

MTA C&D Metro-North Railroad Penn Station Access

PSA Pre-Energization Survey Report



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T U R N E R
E N G I N E E R I N G

Revision History		
Date	Rev.	Description
October 20, 2022	0	Initial release

Executive Summary

The Turner Engineering Corporation (Tenco) measurement team performed a Pre-Energization Survey (PrES) of Electromagnetic Interference (EMI) / Radio Frequency Interference (RFI) at selected locations, along the Amtrak Hell Gate Line (HGL). The Penn Station Access (PSA) Project is a Metropolitan Transportation Authority (MTA) Construction and Development (MTA C&D) public work project in the New York City area that will provide Metro-North customers with service to Penn Station by diverting some New Haven Line (NHL) trains via Amtrak's HGL, creating a new route from Shell interlocking in Westchester, NY to Harold interlocking in Queens, NY. The project will affect approximately 16 mi of Amtrak HGL Right of Way (ROW).

The objective of the measurements performed was to:

- Determine maximum and minimum pre-existing ambient radiated and magnetic field levels along the PSA section of the Amtrak HGL ROW
- Establish baseline Electromagnetic Field (EMF) levels to compare with Post-Energization Survey (PoES) measurements. PoES measurements will be made after energizing the third rail and overhead catenary system (OCS) and before the start of revenue service. Tenco will compare these PrES measurement results when performing the PoES to determine if the PSA project has increased the ambient EMF.

The Tenco measurement team measured and recorded radiated electric fields and magnetic fields at 11 locations along the PSA sections of the HGL ROW. The selected measurement sites included:

- The four new stations to be installed: Co-op City, Morris Park, Parkchester-Van Nest, and Hunts Point Stations
- Five planned or existing substations: Oak AC Substation, New Rochelle AC Substation, Bowery Bay AC Substation, HG-02 DC Substation, and HG-01 DC Substation.

This Pre-Energization Survey Report (PPSR) provides the results, conclusions, complete data, and supporting information for the pre-energization measurements.

In summary, the magnetic field measurements showed:

- The maximum static DC magnetic field measurement of 518.5 mG is consistent with the typical value of 513 mG for the Earth's static magnetic field in the New York City area
- AC magnetic field measurements in the range 0 - 800 Hz at all sites, including at 60 Hz, were insignificant and substantially lower than the broadly applied Institute of Electrical and Electronic Engineers (IEEE) standard C95.1-2019, "Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz." The IEEE Std C95.1 maximum permissible exposure (MPE) limit is 9.0 G at 60 Hz.

- The measurements were also lower than the stricter criterion in the New York State Department of Public Service (DPS) Statement of Interim Policy (NYIP) on Magnetic Fields of Major Electric Transmission Facilities, which specifies a limit of 0.2 G at 60 Hz. The low 60 Hz levels are relevant for measurement location Sites 2 and 7, since the PSA project will install two single-phase 138 kV circuits with buried cables at these two locations.
- The maximum 60 Hz magnetic field measured field level was 3.5 mG, at measurement location Site 6, near an AC substation with operating power equipment nearby. This is a typical level near power lines.

In summary, the electric field measurements showed:

- Measurements were similar at all locations, with more variability in the lower frequency bands
- Measurements at all sites showed typical high emissions levels at FM radio, aeronautical communications, mobile communications, and TV broadcasting frequencies
- Most sites showed a set of relatively strong radiated peaks in the low frequency 10 -160 kHz band, starting at 20 kHz repeating every 20 kHz. These are likely maritime radio navigation signals as well as two standard frequency and time signals at 20 kHz and 60 kHz.
- Measured electric field levels at most sites in bands B0 to B4 exceeded the limits provided by CENELEC standard EN50121-2:2017, “Railway applications - Electromagnetic compatibility - Part 2: Emission of the whole railway system to the outside world.” Electric fields in dense urban areas often exceed the EN 50121-2 limits.

This PPSR also includes a spectral analysis of measured results that considers:

- Possibility of impacts on existing magnetic and electric field levels and of neighbor high level EMI/RFI emitters on planned equipment, including train control, communications, traction power, and station equipment
- Possibility of impacts of emissions from operation of the PSA on potential sensitive neighbor facilities
- Possible EMI/RFI mitigation measures, if any appear to be needed.

The spectral analysis concluded that the electric field and magnetic measurements are compatible with the existing and new systems and equipment planned for the PSA project:

- With the foundational design criterion that the new systems will be equivalent to the existing ones already in MTA and Amtrak service, and
- With the expectations that the PSA designs and installations will comply with relevant EMC criteria and guidelines, and that MTA will maintain and operate the equipment following the applicable procedures.

Table of Contents

Executive Summary

1	Introduction.....	1
1.1	Measurement Objectives	3
1.2	Measurement Requirements	3
1.3	Measurement Scope	4
1.4	Measurement Tasks.....	4
1.5	Report Contents Overview	5
1.6	Report Acronyms and Abbreviation.....	6
1.7	Reference Information	7
2	Results Overview.....	9
2.1	Conclusions and Summary Results	9
2.1.1	Ambient Radiated Electric Field Results.....	9
2.1.2	Ambient Magnetic Field Results	11
2.2	Measurement Schedule	14
2.3	Spectral Analysis	14
3	Measurement Procedure and Locations.....	15
3.1	Measurement Procedure	15
3.2	Measurement Locations	15
3.3	Site 1: Randall's Island, New York, NY	18
3.4	Site 2: Oak AC Substation, The Bronx, NY	19
3.5	Site 3: Co-op City Station, The Bronx, NY.....	20
3.6	Site 4: Morris Park Station, The Bronx, NY	21
3.7	Site 5: Pelham Bay and Split Rock Golf Courses, The Bronx, NY	22
3.8	Site 6: New Rochelle AC Substation, New Rochelle, NY	23
3.9	Site 7: Parkchester-Van Nest Station, The Bronx, NY.....	24
3.10	Site 8: Bowery Bay AC Substation, Queens, NY	25
3.11	Site 9: HG-02 DC Substation, Woodside, NY	26
3.12	Site 10: Electric Substation Near Randall's Island, Woodside, NY.....	27
3.13	Site 11: HG-01 DC Substation, Long Island City, NY	28
4	Radiated Electric Field Measurement Results	29

4.1 Purpose and Requirements	29
4.2 Measurements Performed	29
4.3 Measurement Results	29
4.3.1 B0 Band	31
4.3.2 B1 Band	32
4.3.3 B2 Band	33
4.3.4 B3 Band	34
4.3.5 B4 Band	35
4.3.6 B5 Band	36
4.3.7 B6 Band	37
4.3.8 B7 Band	38
4.4 Measurement Equipment and Calibration	39
4.4.1 Measurement Equipment	39
4.4.2 Measurement Bands	41
4.4.3 Calibration	42
4.5 Measurement Procedure Steps.....	42
5 Magnetic Field Measurements.....	43
5.1 Purpose and Requirements	43
5.2 Measurements Performed	43
5.3 Measurement Results	44
5.3.1 Magnetic Field Test Runs	45
5.4 Measurements Equipment and Calibration	51
5.4.1 Measurement Equipment	51
5.4.2 Measurement Bands	52
5.4.3 Calibration	53
5.5 Magnetic Field Maximum Permissible Exposure Limits	53
5.6 Measurement Procedure Steps.....	55
6 Spectral Analysis.....	56
6.1 Spectral Analysis Evaluation Matrix.....	56
6.2 Spectral Analysis Assessment Conclusion.....	58

Appendix A Radiated Electric Field Measurement Results**Appendix B Magnetic Field Measurement Results****Appendix C Equipment Calibration Records**

MTA C&D Penn Station Access Project Pre-Energization Survey Measurement Report

1 Introduction

The Penn Station Access project (PSA) is a Metropolitan Transportation Authority (MTA) Construction and Development (MTA C&D) public work project in the New York City area. The PSA will provide Metro-North customers with service to Penn Station by diverting some New Haven Line (NHL) trains via Amtrak's Hell Gate Line (HGL), creating a new route from Shell interlocking in Westchester, NY to Harold interlocking in Queens, NY. The Project will design and construct additional passenger tracks, AC and DC traction power substations, overhead contact systems (OCS), new interlockings, updated communication systems, and new signal systems within the approximately 16 mi of Amtrak's HGL right of way. The Project also includes the design and construction of four new Metro-North stations along the HGL in the eastern Bronx; Co-op City, Morris Park, Parkchester-Van Nest, and Hunts Point Stations. Figure 1-1 shows the PSA Access Route Map.

Under MTA C&D Contract CBX001, Halmar International / Railworks Joint Venture (HRJV) is the PSA contractor. Jacobs Engineering Group Inc. (Jacobs) is designing the expansion and support construction.

Jacobs and its Electromagnetic Compatibility (EMC) engineer Turner Engineering Corporation (Tenco) established a Penn Station Access Electromagnetic Compatibility Program Plan (EMCP) and will perform the PSA EMC program to control electromagnetic interference (EMI) and radio frequency interference (RFI) between elements of the PSA project and its environment, within the PSA scope:

- PSA equipment and facilities
- NHL and Amtrak's Hell Gate Line HGL equipment and facilities
- PSA neighbors' equipment and facilities
- PSA passengers, workers, and neighbors.

Tenco developed and submitted the PSA Pre-Energization and Post-Energization Electromagnetic Survey Procedure (PESP) describing the planned EMC measurements. The PESP provides the procedure for carrying out the measurements for the pre-energization and post-energization surveys. Per the PESP:

- The pre-energization measurements consist of radiated electric field and magnetic field measurements at locations along the length of the planned PSA portion of the HGL
- The measurements cover the magnetic fields from static to 800 Hz and radiated electric fields from 10 kHz to 6 GHz. This is the range in which:
 - Equipment typically operates in the urban and suburban environment
 - Train lines and systems emit EMI
 - EMI from other sources could interfere with sensitive MTA equipment.

- The measurements are along the HGL, and are made at 100 ft lateral offset from the track centerline or other safe and reasonable distance.

Tenco performed the Pre-Energization Survey (PrES) per the PESP in August 2022. This PSA Pre-Energization Survey Report (PPSR) provides the results, conclusions, complete data, and supporting information for the pre-existing measurements.

Tenco will also perform a Post-Energization Survey (PoES). The PoES will be of the same radiated electric field and magnetic fields, at the same locations as the PrES. The PoES will be after energizing the third rail and OCS for testing and before the start of revenue service. Tenco will submit a PSA Post-Energization Survey Report (POSR) that summarizes the results of the measurements similar to this report and compares the PoES results to the PrES results provided in this PPSR. The POSR will determine if the PSA project affected or increased the ambient EMF environment.

Figure 1-1
Penn Station Access Route Map



1.1 Measurement Objectives

The PSA PrES objectives are:

- Measure the maximum and minimum pre-energization ambient radiated and magnetic field levels along the HGL, before PSA construction
- Use the measured baseline EMF levels for comparison with the PoES measurements to be made after energizing the third rail and OCS and before the start of revenue service
- Document measured PSA locations for use in the PoES.

The PPSR objective is to document and present the PrES measurement results, site selections, and collection of data.

1.2 Measurement Requirements

RFP Volume 3 Part 1 section 1.4.3.2 requires that:

“All operational systems and equipment provided by or used by the Design-Builder in execution of the Contract requirements do not result in Electromagnetic Interference which will negatively impact its own performance or the performance of any adjacent infrastructure or facilities within interference range. The Design-Builder shall perform a final design installation analysis including any temporary activities, and those activities performed by its subcontractors and suppliers.”

The EMCP Section 4.3 states:

“PSA TP RFP Vol 3, Part 1, Section 1.4.3.2 requires the Electromagnetic Interference Analysis (EIA) of all operational systems and equipment to ensure that they do not produce EMI which negatively affects the project. The EIA will be submitted to MTA C&D for Approval.

EIA elements are:

- Pre-Energization Survey and Assessment
- Factory EMI/RFI Qualification Design Descriptions, Test Plans, Procedures, and Results
- Final Design Installation Analysis”

RFP Volume 3 Part 3 section 3.4.9 states:

“The Design-Builder is responsible to ensure that all operational systems and equipment provided by or used by the Design-Builder in execution of the Project requirements, shall be compatible with the existing system and the new system being provided. Should any portion of the existing or new system be harmfully affected by the Design Builder’s part, the Design-Builder shall be responsible to correct the error and is responsible for any delay as a result of such occurrence. Should any portion of rail operations be negatively affected by the Design-Builder’s activity or actions, the Design-Builder shall be responsible to correct the error and is responsible for any delay as a result of such occurrence.

These requirements include the use of electrical tools, equipment, and any other devices or items that the Design-Builder, or its subcontractors and suppliers may choose to use in carrying out their Work.

This analysis shall be submitted to Amtrak for Approval.”

1.3 Measurement Scope

The PrES scope is the measurement, recording, reporting, and assessment of the ambient EMF environment along the HGL, before energization. Tenco will compare this measured ambient to the future PoES, to quantify electric and magnetic field impacts of the PSA Project.

The scope does not include:

- Measurements of emissions or immunity of HGL equipment such as track circuits, communications, equipment, etc.
- Characterizing emissions or measuring immunity of MTA in-service equipment such as traction power, trains, or communications equipment.

1.4 Measurement Tasks

The PrES work consisted of the following tasks:

- Work with Jacobs and the HRJV to select sites for taking measurements
- Measure at or near the selected sites along the HGL
 - Radiated Electric Field
 - Magnetic Field.

The PESP provided the measurement method, arrangement, and related technical information. The measurement configuration generally matched the PESP configuration, with minor changes noted in Section 3 of this PPSR.

Radiated Electric Field Measurements: Per the PESP, Tenco performed radiated electric field measurements consistent with the EMC Ambient Survey procedure and Radiated Interference in Rapid Transit Systems, Volume II: Suggested Test Procedures, UMTA-MA-06-0153-85-11, method RT/RE01A, “Broadband Emissions of Rapid Transit Vehicles - 140 kHz to 400 MHz.” Tenco made measurements in the frequency range 10 kHz to 6.0 GHz, using an A.H. Systems Active Monopole Antenna, an A.H. Systems Bilogical Antenna, and a Keysight EXA signal analyzer model N9010B.

Magnetic Field Measurements: Tenco performed three-axis static and AC magnetic field measurements per the PESP using an AlphaLab three axis magnetometer and magnetic field probe, with the Tenco TransDAS software. Tenco made magnetic field measurements in the frequency range from 0 Hz, static or Earth field, and from 1 to 800 Hz.

1.5 Report Contents Overview

This PPSR consists of the following sections:

Section 2, Results Overview: The Results Overview section summarizes the measurement schedule and scope, describes the most important results, and states conclusions.

Section 3, Selected Measurement Sites: The Selected Measurement Sites section describes the actual measurement locations relative to the HGL ROW. It provides a map showing the sites and the HGL ROW. It also provides a detailed diagram and photographs for each site.

Section 4, Radiated Electric Field Measurement Results: The Radiated Electric Field Measurement Results section states key pre-energization ambient radiated electric field emissions measurements and results; describes the measurement equipment; and describes measurement procedure steps.

Section 5, Magnetic Field Measurement Results: The Magnetic Field Measurement Results section states key pre-energization ambient magnetic field emissions measurements and results; describes the measurement equipment; and describes measurement procedure steps.

Appendices A, B, and C: Appendices provide complete data for the radiated electric field measurements, magnetic field measurements, and equipment calibration records.

1.6 Report Acronyms and Abbreviation

Table 1-1 provides the acronyms and abbreviations.

**Table 1-1
Acronyms and Abbreviations**

Acronym	Definition
AC	Alternating Current
AM	Amplitude Modulated
CENELEC	European Committee for Electrotechnical Standardization
DC	Direct Current
DPS	Department of Public Service
DSA	Dynamic Signal Analyzer
EIA	Electromagnetic Interference Analysis
EMC	Electromagnetic compatibility
EMCP	EMC Program Plan
EMF	Electromagnetic Field
EMI	Electromagnetic interference
HGL	Hell Gate Line
HRJV	Halmar International / Railworks Joint Venture
Hz	Hertz
IEEE	Institute of Electrical and Electronics Engineers
IF	Intermediate Frequency
Jacobs	Jacobs Engineering Group Inc.
MPE	Maximum Permissible Exposure
MTA	Metropolitan Transportation Authority
MTA C&D	Metropolitan Transportation Authority Construction and Development
NHL	New Haven Line
NYIP	New York State Department of Public Service Statement of Interim Policy
NYS	New York State
OCS	Overhead Contact System
PoES	Post-Energization Survey
POSR	PSA Post-Energization Survey Report
PESP	PSA Pre-Energization and Post-Energization Electromagnetic Survey Procedure
PPE	Personal Protective Equipment
PPSR	PSA Pre-Energization Survey Report
PrES	Pre-Energization Survey
PSA	Penn Station Access
PSNY	Penn Station New York
RF	Radio Frequency
RFI	Radio Frequency Interference
ROW	Right-of-Way
RSTP	Rapid Transit Signaling Systems Volume II: Suggested Test Procedures

**Table 1-1
Acronyms and Abbreviations**

Acronym	Definition
SA	Spectrum Analyzer
STA	Stationing
Tenco	Turner Engineering Corporation
UMTA	Urban Mass Transportation Administration (now Federal Transit Administration)
VAC	Volts of Alternating Current

1.7 Reference Information

**Table 1-2
PSA EMC Survey Reference Information**

ID	Issued By	Title
Technical Provisions Vol 3, Part 1	MTA C&D	Design-Build Services For Metro-North Railroad Penn Station Access Project, September 20, 2021 RFP Documents. Volume 3 Technical Provisions Part 1 – Scope
Technical Provisions Vol 3, Part 3	MTA C&D	Design-Build Services For Metro-North Railroad Penn Station Access Project, September 20, 2021 RFP Documents. Volume 3 Technical Provisions Part 1 – DB Requirements
Technical Specifications Vol 5	MTA C&D	Design-Build Services For Metro-North Railroad Penn Station Access Project, September 20, 2021 RFP Documents. Volume 5 Technical Specifications
Technical Specifications Vol 8	MTA C&D	Design-Build Services For Metro-North Railroad Penn Station Access Project, September 20, 2021 RFP Documents. Volume 8 Leggett Interlocking, Part 2 Technical Specifications
EMCP	Jacobs	MTA C&D Metro-North Railroad Penn Station Access Electromagnetic Compatibility Program Plan, Rev 0, May 2022
PESP	Jacobs	MTA C&D Metro-North Railroad Penn Station Access PSA Pre-Energization and Post-Energization Electromagnetic Survey Procedure, Rev 1, July 2022
IEEE Std 95.1-2019	IEEE	IEEE Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 0 Hz – 300 GHz
NY DPS 1990 Interim Policy (NYIP)	NYS	New York State Department of Public Service (DPS) Statement of Interim Policy (NYIP) on Magnetic Fields of Major Electric Transmission Facilities, September 11, 1990

Table 1-2 PSA EMC Survey Reference Information		
ID	Issued By	Title
UMTA-MA-06-0153-85-10	FTA	Radiated Interference in Rapid Transit Systems - Volume I: Theory and Data
UMTA-MA-06-0153-85-11	FTA	Radiated Interference in Rapid Transit Systems - Volume II: Suggested Test Procedures
EN 50121-2:2017	CENELEC	Railway applications - Electromagnetic compatibility - Part 2: Emission of the whole railway system to the outside world.

2 Results Overview

2.1 Conclusions and Summary Results

Tenco measured and recorded radiated electric fields and magnetic fields at 11 locations along the PSA planned section of the HGL ROW. The selected measurement sites included:

- The four new stations to be installed: Co-op City, Morris Park, Parkchester-Van Nest, and Hunts Point Stations
- Five planned or existing substations: Oak AC Substation, New Rochelle AC Substation, Bowery Bay AC Substation, HG-02 DC Substation, and HG-01 DC Substation.

This section summarizes the measurement results, with select data documenting the conclusions. Section 4 and Section 5 provide a more detailed discussion and presentation of the electric and magnetic field measurement results. Appendix A and Appendix B provide the complete results for the electric and magnetic field measurements.

2.1.1 Ambient Radiated Electric Field Results

Tenco performed 152 radiated electric field measurement runs at the 11 selected sites, from August 8 to August 12, 2022. Per the PESP:

- Tenco measured radiated electric field in frequency bands B0 (10 to 160 kHz) through B7 (1 GHz to 6 GHz). Measurements made with the bi-logical antenna used both the horizontal and vertical polarity.
- The log recorded the measurement number, measurement type, measurement location, band, time, weather conditions, and other relevant information. For each log entry, a screenshot of the signal analyzer was saved along with a CSV file containing the same data. Appendix A provides the complete results for the electric field measurements.

In summary, the PrES measurements showed:

- Measurements were similar at all locations, with more variability in the lower frequency bands
- Measurements at all sites showed typical high emissions levels at FM radio, aeronautical communications, mobile communications, and TV broadcasting frequencies
- Most sites showed a set of relatively strong radiated peaks in the low frequency 10 -160 kHz band, starting at 20 kHz repeating every 20 kHz. These are likely maritime radio navigation signals and two standard frequency and time signals at 20 kHz and 60 kHz.

- Most sites were above the limits in EN50121-2:2017 EN50121-2:2017, “Railway applications - Electromagnetic compatibility - Part 2: Emission of the whole railway system to the outside world,” between bands B0 and B4. Electric fields in dense urban areas often exceed the EN 50121-2 limits.

Table 2-1 summarizes and presents the radiated electric field results:

- For each frequency band, noisiest location or location with strongest emitters
- For each frequency band, most quiet condition
- For each location, noise floor levels and frequency and amplitude of highest peaks
- Notes on potential susceptible neighbors.

Section 4 provides detailed information on the electric field measurements, with a subsection providing typical graphs for each frequency band, demonstrating the results noted in Tale 2-1.

**Table 2-1
Radiated Electric Field Results Summary**

Band	Frequency Range	Results / Notes
B0	10 kHz – 160 kHz	* Site 4 is the noisiest site. Peaks at 20 kHz and 60 kHz are standard frequency and time signals. Noise floor falls from 150 to 125 dB. * Site 5 is the quietest site. The highest peaks are at 20 kHz and 60 kHz. Noise floor between 115 dB and 130 dB.
B1	150 kHz – 650 kHz	* Site 4 is the noisiest site. Peaks at 220 kHz, 440 kHz, and 600 kHz are aeronautical radio navigation and AM radio. Noise floor between 115 and 125 dB. * Site 5 is the quietest site. Three well-defined peaks at 220 kHz, 440 kHz, and 600 kHz are aeronautical, radio navigation and AM radio. Noise floor between 110 and 120 dB.
B2	500 kHz – 3 MHz	* Site 4 is the noisiest site. Peaks every 220 kHz at lower frequencies. Noise floor between 115 and 120 dB. * Site 6 is the quietest site. Peaks at 660 kHz at 880 kHz. Noise floor between 105 and 115 dB.
B3	2.5 MHz – 7.5 MHz	* Site 5 is the noisiest site. Strong signal visible every 220 kHz. Similar to Site 3. Noise floor between 105 and 115 dB. * Site 1 is the quietest site. Noise floor falls from 105 dB to 90 dB, no visible peaks.
B4	5 MHz – 30 MHz	* Site 5 is the noisiest site. Peaks every 220 kHz at lower frequencies. Noise floor falls from 105 to 75 dB. * Site 1 is the quietest site. Significant peaks at 13.6 MHz and 15.8 MHz. Noise floor falls from 90 dB to 55 dB.
B5	25 MHz – 325 MHz	* Site 10 is the noisiest site. Narrowband noise observed in 100 to 200 MHz range are typical TV broadcasting, FM radio, amateur radio, and aeronautical, radio navigation signals. Noise floor between 40 and 50 dB. * Site 6 is the quietest site. Weaker signals than most other sites, but typical broadcast peaks. Noise floor between 35 and 45 dB.

Table 2-1
Radiated Electric Field Results Summary

Band	Frequency Range	Results / Notes
B6	300 MHz – 1.3 GHz	<p>* Site 10 is the noisiest site. Narrowband noise observed at lower frequencies are typical TV broadcasting, land mobile, fixed, amateur radio, and aeronautical, radio navigation signals. Noise floor rises from 40 to 55 dB.</p> <p>* Site 6 is the quietest site. Weaker signals than other sites, but typical broadcast signals. Noise floor rises from 40 to 55 dB.</p>
B7	1 GHz – 6 GHz	<p>* Site 8 is the noisiest site. Strongest signals observed at this location. Typical aeronautical, radio navigation, fixed mobile, and fixed satellite use. Noise floor rises from 50 to 80 dB.</p> <p>* Site 6 is the quietest site. Typical broadcast signals. Signature seen during the survey with weaker peaks. Noise floor rises from 50 to 80 dB.</p>

2.1.2 Ambient Magnetic Field Results

Tenco performed 13 magnetic field measurement runs at the 11 selected sites, from August 8 to August 12, 2022. The measurements covered the three x, y, and z axes.

Tenco kept a log providing the measurement number, measurement type, measurement description, measurement comments and results, and other relevant information including nearby emitters. Appendix B provides the complete results for the magnetic field measurements.

Tenco recorded magnetic field measurements from 0 to 800 Hz during every measurement run.

In summary, the pre-existing magnetic field measurements showed:

- The maximum static DC magnetic field measurement, 518.5 mG, is consistent with the typical value of 513 mG for the Earth's static magnetic field in the New York City area
- AC magnetic field measurements in the range 0 – 800 Hz at all sites, including at 60 Hz, were insignificant and substantially lower than the broadly applied Institute of Electrical and Electronic Engineers (IEEE) standard C95.1-2019, “Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz.” The IEEE Std C95.1 maximum permissible exposure (MPE) limit is 9.0 G at 60 Hz. The measurements were also lower than the stricter criterion in the New York State Department of Public Service (DPS) Statement of Interim Policy (NYIP) on Magnetic Fields of Major Electric Transmission Facilities, which specifies a limit of 0.2 G at 60 Hz. The low 60 Hz levels are relevant for measurement location Sites 2 and 7, since the PSA project will install two single-phase 138 kV circuits with buried cables at these two locations.
- The maximum 60 Hz magnetic field measured field level was 3.5 mG, at measurement location Site 6, near an AC substation with operating power equipment nearby. This is a typical level near power lines.

Table 2-2 summarizes the Magnetic Field results from static to 800 Hz, showing worst-case fields including at 60 Hz. The results show amplitude and frequency of emission, location, conditions, and preliminary assessment of impact.

Section 5 provides detailed information and notable static and AC magnetic field emissions from the 13 runs performed at the 11 measurement sites.

**Table 2-2
Magnetic Field Results Summary**

Site	Frequency Bands					Results / Notes
	Static	60 Hz	180 Hz	360 Hz	720 Hz	
Site 1 Run 0808-02	Earth Level 500 mG	< 1 mG	< 1 mG	< 1 mG	< 1 mG	Quiet site in a field. High voltage transformer 75 ft southwest of measurement point.
Site 2 Run 0808-7	Earth Level 493 mG	< 1 mG	< 1 mG	< 1 mG	< 1 mG	Chain link fences 10 ft northwest and 60 ft southwest of the measurement point. Truck entered measurement area from 35 – 100 s.
Site 3 Run 0809-1	Earth Level 501 mG	3 mG	< 1 mG	< 1 mG	< 1 mG	School bus parked 5 ft west of measurement point. Heavy machinery operating nearby south of measurement point. Amtrak train passed at t = 35 s. 60 Hz harmonic spike at t=80s, likely due to tractor operating nearby.
Site 4 Run 0809-2	Earth Level 499 mG	< 1 mG	< 1 mG	< 1 mG	< 1 mG	Quiet site next to parking structure. Measurement point next to lamp post and chain-link fence.
Site 5 Run 0810-1	Earth Level 518.5 mG	< 1 mG	< 1 mG	< 1 mG	< 1 mG	Quiet site in golf course parking lot. Highest measurement value for static (0 Hz) magnetic field. Quietest site for magnetic fields at 60 Hz harmonics.
Site 6 Run 0810-2	473 mG	3.5 mG	3.5 mG	2.2 mG	< 1 mG	Highest 60 Hz harmonic emissions. Power line 12 ft west of measurement point behind magnetic probe. AC Substation 225 ft north of measurement point. Tree trimmer operating 50 ft west of measurement point on overpass bridge elevated above and behind magnetic probe from t = 85 s onwards.

Table 2-2
Magnetic Field Results Summary

Site	Frequency Bands					Results / Notes
	Static	60 Hz	180 Hz	360 Hz	720 Hz	
Site 7 Run 0810-4	Earth Level 495 mG	2.2 mG	< 1 mG	< 1 mG	< 1 mG	Amtrak train passes at t = 79 s, causing an emissions spike at 60 Hz. Busy street 20 ft south of measurement point. Chain link and iron post fences surrounding measurement point on all sides. Metal dumpster with steel fence scrap 30 ft north-east of measurement point.
Site 8 Run 0811-2	401.5 mG	< 1 mG	< 1 mG	< 1 mG	< 1 mG	Unusual static (0 Hz) field levels due to surrounding steel structures and cars. When height of probe is adjusted from 6 ft to 2 ft the static field changes from about 400 mG to about 600 mG. Traction power transformers located 100 ft north-west of measurement site. Measurement point situated next to steel car barrier directly west in between probe and ROW about 4 ft below the magnetic probe.
Site 9 Run 0811-3	Earth Level 501 mG	< 1 mG	< 1 mG	< 1 mG	< 1 mG	Measurement point situated next to steel car barriers about 4 ft below the magnetic probe. Large iron post fence 8 ft west of measurement point utility power lines overhead.
Site 10 Run 0812-3	Earth Level 502 mG	2.2 mG	1.2 mG	< 1 mG	< 1 mG	Power substation transformers 100 ft southwest of measurement point. Chain link fence 30 ft southeast of measurement point between probe and ROW.
Site 11 Run 0812-4	471 mG	< 1 mG	< 1 mG	< 1 mG	< 1 mG	Low static (0 Hz) measurement likely due to proximity to semi-truck trailer. Semi-truck trailer 5 ft east of measurement point. Chain link fence 8 ft south of measurement point between probe and ROW.

2.2 Measurement Schedule

Tenco performed the radiated electric and magnetic field measurements per the Table 2-3 schedule.

Table 2-3 Measurement Schedule						
Sun 8/7/2022	Mon 8/8/2022	Tue 8/9/2022	Wed 8/10/2022	Thu 8/11/2022	Fri 8/12/2022	Sat 8/13/2022
Travel	Setup and performed measurement for Radiated Electric Field and Magnetic field at Site 1 and Site 2	Setup and performed measurement for Radiated Electric Field and Magnetic field at Site 3 and Site 4	Setup and performed measurement for Radiated Electric Field and Magnetic field at Site 5, Site 6, and Site 7	Setup and performed measurement for Radiated Electric Field and Magnetic field at Site 8 and Site 9	Setup and performed measurement for Radiated Electric Field and Magnetic field at Site 10 and Site 11 Pack and ship equipment	Travel

2.3 Spectral Analysis

The spectral analysis in section 6 assesses the ambient EMF environment along the HGL. The assessment considered potential emitters and potentially susceptible equipment in the PSA systems. The assessment compared the expected emissions and immunity to the measured magnetic and radiated field levels at the 11 selected sites. The measurements at the sites covered the radiated electric field frequency range 10 kHz to 6 GHz. The magnetic field measurements covered the range 0 to 800 Hz.

As summarized and detailed elsewhere, radiated field levels were typical for urban and suburban areas. The static magnetic field level is typical of the Earth's magnetic field. The 60 Hz magnetic field under 60 Hz power lines was typical of fields near power lines. AC magnetic fields were typical for urban and suburban areas.

The spectral analysis concluded that the electric field and magnetic measurements are compatible with the existing and new systems and equipment being provided in the PSA project:

- With the foundational design criterion that the new systems will be equivalent to the existing ones already in MTA and Amtrak service, and
- With the expectations that the PSA designs and installations will comply with relevant EMC criteria and guidelines, and that MTA will maintain and operate the equipment following the applicable procedures.

3 Measurement Procedure and Locations

3.1 Measurement Procedure

Tenco followed the following procedures:

1. Performed measurements during daytime, between 8 am and 8 pm
2. Used a passenger van to transport the measurement equipment to, and to provide shade and shelter at, a predetermined set or representative locations
3. At each location, the engineers
 - Parked in a safe location, wore appropriate Personal Protective Equipment (PPE), and set out traffic cones as necessary
 - Set up two or three measurement antennas connected by cable to equipment just outside the van
 - Set up a 120 VAC power connection
 - Recorded data for up to two hours, depending on variability of environment
 - Packed up and move to the next location.

3.2 Measurement Locations

Tenco performed measurements at 11 PSA planned passenger station locations, existing and proposed substation locations, and other significant locations, including:

- Specific sensitive receptors adjacent to the track centerline
- Worst case ambient EMF locations, such as under high voltage power lines or near significant emitters such as TV broadcast stations and electrical substations
- “Quiet” locations, where the Tenco expected low ambient EMF levels
- Locations where the Tenco expected worst-case PSA trainset EMF levels
- Locations with significant public interaction, such as passenger stations.

The post-energization survey measurements will measure the radiated electric field and magnetic fields at the same set of locations as the pre-energization measurements.

Table 3-1 lists the locations where Tenco made pre-energization survey measurements.

Figure 3-1 is a pre-energization survey measurement location map. The green pins show the 11 representative measurement locations including the four new stations to be installed: Co-op City, Morris Park, Parkchester-Van Nest, and Hunts Point Stations, as well as the 5 proposed or existing substations: Oak AC Substation, New Rochelle AC Substation, Bowery Bay AC Substation, HG-02 DC Substation, and HG-01 DC Substation.

Following subsections describe the measurement sites relative to the PSA section of the existing HGL ROW, including satellite images and photographs.

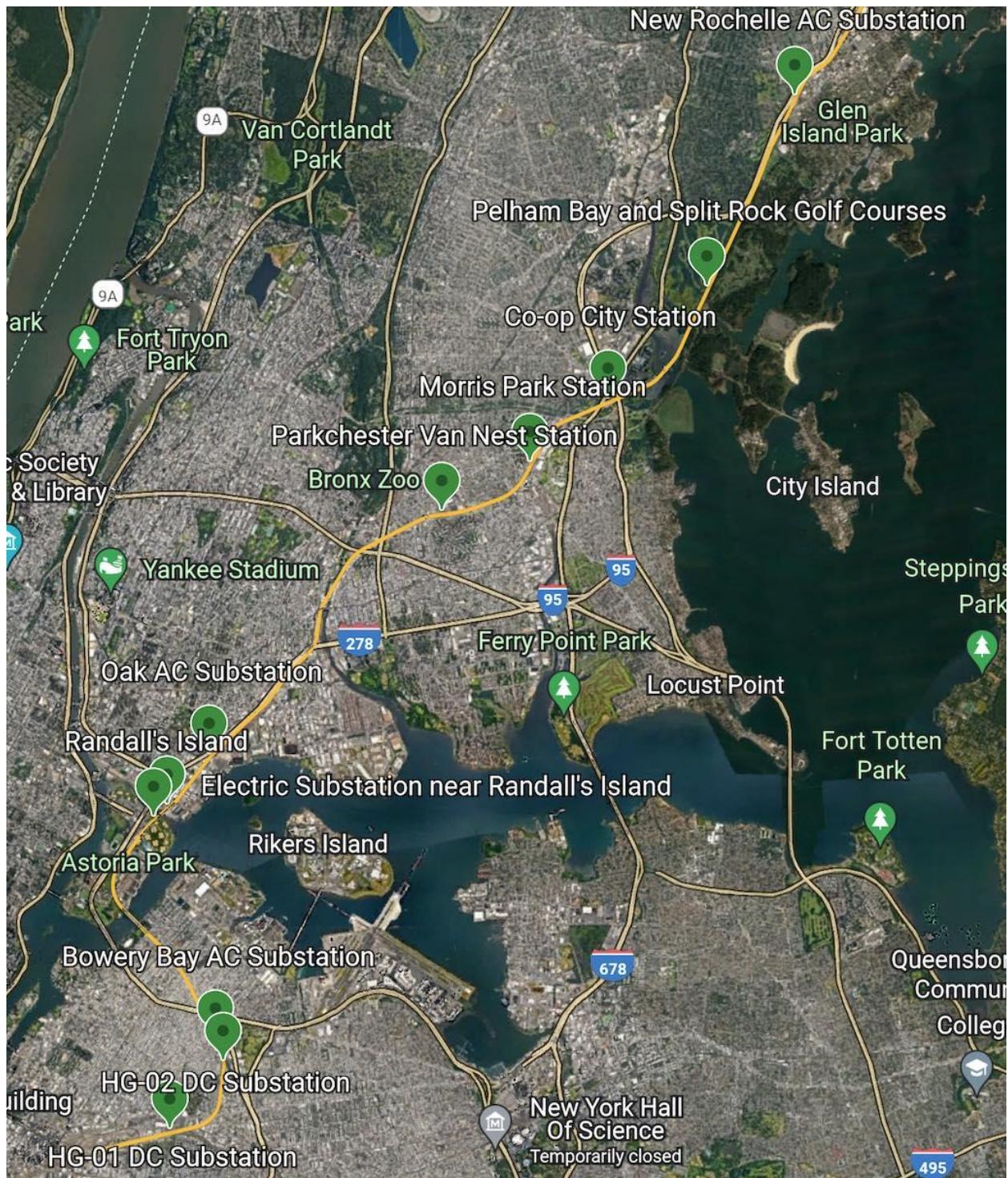
**Table 3-1
Measurement Locations**

Site	Description	STA	GPS Coordinates	Nearest Landmark	Distance to Landmark (ft)
1	Randall's Island	326+55 [Note 2]	40.795365, -73.919125	Oak AC Substation	5380
2	Oak AC Substation [Note 3]	371+96	40.806010, -73.906472	Oak AC Substation	300
3	Co-op City Station	677+32	40.858423, -73.828837	Co-op City Station	56
4	Morris Park Station	619+00	40.850762, -73.842747	Morris Park Station	700
5	Pelham Bay and Split Rock Golf Courses	761+15	40.872038, -73.810816	Co-op City Station	7086
6	New Rochelle AC Substation	873+56	40.902387, -73.793520	New Rochelle AC Substation	136
7	Parkchester-Van Nest Station [Note 3, 4]	562+11	40.841690, -73.861618	Parkchester-Van Nest Station	220
8	Bowery Bay AC Substation	289+00 [Note 1]	40.764183, -73.905127	Bowery Bay AC Substation	47
9	HG-02 DC Substation	277+00 [Note 1]	40.761164, -73.904467	HG-02 DC Substation	285
10	Electric Substation near Randall's Island	336+31 [Note 2]	40.799378, -73.914625	Oak AC Substation	3450
11	HG-01 DC Substation	222+00 [Note 1]	40.751295, -73.914385	HG-01 DC Substation	73

Notes:

- 1] These Stationing (STA) values were provided in the technical proposal drawing but are measured from a different reference than the remaining sites.
- 2] The STA values for these locations do not appear in any technical drawings. They are estimates of distance south of Oak AC Substation.
- 3] Tenco will perform single phase 60 Hz 138 kV line measurements during the post-energization survey and analyze magnetic field strength based on the NYIP limit
- 4] Tenco was not able to access the Parkchester-Van Nest Con Edison site proposed in the PESP. The tested measurement point during PrES testing is likely not close enough to the single phase 60 Hz 138 kV line for the PoES measurement.
- 5] The sites numbers from Table 3-1 differ from the numbers noted in the PESP Table 4-1. The rest of this report will use Table 3-1 below for reference.

Figure 3-1
PSA EMF Survey Measurement Locations Map



3.3 Site 1: Randall's Island, New York, NY

Measurement Point:

- Quiet site next to Randall's Island Field 12
- High voltage transformer located 75 ft Southwest
- Antennas setup 100 ft from existing line track. Tracks located 64 ft above antennas.

Test Date: 08/08/2022

Antennas GPS Coordinates: 40.795365, -73.919125

(Satellite view not suitable for this site)



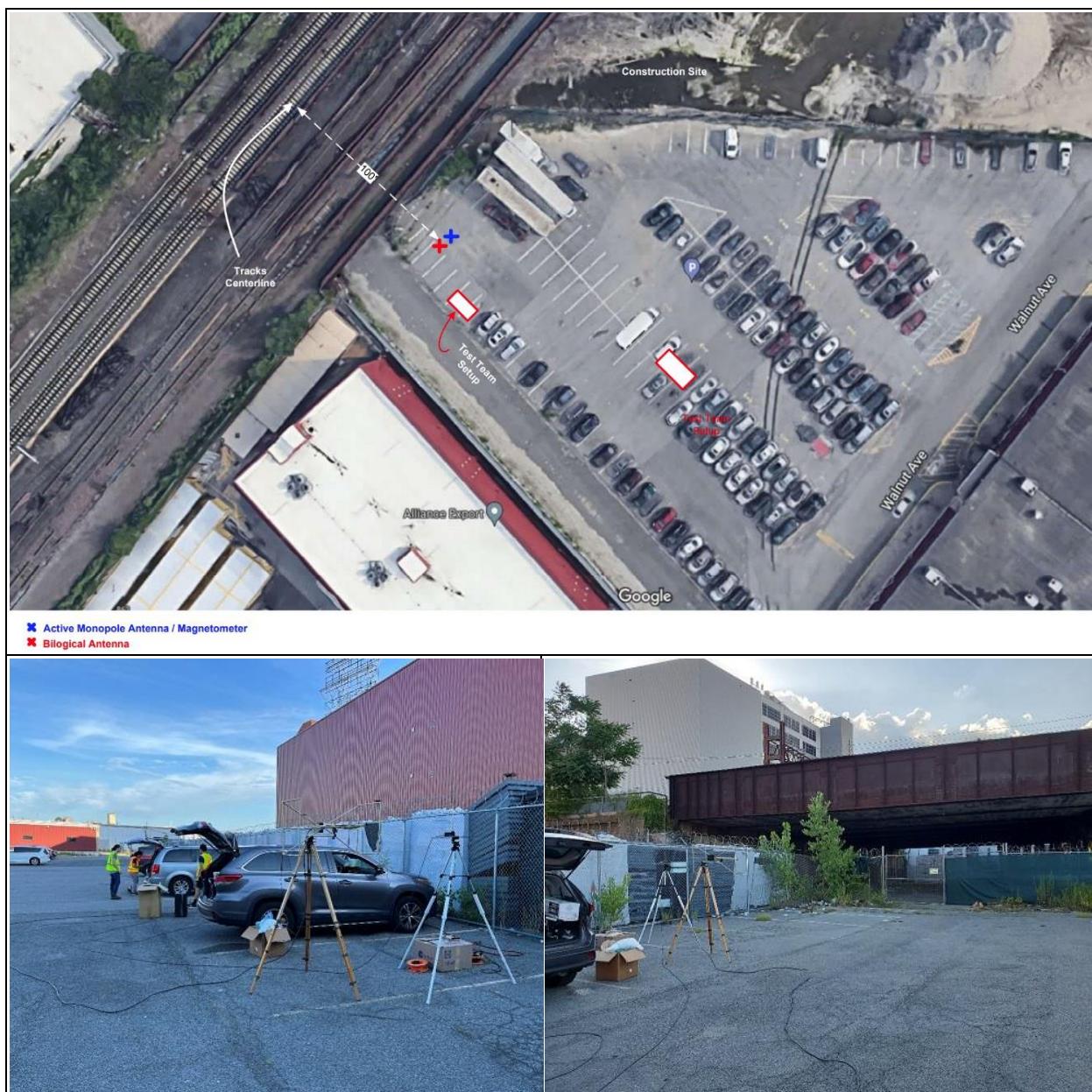
3.4 Site 2: Oak AC Substation, The Bronx, NY

Measurement Point:

- Chain link fences 10 ft Northwest and 60 ft Southwest
- Antennas setup 100 ft from existing line track. Tracks located 12 ft above antennas.

Test Date: 08/08/2022

Antennas GPS Coordinates: 40.806010, -73.906472



3.5 Site 3: Co-op City Station, The Bronx, NY

Measurement Point:

- Power/subtransmission lines above the rails
- School bus parked 5 ft West
- Heavy machinery operating nearby South
- Antennas setup 100 ft from existing line track. Tracks located 7 ft below antennas.

Notes: Subtransmission lines carry electricity at voltages less than 200 kV; typically 66 kV or 115 kV. Subtransmission lines are usually suspended on tall wood or light-weight steel poles.

Test Date: 08/09/2022

Antennas GPS Coordinates: 40.858423, -73.828837



3.6 Site 4: Morris Park Station, The Bronx, NY

Measurement Point:

- Quiet site next to parking structure
- Next to lamp post and chain-link fence
- Antennas setup 100 ft from existing line track. Tracks located 4 ft above antennas.

Test Date: 08/09/2022

Antennas GPS Coordinates: 40.850762, -73.842747

(Satellite view not suitable for this site)



3.7 Site 5: Pelham Bay and Split Rock Golf Courses, The Bronx, NY

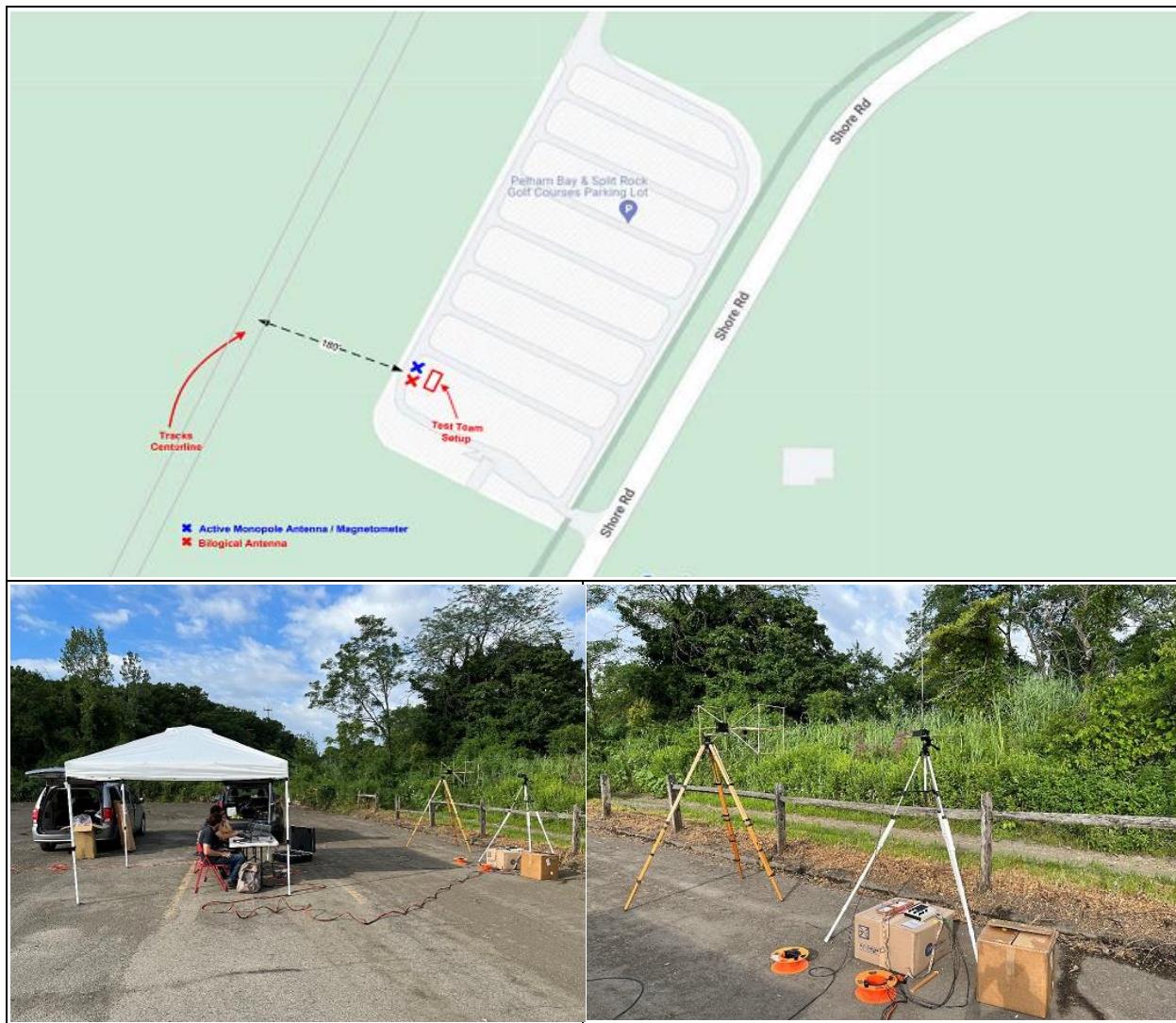
Measurement Point:

- Quiet site in golf course parking lot
- Antennas setup 100 ft from existing line track. Tracks located 3 ft above antennas.

Test Date: 08/10/2022

Antennas GPS Coordinates: 40.872038, -73.810816

(Satellite view not suitable for this site)



3.8 Site 6: New Rochelle AC Substation, New Rochelle, NY

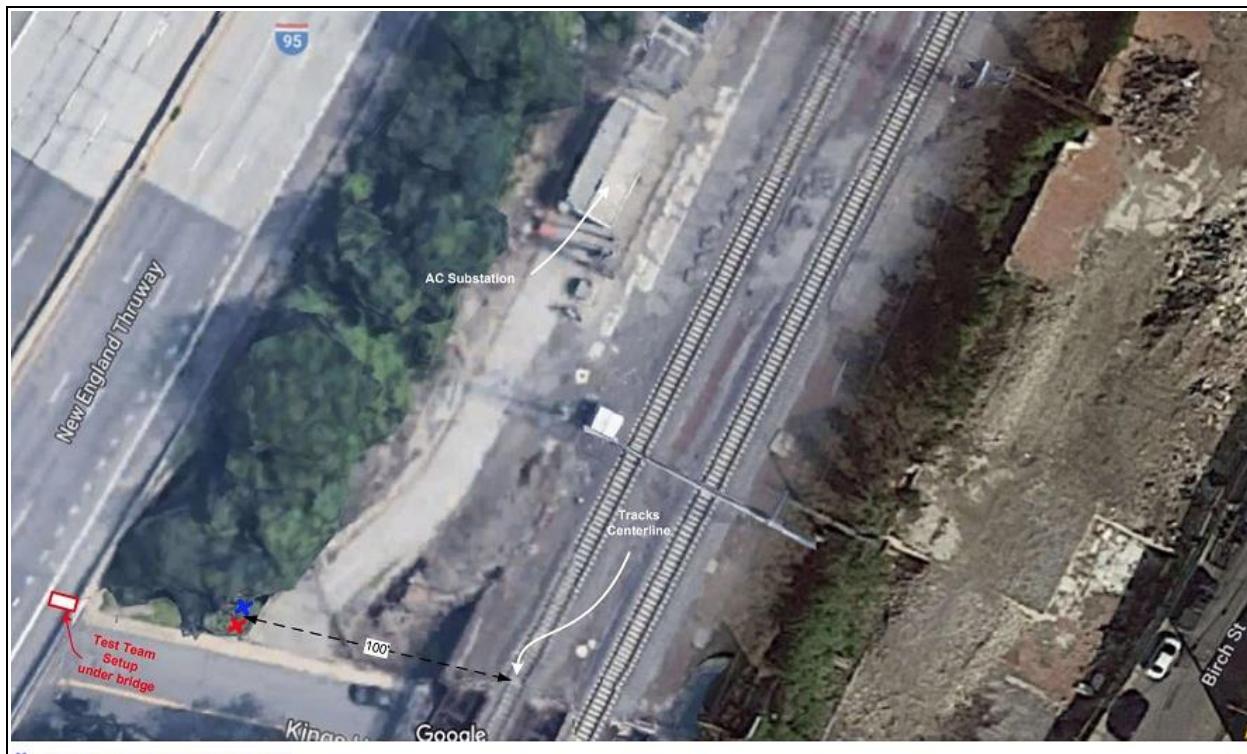
Measurement Point:

- Power/distribution lines 12 ft West from magnetic probe
- AC Substation 225 ft North
- Antennas setup 100 ft from existing line track. Tracks located 4 ft above antennas.

Note: Distribution lines are typically energized at 16 kV, 12 kV, or 4 kV and carry electricity to neighborhoods on wooden poles or underground.

Test Date: 08/10/2022

Antennas GPS Coordinates: 40.902387, -73.793520



3.9 Site 7: Parkchester-Van Nest Station, The Bronx, NY

Tenco could not access the ConEd Van Nest Parking lot to perform the PrES. As shown in the pictures below, Tenco instead performed the Survey at a non-active Halmar construction site, located on the other side of the tracks from the ConEd Van Nest Parking lot. Halmar/Jacobs will need to contact MTA, to get permission for Tenco to perform the Survey at the parking lot in the future.

Measurement Point:

- Busy street 20 ft South
- Chain link and iron post fences surrounding measurement point on all sides
- Metal dumpster with steel fence scrap 30 ft North-East
- Antennas setup 100 ft from existing line track. Tracks located 6 ft above antennas.

Test Date: 08/10/2022

Antennas GPS Coordinates: 40.841690, -73.861618

(Satellite view not suitable for this site)



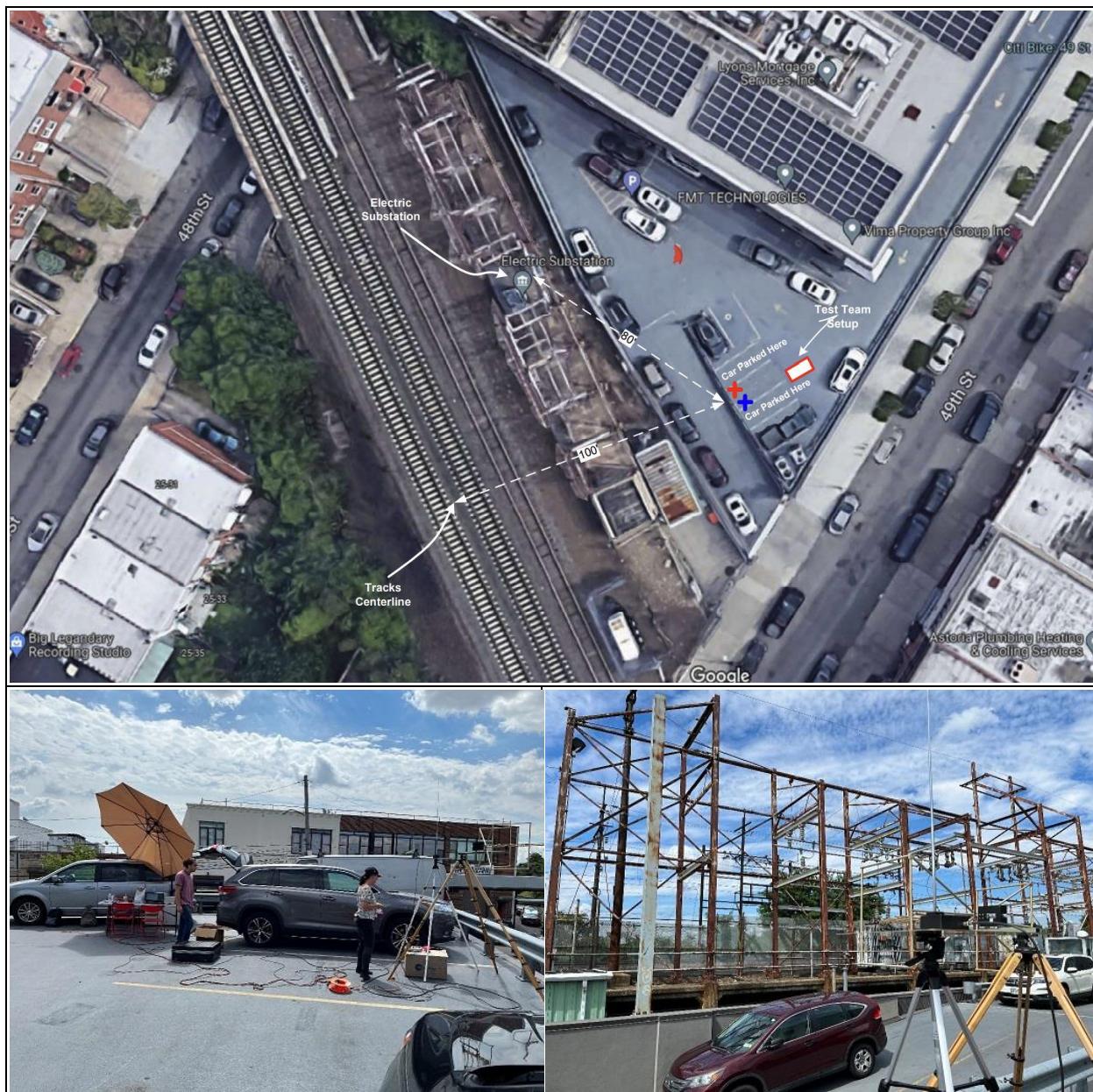
3.10 Site 8: Bowery Bay AC Substation, Queens, NY

Measurement Point:

- Surrounding steel structures and cars
- Traction power transformers located 100 ft North-West
- Next to steel car barrier directly west in between probe and ROW, about 4 ft below the magnetic probe
- Antennas setup 100 ft from existing line track. Tracks located 1 ft below antennas.

Test Date: 08/11/2022

Antennas GPS Coordinates: 40.764183, -73.905127



3.11 Site 9: HG-02 DC Substation, Woodside, NY

Measurement Point:

- Situated next to steel car barriers about 4 ft below the magnetic probe
- Large iron post fence 8 ft West
- Power/distribution lines overhead
- Antennas setup 100 ft from existing line track. Tracks located 27 ft above antennas.

Test Date: 08/11/2022

Antennas GPS Coordinates: 40.761164, -73.904467



3.12 Site 10: Electric Substation Near Randall's Island, Woodside, NY

Measurement Point:

- Power substation transformers 100 ft Southwest
- Chain link fence 30 ft Southeast between probe and ROW
- Antennas setup 100 ft from existing line track. Tracks located 41 ft above antennas.

Test Date: 08/12/2022

Antennas GPS Coordinates: 40.799378, -73.914625



3.13 Site 11: HG-01 DC Substation, Long Island City, NY

Measurement Point:

- Setup next to semi-truck trailer 5 ft East
- Chain link fence 8 ft South between probe and ROW
- Antennas setup 100 ft from existing line track. Tracks located 8 ft above antennas.

Test Date: 08/12/2022

Antennas GPS Coordinates: 40.751295, -73.914385



4 Radiated Electric Field Measurement Results

4.1 Purpose and Requirements

As noted above, the PrES measurement objectives are:

- Measure the maximum and minimum pre-energization ambient radiated and magnetic field levels along the HGL, before PSA construction
- Use the measured baseline EMF levels for comparison with the PoES measurements to be made after energizing the third rail and OCS and before the start of revenue service.

Tenco performed electric field measurements at each of the 11 selected locations along the HGL, presented in Section 3. Following subsections provide key measurement results and describe measurement locations, equipment, steps, and runs.

4.2 Measurements Performed

Tenco performed 152 radiated electric field measurement runs at the 11 selected sites, from August 8 to August 12, 2022. Tenco measured radiated electric field in bands B0 (10 to 160 kHz) through B7 (1 GHz to 6 GHz). Tenco made measurements with the bi-logical antenna in both the horizontal and vertical polarity.

The log recorded the measurement number, measurement type, measurement location, band, time, weather conditions, and other relevant information. For each log entry, a screenshot of the signal analyzer was saved along with a CSV file containing the same data. Appendix A provides the complete results for the electric field measurements.

4.3 Measurement Results

As described in Section 2.1.1 and the executive summary, the electric field measurements showed:

- Measurements were similar at all locations, with more variability in the lower frequency bands
- Measurements at all sites showed typical high emissions levels at FM radio, aeronautical communications, mobile communications, and TV broadcasting frequencies
- Most sites showed a set of relatively strong radiated peaks in the low frequency 10 -160 kHz band, starting at 20 kHz repeating every 20 kHz. These are likely maritime radio navigation signals and two standard frequency and time signals at 20 kHz and 60 kHz.
- Most sites were above the EN50121-2:2017 limits between bands B0 and B4. Electric fields in dense urban areas often exceed the EN 50121-2 limits.

Table 2-1 summarizes the radiated electric field level results. This section provides further detail on the radiated electric field measurements, and highlights important measurement runs.

In the following subsections for each measurement frequency range band, each subsection has two radiated emission graphs:

- Noisiest site
- Quietest site.

Each radiated emission graph shows two traces:

- The top orange trace is the maximum peak hold electric field level
- The bottom bright blue trace is the minimum peak hold electric field level.

On the graphs, where the maximum and minimum traces are vertically separated, this indicates a time-varying level of electric field during the measurement window. Where the maximum and minimum traces have the same peak value, this indicates a steady level of peak electric field. A narrow peak with the same maximum and minimum peak value indicates a narrowband transmitter, such as radio, television, cellphone, or other transmission frequency.

The measurement engineer typically measures for a period of 5 s, so the maximum and minimum levels show the variation of the electric field within the 5 s measurement window.

A broad hump indicates a broadband noise emission typical of high-power equipment other than radio transmitters.

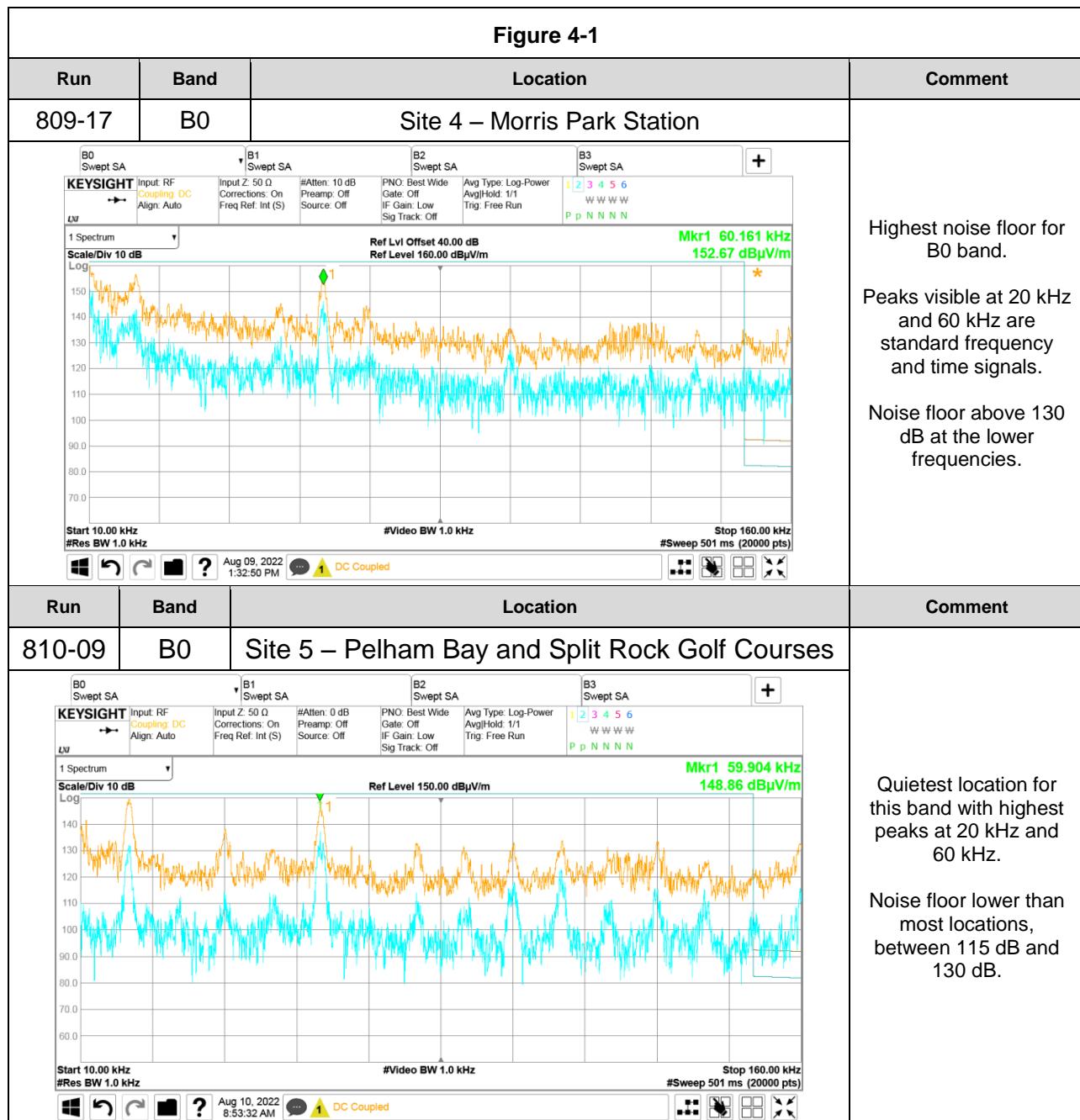
Each radiated emission graph shows a limit line. The limit line was sourced from EN50121-2:2017, Figure 2. Limits were converted to dB_{UV}/m, and limits were converted from the EN standard 10 m measurement distance to the PESP specified 100 ft measurement distance. As stated in EN50121-2:2017, Section 4.2, “Radio frequency noise emissions from the railway substation to the outside world environment measured according to the method defined in Clause 5 shall not exceed the limits in Figure 2.”

The limit line In the measurement graphs shows the relation of the preexisting environment to the EN limits, demonstrating cases in which the limits are exceeded by the preexisting environment.

4.3.1 B0 Band

Figure 4-1 shows key radiated electric field runs for band B0. For B0 runs, all sites showed a set of relatively strong radiated peaks starting at 20 kHz, repeating every 20 kHz. These are likely maritime radio navigation signals. For all sites, the strongest peaks were either at 20 kHz or 60 kHz, generally measuring between 155 dB and 160 dB.

- Run 809-17: Site 4 is the noisiest site, with noise floor levels from 125 dB to 150 dB
- Run 810-09: Site 5 is the quietest site, with noise floor levels from 115 dB to 130 dB.

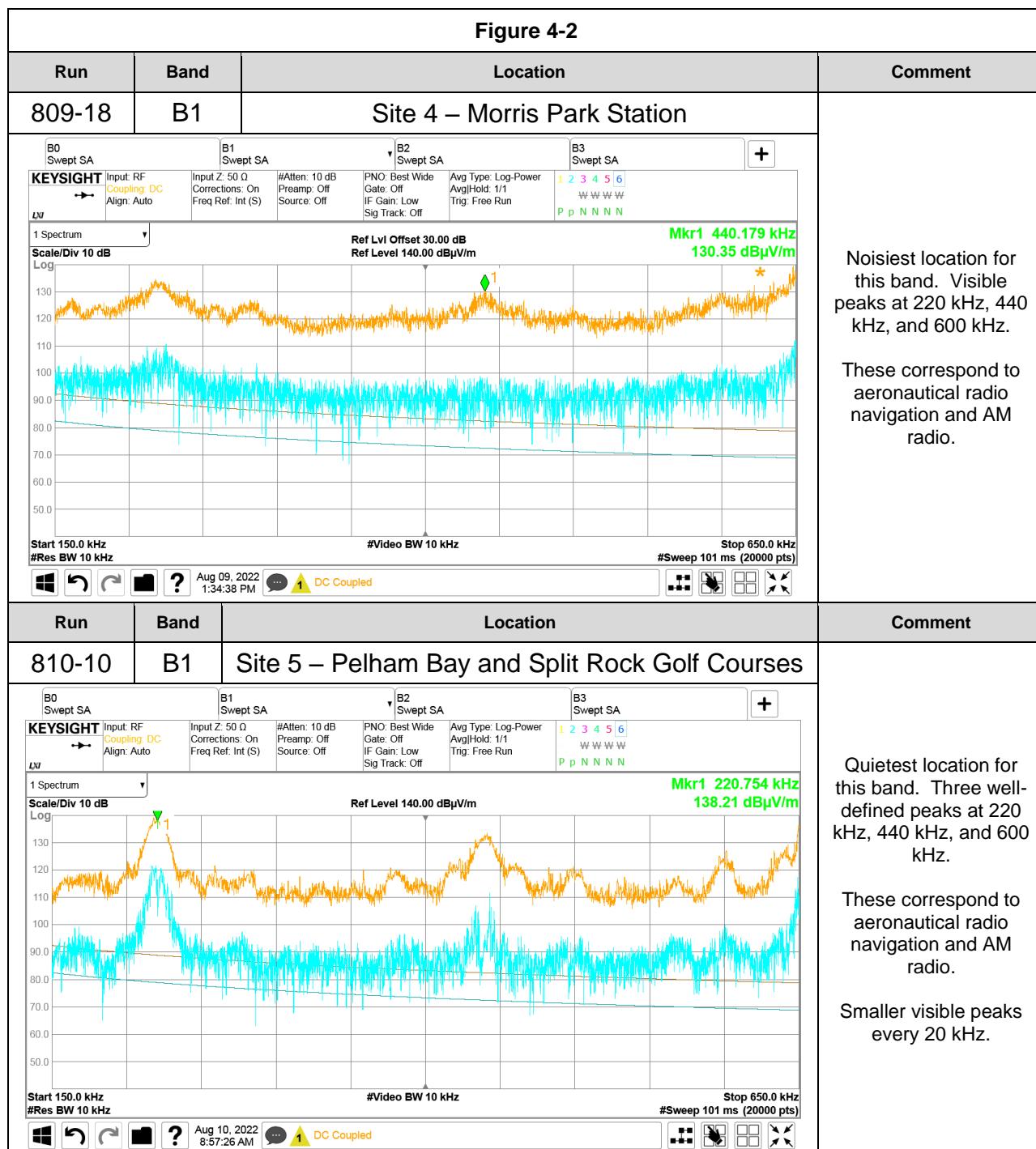


4.3.2 B1 Band

Figure 4-2 shows key radiated electric field runs for band B1. For B1 runs, most sites showed peaks at multiples of 20 kHz, similar to B0.

Sites 3, 4, and 5, showed strong peaks at 220 kHz, 440 kHz and 600 Hz. These are aeronautical radio navigation and AM radio signals. Sites 10 and 11 showed no clear peaks.

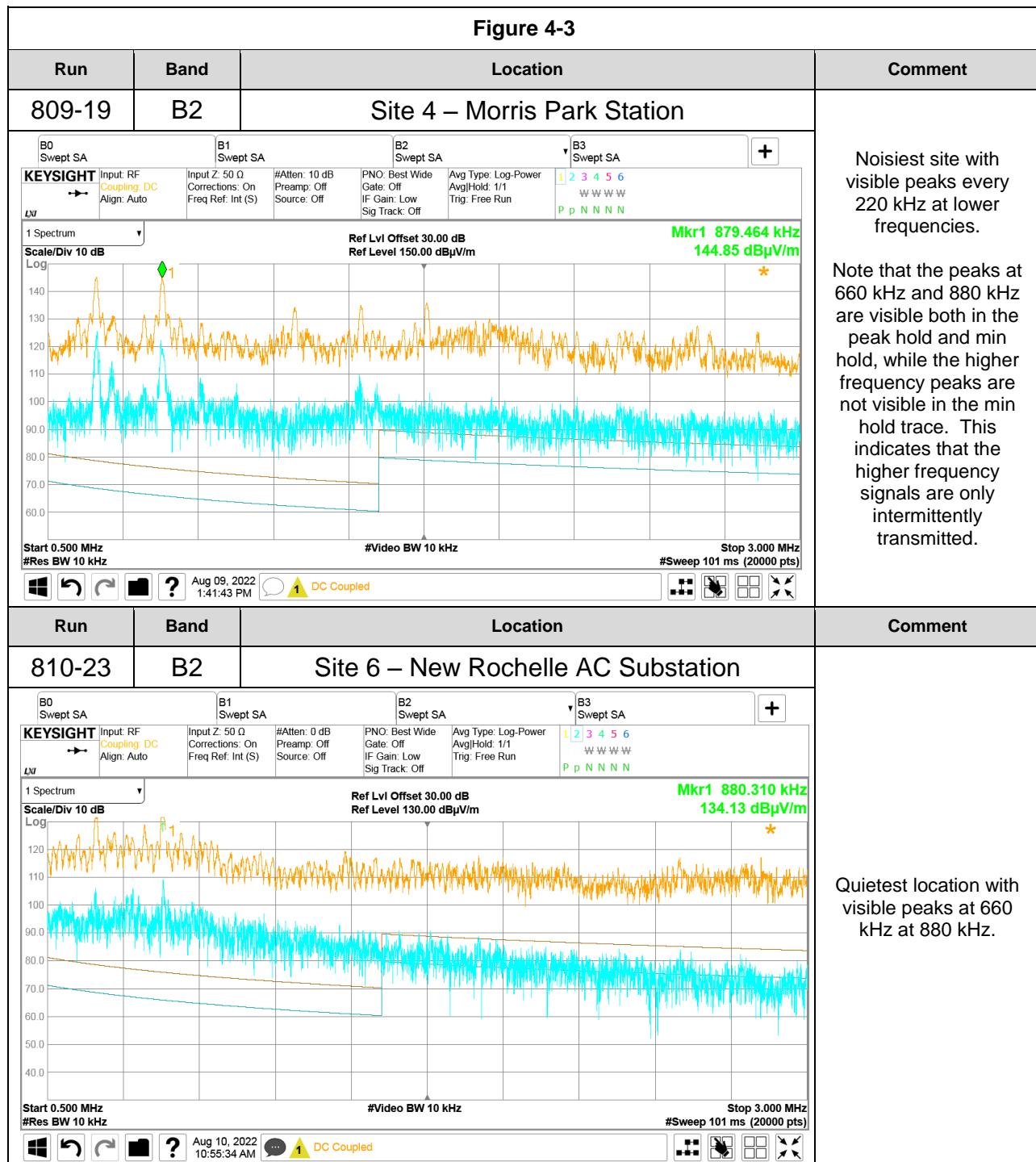
- Run 809-18: Site 4 is the noisiest site, with noise floor levels between 115 and 125 dB
- Run 810-10: Site 5 is the quietest site, with noise floor levels between 110 and 120 dB.



