AMIMON

Antenna Radiation Pattern

TEST REPORT

AMIMON Ltd.

26, Zarhin St, Raanana, Israel

Model: AMN_ANT_1012-0

Report type	**Test Reporet**
Test engineer	**Shalom Gerbi**
Testing Date	**22 March 2021**
Report Date	**18 Aug 2022**
Prepared by	**Shalom Gerbi**
Approved by	**Ron Yogev** VP R&D
Applied by	**Amimon**
Test Site	**Afeka Antenna Range,** **Tel-Aviv,** **Israel**

Versions Control

Revisions of Amimon document No.: AMN_REP_0164

Revision	Date	Author	Description
1.0	18 Aug 2022	SG	Initial release of radiation pattern report of AMN_ANT_1012-0

Table 1: Revision Control

AMIMON

Table of Contents

List of Figures

List of Tables

Chapter 1 PRODUCT INFORMATION

1.1 Scope

The AMN_ANT_1012-0 description is: 5.1GHz-6.425GHz Dipole Antenna, UFL, 150mm.
It is used for various products. The purpose of this report is to verify the characteristics of the antenna and compare to its specification:

- Gain
- Radiation patterna
- The above parameters were tested in conjunction of the frequency band the antenna is used in.

1.2 RF Specification

Specification	Value
Frequency	5.100GHz-6.425GHz
S11	< (-5dB) for all frequency range.
Polarization	Linear Vertical
Elevation	(-35º) to (+35º)
Azimuth	360º
Typical Gain over Ant Band	0dBi
Impedance	50 Ohm
Max Power	5 Watt
Connector Type	U.FL Compatible

Table 2: AMN_ANT_1012-0 Specification

1.3 Mechanical Drawings

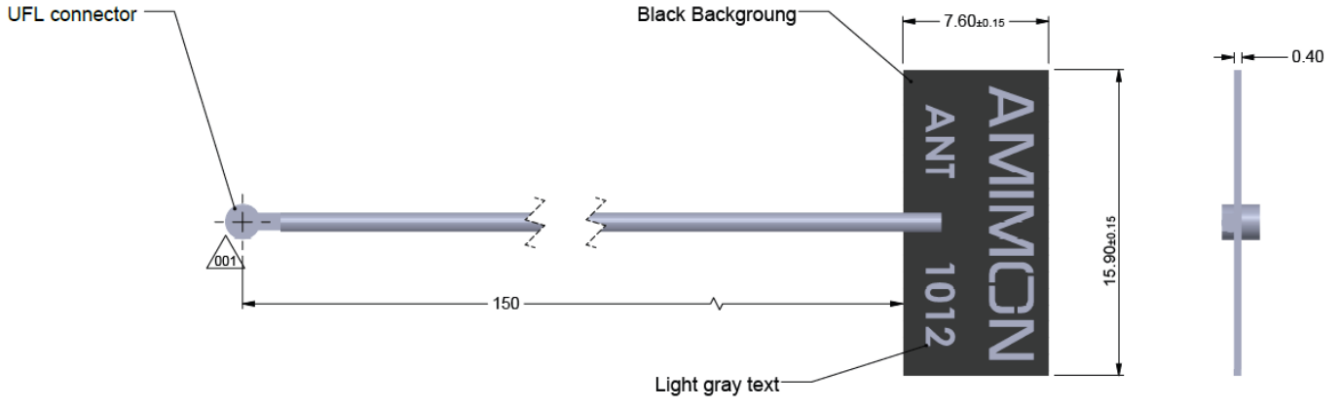


Figure 1: AMN_ANT_1012-0 – Mechanical drawing Test Site Information

Chapter 2 Test Site Information

The following information was provided by the lab:

ACAD
Afeka Center for Antenna Design

Antenna Range description

Prepared by Prof. Ely Levine

ElyL@afeka.ac.il

17 August 2022

1. General

This document specifies the in-door antenna range located in Afeka Academic College of Engineering, 38 Mivtza Kadesh st. Tel Aviv 6910717. The antenna range was utilized for measurements of AMIMON Ltd. antennas during 2022.

2. Chamber

The antenna range is operated in an un-echoic chamber. Gross sizes are 3 x 3 meters. Net distance between transmit and receive antennas is 2 meters.

The walls are covered with a metallic sheet. The shielding of the chamber against external interferences is lower than -60 dB.

The walls, the floor and the ceiling are covered with pyramidal absorbers whose length is 12" (Figure 1). The absorbers provide normal reflection of -35 dB or less at 2-8 GHz range (see enclosed Table 1 for typical results).

