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Operating/Display Modes

- AM/FM Duplex Monitor and Generator
- Audio Synthesizer
- Tracking Generator (Opt.)
- Dual Display (Opt.)
- Cable Fault Locator (Opt.)
- Spectrum Analyzer
- Frequency Counter
- Frequency Error Meter
- Digital Voltmeter
- Power Meter
- Oscilloscope
- Signal Strength Meter
- SINAD/Distortion Meter

General

Displayed Average Noise:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level (DANL)</td>
<td>-140dBm (50 Ohm input termination)</td>
</tr>
<tr>
<td>Dynamic Range</td>
<td>80dB</td>
</tr>
<tr>
<td>Input Related Spurious</td>
<td>-60dBc max</td>
</tr>
<tr>
<td>Residual Spurious (non-input related)</td>
<td>-70dBm</td>
</tr>
</tbody>
</table>

Power

- DC Power Requirements: 15-16VDC @ 8.0A max
- AC Adapter Specs: 100-240VAC, 2.5A max, 50-60Hz
- Battery Power: Internal Battery
- Battery Operation: 1.5 hour typical easily swappable for extended operation

MECHANICAL/ENVIRONMENTAL

- Weight: 13.75 lbs including internal battery (6.24 kg)
- Dimensions: 9.4" (23.9cm) H, 12.7" (32.3cm) W, 7.5" (19.1cm) D
- Operating Altitude: Up to 15,000 ft (4572 m)
- Humidity: 80% maximum relative humidity
- Operating Temperature: -20° to 50°C with external DC; 0° to 50°C using supplied AC adapter
- Storage Temperature: Without battery: -30° to +80°C; With battery: -20° to +50°C
- Battery Charging Temperature: 0° to +45°C
- Shock and Vibration Rating: MIL-PRF-28800F, Class 3

WARRANTY

- Standard Warranty: Two years
- Three Year Service Plan: Optional
- Five Year Service Plan: Optional
### Generator (Receiver Test)

**Port Protection Limit**: 5W for 30 seconds  
**Frequency Range**: 1MHz to 1GHz (250kHz to 1GHz typical); Optional to 3GHz  
**Extended Frequency Range (Optional)**: 1MHz to 3GHz (250kHz to 3GHz typical)  
**Frequency Resolution**: 1Hz

#### OUTPUT LEVEL GENERATE PORT

<table>
<thead>
<tr>
<th>Range FM</th>
<th>+5dBm to -95dBm below 2GHz; -5dBm to -95dBm above 2GHz</th>
<th>Range AM</th>
<th>-1dBm to -95dBm below 2GHz; -11dBm to -95dBm above 2GHz</th>
<th>Resolution:</th>
<th>0.1dB</th>
<th>Accuracy:</th>
<th>±2dB</th>
</tr>
</thead>
</table>

#### OUTPUT LEVEL RF I/O PORT

<table>
<thead>
<tr>
<th>Range FM</th>
<th>-30dBm to -130dBm below 2GHz; -40dBm to -130dBm above 2GHz</th>
<th>Range AM</th>
<th>-36dBm to -130dBm below 2GHz; -46dBm to -130dBm above 2GHz</th>
<th>Resolution:</th>
<th>0.1dB</th>
<th>Accuracy:</th>
<th>±1dB to 1GHz; ±2dB &gt; 1GHz</th>
</tr>
</thead>
</table>

#### SPECTRAL PURITY

<table>
<thead>
<tr>
<th>Harmonic Spurious:</th>
<th>-20dBc max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Harmonic Spurious:</td>
<td>-35dBc max; &lt;-30dBc at mixing product frequencies (3227MHz - Carrier)</td>
</tr>
<tr>
<td>Residual FM:</td>
<td>4Hz, 300Hz to 3kHz (&lt;1GHz); 5Hz, 300Hz to 3 kHz (&gt; 1GHz)</td>
</tr>
<tr>
<td>Residual AM:</td>
<td>1.0% max, 300Hz to 3kHz</td>
</tr>
<tr>
<td>SSB Phase Noise (20 kHz Offset):</td>
<td>-95dBc/Hz max below 1GHz (15° to 35°C); -93dBc/Hz max all frequencies (0° to 50°C)</td>
</tr>
</tbody>
</table>

