

鲨鱼鳍智能天线组合规格书

共26页
(包括封面)

深圳市思翰铭科技有限公司

汽车电子事业部

拟 制 代杰、罗宇航

审 核 _____

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一 天线规格

1.1 5G 天线部分

- (1) 频率范围：低频 700~960、中频 1710~2690；高频 3300~5000；
- (2) V.S.W.R: 5G 主天线:低频 700~960<3.5、中频 1710~2690<2.5；高频 3300~5000<2.5;
5G 分天线:低频 700~960<5、中频 1710~2690<3；高频 3300~5000<3.5;
- (3) 天线增益>0dB
- (4) 特性阻抗：50 Ω

1.2 5G-MIMO 天线部分

- (1) 频率范围：中频 1710~2690；高频 3300~5000；
- (2) V.S.W.R: 5G-MIMO1 中频 1710~2690<2；高频 3300~5000<3;
5G-MIMO2 中频 1710~2690<4；高频 3300~5000<3.5;
- (3) 天线增益>0dB
- (4) 特性阻抗：50 Ω

1.6 环境要求

(1)工作温度：-35℃～+80℃；

(2)存储温度：-40℃～+85℃；

1.7 机械性能要求

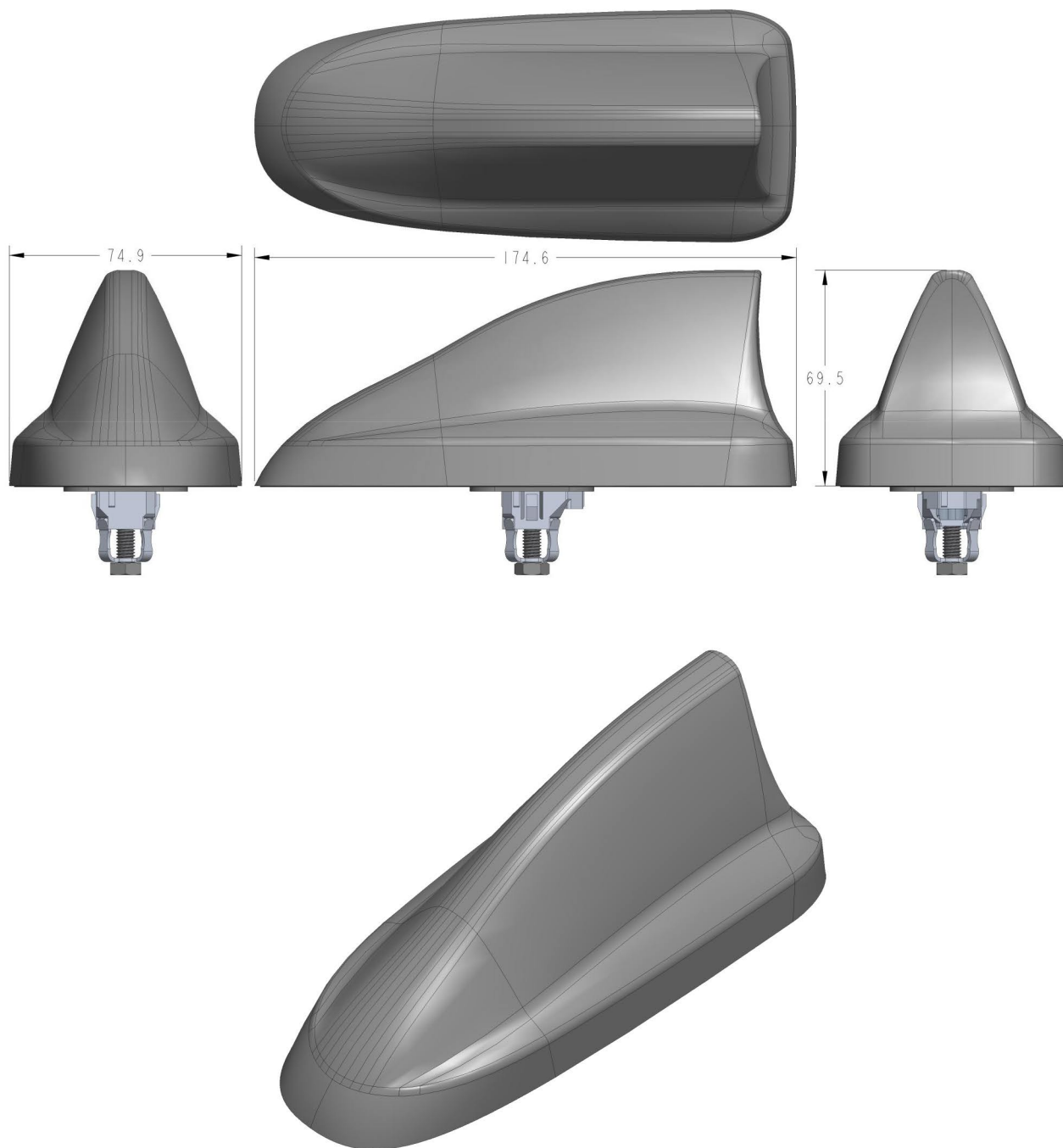
(1)接插件拔脱力：>80N；

(2) 防护等级：IP67、IPX9K

1.8 功能接口定义（可根据需求调整）

序号	功能	接口型号	颜色
1	5G 主	/FAKRA_D 型	枣红色
2	5G 副	/FAKRA_K 型	咖喱色
3	MIMO_1	/FAKRA_I 型	米黄色
4	MIMO_2	/FAKRA_E 型	绿色

二 天线形状

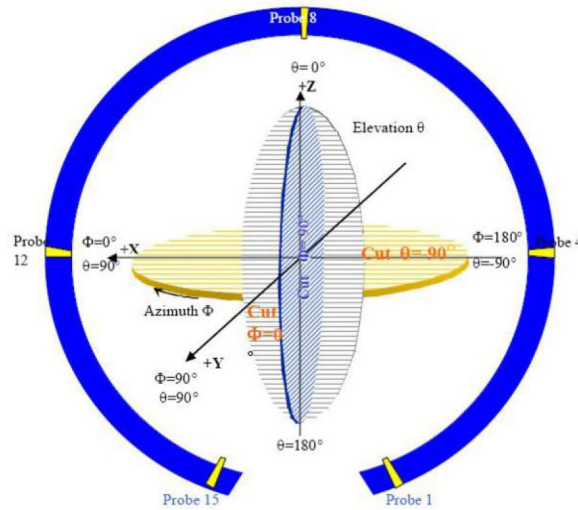


三 天线测试环境

3.1 天线无源测试设备

天线特性测试使用 Agilent E5071C 矢量网络分析仪。

天线辐射特性测试使用 ET Satimo Starlab 3D 近场微波暗室。测试坐标系如下图所示，

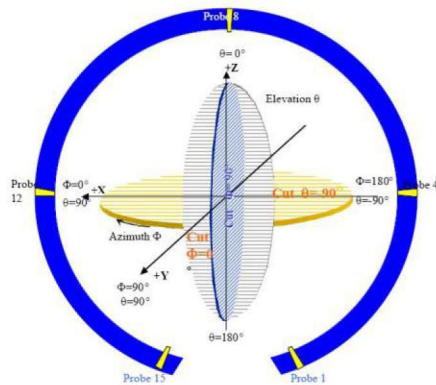


3D 微波暗室测试坐标系 (back view)

3.2 天线有源测试设备

综测仪使用的是 Agilent 8960。

天线辐射特性测试使用 ET Satimo Starlab 3D 近场微波暗室。测试坐标系如图 8 所示。



3D 微波暗室测试坐标系 (back view)

