

知用 EMI 接收机与标准实验室结果对比之 ——开关电源篇

开关电源的传导骚扰信号测量是 EMI 传导测量产品的典型应用之一，下面以某客户的开关电源为例，在标准的实验环境下(倍测检测)，使用知用电子(CYBERTEK) EMI 传导测试系统进行测量，和标准的实验室报告做对比。

1. 实验室环境配置：

倍测检测的传导骚扰测试环境如下：

- 👉 接收机使用 RS 的 ESR 系列
- 👉 人工电源网络使用 RS 的 ENV216



知用电子(CYBERTEK)在相同的实验室环境下, 机器配置选择如下:

- ☞ 接收机使用 EM5080B (9kHz~1GHz)
- ☞ 人工电源网路使用 EM5040B (带共差模分离功能)



2. 测试结果对比如下:

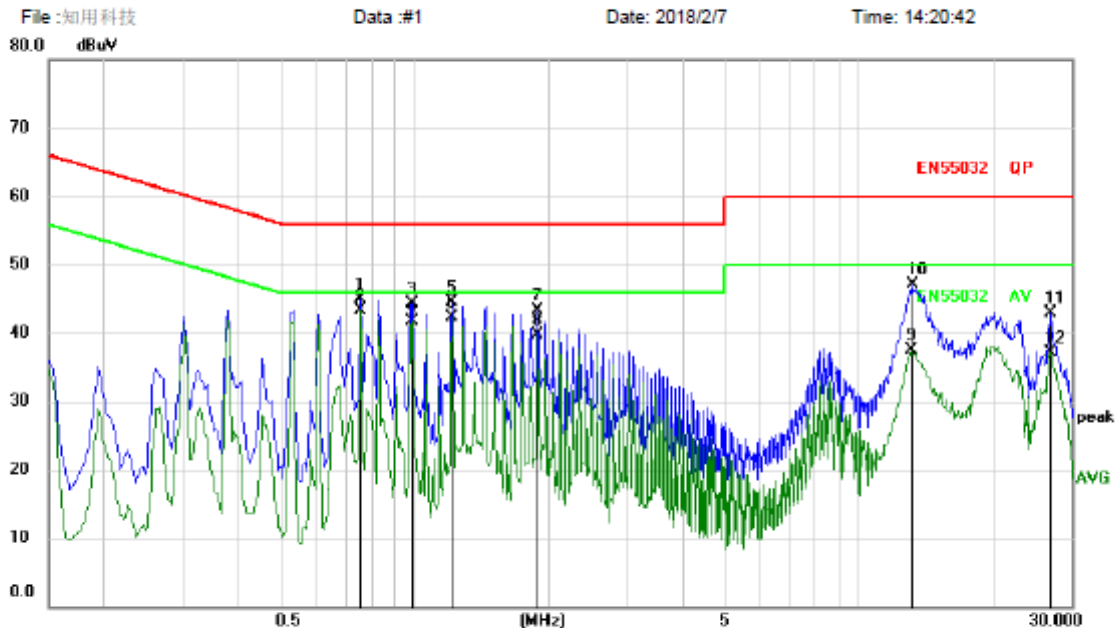
在标准的测试环境下, 使用倍测认证实验室的接收机和人工电源网络, 和使用知用电子(CYBERTEK)的接收机和人工电源网络做对比试验。

倍测的测试数据:

L1 线结果:

倍测检测
BCIC TESTAddress: BCTC Building, Pengzhou Industrial, Fuyuan 1st Road,
Fuyong Town, Bao'an District, Shenzhen, China
Tel: 400-788-9558

Conducted Emission Measurement



Site LAB

Phase: L1

Temperature: 26

Limit: EN55032 QP

Power: AC 230V/50Hz

Humidity: 55 %

EUT:

M/N: PS300-L

Mode:

Note:

