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Airborne Geophysical Survey

Survey Report

GEOSCIENCE AUSTRALIA

East Tasmania

Airborne Magnetic, Radiometric and Digital Elevation Survey

Contract Number: 006710

Project Number: P5020

Prepared by

MAGSPEC Airborne Surveys Pty Ltd

Reference Number: 1298

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1. GENERAL PROJECT INFORMATION

Project Details		
Project Number	5020	
Contract Number	006710	
MAGSPEC Project Number	1298	
Client	Geoscience Australia	
Survey Area Name	East Tasmania	
Survey Size (line kms)	57,178	
Survey Type	Airborne Magnetics, Radiometrics, Digital Elevation	
Aircraft		
Aircraft Location	Cambridge	Swansea
Aircraft Make/Model	AS350B2	AS350B2
Aircraft Registration	VH-SRB	VH-SRB
Personnel		
Field Crew	Name	Position
	David Paton	Pilot
	Peter O'Neill	Pilot
	Peter McDonald	Pilot
	Damien Hennessey	Pilot
	Phillip Turner	Pilot
	Matthew Brown	Pilot
	Hoey Stobard	Pilot
	Marty Fry	Pilot
	Bryan Patterson	Pilot
	William Bennett	Operator
	Andrew Taylor	Operator
Project Management	Peter Spencer	Operations Manager
QA/QC	Andrew Taylor	Quality Control / Technical Support
Final Data Processing	Cameron Johnston	Data Processing Manager
Reporting	Michael Lees	Sales Manager
Technical Support	Peter McMullen	Consultant Technician

1.1 Survey Acquisition Summary

Production on the East Tasmania Airborne Magnetic and Radiometric Survey 2022 began on 20th March 2022, following installation of the geophysical equipment into the helicopter (AS350B2 registration VH-SRB) and subsequent testing and calibrations. The aircraft was initially based in Cambridge Airport, Tasmania, with the crew located in nearby accommodation.

Prior to production, an on-site safety meeting was completed by the crew, base stations were set up, a reconnaissance and magnetic compensation flight was carried out and a radiometric test line was established.

Weather conditions were variable throughout the survey period, ranging from being generally fine, to days of heavy rain and winds, or fog and overcast conditions. Diurnal activity was particularly active on some days, exacerbated by the southern latitude location of the survey area.

Flight planning for the survey was initially split between onshore and offshore areas, however these two sections were further split due to Hobart Airport air traffic control requirements; resulting in five separate blocks being flown, with overlapping line segments.

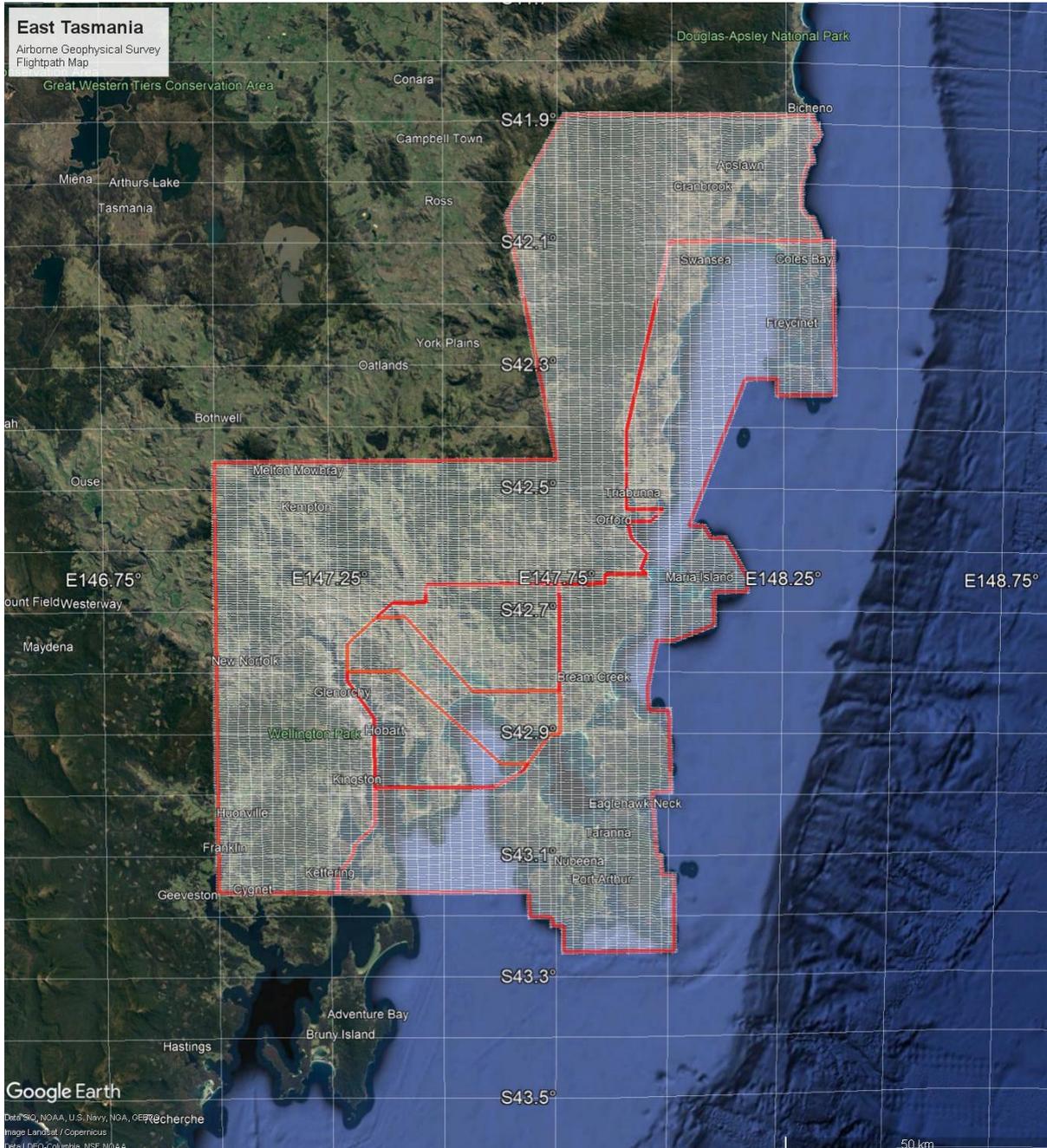
On 24th May 2022, ground calibrations of the radiometric system were undertaken at a prescribed hover range near Meander, Tasmania.

On 27th May 2022, the base of operations was moved to Swansea, Tasmania, to be closer to the remaining survey lines in the north.

Data acquisition was completed on 23rd June 2022; the equipment was removed from the aircraft and the field crew demobilised.

1.2 Survey Area and Flight Specifications

The East Tasmania survey area is located in Southeast Tasmania, as indicated in the following diagram, showing the flightpath and final individual block boundaries: -



East Tasmania (Google Earth)

Boundary Extent Coordinates - MGA55

Easting (m)	Northing (m)	Easting (m) cont.	Northing (m) cont.
610116	5358531	579517	5266705
609191	5356959	577745	5257970
608520	5356985	577938	5253884
608107	5356417	581577	5253976
608210	5354766	581805	5239245
608623	5354585	578495	5239218
608598	5353346	579137	5227472
607746	5353295	579983	5227457
606533	5349449	580041	5223941
606430	5345242	582254	5223941
607462	5343255	582246	5210208
608469	5343255	562527	5210154
609933	5339075	562369	5214897
612051	5339054	560290	5215009
612096	5311026	560263	5216569
601801	5310955	556228	5216738
601784	5313963	556119	5221254
595908	5314002	519858	5221387
585470	5287385	499922	5221301
588168	5287377	499864	5299656
589299	5285090	561737	5299433
592016	5285090	553033	5343978
593523	5282399	563511	5362018
595945	5277798	608639	5362008
595890	5275379	608985	5360314
589870	5275376	609552	5360263
589831	5269383	609552	5359385
582659	5266671		

2. SURVEY EQUIPMENT

2.1 Aircraft

The aircraft used for the survey was an AS350B2 helicopter, specially modified for geophysical survey.

Aircraft Registration - VH-SRB



Survey Aircraft

2.2 Data Acquisition System

High speed digital data acquisition system.

- Sample rates up to 20 Hz
- Integrated Novatel OEM GPS receiver providing positional information that is used to tag incoming data streams in addition to providing pilot navigation guidance
- High precision Cesium vapour magnetometer
- Visual real time on-screen system monitoring / error messages to limit re-flights due to equipment failure

2.3 Magnetometers

The aircraft was equipped with magnetometer sensors mounted inside the boom.

- | | | |
|------------------------|---|-----------------------------------|
| • Model / Type | - | G-823a Cesium vapour magnetometer |
| • Resolution | - | 0.001 nT resolution |
| • Sensitivity | - | 0.01 nT sensitivity |
| • Sample Rate | - | 20 Hz |
| • Compensation | - | 3-axis fluxgate magnetometer |
| • Magnetometer Counter | - | Kroum KMAG4 |

2.4 Gamma-ray Spectrometer

An RSI RS-500 gamma-ray spectrometer was installed within the aircraft, incorporating 2x RSX-4 detector packs.

- Total Crystal Volume - 32 L (downward looking)
- Recorded Channels - 256
- Sample Rate - 1 Hz
- Stabilisation - Multi-peak automatic gain

2.5 Altimeters / Ancillaries

A Bendix/King KRA 405 radar altimeter was installed on the boom.

- Resolution - 0.3 m
- Sample Rate - 20 Hz
- Range - 0-760 m

Barometric pressure sensor: -

- Accuracy - RSS $\pm 0.25\%$ FS (at constant temp)
- Range - 600-1100 hPa

2.6 Magnetic Base Stations

GEM GSM19 Overhauser and Scintrex Envimag proton precession base station magnetometer.

- Resolution - 0.01 / 0.1 nT
- Accuracy - 0.1 / 0.5 nT
- Sample Rate - 1.0 / 0.5 Hz

2.7 Navigation and Flight Path Recovery

Integrated Novatel OEM719 DGPS receiver:

- Bands - L1/L2 + GLONASS Multi Frequency
- Channels - 555
- Sample Rate - 2 Hz

Navigation information is supplied to the pilot via an LCD steering indicator. All data were synchronised to the GPS time.

3. CALIBRATIONS AND CHECKS

Full system calibrations and checks were conducted on the aircraft, in accordance with Geoscience Australia specifications. Refer to the following separate document for details: -

- *P5020_Calibration Report_MAGSPEC.pdf*

4. QUALITY CONTROL

4.1 During Flight

During survey, the pilot was notified of any deviation in system health by prompts on the navigation screen. Whenever any errors occurred, the flight was aborted, and the survey did not recommence until system errors were resolved.

The diurnal base stations were monitored by the ground crew and data were downloaded on a daily basis.

4.2 Post Flight

Upon completion of each flight all survey data were transferred from the acquisition system to the infield data processing computer. Using customised techniques, the data were checked for any errors and compliance with specifications.

All profiles were visually checked. The flight path was plotted with colour-coded indicators of any out of specification height or cross-track. The data were gridded and visually inspected for errors and compared for continuity with previous flights.

The summed 256-channel spectra were plotted and inspected. The test line and pre- and post-flight ground calibration data were tabulated and reviewed.

5. DATA PROCESSING

5.1 Magnetics

The following steps were performed during the magnetics processing:

- Review or application of compensation
- Parallax correction
- Diurnal filtering and subtraction
- IGRF correction using the updated current IGRF model
- Tie line levelling
- Micro levelling

Compensation of the magnetometer data was applied using the recorded XYZ fluxgate data using Geometrics MagComp Airborne compensation software. A suitable compensation flight (comp box) was processed to obtain the optimum compensation solution which was then applied to all survey data.

The base station magnetometer data were reviewed, de-spiked if necessary and filtered with an 11-point non-linear filter. These data were then subtracted from the measured aircraft data using time that was synchronised to both the acquisition system and the base mag unit.

The IGRF correction was applied using the updated IGRF 2020 model adjusted for height of the aircraft. This correction was calculated and applied at each point.

Tieline levelling was applied by way of a least-squares minimisation procedure using a polynomial fit of order 0 over the cross over errors calculated between the traverse and tie line intersections. A fit-to-ties process was selectively applied and constrained by several parameters such as cross over height differences and maximum and minimum allowable corrections.

Using MAGSPEC Airborne Surveys' proprietary micro levelling techniques, some selective micro levelling was carefully applied; and the resulting channel was then considered final.

At all stages of processing the data were stringently checked against and compared to the previous processing stage to ensure the integrity of the data were protected and no detail was removed or altered. The data were gridded using a bi-cubic spline algorithm and delivered with both geodetic and projected coordinates.

5.2 Radiometrics

Radiometric processing consisted of the following steps:

- 256-channel spectral noise reduction in the form of NASVD
- Dead time, cosmic and background radiation corrections

- Energy recalibration
- Channel interaction correction (stripping) and extraction of ROIs
- Height corrections using STP altitude to the nominal survey height
- Radon removal using the Spectral Ratio method
- Levelling

Gamma-ray Spectrometric Data Processing

The raw spectra were first smoothed using the Noise Adjusted Singular Value Decomposition (NASVD) method, on a flight-by flight basis (Hovgaard and Grasty, 1997).

For the NASVD process twenty (20) principal components were generated. These components were visually inspected and the final number of components for reconstructing the spectra were determined. Eight (8) components were used to reconstruct the spectra, following consultation with the Client.

For all spectrometers, spectral drift was checked, by monitoring the potassium and thorium channel positions from average spectra along flight lines. The procedure for determining peak positions was the same as used during calibration. If the thorium peak is found to move more than 1 channel or the potassium peak by more than 0.5 channel, energy calibration is performed to determine the count rates in the standard windows.

Both the aircraft 256-channel background spectra and the scaled 256-channel cosmic spectra were subtracted from the 256-channel data.

Deadtime corrections were applied to each spectrum channel or window.

Radon background removal was performed using the Minty Spectral Ratio method (1992).

In areas of significant topographic variation, the altimeter data were first lightly filtered to smooth sudden jumps that can arise when flying over steep terrain (which cause problems when height-correcting the data). These data were then converted to effective height (h_e) at standard temperature and pressure (STP).

The background-corrected count rates in the 3 windows were stripped to give the counts in the potassium, uranium and thorium windows that originate solely from the potassium, uranium and thorium decay series. The window stripping ratios α , β , γ , a and g were estimated from measurements over calibration pads, where:

α - is the thorium into uranium stripping ratio, (equal to the ratio of counts detected in the uranium window to those detected in the thorium window from a pure thorium source);

β - is the thorium into potassium stripping ratio for a pure thorium source;

γ - is the uranium into potassium stripping ratio for a pure uranium source;

α - is the reversed stripping ratio, uranium into thorium, (equal to the ratio of counts detected in the thorium window to those detected in the uranium window from a pure source of uranium);

g - is the reverse stripping ratio, potassium into uranium for a pure potassium source.

