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# Geophysical Survey Logistics Report (v.2)

## *Regarding the Quantec SPARTAN TENSOR MAGNETOTELLURIC SURVEY over the CURNAMONA MT PROJECT, near Arkaroola, South Australia, AUSTRALIA, on behalf of TERREX SEISMIC PTY LTD, Perth, WA, Australia.*

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Project AU00056S

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## 1. INTRODUCTION

- **QGI Project No:** AU00056S / CA00618I
- **Project Name:** **CURNAMONA MT PROJECT**
- **Survey Areas:** Lake Frome, Strezlecki Desert (SA)
- **Survey Periods:** 25th November – 16th December, 2008
  19th – 27th January, 2009
- **Survey Type**: Tensor Magnetotelluric (MT) Surveys
- **Client:** **TERREX SEISMIC PTY LTD**
- **Client Address** Unit 2
  37 Howson Way
  Bibra Lake, WA
  6163 - Australia
  Telephone: +61 (0)8 9334 4388
- **Representatives:** Mr. Stephen Tobin
- **Objectives:** Deployment and recovery of MT stations at 5 to 10 km station spacing according to the client instruction and producing edited field data in EDI standard format to help determining preferential zones for possible energy resources.
- **Report Type:** Survey logistics, describing the survey parameters and methodology, as well as presenting the survey sounding curves in digital/map forms.

  **Version 2:**
  Report has been updated to reflect new EDI files created after applying azimuth and spectra corrections (conversion to RH-positive down coordinate system).
  Coil Recalibrations were also applied.

## 2. GENERAL SURVEY DETAILS

### 2.1 LOCATION

- **General Location:** The Curnamona MT Project area is located approx. 250 km East of Leigh Creek, SA (see Figure 1).
- **State:** South Australia
- **Nearest Settlements:** Arkaroola, Copley and Leigh Creek
- **Nearest Highway:** Barrier Highway (A32)
- **Datum & Projection** GDA 94 / WGS 84; UTM Zone 54J
- **Latitude/Longitude:** approx. 30°54'38"S , 140°09'46"E
- **UTM position[1]:** approx.420000E, 6580000S (Figure 1)

[1] UTM coordinates (GDA 94) positioning (GPS) supplied by Terrex Seismic Pty Ltd (October, 2008).

