

Antenna Test Report

BLE Antenna

Revision 1.2

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1 Report Summary

The Rocky Mountain ATV BLE antenna has antenna gain characteristics shown in Table 1.

Table 1: Antenna gain summary

Measurement	Gain (dBi)
Peak Gain (2402-2480 MHz)	+1.18
Average Gain (2402-2480 MHz)	-2.95

2 Antenna Description

The antenna manufacturer is Rocky Mountain ATV.

Address: Rocky Mountain ATV
1551 American Way
Payson, Utah 84651, United States

The embedded monopole antenna is a flexible circuit connected to the main PCB, adhered to a plastic riser.

Figure 1: BLE Antenna

Frequency range of interest is 2402 MHz to 2480 MHz.

3 Test Setup and Procedure

Testing was performed on 27FEB2025 at Antenna Test Lab (ATL) in Raleigh, NC, USA. The test data is available as 2025-02-27 Device-Solutions Bluetooth Antennas.zip

For passive gain measurements, a coaxial cable is attached to the PCB at the single ended antenna driving point.

Figure 2: Test setup

The test procedure follows the IEEE Std 149-2021, IEEE Recommended Practice for Antenna Measurements, more commonly called “Substitution Method Testing.” The substitution method uses a lab reference antenna with known characteristics to make a reference measurement. After normalizing the chamber measurement system, the antenna under test (AUT) is substituted for the reference antenna. Finally, the reference antenna’s known gain at all positioner angles is added to the result to obtain the AUT’s gain in dBi. The reference antenna measurement in the ATL chamber is available as 2025-04-03 Reference Horn Sweep for Device Solutions 2300-2550MHz.zip

4 Antenna Patterns

3D rotatable patterns and result tabulations are available in the accompanying data package.

