

Pod 3.0 天线

1. BLE Antenna

BLE Antenna Specifications:

Manufacturer: Ribbiot, Inc.

Type: Integrated PCB antenna (no connector)

Frequency: 2.4 GHz ISM (2402–2484 MHz)

Gain: Peak ≈ -5.5 dBi, Avg ≈ -9.5 dBi

Dimensions: PCB trace integrated (approx 23.5x9.6mm)

Radiation: Omnidirectional

2. UWB Antenna

UWB Antenna Specifications:

Manufacturer: Ribbiot, Inc.

Type: Integrated PCB antenna (no connector)

Frequency: 5.5–8.2 GHz (UWB Ch. 5–9)

Gain: Peak $\approx +0.5$ dBi, Avg ≈ -9 dBi

Dimensions: PCB trace integrated (approx 9.7x7.9mm)

Radiation: Omnidirectional

3. NFC Antenna

Manufacturer: Ribbiot, Inc.

Type: Integrated PCB antenna (no connector)

Frequency: 13.56MHz

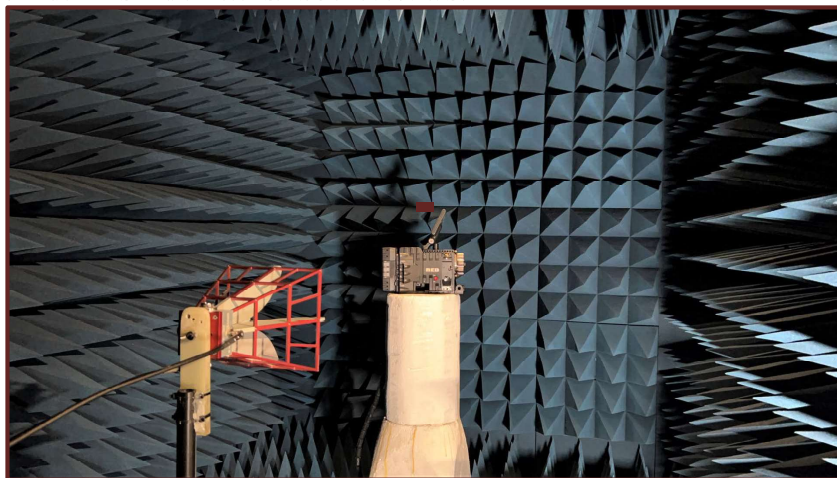
Dimension: PCB trace integrated (approx 25.0X19.6mm)

1 Introduction

VSWR and radiated pattern performance of the Bluetooth and UWB antennas of the Gen-3 Pod were measured and that data is provided in this report.

