

Description and justification of change in FE-LO interface

Introduction

This memo summarises a proposed change in the original FE-LO interface boundary as described in the ALMA projectbook version 4.0 of 2001-02-08.

The primary objective of the proposed change is to establish a clear interface between those sub-systems enabling a more efficient execution of tasks in especially the design, construction and integration phases of both Front End as well as Local Oscillator sub-systems.

The proposed change in FE-LO interface has no impact on the original technical performance of both involved sub-systems as well as the complete ALMA instrument.

This memo is concluded with a section describing the various actions to be taken to implement this change.

Description of new FE-LO interface boundary

The First Local Oscillator sub-system becomes an integral part of the Front End assembly. The FE-LO interface is then:

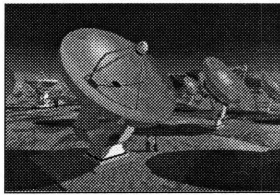
1. The input at the First LO Controller of the 125 MHz reference signal (REF125M) coming from the Reference Receiver.
2. The input at the First LO Controller of the 20.83333 Hz reference signal (REF20) coming from the Reference Receiver.
3. The waveguide input at each Warm Multiplier Assembly for a microwave reference signal generated by the Dual-Laser Photodiode Assembly. For each frequency band there is a separate Warm Multiplier Assembly, resulting in 10 different interfaces.
4. Mechanical interfaces for the Dual-Laser Photodiode Assembly mounted on all 10 Warm Multiplier Assemblies.
5. A mechanical interface between the Reference Receiver and the Front End rack.
6. A mechanical interface between SP10T Optical Switch and Front End Rack
7. Electronic control of SP10T optical switch from First LO Controller

The block diagram attached at the end of this memo gives a graphical representation of this new FE-LO interface boundary. The whole First LO sub-system as depicted in this block diagram comes under the responsibility of the Front End IPT with the exception of the shaded area which remains under the responsibility of the Back End IPT.

Justification of new FE-LO interface boundary

Main reasons for having the First Local Oscillator sub-system as part of the Front End are the following:

- It drastically reduces the number of complicated cross IPT boundary interfaces.
- Organisation and planning of both construction and integration phases of a complete Front End containing the First Local Oscillator is more efficient when it is under the responsibility of one single IPT.
- Testing of the Front End sub-system becomes less critical and resembles closely the actual, operational situation.



ALMA Project

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Doc. No.:

Date: 2001-05-17

Issue No.: 1

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Page: 2 of 3

Placing the LO-FE boundary exactly at the waveguide flange joining the Dual-Laser Photodiode Assembly with the mixer inside the Warm Multiplier Assemblies, allows the development and fabrication of the dual-laser synthesiser and the photodiode assembly to both be done as part of a single sub-system.

For cartridge development, the photodiode assembly would be replaced by a microwave signal source with appropriate waveguide output.

The original Reference Receiver, see ALMA LO: Reference Receiver Block / Doc. No. ALMA09001KX0002D, will be physically split in two separate modules. One part of this Reference Receiver, the so called LO-Photonic Receiver module, will be located mounted inside the Front End rack. This module should be as close as possible to the Dual-Laser Photodiode Assembly, which generates the microwave signal for the Warm Multiplier Assemblies, to minimise phase changes in the First LO signal that can not be compensated by the Line Length Corrector.

However this Reference Receiver, including the LO-Photonic Receiver module, will remain under the responsibility of the Back End IPT despite the close integration with the Front End sub-system. Compelling reason for this is that this Reference Receiver is part of a larger, closed loop compensation scheme in the Fixed Reference Distribution.

Implementation tasks of proposed change

As mentioned before the proposed change in the FE-LO interface boundary has no impact on the original technical performance of the ALMA system. It is merely an organisational change of current activities.

After approval of this change by the ALMA CCB it is advised to execute the following tasks to implement it:

1. Update ALMA project book chapters 2.3, 5 and 7 accordingly to reflect the change
2. Move the following first local oscillator related WBS tasks under the Front End WBS header (WBS 4):
 - WBS 5.05.30 Millimeter LO drivers engineering support
 - WBS 5.05.35 LO multipliers chains engineering support
 - WBS 5.10.10.25.15 Band 9 (602-720 GHz) front end LO
 - WBS 5.10.10.25.20 Band 7 (275-370 GHz) front end LO
 - WBS 5.15.15.05 LO source design and system integration
 - WBS 5.15.15.15 72-95 GHz LO source
 - WBS 5.15.15.20 100-120 GHz LO source
 - WBS 5.15.20.05 LO multiplier chains: final design & documentation
 - WBS 5.15.20.15.05 Band 3 (89-116 GHz) receiver LO
 - WBS 5.15.20.15.10 Band 6 (211-275 GHz) receiver LO
 - WBS 5.15.20.15.15 Band 9 (602-720 GHz) receiver LO
 - WBS 5.15.20.15.20 Band 7 (275-370 GHz) receiver LO
 - WBS 5.15.25 LO test equipment/facilities
3. Establish Interface Control Documents that describe in detail the technical requirements and specifications of all new FE-LO interface boundary.

This change in WBS should also reflect the formal change in responsibility for FE and LO sub-systems as carried by the Front End IPT and Back End IPT.

