AM9040 – Block Downconverter

18 GHz to 50 GHz Wideband downconverter

High performance and low SWaP

- Connectorized module that covers 18 to 50 GHz RF, with 11 GHz instantaneous BW
- Includes sub-octave preselector, internal LO synthesizer, and control FPGA
- Multiple tuner sets can be configured to work together for multi-channel coherent applications



AM9040 is an RF block downconverter that provides high dynamic range coverage from 18 GHz to 50 GHz. The analog IF output spans 4.4 to 15.8 GHz. The connectorized, shielded module is designed for high performance and low size, weight, and power (low SWaP) applications.

The internal circuitry includes sub-octave preselector filter, pre-amplifiers, local oscillator, frequency converter, IF filtering, gain control, power conditioning, temperature sensor, and FPGA-based control interface. The module and AM9018-1 (1-18GHz tuner) are mechanically similar, simplifying integration.

FEATURES

- 18 to 50 GHz RF Frequency Range
- 4.4 to 15.8 GHz IF frequency range
- 11 GHz instantaneous bandwidth
- 3 preselector bands
- 30 dB variable attenuation
- Integrated LO synthesizer
- External 100 MHz reference
- Optional External LO
- Integrated Temperature Sensor
- 14 dB Noise Figure, 0 dBm IIP3
- +5.5V, +3.8V and -2.0V DC Operation
- 7.8 W Power Consumption
- -40C to +70C Operation
- TBD Module Weight
- 1.4" x 3.0" x .341"

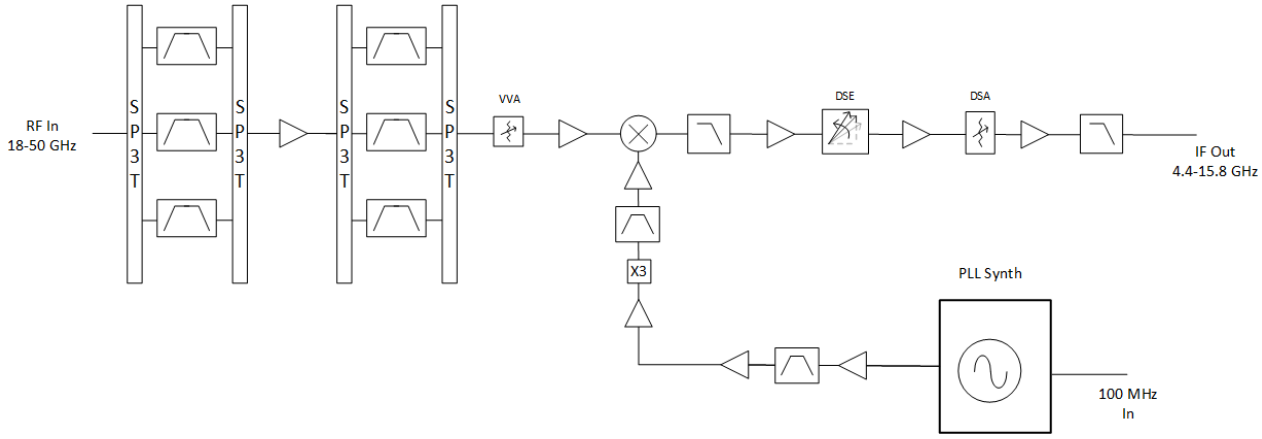
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REVISION HISTORY

Date	Revision	Notes
June 5, 2026	1.5	Minor model changes
July 15, 2026	1.6	Added Measured Data
October 27, 2026	2.0	Release to Website

BLOCK DIAGRAM



Preselector Band	Frequency Range	LO	IF
Band1	18-29 GHz	33.6GHz	4.6-15.6GHz
Band2	29-40GHz	24.6GHz	4.4-15.4GHz
Band3	40-50GHz	34.2 GHz	5.8-15.8GHz

SPECIFICATIONS

Absolute Maximum Ratings

	Testing Conditions	Min	Maximum
RF Input Power	CW		+24 dBm
+5.5 VDC Supply			+5.8 V
+3.8 VDC Supply			+3.9 V
Operating Temperature		-40 C	+85 C
Storage Temperature Range		-50 C	+125 C

Note: Any device operation beyond the Absolute Maximum Ratings may result in permanent damage to the device. The values listed in this table are extremes and do not imply functional operation of the device at these or any other conditions beyond what is listed under Recommended Operating Conditions. Any part subjected to conditions outside of what is recommended for an extended amount of time may suffer from reliability concerns.

Handling Information

	Minimum	Maximum
Storage Temperature Range (Recommended)	-50 C	+125 C



Mercury products are electrostatic sensitive.
Follow safe handling practices to avoid damage.

Recommended Operating Conditions

	Minimum	Typical	Maximum
Operating Case Temperature	-40 C		+70 C

DC Electrical Characteristics

(T = 25 °C unless otherwise specified)

Param	Testing Conditions	Min	Typical	Max
+5.5 VDC Supply		+5.2 V	+5.5 V	+5.8 V
+3.8 VDC Supply		+3.5 V	+3.8 V	+4.0 V
+5.5 VDC Current			1.05A	
+3.8 VDC Current			0.5A	
-2VDC Supply		-2.4V	-2.0V	-1.8V
-2VDC Current			31mA	
Power Dissipated			7.5W	
Logic Level Low		0 V		+0.8 V
Logic Level High		+2.0 V		+3.5 V

RF Performance[1]

(T = 25 °C unless otherwise specified)

