250 mW Lower S-Band FM Transmitter, 2.2-2.3 GHz

V 1P.00

Preliminary

MA05935-XX

Features

- FM transmitter with PLL, VCO and PA devices
- 3 Volt operation
- Parallel hard-wired frequency selection
- Choice of 16 frequency channels @ 1MHz spacing
- High Saturated Output Power: 24 dBm typ.
- 50 Ω Input/Output Matched
- IRIG 106-00 compliant
- STATEK crystal oscillator
- High shock

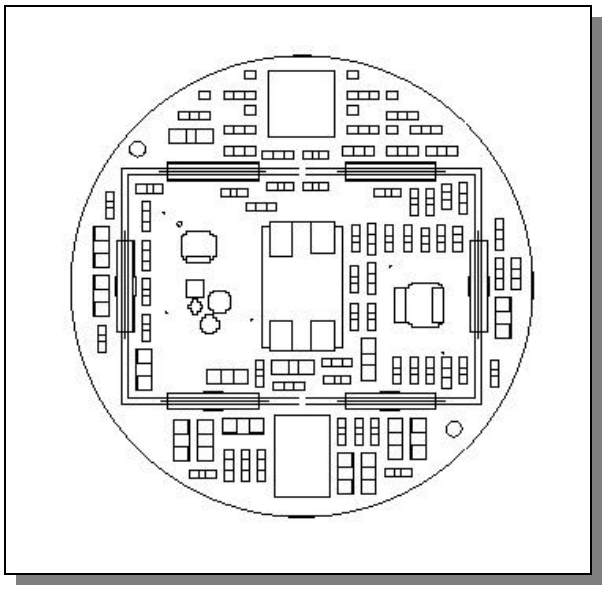
Description

M/A-COM's MA05935 is a miniature, phase-locked, FM transmitter module. The MA05935 is ideally suited for rugged telemetry systems.

The MA05935 contains a shock hardened crystal oscillator, a 0.35µm CMOS silicon phase-locked loop, and an InGaP HBT VCO and power amplifier, with supply line bypassing. The module requires only a single, positive regulated 3VDC power supply. The MA05935 has fully matched (50Ω) input and output networks.

M/A-COM's MA05935 is fabricated on standard FR-4 PC board material, employing automatic assembly of the hybrid technology components (silicon CMOS, InGaP HBT, and SMT). When fully encapsulated, this module will easily survive high shock pulses greater than 30,000G. This product is 100% RF tested to ensure compliance to performance specifications.

OUTLINE DRAWING [1,2,3]



1. Module diameter = 1.125"
2. Module height = 0.2"
3. Module weight = 3 grams typical

Electrical Specifications: Vcc = +3V, Zo = 50 Ohms, T_A = 25°C

Parameter	Test Conditions	Frequency	Units	Min	Typ	Max
Supply Voltage	——	——	volts	2.85	—	3.15
Supply Current	——	2.2 - 2.3 GHz	mA	—	350 typ.	—
Output power	——	2.2 - 2.3 GHz	dBm	—	24 typ.	—
Output VSWR	——	2.2 - 2.3 GHz		—	< 2:1	—
Stability	-40°C to +85°C	2.2 - 2.3 GHz	%	—	0.0002	—
Lock Time	——	2.2 - 2.3 GHz	ms	—	< 20	± 0.4
Harmonics	——	2.2 - 2.3 GHz	dBc	—	< -25	± 0.8
Output Power vs. Temp	-40°C to +85°C	2.2 - 2.3 GHz	dBm		±0.6	
Phase Noise	——	2.2 - 2.3 GHz	dBc @50kHz	—	-85 typ.	—
Power Added Efficency	——	2.2 - 2.3 GHz	%	—	23 typ.	—

Absolute Maximum Ratings [4,5]

Parameter	Absolute Maximum
Input Power	+13 dBm
V_{CC}	+12 volts
V_{BB}	-8 volts to +6 volts
I_{CC}	600 mA
Max. Dissipation Power	1350 mW
Channel Temperature	+150°C
Operating Temperature	0°C to +60°C
Storage Temperature	-65°C to +150°C

4. Operation of this device above any one of these parameters may cause permanent damage.
5. Adequate heat sinking and grounding required.

