

California High-Speed Rail Authority

Bakersfield to Palmdale

Project Section

Draft Project Environmental Impact Report/Environmental Impact Statement

Appendix 3.5-A: Pre-Construction Electromagnetic Measurement Survey along the Bakersfield to Palmdale Section

October 2017



The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being or have been carried out by the State of California pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated July 23, 2019, and executed by the Federal Railroad Administration and the State of California.

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APPENDIX 3.5-A

Pre-Construction Electromagnetic Measurement Survey Along the Bakersfield to Palmdale Section

INTRODUCTION

This Appendix documents measurement results from a preconstruction electromagnetic survey of locations along the proposed HSR Project alignment between Bakersfield and Palmdale. 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 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.

Existing facilities and uses along the entire project section alignment were reviewed with respect to the electromagnetic environment, and nine measurement sites were selected to obtain a cross-section of typical emitters such as power lines and antenna towers, potentially sensitive facilities such as medical facilities, and relatively quiet areas for comparison. The selection criteria, taken from TM 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.

Two types of measurements were performed at each of the nine locations. 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 (HF) and very-high-frequency (VHF) fixed and mobile communications systems (police, fire, emergency medical technician, utilities, and government)
- Local wireless (wireless fidelity [WiFi] and Worldwide Interoperability for Microwave Access [WiMAX])

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 due to passing vehicles and trains

The facilities most sensitive to 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 [MRI], electron microscopes)
- Medical imaging (e.g., computed tomography [CT] scanners, MRI systems)
- University/research (instrumentation for chemistry, physics, electrical engineering, and similar systems to those mentioned for high-tech and medical facilities).

TEST PROCEDURES AND EQUIPMENT

The radio-frequency (RF) environment along the proposed alignment was characterized by measuring the prevailing electric field strength at each of 9 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 biological 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 TM 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 located approximately 50 feet from the proposed alignment.

Electric field measurement files from the spectrum analyzer include both min-hold and max-hold levels as a function of frequency across each of the measurement bands, and a complete file set will be preserved for each measurement location. Reported results include the low frequency measurements with the omni-directional vertical monopole, plus measurements with the biological 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 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 and backed up on USB flash drives.

The RF and magnetic field measurements for the Bakersfield to Palmdale Project Section were performed January 20th and 21st, 2016.

OVERVIEW OF THE MEASUREMENT RESULTS

The measured DC magnetic field strengths were quite uniform and ranged from 450 to 550 mG across the 9 sites (18 measurements). For sites where the magnetometers were located close to the existing railroad tracks, fluctuations in DC level were distinctly noticeable during train passbys. At Site 8 (Lancaster) the magnetometers were approximately 60 feet from the near track centerline. Here the DC levels shifted roughly 5 mG during passbys. At Site 1 (Bakersfield) the magnetometers were 30 feet from the track, with passby-induced changes in the 10-15 mG range. At roadside locations, such as sites 4 and 6, similar fluctuations were observed during car and truck passbys.

As shown in Table 3.5A-1, AC magnetic field strengths varied considerably from site to site, with levels depending almost entirely on the proximity of the site to existing electric power infrastructure, such as transmission lines, electrical substations, and local distribution lines. The large range of observed levels, which vary by a factor of roughly 500, is entirely typical.

Measured AC and DC Magnetic Field Strengths									
Site	DC (mG)			AC 60 Hz (mG)			AC Total (mG)		
	S1	S2	Avg	S1	S2	Avg	S1	S2	Avg
1	466	464	465	0.68	0.67	0.67	0.78	0.75	0.76
2	463	459	461	10.4	9.1	9.7	10.5	9.2	9.8
3	466	466	466	8.0	12.4	10.2	8.0	12.4	10.2
4	467	465	466	0.03	0.02	0.03	0.37	0.33	0.35
5	463	465	464	0.07	0.07	0.07	0.41	0.35	0.38
6	467	464	466	0.55	0.74	0.65	0.68	0.82	0.75
7	463	461	462	0.27	0.25	0.26	0.52	0.48	0.50
8	462	465	463	0.87	0.86	0.86	0.88	0.87	0.87
9	469	465	467	0.04	0.04	0.04	0.37	0.34	0.35

Table 3.5A-1 Magnetic Field Strengths by Site

Because of the very broad range of frequencies of interest, the electric field measurements at each site were divided into eight overlapping frequency bands. Table A3.5-1 summarizes the maximum magnitude of the measured electric field values, by frequency band for each site.

The project area included a number of RF sources. Approximately 40 television and radio (AM and FM broadcast) transmitters were identified along the project alignment, with about 60 percent of these concentrated in the Bakersfield region. In addition, there were dozens of cellular communications towers and point-to-point microwave links operating in the region (again, primarily in the Bakersfield area), as well as a significant number of intermittent fixed- and mobile RF sources. The background levels vary considerably across the RSA due to the concentration of existing sources in the Bakersfield, and to a lesser extent Lancaster/Palmdale areas.

Measured Maximum Electric Filed Strengths by Band								
Site	B0	B1	B2	B3	B4	B5	B6	B7
	10-50 kHz	50-550 kHz	0.5- 3.0 MHz	2.5-7.5 MHz	5-30 MHz	25-200 MHz	0.2-2.2 GHz	2-6 GHz
1	136.8	140.6	141.5	126.4	98.9	97.8	88.2	83.8
2	146.7	146.9	146.3	125.4	97.3	100.5	100.9	102.3
3	130.1	139.8	140.7	119.0	83.0	107.7	101.5	93.3
4	123.9	131.7	131.7	100.5	84.0	79.4	77.1	69.9
5	130.9	117.3	113.3	97.8	87.0	95.0	93.7	89.1
6	132.2	133.9	116.7	104.3	92.9	104.8	97.9	87.5
7	126.9	128.2	144.6	128.1	100.6	100.8	109.9	105.5
8	127.4	124.1	145.1	127.3	95.1	117.9	112.9	100.7
9	122.6	117.2	139.0	99.6	84.3	89.6	107.4	81.9

Table 3.5A-2 Maximum Electric Field Strengths

Figure 3.5A-1 compares graphically the maximum measured electric field strengths by frequency band for the 9 measurement sites. Typical spectrum uses in each frequency band are also indicated in the figure. Because of the range of development within the Project region, the band-by-band measured field strengths varied substantially, with levels in some frequency bands changing by more than 30 dB. Figure A3.5-2 shows the variance in RF field strengths across the 14 sites, by frequency band.

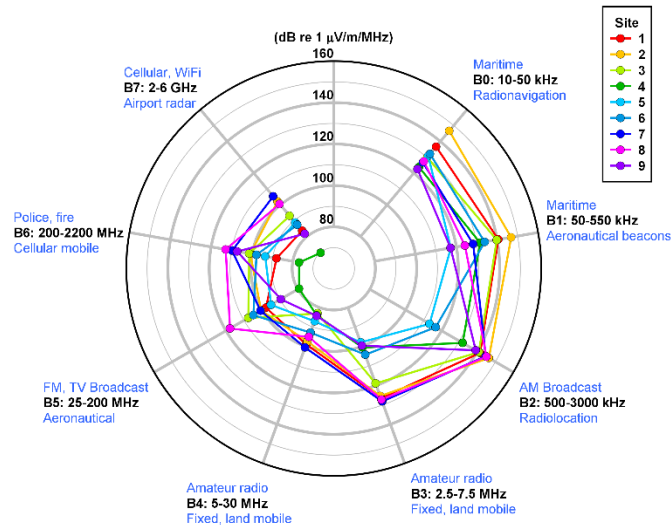


Figure 3.5A-1 Maximum Electric Field Strengths by Frequency Band

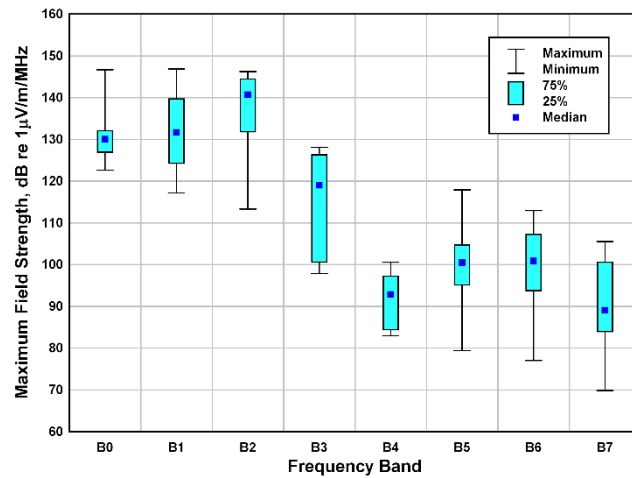


Figure 3.5A-2 Observed Range of Electric Field Strengths by Frequency Band

Finally, Figure 3.5A-3 graphically illustrates the band-by-band electric field strength values for each site, taken from Table A3.5-2.

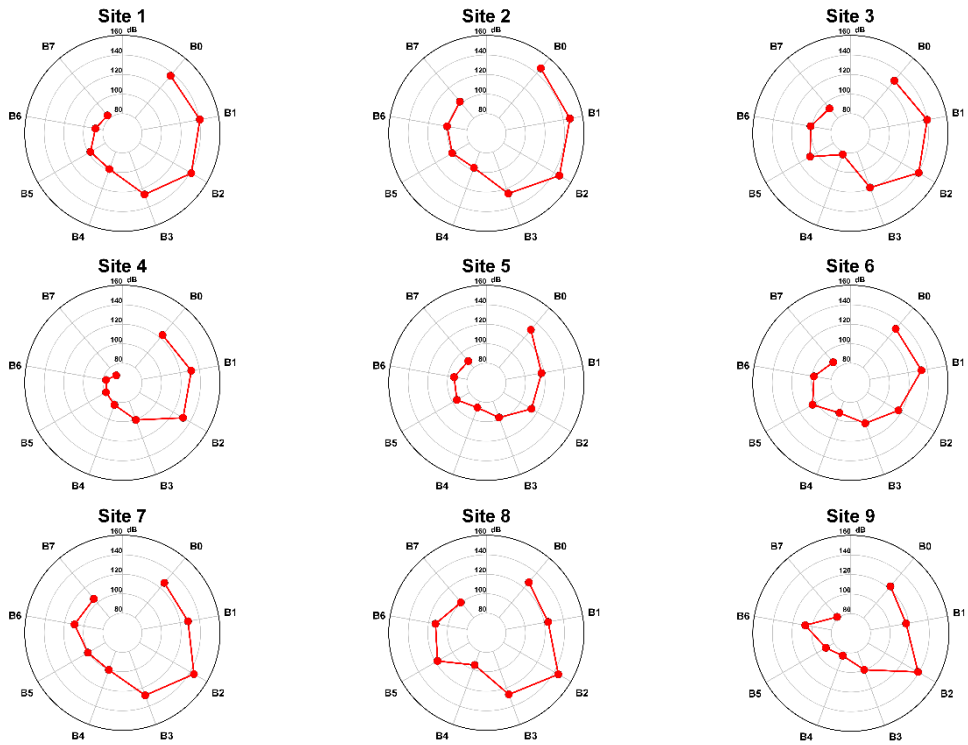


Figure 3.5A-3 Maximum Electric Field Strengths by Site



Figure A3.5-1(a) Location 01: Laguna Seca and Oswell Streets, Bakersfield
Urban setting adjacent to the existing UPRR alignment, with significant RF emitters (Lat 35° 22' 00.99", Lon W118° 56' 53.05")



Figure A3.5-1(b) Location 01: Measurement Location and Site Views

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



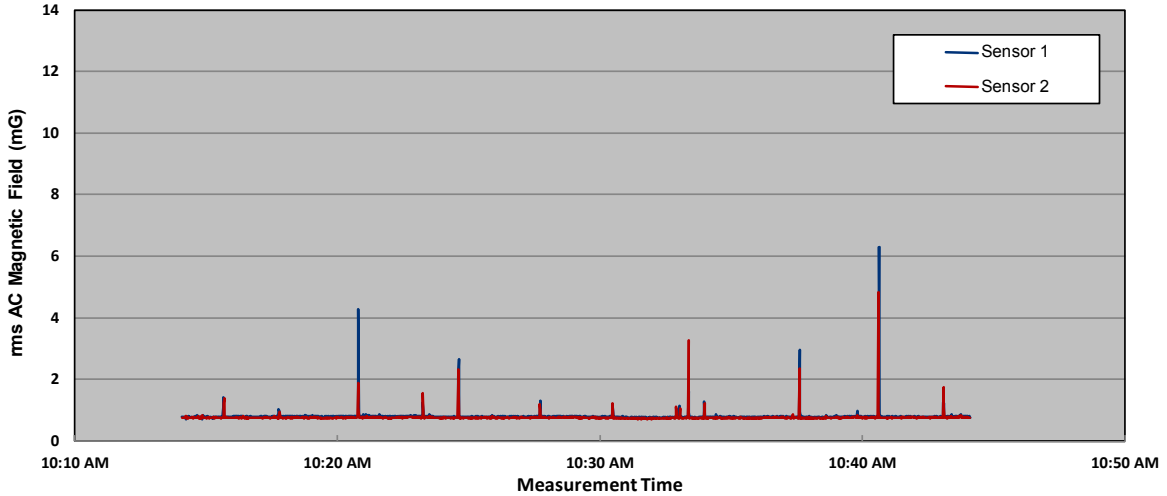
Figure A3.5-1(c) Location 01: Nearby EMF Emitters

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

Measurement Date **Start Time** **End Time** **Duration**
 Wednesday, January 20, 2016 10:14:03 10:44:05 0:30:02

Description: Adjacent to existing tracks, across street from trailer park. Large transients measured from passing vehicle traffic (no train passes in this data set).

AC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	60Hz	Harmonic	60Hz	Harmonic
Maximum	1.03	6.21	0.91	4.76
Minimum	0.38	0.31	0.62	0.29
Median	0.68	0.38	0.67	0.33
Range	0.65	5.89	0.30	4.47
Std. Deviation	0.02	0.19	0.02	0.16



DC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	Br DC (mG)	Time of Observation	Br DC (mG)	Time of Observation
Maximum	468.72	10:43:04	466.03	10:15:39
Minimum	457.40	10:24:36	446.47	10:40:36
Median	466.40	----	463.56	----
Range	11.32	----	19.56	----
Std. Deviation	0.42	----	0.55	----

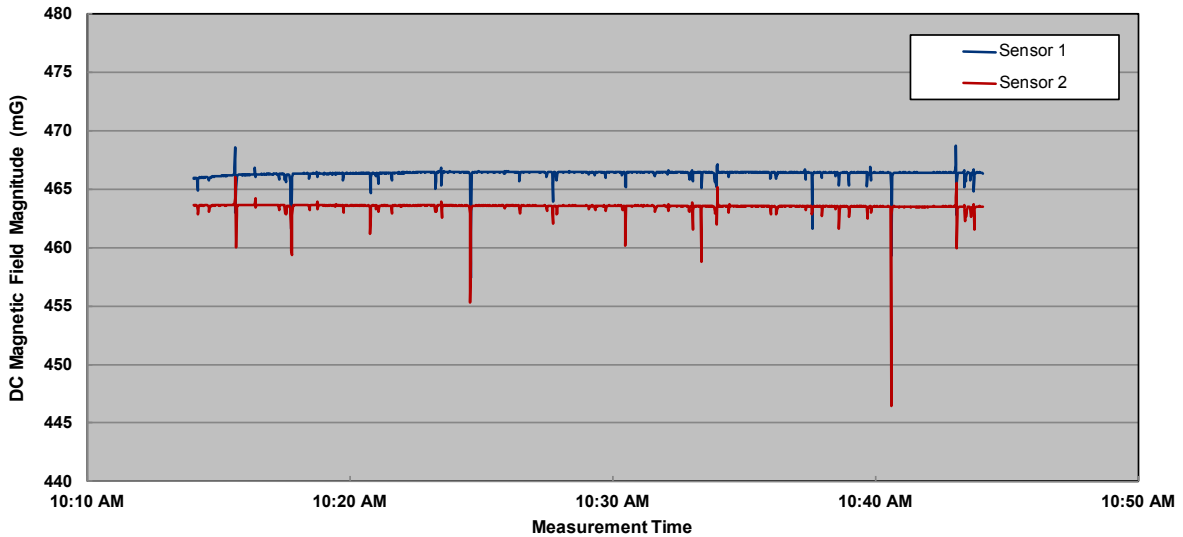
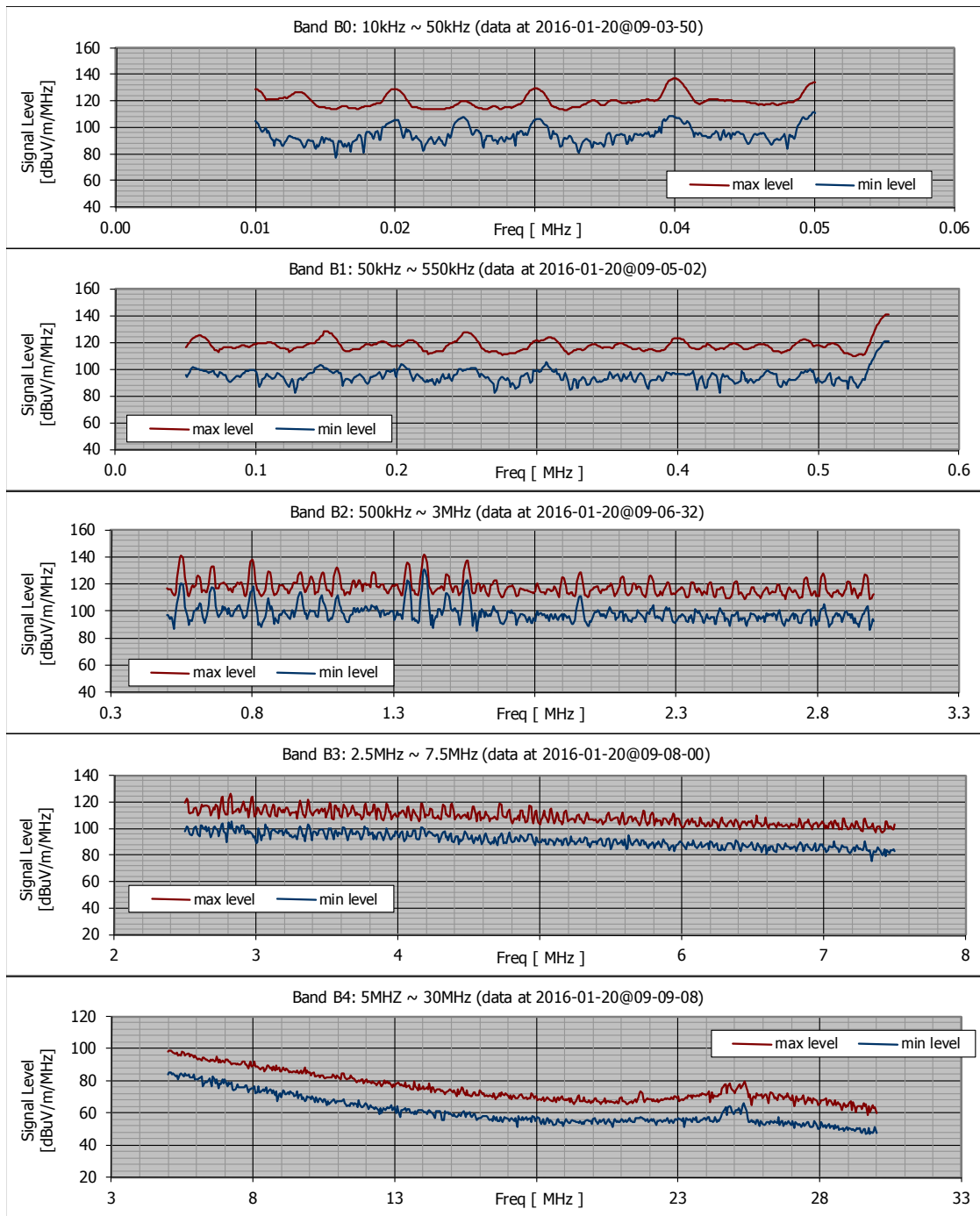
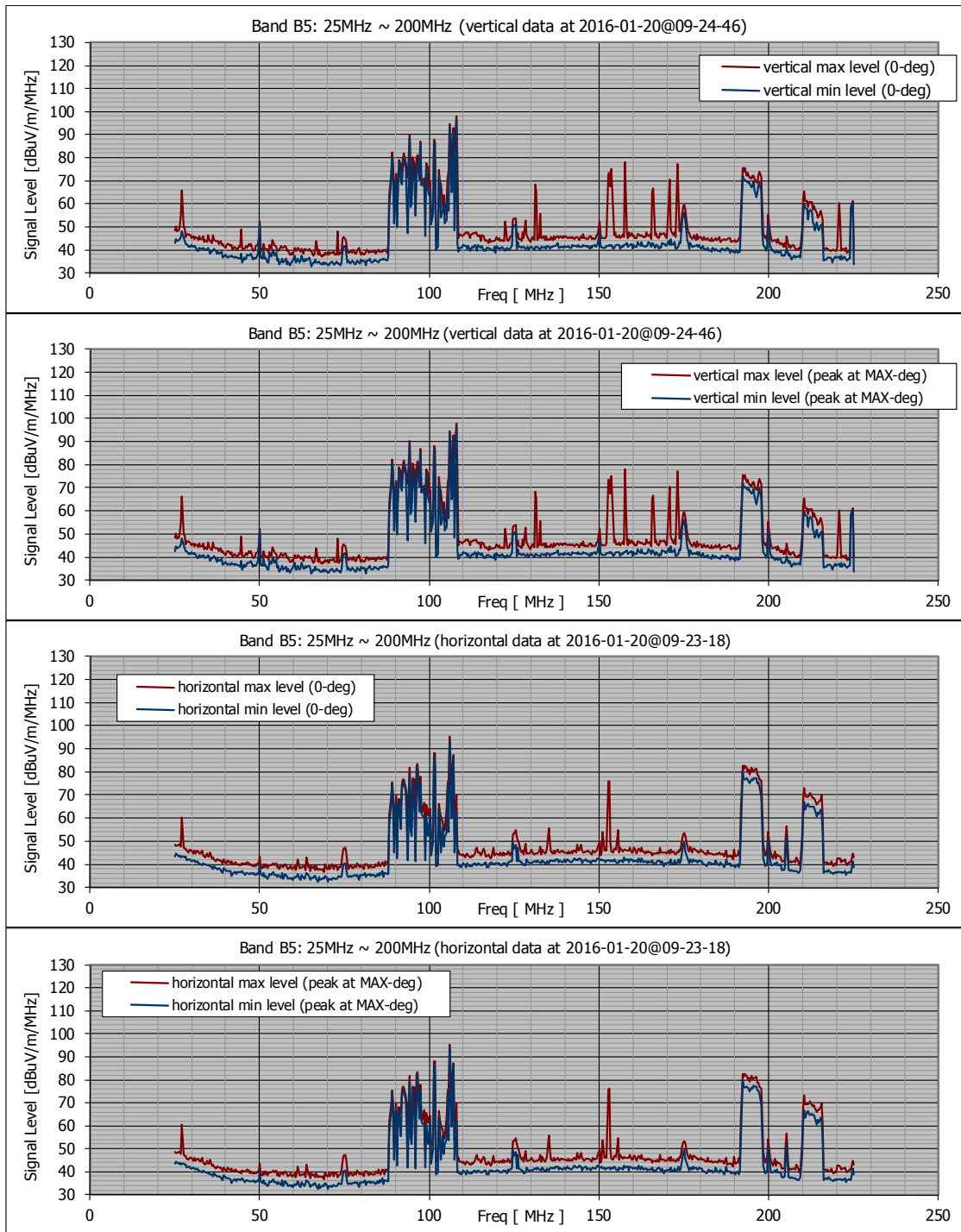


Figure A3.5-1(d) Location 01: AC and DC Magnetic Field Measurement Results



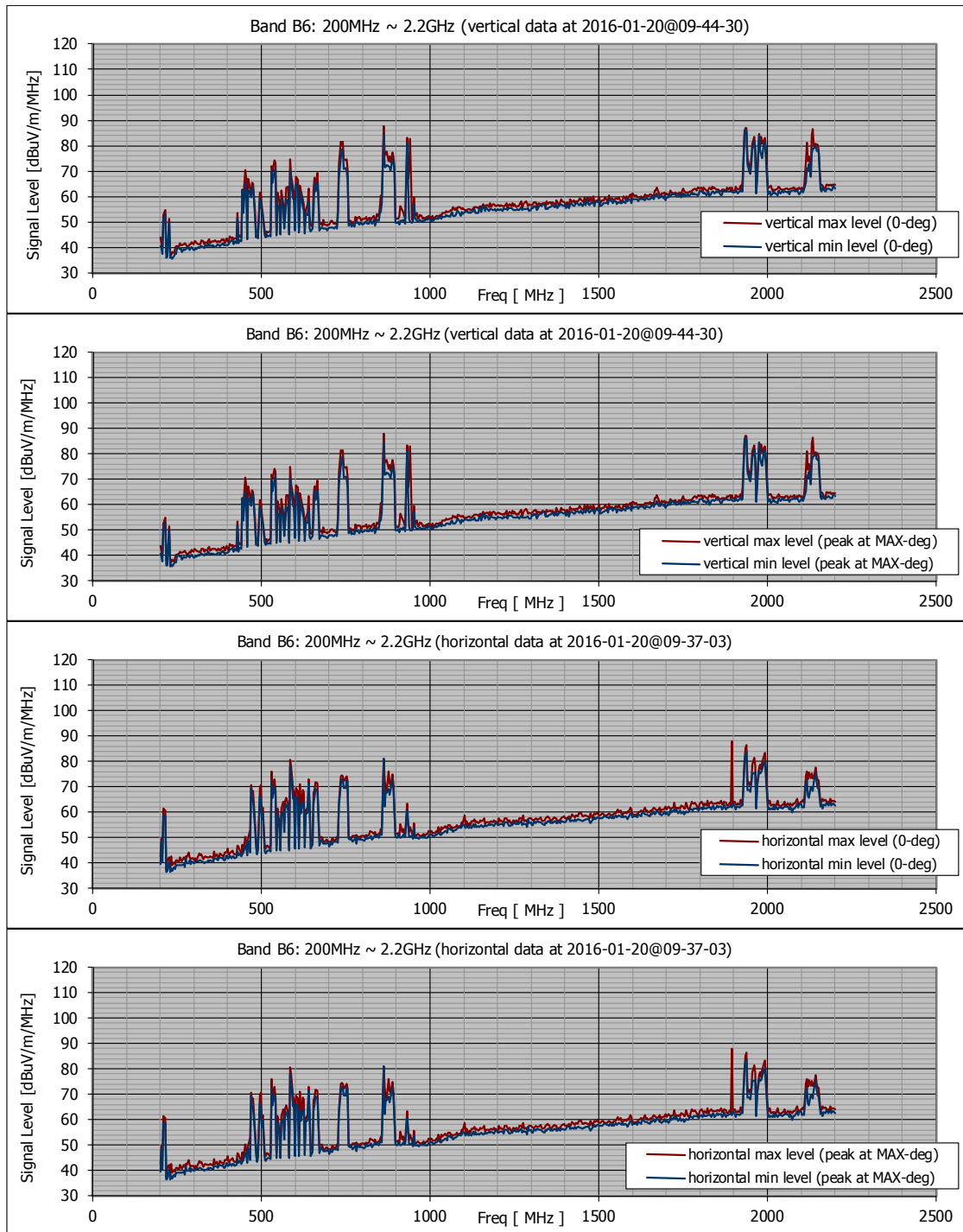
Band	Freq. Range (MHz)	Pk Min-Hold (dB uV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dB uV/m/MHz)	@ Freq. (MHz)
B0	0.01 ~ 0.05	111.2	0.0499	136.8	0.0400
B1	0.05 ~ 0.55	121.1	0.5500	140.6	0.5500
B2	0.50 ~ 3.00	130.3	1.4091	141.5	1.4091
B3	2.5 ~ 7.5	105.5	2.8273	126.4	2.8182
B4	5 ~ 30	85.2	5.0455	98.9	5.0909

Figure A3.5-1(e) Location 01: RF Data from Non-Directional Vertically-Oriented Monopole Antenna