Param	Notes	Min	Typical	Max
Frequency Range		18 GHz		50 GHz
Instantaneous Bandwidth			11 GHz	
IF Center Frequency		9.9 GHz	10.1 GHz	10.8 GHz
RF Center Tune Frequencies	3 bands	23.5 GHz	34.5 GHz	45 GHz
Frequency Reference	External 100 MHz (note 3)	-2dBm (0.5Vpp)	+6dBm	+13.5dBm (3Vpp)
IF Output P1dB			+14 dBm	
Input IP3			0 dBm	
Input IP2	2 tones, with 1 tone out of band		+45 dBm	
Noise Figure			13 dB	
Image Rejection		50 dBc	70 dBc	
IF Leakage			-90 dBm	
LO Radiation	Measured at RF In		-70 dBm	
LO Leakage	Measured at IF Output		-60 dBm	
Gain	RF to IF with 0dB atten		26 dB +/-3.5dB	
Gain Control [1]	(note 1)		30 dB	
Tuning Speed	(note 2)		150 µs	
Phase Noise	1 kHz Offset		-101 dBc/Hz	
	10 kHz Offset		-106 dBc/Hz	
	100 kHz Offset		-106 dBc/Hz	
	1 MHz Offset		-115 dBc/Hz	
	10 MHz Offset		-138 dBc/Hz	

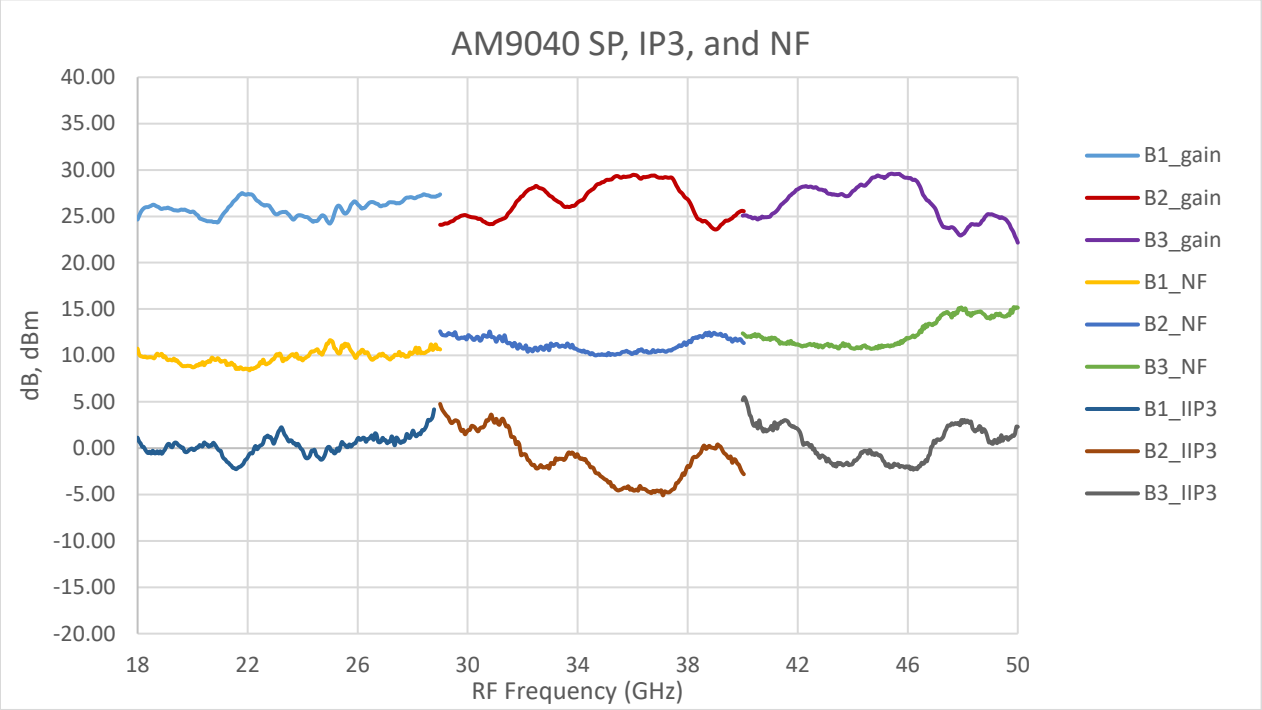
Note 1: Additional gain control beyond calibrated gain, in 1 dB steps.