2025-02-27 Device Solutions Bluetooth Antennas.zip

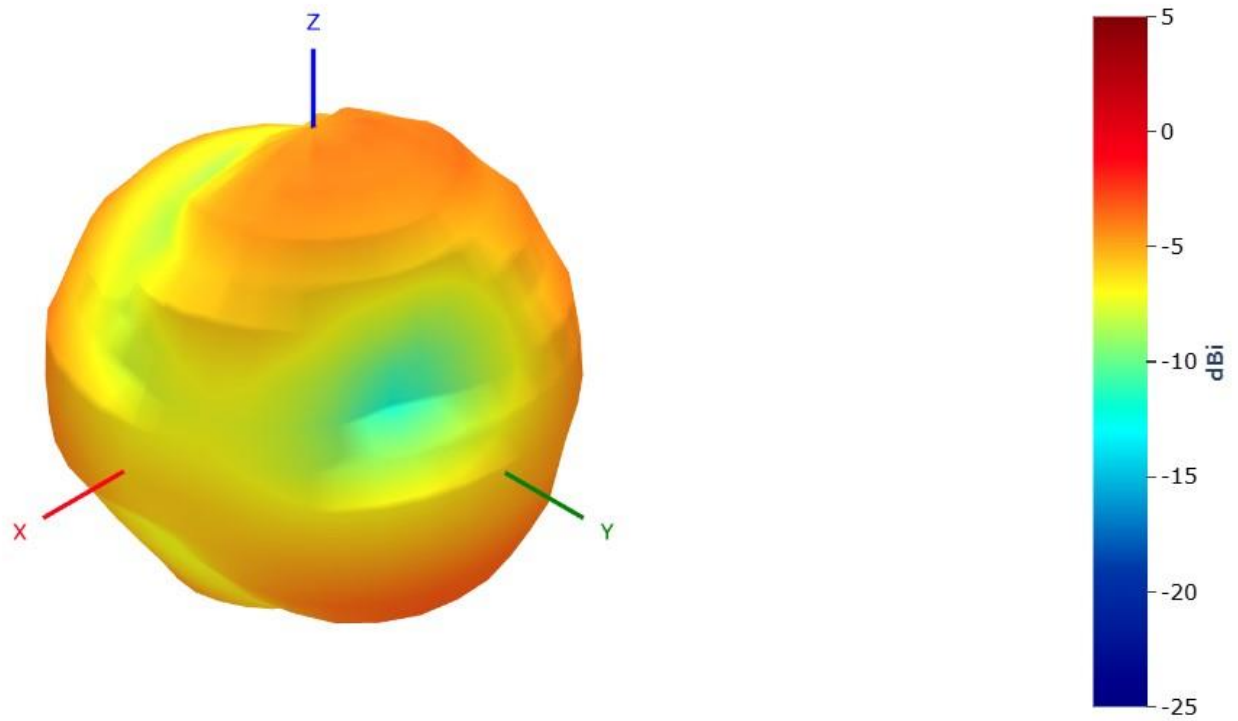