4.3.3 B2 Band

Figure 4-3 shows key radiated electric field runs for band B2. For B2 runs, all sites recorded peaks at 660 kHz and 880 kHz. Sites 3, 4 and 5, also showed peaks at 1.32 MHz, 1.54 MHz, and 1.76 MHz.

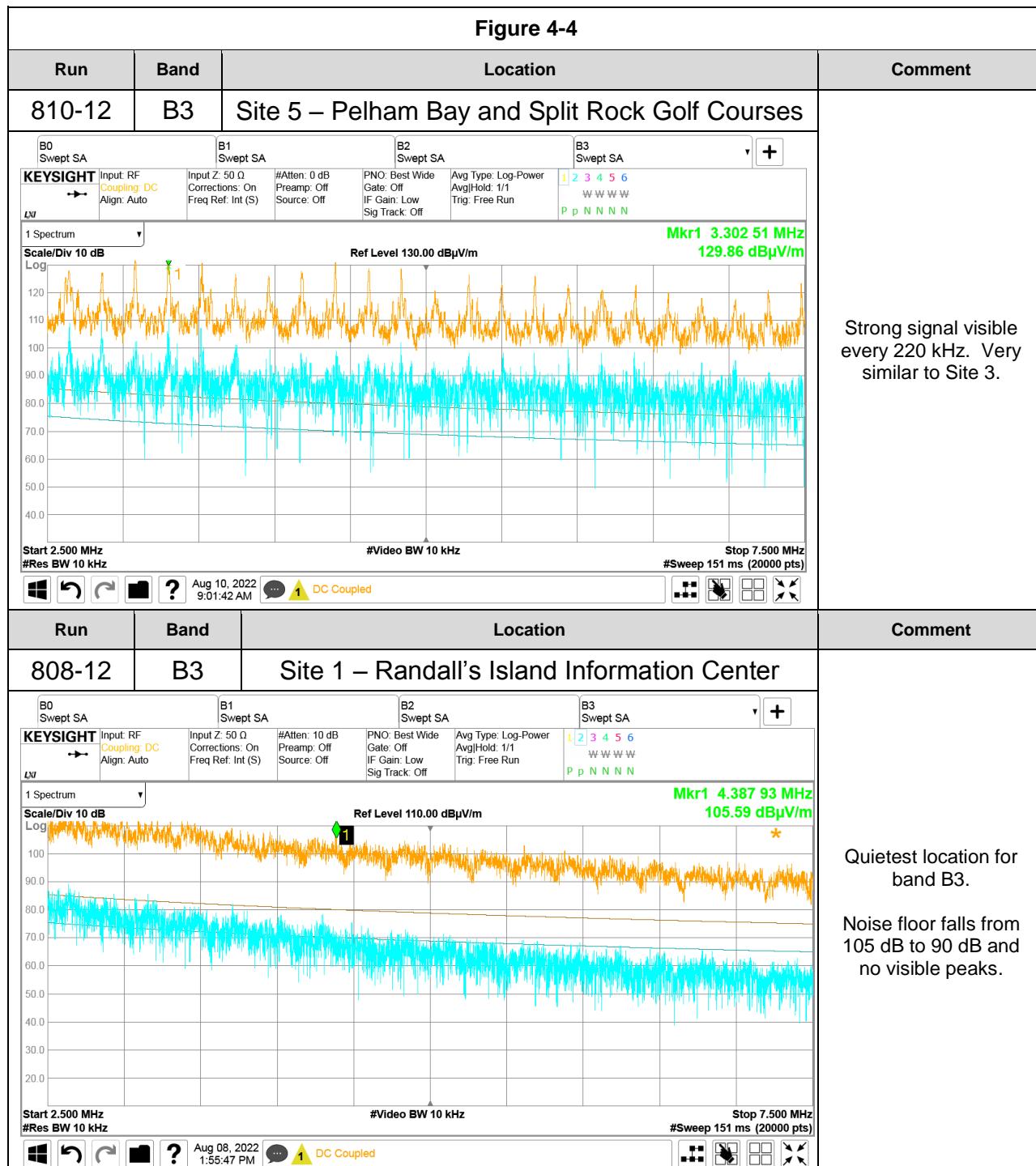
- Run 809-19: Site 4 is the noisiest site, with noise floor levels between 115 and 120 dB
- Run 810-23: Site 6 is the quietest site, with noise floor levels between 105 and 115 dB.



4.3.4 B3 Band

Figure 4-4 shows key radiated electric field runs for band B3. For B3 runs, many sites showed no significant peaks. Sites 3 and 5 continued to show peaks every 220 kHz. Most other sites showed a noise floor that falls from around 110 dB to 100 dB

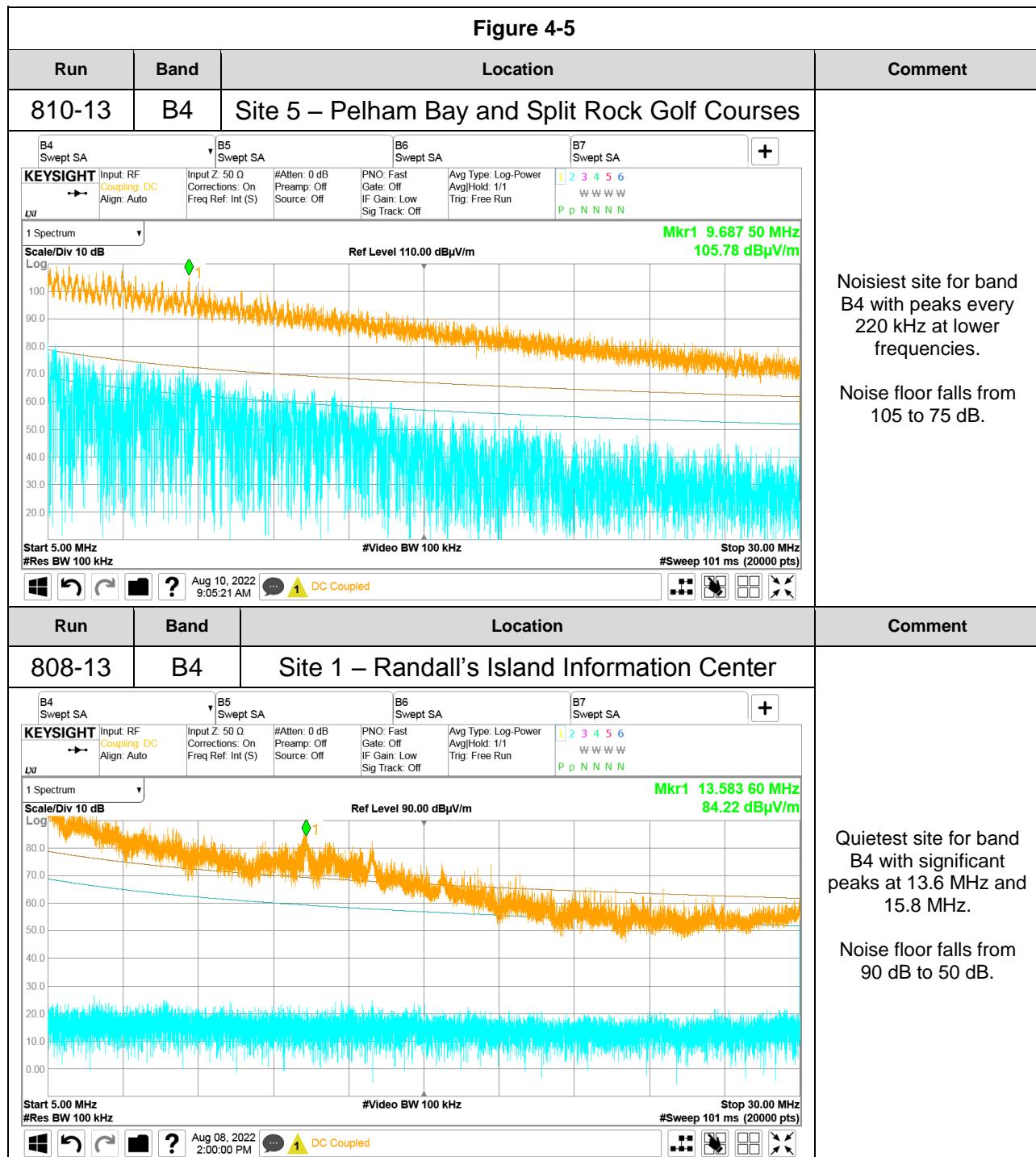
- Run 810-12: Site 5 is the noisiest site, with noise floor levels between 115 and 105 dB
- Run 808-12: Site 1 is the quietest site, with noise floor levels between 105 dB and 90 dB.



4.3.5 B4 Band

Figure 4-5 shows key radiated electric field runs for band B4. At most sites, band B4 was characterized by a consistently decreasing noise floor with few significant peaks, except for Site 11 with a flat in amplitude after 18 MHz.

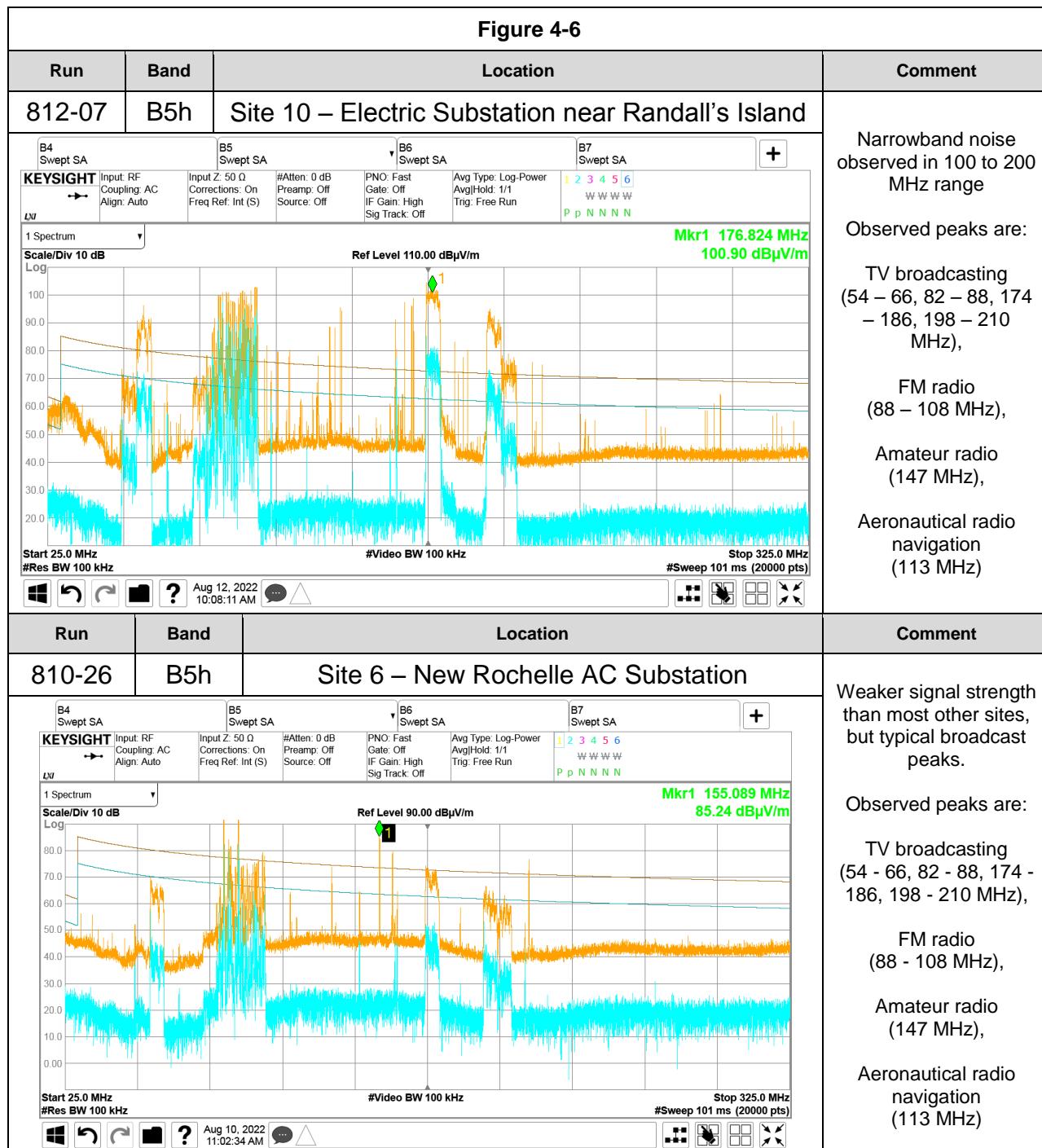
- Run 810-13: Site 5 is the noisiest site, with noise floor levels between 105 dB and 75 dB.
- Run 808-13: Site 1 is the quietest site, with noise floor levels between 90 dB and 55 dB.



4.3.6 B5 Band

Figure 4-6 shows key radiated electric field runs for band B5. Only band B5h measurements are considered in this section as they have the same noise floor and similar signals as those in band B5v. Band B5 showed narrowband peaks, which are typical TV broadcasting, FM radio, amateur radio, and aeronautical radio navigation signals.

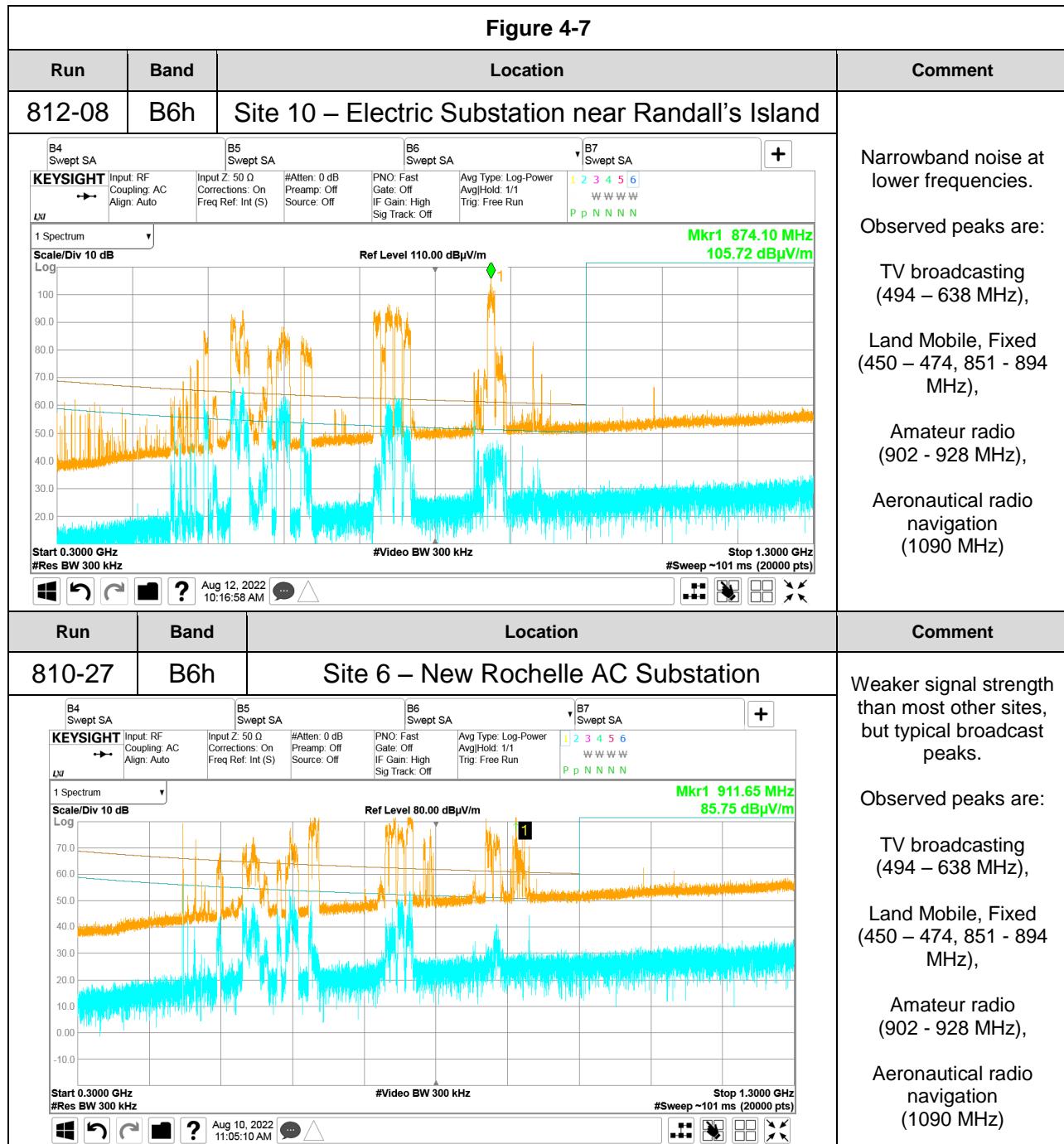
- Run 812-07: Site 10 is the noisiest site, with noise floor levels between 50 dB and 40 dB
- Run 810-26: Site 6 is the quietest site, with noise floor levels between 45 dB and 35 dB.



4.3.7 B6 Band

Figure 4-7 shows key radiated electric field runs for band B6. Only band B6h measurements are considered in this section as they have the same noise floor and similar signals as those in band B6v. Band B6 showed narrowband peaks, which are various TV broadcasting, fixed mobile, amateur radio, and aeronautical radio navigation signals.

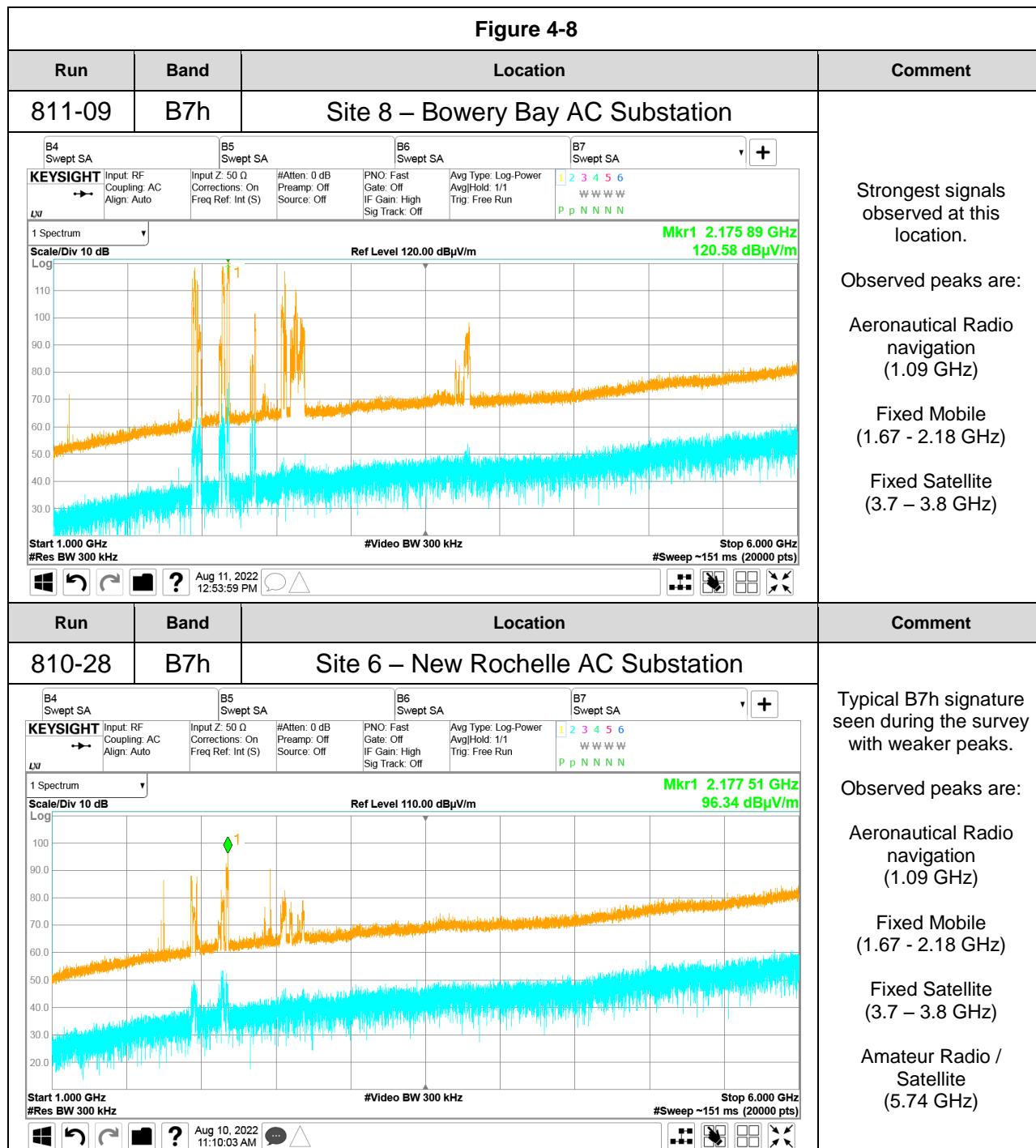
- Run 812-08: Site 10 is the noisiest site, with many narrowband noise at lower frequencies
- Run 810-27: Site 6 is the quietest site, with the lowest signal strengths.



4.3.8 B7 Band

Figure 4-8 shows key radiated electric field runs for band B7. Only band B7h measurements are considered in this section as they have the same noise floor and similar signals as those in band B7v. The band B7 bands showed the most activity in the range of 1.7 to 2.7 GHz which corresponds mostly to mobile activity.

- Run 811-09: Site 8 is the noisiest site, with the strongest signals peaking at 120 dB
- Run 810-28: Site 6 is the quietest site, with the strongest peaks no higher than 95 dB.

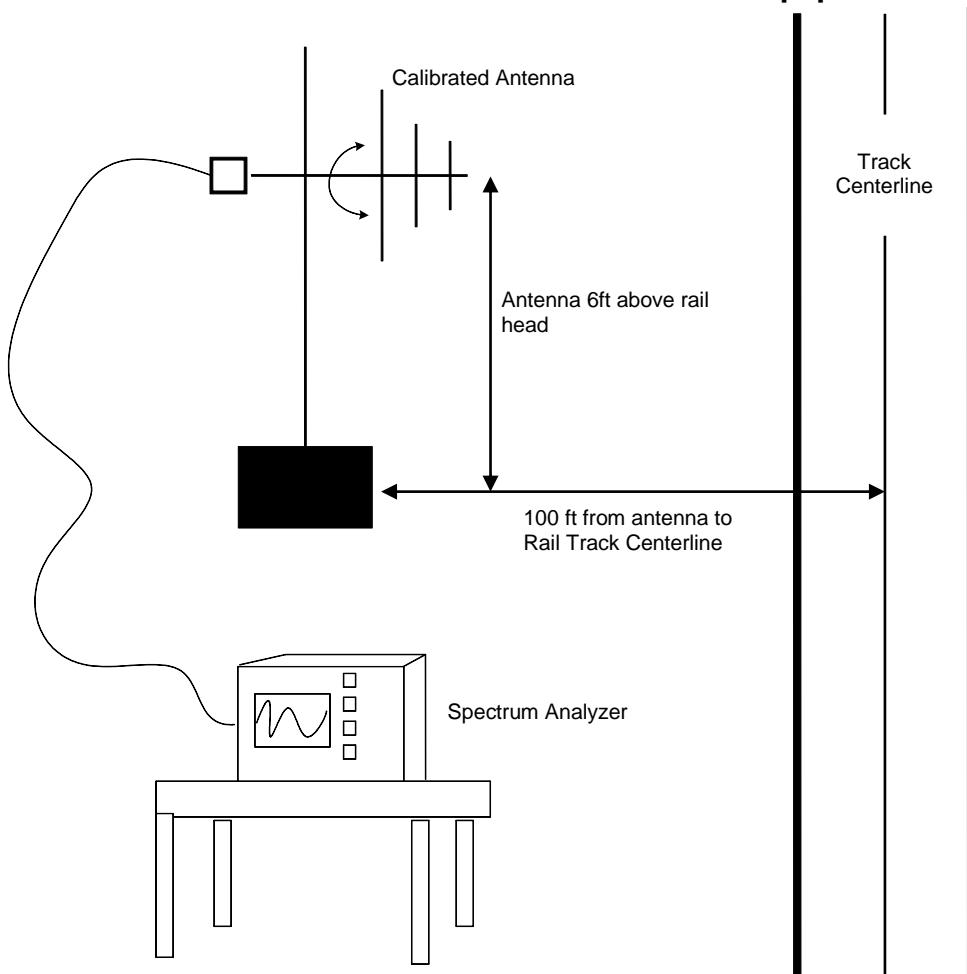


4.4 Measurement Equipment and Calibration

4.4.1 Measurement Equipment

Figure 4-9 is a block diagram of the radiated electric field measurement setup. The measurement used an active monopole antenna and bilogical antennas to measure electromagnetic fields from the ambient environment at each site. The measurement used the monopole antenna for low frequency measurements from 10 kHz to 30 MHz (Bands B0 to B4), and the bilogical antenna for high frequency measurements from 25 MHz to 6 GHz (Bands B5 to B7).

Figure 4-9
Radiated Electric Field Measurement Equipment Setup



The antennas were connected to a Keysight N9010B Spectrum Analyzer, which measured the electromagnetic field levels in each frequency band.

The measurement configuration followed the configuration in the PESP, except for a few minor changes. The Keysight AT/N9010B-507/P07/EDP Signal Analyzer was used instead of the KT-9010A-507/P07/EDP, the SAS-550-1B Active Monopole Antenna was used instead of the SAS-550-1, and the AK-521F-7 Bilogical Antenna was used instead of the SAS-521F-7. The substitute equipment is equivalent.

During each measurement run, the Spectrum Analyzer collected data in peak hold mode for the maximum and minimum field magnitude versus frequency.

Table 4-2 lists the radiated electric field measurement equipment.

Table 4-1 Radiated Electric Field Measurement Equipment List		
#	Item	Comment
1	Keysight AT/N9010B-507/P07/EDP EXA Signal Analyzer	For measuring EMI field intensity between 10 Hz and 6 GHz.
2	A.H. Systems SAS-550-1B: Active Monopole Antenna or equivalent, 9 kHz to 60 MHz	Calibrated antenna for Bands 0 - 4
3	A.H. Systems AK-521F-7: Bilogical Antenna or equivalent, 25 MHz to 7 GHz	Calibrated antenna for Bands 5 - 7
4	A.H. Systems Adjustable Antenna Tripod: * Tripod: ATU-510, * Extension Legs: WEL-510, * Azimuth and Elevation Head: AEH-510	To support antennas
5	Calibrated Coax Cable	Calibrated Coax Cable for Bands 5 - 7
6	Laptop computer	For control of printer and storage of measurement data results
7	AC Power Source	AC line, generator, or car battery inverter.
8	Folding table and chairs	For test team and equipment

The PESP describes the major measurement equipment items in more detail.

Appendix C provides the Measurement Equipment Calibration Record Table and scans of the calibration record sheets sent from AH systems and Keysight for the antennas and analyzer.

4.4.2 Measurement Bands

Tenco performed broadband emission measurements in the range of 10 kHz to 6 GHz using active monopole and bilogical antennas for horizontal and vertical polarizations, as appropriate.

Tenco divided measurements into eight measurement bands, shown in Table 4-3.

Tenco used the active monopole antenna to cover the range from 10 kHz to 30 MHz, in five measurement bands B0 to B4. Per the UMTA procedure, Tenco measured with the active monopole oriented vertically. The active monopole antenna is omni-directional, so a single measurement recorded fields in all compass directions.

Tenco used the bilogical antenna to cover the range from 30 MHz to 6 GHz, in three bands B5 to B7, for both horizontal and vertical polarization.

**Table 4-2
Radiated Emissions Measurement Bands**

ID	Band Frequency Range	Antenna	Antenna Orientation	Resolution Bandwidth
B0	10 kHz – 160 kHz	Active Monopole	Vertical	1 kHz
B1	150 kHz – 650 kHz	Active Monopole	Vertical	10 kHz
B2	500 kHz – 3 MHz	Active Monopole	Vertical	10 kHz
B3	2.5 MHz – 7.5 MHz	Active Monopole	Vertical	10 kHz
B4	5 MHz – 30 MHz	Active Monopole	Vertical	100 kHz
B5h	25 MHz – 325 MHz	Bilogical	Horizontal	100 kHz
B5v	25 MHz – 325 MHz	Bilogical	Vertical	100 kHz
B6h	300 MHz – 1.3 GHz	Bilogical	Horizontal	300 kHz
B6v	300 MHz – 1.3 GHz	Bilogical	Vertical	300 kHz
B7h	1 GHz – 6 GHz	Bilogical	Horizontal	300 kHz
B7v	1 GHz – 6 GHz	Bilogical	Vertical	300 kHz

Per the PESP, Tenco modified the antenna factors to include a broadband correction factor for the specified SA resolution bandwidth, to convert the measurements into units of dBuV/m/MHz. The resolution bandwidth correction factors were:

- 57.08 dB for 1 kHz
- 37.08 dB for 10 kHz
- 17.08 dB for 100 kHz
- 7.54 dB for 300 kHz.

4.4.3 Calibration

Calibration was maintained by performing a measurement using a 50-ohm termination on the RF input and comparing it to a base-line measurement that was performed at the beginning of the survey. These 50-ohm resistor measurements were taken on the first day of testing at Site 1 and on the third day at Site 5 to confirm the SA was operating correctly.

Additionally, The SA performs background alignments which are run periodically between measurement acquisitions throughout each test day. The instrument's software determines when alignments are to be performed to maintain warranted operation. Failure to auto-align, or operation of the SA that is out of alignment, results in an on-screen alert notifying the user the instrument needs an alignment.

4.5 Measurement Procedure Steps

Tenco followed the steps in the PESP to measure ambient radiated electric field at each site.

5 Magnetic Field Measurements

5.1 Purpose and Requirements

The magnetic field measurements cover the static and AC magnetic fields from 0 Hz to 800 Hz, in three axes, at a height of 6.6 ft (2 m) above the ground.

As noted above, the PrES measurement objectives are:

- Find and record the maximum and minimum magnetic field strengths, vectors, and magnitudes, and changes related to ambient conditions
- Measure the maximum and minimum pre-energization ambient radiated and magnetic field levels along the HGL, before PSA construction
- Use the measured baseline EMF levels for comparison with the PoES measurements to be made after energizing the third rail and OCS and before the start of revenue service.
- Determine that the pre-energization magnetic field levels along the PSA section of the HGL ROW are below the IEEE Std C95.1 MPE limit of 9.0 G at 60 Hz for all sites, and the NYIP limit of 0.2 G at 60 Hz for relevant Sites 2 and 7.

Tenco performed magnetic field measurements at each of the 11 selected locations along the PSA section of the HGL ROW. The following subsections provide summary results and descriptions of measurement locations, equipment, and steps and runs. Appendix B provides the complete results for the magnetic field measurements.

5.2 Measurements Performed

Tenco performed 13 magnetic field measurement runs at the 11 selected sites, from August 8 to August 12, 2022. The measurements covered the three x, y, and z axes.

The log recorded the measurement number, measurement type, measurement description, measurement comments and results, and other relevant information including nearby emitters.

Tenco recorded magnetic field measurements from 0 to 800 Hz during every measurement run. For each site, Tenco recorded magnetic field measurements for 100 seconds on the Tenco TransDAS. The TransDAS measurements exhibit readings in 5 bands, focusing on critical frequencies of 60, 180, 360, and 720 Hz as well as Earth's static magnetic field or 0 Hz.

The post-energization survey measurement will measure the magnetic field levels, at the same locations, after energizing the third rail and OCS and before the start of revenue service. Tenco will then compare the electromagnetic field emissions to pre-PSA operations, and make sure the levels are still below the IEEE Std C95.1 MPE limits and NYIP limits where applicable.

5.3 Measurement Results

AC magnetic field measurements in the range 0 - 800 Hz at all sites, including at 60 Hz, were insignificant and substantially lower than the IEEE Std C95.1 MPE limit of 9.0 G at 60 Hz, as expected for ambient measurements.

All 60 Hz emissions at the relevant sites, Sites 2 and 7, were substantially lower than NYIP limits of 0.2 G for 60 Hz magnetic fields near single 138 kV transmission lines.

The maximum static, 0 Hz or DC, measurement of 518.5 mG is consistent with the typical value of 513 mG for Earth's static magnetic field in New York City, per the NOAA National Centers for Environmental Information.

As noted in the executive summary, Tenco observed minimal static magnetic field fluctuation during most runs. For most sites, the static field levels were very close to the Earth level, which is about 513 mG in New York City.

Sites 6, 8, and 11 showed lower than expected static field levels.

Site 8, Bowery Bay Substation, exhibited the most notable static field level with a measurement reading of 401.5 mG with the magnetic probe positioned 6 ft above ground level. When the test team moved the probe to be 2 ft above ground level in the same exact position, the static field level rose to levels greater than 600 mG. At Site 8, the test team performed the measurements on the second level of a steel beamed parking structure. The unusual readings are likely due to the measurement probe being surrounded by steel structures and cars.

The maximum 60 Hz magnetic field measured field level was 3.5 mG, at measurement location Site 6, near an AC substation with operating power equipment nearby. This is a typical level near power lines, which is still very low compared to the IEEE Std C95.1 MPE limit of 9.0 G at 60 Hz.

Tenco observed a maximum AC magnetic field of 2.2 mG at 60 Hz at Site 7, which is located near one of the two locations where the PSA project will install a single-phase 138 kV transmission line. The measured levels at Site 7 were still very low compared to both the IEEE Std C95.1 MPE limit of 9.0 G, and the applicable NYIP limit of 0.2 G at 60 Hz.

As noted in the executive summary, Tenco measured the higher AC magnetic field levels near high voltage power lines, power substations, and zones with active heavy machinery. Those levels are higher due to AC currents in the power cables and operating equipment.

5.3.1 Magnetic Field Test Runs

Figure 5-1 shows run 0810-2, the maximum AC magnetic field measurement with 3.5 mG at 60 Hz, 3.5 mG at 180 Hz, and 2.2 mG at 360 Hz. These levels are far below the IEEE Std C95.1 limit of 9.0 G for unrestricted environments for frequencies between 20 and 751 Hz.

Run 0810-2 was performed at Site 6, with an AC substation located 225 ft North of the measurement point and a utility power line 12 ft West of the measurement point. During this run, a tree trimmer was operating 50 ft West of the measurement point, on an overpass bridge above and behind the magnetic probe. The tree trimmer was the cause for the AC emissions spikes. Figure 5-1 shows that the spikes occur during the equipment operation from $t = 85$ seconds onwards.

Figure 5-1
Run 0810-2 – Maximum AC Magnetic Field Run

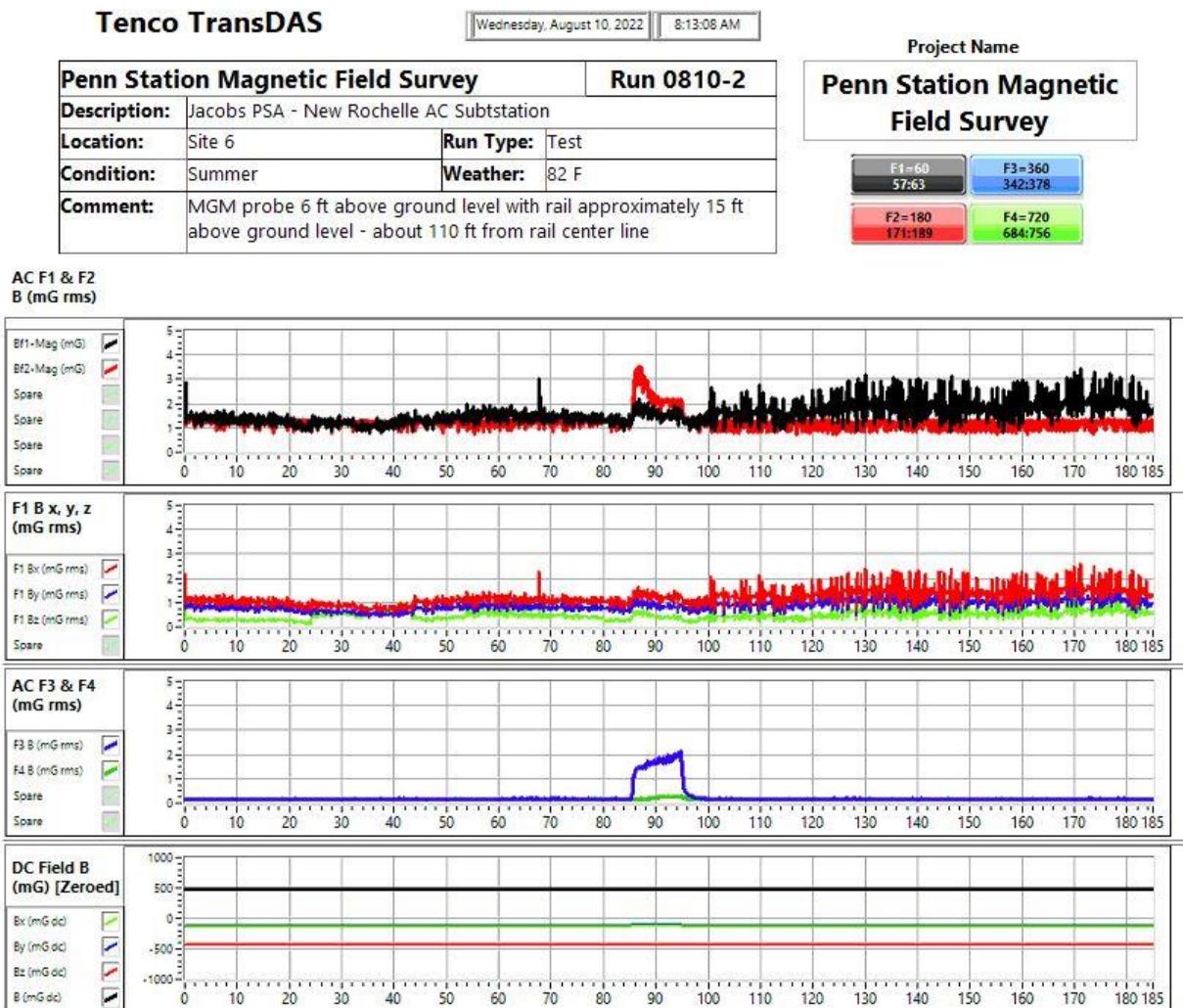


Figure 5-2 shows run 0809-1, the next highest AC magnetic field measurements, with 3 mG at 60 Hz. These levels are far below the IEEE Std C95.1 limit of 9.0 G at 60 Hz for unrestricted environments.

Run 0722-17 was performed at Site 3, with heavy machinery operating nearby, notably at $t = 80$ seconds, and an Amtrak train passing at $t = 35$ seconds. The measurement point was nearby a multitude of parked school buses as well. The 3 mG spike is likely due to operation of backhoes and tractors nearby based on the notable events occurring in the measurement environment at this time.

Figure 5-2
Run 0809-1 – Notable AC Magnetic Field Run

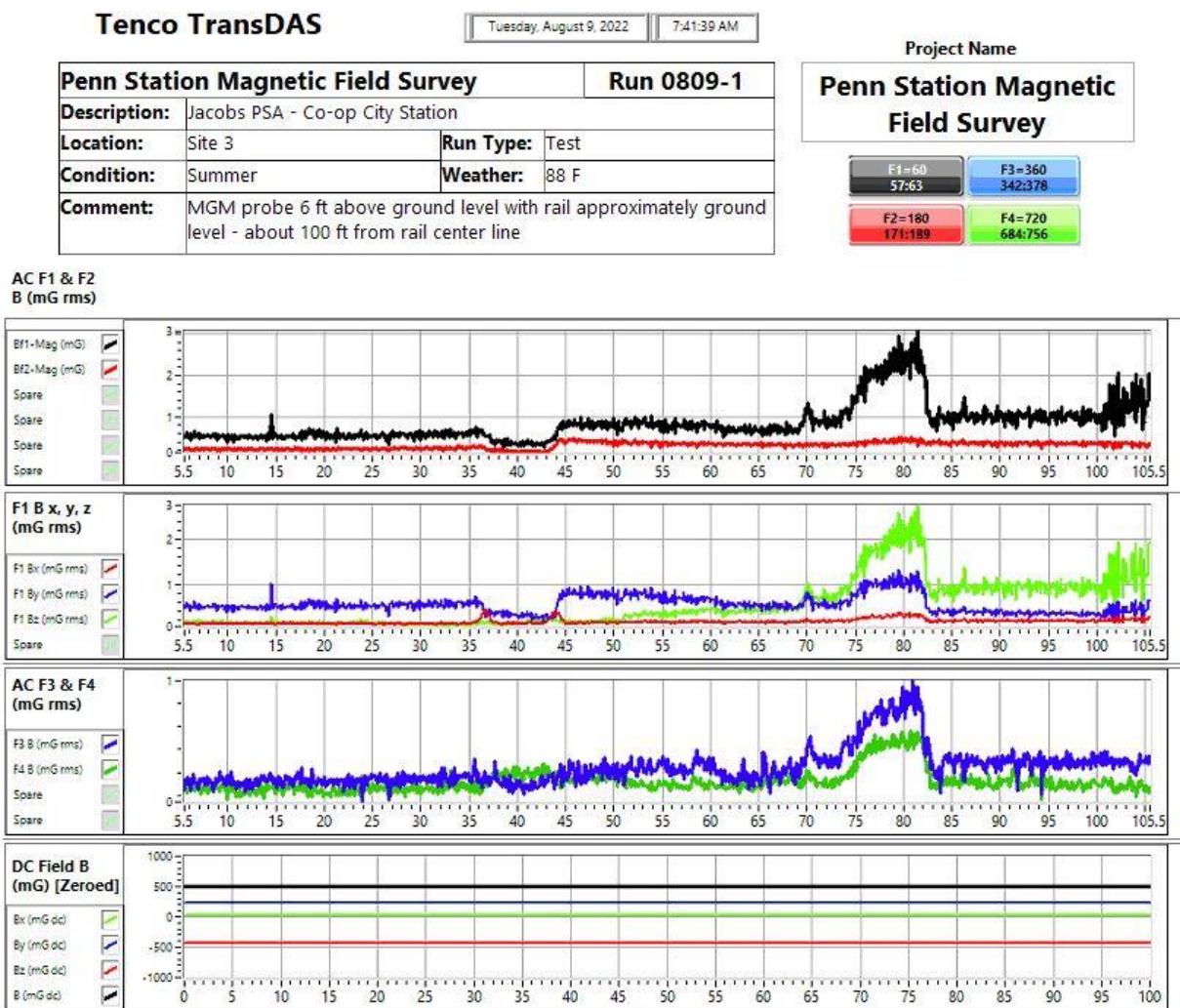


Figure 5-3 shows run 0810-4, the highest AC magnetic field measurement, with 2.2 mG at 60 Hz. This run was performed at Site 7, near one of the two locations where the PSA plans to install a single-phase 138 kV transmission line. The measured levels at Site 7 were low compared to both the IEEE Std C95.1 MPE limit of 9.0 G, and the applicable NYIP limit of 0.2 G at 60 Hz.

Run 0810-4 was performed in front of a busy street, with chain link and iron post fences surrounding the measurement point, and a metal dumpster containing chain link fence scrap 30 ft North-East of the measurement point. The operation of an Amtrak train passing at $t = 79$ seconds is potentially the cause of the 2.2 mG 60 Hz emission spike.

Figure 5-3
0810-4 – Highest AC Magnetic Field Run Near Proposed Single 138 kV Transmission Line (NYIP 60 Hz Limit Applies)

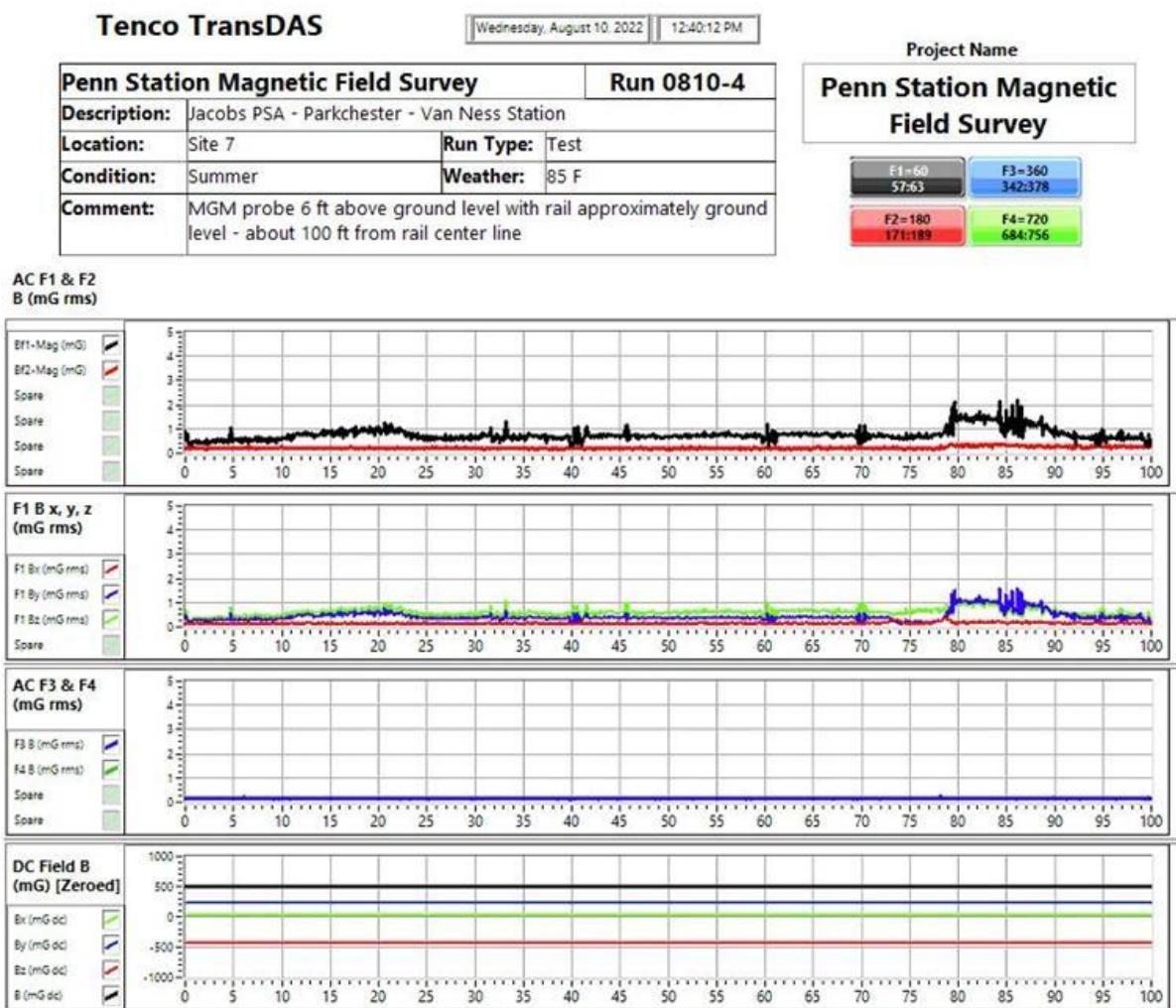


Figure 5-4 shows run 0810-1, the maximum static magnetic field measurement with 518.5 mG at 0 Hz. This level is similar to the typical earth level of 513 mG for the New York City region.

Run 0810-1 was performed at Site 5, with no notable equipment, facilities, or utility lines in the immediate area. This site proved to be the quietest site for emissions in the range of 1 – 800 Hz.

Figure 5-4
Run 0810-01 – Highest Static Magnetic Field Run

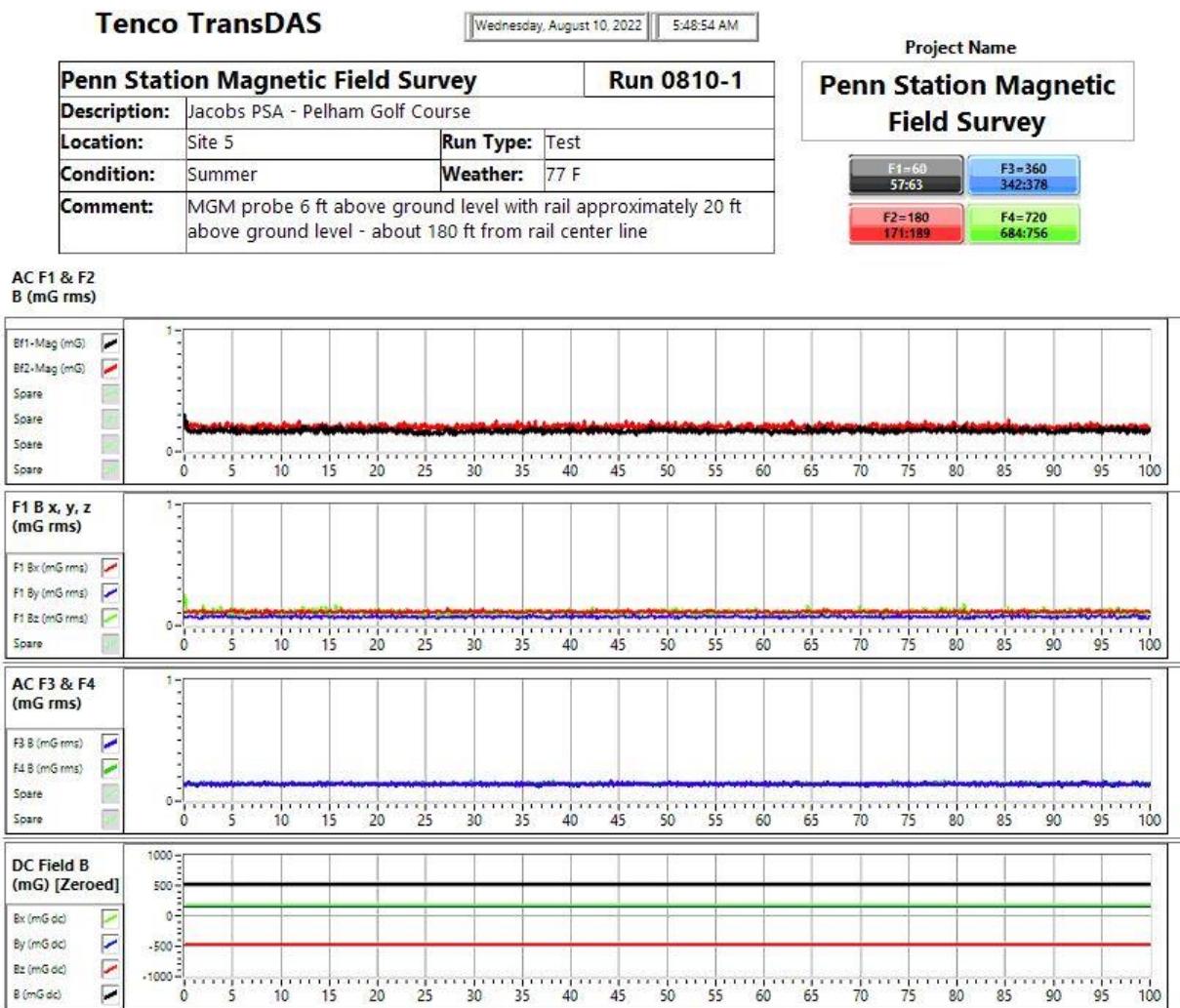


Figure 5-5 shows run 0811-2, the minimum static field measurement with a reading of 401.5 mG at 0 Hz. This level is significantly lower than the typical value of 513 mG for the region.

Run 0811-2 was performed at Site 8, located on the second floor of a parking garage surrounded by cars and steel structures, and near an existing AC substation with large transformers.

Figure 5-5
Run 0811-2 – Notably Low Static Magnetic Field Run

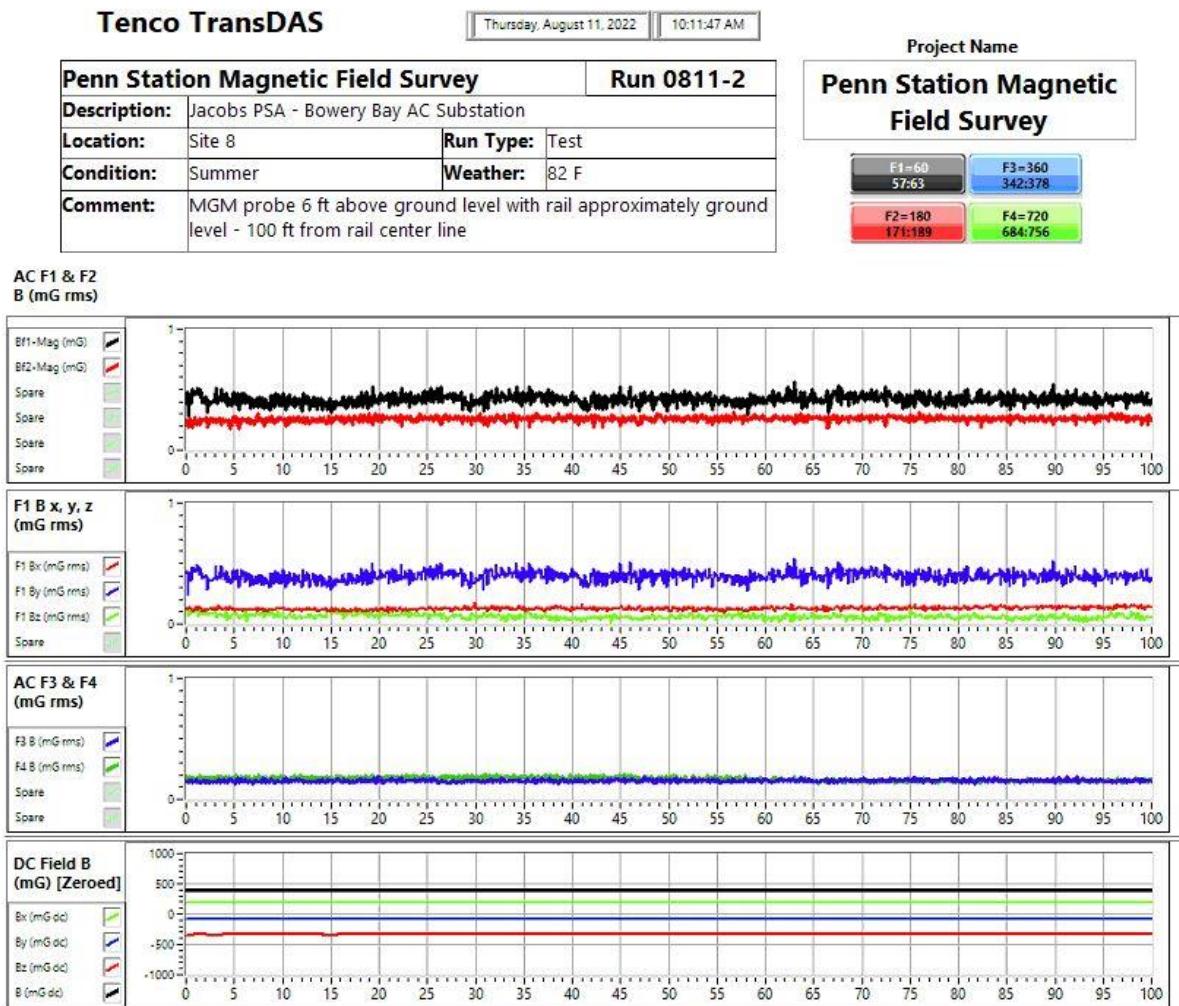
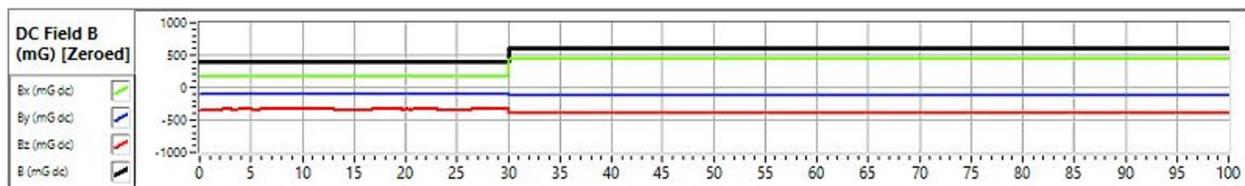


Figure 5-6 shows run 0811-1, Site 8, static field close-up view. This run exhibits static field fluctuation measurement due to measurement probe height change from 6 ft to 2 ft above the ground at t = 30 seconds. This figure shows the static field values with the greatest difference compared to the expected value of 513 mG for the region.

Figure 5-6
Run 0811-1 – Notable Static Magnetic Field Run Adjusting Probe Height, Close-up View



5.4 Measurements Equipment and Calibration

5.4.1 Measurement Equipment

Figure 5-7 shows the measurement equipment setup for the magnetic field measurement.

The magnetic field probe is generally positioned 2 m (6.6 ft) above the ground and about 30 m (100 ft) from the center of ROW per the PESP.

Table 5-1 lists the magnetic field measurement equipment. The PESP describes the major measurement equipment items in more detail.

Figure 5-7
Magnetic Field Measurement Equipment Setup

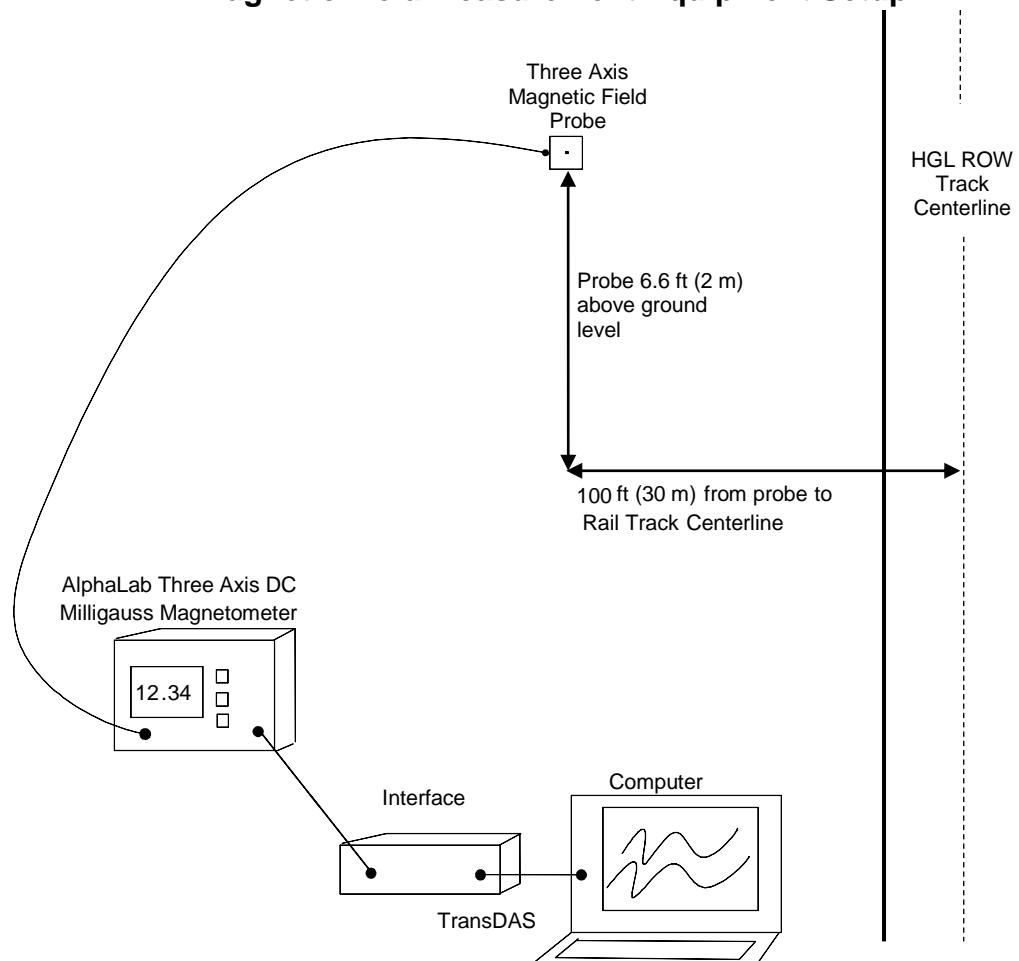


Table 5-1
Magnetic Field Measurement Equipment List

#	Item	Serial #	Calibration Date	Comment
1	Tenco TransDAS Data Acquisition System	NI 6216 TransDAS 01FCBBA0	Internal cal at each site External cal: 3/18/2016	For measuring emission signals
2	AlphaLab Inc. Three Axis DC Milligauss Magnetometer with Analog Outputs	Model #3AMG S/N 843	7/13/2022	For measuring magnetic field
3	Adjustable Antenna Tripod	N/A	N/A	To support magnetic field probe
4	AC Power Source	Honda EU2200i	N/A	Generator
5	Dell Inspiron 17R Laptop computer	9YY6QX1	N/A	For control of TransDAS and storage of measurement data results

5.4.2 Measurement Bands

Tenco performed narrowband emission measurements in the range of static to 800 Hz, using the magnetometer, probe, and TransDAS. Tenco measured and processed emissions in three axes to determine the orientation of the highest field.

Tenco measured magnetic fields at 0 Hz (static or DC) and from 1 Hz to 800 Hz (AC). If a measurement showed high levels of magnetic fields at a specific frequency, Tenco made a following measurement to zoom in on that frequency.

The test team measured magnetic field as the frequencies and bands listed in Table 5-2.

Table 5-2
Magnetic Field Measurement Bands

ID	Frequency Range
F0	DC
F1	57 Hz – 63 Hz
F2	171 Hz - 189 Hz
F3	342 Hz - 378 Hz
F4	684 Hz - 756 Hz

Narrowband Measurements

The expected magnetic field components are the Earth's magnetic field, AC magnetic fields due to nearby 60 Hz utility power cables, and other AC magnetic fields due to other frequency currents in nearby cables.

Since all these expected components are narrowband in nature, Tenco made these measurements with a narrowband mode and calibration. The TransDAS is a suitable instrument for making narrowband measurements.

5.4.3 Calibration

Tenco performed the following steps to verify proper operation of the magnetometer:

1. Turn on the magnetometer and let it warm up
2. After warm up, check the static magnetic field offset of each axis
 - o Check the axis reading
 - o Flip the probe cube over
 - If the magnetometer is properly zeroed, the axis reading should go from +xyz to -xyz
 - o Repeat for each axis
 - o Restore the probe to the nominal position
3. Check that the magnitude of the static electric field is close to the expected value for New York City.

5.5 Magnetic Field Maximum Permissible Exposure Limits

Per the EMCP, the test team used the magnetic field limits provided in the following standards/regulations:

- The New York State Department of Public Service (DPS) Statement of Interim Policy (NYIP) on Magnetic Fields of Major Electric Transmission Facilities for 60 Hz Magnetic Fields near single 138 kV transmission lines (Sites 2 and 7)
- IEEE Std C95.1-2019 Table 2 unrestricted environments for all other EMF Survey Sites.

These magnetic field limits shown in Table 5-3 and Figure 5-8 are provided as a reference during the PrES and not to be considered pass/fail criteria. These limits only apply to the effects of new construction during the PoES, and not to existing background magnetic fields.

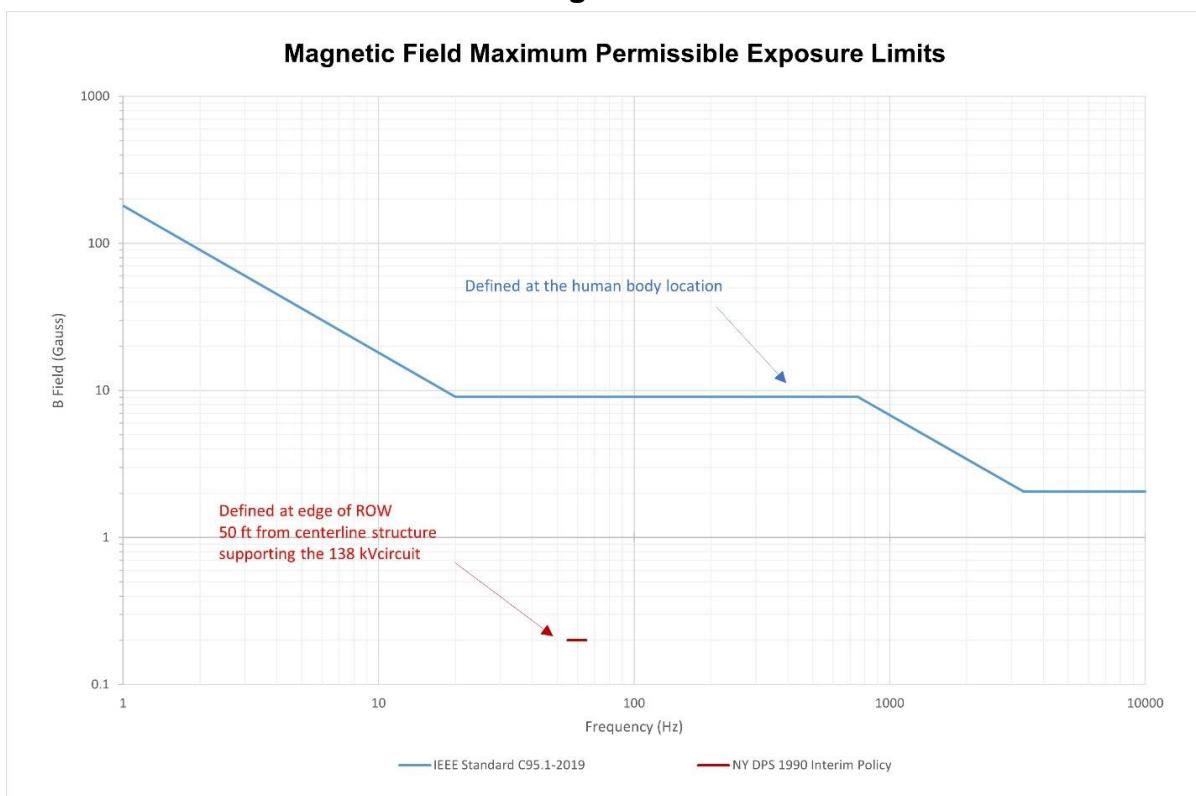
Table 5-3
PSA Magnetic Field MPE Regulations and Standards

Standard/Regulation	Full Standard Frequency Range	Full Standard B Field Limit (G)
NY DPS 1990 Interim Policy (NYIP)	60 Hz	0.2
IEEE Std C95.1-2019 Table 2 unrestricted environments	< 0.153 Hz	1180
	0.153 – 20 Hz	181 / f
	20 – 751 Hz	9.04
	751 Hz – 3.35 kHz	6870 / f
	3.35 – 500 kHz	2.05

Notes:

- 1] The NYIP specifies limits at the edge of the right of way (ROW). If a ROW is not established, the standard specifies the edge of the right-of-way to be at a horizontal distance of 50 ft (15.2 m) from the centerline of the structures supporting the circuit for 138 kV systems. IEEE standards are specified at the location of the human body.

Figure 5-8
New York Magnetic MPE Limits



5.6 Measurement Procedure Steps

Tenco followed the steps in the PESP to measure ambient magnetic field at each site. Except for the use of the magnetometer probe at 6.6 ft above the ground, rather than 3.3 ft above the ground, there were no significant deviations from the procedure steps and measurement runs. The test team decided to use the TransDAS to measure the magnetic field in 5 bands in the range of static to 800 Hz for a duration of 100 seconds for each test run.

6 Spectral Analysis

This spectral analysis provides results and an assessment of measured results that considers possibility of impacts on existing magnetic and electric field levels and of neighbor high level EMI/RFI emitters on planned equipment, including train control, communications, traction power, and station equipment.

The assessment compared the expected emissions and immunity to the measured magnetic and radiated field levels at the 11 selected sites. The measurements at the sites covered the radiated electric field frequency range 10 kHz to 6 GHz. The magnetic field measurements covered the range 0 to 800 Hz.

6.1 Spectral Analysis Evaluation Matrix

Table 6-1 shows the Spectral Analysis Evaluation Matrix. The Evaluation Matrix has a column for each measured electric field band and magnetic field band, as described in section 4.4.2. Rows near the top summarize the maximum measured levels at the noisiest and quietest sites.

The Evaluation Matrix has a row for each major PSA system, listing the equipment to be provided in that system per the Technical Provisions. Table 6-2 lists the reference documents used to develop the row listings.

Each cell or group of cells in the body of the Evaluation Matrix contains the evaluation of the equipment listed in the row with respect to the magnetic or radiated fields listed in the column or columns.

Table 6-1

MTA C&D Penn Station Access Spectral Analysis Evaluation Matrix - Pre-Existing Spectral Conditions											
Field	Magnetic Field		Radiated Electric Field								
	DC Field: 0 Hz	AC Field: 1 - 800 Hz	B0: 10 kHz-160 kHz	B1: 150 kHz - 650 kHz	B2: 500 kHz - 3 MHz	B3: 2.5 MHz - 7.5 MHz	B4: 5 MHz - 30 MHz	B5: 25 MHz - 325 MHz	B6: 300 MHz - 1.3 GHz	B7: 1 GHz - 6 GHz	
Maximum Measurement Results at Noisiest Site	501 mG	3.5 mG at 60 Hz All measurements substantially lower than typical human exposure limit of 9 G, and DPS NYIP limit of 0.2 G at 60 Hz	153 dB at 20 kHz and 60 kHz. Noise floor: 125 dB - 150 dB.	130 dB at 220 kHz and 440 kHz. Noise floor: 115 dB - 125 dB.	144 dB at 880 kHz. Noise floor: 115 dB - 120 dB.	Strong peaks every 220 kHz. Noise floor: 105 dB - 115 dB.	Peaks every 220 kHz at lower frequencies. Noise floor: 75 dB - 105 dB.	101 dB at 176 MHz	106 dB at 874 MHz	120 dB at 2.17 GHz	
Maximum Measurement Results at Quietest Site	518.5 mG	< 1 mG	149 dB at 20 kHz and 60 kHz. Noise floor: 115 dB - 130 dB.	138 dB at 220 kHz. Noise floor: 110 dB - 120 dB.	134 dB at 880 kHz. Noise floor: 105 dB - 115 dB.	No visible peaks. Noise floor: 90 dB - 105 dB.	84 dB at 13.6 MHz. Noise floor: 55 dB - 90 dB.	85 dB at 155 MHz	86 dB at 911 MHz	96 dB at 2.17 GHz	
PSA Equipment and Facilities	Effects of Magnetic Fields on PSA Equipment and Facilities		Effects of Radio Frequency Electric Fields on PSA Equipment and Facilities								
COMMUNICATIONS SYSTEMS: * Backbone Communication Systems * Application Communication Systems	DC Magnetic and AC Magnetic field measurements are compatible with specified PSA Communications Systems, assuming that new equipment is equivalent to existing and that design and installation comply with relevant EMC guidelines.		Radiated Electric field measurements are compatible with specified PSA Communications, assuming that new equipment is equivalent to existing and that design and installation comply with relevant EMC guidelines.								
SIGNALS AND TRAIN CONTROL: * Signals on HGL * Positive Train Control (PTC)	DC Magnetic and AC Magnetic field measurements are compatible with specified PSA Signaling and Train Control, assuming that new equipment is equivalent to existing and that design and installation comply with relevant EMC guidelines.		Radiated Electric field measurements are compatible with specified PSA Signaling and Train Control, assuming that new equipment is equivalent to existing and that design and installation comply with relevant EMC guidelines.								
AC TRACTION POWER SYSTEM: * Upgrades to existing traction power substation facilities * New traction power substations and distribution substations * New 480 V wayside power facilities * New 100 Hz signal power	DC Magnetic and AC Magnetic field measurements are compatible with specified PSA AC Traction Power System, assuming that new equipment is equivalent to existing equipment and that design and installation comply with relevant EMC guidelines.		Radiated Electric field measurements are compatible with specified PSA AC Traction Power System, assuming that new equipment is equivalent to existing equipment and that design and installation comply with relevant EMC guidelines.								
DC TRACTION POWER SYSTEM: * DC Traction Power Supply System * DC Traction Power Distribution System * Third Rail Heater System	DC Magnetic and AC Magnetic field measurements are compatible with specified PSA DC Traction Power System, assuming that new equipment is equivalent to existing equipment and that design and installation comply with relevant EMC guidelines.		Radiated Electric field measurements are compatible with specified PSA DC Traction Power, assuming that new equipment is equivalent to existing equipment and that design and installation comply with relevant EMC guidelines.								
STATIONS EQUIPMENT: Communications, Mechanical, Electrical, Plumbing, Vertical Transportation, Fire Protection, Lighting	DC Magnetic and AC Magnetic field measurements are compatible with specified PSA Stations Equipment, assuming that new equipment is equivalent to existing equipment and that design and installation comply with relevant EMC guidelines.		Radiated Electric field measurements are compatible with specified PSA Stations Equipment, assuming that new equipment is equivalent to existing equipment and that design and installation comply with relevant EMC guidelines.								