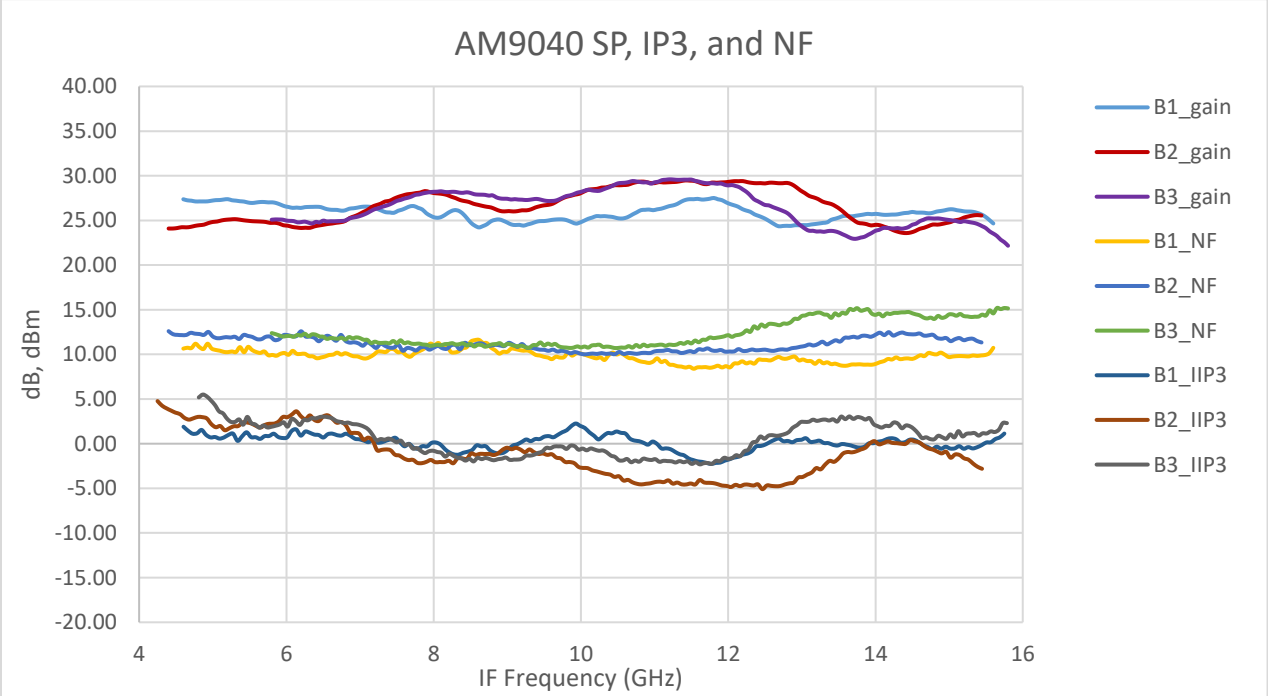
Note 2: From receipt of command until IF signal is within 1kHz of final frequency

Note 3: External reference input impedance is 50 Ohms. Tolerant of sine wave or square wave. Reference waveform may affect spurious and phase noise performance of the tuner.

TYPICAL PERFORMANCE

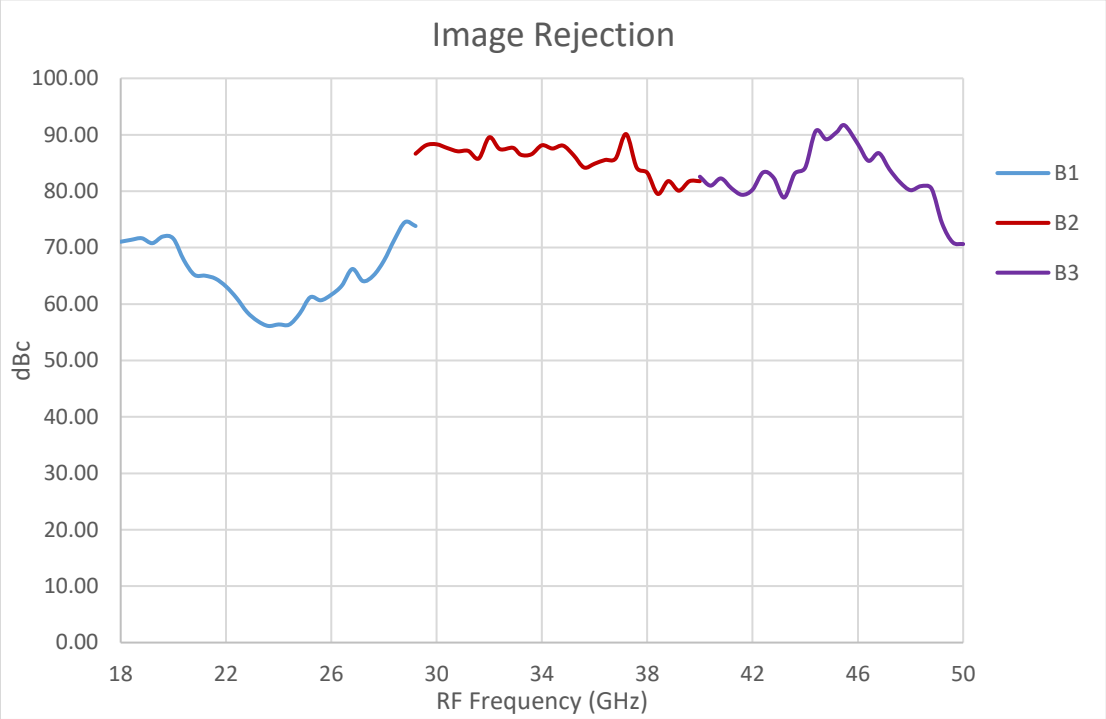
Plot is representative of AM9040 unit set in nominal gain state (26dB)