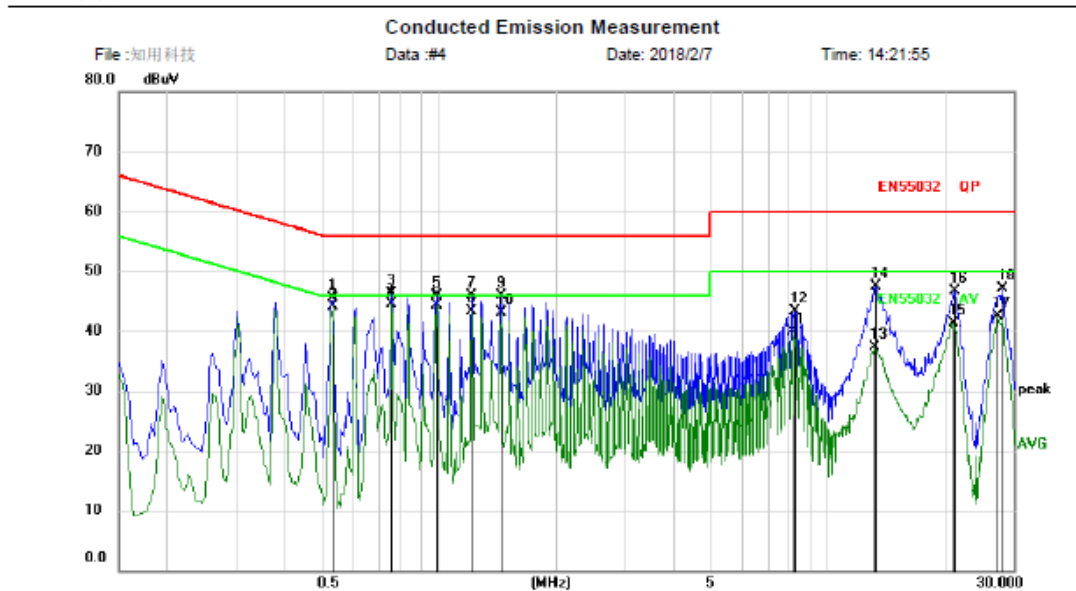
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.7575	35.22	9.68	44.90	56.00	-11.10	peak	
2	*	0.7575	33.64	9.68	43.32	46.00	-2.68	AVG	
3		0.9870	34.52	9.71	44.23	56.00	-11.77	peak	
4		0.9870	32.03	9.71	41.74	46.00	-4.26	AVG	
5		1.2120	34.86	9.71	44.57	56.00	-11.43	peak	
6		1.2120	32.50	9.71	42.21	46.00	-3.79	AVG	
7		1.8960	33.57	9.71	43.28	56.00	-12.72	peak	
8		1.8960	30.02	9.71	39.73	46.00	-6.27	AVG	
9		13.0830	27.71	9.88	37.59	50.00	-12.41	AVG	
10		13.1505	37.22	9.89	47.11	60.00	-12.89	peak	
11		26.9025	32.81	10.07	42.88	60.00	-17.12	peak	
12		26.9025	27.09	10.07	37.16	50.00	-12.84	AVG	

N 线结果:



倍测检测
BCIC TEST

Address: BCTC Building, Pengzhou Industrial, Fuyuan 1st Road,
Fuyong Town, Bao'an District, Shenzhen, China
Tel: 400-788-9558



Site: LAB

Phase: N

Temperature: 26

Limit: EN55032 QP

Power: AC 230V/50Hz

Humidity: 55 %

EUT:

M/N: PS300-L

Mode:

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.5325	35.82	9.68	45.50	56.00	-10.50	peak	
2		0.5325	34.34	9.68	44.02	46.00	-1.98	AVG	
3		0.7575	36.53	9.68	46.21	56.00	-9.79	peak	
4 *		0.7575	34.82	9.68	44.50	46.00	-1.50	AVG	
5		0.9870	36.12	9.71	45.83	56.00	-10.17	peak	
6		0.9870	34.50	9.71	44.21	46.00	-1.79	AVG	
7		1.2120	36.24	9.71	45.95	56.00	-10.05	peak	
8		1.2120	33.52	9.71	43.23	46.00	-2.77	AVG	
9		1.4415	36.13	9.71	45.84	56.00	-10.16	peak	
10		1.4415	33.40	9.71	43.11	46.00	-2.89	AVG	
11		8.1240	30.07	9.81	39.88	50.00	-10.12	AVG	
12		8.2005	33.55	9.81	43.36	60.00	-16.64	peak	
13		13.1415	27.48	9.89	37.37	50.00	-12.63	AVG	
14		13.2675	37.69	9.89	47.58	60.00	-12.42	peak	
15		21.0210	31.37	9.98	41.35	50.00	-8.65	AVG	
16		21.2460	36.65	9.98	46.63	60.00	-13.37	peak	
17		27.3975	32.45	10.07	42.52	50.00	-7.48	AVG	
18		28.0815	37.03	10.08	47.11	60.00	-12.89	peak	