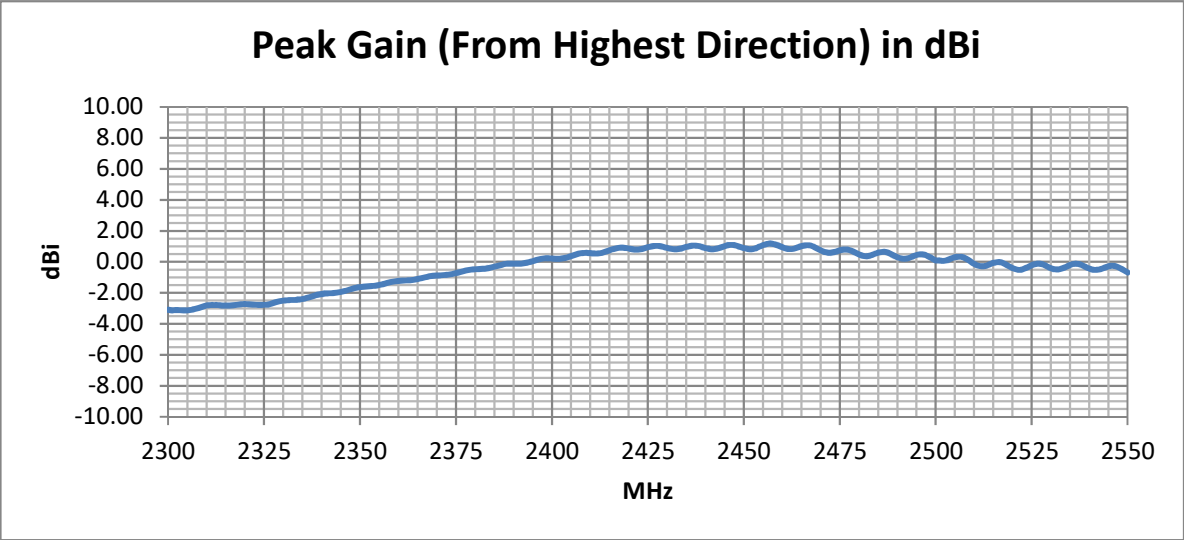
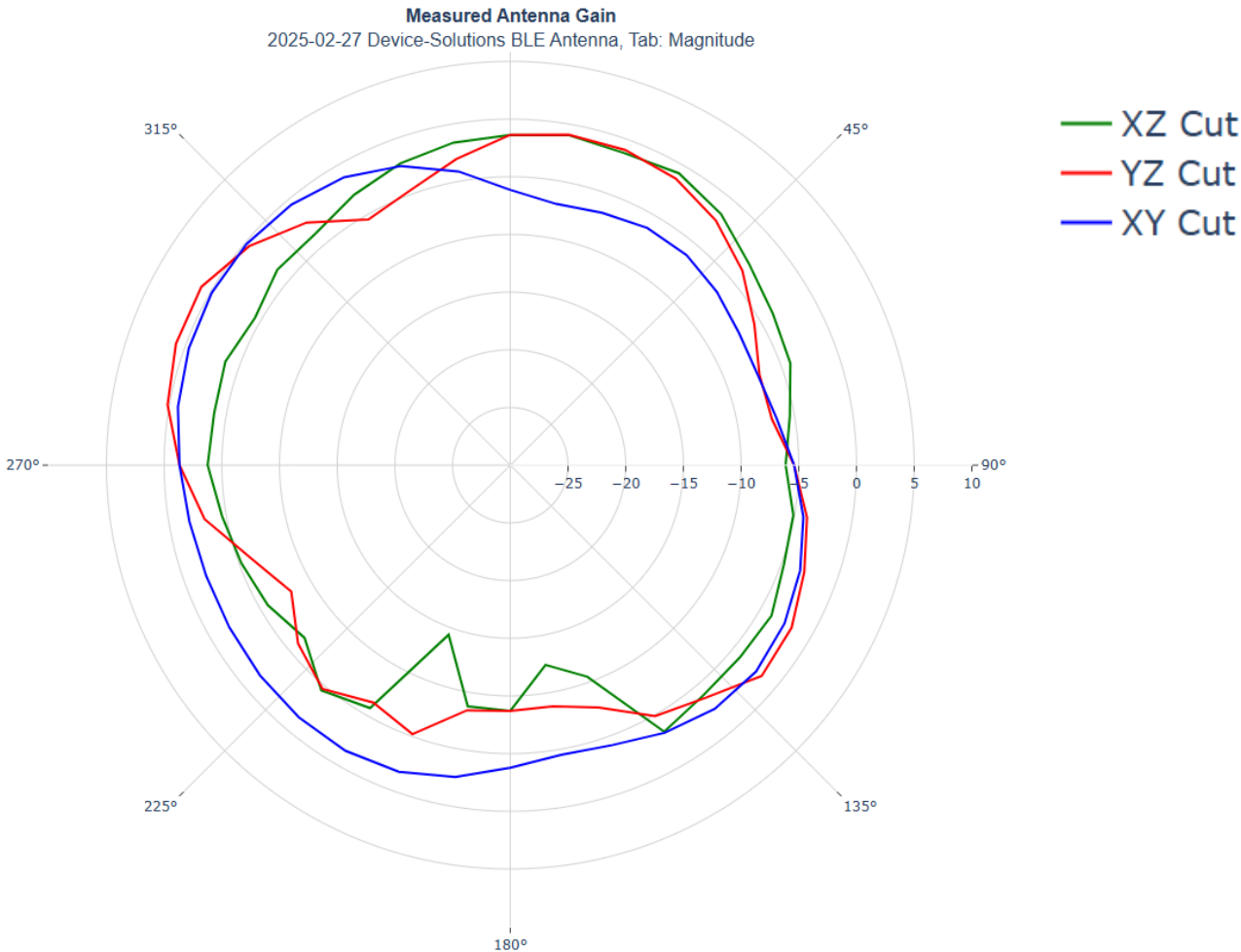
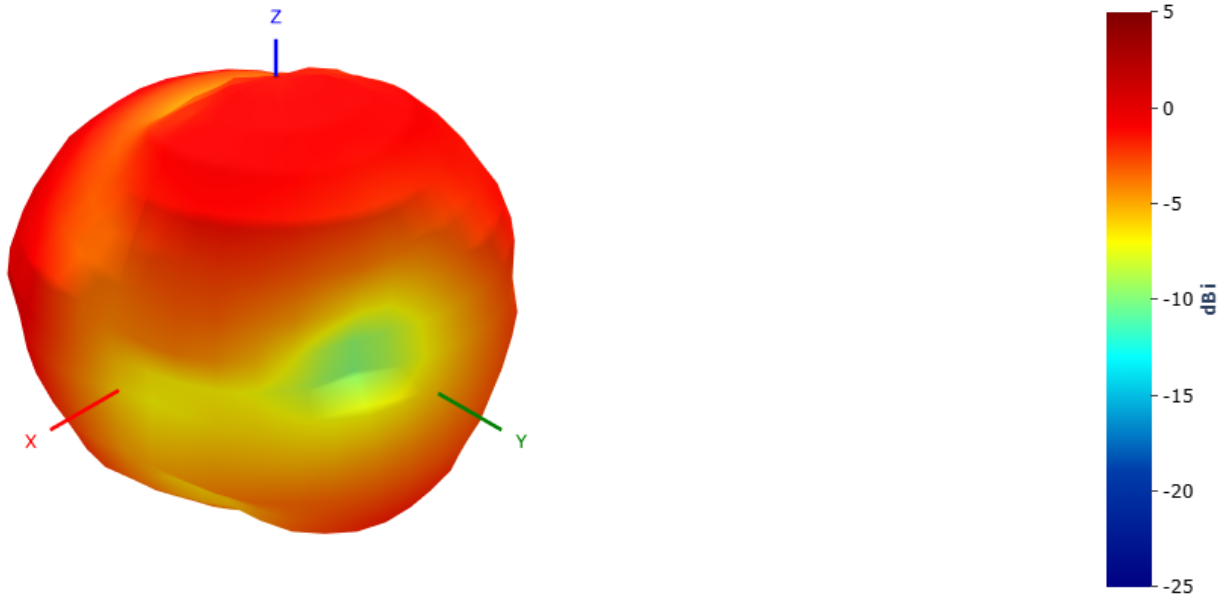