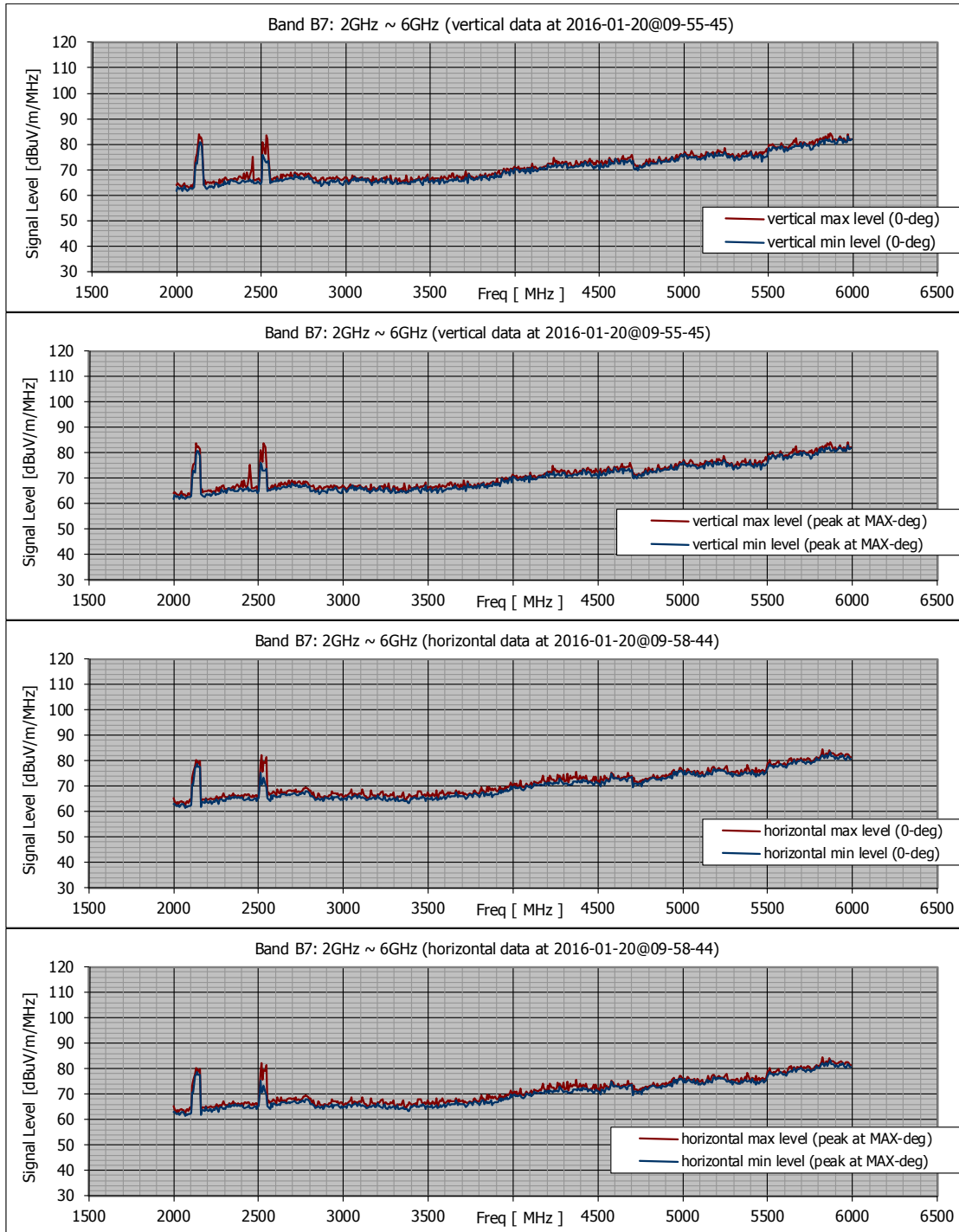
Band	Freq. Range (MHz)	Vertical				Horizontal			
		Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B5	25 ~ 200	96.3	107.909	97.8	107.909	93.2	106.091	95.4	106.091

Figure A3.5-1(f) Location 01: RF Data, Band B5, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Band	Freq. Range (MHz)	Vertical				Horizontal			
		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	86.5	1934.55	87.8	861.82	83.8	1938.18	88.2	1894.55

Figure A3.5-1(g) Location 01: RF Data, Band B6, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Band	Freq. Range (MHz)	Vertical				Horizontal			
		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	80.9	2138.2	83.8	2130.9	78.6	2138.2	82.4	2516.4

Figure A3.5-1(h) Location 01: RF Data, Band B7, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation

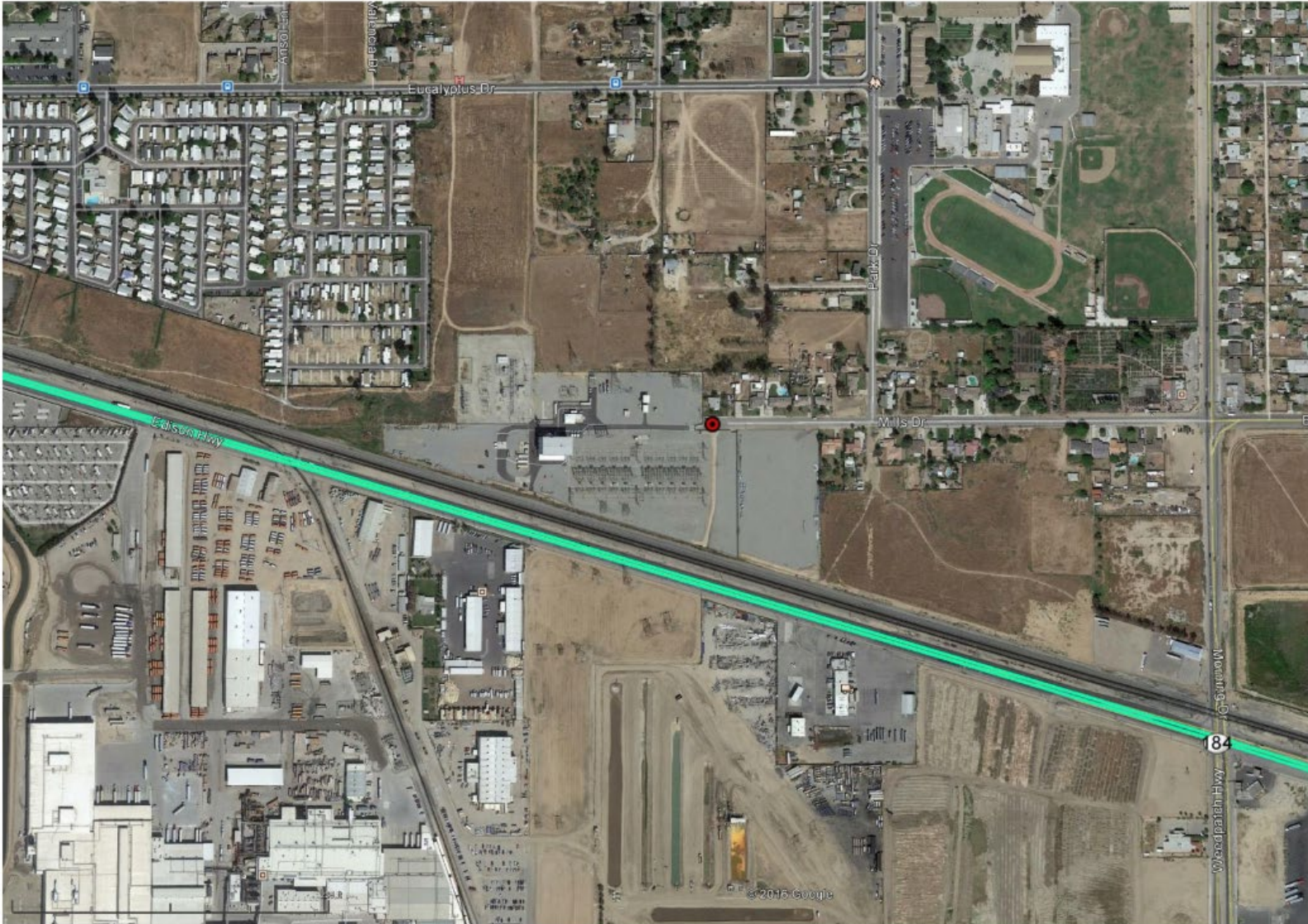


Figure A3.5-2(a) Location 02: Mills Drive, Bakersfield
Adjacent to SCE Substation and near the existing UPRR alignment, with significant RF emitters (Lat 35° 21' 41.83", Lon W118° 55' 14.87")



Figure A3.5-2(b) Location 02: Measurement Location and Site Views

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

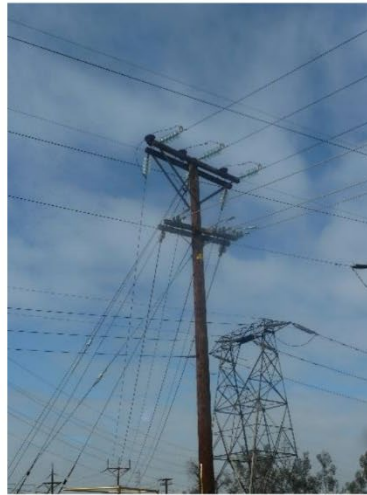
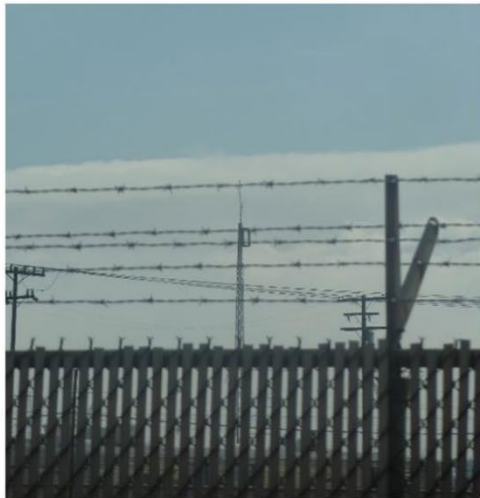
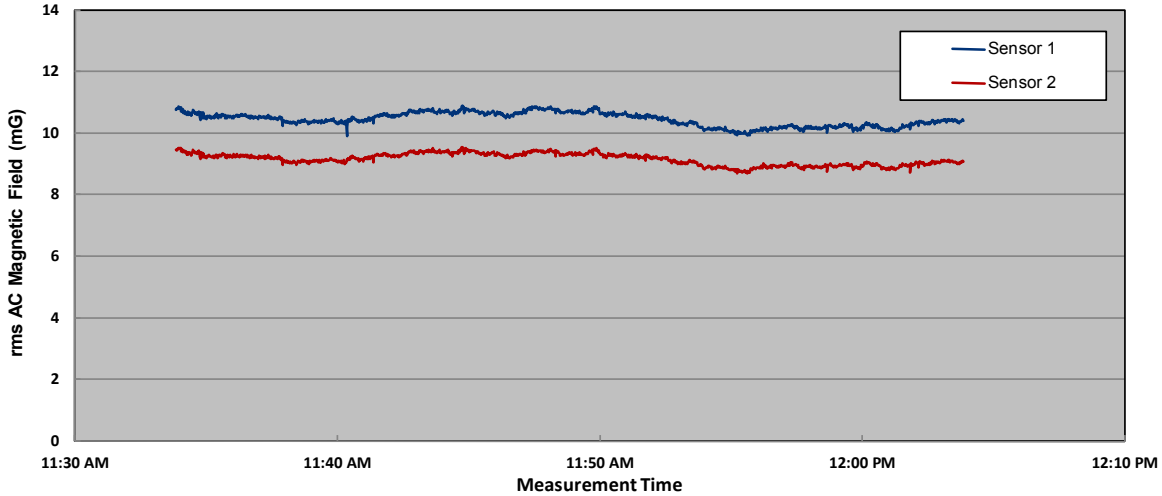


Figure A3.5-2(c) Location 02: Mills Drive, Bakersfield
Nearby emitters include HV transmission lines, communications towers, and local power distribution
Photos depicting visible close-proximity emitters. Other emissions sources are assumed to exist but are not visible from the site.

Measurement Date **Start Time** **End Time** **Duration**
 Wednesday, January 20, 2016 11:33:50 12:03:50 0:30:00

Description: Just outside Southern California Edison substation. Near overhead transmission lines. Two truck passes can be seen in DC measurements.

AC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	60Hz	Harmonic	60Hz	Harmonic
Maximum	10.79	1.74	9.42	1.62
Minimum	9.76	1.40	8.54	1.43
Median	10.36	1.50	9.05	1.54
Range	1.03	0.35	0.88	0.19
Std. Deviation	0.23	0.02	0.20	0.02



DC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	Br DC (mG)	Time of Observation	Br DC (mG)	Time of Observation
Maximum	463.06	11:40:20	459.15	11:40:17
Minimum	459.98	11:35:24	456.57	11:35:26
Median	462.52	----	458.92	----
Range	3.08	----	2.59	----
Std. Deviation	0.14	----	0.09	----

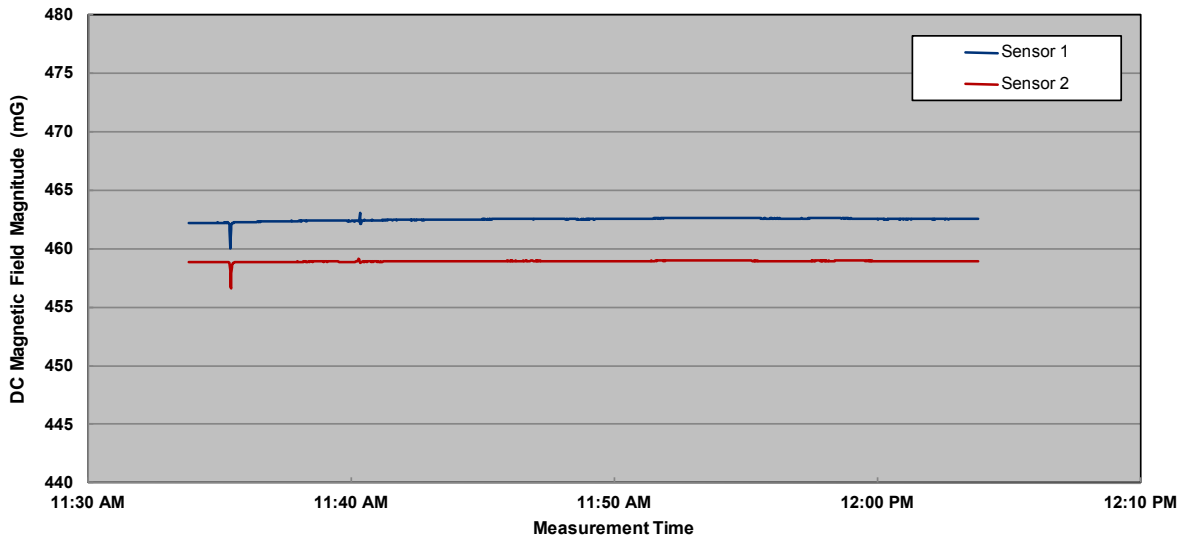
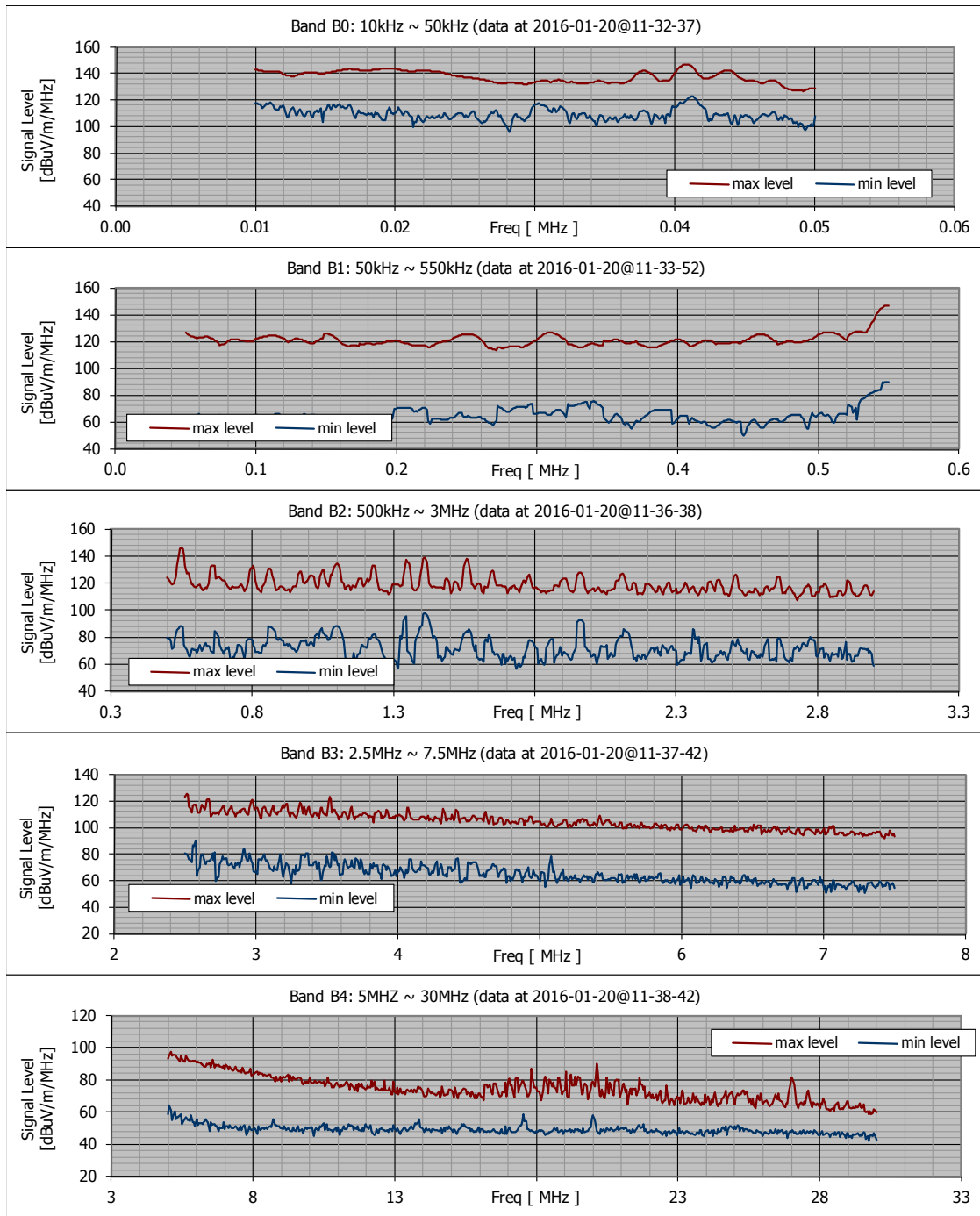
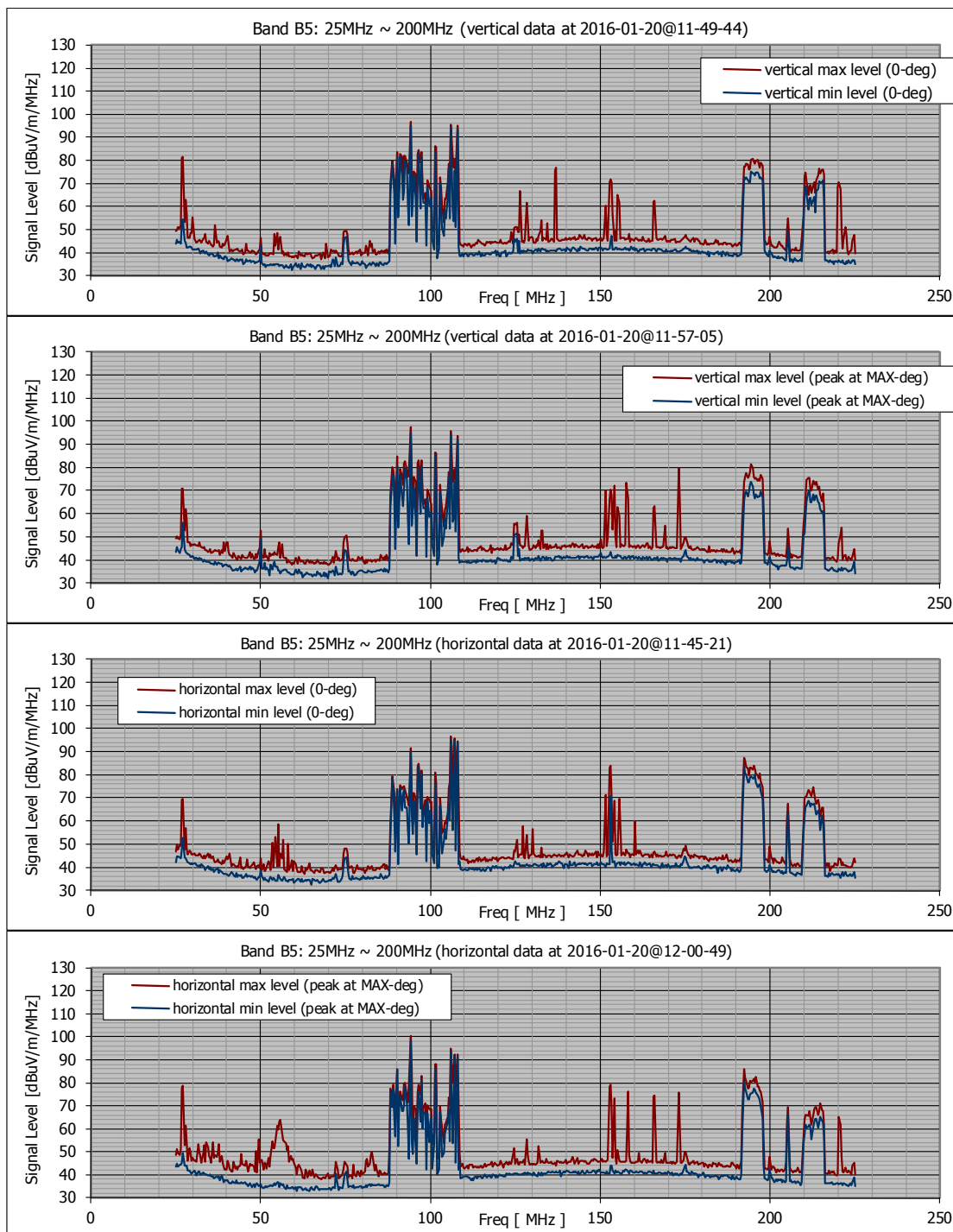


Figure A3.5-2(d) Location 02: AC and DC Magnetic Field Measurement Results



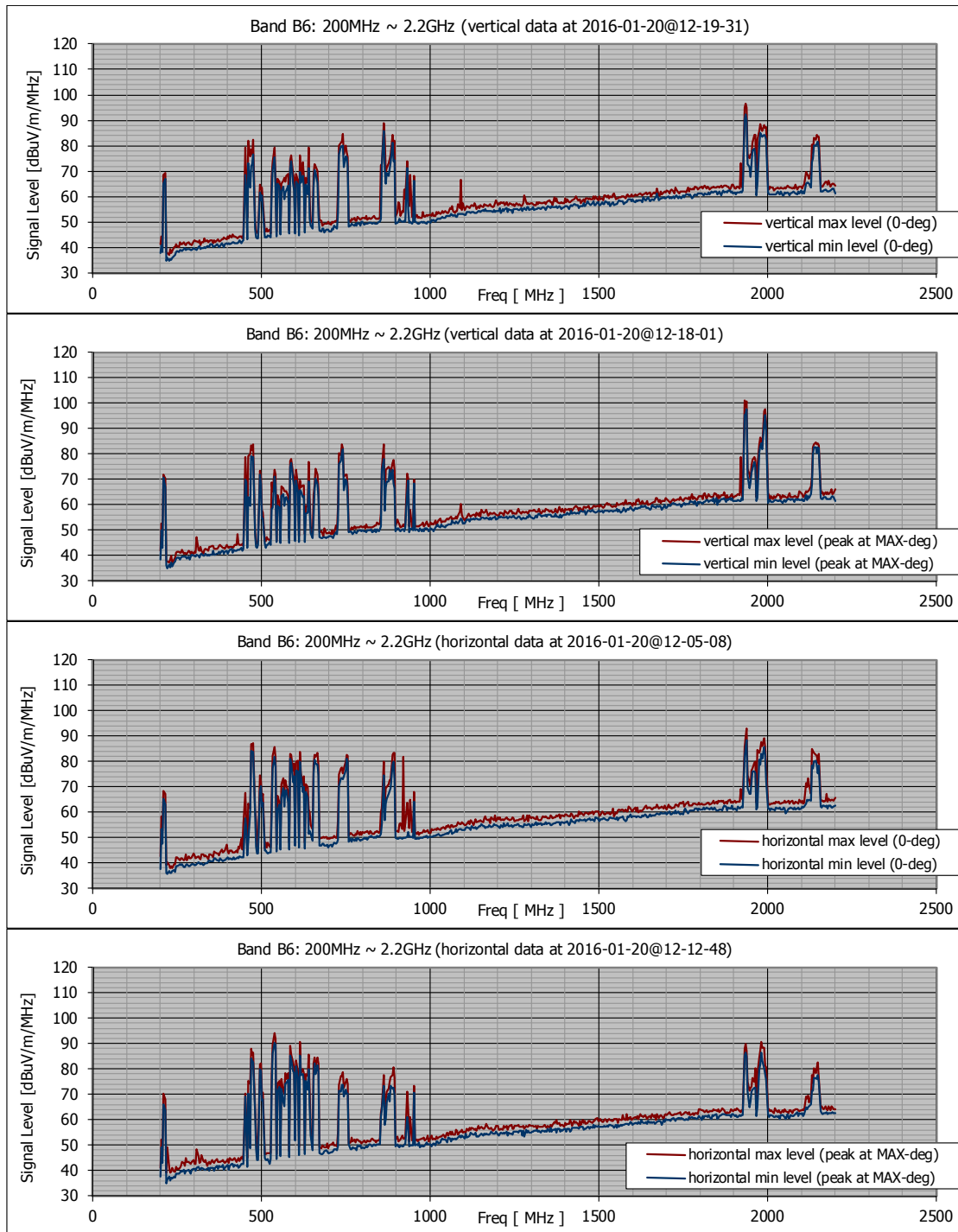
Band	Freq. Range (MHz)	Pk Min-Hold (dB uV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dB uV/m/MHz)	@ Freq. (MHz)
B0	0.01 ~ 0.05	122.9	0.0412	146.7	0.0408
B1	0.05 ~ 0.55	89.5	0.5482	146.9	0.5500
B2	0.50 ~ 3.00	97.4	1.4091	146.3	0.5500
B3	2.5 ~ 7.5	90.6	2.5727	125.4	2.5091
B4	5 ~ 30	63.9	5.0455	97.3	5.0909

Figure A3.5-2(e) Location 02: RF Data from Non-Directional Vertically-Oriented Monopole Antenna



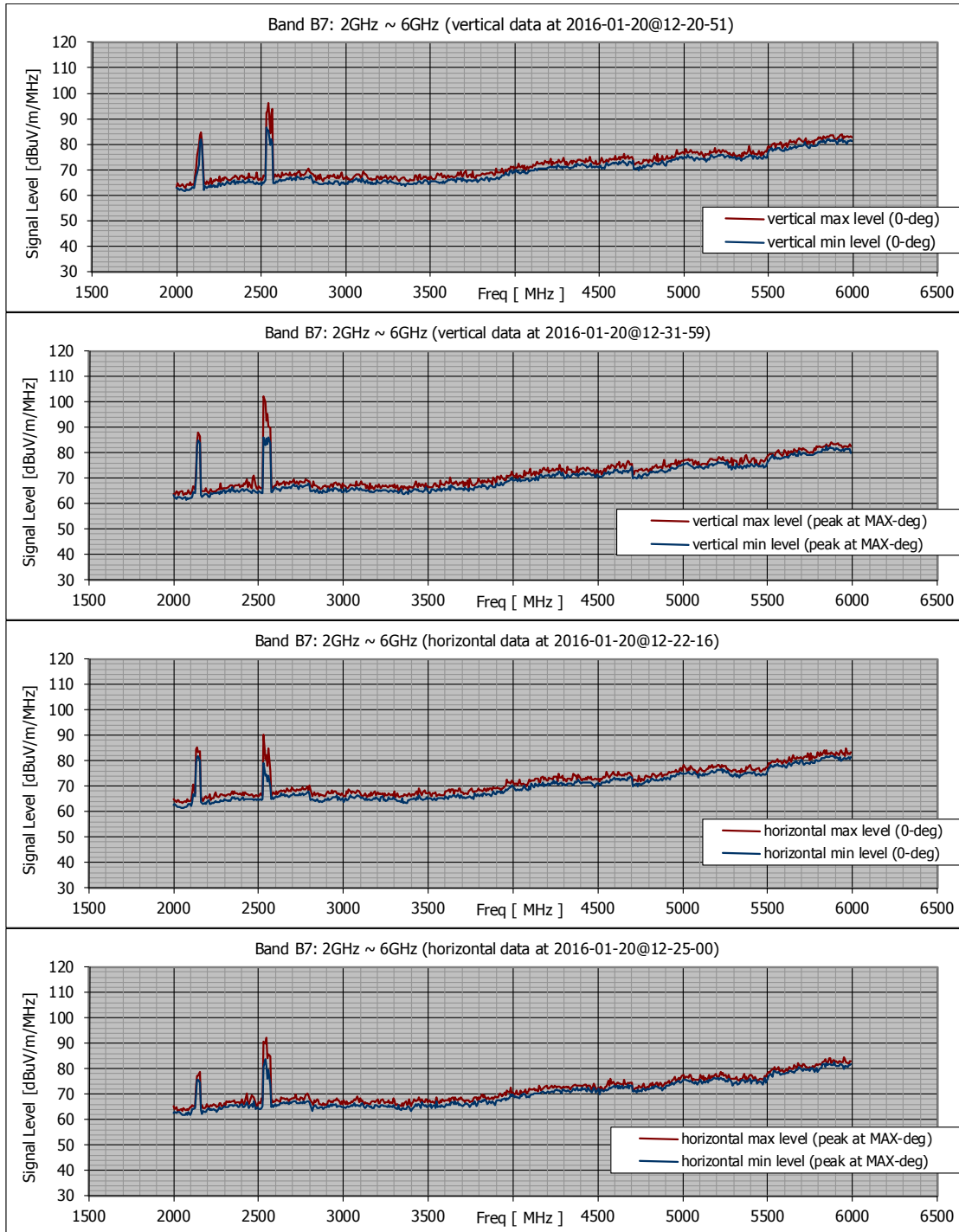
Band	Freq. Range (MHz)	Vertical				Horizontal			
		Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B5	25 ~ 200	94.9	94.091	97.6	94.091	98.4	94.091	100.5	94.091