#### FM MODULATION

| Deviation Range: | 0 to 75kHz |
| Deviation Resolution: | 1 Hz |
| Deviation Accuracy: | 5% of setting |
| RF Output Frequency Range: | 0 to 40 kHz |
| Modulation Output Frequency Range: | 0 to 20kHz |
| RF Output Modulation Bandwidth: | DC to 100 kHz |
| Modulation Output Bandwidth: | 5 Hz to 20kHz |
| IF Bandwidth: | > 200 kHz |
| Pre-emphasis: | 750 µs (selectable) |
| Total Harmonic Distortion: | 1% (1 kHz rate, 6 kHz Deviation FM, 300 Hz to 3 kHz Audio BW) |

#### AM MODULATION

| Deviation Range: | 0 to 90% (AM Depth) |
| Deviation Resolution: | 1% |
| Deviation Accuracy: | 5% of setting |
| RF Output Modulation Frequency Range: | 0 to 40 kHz |
| Modulation Output Frequency Range: | 0 to 20 kHz |
| RF Output Bandwidth: | DC to 100 kHz |
| Modulation Output Bandwidth: | 5 Hz to 20kHz |
| IF Bandwidth: | > 200 kHz |
| Total Harmonic Distortion: | 1% (1 kHz rate, 10 % to 85 % AM, 300 Hz to 3 kHz Audio BW) |

#### SSB-AM (USB or LSB) Modulation

| AM Depth Range: | 0 to 90% |
| Depth Resolution: | 1% |
| Modulation Bandwidth: | 300Hz to 20kHz |

#### Receiver (Transmitter Test)

**Frequency Range**: 250kHz – 1GHz (3GHz optional)

#### SENSITIVITY

| Narrowband FM: | 2.0uV for 10dB EIA SINAD |
| Wideband FM: | 10uV for 10dB EIA SINAD |
| AM: | 10uV for 10dB EIA SINAD |
### RF I/O PORT

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>VSWR</td>
<td>&lt; 1.2 to 2GHz, ∼1.5 to 3GHz</td>
</tr>
<tr>
<td>Max Power</td>
<td>50W for 5 minutes</td>
</tr>
<tr>
<td>Absolute Max Power</td>
<td>150W for 30 seconds (30 sec. on, 5 min. off)</td>
</tr>
<tr>
<td>Alarm</td>
<td>Internal temperature alarm</td>
</tr>
</tbody>
</table>

### ANTENNA PORT

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Power</td>
<td>0dBm</td>
</tr>
<tr>
<td>Alarm</td>
<td>+10dBm</td>
</tr>
</tbody>
</table>

### IF FILTERS:

- 6.25kHz, 12.5kHz, 25kHz, 50kHz, 100kHz, 200kHz

### FREQUENCY ERROR MEASUREMENT

- Type of Display: Autoranging
- Resolution: 1Hz

### FM DEVIATION MEASUREMENT

- Demodulation Range: Up to ±75kHz
- Accuracy: ±5% plus residual FM
- Frequency Response: Selectable per the following:
  - Low Pass Filters: 300Hz, 3kHz, 20kHz
  - High Pass Filters: 1Hz, 300Hz, 3kHz

### DEMOD HARDWARE CHARACTERISTICS

- Demodulation Output Level:
  - 6.25kHz B/W: 2.56V / 1kHz
  - 12.5kHz B/W: 1.28V / 1kHz
  - 25kHz B/W: 0.64V / 1kHz
  - 50kHz B/W: 0.32V / 1kHz
  - 100kHz B/W: 1.6V / 10kHz
  - 200kHz B/W: 0.8V / 10kHz
- Demodulation Output Amplitude Flatness: ±0.2dB (300Hz to 3kHz), 1dB point @ 20kHz
- Demodulation Output Impedance: 100 ohms nominal

