PIP-II Project

Interface Specification Document for PIP2IT 650 MHz RF Distribution LLRF and Cooling Systems

Document #: ED0012144 Revision #: -

May 25, 2020

Revision History

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| --- | --- | --- | --- |
| Version # | Date | Author | Comment |
| 0.0 | May 25, 2020 | James Steimel | Initial Version of the document |
|  |  |  | Changes / revisions |
|  |  |  |  |

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# Purpose

The purpose of this document is to describe the external interfaces between the 650 MHz RF Distribution and the builing infrastructure for PIP2IT. It also describes the external interfaces between the 650 MHz RF Distribution and the LLRF system at PIP2IT and the cavity input coupler.

# Scope

The RF distribution connects the output of the RF amplifier to a cavity input coupler. It includes the transmission line hardware required to transport the RF signal between the two points and a means of measuring the forward and reflected power at the cavity input coupler. It also includes a circulator to protect the amplifier from large reflected power signals from the input coupler.

The scope of this document covers the RF distribution required to perform cryomodule tests on the PIP-II HB650 and LB650 cryomodules at PIP2IT. Fig n shows a block diagram of the PIP2IT 650MHz distribution design and the interfaces.



Figure 1: PIP2IT 650MHz RF Distribution Conceptual Design

# Acronyms

|  |  |
| --- | --- |
| CMTF | Cryomodule Test Facility |
| CW | Continues Waves |
| FRS | Functional Requirements Specification |
| HPRF | High Power Radio Frequency |
| HB650 | High Beta 650 |
| LB650 | Low Beta 650 |
| LLRF | Low Level Radio Frequency |
| PA | Power Amplifier |
| PIP | Proton Improvement Plan |
| PIP2IT | PIP-II Injector Test |
| RF | Radio Frequency |
| SSA | Solid State Amplifier |

# Reference

|  |  |  |
| --- | --- | --- |
| **#** | **Reference** | **Document #** |
| 1 | PIP2IT Test Facility 650 MHz RF Distribution System FRS | ED0012138 |
| 2 | PIP2IT Test Facility 650 MHz RF Distribution System TRS | ED0012142 |

# Building Infrastructure

* 1. Building Environment
* Possible environment temperature: 10-40 ⁰C.
* Possible environment humidity (dew point maximum): 27 ⁰C

## Water Cooling

* Maximum inlet water pressure: 145 psig
* Maximum water pressure drop: 29 psi
* Required flow, circulator: 10 gpm maximum
* Required flow, load: 10 gpm maximum
* Cooling water temperature nominal: 25-35 ⁰C.
* Cooling water header, Circulator: SS NPT (male) of 1/2” size
* Cooling water header, Load: SS NPT (male) of 1/2” size

## Water Cooling Instrumentation

* Circulator return temperature electrical interface
* Circulator flow meter electrical interface
* Load return temperature electrical interface
* Load flow meter electrical interface

# LLRF

* Forward and reflected coupler connection: Type – N, female, for 3/8” flexible (50 ohm), coaxial RF cable
* Maximum forward signal power: 26 dBm
* Maximum reflected signal power: 30 dBm

# 650 MHz Cavity Input Coupler

* Flange: standard WR1150 rectangular waveguide, CPRF