M3000B Wi-Fi Antenna Specifications

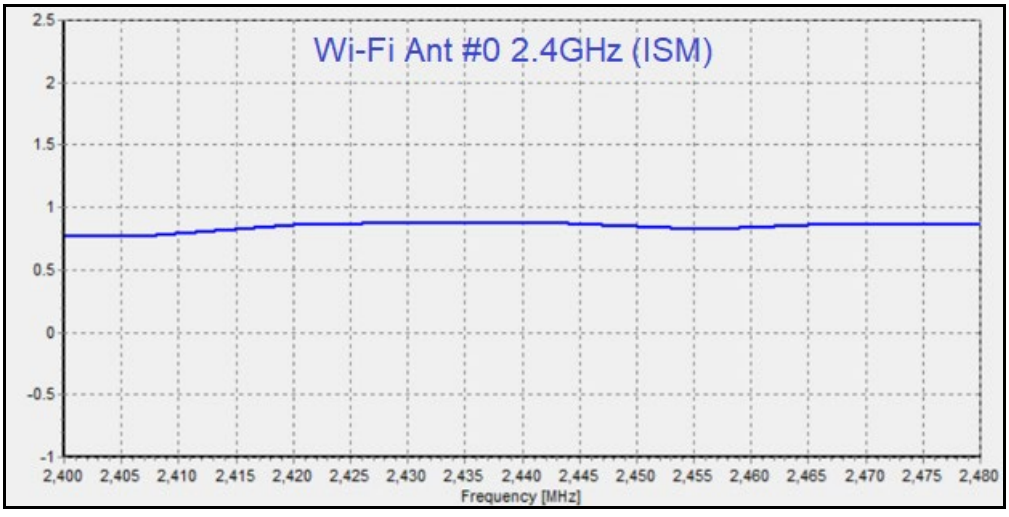
1. Inseego Custom Antenna Part#'s:
   - WiFi Ant #0 Part Number: 12023299
   - WiFi Ant #1 Part Number: 12023300

2. Construction:
   - Flexible Printed Circuit (FPC) Design consisting of Copper, Polyimide, and Adhesive
   - Type: Planar Inverted-F Antenna (PIFA)

3. Antenna Passive Pk Gain Results Table:

Wi-Fi Ant #0	Frequency Range	Pk Gain
ISM	2440MHz (2412MHz to 2462MHz)	0.9 dBi
UNI-1	5200MHz (5170MHz to 5250MHz)	3.1 dBi
UNI-3	5700MHz (5735MHz to 5835MHz)	3.9 dBi
Wi-Fi Ant #1	Frequency Range	Pk Gain
ISM	2440MHz (2412MHz to 2462MHz)	4.3 dBi
UNI-1	5200MHz (5170MHz to 5250MHz)	4.5 dBi
UNI-3	5700MHz (5735MHz to 5835MHz)	6.4 dBi

4. Antenna Passive Gain (dBi) Charts:
   - Antenna Engineer: Matt Salvino
   - Passive Measurement Date: 03-22-2022



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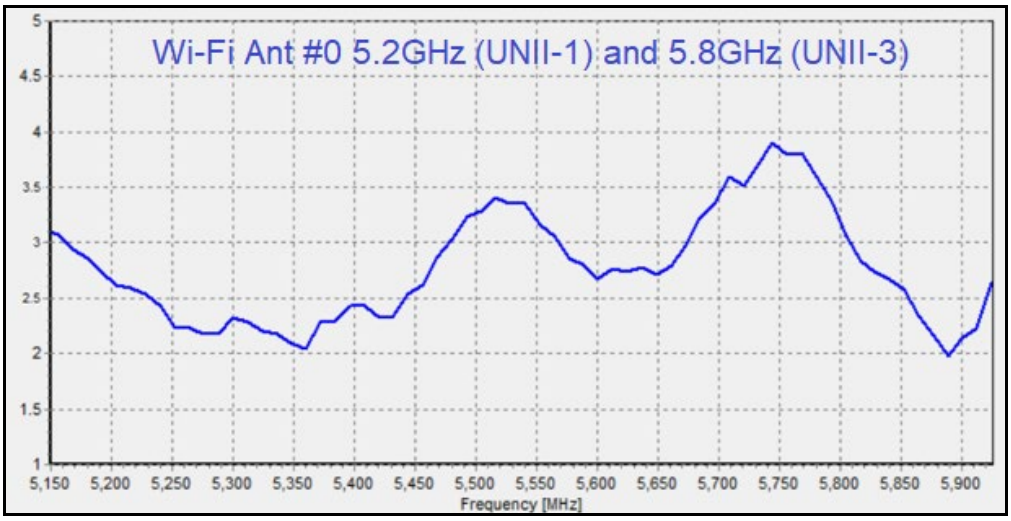

