**Naval Electromagnetic Radiation Facilities Description**

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Arlington, VA 22243

**Abstract (Maximum 200 words):**

This presentation shows the facilities available at the Naval Electromagnetic Radiation Facility. Some areas include: Test areas, Continuous Steel Ground Plane, Aircraft Anechoic Test Facility, the hangar, Test Vans, Telemetry Van Layout, Radar Transmitters, Amplifiers, Modulation Sources, etc.

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19960506 147

**Subject Terms:** Electromagnetic, Radiation, Aircraft Anechoic Test Facility, Waveforms, Pulse

**Security Classification of Report:** UNCLASSIFIED

**Security Classification of this Page:** UNCLASSIFIED

**Security Classification of Abstract:** N/A

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GRACE - 604-2822, X4605
Naval Electromagnetic Radiation Facility Capabilities Description
Naval

Electromagnetic Radiation Facility

Capabilities Description

Naval Electromagnetic Radiation Facility                January 2, 1996
Facilities

- Test Areas
- Test Vans
- Transmitter Equipment
- E-Field Calibration Equipment
Test Areas

- **Hangar Apron** (embedded ground plane)

- **AATF**
Test Areas

- Inside Hangar
- Inside AATF

Naval Electromagnetic Radiation Facility

January 2, 1996
Continuous Steel Ground Plane

- 100' Wide x 240' Long Steel Ground Plane with a modified set of Alameda Chocks with blast deflector
  - Electric Service
    - 480VAC, 60 Hz, 3-Phase Delta, 400 Amps (8 100 AMP Receptacles)
    - 120/208 VAC, 60 Hz, 3-Phase Wye 100 KVA Service
    - 115VAC, 400 Hz, 3-Phase Delta, 200 KVA Service (Standard DOD Aircraft Plugs)
Hangar Apron

- 300' wide x 600' long Apron in front of the Shielded Hangar
  - Embedded 200' wide x 400' long, wire grid (10' x 10') ground plane under the concrete
  - Electric Service
    480VAC, 60 Hz, 3-Phase Delta, 400 Amps (5 100 AMP Receptacles)
  - Aircraft Turns Allowed

Naval Electromagnetic Radiation Facility
January 2, 1996
Aircraft Anechoic Test Facility (limited frequency coverage)

- Electric Service
  - 480VAC, 60 Hz, 3-Phase Delta
  - 120/208 VAC, 60 Hz, 3-Phase Wye 100 A Service
  - Standard DOD 28VDC Aircraft Power
  - 115VAC, 400 Hz, 3-Phase Delta, 200 kVA Service (Standard DOD Aircraft Plugs)
Inside the Shielded Hangar (limited frequency coverage)

- Electric Service

480VAC, 60 Hz, 3-Phase Delta, 400 Amp Service

120/208 VAC, 60 Hz, 3-Phase Wye 100 KVA Service

Standard DOD 28VDC Aircraft Power

115VAC, 400 Hz, 3-Phase Delta, 200 KVA Service (Standard DOD Aircraft Plugs)
Frequencies and power levels are limited to those frequencies and power levels for which safety of personnel and equipment can be maintained and must be evaluated on a case by case basis. Generally, frequencies above 1 GHz are ok.
TV#1

- Contains Class A High Power Amplifier Systems
- 45' Semitrailer
- Self Contained Heating and Cooling
- Two Separate, Completely Shielded Rooms
- 30' Waveguide Cart Attached to Side
- Requires 3 480VAC, 60 Hz, 3-phase, 100 Amp Standard GSE Power Receptacles

Naval Electromagnetic Radiation Facility

January 2, 1996
TV#2

- Contains the Cober 1-34 GHz Magnetron Transmitter
- 45' Semitrailer
- Self Contained Heating and Cooling
- 30' Waveguide Cart Attached to Side
- Requires 480VAC, 60 Hz, 3-phase, 100 Amp Standard GSE Power Receptacle

Naval Electromagnetic Radiation Facility

January 2, 1996
TV#3

- Contains the B&C (400 & 900 MHz) Transmitters
- 45' Semitrailer
- Self Contained Heating and Cooling
- Requires 480VAC, 60 Hz, 3-phase, 100 Amp Standard GSE Power Receptacles
TV#4

- Contains the A Band (200 MHz) Transmitter
- 25' Lowboy Semitrailer
- Self Contained Heating and Cooling
- Requires 480VAC, 60 Hz, 3-phase, 100 Amp Standard GSE Power Receptacle (1 50 Amp min.)
Telemetry Van