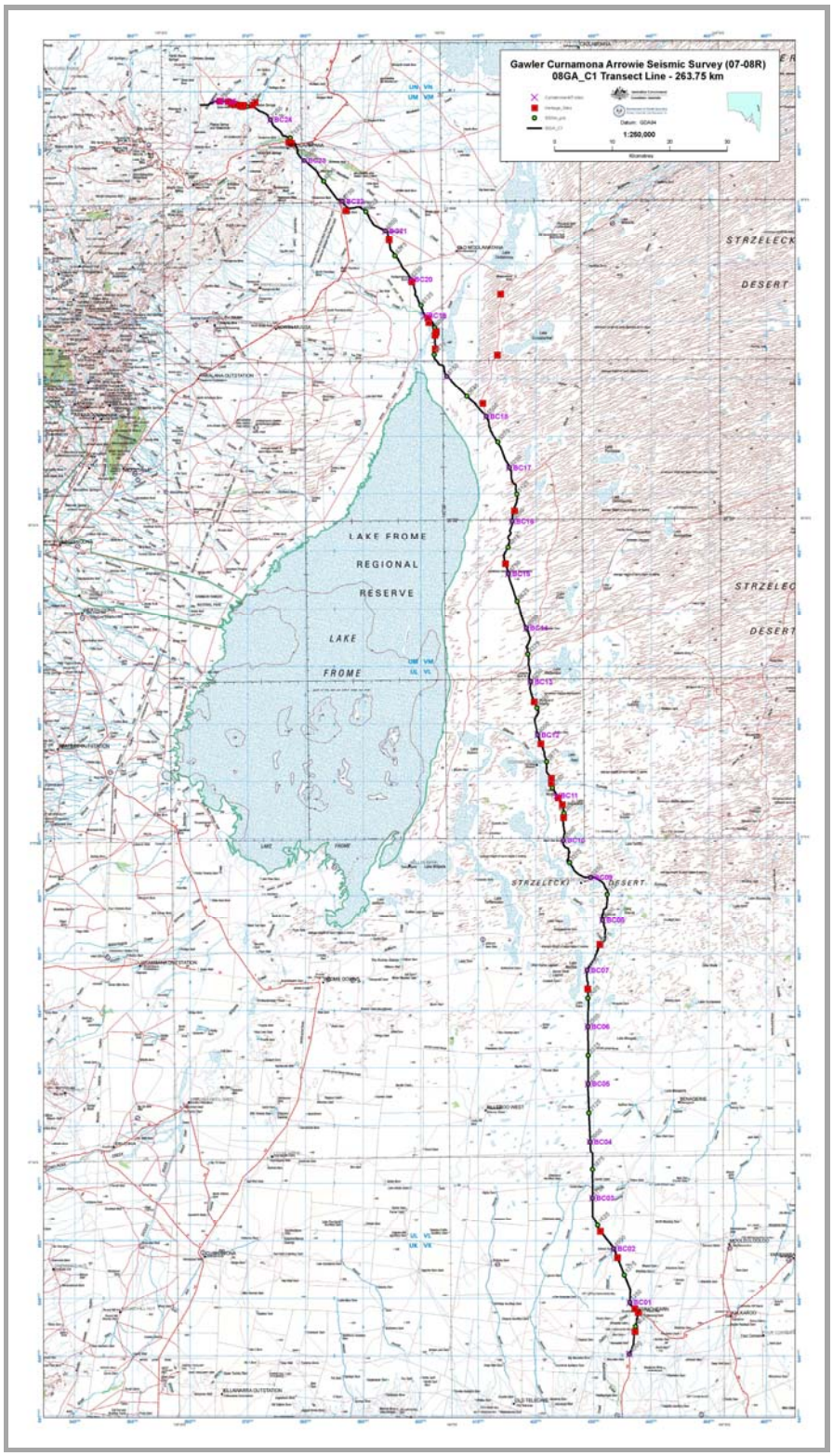


***Figure 1: Curnamona MT Project: General Location Map (supplied by Geoscience Australia, 2008).***

## 2.2 Access

- **Base of Operations:** Wooltana Station and Moolawatana Station
- **Mode of Access to Sites:** Trucks and foot

## 2.3 Survey Grid

- **Previously established by:** Terrex Seismic Pty Ltd (see Table I)
- **Coordinate Reference System:** Survey Grid Coordinates referenced to UTM Coordinates (see Table I).
- **Site Direction:** X-orientation at 0 deg (North), Y at 270 deg (West).
- **Site Separation:** approx. 5 to 10 km
- **Site Location:** GPS surveyed

| Site | UTM Easting (GDA 94 – UTM Zone 54J) | UTM Northing (GDA 94 – UTM Zone 54J) |
|---|---|---|
| **BC01** | 436320 | 6489301 |
| **BC02** | 433527 | 6498631 |
| **BC03** | 429851 | 6507414 |
| **BC04** | 429442 | 6517250 |
| **BC05** | 429086 | 6527235 |
| **BC06** | 429046 | 6537225 |
| **BC07** | 428904 | 6547087 |
| **BC08** | 431593 | 6555690 |
| **BC09** | 429527 | 6563192 |
| **BC10** | 424803 | 6569668 |
| **BC11** | 423656 | 6577500 |
| **BC12** | 420321 | 6588074 |
| **BC13** | 419115 | 6597299 |
| **BC14** | 418372 | 6606650 |
| **BC15** | 415260 | 6616058 |
| **BC16** | 415915 | 6625197 |
| **BC17** | 415437 | 6634517 |
| **BC18** | 411431 | 6643407 |
| **BC19** | 400684 | 6660957 |
| **BC20** | 398273 | 6667261 |
| **BC21** | 393914 | 6675675 |
| **BC22** | 386450 | 6680834 |
| **BC23** | 379826 | 6687975 |
| **BC24** | 373945 | 6695124 |
| **BC25** | 364310 | 6698304 |