3.3 天线测试设备实物图



AMS 8500 暗室



AMS8500 暗室



AMS 8500 暗室

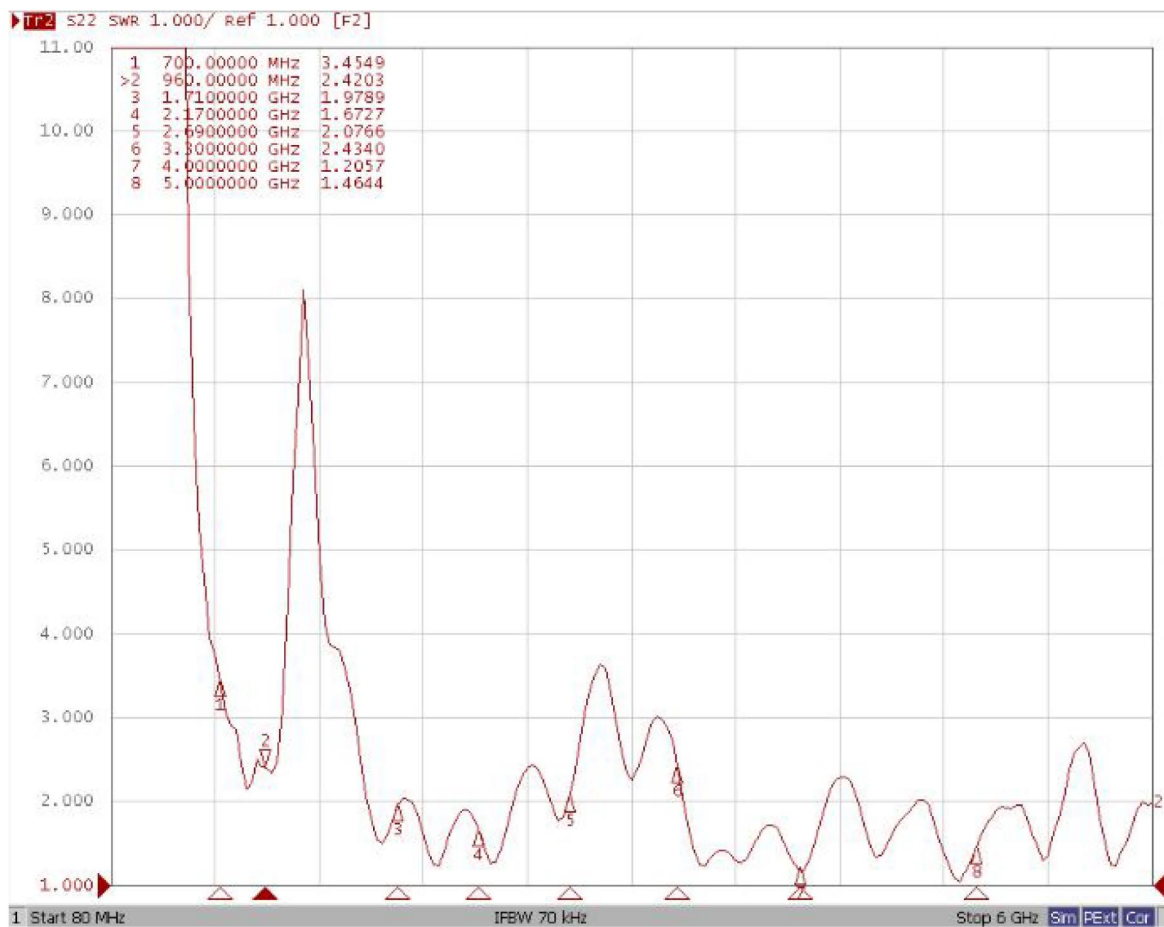
3.4 网分测试图



四 天线测试结果

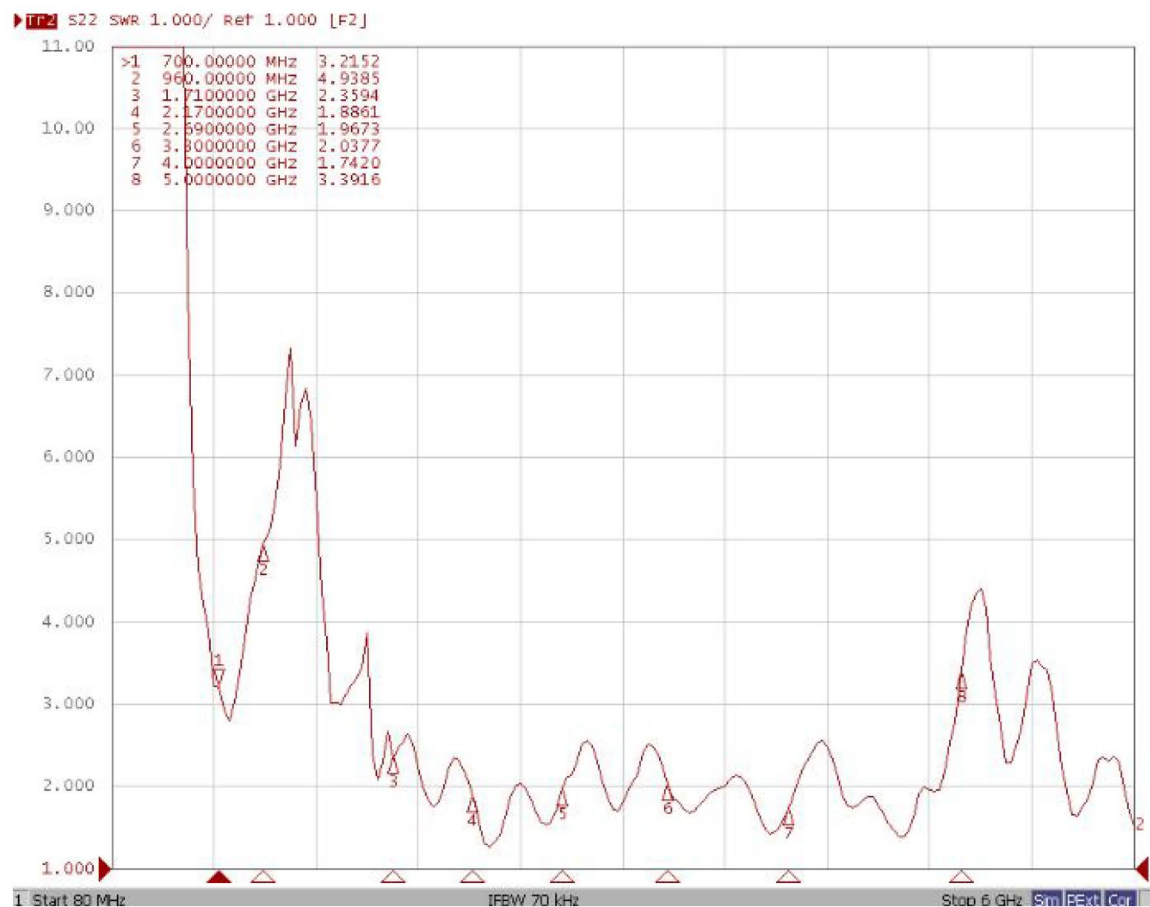
4.1 5G 天线 VSWR 测试

5G 主天线 VSWR



MARKER	频率/MHz	VSWR
1	700	3.45
2	960	2.42
3	1710	1.97
4	2170	1.67
5	2690	2.07
6	3300	2.43
7	4000	1.20
8	5000	1.46

5G 分天线 VSWR



MARKER	频率/MHz	VSWR
1	700	3.21
2	960	4.93
3	1710	2.35
4	2170	1.88
5	2690	1.96
6	3300	2.03
7	4000	1.74
8	5000	3.39

4.2 5G 天线效率数据

5G 主天线效率数据

频点	效率	损耗	频点	效率	损耗
700	34.85%	-4.58	1830	57.32%	-2.42
710	35.34%	-4.52	1850	58.60%	-2.32
720	36.92%	-4.33	1870	59.86%	-2.23
730	37.54%	-4.26	1890	61.10%	-2.14
740	38.68%	-4.13	1910	62.61%	-2.03
750	39.53%	-4.03	1930	63.72%	-1.96
760	41.33%	-3.84	1950	64.82%	-1.88
770	40.38%	-3.94	1970	64.39%	-1.91
780	41.79%	-3.79	1990	64.03%	-1.94
790	42.55%	-3.71	2010	63.34%	-1.98
800	39.86%	-3.99	2030	61.61%	-2.10
810	41.52%	-3.82	2050	60.43%	-2.19
820	40.27%	-3.95	2070	59.21%	-2.28
830	40.95%	-3.88	2090	59.41%	-2.26
840	38.91%	-4.10	2110	61.32%	-2.12
850	37.29%	-4.28	2130	60.82%	-2.16
860	37.58%	-4.25	2150	60.40%	-2.19
870	37.43%	-4.27	2170	61.53%	-2.11
880	37.95%	-4.21	2190	63.34%	-1.98
890	38.34%	-4.16	2210	64.94%	-1.87
900	38.53%	-4.14	2230	66.47%	-1.77
910	38.64%	-4.13	2250	65.18%	-1.86
920	38.66%	-4.13	2270	65.05%	-1.87
930	38.68%	-4.13	2290	64.26%	-1.92
940	38.21%	-4.18	2310	64.30%	-1.92
950	37.58%	-4.25	2330	62.12%	-2.07
960	37.21%	-4.29	2350	62.60%	-2.03
			2370	61.51%	-2.11
1710	52.92%	-2.76	2390	59.04%	-2.29
1730	52.71%	-2.78	2410	56.50%	-2.48
1750	53.40%	-2.72	2430	53.44%	-2.72
1770	54.06%	-2.67	2450	52.40%	-2.81
1790	54.16%	-2.66	2470	52.00%	-2.84
1810	56.11%	-2.51	2490	51.85%	-2.85

