

Comparison Evaluation of Electrolytic Capacitors



Table of Contents

I. Introduction

II. Environmental test (raw data, graphs)

III. X-ray analyses

IV. SEM analyses

V. Summary and conclusions



I. Introduction



Introduction

- **Specimen:** Electrolytic Capacitors
- **Test:**
 - Electrical characteristic evaluation
 - Environmental test
 - X-ray analyses
 - SEM analyses
- **Test term:** 2018. 08. 20 ~ 2018. 11. 28
- **Test environment:** (25 ± 5) °C, Below 75% room humidity
- **Test apparatuses:**
 - Precision LCR meter (4284A, Agilent, USA)
 - Withstanding voltage tester (TOS-9201, Kikusui, Japan)
 - X-ray (XT V160, Nikon, Japan)
 - Focused ion beam (Quanta 3D DualBeam, FEI, Netherland)
 - Temperature and humidity test chamber (HYGROS 250C, ACS, Italy)
 - Temperature and humidity test chamber (SE-CT-02, SuksanTech, Korea)
 - Temperature and humidity test chamber (SE-CT-04, SuksanTech, Korea)
 - Thermal shock test chamber (Excal 120 CT, Climats, France)
 - Surge ESD system(E103, KeyTek, USA)
- **Etc:** Blind test
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Introduction

- **Test apparatuses:**
 - Precision LCR Meter (4284A, Agilent, USA)



Introduction

- **Test apparatuses:**
 - Withstanding voltage tester (TOS-9201, Kikusui, Japan)



Introduction

- **Test apparatuses:**
 - X-ray (XT V160, Nikon, Japan)



Introduction

- **Test apparatuses:**
 - Focused ion beam (Quanta 3D DualBeam, FEI, Netherland)



Introduction

- **Test apparatuses:**
 - Temperature and humidity test chamber (HYGROS 250C, ACS, Italy)



Introduction

- **Test apparatuses:**
 - Temperature and humidity test chamber (SE-CT-02, SuksanTech, Korea)



Introduction

- **Test apparatuses:**
 - Temperature and humidity test chamber (SE-CT-04, SuksanTech, Korea)



Introduction

- **Test apparatuses:**
 - Thermal shock test chamber (Excal 120 CT, Climats, France)

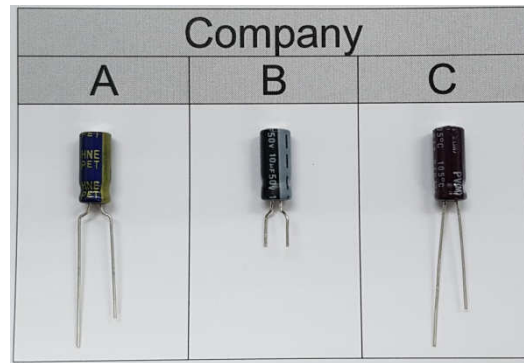


Introduction

- **Test apparatuses:**
 - Surge ESD system (E103, KeyTek, USA)



Specimens



Sample	Capacitance (μF)	Rated voltage (V _{DC})	Capacitance tolerance (%) (@120 Hz, 20 °C)	Diameter housing (mm)	Length (mm)	Lifetime (hr)	Operation Temp. (°C)
A	10	50	±20	5	11	5,000	-40 ~ +105
B	10	50	±20	5	11	5,000	-40 ~ +85
C	10	50	±20	5	11	5,000	-55 ~ +105

Environmental test conditions

- **Test:**

- High temperature test: 85 °C, 500 hr
- Low temperature test: -25 °C, 500 hr
- High temperature and high humidity test: 85 °C 85 %R.H., 500 hr
- Thermal shock test: (-25~85) °C, each 5 min., 240 cycles
- surge test: wave form 1.2/50 us~8/20 us, test voltage ± 1 kV 5 times
- Withstanding voltage: 60 V_{DC}, 60 sec, 10 mA
- Insulation resistance: 60 V_{DC}, 60 sec, 0.01 M Ω

II. Environmental test (raw data, graphs)



Summary

- 環境試験によるキャパシタの静電容量の変化 (@1 kHz) (平均値)

High temp.	Rate of change (%)	Low temp.	Rate of change (%)	85°C/85%	Rate of change (%)	Thermal shock	Rate of change (%)	Surge	Rate of change (%)
A1	-1.10%	A1	0.18%	A1	-1.42%	A1	-0.82%	A1	-0.01%
A2	-1.81%	A2	-0.33%	A2	-1.11%	A2	-0.23%	A2	1.52%
A3	-1.01%	A3	-0.02%	A3	-1.54%	A3	-0.87%	A3	-0.12%
A4	-1.22%	A4	-0.26%	A4	-1.15%	A4	-0.63%	A4	-0.45%
A5	-1.16%	A5	0.14%	A5	-1.09%	A5	-0.85%	A5	-0.36%
average	-1.26%	average	-0.06%	average	-1.26%	average	-0.68%	average	0.11%
B1	-1.59%	B1	-2.85%	B1	-0.63%	B1	-2.82%	B1	0.00%
B2	-5.88%	B2	-1.65%	B2	-2.80%	B2	-1.05%	B2	-0.05%
B3	-1.07%	B3	-1.43%	B3	-1.93%	B3	-0.92%	B3	-0.24%
B4	-3.72%	B4	-1.28%	B4	0.28%	B4	-2.03%	B4	0.07%
B5	-3.26%	B5	-0.60%	B5	-1.08%	B5	-1.70%	B5	-0.06%
average	-3.10%	average	-1.56%	average	-1.23%	average	-1.70%	average	-0.05%
C1	-3.25%	C1	-0.98%	C1	-2.48%	C1	-1.46%	C1	-0.50%
C2	-3.54%	C2	-0.76%	C2	-3.46%	C2	-2.11%	C2	-1.78%
C3	-3.50%	C3	-1.45%	C3	-3.78%	C3	-1.69%	C3	-1.05%
C4	-2.14%	C4	-0.48%	C4	-1.88%	C4	-1.84%	C4	-1.05%
C5	-3.64%	C5	-1.13%	C5	-3.22%	C5	-0.41%	C5	-0.76%
average	-3.21%	average	-0.96%	average	-2.96%	average	-1.50%	average	-1.03%

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No.	Time	Capacitance(μ F)				Tan(δ)				ESR(Ω)			
		1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz
1	Before Test	9.73584	8.44077	1.49935	0.51591	0.059605	0.300183	2.03447	3.52175	0.97016	0.51731	0.41685	0.40131
	24hr	9.73044	8.52622	1.64832	0.56507	0.060202	0.292803	1.97381	3.39436	0.98753	0.51412	0.41477	0.40066
	48hr	9.67777	8.39984	1.51332	0.51576	0.060356	0.292491	2.01987	3.55085	0.98527	0.50075	0.40125	0.38203
	72hr	9.70103	8.49412	1.63125	0.54826	0.060973	0.294315	1.99186	3.45877	1.00279	0.51903	0.41952	0.40583
	120hr	9.64534	8.33933	1.47174	0.50751	0.061646	0.300413	2.03702	3.52773	1.01115	0.51977	0.41727	0.40058
	240hr	9.65552	8.39942	1.52852	0.51245	0.062037	0.299389	2.04055	3.57339	1.02283	0.52787	0.42714	0.41284
	360hr	9.62921	8.35541	1.50136	0.51010	0.063118	0.307398	2.06532	3.54614	1.04493	0.54752	0.44384	0.42974
	500hr	9.62839	8.35666	1.50379	0.50720	0.063147	0.307198	2.07240	3.57501	1.04692	0.54765	0.44419	0.42995
2	Before Test	9.58445	8.20155	1.6067	0.54878	0.072977	0.278384	1.92798	3.42631	1.19961	0.49163	0.38615	0.36690
	24hr	9.52983	8.14048	1.58574	0.53791	0.74616	0.278028	1.93244	3.46462	1.23033	0.49298	0.38671	0.37076
	48hr	9.54705	8.19595	1.69163	0.57112	0.075812	0.280497	1.91462	3.36295	1.26354	0.51312	0.41070	0.39755
	72hr	9.49625	8.08833	1.53492	0.52212	0.076147	0.282305	1.95387	3.47849	1.26272	0.50532	0.39992	0.38505
	120hr	9.52123	8.16144	1.63643	0.54513	0.077054	0.284475	1.94912	3.42499	1.28793	0.52237	0.41894	0.40595
	240hr	9.46449	8.04761	1.51963	0.52522	0.077363	0.286699	1.96148	3.41832	1.28921	0.51773	0.41051	0.39252
	360hr	9.42250	7.94192	1.36537	0.46581	0.080294	0.306872	2.09953	3.62834	1.34822	0.56325	0.45505	0.44041
	500hr	9.41061	7.95483	1.40733	0.48424	0.078935	0.295896	2.03812	3.56718	1.31415	0.52687	0.41592	0.39195
3	Before Test	9.75011	8.43865	1.62849	0.55563	0.062569	0.286728	1.95361	3.43181	1.01811	0.50082	0.39952	0.38705
	24hr	9.74743	8.51128	1.77460	0.593351	0.062666	0.278206	1.89906	3.39641	1.02662	0.49413	0.39436	0.38245
	48hr	9.69651	8.38221	1.63557	0.559318	0.062861	0.280165	1.91889	3.41476	1.02388	0.48339	0.38056	0.36581
	72hr	9.70505	8.40731	1.65275	0.554255	0.064187	0.286795	1.95887	3.47747	1.05248	0.50815	0.40589	0.39328
	120hr	9.66634	8.31716	1.56518	0.536887	0.064531	0.289244	1.96922	3.45911	1.05589	0.50573	0.40066	0.38418
	240hr	9.67832	8.38044	1.65087	0.557466	0.064817	0.288523	1.95211	3.41675	1.06775	0.51509	0.41108	0.39917
	360hr	9.62613	8.22907	1.45219	0.491223	0.067033	0.305816	2.07369	3.60822	1.10498	0.54387	0.43658	0.42239
	500hr	9.65144	8.32366	1.58376	0.534212	0.066071	0.297701	2.00478	3.48367	1.09051	0.53261	0.42683	0.41346
4	Before Test	9.59385	8.21768	1.59575	0.55138	0.062112	0.293505	1.92965	3.36511	1.02557	0.52138	0.40422	0.39034
	24hr	9.56283	8.22113	1.63337	0.547551	0.061466	0.283599	1.90734	3.47508	1.01339	0.49816	0.38314	0.36948
	48hr	9.57795	8.28030	1.73277	0.585131	0.061874	0.283270	1.87656	3.35155	1.02861	0.51125	0.39722	0.38557
	72hr	9.54318	8.18302	1.60445	0.547534	0.062206	0.286877	1.91272	3.42506	1.02873	0.50725	0.39037	0.37641
	120hr	9.53494	8.16553	1.60024	0.54219	0.063848	0.294032	1.94383	3.42776	1.06309	0.53124	0.41347	0.40046
	240hr	9.51216	8.12591	1.55615	0.528414	0.063799	0.293672	1.95349	3.47203	1.06109	0.52577	0.40732	0.39216
	360hr	9.47339	8.00679	1.39925	0.470276	0.066741	0.313303	2.08231	3.66102	1.11758	0.57046	0.44933	0.43544
	500hr	9.47727	8.04011	1.46215	0.499176	0.064992	0.302772	2.00704	3.52622	1.08004	0.53825	0.4166	0.40125
5	Before Test	9.74886	8.40861	1.67529	0.57978 0	0.064443	0.284062	1.91476	3.32471	1.04976	0.50048	0.39744	0.38418
	24hr	9.73376	8.44131	1.77168	0.594986	0.063492	0.275348	1.88925	3.39537	1.03855	0.48922	0.38927	0.37711
	48hr	9.69801	8.35924	1.68822	0.584774	0.063816	0.276255	1.87951	3.31504	1.04015	0.47683	0.37375	0.35877
	72hr	9.70911	8.39795	1.73427	0.586428	0.064606	0.278716	1.89782	3.36228	1.05875	0.49703	0.39542	0.38317
	120hr	9.66431	8.29063	1.60536	0.555471	0.065427	0.283523	1.92799	3.37706	1.06885	0.49752	0.39313	0.37845
	240hr	9.66692	8.32431	1.66169	0.567218	0.065711	0.283229	1.92377	3.37535	1.07975	0.50531	0.40206	0.38884
	360hr	9.60479	8.15218	1.42332	0.483128	0.068688	0.303023	2.07423	3.62876	1.13167	0.53997	0.43346	0.41877
	500hr	9.63538	8.27366	1.59171	0.541715	0.067717	0.292846	1.97969	3.41847	1.12666	0.53212	0.42577	0.41116