***Table I: Proposed MT Site Locations.***

# 3. SURVEY WORK UNDERTAKEN

## 3.1 GENERALITIES

- **Survey Dates:** November 25th to December 16th, 2008
  January 15th to January 27th, 2009
- **Survey Period I:** 22 days
- **Survey Period II:** 8.5 days
- **Survey Days (read time):** 16.5 days
- **Weather Days:** 4
- **Number of Lines Surveyed:** 1
- **Number of Sites Surveyed:** 25

## 3.2 PERSONNEL

- **Project Manager:** Trent Retallick – QG Australia
- **Geophysicists/Interpreters:** Mehran Gharibi – QGL (Toronto, ON)
- **Data Processing (office):** Joel Stockill
  Dominic Brown
  Susanna Scappin
- **Field Operators:** Yatha Hoffman
  Lee Davison
- **Field Technicians:** Shaun Burnett
  Clinton Efford

## 3.3 SURVEY SPECIFICATIONS

- **Technique:** Tensor soundings, remote-referenced
- **Station Configuration:** "L" shaped E-field array (Figure 2)
  Ex – North(0deg)
  Ey –West (270deg)
  3 Low Frequencies coils Hx, Hy, Hz
- **Remote Configuration:** "L" shaped E-field array (Figure 2)
  Ex –North(0deg),
  Ey –West (270deg)
  3 Low Frequencies coils Hx, Hy, Hz
- **Remote Reference Measurements**
  1 Hx/Hy set
  1 Ex/Ey set (for verification/monitoring)
- **Dipole Length:** 100 metres
- **Remote Reference site:** The remote station is a site along the line reading contemporaneously (see Table II).

- **Data Acquisition:** Full-waveform time-series acquisition
  Data processing/output in frequency-domain
- **Frequency bandwidth:** 0.001 Hz to 250 Hz

