

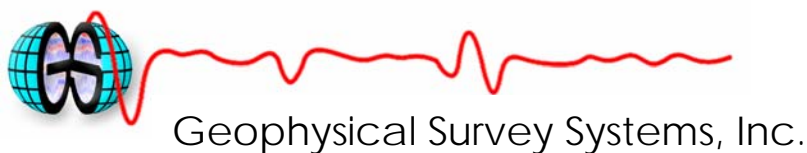
# Model 4105 Horn Antenna

## System Settings and User Notes



*The Difference is the Data*

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## **FCC Notice (for U.S. Customers):**

This device complies with part 15 of the FCC Rules:

Operation is subject to the following conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation

**Warning:** Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Operation of this device is restricted to law enforcement, fire and rescue officials, scientific research institutes, commercial mining companies, and construction companies. Operation by any other party is a violation of 47 U.S.C. § 301 and could subject the operator to serious legal penalties.

### **Coordination Requirements.**

(a) UWB imaging systems require coordination through the FCC before the equipment may be used. The operator shall comply with any constraints on equipment usage resulting from this coordination.

(b) The users of UWB imaging devices shall supply detailed operational areas to the FCC Office of Engineering and Technology who shall coordinate this information with the Federal Government through the National Telecommunications and Information Administration. The information provided by the UWB operator shall include the name, address and other pertinent contact information of the user, the desired geographical area of operation, and the FCC ID number and other nomenclature of the UWB device. This material shall be submitted to the following address:

Frequency Coordination Branch., OET  
Federal Communications Commission  
445 12<sup>th</sup> Street, SW  
Washington, D.C. 20554  
ATTN: UWB Coordination

(d) Users of authorized, coordinated UWB systems may transfer them to other qualified users and to different locations upon coordination of change of ownership or location to the FCC and coordination with existing authorized operations.

(e) The NTIA/FCC coordination report shall include any needed constraints that apply to day-to-day operations. Such constraints could specify prohibited areas of operations or areas located near authorized radio stations for which additional coordination is required before operation of the UWB equipment. If additional local coordination is required, a local coordination contact will be provided.

(f) The coordination of routine UWB operations shall not take longer than 15 business days from the receipt of the coordination request by NTIA. Special temporary operations may be handled with an expedited turn-around time when circumstances warrant. The operation of UWB systems in emergency situations involving the safety of life or property may occur without coordination provided a notification procedure, similar to that contained in CFR47 Section 2.405(a)-(e), is followed by the UWB equipment user.

**NOTICE:** Use of this device as a wall imaging system is prohibited by FCC regulations.

## Introduction

Thank you for purchasing a Model 4105 High Frequency Air Launched Antenna (Horn). The 4105 Horn represents the state of the art in high-speed, high-resolution pavement thickness and bridge deck analysis ground penetrating equipment. This antenna is designed for applications requiring very high resolution survey from a moving vehicle. The unique air-launched design allows you to survey at high speeds without causing damage and wear to the antenna. Furthermore, it allows GSSI's RADAN post-processing software to separate the direct-coupling reflection from the pavement surface reflection. This allows a very accurate measure of pavement thickness.

The 4105 has a center frequency of 2.0 GHz in air.