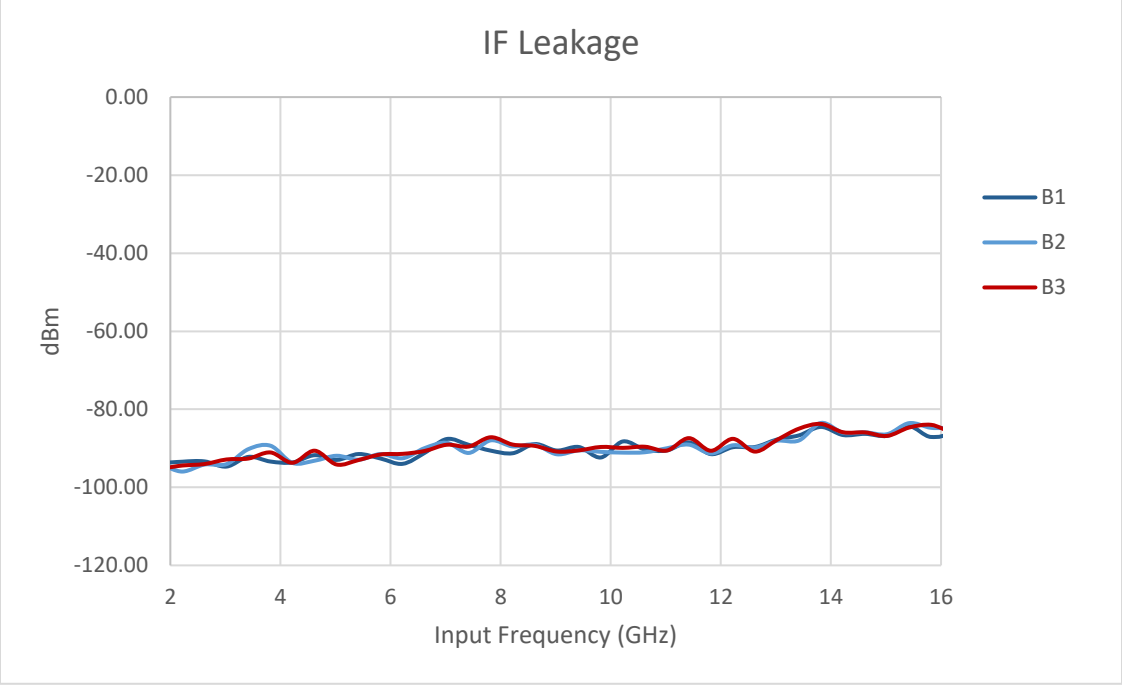




TYPICAL PERFORMANCE Continued

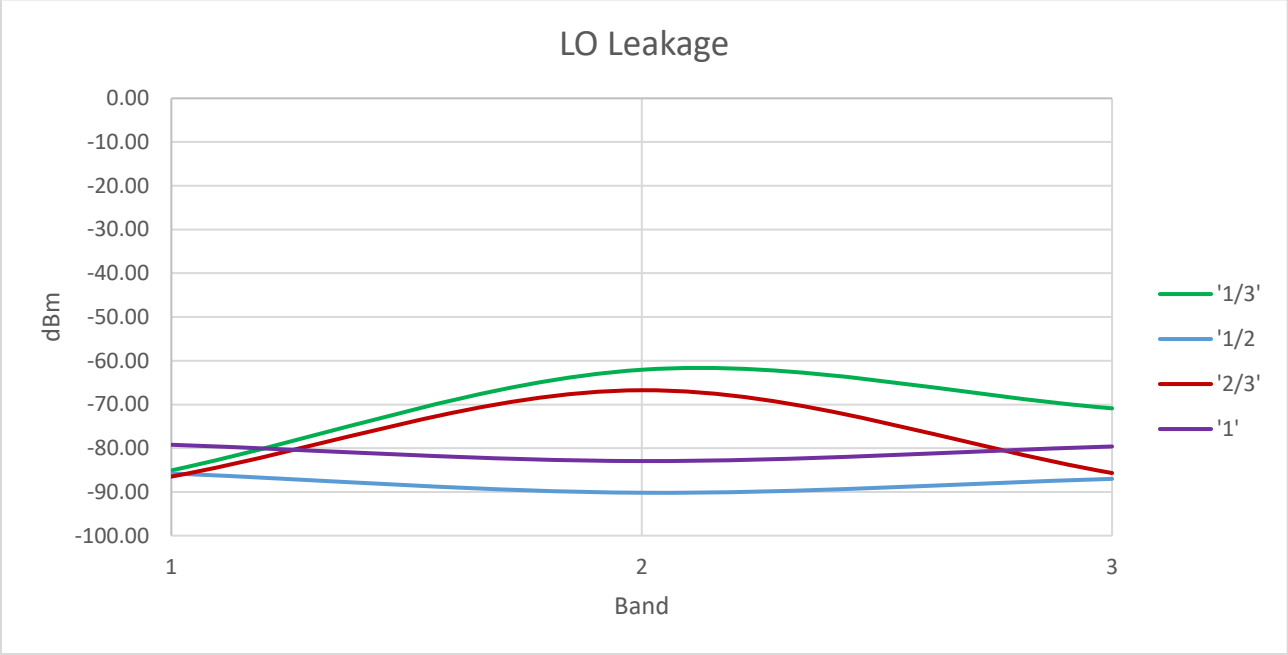
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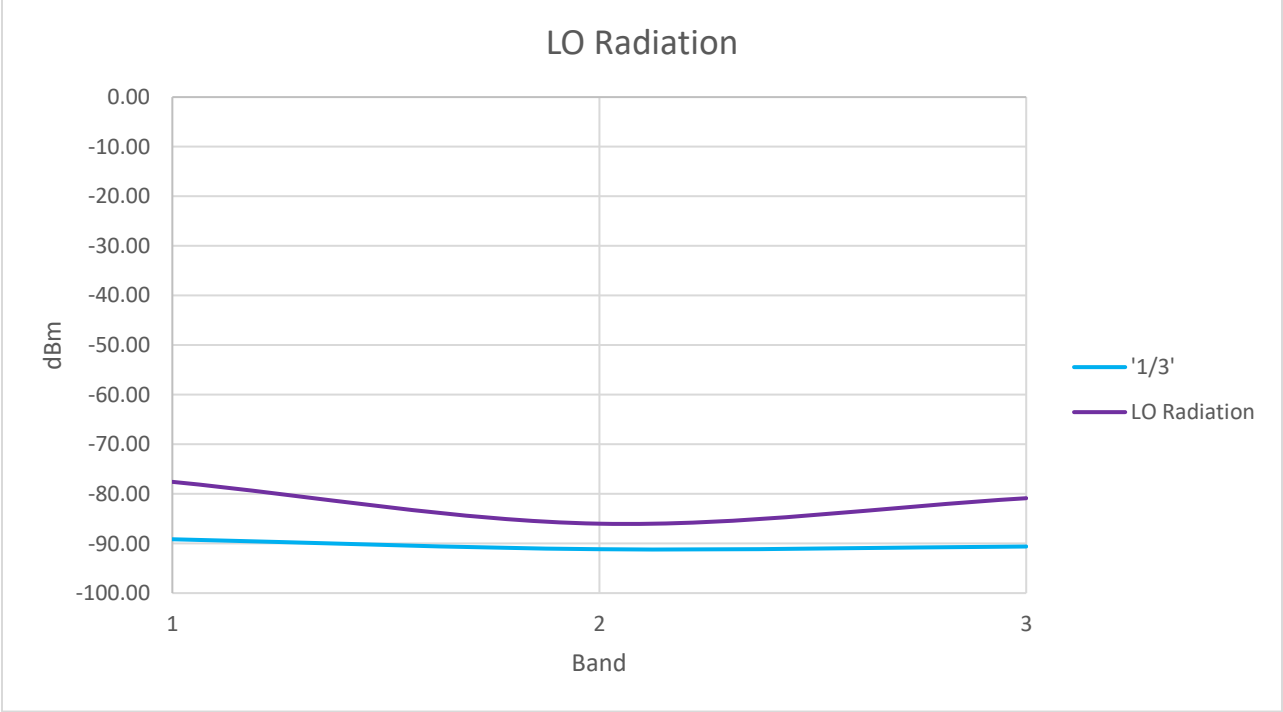