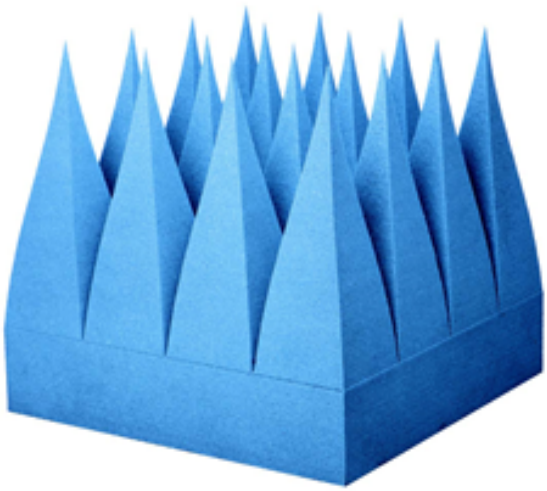


Figure 1 overall view of the absorbers (manufacturer MVG Ltd. formerly ORBIT FR Ltd. Israel).

TYPICAL PERFORMANCE OF PYRAMIDAL ABSORBER:

Absorber Type)	Reflectivity (dB) for near normal incidence relative to metal surface of same size at different frequency.							
	Thickness (Inches	80	250	500	1.0GHz	3.0GHz	10GHz	18GHz0
FU-SE 70/45/36	TO BE DESIGNED FOR THE GIVEN FERRITE TO MAKE HYBRID ABSORBERS AT LOW FREQUNCIES							
FU-SE-24	24	-6	-20	-35	-40	-50	-50	-50
FU-SE-18	18			-30	-40	-45	-50	-50
FU-SE-12	12				-25	-40	-50	-50
FU-SE-8	8					-25	-50	-50
FU-SE-4	4						-40	-50
FU-P-SE-24	12			-30	-40	-40	-45	-40
FU-P-SE-12	18				-25	-40	-45	-40

Table 1 typical reflectivity of graphite absorbers. Our pyramids are 12" long (red arrow).

3. Geometry

The Transmit antenna is mounted on a tripod at height 1.5m. The Receive antenna is mounted in the "quiet zone", at the same height, on a plastic pipe, above an Azimuthal pedestal (positioner). Net distance between phase centers of the antennas is 2.0m.

Radiation patterns are measured by rotating the positioner over 360° in azimuth or in elevation as shown in Figure 1. Power gain is measured by rotating a reference (calibrated) antenna over +/-20°.

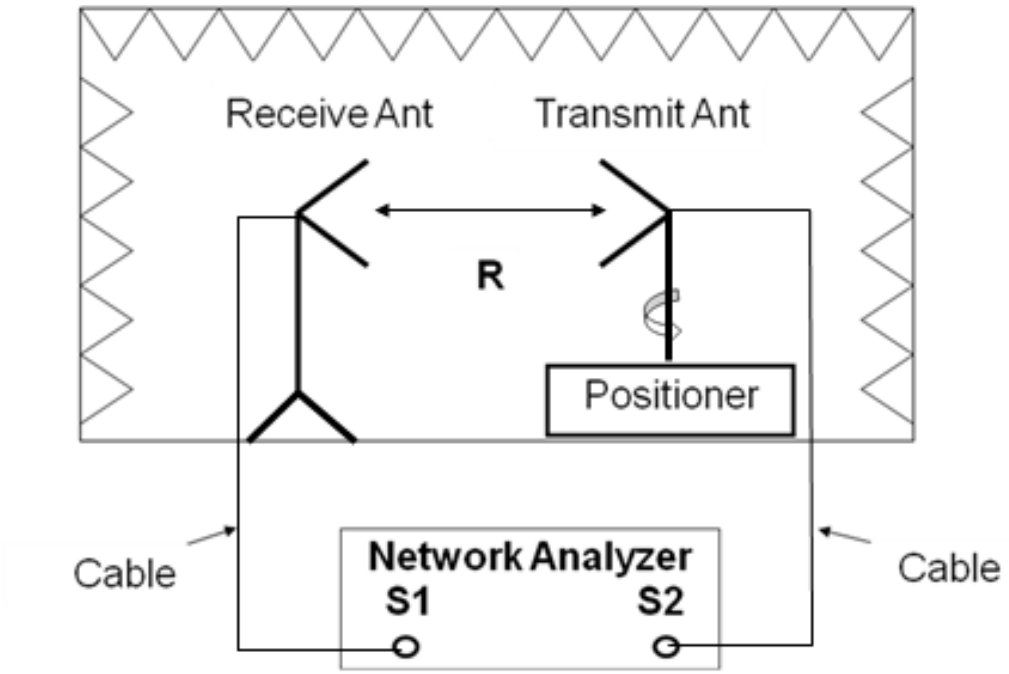


Figure 1 Geometry for radiation pattern measurements. R = 2m.

