NRSC-R37

NOTICE

NRSC Standards, Guidelines, Reports and other technical publications are designed to serve the public interest through eliminating misunderstandings between manufacturers and purchasers, facilitating interchangeability and improvement of products, and assisting the purchaser in selecting and obtaining with minimum delay the proper product for his particular need. Existence of such Standards, Guidelines, Reports and other technical publications shall not in any respect preclude any member or nonmember of the Consumer Electronics Association (CEA) or the National Association of Broadcasters (NAB) from manufacturing or selling products not conforming to such Standards, Guidelines, Reports and other technical publications, nor shall the existence of such Standards, Guidelines, Reports and other technical publications preclude their voluntary use by those other than CEA or NAB members, whether to be used either domestically or internationally.

Standards, Guidelines, Reports and other technical publications are adopted by the NRSC in accordance with the NRSC patent policy. By such action, CEA and NAB do not assume any liability to any patent owner, nor do they assume any obligation whatever to parties adopting the Standard, Guideline, Report or other technical publication.

This Guideline does not purport to address all safety problems associated with its use or all applicable regulatory requirements. It is the responsibility of the user of this Guideline to establish appropriate safety and health practices and to determine the applicability of regulatory limitations before its use.

Published by
CONSUMER ELECTRONICS ASSOCIATION
Technology & Standards Department
1919 S. Eads St.
Arlington, VA 22202

NATIONAL ASSOCIATION OF BROADCASTERS
Science and Technology Department
1771 N Street, NW
Washington, DC 20036

©2009 CEA & NAB. All rights reserved.

This document is available free of charge via the NRSC website at www.nrscstandards.org. Republication or further distribution of this document, in whole or in part, requires prior permission of CEA or NAB.
NRSC-R37, FM Receiver Interference Tests - Laboratory Test Report, presents the results of a technical study conducted for National Public Radio, the Consumer Electronics Manufacturers Association (CEMA, precursor to CEA), and the Corporation for Public Broadcasting to document the sensitivity of consumer FM receivers to interference from other FM band signals. This report was filed with the FCC on August 2, 1999 in MM Docket No. 99-25, In the Matter of Creation of a Low Power Radio Service.

The NRSC is jointly sponsored by the Consumer Electronics Association and the National Association of Broadcasters. It serves as an industry-wide standards-setting body for technical aspects of terrestrial over-the-air radio broadcasting systems in the United States.
Appendix

RECEIVER
Receiver

Certification Procedure
FM Receiver Test Laboratory

Date: __________
Engineers: __________
Project: FM Receiver Test A1

Receiver Test No.: __________
Class: __________
Radio Mfg.: __________
Model: __________
Serial: __________

Antenna Network: __________ FM
Audio load: __________ Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position. Loudness control off. Balance Fader controls centered (set to mid position). Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15 kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms

Comments: __________

<table>
<thead>
<tr>
<th>Standard RF Levels</th>
<th>Standard FM Test Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong: -45 dBm</td>
<td>Low: 94.1 MHz</td>
</tr>
<tr>
<td>Medium: -55 dBm</td>
<td></td>
</tr>
<tr>
<td>Weak: -65 dBm</td>
<td></td>
</tr>
</tbody>
</table>

Standard Test Set Ups

1  Strong Signal Overload
2  Single RF Tone Tests
3  Two RF Tone Tests
4  Measurement Set up

Standard Tests

1  Local Oscillator Frequency (Tuning Error)
2  Standard Audio Output (Audio level and distortion)
3  RF Input Overload (RF level required for 5% THD)
4  AM Rejection
5  Image Rejection
6  Curve Tests (plots of RF Level Vs Signal - Mono & Stereo, Noise - Mono & Stereo, Stereo Separation) Capture Ratio
8  Selectivity: 1st Adjacent (30dB noise figure)
9  Selectivity: 2nd Adjacent (30dB noise figure)
10 Selectivity: 1st Adjacent (50dB noise figure)
11 Selectivity: 2nd Adjacent (50dB noise figure)
12 Selectivity: 3rd Adjacent (50dB noise figure)
13 - 15 Additional 10.7 MHz Tests
**FM Receiver Test Laboratory**

**Single RF Tone Tests**

1. **Local Oscillator Frequency (Tuning Error)**
   - **Set Up:** Connect Spectrum Analyzer to Radio Antenna input
   - **Adjust:** Tune radio to Test Freq. 1, measure L.O. Freq 1
   - **Tune radio to Test Freq. 2, measure L.O. Freq 2**
   - **Measurement:**
     - L.O. Freq 1 ______ MHz
     - L.O. Freq 2 ______ MHz

2. **Standard Audio Output**
   - **Set Up:** Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   - **Adjust:** Set Radio Volume to Std. Ref. Level, record Left and Right channel audio level and THD
   - **Measurement:**
     - Left Ch
       - **Level**
       - **Vrms** = 0dB
       - **THD** ______ %
     - Right Ch
       - **Level**
       - **Vrms**
       - **THD** ______ %

3. **RF Input Overload**
   - **Set Up:** Test Set Up 1, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   - **Adjust:** Set Radio audio to Std. Ref. Level
   - **Increase RF Level until 5% THD at Radio output, record RF Level**
   - **Measurement:**
     - **RF Lev.** ______ dBm (at 5% THD)
     - **EOC:**

4. **AM Rejection**
   - **Set Up:** Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   - **Adjust:** Set Radio audio to Std. Ref. Level, record THD
   - **Set modulation mode to FM (75kHz), AM (30%), record THD**
   - **Measurement:**
     - **THD** ______ % = ______ dB (FM Only)
     - **THD** ______ % = ______ dB (FM + AM 30%)

5. **Image Rejection**
   - **Set Up:** Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   - **Adjust:** Set Radio audio to Std. Ref. Level (0dB)
   - **Decrease RF Level until S/N Ratio = 30dB, record RF Lev1**
   - **Tune RF Gen to Desired Freq. +/- 2 X IF Freq.**
   - **Adjust RF Level until S/N Ratio = 30dB, record RF Lev2**
   - **Measurement:**
     - **RF Lev1** ______ dBm (S/N Ratio = 30dB)
     - **RF Lev2** ______ dBm (21.4MHz + 94.1MHz = 115.5MHz)
     - **Image Rejection:** ______ dB (RF Lev1 - RF Lev2)
Curve Tests
Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
Adjust: Set Radio audio to Std. Ref. Level (0dB) for both Mono and Stereo set ups.

Plot: Signal, Noise Vs RF Level (Mono)
     Signal, Noise Vs RF Level (L+R, Stereo)
     Stereo Separation Vs RF Level (L only, Stereo)
Record: Noise floor at -45dBm without Low Pass Filter as a measure of pilot rejection

### Curve Data

<table>
<thead>
<tr>
<th>RF Level (dBm)</th>
<th>Mono (L)</th>
<th>Stereo (L)</th>
<th>Separation L-R</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Signal</td>
<td>Noise</td>
<td>Signal</td>
</tr>
<tr>
<td>-130</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-125</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-120</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-115</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-110</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-105</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-55</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-45</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
FM Receiver Test Laboratory

Two RF Tone Tests

7 Capture Ratio
Set Up: Test Set Up 3
Desired: Test Freq. 1, -55dBm, 1kHz, 22.5kHz Dev, Mono
Undesired: Test Freq. 1, -130dBm, CW
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Increase Undesired signal until audio level drops 1dB, record Undesired RF level as RF Lev 1
Increase Undesired signal until audio level drops 30dB, record Undesired RF level as RF Lev 2

Measurement: RF Lev 1 ________ dBm
RF Lev 2 ________ dBm

Capture Ratio: 0.00 dB (RF Lev 1 - RF Lev 2)/2

8 Selectivity - 1st Adjacent 30dB S/N (Upper and Lower)
Upper 1st
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper 1st

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower 1st

Selectivity, 1st Adj.: Desired Lev -55.00 dBm
Undesired Upper Lev -55.00 dBm
Undesired Lower Lev -55.00 dBm
(RF D/U Up + RF D/U Lo)/2

9 Selectivity - 2nd Adjacent 30dB S/N (Upper and Lower)
Upper 2nd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper 2nd

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower 2nd

Selectivity, 2nd Adj.: Desired Lev -55.00 dBm
Undesired Upper Lev -55.00 dBm
Undesired Lower Lev -55.00 dBm
(RF D/U Up + RF D/U Lo)/2
10 Selectivity - 1st Adjacent 50dB S/N (Upper and Lower)
Upper 1st
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Low

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>dBm</td>
</tr>
<tr>
<td>D/U</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Level</td>
<td>55.00</td>
</tr>
<tr>
<td>Undesired Upper Level</td>
<td>55.00</td>
</tr>
<tr>
<td>Undesired Lower Level</td>
<td>55.00</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.</td>
<td>55.00</td>
</tr>
</tbody>
</table>

11 Selectivity - 2nd Adjacent 50dB S/N (Upper and Lower)
Upper 2nd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Low

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>dBm</td>
</tr>
<tr>
<td>D/U</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Level</td>
<td>55.00</td>
</tr>
<tr>
<td>Undesired Upper Level</td>
<td>55.00</td>
</tr>
<tr>
<td>Undesired Lower Level</td>
<td>55.00</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.</td>
<td>55.00</td>
</tr>
</tbody>
</table>

12 Selectivity - 3rd Adjacent 50dB S/N (Upper and Lower)
Upper 3rd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper

Lower 3rd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Low

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>dBm</td>
</tr>
<tr>
<td>D/U</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Level</td>
<td>55.00</td>
</tr>
<tr>
<td>Undesired Upper Level</td>
<td>55.00</td>
</tr>
<tr>
<td>Undesired Lower Level</td>
<td>55.00</td>
</tr>
<tr>
<td>Selectivity, 3rd Adj.</td>
<td>55.00</td>
</tr>
</tbody>
</table>

Additional Tests
**13 10.7MHz Rejection**

Using Test Set Up 1 at the desired frequency of 94.1MHz;
Set generator to 1kHz, 75kHz dev / CW
Reduce RF level to obtain 30dB S/N ratio.
Record RF Level as RF Lev 1
Set RF generator to 10.7MHz
Adjust RF level to obtain 30dB S/N ratio
Record RF Level as RF Lev 2
Calculate the difference between the two RF levels

<table>
<thead>
<tr>
<th>RF Lev 1</th>
<th>dBm</th>
<th>EOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Lev 2</td>
<td>dBm</td>
<td>D/U 0.00 dB</td>
</tr>
</tbody>
</table>

**14 10.7 IM Test**

Using the three generator set up, set generators as follows;
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
        Lower Undesired: 88.7MHz, 1kHz, 75kHz dev
        Upper Undesired: 99.3MHz, 400Hz, 75kHz dev
Adjust: Undesired RF level to obtain -50dB noise floor, record RF lev 10.6MHz Spacing
        Set upper undesired generator to 99.4MHz. Adjust RF lev for -50dB noise floor. (RF lev 10.7MHz)

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>dBm</th>
<th>10.7MHz Spacing</th>
<th>dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>-45.00</td>
<td>-45.00</td>
<td>-45.00</td>
<td></td>
</tr>
</tbody>
</table>

EOC:

**15 10.7MHz (10.6MHz) Local Osc Interference Test**

Set Up: Desired: 94.1MHz, -45dBm, Pilot only
Set upper interferer generator to 104.7MHz (94.1MHz + 10.6MHz), 400Hz, 75kHz dev
a) Increase level of undesired signals until noise floor is -50dB (+/- 2dB). Record RF Lev for 10.6M
b) Re-adjust upper interfering generator to 104.8MHz (94.1MHz + 10.7MHz)
Re-adjust RF level for -50dB and record RF lev for 10.7MHz spacing

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>dBm</th>
<th>10.7MHz Spacing</th>
<th>dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>-45.00</td>
<td>-45.00</td>
<td>-43.00</td>
<td></td>
</tr>
</tbody>
</table>

EOC:
FM Receiver Test Laboratory

Date: 1/0/00
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 0
Class: 0
Radio Mfg.: 0
Model: 0
Serial: 0

Antenna Network: 0 FM

Audio load: 0 Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15 kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms.

