

ZFB827 Built-in Combined (LoRa) Measurement Type Active Antenna

product presentation

The built-in combined measurement type active antenna can meet the high-precision positioning measurement requirements for multiple systems compatibility in various harsh environments. It is widely applicable to high-precision position measurement scenarios such as surveying and mapping, geological disaster monitoring, deformation monitoring, lawn mowing robots, and integrated navigation.

Product technical features

1. Compact structure, low profile, low price, good signal, strong product adaptability;
2. The antenna part adopts a four-feed high-precision antenna design, featuring high stability in phase center;
3. Achieve high gain across the entire system and throughout the entire frequency band;
4. The LoRa full-band antenna has a bandwidth and efficiency that are 20% higher than those of the traditional PIFA antenna, significantly improving the communication quality of LoRa.

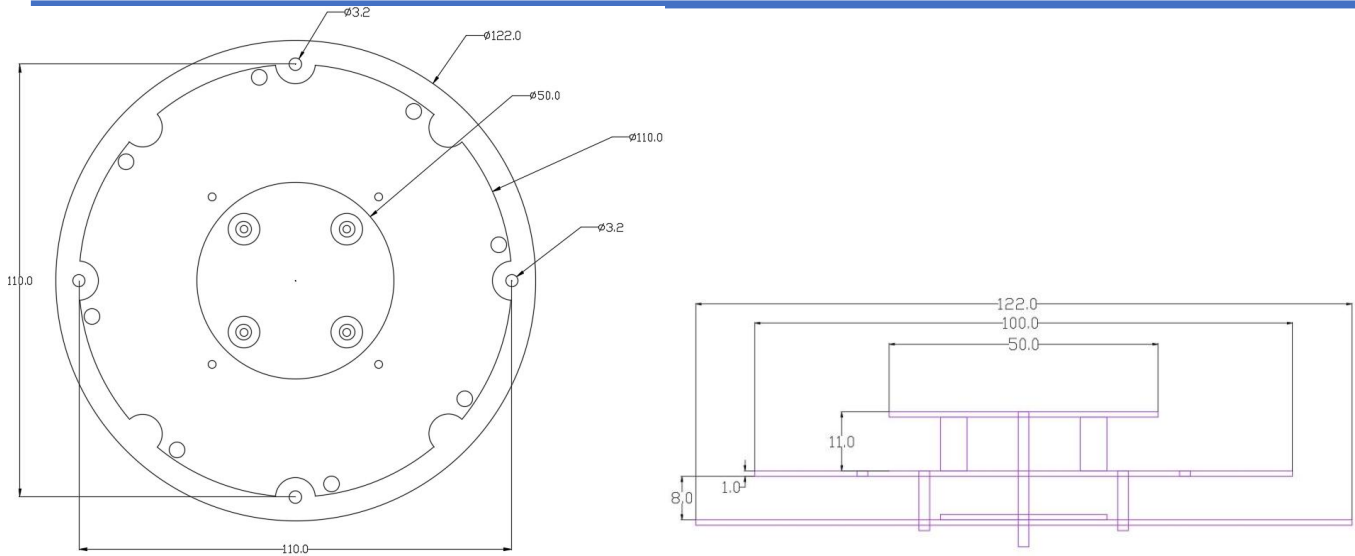
Technical specification

Antenna performance Indicators		
Working frequency range	BDS : B1/ B2/B3 GPS L1/ L2/L5/ GLONASS : G1/G2 GALILEO : E1/E2/ E5a/E5b QZSS : L1/L2/L5/L6 L-Band	LORA:902-928MHz
Impedance	50Ω	50Ω
Polarization	Right-Handed Circular Polarization(RHCP)	Bertical Polarization
Elevation Coverage	360°	/
Antenna axis ratio	≤3dB	/
Output VSWR	≤2	≤3
Peak Gain	≥4dBi	≥0.5dBi
Phase Center Error	±2mm	/
Antenna Type	GNSS	LoRa
GNSS Low-noise Amplifier Specifications		
Gain	28dB±2dB@L2	

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	28dB±2dB@L1
Noise Figure	≤2dB
Output VSWR	≤2
Flatness In Band	±2dB
P1dB point of compression	≥0 dB
Working voltage	DC 3.3~16V
Working current	≤45mA(typical value)
Size	
Overall size	Φ 122mm*20mm
Environmental Suitability	
Working temperature	-40°C ~ +85°C
Storage temperature	-55°C ~ +85°C
Humidity	95% incondensable

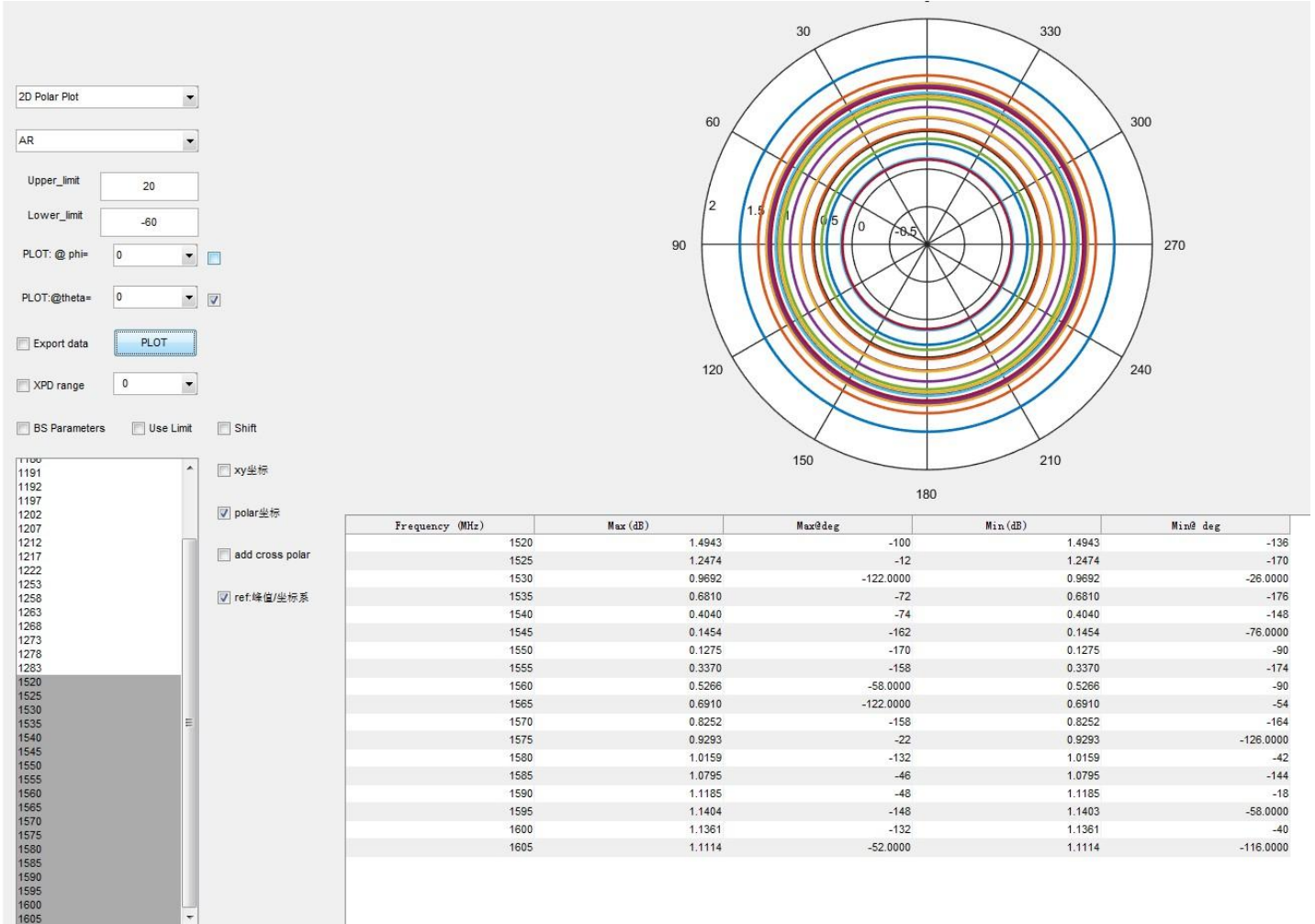
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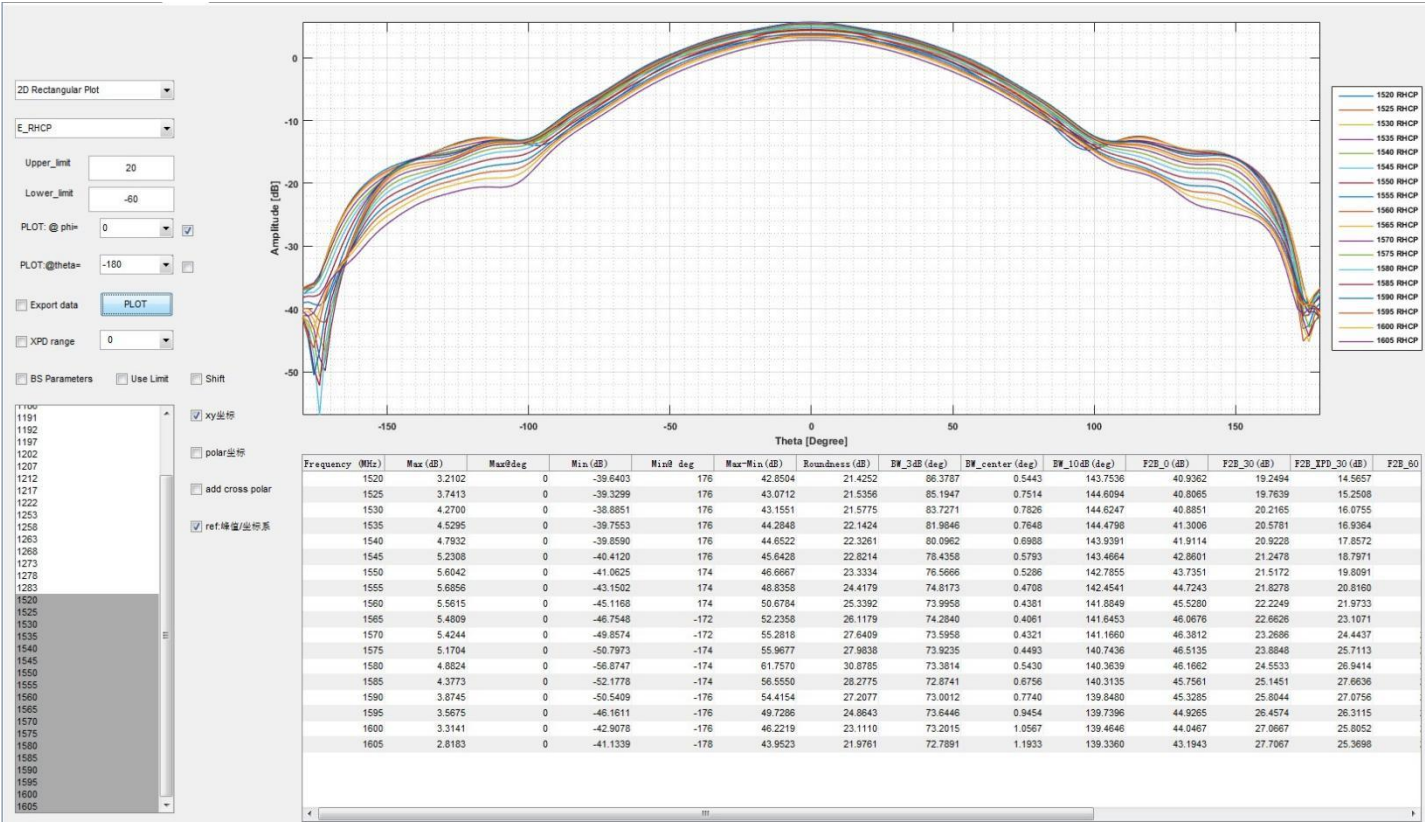
The specific dimensions are based on the 3D model