No.	Time	Capacitance(μ F)				Tan(δ)				ESR(Ω)			
		1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz
1	Before Test	9.67933	8.37035	1.63066	0.55832	0.062353	0.281692	1.93671	3.40594	1.02118	0.49629	0.39792	0.38534
	24hr	9.68625	8.40175	1.68431	0.575441	0.060881	0.272492	1.88724	3.38374	0.99197	0.46905	0.36985	0.35555
	48hr	9.69982	8.43551	1.73141	0.585195	0.061954	0.277941	1.90075	3.34519	1.01583	0.49177	0.39317	0.38046
	72hr	9.67475	8.36222	1.62287	0.553373	0.061977	0.280416	1.93476	3.43589	1.01173	0.48628	0.38611	0.37115
	120hr	9.70754	8.44812	1.74118	0.576903	0.062933	0.283709	1.92771	3.35577	1.03413	0.50518	0.40507	0.39189
	240hr	9.65832	8.30673	1.53492	0.520413	0.063587	0.290042	2.00011	3.53852	1.04279	0.51129	0.41086	0.39735
	360hr	9.65338	8.30119	1.54677	0.533709	0.063305	0.287667	1.96957	3.44087	1.03579	0.50044	0.39394	0.37777
	500hr	9.69641	8.41286	1.68106	0.559993	0.063644	0.288378	1.96767	3.43615	1.04708	0.51415	0.41397	0.40145
2	Before Test	9.76446	8.33421	1.57501	0.54832	0.068748	0.294256	1.96745	3.37956	1.11610	0.51835	0.41132	0.39726
	24hr	9.80441	8.45111	1.71109	0.571156	0.067302	0.285495	1.92927	3.41721	1.09277	0.50510	0.40102	0.38811
	48hr	9.76547	8.35222	1.61650	0.566038	0.066648	0.282975	1.90173	3.32624	1.07224	0.48108	0.37341	0.35197
	72hr	9.78619	8.39304	1.63651	0.557192	0.068127	0.290346	1.95387	3.42501	1.10744	0.51486	0.40936	0.39572
	120hr	9.75291	8.31035	1.55408	0.542415	0.067822	0.290727	1.95661	3.40393	1.09489	0.50147	0.38599	0.36845
	240hr	9.74594	8.28514	1.51161	0.514133	0.069385	0.299823	2.00652	3.45762	1.12731	0.52768	0.41902	0.40392
	360hr	9.76367	8.33815	1.56337	0.532099	0.069596	0.300625	2.01199	3.47584	1.13449	0.53389	0.42603	0.41254
	500hr	9.73249	8.23966	1.44952	0.501009	0.069625	0.302811	2.03533	3.51452	1.12233	0.52128	0.41079	0.39278
3	Before Test	9.73918	8.30762	1.58116	0.55064	0.073003	0.289719	1.95504	3.36615	1.18611	0.51177	0.40779	0.39426
	24hr	9.74826	8.33115	1.60045	0.548565	0.071268	0.281788	1.93302	3.42607	1.14777	0.48412	0.37968	0.36351
	48hr	9.78491	8.41421	1.72577	0.56802	0.072898	0.288591	1.94496	3.35812	1.18594	0.51272	0.40838	0.39476
	72hr	9.73225	8.28679	1.54428	0.532221	0.073176	0.291767	1.98146	3.45281	1.18749	0.51195	0.40653	0.39129
	120hr	9.74634	8.30911	1.55112	0.527231	0.074156	0.296942	2.01671	3.50793	1.20797	0.52777	0.42252	0.40852
	240hr	9.74085	8.30415	1.55789	0.533114	0.074044	0.295657	1.99622	3.45178	1.20632	0.52574	0.42014	0.40599
	360hr	9.71106	8.22515	1.47437	0.512087	0.074076	0.297641	2.01736	3.47555	1.20196	0.51629	0.40854	0.39315
	500hr	9.73711	8.28255	1.52351	0.518151	0.074807	0.300579	2.03177	3.51299	1.22135	0.53707	0.43116	0.41718
4	Before Test	9.60181	8.29013	1.63948	0.56501 0	0.061777	0.281862	1.91174	3.35264	1.01965	0.50005	0.39684	0.38351
	24hr	9.63747	8.37711	1.77131	0.605012	0.061226	0.276364	1.86588	3.29235	1.01221	0.49473	0.39252	0.37995
	48hr	9.60538	8.30356	1.66882	0.576144	0.059989	0.274075	1.86221	3.32801	0.98123	0.46627	0.36192	0.34458
	72hr	9.61031	8.30908	1.66146	0.566101	0.062350	0.283707	1.92236	3.38531	1.01377	0.50834	0.40444	0.39131
	120hr	9.58922	8.24521	1.58376	0.548328	0.062007	0.284491	1.92833	3.38021	1.02085	0.49738	0.39053	0.39373
	240hr	9.58943	8.24299	1.56869	0.538117	0.062478	0.287191	1.95542	3.43788	1.02998	0.50703	0.40123	0.38589
	360hr	9.59736	8.27236	1.59603	0.540777	0.063196	0.291355	1.97507	3.46491	1.04782	0.52361	0.41888	0.40581
	500hr	9.57703	8.20236	1.50673	0.516481	0.063094	0.292284	1.99123	3.50548	1.04041	0.51325	0.40571	0.38874
5	Before Test	9.66864	8.25744	1.59346	0.55605	0.062938	0.296687	1.92863	3.33151	1.03076	0.52267	0.40264	0.38758
	24hr	9.67674	8.28277	1.61414	0.554067	0.062033	0.291796	1.92081	3.40801	1.01147	0.50747	0.38698	0.36971
	48hr	9.70842	8.38041	1.75092	0.590747	0.062535	0.293103	1.89802	3.29625	1.02731	0.52295	0.40478	0.39117
	72hr	9.66245	8.23855	1.56444	0.542312	0.062877	0.297165	1.94175	3.39377	1.02867	0.52047	0.39835	0.38127
	120hr	9.68275	8.30043	1.62313	0.548343	0.063585	0.301342	1.96144	3.40872	1.04544	0.53793	0.41832	0.40415
	240hr	9.67081	8.26385	1.58613	0.545631	0.063687	0.302149	1.96615	3.40212	1.04672	0.53791	0.41762	0.40354
	360hr	9.68072	8.28611	1.59427	0.539617	0.063851	0.303481	1.98357	3.45773	1.05113	0.54357	0.42487	0.41141
	500hr	9.68173	8.29477	1.60195	0.543247	0.064069	0.304852	1.98454	3.44532	1.05424	0.54595	0.42593	0.41218