知用电子(CYBERTEK)测试数据:

L1 线结果:

产品:PS300-L L1 线

生产商:某厂

测试条件:倍测实验室

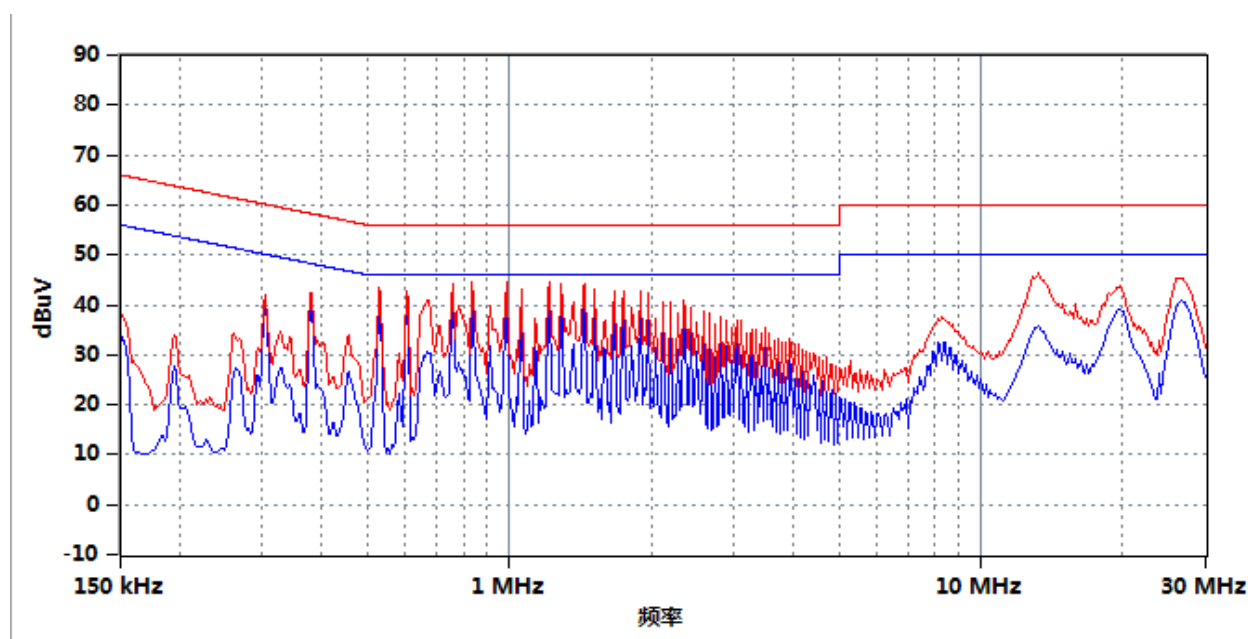
测试人员:陈工

测试标准:EN55022-MainTermB

测试模式:标准

备忘:

测试时间:2018/2/7



	频率	读取值 (dBuV)	补偿 (dB)	综合值 (dBuV)	标准线 (dBuV)	超标 (dB)	注释
1	760.012kHz	33.38	9.53	42.91	46.00	-3.09	AV
2	760.012kHz	34.65	9.53	44.18	56.00	-11.82	PK
3	987.307kHz	33.24	9.53	42.77	46.00	-3.23	AV
4	987.307kHz	35.09	9.53	44.62	56.00	-11.38	PK
5	1.215MHz	32.47	9.54	42.01	46.00	-3.99	AV
6	1.215MHz	35.02	9.54	44.56	56.00	-11.44	PK
7	1.898MHz	30.66	9.54	40.20	46.00	-5.80	AV
8	1.898MHz	33.39	9.54	42.93	56.00	-13.07	PK
9	13.071MHz	25.47	9.57	35.04	50.00	-14.96	AV
10	13.071MHz	35.72	9.57	45.29	60.00	-14.71	PK
11	13.260MHz	25.13	9.57	34.70	50.00	-15.30	AV
12	13.260MHz	36.09	9.57	45.66	60.00	-14.34	PK
13	26.880MHz	27.13	9.59	36.72	50.00	-13.28	AV
14	26.880MHz	34.18	9.59	43.76	60.00	-16.24	PK

N 线结果:

产品:PS300-L N 线

生产商:某厂

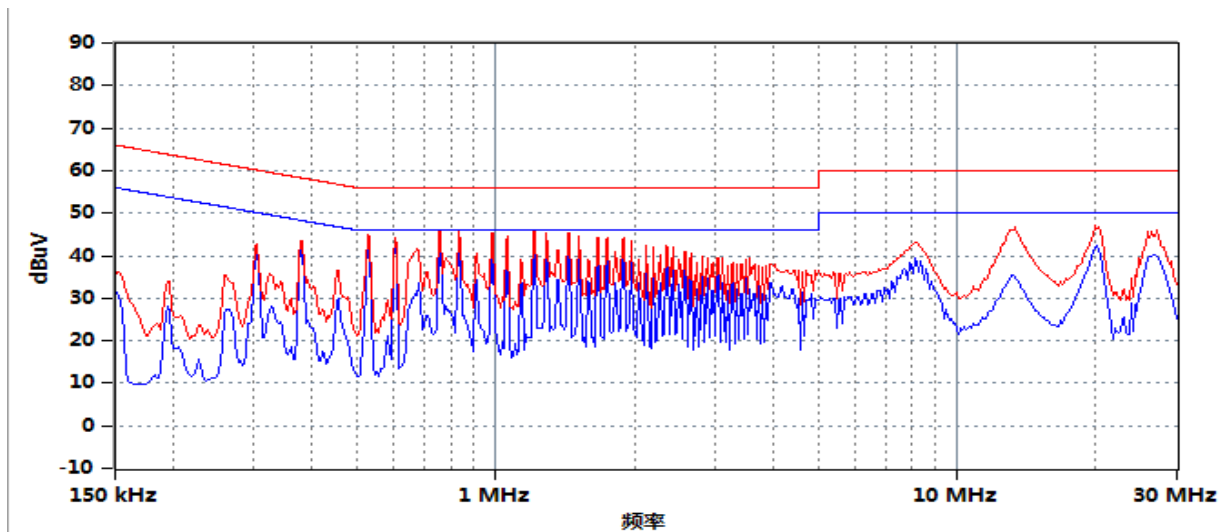
测试条件:倍测实验室

测试人员:陈工

测试标准:EN55022-MainTermB

测试模式:标准


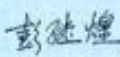

测试时间:2018/2/7



	频率	读取值 (dBuV)	补偿 (dB)	综合值 (dBuV)	标准线 (dBuV)	超标 (dB)	注释
1	532.500kHz	33.94	9.53	43.47	46.00	-2.53	AV
2	532.500kHz	35.50	9.53	45.03	56.00	-10.97	PK
3	834kHz	33.21	9.53	42.74	46.00	-3.26	AV
4	834kHz	35.46	9.53	44.99	56.00	-11.01	PK
5	1.216MHz	33.54	9.54	43.08	46.00	-2.92	AV
6	1.216MHz	36.14	9.54	45.68	56.00	-10.32	PK
7	1.901MHz	31.85	9.54	41.39	46.00	-4.61	AV
8	1.901MHz	34.37	9.54	43.91	56.00	-12.09	PK
9	13.207MHz	25.61	9.57	35.18	50.00	-14.82	AV
10	13.207MHz	36.16	9.57	45.73	60.00	-14.27	PK
11	13.332MHz	24.92	9.57	34.49	50.00	-15.51	AV
12	13.332MHz	37.16	9.57	46.73	60.00	-13.27	PK
13	20.365MHz	30.62	9.60	40.22	50.00	-9.78	AV
14	20.365MHz	37.00	9.60	46.60	60.00	-13.40	PK
15	27.199MHz	29.79	9.59	39.38	50.00	-10.62	AV
16	27.199MHz	36.11	9.59	45.69	60.00	-14.31	PK

通过以上实验对比看出，曲线的趋势基本一致，不同的产品传导骚扰信号是有波动的，所以不同时间的扫描，测量值有几个dB的误差都属于比较正常的现象，知用电子（CYBERTEK）EMI传导测试系统完全符合传导测量要求。