Figure A3.5-2(f) Location 02: RF Data, Band B5, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Band	Freq. Range (MHz)	Vertical				Horizontal			
		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	97.6	1938.18	100.9	1930.91	90.3	538.18	94.3	538.18

Figure A3.5-2(g) Location 02: RF Data, Band B6, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Band	Freq. Range (MHz)	Vertical				Horizontal			
		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	86.6	2530.9	102.3	2530.9	83.6	2538.2	92.4	2545.5

Figure A3.5-2(h) Location 02: RF Data, Band B7, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation

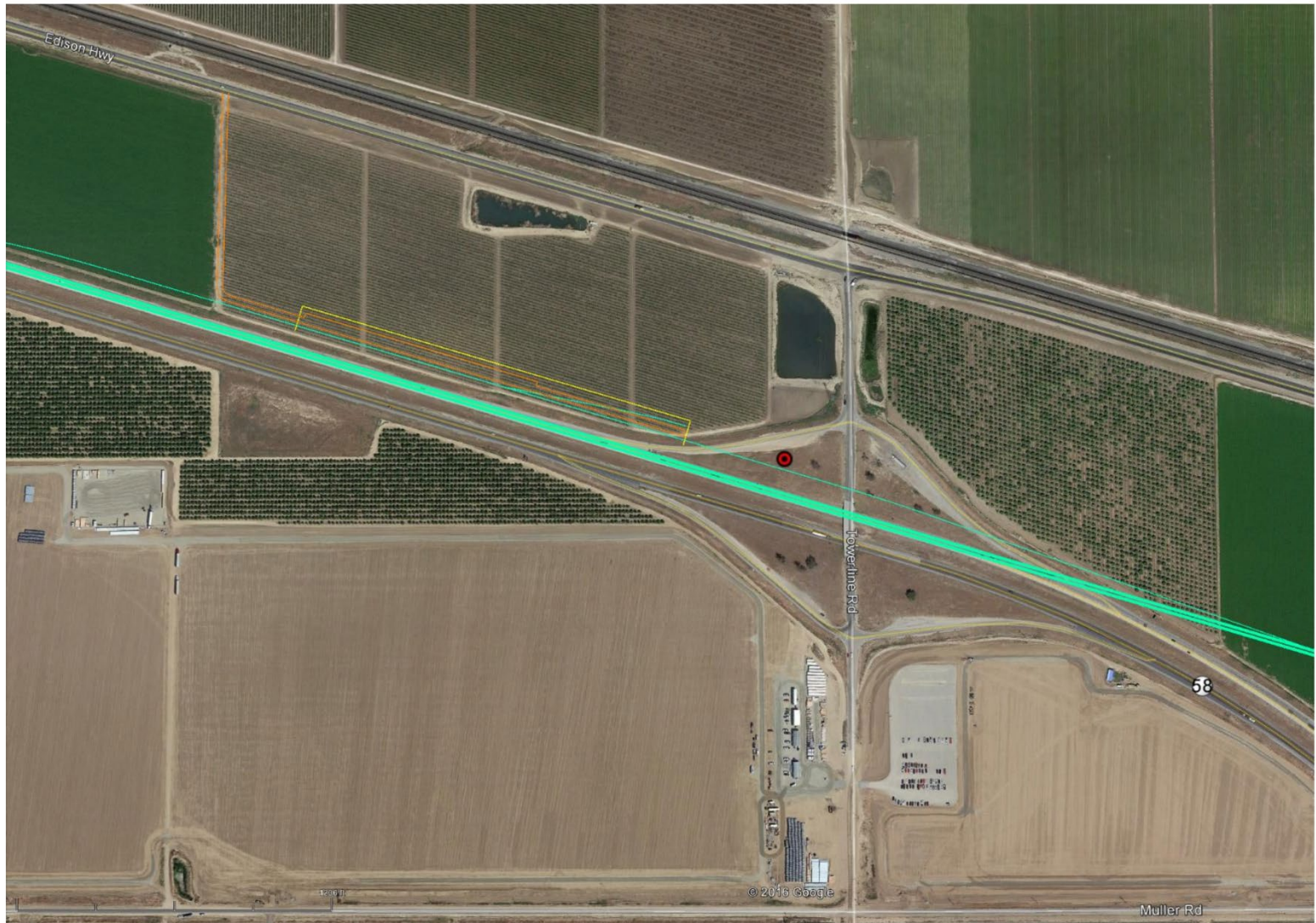


Figure A3.5-3(a) Location 03: Towerline Road, Edison
Rural setting east of Edison (Lat 35° 19' 49.72", Lon W118° 48' 30.24")

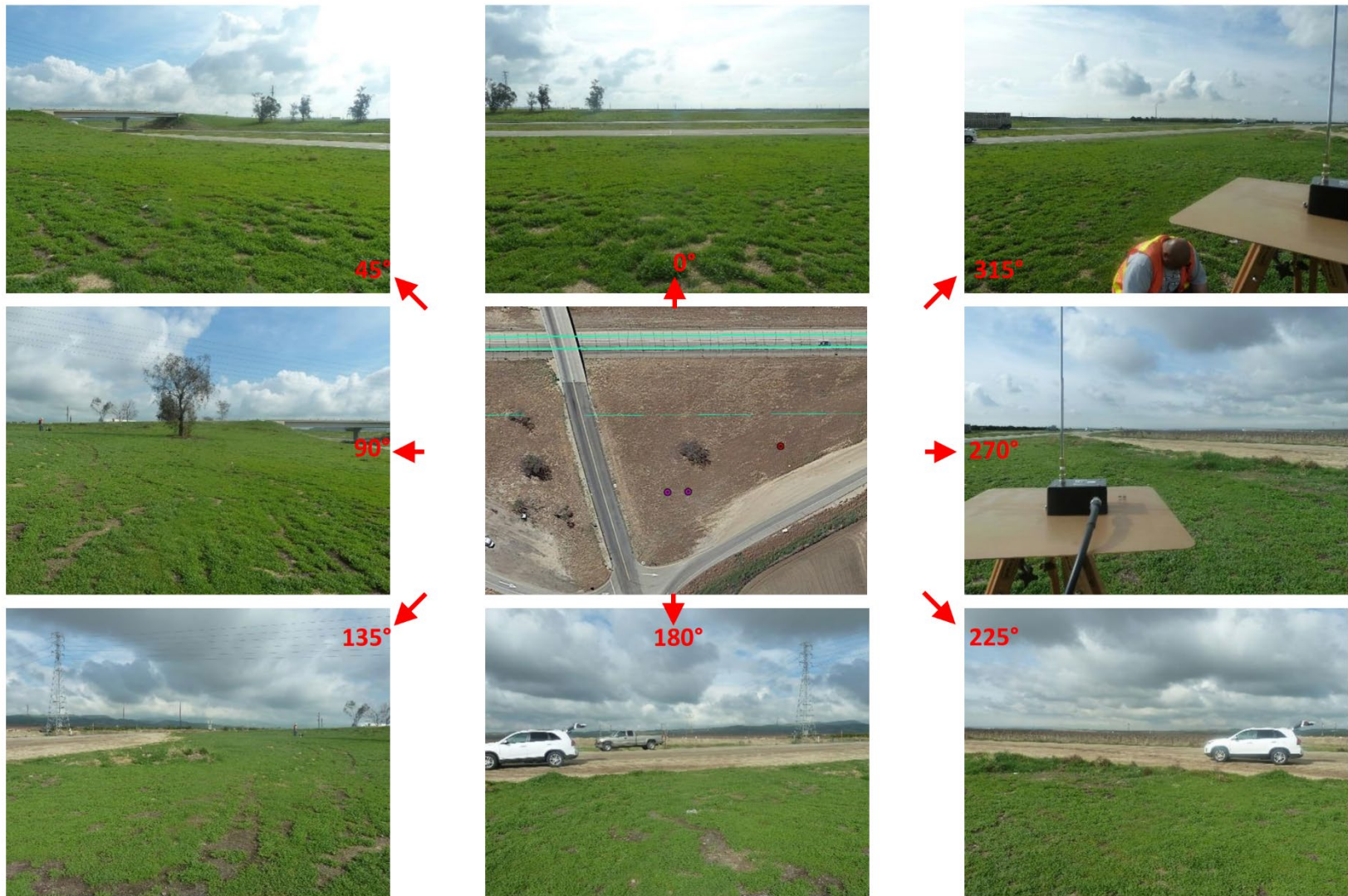


Figure A3.5-3(b) Location 03: Measurement Location and Site Views

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



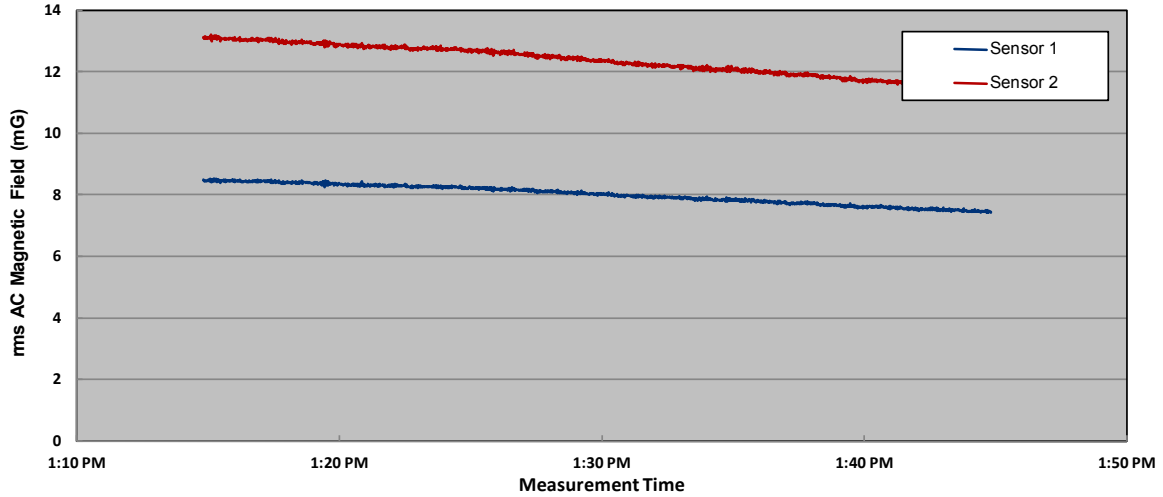
Figure A3.5-3(c) Location 03: Towerline Road, Edison

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

Measurement Date **Start Time** **End Time** **Duration**
 Wednesday, January 20, 2016 13:14:48 13:44:49 0:30:01

Description: Near overhead transmission line in agricultural area. AC readings show decreasing load on the line.

AC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	60Hz	Harmonic	60Hz	Harmonic
Maximum	8.51	0.44	13.20	0.44
Minimum	7.40	0.32	11.41	0.34
Median	8.02	0.39	12.36	0.39
Range	1.11	0.12	1.79	0.10
Std. Deviation	0.31	0.02	0.50	0.02



DC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	Br DC (mG)	Time of Observation	Br DC (mG)	Time of Observation
Maximum	465.76	13:29:24	465.80	13:28:30
Minimum	464.60	13:14:48	465.31	13:43:37
Median	465.65	----	465.74	----
Range	1.16	----	0.49	----
Std. Deviation	0.21	----	0.05	----

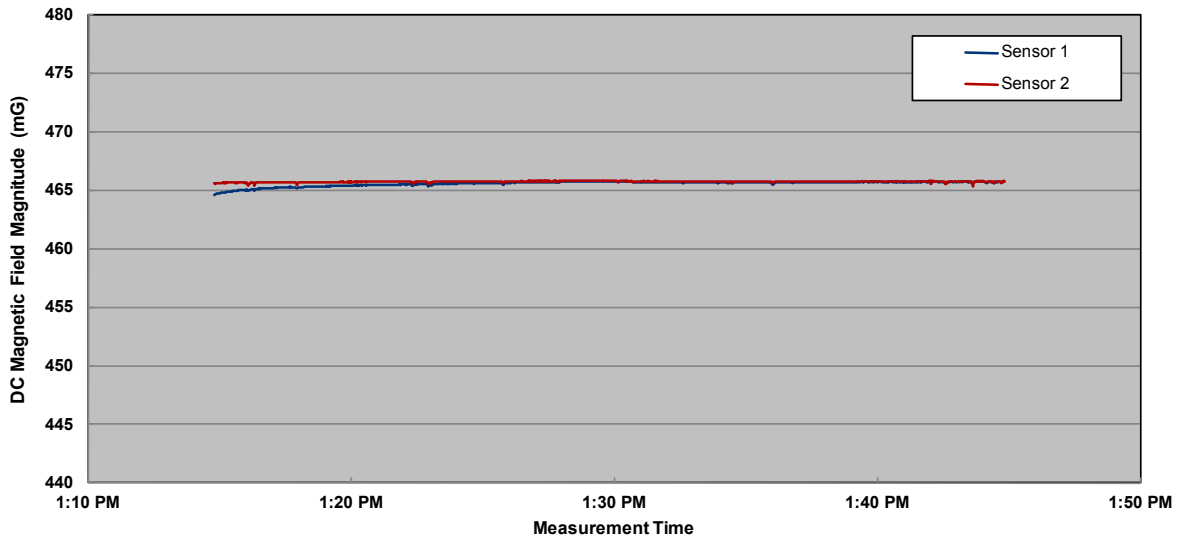
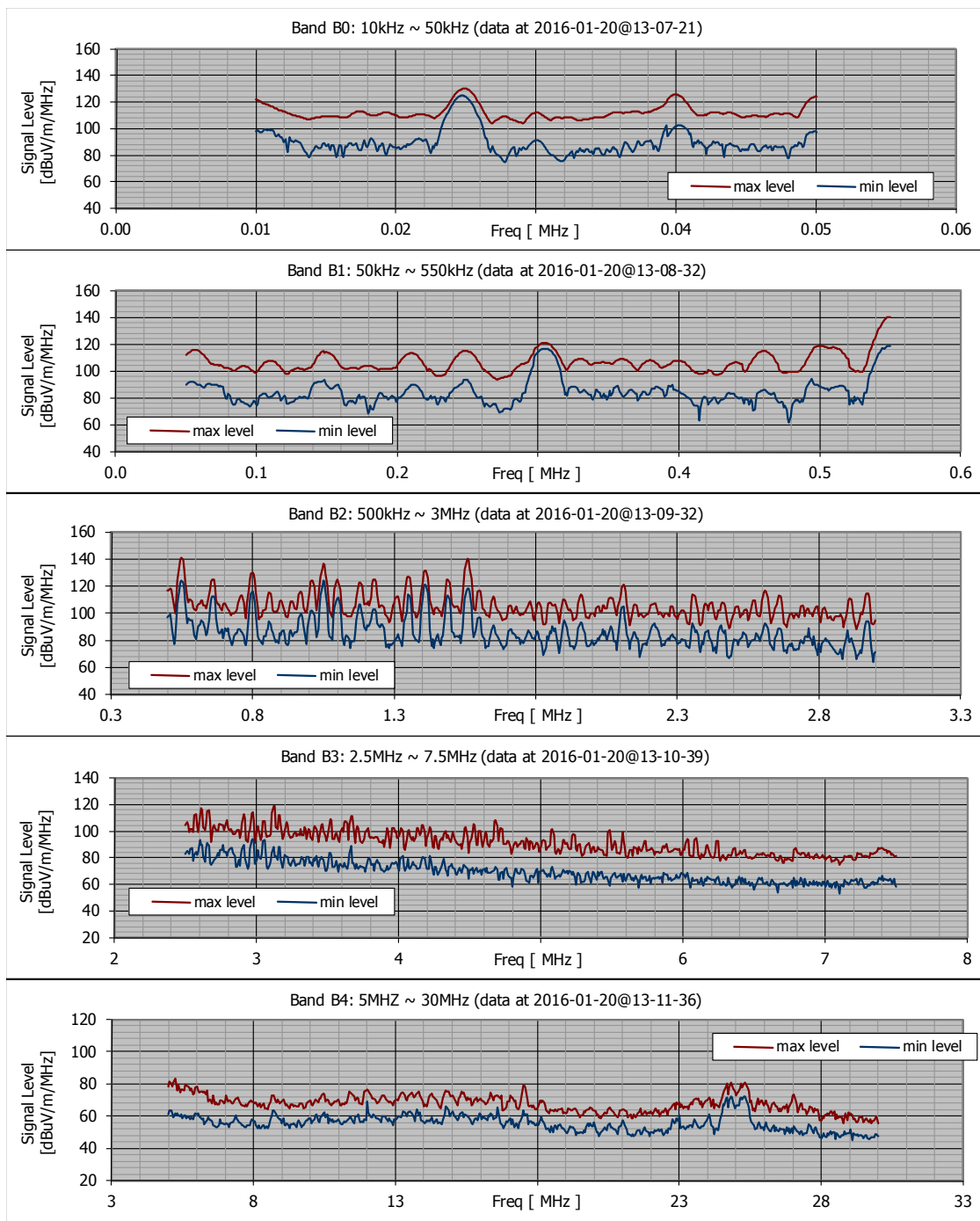
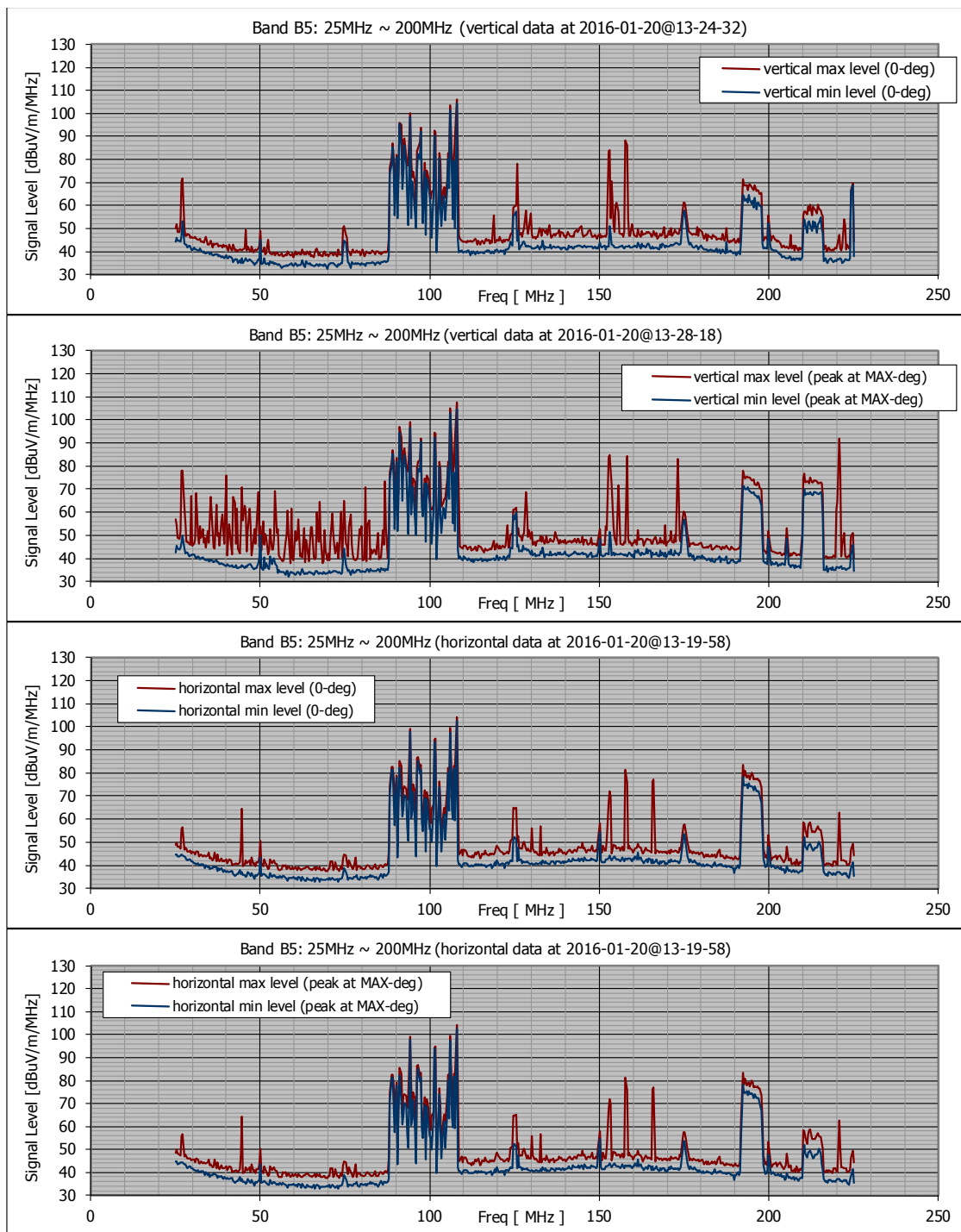


Figure A3.5-3(d) Location 03: AC and DC Magnetic Field Measurement Results



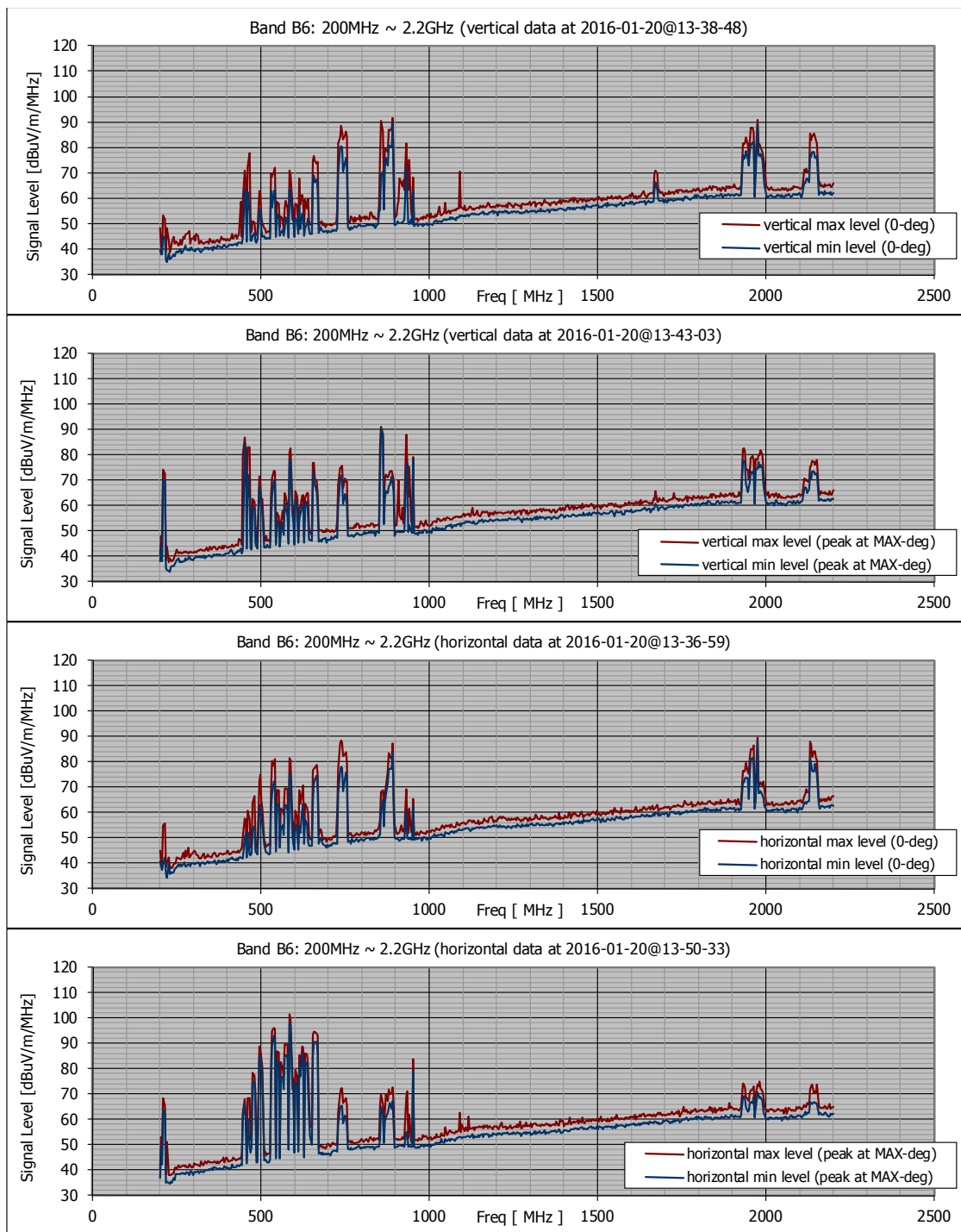
Band	Freq. Range (MHz)	Pk Min-Hold (dB uV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dB uV/m/MHz)	@ Freq. (MHz)
B0	0.01 ~ 0.05	124.7	0.0248	130.1	0.0249
B1	0.05 ~ 0.55	118.4	0.5491	139.8	0.5500
B2	0.50 ~ 3.00	124.1	1.0500	140.7	0.5500
B3	2.5 ~ 7.5	94.0	2.9727	119.0	3.1273
B4	5 ~ 30	72.3	24.8182	83.0	5.2273

Figure A3.5-3(e) Location 03: RF Data from Non-Directional Vertically-Oriented Monopole Antenna



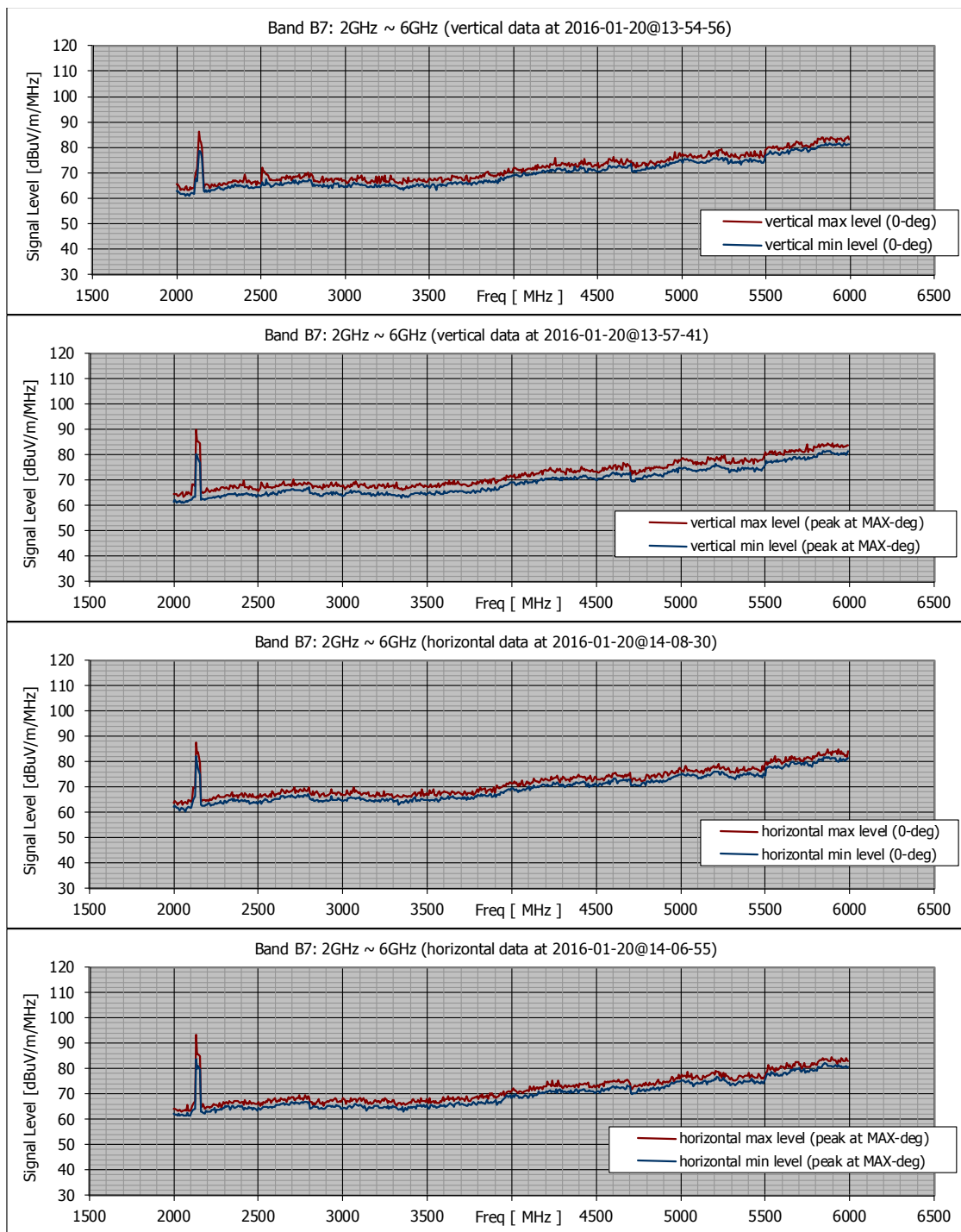
Band	Freq. Range (MHz)	Vertical				Horizontal			
		Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B5	25 ~ 200	104.5	107.909	107.7	107.909	102.7	107.909	104.1	107.909

Figure A3.5-3(f) Location 03: RF Data, Band B5, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Band	Freq. Range (MHz)	Vertical				Horizontal			
		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	90.4	858.18	91.5	890.91	97.9	585.45	101.5	585.45