### AUDIO WEIGHTING FILTERS

- Filters: none, C-message, CCITT
- De-emphasis (selectable): 750's

### AM MODULATION MEASUREMENTS

- Demodulation Range: 0 to 100%
- Accuracy: ±5% for levels below 80%
- Frequency Response: Selectable per the following:
- Demodulation Output Level:
  - Low Pass Filters: 300Hz, 3kHz, 20kHz
  - High Pass Filters: 1Hz, 300Hz, 3kHz
- Demodulation Output Amplitude Flatness: 0.8V peak per 10% AM Modulation
- Output Impedance: ±0.2dB (300Hz to 3kHz), 1dB point @ 20kHz
- 100 ohms nominal
- SSB Sideband Suppression: >70 dB

### RECEIVE SIGNAL STRENGTH LEVEL METER

- Frequency Range: 1MHz to 1GHz (250kHz to 1GHz typical); Optional to 3GHz
- Accuracy: ±2dB
- Sensitivity: -120dBm (Antenna Port; Preamp on; 6.25kHz IF B/W)
**Spectrum Analyzer**

**Sweep**
- Frequency Range: 1 MHz to 1 GHz (250 kHz to 1 GHz typical); Optional to 3 GHz
- Frequency Resolution: 1 Hz
- Span Accuracy: 5%
- Update Rate: ~10 times per second (depending on span)

**Amplitude**
- Level Accuracy: ±2 dB
- Scales (dB/div): 10 (1, 2, & 5 with ESA option)
- Log Linearity Accuracy: <0.1 dB
- Reference Level Resolution: 1 dB
- Reference Level Range: +60 to -70 dB
- T/R Port Dynamic Range: 80 dB
- Typical Noise Floor Performance: -140 dBm
- SSB Phase Noise (20 kHz Offset): -95 dBc/Hz max below 1 GHz (15° to 35° C)
- -93 dBc/Hz max all frequencies (0° to 50° C)
- Resolution Bandwidth: Auto Selected
- Harmonic Spurious (Antenna Port, No Attenuation): -20 dBc max
- Non-Harmonic Spurious (Antenna Port, No Attenuation): -60 dBc max
- Residual Spurious (Input Terminated): -70 dBm
- Markers: Delta, Absolute, and Frequency
- Modes: Standard, Average, Freeze, Max Hold, and Peak Hold

**Sine AM Meter**
- Accuracy: ±1 dB @ 12 dB SINAD
- Input Level: 0.1 V rms min
- Frequency Range: 300 Hz to 10 kHz
- Reading Range: 0 to >60 dB
- Resolution: 0.01 dB

**Distortion Meter**
- Reading Range: 0.00% to 100%
- Distortion Accuracy: The greater of: ±0.5% of distortion or ±10% of reading
- Input Level: 0.1 V rms min
- Frequency Range: 300 Hz to 10 kHz
- Resolution: 0.01%

**Optional Modes**
- DMR (MOTOTRBO™), dPMR, NDXN (Conventional and Type-C Trunking)
- P25 Phase 1 (Conventional and Trunking), P25 Phase 2, PTC (ITCR), TETRA

