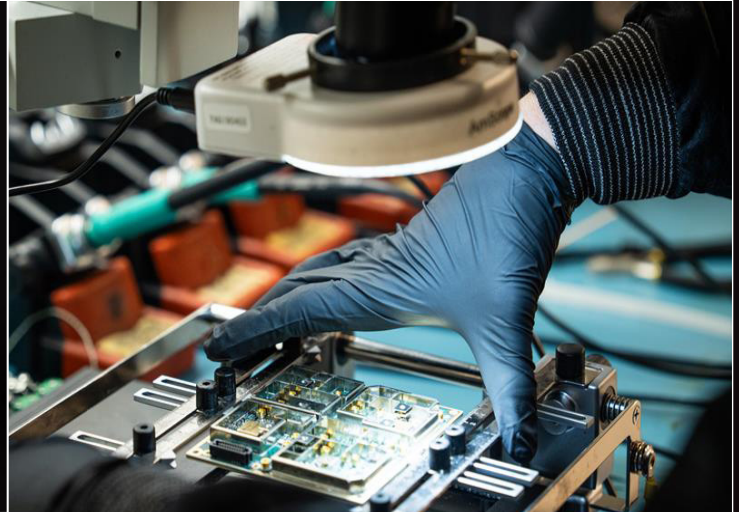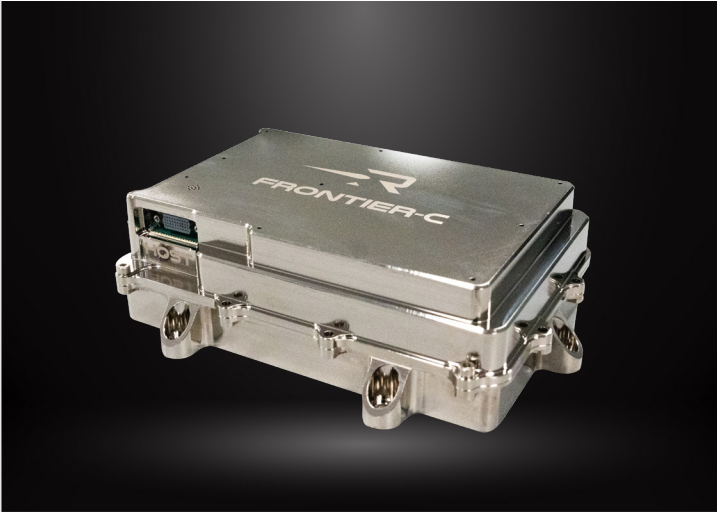# FRONTIER RADIO

Software-Defined TT&C Radio

OVERVIEW

The Frontier radio series by Rocket Lab is a flight-proven, software-defined radio designed for reliable Telemetry, Tracking, and Command. With an industry-leading compact footprint and superior power efficiency, our Frontier radios deliver robust performance even in the harshest space environments.

Frontier radios are based on the Johns Hopkins University Applied Physics Lab (APL) Frontier radio. A highly capable radio providing Deep Space Network (DSN) and other typical waveforms (TDRSS, NEN, AFSCN, commercial) into a small compact package efficiently and reliably. Various configurations of the Frontier radio has been flown into different orbits, as far as the moon. and soon beyond.

A few unique functionalities, including radiometric navigation methods, timekeeping functions and hardware based critical command decoder (CCD), enables mission beyond LEO easy to navigate.

