

Grandstream Networks, Inc.

GWN76XX

WiFi Access Points

Antenna Radiation Patterns



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INTRODUCTION

One of the major components of a wireless Access Point is the antenna. These radio components come with different shapes and sizes to fit specific deployment needs, and each access point can bundle multiple antennas for sending and receiving signals in order to benefit from the MIMO (Multiple Input/Multiple Output) technology and obtain higher throughput and signal resilience, also the arrangement of multiple antennas internally to a single WLAN access point can be used to influence the shape and behavior of the wireless signal (both on transmit and receive). To better understand how each GWN access point model broadcasts wireless signal, this paper provides radiation patterns to help engineers during the deployment process.

Grandstream's powerful WiFi Access Points GWN76XX series offer high performance networking, tremendous WiFi coverage range for up to 175 meters and do support MIMO technology for GWN7610 and MU-MIMO (Multi-User) for GWN7600 when operation on 802.11ac wave2 norm, as well as a separate model (GWN7600LR) for outdoor usage with a coverage range of 300 meters.

We begin this report with a glossary of basic definitions related to antennas radio characteristics and then progress through the specific radiation patterns for each GWN76XX access point series.



TERMINOLOGY

On this first part, we will provide quick brief review of some fundamental concepts related to antennas and radio propagation:

Antenna: An antenna is a transducer between a feed signal and radiated wave over the space, it is usually attached to a transmitter/receiver unit and the radiated energy is characterized by the antenna's radiation pattern.

Antenna pattern: The radiation pattern or antenna pattern is the graphical representation of the radiation properties of the antenna and how it radiates energy out into space or how it receives energy (reciprocity). An antenna radiates energy in all directions, at least to some extent, so the antenna pattern is actually three-dimensional. It is common, however, to describe this 3D pattern with planar patterns, called the principal plane patterns. These principal plane plots are commonly referred to as the antenna radiation patterns.

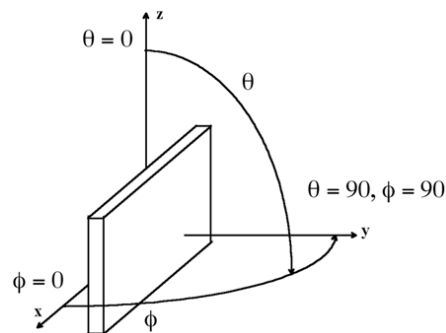


Figure 1: Polar Coordinates

Isotropic radiator: An isotropic radiator is a hypothetical lossless antenna that radiates its energy equally in all directions. This imaginary antenna would have a spherical radiation pattern and the principal plane cuts would both be circles since any plane cut through a sphere would be a circle.

Gain: The gain of an antenna (in a given direction) is defined as the ratio of the power gain in that direction to the power gain of a reference antenna in the same direction, usually an isotropic radiator is set as reference and the value of the gain is expressed in dBi. It is important to state that an antenna with gain doesn't generate power and it does simply direct the way the radiated power is distributed relative to radiating the power equally in all directions, thus the gain is just a characterization of the way the power is radiated.

Efficiency: The efficiency of an antenna is a ratio of the power delivered to the antenna relative to the power radiated from the antenna. A high efficiency antenna has most of the power present at the antenna's input radiated away. A low efficiency antenna has most of the power absorbed as losses within the antenna, or reflected away due to impedance mismatch. What causes an antenna to not have an efficiency of 100%.

Antenna efficiency losses are typically due to:

- Conduction losses (due to finite conductivity of the metal that forms the antenna).
- Dielectric losses (due to conductivity of a dielectric material near an antenna).
- Impedance mismatch loss.



TEST ENVIRONMENT

This test report gives schematic diagrams with antennas distribution of GWN76XX access points series, along with the antenna radiation patterns both 2.4Ghz and 5Ghz frequencies in order to help engineers during deployment process.

Please note that these radiation patterns are gathered in a fully anechoic environment. Their shape will change in installed environments depending on the obstacles that the wireless signal might face. Every deployment will behave differently due to materials, geometries of structures, etc and how these materials behave at 2.4GHz and 5GHz.

