

HK INSTRUMENT SYSTEMS

PITTSBURGH, PA

MEASURING THE %H₂O OF A BULK MATERIAL

APPLICATION: **MEASURING THE AMOUNT OF MOISTURE IN A BULK AGRICULTURAL MATERIAL BEING TRANSPORTED ON A BELT OR IN A CHUTE.** CORN, SOYBEANS, FLAKES AND GRAINS ARE EXAMPLES OF TYPICAL BULK FOOD MATERIALS. IT IS POSSIBLE TO MEASURE FROM 2% TO 50% MOISTURE.

INSTALLATION: THE MICROWAVE HORN OR SPIRAL ANTENNAE ARE INSTALLED AS NON-CONTACTING SENSORS ON A BELT OR ON A CHUTE. THERE IS AN ANTENNA ON ONE SIDE OF THE MATERIAL AND ONE ON THE OTHER.

THE COMPLETE MICROWAVE SYSTEM WILL BE COMPRISED OF TWO HORN ANTENNA, TWO COAXIAL CABLES, AND A MICROWAVE TRANSMITTER.

Typical Bulk Density Compensation is done with a Nuclear Gage or a Belt Scale. If a Belt Scale is used, the accuracy of the measurement will be directly related to the accuracy of the Belt Scale measurement and the Profile of the Material on the Belt.

VALIDATION: THE STANDARD TEST METHOD WHICH IS USED BY LABS TO DETERMINE THE % MOISTURE OF A BULK FOOD MATERIAL IS LOSS OF WEIGHT BY DRYING. AN OVEN OR A SIMILAR DEVICE IS USED TO DRY THE SAMPLE. THE AMOUNT OF WEIGHT LOSS WILL BE USED TO DETERMINE THE SAMPLE'S MOISTURE CONTENT.

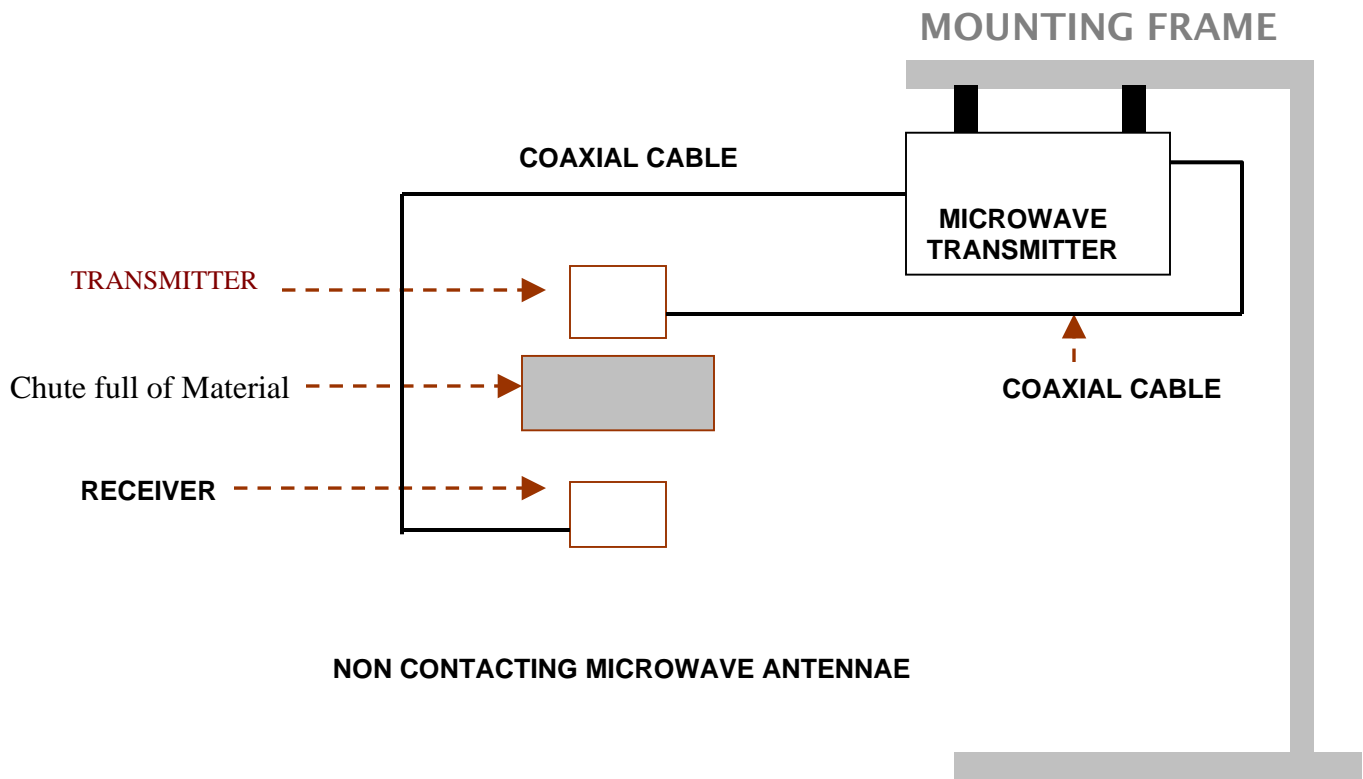
RESULTS:

