Dual Polarization Calibration
L3 – Baron Services Design for the WSR-88D

NEXRAD TAC Meeting
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Overview

- Review Calibration System Approach
  - Based on PDR, CDR, and Contractor Documents
  - Baron Services Calibration and Uncertainty Analysis revised 9/11/2009
- Changes Since CDR
  - remove vertex feed
  - added low noise amplifiers to RF Pallet
- Calibration Functions
  - Z calibration, ZDR calibration, System Initial Phase
- Today’s Approach
  - Present Functional Diagrams
NEXRAD Calibrations

- The initial Dual Pol calibrations are sun check and test signal bias check to
determine the imbalance in the test signal.

Sun Check
- Used to check initial receiver imbalance
  - This is used for the test signal bias check.
- Performance Check

Test Signal Bias
- Used to calculate imbalance in CW test signal
  - First, read both H and V channels at IFD and calculate difference
  - Reverse test signal, and take another reading.
  - Using previous two readings, calculate imbalance in the CW test signal.

Approach is considered an “Engineering Calibration” supplemented by solar scans

Similar to methods used by NSSL on the KOUN Radar, but highly automated

Some highlights: Test signal switching, including a matrix switch, phase shifting, ‘ZDR Control’, Variable Phase power divider, TX input and divided power sensing

From L3 – Baron PDR Material

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determine the imbalance in the test signal.
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- Test Signal Bias
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AME Essential Element for:
- Noise Level Calibration
- Noise Temperature Check
- Fast linearity Calibration
- Dynamic Range
- Clutter Suppression Test
- Full linearity Calibration
- Complex Spectrum
- Spectrum Width and Velocity Check
- Existing Receiver tests
  - Klystron RF
  - RF Driver
  - STALO RF

From L3 – Baron PDR Material:

- ZDR Calibration
  - Measure H vs V transmitter imbalance using the AME transmit power sense.
  - Inject CW test signal into test feed.
  - Measure Zdr at signal processor and correct for test signal imbalance
    - Result is receiver imbalance
  - Add transmitter imbalance to receiver imbalance to get ZDR Offset.
RF Pallet
- Power divider
- Isolator
- TR limiter
- Couplers
- LNA's

Receiver
- Couplers
- Filters
- LNA's
- Down converter

Pulse and Noise BITE Generator
- RF Delay
- Noise Source

CW BITE Generator
- Up converter
- Step attenuator

RVP8

Example
- ZDR HV
- RX BIAS

STALO

Antenna

TX Signal

TX Power Sense

H & V Power Sense

H & V Bias

CW Tests

AME

H & V Bias

CW Modulator
- Two channels
- Phase shifter
- Matrix switch

Example
- ZDR HV
- RX BIAS
Summary of L3 - Baron Approach

- Some elements “Factory Calibrated”, meaning paths measured with calibrated power meters
- Some paths calibrated using a noise source (tracable to NIST)
- Z calibration essentially same as WSR-88D, determine dBZo and ensure the receiver is linear
- ZDR calibration accomplished via combination of solar scans, power sense path difference measurements, test path calibrations, and through use of a matrix switch to cross connect CW test signals
- All basic WSR-88D calibration and fault monitoring functions are integrated into the design
- System Initial Phase Determination based on ground clutter targets