



DEPARTMENT OF THE AIR FORCE
85th ENGINEERING INSTALLATION SQUADRON (ACC)
KEESLER AIR FORCE BASE MISSISSIPPI

31 January 2007

MEMORANDUM FOR 850 ELSG/KD

FROM: 85 EIS/SCY
670 Maltby Hall Drive, Suite 234
Keesler AFB MS 39534-2633

SUBJECT: UEWR EMRH Survey at Beale AFB CA

1. References.

- a. DODI 6055.11, Protection of DOD Personnel from Exposure to Radio Frequency Radiation and Military Exempt Lasers, 21 February 1995, Change 1, 6 May 1996.
- b. ANSI C63 C95.1-1999 "IEEE Standard for Safety Levels with Respect to Human Exposure To Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," 8 December 1999
- c. ANSI C63.12-1999; American National Standard, Recommended Practice for Electromagnetic Compatibility Limits; 14 December 1999
- d. 85 EIS, Project Identification Number: A604EM065.

2. Background. An Electromagnetic Radiation Hazard (EMRH) survey was performed on the Upgraded Early Warning Radar (UEWR) at Beale AFB CA. The measurements are required because of the system upgrade. A formal report will follow this memorandum.

3. Survey Approach/Locations. EMRH measurements were performed at locations on Beale AFB to identify any possible EMRH concerns due to the upgrade to the Early Warning Radar. EMRH measurements were also performed in the planned housing development adjacent to Beale AFB to update the measurements performed in 1993. The survey included peak field strength measurements to assess the potential of interference affecting consumer electronics. A description of the measurement locations and figures showing their relative locations to the UEWR are included as Attachment 1. Test points 1-10 are locations measured in 1993, except for test point 3 which was deleted and test point 7 which was replaced by test point 11. Measurements were performed at heights of 15 feet and 42 feet above ground level. Pictures taken during the survey are included in Attachment 2.

4. Measurement Results. The results of the measurements and the test equipment used are included in Attachment 3. The EMRH results are provided as power density, milliwatts per square centimeter (mW/cm^2), to mirror those units used in the safety criteria (Reference A and B). The permissible exposure limit (PEL) for personnel, at the worst case UEWR frequency band, is $0.28 \text{ mW}/\text{cm}^2$ for uncontrolled environments, and $1.40 \text{ mW}/\text{cm}^2$ for controlled environments. The peak field strength measurements results are in units of volts per meter (V/m). There are currently no enforceable standards for RF immunity limits, but general guidelines (Reference C) are currently listed as 1 V/m as low, 3 V/m as Normal, 10 V/m as high and 200 V/m as severe.

5. Electromagnetic Radiation Measurement Conclusions. There were no levels measured at the survey test points outside of the secure area that exceeded the current controlled or uncontrolled criteria for personnel PELs. Measurements performed in the secure area in front of the UEWR with the Narda meter resulted in levels that exceeded the $0.28\text{mW}/\text{cm}^2$ uncontrolled environment criteria but none that exceeded the $1.40\text{mW}/\text{cm}^2$ for controlled environments. An opportunity to measure the radar in both modes was provided during this survey and allowed for comparative measurement using the same test equipment at the same locations. The results showed a power density increase in the range of 18% – 27 % from EWR to UEWR. This average power increase was expected due to the emission change associated with the UEWR. The levels measured were within the range of what was measured in the past and characteristic of radar side lobe emissions. The main beam of the radar is significantly above areas accessible from ground level.

6. Field Strength Measurement Conclusions. The field strength levels measured at the test points varied within the low to high range. The highest field strengths were found in the secure area around the UEWR compound, specifically at the entry control point (test point 12) and at the test points near the UEWR face (test points 19 and 20). The field strength levels of significance outside of the UEWR compound were generally found at elevated test points, either when the test antenna was elevated and/or when the test point was located on a hill. It is not possible to accurately predict EMI to consumer electronics since there is currently no enforceable immunity level. The primary areas of concern would be on the hills just north of the Beale AFB perimeter, near test points 1, 6, and 9, since these are the areas where field strengths were measured greater than 10 V/m. In addition to the concern of interference to consumer electronics from the UEWR, there is also a potential for EMI to the UEWR from consumer electronics or other RF emitters that may be present in the Yuba Highlands, particularly in areas just north of Beale AFB. There are FCC regulations prohibiting unauthorized and limited RF transmissions at UEWR frequencies but systems can malfunction and emit unintentional EMI.

