



CSIR - Ultra High Frequency (UHF)

INTRODUCTION

In the rapidly evolving landscape of military communications, Ultra High Frequency (UHF) technology stands as a cornerstone for secure, reliable, and global communication capabilities, essential for modern military operations. The Ultra High Frequency Follow-On (UFO) and Mobile User Objective System (MUOS), with advanced UHF satellite communication infrastructure offering an increase in capacity over legacy systems and enabling data, video, and voice services directly to mobile users.

As the demand for robust and uninterrupted communication grows, the challenge of increased security in UHF applications becomes increasingly critical. iDirect Government is at the forefront of addressing these challenges, utilizing its Communications Signal Interference Removal (CSIR) technology to improve the integrity and reliability of UHF satellite communications.

CSIR UHF OVERVIEW

iDirectGov's CSIR technology stands out as a well-established and reliable solution for eliminating co-channel interference in digital communications. Its key advantage lies in its ability to remove interference without needing prior knowledge of the interfering signal itself. This design ensures that CSIR maintains a minimal software footprint, making it highly efficient, quick to respond, and effective in combating various forms of interference and jamming signals. Originally crafted for use in Super High Frequency (SHF) Satcom environments within the iDirectGov Evolution Defense framework, CSIR's versatility allows it to excel in a wide range of wireless communication settings. It can be implemented as an independent inline device or incorporated into existing Field Programmable Gate Arrays (FPGAs), showcasing its adaptability and robustness in enhancing communication integrity.

This whitepaper delves into the preliminary testing stages between UHF communications and CSIR strategies, showcasing how iDirect Government leverages cutting-edge technologies to provide secure, reliable, and efficient communication solutions, ensuring that military and government operations remain connected and coordinated, even in the most challenging environments.

TEST SCENARIO

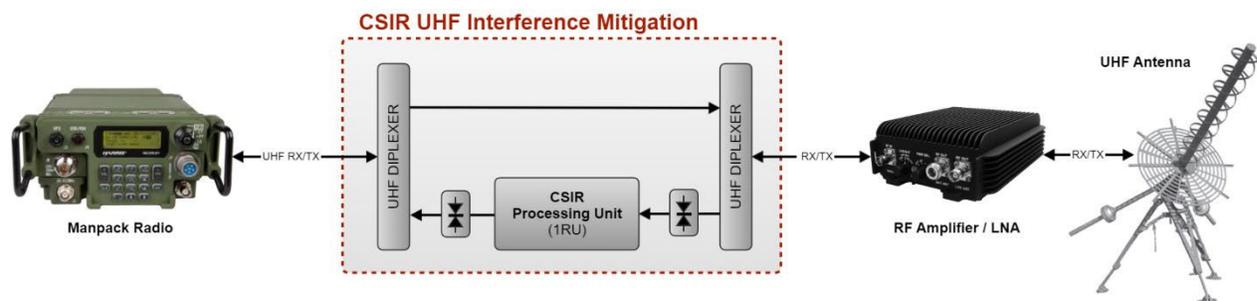


Figure 1

The iDirectGov solution (Figure 1) was tested to address a simulated instance of deliberate interference that disrupted communication on a user's channel. For the preliminary evaluation of CSIR's effectiveness, we conducted tests using qualitative data and observed the impact of interference on an operational UHF channel. We replicated the worst-case scenario of interference for these tests and then analyzed the qualitative outcomes through two varied metric variables.

The evaluation commenced with the deployment of a sophisticated audio analyzer, leveraging the Perceptual Objective Listening Quality Assessment (POLQA) framework for testing. POLQA utilizes advanced psychoacoustic modeling algorithms to objectively rate audio samples on a scale from 1 (poor quality) to 5 (excellent quality). The aggregation of these scores yields the Mean Opinion Score (MOS), facilitating a standardized assessment of audio quality. This methodology enables swift, automated iterations of testing and analysis crucial for line verification, ensuring measurements are objective, unaffected by human bias or varying test conditions, and yielding consistent, repeatable results.

PERCEPTUAL OBJECTIVE LISTENING QUALITY ASSESSMENT (POLQA)

When faced with channel interference, CSIR effectively eliminates such disruptions, restoring channel integrity to a state indistinguishable from scenarios where interference was absent.

