Improvements in Counter-UAS Technology

Mitigating the Drone Threat through Dynamically Engineered Solutions

ALARIS
THE RF TECHNOLOGY GROUP
INSPIRING THE NEXT SOLUTION

Introduction

Unmanned Aircraft Systems (UAS), commonly referred to as drones, have seen rapid proliferation, posing significant challenges in terms of safety and security. The availability of commercially accessible, low-cost drones has increased the risk of unauthorized intelligence gathering and surveillance activities. To combat this threat, the development of Counter-UAS (C-UAS) technology has emerged and, in this article, we will explore the components used in C-UAS technologies and their role in effectively detecting, tracking, and neutralizing rogue drone operations.

Understanding the Threat

The unique characteristics of drones, including their small size, composite construction, and variable flight altitudes, make them difficult to detect using conventional air defence systems, for instance due to their reduced radar cross section (RCS). Furthermore, the advent of autonomous drones eliminates the need for human intervention, adding complexity to the threat landscape. To address this challenge, strong and often multi-layered RF (Radio Frequency) countermeasures are required to limit and halt unauthorized drone activities effectively.

The Components of UAS

A deep understanding of UAS components is crucial to develop an effective C-UAS solutions. A typical UAS system comprises of three main elements, namely, an aerial platform, a Ground Control System (GCS) and an operator. The controlling device is used for the remote operation and monitoring of the aerial platform and the GCS is used to establish a bi-directional RF link enabling communication between the platform/drone and the GCS. These RF communications links as well as the drone's navigation system, relying on Global Navigation Satellite System (GNSS) signals, serve as primary targets for RF inhibiting C-UAS systems.

Electronic Warfare in Counter-UAS

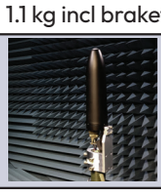
Electronic Warfare (EW) systems play a pivotal role in countering unauthorised drone movement by utilizing different RF sensors or systems to identify and detect either the UAS or its GCS via the bi-directional communication link employed by the UAS for communication. Once detected, the drone or GCS can be engaged or disabled. Electronic warfare techniques, such as jamming, are employed to disrupt the bi-directional communication link between the drone and GCS. Jamming can also interfere with the drone's navigation system, compromising its flight stability and positional accuracy. The UAS can be detected by resolving the angle of arrival (AoA) between various spatially de-located sensors and allowing the threat to be located via geolocation.

Advanced DF Antennas

Alaris Antennas' DF antenna systems leverage correlative methods to enhance the systems' accuracy and sensitivity. Despite their compact form factor, these solutions exhibit exceptional performance. Due to their scalable functionality our sensors can be tailored to varying operational environments.

Wideband capabilities of DF antennas enable the reliable detection and precise localization of RF emissions originating from drones, even if such communication links reside outside of conventional ISM frequency bands.

The basic parameters of representative detection sensors which are deployed in C-UAS systems are shown in the table below:

Product Code	DF-A0121	DF-A0254	DF-A0269
Platform	Fixed/Vehicle	Low SWaP Man-pack	Low SWaP Man-pack
Frequency	400 - 6000 MHz	400 - 6000 MHz	400 - 8000 MHz
DF Accuracy (typical)	< 1 °	< 5 °	< 3 °
Size (height x diam. & mass)	765 mm x 315 mm 12 kg	373 x 101 mm 1.1 kg incl bracket	373 mm x 101 mm 1.1 kg incl braket
Form Factor			
DF method	5-channel (from 5- to 2-channel receiver compatible)	Watson – Watt (WW) or 3-channel correlative DF (CDF)	4-channel correlative DF (CDF)

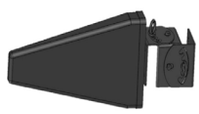
The Power of Jamming

Effective disruption and neutralization of unauthorized drone communication links are key components of C-UAS systems. Alaris Holdings provides RF components and jamming solutions designed to interfere with the control signals between the drone and GCS.

Through selective jamming of relevant frequencies, these systems render the drone inoperable, compelling it to land or return to its operator.