FEATURES

› DSN, SN, NEN, AFSCN, Unified S-band (USB) and commercial waveform compatible

› CCSDS compatible, turbo and convolutional encoding

› Industry leading small form factor for deep space missions

› Superior lead time

› Flight proven, in production

› Two-way Doppler and two-way ranging for navigation in space

› Ideal for Class B/C/D missions as well as commercial

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	FRONTIER-S	FRONTIER-X	FRONTIER-L	FRONTIER-C
GENERAL				
Dimension	179.9 mm x 125.4 mm x 35.0 mm	184 mm x 128 mm x 50 mm	184 mm x 128 mm x 50 mm	184 mm x 128 mm x 50 mm
Mass	590 g	920 g	920 g	920 g
Bus Voltage	22 – 35 V, 30 V Nominal	22 – 35 V, 30 V Nominal	22 – 35 V, 30 V Nominal	22 – 35 V, 30 V Nominal
Power Consumption	<3.5 W Rx only <6.8 W full duplex	≤ 1.5 W Standby ≤ 7 W Rx only ≤ 12 W Rx + Tx	≤ 1.5 W Standby ≤ 7 W Rx only ≤ 12 W Rx + Tx	≤ 1.5 W Standby ≤ 7 W Rx only ≤ 12 W Rx + Tx
Interface	SpaceWire – ECSS-E-ST-50-12C single portFPGA LVDS	SpaceWire – ECSS-E-ST-50-12C single port	SpaceWire – ECSS-E-ST-50-12C single port	SpaceWire – ECSS-E-ST-50-12C single port
Mission Life	> 7 years	5 – 7 years	5 – 7 years	5 – 7 years
RECEIVER				
Center Frequency	2020 to 2120 MHz	7145 to 7235 MHz	7145 to 7235 MHz	7145 to 7235 MHz
Data Rate	0.88 bps – 0.88 Mbps 10 Bd – 1 MBd	0.88 bps – 0.88 Mbps 10 Bd – 1 MBd	0.88 bps – 0.88 Mbps 10 Bd – 1 MBd	0.88 bps – 0.88 Mbps 10 Bd – 1 MBd
Modulation	PM, BPSK	PM, BPSK	PM, BPSK	PM, BPSK
Noise Figure	<5.7 dB	≤ 2.0 dB	≤ 2.0 dB	≤ 1.0 dB
Dynamic Range	–145 dBm to –70dBm	–154 dBm to –60dBm	–154 dBm to –60dBm	–152 dBm to –80dBm
TRANSMITTER				
Frequency	2200 to 2300 MHz	8400 to 8500 MHz	6875.9 to 6879.1 MHz	1626.5 to 1675 MHz
Data Rate	up to 10 Mbps	up to 10 Mbps	up to 10 Mbps	up to 256kbps
Modulation	PM, BPSK, QPSK, O/SQPSK	PM, BPSK, QPSK, O/SQPSK	PM, BPSK, QPSK, O/SQPSK	PM, BPSK, QPSK, O/SQPSK
Freq Stability	<32 ppb/°C, <1 ppm/year	<32 ppb/°C, <1 ppm/year	<32 ppb/°C, <1 ppm/year	'+14 dBm ± 1dB (low power) +32 dBm (high power)
Output power	700 mW (28.5 dBm)	+14 dBm ± 1dB	+14 dBm ± 1dB	+14 dBm ± 1dB +32 dBm (high power)
ENVIRONMENT				
Temperature	–30 to +60 °C operation –40 to+85 °C non-operation	–25 to +55 °C operation –35 +70 °C non-operation	–25 to +55 °C operation –35 to+70 °C non-operation	–25 to +55 °C operation –35 +70 °C non-operation
EMI / EMC	MIL-STD-461C/F	MIL-STD-461C/F	MIL-STD-461C/F	MIL-STD-461C/F
TID	>20 kRad, component level, enclosure not included (ST). Sensitive components are spot shielded.Custom kRad – with enhanced bulk and spot shield (HR)	>20 kRad, component level, enclosure not included (ST). Sensitive components are spot shielded.Custom kRad – with enhanced bulk and spot shield (HR)	>20 kRad, component level, enclosure not included (ST). Sensitive components are spot shielded.Custom kRad – with enhanced bulk and spot shield (HR)	>20 kRad, component level, enclosure not included (ST). Sensitive components are spot shielded.Custom kRad – with enhanced bulk and spot shield (HR)
SE LET	No destructive latchup, >68 MeV-cm2/mg	No destructive latchup >68MeV-cm2/mg	No destructive latchup >68MeV-cm2/mg	No destructive latchup 68MeV-cm2/mg
SEU / SEFIET	<1 Event/Year @ GEO / Self-detecting and correcting through scrubbing ECC, TMR, and WDT	<1 Event/Year @ GEO / Self-detecting and correcting through scrubbing ECC, TMR, and WDT	<1 Event/Year @ GEO / Self-detecting and correcting through scrubbing ECC, TMR, and WDT	<1 Event/Year @ GEO / Self-detecting and correcting through scrubbing ECC, TMR, and WDT

UNIQUE FEATURES FOR FRONTIER SERIES	
Network Compatibility	DSN. NEN, SN
Coherency	Software selectable turnaround ratio
Ranging	Turnaroundchannel,regenerativePNranging,twowayDopplerranging.
Beacon Tones	Tone based semaphores (up to 128) to quickly transmit spacecraft state of health
Ground Compatibility	KSAT, Leaf Space RFTC
Production Status	All models currently in production

ROCKETLAB