Below figure gives an overview of the used test environment:

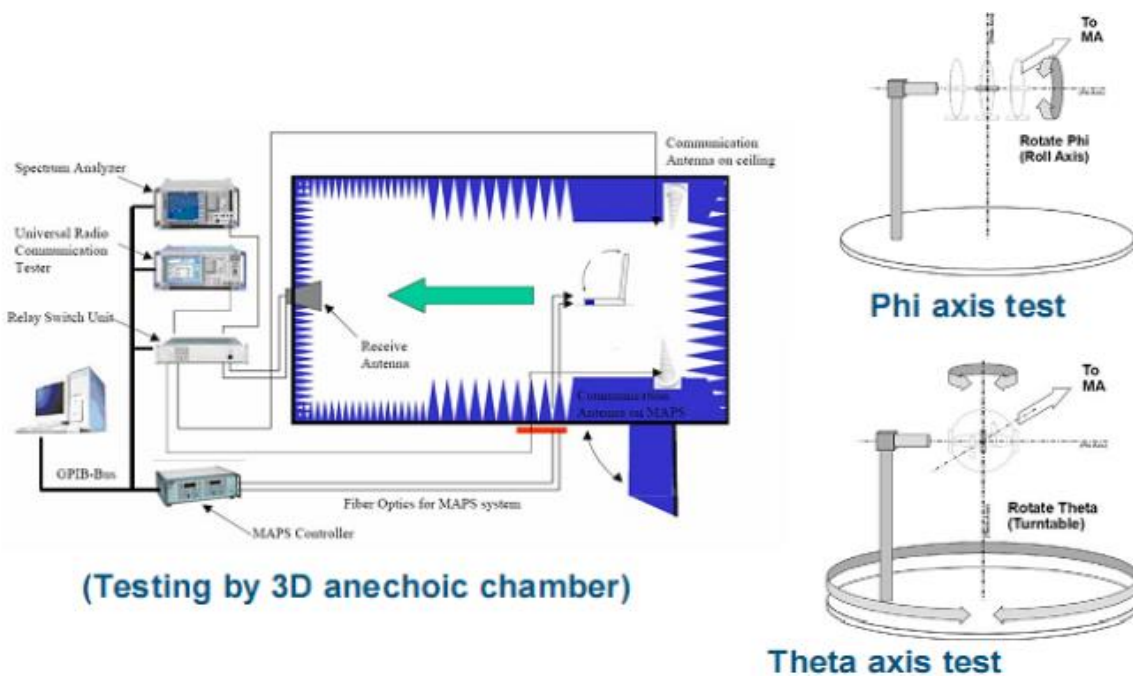


Figure 2: Test Environment



GWN7610 ANTENNA CHARACTERISTICS

Schematic Diagram

The following diagram shows the schematics on how the labeled antennas are distributed within the GWN7610 access points, and the table below gives the radiation patterns for both 2.4Ghz and 5Ghz.

Schematic diagram

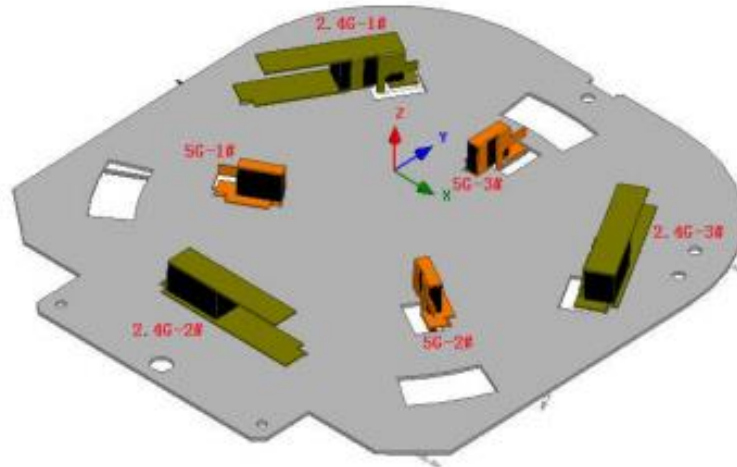
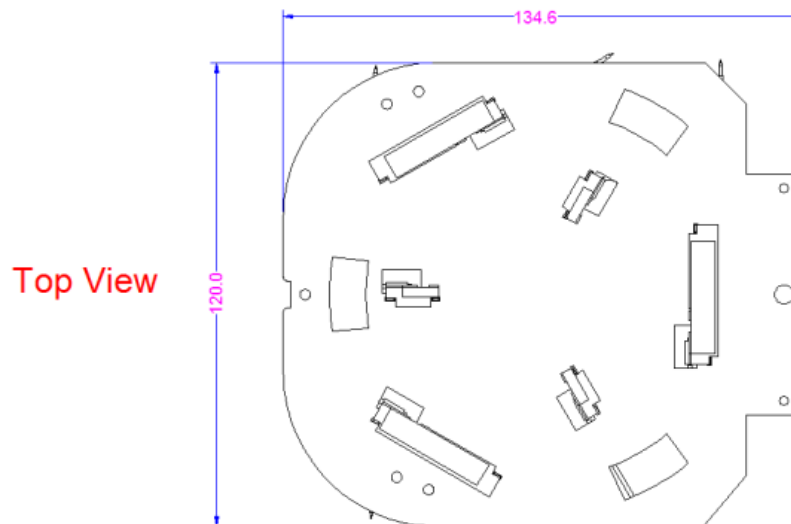


