

Antenna Gain Information: A04659

Equipment Description:

This report contains the antenna gain information for four antennas of Garmin Model A04659. The operational frequency of these technologies is shown in the table below, and the maximum gain within the frequency band is reported. Please refer to the Operational Description for additional details (held in Long-Term Confidentiality).

Antenna No.	Technology	Frequency Range
Antenna 1	Multi-Use Radio Service (MURS, VHF)	151.82 - 154.6 MHz
Antenna 2 (Extended Range)	Multi-Use Radio Service (MURS, VHF)	151.82 - 154.6 MHz
Antenna 3	Mobile Earth Station	1616 – 1626 MHz
Antenna 4	Bluetooth Low-Energy, ANT, Wi-Fi	2402 – 2480 MHz

Reported Data:

Maximum Gain for Multi-Use Radio Service (MURS, VHF) (Antenna 1): **-8.53 dBi @ 151.82 MHz**

Maximum Gain for Multi-Use Radio Service (MURS, VHF) (Antenna 2): **-2.45 dBi @ 154.6 MHz**

Maximum Gain for Mobile Earth Station (Antenna 3): **2.209 dBi @ 1616 MHz**

Maximum Gain for Bluetooth Low-Energy, ANT, Wi-Fi (Antenna 4): **0.43 dBi @ 2437 MHz**

Procedure, Antennas 1 and 2:

For Antennas 1 and 2, gain was measured in a 10-meter semi-anechoic chamber, with the antenna oriented horizontally (x-plane) and vertically (y-plane), separately. The antenna was positioned at a height of 1.5 meter and rotated through 360-degrees of azimuth and measured in 15-degree increments. The measurement antenna was polarized both horizontally and vertically, and the vector sum of the horizontal and vertical gains were calculated. Measurements were taken at 150 MHz, 160 MHz, and 170 MHz, and the worst-case antenna gains were interpolated at the frequencies of interest (151.82 - 154.6 MHz).

Setup, Antennas 1 and 2:

For Antennas 1 and 2, gain was measured by the following laboratory:

Test Laboratory	International Certification Corporation
Test Site	CO01-WS, 03CH01-WS, TH01-WS
Address of Test Site	No.3-1, Lane 6, Wen San 3rd St., Kwei Shan Dist., Tao Yuan City 33381, Taiwan (R.O.C.)

➤ FCC Designation No.: TW2732

➤ FCC site registration No.: 181692

Procedure, Antenna 4:

For antenna 4, gain was measured using the substitution method as the noted in test report numbers R20220628-20-E1A and R20220628-20-E3A .

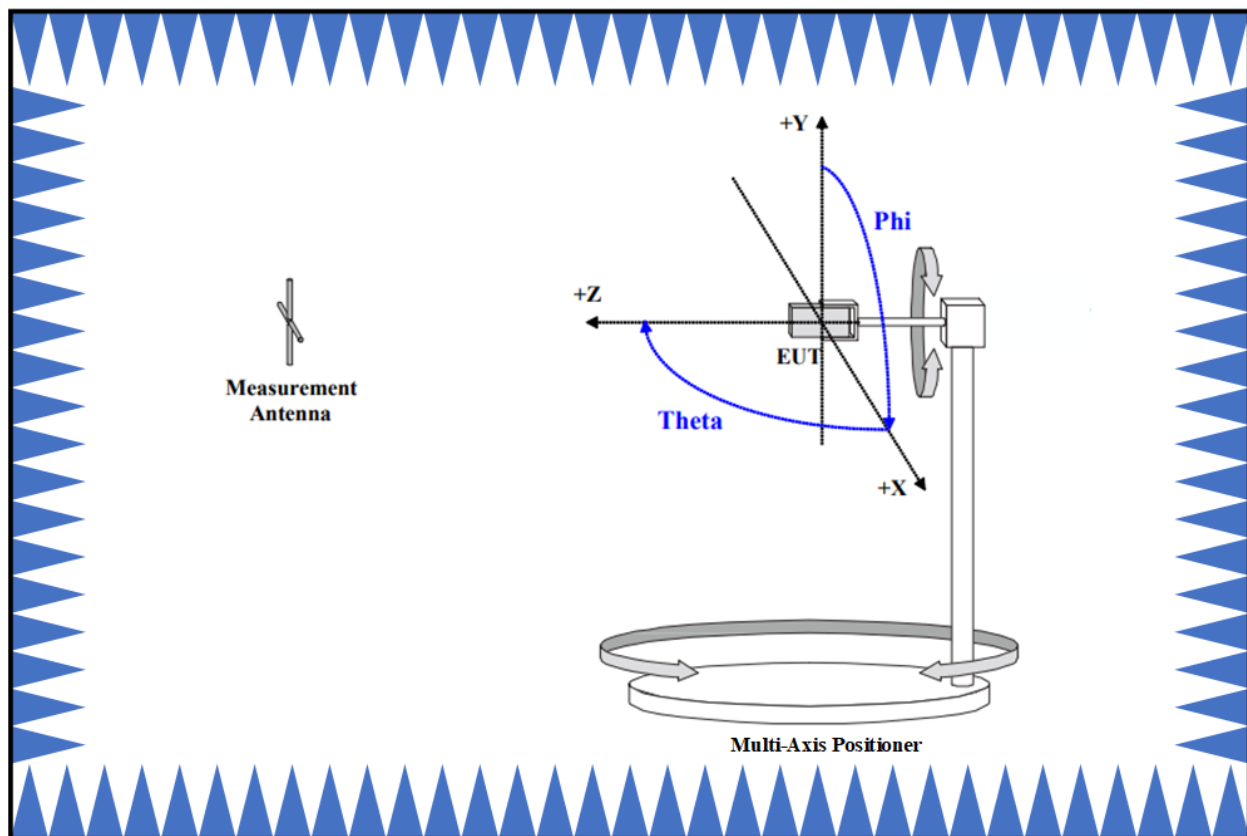
Setup, Antenna 4:

For antenna 4, gain was measured by Nebraska Center for Excellence in Electronics (NCEE Labs). Refer to the test reports for test setup information.

Procedure, Antenna 3:

Garmin uses an ETS-Lindgren AMS-8500 3D Fully Anechoic Automated Antenna Measurement System. The measurement chamber is fully anechoic and contains both the Equipment Under Test (EUT) and the measurement antenna. The EUT is mounted on a Multi-Axis Positioner, which can orient the antenna in all orientations relative to the measurement antenna. The measurement antenna is dual-polarized and measures both horizontal and vertical polarization simultaneously. The other equipment includes a Vector Signal Generator, a multi-channel Vector Network Analyzer, and a control PC. Data is taken and analyzed using EMQuest Data Acquisition and Analysis Software. The output includes the maximum 3D antenna gain within the frequency band.

Setup:



Equipment List:

3D Chamber PC interfaced to Test Equipment
EMQuest Software w/ Required Drivers for Equipment Installed
AMS-8500 Anechoic Wireless Test Chamber
Dual Polarization Measurement Antenna (ETS 3164)
Multi-Axis Positioning System (MAPS)
Multi-Axis Positioning Controller (ETS EMCO Model 2090)
Network Analyzer (Agilent E5017C)
Automated RF Switch Controller (Agilent)

Additional Information:

- Photos of the antenna are provided in separate exhibits: A04659-A03302 Internal Photos and A04659-A03302_External_Photos.
- The Photos include a scale for dimensions
- The RF cable length is 32 mm

Signature:

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