BUILDING YOUR OWN GNSS SIMULATOR
Skydel's Power. Your Hardware.

ADVANCED

The Skydel Simulation Engine

Skydel is packed with a rich feature set – multi-constellation/multi-frequency signal generation, remote control from user-defined scripts, and integrated interference generation. Despite all these features, one of Skydel's greatest assets is its open, software-defined architecture. This GNSS simulation approach gives Skydel maximum scalability and flexibility, and provides users with the ability to develop and innovate while not limited by hardware design. With a Skydel software license in hand, users can simply purchase the hardware they need, and start simulating.

GNSS Simulation Hardware Components

This document outlines the necessary hardware for assembling your own Skydel-powered GNSS simulator. Described below are the specifications required for the following hardware components:

- Computer
- Motherboard
- CPU
- Cooling
- RAM
- Storage
- Network adapters
- Case

- Power Supply
- Operating System
- Cables
- Radio / Modulator / SDR
- Timing Source
- DC Block
- Attenuator

Building your own GNSS simulator system can be enjoyable, but it requires technical expertise. We provide general guidance and recommendations, but accuracy isn't guaranteed. We hold no responsibility for any issues arising from this information or your build. If you wish to learn more about our turnkey systems, please see our GNSS products page.

Advanced Simulation Build

Building a GNSS simulator for Advanced simulation requires mid-range hardware components. Users of this build are typically focused on multi-constellation / multi frequency scenarios, injecting errors using pre-defined models, open-loop HIL, and signal editing capabilities. Integrators and RF engineers creating test suites could also benefit from this build.

Advanced simulation builds are targeting the following output specifications:

- 250 to 500+ Signals
- 2 RF Outputs

In order to achieve this number of signals and RF outputs, Safran has produced this document to help guide users in the assembly of an effective GNSS simulator using your own components.

RF Signals

Radio frequency (RF) outputs in Skydel-based systems are very flexible. Systems with multiple outputs can combine RF signals to a single output or be used individually with a receiver.

Each output can be configured with:

- Upper Band GNSS Signals
- Lower Band GNSS Signals
- Interference/Jamming signal
- Used for a separate simulation
- Different amounts of attenuation added on each RF output
- Used for individual simulations (with multi-instance)

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Building Your Own System

When undertaking the task of building your own system, it may be difficult to procure some hardware components. It is possible to replace some of the components listed below with those of other manufacturers or slightly different models.

As with any hardware build, it is important to be aware of possible conflicts or incompatibilities between hardware components — especially with regard to the number of PCIe slots available, and the space certain cards can take on the motherboard.

Safran strongly recommends to align your build as closely as possible with the components listed below. It is possible to mix components from the Minimum and Recommended columns, unless stated otherwise.

Computer

The GNSS simulator main computer components for an Advanced simulation build are listed below with suggested models and/or specifications.

Component	Recommended Requirements	Alternative Requirements	Notes
CPU	Quantity: 1 Intel i9 13900k	Quantity: 1 AMD Ryzen 9 7950x	CPU & Motherboard must be from the same column. Other parts are interchangeable.
CPU Cooler	Quantity: 1 Model: Noctua NH-U12A		
Motherboard	Any of the following: • ASUS PRIME Z790-P • MSI Z790 Gaming WIFI • MSI B760 Gaming PLUS WIFI ATX • NZXT N7 Z790	Any of the following: • Asus PRIME X670-P • Asus PRIME X670-P-CSM	If using a motherboard other than the one recommended above, a minimum of 1 PCIe (16x) slot, and 1 PCIe (x4) slot is needed provided there is enough space between them to accommodate the GPU. Two slots for the GPU cards and one for either the Network Card, or the SDR, plus slots for expandability. NOTE : The GPUs are large and occupy significant space (3-4 slots) on the motherboard.
Memory	2x 32GB DDR5 6000Mhz		
Storage	Samsung 980 Pro 2 TB M.2-2280	Samsung 970 Evo Plus 2 TB M.2-2280	
Graphics	Any of the following: Quantity: 1 GeForce RTX 4060 Ti GeForce RTX 4070	Any of the following: Quantity: 1 GeForce RTX 4070 Ti (Mid-Range Performance) GeForce RTX 4080 (High Performance)	See our detailed GPU Guide for further guidance.
Software defined radios can be either internal or external (connected via a network card).			
Software-Defined Radio (SDR)* NOTE: Skydel builds do not support mixed SDR models..	Internal: SDRs are connected to a PCIe slot on motherboard Quantity: 2 DekTec DTA-2116 (recommended)		See our Supported Software-Defined Radios article for more details. NOTE: This component will occupy a PCIe slot
	External: SDR (such as a x300 or an N310) is connected externally to a network card (10Gb). Quantity: 1 Any of the following cards: • Intel X710-BM2 • Intel XXV710-AM2 • Intel XXV710-DA2 • Intel E810XXV-AM2 • Intel E810XXV-DA2		Alternatively, you can also use any network card that supports: • PCIe • Compatible SFP+ • 10Gbps or higher • Ubuntu Compatible • Jumbo Frames with an MTU of 9000 or higher NOTE: This component will occupy a PCIe slot

