S18WI Splitter for Wireless Infrastructure

Product User's Manual

Features

- **Amplified to Offset Splitter Losses**
- **Standard Antenna DC Bias Select**
- **Optional Antenna Current Monitor and Alarm**
- **Optional Filtered L1 Output**
- **Pole-mount Environmental Housing Available (IEC 529 level IP55)**
- **Surge Protection Standard (Tested to EN61000-4-5)**

Description

Eliminate the cost of multiple antennas and long cable runs in your wireless base stations! Designed to meet the demanding, high reliability requirements of the wireless infrastructure market, the GPS Source S18WI is a high performance GPS signal splitter. The device can be configured to monitor the GPS antenna current, providing an alarm indication if the antenna is not operating according to spec. The S18WI also features a standard antenna DC bias "Pick-&-Choose" circuit which allows for the active antenna DC input to be applied to any or all of the RF outputs. With this option, one DC voltage will be chosen to power the antenna while the other inputs will be switched to DC loads. If the selected DC bias input should fail, the DC bias will be automatically switched to another DC input so as to ensure an uninterrupted supply to the active antenna. The S18WI is an active device with customer defined gain, giving the network engineer the flexibility to specify the device gain and port-to-port isolation. The S18WI also features an option for Filtered L1 output that offers excellent selectivity around the L1 band to prevent interference from other high power radio frequency sources, such as cellular transmitter stations. The S18WI offers surge protection on all nine ports and in a sealed housing sufficient for many years of operation in external environments.

Functional Block Diagram

Figure 1 below illustrates the functionality of the GPS Source S18WI GPS Splitter. The S18WI consists of an RF Signal Processing System (illustrated in Blue), a DC Bias Select System (illustrated in Red), an Active GPS Antenna Monitoring System (illustrated in Green), and a Surge Arrestor System.