No.	Time	Capacitance(μ F)				Tan(δ)				ESR(Ω)			
		1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz
1	Before Test	9.70319	8.36885	1.61347	0.556831	0.06301	0.291361	1.93844	3.38214	1.01811	0.51101	0.40261	0.38909
	24hr	9.69314	8.43106	1.74546	0.591204	0.062155	0.282696	1.89131	3.36835	1.02153	0.50248	0.39542	0.38265
	48hr	9.68604	8.40755	1.72246	0.580887	0.063046	0.287121	1.90811	3.360110	1.03779	0.51148	0.40344	0.39043
	72hr	9.63084	8.26729	1.54399	0.524327	0.064325	0.295455	1.98165	3.50634	1.05808	0.52107	0.40964	0.39466
	120hr	9.61540	8.24513	1.51211	0.531787	0.065219	0.299400	1.98333	3.44153	1.07562	0.53197	0.4193	0.40446
	240hr	9.60931	8.26702	1.58282	0.538284	0.065351	0.295261	1.96808	3.45445	1.07939	0.52581	0.41455	0.40023
	360hr	9.60307	8.26055	1.58777	0.543189	0.065723	0.297492	1.97163	3.39345	1.08214	0.51999	0.40511	0.38904
	500hr	9.56493	8.17791	1.50131	0.520511	0.065467	0.294922	1.96895	3.46628	1.07903	0.51634	0.40169	0.38122
2	Before Test	9.74488	8.42643	1.74163	0.613577	0.066315	0.270815	1.85106	3.20073	1.07567	0.47225	0.37475	0.35958
	24hr	9.70221	8.38647	1.73005	0.596552	0.067143	0.267401	1.85893	3.30987	1.09066	0.46154	0.36496	0.35003
	48hr	9.68235	8.34441	1.66913	0.574008	0.068093	0.270615	1.89835	3.36193	1.10752	0.46875	0.37044	0.35685
	72hr	9.69131	8.37437	1.70333	0.573188	0.069407	0.275041	1.91305	3.42663	1.14379	0.49415	0.39823	0.38563
	120hr	9.65234	8.28802	1.60081	0.550224	0.070388	0.281642	1.94772	3.41019	1.15414	0.50005	0.40167	0.38825
	240hr	9.64932	8.30194	1.63005	0.558633	0.069717	0.277145	1.92578	3.40292	1.14235	0.49025	0.39174	0.37791
	360hr	9.67023	8.34165	1.68329	0.552074	0.070837	0.283866	1.95855	3.41952	1.16638	0.50976	0.41145	0.39818
	500hr	9.63638	8.29274	1.61292	0.550189	0.070750	0.283857	1.95993	3.42522	1.16634	0.50937	0.41142	0.39819
3	Before Test	9.67026	8.27844	1.61624	0.555359	0.066044	0.293245	1.93545	3.35231	1.08363	0.52123	0.40848	0.39516
	24hr	9.63559	8.26441	1.63275	0.549212	0.066545	0.289780	1.93956	3.46462	1.09753	0.51948	0.40762	0.39447
	48hr	9.61950	8.23671	1.60111	0.537399	0.067592	0.293791	1.96361	3.49245	1.11696	0.52918	0.41626	0.40308
	72hr	9.58865	8.17412	1.54106	0.522397	0.067482	0.292950	1.96719	3.50723	1.10936	0.51699	0.40291	0.38713
	120hr	9.56952	8.13045	1.49786	0.511945	0.069251	0.302771	2.00713	3.50021	1.14733	0.54498	0.42862	0.41418
	240hr	9.55485	8.11523	1.49324	0.507191	0.069455	0.301211	2.00921	3.53435	1.15163	0.54226	0.42651	0.41223
	360hr	9.53416	8.06793	1.45195	0.497046	0.069764	0.302128	2.01626	3.53922	1.15462	0.53869	0.42131	0.40811
	500hr	9.52112	8.03722	1.40132	0.468577	0.070667	0.307411	2.07626	3.69828	1.17086	0.54977	0.43277	0.41011
4	Before Test	9.73071	8.32068	1.62651	0.559125	0.064973	0.292912	1.93607	3.37962	1.05934	0.51787	0.40429	0.39117
	24hr	9.70037	8.32711	1.72026	0.598323	0.633730	0.273175	1.81951	3.24085	1.02822	0.46982	0.35659	0.34057
	48hr	9.67944	8.27522	1.65225	0.572043	0.065379	0.282973	1.88434	3.33734	1.06399	0.49152	0.37716	0.36185
	72hr	9.68822	8.30237	1.69143	0.598087	0.066675	0.286917	1.89985	3.34735	1.09474	0.51426	0.40153	0.38853
	120hr	9.64599	8.20456	1.57215	0.542452	0.067521	0.293033	1.94375	3.40575	1.10733	0.52043	0.40492	0.38997
	240hr	9.63519	8.20062	1.58847	0.549311	0.067719	0.292456	1.93475	3.37901	1.11301	0.52197	0.40658	0.39261
	360hr	9.65123	8.24707	1.63222	0.545204	0.067925	0.294773	1.95650	3.43823	1.12093	0.53241	0.41777	0.40446
	500hr	9.61897	8.18334	1.56777	0.532126	0.068971	0.298422	1.97931	3.46041	1.13851	0.53784	0.42242	0.40853
5	Before Test	9.77414	8.33256	1.63113	0.565671	0.067224	0.288111	1.91912	3.34472	1.08816	0.50577	0.39533	0.38072
	24hr	9.79204	8.44766	1.87711	0.646741	0.065673	0.273197	1.80972	3.17371	1.07044	0.48825	0.38127	0.36878
	48hr	9.76722	8.40345	1.80146	0.611271	0.668330	0.278805	1.86174	3.28871	1.08981	0.38594	0.39136	0.37867
	72hr	9.72022	8.28757	1.64434	0.569028	0.067877	0.285022	1.90364	3.34221	1.09785	0.49854	0.38519	0.36945
	120hr	9.71916	8.29428	1.64704	0.564277	0.068174	0.288877	1.92513	3.36893	1.11375	0.51546	0.40479	0.39125
	240hr	9.67198	8.27335	1.64768	0.572401	0.068284	0.288446	1.90829	3.36871	1.11611	0.51419	0.40219	0.38829
	360hr	9.67334	8.21007	1.56772	0.546055	0.068192	0.289811	1.92911	3.36424	1.10827	0.50744	0.39372	0.37277
	500hr	9.66761	8.20811	1.56931	0.546616	0.068137	0.290823	1.93542	3.37672	1.11115	0.51179	0.39765	0.38242

No.	Time	Capacitance(μ F)				Tan(δ)				ESR(ohm)			
		1 kHz	1 0kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz
1	Before Test	9.68344	8.27552	1.60611	0.554412	0.072833	0.28848	1.95065	3.36116	1.19335	0.51564	0.41193	0.39853
	After test	9.60379	8.17469	1.53534	0.525713	0.074627	0.287341	1.97555	3.47986	1.22643	0.51166	0.40652	0.38666
2	Before Test	9.80702	8.42814	1.58757	0.544648	0.061287	0.293361	1.96814	3.45181	0.98922	0.50685	0.39922	0.38432
	After test	9.78473	8.41653	1.62545	0.558213	0.062719	0.292534	1.94876	3.39601	1.01988	0.51307	0.40419	0.39029
3	Before Test	9.67915	8.23787	1.57715	0.542434	0.074488	0.287692	1.95435	3.41520	1.21707	0.51197	0.40671	0.39303
	After test	9.59537	8.15974	1.55752	0.539202	0.076357	0.283755	1.94231	3.41612	1.25303	0.50102	0.38756	0.37219
4	Before Test	9.69839	8.33525	1.65509	0.571441	0.065663	0.289145	1.91642	3.32623	1.07505	0.51264	0.40238	0.38961
	After test	9.63698	8.26333	1.62108	0.548068	0.067903	0.294716	1.95251	3.43999	1.12018	0.52887	0.41577	0.40273
5	Before Test	9.59022	8.11611	1.55247	0.529143	0.079195	0.295869	1.96734	3.43775	1.30883	0.53676	0.42217	0.40881
	After test	9.50886	8.02605	1.49737	0.510244	0.079799	0.292847	1.97332	3.50175	1.31959	0.51894	0.40333	0.38606

No.	Time	Capacitance(μF)				Tan(δ)				ESR(ohm)			
		1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz
1	Before Test	9.36191	7.75082	1.24546	0.42284	0.089843	0.325246	2.18487	3.75776	1.51515	0.60396	0.48398	0.46816
	After test	9.36142	7.75374	1.24192	0.41416	0.093305	0.343516	2.26118	3.78624	1.60592	0.66372	0.53579	0.51779
2	Before Test	9.47286	8.21336	1.65444	0.57523	0.065427	0.298197	1.88627	3.27413	1.07397	0.53416	0.40538	0.39211
	After test	9.61679	8.01912	1.41414	0.49242	0.067735	0.315303	2.01865	3.49224	1.10932	0.55443	0.41811	0.40034
3	Before Test	9.36448	8.12387	1.63025	0.56456	0.060899	0.280062	1.88927	3.30644	1.03013	0.50693	0.39799	0.38367
	After test	9.35286	8.05643	1.50369	0.50812	0.063903	0.301903	2.02876	3.51513	1.08877	0.55634	0.44512	0.43158
4	Before Test	9.57449	8.19826	1.58637	0.55116	0.070293	0.286729	1.93667	3.34935	1.16274	0.51437	0.40931	0.39588
	After test	9.53093	8.06535	1.40513	0.48830	0.071904	0.300761	2.04206	3.52807	1.18359	0.52562	0.41412	0.39439
5	Before Test	9.49638	7.86132	1.4033	0.48392	0.090572	0.313108	2.04327	3.50646	1.50702	0.57892	0.45174	0.43672
	After test	9.46216	7.78154	1.28303	0.43507	0.094424	0.33376	2.17627	3.70041	1.58457	0.62526	0.49392	0.47817