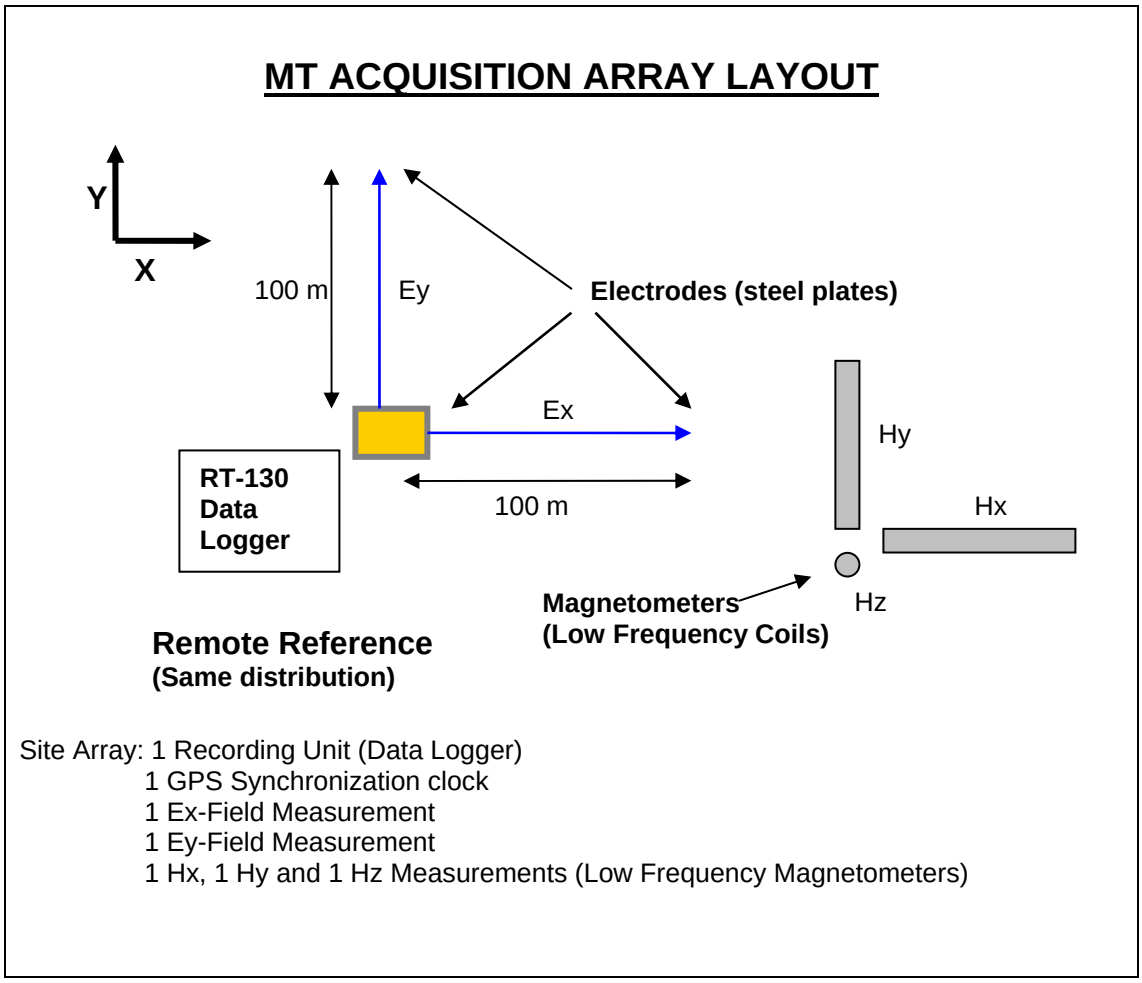


***Figure 2: Magnetotelluric Station Survey Layout.***

| Curnamona Line | | | | | |
|---|---|---|---|---|---|
| **Site** | **Reference Site** | **Site** | **Reference Site** | **Site** | **Reference Site** |
| **BC01** | BC03 | **BC10** | BC08 | **BC19** | BC18 |
| **BC02** | BC03 | **BC11** | BC13 | **BC20** | BC22 |
| **BC03** | BC01 | **BC12** | BC13 | **BC21** | BC22 |
| **BC04** | BC05 | **BC13** | BC12 | **BC22** | BC21 |
| **BC05** | BC07 | **BC14** | BC16 | **BC23** | BC24 |
| **BC06** | BC05 | **BC15** | BC16 | **BC24R** | BC23R |
| **BC07** | BC05 | **BC16** | BC15 | **BC25** | BC23 |
| **BC08** | BC10 | **BC17** | BC19 | | |
| **BC09** | BC10 | **BC18** | BC19 | | |