Figure 3: BLE Antenna pattern

Frequency (MHz)	Peak Gain (From Highest Direction) in dBi
2300	-3.09
2301	-3.13
2302	-3.11
2303	-3.12
2304	-3.13
2305	-3.13
2306	-3.10
2307	-3.04
2308	-2.97
2309	-2.89
2310	-2.82
2311	-2.79
2312	-2.79
2313	-2.79
2314	-2.82
2315	-2.83
2316	-2.82
2317	-2.80
2318	-2.77
2319	-2.74
2320	-2.72
2321	-2.74
2322	-2.76
2323	-2.77
2324	-2.78
2325	-2.77
2326	-2.76
2327	-2.69
2328	-2.61
2329	-2.55
2330	-2.50
2331	-2.48
2332	-2.46
2333	-2.46
2334	-2.43
2335	-2.40
2336	-2.34
2337	-2.27
2338	-2.19
2339	-2.12
2340	-2.08
2341	-2.04
2342	-2.03
2343	-2.02
2344	-1.99
2345	-1.95
2346	-1.89
2347	-1.81
2348	-1.74
2349	-1.67
2350	-1.63
2351	-1.60
2352	-1.58
2353	-1.56
2354	-1.54
2355	-1.49
2356	-1.44
2357	-1.37
2358	-1.31
2359	-1.26
2360	-1.23
2361	-1.21
2362	-1.20
2363	-1.19
2364	-1.16
2365	-1.11
2366	-1.05
2367	-1.00
2368	-0.94
2369	-0.90