TYPICAL PERFORMANCE Continued 2

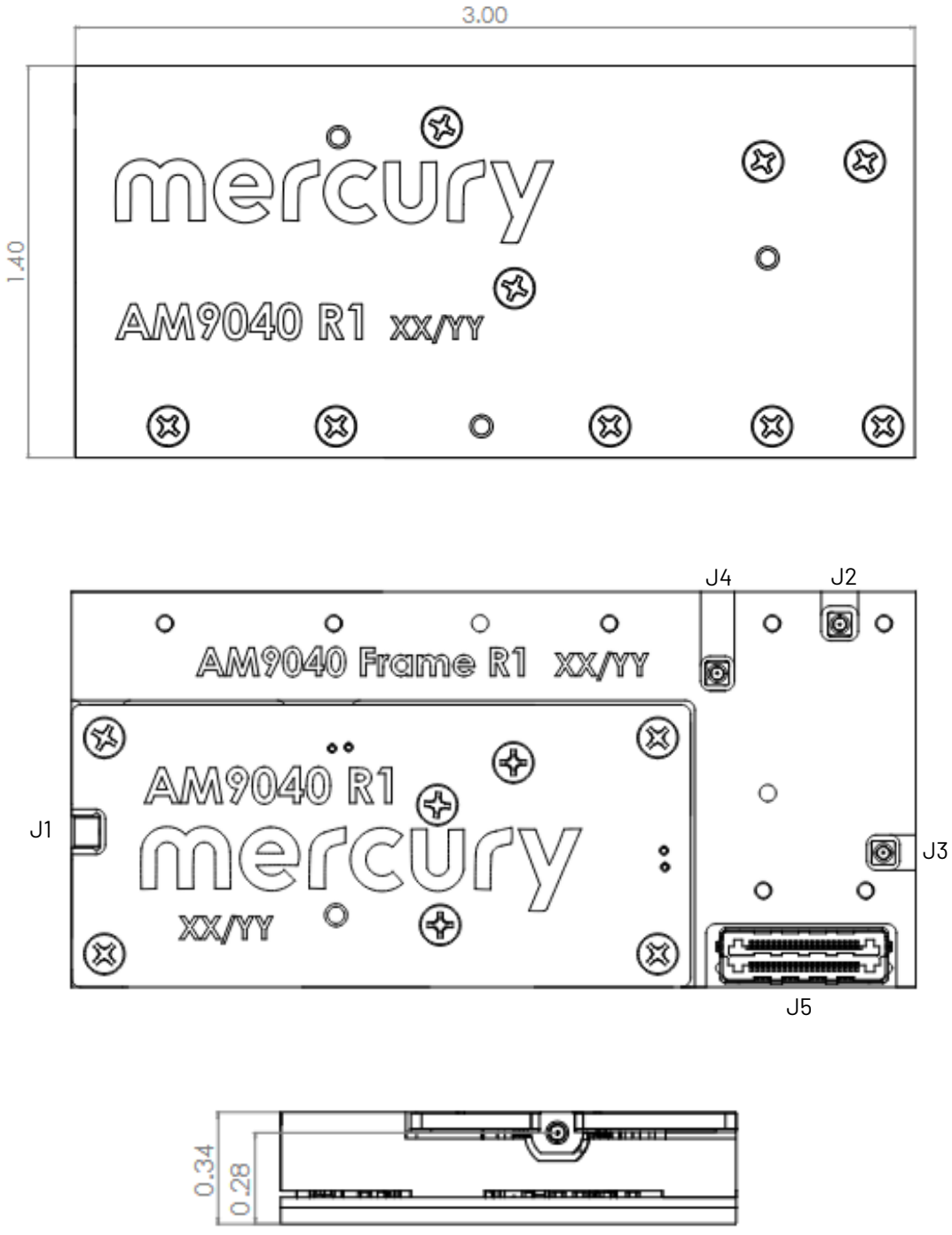
Plot is representative of AM9040 unit set in nominal gain state (26dB)