频点	效率	损耗	频点	效率	损耗
2510	53.08%	-2.75	3900	57.96%	-2.37
2530	55.44%	-2.56	3950	58.80%	-2.31
2550	57.18%	-2.43	4000	59.15%	-2.28
2570	57.95%	-2.37	4050	58.92%	-2.30
2590	58.08%	-2.36	4100	55.17%	-2.58
2610	59.44%	-2.26	4150	50.07%	-3.00
2630	59.69%	-2.24	4200	48.96%	-3.10
2650	60.02%	-2.22	4250	51.05%	-2.92
2670	60.29%	-2.20	4300	53.45%	-2.72
2690	60.65%	-2.17	4350	56.86%	-2.45
			4400	59.86%	-2.23
3300	54.75%	-2.62	4450	60.78%	-2.16
3350	57.56%	-2.40	4500	59.74%	-2.24
3400	63.23%	-1.99	4550	57.47%	-2.41
3450	60.24%	-2.20	4600	53.60%	-2.71
3500	58.35%	-2.34	4650	52.31%	-2.81
3550	56.50%	-2.48	4700	56.75%	-2.46
3600	56.41%	-2.49	4750	57.11%	-2.43
3650	56.72%	-2.46	4800	60.53%	-2.18
3700	54.80%	-2.61	4850	60.46%	-2.19
3750	53.76%	-2.70	4900	58.54%	-2.33
3800	53.51%	-2.72	4950	58.94%	-2.30
3850	54.07%	-2.67	5000	55.60%	-2.55

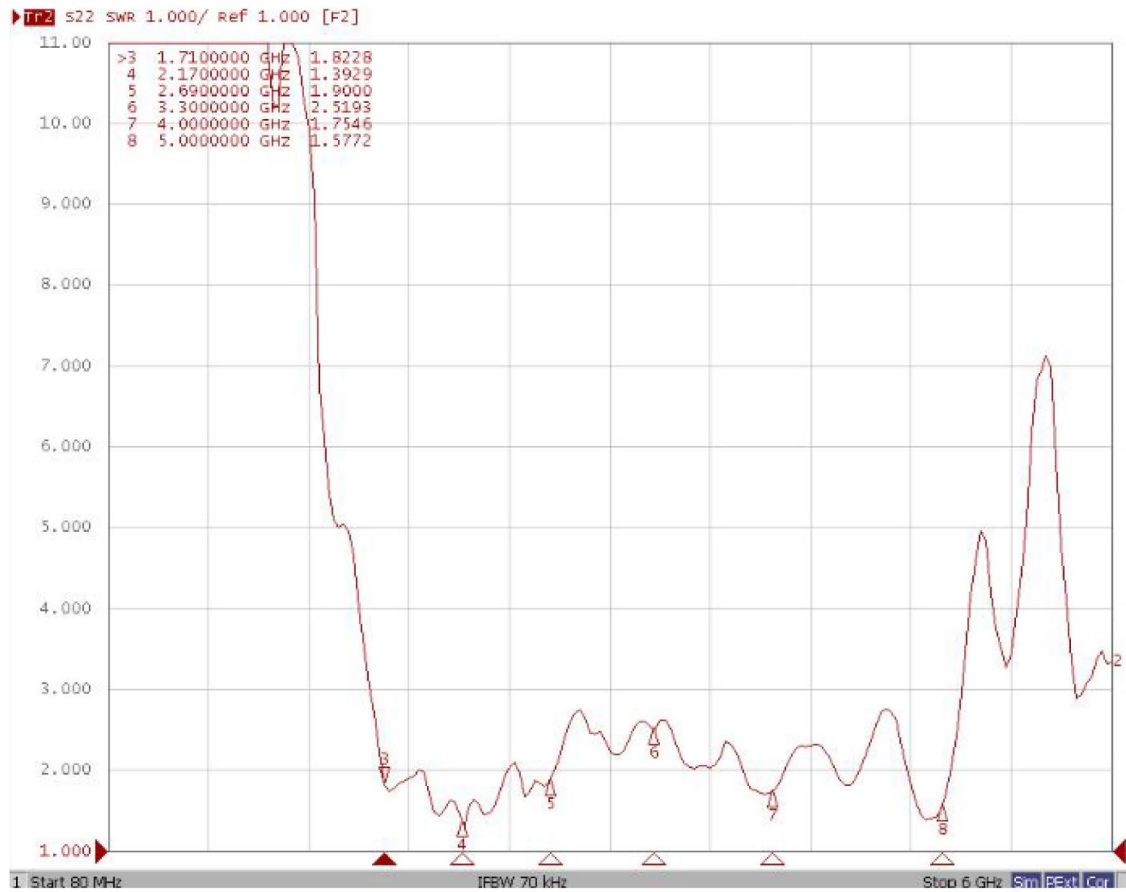
5G 分天线效率数据

频点	效率	损耗	频点	效率	损耗
700	31.73%	-4.99	1910	50.19%	-2.99
710	32.14%	-4.93	1930	51.39%	-2.89
720	30.14%	-5.21	1950	52.61%	-2.79
730	30.74%	-5.12	1970	50.48%	-2.97
740	31.77%	-4.98	1990	49.55%	-3.05
750	33.90%	-4.70	2010	48.54%	-3.14
760	33.06%	-4.81	2030	45.43%	-3.43
770	34.70%	-4.60	2050	43.54%	-3.61
780	36.95%	-4.32	2070	45.31%	-3.44
790	36.93%	-4.33	2090	45.70%	-3.40
800	33.67%	-4.73	2110	47.97%	-3.19
810	37.73%	-4.23	2130	49.66%	-3.04
820	36.46%	-4.38	2150	52.54%	-2.80
830	34.09%	-4.67	2170	54.30%	-2.65
840	34.11%	-4.67	2190	53.46%	-2.72
850	34.23%	-4.66	2210	42.22%	-3.74
860	33.89%	-4.70	2230	54.31%	-2.65
870	33.16%	-4.79	2250	61.77%	-2.09
880	32.46%	-4.89	2270	65.16%	-1.86
890	32.02%	-4.95	2290	63.22%	-1.99
900	32.06%	-4.94	2310	61.21%	-2.13
910	31.96%	-4.95	2330	67.22%	-1.73
920	31.93%	-4.96	2350	65.68%	-1.83
930	32.11%	-4.93	2370	57.93%	-2.37
940	31.89%	-4.96	2390	50.25%	-2.99
950	31.65%	-5.00	2410	50.55%	-2.96
960	31.04%	-5.08	2430	51.75%	-2.86
			2450	52.56%	-2.79
1800	38.12%	-4.19	2470	54.31%	-2.65
1810	39.34%	-4.05	2490	56.15%	-2.51
1830	43.39%	-3.63	2510	57.93%	-2.37
1850	43.81%	-3.58	2530	57.03%	-2.44
1870	45.94%	-3.38	2550	59.37%	-2.26
1890	48.38%	-3.15	2570	61.43%	-2.12

频点	效率	损耗	频点	效率	损耗
2590	63.04%	-2.00	4100	42.98%	-3.67
2610	65.05%	-1.87	4150	41.57%	-3.81
2630	67.19%	-1.73	4200	48.39%	-3.15
2650	64.58%	-1.90	4250	54.58%	-2.63
2670	62.14%	-2.07	4300	56.93%	-2.45
2690	60.53%	-2.30	4350	55.03%	-2.59
			4400	51.16%	-2.91
3300	46.68%	-3.31	4450	44.31%	-3.54
3350	53.72%	-2.70	4500	42.86%	-3.68
3400	62.56%	-2.04	4550	42.20%	-3.75
3450	63.59%	-1.97	4600	48.68%	-3.13
3500	64.97%	-1.87	4650	50.15%	-3.00
3550	62.30%	-2.06	4700	46.05%	-3.37
3600	58.01%	-2.36	4750	44.32%	-3.53
3650	53.32%	-2.73	4800	45.82%	-3.39
3700	50.04%	-3.01	4850	47.81%	-3.20
3750	52.64%	-2.79	4900	47.63%	-3.22
3800	59.50%	-2.25	4950	43.65%	-3.60
3850	62.13%	-2.07	5000	43.64%	-3.60
3900	63.42%	-1.98			
3950	61.88%	-2.08			
4000	56.69%	-2.46			
4050	49.34%	-3.07			

