

# CSA.70

## Failure Mode Mitigation



### Outcomes and Deliverables

- Detailed analysis of implemented hardware and all design files.
- Reproduce problem with appropriate RF test equipment.
- Interference Frequency Analysis.
- Interactive mitigation experiments to existing hardware.
- Report of tests done, results and recommended changes.
- Modified copy of hardware if possible

### Duration

3-9 weeks (this is a typical estimated duration – actual duration on quote may differ).

### What We Need

- 3D CAD files – preferably STEP files.
- Mechanical drawings.
- PCB files and circuit schematics – preferably native Altium files.
- 4 fully functioning samples.
- Instructions for operating device.

### What is the problem or concern we are addressing?

Taoglas can evaluate and solve issues that relate to the antenna and RF performance, receiver interference and spurious transmitter emissions that cause performance and certification issues.

All wireless devices face common performance and certification challenges, regardless of the types of radios being used. These challenges are never obvious and different types of wireless systems and products exacerbate different issues more than others. This service offering is focused on addressing problems found during design verification tests where real hardware has been built, tested and some aspect of performance must be improved to meet certification or customer expectations.

Experienced Taoglas engineering staff will evaluate your device, the testing that has been done, any additional testing that may need to be done and the failures identified in the testing. From this evaluation we will design and execute experiments to reproduce the failure in our controlled lab environment. Once we can reproduce and measure the failing symptom, we will design and execute experiments to determine the underlying failure mode.

Knowing that failure mode, the next experiments will attempt to specifically mitigate that failure mode on the existing hardware to the extent it is physically possible to do so. Many failure modes are closely tied to PCB layout details and, as such, it may not be possible to prove out a fix without doing a PCB design and fabrication cycle, but the goal is always to verify as much of the proposed mitigation changes as possible before doing a PCB revision. Once all avenues of mitigation have been exhausted with the existing hardware a PCB revision will likely be needed to make changes to the PCB layout.

After these PCB changes, testing is repeated to verify success. If there are still open issues, the process is repeated. It's important to note that, depending on the holistic system design, it's possible that the product cannot ever achieve acceptable radio performance. In these cases, significant system level changes are required—including major changes to mechanical aspects, such as battery, electronics, sensors, display, antenna location and the system enclosure.

Passive and active (OTA) testing may be performed by Taoglas in their facilities at their discretion during this service. Outside of these and after the CSA.70 service has concluded, Taoglas offers several follow-on services.

The CSA.70 service can address any type of radio performance issue, but cellular and LTE certification and performance problems are the most common. Note that radio certification testing simply shows compliance as per the regulating organization standards (e.g., PTCRB or carrier certification). Many of the network operators in North America have specific tests and metrics for radiated performance on transmit (TRP), receive (TIS) and co-existence/ interference (RSE).

Product performance itself, however, is not the responsibility of a certification body. The FCC in the US has no test standards for the quality of a receiver. It's not enough to pass certification; the radio elements of the product must work well. Taoglas engineering understands these issues. We have experience in resolving not just antenna or noise issues, but system issues - what the problems are, what causes them, how to avoid most of them in the first place and how to mitigate the few that get through. We can get you to market faster and, in a cost-effective way by supporting your engineering team dealing with these issues.

## The Process

### Part 1 – Mitigation Experiments

This service consists of the following:

- Analysis of the testing done to date and recommendations of additional testing as needed to determine exactly what aspect of performance or certification is insufficient.
- Reproduction of the failure mode in our controlled lab environment.
- Experimentation on the existing physical hardware to determine the failure mode and the root cause of the failure mode.
- Analysis of mechanical design, schematics, PCB layout and bill of materials for each board in the product to create a series of experiments to mitigate the root cause of the failure mode.
- Experimentation on the existing hardware of specific mitigation measures selected to address the root cause of the failure mode.
- A specific list of the mitigations to be applied to the device to address the failure mode.
- Iteration through these test steps as PCB changes are made to ensure the issues are resolved.
- Passive and active (OTA) testing at the discretion of Taoglas to determine effectiveness of mitigation measures.

#### *What does Taoglas need?*

In the situation where a product that has already had prototypes built, then testing on those prototypes is done to identify the baseline. If testing has already been performed (e.g. pre-scans) Taoglas requires all the test data gathered including summary reports, data, and pictures of the test setup.

We require four fully functional samples of the existing device hardware. These devices will be consumed in the process. We will also require one complete set of any support devices such as spare battery packs, battery charger, programing interfaces or cables.

Instructions on how to connect the device, power on the device, and connect to the AT command interface, if

applicable. If the battery will need to be charged or replaced, include instructions on how to do so.

We require any 3D CAD and 2D design files you may have. We require these files to do cross sections, hide components and make accurate measurements. We accept a variety of 3D files formats, but STEP files are preferred.

We also require any documents you have relating to the PCB of the device. These documents should define the PCB stack-up, layer thicknesses, materials and finishes for the PCB. A bill of materials for each PCB is also recommended. Ideally these files should be native Altium files.

Circuit schematics of all the PCBs in your device are also required. This is to better understand the RF paths in your design. Once again, these files should ideally be native Altium files.

### Part 2 – Product Mitigation Changes

The output of the mitigation experiments will be a list of changes to your design that will mitigate the failure modes observed in testing. Your engineering team will implement the changes in a new set of design files. All the changes are equally important and need to be executed.

Many failing products have several factors causing the same failure mode and they all must be addressed without compromise, or the risk of failure remains.

Taoglas will review the changes to the design files. Output from this review will be appended to the initial design report and distributed to you and your engineering team. This is included as part of this service.

In the event it is not possible to apply physical mitigations to the existing hardware to prove all failure modes have been addressed, changes will be required to the design to apply additional mitigations as part of a full design revision including mechanical, schematic, PCB & BOM changes. In the event the provided changes are insufficient to address all failure modes, the process is repeated until all failure modes are addressed.

### Part 3 – Next Steps

Once the mitigations have addressed the failure modes, Taoglas can then perform passive antenna performance testing, active mode receiver sensitivity testing as well as active mode intentional and unintentional radiator testing. This testing is offered as separate service offerings to allow for different types of testing to the needs of different types of radios. Taoglas also offers a number of other testing services which can address the design verification test needs of your project.

Next services:

- **CSA.20:** Passive Antenna Testing, Matching and Fine Tuning.

- **CSA.30:** Cellular OTA TRP Testing
- **CSA.31:** Cellular OTA TIS Testing
- **GSA.30:** GPS Acquisition & Tracking Sensitivity
- **GSA.40:** GNSS Field Testing
- **CSA.50:** Custom Antenna Design

Visit [Taoglas Website](#) or contact [Taoglas sales](#) for further information.

Please note - devices, systems and equipment falling within the scope of Annex I of the EU Dual Use Regulation 821/2021 are not eligible for this service. For queries, please consult your legal department or contact [exportcompliance@taoglas.com](mailto:exportcompliance@taoglas.com).