**IONOS SIM HF/VHF Channel Simulator Specifications**

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**Description:** IONOS SIM is a self-contained audio DSP based ionospheric simulator based on the Watterson Model [1] for standardized HF and VHF propagation paths. It uses the Teensy 4.0 CPU (ARM Cortex-M7 processor at 600 MHz) and Teensy Audio DSP Library.

**Primary Use:** The development, characterization, maintenance and comparison of HF and VHF modems and protocols including “sound card” protocols.

**Channels Modeled:** WGN (White Gaussian Noise: Spread 0 Hz, Delay:0 MS); , MPG (CCIR Multipath Good) Spread .1 Hz, Delay .5ms ; MPM (CCIR Multipath Moderate) Spread .5Hz, Delay 1ms; , MPP (CCIR Multipath Poor) Spread 1 Hz, Delay 2ms; MPD (Multipath disturbed) Spread 2.5 Hz, Delay 5 MS; Flat Fading 0-40 dB Fade, variable rate; Fixed Freq offset +/- 200 Hz; Slow FM deviation +/- 100 Hz, Rate .1 to 100 Hz. Multipath Delay update rate 40x spread.

**Audio Paths:** WGN: 1 path. Multipath: 2 channels, each with I and Q (4 total rays). Input to Output Delay: Min 3ms (WGN); Max 15 MS (Multipath Disturbed).

**Connections Modeled:** 1 Simulator: Half duplex, both sides, symmetric channel models. 2 Simulators: Full Duplex both sides: symmetric or asymmetric channel models.

**Bandwidths:** .1 to 3.3 KHz, .1 to 6.3 KHz. Ripple < 1dB Sampling rate: 44.1 KHz

**Noise modeling:** WGN filtered to 3 KHz or 6 KHz bandwidth. S:N -40 to +40 dB, 1 dB steps.

**Inputs:** Ch1, Ch2 via standard Stereo 1/8” (3..5 mm) jack. AC coupled. Input protection. Impedance > 50KOhms. Nominal range: 20 – 2000 mv p-p.

**Outputs:** Ch1, Ch2 via standard Stereo 1/8” (3.5 mm) jack. AC Coupled. Short circuit protection. Impedance 150 Ohms. Nominal range 100-2000 mv p-p.

**Power Required:** Nominal 5 v (internally reg. to 3.3 V) via micro USB connector. < 200 ma.

**Display:** 320 x 240 pixel color TFT for Text and Graphics.

**Modes:** Self-Test and Calibration verification, Setup modes and parameters, Spectrum Display 3 & 6 KHz, Multipath IQ plot.

**User Parameter and control:** Two Incremental encoders (Mode, Parameter) each with push toggle. Optional USB serial ASCII commands for automated operation.

**Size:** 6.1” (155 mm) L x 4.7” (120 mm) W x 1.4” (36 mm) H (excluding knobs).

**Alternate Functions:** Integrated Busy Channel Detector (experimental). Uses only serial USB ASCII command interface with host program.

[1] Watterson, C.C., J.R. Juroshek, & W.D. Bensema. 1970 Experimental confirmation of an HF channel model IEEE Transaction of Communication. Technology. Vol COM-18. Pp 792-803 Dec 1970