Figure A3.5-3(g) Location 03: RF Data, Band B6, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Band	Freq. Range (MHz)	Vertical				Horizontal			
		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	80.2	2130.9	89.9	2130.9	83.6	2130.9	93.3	2130.9

Figure A3.5-3(h) Location 03: RF Data, Band B7, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation

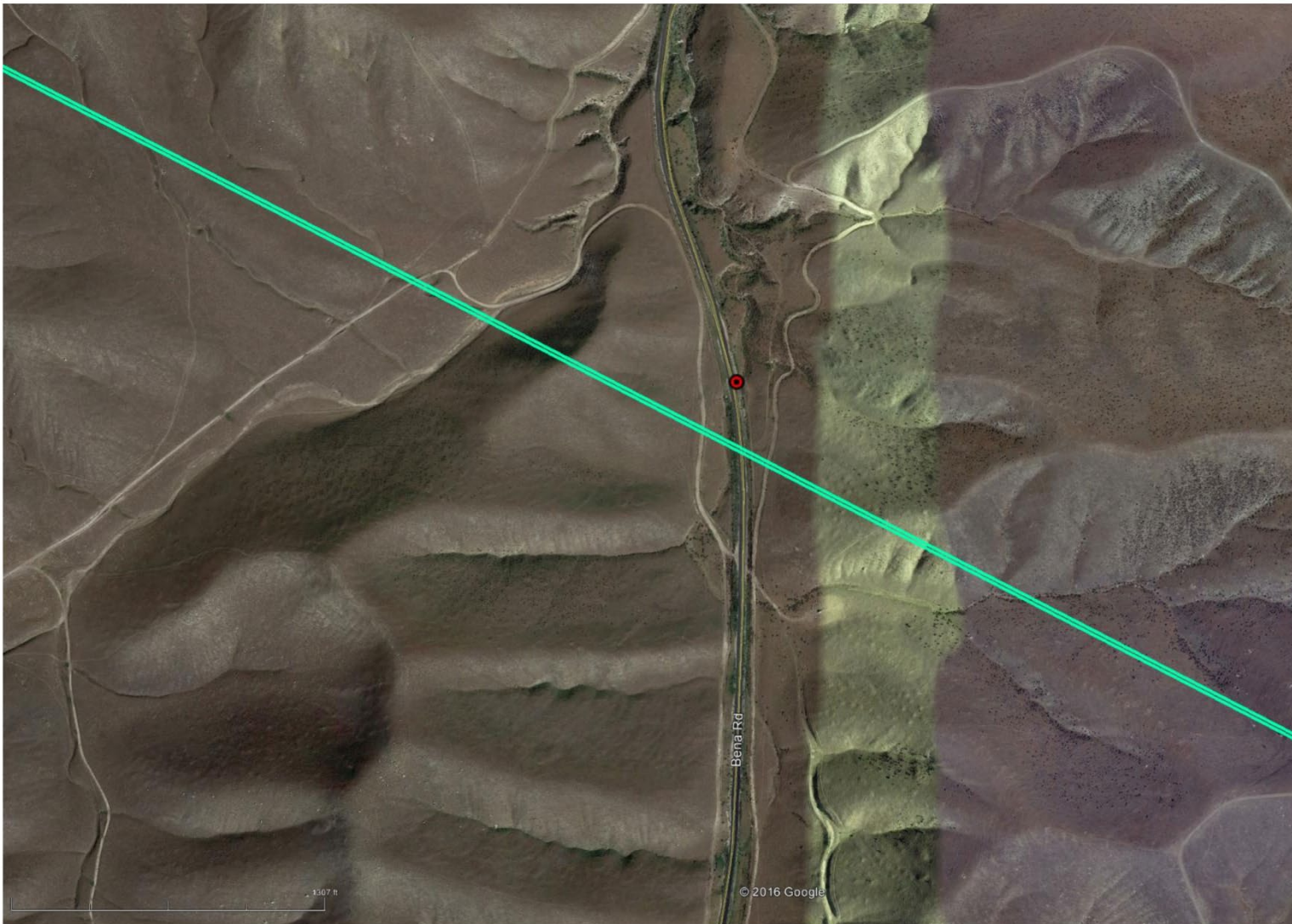


Figure A3.5-4(a) Location 04: Bena Road, Caliente
Rural setting west of Caliente, (Lat 35° 17' 21.80", Lon W118° 41' 42.44")



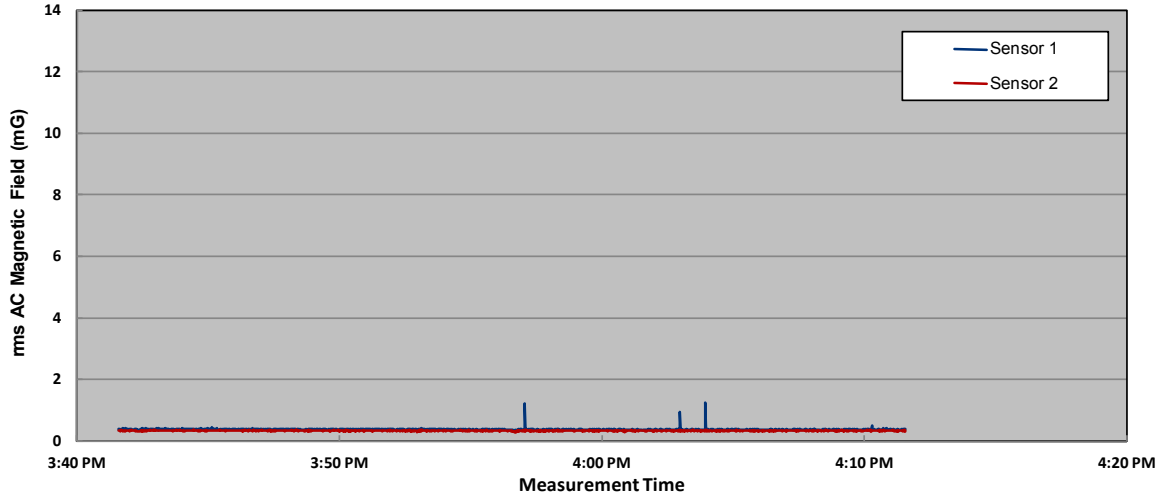
Figure A3.5-4(b) Location 04: Measurement Location and Site Views

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

Measurement Date **Start Time** **End Time** **Duration**
 Wednesday, January 20, 2016 15:41:34 16:11:33 0:29:59

Description: Rural 'quiet' area in hills. Transients of passing traffic are captured.

AC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	60Hz	Harmonic	60Hz	Harmonic
Maximum	0.18	1.23	0.16	0.37
Minimum	0.01	0.32	0.00	0.28
Median	0.03	0.37	0.02	0.33
Range	0.17	0.91	0.16	0.08
Std. Deviation	0.01	0.03	0.01	0.01



DC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	Br DC (mG)	Time of Observation	Br DC (mG)	Time of Observation
Maximum	467.17	16:03:56	465.27	15:42:19
Minimum	465.84	16:02:58	464.79	15:57:03
Median	466.62	----	465.12	----
Range	1.34	----	0.48	----
Std. Deviation	0.04	----	0.04	----

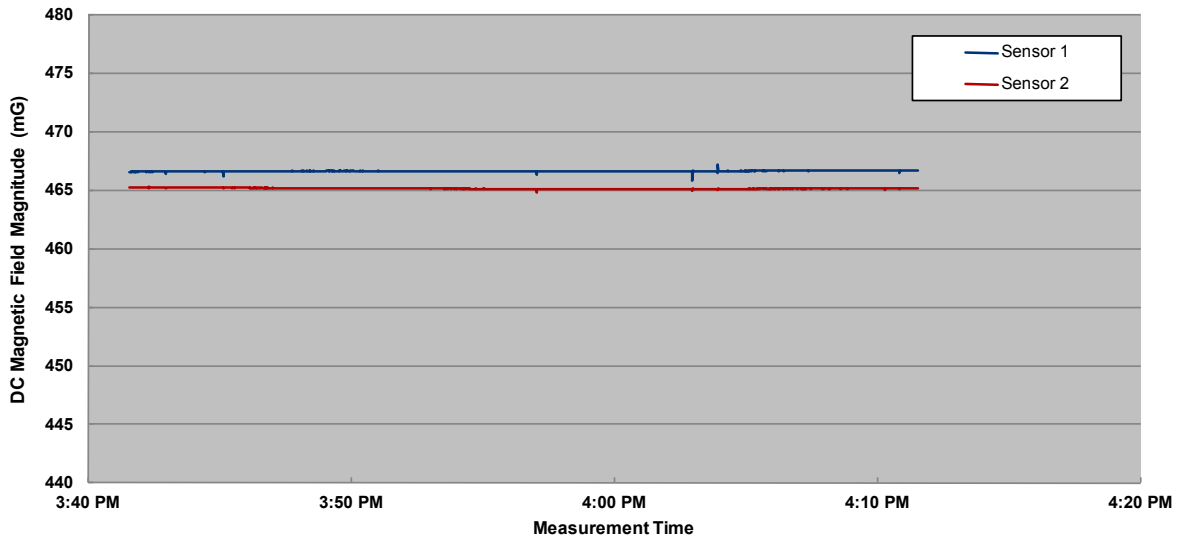
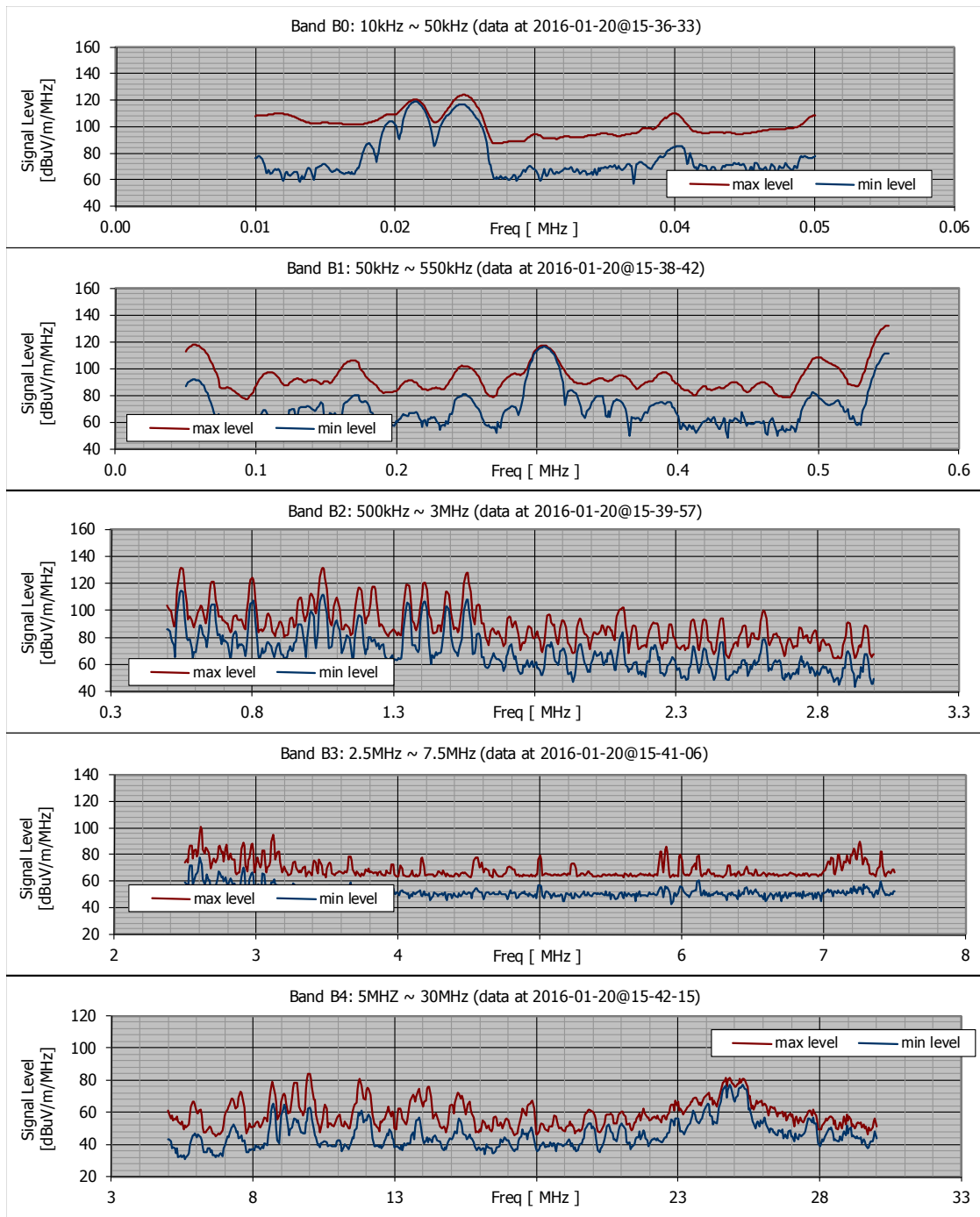
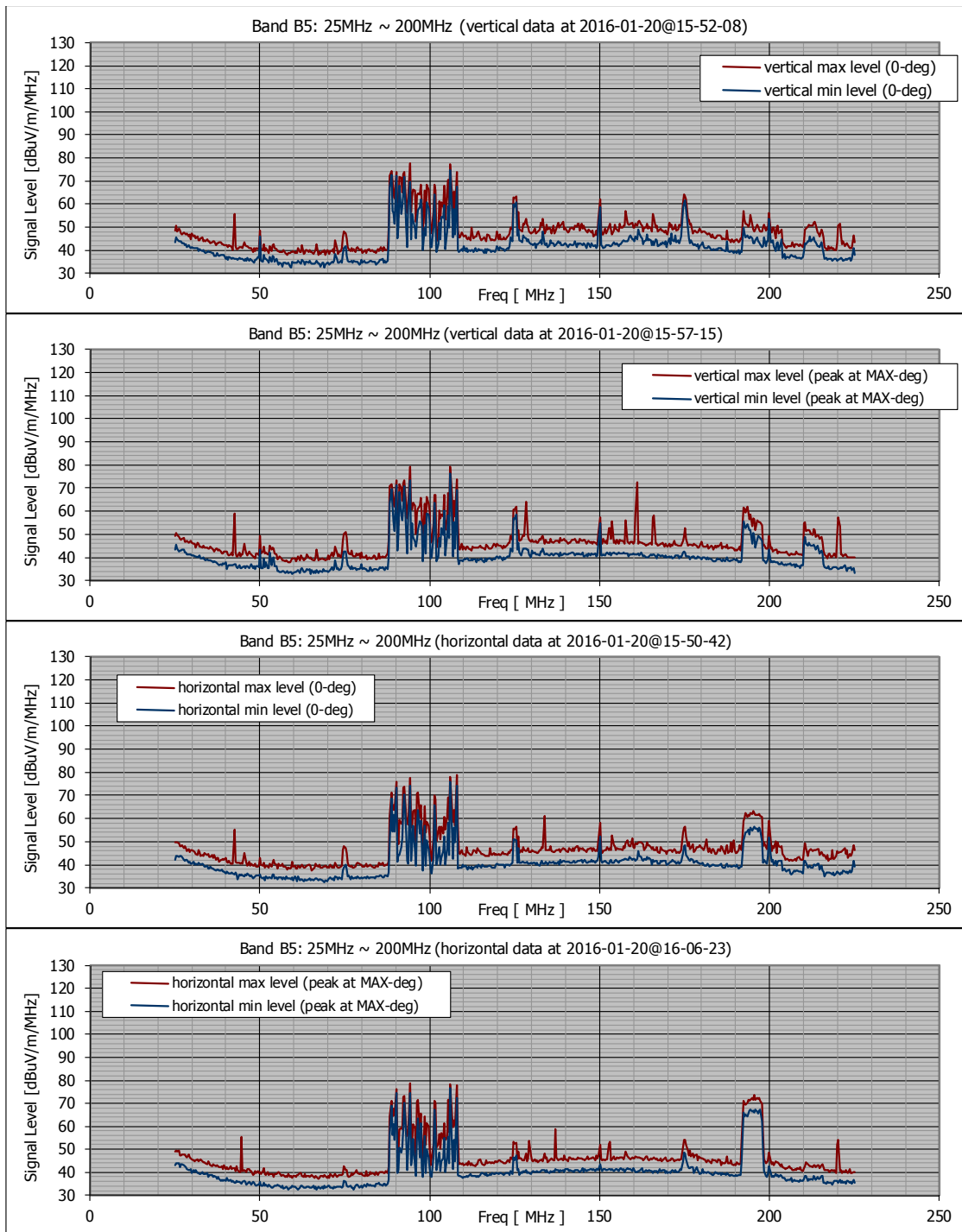


Figure A3.5-4(d) Location 04: AC and DC Magnetic Field Measurement Results



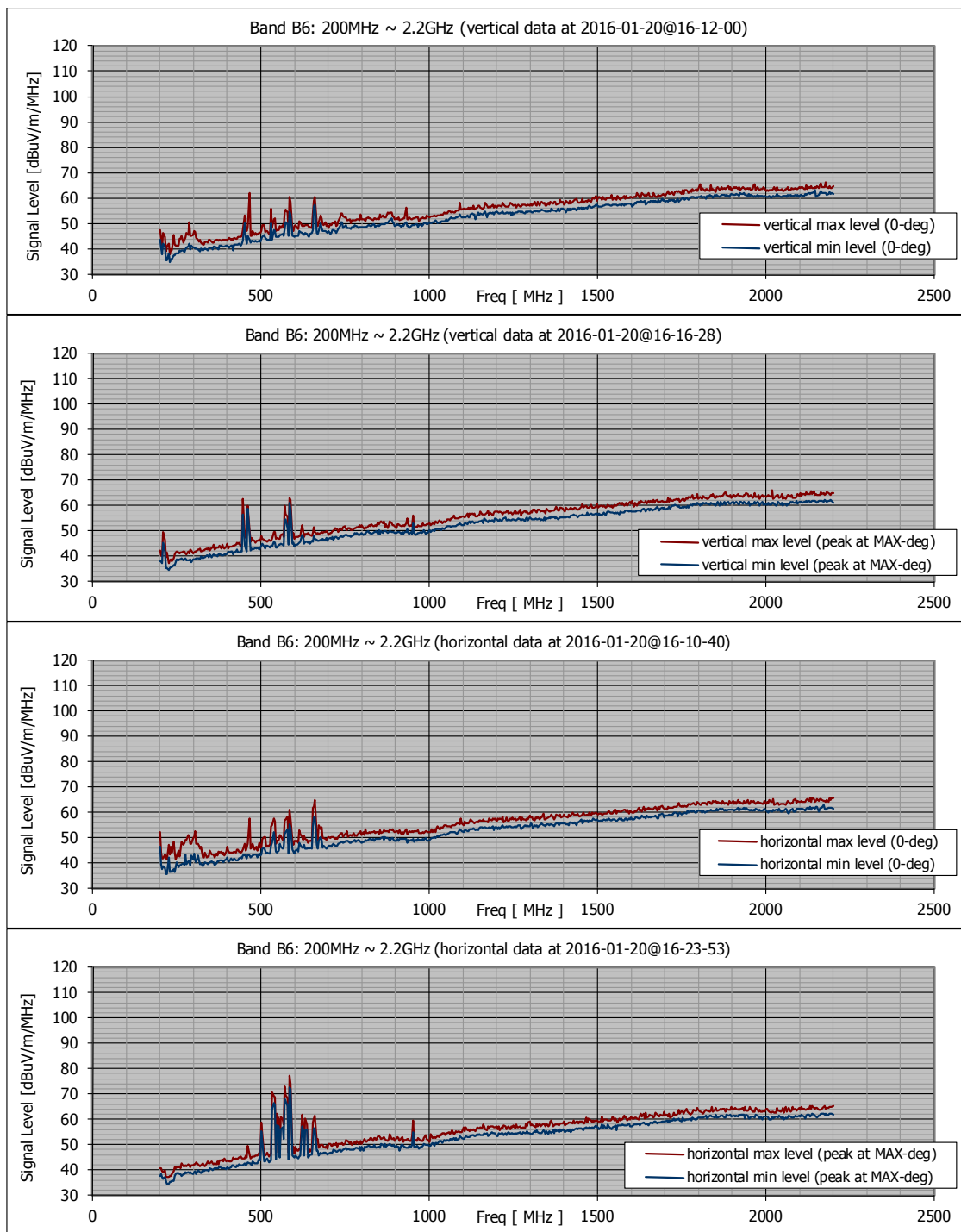
Band	Freq. Range (MHz)	Pk Min-Hold (dB uV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dB uV/m/MHz)	@ Freq. (MHz)
B0	0.01 ~ 0.05	118.7	0.0215	123.9	0.0249
B1	0.05 ~ 0.55	116.0	0.3045	131.7	0.5500
B2	0.50 ~ 3.00	114.5	0.5500	131.7	1.0500
B3	2.5 ~ 7.5	77.6	2.6000	100.5	2.6091
B4	5 ~ 30	76.9	25.2727	84.0	9.9545

Figure A3.5-4(e) Location 04: RF Data from Non-Directional Vertically-Oriented Monopole Antenna



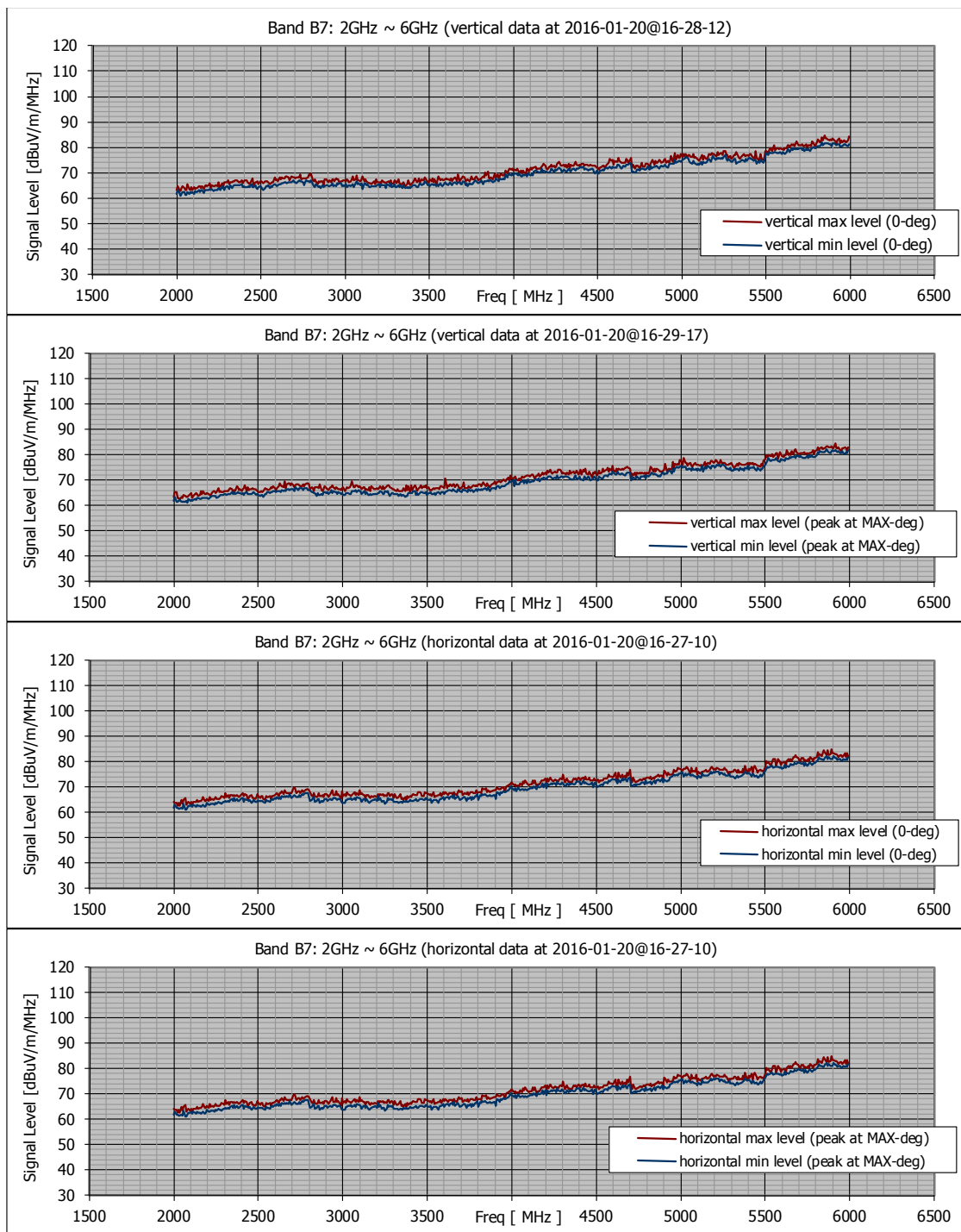
Band	Freq. Range (MHz)	Vertical				Horizontal			
		Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B5	25 ~ 200	76.3	106.091	79.4	94.091	76.6	106.091	78.9	107.909

Figure A3.5-4(f) Location 04: RF Data, Band B5, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Band	Freq. Range (MHz)	Vertical				Horizontal			
		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	63.2	2145.45	66.3	2178.18	72.7	585.45	77.1	585.45

Figure A3.5-4(g) Location 04: RF Data, Band B6, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Band	Freq. Range (MHz)	Vertical				Horizontal			
		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	67.2	2720.0	69.4	2654.5	67.1	2683.6	69.9	2712.7

Figure A3.5-4(h) Location 04: RF Data, Band B7, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Figure A3.5-5(a) Location 05: Alan Avenue and Lois Street, Tehachapi
Suburban setting in Tehachapi, with few RF emitters (Lat 35° 08' 02.05", Lon W118° 25' 44.36")



Figure A3.5-5(b) Location 05: Measurement Location and Site Views

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



Figure A3.5-5(c) Location 05: Alan Avenue and Lois Street, Tehachapi

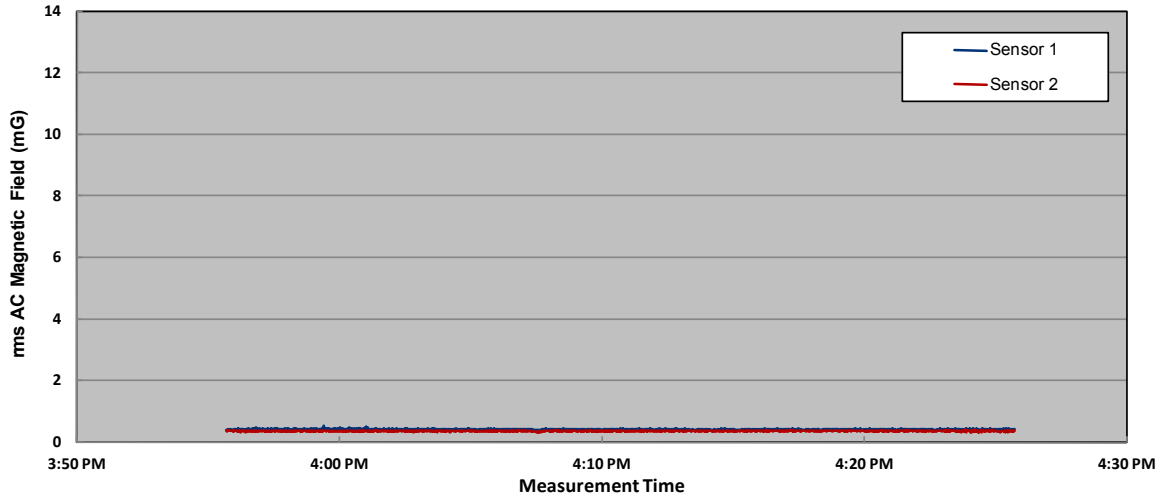
Nearby emitters include local distribution lines.

Photos depicting visible close-proximity emitters. Other emissions sources are assumed to exist but are not visible from the site.

Measurement Date **Start Time** **End Time** **Duration**
 Thursday, January 21, 2016 15:55:40 16:25:42 0:30:02

Description: Adjacent to residences, no nearby overhead distribution lines.