***Table II: Sites and related reference sites.***

## 3.4 SURVEY COVERAGE

### 3.4.1 Curnamona Line

| Curnamona Line | | | | | |
|---|---|---|---|---|---|
| **Site** | **East UTM** | **North UTM** | **Elevation (m)** | **Latitude** | **Longitude** |
| | **(WGS 84 – UTM Zone 54J)** | | | | |
| **BC01** | 436332 | 6489273 | 137 | 31°43'48.71"S | 140°19'40.49"E |
| **BC02** | 433556 | 6498642 | 117 | 31°38'43.85"S | 140°17'57.29"E |
| **BC03** | 429856 | 6507387 | 98 | 31°33'59.04"S | 140°15'39.06"E |
| **BC04R** | 429446 | 6517229 | 83 | 31°28'39.30"S | 140°15'26.04"E |
| **BC05** | 429090 | 6527212 | 67 | 31°23'14.99"S | 140°15'15.12"E |
| **BC06** | 429041 | 6537202 | 47 | 31°17'50.51"S | 140°15'15.82"E |
| **BC07** | 428983 | 6547007 | 33 | 31°12'32.04"S | 140°15'16.13"E |
| **BC08** | 431576 | 6555697 | 32 | 31°07'50.34"S | 140°16'56.26"E |
| **BC09** | 429387 | 6563257 | 34 | 31°03'44.33"S | 140°15'35.50"E |
| **BC10** | 424971 | 6568661 | 23 | 31°00'47.81"S | 140°12'50.33"E |
| **BC11** | 423640 | 6577507 | 22 | 30°56'00.18"S | 140°12'02.53"E |
| **BC12** | 420314 | 6588043 | 27 | 30°50'17.17"S | 140°10'00.17"E |
| **BC13** | 419096 | 6597248 | 22 | 30°45'17.89"S | 140°09'16.94"E |
| **BC14** | 418369 | 6606632 | 37 | 30°40'12.90"S | 140°08'52.28"E |
| **BC15** | 415258 | 6616047 | 21 | 30°35'06.31"S | 140°06'58.16"E |
| **BC16** | 415877 | 6625188 | 23 | 30°30'09.54"S | 140°07'24.06"E |
| **BC17** | 415497 | 6634563 | 14 | 30°25'04.93"S | 140°07'12.55"E |
| **BC18** | 411560 | 6643435 | 19 | 30°20'15.72"S | 140°04'47.69"E |
| **BC19** | 400216 | 6661246 | 2 | 30°10'34.01"S | 139°57'48.96"E |
| **BC20** | 398284 | 6667262 | 14 | 30°07'18.02"S | 139°56'38.82"E |
| **BC21** | 393927 | 6675711 | 34 | 30°02'42.24"S | 139°53'59.06"E |
| **BC22** | 386437 | 6680799 | 46 | 29°59'54.55"S | 139°49'21.37"E |
| **BC23** | 379872 | 6688178 | 72 | 29°55'52.62"S | 139°45'19.37"E |
| **BC24** | 373994 | 6695141 | 104 | 29°52'04.33"S | 139°41'43.12"E |
| **BC25** | 363364 | 6697870 | 114 | 29°50'31.62"S | 139°35'08.24"E |