Table 6-2
Reference Information for Spectral Analysis

Publisher	Document Number / Name	Title
MTA C&D	Technical Provisions Vol 3, Part 1	Design-Build Services For Metro-North Railroad Penn Station Access Project, September 20, 2021 RFP Documents. Volume 3 Technical Provisions Part 1 – Scope
MTA C&D	Technical Provisions Vol 3, Part 3	Design-Build Services For Metro-North Railroad Penn Station Access Project, September 20, 2021 RFP Documents. Volume 3 Technical Provisions Part 1 – DB Requirements
MTA C&D	Technical Specifications Vol 5	Design-Build Services For Metro-North Railroad Penn Station Access Project, September 20, 2021 RFP Documents. Volume 5 Technical Specifications
MTA C&D	Technical Specifications Vol 8	Design-Build Services For Metro-North Railroad Penn Station Access Project, September 20, 2021 RFP Documents. Volume 8 Leggett Interlocking, Part 2 Technical Specifications
Jacobs	MTA PSA EMCP	Draft Electromagnetic Compatibility Program Plan, Rev.0, May 20, 2022

6.2 Spectral Analysis Assessment Conclusion

The spectral analysis concluded that the electric field and magnetic measurements are compatible with the existing and new systems and equipment planned for the PSA project:

- With the foundational design criterion that the new systems will be equivalent to the existing ones already in MTA and Amtrak service, and
- With the expectations that the PSA designs and installations will comply with relevant EMC criteria and guidelines, and that MTA will maintain and operate the equipment following the applicable procedures.

Appendix A

Radiated Electric Field Measurement Results

- Radiated Electric Field Measurement Sites Log
- Radiated Electric Field Measurement Run Log
- Radiated Electric Field Measurement Results Record

Radiated Electric Field Measurement

Sites Log

Site No.	Short Name	Full Name	Site Notes	Date	Start Time	End Time	Temp (F)	Humid (%)	Cloud Cover	Planned GPS Coordinates	Measurement GPS Coordinates	Distance to planned site (ft)
1	Randall's Island	Randall's Island Information Booth	This site formerly called "Randall's Island Field #43". Measurement location near high voltage transformer.	8/8/22	1:34 PM	2:26 PM	89	57	Cloudy	40.797109, -73.918248	40.795365, -73.919125	700
2	Oak AC Substation	Oak AC Substation	Future Oak AC Substation Site - Parking Lot on Walnut Ave.	8/8/22	6:36 PM	7:02 PM	89	54	Sunny	40.806752, -73.906753	40.806010, -73.906472	300
3	Co-op City	Co-op City Station	School bus parking lot near future passenger station. Heavy machinery moving around about 100 ft behind measurement equipment.	8/9/22	10:00 AM	10:48 AM	88	59	Sunny	40.858275, -73.828892	40.858423, -73.828837	50
4	Morris Park	Morris Park Station	Residence Inn Hotel parking lot near Amazon facility. Near chain link fence and lamp post.	8/9/22	1:30 PM	2:03 PM	93	44	Partly Cloudy	40.849332, -73.844453	40.850762, -73.842747	700
5	Golf Course	Pelham Bay and Split Rock Golf Courses	Golf course parking lot.	8/10/22	8:51 AM	9:30 AM	76	59	Partly Cloudy	40.875269, -73.810160	40.872038, -73.810816	1200
6	New Rochelle	New Rochelle AC Substation	Measurement equipment under 3-phase 60 Hz power cables at busy intersection. Construction site on the other side of the ROW. Measuring 100 ft from the center point of the	8/10/22	10:46 AM	11:16 AM	77	60	Overcast	40.902644, -73.793171	40.902387, -73.793520	150
7	Parkchester-Van Nest	Parkchester-Van Nest Station	Busy street behind antennas. Metal dumpster with chain link fence scraps, 30 ft from the antennas.	8/10/22	3:11 PM	3:52 PM	85	46	Mostly Cloudy	40.842239, -73.861933	40.841690, -73.861618	200
8	Bowery Bay	Bowery Bay AC Substation	Second floor of parking lot for the Mega Contracting business. Contact Callie for site access.	8/11/22	11:41 AM	1:03 PM	80	58	Partly Cloudy	40.764293, -73.905214	40.764183, -73.905127	50
9	HG-02	HG-02 DC Substation	Power line not far overhead from antenna.	8/11/22	3:51 PM	5:18 PM	88	32	Partly Cloudy	40.760644, -73.903683	40.761164, -73.904467	300

Site No.	Short Name	Full Name	Site Notes	Date	Start Time	End Time	Temp (F)	Humid (%)	Cloud Cover	Planned GPS Coordinates	Measurement GPS Coordinates	Distance to planned site (ft)
10	Electric Substation	Electric Substation near Randall's Island	Equipment set up in empty parking lot north of electric substation	8/12/22	9:05 AM	10:35 AM	74	53	Partly Cloudy	40.798477, -73.914738	40.799378, -73.914625	350
11	HG-01	HG-01 DC Substation	Loud area with trucks and cars passing the site regularly. Equipment set up on side walk next to Home Depot storage yard. Power line maybe 80 ft away.	8/12/22	12:34 PM	1:20 PM	80	33	Clear sky	40.751163, -73.914592	40.751295, -73.914385	50

Radiated Electric Field Measurement

Run Log

MTA PSA Pre Energization Survey Radiated Emissions Test Log

Test team: Stephane Yu, Temba Mateke, Joe Nicholas, Ursula Monaghan
 Dates: August 8 - 12, 2022

Randall's Island Information Booth									
This site formerly called "Randall's Island Field #43". Measurement location near high voltage transformer							Temp (F)	Humid (%)	Cloud Cover
Run ID	Date	Time	Type	Freq Band	Location	Notes			
808-01	8/8/22	12:52 PM	50 ohm cal	B0	Randall's Island		89	57	Cloudy
808-02	8/8/22	12:54 PM	50 ohm cal	B1	Randall's Island		89	57	Cloudy
808-03	8/8/22	12:56 PM	50 ohm cal	B2	Randall's Island		89	57	Cloudy
808-04	8/8/22	12:58 PM	50 ohm cal	B3	Randall's Island		89	57	Cloudy
808-05	8/8/22	1:00 PM	50 ohm cal	B4	Randall's Island		89	57	Cloudy
808-06	8/8/22	1:02 PM	50 ohm cal	B5	Randall's Island		89	57	Cloudy
808-07	8/8/22	1:04 PM	50 ohm cal	B6	Randall's Island		89	57	Cloudy
808-08	8/8/22	1:06 PM	50 ohm cal	B7	Randall's Island		89	57	Cloudy
808-09	8/8/22	1:34 PM	RE	B0	Randall's Island	Noisy area, max hold noise floor around 130 db and peaks up to 163 db, peaks from 20 kHz to 160 kHz every 20 kHz. Dump truck drove by	89	57	Cloudy
808-10	8/8/22	1:35 PM	RE	B1	Randall's Island	Max hold around 120, min hold around 100, visible bumps every 20 kHz from 160 to 380	89	57	Cloudy
808-11	8/8/22	1:42 PM	RE	B2	Randall's Island	peaks up to 135 db. From 1mhz to 3mhz noise floor between 110 and 120. Semi truck drove by	89	57	Cloudy
808-12	8/8/22	1:35 PM	RE	B3	Randall's Island	Relatively flat. Max hold 110 db at 2.5 MHz to 90 db at 7.5 MHz	89	57	Cloudy
808-13	8/8/22	1:57 PM	RE	B4	Randall's Island	Peak hold 90 db at 5 mHz to 56 db at 30 mHz. Peaks at 13.5 mHz, 15.775 mHz, 18.1 mHz. Peaks align with TV broadcast signals	89	57	Cloudy
808-14	8/8/22	2:04 PM	RE	B5h	Randall's Island	Large broadband spiky peaks from 54 to 65 mhz. from 82 mhz to 108 mhz, 174 to 180 mhz, 198 to 210 mhz. Various narrowband peaks between 25 mhz and 218 mhz	89	57	Cloudy
808-15	8/8/22	2:07 PM	RE	B6h	Randall's Island	Peaks between 453 to 636, 722 to 766, 850 to 890	89	57	Cloudy
808-16	8/8/22	2:14 PM	RE	B7h	Randall's Island	1.99, from 2.112 to 2.189, clump of spaced ones from 2.327 to 2.89, clump around 3.74 ghz. peaks around 5.176 ghz	89	57	Cloudy
808-17	8/8/22	2:18 PM	RE	B5v	Randall's Island	Compare to b5h.	89	57	Cloudy
808-18	8/8/22	2:22 PM	RE	B6v	Randall's Island	peak at 114 db at 752 mhz	89	57	Cloudy
808-19	8/8/22	2:26 PM	RE	B7v	Randall's Island	peak at 105 db at 1.578 ghz	89	57	Cloudy

MTA PSA Pre Energization Survey Radiated Emissions Test Log

Test team: Stephane Yu, Temba Mateke, Joe Nicholas, Ursula Monaghan

Dates: August 8 - 12, 2022

Oak AC Substation Future Oak AC Substation Site - Parking Lot on Walnut Ave.									
Run ID	Date	Time	Type	Freq Band	Location	Notes	Temp (F)	Humid (%)	Cloud Cover
808-20	8/8/22	6:36 PM	RE	B0	Oak AC Substation	Much lower noise level than previous	89	54	Sunny
808-21	8/8/22	6:40 PM	RE	B1	Oak AC Substation		89	54	Sunny
808-22	8/8/22	6:42 PM	RE	B2	Oak AC Substation	Mislabelled as B2, actually use B1 state file	89	54	Sunny
808-23	8/8/22	6:44 PM	RE	B3	Oak AC Substation		89	54	Sunny
808-24	8/8/22	6:47 PM	RE	B4	Oak AC Substation	Very flat as well	89	54	Sunny
808-25	8/8/22	6:50 PM	RE	B5h	Oak AC Substation		89	54	Sunny
808-26	8/8/22	6:52 PM	RE	B6h	Oak AC Substation		89	54	Sunny
808-27	8/8/22	6:54 PM	RE	B7h	Oak AC Substation		89	54	Sunny
808-28	8/8/22	6:57 PM	RE	B5v	Oak AC Substation		89	54	Sunny
808-29	8/8/22	6:59 PM	RE	B6v	Oak AC Substation		89	54	Sunny
808-30	8/8/22	7:02 PM	RE	B7v	Oak AC Substation		89	54	Sunny

MTA PSA Pre Energization Survey Radiated Emissions Test Log

Test team: Stephane Yu, Temba Mateke, Joe Nicholas, Ursula Monaghan
 Dates: August 8 - 12, 2022

Co-op City Station									
School bus parking lot near future passenger station. Heavy machinery moving around about 100 ft behind measurement equipment.									
Run ID	Date	Time	Type	Freq Band	Location	Notes	Temp (F)	Humid (%)	Cloud Cover
809-01	8/9/22	10:00 AM	RE	B0	Co-op City	Amtrak Train Passed at ~50 mph. Heavy machinery nearby	88	59	Sunny
809-02	8/9/22	10:04 AM	RE	B0	Co-op City	Tractor moving ~ 100ft behind the monopole	88	59	Sunny
809-03	8/9/22	10:08 AM	RE	B1	Co-op City	Ambient b1 tractor	88	59	Sunny
809-04	8/9/22	10:12 AM	RE	B2	Co-op City	bus moving next to antenna	88	59	Sunny
809-05	8/9/22	10:16 AM	RE	B2	Co-op City	ambient	88	59	Sunny
809-06	8/9/22	10:20 AM	RE	B3	Co-op City		88	59	Sunny
809-07	8/9/22	10:25 AM	RE	B4	Co-op City	high narrowband peaks above noise floor up to 20 db	88	59	Sunny
809-08	8/9/22	10:30 AM	RE	B0	Co-op City	School bus just parked right near antenna	88	59	Sunny
809-09	8/9/22	10:32 AM	RE	B5h	Co-op City	Moving biological antenna to ~10ft from signal analyzer	88	59	Sunny
809-10	8/9/22	10:34 AM	RE	B6h	Co-op City		88	59	Sunny
809-11	8/9/22	10:35 AM	RE	B6h	Co-op City	Acela Amtrak passing, tail end of it, started when it was leaving	88	59	Sunny
809-12	8/9/22	10:37 AM	RE	B7h	Co-op City	Right side of square arm of biological antenna disconnected. Screw missing, have to set up carefully, probably disconnected when moved a few moments ago. Just fixed	88	59	Sunny
809-13	8/9/22	10:42 AM	RE	B5v	Co-op City		88	59	Sunny
809-14	8/9/22	10:46 AM	RE	B6v	Co-op City		88	59	Sunny
809-15	8/9/22	10:48 AM	RE	B7v	Co-op City		88	59	Sunny

MTA PSA Pre Energization Survey Radiated Emissions Test Log

Test team: Stephane Yu, Temba Mateke, Joe Nicholas, Ursula Monaghan

Dates: August 8 - 12, 2022

Morris Park Station									
Residence Inn Hotel parking lot near Amazon facility. Near chain link fence and lamp post.									
Run ID	Date	Time	Type	Freq Band	Location	Notes	Temp (F)	Humid (%)	Cloud Cover
809-16	8/9/22	1:30 PM	RE	B0	Morris Park	Amtrak train going west.	93	44	Partly Cloudy
809-17	8/9/22	1:32 PM	RE	B0	Morris Park	Car drove past	93	44	Partly Cloudy
809-18	8/9/22	1:34 PM	RE	B1	Morris Park		93	44	Partly Cloudy
809-19	8/9/22	1:41 PM	RE	B2	Morris Park		93	44	Partly Cloudy
809-20	8/9/22	1:43 PM	RE	B3	Morris Park		93	44	Partly Cloudy
809-21	8/9/22	1:45 AM	RE	B4	Morris Park	Probably used the 100 kHz Biologic ant correction file on accident.	93	44	Partly Cloudy
809-22	8/9/22	1:52 PM	RE	B5h	Morris Park		93	44	Partly Cloudy
809-23	8/9/22	1:52 PM	RE	B6h	Morris Park		93	44	Partly Cloudy
809-24	8/9/22	1:56 PM	RE	B7h	Morris Park		93	44	Partly Cloudy
809-25	8/9/22	1:59 PM	RE	B5v	Morris Park		93	44	Partly Cloudy
809-26	8/9/22	2:01 PM	RE	B6v	Morris Park		93	44	Partly Cloudy
809-27	8/9/22	2:03 PM	RE	B7v	Morris Park		93	44	Partly Cloudy

MTA PSA Pre Energization Survey Radiated Emissions Test Log

Test team: Stephane Yu, Temba Mateke, Joe Nicholas, Ursula Monaghan
 Dates: August 8 - 12, 2022

Pelham Bay and Split Rock Golf Courses Golf course parking lot.									
Run ID	Date	Time	Type	Freq Band	Location	Notes	Temp (F)	Humid (%)	Cloud Cover
810-01	8/10/22	8:21 AM	50 ohm cal	B0	Golf Course		76	59	Partly Cloudy
810-02	8/10/22	8:29 AM	50 ohm cal	B1	Golf Course		76	59	Partly Cloudy
810-03	8/10/22	8:32 AM	50 ohm cal	B2	Golf Course		76	59	Partly Cloudy
810-04	8/10/22	8:34 AM	50 ohm cal	B3	Golf Course		76	59	Partly Cloudy
810-05	8/10/22	8:37 AM	50 ohm cal	B4	Golf Course		76	59	Partly Cloudy
810-06	8/10/22	8:41 AM	50 ohm cal	B5	Golf Course		76	59	Partly Cloudy
810-07	8/10/22	8:42 AM	50 ohm cal	B6	Golf Course		76	59	Partly Cloudy
810-08	8/10/22	8:45 AM	50 ohm cal	B7	Golf Course		76	59	Partly Cloudy
810-09	8/10/22	8:51 AM	RE	B0	Golf Course	Antennas ~180 ft from center of ROW.	76	59	Partly Cloudy
810-10	8/10/22	8:57 AM	RE	B1	Golf Course	Train passed just after we finished recording.	76	59	Partly Cloudy
810-11	8/10/22	8:59 AM	RE	B2	Golf Course		76	59	Partly Cloudy
810-12	8/10/22	9:23 AM	RE	B3	Golf Course		76	59	Partly Cloudy
810-13	8/10/22	9:03 AM	RE	B4	Golf Course		76	59	Partly Cloudy
810-14	8/10/22	9:08 AM	RE	B5h	Golf Course	Narrowband at 97.54 dB, 217 MHz. ~50 dB above the 40 dB noise floor. Based on FCC chart, this is likely radio communication/location, near golf course.	76	59	Partly Cloudy
810-15	8/10/22	9:14 AM	RE	B6h	Golf Course		76	59	Partly Cloudy
810-16	8/10/22	9:18 AM	RE	B7h	Golf Course	X-axis was fine, but set to only show center frequency. Range is from 1 - 6 GHz.	76	59	Partly Cloudy
810-17	8/10/22	9:21 AM	RE	B5v	Golf Course	Same narrowband spike as B5h in run 810-14. Amtrak Train Passed during the test.	76	59	Partly Cloudy
810-18	8/10/22	9:25 AM	RE	B5v	Golf Course	Repeated run without amtrak train. Similar.	76	59	Partly Cloudy
810-19	8/10/22	9:27 AM	RE	B6v	Golf Course		76	59	Partly Cloudy
810-20	8/10/22	9:30 AM	RE	B7v	Golf Course		76	59	Partly Cloudy

MTA PSA Pre Energization Survey Radiated Emissions Test Log

Test team: Stephane Yu, Temba Mateke, Joe Nicholas, Ursula Monaghan

Dates: August 8 - 12, 2022

New Rochelle AC Substation									
Measurement equipment under 3-phase 60 Hz power cables at busy intersection. Construction site on the other side of the ROW. ROW about 10 ft above antennas.							Temp (F)	Humid (%)	Cloud Cover
Run ID	Date	Time	Type	Freq Band	Location	Notes			
810-21	8/10/22	10:46 AM	RE	B0	New Rochelle	High peaks at 20 kHz intervals. similar signature to Randalls island site.	77	60	Overcast
810-22	8/10/22	10:52 AM	RE	B1	New Rochelle		77	60	Overcast
810-23	8/10/22	10:54 AM	RE	B2	New Rochelle		77	60	Overcast
810-24	8/10/22	10:56 AM	RE	B3	New Rochelle		77	60	Overcast
810-25	8/10/22	10:58 AM	RE	B4	New Rochelle		77	60	Overcast
810-26	8/10/22	11:03 AM	RE	B5h	New Rochelle	217 MHz that we saw at golf course is here too. 85 dB Peak at 155 MHz.	77	60	Overcast
810-27	8/10/22	11:04 AM	RE	B6h	New Rochelle	Tree trimmer on overpass ~50 ft from antennas.	77	60	Overcast
810-28	8/10/22	11:10 AM	RE	B7h	New Rochelle		77	60	Overcast
810-29	8/10/22	11:14 AM	RE	B5v	New Rochelle		77	60	Overcast
810-30	8/10/22	11:15 AM	RE	B6v	New Rochelle		77	60	Overcast
810-31	8/10/22	11:16 AM	RE	B7v	New Rochelle		77	60	Overcast

MTA PSA Pre Energization Survey Radiated Emissions Test Log

Test team: Stephane Yu, Temba Mateke, Joe Nicholas, Ursula Monaghan

Dates: August 8 - 12, 2022

Parkchester-Van Nest Station Busy street behind antennas. Metal dumpster with chain link fence scraps, 30 ft from the antennas.									
Run ID	Date	Time	Type	Freq Band	Location	Notes	Temp (F)	Humid (%)	Cloud Cover
810-32	8/10/22	3:11 PM	RE	B0	Parkchester-Van Nest		85	46	Mostly Cloudy
810-33	8/10/22	3:17 PM	RE	B1	Parkchester-Van Nest		85	46	Mostly Cloudy
810-34	8/10/22	3:19 PM	RE	B2	Parkchester-Van Nest		85	46	Mostly Cloudy
810-35	8/10/22	3:22 PM	RE	B3	Parkchester-Van Nest		85	46	Mostly Cloudy
810-36	8/10/22	3:24 PM	RE	B4	Parkchester-Van Nes	Looks quiet. repeated to see if it changed and it remained the same.	85	46	Mostly Cloudy
810-37	8/10/22	3:32 PM	RE	B5h	Parkchester-Van Nest		85	46	Mostly Cloudy
810-38	8/10/22	3:36 PM	RE	B6h	Parkchester-Van Nest		85	46	Mostly Cloudy
810-39	8/10/22	-	-	-	Parkchester-Van Nes	Accidentally skipped this run ID	85	46	Mostly Cloudy
810-40	8/10/22	3:40 PM	RE	B5h	Parkchester-Van Nes	Repeated run since we didn't save CSV on last B5h. Skipped 39	85	46	Mostly Cloudy
810-41	8/10/22	3:44 PM	RE	B7h	Parkchester-Van Nest		85	46	Mostly Cloudy
810-42	8/10/22	3:49 PM	RE	B5v	Parkchester-Van Nest		85	46	Mostly Cloudy
810-43	8/10/22	3:51 PM	RE	B6v	Parkchester-Van Nest		85	46	Mostly Cloudy
810-44	8/10/22	3:52 AM	RE	B7v	Parkchester-Van Nest		85	46	Mostly Cloudy

MTA PSA Pre Energization Survey Radiated Emissions Test Log

Test team: Stephane Yu, Temba Mateke, Joe Nicholas, Ursula Monaghan

Dates: August 8 - 12, 2022

Bowery Bay AC Substation Second floor of parking lot for the Mega Contracting business. Contact Callie for site access.									
Run ID	Date	Time	Type	Freq Band	Location	Notes	Temp (F)	Humid (%)	Cloud Cover
811-01	8/11/22	11:41 AM	RE	B0	Bowery Bay	High peaks every 20 kHz, with smaller peaks every 10 kHz.	80	58	Partly Cloudy
811-02	8/11/22	11:47 AM	RE	B1	Bowery Bay	Max floor is around 130 dB. Min hold around 120.	80	58	Partly Cloudy
811-03	8/11/22	12:11 PM	RE	B2	Bowery Bay	Highest peak at 141 dB 879 kHz. Noise floor around 120 dB.	80	58	Partly Cloudy
811-04	8/11/22	12:17 PM	RE	B3	Bowery Bay	Max hold noise floor around 115 dB at 2.5 MHz, to 100 dB at 7.5 MHz.	80	58	Partly Cloudy
811-05	8/11/22	12:22 PM	RE	B4	Bowery Bay	100 dB at 5.6 MHz. Noise floow about 100 at 5MHz to 65 at 30 MHz.	80	58	Partly Cloudy
811-06	8/11/22	12:43 PM	RE	B5h	Bowery Bay	Amtrak Train passing. Lots of narrow band peaks through the whole B5 band. Probably hadn't uploaded the correction factor.	80	58	Partly Cloudy
811-07	8/11/22	12:27 PM	RE	B5h	Bowery Bay	Ambient, repeated Band measurement without a train. Car driving past measurement sight.	80	58	Partly Cloudy
811-08	8/11/22	12:51 PM	RE	B6h	Bowery Bay	Might be louder than usual B6h. Need to check.	80	58	Partly Cloudy
811-09	8/11/22	12:53 PM	RE	B7h	Bowery Bay		80	58	Partly Cloudy
811-10	8/11/22	12:56 PM	RE	B5v	Bowery Bay		80	58	Partly Cloudy
811-11	8/11/22	12:57 PM	RE	B6v	Bowery Bay		80	58	Partly Cloudy
811-12	8/11/22	1:00 PM	RE	B7v	Bowery Bay	Amtrak passing	80	58	Partly Cloudy
811-13	8/11/22	1:03 PM	RE	B7v	Bowery Bay	Ambient	80	58	Partly Cloudy

MTA PSA Pre Energization Survey Radiated Emissions Test Log

Test team: Stephane Yu, Temba Mateke, Joe Nicholas, Ursula Monaghan

Dates: August 8 - 12, 2022

HG-02 DC Substation Power line not far overhead from antenna.									
Run ID	Date	Time	Type	Freq Band	Location	Notes	Temp (F)	Humid (%)	Cloud Cover
811-14	8/11/22	3:51 PM	RE	B0	HG-02	Highest peak 161 db at 20 kHz.	88	32	Partly Cloudy
811-15	8/11/22	4:01 PM	RE	B1	HG-02	Peak at 601 khz 129 db	88	32	Partly Cloudy
811-16	8/11/22	4:10 PM	RE	B2	HG-02	Peak at 882 khz, of 135 db	88	32	Partly Cloudy
811-17	8/11/22	4:16 PM	RE	B3	HG-02	Peak at 3.44 mhz of 118 db	88	32	Partly Cloudy
811-18	8/11/22	4:20 PM	RE	B4	HG-02	Interesting upslope at the end	88	32	Partly Cloudy
811-19	8/11/22	4:28 PM	RE	B4	HG-02	This band slopes upward at the end with AC coupling. Other B4s just go down	88	32	Partly Cloudy
811-20	8/11/22	4:36 PM	RE	B5h	HG-02	Broadband peaks seem higher	88	32	Partly Cloudy
811-21	8/11/22	4:45 PM	RE	B6h	HG-02	Peak at 543 mhz at 103 db	88	32	Partly Cloudy
811-22	8/11/22	4:54 PM	RE	B7h	HG-02	peak at 1.731 89 db. Might want to double check that this image mages the trace. Forgot to save the image and saved it later	88	32	Partly Cloudy
811-23	8/11/22	5:02 PM	RE	B5v	HG-02	Narrow spike at 217 mhz	88	32	Partly Cloudy
811-24	8/11/22	5:14 PM	RE	B6v	HG-02	peak at 750 mhz of 104 db	88	32	Partly Cloudy
811-25	8/11/22	5:18 PM	RE	B7v	HG-02	peak at 1.98 ghz of 96 db	88	32	Partly Cloudy

MTA PSA Pre Energization Survey Radiated Emissions Test Log

Test team: Stephane Yu, Temba Mateke, Joe Nicholas, Ursula Monaghan
 Dates: August 8 - 12, 2022

Electric Substation near Randall's Island Equipment set up in empty parking lot north of electric substation									
Run ID	Date	Time	Type	Freq Band	Location	Notes	Temp (F)	Humid (%)	Cloud Cover
812-01	8/12/22	9:05 AM	RE	B0	Electric Substation	High peaks every 20 kHz, with smaller peaks every 10 kHz. Highest peak is 161.59 at about 20 kHz	74	53	Partly Cloudy
812-02	8/12/22	9:25 AM	RE	B1	Electric Substation	Small peak of 127.7 at 570.5 kHz	74	53	Partly Cloudy
812-03	8/12/22	9:36 AM	RE	B2	Electric Substation	Peaks every 55 kHz. Highest peak is 139 at 662.5 kHz	74	53	Partly Cloudy
812-04	8/12/22	9:45 AM	RE	B3	Electric Substation		74	53	Partly Cloudy
812-05	8/12/22	9:49 AM	RE	B4	Electric Substation		74	53	Partly Cloudy
812-06	8/12/22	9:57 AM	RE	B5h	Electric Substation	Highest peak is 103.8 at 176.8 MHz Noisy compared to other sites, many narrow band transients throughout B5 spectrum	74	53	Partly Cloudy
812-07	8/12/22	10:08 AM	RE	B5h	Electric Substation	From 210 to 325 MHz there is less noise than the previous run in the same band	74	53	Partly Cloudy
812-08	8/12/22	10:13 AM	RE	B6h	Electric Substation	Highest peak is 105.7 at 874.1	74	53	Partly Cloudy
812-09	8/12/22	10:21 AM	RE	B7h	Electric Substation	Highest peak is 96.96 dB at 1.967 GHz, approximately 40 dB above noise floor.	74	53	Partly Cloudy
812-10	8/12/22	10:26 AM	RE	B5v	Electric Substation	High narrowband peaks throughout the whole band. 102.5 dB at 97.187 MHz. ~45 dB above the noise floor.	74	53	Partly Cloudy
812-11	8/12/22	10:30 AM	RE	B6v	Electric Substation	105.4 dB at 869.8 MHz ~ 55 dB above noise floor.	74	53	Partly Cloudy
812-12	8/12/22	10:33 AM	RE	B7v	Electric Substation	Amtrak Train Passing	74	53	Partly Cloudy
812-13	8/12/22	10:35 AM	RE	B7v	Electric Substation	Repeated to get ambientPeak at 99.68 dB at 1.966 GHz, approx 40 dB above noise floor. mislabelled as run 12 in some locations	74	53	Partly Cloudy

MTA PSA Pre Energization Survey Radiated Emissions Test Log

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 Dates: August 8 - 12, 2022

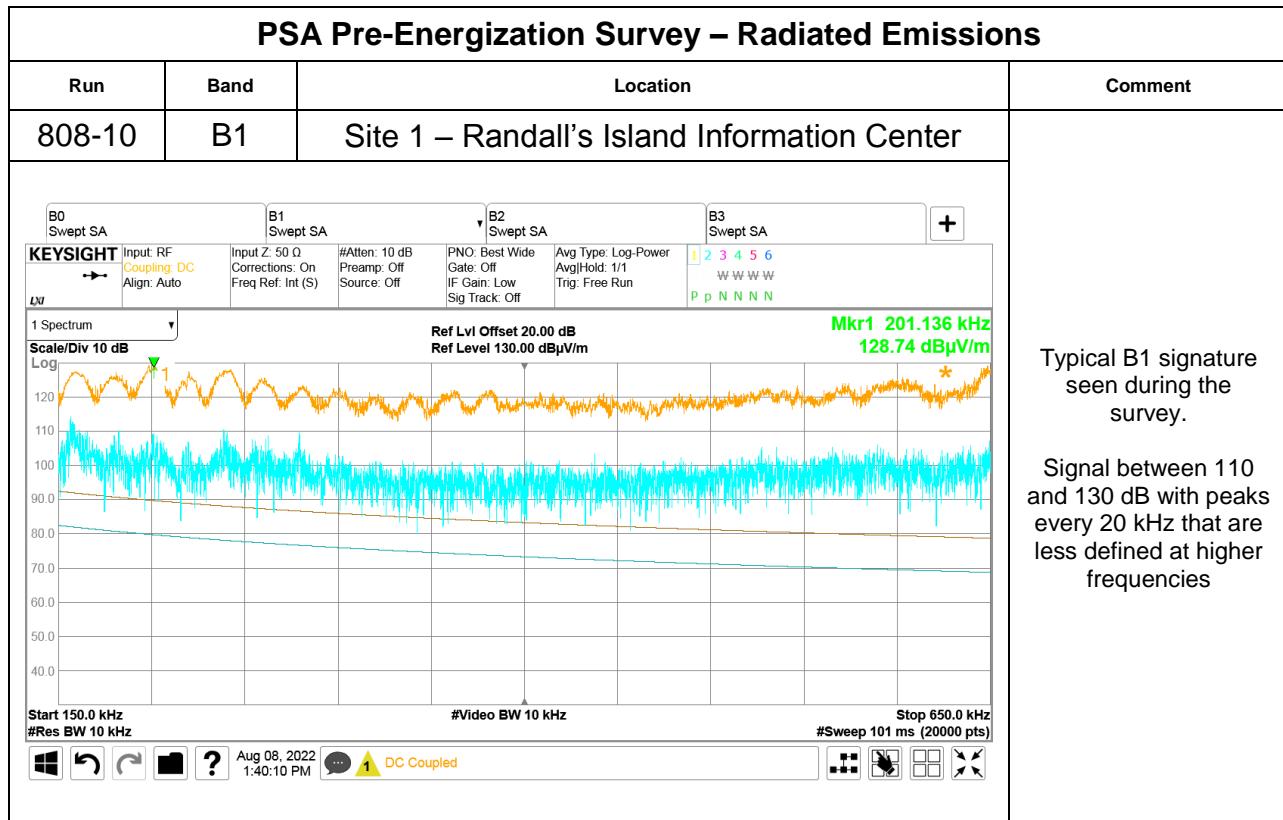
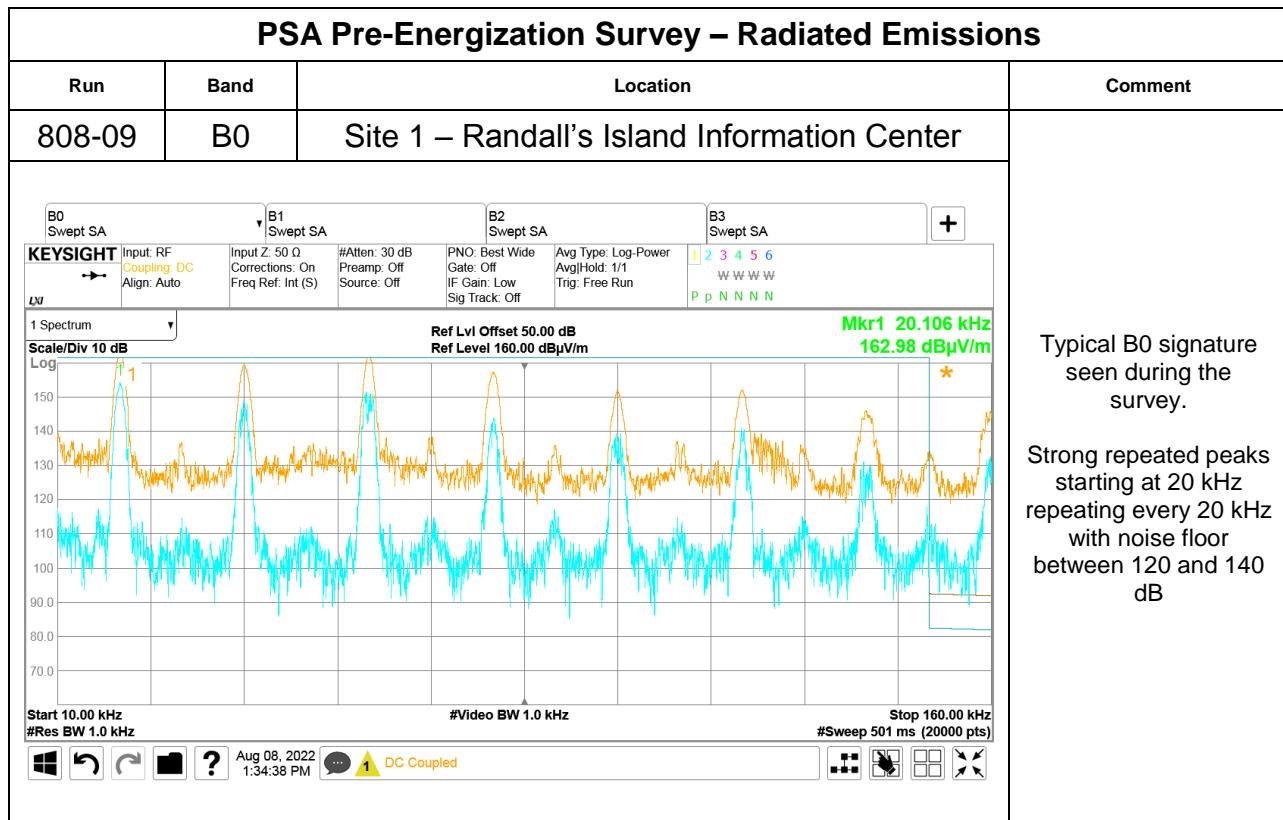
HG-01 DC Substation									
Loud area with trucks and cars passing the site regularly. Equipment set up on side walk next to Home Depot storage yard. Power line maybe 80 ft away.									
Run ID	Date	Time	Type	Freq Band	Location	Notes	Temp (F)	Humid (%)	Cloud Cover
812-14	8/12/22	12:34 PM	RE	B0	HG-01	Loud area. Trucks and cars passing the site regularly. Peaks at 20 kHz intervals. Side walk next to Home Depot storage yard. power line maybe 80 ft away	80	33	Clear sky
812-15	8/12/22	12:38 PM	RE	B1	HG-01	ambient	80	33	Clear sky
812-16	8/12/22	12:39 PM	RE	B2	HG-01	Amtrak passed. only saved the image	80	33	Clear sky
812-17	8/12/22	12:42 PM	RE	B2	HG-01	amtrak acela passed	80	33	Clear sky
812-18	8/12/22	12:44 PM	RE	B2	HG-01	Cars passing. 2 large broadband humps 10 dB tall, from 1.75 MHz to 2.3 MHz, and 2.3 to 2.8 MHz	80	33	Clear sky
812-19	8/12/22	12:49 PM	RE	B3	HG-01		80	33	Clear sky
812-20	8/12/22	12:52 PM	RE	B4	HG-01		80	33	Clear sky
812-21	8/12/22	1:07 PM	RE	B5h	HG-01		80	33	Clear sky
812-22	8/12/22	1:08 PM	RE	B6h	HG-01	Train passing	80	33	Clear sky
812-23	8/12/22	1:11 PM	RE	B7h	HG-01		80	33	Clear sky
812-24	8/12/22	1:14 PM	RE	B5v	HG-01		80	33	Clear sky
812-25	8/12/22	1:16 PM	RE	B6v	HG-01	Seems noisier than B6h	80	33	Clear sky
812-26	8/12/22	1:18 PM	RE	B7v	HG-01	LIRR passing. peak at 2.465 GHz.	80	33	Clear sky
812-27	8/12/22	1:20 PM	RE	B7v	HG-01		80	33	Clear sky

Radiated Electric Field Measurement

Results Records

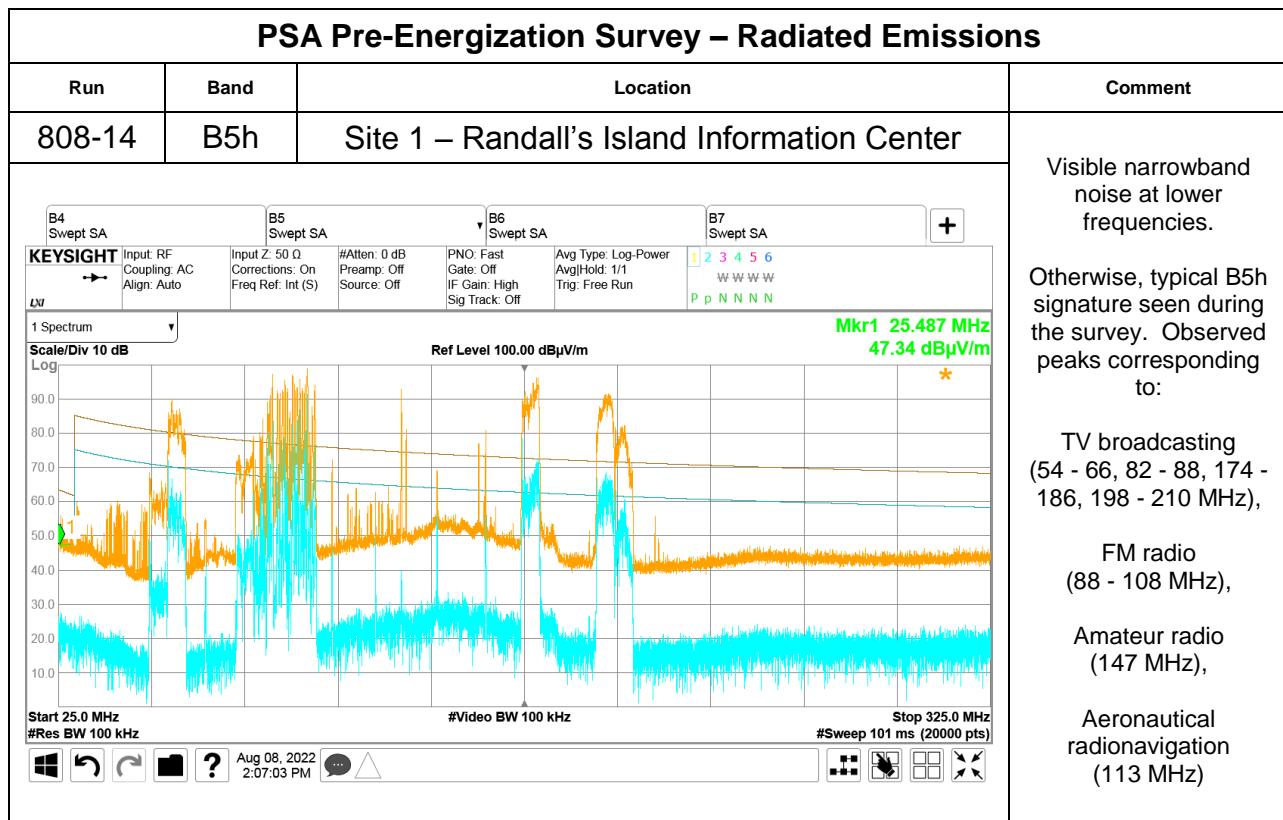
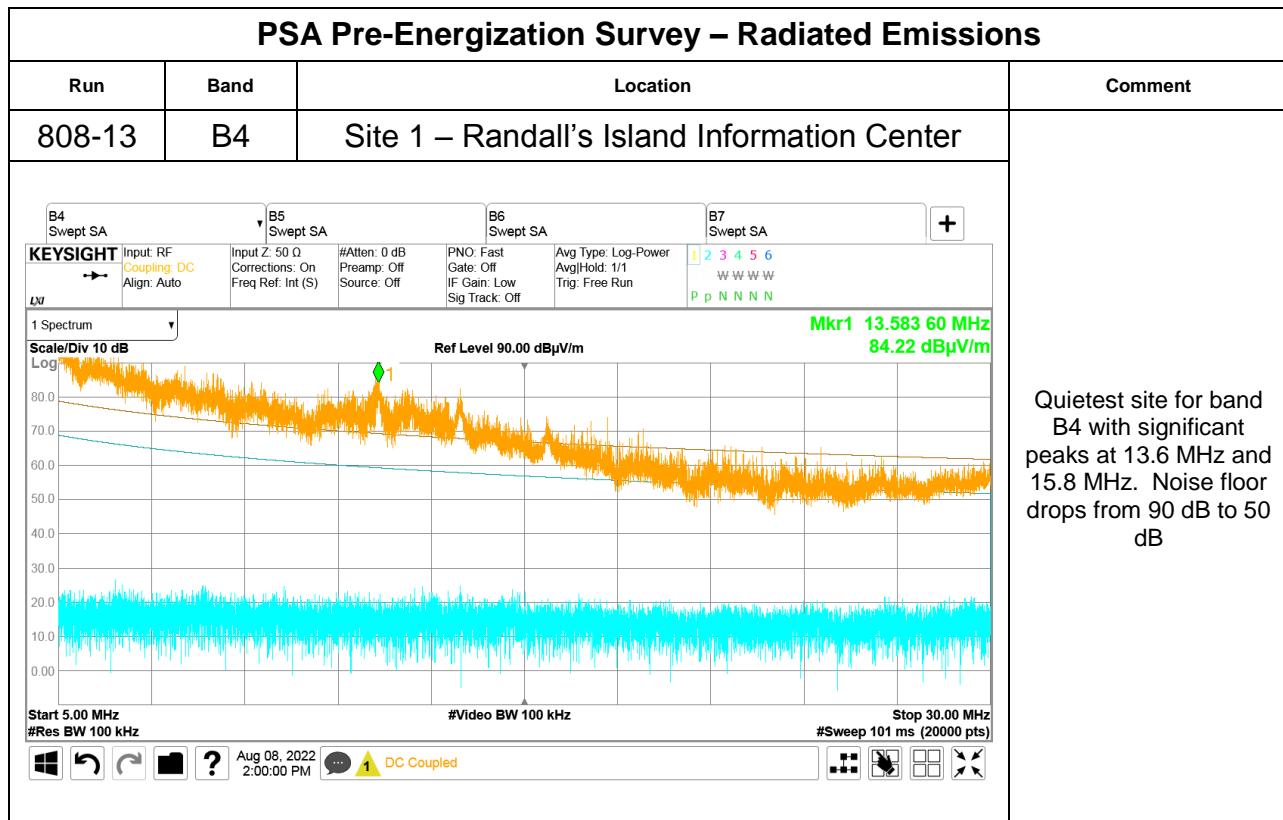
Site 1

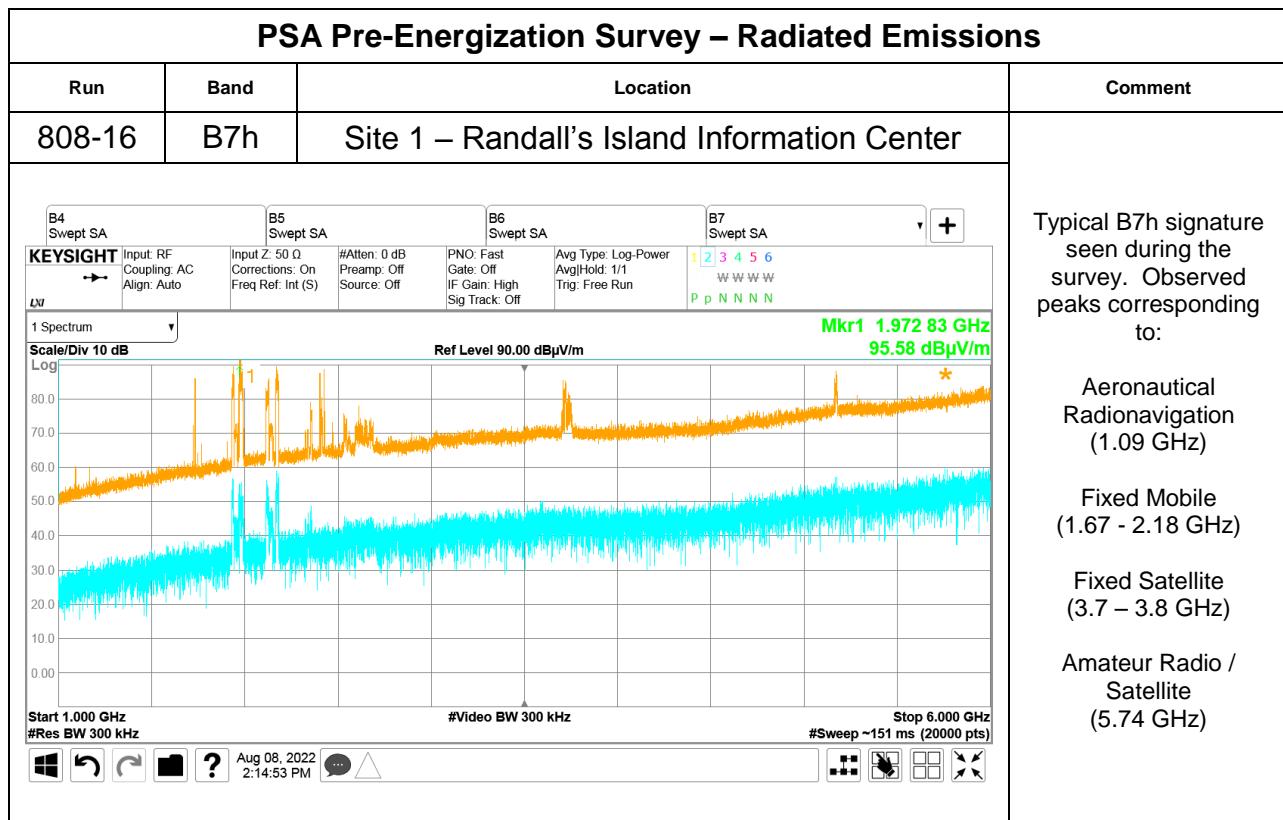
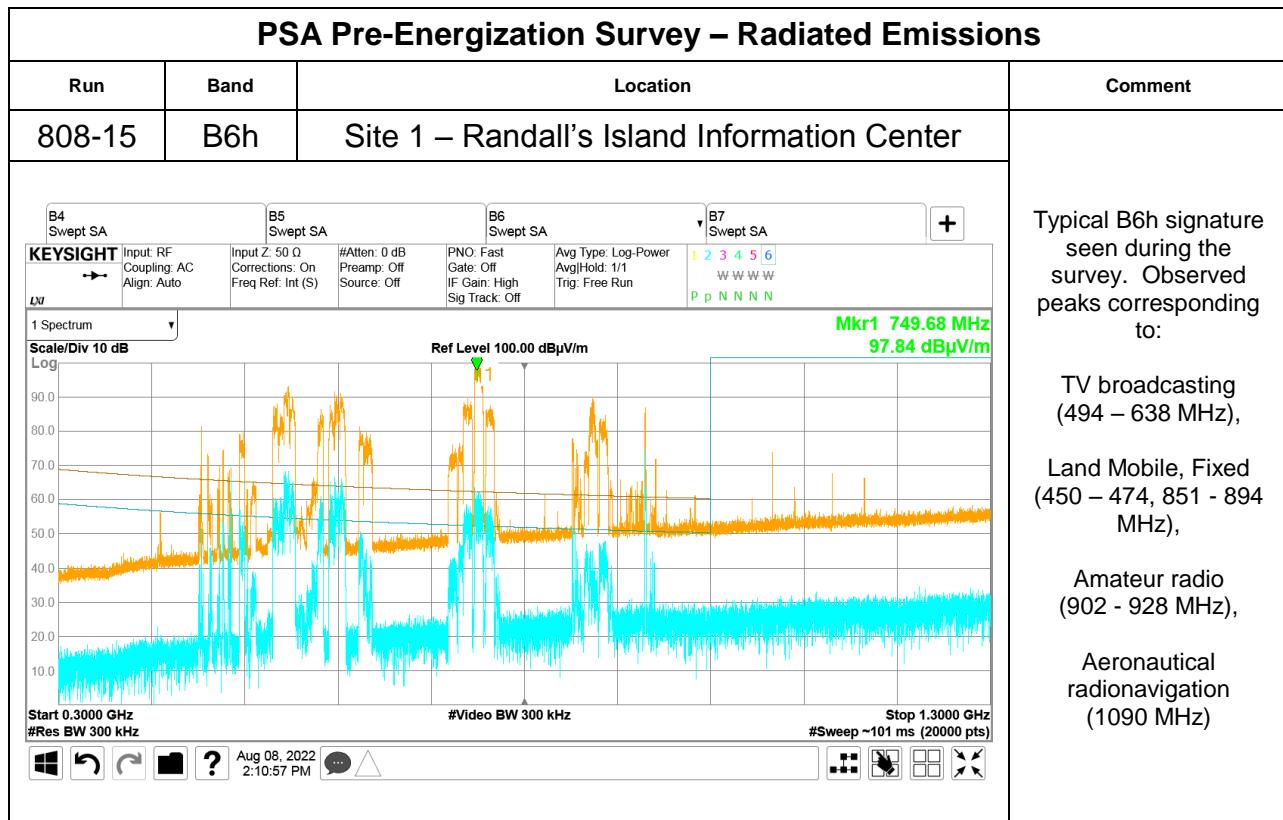
Randall's Island Information Center



PSA Pre-Energization Survey – Radiated Emissions					
Run	Band	Location			Comment
808-11	B2	Site 1 – Randall's Island Information Center			
		<p>KEYSIGHT Input: RF Coupling: DC Align: Auto</p> <p>B0 Swept SA B1 Swept SA B2 Swept SA B3 Swept SA</p> <p>LN</p> <p>1 Spectrum Ref Lvl Offset 20.00 dB Scale/Div 10 dB Ref Level 130.00 dBμV/m</p> <p>Mkr1 712.097 kHz 135.52 dBμV/m</p> <p>Start 0.500 MHz Stop 3.000 MHz #Res BW 10 kHz #Video BW 10 kHz #Sweep 101 ms (20000 pts)</p> <p>Aug 08, 2022 1:44:48 PM DC Coupled</p>	Strong peaks at 660 and 880 kHz		

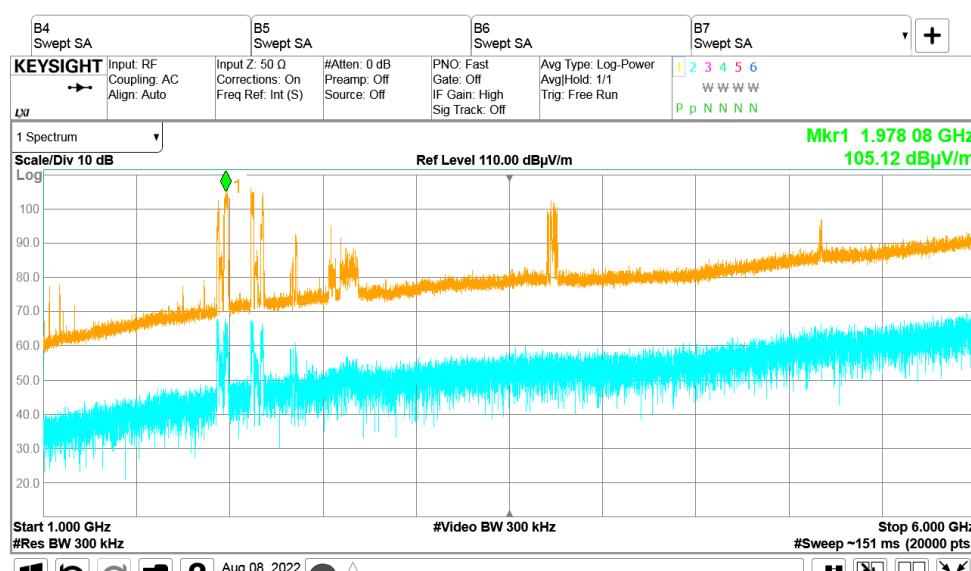
PSA Pre-Energization Survey – Radiated Emissions					
Run	Band	Location			Comment
808-12	B3	Site 1 – Randall's Island Information Center			
		<p>KEYSIGHT Input: RF Coupling: DC Align: Auto</p> <p>B0 Swept SA B1 Swept SA B2 Swept SA B3 Swept SA</p> <p>LN</p> <p>1 Spectrum Ref Level 110.00 dBμV/m</p> <p>Scale/Div 10 dB</p> <p>Mkr1 4.387 93 MHz 105.59 dBμV/m</p> <p>Start 2.500 MHz Stop 7.500 MHz #Res BW 10 kHz #Video BW 10 kHz #Sweep 151 ms (20000 pts)</p> <p>Aug 08, 2022 1:55:47 PM DC Coupled</p>	Quietest location for band B3 with noise floor falling from 105 dB to 90 dB and no visible peaks		





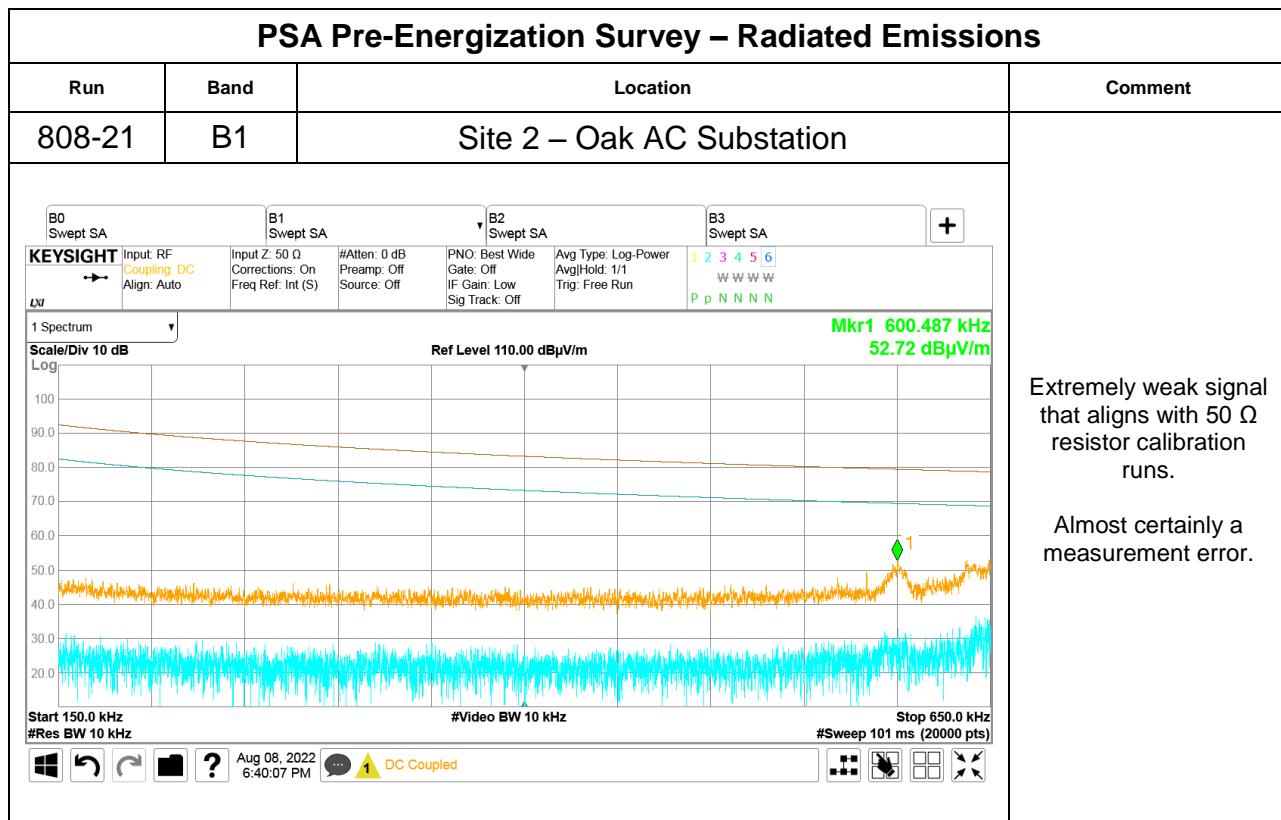
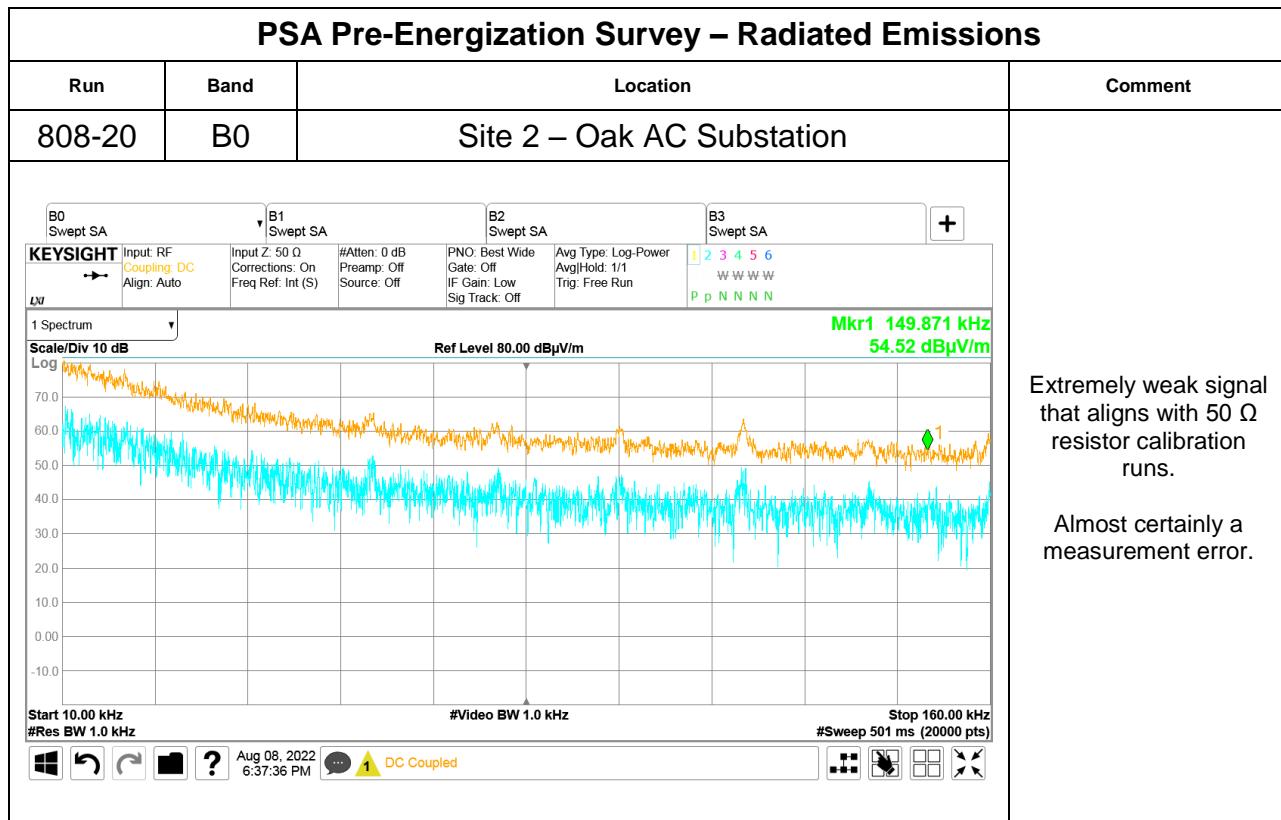
PSA Pre-Energization Survey – Radiated Emissions					
Run	Band	Location			Comment
808-17	B5v	Site 1 – Randall's Island Information Center			
		<p>B4 Swept SA B5 Swept SA B6 Swept SA B7 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: AC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref: Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: High Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run 1 Spectrum 1 2 3 4 5 6 LN</p> <p>Scale/Div 10 dB Ref Level 100.00 dBμV/m Log</p> <p>Mkr1 106.818 MHz 98.23 dBμV/m</p> <p>Start 25.0 MHz Stop 325.0 MHz #Res BW 100 kHz #Video BW 100 kHz #Sweep 101 ms (20000 pts)</p> <p>Aug 08, 2022 2:19:42 PM</p>	<p>Compare with B5h for this site.</p> <p>Higher noise floor at lower frequencies</p>		

PSA Pre-Energization Survey – Radiated Emissions					
Run	Band	Location			Comment
808-18	B6v	Site 1 – Randall's Island Information Center			
		<p>B4 Swept SA B5 Swept SA B6 Swept SA B7 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: AC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref: Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: High Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run 1 Spectrum 1 2 3 4 5 6 LN</p> <p>Scale/Div 10 dB Ref Level 110.00 dBμV/m Log</p> <p>Mkr1 752.11 MHz 114.41 dBμV/m</p> <p>Start 0.3000 GHz Stop 1.3000 GHz #Res BW 300 kHz #Video BW 300 kHz #Sweep ~101 ms (20000 pts)</p> <p>Aug 08, 2022 2:22:30 PM</p>	<p>Very similar to B6h for this site</p>		

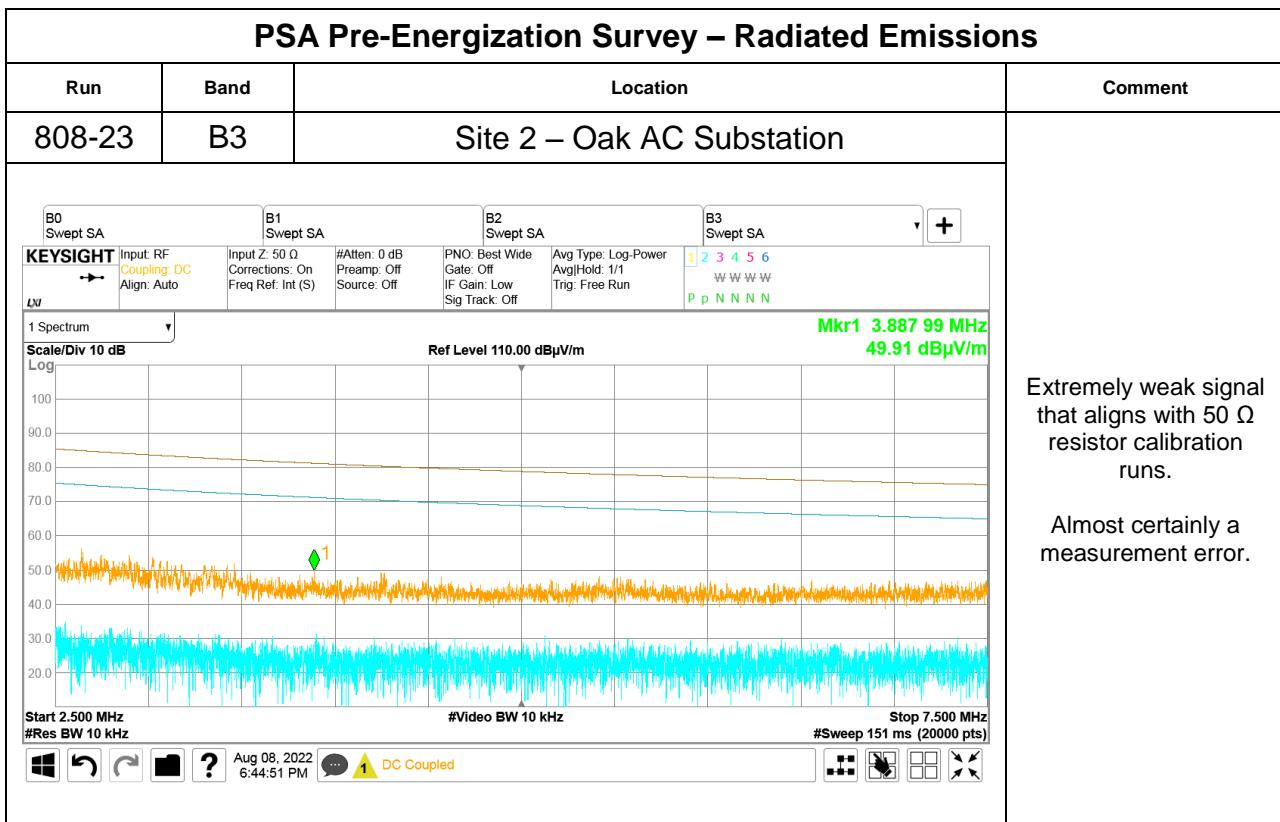
PSA Pre-Energization Survey – Radiated Emissions			
Run	Band	Location	Comment
808-19	B7v	Site 1 – Randall's Island Information Center	
 <p>KEYSIGHT Input: RF Coupling: AC Align: Auto</p> <p>Input Z: 50 Ω Corrections: On Freq Ref. Int (S)</p> <p>#Atten: 0 dB Preampl.: Off</p> <p>PNO: Fast Gate: Off IF Gain: High Sig Track: Off</p> <p>Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run</p> <p>Mkr1 1.978 08 GHZ 105.12 dBµV/m</p> <p>Scale/Div 10 dB Ref Level 110.00 dBµV/m</p> <p>Start 1.000 GHz #Res BW 300 kHz</p> <p>#Video BW 300 kHz</p> <p>Stop 6.000 GHz #Sweep ~151 ms (20000 pts)</p>			Trace appears to have the wrong correction file applied

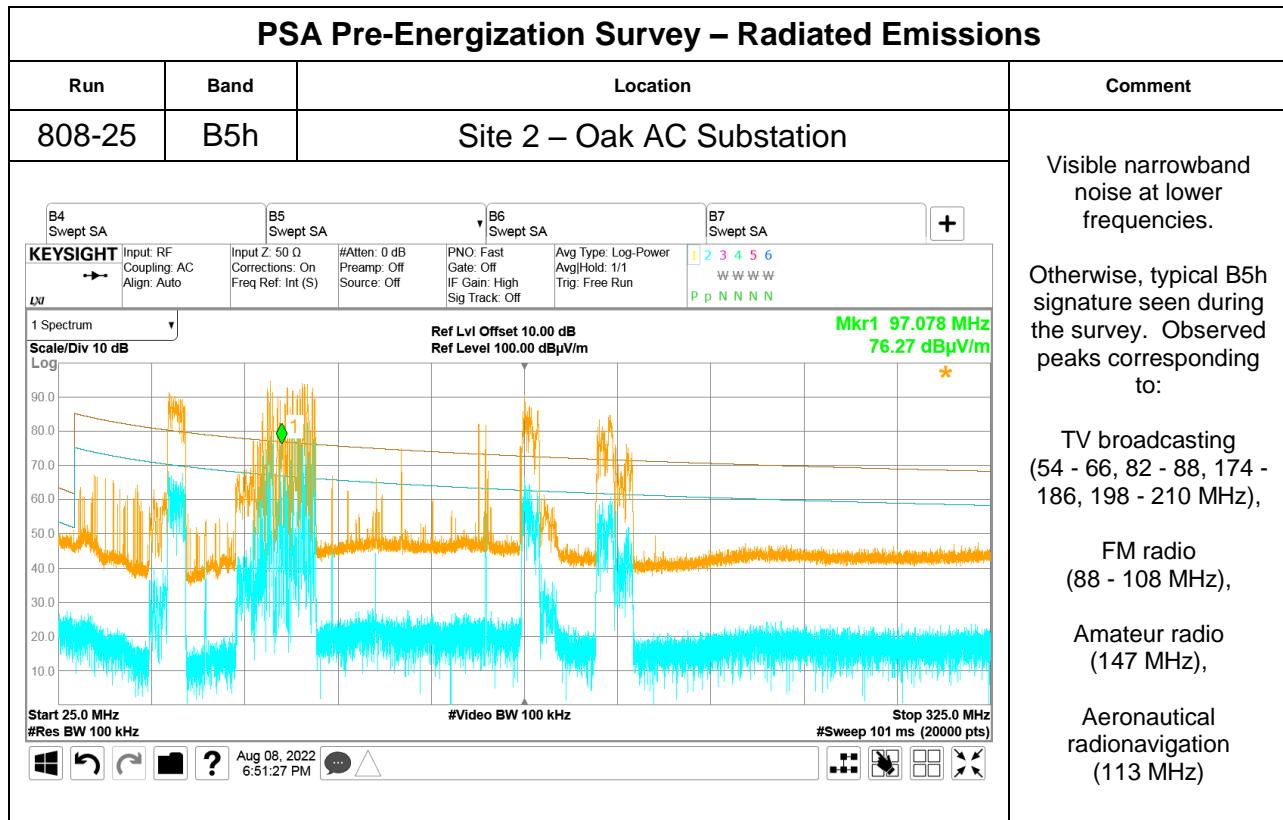
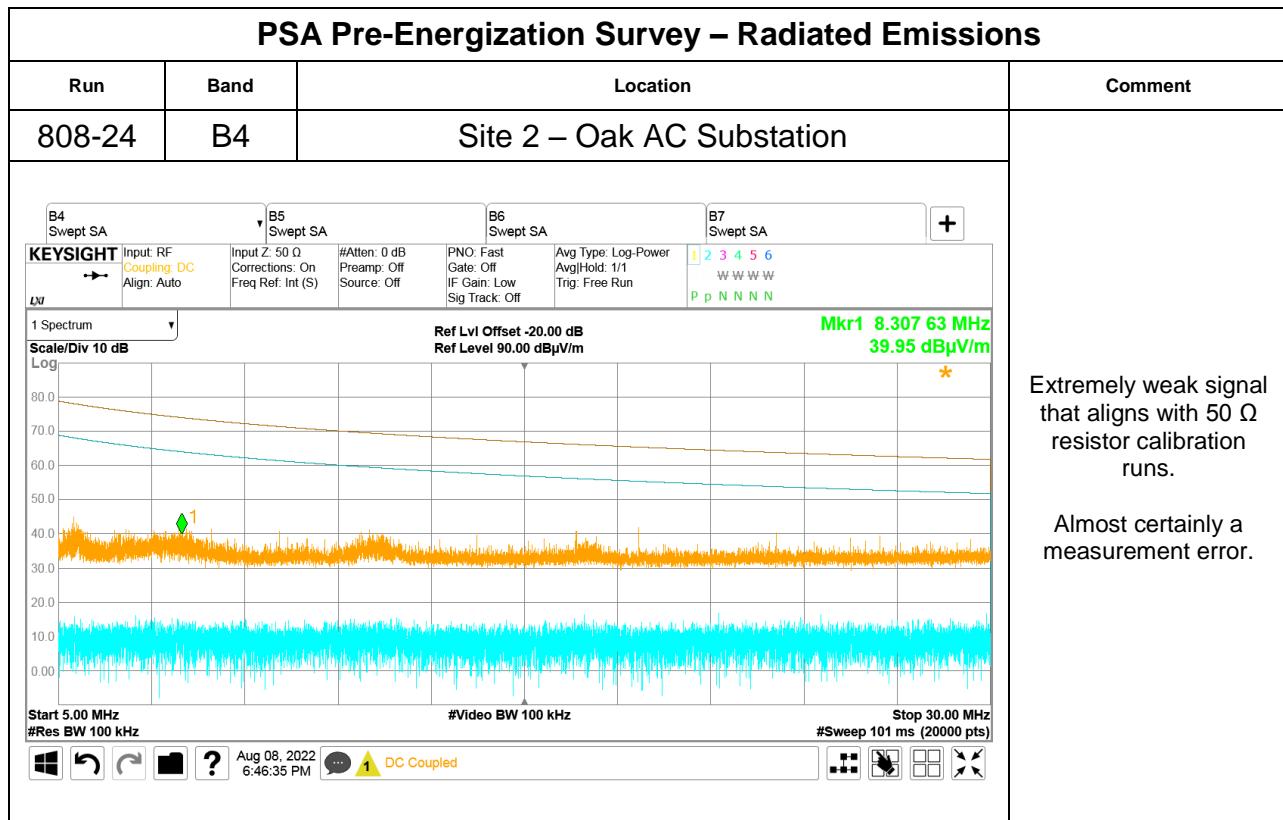
Site 2

Oak AC Substation



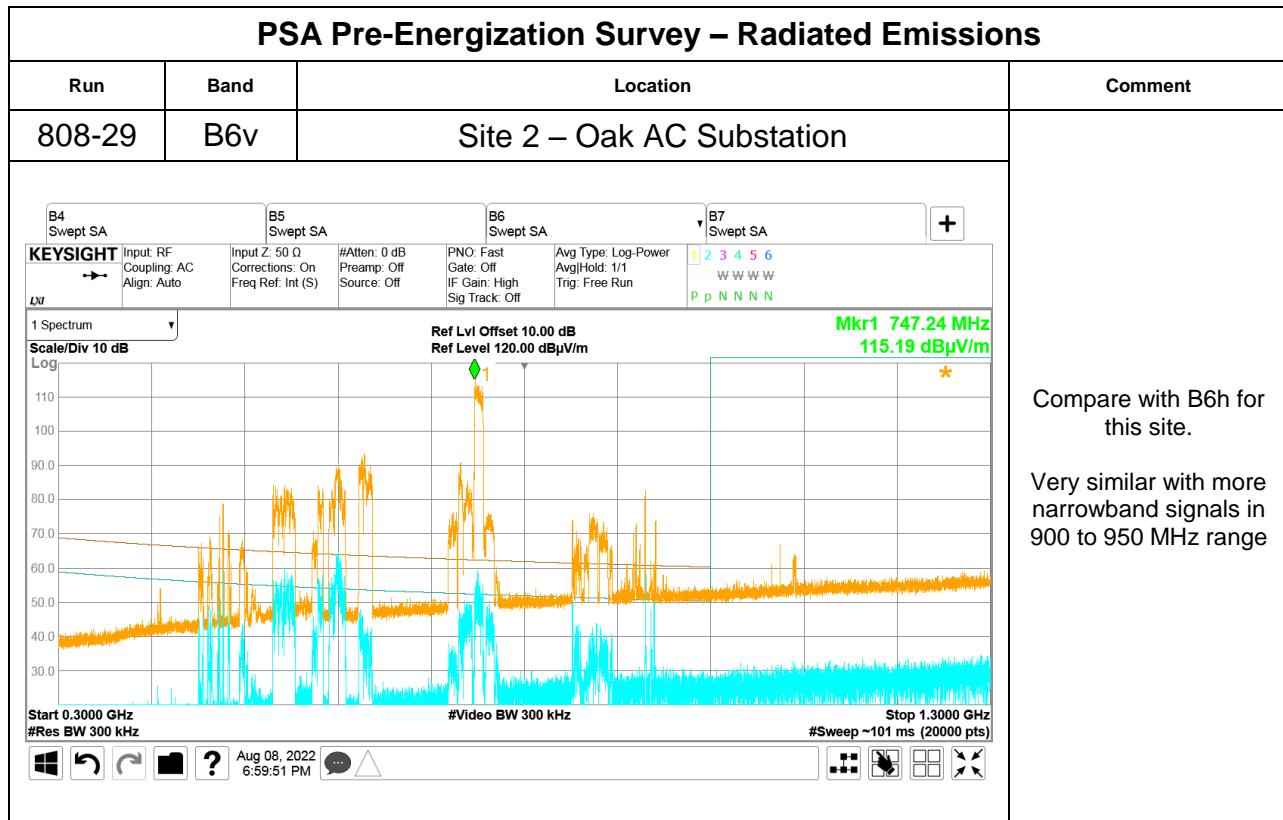
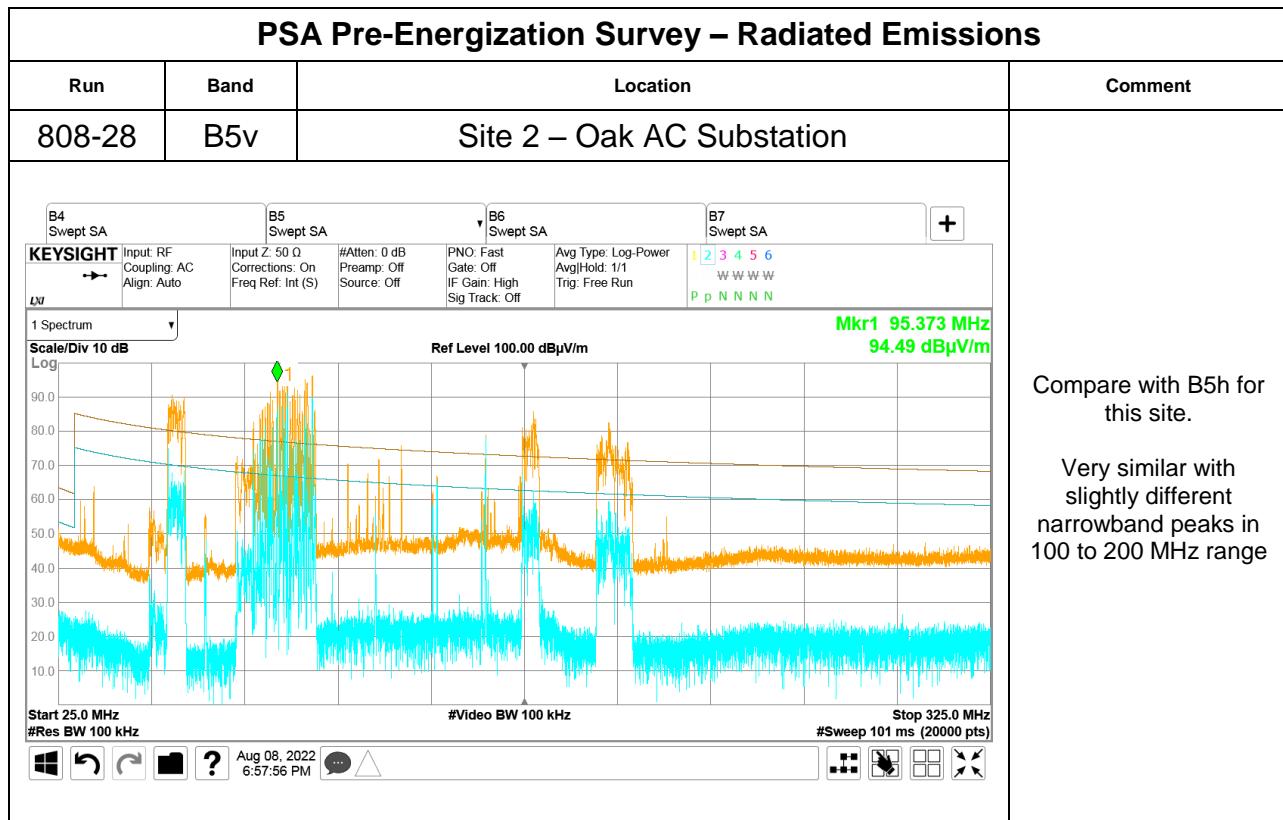
PSA Pre-Energization Survey – Radiated Emissions			
Run	Band	Location	Comment
N/A	B2	Site 2 – Oak AC Substation	
N/A			Band B2 was not recorded at this site due to a configuration error.

