FREEDOM
Communications System Analyzer
R8000C

DATA SHEET

FREEDOM
Communication Technologies

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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 10,000 ft (3048 m)
Humidity:	80% maximum relative humidity
Operating Temperature:	0º to 50º C
Storage Temperature:	-30º to +80º 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 Accuracy:	5% of setting
Deviation Range:	0 to 75kHz
Deviation Resolution:	1Hz
Pre-emphasis (selectable):	750µs
Modulation Bandwidth:	5Hz to 20kHz
AM MODULATION	
AM Depth Range:	0 to 90%
Deviation Resolution:	1% of setting
Modulation Bandwidth:	100Hz to 10kHz
Deviation Accuracy:	5% of setting

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	
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 ±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):	750µs

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 Ouput Amplitude Flatness:	0.8V peak per 10% AM Modulation
Output Impedance:	±0.2dB (300Hz to 3kHz),1dB point @ 20kHz
	100 ohms nominal

RECEIVE SIGNAL STRENGTH LEVEL METER	
Frequency Range:	1MHz to 1GHz (250kHz to 1GHz typical); Optional to 3GHz
Accuracy:	±2dB
Sensitivity:	-120dBm (Antenna Port; Preamplifier 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
DISTORTION METER	
Range:	1% to 20%
Distortion Accuracy:	The greater of: ±0.5% of distortion or ±10% of reading
Input Level:	0.1V rms min
OPTIONAL MODES	
	DMR (MOTOTRBO™), NDXN, NXDN Type C Trunking, P25 Phase 1 (Conventional and Trunked), P25 Phase 2, TETRA, PTC (ITCR)

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 Porta, 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:	±100VDC, ±70Vrms 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, Private Line, Digital Private Line (w/ DPL Invert), Single Tone, DTMF,Two-Tone Paging, 5/6 Tone Paging, POCSAG, A&B Independent Synths., EURO Tones, User Def ned Tone Sequences, and External inputs from both a supplied micro-phone and BNC input.
Modulation Ouput Level:	Programmable to ±8V peak
Amplitude Flatness:	±0.2dB (300Hz to 3kHz), 1dB point @ 20kHz
1 kHz Tone Distortion:	Not to exceed 1% THD
Impedance:	100 Ohms
External Modulation Input Level:	±1V peak reference
Amplitude Flatness:	±0.2dB (300Hz to 3kHz), 1dB point @ 20kHz
Impedance:	600 Ohms
External 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	
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%

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%

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%

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
Communication Technologies

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