The 3 principal stripping ratios (α , β and γ) increase with altitude above the ground as shown in the Table 1.1.

Table 1.1. Stripping ratio increase with Aircraft altitude at STP.

Stripping Ratio	Increase per metre
α	0.00049
β	0.00065
γ	0.00069

Each of the 3 main stripping ratios were adjusted for altitude before stripping was carried out. If 5 stripping ratios are used, then the stripped count rates in the potassium, uranium and thorium channels (N_K , N_U , N_{Th}) are given by:

$$N_K = \frac{[n_{Th}(\alpha\gamma - \beta) + n_U(a\beta - \gamma) + n_K(1 - a\alpha)]}{A}, \quad (A5)$$

$$N_U = \frac{[n_{Th}(g\beta - \alpha) + n_U - n_Kg]}{A}, \quad (A6)$$

$$N_{Th} = \frac{[n_{Th}(1 - g\gamma) - n_Ua + n_Kag]}{A}, \quad (A7)$$

Where: -

$$A = 1 - g\gamma - a(\alpha - g\beta). \quad (A8)$$

The background-corrected and stripped count rates were corrected for variations in the altitude of the detector using the equation:

$$N_{corr} = N_{obs} e^{-\mu(h_0 - h)}, \quad (A9)$$

where: -

- N_{corr} = the count rate normalized to the nominal Survey altitude, h_0 ;
- N_{obs} = the background corrected, stripped count rate at STP height h ;
- μ = the attenuation coefficient for that window.

Where the STP height above ground level exceeds 300 m, a value of $h = 300$ is used in equation A9.

The resulting potassium, uranium, thorium and total count (cps) were converted to concentrations using the coefficients derived from the Carnamah (WA) radiometric test range and Meander (Tas) hover range.

Where required, tieline levelling was applied to the Total Count and Uranium channels to remove any effects caused by residual radon background. A least-squares/median filter procedure over the calculated cross over errors at each intersection of the flight and tie lines generated a correction value. A new tie-line levelled channel was then output by application of this correction value to the original channel.

Where required, using MAGSPEC Airborne Surveys' proprietary micro levelling techniques, some selective micro levelling was carefully applied; and the resulting channel was then considered final. At all stages of processing the data were stringently checked against and compared to the previous processing stage to ensure the integrity of the data was protected and no detail was removed or altered. The data were gridded using a minimum curvature algorithm and delivered with both geodetic and projected coordinates.

5.3 Digital Elevation Model

DEM processing consisted of the following steps:

- Inspection of height channels
- Parallax correction of radar altimeter
- Subtraction of radar altimeter from GPS height
- Tie line and micro levelling

The GPS and radar heights were visually inspected for errors and any spikes were carefully corrected. The GPS ellipsoid height was converted to the geoid height using values from the Australian Vertical Working Surface (AVWS). The altimeter data were subtracted from the GPS height to create the Digital Elevation channels.

Tieline levelling was applied by way of a least-squares minimisation procedure using a polynomial fit of order 0 over the cross over errors calculated between the traverse and tie line intersections. Using MAGSPEC Airborne Surveys' proprietary micro levelling techniques, some selective micro levelling was carefully applied; and the resulting channel was then considered final. At all stages of processing the data were stringently checked against and compared to the previous processing stage to ensure the integrity of the data was protected and no detail was removed or altered. The data were gridded using a minimum curvature algorithm and delivered with both geodetic and projected coordinates.

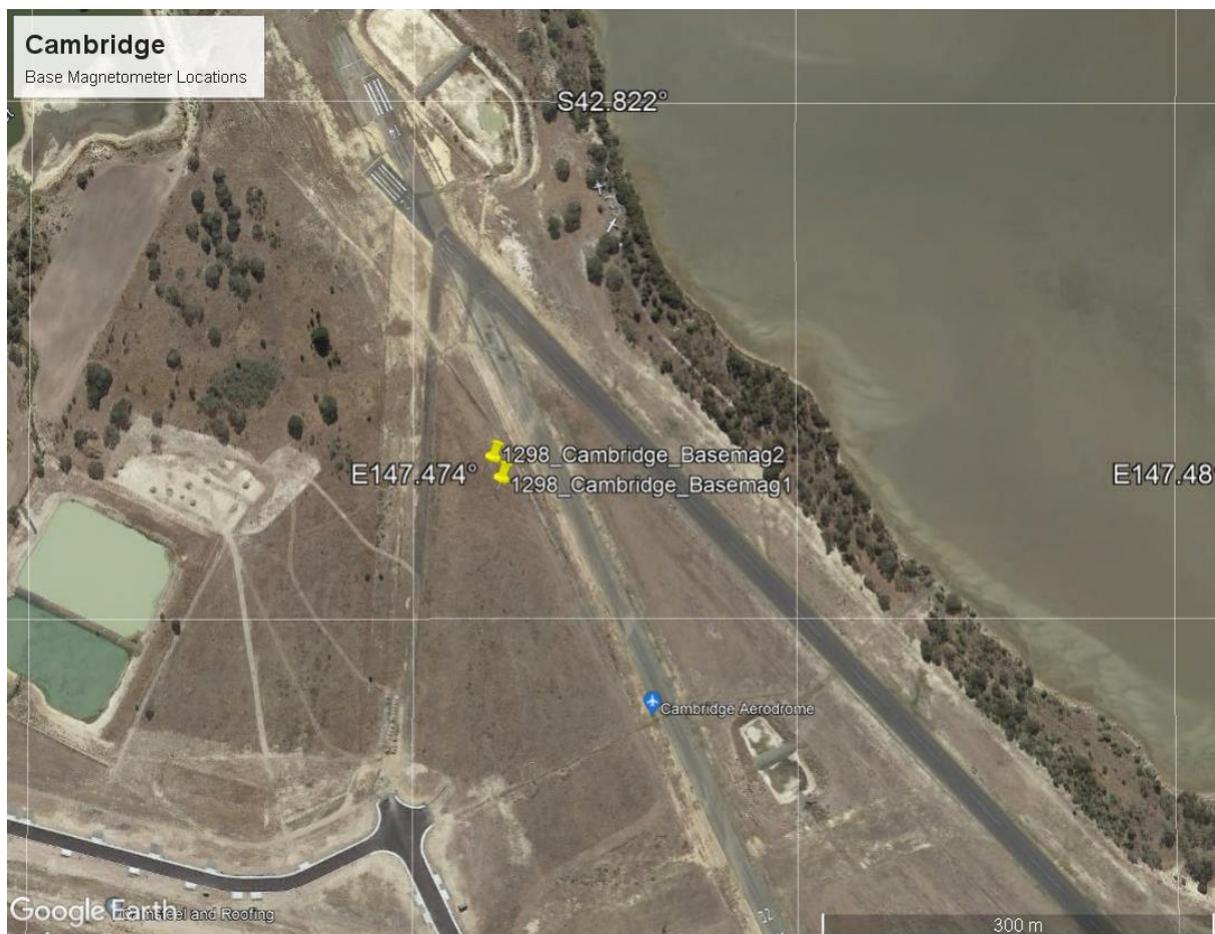
APPENDIX 1 FIELD OPERATIONS AND PROJECT MANAGEMENT

Operational Bases

The aircraft and crew were initially based in Cambridge (20/03/22 - 26/05/22), before moving to Swansea (28/05/22 – 22/06/22).

Base Station Magnetometers

The base station magnetometers were positioned near the airstrips with locations shown below: -



Base station 1 location co-ordinates (GDA2020): -42.8247116 °S; 147.4747867 °E

Base station 2 location co-ordinates (GDA2020): -42.8245662 °S; 147.4747078 °E



Base station 1 location co-ordinates (GDA2020): -42.1256145 °S;148.0610916 °E

Base station 2 location co-ordinates (GDA2020): -42.1257218 °S;148.0610744 °E

APPENDIX 2 DAILY CALIBRATIONS

Thorium Source Ground Calibration Checks

During the survey, pre- and post- flight thorium source calibration checks were undertaken with the aircraft stationary at the same location (where practical) at each base of operation, to confirm the health of the radiometric system.

The tabulated results of the daily thorium checks are shown below: -

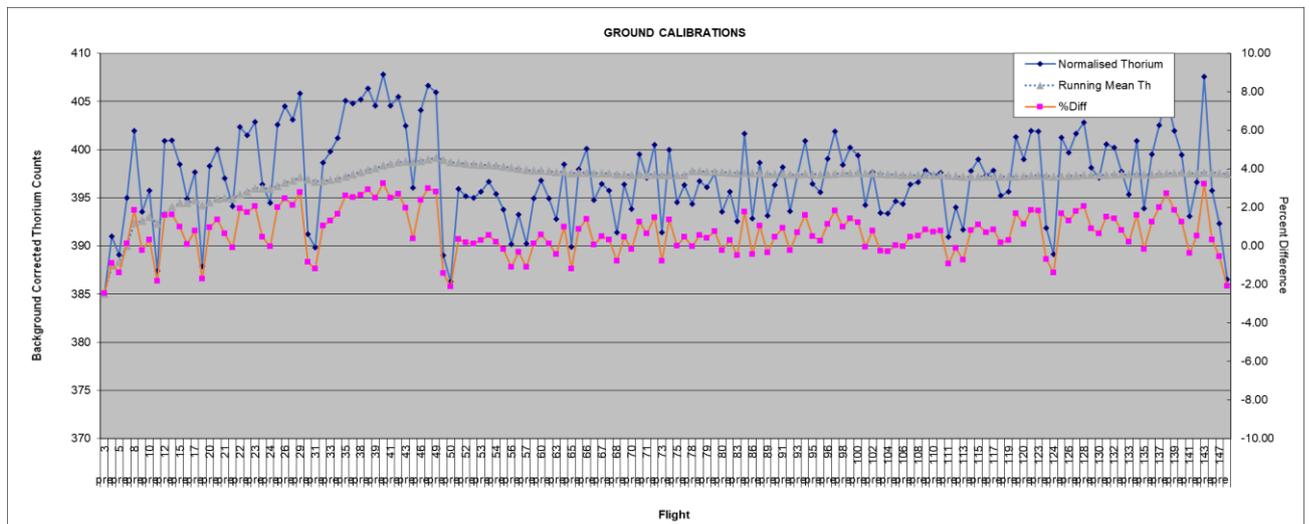
Date	Test	Flight #	Thorium Peak Ch #	Th Peak Resolution	Raw Th Count (cps)	Background Count (cps)	Background corrected (BC) Th (cps)	BC running average Th (cps)	% Change in BC Th average
20/03/2022	pre	3	217.50	4.67	432.48	47.47	385.01	385.01	-2.47
	pst	4	217.48	4.59	438.78	47.78	391.00	388.00	-0.90
21/03/2022	pre	5	217.38	4.73	436.09	47.04	389.06	388.35	-1.40
	pst	6	217.53	4.65	443.49	48.50	395.00	390.01	0.13
24/03/2022	pre	8	217.37	4.69	450.25	48.28	401.97	392.40	1.86
	pst	9	217.49	4.62	443.30	49.73	393.57	392.60	-0.24
25/03/2022	pre	10	217.27	4.70	444.31	48.58	395.73	393.05	0.31
	pst	11	217.58	4.66	435.67	48.26	387.41	392.34	-1.83
26/03/2022	pre	12	217.54	4.76	449.43	48.53	400.90	393.29	1.60
	pst	14	217.55	4.68	449.29	48.31	400.98	394.06	1.62
27/03/2022	pre	15	217.35	4.63	446.90	48.40	398.50	394.47	1.00
	pst	16	217.55	4.66	443.31	48.44	394.87	394.50	0.09
28/03/2022	pre	17	217.32	4.68	446.06	48.37	397.69	394.74	0.80
	pst	19	217.50	4.71	435.92	48.03	387.89	394.25	-1.70
29/03/2022	pre	20	217.38	4.78	447.03	48.73	398.30	394.52	0.95
	pst	20	217.45	4.66	448.87	48.86	400.02	394.87	1.38
31/03/2022	pre	21	217.44	4.71	444.36	47.35	397.02	394.99	0.63
	pst	21	217.42	4.72	441.68	47.53	394.15	394.95	-0.09
1/04/2022	pre	22	217.30	4.61	450.15	47.77	402.37	395.34	1.96
	pst	22	217.42	4.62	449.51	48.01	401.50	395.65	1.74
2/04/2022	pre	23	217.33	4.68	449.79	46.93	402.86	395.99	2.07
	pst	23	217.49	4.66	444.47	48.09	396.37	396.01	0.47
3/04/2022	pre	24	217.31	4.63	442.33	47.87	394.46	395.94	-0.01
	pst	25	217.45	4.75	455.42	47.85	402.57	396.22	2.00
4/04/2022	pre	26	217.28	4.63	452.95	48.44	404.51	396.55	2.48
	pst	28	217.45	4.67	456.18	48.08	403.10	396.80	2.13
5/04/2022	pre	29	217.42	4.72	453.20	47.37	405.84	397.13	2.79
	pst	30	217.53	4.60	433.68	42.43	391.26	396.92	-0.83
6/04/2022	pre	31	217.37	4.64	432.18	42.34	389.84	396.68	-1.20
	pst	32	217.55	4.67	442.07	43.42	398.65	396.75	1.04
7/04/2022	pre	33	217.44	4.69	442.74	42.95	399.79	396.84	1.32

