



ANTENNA TEST REPORT

for

STANLEY BLACK & DECKER, INC.

FCC ID: YJ7DCR025B

IC ID: 9082A-DCR025B

WLL REPORT# 18459-01 REV 0

Prepared for:

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701 E. Joppa Road - TW116

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Testing Certificate AT-1448



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WLL Report# 18459-01 Rev 0

January 17, 2024

Prepared by:

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Ryan Mascaro
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Steven D. Koster
President



Abstract

This report has been prepared on behalf of Stanley Black & Decker, Inc. to document the testing results of the Bluetooth Antenna that is contained within the applicant’s device, currently seeking authorization under FCC ID: YJ7-DCR025B. The information provided within this report is only applicable to the device herein documented as the EUT.

Testing was performed in the Free-space Anechoic Chamber Test-site (FACT) 3m chamber of Washington Laboratories, Ltd., located at: 4840 Winchester Boulevard, Suite #5., Frederick, MD 21703.

Revision History	Description of Change	Date
Rev 0	Initial Release	January 17, 2024



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1 Introduction

1.1 Test Scope

Testing was to determine the isotropic gain of the PCB BT antenna.

1.2 Contract Information

Customer:	Stanley Black & Decker, Inc.
Purchase Order Number:	V605123
Quotation Number:	74382

1.3 Test and Support Personnel

Washington Laboratories, LTD	Ronald Wilson and Samuel Violette
Customer Representative	Cedric Valiente

1.4 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Frederick, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by ANAB under Testing Certificate AT-1448 as an independent FCC test laboratory (ISED Canada Number 3035A).



2 Equipment Under Test

2.1 EUT Identification & Description

The results obtained relate only to the item(s) tested.

Table 1: Antenna Summary

EUT Name, Model(s) Tested:	DCR025B - ANT
Manufacturer:	Phihong Technology Co., LTD
Antenna Type:	Meander Line, PCB Trace
Antenna Gain:	+ 1.54 dBi
Testing Date(s):	11/17/2023

The Stanley Black & Decker, Inc. FCC ID: YJ7-DCR025B employs a PCB trace Bluetooth antenna with +1.54 dBi of gain.

The final test data is provided below.



