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Title: Car Stereo Tester

Description: To test a car stereo is a long process involving several different test set-ups and test equipment. The Car Stereo Tester will permit a technician to quickly and easily test a car stereo by eliminating the multiple set-ups. The NEC uPD780318 was chosen for this design.

Features: The unit will be able to perform the following tests –

1. Output Power
 - a. Right Front
 - b. Right Rear
 - c. Left Front
 - d. Left Rear
2. Harmonic Distortion for
 - a. Auxiliary Input
 - b. AM Radio
 - c. FM Radio
 - d. CD Player (if applicable)
 - e. Cassette Player (if applicable)
3. Efficiency (as defined by Power In divided by Power Out)
4. Frequency Response for
 - a. Auxiliary Input
 - b. AM Radio
 - c. FM Radio
 - d. CD Player (if applicable)
 - e. Cassette Player (if applicable)
5. AM & FM Sensitivity
6. Signal to Noise Ratio for
 - a. AM Radio
 - b. FM Radio
 - c. CD Player (if applicable)
 - d. Cassette Player (if applicable)

It will have an LCD display so that the operator can monitor the status of the tests and see the final results. Also the display will prompt the operator to make any changes to the stereo unit – for example

1. Increase the Volume
2. Adjust the Balance or Fader Controls
3. Select AM or FM
4. Select the desired frequency for AM or FM

5. Insert and play the test CD or Cassette

There will also be an audible signal to alert the operator that a test has failed or the test sequence has finished. Finally, the data will be stored in memory so that it can be uploaded to a PC for further analysis and storage.

Market it Addresses: Small, Medium, Large Car Stereo retailers/installers and Warranty Repair Centers.

Warranty repair costs can be very high since it can take a technician many hours to repair and test a car stereo. It requires a large amount of specialized (and possibly expensive) test equipment to perform many of the tests. Also, many people do not get their stereo systems repaired (once the warranty has expired) since it takes so long to determine where the problem is located and this can be very expensive.

The Car Stereo Tester would speed up this process considerably. Even to the point that a part time person (i.e. someone going to school to learn about electronics) could do the initial testing of a unit coming into the shop as well as the final check out of a repaired unit.

Specific Functions Used in the Microcontroller:

The microcontroller will control the

1. Ultra Low Distortion Audio Generator
 - a. Port 2 is used to control the frequency of the audio generator. The frequency adjusted via 6-bit digital potentiometer.
 - b. Port 3 is used to control the amplitude of the audio generator. The amplitude is adjusted via a 5-bit digital potentiometer.
2. D.U.T. Power Supply
 - a. The D.U.T. must be tested at voltage extremes – 10 V to 17 V
3. RF Signal Generator
 - a. A Direct Digital Synthesizer (DDS) is used to generate the RF signal.
 - b. The DDS is a 16-bit device, but it is set up to have a high and low byte registers, which are loaded separately.
 - c. By selecting different registers the amplitude of the DDS is controlled.
4. The built in ADC will be used to monitor and record -
 - a. The output of each speaker connection
 - b. Input voltage and current to the D.U.T.
5. The DAC output will be used to control the audio switch.
 - a. Selecting the DDS for AM/FM modulation
 - b. Selecting the D.U.T. directly for auxiliary input testing.
6. The buzzer function will have a dual purpose
 - a. Alerting the operator that the tests are complete
 - b. Notifying the operator that a test has failed.
7. Five push buttons will be used to
 - a. **Select:** the stereo system that will be tested needs to be selected.
 - b. **Start/Next:** this will start the test sequence or select a specific test. Selecting a specific test is accomplished by pressing the Start/Next button multiply times. This is needed so that an operator can bypass certain tests. For example if the unit is testing a 2 channel stereo, the Right and Left Rear tests would be skipped.
 - c. **Review the Results:** this will permit the operator to check the results of the various tests.
 - d. **Accept/Okay:** this permits the operator to accept the test results or delete them and perform the test again.
 - e. **Stop:** this enables the operator to stop the test or test sequence for whatever reason.

The test sequence is listed below

1. Output Power – each audio channel
 - a. Right Front
 - b. Right Rear
 - c. Left Front
 - d. Left Rear
2. Harmonic Distortion for
 - e. Auxiliary Input
 - f. AM Radio
 - g. FM Radio
 - h. CD Player (if applicable)
 - i. Cassette Player (if applicable)
3. Efficiency (as defined by Power In divided by Power Out)
4. Frequency Response for
 - j. Auxiliary Input
 - k. AM Radio
 - l. FM Radio
 - m. CD Player (if applicable)
 - n. Cassette Player (if applicable)
5. AM & FM Sensitivity
6. Signal to Noise Ratio for
 - o. AM Radio
 - p. FM Radio
 - q. CD Player (if applicable)
 - r. Cassette Player (if applicable)

Setup for Testing a Car Stereo Unit (Device Under Test - D.U.T.):

The setup for testing a stereo unit is very simple and straightforward.

1. Connect the 4 speaker connections (Right Front, Right Rear, Left Front, and Left Rear) of the D.U.T. to the corresponding connection on the tester.
2. Connect the RF signal line to the antenna input of the D.U.T.
3. Connect the audio signal to the auxiliary input of the D.U.T. (if applicable)
4. Connect the power supply to the D.U.T.
5. Turn on the tester.
6. Start the tests.
7. Download the data to the PC for storage and analysis
 - a. The analysis will be used to identify trends (i.e. does a certain component fail?)

Block Diagram:

All components marked with an asterisk (*) are part of the Car Stereo Tester.