◆ Product testing diagram (GNSS)

◆ L1 2D/3D test and dBi



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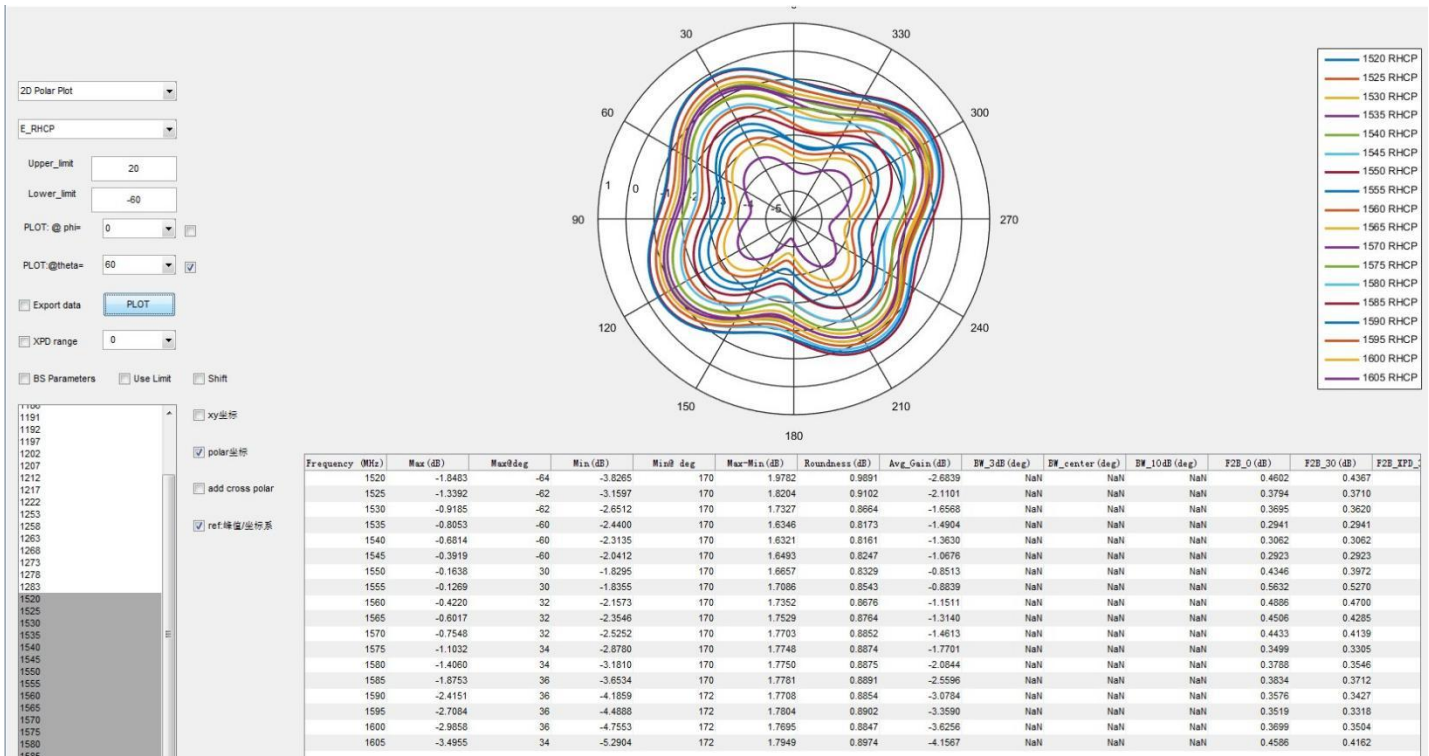
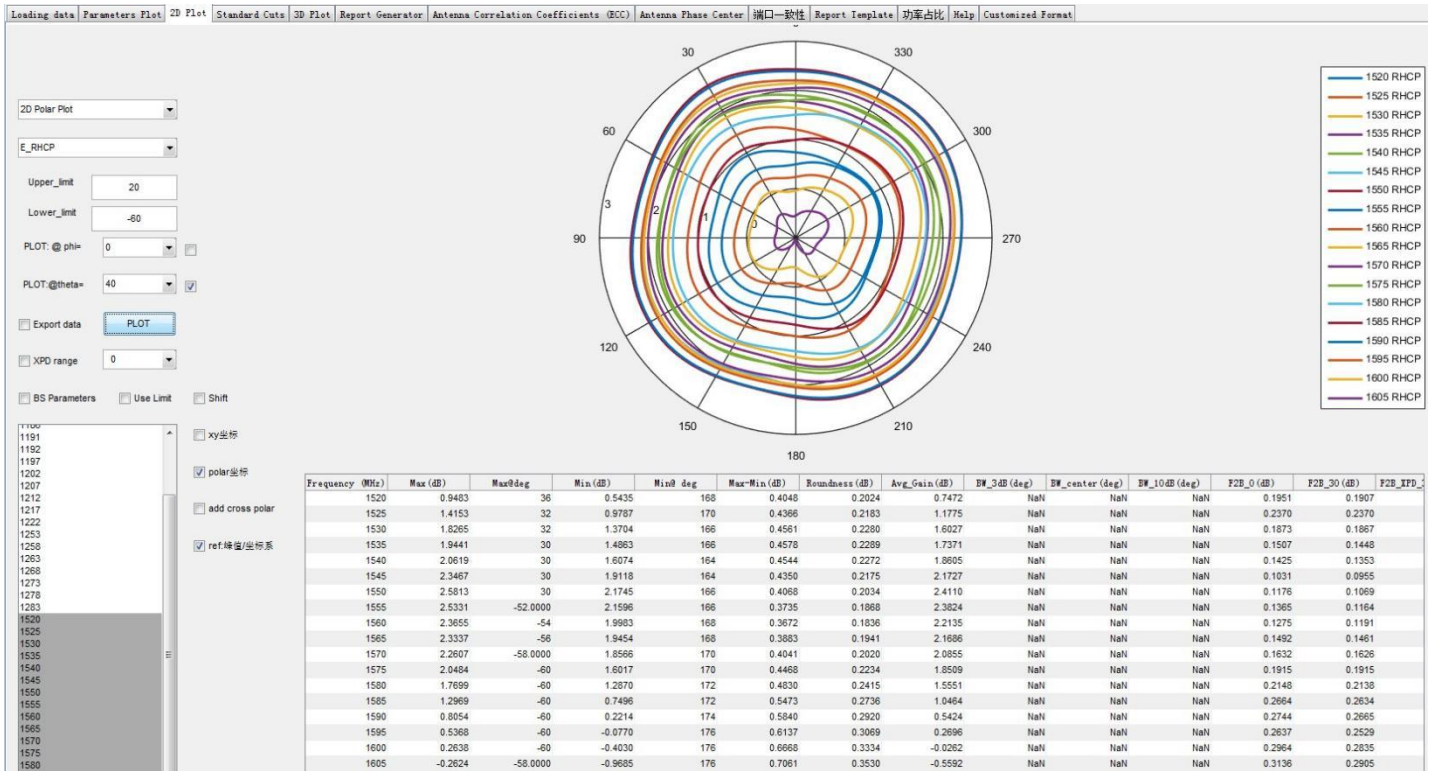
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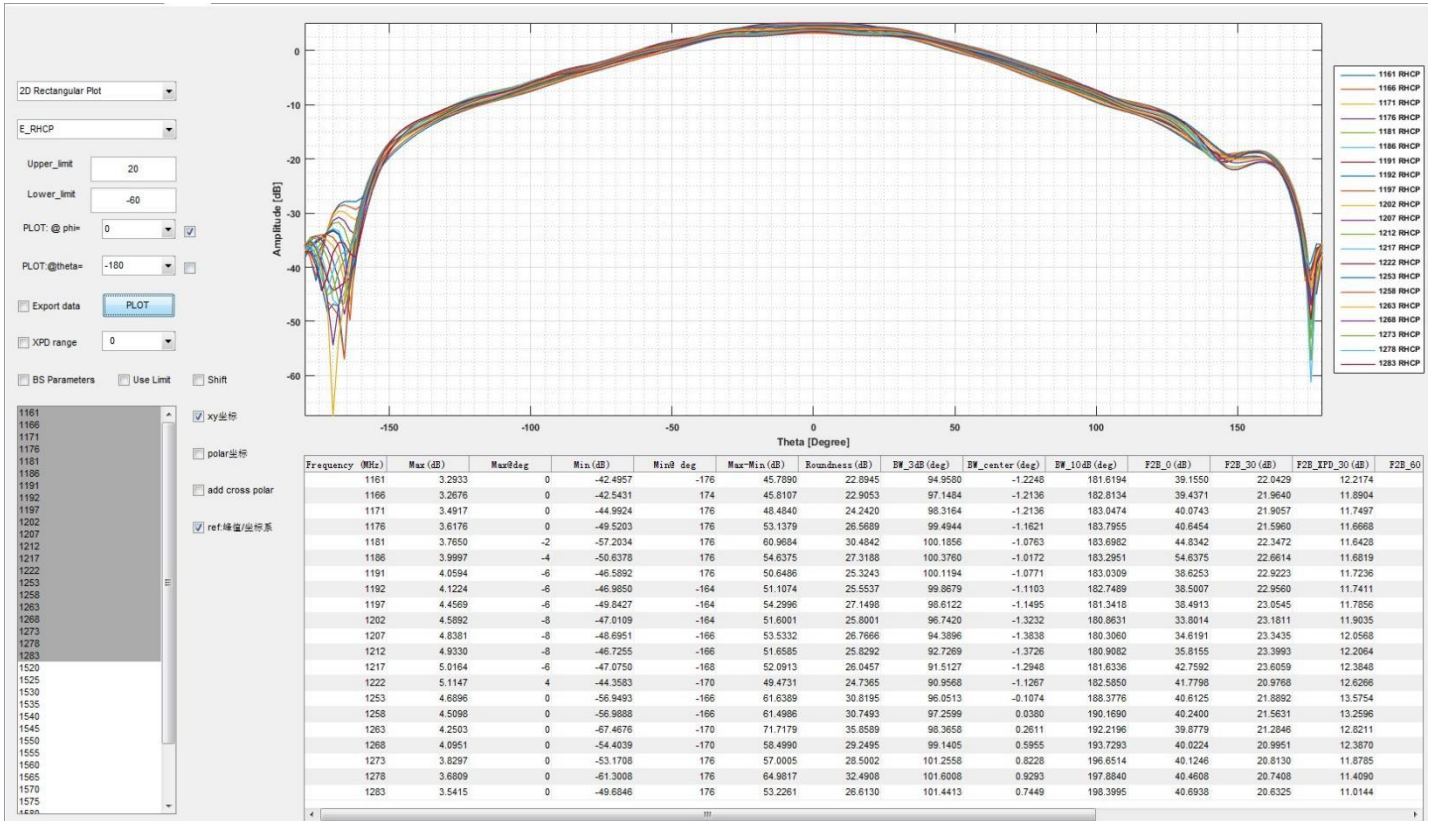
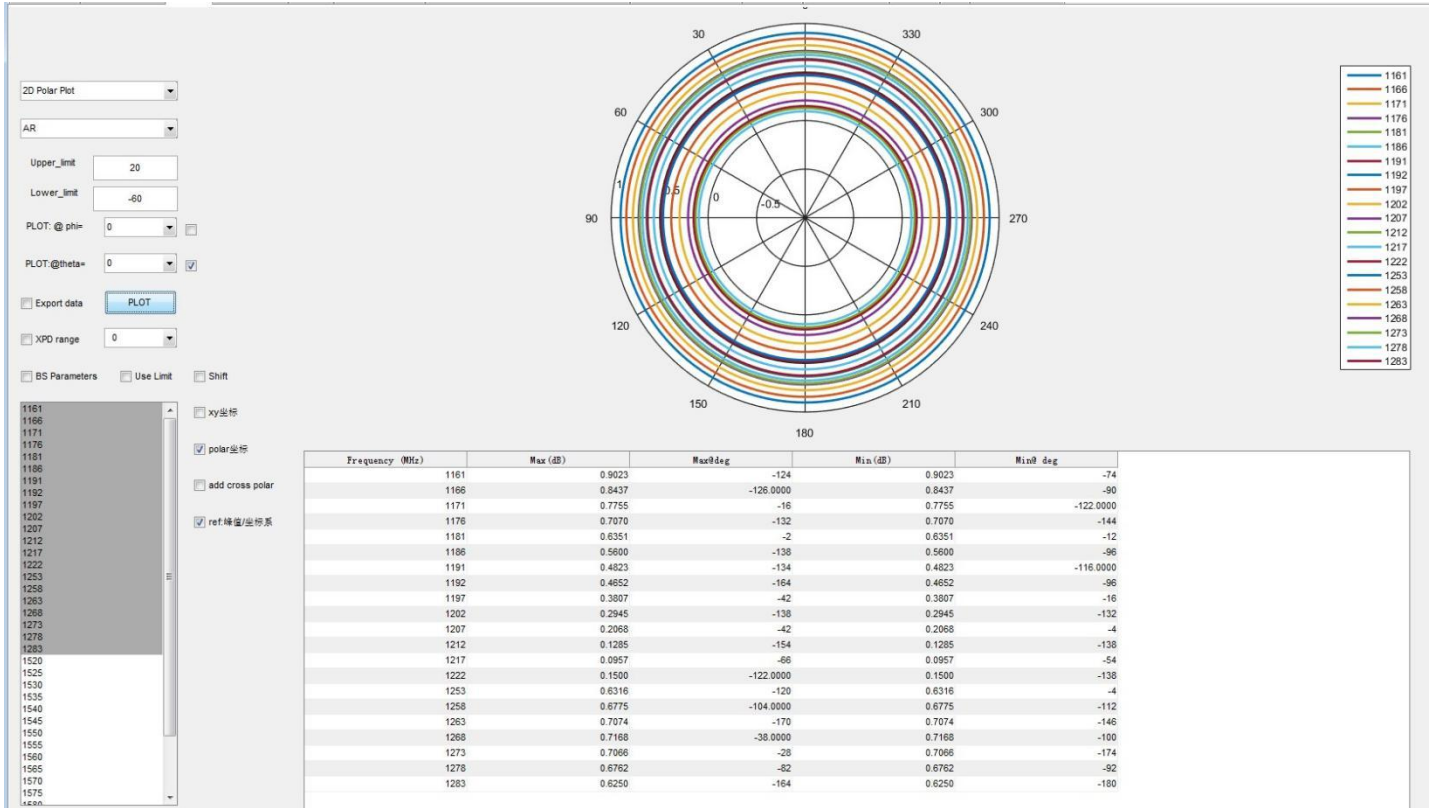
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Frequency (MHz)	1253	1258	1263	1268	1273	1278	1283	1520	1525	1530	1535	1540	1545	1550	1555	1560	1565	1570	1575	1580	1585	1590	1595	1600	1605
Directivity (dB)	6.2875	6.2156	6.1357	6.0951	6.0200	6.0186	6.0455	7.0130	7.0785	7.1840	7.3066	7.4411	7.5643	7.6923	7.7825	7.8547	7.8532	7.8992	7.9059	7.9205	7.9280	7.9310	7.9147	7.9391	7.9657
Gain (dB)	4.6983	4.5222	4.2575	4.1025	3.8369	3.6875	3.5471	3.2578	3.7687	4.2835	4.5362	4.7956	5.2312	5.6044	5.6872	5.5655	5.4878	5.4342	5.1828	4.8972	4.3966	3.8936	3.5863	3.3326	2.8360
Efficiency (dB)	-1.5891	-1.6934	-1.8762	-1.9926	-2.1831	-2.3311	-2.4984	-3.7552	-3.3098	-2.9005	-2.7705	-2.6455	-2.3332	-2.0879	-2.0953	-2.2892	-2.3654	-2.4651	-2.7231	-3.0233	-3.5314	-4.0374	-4.3284	-4.6065	-5.1296
Efficiency (K)	69.3566	67.7112	64.8896	63.2039	60.4903	58.4637	56.2553	42.1190	46.6883	51.2797	52.3368	54.3814	58.4362	61.8322	61.7266	59.0312	56.6879	53.4184	49.8501	44.3466	39.4893	36.9113	34.6222	30.6920	
EWPhi=90	96.5015	97.7351	98.8277	99.8275	101.7976	102.1489	101.9869	86.0750	85.0073	83.6551	81.9892	80.1406	78.5019	76.6282	74.8542	73.5953	74.2414	73.5053	73.2195	72.6753	72.0505	73.4565	73.0359	72.6529	
EWTheta=90	349.8169	351.9004	353.9091	NaN	NaN	NaN	97.7379	88.0824	86.2368	84.3488	82.3464	80.2985	78.6453	76.9191	75.3585	74.8331	75.4323	75.1762	75.8026	75.7127	75.6155	75.6786	76.6223	76.1465	75.7022
SoundnessTheta=30	0.1970	0.2241	0.1728	0.2064	0.2284	0.1926	0.1687	0.1253	0.1194	0.1137	0.1084	0.1267	0.1207	0.1081	0.0791	0.0849	0.0873	0.0832	0.0681	0.0215	0.0275	0.0267	0.0171	0.0167	0.0235
SoundnessTheta=90	0.4786	0.4566	0.4684	0.4702	0.4698	0.4401	0.3750	0.3822	0.3897	0.3823	0.3065	0.3035	0.3177	0.3409	0.3763	0.3932	0.3961	0.3925	0.3925	0.3927	0.3927	0.3911	0.3916	0.3887	0.3903
SoundnessPhi=90	1.5489	1.5283	1.5174	1.4787	1.4907	1.4422	1.4517	1.4346	1.4694	1.3971	1.3820	1.3620	1.3434	1.3416	1.3221	1.3623	1.3637	1.3637	1.3637	1.3637	1.3637	1.3637	1.3637	1.3637	1.3637
Peak GainPhi (deg)	118.0000	108.0000	178.0000	178.0000	178.0000	178.0000	178.0000	104.0000	88.0000	178.0000	178.0000	178.0000	178.0000	178.0000	178.0000	178.0000	178.0000	178.0000	178.0000	178.0000	178.0000	178.0000	178.0000	178.0000	178.0000
Peak GainTheta (deg)	-2	-2	0	0	0	0	0	4	2	0	0	0	0	0	0	0	0	0	0	0	-2	-2	-2	0	0
Null0Phi (deg)	160.0000	162.0000	166.0000	166.0000	170.0000	170.0000	168.0000	146.0000	144.0000	144.0000	142.0000	144.0000	148.0000	98.0000	100.0000	134.0000	176.0000	172.0000	154.0000	0	0	156.0000	158.0000	160.0000	160.0000
