MANTIS Technology

SCE-C4202 Wireless Channel Emulator



Datasheet

SCE-C4202 WIRELESS CHANNEL EMULATOR

The SCE-C4202 is a two-channel wireless channel emulator that applies delay, Doppler (frequency offset), gain, additive white Gaussian noise (AWGN) and multipath fading to an RF signal in real time. It reproduces GEO satellite, LEO satellite, fixed base station and mobile station link conditions in a controlled laboratory environment, over 200 to 2100 MHz with up to 600 MHz of bandwidth per channel.

Four emulation modes cover the typical test cases. Fixed mode applies a static delay (16 µs to 500 ms in 1 ns steps), frequency offset, gain and AWGN, suited to GEO and fixed-station links. Satellite LEO mode derives time-varying delay, Doppler and distance-related attenuation from the satellite altitude and service angle. Profile mode plays user-defined Delay, Frequency Offset and Gain profiles from CSV files for GEO, LEO, fixed-station and mobile-station scenarios. Fading Channel mode applies Rayleigh or Rician multipath profiles of up to 24 taps.

Each channel is configured independently, so CH1 and CH2 can emulate the uplink and downlink of the same link. Parameters are entered on the 7-inch touch screen, and the built-in spectrum view shows the input and output signals together with live Delay, FO and Gain curves.

Profiles are prepared on a PC, copied to a USB memory stick and loaded through the front-panel USB port. Several profiles can be started together with SYNC RUN, or repeated with LOOP. The instrument is a 19-inch rack-mount unit with an external 10 MHz reference clock input.



SPECS

- 2 independent channels (CH1 / CH2)
- RF range 200 to 2100 MHz
- Up to 600 MHz bandwidth per channel
- Delay 16 µs to 500 ms, 1 ns steps
- Frequency offset ±10 MHz, 1 Hz steps
- Gain −20 to +20 dB
- AWGN −150 to −100 dBm/Hz

APPLICATIONS

Typical applications for the SCE-C4202 include:

- GEO satellite link emulation (fixed delay)
- LEO satellite pass emulation (delay, Doppler, path attenuation)
- Fixed base station link emulation
- Mobile station channel emulation
- Multipath fading tests (Rayleigh / Rician)
- Uplink / downlink emulation using two channels

FEATURES

- Four emulation modes: Fixed, Satellite LEO, Profile, Fading Channel
- Dynamic delay, Doppler and gain driven by profiles of up to 1024 lines
- SYNC RUN to start different profiles on a single timing, LOOP for repeated runs
- Multipath fading with up to 24 taps
- Real-time spectrum view with Delay / FO / Gain curves
- Channel status indicators and 10 MHz reference clock input

SIMPLE WORKFLOW

Select the mode on the touch GUI, enter values with the on-screen keypad, and press Apply or Run. For dynamic scenarios, create a CSV profile on a PC from the provided template, save it to a USB memory stick, plug it into the front-panel USB port and choose it with File Open. The Spectrum screen then confirms the applied delay, frequency offset and gain while the emulation runs.