Comments: 0

Standard RF Levels

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>-45 dBm</td>
</tr>
<tr>
<td>Medium</td>
<td>-55 dBm</td>
</tr>
<tr>
<td>Weak</td>
<td>-65 dBm</td>
</tr>
</tbody>
</table>

Standard FM Test Frequencies

<table>
<thead>
<tr>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>94.1 MHz</td>
</tr>
</tbody>
</table>

Standard Test Set Ups

1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

Standard Tests

1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF Input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
6. Curve Tests (plots of RF Level Vs Audio Output)
7. Capture Ratio
8. Selectivity, 1st Adjacent (30dB noise figure)
9. Selectivity, 2nd Adjacent (30dB noise figure)
10. Selectivity, 1st Adjacent (50dB noise figure)
11. Selectivity, 2nd Adjacent (50dB noise figure)
12. Selectivity, 3rd Adjacent (50dB noise figure)
13. 10.7 MHz Rejection
14. 10.7 MHz Intermodulation
15. 10.7 MHz Spurious (Local Osc. Interference)
Test Results:

1. **Local Oscillator Frequency:**
   - 0.000 MHz

2. **Standard Audio Output:**
   - **Left Channel:**
     - THD: 0.00 %
     - Vrms: 0
   - **Right Channel:**
     - THD: 0.00 %
     - Vrms: 0

3. **RF Input Overload:**
   - 0.00 dBm

4. **AM Rejection:**
   - #NUM! dB

5. **Image Rejection:**
   - 0.00 dB

6. **Curve Tests:**
   - (See Flota)

7. **Capture Ratio:**
   - 0.00 dB

8. **Selectivity, First Adjacent, 30dB Noise Floor (Ave. D/U)**
   - DB Mono: -55.00 dB
   - DB Stereo: -55.00 dB

9. **Selectivity, Second Adjacent, 30dB Noise Floor (Ave. D/U)**
   - DB Mono: -55.00 dB
   - DB Stereo: -55.00 dB

10. **Selectivity, First Adjacent, 50dB Noise Floor (Ave D/U)**
    - DB Mono: -55.00 dB
    - DB Stereo: -55.00 dB

11. **Selectivity, Second Adjacent, 50dB Noise Floor (Ave. D/U)**
    - DB Mono: -55.00 dB
    - DB Stereo: -55.00 dB

12. **Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)**
    - DB Mono: -55.00 dB
    - DB Stereo: -55.00 dB

13. **10.7MHz Rejection**
    - 0.00 dB

14. **10.7MHz IM**
    - DB (10.6) MHz RF: -45.00 dB
    - DB (10.7) MHz RF: -45.00 dB

15. **10.7MHz Spurious (Local Osc. Interference)**
    - DB (10.6) MHz RF: -45.00 dB
    - DB (10.7) MHz RF: -45.00 dB
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

File Name: lc_temp

FM Mono Plot
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

File Name: lc temp

FM Stereo Separation Plot
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6 dB
1st and 2nd ADJACENT CHANNEL SELECTIVITY
(30dB Noise Floor)

Insertion loss = -6dB

File Name: 1c_temp

Selectivity 30dB
1st, 2nd and 3rd ADJACENT CHANNEL SELECTIVITY
(50dB Noise Floor)

Insertion loss = -6dB
FM Receiver Test Laboratory

**IM & L.O. Rejection**
(50dB Noise Floor)

- RF Level (dBm)
- Frequency (MHz)

Insertion loss = -6dB
Receiver #1

Delco

Auto
Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 1
Class: Automotive
Radio Mfg.: Delco
Model: 16192463
Serial: 1000499
Antenna Network: Delco FM AM
Audio load: 4 Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms.

Comments: Graphic equalizer set to flat
Loudness off

<table>
<thead>
<tr>
<th>Standard RF Levels</th>
<th>Standard FM Test Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong:</td>
<td>Low: 94.1 MHz</td>
</tr>
<tr>
<td>Medium:</td>
<td></td>
</tr>
<tr>
<td>Weak:</td>
<td></td>
</tr>
<tr>
<td>dBm</td>
<td></td>
</tr>
<tr>
<td>-45</td>
<td></td>
</tr>
<tr>
<td>-55</td>
<td></td>
</tr>
<tr>
<td>-65</td>
<td></td>
</tr>
</tbody>
</table>

Standard Test Set Ups
1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

Standard Tests
1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF Input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
7. Capture Ratio
8. Selectivity; 1st Adjacent (30dB noise figure)
9. Selectivity; 2nd Adjacent (30dB noise figure)
10. Selectivity; 1st Adjacent (50dB noise figure)
11. Selectivity; 2nd Adjacent (50dB noise figure)
12. Selectivity; 3rd Adjacent (50dB noise figure)
Single RF Tone Tests

1 Local Oscillator Frequency (Tuning Error)
   Set Up: Connect Spectrum Analyzer to Radio Antenna input
   Adjust: Tune radio to Test Freq. 1, measure L.O. Freq 1
           Tune radio to Test Freq. 2, measure L.O. Freq 2

   Measurement:  L.O. Freq 1  _______ 104.800 MHz
                 L.O. Freq 2  _______ MHz

2 Standard Audio Output
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio Volume to Std. Ref. Level, record Left and Right channel audio level and THD

   Measurement:
   Level  Left Ch 2 Vrms = 0dB  Right Ch
   THD  .64  %

3 RF Input Overload
   Set Up: Test Set Up 1, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set RF Level to Std. Ref. Level
           Increase RF Level until 5% THD at Radio output, record RF Level

   Measurement:  RF Lev. _______ 22 dBm (at 5% THD)
                 Max Test Bed RF level - no change in level or THD

4 AM Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio Volume to Std. Ref. Level, record THD
           Set modulation mode to FM (75kHz), AM (30%), record THD

   Measurement:
   THD  0.64  % = -43.88  dB (FM Only)
   THD  0.64  % = -43.88  dB (FM + AM 30%)

   AM Rejection: _______ 0.00  dB

5 Image Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio Volume to Std. Ref. Level (0dB)
           Decrease RF Level until S/N Ratio = 30dB, record RF Lev1
           Tune RF Gen to Desired Freq. ^ - 2 X IF Freq.
           Adjust RF Level until S/N Ratio = 30dB, record RF Lev2

   Measurement:
   RF Lev1 _______ -106 dBm (S/N Ratio = 30dB)
   RF Lev2 _______ -62 dBm (21.4MHz + 94.1MHz = 115.5MHz)

   Image Rejection: _______ -44.0 dB (RF Lev1 - RF Lev2)
### Curve Tests

Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
Adjust: Set Radio audio to Std. Ref. Level (0dB) for both Mono and Stereo set ups.

Plot: Signal, Noise Vs RF Level (Mono)
Signal, Noise Vs RF Level (L+R, Stereo)
Stereo Separation Vs RF Level (L only, Stereo)
Record: Noise floor at -45dBm without Low Pass Filter as a measure of pilot rejection

### CURVE DATA

#### SIGNAL, NOISE & SEPARATION VS RF LEVEL

<table>
<thead>
<tr>
<th>RF Level dBm</th>
<th>Mono (L)</th>
<th></th>
<th></th>
<th>Stereo (L)</th>
<th></th>
<th></th>
<th>Separation L+R</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Signal dB</td>
<td>Noise dB</td>
<td>Signal dB</td>
<td>Filt. Noise dB</td>
<td>Noise dB</td>
<td>Left dB</td>
<td>Right dB</td>
</tr>
<tr>
<td>-130</td>
<td>-23.00</td>
<td>-23.00</td>
<td>-23.00</td>
<td>-23.00</td>
<td>-23.00</td>
<td>-23.00</td>
<td>-23.00</td>
</tr>
<tr>
<td>-125</td>
<td>-23.00</td>
<td>-23.00</td>
<td>-23.00</td>
<td>-23.00</td>
<td>-23.00</td>
<td>-23.00</td>
<td>-23.00</td>
</tr>
<tr>
<td>-120</td>
<td>-22.00</td>
<td>-22.00</td>
<td>-22.00</td>
<td>-22.00</td>
<td>-21.50</td>
<td>-22.00</td>
<td>-22.00</td>
</tr>
<tr>
<td>-115</td>
<td>-16.00</td>
<td>-25.00</td>
<td>-17.00</td>
<td>-24.50</td>
<td>-20.50</td>
<td>-20.50</td>
<td>-110</td>
</tr>
<tr>
<td>-110</td>
<td>-8.00</td>
<td>-27.00</td>
<td>-9.00</td>
<td>-26.50</td>
<td>-14.00</td>
<td>-14.00</td>
<td>-110</td>
</tr>
<tr>
<td>-105</td>
<td>-2.50</td>
<td>-35.50</td>
<td>-3.20</td>
<td>-34.00</td>
<td>-9.00</td>
<td>-9.00</td>
<td>-105</td>
</tr>
<tr>
<td>-100</td>
<td>-0.50</td>
<td>-50.00</td>
<td>-0.80</td>
<td>-47.00</td>
<td>-7.00</td>
<td>-6.50</td>
<td>-100</td>
</tr>
<tr>
<td>-95</td>
<td>0.00</td>
<td>-58.00</td>
<td>-0.50</td>
<td>-54.50</td>
<td>-6.00</td>
<td>-7.00</td>
<td>-95</td>
</tr>
<tr>
<td>-90</td>
<td>0.00</td>
<td>-62.00</td>
<td>-0.40</td>
<td>-55.00</td>
<td>-5.00</td>
<td>-8.00</td>
<td>-90</td>
</tr>
<tr>
<td>-85</td>
<td>0.00</td>
<td>-62.00</td>
<td>-0.30</td>
<td>-55.00</td>
<td>-4.00</td>
<td>-9.50</td>
<td>-85</td>
</tr>
<tr>
<td>-80</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-55.00</td>
<td>-2.00</td>
<td>-13.00</td>
<td>-80</td>
</tr>
<tr>
<td>-75</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-57.00</td>
<td>-1.20</td>
<td>-17.00</td>
<td>-75</td>
</tr>
<tr>
<td>-70</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-58.50</td>
<td>-0.50</td>
<td>-32.50</td>
<td>-70</td>
</tr>
<tr>
<td>-65</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-60.00</td>
<td>0.00</td>
<td>-38.00</td>
<td>-65</td>
</tr>
<tr>
<td>-60</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-61.00</td>
<td>0.00</td>
<td>-38.00</td>
<td>-60</td>
</tr>
<tr>
<td>-55</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-61.00</td>
<td>0.00</td>
<td>-38.00</td>
<td>-55</td>
</tr>
<tr>
<td>-50</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-61.00</td>
<td>0.00</td>
<td>-38.00</td>
<td>-50</td>
</tr>
<tr>
<td>-45</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-61.00</td>
<td>0.00</td>
<td>-38.00</td>
<td>-45</td>
</tr>
</tbody>
</table>
Two RF Tone Tests

Capture Ratio
Set Up: Test Set Up 3
Desired: Test Freq. 1, -55dBm, 1kHz, 22.5kHz dev, Mono
Undesired: Test Freq. 1, -130dBm, CW
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Increase Undesired signal until audio level drops 1dB, record Undesired RF level as RF Lev 1
Increase Undesired signal until audio level drops 30dB, record Undesired RF level as RF Lev 2

Measurement: RF Lev 1 -60.00 dBm
RF Lev 2 -50.00 dBm

Capture Ratio: -5.00 dB (RF Lev 1 - RF Lev 2)/2

Selectivity - 1st Adjacent 30dB S/N (Upper and Lower)

Upper 1st
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>dBm</td>
</tr>
<tr>
<td>Desired</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-36.42</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-35.32</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.:</td>
<td>-19.13</td>
</tr>
</tbody>
</table>

Selectivity - 2nd Adjacent 30dB S/N (Upper and Lower)

Upper 2nd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>dBm</td>
</tr>
<tr>
<td>Desired</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>8.00</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>8.00</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.:</td>
<td>8.00</td>
</tr>
</tbody>
</table>

(RF D/U Up + RF D/U Lo)/2
FM Receiver Test Laboratory

10 Selectivity - 1st Adjacent 50dB S/N (Upper and Lower)
Upper 1st
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>-55.00</th>
<th>-55.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undesired Upper Lev</td>
<td>-59.12</td>
<td>-4.12</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-62.82</td>
<td>7.82</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.</td>
<td>5.97</td>
<td>7.42</td>
</tr>
</tbody>
</table>

11 Selectivity - 2nd Adjacent 50dB S/N (Upper and Lower)
Upper 2nd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>-55.00</th>
<th>-55.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undesired Upper Lev</td>
<td>0.08</td>
<td>-55.08</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-0.92</td>
<td>-54.08</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.</td>
<td>-54.58</td>
<td>-52.58</td>
</tr>
</tbody>
</table>

12 Selectivity - 3rd Adjacent 50dB S/N (Upper and Lower)
Upper 3rd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 3rd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>-55.00</th>
<th>-55.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undesired Upper Lev</td>
<td>3.08</td>
<td>-58.08</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>0.08</td>
<td>-55.08</td>
</tr>
<tr>
<td>Selectivity, 3rd Adj.</td>
<td>-56.58</td>
<td>-54.58</td>
</tr>
</tbody>
</table>
Additional Tests

13 10.7MHz Rejection
Using Test Set Up 1 at the desired frequency of 94.1MHz;
Set generator to 1kHz, 75kHz dev. / CW
Reduce RF level to obtain 30dB S/N ratio.
Record RF Level as RF Lev 1
Set RF generator to 10.7MHz
Adjust RF level to obtain 30dB S/N ratio
Record RF Level as RF Lev 2
Calculate the difference between the two RF levels

<table>
<thead>
<tr>
<th>RF Lev 1</th>
<th>-105.00 dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Lev 2</td>
<td>-105.00 dB</td>
</tr>
</tbody>
</table>

EOC: Could not attain a reading for this test

14 10.7 IM Test
Using the three generator set up, set generators as follows;
Set Up:
Desired: 94.1MHz, -45dBm, Pilot only
Lower Undesired: 88.7MHz, 1kHz, 75kHz dev
Upper Undesired: 99.3MHz, 400Hz, 75kHz dev
Adjust:
Undesired RF level to obtain -50dB noise floor, record RF lev 10.6MHz Spacing
Set upper undesired generator to 99.4MHz. Adjust RF lev for -50dB noise floor. (RF lev 10.7MHz Spacing)