Figure 1: Antenna Design, Diagram

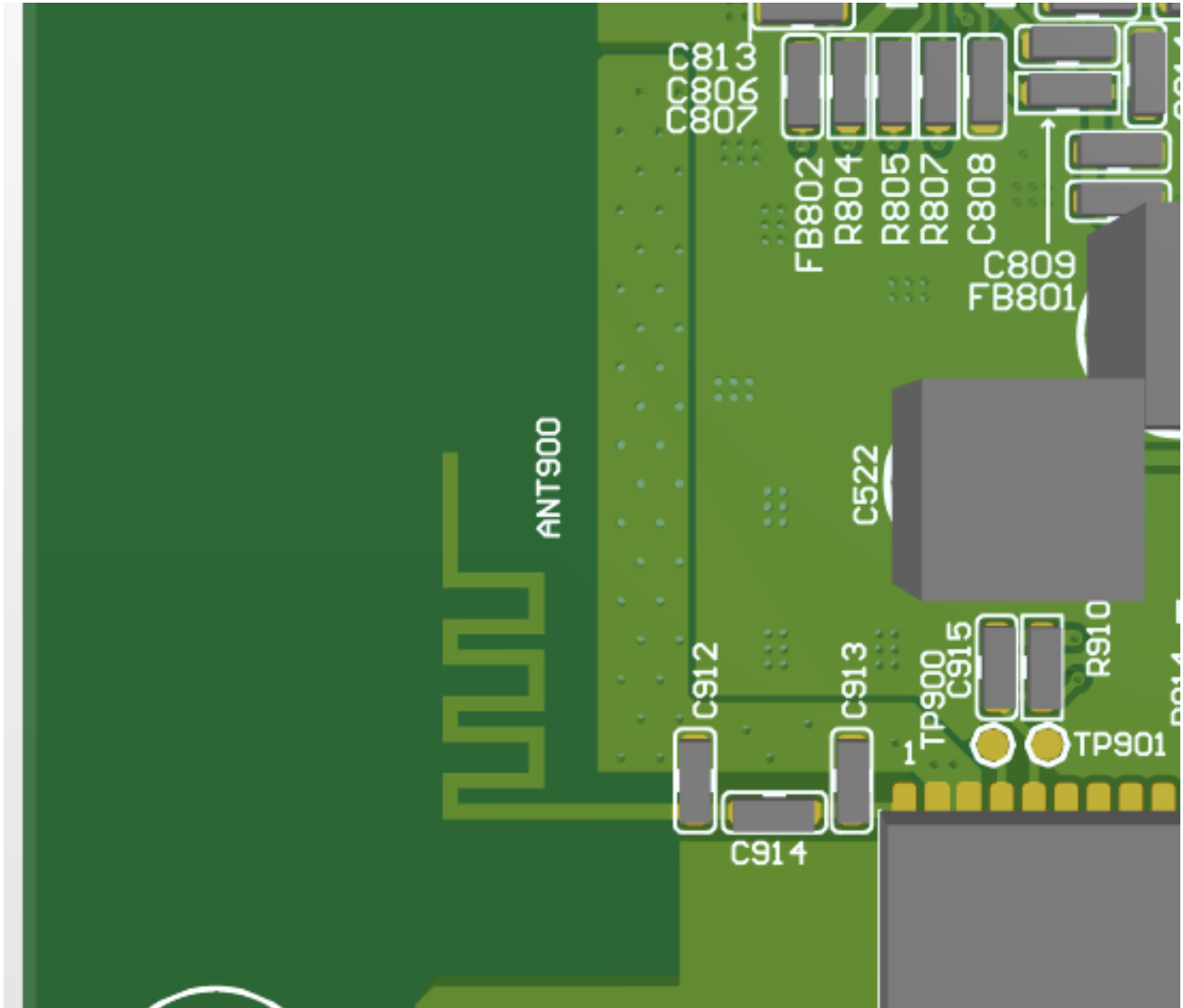




Figure 2: Antenna Design, Dimensions

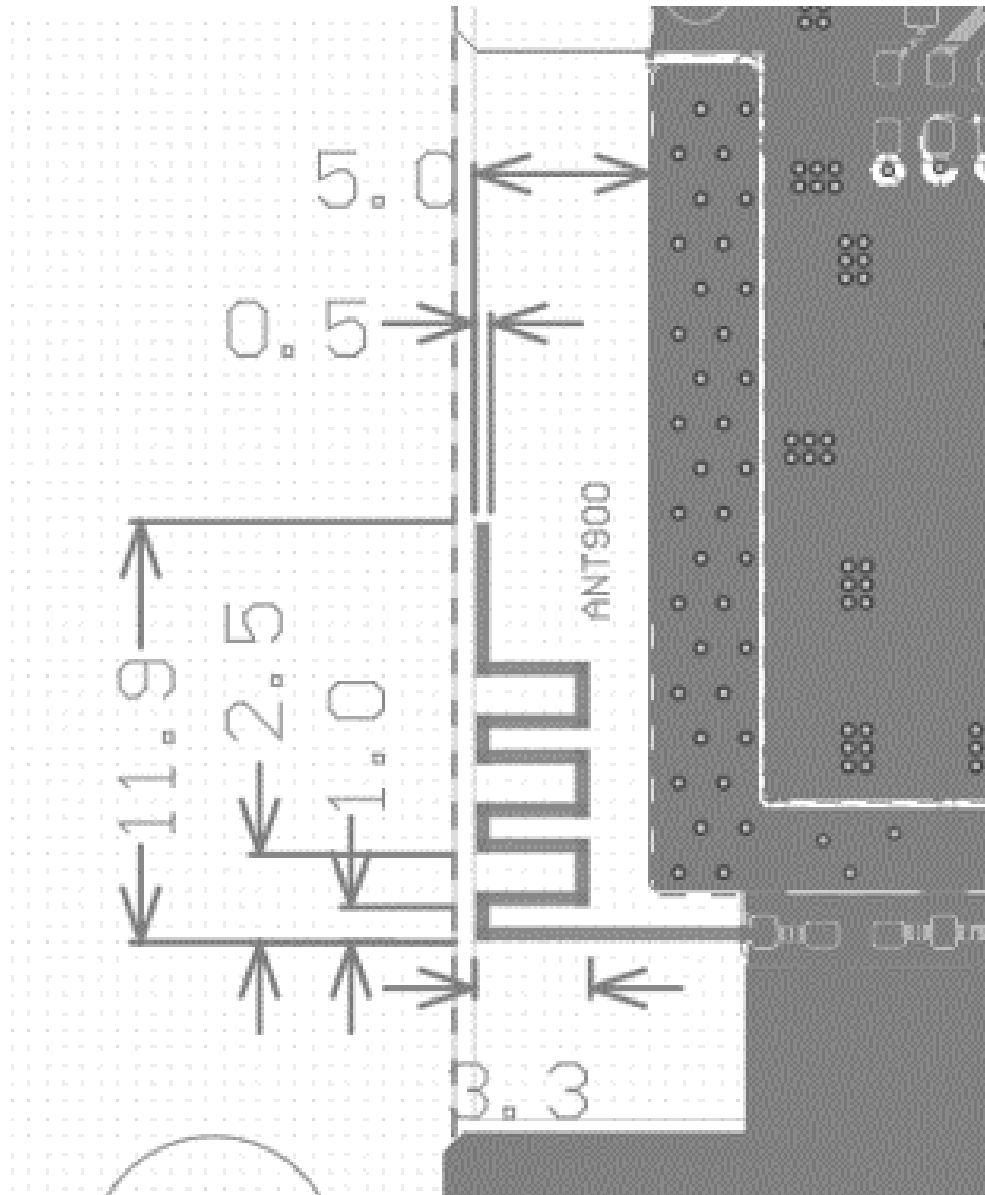




Figure 3: Antenna and PCB Photograph, As Tested (View #1)

