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Custom Integrated Antennas (CIA)

"Zygo Coach's Unit VHF Antenna Report" 11/07/2019)

(Reference "Zygo Coach's Unit Bluetooth Antenna Report_CIA 09-20-2022" for That Antenna Data Analysis.)

Originally Submitted to Zygo on:

November 07, 2019

Table of Contents

Revision History

Date of Revision	Revision Comments	Pages Affected
11/07/2019	Entire Document	All
09/20/2022	Updated title with current information, added the "Key Antenna Specifications" table on page 7, added note on page 8 regarding the DUT name, added the "Peak Gain" details paragraph at the end of the "Conclusions" section on page 9. Also, the "Table of Contents" changed as a result of the additions.	1, 2, 7, 8, and 9

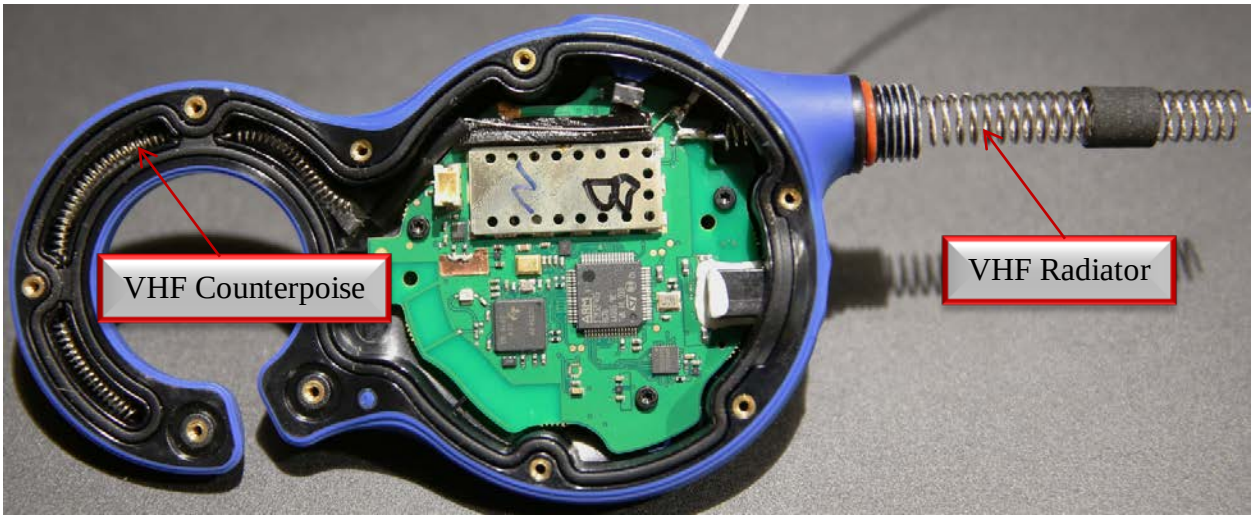
Zygo Coach's Unit VHF Antenna Report (CIA_11/07/2019)

