

Radar Manual & Integrator Instructions

These module integration instructions provide OEM integrator instructions for using the Patroness RADAR module. Please review and understand the conditions, limitations, and authorized uses of this module prior to integration.

Overview of Module

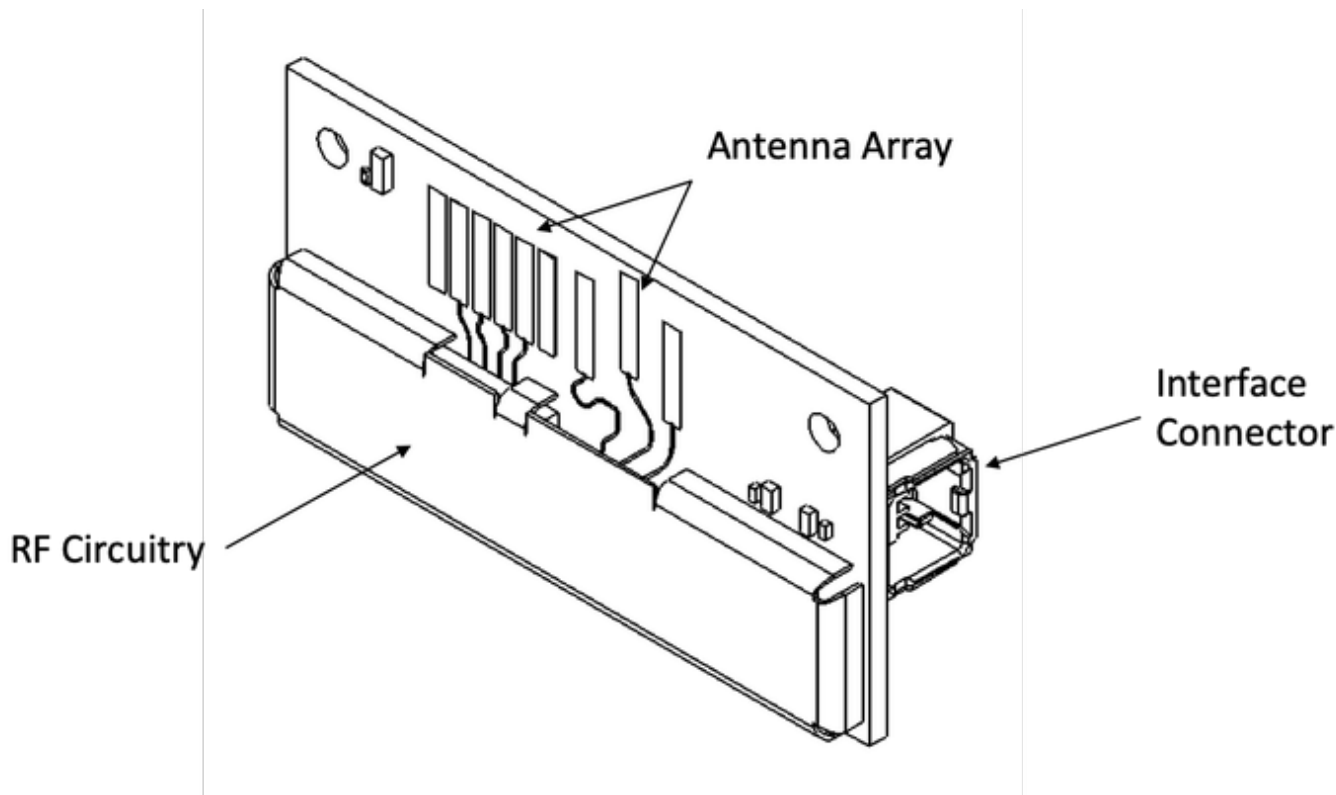


Figure 1. Patroness RADAR module.

The Patroness RADAR module is a mmWave sensor based on frequency-modulated continuous wave (FMCW) radar technology capable of operation in the 76- to 81-GHz bandwidth up to 4 GHz continuous chirp. It is built with a Texas Instruments IWR1443 System on Chip (SoC) main processor and integrated custom 3 Tx, 4 Rx antenna array capable of generating x,y,z coordinates for up to 100 unique targets in its field of view. Communication with the module is accomplished via SPI protocol (Serial Peripheral Interface).