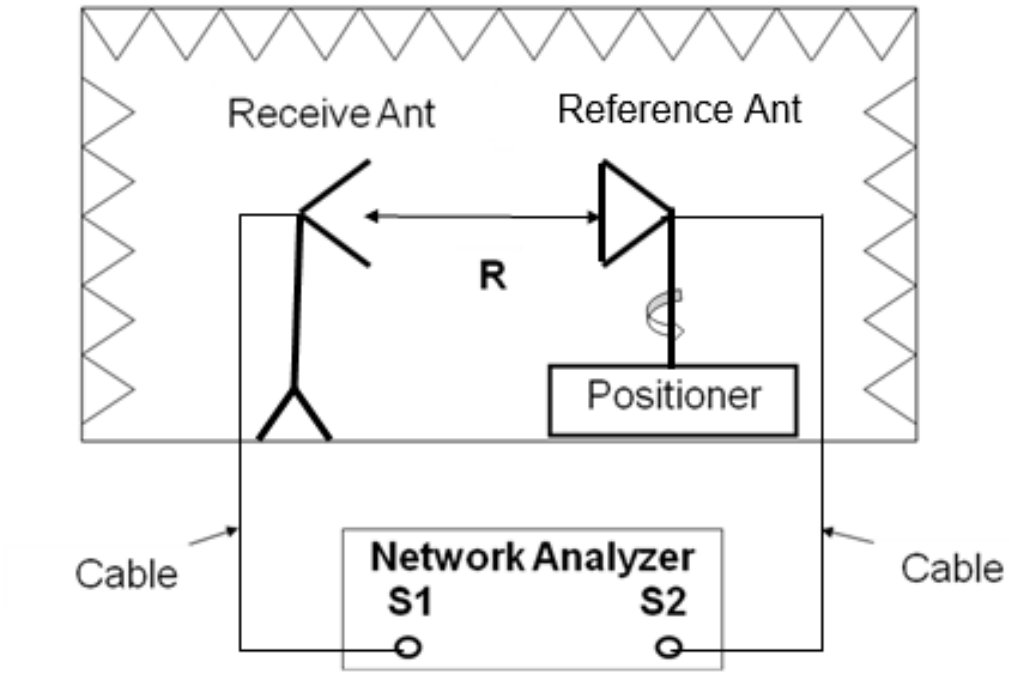


Figure 2 Geometry for gain measurements. R = 2m.

The tested antenna gain G(test) is given by reference gain G(ref) times the received power by the test antenna Pr(G(test)), divided by the received power by the reference antenna Pr(G(ref)), as follows:

$$G(test) = \frac{Pr(G\ test)}{Pr(G\ ref)}\ G(ref)$$

4. Equipment

- The ratio between the received power and the Transmit power is measured by a Vector Network Analyzer (S12 or S21). Since in all measurements the Transmit power is identical, we can compare the received power of the test antenna with the received power of the reference antenna and find the power gain.

The antennas are connected to the Network Analyzer by cables plus some adapters. In radiation patterns we are interested only in the dB values normalized to the peak power. In gain measurements we are interested in the ratio between received powers of the **test** antenna and the **reference** antenna. Thus the specific attenuation of the cables has no meaning.

Network Analyzer Agilent N5230A (87405C) 10 MHz – 20 GHz
S/N MY55380158
Calibrated on 13 Sept 2019 in Keysight Technologies Malaysia
Standard transmit power 10 dBm

Pedestal (positioner) including digital motor and control software
MIDAS and absorbers manufactured by MVG Ltd. Formerly ORBIT FR Israel.

Cables SF104 6m + 8m + adapters (DC to 18 GHz), manufactured by Huber-Suhner. Typical attenuation is 1 dB/m.

TX and reference antennas are Log Periodic Dipole Arrays, model LPD118, manufactured by A.R.A (American Research Antennas), with nominal gain of 7 dBi at 1 – 18 GHz, see figure 3.