Null0Theta (deg)	172	172	172	172	172	172	172	172	172	172	172	172	172	174	174	174	170	170	-172	-174	-174	-172	-172	-172	-172
Upper spherical efficiency...	-2.0782	-2.2056	-2.4201	-2.5688	-2.8016	-2.9838	-3.1842	-4.1341	-3.6729	-3.2484	-3.1125	-2.9834	-2.6692	-2.4252	-2.4351	-2.6200	-2.6983	-2.7899	-3.0381	-3.3313	-3.8357	-4.3349	-4.6212	-4.8954	-5.4154
Lower spherical efficiency...	61.9692	60.1777	57.2777	55.3755	52.4611	50.3060	48.0374	38.6003	42.9251	47.3213	48.8371	50.3107	54.0848	57.2110	57.0812	54.6265	52.6034	49.6813	46.4381	41.3458	36.8559	34.5049	32.3935	28.7380	
Upper spherical efficiency...	-11.3151	-11.2300	-11.1850	-11.0632	-10.9533	-10.8844	-10.8524	-14.5362	-14.2676	-14.0247	-13.9775	-13.9033	-13.6137	-13.3525	-13.3295	-13.5608	-13.6884	-13.8886	-14.2747	-14.6698	-15.2275	-15.8279	-16.1863	-16.5196	-17.0889
Lower spherical efficiency...	7.3874	7.5335	7.6120	7.8285	8.0292	8.1576	8.2179	3.5187	3.7432	3.9585	4.0017	4.0707	4.3514	4.6211	4.6456	4.4047	4.2792	4.0845	3.7371	3.4121	3.0009	2.6134	2.4064	2.2286	1.9548
Efficiency_LMCP (dB)	-14.8013	-14.5177	-14.2625	-13.9345	-13.6422	-13.4027	-13.2081	-16.9314	-16.9258	-16.9783	-17.2299	-17.4242	-17.3760	-17.3496	-17.5406	-17.9614	-18.2925	-18.6608	-19.2393	-19.8940	-20.7484	-21.8517	-22.2891	-22.9456	-23.7616
Efficiency_RHCP (dB)	3.3103	3.5337	3.7476	4.0416	4.3230	4.5680	4.7774	2.0270	2.0297	2.0053	1.8924	1.8096	1.6298	1.6409	1.7585	1.5990	1.4817	1.3612	1.1914	1.0247	0.8417	0.6836	0.5903	0.5075	0.4206
Efficiency_LMCP (dB)	-1.8015	-1.9262	-2.1368	-2.2795	-2.4845	-2.6845	-2.8694	-3.9694	-3.9738	-3.9738	-3.9738	-2.7925	-2.4713	-2.2191	-2.2208	-2.4084	-2.4778	-2.5706	-2.8211	-3.1135	-3.6148	-4.1133	-4.3984	-4.6706	-5.1896
Efficiency_RHCP (dB)	68.0463	64.1775	61.1421	59.1623	56.1673	53.8957	51.4779	40.0920	44.6366	49.2744	50.9464	52.5716	56.6864	59.9912	57.4322	56.5220	55.3287	52.2270	48.8254	43.5649	38.7857	36.3210	34.1147	30.2722	
Gain_LMCP (dB)	-8.1486	-8.0455	-7.9420	-7.7311	-7.4777	-7.0788	-6.8157	-11.0596	-11.1222	-11.0289	-11.0568	-11.0711	-10.8155	-10.6799	-10.8106	-11.2398	-11.8450	-11.9858	-12.4918	-13.2698	-13.9516	-14.6560	-15.4835	-16.2632	-17.3079
Gain_RHCP (dB)	4.6933	4.5163	4.2503	4.0951	3.8297	3.6009	3.5415	3.2294	3.7470	4.2700	4.5296	4.7933	5.2309	5.6042	5.6872	5.5616	5.4809	5.4244	5.1704	4.8624	4.3795	3.8752	3.5675	3.3141	2.8183
AR @ 0	1.0423	1.0454	1.0475	1.0481	1.0474	1.0453	1.0418	1.1027	1.0851	1.0655	1.0456	1.0268	1.0096	1.0084	1.0223	1.0351	1.0463	1.0556	1.0628	1.0688	1.0733	1.0760	1.0775	1.0772	1.0755
AR @ 0	0.3596	0.3857	0.4027	0.4080	0.4022	0.3849	0.3558	0.8495	0.7095	0.5515	0.3876	0.2300	0.0828	0.0726	0.1919	0.2998	0.3933	0.4697	0.5288	0.5780	0.6141	0.6363	0.6487	0.6463	0.6323
功率占比 (K)	35.6860	35.6907	35.6475	35.6819	35.8099	35.8460	35.8164	33.9231	34.4194	34.4905	34.5062	34.3681	34.0943	33.8864	33.7455	33.3656	32.9337	32.7143	32.3254	32.2727	32.3632	32.1652	32.0653	32.0210	31.9742