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
</tbody>
</table>

EOC:

15 10.7MHz (10.6MHz) Local Osc Interference Test
Set Up:
Desired: 94.1MHz, -45dBm, Pilot only
Set upper interferer generator to 104.7MHz (94.1MHz + 10.6MHz), 400Hz, 75kHz dev
a) Increase level of undesired signals until noise floor is -50dB (+/- 2dB). Record RF Lev for 10.6MHz Spacing
b) Re-adjust upper interfering generator to 104.8MHz (94.1MHz + 10.7MHz)
Re-adjust RF level for -50dB and record RF lev for 10.7MHz spacing

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
</tbody>
</table>

EOC: There was enough interference to raise the noise floor to -54dB - beat note type noise
Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 1
Class: Automotive
Radio Mfg.: Delco
Model: 16192463
Serial: 1000499

Antenna Network: Delco
Audio load: 4 Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output
Any other control settings unique to the radio under test shall be noted in the Comments section.
Left channel shall be used for all Signal (and S/N ratio) measurements.
15kHz Low Pass filter shall be used on the output of the left channel for all measurements.
Right channel shall be used for Noise measurements - Stereo Separation test only.
All level measurements are rms

Comments: Graphic equalizer set to flat
Loudness off
0
0

Standard RF Levels
Strong: -45 dBm
Medium: -55 dBm
Weak: -65 dBm

Standard FM Test Frequencies
94.1MHz

Standard Test Set Ups
1  Strong Signal Overload
2  Single RF Tone Tests
3  Two RF Tone Tests
4  Measurement Set up

Standard Tests
1  Local Oscillator Frequency (Tuning Error)
2  Standard Audio Output (Audio level and distortion)
3  RF Input Overload (RF level required for 5% THD)
4  AM Rejection
5  Image Rejection
6  Curve Tests (plots of RF Level Vs Audio Output)
7  Capture Ratio
8  Selectivity, 1st Adjacent (30dB noise figure)
9  Selectivity, 2nd Adjacent (30dB noise figure)
10 Selectivity, 1st Adjacent (50dB noise figure)
11 Selectivity, 2nd Adjacent (50dB noise figure)
12 Selectivity, 3rd Adjacent (50dB noise figure)
13 10.7MHz Rejection
14 10.7MHz Intermodulation
15 10.7MHz Spurious (Local Osc. Interference)
Test Results:

1. **Local Oscillator Frequency:**
   - 104.800 MHz

2. **Standard Audio Output:**
   - Left Channel
     - 2 Vrms
     - THD: 6.4 %
   - Right Channel
     - 2 Vrms
     - THD: 4.5 %

3. **RF Input Overload:**
   - 22.00 dBm
   - Max Test Bed RF level - no change in level or THD

4. **AM Rejection:**
   - 0.00 dB

5. **Image Rejection:**
   - -44.00 dB

6. **Curve Tests:**
   - (See Plots)

7. **Capture Ratio:**
   - -5.00 dB

8. **Selectivity, First Adjacent, 30dB Noise Floor (Ave. D/U)**
   - Mono: -19.13 dB
   - Stereo: -18.58 dB

9. **Selectivity, Second Adjacent, 30dB Noise Floor (Ave. D/U)**
   - Mono: -63.00 dB
   - Stereo: -63.00 dB

10. **Selectivity, First Adjacent, 50dB Noise Floor (Ave D/U)**
    - Mono: 5.97 dB
    - Stereo: 7.42 dB

11. **Selectivity, Second Adjacent, 50dB Noise Floor (Ave. D/U)**
    - Mono: -54.58 dB
    - Stereo: -52.58 dB

12. **Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)**
    - Mono: -56.58 dB
    - Stereo: -54.58 dB

13. **10.7MHz Rejection**
    - 105.00 dB
    - Could not attain a reading for this test

14. **10.7MHz IM (D/U)**
    - Mono: -31.93 dB (10.6)
      - Max RF: 0
    - Mono: -31.93 dB (10.7)
      - Max RF: 0

15. **10.7MHz Spurious - Local Osc. Interference (D/U)**
    - Mono: -31.93 dB (10.6)
      - Max RF: There was enough interference to raise the noise floor to -54dB - beat note type noise
    - Mono: -31.93 dB (10.7)
      - Max RF: 0
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

Delco 16192463
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Delco 16192463

File Name: C_delco
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

RF LEVEL (dBm)

Audio Level (dB)

Delco 16192463

File Name: C_delco
FM Receiver Test Laboratory

1st and 2nd ADJACENT CHANNEL SELECTIVITY
(30dB Noise Floor)

Insertion loss = -6dB

Delco 16192463
1st, 2nd and 3rd ADJACENT CHANNEL SELECTIVITY

(50dB Noise Floor)

Insertion loss = -6dB

Max Level

RF Level (dBm)

93.50 93.60 93.70 93.80 93.90 94.00 94.10 94.20 94.30 94.40 94.50 94.60 94.70

Frequency (MHz)

Delco 16192463
IM & L.O. Rejection
(50dB Noise Floor)

Insertion loss = -6dB

Delco 16192463
Receiver #2
Denon
Home HiFi
Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 2
Class: Home Hi Fi Tuner
Radio Mfg.: Denon
Model: TU-380RD
Serial: 4056301149

Antenna Network: 50/75 Ohm Trans. FM
AM
Audio load: 10K Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms.

Comments: RF Attenuator: Off
Auto/Manual switch: Manual for Mono tests
Auto/Manual switch: Auto for Stereo tests

<table>
<thead>
<tr>
<th>Standard RF Levels</th>
<th>Standard FM Test Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong: -45 dBm</td>
<td>Low: 94.1 MHz</td>
</tr>
<tr>
<td>Medium: -55 dBm</td>
<td></td>
</tr>
<tr>
<td>Weak: -65 dBm</td>
<td></td>
</tr>
</tbody>
</table>

Standard Test Set Ups

1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

Standard Tests

1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF Input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
7. Capture Ratio
8. Selectivity; 1st Adjacent (30dB noise figure)
9. Selectivity; 2nd Adjacent (30dB noise figure)
10. Selectivity; 1st Adjacent (50dB noise figure)
11. Selectivity; 2nd Adjacent (50dB noise figure)
12. Selectivity; 3rd Adjacent (50dB noise figure)
Single RF Tone Tests

1 Local Oscillator Frequency (Tuning Error)
Set Up: Connect Spectrum Analyzer to Radio Antenna input
Adjust: Tune radio to Test Freq. 1, measure L.O. Freq 1
Tune radio to Test Freq. 2, measure L.O. Freq 2

Measurement: L.O. Freq 1 104.794 MHz
L.O. Freq 2 __________ MHz

2 Standard Audio Output
Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio Volume to Std. Ref. Level, record Left and Right channel audio level and THD

Measurement:

<table>
<thead>
<tr>
<th>Left Ch</th>
<th>Right Ch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>0.775 Vrms</td>
</tr>
<tr>
<td>THD</td>
<td>0.16 %</td>
</tr>
<tr>
<td></td>
<td>= 0dB</td>
</tr>
</tbody>
</table>

3 RF Input Overload
Set Up: Test Set Up 1, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level
Increase RF Level until 5% THD at Radio output, record RF Level

Measurement: RF Lev. 22.00 dBm (@ 5% THD)
Max Test Bed RF level - slight increase in THD (0.36%)

4 AM Rejection
Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level, record THD
Set modulation mode to FM (75kHz), AM (30%), record THD

Measurement:

<table>
<thead>
<tr>
<th>THD</th>
<th>0.16 % = -55.92 dB (FM Only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>THD</td>
<td>0.16 % = -55.92 dB (FM + AM 30%)</td>
</tr>
</tbody>
</table>

AM Rejection: 0.00 dB

5 Image Rejection
Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Decrease RF Level until S/N Ratio = 30dB, record RF Lev1
Tune RF Gen to; Desired Freq. +/- 2X IF Freq.
Adjust RF Level until S/N Ratio = 30dB, record RF Lev2

Measurement:

<table>
<thead>
<tr>
<th>RF Lev1</th>
<th>-106.0 dBm (S/N Ratio = 30dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Lev2</td>
<td>-53.0 dBm (21.4MHz + 94.1MHz = 115.5MHz)</td>
</tr>
</tbody>
</table>

Image Rejection: -53.00 dB (RF Lev1 - RF Lev2)
6 Curve Tests
Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
Adjust: Set Radio audio to Std. Ref. Level (0dB) for both Mono and Stereo set ups.

Plot: Signal, Noise Vs RF Level (Mono)
Signal, Noise Vs RF Level (L=R, Stereo)
Stereo Separation Vs RF Level (L only, Stereo)
Record: Noise floor at -45dBm without Low Pass Filter as a measure of pilot rejection

CURVE DATA

## SIGNAL, NOISE & SEPARATION VS RF LEVEL

<table>
<thead>
<tr>
<th>RF Level (dBm)</th>
<th>Mono (L)</th>
<th>Noise</th>
<th>Signal</th>
<th>Filt. Noise</th>
<th>Noise</th>
<th>Left</th>
<th>Right</th>
<th>Separation L&gt;R</th>
</tr>
</thead>
<tbody>
<tr>
<td>-130</td>
<td>-14.50</td>
<td>-14.50</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-130</td>
</tr>
<tr>
<td>-125</td>
<td>-14.50</td>
<td>-14.50</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-125</td>
</tr>
<tr>
<td>-120</td>
<td>-14.50</td>
<td>-15.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-120</td>
</tr>
<tr>
<td>-115</td>
<td>-12.00</td>
<td>-16.50</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-115</td>
</tr>
<tr>
<td>-110</td>
<td>-6.50</td>
<td>-21.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-110</td>
</tr>
<tr>
<td>-105</td>
<td>-2.00</td>
<td>-35.50</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-105</td>
</tr>
<tr>
<td>-100</td>
<td>-0.25</td>
<td>-49.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-100</td>
</tr>
<tr>
<td>-95</td>
<td>0.00</td>
<td>-54.50</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-95</td>
</tr>
<tr>
<td>-90</td>
<td>0.00</td>
<td>-60.00</td>
<td>0.00</td>
<td>-36.00</td>
<td>0.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-90</td>
</tr>
<tr>
<td>-85</td>
<td>0.00</td>
<td>-65.50</td>
<td>0.00</td>
<td>-41.00</td>
<td>0.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-85</td>
</tr>
<tr>
<td>-80</td>
<td>0.00</td>
<td>-71.00</td>
<td>0.00</td>
<td>-46.00</td>
<td>0.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-80</td>
</tr>
<tr>
<td>-75</td>
<td>0.00</td>
<td>-76.00</td>
<td>0.00</td>
<td>-51.00</td>
<td>0.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-75</td>
</tr>
<tr>
<td>-70</td>
<td>0.00</td>
<td>-80.00</td>
<td>0.00</td>
<td>-55.50</td>
<td>0.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-70</td>
</tr>
<tr>
<td>-65</td>
<td>0.00</td>
<td>-80.00</td>
<td>0.00</td>
<td>-60.50</td>
<td>0.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-65</td>
</tr>
<tr>
<td>-60</td>
<td>0.00</td>
<td>-80.00</td>
<td>0.00</td>
<td>-65.00</td>
<td>0.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-60</td>
</tr>
<tr>
<td>-55</td>
<td>0.00</td>
<td>-80.00</td>
<td>0.00</td>
<td>-69.00</td>
<td>0.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-55</td>
</tr>
<tr>
<td>-50</td>
<td>0.00</td>
<td>-80.00</td>
<td>0.00</td>
<td>-71.50</td>
<td>0.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-50</td>
</tr>
<tr>
<td>-45</td>
<td>0.00</td>
<td>-80.00</td>
<td>0.00</td>
<td>-72.50</td>
<td>0.00</td>
<td>-77.00</td>
<td>-77.00</td>
<td>-45</td>
</tr>
</tbody>
</table>
Two RF Tone Tests

7 Capture Ratio
Set Up: Test Set Up 3
Desired: Test Freq. 1, -55dBm, 1kHz, 22.5kHz dev, Mono
Undesired: Test Freq. 1, -130dBm, CW
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Increase Undesired signal until audio level drops 1dB, record Undesired RF level as RF Lev 1
Increase Undesired signal until audio level drops 30dB, record Undesired RF level as RF Lev 2

Measurement:
RF Lev 1 -55.60 dBm
RF Lev 2 -54.50 dBm

Capture Ratio: -0.55 dB (RF Lev 1 - RF Lev 2)/2

8 Selectivity - 1st Adjacent 30dB S/N (Upper and Lower)
Upper 1st
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

Selectivity, 1st Adj.: Mono 30dB | Stereo 30dB
-55.00 | -55.00
-40.22 | -14.78
-50.52 | -4.48
-58.63 | -9.48

(RF/D/U Up + RF/D/U Lo)/2

9 Selectivity - 2nd Adjacent 30dB S/N (Upper and Lower)
Upper 2nd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

Selectivity, 2nd Adj.: Mono 30dB | Stereo 30dB
-55.00 | -55.00
8.08 | -63.08
8.08 | -63.08

(RF/D/U Up + RF/D/U Lo)/2
Selectivity - 1st Adjacent 50dB S/N (Upper and Lower)