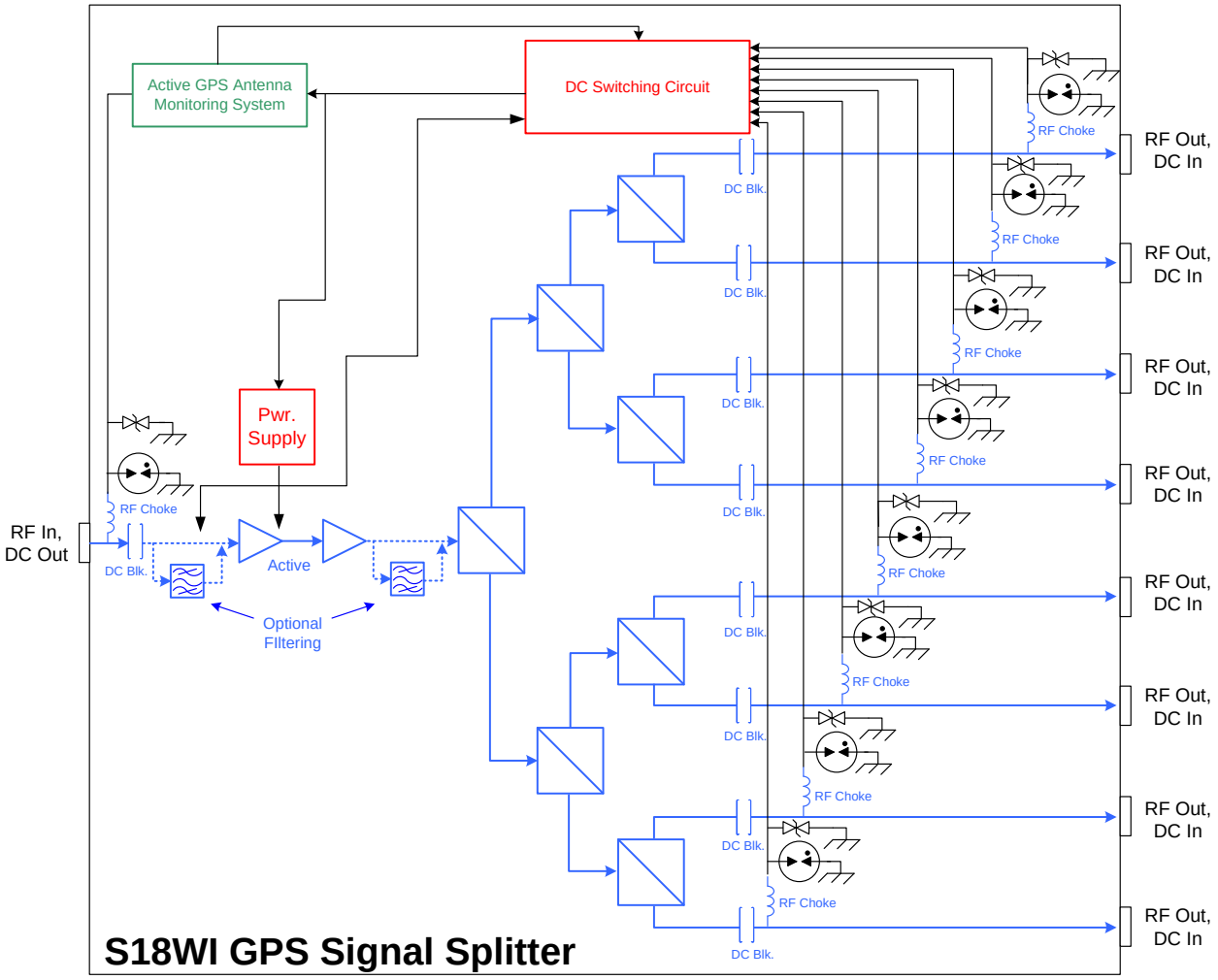


Figure 1 S18WI Functional Block Diagram

Operational Description

RF Signal Processing System

The RF signal processing system consists fundamentally of amplification stages and seven classical Wilkinson Splitter elements that divide the RF signal from the antenna input evenly between eight RF output ports.

There are a couple of options that are available concerning the RF Signal Processing System. These options are:

1. Filtered
2. Gain

Filtered Option

The S18WI is available with a filtered option which should be chosen if the S18WI is expected to operate in a severe EMI/EMC environment. The filtered option includes a low insertion loss preselection filter prior to the gain stages to protect the amplifiers from saturation and overload due to very strong out-of-band signals in the vicinity of the S18WI (e.g. Cellular or PCS cell towers). The filtered option further includes a high rejection filter after the gain stages which further filter signals that are not strong enough to saturate the initial gain stages but yet may be strong enough to disrupt GPS signal processing in the application receivers downstream.

Gain Option

The S18WI gain may be specified by the customer to have any input-to-output gain from -10dB to 15dB. If necessary, the gain may be specified over this range independently for each individual port (e.g. The gain for ports 0, 1, & 2 may be specified to be 0dB, while the gain for the remaining ports may be specified to be 10dB).

Note that to some extent, the port-to-port isolation performance is a function of the input-to-output gain. For example, the lower the specified gain, the higher the port-to-port isolation. At 15dB gain, the port-to-port isolation is minimized to approximately 18dB. At 6dB gain, the port-to-port isolation is approximately 35dB. The port-to-port isolation is maximized when the gain is 0dB or lower.

Termination of Unused Ports

Note that if the input-to-output gain is selected to be 7dB to 15dB, the unused output ports must be terminated into a 50Ω load for the S18WI to operate 100% complaint to the specifications. However, if the input-to-output gain is selected to be 6dB or less, unused output ports may be left unterminated without affecting the RF performance of the S18WI.

