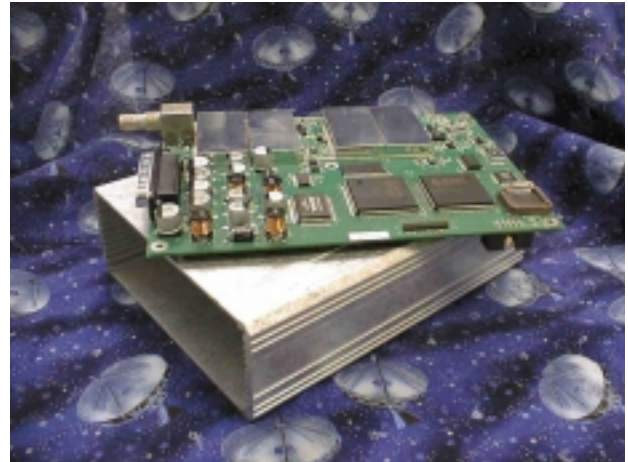


# MSS-312

# L-Band Satellite Receiver 10 Kbps – 2 Mbps

## Key Features

- L-band receiver 1530MHz to 1559MHz, tunable.
- QPSK demodulation for data rates in the range 10 Kbps – 2 Mbps.
- Supplies +5VDC power to an external LNA/ active antenna.
- Input sensitivity: -83 dBm.  
Maximum receiver gain: 105 dB.
- AGC:  
20 dB RF AGC (34 MHz BW)  
20 dB IF AGC (2 MHz BW)  
18 dB Digital AGC.(channel BW)
- Internal TXCO frequency reference accurate to within +/- 2ppm over 0-40C.  
Additional frequency calibration using satellite beacon, accurate to within 1 Hz.
- Turbo product code for error correction:  
7.3 dB coding gain @  $10^{-6}$  BER (rate 0.793).
- Support for over-the-air signaling channel.  
Data and signaling streams are multiplexed using HDLC.
- 10 – 32VDC unregulated power supply.  
Low power consumption (< 4W)



## Modem Inputs / Outputs

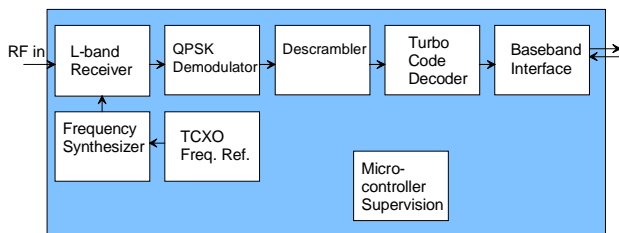
Modem	Definition
RF IN	TNC female. 50 Ohm impedance. Center frequency: 1530 – 1559 MHz. Tunable by steps of 1 Hz. Input sensitivity: -83 dBm. VSWR: 1.5:1 Provides up to 50mA @ 5V to an external LNA.
Baseband data, M&C	DB25. See baseband interface section.

For the latest data sheet, please refer to the MSS web site:

[www.mobile-sat.com/download/mss312.pdf](http://www.mobile-sat.com/download/mss312.pdf)

These specifications are subject to change without notice.

## Block Diagram



## Baseband Interface

The DB25 connector contains three main interfaces:

- 1) Multi-Functional Display
- 2) Power Supply
- 3) Microcontroller programming port.

In addition, there is a second serial port which interfaces with the microcontroller and is used for programming the flash memory.

Connector Type: DB25; Male; 90Degree

Pin No.	Name	I/O	Function
1	GND	I	Ground
2	GND	I	Ground
3	V_IN	I	Supply Voltage to receiver.
4	NC	-	Unused Pin
5	NC	-	Unused Pin
6	GND	O	Ground return from uController programming cable.
7	uC_RST#	I/O	UController programming RST# Pin.
8	uC_MISO	I/O	UController programming MISO Pin.
9	COM2_RS 485_TX_P	O	Com Port 2; Transmit Data Positive; RS-485*;
10	COM2_RS 232_RX	I	Com Port 2; Receive Data; RS-232
11	COM1_RS 485_TX_P	O	Com Port 1; Transmit Data Positive; RS-485*;
12	COM1_RS 232_RTS	O	Com Port 1; Request to Send; RS-232
13	COM1_RS 232_RX	I	Com Port 1; Receive Data; RS-232
14	GND	I	Ground
15	V_IN	I	Supply Voltage to receiver.
16	V_IN	I	Supply Voltage to receiver.
17	NC	-	Unused Pin
18	uC_PROG _+3.3V	O	+3.3V Supply to uController programming cable.
19	uC_MOSI	I/O	UController programming MOSI Pin.