Upper 1st

Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1+200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)

Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st

Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1-200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)

Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-52.42</td>
</tr>
</tbody>
</table>

Selectivity, 1st Adj.: -8.08 (RF D/U Up + RF D/U Lo)/2

Selectivity - 2nd Adjacent 50dB S/N (Upper and Lower)

Upper 2nd

Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1+400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)

Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd

Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1-400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)

Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-6.92</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>8.08</td>
</tr>
</tbody>
</table>

Selectivity, 2nd Adj.: -55.58 (RF D/U Up + RF D/U Lo)/2

Selectivity - 3rd Adjacent 50dB S/N (Upper and Lower)

Upper 3rd

Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1+600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)

Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 3rd

Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1-600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)

Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>7.90</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>8.08</td>
</tr>
</tbody>
</table>

Selectivity, 3rd Adj.: -62.90 (RF D/U Up + RF D/U Lo)/2

File Name: C_den380
Page 5 of 15
Additional Tests

13 10.7MHz Rejection
Using Test Set Up 1 at the desired frequency of 94.1MHz;
Set generator to 1kHz, 75kHz dev. / CW
Reduce RF level to obtain 30dB S/N ratio.
Record RF Level as RF Lev 1
Set RF generator to 10.7MHz
Adjust RF level to obtain 30dB S/N ratio
Record RF Level as RF Lev 2
Calculate the difference between the two RF levels

<table>
<thead>
<tr>
<th>RF Lev 1</th>
<th>-104.70 dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Lev 2</td>
<td>-17.00 dBm</td>
</tr>
<tr>
<td>D/U</td>
<td>-87.70 dB</td>
</tr>
</tbody>
</table>

14 10.7 IM Test
Using the three generator set up, set generators as follows;
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
Lower Undesired: 88.7MHz, 1kHz, 75kHz dev
Upper Undesired: 99.3MHz, 400Hz, 75kHz dev
Adjust: Undesired RF level to obtain -50dB noise floor, record RF lev 10.6MHz Spacing
Set upper undesired generator to 99.4MHz. Adjust RF lev for -50dB noise floor. (RF lev 10.7MHz Spacing)

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>D/U</td>
<td>D/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td>-28.63</td>
<td>-19.63</td>
</tr>
</tbody>
</table>

EOC:

15 10.7MHz (10.6MHz) Local Osc Interference Test
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
Set upper interferer generator to 104.7MHz (94.1MHz + 10.6MHz), 400Hz, 75kHz dev
a) Increase level of undesired signals until noise floor is -50dB (+/- 2dB). Record RF Lev for 10.6MHz Spacing
b) Re-adjust upper interfering generator to 104.8MHz (94.1MHz + 10.7MHz)
Re-adjust RF level for -50dB and record RF lev for 10.7MHz spacing

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>D/U</td>
<td>D/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td>Mot If</td>
<td>-31.63</td>
</tr>
</tbody>
</table>

EOC: Objectionable beat notes
FM Receiver Test Laboratory

Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 2
Class: Home Hi Fi Tuner
Radio Mfg: Denon
Model: TU-380RD
Serial: 4056301149

Antenna Network: 50/75 Ohm Trans. FM

Audio load: 10K Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output
Any other control settings unique to the radio under test shall be noted in the Comments section.
Left channel shall be used for all Signal (and S/N ratio) measurements.
15KHz Low Pass filter shall be used on the output of the left channel for all measurements.
Right channel shall be used for Noise measurements - Stereo Separation test only.
All level measurements are rms

Comments: RF Atten: Off
Auto/Manual switch: Manual for Mono tests
Auto/Manual switch, Auto for Stereo tests

Standard RF Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>-45</td>
</tr>
<tr>
<td>Medium</td>
<td>-55</td>
</tr>
<tr>
<td>Weak</td>
<td>-65</td>
</tr>
</tbody>
</table>

Standard FM Test Frequencies

<table>
<thead>
<tr>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>94.1MHz</td>
</tr>
</tbody>
</table>

Standard Test Set Ups

1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

Standard Tests

1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF Input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
6. Curve Tests (plots of RF Level Vs Audio Output)
7. Capture Ratio
8. Selectivity; 1st Adjacent (30dB noise figure)
9. Selectivity; 2nd Adjacent (30dB noise figure)
10. Selectivity; 1st Adjacent (50dB noise figure)
11. Selectivity; 2nd Adjacent (50dB noise figure)
12. Selectivity; 3rd Adjacent (50dB noise figure)
13. 10.7MHz Rejection
14. 10.7MHz Intermodulation
15. 10.7MHz Spurious (Local Osc. Interference)
Test Results:

1. Local Oscillator Frequency:
   - 104.794 MHz

2. Standard Audio Output:
<table>
<thead>
<tr>
<th>Left Channel</th>
<th>THD</th>
<th>Right Channel</th>
<th>THD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.775 Vrms</td>
<td>0.16%</td>
<td>0.78 Vrms</td>
<td>0.16%</td>
</tr>
</tbody>
</table>

3. RF Input Overload:
   - 22.00 dBm
   - Max Test Bed RF level - slight increase in THD (0.36%)

4. AM Rejection:
   - 0.00 dB

5. Image Rejection:
   - -53.00 dB

6. Curve Tests:
   (See Plots)

7. Capture Ratio:
   - -0.55 dB

8. Selectivity, First Adjacent, 30dB Noise Floor (Ave. D/U)
   - Mono: -9.63 dB
   - Stereo: -9.48 dB

   - Mono: -63.08 dB
   - Stereo: -62.89 dB

10. Selectivity, First Adjacent, 50dB Noise Floor (Ave D/U)
    - Mono: -8.08 dB
    - Stereo: 9.42 dB

11. Selectivity, Second Adjacent, 50dB Noise Floor (Ave. D/U)
    - Mono: -15.98 dB
    - Stereo: 48.08 dB

12. Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)
    - Mono: -62.99 dB
    - Stereo: -43.58 dB

13. 10.7MHz Rejection
    - -87.70 dB

14. 10.7MHz IM
    - Mono: -20.63 dB (10.6)
    - Stereo: -19.63 dB (10.7)

15. 10.7MHz Spurious (Local Osc. Interference)
    - Mono: -31.63 dB (10.6)
    - Stereo: -18.63 dB (10.7)

   Objectionable beat notes
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6 dB

Denon TU-380RD
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

- Insertion loss = -6dB

Denon TU-380RD
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

-80.00 -70.00 -60.00 -50.00 -40.00 -30.00 -20.00 -10.00 0.00 10.00

AUDIOL (dB)

RF LEVEL (dBm)


Denon TU-380RD

- Left
- Right

Insertion loss

File Name: C_den380
FM Stereo Separation Plot
1st and 2nd ADJACENT CHANNEL SELECTIVITY
(30dB Noise Floor)

Insertion loss = -6dB

Denon TU-380RD
1st, 2nd and 3rd ADJACENT CHANNEL SELECTIVITY
(50dB Noise Floor)

Max Level

Insertion loss = -6dB

Denon TU-380RD
Receiver #3

Panasonic

Portable
Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 3
Class: AM/FM/Cass Portable
Radio Mfg.: Panasonic
Model: RX-FS430
Serial: GR31A01184

Antenna Network: 50/75 Ohm Trans. FM
AM
Audio load: 10K Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position). Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms

Comments: Tone control full clockwise
Band switch in FM Stereo

<table>
<thead>
<tr>
<th>Standard RF Levels</th>
<th>Standard FM Test Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong: -45 dBm</td>
<td>Low: 94.1 MHz</td>
</tr>
<tr>
<td>Medium: -55 dBm</td>
<td></td>
</tr>
<tr>
<td>Weak: -65 dBm</td>
<td></td>
</tr>
</tbody>
</table>

Standard Test Set Ups

1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

Standard Tests

1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF Input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
7. Capture Ratio
8. Selectivity, 1st Adjacent (30dB noise figure)
9. Selectivity, 2nd Adjacent (30dB noise figure)
10. Selectivity, 1st Adjacent (50dB noise figure)
11. Selectivity, 2nd Adjacent (50dB noise figure)
12. Selectivity, 3rd Adjacent (50dB noise figure)
13 - 15 Additional 10.7MHz Tests
FM Receiver Test Laboratory

Single RF Tone Tests

1 Local Oscillator Frequency (Tuning Error)
   Set Up: Connect Spectrum Analyzer to Radio Antenna input
   Adjust: Tune radio to Test Freq. 1, measure L.O. Freq 1
   Tune radio to Test Freq. 2, measure L.O. Freq 2

   Measurement: L.O. Freq 1 104.898 MHz
                 L.O. Freq 2 _______ MHz

2 Standard Audio Output
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio Volume to Std. Ref. Level, record Left and Right channel audio level and THD

   Measurement: Left Ch   Right Ch
                 Level 1.000 Vrms  = 0dB  Level 0.950 Vrms
                 THD 0.56 %        THD 0.54 %

3 RF Input Overload
   Set Up: Test Set Up 1, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level
   Increase RF Level until 5% THD at Radio output, record RF Level

   Measurement: RF Lev. 19.50 dBm  (@ 5% THD)

4 AM Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level, record THD
   Set modulation mode to FM (75kHz), AM (30%), record THD

   Measurement: THD 0.55 %  = -45.19 dB  (FM Only)
                 THD 0.6 %    = -44.44 dB  (FM + AM 30%)

   AM Rejection: -0.76 dB

5 Image Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level (0dB)
   Decrease RF Level until S/N Ratio = 30dB, record RF Lev1
   Tune RF Gen to; Desired Freq. +/- 2 X IF Freq.
   Adjust RF Level until S/N Ratio = 30dB, record RF Lev2

   Measurement: RF Lev1 -101.0 dBm  (S/N Ratio = 30dB)
                 RF Lev2 -65.0 dBm  (21.4MHz + 94.1MHz = 115.5MHz)

   Image Rejection: -36.00 dB  (RF Lev1 - RF Lev2)
6 Curve Tests

Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
Adjust: Set Radio audio to Std. Ref. Level (0dB) for both Mono and Stereo set ups.

Plot: Signal, Noise Vs RF Level (Mono)
Signal, Noise Vs RF Level (L-R, Stereo)
Stereo Separation Vs RF Level (L-Only, Stereo)
Record: Noise floor at -45dBm without Low Pass Filter as a measure of pilot rejection

CURVE DATA

<table>
<thead>
<tr>
<th>RF Level dBM</th>
<th>Mono (L)</th>
<th>Stereo (L)</th>
<th>Separation L-R</th>
<th>RF Level dBM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Signal db</td>
<td>Noise db</td>
<td>Signal db</td>
<td>Noise db</td>
</tr>
<tr>
<td>-130</td>
<td>-30.00</td>
<td>-30.00</td>
<td>-29.50</td>
<td>-29.50</td>
</tr>
<tr>
<td>-125</td>
<td>-30.00</td>
<td>-30.00</td>
<td>-29.50</td>
<td>-29.50</td>
</tr>
<tr>
<td>-120</td>
<td>-30.00</td>
<td>-30.00</td>
<td>-29.50</td>
<td>-29.50</td>
</tr>
<tr>
<td>-115</td>
<td>-26.50</td>
<td>-30.00</td>
<td>-26.00</td>
<td>-29.00</td>
</tr>
<tr>
<td>-110</td>
<td>-18.50</td>
<td>-30.00</td>
<td>-18.00</td>
<td>-29.00</td>
</tr>
<tr>
<td>-105</td>
<td>-10.00</td>
<td>-31.00</td>
<td>-10.00</td>
<td>-29.50</td>
</tr>
<tr>
<td>-100</td>
<td>-3.50</td>
<td>-36.00</td>
<td>-3.25</td>
<td>-27.00</td>
</tr>
<tr>
<td>-95</td>
<td>0.00</td>
<td>-58.00</td>
<td>0.00</td>
<td>-38.00</td>
</tr>
<tr>
<td>-90</td>
<td>0.00</td>
<td>-64.00</td>
<td>0.00</td>
<td>-43.00</td>
</tr>
<tr>
<td>-85</td>
<td>0.00</td>
<td>-68.50</td>
<td>0.00</td>
<td>-48.00</td>
</tr>
<tr>
<td>-80</td>
<td>0.00</td>
<td>-70.50</td>
<td>0.00</td>
<td>-53.00</td>
</tr>
<tr>
<td>-75</td>
<td>0.00</td>
<td>-71.50</td>
<td>0.00</td>
<td>-57.50</td>
</tr>
<tr>
<td>-70</td>
<td>0.00</td>
<td>-71.00</td>
<td>0.00</td>
<td>-62.00</td>
</tr>
<tr>
<td>-65</td>
<td>0.00</td>
<td>-71.80</td>
<td>0.00</td>
<td>-65.00</td>
</tr>
<tr>
<td>-60</td>
<td>0.00</td>
<td>-72.00</td>
<td>0.00</td>
<td>-67.20</td>
</tr>
<tr>
<td>-55</td>
<td>0.00</td>
<td>-72.00</td>
<td>0.00</td>
<td>-68.00</td>
</tr>
<tr>
<td>-50</td>
<td>0.00</td>
<td>-72.00</td>
<td>0.00</td>
<td>-68.50</td>
</tr>
<tr>
<td>-45</td>
<td>0.00</td>
<td>-72.00</td>
<td>0.00</td>
<td>-36.20</td>
</tr>
</tbody>
</table>
Two RF Tone Tests