3. EM5080B 校准报告如下:

中国赛宝实验室 (工业和信息化部电子第五研究所) CEPREI CHINA CEPREI LABORATORY		CNAS CALIBRATION CNAS L0482	
校准证书 CALIBRATION CERTIFICATE			
证书编号: Certificate No.	1GA17007384-0015		
委托单位: Client	深圳市金威源科技股份有限公司		
委托方地址: Address	深圳市坪山新区大工业区聚龙山片区金威源工业厂区A栋第1-3层, B2 栋第1-5层		
仪器名称: Description	数字接收机		
型号规格: Model/Type	EM5080B		
制造商: Manufacturer	CYBERTEK		
机身号: Serial No.	E155080322		
校准日期: Cal. Date	2017年06月21日		
建议再校日期: Next Cal. Date	2018年06月21日		
结论: Conclusion	所校准项目合格(Passed at Calibration Items)		
CEPREI			
校准: Calibrated by		核验: Inspected by	
签发: Approved by	 室主任 Department Supervisor	印章: Stamp	
赛宝计量检测中心 广州总部地址: 广州天河区东莞庄路110号 客服电话: 020-87237633 传真: 020-87236189 投诉电话: 020-87236896, 020-87236789 邮件: cal@ceprei.com 网址: www.ceprei-cal.com		CEPREI Calibration and Testing Center H.Q. Addr: No.110 Dongguanhuang Road, Tianhe District, Guangzhou Tel: 020-87237633 Fax: 020-87236189 Complaint phone: 020-87236896, 020-87236789 Email: cal@ceprei.com Website: www.ceprei-cal.com	
Page 1 of 7			

说明

DIRECTIONS

证书编号(Certificate No.): 1GA17007384-0015

1. 本机构质量管理体系符合ISO/IEC 17025的要求, 获得中国合格评定国家认可委员会(CNAS)认可, 认可证书号为: CNAS L0462.

This laboratory quality management system meets the ISO/IEC 17025 and is accredited by the China National Accreditation Service for Conformity Assessment, No. CNAS L0462.

2. 本机构出具的数据均可溯源到国家计量基准和国际单位制(SI)。

The data issued by this laboratory is traceable to national primary standards and International system of Units (SI).

3. 本次校准的技术依据及CNAS认可范围(Reference documents and CNAS accredited scopes):

• JJF 1144-2006 电磁骚扰测量接收机校准规范: 参考频率:10MHz;中频频率:9kHz~500MHz;频率读数准确度:9kHz~26.5GHz;分辨率带宽:1Hz~10MHz;电平:(-120~20)dBm;指示线性:(-80~10)dB;衰减器:(10~75)dB;射频输入端的电压驻波比:(1.0~10)@(9kHz~20GHz);脉冲响应:9kHz~1000MHz

• 详细认可范围请查看CNAS网站中注册编号为L0462的证书附件(Please see the attachment of certificate No. L0462 at CNAS website for details).

4. 本次校准所使用的主要测量标准(The main measurement standards used during the calibration):

名称 (Description)	技术指标 (Specification)	证书编号 (Certificate No.)	有效期至 (Due Date)
模拟信号发生器	f: $\pm 1 \times 10^{-1}$; L: ± 0.7 dB	4GC17000012-0031	2018-02-15
脉冲信号发生器/Pulse Generator	Pulse Level; BandA/B: ± 0.5 dB; BandC/D: ± 0.8 dB	XDdj2017-1424	2018-04-18

5. 校准地点(The calibration place): 深圳市坪山新区大工业区聚龙山片区金威源工业厂区A栋第1-3层, B2栋第1-5层

6. 环境条件(Environmental conditions): 温度(Temperature): 22℃ 相对湿度(Relative Humidity): 60%

7. 依据《JJF 1059.1-2012 测量不确定度评定与表示》进行测量结果不确定度评定。评定结果以包含因子为k的扩展不确定度U或相对扩展不确定度 U_{rel} 表示。

The evaluation was made according to JJF 1059.1-2012 Evaluation and Expression of Uncertainty in Measurement. The evaluation results were expressed by the extended uncertainty U or relative expanded uncertainty U_{rel} with a coverage factor k.

8. 证书中“P”、“合格”代表“测量结果在允许范围内”, “F”、“不合格”代表“测量结果不在允许范围内”, “N/A”代表“不适用”。

"P" and "Pass" in this certificate stand for "Low Limit \leq the measured value \leq High Limit", "F" and "Fail" stand for "the measured value $<$ Low Limit or the measured value $>$ High Limit", "N/A" stands for "Not Applicable".

CEPREI

注: 1. 本证书未经本机构书面授权, 不得部分复制。(The certificate shall not be partly reproduced without written approval of the laboratory.)