***Table III: MT Site Coverage for Curnamona Line.***

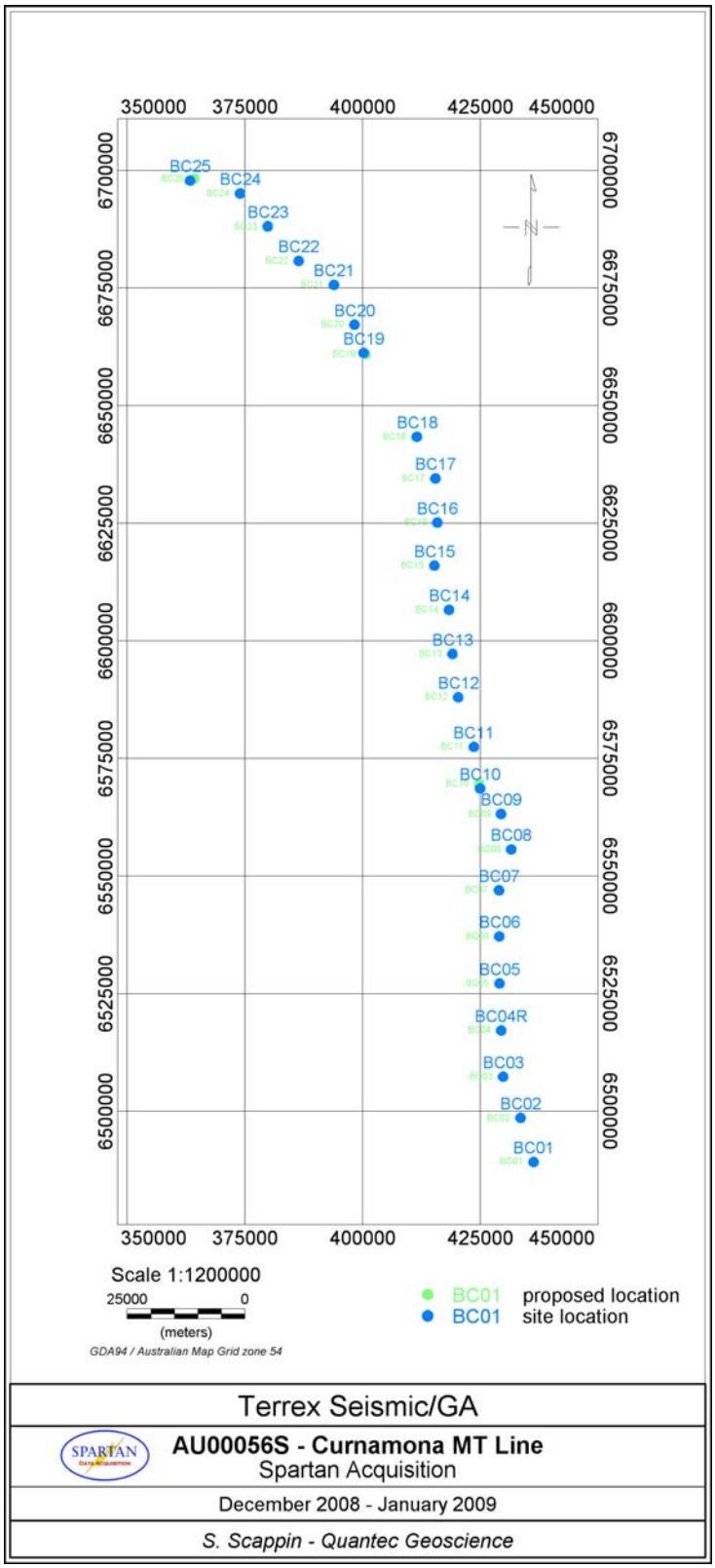


***Figure 3: MT Site Location for Curnamona Line.***

### 3.5 INSTRUMENTATION

- **Receiver System:** Quantec RT-130 Data Logger, comprising:
  - 6 channels max. per system (5 channels operationally) with internal A/D conversion (24bit @120db, and 6Mb buffer memory).
  - 9 Recording Units (loggers), deployed simultaneously for recording site and remote reference (3 units at the time)
  - 9 GPS synchronization clocks (10nsec precision /12.3MHz clock-speed)
- **Receiver Coils:** In two acquisition periods, 30 Phoenix model P50, and 13 EMI model BF4 and BF7 (10000sec to 1000Hz) Magnetometers, 3 at each site (Hx, Hy, and Hz)
- **Receiver Electrodes** Ground contacts using steel plates

### 3.6 PARAMETERS

- **Frequency Bandwidth:** Operating: 0.001 to 1000 Hz
  Effective: 0.001 to 250 Hz
- **Time-series Sampling:** High Range: 1000 samples/sec
  Low range: 20 samples/sec (QuickLay resampling)
- **Remote-Base Synchronization**: GPS clocks (10μsec time-accuracy)
- **Time-Series Stacking:** High Range: ~6912000 samples
  Low Range: ~3000000 samples
- **Sample/Record Time:** High Range: 4 to 17 sub-events @ 4 hrs. per event and 1 to 5 sub-events @ 12-15 hrs.
  (total recording and retrieving time approx. 19 to 72 hours)
- **Post-Processing:** Using QGI Quicklay version 3.0.Alpha_33

  1) Coherent noise rejection using remote-reference
  2) Proprietary digital filtering (scrubbing)
  3) Coherency sorting
  4) Impedance estimate stacking
- **Final Data Processing:** Edited and un-edited phase & resistivity sounding curves (0.001-250 Hz @ 8 pts. per decade) using Geotools.
- **Final Data Output:** 1) Auto and cross-power spectral estimates
  2) Unrotated (XY & YX) Tensor impedances + errors (apparent resistivities and E/H phase – Tipper Transfer Functions (Txr, Txi & Tyr, Tyi) – See Figure 4)

