

# **FREEDOM** Communications System Analyzer **R8000C**



**DATA SHEET**

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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:

Level (DANL):	-140 dBm (50 Ohm input termination)
Dynamic Range:	80 dB
Input Related Spurious:	-60 dBc max
Residual Spurious (non-input related):	-70 dBm

### Power

DC Power Requirements:	24 VDC @ 5.0 A max
AC Adapter Specs:	100-240 VAC, 2.5 A max, 50-60 Hz
Battery Power:	Optional External Battery
Battery Operation:	1 hour minimum

### MECHANICAL/ENVIRONMENTAL

Weight:	11.7 lbs (5.3kg)
Dimensions:	9.4" (23.9 cm) H, 12.7" (32.3 cm) W, 7.5" (19.1 cm) 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:	-30° to +80°C

### 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

Range FM:	+5dBm to -95dBm below 2GHz; -5dBm to -95dBm above 2GHz
Range AM:	-1dBm to -95dBm below 2GHz; -11dBm to -95dBm above 2GHz
Resolution:	0.1dB
Accuracy:	±2dB

### OUTPUT LEVEL RF I/O PORT

Range FM:	-30dBm to -130dBm below 2GHz; -40dBm to -130dBm above 2GHz
Range AM:	-36dBm to -130dBm below 2GHz; -46dBm to -130dBm above 2GHz
Resolution:	0.1dB
Accuracy:	±1dB to 1GHz ; ±2dB > 1GHz

### SPECTRAL PURITY

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

### 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)

### AM MODULATION

Deviation Range:	0 to 90% (AM Depth)
Deviation Resolution:	1%
Deviation Accuracy:	5% of setting
RF Output Frequency Range:	0 to 40 kHz
Modulation Output Frequency Range:	0 to 20 kHz
RF Output Modulation Bandwidth:	DC to 100 kHz
Modulation Output Bandwidth:	5 Hz to 20kHz
IF Bandwidth:	> 200 kHz

### 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)
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### 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

VSWR:	< 1.2 to 2GHz, ~ 1.5 to 3GHz
Max Power:	50W for 5 minutes 150W for 30 seconds (30 sec. on, 5 min. off)
Absolute Max Power:	150W
Alarm:	Internal temperature alarm

## ANTENNA PORT

Maximum Power:	0dBm
Alarm:	+10dBm

## 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 $\pm 75$ kHz
Accuracy:	$\pm 5\%$ plus residual FM
Frequency Response:	Selectable per the following: Low Pass Filters: 300Hz, 3kHz, 20kHz High Pass Filters: 1Hz, 300Hz, 3kHz

## DEMODO HARWARE 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:	$\pm 0.2$ dB (300Hz to 3kHz), 1dB point @ 20kHz
Demodulation Output Impedance:	100 ohms nominal

## AUDIO WEIGHTING FILTERS

Filters:	none, C-message, CCITT
De-emphasis (selectable):	750 $\mu$ s

## AM MODULATION MEASUREMENTS

Demodulation Range:	0 to 100%
Accuracy:	$\pm 5\%$ 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:	$\pm 0.2$ dB (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:	$\pm 2$ dB
Sensitivity:	-120dBm (Antenna Port; Preamplicifier on; 6.25kHz IF B/W)

## BROADBAND POWER METER (RF In/Out Port)

Frequency Range:	1MHz to 1GHz (250kHz to 1GHz typical); Optional to 3GHz
Measurement Range:	0.1W to 150W
Input Impedance:	50 Ohms
Accuracy:	±10%(2 KHz - 1GHz); ±10%(1GHz - 3GHz <2.5W)
Protection:	Over temperature alarms

## FREQUENCY COUNTER

Frequency Range:	5Hz to 100kHz
Period Counter Range:	5Hz to 20kHz
Input Level:	0.1V rms min

## SINAD METER

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

## DISTORTION METER

Reading Range:	0.00% to 100%
Distortion Accuracy:	The greater of: ±0.5% of distortion or ±10% of reading
Input Level:	0.1V rms min
Frequency Range:	300Hz to 10kHz
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), PTC(ACSES), TETRA DMO, TETRA TMO, TETRA Base Station Monitoring, TETRA Base Station T1