Antenna DC Bias System

The S18WI splitter requires that a DC voltage be applied to one or more of the RF output ports by way of the RF connector center conductor. If DC voltages are applied to more than one of the RF output ports, the S18WI DC Bias Select System will choose one of these DC inputs to

power the active circuitry of the S18WI and will also pass this DC voltage through the splitter to the center conductor of the RF input port. The DC voltage available on the RF input port can then be used to power the application's active antenna. The DC voltages applied to the RF outputs that are not chosen by the DC Bias Select circuitry will be automatically switched through an RF choke to 200Ω DC loads. The DC voltages may be applied to any or all of the RF outputs; however, the DC Bias Select circuit will always select the DC voltage on the lowest numbered RF port that has a DC voltage applied to power the S18WI and the application's antenna. If the chosen DC input were to be removed or fail, the DC Bias Select circuit will automatically switch to the next higher numbered RF port to which a DC voltage is applied.

The S18WI requires that only one RF output port have an external DC voltage applied (i.e. the device will operate properly even if any one, two, or three ports do not have a DC voltage applied or if a DC voltage is removed from one of the ports). Ports that do not have an external DC voltage applied or from which an external DC voltage is removed are internally pulled down so as to ensure that false input voltage indications do not occur.

Example:

Assume DC voltages are applied to RF outputs 1, 3 and 4. In this scenario, the DC voltage on port 1 will be used to power the S18WI and the application antenna. Ports 3 & 4 will be switched to 200Ω DC loads.

Now assume that the DC voltage on port 1 is removed. The S18WI will automatically terminate the input internally with a pull down resistor and switch operation of the splitter and antenna to the DC voltage applied to the next high numbered port with a DC voltage applied: port 3. Port 4 will remained switched to a 200 Ω load.

Active GPS Antenna Monitoring System

The S18WI includes an option to monitor the status of the application's active antenna and to provide an alarm indication if the antenna's current is not within a specified range. The default current window for the S18WI is 15mA to 150mA (e.g. antenna current below 15mA indicates an open circuit, above 150mA indicates a short circuit); however, for large volume orders, the antenna current window may be specified to meet the customer's specific requirements.

The S18WI samples the antenna current 16 times per second. So long as the average of four samples are within the specified antenna current window, the S18WI will continue to operate normally, passing the DC voltage applied to lowest number RF output on to the RF input. In this mode, DC voltages applied to the remaining RF outputs are switched to 200Ω DC loads. If the average of four antenna current samples falls outside of the specified antenna monitor current window, the DC voltage to the antenna is removed (open circuit) and all DC inputs are switch to Pass DC. Since the DC path to the antenna has been opened, the DC current on all four DC inputs will be at or near zero (less than 0.5mA for the passive configuration and less than 5mA

each for the active). In this alarm condition, all GPS receivers connected to the RF outputs will also see very low antenna current draw, resulting in corresponding antenna alarm conditions within each receiver.

Once in the alarm condition, the S18WI will periodically (every 60 seconds) attempt to re-connect DC power to the antenna. If the antenna failure condition persists, the S18WI will re-enter the fault condition, repeating this cycle until the fault condition is removed.

Surge Arrestor System

The S18WI includes standard Gas Discharge Tubes and Transient Voltage Suppressors on each RF input/output. Furthermore, provisions for high current grounding are included in the metal enclosure of the device. The Surge Arrestor System is intended to provide a limited capability to survive power line surges and voltage surges that may be induced by "near miss" lighting strikes. Protection is rated to 4KA, according the IEC-61000-4-5. In order to ensure proper protection of the device, the S18WI must be connected via a (8 AWG minimum) ground cable to a low impedance ground.

Connecting the S18WI

When installing the S18WI, connect the coaxial cable feeding the active GPS antenna prior to connecting RF outputs. Once the antenna coaxial cable is attached, coaxial cables with or without DC voltages may be connected to the outputs. Note that at least one coaxial cable connected any output of the device must provide a DC voltage suitable for operating the active GPS antenna and the S18WI.

