Grandstream Networks, Inc.

Wi-Fi Access Points – GWN7662

Antenna Radiation Patterns

INTRODUCTION

One of the major components of a wireless Access Point is the antenna. These radio components come in 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 the wireless signals, this paper provides radiation patterns to help engineers during the deployment process.

The GWN7662 is a Wi-Fi 6 (802.11ax) access point ideal for small-to-medium sized businesses, home offices, retail shops, restaurants, and more. It offers 4×4:4 MU-MIMO technology on the 5G band and 2×2:2 MU-MIMO on the 2.4G band as well as a sophisticated antenna design for maximum network throughput and expanded Wi-Fi coverage range. To ensure easy installation and management, the GWN7662 uses a controller-less distributed network management design in which the controller is embedded within the product's web user interface. The GWN7662 is also supported by GWN.Cloud and GWN Manager, Grandstream's free cloud and on-premise Wi-Fi management platform. It is the ideal Wi-Fi AP for voice-over-Wi-Fi deployments and offers a seamless connection with Grandstream's Wi-Fi capable IP phones. With support for advanced QoS, low-latency real-time applications, mesh networks, captive portals, 256 concurrent clients per AP, and dual Gigabit network ports with PoE/ PoE+, the GWN7662 is the ideal Wi-Fi access point for medium wireless network deployments with medium user density.

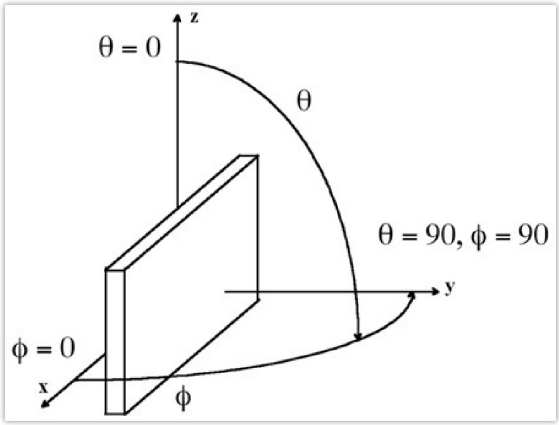
We begin this report with a glossary of basic definitions related to antenna radio characteristics and then progress through the specific radiation patterns for the GWN7662 access point.

TERMINOLOGY

In this first part, we will provide a 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 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 antenna radiation patterns.



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 the 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 This causes an antenna to not have an efficiency of 100%.

Antenna efficiency losses are typically due to:

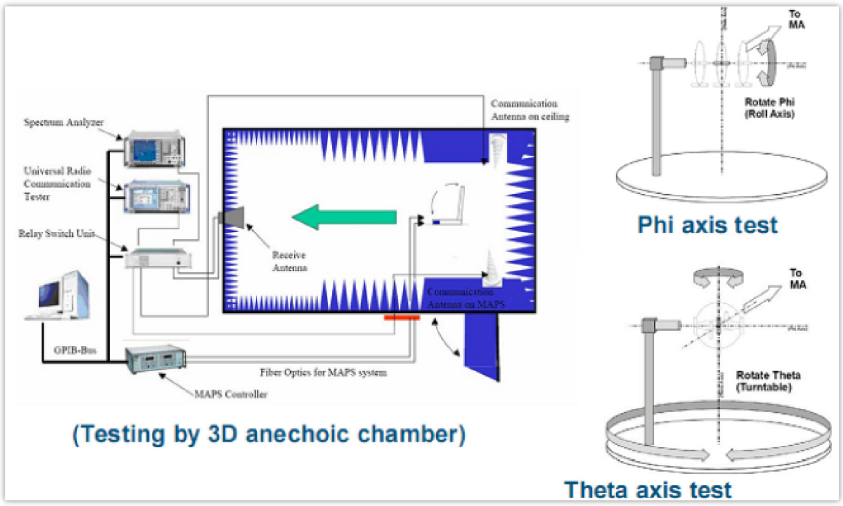
- Conduction losses (due to finite conductivity of the metal that forms the antenna).
- Dielectric losses (due to the conductivity of a dielectric material near an antenna).
- Impedance mismatch loss.