Measured Antenna Gain
2025-02-27 Device-Solutions BLE Antenna, Tab: Magnitude

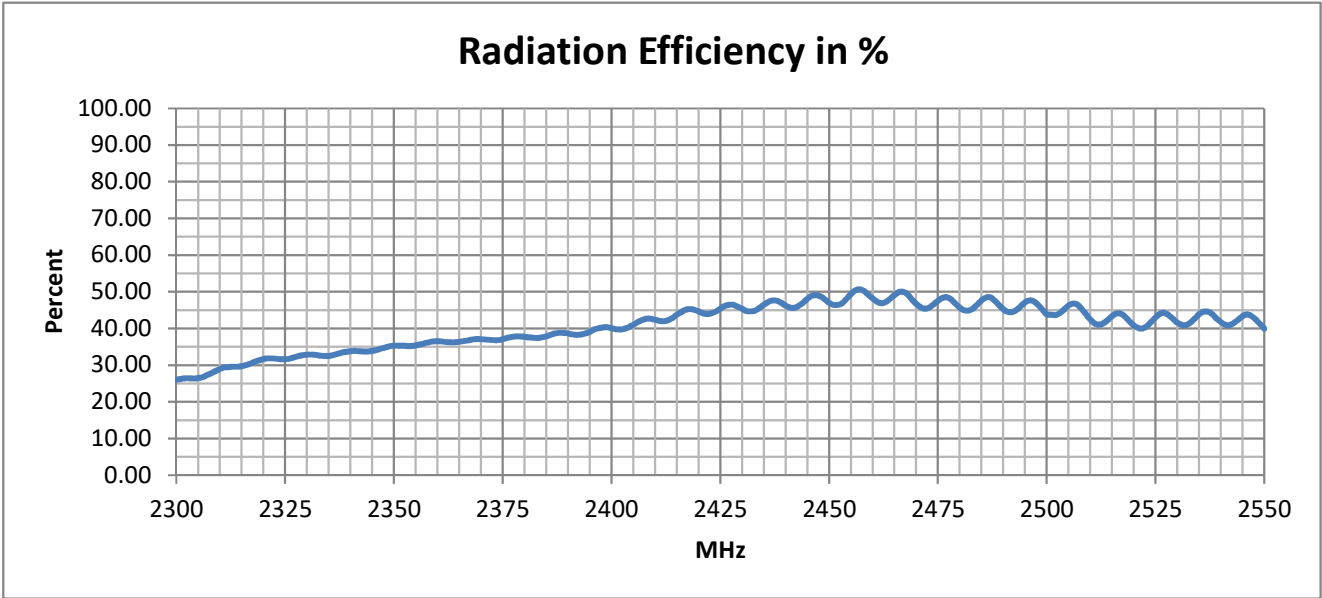
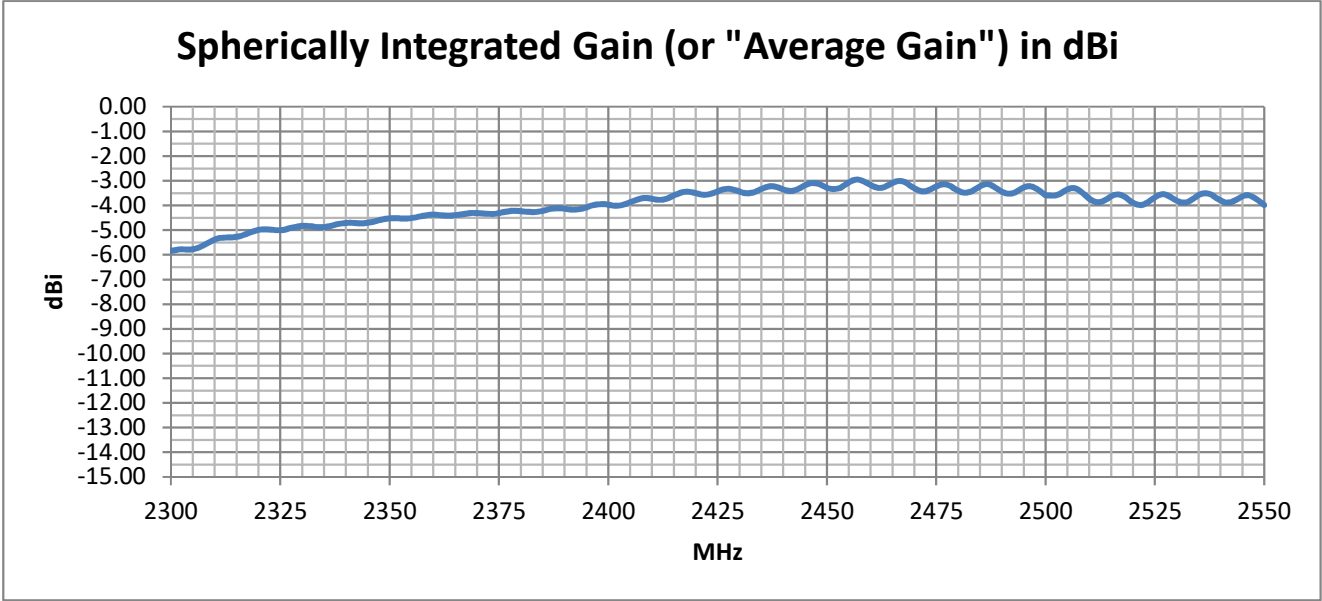


