

TDS-536 TV Dipole Set Operation Manual

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INTRODUCTION



CONTENTS – TUNED DIPOLE SET, TV

QTY	Model Number	Part Number	Description
1	TSC-536	2573	Transit Storage Case
2	N/A	N/A	Keys
1	TV-1	2572	Tuned Dipole Antenna (50 MHz – 220 MHz)
2	N/A	N/A	17" Extension Elements
2	N/A	2337-2	Telescoping Elements
1	TV-2	2580	Tuned Dipole Antenna (325 MHz – 1000 MHz)
1	SAC-213	2111	3 Meter Cable, N(m) to N(m)
1	ABC-TD	2332-1	Clamp
1	N/A	2346	Tape Measurer

INTENDED PURPOSES

This equipment is intended for indoor and outdoor use in a wide variety of industrial and scientific applications, and designed to be used in the process of generating, controlling and measuring high levels of electromagnetic Radio Frequency (RF) energy. It is the responsibility of the user to assure that the device is operated in a location which will control the radiated energy such that it will not cause injury and will not violate regulatory levels of electromagnetic interference.

RANGE OF ENVIRONMENTAL CONDITIONS

This equipment is designed to be safe under the following environmental conditions:

Indoor use

Altitude up to 2000M

Temperature of 5°C to 40°C

Maximum relative humidity 80 % for temperatures up to 31°C.

Decreasing linearly to 50% at 40°C

Pollution degree 2: Normally non-conductive with occasional condensation.

While the equipment will not cause hazardous condition over this environmental range, performance may vary.

GENERAL INFORMATION

GENERAL DESCRIPTION

The tuned dipole antenna set is designed for radiated emissions measurements over the 50 MHz – 222 MHz and 325 MHz – 1000 MHz frequency ranges. The antenna set consists of two baluns and one set of adjustable elements. A tape measure is also included for the users convenience. A mounting clamp is included for attaching the dipoles to a tripod or any other mounting device that has a ¼-20 threaded screw. Review this manual and become familiar with all safety markings and instructions. Verify that the equipment impedance is compatible with the receiver impedance.

ANTENNA SPECIFICATIONS

The TV-1 Dipole Antenna specifications:

Frequency Range	50 MHz - 220 MHz
Maximum Continuous Power	60 Watts
Antenna Factor	4 to 16 dB/m
Gain	2 dBi
Average VSWR	< 2:1
Impedance	50 Ω
Connector Type.....	N-type Female
Weight	0.7 lbs.
.....	318 grams
Size (W x H x D).....	65" X 17.5" X 1.5"
.....	165cm X 44cm X 3.8cm

The TV-2 Dipole Antenna specifications:

Frequency Range	325 MHz - 1000 MHz
Maximum Continuous Power	60 Watts
Antenna Factor.....	19 to 29 dB/m
Gain	2 dBi
Average VSWR	< 2:1
Impedance	50 Ω
Connector Type.....	N-type Female
Weight	0.4 lbs.
.....	181 grams
Size (W x H x D).....	16" X 9" X 1.5"
.....	41cm X 23cm X 3.8cm

OPERATING INSTRUCTIONS

ASSEMBLY INSTRUCTIONS

To prepare the antenna for operation, attach the appropriate elements to the balun, which covers the frequency of desired operation. See the table below for details. Screw elements on opposite ends of the top portion of the balun to make a symmetrical dipole. Attach the supplied 50-ohm cable from any receiver to the balun.

Dipole Antenna	Frequency	Elements	Length
TV-1	50 MHz – 220 MHz	2 detachable elements	Adjustable 8" to 65"
TV-2	325 MHz – 1000 MHz	2 fixed elements	Adjustable 3" to 8"

MOUNTING INSTRUCTIONS

Mount the ADP-TD to any 1/4-20 screw. Insert the balun into the balun clamp and tighten the 1/4-20 wing nut.

GENERAL USE INSTRUCTIONS

The calibration tables that follow in this manual provide a list of the frequencies of operation for each antenna. Listed next to each frequency is the antenna factor, gain (dBi) and the element tuning length (L/2) for each frequency.

The "L/2" lengths given in the data tables are the half length of the dipole at each frequency. "L/2" is the length measured from the notch in the center of the antenna to each tip of the two elements. The overall tip to tip dipole element length will be 2 X "L/2" in length.

NOTE: Due to the finite diameter of the antenna elements, the optimum or tuned length of the dipole is found to be slightly less than the half-wavelength determined by calculations.

