

**SECTION 41 66 10
MOBILE GROUND PENETRATING RADAR EQUIPMENT**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Specifications for Mobile Ground Penetrating Radar Equipment, including:
 - 1. System
 - 2. System Scan Modes
 - 3. Radar Power Requirements
 - 4. Radar Hardware Requirements
 - 5. Physical Characteristics
 - 6. Dual Frequency
 - 7. Recommended PC Requirements
 - 8. Software
 - 9. GPS Requirements

1.02 REFERENCE STANDARDS

- A. D6432-11 - Standard Guide for Using the Surface Ground Penetrating Radar Method for Subsurface Investigation

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administration of Contracts and Project Procedures, for submittal procedures.
- B. Product Data: Provide product literature for mobile ground penetrating radar equipment.
- C. Certificate: Certify that products of this section meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Subsite Electronics (www.subsite.com).
- B. GSSI (geophysical.com).
- C. USRADAR INC..

2.02 MOBILE GROUND PENETRATING RADAR EQUIPMENT

- A. System

Survey Path Width:	19.68 inches
Recording Channels:	2
Transmit Pulse Frequency:	200 kHz
Typical Antenna Frequency:	250 and 70 MHz
Typical Collection Speed (scans/second):	100
Typical Collection Speed at 2-in (5cm)	5.6 mph
Sampling Interval:	
Display Mode:	Gray scale/color palette
Zoom:	Up to 4x
Data Storage:	Laptop hard drive
Profile Length, max:	Virtually unlimited
Stored Data Format:	Raw data (for further data analysis)

Setting of GPR Propagation Velocity (for accurate depth of targets):	Ground truth or hyperbola fitting methods
Reading of Pipe Position/Depth:	Software cursor
System Output:	Printable radar map with descriptor of detected utilities
Diagnostic:	Radar and power supply status, excessive speed, data loss
Data Collection Type:	Parallel profile lines, perpendicular to the expected orientation of utilities

B. B. System Scan Modes

Maximum Typical Logging Scan Rate:	390 Scans per second
Trigger Modes:	Free Run, timed interval, shaft encoder, GPS, manual
Nominal Sampling Rate:	650,000,000 samples per second
Maximum Sample Rate:	100 Gigasamples per second
Hardware Time Varying Gain:	45dB
Software Time Varying Gain:	60dB
Software Flate Gain:	60dB

C. C. Radar Power Requirements

Battery Operating Time:	<10 hours
Power Supply:	12V sealed lead acid, 12 Ah

D. D. Radar Hardware Requirements

Total System Dynamic Range:	>130dB
Receiver Dynamic Range:	>90dB
Sampling Interval:	10 ps-6.4 ns
Time Range Adjustment Interval:	10 ps
Pulse Repetition Frequency:	0.1-4 MHz-adjustable
Samples Per Trace:	2-8192, adjustable
Effective Bandwidth (typ.):	>4 GHz
Stacking:	Automatic
Transmitter:	Stepped Ultra Wideband Triple Frequency

E. E. Physical Characteristics (weight, width, length and height are shown as max or typical for 4-wheel cart - will vary by model/manufacturer)

Operating Temperature:	14- 104 degrees Fahrenheit
Humidity:	100% (sealed)
Weight, without Battery or PC	60 lbs.
Weight, without PC:	68 lbs.
Weight, Total:	73 lbs.
Width:	21 inch.
Length, Handle Fully Extended:	50 inch.
Length, Folded:	40 inch.
Height, Handle Fully extended:	40 in.
Height, Folded:	20 inch.

F. F. Dual Frequency

Antenna Technology:	Ultra-wide band, ground coupled, shielded dipole
Typical Range:	.32- 8.2 feet
Range, max:	.32-19.7ft.

G. G. Recommended PC Specifications

Processor:	Intel Core i5 1.9 GHz (minimum: Intel Core i3 1.7 GHz)
RAM:	4GB (minimum 1GB)
Display:	11.6 inch, HD daylight-readable, ten-point multi touch + digitizer
Operating System:	Windows 7 or 10 (64 bit)
I/O Interface:	Ethernet port, DC power port, HDMI, Wi-Fi and Bluetooth
Communications:	Wi-Fi, Bluetooth, and optional 4GLTE or 3G Gobi
Durability:	MIL-STD-810G, 4-foot drop and all-weather IP65 dust and water-resistant design
Shock Proof Hard Disk Drive	
Serial Port RS 232 (only used with the GPS)	
USB 3.0 Port	
Intel HD Graphics 3000 or nVidia graphic adapter compatible with OpenGL 2.1 or newer (minimum: graphic adapter compatible with Open GL 2.1)	

H. H. Software:

Microsoft Windows
A Scan Display (Oscilloscope Mode)
B Scan Display (Cross-Sectional View)
C Scan Display (3D)
Real-time Signal Processing
Data Storage and Playback

I. I. GPS Requirements

1. 1. System may be specified to be used with a GPS to position the scans in real time without the need of creating a grid. Requirements are:
 - a. a. Dual frequency (L1+L2)
 - b. b. Positioning update greater than 5Hz
 - c. c. RTK: connection to a base station via radio link (UHF or GSM) or connection to a Continuously Operating Reference Station (CORS) via internet
 - d. d. NMEA output
 - e. e. Serial cable (RS232) or Bluetooth connectivity

PART 3 EXECUTION

3.01 3.01 OPERATION

- A. A. Operate equipment in accordance with manufacturer's instructions

3.02 3.02 ADJUSTING

- A. A. Adjust Mobile Ground Radar Penetrating Equipment for smooth operation, as needed.

END OF SECTION 41 66 10