MECHANICAL DETAILS

Mechanical Drawing



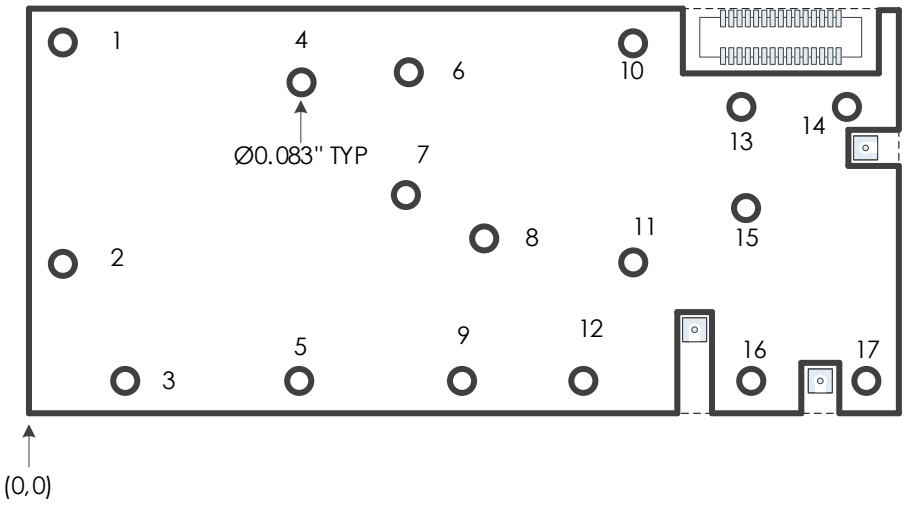
Note: Top, Bottom, Side Views are shown respectively.

CONNECTOR AND PIN DEFINITIONS

Board Connector Layout:

Connector	Name	Function
J1	RF IN	18 to 50 GHz. AC coupled, 50 Ohms
J2	Ref In	100 MHz reference input. AC coupled. 50 Ohms. +4dBm sinewave or square wave
J3	Ext LO	Optional LO input (factory configured)
J4	IF OUT	Wideband IF output. AC coupled, 50 Ohms. 3.5 to 15.5 GHz
J5	Multipin Connector	SPI Control, +5VDC, +3.3VDC, and miscellaneous control I/O

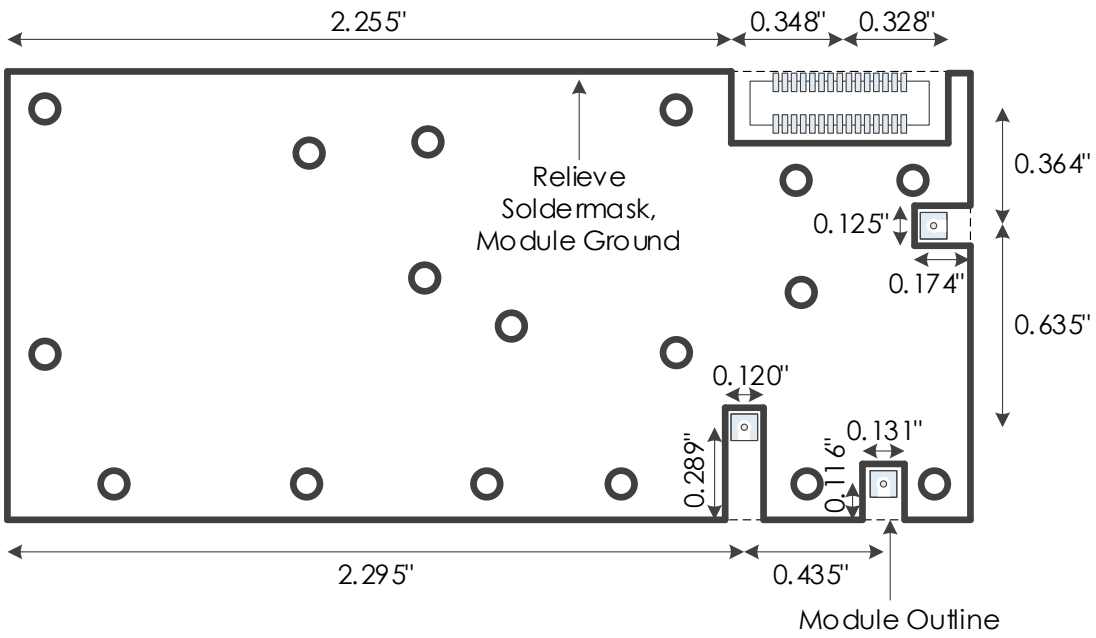
PCB Locations of Screw Holes and Connectors



Number	Dimension (X, Y) in Inches	Number	Dimension (X, Y) in Inches
1	(0.1167, 1.283)	**10**	(2.083, 1.280)
2	(0.117, 0.517)	**11**	(2.084, 0.522)
3	(0.332, 0.112)	**12**	(1.912, 0.112)
4	(0.940, 1.145)	**13**	(2.457, 1.060)
5	(0.932, 0.112)	**14**	(2.821, 1.060)
6	(1.310, 1.180)	**15**	(2.473, 0.710)
7	(1.300, 0.755)	**16**	(2.491, 0.112)
8	(1.570, 0.605)	**17**	(2.888, 0.112)
9	(1.452, 0.112)		

All labeled screw holes are #1-72, with a depth TBD. Only a few of the screws will be provided for customer mounting.