AC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	60Hz	Harmonic	60Hz	Harmonic
Maximum	0.14	0.53	0.14	0.40
Minimum	0.02	0.33	0.03	0.30
Median	0.07	0.40	0.07	0.35
Range	0.12	0.20	0.10	0.10
Std. Deviation	0.01	0.02	0.01	0.01



DC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	Br DC (mG)	Time of Observation	Br DC (mG)	Time of Observation
Maximum	463.39	16:21:35	464.62	15:57:31
Minimum	463.18	15:55:51	464.58	16:13:30
Median	463.33	----	464.60	----
Range	0.21	----	0.04	----
Std. Deviation	0.04	----	0.01	----

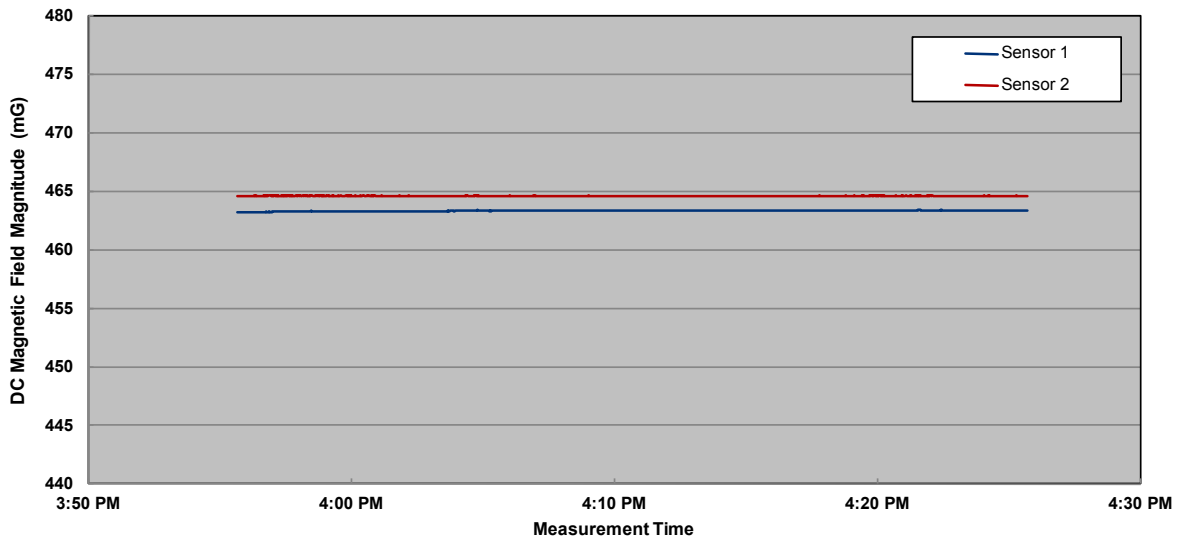


Figure A3.5-5(d) Location 05: AC and DC Magnetic Field Measurement Results

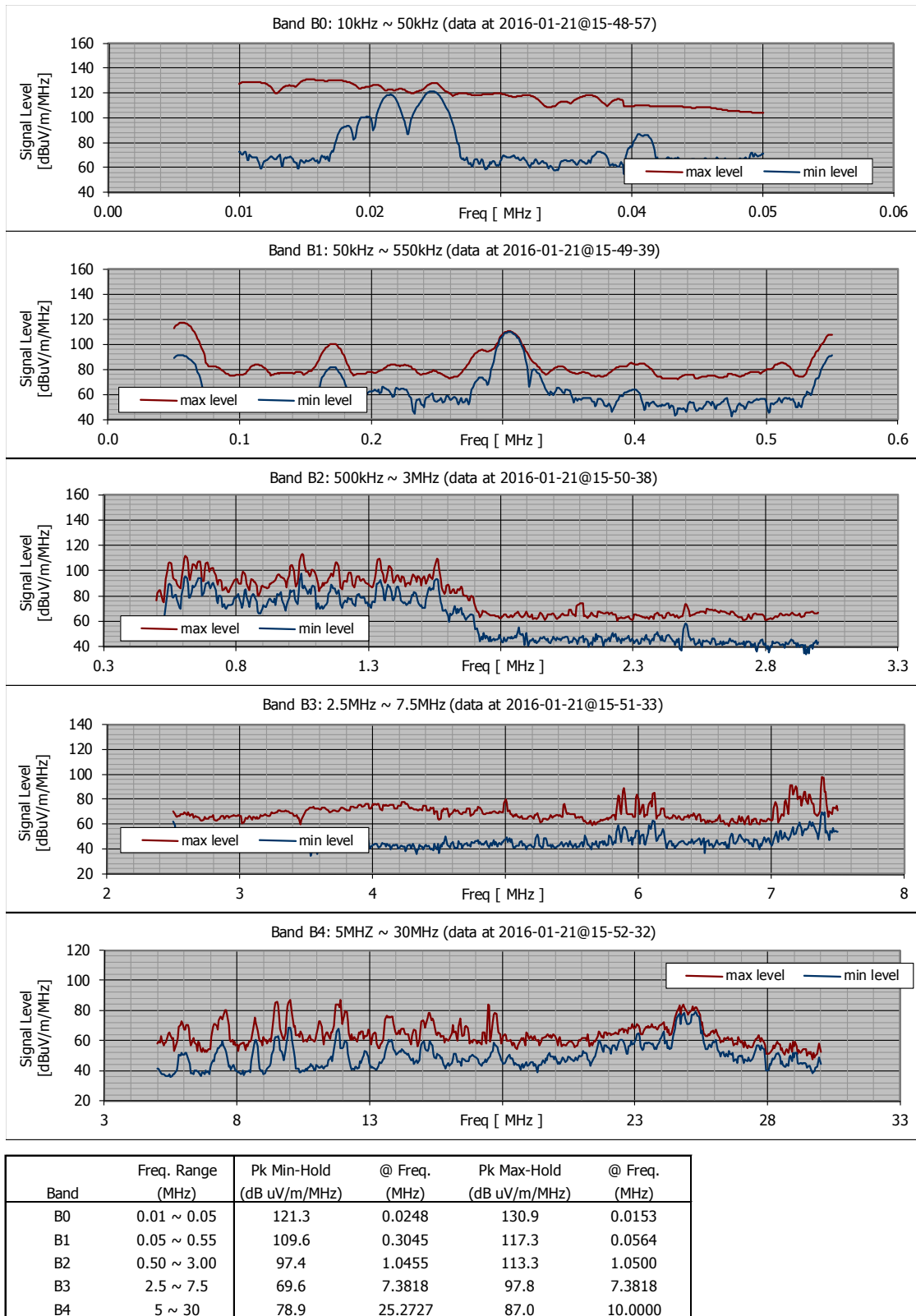
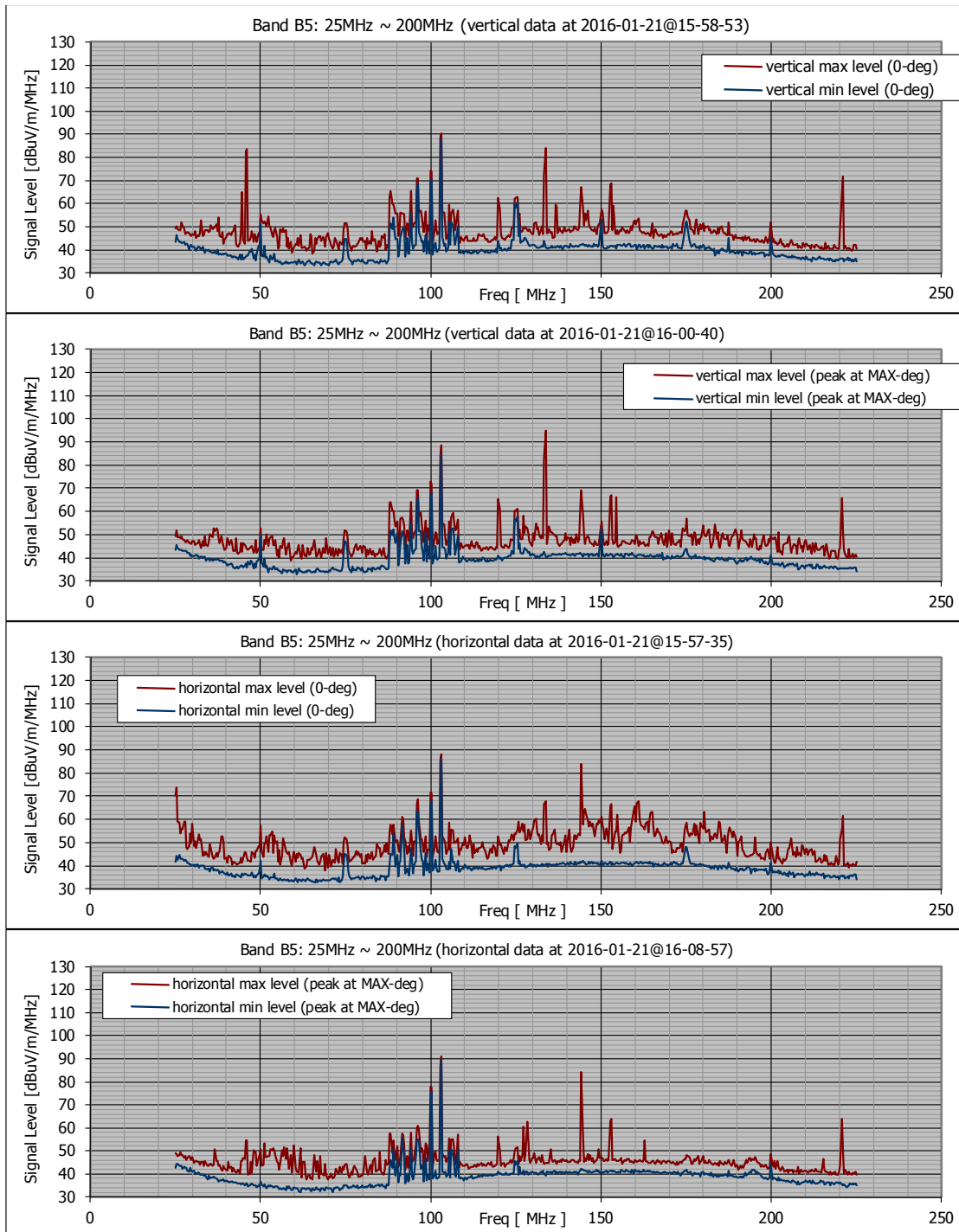
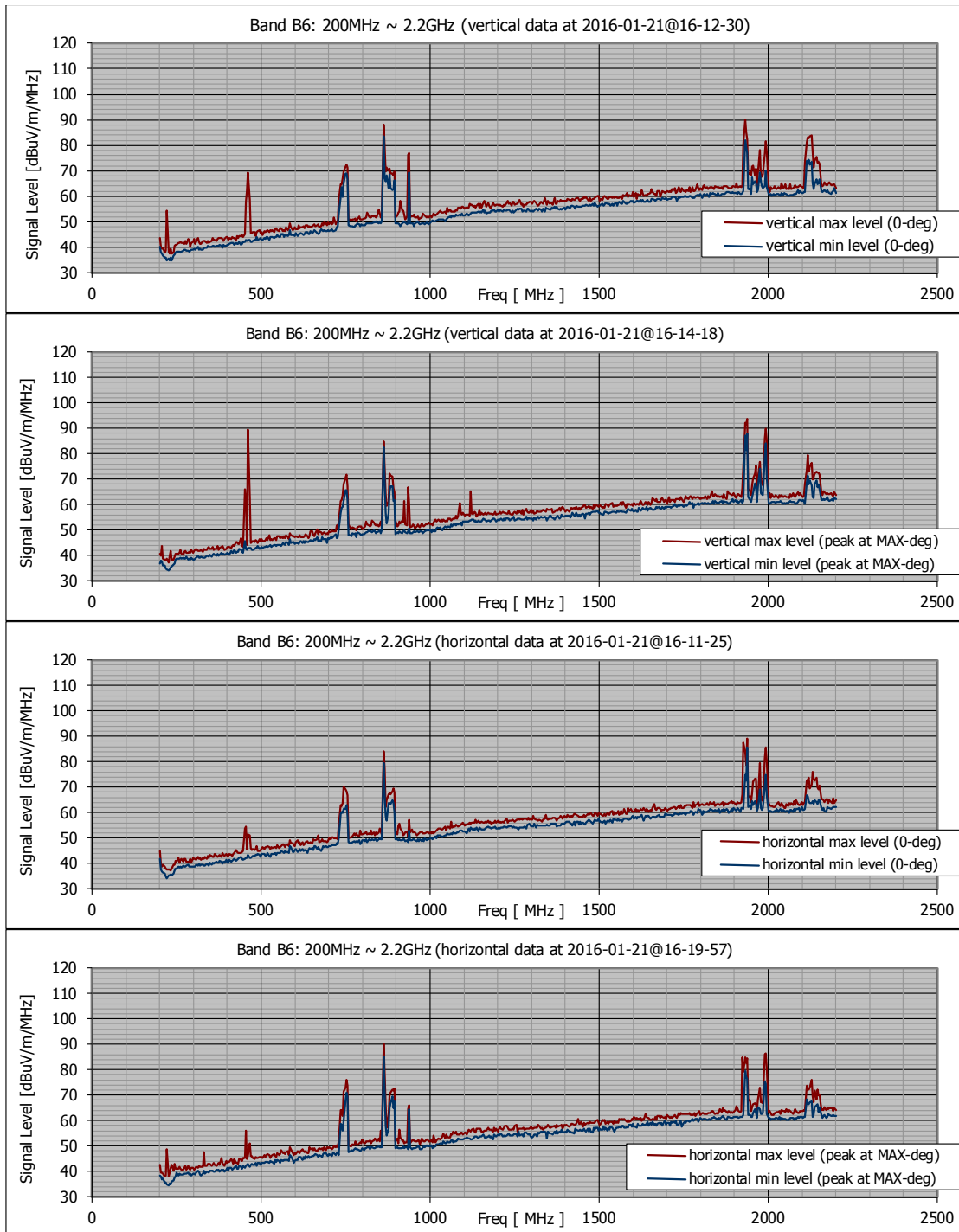


Figure A3.5-5(e) Location 05: RF Data from Non-Directional Vertically-Oriented Monopole Antenna



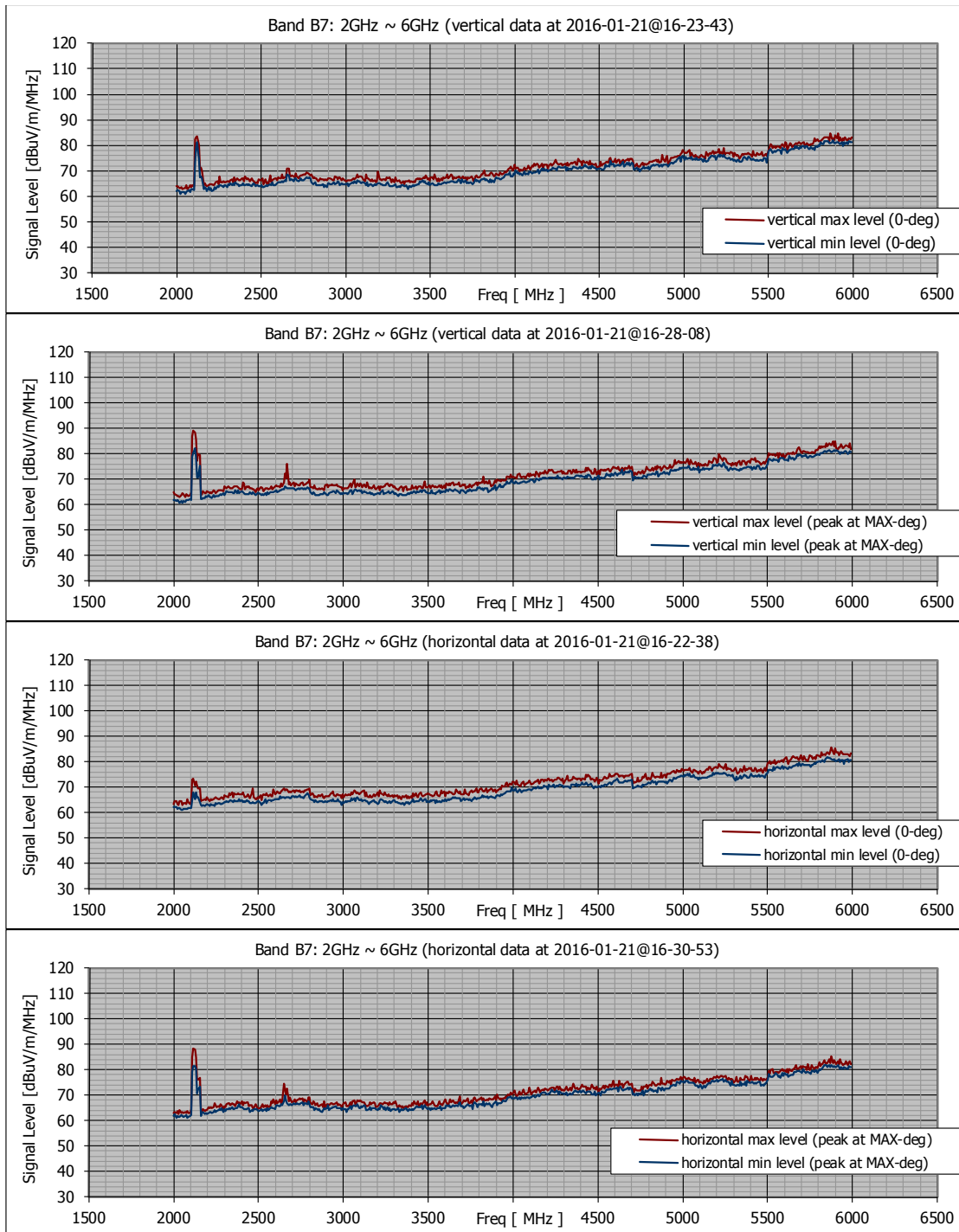
Band	Freq. Range (MHz)	Vertical				Horizontal			
		Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B5	25 ~ 200	87.7	103.182	95.0	133.727	89.3	103.182	91.1	103.182

Figure A3.5-5(f) Location 05: RF Data, Band B5, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Band	Freq. Range (MHz)	Vertical				Horizontal			
		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	88.0	1938.18	93.7	1938.18	85.8	1938.18	90.1	861.82

Figure A3.5-5(g) Location 05: RF Data, Band B6, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Band	Freq. Range (MHz)	Vertical				Horizontal			
		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	82.1	2123.6	89.1	2116.4	81.4	2123.6	88.2	2116.4

Figure A3.5-5(h) Location 05: RF Data, Band B7, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Figure A3.5-6(a) Location 06: Tehachapi – Willow Springs Road
Rural setting south of Monolith CA, with few RF emitters (Lat 35° 02' 44.25", Lon W118° 21' 13.19")



Figure A3.5-6(b) Location 06: Measurement Location and Site Views

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



Figure A3.5-6(c)

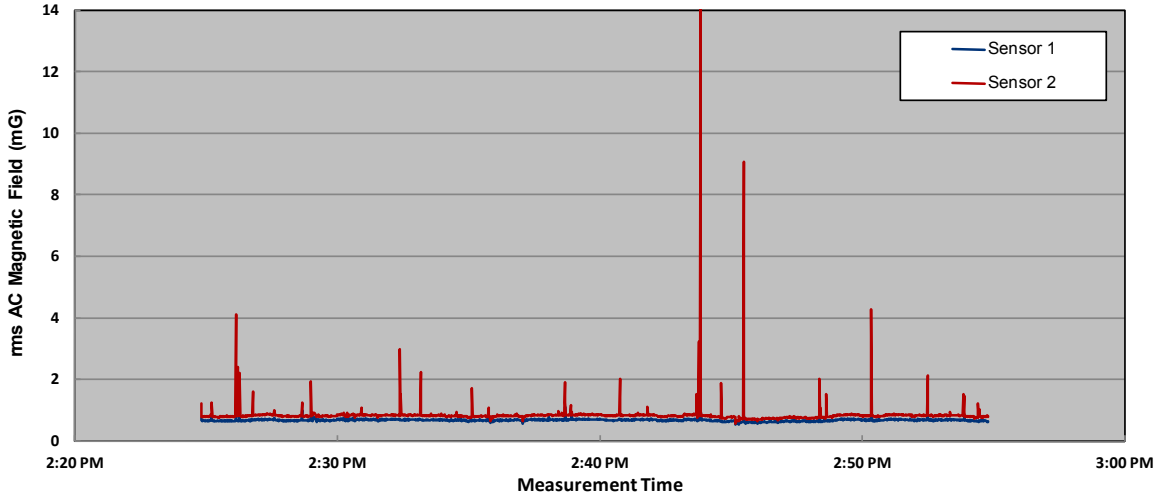
Location 06: Tehachapi-Willow Springs Road

Nearby emitters include communications towers and distribution lines parallel to the roadway.
Photos depicting visible close-proximity emitters. Other emissions sources are assumed to exist but are not visible from the site.

Measurement Date **Start Time** **End Time** **Duration**
 Thursday, January 21, 2016 14:24:48 14:54:47 0:29:59

Description: Wind farm. Sensors beside the road captured significant transients from passing vehicles. Overhead distribution lines running on opposite side of road.

AC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	60Hz	Harmonic	60Hz	Harmonic
Maximum	0.70	1.63	1.58	14.21
Minimum	0.34	0.34	0.44	0.30
Median	0.55	0.39	0.74	0.36
Range	0.37	1.30	1.14	13.91
Std. Deviation	0.04	0.04	0.05	0.43



DC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	Br DC (mG)	Time of Observation	Br DC (mG)	Time of Observation
Maximum	467.82	14:43:50	465.78	14:38:39
Minimum	463.33	14:43:49	450.49	14:43:49
Median	466.84	-----	464.37	-----
Range	4.49	-----	15.29	-----
Std. Deviation	0.14	-----	0.43	-----

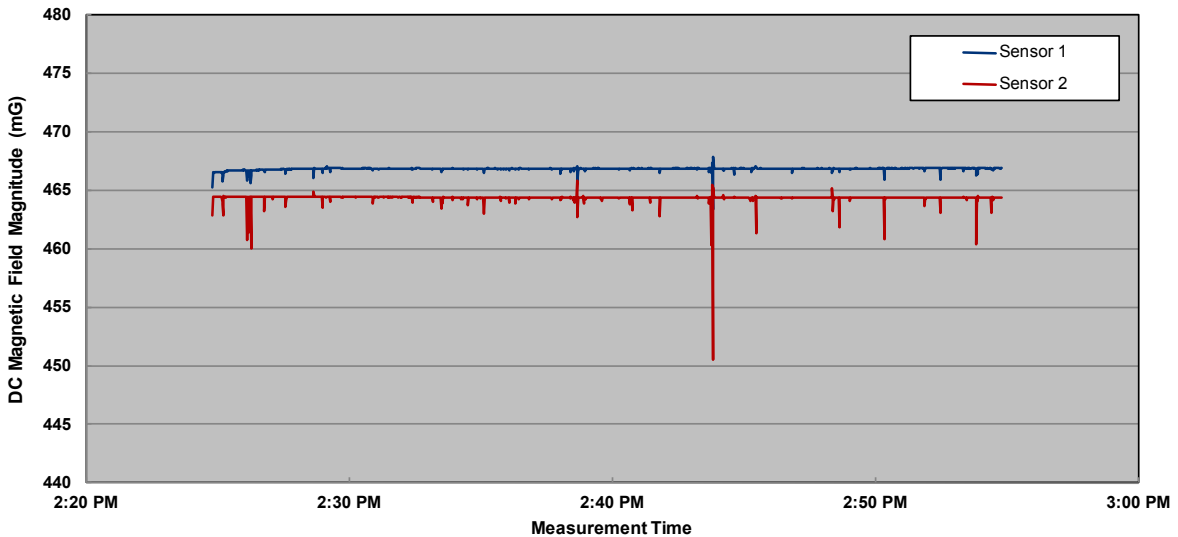
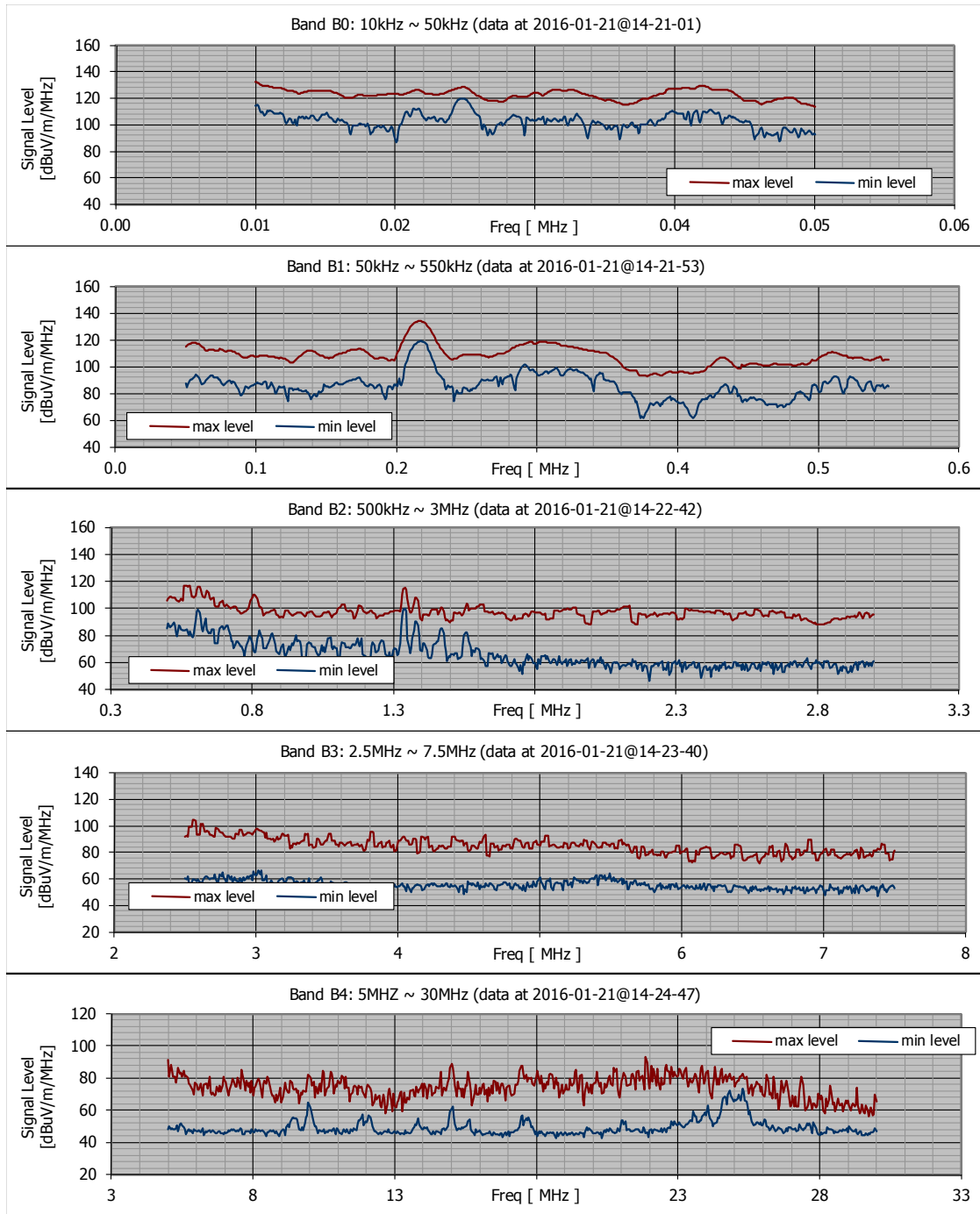
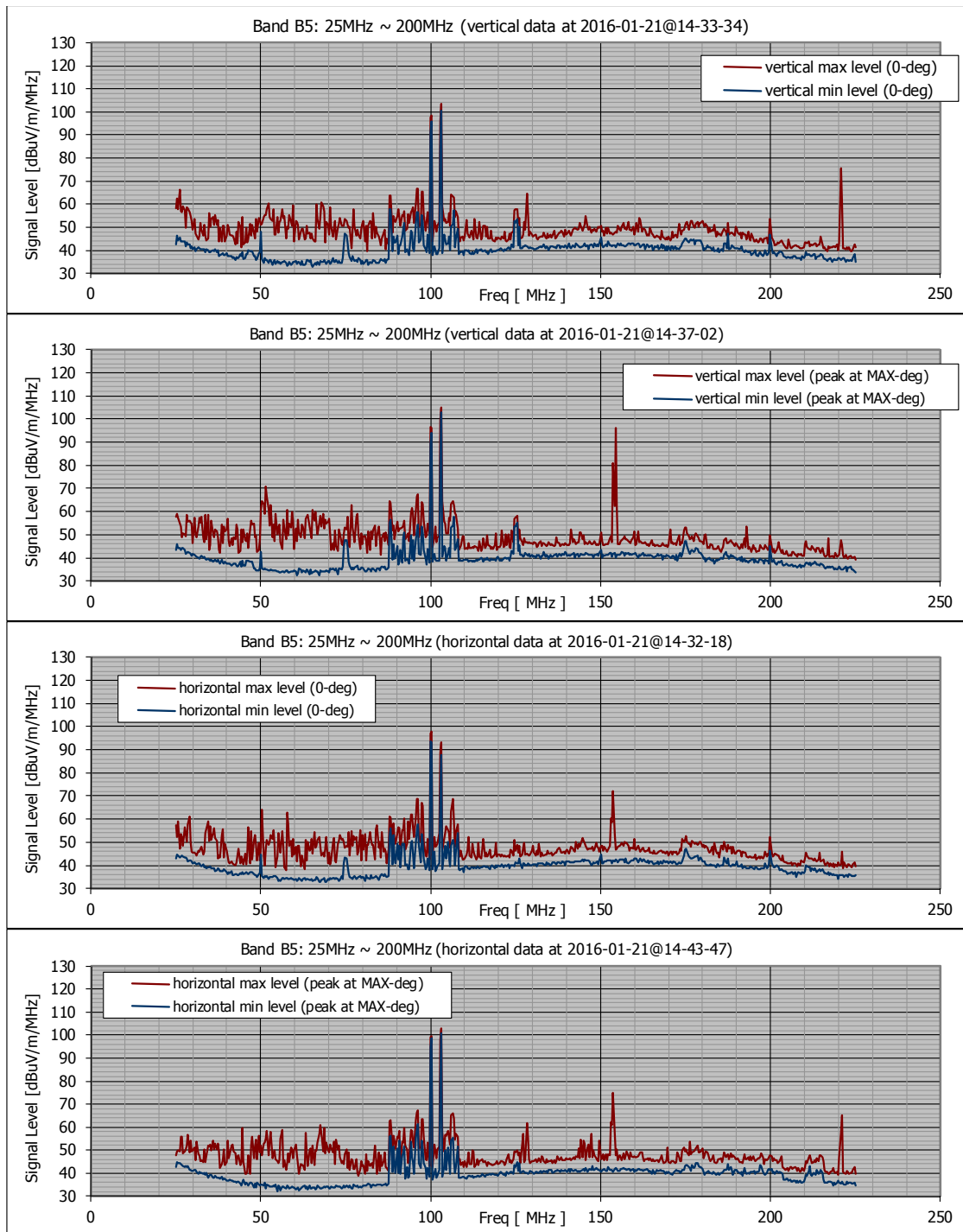