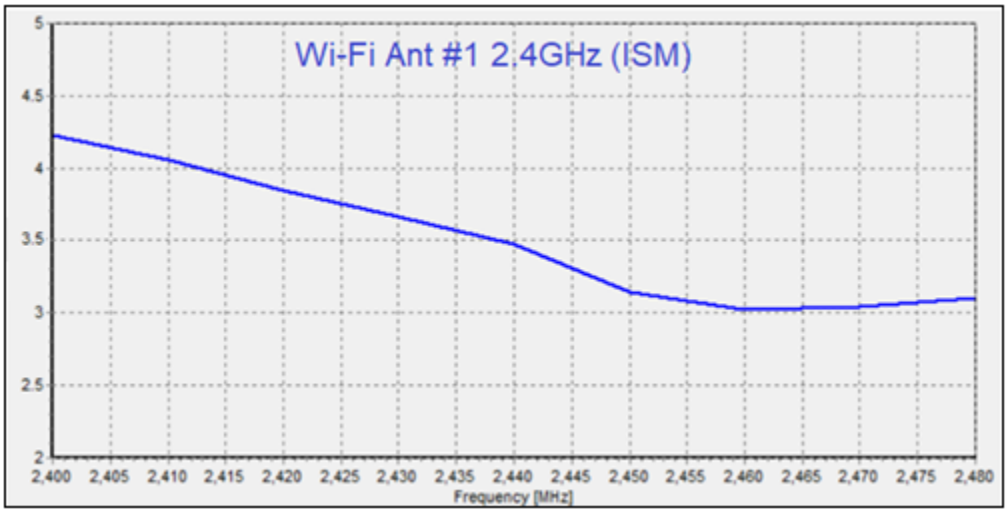

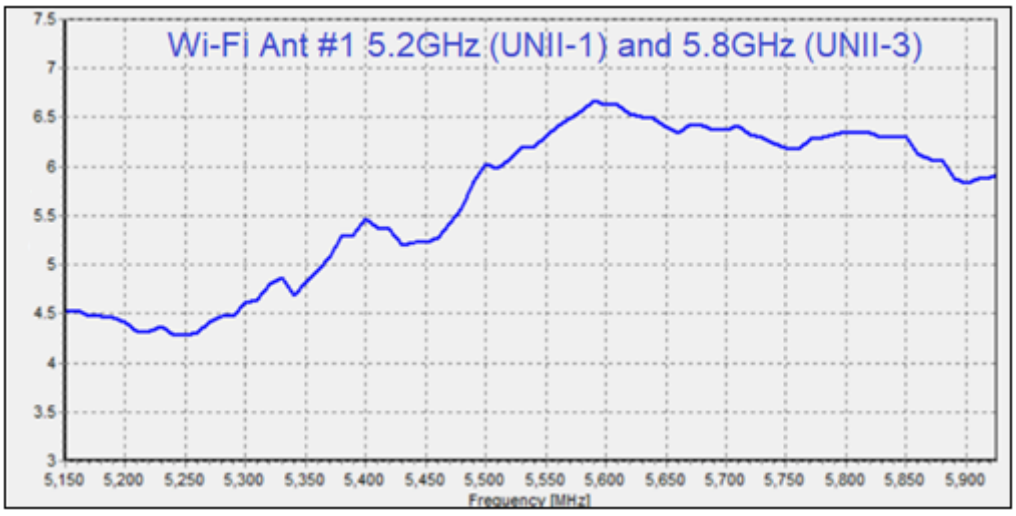

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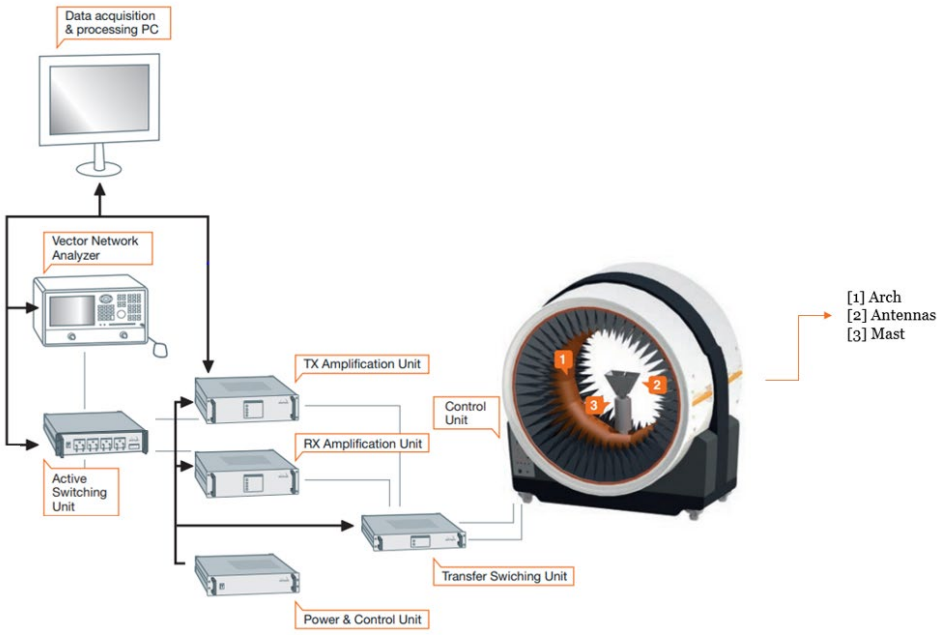
5. Measurement Setup Illustration:

Passive Performance Test System components and diagram:

Frequency Bands: 600 MHz to 10 GHz
Max. Size of DUT: 450mm for spherical set-up
Max. Weight of DUT: 10 kgs
The system is capable of the following measurements:

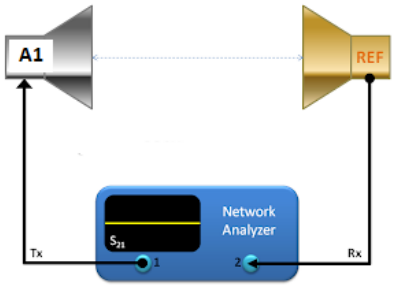
- Gain
- Directivity
- Beamwidth
- Cross polar discrimination
- Sidelobe levels
- 3D radiation pattern
- Radiation pattern in any polarization (linear or circular)
- Antenna efficiency test



Gain Measurement method Explained:

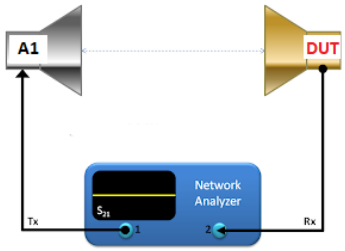
a) **Calibration**: Use Two Antennas (one has to have a known gain [In this case Ref]) to measure and record the S parameter S(21) which is the input/output relation ship between the ports on the Network analyzer
   a. Normalize the calibration to produce 0 DB reference on the network Analyzer.
   b. All cable loss factors are accounted for in the system

Notes : A1 represents Arch antennas in system
The software instructs the VNA to produce a sweep signal over the frequency range specified. The it will generate the signal is a swept CW between the start and end frequency and pausing at predetermined points long enough to collect measurement.



Calibration diagram

b) **DUT Measurements**: Replace reference Antenna with DUT Antenna (maintaining the same conditions) distance etc.

