



Heads Up/Hands Free RSA Display

USER MANUAL

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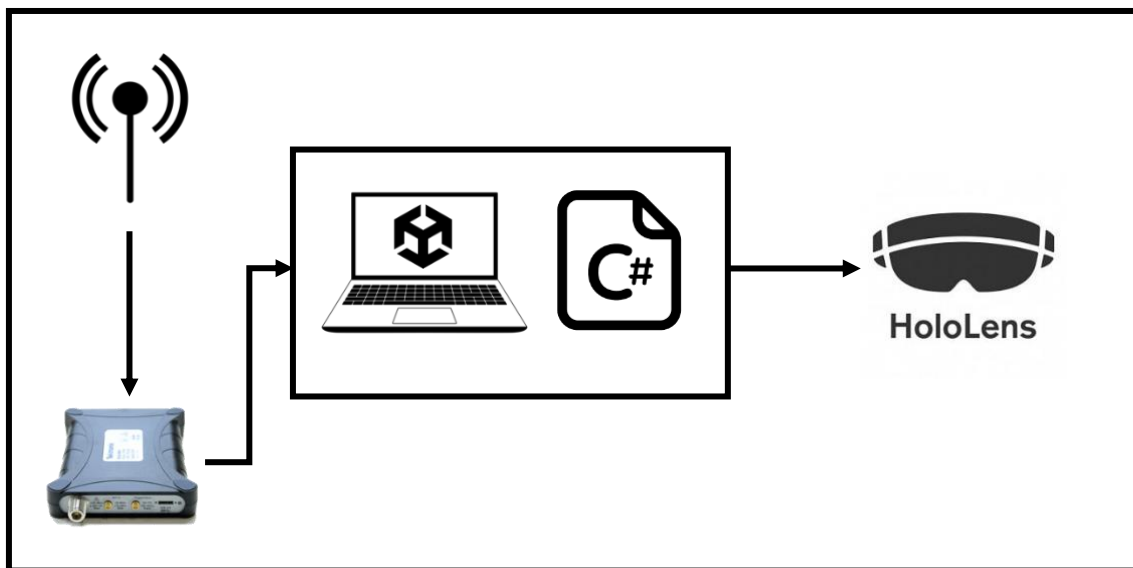
1. Statement of Purpose

The purpose of this User Manual (UM) is to provide Tektronix field surveyors the necessary information required to properly and safely, use and setup the heads up/hands free RSA display (HHRD) powered by the Microsoft HoloLens 2.

2. Overview

The primary functionality of the HHRD system is to allow users to identify signals emitting at various frequencies from nearby sources and getting an accurate visual representation of the raw data through the HoloLens. There are five key actors within the HHRD system: a compatible antenna, portable system controller (computer), Real Time Spectrum Analyzers (RSA), Microsoft HoloLens 2, and the user. As a general overview, the antenna and the RSA will work in sync to generate raw spectrum data. This data is then sent to the portable system controller where the data is analyzed in Unity (C# scripts) through integration with the RSA API and converted into a bitmap. The bitmap is then displayed onto the user interface. Below is a simple system diagram which illustrates the complete process.

System Diagram



3. Getting Started

Section 3 describes how to properly get setup to use the HHRD system.

3.1 Prerequisites

Before getting started, all the following software, hardware, and Wi-Fi requirements must be met/setup.

3.1.1 Software Installations

Associated software links can be found below in Appendix A.

- GitHub Repository
- Mixed Reality Toolkit
- SignalVu (optional)
- RSA API
- Holographic Remoting App (download on the HoloLens)
- Unity Hub (Editor Version 2020.3.41f1)
- Universal Windows Platform Build Support Module
- Windows Build Support (IL2CPP) Module

3.1.2 Hardware Connections

- Connect compatible antenna to the RSA via the RF cable.
- Connect RSA to the system controller (computer) via a USB 3.0 cable.
- Verify RSA is connected via a green light on the RSA.

3.1.3 Wi-Fi

- If running wireless, the system controller and the HoloLens 2 must be connected to the same Wi-Fi network.

3.2 Running the System

After section 3.1 prerequisites have been met, we can start running the system.

3.2.1 Connect HoloLens

Prepare the HoloLens by first booting it up and logging in by entering the pin. After login, access the *apps* folder and open **Holographic Remoting** (*Alternatively, user can use voice command and say “open holographic remoting”*). Once inside Holographic remoting, you will be prompted with a black screen with text, stating “waiting for connection on **IP address**”. HoloLens is now ready to be paired.