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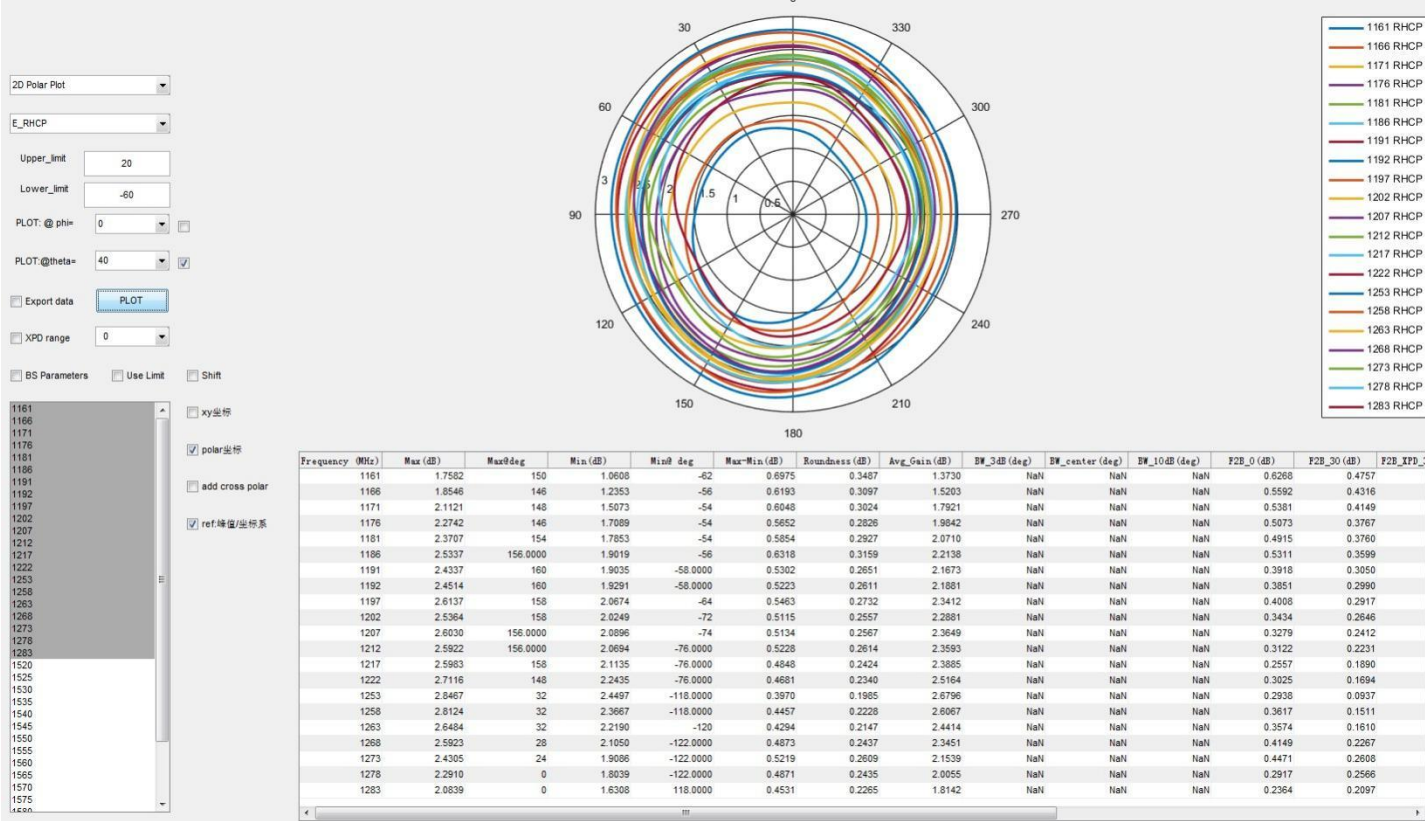


