

# Software Release Notes – S240v5 RTSA Application v5.1.0

February 2020

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# 1 Introduction

This document describes the second major release of the S240v5 Real-Time Spectrum Analyzer (RTSA) software, version 5.1.0. It supersedes S240v5 version 5.0.1.

This software is distributed as a single Microsoft Windows binary file  
**S240v5\_RTSA\_v5.1.0\_Installer.exe.**

*Reminder: S240v5 supports current RTSA devices such as R5500, R5550, R5700, & R5750, but not obsolete WSA products such as the WSA5000. End of life products are still supported by the S240 application.*

## 2 Fixed Defects

Version 5.1.0 addresses one defect:

The 57x0 series of devices have built-in GPS support and report their locations every second as a context packet in the VRT stream. These packets appear in recordings as well, even when the device cannot lock onto satellites because of coverage dropouts. In that case, special values tell the S240v5 application that the GPS signal is missing. These values were shown to the user in previous releases, leading to confusion because the interface looked frozen with bad values.

This release replaces this behaviour with red text indicating that the GPS signal was lost, which is an accurate portrayal of the actual situation. This happens live and in recordings.

## 3 New Features

Release 5.1.0 adds one new major feature, with many sub-features that are described in the following paragraphs.

### 3.1 Demodulation

Demodulation is supported for FM and AM, with AM being considered experimental and FM being thoroughly tested on broadcast radio (mono demodulation only).

This feature is driven by a new user interface that pops up as a dialog over the S240v5 user interface, the latter going dormant until the demodulation panel is closed. Captures for the S240v5 are paused while demodulating and resumed when the panel has closed.

The interface provides a slider to choose analysis bandwidths that apply to the final samples that are demodulated and to the FIR filters used for anti-aliasing and for deemphasis for FM broadcast. The deemphasis filter can be switched in and out independently.

### 3.2 Streaming

Gapless streaming is implemented in support of demodulation, allowing seamless playback of demodulated audio. The stream is started on launch of the demodulation panel with automatic connection to the device in streaming mode. When demodulation is paused, the audio stream is filled with silence and the audio “Listen” button is toggled off. It must be pressed again once demodulation is started.

### 3.3 Audio

Audio playback uses the default audio device on a Windows 10 computer. The audio can be amplified from 100% (the default) up to 300% or quieted to 0% with an amplitude slider. The Listen button controls the presence or absence of audio and can be used to flush buffers and “catch up” if the stream becomes too delayed. All audio systems have some amount of latency that is used to provide some buffering against exhaustion of the audio feed. This smooths the listening experience,

removing distractions. Every time the audio stream is started or restarted, a short test tone is played before the audio starts.

## **3.4 Graphs**

There are three graphs implemented in the user interface:

### **3.4.1 Constellation**

The constellation graph displays IQ data prior to demodulation. The IQ data is plotted on a square unity scale showing amplitude against phase, which indicates the quality of any given signal.

For example, FM broadcast shows a clean ring when the signal is strong, and a noise-filled ring (or just a noise field) otherwise. Audio might still be heard with the Listen button, but significant noise can obscure the message when the signal is compromised.

Note that the constellation can also show QUAM encoding over AM when present. This has been tested with a signal generator with QUAM 16. Digital demodulation is not present in this release.

### **3.4.2 Frequency Domain**

The frequency spectrum of the demodulated data is shown in the frequency domain graph. Note that this graph only appears once the “demodulate” button has been pressed. The graph freezes when demodulation is toggled off. The current demodulated signal is displayed periodically, as much as twice per second, to show the components of the signal. For example, FM signals clearly show the 19kHz and 38kHz carriers when present. A mono FM station shows a smooth graph of the familiar caterpillar shape.

### **3.4.3 Time Domain**

Demodulated data can also be viewed in the time domain, which is displayed several times per second indicating the power and frequency of voice or other audible signals in real time.

As mentioned earlier, there is lag between the time domain graph and the audio, so the relevancy between audio and the graph will remain variable in this release.

## **3.5 Recording and Playback**

The demodulation panel connects to a ThinkRF device and sources a gapless IQ stream, as mentioned earlier. These streams can be recorded and played back with full demodulation and graphing support. In fact, there is no difference whatsoever between the live and recorded display as the stream is saved in pure Vita-49 format, byte for byte. The file extension is always vrt. A vrtmeta file is saved in parallel and must remain in the same folder with the vrt file in order to the stream to be playable.

Playback cannot be paused. The “Demodulate” button pauses and resumes the demodulation itself while the listen button pauses and resumes the audio stream.

## **4 Missing Features and Limitations**

### **4.1 Scrubbing and Stepping**

Scrubbing and the associated ability to step through the signals has not been implemented in this release. Although it is possible to see the location of the playback within a saved stream using the slider below the graph section of the user interface, it is not yet possible to move back and forth manually. Nor is it yet possible to move frame by frame in either direction.

## **4.2 Audio Record and Playback**

The audio streams after demodulation cannot yet be saved and played independently of the IQ data. To hear the audio again, it must be demodulated again from the original saved vrt stream.

## **4.3 AM Broadcast**

The application cannot at this time tune down into the AM broadcast frequencies. This limitation may be lifted in the future.

## Document Revision History

This section summarizes document revision history.

Document Version	Release Date	Revisions and Notes
v1.0	20 February 2020	First release for S240v5 RTSA v5.1.0

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