APPENDIX 3.5-A PRECONSTRUCTION ELECTROMAGNETIC MEASUREMENT SURVEY

3.5-A.1 Introduction

This appendix documents measurement results from a preconstruction electromagnetic survey of locations along the proposed Shared Passenger Track Alternatives between Los Angeles and Anaheim. The purpose of the survey was to: (1) provide a baseline characterization of the existing electromagnetic environment, (2) permit comparisons with the expected electromagnetic footprint from the planned high-speed rail (HSR) system, and (3) provide guidance for electromagnetic compatibility (EMC) requirements by defining the typical electromagnetic environment that the HSR system must operate in without interference.

Land uses, existing facilities, and infrastructure along the alignment were reviewed, with a list of approximately 15 initial candidate sites evaluated. This review concentrated on identifying potentially electromagnetic interference (EMI)-sensitive facilities as well as existing electromagnetic field (EMF) sources such as power generation, power distribution, and communications facilities. The selection criteria, taken from the California High-Speed Rail Authority's Technical Memorandum 3.4.11, favored providing a balanced coverage of:

- The geographic extent of the segment
- High-emission sites
- Low-emission sites
- Sites with high-sensitivity receptors

A final group consisting of seven sites, out of the 15 candidate sites, was selected based upon the above considerations and to provide representative coverage of land uses.

Two types of measurements were performed at each location. The first involved measurement of radiated electric fields from 10 kilohertz (kHz) to 6 gigahertz (GHz), meant to characterize the radio-frequency (RF) environment. These electric field strengths were measured using an RF spectrum analyzer and calibrated antennas. Expected sources of RF signals include:

- Cell towers (cellular telephone)
- Broadcast towers (radio and television broadcasts)
- Airport radars and aircraft communications equipment
- General high-frequency and very-high-frequency fixed and mobile communications systems (police, fire, emergency medical technician, utilities, and government)
- Local wireless (wireless fidelity and Worldwide Interoperability for Microwave Access)

The second part of the test procedure involved measurements of background direct current (DC) and power frequency magnetic fields along the alignment. These magnetic fields were recorded using a three-axis fluxgate sensor with a waveform recording data acquisition system. Expected sources of DC and low-frequency magnetic fields include:

- The geomagnetic field
- High-voltage transmission lines
- Electric distribution lines
- Substations/generation facilities
- Geomagnetic perturbations from passing vehicles and trains

The facilities most sensitive to abrupt shifts in the DC (geomagnetic perturbations) and alternating-current (AC) magnetic fields are:

- High-tech semiconductor (e.g., electron microscopes [transmission electron microscopes/scanning electron microscopes], electron-beam lithography, ion-writing systems, focused ion-beam systems)

- High-tech biology (e.g., nuclear magnetic resonance, magnetic resonance imaging, electron microscopes)
- Medical imaging (e.g., computed tomography scanners, magnetic resonance imaging systems)
- University/research (instrumentation for chemistry, physics, electrical engineering, and similar systems to those mentioned for high-tech and medical facilities)

3.5-A.2 TEST PROCEDURES AND EQUIPMENT

Characterization of the RF environment along the proposed alignment was done by measuring the prevailing electric field strength at each of seven test sites, over the frequency range from 10 kHz to 6 GHz.

Measurements were made using a vertical monopole antenna (AH Systems SAS-550-1) for the frequency range from 10 kHz to 30 MHz, and a broadband bilogical[1] antenna (AH Systems SAS-521-7) for the frequency range from 25 MHz to 6 GHz, connected to an Anritsu MS2721B Spectrum Analyzer. Measurements were made in eight contiguous frequency bands and recorded per Section 6.4 of Technical Memorandum 3.4.11. Data were transferred to a laptop computer and backed up on USB flash drives for archiving and post-survey analysis. Where practical, the RF antennas were approximately 50 feet from the proposed alignment.

Electric field measurement files from the spectrum analyzer included both minimum-hold and maximum-hold levels as a function of frequency across each of the measurement bands. Reported results include the low frequency measurements with the omni-directional vertical monopole, plus measurements with the bilogical antenna in both horizontal and vertical positions, first facing the proposed alignment, and then in the direction that exhibited the maximum signal strength in each measurement band.

The magnetic field measurements characterized the prevailing background magnetic field levels as well as the temporal variations caused by the passing of trains on the existing right-of way. Measurements were made at two positions at each site, separated by approximately 30 feet.

The magnetic field measurements were performed using a pair of three-axis 5 gauss Bartington fluxgate sensors (bandwidth DC to 3 kHz), connected to a National Instruments data acquisition system. Magnetic field waveforms were recorded so that DC and full frequency information is available over the entire sensor bandwidth. Measurement data were downloaded to a laptop computer in the field, and backed up on USB flash drives.

The RF and magnetic field measurements for the Los Angeles to Anaheim Project Section were performed between September 12 and 16, 2016, which represent no substantial change in the Los Angeles to Anaheim Project Section. The 2016 field survey data have been retained as the primary method of assessing existing conditions in the project area because the changes in the Los Angeles to Anaheim Project Section are not substantial. A desktop review of current conditions has been conducted to reflect the latest available information, and additional sensitive receptors were identified.

3.5-A.3 OVERVIEW OF THE MEASUREMENT RESULTS

3.5-A.3.1 Magnetic Fields

Figure 3.5-A-1 depicts the measured AC magnetic field strengths at three measurement sites: a largely residential location (Norwalk, Site 4), a commercial/industrial setting (Los Angeles, Site 1), and a commercial area (Fullerton, Site 5). These sites encompass the full range of observed

[1] Antenna designed for making measurements over a wide frequency range. It is a hybrid design combining elements of Biconical and Log-periodic antennas.

60 Hz magnetic field levels, with Site 4 the lowest, Site 5 the highest, and Site 1 representing the median level. Plotted are levels for the 60 Hz fundamental and the next six harmonics. The AC magnetic field strengths at the seven sites varied by two orders of magnitude, from 0.02 milligauss (mG) to 4.88 mG. This is a typical range for heterogeneous, highly developed settings such as the one found along the Los Angeles to Anaheim Project Section. The AC ambient field is determined almost solely by the site's proximity to power (medium-voltage distribution and high-voltage transmission) lines and other electrical system infrastructure.

The DC magnetic fields also varied, but by much smaller amounts, and were comparable to the expected ambient geomagnetic field strength. The measured values across the seven measurement sites ranged from a low of 396 mG to a high of 492 mG. At individual sites, the difference in DC field strength between the two sensors ranged from 5 to 42 mG. These differentials typically are the result of the differing influence from passing vehicles or from the influence of nearby steel objects.

Measured transient shifts in the DC magnetic field were generally very small and attributable to nearby vehicular traffic, with some exceptions noted at Sites 3 and 6. Site 3 (Riviera Road and Vicki Drive in Santa Fe Springs) indicated variations of approximately 20 mG from a passing freight train. The DC fields strengths at Site 6 (Sycamore Street and Vine Street in Anaheim) indicated shifts of up to 20 mG from Metrolink passbys.

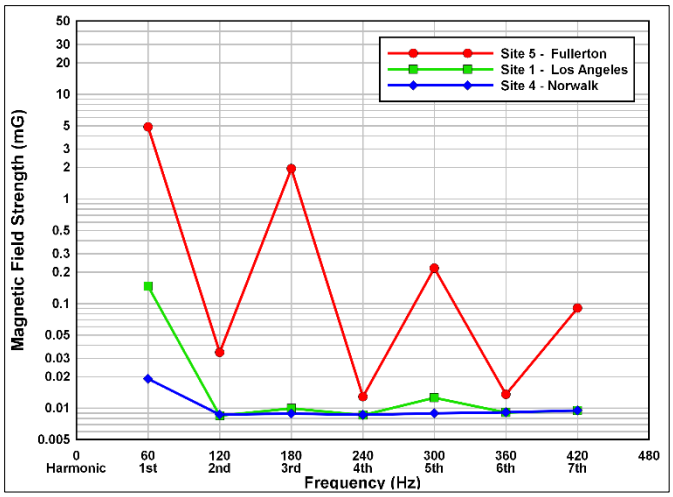


Figure 3.5-A-1 Average Measured Alternating Current Magnetic Field Strengths

3.5-A.3.2 Electric Fields

Because of the broad range of frequencies of interest, the electric field measurements at each site were divided into eight overlapping frequency bands in order to provide the desired frequency resolution in each band (Authority 2010). Table 3.5-A-1 summarizes the magnitude of the maximum measured electric field by frequency band for each site. The maximum electric field strengths in bands B0 through B4 were broadly consistent across the measurement sites, with standard deviations of less than 10 decibels (dB) in all bands. As depicted in Figure 3.5-A-2, maximum measured levels in band B2 were particularly consistent, reflecting the ubiquitous coverage of AM broadcast stations in the region. Such uniformity in levels is commonly encountered in densely populated, urban project sections such as this one.

Table 3.5-A-1 Maximum Measured Electric Field Strengths by Band

Measurement Site	B0 10–50 kHz	B1 50–550 kHz	B2 .50–3.0 MHz	B3 2.5–7.5 MHz	B4 5.0–30 MHz	B5 25–200 MHz	B6 0.2–2.2 GHz	B7 2.0–6.0 GHz
1. Los Angeles (Commercial St/Garey St)	150.3	124.0	142.8	133.7	108.5	113.1	123.0	117.8
2. Commerce (Telegraph Rd/Garfield Ave)	141.2	130.3	142.9	123.3	95.9	104.1	120.6	115.7
3. Santa Fe Springs (Rivera Rd/Vicki Dr)	137.7	130.1	143.3	123.4	94.5	107.2	106.5	98.0
4. Norwalk (Foster Rd/Shoemaker Ave)	132.6	129.2	145.5	130.8	97.4	98.9	106.2	92.7
5. Fullerton (Walnut Ave/Walnut Wy)	132.3	127.6	145.3	128.3	90.2	103.9	111.5	105.1
6. Anaheim (Sycamore St/Vine St)	132.6	116.8	142.7	107.2	89.7	100.7	114.3	111.2
7. Anaheim (Katella Ave/Douglass Rd)	128.8	124.2	145.0	119.7	82.3	110.5	114.7	115.0

GHz = gigahertz; kHz = kilohertz; MHz = megahertz

The project area is highly developed and includes a large number of RF sources. Approximately 100 television and radio (AM and FM broadcast) transmitters operate within the region. In addition, there are dozens of cellular communications towers and point-to-point microwave links operating in the region, as well as a substantial number of intermittent fixed and mobile RF sources. This activity results in remarkably uniform—and relatively high—background levels within the resource study area over much of the RF spectrum.

Figure 3.5-A-2 graphically depicts the maximum measured electric field strengths by frequency band for the seven measurement sites. Typical spectrum uses in each frequency band are also indicated. Increasing distance from the plot center indicates higher field strength. Because of the well-developed nature of the region, the band-by-band measured field strengths were relatively consistent, with only five instances of levels falling more than 10 dB from the mean in a given frequency band. Figure 3.5-A-3 depicts the variance in RF field strengths across the seven sites by frequency band.

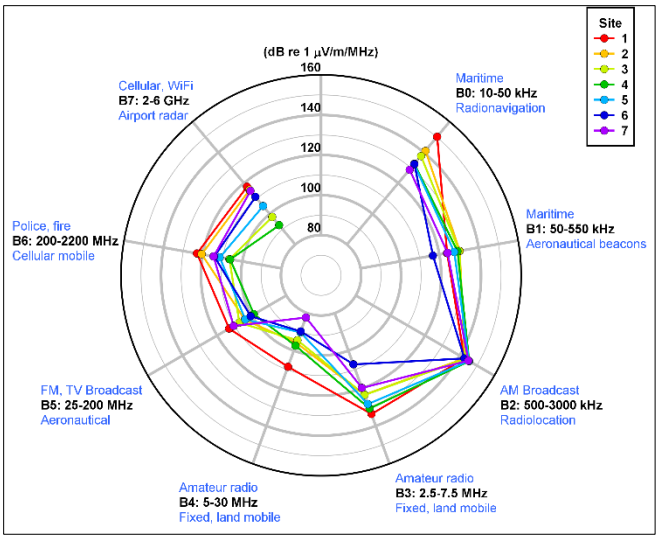


Figure 3.5-A-2 Maximum Electric Field Strengths by Spectral Band

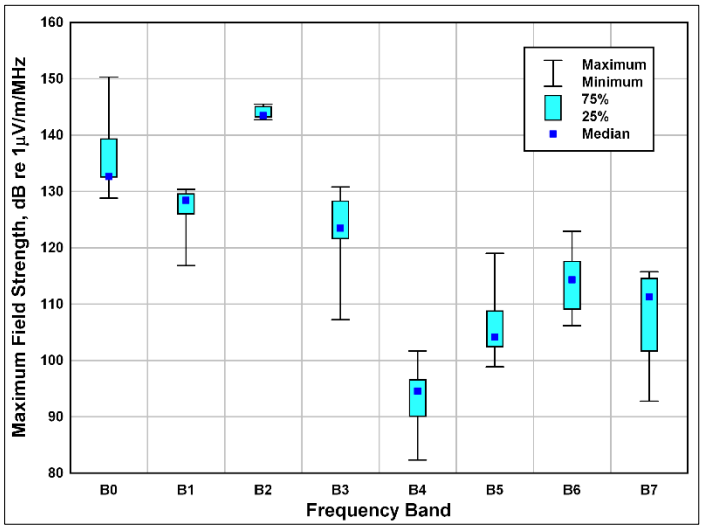


Figure 3.5-A-3 Range of Electric Field Strengths Across All Sites

The seven panels in Figure 3.5-A-4 separately illustrate the tabulated electric field strength values in Table 3.5-A-1. As elsewhere, the field strength values are in dB, referenced to 1 microvolt per meter per megahertz (re: 1 µV/m/MHz).

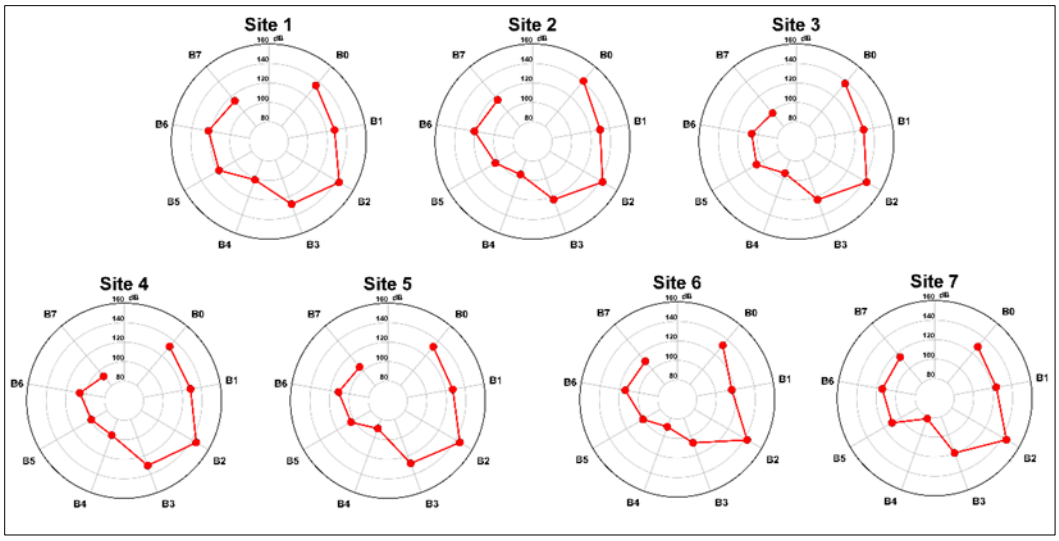


Figure 3.5-A-4 Polar Plots for the Los Angeles to Anaheim Project Section

3.5-A.4 INDIVIDUAL SITE OBSERVATIONS

3.5-A.4.1 Site 1 Los Angeles (Commercial Street/Garey Street)

Site 1 is in Los Angeles at Commercial Street and Garey Street, at the northbound Highway 101 off-ramp, south of Los Angeles Union Station (Figure 3.5-A-5 through Figure 3.5-A-12). Both sensor positions indicate continuous low-level variations from vehicle traffic. AC magnetic fields of approximately 1.6 mG were relatively constant, produced by a combination of distribution lines on the south side of Commercial Street and low-voltage circuits supplying power to the traffic light and street lamps.

3.5-A.4.2 Site 2 Commerce (Telegraph Road/Garfield Avenue)

Site 2 is in Commerce at Telegraph Road and Garfield Avenue (Figure 3.5-A-13 through Figure 3.5-A-20). DC magnetic field shifts are due to passing vehicles along Garfield Avenue, with sensor 1 indicating larger variations because it was closest to the road. AC magnetic fields were approximately 1.2 to 1.6 mG, with transient spikes indicating up on sensor 1 from passing vehicles.

3.5-A.4.3 Site 3 Santa Fe Springs (Rivera Road/Vicki Drive)

Site 3 is in Santa Fe Springs along the north side of tracks parallel to Rivera Road near Vicki Drive (Figure 3.5-A-21 through Figure 3.5-A-28). A freight train passed, causing large DC magnetic field variations at the start of the data recording. Otherwise, small changes in DC magnetic fields are due to vehicle traffic along the street. AC magnetic fields of approximately 1 mG are from overhead distribution lines on the north side of Rivera Road. The transient variations produced by the passing freight train have 60 Hz components at the start.

3.5-A.4.4 Site 4 Norwalk (Foster Road/Hayden Avenue)

Site 4 is in a Norwalk cul-de-sac at end of Foster Road, adjacent to John Glenn High School (Figure 3.5-A-29 through Figure 3.5-A-35). Periods of varying DC magnetic fields are produced by two passing freight trains. AC magnetic fields were near zero, with small transient variations. The source of the small transient variations was not clear, because there were no visible power lines.

3.5-A.4.5 Site 5 Fullerton (Walnut Avenue/Walnut Way)

Site 5 is at East Walnut Avenue and Walnut Way, south of the tracks and just east of Fullerton Station (Figure 3.5-A-36 through Figure 3.5-A-43). DC magnetic field variations are produced by both trains and vehicle traffic along Walnut Way. Two freight trains and two Amtrak trains passed. AC magnetic fields of 4 and 6 mG are produced by overhead lines at this location. There is a substation across the street.

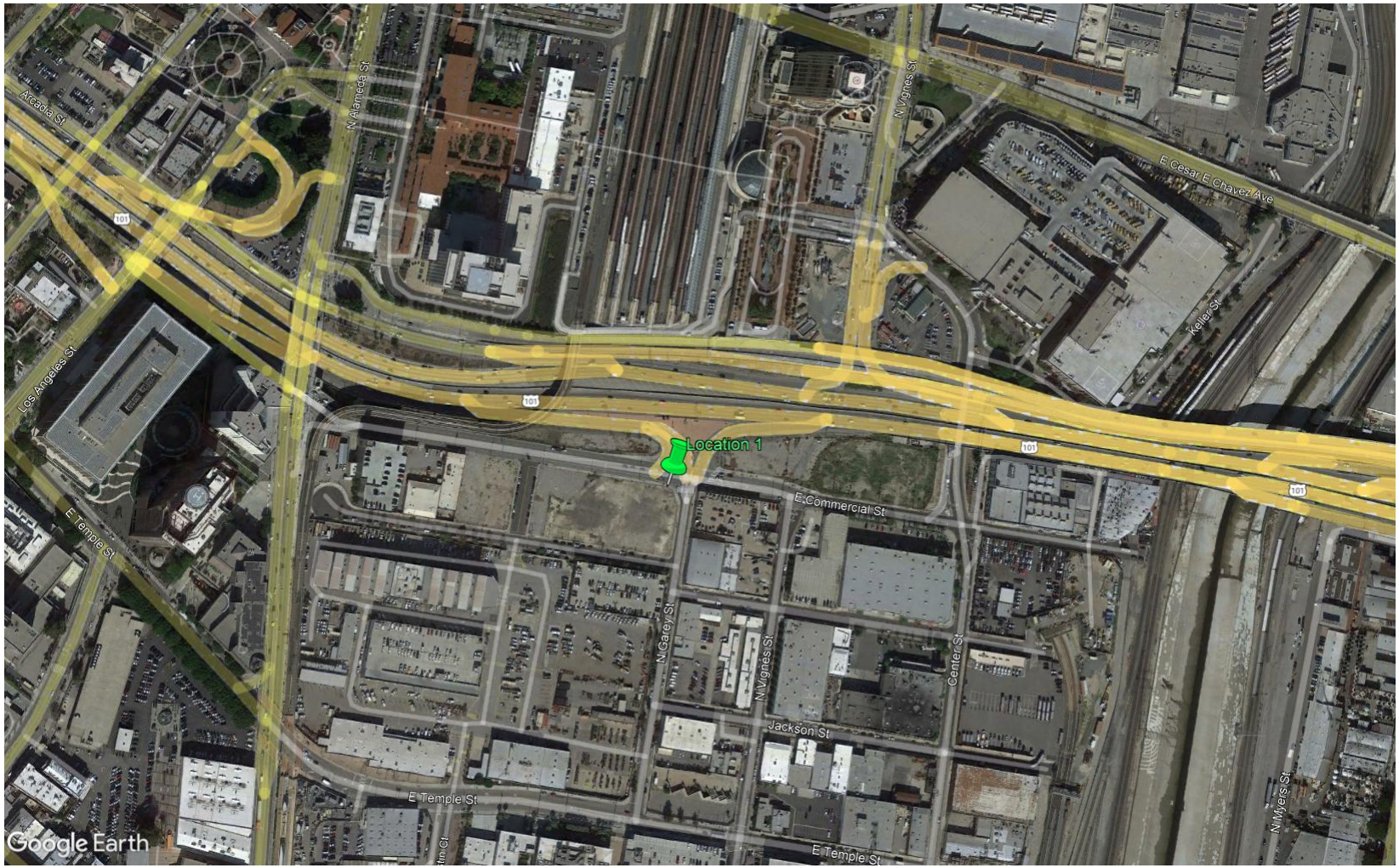
3.5-A.4.6 Site 6 Anaheim (Sycamore Street/Vine Street)

Site 6 is in Anaheim along East Sycamore Street, on the east side of the tracks and adjacent to the Veterans of Foreign Wars facility (Figure 3.5-A-44 through Figure 3.5-A-51). Numerous small DC magnetic field variations are present on the first sensor from street traffic, and a few larger variations are visible from both sensors from passing trains. AC magnetic fields of 2 to 3 mG are from overhead distribution lines. The AC magnetic fields have significant variation as load currents change on the power lines.

3.5-A.4.7 Site 7 Anaheim (Katella Avenue/Douglass Road)

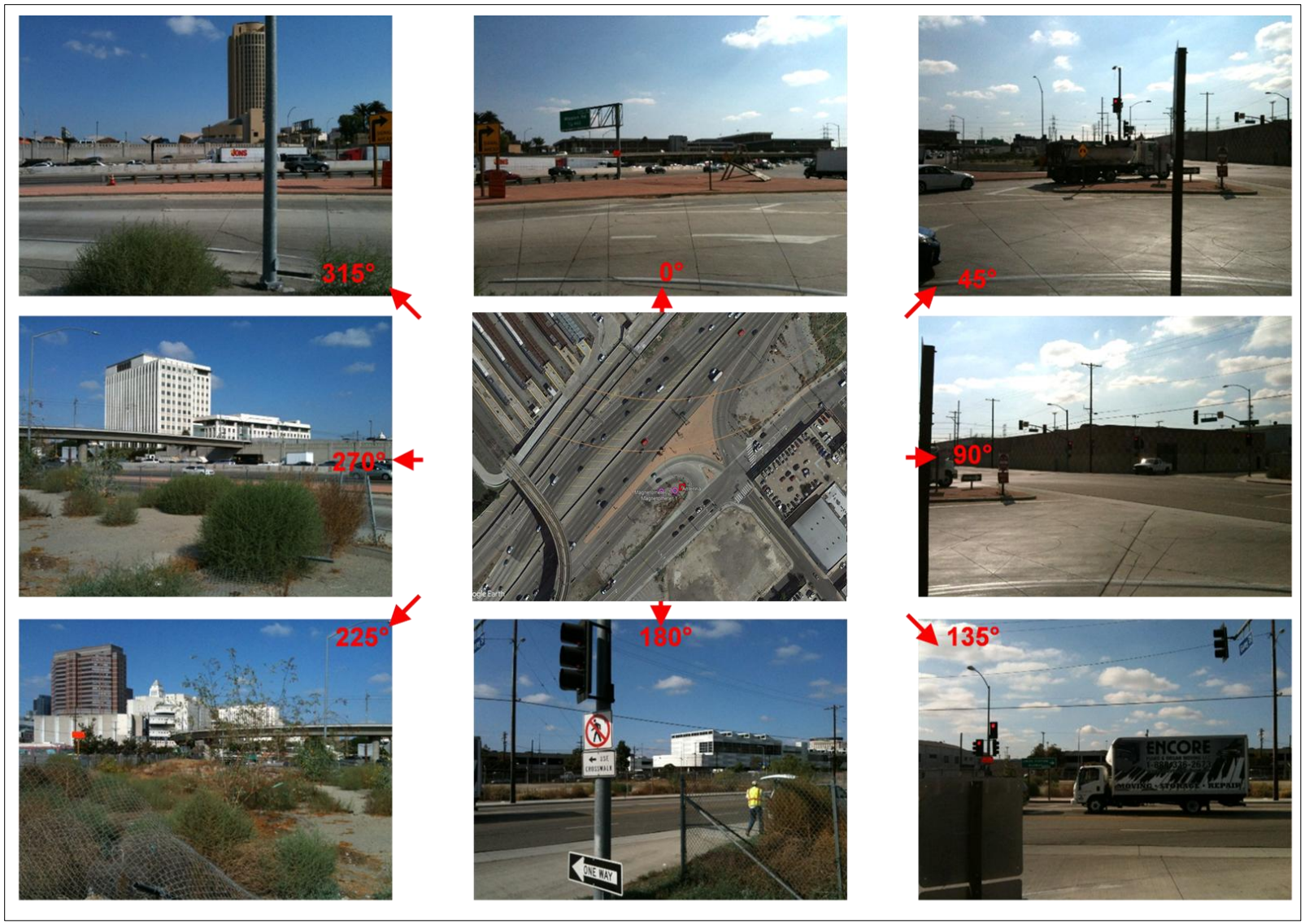
Site 7 is adjacent to the Anaheim Regional Transportation Intermodal Center parking entrance on the south side of the tracks (Figure 3.5-A-52 through Figure 3.5-A-59). DC magnetic fields are relatively quiet, although more variation is present on the first sensor, which was closer to passing vehicles entering and exiting the parking lot. AC magnetic fields are very low, on the order of 0.1 mG, with no nearby power lines. Low-level variations are present at the start and, after a pause in recording, while at the end of the measurements after a pause, the AC fields are relatively constant.