The module is intended for integration into non-automobile motorized devices such as powered mobile chairs, mobility scooters, electronic conveyance vehicles, riding lawn mowers, grocery carts, all-terrain vehicles (ATVs), golf carts, and other mobile systems. It is not intended to be used in automobiles (passenger cars, trucks, passenger buses, and other passenger or property transporting motorized vehicles intended for licensed operation on state and national highways) or for fixed applications.

Features

- Precise, non-contact target tracking measurement for multiple objects
- Low power and data processing requirements compared to competing approaches such as a scanning LIDAR
- Easy to use serial interface
- RoHS Compliant

Performance Characteristics

The following table describes typical performance characteristics of the default configuration of the Patroness RADAR module. The values given are based on controlled range testing without any enclosure or housing. Enclosure and mechanical configuration impacts the performance of the system and integrators should confirm performance for their unique application prior to release.

Parameter	Value	Notes
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Frequency	76-81 GHz coverage with 4-GHz bandwidth	-
Transmit Power	Up to 0.98 dBm	EIRP
Vertical FOV	90 degrees	-
Horizontal FOV	95 degrees	-
Power Usage	Less than 2 Watts	Typical, active
Data Rate	50 KBps	Typical, active
Max Reports	100	Maximum number of simultaneous, individual reports from sensor
Max Range	6 meters	Max distance an object can be detected
Min Range	6 cm	Closest distance an object can be detected
Resolution	4 cm	Range measurement resolution

Applicable Rules

Do Not Modify

Changes or modifications not expressly approved by Patroness may void your authority to operate the equipment.

FCC ID: 2ASQO-P003110

This device complies with part 95 and part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Consult the dealer or an experienced radio/TV technician for help.

IC: 24864-P003110

This device complies with Industry Canada RSS 251 and RSS-GEN standards. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil est conforme avec Industrie Canada exempts de licence standard RSS 251 et RSS-GEN. Son fonctionnement est soumis aux deux conditions suivantes: (1) cet appareil ne doit pas provoquer d'interférences et (2) cet appareil doit accepter toute interférence, y compris celles pouvant causer un mauvais fonctionnement de l'appareil.

Operating Conditions

Description	High	Low
Operating Temperature	40 C	-10 C
Storage Temperature	80 C	-40 C
Water & Dust	Not rated, dependent on enclosure	

Physical Mounting & Packaging

ESD Protection

This module can be damaged by ESD. Patroness recommends that all modules be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure.

Antenna Care

Particular care should be taken to avoid scratching or damaging the antenna array.

The module is intended to be mounted in an enclosure for protection against the elements and damage.

The board nominal thickness is 1.6 mm.