2 Test Equipment Used

-  Vector Network Analyzer “VNA” used was a CMT (Copper Mountain Technologies) Model: S5085; a 50 Ohm, 2-Port, 2-Path, 9 kHz to 8.5 GHz, S/N: 20107496.
-  CIA custom designed and built, 13 ft. x 9 ft. x 9 ft. anechoic antenna measurement chamber fully lined with Cumming Microwave “C-RAM SFC-18”, 18 in. deep pyramidal absorber and associated Cumming Microwave corner and walkway absorber treatments, see image below.
-  RF Spin Model: QRH11, Quad Ridged Horn, S/N: 200721Q11 chamber source antenna.
-  Green Heron Engineering Model RT-21D-v4 Deluxe Rotator Controller, S/N: 06152.
-  AlfaSpid RAK-1, double worm gear, 550 lb. load capacity, 1 degree/pulse precision, rotator.
-  Custom built liquid heat sink and fan cooled, computer system, with Intel 16 Core 2.50 GHz i9 (12th Gen) i9-12900KS Desktop Processor, 64 GB G.SKILL Trident Z5 RGB Series (Intel XMP 3.0) DDR5 RAM UDIMM, Dell S3221QS 32 Inch Curved 4K UHD display.
-  Bosch Professional Laser Level Model GLL 1P 3 601 K66 C10, S/N: 327005416
-  CMT (Copper Mountain Technologies) Model: TW-SMA Torque Wrench (no S/N).
-  CMT (Copper Mountain Technologies) Model: S911T 3.5 mm Calibration Kit, SN: A266049.
-  Calibrated 67 mm RG-178/MMCX DUT test cables for each DUT. Semi-rigid and shorter flexible cables applied too much stress to connections and lifted pads or otherwise damaged the cables.
-  Various Mini-Circuits “Flex Test” test cables, Pasternack Precision connectors and adapters, and Teledyne coaxial switches were used in the closed system setup.
-  Mini-Circuits “Flex Test” Part numbers “CBL-xxFT-SMSM+” with Case Style: GM1006-xx, where xx indicates length in feet.
-  Precision SMA female to SMA female, 18 GHz “bullet” adapters, Pasternack P/N: PE 9695.
-  Precision SMA male to SMA female 27 GHz mitered right angle adapter, Pasternack P/N: PE91504
-  Two Teledyne CCR33S80T coaxial switches, Lot #: TR 109-71-M.
-  Various small power and hand tools required for antenna design, tuning, and testing.
-  Two TrackLife Model MDC01 Variable Regulated (0 – 30 V / 5 A max) power supply.
-  Omano 7x to 45 x trinocular microscope, with Hayear Model: HY-5099 (no S/N) Industrial Inspection Camera and Hayear inspection and measurement SW.
-  Mitutoyo, 6 in. ± 0.001 in., Digital Caliper, Model: CD-6 CS, S/N: 0422822.
-  Canon EOS 5D Camera, with lenses, ranging from MP-E 65 extreme macro to EF 100 – 400 mm Zoom, various flash and lighting solutions, tripods, Cognisys StackShot controller S/N: 10241 and focusing rail with 2.5 μ m precision, and numerous other accessories (as needed). In some cases, an iPhone 17 Pro Max is used.
-  Fluke 177 True RMS Multimeter S/N: 38480875WS.