3.5-A.5 SITE PHOTOGRAPHS AND MEASUREMENT DATA



Urban setting near Los Angeles Union Station, with significant radio frequency emitters (Latitude 34.052983°, Longitude -118.234269°)

Figure 3.5-A-5 Site 1 (Los Angeles): Commercial Street/Garey Street

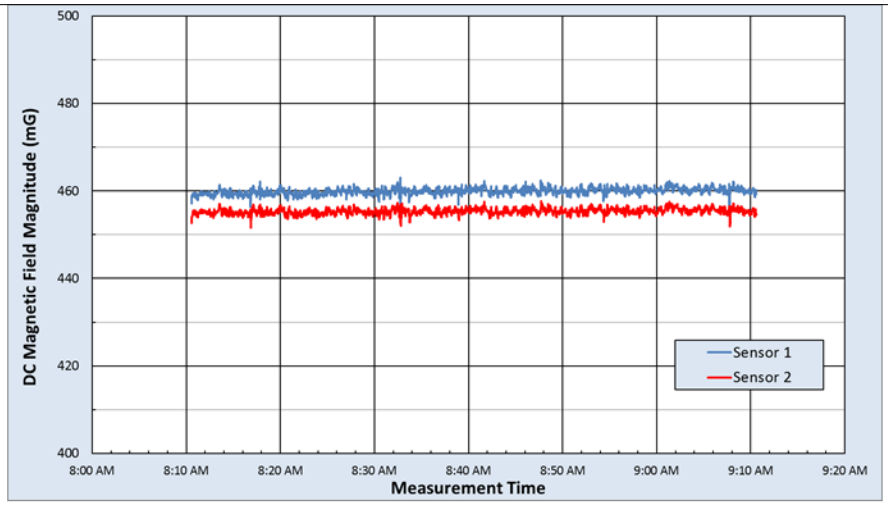


Photos depicting the site from the perspective of the radio frequency measurement location. In the center is a satellite view, indicating the footprint and measurement points (red = radio frequency, magenta = magnetometers). The satellite view is rotated so that the image at 0° faces the footprint.

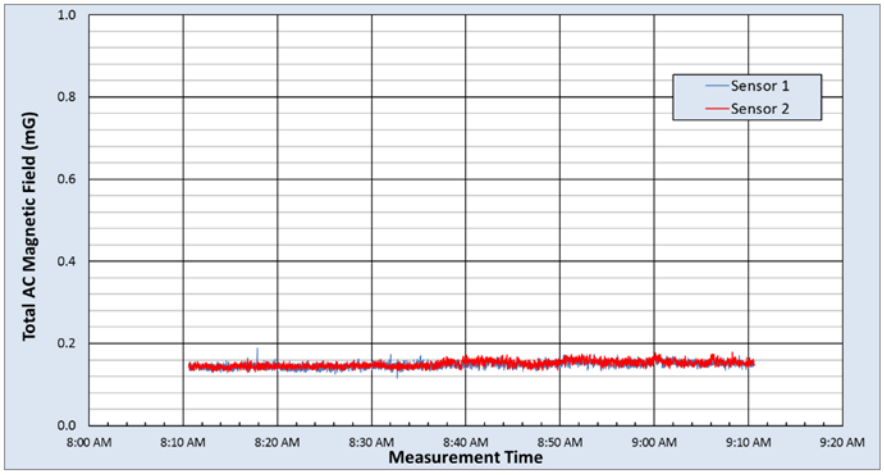
Figure 3.5-A-6 Site 1 (Los Angeles): Measurement Location and Site Views

Nearby emitters include high-voltage transmission lines, cellular and microwave communications, and distribution lines. Photos depicting visible close-proximity emitters. Other emissions sources may exist but are not visible from the site.

Figure 3.5-A-7 Site 1 (Los Angeles): Local Electromagnetic Field Sources

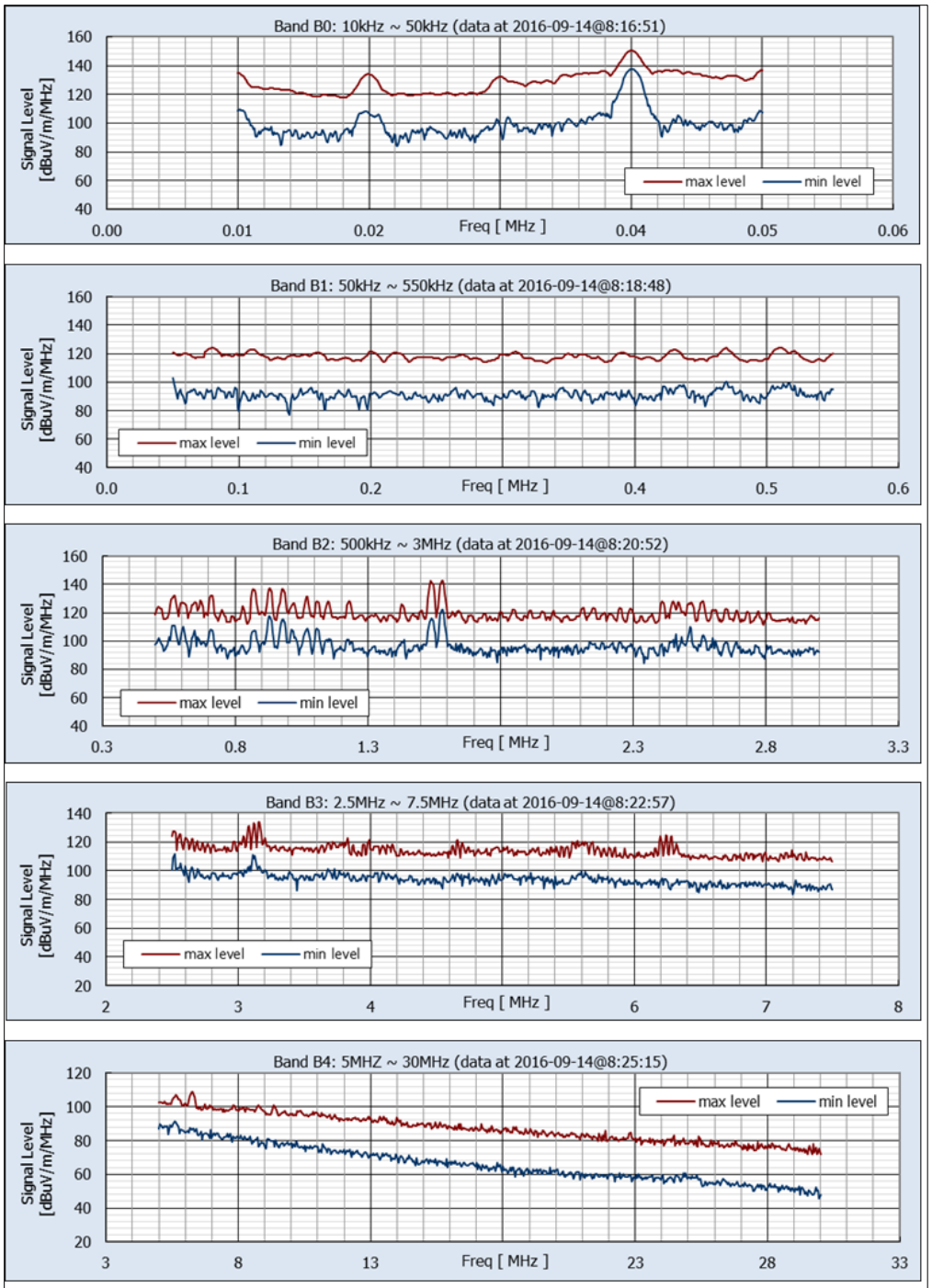


DC Magnetic Field Measurement Statistics						
	B Horizontal (mG)		B Vertical (mG)		B Total (mG)	
	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2
Max	275.9	258.7	375.1	380.2	463.1	457.6
Median	270.4	254.5	372.0	377.5	459.9	455.3
Min	265.7	249.4	368.9	373.8	456.4	451.7
Range	10.2	9.4	6.2	6.4	6.7	5.9
Std Dev	0.5	0.5	0.8	0.7	0.7	0.7



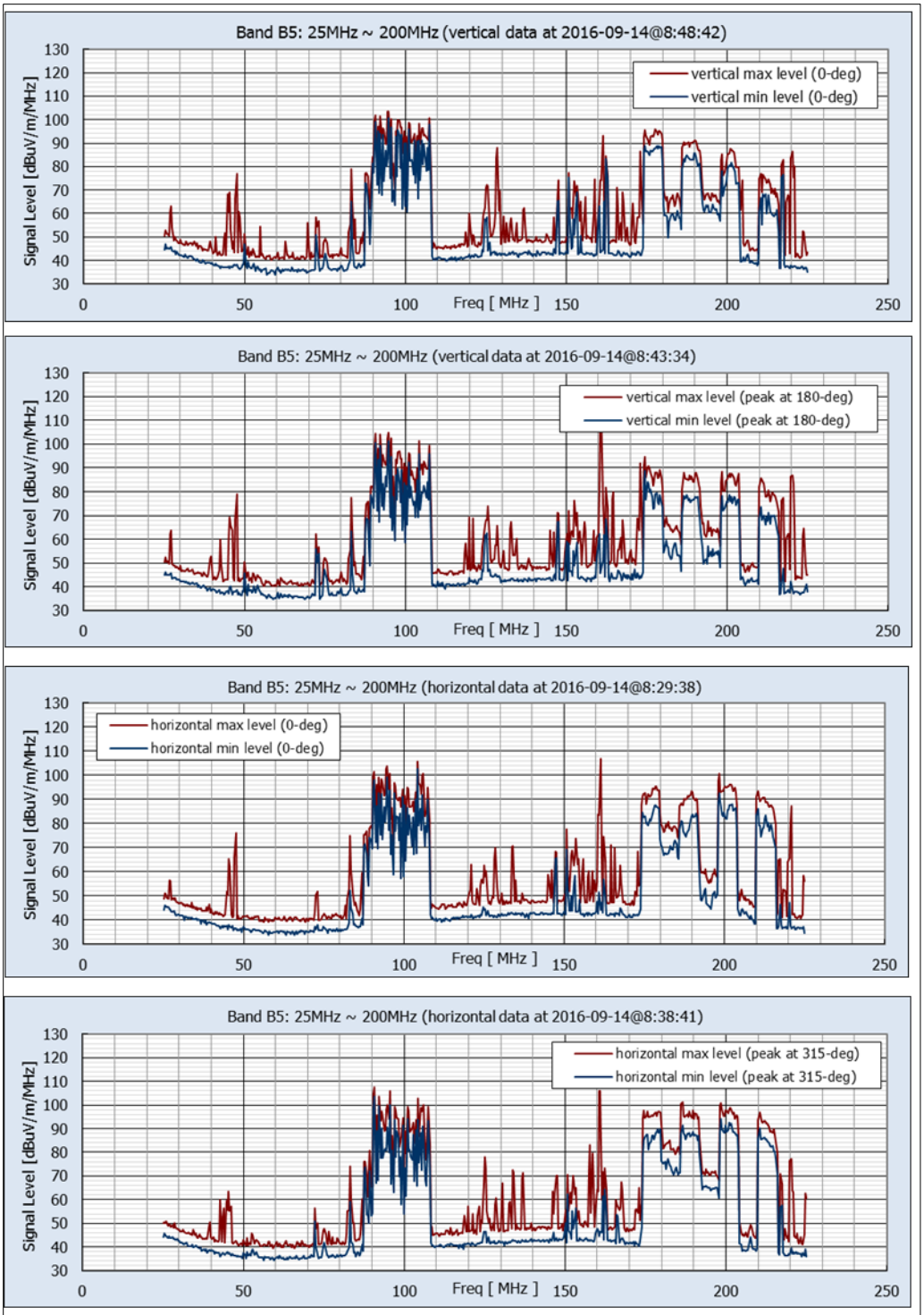
rms AC Magnetic Field Measurement Statistics																
	Fund 60Hz (mG)		2nd (mG)		3rd (mG)		4th (mG)		5th (mG)		6th (mG)		7th (mG)		Total AC (mG)	
	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2
Max	0.184	0.176	0.024	0.020	0.026	0.025	0.022	0.021	0.028	0.030	0.024	0.023	0.022	0.020	0.188	0.178
Median	0.145	0.148	0.009	0.008	0.010	0.010	0.009	0.008	0.013	0.012	0.009	0.009	0.010	0.009	0.147	0.150
Min	0.109	0.126	0.002	0.001	0.002	0.002	0.002	0.002	0.003	0.002	0.002	0.002	0.002	0.002	0.115	0.129
Range	0.075	0.050	0.022	0.019	0.024	0.024	0.020	0.019	0.024	0.028	0.022	0.021	0.020	0.018	0.073	0.049
Std Dev	0.008	0.008	0.003	0.002	0.003	0.003	0.003	0.002	0.004	0.003	0.003	0.003	0.003	0.003	0.008	0.008

Figure 3.5-A-8 Site 1 (Los Angeles): Measured Direct Current and Alternating Current Magnetic Field Strengths



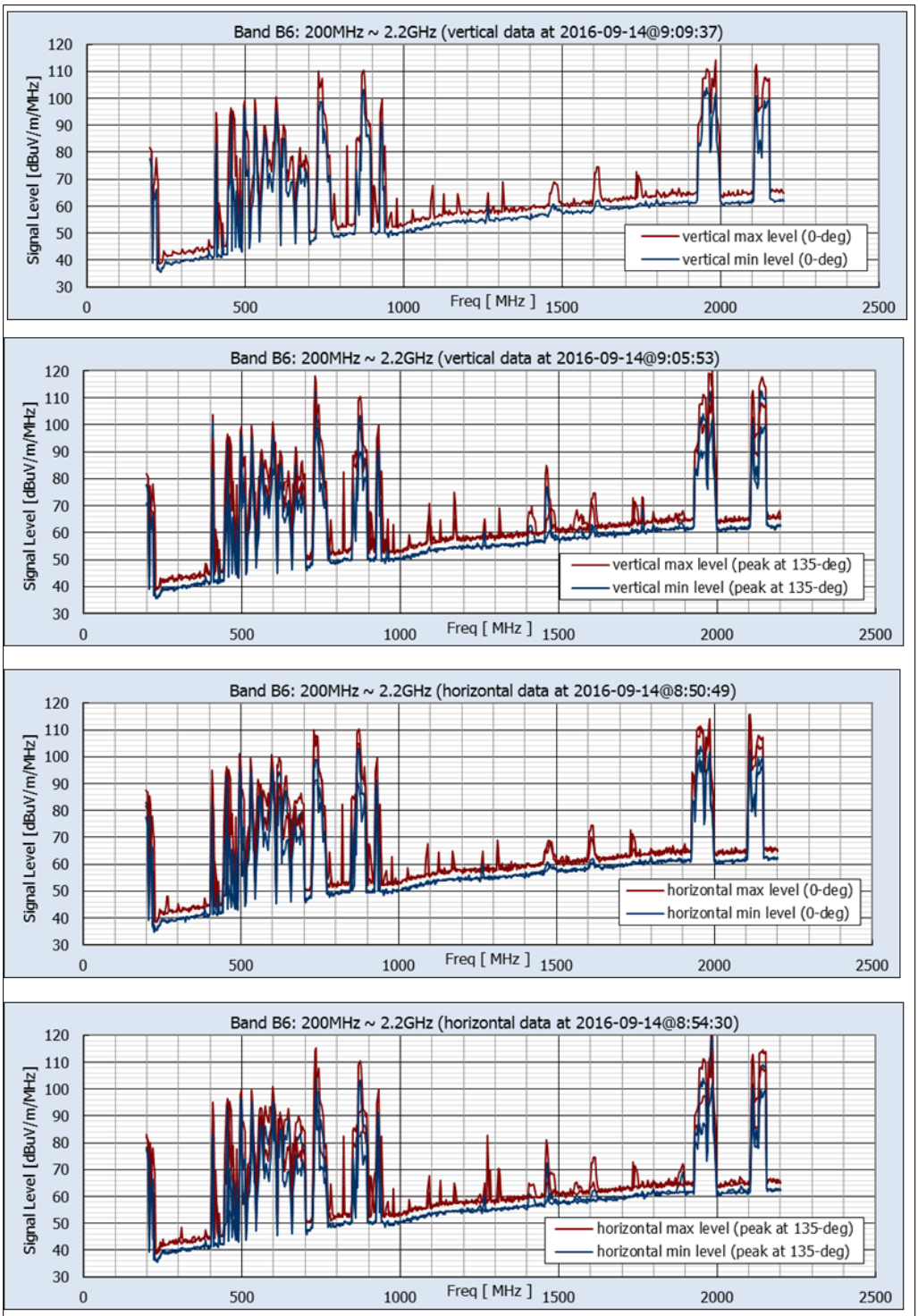
Maximum Levels					
Band number	Freq. Range (MHz)	Pk Min-Hold (dB uV/m/MHz	@ Freq. (MHz)	Pk Max-Hold (dB uV/m/MHz	@ Freq. (MHz)
B0	0.01 ~ 0.05	137.6	0.0400	150.3	0.0400
B1	0.05 ~ 0.55	102.9	0.0500	124.0	0.5100
B2	0.50 ~ 3.00	122.4	1.5818	142.8	1.5364
B3	2.5 ~ 7.5	111.6	2.5182	133.7	3.1636
B4	5 ~ 30	91.3	5.5909	108.5	6.2273

Figure 3.5-A-9 Site 1 (Los Angeles): Measured Environmental Radio Frequency Levels, Nondirectional Data from Vertically Oriented Monopole Antenna, Bands 0–4



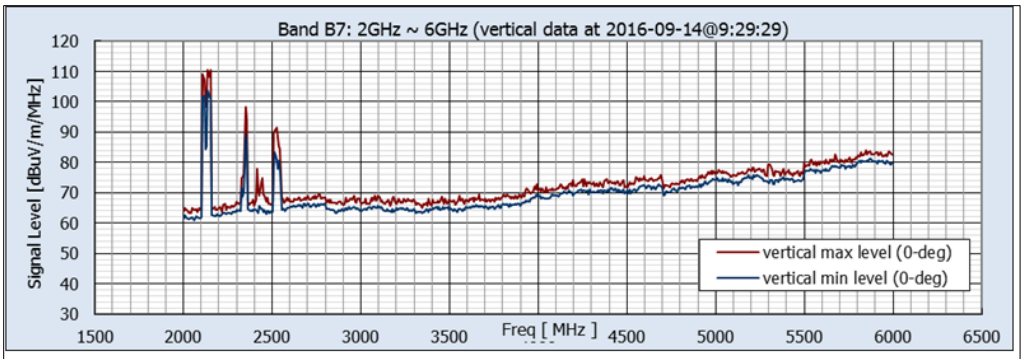
Maximum Levels									
		Vertical				Horizontal			
Band number	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B5	25 ~ 200	101.5	94.818	113.1	160.636	103.5	90.818	107.7	90.818

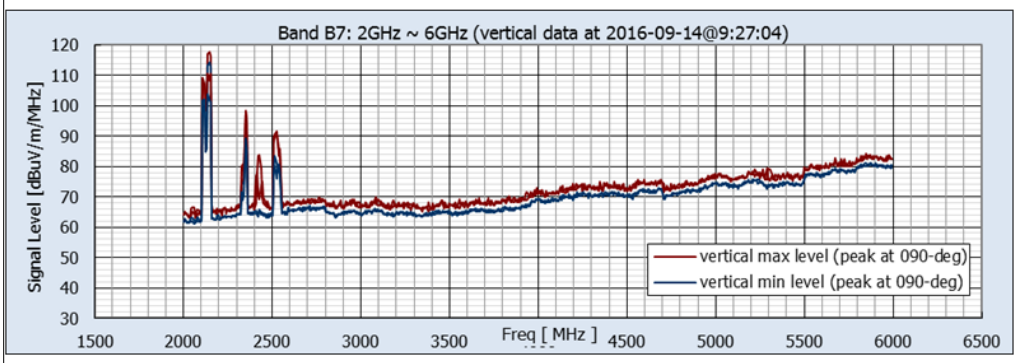
Figure 3.5-A-10 Site 1 (Los Angeles): Measured Environmental Radio Frequency Levels, Band 5 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation

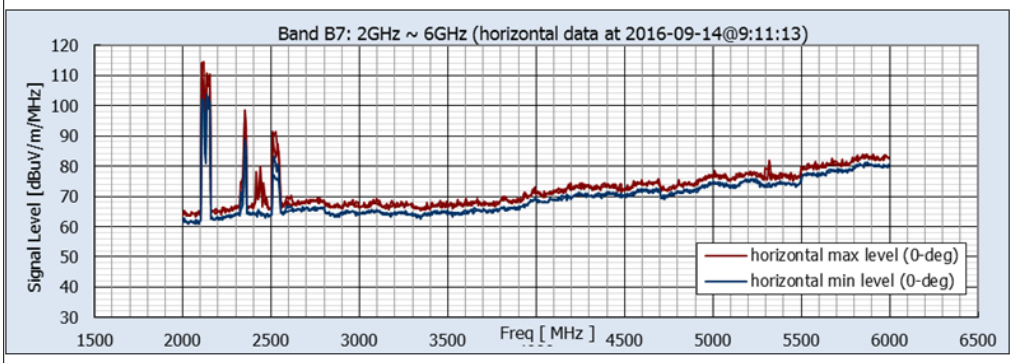


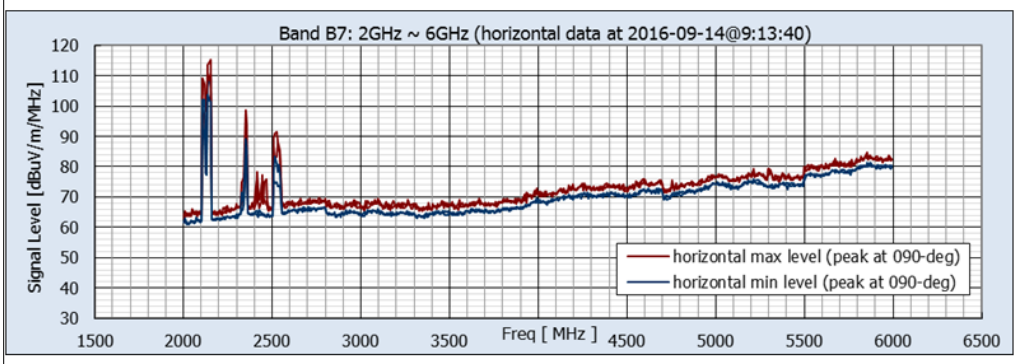
Maximum Levels									
		Vertical				Horizontal			
Band	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B6	200 ~ 2200	112.6	2138.182	120.1	1985.455	119.1	1981.818	123.0	1981.818

Figure 3.5-A-11 Site 1 (Los Angeles): Measured Environmental Radio Frequency Levels, Band 6 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation



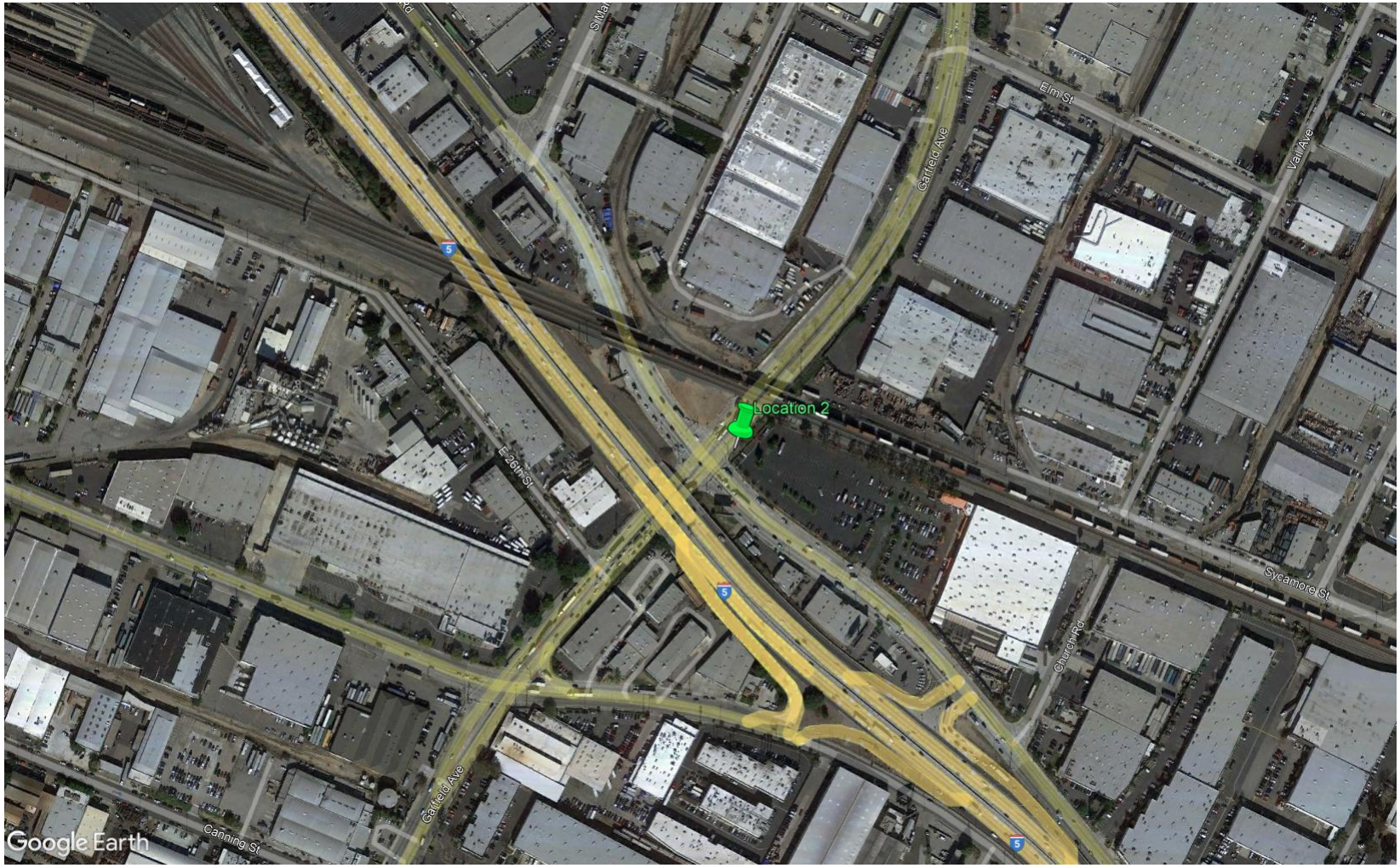






Maximum Levels									
		Vertical				Horizontal			
Band	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B7	2000~6000	114.2	2145.455	117.8	2145.455	109.8	2152.727	115.1	2152.727

Figure 3.5-A-12 Site 1 (Los Angeles): Measured Environmental Radio Frequency Levels, Band 7 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation



Adjacent to existing rail, with significant radio frequency emitters (Latitude 33.988000°, Longitude -118.136874°)

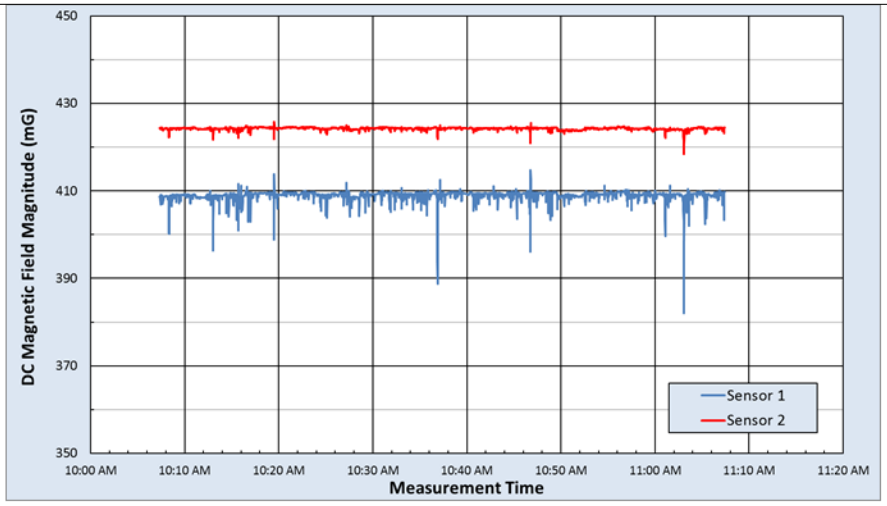
Figure 3.5-A-13 Site 2 (Commerce): Garfield Avenue/Telegraph Road

Photos depicting the site from the perspective of the radio frequency measurement location. In the center is a satellite view, indicating the alignment right-of-way and measurement points (red = radio frequency, magenta = magnetometers). The satellite view is rotated so that the image at 0° faces the alignment.