Figure A3.5-6(d) Location 06: AC and DC Magnetic Field Measurement Results



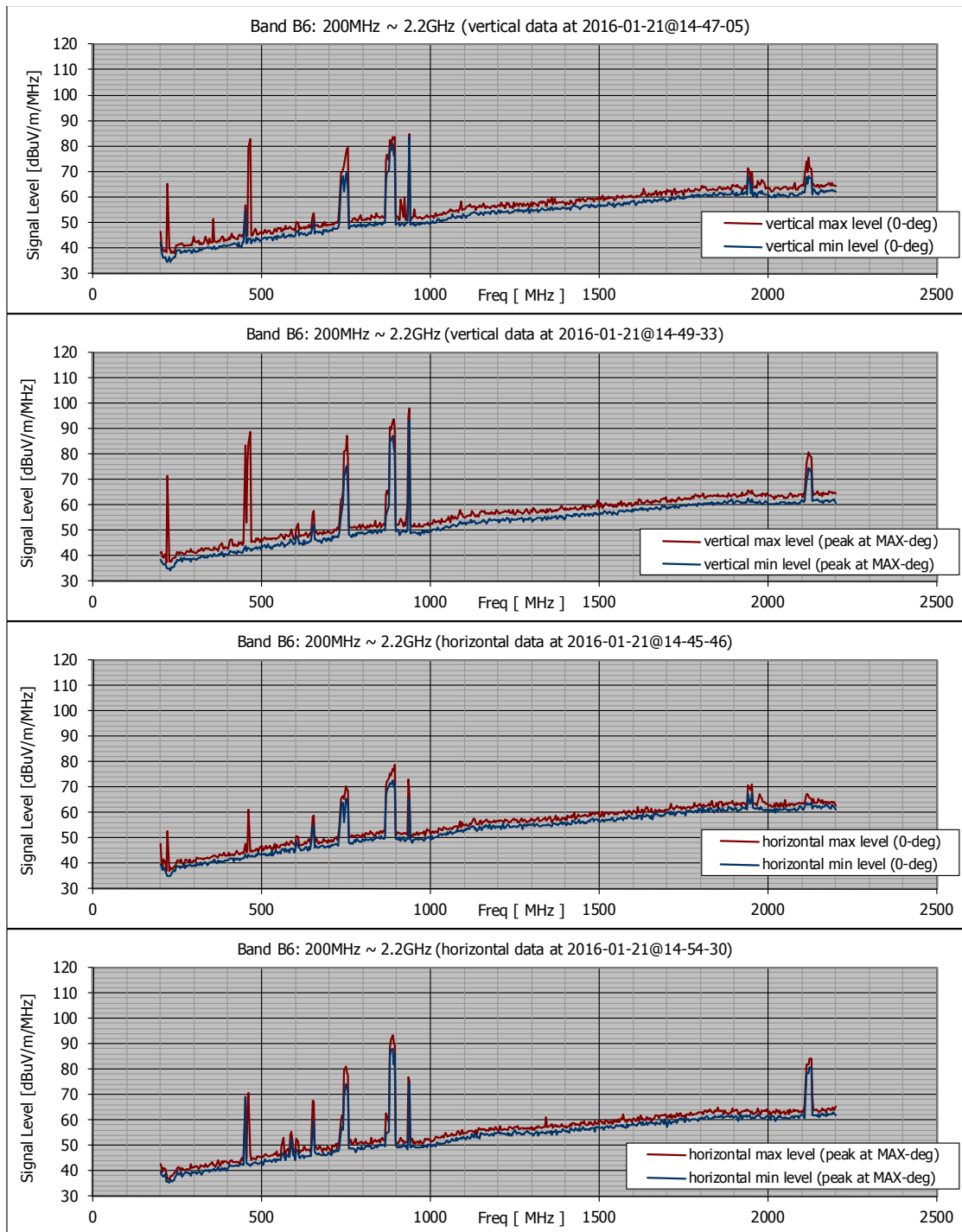
Band	Freq. Range (MHz)	Pk Min-Hold (dB uV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dB uV/m/MHz)	@ Freq. (MHz)
B0	0.01 ~ 0.05	119.6	0.0246	132.2	0.0100
B1	0.05 ~ 0.55	118.9	0.2173	133.9	0.2164
B2	0.50 ~ 3.00	99.5	1.3409	116.7	0.5591
B3	2.5 ~ 7.5	66.3	3.0364	104.3	2.5545
B4	5 ~ 30	73.2	25.2727	92.9	21.8636

Figure A3.5-6(e) Location 06: RF Data from Non-Directional Vertically-Oriented Monopole Antenna



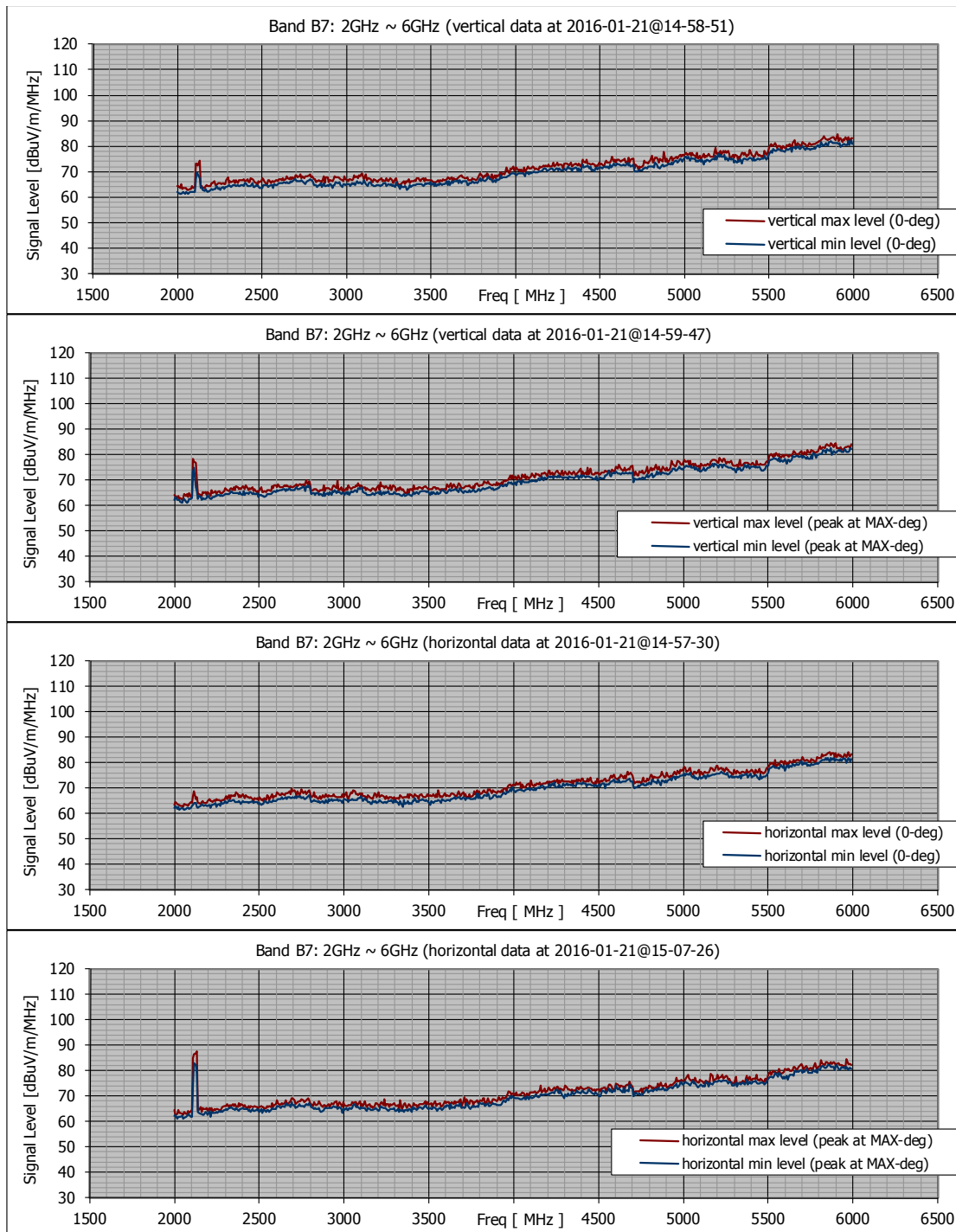
Band	Freq. Range (MHz)	Vertical				Horizontal			
		Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B5	25 ~ 200	102.9	103.182	104.8	103.182	100.8	103.182	102.7	103.182

Figure A3.5-6(f) Location 06: RF Data, Band B5, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Band	Freq. Range (MHz)	Vertical				Horizontal			
		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	93.2	938.18	97.9	938.18	88.0	887.27	93.2	887.27

Figure A3.5-6(g) Location 06: RF Data, Band B6, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Band	Freq. Range (MHz)	Vertical				Horizontal			
		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	74.9	2116.4	78.5	2109.1	82.8	2116.4	87.5	2130.9

Figure A3.5-6(h) Location 06: RF Data, Band B7, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Figure A3.5-7(a) Location 07: Avenue H and Sierra Highway, Lancaster
Suburban setting in Lancaster near the existing UPRR alignment, with some RF emitters (Lat 34° 43' 04.73", Lon W118° 08' 24.13")



Figure A3.5-7(b) Location 07: Measurement Location and Site Views

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



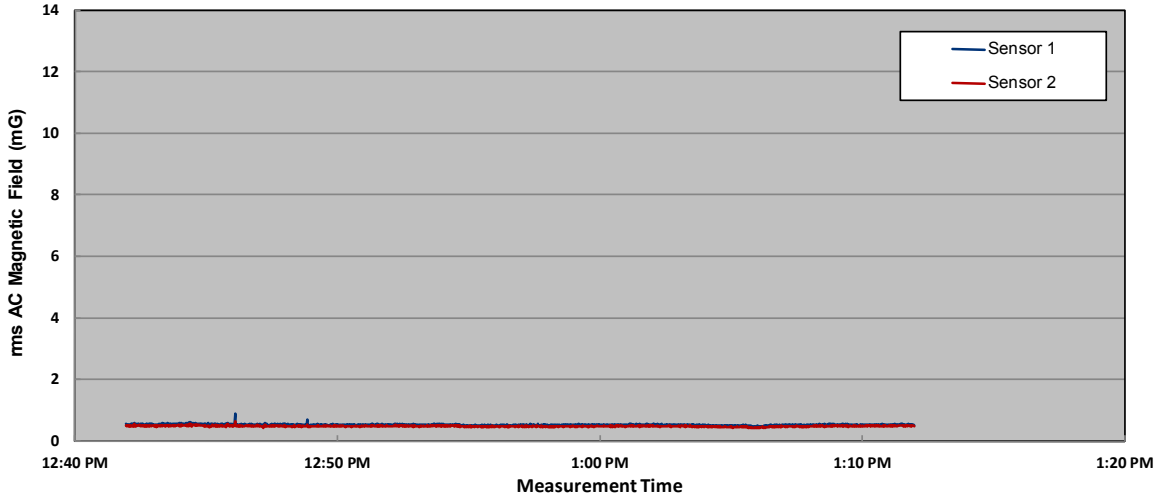
Figure A3.5-7(c) Location 07: Avenue H and Sierra Highway, Lancaster

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

Measurement Date **Start Time** **End Time** **Duration**
Thursday, January 21, 2016 12:41:56 13:11:57 0:30:01

Description: Open area between Sierra Hwy and residential development. Transients from road traffic; no nearby overhead electric lines.

AC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	60Hz	Harmonic	60Hz	Harmonic
Maximum	0.44	0.83	0.42	0.58
Minimum	0.17	0.40	0.16	0.36
Median	0.27	0.45	0.25	0.41
Range	0.27	0.44	0.26	0.22
Std. Deviation	0.03	0.02	0.03	0.01



DC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	Br DC (mG)	Time of Observation	Br DC (mG)	Time of Observation
Maximum	462.90	13:11:33	461.22	13:11:54
Minimum	461.37	12:46:05	460.60	12:48:50
Median	462.66	----	461.12	----
Range	1.53	----	0.62	----
Std. Deviation	0.18	----	0.05	----

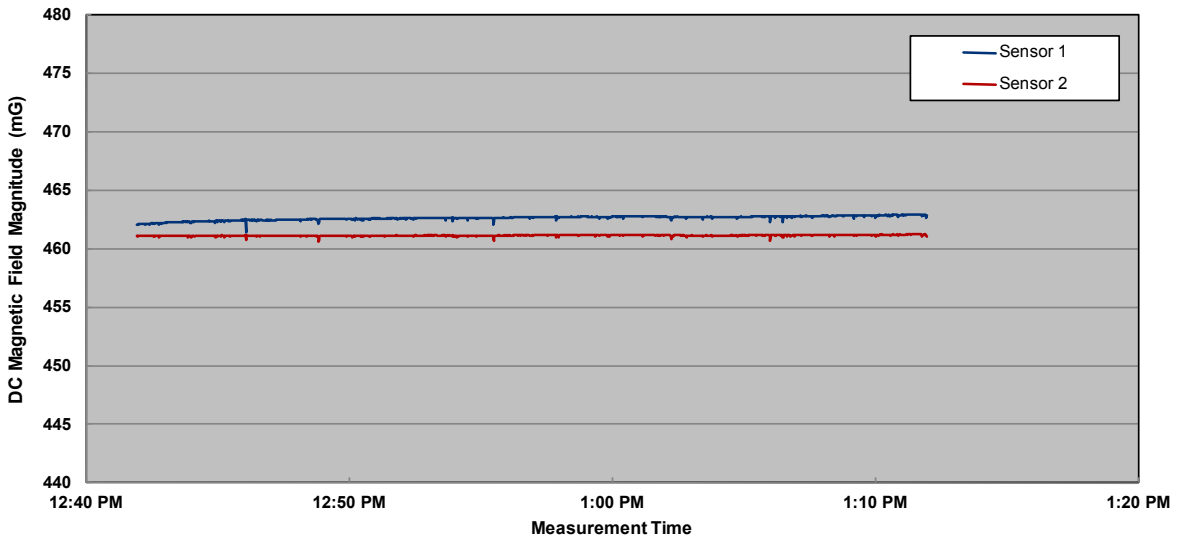
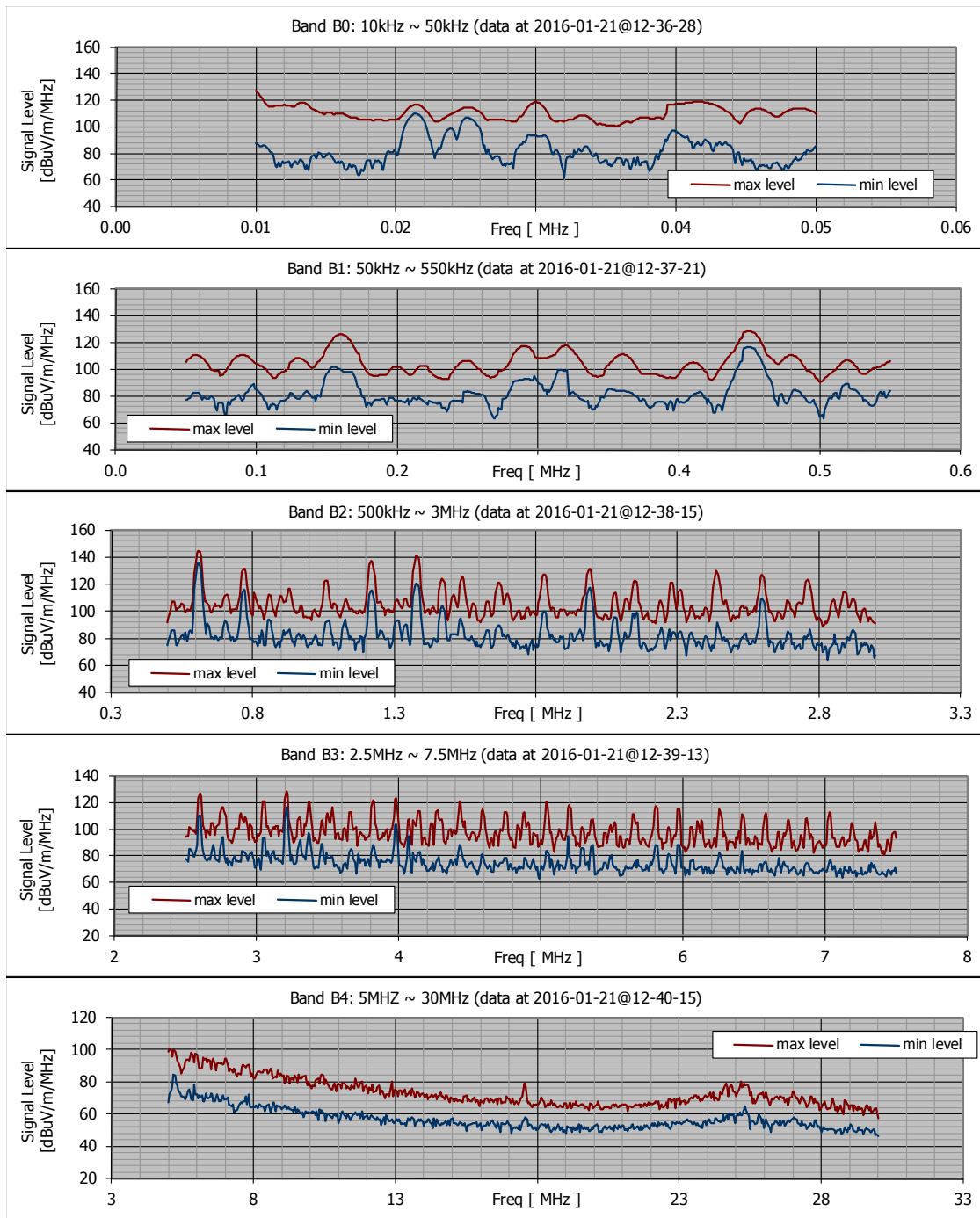
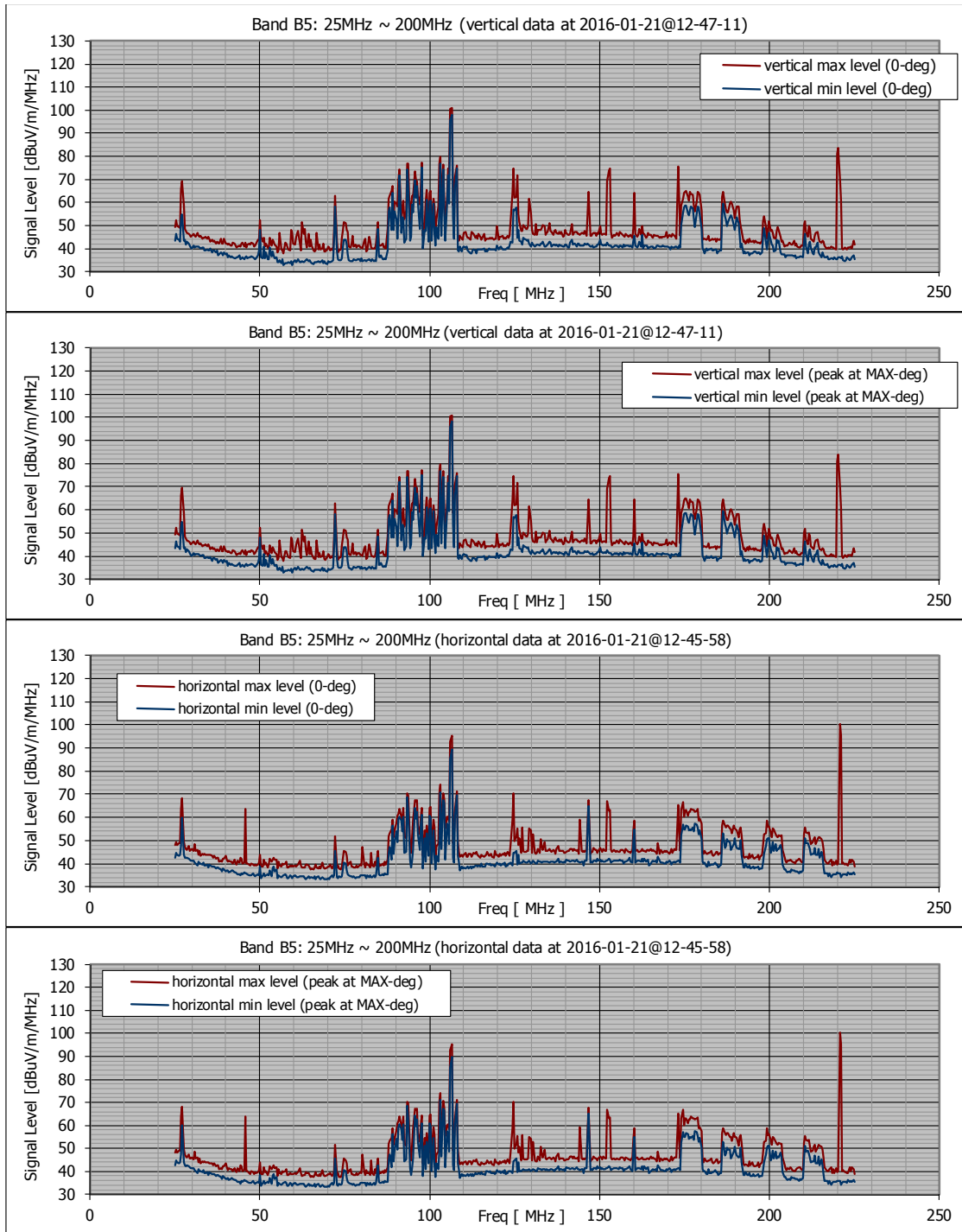


Figure A3.5-7(d) Location 07: AC and DC Magnetic Field Measurement Results



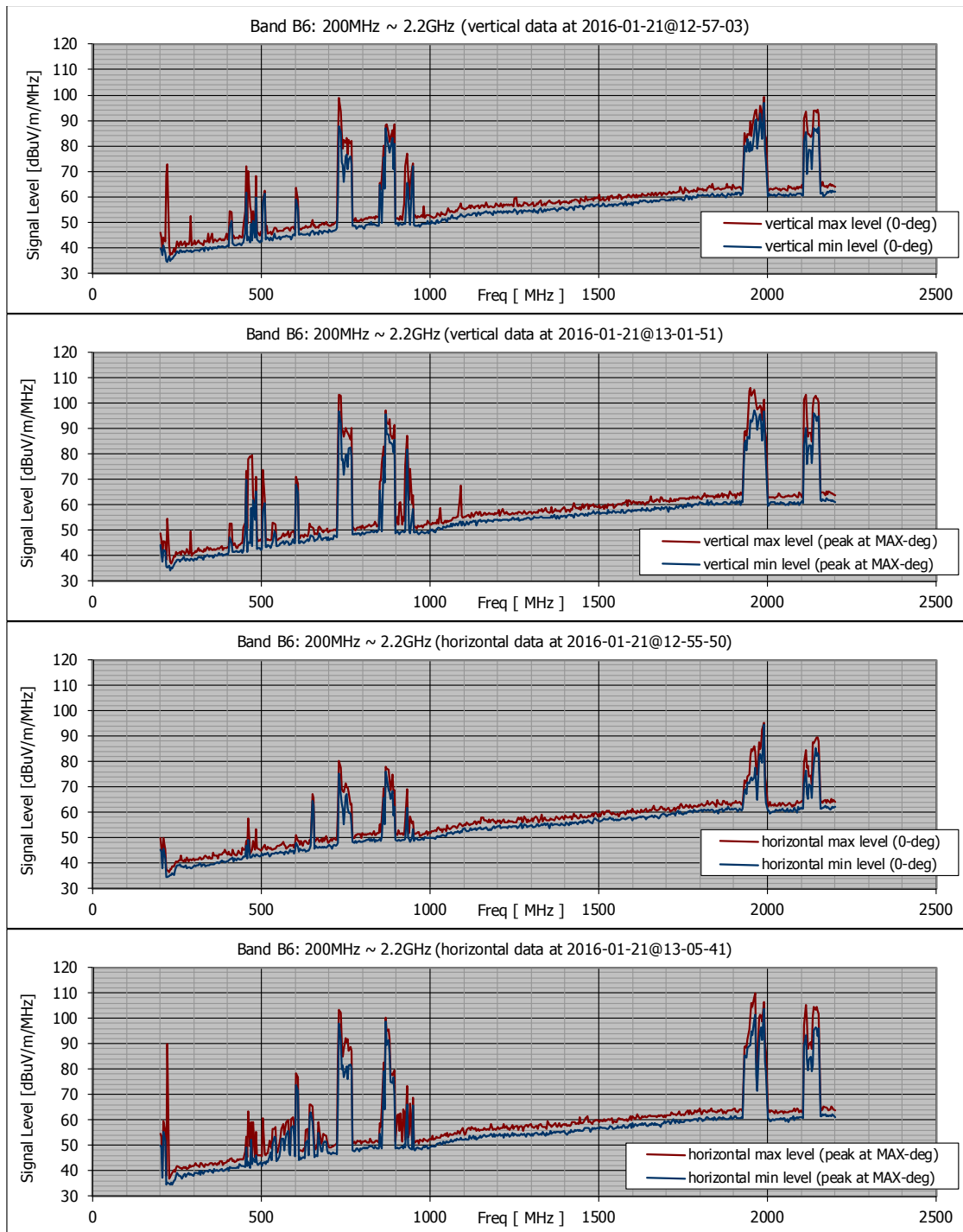
Band	Freq. Range (MHz)	Pk Min-Hold (dB uV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dB uV/m/MHz)	@ Freq. (MHz)
B0	0.01 ~ 0.05	109.9	0.0214	126.9	0.0100
B1	0.05 ~ 0.55	116.4	0.4500	128.2	0.4500
B2	0.50 ~ 3.00	135.7	0.6091	144.6	0.6091
B3	2.5 ~ 7.5	116.1	3.2091	128.1	3.2091
B4	5 ~ 30	84.6	5.1818	100.6	5.0455

Figure A3.5-7(e) Location 07: RF Data from Non-Directional Vertically-Oriented Monopole Antenna



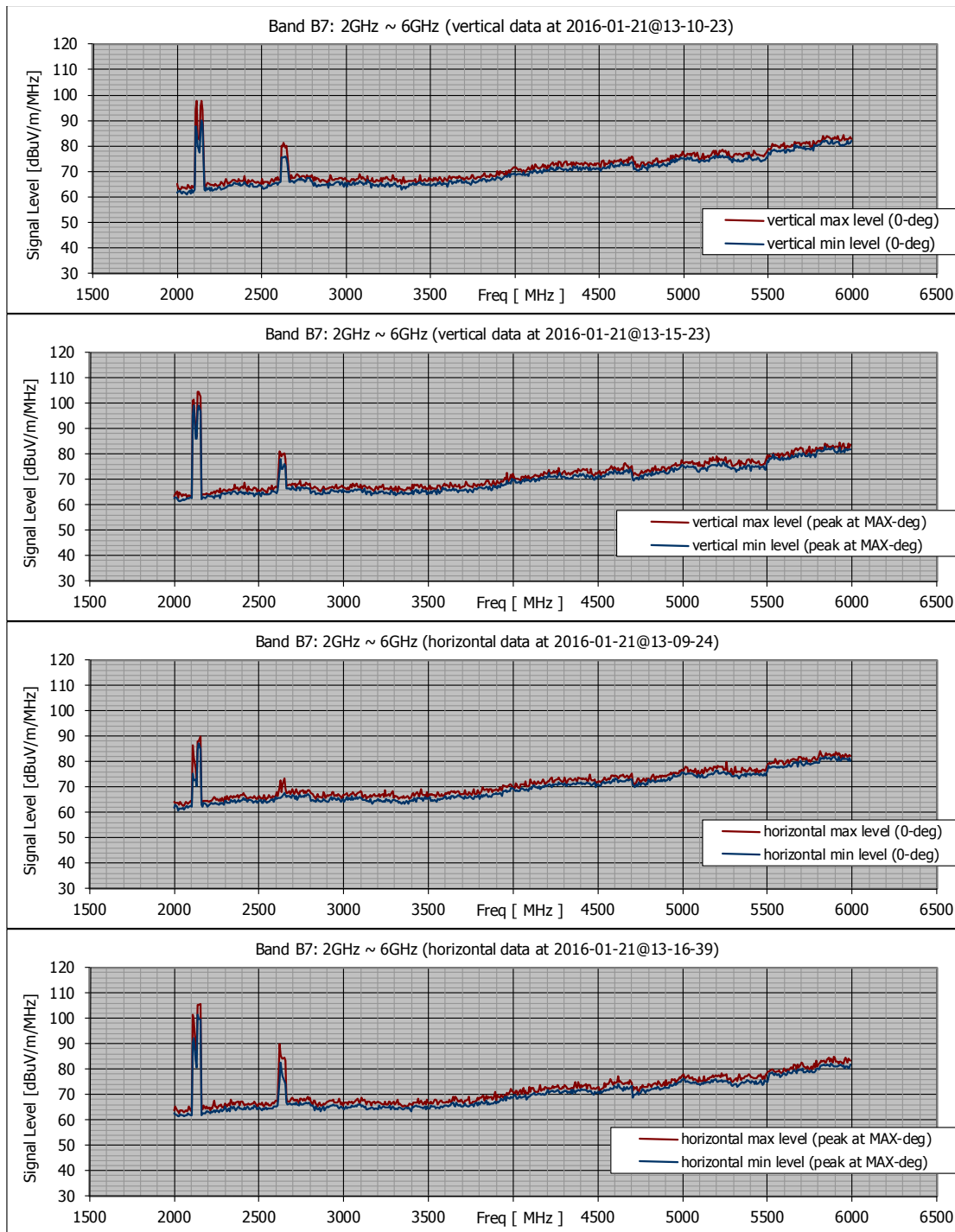
Band	Freq. Range (MHz)	Vertical				Horizontal			
		Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B5	25 ~ 200	98.1	106.455	100.8	106.455	89.6	106.455	100.4	220.636