When making a measurement, mount the antenna on an appropriate mast or tripod. Point the main lobe of the dipole toward the transmission source.

ANTENNA FORMULAS AND CALCULATIONS

A specific antenna factor is associated with each frequency. This number is to be added to the receiver reading (in dBuV) to convert to field intensity in dBuV/Meter.

EXAMPLE:

Assume the transmitter to be measured is operating at 160 MHz and the receiver reading indicates 44.0 dBuV

$$\text{AF (dB/m)} = 11.4$$

$$\text{Receiver reading (dBuV)} = 44 \text{ dBuV}$$

$$\text{Cable loss (dB)} = 0.7$$

$$\text{Field Intensity} = \text{AF} + \text{receiver reading} + \text{cable loss}$$

$$\text{Field Intensity} = 11.4 + 44.0 + 0.7$$

$$\text{Field Intensity} = 56.1 \text{ dBuV/Meter}$$

CALCULATIONS

EMISSIONS TESTING

Individual calibration data for the log periodic antenna is supplied at appropriate distances (3, and 10 meter) to comply with various emissions test requirements. For emissions measurements, add antenna factor plus cable loss to receiver reading in dB μ V to convert to field strength in dB μ V/meter.

$$\text{Field Strength(dBuV/m)} = \text{SA(dBuV)} + \text{AF(dB/m)} + \text{cable loss (dB)}$$

SA = Spectrum Analyzer or Receiver voltage reading

AF = Antenna Correction Factor

CL = Cable Loss in dB

IMMUNITY TESTING

For Immunity measurements, the generated electric field strength can be calculated by:

FS = Approximate Field Strength in (V/m)

$$\text{FS (V/m)} = \frac{\sqrt{30Pg}}{d}$$

P = Power in watts

g = Numeric Gain

d = Distance in meters

TYPICAL CONVERSION FORMULAS

LOG -> LINEAR VOLTAGE

dB μ V to Volts	$V = 10^{((dB\mu V - 120) / 20)}$
Volts to dB μ V	$dB\mu V = 20 \log(V) + 120$
dBV to Volts	$V = 10^{(dBV / 20)}$
Volts to dBV	$dBV = 20 \log(V)$
dBV to dB μ V	$dB\mu V = dBV + 120$
dB μ V to dBV	$dBV = dB\mu V - 120$

LOG -> LINEAR CURRENT

dB μ A to μ A	$\mu A = 10^{(dB\mu A / 20)}$
μ A to dB μ A	$dB\mu A = 20 \log(\mu A)$
dBA to A	$A = 10^{(dBA / 20)}$
A to dBA	$dBA = 20 \log(A)$
dBA to dB μ A	$dB\mu A = dBA + 120$
dB μ A to dBA	$dBA = dB\mu A - 120$

LOG -> LINEAR POWER

dBm to Watts	$W = 10^{((dBm - 30) / 10)}$
Watts to dBm	$dBm = 10 \log(W) + 30$
dBW to Watts	$W = 10^{(dBW / 10)}$
Watts to dBW	$dBW = 10 \log(W)$
dBW to dBm	$dBm = dBW + 30$
dBm to dBW	$dBW = dBm - 30$

TERM CONVERSIONS

dBm to dB μ V	$dB\mu V = dBm + 107$ (50 Ω) $dB\mu V = 90 + 10 \log(Z) + dBm$
dB μ V to dBm	$dBm = dB\mu V - 73$ (50 Ω) $dBm = dB\mu V - 90 - 10 \log(Z)$
dBm to dB μ A	$dB\mu A = dBm - 107$ (50 Ω) $dB\mu A = dBm - 10 \log(Z) + 90$
dB μ A to dBm	$dBm = dB\mu A - 73$ (50 Ω) $dBm = dB\mu A + 10 \log(Z) - 90$
dB μ A to dB μ V	$dB\mu V = dB\mu A + 34$ (50 Ω) $dB\mu V = dB\mu A + 20 \log(Z)$
dB μ V to dB μ A	$dB\mu A = dB\mu V - 34$ (50 Ω) $dB\mu A = dB\mu V - 20 \log(Z)$