Note that in some instances, upon initial connection of the DC voltage, the S18WI may power up in the "Antenna Fault" mode which will prevent DC voltage from being applied to the active antenna. If this behavior is observed immediately after power up, wait for approximately one minute. Proper operation should be restored by this time. If after 1 minute proper operation is not observed, ensure that a "known-good" active GPS antenna that sinks a DC current within the specified range is connected to the IN port of the S18WI via a "known-good" RF coaxial cable.

Performance Specifications

For additional detailed electrical performance specifications, see the S18WI Datasheet.

Electrical Specifications, Operating Temperature -40 to 85°C

Parameter	Conditions	Min	Typ	Max	Units
Freq. Range[1]	Ant – Any Port, Unused Ports - 50 Ω[2]	1.2		1.6	GHz
Bandwidth (3dB) Filtered Option		-15	1575.42	+15	MHz
Selectivity(Fltrd Opt)	+/-50MHz, Ant Output		40		dB
Gain[3] -Amplified (Norm)	Ant – Any Port, Unused Ports - 50 Ω[2] (Gain may be specified by the customer)	13	15	17	dB
-Amplified (Hi Iso.)		4	6	8	
Input/Output SWR	All Ports 50Ω[2]		1.3:1		-
Gain Compression Point (P1dB)	Filtered Option: -1565MHz < f < 1586MHz - For f <1560MHz and f > 1591MHz Unfiltered Option:	-35 -25 -25			dBm
RF Input (damage Threshold)	1575MHz +/-50MHz, Ant Output			+10	dBm
Noise Figure-Amplified	Ant – Any Port, Unused Ports - 50 Ω[2], Gain = 15dB			3.0	dB
Amp. Balance	|J1 - J2|, Ant–Any Port, Unused Ports - 50 Ω[2]			1.0	dB
Phase Balance	Phase (J1 - J2), Ant – Any Port, Unused Ports - 50 Ω[2]			1.0	deg
Delay	Ant – Any Port, Unused Ports - 50 Ω[2], L1			5	ns
Isolation -Gain = 6dB	Adjacent Ports: Ant - 50Ω[2]	35			dB
	Alternate Ports: Ant – 50Ω[2]	35			
DC IN	DC Input on any RF Output	4		12	VDC
Out-to-IN V_{DROP}	Antenna current of 30mA		0.1	0.25	VDC
Device Current	Current Consumption of Active device, excludes Ant. Cur.		18	20	mA
Ant/Thru Current[4]	Max source DC current through device			250	mA
Antenna Monitor [5] I_{OC}	Range for Open Circuit Threshold	15		75	mA
Antenna Monitor [5] I_{SC}	Range for Short Circuit Threshold[5]	100		180	mA
Surge Protection	8/20us		4		KA