- 8' x 25' Shielded Military COMM Van
- Self Contained Heating and Cooling
- 120/208, 60 Hz Power Available
- Minimum 50' of Power Cord
- Requires 408VAC, 60 Hz, 3-phase Delta, 100 Amp GSE Receptacle
- Built In Work Benches and Open Floor Space
- Bulkhead Feedthrus, VHF Radio

Naval Electromagnetic Radiation Facility

January 2, 1996
Radar Transmitters

- Discrete Frequency Tuned
- Magnetron and Tetrode Tube Based
- Antenna Scan Parameter Simulations
- No EW Modulation Capabilities
## Radar Transmitter Parameters

<table>
<thead>
<tr>
<th>Transmitter</th>
<th>Band</th>
<th>Freq Range (GHz)</th>
<th>PW (μS)</th>
<th>PRF (Hz)</th>
<th>Max Duty Cycle</th>
<th>Max Peak Power (KW)</th>
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<tbody>
<tr>
<td>H-6 A</td>
<td>A</td>
<td>.2-.24</td>
<td>1-200</td>
<td>&lt;1000</td>
<td>.01</td>
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<td>.007</td>
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<td>H-6 B</td>
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<td>.39-.48</td>
<td>1-200</td>
<td>&lt;1000</td>
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<td>.007</td>
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<td>H-6 C</td>
<td>C</td>
<td>.870-.940</td>
<td>1-50</td>
<td>&lt;1000</td>
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<td>100</td>
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<td>Cober</td>
<td>D</td>
<td>1.22-1.35</td>
<td>1,1.5,2,3,4</td>
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<td>F</td>
<td>3.1-3.65</td>
<td>1,1.5</td>
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<td>.002</td>
<td>1000</td>
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<td>G</td>
<td>5.4-5.9</td>
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<td>&lt;2000</td>
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<td>1000</td>
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<td>I</td>
<td>14-15.2</td>
<td>1,1.5,2</td>
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<td>J</td>
<td>35</td>
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<td>&lt;2000</td>
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# Radar Transmit Antennas

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<tr>
<th>Band</th>
<th>Antenna Make</th>
<th>Part Number</th>
<th>Freq. (MHz)</th>
<th>Gain (dBi)</th>
<th>3 dB BW E/H Plane</th>
<th>2M Illum. Area (ft²)</th>
<th>E Plane Width (M)</th>
<th>H Plane Width (M)</th>
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<tbody>
<tr>
<td>A</td>
<td>Chu Corner Reflector</td>
<td>CA-3524</td>
<td>195</td>
<td>12.8</td>
<td>56.5/37</td>
<td>30</td>
<td>2.1</td>
<td>1.33</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>220</td>
<td>11.1</td>
<td>50/38.5</td>
<td>19.8</td>
<td>1.3</td>
<td>1.39</td>
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<td></td>
<td></td>
<td></td>
<td>245</td>
<td>12.9</td>
<td>44/35.5</td>
<td>20.6</td>
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<td>B</td>
<td>Chu Corner Reflector</td>
<td>CA-3525</td>
<td>385</td>
<td>11.5</td>
<td>53.5/45</td>
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<td>2</td>
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<td>435</td>
<td>11.8</td>
<td>55.5/40.5</td>
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<td>485</td>
<td>12.8</td>
<td>48.5/35.5</td>
<td>24.5</td>
<td>1.78</td>
<td>1.28</td>
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<td>C</td>
<td>Seavey Engr Assoc Horn</td>
<td>SGA-07</td>
<td>850</td>
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<td>27/30</td>
<td>10.3</td>
<td>.96</td>
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<td>900</td>
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<td>27/30</td>
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<td>910</td>
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<td>10.3</td>
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<td>1</td>
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<td></td>
<td></td>
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<td>940</td>
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<td>27/30</td>
<td>10.3</td>
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<td>1</td>
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<td>D</td>
<td>Scientific Atlanta Horn</td>
<td>12-1.1</td>
<td>1250</td>
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<td>1300</td>
<td>15.5</td>
<td>30/27</td>
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<td></td>
<td></td>
<td>1350</td>
<td>15.7</td>
<td>30/27</td>
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<td>1</td>
<td>.96</td>
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<td>E</td>
<td>Seavey Engr Assoc Horn</td>
<td>HPH-27</td>
<td>2700</td>
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<td>30/27</td>
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<td>2900</td>
<td>17.3</td>
<td>23/27</td>
<td>8.3</td>
<td>.81</td>
<td>.96</td>
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<td>3100</td>
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<td>23/22</td>
<td>6.7</td>
<td>.81</td>
<td>.77</td>
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<td></td>
<td></td>
<td></td>
<td>3600</td>
<td>19.15</td>
<td>23/22</td>
<td>6.7</td>
<td>.81</td>
<td>.77</td>
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<tr>
<td>G</td>
<td>Scientific Atlanta Horn</td>
<td>12-3.9</td>
<td>5650</td>
<td>19.38</td>
<td>23/22</td>
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<td>.77</td>
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<td>I</td>
<td>Systron Donner Horn</td>
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<td>16/14</td>
<td>3</td>
<td>.56</td>
<td>.49</td>
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<td></td>
<td></td>
<td></td>
<td>9400</td>
<td>20.22</td>
<td>16/14</td>
<td>3</td>
<td>.56</td>
<td>.49</td>
</tr>
<tr>
<td>J</td>
<td>Scientific Atlanta Horn</td>
<td>12-12</td>
<td>14 GHz</td>
<td>24.15</td>
<td>9/10</td>
<td>1.1</td>
<td>.31</td>
<td>.34</td>
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<td>K</td>
<td>Scientific Atlanta Horn</td>
<td>12A-26</td>
<td>35 GHz</td>
<td>24.7</td>
<td>9/10</td>
<td>1.1</td>
<td>.31</td>
<td>.34</td>
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<tr>
<td>K</td>
<td>4' Dish</td>
<td>SPN-42</td>
<td>35 GHz</td>
<td>48</td>
<td>0.5/0.5</td>
<td>1 @ 80'</td>
<td>.3</td>
<td>.3</td>
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</table>
Radar Transmitters
Maximum Peak Power Densities at the Near Field Boundary