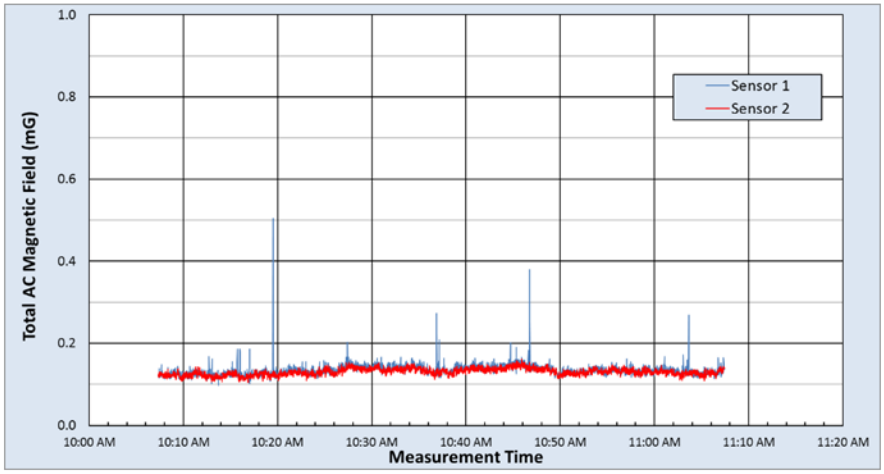
Figure 3.5-A-14 Site 2 (Commerce): Measurement Location and Site Views

Nearby emitters include distribution lines perpendicular and parallel to the alignment, and cellular communications. Photos depicting visible close-proximity emitters. Other emissions sources may exist but are not visible from the site.

Figure 3.5-A-15 Site 2 (Commerce): Local Electromagnetic Field Sources

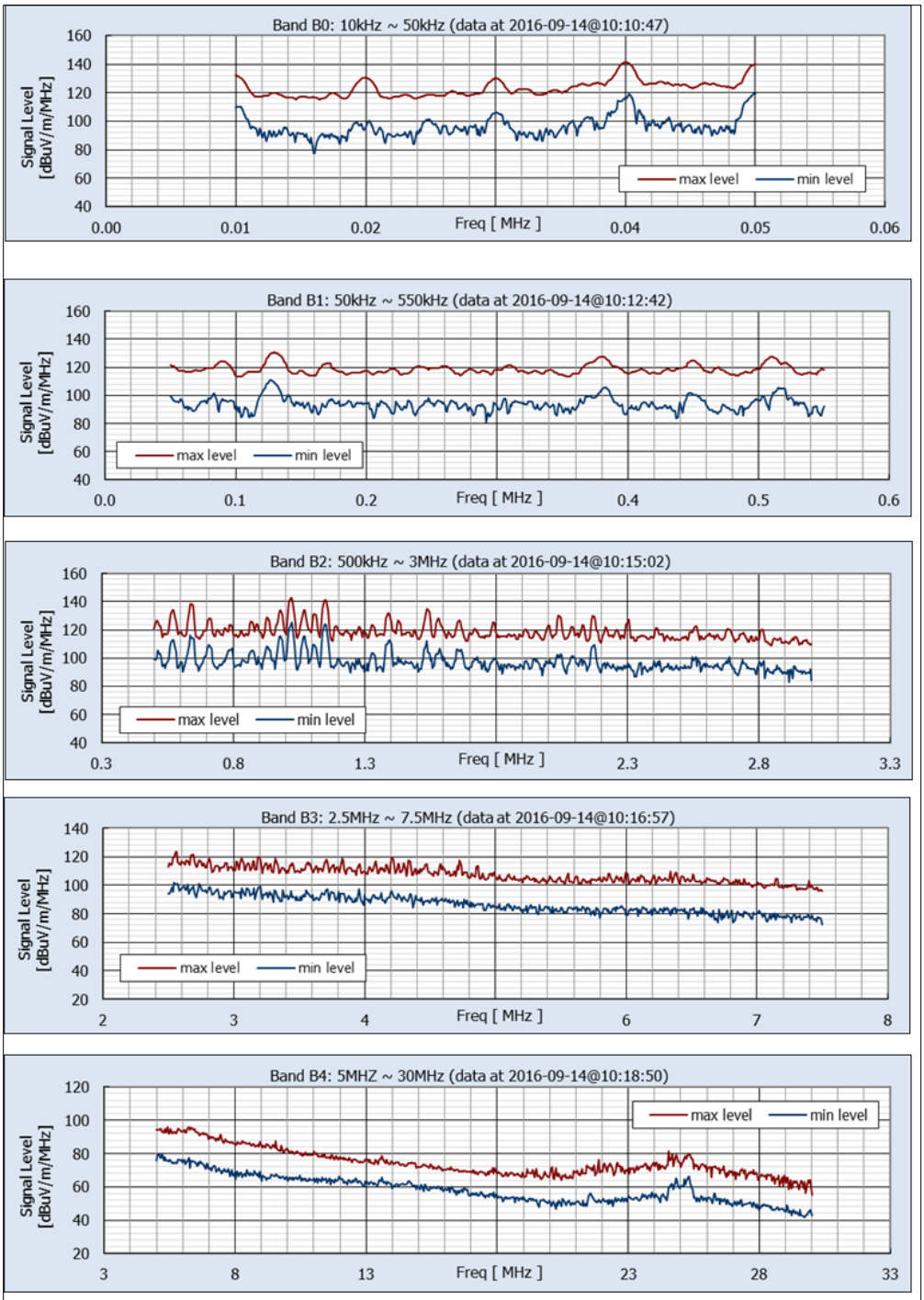


DC Magnetic Field Measurement Statistics						
	B Horizontal (mG)		B Vertical (mG)		B Total (mG)	
	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2
Max	234.2	222.5	347.4	363.6	414.7	425.8
Median	219.9	219.9	345.1	362.9	409.2	424.3
Min	193.3	214.6	316.3	356.3	382.1	418.6
Range	41.0	7.9	31.1	7.4	32.6	7.2
Std Dev	1.1	0.3	1.2	0.4	1.2	0.3



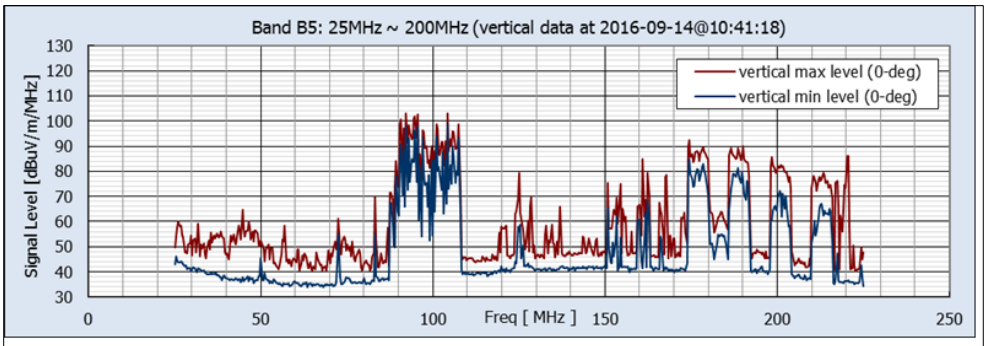
rms AC Magnetic Field Measurement Statistics																
	Fund 60Hz (mG)		2nd (mG)		3rd (mG)		4th (mG)		5th (mG)		6th (mG)		7th (mG)		Total AC (mG)	
	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2
Max	0.424	0.161	0.185	0.027	0.131	0.019	0.094	0.020	0.084	0.022	0.064	0.019	0.063	0.023	0.505	0.163
Median	0.131	0.128	0.013	0.013	0.010	0.009	0.009	0.008	0.010	0.009	0.009	0.009	0.011	0.011	0.134	0.130
Min	0.091	0.103	0.004	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.098	0.105
Range	0.333	0.058	0.181	0.024	0.129	0.017	0.092	0.018	0.082	0.020	0.062	0.018	0.060	0.021	0.407	0.058
Std Dev	0.012	0.009	0.006	0.003	0.004	0.003	0.004	0.003	0.003	0.003	0.003	0.003	0.004	0.003	0.013	0.008

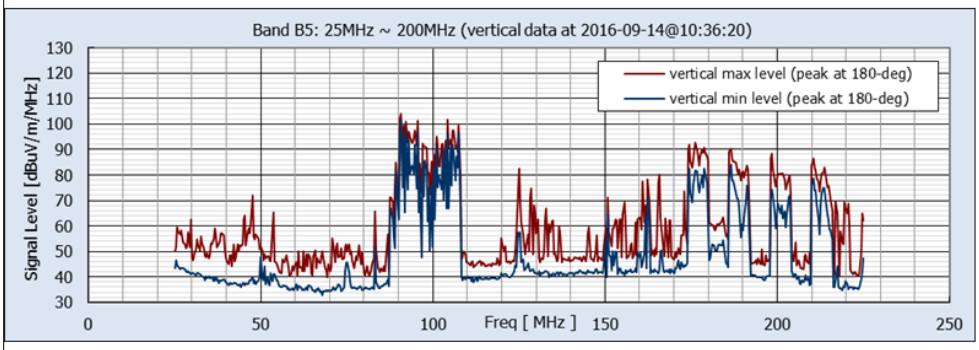
Figure 3.5-A-16 Site 2 (Commerce): Alternating Current and Direct Current Magnetic Field Measurement Results

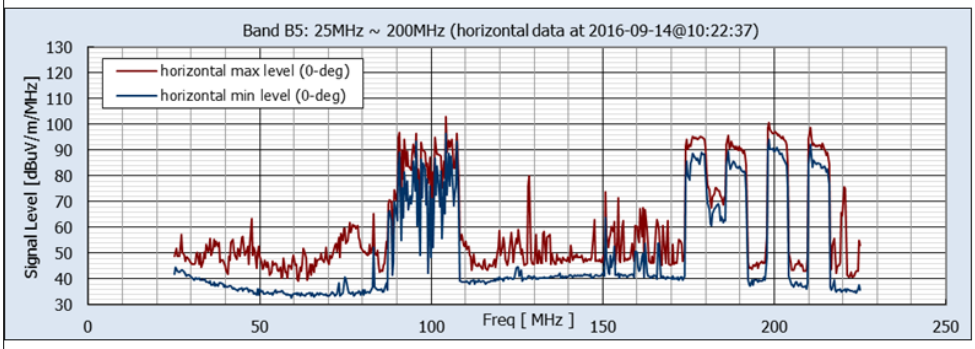


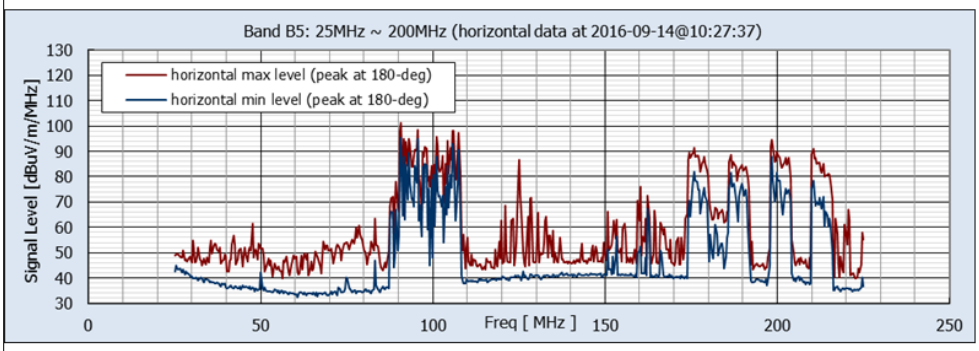
Maximum Levels					
Band number	Freq. Range (MHz)	Pk Min-Hold dB uV/m/MHz	@ Freq. (MHz)	Pk Max-Hold dB uV/m/MHz	@ Freq. (MHz)
B0	0.01 ~ 0.05	119.4	0.0499	141.2	0.0400
B1	0.05 ~ 0.55	110.5	0.1264	130.4	0.1300
B2	0.50 ~ 3.00	125.5	1.0227	142.9	1.0182
B3	2.5 ~ 7.5	101.6	2.5455	123.4	2.5636
B4	5 ~ 30	79.8	5.0909	95.9	5.4091

Figure 3.5-A-17 Site 2 (Commerce): Measured Environmental Radio Frequency Levels, Nondirectional Data from Vertically Oriented Monopole Antenna, Bands 0–4



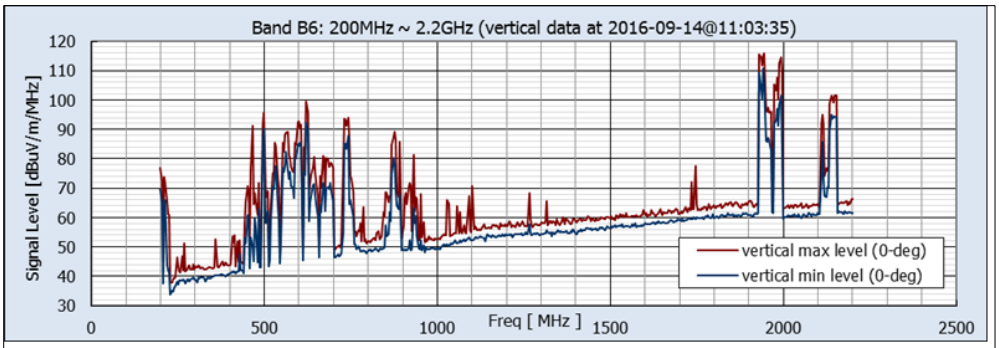


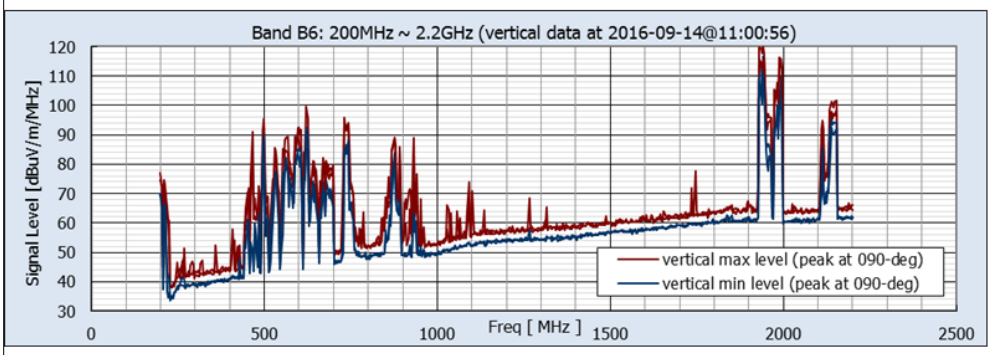


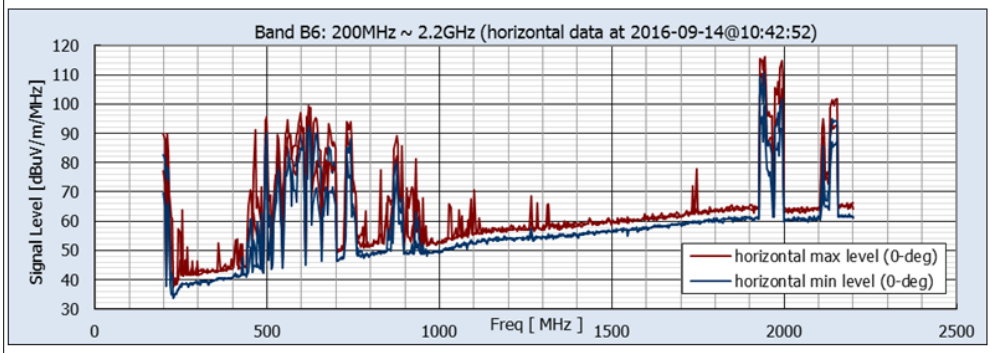


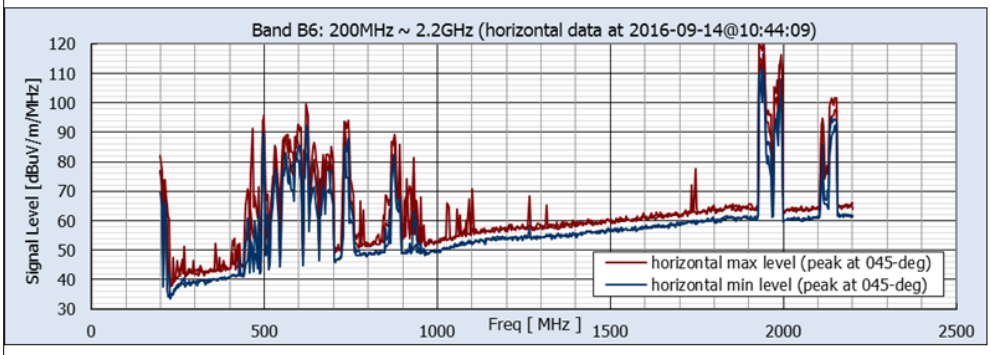
Maximum Levels									
		Vertical				Horizontal			
Band number	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B5	25 ~ 200	101.7	90.818	104.1	90.818	96.6	104.273	103.1	104.273

Figure 3.5-A-18 Site 2 (Commerce): Measured Environmental Radio Frequency Levels, Band 5 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation



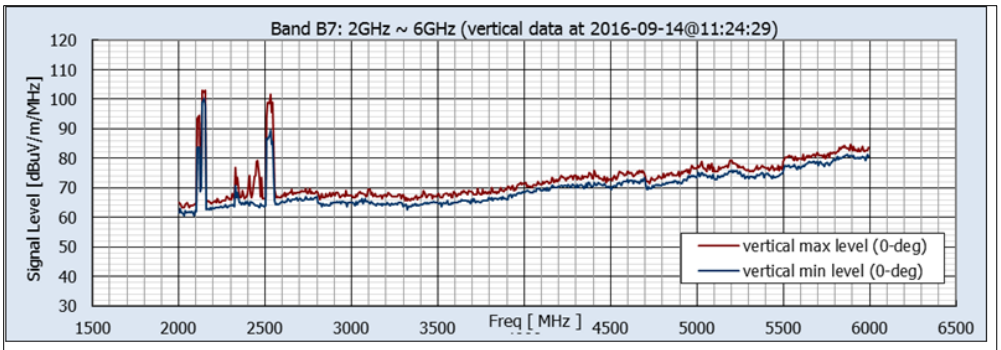


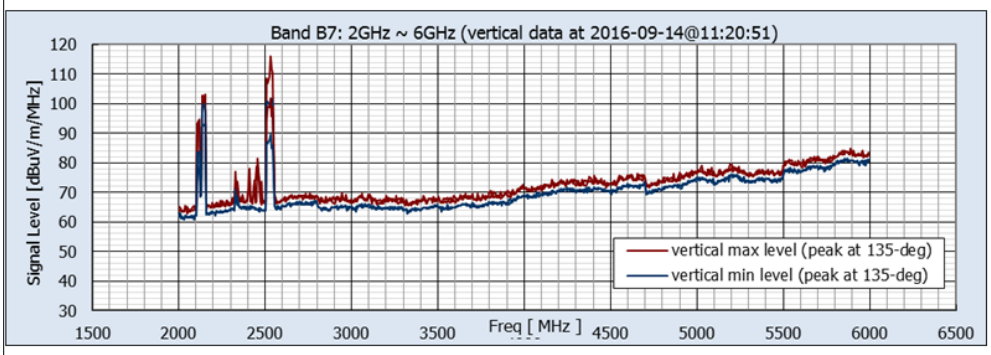


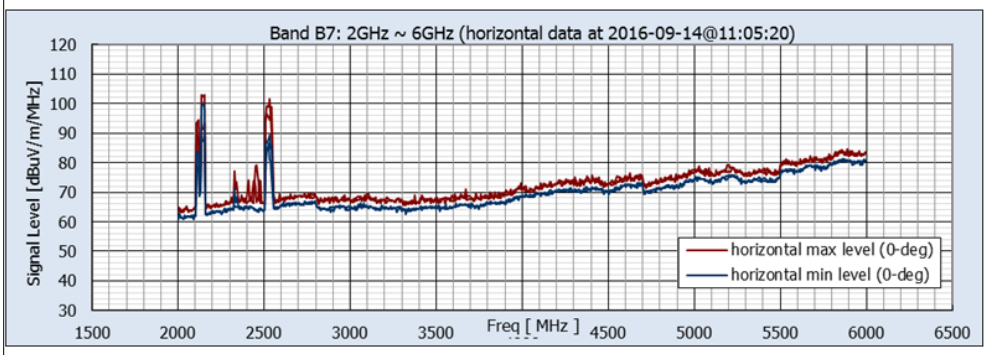


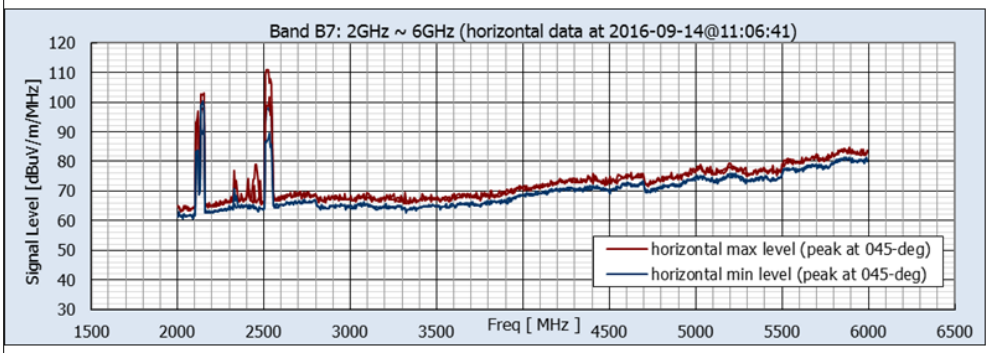
Maximum Levels									
		Vertical				Horizontal			
Band	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B6	200 ~ 2200	116.9	1941.818	120.2	1941.818	116.6	1941.818	120.8	1941.818

Figure 3.5-A-19 Site 2 (Commerce): Measured Environmental Radio Frequency Levels, Band 6 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation



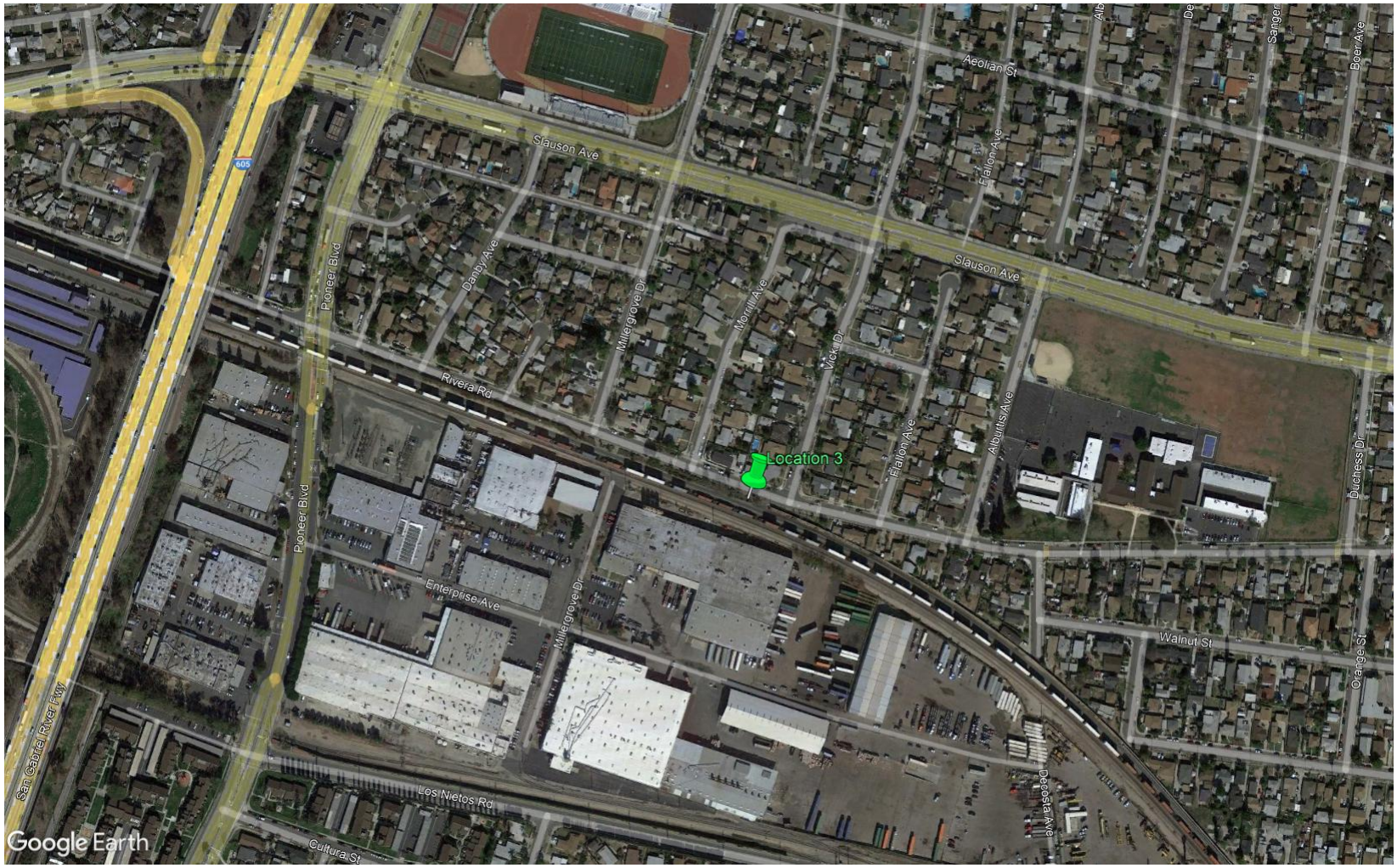






Maximum Levels									
		Vertical				Horizontal			
Band	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B7	2000~6000	101.9	2538.182	115.9	2530.909	98.7	2538.182	110.8	2516.364

Figure 3.5-A-20 Site 2 (Commerce): Measured Environmental Radio Frequency Levels, Band 7 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation



Residential area adjacent to existing rail (Latitude 33.963785°, Longitude -118.078751°)

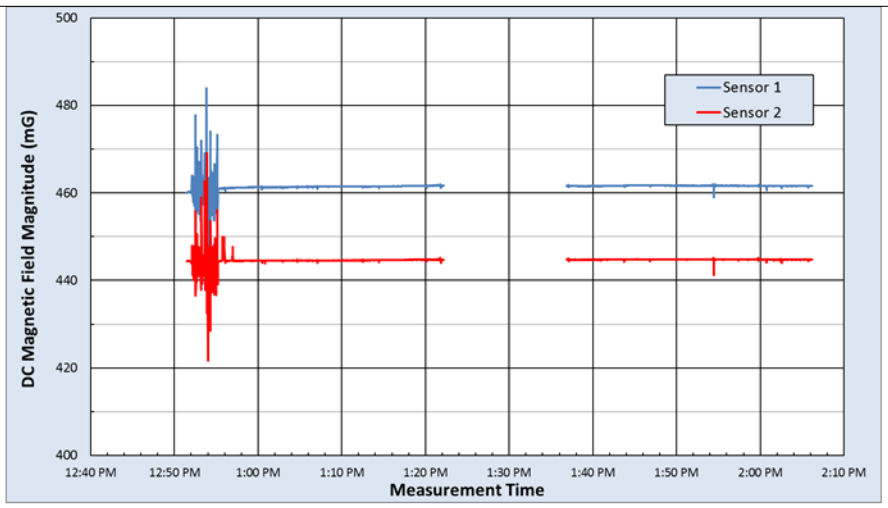
Figure 3.5-A-21 Site 3 (Santa Fe Springs): Rivera Road/Vicki Drive

Photos depicting the site from the perspective of the radio frequency measurement location. In the center is a satellite view, indicating the alignment right-of-way and measurement points (red = radio frequency, magenta = magnetometers). The satellite view is rotated so that the image at 0° faces the alignment.