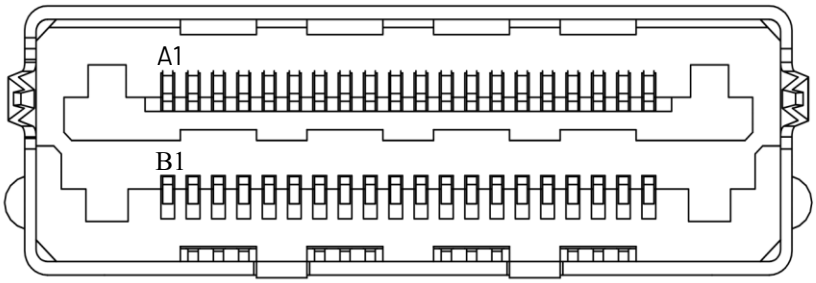
Module Solder Mask Relief



This drawing shows the area where solder mask should be relieved. It is a minimum of 0.127 mm (5 mils) outside of the physical module dimensions.

Required Components List

Connector	Mating Connector Part Number	Manufacturer
J1	55056-001J	Southwest Microwave edge launch 0.9mm connector
J2, J3, J4	55057-006J 54033-003B	Southwest Microwave SSBB full detent connector and bullet
J5	LSHM-120-02.5-L-DV-A-S	Samtec dual row 0.5mm pitch 40 position connector Mating connector is LSHM-120-04.0-L-DV-A-S for 6.5mm board to board



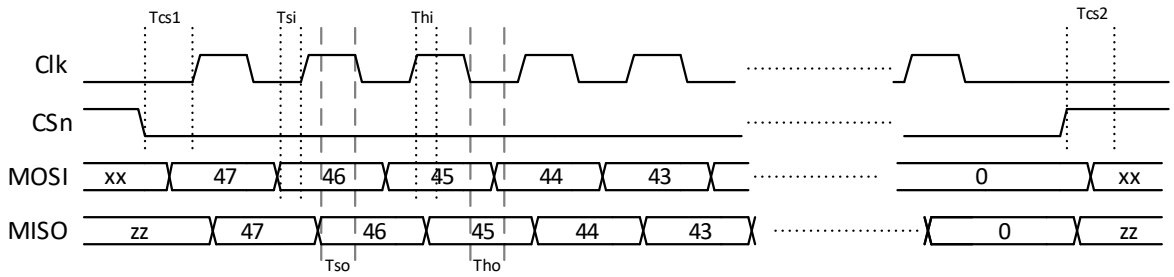
J5 Pinout

Pin	Pin Name	Pin Function
A1-A4	+3.8VDC	+3.8VDC supply voltage. Max current 0.9A
A5, A6	GND	Ground
A7	SPI Clock	SPI Clock Input. 3.3V logic level
A8	SPI MOSI	SPI MOSI input. 3.3V logic level
A9	SPI MISO	SPI MISO output. 3.3V logic level
A10	CMD_CSn	Chip select line for SPI interface used to send configuration commands to this module. 3.3V logic level
A11	PROG_CSn	Chip select line for SPI interface used to send commands accessing core FPGA functionality for this module.
A12-A16	GND	Ground
A17-20	-2.0VDC	-2.0VDC supply voltage. Max current 200 mA
B1-B4	+5.5VDC	+5.5VDC supply voltage. Max current is 1.3 A
B5-B7	GND	Ground
B8	DTS	Direct Tune Strobe. +3.3V logic level, triggered on rising edge. When triggered, AM9040 tunes to the next band.
B9	PWR_EN	Power Enable. +3.3V logic level
B10	GND	Ground
B11	SPARE1	Spare control line
B12	SPARE2	Spare control line
B13-B17	GND	Ground
B18	SPARE3	Spare control line
B19	SPARE4	Spare control line
B20	GND	Ground

CONTROL DETAILS

The AM9040 is controlled over a serial peripheral interface to an integrated FPGA. The SPI Interface consists of 5 control lines: SCLK, CMD_CSn, PROG_CSn, MOSI (Master Out – Slave In). The user system controlling the tuner is always the master device. CMD_CSn is the chip select line used for control/query messages, and PROG_CSn is reserved for programming only. The command structure is based upon a 48-bit word, where the upper M bits indicated the command type, and the lower N bits indicated the various parameter values.