FIELD STRENGTH & POWER DENSITY

dB μ V/m to V/m	$V/m = 10^{(((dB\mu V/m) - 120) / 20)}$
V/m to dB μ V/m	$dB\mu V/m = 20 \log(V/m) + 120$
dB μ V/m to dBmW/m ²	$dBmW/m^2 = dB\mu V/m - 115.8$
dBmW/m ² to dB μ V/m	$dB\mu V/m = dBmW/m^2 + 115.8$
dB μ V/m to dB μ A/m	$dB\mu A/m = dB\mu V/m - 51.5$
dB μ A/m to dB μ V/m	$dB\mu V/m = dB\mu A + 51.5$
dB μ A/m to dBpT	$dBpT = dB\mu A/m + 2$
dBpT to dB μ A/m	$dB\mu A/m = dBpT - 2$
W/m ² to V/m	$V/m = \text{SQRT}(W/m^2 * 377)$
V/m to W/m ²	$W/m^2 = (V/m)^2 / 377$
μ T to A/m	$A/m = \mu T / 1.25$
A/m to μ T	$\mu T = 1.25 * A/m$

E-FIELD ANTENNAS

Correction Factor	$dB\mu V/m = dB\mu V + AF$
Field Strength	$V/m = \sqrt{\frac{30 * \text{watts} * \text{Gain}_{\text{numeric}}}{\text{meters}}}$
Required Power	$\text{Watts} = \frac{(V/m * \text{meters})^2}{30 * \text{Gain}_{\text{numeric}}}$

LOOP ANTENNAS

Correction Factors	$dB\mu A/m = dB\mu V + AF$
Assumed E-field for shielded loops	$dB\mu V/m = dB\mu A/m + 51.5$
	$dBpT = dB\mu V + dBpT/\mu V$

CURRENT PROBES

Correction Factor	$dB\mu A = dB\mu V - dB_{(ohm)}$
Power needed for injection probe given voltage(V) into 50 Ω load and Probe Insertion Loss (I _L)	$\text{Watts} = 10^{((I_L + 10 \log(V^2/50)) / 10)}$

MAINTENANCE

MAINTENANCE PROCEDURES

Proper antenna maintenance should include:

- Visual inspection of RF connectors
- Check for bent and loose elements
- Check for loose or missing hardware
- Corrosion near the element joints

At least once a month it is a good idea to wipe down the antenna with a damp rag.

ANNUAL CALIBRATION

To ensure reliable and repeatable long-term performance, annual re-calibration of your antennas, preamplifiers and current probes by A.H. Systems experienced technicians is recommended. Our staff can calibrate almost any type or brand of antenna.

It is always up to the user to determine the appropriate interval for calibration certification based on the requirements of the end users specific test/application. The calibration of EMC antennas is important for those conforming to compatibility standard. Radiated emissions testing for electromagnetic compatibility (EMC) requires the measurement of electric field (E-field) strength, which is compared with a limit level. The output voltage of an antenna is converted to E-field strength via its antenna factor, the measurement of which must include the uncertainty components related to that particular antenna, taking into consideration the environment in which the antenna is to be used for the testing. Most standards will specify the appropriate interval for re-calibration of your EMC antenna.

In some cases these antennas are used for a manufacturers pre-compliance testing, field monitoring, surveillance and/or other applications where the exact field intensity of the received signal is not of importance. For those customers a yearly re-calibration is not necessary, however it is recommended that an interval for maintenance be performed.

For more information about our calibration services or to place an order for antenna calibration visit our website at <http://www.AHSystems.com> or call 1(818) 998-0223.

WARRANTY INFORMATION

A.H. Systems Inc., warrants that our Antennas, Sensors and Probes will be free from defects in materials and workmanship for a period of three (3) years. All other products delivered under contract will be warranted for a period of two (2) years. Damage caused by excessive signals at the product's input is not covered under the warranty. A.H. Systems' obligation under this warranty shall be limited to repairing or replacing, F.O.B. Chatsworth, California, each part of the product which is defective, provided that the buyer gives A.H. Systems notice of such defect within the warranty period commencing with the delivery of the product by A.H. Systems.

The remedy set forth herein shall be the only remedy available to the buyer, and in no event shall A.H. Systems be liable for direct, indirect, incidental or consequential damages.

This warranty shall not apply to any part of the product which, without fault of A.H. Systems has been subject to alteration, failure caused by a part not supplied by A.H. Systems, accident, fire or other casualty, negligence, misuse or normal wear of materials.

Except for the warranty set forth above, there are no other warranties, expressed or implied, with respect to the condition of the product or its suitability for the use intended for them by the buyer.

For prompt service, please contact our service department for a Return Material Authorization Number before shipping equipment back to us.