	pst	34	217.50	4.64	457.25	47.06	401.19	396.98	1.67
9/04/2022	pre	35	217.44	4.74	453.01	47.93	405.08	397.23	2.61
	pst	37	217.50	4.73	452.55	47.77	404.79	397.45	2.54
10/04/2022	pre	38	217.31	4.71	454.20	48.98	405.22	397.67	2.65
	pst	38	217.41	4.67	449.72	43.35	406.37	397.91	2.92
11/04/2022	pre	39	217.30	4.73	448.19	43.60	404.59	398.09	2.49
	pst	40	217.44	4.64	450.62	42.80	407.82	398.35	3.27
12/04/2022	pre	41	217.34	4.72	448.58	44.02	404.55	398.51	2.49
	pst	42	217.50	4.63	452.80	43.30	405.50	398.68	2.71
13/04/2022	pre	43	217.37	4.74	455.89	43.39	402.50	398.77	1.99
	pst	45	217.50	4.64	439.82	43.80	396.02	398.71	0.38
14/04/2022	pre	46	217.40	4.71	458.02	43.92	404.10	398.83	2.38
	pst	48	217.48	4.54	459.77	43.12	406.66	399.01	2.99
15/04/2022	pre	49	217.34	4.61	459.85	43.88	405.98	399.17	2.83
	pst	49	217.65	4.67	432.23	43.22	389.01	398.95	-1.41
16/04/2022	pre	50	217.24	4.69	431.05	44.72	386.33	398.68	-2.11
	pst	51	217.56	4.69	439.30	43.39	395.92	398.62	0.36
17/04/2022	pre	52	217.29	4.66	439.13	43.94	395.19	398.55	0.17
	pst	52	217.44	4.71	438.00	42.99	395.01	398.48	0.13
18/04/2022	pre	53	217.27	4.64	439.11	43.47	395.64	398.42	0.29
	pst	53	217.53	4.67	439.77	43.10	396.67	398.39	0.55
19/04/2022	pre	54	217.38	4.78	439.93	44.56	395.38	398.33	0.22
	pst	55	217.48	4.68	437.57	43.76	393.81	398.25	-0.18
21/04/2022	pre	56	217.34	4.71	432.53	42.33	390.20	398.10	-1.10
	pst	56	217.62	4.64	437.15	43.91	393.24	398.02	-0.32
22/04/2022	pre	57	217.53	4.63	433.30	43.04	390.26	397.88	-1.09
	pst	59	217.50	4.62	437.11	42.18	394.93	397.83	0.11
23/04/2022	pre	60	217.49	4.71	440.35	43.57	396.78	397.81	0.57
	pst	62	217.53	4.66	437.39	42.44	394.95	397.76	0.11
24/04/2022	pre	63	217.38	4.67	474.71	81.92	392.79	397.68	-0.43
	pst	64	217.59	4.73	441.80	43.32	398.48	397.70	1.00
25/04/2022	pre	65	217.35	4.68	433.77	43.85	389.91	397.57	-1.18
	pst	65	217.52	4.65	441.18	43.22	397.96	397.58	0.87
26/04/2022	pre	66	217.37	4.76	442.08	42.00	400.08	397.62	1.40
	pst	66	217.49	4.68	438.36	43.58	394.78	397.57	0.07
27/04/2022	pre	67	217.50	4.66	439.42	42.97	396.45	397.56	0.49
	pst	67	217.50	4.65	438.84	43.06	395.78	397.53	0.32
29/04/2022	pre	68	217.45	4.68	441.16	49.74	391.42	397.44	-0.79
	pst	69	217.51	4.72	438.77	42.38	396.39	397.43	0.48
30/04/2022	pre	70	217.29	4.58	435.14	41.31	393.84	397.38	-0.17
	pst	70	217.40	4.63	442.14	42.60	399.54	397.41	1.26
1/05/2022	pre	71	217.41	4.71	439.07	41.97	397.10	397.40	0.66
	pst	72	217.50	4.71	443.15	42.66	400.49	397.44	1.50
2/05/2022	pre	73	217.38	4.67	435.24	43.82	391.42	397.36	-0.79
	pst	74	217.50	4.73	443.06	43.06	400.00	397.40	1.37
3/05/2022	pre	75	217.37	4.74	437.58	43.05	394.53	397.36	0.01

	pst	77	217.48	4.66	440.36	44.04	396.31	397.35	0.46
4/05/2022	pre	78	217.36	4.69	437.66	43.29	394.37	397.79	-0.03
	pst	78	217.40	4.74	444.91	48.16	396.75	397.77	0.57
6/05/2022	pre	79	217.34	4.64	444.48	48.38	396.11	397.74	0.41
	pst	79	217.39	4.69	439.15	41.58	397.57	397.74	0.77
9/05/2022	pre	80	217.43	4.67	436.96	43.40	393.56	397.67	-0.24
	pst	82	217.60	4.59	437.76	42.14	395.61	397.63	0.28
10/05/2022	pre	83	217.48	4.71	434.11	41.56	392.55	397.55	-0.50
	pst	85	217.60	4.58	444.64	41.96	401.68	397.62	1.79
11/05/2022	pre	86	217.50	4.75	433.65	40.80	392.85	397.54	-0.42
	pst	88	217.53	4.63	440.64	42.00	398.64	397.56	1.04
12/05/2022	pre	89	217.39	4.65	435.52	42.40	393.12	397.49	-0.35
	pst	90	217.48	4.64	437.75	41.42	396.33	397.47	0.46
13/05/2022	pre	91	217.47	4.73	439.81	41.61	398.20	397.48	0.93
	pst	92	217.47	4.75	435.86	42.24	393.62	397.43	-0.22
15/05/2022	pre	93	217.41	4.69	439.25	41.96	397.30	397.42	0.70
	pst	94	217.60	4.65	443.01	42.09	400.93	397.47	1.60
17/05/2022	pre	95	217.51	4.68	437.98	41.55	396.43	397.46	0.49
	pst	95	217.49	4.63	436.55	41.00	395.55	397.43	0.27
20/05/2022	pre	96	217.55	4.72	439.90	40.83	399.08	397.45	1.15
	pst	97	217.49	4.65	443.41	41.52	401.89	397.51	1.84
21/05/2022	pre	98	217.42	4.84	439.62	41.21	398.41	397.53	0.98
	pst	99	217.59	4.65	441.98	41.77	400.21	397.56	1.43
22/05/2022	pre	100	217.57	4.67	440.18	40.79	399.39	397.59	1.22
	pst	101	217.63	4.65	435.50	41.23	394.27	397.54	-0.06
23/05/2022	pre	102	217.52	4.65	438.71	41.02	397.69	397.54	0.80
	pst	103	217.56	4.73	435.20	41.76	393.44	397.49	-0.27
24/05/2022	pre	104	217.33	4.63	434.11	40.76	393.35	397.44	-0.29
	pst	105	217.62	4.65	435.58	40.93	394.64	397.41	0.04
25/05/2022	pre	106	217.44	4.79	436.59	42.22	394.36	397.37	-0.03
	pst	107	217.65	4.65	438.28	41.90	396.39	397.36	0.48
26/05/2022	pre	108	217.51	4.78	438.83	42.20	396.63	397.35	0.54
	pst	109	217.44	4.70	438.38	40.56	397.82	397.36	0.83
28/05/2022	pre	110	217.45	4.67	449.09	51.72	397.37	397.36	0.72
	pst	110	217.53	4.74	448.53	50.94	397.59	397.36	0.78
29/05/2022	pre	111	217.49	4.73	443.11	52.20	390.91	397.29	-0.92
	pst	112	217.66	4.65	445.26	51.23	394.03	397.25	-0.12
30/05/2022	pre	113	217.46	4.70	442.97	51.26	391.71	397.19	-0.71
	pst	114	217.68	4.62	450.16	52.37	397.79	397.20	0.83
31/05/2022	pre	115	217.54	4.81	451.02	52.05	398.97	397.22	1.12
	pst	116	217.67	4.67	449.31	52.00	397.31	397.22	0.71
2/06/2022	pre	117	217.53	4.74	447.66	49.85	397.81	397.22	0.83
	pst	118	217.56	4.68	446.56	51.32	395.24	397.20	0.19
3/06/2022	pre	119	217.53	4.75	446.18	50.56	395.62	397.19	0.28
	pst	119	217.62	4.69	455.78	51.46	401.31	397.23	1.70
4/06/2022	pre	120	217.46	4.73	450.40	51.39	399.02	397.25	1.13

	pst	122	217.61	4.60	454.24	50.29	401.95	397.29	1.85
6/06/2022	pre	123	217.43	4.69	452.24	49.36	401.88	397.34	1.84
	pst	123	217.48	4.73	443.40	51.56	391.84	397.28	-0.68
7/06/2022	pre	124	217.48	4.66	437.07	49.95	389.12	397.21	-1.38
	pst	125	217.50	4.65	452.29	50.04	401.25	397.24	1.68
8/06/2022	pre	126	217.50	4.72	449.97	50.29	399.69	397.27	1.30
	pst	127	217.63	4.57	453.00	50.32	401.68	397.31	1.79
13/06/2022	pre	128	217.48	4.69	455.26	51.45	402.81	397.36	2.06
	pst	129	217.55	4.64	449.02	50.88	398.14	397.37	0.92
14/06/2022	pre	130	217.39	4.73	447.31	50.24	397.07	397.37	0.65
	pst	131	217.73	4.61	451.30	50.75	400.55	397.39	1.51
15/06/2022	pre	132	217.43	4.68	450.51	50.31	400.20	397.42	1.43
	pst	132	217.43	4.83	450.72	52.99	397.73	397.42	0.81
16/06/2022	pre	133	217.49	4.74	445.34	49.99	395.35	397.40	0.21
	pst	134	217.56	4.66	449.82	48.93	400.90	397.43	1.60
17/06/2022	pre	135	217.46	4.68	444.17	50.30	393.88	397.40	-0.16
	pst	136	217.65	4.62	449.73	50.20	399.54	397.42	1.26
18/06/2022	pre	137	217.45	4.69	450.04	47.52	402.52	397.47	1.99
	pst	138	217.64	4.67	455.18	49.61	405.57	397.53	2.73
19/06/2022	pre	139	217.50	4.74	448.38	46.43	401.95	397.57	1.85
	pst	140	217.59	4.63	447.85	48.39	399.46	397.59	1.24
20/06/2022	pre	141	217.57	4.68	442.35	49.26	393.09	397.55	-0.36
	pst	141	217.55	4.75	445.90	49.31	396.59	397.54	0.53
21/06/2022	pre	143	217.59	4.72	456.63	49.05	407.58	397.62	3.21
	pst	146	217.67	4.65	445.26	49.50	395.76	397.61	0.32
22/06/2022	pre	147	217.47	4.71	441.46	49.12	392.34	397.57	-0.55
	pst	147	217.48	4.71	428.77	42.27	386.50	397.48	-2.07

A summary plot of the thorium ground calibration checks is shown below: -



GPS Accuracy - Static Positions

The GPS position (XYZ) of the aircraft was recorded during the daily ground calibrations at the base of operations and are tabled below: -

Cambridge

Date	Average Easting (MGA55)	Average Northing (MGA55)	Average Height (m)
220320	538846.61	5258047.36	18.27
220321	538847.16	5258046.32	18.85
220321	538847.15	5258046.28	18.86
220324	538848.30	5258047.61	19.25
220324	538848.16	5258047.43	18.55
220325	538846.82	5258044.89	18.48
220325	538846.78	5258044.92	18.42
220326	538845.83	5258046.64	17.65
220326	538845.87	5258046.51	17.56
220327	538848.12	5258047.58	19.09
220327	538848.13	5258047.46	19.16
220328	538847.71	5258047.68	18.45
220328	538847.49	5258047.61	19.20
220329	538847.45	5258049.53	15.59
220329	538847.45	5258049.52	15.60
220331	538847.06	5258046.50	18.09
220331	538847.08	5258046.52	18.20
220401	538847.36	5258047.73	18.73
220401	538847.50	5258047.61	18.44
220402	538847.90	5258047.20	18.41
220402	538848.08	5258047.13	17.68
220403	538846.68	5258046.99	17.81
220403	538846.73	5258047.55	19.10
220404	538848.34	5258046.92	18.05
220404	538848.20	5258046.96	18.31
220405	538848.65	5258046.28	16.54
220405	538848.61	5258046.73	17.26
220406	538832.56	5258062.95	19.06
220406	538832.56	5258062.94	19.05

220407	538831.63	5258063.35	19.68
220407	538831.60	5258063.50	19.63
220409	538847.23	5258048.52	20.13
220409	538847.32	5258048.47	20.03
220410	538846.88	5258046.38	19.21
220410	538846.83	5258046.33	19.23
220411	538832.93	5258063.67	18.75
220411	538832.92	5258063.71	18.69
220412	538832.88	5258063.04	18.94
220412	538831.86	5258063.55	18.73
220413	538832.33	5258062.90	17.55
220413	538831.61	5258063.50	18.24
220414	538832.02	5258062.85	19.15
220414	538831.93	5258063.24	18.99
220415	538831.89	5258063.51	18.61
220415	538832.04	5258063.33	18.89
220416	538833.85	5258064.04	18.83
220416	538833.39	5258064.02	18.45
220417	538832.56	5258063.54	18.29
220417	538832.41	5258063.41	18.76
220418	538834.26	5258063.57	18.94
220418	538834.13	5258063.25	18.25
220419	538834.09	5258064.09	18.46
220419	538834.76	5258064.25	18.82
220421	538832.02	5258063.98	19.27
220421	538832.95	5258063.24	19.04
220422	538832.90	5258063.24	18.99
220422	538831.61	5258063.71	18.72
220423	538833.80	5258063.37	18.59
220423	538833.50	5258063.14	19.11
220424	538832.41	5258063.20	18.22
220424	538832.42	5258063.20	18.15
220425	538832.93	5258063.60	17.75
220425	538833.06	5258063.57	18.49
220426	538832.55	5258064.19	18.71
220426	538832.53	5258063.72	18.46

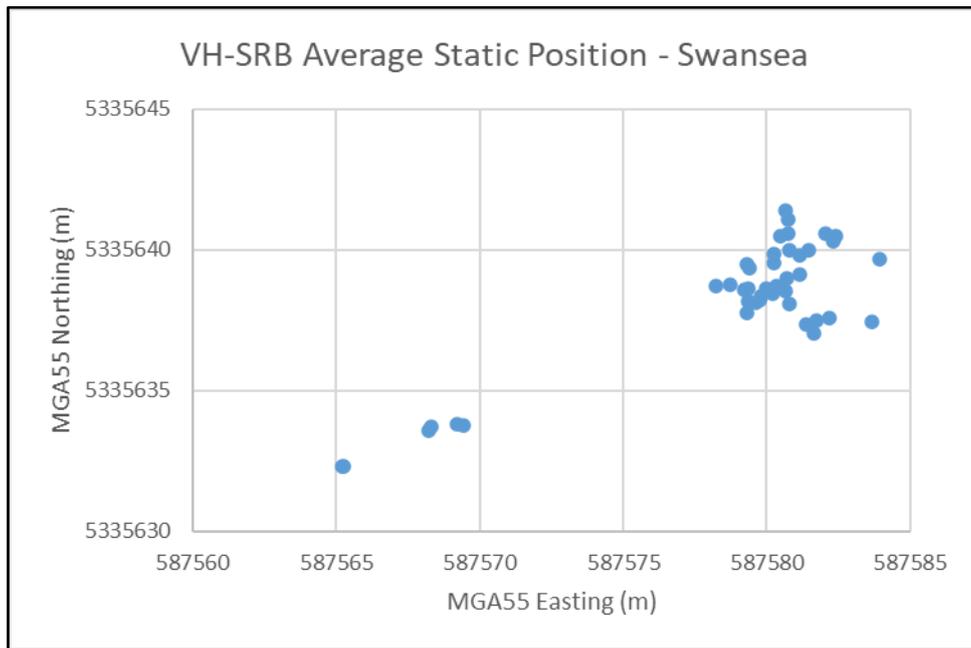
220427	538832.02	5258062.76	18.90
220427	538831.86	5258062.95	18.48
220429	538832.21	5258063.98	18.41
220429	538832.17	5258063.94	18.33
220430	538832.70	5258064.00	19.44
220430	538832.43	5258063.96	18.80
220501	538832.22	5258063.21	18.55
220501	538832.16	5258063.79	18.69
220502	538833.33	5258064.58	18.70
220502	538834.18	5258064.40	18.65
220503	538832.56	5258064.24	18.38
220503	538833.36	5258064.23	18.78
220504	538835.19	5258063.77	18.03
220504	538834.67	5258063.68	17.92
220506	538841.31	5258042.24	16.71
220506	538841.57	5258042.39	18.16
220509	538834.33	5258063.43	18.49
220509	538834.30	5258063.42	18.48
220510	538834.56	5258064.82	18.72
220510	538834.97	5258064.63	19.05
220511	538833.05	5258064.72	17.92
220511	538832.74	5258064.72	18.56
220512	538834.45	5258063.91	18.08
220512	538834.02	5258063.99	18.68
220513	538833.69	5258064.22	17.99
220513	538833.04	5258064.10	18.11
220515	538836.59	5258079.21	18.29
220515	538836.67	5258079.33	18.59
220517	538833.05	5258063.54	18.10
220517	538833.00	5258063.61	18.27
220520	538833.22	5258064.74	19.29
220520	538833.26	5258064.67	19.14
220521	538831.88	5258064.35	18.73
220521	538831.70	5258064.32	18.47
220522	538830.91	5258064.18	18.69
220522	538830.95	5258064.15	18.44