Figure 3: GWN7610 Antenna Diagram

Mechanical Drawing



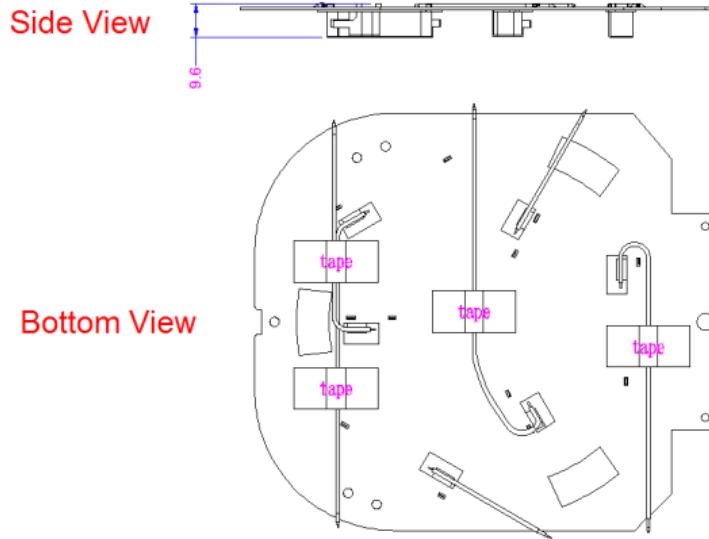


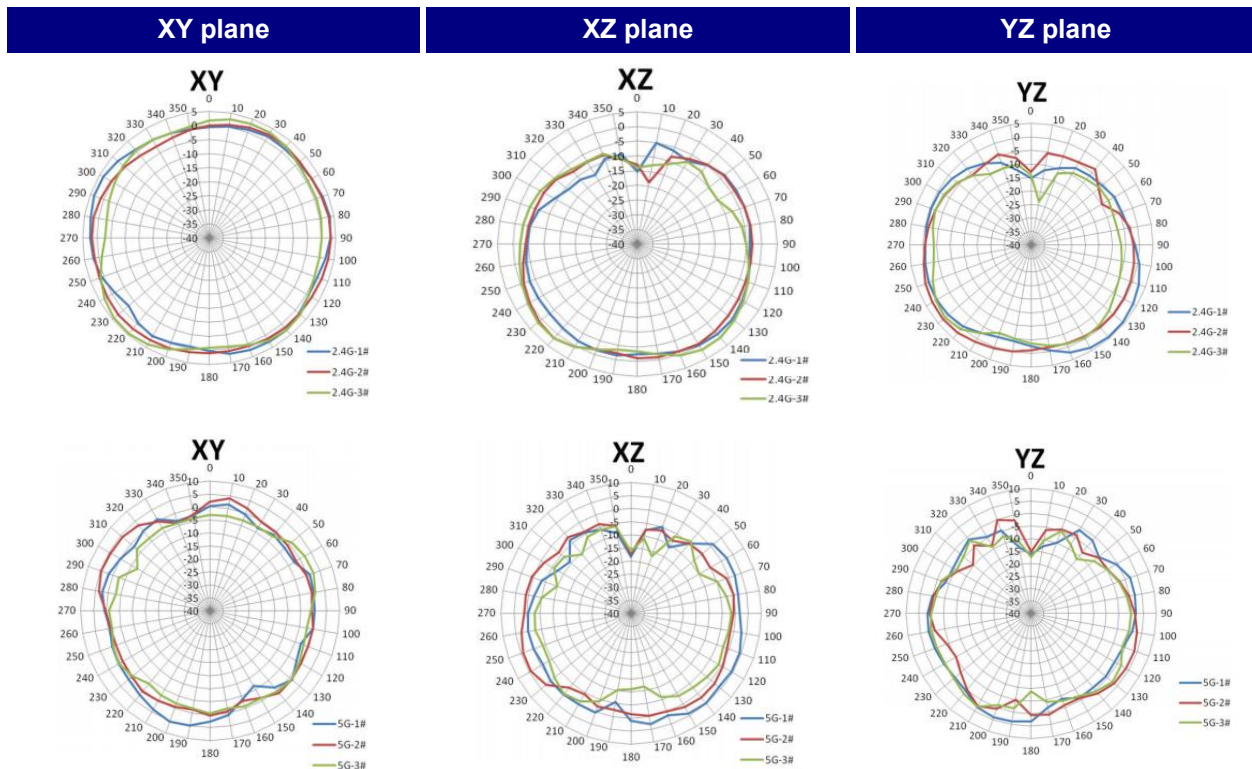
Figure 4: GWN7610 Mechanical Drawing

Antenna Patterns

On this section, we provide the resulting antenna radiation patterns for GWN7610 access point from the conducted tests, the pattern plots provided are for XY, XZ and YZ planes (refer to Figure 3: GWN7610 Antenna Diagram).