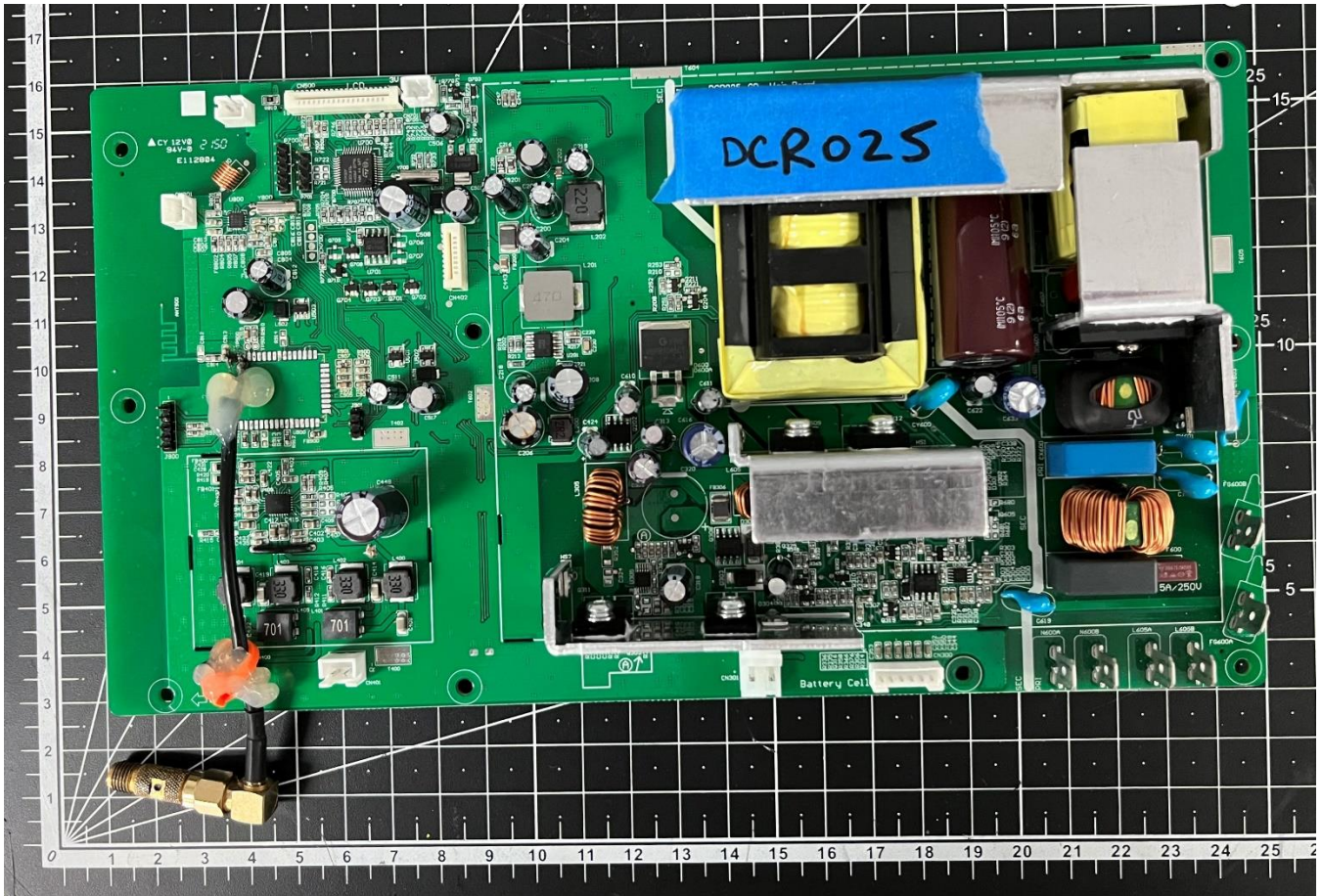
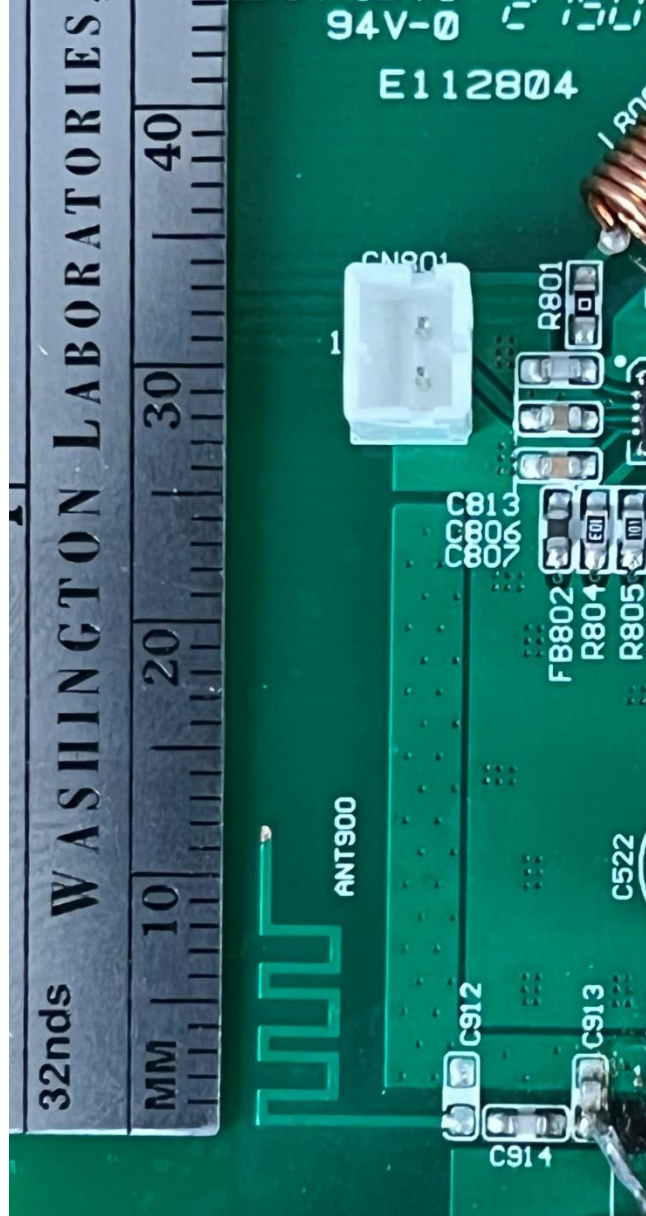