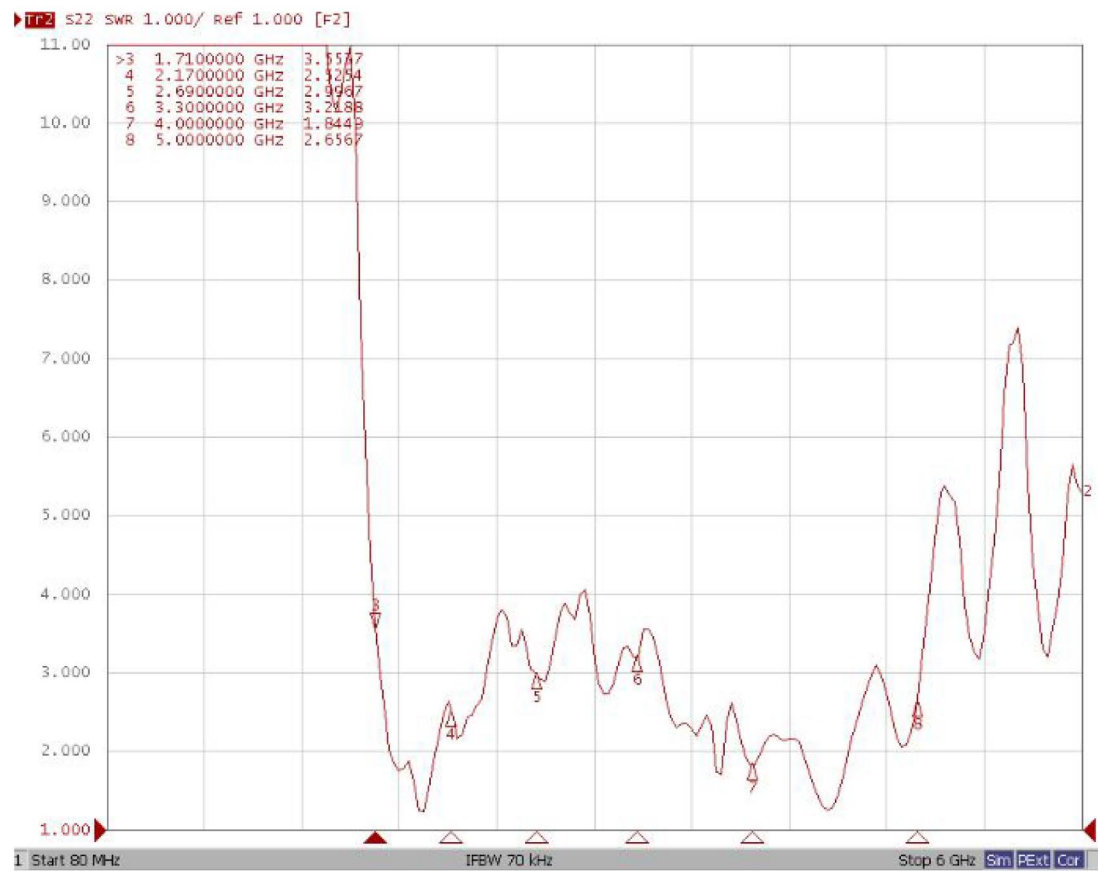
4.3 5G-MIMO 天线 VSWR 测试

5G-MIMO1 天线 VSWR



MARKER	频率/MHz	VSWR
3	1710	1.82
4	2170	1.39
5	2690	1.90
6	3300	2.51
7	4000	1.75
8	5000	1.57

5G-MIMO2 天线 VSWR



MARKER	频率/MHz	VSWR
3	1710	3.55
4	2170	2.52
5	2690	2.99
6	3300	3.21
7	4000	1.84
8	5000	2.65

4.4 5G-MIMO 天线效率数据

5G-MIMO1 天线效率数据

频点	效率	损耗	频点	效率	损耗
1710	48.19%	-3.17	2390	60.53%	-2.18
1730	48.54%	-3.14	2410	59.66%	-2.24
1750	47.63%	-3.22	2430	57.41%	-2.41
1770	43.03%	-3.66	2450	55.27%	-2.58
1790	44.67%	-3.50	2470	53.08%	-2.75
1810	44.47%	-3.52	2490	50.51%	-2.97
1830	44.20%	-3.55	2510	49.71%	-3.04
1850	45.19%	-3.45	2530	50.31%	-2.98
1870	46.72%	-3.30	2550	49.27%	-3.07
1890	47.58%	-3.23	2570	51.63%	-2.87
1910	48.73%	-3.12	2590	54.06%	-2.67
1930	49.95%	-3.01	2610	55.58%	-2.55
1950	51.71%	-2.86	2630	56.62%	-2.47
1970	53.39%	-2.73	2650	56.98%	-2.44
1990	54.46%	-2.64	2670	55.82%	-2.53
2010	54.61%	-2.63	2690	57.99%	-2.37
2030	56.06%	-2.51			
2050	58.74%	-2.31	3300	45.30%	-3.74
2070	58.34%	-2.34	3350	49.01%	-3.66
2090	57.59%	-2.40	3400	50.52%	-2.97
2110	57.65%	-2.39	3450	55.91%	-2.52
2130	56.68%	-2.47	3500	61.14%	-2.14
2150	57.13%	-2.43	3550	62.48%	-2.04
2170	56.47%	-2.48	3600	61.50%	-2.11
2190	57.57%	-2.40	3650	54.58%	-2.63
2210	58.95%	-2.30	3700	49.64%	-3.04
2230	60.85%	-2.16	3750	49.51%	-3.05
2250	59.54%	-2.25	3800	54.71%	-2.62
2270	59.65%	-2.24	3850	55.81%	-2.53
2290	59.95%	-2.22	3900	57.51%	-2.40
2310	60.11%	-2.21	3950	59.90%	-2.23
2330	59.59%	-2.25	4000	60.47%	-2.18
2350	60.57%	-2.18	4050	57.25%	-2.42
2370	61.62%	-2.10	4100	50.36%	-2.98

频点	效率	损耗	频点	效率	损耗
4150	52.86%	-3.48	4600	50.01%	-3.98
4200	55.25%	-3.44	4650	49.31%	-3.84
4250	51.73%	-3.21	4700	49.48%	-3.14
4300	51.92%	-2.85	4750	52.86%	-2.77
4350	56.89%	-2.45	4800	56.45%	-2.48
4400	60.00%	-2.22	4850	59.23%	-2.27
4450	58.77%	-2.31	4900	58.36%	-2.34
4500	51.87%	-2.85	4950	56.35%	-2.49
4550	51.66%	-3.60	5000	50.58%	-2.96