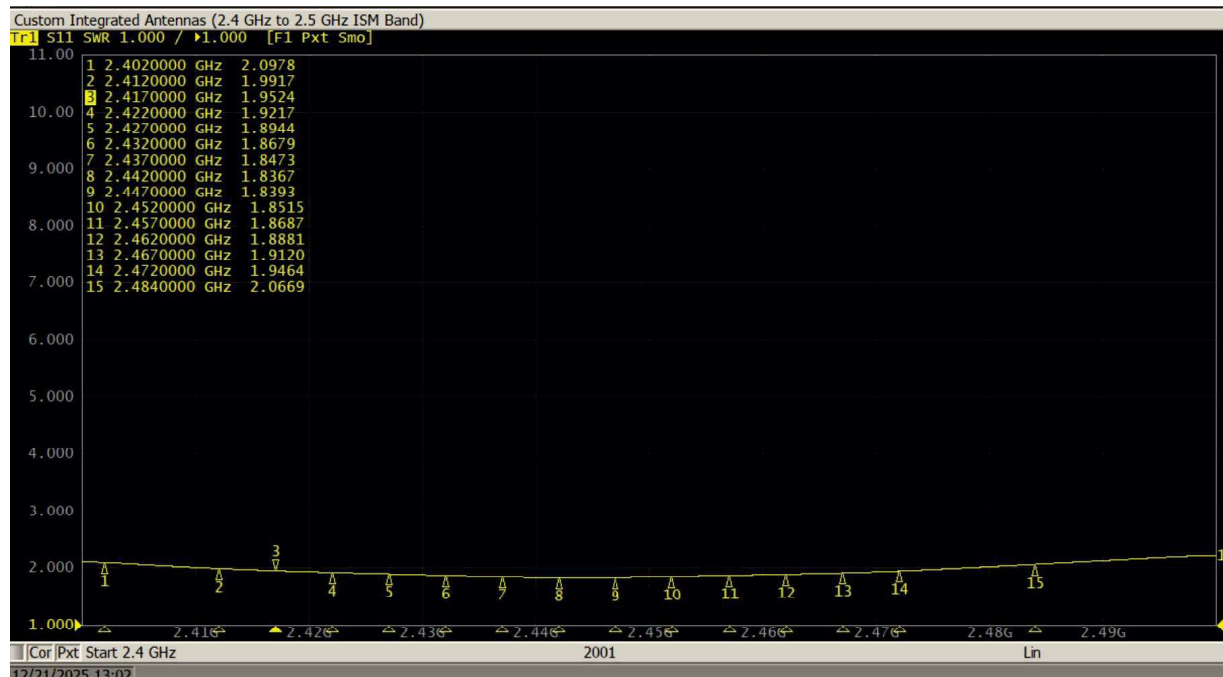
CIA's Anechoic Chamber

3 Gen3-Pod Bluetooth Antenna

The Bluetooth antenna (left) after trimming the radiator for resonance and impedance match. The trim produced the VSWR shown in the plot below. No SMT matching components were required. The UWB antenna (bottom) required no changes during this testing effort.