Figure 1.0

3.2.2 Connect Unity

Prepare Unity by opening the editor and loading the project repository from GitHub. After loading and verifying no errors, select **Mixed Reality Toolkit** located in the header options of the editor. From there, select **Remoting, Holographic Remoting for Play Mode**. In the newly prompted dialog box (figure 2.0), under “Remote *Host Name*” enter the **IP Address** prompted in section 3.2.1.

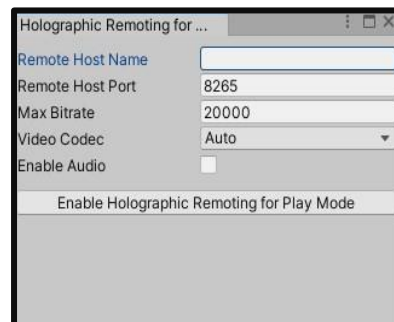


Figure 2.0

3.2.3 Execution

After the HoloLens and Unity have been set up correctly, along with the project loaded, you should now be ready to execute the program. Figure 3.0 illustrates what a successfully loaded project in unity should look like. To execute the program, simply click the **play** button at the top center of the screen.

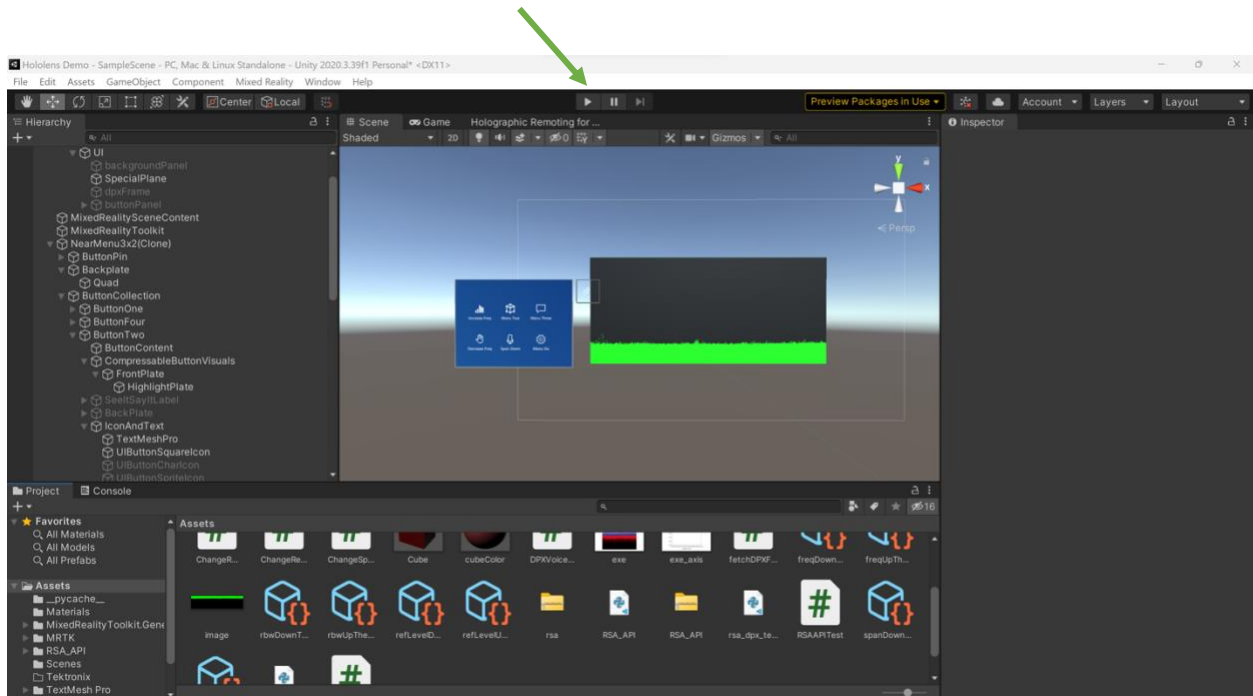


Figure 3.0

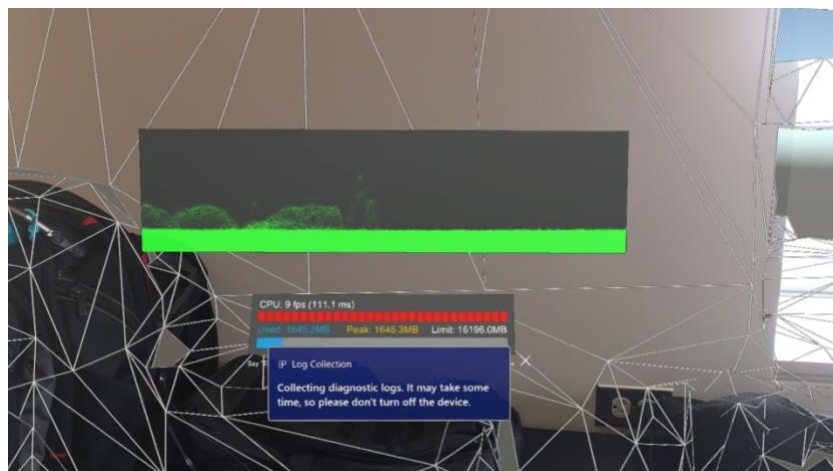


Figure 4.0

Finally, figure 4.0 illustrates the application successfully running on the Microsoft HoloLens 2.

3.3 Exiting the System

The user has various options when exiting the HHRD system. The safest to exit the system is by pressing the “X” icon at the top right of Holographic Remoting, this will close the application. Alternatively, the user can use voice commands “*Cortana, exit Holographic Remoting*”. Once the user has exited Holographic Remoting, they can shut down the system. Lastly, the user can simply shut off the HoloLens by pressing the power button on the device, however this is an unsafe method to shut down the system and is only recommended for the ultimate option.

4. Features

4.1 RSA API

One of the key features of the HHRD system is the Tektronix RSA API. The RSA API store all the key libraries required to extract the spectrum data picked up by the antenna and the RSA. The RSA API is the link between the RSA and the system controller.

4.1.1 Dynamically Linked Libraries

The primary feature of the RSA API is that it provides the dynamic linked libraries (DLL) which allow the user to modify key RSA settings. The DLLs provide functions through which users can edit the **frequency**, **amplitude**, and **span** settings upon which the RSA collects its spectrum data.

4.1.2 Voice Commands to Change Settings

A new feature which was implemented was the ability to change the RSA settings. User can use their voice as the controlling mechanism to alter the key settings of frequency, amplitude, and span. The value of the settings is currently set to increment/decrement by a set value. For example, user can simply say “*increase frequency*” or “*decrease frequency*” to change the frequency value.