TEST ENVIRONMENT

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

The below figure gives an overview of the used test environment:



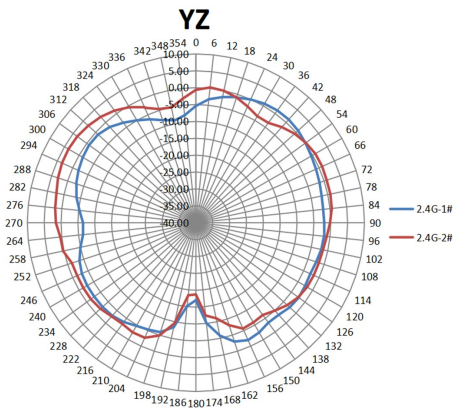
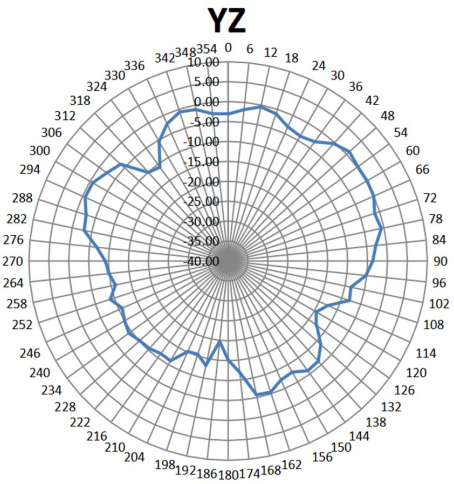
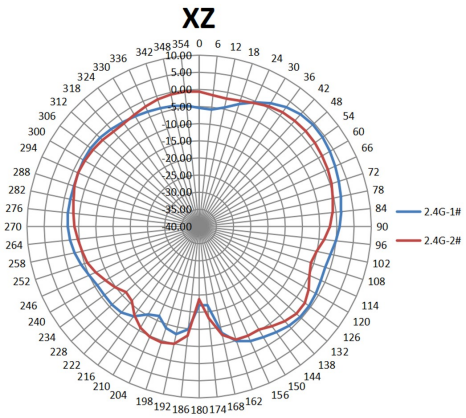
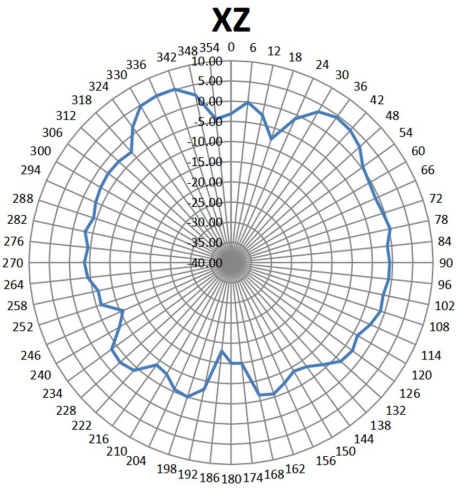
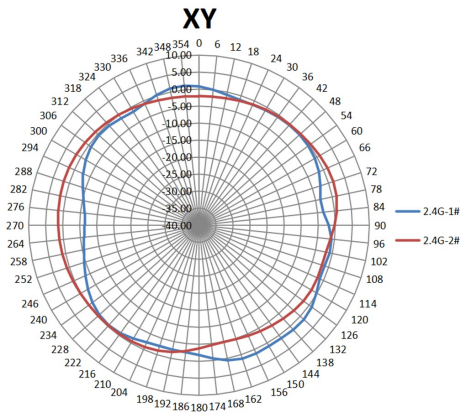
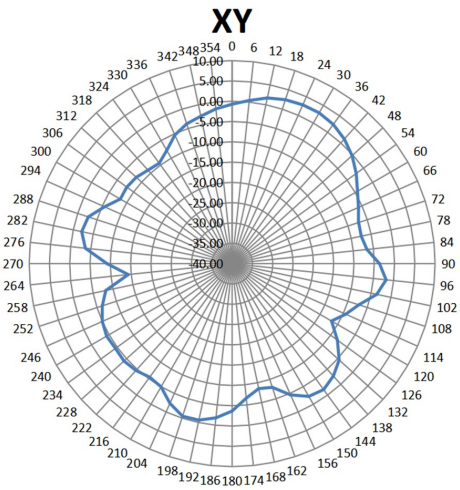
Test Environment

GWN7662 ANTENNA CHARACTERISTICS

Antenna Patterns

In this section, we provide the resulting antenna radiation patterns for the GWN7662 access point from the conducted test, the pattern plots provided are for the elevation (vertical at 0° and 90°) plane and azimuth (horizontal) plane.

Label	2.4G	5G

Elevation - 90°		
Elevation - 0°		
Azimuth		

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