3.1 VSWR

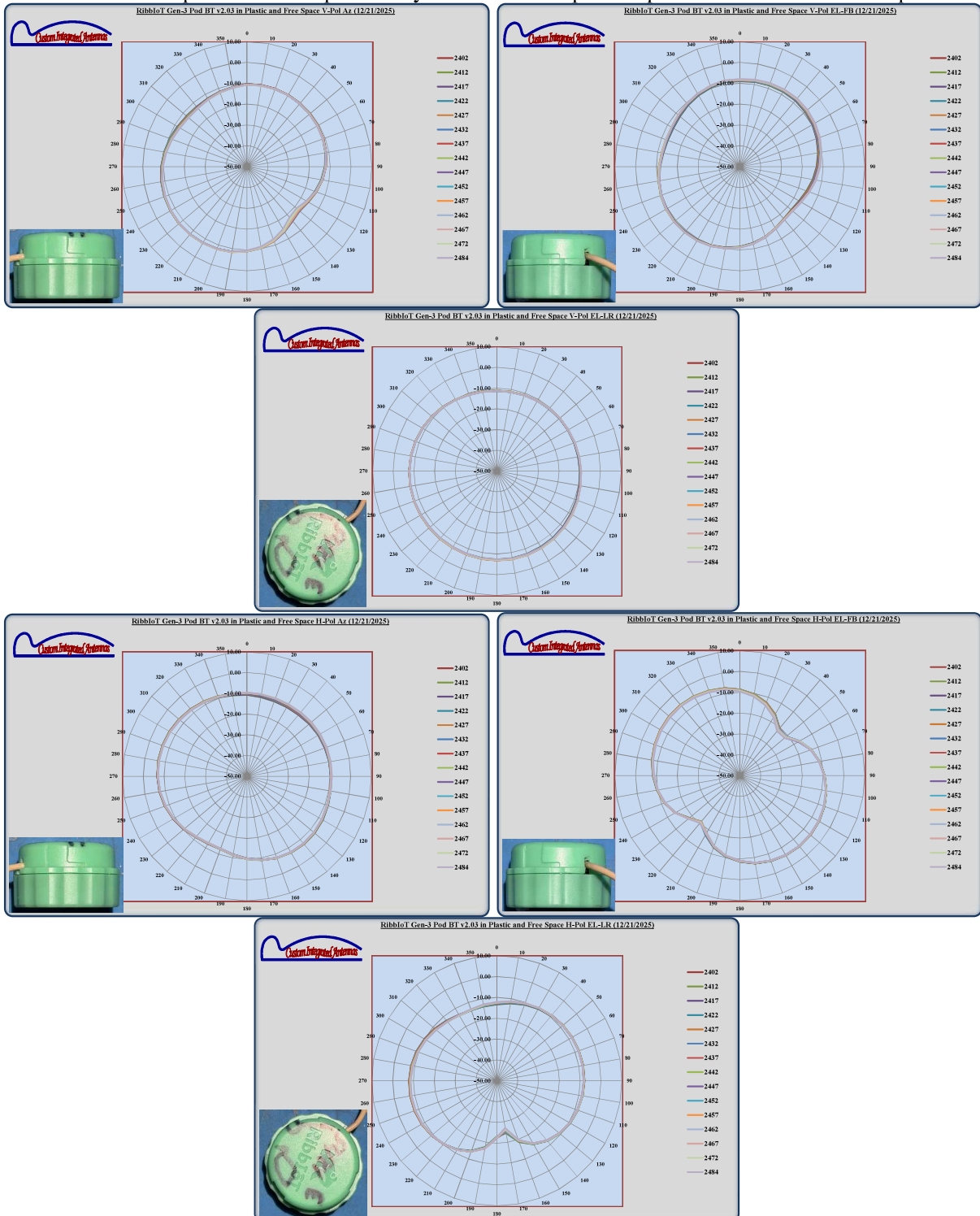
3.1.1 In Plastic Only



VSWR of the Gen-3 Pod as measured, with no SMT matching components and completely assembled along with all components in the production quality plastic housing, as pictured in all the pattern plots.

3.2 Gen-3 Pod BT Radiated Patterns Completely assembled in its Plastic Housing

A picture of the fully assembled Gen-3 Pod is provided on each radiated pattern plot relative to the angular position for the data measured on each individual plot. These pictures are as the DUT was seen from the ceiling of the anechoic chamber during pattern measurements and can alternatively be imagined at the center of the polar radiation plot. They are outside the plot for picture size/detail in this report.



3.3 Tabular Bluetooth Data

Average Gain Comparison: All data points averaged for each frequency and all angles (dBi)								
Frequency (MHz)	2402	2412	2417	2422	2427	2432	2437	2442
RibbloT Gen-3 Pod BT v2.03 in Plastic and Free Space V-Pol Az (12/21/2025)	-10.51	-10.43	-10.41	-10.35	-10.33	-10.40	-10.39	-10.41
RibbloT Gen-3 Pod BT v2.03 in Plastic and Free Space V-Pol EL-FB (12/21/2025)	-11.17	-10.89	-10.83	-10.67	-10.56	-10.51	-10.42	-10.33
RibbloT Gen-3 Pod BT v2.03 in Plastic and Free Space V-Pol EL-LR (12/21/2025)	-8.95	-8.83	-8.77	-8.68	-8.60	-8.64	-8.54	-8.51
RibbloT Gen-3 Pod BT v2.03 in Plastic and Free Space H-Pol Az (12/21/2025)	-9.16	-8.99	-8.98	-8.84	-8.81	-8.83	-8.82	-8.80
RibbloT Gen-3 Pod BT v2.03 in Plastic and Free Space H-Pol EL-FB (12/21/2025)	-8.91	-8.73	-8.74	-8.60	-8.58	-8.63	-8.65	-8.64
RibbloT Gen-3 Pod BT v2.03 in Plastic and Free Space H-Pol EL-LR (12/21/2025)	-10.50	-10.34	-10.31	-10.24	-10.22	-10.30	-10.30	-10.32

Average Gain Comparison: All data points averaged for each frequency and all angles (dBi)								Avg Gain (dBi)	Peak Gain (dBi)
Frequency (MHz)	2447	2452	2457	2462	2467	2472	2484	Bluetooth	Bluetooth
RibbloT Gen-3 Pod BT v2.03 in Plastic and Free Space V-Pol Az (12/21/2025)	-10.46	-10.53	-10.52	-10.59	-10.59	-10.63	-10.74	-10.49	-7.40
RibbloT Gen-3 Pod BT v2.03 in Plastic and Free Space V-Pol EL-FB (12/21/2025)	-10.34	-10.29	-10.19	-10.17	-10.15	-10.06	-10.00	-10.43	-7.20
RibbloT Gen-3 Pod BT v2.03 in Plastic and Free Space V-Pol EL-LR (12/21/2025)	-8.51	-8.54	-8.49	-8.56	-8.56	-8.58	-8.70	-8.63	-6.81
RibbloT Gen-3 Pod BT v2.03 in Plastic and Free Space H-Pol Az (12/21/2025)	-8.90	-8.90	-8.87	-8.89	-8.92	-8.86	-8.88	-8.90	-6.50
RibbloT Gen-3 Pod BT v2.03 in Plastic and Free Space H-Pol EL-FB (12/21/2025)	-8.77	-8.81	-8.80	-8.85	-8.93	-8.92	-9.07	-8.77	-5.55
RibbloT Gen-3 Pod BT v2.03 in Plastic and Free Space H-Pol EL-LR (12/21/2025)	-10.41	-10.45	-10.41	-10.45	-10.45	-10.44	-10.49	-10.37	-7.75