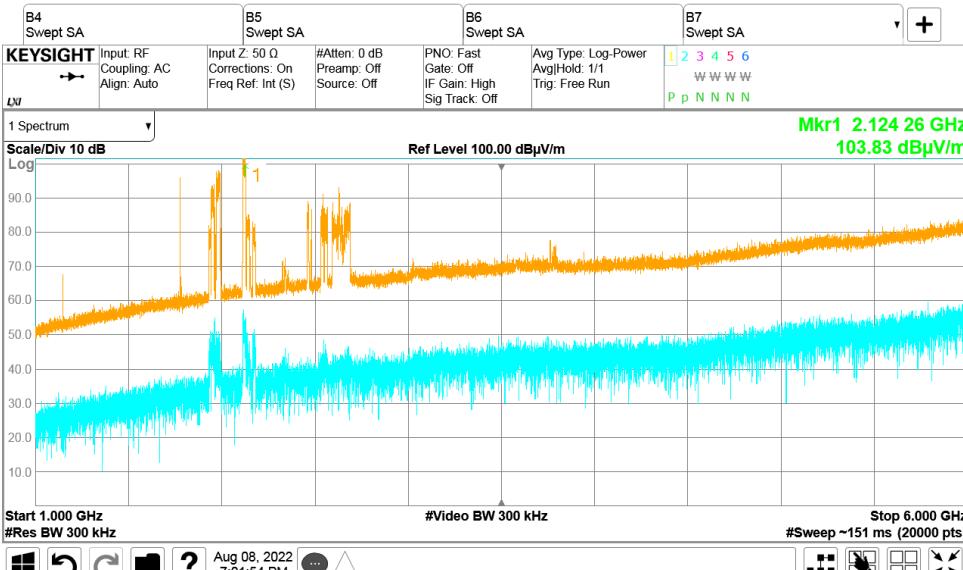




PSA Pre-Energization Survey – Radiated Emissions				
Run	Band	Location		Comment
808-26	B6h	Site 2 – Oak AC Substation		
		<p>B4 Swept SA B5 Swept SA B6 Swept SA B7 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: AC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref. Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: High Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run</p> <p>LN</p> <p>1 Spectrum Ref Level 110.00 dB_PV/m</p> <p>Scale/Div 10 dB</p> <p>Mkr1 751.30 MHz 107.71 dB_PV/m</p> <p>Start 0.3000 GHz Stop 1.3000 GHz #Res BW 300 kHz #Sweep ~101 ms (20000 pts)</p> <p>Aug 08, 2022 6:53:20 PM</p>	<p>Typical B6h signature seen during the survey. Observed peaks corresponding to:</p> <ul style="list-style-type: none"> TV broadcasting (494 – 638 MHz), Land Mobile, Fixed (450 – 474, 851 - 894 MHz), Amateur radio (902 - 928 MHz), Aeronautical radionavigation (1090 MHz) 	

PSA Pre-Energization Survey – Radiated Emissions				
Run	Band	Location		Comment
808-27	B7h	Site 2 – Oak AC Substation		
		<p>B4 Swept SA B5 Swept SA B6 Swept SA B7 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: AC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref. Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: High Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run</p> <p>LN</p> <p>1 Spectrum Ref Level 110.00 dB_PV/m</p> <p>Scale/Div 10 dB</p> <p>Mkr1 2.11957 GHz 106.74 dB_PV/m</p> <p>Start 1.0000 GHz Stop 6.0000 GHz #Res BW 300 kHz #Sweep ~151 ms (20000 pts)</p> <p>Aug 08, 2022 6:54:09 PM</p>	<p>Typical B7h signature seen during the survey. Observed peaks corresponding to:</p> <ul style="list-style-type: none"> Aeronautical Radionavigation (1.09 GHz) Fixed Mobile (1.67 - 2.18 GHz) Fixed Satellite (3.7 – 3.8 GHz) Amateur Radio / Satellite (5.74 GHz) 	

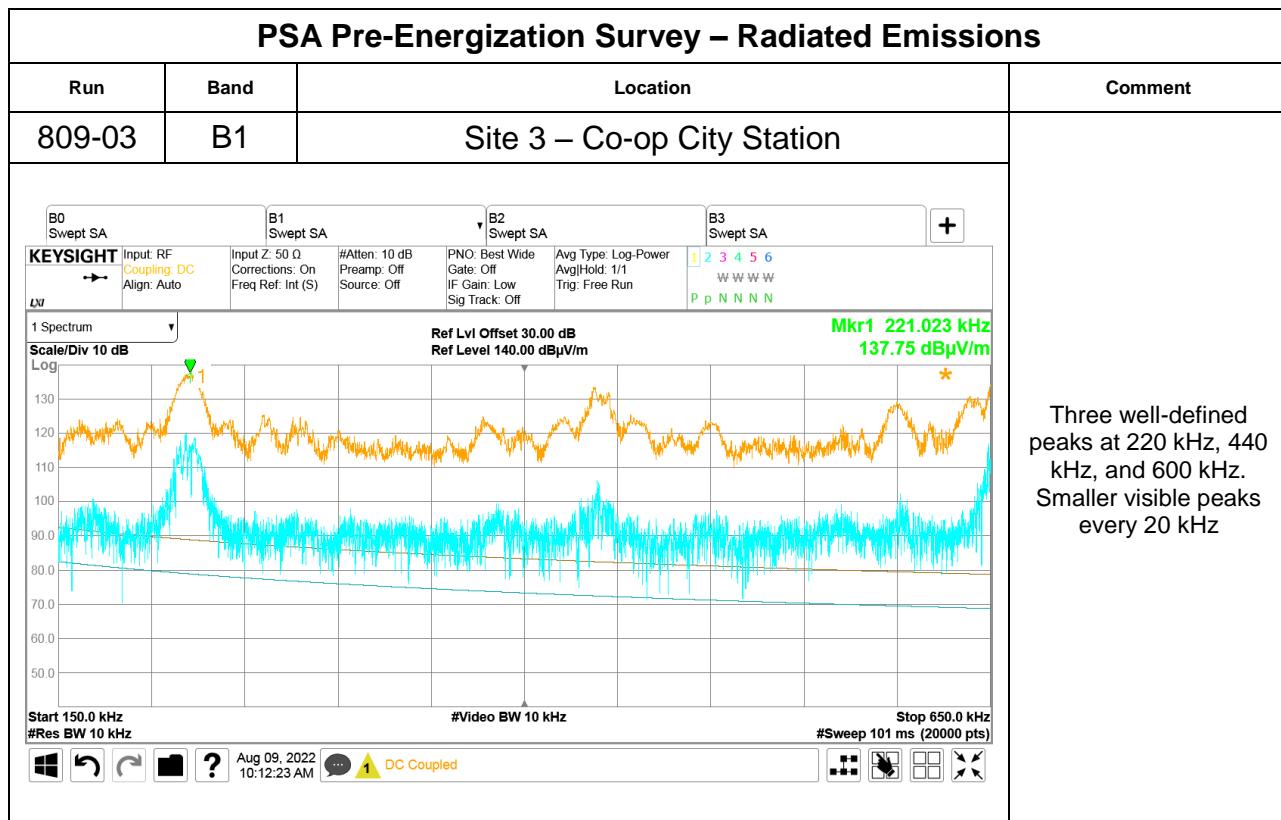
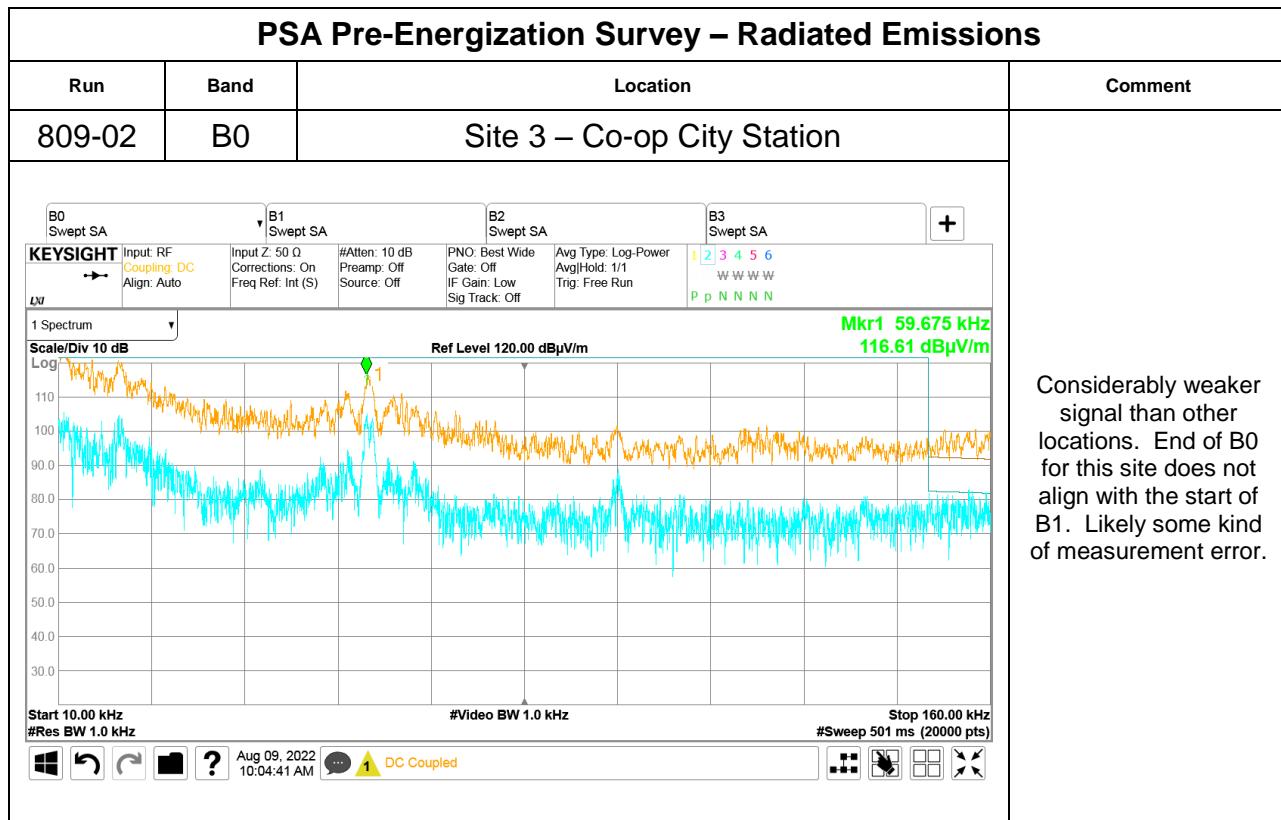


PSA Pre-Energization Survey – Radiated Emissions			
Run	Band	Location	Comment
808-30	B7v	Site 2 – Oak AC Substation	
 <p>KEYSIGHT Input RF Coupling: AC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref. Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: High Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run Sig Track: Off Mkr1 2.124 26 GHz 103.83 dBµV/m</p> <p>Scale/Div 10 dB Ref Level 100.00 dBµV/m</p> <p>Start 1.000 GHz #Res BW 300 kHz Stop 6.000 GHz #Sweep ~151 ms (20000 pts)</p> <p>Aug 08, 2022 7:01:54 PM</p>			

See B7h at this site

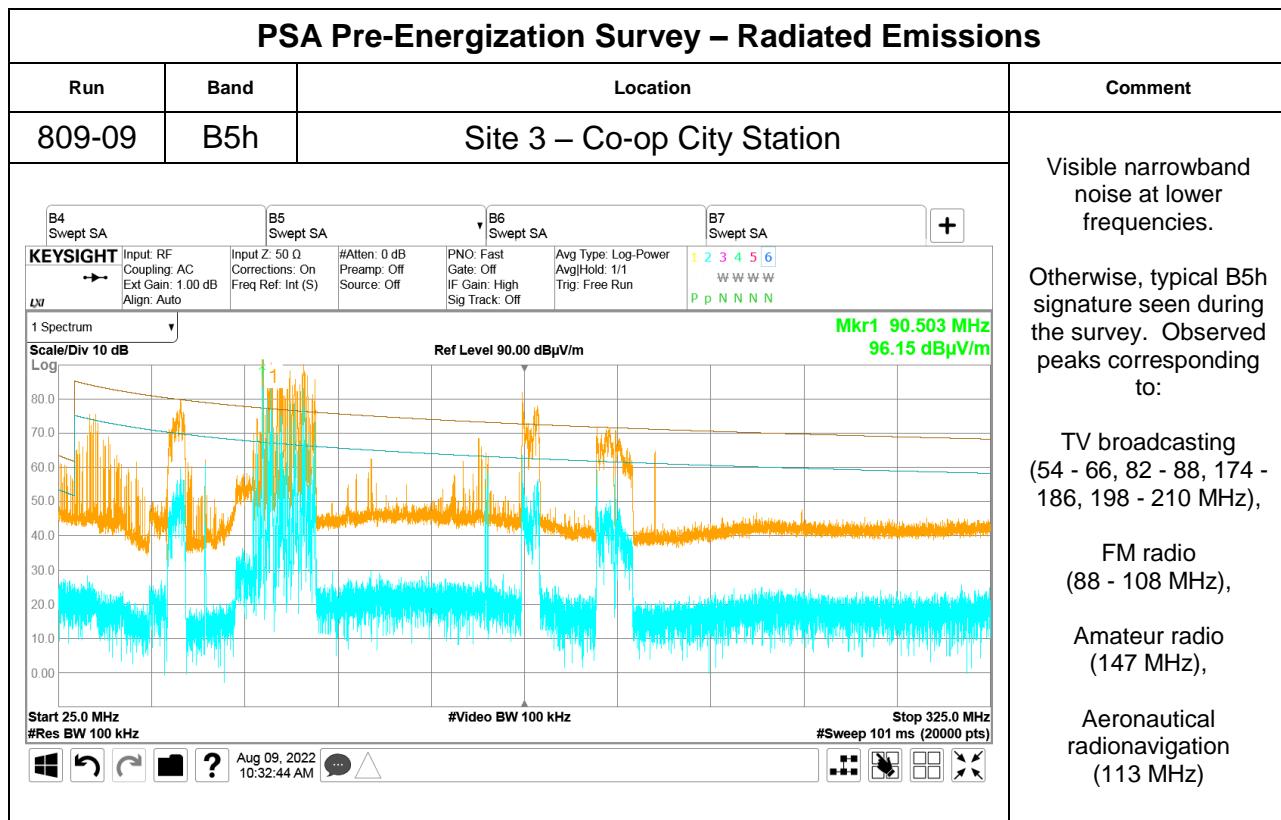
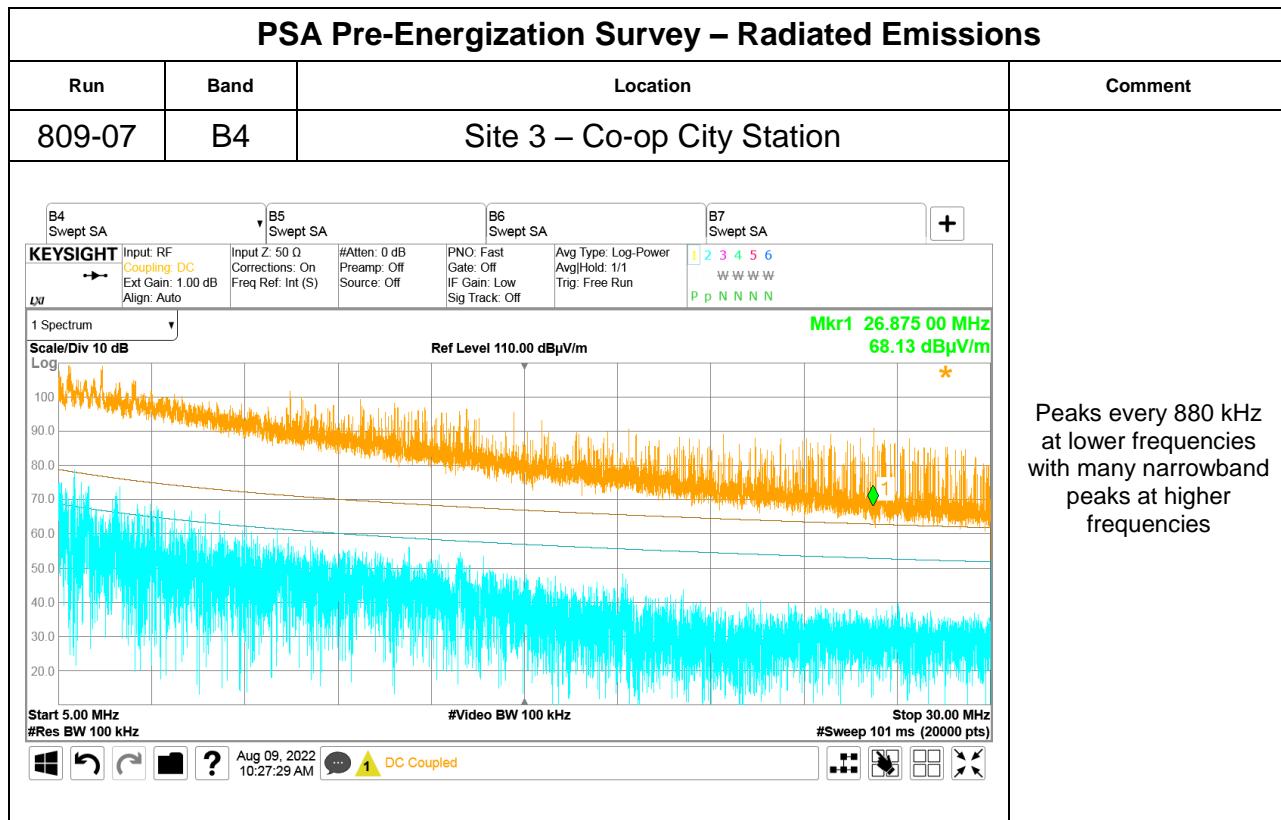
Site 3

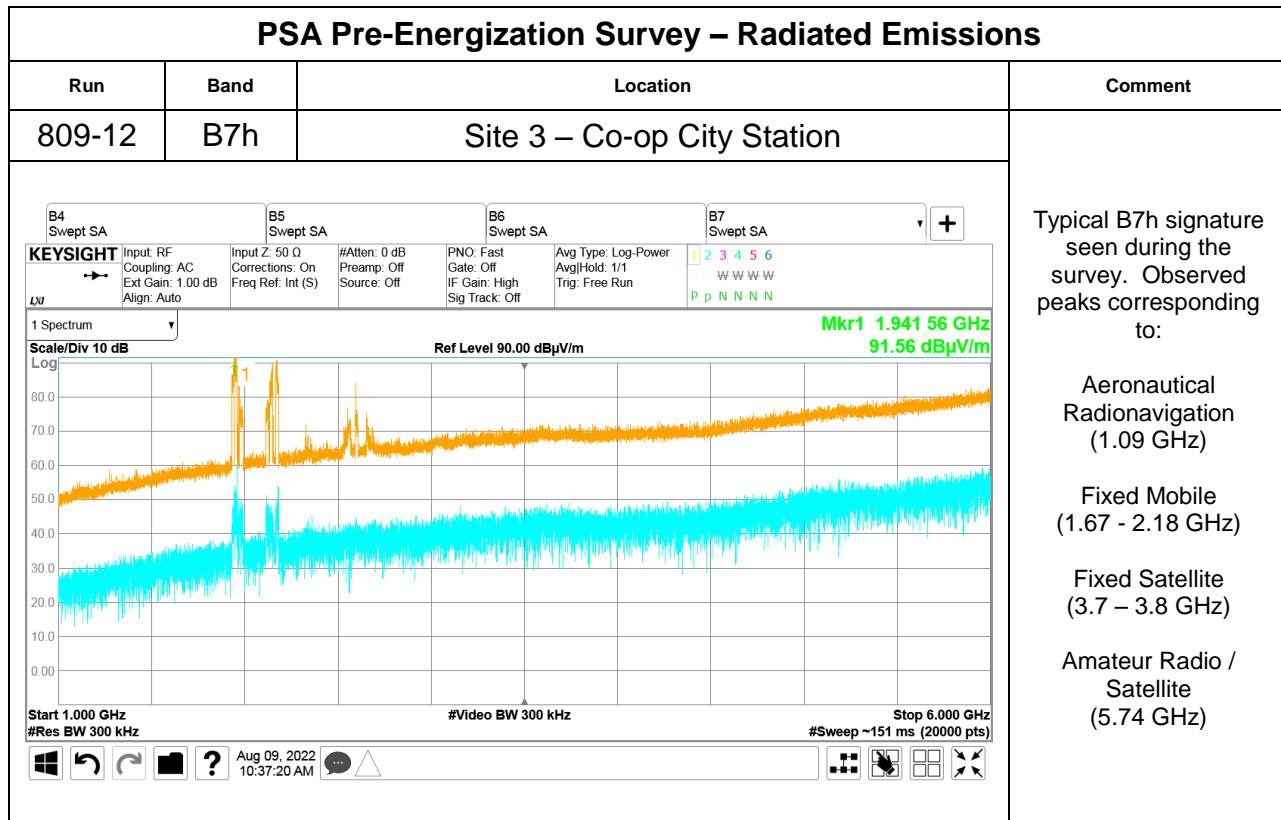
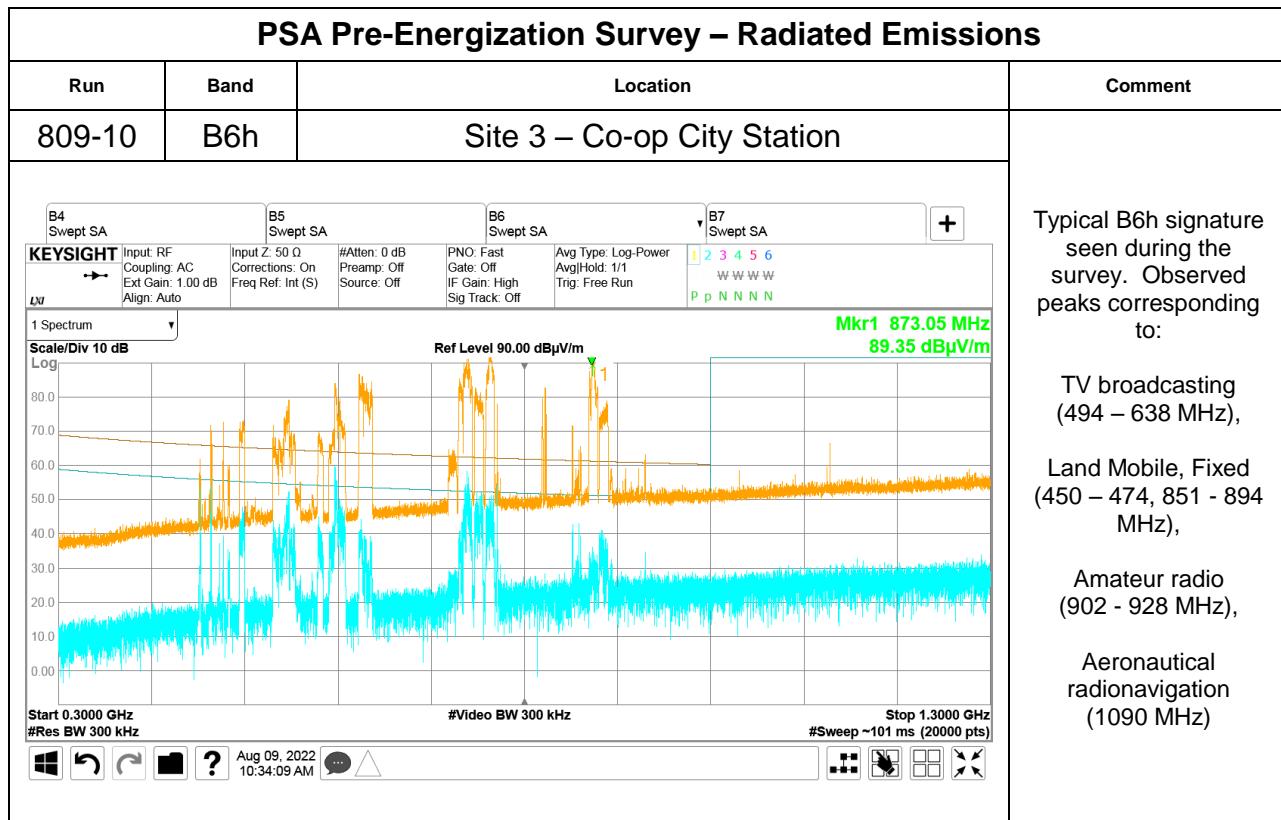
Co-op City Station



PSA Pre-Energization Survey – Radiated Emissions					
Run	Band	Location			Comment
809-05	B2	Site 3 – Co-op City Station			
		<p>B0 Swept SA B1 Swept SA B2 Swept SA B3 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: DC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref: Int (S) #Atten: 10 dB Preamp: Off Source: Off PNO: Best Wide Gate: Off AvgHold: 1/1 IF Gain: Low Trig: Free Run Sig Track: Off</p> <p>LN</p> <p>1 Spectrum Scale/Div 10 dB</p> <p>Ref Lvl Offset 30.00 dB Ref Level 150.00 dBµV/m</p> <p>Mkr1 883.523 kHz 145.76 dBµV/m</p> <p>Start 0.500 MHz #Res BW 10 kHz #Video BW 10 kHz Stop 3.000 MHz #Sweep 101 ms (20000 pts)</p> <p>Aug 09, 2022 10:18:02 AM DC Coupled</p>			

PSA Pre-Energization Survey – Radiated Emissions					
Run	Band	Location			Comment
809-06	B3	Site 3 – Co-op City Station			
		<p>B0 Swept SA B1 Swept SA B2 Swept SA B3 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: DC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref: Int (S) #Atten: 10 dB Preamp: Off Source: Off PNO: Best Wide Gate: Off AvgHold: 1/1 IF Gain: Low Trig: Free Run Sig Track: Off</p> <p>LN</p> <p>1 Spectrum Scale/Div 10 dB</p> <p>Ref Lvl Offset 30.00 dB Ref Level 150.00 dBµV/m</p> <p>Mkr1 883.523 kHz 145.76 dBµV/m</p> <p>Start 0.500 MHz #Res BW 10 kHz #Video BW 10 kHz Stop 3.000 MHz #Sweep 101 ms (20000 pts)</p> <p>Aug 09, 2022 10:18:02 AM DC Coupled</p>	Strong signal visible every 220 kHz. Very similar to Site 5		





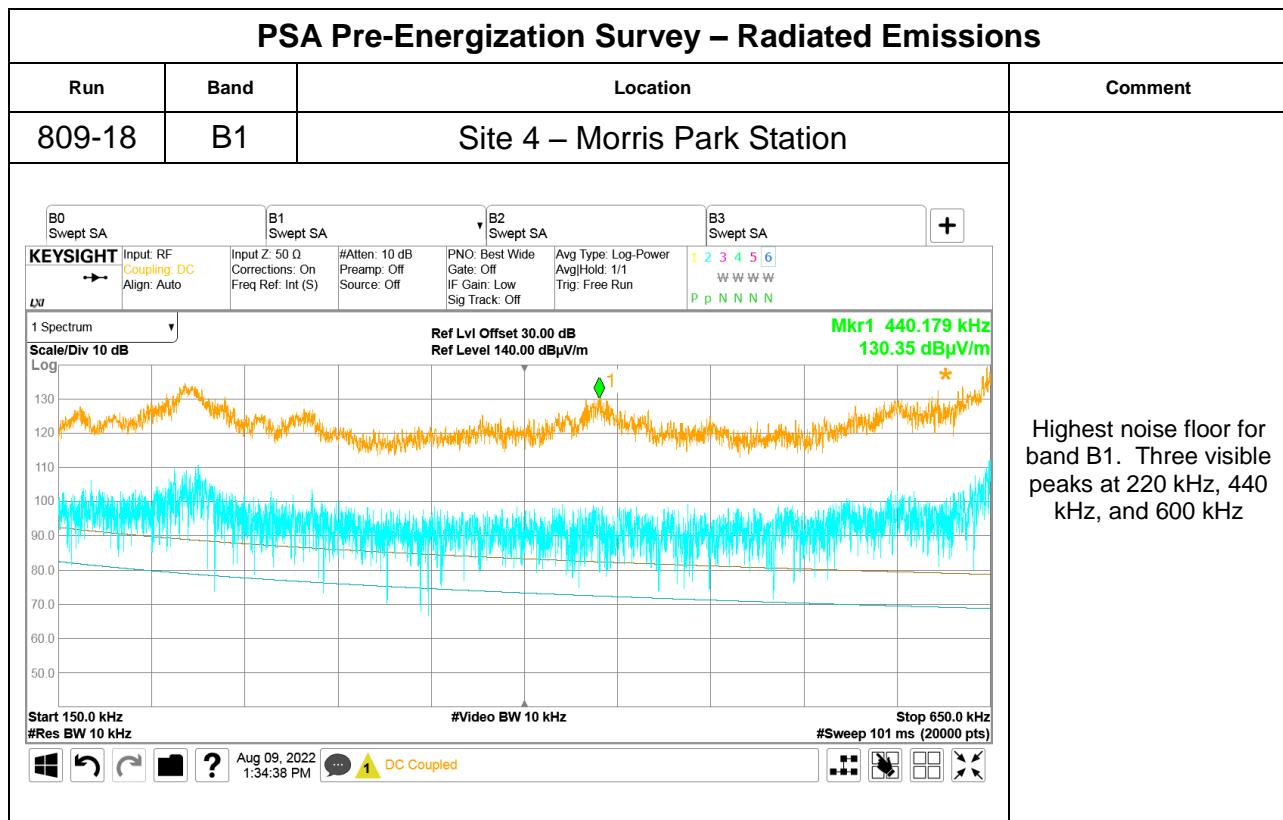
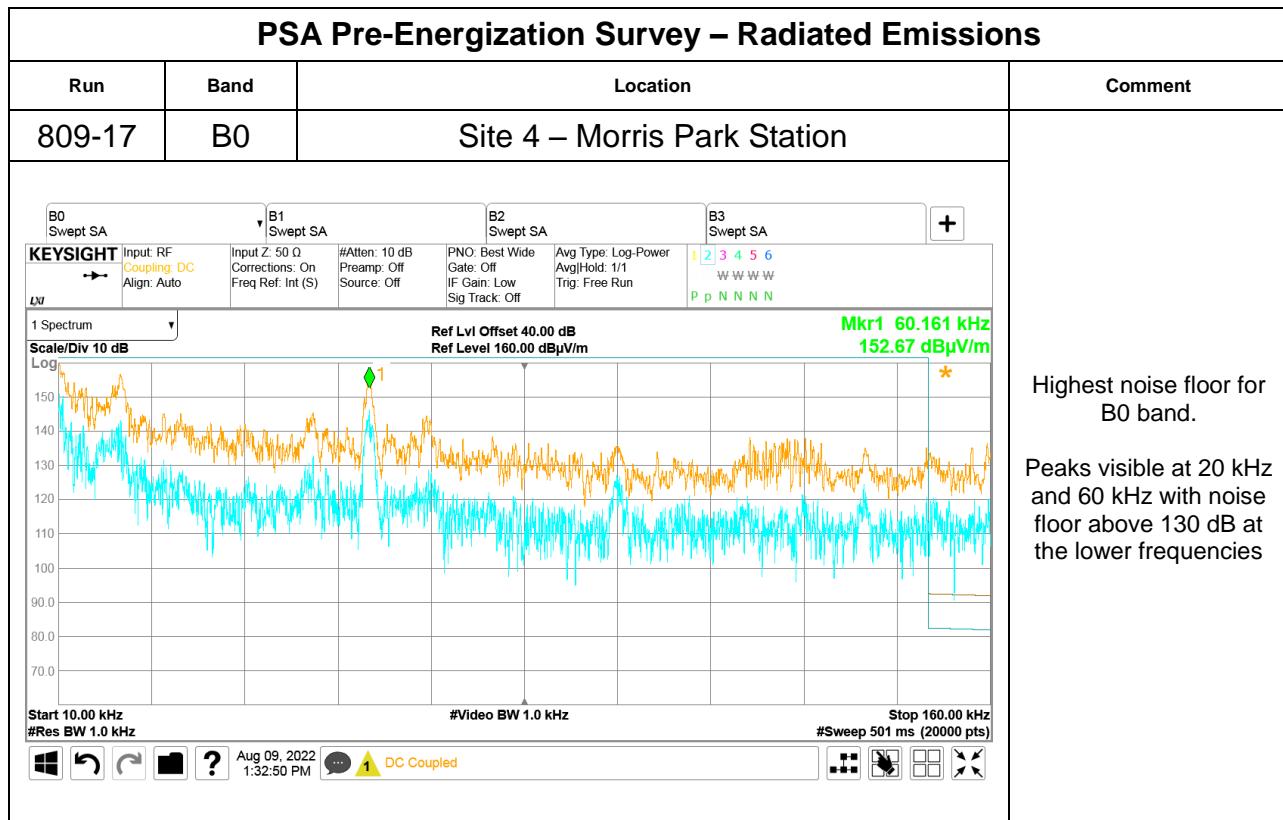
PSA Pre-Energization Survey – Radiated Emissions				
Run	Band	Location		Comment
809-13	B5v	Site 3 – Co-op City Station		
B4 Swept SA	B5 Swept SA	B6 Swept SA	B7 Swept SA	<p>KEYSIGHT Input: RF Coupling: AC Ext Gain: 1.00 dB Align: Auto</p> <p>Input Z: 50 Ω Corrections: On Freq Ref: Int (S)</p> <p>#Atten: 0 dB Preamp: Off Source: Off</p> <p>PNO: Fast Gate: Off IF Gain: High Sig Track: Off</p> <p>Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run</p> <p>1 2 3 4 5 6 W W W W P p N N N</p> <p>Mkr1 90.743 MHz 98.20 dBμV/m</p> <p>Start 25.0 MHz #Res BW 100 kHz Stop 325.0 MHz #Sweep 101 ms (20000 pts)</p> <p>Aug 09, 2022 10:45:37 AM</p>

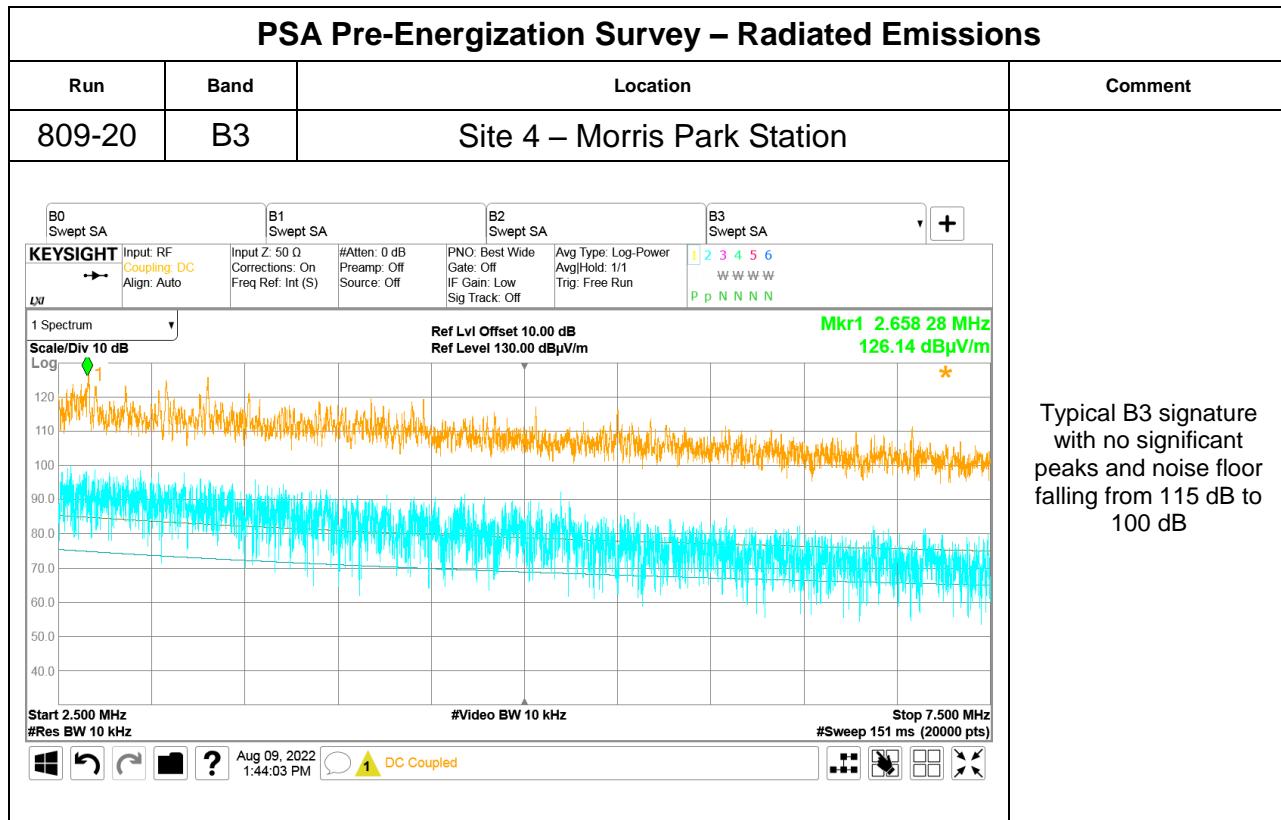
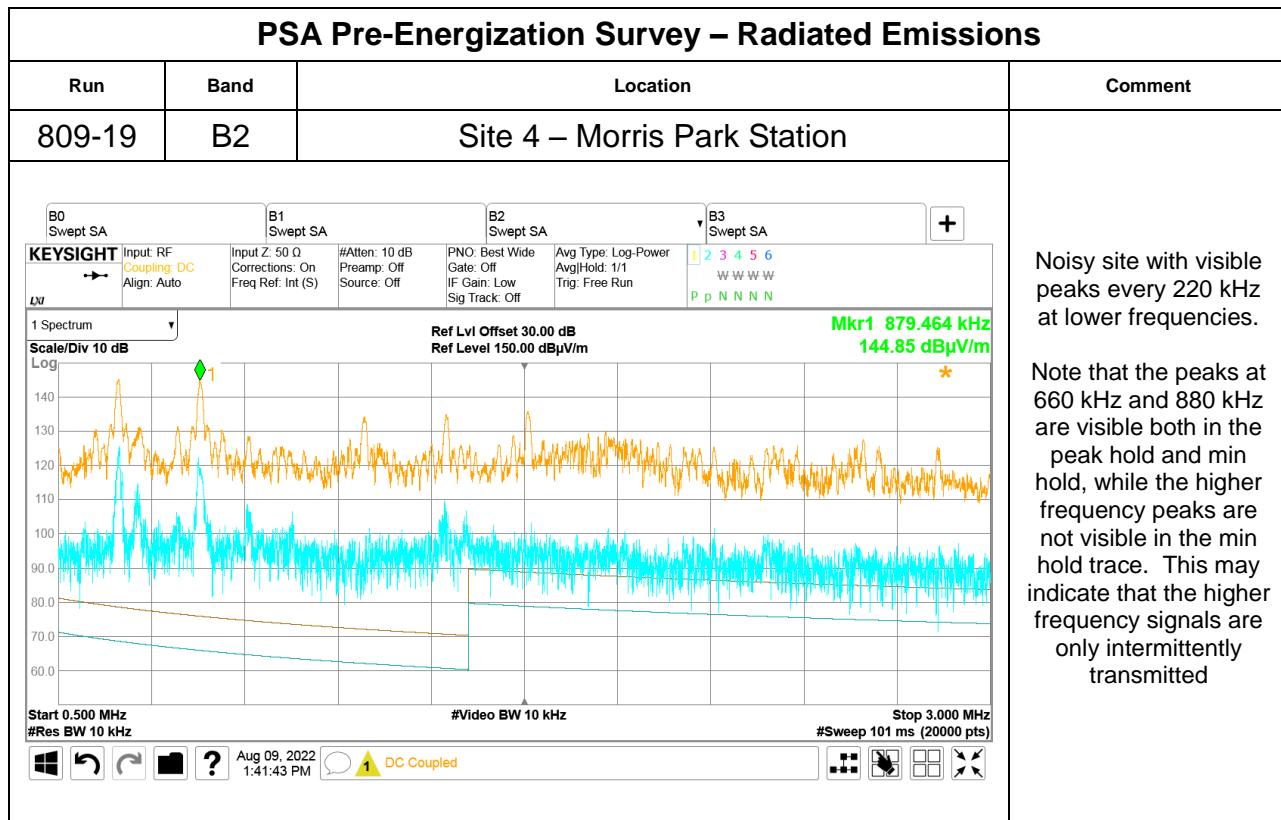
PSA Pre-Energization Survey – Radiated Emissions				
Run	Band	Location		Comment
809-14	B6v	Site 3 – Co-op City Station		
B4 Swept SA	B5 Swept SA	B6 Swept SA	B7 Swept SA	<p>KEYSIGHT Input: RF Coupling: AC Ext Gain: 1.00 dB Align: Auto</p> <p>Input Z: 50 Ω Corrections: On Freq Ref: Int (S)</p> <p>#Atten: 0 dB Preamp: Off Source: Off</p> <p>PNO: Fast Gate: Off IF Gain: High Sig Track: Off</p> <p>Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run</p> <p>1 2 3 4 5 6 W W W W P p N N N</p> <p>Mkr1 763.47 MHz 92.94 dBμV/m</p> <p>Start 0.3000 GHz #Res BW 300 kHz Stop 1.3000 GHz #Sweep ~101 ms (20000 pts)</p> <p>Aug 09, 2022 10:46:38 AM</p>

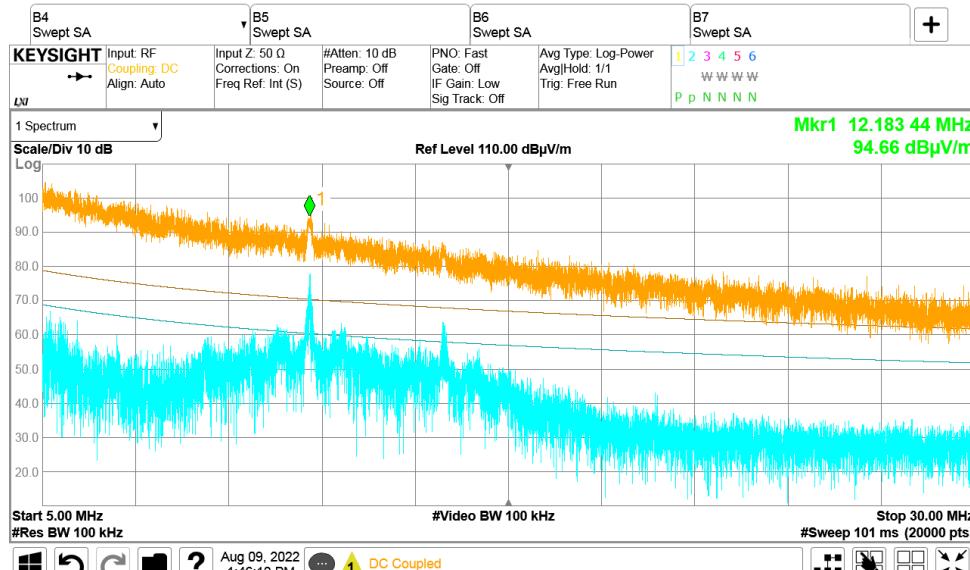
PSA Pre-Energization Survey – Radiated Emissions			
Run	Band	Location	Comment
809-15	B7v	Site 3 – Co-op City Station	
<p>B4 Swept SA B5 Swept SA B6 Swept SA B7 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: AC Ext Gain: 1.00 dB Freq Ref. Int (S) Align: Auto</p> <p>Input Z: 50 Ω Corrections: On Preampl: Off Source: Off</p> <p>#Atten: 0 dB PNO: Fast Gate: Off IF Gain: High Sig Track: Off</p> <p>Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run</p> <p>1 Spectrum</p> <p>Scale/Div 10 dB</p> <p>Ref Level 90.00 dBμV/m</p> <p>Mkr1 2.132 31 GHz 90.41 dBμV/m</p> <p>Start 1.000 GHz #Res BW 300 kHz Stop 6.000 GHz #Sweep ~151 ms (20000 pts)</p> <p>Aug 09, 2022 10:47:53 AM</p> <p>See B7h at this site</p>			

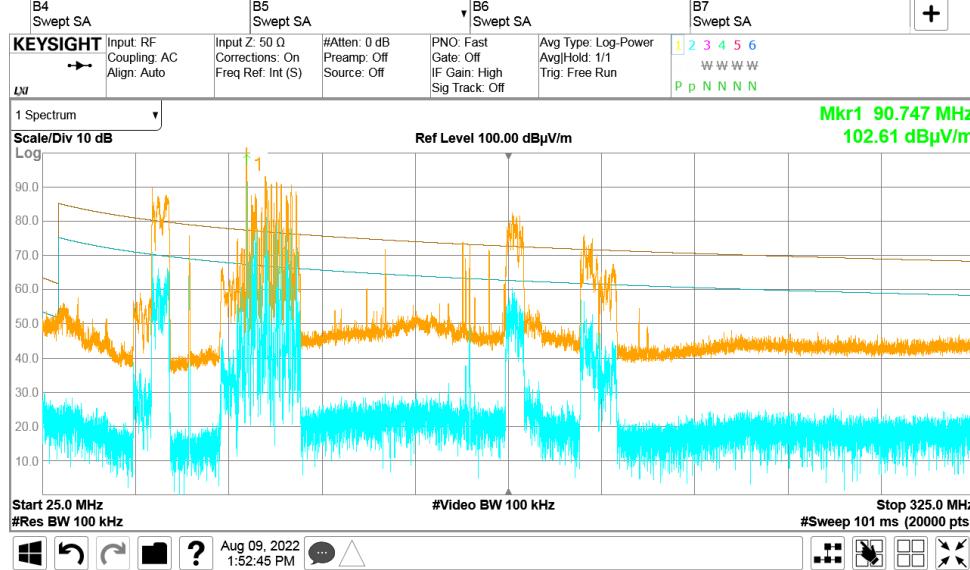
Site 4

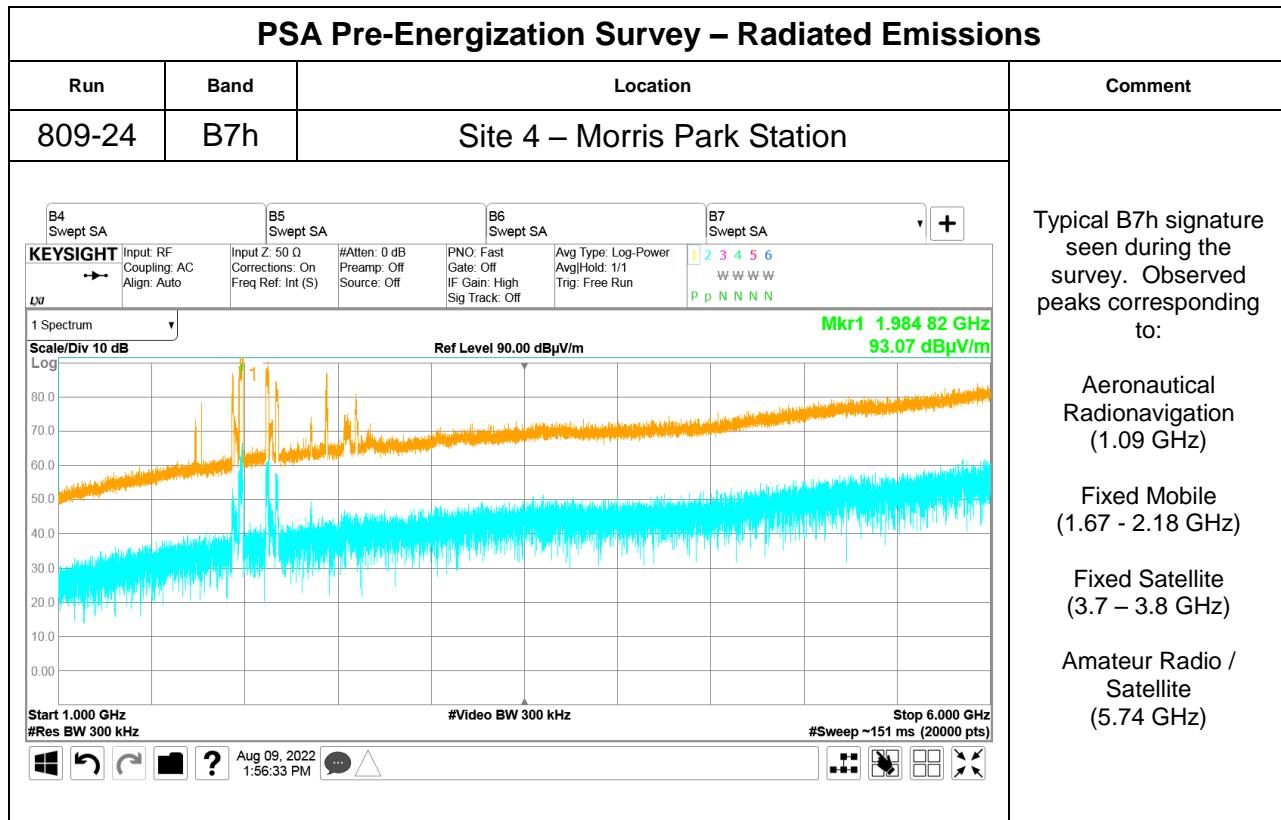
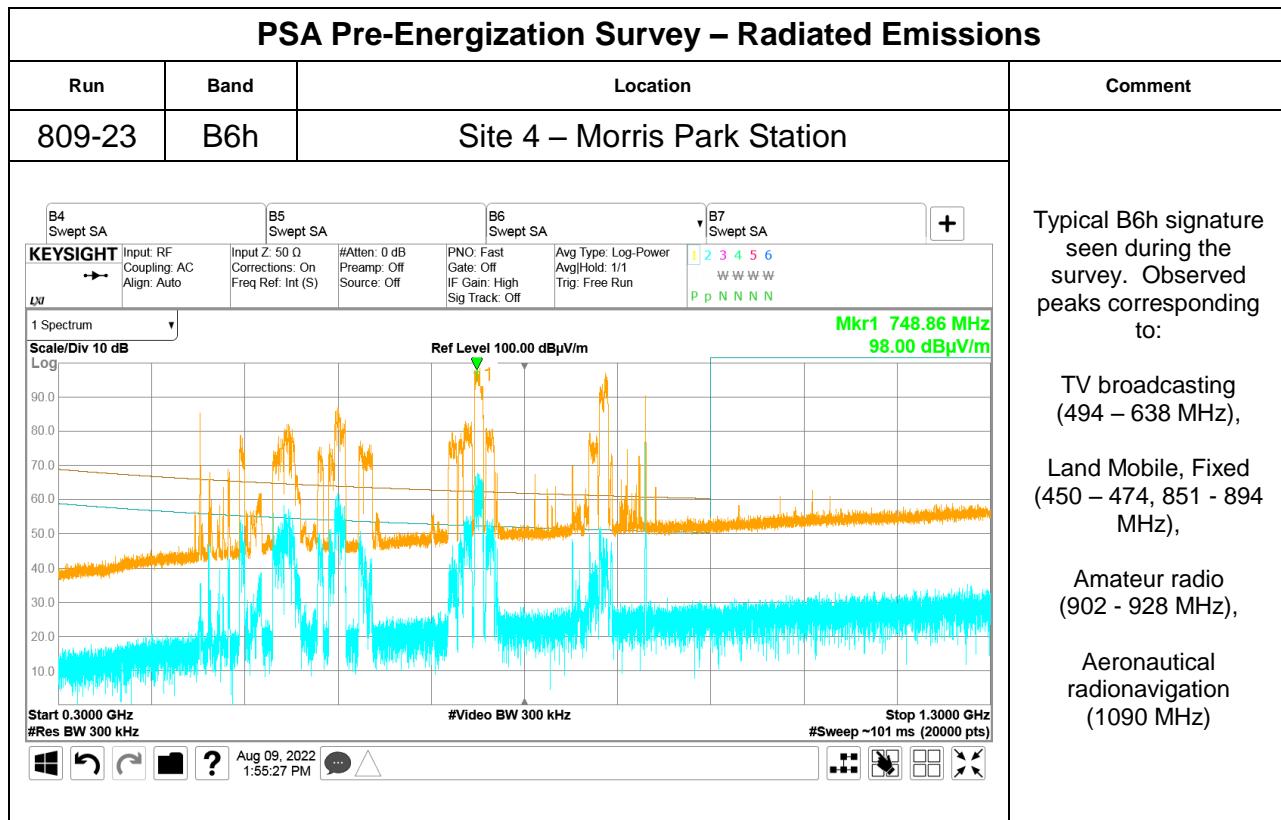
Morris Park Station

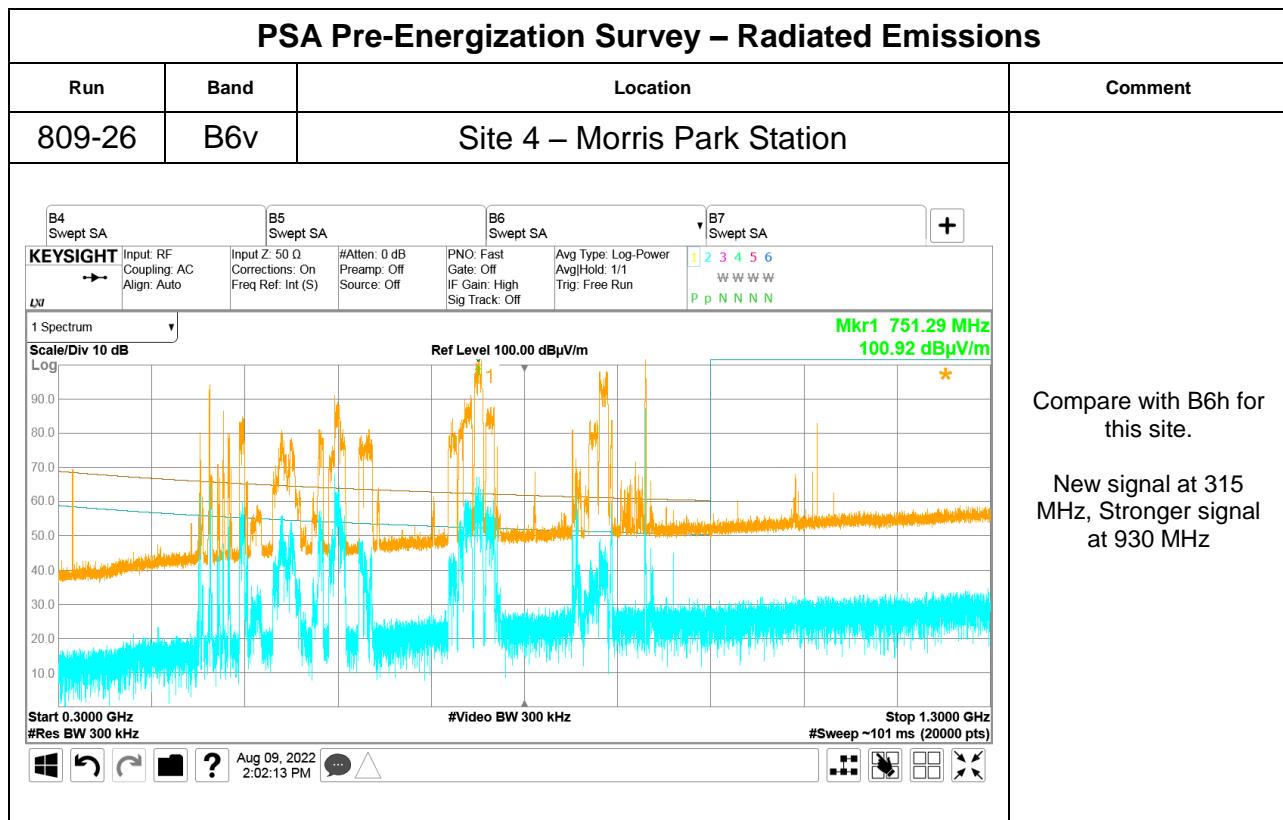
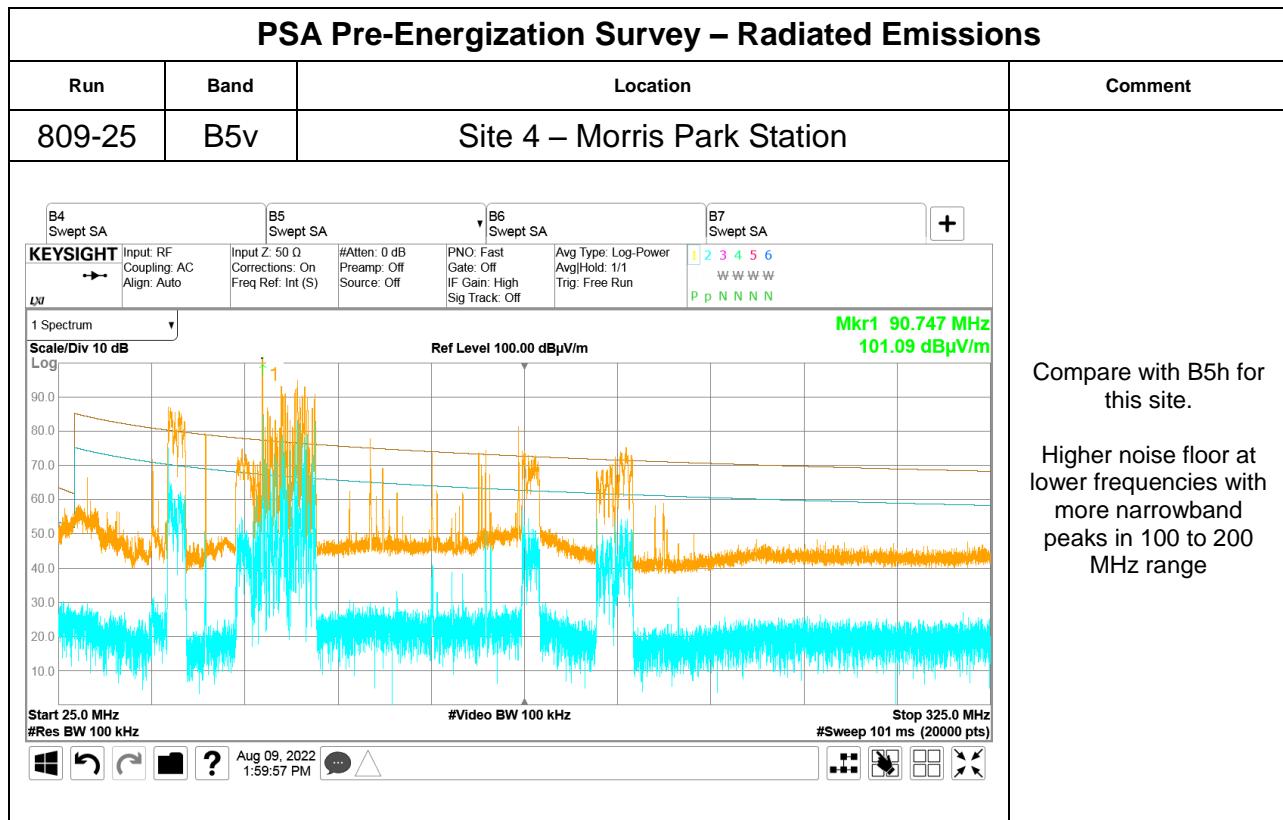




PSA Pre-Energization Survey – Radiated Emissions			
Run	Band	Location	Comment
809-21	B4	Site 4 – Morris Park Station	<p>Typical B4 signature with noise floor falling from 95 to 65 dB</p> <p>Visible peak at 12.15 MHz</p> 

PSA Pre-Energization Survey – Radiated Emissions			
Run	Band	Location	Comment
809-22	B5h	Site 4 – Morris Park Station	<p>Typical B5h signature seen during the survey. Observed peaks corresponding to:</p> <ul style="list-style-type: none"> TV broadcasting (54 - 66, 82 - 88, 174 - 186, 198 - 210 MHz), FM radio (88 - 108 MHz), Amateur radio (147 MHz), Aeronautical radionavigation (113 MHz) 