Note: Click on each picture to maximize it.

Table 1: GWN7610 Antenna Radiation Patterns



GWN7600 ANTENNA CHARACTERISTICS

Schematic Diagram

The following diagram shows the schematics on how the antennas are distributed within the GWN7600 access points, and the table below gives the radiation patterns both 2.4Ghz and 5Ghz.

Schematic diagram

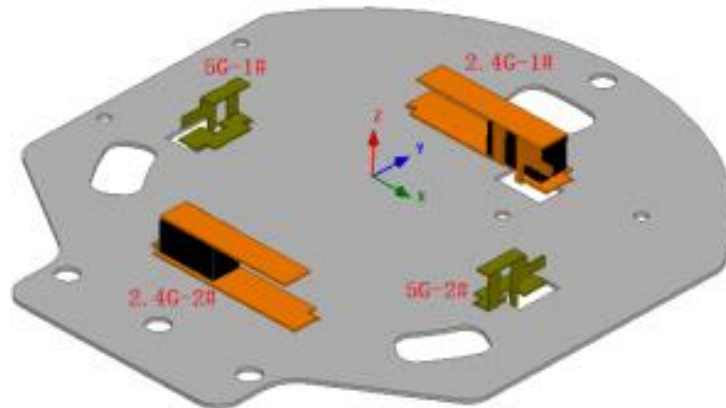
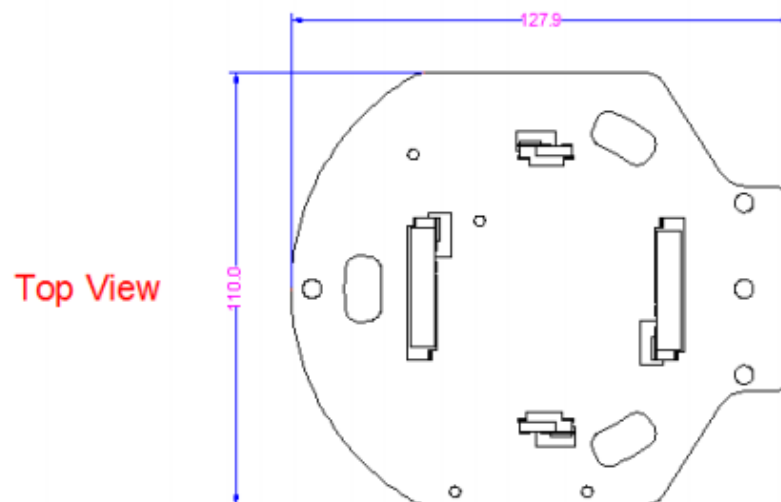