<table>
<thead>
<tr>
<th>BAND</th>
<th>DISTANCE (M)</th>
<th>PEAK POWER DENSITY (MW/CM²)</th>
<th>PEAK FIELD INTENSITY (V/M)</th>
<th>DUTY</th>
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<tbody>
<tr>
<td>A</td>
<td>6.5</td>
<td>2,131</td>
<td>2,835</td>
<td>.007</td>
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<tr>
<td>B</td>
<td>3.5</td>
<td>1,188</td>
<td>2,116</td>
<td>.01</td>
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<tr>
<td>C</td>
<td>3.8</td>
<td>1,243</td>
<td>2,165</td>
<td>.01</td>
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<td>D</td>
<td>2.7</td>
<td>11,319</td>
<td>6,533</td>
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<td>E</td>
<td>2.0</td>
<td>73,562</td>
<td>16,653</td>
<td>.0008</td>
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<td>F</td>
<td>2.5</td>
<td>30,200</td>
<td>10,669</td>
<td>.001</td>
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<td>G</td>
<td>1.8</td>
<td>100,410</td>
<td>19,456</td>
<td>.001</td>
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<td>I</td>
<td>1.0</td>
<td>106,554</td>
<td>20,043</td>
<td>.001</td>
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<tr>
<td>J</td>
<td>2.1</td>
<td>2,238</td>
<td>2,905</td>
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<td>K</td>
<td>23.0</td>
<td>2,500</td>
<td>3,070</td>
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Class A High Power Amplifier Systems

- Block Diagram
- Class A Amplifiers
- Synthesized Signal Generators
- Modulation Sources
- Summary Capabilities & Antennas
- E-Field Calibration Equipment
- Typical Maximum E-Field Levels

Naval Electromagnetic Radiation Facility

January 2, 1996
# Class A Amplifiers

<table>
<thead>
<tr>
<th>Freq Range</th>
<th>Model Number</th>
<th>Min CW Power Output</th>
<th>Gain Flatness</th>
<th>Harmonic Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 KHz - 100 MHz</td>
<td>AR 10,000L</td>
<td>10 KW</td>
<td>±1.5 dB</td>
<td>&lt;20dB</td>
</tr>
<tr>
<td>100 MHz - 1000 MHz</td>
<td>AR LM10000W</td>
<td>1 KW</td>
<td>±2 dB</td>
<td>&lt;20dB</td>
</tr>
<tr>
<td>1 GHz - 2 GHz</td>
<td>Logimetrics A682/L</td>
<td>1 KW</td>
<td>±1.5 dB</td>
<td>&lt;20dB</td>
</tr>
<tr>
<td>2 GHz - 4 GHz</td>
<td>Logimetrics A682/S</td>
<td>1 KW</td>
<td>±1.5 dB</td>
<td>&lt;50dB</td>
</tr>
<tr>
<td>4 GHz - 8 GHz</td>
<td>Logimetrics A682/C</td>
<td>1 KW</td>
<td>±1.5 dB</td>
<td>&lt;50dB</td>
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<tr>
<td>8 GHz - 18 GHz</td>
<td>Logimetrics A682/IE</td>
<td>800 Watts</td>
<td>±1.5 dB</td>
<td>&lt;50dB</td>
</tr>
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</table>