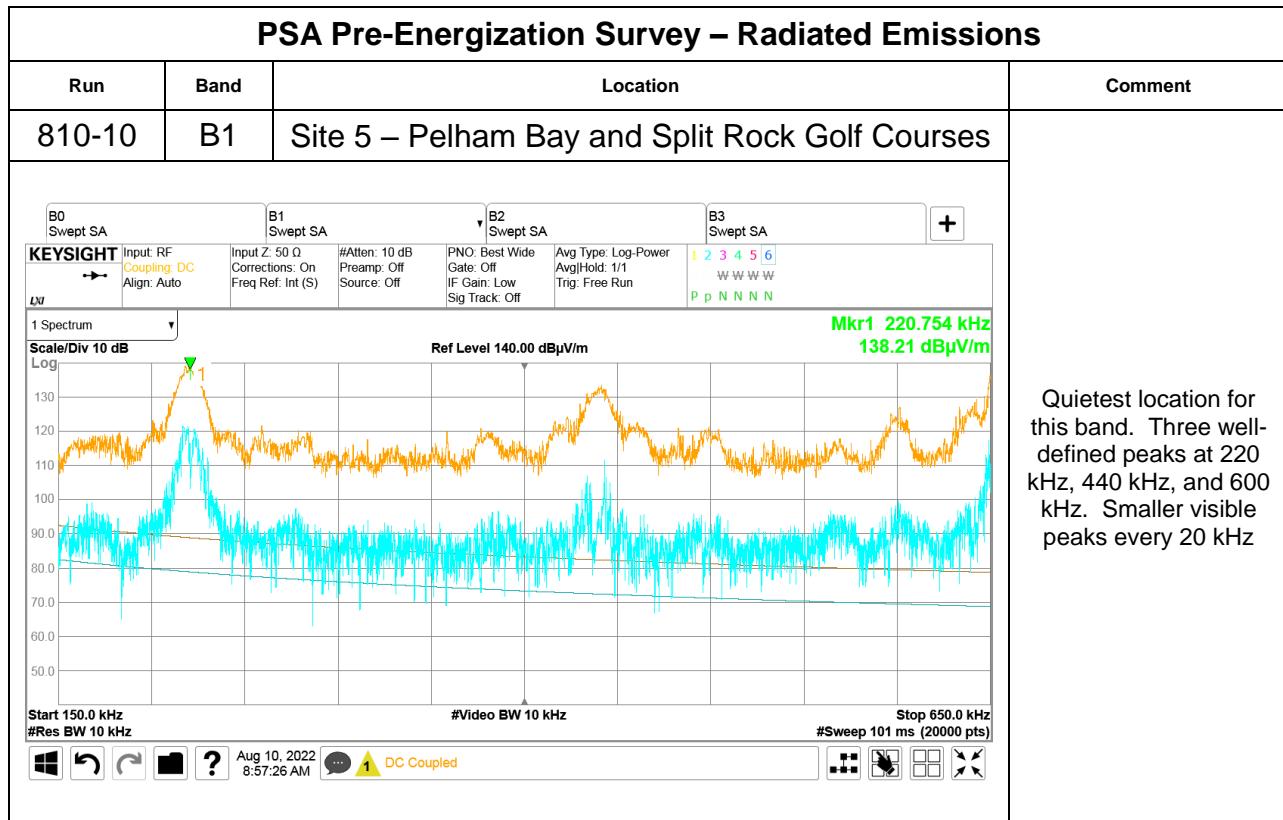
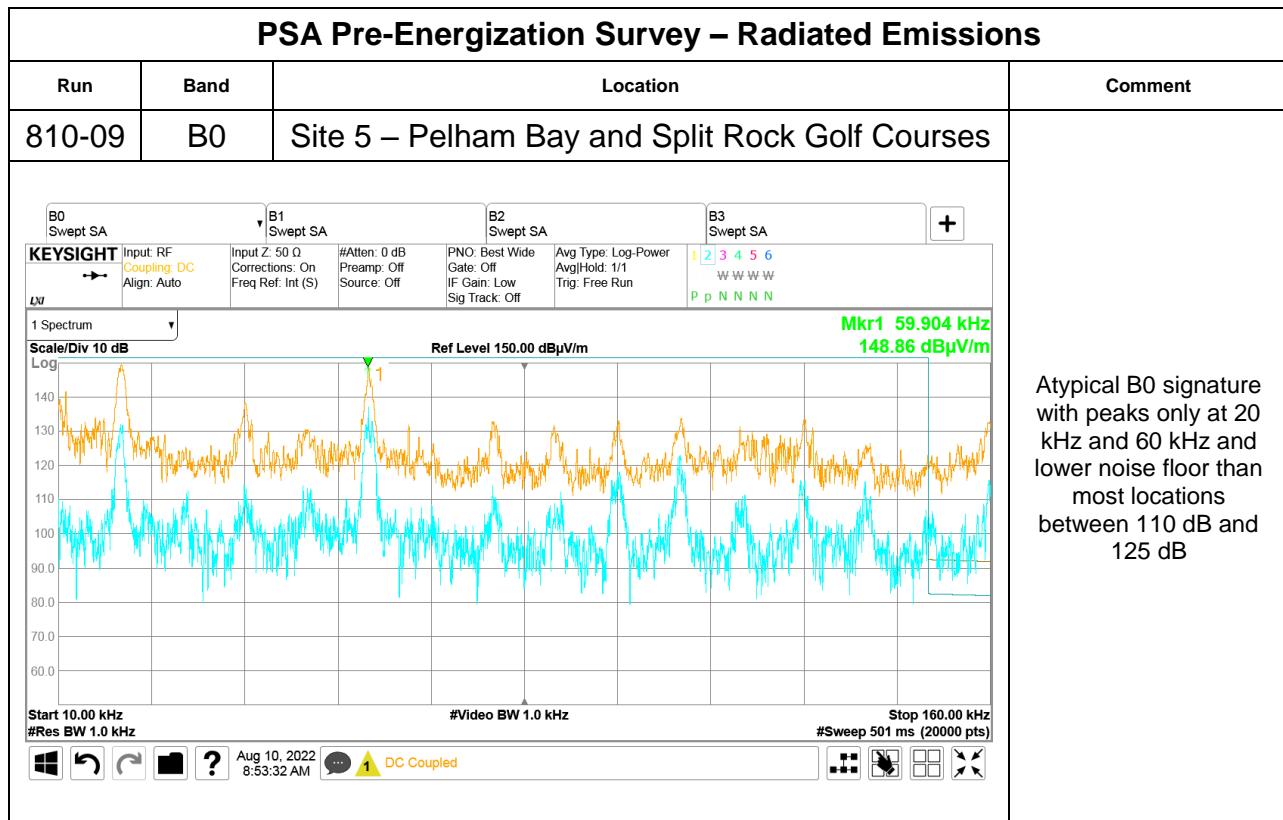


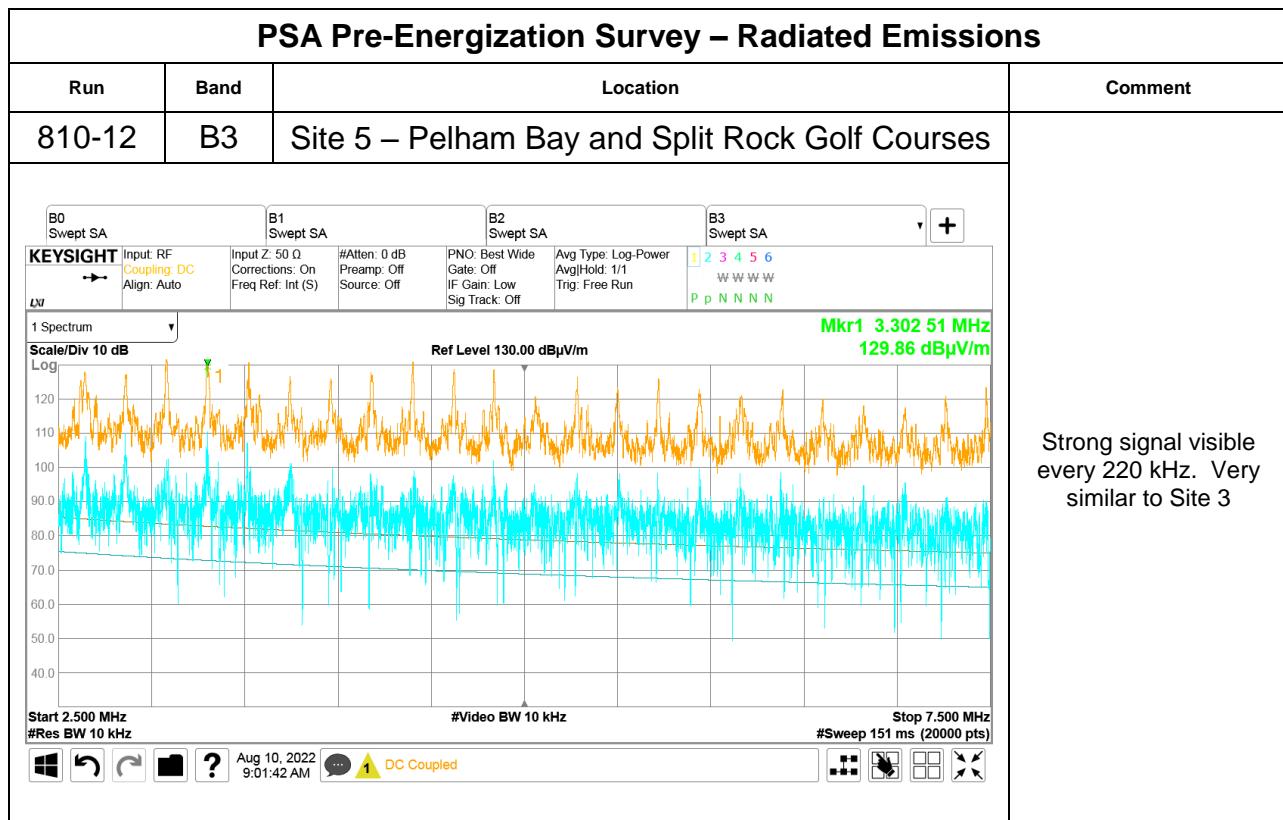
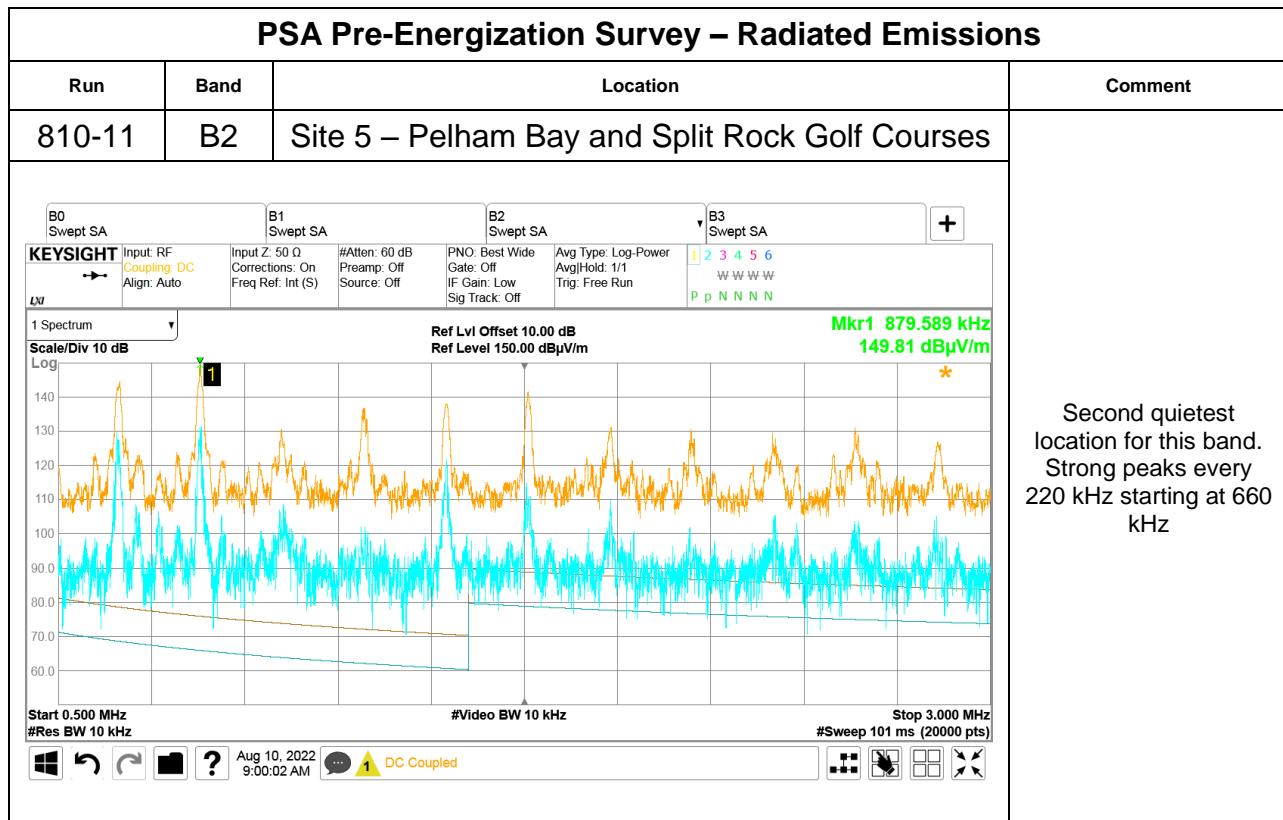


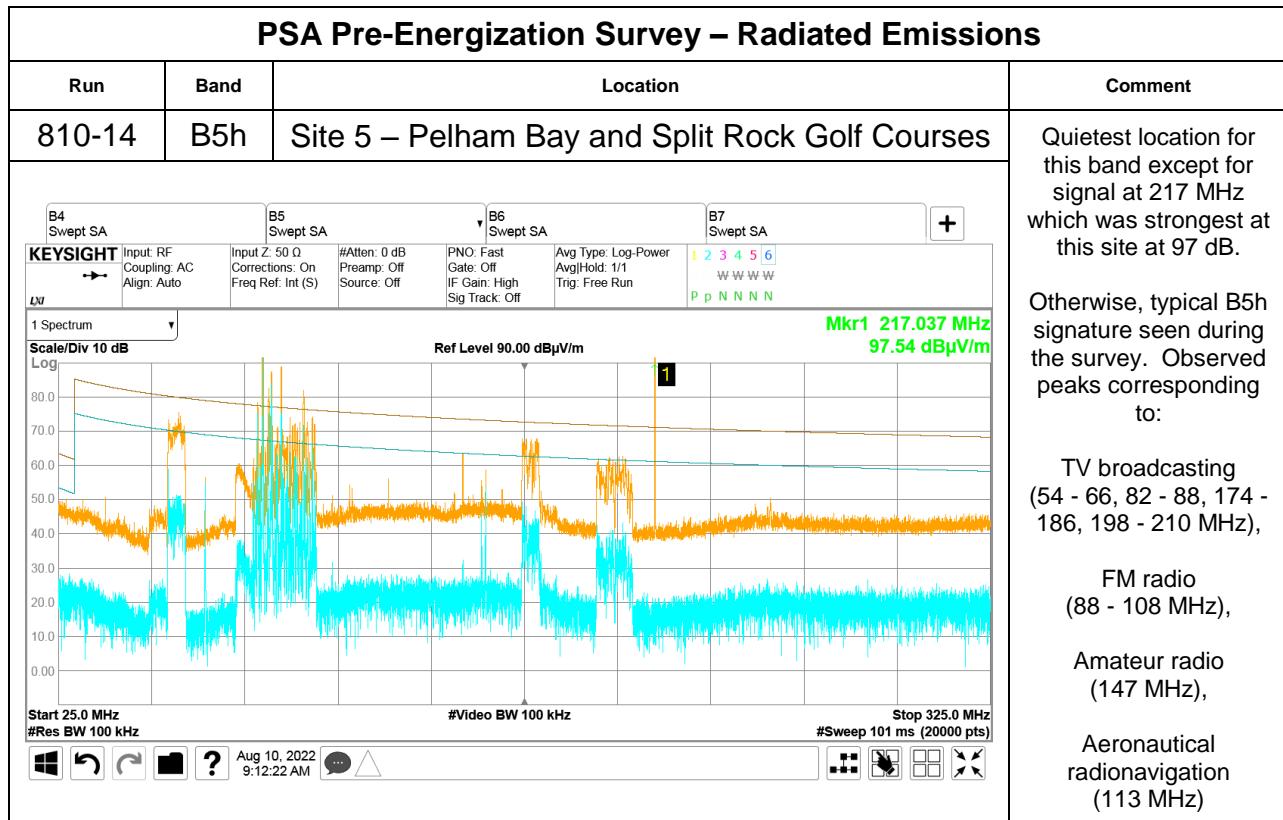
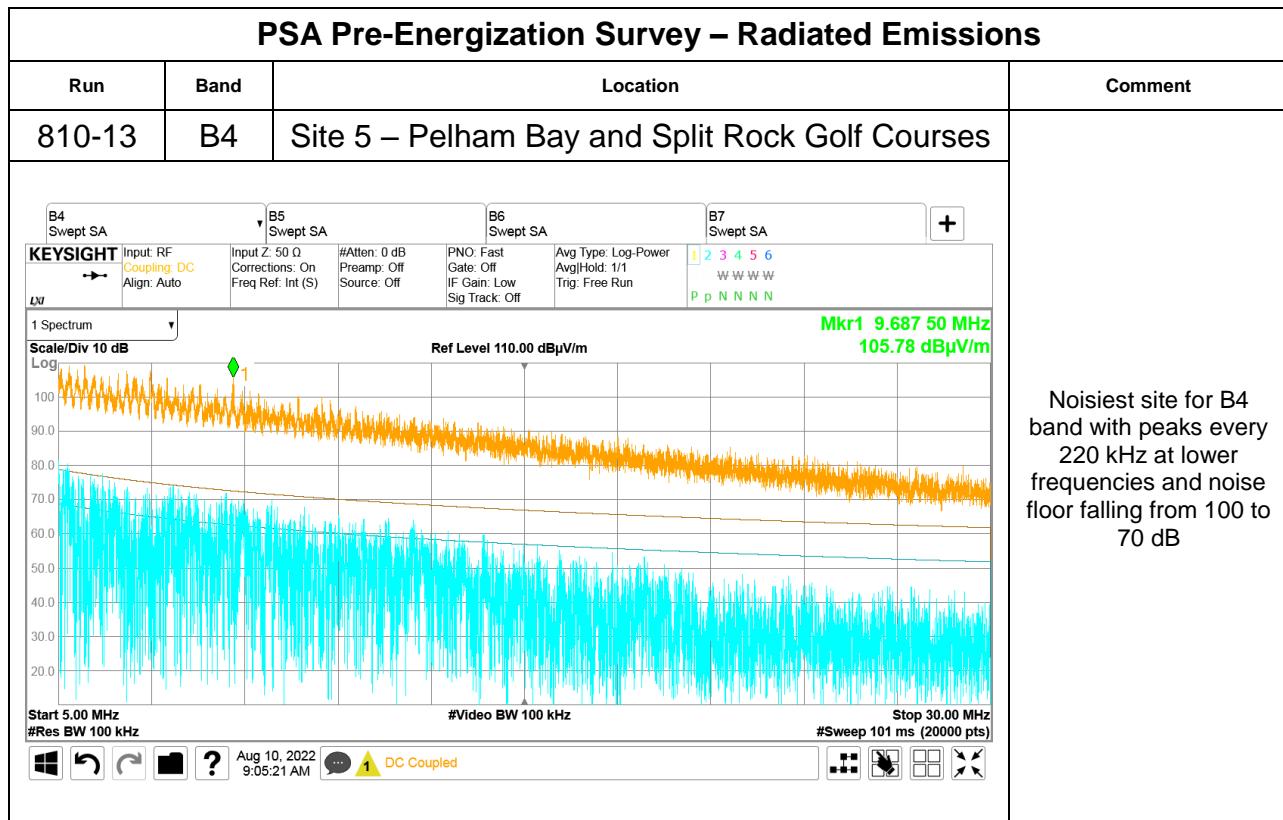
PSA Pre-Energization Survey – Radiated Emissions				
Run	Band	Location		Comment
809-27	B7v	Site 4 – Morris Park Station		
		<p>B4 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: AC Align: Auto</p> <p>B5 Swept SA</p> <p>Input Z: 50 Ω Corrections: On Freq Ref. Int (S)</p> <p>B6 Swept SA</p> <p>#Atten: 0 dB Preamp: Off Source: Off</p> <p>B7 Swept SA</p> <p>PNO: Fast Gate: Off IF Gain: High Sig Track: Off</p> <p>Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run</p> <p>1 Spectrum</p> <p>Scale/Div 10 dB</p> <p>Ref Level 100.00 dBμV/m</p> <p>Mkr1 2.401 95 GHz 97.14 dBμV/m</p> <p>Start 1.000 GHz #Res BW 300 kHz</p> <p>Stop 6.000 GHz #Sweep ~151 ms (20000 pts)</p> <p>Aug 09, 2022 2:03:37 PM</p>	See B7h at this site	

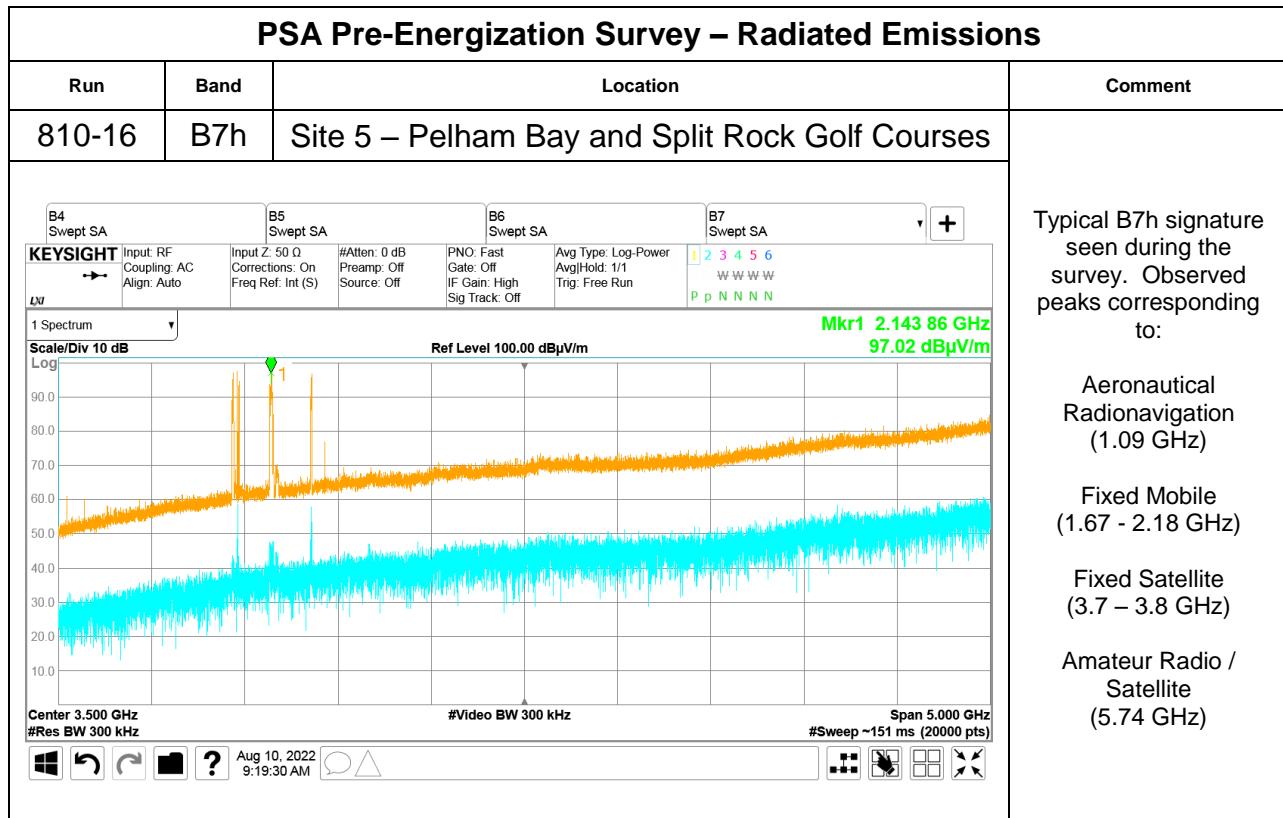
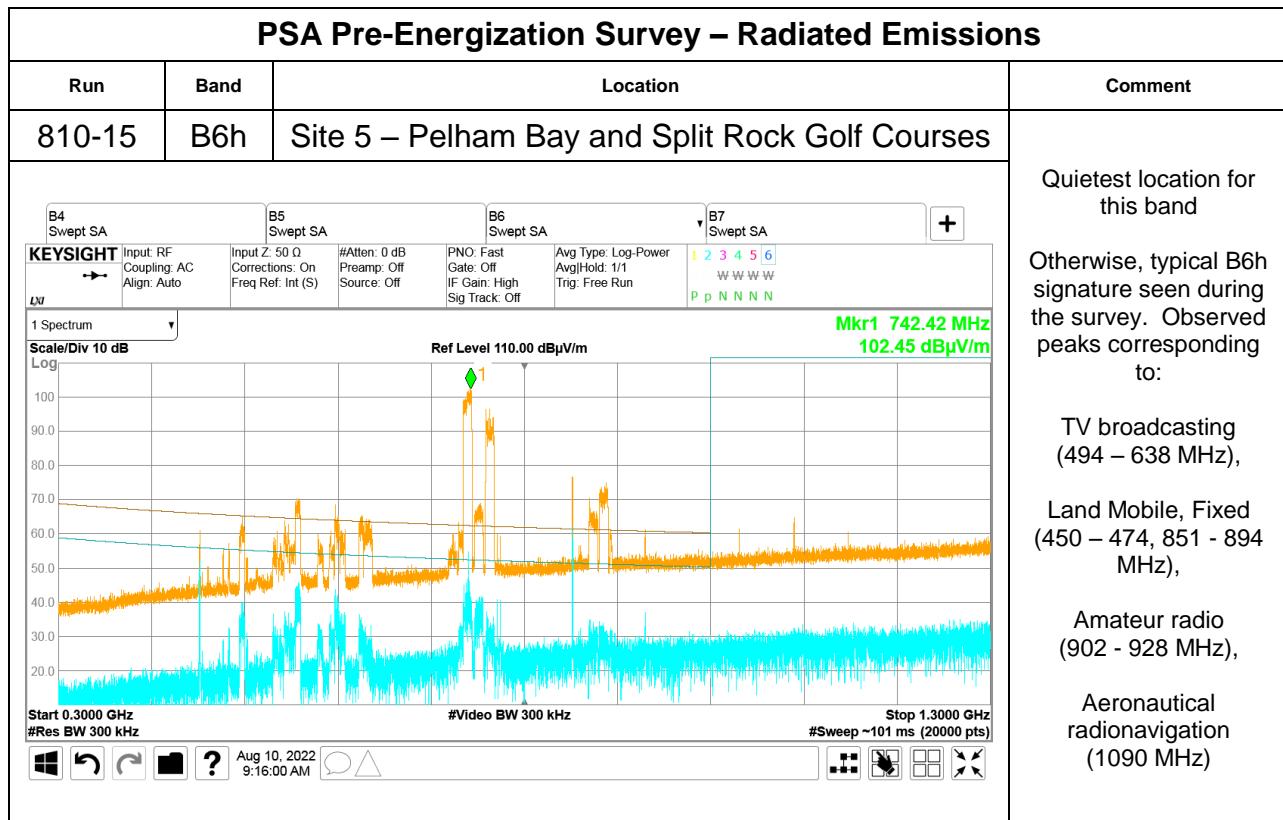
Site 5

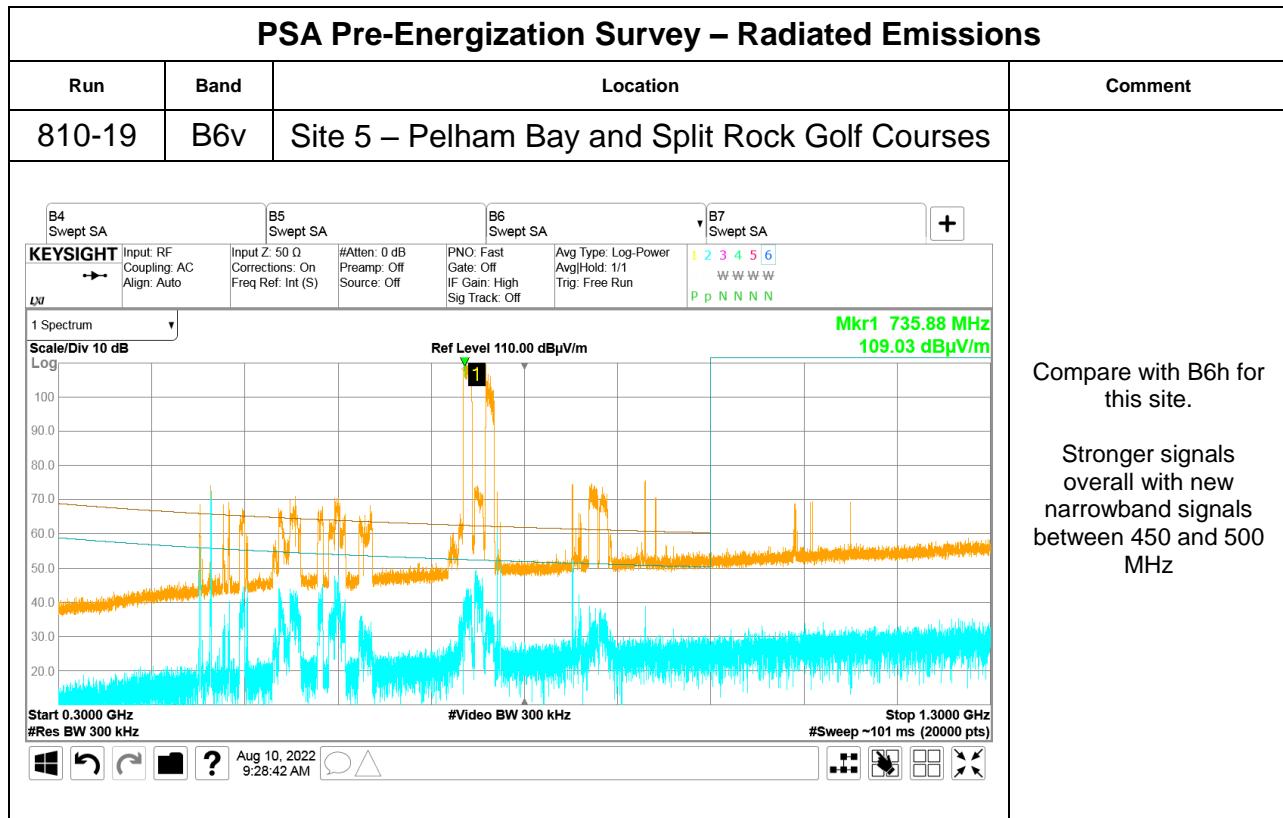
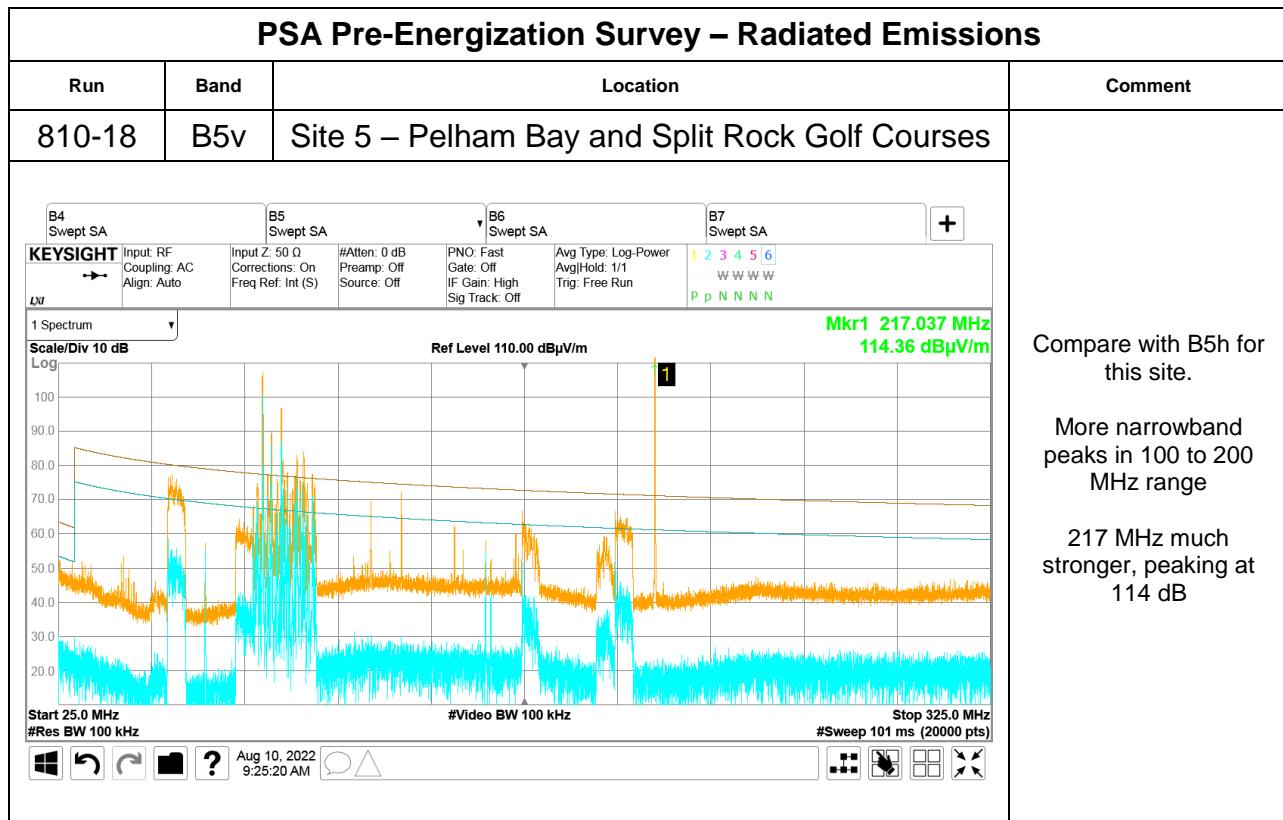
Pelham Bay and Split Rock Golf Courses







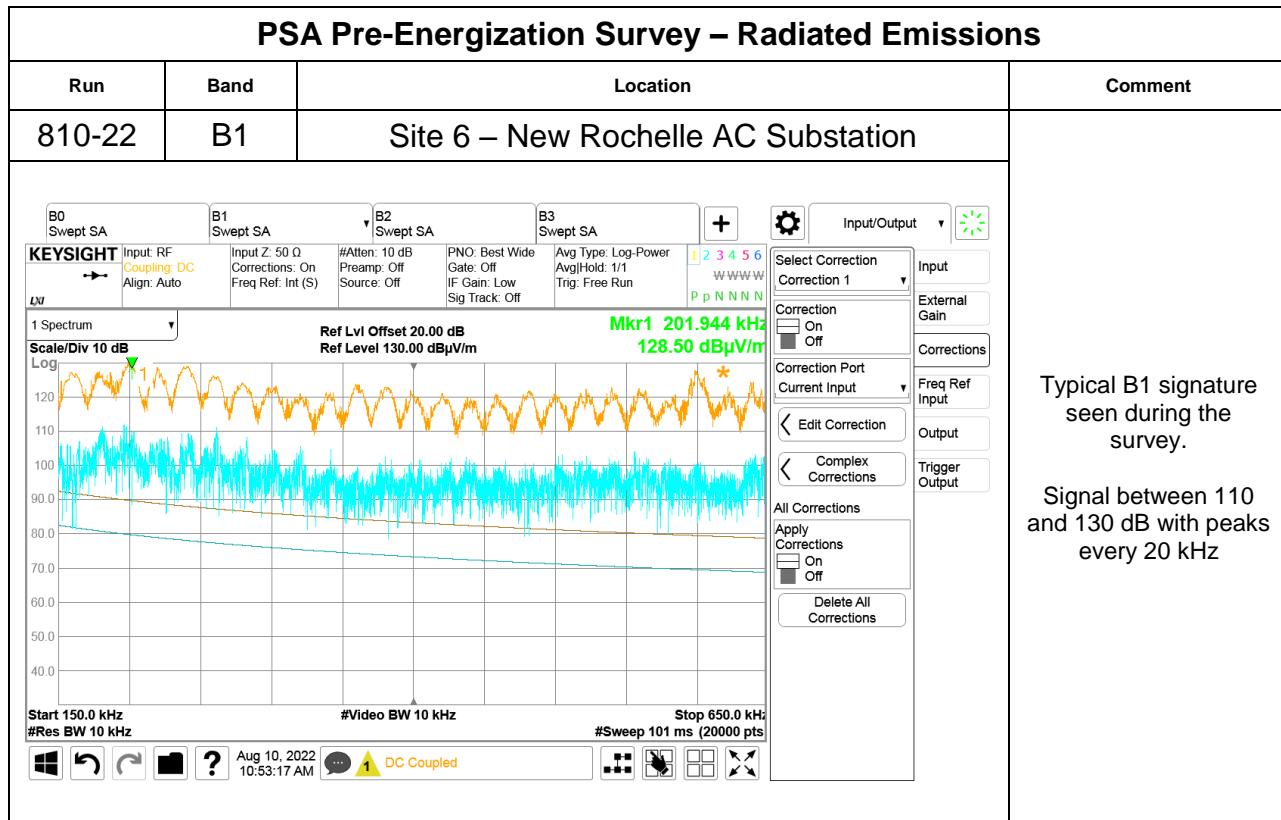
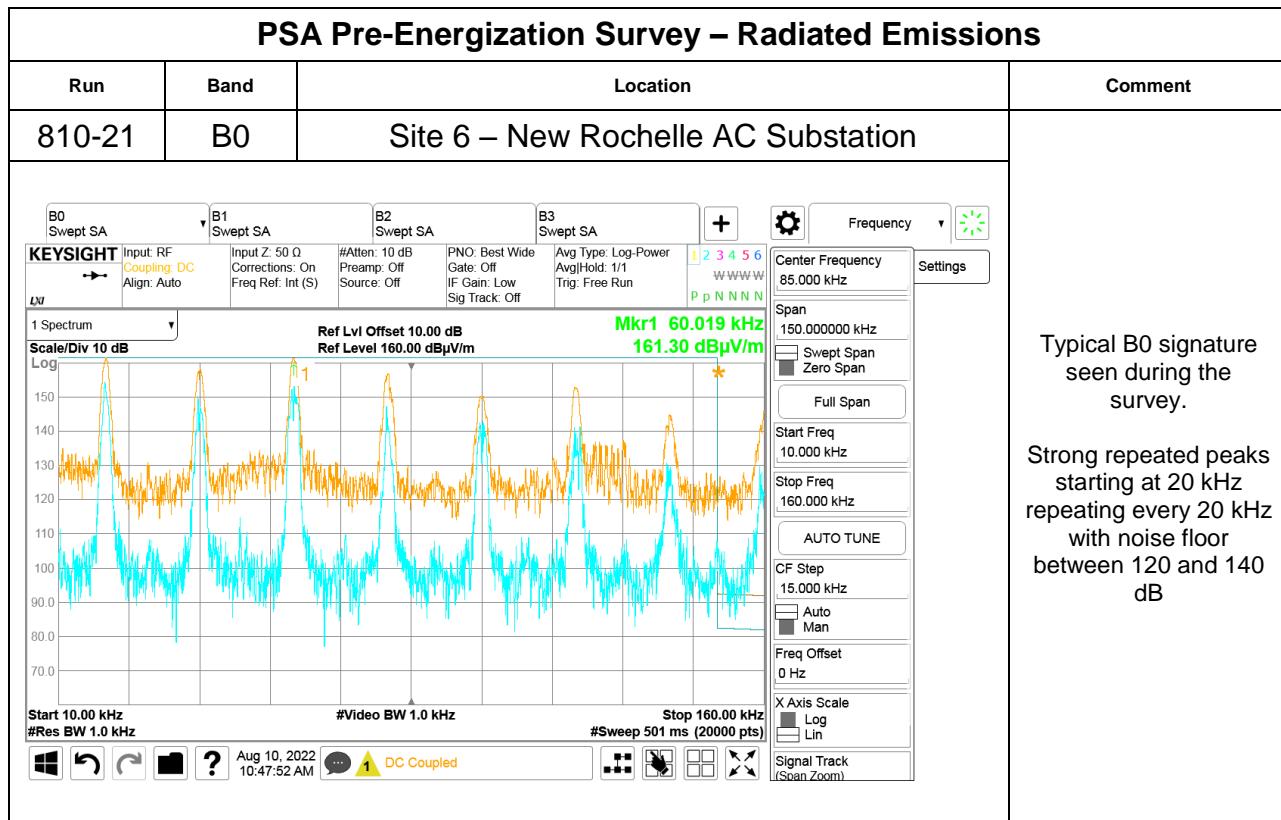


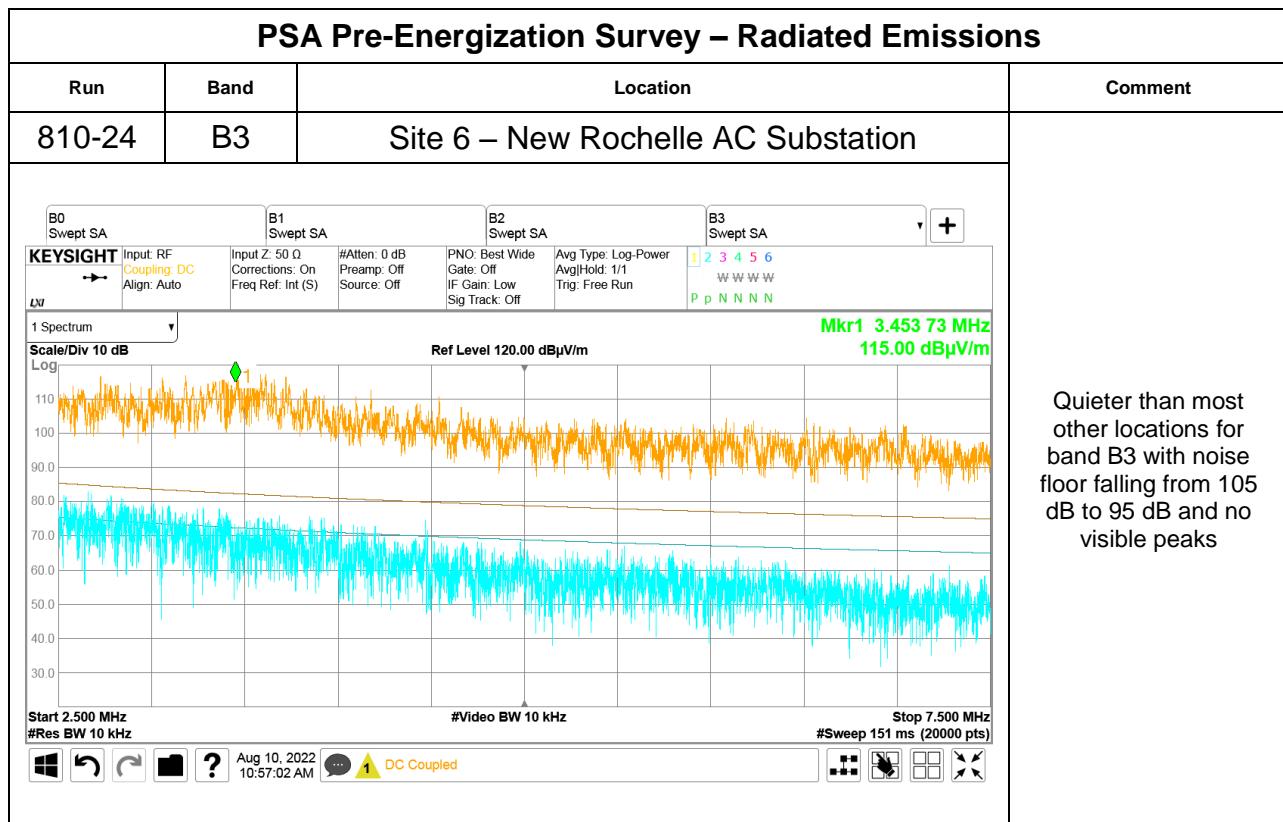
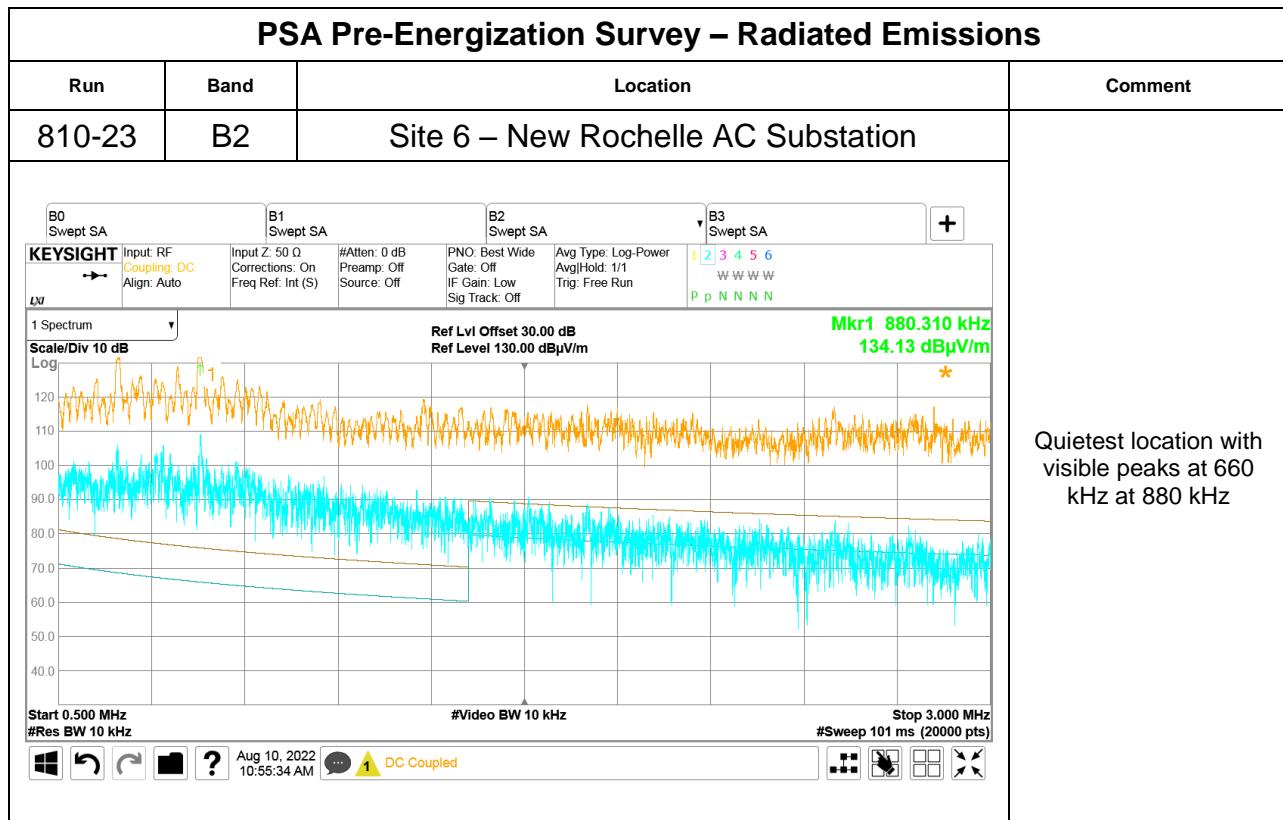


PSA Pre-Energization Survey – Radiated Emissions			
Run	Band	Location	Comment
810-20	B7v	Site 5 – Pelham Bay and Split Rock Golf Courses	
<p>Compare with B7v for this site.</p> <p>Similar with new peak at 5.74 GHz</p>			

Site 6

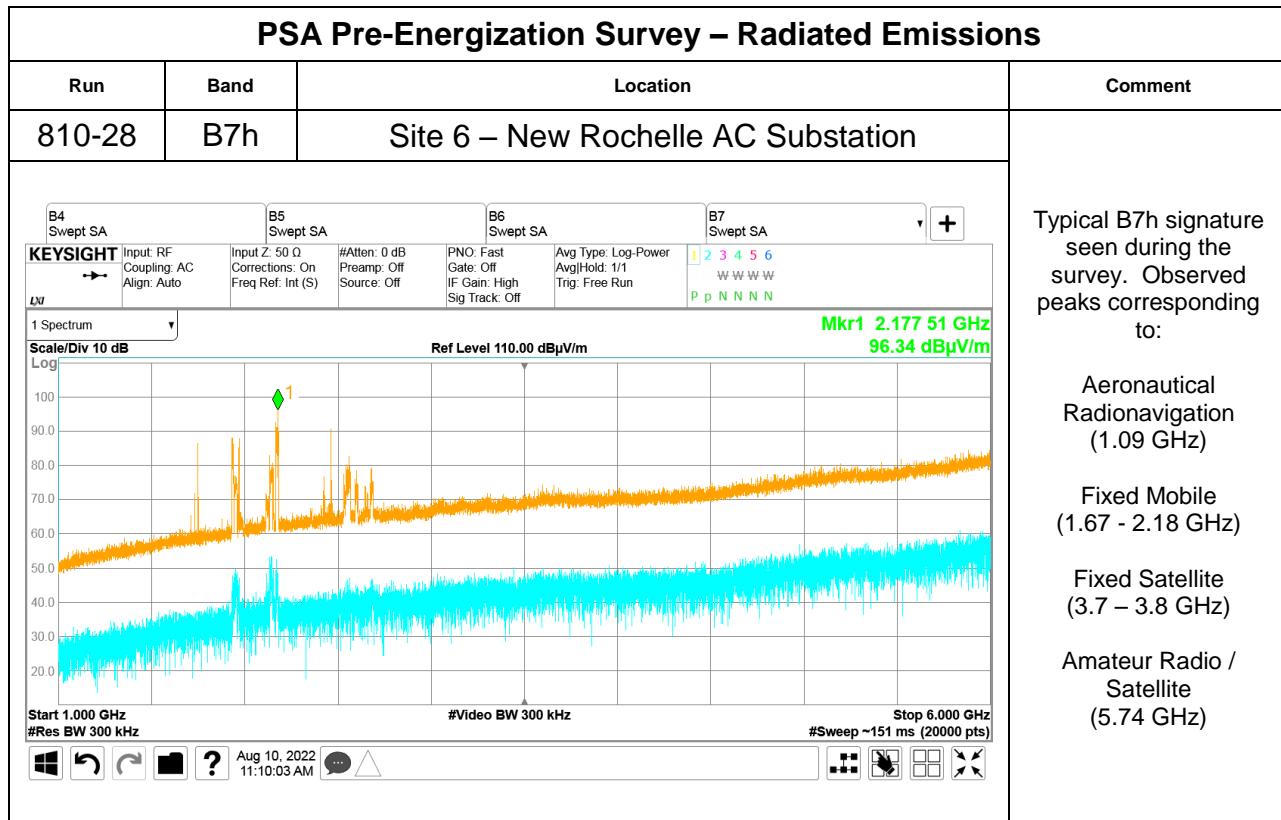
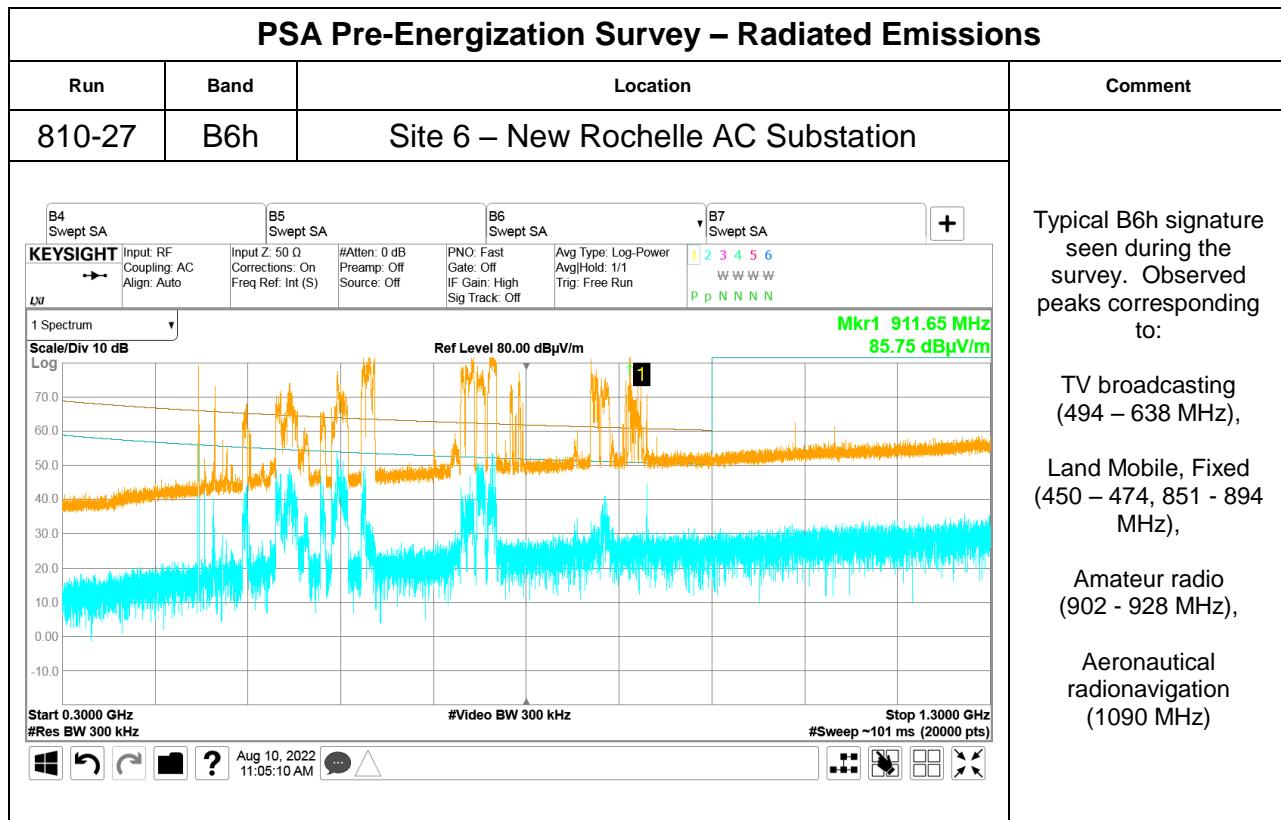
New Rochelle AC Substation

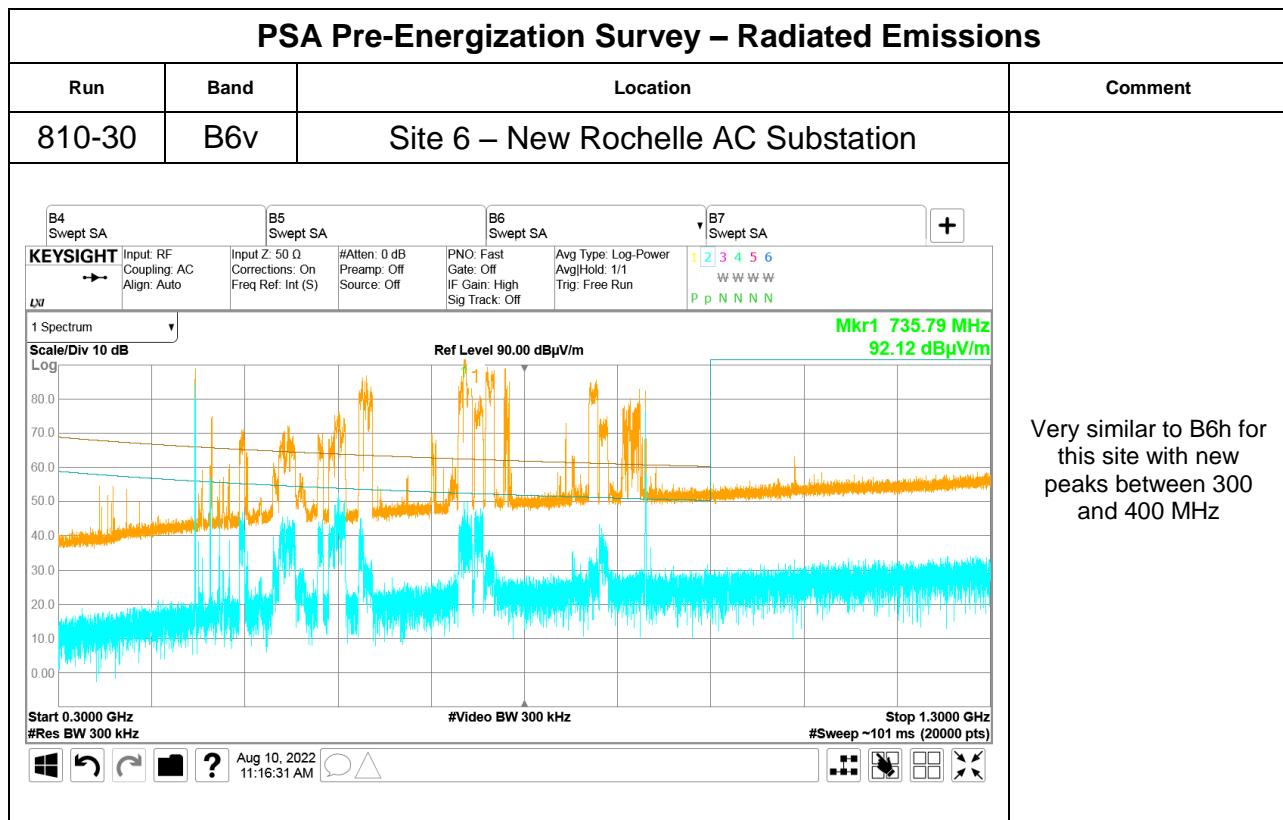
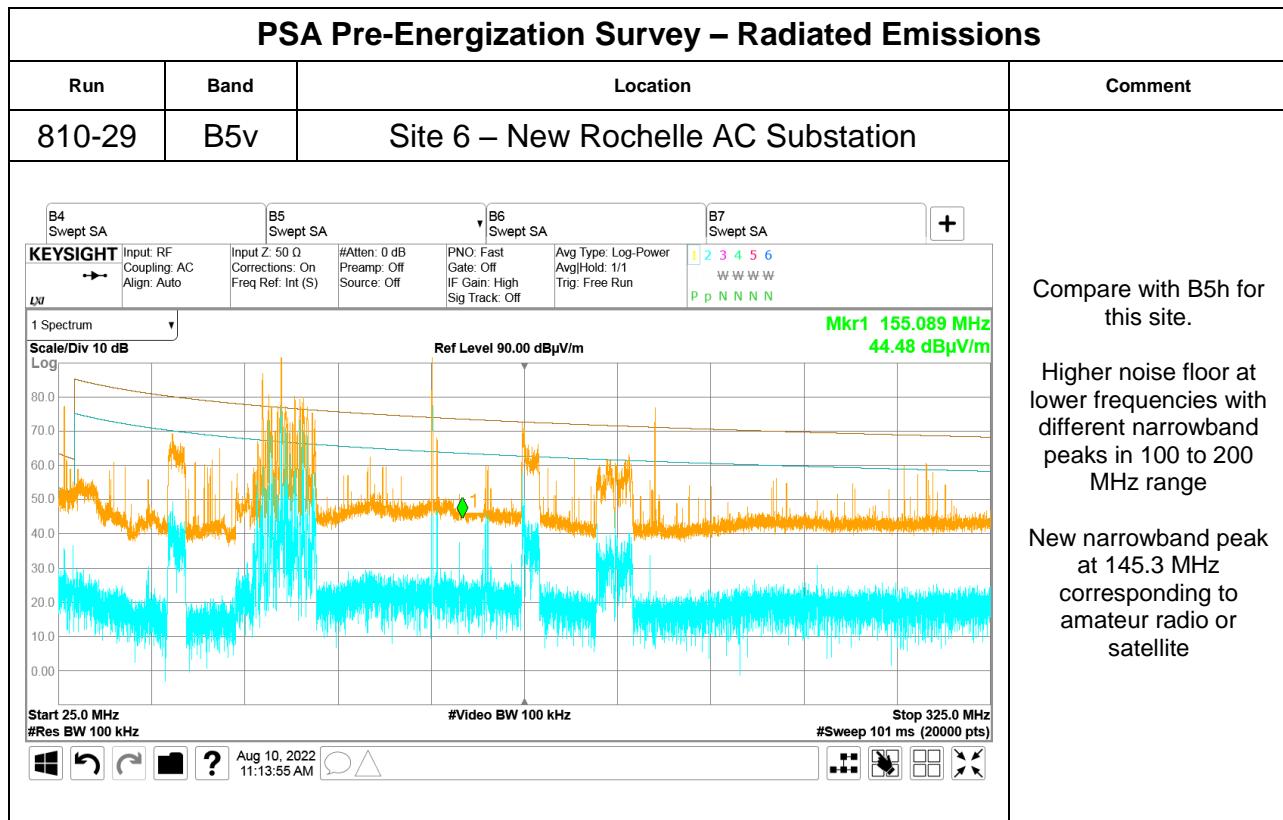




PSA Pre-Energization Survey – Radiated Emissions					
Run	Band	Location			Comment
810-25	B4	Site 6 – New Rochelle AC Substation			
		<p>B4 Swept SA B5 Swept SA B6 Swept SA B7 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: DC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref: Int (S) #Atten: 10 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: Low Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run</p> <p>Mkr1 15.754 87 MHz 78.48 dBμV/m</p> <p>Start 5.00 MHz #Res BW 100 kHz Stop 30.00 MHz #Sweep 101 ms (20000 pts)</p> <p>Aug 10, 2022 10:59:00 AM DC Coupled</p>		<p>Second quietest site for band B4 with significant peak at 15.8 MHz. Noise floor drops from 90 dB to 50 dB</p>	

PSA Pre-Energization Survey – Radiated Emissions					
Run	Band	Location			Comment
810-26	B5h	Site 6 – New Rochelle AC Substation			
		<p>B4 Swept SA B5 Swept SA B6 Swept SA B7 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: AC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref: Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: High Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run</p> <p>Mkr1 155.089 MHz 85.24 dBμV/m</p> <p>Start 25.0 MHz #Res BW 100 kHz Stop 325.0 MHz #Sweep 101 ms (20000 pts)</p> <p>Aug 10, 2022 11:02:34 AM</p>	<p>Weaker signal strength than most other sites.</p> <p>Otherwise, typical B5h signature seen during the survey. Observed peaks corresponding to:</p> <ul style="list-style-type: none"> TV broadcasting (54 - 66, 82 - 88, 174 - 186, 198 - 210 MHz), FM radio (88 - 108 MHz), Amateur radio (147 MHz), Aeronautical radionavigation (113 MHz) 		

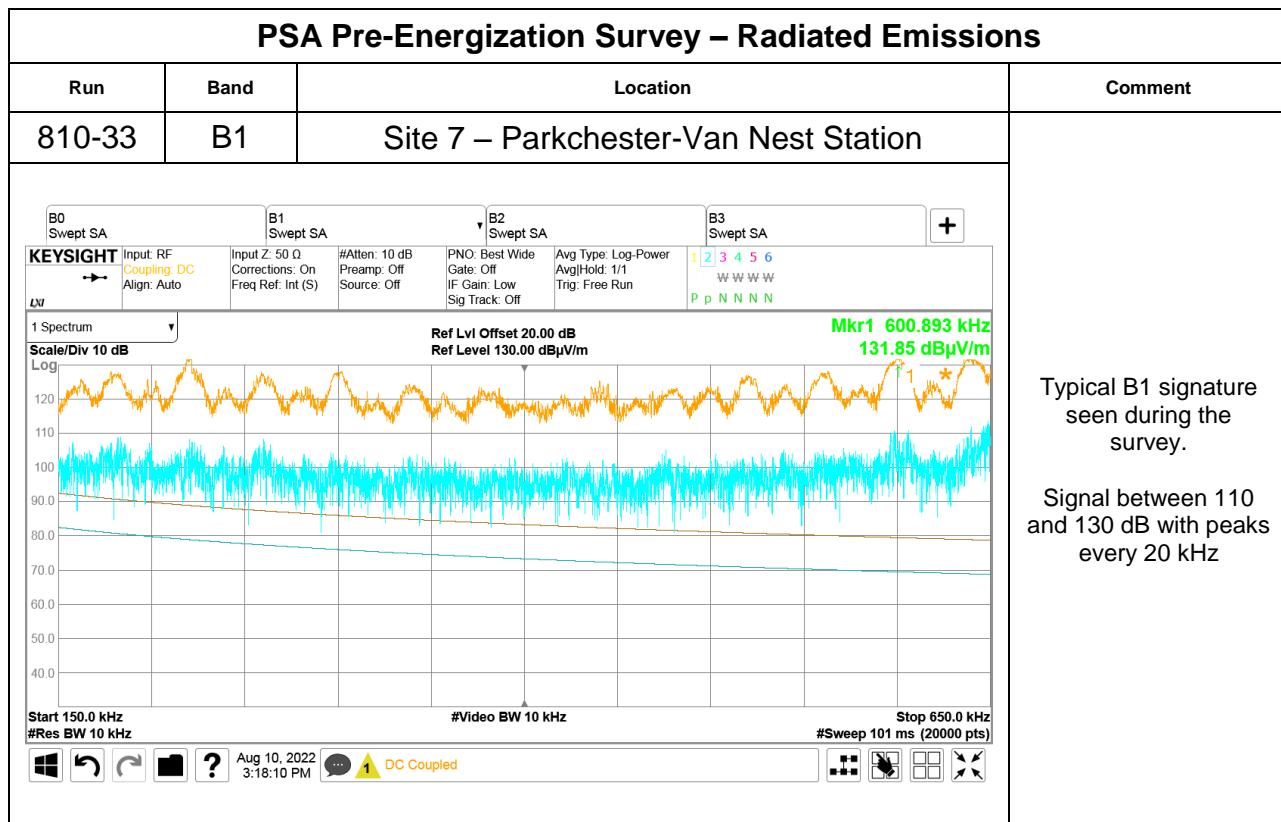
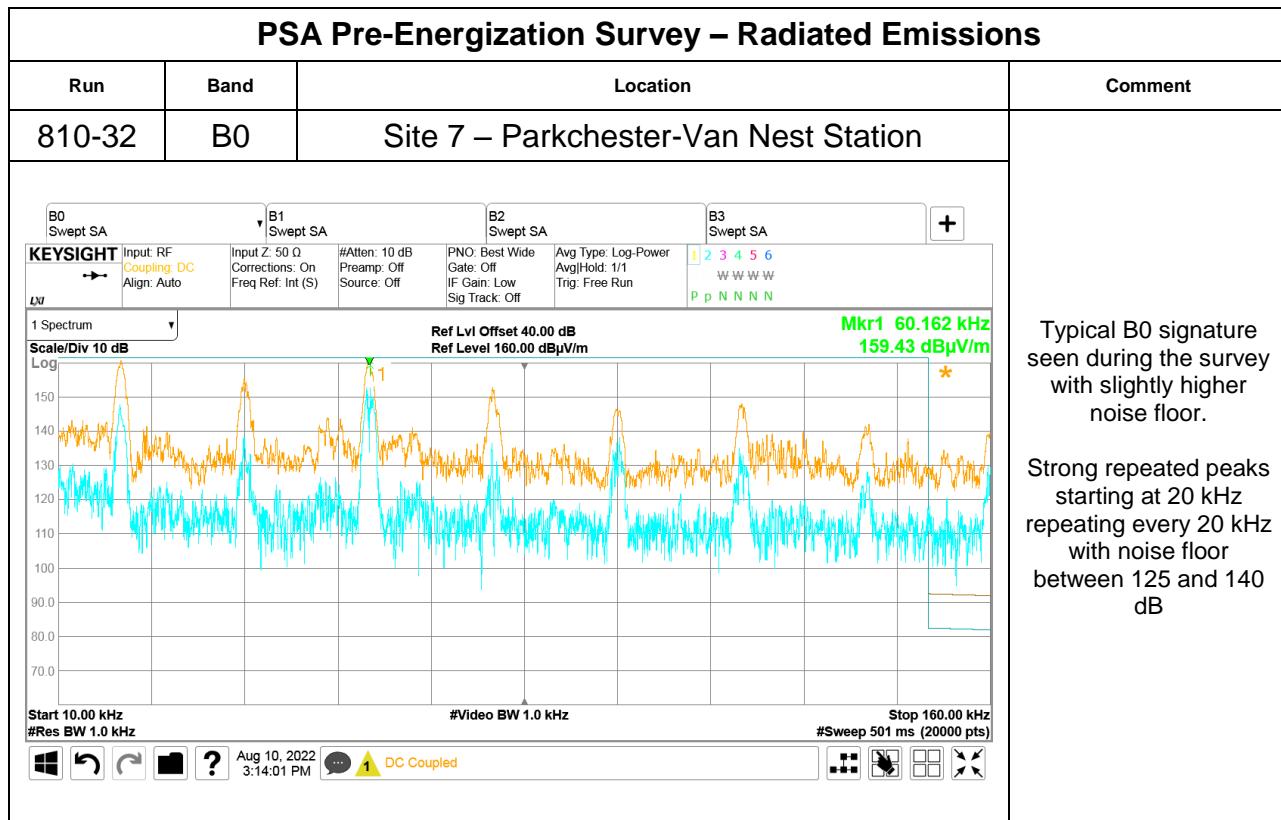


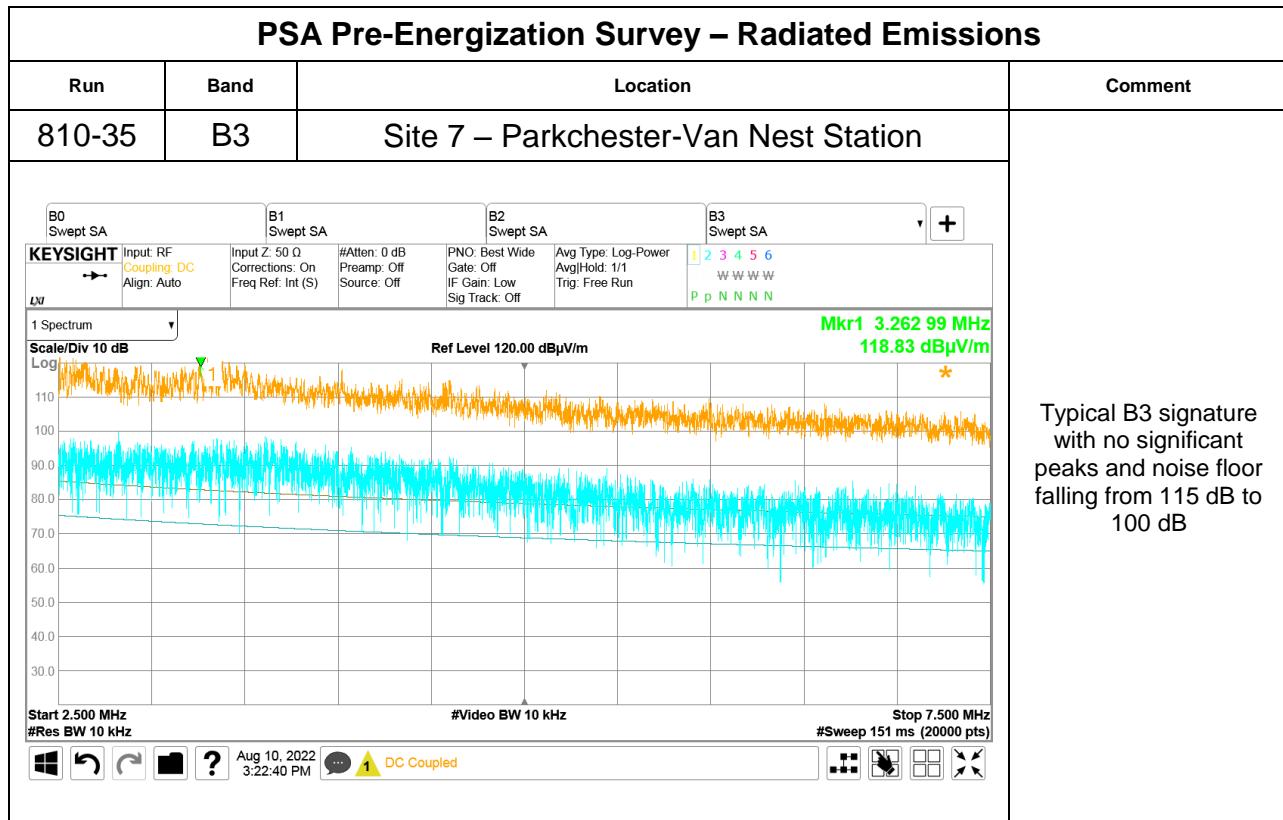
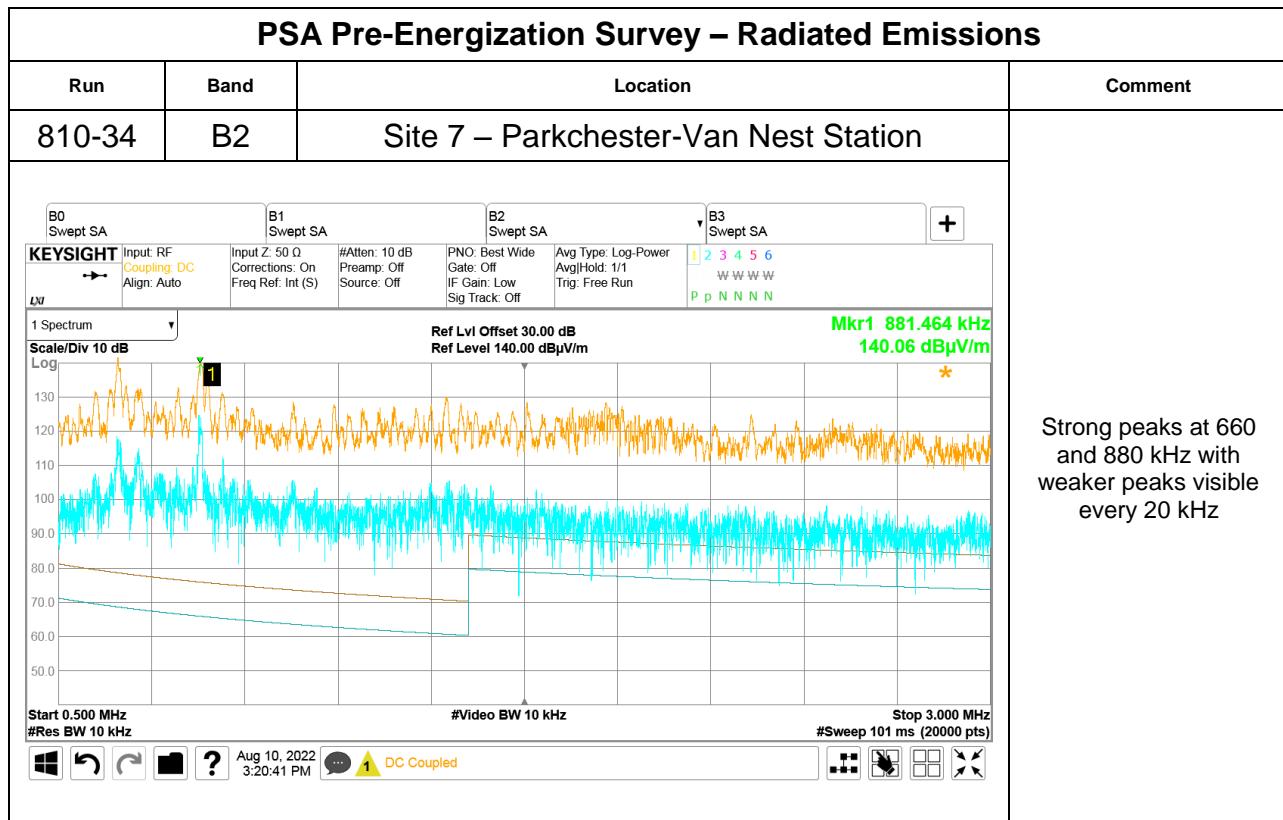