Figure 5: GWN7600 Antenna Diagram

Mechanical Drawing



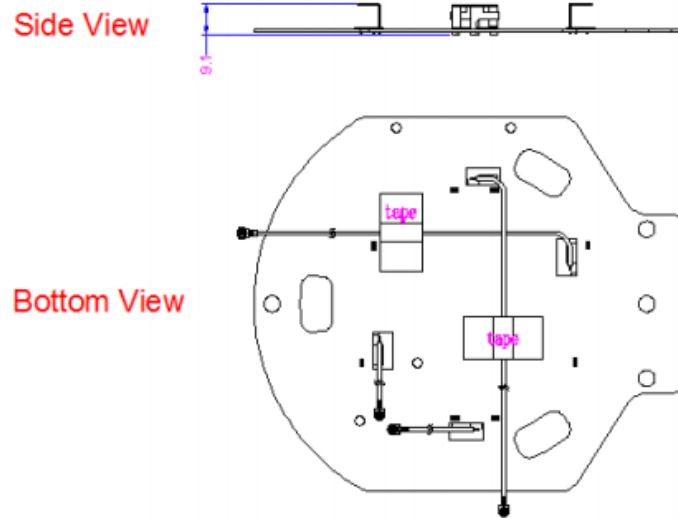


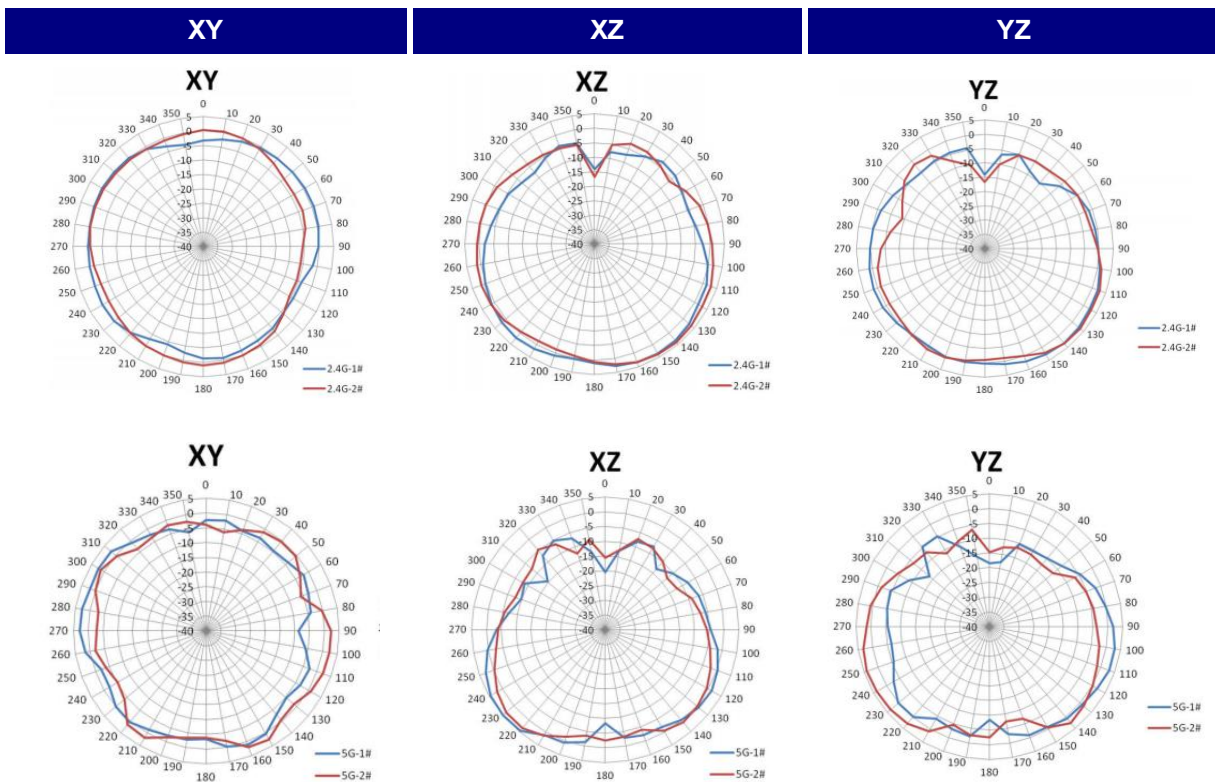
Figure 6: GWN7600 Mechanical Drawing

Antenna Patterns

On this section, we provide the resulting antenna radiation patterns for GWN7600 access point from the conducted tests, the pattern plots provided are for XY, XZ and YZ planes (refer to Figure 5: GWN7600 Antenna Diagram).

Note: Click on each picture to maximize it.

