RADIATION HAZARD (RADHAZ / HERP) ANALYSIS REPORT

Site	Rickenbacker Int Airport, Ashville, OH
Coordinates	39 deg 48' 25" N, 82 deg 56' 45" W
FCC Reference	Experimental License Application 0333-EX-CN-2026 (Form 442)
Exposure Classification	Uncontrolled / General Population
Report Date	2026-05-13

1. PURPOSE AND SCOPE

This report documents the Hazards of Electromagnetic Radiation to Personnel (HERP) analysis for four radar systems proposed for simultaneous deployment at Rickenbacker International Airport. The analysis establishes compliance with FCC Maximum Permissible Exposure (MPE) limits and defines personnel keep out distances as a function of antenna mount height.

2. CONTROLLING STANDARDS

- 47 CFR 1.1310, FCC MPE limits for uncontrolled and controlled exposure.
- OET Bulletin 65 (Edition 97-01) and OET-65 Supplement C, FCC evaluation methodology for RF exposure.
- IEEE C95.1-1992, basis for the 47 CFR 1.1310 plateau limits.

2.1 Applicable MPE Limits for f greater than 1500 MHz

Environment	Power Density / Averaging
Controlled / Occupational	50 W per m^2 6 minutes
Uncontrolled / Gen Population	10 W per m^2 30 minutes

All four radars operate above 1500 MHz, so the frequency-independent plateau limits apply.

3. SITE CHARACTERIZATION

Environment: Airport property, fenced perimeter. Single perimeter fence; no secondary interior exclusion fence planned.

Classification: Uncontrolled. Personnel without RF training may be present within the fenced zone and in adjacent public areas beyond the fence.

Mount height range: 2.0 meters (hardware floor) to 5.9 meters (maximum). Mount height is a variable installation parameter; the keep out table in Section 8 specifies compliance distances by height.

Simultaneous operation: All four radars may operate concurrently.

4. SYSTEM INVENTORY

System	Manufacturer	Band	Center Frequency
Spyglass	Anduril	Ku	15.7 to 17.2 GHz
Echoshield	Echodyne	Ku	15.7 to 16.6 GHz
RPS-42	RADA	S	3.30 to 3.40 GHz
RPS-82	RADA	S	3.30 to 3.40 GHz

4.1 Transmitter Parameters

All values represent single-radar engineering parameters. EIRP is computed as Pt multiplied by the linear gain (dBi reference). Peak ERP values filed on Form 442 use the dipole reference (dBd) and are 2.15 dB lower than EIRP.

Parameter	Spyglass	Echoshield	RPS-42	RPS-82
Peak Pt (W)	64	180	328	956
Main-beam gain (dBi)	25.0	26.5	22.0	26.0
Peak EIRP (kW)	20.24	80.4	51.98	380.59
Peak ERP Files (kW)	12.33	48.98	31.69	232
Horizontal beamwidth (Deg)	8	8.5	15	9
Vertical beamwidth (Deg)	8	4.5	15	9
Max waveform duty cycle	22.5%	15%	10.03%	10.03%
First sidelobe level (dB)		-25	-17	-17
Steering Type	AESA Scan	MESA Track	AESA Scan	AESA Scan

4.2 Mitigations Incorporated into This Analysis

The following engineering controls are assumed in force at all four radars throughout this analysis and are prerequisites for the keep out distances given in Section 8:

M1. A non-defeatable mechanical antenna up-tilt of at least 5 degrees from horizontal is built into the system mounting hardware. The antenna boresight axis cannot point at or below the horizon.

M2. Firmware prevents any electronic beam steering below the mechanical boresight. The minimum beam-axis elevation is therefore plus 5 degrees or greater.

M3. Firmware dwell limiting is enforced on the three AESA systems (Spyglass, RPS-42, RPS-82). Maximum continuous dwell time on any single azimuth is bounded such that the OET-65 scanning-antenna time-averaging reduction is defensible.

M4. Echoshield, being a tracker, cannot employ scan-duty reduction. Its time-averaged EIRP is computed using the percent maximum pulse duty cycle only.

4.3 Duty Cycle Basis

Waveform duty cycles are taken directly from existing formal documentation, namely DD Form 1494 pulse-characteristics tables. For RPS-42 and RPS-82, the bounding waveform is the one with largest pulse-repetition-rate times pulse-width product. The documented hardware maximum is 10.03 percent for any single waveform.