1 DUT Description

1.1 Zygo Coach's Unit

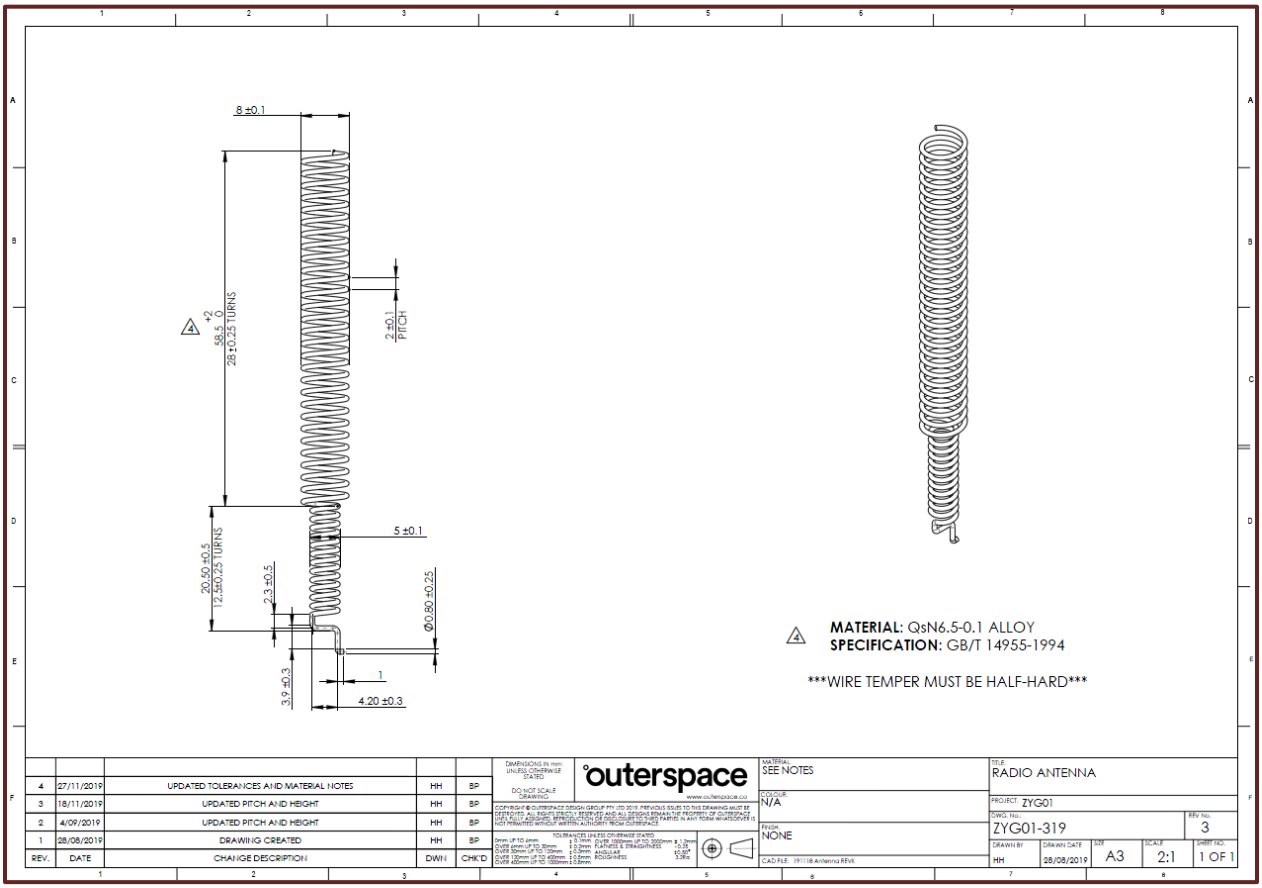
1.1.1 External View

1.1.2 Internal View

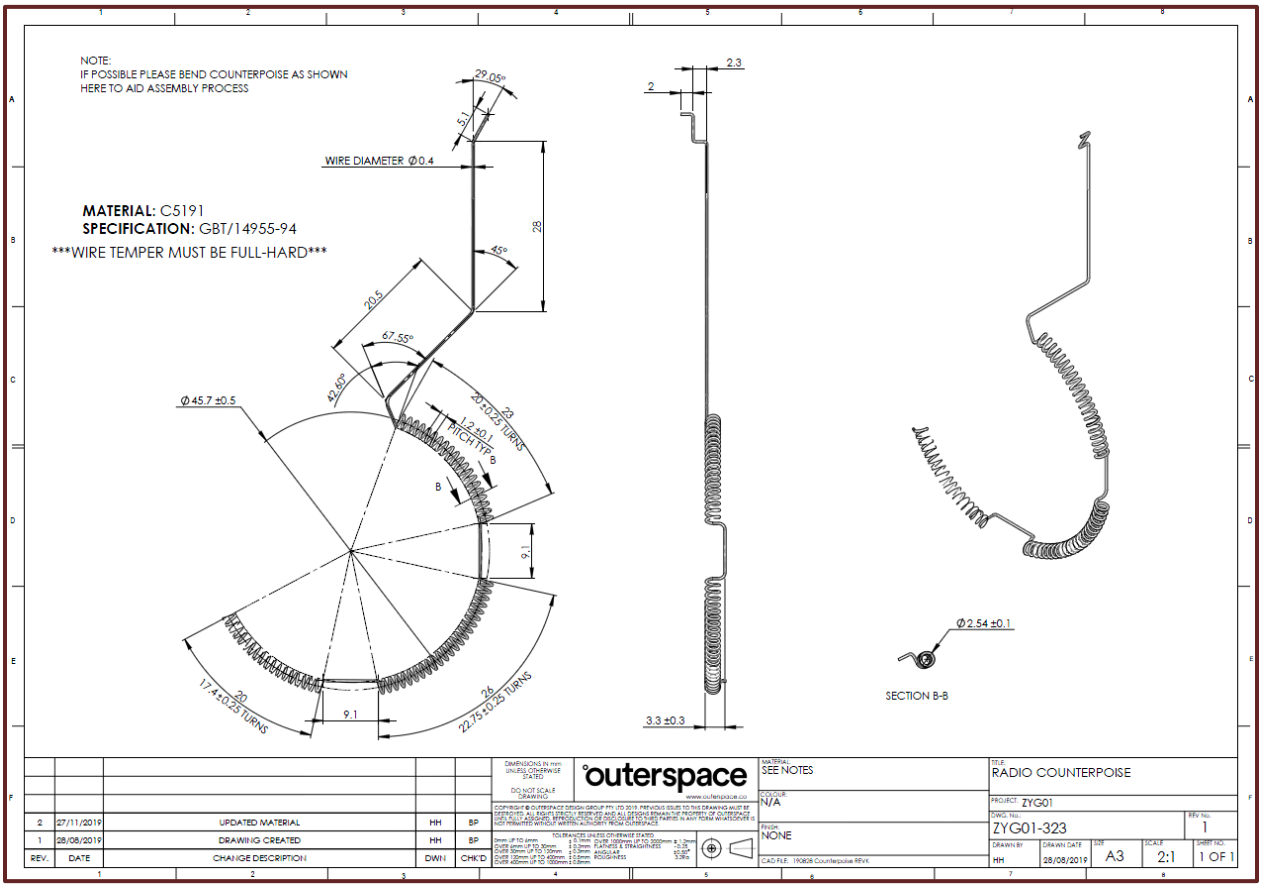


1.2 Antenna Components

1.2.1 Radiating Element (Radiator)



1.2.2 Counterpoise



2 Test Equipment Used

- Test Range = Open Air Test Site "OATS". DUT and test antenna seperation was 120 inches.
- Test (Site Source) Antenna = ETS EMCO Model 3146 Log Periodic Antenna S/N: 9401-3791
- Vector Network Analyzer "VNA" = Pico Technology Model "PicoVNA 106 300 kHz – 6 GHz Quad RX, S/N: A0063/08671.
- Coaxial Cables = 2 (one TX and one RX) Mini Circuits CBL-25FT-SMSM+
- Adapters = 2 (one TX and one RX) Pasternack PE91339, Precision N-Male to SMA-Female Adapters
- Channel Master 360 degree programmable turntable with Styrofoam pedestal DUT mounting platform

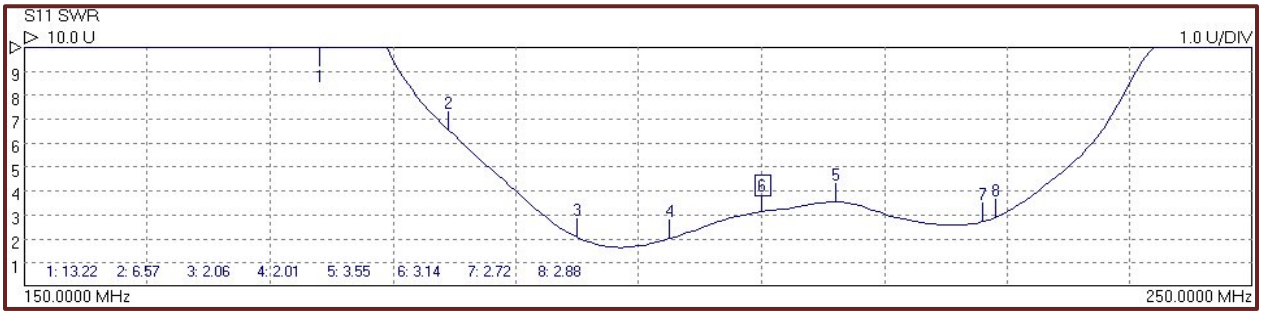
3 Key Antenna Specifications

Antenna Parameter	Values / Comments
Antenna Type	Custom Helical Dipole with an internal conformal counterpoise having three helical sections and a single 2 stage (varied diameters) radiating element mostly residing outside the housing in a screw on radome and soldered directly to the PCBA transmission line through hole and pad feed point internally.
Frequency Band (MHz)	174-216
Nominal Impedance	50 Ω
Peak Gain (dBi) Highest gain measured of all data points	-5.50 (Found at 216 MHz and angle 135 degrees in the H-Pol Azimuth plane plot below)
Efficiency (%) Average efficiency of all data points measured	4.84
Pattern Characteristics	
Overall Pattern Shape	Omni-Directional
HPBW (**H**alf **P**ower **B**eam **W**idth) Typical	(N/A)
Front-to-back Ratio (Typical)	(N/A)
2:1 VSWR Band Width (MHz)	7
Connection Requirement	Soldered to a PCB Through Hole / Pad
Power Handling (Watts)	5
Physical Dimensions	See production drawings above
Length (mm)	See production drawings above
Width or diameter (mm)	See production drawings above
Depth or thickness (mm)	See production drawings above
Material	See production drawings above

4 Measured Data

NOTE: The DUT referred to in the measured data below as "Handset" is referred to as "Coach's Unit" elsewhere in this report and other filing documents.