7. Recommendations. We recommend that the results of the EMRH survey be used as a guide to ensure the safety and health of personnel in the area around the UEWR and Beale AFB. It is recommended that the security police not spend any more time than is necessary when patrolling the fence line in front of the UEWR. The time limit associated with the uncontrolled hazard is 30 minutes. Since the area in front of the radar (UEWR compound fence) is considered a controlled area, this recommendation is given as conservative safety advice. The field strength measurement results can be used to ascertain the relative RF environment around the UEWR. The measurements conducted in the Yuba Highlands area can be used to predict the potential for EMI. POCs are Mr. Fred Blache, DSN 597-3926 and Mr. Tom Lipski, DSN 597-1084.



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Attachments:

1. Test Point Locations and Drawings
2. Pictures from Survey
3. Power Density/Field Strength Data and Test Equipment List

Table 1: Test Point Location Descriptions

Test Point	Description	Latitude (N)	Longitude (W)	Elev. (ft)
01	Yuba Highlands Hilltop	39 08' 58.74"	121 21' 43.00"	451
02	Yuba Highlands Hilltop	39 09' 15.20"	121 21' 49.40"	417
04	Yuba Highlands Valley	39 09' 07.30"	121 21' 16.30"	363
05	Yuba Highlands	39 09' 12.20"	121 20' 46.50"	494
06	Yuba Highlands	39 09' 31.60"	121 20' 44.70"	526
08	Yuba Highlands	39 10' 34.90"	121 19' 41.10"	698
09	Yuba Highlands Beale Fence Line	39 08' 41.90"	121 21' 44.60"	358
10	Yuba Highlands Beale Fence Line	39 08' 41.30"	121 21' 25.10"	352
11	Yuba Highlands (Substitute for Old TP07)	39 08' 58.70"	121 20' 39.10"	580
12	UEWR Entry Control Point (ECP)	39 08' 07.54"	121 20' 58.79"	368
13	School Beale AFB	39 06' 13.40"	121 20' 06.60"	291
14	Clinic - Beale AFB	39 06' 55.10"	121 20' 35.40"	249
15	Camp -Beale AFB	39 07' 26.80"	121 23' 01.80"	132
16	Flightline Roadside - Beale AFB	39 08' 31.10"	121 25' 27.50"	145
17	Water Tank - Beale AFB	39 07' 48.97"	121 20' 31.08"	421
18	Flightline Tower - Beale AFB	39 08' 20.02"	121 25' 41.35"	131
19	UEWR Face Center - Beale AFB	39 08' 06.94"	121 21' 02.86"	377
20	UEWR Face Corner - Beale AFB	39 08' 06.64"	121 20' 59.49"	370