◆ L2&L5 2D/3D test and dBi

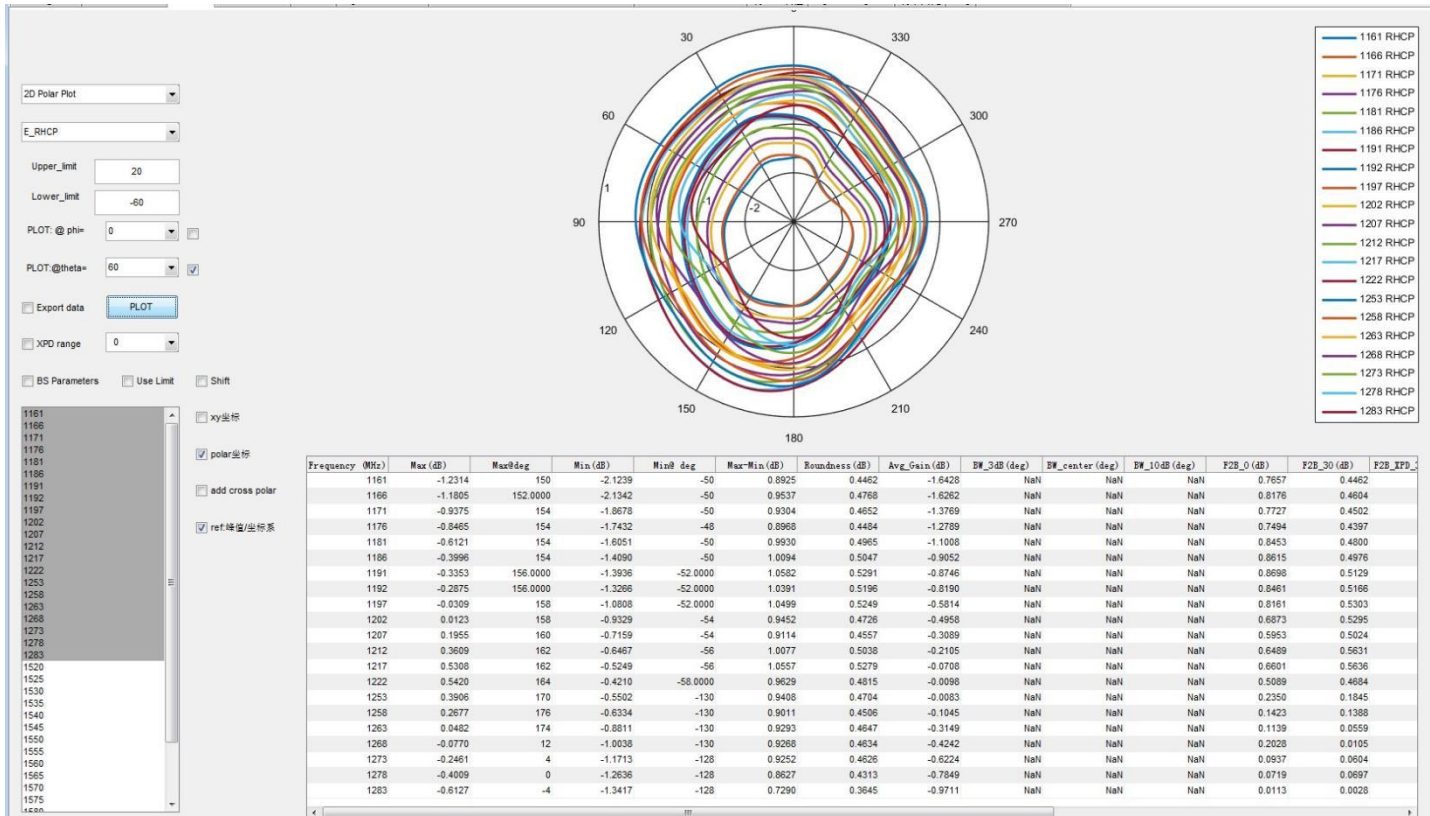


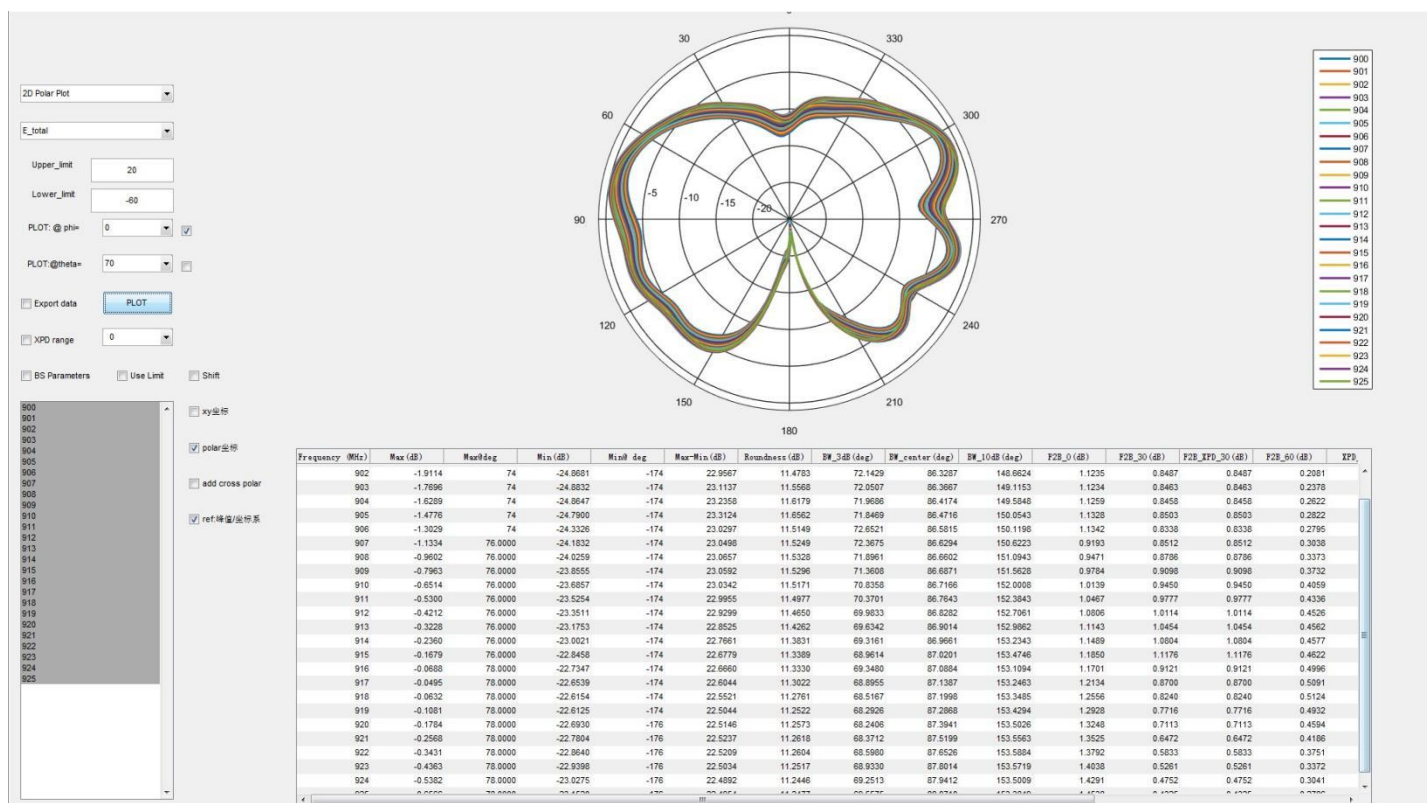
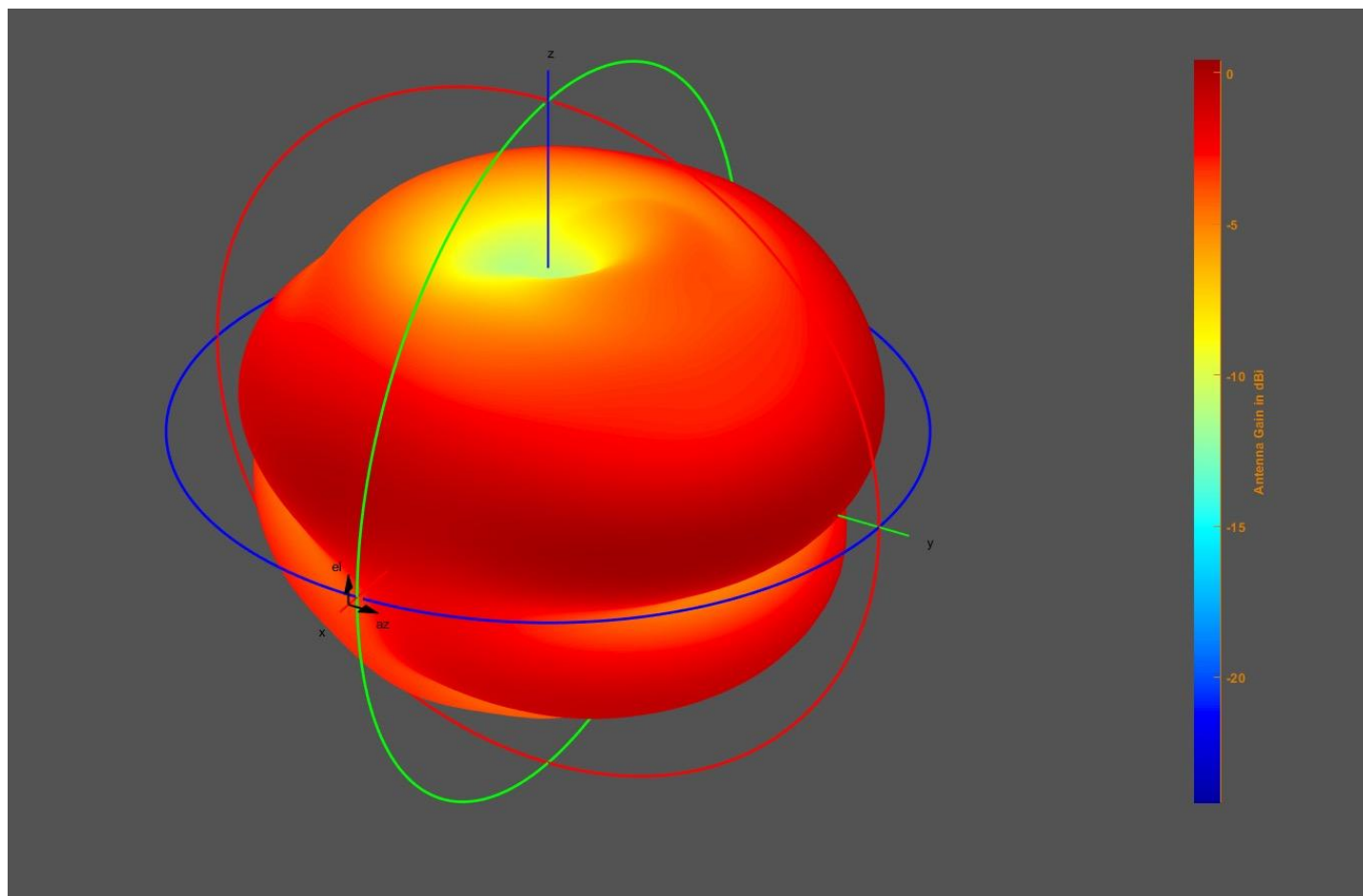
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Frequency (MHz)	1161 1166 1171 1176 1181 1186 1191 1192 1197 1202 1207 1212 1217 1222 1253 1258 1263 1268 1273 1278 1283 1520 1525 1530 1535
Directivity (dB)	6.3531 6.2784 6.2286 6.2127 6.2173 6.2818 6.3348 6.3626 6.4822 6.5783 6.6693 6.7297 6.7362 6.7287 6.2875 6.2158 6.1357 6.0951 6.0200 6.0186 6.0455 7.0130 7.0785 7.1840 7.3066
Gain (dB)	3.3294 3.3404 3.5176 3.6598 3.7783 4.0162 4.0655 4.1272 4.4624 4.5936 4.8409 4.9701 5.0623 5.1659 4.6983 4.5222 4.2575 4.1025 3.8369 3.6975 3.5471 3.2578 3.7687 4.2835 4.5382
Efficiency (dB)	-3.0237 -2.9379 -2.7110 -2.5530 -2.4390 -2.2657 -2.2694 -2.2354 -2.0198 -1.9847 -1.8284 -1.7596 -1.6739 -1.5628 -1.5891 -1.6934 -1.8782 -1.9928 -2.1831 -2.3311 -2.4984 -3.7552 -3.3098 -2.9005 -2.7705
Efficiency (%)	49.8456 50.8403 53.5668 55.5526 57.0296 59.3515 59.3010 59.7668 62.8082 63.1900 65.6389 66.6868 68.0162 69.7783 69.3566 67.7112 64.8896 63.2039 60.4903 58.4637 56.2553 42.1190 46.6683 51.2797 52.8388
BWPhi=0	94.8916 97.0824 98.2651 99.4560 100.1500 100.3516 100.1251 99.8808 98.6636 96.8471 94.5544 92.9964 91.8714 91.3521 96.5015 97.7351 98.8277 99.6275 101.7978 102.1489 101.9869 96.0750 85.0073 83.6551 81.9892
BWPhi=90	92.5170 94.3105 96.0848 97.0539 97.9485 98.0367 97.8484 97.6133 95.9729 94.2455 91.5015 88.1281 87.0223 86.6160 93.6940 94.8036 95.9356 96.5762 98.1822 98.2161 97.7379 88.0824 86.2358 84.3488 82.3464
BWPhi=90	NaN NaN NaN NaN NaN 323.9507 316.3786 318.2561 312.6620 322.3846 335.5134 355.1100 NaN NaN 348.8169 351.9004 353.9091 NaN NaN NaN NaN 50.9275 51.3992 52.0227 52.5162
RoundnessTheta=30	0.2453 0.1964 0.2290 0.1896 0.2579 0.2742 0.2201 0.2297 0.1988 0.1903 0.1827 0.1717 0.1835 0.1569 0.1970 0.2241 0.1728 0.2064 0.2284 0.1926 0.1687 0.1253 0.1194 0.1137 0.1084
RoundnessTheta=60	0.4186 0.4491 0.4407 0.4273 0.4755 0.4856 0.5068 0.4967 0.5014 0.4454 0.4256 0.4709 0.5061 0.4813 0.4768 0.4568 0.4664 0.4702 0.4698 0.4401 0.3750 0.9822 0.8997 0.8523 0.8065
RoundnessTheta=90	1.0586 1.1083 1.1301 1.3299 1.4852 1.6809 1.7773 1.7613 1.8536 1.7529 1.6173 1.5055 1.3708 1.3162 1.5489 1.5283 1.5174 1.4787 1.4607 1.4099 1.4422 4.5717 4.3486 4.1694 3.9781
Peak GainPhi (deg)	96.0000 98.0000 108.0000 110.0000 134.0000 140.0000 162.0000 14.0000 154.0000 18.0000 14.0000 98.0000 86.0000 82.0000 118.0000 108.0000 178.0000 178.0000 178.0000 178.0000 104.0000 88.0000 178.0000 178.0000
Peak GainPhi (deg)	4 4 4 4 2 4 6 6 6 6 6 8 8 8 8 8 8 8 8 8 8 8 8 8
NullPhi (deg)	18.0000 24.0000 130.0000 132.0000 134.0000 136.0000 140.0000 138.0000 144.0000 150.0000 168.0000 6.0000 112.0000 118.0000 160.0000 162.0000 166.0000 166.0000 170.0000 170.0000 168.0000 146.0000 144.0000 144.0000