No.	Withstanding voltage(uA)
1	3
2	4
3	3
4	6
5	5

No.	Insulation resistance(MΩ)
1	0.00
2	0.00
3	0.00
4	0.00
5	0.00

No.	Time	Capacitance(uF)				Tan(δ)				ESR(ohm)			
		1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz
1	Before Test	8.59981	3.09325	0.092901	0.0349531	0.199525	1.24826	7.39343	9.99999	3.55428	2.52493	2.28856	2.24513
	24hr	8.59294	3.25427	0.100944	0.0375707	0.190284	1.17364	7.08577	9.86417	3.35954	2.3189	2.06632	2.00707
	48hr	8.67642	3.54349	0.111577	0.0404466	0.187097	1.14823	6.92661	9.63375	3.34172	2.32965	2.10495	2.06698
	72hr	8.59451	3.25827	0.102284	0.0382106	0.191249	1.17148	7.02265	9.71516	3.39612	2.35417	2.10411	2.04757
	120hr	8.64738	3.48121	0.113124	0.0413607	0.187467	1.13635	6.78347	9.46217	3.35362	2.32198	2.08653	2.04444
	240hr	8.61786	3.63729	0.121745	0.0439511	0.188042	1.10047	6.50766	9.16804	3.37797	2.27743	2.02959	1.99325
	360hr	8.37001	3.07195	0.100646	0.0381258	0.208002	1.19923	6.82319	9.31156	3.78965	2.54369	2.26411	2.21215
	500hr	8.46266	3.53207	0.121138	0.0430971	0.204999	1.14692	6.53745	8.96845	3.78945	2.51558	2.24305	2.19875
2	Before Test	8.70707	3.89517	0.121575	0.0417288	0.188794	1.14096	6.92997	9.64615	3.41557	2.37616	2.15927	2.12575
	24hr	8.55255	3.51524	0.112437	0.0410076	0.187589	1.13144	6.85865	9.52844	3.40613	2.35711	2.13141	2.09171
	48hr	8.48895	3.44845	0.111033	0.0412249	0.182976	1.10042	6.75824	9.45130	3.30277	2.23544	2.00488	1.95201
	72hr	8.44377	3.65618	0.119312	0.0430444	0.186141	1.09167	6.67707	9.32601	3.42717	2.31219	2.09124	2.05562
	120hr	8.42512	3.38079	0.111155	0.0414959	0.190319	1.08397	6.62154	9.19663	3.55808	2.29304	2.05317	2.00254
	240hr	8.43138	3.77942	0.125611	0.0442401	0.188287	1.04801	6.42813	9.16966	3.55199	2.27371	2.04188	2.00177
	360hr	8.15409	3.58126	0.124035	0.0444474	0.199111	1.09716	6.44275	8.86756	3.79738	2.44411	2.19311	2.15111
	500hr	8.19550	3.44206	0.11805	0.0433335	0.20411	1.12452	6.44658	8.77812	3.90519	2.52583	2.26235	2.21832
3	Before Test	8.62278	3.24581	0.097907	0.0366446	0.188838	1.20312	7.28617	9.98735	3.36655	2.41836	2.19714	2.15557
	24hr	8.62476	3.43445	0.107671	0.0399106	0.178286	1.11438	6.89747	9.70118	3.16312	2.18986	1.95993	1.91215
	48hr	8.72446	3.81292	0.122504	0.0438247	0.175866	1.08774	6.73177	9.52297	3.13744	2.19647	1.98859	1.95442
	72hr	8.66639	3.62731	0.117143	0.0428617	0.172155	1.07113	6.69771	9.52355	3.04699	2.10273	1.87903	1.83215
	120hr	8.64737	3.86224	0.128165	0.0456633	0.172452	1.05237	6.53927	9.32595	3.10255	2.14129	1.93274	1.89675
	240hr	8.55218	3.88344	0.131367	0.0467038	0.176573	1.03444	6.36978	9.10345	3.20634	2.14299	1.91907	1.88092
	360hr	8.50067	3.85619	0.133619	0.0471771	0.184418	1.06372	6.42536	9.06207	3.38848	2.26835	2.03615	1.99888
	500hr	8.53076	3.87172	0.134174	0.0474597	0.190911	1.10244	6.51975	9.00642	3.51693	2.35188	2.10873	2.06536
4	Before Test	8.59686	3.73513	0.118843	0.0424553	0.175571	1.09887	6.77189	9.60404	3.17582	2.23693	2.02608	1.99363
	24hr	8.58463	3.81192	0.126544	0.0447999	0.173135	1.07221	6.59897	9.35532	3.14142	2.19171	1.97969	1.94483
	48hr	8.53512	3.72915	0.124624	0.0452610	0.166987	1.03472	6.48566	9.27355	3.00398	2.03475	1.80702	1.72742
	72hr	8.58449	3.96451	0.133816	0.0467767	0.167268	1.03261	6.4377	9.24992	3.04148	2.11103	1.90401	1.86875
	120hr	8.50877	3.81811	0.131801	0.0476885	0.166158	1.01227	6.28961	9.02974	3.01179	2.04296	1.81435	1.76977
	240hr	8.52815	4.08250	0.144815	0.0510948	0.168823	0.990532	6.08215	8.74313	3.09222	2.04994	1.82855	1.79033
	360hr	8.42505	4.06317	0.14905	0.0520211	0.170304	0.996212	6.00924	8.59611	3.19606	2.13901	1.91527	1.87834
	500hr	8.27727	4.05013	0.144001	0.0511001	0.174105	1.01755	6.02811	8.47828	3.31341	2.22115	1.98309	1.94331
5	Before Test	8.81031	3.67739	0.117941	0.0434262	0.167967	1.09606	6.77131	9.57882	2.92824	2.10439	1.87135	1.81922
	24hr	8.78154	3.80261	0.125861	0.0459158	0.162282	1.04919	6.52845	9.30661	2.82911	1.98712	1.7719	1.72806
	48hr	8.85189	4.14992	0.141811	0.0504413	0.161686	1.03269	6.39103	9.10535	2.86172	2.03211	1.83315	1.79726
	72hr	8.71531	3.96745	0.136135	0.0494094	0.155162	0.995012	6.28355	9.03175	2.74687	1.91038	1.70431	1.65581
	120hr	8.62977	4.12522	0.14442	0.0519344	0.154027	0.990992	6.15449	8.79414	2.78533	1.98277	1.78512	1.74878
	240hr	8.63174	4.28511	0.153314	0.0536591	0.156778	0.976505	6.00231	8.62153	2.84305	1.97391	1.76402	1.72571
	360hr	8.57272	4.16222	0.15107	0.0536113	0.161397	0.997027	6.02333	8.55836	2.95178	2.05635	1.84124	1.80555
	500hr	8.52345	4.12005	0.152195	0.0534111	0.166697	1.01701	6.03727	8.52421	3.07732	2.13807	1.91212	1.87391