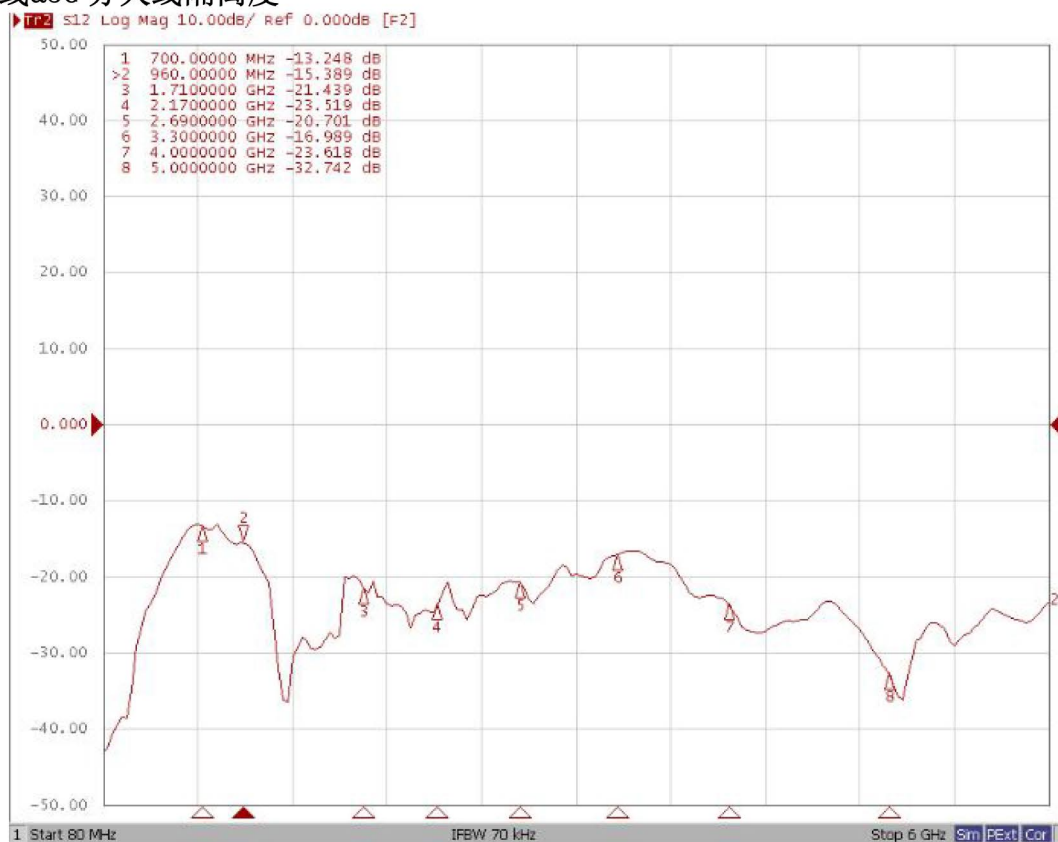
5G-MIMO2 天线效率数据

频点	效率	损耗	频点	效率	损耗
1710	37.09%	-4.31	2390	43.11%	-3.65
1730	38.97%	-4.09	2410	41.67%	-3.80
1750	39.57%	-4.03	2430	41.45%	-3.82
1770	41.28%	-3.84	2450	40.36%	-3.94
1790	42.82%	-3.68	2470	38.69%	-4.12
1810	41.96%	-3.77	2490	40.71%	-3.90
1830	43.55%	-3.61	2510	41.28%	-3.84
1850	42.99%	-3.67	2530	41.33%	-3.84
1870	43.67%	-3.60	2550	40.89%	-3.88
1890	42.29%	-3.74	2570	40.25%	-3.95
1910	44.28%	-3.54	2590	40.50%	-3.93
1930	45.46%	-3.42	2610	40.23%	-3.95
1950	46.13%	-3.36	2630	43.11%	-3.65
1970	45.82%	-3.39	2650	45.00%	-3.47
1990	45.38%	-3.43	2670	46.18%	-3.36
2010	42.62%	-3.70	2690	47.76%	-3.21
2030	42.50%	-3.72			
2050	41.76%	-3.79	3300	38.83%	-4.11
2070	41.83%	-3.78	3350	35.37%	-4.51
2090	41.31%	-3.84	3400	36.85%	-4.34
2110	40.67%	-3.91	3450	39.59%	-4.02
2130	40.46%	-3.93	3500	44.22%	-3.54
2150	40.98%	-3.87	3550	47.33%	-3.25
2170	40.59%	-3.92	3600	49.42%	-3.06
2190	41.82%	-3.79	3650	42.96%	-3.67
2210	41.74%	-3.79	3700	40.59%	-4.49
2230	40.63%	-3.91	3750	41.18%	-4.66
2250	40.46%	-3.93	3800	40.21%	-3.96
2270	41.16%	-3.86	3850	46.63%	-3.31
2290	40.52%	-3.92	3900	52.58%	-2.79
2310	40.15%	-3.96	3950	57.15%	-2.43
2330	39.97%	-3.98	4000	58.94%	-2.30
2350	41.36%	-3.83	4050	56.39%	-2.49
2370	42.76%	-3.69	4100	52.08%	-2.83

频点	效率	损耗	频点	效率	损耗
4150	49.57%	-3.05	4600	43.41%	-3.62
4200	50.85%	-2.94	4650	41.59%	-3.81
4250	53.15%	-2.74	4700	44.37%	-3.53
4300	56.55%	-2.48	4750	46.25%	-3.35
4350	61.28%	-2.13	4800	48.56%	-3.14
4400	63.56%	-1.97	4850	52.08%	-2.83
4450	62.78%	-2.02	4900	52.00%	-2.84
4500	57.67%	-2.39	4950	46.83%	-3.29
4550	49.22%	-3.08	5000	45.34%	-4.52