We executed two distinct test scenarios pre and post-CSIR implementation, conducting five iterations for each scenario under conditions of both constant and no interference. The tests demonstrated that CSIR installation inline with the UHF radio's receive path introduces no negative impact on communication quality in the absence of interference.

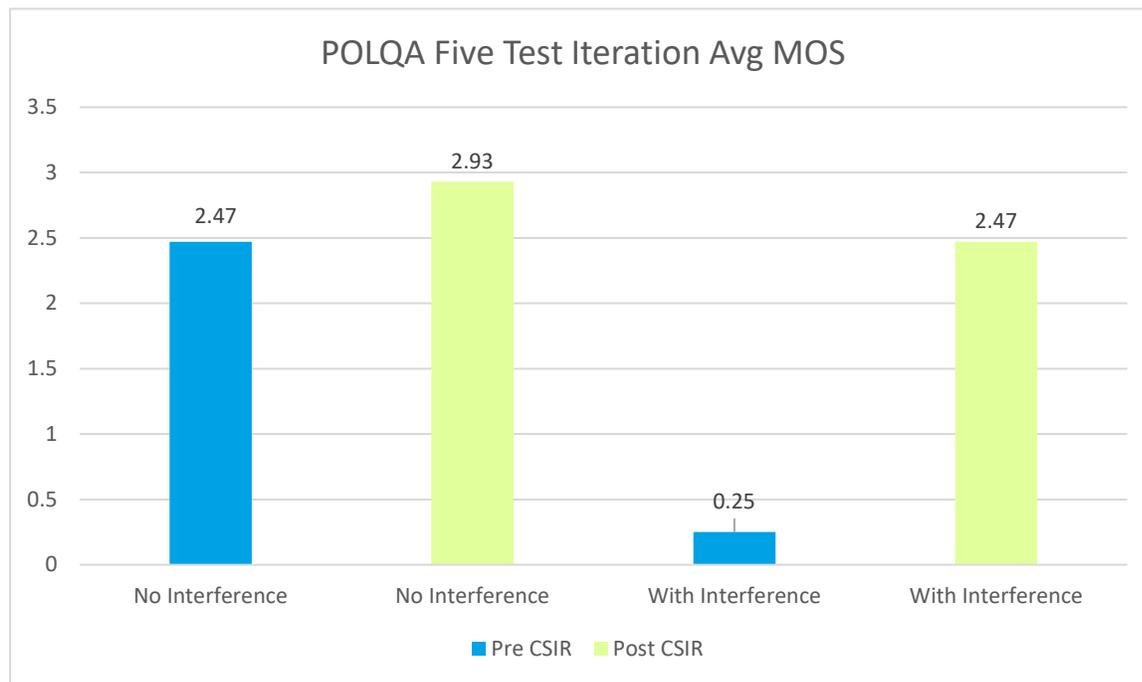


Figure 2

The UHF CSIR system was put through a scenario designed to closely replicate the conditions radio operators might face during live missions, especially under the influence of interference, both with the CSIR technology implemented and without it. This phase focused on the clarity and reliability of voice transmission amidst varying degrees of communication disruption.

The test protocol involved operators broadcasting a sequence of ten specifically chosen sentences using the radio's push-to-talk (PTT) functionality under two distinct conditions. The first condition maintained the PTT feature activated continuously throughout the transmission of all sentences, aiming to test the system's performance under a steady communication stream. The second condition introduced a variation where operators would disengage the PTT after delivering each sentence, testing the system's adaptability to intermittent communication patterns. These tests were conducted under both scenarios of existing and non-existing channel interference, following the structured approach established in the initial test series (Figure 2).

Initial findings from this phase indicated a significant effectiveness of the UHF CSIR solution in ensuring uninterrupted and clear communication, even when faced with constant interference. Operators were able to transmit and receive all ten sentences clearly, demonstrating the system's robustness in maintaining communication integrity, whether in continuous or interrupted transmission modes. This test further validated the CSIR system's capability to enhance operational communication under adverse conditions, marking a consistent performance in our series of evaluations (Figure 3).