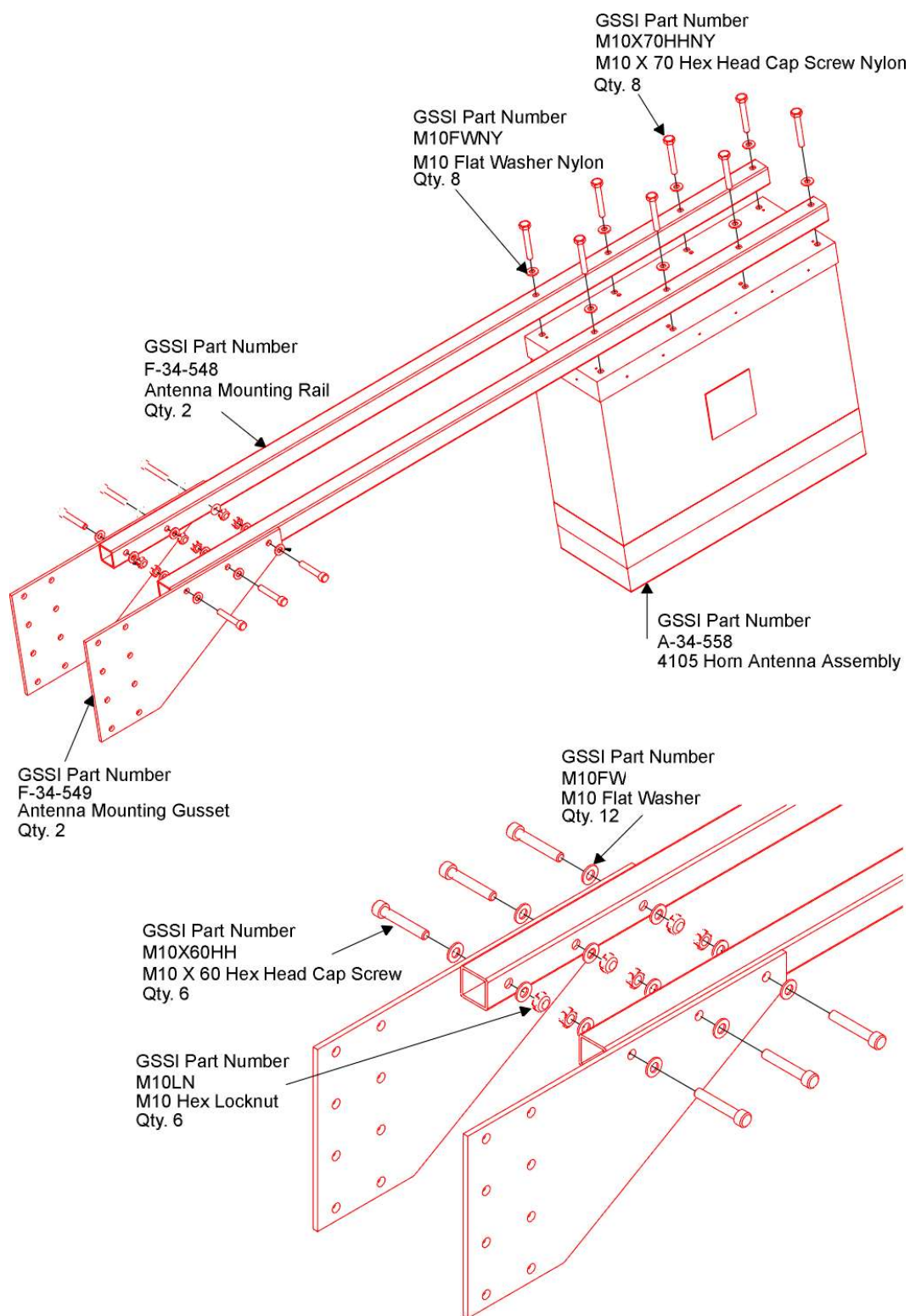
Please read through this manual, as well as the manual for the control unit you are using, thoroughly before attempting to set up and collect data.

If you experience operation problems with your system, GSSI Tech Support can be reached 9am-5pm EST, Monday-Friday, at 1-800-524-3011, or at (603) 893-1109 (International).