4.1 VSWR



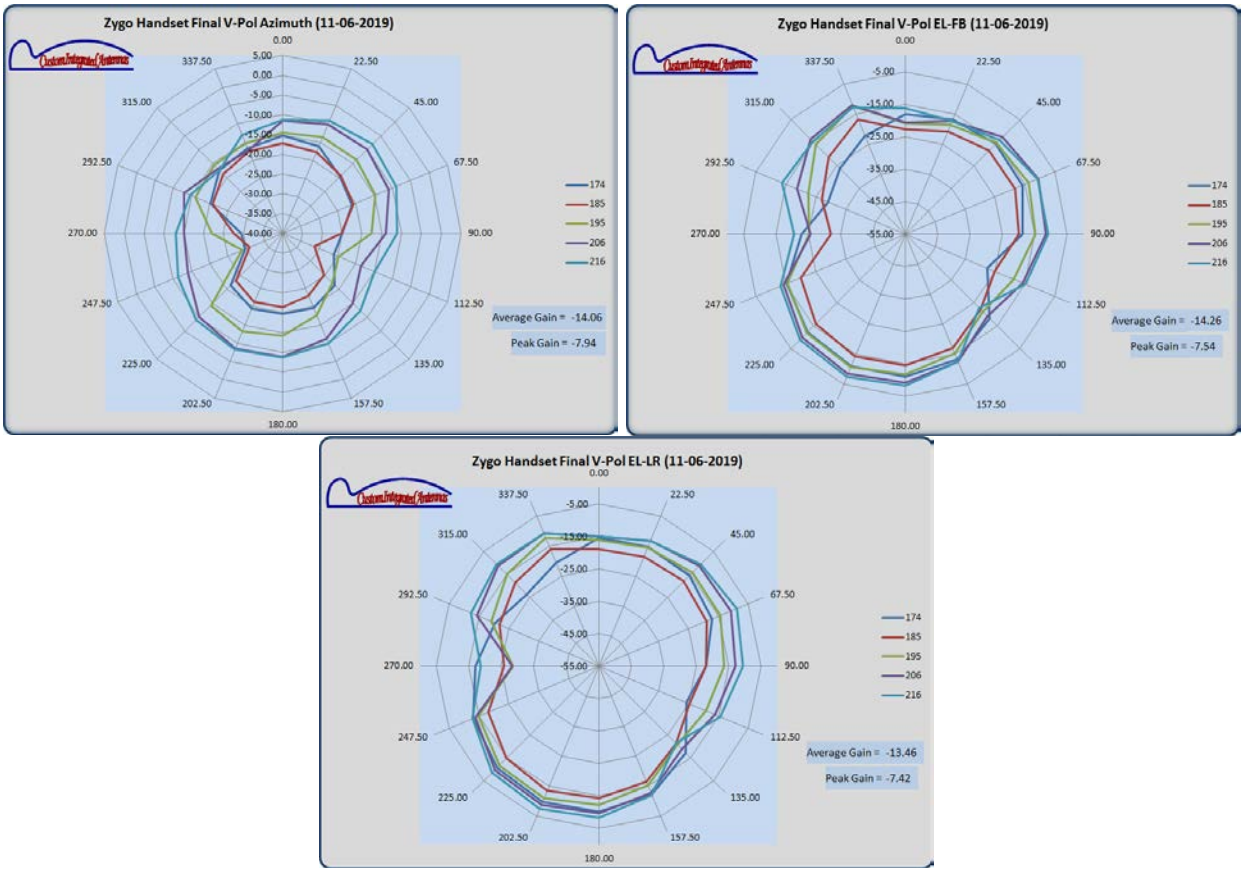
NOTE: Marker values are

1. 174 MHz
2. 184.5 MHz
3. 195 MHz
4. 202.5 MHz
5. 216 MHz

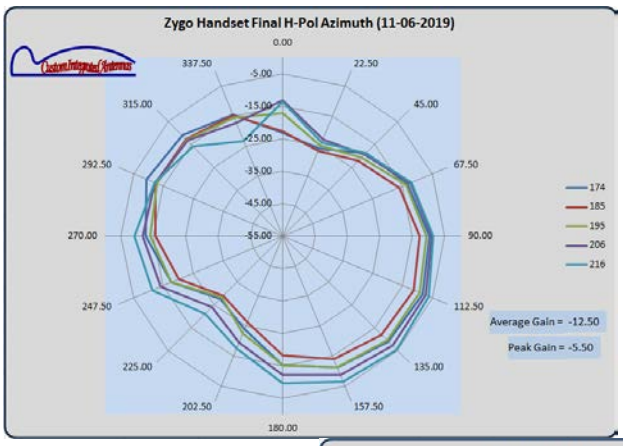
Markers 6 – 8 do not apply to the band of interest