No.	Time	Capacitance(uF)				Tan(δ)				ESR(ohm)			
		1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz
1	Before Test	8.75353	3.8042	0.123894	0.0442406	0.165886	1.09788	6.72533	9.50842	2.94148	2.18491	1.97958	1.94358
	24hr	8.66522	3.81395	0.124449	0.0447418	0.166978	1.10377	6.68785	9.34711	3.01493	2.23176	2.02443	1.98991
	48hr	8.54215	3.43025	0.109735	0.0410545	0.168276	1.12537	6.81495	9.47227	3.00513	2.16511	1.93487	1.86931
	72hr	8.52089	3.35197	0.105228	0.0394219	0.175463	1.17755	6.99124	9.55513	3.18424	2.38331	2.15863	2.11461
	120hr	8.51479	3.31776	0.104617	0.0396882	0.171718	1.15432	6.92685	9.51811	3.09175	2.27637	2.02577	1.93446
	240hr	8.58204	3.54113	0.111115	0.0407349	0.173045	1.15756	6.91303	9.51621	3.14323	2.34881	2.12971	2.09085
	360hr	8.59435	3.65273	0.114262	0.0411415	0.174585	1.16221	6.92637	9.53415	3.18741	2.40755	2.18954	2.15193
	500hr	8.50423	3.20607	0.098330	0.0372023	0.180989	1.22448	7.17983	9.69583	3.29298	2.49155	2.25963	2.21358
2	Before Test	8.70813	3.87030	0.126195	0.0455181	0.164463	1.07387	6.64792	9.37567	2.94393	2.13255	1.94235	1.90729
	24hr	8.61376	3.63416	0.117513	0.0438901	0.164258	1.07146	6.65324	9.31525	2.92666	2.06891	1.85444	1.78893
	48hr	8.61647	3.80176	0.121537	0.0438444	0.169232	1.09914	6.73798	9.37189	3.06675	2.22198	2.02195	1.98631
	72hr	8.60323	3.74321	0.119175	0.0434062	0.171414	1.11487	6.79555	9.39403	3.11338	2.26505	2.06375	2.03114
	120hr	8.57962	3.58775	0.113371	0.0418777	0.173583	1.13439	6.87554	9.43864	3.14906	2.29954	2.09283	2.05354
	240hr	8.57448	3.58524	0.113508	0.0419152	0.173099	1.13147	6.87118	9.45641	3.13565	2.28681	2.08298	2.04502
	360hr	8.62004	3.67449	0.114429	0.0415225	0.175717	1.15125	6.93751	9.50176	3.19544	2.35206	2.14515	2.11277
	500hr	8.56427	3.43229	0.106579	0.0397799	0.178729	1.17791	7.05082	9.56737	3.24176	2.3945	2.18243	2.14075
3	Before Test	8.62297	3.75027	0.119009	0.0427908	0.170453	1.10247	6.78614	9.54816	3.07715	2.22298	2.01546	1.97785
	24hr	8.57911	3.64218	0.116412	0.0424148	0.173115	1.11413	6.80753	9.50716	3.13777	2.26074	2.04856	2.01222
	48hr	8.45548	3.41936	0.108617	0.0405524	0.172211	1.12348	6.85314	9.52132	3.12883	2.24667	2.02175	1.91435
	72hr	8.44239	3.34885	0.105731	0.0399050	0.171737	1.12433	6.86414	9.50523	3.09403	2.17994	1.94733	1.87818
	120hr	8.39681	3.27079	0.101857	0.0385118	0.176445	1.16194	7.02255	9.60357	3.22913	2.34744	2.11524	2.05347
	240hr	8.46239	3.52645	0.110687	0.0406305	0.175453	1.14636	6.92895	9.54755	3.22673	2.35737	2.14235	2.10211
	360hr	8.49423	3.52022	0.110305	0.0402104	0.177503	1.15913	6.97987	9.61714	3.27735	2.41554	2.20405	2.16811
	500hr	8.49937	3.52202	0.110462	0.0399041	0.179272	1.17566	7.03928	9.62810	3.29402	2.43615	2.21976	2.18101
4	Before Test	8.67578	3.41113	0.103696	0.0376057	0.185622	1.19444	7.24531	9.99999	3.31501	2.40941	2.19077	2.15499
	24hr	8.56942	3.14644	0.094859	0.0356955	0.188894	1.20981	7.31845	9.99999	3.35942	2.38676	2.13827	2.07644
	48hr	8.56739	3.26104	0.098548	0.0365195	0.192385	1.22341	7.30734	9.97752	3.47273	2.50718	2.28332	2.2447
	72hr	8.58050	3.29486	0.098610	0.0362522	0.195193	1.24489	7.39643	9.99999	3.53412	2.56336	2.33373	2.29406
	120hr	8.52607	3.11074	0.092315	0.0347082	0.197593	1.26477	7.46351	9.99999	3.57466	2.60723	2.37398	2.33055
	240hr	8.52093	3.11435	0.092712	0.0348622	0.196778	1.25698	7.44397	9.99999	3.55951	2.58178	2.35035	2.30905
	360hr	8.56618	3.24412	0.093558	0.0347331	0.199713	1.29403	7.63657	9.99999	3.56445	2.55387	2.29449	2.21815
	500hr	8.56486	3.24377	0.09445	0.0351228	0.199329	1.27086	7.44978	9.99999	3.61903	2.64721	2.41876	2.38277
5	Before Test	8.81934	3.52515	0.110227	0.0405877	0.176917	1.11677	6.94917	9.81411	3.06718	2.14442	1.91512	1.8481
	24hr	8.82702	3.57275	0.110666	0.0397401	0.185000	1.16024	7.11342	9.95811	3.24795	2.30655	2.09464	2.05867
	48hr	8.70975	3.32145	0.102079	0.0380451	0.186666	1.62443	7.13321	9.90798	3.27327	2.27972	2.05411	1.98725
	72hr	8.69912	3.28437	0.100172	0.0374552	0.188237	1.17431	7.18052	9.95906	3.30086	2.28734	2.01272	1.92852
	120hr	8.68555	3.20778	0.097189	0.0368122	0.191553	1.20177	7.26276	9.91895	3.36265	2.36517	2.12197	2.06221
	240hr	8.74704	3.38554	0.102799	0.0379544	0.191646	1.19587	7.21916	9.91425	3.38777	2.40808	2.18955	2.15185
	360hr	8.76375	3.40032	0.103042	0.0376105	0.197357	1.24182	7.33791	9.93341	3.49175	2.15277	2.28624	2.24738
	500hr	8.76622	3.39146	0.102333	0.0376225	0.194499	1.22101	7.29831	9.97512	3.44133	2.47695	2.25712	2.22098

No.	Time	Capacitance(uF)				Tan(δ)				ESR(ohm)			
		1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz
1	Before Test	8.59412	3.0915	0.093623	0.0353314	0.190198	1.21708	7.31585	9.99999	3.36787	2.38924	2.13771	2.08358
	24hr	8.60237	3.3035	0.103525	0.0385038	0.18349	1.15913	7.00727	9.76772	3.23409	2.26902	2.01942	1.95774
	48hr	8.59905	3.38237	0.107253	0.0398404	0.177886	1.12279	6.88271	9.66329	3.15542	2.19572	1.94512	1.86178
	72hr	8.65048	3.64221	0.116734	0.0421113	0.178375	1.11511	6.77777	9.53775	3.20423	2.27418	2.05276	2.01669
	120hr	8.54494	3.50302	0.115284	0.0423535	0.178188	1.08682	6.63133	9.38733	3.19375	2.18116	1.91535	1.84808
	240hr	8.51153	3.69726	0.129127	0.0466415	0.177692	1.03035	6.27759	9.02661	3.20915	2.10995	1.86499	1.81368
	360hr	8.54621	3.69423	0.128298	0.0465412	0.183777	1.05095	6.27913	8.91443	3.34986	2.20476	1.95667	1.91584
	500hr	8.53983	3.78197	0.133738	0.0484122	0.182376	1.03226	6.14295	8.73743	3.33078	2.17098	1.92247	1.88197
2	Before Test	8.66846	3.1257	0.093805	0.0352875	0.196391	1.26237	7.39707	9.99999	3.49401	2.56286	2.33601	2.28061
	24hr	8.73521	3.48189	0.110448	0.0405149	0.183621	1.16295	6.93502	9.61582	3.25884	2.34706	2.12591	2.08703
	48hr	8.73881	3.60648	0.116712	0.0422657	0.181296	1.14087	6.81166	9.46887	3.22411	2.30981	2.08557	2.04834
	72hr	8.68654	3.48955	0.112771	0.0418833	0.177902	1.11884	6.76111	9.43915	3.14767	2.21657	1.98379	1.93013
	120hr	8.56411	3.64341	0.121494	0.0446349	0.174187	1.09431	6.55955	9.12493	3.15745	2.24153	2.01776	1.97734
	240hr	8.51023	3.79402	0.127885	0.045723	0.170224	1.04757	6.36514	9.13555	3.12666	2.17885	1.94532	1.90614
	360hr	8.46909	3.73427	0.132282	0.0466919	0.178069	1.05036	6.25187	8.87909	3.31471	2.25367	1.99981	1.96159
	500hr	8.42599	3.71367	0.133332	0.0481998	0.176849	1.03073	6.12529	8.68576	3.31484	2.21983	1.97044	1.92976
3	Before Test	8.57069	3.22422	0.09878	0.0367616	0.186651	1.17722	7.17316	9.99877	3.01873	2.32821	2.08611	2.02442
	24hr	8.57206	3.35744	0.105845	0.0393282	0.182253	1.14147	6.94992	9.69711	3.25711	2.27488	2.03791	1.98277
	48hr	8.55681	3.45223	0.110036	0.0404947	0.177791	1.11248	6.83999	9.64951	3.18633	2.21635	1.97059	1.91052
	72hr	8.61255	3.86017	0.118515	0.0425676	0.175451	1.09565	6.72813	9.49877	3.17802	2.23449	2.01637	1.97847
	120hr	8.52925	3.62666	0.120507	0.0440153	0.170513	1.05631	6.53507	9.29751	3.07312	2.10132	1.86906	1.82315
	240hr	8.44447	3.81735	0.134913	0.0484105	0.161244	0.988795	6.15315	8.93307	2.98644	2.02982	1.79925	1.74777
	360hr	8.42827	3.97149	0.142531	0.0497075	0.164615	0.993411	6.10561	8.83457	3.07873	2.10063	1.87371	1.84175
	500hr	8.40512	4.02325	0.146474	0.0515475	0.162691	0.977924	6.00683	8.67358	3.04667	2.06249	1.83765	1.80029
4	Before Test	8.60257	3.12503	0.092164	0.0344911	0.192272	1.27505	7.52355	9.99999	3.45612	2.58816	2.36146	2.32056
	24hr	8.59683	3.35235	0.102291	0.0376457	0.18573	1.21339	7.22901	9.86418	3.35707	2.47911	2.26372	2.22414
	48hr	8.61261	3.47411	0.107379	0.0393673	0.182677	1.18744	7.10282	9.72757	3.30246	2.42317	2.20458	2.16519
	72hr	8.55757	3.28846	0.101397	0.0382459	0.180146	1.17649	7.10255	9.72621	3.21153	2.32561	2.08135	2.02535
	120hr	8.61252	3.62148	0.115617	0.0421351	0.178421	1.15134	6.93319	9.47729	3.21956	2.33033	2.11235	2.07011
	240hr	8.6087	3.72441	0.124537	0.0446513	0.173541	1.08216	6.57131	9.35237	3.13222	2.2046	1.98306	1.94451
	360hr	8.59238	3.78206	0.127844	0.0443157	0.177147	1.08411	6.43834	8.99277	3.21414	2.24083	2.00628	1.96511
	500hr	8.62641	3.94244	0.138608	0.0497717	0.172566	1.04294	6.18734	8.69789	3.13515	2.15875	1.93187	1.90212
5	Before Test	8.57062	3.18407	0.098213	0.0369116	0.183004	1.18255	7.11759	9.87533	3.25353	2.32757	2.07609	2.02284
	24hr	8.56311	3.33111	0.105923	0.0395301	0.179596	1.14991	6.89722	9.59289	3.21622	2.29413	2.04915	1.98544
	48hr	8.57012	3.43025	0.110932	0.0413114	0.173677	1.10689	6.71835	9.42889	3.09847	2.17315	1.92516	1.85978
	72hr	8.62355	3.64116	0.117652	0.0429504	0.173895	1.10647	6.69403	9.38925	3.13845	2.25033	2.02595	1.98574
	120hr	8.58737	3.61807	0.121098	0.0445817	0.169571	1.07545	6.52218	9.18832	3.03413	2.12064	1.88351	1.83361
	240hr	8.50958	3.73741	0.129725	0.0465447	0.172571	1.03261	6.31224	9.11013	3.13174	2.12016	1.88741	1.84929
	360hr	8.50074	3.84231	0.132877	0.0479204	0.182782	1.03372	6.17935	8.79913	3.36887	2.19722	1.95111	1.91144
	500hr	8.47795	4.00181	0.146069	0.0514915	0.180319	1.00792	6.00901	8.57707	3.33335	2.14995	1.90391	1.86462