Handling

Permanent damage to the MA05935 may occur if the following precautions are not adhered to:

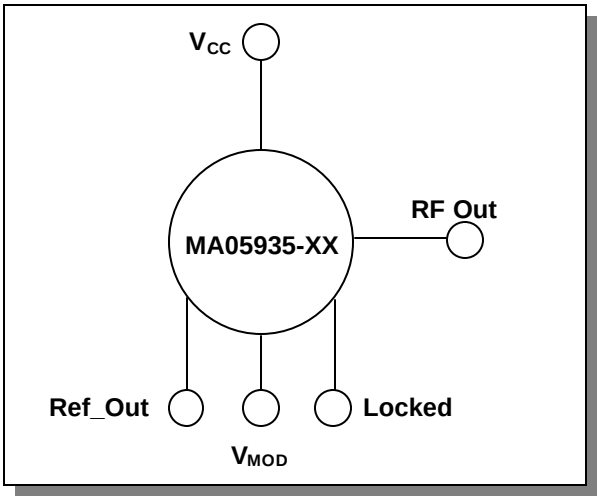
A. Static Sensitivity – All die handling equipment and personnel should comply with DOD-STD-1686 Class I.

B. Transients – Avoid instruments and power supply transients while bias is connected to the MA05935. Use shielded signal and bias cables to minimize inductive pick-up.

Mounting

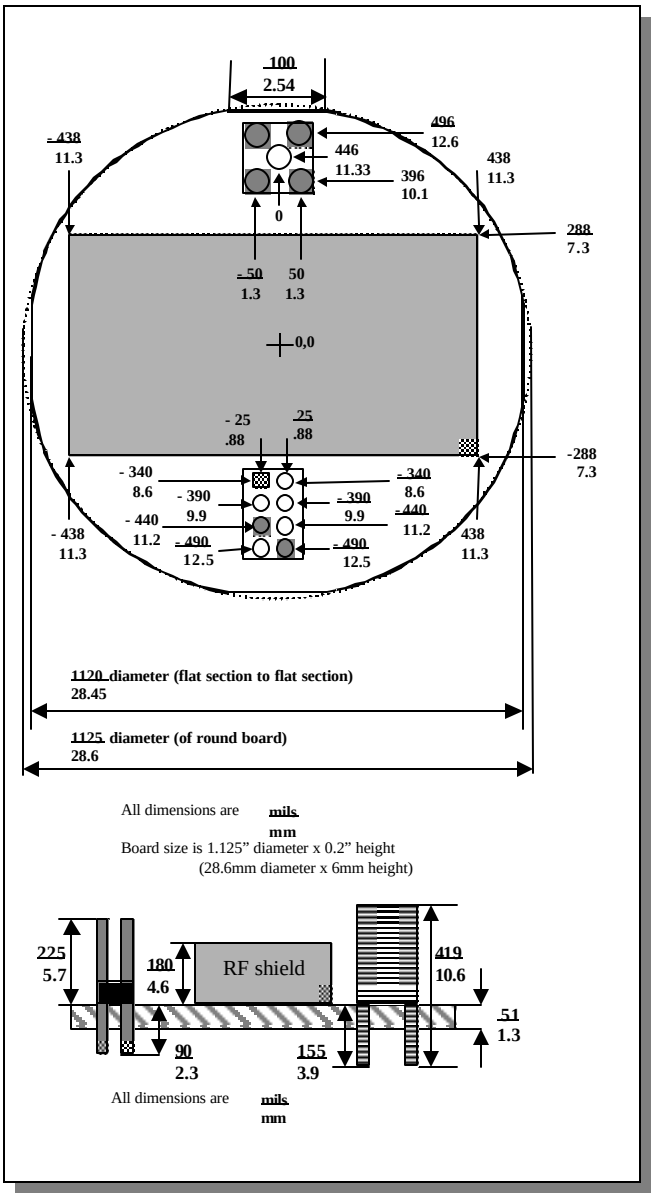
DO NOT expose the MA05935 to temperatures greater than 180°C for more than 20 seconds. Higher temperatures may result in reflow of the Sn63/Pb37 solder used for SMT component attach.

