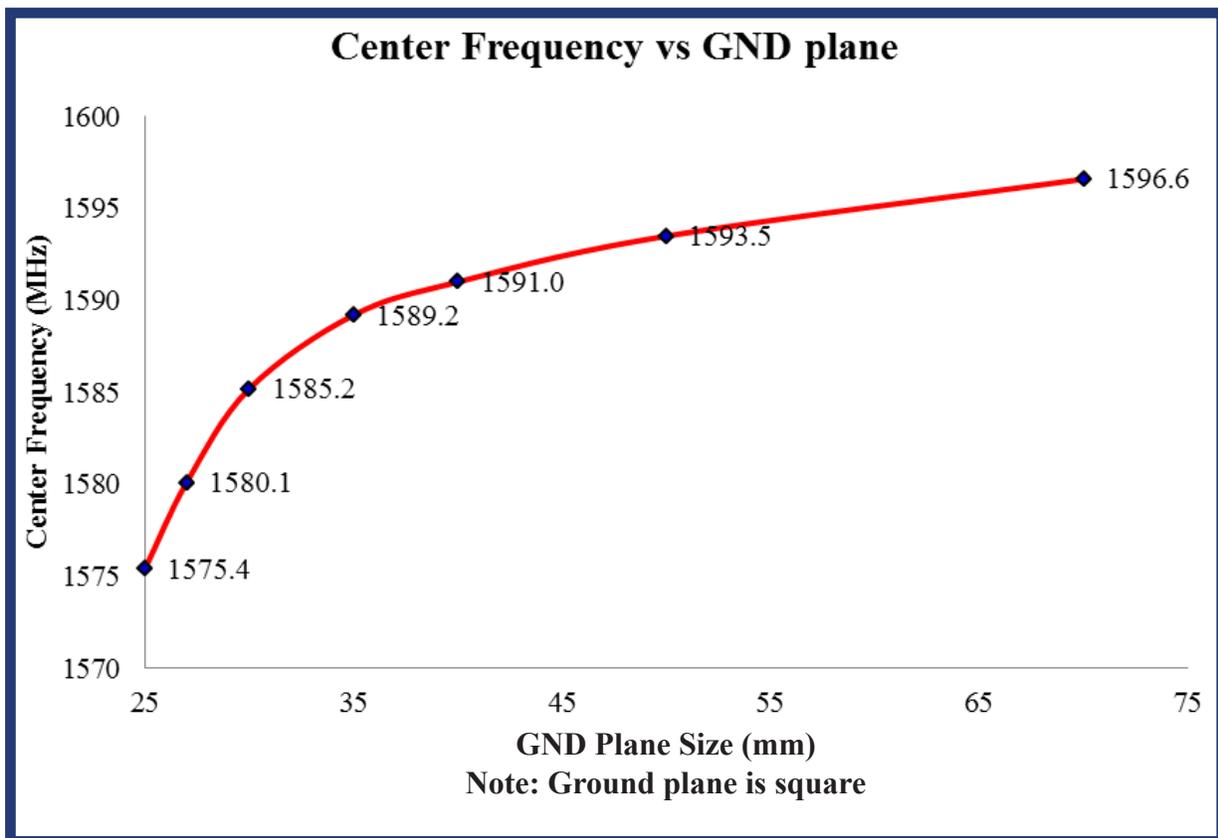


# Antenna Optimization Service

Abracon offers an Antenna Optimization service for customers who hope to maximize the performance of the antenna in their application. Passive patch antennas should be tuned to the ground plane to which they are mounted. This compensates for the frequency shifts occurring due to the device environment in which the antenna is placed. The center frequency of the patch antenna varies proportionally with the size of the ground plane. Fine tuning of the patch antenna is required in end-customer's application in order to achieve the desired center frequency.

Typical change in the center frequency for a GPS patch antenna with different ground planes is shown in the graph below.