No.	Time	Capacitance(μ F)				Tan(δ)				ESR(ohm)			
		1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz
1	Before Test	8.58442	3.10007	0.094123	0.0357615	0.182053	1.22286	7.28691	9.96821	3.23246	2.38905	2.13942	2.08007
	After test	8.34271	3.43131	0.107507	0.0392109	0.188542	1.20837	7.03429	9.46319	3.53626	2.59369	2.34674	2.30315
2	Before Test	8.59107	3.23707	0.096241	0.0355949	0.185513	1.23835	7.40788	9.99999	3.34888	2.51392	2.28971	2.25083
	After test	8.50085	3.37409	0.09931	0.0365715	0.189557	1.22481	7.24873	9.88315	3.47535	2.55429	2.32976	2.29231
3	Before Test	8.6569	3.42517	0.105777	0.0385419	0.182391	1.18999	7.08611	9.82662	3.27274	2.42122	2.19301	2.15192
	After test	8.57708	3.3719	0.106413	0.0391309	0.189474	1.22531	7.16931	9.62951	3.42692	2.51035	2.26637	2.21955
4	Before Test	8.58531	3.95104	0.118503	0.0444183	0.179861	1.12837	6.79723	9.48077	3.30377	2.37223	2.15408	2.1198
	After test	8.41136	3.63277	0.118301	0.0425644	0.186679	1.12799	6.68411	9.15501	3.53814	2.45445	2.22213	2.18225
5	Before Test	8.64681	3.86358	0.125354	0.0447119	0.166246	1.08045	6.72667	9.51501	2.99817	2.17331	1.97293	1.93767
	After test	8.50002	4.24444	0.145486	0.0496402	0.158571	1.00703	6.31773	9.22691	2.94275	2.09704	1.90858	1.97995

No.	Time	Capacitance(μ F)				Tan(δ)				ESR(ohm)			
		1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz
1	Before Test	8.50551	3.40452	0.10648	0.03983	0.179105	1.14707	6.96937	9.59316	3.24736	2.31615	2.10222	2.06083
	After test	8.50554	3.37507	0.10288	0.03740	0.190423	1.23741	7.26606	9.77473	3.49168	2.56619	2.34417	2.30525
2	Before Test	8.52677	3.80535	0.12444	0.04370	0.173955	1.07126	6.65877	9.53529	3.17918	2.19997	1.98887	1.95447
	After test	8.52265	3.78107	0.12238	0.04304	0.184161	1.14195	6.85948	9.51715	3.40372	2.42184	2.20721	2.17821
3	Before Test	8.53972	3.38505	0.10486	0.03851	0.183912	1.18773	7.10234	9.77476	3.34707	2.44172	2.21751	2.17716
	After test	8.51888	3.25231	0.09734	0.03593	0.196917	1.28272	7.40871	9.88896	3.62432	2.71212	2.47914	2.44243
4	Before Test	8.53167	3.16431	0.09570	0.03593	0.179254	1.20315	7.28417	9.99999	3.20714	2.35248	2.09908	2.04477
	After test	8.53799	3.17258	0.09321	0.03444	0.197225	1.30723	7.53792	9.99999	3.60471	2.75502	2.51903	2.48592
5	Before Test	8.50677	3.21618	0.09916	0.03710	0.182061	1.17871	7.11949	9.88637	3.27251	2.34413	2.10534	2.23815
	After test	8.50197	3.1212	0.09351	0.03477	0.197795	1.29199	7.45759	9.97249	3.61513	2.69202	2.45295	2.41222

No.	Withstanding voltage(uA)
1	2
2	1
3	2
4	1
5	2

No.	Insulation resistance(MΩ)
1	0.00
2	0.00
3	0.00
4	0.00
5	0.00

No.	Time	Capacitance(μ F)				Tan(δ)				ESR(Ω)			
		1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz
1	Before Test	9.17346	5.53854	0.268132	0.100695	0.117129	0.737031	4.64864	6.51611	2.00464	1.37239	1.22015	1.18426
	24hr	9.18454	5.73161	0.274552	0.100344	0.118977	0.750772	4.71873	6.61636	2.05177	1.42124	1.26881	1.23291
	48hr	9.09857	5.22237	0.238206	0.0913416	0.120327	0.776647	4.83449	6.68321	2.05355	1.40476	1.23744	1.18294
	72hr	9.09335	5.16151	0.228755	0.0866218	0.126715	0.817059	4.99995	6.86317	2.19375	1.55245	1.38775	1.34528
	120hr	9.02645	4.81614	0.203114	0.0793705	0.130536	0.852274	5.15779	6.96382	2.25569	1.60052	1.42478	1.36462
	240hr	9.02852	4.90478	0.207226	0.0797215	0.133422	0.871305	5.20245	6.97513	2.32499	1.67592	1.50277	1.45762
	360hr	8.94658	4.43125	0.177493	0.0712531	0.139057	0.922871	5.38476	7.07145	2.41618	1.74504	1.55533	1.49801
	500hr	8.87571	4.25529	0.166319	0.0671764	0.143211	0.957444	5.51453	7.18911	2.50722	1.83552	1.63846	1.56902
2	Before Test	9.11388	5.58631	0.277492	0.1045480	0.118743	0.733635	4.56219	6.31508	2.05119	1.38575	1.22977	1.19213
	24hr	9.02266	5.2743	0.249297	0.0958588	0.119975	0.751806	4.68699	6.50343	2.06295	1.38072	1.21337	1.16925
	48hr	9.01437	5.30407	0.24966	0.0946755	0.124664	0.786137	4.77175	6.51083	2.17814	1.50844	1.34442	1.30221
	72hr	8.94884	4.96706	0.222028	0.0871553	0.126482	0.809711	4.90128	6.62461	2.20078	1.52163	1.34887	1.30275
	120hr	8.90382	4.81773	0.207859	0.0815035	0.132971	0.859271	5.07936	6.76277	2.34173	1.66396	1.48698	1.43782
	240hr	8.85345	4.60159	0.193545	0.0772322	0.134239	0.874019	5.15825	6.83559	2.35295	1.66218	1.47261	1.42118
	360hr	8.83032	4.46828	0.181654	0.0725912	0.141412	0.932912	5.34252	6.94218	2.50951	1.82864	1.64055	1.58498
	500hr	8.79151	4.25485	0.169413	0.0690171	0.146171	0.967212	5.42622	6.94859	2.59715	1.90218	1.70506	1.64528
3	Before Test	9.10715	5.52846	0.271661	0.103282	0.114274	0.723118	4.56311	6.37613	1.95713	1.32117	1.15229	1.10405
	24hr	9.09482	5.72136	0.285755	0.103797	0.117286	0.738974	4.61802	6.49532	2.04779	1.41766	1.27098	1.23787
	48hr	9.00189	5.15637	0.235616	0.0908911	0.120681	0.776118	4.81376	6.61604	2.08628	1.43981	1.27335	1.22747
	72hr	9.00609	5.17551	0.235189	0.0896625	0.125735	0.813075	4.8984	6.6441	2.19731	1.55693	1.39199	1.34732
	120hr	8.92849	4.76812	0.203311	0.0803276	0.129713	0.852274	5.09599	6.81733	2.26404	1.61394	1.43735	1.38692
	240hr	8.92425	4.78541	0.203451	0.0797444	0.134591	0.879114	5.13711	6.78375	2.36893	1.70658	1.52951	1.47898
	360hr	8.85646	4.40544	0.179611	0.0727601	0.136584	0.907886	5.27932	6.91885	2.38855	1.71412	1.52305	1.46587
	500hr	8.78864	4.26401	0.172023	0.0705703	0.138895	0.934774	5.33958	6.90233	2.44502	1.77772	1.57592	1.51044
4	Before Test	9.26075	5.54822	0.268437	0.102261	0.117138	0.745831	4.63661	6.41512	1.98577	1.37463	1.22163	1.18396
	24hr	9.21827	5.36463	0.244534	0.0917012	0.118032	0.763074	4.84392	6.85697	1.99732	1.38269	1.22463	1.18537
	48hr	9.23012	5.47302	0.248812	0.0920600	0.123185	0.799175	4.87353	6.65897	2.10472	1.49602	1.33454	1.29144
	72hr	9.21258	5.36718	0.242356	0.0901681	0.125078	0.813393	4.97725	6.84705	2.14463	1.53489	1.37423	1.33295
	120hr	9.15411	4.98502	0.214855	0.0834315	0.130577	0.859973	5.09418	6.79716	2.24044	1.62278	1.45238	1.40581
	240hr	9.09432	4.65187	0.192618	0.0770223	0.134461	0.895113	5.22424	6.88477	2.27703	1.64522	1.46207	1.40685
	360hr	9.08211	4.60184	0.187487	0.0745715	0.139354	0.930884	5.33377	6.96533	2.40987	1.77964	1.59707	1.54458
	500hr	9.06255	4.52404	0.181602	0.072221	0.142372	0.954922	5.40774	7.00531	2.46385	1.83098	1.64352	1.58842
5	Before Test	9.11115	5.41692	0.261432	0.100062	0.119638	0.750530	4.64442	6.39305	2.06016	1.41039	1.25251	1.21403
	24hr	9.09725	5.44202	0.258248	0.0960116	0.122182	0.769153	4.76524	6.62096	2.11733	1.46631	1.30705	1.26777
	48hr	9.03542	5.09644	0.230557	0.0895015	0.123911	0.791755	4.85244	6.64259	2.10313	1.43175	1.25398	1.18322
	72hr	9.00527	4.95043	0.217878	0.0850422	0.127557	0.819606	4.97211	6.73382	2.20912	1.54209	1.36516	1.31297
	120hr	8.96117	4.71594	0.199134	0.078700	0.132473	0.860855	5.14834	6.86837	2.28909	1.60692	1.41562	1.34717
	240hr	8.93814	4.65747	0.192078	0.0751045	0.137832	0.899311	5.28918	7.02461	2.41638	1.73936	1.55897	1.50919
	360hr	8.82793	4.30786	0.173637	0.0706922	0.141177	0.935881	5.35229	6.93859	2.47902	1.78728	1.58717	1.52844
	500hr	8.77970	4.19251	0.167037	0.0683347	0.143457	0.952718	5.41964	7.00914	2.51595	1.81905	1.60076	1.53275