**Broadband Power Meter (RF In/Out Port)**
- Frequency Range: 1 MHz to 1 GHz (250 kHz to 1 GHz typical); Optional to 3 GHz
- Measurement Range: 0.1 W to 150 W
- Input Impedance: 50 Ohms
- Accuracy: ±10% (2 KHz - 1 GHz); ±10% (1 GHz - 3 GHz <2.5 W)
- Protection: Over temperature alarms
- Frequency Range: 1 MHz to 1 GHz (250 kHz to 1 GHz typical); Optional to 3 GHz
- Period Counter Range: 5 Hz to 20 kHz
- Input Level: 0.1 V rms min
- Measurement Range: 0.1 W to 150 W
- Input Impedance: 50 Ohms
- Accuracy: ±10% (2 KHz - 1 GHz); ±10% (1 GHz - 3 GHz <2.5 W)
- Protection: Over temperature alarms
- Log Linearity Accuracy: <0.1 dB
- Reference Level Resolution: 1 dB
- Reference Level Range: +60 to -70 dB
- T/R Port Dynamic Range: 80 dB
- Typical Noise Floor Performance: -140 dBm
- SSB Phase Noise (20 kHz Offset): -95 dBc/Hz max below 1 GHz (15° to 35° C)
- -93 dBc/Hz max all frequencies (0° to 50° C)
- Resolution Bandwidth: Auto Selected
- Harmonic Spurious (Antenna Port, No Attenuation): -20 dBc max
- Non-Harmonic Spurious (Antenna Port, No Attenuation): -60 dBc max
- Residual Spurious (Input Terminated): -70 dBm
- Markers: Delta, Absolute, and Frequency
- Modes: Standard, Average, Freeze, Max Hold, and Peak Hold
Oscilloscope

**VERTICAL INPUT**

- **Input Impedance:** 1 Meg Ohm / 600 Ohm (Selectable)
- **Range:** ±70 VDC, ±33 Vrms AC / ±24 VDC, ±15 Vrms AC
- **Accuracy:** 5% of full scale
- **Bandwidth:** 0 to 50kHz

**HORIZONTAL SWEEP**

- **Range:** 20 uSec to 1 Sec / div. (Selectable)

**TRIGGER SELECTION**

- Normal, Auto (Free Running), Single Sweep and Freeze

**SPECIAL FUNCTIONS**

- Markers: Absolute Voltage, Delta Voltage, Delta Frequency and Delta Period

**Audio Modulation Synthesizer**

- **Modulation Types:** 1 kHz tone, Standard formats (Private Line, Digital Private Line, DPL Invert, Two-Tone Paging, 5/6 Tone Paging, POCSAG, EURO Tones, or User Defined Tone Sequences), Tone-A, Tone B, Tone C (RF Output), DTMF, and external inputs from both a supplied microphone and BNC connector.

- **Modulation Output Level:** ±8V peak (±16/BW V/kHz FM, ±0.08V/% AM)
- **Amplitude Flatness:** ±0.2dB (300Hz to 3kHz), 1dB point @ 20kHz
- **1 kHz Tone Distortion:** Not to exceed 1% THD
- **Impedance:** 100 Ohms

- **Modulation Input Level:** ±1V peak reference
- **Amplitude Flatness:** ±0.2dB (300Hz to 3kHz), 1dB point @ 20kHz
- **Impedance:** 600 Ohms

- **Microphone Input Amplitude Flatness:** ±0.2dB (300Hz to 3kHz), 1dB point @ 20kHz

**Tracking Generator**

- **Frequency Range:** 1MHz to 1GHz (250kHz to 1GHz typical); Optional to 3GHz

**Digital Voltmeter (DVM)**

- **Input Impedance:** 1 Meg Ohm / 600 Ohm (Selectable)
- **Voltage Range:** 1V, 10V, 70V full scale
- **Frequency Range:** 50Hz to 20kHz
- **DC Accuracy:** 1% full scale ±1 LSB
- **AC Accuracy:** 5% full scale ±1 LSB

**Timebase**

- **Output Frequency:** 10MHz
- **Stability:** Aging: ±0.1ppm / year  Temp.: ±0.01ppm
- **Output Level:** Minimum 0dBm into 50 Ohms
- **Warm Up:** 3 minutes: within ±0.1ppm