***The Difference is the Data***



## Antenna Mounting Assembly

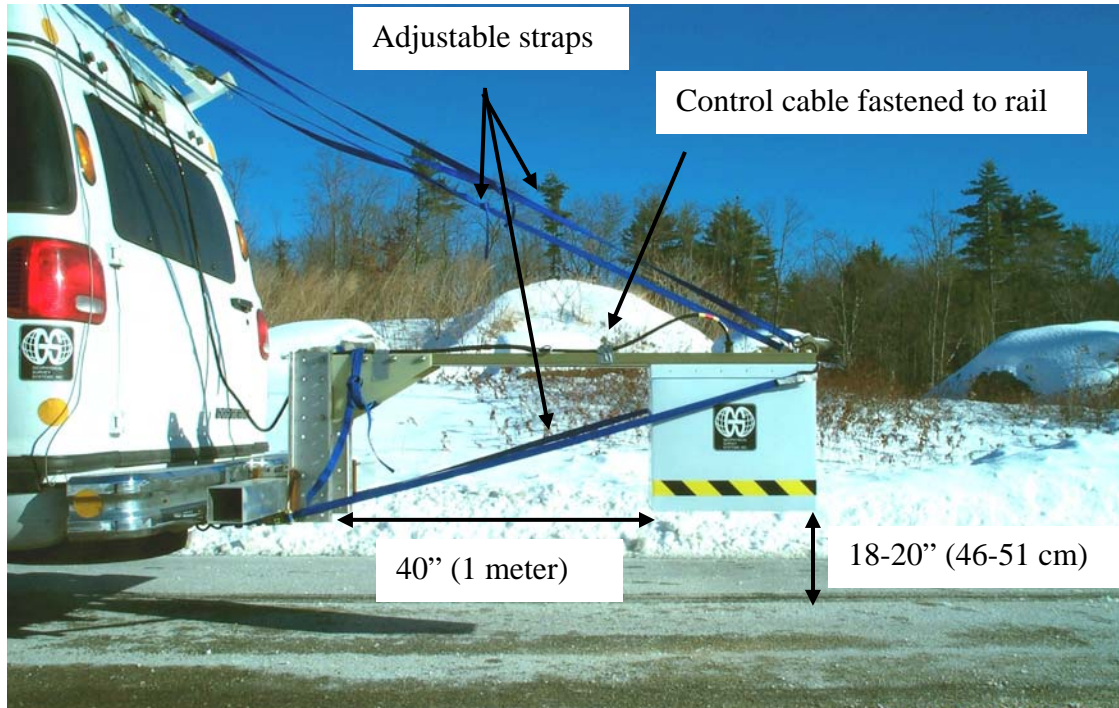




## Mounting and Data Collection Recommendations

### Mounting Specifications:

The Model 4105 antenna mounting kit includes 2 square fiberglass tubes, 2 gusset plates and associated hardware. Figure 1 shows a typical 4105 setup on the back of GSSI's van.



**Figure 1: Typical Model 4105 setup showing fiberglass rods and gusset plates.  
The vertical metal pieces attached to the gusset plates are sold separately.**

GSSI recommends that you follow the following specifications for mounting the 4105 antennas:

1. Recommended antenna bottom height above pavement with vehicle stationary:  
18-20" (46 – 51 cm)
2. Recommended closest distance between antenna and significant metal (vertical metal rods or the vehicle's bumper) should be at least 40" (1 m).
3. The control cable should be fastened to one of fiberglass rails to prevent cable movement.
4. Excessive antenna bouncing should be minimized. The GSSI universal horn antenna mounting kit includes 4 adjustable straps (ratchet straps) that minimize vertical and horizontal antenna movement, especially on bumpy roads.

## Data Collection Recommendations:

The following software settings are recommended for general Model 4105 data collection. See the SIR-10B/H or SIR-20 manual for instructions on how to make setting modifications.

**Table 1. Recommended data collection settings for Model 4105 antenna.**

	<b>SIR-10B/H</b>	<b>SIR-20</b>
Transmit Rate	Fast	100-500 KHz <sup>†</sup>
Samples/Scan	512	512
<b>Scans/Sec:</b>	160	100 – 500* <sup>†</sup>
Time Range	10 ns	10 ns
Bits/Sample	16	16
Vertical Filter Settings:		
IIR High Pass	100 MHz (1 Pole)	0-1 MHz **
FIR High Pass	250 MHz (Boxcar)	250 MHz
FIR Low Pass	4000 MHz (Boxcar)	5000 MHz

\* Use higher scans/sec rate when collecting data at higher scans/m.

\*\* Use 1 MHz IIR High Pass to remove signal slopes near bottom of scan (as shown in Figure 2).

