

# 32T Test Plan -- Tile / Beam-former

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## 1 Introduction

The antenna tile / beam-former combination forms the primary collector of the Radio Frequency energy being observed by the overall instrument. As such, the antenna tile and beam-former systems operate entirely in the analogue electronics domain (the first stage digitization is conducted down-stream from the beam-former). This Plan is responsive to requirement #8 contained in the memo “MWA 32-T Objectives and Quality Assurance Evaluation Criteria”, dated 4 Sept 2009.

## 2 References

*There is a placeholder containing an empty ICD in the MWA knowledge tree, it should be fleshed out!!! – see*  
*<http://mwa-lfd.haystack.mit.edu/knowledgetree/view.php?fDocumentId=227>.*

Also there is a very good set of manufacturing and procurement documentation held by Steve Burns of Burns Industries Inc. the expected manufacturer of the tiles and beam formers. The bulk of the manufacturing work will be carried out in China, and as a result much of this documentation is currently in Chinese. It is also likely that Burns Industries representatives will handle the site assembly and installation of the antenna tiles *and beam-formers?*

See also: 32TtileBfTestPlanWeatherReliability.doc

## 3 Measurement / Test Description

In general the antenna tiles will be “tested by analysis”, augmented with some details from field experience and observations, as per the above referenced Weather and Reliability test plan.

Beam-formers can be subject to laboratory testing to meet most of the design requirements, but it is possible that final performance cannot be ascertained except in the radio-quiet environment on-site at the Murchison Radio Observatory.

Therefore, it is vital to ensure thorough design review on this part of the system.

*Actual test descriptions for LNA circuit boards and Beam-former assemblies required here – Haystack / Burns?*

## **4 Resources Required**

### **4.1 Staffing**

Since the tiles and beam formers are to be manufactured and likely installed on site by Burns Industries or their representatives, it is anticipated that testing will take place in several locations. Assemblies and sub-assemblies will be tested prior to departure from the relevant factories and the completed tiles / beam formers will be ultimately tested on site at the Murchison Radio Observatory.

Antenna components will be tested at the factory using Burns Industries resources and as part of the overall quality assurance of manufacturing process.

It is anticipated that the beam former testing will be conducted by Burns Industries staff, in consultation with Haystack, and with test equipment located at Burns Industries.

Further, final on-site testing will require sufficient personnel to operate the system, but no fewer than two people, for reasons of site safety.

### **4.2 Hardware**

4.2.1 Factory testing of antenna components.  
*Equipment as per procedure(s) defined by Burns Industries.*

4.2.2 Factory testing of beam-former.  
*Equipment as per procedure(s) defined by Haystack and Burns Industries.*

4.2.3 Full on-site testing.

To demonstrate the tile / beam-former capabilities we will not attempt to operate under all possible combinations of circumstance. The following are the minimum set of equipment required:

- System power sufficient for needs.
- One operational air conditioner.
- One fully operational receiver node, connected to the tile under test.
- One fully operational receiver node, connected to known good tile(s).
- *One correlator, either software or hardware?*
- One Diagnostic Computer (may be shared with the software correlator).
- One laptop computer with an Ethernet port and cable.

### **4.3 Software**

4.3.1 Factory testing of antenna components  
*Software as per procedure(s) defined by Burns Industries.*

4.3.2 Factory testing of beam-former

*Software as per procedure(s) defined by Haystack.*

#### 4.3.3 Full on-site testing

A minimal set of software diagnostic routines is required to test the tiles, as follows:

- Suitable terminal and other software on the laptop to talk to required hardware.
- Commands to select beam-former “pointings”.
- Commands to collect test data from the receiver node(s).
- Diagnostic tool(s) to produce test-plots from the above data.
- *Criteria on which to evaluate the above test-plots.*

### **4.4 Execution Time and Constraints**

#### 4.4.1 Factory testing of antenna components

All mechanical components will be inspected for dimensional tolerance as per specifications from Burns Industries. Weld quality and other process results will also be assessed as per specifications. This would be expected as part of ongoing quality assurance during manufacture and the execution time for this is folded into the manufacturing processes.

*LNA circuits will be tested as per specifications from ??? It would be expected that execution time for LNA testing would be ?? minutes/hours per circuit board.*

#### 4.4.2 Factory testing of beam-former

*I have no idea of the scale or scope or methods of testing the beam-formers, this would require input from Haystack and Burns.*

#### 4.4.3 Full on-site testing

It will not be possible to carry out any other “observations” or tests during the on-site commissioning tests of the tiles / beam-formers. *It is estimated to take ?? hours to test one tile / beam-former combination.*

## **5 Success Criteria**

Success criteria for the mechanical items will be that they measure within tolerance as per specifications.

*Other success criteria to be defined once the testing is defined above.*

## Revision History

<b>Rev Ltr</b>	<b>Date</b>	<b>Author</b>	<b>Description</b>
01	2009-Sep-28	DJE	Initial draft