1. CORRELATION BETWEEN LAB VALUES AND MICROWAVE READINGS IS GOOD IF THE BULK DENSITY OF THE MATERIAL IS VERY CONSTANT. **OR**
2. CORRELATION IS ALSO GOOD IF CHANGES IN THE BULK DENSITY CAN BE ACCURATELY MEASURED AND COMPENSATED FOR.

CONCLUSIONS:

1. THE HK-1 MICROWAVE INSTRUMENT SYSTEM WILL ACCURATELY MEASURE AND CONTROL THE % MOISTURE OF MANY BULK FOOD MATERIALS BEING TRANSPORTED ON A BELT OR IN A CHUTE.
2. FOR A HIGH DEGREE OF ACCURACY:
 - A. LOADING ON A BELT OR IN A CHUTE MUST BE AS CONSTANT AS POSSIBLE. THIS REQUIRES THE HEIGHT AND WIDTH OF THE MATERIAL ON THE BELT TO BE CONSTANT, AND THAT THE SURFACE OF THE MATERIAL BE FLAT.
 - B. PROCESS CONDITIONS MUST BE STABLE. WHEN THE APPLICATION IS A BATCH PROCESS, BATCH RUNS MUST BE LONG ENOUGH TO STABILIZE PROCESS CONDITIONS.
 - C. AMBIENT CONDITIONS MUST BE CONTROLLED. INSTALLATIONS WITH LARGE AMBIENT TEMPERATURE NEED COMPENSATION.

DRAWING OF CHUTE INSTALLATION FOR HORN ANTENNA SYSTEM



DESCRIPTION:

1. THE MATERIAL WHICH IS FLOWING IN A CHUTE PASSES BETWEEN TWO MICROWAVE ANTENNAE WHICH ARE MOUNTED ON A FRAME AND CONNECTED TO A MICROWAVE TRANSMITTER WITH COAXIAL CABLES.
2. THE MICROWAVE TRANSMITTER GENERATES A MICROWAVE SIGNAL. IT TRAVELS TO THE TRANSMITTING ANTENNA OVER A COAXIAL CABLE.
3. THE TRANSMITTING ANTENNA SENDS A SIGNAL WHICH TRAVELS THROUGH THE MATERIAL, AND TO THE RECEIVING ANTENNA.
4. THE RECEIVING ANTENNA MEASURES THE SIGNAL AND SENDS IT TO MICROWAVE TRANSMITTER WHERE IT IS ANALYZED.
5. CHANGES IN THE MICROWAVE SIGNAL ARE USED TO CALCULATE MOISTURE CONTENT (% H₂O).