20	uC_SCLK	I/O	UController programming SCLK Pin.
21	COM2_RS 485_TX_N	O	Com Port 2; Transmit Data Negative; RS-485*;
22	COM2_RS 232_TX	O	Com Port 2; Transmit Data; RS-232
23	COM1_RS 485_TX_N	O	Com Port 1; Transmit Data Negative; RS-485*;
24	COM1_RS 232_CTS	I	Com Port 1; Clear to Send; RS-232
25	COM1_RS2 32_TX	O	Com Port 1; Transmit Data; RS-232

\* The Transceiver technology RS-485 supercedes RS-422 and is backwards compatible.

## Configuration

The receiver configuration parameters are listed below. They are stored in non-volatile memory.

Parameters	Configuration
Satellite Beacon frequency beam 1	Frequency expressed in Hz
Satellite Beacon frequency beam 2	Frequency expressed in Hz
Satellite Beacon frequency beam 3	Frequency expressed in Hz
Channel frequency beam 1	Frequency expressed in Hz
Channel frequency beam 2	Frequency expressed in Hz
Channel frequency beam 3	Frequency expressed in Hz
Scrambling	0 = off 1 = on
Receiver spectral inversion	0 = off 1 = on

## Monitoring (via Serial Link / LAN)

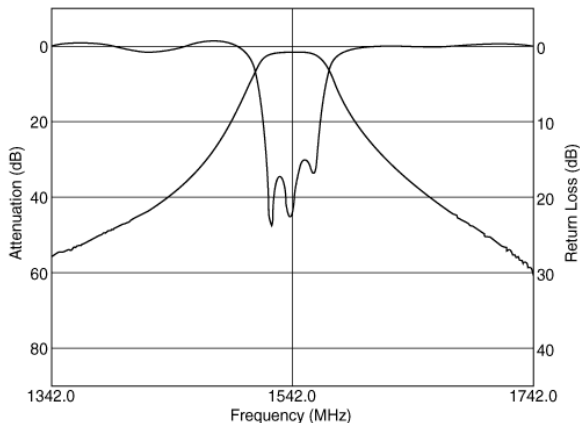
Parameters	Monitoring
Version	Returns version number "MSS312x"
BER	The bit error rate is measured using the 32-bit unique words transmitted every frame. The BER is expressed as the number of errors per 1024 bits. The BER measurement is updated once every 32 frames.
Lock detect	This reliable lock detect is based on the presence of unique word detections.
TCXO frequency	RF residual frequency error based on the satellite beacon reception.

error	
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## Implementation

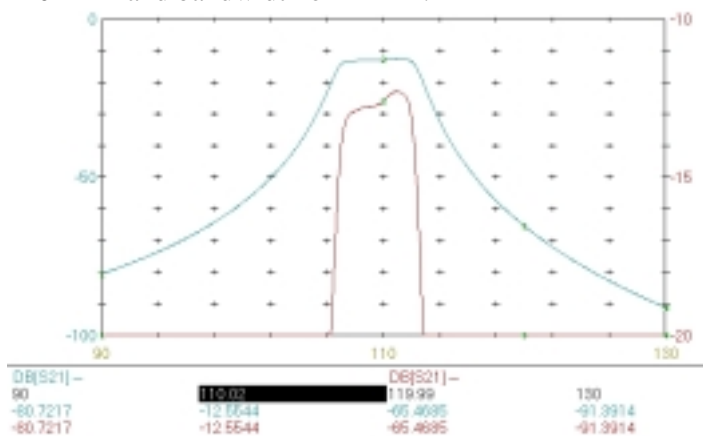
### RF Input Filters

The signal is filtered twice at RF using ceramic filters with the following characteristics:  
 Center frequency of 1542 MHz  
 Bandwidth of 34 MHz.



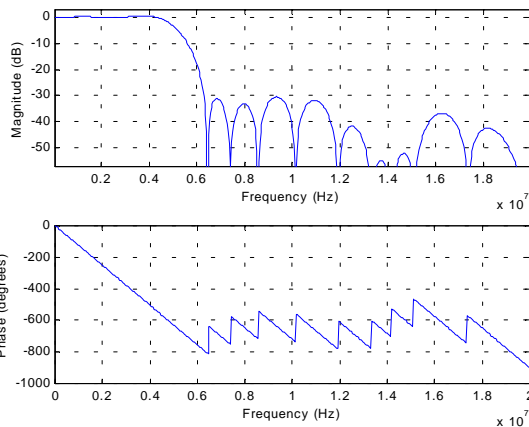
### IF Filter

The intermediate frequency (IF) signal is filtered using a discrete LC filter with a center frequency of 110 MHz and bandwidth of 2 MHz.