Module Mounting

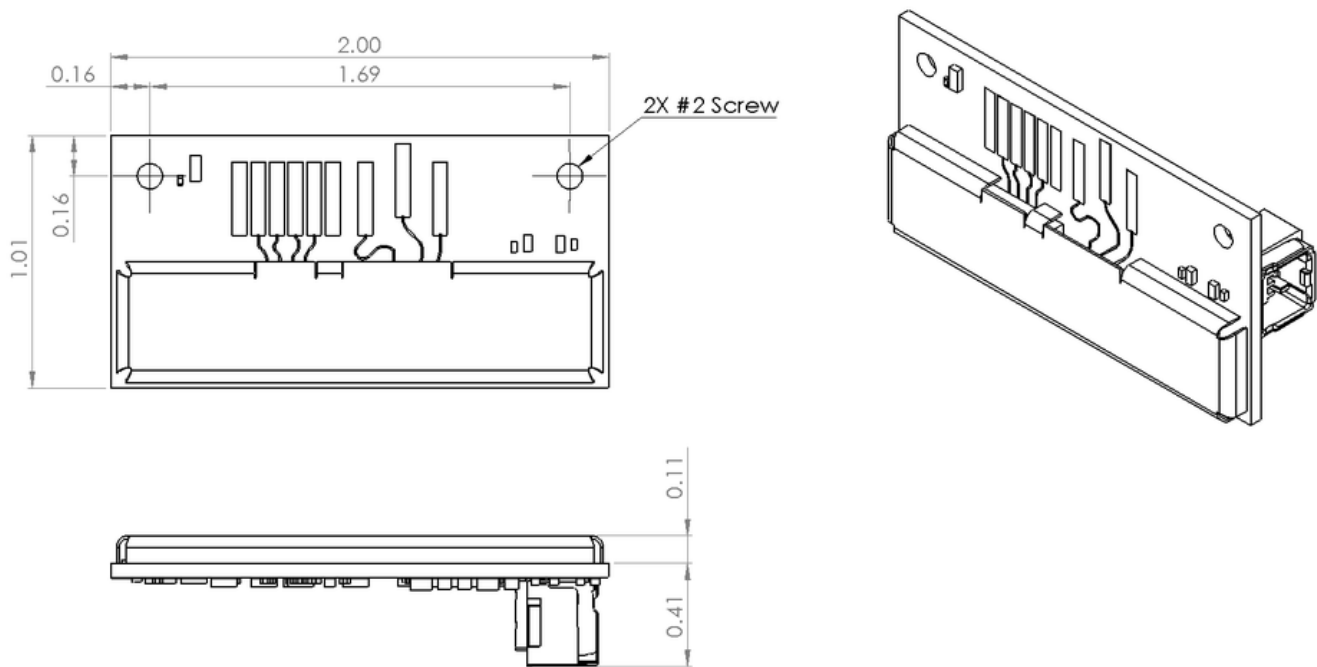


Figure 2. Patroness RADAR module dimensions.

Electrical & Communication Interface

	The interface connector on the RADAR accepts a Molex PN 5054320801 8-Position Rectangular Housing Connector. The pinout is detailed below.
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Pin	Definition	Details
1	+5V	5 Volts DC
2	SPI_CS	Chip select
3	SPI_MISO	Serial Master In/Slave Out
4	SPI_HOST_INTR	Serial interrupt
5	SPI_CLK	Serial clock from master
6	PMIC_EN	Set high to enable power to main processor
7	SPI_MOSI	Serial Master Out/Slave In
8	GND	Ground

The module must be powered by an external 5 Volt power supply (0.5 Amp current limit). When 5 Volt power is applied to the module, and the PMIC enable pin is set high, the IWR1443 SoC is powered for use. Note, that the power up of the PMIC takes approximately 5 ms once the

enable signal is released.

Once powered for use, the IWR1443 SoC begins running based on the onboard configuration settings and sends target data back to the host over serial protocol. Data is reported out 64 bytes at a time and the host interrupt pin is toggled when data is ready to read.

The Patroness RADAR will continue to report data based on a RADAR sampling rate of 12 Hz until the enable pin status is changed or power is lost to the device.

Modes of Operation

There are no alternative modes of operation.

RF Exposure Considerations

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body.

This device is intended only for OEM integrators under the following conditions:

1. The host product operating conditions must be such that there is a minimum separation distance of 20 cm between the antenna radiating structures and nearby persons. The host manufacturer is obligated to confirm the use conditions of the host product to ensure that the distance specified in the instructions is met, and
2. The transmitter module may not be co-located with any other transmitter or antenna.

Antennas

Do Not Modify Antennas

Any modification of the trace antenna will void your authority to operate the equipment.

The module includes onboard etched antennas for four receivers (rx1-4) and three transmitters (tx1-3). The physical location of these antennas are labeled in Figure 3.