PSA Pre-Energization Survey – Radiated Emissions				
Run	Band	Location		Comment
810-31	B7v	Site 6 – New Rochelle AC Substation		
		<p>B4 Swept SA B5 Swept SA B6 Swept SA B7 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: AC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref. Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: High Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run Sig Track: Off</p> <p>Mkr1 2.177 51 GHz 92.04 dBμV/m</p> <p>1 Spectrum Scale/Div 10 dB Ref Level 110.00 dBμV/m</p>	<p>Compare with B7v for this site.</p> <p>Stronger signals.</p>	

Site 7

Parkchester-Van Nest Station



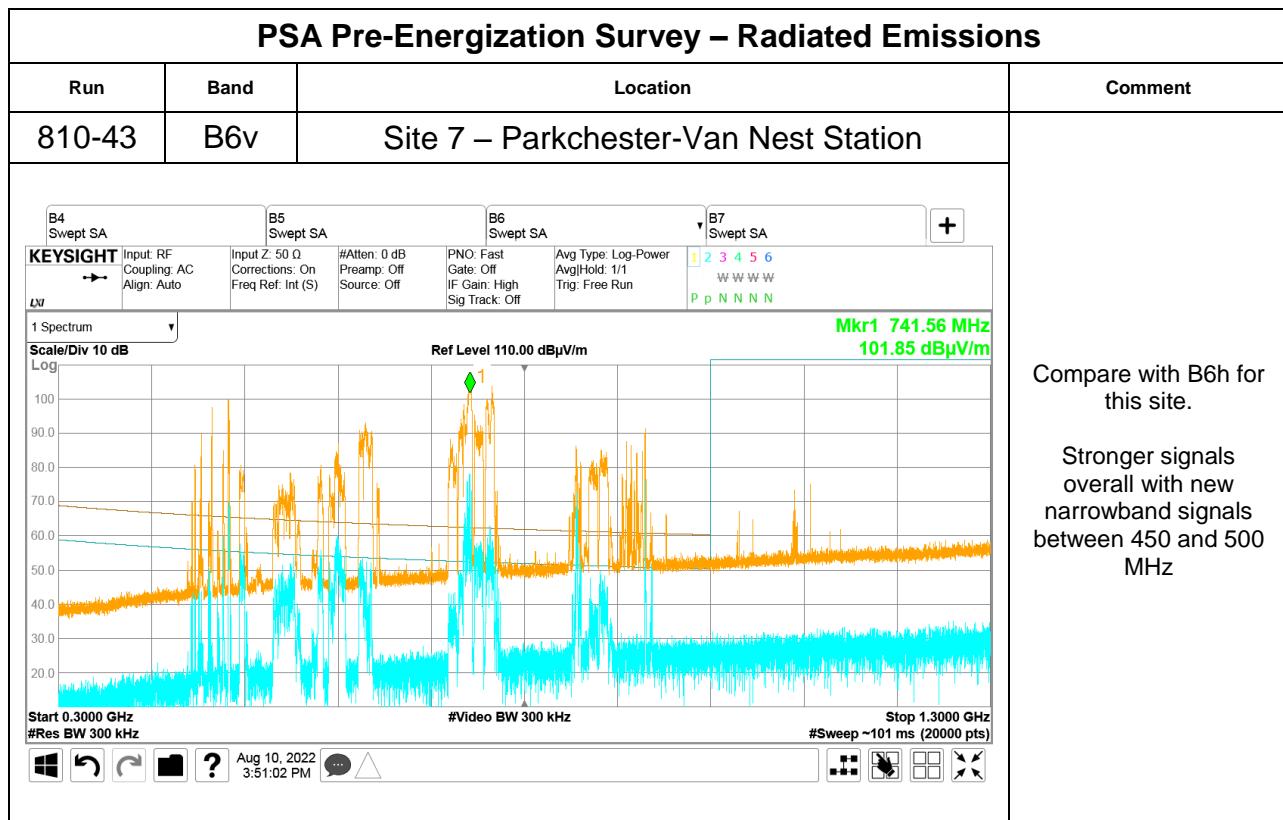
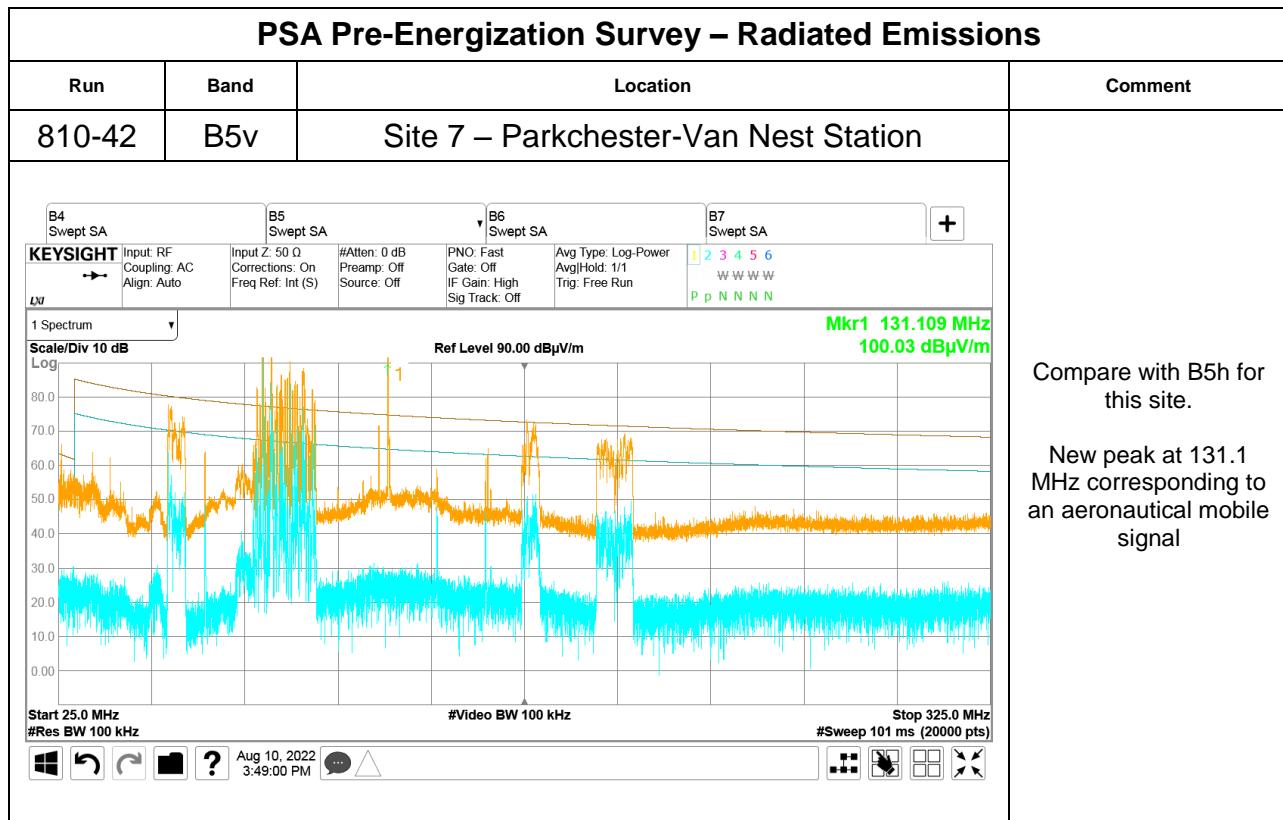


PSA Pre-Energization Survey – Radiated Emissions					
Run	Band	Location			Comment
810-36	B4	Site 7 – Parkchester-Van Nest Station			
		<p>B4 Swept SA B5 Swept SA B6 Swept SA B7 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: DC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref: Int (S) #Atten: 10 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: Low Sig Track: Off Avg Type: Log-Power 1 2 3 4 5 6 LNJ Ref Level 110.00 dBµV/m AvgHold: 1/1 Trig: Free Run P p N N N N</p> <p>1 Spectrum Scale/Div 10 dB Mkr1 17.256 49 MHz Log Ref Level 110.00 dBµV/m 81.15 dBµV/m</p> <p>Start 5.00 MHz #Res BW 100 kHz #Video BW 100 kHz Stop 30.00 MHz #Sweep 101 ms (20000 pts)</p> <p>Aug 10, 2022 3:25:31 PM DC Coupled</p>	Typical B4 signature with noise floor falling from 95 dB to 65 dB		

PSA Pre-Energization Survey – Radiated Emissions					
Run	Band	Location			Comment
810-40	B5h	Site 7 – Parkchester-Van Nest Station			
		<p>B4 Swept SA B5 Swept SA B6 Swept SA B7 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: AC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref: Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: High Sig Track: Off Avg Type: Log-Power 1 2 3 4 5 6 LNJ Ref Level 90.00 dBµV/m AvgHold: 1/1 Trig: Free Run P p N N N N</p> <p>1 Spectrum Scale/Div 10 dB Mkr1 175.487 MHz Log Ref Level 90.00 dBµV/m 82.26 dBµV/m</p> <p>Start 25.0 MHz #Res BW 100 kHz #Video BW 100 kHz Stop 325.0 MHz #Sweep 101 ms (20000 pts)</p> <p>Aug 10, 2022 3:41:22 PM</p>	<p>Typical B5h signature seen during the survey. Observed peaks corresponding to:</p> <ul style="list-style-type: none"> TV broadcasting (54 - 66, 82 - 88, 174 - 186, 198 - 210 MHz), FM radio (88 - 108 MHz), Amateur radio (147 MHz), Aeronautical radionavigation (113 MHz) 		

PSA Pre-Energization Survey – Radiated Emissions					
Run	Band	Location			Comment
810-38	B6h	Site 7 – Parkchester-Van Nest Station			
		<p>B4 Swept SA B5 Swept SA B6 Swept SA B7 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: AC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref. Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: High Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run</p> <p>Mkr1 741.56 MHz 101.99 dB_PV/m</p> <p>1 Spectrum Scale/Div 10 dB Ref Level 110.00 dB_PV/m</p> <p>Start 0.3000 GHz Stop 1.3000 GHz #Res BW 300 kHz #Video BW 300 kHz #Sweep ~101 ms (20000 pts)</p> <p>Aug 10, 2022 3:37:00 PM</p>		<p>Typical B6h signature seen during the survey. Observed peaks corresponding to:</p> <ul style="list-style-type: none"> TV broadcasting (494 – 638 MHz), Land Mobile, Fixed (450 – 474, 851 - 894 MHz), Amateur radio (902 - 928 MHz), Aeronautical radionavigation (1090 MHz) 	

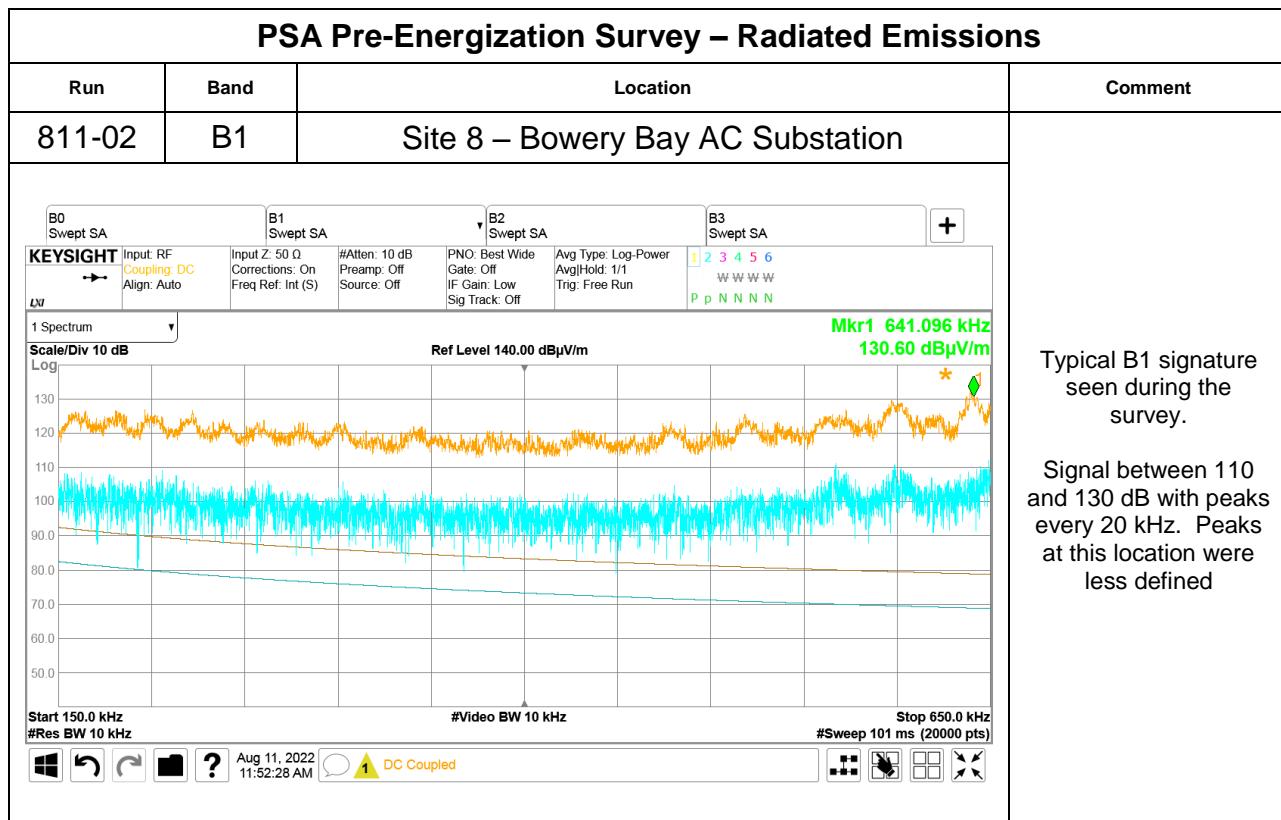
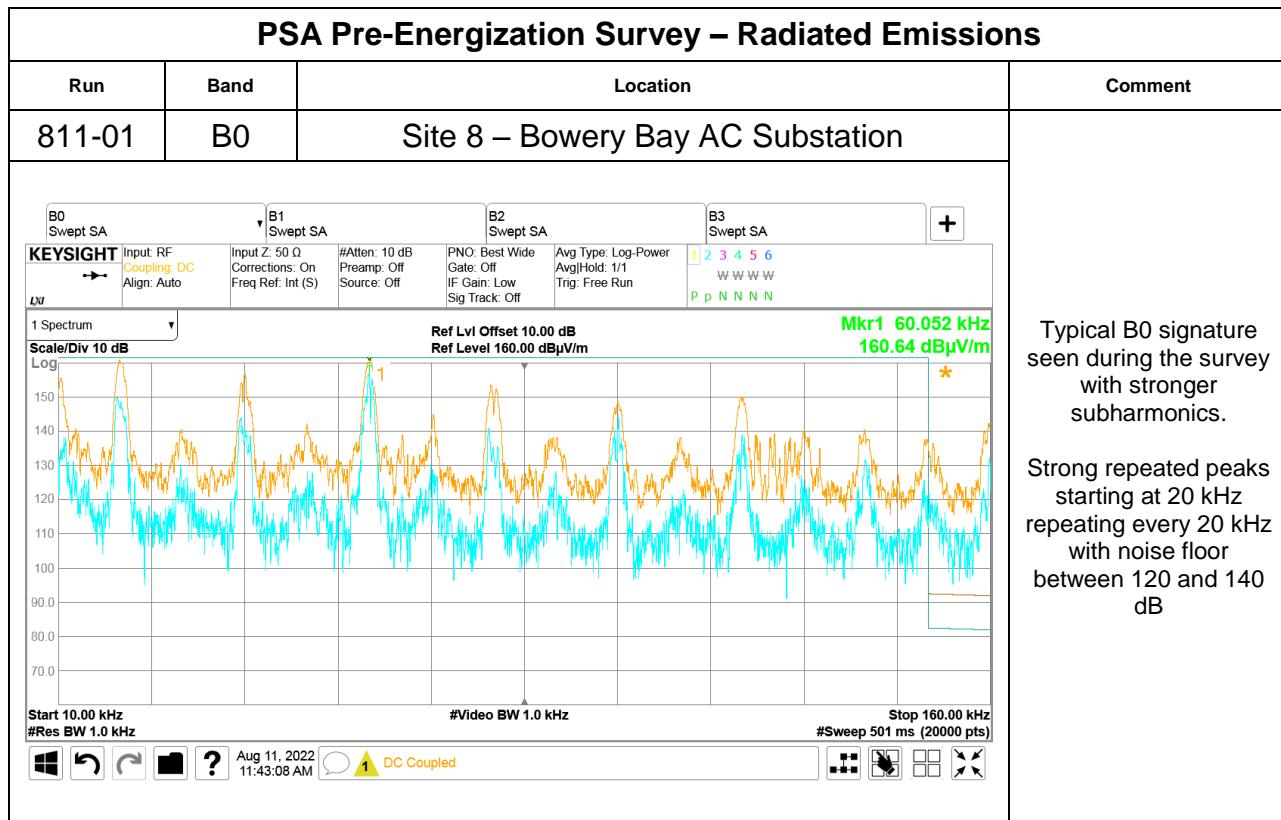
PSA Pre-Energization Survey – Radiated Emissions					
Run	Band	Location			Comment
810-41	B7h	Site 7 – Parkchester-Van Nest Station			
		<p>B4 Swept SA B5 Swept SA B6 Swept SA B7 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: AC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref. Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: High Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run</p> <p>Mkr1 2.136 06 GHz 101.20 dB_PV/m</p> <p>1 Spectrum Scale/Div 10 dB Ref Level 110.00 dB_PV/m</p> <p>Start 1.000 GHz Stop 6.000 GHz #Res BW 300 kHz #Video BW 300 kHz #Sweep ~151 ms (20000 pts)</p> <p>Aug 10, 2022 3:45:03 PM</p>	<p>Typical B7h signature seen during the survey. Observed peaks corresponding to:</p> <ul style="list-style-type: none"> Aeronautical Radionavigation (1.09 GHz) Fixed Mobile (1.67 - 2.18 GHz) Fixed Satellite (3.7 – 3.8 GHz) Amateur Radio / Satellite (5.74 GHz) 		

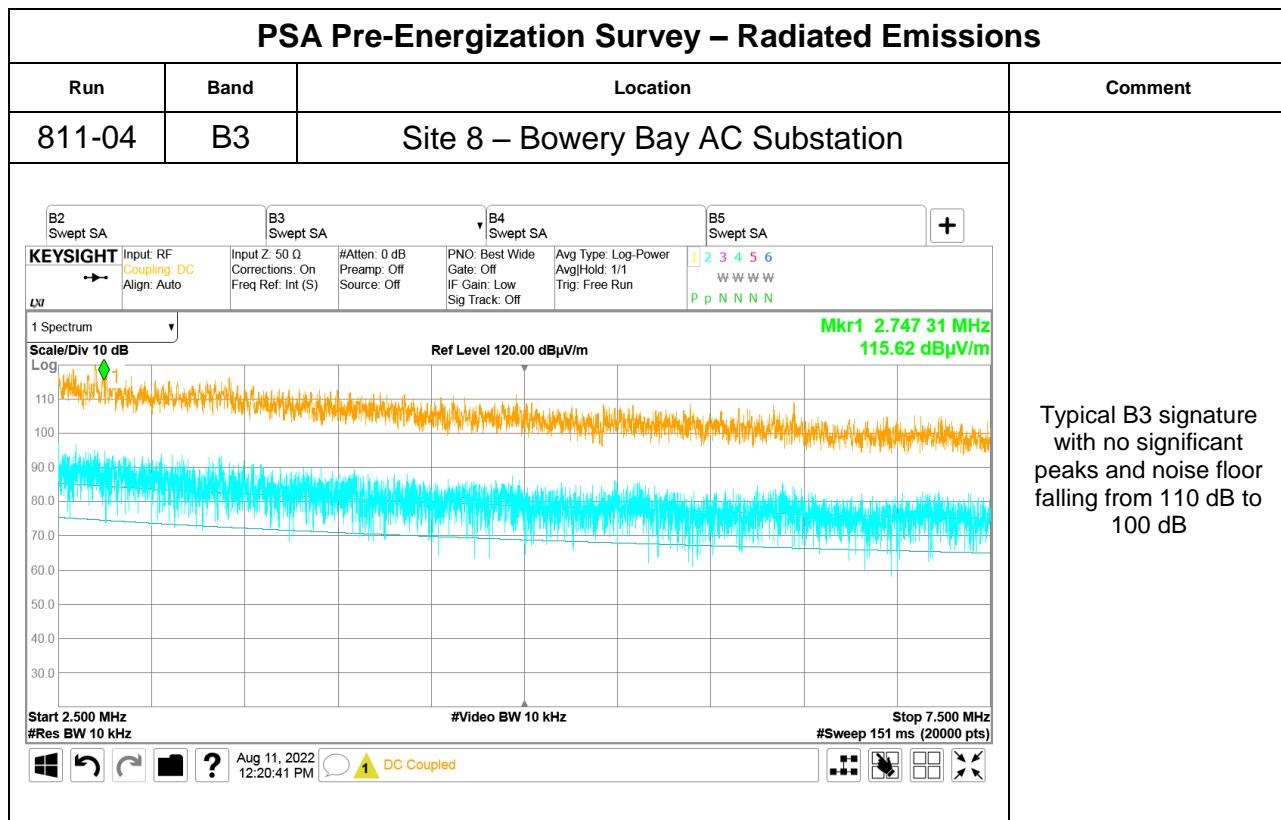
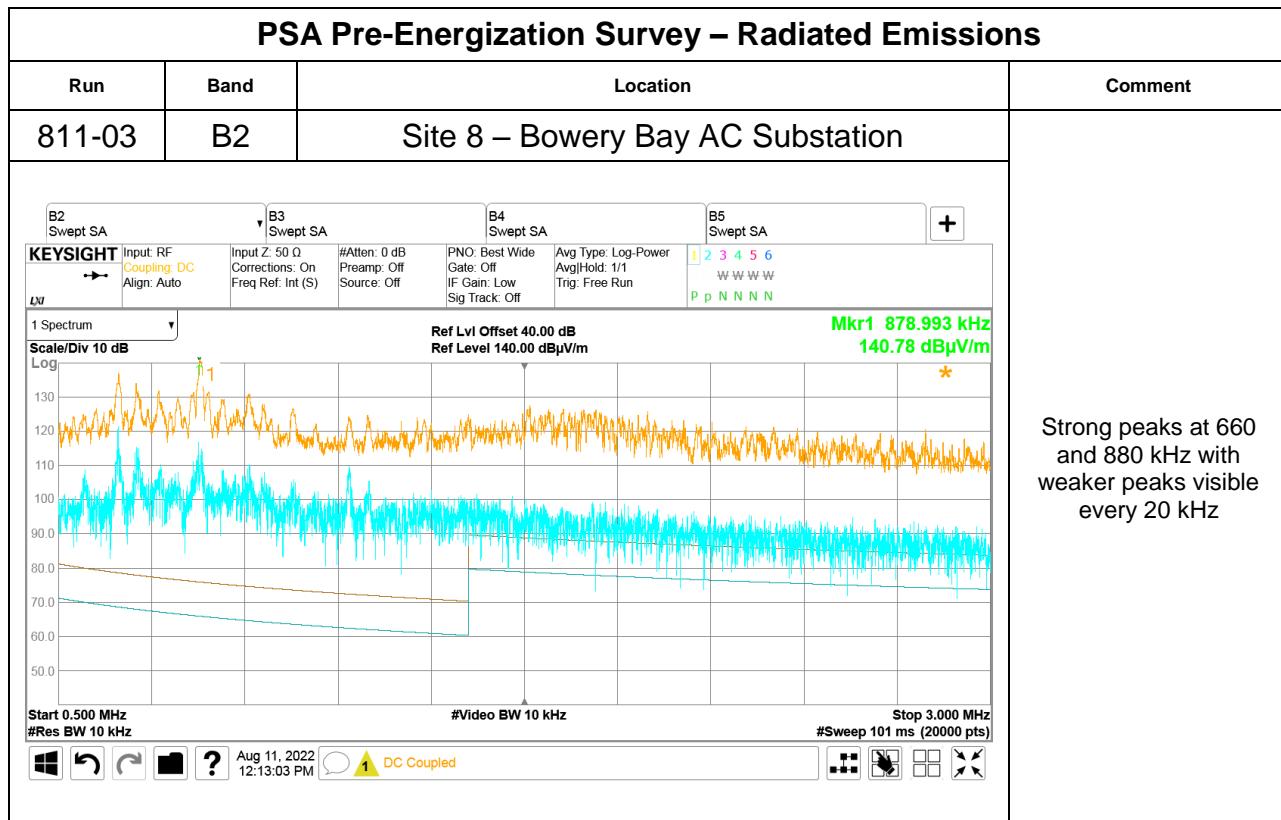


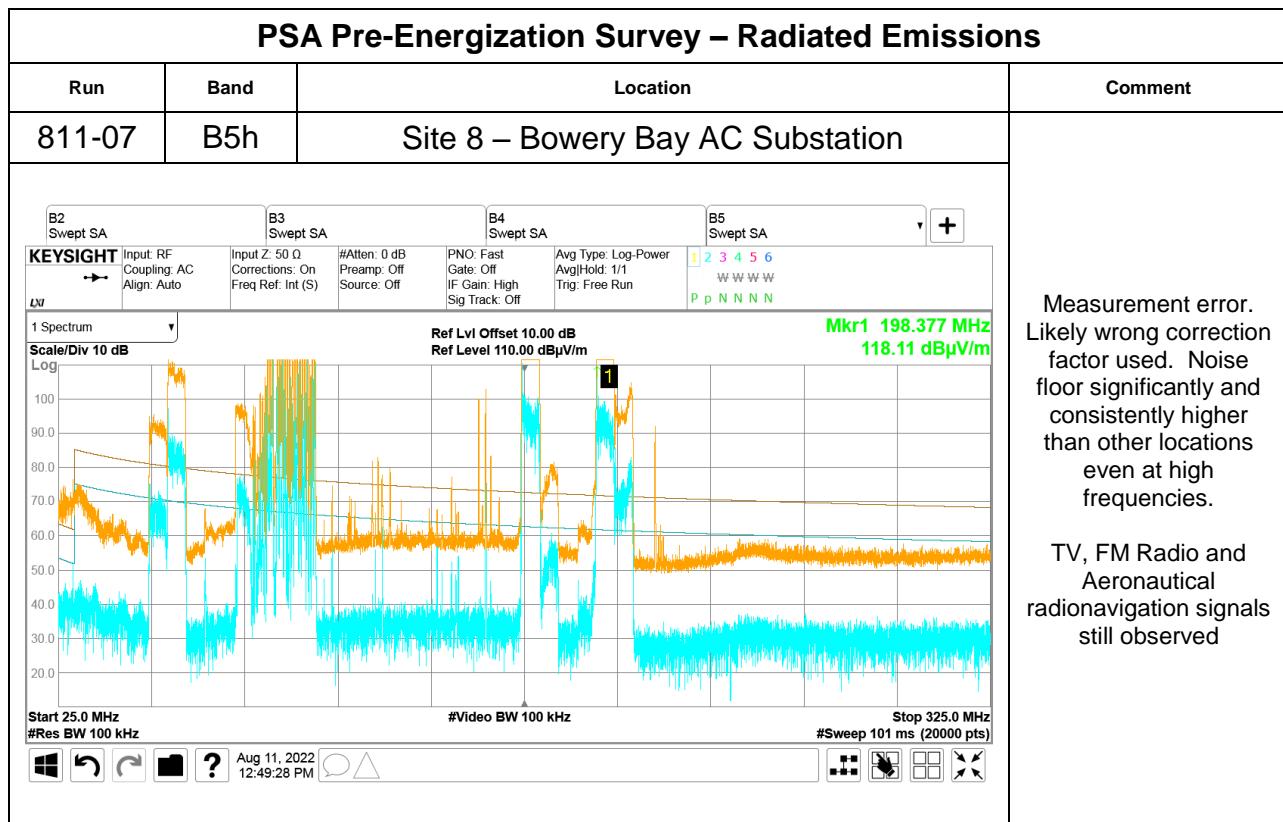
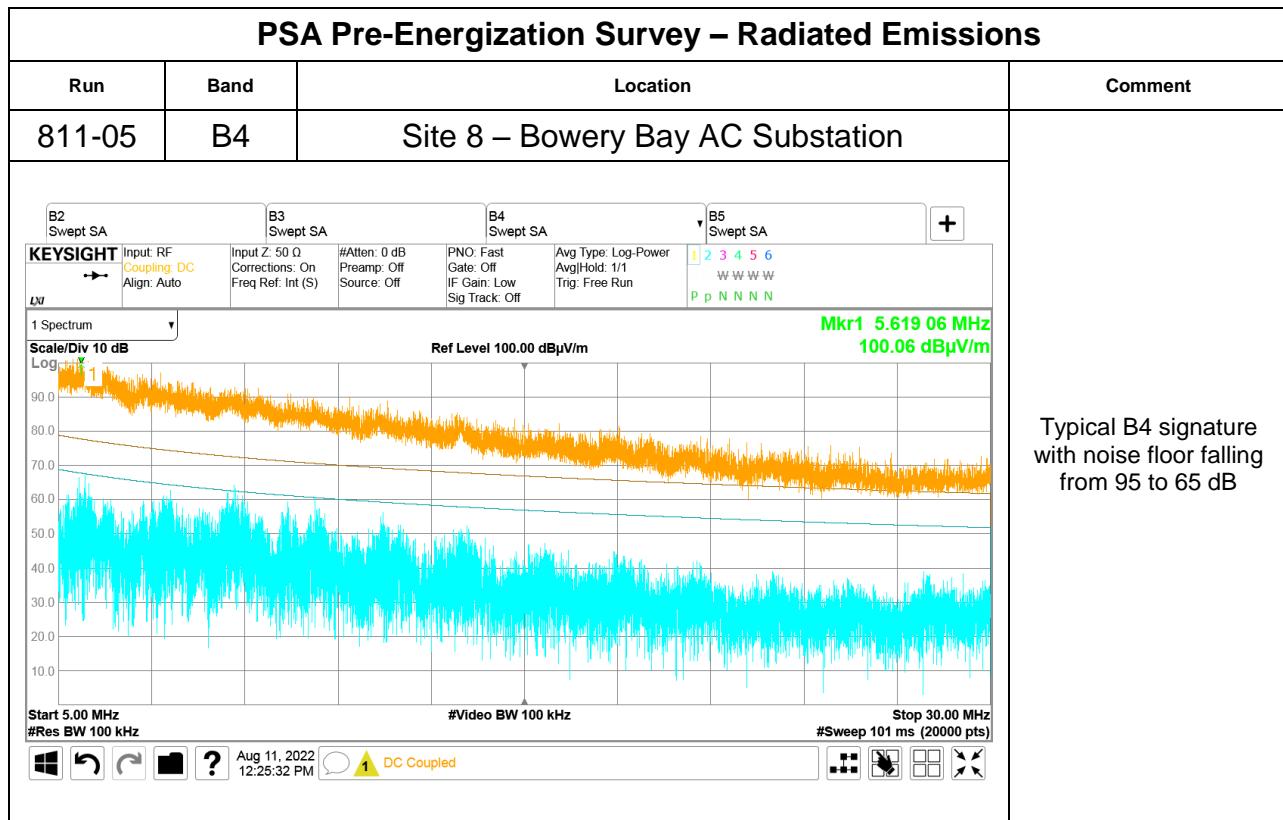
PSA Pre-Energization Survey – Radiated Emissions						
Run	Band	Location		Comment		
810-44	B7v	Site 7 – Parkchester-Van Nest Station				
<p>B4 Swept SA B5 Swept SA B6 Swept SA B7 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: AC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref. Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: High Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run 1 Spectrum Mkr1 2.136 06 GHz Scale/Div 10 dB 100.74 dBμV/m Ref Level 110.00 dBμV/m Log Start 1.000 GHz Stop 6.000 GHz #Res BW 300 kHz #Sweep ~151 ms (20000 pts) Aug 10, 2022 3:52:32 PM </p>						
See Site 11 B7v						

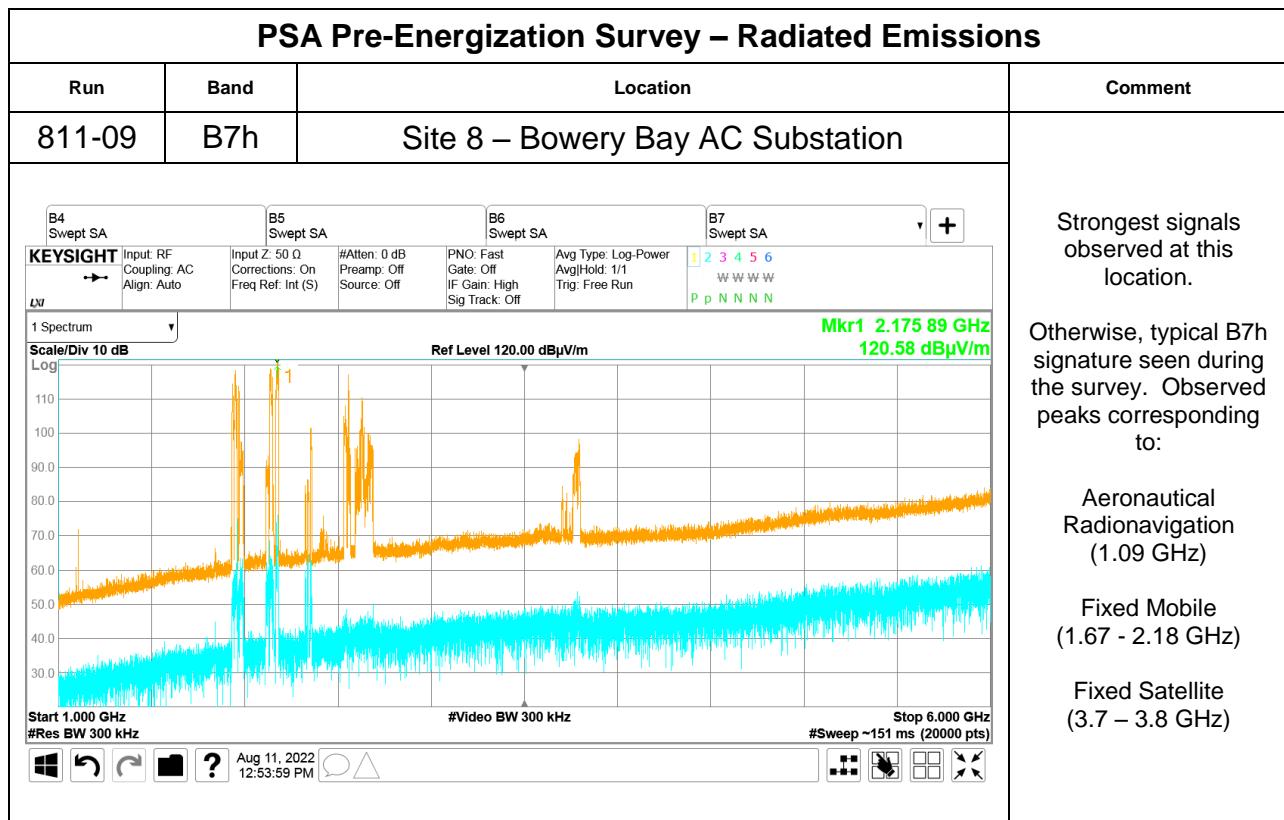
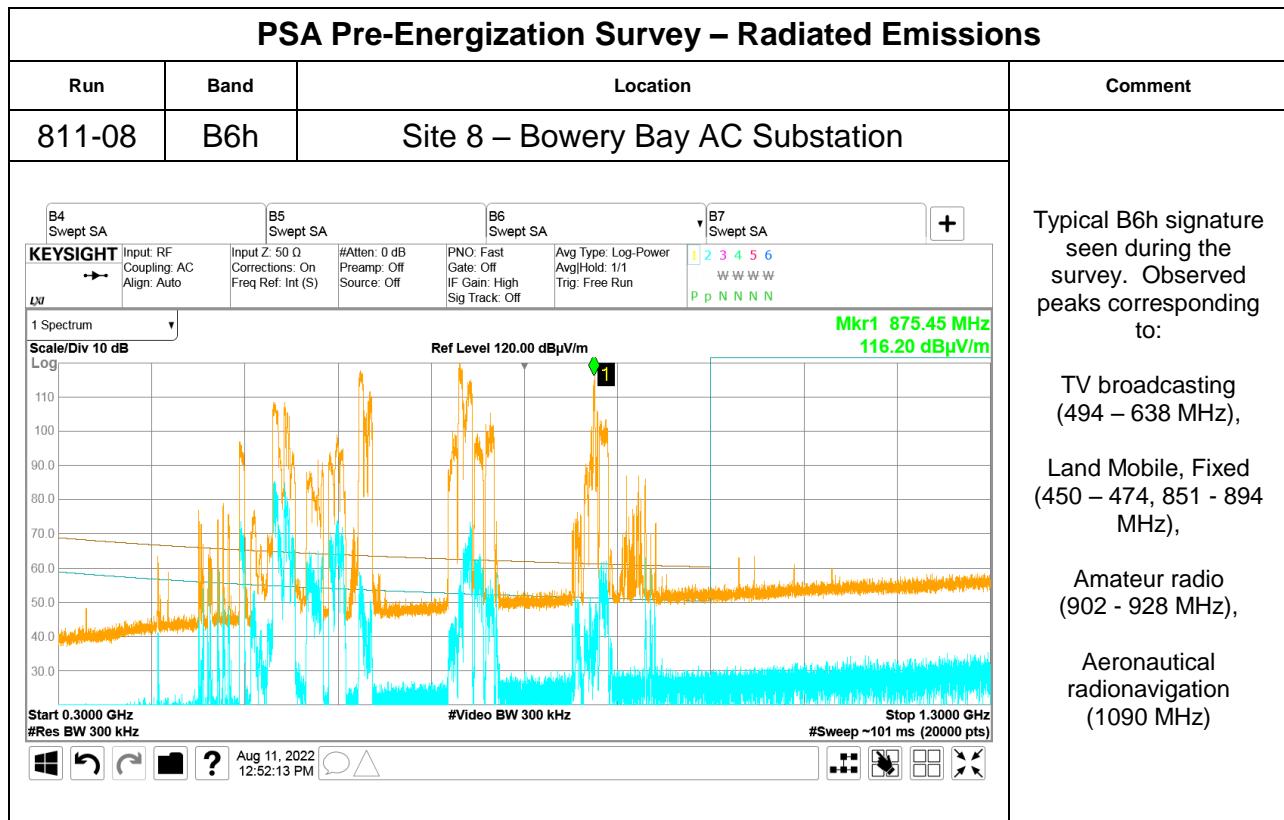
Site 8

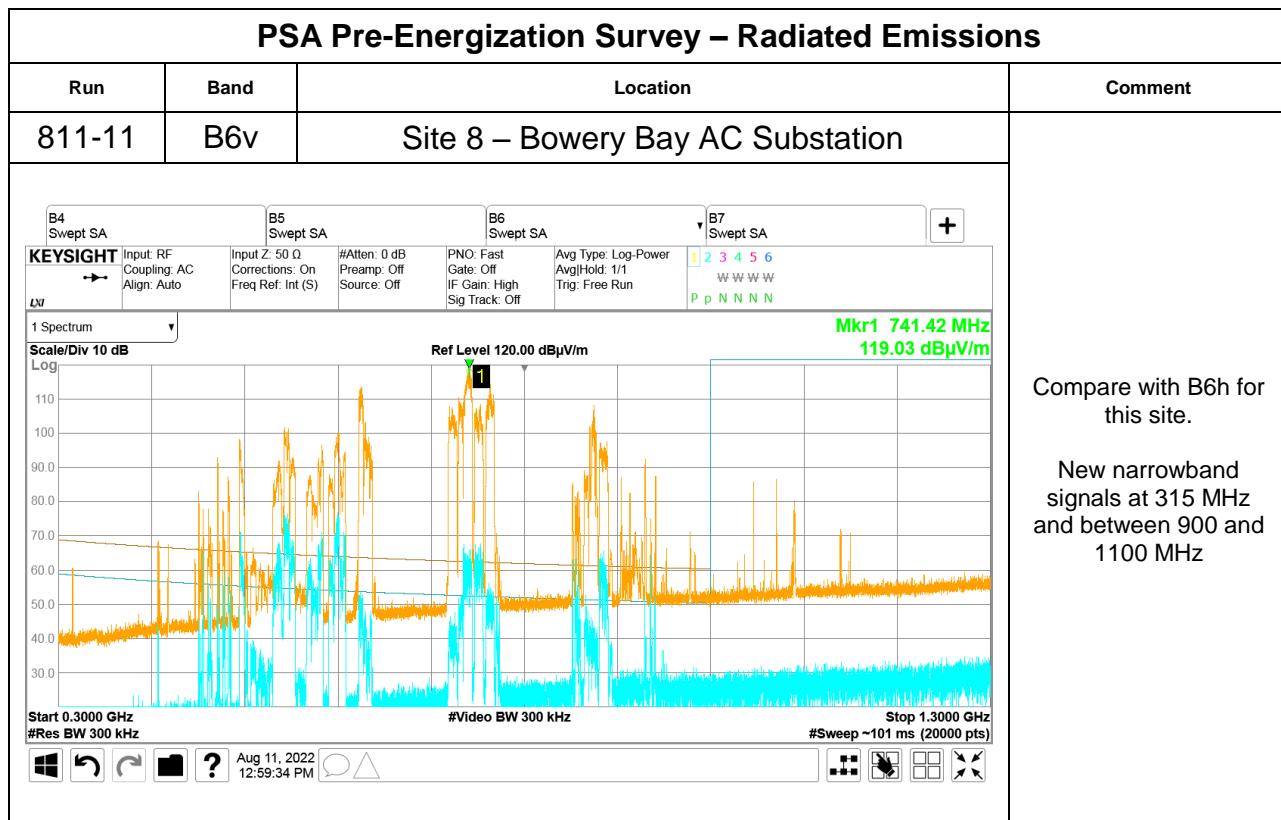
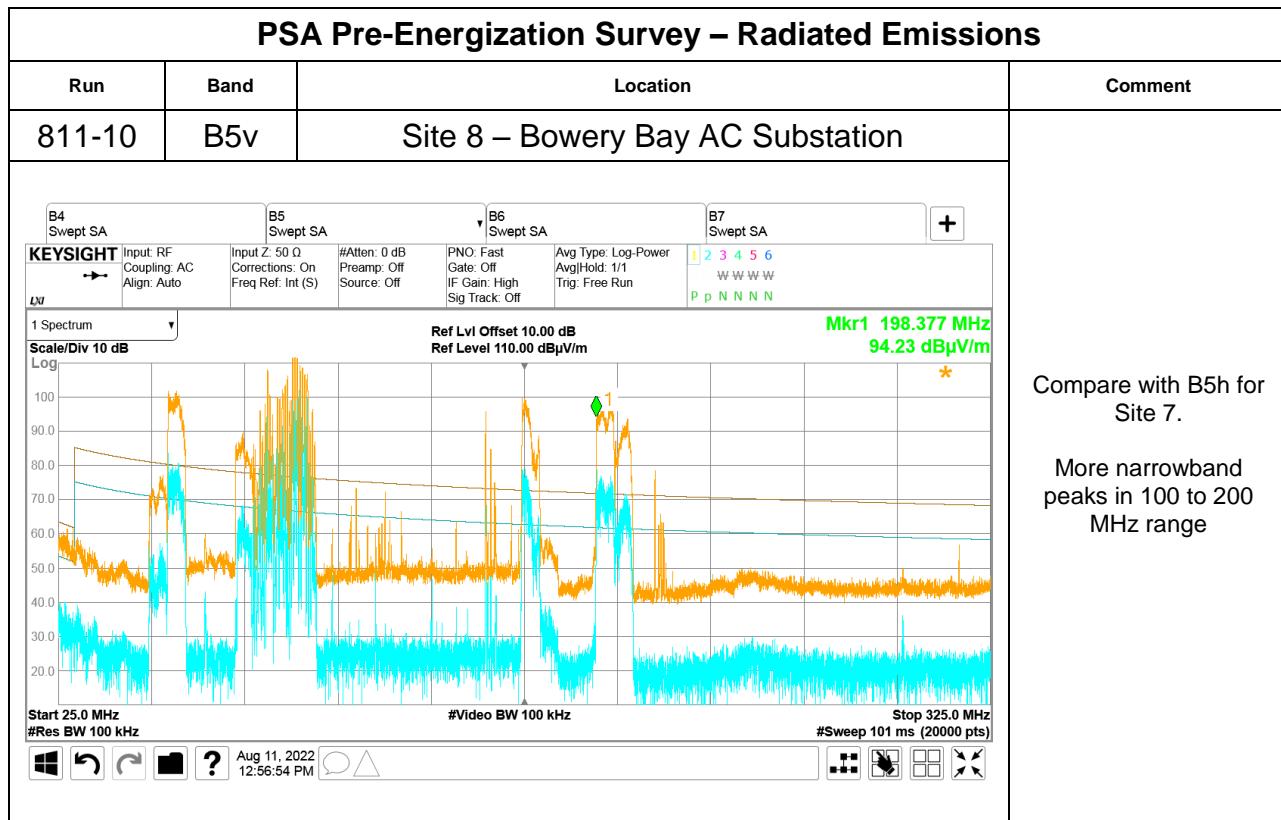
Bowery Bay AC Substation







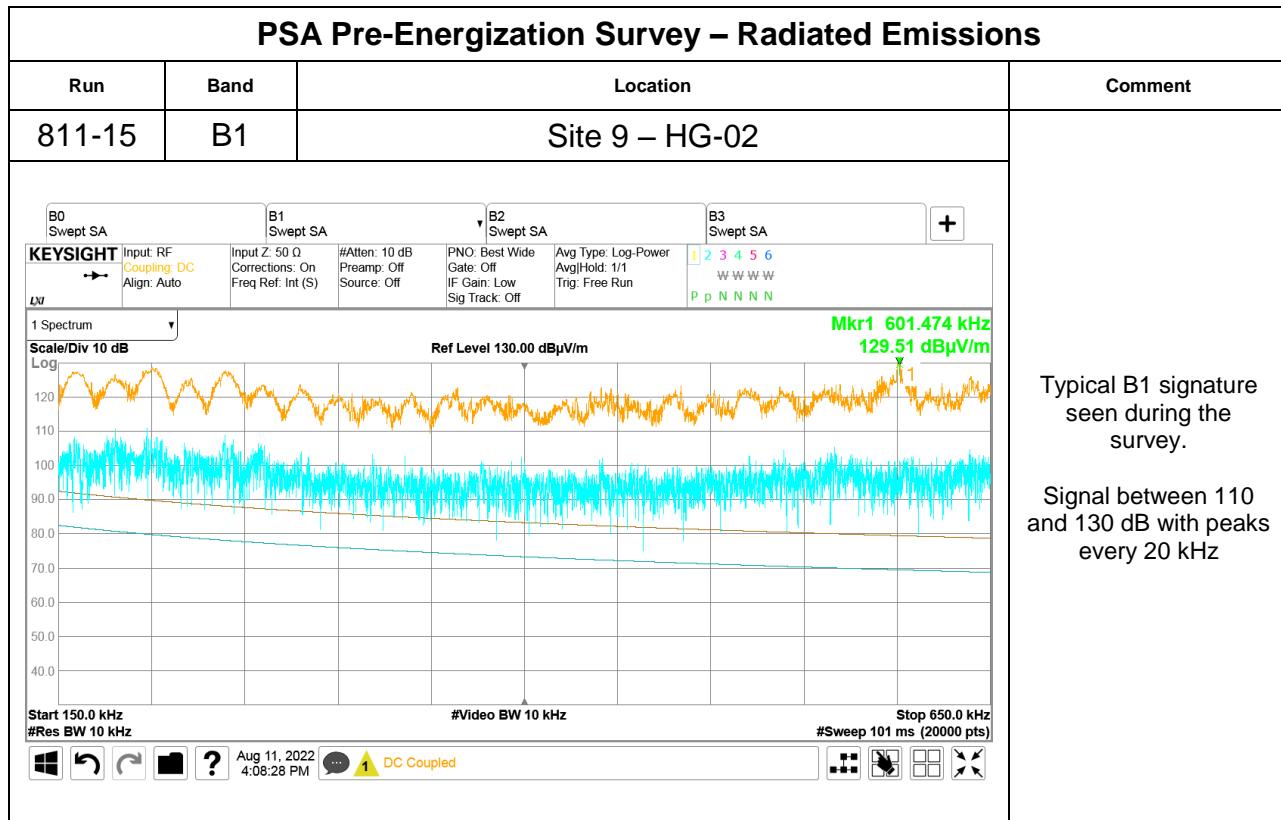
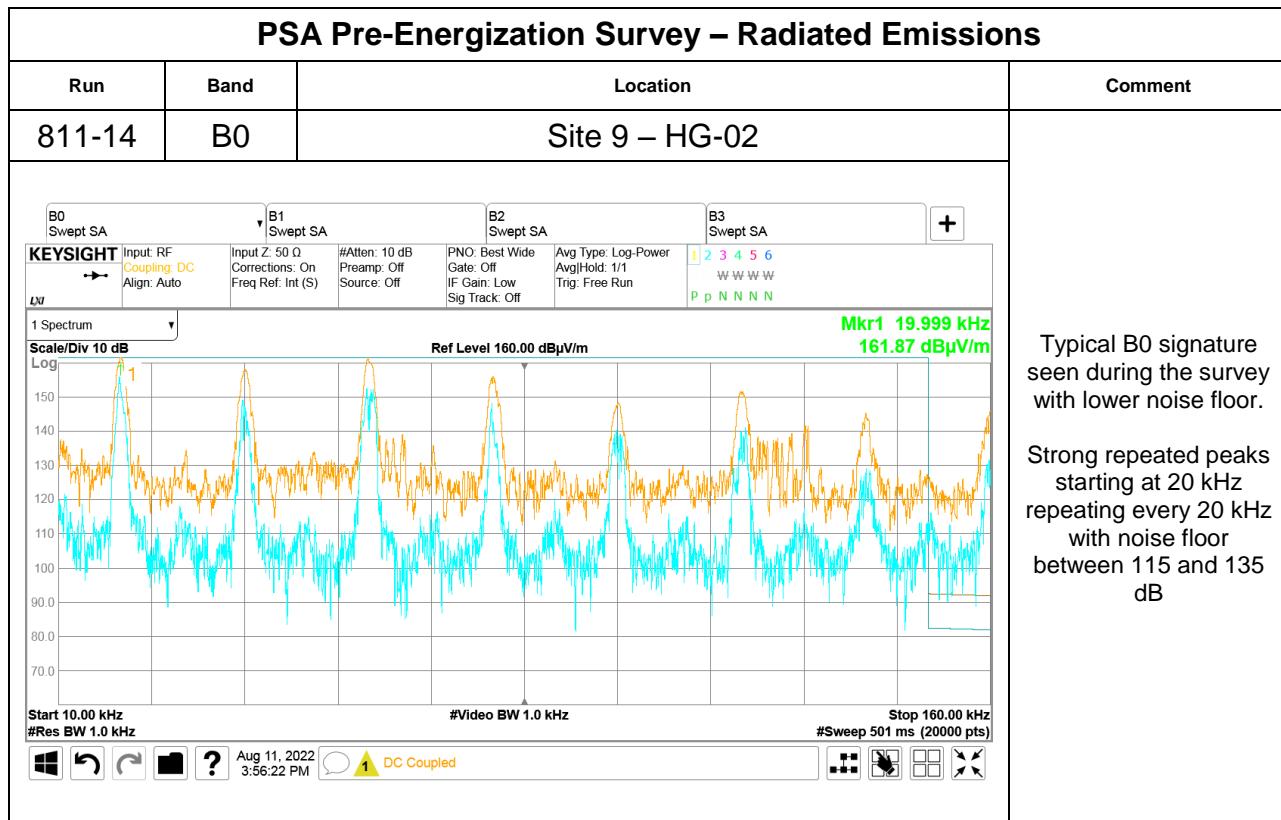


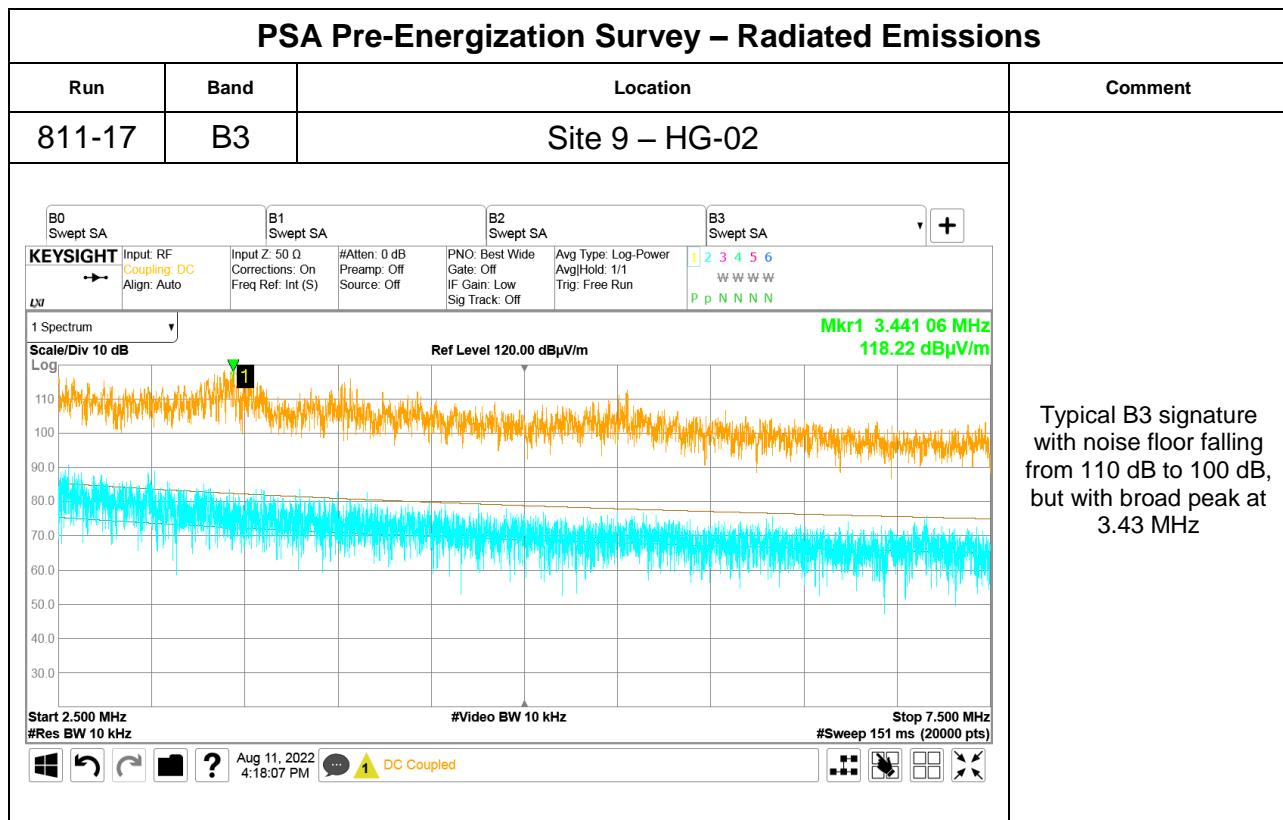
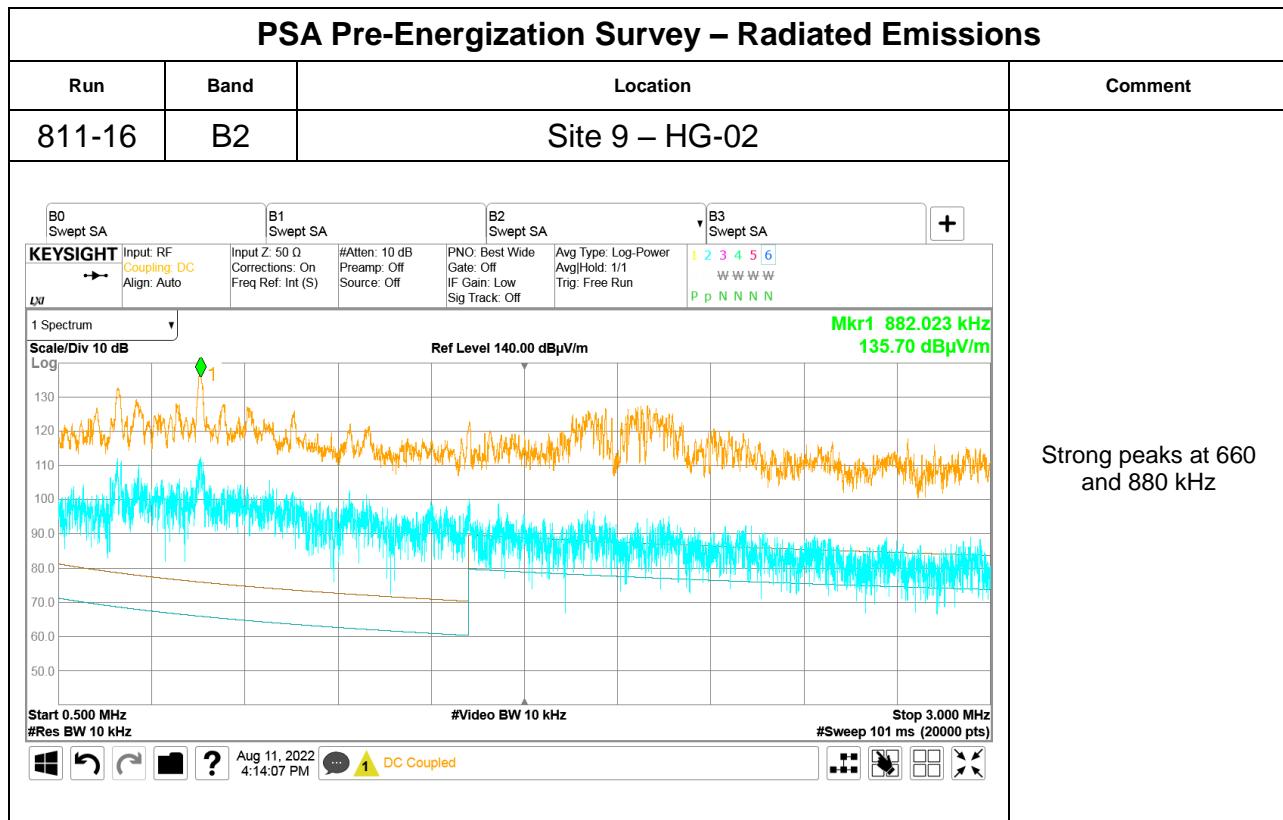


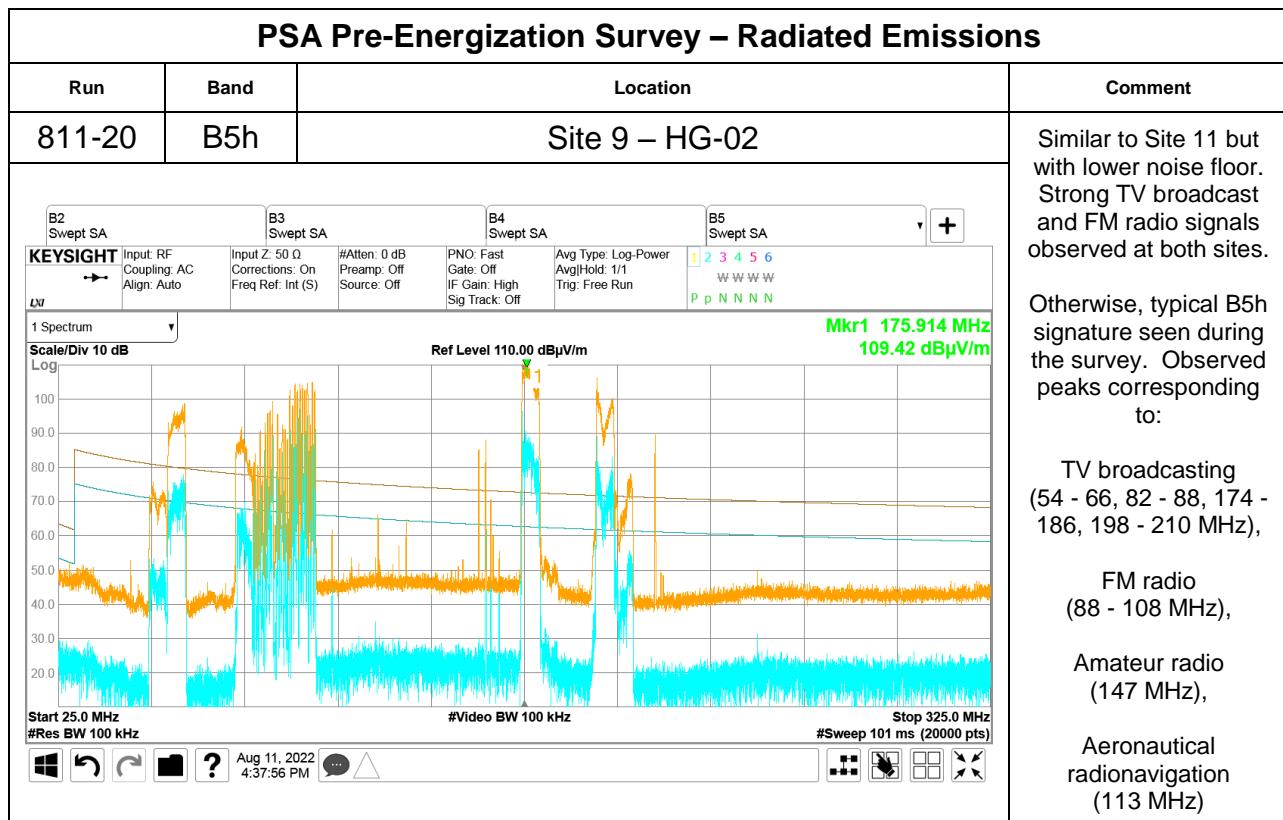
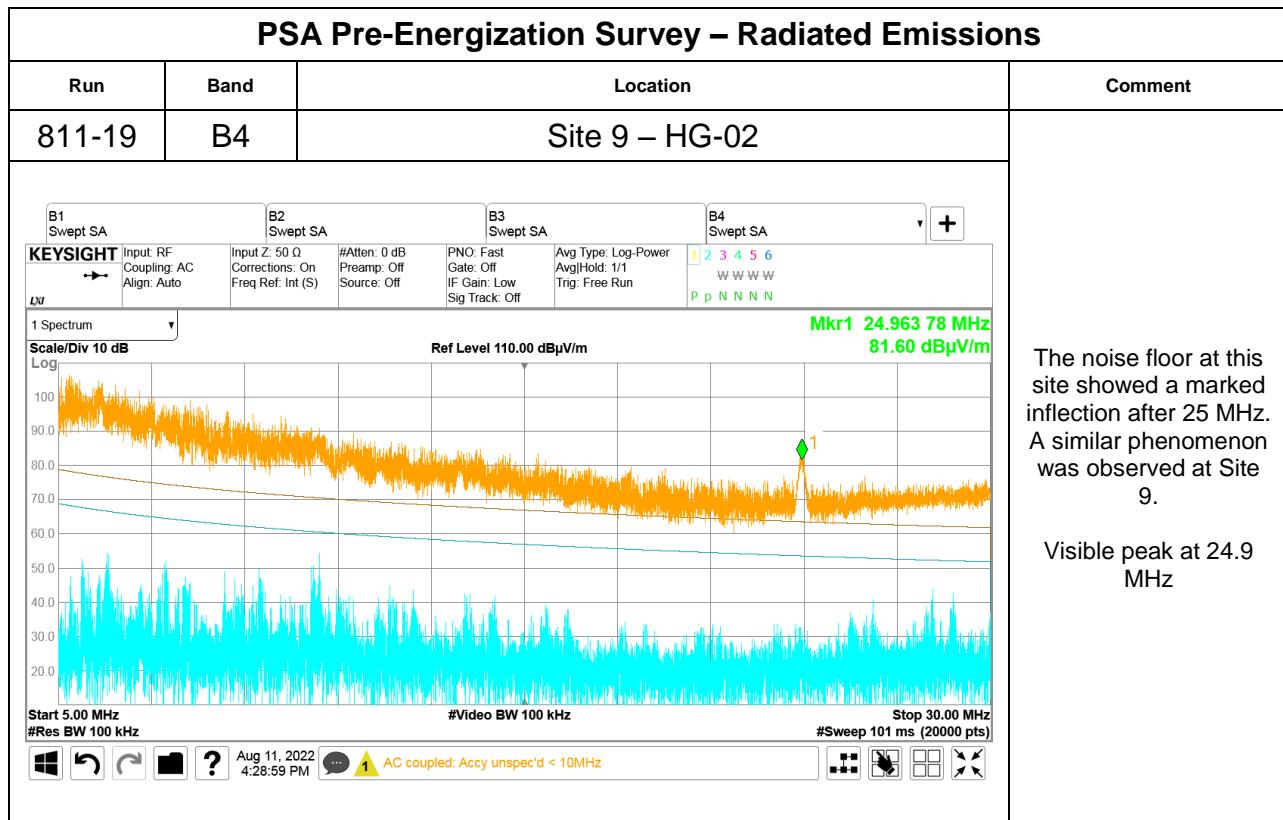
PSA Pre-Energization Survey – Radiated Emissions				
Run	Band	Location		Comment
811-13	B7v	Site 8 – Bowery Bay AC Substation		
		<p>B4 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: AC Align: Auto</p> <p>B5 Swept SA</p> <p>Input Z: 50 Ω Corrections: On Freq Ref. Int (S)</p> <p>B6 Swept SA</p> <p>#Atten: 0 dB Preamp: Off Source: Off</p> <p>B7 Swept SA</p> <p>PNO: Fast Gate: Off IF Gain: High Sig Track: Off</p> <p>Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run</p> <p>1 Spectrum</p> <p>Scale/Div 10 dB</p> <p>Ref Level 120.00 dBμV/m</p> <p>Mkr1 2.175 89 GHz 121.42 dBμV/m</p> <p>Start 1.000 GHz #Res BW 300 kHz</p> <p>#Video BW 300 kHz</p> <p>Stop 6.000 GHz #Sweep ~151 ms (20000 pts)</p> <p>Aug 11, 2022 1:02:11 PM</p>	See B7h for this site	

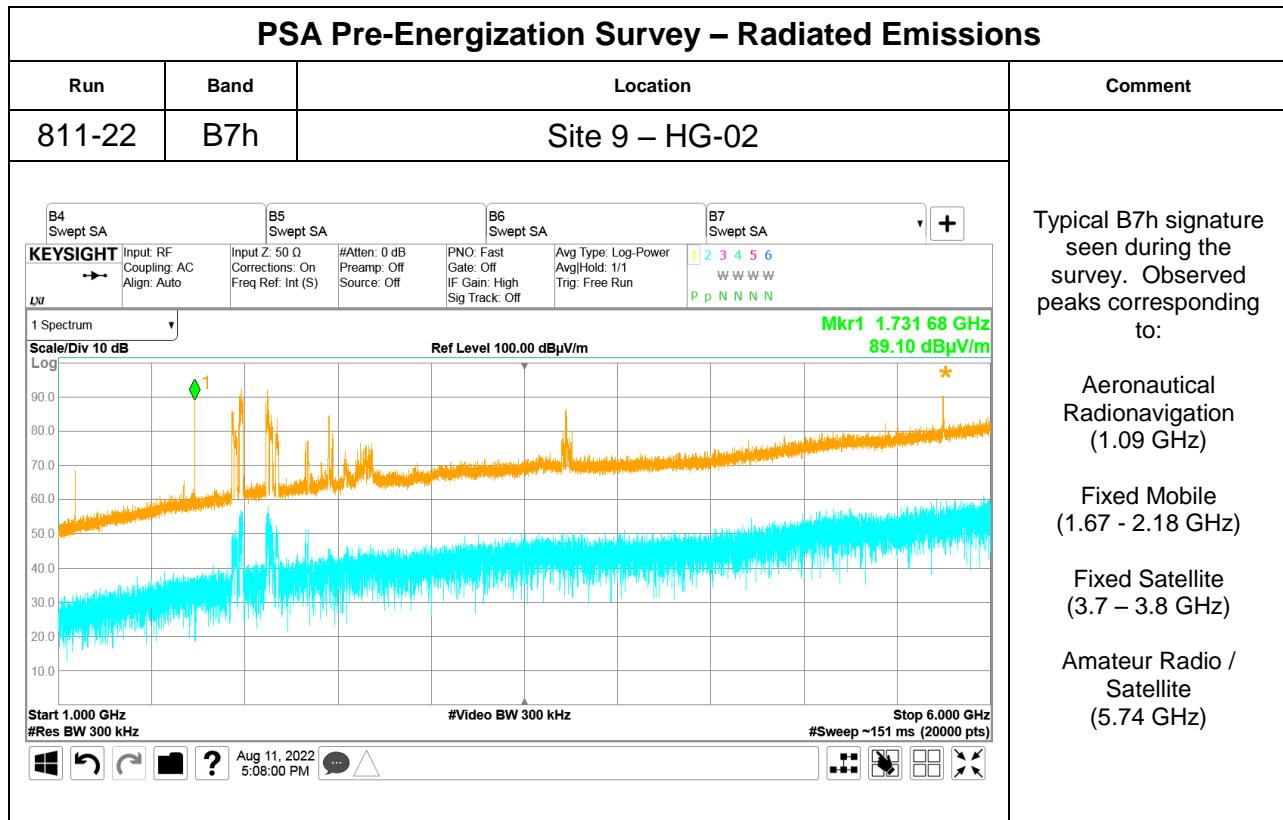
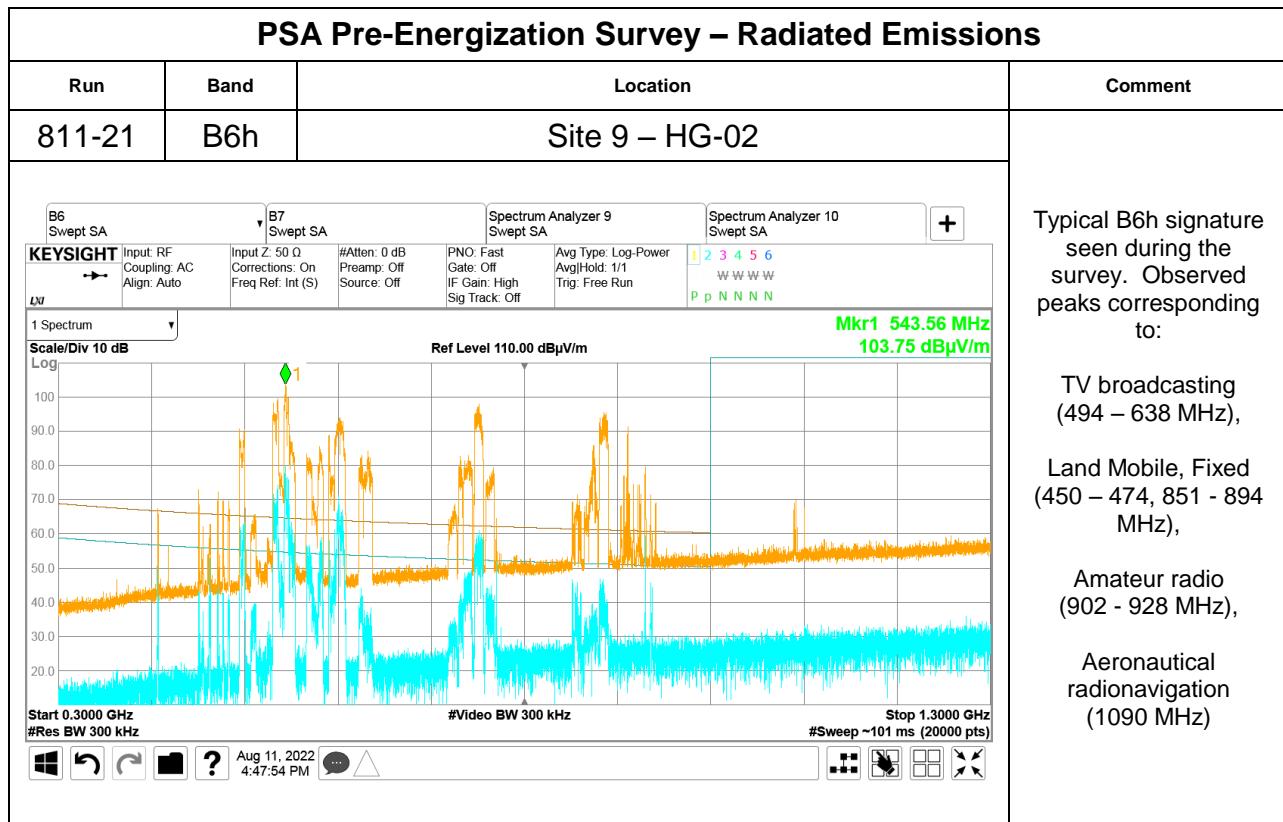
Site 9