220523	538832.42	5258064.31	18.24
220523	538832.35	5258063.93	18.03
220524	538831.14	5258063.91	18.38
220524	538831.57	5258063.59	17.58
220525	538831.46	5258064.60	18.31
220525	538831.25	5258064.68	18.28
220526	538831.59	5258064.39	18.87
220526	538831.83	5258064.48	18.54

Swansea

Date	Average Easting (MGA55)	Average Northing (MGA55)	Average Height (m)
220528	587579.36	5335638.15	11.65
220528	587579.62	5335638.13	11.74
220529	587580.47	5335640.47	11.73
220529	587580.75	5335640.56	11.88
220530	587580.73	5335641.06	12.33
220530	587580.64	5335641.39	12.46
220531	587568.32	5335633.70	12.15
220531	587568.21	5335633.57	12.17
220602	587569.42	5335633.77	12.09
220602	587569.20	5335633.81	11.82
220603	587579.22	5335638.57	12.19
220603	587579.35	5335638.61	12.21
220604	587565.22	5335632.32	12.20
220604	587565.25	5335632.32	12.19
220606	587581.73	5335637.50	11.63
220606	587582.17	5335637.57	12.24
220607	587581.66	5335637.03	11.07
220607	587581.37	5335637.34	11.68
220608	587579.42	5335639.34	10.38
220608	587579.30	5335639.47	11.83
220613	587580.78	5335638.07	12.27
220613	587579.75	5335638.20	12.03
220614	587579.98	5335638.63	11.27

220614	587580.35	5335638.71	12.16
220615	587581.15	5335639.12	13.96
220615	587580.68	5335638.96	12.02
220616	587580.21	5335638.43	11.05
220616	587580.64	5335638.54	11.81
220617	587582.04	5335640.57	12.96
220617	587582.30	5335640.32	12.42
220618	587581.48	5335639.97	11.02
220618	587582.40	5335640.46	12.24
220619	587579.30	5335637.75	11.80
220619	587579.79	5335638.34	12.34
220620	587583.66	5335637.43	9.43
220620	587583.93	5335639.67	11.68
220622	587580.23	5335639.84	12.59
220622	587580.26	5335639.51	11.03
220621	587581.17	5335639.79	11.86
220621	587580.77	5335639.97	11.59
220623	587578.72	5335638.76	12.39
220623	587578.21	5335638.72	11.62



Average Static Positions – Swansea
(n.b. aircraft parking position changes)

Low Level Test Lines

Radiometric low-level test lines were established near each base of operation. The daily data were collected to monitor the effects of soil moisture and the average thorium counts were tabulated and plotted.

Cambridge Base



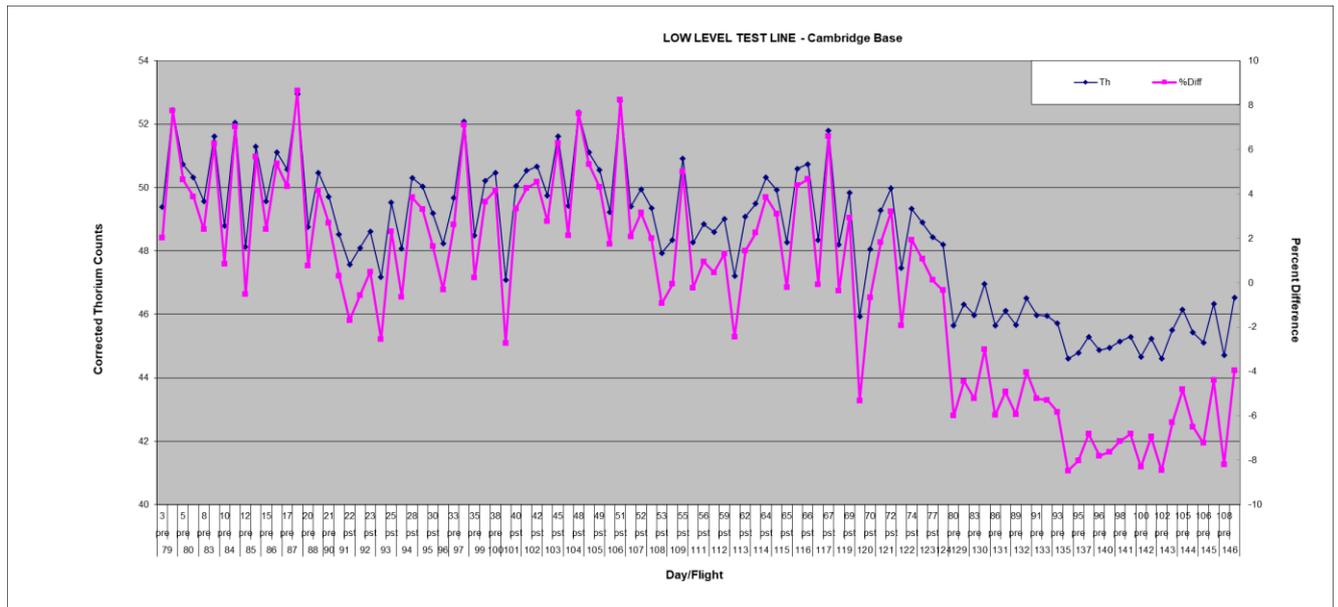
Radiometric Testline – Cambridge Base

Start and end coordinates (MGA55): 537468 E, 5259930 N to 539406 E, 5257950 N

Date	Flight #	Average Corrected Th (cps)	Deviation from Mean (%)
20/03/2022	3	49.38	2.03
	4	52.44	7.75
21/03/2022	5	50.73	4.64
	6	50.33	3.88
24/03/2022	8	49.57	2.40
	9	51.61	6.26
25/03/2022	10	48.79	0.85
	11	52.04	7.04
26/03/2022	12	48.12	-0.53
	14	51.29	5.68
27/03/2022	15	49.58	2.42
	16	51.11	5.36
28/03/2022	17	50.57	4.34
	19	52.95	8.64
29/03/2022	20	48.75	0.76
	20	50.47	4.15
31/03/2022	21	49.71	2.69
1/04/2022	22	48.52	0.29
	22	47.57	-1.70
2/04/2022	23	48.10	-0.58
	23	48.62	0.49
3/04/2022	24	47.17	-2.55
	25	49.52	2.32
4/04/2022	26	48.07	-0.64
	28	50.31	3.84
5/04/2022	29	50.04	3.31
	30	49.18	1.64
6/04/2022	31	48.23	-0.31
7/04/2022	33	49.67	2.61
	34	52.08	7.11
9/04/2022	35	48.49	0.23
	37	50.21	3.65
10/04/2022	38	50.47	4.15
11/04/2022	39	47.09	-2.73
	40	50.05	3.33
12/04/2022	41	50.53	4.26
	42	50.67	4.53
13/04/2022	43	49.75	2.76
	45	51.62	6.28
14/04/2022	46	49.43	2.13
	48	52.37	7.62

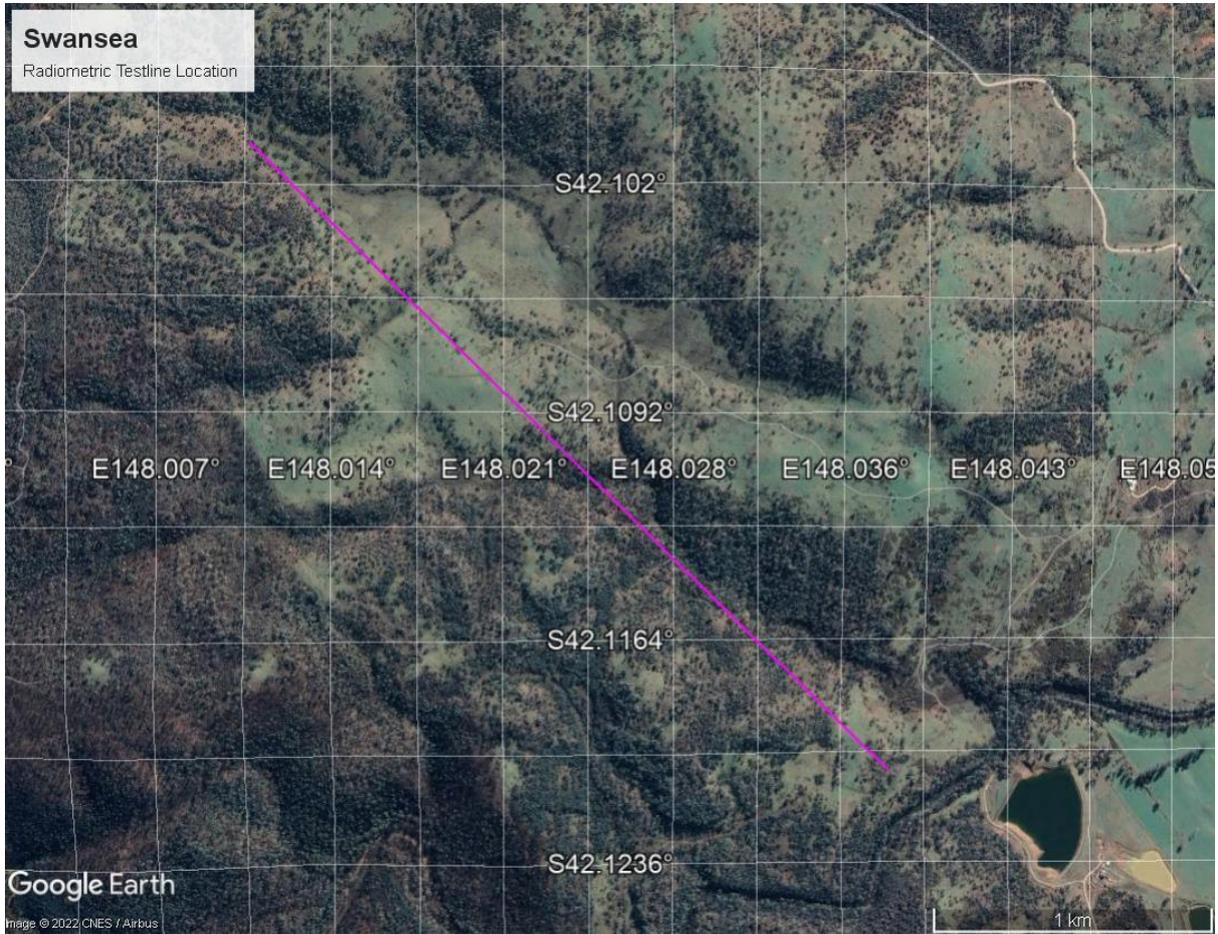
15/04/2022	49	51.11	5.34
	49	50.55	4.30
16/04/2022	50	49.23	1.73
	51	52.72	8.24
17/04/2022	52	49.40	2.08
	52	49.95	3.15
18/04/2022	53	49.36	1.99
	53	47.93	-0.93
19/04/2022	54	48.34	-0.07
	55	50.92	4.99
21/04/2022	56	48.26	-0.24
	56	48.84	0.95
22/04/2022	57	48.60	0.46
	59	49.02	1.30
23/04/2022	60	47.22	-2.46
	62	49.09	1.44
24/04/2022	63	49.49	2.25
	64	50.31	3.85
25/04/2022	65	49.93	3.10
	65	48.28	-0.21
26/04/2022	66	50.60	4.38
	66	50.74	4.66
27/04/2022	67	48.34	-0.08
	67	51.79	6.59
29/04/2022	68	48.20	-0.36
	69	49.83	2.92
30/04/2022	70	45.93	-5.32
	70	48.05	-0.68
1/05/2022	71	49.28	1.82
	72	49.98	3.21
2/05/2022	73	47.46	-1.92
	74	49.33	1.93
3/05/2022	75	48.90	1.07
	77	48.44	0.12
4/05/2022	78	48.21	-0.35
9/05/2022	80	45.64	-5.99
	82	46.32	-4.45
10/05/2022	83	45.98	-5.22
	85	46.97	-3.00
11/05/2022	86	45.65	-5.97
	88	46.11	-4.91
12/05/2022	89	45.67	-5.94
	90	46.50	-4.03
13/05/2022	91	45.97	-5.23
	92	45.95	-5.29
15/05/2022	93	45.71	-5.83

17/05/2022	95	44.79	-8.02
	95	45.29	-6.81
20/05/2022	96	44.87	-7.81
	97	44.95	-7.62
21/05/2022	98	45.15	-7.14
	99	45.29	-6.81
22/05/2022	100	44.67	-8.31
	101	45.24	-6.94
23/05/2022	102	44.60	-8.46
	103	45.51	-6.30
24/05/2022	105	46.16	-4.81
	105	45.43	-6.50
25/05/2022	106	45.12	-7.23
	107	46.34	-4.40
26/05/2022	108	44.71	-8.19
	109	46.53	-3.97



Low level test line – Cambridge Base
 (n.b. drop in counts after 4th May 2022 due to heavy rains)