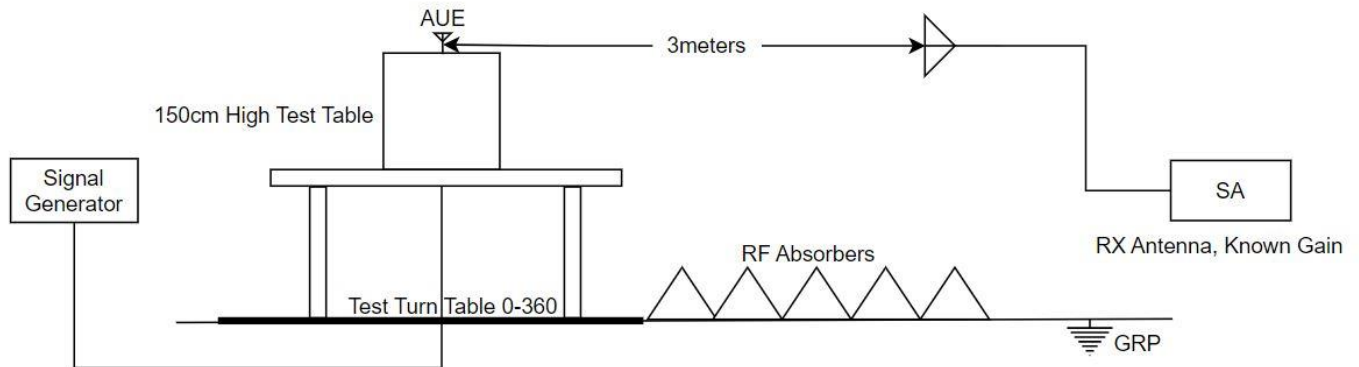
Figure 5: Antenna and PCB Photograph, As Tested (View #3)





2.2 Test Configuration

Figure 6: EUT Test Configuration



2.2.1 Test Equipment Used

Table 2: Test Equipment List and Calibration Due Dates

Test Name: Antenna Gain Testing		Test Date: 11/17/2023	
Asset #	Manufacturer/Model	Description	Cal. Due
00425	ARA, DRG-118/A	ANTENNA DRG 1-18GHZ	11/7/2024
00605	AGILENT, N1911A	POWER METER	6/21/2025
00934	HP/AGILENT, 8648D	SIGNAL GENERATOR	5/12/2024
00942	AGILENT, MXA-N9020A	SPECTRUM ANALYZER	12/19/2024
00977	JUNKOSHA MWX322-06000	ARMORED COAXIAL CABLE	12/28/2023
00806	MINI-CIRCUITS CBL	6FT SMA -SMA	12/28/2023
00834	ULTIFLEX UFA 2108	SMA COAXIAL CABLE, 90CM	12/28/2023



3 Test Results

3.1 Antenna Pattern

3.1.1 Test Procedure Summary

Antenna gain testing was performed on the DCR025B Bluetooth meander-trace antenna. The test frequency was chosen in the center of the 2.4GHz unlicensed ISM band. An unmodulated CW at 2450.0 MHz was applied to the SMA cable, coupled to the transmit path of the PCB trace, right before the Antenna Under Test (AUT). All cable losses (RX & TX) were measured at the test frequency prior to the evaluation. A pre-verification was also performed, utilizing two known gain antennas, prior to the scans. The AUT was setup and verified to be transmitting, and a worst-case orientation scan was performed. The measurement receiver was placed in max hold, and the turn table was set to a 12% RPM. The three orthogonal planes of the AUT were evaluated in regards to both polarities of the receive antenna for the pre-liminary evaluation.

3.1.2 Radiated Data Reduction and Reporting

The following calculation was used to determine the gain of the AUT:

$$G_{TX} = ((P_{RX} + G_{RX} + L_{RX}) - FSPL) + L_{TX}$$

where,

G_{TX} = the final Peak gain of the AUT in dBi

P_{RX} = measured by the spectrum analyzer on the receive side in dBm

G_{RX} = the known gain of the receive antenna in dBi

L_{RX} = cable loss on the receive side in dB

$FSPL$ = calculated based on frequency (note: assumes two antennas with 0 dBi of gain)

L_{TX} = cable loss on the AUT side in dB (SMA, drive cable)