CHANNEL EMULATION MODES

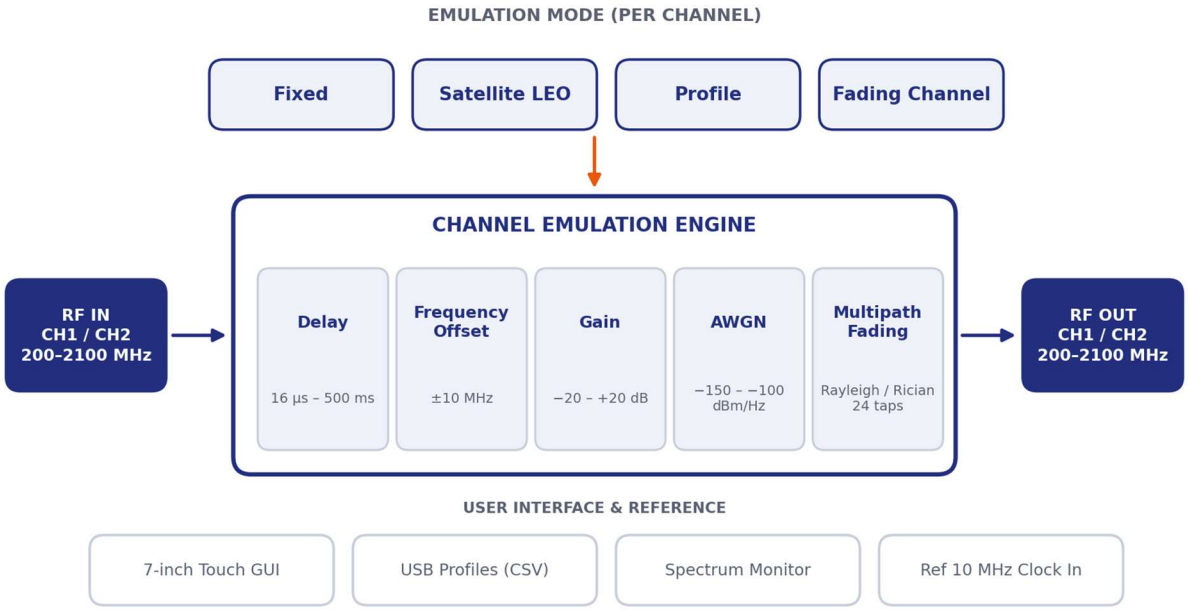
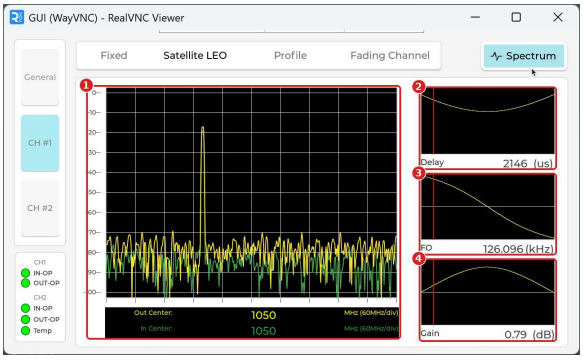


Figure 1. Mode selection, emulation engine and user interface (CH1 and CH2 are configured independently)

SATELLITE LEO MODE

Enter the satellite altitude and the service angle, and the emulator generates the delay, Doppler and distance-related attenuation profile of a low-earth-orbit pass, assuming a spherical earth. The signal frequency sets the Doppler reference, and the computed satellite speed, service time and maximum Doppler are displayed before the run starts.

With CH Sync enabled, the same altitude and angle profile is applied to CH2 at its own frequency, which is convenient for uplink and downlink testing. Progress of the pass is shown on the Spectrum screen as Delay, FO and Gain curves with a moving position marker.

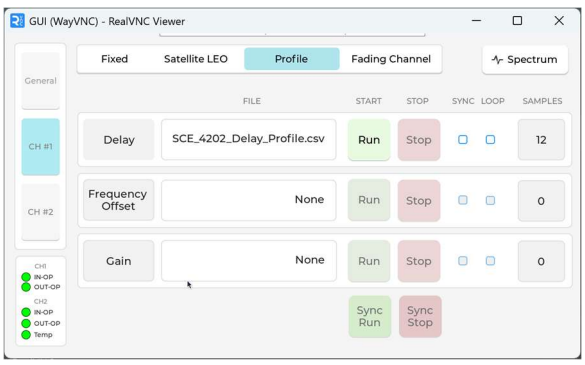


Satellite LEO mode, Spectrum view

PROFILE AND FADING MODES

Profile mode loads standard CSV files for Delay, Frequency Offset and Gain, each with up to 1024 lines and a period in milliseconds per line. Profiles can be run individually, started together with SYNC RUN, or repeated with LOOP. Files in the wrong format are rejected with an E-1 indication.

Fading Channel mode applies a Rayleigh or Rician distribution with up to 24 taps, each defined by delay, gain and maximum Doppler. Fading is configured through a profile file, and the resulting tap table is shown on screen.



Profile mode

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SPECIFICATIONS

General	
Number of channels	2 independent channels (CH1, CH2)
Emulation modes	Fixed, Satellite LEO, Profile, Fading Channel
Display	7-inch touch screen
RF	
RF input frequency	200 to 2100 MHz
RF output frequency	200 to 2100 MHz
Bandwidth	Up to 600 MHz per channel
RF input level	0 dBm max
RF output level	−10 dBm max
Signal ports	2 input and 2 output channels (2 additional dummy channels; CH3 / CH4 are used on the SCE-C4400 only)
Delay	
Range	16 µs to 500 ms
Resolution	1 ns
Dynamic delay	Profile-based, in Satellite LEO and Profile modes
Profile initial delay range	16,000 to 500,000,000 ns
Frequency Offset	
Range	±10 MHz
Resolution	1 Hz
Offsets beyond ±10 MHz	Set different input and output frequencies on the General tab
Profile initial FO range	−10 to 10,000,000 Hz
Gain	
Fixed gain	−20 to +20 dB (within the −10 dBm maximum output level)
Dynamic gain control	−20 to +20 dB, profile-based
Profile initial gain range	−20.00 to +20.00 dB
AWGN	
Noise density range	−150 to −100 dBm/Hz
Default	−150 dBm/Hz