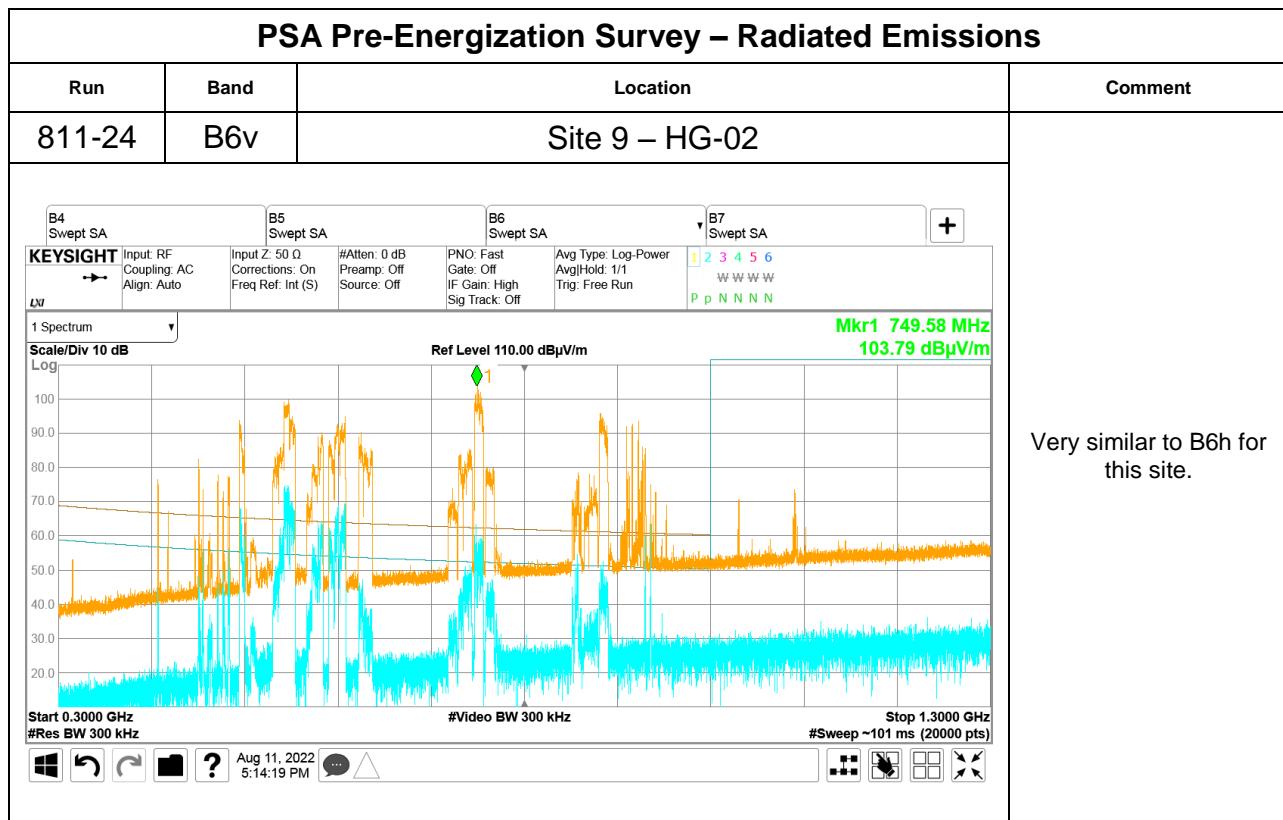
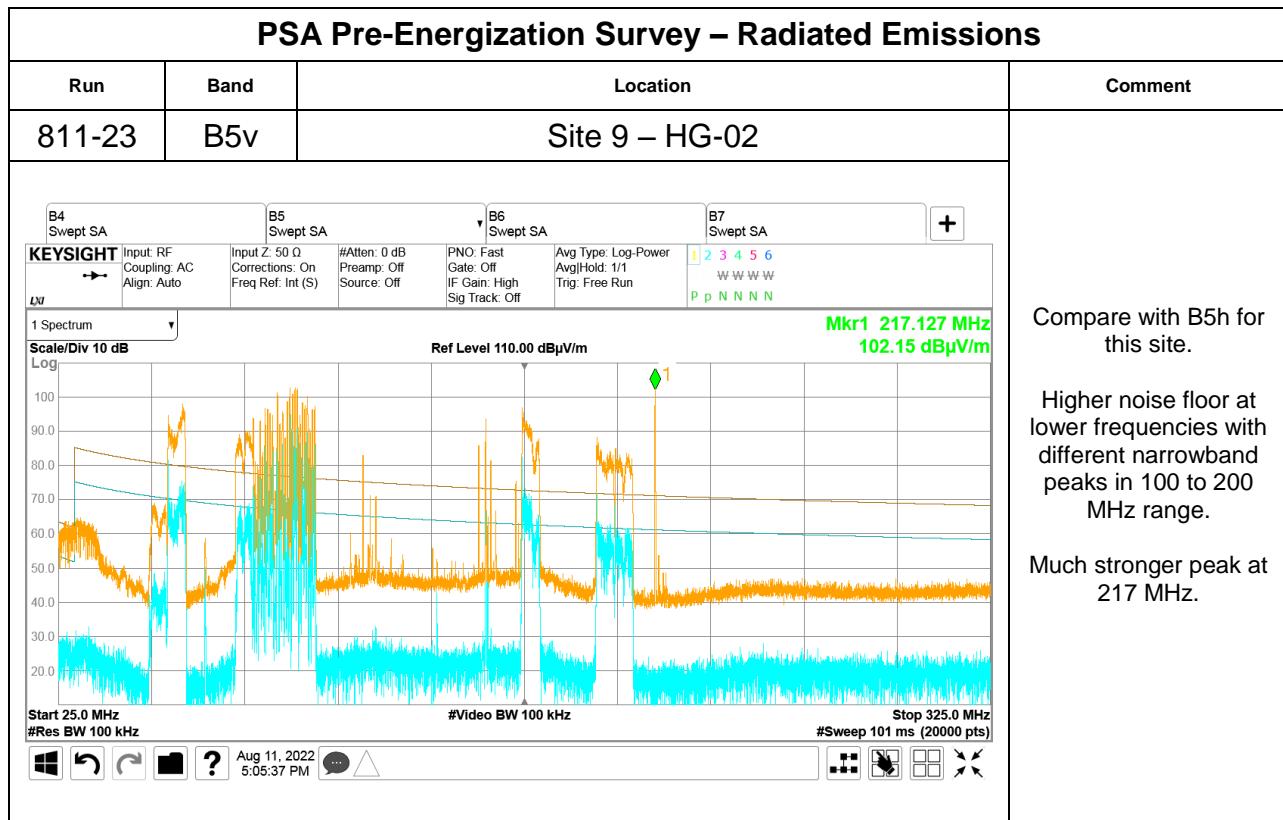
HG-02







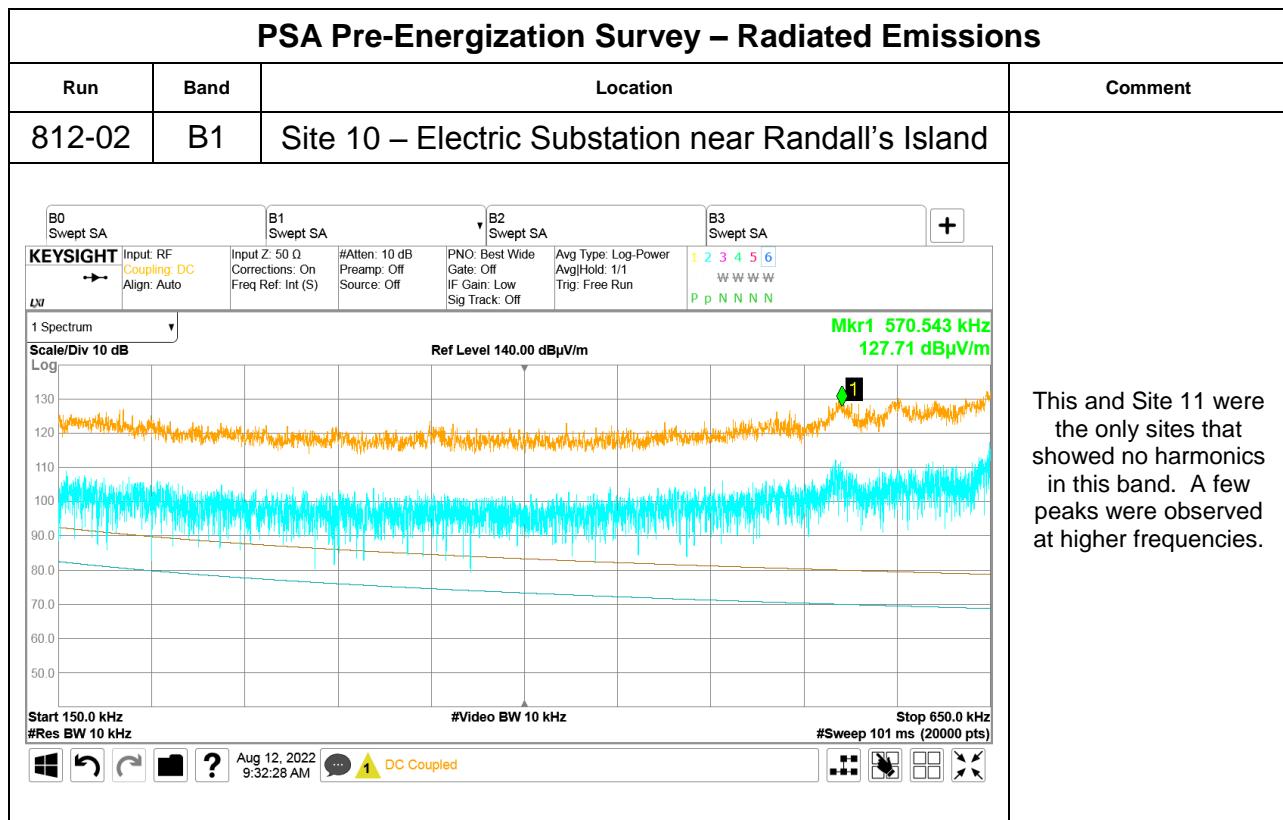
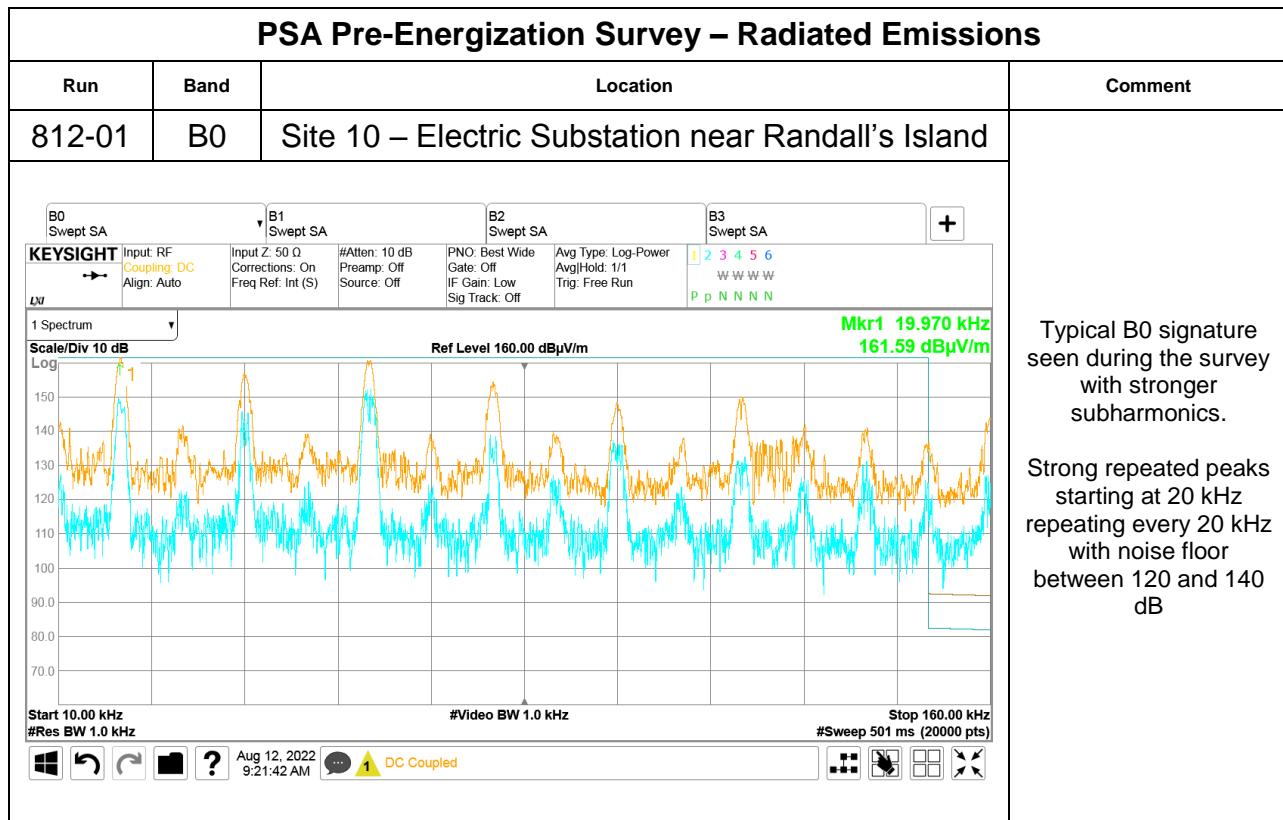


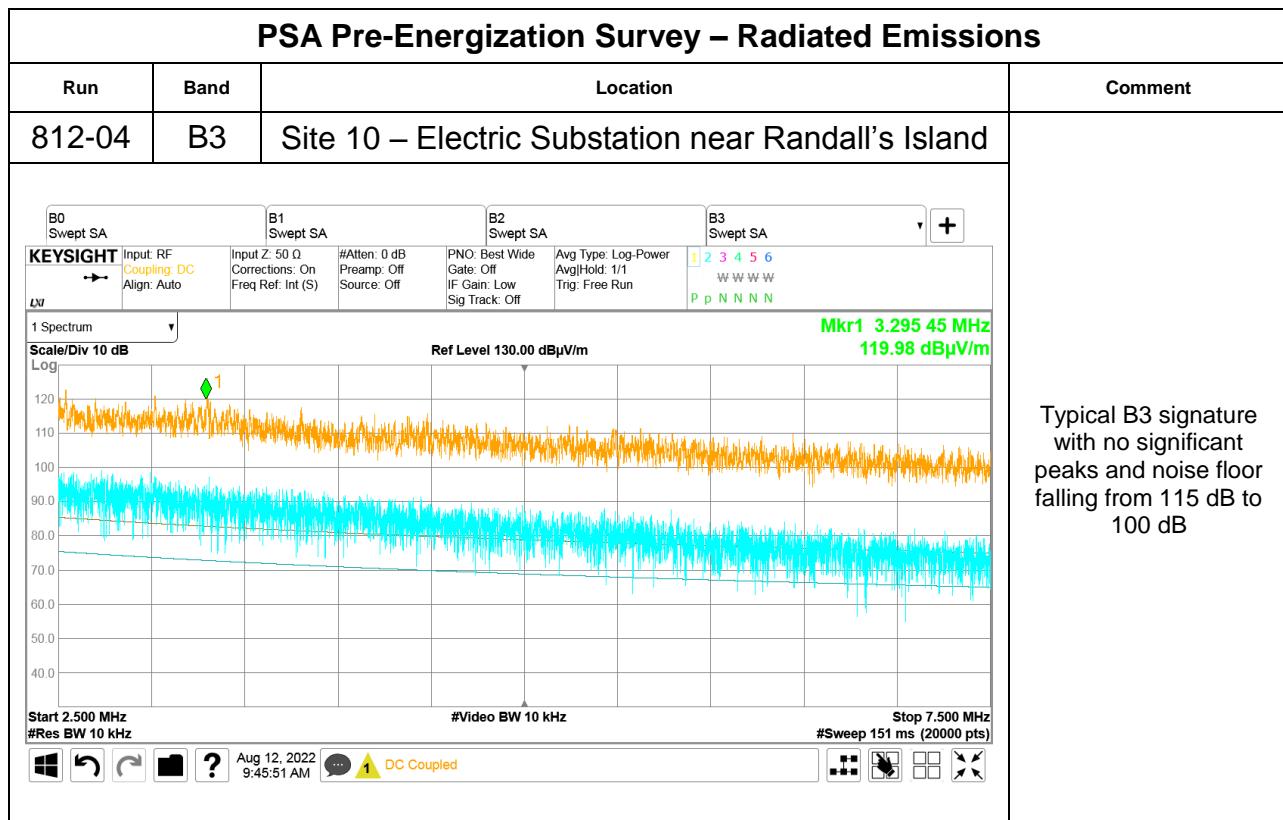
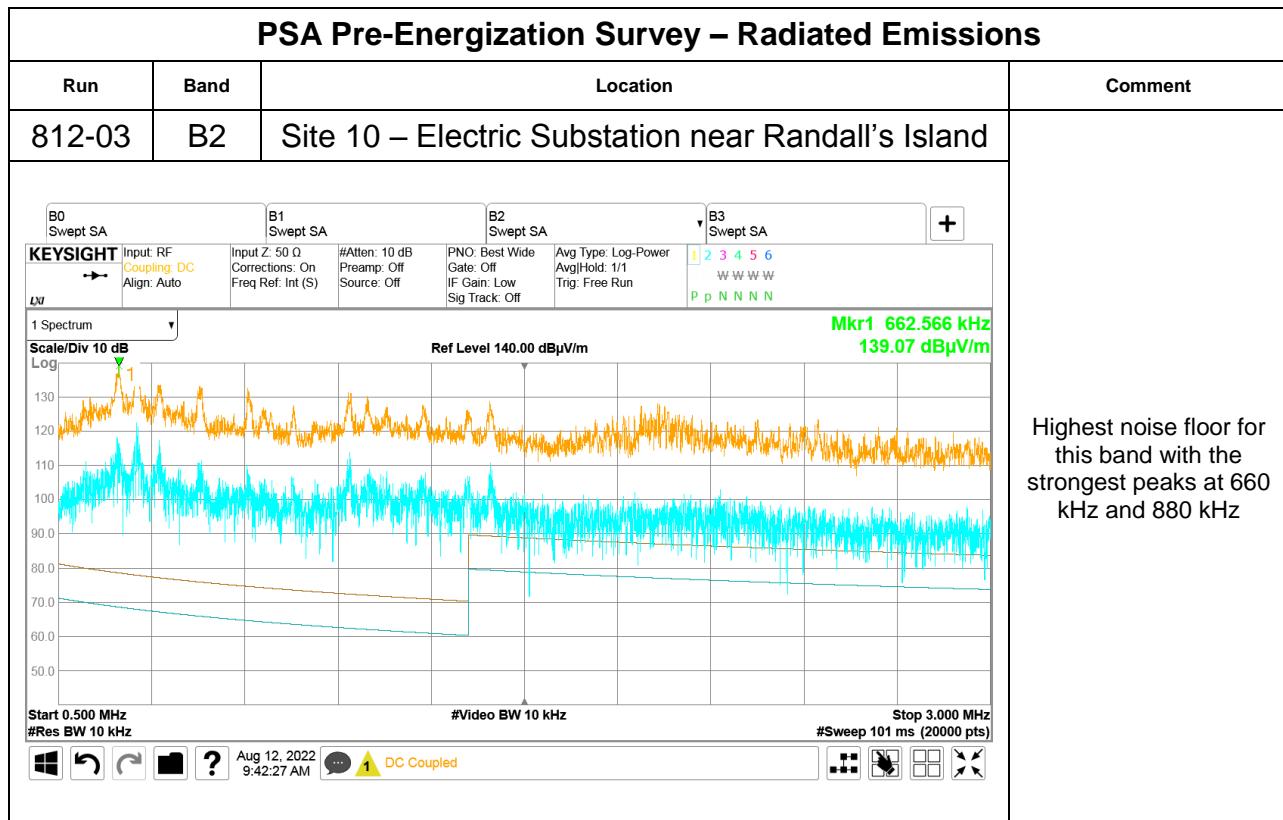


PSA Pre-Energization Survey – Radiated Emissions				
Run	Band	Location		Comment
811-25	B7v	Site 9 – HG-02		
		<p>B4 Swept SA B5 Swept SA B6 Swept SA B7 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: AC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref. Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: High Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run 1 Spectrum 1 2 3 4 5 6 Scale/Div 10 dB W W W W Ref Level 100.00 dBμV/m P p N N N N</p> <p>Start 1.000 GHz #Res BW 300 kHz #Video BW 300 kHz Stop 6.000 GHz #Sweep ~151 ms (20000 pts)</p> <p>Aug 11, 2022 5:16:46 PM</p> <p>Windows icon, left arrow, right arrow, folder icon, question mark icon, speech bubble icon, triangle icon, square icon, diamond icon, cross icon.</p>	<p>Compare with B7v for this site. Stronger signals.</p>	

Site 10

Electric Substation near Randall's Island





PSA Pre-Energization Survey – Radiated Emissions					
Run	Band	Location			Comment
812-05	B4	Site 10 – Electric Substation near Randall's Island			
		<p>B4 Swept SA B5 Swept SA B6 Swept SA B7 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: DC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref: Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: Low Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run</p> <p>Mkr1 5.489 51 MHz 104.11 dB_PV/m</p> <p>Start 5.00 MHz #Res BW 100 kHz Stop 30.00 MHz #Sweep 101 ms (20000 pts)</p> <p>Aug 12, 2022 9:51:41 AM DC Coupled</p>	<p>Typical B4 signature with noise floor falling from 95 to 65 dB</p>		

PSA Pre-Energization Survey – Radiated Emissions					
Run	Band	Location			Comment
812-07	B5h	Site 10 – Electric Substation near Randall's Island			
		<p>B4 Swept SA B5 Swept SA B6 Swept SA B7 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: AC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref: Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: High Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run</p> <p>Mkr1 176.824 MHz 100.90 dB_PV/m</p> <p>Start 25.0 MHz #Res BW 100 kHz Stop 325.0 MHz #Sweep 101 ms (20000 pts)</p> <p>Aug 12, 2022 10:08:11 AM</p>	<p>More narrowband noise observed in 100 to 200 MHz range than at other sites.</p> <p>Otherwise, typical B5h signature seen during the survey. Observed peaks corresponding to:</p> <ul style="list-style-type: none"> TV broadcasting (54 - 66, 82 - 88, 174 - 186, 198 - 210 MHz), FM radio (88 - 108 MHz), Amateur radio (147 MHz), Aeronautical radionavigation (113 MHz) 		

PSA Pre-Energization Survey – Radiated Emissions			
Run	Band	Location	Comment
812-08	B6h	Site 10 – Electric Substation near Randall's Island	<p>Narrowband noise at lower frequencies.</p> <p>Otherwise, typical B6h signature seen during the survey. Observed peaks corresponding to:</p> <ul style="list-style-type: none"> TV broadcasting (494 – 638 MHz), Land Mobile, Fixed (450 – 474, 851 – 894 MHz), Amateur radio (902 - 928 MHz), Aeronautical radionavigation (1090 MHz)

PSA Pre-Energization Survey – Radiated Emissions			
Run	Band	Location	Comment
812-09	B7h	Site 10 – Electric Substation near Randall's Island	<p>Typical B7h signature seen during the survey. Observed peaks corresponding to:</p> <ul style="list-style-type: none"> Aeronautical Radionavigation (1.09 GHz) Fixed Mobile (1.67 - 2.18 GHz) Fixed Satellite (3.7 – 3.8 GHz) Amateur Radio / Satellite (5.74 GHz)

PSA Pre-Energization Survey – Radiated Emissions					
Run	Band	Location			Comment
812-10	B5v	Site 10 – Electric Substation near Randall's Island			
		<p>B4 Swept SA B5 Swept SA B6 Swept SA B7 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: AC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref: Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: High Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run 1 2 3 4 5 6 W W W W P p N N N N</p> <p>1 Spectrum Scale/Div 10 dB Ref Level 110.00 dBμV/m</p> <p>Mkr1 97.187 MHz 102.55 dBμV/m</p> <p>Start 25.0 MHz #Res BW 100 kHz #Video BW 100 kHz Stop 325.0 MHz #Sweep 101 ms (20000 pts)</p> <p>Aug 12, 2022 10:29:23 AM</p>	<p>Compare with Run 812-06 B5h for this site.</p> <p>This run showed significant narrowband noise at all frequencies. A similar signal is seen in run 812-06. 812-07, recorded a few minutes after 812-06, shows no such noise.</p> <p>Otherwise, signals observed very similar to both B5h runs for this site.</p>		

PSA Pre-Energization Survey – Radiated Emissions					
Run	Band	Location			Comment
812-11	B6v	Site 10 – Electric Substation near Randall's Island			
		<p>B4 Swept SA B5 Swept SA B6 Swept SA B7 Swept SA</p> <p>KEYSIGHT Input: RF Coupling: AC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref: Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: High Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run 1 2 3 4 5 6 W W W W P p N N N N</p> <p>1 Spectrum Scale/Div 10 dB Ref Level 110.00 dBμV/m</p> <p>Mkr1 869.86 MHz 105.40 dBμV/m</p> <p>Start 0.3000 GHz #Res BW 300 kHz #Video BW 300 kHz Stop 1.3000 GHz #Sweep ~101 ms (20000 pts)</p> <p>Aug 12, 2022 10:32:21 AM</p>	<p>Compare with B6h for this site.</p> <p>Stronger signals overall with new narrowband signals between 1 and 1.2 GHz</p>		

PSA Pre-Energization Survey – Radiated Emissions																												
Run	Band	Location	Comment																									
812-13	B7v	Site 10 – Electric Substation near Randall's Island																										
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">B4 Swept SA</td> <td style="padding: 2px;">B5 Swept SA</td> <td style="padding: 2px;">B6 Swept SA</td> <td style="padding: 2px;">B7 Swept SA</td> </tr> <tr> <td style="padding: 2px;">KEYSIGHT LW</td> <td style="padding: 2px;">Input: RF Coupling: AC Align: Auto</td> <td style="padding: 2px;">Input Z: 50 Ω Corrections: On Freq Ref. Int (S)</td> <td style="padding: 2px;">#Atten: 0 dB Preamp: Off Source: Off</td> </tr> <tr> <td style="padding: 2px;"></td> <td style="padding: 2px;">PNO: Fast Gate: Off IF Gain: High Sig Track: Off</td> <td style="padding: 2px;">Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run</td> <td style="padding: 2px;">1 2 3 4 5 6 W W W W P p N N N N</td> </tr> <tr> <td style="padding: 2px;"></td> <td style="padding: 2px;"></td> <td style="padding: 2px;">Ref Level 110.00 dBμV/m</td> <td style="padding: 2px;">Mkr1 1.966 14 GHz 99.68 dBμV/m</td> </tr> <tr> <td style="padding: 2px;">Scale/Div 10 dB</td> <td style="padding: 2px;">Log</td> <td style="padding: 2px;">Start 1.000 GHz #Res BW 300 kHz</td> <td style="padding: 2px;">Stop 6.000 GHz #Sweep ~151 ms (20000 pts)</td> </tr> <tr> <td style="padding: 2px;"></td> <td style="padding: 2px;"></td> <td style="padding: 2px;">#Video BW 300 kHz</td> <td style="padding: 2px;"></td> </tr> <tr> <td style="padding: 2px;"></td> <td style="padding: 2px;"></td> <td style="padding: 2px;">Aug 12, 2022 10:38:02 AM</td> <td style="padding: 2px;">[Icons]</td> </tr> </table>	B4 Swept SA	B5 Swept SA	B6 Swept SA	B7 Swept SA	KEYSIGHT LW	Input: RF Coupling: AC Align: Auto	Input Z: 50 Ω Corrections: On Freq Ref. Int (S)	#Atten: 0 dB Preamp: Off Source: Off		PNO: Fast Gate: Off IF Gain: High Sig Track: Off	Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run	1 2 3 4 5 6 W W W W P p N N N N			Ref Level 110.00 dB μ V/m	Mkr1 1.966 14 GHz 99.68 dB μ V/m	Scale/Div 10 dB	Log	Start 1.000 GHz #Res BW 300 kHz	Stop 6.000 GHz #Sweep ~151 ms (20000 pts)			#Video BW 300 kHz				Aug 12, 2022 10:38:02 AM	[Icons]
B4 Swept SA	B5 Swept SA	B6 Swept SA	B7 Swept SA																									
KEYSIGHT LW	Input: RF Coupling: AC Align: Auto	Input Z: 50 Ω Corrections: On Freq Ref. Int (S)	#Atten: 0 dB Preamp: Off Source: Off																									
	PNO: Fast Gate: Off IF Gain: High Sig Track: Off	Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run	1 2 3 4 5 6 W W W W P p N N N N																									
		Ref Level 110.00 dB μ V/m	Mkr1 1.966 14 GHz 99.68 dB μ V/m																									
Scale/Div 10 dB	Log	Start 1.000 GHz #Res BW 300 kHz	Stop 6.000 GHz #Sweep ~151 ms (20000 pts)																									
		#Video BW 300 kHz																										
		Aug 12, 2022 10:38:02 AM	[Icons]																									

See B7h for this site

Site 11

HG-01

PSA Pre-Energization Survey – Radiated Emissions				
Run	Band	Location		Comment
812-14	B0	Site 11 – HG-01		
				<p>Typical B0 signature seen during the survey with stronger subharmonics.</p> <p>Strong repeated peaks starting at 20 kHz repeating every 20 kHz with noise floor between 120 and 140 dB</p>

PSA Pre-Energization Survey – Radiated Emissions				
Run	Band	Location		Comment
812-15	B1	Site 11 – HG-01		
				<p>This and Site 10 were the only sites that showed no harmonics in this band. A few peaks were observed at higher frequencies.</p>

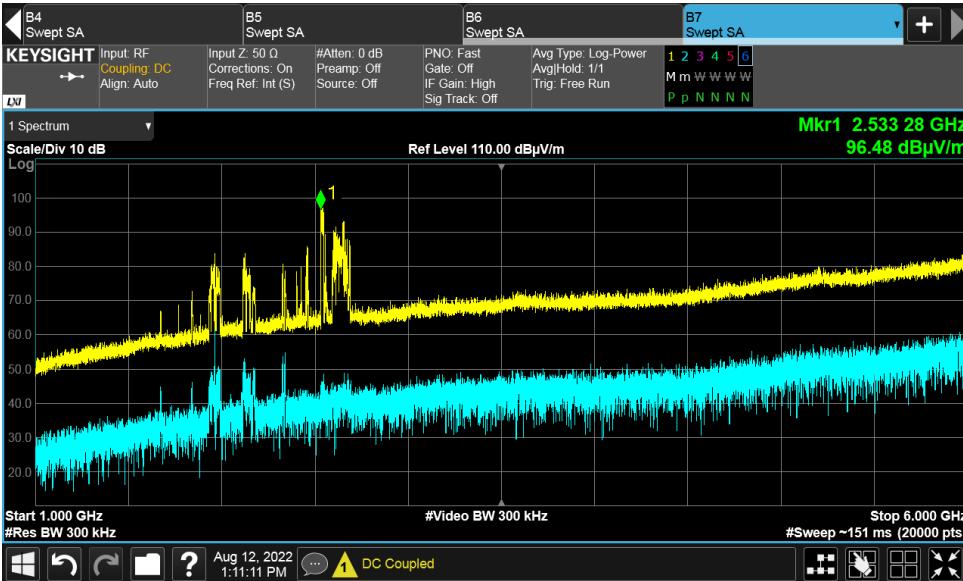
PSA Pre-Energization Survey – Radiated Emissions				
Run	Band	Location		Comment
812-18	B2	Site 11 – HG-01		
 <p>KEYSIGHT Input: RF Coupling: DC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref. Int (S) #Atten: 10 dB Preamp: Off Source: Off PNO: Best Wide Gate: Off IF Gain: Low Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run M m W W W W P p N N N N</p> <p>Mkr1 2.567 776 MHz 121.81 dBμV/m</p> <p>1 Spectrum Scale/Div 10 dB Ref Level 140.00 dBμV/m Log Start 0.500 MHz #Res BW 10 kHz #Video BW 10 kHz Stop 3.000 MHz #Sweep 101 ms (20000 pts)</p> <p>Aug 12, 2022 12:48:48 PM DC Coupled</p>				

PSA Pre-Energization Survey – Radiated Emissions				
Run	Band	Location		Comment
812-19	B3	Site 11 – HG-01		
 <p>KEYSIGHT Input: RF Coupling: DC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref. Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Best Wide Gate: Off IF Gain: Low Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run M m W W W W P p N N N N</p> <p>Mkr1 4.427 76 MHz 117.50 dBμV/m</p> <p>1 Spectrum Scale/Div 10 dB Ref Level 120.00 dBμV/m Log Start 2.500 MHz #Res BW 10 kHz #Video BW 10 kHz Stop 7.500 MHz #Sweep 151 ms (20000 pts)</p> <p>Aug 12, 2022 12:50:59 PM DC Coupled</p>				

PSA Pre-Energization Survey – Radiated Emissions				
Run	Band	Location		Comment
812-20	B4	Site 11 – HG-01		
 <p>KEYSIGHT Input: RF Coupling: DC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref. Int (S) #Atten: 10 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: Low Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run M m W W W W P p N N N N</p> <p>1 Spectrum Scale/Div 10 dB Ref Level 110.00 dBµV/m Log 100 90 80 70 60 50 40 30 20 Start 5.00 MHz #Res BW 100 kHz #Video BW 100 kHz Stop 30.00 MHz #Sweep 101 ms (20000 pts)</p> <p>Aug 12, 2022 12:53:27 PM DC Coupled</p>				

PSA Pre-Energization Survey – Radiated Emissions				
Run	Band	Location		Comment
812-21	B5h	Site 11 – HG-01		
 <p>KEYSIGHT Input: RF Coupling: DC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref. Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: High Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run M m W W W W P p N N N N</p> <p>1 Spectrum Scale/Div 10 dB Ref Level 110.00 dBµV/m Log 100 90 80 70 60 50 40 30 20 Start 25.0 MHz #Res BW 100 kHz #Video BW 100 kHz Stop 325.0 MHz #Sweep 101 ms (20000 pts)</p> <p>Aug 12, 2022 1:07:26 PM DC Coupled</p>				

PSA Pre-Energization Survey – Radiated Emissions				
Run	Band	Location		Comment
812-22	B6h	Site 11 – HG-01		
 <p>KEYSIGHT Input: RF Coupling: DC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref. Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: High Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run M m W W W W P p N N N N</p> <p>Mkr1 939.25 MHz 73.95 dBμV/m</p> <p>1 Spectrum Scale/Div 10 dB Ref Level 100.00 dBμV/m</p> <p>Log</p> <p>Start 0.3000 GHz #Res BW 300 kHz #Video BW 300 kHz Stop 1.3000 GHz #Sweep ~101 ms (20000 pts)</p> <p>Aug 12, 2022 1:10:23 PM DC Coupled</p>				

PSA Pre-Energization Survey – Radiated Emissions				
Run	Band	Location		Comment
812-23	B7h	Site 11 – HG-01		
 <p>KEYSIGHT Input: RF Coupling: DC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref. Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off IF Gain: High Sig Track: Off Avg Type: Log-Power AvgHold: 1/1 Trig: Free Run M m W W W W P p N N N N</p> <p>Mkr1 2.533 28 GHz 96.48 dBμV/m</p> <p>1 Spectrum Scale/Div 10 dB Ref Level 110.00 dBμV/m</p> <p>Log</p> <p>Start 1.000 GHz #Res BW 300 kHz #Video BW 300 kHz Stop 6.000 GHz #Sweep ~151 ms (20000 pts)</p> <p>Aug 12, 2022 1:11:11 PM DC Coupled</p>				

PSA Pre-Energization Survey – Radiated Emissions				
Run	Band	Location		Comment
812-24	B5v	Site 11 – HG-01		
<p>KEYSIGHT Input: RF Coupling: DC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref. Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off AvgType: Log-Power AvgHold: 1/1 IF Gain: High Trig: Free Run Sig Track: Off 1 2 3 4 5 6 M m W W W W P p N N N N</p> <p>1 Spectrum Scale/Div 10 dB Ref Level 110.00 dBµV/m Log Mkr1 198.377 MHz 77.99 dBµV/m</p> <p>Start 25.0 MHz #Res BW 100 kHz Aug 12, 2022 1:14:24 PM #Video BW 100 kHz DC Coupled Stop 325.0 MHz #Sweep 101 ms (20000 pts)</p>				

PSA Pre-Energization Survey – Radiated Emissions				
Run	Band	Location		Comment
812-25	B6v	Site 11 – HG-01		
<p>KEYSIGHT Input: RF Coupling: DC Align: Auto Input Z: 50 Ω Corrections: On Freq Ref. Int (S) #Atten: 0 dB Preamp: Off Source: Off PNO: Fast Gate: Off AvgType: Log-Power AvgHold: 1/1 IF Gain: High Trig: Free Run Sig Track: Off 1 2 3 4 5 6 M m W W W W P p N N N N</p> <p>1 Spectrum Scale/Div 10 dB Ref Level 100.00 dBµV/m Log Mkr1 939.25 MHz 80.33 dBµV/m</p> <p>Start 0.3000 GHz #Res BW 300 kHz Aug 12, 2022 1:16:38 PM #Video BW 300 kHz DC Coupled Stop 1.3000 GHz #Sweep ~101 ms (20000 pts)</p>				

PSA Pre-Energization Survey – Radiated Emissions			
Run	Band	Location	Comment
812-27	B7v	Site 11 – HG-01	
			Compare with B7h for this site. New peaks at lower frequencies, lower peaks at higher frequencies.

Appendix B

Magnetic Field Measurement Results

- Magnetic Field Measurement Sites Log
- Magnetic Field Measurement Run Log
- Magnetic Field Measurement Results Record

Magnetic Field Measurement

Sites Log

Site No.	Short Name	Full Name	Site Notes	Date	Start Time	End Time	Temp (F)	Humid (%)	Cloud Cover	Planned GPS Coordinates	Measurement GPS Coordinates	Distance to planned site (ft)
1	Randall's Island	Randall's Island Information Booth	This site formerly called "Randall's Island Field #43". Measurement location near high voltage transformer.	8/8/22	1:34 PM	2:26 PM	89	57	Cloudy	40.797109, -73.918248	40.795365, -73.919125	700
2	Oak AC Substation	Oak AC Substation	Future Oak AC Substation Site - Parking Lot on Walnut Ave.	8/8/22	6:36 PM	7:02 PM	89	54	Sunny	40.806752, -73.906753	40.806010, -73.906472	300
3	Co-op City	Co-op City Station	School bus parking lot near future passenger station. Heavy machinery moving around about 100 ft behind measurement equipment.	8/9/22	10:00 AM	10:48 AM	88	59	Sunny	40.858275, -73.828892	40.858423, -73.828837	50
4	Morris Park	Morris Park Station	Residence Inn Hotel parking lot near Amazon facility. Near chain link fence and lamp post.	8/9/22	1:30 PM	2:03 PM	93	44	Partly Cloudy	40.849332, -73.844453	40.850762, -73.842747	700
5	Golf Course	Pelham Bay and Split Rock Golf Courses	Golf course parking lot.	8/10/22	8:51 AM	9:30 AM	76	59	Partly Cloudy	40.875269, -73.810160	40.872038, -73.810816	1200
6	New Rochelle	New Rochelle AC Substation	Measurement equipment under 3-phase 60 Hz power cables at busy intersection. Construction site on the other side of the ROW. Measuring 100 ft from the center point of the	8/10/22	10:46 AM	11:16 AM	77	60	Overcast	40.902644, -73.793171	40.902387, -73.793520	150
7	Parkchester-Van Nest	Parkchester-Van Nest Station	Busy street behind antennas. Metal dumpster with chain link fence scraps, 30 ft from the antennas.	8/10/22	3:11 PM	3:52 PM	85	46	Mostly Cloudy	40.842239, -73.861933	40.841690, -73.861618	200
8	Bowery Bay	Bowery Bay AC Substation	Second floor of parking lot for the Mega Contracting business. Contact Callie for site access.	8/11/22	11:41 AM	1:03 PM	80	58	Partly Cloudy	40.764293, -73.905214	40.764183, -73.905127	50
9	HG-02	HG-02 DC Substation	Power line not far overhead from antenna.	8/11/22	3:51 PM	5:18 PM	88	32	Partly Cloudy	40.760644, -73.903683	40.761164, -73.904467	300

Site No.	Short Name	Full Name	Site Notes	Date	Start Time	End Time	Temp (F)	Humid (%)	Cloud Cover	Planned GPS Coordinates	Measurement GPS Coordinates	Distance to planned site (ft)
10	Electric Substation	Electric Substation near Randall's Island	Equipment set up in empty parking lot north of electric substation	8/12/22	9:05 AM	10:35 AM	74	53	Partly Cloudy	40.798477, -73.914738	40.799378, -73.914625	350
11	HG-01	HG-01 DC Substation	Loud area with trucks and cars passing the site regularly. Equipment set up on side walk next to Home Depot storage yard. Power line maybe 80 ft away.	8/12/22	12:34 PM	1:20 PM	80	33	Clear sky	40.751163, -73.914592	40.751295, -73.914385	50

Magnetic Field Measurement

Run Log

MTA PSA Pre Energization Survey Magnetic Emissions Test Log

Test team: Stephane Yu, Temba Mateke, Joe Nicholas, Ursula Monaghan
 Dates: August 8 - 12, 2022

Run ID	Date	Time	Type	Location	Results	Notes / Conditions	Temp (F)	Humid (%)	Cloud cover
808M-02	8/8/22	-	MFE	Randall's Island			89	57	cloudy
808-7	8/8/22	7:14 PM	MFE	Oak AC Substation	Truck entered measurement area from 35 - 100 s.	Chain Link Fence 10 ft South of the MFE. Another Chain Link Fence 60 ft west of MFE. Quiet parking lot, future location of Oak AC Substation. The probe is 6 ft above the substation, with rails overhead.	89	54	Sunny
809-1	8/9/22	10:35 AM	MFE	Co-op City		Amtrak passed at t=35 acceletrain. 60 Hz harmonic spike at t=80s, likely due to tractor operating nearby. Loud machinery	88	59	Sunny
809-2	8/9/22	1:59 PM	MFE	Morris Park		Near lamp post and chain link fence	93	44	Partly Cloudy
810-1	8/10/22	8:43 AM	MFE	Golf Course	Quietest mag field measurement site so far. DC is measurement is ~15 mG higher than at previous locations. Measured 518 mG, based on our location the NOAA says this zip code should be ~512 mG.	Quiet Golf Course Parking Lot.	76	59	Partly Cloudy
810-2	8/10/22	11:05 AM	MFE	New Rochelle	at t=85s, overpass bridge tree trimmer passed over test team, ~50 ft from probe. Highest 60 Hz magnetic field measurements so far: 4.5 mG for 60 Hz and 180 Hz.	Overhead power line ~12 ft horizontal behind the probe. Next to a high traffic street. Construction nearby, just on the other side of the ROW. Tree trimmers on the overpass above teh.	77	60	Overcast
810-3	8/10/22	11:40 AM	MFE	New Rochelle AC Sub - moving test under 3ph power line	Walk from ~10 ft to +20 ft past 3 Phase overhead Power line. Held antenna ~6 ft in the air during traverse. Barely noticeable change.		77	60	Overcast
810-4	8/10/22	3:33 AM	MFE	Parkchester-Van Nest	Amtrak passed at t=79s.	Busy street behind probe. Metal dumpster with chain link fence scraps, 30 ft from the probe.	85	46	Mostly Cloudy
811-1	8/11/22	12:58 PM	MFE	Bowery Bay	at t=30 s, moved the probe from 6 ft above ground to 2 ft above ground, and DC field jumped from 411 to 600 mG. Unsure why, but in an active parking building lot, with cars parked on both sides of the tripod. Large traction Power transformers next to track.	Transformers ~ 80 ft from the probe.	80	58	Partly Cloudy
811-2	8/11/22	1:07 PM	MFE	Bowery Bay	Surrounded by cars and metal objects that may be obstructing field. DC showing at 400. Actual dc in area about 510		80	58	Partly Cloudy
811-3	8/11/22	4:52 PM	MFE	HG-02	Peak 60 Hz is .3 mg at t=59		88	32	Partly Cloudy
812-3	8/12/22	9:57 AM	MFE	Electric Substation	one of the noisiest site. likely the 2nd noisiest behind coop city site for 60 Hz harmonics.	100 ft from rail center line, 100 ft from transformers in the substation. 30 ft from the chain link fence. Chain link fence is between probe and centerline.	74	53	Partly Cloudy
812-4	8/12/22	12:59 PM	MFE	HG-01	LIRR passing between t 30s and t 45s. Traffic and semi-truck movement occurring behind probe. DC field is 470 likely due to being close to semi truck.	100 ft from rail center line, chain link fence 8 ft directly in front of probe. Semi truck parked 10 ft directly to the left to the probe.	80	33	Clear sky

Magnetic Field Measurement

Results Records

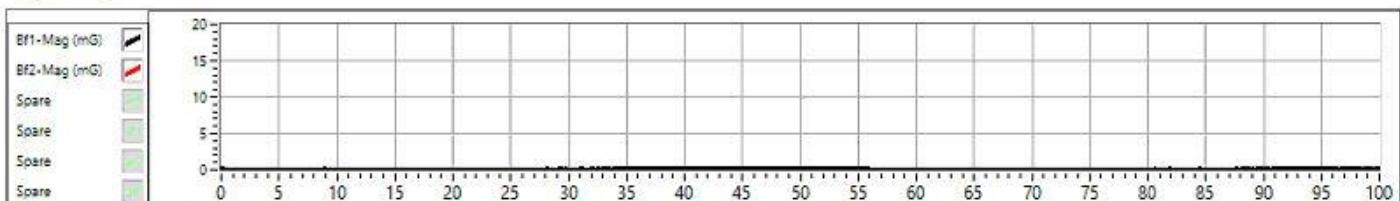
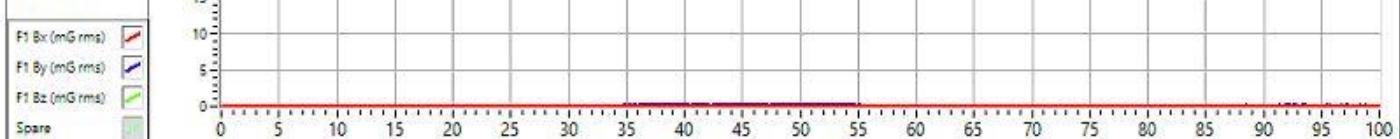
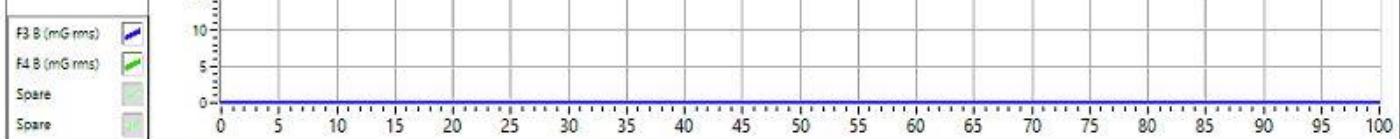
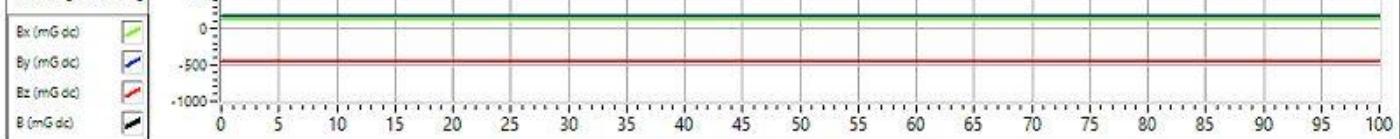
Site 1

Randall's Island Information Center

Tenco TransDAS

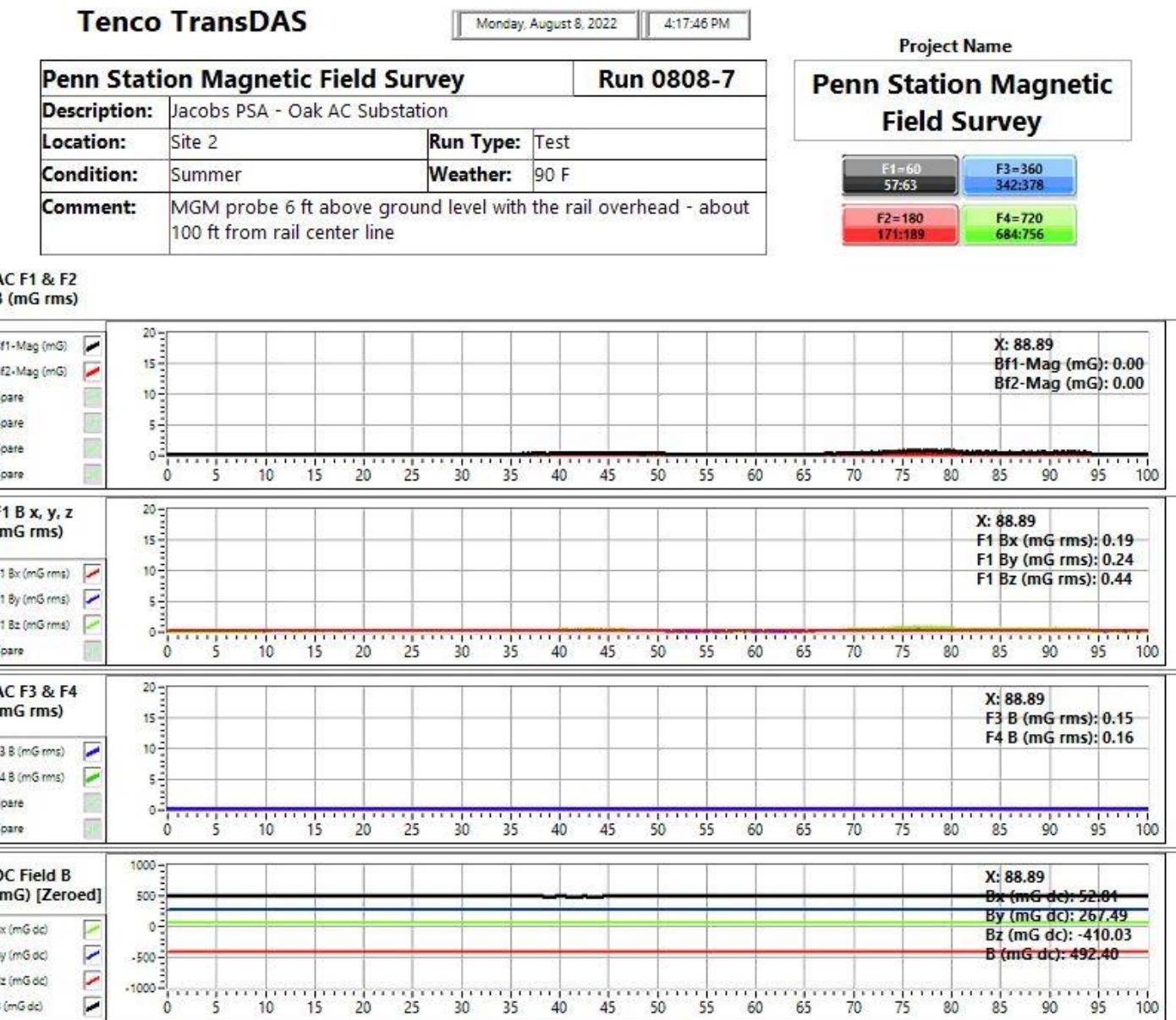
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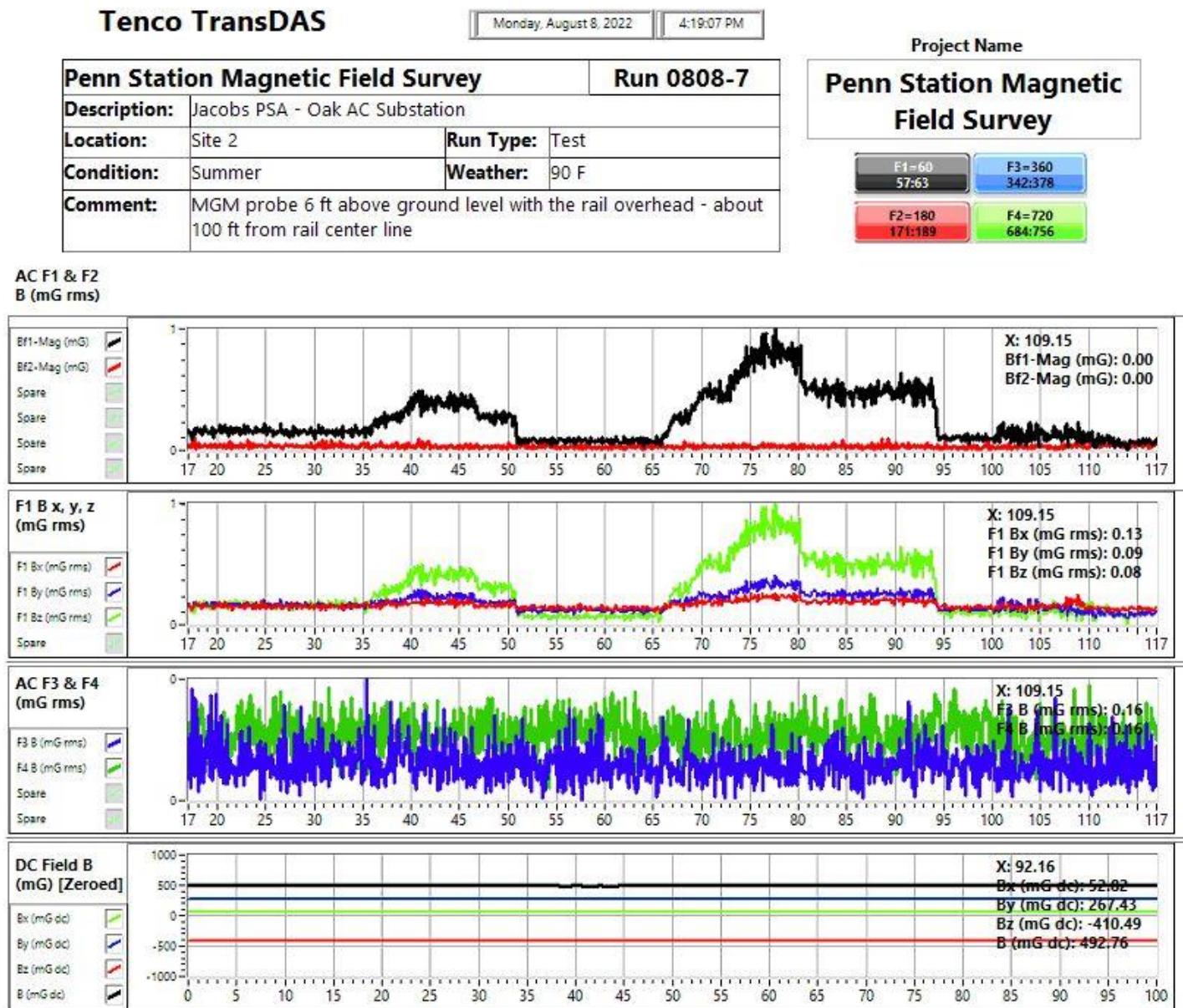
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Description:	Jacobs PSA - Randall's Island Field 12	
Location:	Site 1	Run Type: Test
Condition:	Summer	Weather: 92 F
Comment:		MGM probe 6 ft above ground level with the rail overhead - 100 ft from rail center line - 73 ft north of high voltage transformer

Project Name**Penn Station Magnetic Field Survey**F1=60
57:63F3=360
342:378F2=180
171:189F4=720
684:756**AC F1 & F2**
B (mG rms)**F1 B x, y, z**
(mG rms)**AC F3 & F4**
(mG rms)**DC Field B**
(mG) [Zeroed]

Site 2

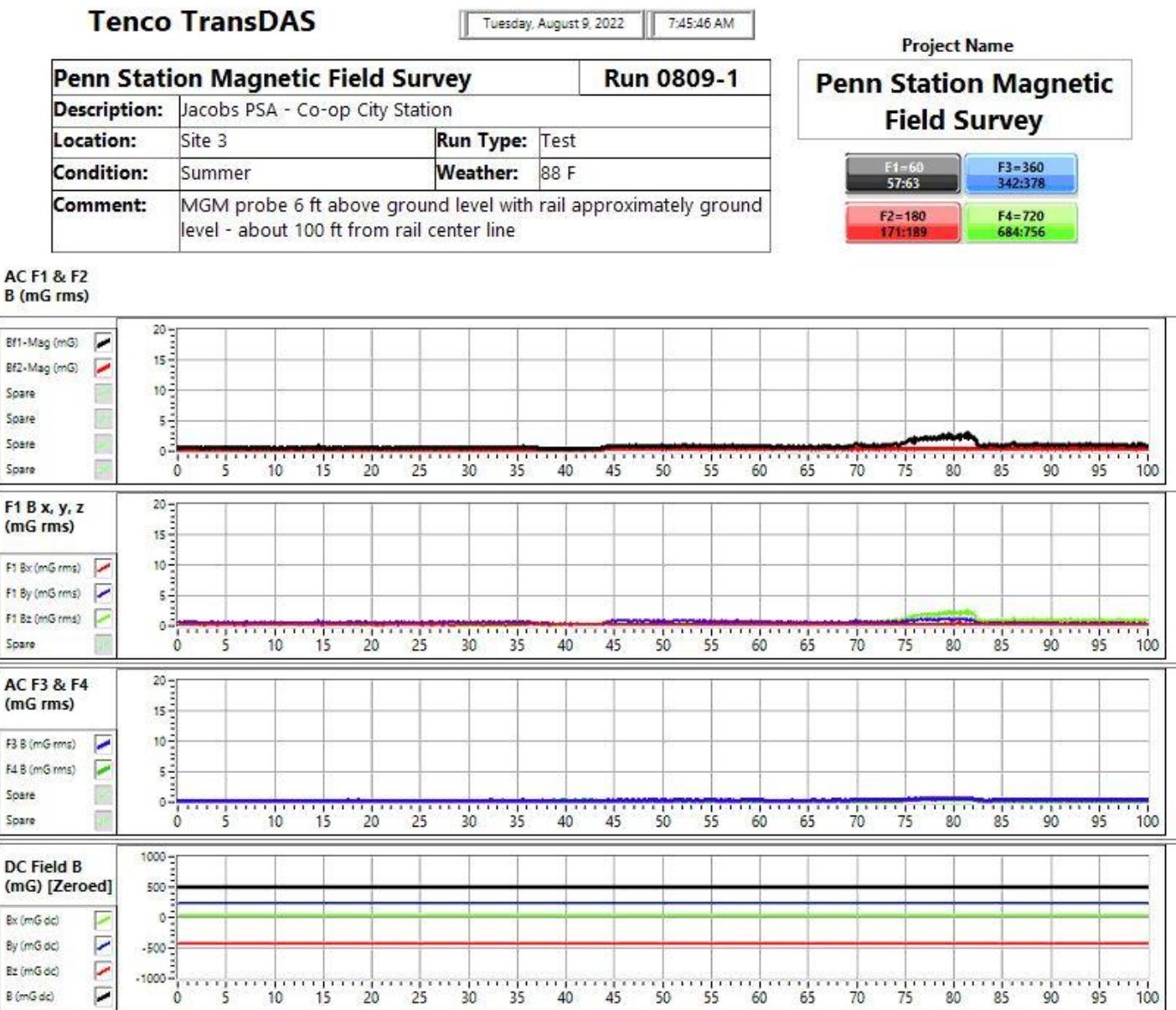
Oak AC Substation





Site 3

Co-op City Station



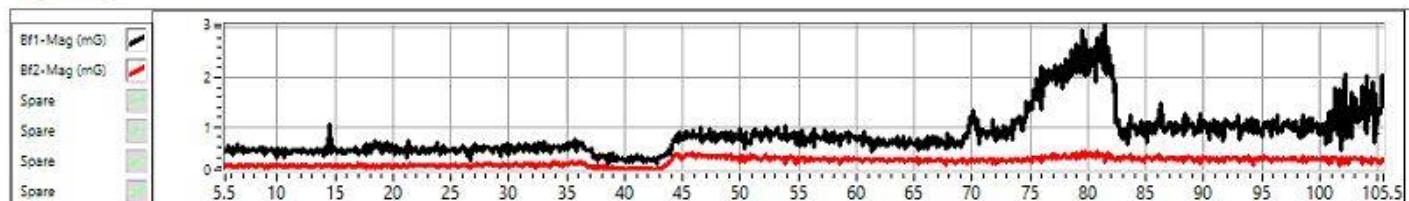
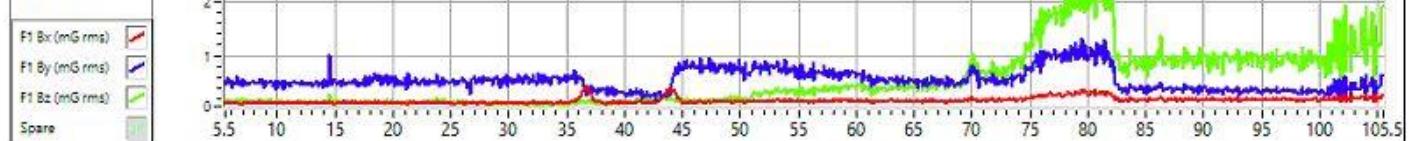
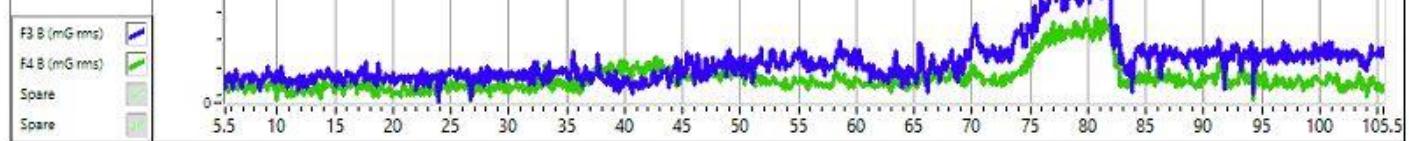
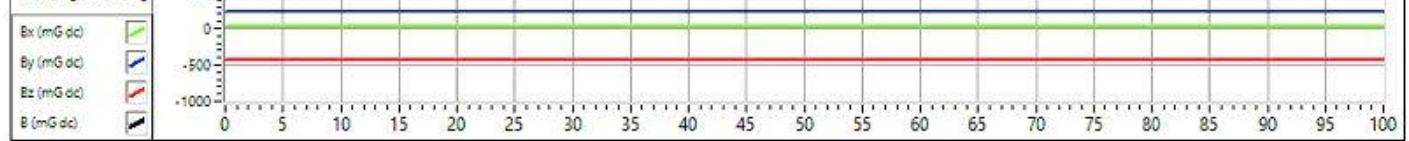
Tenco TransDAS

Tuesday, August 9, 2022 | 7:41:39 AM

Penn Station Magnetic Field Survey		Run 0809-1
Description:	Jacobs PSA - Co-op City Station	
Location:	Site 3	Run Type: Test
Condition:	Summer	Weather: 88 F
Comment:		MGM probe 6 ft above ground level with rail approximately ground level - about 100 ft from rail center line

Project Name**Penn Station Magnetic Field Survey**

F1=60 57:63	F3=360 342:378
F2=180 171:189	F4=720 684:756

AC F1 & F2
B (mG rms)F1 B x, y, z
(mG rms)AC F3 & F4
(mG rms)DC Field B
(mG) [Zeroed]

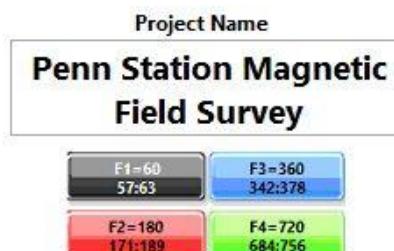
Site 4

Morris Park Station

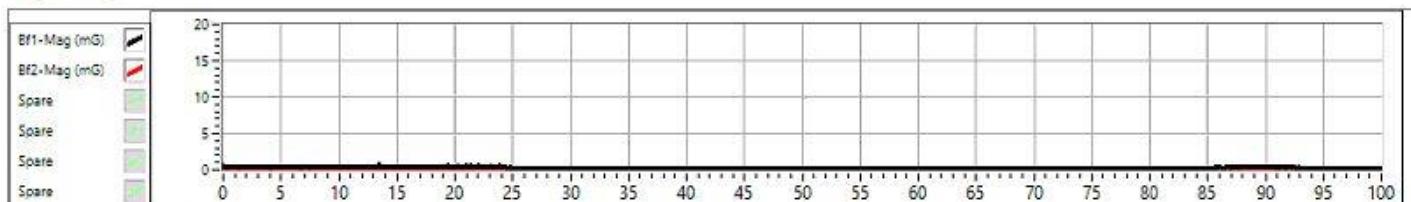
Tenco TransDAS

Tuesday, August 9, 2022 | 11:07:31 AM

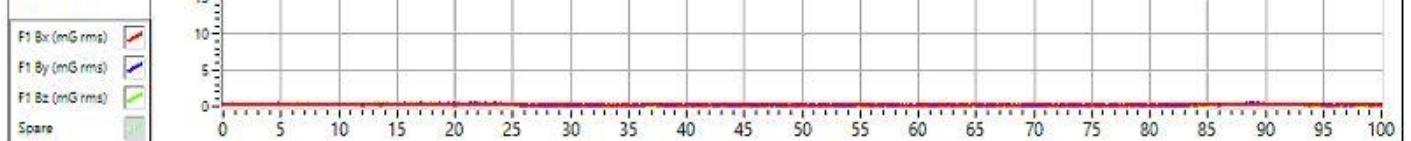
Penn Station Magnetic Field Survey		Run 0809-2
Description:	Jacobs PSA - Morris Park Station	
Location:	Site 4	Run Type: Test
Condition:	Summer	Weather: 95 F
Comment:		MGM probe 6 ft above ground level with rail approximately 10 ft above ground level - about 100 ft from rail center line



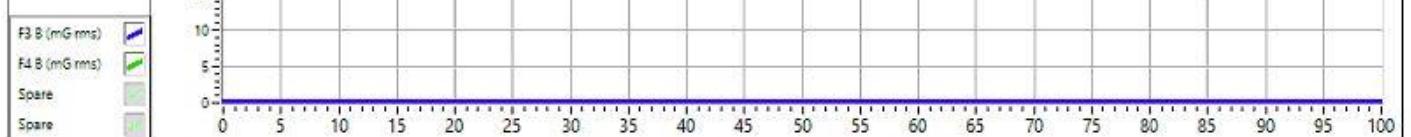
AC F1 & F2
B (mG rms)



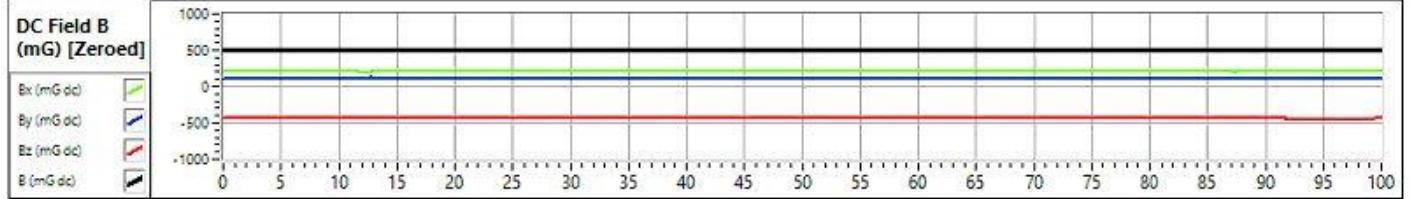
F1 B x, y, z
(mG rms)

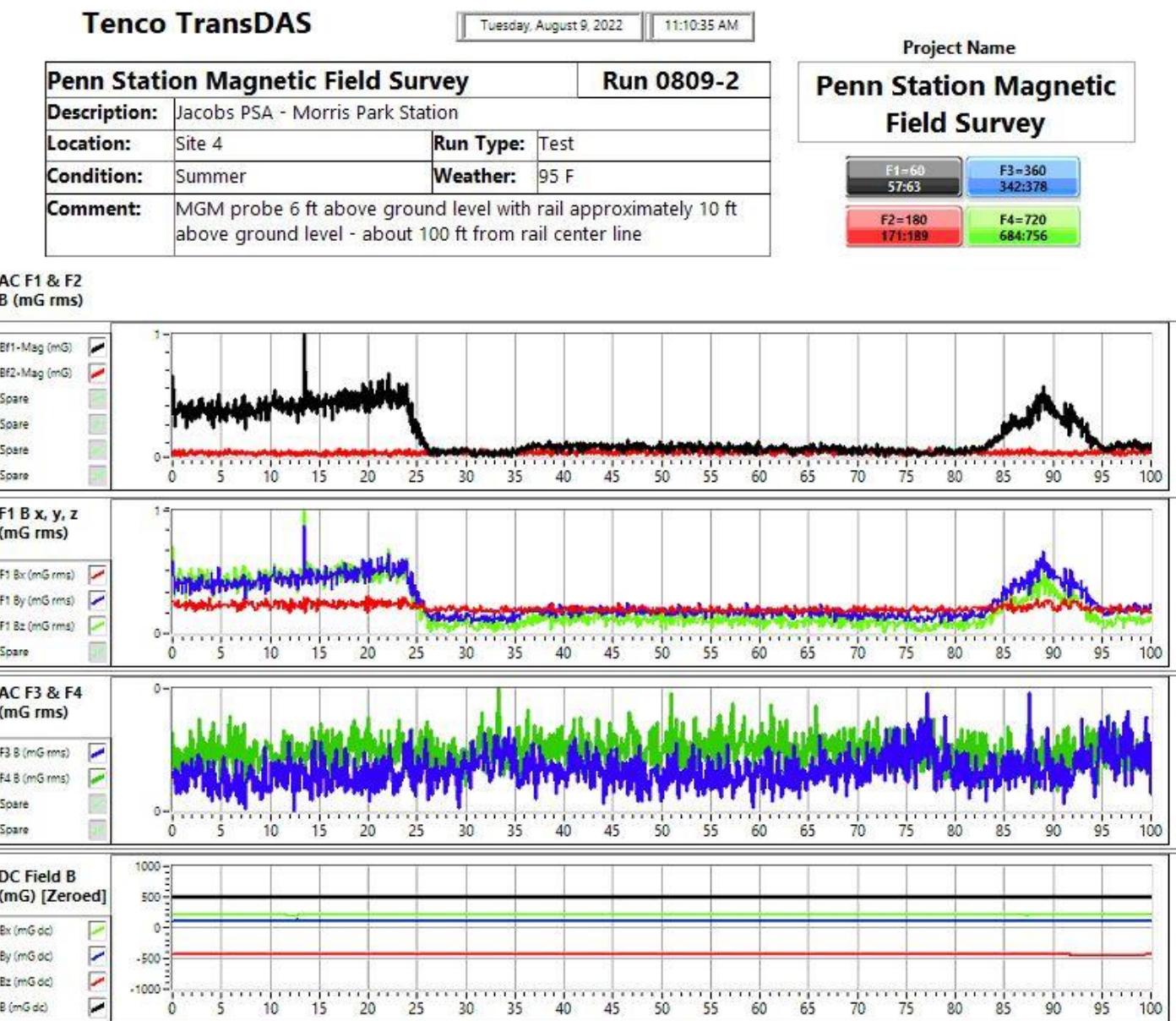


AC F3 & F4
(mG rms)