Table 3: Worst Case Orientation(s) Test Data

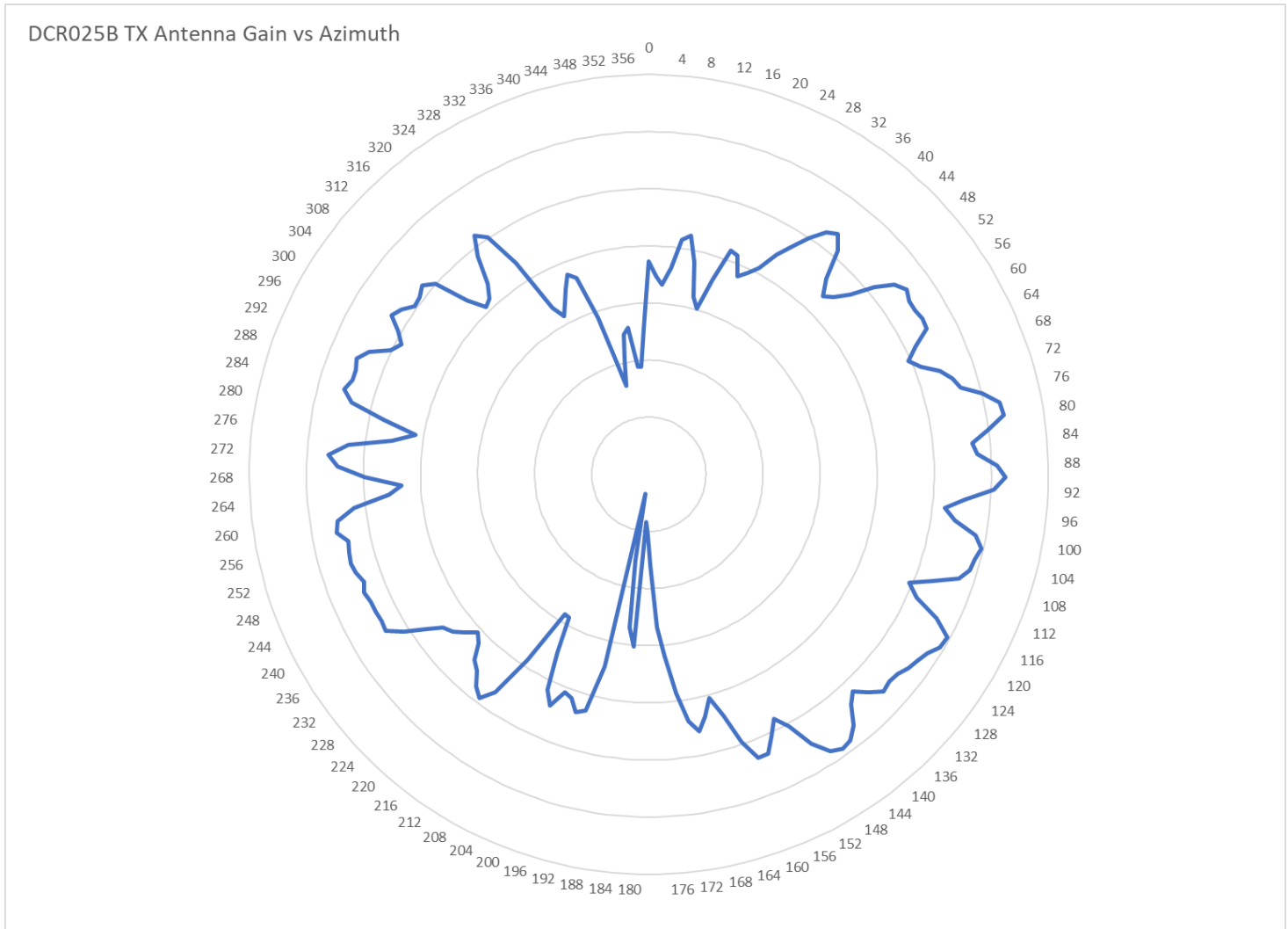
RX Antenna Polarity	EUT Axis	SA Level P _{RX} (dBm)	P _{TX} (dBm)	G _{RX} (dB)	L _{TX} (dB)	FSPL (dB)	L _{RX} (dB)	Final G _{TX} (dBi)	Turn Table (Degrees)	SA Trace	Turn Table RPM (%)
V	X	-51.43	0	9.50	-4.03	-49.76	3.73	-3.41	0-360	Max Hold	12
V	Y	-46.48	0	9.50	-4.03	-49.76	3.73	1.54	0-360	Max Hold	12
V	Z	-50.39	0	9.50	-4.03	-49.76	3.73	-2.38	0-360	Max Hold	12
H	X	-47.16	0	9.50	-4.03	-49.76	3.73	0.86	0-360	Max Hold	12
H	Y	-51.68	0	9.50	-4.03	-49.76	3.73	-3.66	0-360	Max Hold	12
H	Z	-53.31	0	9.50	-4.03	-49.76	3.73	-5.29	0-360	Max Hold	12

* the highest EUT gain was recorded as +1.54 dBi. The orientation that produced this gain shall be employed for the final antenna patten plot, which is provided in Figure 7. The following settings were employed:

- RX Antenna = Vertical
- EUT Axis = Y
- SA, RBW = 100 kHz
- SA, VBW = 300 kHz
- Detector = Peak



Figure 7: DCR025B, Final Antenna Pattern vs Azimuth (Worst-Case Data)



* Measured in two-degree increments, see following test table data.

* Plot Reference Level: +5dBi



3.1.3 Complete Test Data

Table 4: DCR025B BT Antenna (2.45GHz) vs. Azimuth, Final Test Data

SA Level P _{RX} (dBm)	P _{TX} (dBm)	G _{RX} (dB)	L _{TX} (dB)	FSPL (dB)	L _{RX} (dB)	Final Gain (dBi)	Turn Table (Degrees)
-59.358	0	9.50	-4.03	-49.76	3.731	-11.34	0
-60.687	0	9.50	-4.03	-49.76	3.731	-12.67	2
-61.372	0	9.50	-4.03	-49.76	3.731	-13.35	4
-59.839	0	9.50	-4.03	-49.76	3.731	-11.82	6
-57.27	0	9.50	-4.03	-49.76	3.731	-9.25	8
-56.78	0	9.50	-4.03	-49.76	3.731	-8.76	10
-59.02	0	9.50	-4.03	-49.76	3.731	-11.00	12
-62.028	0	9.50	-4.03	-49.76	3.731	-14.01	14
-62.897	0	9.50	-4.03	-49.76	3.731	-14.88	16
-60.07	0	9.50	-4.03	-49.76	3.731	-12.05	18
-57.119	0	9.50	-4.03	-49.76	3.731	-9.10	20
-57.372	0	9.50	-4.03	-49.76	3.731	-9.35	22
-59.051	0	9.50	-4.03	-49.76	3.731	-11.03	24
-58.411	0	9.50	-4.03	-49.76	3.731	-10.39	26
-57.549	0	9.50	-4.03	-49.76	3.731	-9.53	28
-55.764	0	9.50	-4.03	-49.76	3.731	-7.74	30
-54.468	0	9.50	-4.03	-49.76	3.731	-6.45	32
-53.049	0	9.50	-4.03	-49.76	3.731	-5.03	34
-51.736	0	9.50	-4.03	-49.76	3.731	-3.72	36
-51.275	0	9.50	-4.03	-49.76	3.731	-3.25	38
-52.39	0	9.50	-4.03	-49.76	3.731	-4.37	40
-54.915	0	9.50	-4.03	-49.76	3.731	-6.89	42
-56.211	0	9.50	-4.03	-49.76	3.731	-8.19	44
-55.583	0	9.50	-4.03	-49.76	3.731	-7.56	46
-54.367	0	9.50	-4.03	-49.76	3.731	-6.35	48
-52.349	0	9.50	-4.03	-49.76	3.731	-4.33	50
-50.822	0	9.50	-4.03	-49.76	3.731	-2.80	52
-50.243	0	9.50	-4.03	-49.76	3.731	-2.22	54
-50.639	0	9.50	-4.03	-49.76	3.731	-2.62	56
-50.646	0	9.50	-4.03	-49.76	3.731	-2.63	58