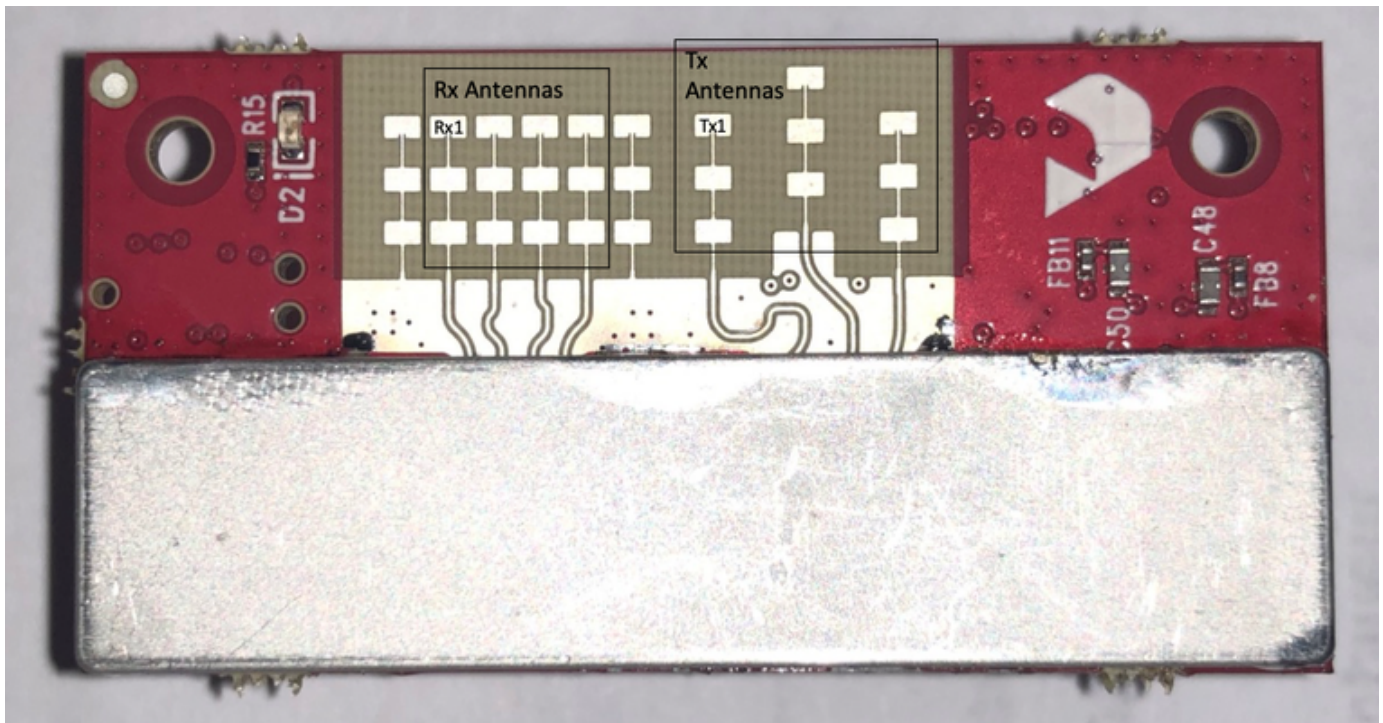


Figure 3. Antenna locations on Patroness RADAR module.

Antenna List

The antenna peak gain is 10.85 dBi across the frequency band of 76 to 81 GHz. The radiation paternities of the antenna in the horizontal plan (H-plane) and elevation plan (E-plane) is shown in Figure 4 and Figure 5.