DC Field B
(mG) [Zeroed]





Site 5

Pelham Bay and Split Rock Golf Courses

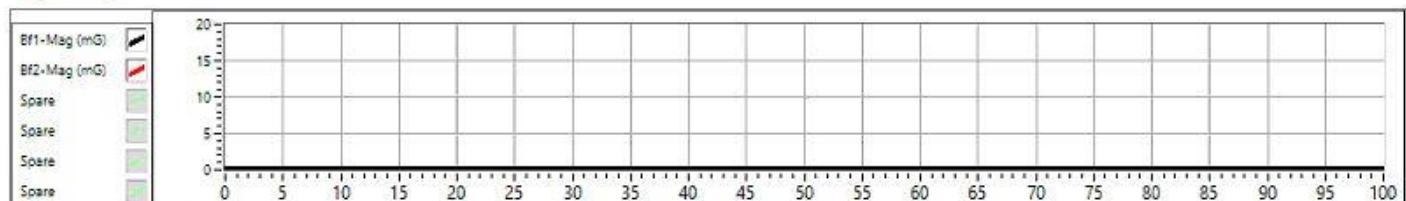
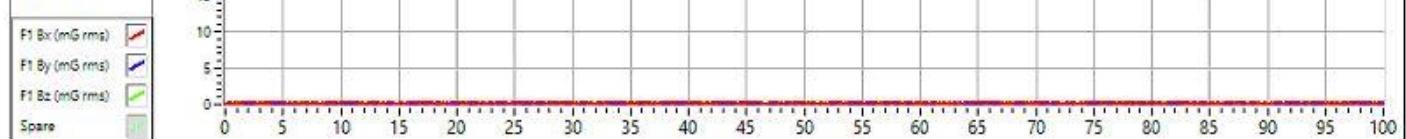
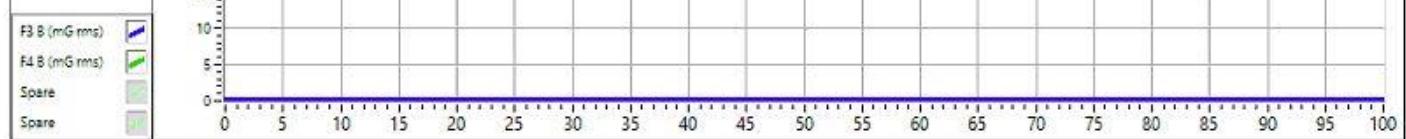
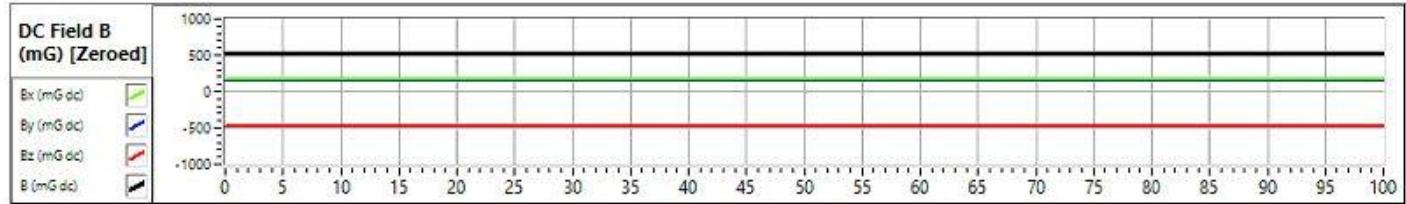
Tenco TransDAS

Wednesday, August 10, 2022 | 5:44:53 AM

Penn Station Magnetic Field Survey		Run 0810-1
Description:	Jacobs PSA - Pelham Golf Course	
Location:	Site 5	Run Type: Test
Condition:	Summer	Weather: 77 F
Comment:		MGM probe 6 ft above ground level with rail approximately 20 ft above ground level - about 180 ft from rail center line

Project Name**Penn Station Magnetic Field Survey**

F1=60 57:63	F3=360 342:378
F2=180 171:189	F4=720 684:756

**AC F1 & F2
B (mG rms)****F1 B x, y, z
(mG rms)****AC F3 & F4
(mG rms)****DC Field B
(mG) [Zeroed]**

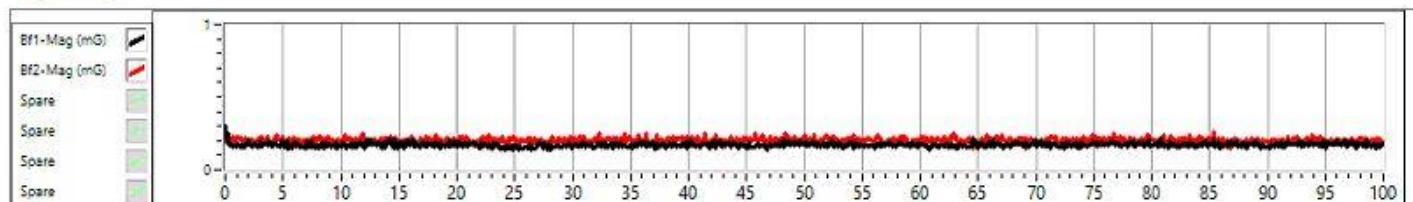
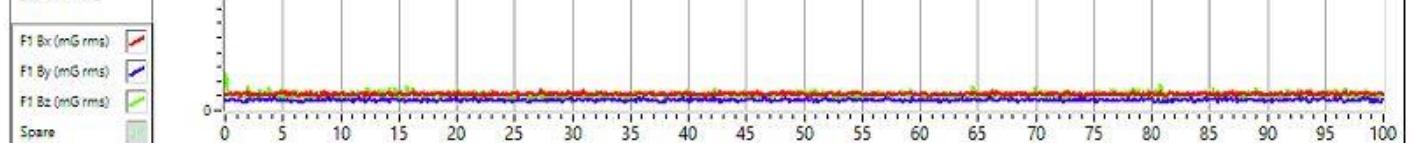
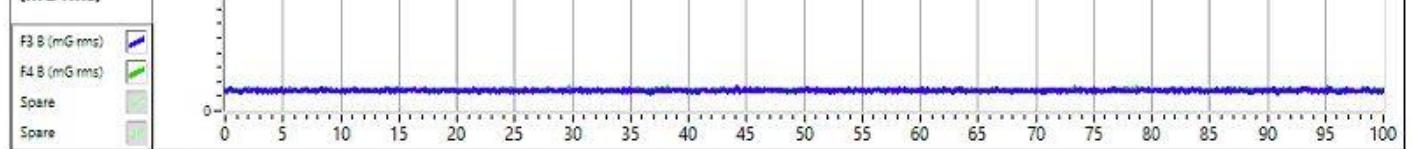
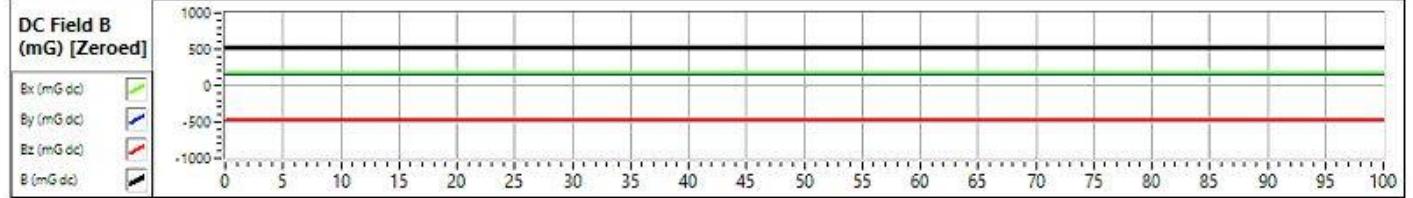
Tenco TransDAS

Wednesday, August 10, 2022 | 5:48:54 AM

Penn Station Magnetic Field Survey		Run 0810-1
Description:	Jacobs PSA - Pelham Golf Course	
Location:	Site 5	Run Type: Test
Condition:	Summer	Weather: 77 F
Comment:		MGM probe 6 ft above ground level with rail approximately 20 ft above ground level - about 180 ft from rail center line

Project Name**Penn Station Magnetic Field Survey**

F1=60 57:63	F3=360 342:378
F2=180 171:189	F4=720 684:756

**AC F1 & F2
B (mG rms)****F1 B x, y, z
(mG rms)****AC F3 & F4
(mG rms)****DC Field B
(mG) [Zeroed]**

Site 6

New Rochelle AC Substation

Tenco TransDAS

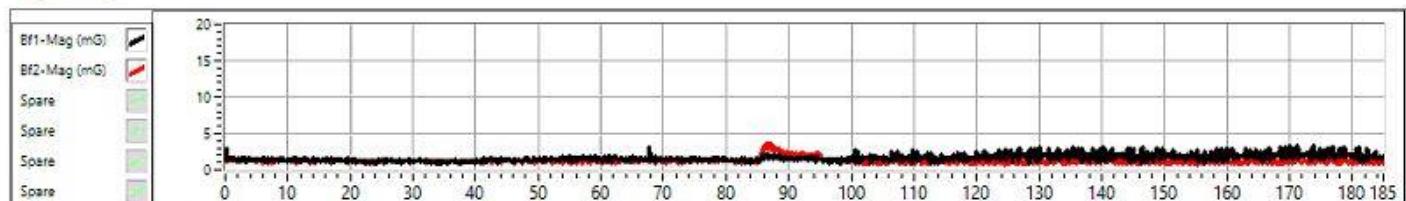
Wednesday, August 10, 2022 | 8:11:19 AM

Penn Station Magnetic Field Survey		Run 0810-2
Description:	Jacobs PSA - New Rochelle AC Substation	
Location:	Site 6	Run Type: Test
Condition:	Summer	Weather: 82 F
Comment: MGM probe 6 ft above ground level with rail approximately 15 ft above ground level - about 110 ft from rail center line		

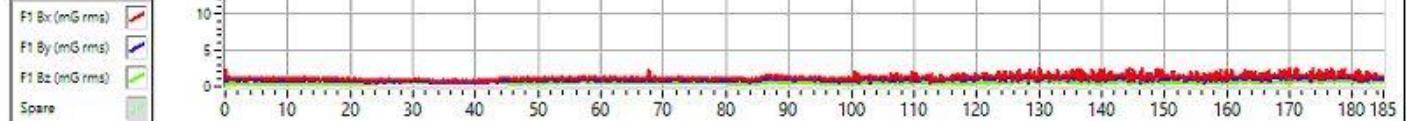
Project Name**Penn Station Magnetic Field Survey**

F1=60 57:63	F3=360 342:378
F2=180 171:189	F4=720 684:756

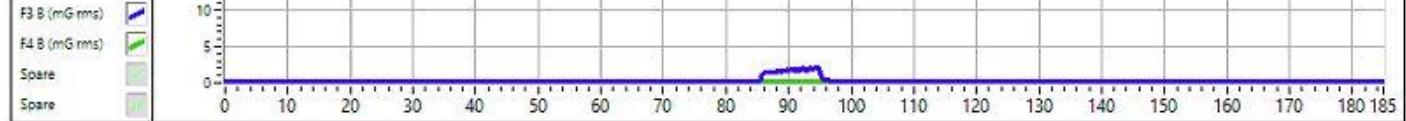
AC F1 & F2
B (mG rms)



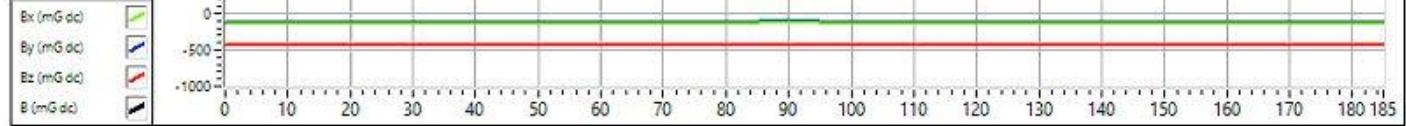
F1 B x, y, z (mG rms)



AC F3 & F4 (mG rms)



DC Field B (mG) [Zeroed]



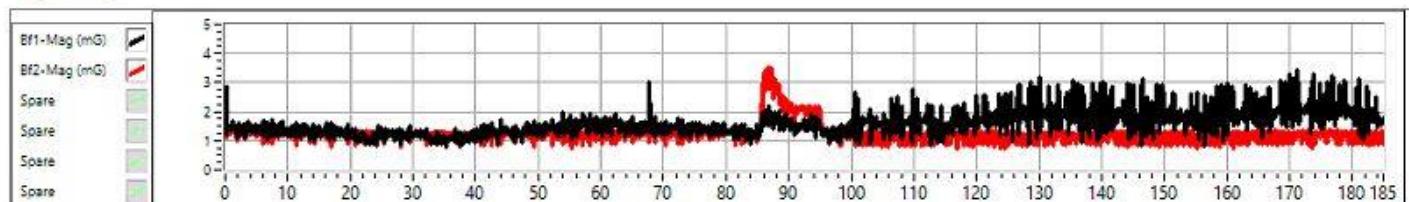
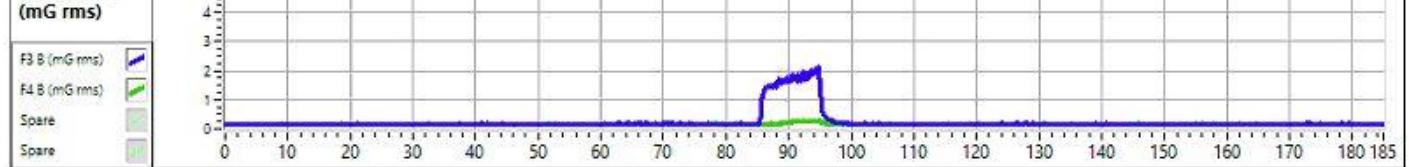
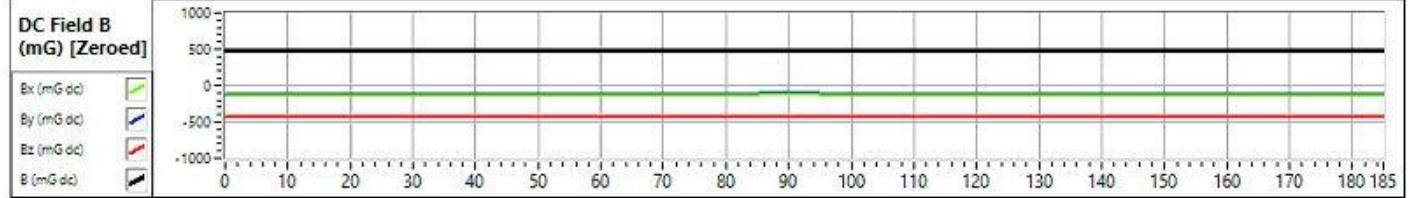
Tenco TransDAS

Wednesday, August 10, 2022 | 8:13:08 AM

Penn Station Magnetic Field Survey		Run 0810-2
Description:	Jacobs PSA - New Rochelle AC Substation	
Location:	Site 6	Run Type: Test
Condition:	Summer	Weather: 82 F
Comment: MGM probe 6 ft above ground level with rail approximately 15 ft above ground level - about 110 ft from rail center line		

Project Name**Penn Station Magnetic Field Survey**

F1=60 57:63	F3=360 342:378
F2=180 171:189	F4=720 684:756

AC F1 & F2
B (mG rms)**F1 B x, y, z (mG rms)****AC F3 & F4 (mG rms)****DC Field B (mG) [Zeroed]**

Site 7

Parkchester-Van Nest Station

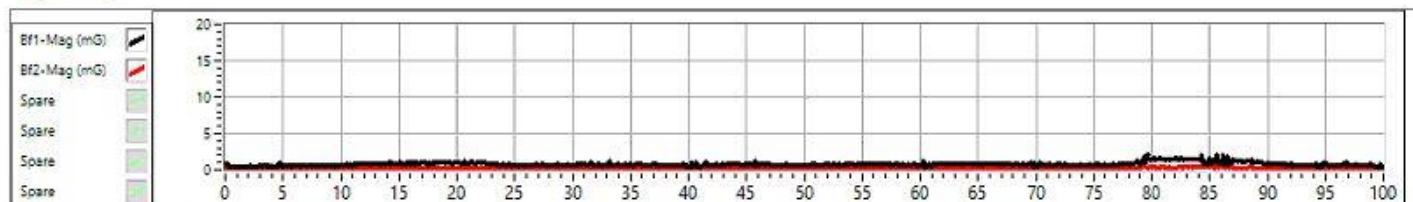
Tenco TransDAS

Wednesday, August 10, 2022 | 12:37:41 PM

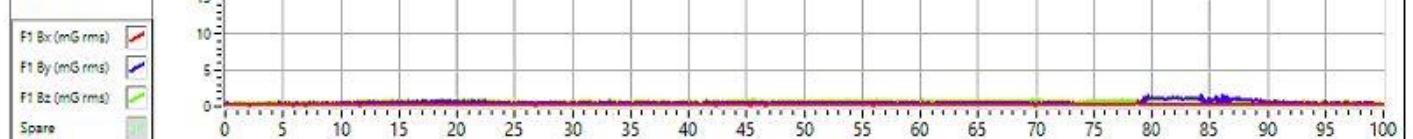
Penn Station Magnetic Field Survey		Run 0810-4
Description:	Jacobs PSA - Parkchester - Van Ness Station	
Location:	Site 7	Run Type: Test
Condition:	Summer	Weather: 85 F
Comment:		MGM probe 6 ft above ground level with rail approximately ground level - about 100 ft from rail center line

Penn Station Magnetic Field Survey	
F1=60 57:63	F3=360 342:378
F2=180 171:189	F4=720 684:756

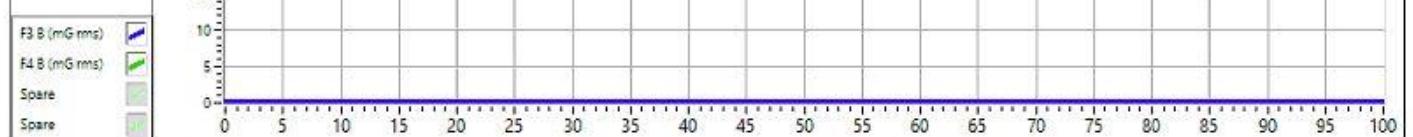
AC F1 & F2
B (mG rms)



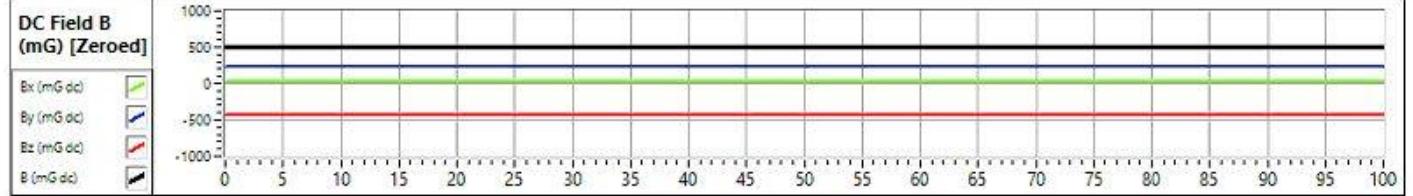
F1 B x, y, z
(mG rms)



AC F3 & F4
(mG rms)



DC Field B
(mG) [Zeroed]



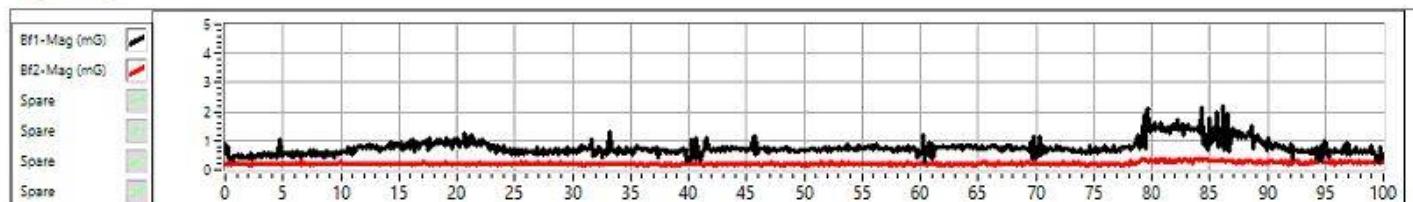
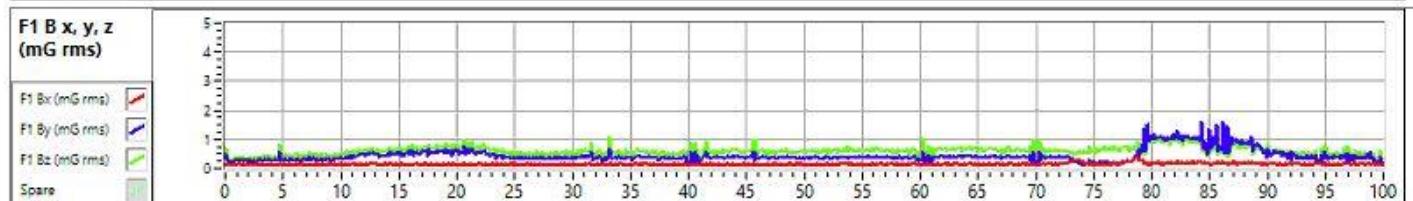
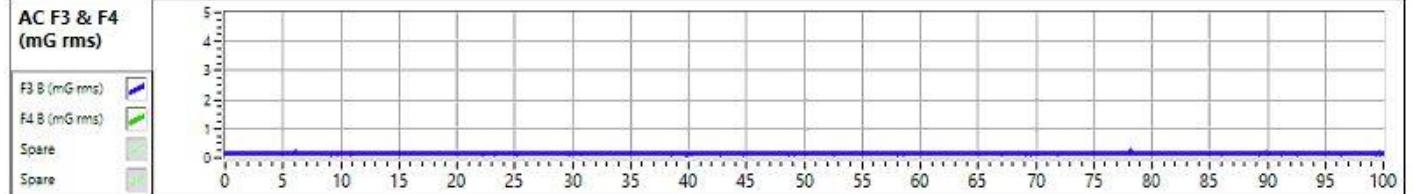
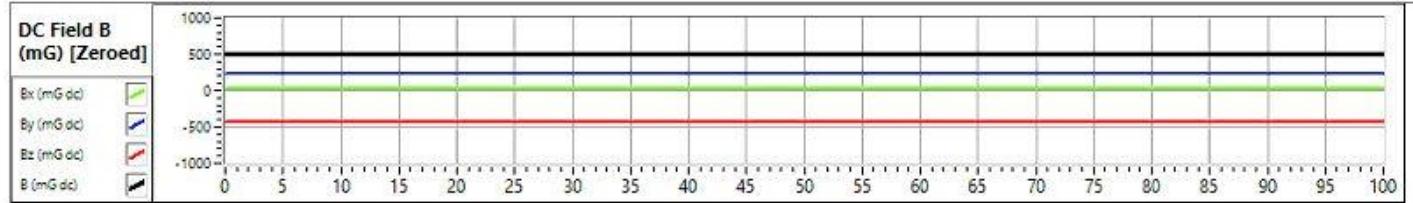
Tenco TransDAS

Wednesday, August 10, 2022 | 12:40:12 PM

Penn Station Magnetic Field Survey		Run 0810-4
Description:	Jacobs PSA - Parkchester - Van Ness Station	
Location:	Site 7	Run Type: Test
Condition:	Summer	Weather: 85 F
Comment:		MGM probe 6 ft above ground level with rail approximately ground level - about 100 ft from rail center line

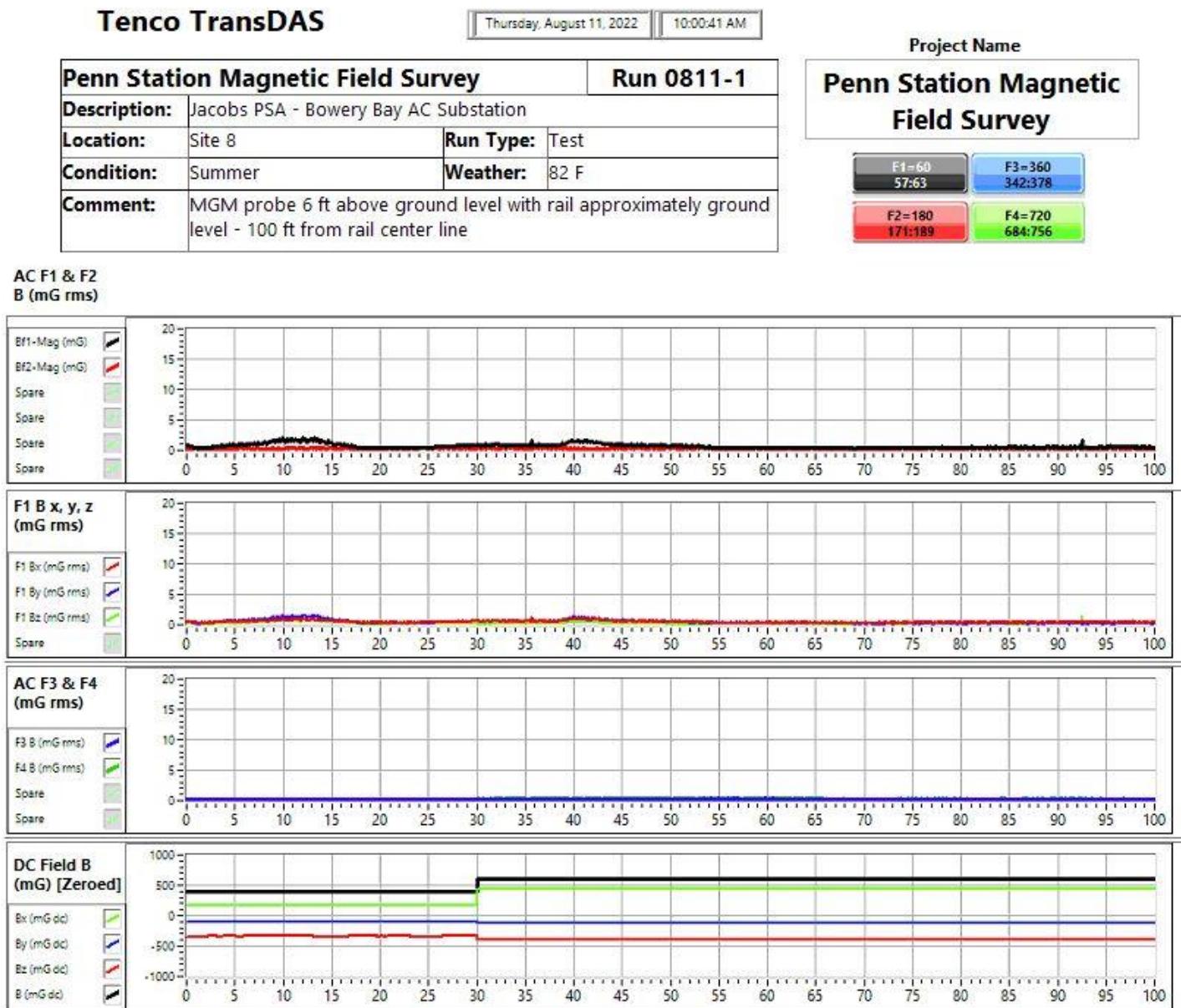
Project Name**Penn Station Magnetic Field Survey**

F1=60 57:63	F3=360 342:378
F2=180 171:189	F4=720 684:756

AC F1 & F2
B (mG rms)F1 B x, y, z
(mG rms)AC F3 & F4
(mG rms)DC Field B
(mG) [Zeroed]

Site 8

Bowery Bay AC Substation



Tenco TransDAS

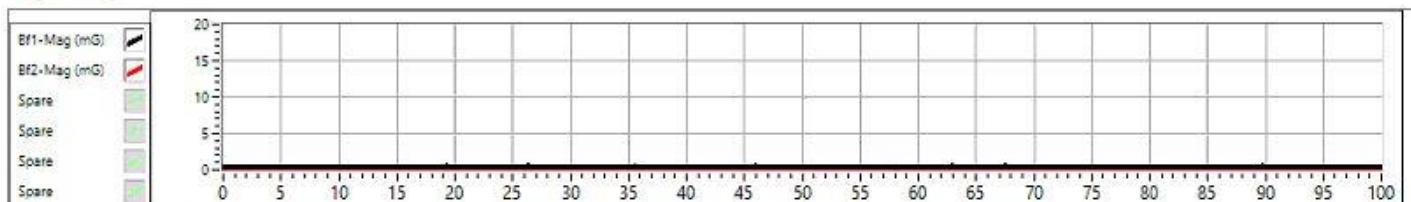
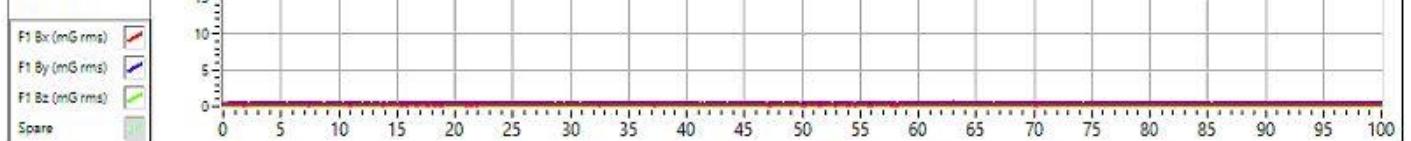
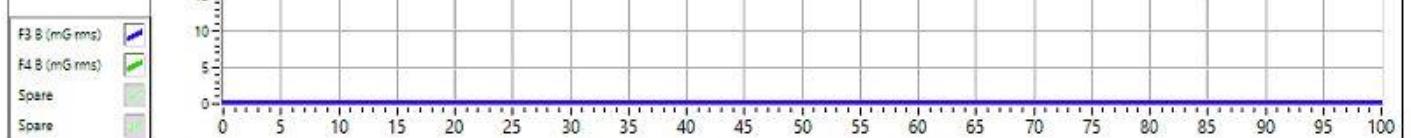
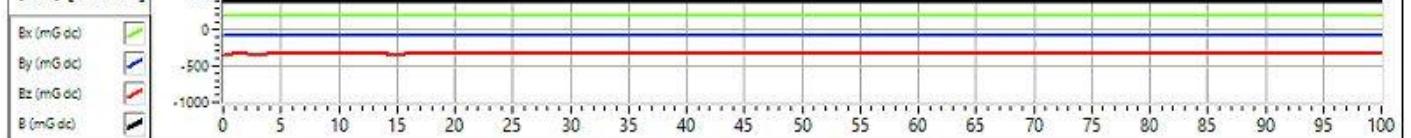
Thursday, August 11, 2022

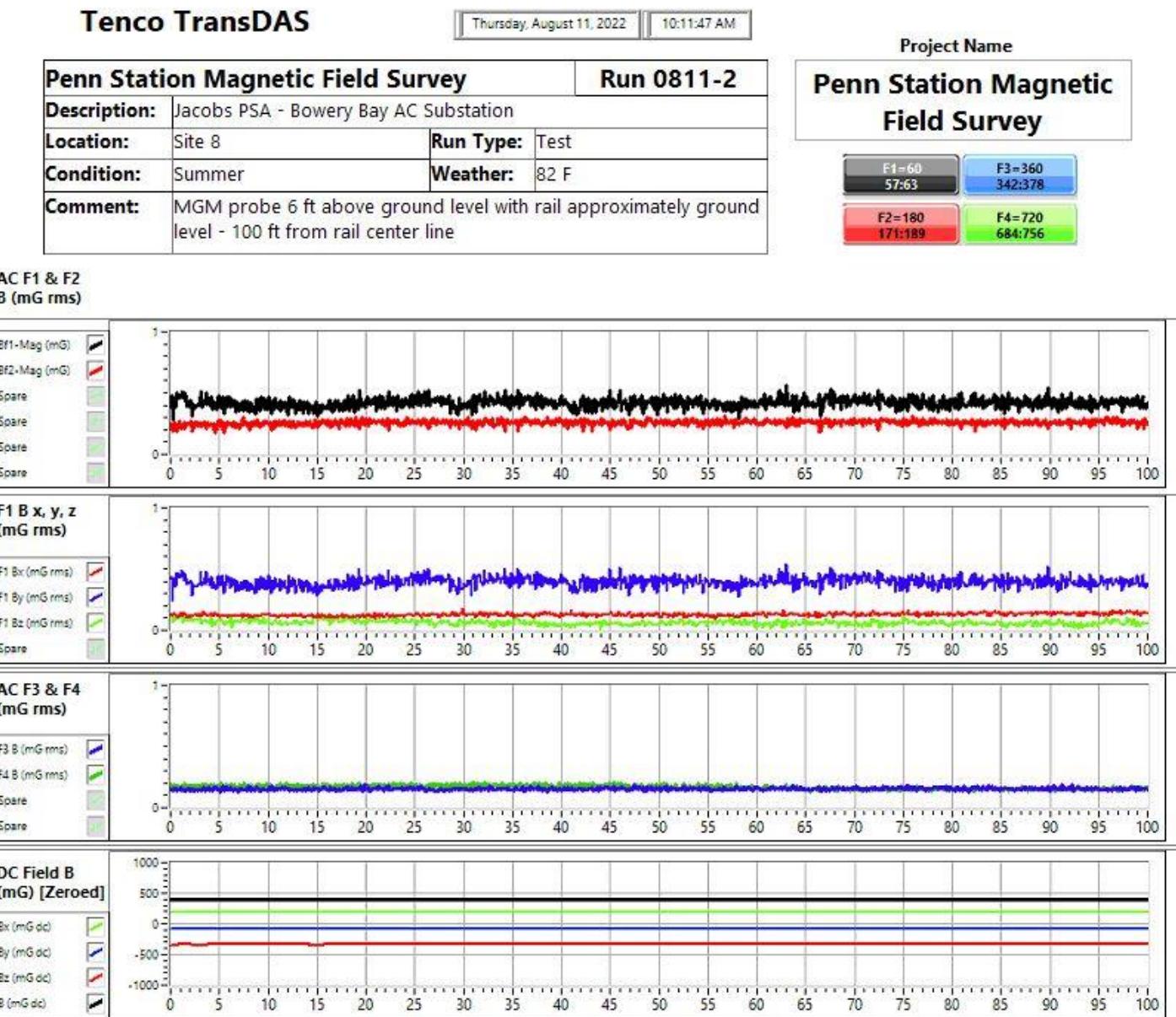
10:09:48 AM

Penn Station Magnetic Field Survey		Run 0811-2
Description:	Jacobs PSA - Bowery Bay AC Substation	
Location:	Site 8	Run Type: Test
Condition:	Summer	Weather: 82 F
Comment:		MGM probe 6 ft above ground level with rail approximately ground level - 100 ft from rail center line

Project Name**Penn Station Magnetic Field Survey**

F1=60 57:63	F3=360 342:378
F2=180 171:189	F4=720 684:756

**AC F1 & F2
B (mG rms)****F1 B x, y, z
(mG rms)****AC F3 & F4
(mG rms)****DC Field B
(mG) [Zeroed]**



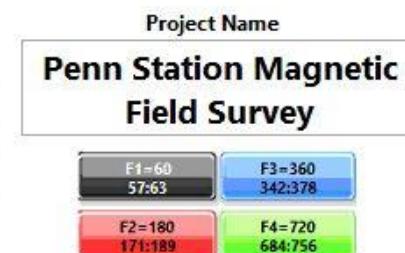
Site 9

HG-02

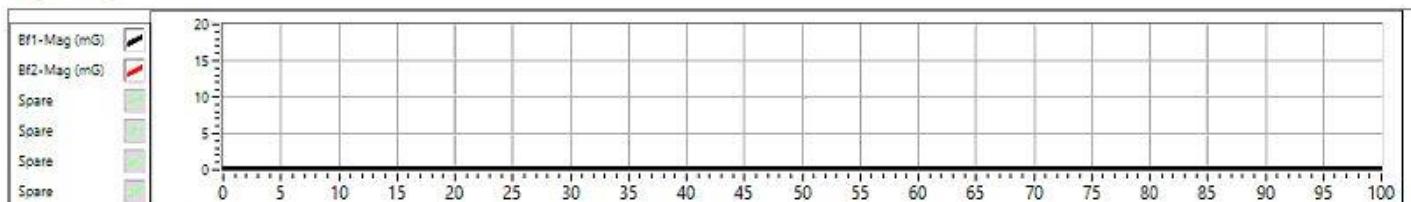
Tenco TransDAS

Thursday, August 11, 2022 | 1:56:46 PM

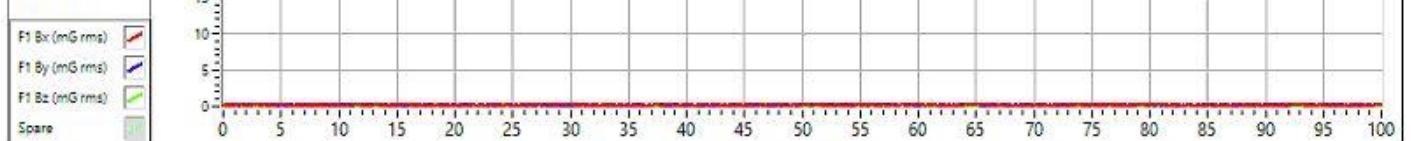
Penn Station Magnetic Field Survey		Run 0811-3
Description:	Jacobs PSA - HG-01 DC Substation	
Location:	Site 9	Run Type: Test
Condition:	Summer	Weather: 89 F
Comment:		MGM probe 6 ft above ground level with rail approximately 30 ft below the rail. 100 ft horizontal from ROW centerline.



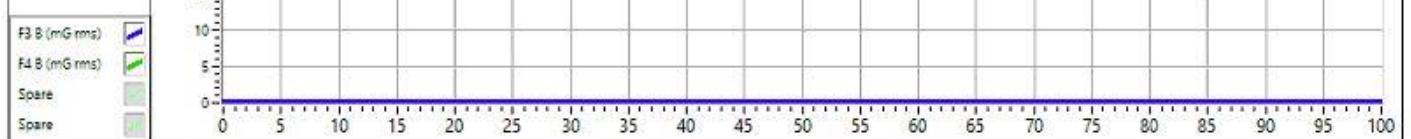
AC F1 & F2
B (mG rms)



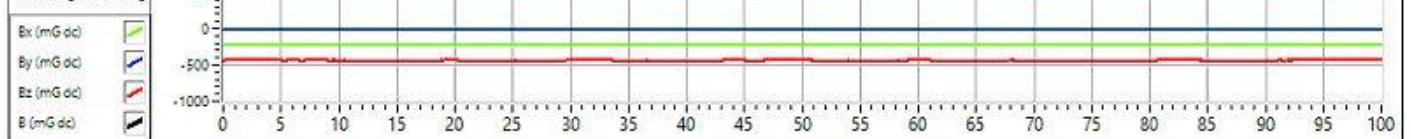
F1 B x, y, z
(mG rms)



AC F3 & F4
(mG rms)



DC Field B
(mG) [Zeroed]



Tenco TransDAS

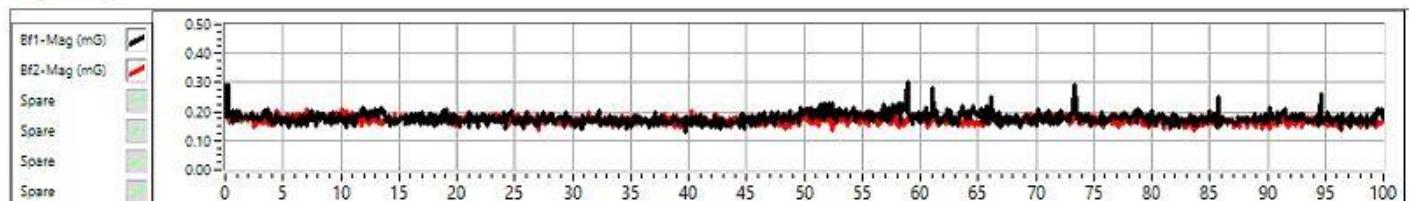
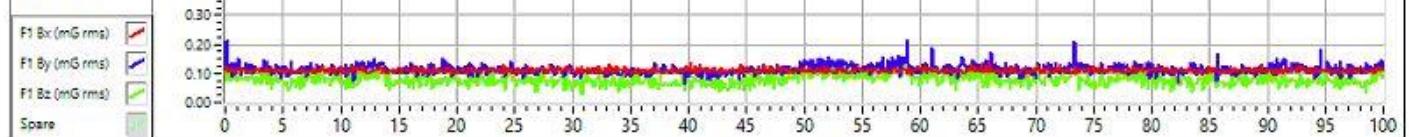
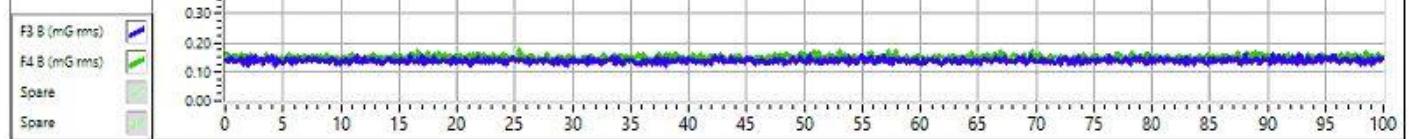
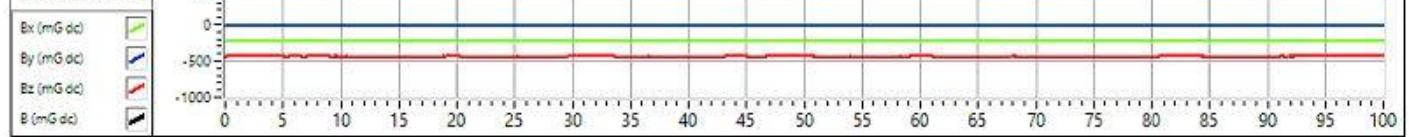
Thursday, August 11, 2022

2:06:09 PM

Penn Station Magnetic Field Survey		Run 0811-3
Description:	Jacobs PSA - HG-01 DC Substation	
Location:	Site 9	Run Type: Test
Condition:	Summer	Weather: 89 F
Comment:		MGM probe 6 ft above ground level with rail approximately 30 ft below the rail. 100 ft horizontal from ROW centerline.

Project Name**Penn Station Magnetic Field Survey**

F1=60 57:63	F3=360 342:378
F2=180 171:189	F4=720 684:756

AC F1 & F2
B (mG rms)**F1 B x, y, z**
(mG rms)**AC F3 & F4**
(mG rms)**DC Field B**
(mG) [Zeroed]

Site 10

Electric Substation near Randall's Island

Tenco TransDAS

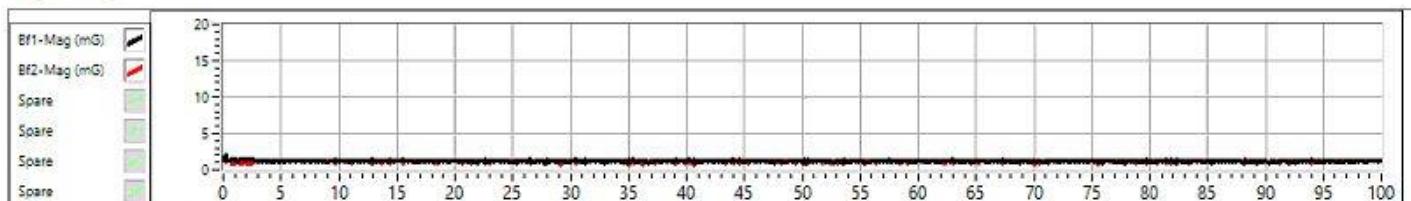
Friday, August 12, 2022 | 6:59:53 AM

Penn Station Magnetic Field Survey		Run 0812-3
Description:	Jacobs PSA - Electric Substation near Randalls Island	
Location:	Site 10	Run Type: Test
Condition:	Summer	Weather: 73 F
Comment: MGM probe 6 ft above ground level with the rail overhead - 100 ft from rail center line - 30 ft below track, 50 ft from sub xformers		

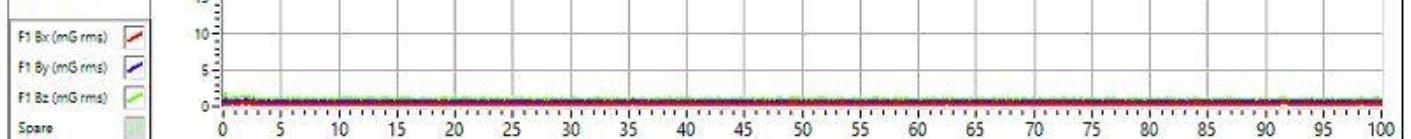
Project Name**Penn Station Magnetic Field Survey**

F1=60 57:63	F3=360 342:378
F2=180 171:189	F4=720 684:756

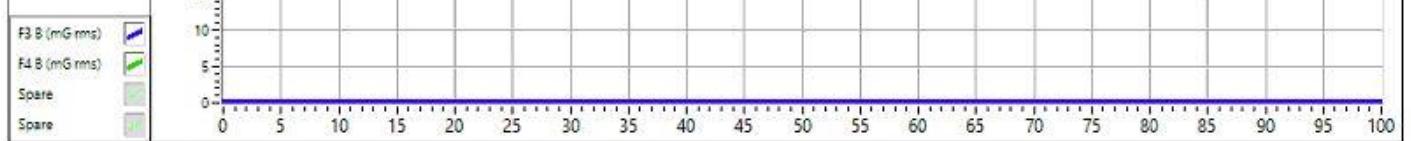
AC F1 & F2
B (mG rms)



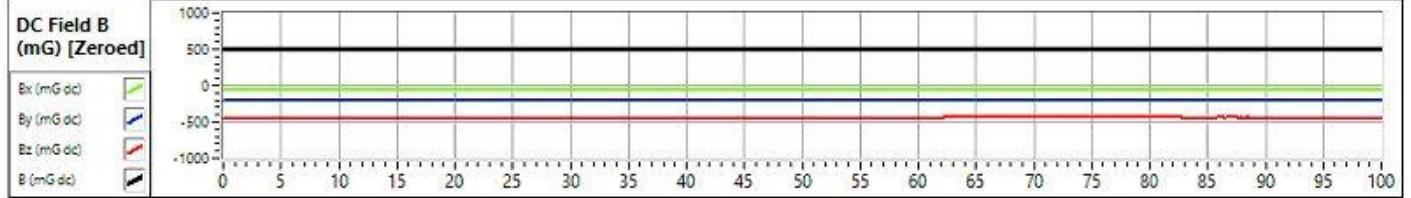
F1 B x, y, z
(mG rms)



AC F3 & F4
(mG rms)



DC Field B
(mG) [Zeroed]



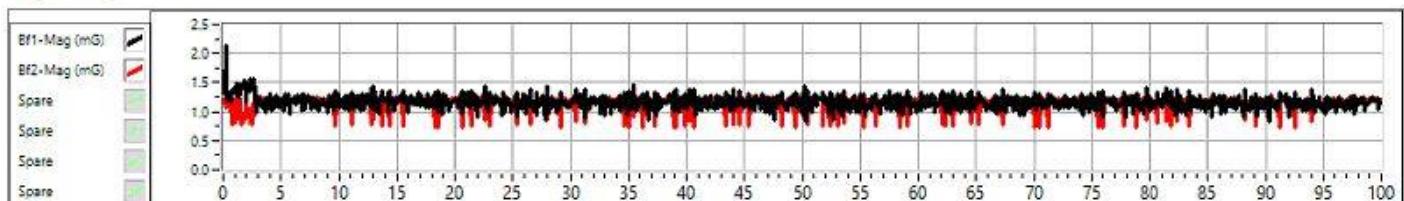
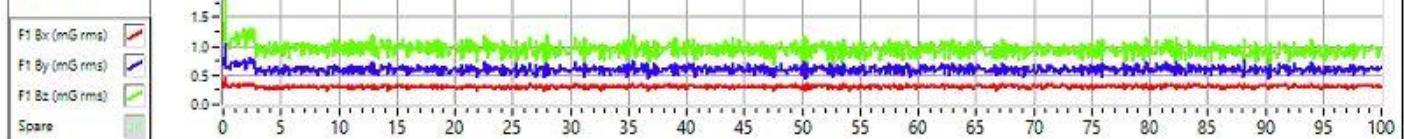
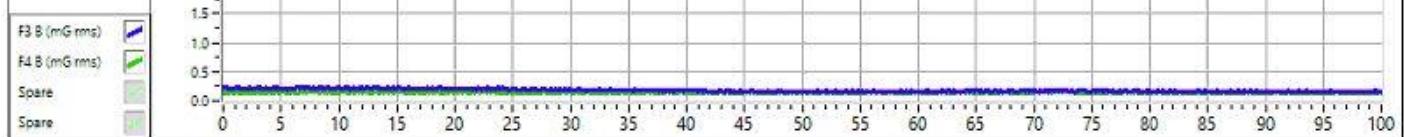
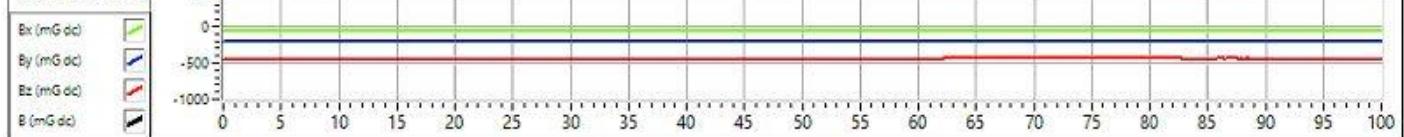
Tenco TransDAS

Friday, August 12, 2022 | 7:08:40 AM

Penn Station Magnetic Field Survey		Run 0812-3
Description:	Jacobs PSA - Electric Substation near Randalls Island	
Location:	Site 10	Run Type: Test
Condition:	Summer	Weather: 73 F
Comment: MGM probe 6 ft above ground level with the rail overhead - 100 ft from rail center line - 30 ft below track, 50 ft from sub xformers		

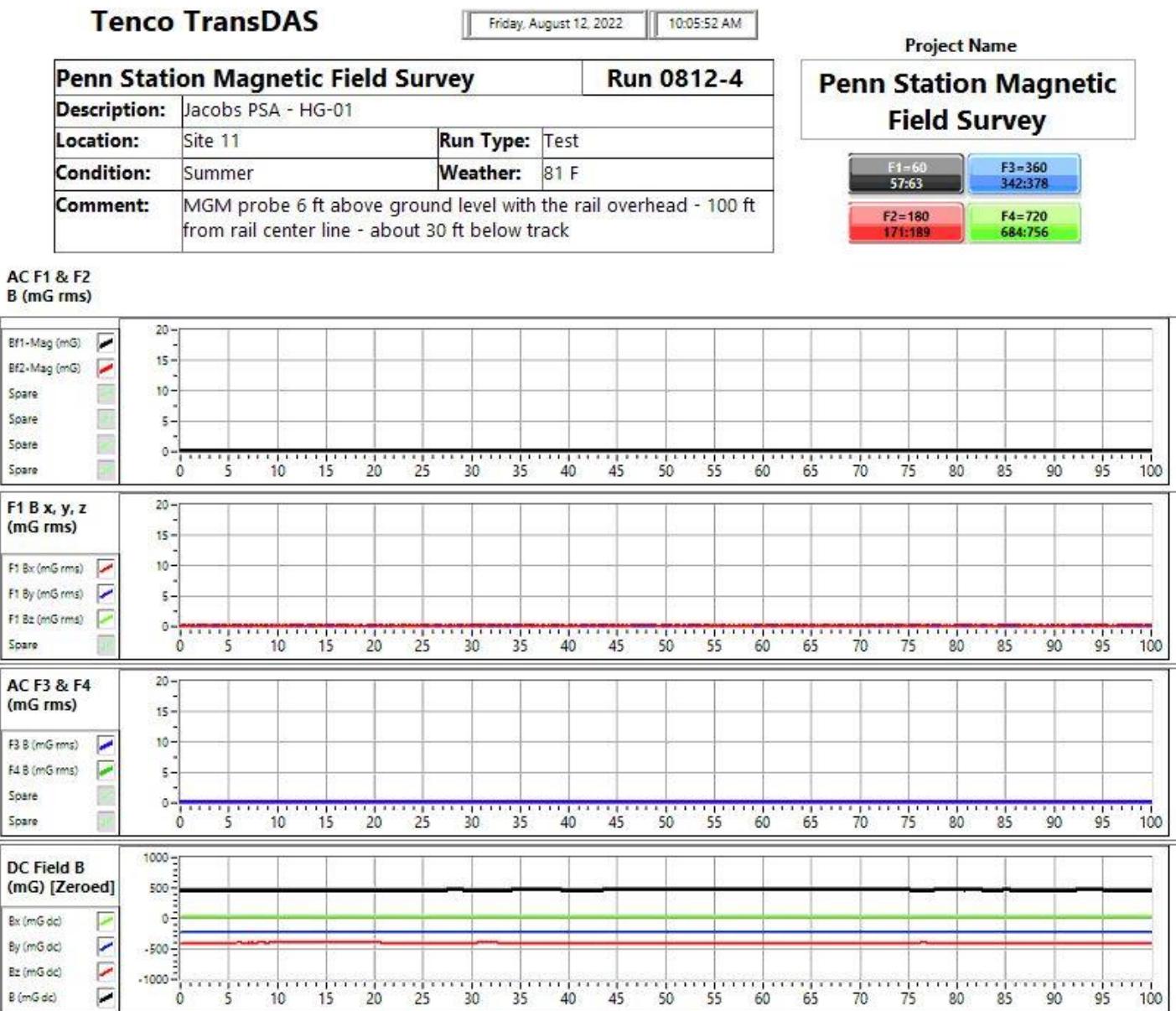
Project Name**Penn Station Magnetic Field Survey**

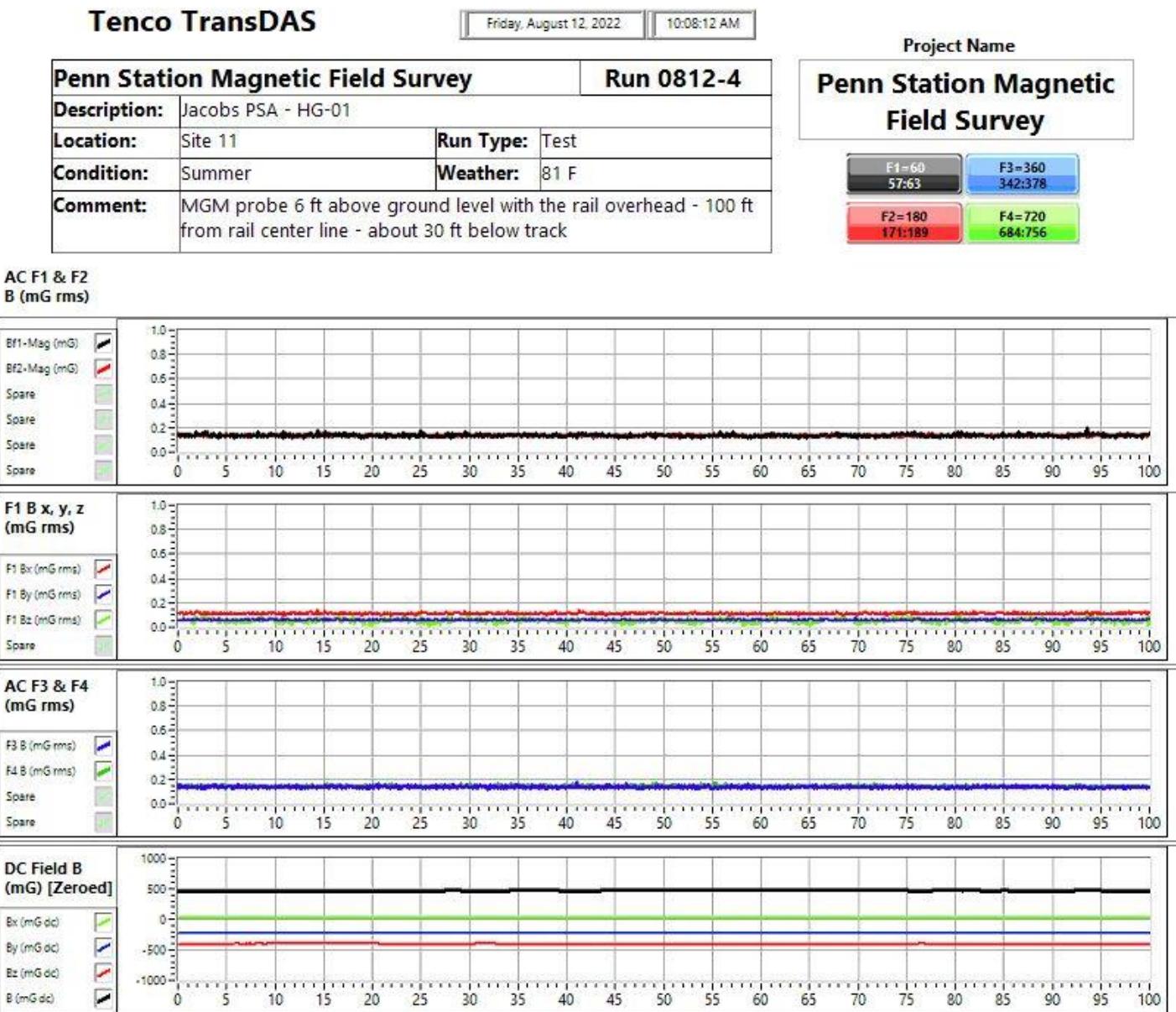
F1=60 57:63	F3=360 342:378
F2=180 171:189	F4=720 684:756

AC F1 & F2
B (mG rms)**F1 B x, y, z**
(mG rms)**AC F3 & F4**
(mG rms)**DC Field B**
(mG) [Zeroed]

Site 11

HG-01





Appendix C

Equipment Calibration Records

- PSA Pre-Energization Survey Calibration Record Table
- Milligauss Meter Calibration Certificate
- EXA Signal Analyzer Calibration Certificate
- Bilogic Antenna Calibration Certificate and Antenna Correction Factors
- Monopole Antenna Calibration Certificate and Antenna Correction Factors

PSA Pre-Energization Survey

Calibration Record Table

Recorded by: Stephane Yu, Temba Mateke, Joe Nicholas, Ursula Monaghan

Date: 08/08/2022

TCC Spectral Analysis Equipment Calibration Record Table				
#	Item	Manufacturer	Model/Serial Number	Calibration / Date
1	TransDAS Data Acquisition System	Tenco	TransDas	Internal Cal.
2	Three Axis DC Milligauss Magnetometer with Analog Outputs	AlphaLab Inc.	Model #MR3 Serial #843	July 13, 2022
3	RF Signal Analyzer with EMI Measurement application	Keysight Technologies	AT/N9010B-507;C Serial #MY57110397	July 7, 2022
4	Biological Antenna 25 MHz to 7 GHz	A.H. Systems	SAS-521F-7 Serial #249	July 22, 2022
5	Passive Monopole Antenna 10 kHz to 60 MHz	A.H. Systems, Inc.	SAS-550-1 Serial #1437	July 22, 2022
6	Laptop computer	Lenovo	E550	
7				
8				

Milligauss Meter
Calibration Certificate



ALPHALAB INC.

Certificate of Calibration

Model MR3
Serial # 843

This AlphaLab, Inc. Magnetoresistive 3 Axis Milligauss Meter is certified to display DC magnetic flux density in each axis with a scaling accuracy of +/-0.5% (of reading) over the temperature range -1°C to 43°C (30°F to 110°F) in the dynamic range 0 to +/-1999.9 milligauss. Accuracy of absolute zero field level as factory-calibrated is +/-0.5 milligauss. The linearity over the range is +/-0.2% and this unit was calibrated at fields of +/- 0.500 and 1.500 gauss +/- 0.1% in a Helmholtz coil.

Calibration was performed by a Helmholtz coil with calibrated field strength, traceable to NIST or to natural physical constants. Verification of the coil field strength is performed at least once every six months by direct measurement of lengths and electrical current. The current measurement in the Helmholtz coil was done with an Extech Instruments Model 560A Multimeter, serial #Z335975. The Helmholtz dimensions were measured using a Mitutoyo 500-321 Digimatic Caliper, serial #7043458. Calibration of the multimeter and the caliper were done using ISO/IEC 17025 and ANSI/NCSL Z540-1 traceable to NIST standards and is current and performed annually. Uncertainty of the standards is less than +/-1%, so the TAR is greater than 4:1.

	Applied Field	As Received	As Returned
X	415.75	414.35	415.7
Y	415.75	414.7	415.75
Z	415.75	414.35	415.65

All gains recalibrated to +/-0.15%, offsets to +/-0.2 milligauss.

Ambient conditions during primary calibration were temperature 23° +/- 1°C, RH 40% +/- 5%.

This certificate of calibration is valid for one year.

Calibration requested by:

Turner Engineering
18814 Fairfield Rd
Northridge, CA 91326

Calibration performed by:

Tristan Volpe

JUL 13 2022

Date

EXA Signal Analyzer

Calibration Certificate



1830 West Airfield Drive
DFW Airport, Texas 75261

Calibration Certificate Traceability Statement

Asset Number: 1208140
MFG/Model Number: AT/N9010B-507;C
Serial Number: MY57110397
Description: EXA Signal Analyzer
Customer: TURNER ENGINEERING CORPORATION
Address: 432 EAST 120TH STREET APT 4W
NEW YORK NY 10035
Customer P.O. No: CREDIT CARD/RA 1850547
Rental Agreement Number: 1850547-0
Certificate Number: 185054701208140227 7

This certificate applies to the instrument identified above and shall not be reproduced, except in full, without written approval of TRS-RenTelco.

This certifies that the above instrument was calibrated to manufacturer's specifications using approved procedures and traceable measurement standards.

This calibration was performed by TRS-RenTelco, located at 1830 West Airfield Drive DFW Airport, TX 75261.

The Quality System of TRS-RenTelco is registered by UL DQS Certificate Number 10000112 to the Quality Management System Standard ISO 9001:2015. TRS-RenTelco's Laboratory is in compliance with MIL-STD-45662A, ANSI/NCSL Z540-1-1994, ISO/IEC 17025:2017 and ISO 10012-2003.

Measurement standards are calibrated at planned intervals. Traceability is to the International System of Units (SI) through the National Institute of Standards and Technology (NIST) or other recognized National Metrology Institute (NMI), natural physical constants, consensus standards, or by ratio type measurements using self calibrating techniques. Supporting documentation relative to traceability is available for review by appointment.

This instrument is initially being sent to the above customer calibrated and fully functional. Before being placed in service, the instrument was properly stored after being calibrated. Calibration interval time is started when the instrument is initially placed in service.

Although the calibration laboratory is in compliance with ANSI/NCSL Z540-1-1994 and MIL-STD-45662A this calibration certificate is issued only as a Traceability Statement and does not carry the requirement of recalibration at the end of rental and customer notification of Out of Tolerance conditions.

TRS-RenTelco's calibration interval for this instrument is 24 months.

Conditions of calibration are as follows:

Temperature:	23 °C	Relative Humidity:	42 %
Calibration Procedure:	CS943838.28	Calibration Date:	Jul 07, 2022
Calibrated By:	CHRISTOPHER SIKES	In Service Date:	Jul 22, 2022
		Calibration Due Date:	Jul 22, 2024

Quality Assurance:

Peel Off Sticker Here →

TRS-RenTelco 800-621-6354
ID: 1208140 Cal: 07/07/22
SIKESCH Due: 07/22/24
In Service Date: 07/22/22

Certificate Print Date: July 25, 2022

Page 1 of 2

91021-1

Form Date: May 18, 2016



RenTelco
1830 West Airfield Drive
DFW Airport, Texas 75261

Calibration Certificate Traceability Statement

Asset Number: 1208140
MFG/Model Number: AT/N9010B-507.C
Serial Number: MY57110397
Description: EXA Signal Analyzer
Customer: TURNER ENGINEERING CORPORATION
Address: 432 EAST 120TH STREET APT 4W
 NEW YORK NY 10035
Customer P.O. No: CREDIT CARD/RA 1850547
Rental Agreement Number: 1850547-0
Certificate Number: 185054701208140227 7

Laboratory Standards

MFG/MDL	Description	Asset	Cal. Type	Cal. Date	Due Cal
AT/8482A	POWER SENSOR	1040708	CAL	Oct 20, 2021	Oct 20, 2022
AT/11582A	ATTENUATOR SET	1049043	CAL	Feb 25, 2022	Feb 25, 2023
AT/E8257D-550	50 GHz PSG Analog Signal Generator	1062722	CAL	Jan 18, 2022	Jan 18, 2024
AT/53132A	UNIVERSAL COUNTER	1062841	CAL	Mar 12, 2021	Mar 12, 2023
AT/8485A	POWER SENSOR	1083906	CAL	Dec 03, 2021	Dec 03, 2022
AT/8482A-H84	STANDARD POWER SENSOR	1096809	CAL	Jan 24, 2022	Jan 24, 2023
WENZEL/500-13438	ULTRA-LOW NOISE REFERENCE SOURCE	1118642	CAL	Apr 07, 2022	Apr 07, 2023
AT/86205A	DIRECTIONAL BRIDGE	1133586	CAL	May 13, 2022	May 13, 2023
AT/11667B	POWER SPLITTER	1148925	CAL	Nov 10, 2021	Nov 10, 2022
AT/8485D	POWER SENSOR	1186991	CAL	Jul 16, 2021	Jul 16, 2022
AT/11667A	POWER SPLITTER	1180486	CAL	Aug 20, 2021	Aug 20, 2022
AT/E8257D-550	SIGNAL GENERATOR	1193254	CAL	Feb 11, 2022	Feb 11, 2024
AT/3458A	8- 1/2-Digital Multimeter	1194748	CAL	Sep 15, 2021	Sep 15, 2022
STD/AT/8494H	11 dB, DC - 18 GHz Programmable Step Attenuator	1217023	CAL	Aug 11, 2021	Aug 11, 2022
STD/AT/8498H	110 dB, DC - 18 GHz Programmable Step Attenuator	1217024	CAL	Aug 11, 2021	Aug 11, 2022
STD/AT/N1914A;E	EPM Series 4 Channel Power Meter	1218255	CAL	Jun 08, 2022	Jun 08, 2024
PEND/GPS-68	GPS-controlled frequency standard,	1245620	CAL	Nov 18, 2021	Nov 18, 2023
AT/8485D	POWER SENSOR	988389	CAL	Dec 03, 2021	Dec 03, 2022
AT/33250A	FUNCTION/ARB GEN	996063	CAL	Apr 25, 2022	Apr 25, 2023
AT/8485A	STANDARD POWER SENSOR	9972	CAL	Dec 03, 2021	Dec 03, 2022

Peel Off Sticker Here ---> **TRS-RenTelco 800-621-6354**
 ID: 1208140 Cal. 07/07/22
 SIKESCH Due: 07/22/24
 In Service Date: 07/22/22

Certificate Print Date: July 25, 2022

Page 2 of 2

91021-1

Form Date: May 18, 2016

Bilogic Antenna
Calibration Certificate



A.H. Systems, Inc.
9710 Cozycroft Ave
Chatsworth, CA 91311



Tel: (818) 998-0223 • sales@AHSystems.com
Fax: (818) 998-6892 • www.AHSystems.com

Certificate Number: 2207-9833

Certificate of Calibration

The instrument identified below has been individually calibrated per the following standard(s):

AHSI Procedure No. 5.04 Rev 21-Jul-17, ref ARP-958 rev S
ANSI C63.5-2017 Calibration and Qualification of Antennas

Manufacturer: A.H. Systems, inc.

Date Calibrated: 22-Jul-22

Model Number: SAS-521F-7

Calibration Interval: 12 Months

Serial Number: 249

Calibration Due Date: 22-Jul-23

Customer: Turner Engineering Corporation

Temperature: 77 F (25 0 C)

Humidity: 68% Relative Humidity

Remarks:

This calibration is traceable to the National Institute of Standards and Technology through documents on file in the Chatsworth Metrology Laboratory. Copies of NIST Traceability and test reports are available upon request. All calibrations conform to ANSI/NCSL Z540-1-1994 and ISO/IEC 17025:2017. Uncertainties listed are derived from methods described by NIST Tech Note 1297.

Measurement Standards and Equipment Used:

Manufacturer	Model Number	SN	Due Date
Agilent	E5061B	MY49406483	29-Mar-23
Agilent	8722ES	US39175359	29-Mar-23
A.H. Systems, inc	SAS-521-7	AH-029	3-May-23
A.H. Systems, inc	SAS-521-7	141	3-May-23

Condition of Instrumentation

Condition received: Within Manufacturer's Specifications

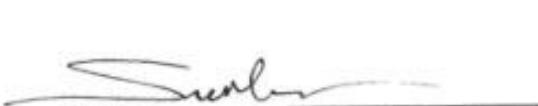
Condition returned: Within Manufacturer's Specifications

Calibration Uncertainty

95% Confidence Level using a coverage factor of $k=2$

1 Meter ± 0.82 dB

3 & 10 Meter ± 0.78 dB



Rui Sieng
RF Technician



Travis P. Samuels
Quality Control Manager

The information shown on this certificate applies only to the instrument identified above and may not be reproduced, except in full, without the written approval of A.H. Systems, inc. There is no implied warranty that the instrument will maintain its specified tolerances during the calibration interval due to possible drift, environment, or other factors beyond our control.

Monopole Antenna

Calibration Certificate



A.H. Systems, Inc.
9710 Cozycroft Ave.
Chatsworth, CA 91311



Tel: (818) 998-0223 ◆ sales@AHSystems.com
Fax: (818) 998-6892 ◆ www.AHSystems.com

Certificate Number: 2207-9834

Certificate of Calibration

The instrument identified below has been individually calibrated per the following standard(s):
SAE ARP 958E 2021 - Electromagnetic Interference Measurement Antennas; Standard Calibration Method

Manufacturer: A.H. Systems Inc.

Date Calibrated: 22-Jul-22

Model Number: SAS-550-1B

Calibration Interval: 12 Months

Serial Number: 1437

Calibration Due Date: 22-Jul-23

Customer: Turner Engineering Corporation

Temperature: 77 F (25.0 C)

Remarks:

Humidity: 68% Relitive Humidity

This calibration is traceable to the National Institute of Standards and Technology through documents on file in the Chatsworth Metrology Laboratory. Copies of NIST Traceability and test reports are available upon request. All calibrations conform to ANSI/NCSL Z540-1-1994 and ISO/IEC 17025:2017. Uncertainties listed are derived from methods described by NIST Tech Note 1297.

Measurement Standards and Equipment Used:

Manufacturer	Model Number	SN	Due Date
Agilent	E5061B	MY49406483	29-Mar-23
A.H. Systems, inc	ECF-12K	AH-033	15-Sep-22

Condition of Instrumentation

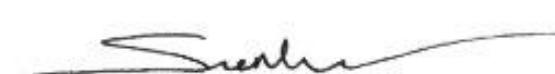
Condition received: Within Manufacturer's Specifications

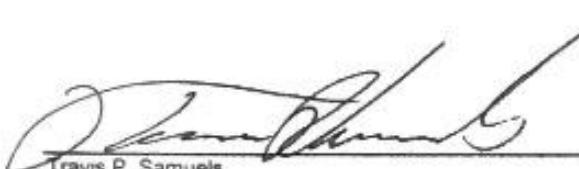
Condition returned: Within Manufacturer's Specifications

Calibration Uncertainty

95% Confidence Level using a coverage factor of $k=2$

ECSM +/- 0.76 dB


Rit Sieng
RF Technician


Travis P. Samuels
Quality Control Manager

The information shown on this certificate applies only to the instrument identified above and may not be reproduced except in full without the written approval of A.H. Systems, Inc. There is no implied warranty that the instrument will maintain its specified tolerances during the calibration interval due to possible drift, environment, or other factors beyond our control.