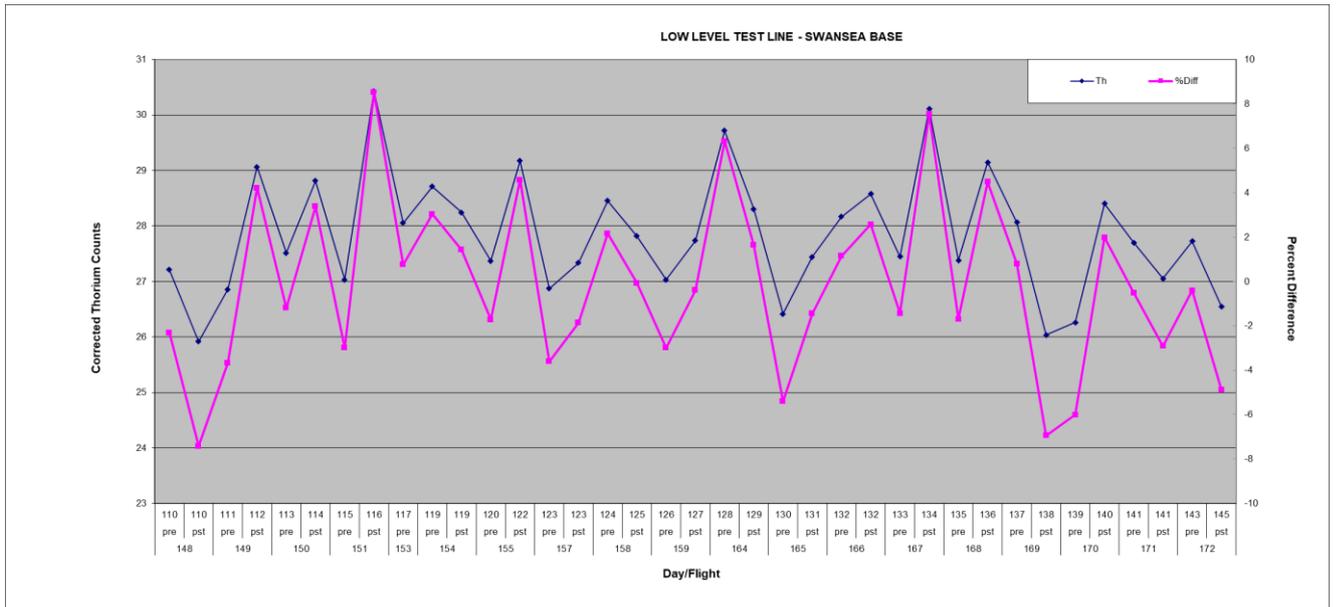
Swansea Base



Radiometric Testline – Swansea Base

Start and end coordinates (MGA55): 583552 E, 5338552 N to 585777 E, 5336308 N

Date	Flight #	Average Corrected Th (cps)	Deviation from Mean (%)
28/05/2022	110	27.21	-2.32
	110	25.92	-7.42
29/05/2022	111	26.86	-3.67
	112	29.06	4.21
30/05/2022	113	27.51	-1.19
	114	28.82	3.38
31/05/2022	115	27.03	-2.99
	116	30.43	8.51
2/06/2022	117	28.05	0.75
3/06/2022	119	28.71	3.03
	119	28.24	1.42
4/06/2022	120	27.37	-1.72
	122	29.17	4.57
6/06/2022	123	26.87	-3.61
	123	27.33	-1.86
7/06/2022	124	28.45	2.16
	125	27.82	-0.08
8/06/2022	126	27.03	-3.00
	127	27.73	-0.39
13/06/2022	128	29.72	6.32
	129	28.30	1.63
14/06/2022	130	26.41	-5.41
	131	27.44	-1.45
15/06/2022	132	28.16	1.15
	132	28.58	2.57
16/06/2022	133	27.45	-1.44
	134	30.11	7.53
17/06/2022	135	27.38	-1.69
	136	29.15	4.49
18/06/2022	137	28.07	0.80
	138	26.03	-6.95
19/06/2022	139	26.26	-6.01
	140	28.40	1.97
20/06/2022	141	27.70	-0.51
	141	27.05	-2.92
21/06/2022	143	27.73	-0.41
	145	26.55	-4.87



Low level test line – Swansea Base

APPENDIX 3 PROCESSING PARAMETERS AND DELIVERABLES

Magnetics

Average Diurnal

Cambridge: 61,800 nT
Swansea: 61,125 nT

IGRF Correction Parameters

Year: 2022.33
Height: 270 m
Latitude: -42.6086587 °
Longitude: 147.6824184 °
Total Field: 61816.90 nT
Declination: 15.3669 °
Inclination: -72.3201 °

Radiometrics

Radiometric Correction Parameters

Height Attenuation Coefficients (theoretical values used)

Total Count:	-0.0074
Potassium:	-0.0094
Uranium:	-0.0084
Thorium:	-0.0074

Aircraft Background Coefficients

Total Count:	78.491
Potassium:	7.0611
Uranium:	4.187
Thorium:	0.00

Cosmic Correction Coefficients

Total Count:	1.1399
Potassium:	0.0648

Uranium:	0.0497
Thorium:	0.0645

Radiometric Stripping Coefficients

Alpha:	0.3030
Beta:	0.4847
Gamma:	0.7935
a:	0.0413

Radiometric Concentration Coefficients

Total Count:	26.9
Potassium:	89.6
Uranium:	9.6
Thorium:	4.8

Located and Gridded Data

Located data were supplied in ASEG-GDF format (.DAT, .DES, .DFN). Gridded data were supplied in ERMapper format (.ERS).

Raw ASCII Located Data File Formats and Channels

Magnetics

flight:I5:NULL=-999
LINE:I9:NULL=-9999999
fiducial:I9:NULL=-9999999
date:I10:NULL=-99999999:UNIT=YYYYMMDD
time_gps:F10.2:NULL=-99999.99:UNIT=seconds past midnight UTC
time_local:F10.2:NULL=-99999.99:UNIT=seconds past midnight AEDT
longitude:F13.7:NULL=-999.9999999:UNIT=decimal degrees
latitude:F13.7:NULL=-999.9999999:UNIT=decimal degrees
easting:F11.2:NULL=-999999.99:UNIT=metres
northing:F12.2:NULL=-9999999.99:UNIT=metres
gnss_height:F8.2:NULL=-999.99:UNIT=metres
gnss_height_edited:F8.2:NULL=-999.99:UNIT=metres
sv_number:I4:NULL=-99
radar_raw:F8.2:NULL=-999.99:UNIT=metres
radar_calibrated:F8.2:NULL=-999.99:UNIT=metres
radar_calibrated_edited:F8.2:NULL=-999.99:UNIT=metres
fluxgate_x:F11.3:NULL=-99999.999:UNIT=nT
fluxgate_y:F11.3:NULL=-99999.999:UNIT=nT
fluxgate_z:F11.3:NULL=-99999.999:UNIT=nT
magnetics_raw:F11.3:NULL=-99999.999:UNIT=nT
magnetics_compensated:F11.3:NULL=-99999.999:UNIT=nT
magnetics_compensated_edited:F11.3:NULL=-99999.999:UNIT=nT
magnetic_diurnal:F11.3:NULL=-99999.999:UNIT=nT

Diurnal

date:I10:NULL=-99999999:UNIT=YYYYMMDD
time_gps:F10.2:NULL=-99999.99:UNIT=seconds past midnight UTC
time_local:F10.2:NULL=-99999.99:UNIT=seconds past midnight AEDT
magnetic_diurnal_raw:F11.3:NULL=-99999.999:UNIT=nT

Radiometrics

flight:I5:NULL=-999
LINE:I9:NULL=-9999999
fiducial:I9:NULL=-9999999
date:I10:NULL=-99999999

time_gps:F10.2:NULL=-99999.99:UNIT=seconds past midnight UTC
time_local:F10.2:NULL=-99999.99:UNIT=seconds past midnight AEDT
longitude:F13.7:NULL=-999.9999999:UNIT=degrees
latitude:F13.7:NULL=-999.9999999:UNIT=degrees
easting:F11.2:NULL=-999999.99:UNIT=metres
northing:F12.2:NULL=-9999999.99:UNIT=metres
gnss_height_edited:F8.2:NULL=-999.99:UNIT=metres
radar_calibrated_edited:F8.2:NULL=-999.99:UNIT=metres
pressure:F8.2:NULL=-999.99:UNIT=mbar
temperature:F7.2:NULL=-99.99:UNIT=degrees C
k_raw:F9.2:NULL=-999.99:UNIT=cps
u_raw:F9.2:NULL=-999.99:UNIT=cps
th_raw:F9.2:NULL=-999.99:UNIT=cps
total_count_raw:F10.2:NULL=-9999.99:UNIT=cps
k_nasvd:F9.2:NULL=-999.99:UNIT=cps
u_nasvd:F9.2:NULL=-999.99:UNIT=cps
th_nasvd:F9.2:NULL=-999.99:UNIT=cps
total_count_nasvd:F10.2:NULL=-9999.99:UNIT=cps
cosmic_raw:F9.2:NULL=-999.99:UNIT=cps
sample_integration:I6:NULL=-9999:UNIT=ms
live_time:I6:NULL=-9999:UNIT=ms
resolution:F6.2:NULL=-9.99:UNIT=percent
spectrum:256F6.0:NULL=-99:UNIT=cps

Final ASCII Located Data File Formats and Channels

Magnetics

flight:I5:NULL=-999
LINE:I9:NULL=-9999999
fiducial:I9:NULL=-9999999
date:I10:NULL=-99999999
longitude:F13.7:NULL=-999.9999999:UNIT=decimal degrees
latitude:F13.7:NULL=-999.9999999:UNIT=decimal degrees
easting:F11.2:NULL=-999999.99:UNIT=metres
northing:F12.2:NULL=-9999999.99:UNIT=metres
gnss_height:F8.2:NULL=-999.99:UNIT=metres
radar_altimeter:F8.2:NULL=-999.99:UNIT=metres
radar_dem:F8.2:NULL=-999.99:UNIT=metres
magnetics_corrected:F11.3:NULL=-99999.999:UNIT=nT
magnetics_corrected_tielevelled:F11.3:NULL=-99999.999:UNIT=nT
magnetics_corrected_microlevelled:F11.3:NULL=-99999.999:UNIT=nT
magnetics_corrected_microlevelled_1vd:F11.6:NULL=-99.9999999:UNIT=nT/m
magnetic_diurnal:F11.3:NULL=-99999.999:UNIT=nT
magnetic_igrf:F11.3:NULL=-99999.999:UNIT=nT

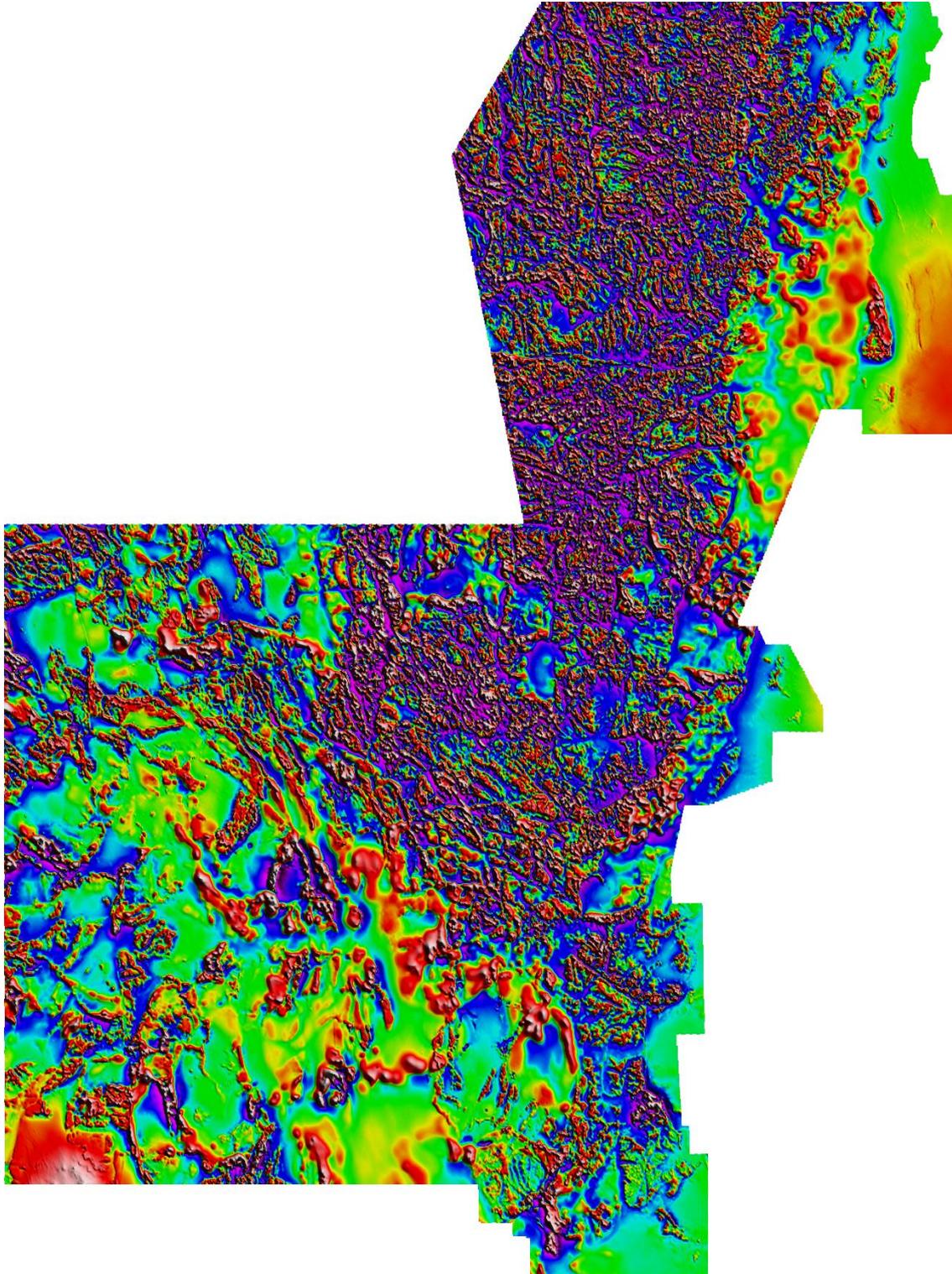
Radiometrics

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LINE:I9:NULL=-9999999
fiducial:I9:NULL=-9999999
date:I10:NULL=-99999999
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latitude:F13.7:NULL=-999.9999999:UNIT=degrees
easting:F11.2:NULL=-999999.99:UNIT=metres
northing:F12.2:NULL=-9999999.99:UNIT=metres
gnss_height:F8.2:NULL=-999.99:UNIT=metres
radar_altimeter:F8.2:NULL=-999.99:UNIT=metres
radar_dem:F8.2:NULL=-999.99:UNIT=metres
pressure:F8.2:NULL=-999.99:UNIT=mbar
temperature:F7.2:NULL=-99.99:UNIT=degrees C
dose_rate:F11.3:NULL=-9999.999:UNIT=nGy/hr
k_percent:F9.2:NULL=-999.99:UNIT=percent
th_ppm:F9.2:NULL=-999.99:UNIT=ppm
u_ppm:F9.2:NULL=-999.99:UNIT=ppm
dose_rate_nasvd:F11.3:NULL=-9999.999:UNIT=nGy/hr
k_percent_nasvd:F9.2:NULL=-999.99:UNIT=percent
th_ppm_nasvd:F9.2:NULL=-999.99:UNIT=ppm
u_ppm_nasvd:F9.2:NULL=-999.99:UNIT=ppm