Typical Bias Configuration [6,7]



6. Apply +3 volts V_{CC}. Apply V_{MOD}.
7. V_{CC} bypassing is performed on board.

Module Outline



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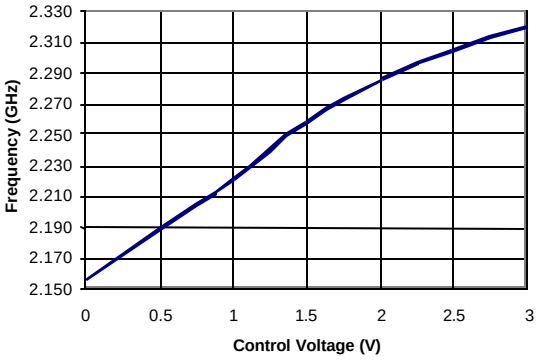
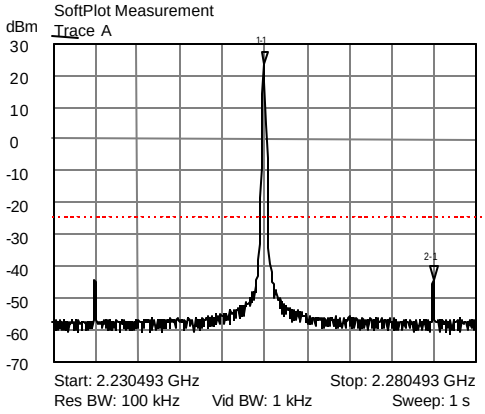
Typical Performance Curves

Frequency vs Tune Voltage

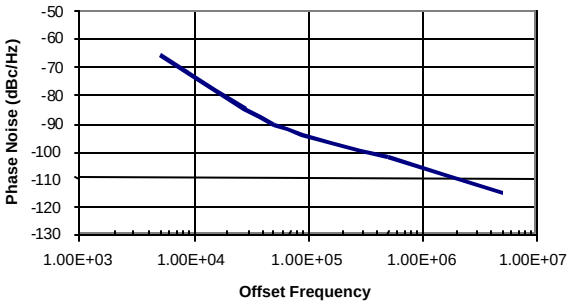


Spurious Emissions

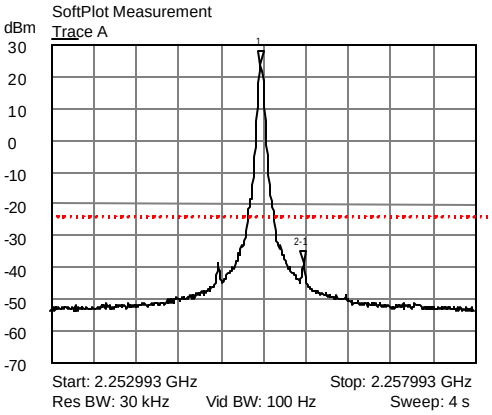


Saturated Output Power vs.

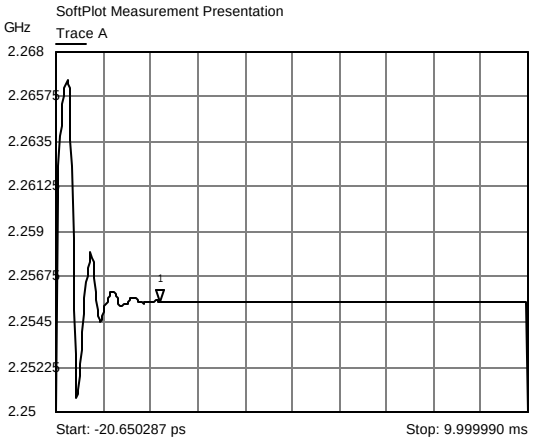
PHASE NOISE



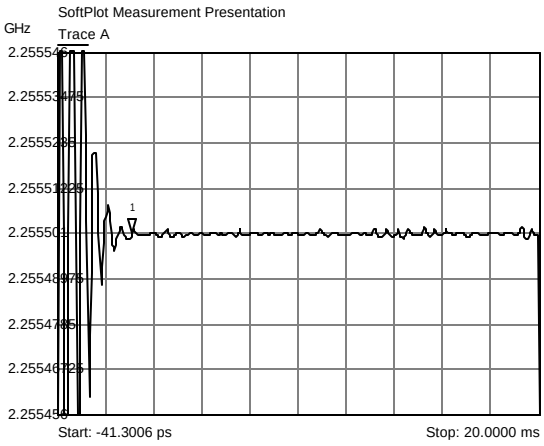
Spurious Emissions



Lock Time



Stability (y-axis displays ±0.002% of lock freq)