5. MPE METHODOLOGY

5.1 Far-Field Power Density

For a directional antenna at range R radiating time-averaged EIRP:

S (R) = EIRP_avg / (4 pi R squared)

Solving for the compliance distance at a given MPE limit S_MPE:

R_MPE = square root of (EIRP_avg / (4 pi S_MPE))

5.2 Near-Field Boundary

R_nf = D squared / (4 lambda)

where D is the largest aperture dimension and lambda is the wavelength. Within R_nf, near-field on-axis power density saturates near:

S_nf = 4 P_avg eta / A_aperture

5.3 Time Averaging

The OET-65 uncontrolled averaging interval is 30 minutes. Two reduction factors apply in series:

a. Waveform duty. EIRP_stare = EIRP_peak times the pulse duty cycle. This is a hardware limited reduction and applies in every case.

b. Scan duty. EIRP_scan = EIRP_stare times (3-dB beamwidth /azimuth sector) times (scan repeat interval / averaging interval). For the three AESAs at 30 scans per minute azimuth scan, this factor further reduces EIRP at any fixed point. Credit for scan duty is contingent on firmware dwell limiting (M3 above). Without M3, the stare case governs.

5.4 Beam Geometry Versus Mount Height

With M1 applied, the main-beam 3 dB lower edge elevation is the boresight axis (plus 5 degrees minimum) less one half of the vertical beamwidth:

Spyglass	lower edge at 5 - 4 = plus 1 degrees
Echoshield	lower edge at 5 - 2.25 = plus 2.75 degrees
RPS-42	lower edge at 5 - 7.5 = minus 2.5 degrees
RPS-82	lower edge at 5 - 4.5 = plus 0.5 degrees

For a mount height h and a 2-meter head-height exposure plane, the main beam is clear of the head-height plane within a given range R_keep when:

h greater than or equal to 2 + R_keep times tangent of the absolute value of the lower-edge angle, for lower edges below horizon; or

h greater than or equal to 2 always, for lower edges above horizon.

When this condition holds within the main-beam keepout distance, only sidelobe radiation contributes to exposure at head height and the governing keepout collapses to the sidelobe-driven value.

6. PER-RADAR CALCULATED VALUES

6.1 Spyglass (Ku-band AESA, scanning)

Peak EIRP	20.24 kilowatts
Stare-case EIRP, 22.5 percent duty	4.55 kilowatts
Scan-reduced EIRP at fixed point	0.73 kilowatts
Near-field boundary R_nf	0.35 meters
Main-beam R_unctrl stare	6.02 meters
Main-beam R_unctrl scan	2.41 meters
Sidelobe-only R_unctrl scan, -17 dB	0.34 meters

6.2 Echoshield (Ku-band MESA, tracker)

Peak EIRP	80.40 kilowatts
Stare-case EIRP, 15 percent duty	12.06 kilowatts
Near-field boundary R_nf	1.12 meters
Near-field on-axis S_nf	1.7 kW per m^2
Main-beam R_unctrl stare / tracker	9.80 meters
Sidelobe-only R_unctrl, -17 dB	1.38 meters

Note: Echoshield is a tracker. The beam dwells on a designated target and no scan-duty reduction is credited. Stare and operational averaged EIRP are the same value.

6.3 RPS-42 (S-band AESA, scanning)

Peak EIRP	51.98 kilowatts
Stare-case EIRP, 10.03 percent duty	5.21 kilowatts
Scan-reduced EIRP at fixed point	1.12 kilowatts
Near-field boundary R_nf	0.49 meters
Main-beam R_unctrl stare	6.44 meters
Main-beam R_unctrl scan	2.98 meters
Sidelobe-only R_unctrl scan, -17 dB	0.42 meters

6.4 RPS-82 (S-band AESA, scanning)

Peak EIRP	380.6 kilowatts

Stare-case EIRP, 10.03 percent duty 38.17 kilowatts
Scan-reduced EIRP at fixed point 4.91 kilowatts
Near-field boundary R_nf 1.35 meters
Near-field on-axis S_nf 6.4 kW per m^2
Main-beam R_unctrl stare 17.43 meters
Main-beam R_unctrl scan 6.25 meters
Sidelobe-only R_unctrl scan, -17 dB 0.88 meters

RPS-82 is the dominant single-radar contributor to the worst-case keep out envelope. Mitigations M1, M2, and M3 are therefore specifically required on this system.