Table 2: GWN7600 Antenna Radiation Patterns



GWN7600LR ANTENNA CHARACTERISTICS

Schematic Diagram

The following diagram shows the schematics on how the antennas are distributed within the GWN7600LR access points, and the table below gives the radiation patterns for each antenna while taking into consideration the test environment described on the first section.

Schematic diagram

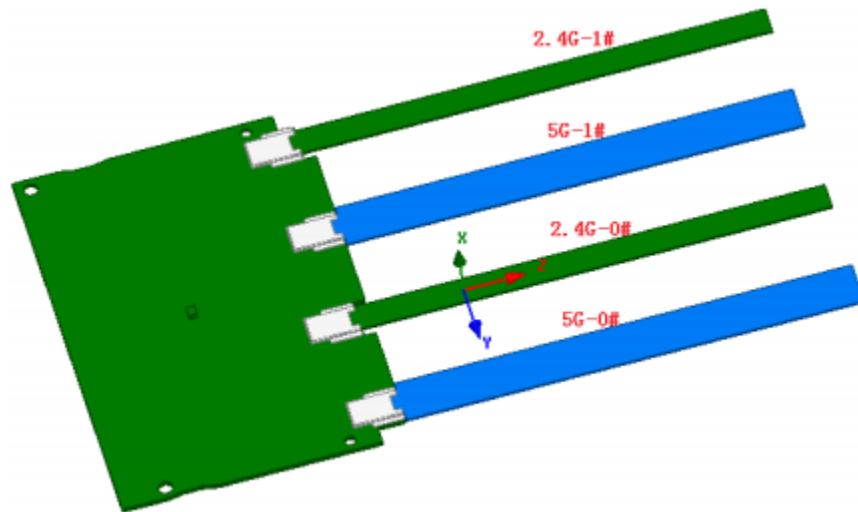
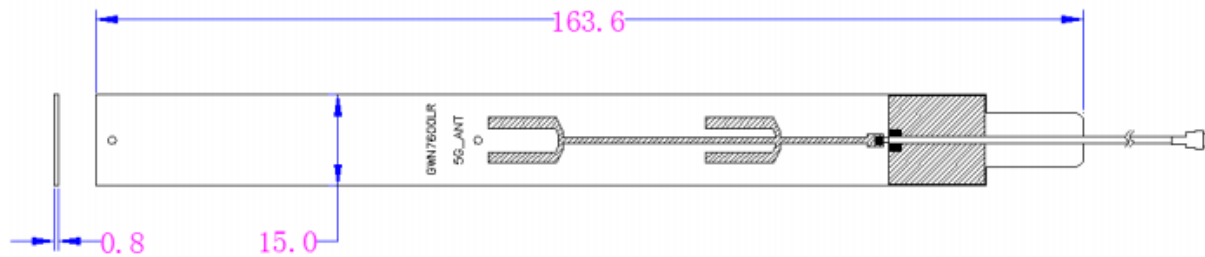


Figure 7: GWN7600LR Antenna Diagram

Mechanical Drawing



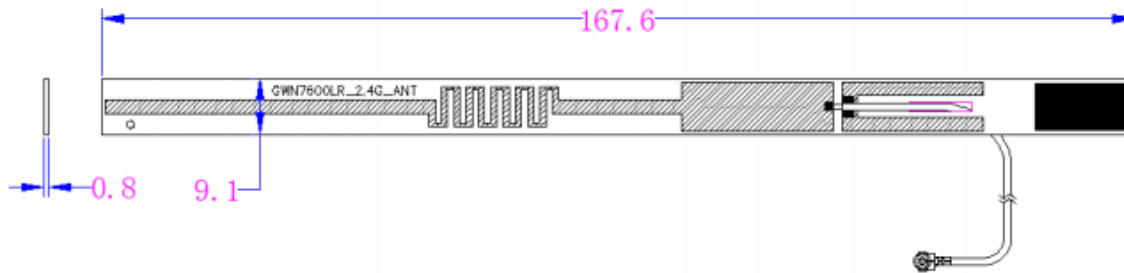


Figure 8: GWN7600LR Mechanical Drawing

Antenna Patterns

On this section, we provide the resulting antenna radiation patterns for GWN7600 access point from the conducted tests, the pattern plots provided are for XY, XZ and YZ planes (refer to Figure 7: GWN7600LR Antenna Diagram).

Note: Click on each picture to maximize it.

Table 3: GWN7600LR Antenna Radiation Patterns