The **red** highlighted value is the peak gain referenced to an ideal isotropic radiator (dBi) of all 3,240 data points measured.

Vertical and Horizontal Average Gain of All Frequencies and Orientations Tested (dBi)	
AUT	Bluetooth
RibbloT Gen-3 Pod BT v2.03 in Plastic and Free Space V-Pol (12/21/2025)	-9.76
RibbloT Gen-3 Pod BT v2.03 in Plastic and Free Space H-Pol (12/21/2025)	-9.29

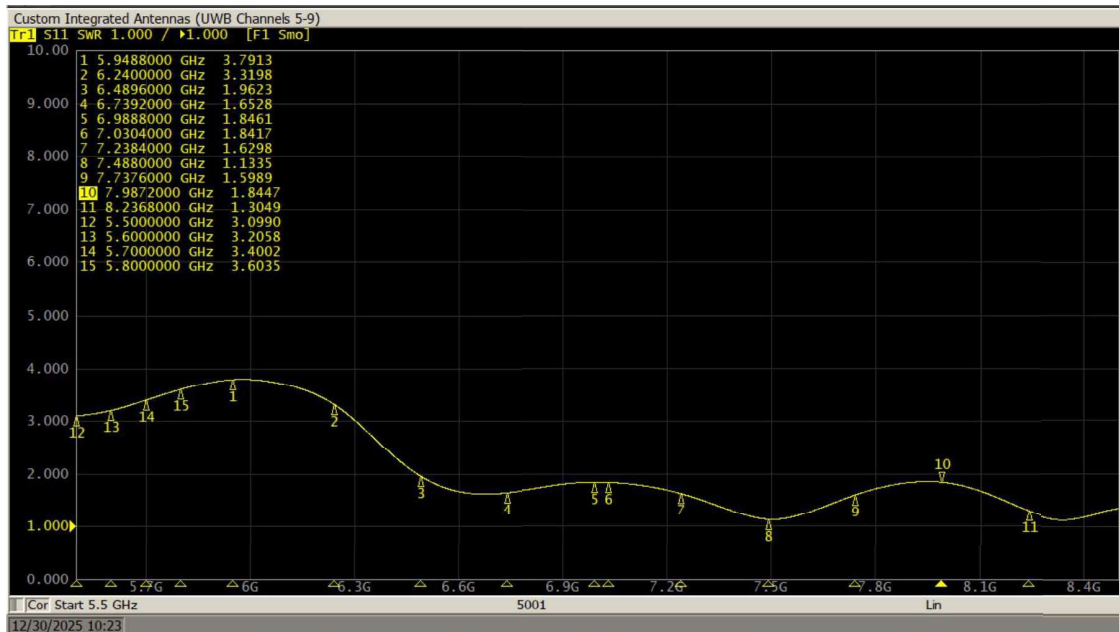
Overall Average Gain (dBi) *Consider this Table a Quality Factor	
AUT	Bluetooth
RibbloT Gen-3 Pod BT v2.03 in Plastic and Free Space (12/21/2025)	-9.52

4 Gen-3 Pod UWB Antenna

No changes were necessary for the UWB antenna. The impedance discontinuity in the lower portion of channel 5 was not addressed, since the client was satisfied with UWB performance and UWB has modulation and timing redundancies that can mask such details, within reason.