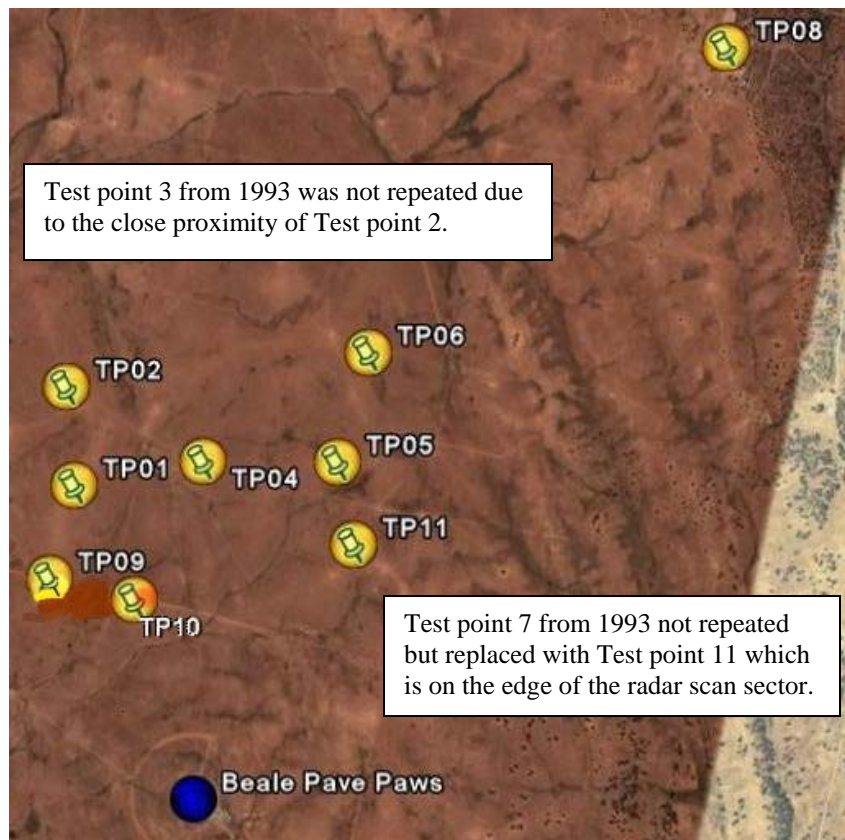


Figure 1: Test Point Locations (Map 1)



Figure 2: Test Point Locations (Map 2)



Figure 3: Test Point Locations (Map 3)



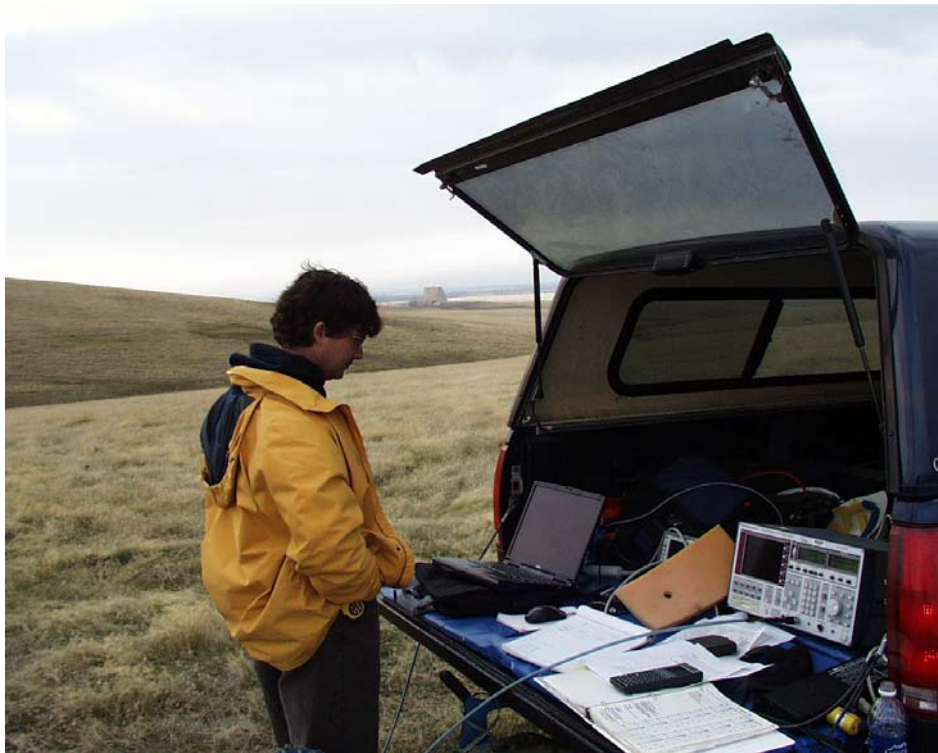
Photograph 1: Mobile Shielded Laboratory near UEWR