7 Capture Ratio
Set Up: Test Set Up 3
Desired: Test Freq. 1, -55dBm, 1kHz, 22.5kHz dev, Mono
Undesired: Test Freq. 1, -130dBm, CW
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Increase Undesired signal until audio level drops 1dB, record Undesired RF level as RF Lev 1
Increase Undesired signal until audio level drops 30dB, record Undesired RF level as RF Lev 2

Measurement: RF Lev 1 -53.78 dBm
RF Lev 2 -50.78 dBm

Capture Ratio: -1.50 dB (RF Lev 1 - RF Lev 2)/2

8 Selectivity - 1st Adjacent 30dB S/N (Upper and Lower)
Upper 1st
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

Selectivity, 1st Adj.: 4.28 (RF D/U Up + RF D/U Lo)/2

9 Selectivity - 2nd Adjacent 30dB S/N (Upper and Lower)
Upper 2nd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

Selectivity, 2nd Adj.: -27.23 (RF D/U Up + RF D/U Lo)/2
10 Selectivity - 1st Adjacent 50dB S/N (Upper and Lower)
Upper 1st
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DBm</td>
<td>D/U</td>
</tr>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
</tr>
</tbody>
</table>

Selectivity, 1st Adj.: (-55.00 + (RF D/U Up + RF D/U Lo))/2

11 Selectivity - 2nd Adjacent 50dB S/N (Upper and Lower)
Upper 2nd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DBm</td>
<td>D/U</td>
</tr>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
</tr>
</tbody>
</table>

Selectivity, 2nd Adj.: (-38.32 + (RF D/U Up + RF D/U Lo))/2

12 Selectivity - 3rd Adjacent 50dB S/N (Upper and Lower)
Upper 3rd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 3rd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DBm</td>
<td>D/U</td>
</tr>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
</tr>
</tbody>
</table>

Selectivity, 3rd Adj.: (-30.92 + (RF D/U Up + RF D/U Lo))/2
Additional Tests

13 10.7MHz Rejection
Using Test Set Up 1 at the desired frequency of 94.1MHz;
Set generator to 1kHz, 75kHz dev. / CW
Reduce RF level to obtain 30dB S/N ratio.
Record RF Level as RF Lev 1
Set RF generator to 10.7MHz
Adjust RF level to obtain 30dB S/N ratio
Record RF Level as RF Lev 2
Calculate the difference between the two RF levels

<table>
<thead>
<tr>
<th>RF Lev 1</th>
<th>RF Lev 2</th>
<th>D/U</th>
<th>EOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>-100.00</td>
<td>-32.00</td>
<td>-68.00</td>
<td></td>
</tr>
</tbody>
</table>

14 10.7 IM Test
Using the three generator set up, set generators as follows;
Set Up:  
Desired: 94.1MHz, -45dBm, Pilot only
Lower Undesired: 88.7MHz, 1kHz, 75kHz dev
Upper Undesired: 99.3MHz, 400Hz, 75kHz dev
Adjust: Undesired RF level to obtain -50dB noise floor, record RF lev 10.6MHz Spacing
Set upper undesired generator to 99.4MHz. Adjust RF lev for -50dB noise floor. (RF lev 10.7MHz Spacing)

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm D/U</td>
<td>dBm D/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td>-24.37</td>
<td>-20.63</td>
</tr>
<tr>
<td></td>
<td>-29.37</td>
</tr>
<tr>
<td></td>
<td>-15.63</td>
</tr>
</tbody>
</table>

EOC: Objectionable beat notes

15 10.7MHz (10.6MHz) Local Osc Interference Test
Set Up:  
Desired: 94.1MHz, -45dBm, Pilot only
Set upper interferer generator to 104.7MHz (94.1MHz + 10.6MHz), 400Hz, 75kHz dev
a) Increase level of undesired signals until noise floor is -50dB (+/- 2dB). Record RF Lev for 10.6MHz Spacing
b) Re-adjust upper interfering generator to 104.8MHz (94.1MHz + 10.7MHz)
Re-adjust RF level for -50dB and record RF lev for 10.7MHz spacing

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm D/U</td>
<td>dBm D/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td>-29.37</td>
<td>-15.63</td>
</tr>
<tr>
<td></td>
<td>-51.37</td>
</tr>
<tr>
<td></td>
<td>6.37</td>
</tr>
</tbody>
</table>

EOC: Objectionable beat notes
FM Receiver Test Laboratory

Date: 2/28/99
Engineer: RMc
Project: FM Receiver Test A1

Receiver Test No.: 3
Class: AM/FM/Cass Portable
Radio Mfg.: Panasonic
Model: RX-FS430
Serial: GR31A01184

Antenna Network: 50/75 Ohm Trans. FM

Audio load: 10K Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output
Any other control settings unique to the radio under test shall be noted in the Comments section.
Left channel shall be used for all Signal (and S/N ratio) measurements.
15Hz Low Pass filter shall be used on the output of the left channel for all measurements.
Right channel shall be used for Noise measurements - Stereo Separation test only.
All level measurements are rms

Comments: Tone control full clockwise
Band switch in FM Stereo

Standard RF Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>-45</td>
</tr>
<tr>
<td>Medium</td>
<td>-55</td>
</tr>
<tr>
<td>Weak</td>
<td>-65</td>
</tr>
</tbody>
</table>

Standard FM Test Frequencies

| Frequency | 94.1MHz |

Standard Test Set Ups

1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

Standard Tests

1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF Input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
6. Curve Tests (plots of RF Level Vs Audio Output)
7. Capture Ratio
8. Selectivity; 1st Adjacent (30dB noise figure)
9. Selectivity; 2nd Adjacent (30dB noise figure)
10. Selectivity; 1st Adjacent (50dB noise figure)
11. Selectivity; 2nd Adjacent (50dB noise figure)
12. Selectivity; 3rd Adjacent (50dB noise figure)
**Test Results:**

1. **Local Oscillator Frequency:**
   - 104.898 MHz

2. **Standard Audio Output:**
<table>
<thead>
<tr>
<th>Left Channel</th>
<th>THD</th>
<th>Right Channel</th>
<th>THD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Vrms</td>
<td>0.56%</td>
<td>0.95 Vrms</td>
<td>0.54%</td>
</tr>
</tbody>
</table>

3. **RF Input Overload:**
   - 19.50 dBm
   - 0

4. **AM Rejection:**
   - -0.76 dB

5. **Image Rejection:**
   - -36.00 dB

6. **Curve Tests:**
   (See Plots)

7. **Capture Ratio:**
   - -1.50 dB

8. **Selectivity, First Adjacent, 30dB Noise Floor (Ave. D/U)**
<table>
<thead>
<tr>
<th>Mono</th>
<th>Stereo</th>
</tr>
</thead>
<tbody>
<tr>
<td>-4.28 dB</td>
<td>-3.58 dB</td>
</tr>
</tbody>
</table>

9. **Selectivity, Second Adjacent, 30dB Noise Floor (Ave. D/U)**
<table>
<thead>
<tr>
<th>Mono</th>
<th>Stereo</th>
</tr>
</thead>
<tbody>
<tr>
<td>-27.23 dB</td>
<td>-26.98 dB</td>
</tr>
</tbody>
</table>

10. **Selectivity, First Adjacent, 50dB Noise Floor (Ave D/U)**
    | Mono | Stereo |
    |------|--------|
    | -0.78 dB | 14.67 dB |

11. **Selectivity, Second Adjacent, 50dB Noise Floor (Ave. D/U)**
    | Mono | Stereo |
    |------|--------|
    | -18.88 dB | -15.58 dB |

12. **Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)**
    | Mono | Stereo |
    |------|--------|
    | -30.58 dB | -28.58 dB |

13. **10.7MHz Rejection**
    - -68.00 dB

14. **10.7MHz IM**
    | Mono | Stereo |
    |------|--------|
    | -20.63 dB (10.6) | Objectionable beat notes |
    | -15.63 dB (10.7) | 0 |

15. **10.7MHz Spurious (Local Osc. Interference)**
    | Mono | Stereo |
    |------|--------|
    | -15.63 dB (10.6) | Objectionable beat notes |
    | 6.37 dB (10.7) | 0 |
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion oss = -6dB

Panasonic RX-FS430
FM Receiver Test Laboratory

**SIGNAL/NOISE VS RF LEVEL**

Insertion loss = -6dB

Panasonic RX-FS430

FILE_NAME: C_pana

FM Stereo Plot
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Panasonic RX-FS430

Insertion loss = -6dB

Left

Right
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Panasonic RX-FS430

Insertion loss = -6dB
1st and 2nd ADJACENT CHANNEL SELECTIVITY
(30dB Noise Floor)

Insertion loss = -6dB

Panasonic RX-FS430
1st, 2nd and 3rd ADJACENT CHANNEL SELECTIVITY
(50dB Noise Floor)

Insertion loss = -6dB

Frequency (MHz)
Panasonic RX-FS430

File Name: C_pana
Selectivity 50dB
IM & L.O. Rejection
(50dB Noise Floor)

Insertion loss = -6dB

Panasonic RX-FS430
Receiver #4

Pioneer

Home HiFi
Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 4
Class: Home Hi Fi Receiver
Radio Mfg.: Pioneer
Model: SX-201
Serial: OA3965843C

Antenna Network: 50/75 Ohm Trans.  FM
Audio load: 10K Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and
Fader controls centered (set to mid position), Volume set to Standard Output
Any other control settings unique to the radio under test shall be noted in the Comments section.
Left channel shall be used for all Signal (and S/N ratio) measurements.
15kHz Low Pass filter shall be used on the output of the left channel for all measurements.
Right channel shall be used for Noise measurements - Stereo Separation test only.
All level measurements are rms

Comments: FM Mode Switch: Auto/Stereo
FM Tuning Switch: Manual
Buffered line outputs used for audio measurements

<table>
<thead>
<tr>
<th>Standard RF Levels</th>
<th>Standard FM Test Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong: -45 dBm</td>
<td>Low: 94.1 MHz</td>
</tr>
<tr>
<td>Medium: -55 dBm</td>
<td></td>
</tr>
<tr>
<td>Weak: -65 dBm</td>
<td></td>
</tr>
</tbody>
</table>

Standard Test Set Ups
1 Strong Signal Overload
2 Single RF Tone Tests
3 Two RF Tone Tests
4 Measurement Set up

Standard Tests
1 Local Oscillator Frequency (Tuning Error)
2 Standard Audio Output (Audio level and distortion)
3 RF Input Overload (RF level required for 5% THD)
4 AM Rejection
5 Image Rejection
6 Curve Tests (plots of RF Level Vs Signal - Mono & Stereo, Noise - Mono & Stereo, Stereo Separation
7 Capture Ratio
8 Selectivity, 1st Adjacent (30dB noise figure)
9 Selectivity, 2nd Adjacent (30dB noise figure)
10 Selectivity, 1st Adjacent (50dB noise figure)
11 Selectivity, 2nd Adjacent (50dB noise figure)
12 Selectivity, 3rd Adjacent (50dB noise figure)
13 - 15 Additional 10.7MHz Tests
Single RF Tone Tests

1 Local Oscillator Frequency (Tuning Error)
   Set Up: Connect Spectrum Analyzer to Radio Antenna input
   Adjust: Tune radio to Test Freq. 1, measure L.O. Freq 1
          Tune radio to Test Freq. 2, measure L.O. Freq 2
   Measurement: L.O. Freq 1 104.806 MHz
                L.O. Freq 2 __________ MHz

2 Standard Audio Output
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio Volume to Std. Ref. Level, record Left and Right channel audio level and THD
   Measurement:

   Left Ch: Level 0.710 Vrms = 0dB
            THD 0.95 %
   Right Ch: Level 0.710 Vrms
            THD 0.90 %

3 RF Input Overload
   Set Up: Test Set Up 1, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level
          Increase RF Level until 5% THD at Radio output, record RF Level
   Measurement: RF Lev. 22.00 dBm (@ 5% THD)
               Max Test Bed RF level - slight increase in THD (1.3%)

4 AM Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level, record THD
          Set modulation mode to FM (75kHz), AM (30%), record THD
   Measurement:

   THD 0.95 % = -40.45 dB (FM Only)
   THD 0.95 % = -40.45 dB (FM + AM 30%)

   AM Rejection: 0.00 dB

5 Image Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level (0dB)
          Decrease RF Level until S/N Ratio = 30dB, record RF Lev1
          Tune RF Gen to; Desired Freq. +/- 2 X IF Freq.
          Adjust RF Level until S/N Ratio = 30dB, record RF Lev2
   Measurement:

   RF Lev1 -86.0 dBm (S/N Ratio = 30dB)
   RF Lev2 -55.0 dBm (21.4MHz + 94.1MHz = 115.5MHz)
   Image Rejection: -31.00 dB (RF Lev1 - RF Lev2)
6 Curve Tests

Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
Adjust: Set Radio audio to Std. Ref. Level (dB) for both Mono and Stereo set ups.