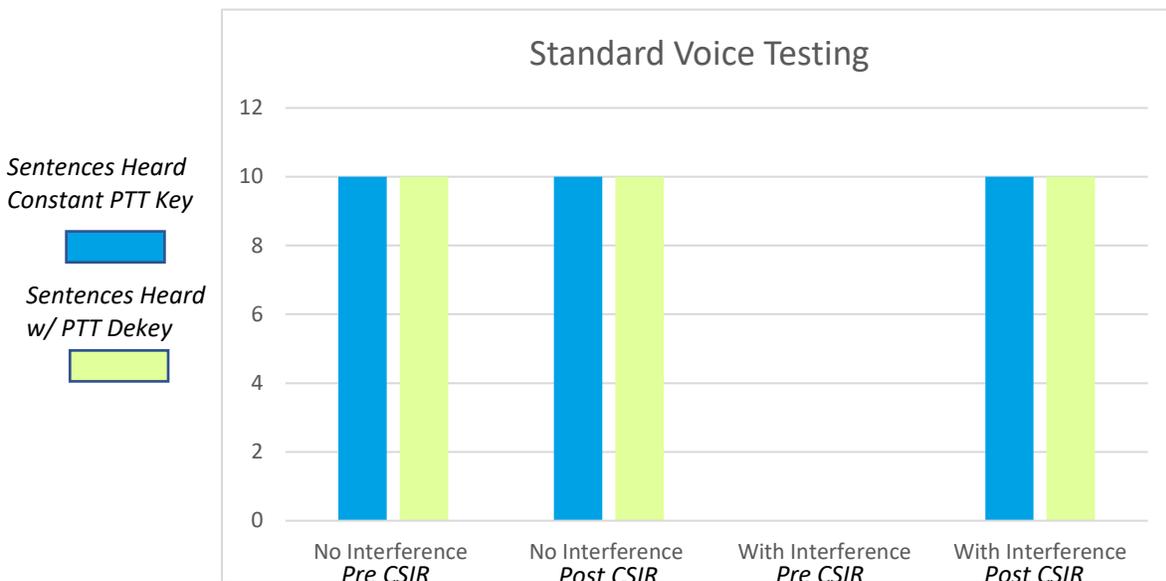


Figure 3

CONCLUSION

In conclusion, amidst the escalating demands for seamless and secure communication, iDirectGov's deployment of CSIR technology emerges as a pivotal innovation, addressing the critical challenge of co-channel interference that threatens the integrity and reliability of UHF satellite communications.

This whitepaper has demonstrated how iDirectGov's CSIR technology not only effectively counters deliberate interference scenarios but also showcases the system's adaptability and efficiency in maintaining high-quality communication without the need for prior knowledge of the interfering signals. The use of advanced tools like the POLQA has further substantiated the effectiveness of CSIR technology in preserving communication clarity and integrity, even in environments afflicted by constant interference. The detailed evaluation process, encompassing both controlled tests and simulations of real-world operational scenarios, underscores the robustness of the UHF CSIR solution in ensuring uninterrupted and intelligible communications. The system's performance under various conditions—ranging from continuous transmission modes to scenarios incorporating strategic pauses—validates its utility in enhancing the operational capabilities of military and government communications.

This body of work not only highlights the technological strides made in the field of military communications but also reinforces the commitment of iDirect Government to developing solutions that ensure secure, reliable, and efficient communication channels. As military operations continue to evolve in complexity and scale, the role of technologies like CSIR in overcoming communication barriers and

enhancing mission effectiveness cannot be overstated. The preliminary tests outlined in this whitepaper pave the way for ongoing research and development efforts, promising further advancements in communication security and reliability for critical military and government operations.

About

iDirectGov, LLC, a U.S. corporation, delivers secure satellite-based voice, video and data applications with anytime and anywhere connectivity in the air, at sea and on land. iDirectGov's advanced satellite IP solutions are used for critical ISR, airborne, maritime and COTM communications to support force protection, logistics, situational awareness, disaster recovery and emergency response. Building on more than 15-years of global satellite communications experience, iDirectGov provides the most bandwidth-efficient, scalable and highly secure platform to meet specialized applications of multiple federal, state and local government agencies, including the Department of Defense, both domestically and abroad. iDirectGov has been a trusted partner of the U.S. government for more than 17 years. All its employees are U.S. citizens, with a third being U.S. military veterans.

iDirectGov's specialized technology includes transmission security (TRANSEC), Communication Signal Interference Removal (CSIR) anti-jam technology and Open Antenna Modem Interface Protocol (OpenAMIP). All Defense-grade products sold by iDirectGov are designed, developed, assembled, programmed and verified within the United States.