No.	Time	Capacitance(μ F)				Tan(δ)				ESR(Ω)			
		1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz
1	Before Test	9.10611	5.49198	0.269302	0.102346	0.115164	0.729222	4.57011	6.37192	1.96611	1.32506	1.15091	1.0647
	24hr	9.08367	5.37503	0.255767	0.0964208	0.11598	0.736418	4.66818	6.59732	1.98464	1.34115	1.17474	1.12153
	48hr	9.08083	5.40475	0.256309	0.0954205	0.120707	0.764216	4.72551	6.56476	2.09353	1.45204	1.29277	1.25384
	72hr	9.06733	5.34295	0.251369	0.09481	0.121654	0.773116	4.76041	6.58557	2.11598	1.47402	1.31275	1.27198
	120hr	9.06451	5.30333	0.246215	0.0935667	0.123127	0.785711	4.7963	6.58295	2.13579	1.49332	1.3297	1.28884
	240hr	9.04633	5.18011	0.238814	0.09222064	0.122776	0.785461	4.79638	6.56342	2.12211	1.47081	1.30206	1.23823
	360hr	9.04825	5.18644	0.236582	0.0903706	0.125851	0.808505	4.88566	6.64898	2.18936	1.54515	1.37798	1.33525
	500hr	9.01655	4.96405	0.220222	0.0862302	0.126276	0.821798	4.94187	6.66193	2.18116	1.52427	1.34662	1.27518
2	Before Test	9.17662	5.59647	0.278737	0.105755	0.115846	0.726344	4.53838	6.30972	1.98041	1.34845	1.19367	1.15341
	24hr	9.18519	5.72515	0.286115	0.105191	0.116875	0.732791	4.58526	6.45432	2.01984	1.39115	1.24124	1.20511
	48hr	9.10403	5.35605	0.255615	0.0974103	0.118095	0.748677	4.68736	6.5236	2.02568	1.38375	1.22276	1.17698
	72hr	9.08597	5.29095	0.247286	0.0945065	0.121068	0.771707	4.76171	6.57112	2.08635	1.44606	1.28277	1.24023
	120hr	9.08217	5.24618	0.244385	0.0942722	0.121792	0.777564	4.7637	6.51911	2.09757	1.45377	1.28793	1.24052
	240hr	9.10888	5.40195	0.255129	0.0960125	0.121689	0.774311	4.75364	6.53562	2.10438	1.46475	1.30352	1.26322
	360hr	9.06108	5.11744	0.232917	0.0907235	0.123487	0.792721	4.83447	6.58627	2.11931	1.45905	1.28453	1.22959
	500hr	9.10714	5.30018	0.238561	0.0915504	0.125547	0.804641	4.86235	6.58773	2.17442	1.53283	1.36694	1.32473
3	Before Test	9.15126	5.60088	0.277878	0.104551	0.116668	0.731493	4.57744	6.3796	1.96607	1.3114	1.14723	1.097
	24hr	9.11279	5.35332	0.252002	0.0951371	0.118885	0.752703	4.73032	6.64743	2.03764	1.38373	1.17677	1.16773
	48hr	9.11791	5.49231	0.262372	0.0978275	0.121064	0.770315	4.74055	6.52397	2.09145	1.45394	1.29376	1.25439
	72hr	9.05392	5.38154	0.252154	0.0953367	0.121886	0.781108	4.79381	6.58251	2.11939	1.48041	1.31853	1.27727
	120hr	9.04744	5.24188	0.241322	0.0924042	0.122893	0.790729	4.82527	6.59216	2.13439	1.50013	1.33695	1.29544
	240hr	9.03725	5.17932	0.236946	0.0912255	0.121653	0.782924	4.82697	6.62306	2.10406	1.46074	1.28715	1.23624
	360hr	9.02945	5.17505	0.235211	0.0896221	0.126115	0.814639	4.90711	6.62576	2.19636	1.55486	1.38739	1.34377
	500hr	9.01822	4.99622	0.220878	0.0860403	0.125464	0.814277	4.95193	6.72642	2.16904	1.52204	1.34411	1.29058
4	Before Test	9.20198	5.52077	0.266159	0.101033	0.118082	0.744273	4.64811	6.45342	2.01357	1.37985	1.22815	1.19106
	24hr	9.22707	5.64174	0.272396	0.100547	0.119991	0.75887	4.71497	6.59369	2.05499	1.25741	1.26943	1.23265
	48hr	9.17477	5.32425	0.247082	0.0950089	0.119155	0.766673	4.75545	6.56144	2.02268	1.37444	1.20718	1.15632
	72hr	9.17103	5.30727	0.24459	0.0936687	0.11969	0.761727	4.77311	6.64624	2.02807	1.37885	1.21688	1.16605
	120hr	9.15555	5.18749	0.234279	0.0907083	0.124376	0.799272	4.87808	6.63954	2.12496	1.48369	1.31789	1.25972
	240hr	9.17701	5.32281	0.244371	0.0929234	0.123936	0.793252	4.84972	6.62634	2.12368	1.48627	1.32675	1.28543
	360hr	9.13637	5.05311	0.223331	0.0874126	0.125391	0.812919	4.93587	6.68114	2.13551	1.48445	1.31237	1.26391
	500hr	9.15753	5.12573	0.226694	0.0877919	0.128166	0.828211	4.97616	6.70363	2.20257	1.56176	1.39616	1.35164
5	Before Test	9.23345	5.75222	0.292429	0.109179	0.114954	0.725342	4.51439	6.27122	1.96429	1.35074	1.19743	1.16070
	24hr	9.18347	5.48604	0.266274	0.100899	0.114603	0.726815	4.59726	6.49511	1.93671	1.30751	1.14261	1.08936
	48hr	9.20578	5.59117	0.273113	0.100814	0.119055	0.756717	4.66087	6.44924	2.04115	1.42094	1.26326	1.22498
	72hr	9.19193	5.46167	0.257635	0.0974035	0.120493	0.769955	4.72824	6.52916	2.06496	1.44475	1.28495	1.24517
	120hr	9.17121	5.35413	0.251366	0.0958807	0.122227	0.784396	4.77166	6.51785	2.09701	1.47284	1.31029	1.26878
	240hr	9.15312	5.25433	0.243044	0.0936171	0.122178	0.785227	4.79342	6.56914	2.08949	1.46172	1.29717	1.25319
	360hr	9.17297	5.37342	0.248091	0.0933334	0.124655	0.802415	4.83372	6.57316	2.14446	1.51745	1.35318	1.31079
	500hr	9.12872	5.06218	0.226861	0.0887242	0.125465	0.814335	4.89817	6.62243	2.14619	1.51067	1.33175	1.27445