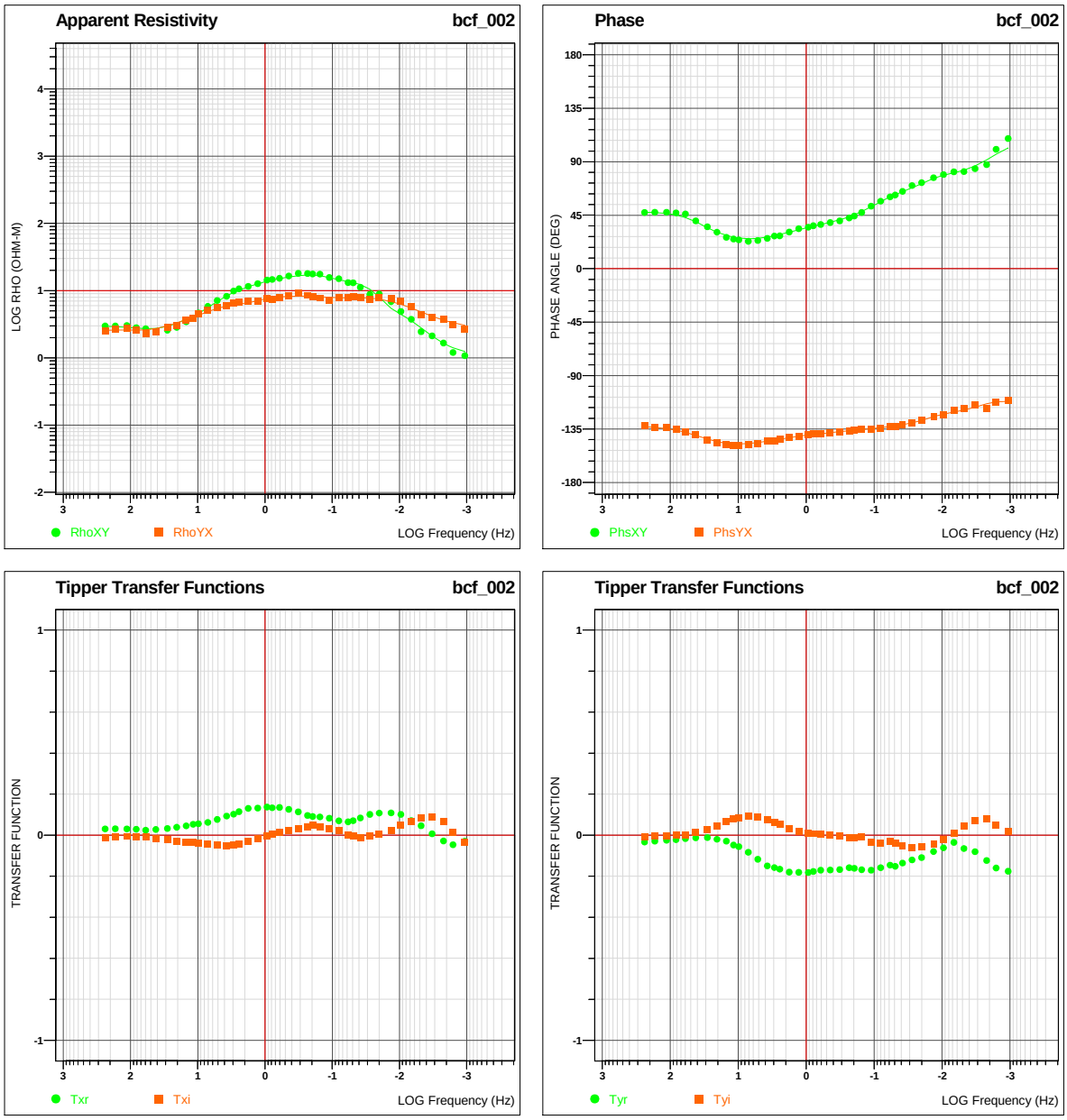


***Figure 4: Example of Apparent Resistivity, Phase (XY and YX), Tipper Transfer Function (Txr, Txi & Tyr, Tyi) Sounding Curves.***