Frequency (MHz)	Peak Gain (From Highest Direction) in dBi
2370	-0.88
2371	-0.87
2372	-0.85
2373	-0.83
2374	-0.79
2375	-0.73
2376	-0.66
2377	-0.60
2378	-0.54
2379	-0.50
2380	-0.48
2381	-0.47
2382	-0.45
2383	-0.43
2384	-0.38
2385	-0.32
2386	-0.25
2387	-0.18
2388	-0.13
2389	-0.11
2390	-0.12
2391	-0.11
2392	-0.11
2393	-0.08
2394	-0.02
2395	0.04
2396	0.12
2397	0.18
2398	0.22
2399	0.24
2400	0.21
2401	0.20
2402	0.20
2403	0.23
2404	0.28
2405	0.37
2406	0.45
2407	0.53
2408	0.57
2409	0.58
2410	0.56
2411	0.54
2412	0.54
2413	0.58
2414	0.65
2415	0.74
2416	0.83
2417	0.89
2418	0.92
2419	0.90
2420	0.86
2421	0.81
2422	0.79
2423	0.81
2424	0.87
2425	0.94
2426	1.00
2427	1.03
2428	1.02
2429	0.97
2430	0.90
2431	0.84
2432	0.81
2433	0.83
2434	0.89
2435	0.96
2436	1.02
2437	1.05
2438	1.03
2439	0.97

Frequency (MHz)	Peak Gain (From Highest Direction) in dBi
2440	0.89
2441	0.83
2442	0.82
2443	0.85
2444	0.93
2445	1.01
2446	1.08
2447	1.09
2448	1.05
2449	0.97
2450	0.89
2451	0.83
2452	0.82
2453	0.86
2454	0.97
2455	1.08
2456	1.15
2457	1.18
2458	1.14
2459	1.05
2460	0.95
2461	0.86
2462	0.82
2463	0.84
2464	0.92
2465	1.01
2466	1.06
2467	1.07
2468	1.00
2469	0.87
2470	0.74
2471	0.64
2472	0.59
2473	0.60
2474	0.66
2475	0.74
2476	0.79
2477	0.79
2478	0.72
2479	0.60
2480	0.48
2481	0.39
2482	0.36
2483	0.41
2484	0.50
2485	0.59
2486	0.64
2487	0.64
2488	0.54
2489	0.42
2490	0.30
2491	0.22
2492	0.20
2493	0.25
2494	0.35
2495	0.44
2496	0.48
2497	0.46
2498	0.36
2499	0.23
2500	0.09
2501	0.09
2502	0.06
2503	0.11
2504	0.21
2505	0.30
2506	0.33
2507	0.31
2508	0.19
2509	0.04

Frequency (MHz)	Peak Gain (From Highest Direction) in dBi
2510	-0.13
2511	-0.24
2512	-0.28
2513	-0.26
2514	-0.17
2515	-0.07
2516	-0.02
2517	-0.03
2518	-0.13
2519	-0.27
2520	-0.40
2521	-0.49
2522	-0.52
2523	-0.45
2524	-0.34
2525	-0.22
2526	-0.14
2527	-0.12
2528	-0.17
2529	-0.29
2530	-0.41
2531	-0.48
2532	-0.49
2533	-0.42
2534	-0.32
2535	-0.20
2536	-0.13
2537	-0.13
2538	-0.20
2539	-0.32
2540	-0.43
2541	-0.51
2542	-0.51
2543	-0.47
2544	-0.38
2545	-0.29
2546	-0.25
2547	-0.30
2548	-0.40
2549	-0.54
2550	-0.69