<sup>†</sup> – FCC regulations require that SIR-20 systems sold in the U.S. are limited to a transmit rate of 100 KHz.



**Position:** Signal position should be adjusted so that the latest arriving wavelet of the direct-coupling is near the top of the scan. This wavelet should always be visible in the data. GSSI's RADAN post-processing software requires the presence of this wavelet in the data. Figure 2 shows a typical scan of data with the signal properly positioned. The largest amplitude reflection will be the pavement surface. The next largest reflection will be desired direct-coupling waveform. This will occur several nanoseconds before the pavement surface reflection and appear in the Position window (below) as the next significant waveform to the left of that pavement surface. Unlike ground-coupled antennas, the desired direct-coupling waveform is not the first significant return in the trace. You may see another waveform that looks similar to the direct-coupling higher in the trace. You do not want this waveform, but the second one. Since the antenna and the pavement are separated by nothing but air, the trace between the pavement reflector and the desired waveform should be fairly flat (as below). If you accidentally set the position to the incorrect waveform, the post-processing will not work correctly.

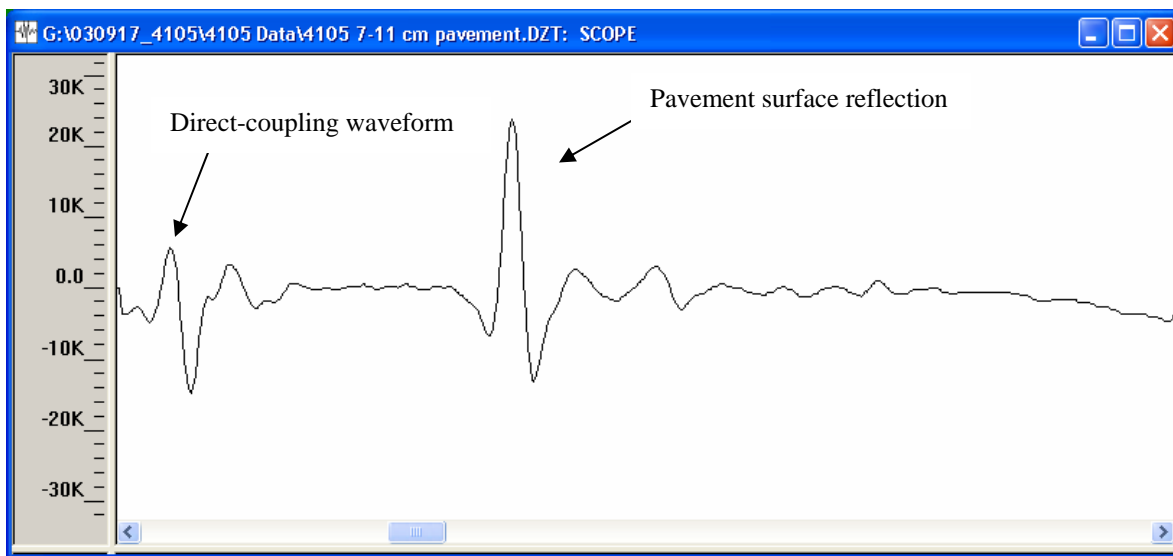


Figure 2: Typical data scan obtained with Model 4105 and recommended software settings.

**Gain:** Data collection gain for the 4105 antenna should be adjusted so that the peak amplitude of the pavement surface reflection is approximately 2/3 of the total screen width. For example, in Figure 2 the pavement surface reflection has an amplitude of approximately 20000 and the full screen width is 32000. **It is very important that the pavement surface reflection amplitude (and metal plate reflection when performing calibration) never reach its maximum (i.e., clip).** If they jump off of the top or the bottom of the window, they are collected with too much gain. This will cause errors in the post-processing. Figure 3 shows an improperly gained signal.