No.	Time	Capacitance(uF)				Tan(δ)				ESR(ohm)			
		1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz
1	Before Test	9.10006	5.51083	0.269844	0.1025260	0.116315	0.733698	4.59322	6.37768	2.00625	1.37466	1.22132	1.18335
	24hr	9.10524	5.49702	0.26144	0.0972724	0.120677	0.766992	4.75647	6.57338	2.09564	1.45799	1.30072	1.26173
	48hr	9.09426	5.45319	0.255181	0.0953530	0.122962	0.782406	4.80356	6.58251	2.14601	1.50328	1.34375	1.30412
	72hr	9.00944	5.02767	0.220041	0.0843182	0.123845	0.802257	4.99445	6.90457	2.14375	1.49346	1.32573	1.27859
	120hr	8.99199	4.94216	0.211717	0.0817697	0.131296	0.856711	5.10923	6.85744	2.29613	1.64723	1.47525	1.42792
	240hr	8.91175	4.55307	0.185332	0.0732448	0.136271	0.900909	5.32313	7.08679	2.38724	1.73053	1.55198	1.49962
	360hr	8.88845	4.47134	0.182666	0.0736951	0.137078	0.908177	5.28191	6.91591	2.39952	1.73195	1.54277	1.48274
	500hr	8.87416	4.44848	0.181527	0.0733108	0.136744	0.908544	5.28712	6.92409	2.39351	1.72546	1.53525	1.47136
2	Before Test	9.13590	5.74071	0.282261	0.1038770	0.114477	0.709024	4.40190	6.22559	1.94208	1.34811	1.1998	1.16730
	24hr	9.07312	5.35016	0.256124	0.0975055	0.116591	0.741705	4.65088	6.50362	2.00027	1.34682	1.17921	1.12672
	48hr	8.99330	5.16692	0.238759	0.0915410	0.120709	0.774448	4.78936	6.63509	2.09097	1.43691	1.2611	1.21722
	72hr	8.97006	5.24112	0.244387	0.0925404	0.124648	0.794497	4.80511	6.53453	2.18901	1.52937	1.36247	1.31901
	120hr	8.87105	4.80513	0.209875	0.0825572	0.127732	0.823772	4.96852	6.72317	2.23644	1.55789	1.37463	1.31271
	240hr	8.81461	4.61302	0.194824	0.0771219	0.135615	0.880409	5.15638	6.84875	2.40552	1.71902	1.53815	1.49111
	360hr	8.82731	4.66358	0.197703	0.0778519	0.136586	0.887941	5.15143	6.81141	2.43175	1.74588	1.56119	1.50929
	500hr	8.81937	4.64512	0.195554	0.0766102	0.137042	0.892492	5.19155	6.86953	2.43968	1.76055	1.57499	1.52268
3	Before Test	9.10071	5.62574	0.283975	0.1052440	0.117642	0.727772	4.54613	6.35221	2.03861	1.38390	1.22549	1.18995
	24hr	9.07711	5.68254	0.284405	0.1026070	0.119702	0.743475	4.64331	6.57805	2.09455	1.44185	1.28242	1.24731
	48hr	9.00024	5.20494	0.240347	0.0911191	0.125438	0.791852	4.83912	6.64822	2.19276	1.52531	1.35721	1.31629
	72hr	8.94309	4.97616	0.223105	0.0865285	0.126946	0.807577	4.90511	6.68072	2.21455	1.53164	1.35264	1.30204
	120hr	8.96644	5.11051	0.230107	0.0873922	0.130097	0.828915	4.95781	6.67777	2.29724	1.62305	1.44987	1.41083
	240hr	8.81538	4.56266	0.192148	0.0766485	0.135875	0.884227	5.16726	6.82455	2.40704	1.72283	1.53614	1.48372
	360hr	8.77979	4.51327	0.189228	0.0758202	0.134498	0.881941	5.17252	6.83122	2.37702	1.67503	1.47827	1.41867
	500hr	8.75677	4.47134	0.186701	0.0748506	0.136223	0.888421	5.19276	6.84595	2.41212	1.70873	1.50569	1.44264
4	Before Test	9.17949	5.52779	0.274025	0.1041380	0.121274	0.736037	4.56214	6.32417	2.07295	1.37853	1.21893	1.18176
	24hr	9.13085	5.31818	0.250613	0.0951207	0.121074	0.743755	4.70508	6.64632	2.05861	1.34671	1.16722	1.20897
	48hr	9.10533	5.20222	0.238684	0.0908306	0.124561	0.771409	4.81571	6.73731	2.12778	1.41970	1.24672	1.19775
	72hr	9.12511	5.04613	0.226454	0.0878012	0.131231	0.819021	4.91895	6.66111	2.26225	1.55424	1.38146	1.33581
	120hr	9.04624	4.83372	0.210131	0.0828146	0.132554	0.833474	4.99997	6.75288	2.27422	1.55313	1.36812	1.29587
	240hr	9.00512	4.61779	0.194206	0.0776677	0.14072	0.895744	5.17836	6.80734	2.43953	1.71905	1.53413	1.48280
	360hr	9.01407	4.67629	0.196404	0.0779006	0.141659	0.902772	5.19219	6.80317	2.46495	1.75175	1.56449	1.51186
	500hr	9.00684	4.71423	0.196366	0.0774098	0.142075	0.907404	5.21259	6.83321	2.47487	1.76197	1.57442	1.52157
5	Before Test	9.22808	5.83121	0.293311	0.1074470	0.11491	0.717506	4.56525	6.44259	1.96925	1.34515	1.20147	1.16767
	24hr	9.15607	5.48526	0.258666	0.0964004	0.120593	0.765972	4.77721	6.63705	2.07667	1.44511	1.29336	1.25521
	48hr	9.13012	5.35137	0.244204	0.0916707	0.123097	0.786626	4.88477	6.76226	2.12298	1.48951	1.33416	1.29437
	72hr	9.05797	5.03487	0.220547	0.0855337	0.126603	0.819386	5.00013	6.78601	2.18035	1.53476	1.37039	1.31744
	120hr	9.03859	5.03524	0.217617	0.0834447	0.129799	0.842533	5.09974	6.88445	2.26307	1.61642	1.45271	1.40881
	240hr	8.95314	4.69712	0.195133	0.0771647	0.134348	0.883549	5.22427	6.91555	2.34821	1.67187	1.51841	1.46785
	360hr	9.00407	4.83912	0.200751	0.0783275	0.136575	0.893773	5.22451	6.91377	2.38966	1.72741	1.55345	1.50445
	500hr	8.93115	4.50550	0.182127	0.0730005	0.137967	0.911222	5.33556	7.01307	2.40702	1.73483	1.55205	1.49362

No.	Time	Capacitance(μ F)				Tan(δ)				ESR(ohm)			
		1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz
1	Before Test	9.23770	5.7388	0.28653	0.104521	0.118368	0.737701	4.61234	6.44441	2.02813	1.38719	1.23250	1.19667
	After test	9.10255	5.51295	0.262037	0.0970991	0.122487	0.772444	4.77472	6.60404	2.12647	1.47497	1.31676	1.28156
2	Before Test	9.23295	5.63988	0.275301	0.102517	0.118808	0.752711	4.67334	6.45918	2.05271	1.41532	1.25563	1.21551
	After test	9.03858	5.08821	0.229616	0.0892991	0.120846	0.808045	4.88696	6.61642	2.07989	1.43150	1.25877	1.20281
3	Before Test	9.15062	5.47112	0.262771	0.0995577	0.119022	0.745607	4.67332	6.49455	2.04083	1.39355	1.23945	1.20236
	After test	8.99641	5.19414	0.236772	0.0905572	0.124886	0.793991	4.86523	6.65245	2.18129	1.51786	1.35455	1.31221
4	Before Test	9.16939	5.54846	0.271355	0.1023330	0.117223	0.735177	4.60984	6.43755	2.00754	1.36954	1.21635	1.17992
	After test	9.00089	5.15972	0.235591	0.0907897	0.121442	0.774811	4.82077	6.62625	2.10336	1.44192	1.27477	1.21771
5	Before Test	9.15677	5.48485	0.264835	0.100938	0.118715	0.745503	4.64427	6.42101	2.03496	1.38972	1.23676	1.19906
	After test	9.11948	5.50212	0.261480	0.0974502	0.122687	0.777604	4.77707	6.55817	2.12681	1.48058	1.32457	1.28632

No.	Time	Capacitance(μ F)				Tan(δ)				ESR(ohm)			
		1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz	1 kHz	10 kHz	100 kHz	200 kHz
1	Before Test	9.09022	5.54437	0.27352	0.10303	0.110301	0.6942	4.46513	6.34513	1.9891	1.35782	1.20271	1.16233
	After test	9.04449	5.07719	0.22508	0.08633	0.130674	0.851917	5.01754	6.69275	2.28079	1.64179	1.46919	1.42297
2	Before Test	9.08141	5.85771	0.30447	0.10324	0.109146	0.695084	4.52893	6.49418	2.03359	1.39626	1.24008	1.20391
	After test	8.92015	4.76110	0.20382	0.08041	0.128112	0.841771	5.07510	6.82715	2.22865	1.57116	1.38715	1.32813
3	Before Test	9.03733	5.71649	0.30502	0.11678	0.112741	0.707780	4.54377	6.45545	1.99915	1.36227	1.20977	1.17122
	After test	8.94228	4.95551	0.21702	0.08445	0.130811	0.852792	5.02322	6.65639	2.30272	1.65132	1.47691	1.42934
4	Before Test	9.04256	5.47026	0.26622	0.10089	0.116647	0.737315	4.61892	6.41188	2.02578	1.39133	1.23812	1.20088
	After test	8.94727	4.73459	0.20121	0.07981	0.128144	0.847003	5.09644	6.81245	2.21313	1.54751	1.35972	1.29242
5	Before Test	9.06226	5.56335	0.27645	0.10451	0.113798	0.714122	4.53898	6.36579	1.95374	1.31212	1.15409	1.10517
	After test	8.99351	4.92595	0.21355	0.08339	0.131068	0.855585	5.06527	6.72552	2.28975	1.64255	1.47057	1.42336

No.	Withstanding voltage(uA)
1	1
2	1
3	1
4	1
5	1

No.	Insulation resistance(MΩ)
1	0.01
2	0.01
3	0.01
4	0.01
5	0.01