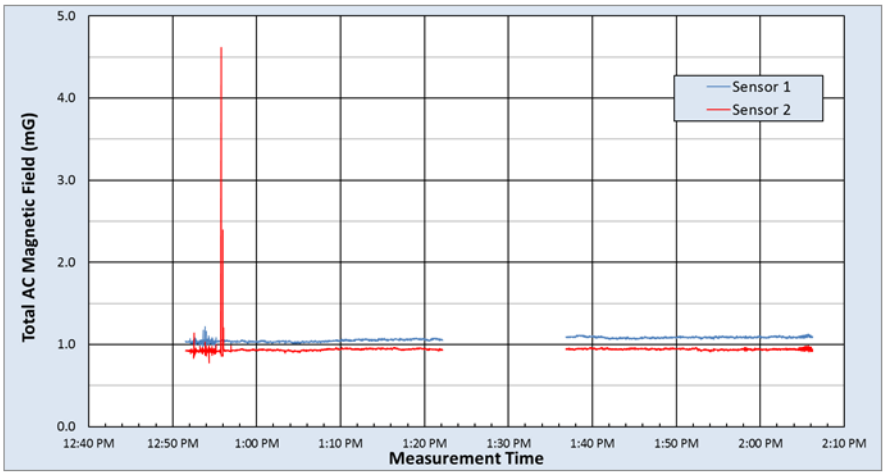
Figure 3.5-A-22 Site 3 (Santa Fe Springs): Measurement Location and Site Views

Nearby emitters include distribution lines perpendicular to the alignment and relatively distant cellular communications. *Photos depicting visible close-proximity emitters. Other emissions sources may exist but are not visible from the site.*

Figure 3.5-A-23 Site 3 (Santa Fe Springs): Local Electromagnetic Field Sources

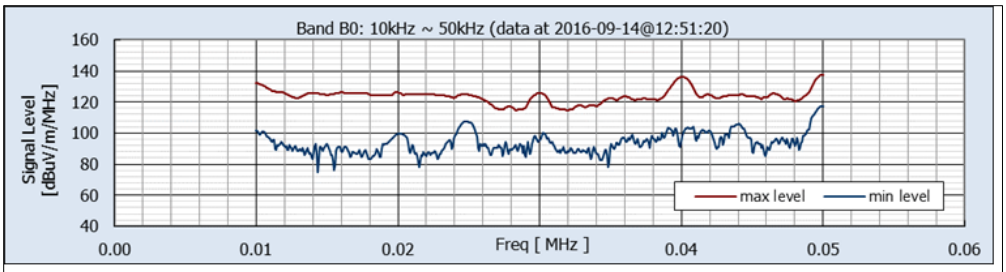


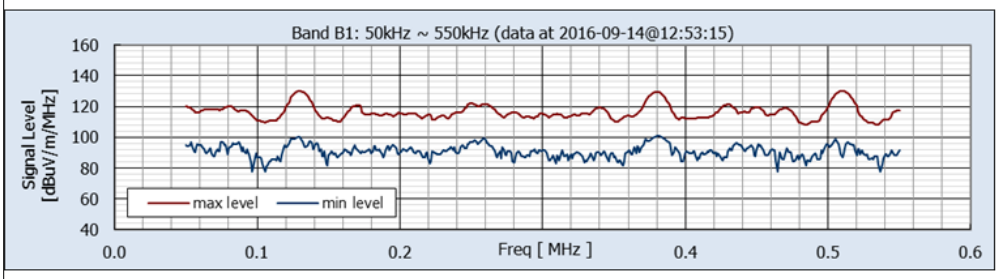
DC Magnetic Field Measurement Statistics						
	B Horizontal (mG)		B Vertical (mG)		B Total (mG)	
	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2
Max	294.3	431.5	392.8	410.7	483.9	469.1
Median	267.2	251.9	376.2	366.4	461.6	444.7
Min	249.6	172.2	358.0	127.4	439.8	421.6
Range	44.7	259.3	34.8	283.3	44.2	47.5
Std Dev	2.1	12.4	1.5	15.0	1.1	1.1

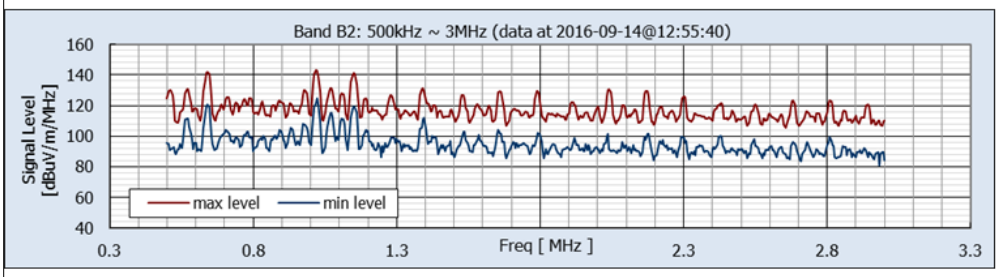


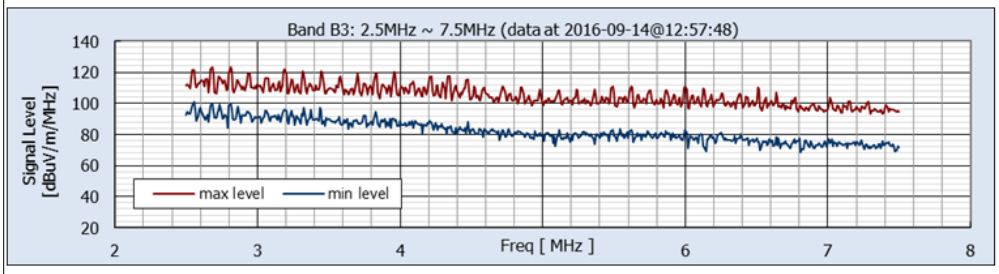
rms AC Magnetic Field Measurement Statistics																
	Fund 60Hz (mG)		2nd (mG)		3rd (mG)		4th (mG)		5th (mG)		6th (mG)		7th (mG)		Total AC (mG)	
	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2
Max	1.211	3.728	0.099	1.857	0.082	1.247	0.086	0.964	0.106	0.794	0.088	0.685	0.092	0.618	1.220	4.617
Median	1.066	0.938	0.012	0.011	0.025	0.017	0.009	0.009	0.060	0.059	0.010	0.010	0.022	0.019	1.069	0.941
Min	0.916	0.745	0.003	0.002	0.010	0.006	0.002	0.002	0.039	0.036	0.002	0.002	0.008	0.007	0.926	0.779
Range	0.295	2.983	0.096	1.855	0.072	1.242	0.084	0.962	0.068	0.757	0.086	0.683	0.084	0.612	0.294	3.837
Std Dev	0.026	0.053	0.007	0.037	0.006	0.025	0.007	0.020	0.006	0.015	0.011	0.017	0.006	0.013	0.026	0.070

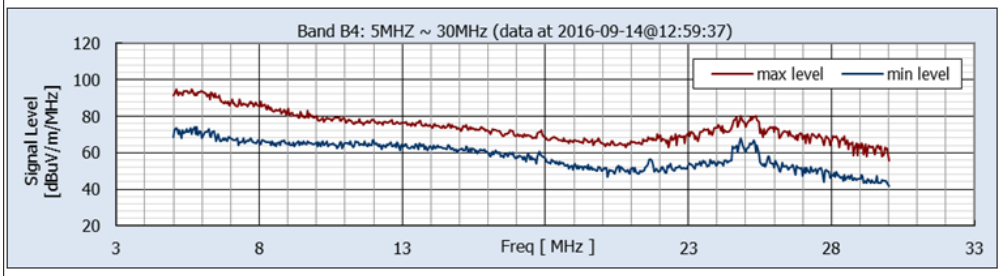
Figure 3.5-A-24 Site 3 (Santa Fe Springs): Alternating Current and Direct Current Magnetic Field Measurement Results





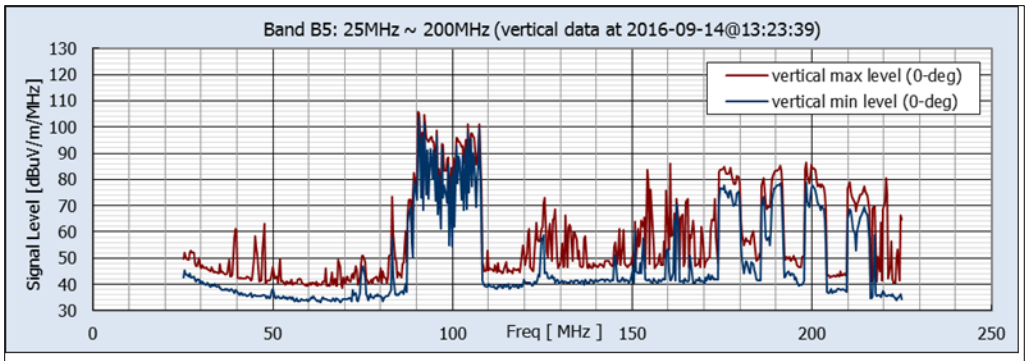


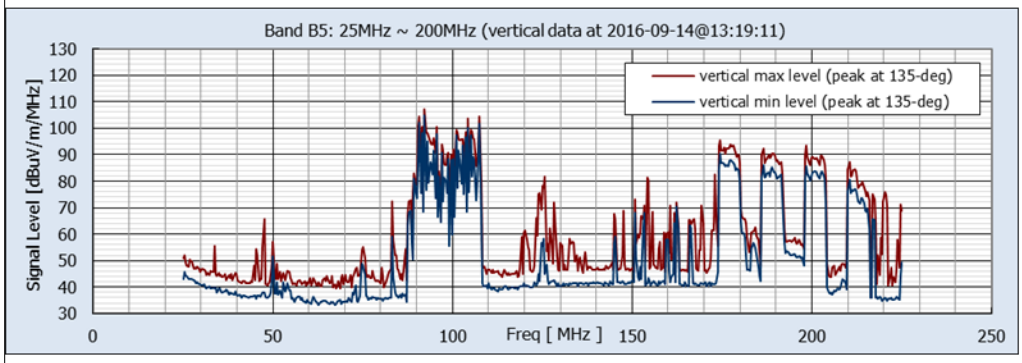


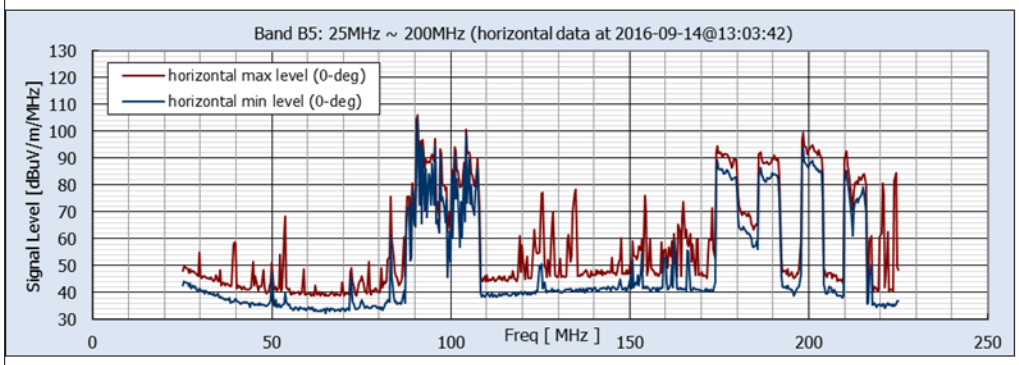


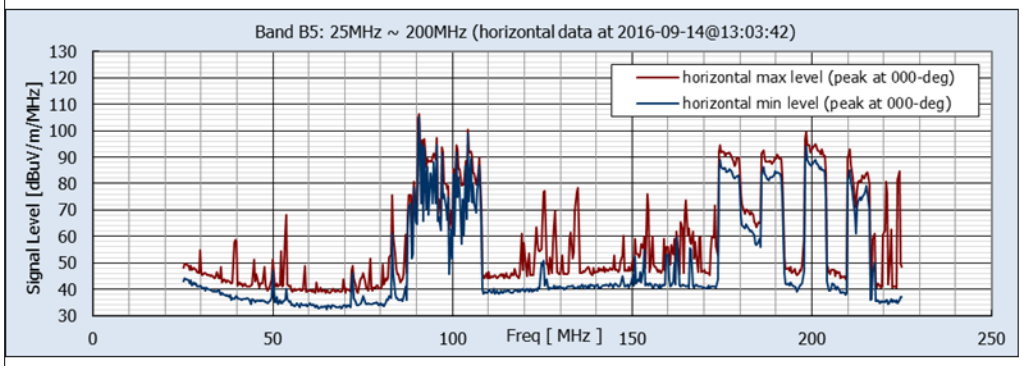
Maximum Levels					
Band number	Freq. Range (MHz)	Pk Min-Hold (dB uV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dB uV/m/MHz)	@ Freq. (MHz)
B0	0.01 ~ 0.05	117.3	0.0499	137.7	0.0500
B1	0.05 ~ 0.55	100.7	0.3809	130.1	0.5100
B2	0.50 ~ 3.00	124.6	1.0227	143.4	1.0182
B3	2.5 ~ 7.5	101.2	2.5545	123.5	2.8091
B4	5 ~ 30	74.1	5.7273	94.6	5.0909

Figure 3.5-A-25 Site 3 (Santa Fe Springs): Measured Environmental Radio Frequency Levels, Nondirectional Data from Vertically Oriented Monopole Antenna, Bands 0–4



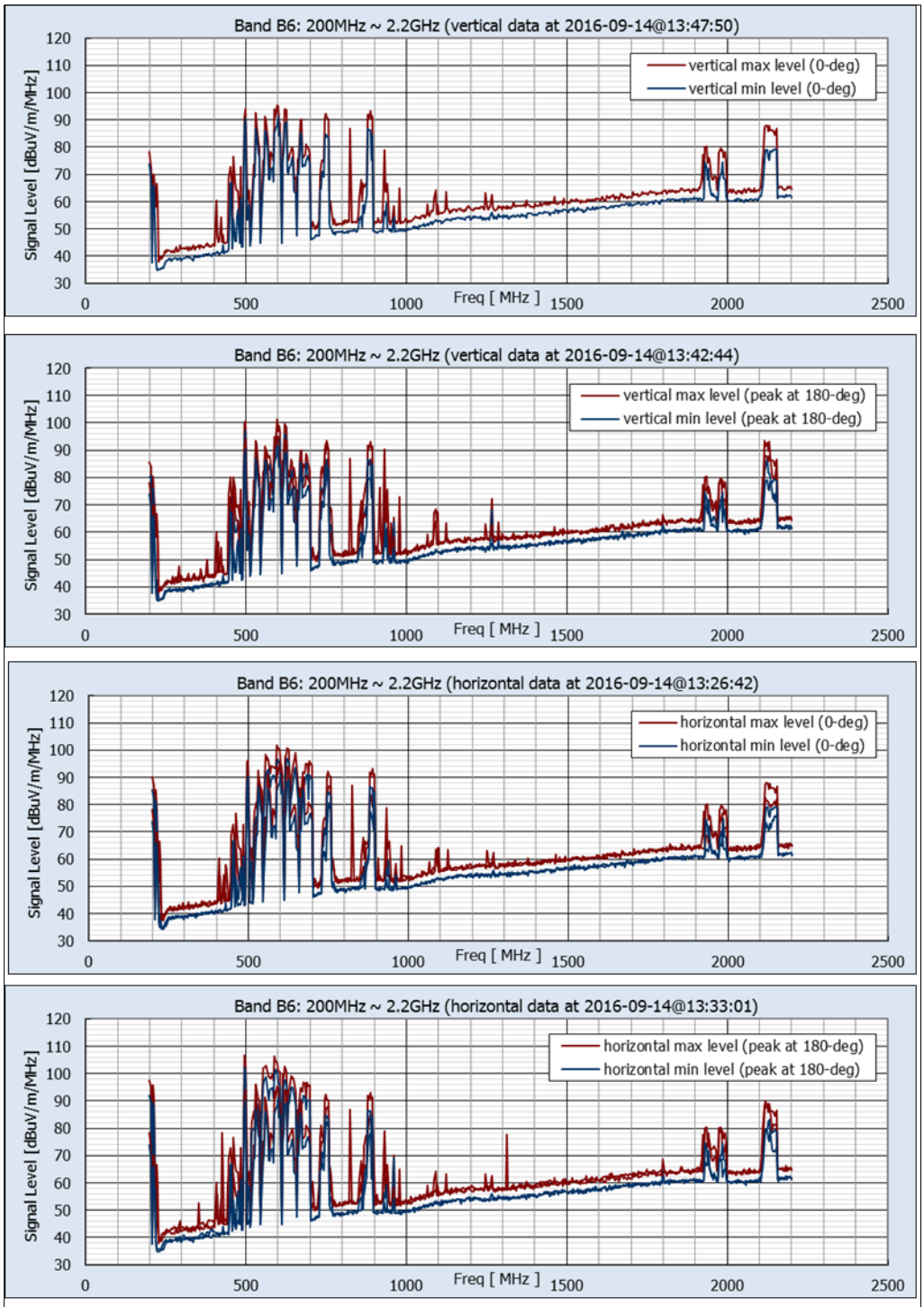






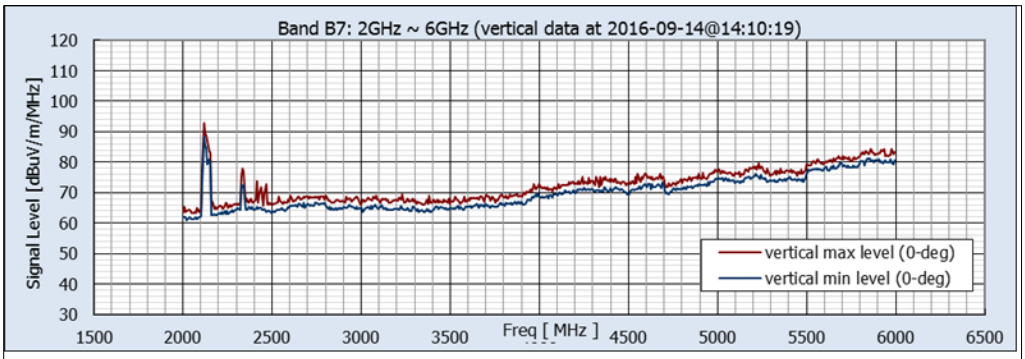
Maximum Levels									
		Vertical				Horizontal			
Band number	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B5	25 ~ 200	104.7	92.273	107.3	92.273	105.1	90.818	106.3	90.818

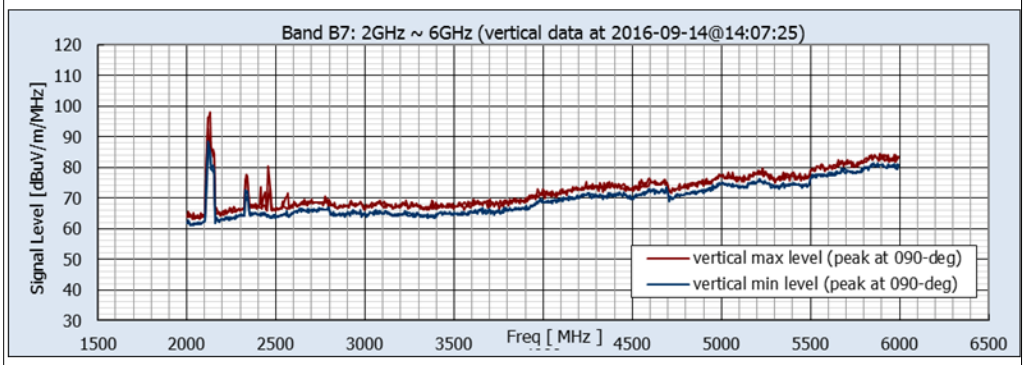
Figure 3.5-A-26 Site 3 (Santa Fe Springs): Measured Environmental Radio Frequency Levels, Band 5 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation

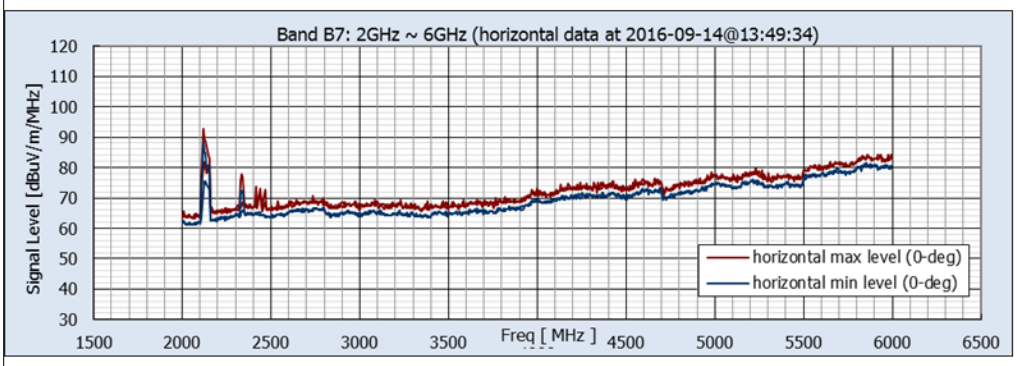


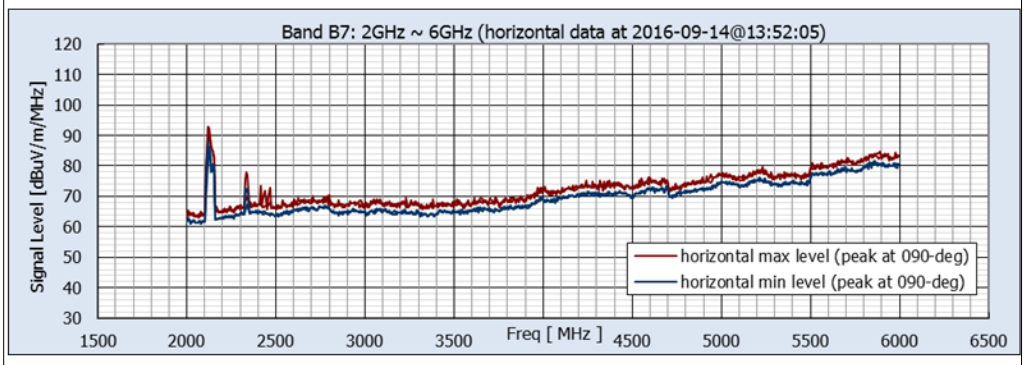
Maximum Levels									
		Vertical				Horizontal			
Band	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B6	200 ~ 2200	97.2	498.182	101.3	596.364	102.3	494.545	106.7	494.545

Figure 3.5-A-27 Sites 3 (Santa Fe Springs): Measured Environmental Radio Frequency Levels, Band 6 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation



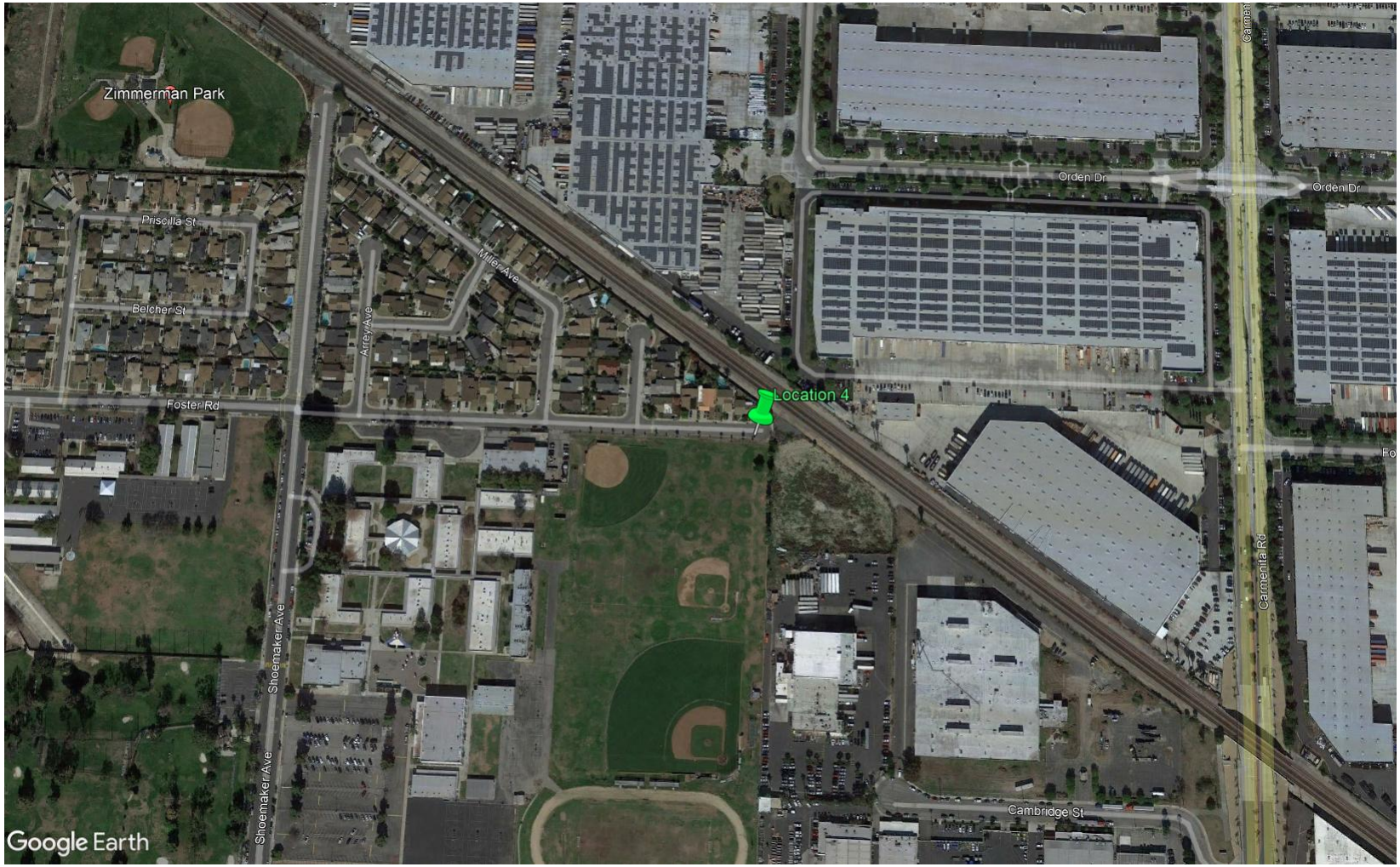






Maximum Levels									
		Vertical				Horizontal			
Band	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B7	2000~6000	88.6	2123.636	98.2	2130.909	86.0	2123.636	92.6	2123.636