Technical Specifications

Computer Assembly

Computer Case

Although a case can be a personal or aesthetic choice, the options listed below will accommodate the components listed in this document.
  • Fractal Design Torrent Compact
  • Corsair 4000D Airflow

Power Supply

In order to provide enough power to the CPU, and other components, Safran recommends one of the following power supplies:
  • EVGA SuperNOVA 1000 G5
  • SeaSonic PRIME Ultra 1000 W 80+ Gold

Cable

Quantity: 1 (only necessary for SDR X300/X310/N310)
Model: Generic Compatible 10Gb SFP+ Twinax Cable, 2.0m or similar.

SDR (External)

Quantity SDR: 2
Depending on a user's needs and budget, we recommend the following models:
  • USRP N310 networked software-defined radio
  • USRP X300 networked software-defined radio

Quantity Daughterboards: 4 (2 per SDR)
Depending on a user's needs, each 10 Gb card has 2 ports so it can drive 2 x SDRs.
  • 1 x Ettus UBX-160 daughterboards per SDR.

NOTE: An external SDR is not required if using an internal radio as defined in the Computer specifications above.

Timing Source

Quantity: 1
Safran suggest any one of these models of timing source components.
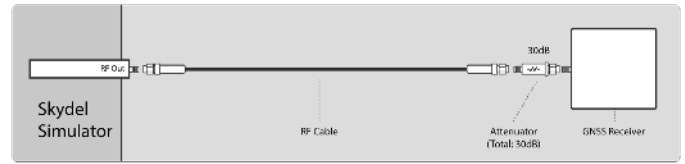 • Safran CDM-7 (recommended)
  • Safran CDM-5

DC Blocks

Safran recommends a DC Block with 10Hz to 18GHz, 50ohm, <1dB insertion loss.
Example: CP01R-DCBK-5018 Mini-Circuits DC-Block, or similar.

Attenuators

  • Safran recommends the following attenuators:
  • Attenuator 10dB SMA
  • Attenuator 20dB SMA
  • Attenuator 30dB SMA

Example of a 10dB model

Connection using a DC Block and attenuator

Operating System

Skydel supports both Linux and Windows environments. We recommend the following versions:
  • Preferred: Linux Ubuntu 22.04 LTS
  • Windows 10 Home or Pro

NOTE: In order to extract the maximum performance form your Skydel build, we recommend the use of the Linux operating system.

Additional Accessories

Users may need additional combinations of coaxial cables. The following or similar are recommended:
  • 50 Ohms compatible LMR 195 type
Also, mixing several radio outputs will require a combiner. We recommend this model, or similar.
PD5144 - L Band Splitter, DC Block All Ports

Support

In order to receive Safran support, your system must use the components listed in this document. Simulators using hardware other than those listed, may not be covered by support.

Support from Safran for «Building Your Own SImulator» is offered on a best-effort basis and includes up to 10 hours of support.

More Information

For additional information on hardware selection, accessories, and installation, the following resources are available:
  • Skydel User Manual (Hardware Selection)
  • Skydel User Manual (Hardware Components)
  • Skydel Certification Courses
  • Applicaton Note: Measuring a GNSS Signal & Gaussian Noise Power

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