**Display**

**FRONT PANEL DISPLAY**

- **Resolution:** 800 x 600
- **Size:** Size: 8.4" (21.3cm) Full Color LCD

**EXTERNAL DISPLAY**

- **External Display:** VGA

**REMOTE FRONT PANEL**

- **Remote Front Panel:** Available over Ethernet
## Supplemental Digital Specifications

### DMR

<table>
<thead>
<tr>
<th>Specification</th>
<th>Range</th>
<th>Accuracy (2% to 10%)</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSK ERROR</td>
<td>0 to 10%</td>
<td>&lt;5%</td>
<td>0.01%</td>
</tr>
<tr>
<td>MAGNITUDE ERROR</td>
<td>0-5%</td>
<td>&lt;5% of reading</td>
<td>0.01%</td>
</tr>
<tr>
<td>SYMBOL DEVIATION</td>
<td>1500 to 2350Hz</td>
<td>±10Hz</td>
<td>.1Hz</td>
</tr>
<tr>
<td>BER</td>
<td>0 to 20%</td>
<td></td>
<td>0.00001%</td>
</tr>
</tbody>
</table>

### dPMR

<table>
<thead>
<tr>
<th>Specification</th>
<th>Range</th>
<th>Accuracy (2% to 10%)</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSK ERROR</td>
<td>0 to 10%</td>
<td>&lt;5%</td>
<td>0.01%</td>
</tr>
<tr>
<td>MAGNITUDE ERROR</td>
<td>0-5%</td>
<td>&lt;5% of reading</td>
<td>0.01%</td>
</tr>
<tr>
<td>SYMBOL DEVIATION</td>
<td>1500 to 2350Hz</td>
<td>±10Hz</td>
<td>.1Hz</td>
</tr>
<tr>
<td>BER</td>
<td>0 to 20%</td>
<td></td>
<td>0.00001%</td>
</tr>
</tbody>
</table>

### NXDN

<table>
<thead>
<tr>
<th>Specification</th>
<th>Range</th>
<th>Accuracy (2% to 10%)</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSK ERROR</td>
<td>0 to 10%</td>
<td>&lt;5%</td>
<td>0.01%</td>
</tr>
<tr>
<td>MAGNITUDE ERROR</td>
<td>0-5%</td>
<td>&lt;5% of reading</td>
<td>0.01%</td>
</tr>
<tr>
<td>SYMBOL DEVIATION</td>
<td>840 to 1260Hz (4800bps) 1920 to 2880Hz (9600bps)</td>
<td>±10Hz</td>
<td>.1Hz</td>
</tr>
<tr>
<td>BER</td>
<td>0 to 20%</td>
<td></td>
<td>0.00001%</td>
</tr>
</tbody>
</table>

### TETRA

<table>
<thead>
<tr>
<th>Specification</th>
<th>Range</th>
<th>Accuracy (2% to 10%)</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVM (RMS)</td>
<td>0 to 20%</td>
<td>&lt;10%</td>
<td>0.10%</td>
</tr>
<tr>
<td>RESIDUAL CARRIER</td>
<td>0-10%</td>
<td>±0.1%</td>
<td>0.10%</td>
</tr>
<tr>
<td>FREQUENCY ERROR</td>
<td>±500Hz</td>
<td></td>
<td>1 Hz</td>
</tr>
<tr>
<td>BER</td>
<td>0 to 20%</td>
<td></td>
<td>0.01%</td>
</tr>
</tbody>
</table>

### P25 MEASUREMENT MODULATION FIDELITY

<table>
<thead>
<tr>
<th>Specification</th>
<th>Range</th>
<th>Accuracy (2% to 10%)</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>BER</td>
<td>0 to 20%</td>
<td>&lt;5.0% of reading</td>
<td>0.01%</td>
</tr>
</tbody>
</table>

#### Remote Interface (Optional Feature)

**REMOTE FRONT PANEL**

Available over Ethernet

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**FREEDOM**

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