-50.431	0	9.50	-4.03	-49.76	3.731	-2.41	60
-50.59	0	9.50	-4.03	-49.76	3.731	-2.57	62
-52.098	0	9.50	-4.03	-49.76	3.731	-4.08	64
-53.248	0	9.50	-4.03	-49.76	3.731	-5.23	66
-52.401	0	9.50	-4.03	-49.76	3.731	-4.38	68
-50.992	0	9.50	-4.03	-49.76	3.731	-2.97	70
-50.167	0	9.50	-4.03	-49.76	3.731	-2.15	72
-49.642	0	9.50	-4.03	-49.76	3.731	-1.62	74
-47.973	0	9.50	-4.03	-49.76	3.731	0.05	76
-46.636	0	9.50	-4.03	-49.76	3.731	1.39	78
-46.481	0	9.50	-4.03	-49.76	3.731	1.54	80
-48.072	0	9.50	-4.03	-49.76	3.731	-0.05	82
-49.537	0	9.50	-4.03	-49.76	3.731	-1.52	84
-49.237	0	9.50	-4.03	-49.76	3.731	-1.22	86
-47.536	0	9.50	-4.03	-49.76	3.731	0.48	88
-46.814	0	9.50	-4.03	-49.76	3.731	1.21	90
-47.805	0	9.50	-4.03	-49.76	3.731	0.22	92
-50.241	0	9.50	-4.03	-49.76	3.731	-2.22	94
-51.935	0	9.50	-4.03	-49.76	3.731	-3.91	96
-50.883	0	9.50	-4.03	-49.76	3.731	-2.86	98
-48.885	0	9.50	-4.03	-49.76	3.731	-0.86	100
-48.166	0	9.50	-4.03	-49.76	3.731	-0.14	102
-48.502	0	9.50	-4.03	-49.76	3.731	-0.48	104
-48.684	0	9.50	-4.03	-49.76	3.731	-0.66	106
-49.382	0	9.50	-4.03	-49.76	3.731	-1.36	108
-51.453	0	9.50	-4.03	-49.76	3.731	-3.43	110
-53.308	0	9.50	-4.03	-49.76	3.731	-5.29	112
-52.216	0	9.50	-4.03	-49.76	3.731	-4.20	114
-49.839	0	9.50	-4.03	-49.76	3.731	-1.82	116
-48.263	0	9.50	-4.03	-49.76	3.731	-0.24	118
-48.343	0	9.50	-4.03	-49.76	3.731	-0.32	120
-49.046	0	9.50	-4.03	-49.76	3.731	-1.03	122
-49.412	0	9.50	-4.03	-49.76	3.731	-1.39	124
-49.647	0	9.50	-4.03	-49.76	3.731	-1.63	126
-50.131	0	9.50	-4.03	-49.76	3.731	-2.11	128
-50.204	0	9.50	-4.03	-49.76	3.731	-2.18	130
-50.024	0	9.50	-4.03	-49.76	3.731	-2.00	132
-50.901	0	9.50	-4.03	-49.76	3.731	-2.88	134
-51.906	0	9.50	-4.03	-49.76	3.731	-3.89	136
-51.175	0	9.50	-4.03	-49.76	3.731	-3.15	138