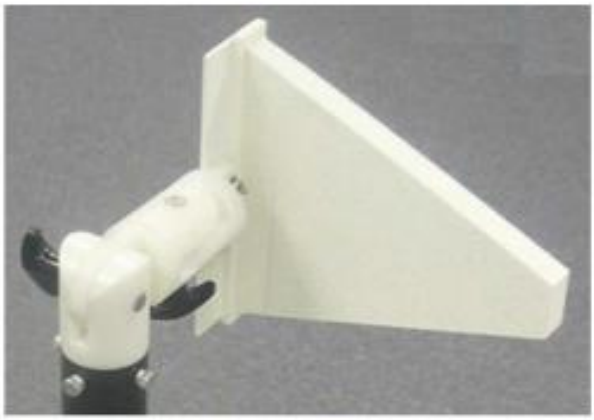
A.R.A. Antenna Research

WIDEBAND PRODUCTS DIVISION

COMMUNICATIONANTENNAS

LPD-118

The **LPD-118** is a small Log-Periodic antenna that is ideal for tactical and field communications applications. These are extremely durable antennas that can be deployed many times in harsh environments. The complete assembly has one main circuit board with elements that are enclosed with a closed cell low loss foam radome. The antenna is shown with an optional universal joint and mast.



SPECIFICATIONS:

Frequency	1 to 18 GHz
Gain	7 dBi nominal
Polarization	Linear Horizontal or Vertical
Impedance	50 Ohms
VSWR	2.0:1 nominal
Beamwidth (nominal)	75 deg E-plane x 120 deg H-plane
Operating Temperature	-30˚ to +70˚C
Storage Temperature	-47˚ to +85˚C
Power Handling	5 W CW; 25 W Peak
Antenna Connectors	SMA Female
Dimensions	8" x 9" x 1"
Mounting	Two #10-32 tap holes 5.85: apart

Antenna Research

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Figure 3 Tx antenna and reference antennas. Gain 7 dBi (red arrow).

Since the polarization is linear, we can perform either **Vertical** or **Horizontal** polarized measurements.

5. Tolerance/Accuracy

The estimated tolerance of pattern measurements (connector closing, position of the tripod, effects of cables, network biasing and temperature drift etc.) is 1dB.

The estimated accuracy of power gain measurements (reference antenna accuracy, exact positioning of the antennas, moving of phase centers as a function of frequency and walls / floor / ceiling reflectivity) is 1 dB.

For higher accuracy we recommend to our customers to repeat the measurements at 4 or 6 distances (steps of $\lambda/4$) and average the results.

6. Confirmation

This document had been prepared by Prof. Ely Levine, Manager in charge of the Afeka antenna range. E. Levine holds a BSEE and a MSEE degrees in Electrical Engineering from the Technion, Haifa, Israel and PhD in applied physics from the Weizmann Institute of Science, Rehovot, Israel. Prof. Levine held senior development positions in leading electronics companies (Elta, Elop and others) and took part in hundreds of consulting projects. He joined Afeka Academic College of Engineering, Tel Aviv in 2005 where he teaches Communications, Antennas, Microwave systems and components, Wireless radio and Radar systems. He published more than 80 papers and conference proceedings and co-authored four books.