Figure A3.5-7(f) Location 07: RF Data, Band B5, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Band	Freq. Range (MHz)	Vertical				Horizontal			
		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	97.3	1960.00	106.1	1949.09	103.9	1989.09	109.9	1963.64

Figure A3.5-7(g) Location 07: RF Data, Band B6, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Band	Freq. Range (MHz)	Vertical				Horizontal			
		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	99.2	2145.5	104.5	2145.5	101.3	2138.2	105.5	2152.7

Figure A3.5-7(h) Location 07: RF Data, Band B7, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation

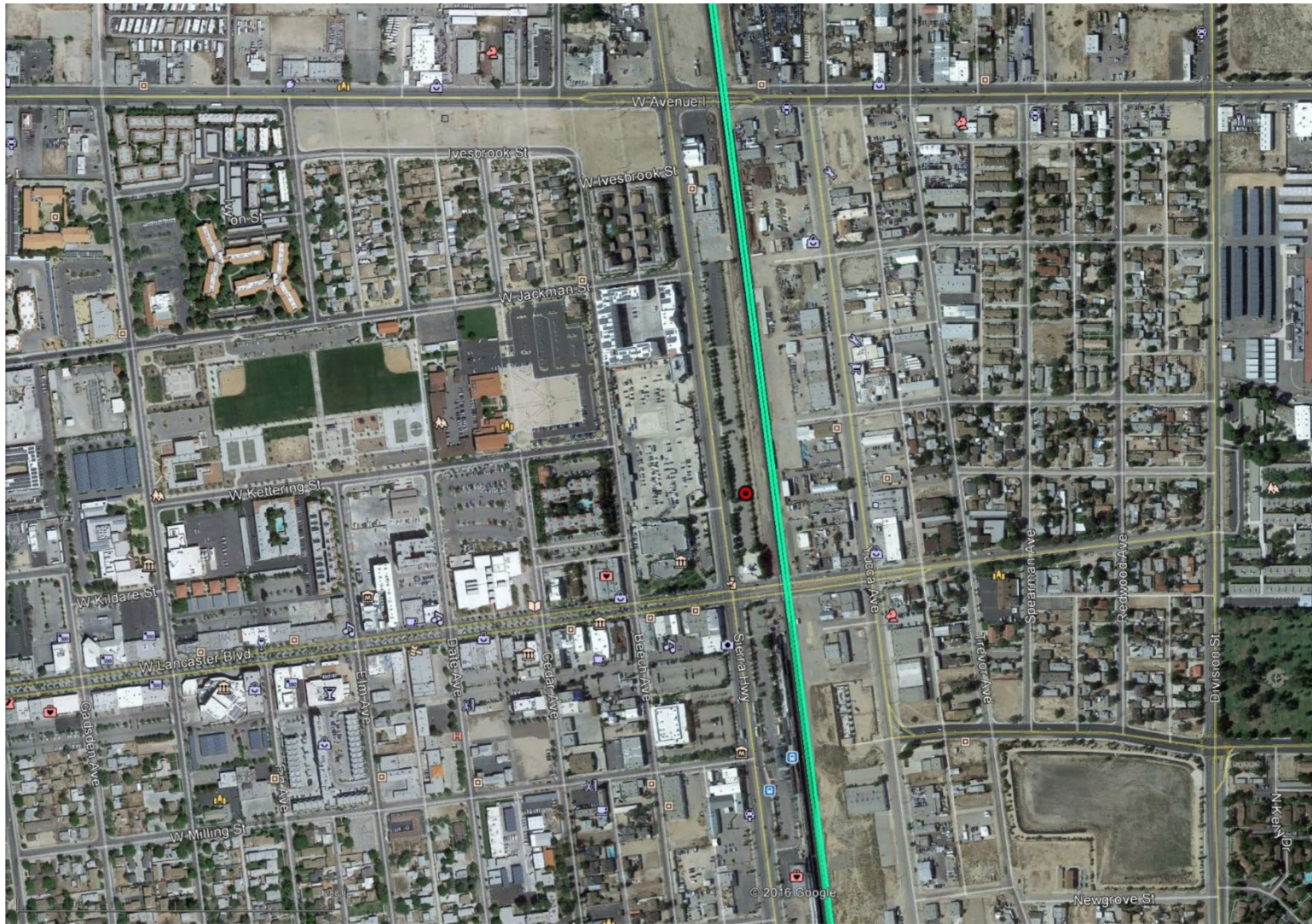


Figure A3.5-8(a) Location 08: Lancaster Blvd. and Sierra Hwy., Lancaster
Urban setting in Lancaster near the existing UPRR alignment, with significant RF emitters (Lat 34° 41' 58.28", Lon W118° 08' 12.29")



Figure A3.5-8(b) Location 08: Measurement Location and Site Views

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

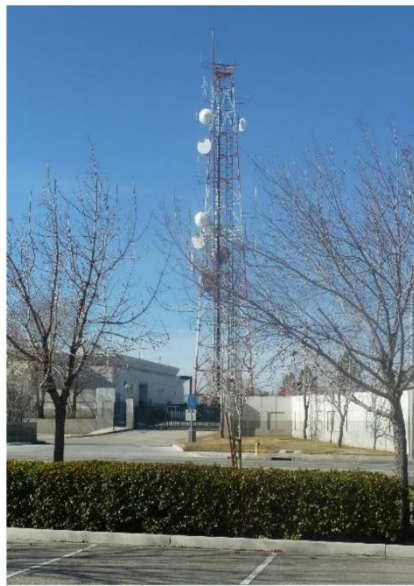


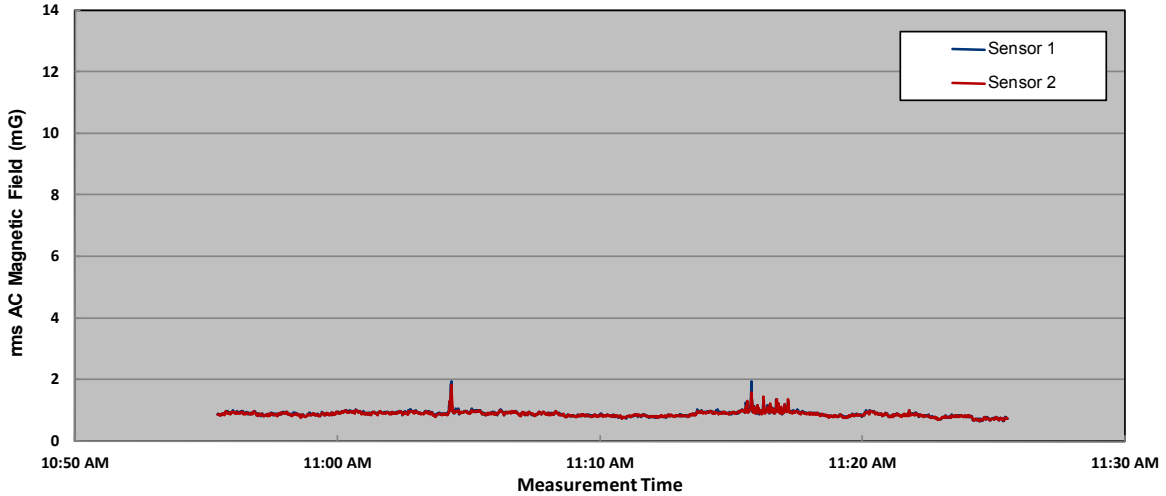
Figure A3.5-8(c) Location 08: Lancaster Blvd. and Sierra Highway, Lancaster
Nearby emitters include distribution lines, communications towers, and rail activities

Photos depicting visible close-proximity emitters. Other emissions sources are assumed to exist but are not visible from the site.

Measurement Date **Start Time** **End Time** **Duration**
Thursday, January 21, 2016 10:55:26 11:25:31 0:30:05

Description: Parking lot beside railroad tracks and Sierra Hwy in Lancaster. Two freight trains passes can be seen in DC readings.

AC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	60Hz	Harmonic	60Hz	Harmonic
Maximum	1.04	1.66	1.02	1.55
Minimum	0.63	0.08	0.64	0.07
Median	0.87	0.12	0.86	0.09
Range	0.40	1.57	0.38	1.48
Std. Deviation	0.07	0.11	0.06	0.11



DC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	Br DC (mG)	Time of Observation	Br DC (mG)	Time of Observation
Maximum	463.01	11:04:18	467.12	11:04:19
Minimum	454.27	11:04:20	457.32	11:04:21
Median	461.87	----	465.13	----
Range	8.74	----	9.80	----
Std. Deviation	1.18	----	1.16	----

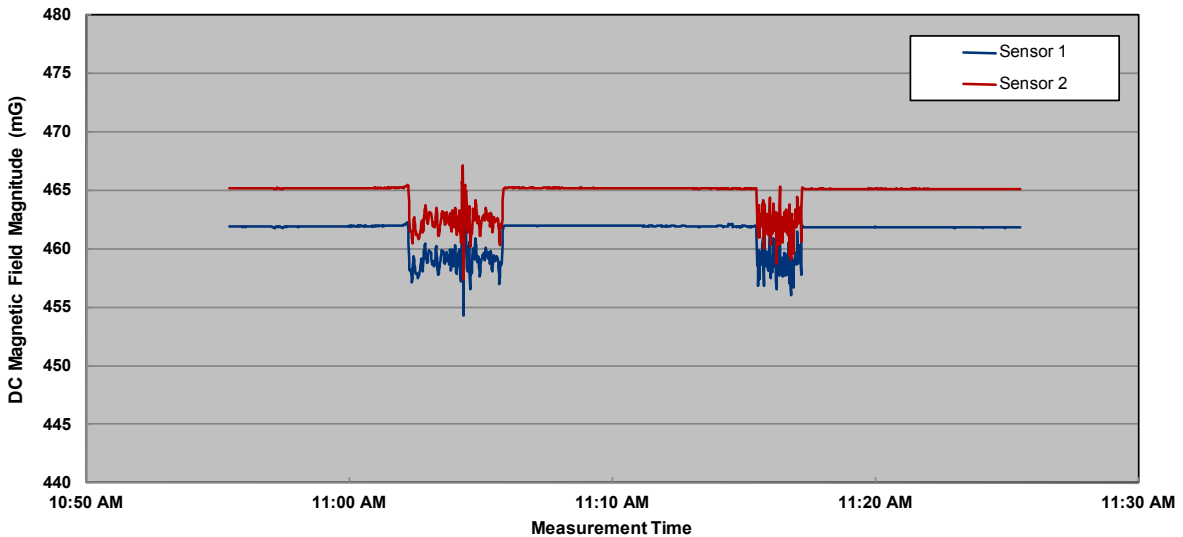
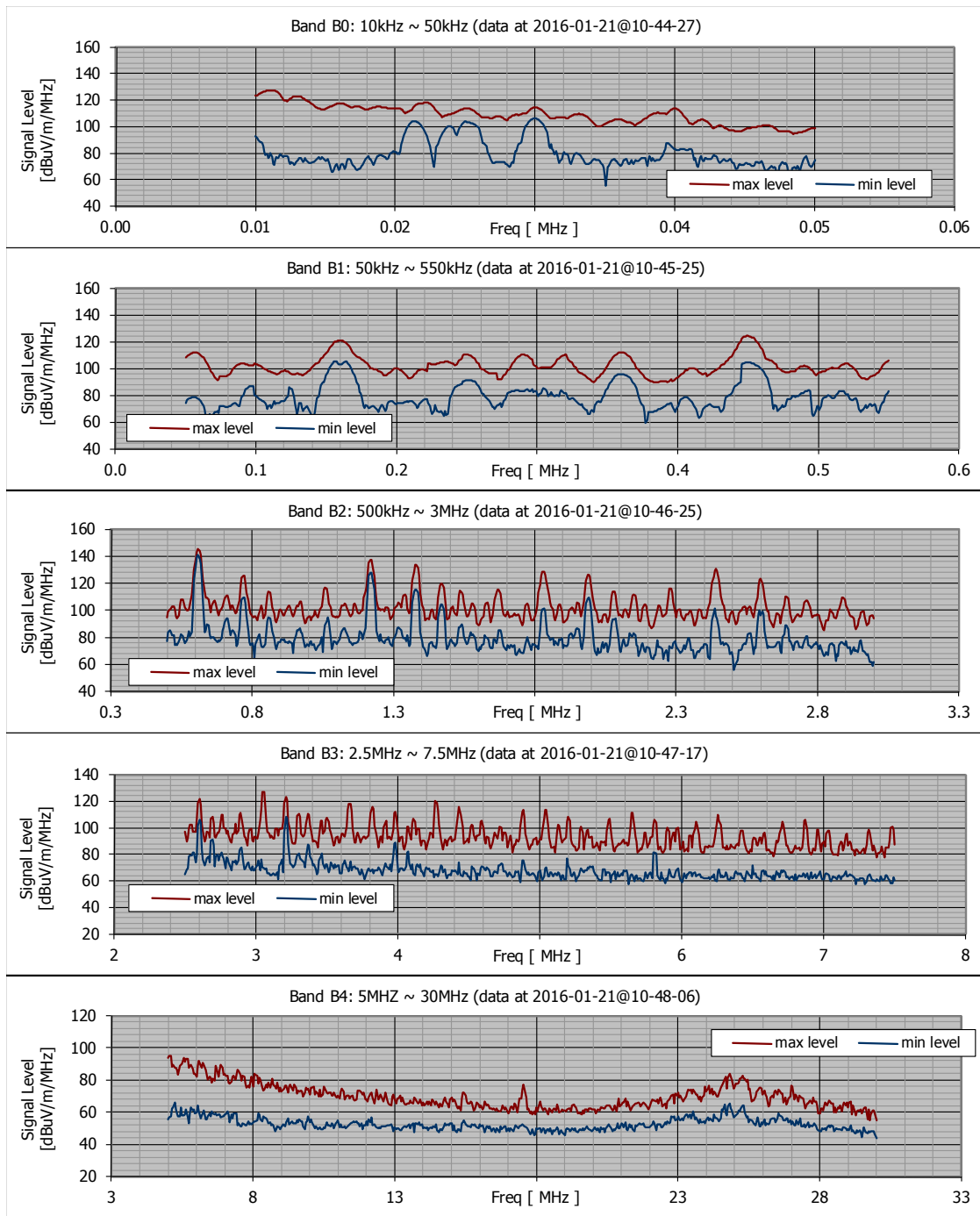
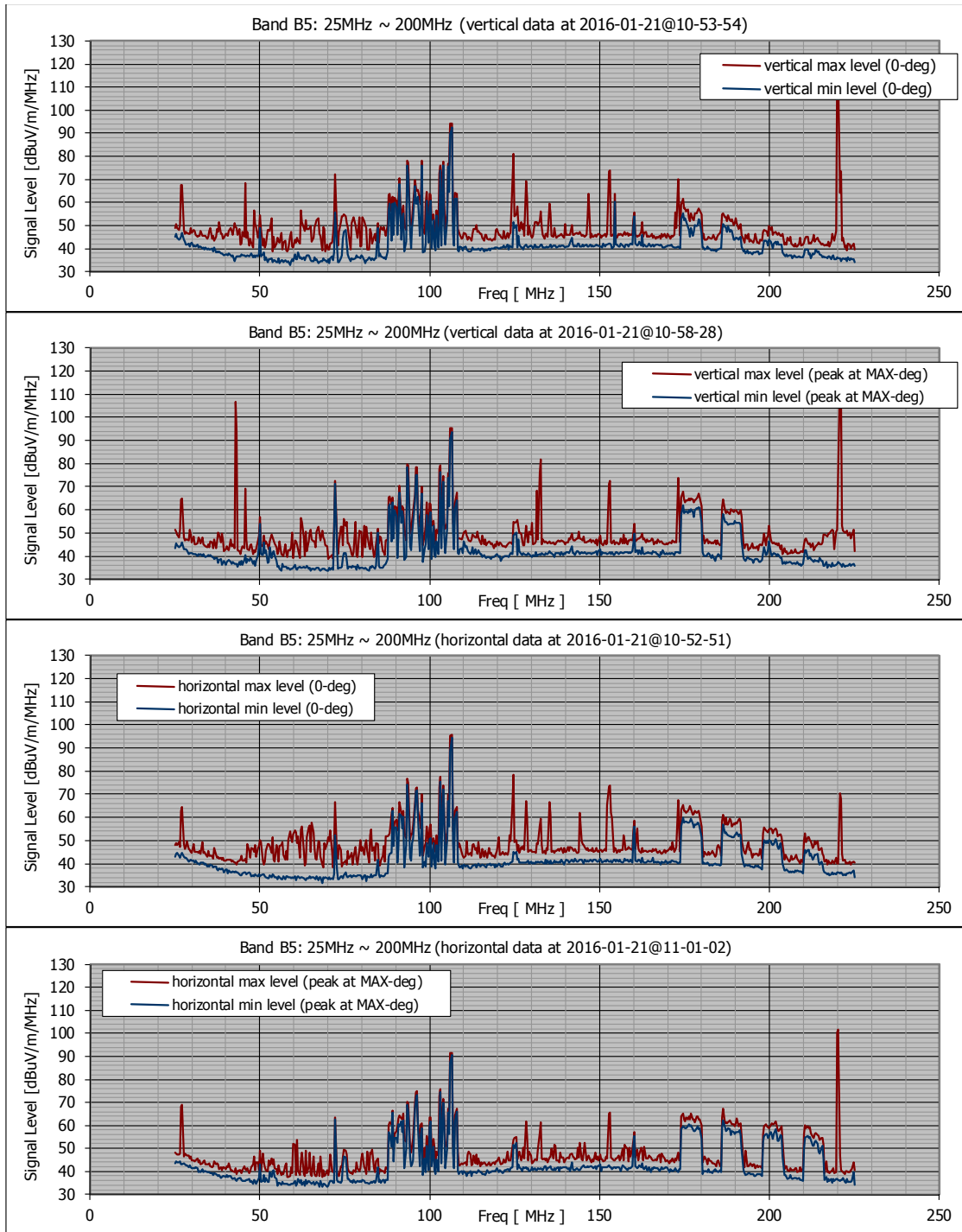


Figure A3.5-8(d) Location 08: AC and DC Magnetic Field Measurement Results



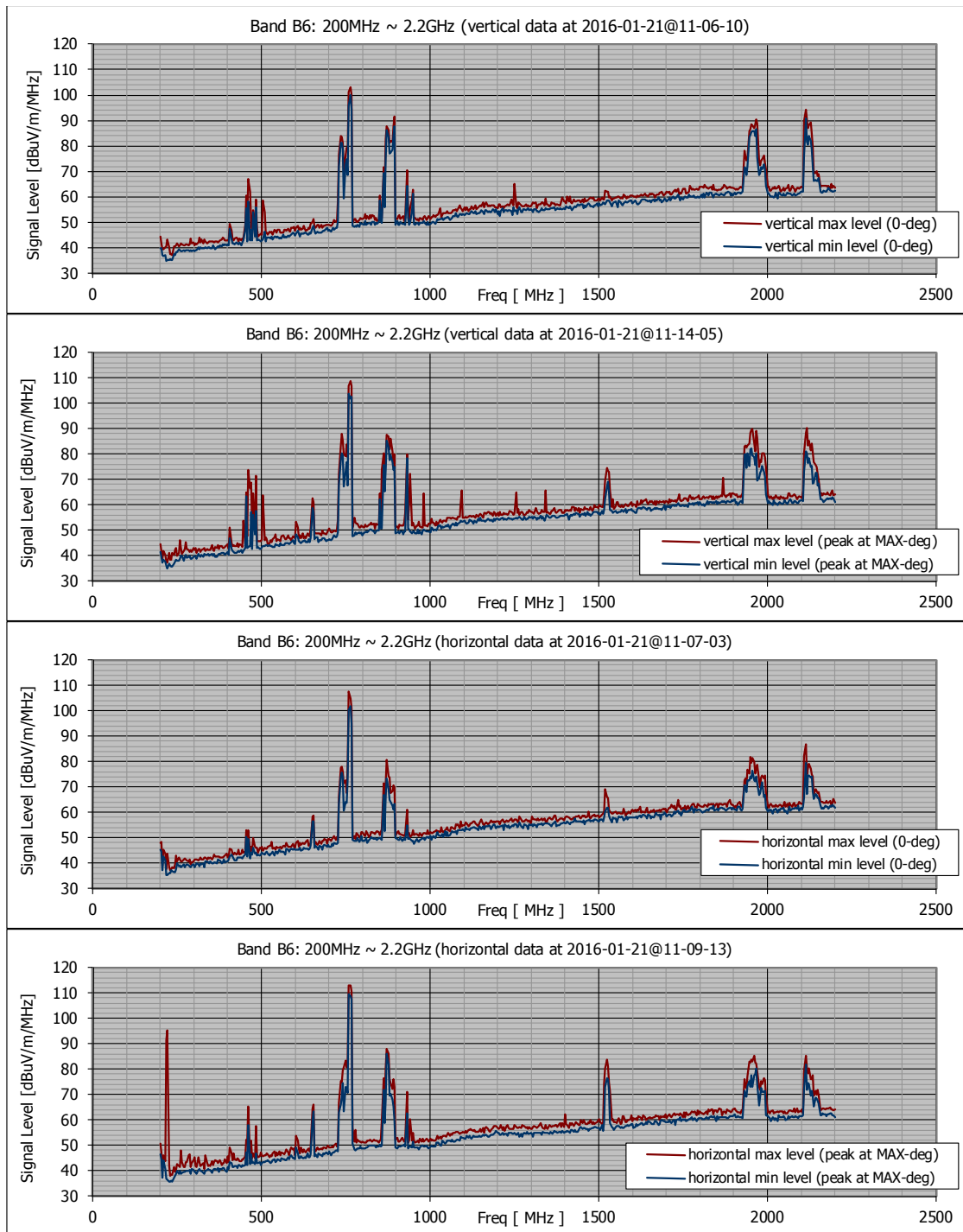
Band	Freq. Range (MHz)	Pk Min-Hold (dB uV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dB uV/m/MHz)	@ Freq. (MHz)
B0	0.01 ~ 0.05	106.0	0.0300	127.4	0.0110
B1	0.05 ~ 0.55	105.1	0.1564	124.1	0.4500
B2	0.50 ~ 3.00	141.1	0.6091	145.1	0.6091
B3	2.5 ~ 7.5	108.6	3.2091	127.3	3.0545
B4	5 ~ 30	65.9	5.2273	95.1	5.0455

Figure A3.5-8(e) Location 08: RF Data from Non-Directional Vertically-Oriented Monopole Antenna



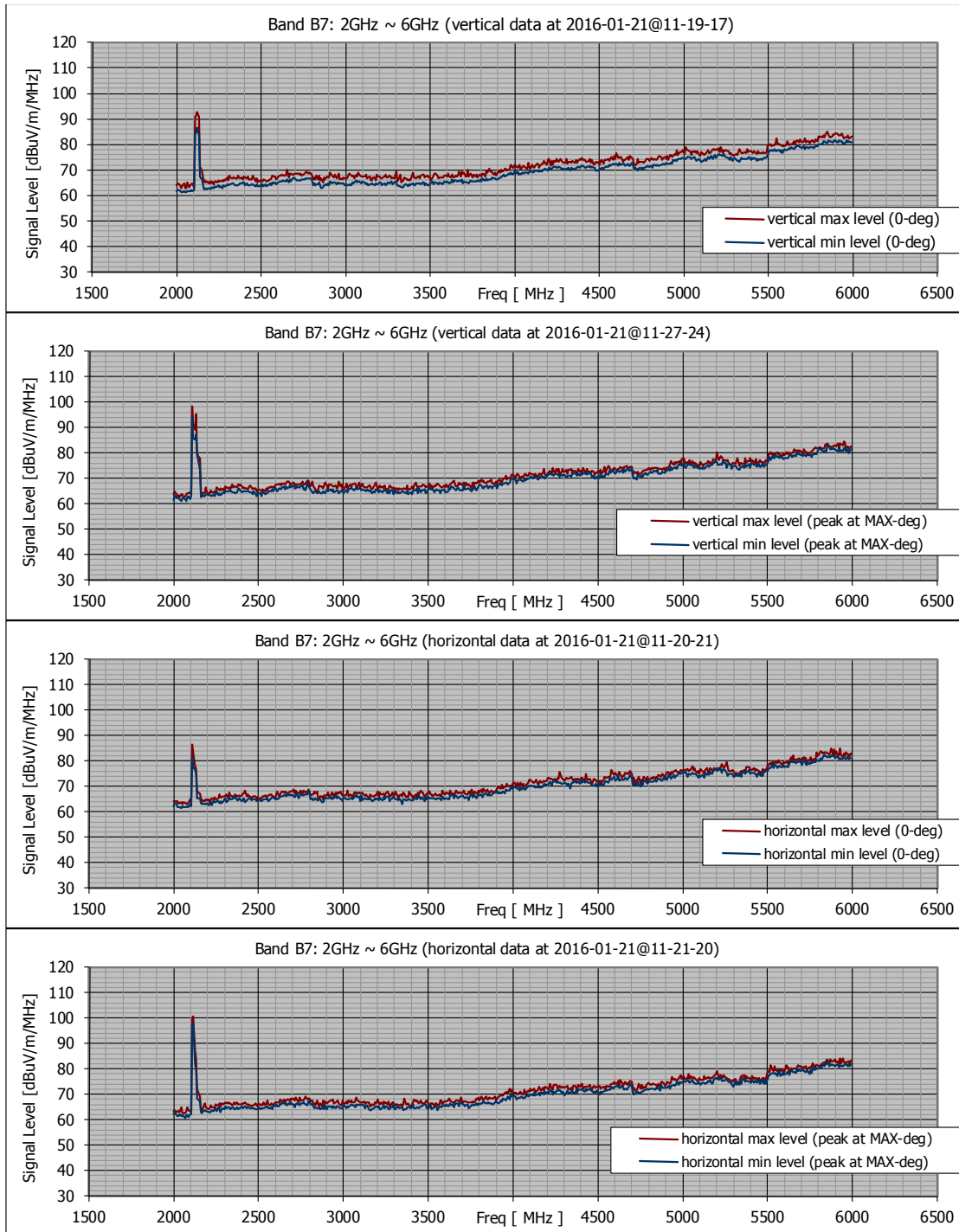
Band	Freq. Range (MHz)	Vertical				Horizontal			
		Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B5	25 ~ 200	93.6	106.455	117.9	220.636	94.6	106.455	101.8	220.273

Figure A3.5-8(f) Location 08: RF Data, Band B5, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Band	Freq. Range (MHz)	Vertical				Horizontal			
		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	103.7	760.00	108.7	763.64	109.4	760.00	112.9	763.64

Figure A3.5-8(g) Location 08: RF Data, Band B6, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Band	Freq. Range (MHz)	Vertical				Horizontal			
		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	94.4	2109.1	98.4	2109.1	97.9	2116.4	100.7	2116.4

Figure A3.5-8(h) Location 08: RF Data, Band B7, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation

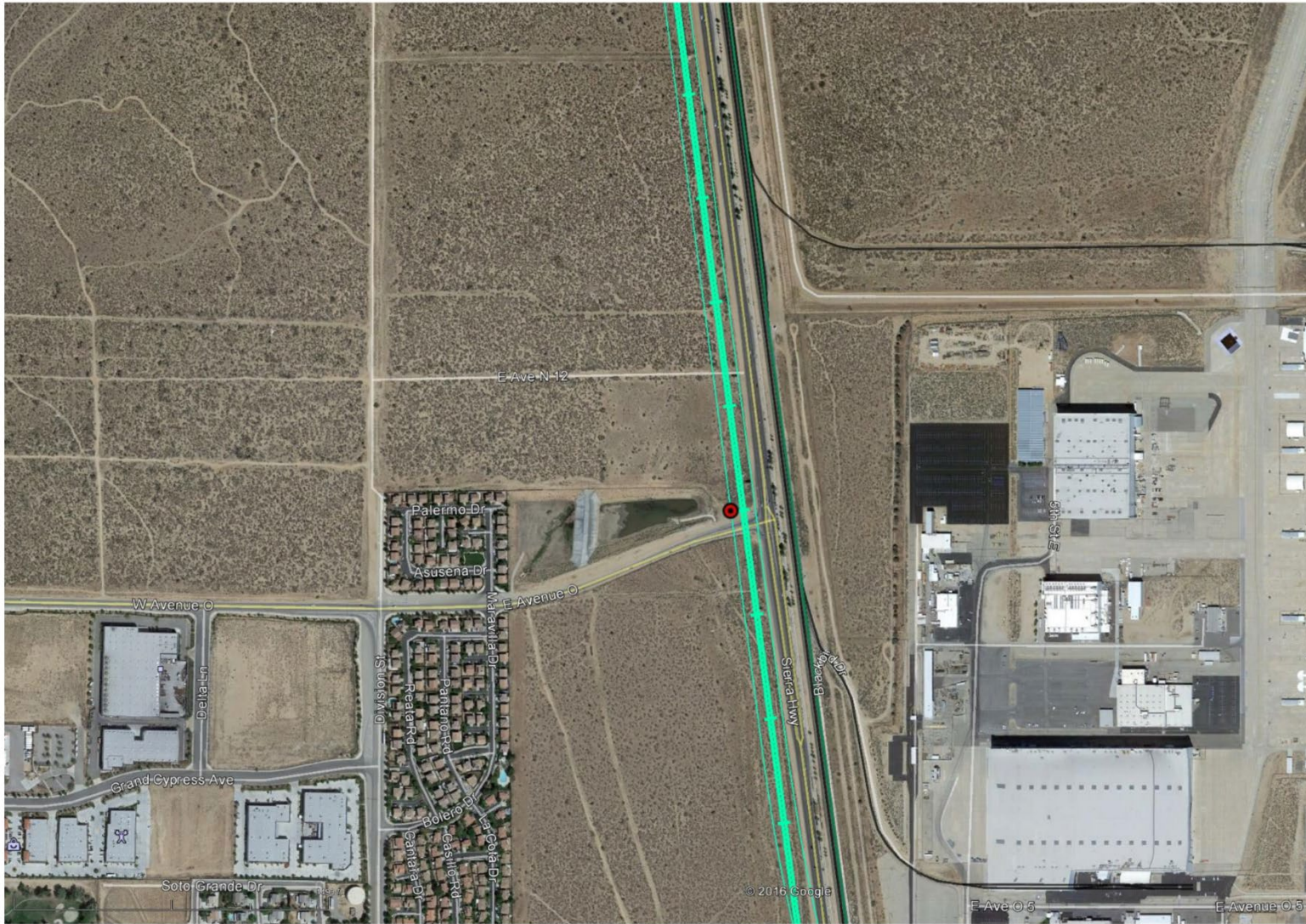


Figure A3.5-9(a) Location 09: Avenue O and Sierra Highway, Palmdale
Industrial setting in Palmdale near the existing UPRR alignment, with significant RF emitters (Lat 34° 37' 03.16", Lon W118° 07' 27.83")



Figure A3.5-9(b) Location 09: Measurement Location and Site Views

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

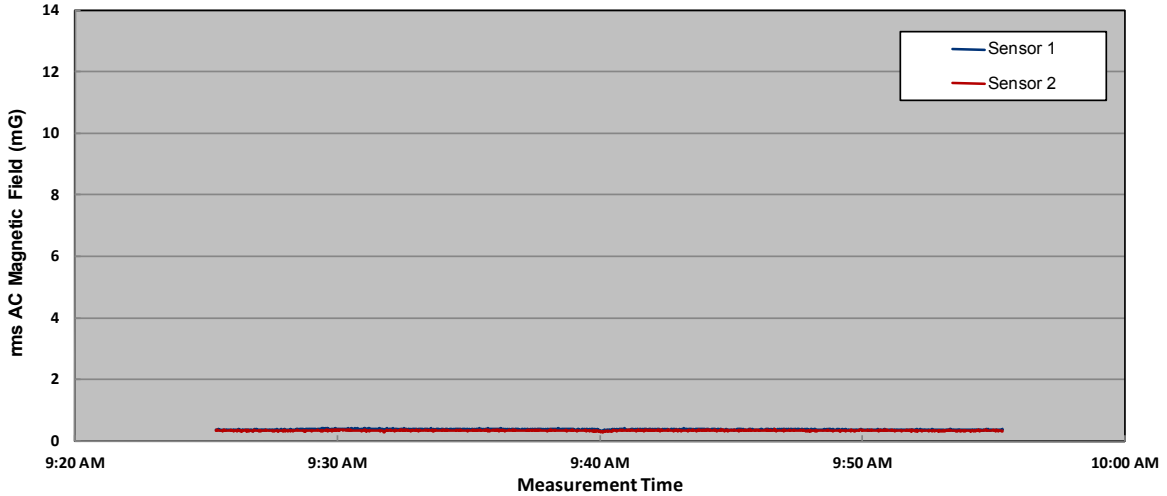


Figure A3.5-9(c) Location 09: Avenue O and Sierra Highway, Palmdale
Nearby emitters include railway communications and distribution lines perpendicular to the alignment.
Photos depicting visible close-proximity emitters. Other emissions sources are assumed to exist but are not visible from the site.

Measurement Date **Start Time** **End Time** **Duration**
Thursday, January 21, 2016 9:25:21 9:55:20 0:29:59

Description: Across Sierra Hwy from Lockheed Martin. Some transients due to traffic. No significant overhead electric lines.

AC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	60Hz	Harmonic	60Hz	Harmonic
Maximum	0.17	0.42	0.17	0.37
Minimum	0.01	0.31	0.01	0.27
Median	0.04	0.37	0.04	0.34
Range	0.16	0.11	0.16	0.11
Std. Deviation	0.02	0.02	0.02	0.01



DC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	Br DC (mG)	Time of Observation	Br DC (mG)	Time of Observation
Maximum	468.77	9:55:19	464.90	9:51:14
Minimum	467.88	9:25:27	464.07	9:25:28
Median	468.60	----	464.68	----
Range	0.90	----	0.83	----
Std. Deviation	0.13	----	0.15	----

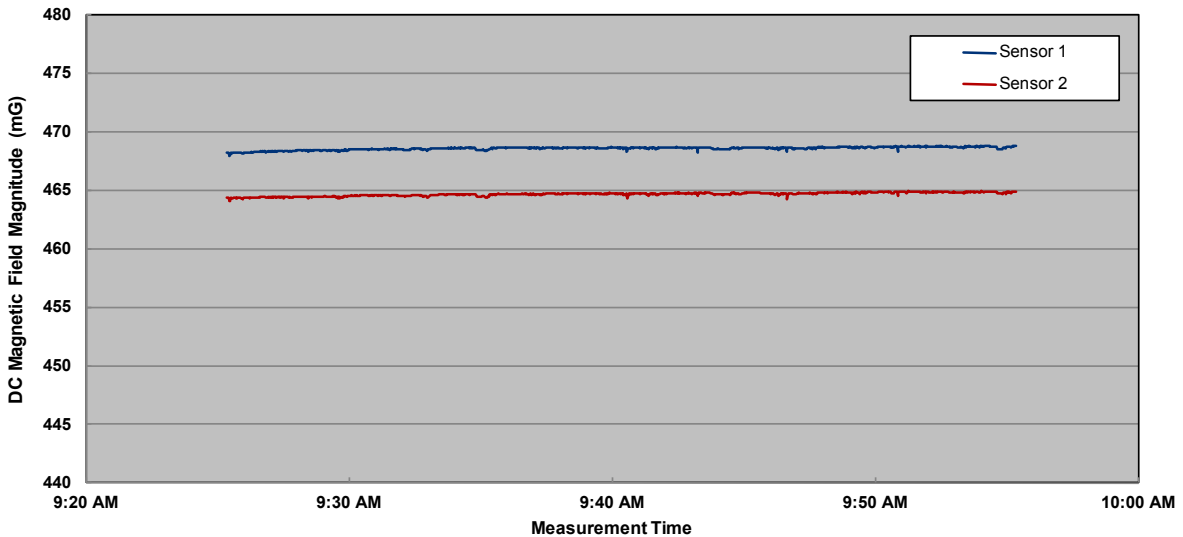
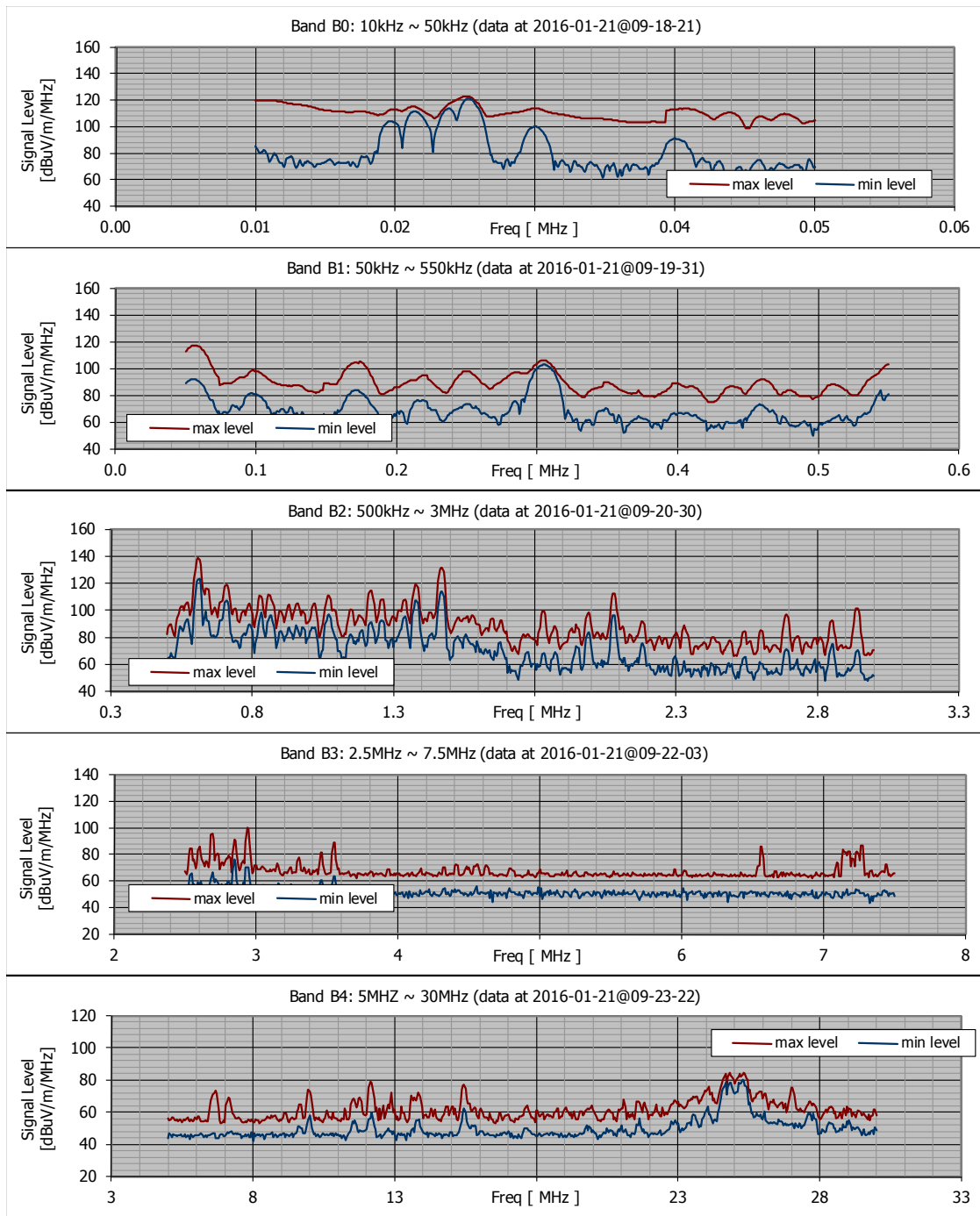
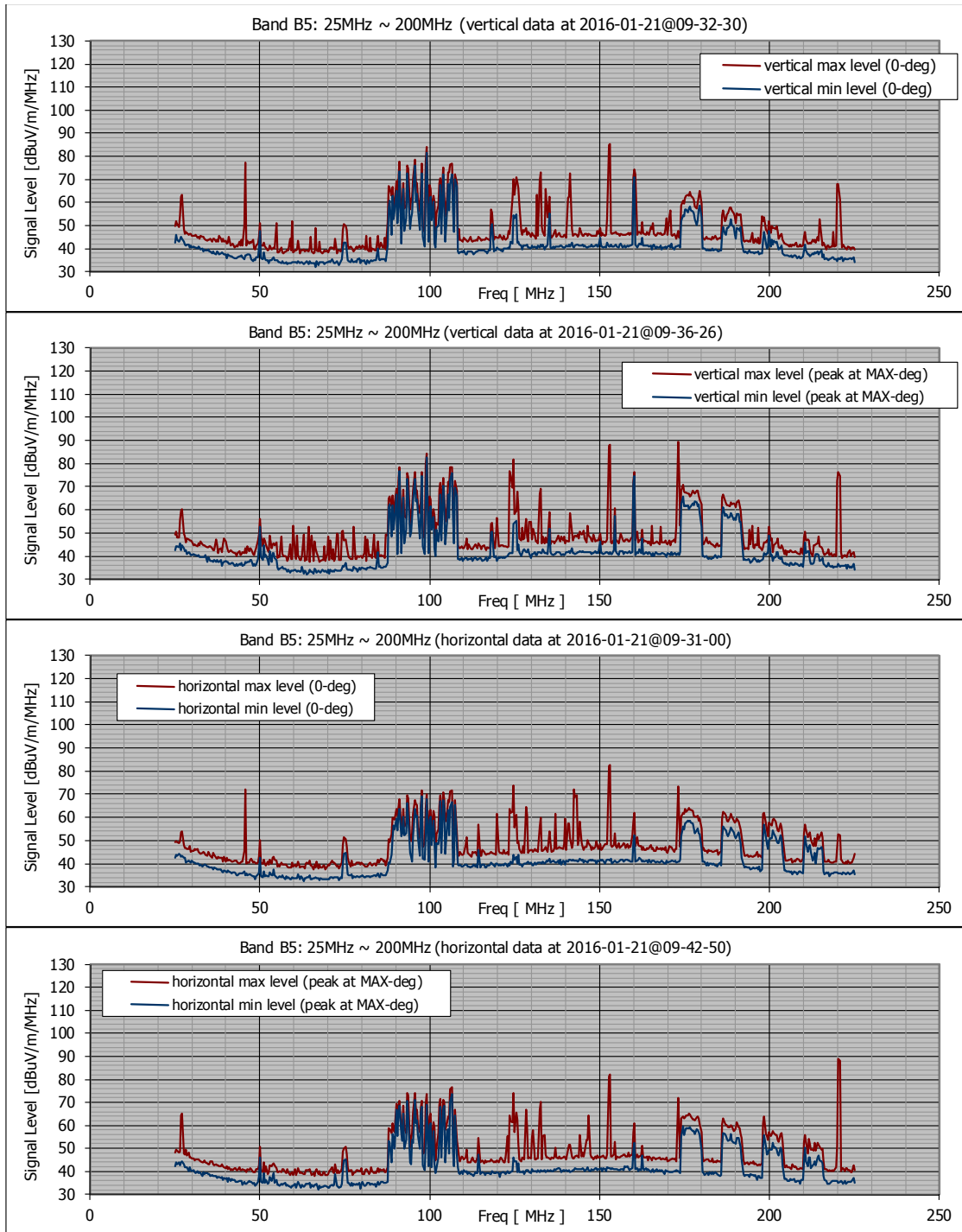


Figure A3.5-9(d) Location 09: AC and DC Magnetic Field Measurement Results



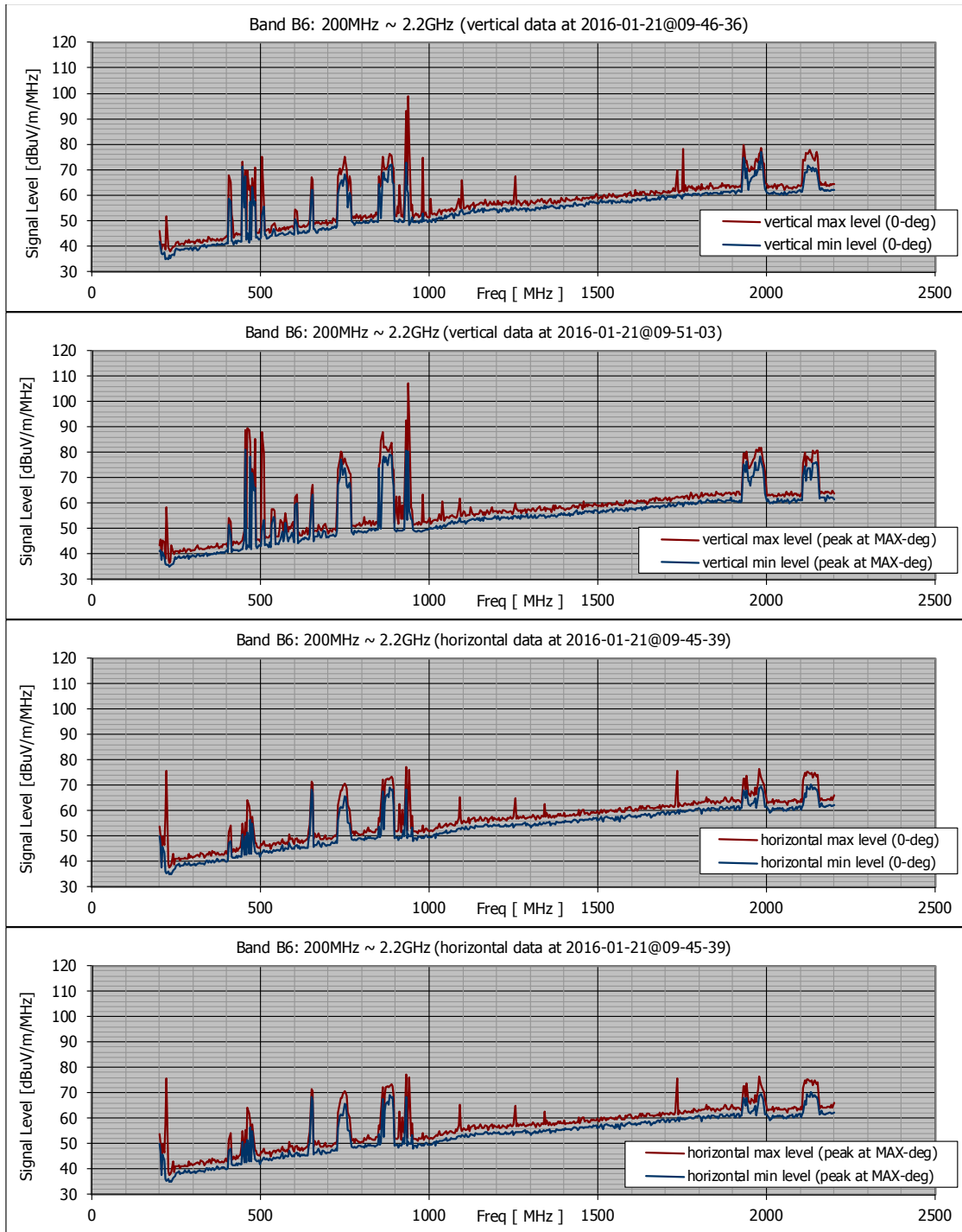
Band	Freq. Range (MHz)	Pk Min-Hold (dB uV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dB uV/m/MHz)	@ Freq. (MHz)
B0	0.01 ~ 0.05	121.2	0.0252	122.6	0.0251
B1	0.05 ~ 0.55	102.7	0.3045	117.2	0.0564
B2	0.50 ~ 3.00	123.4	0.6136	139.0	0.6091
B3	2.5 ~ 7.5	76.4	2.8455	99.6	2.9364
B4	5 ~ 30	80.1	25.2727	84.3	25.3182

Figure A3.5-9(e) Location 09: RF Data from Non-Directional Vertically-Oriented Monopole Antenna



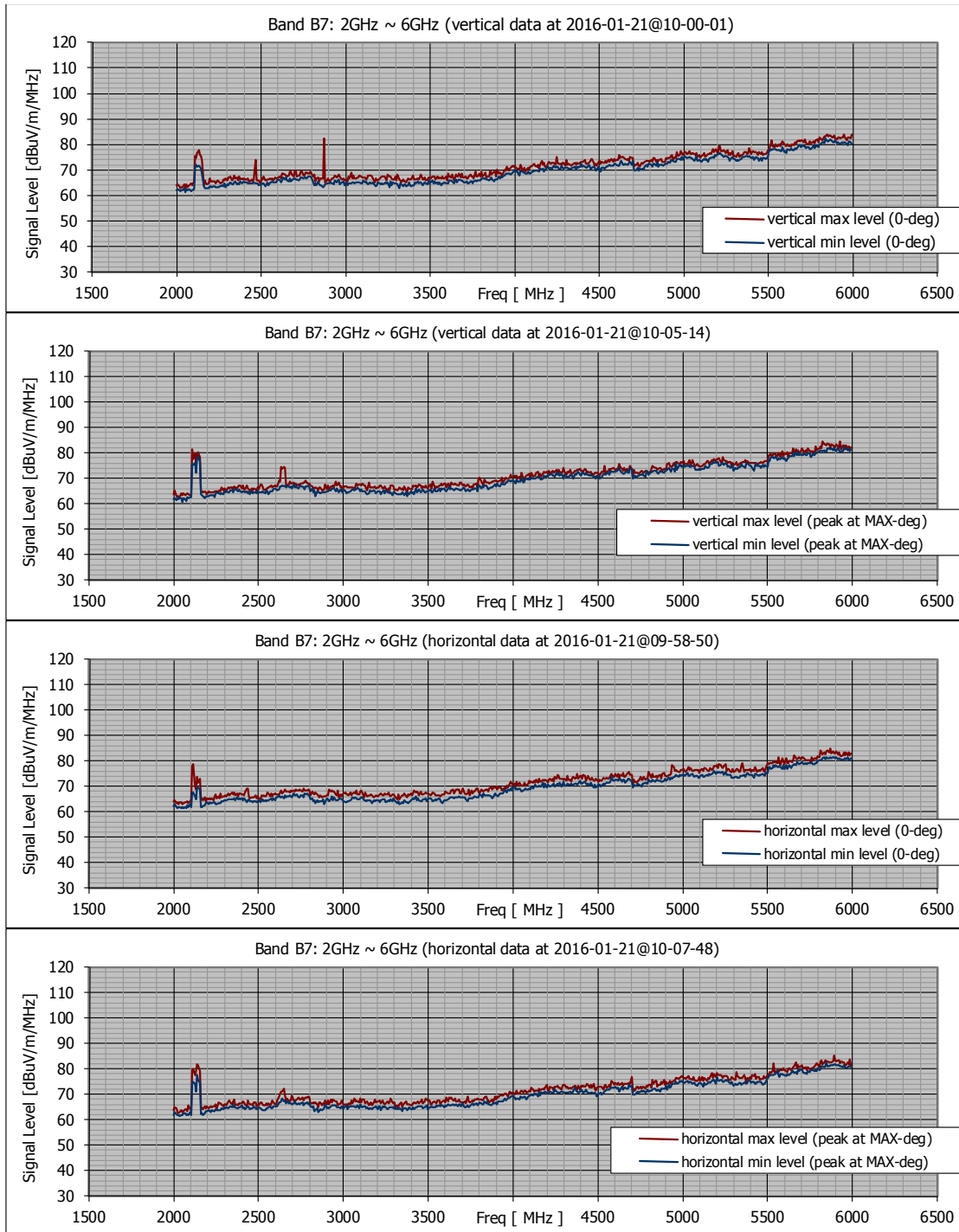
Band	Freq. Range (MHz)	Vertical				Horizontal			
		Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B5	25 ~ 200	82.6	99.182	89.6	173.000	73.5	106.455	88.8	220.273

Figure A3.5-9(f) Location 09: RF Data, Band B5, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



Band	Freq. Range (MHz)	Vertical				Horizontal			
		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	81.2	454.55	107.4	938.18	70.2	2130.91	77.3	930.91

Figure A3.5-9(g) Location 09: RF Data, Band B6, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation



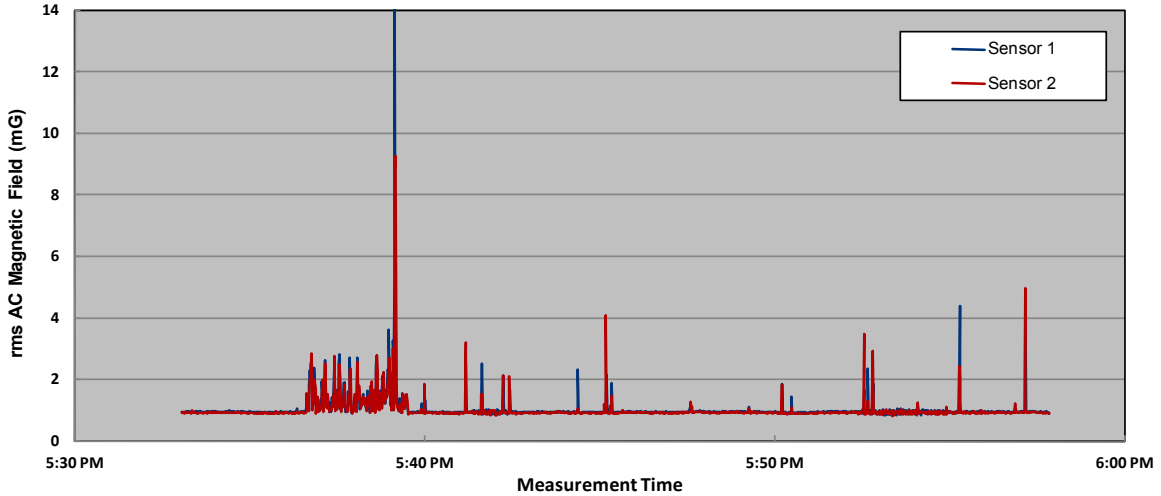
Band	Freq. Range (MHz)	Vertical				Horizontal			
		Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Min-Hold (dBuV/m/MHz)	@ Freq. (MHz)	Pk Max-Hold (dBuV/m/MHz)	@ Freq. (MHz)
B7	2000~6000	78.7	2145.5	81.4	2109.1	77.6	2138.2	81.9	2138.2

Figure A3.5-9(h) Location 09: RF Data, Band B7, Vertical and Horizontal Components at Zero Degrees (Facing Alignment) and at Peak Orientation

Measurement Date **Start Time** **End Time** **Duration**
Thursday, January 21, 2016 17:33:02 17:57:50 0:24:48

Description: Repeat of measurements at Site 1 to capture a freight train pass. The short spikes in DC data are passing vehicles, while the train pass is 5:36 to 5:39.

AC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	60Hz	Harmonic	60Hz	Harmonic
Maximum	2.27	14.65	1.50	9.16
Minimum	0.67	0.32	0.59	0.29
Median	0.86	0.38	0.85	0.35
Range	1.60	14.32	0.91	8.86
Std. Deviation	0.05	0.54	0.04	0.49



DC Magnetic Field at Fixed Positions (mG)				
	Sensor 1		Sensor 2	
	Br DC (mG)	Time of Observation	Br DC (mG)	Time of Observation
Maximum	497.64	17:39:07	501.85	17:39:08
Minimum	442.70	17:39:09	425.94	17:39:09
Median	466.84	----	462.83	----
Range	54.94	----	75.91	----
Std. Deviation	2.41	----	2.63	----

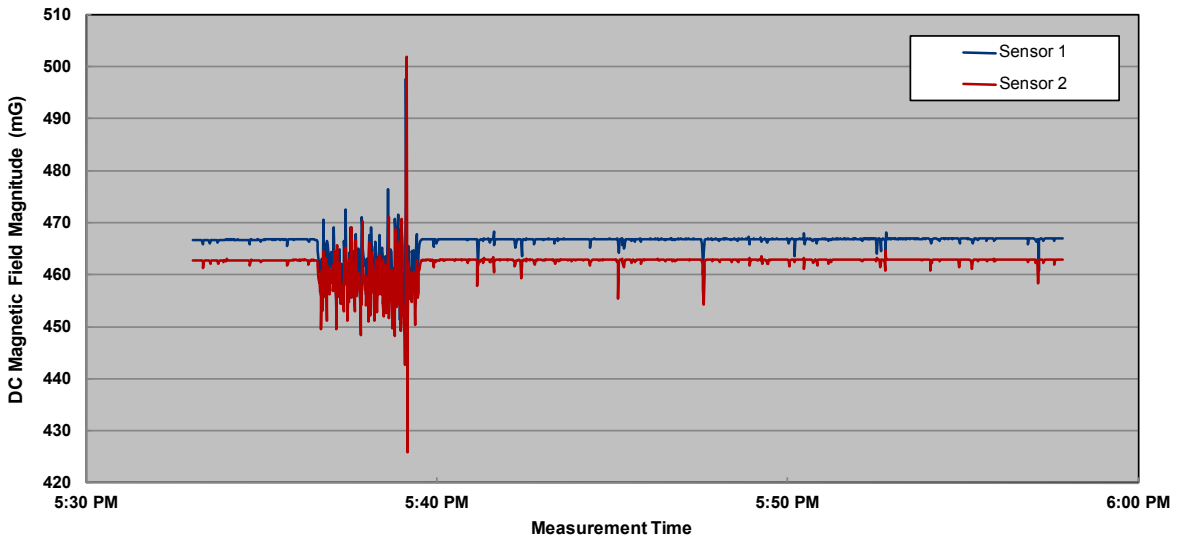


Figure A3.5-10 Location 01: Magnetic Field Measurement with Train Passby