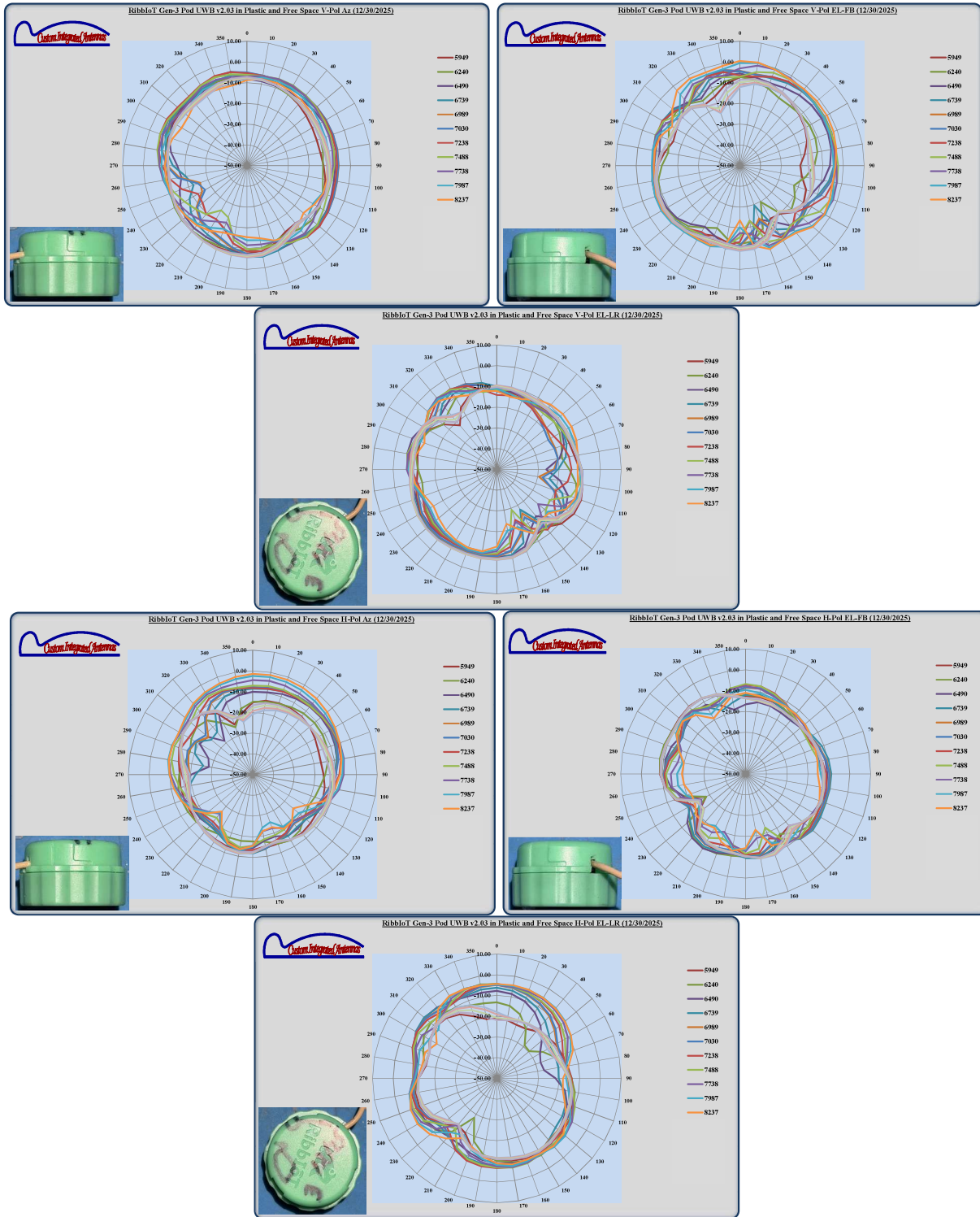
4.1 Gen-3 Pod UWB VSWR

4.1.1 In Plastic Housing



UWB VSWR in plastic housing only and on a Styrofoam block. No matching components are used, just the 0 Ohm jumper at the C22 position.