Figure 3.5-A-28 Site 3 (Santa Fe Springs): Measured Environmental Radio Frequency Levels, Band 7 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation

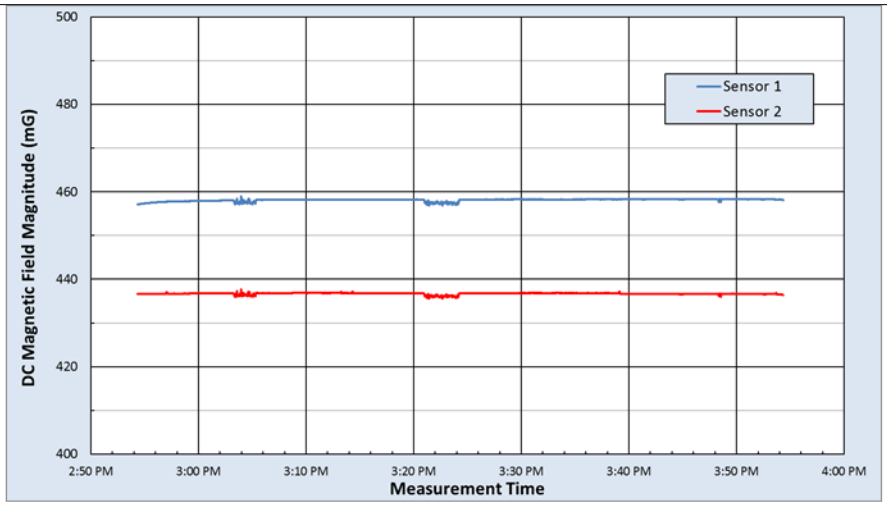


Residential/Industrial area (Latitude 33.909585°, Longitude -118.051213°)

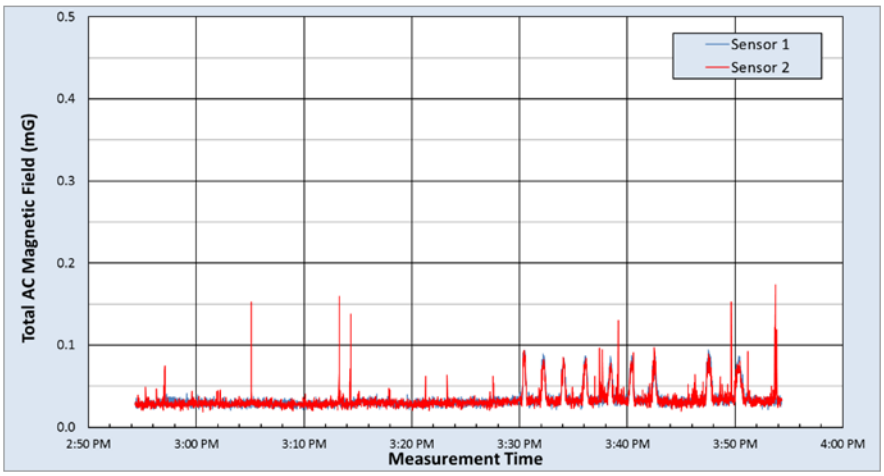
Figure 3.5-A-29 Site 4 (Norwalk): Shoemaker Avenue/Foster Road

Photos depicting the site from the perspective of the radio frequency measurement location. In the center is a satellite view, indicating the alignment right-of-way and measurement points (red = radio frequency, magenta = magnetometers). The satellite view is rotated so that the image at 0° faces the alignment.

Figure 3.5-A-30 Site 4 (Norwalk): Measurement Location and Site Views

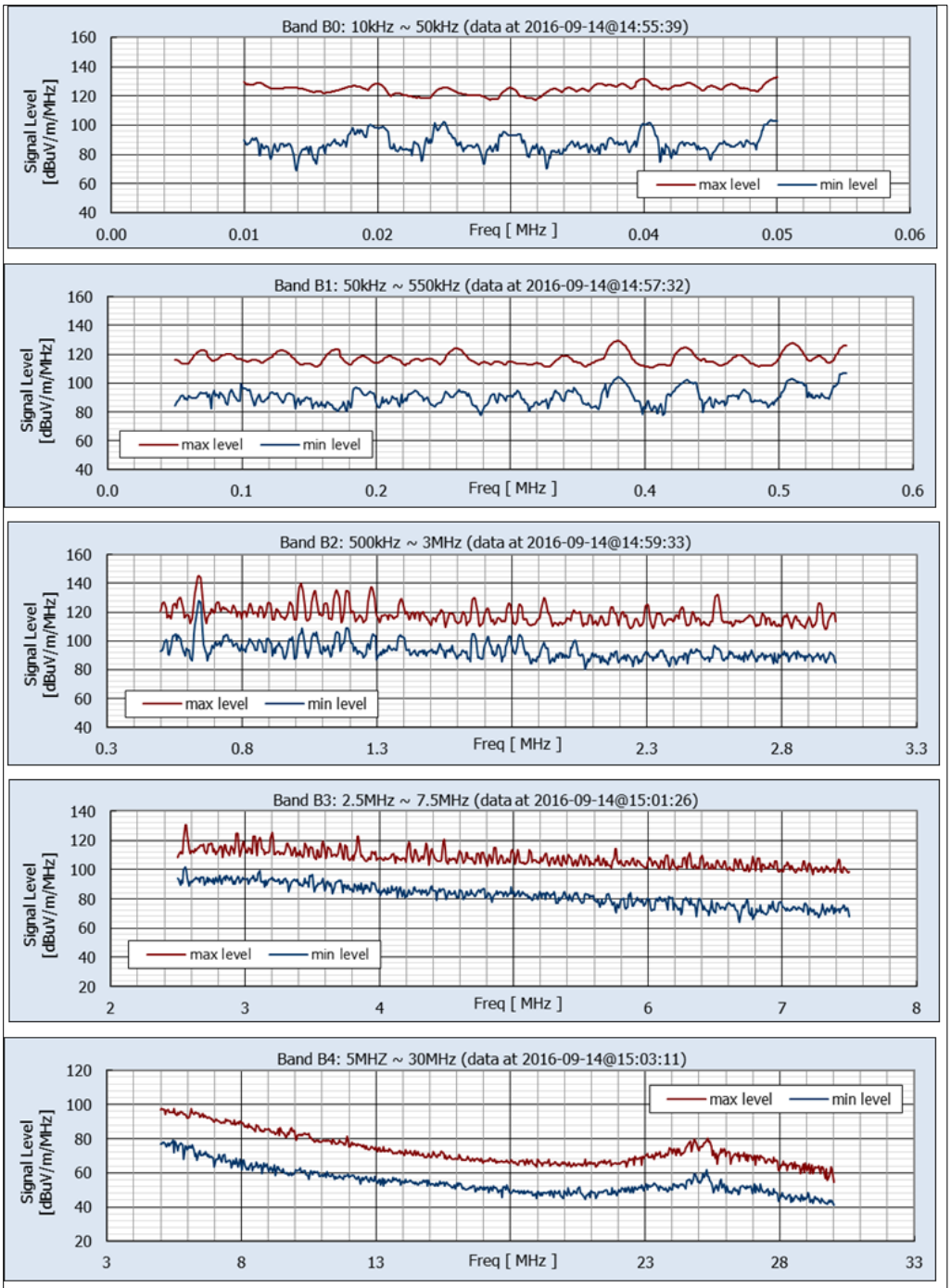


DC Magnetic Field Measurement Statistics						
	B Horizontal (mG)		B Vertical (mG)		B Total (mG)	
	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2
Max	247.9	254.4	387.5	367.2	459.0	437.7
Median	245.4	237.5	386.9	366.5	458.2	436.8
Min	244.3	236.2	385.5	355.0	456.9	435.6
Range	3.6	18.2	2.0	12.2	2.1	2.1
Std Dev	0.3	1.1	0.4	0.7	0.3	0.2



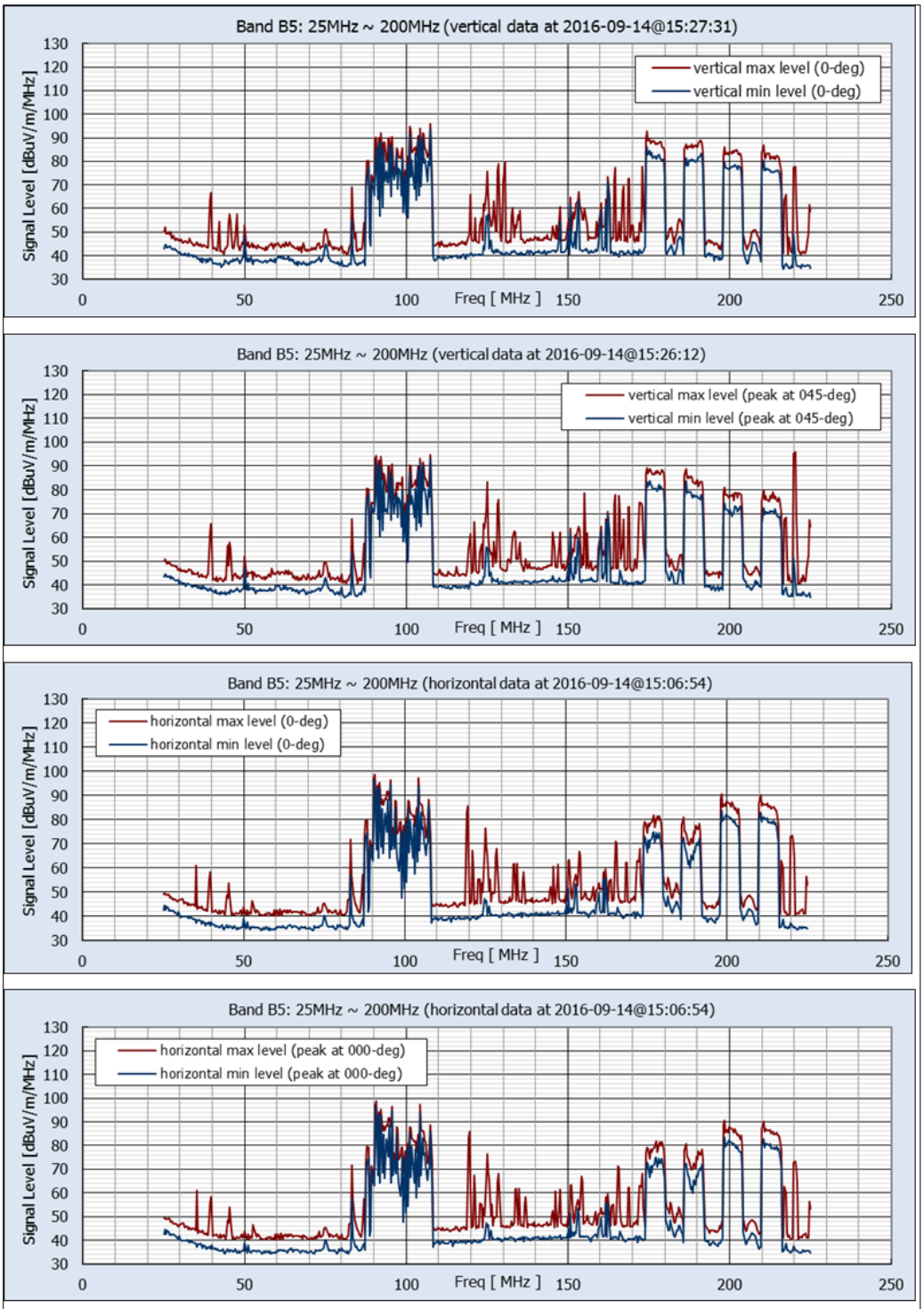
rms AC Magnetic Field Measurement Statistics																
	Fund 60Hz (mG)		2nd (mG)		3rd (mG)		4th (mG)		5th (mG)		6th (mG)		7th (mG)		Total AC (mG)	
	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2
Max	0.091	0.137	0.083	0.075	0.082	0.073	0.082	0.076	0.080	0.076	0.084	0.076	0.088	0.090	0.094	0.173
Median	0.019	0.019	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.010	0.010	0.031	0.030
Min	0.008	0.007	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.021	0.019
Range	0.083	0.130	0.081	0.073	0.079	0.071	0.080	0.075	0.079	0.074	0.082	0.075	0.087	0.089	0.073	0.155
Std Dev	0.007	0.009	0.008	0.008	0.005	0.005	0.006	0.005	0.005	0.005	0.006	0.005	0.006	0.006	0.011	0.012

Figure 3.5-A-31 Site 4 (Norwalk): Alternating Current and Direct Current Magnetic Field Measurement Results



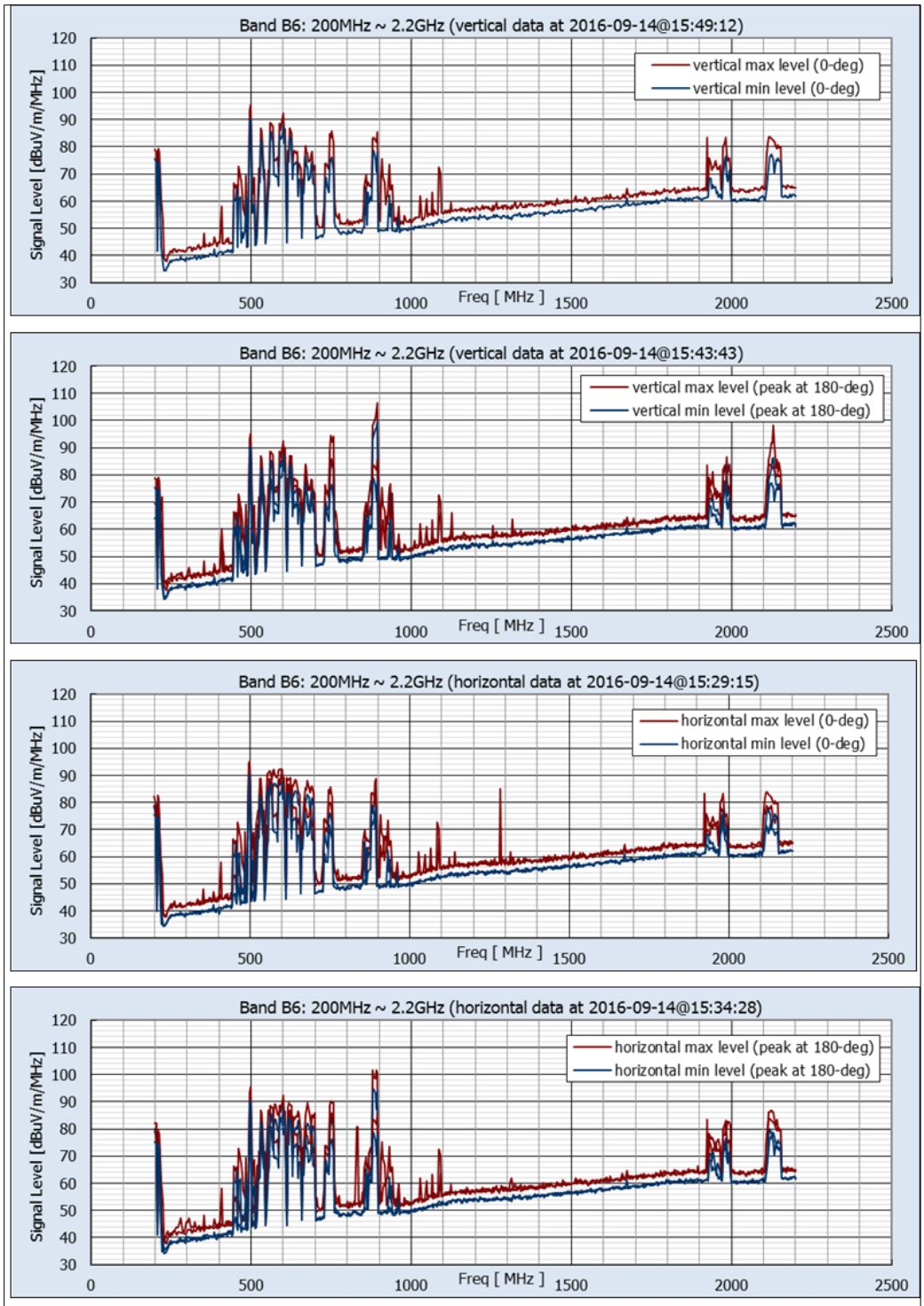
Maximum Levels					
Band number	Freq. Range (MHz)	Pk Min-Hold dB uV/m/MHz	@ Freq. (MHz)	Pk Max-Hold dB uV/m/MHz	@ Freq. (MHz)
B0	0.01 ~ 0.05	103.5	0.0495	132.6	0.0500
B1	0.05 ~ 0.55	107.0	0.5491	129.2	0.3800
B2	0.50 ~ 3.00	128.1	0.6409	145.5	0.6409
B3	2.5 ~ 7.5	101.9	2.5545	130.8	2.5636
B4	5 ~ 30	79.1	5.4545	97.5	5.5000

Figure 3.5-A-32 Site 4 (Norwalk): Measured Environmental Radio Frequency Levels, Nondirectional Data from Vertically Oriented Monopole Antenna, Bands 0–4



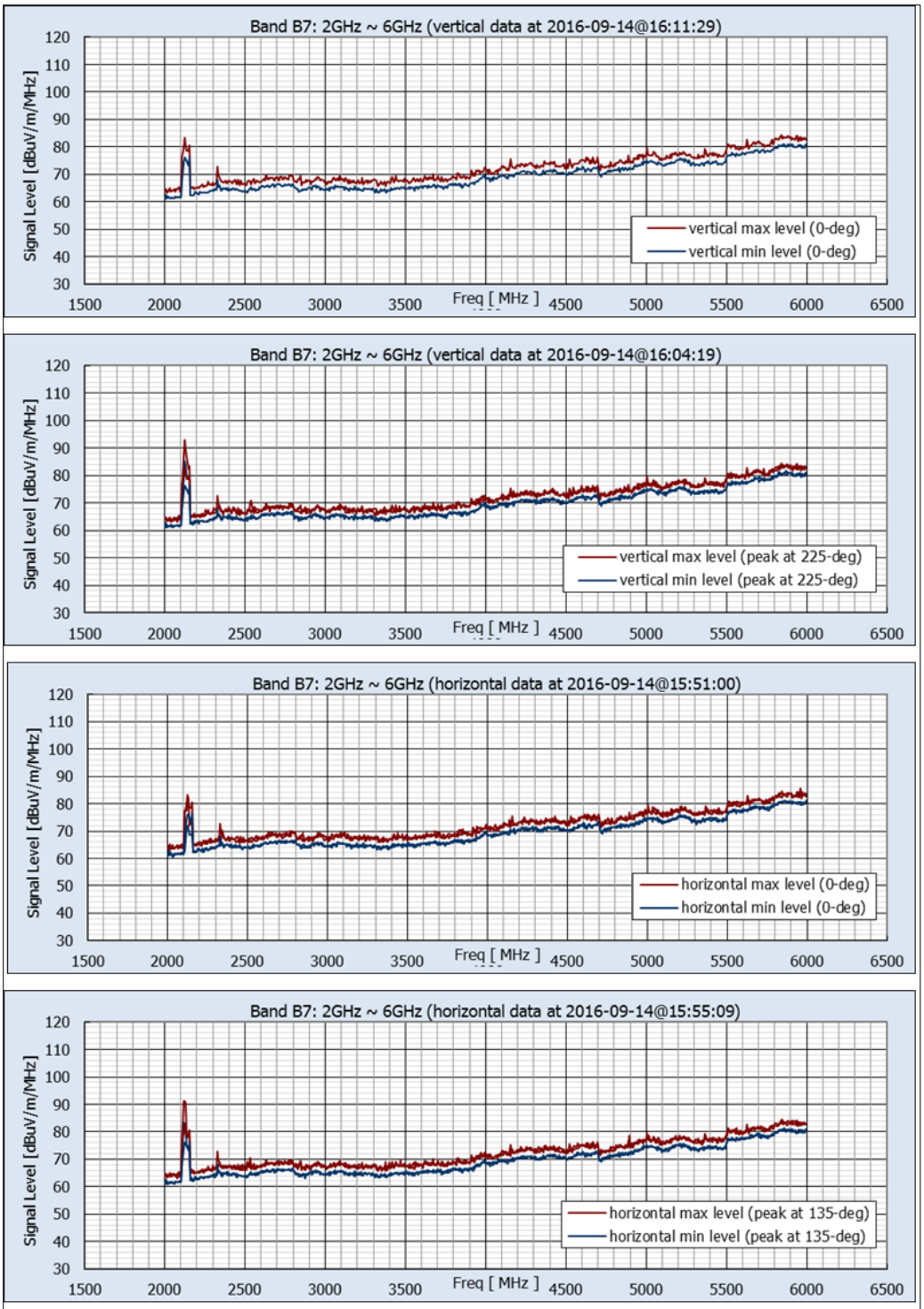
Maximum Levels									
		Vertical				Horizontal			
Band number	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B5	25 ~ 200	93.5	107.545	96.0	107.545	96.5	90.818	98.9	90.818

Figure 3.5-A-33 Site 4 (Norwalk): Measured Environmental Radio Frequency Levels, Band 5 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation



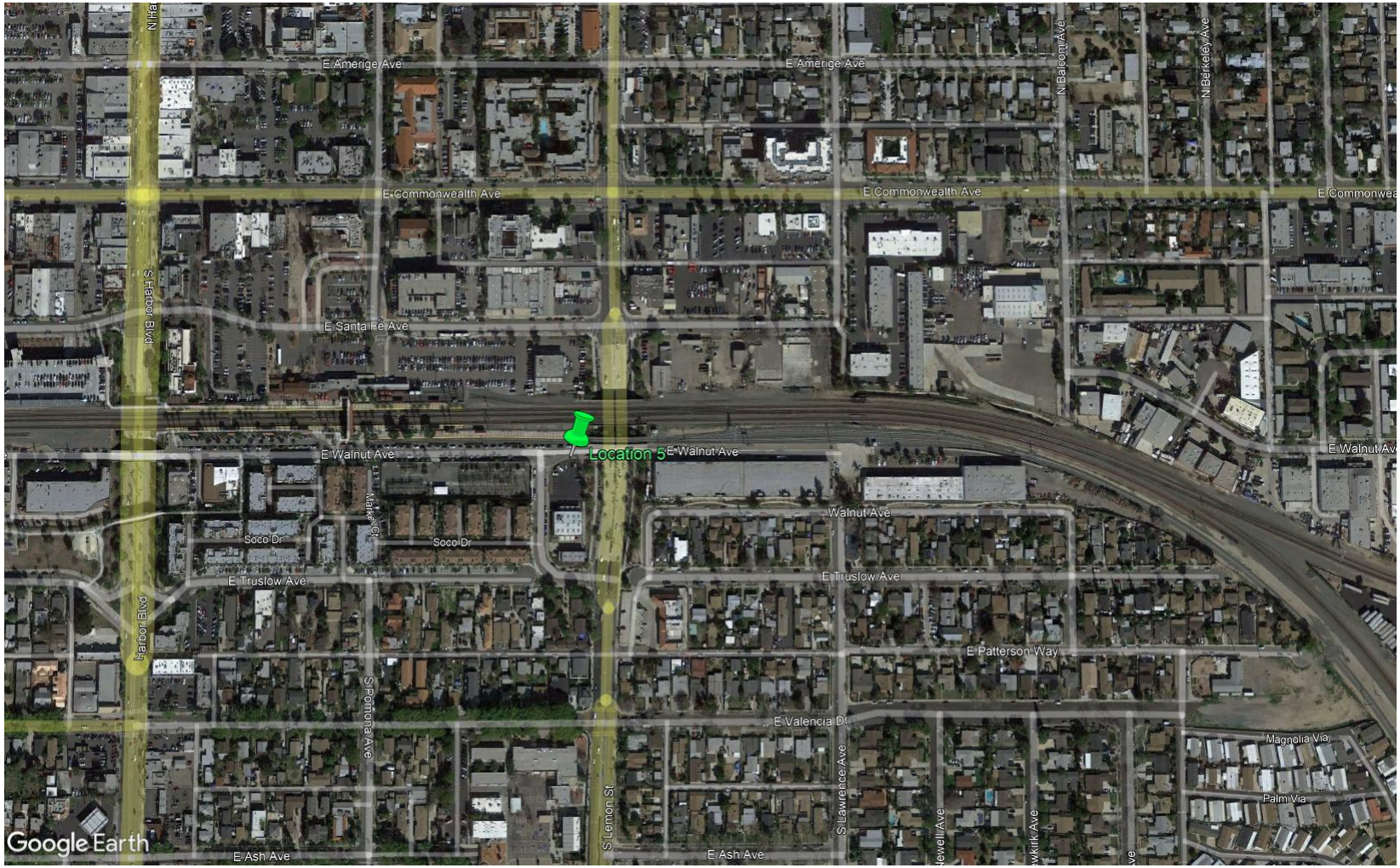
Maximum Levels									
		Vertical				Horizontal			
Band	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B6	200 ~ 2200	99.8	894.545	106.3	894.545	94.6	883.636	101.6	880.000

Figure 3.5-A-34 Site 4 (Norwalk): Measured Environmental Radio Frequency Levels, Band 6 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation



Maximum Levels									
		Vertical				Horizontal			
Band	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B7	2000~6000	85.1	2123.636	92.9	2123.636	83.4	2116.364	91.2	2116.364

Figure 3.5-A-35 Site 4 (Norwalk): Measured Environmental Radio Frequency Levels, Band 7 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation



Residential/Commercial setting, adjacent to the Fullerton Metrolink station (Latitude 33.868297°, Longitude -117.920212°)

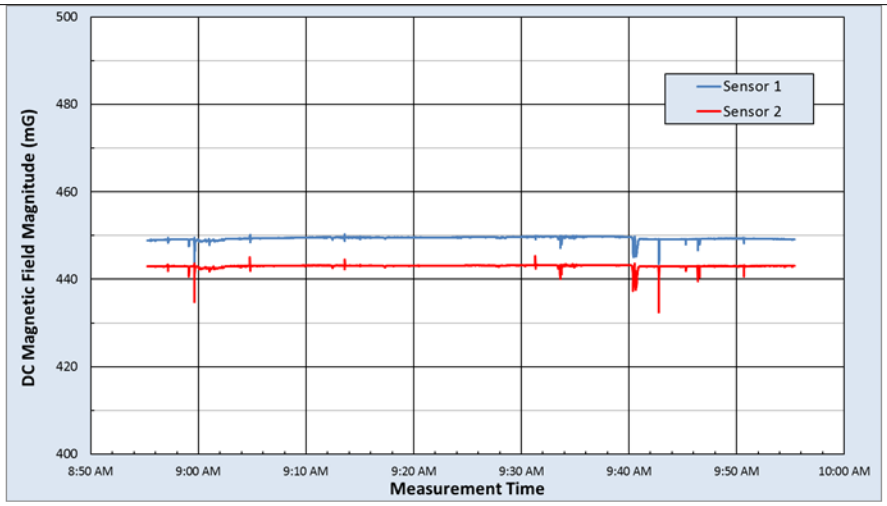
Figure 3.5-A-36 Site 5 (Fullerton): Lemon Street/Walnut Avenue

Photos depicting the site from the perspective of the radio frequency measurement location. In the center is a satellite view, indicating the alignment right-of-way and measurement points (red = radio frequency, magenta = magnetometers). The satellite view is rotated so that the image at 0° faces the alignment.

