Integration, Implementation and Testing of the X band SASAR II Radar Unit

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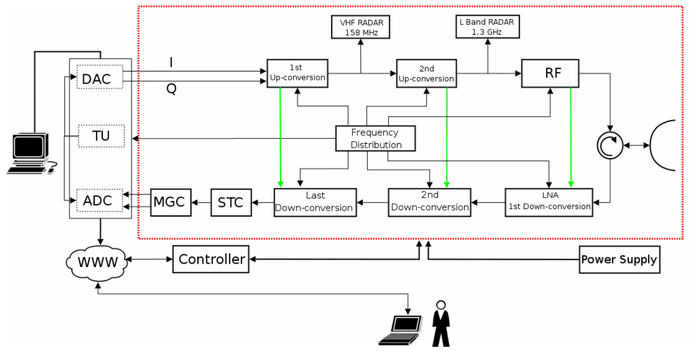
1. SASAR II System Diagram

The SASAR II is an X Band (9.3 GHz) high resolution (2m) imaging radar. The purpose of this dissertation was to integrate the various subsystems (see system diagram below) and to verify their design specifications.

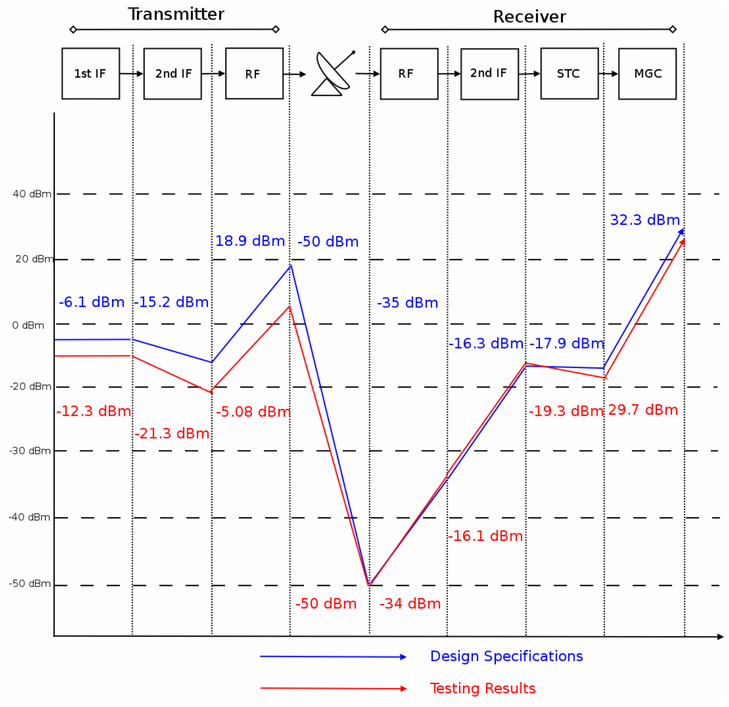


The SASAR II system consists of a three stage up-conversion transmitter with intermediate frequencies at 158 MHz, and 1.3 GHz. The input to the transmitter is generated by the digital to analogue converter. For the purposes of this dissertation the testing was restricted to low power loop back testing.

The receiver system is essentially the reverse process of the transmitter with the exception of two additional gain stages: the sensitivity time control and the manual gain control. Both systems are designed to attenuate strong returns from close targets and amplify weaker signals from further targets. The received signal is digitized by direct IF sampling by the analogue to digital converter for compression and focusing.

2. System Power Levels

This diagram indicates clearly the system power levels for the design specification and empirical results.



Peak Pulse Power = (Mainlobe Amplitude) – 20log(duty cycle)

Where 20log(duty cycle) is the Pulse Desensitization Factor (PDF)

The signal power measured by the spectrum analyser is not a true reflection of the total signal power. The difference between the peak power and the main lobe power is referred to as the pulse desensitization. This "desensitization" occurs because the power of a pulsed CW carrier is distributed over a number of spectral components, namely the sidebands. As a result each spectral component only contains a fraction of the total power.

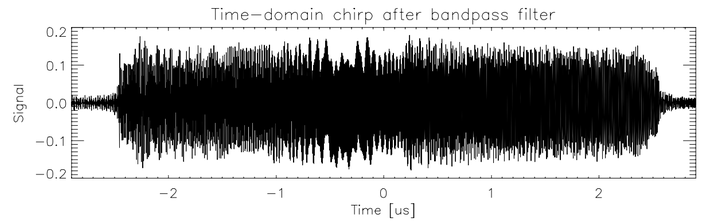
The system power levels shown indicate a deviation from the design specifications in both the transmitter and receiver. This significant drop in power levels can be attributed to:

- high conversion losses through the mixers
- cable losses
- inaccurate product design specifications

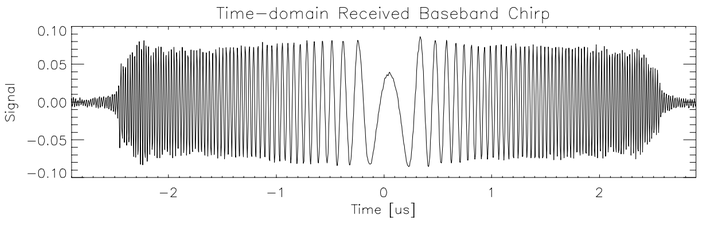
Compensating for the PDF of 3dB improves the dynamic range of the system to the design specs.

3. Digital Post Processing

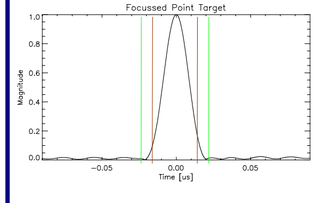
Time Domain Received Chirp (Direct IF sample, 158 MHz)



Match Filtered Chirp signal

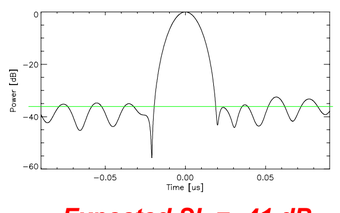


4. Focused Received Pulse



Expected PW = 1.5 m

Measured PW = 2m



Expected SL = -41 dB

Measured SL = -38 dB

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