NullPhi (deg)	172 172
Upper spherical efficiency...	-3.5816 -3.5136 -3.3023 -3.1520 -3.0429 -2.8645 -2.8605 -2.8245 -2.5961 -2.5488 -2.3779 -2.2989 -2.2000 -2.0748 -2.0782 -2.2058 -2.4201 -2.5688 -2.8016 -2.9838 -3.1842 -4.1341 -3.8729 -3.2494 -3.1125
Upper spherical efficiency...	43.8368 44.5287 46.7487 48.3948 49.6261 51.7073 51.7346 52.1849 55.0034 55.6058 57.8372 58.8993 60.2566 62.0176 61.9692 60.1777 57.2777 55.7555 52.4611 50.3060 48.0374 38.6003 42.9251 47.3213 48.0371
Lower spherical efficiency...	-12.2121 -11.9986 -11.6834 -11.4522 -11.3056 -11.1667 -11.2226 -11.2022 -11.0764 -11.1277 -11.0781 -11.0860 -11.1016 -11.1010 -11.3151 -11.2300 -11.1850 -11.0632 -10.9533 -10.8844 -10.8824 -14.5362 -14.2676 -13.9775
Lower spherical efficiency...	6.0088 6.3117 6.8181 7.1578 7.4035 7.6442 7.5484 7.5819 7.8048 7.7132 7.8017 7.7876 7.7596 7.7607 7.3874 7.5335 7.6120 7.8285 8.0292 8.1576 8.2179 3.5187 3.7432 3.9585 4.0017
Efficiency_LNCP (dB)	-14.9046 -14.6294 -14.2719 -14.0667 -13.9349 -13.8415 -13.9582 -13.9544 -13.9348 -14.1227 -14.2341 -14.4222 -14.6114 -14.7721 -14.8013 -14.5177 -14.2625 -13.9345 -13.6422 -13.4027 -13.2081 -16.9314 -16.9258 -16.9783 -17.2299
Efficiency_LNCP (%)	3.2325 3.4440 3.7395 3.9204 4.0412 4.1290 4.0196 4.0231 4.0413 3.8702 3.7721 3.6123 3.4583 3.3326 3.3103 3.5337 3.7476 4.0416 4.3230 4.5680 4.7774 2.0270 2.0297 2.0053 1.8924
Efficiency_RNCP (dB)	-3.3149 -3.2426 -3.0253 -2.8708 -2.7582 -2.5788 -2.5742 -2.5300 -2.3087 -2.2586 -2.0854 -2.0015 -1.9005 -1.7753 -1.8015 -1.9262 -2.1366 -2.2795 -2.5052 -2.6945 -2.8838 -3.9694 -3.5029 -3.0738 -2.9289
Efficiency_RNCP (%)	46.6131 47.3963 49.8273 51.6322 52.9684 55.2225 55.2814 55.7348 58.7669 59.4488 61.8667 63.0746 64.5580 66.4457 66.0463 64.1775 61.1421 59.1623 56.1673 53.8957 51.4779 40.0920 44.6388 49.2744 50.9494
Gain_LNCP (dB)	-8.1733 -7.9141 -7.5221 -7.3266 -7.1811 -7.0134 -7.0904 -7.0552 -6.8517 -6.8389 -6.7100 -6.8496 -6.6661 -6.7623 -6.1486 -6.0455 -7.9420 -7.7311 -7.4777 -7.0768 -6.8157 -11.0598 -11.1272 -11.0269 -11.0568
Gain_RNCP (dB)	3.3188 3.3294 3.5071 3.6502 3.7711 4.0086 4.0605 4.1249 4.4593 4.5935 4.8408 4.9680 5.0606 5.1644 4.6933 4.5163 4.2503 4.0951 3.8297 3.6809 3.5415 3.2294 3.7470 4.2700 4.5295
AR @ 0	1.0609 1.0568 1.0521 1.0474 1.0425 1.0374 1.0321 1.0310 1.0253 1.0195 1.0136 1.0085 1.0099 1.0423 1.0454 1.0475 1.0481 1.0474 1.0453 1.0418 1.0474 1.1027 1.0851 1.0655 1.0456
AR @ 0	0.5135 0.4802 0.4414 0.4024 0.3615 0.3188 0.2746 0.2649 0.2168 0.1877 0.1177 0.0732 0.0545 0.0854 0.3596 0.3857 0.4027 0.4080 0.4022 0.3849 0.3558 0.8495 0.7095 0.5515 0.3876
功率占比 (%)	34.4801 34.4264 34.8458 34.9501 35.5496 35.9140 36.0702 36.1498 36.1751 36.1403 36.0222 35.8864 35.9344 35.5765 35.6860 35.6907 35.6475 35.6819 35.8099 35.8460 35.8164 33.9231 34.4194 34.4905 34.5082