Naval Electromagnetic Radiation Facility

January 2, 1996
# CWPS Synthesized Signal Generators

<table>
<thead>
<tr>
<th>Freq Range</th>
<th>Model Number</th>
<th>Internal Modulation</th>
<th>External Modulation</th>
<th>Modulation Modes</th>
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<tbody>
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<td>10 KHz - 1.28 GHz</td>
<td>HP8662</td>
<td>AM:0-95% Depth</td>
<td>AM:0-95% Depth</td>
<td>AM</td>
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<td></td>
<td></td>
<td>400 Hz or 1 KHz Rate</td>
<td>DC- 10 KHz(freq dependent) Rate</td>
<td>FM</td>
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<tr>
<td></td>
<td></td>
<td>FM:400 Hz or 1 KHz Rate</td>
<td>FM:DC - 100 KHz Rate</td>
<td>AM/FM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rate</td>
<td>Deviation: ,100 KHz; very Frequency Dependent</td>
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</tr>
<tr>
<td>10 MHz - 20 GHz</td>
<td>HP 83732B</td>
<td>Waveforms: Sine, Ramp, Square, Triangle, Uniform Noise,</td>
<td>Any Waveform compatible with band width considerations.</td>
<td>Linear/Log AM AM/PM</td>
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<tr>
<td></td>
<td></td>
<td>Guassian Noise</td>
<td>AM:0-99.9% Depth</td>
<td>FM</td>
</tr>
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<td></td>
<td></td>
<td>AM: 0-99.9% Depth</td>
<td>DC - 100 KHZ Rate</td>
<td>PM</td>
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<td>FM: 1KHz-1 MHz Rate</td>
<td>FM:10 Hz - 5 MHz Rate</td>
<td>AM/PM</td>
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<td>&lt;10MHz Peak Dev</td>
<td>&lt;10 MHz Deviation</td>
<td>Phase</td>
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<td>PM: 3Hz-3MHz PRF</td>
<td>PM: PRF: 5 Hz - 5 MHz</td>
<td>Scan Modulation</td>
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<td>25nS-419mS PW</td>
<td>PW: &gt;50 nSec</td>
<td>Phase/FM</td>
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<tr>
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<td></td>
<td>Scan: &gt;60dB Depth</td>
<td>On/Off Ratio &gt;80 dB</td>
<td>AM/PM/FM/Phase</td>
</tr>
</tbody>
</table>
Modulation Sources

☐ Custom In House Developed Function Generators

☐ TV Signal Simulator
  Standard and CATV Channels
  Test Patterns or Live action
  Choice of Audio

☐ Pulse Generator
  1-99% Duty Cycle
  250nS Rise Time
  50nS Fall Time

☐ Wobulator
  300-6000Hz Sweep Generator
  0.3-33 Hz Sweep Rate
Modulation Sources

- HP3326A
  - DC - 13 MHz
  - Sine, Square, Pulse, DC Waveforms
  - Modes
    - 2 Phase
    - 2 Tone
    - Pulse
    - Swept Frequency

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Modulation Sources

- External Source
  - Any source compatible with the HP8662 or the HP83732 signal generators.
  - Any source that can drive a class A amplifier.

