	79.81	79.82	79.81	79.80	79.83	79.85
7.000	79.57	80.92	80.86	80.81	80.82	80.81	80.81	80.84	80.86	80.86
8.000	80.48	81.82	81.76	81.73	81.75	81.75	81.74	81.76	81.76	81.76
9.000	81.30	82.69	82.65	82.67	82.66	82.72	82.69	82.70	82.68	82.72
10.000	82.04	83.59	83.56	83.52	83.53	83.53	83.54	83.52	83.54	83.55
11.000	82.72	84.31	84.30	84.23	84.25	84.26	84.27	84.23	84.26	84.27
12.000	83.34	85.01	84.97	84.89	84.91	84.92	84.94	84.89	84.92	84.94
13.000	83.91	85.56	85.53	85.42	85.43	85.45	85.46	85.41	85.46	85.48
14.000	84.42	86.00	85.97	85.85	85.86	85.89	85.91	85.84	85.89	85.94
15.000	84.90	86.44	86.40	86.26	86.26	86.30	86.32	86.26	86.31	86.35
16.000	85.34	86.90	86.87	86.69	86.70	86.74	86.77	86.70	86.75	86.80
17.000	85.75	87.30	87.29	87.08	87.10	87.14	87.18	87.08	87.15	87.21
18.000	86.13	87.71	87.71	87.50	87.52	87.56	87.59	87.48	87.55	87.61
19.000	86.48	88.09	88.06	87.79	87.81	87.87	87.93	87.79	87.87	87.95
20.000	86.81	88.30	88.29	88.01	88.04	88.09	88.13	88.00	88.08	88.17
21.000	87.12	88.59	88.56	88.22	88.24	88.28	88.37	88.22	88.31	88.41
22.000	87.41	88.83	88.80	88.40	88.43	88.48	88.57	88.42	88.52	88.64
23.000	87.68	89.15	89.13	88.67	88.70	88.75	88.86	88.69	88.82	88.95
24.000	87.95	89.55	89.51	88.94	88.98	89.03	89.16	89.01	89.15	89.30
25.000	88.19	89.91	89.88	89.19	89.23	89.28	89.45	89.29	89.45	89.63
26.000	88.43	90.15	90.11	89.33	89.39	89.43	89.61	89.45	89.63	89.82
27.000	88.66	90.34	90.25	89.45	89.49	89.55	89.75	89.61	89.79	89.98
28.000	88.88	90.43	90.36	89.50	89.56	89.62	89.82	89.68	89.89	90.10
29.000	89.09	90.58	90.45	89.57	89.65	89.69	89.91	89.78	89.98	90.20
30.000	89.30	90.69	90.58	89.69	89.77	89.82	90.08	89.93	90.13	90.35



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频率 Frequency (MHz)	Z 环确认系数 Validation factor for Z Loop (dB(Ω))									
	标称值 Nominal	0°	45°	90°	135°	180°	225°	270°	315°	360°
0.009	72.52	73.41	73.47	73.50	73.53	73.53	73.55	73.57	73.58	73.58
0.010	72.52	73.34	73.40	73.41	73.43	73.44	73.47	73.51	73.51	73.52
0.020	72.52	73.22	73.22	73.26	73.27	73.29	73.31	73.34	73.35	73.34
0.030	72.52	73.17	73.24	73.26	73.27	73.29	73.31	73.32	73.31	73.32
0.040	72.52	73.13	73.20	73.24	73.25	73.27	73.30	73.31	73.31	73.30
0.050	72.52	73.13	73.21	73.25	73.26	73.26	73.28	73.30	73.29	73.28
0.060	72.52	73.10	73.18	73.22	73.23	73.24	73.27	73.29	73.29	73.28
0.070	72.52	73.12	73.20	73.24	73.24	73.23	73.25	73.27	73.27	73.27
0.080	72.52	73.16	73.19	73.21	73.23	73.24	73.26	73.28	73.28	73.27
0.090	72.52	73.15	73.19	73.22	73.23	73.22	73.25	73.27	73.26	73.26
0.100	72.52	73.15	73.14	73.18	73.19	73.21	73.25	73.26	73.27	73.27
0.200	72.54	73.07	73.12	73.16	73.17	73.19	73.20	73.23	73.22	73.22
0.300	72.55	73.08	73.14	73.17	73.18	73.18	73.21	73.22	73.21	73.21
0.400	72.58	73.08	73.14	73.18	73.18	73.19	73.21	73.24	73.23	73.24
0.500	72.61	73.17	73.18	73.22	73.23	73.24	73.26	73.28	73.29	73.27
0.600	72.65	73.20	73.22	73.25	73.26	73.26	73.30	73.31	73.32	73.32
0.700	72.70	73.28	73.29	73.33	73.34	73.34	73.34	73.37	73.37	73.36
0.800	72.75	73.31	73.33	73.38	73.39	73.39	73.39	73.41	73.42	73.43
0.900	72.81	73.27	73.35	73.41	73.43	73.44	73.47	73.49	73.48	73.49
1.000	72.88	73.51	73.50	73.53	73.54	73.54	73.55	73.58	73.58	73.58
2.000	73.81	74.44	74.43	74.48	74.50	74.50	74.52	74.54	74.55	74.55
3.000	75.01	75.65	75.72	75.77	75.79	75.80	75.83	75.84	75.83	75.82
4.000	76.26	76.92	77.03	77.09	77.09	77.10	77.12	77.15	77.15	77.15
5.000	77.46	78.17	78.22	78.26	78.29	78.28	78.29	78.34	78.35	78.34