Plot: Signal, Noise Vs RF Level (Mono)
Signal, Noise Vs RF Level (L->R, Stereo)
Stereo Separation Vs RF Level (L only, Stereo)
Record: Noise floor at -45dBm without Low Pass Filter as a measure of pilot rejection

CURVE DATA

<table>
<thead>
<tr>
<th>RF Level dBm</th>
<th>Signal Mono (L)</th>
<th>Noise Mono (L)</th>
<th>Signal Stereo (L)</th>
<th>Filter Noise Stereo (L)</th>
<th>Noise Stereo (L)</th>
<th>Separation L-&gt;R</th>
<th>Left dB</th>
<th>Right dB</th>
<th>RF Level dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>-130</td>
<td>-16.00</td>
<td>-16.00</td>
<td>-15.00</td>
<td>-15.00</td>
<td>-15.00</td>
<td>-15.00</td>
<td>-15.00</td>
<td>-15.00</td>
<td>-130</td>
</tr>
<tr>
<td>-125</td>
<td>-16.00</td>
<td>-16.00</td>
<td>-15.00</td>
<td>-15.00</td>
<td>-15.00</td>
<td>-15.00</td>
<td>-15.00</td>
<td>-15.00</td>
<td>-125</td>
</tr>
<tr>
<td>-120</td>
<td>-14.50</td>
<td>-16.50</td>
<td>-14.00</td>
<td>-15.50</td>
<td>-15.00</td>
<td>-15.00</td>
<td>-15.00</td>
<td>-15.00</td>
<td>-120</td>
</tr>
<tr>
<td>-115</td>
<td>-9.50</td>
<td>-18.00</td>
<td>-9.00</td>
<td>-17.00</td>
<td>-15.00</td>
<td>-15.00</td>
<td>-15.00</td>
<td>-15.00</td>
<td>-115</td>
</tr>
<tr>
<td>-110</td>
<td>-3.00</td>
<td>-24.00</td>
<td>-3.00</td>
<td>-23.00</td>
<td>-10.00</td>
<td>-10.00</td>
<td>-10.00</td>
<td>-10.00</td>
<td>-110</td>
</tr>
<tr>
<td>-105</td>
<td>-0.50</td>
<td>-45.50</td>
<td>-0.50</td>
<td>-44.00</td>
<td>-6.00</td>
<td>-6.00</td>
<td>-6.00</td>
<td>-6.00</td>
<td>-105</td>
</tr>
<tr>
<td>-100</td>
<td>0.00</td>
<td>-52.50</td>
<td>0.00</td>
<td>-51.50</td>
<td>-6.00</td>
<td>-6.00</td>
<td>-6.00</td>
<td>-6.00</td>
<td>-100</td>
</tr>
<tr>
<td>-95</td>
<td>0.00</td>
<td>-58.00</td>
<td>0.00</td>
<td>-57.00</td>
<td>-6.00</td>
<td>-6.00</td>
<td>-6.00</td>
<td>-6.00</td>
<td>-95</td>
</tr>
<tr>
<td>-90</td>
<td>0.00</td>
<td>-63.00</td>
<td>0.00</td>
<td>-62.00</td>
<td>-6.00</td>
<td>-6.00</td>
<td>-6.00</td>
<td>-6.00</td>
<td>-90</td>
</tr>
<tr>
<td>-85</td>
<td>0.00</td>
<td>-68.00</td>
<td>0.00</td>
<td>-67.00</td>
<td>-6.00</td>
<td>-6.00</td>
<td>-6.00</td>
<td>-6.00</td>
<td>-85</td>
</tr>
<tr>
<td>-80</td>
<td>0.00</td>
<td>-73.00</td>
<td>0.00</td>
<td>-70.00</td>
<td>0.00</td>
<td>-34.50</td>
<td>-34.50</td>
<td>-34.50</td>
<td>-80</td>
</tr>
<tr>
<td>-75</td>
<td>0.00</td>
<td>-75.00</td>
<td>0.00</td>
<td>-55.00</td>
<td>0.00</td>
<td>-35.00</td>
<td>-35.00</td>
<td>-35.00</td>
<td>-75</td>
</tr>
<tr>
<td>-70</td>
<td>0.00</td>
<td>-75.00</td>
<td>0.00</td>
<td>-60.00</td>
<td>0.00</td>
<td>-35.00</td>
<td>-35.00</td>
<td>-35.00</td>
<td>-70</td>
</tr>
<tr>
<td>-65</td>
<td>0.00</td>
<td>-75.00</td>
<td>0.00</td>
<td>-64.50</td>
<td>0.00</td>
<td>-35.50</td>
<td>-35.50</td>
<td>-35.50</td>
<td>-65</td>
</tr>
<tr>
<td>-60</td>
<td>0.00</td>
<td>-75.00</td>
<td>0.00</td>
<td>-68.00</td>
<td>0.00</td>
<td>-35.50</td>
<td>-35.50</td>
<td>-35.50</td>
<td>-60</td>
</tr>
<tr>
<td>-55</td>
<td>0.00</td>
<td>-75.00</td>
<td>0.00</td>
<td>-70.00</td>
<td>0.00</td>
<td>-36.00</td>
<td>-36.00</td>
<td>-36.00</td>
<td>-55</td>
</tr>
<tr>
<td>-50</td>
<td>0.00</td>
<td>-75.00</td>
<td>0.00</td>
<td>-72.00</td>
<td>0.00</td>
<td>-36.00</td>
<td>-36.00</td>
<td>-36.00</td>
<td>-50</td>
</tr>
<tr>
<td>-45</td>
<td>0.00</td>
<td>-75.00</td>
<td>0.00</td>
<td>-72.00</td>
<td>-33.00</td>
<td>0.00</td>
<td>-36.00</td>
<td>-36.00</td>
<td>-45</td>
</tr>
</tbody>
</table>
FM Receiver Test Laboratory

Two RF Tone Tests

7 Capture Ratio
Set Up: Test Set Up 3
- Desired: Test Freq. 1, -55dBm, 1kHz, 22.5kHz dev, Mono
- Undesired: Test Freq. 1, -130dBm, CW
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Increase Undesired signal until audio level drops 1dB, record Undesired RF level as RF Lev 1
- Increase Undesired signal until audio level drops 30dB, record Undesired RF level as RF Lev 2

Measurement:
- RF Lev 1: -55.60 dBm
- RF Lev 2: -50.00 dBm

Capture Ratio: \(-2.80\) dB \(\text{(RF Lev 1 - RF Lev 2)/2}\)

8 Selectivity - 1st Adjacent 30dB S/N (Upper and Lower)

Upper 1st
Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up:
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-46.72</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-53.22</td>
</tr>
</tbody>
</table>

Selectivity, 1st Adj.: \(-5.03\) dB \(\text{RF D/U Up} + \text{RF D/U Lo}/2\)

9 Selectivity - 2nd Adjacent 30dB S/N (Upper and Lower)

Upper 2nd
Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up:
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-7.62</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-9.22</td>
</tr>
</tbody>
</table>

Selectivity, 2nd Adj.: \(-46.58\) dB \(\text{RF D/U Up} + \text{RF D/U Lo}/2\)
Selectivity - 1st Adjacent 50dB S/N (Upper and Lower)

Upper 1st
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-51.92</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-54.72</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.:</td>
<td>-1.68</td>
</tr>
</tbody>
</table>

Selectivity - 2nd Adjacent 50dB S/N (Upper and Lower)

Upper 2nd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-26.92</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-23.92</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.:</td>
<td>-29.58</td>
</tr>
</tbody>
</table>

Selectivity - 3rd Adjacent 50dB S/N (Upper and Lower)

Upper 3rd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 3rd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>3.08</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-24.92</td>
</tr>
<tr>
<td>Selectivity, 3rd Adj.:</td>
<td>-44.08</td>
</tr>
</tbody>
</table>

(RF D/U Up + RF D/U Lo)/2
13 **10.7MHz Rejection**
Using Test Set Up 1 at the desired frequency of 94.1MHz;
Set generator to 1kHz, 75kHz dev. / CW
Reduce RF level to obtain 30dB S/N ratio.
Record RF Level as RF Lev 1
Set RF generator to 10.7MHz
Adjust RF level to obtain 30dB S/N ratio
Record RF Level as RF Lev 2
Calculate the difference between the two RF levels

<table>
<thead>
<tr>
<th>RF Lev 1</th>
<th>-106.30</th>
<th>EOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Lev 2</td>
<td>-18.00</td>
<td>D/U</td>
</tr>
<tr>
<td></td>
<td>-88.30</td>
<td></td>
</tr>
</tbody>
</table>

14 **10.7 IM Test**
Using the three generator set up, set generators as follows;
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
Lower Undesired: 88.7MHz, 1kHz, 75kHz dev
Upper Undesired: 99.3MHz, 400Hz, 75kHz dev
Adjust: Undesired RF level to obtain -50dB noise floor, record RF lev 10.6MHz Spacing
Set upper undesired generator to 99.4MHz. Adjust RF lev for -50dB noise floor. (RF lev 10.7MHz Spacing)

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td>-33.37</td>
<td>-35.37</td>
</tr>
<tr>
<td>-11.63</td>
<td>-9.63</td>
</tr>
</tbody>
</table>

EOC: Hiss

15 **10.7MHz (10.6MHz) Local Osc Interference Test**
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
Set upper interferer generator to 104.7MHz (94.1MHz + 10.6MHz), 400Hz, 75kHz dev
a) Increase level of undesired signals until noise floor is -50dB (+/- 2dB). Record RF Lev for 10.6MHz Spacing
b) Re-adjust upper interfering generator to 104.8MHz (94.1MHz + 10.7MHz)
Re-adjust RF level for -50dB and record RF lev for 10.7MHz spacing

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td>-29.14</td>
<td>-38.14</td>
</tr>
<tr>
<td>-15.86</td>
<td>-6.86</td>
</tr>
</tbody>
</table>

EOC: Objectionable beat noise
Date: 2/28/99

Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 4
Class: Home Hi Fi Receiver
Radio Mfg.: Pioneer
Model: SX-201
Serial: OA3965843C

Antenna Network: 50/75 Ohm Trans. FM

Audio load: 10K Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms.

Comments: FM Mode Switch: Auto/Stereo
FM Tuning Switch: Manual
Buffered line outputs used for audio measurements

<table>
<thead>
<tr>
<th>Standard RF Levels</th>
<th>Standard FM Test Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong: -45 dBm</td>
<td>94.1MHz</td>
</tr>
<tr>
<td>Medium: -55 dBm</td>
<td></td>
</tr>
<tr>
<td>Weak: -65 dBm</td>
<td></td>
</tr>
</tbody>
</table>

Standard Test Set Ups
1 Strong Signal Overload
2 Single RF Tone Tests
3 Two RF Tone Tests
4 Measurement Set up

Standard Tests
1 Local Oscillator Frequency (Tuning Error) 13 10.7MHz Rejection
2 Standard Audio Output (Audio level and distortion) 14 10.7MHz Intermodulation
3 RF Input Overload (RF level required for 5% THD) 15 10.7MHz Spurious (Local Osc. Interference)
4 AM Rejection
5 Image Rejection
6 Curve Tests (plots of RF Level Vs Audio Output)
7 Capture Ratio
8 Selectivity; 1st Adjacent (30dB noise figure)
9 Selectivity; 2nd Adjacent (30dB noise figure)
10 Selectivity; 1st Adjacent (50dB noise figure)
11 Selectivity; 2nd Adjacent (50dB noise figure)
12 Selectivity; 3rd Adjacent (50dB noise figure)
Test Results:

1 Local Oscillator Frequency:
   104.806 MHz

2 Standard Audio Output:
   | Left Channel | THD | Right Channel | THD |
   | Vrms | %   | Vrms | %   |
   | 0.71 | 0.95% | 0.71 | 0.90% |

3 RF Input Overload:
   22.00 dBm Max Test Bed RF level - slight increase in THD (1.3%)

4 AM Rejection:
   0.00 dB

5 Image Rejection:
   -31.00 dB

6 Curve Tests:
   (See Flota)

7 Capture Ratio:
   -2.80 dB

8 Selectivity, First Adjacent, 30dB Noise Floor (Ave. D/U)
   -5.03 dB Mono
   -2.53 dB Stereo

9 Selectivity, Second Adjacent, 30dB Noise Floor (Ave. D/U)
   -46.58 dB Mono
   -46.43 dB Stereo

10 Selectivity, First Adjacent, 50dB Noise Floor (Ave D/U)
    -1.68 dB Mono
    17.02 dB Stereo

11 Selectivity, Second Adjacent, 50dB Noise Floor (Ave. D/U)
   -29.58 dB Mono
   -27.38 dB Stereo

12 Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)
    -44.08 dB Mono
    -44.08 dB Stereo

13 10.7MHz Rejection
    -88.30 dB

14 10.7MHz IM
    -11.63 dB (10.6) His
    -9.63 dB (10.7) 0

15 10.7MHz Spurious (Local Osc. Interference)
    -15.86 dB (10.6) Objectionable beat noise
    -6.86 dB (10.7) 0
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

Pioneer SX-201
SIGNAL/NOISE VS RF LEVEL

RF LEVEL (dBm)

AUDI0 LEVEL (dB)