### 3.7 Data Accuracy and Repeatability

- **Data Error:** Apparent Resistivity = <1/20$^{TH}$ decade avg.
  Phase = <3 degrees avg.
- **Parallel Sensor Test:** Low Freq-Range Test for Phoenix model P50 and EMI models BF4 and BF7 (see Figure 5)

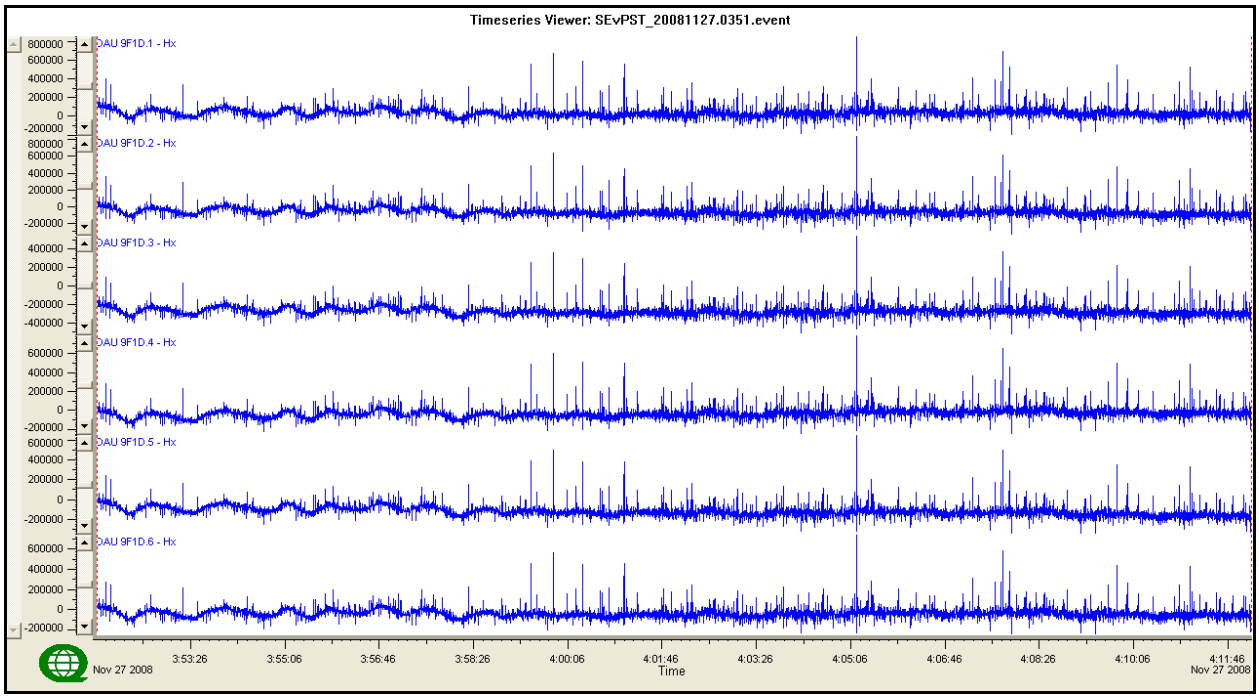


***Figure 5: Time Series taken from Parallel Sensor Test[2]***

[2] Parallel Sensor Test: all coils are Phoenix P50.

### 3.8 DATA PRESENTATION

- **Sounding Curves** — MT Apparent Resistivity and Phase (XY and YX), Tipper Transfer Function (Txr, Txi & Tyr, Tyi) (See Appendix C)
- **Digital**
  - Raw data: — Site and Remote Raw data that contains information on the location and time of the event archived onto external hard drive daily.
  - Processed data: — MT DATA, in EDI (electronic data interchange) file, created in Geotools™ containing tensor sounding data (XY & YX) for individual stations (sites) in a format conforming to SEG standard for the storage MT data.

RESPECTFULLY SUBMITTED

QUANTEC GEOSCIENCE LTD.

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