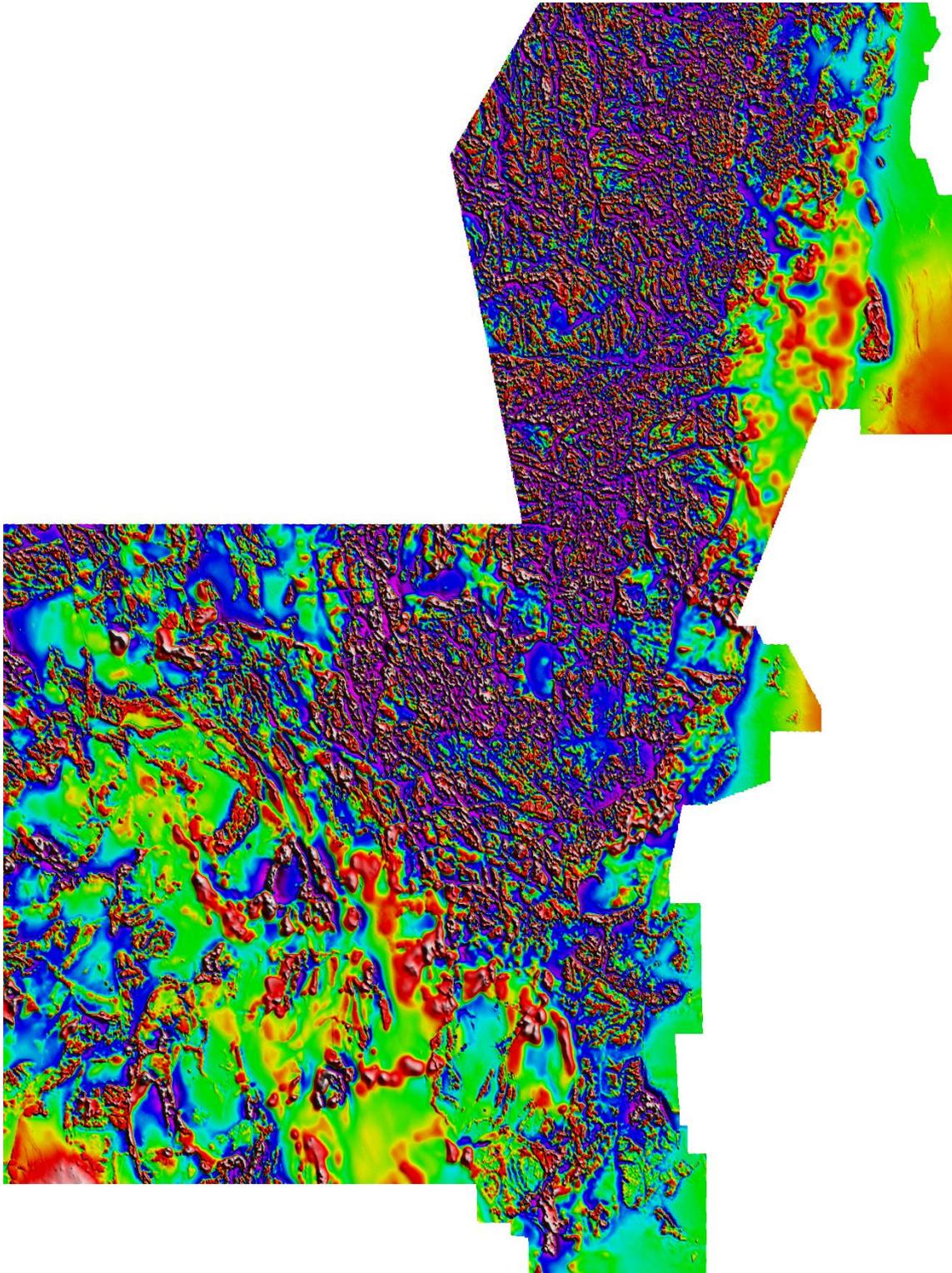
Gridded Data File Names and Descriptions

20220921_P5020_1_TMI:	Total Magnetic Intensity (TMI)
20220921_P5020_1_TMI_RTP:	TMI Reduced to Pole (RTP)
20220921_P5020_1_TMI_RTP_1VD:	TMI RTP with a First Vertical Derivative applied (1VD)
20220921_P5020_1_radar_DEM:	Radar Digital Elevation Model
20220921_P5020_1_dose_rate_nasvd:	Dose Rate NASVD smoothed
20220921_P5020_1_K_percent_nasvd:	Potassium NASVD smoothed
20220921_P5020_1_Th_ppm_nasvd:	Thorium NASVD smoothed
20220921_P5020_1_U_ppm_nasvd:	Uranium NASVD smoothed

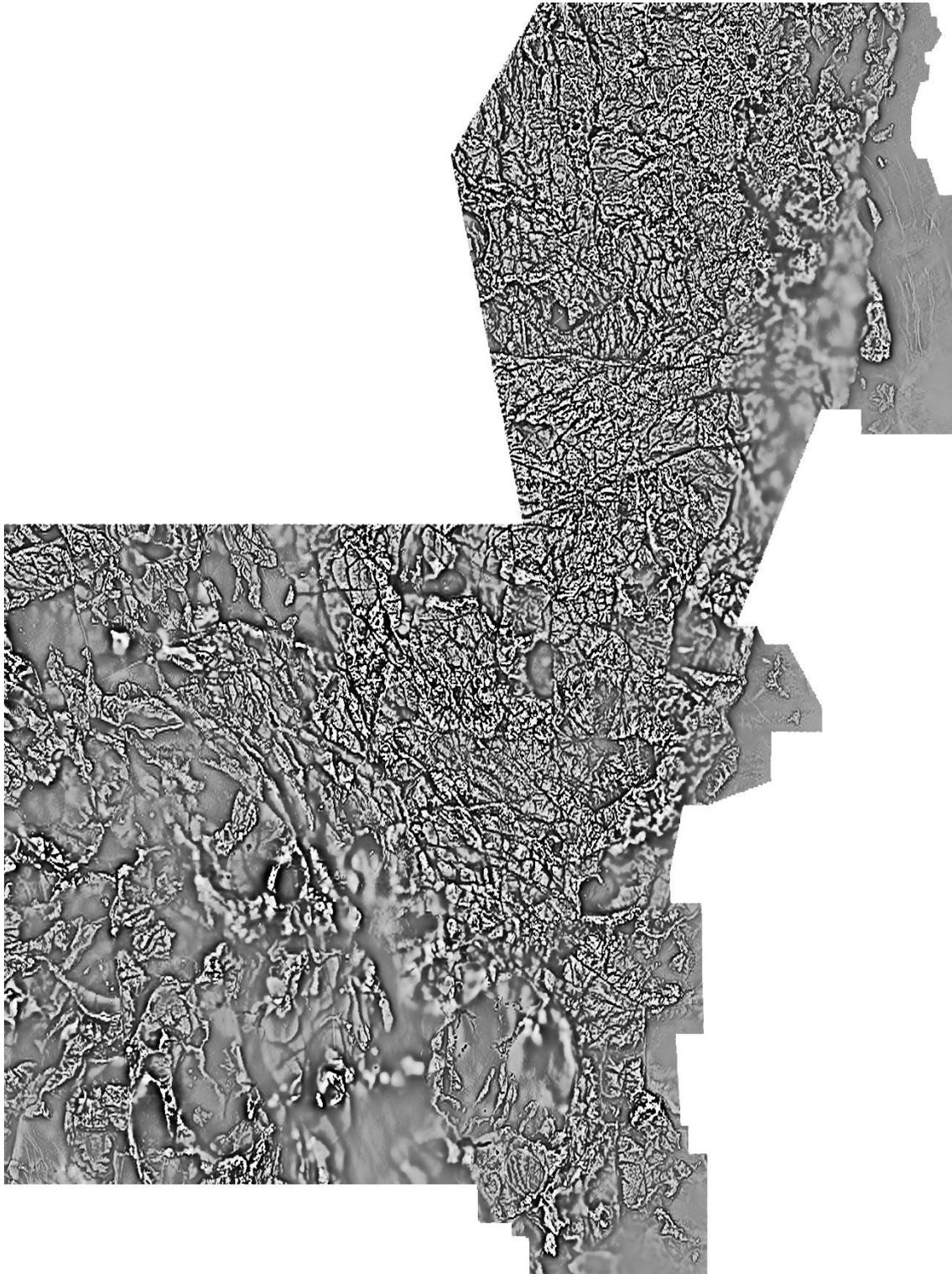
APPENDIX 4 VERIFICATION IMAGES



Total Magnetic Intensity



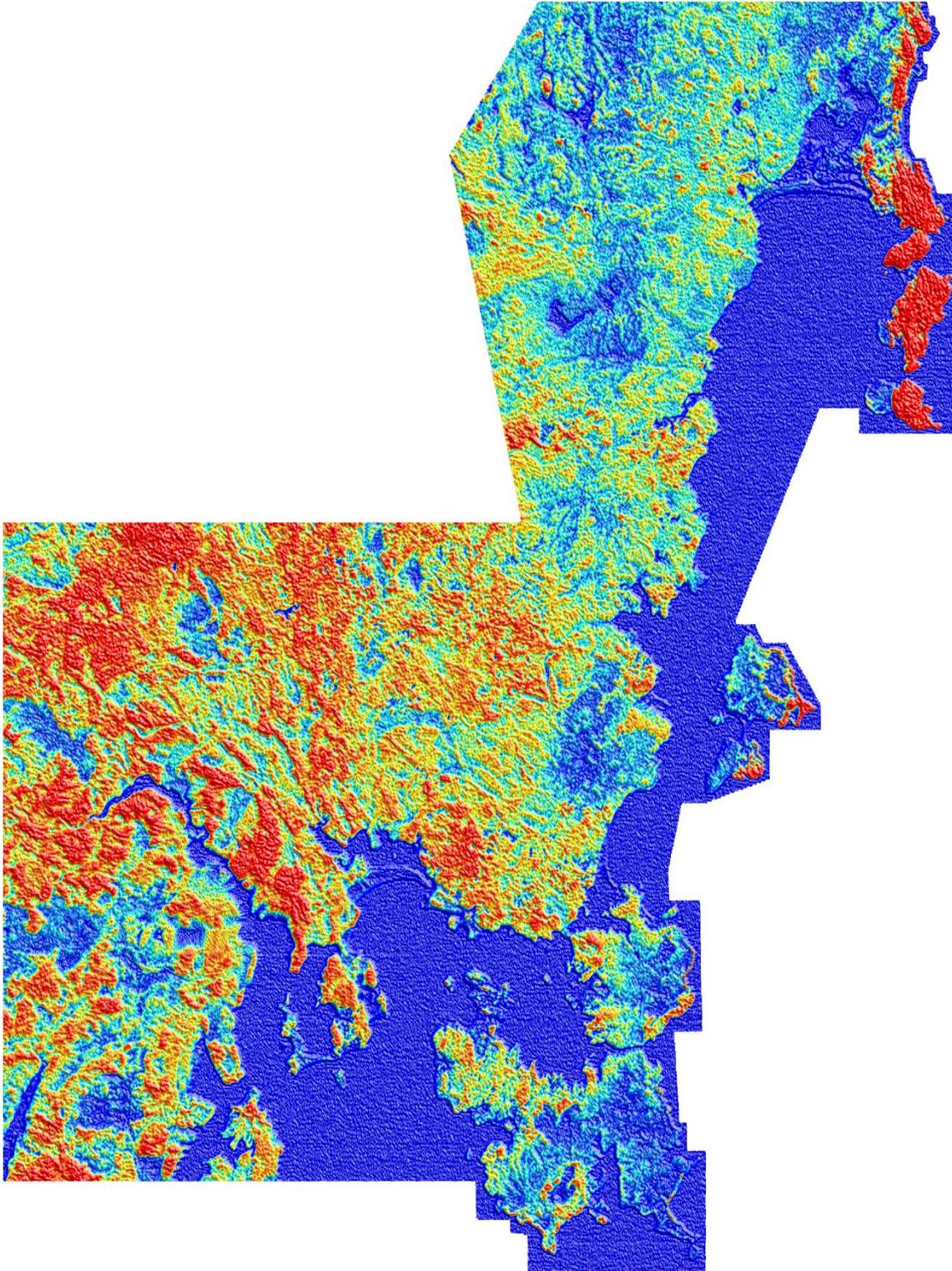
Reduced to Pole Total Magnetic Intensity