The basic parameters of representative directional and omni-directional antenna designs, are shown in the tables below:

Product Code	LPDA – A0141	LPDA – A0160	SPRL - A0010	HELI - A0105
Frequency /MHz/	400 – 6000	2000 – 6000	900 – 2500 2500 – 6000	2400 – 2500 5100 – 6000
Power rating /W - CW/	150+	100+	100 50	125
Polarisation	L (V or H) - adjustable	L (V or H) - adjustable	RHCP and LHCP	RHCP
Gain /dBi(c)/	8 (typical)	9.5 (typical)	> 6	> 12
Size (height / length x width / diam. & mass)	770mm x 450mm 3.7 kg (including bracket)	332mm x 106mm 700g 400g (bracket)	450mm x 165mm radome (220mm mounting flange) < 2 kg (including bracket)	386mm x 44mm radome (136mm mounting flange) < 1 kg (including bracket)
Form factor				

Product Code	WB425XM	WB480W	WB480M	DA36B	DA4338
Frequency /MHz/	400 - 6000	420 - 8000	400 - 8000	3000 - 6000	430 - 480
Power rating /W - CW/	400	200 decreasing to 60	200 decreasing to 100	20	100
Radiation pattern	Omnidirectional	Omnidirectional	Omnidirectional	Directional	Directional
Polarisation	Nominally vertical	Nominally vertical	Nominally vertical	Vertical or horizontal	Nominally vertical
Gain /dBi/	On request	On request	On request	8.5	> 6
Size /mm/	130 (height)	142 (height)	130 (height)	300 x 80 x 360	300 x 300 x 100
Weight	1.0 kg	0.9 kg	1.0 kg	1.5 kg	2.0 kg
Form factor					

Steerable Beam Antennas

SBAs for quick and simple direction of arrival detection (i.e., amplitude based) and countermeasures (like jamming or spoofing) in Counter-UAS applications:

Product Code	SBA2456DB	SBA2456XDB	SBA1327BS
Frequency /MHz/	2400 - 2500 5000 - 6000	2400 - 2500 5000 - 6000	1350 - 2700
Power rating /W - CW/	10	100	10
Radiation pattern	Steerable Beam Antenna -Directional and Omnidirectional		
Polarisation	Nominally vertical	Nominally vertical	Nominally vertical
Gain - sharp beam modes	10 to 14 dBi	10 to 14 dBi	10 to 15 dBi
Height x diameter	405 mm (incl. mast mount adapter) x 320mm	405 mm (incl. mast mount adapter) x 320mm	420 mm (incl. mast mount adapter) x 420mm
Weight	4.6 kg	4.9 kg	6.5 kg
Form factor			

Power and Low-Noise Amplifiers

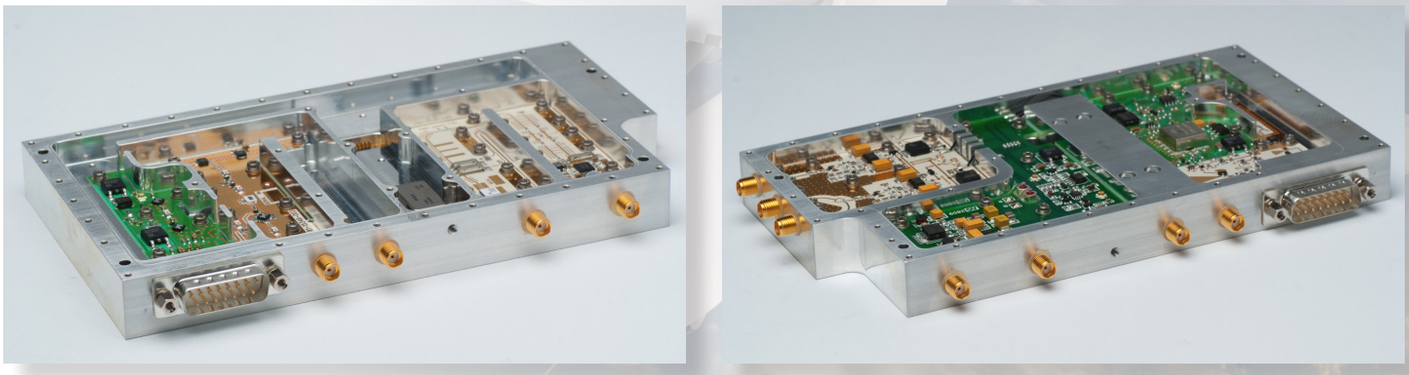
Our amplifiers use latest GaN technology, providing high gain and low noise-figure solutions in small and lightweight units:

Product	Power Amplifier	Power Amplifier	Power Amplifier
Product code	KU PA BB 070270-80 A 2.1.1	KU PA BB 003350-15 B	KU PA BB 003055-100 B
Frequency range	600 - 2700 MHz	30 - 3500 MHz	30 - 550 MHz
Power rating /W/	Min. 80	> 15 (30 - 2500 MHz) > 10 (2500 - 3500 MHz)	Typ. 100 Min. 80 W
Noise figure @ 18 °C	-	Max. 15 dB (30 - 200 MHz) Max. 9 dB (200 - 3500 MHz)	-
Gain /dB/	Typ. 52	Min. 45	Typ. 49, Min. 47
Dimensions /mm/ and Weight /g/	180 x 95 x 26 800	200 x 115 x 25 950	192 x 80 x 22 580
Application	Communication systems Jammer applications	Communication systems Jammer applications	Analog transmission systems Jammer applications

Integrated Jamming Solutions

We are also able to offer bespoke integrated jamming solutions where standard COTS components/ modules will not provide the required performance or function within a customers' specific application. The integrated jamming solution can be a narrow band design to deal with a certain type of drone threat or a wideband system to provide maximum flexibility and capability of the jamming capability. We can provide integrated solutions that will operate to 18GHz and beyond.

Product	Low Noise Amplifier	Low Noise Amplifier
Product code	KU LNA BB 0011000 AB	KU LNA 163 BH TM
Frequency range	1 - 10 GHz	1500 - 1700 MHz
Power rating /W/	Min. 80	> 15 (30 - 2500 MHz) > 10 (2500 - 3500 MHz)
Noise figure @ 18 °C	Typ. 2.3 dB, Max. 4.5 dB (200 MHz - 10 GHz) Typ. 3 dB, max. 6 dB (100 MHz - 200 MHz)	Typ. 0.7 dB, Max. 0.8 dB
Gain /dB/	Typ. 24 (10 MHz - 8 GHz) Typ. 22 (8 GHz - 10 GHz)	Min. 31
Dimensions /mm/ and Weight /g/	58 x 45 x 12 200	145 x 70 x 98 370
Application	Communication systems	Analog and digital transmission systems Radar receiving systems



Typical Integrated Front end module

Conclusion

With the continuous proliferation of commercial drones and the accompanying challenges they pose, the development of robust C-UAS technology is essential. Alaris Group, leveraging its engineering expertise in electronic warfare antenna and RF sub-systems, stands at the forefront of providing cutting-edge solutions for detecting, tracking, and neutralizing unauthorized drone activities. Through their innovative C-UAS components, such as wideband DF antennas and directional and omni-directional jamming systems, Alaris Holdings contributes significantly to safeguarding critical infrastructure and ensuring public safety. The ongoing advancements in C-UAS technology continue to enhance our capabilities in mitigating the evolving threats posed by commercial drones.

ALARIS - THE RF TECHNOLOGY GROUP: Leading the Way in C-UAS Sub-systems

Alaris Group, a prominent supplier in the field of C-UAS technology, offers a range of critical sub-systems for robust C-UAS solutions. Alaris Antennas, a subsidiary of Alaris Holdings, specializes in the development of high-performance, wide-band tactical antennas designed for Communication Intelligence (COMINT), Direction Finding (DF), and jamming applications. These antennas cover an extensive frequency range, from 1 to 8000 MHz, ensuring comprehensive coverage and optimal performance.