Timing Diagram



Control Word Diagram

Specification	Minimum	Typical	Maximum
SPI Clock Frequency			20 MHz
Tcs1(TCSn to rising clk edge)	15 ns		
Ts	7 ns		
Th	2 ns		
Tcs2	25 ns		

At a minimum, command messages will include the following:

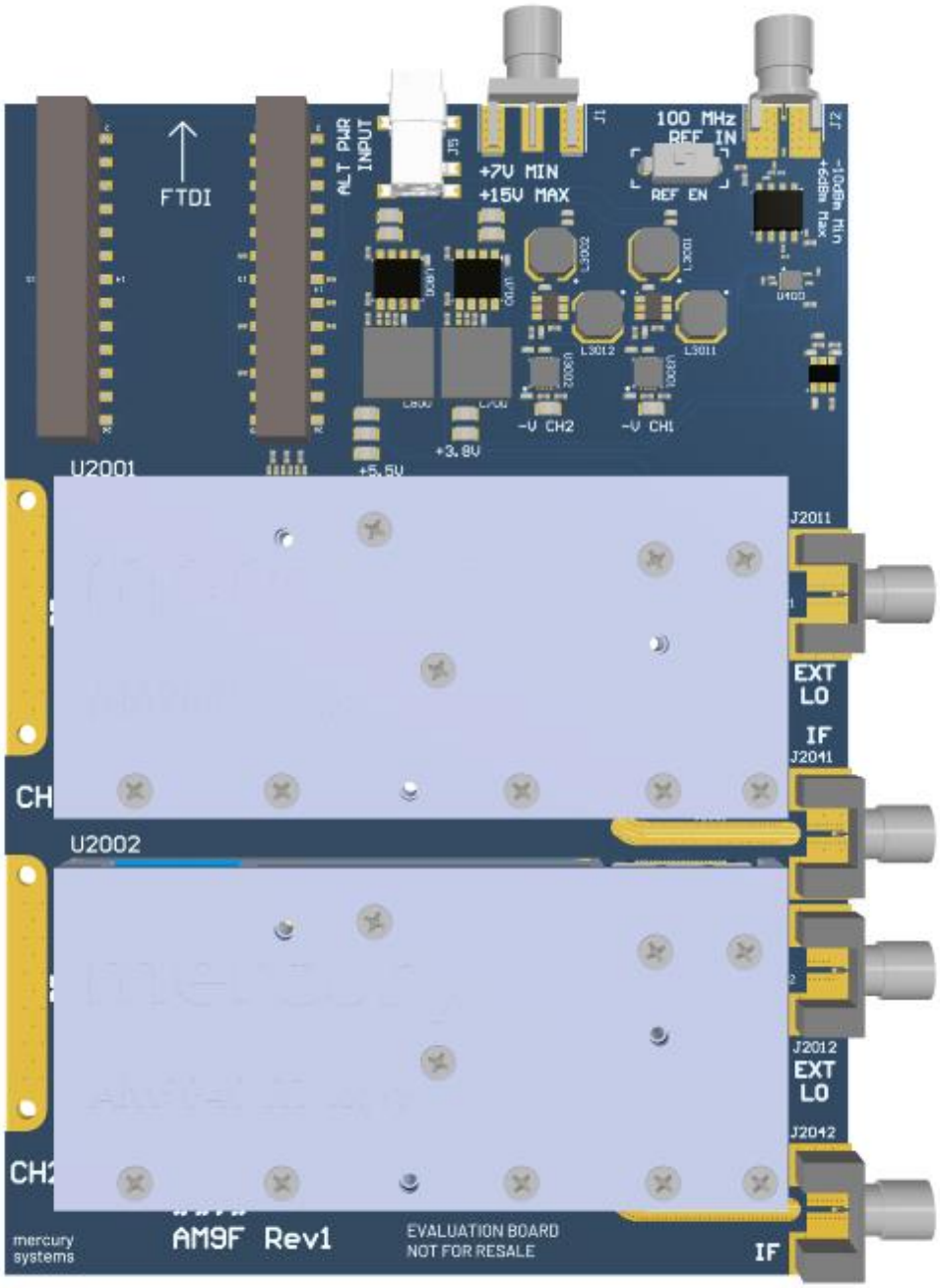
Tuner_Status – read back status information such as PLL Lock, temperature, error conditions

Tuner_Read – read back information such as hardware ID, serial number, firmware revision, etc.

Set_Freq – set tune frequency

Set_Atten – set user attenuation

AM9040 EVAL BOARD



Note: Includes 1 or 2 AM9040 tuner modules. Tuners can be controlled independently or configured for coherent operation.

See "Part Ordering Details" section for more information or contact MMICsales@mrcy.com

PART ORDERING DETAILS

There are 2 different standalone AM9040 tuner module configurations and 2 different evaluation board configurations. All eval boards come with Windows GUI control software and a user's guide. The ordering options are below:

Part Number	Description
AM9040	Standalone Tuner Module, Integrated LO synthesizer, Requires 100MHz Reference
AM9040-Ext	Standalone Tuner Module, Requires External LO
AM9040-Eval	Single channel AM9040 Eval board
AM9040-Eval-2CH	Dual Channel AM9040 Eval Board

RELATED PARTS

Part Number	Description
AM9035A	18 to 44 GHz wideband downconverter, with 4GHz IF, in connectorized module 3.3" x 3.5" x .75"
AM9017	0.1 to 18 GHz downconverter module with 0.5GHz inst bandwidth 1.38"x2.69"x0.26"
AM9018-1	0.9 to 18 GHz downconverter module with 1GHz inst bandwidth, in 1.4" x 3.0" pluggable module
AM9030-1	0.9 to 18 GHz upconverter module with 1GHz inst bandwidth, in 1.4" x 3.0" pluggable module

Corporate Headquarters

50 Minuteman Road
Andover, MA 01810 USA
+1 978.967.1401 tel
+1 866.627.6951 tel
+1 978.256.3599 fax

International Headquarters
Mercury International
Avenue Eugène-Lance, 38
PO Box 584
CH-1212 Grand-Lancy 1
Geneva, Switzerland
+41 22 884 5100 tel

Learn more
Visit: mrcy.com
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For technical details, contact: MMICsupport@mrcy.com

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