Microwave Memos
Memo 16

The EM Gauntlet

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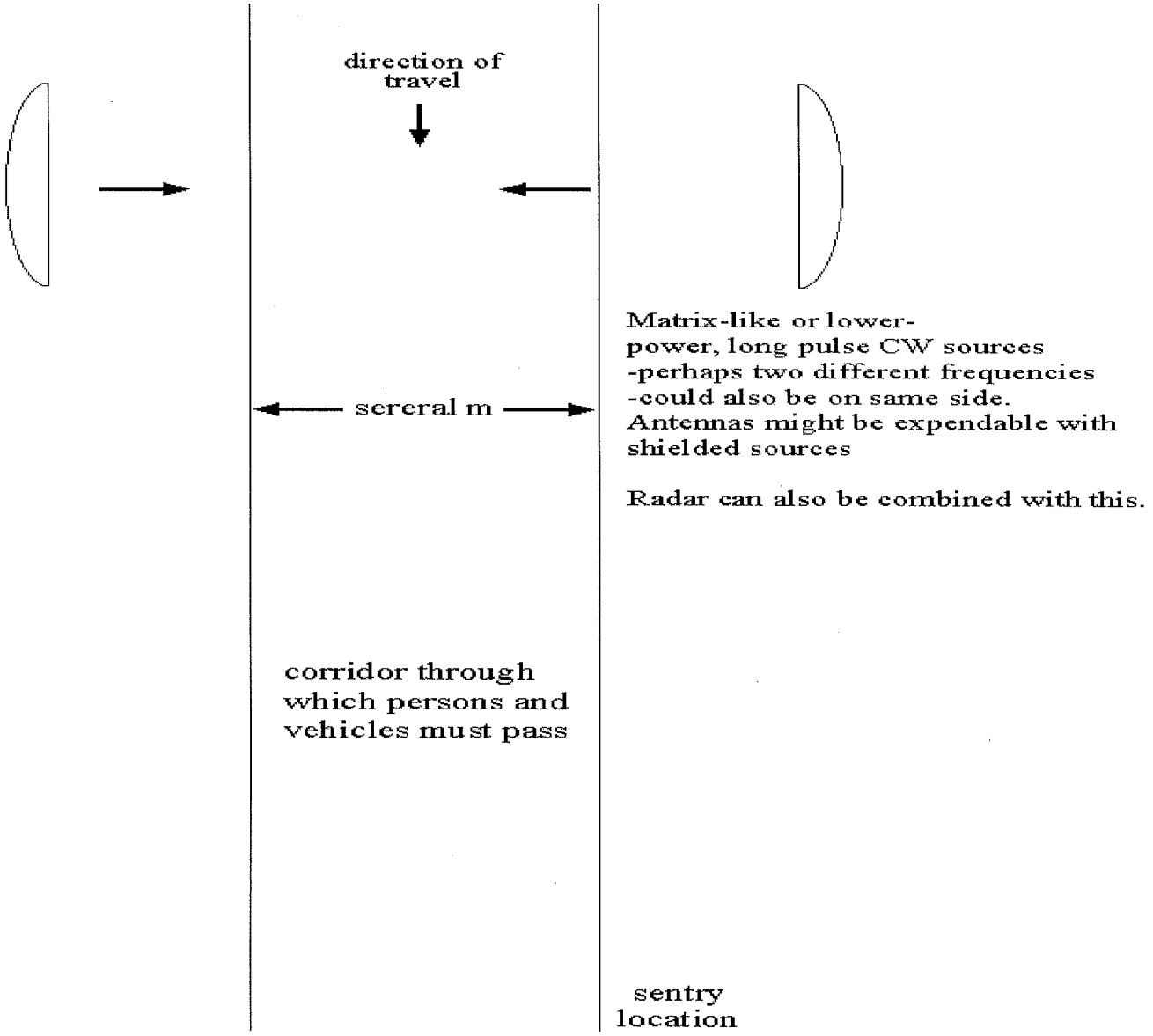

Matrix-like at ≅ 200Mhz

$E_{inc} \cong 100\text{kV/m}$ at ≅ 3m or so

Estimate from μ wave memo 15

$$I \cong j\frac{E_{inc}}{\mathrm{f}\mu_0[-5.59]} \cong -j\frac{10^5}{2\times10^8\times4\pi\times10^{-7}\times5.59}$$

$$\cong 71\,\text{A in magnitude}$$

$$P \cong \frac{\mathrm{I}^2}{2}Z_{\text{Load}} \cong 2.5\text{kW},\quad Z_{\text{Load}} \cong 1\Omega$$

$$\Delta t \cong 20\text{ns}$$

$$U \cong 50\mu\text{J or .05 mJ} \quad \text{for one pulse}$$

CW source

What E for 1ms is needed for say 10mJ in load?

$$P = 10\,W \text{ in load}$$

$$= \frac{I^2}{2}Z_{\text{Load}} \quad , \quad Z_{\text{Load}} \cong 1\Omega$$

$$I = \sqrt{\frac{2P}{Z_{\text{Load}}}} \cong 4.5\text{A for 1ms}$$

This requires an E_{inc} (magnitude) from μwave memo 15 for 200MHz

$$E_{inc} = \mathrm{f}\mu_0[5.59]\,I \cong 2\times10^8\times4\pi\times10^{-7}[5.59]\,4.5$$

$$\cong 6.3\,\text{kV/m}$$

$$P_{inc} = \frac{E^2}{2Z_0} \cong 52\,\text{kW/m}^2$$

If ≅ 2m^2 is exposed (beam area)

$P_{\text{Source}} \cong 100\text{kW}$

For 1ms this is a healthy source, delivering 100 J on target area.

Human exposure limit

$\cong 10\text{W/m}^2$ integrated over 6 min.

For 1 ms this allows

$$P_{inc} \cong \frac{10 \times 6 \times 60}{10^{-3}} \cong 360 \times 10^4 \cong 3.6\,\text{MW/m}^2$$

- roughly 100 times under limit for previous pulsed CW source. So even more than 1ms fits within limit.