4.2 V 2.03 UWB Radiated Patterns in Plastic Housing Only



4.2.1 Tabular UWB Data; Version 2.03 Only

Average Gain Comparison: All data points averaged for each frequency and all angles (dBi)							
Frequency (MHz)	5949	6240	6490	6739	6989	7030	7238
RibbloT Gen-3 Pod UWB v2.03 in Plastic and Free Space V-Pol Az (12/30/2025)	-9.56	-9.37	-8.34	-7.53	-7.05	-7.01	-7.03
RibbloT Gen-3 Pod UWB v2.03 in Plastic and Free Space V-Pol EL-FB (12/30/2025)	-11.43	-11.90	-8.49	-6.82	-6.48	-6.49	-6.52
RibbloT Gen-3 Pod UWB v2.03 in Plastic and Free Space V-Pol EL-LR (12/30/2025)	-9.81	-10.79	-9.93	-9.41	-10.26	-10.41	-10.61
RibbloT Gen-3 Pod UWB v2.03 in Plastic and Free Space H-Pol Az (12/30/2025)	-13.96	-14.82	-12.21	-11.25	-10.97	-10.91	-10.52
RibbloT Gen-3 Pod UWB v2.03 in Plastic and Free Space H-Pol EL-FB (12/30/2025)	-11.46	-11.19	-11.89	-11.38	-11.41	-11.47	-11.70
RibbloT Gen-3 Pod UWB v2.03 in Plastic and Free Space H-Pol EL-LR (12/30/2025)	-12.92	-11.41	-9.74	-9.24	-8.75	-8.62	-8.10

Average Gain Comparison: All data points averaged for each frequency and all angles (dBi)					Avg Gain (dBi)	Peak Gain (dBi)
Frequency (MHz)	7488	7738	7987	8237	UWB (Ch 5 - 9)	UWB (Ch 5 - 9)
RibbloT Gen-3 Pod UWB v2.03 in Plastic and Free Space V-Pol Az (12/30/2025)	-7.49	-8.40	-9.70	-10.97	-8.23	-4.10
RibbloT Gen-3 Pod UWB v2.03 in Plastic and Free Space V-Pol EL-FB (12/30/2025)	-5.85	-5.18	-4.68	-4.08	-6.52	0.47
RibbloT Gen-3 Pod UWB v2.03 in Plastic and Free Space V-Pol EL-LR (12/30/2025)	-10.04	-9.94	-10.31	-10.86	-10.19	-5.09
RibbloT Gen-3 Pod UWB v2.03 in Plastic and Free Space H-Pol Az (12/30/2025)	-9.56	-8.29	-7.24	-6.54	-9.89	-1.21
RibbloT Gen-3 Pod UWB v2.03 in Plastic and Free Space H-Pol EL-FB (12/30/2025)	-12.10	-12.68	-13.46	-14.12	-11.99	-6.74
RibbloT Gen-3 Pod UWB v2.03 in Plastic and Free Space H-Pol EL-LR (12/30/2025)	-7.96	-7.93	-7.83	-7.92	-8.89	-3.91

The red highlighted value is the peak gain referenced to an ideal isotropic radiator (dBi) of all 3,240 data points measured.

Vertical and Horizontal Average Gain of All Frequencies and Orientations Tested (dBi)	
AUT	UWB (Ch 5 - 9)
RibbloT Gen-3 Pod UWB v2.03 in Plastic and Free Space V-Pol (12/30/2025)	-8.06
RibbloT Gen-3 Pod UWB v2.03 in Plastic and Free Space H-Pol (12/30/2025)	-10.07

Overall Average Gain (dBi) *Consider this Table a Quality Factor	
AUT	UWB (Ch 5 - 9)
RibbloT Gen-3 Pod UWB v2.03 in Plastic and Free Space V-Pol Az (12/30/2025)	-8.95