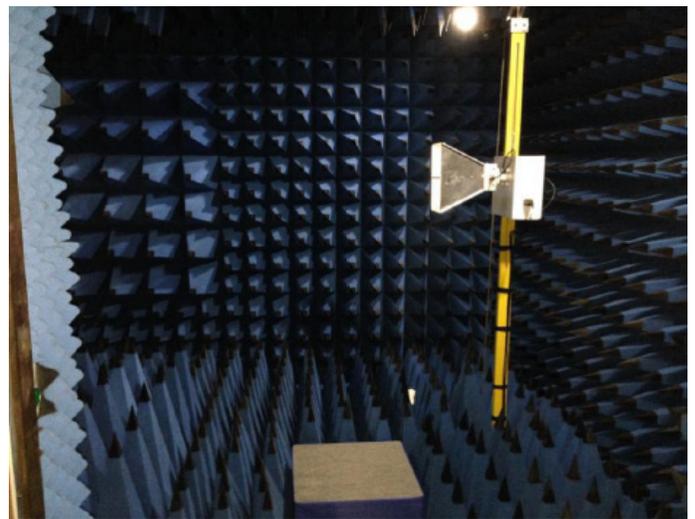
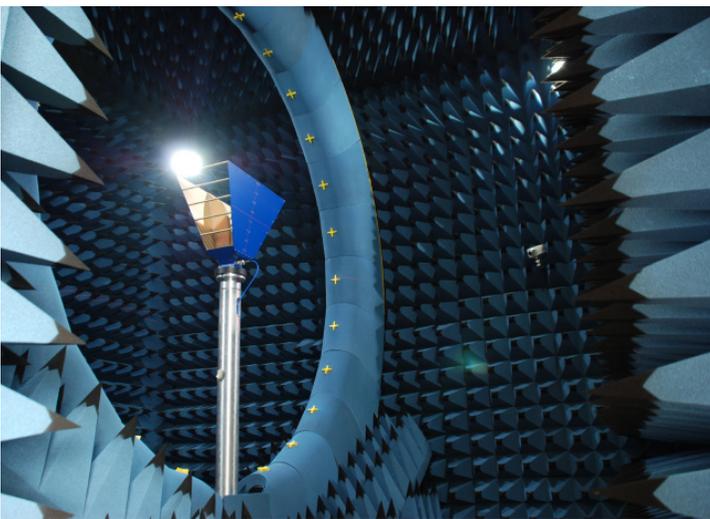


# Antenna Optimization Service

An antenna's performance is affected by its environment such as its proximity to other components or to the enclosure. In most cases, tuning is required after the patch antenna is mounted in the end-application, especially if the antenna operating bandwidth is narrow. There are several methods to tune the patch antenna such as moving the feed point, changing the shape of the top silver electrode and removing the corners or sides of the top silver plate. For chip antennas, the efficiency of the antenna depends mainly on the size and shape of the ground plane to which it is mounted as well as the impedance matching of the antenna to the feed line. The antenna has to be tuned to center resonant frequency by matching the impedance to the antenna using inductors and capacitors. Higher efficiency guarantees more radiated power and increased operating range for the antennas.

## Process

Per Abracon's standard procedure, customers purchase standard products from our distribution channel and connect them in their application. In the majority of cases, the patch needs to be tuned to account for overall environmental effects in the end-application. At this point, our customer sends us their PCB, samples of patch antenna, necessary cables and accessories and any additional coverage (such as dome, enclosure etc.) for fine tuning. The patch is then tuned exactly to the desired frequency in the final board or assembly. Then, the antenna is sent back to the customer for validation at their end. Test data is provided before and after tuning for comparison purposes. Once the customer receives the tuned patches, these devices are tested in the end-application. If the performance is deemed satisfactory, a custom part number is issued for the patch with the best performance (from the supplied samples). Once confirmed, the boards and accessories are returned to the customer. The shipping details and AWB number are provided. A custom data sheet is created based on the tuning results for mass production. Subsequent orders are manufactured in accordance with the custom data sheet.



Measurements in Anechoic Chamber

# Antenna Optimization Service

The charge for this service starts at \$350 and includes all associated shipping costs of returning the product to the customer after completion of the optimization service. The customer is issued an Authorization Form which outlines what is covered by the service, and confirms our Non Disclosure policy for client protection.



Optimized Patch Antenna

## Ordering Information:

Orderable Part Number: ABAOS-5WK

Lead Time: 5 weeks

Applicable to below part numbers:

| 5G/4G/LTE                     |                       |                      |                      |
|-------------------------------|-----------------------|----------------------|----------------------|
| ACAR3705-S698                 |                       | ACAR4008-S698        |                      |
| 2G/3G/GSM                     |                       |                      |                      |
| ACAR3005-S824                 |                       |                      |                      |
| WIFI/BLUETOOTH/BLE/ZIGBEE/ISM |                       |                      |                      |
| ACAG0201-2450-T               | AMCA31-2R450G-S1F-T   | ACAG0801-2450-T      | AMCA72-2R470G-S1F-T  |
| ACAG0301-2450-T               | ACAG0301-5500-T       | ACAR0301-SW2         | ACAG0301-24505500-T  |
| APARN1204-S2450               | APAKN1304-S2450-T     | APAKN2504-S2448-T    | APAKN1304-S5517-T    |
| APARC2505-S2450               |                       |                      |                      |
| LPWA/LORA/SIGFOX/NB-IOT/ISM   |                       |                      |                      |
| ACAG1204-433-T                | ACAG1204-868-T        | ACAG1204-915-T       | ACAR3705-SB          |
| APAE868R2540JBDB2-T           | APAE915R2540ABDB1-T   | APAES923R3640C16-T   | APAES923R4560C16-T   |
| APAES915R6460C16-T            | APAES915R80C16-T      | APAES868R8060C16-T   |                      |
| GNSS                          |                       |                      |                      |
| ACAG0301-1575-T               | ACAR0301-SG3          | APAKN0904-S1575-T    | APAE1575R1240ABDD1-T |
| APAE1575R1340ABDD6-T          | APAE1575R1540AZDB2F-T | APAE1575R1820ABDC1-T | APAE1575R1840AADB7-T |
| APAE1575R1840BADB1F-T         | APAE1575R2040ABDD2-T  | APAE1575R2520ABDD7-T | APAE1575R2540AADBE-T |
| APAE1575R2540BBDB1-T          | APAEA1575R0940K14-T   | APAES1575R1040J34-T  | APAE1590R1340AKDB2-T |
| APAE1590R1350AKDB5-T          | APAE1590R2540AKDB1-T  | APARM1504-SG3        | APARM1804-SG3        |
| APARM2504-SG3                 | APARM3503-SG3         | APAGM3606-SG3        | APAKN1304-C2G-T      |
| APAKN1804-C2G-T               | APAKN2504-C2G-T       | APAKM3513-SGL2       | APAKM2507S-SGL5      |
| APARM2508S-SG3L5              |                       | APARM2508S-SGL2L5    |                      |
| SATELLITE COMMUNICATIONS      |                       |                      |                      |
| APAE1621R2540ABDD1-T          |                       | APAE2338L2540DDDB1-T |                      |
| RFID READER ANTENNAS          |                       |                      |                      |
| APAE868R2540JBDB2-T           | APAE915R2540ABDB1-T   | APAES923R3640C16-T   | APAES923R4560C16-T   |
| APAES915R6460C16-T            | APAES868R8060C16-T    | APAES915R80C16-T     |                      |
| COMBINATION ANTENNAS          |                       |                      |                      |
| ACAG0301-15752450-T           | ACAR3005-C2WB         | APARM2504-C2GR       | APAKM4012-C2G3D      |

# Antenna Optimization Service

## Deliverables:

1. Test report with center frequency and gain measurements.
2. Recommended custom part number for production, if applicable
3. Custom source control document with custom P/N

## End Customer Instructions

1. Please place (2) functioning boards in an ESD bag without the patch antenna soldered on the boards.
2. Please place (2) sets of patch antenna in another ESD bag. The part number should be clearly written on the ESD bag.
3. Place the product enclosure along with the PCBs in the box. The product's case or cover affects tuning and performance of the antenna. Therefore, it is essential we include this to determine the impact on tuning.
4. Include a printed copy of the schematic.
5. Include a printed and marked copy of the layout for the patch antenna section.
6. Provide clear and detailed power-up instructions. Identify where to connect the power and ground.
7. Include any special cabling, sockets or fixtures needed to properly bias the boards, as applicable.
8. Please place all the above contents in a FEDEX/UPS box of appropriate size and ship it to:

RF Optimization Service  
FAO: Abracon Engineering  
5101 Hidden Creek Ln  
Spicewood TX, 78669  
Phone: (512) 371-6159

# Antenna Optimization Service Authorization Form

In order to service our valued Customers effectively, Abracon LLC is pleased to provide Factory Optimization Services **for our APA Series Patch Antenna product**. We highly recommend Factory Optimization to our Customers in order to determine and implement the optimal parameters and components for reliable performance in our Customers' applications.

By authorizing this service on behalf of your organization: \_\_\_\_\_ ;  
located at: \_\_\_\_\_ ;  
is authorizing Abracon LLC and the Factory production site to receive Customer Products, Assemblies, Sub-Assemblies, Equipment and related Materials, included but not necessarily limited to: Schematics, Design Notes, Datasheets, Drawings, Application Notes, Cables, Power Supplies etc. which will be used in the performance of the optimization service.

Abracon LLC certifies that the Optimization Service will be performed by personnel at the original factory production facility and that at no time will the Customer's Products, Assemblies, Sub-Assemblies, Equipment and related Materials as previously described be provided to a Third Party; nor will Abracon LLC or factory production personnel divulge any Customer information related to the Optimization Service or any related services to any Third Party without obtaining written permission from the Customer.

All materials and information furnished to Abracon LLC and/or Factory personnel for the purposes of the APA Series Optimization Service and related services will be returned to the Customer following the Optimization effort. These materials will be shipped to the Customer. The cost of the Optimization Service starts at \$350.00 USD and includes all shipping charges – Abracon shipment to the Factory site and return shipment to Abracon LLC, then final shipment of all materials to the Customer upon completion of the Optimization Service.

## SCOPE OF WORK:

The following APA Series part number is to be used/ investigated for this Patch Antenna Optimization Service per this agreement:

|                       |
|-----------------------|
| <b>Antenna Part #</b> |
|                       |

## Customer Comments/Special Instructions:

**ABRACON LLC**  
a California Corporation  
By: \_\_\_\_\_  
Title: \_\_\_\_\_  
Date: \_\_\_\_\_

**[ENTER CUSTOMER NAME]** \_\_\_\_\_  
a \_\_\_\_\_ Corporation ("Customer")  
By: \_\_\_\_\_  
(Official Company Agent)  
Title: \_\_\_\_\_  
Date: \_\_\_\_\_