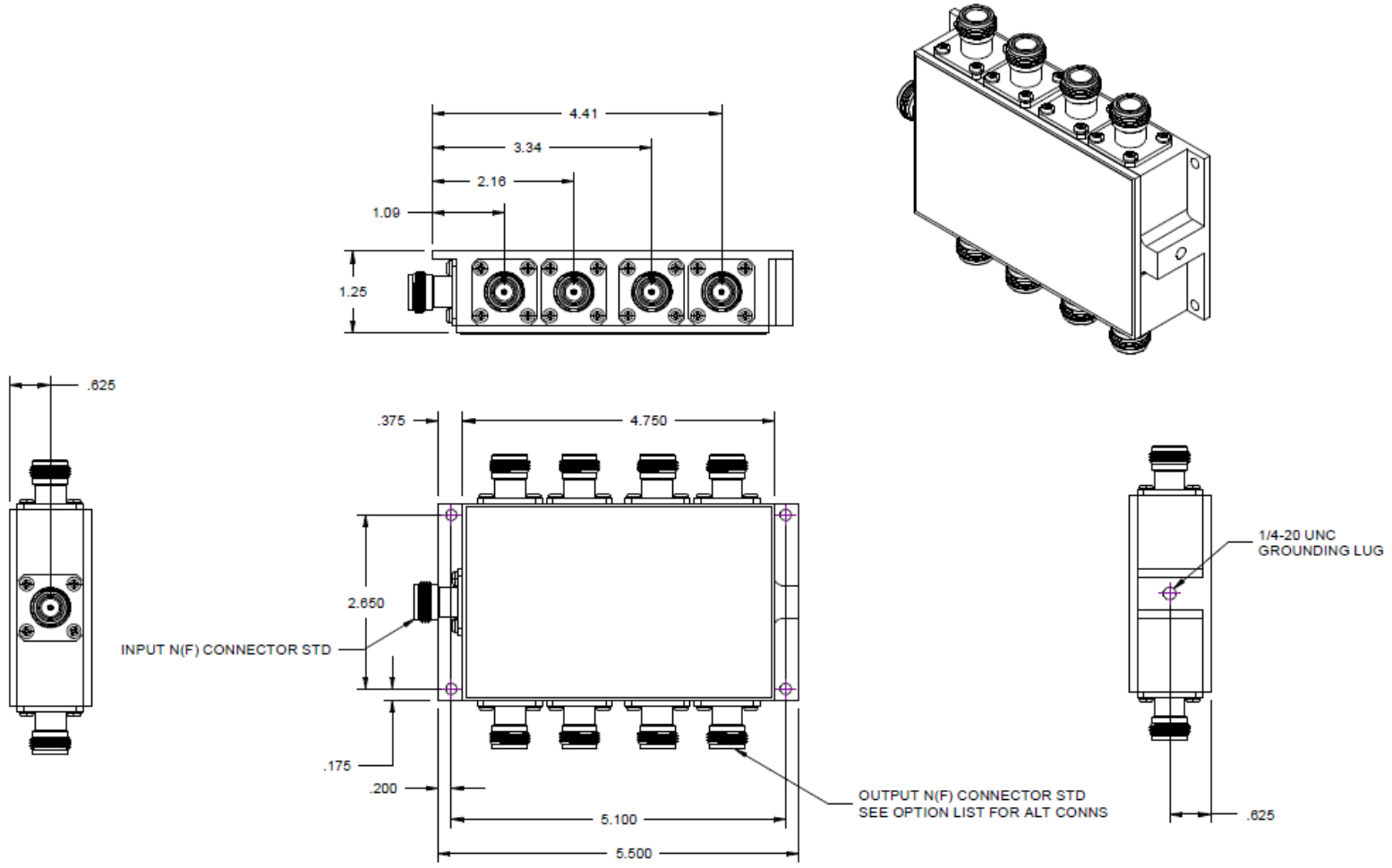
Notes:

(1). The S18WI supports broad band (L1 & L2) or L1 only filtered options
(2). For proper RF performance, the Splitter may require all RF ports terminated into a 50Ohm coaxial cable system or a 50Ω load
(3). Custom gain option available.
(4). Maximum current available from the DC source through the S18WI when output of S18WI is short circuited.
(5). Open circuit and Short Circuit Current (I_{OC}, I_{SC}) may be specified by the customer within the specified range.
(6). In-rush current shall not exceed 3A or exceed Isc for greater than 1ms

Certifications and Approvals

- EMC/Emissions: FCC part 15B and R&TTE equivalent
- Power Line Surge: IEC-61000-4-5
- Safety/Low Voltage: EN60950-1
- Environmental: IEC 60529, IP55

Mechanical


4.41
3.34
2.16
1.09
1.25
.625
.375
4.750
2.650
INPUT N(F) CONNECTOR STD
.175
.200
5.100
5.500
OUTPUT N(F) CONNECTOR STD
SEE OPTION LIST FOR ALT CONNS
1/4-20 UNC
GROUNDING LUG
.625