Photograph 2: Test Point 13 - School - Beale AFB



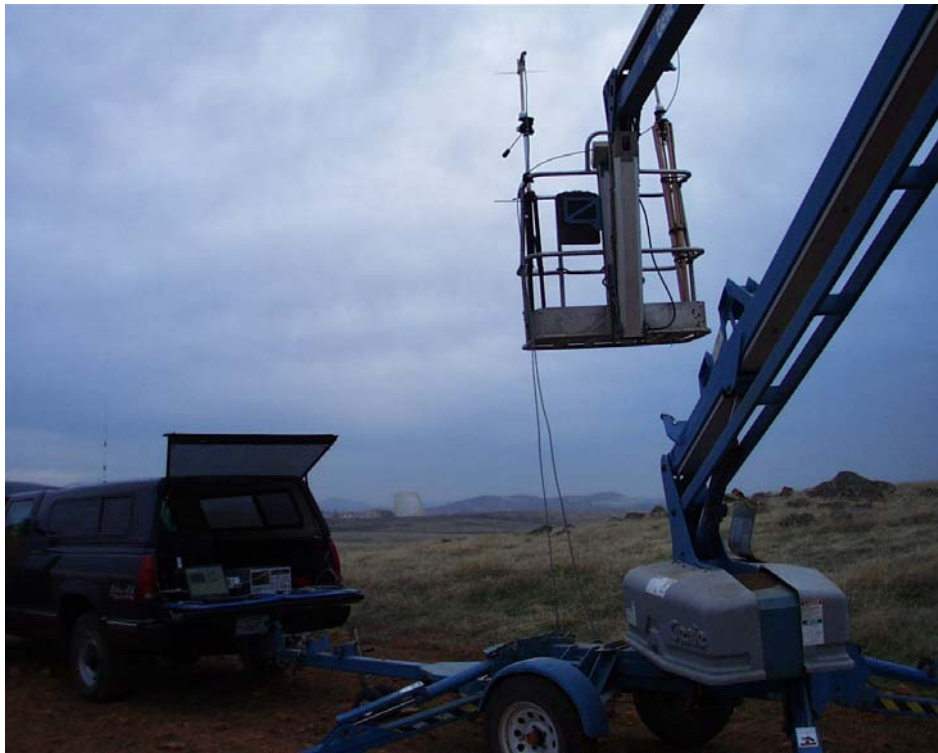
Photograph 3: Test Point 12 – Entry Control Point



Photograph 4: Mr. Lipski/Test Equipment



Photograph 5: Yuba Highlands – Antennas in High Position



Photograph 6: Yuba Highlands – Antennas in Low Position

Table 2: UEWR EMRH Survey Results

Test Point	Description	Average Power Density * mW/cm ²		Field Strength ** V/m	
		Low 15'AGL	High 42'AGL	Low 15'AGL	High 42'AGL
01	Yuba Highlands Hilltop	0.000700	0.001030	9.89	16.07
02	Yuba Highlands Hilltop	0.000018	0.000060	1.61	4.53
04	Yuba Highlands Valley	0.000022	0.000055	1.19	2.70
05	Yuba Highlands	0.000516	0.000208	8.43	8.93
06	Yuba Highlands	0.001370	0.000749	17.02	13.84
08	Yuba Highlands	0.000001	0.000002	0.10	0.12
09	Yuba Highlands Beale Fence Line	0.001142	0.001044	16.44	18.03
10	Yuba Highlands Beale Fence Line	0.000015	0.000118	0.69	3.24
11	Yuba Highlands (sub for 1993 TP07)	0.000170	0.000050	3.86	2.22
12	Entry Control Point (ECP)	0.029900	0.020680	97.96	92.48
13	School	0.000029	0.000070	2.89	5.14
14	Clinic	0.000146	0.000194	2.24	2.73
15	Camp	0.000436	0.000278	4.33	3.52
16	Flightline Roadside	0.000004	0.000021	0.54	0.94
17	Water Tank	0.001400	0.000110	5.97	30.27
18	Flightline Tower (tripod on catwalk)		0.000069		4.90
19	Pave Paws Face Center	0.140200	0.186600	102.57	120.51
20	Pave Paws Face Corner	0.021830	0.062000	31.70	71.78

* Personnel PELs: 0.28 mW/cm² for uncontrolled and 1.40 mW/cm² for controlled environments.

** RF immunity limits: 1 V/m as low, 3 V/m as Normal, 10 V/m as high and 200 V/m as severe.

Table 3: Test Equipment

Test Equipment Nomenclature	Model Number
Hewlett Packard Spectrum Analyzer	8562A
Rohde & Schwarz Field Strength Meter	ESCS 30
Rohde and Schwarz Signal Generator	SMR20
Narda Electromagnetic Survey Meter	8518
Narda Isotropic Electric Field Probe	8721D/8723D
Narda Fixed Attenuators	768-10/20
Agilent Power Meter	N1912A
Agilent Power Sensor	N1921A
Compliance Design Roberts Dipole Antennas	Antenna 4