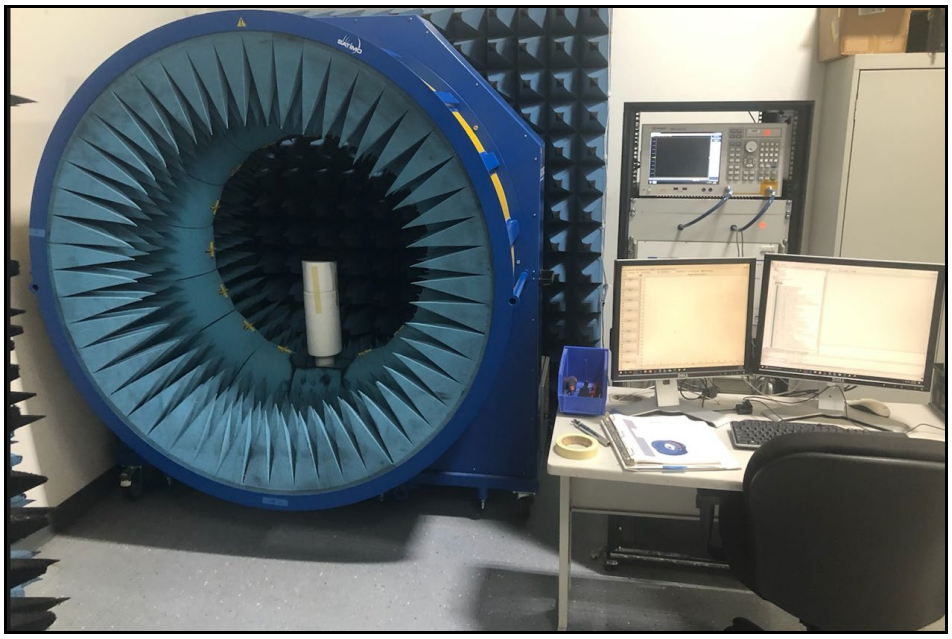


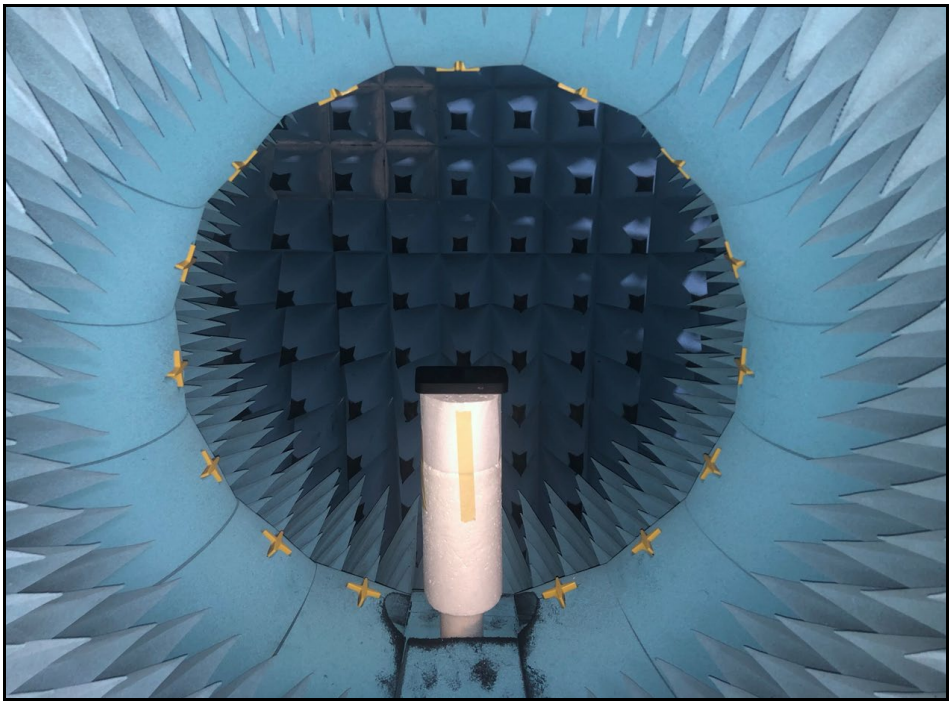
DUT Measurement diagram

c) Remeasure S(21) response which now represents the gain relative to reference antenna. Collect G(Rel).

d) Calculate G(Dut)=G(ref)+ G(rel)

Note that the system used in the chamber is automated. (the measurement is taken at multiple locations by rotating the DUT and the arch)