2. 本次校准结果仅与被校物有关。(The results are only related to the items calibrated.)



赛宝计量检测中心

CEPREI CALIBRATION & TESTING CENTER

证书编号(Certificate No.): 1GA17007384-0015

1 外观与工作正常性检查(Appearance and Function Check)

P

结论

(Pass/Fail)

P

2 频率设定准确度(Frequency Setting Accuracy)

设定值 (Setting) (MHz)	标准值 (Reference) (MHz)	误差 (Error) (Hz)	允许误差 (Limit) (Hz)	结论 (Pass/Fail)	<i>U</i> (Hz)
0.100	0.09999990	0.10	±0.15	P	0.03
1.000	1.0000000	0.0	±1.1	P	0.2
10.000	9.9999998	0.2	±10.1	P	2.0
30.000	30.0000000	0.0	±30.1	P	6.0
100.000	100.0000012	-1.2	±100.1	P	20.0
300.000	300.0000025	-2.5	±300.1	P	60.0
900.000	900.0000560	-56.0	±900.1	P	180.0

3 中频带宽(IF Bandwidth)(-6dB)

标称值 (Nominal) (Hz)	标准值 (Reference) (Hz)	误差 (Error) (Hz)	允许误差 (Limit) (Hz)	结论 (Pass/Fail)	<i>U</i> (Hz)
200	204.2	-4.2	±6.0	P	4.6
9	9.02	-0.02	±0.27	P	0.21
120	122.1	-2.1	±3.6	P	2.8
1	1.009	-0.009	±0.100	P	0.023



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4 正弦波电压测量准确度(Sinewave level measurement accuracy)

检波器 (Detector)	频率 (Frequency)	标准值 (Reference)	指示值 (Response)	误差 (Error)	允许误差 (Limit)	结论 (Pass/Fail)	L (dB)
	(MHz)	(dB μ V)	(dB μ V)	(dB)	(dB)		
Av	0.009	90.00	90.23	0.23	± 1.5	P	0.22
	0.05	90.00	90.12	0.12	± 1.5	P	0.22
	0.07	90.00	90.05	0.05	± 1.5	P	0.34
	0.1	90.00	90.06	0.06	± 1.5	P	0.34
	0.5	90.00	90.05	0.05	± 1.5	P	0.34
	0.7	90.00	90.06	0.06	± 1.5	P	0.34
	1	90.00	90.07	0.07	± 1.5	P	0.34
	5	90.00	90.12	0.12	± 1.5	P	0.34
	7	90.00	90.13	0.13	± 1.5	P	0.34
	10	90.00	90.16	0.16	± 1.5	P	0.34
	50	90.00	90.23	0.23	± 1.5	P	0.40
	70	90.00	90.21	0.21	± 1.5	P	0.42
	100	90.00	90.19	0.19	± 1.5	P	0.42
	200	90.00	90.21	0.21	± 1.5	P	0.42
	300	90.00	90.45	0.45	± 1.5	P	0.46
500	90.00	90.42	0.42	± 1.5	P	0.46	
700	90.00	90.43	0.43	± 1.5	P	0.46	
999	90.00	90.45	0.45	± 1.5	P	0.46	
Qp	0.009	90.00	90.23	0.23	± 1.5	P	0.22
	0.05	90.00	90.12	0.12	± 1.5	P	0.22
	0.07	90.00	90.05	0.05	± 1.5	P	0.34
	0.1	90.00	90.05	0.05	± 1.5	P	0.34
	0.5	90.00	90.04	0.04	± 1.5	P	0.34
	0.7	90.00	90.05	0.05	± 1.5	P	0.34
	1	90.00	90.07	0.07	± 1.5	P	0.34
	5	90.00	90.12	0.12	± 1.5	P	0.34
7	90.00	90.12	0.12	± 1.5	P	0.34	



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4 正弦波电压测量准确度(Sinewave-level measurement accuracy, RF attenuation 20dB (cont'd))