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SPECIFICATIONS CONTINUED

Satellite LEO Mode	
Satellite altitude	Typically 300 to 2000 km
Service angle	10° to 80° above the horizon
Signal frequency (Doppler reference)	100 MHz to 40 GHz
Second channel	CH Sync applies the same altitude and angle profile to CH2 at its own frequency
Computed values	Satellite speed, service time, maximum Doppler
Example	500 km, 43°, 8250 MHz: 7.61 km/s, 135.55 s, 141,538.05 Hz maximum Doppler
Live display	Delay, FO and Gain curves with progress marker
Profile Mode	
Profile types	Delay, Frequency Offset, Gain (CSV files)
Profile length	1 to 1024 lines
Time base	Period per line in ms
Run control	Individual RUN / STOP, SYNC RUN, LOOP
Loading	USB memory stick via the front-panel USB port
Format check	Mismatched files are flagged E-1 and cannot be run
Fading Channel Mode	
Distribution	Rayleigh, Rician
Number of taps	Up to 24
Tap parameters	Delay (ns), Gain (dB), Max Doppler (Hz)
K factor	Rician only (K = 0 in the profile selects Rayleigh)
Configuration	Profile file (CSV)
Control and Interfaces	
Local control	7-inch touch GUI with on-screen keypad
Spectrum display	Input and output spectrum, 60 MHz/div
Status indicators	CH1: IN-OP, OUT-OP; CH2: IN-OP, OUT-OP, Temp
Ports	Ethernet (admin), USB-A, USB-C (admin), Optical (admin), Ref 10 MHz Clock In
Power and Mechanical	
Input voltage	110/220 VAC (AC 115 to 230 V)
Power consumption	150 W max
Dimensions (W × H × D)	476.0 × 132.0 × 546.5 mm
Weight	6.5 kg
Mounting	19-inch standard rack
Warranty	1 year from the date of purchase

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INTERFACES AND MECHANICAL



Figure 2. Front and rear panels (CH3 / CH4 ports are used on the SCE-C4400 only)

1 Handle
2 Power ON/OFF switch
3 Touch GUI (function selection, status)
4 Analog signal input / output ports
5 19-inch rack mounting holes
6 AC power input (115–230 V) with switch
7 Ethernet (admin port)
8 USB A
9 USB C (admin port)
10 Optical port (admin port)
11 Ref 10 MHz Clock In

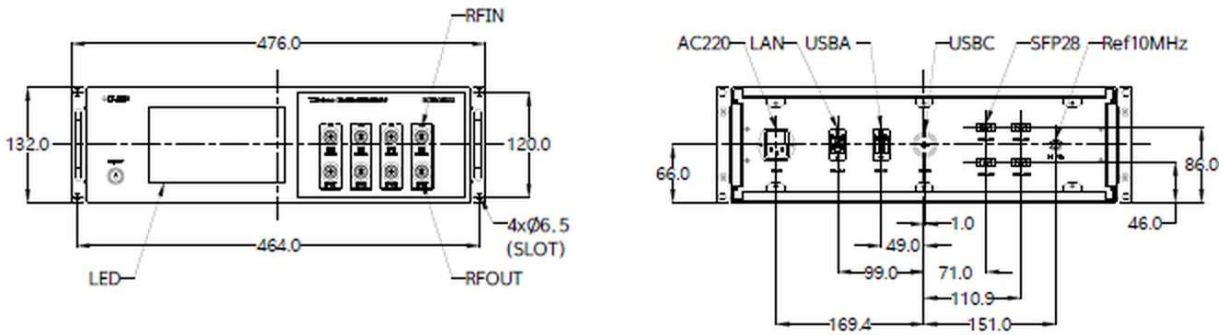


Figure 3. Outline drawing: front view (left) and rear view (right), dimensions in mm

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