

Cloud Removal & Compression Module

The CogniSAT-CRC module delivers downlink efficiency maximisation using edge AI compression for Earth Observation Satellites

Part of the CogniSAT[™] platform, CogniSAT-CRC is a self-contained module combining the power of the CogniSAT-XE family of On-Board AI Payload Processors with software functionality combining Cloud Detection and Removal and an AI-based multi-dimensional lossless image compression algorithm to maximise the utilisation of the satellite downlink connection. The use of this module can result in a six-fold increase in the number of useful images which can be transmitted to the ground station.

AI Engine combines image analysis and compression

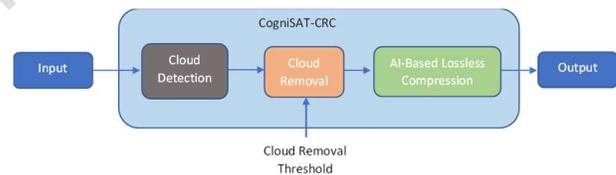
Maximising Downlink Efficiency

All multispectral and hyperspectral image sensors are subject to their images being obscured by atmospheric conditions, most notably cloud cover. It is estimated that, at any time, approximately 50% of the earth is obscured by clouds. This means that, on average, half of the information captured by a satellite-based imager is of no use for most applications. Transmitting this data, even if compressed, results in communications bandwidth being wasted. The CogniSAT-CRC solves this problem by performing cloud detection and removal on the sensor images before compression. This results in a six-fold increase in the usable data received by the ground station when compared with the transmission of uncompressed images and a two-fold increase when compared with the use of standard compression approaches.

Modular Implementation

The CogniSAT-CRC module combines a state-of-the-art Neural Network-based cloud detection algorithm with AI-optimised lossless multispectral compression to compress only those images which contain useful information and provide them to the OBC for

transmission to the ground station. This approach guarantees the optimum utilisation of the communication network.



Post-Launch Flexibility

The performance and capabilities of the CogniSAT-CRC implementation are not fixed once the satellite is in orbit. The cloud detection and compression algorithm will be tuned with historic data prior to launch but this can be further optimised using real operational data post-launch. Additional algorithms for the analysis of raw satellite data can be uploaded to the CogniSAT platform after launch, further reducing the amount of data to be transmitted to ground and increasing the return on investment of space assets.

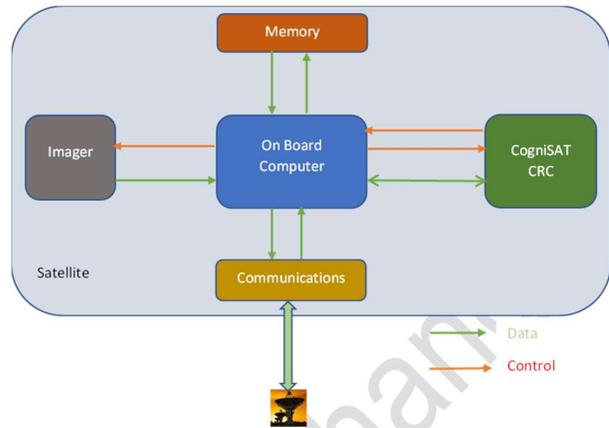
System Architectural Overview

System Connectivity

The CogniSAT-CRC (CRC) is a self-contained system module which acts as an AI coprocessor to the satellite On-Board Computer (OBC). Connectivity between the OBC and the CRC is implemented by the use of a defined set of API calls. Documentation provided with the CRC module defines both these calls and the image memory structure which the CRC requires for seamless operation.

System Architecture

As shown in the block diagram, the CogniSAT-CRC accesses all satellite resources through the OBC. The OBC controls the Imager and stores its images, in a format compatible with the CRC, in its memory. The OBC calls the CRC, using a defined API which specifies the operation to be performed, the cloud density



threshold and the location of the images to be analysed. This API returns the compressed image ready for transmission to the ground station.

Module Specifications

Size, Weight & Power	
Nominal power consumption	2W (typical operational)
Mass	80g
Form Factor	PC-104
Length	94mm (98mm incl. connectors)
Width	90mm (99mm incl. connectors)
Height (max)	15mm

Operational Parameters	
Supported Sensors	Pan/Mono
	RGB
	Multispectral
	Hyperspectral
Compression Factor	5,98 (Typical)
Connection Interfaces	10/100/1000BaseT Enet
	USB 2.0/3.0
MIPI	4-lane CSI-2 camera I/F
CIF	16-lane parallel camera I/F

Ordering Information

Part Number	Description
CogniSAT-CRC-1-EM	CRC Module integrated in CogniSAT-XE1 Engineering Model
CogniSAT-CRC-1-FM	CRC Module integrated in CogniSAT-XE1 Flight Model