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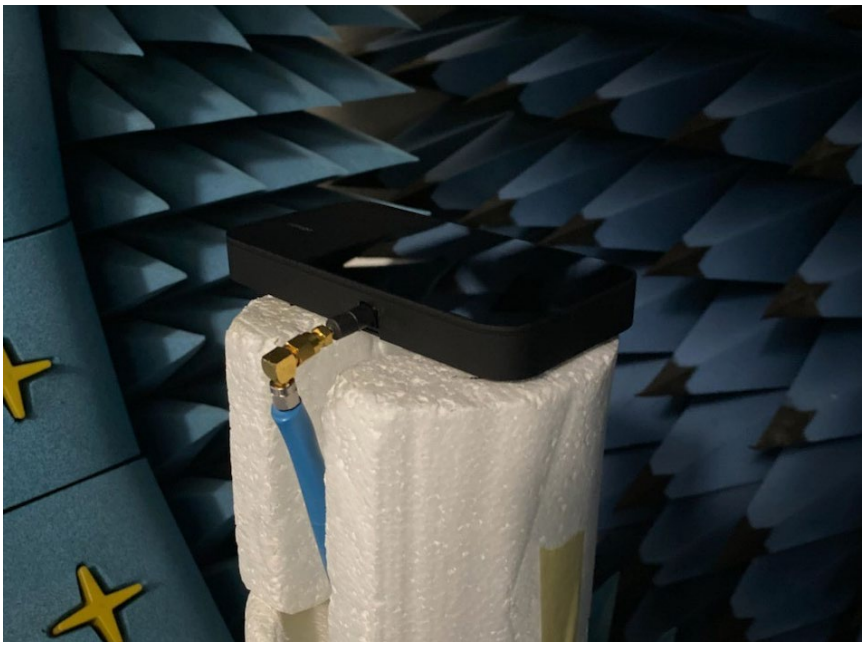
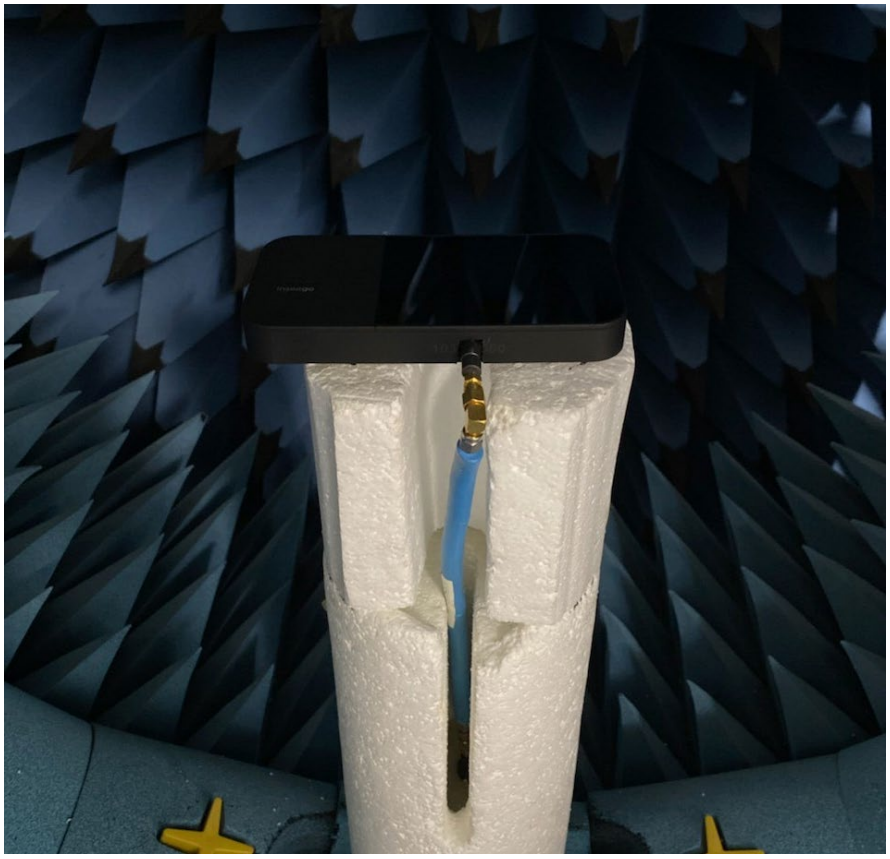


DUT connection Photo 1



DUT connection Photo 2

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6. Measurement Equipment calibration:
    - MVG StarLab Multi-Probe Compact Passive Antenna Measurement Chamber Calibration Certificate:

Calibration Certificate

Manufacturer's Name :	MVG Industries
Manufacturer's Address :	13, rue du Zéphir Parc d'Activité de l'Océane 91140 Villejust FRANCE

Declares that product

Customer name :	INSEEGO
Product Name:	SL v1
Serial Number :	C253
Calibration date	19/02/2022

Has been calibrated according MVG procedure and \ Or according ISO 9001 requirements.

19 February, 2022 MVG Quality Manager

MICROWAVE VISION
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- E5071C Network Analyzer Calibration Certificate:

Certificate of Calibration

KEYSIGHT TECHNOLOGIES

ISO/IEC 17025:2017 and ANSI/NCSL Z540.1-1994

Certificate Number 1-13571508236-1

ilac-MRA ANAB ANSI National Accreditation Board ACCREDITED CALIBRATION LABORATORY AC-1498

Model Number	E5071C
Manufacturer	Keysight Technologies Inc
Description	ENA Series Network analyzer
Serial Number	MY46103762
Date of Calibration	17 Dec 2020
Procedure	STE-501 14528-C.06.06
Temperature	(23 ± 5) °C
Humidity	(50 ± 30) %RH

Customer
Inseego Corp
9710 Scranton Rd Ste 200
SAN DIEGO CA 92121-1744
United States

Location of Calibration
Keysight Technologies Inc
10090 Foothills Blvd.
Roseville CA 95747-7102
UNITED STATES

This certifies that the equipment has been calibrated using applicable Keysight Technologies procedures and in compliance with ISO/IEC 17025:2017 and ANSI/NCSL Z540.1-1994 (R2002). The quality management system is registered to ISO 9001:2015.