检波器 (Detector)	频率 (Frequency) (MHz)	标准值 (Reference) (dB μ V)	指示值 (Response) (dB μ V)	误差 (Error) (dB)	允许误差 (Limit) (dB)	结论 (Pass/Fail)	U (dB)
	10	90.00	90.15	0.15	± 1.5	P	0.34
	50	90.00	90.22	0.22	± 1.5	P	0.40
	70	90.00	90.20	0.20	± 1.5	P	0.42
	100	90.00	90.18	0.18	± 1.5	P	0.42
	200	90.00	90.20	0.20	± 1.5	P	0.42
	300	90.00	90.45	0.45	± 1.5	P	0.46
	500	90.00	90.40	0.40	± 1.5	P	0.46
	700	90.00	90.43	0.43	± 1.5	P	0.46
	999	90.00	90.44	0.44	± 1.5	P	0.46
Pk	0.009	90.00	90.23	0.23	± 1.5	P	0.22
	0.05	90.00	90.12	0.12	± 1.5	P	0.22
	0.07	90.00	90.05	0.05	± 1.5	P	0.34
	0.1	90.00	90.05	0.05	± 1.5	P	0.34
	0.5	90.00	90.05	0.05	± 1.5	P	0.34
	0.7	90.00	90.05	0.05	± 1.5	P	0.34
	1	90.00	90.07	0.07	± 1.5	P	0.34
	5	90.00	90.12	0.12	± 1.5	P	0.34
	7	90.00	90.12	0.12	± 1.5	P	0.34
	10	90.00	90.16	0.16	± 1.5	P	0.34
	50	90.00	90.22	0.22	± 1.5	P	0.40
	70	90.00	90.20	0.20	± 1.5	P	0.42
	100	90.00	90.19	0.19	± 1.5	P	0.42
	200	90.00	90.22	0.22	± 1.5	P	0.42
	300	90.00	90.46	0.46	± 1.5	P	0.46
	500	90.00	90.42	0.42	± 1.5	P	0.46
	700	90.00	90.44	0.44	± 1.5	P	0.46
	999	90.00	90.46	0.46	± 1.5	P	0.46



赛宝计量检测中心

CEPREI CALIBRATION & TESTING CENTER 证书编号(Certificate No.): 1GA17007384-0015

5 平均噪声电平显示(Average Noise Level Indication) (Preamplifier off)(BW 120KHz)

频率 (Frequency) (MHz)	平均噪声电平 (Average Noise Level) (dB μ V)	U (k=2) (dB)
20	5.2	
100	16.7	
500	19.6	
600	17.4	
999	19.9	

6 脉冲响应(Pulse Response)(QP)

6.1 幅度关系(Amplitude Relationship)

	频率 (Frequency) (MHz)	标准值 (Reference) (dB μ V)	指示值 (Indicated) (dB μ V)	误差 (Error) (dB)	U (k=2) (dB)
25Hz脉冲	0.1	60.0	57.5	2.5	0.6
100Hz脉冲	1	60.0	59.4	0.6	0.6
100Hz脉冲	100	60.0	58.3	1.7	1.0

6.2 随重复频率的变化-相对校准(Variation with Repetition Frequency-Relative Calibration)

	重复频率 (Repetition Freq.) (Hz)	标准值 (Reference) (dB)	指示值 (Indicated) (dB)	误差 (Error) (dB)	允许误差 (Limit) (dB)	结论 (Pass/Fail)	U (k=2) (dB)
Band A	25	0.0	0.0	0.0	(Ref.)	---	
	100	4.0	3.7	-0.3	± 1	P	0.6
	60	3.0	2.6	-0.4	± 1	P	0.6
	10	-4.0	-3.8	0.2	± 1	P	0.6
	5	-7.5	-8.0	-0.5	± 1.5	P	0.6
	2	-13.0	-11.3	1.7	± 2	P	0.7
Band B	100	0.0	0.0	0.0	(Ref.)	---	
	1000	4.5	5.1	0.6	± 1	P	0.6
	20	-6.5	-5.7	0.8	± 1	P	0.6
	10	-10.0	-8.6	1.4	± 1.5	P	0.6



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6.2 随重复频率的变化-相对校准(Variation with Repetition Frequency-Relative Calibration)

	重复频率 (Repetition Freq.) (Hz)	标准值 (Reference) (dB)	指示值 (Indicated) (dB)	误差 (Error) (dB)	允许误差 (Limit) (dB)	结论 (Pass/Fail)	U (dB)
Band C/D	100	0.0	0.0	0.0	(Ref.)	---	1.0
	1000	8.0	-7.4	-0.6	±1	P	1.0
	20	-9.0	-8.3	0.7	±1	P	1.0
	10	-14.0	-12.8	1.2	±1.5	P	1.0

注: 按客户要求校准。

以下空白/No data hereafter