-49.657	0	9.50	-4.03	-49.76	3.731	-1.64	140
-48.808	0	9.50	-4.03	-49.76	3.731	-0.79	142
-48.588	0	9.50	-4.03	-49.76	3.731	-0.57	144
-49.025	0	9.50	-4.03	-49.76	3.731	-1.00	146
-50.483	0	9.50	-4.03	-49.76	3.731	-2.46	148
-52.788	0	9.50	-4.03	-49.76	3.731	-4.77	150
-54.003	0	9.50	-4.03	-49.76	3.731	-5.98	152
-52.7	0	9.50	-4.03	-49.76	3.731	-4.68	154
-51.402	0	9.50	-4.03	-49.76	3.731	-3.38	156
-51.452	0	9.50	-4.03	-49.76	3.731	-3.43	158
-53.226	0	9.50	-4.03	-49.76	3.731	-5.21	160
-55.921	0	9.50	-4.03	-49.76	3.731	-7.90	162
-57.738	0	9.50	-4.03	-49.76	3.731	-9.72	164
-56.299	0	9.50	-4.03	-49.76	3.731	-8.28	166
-55.142	0	9.50	-4.03	-49.76	3.731	-7.12	168
-56.145	0	9.50	-4.03	-49.76	3.731	-8.12	170
-58.74	0	9.50	-4.03	-49.76	3.731	-10.72	172
-62.087	0	9.50	-4.03	-49.76	3.731	-14.07	174
-64.605	0	9.50	-4.03	-49.76	3.731	-16.58	176
-70.03	0	9.50	-4.03	-49.76	3.731	-22.01	178
-72.67	0	9.50	-4.03	-49.76	3.731	-24.65	180
-73.833	0	9.50	-4.03	-49.76	3.731	-25.81	182
-62.854	0	9.50	-4.03	-49.76	3.731	-14.83	184
-64.504	0	9.50	-4.03	-49.76	3.731	-16.48	186
-70.424	0	9.50	-4.03	-49.76	3.731	-22.40	188
-76.27	0	9.50	-4.03	-49.76	3.731	-28.25	190
-60.789	0	9.50	-4.03	-49.76	3.731	-12.77	192
-56.584	0	9.50	-4.03	-49.76	3.731	-8.56	194
-56.251	0	9.50	-4.03	-49.76	3.731	-8.23	196
-57.305	0	9.50	-4.03	-49.76	3.731	-9.28	198
-57.567	0	9.50	-4.03	-49.76	3.731	-9.55	200
-55.987	0	9.50	-4.03	-49.76	3.731	-7.97	202
-57.174	0	9.50	-4.03	-49.76	3.731	-9.15	204
-60.474	0	9.50	-4.03	-49.76	3.731	-12.45	206
-63.668	0	9.50	-4.03	-49.76	3.731	-15.65	208
-63.744	0	9.50	-4.03	-49.76	3.731	-15.72	210
-58.656	0	9.50	-4.03	-49.76	3.731	-10.64	212
-54.642	0	9.50	-4.03	-49.76	3.731	-6.62	214
-53.42	0	9.50	-4.03	-49.76	3.731	-5.40	216
-54.032	0	9.50	-4.03	-49.76	3.731	-6.01	218



-55.152	0	9.50	-4.03	-49.76	3.731	-7.13	220
-55.75	0	9.50	-4.03	-49.76	3.731	-7.73	222
-57.045	0	9.50	-4.03	-49.76	3.731	-9.02	224
-57.659	0	9.50	-4.03	-49.76	3.731	-9.64	226
-56.793	0	9.50	-4.03	-49.76	3.731	-8.77	228
-56.013	0	9.50	-4.03	-49.76	3.731	-7.99	230
-55.563	0	9.50	-4.03	-49.76	3.731	-7.54	232
-54.244	0	9.50	-4.03	-49.76	3.731	-6.22	234
-52.565	0	9.50	-4.03	-49.76	3.731	-4.54	236
-51.174	0	9.50	-4.03	-49.76	3.731	-3.15	238
-51.356	0	9.50	-4.03	-49.76	3.731	-3.34	240
-51.241	0	9.50	-4.03	-49.76	3.731	-3.22	242
-51.199	0	9.50	-4.03	-49.76	3.731	-3.18	244
-51.029	0	9.50	-4.03	-49.76	3.731	-3.01	246
-51.347	0	9.50	-4.03	-49.76	3.731	-3.33	248
-50.955	0	9.50	-4.03	-49.76	3.731	-2.93	250
-50.782	0	9.50	-4.03	-49.76	3.731	-2.76	252
-50.858	0	9.50	-4.03	-49.76	3.731	-2.84	254
-51.045	0	9.50	-4.03	-49.76	3.731	-3.02	256
-50.2	0	9.50	-4.03	-49.76	3.731	-2.18	258
-50.433	0	9.50	-4.03	-49.76	3.731	-2.41	260
-52.001	0	9.50	-4.03	-49.76	3.731	-3.98	262
-55.178	0	9.50	-4.03	-49.76	3.731	-7.16	264
-56.358	0	9.50	-4.03	-49.76	3.731	-8.34	266
-53.136	0	9.50	-4.03	-49.76	3.731	-5.12	268
-50.721	0	9.50	-4.03	-49.76	3.731	-2.70	270
-49.881	0	9.50	-4.03	-49.76	3.731	-1.86	272
-51.561	0	9.50	-4.03	-49.76	3.731	-3.54	274
-55.36	0	9.50	-4.03	-49.76	3.731	-7.34	276
-57.313	0	9.50	-4.03	-49.76	3.731	-9.29	278
-54.309	0	9.50	-4.03	-49.76	3.731	-6.29	280
-51.204	0	9.50	-4.03	-49.76	3.731	-3.18	282
-50.302	0	9.50	-4.03	-49.76	3.731	-2.28	284
-50.758	0	9.50	-4.03	-49.76	3.731	-2.74	286
-50.752	0	9.50	-4.03	-49.76	3.731	-2.73	288
-50.508	0	9.50	-4.03	-49.76	3.731	-2.49	290
-51.295	0	9.50	-4.03	-49.76	3.731	-3.27	292
-52.949	0	9.50	-4.03	-49.76	3.731	-4.93	294
-53.557	0	9.50	-4.03	-49.76	3.731	-5.54	296
-52.717	0	9.50	-4.03	-49.76	3.731	-4.70	298