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Chapter 3 Test Results

3.1 Antenna gain [dBi] vs. azimuth [deg] (Plane XY), per frequency

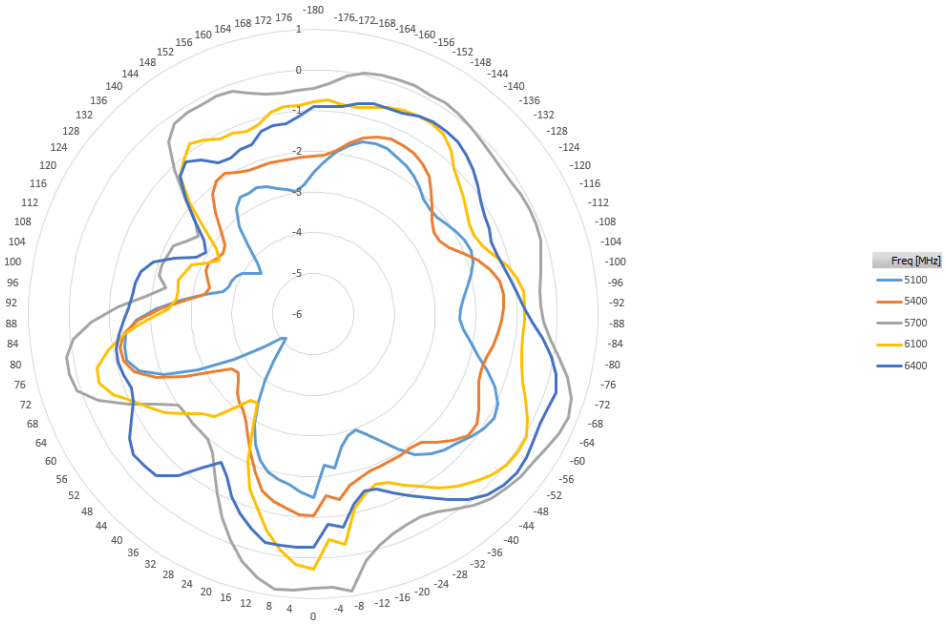

Figure 2: Antenna Gain at Azimuth Performance vs. frequency

3.2 Antenna gain [dBi] vs. elevation [deg] (Plane XY), per frequency

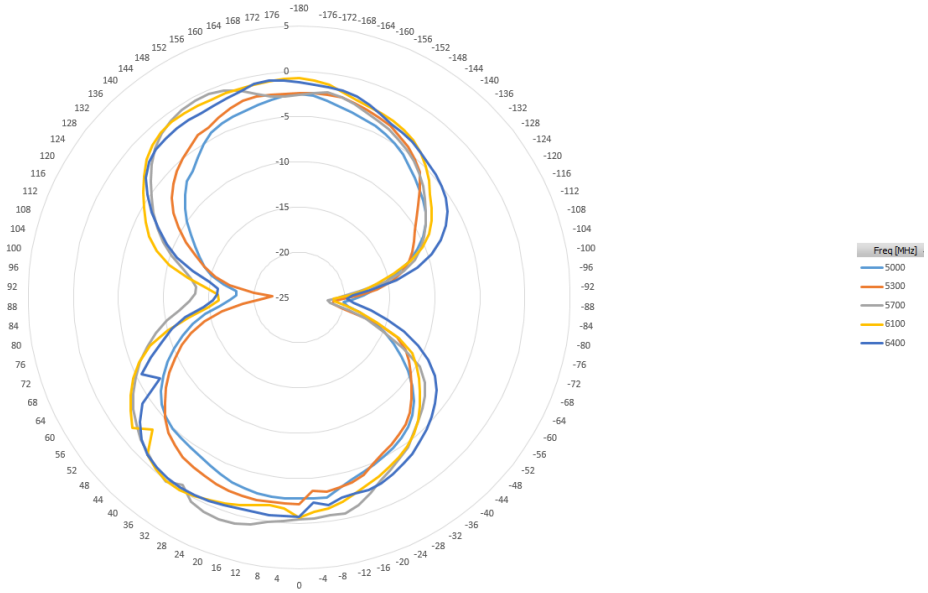

Figure 3: Antenna Gain at Elevation performance vs. frequency

Chapter 4 TEST SETUP PHOTOGRAPHS

4.1 Set up at Azimuth

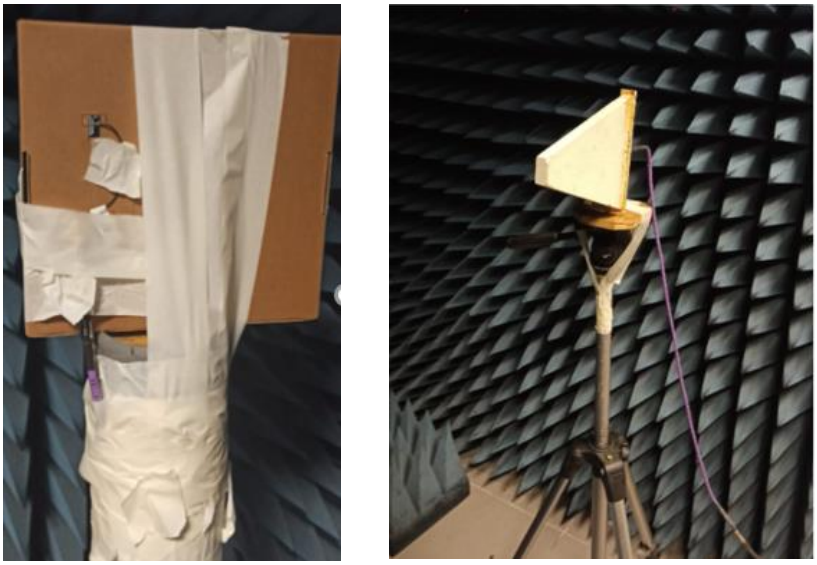

Figure 4: Test Setup at Azimuth

4.2 Set up at Elevation

Figure 5: Test Setup at Elevation