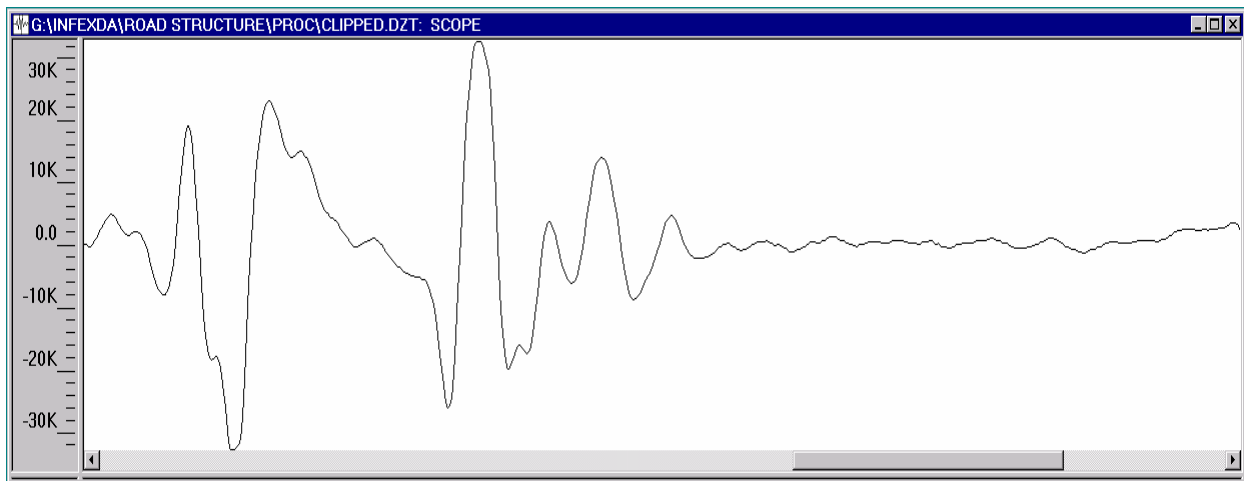




Figure 3: Example of Model 4105 data scan collected with too much gain.

## Quick Setup Procedure SIR-10B/H

1. Connect the transducer cable from the SIR unit (Channel 1) to the Model 4105 antenna.
2. Connect all other necessary cables to the SIR unit (power, video, keyboard).
3. Turn on the SIR unit.
4. From the Main menu select Recall Saved Radar Setting (Option 4).
5. Select Highway Data (Option 4).
6. From the list of antenna configurations select "2G".
7. Back in the Main menu, select Collect Radar Data (Option 2).
8. A message will appear on the screen indicating that settings have been changed, then the screen should change and you should see a signal similar to the signal shown in Figure 2 on the right side of the screen. The position of the signal may be shifted and the data collection settings may be slightly different than those currently recommended.
  - Compare all of the settings listed in the Data Collection Recommendations section to those on the SIR unit and make any necessary adjustments prior to collecting data.

## Quick Setup Procedure SIR-20

1. Connect the transducer cable from the SIR-20 (Channel 1) to the Model 4105 antenna.
2. Connect the power supply to the SIR-20.
3. Turn on the SIR-20 and wait until it is booted-up.
4. Double-click on the SIR-20 Desktop shortcut.
5. Press  to recall a saved project for the Model 4105 antenna.
  - First time users should locate the folder “Fixed SIR-20 Setups” and select the project “2.5 GHz Horn Free Run.” Note, this setup applies to both 2.0 and 2.5 GHz horns.
  - If the project cannot be found (older RADAN versions don't have this project) select the “1GHz Horn Free Run” project from the folder.
6. Press  to run the project.
7. The position of the signal may be shifted and the data collection settings may be slightly different than those currently recommended. Change the signal position if necessary so that it is similar to the signal position shown in Figure 1.
  - Compare all of the settings listed in Table 1 to those on the SIR unit and make any necessary adjustments prior to collecting data.
  - Also check the gain of the signal to make sure it is not clipping. Save any changes made to the signal position and signal gain to a new macro prior to collecting data.
  - Prior to collecting any distance-based data, the survey wheel option will need to be checked (see SIR-20 manual for details).