# Spectrum Analyzer

## SWEEP

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

## AMPLITUDE

Level Accuracy:	±2 dB
Scales (dB/div):	10 (1,2, & 5 w/ESA option)
Log Linearity Accuracy:	<0.1dB
Reference Level Resolution:	1dB
Reference Level Range:	+60 to -70dB
T/R Port Dynamic Range:	80dB
Typical Noise Floor Performance:	-140dBm
SSB Phase Noise (20 kHz Offset):	-95dBc/Hz max below 1GHz (15° to 35° C) -93dBc/Hz max all frequencies (0° to 50° C)
Resolution Bandwidth	Auto Selected
Harmonic Spurious (Antenna Port, No Attenuation):	-20dBc max
Non-Harmonic Spurious (Antenna Port, No Attenuation):	-60dBc max
Residual Spurious (Input Terminated):	-70dBm
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:	$\pm 100\text{VDC}$ , $\pm 70\text{Vrms AC}$
Accuracy:	5% of full scale
Bandwidth:	0 to 50kHz

### HORIZONTAL SWEEP

Range:	20 uSec to 1 Sec / div. (Selectable)
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### TRIGGER SELECTION

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

### SPECIAL FUNCTIONS

Markers:	Absolute Voltage, Delta Voltage, Delta Frequency and Delta Period
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## 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:	$\pm 8\text{V peak}$ ( $\pm 16/\text{BW V/kHz FM}$ , $\pm 0.08\text{V/\% AM}$ )
Amplitude Flatness:	$\pm 0.2\text{dB}$ (300Hz to 3kHz), 1dB point @ 20kHz
1 kHz Tone Distortion:	Not to exceed 1% THD
Impedance:	100 Ohms
Modulation Input Level:	$\pm 1\text{V peak reference}$
Amplitude Flatness:	$\pm 0.2\text{dB}$ (300Hz to 3kHz), 1dB point @ 20kHz
Impedance:	600 Ohms
Microphone Input Amplitude Flatness:	$\pm 0.2\text{dB}$ (300Hz to 3kHz), 1dB point @ 20kHz

## Tracking Generator

Frequency Range:	1MHz to 1GHz (250kHz to 1GHz typical); Optional to 3GHz
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## 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 $\pm 1$ LSB
AC Accuracy:	5% full scale $\pm 1$ LSB

## Timebase

Output Frequency:	10MHz
Stability:	Aging: $\pm 0.1\text{ppm / year}$ Temp.: $\pm 0.01\text{ppm}$
Output Level:	Minimum 0dBm into 50 Ohms
Warm Up:	3 minutes: within $\pm 0.1\text{ppm}$

## Display

### FRONT PANEL DISPLAY

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

### EXTERNAL DISPLAY

External Display:	VGA
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### REMOTE FRONT PANEL

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

DMR	
FSK ERROR	
Range:	0 to 10%
Accuracy (2% to 10%):	<5%
Resolution:	0.01%
MAGNITUDE ERROR	
Range:	0-5%
Accuracy:	<5% of reading
Resolution:	0.01%
SYMBOL DEVIATION	
Range:	1500 to 2350Hz
Accuracy:	±10Hz
Resolution:	.1Hz
BER	
Range:	0 to 20%
Resolution:	0.00001%

NXDN	
FSK ERROR	
Range:	0 to 10%
Accuracy (2% to 10%):	<5%
Resolution:	0.01%
MAGNITUDE ERROR	
Range:	0-5%
Accuracy:	<5% of reading
Resolution:	0.01%
SYMBOL DEVIATION	
Range:	840 to 1260Hz (4800bps) 1920 to 2880Hz (9600bps)
Accuracy:	±10Hz
Resolution:	.1Hz
BER	
Range:	0 to 20%
Resolution:	0.00001%

dPMR	
FSK ERROR	
Range:	0 to 10%
Accuracy (2% to 10%):	<5%
Resolution:	0.01%
MAGNITUDE ERROR	
Range:	0-5%
Accuracy:	<5% of reading
Resolution:	0.01%
SYMBOL DEVIATION	
Range:	1500 to 2350Hz
Accuracy:	±10Hz
Resolution:	.1Hz
BER	
Range:	0 to 20%
Resolution:	0.00001%

TETRA	
EVM (RMS)	
Range:	0 to 20%
Accuracy (2% to 10%):	<10%
Resolution:	0.10%
RESIDUAL CARRIER	
Range:	0-10%
Accuracy:	±0.1%
Resolution:	0.10%
FREQUENCY ERROR	
Accuracy:	±500Hz
Resolution:	1 Hz

P25 MEASUREMENT MODULATION FIDELITY	
Range:	0 to 10%
Resolution:	0.01%
Accuracy:	<5.0% of reading for 2.0 % and higher

## Remote Interface (Optional Feature)

### REMOTE FRONT PANEL

Available over Ethernet

# FREEDOM

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