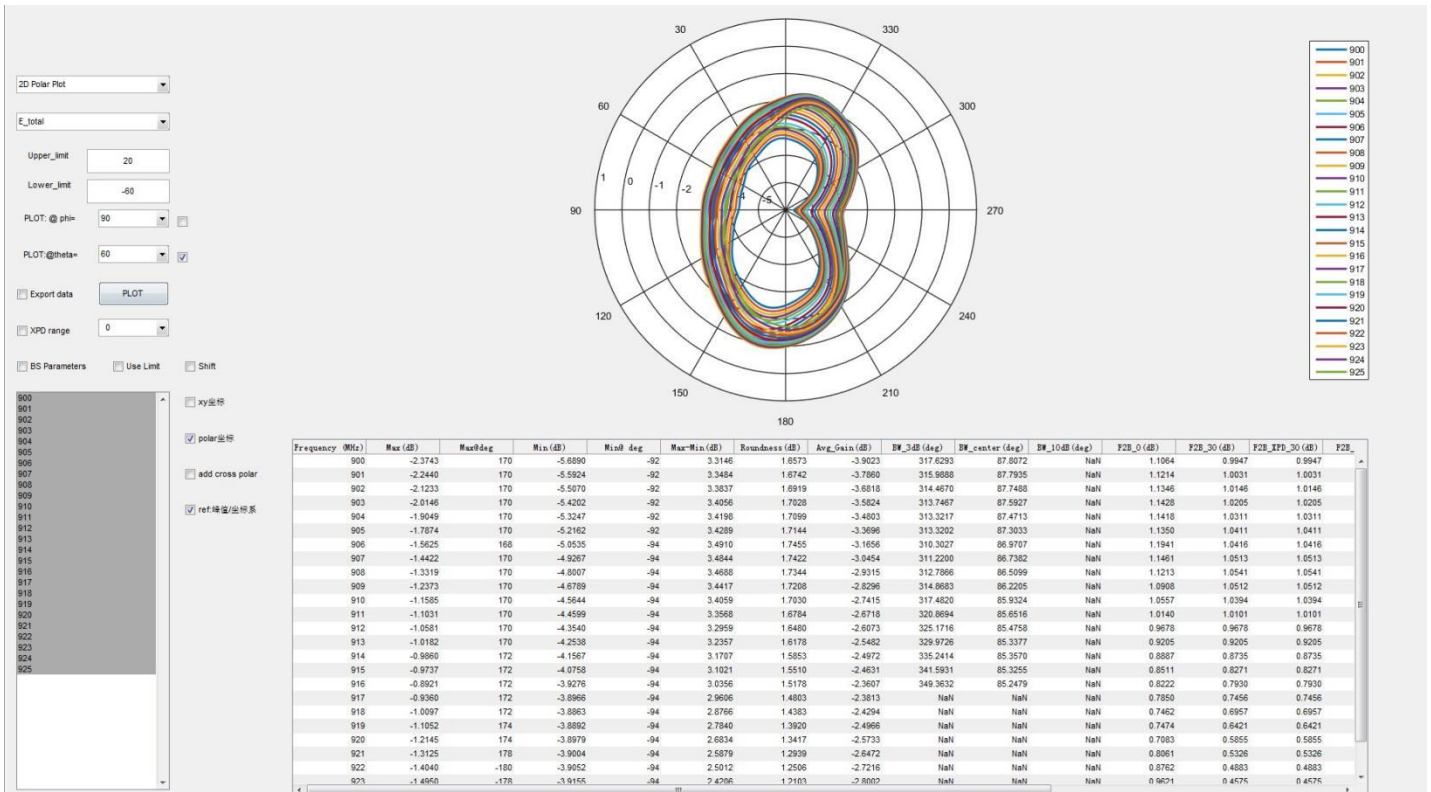
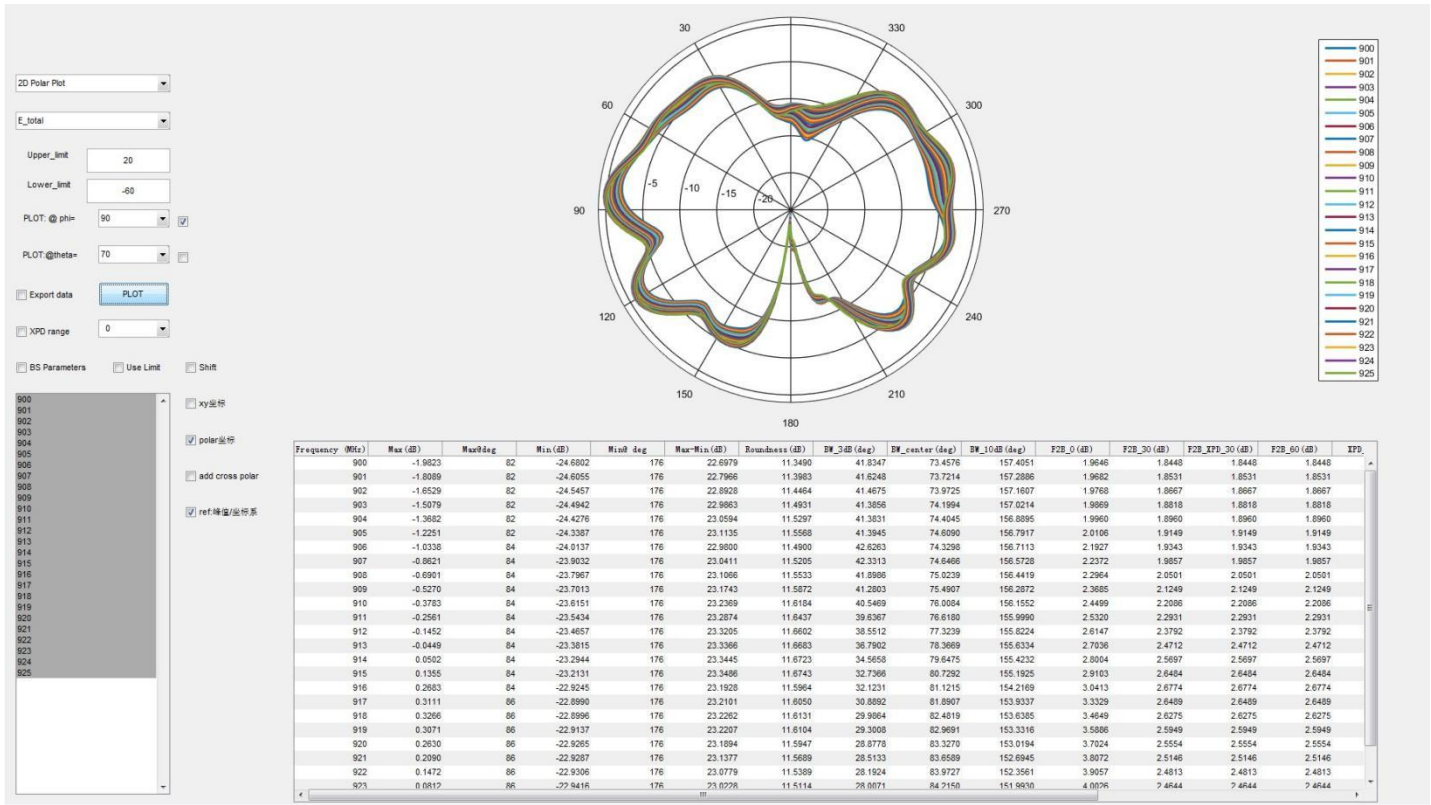


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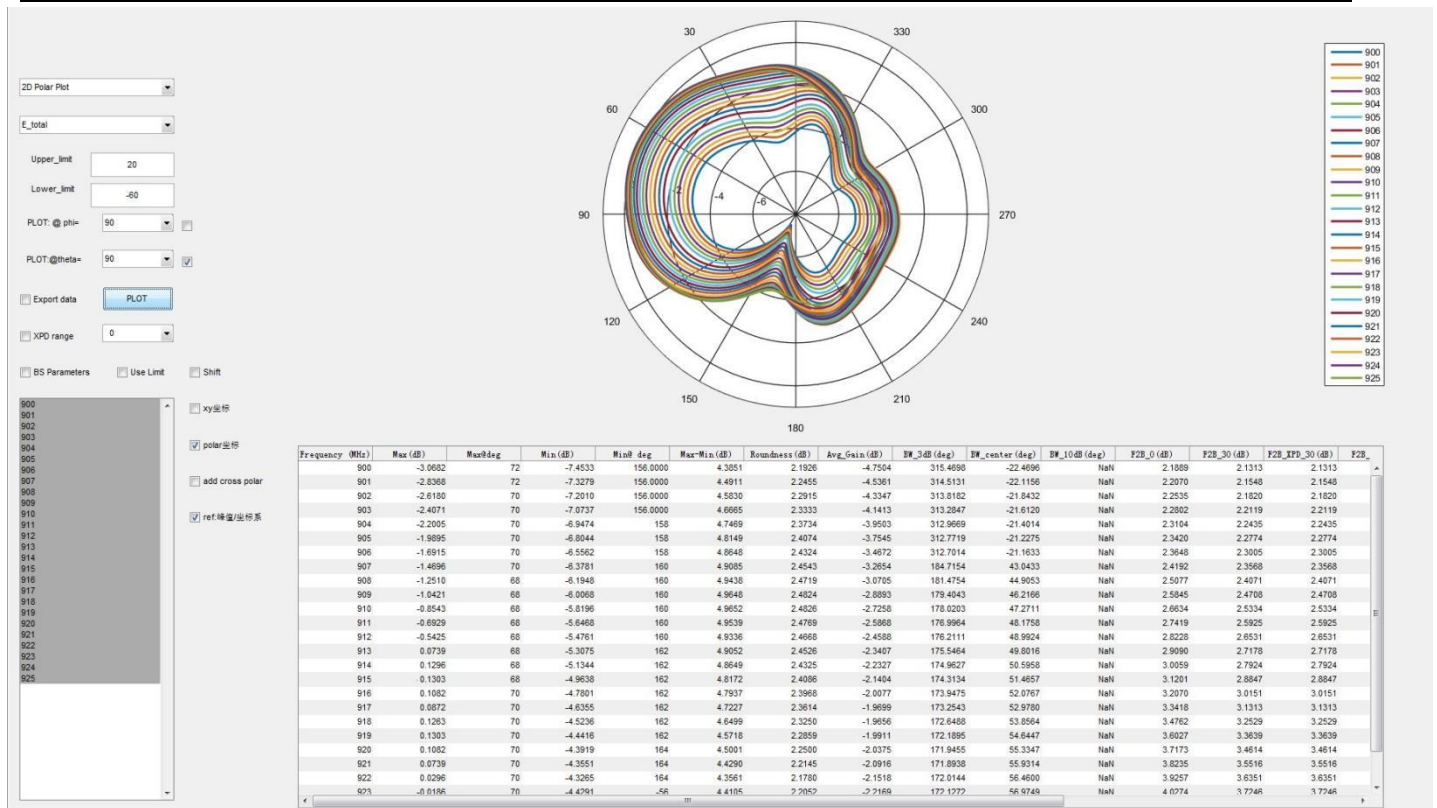