4.2 HoloLens 2

Another important feature of the HHRD system is the Microsoft HoloLens 2. The HoloLens defines the *heads up/hands free* portion of the title. This device sits on the user’s head providing HD display of the spectrum data collected by the RSA.

4.2.1 Augmented Reality

The HoloLens's most attractive feature is its ability to display data through Augmented Reality (AR). Microsoft's HoloLens is one of the top AR products on the market. The ability to incorporate this product into the HHRD system is extremely valuable. With the data being displayed with AR, the user field surveyor can easily track their movement and see where they are going. Alternative to AR, is Virtual Reality (VR) where your field of view is completely blocked by the application. AR provides a safer and more effective method of navigation for the field surveyor when collecting spectrum data.

4.2.2 Holographic Remoting

Holographic Remoting is an app installed on the HoloLens. This app provides users/developers to connect to the HoloLens via devices. In respect to the HHRD system, we use Holographic Remoting to connect to Unity which renders the whole project.

5. Cautions & Warnings

If using the system outside, ensure there is formidable weather. Do not use it while in the rain, snow, fog, or otherwise bad conditions which may cause damage to the HoloLens 2, antenna, or RSA.

6. Support

For any type of assistance needed with setting up/using the HHRD system, please contact any member of the support team below.

Contact	Organization	Email	Role
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APPENDIX A: Reference Documents and Software Links

Document Name	Document Location and/or URL
GitHub Repository	https://github.com/morganco23/UP_Tektronix_Capstone
RSA306 Manual	https://www.tek.com/en/spectrum-analyzer/rsa306-manual
RSA API Manual	https://download.tek.com/manual/RSA300-500-600-Series-SpectrumAnalyzers-API-Programming-Reference-077103104.pdf
Unity 2020.3f Manual	https://docs.unity3d.com/2020.3/Documentation/Manual/UnityManual.html
RSA API Repo	https://github.com/tektronix/RSA_API
Mixed Reality Toolkit	https://www.microsoft.com/en-us/download/details.aspx?id=102778
SignalVu	https://tinyurl.com/3bcrkv9t
Unity Hub	https://unity3d.com/get-unity/download