4.9 天线隔离度

5G 主天线&5G 分天线隔离度

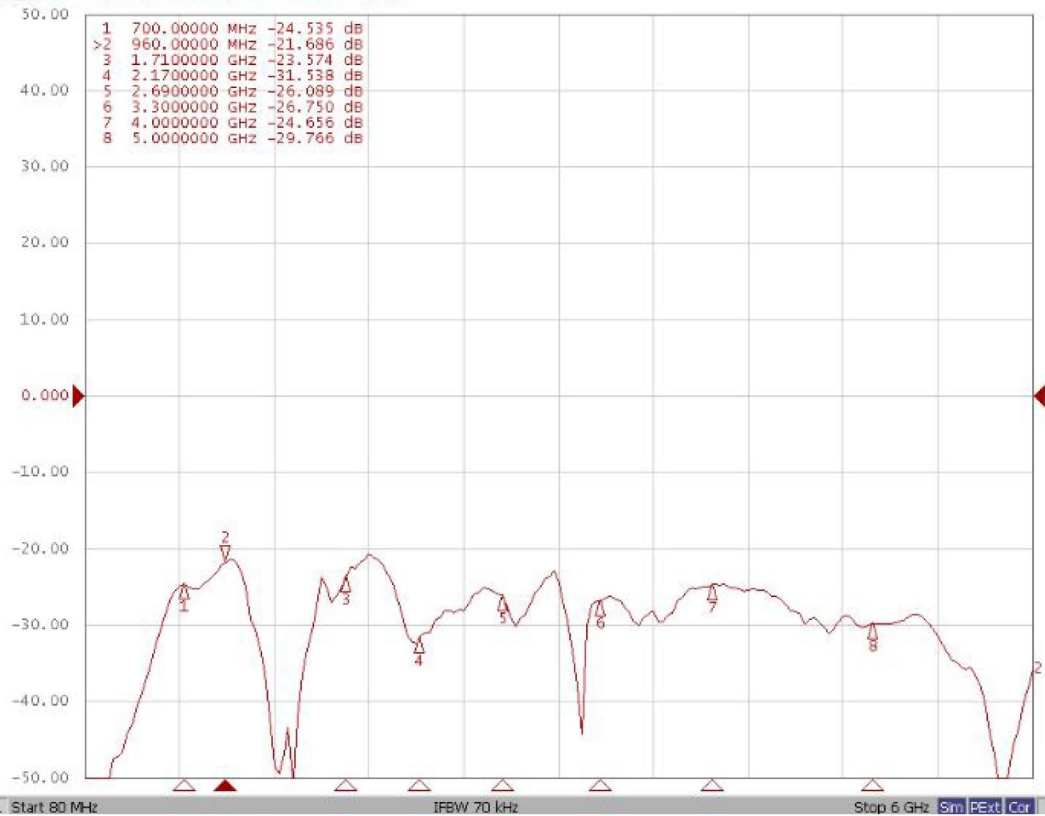


5G 主天线&5G-MIM01 隔离度



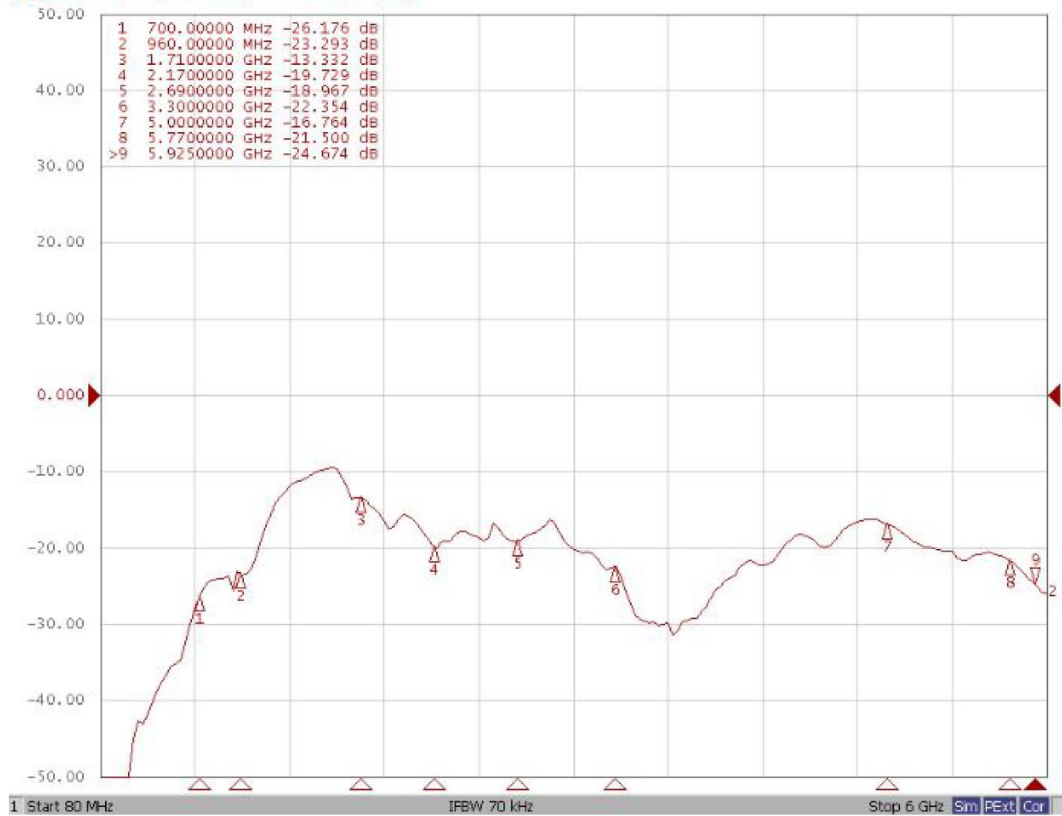
5G 主天线&5G-MIMO2 隔离度

▶ F2 S12 Log Mag 10.00dB/ Ref 0.000dB [F2]

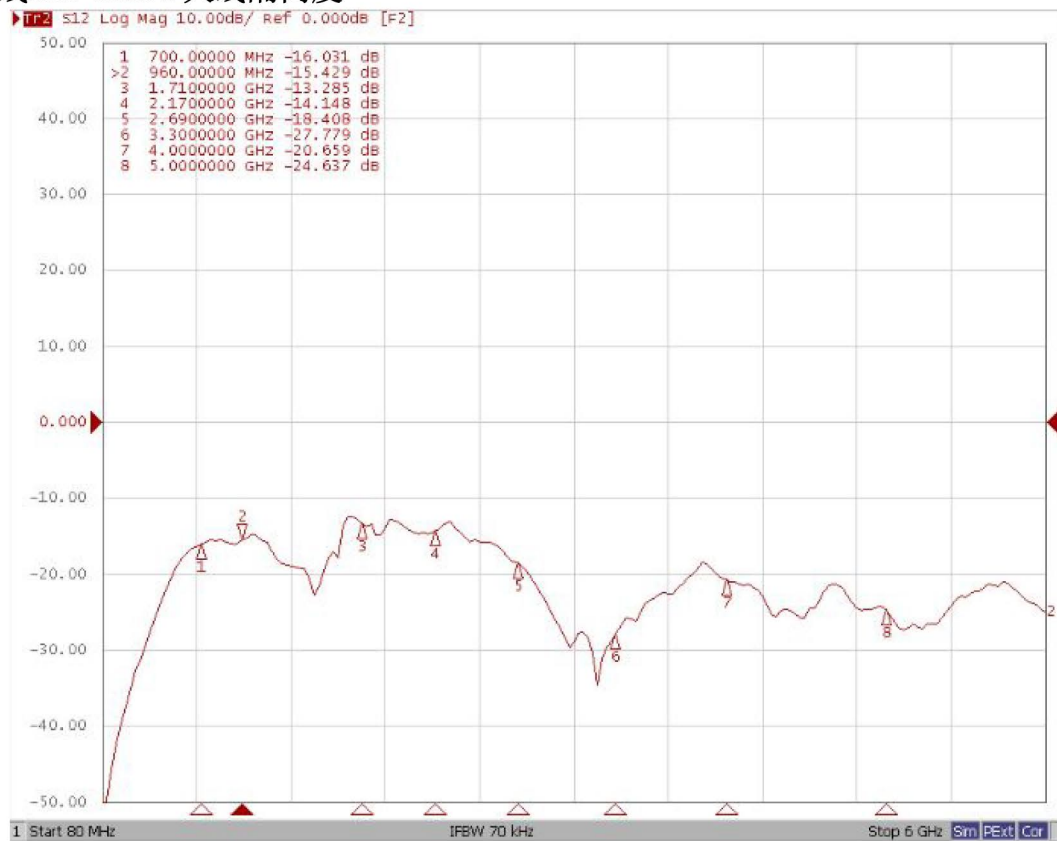


5G 主天线&V2X-1 天线隔离度

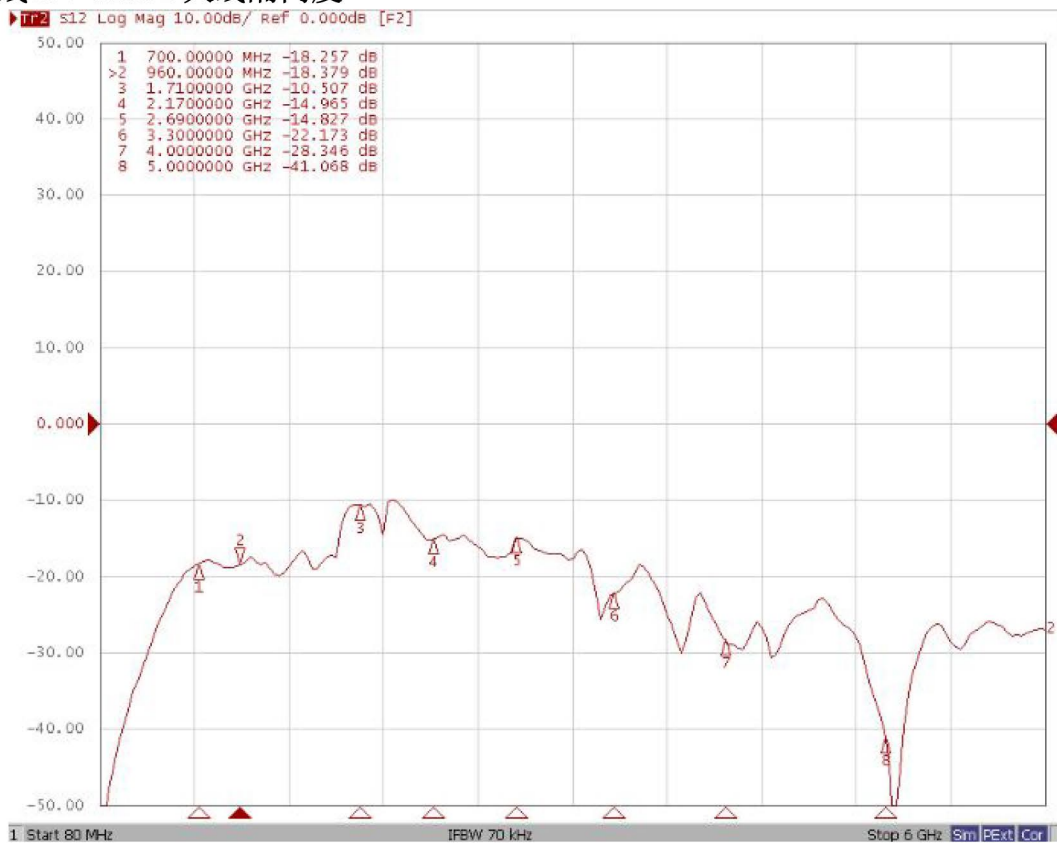
▶ F2 S12 Log Mag 10.00dB/ Ref 0.000dB [F2]