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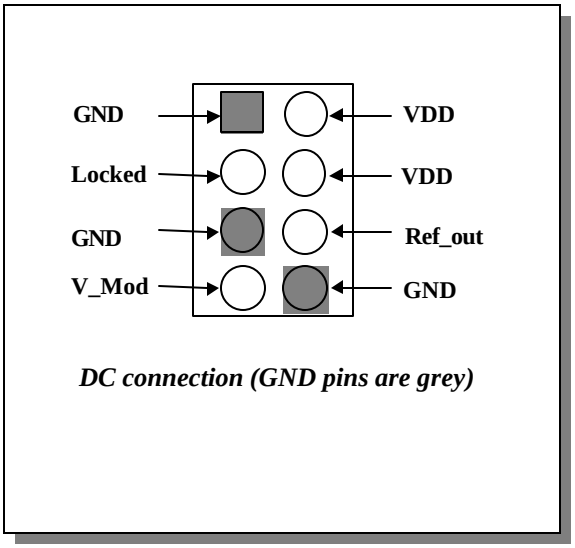
Application Notes

DC connector

The DC connector of the MA05935-XX is a standard dual body 0.050“ (1.27mm) pitch, 8-pin header connector. The pin assignments of this connector are shown below.
The through-hole connector was chosen to allow freedom in mounting; this connector may be either placed or omitted to allow use of other connector types.
The DC connector provided with the MA05935 is supplied unattached to the board.

DC CONNECTOR PINOUT



DC connection (GND pins are grey)

RF connector

The RF connector is a standard-sized, through-hole mounted connector. To afford user flexibility, the RF connector provided with the MA05935 is supplied unattached to the board.

Channel Selection

The PLL determines the frequency of operation of the board. The channels available are listed in the following tables. There are 16 frequencies available, at 1MHz spacing.

The channel selection on the board is performed through the use of 0402 SMT zero ohm resistors, connected to the parallel input lines of the PLL. Configuration pads to these lines are located to the right of the RF connector, when the board is oriented with the DC connector in the lower part of the board, and RF connector in the upper part (see figure below table on following page).

The following table (Table 1) details the frequency choices, and the required resistor positions.
For a zero (0) value, the resistor must be loaded horizontally (that is, between the common SMT pad and GND), and for a value of high (1), the zero ohm resistor must be loaded vertically (i.e., between the common SMT pad and VDD).

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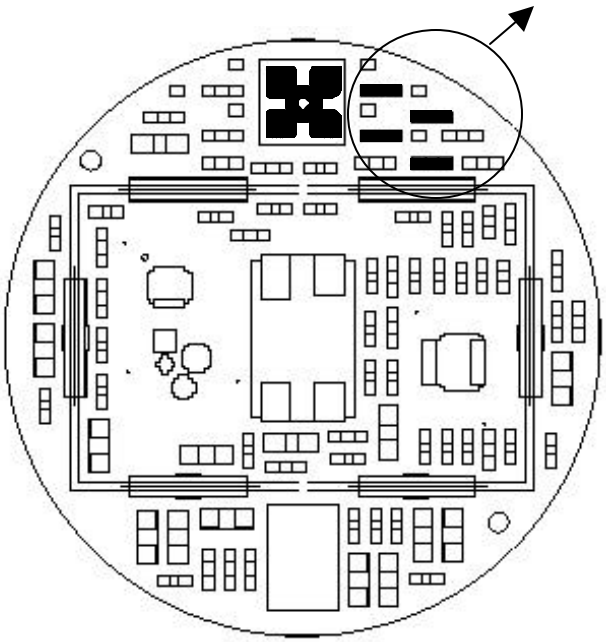
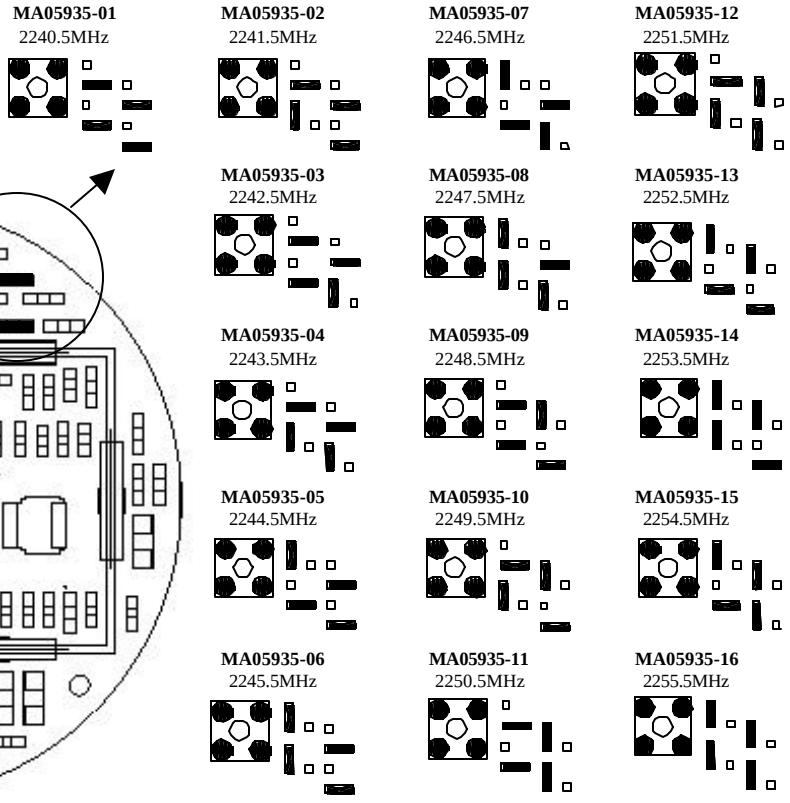
Table 1 Frequency selection for S_{LOWER} band

