

DRAFT SPECIFICATION PATENT PENDING

Part No:

CMM200.A

Product Name:

Adaptrix 5

5-6GHz Passive Massive MIMO Modular Panel System







1. INTRODUCTION

The patent pending CMM200 Massive MIMO Modular Passive Panel is the preferred testbed for Massive MIMO research, allowing the radio researcher ease and flexibility in assembling an array of variable size and shape which always has constant array spacing for minimization of grating lobes.

The modules attach to each other and to ground plane extensions with a proprietary fastening design that enables quick assembly without threaded fasteners. When attached, a module-module or module-extension connection has excellent ground plane continuity due to a conductive elastomeric gasket around the periphery that ensures optimal field pattern from each element.

Each module has 16 patch antenna elements, each having a dual polarization with very high cross polarization isolation and low mutual coupling between adjacent elements.

Massive MIMO reciprocity calibration is accomplished easily with the modules, because each module has a network of couplers that meanders through the antenna PCB, coupling energy off of each of the 2x16 radiating elements, and connecting to a common RF calibration (CAL) port. There is also an additional port in this calibration network for daisy chaining the calibration line to other modules (CAL_DAISY) which can permit a single connection to the reference radio used for calibration.

The radiating elements are high-efficiency patch antennas which are soldered to the antenna PCB for the highest reliability and performance. These exhibit good return loss and field pattern over a broad bandwidth, enabling freedom of choice in the research frequency used.

The modules have an integrated radome made of high-impact UV stabilized plastic. The radome is sealed to the housing with an O-ring which supports IP55 immersion rating for outdoor operation.

Each module has on the back side a set of 34 SMA connectors for the 32 antenna ports and two reciprocity calibration ports. The modules can be delivered pre-assembled with cables for increased ease of use.



2. SPECIFICATION

ELECTRICAL										
Standard										
Frequency (MHz)		5500-5790	5790-5990	5990-6250						
Max VSWR*		2.0:1	1.5:1	2.0:1						
Max Return Loss (dE	8)*	-10	-14	-10						
Peak Gain (dBi)*		6.5	7	6.5						
Efficiency (%)*		75	80	75						
Average Gain (dB)	*	-1.25	-1.25							
3dB beamwidth*		±45°	±45°							
Field pattern		Endfire								
Isolation, H-V same elements	ment*	-20 typ	-30 typ	-20 typ						
Isloation, V-V horz offset, or H-H	vert offset, dB*	-17 max	-17 max	-17 max						
Isolation, V-V vert offset, or H-	H horz offset*	-19 max	-20 max	-20 max						
Coupling, any element to CA	L port, dB*	-27 to -38	-27 to -38	-27 to -38						
Insertion loss, CAL port to CAL	_DAISY port*	-3.5dB max	3.5dB max	3.5dB max						
Return Loss, CAL or CAL_DAISY port*		-20dB	-20dB	-20dB						
Max Input Power (Watts)		5								
Polarization		Dual linear with H and V polarization								
Impedance (Ohms)	50 Ohms								
MECHANICAL										
Arraying Dimensions (mm)	56x224x32 mm									
Max Dimensions (mm)	61x229x32 mm									
Material	Aluminum and Hi-Impact ABS									
Connector	SMA-F for each of 32 antenna ports and 2 calibration ports									
ENVIRONMENTAL										
Operation Temperature	-40°C to 85°C									
Storage Temperature	-40°C to 85°C									
Relative Humidity	40% to 95%									
RoHs Compliant										

* Measured with loads on all other ports and ground extensions installed around periphery.



3. DETAILED DESCRIPTION

3.1 Overview

The CMM200 is a 2x8-element dual-polarization antenna sub-array module which can be used to construct the passive radiator section of a Massive MIMO system capable of operating in the 5-6GHz band. The CMM200 will maintain a constant spacing between elements when attached to other CMM200 modules using its proprietary threadless fastening scheme. Each module can be mated with another module on either the long or short side. This property allows for a large number of array configurations to be easily realized.

Upon mating, conductive O-rings located around the perimeter of the modules near the antenna end make intimate contact with O-rings from the mating module, implementing a large ground plane automatically as a result of fastening the two modules together. This ground plane can be extended with the ground plane extensions (GPEs) included with the research kit, which have the same fastening pattern and dimensions as the modules. The GPEs have 4 threaded bosses evenly spaced at twice the lattice spacing constant (2x28mm=56mm) which allows for fastening to infrastructure.

The ground plane formation due to making up a larger array supports a uniform endfire pattern for each radiating element, since the elements are dual-polarization patches having 3dB-beamwidth of $\pm 45^{\circ}$. This arrangement allows for a high front-to-back ratio of at least 15dB, allowing for frequency reuse in other sectors.

These salient features allow for a large number of possible array configurations and field scenarios to be implemented in terms of array configuration, site location and the resultant implications on beamforming and propagation properties.

The CMM200 passive version has 34 SMA connectors on the back side of the module for each of the 32 antenna ports (16 horizontal, 16 vertical), as well as 2 connectors for calibration and calibration daisy chaining. The connectors can be delivered terminated with cable upon request for ease of use.

The CAL port has a 28-35dB coupling and network loss between itself and each of the 32 addressable radiating element ports using a meandering coupling network. The CAL and CAL_DSY ports allow for the transceivers (which are attached to each SMA port) for each antenna to be coupled to a reference transceiver (on the CAL port) for TDD reciprocity calibration. This network does not increase coupling or crosstalk between elements enough to be any system impairment. The CAL_DSY port has a 3dB insertion loss relative to the CAL port and is used to daisy chain other modules.



3.2 Connector Assignment

Below figure illustrates the numbering guide for the module ports. Numbering is as seen from the back side of the device.



The Taoglas CMM200





4. ANTENNA PARAMETERS



4.1. ANTENNA RETURN LOSS

4.2. MUTUAL COUPLING





4.3. CALIBRATION PORT









4.4. Efficiency





4.5. Peak Gain





4.6. Average Gain



5. Radiation Pattern







6V @5.775 GHz

6V @5.975 GHz



. MECHANICAL DRAWING (Unit: mm)

6.1 Antenna Aluminum Panel





6.2 Ground Plane Extension

Ground Plane Extentsion Piece









6.3 Antenna Panels and Ground Plane Extensions Assembly





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