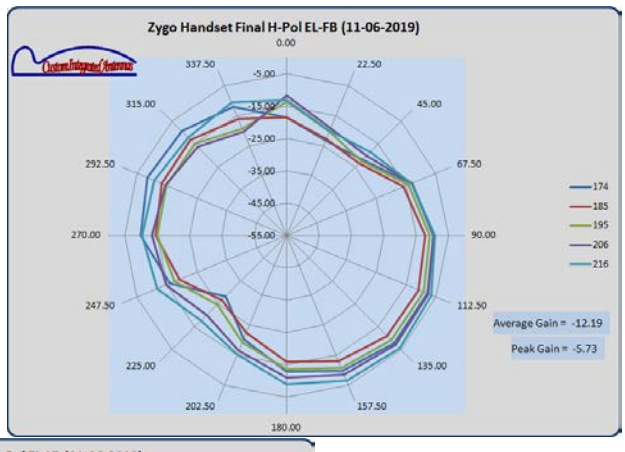
4.2 Principal Radiated Patterns

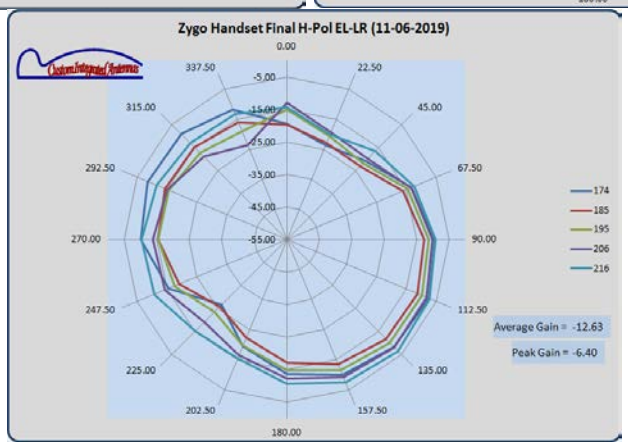
4.2.1 Vertically Polarized DUT (V-Pol)



4.2.2 Horizontally Polarized DUT (H-Pol)







4.3 Tabular Data Summary

Average Gain Comparison: All data points averaged for each frequency and all angles measured (dBi)						Avg Gain of All Data Points (dBi)	Maximum Gain (dBi)
Frequency (MHz)	**174**	**185**	**195**	**206**	**216**		**Maximum (dBi)**
Zygo Handset Final V-Pol Azimuth (11-06-2019)	-19.55	-20.91	-15.91	-11.90	-10.60	**-14.06**	-7.94
Zygo Handset Final V-Pol EL-FB (11-06-2019)	-15.74	-18.62	-14.96	-12.68	-12.13	**-14.26**	-7.54
Zygo Handset Final V-Pol EL-LR (11-06-2019)	-14.50	-17.71	-14.68	-12.19	-11.06	**-13.46**	-7.42
Zygo Handset Final H-Pol Azimuth (11-06-2019)	-12.70	-15.33	-13.69	-11.79	-10.49	**-12.50**	**-5.50**
Zygo Handset Final H-Pol EL-FB (11-06-2019)	-11.57	-14.86	-13.69	-12.04	-10.24	**-12.19**	-5.73
Zygo Handset Final H-Pol EL-LR (11-06-2019)	-11.51	-15.52	-14.36	-12.70	-10.75	**-12.63**	-6.40

Red Highlighted Cell is the DUT's Peak Gain (dBi) of all data points measured.

5 Conclusion

As expected the band width and efficiency of this short antenna for such a low frequency application was poor when compared to a more appropriately sized antenna. This subject was discussed and acknowledged in the early design discussions.

The peak gain of the antenna -5.50 dBi. The peak gain value was measured at 216 MHz at the 135 degrees data point of the polar plot provided above, i.e., "Zygo Handset Final H-Pol Azimuth (11/06/2019).