Part number	CS3 (R4=0W)	CS2 (R3=0W)	CS1 (R17=0W)	CS0 (R13=0W)	S_{LOWER} BAND Frequency
MA05935-01	0 V	0 V	0 V	0 V	2.2405 GHz
MA05935-02	0 V	0 V	0 V	3 V	2.2415 GHz
MA05935-03	0 V	0 V	3 V	0 V	2.2425 GHz
MA05935-04	0 V	0 V	3 V	3 V	2.2435 GHz
MA05935-05	0 V	3 V	0 V	0 V	2.2445 GHz
MA05935-06	0 V	3 V	0 V	3 V	2.2455 GHz
MA05935-07	0 V	3 V	3 V	0 V	2.2465 GHz
MA05935-08	0 V	3 V	3 V	3 V	2.2475 GHz
MA05935-09	3 V	0 V	0 V	0 V	2.2485 GHz
MA05935-10	3 V	0 V	0 V	3 V	2.2495 GHz
MA05935-11	3 V	0 V	3 V	0 V	2.2505 GHz
MA05935-12	3 V	0 V	3 V	3 V	2.2515 GHz
MA05935-13	3 V	3 V	0 V	0 V	2.2525 GHz
MA05935-14	3 V	3 V	0 V	3 V	2.2535 GHz
MA05935-15	3 V	3 V	3 V	0 V	2.2545 GHz
MA05935-16	3 V	3 V	3 V	3 V	2.2555 GHz

Resistors
R4, R3, R17, R13(LSB)
are zero ohm resistors
for channel select bits





Channel select configuration of zero ohm resistors for frequency selection

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Ordering Information

PART NO.	DESCRIPTION
MA05935-01	24dBm module (operates at 2240.5MHz)
MA05935-02	24dBm module (operates at 2241.5MHz)
MA05935-03	24dBm module (operates at 2242.5MHz)
MA05935-04	24dBm module (operates at 2243.5MHz)
MA05935-05	24dBm module (operates at 2244.5MHz)
MA05935-06	24dBm module (operates at 2245.5MHz)
MA05935-07	24dBm module (operates at 2246.5MHz)
MA05935-08	24dBm module (operates at 2247.5MHz)
MA05935-09	24dBm module (operates at 2248.5MHz)
MA05935-10	24dBm module (operates at 2249.5MHz)
MA05935-11	24dBm module (operates at 2250.5MHz)
MA05935-12	24dBm module (operates at 2251.5MHz)
MA05935-13	24dBm module (operates at 2252.5MHz)
MA05935-14	24dBm module (operates at 2253.5MHz)
MA05935-15	24dBm module (operates at 2254.5MHz)
MA05935-16	24dBm module (operates at 2255.5MHz)

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