7. CO-SITE SUPERPOSITION

With all four systems operating simultaneously and their individual contributions at a common observation point summed (conservative incoherent-sum assumption), total time-averaged EIRP at head height is obtained by summing the per-radar contributions appropriate to the geometry. The combined keep out radius is:

R_combined = square root of (sum of EIRP_i / (4 pi S_MPE))

8. KEEPOUT DISTANCE VERSUS MOUNT HEIGHT

The table below gives the governing keep out distance at the uncontrolled MPE limit (10 W per m^2) for the four-radar cluster as a function of antenna mount height, with mitigations M1, M2, and M3 in force. All distances are measured horizontally from the antenna cluster centerline.

8.1 Primary Table, Dwell Limit Active (Mitigation M3 Applied)

Mount Height (meters)	Notes	Combined Keep out (meters)
2.0	RPS-42 main beam clips head plane within its 2.98 m scan keep out; other three systems are sidelobe only	3.4
2.5	All four systems sidelobe only	1.8
3.0	All four systems sidelobe only	1.8
4.0	All four systems sidelobe only	1.8
5.0	All four systems sidelobe only	1.8
5.9	All four systems sidelobe only	1.8

The transition occurs at mount height 2.13 meters: above this height the RPS-42 main beam lower edge stays above the 2-meter head plane throughout its 2.98 meter scan keep out, and sidelobe emission alone governs.

8.2 Secondary Table, Dwell Limit Not Active

Provided for reference. This table would apply if mitigation M3 cannot be implemented. Mitigation M1 and M2 remain in force.

Mount Height (meters)	Notes	Combined Keep out (meters)
2.0	RPS-42 main beam clips head plane within its 2.98 m scan keep out; other three systems are sidelobe only	7.1
2.3	All four systems sidelobe only, stare time-averaging	3.1
3.0	All four systems sidelobe only, stare time-averaging	3.1
4.0	All four systems sidelobe only, stare time-averaging	3.1
5.0	All four systems sidelobe only, stare time-averaging	3.1
5.9	All four systems sidelobe only, stare time-averaging	3.1

The transition in the stare-only case is at 2.28 meters.

8.3 Controlled Environment, For Reference

If any portion of the installation is re-classified as controlled (trained personnel, RF awareness, signage per ANSI C95.2), the 5 mW per cm squared limit applies and all distances in Section 8.1 scale by the square root of one fifth, that is by 0.447. The controlled combined keep out is therefore approximately 0.8 meter at any mount height at or above 2.13 meters with dwell limiting, and 1.5 meters at 2.0-meter mount height.

9. COMPLIANCE FINDINGS

9.1 With all four mitigations M1 through M4 in force and mount height at or above 2.5 meters, the combined uncontrolled keep out is 1.8 meters, which is within the footprint of any reasonable radar enclosure and is well inside the existing airport perimeter fence.

9.2 At the 2.0-meter hardware mount floor, the combined uncontrolled keep out is 3.4 meters. This remains within typical airport standoff distances.

9.3 Near-field on-axis power density inside R_nf for Echoshield and RPS-82 exceeds uncontrolled MPE by more than two orders of magnitude. Personnel must not enter the volume directly in front of the aperture within 1.35 meters of RPS-82 and 1.12 meters of Echoshield under any operating condition. The mechanical up-tilt (M1) makes direct boresight intersection with a person on foot impossible at any mount height at or above 2 meters.

10. ASSUMPTIONS

10.1 Perfect-ground reflection (up to plus 4 dB per OET-65 Section 2.2) is not applied in the primary analysis. If applied, all keepout distances in Section 8 scale by 1.6. The RF survey required in Section 9.4 will inherently include ground reflection effects and is the authoritative compliance record.

10.2 The first-sidelobe level is taken from manufacturer documentation (minus 17 dB for the RADA AESAs, minus 25 dB for Echoshield). Spyglass sidelobe level was not specified; minus 17 dB is used as a conservative value.

10.3 Aperture efficiency of 0.7 is assumed for near-field on-axis saturation calculations.

10.4 Combined multi-radar exposure uses incoherent power summation. This is conservative relative to phase-coherent combining.