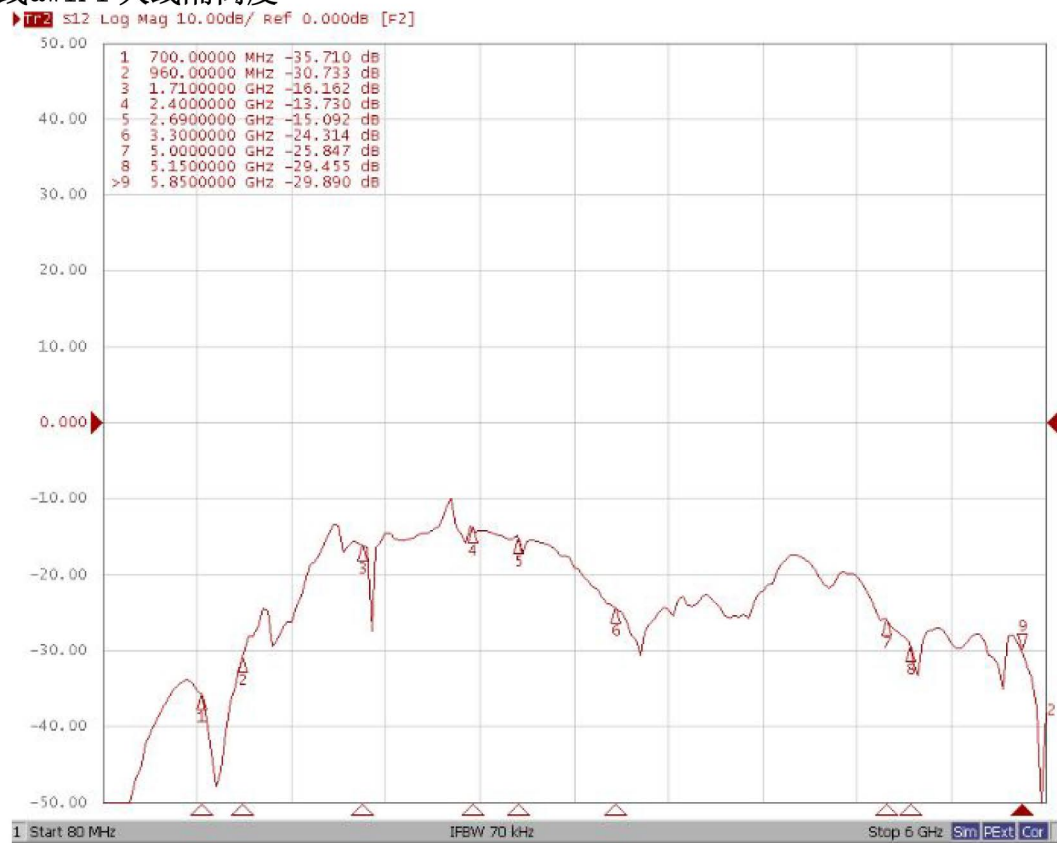
5G 分天线&5G-MIMO1 天线隔离度



5G 分天线&5G-MIMO2 天线隔离度



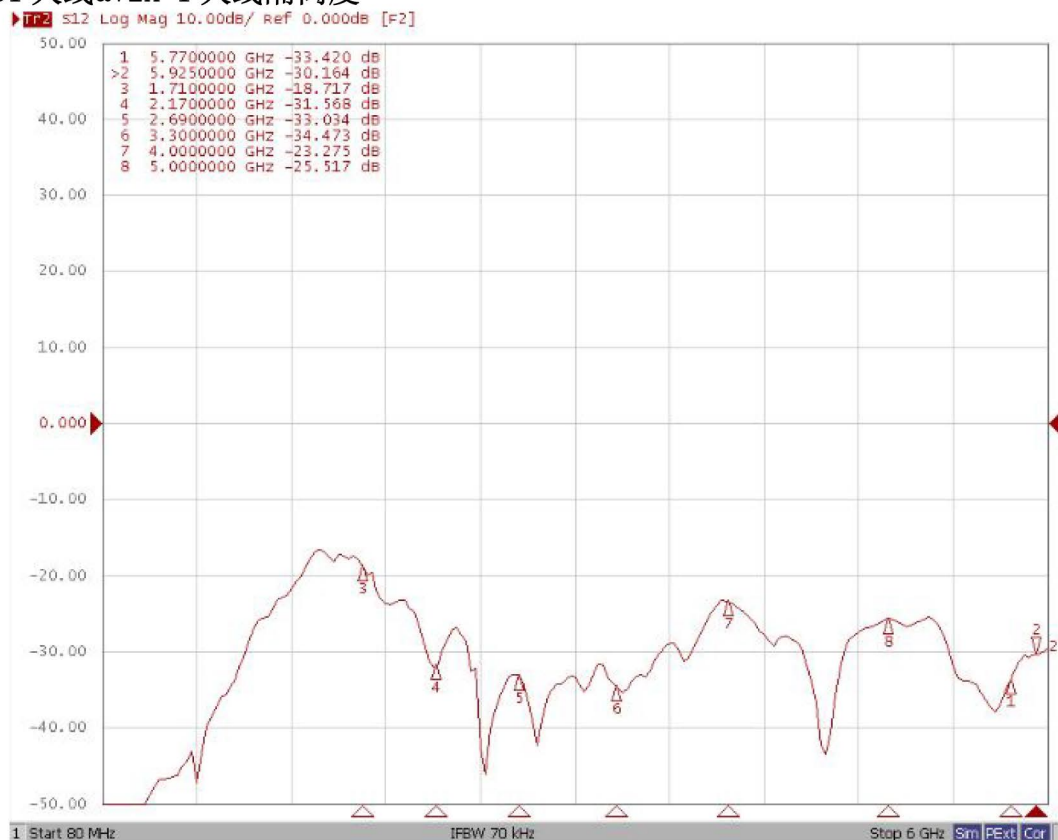
5G 分天线&WIFI 天线隔离度



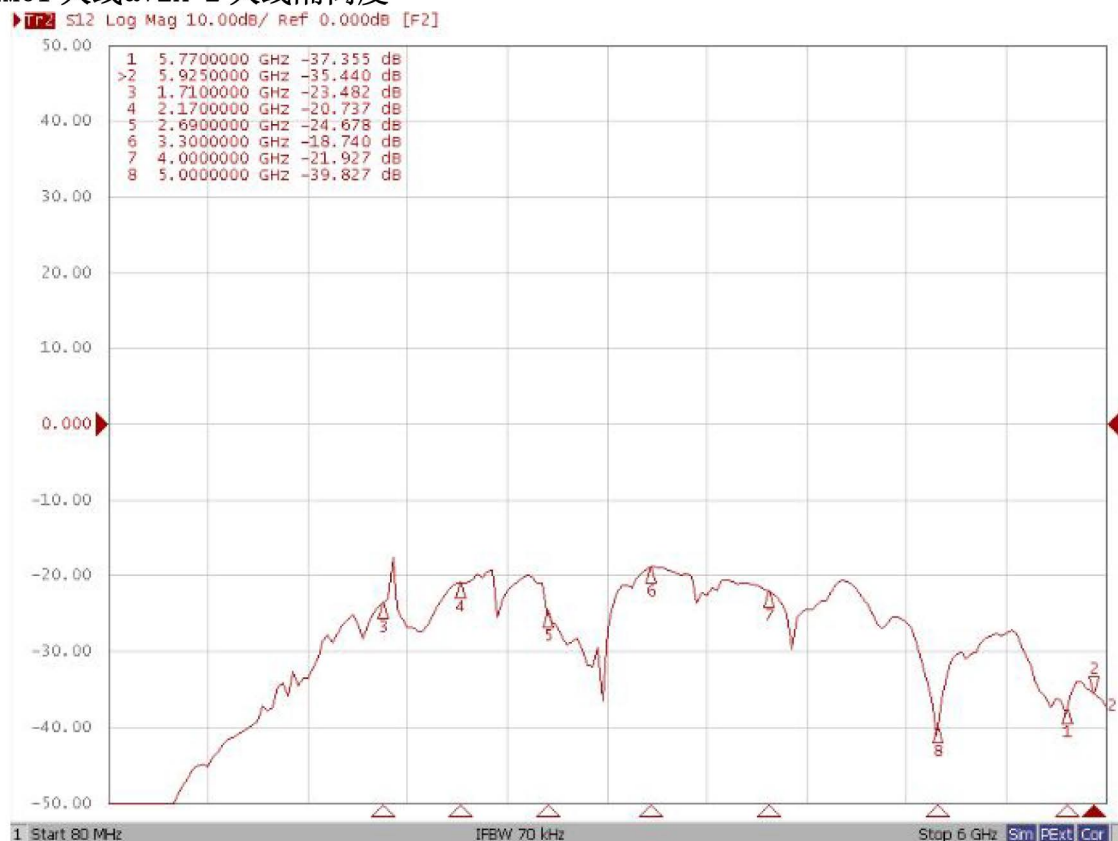
5G-MIM01 天线&5G-MIM02 天线隔离度



5G-MIM01 天线&V2X-1 天线隔离度

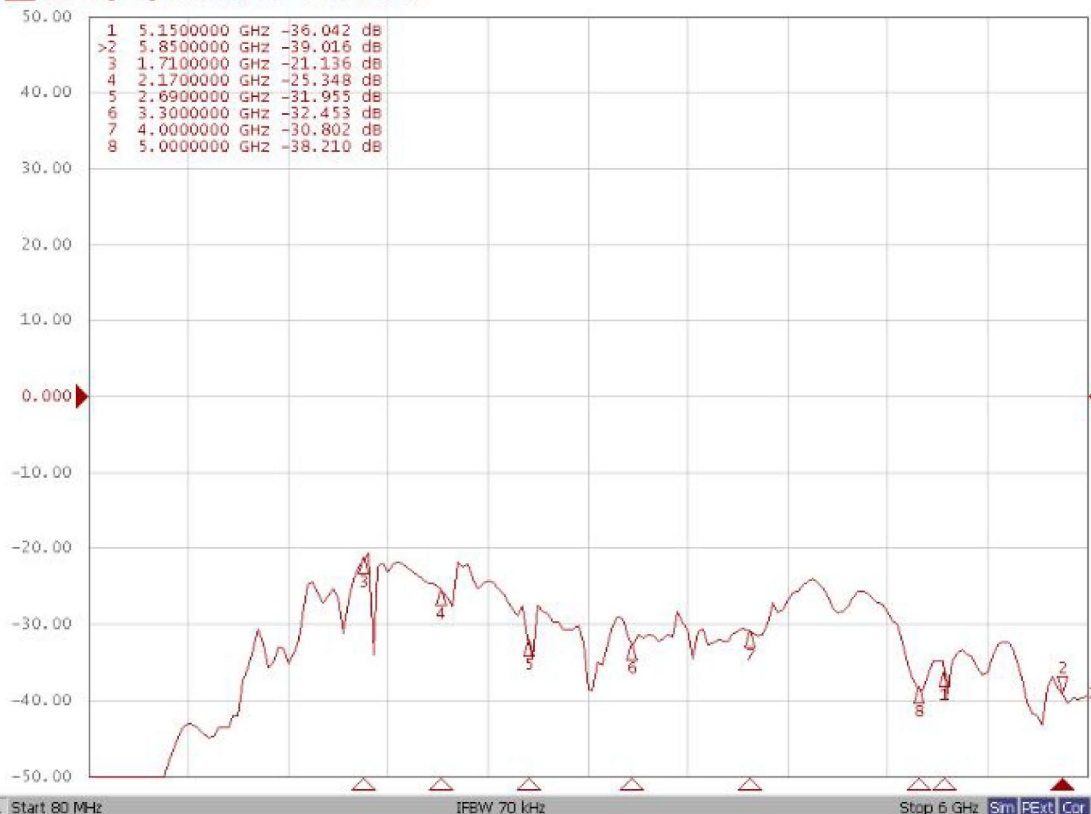


5G-MIM01 天线&V2X-2 天线隔离度



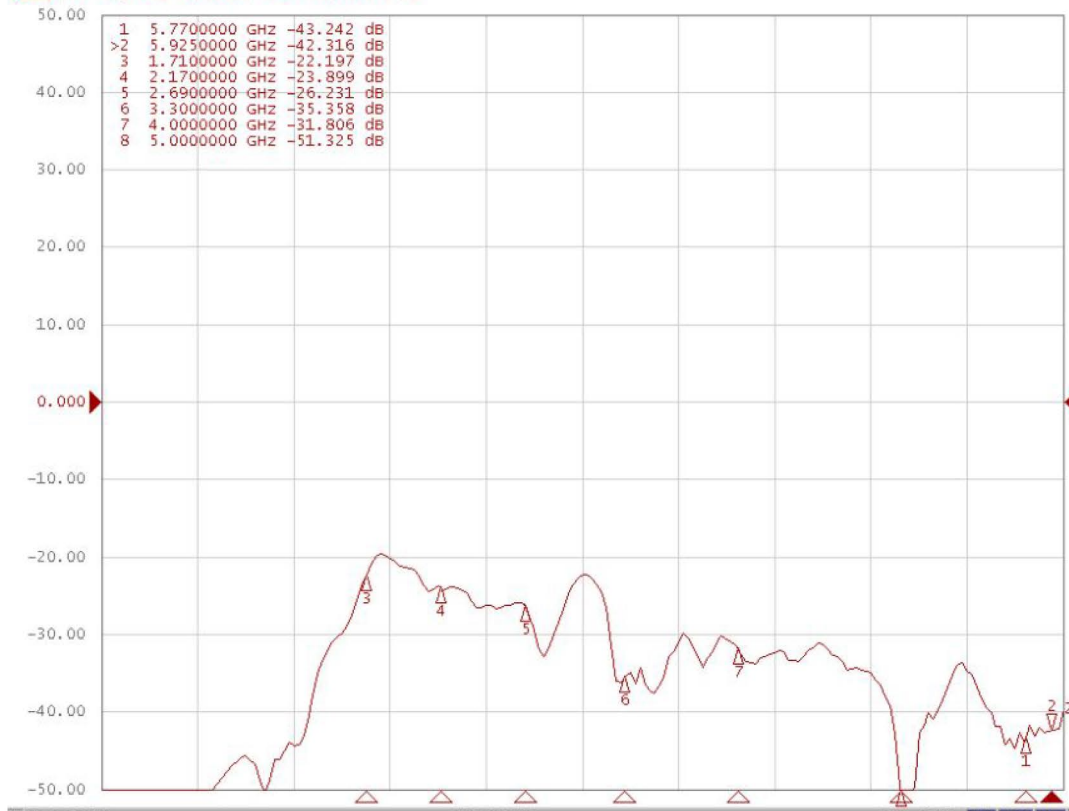