-51.535	0	9.50	-4.03	-49.76	3.731	-3.51	300
-51.951	0	9.50	-4.03	-49.76	3.731	-3.93	302
-52.743	0	9.50	-4.03	-49.76	3.731	-4.72	304
-52.61	0	9.50	-4.03	-49.76	3.731	-4.59	306
-52.176	0	9.50	-4.03	-49.76	3.731	-4.16	308
-52.966	0	9.50	-4.03	-49.76	3.731	-4.95	310
-55.944	0	9.50	-4.03	-49.76	3.731	-7.92	312
-57.596	0	9.50	-4.03	-49.76	3.731	-9.58	314
-57.265	0	9.50	-4.03	-49.76	3.731	-9.24	316
-56.198	0	9.50	-4.03	-49.76	3.731	-8.18	318
-53.735	0	9.50	-4.03	-49.76	3.731	-5.71	320
-52.125	0	9.50	-4.03	-49.76	3.731	-4.10	322
-52.933	0	9.50	-4.03	-49.76	3.731	-4.91	324
-56.181	0	9.50	-4.03	-49.76	3.731	-8.16	326
-61.191	0	9.50	-4.03	-49.76	3.731	-13.17	328
-62.352	0	9.50	-4.03	-49.76	3.731	-14.33	330
-61.344	0	9.50	-4.03	-49.76	3.731	-13.32	332
-60.225	0	9.50	-4.03	-49.76	3.731	-12.20	334
-59.125	0	9.50	-4.03	-49.76	3.731	-11.10	336
-59.677	0	9.50	-4.03	-49.76	3.731	-11.66	338
-63.591	0	9.50	-4.03	-49.76	3.731	-15.57	340
-67.927	0	9.50	-4.03	-49.76	3.731	-19.91	342
-70.016	0	9.50	-4.03	-49.76	3.731	-22.00	344
-67.79	0	9.50	-4.03	-49.76	3.731	-19.77	346
-65.56	0	9.50	-4.03	-49.76	3.731	-17.54	348
-65.086	0	9.50	-4.03	-49.76	3.731	-17.07	350
-68.575	0	9.50	-4.03	-49.76	3.731	-20.55	352
-68.575	0	9.50	-4.03	-49.76	3.731	-20.55	354
-65.285	0	9.50	-4.03	-49.76	3.731	-17.26	356

4 Test Setup Photographs

Figure 8: Antenna Gain Testing (Sample View #1)

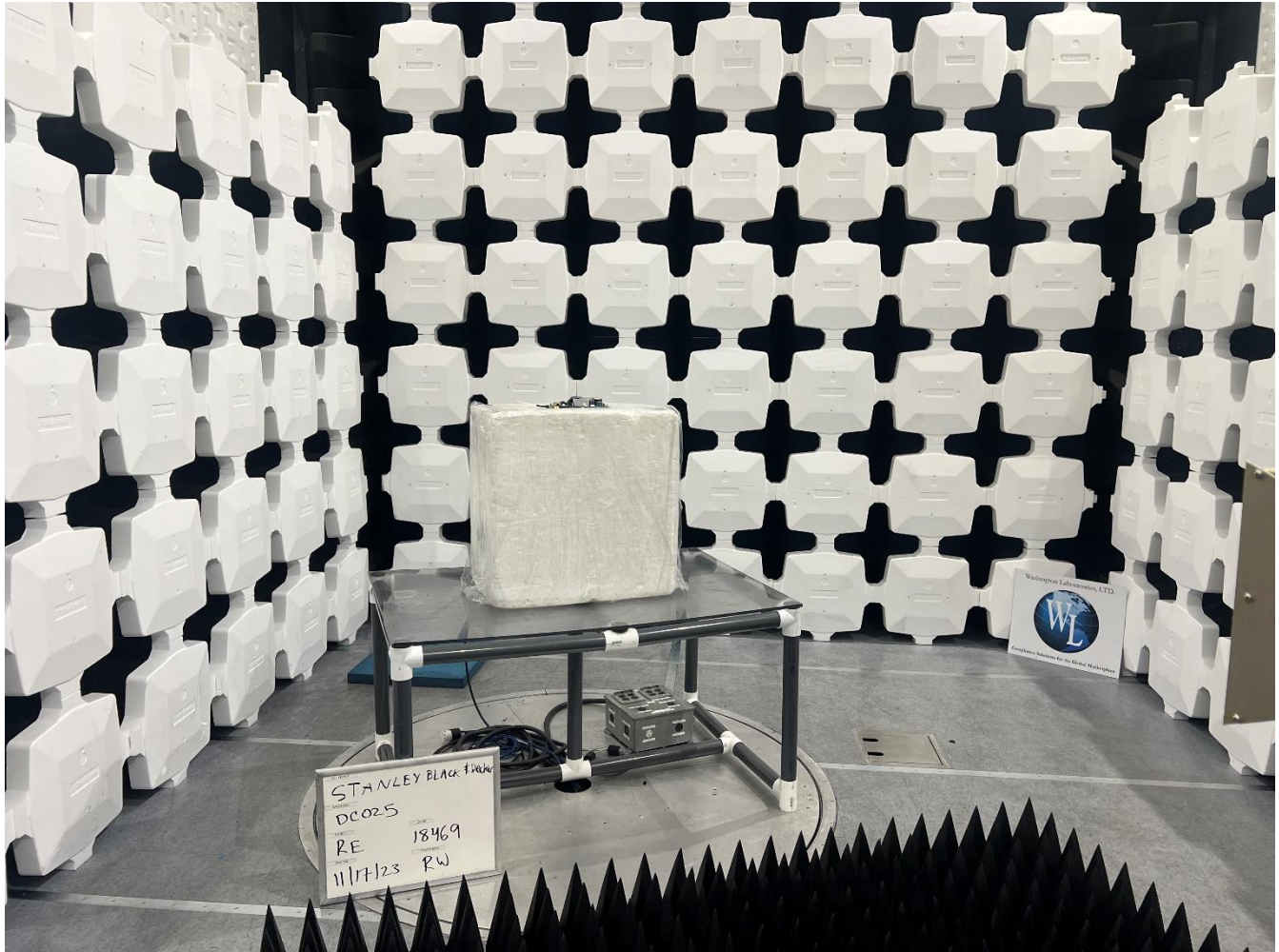




Figure 9: Antenna Gain Testing (Sample View #2)