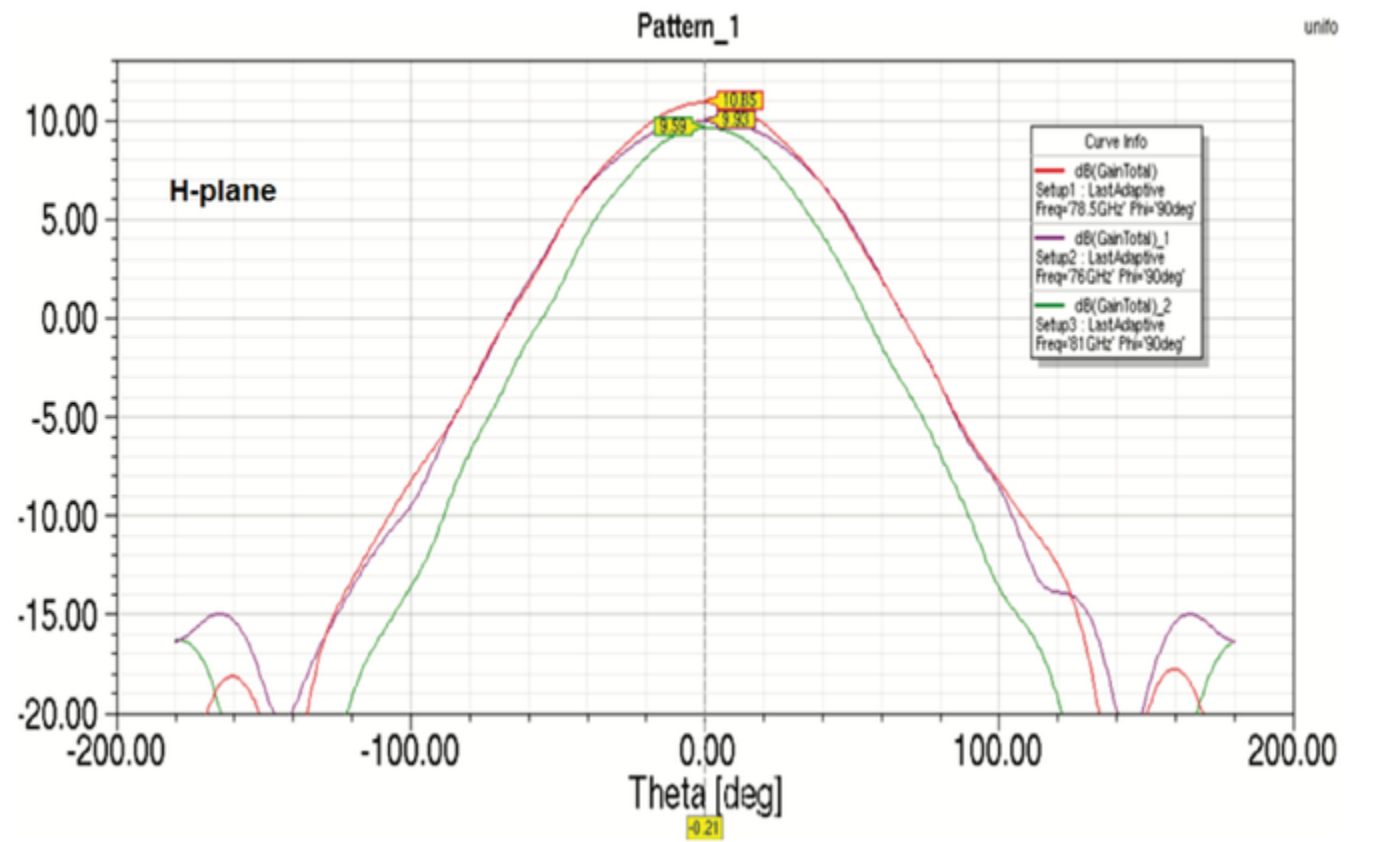


Figure 4. Antenna Pattern in H-Plane

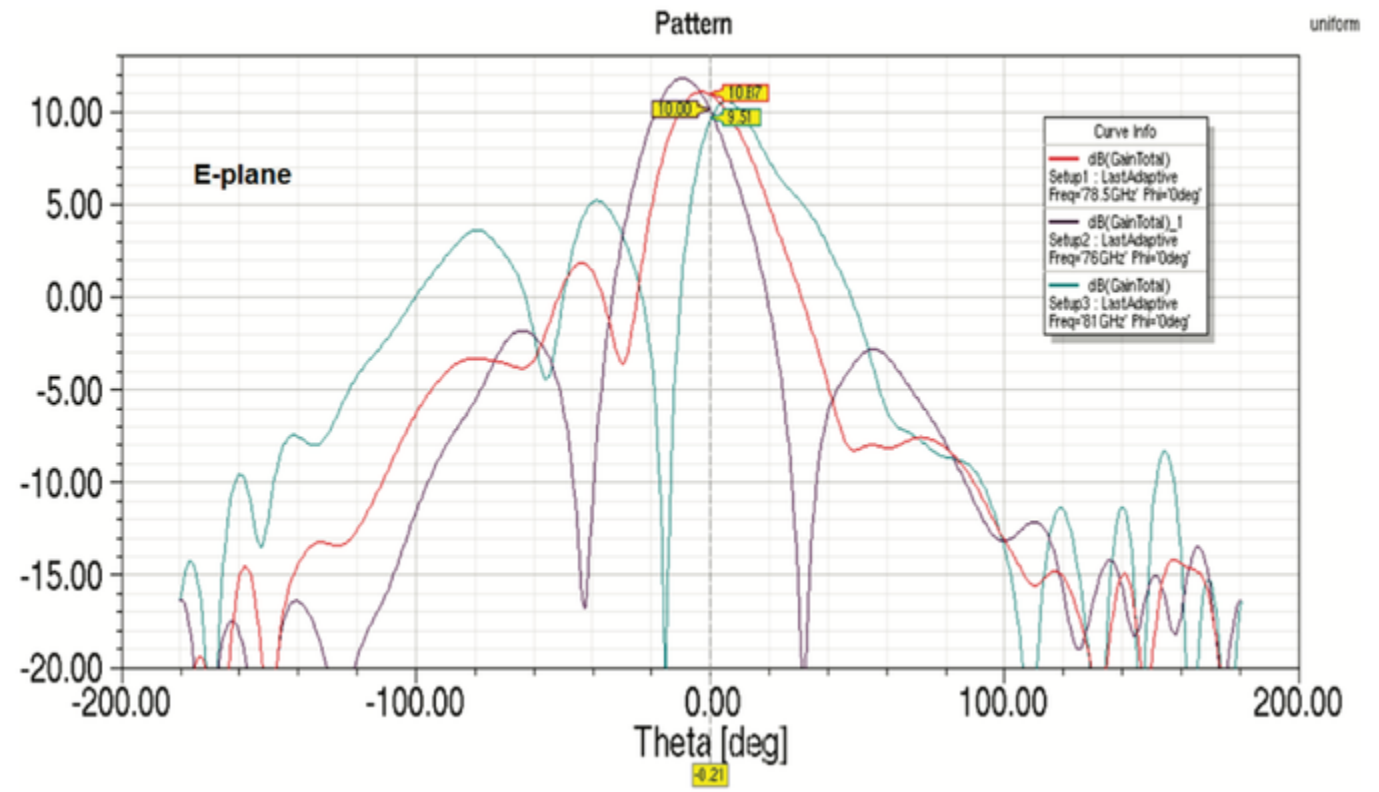


Figure 5. Antenna Pattern in E-Plane

The beamwidth of the antenna is determined from the radiation patterns described in the previous figures. For example, at 78 GHz, based on a 3-dB drop in the gain as compared to bore sight, the horizontal 3dB-beamwidth is approximately +/-28 degrees (see Figure 4), and elevation 3dB-beamwidth is approximately +/-14 degrees (see Figure 5). Similarly, the horizontal 6dB-beamwidth is approximately +/-50 degrees and the elevation 6dB-beamwidth is approximately +/-20 degrees.

Label and Compliance Information

Labeling Required

If the FCC identification number of the module label is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module.

This exterior label can use wording such as the following: “Contains Transmitter Module FCC ID: 2ASQO-P003110” or “Contains FCC ID: 2ASQO-P003110.”

Information on Test Modes

Contact Patroness if specific test modes are required for host device testing.

Additional Testing, Part 15 Subpart B Disclaimer

The P003110 modular transmitter is only FCC authorized for the specific rule parts listed and it is the host installer's responsibility to perform some investigative measurements to confirm that the resulting composite system does not exceed the spurious emissions limits or band edge limits. This investigation is especially important when integrating multiple modular transmitters. If the investigation indicates a compliance concern the host product manufacturer is obligated to mitigate the issue. Host products using a modular transmitter are subject to all the applicable individual technical rules as well as to the general conditions of operation in Sections 15.5, 15.15, and 15.29 to not cause interference. The operator of the host product will be obligated to stop operating the device until the interference has been corrected. If the host product is marketed as being Part 15 Subpart B compliant and it contains other unintentional-radiator digital circuitry, then the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

Patroness Contact Information

Please contact us with feedback, to report problems, or to suggest changes that will help improve the quality and usability of our products. You may reach us at:

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