5G-MIMO1 天线&WIFI 天线隔离度

▶ F2 S12 Log Mag 10.00dB/ Ref 0.000dB [F2]



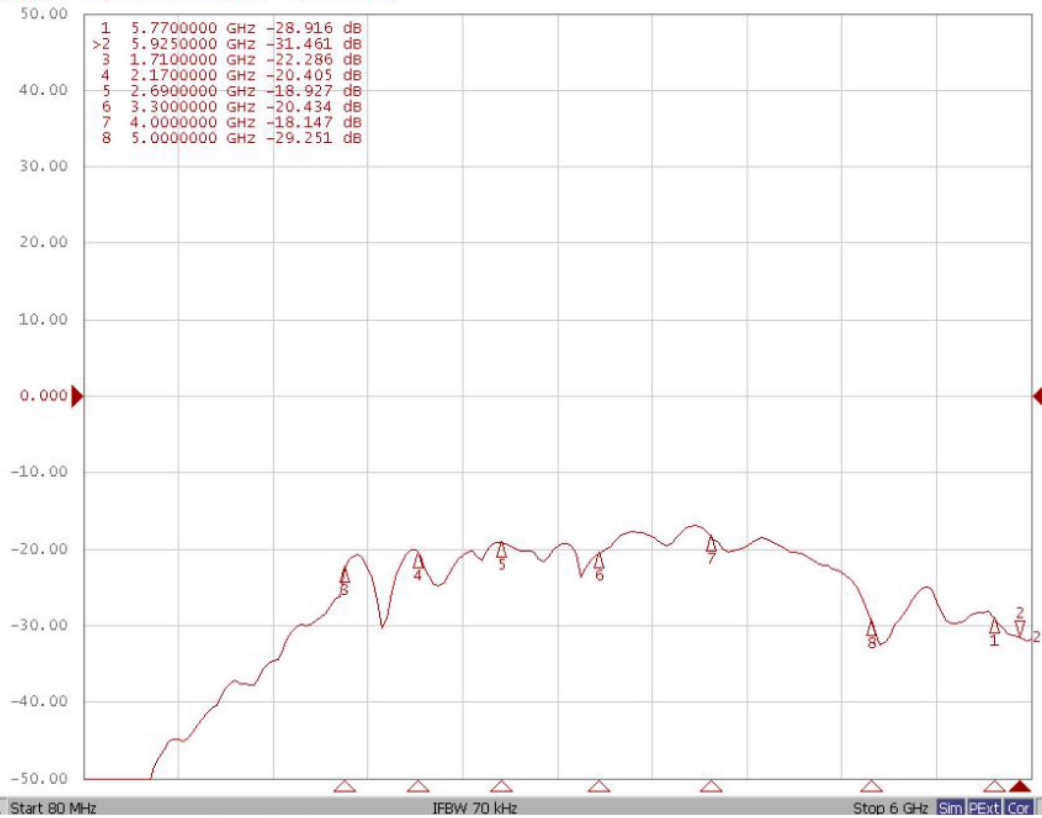
5G-MIMO2 天线&V2X-1 天线隔离度

▶ F2 S12 Log Mag 10.00dB/ Ref 0.000dB [F2]



5G-MIMO2 天线&V2X-2 天线隔离度

► F2 S12 Log Mag 10.00dB/ Ref 0.000dB [F2]



5G-MIMO2 天线&WIFI 天线隔离度

► F2 S12 Log Mag 10.00dB/ Ref 0.000dB [F2]