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Antenna Scan Simulation

- HP33120A Function/Arbitrary Waveform Generator

  Standard Waveforms: Sine, Square, Triangle, \( \frac{\sin (X)}{X} \)

  Arb Waveforms: 8 to 16K Points, 12 Bit Resolution

- Purpose: Realistic Emitters
  Limit/Control Personnel RADHAZ Exposure

Naval Electromagnetic Radiation Facility

January 2, 1996
# Class A High Power Transmitters

## Summary Capabilities and Antennas

<table>
<thead>
<tr>
<th>Freq Range</th>
<th>Modulation</th>
<th>Transmitter Power</th>
<th>Antenna Type</th>
<th>Antenna Polarization</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 KHz - 4 MHz</td>
<td>AM, FM, Pulsed, AM/FM, Wobulated(swept audio)</td>
<td>&gt;15 KW</td>
<td>Long Wire</td>
<td>Vertical</td>
</tr>
<tr>
<td>4 MHz - 30 MHz</td>
<td>AM, FM, Pulsed, AM/FM, Wobulated, SSB</td>
<td>&gt;15 KW</td>
<td>37' Trussed Whip</td>
<td>Vertical</td>
</tr>
<tr>
<td>30 MHz - 100 MHz</td>
<td>AM, FM, Pulsed, phase, Wobulated(swept audio)</td>
<td>&gt;10 KW</td>
<td>10' Discone</td>
<td>Vertical</td>
</tr>
<tr>
<td>50 MHz - 100 MHz</td>
<td>AM, FM, Pulsed, phase, Wobulated(swept audio)</td>
<td>&gt;10 KW</td>
<td>12' Log Periodic</td>
<td>Horizontal</td>
</tr>
<tr>
<td>100 MHz - 200 MHz</td>
<td>AM, FM, Pulsed, phase, Wobulated(swept audio)</td>
<td>1000 W</td>
<td>6' Log Periodic</td>
<td>Horz or Vert</td>
</tr>
<tr>
<td>200 MHz - 1000 MHz</td>
<td>AM, FM, Pulsed, phase, Wobulated(swept audio)</td>
<td>1000 W</td>
<td>Custom Double Ridge Horn</td>
<td>Horz or Vert</td>
</tr>
<tr>
<td>1 GHz - 2 GHz</td>
<td>AM, FM, Pulsed, phase, Wobulated(swept audio)</td>
<td>1000 W</td>
<td>Custom Double Ridge Horn</td>
<td>Horz or Vert</td>
</tr>
<tr>
<td>2 GHz - 4 GHz</td>
<td>AM, FM, Pulsed, phase, Wobulated(swept audio)</td>
<td>1000 W</td>
<td>Custom Double Ridge Horn</td>
<td>Horz or Vert</td>
</tr>
<tr>
<td>4 GHz - 8 GHz</td>
<td>AM, FM, Pulsed, phase, Wobulated(swept audio)</td>
<td>1000 W</td>
<td>Custom Double Ridge Horn</td>
<td>Horz or Vert</td>
</tr>
<tr>
<td>8 GHz - 18 GHz</td>
<td>AM, FM, Pulsed, phase, Wobulated(swept audio)</td>
<td>800 W</td>
<td>Custom Double Ridge Horn</td>
<td>Horz or Vert</td>
</tr>
</tbody>
</table>

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Class A High Power Antennas

* 50-100 MHz

* 30-100 MHz

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Class A High Power Antennas

* 100-200 MHz

* 200-1000 MHz

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Class A High Power Antennas

* 4-30 MHz

* 10 KHz-4 MHz

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Class A High Power Antennas

* 100-1100 MHz
## E-Field Calibration Equipment

- **Amplifier Research FM 2000 Meter**, FP 2080 Probe
  - 80 MHz - 40 GHz
  - 1 - 300 V/M
  - 4 Probes, 1 Meter Available

- **3-Axis E-Field Probe**
  - Amplifier Research FP2000 Probe/FM2000 Meter
  - 10 KHz - 1 GHz
  - 4-300 V/M ± 1 dB
  - Up to 8 Probes, 2 meters Available

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E-Field Calibration Equipment (Cont.)

- E x H Field Probe
  - ARA IBS-30
  - Freq: 0.075-30 MHz
  - E-Field: 6-1500 V/M
  - H-Field: 0.04-6 A/M

- Features
  - Simultaneous E&H Field Measurements
  - Evaluation of Poynting Vector & Power Density
  - Evaluation of Wave Impedance

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Typical Maximum E-Field Levels

- 10KHz - 18 GHz
- 10KHz - 4 MHZ
- 4MHz - 30 MHz
- 30 MHz - 100 MHz
- 100 MHz - 1 GHz
- 1 GHz - 18 GHz
Max Possible Field Levels
4MHz - 30 MHz

V/m

FREQ (MHz)

0 100 150 200 250


37° Trussed Whip

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30 MHz - 100 MHz

Max Possible Field Levels

MHz

V/M

30 40 50 60 70 80 90 100

3109@1M Discone@10', 6'H 12' Log Periodic@1.5M

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