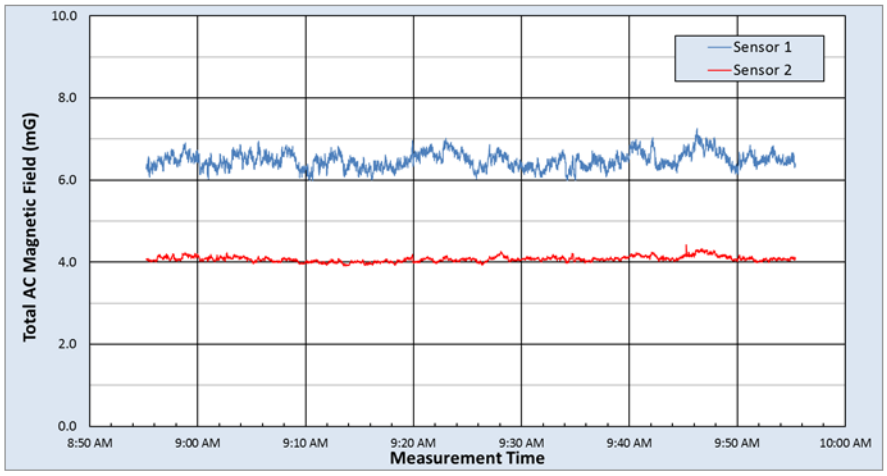
Figure 3.5-A-37 Site 5 (Fullerton): Measurement Location and Site Views

Immediately adjacent to the Southern California Edison Substation. Nearby emitters include railway communications, transmission lines and substation equipment. *Photos depicting visible close-proximity emitters. Other emissions sources may exist but are not visible from the site.*

Figure 3.5-A-38 Site 5 (Fullerton): Local Electromagnetic Field Sources

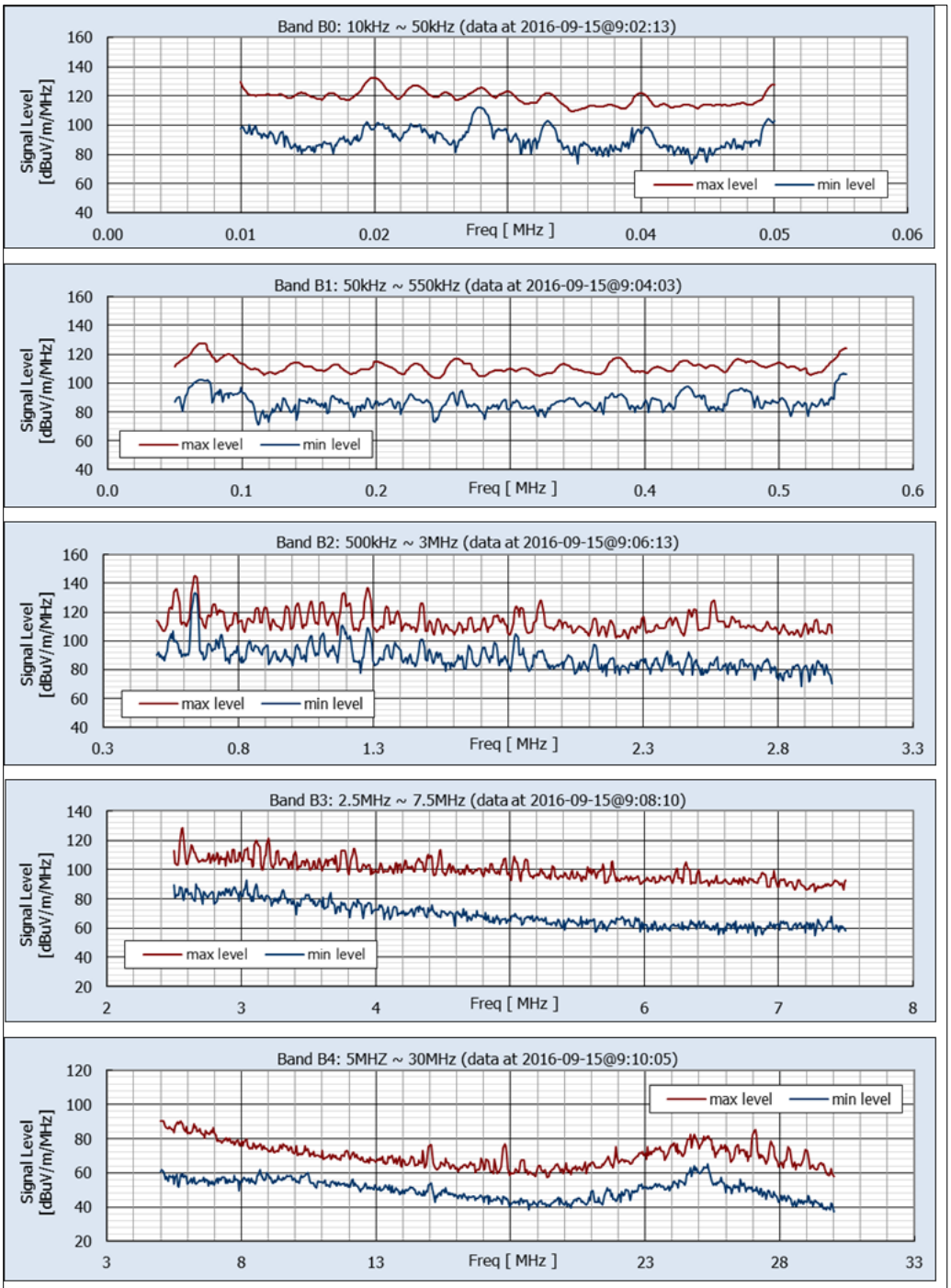


DC Magnetic Field Measurement Statistics						
	B Horizontal (mG)		B Vertical (mG)		B Total (mG)	
	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2
Max	263.5	246.2	367.6	378.4	450.3	445.3
Median	259.6	231.7	366.9	377.6	449.5	443.1
Min	253.5	220.5	359.8	368.1	440.2	432.6
Range	10.0	25.7	7.8	10.3	10.1	12.8
Std Dev	0.6	0.9	0.6	0.6	0.4	0.4



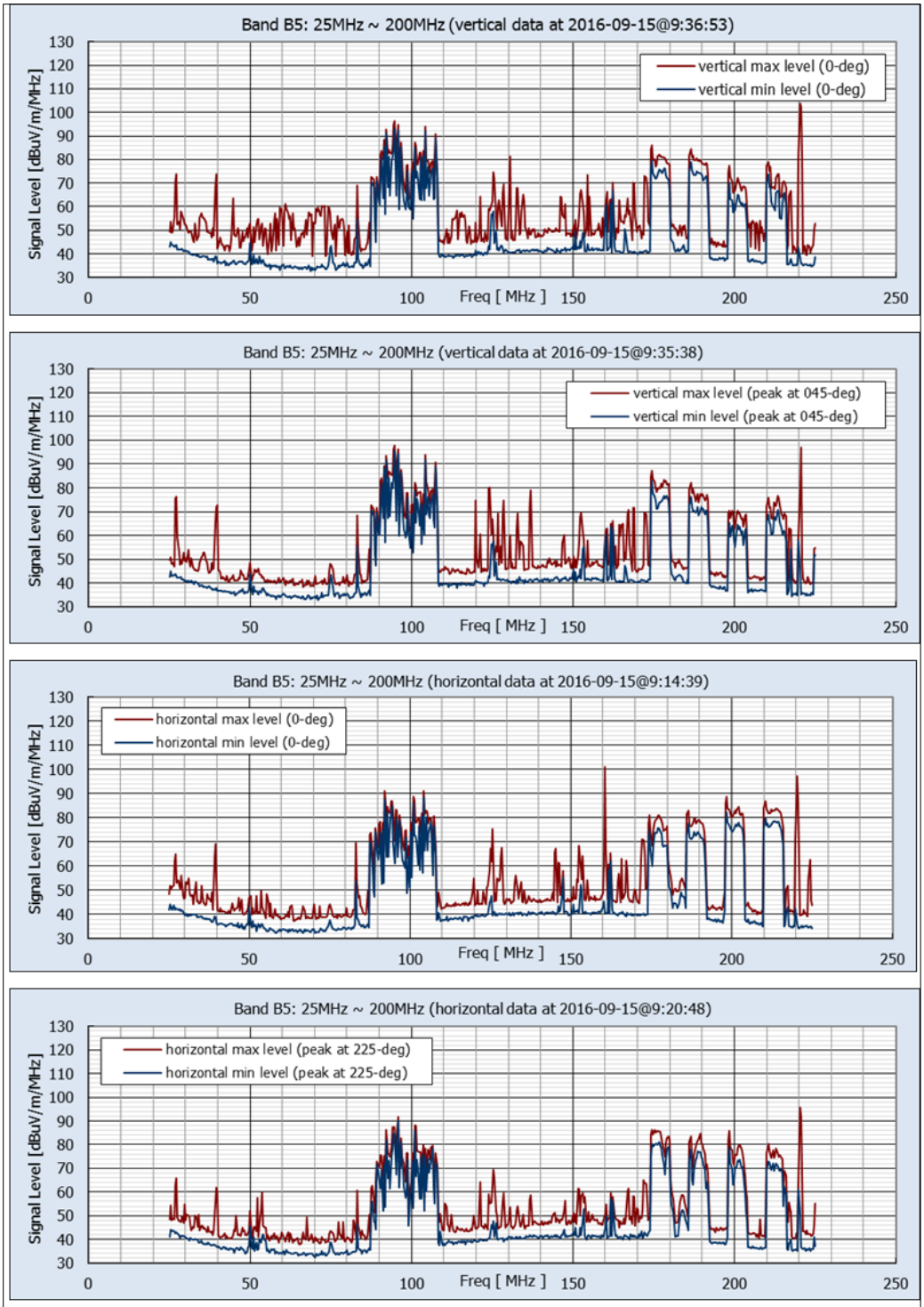
rms AC Magnetic Field Measurement Statistics																
	Fund 60Hz (mG)		2nd (mG)		3rd (mG)		4th (mG)		5th (mG)		6th (mG)		7th (mG)		Total AC (mG)	
	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2
Max	6.901	4.063	0.109	0.135	2.327	1.825	0.052	0.067	0.335	0.183	0.045	0.050	0.148	0.099	7.258	4.425
Median	6.087	3.688	0.038	0.031	2.184	1.707	0.014	0.012	0.292	0.144	0.014	0.013	0.108	0.074	6.471	4.070
Min	5.575	3.529	0.007	0.004	2.057	1.614	0.003	0.003	0.262	0.120	0.003	0.002	0.083	0.052	5.979	3.909
Range	1.326	0.534	0.102	0.131	0.269	0.211	0.049	0.064	0.073	0.063	0.043	0.048	0.065	0.047	1.279	0.517
Std Dev	0.203	0.070	0.014	0.011	0.039	0.030	0.007	0.006	0.011	0.008	0.006	0.006	0.010	0.007	0.194	0.068

Figure 3.5-A-39 Site 5 (Fullerton): Alternating Current and Direct Current Magnetic Field Measurement Results



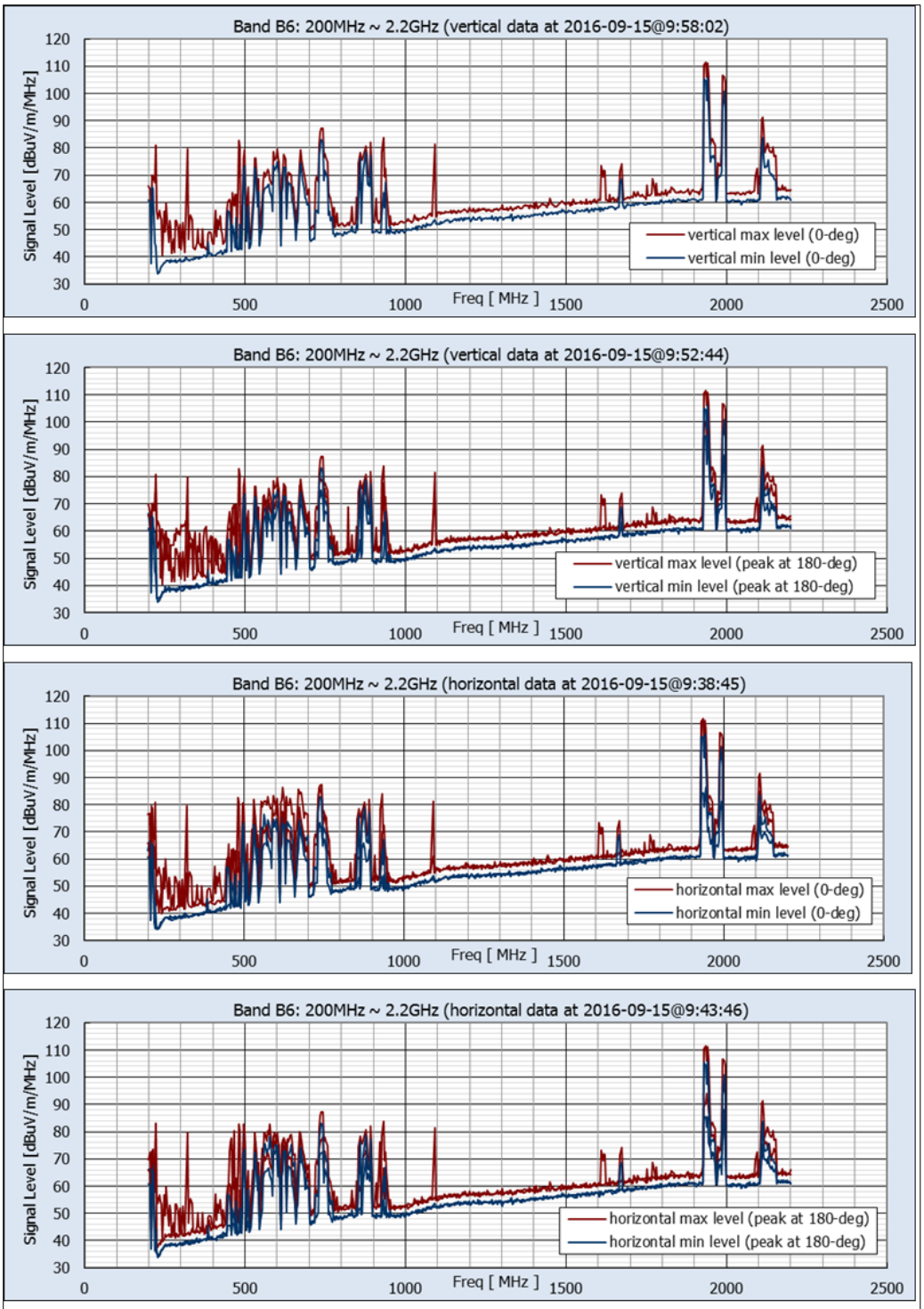
Maximum Levels					
Band number	Freq. Range (MHz)	Pk Min-Hold dB uV/m/MHz	@ Freq. (MHz)	Pk Max-Hold dB uV/m/MHz	@ Freq. (MHz)
B0	0.01 ~ 0.05	112.0	0.0279	132.4	0.0200
B1	0.05 ~ 0.55	106.5	0.5482	127.6	0.0709
B2	0.50 ~ 3.00	133.3	0.6409	145.3	0.6409
B3	2.5 ~ 7.5	92.8	3.0364	128.3	2.5636
B4	5 ~ 30	65.0	25.3182	90.3	5.0909

Figure 3.5-A-40 Site 5 (Fullerton): Measured Environmental Radio Frequency Levels, Nondirectional Data from Vertically Oriented Monopole Antenna, Bands 0–4



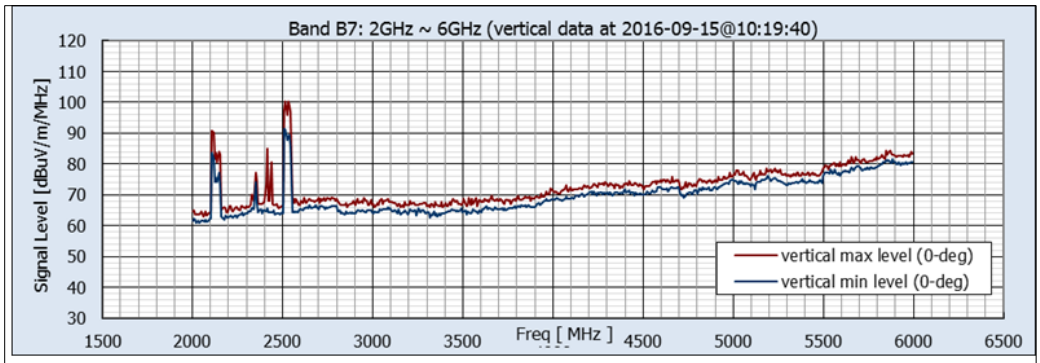
Maximum Levels									
		Vertical				Horizontal			
Band number	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B5	25 ~ 200	95.5	94.818	104.0	220.273	90.1	95.909	101.1	160.636

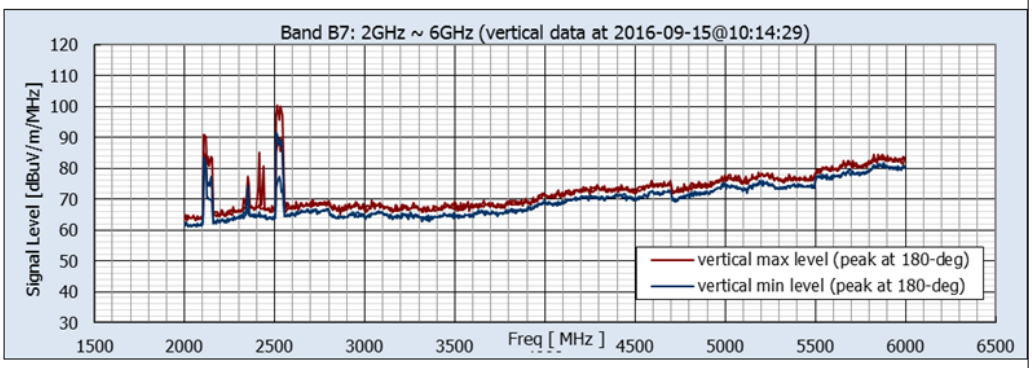
Figure 3.5-A-41 Site 5 (Fullerton): Measured Environmental Radio Frequency Levels, Band 5 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation

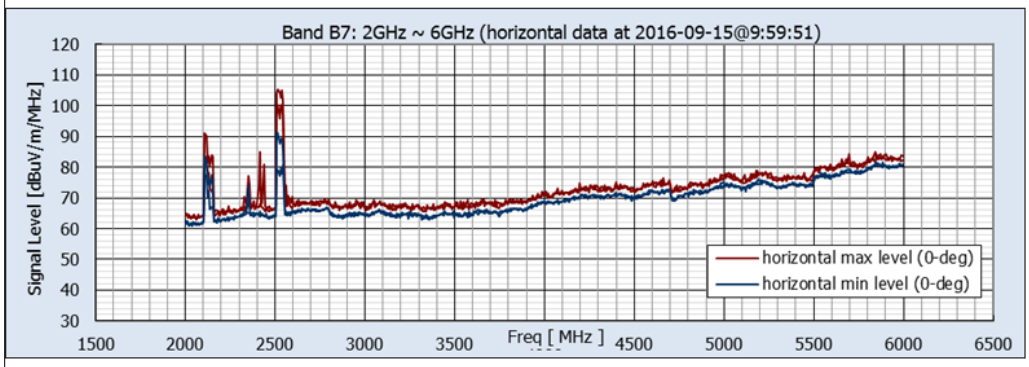


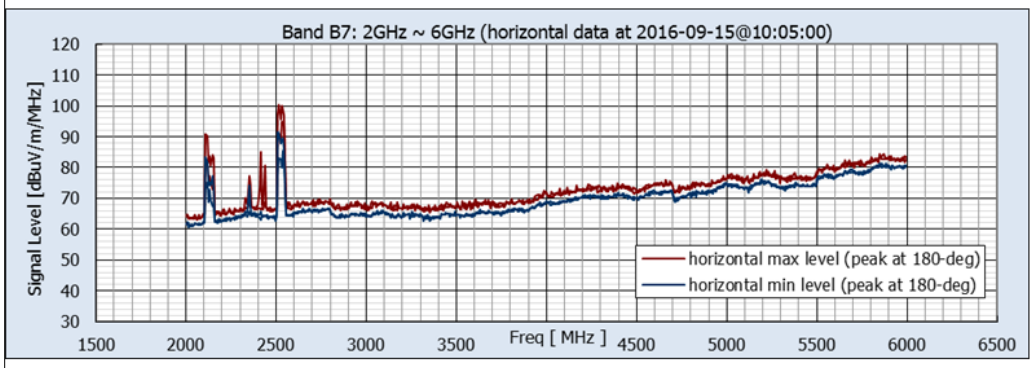
Maximum Levels									
		Vertical				Horizontal			
Band	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B6	200 ~ 2200	106.0	1941.818	111.6	1934.545	88.3	1992.727	110.6	1930.909

Figure 3.5-A-42 Site 5 (Fullerton): Measured Environmental Radio Frequency Levels, Band 6 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation



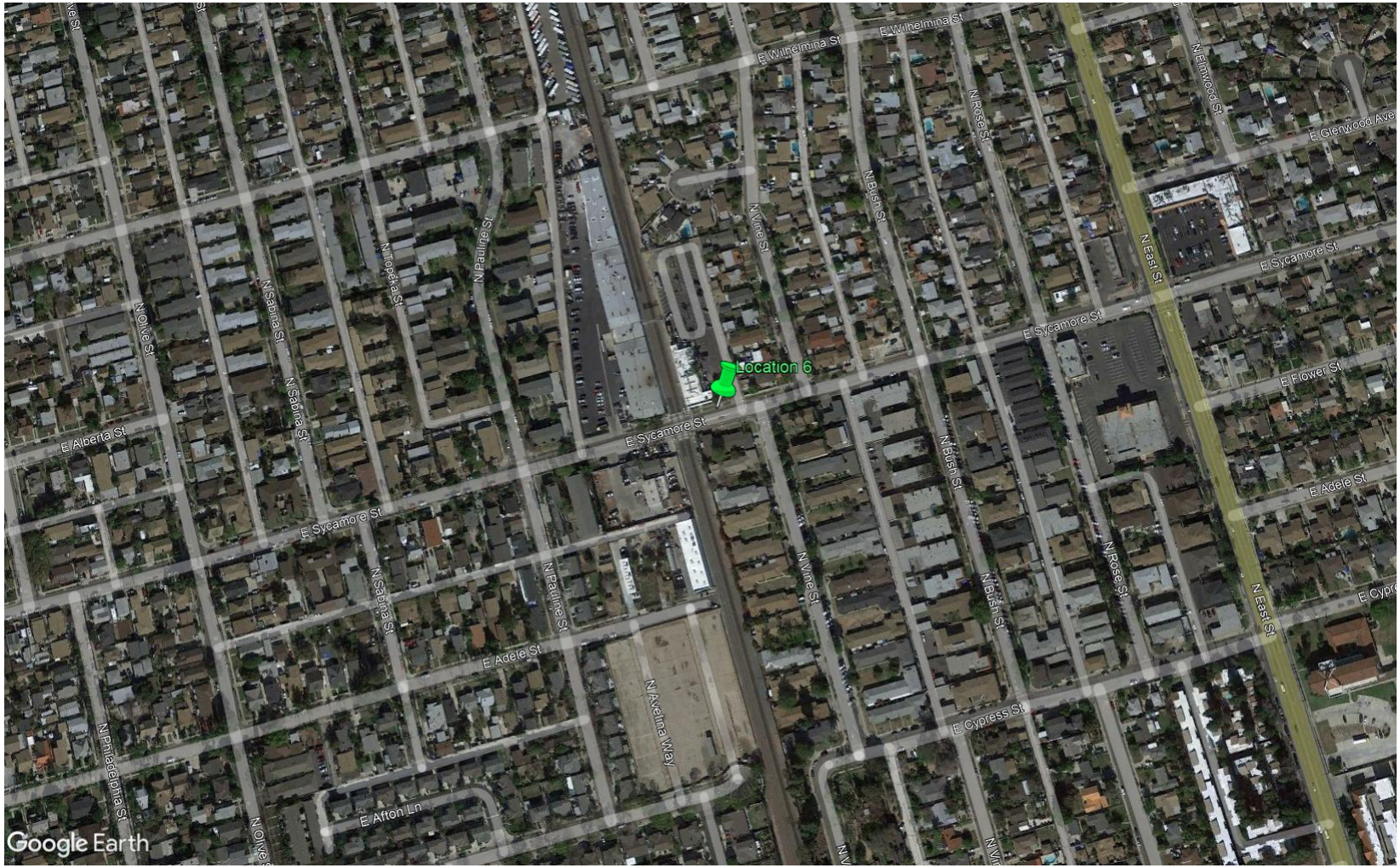






Maximum Levels									
		Vertical				Horizontal			
Band	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B7	2000~6000	91.5	2509.091	100.3	2516.364	85.5	2538.182	105.3	2516.364

Figure 3.5-A-43 Site 5 (Fullerton): Measured Environmental Radio Frequency Levels, Band 7 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation



Residential area, with numerous radio frequency emitters (Latitude 33.841725°, Longitude -117.907607°)

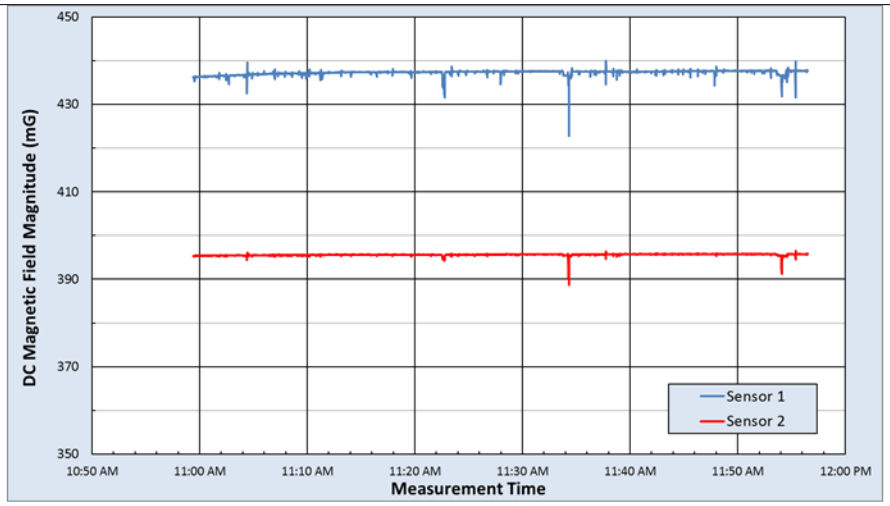
Figure 3.5-A-44 Site 6 (Anaheim): Sycamore Street/Vine Avenue

Photos depicting the site from the perspective of the radio frequency measurement location. In the center is a satellite view, indicating the alignment right-of-way and measurement points (red = radio frequency, magenta = magnetometers). The satellite view is rotated so that the image at 0° faces the alignment.