10.5 Personnel head-height exposure plane is taken as 2.0 meters above local grade.

10.6 All four radars are assumed to point their main beam directly at the observer in the worst-case geometric analysis (before mitigations M1 through M3 are applied).

11. RECOMMENDATIONS / INTENDED INSTALLATION PARAMETERS

R1. Implement mitigation M1, a mechanical antenna up-tilt of at least 5 degrees, on all four radar mounts. This is baked into the production mount hardware.

R2. Implement mitigation M2, a firmware lock preventing electronic steering below the mechanical boresight, on all four systems. The firmware change is feasible on all four platforms.

R3. Implement mitigation M3, firmware dwell limiting, on the three AESA systems. The implementation bounds continuous dwell on any
single azimuth such that the scan-duty time-averaging reduction is defensible to OET.

R4. Install antennas at a mount height of 2.5 meters or greater where feasible. The primary keep out table (Section 8.1) drops from 3.4 meters at 2.0-meter mount height to 1.8 meters at and above 2.5-meter mount height. The 5.9-meter maximum mount is not required for RF compliance but provides additional margin.

R5. RF-hazard signage per ANSI C95.2 shall be posted at the perimeter fence and at each radar enclosure.

12. FCC FILING RECORD

12.1 Form 442, Application 0333-EX-CN-2026, has been updated to reflect Peak ERP values computed as Pt times linear antenna gain referenced to a dipole (dBd), with all four emissions designated Peak (P). Updated ERP values on file are:

Spyglass 12.33 kilowatts
Echoshield 48.98 kilowatts
RPS-42 31.69 kilowatts

RPS-82 232.0 kilowatts

12.2 This report is submitted as a Form 442 exhibit supporting OET sign-off.

APPENDIX A. SUMMARY TABLE OF SINGLE-RADAR COMPLIANCE DISTANCES

All values in meters. Uncontrolled limit 10 W per m squared.
Controlled limit 50 W per m squared.

System	Peak EIRP (kW)	R_u Peak	R_u Stare	R_u Scan	R_c Stare	R_nf
Spyglass	20.24	12.7	6.02	2.41	2.69	0.35
Echoshield	80.40	25.3	9.80	9.80	4.38	1.12
RPS-42	51.98	20.3	6.44	2.98	2.88	0.49
RPS-82	380.59	55.0	17.43	6.25	7.79	1.35
All four co-site	533.2	65.1	21.85	12.2	9.77	n/a

Notes:

- R_u Peak: worst-case continuous wave at peak EIRP, no mitigations.
- R_u Stare: pulse-duty averaged, beam parked on target.
- R_u Scan: pulse-duty averaged and scan-duty averaged.
- Echoshield R_u Scan equals R_u Stare because it is a tracker.
- The co-site row is provided for reference; the governing keep out in operational configuration is given in Section 8, not here.

APPENDIX B. FORMULAS

Far-field compliance distance
R = square root of (EIRP_avg / (4 pi S_MPE))

Near-field boundary
R_nf = D squared / (4 lambda)

Near-field on-axis power density
S_nf = 4 P_avg eta / A_aperture

Pulse duty cycle
D = PW / PRI = PW times PRR

Scan duty factor at a fixed point
d_scan = (3 dB beamwidth) divided by
(scan rate times scan period)

ERP to EIRP conversion
EIRP (dBi) = ERP (dBd) plus 2.15 dB

EIRP linear = ERP linear times 1.64

APPENDIX C. SOURCE DOCUMENTS

C.1 FCC Form 442, Experimental License Application 0333-EX-CN-2026.

C.2 DD Form 1494 / J F 12 10810, RPS-42 UAS Detection Radar, RADA Electronic Industries Inc.

C.3 DD Form 1494 / J F 12 11455, RPS-82 Radar, RADA Electronic Industries Inc.

C.4 J F 12 13559, Echoshield, Echodyne Corporation.

C.5 Anduril Spyglass operational specifications, applicant-supplied.

C.6 FCC OET Bulletin 65, Edition 97-01, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields.

C.7 47 CFR 1.1310, Radiofrequency radiation exposure limits.

C.8 IEEE C95.1-1992, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

C.9 ANSI C95.2, American National Standard for Radio Frequency Radiation Hazard Warning Symbol.