

Rapid Design and Production of an RF Antenna Test Probe (C-CUTS) Case Study 015

Reliability and operational availability are critical to military mobile RF detection equipment; particularly when it is used in theatre for IED detection and inhibition.

Introduction

UKMOD requested our involvement with this RF antenna test probe following an initial prototype development carried out by its scientific research arm, DSTL. A quick and simple RF Go/No-Go gauge was required, to enable the user of an IED detection system to confirm that it was functioning correctly.

Requirements summary:

- RF antenna test probe with defined power level and frequency
- compact, lightweight and ergonomic
- quick and simple to use
- rapid design for production under UOR time constraints
- reliable operation from a single battery
- low production volume to military specification
- compatible with existing operating procedures (SOPs)
- cost within budget.



Figure 1 – C-CUTS Product

PPM Custom Design Capability

PPM specialise in custom military RF and optoelectronic design. Developing this C-CUTS test probe fitted well with our capabilities, but also with our ethos of involvement with the customer/user, at all levels. Our security cleared personnel, and first hand understanding of the user requirement, offered the UKMOD a solution they could be confident in.

C-CUTS Test Probe – Fast Track Product Design and Manufacture

The Product Cycle

We established a 'technical partnership' with DSTL, the User and UKMOD in order to define a product requirements matrix. This important first step in the product cycle ultimately drives the product specification, with a strong emphasis on 'design-for-production'. Project planning followed to manage prototyping, B-model development, user trials, design verification, and production.

The remit was to design, develop and produce (in low volume) a compact, lightweight, robust unit; as a basic Go/No-go signal source. The single enclosure housed a remote RF transmitter and antenna, which was battery powered.

C-CUTS critical design features:

- simple RF signal source
- small and lightweight (<150g)
- robust and suitable for use in harsh environments
- a single on/off switch with visual status indication
- transmit power of -50dBm at a fixed frequency
- RF power monitor and alarm
- auto power-off circuit with low battery warning
- operating temperature range -10°C to +50°C
- minimum 100 x 10 minute operational cycles on single battery
- consistent coupling and power level injected into the antenna
- reconfigurable for other operating frequencies
- "no-tools" battery replacement.

The C-CUTS unit has a crystal oscillator drive circuit which generates an RF output of -50dBm to excite a helical antenna. The unit has an ergonomic hand-held shape and operates via a simple membrane switch to toggle power on/off. Two visual LED indicators confirm the operational state of the device. To minimise weight, C-CUTS is fitted with a single AAA battery regulated via a switched mode booster converter.

The C-CUTS mechanical casing snaps together and requires no fixing screws. The durable plastic moulding makes the portable device extremely lightweight and robust. It is equipped with a sealed tactile membrane keypad containing one membrane key and two indicator LEDs. The case has a removable bottom cover to enable battery replacement without the need for any tools.

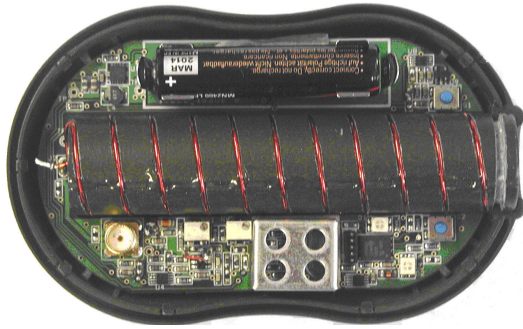


Figure 2 – C-CUTS Internal Layout

B model development and evaluation

Once the initial prototype phase was completed the design specification was agreed with all the stakeholders. B Models were produced using an SLA technology. The user was given a number of devices for evaluation at their training facility.

Following input from the user evaluation, modifications were made to the electronics and enclosure construction, and then “hard tooled” enclosures were created.

Design Verification

The design verification process is a critical part of any development programme. Design verification testing was carried out in conjunction with DSTL, to ensure that the “B” model design met or exceeded the agreed specification.

Key design verification parameters:

- output power and frequency stability
- antenna coupling performance
- temperature testing and start-up
- shock and vibration testing
- operational life on single battery.

Production of C-CUTS

An initial pilot-production run was carried out with evaluation samples provided to the stakeholders to assist in final production sign-off. Once this stage was agreed a short production run in the low hundreds was completed in just a few weeks.

Toll-gate development and reporting

Keeping the customer informed and providing the opportunity to proceed with the development programme in a well planned and costed manner is vital. We always provide costed and documented technical and commercial proposals before project inception. Then technical reports are provided for each development stage, allowing the customer a “sign-off” before the next stage commences.



Conclusions and Outcome

This short timescale product development exceeded the rigorous operational specifications:

- operates at the desired frequency and power level
- significantly lighter than the target weight at 75g
- production unit is small and can work in tough environmental conditions.
- low power consumption and auto-off feature are extremely effective in extending the operational life cycle from a standard battery.
- user is confident and comfortable with its operation
- developed and delivered within budget and to timescale required.

If you have a development programme or product idea and need our RF and/or optoelectronic design and manufacturing capability please get in touch.