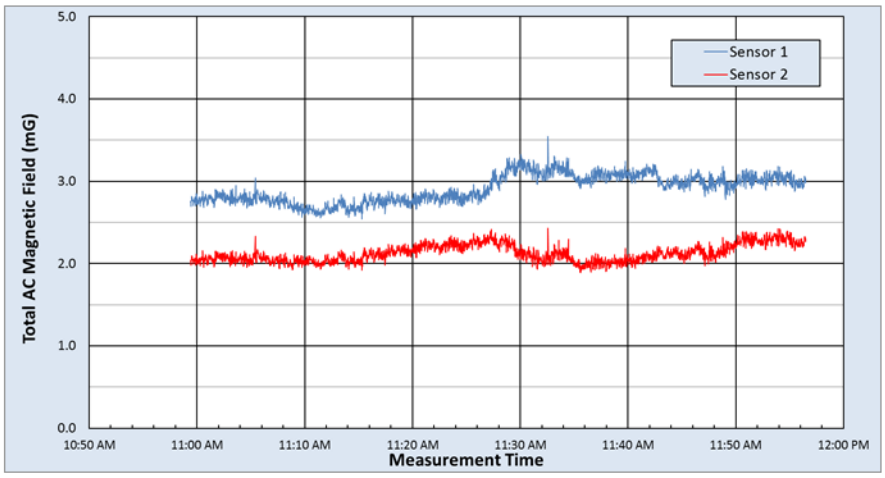
Figure 3.5-A-45 Site 6 (Anaheim): Measurement Location and Site Views

Nearby emitters include distribution lines, cellular communications, and railway communications. *Photos depicting visible close-proximity emitters. Other emissions sources may exist but are not visible from the site.*

Figure 3.5-A-46 Site 6 (Anaheim): Local Electromagnetic Field Sources

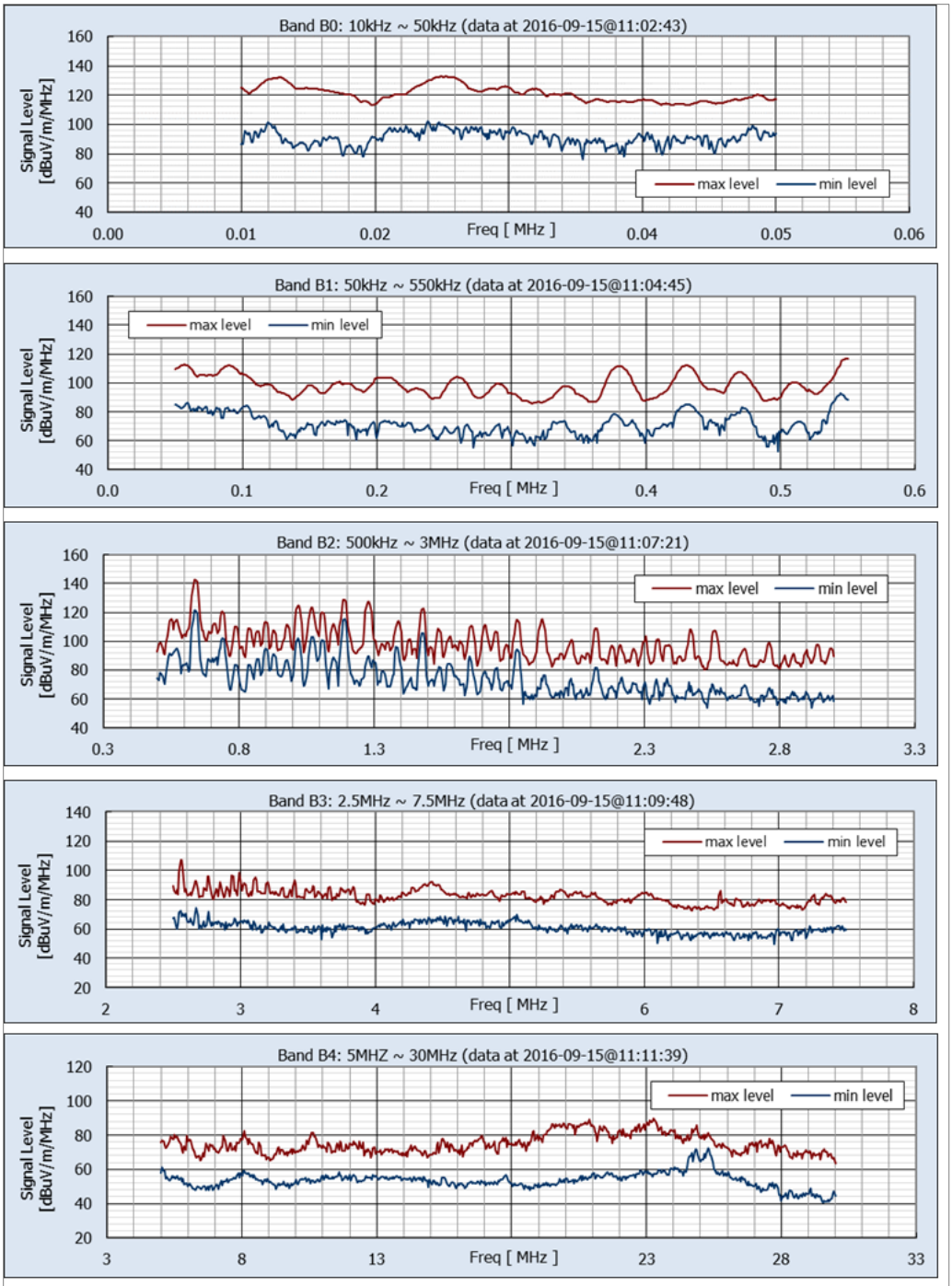


DC Magnetic Field Measurement Statistics						
	B Horizontal (mG)		B Vertical (mG)		B Total (mG)	
	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2
Max	292.5	247.6	330.4	314.3	439.9	396.4
Median	287.3	240.6	329.8	314.1	437.4	395.6
Min	280.3	238.7	312.0	300.0	422.9	388.9
Range	12.2	8.9	18.4	14.3	17.0	7.5
Std Dev	0.6	0.2	0.6	0.3	0.6	0.2



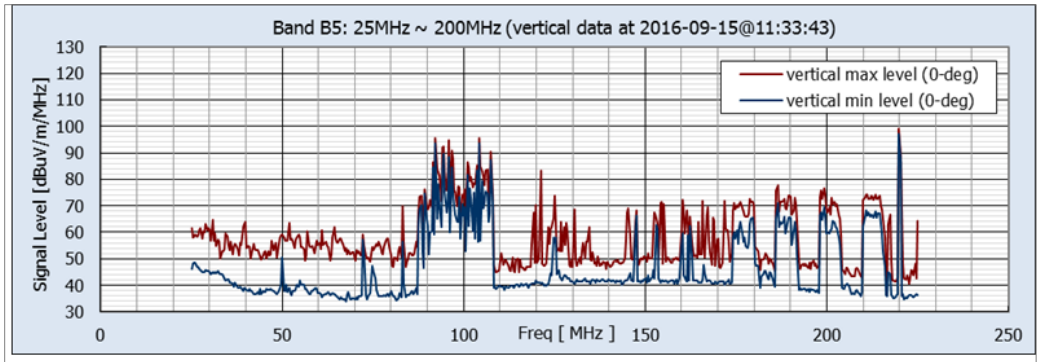
rms AC Magnetic Field Measurement Statistics																
	Fund 60Hz (mG)		2nd (mG)		3rd (mG)		4th (mG)		5th (mG)		6th (mG)		7th (mG)		Total AC (mG)	
	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2
Max	3.489	2.391	0.132	0.167	0.619	0.460	0.036	0.062	0.234	0.178	0.032	0.057	0.192	0.145	3.543	2.433
Median	2.840	2.053	0.055	0.027	0.568	0.423	0.014	0.012	0.215	0.158	0.010	0.010	0.169	0.121	2.909	2.105
Min	2.462	1.831	0.037	0.012	0.525	0.393	0.003	0.003	0.186	0.137	0.001	0.002	0.148	0.100	2.544	1.889
Range	1.027	0.560	0.095	0.155	0.094	0.067	0.033	0.058	0.048	0.040	0.031	0.055	0.044	0.045	0.999	0.544
Std Dev	0.173	0.108	0.006	0.005	0.010	0.009	0.004	0.003	0.006	0.005	0.003	0.003	0.007	0.007	0.168	0.106

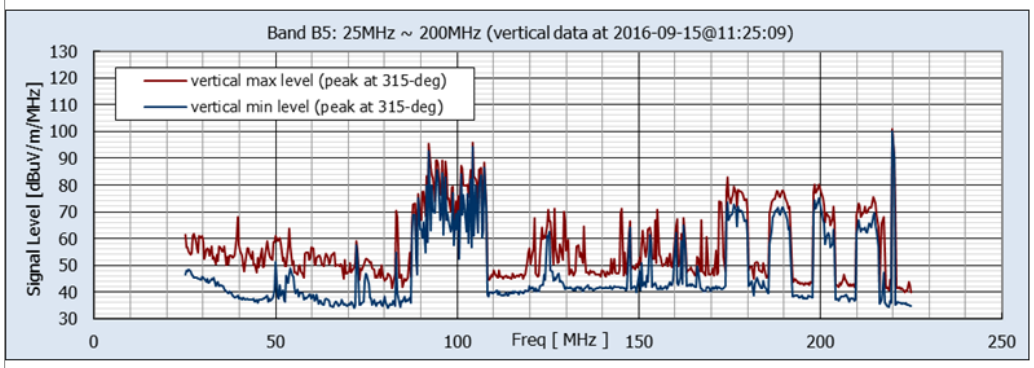
Figure 3.5-A-47 Site 6 (Anaheim): Alternating Current and Direct Current Magnetic Field Measurement Results

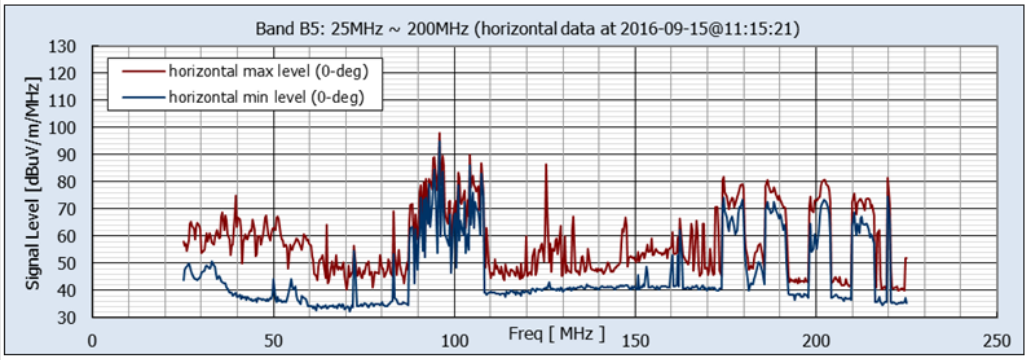


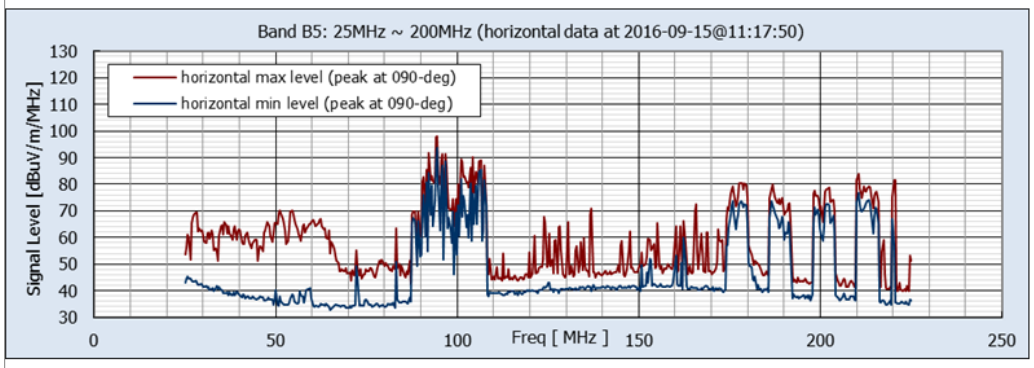
Maximum Levels					
Band number	Freq. Range (MHz)	Pk Min-Hold dB uV/m/MHz	@ Freq. (MHz)	Pk Max-Hold dB uV/m/MHz	@ Freq. (MHz)
B0	0.01 ~ 0.05	102.3	0.0240	132.6	0.0253
B1	0.05 ~ 0.55	92.6	0.5445	116.8	0.5500
B2	0.50 ~ 3.00	121.2	0.6364	142.8	0.6409
B3	2.5 ~ 7.5	74.5	2.6727	107.3	2.5545
B4	5 ~ 30	72.3	25.2727	89.7	23.2727

Figure 3.5-A-48 Site 6 (Anaheim): Measured Environmental Radio Frequency Levels, Nondirectional Data from Vertically Oriented Monopole Antenna, Bands 0–4



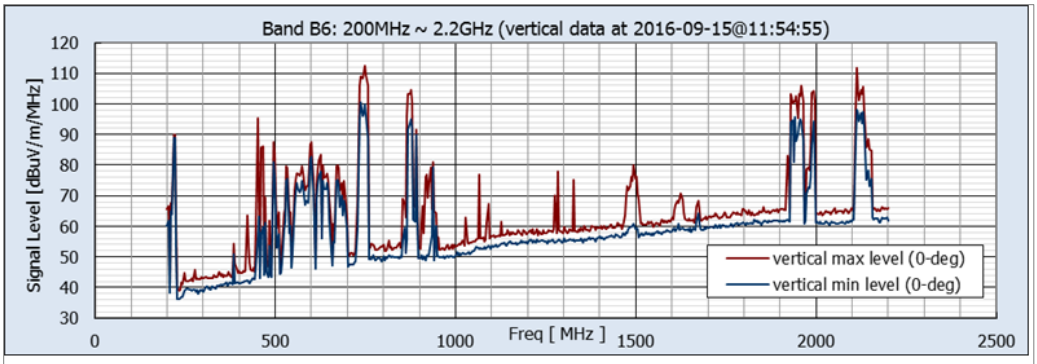


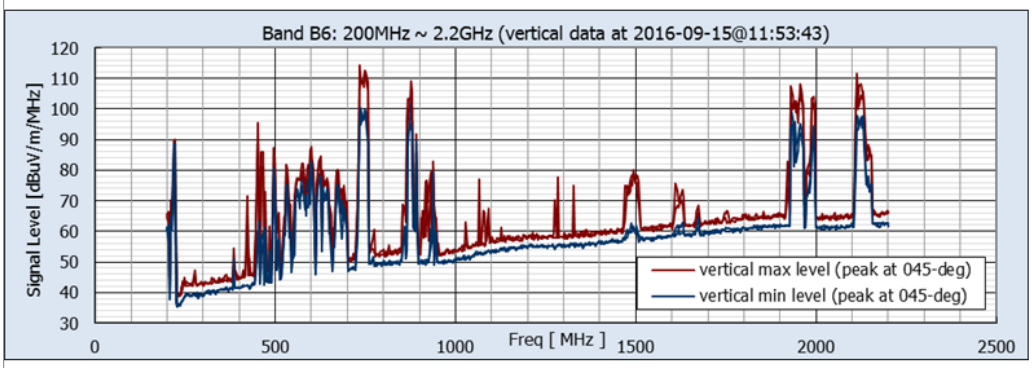


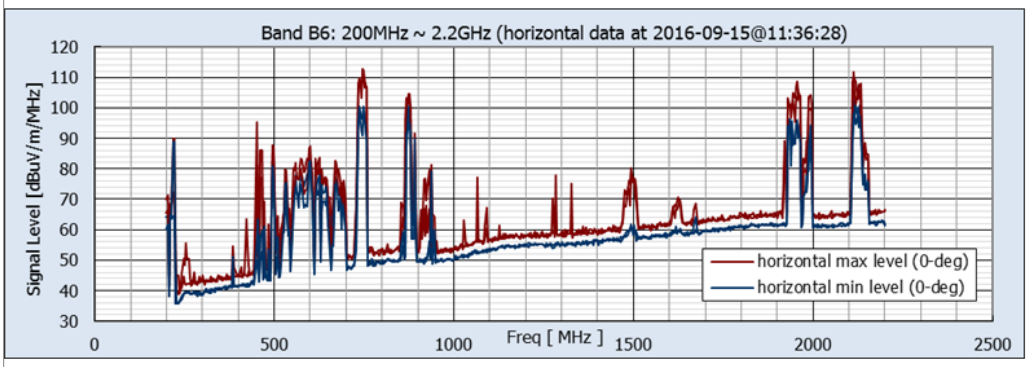


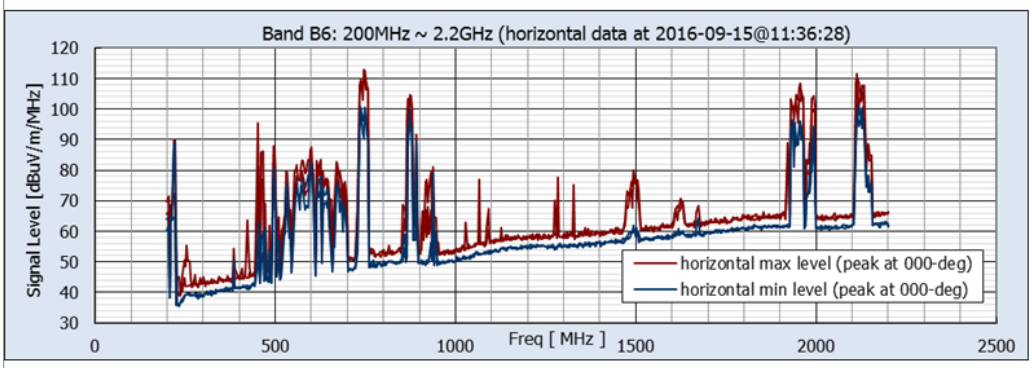
Maximum Levels									
		Vertical				Horizontal			
Band number	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B5	25 ~ 200	100.1	219.909	100.8	219.909	95.0	95.909	98.1	95.909

Figure 3.5-A-49 Site 6 (Anaheim): Measured Environmental Radio Frequency Levels, Band 5 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation



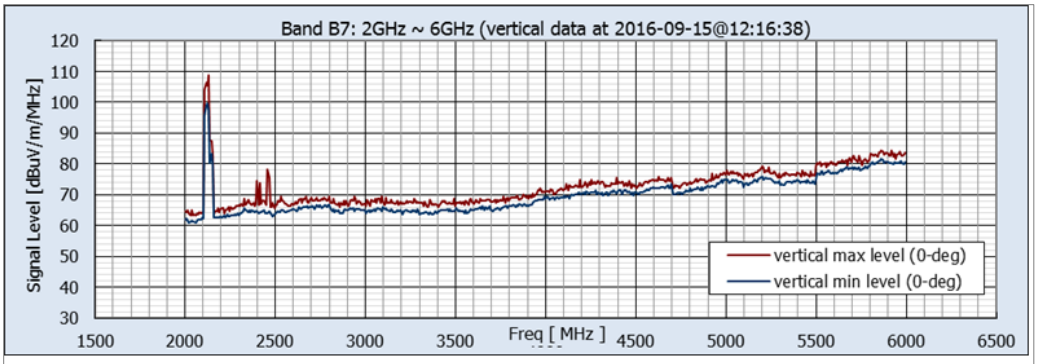


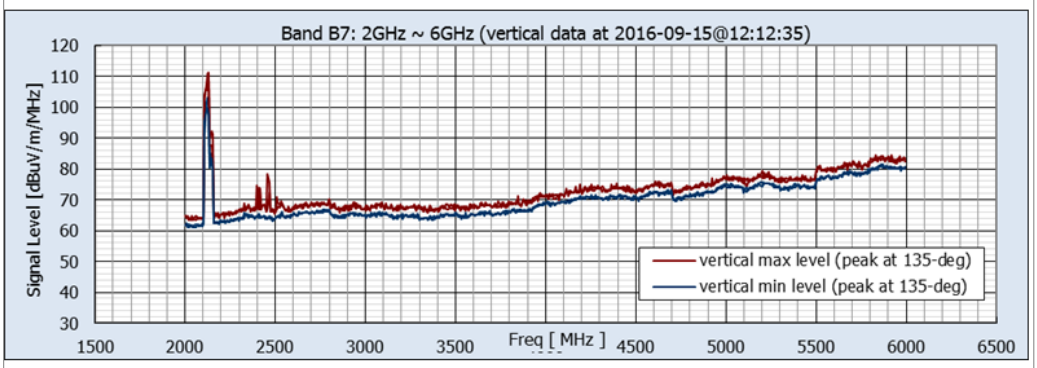


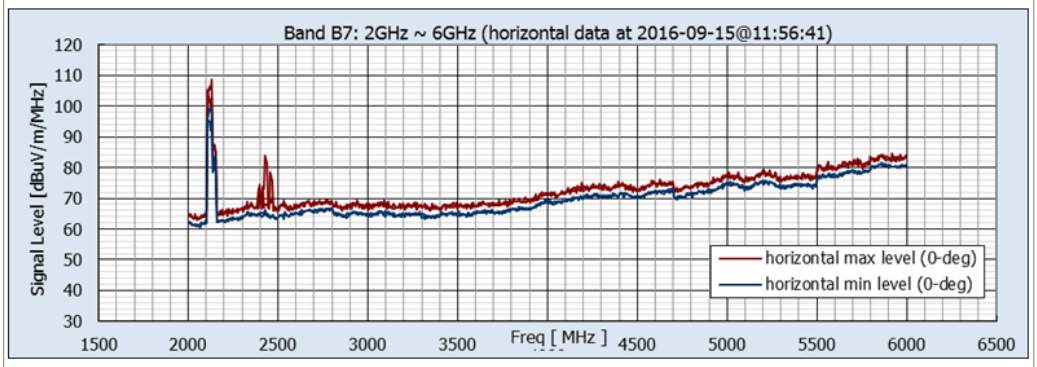


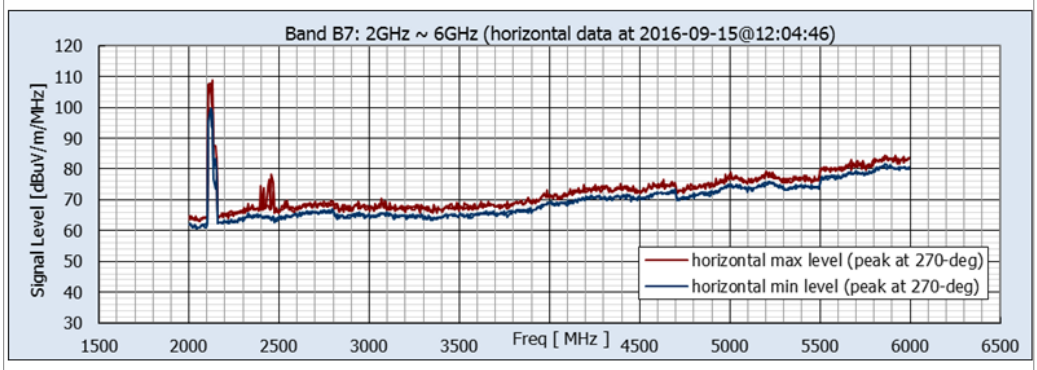
Maximum Levels									
		Vertical				Horizontal			
Band	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B6	200 ~ 2200	103.2	876.364	114.5	734.545	102.4	2112.727	112.8	745.455

Figure 3.5-A-50 Site 6 (Anaheim): Measured Environmental Radio Frequency Levels, Band 6 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation



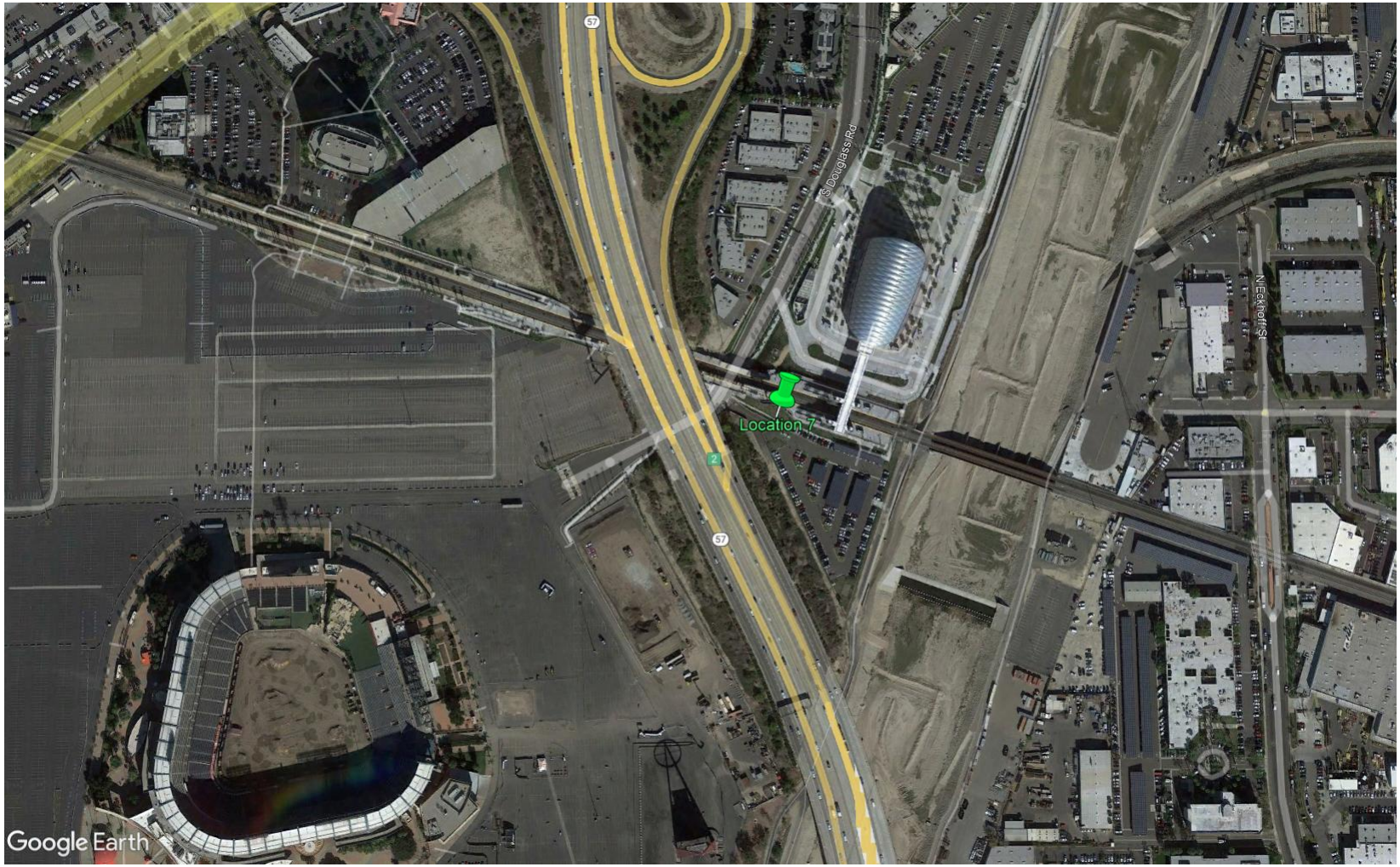






Maximum Levels									
		Vertical				Horizontal			
Band	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B7	2000~6000	103.3	2130.909	111.4	2130.909	98.7	2116.364	107.7	2116.364

Figure 3.5-A-51 Site 6 (Anaheim): Measured Environmental Radio Frequency Levels, Band 7 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation



Urban setting adjacent to Anaheim Regional Transportation Intermodal Center, Anaheim Stadium (Latitude 33.802430°, Longitude -117.878446°)

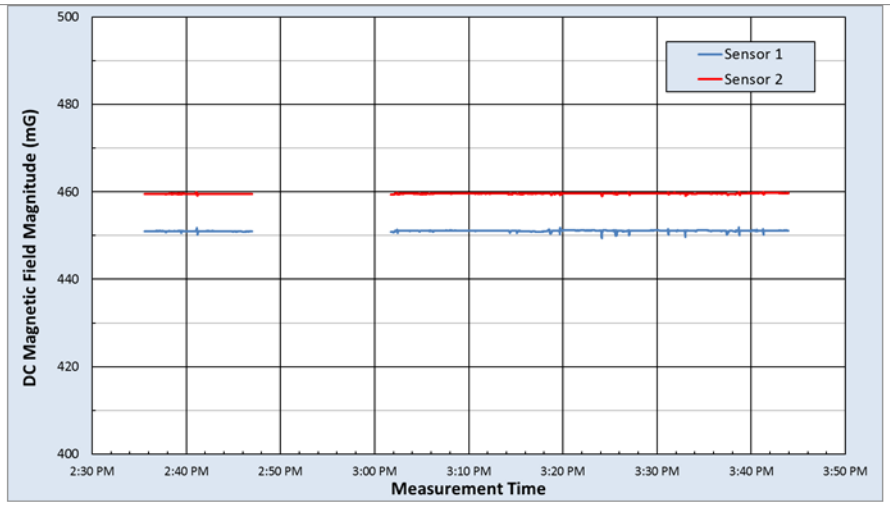
Figure 3.5-A-52 Site 7 (Anaheim): South Douglass Road/West Katella Avenue

Photos depicting the site from the perspective of the radio frequency measurement location. In the center is a satellite view, indicating the alignment right-of-way and measurement points (red = radio frequency, magenta = magnetometers). The satellite view is rotated so that the image at 0° faces the alignment.

