

WORLD METEOROLOGICAL ORGANIZATION

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CBS/ET-SBR SO-2 & CIMO/ET-ORS-1/Doc.3.4.4

**JOINT MEETING OF  
CBS EXPERT TEAM ON SURFACE-BASED REMOTELY-  
SENSED OBSERVATIONS  
(Second Session)  
AND  
CIMO EXPERT TEAM ON OPERATIONAL REMOTE  
SENSING  
(First Session)**

(15.XI.2011)

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(GENEVA, SWITZERLAND, 5-9 DECEMBER 2011)

**WEATHER RADAR OPERATIONS, STATUS, ISSUES, REQUIREMENTS FOR DATA EXCHANGE  
AND PLANS**

*Quality Control Issues*

Standardisation and Requirements for Calibration and Maintenance of Weather Radars

*(Submitted by Oguzhan Sireci, Turkish State Meteorological Service)*

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**SUMMARY AND PURPOSE OF DOCUMENT**

Presents content of the standardisation and requirements for calibration and maintenance of weather radars document, which will be prepared in 2010-2013 intersession.

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**ACTION PROPOSED**

1. The Joint Meeting is invited to review the content of the standardization and requirements for calibration and maintenance of weather radars document and to define the content precisely.
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## **Introduction**

Weather radar networks have a vital importance with their capability of providing spatial information about precipitation. They have been renewing and expanding around the world. Some networks have already been integrated with other networks and became a larger network like in Europe. The importance of standardisation and requirements for calibration and maintenance of weather radars has been increasing accordingly. Regular maintenance and calibration of radar systems is one of the critical aspects of operating a radar network properly and efficiently and to maintain the availability of data of high quality. On the other hand, the proper calibration of weather radars for accurate rainfall measurements has been a serious matter for many years because of weather radar's complexity. The fifteenth session of the Commission for Instruments and Methods of Observation (CIMO) requested the CIMO Expert Team on Operational Remote Sensing to establish a document on Standardisation and requirements for calibration and maintenance of weather radars. A number of maintenance and calibration methods, procedures and recommendations for weather radars will be included in this document.

## **Content of the Document**

### **1. Implementation of Maintenance and Calibration Procedures**

Realization of the maintenance and calibration tasks can be done by The institution/organization (National Meteorological Service) which is owner of the radars, private contractors under the scope of a maintenance contract or manufacturers. These options will be searched with pros and cons and general overview of the world is going to be presented.

### **2. Maintenance Types and Procedures**

Maintenance types like Preventive and Corrective Maintenance for Weather Radars will be examined. In this context, Recommendations for Periodical Checks of Weather Radars, Fault Finding Methods like Built in Test Equipments (BITE), Maintenance Softwares and Diagrams/Charts will be mentioned.

### **3. Maintenance Equipments Used for Radar Maintenance**

General test and measuring equipment needed for maintenance and calibration tasks of a radar and calibration of this equipment will be examined.

### **4. Maintenance measurements on transmitter and receiver**

During routine maintenance of a weather radar system, input and output levels of sub-systems should be measured with calibrated maintenance equipments according to procedures.

**5. Maintenance of antenna and radom**

Weather radars are also mechanical devices which are continuously running under severe weather conditions. Antennas and radomes should be an important part of maintenance procedures.

**6. Transmitter calibration**

The output power determined during the test measurements should be set into radar signal processor to define new radar constant values for the calculation of reflectivity.

**7. Receiver calibration and Intensity and noise level check**

Receiver response curve for radar defines that which value of signal processor input corresponds to which value of RX input. After this curve is set by calibration, assumptions are done by the help of the curve. In time, receiver response to a coming signal can change. So the new curve has to be introduced to the system, otherwise the calculations would be faulty. By the help of an internal or external Signal Generator, Receiver response to a wide range of incoming signal should be defined. Then the new curve which represents the receiver response is recognized to the system.

**8. Velocity calibration**

Velocity calibration methods will be examined in the document. Phase noise and MTI issues will be examined.

**9. Solar gain measurements and calibration technique**

There are a number of solar observatories located around the world which measure the solar flux density at a number of different frequencies each day. The sun can be used as a “standard target” By knowing (from the measurements of others) how much power the sun is emitting, we can get the gain of a radar antenna. Solar flux density is measured at several locations around the world: Australia, Canada, Italy, Massachusetts, Hawaii Measurements are made at various frequencies

## **10. Dual Polarization Products Calibration recommendations**

### **a) ZDR Calibration**

ZDR calibration technique(s) like vertical looking in precipitation with sample applications

### **b) PhiDP Calibration**

Recommendation(s) for PhiDP product calibration like phase adjustment

### **c) LDR Calibration**

Recommendation(s) for LDR product calibration like sunca offset adjustment

## **11. Antenna position calibration**

The sun radiates not only visible light but also electromagnetic energy at all frequencies. The amount of energy emitted by the sun at radar frequencies is sufficient to be detectable by most modern radar receivers. It is simply a matter of aiming the antenna at the sun and measuring the power received. Note that we do not use the transmitter for this. We are not bouncing an echo off the sun; we are using the sun as a "calibrated" signal generator at a known position. If we get correct time and correct position of the sun then we do sun tracking.

## **Conclusion**

Weather radar survey executed in 2009 by CIMO revealed that radar operators carry out mainly receiver, transmitter and antenna calibrations which are insufficient level. Other calibrations carried out by operators are also inadequate. This document will include maintenance and calibration techniques, procedures and recommendations to improve NHMS's weather radar calibration and maintenance information and capacity.

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