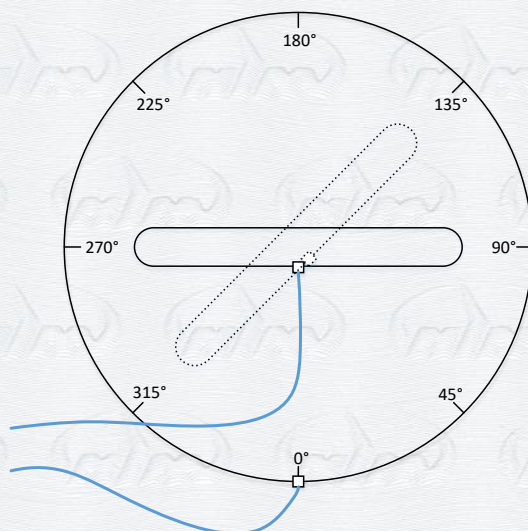
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频率 Frequency (MHz)	Z 环确认系数 Validation factor for Z Loop (dB(Ω))									
	标称值 Nominal	0°	45°	90°	135°	180°	225°	270°	315°	360°
6.000	78.56	79.32	79.33	79.38	79.39	79.39	79.44	79.46	79.46	79.43
7.000	79.57	80.32	80.40	80.41	80.42	80.44	80.49	80.51	80.51	80.52
8.000	80.48	81.18	81.31	81.34	81.35	81.40	81.45	81.50	81.49	81.47
9.000	81.30	82.25	82.29	82.33	82.36	82.42	82.44	82.48	82.47	82.49
10.000	82.04	83.07	83.13	83.16	83.19	83.26	83.31	83.34	83.33	83.32
11.000	82.72	83.80	83.84	83.87	83.91	83.99	84.04	84.07	84.05	84.05
12.000	83.34	84.42	84.53	84.55	84.59	84.68	84.73	84.75	84.73	84.72
13.000	83.91	85.00	85.10	85.13	85.16	85.25	85.29	85.29	85.27	85.27
14.000	84.42	85.48	85.60	85.64	85.67	85.77	85.80	85.80	85.78	85.78
15.000	84.90	86.01	86.14	86.16	86.20	86.29	86.31	86.31	86.29	86.30
16.000	85.34	86.63	86.71	86.74	86.77	86.86	86.85	86.82	86.80	86.83
17.000	85.75	86.99	87.14	87.17	87.20	87.28	87.28	87.25	87.23	87.26
18.000	86.13	87.43	87.61	87.65	87.68	87.76	87.73	87.68	87.66	87.70
19.000	86.48	87.89	88.07	88.10	88.12	88.20	88.14	88.06	88.03	88.11
20.000	86.81	88.15	88.36	88.40	88.42	88.48	88.40	88.30	88.28	88.38
21.000	87.12	88.44	88.70	88.71	88.72	88.77	88.67	88.54	88.53	88.65
22.000	87.41	88.73	88.96	88.99	89.00	89.04	88.94	88.81	88.79	88.93
23.000	87.68	89.02	89.31	89.30	89.30	89.35	89.25	89.11	89.09	89.25
24.000	87.95	89.35	89.67	89.65	89.65	89.69	89.58	89.45	89.44	89.62
25.000	88.19	89.64	90.02	90.00	89.98	90.03	89.91	89.77	89.74	89.93
26.000	88.43	89.84	90.25	90.22	90.19	90.24	90.10	89.95	89.93	90.14
27.000	88.66	90.07	90.48	90.43	90.39	90.43	90.28	90.11	90.09	90.31
28.000	88.88	90.11	90.60	90.54	90.50	90.54	90.38	90.21	90.20	90.45
29.000	89.09	90.24	90.70	90.63	90.59	90.64	90.49	90.34	90.32	90.57
30.000	89.30	90.41	90.86	90.79	90.74	90.79	90.65	90.48	90.46	90.72

证书编号 XDJ2025-01622
Certificate No.

校准结果

Calibration Results

校准结果不确定度: $U=0.70\text{dB}$ ($k=2$)Measurement uncertainty: $U=0.70\text{dB}$ ($k=2$)环天线和偶极子天线摆放位置示意图
(实线为 0° 的位置, 虚线为 45° 的位置)-----以下空白-----
Blank below

建议 Suggestion:

根据客户要求, 通常情况下 12 个月校准一次。According to the client, the recommended calibration cycle is 12 months.

声明 Statement:

1. 我院仅对加盖“中国计量科学研院校准专用章”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: 王少华

Calibrated by

核验员: 黄璿

Checked by