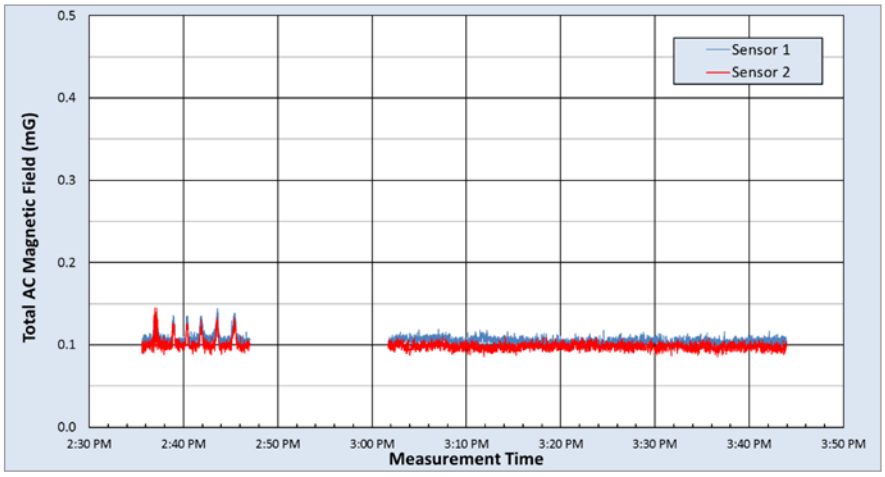
Figure 3.5-A-53 Site 7 (Anaheim): Measurement Location and Site Views

Nearby emitters include cell towers, railway communications, and distribution lines parallel to the alignment. Photos depicting visible close-proximity emitters. Other emissions sources may exist but are not visible from the site.

Figure 3.5-A-54 Site 7 (Anaheim): Local Electromagnetic Field Sources

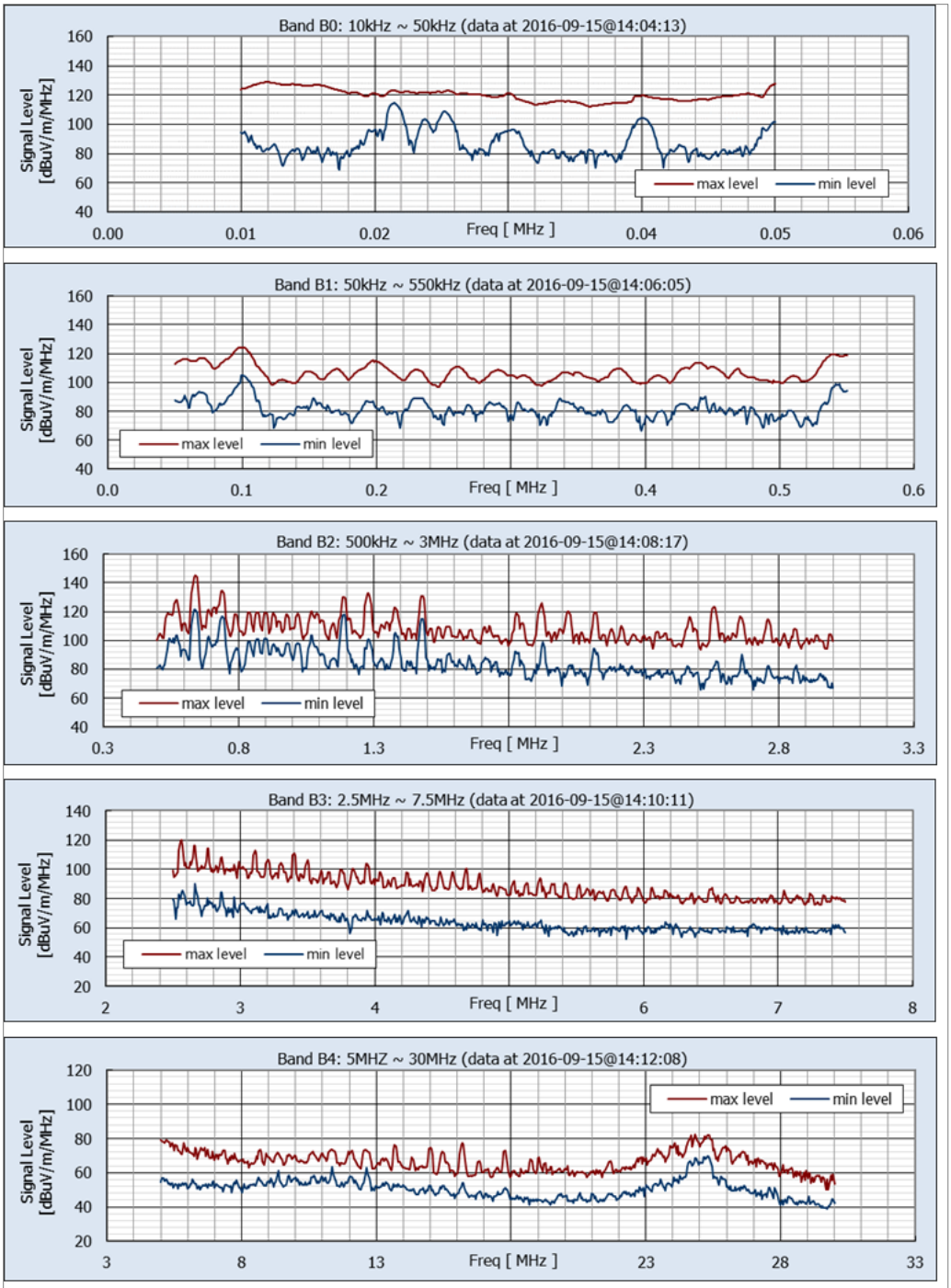


DC Magnetic Field Measurement Statistics						
	B Horizontal (mG)		B Vertical (mG)		B Total (mG)	
	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2
Max	248.4	265.3	380.8	376.9	451.9	459.9
Median	246.5	264.5	377.8	375.9	451.1	459.6
Min	241.2	263.1	376.6	375.3	449.4	459.0
Range	7.2	2.2	4.2	1.7	2.5	0.9
Std Dev	1.7	0.3	1.1	0.2	0.1	0.1



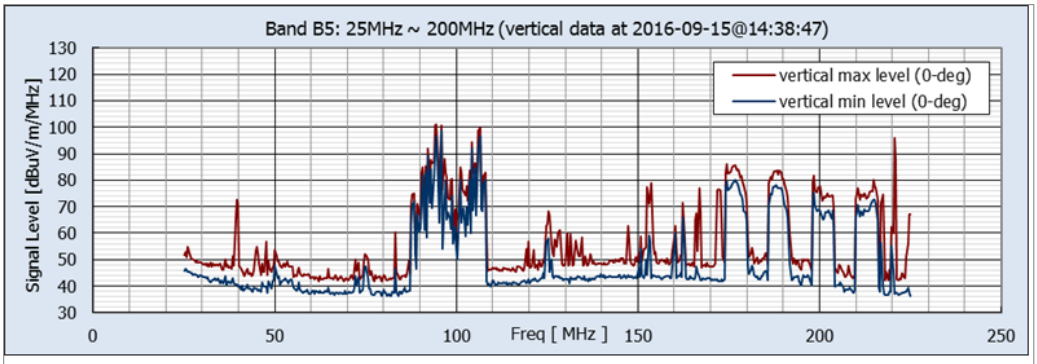
rms AC Magnetic Field Measurement Statistics																
	Fund 60Hz (mG)		2nd (mG)		3rd (mG)		4th (mG)		5th (mG)		6th (mG)		7th (mG)		Total AC (mG)	
	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2	Sensor 1	Sensor 2
Max	0.140	0.143	0.084	0.076	0.087	0.073	0.086	0.078	0.095	0.089	0.090	0.085	0.025	0.024	0.144	0.145
Median	0.102	0.096	0.008	0.008	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.010	0.009	0.105	0.098
Min	0.079	0.083	0.001	0.002	0.003	0.002	0.002	0.002	0.001	0.002	0.002	0.002	0.002	0.002	0.092	0.086
Range	0.061	0.060	0.083	0.074	0.085	0.071	0.084	0.076	0.094	0.087	0.088	0.083	0.023	0.022	0.052	0.059
Std Dev	0.005	0.004	0.005	0.005	0.005	0.005	0.006	0.005	0.006	0.005	0.007	0.006	0.003	0.003	0.006	0.006

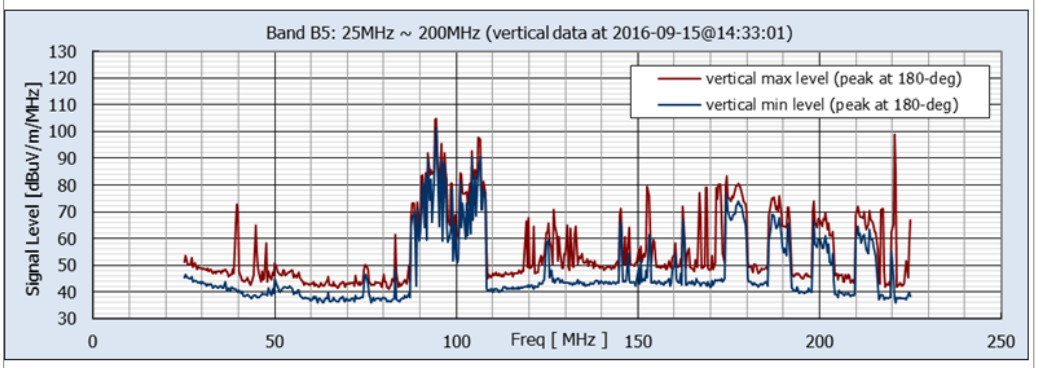
Figure 3.5-A-55 Site 7 (Anaheim): Alternating Current and Direct Current Magnetic Field Measurement Results

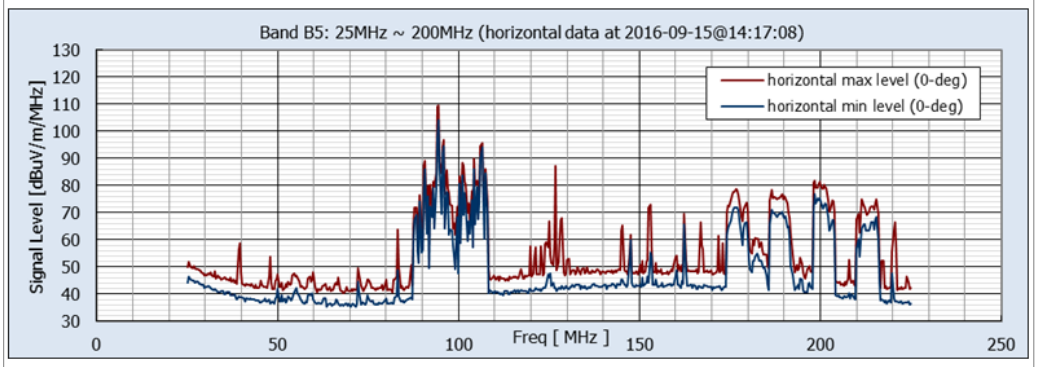


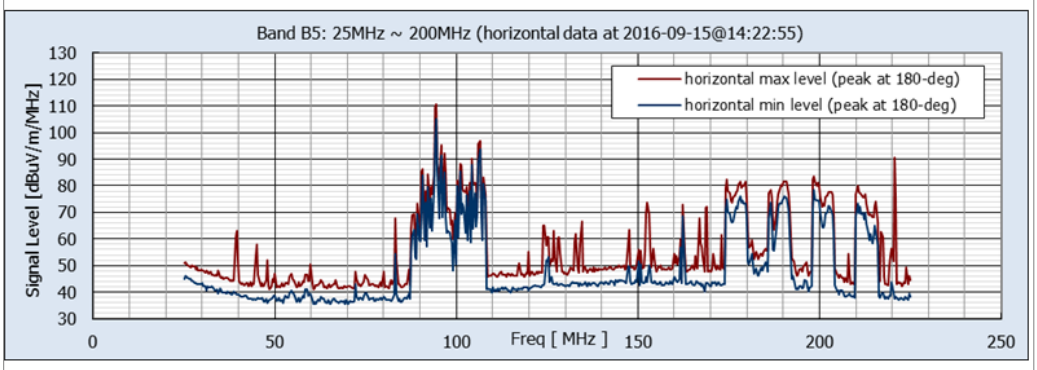
Maximum Levels					
Band number	Freq. Range (MHz)	Pk Min-Hold dB uV/m/MHz	@ Freq. (MHz)	Pk Max-Hold dB uV/m/MHz	@ Freq. (MHz)
B0	0.01 ~ 0.05	114.4	0.0214	128.8	0.0120
B1	0.05 ~ 0.55	104.7	0.0991	124.3	0.0982
B2	0.50 ~ 3.00	121.6	0.6409	145.1	0.6409
B3	2.5 ~ 7.5	90.1	2.6636	119.8	2.5636
B4	5 ~ 30	69.8	25.3182	82.3	24.8182

Figure 3.5-A-56 Site 7 (Anaheim): Measured Environmental Radio Frequency Levels, Nondirectional Data from Vertically Oriented Monopole Antenna, Bands 0–4



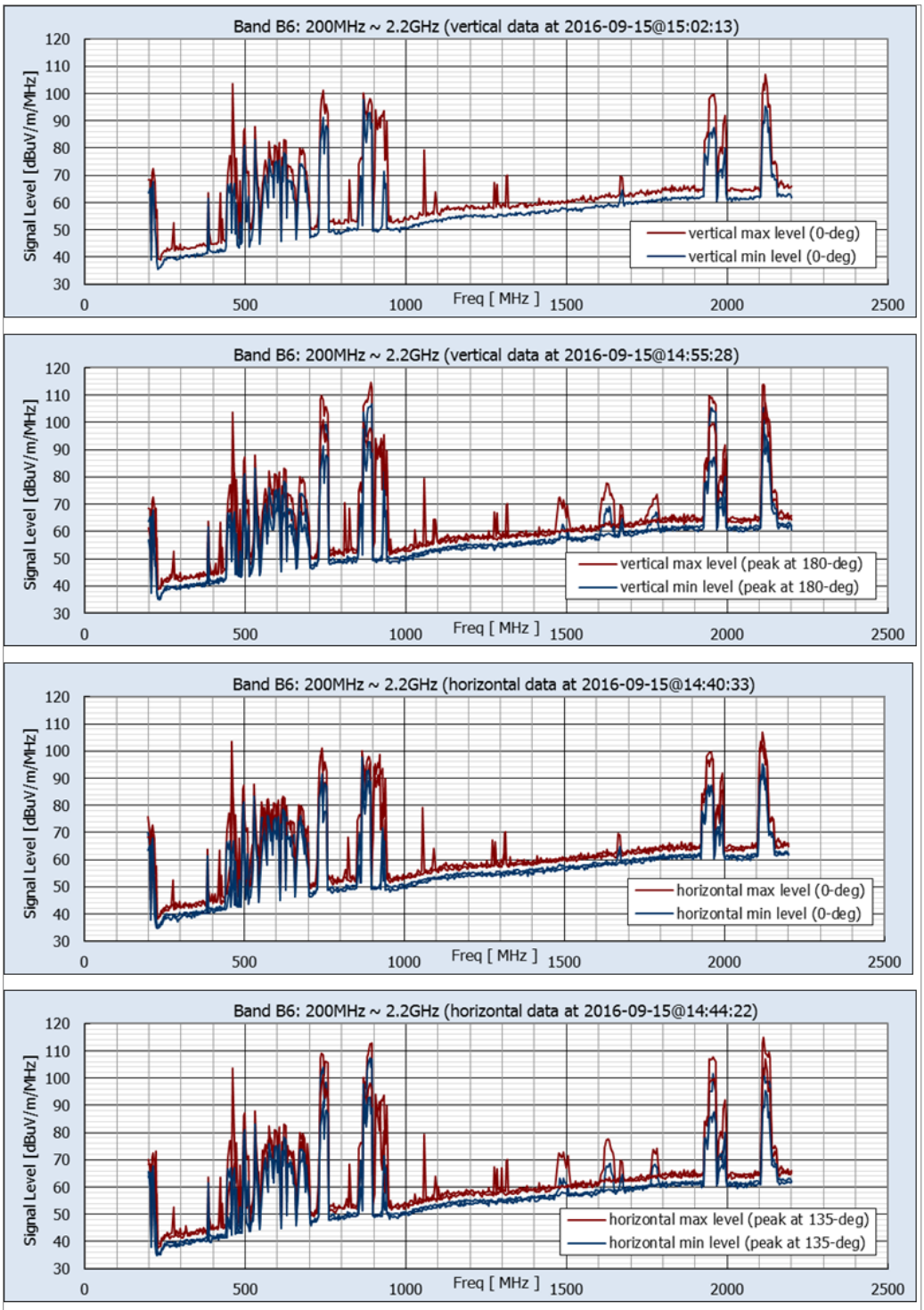






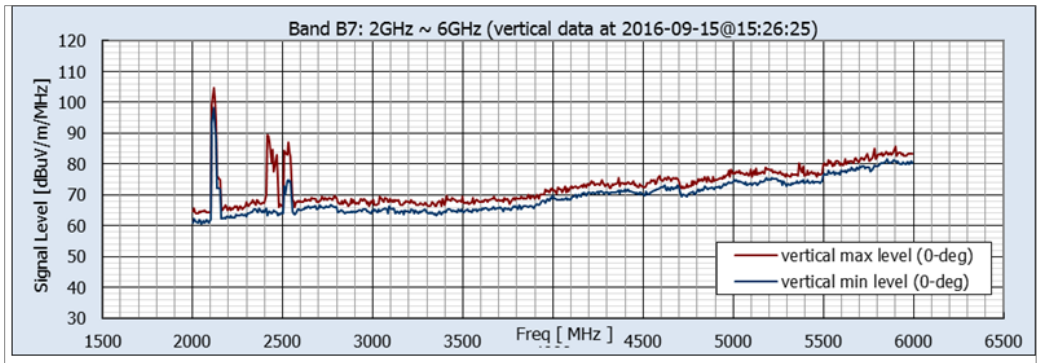
Maximum Levels									
		Vertical				Horizontal			
Band number	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B5	25 ~ 200	101.4	94.455	104.9	94.455	105.2	94.455	110.5	94.455

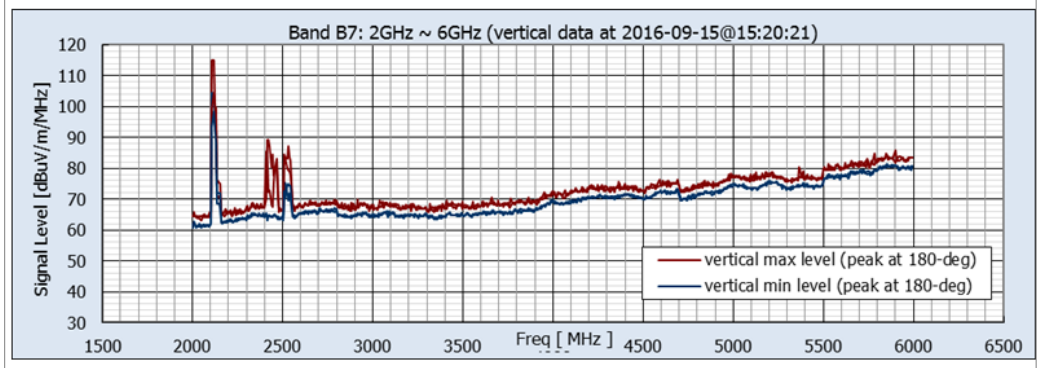
Figure 3.5-A-57 Site 7 (Anaheim): Measured Environmental Radio Frequency Levels, Band 5 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation

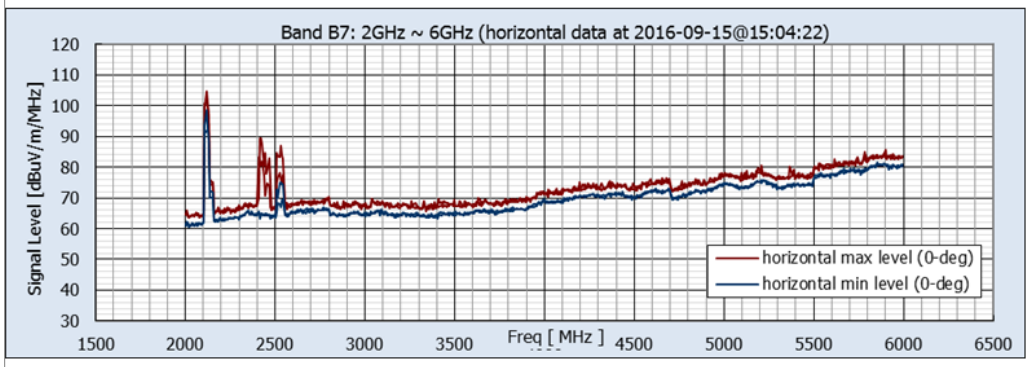


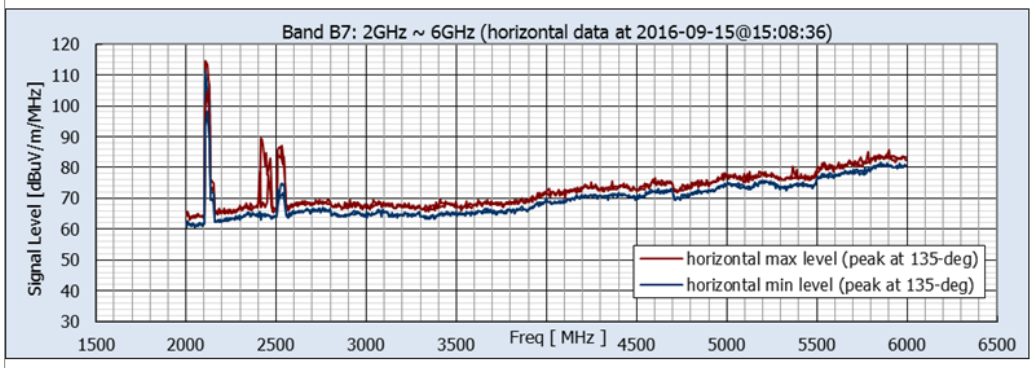
Maximum Levels									
		Vertical				Horizontal			
Band	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B6	200 ~ 2200	106.9	894.545	114.7	890.909	107.5	887.273	114.8	2112.727

Figure 3.5-A-58 Site 7 (Anaheim): Measured Environmental Radio Frequency Levels, Band 6 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation









Maximum Levels									
		Vertical				Horizontal			
Band	Freq. Range (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B7	2000~6000	104.5	2109.091	115.1	2116.364	111.2	2109.091	114.6	2109.091

Figure 3.5-A-59 Site 7 (Anaheim): Measured Environmental Radio Frequency Levels, Band 7 Vertical and Horizontal Components, Facing Alignment (0-degree) and at Peak Orientation

3.5-A.6 REFERENCES

California High-Speed Rail Authority (Authority). 2010. *Technical Memorandum, Measurement Procedure for Assessment of CHSTP Alignment EMI Footprint,* TM 3.4.11. Prepared by Parsons Brinckerhoff. March 3, 2010.