Shenzhen ZhidaoTong Technology Co., Ltd. Products Introduction



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Frequency (MHz)	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928
Directivity(dB)	3.5831	3.5603	3.5655	3.5687	3.5638	3.5539	3.5203	3.5165	3.5205	3.5413	3.5549	3.5656	3.5730	3.5843	3.6008	3.6213	3.6580	3.6869	3.7075	3.7219	3.7289	3.7296	3.7288	3.7288	3.7302	3.7520	3.7288	3.6869	3.5803
Gain(dB)	-1.6096	-1.4494	-1.2936	-1.1469	-1.0088	-0.8693	-0.6911	-0.5355	-0.3809	-0.2128	-0.0717	0.2085	0.3632	0.4380	0.5047	0.5614	0.5556	0.5931	0.5937	0.5814	0.5047	0.4380	0.3832	0.2885	0.2105	0.1213	0.2885	0.5931	-1.4494
Efficiency(dB)	-5.1727	-5.0097	-4.8591	-4.7155	-4.5726	-4.4322	-4.2113	-4.0520	-3.8973	-3.7541	-3.6286	-3.5213	-3.4255	-3.3382	-3.2601	-3.1976	-3.1025	-3.0928	-3.1138	-3.1605	-3.2242	-3.2918	-3.3636	-3.4404	-3.5277	-3.6307	-3.4404	-3.0928	-5.0097
Efficiency(%)	30.3888	31.5519	32.6658	33.7634	34.8932	36.1144	37.9197	39.3369	40.7632	42.1298	43.3852	44.4495	45.4409	46.3637	47.2050	47.8894	48.9500	49.0592	48.8226	48.3000	47.5969	46.8624	46.0940	45.2881	44.3644	43.3441	45.2881	49.0592	31.5519
RMPhi=0	72.4530	72.2914	72.1429	72.0507	71.9688	71.8469	72.6521	72.3675	71.8961	71.3680	70.8358	70.3701	69.9833	69.6342	69.3161	68.9614	69.3480	68.8955	68.5167	68.2928	68.2406	68.3712	68.5980	68.9330	69.2513	69.5575	68.9330	68.8955	72.2914
RMPhi=90	41.8347	41.6240	41.4075	41.3056	41.3031	41.3945	42.0203	42.3013	41.8986	41.2903	40.5409	39.6267	39.5512	38.7902	34.5559	32.7366	32.1221	30.0902	29.8694	29.3008	28.8778	28.5103	28.1624	28.0071	27.8572	27.7212	28.0071	30.8892	41.6240
RoundnessTheta=30	2.6181	2.6062	2.5884	2.5681	2.5384	2.5087	2.4781	2.4305	2.3766	2.3148	2.2477	2.1799	2.1120	2.0432	1.9733	1.8987	1.8454	1.7654	1.6842	1.6045	1.5310	1.4612	1.3973	1.3373	1.2782	1.2165	1.3373	1.7654	2.6062
RoundnessTheta=90	1.6573	1.6742	1.6919	1.7028	1.7099	1.7144	1.7455	1.7422	1.7344	1.7208	1.7030	1.6784	1.6480	1.6178	1.5853	1.5510	1.5178	1.4803	1.4383	1.3920	1.3417	1.2939	1.2506	1.2103	1.1750	1.1395	1.2103	1.4803	1.6742
Peak GainPhi(deg)	21.6259	22.4455	22.9135	23.3374	23.7044	24.0244	24.3244	24.5424	24.6804	24.7284	24.6884	24.5604	24.3884	24.1804	23.8484	23.4684	23.0684	22.6684	22.2684	21.8684	21.4684	21.0684	20.6684	20.2684	19.8684	19.4684	20.2684	21.4684	21.6259
Peak GainTheta(deg)	38.0000	36.0000	42.0000	42.0000	42.0000	42.0000	48.0000	48.0000	48.0000	48.0000	48.0000	46.0000	46.0000	54.0000	54.0000	54.0000	54.0000	52.0000	52.0000	52.0000	50.0000	50.0000	50.0000	50.0000	60.0000	60.0000	60.0000	52.0000	38.0000
HalfPhi(deg)	146.0000	142.0000	140.0000	136.0000	136.0000	134.0000	126.0000	126.0000	126.0000	126.0000	126.0000	124.0000	124.0000	124.0000	124.0000	124.0000	126.0000	126.0000	126.0000	124.0000	144.0000	144.0000	144.0000	142.0000	142.0000	144.0000	142.0000	124.0000	146.0000
HalfTheta(deg)	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	176	174	174	174	174	174	174	176	176
Upper spherical efficiency...	-7.7857	-7.6221	-7.4703	-7.3250	-7.1792	-7.0257	-6.8148	-6.6483	-6.4854	-6.3330	-6.1955	-6.0799	-5.9737	-5.8760	-5.7880	-5.7182	-5.6119	-5.5948	-5.6092	-5.6502	-5.7089	-5.7726	-5.8416	-5.9168	-6.0037	-6.1077	-5.9168	-5.5948	-7.6221
Upper spherical efficiency...	16.6505	17.2886	17.9048	18.5139	19.1461	19.8350	20.8228	21.6357	22.4624	23.2647	24.0130	24.6607	25.2715	25.8483	26.3757	26.8153	27.4669	27.5795	27.4842	27.2256	26.8600	26.4692	26.0517	25.6047	25.0972	24.5038	25.6047	27.5795	17.2886
Lower spherical efficiency...	-8.6263	-8.4581	-8.3086	-8.1674	-8.0280	-7.8938	-7.6708	-7.3753	-7.2434	-7.1262	-7.0258	-6.9531	-6.8132	-6.6786	-6.5590	-6.4526	-6.3590	-6.2784	-6.2095	-6.1525	-6.1061	-6.0702	-6.0442	-6.0281	-6.0220	-6.0259	-6.0398	-6.0537	-8.4581
Lower spherical efficiency...	13.7393	14.2622	14.7612	15.2495	15.7476	16.2794	17.0699	17.7011	18.3008	18.8652	19.3722	19.7898	20.1694	20.5175	20.8294	21.0741	21.4531	21.4536	21.3394	21.0744	20.7369	20.3932	20.0423	19.6915	19.2572	18.8403	19.6915	21.4536	14.2622
Efficiency_LMCP (dB)	-8.1540	-7.9922	-7.8429	-7.7013	-7.5610	-7.4151	-7.2172	-7.0629	-6.9137	-6.7781	-6.6536	-6.5530	-6.4609	-6.3764	-6.3008	-6.2402	-6.1525	-6.1485	-6.1695	-6.2190	-6.2854	-6.3549	-6.4277	-6.5050	-6.5923	-6.6952	-6.5923	-6.1485	-7.9922
Efficiency_LMCP (dB)	15.2669	15.8775	16.4326	16.9774	17.5347	18.1339	18.7971	19.6857	20.3529	21.0091	21.6511	22.1587	22.5897	23.0333	23.4388	24.2912	24.2912	24.1578	23.8834	23.5212	23.1480	22.7631	22.3616	21.9164	21.4033	22.3616	24.2912	15.8775	15.2669
Efficiency_RMCP (dB)	-8.2123	-8.0481	-7.8960	-7.7505	-7.6049	-7.4520	-7.2281	-7.0617	-6.9015	-6.7528	-6.6202	-6.5104	-6.4109	-6.3206	-6.2404	-6.1759	-6.0734	-6.0611	-6.0792	-6.1231	-6.1842	-6.2499	-6.3207	-6.3970	-6.4843	-6.5875	-6.4843	-6.0611	-8.0481
Efficiency_RMCP (dB)	15.0930	15.6744	16.2332	16.7660	17.3685	17.9605	18.6406	19.6712	20.4103	21.1214	21.7761	22.3337	22.8512	23.3305	23.7662	24.1220	24.6980	24.7680	24.6651	24.4166	24.0758	23.7144	23.3309	22.9245	22.4680	21.9408	22.9245	24.7680	15.6744
Gain_LMCP (dB)	-2.2941	-2.7437	-2.6040	-2.4799	-2.3609	-2.2415	-2.0939	-1.9709	-1.8708	-1.7725	-1.6859	-1.6024	-1.5319	-1.4693	-1.4227	-1.4053	-1.4201	-1.4768	-1.5400	-1.6332	-1.7135	-1.7925	-1.8672	-1.9344	-2.0128	-1.8672	-1.4201	-2.7437	-2.2941
Gain_RMCP (dB)	-2.8082	-2.8217	-2.6890	-2.5325	-2.4006	-2.2687	-2.0977	-1.9394	-1.7936	-1.6376	-1.5055	-1.3994	-1.3081	-1.2264	-1.1507	-1.0799	-0.9607	-0.9358	-0.9487	-0.9959	-1.0646	-1.1473	-1.2342	-1.3146	-1.4025	-1.4986	-1.3146	-0.9358	-2.8217
AR @ 0 (°)	2.0357e+03	1.0929e+03	447.7719	257.7695	189.0834	150.2404	78.2202	70.3568	64.0783	58.7904	54.1149	50.0216	47.0121	44.0047	41.4001	39.1507	37.4323	34.2334	31.5372	30.3326	29.3068	28.4256	27.7538	27.1238	26.7815	26.5294	27.1238	32.4334	1.0929e+03
AR @ 90 (°)	66.1742	60.7719	53.0211	48.2248	45.5331	43.5337	37.8064	36.8461	36.1339	35.3861	34.6663	33.8632	33.4240	32.7800	32.3658	31.8548	30.2199	29.9784	29.6832	29.3394	29.0742	28.8628	28.6670	28.5502	28.4475	28.6670	30.2199	60.7719	66.1742
Gain @ 0 (dB)	38.8084	36.7719	35.6246	36.3211	36.7132	36.2248	36.1137	36.0446	35.9845	35.9344	35.8964	35.8710	35.8555	35.8488	35.8378	35.8270	35.8152	35.8093	35.7995	35.7896	35.7699	35.7584	35.7538	35.7445	35.7488	35.6591	35.7448	35.3970	36.7719