Frequency (MHz)	Integrated Spherical Total Isotropic Gain (dBi)	Estimated Radiation Efficiency (%)
2300	-5.84	26.06
2301	-5.81	26.24
2302	-5.78	26.42
2303	-5.78	26.42
2304	-5.79	26.36
2305	-5.77	26.49
2306	-5.73	26.73
2307	-5.65	27.23
2308	-5.56	27.80
2309	-5.47	28.38
2310	-5.38	28.97
2311	-5.32	29.38
2312	-5.31	29.44
2313	-5.29	29.58
2314	-5.29	29.58
2315	-5.27	29.72
2316	-5.23	29.99
2317	-5.17	30.41
2318	-5.10	30.90
2319	-5.04	31.33
2320	-4.99	31.70
2321	-4.97	31.84
2322	-4.97	31.84
2323	-4.98	31.77
2324	-5.00	31.62
2325	-5.00	31.62
2326	-4.98	31.77
2327	-4.93	32.14
2328	-4.89	32.43
2329	-4.85	32.73
2330	-4.83	32.89
2331	-4.83	32.89
2332	-4.84	32.81
2333	-4.87	32.58
2334	-4.88	32.51
2335	-4.88	32.51
2336	-4.85	32.73
2337	-4.81	33.04
2338	-4.76	33.42
2339	-4.73	33.65
2340	-4.71	33.81
2341	-4.70	33.88
2342	-4.71	33.81
2343	-4.72	33.73
2344	-4.72	33.73
2345	-4.70	33.88
2346	-4.67	34.12
2347	-4.62	34.51
2348	-4.58	34.83
2349	-4.54	35.16
2350	-4.52	35.32
2351	-4.52	35.32
2352	-4.52	35.32
2353	-4.53	35.24
2354	-4.53	35.24
2355	-4.51	35.40
2356	-4.48	35.65
2357	-4.44	35.97
2358	-4.41	36.22
2359	-4.38	36.48
2360	-4.37	36.56
2361	-4.38	36.48
2362	-4.40	36.31
2363	-4.41	36.22
2364	-4.41	36.22
2365	-4.39	36.39
2366	-4.37	36.56
2367	-4.35	36.73
2368	-4.32	36.98
2369	-4.30	37.15



Frequency (MHz)	Integrated Spherical Total Isotropic Gain (dBi)	Estimated Radiation Efficiency (%)
2370	-4.31	37.07
2371	-4.32	36.98
2372	-4.33	36.90
2373	-4.34	36.81
2374	-4.34	36.81
2375	-4.31	37.07
2376	-4.27	37.41
2377	-4.24	37.67
2378	-4.22	37.84
2379	-4.22	37.84
2380	-4.23	37.76
2381	-4.25	37.58
2382	-4.26	37.50
2383	-4.27	37.41
2384	-4.25	37.58
2385	-4.22	37.84
2386	-4.17	38.28
2387	-4.13	38.64
2388	-4.11	38.82
2389	-4.11	38.82
2390	-4.13	38.64
2391	-4.16	38.37
2392	-4.17	38.28
2393	-4.16	38.37
2394	-4.13	38.64
2395	-4.08	39.08
2396	-4.01	39.72
2397	-3.97	40.09
2398	-3.95	40.27
2399	-3.94	40.36
2400	-3.97	40.09
2401	-4.00	39.81
2402	-4.01	39.72
2403	-3.99	39.90
2404	-3.94	40.36
2405	-3.87	41.02
2406	-3.80	41.69
2407	-3.74	42.27
2408	-3.70	42.66
2409	-3.70	42.66
2410	-3.73	42.36
2411	-3.76	42.07
2412	-3.77	41.98
2413	-3.74	42.27
2414	-3.68	42.85
2415	-3.59	43.75
2416	-3.52	44.46
2417	-3.46	45.08
2418	-3.44	45.29
2419	-3.46	45.08
2420	-3.50	44.67
2421	-3.55	44.16
2422	-3.57	43.95
2423	-3.55	44.16
2424	-3.50	44.67
2425	-3.43	45.39
2426	-3.36	46.13
2427	-3.33	46.45
2428	-3.33	46.45
2429	-3.38	45.92
2430	-3.43	45.39
2431	-3.49	44.77
2432	-3.50	44.67
2433	-3.48	44.87
2434	-3.41	45.60
2435	-3.33	46.45
2436	-3.26	47.21
2437	-3.22	47.64
2438	-3.23	47.53
2439	-3.28	46.99