### Digital Filter

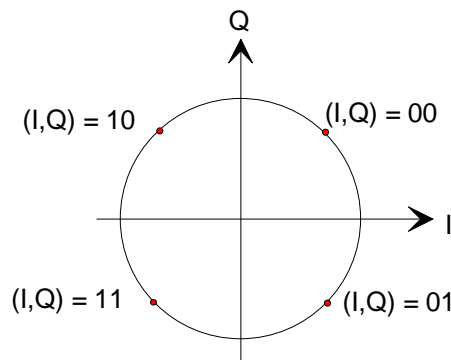
A raised cosine square root filter with 20% rolloff is used to select the desired channel digitally.



The raised cosine square root filter with 20% rolloff is a 29-tap FIR filter with the following impulse response:

- Coeff(0) = -8/1024
- Coeff(1) = -16/1024
- Coeff(2) = -8/1024
- Coeff(3) = 8/1024
- Coeff(4) = 24/1024
- Coeff(5) = 24/1024
- Coeff(6) = 12/1024
- Coeff(7) = -16/1024
- Coeff(8) = -48/1024
- Coeff(9) = -52/1024
- Coeff(10) = -16/1024
- Coeff(11) = 64/1024
- Coeff(12) = 160/1024
- Coeff(13) = 240/1024
- Coeff(14) = 272/1024
- Coeff(j=15:28) = coeff(28-j);

### Phase Map



### Phase Noise

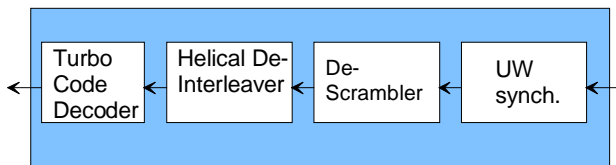
The local oscillator phase noise performances are consistent with operations down to 10 Kbit/s.

Phase Noise (Typ):	
400 Hz	-60 dBc
1 KHz	-65 dBc
4 KHz	-75 dBc
10 KHz	-80 dBc
100 KHz	-100 dBc

## Turbo Code

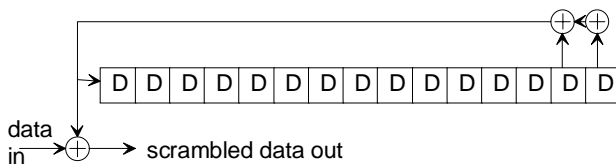
Turbo product codes (TPC) are used for error correction. A two-dimensional (64,57)x(64,57) TPC is used to provide 7.3 dB coding gain at  $10^{-6}$  bit error rate. The block size is 4096 bits.

In order to keep the TPC encoder and TPC decoder synchronized, a 32-bit unique words is inserted before each 4096-bit block. The UW is 01011010 00001111 10111110 01100110 (binary) 0x 5A 0F BE 66 (hex)



## Descrambling

A scrambler can be used at the modulator to randomize the transmitted bit pattern. The scrambler and descrambler are 16-bit linear feedback shift registers with generator polynomial  $1 + x^{14} + x^{15}$ .



The descrambling feature can be enabled or disabled by software command.

## HDLC Decoding

HDLC is used to separate two logical channels transmitted over the common satellite link.

## Satellite Beam Search

In multi-beam L-band satellite coverages, it is incumbent upon the receiver to detect which beam it is located. The receiver, when not in lock, will search for the best beam based on the received

power of beacons for each beam. The search typically takes 5 seconds per beam.

## Receiver ID

Each receiver has a unique serial number embedded in the microprocessor EEPROM. This number is programmed at the time of manufacturing.

## Custom Micro-Controller Software

Custom application software can be developed on the Atmel AVR microcontroller. (Part number AT90)

## Power Supply

10 – 32VDC unregulated.  
Power consumption: 4W typ.  
Reverse voltage protection.

## Mechanical

Aluminum case.  
Size 5.3" x 7.0" x 2.0"  
Color: black  
Weight: 4 lbs.

## Ordering Information

MSS-312      L-Band Satellite Receiver  
10 Kbps – 2 Mbps.

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