Reduced to Pole TMI First Vertical Derivative



Colour Digital Elevation Model



Dose Rate



Radiometric Ternary

APPENDIX 5 LINE LISTING

Line Number	Date (YYMMDD)	Flight #	Start Fiducial	End Fiducial
> 100020	220320	3	2263000	2739000
< 100030	220320	3	2775000	3247000
> 100040	220320	3	3296000	3750000
< 100050	220320	3	3804000	4275000
> 100060	220320	3	4326000	4786000
< 100090	220320	3	5903000	6411000
> 100120	220320	3	7572000	8057000
< 100130	220320	3	8113000	8632000
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> 100200	220320	4	4048000	4556000
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< 100850	220321	5	8599000	9242000
< 100640	220325	10	1256000	1871000
> 100670	220325	10	3208000	3773000
< 100680	220325	10	3825000	4524000
< 100700	220325	10	5227000	5928000
< 100720	220325	10	6808000	7521000
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> 500150	220403	24	8263000	8780000
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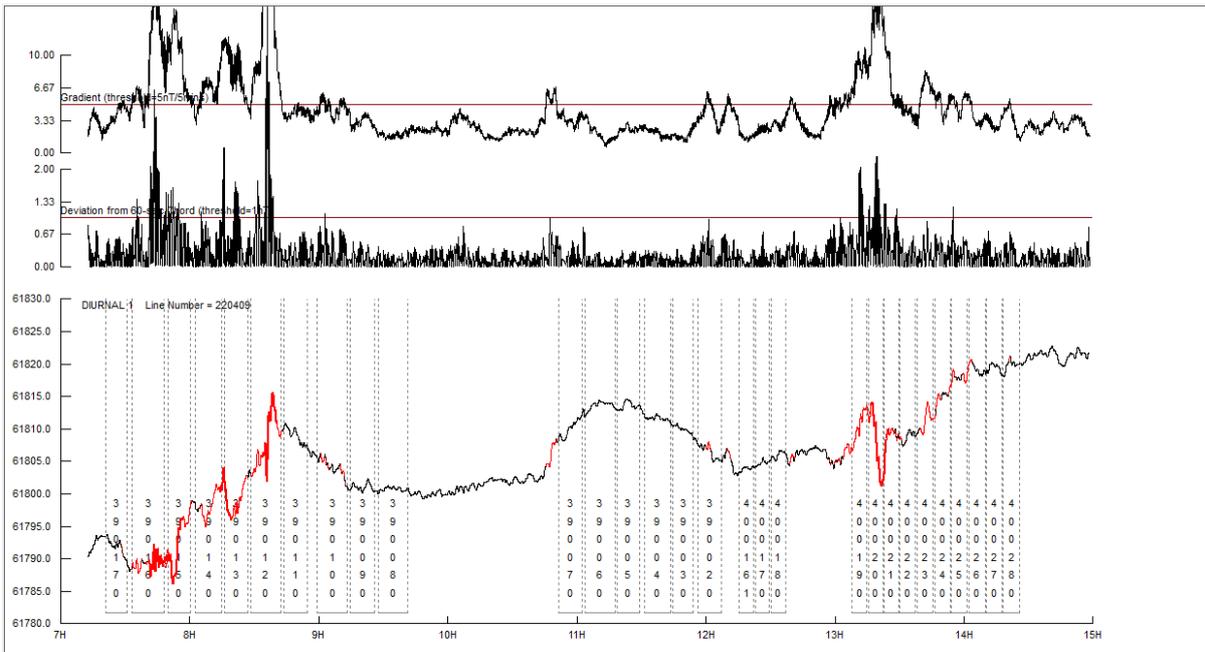
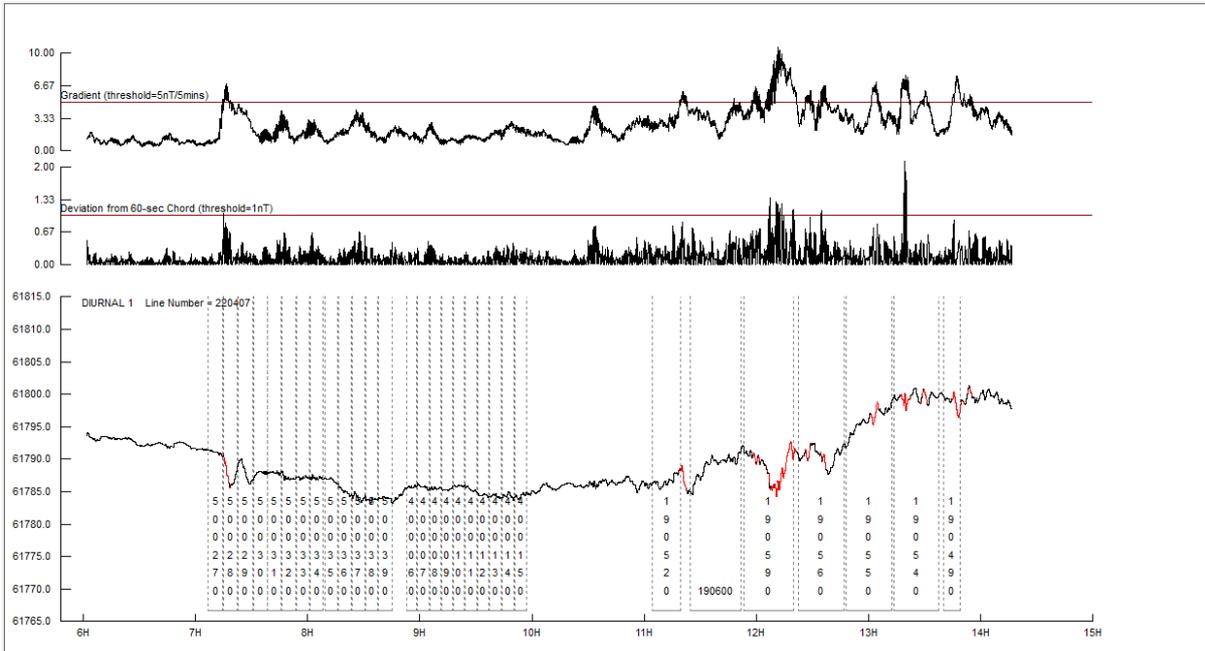
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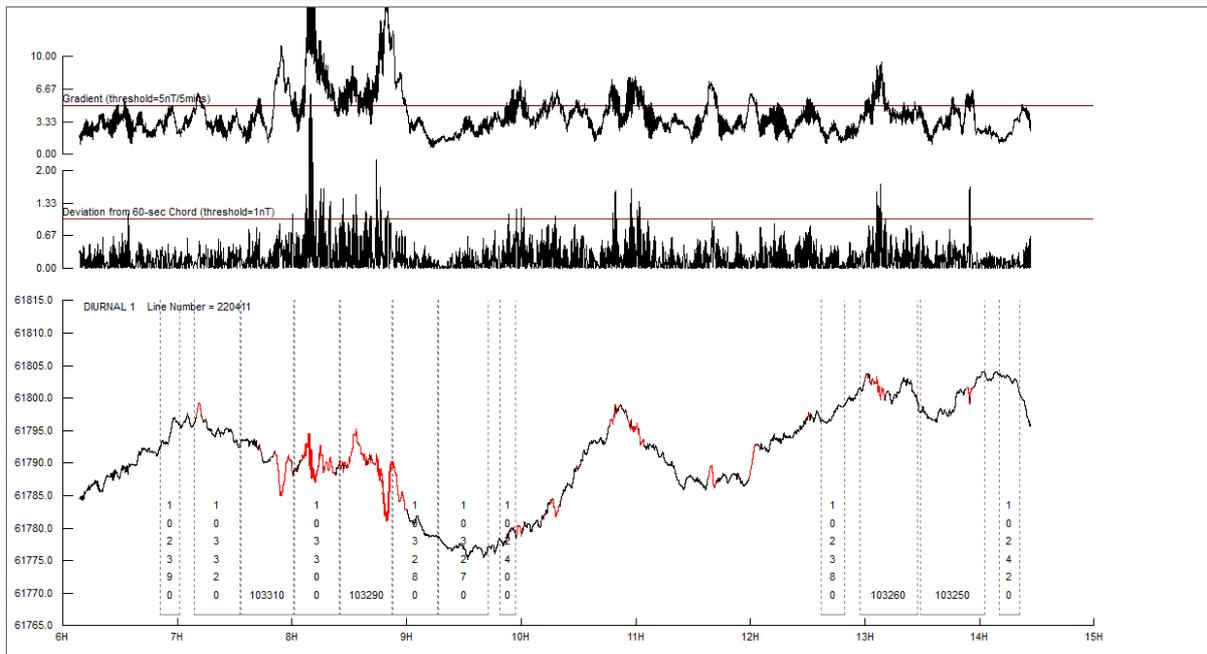
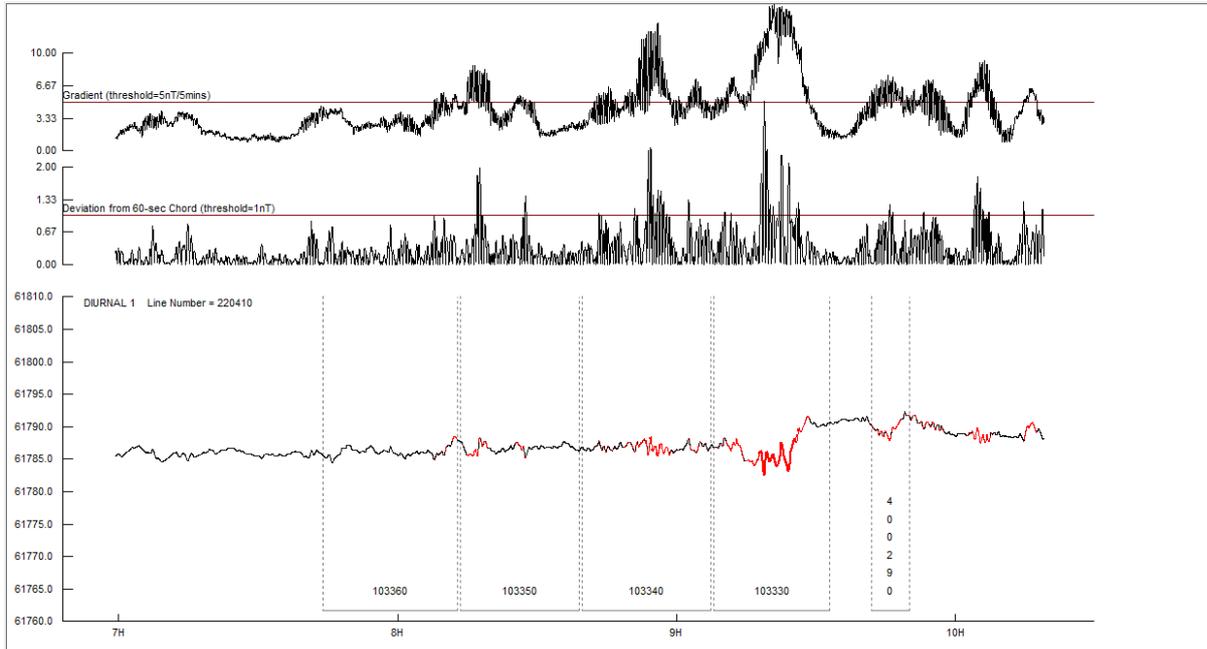
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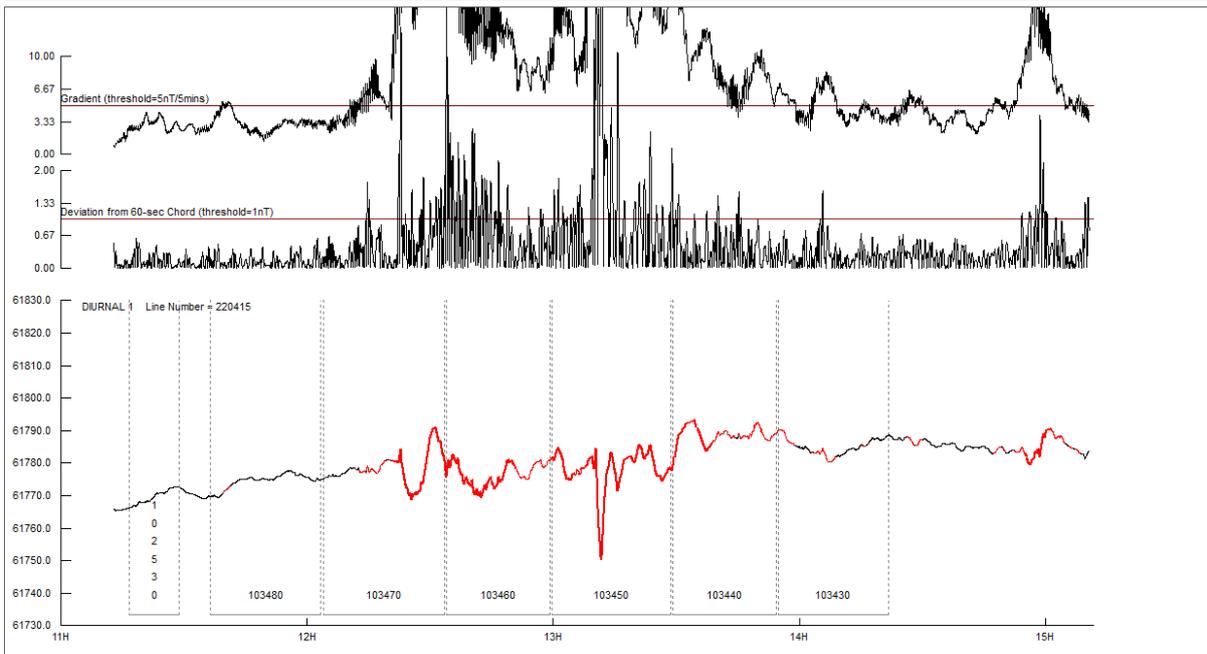
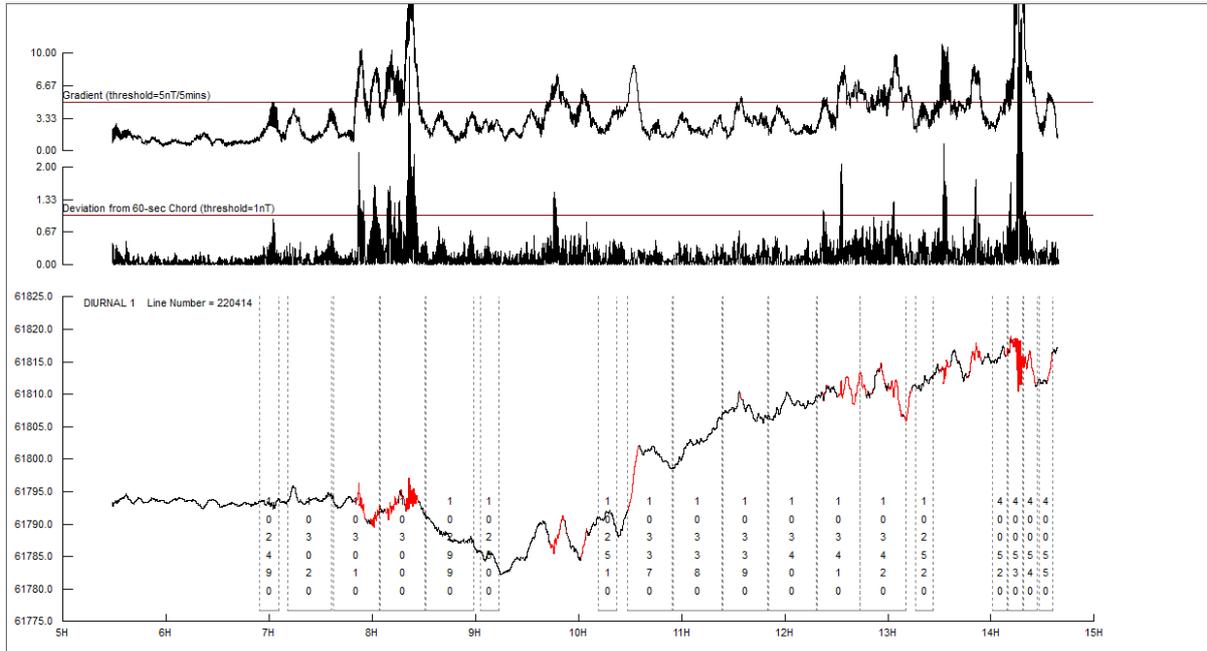
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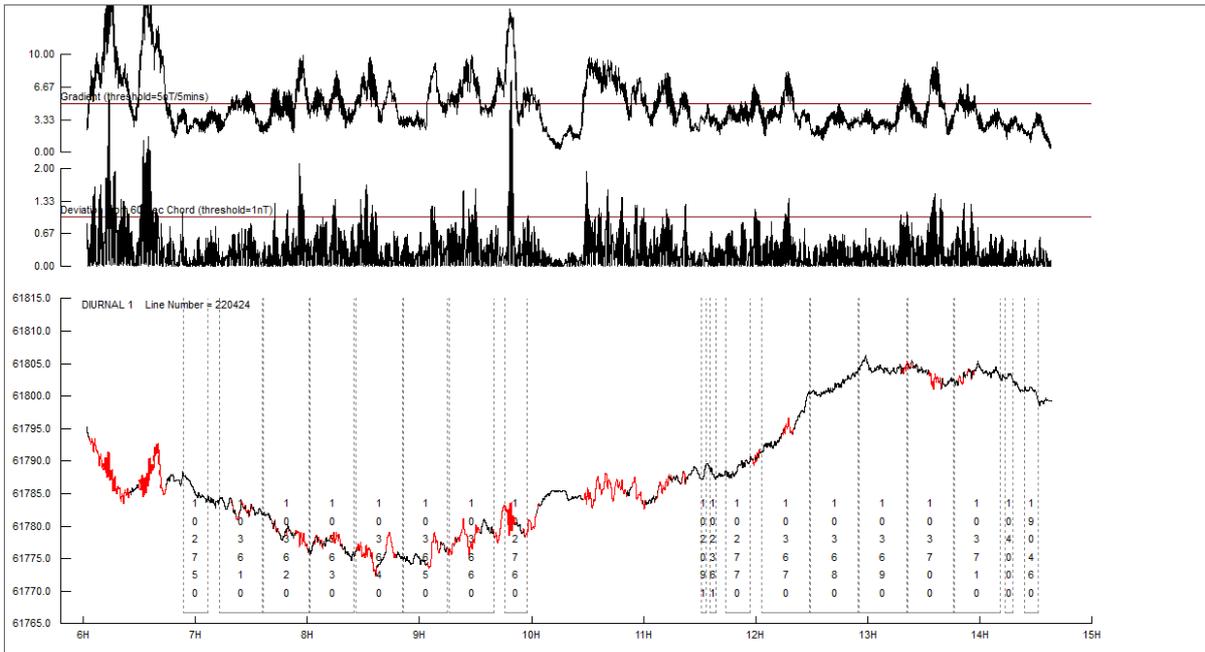
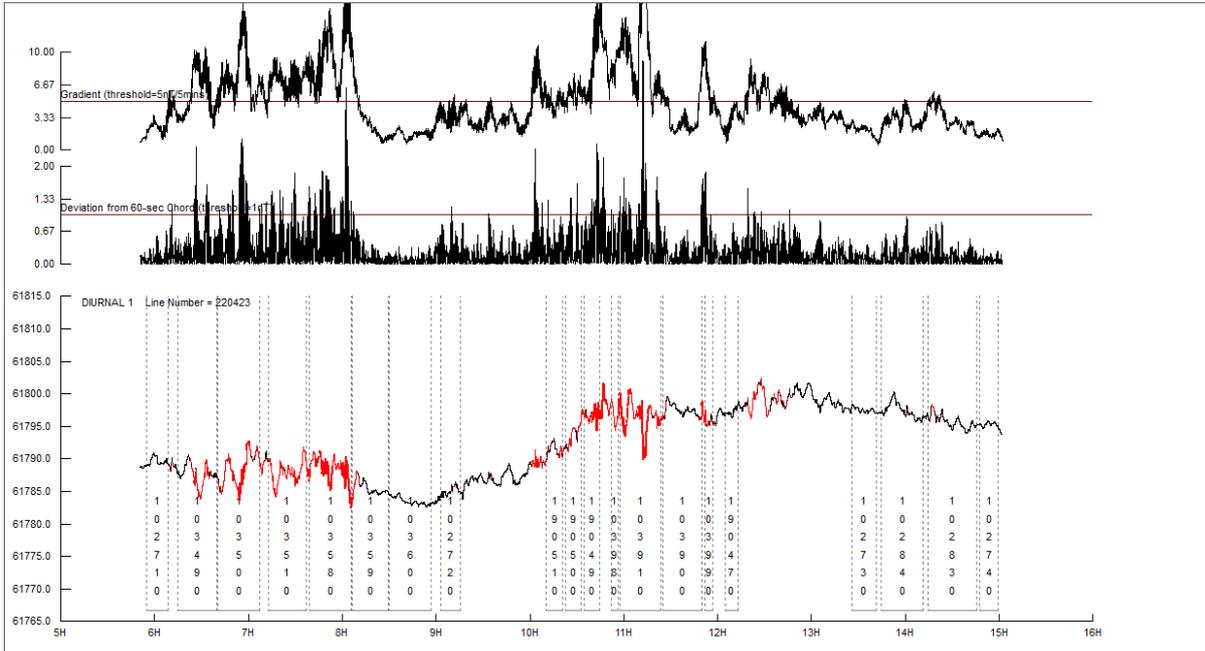
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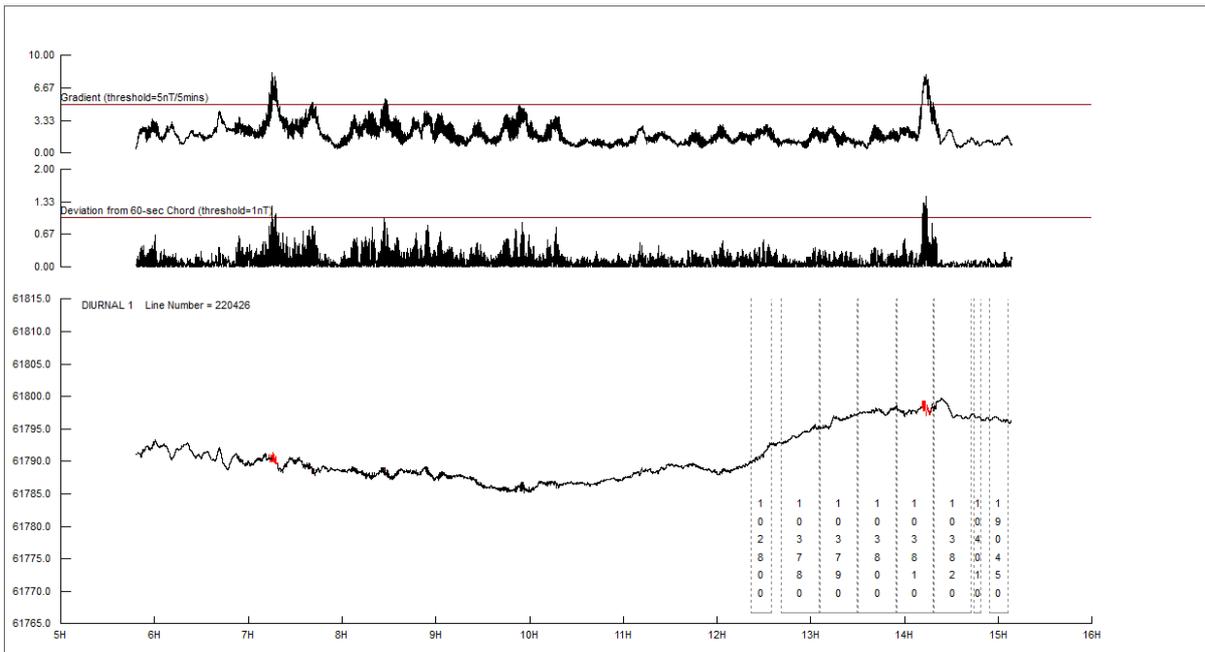
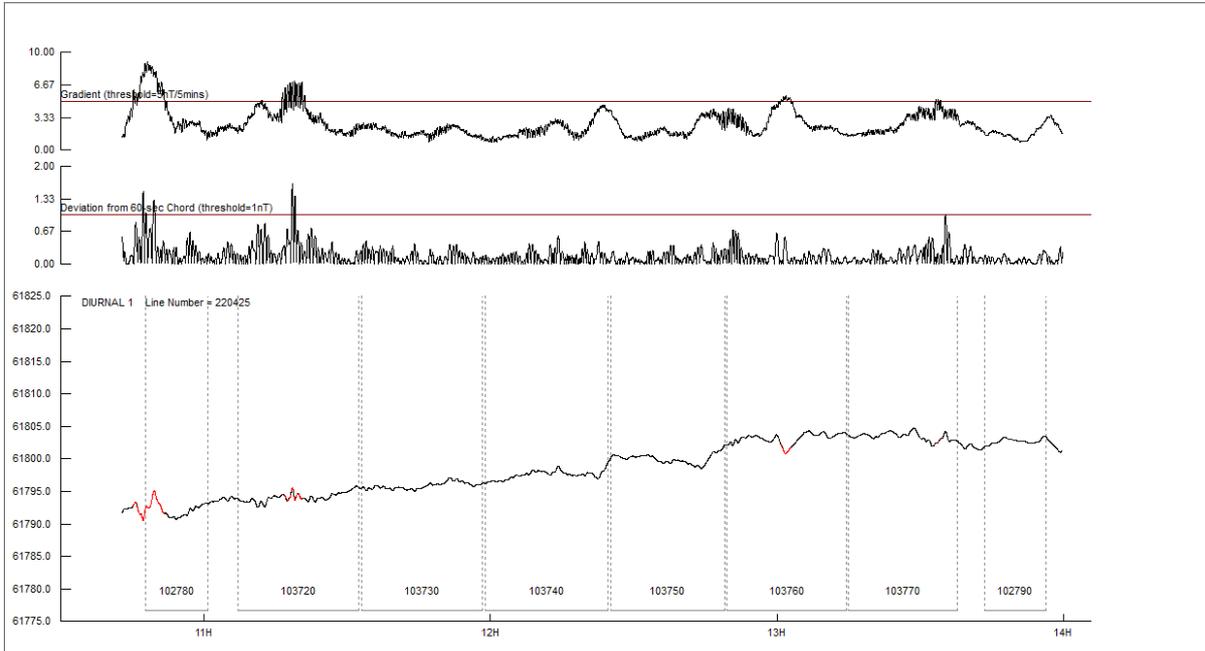
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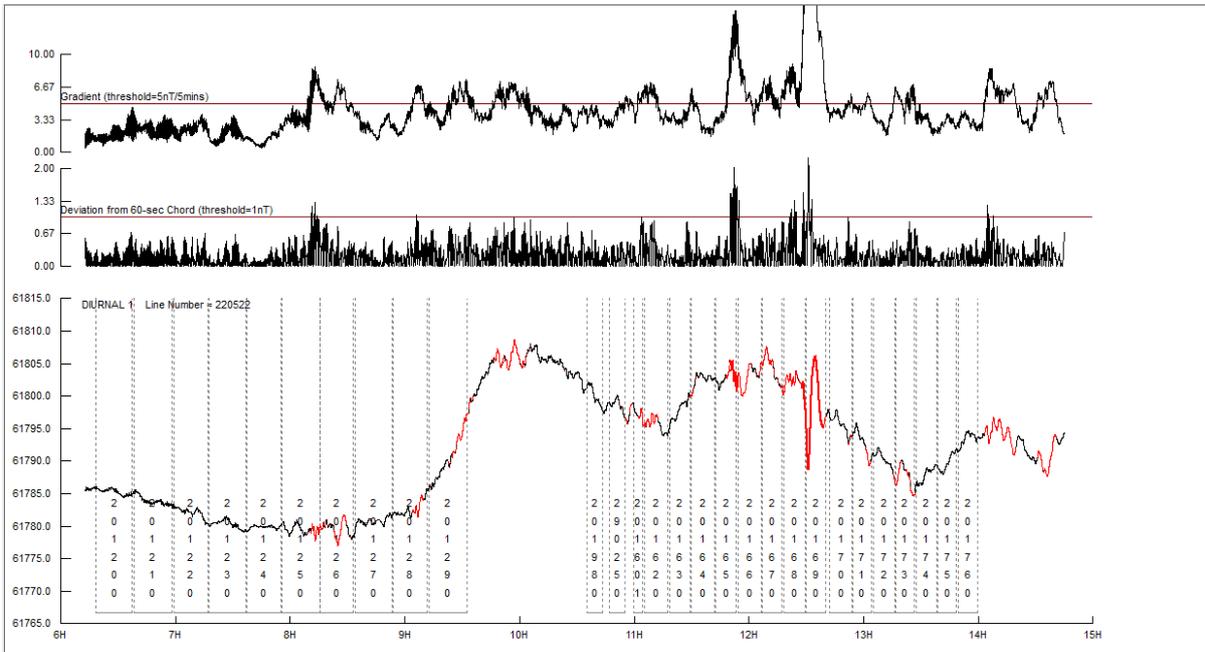
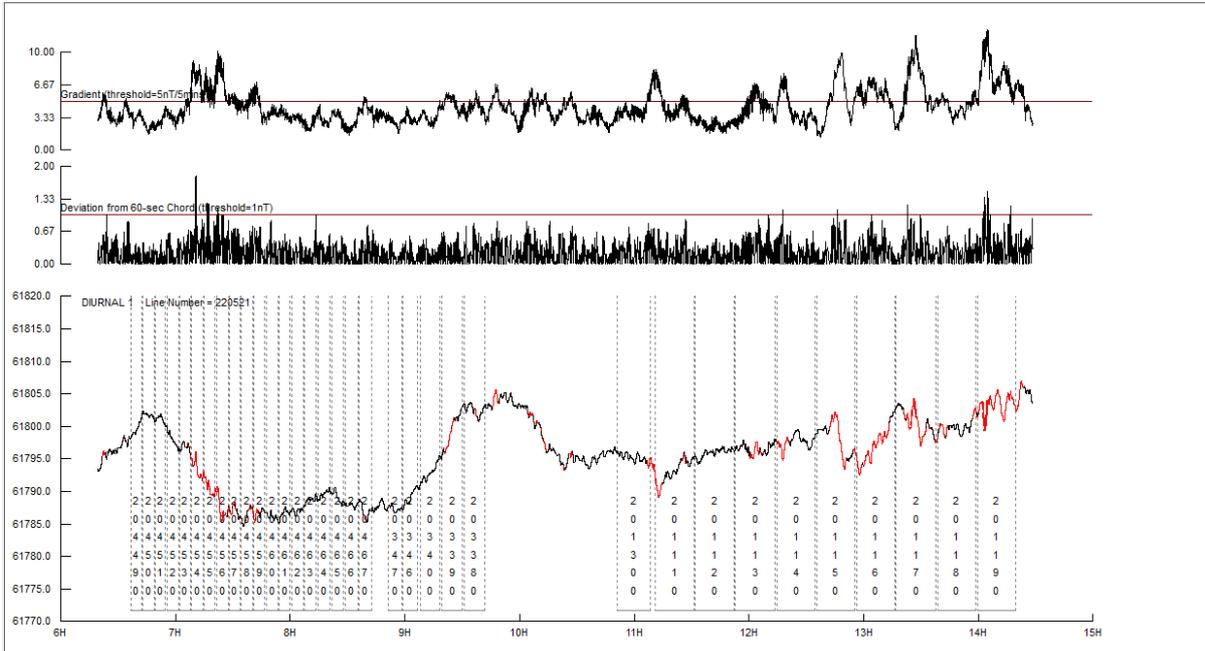












APPENDIX 7 RADIOMETRIC SPECTRA