Frequency (MHz)	Integrated Spherical Total Isotropic Gain (dBi)	Estimated Radiation Efficiency (%)
2440	-3.35	46.24
2441	-3.40	45.71
2442	-3.41	45.60
2443	-3.36	46.13
2444	-3.28	46.99
2445	-3.18	48.08
2446	-3.11	48.87
2447	-3.09	49.09
2448	-3.12	48.75
2449	-3.19	47.97
2450	-3.28	46.99
2451	-3.33	46.45
2452	-3.33	46.45
2453	-3.29	46.88
2454	-3.18	48.08
2455	-3.07	49.32
2456	-2.98	50.35
2457	-2.95	50.70
2458	-2.99	50.23
2459	-3.08	49.20
2460	-3.17	48.19
2461	-3.25	47.32
2462	-3.29	46.88
2463	-3.26	47.21
2464	-3.18	48.08
2465	-3.09	49.09
2466	-3.02	49.89
2467	-3.01	50.00
2468	-3.07	49.32
2469	-3.19	47.97
2470	-3.30	46.77
2471	-3.39	45.81
2472	-3.43	45.39
2473	-3.40	45.71
2474	-3.32	46.56
2475	-3.23	47.53
2476	-3.16	48.31
2477	-3.14	48.53
2478	-3.19	47.97
2479	-3.30	46.77
2480	-3.40	45.71
2481	-3.47	44.98
2482	-3.48	44.87
2483	-3.43	45.39
2484	-3.33	46.45
2485	-3.22	47.64
2486	-3.15	48.42
2487	-3.14	48.53
2488	-3.22	47.64
2489	-3.33	46.45
2490	-3.44	45.29
2491	-3.51	44.57
2492	-3.52	44.46
2493	-3.47	44.98
2494	-3.37	46.03
2495	-3.27	47.10
2496	-3.22	47.64
2497	-3.24	47.42
2498	-3.33	46.45
2499	-3.45	45.19
2500	-3.58	43.85
2501	-3.59	43.75
2502	-3.60	43.65
2503	-3.55	44.16
2504	-3.45	45.19
2505	-3.35	46.24
2506	-3.30	46.77
2507	-3.32	46.56
2508	-3.43	45.39
2509	-3.57	43.95

Frequency (MHz)	Integrated Spherical Total Isotropic Gain (dBi)	Estimated Radiation Efficiency (%)
2510	-3.72	42.46
2511	-3.83	41.40
2512	-3.87	41.02
2513	-3.83	41.40
2514	-3.74	42.27
2515	-3.63	43.35
2516	-3.56	44.06
2517	-3.56	44.06
2518	-3.64	43.25
2519	-3.77	41.98
2520	-3.89	40.83
2521	-3.96	40.18
2522	-3.98	39.99
2523	-3.91	40.64
2524	-3.79	41.78
2525	-3.67	42.95
2526	-3.57	43.95
2527	-3.54	44.26
2528	-3.60	43.65
2529	-3.70	42.66
2530	-3.81	41.59
2531	-3.87	41.02
2532	-3.88	40.93
2533	-3.81	41.59
2534	-3.70	42.66
2535	-3.58	43.85
2536	-3.51	44.57
2537	-3.51	44.57
2538	-3.57	43.95
2539	-3.69	42.76
2540	-3.79	41.78
2541	-3.87	41.02
2542	-3.88	40.93
2543	-3.82	41.50
2544	-3.73	42.36
2545	-3.63	43.35
2546	-3.58	43.85
2547	-3.62	43.45
2548	-3.72	42.46
2549	-3.84	41.30
2550	-3.98	39.99