-80.00 -70.00 -60.00 -50.00 -40.00 -30.00 -20.00 -10.00 0.00 10.00

Pioneer SX-201

Insertion loss = -5dB

- Left

- Right
1st and 2nd ADJACENT CHANNEL SELECTIVITY
(30dB Noise Floor)

Insertion loss = -6dB

Pioneer SX-201
FM Receiver Test Laboratory

IM & L.O. Rejection
(50dB Noise Floor)

Frequency (MHz)

Pioneer SX-201

Insertion loss = -6dB
Receiver #5
Ford
Auto
Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 5
Class: Automotive
Radio Mfg.: Ford
Model: F4XF-19B132-CB
Serial: 9411

Antenna Network: Ford FM
AM
Audio load: 4 Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms

Comments:


Standard RF Levels

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>-45 dBm</td>
</tr>
<tr>
<td>Medium</td>
<td>-55 dBm</td>
</tr>
<tr>
<td>Weak</td>
<td>-65 dBm</td>
</tr>
</tbody>
</table>

Standard Test Set Ups

1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

Standard Tests

1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF Input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
7. Capture Ratio
8. Selectivity; 1st Adjacent (30dB noise figure)
9. Selectivity; 2nd Adjacent (30dB noise figure)
10. Selectivity; 1st Adjacent (50dB noise figure)
11. Selectivity; 2nd Adjacent (50dB noise figure)
**FM Receiver Test Laboratory**

**Single RF Tone Tests**

1. **Local Oscillator Frequency (Tuning Error)**
   Set Up: Connect Spectrum Analyzer to Radio Antenna input
   Adjust: Tune radio to Test Freq. 1, measure L.O. Freq 1
   Tune radio to Test Freq. 2, measure L.O. Freq 2
   
   Measurement:
   - L.O. Freq 1: 104.800 MHz
   - L.O. Freq 2: ________ MHz

2. **Standard Audio Output**
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio Volume to Std. Ref. Level, record Left and Right channel audio level and THD
   
   Measurement:
<table>
<thead>
<tr>
<th>Left Ch</th>
<th>Level</th>
<th>1.70</th>
<th>Vrms</th>
<th>%</th>
<th>Right Ch</th>
<th>Level</th>
<th>1.70</th>
<th>Vrms</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>THD</td>
<td></td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0dB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. **RF Input Overload**
   Set Up: Test Set Up 1, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level
   Increase RF Level until 5% THD at Radio output, record RF Level
   
   Measurement:
   - RF Lev.: 22 dBm (@ 5% THD)
   - Max Test Bed RF level - no change in level or THD

4. **AM Rejection**
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level, record THD
   - Set modulation mode to FM (75kHz), AM (30%), record THD
   
   Measurement:
   - THD 1 % = -40.00 dB (FM Only)
   - THD 1 % = -40.00 dB (FM + AM 30%)
   - AM Rejection: 0.00 dB

5. **Image Rejection**
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level (0dB)
   Decrease RF Level until S/N Ratio = 30dB, record RF Lev1
   Tune RF Gen to; Desired Freq. +/- 2 X IF Freq.
   Adjust RF Level until S/N Ratio = 30dB, record RF Lev2
   
   Measurement:
   - RF Lev1: -102.0 dBm (S/N Ratio = 30dB)
   - RF Lev2: -55.0 dBm (21.4MHz + 94.1MHz = 115.5MHz)
   - Image Rejection: -47.0 dB (RF Lev1 - RF Lev2)
Curve Tests
Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
Adjust: Set Radio audio to Std. Ref. Level (0dB) for both Mono and Stereo set ups.

Plot: Signal, Noise Vs RF Level (Mono)
   Signal, Noise Vs RF Level (L+R, Stereo)
   Stereo Separation Vs RF Level (L only, Stereo)
Record: Noise floor at -45dBm without Low Pass Filter as a measure of pilot rejection

CURVE DATA

<table>
<thead>
<tr>
<th>RF Level dBm</th>
<th>Signal Mono (dB)</th>
<th>Noise Mono (dB)</th>
<th>Signal Stereo (dB)</th>
<th>Filter Noise Stereo (dB)</th>
<th>Noise Stereo (dB)</th>
<th>Left Separation (dB)</th>
<th>Right Separation (dB)</th>
<th>RF Level dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>-130</td>
<td>-36.00</td>
<td>-36.00</td>
<td>-35.00</td>
<td>-35.00</td>
<td>-35.00</td>
<td>-35.00</td>
<td>-35.00</td>
<td>-130</td>
</tr>
<tr>
<td>-125</td>
<td>-36.00</td>
<td>-36.00</td>
<td>-35.00</td>
<td>-35.00</td>
<td>-35.00</td>
<td>-35.00</td>
<td>-35.00</td>
<td>-125</td>
</tr>
<tr>
<td>-120</td>
<td>-35.50</td>
<td>-36.00</td>
<td>-34.50</td>
<td>-35.00</td>
<td>-34.50</td>
<td>-34.50</td>
<td>-35.00</td>
<td>-120</td>
</tr>
<tr>
<td>-115</td>
<td>-34.00</td>
<td>-36.00</td>
<td>-33.00</td>
<td>-35.00</td>
<td>-34.00</td>
<td>-34.00</td>
<td>-35.00</td>
<td>-115</td>
</tr>
<tr>
<td>-110</td>
<td>-27.80</td>
<td>-37.00</td>
<td>-28.50</td>
<td>-36.50</td>
<td>-30.50</td>
<td>-30.50</td>
<td>-31.50</td>
<td>-110</td>
</tr>
<tr>
<td>-105</td>
<td>-20.00</td>
<td>-40.00</td>
<td>-19.50</td>
<td>-39.00</td>
<td>-23.80</td>
<td>-23.80</td>
<td>-25.00</td>
<td>-105</td>
</tr>
<tr>
<td>-100</td>
<td>-11.00</td>
<td>-47.00</td>
<td>-11.00</td>
<td>-45.50</td>
<td>-14.00</td>
<td>-14.00</td>
<td>-15.00</td>
<td>-100</td>
</tr>
<tr>
<td>-95</td>
<td>-2.50</td>
<td>-54.50</td>
<td>-2.50</td>
<td>-54.00</td>
<td>-8.00</td>
<td>-8.00</td>
<td>-9.00</td>
<td>-95</td>
</tr>
<tr>
<td>-90</td>
<td>-1.75</td>
<td>-58.50</td>
<td>-1.80</td>
<td>-58.00</td>
<td>-7.00</td>
<td>-7.00</td>
<td>-8.00</td>
<td>-90</td>
</tr>
<tr>
<td>-85</td>
<td>-1.25</td>
<td>-62.50</td>
<td>-1.30</td>
<td>-61.00</td>
<td>-6.80</td>
<td>-7.00</td>
<td>-8.00</td>
<td>-85</td>
</tr>
<tr>
<td>-80</td>
<td>-1.00</td>
<td>-65.50</td>
<td>-1.00</td>
<td>-64.00</td>
<td>-6.00</td>
<td>-6.50</td>
<td>-8.00</td>
<td>-80</td>
</tr>
<tr>
<td>-75</td>
<td>-0.60</td>
<td>-67.00</td>
<td>-0.80</td>
<td>-65.00</td>
<td>-6.00</td>
<td>-6.50</td>
<td>-7.50</td>
<td>-75</td>
</tr>
<tr>
<td>-70</td>
<td>-0.30</td>
<td>-68.50</td>
<td>-0.50</td>
<td>-66.00</td>
<td>-5.30</td>
<td>-6.50</td>
<td>-7.50</td>
<td>-70</td>
</tr>
<tr>
<td>-65</td>
<td>0.00</td>
<td>-69.00</td>
<td>-0.25</td>
<td>-66.00</td>
<td>-4.50</td>
<td>-7.00</td>
<td>-6.50</td>
<td>-65</td>
</tr>
<tr>
<td>-60</td>
<td>0.00</td>
<td>-69.00</td>
<td>0.00</td>
<td>-66.00</td>
<td>-3.30</td>
<td>-9.00</td>
<td>-6.00</td>
<td>-60</td>
</tr>
<tr>
<td>-55</td>
<td>0.00</td>
<td>-69.00</td>
<td>0.00</td>
<td>-66.00</td>
<td>-2.00</td>
<td>-12.00</td>
<td>-5.50</td>
<td>-55</td>
</tr>
<tr>
<td>-50</td>
<td>0.00</td>
<td>-69.00</td>
<td>0.00</td>
<td>-66.00</td>
<td>-0.80</td>
<td>-17.50</td>
<td>-5.00</td>
<td>-50</td>
</tr>
<tr>
<td>-45</td>
<td>0.00</td>
<td>-69.00</td>
<td>0.00</td>
<td>-66.00</td>
<td>-41.50</td>
<td>0.00</td>
<td>-23.00</td>
<td>-45</td>
</tr>
</tbody>
</table>
FM Receiver Test Laboratory

7 Capture Ratio

NDY
Set Up: Test Set Up 3
Desired: Test Freq. 1, -55dBm, 1kHz, 22.5kHz dev, Mono
Undesired: Test Freq. 1, -130dBm, CW
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Increase Undesired signal until audio level drops 1dB, record Undesired RF level as RF Lev 1
Increase Undesired signal until audio level drops 30dB, record Undesired RF level as RF Lev 2

Measurement:
RF Lev 1: -56.92 dBm
RF Lev 2: -49.92 dBm

Capture Ratio: -3.50 dB (RF Lev 1 - RF Lev 2)/2

8 Selectivity - 1st Adjacent 30dB S/N (Upper and Lower)

Upper 1st
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1, -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1, -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBM</td>
<td>dBM</td>
</tr>
<tr>
<td>D/U</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-30.92</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-38.02</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.</td>
<td>-20.53</td>
</tr>
</tbody>
</table>

9 Selectivity - 2nd Adjacent 30dB S/N (Upper and Lower)

Upper 2nd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1, -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1, -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBM</td>
<td>dBM</td>
</tr>
<tr>
<td>D/U</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>8.08</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>8.08</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.</td>
<td>Max RF: -63.08</td>
</tr>
</tbody>
</table>
FM Receiver Test Laboratory

10 Selectivity - 1st Adjacent 50dB S/N (Upper and Lower)

Upper 1st
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBM</td>
<td>dBm</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-33.92</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-39.52</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.</td>
<td>-18.28</td>
</tr>
</tbody>
</table>

(RF D/U Up + RF D/U Lo)/2

11 Selectivity - 2nd Adjacent 50dB S/N (Upper and Lower)

Upper 2nd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBM</td>
<td>dBm</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-27.92</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-26.92</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.</td>
<td>-27.58</td>
</tr>
</tbody>
</table>

(RF D/U Up + RF D/U Lo)/2

12 Selectivity - 3rd Adjacent 50dB S/N (Upper and Lower)

Upper 3rd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 3rd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBM</td>
<td>dBm</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-25.92</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-20.92</td>
</tr>
<tr>
<td>Selectivity, 3rd Adj.</td>
<td>-31.58</td>
</tr>
</tbody>
</table>

(RF D/U Up + RF D/U Lo)/2
Additional Tests

13 10.7MHz Rejection
Using Test Set Up 1 at the desired frequency of 94.1MHz;
Set generator to 1kHz, 75kHz dev. / CW
Reduce RF level to obtain 30dB S/N ratio.
Record RF Level as RF Lev 1
Set RF generator to 10.7MHz
Adjust RF level to obtain 30dB S/N ratio
Record RF Level as RF Lev 2
Calculate the difference between the two RF levels

RF Lev 1 -103.70 dBm
RF Lev 2 -26.00 dBm
D/U -77.70 dB

14 10.7 IM Test
Using the three generator set up, set generators as follows;
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
Lower Undesired: 88.7MHz, 1kHz, 75kHz dev
Upper Undesired: 99.3MHz, 400Hz, 75kHz dev
Adjust: Undesired RF level to obtain -50dB noise floor, record RF lev 10.6MHz Spacing
Set upper undesired generator to 99.4MHz, Adjust RF lev for -50dB noise floor. (RF lev 10.7MHz Spacing)

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>dBm</td>
</tr>
<tr>
<td>D/U</td>
<td>D/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td>-13.07</td>
<td>-31.93</td>
</tr>
<tr>
<td></td>
<td>-13.07</td>
</tr>
<tr>
<td></td>
<td>-31.93</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Max Lev</td>
<td>-31.93</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>EOC:</td>
<td></td>
</tr>
</tbody>
</table>

15 10.7MHz (10.6MHz) Local Osc Interference Test
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
Set upper interferer generator to 104.7MHz (94.1MHz + 10.6MHz), 400Hz, 75kHz dev
a) Increase level of undesired signals until noise floor is -50dB (+/- 2dB). Record RF Lev for 10.6MHz Spacing
b) Re-adjust upper interfering generator to 104.8MHz (94.1MHz + 10.7MHz)
Re-adjust RF level for -50dB and record RF lev for 10.7MHz spacing

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>dBm</td>
</tr>
<tr>
<td>D/U</td>
<td>D/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td>-16.07</td>
<td>-28.93</td>
</tr>
<tr>
<td></td>
<td>-30.07</td>
</tr>
<tr>
<td></td>
<td>-14.93</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>EOC:</td>
<td></td>
</tr>
</tbody>
</table>
FM Receiver Test Laboratory

Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 5
Class: Automotive
Radio Mfg.: Ford
Model: F4XF-19B132-CB
Serial: 9411
Antenna Network: Ford FM
Audio load: 4 Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms

Comments: 0

Standard RF Levels

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>-45 dBm</td>
</tr>
<tr>
<td>Medium</td>
<td>-55 dBm</td>
</tr>
<tr>
<td>Weak</td>
<td>-65 dBm</td>
</tr>
</tbody>
</table>

Standard Test Set Ups

1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

Standard Tests

<table>
<thead>
<tr>
<th>Test Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Local Oscillator Frequency (Tuning Error)</td>
</tr>
<tr>
<td>2</td>
<td>Standard Audio Output (Audio level and distortion)</td>
</tr>
<tr>
<td>3</td>
<td>RF Input Overload (RF level required for 5% THD)</td>
</tr>
<tr>
<td>4</td>
<td>AM Rejection</td>
</tr>
<tr>
<td>5</td>
<td>Image Rejection</td>
</tr>
<tr>
<td>6</td>
<td>Curve Tests (plots of RF Level Vs Audio Output)</td>
</tr>
<tr>
<td>7</td>
<td>Capture Ratio</td>
</tr>
<tr>
<td>8</td>
<td>Selectivity; 1st Adjacent (30dB noise figure)</td>
</tr>
<tr>
<td>9</td>
<td>Selectivity; 2nd Adjacent (30dB noise figure)</td>
</tr>
<tr>
<td>10</td>
<td>Selectivity; 1st Adjacent (50dB noise figure)</td>
</tr>
<tr>
<td>11</td>
<td>Selectivity; 2nd Adjacent (50dB noise figure)</td>
</tr>
<tr>
<td>12</td>
<td>Selectivity; 3rd Adjacent (50dB noise figure)</td>
</tr>
<tr>
<td>13</td>
<td>10.7MHz Rejection</td>
</tr>
<tr>
<td>14</td>
<td>10.7MHz Intermodulation</td>
</tr>
<tr>
<td>15</td>
<td>10.7MHz Spurious (Local Osc. Interference)</td>
</tr>
</tbody>
</table>
Test Results:

1. Local Oscillator Frequency:
   104.800 MHz

2. Standard Audio Output:
   | Left Channel | THD   | Right Channel | THD   |
   | Vrms         | %     | Vrms          | %     |
   | 1.7          | 1.00% | 1.7           | 1.00% |

3. RF Input Overload:
   22.00 dBm Max Test Bed RF level - no change in level or THD

4. AM Rejection:
   0.00 dB

5. Image Rejection:
   -47.00 dB

6. Curve Tests:
   (See Flots)

7. Capture Ratio:
   -3.50 dB

8. Selectivity, First Adjacent, 30dB Noise Floor (Ave. D/U)
   -20.53 dB Mono
   -20.53 dB Stereo

   -63.08 dB Mono Max RF
   -63.08 dB Stereo Max RF

10. Selectivity, First Adjacent, 50dB Noise Floor (Ave D/U)
    -18.28 dB Mono
    -18.28 dB Stereo

11. Selectivity, Second Adjacent, 50dB Noise Floor (Ave. D/U)
    -27.58 dB Mono
    -27.58 dB Stereo

12. Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)
    -31.58 dB Mono
    -31.58 dB Stereo

13. 10.7MHz Rejection
    -77.70 dB

14. 10.7MHz IM
    -31.93 dB (10.6) Max RF
    -31.93 dB (10.7) Max RF

15. 10.7MHz Spurious (Local Osc. Interference)
    -28.93 dB (10.6) 0
    -14.93 dB (10.7) 0
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

Ford F4XF-19B132-CB
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

RF LEVEL (dBm)

Ford F4XF-19B132-CB
SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

Ford F4XF-19B132-CB
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

RF LEVEL (dBm)

 AUDIO LEVEL (dB)

Ford F4XF-19B132-CB
1st and 2nd ADJACENT CHANNEL SELECTIVITY
(30dB Noise Floor)

Insertion loss = -6dB

Max Level

RF Level (dBm)

Frequency (MHz)

93.50 93.60 93.70 93.80 93.90 94.00 94.10 94.20 94.30 94.40 94.50 94.60 94.70

Ford F4XF-19B132-CB
FM Receiver Test Laboratory

IM & L.O. Rejection
(50dB Noise Floor)

Insertion loss = -6dB

Frequency (MHz)

Ford F4XF-19B132-CB
Receiver #6

Denon

Home HiFi
FM Receiver Test Laboratory

Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 6
Class: Home Hi Fi Tuner
Radio Mfg.: Denon
Model: TU-680NAB
Serial: 2092400103

Antenna Network: 50/75 Ohm Trans. FM
________________________ AM

Audio load: 10K Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15KHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms.

Comments: Auto Mute/Man switch set to Auto for Stereo tests
Auto Mute/Man switch set to Man for Mono tests
Bandwidth switch set to Wide
NR/NE switch set to Off

Standard RF Levels
Strong: -45 dBm
Medium: -55 dBm
Weak: -65 dBm

Standard FM Test Frequencies
Low: 94.1 MHz
High: MHz

Standard Test Set Ups
1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

Standard Tests
1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF Input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
7. Capture Ratio
8. Selectivity; 1st Adjacent (30dB noise figure)
9. Selectivity; 2nd Adjacent (30dB noise figure)
10. Selectivity; 1st Adjacent (50dB noise figure)
11. Selectivity; 2nd Adjacent (50dB noise figure)
Single RF Tune Tests

1 Local Oscillator Frequency (Tuning Error)
Set Up: Connect Spectrum Analyzer to Radio Antenna input
Adjust: Tune radio to Test Freq. 1, measure L.O. Freq 1
       Tune radio to Test Freq. 2, measure L.O. Freq 2
Measurement: L.O. Freq 1  104.800 MHz
             L.O. Freq 2         MHz

2 Standard Audio Output
Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio Volume to Std. Ref. Level, record Left and Right channel audio level and THD
Measurement:

<table>
<thead>
<tr>
<th></th>
<th>Left Ch</th>
<th></th>
<th>Right Ch</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>0.58</td>
<td>Vrms 0 dB</td>
<td>0.56</td>
<td>Vrms</td>
</tr>
<tr>
<td>THD %</td>
<td>0.047 %</td>
<td>THD %</td>
<td>0.055 %</td>
<td></td>
</tr>
</tbody>
</table>

3 RF Input Overload
Set Up: Test Set Up 1, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level
       Increase RF Level until 5% THD at Radio output, record RF Level
Measurement: RF Lev.  22 dBm (@ 5% THD)
             EOC Worst case THD: 0.13%

4 AM Rejection
Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level, record THD
       Set modulation mode to FM (75kHz), AM (30%), record THD
Measurement:

<table>
<thead>
<tr>
<th>THD %</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0.06</td>
<td></td>
<td>0.06</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>THD</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.06</td>
<td></td>
<td>0.06</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AM Rejection:</th>
<th>0.00 dB</th>
</tr>
</thead>
</table>

5 Image Rejection
Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
       Decrease RF Level until S/N Ratio = 30dB, record RF Lev1
       Tune RF Gen to; Desired Freq. +/- 2 X IF Freq.
       Adjust RF Level until S/N Ratio = 30dB, record RF Lev2
Measurement:

<table>
<thead>
<tr>
<th>RF Lev1</th>
<th>-108 dBm</th>
<th>(S/N Ratio = 30dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Lev2</td>
<td>-26.68 dBm</td>
<td>(21.4MHz + 94.1MHz = 115.5MHz)</td>
</tr>
<tr>
<td>Image Rejection:</td>
<td>-81.3 dB</td>
<td>(RF Lev1 - RF Lev2)</td>
</tr>
</tbody>
</table>

(Within 0.5dB of max test bod RF level)
6 Curve Tests

Set Up: Test Set Up 2, Test Freq. 1, Medium, 1 kHz, 75kHz Dev, Mono/Stereo
Adjust: Set Radio audio to Std. Ref. Level (0dB) for both Mono and Stereo set ups.

Plot: Signal, Noise Vs RF Level (Mono)
                  Signal, Noise Vs RF Level (L=R, Stereo)
                  Stereo Separation Vs RF Level (L only, Stereo)
Record: Noise floor at -45dBm without Low Pass Filter as a measure of pilot rejection

CURVE DATA

<table>
<thead>
<tr>
<th>RF Level dBm</th>
<th>Mono (L) Signal dB</th>
<th>Noise dB</th>
<th>Stereo (L) Signal dB</th>
<th>Filt. Noise dB</th>
<th>Noise dB</th>
<th>Left dB</th>
<th>Right dB</th>
<th>RF Level dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>-130</td>
<td>-14.00</td>
<td>-14.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-130</td>
</tr>
<tr>
<td>-125</td>
<td>-14.00</td>
<td>-14.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-125</td>
</tr>
<tr>
<td>-120</td>
<td>-13.00</td>
<td>-15.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-120</td>
</tr>
<tr>
<td>-115</td>
<td>-9.00</td>
<td>-17.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-115</td>
</tr>
<tr>
<td>-110</td>
<td>-3.50</td>
<td>-24.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-110</td>
</tr>
<tr>
<td>-105</td>
<td>-1.00</td>
<td>-43.50</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-105</td>
</tr>
<tr>
<td>-100</td>
<td>0.00</td>
<td>-53.50</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-100</td>
</tr>
<tr>
<td>-95</td>
<td>0.00</td>
<td>-59.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-74.00</td>
<td>-95</td>
</tr>
<tr>
<td>-90</td>
<td>0.00</td>
<td>-64.50</td>
<td>0.00</td>
<td>-41.50</td>
<td>0.00</td>
<td>-38.50</td>
<td>-90</td>
<td></td>
</tr>
<tr>
<td>-85</td>
<td>0.00</td>
<td>-70.00</td>
<td>0.00</td>
<td>-46.50</td>
<td>0.00</td>
<td>-40.00</td>
<td>-85</td>
<td></td>
</tr>
<tr>
<td>-80</td>
<td>0.00</td>
<td>-74.00</td>
<td>0.00</td>
<td>-51.50</td>
<td>0.00</td>
<td>-40.50</td>
<td>-80</td>
<td></td>
</tr>
<tr>
<td>-75</td>
<td>0.00</td>
<td>-74.00</td>
<td>0.00</td>
<td>-56.00</td>
<td>0.00</td>
<td>-40.50</td>
<td>-75</td>
<td></td>
</tr>
<tr>
<td>-70</td>
<td>0.00</td>
<td>-74.00</td>
<td>0.00</td>
<td>-61.50</td>
<td>0.00</td>
<td>-40.50</td>
<td>-70</td>
<td></td>
</tr>
<tr>
<td>-65</td>
<td>0.00</td>
<td>-74.00</td>
<td>0.00</td>
<td>-66.50</td>
<td>0.00</td>
<td>-40.50</td>
<td>-65</td>
<td></td>
</tr>
<tr>
<td>-60</td>
<td>0.00</td>
<td>-74.00</td>
<td>0.00</td>
<td>-69.00</td>
<td>0.00</td>
<td>-40.50</td>
<td>-60</td>
<td></td>
</tr>
<tr>
<td>-55</td>
<td>0.00</td>
<td>-74.00</td>
<td>0.00</td>
<td>-71.00</td>
<td>0.00</td>
<td>-40.50</td>
<td>-55</td>
<td></td>
</tr>
<tr>
<td>-50</td>
<td>0.00</td>
<td>-74.00</td>
<td>0.00</td>
<td>-71.00</td>
<td>0.00</td>
<td>-40.50</td>
<td>-50</td>
<td></td>
</tr>
<tr>
<td>-45</td>
<td>0.00</td>
<td>-74.00</td>
<td>0.00</td>
<td>-71.00</td>
<td>0.00</td>
<td>-40.50</td>
<td>-45</td>
<td></td>
</tr>
</tbody>
</table>
Two RF Tone Tests

7 Capture Ratio
Set Up: Test Set Up 3
- Desired: Test Freq. 1, -55dBm, 1kHz, 22.5kHz dev, Mono
- Undesired: Test Freq. 1, -130dBm, CW
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Increase Undesired signal until audio level drops 1dB, record Undesired RF level as RF Lev 1
Increase Undesired signal until audio level drops 30dB, record Undesired RF level as RF Lev 2

Measurement:
- RF Lev 1: -55.22 dBm
- RF Lev 2: -52.92 dBm

Capture Ratio: \(-1.15\) dB (RF Lev 1 - RF Lev 2)/2

8 Selectivity - 1st Adjacent 30dB S/N (Upper and Lower)
Upper 1st
Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>dBm</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>D/U</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-42.22</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-54.22</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.:</td>
<td>-6.78</td>
</tr>
</tbody>
</table>

9 Selectivity - 2nd Adjacent 30dB S/N (Upper and Lower)
Upper 2nd
Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>dBm</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>D/U</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>2.68</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-9.52</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.:</td>
<td>-51.58</td>
</tr>
</tbody>
</table>
# FM Receiver Test Laboratory

## 10 Selectivity - 1st Adjacent 50dB S/N (Upper and Lower)

### Upper 1st

Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono

Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

### Lower 1st

Set Up: 
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono

Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-58.52</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.</td>
<td>-2.53</td>
</tr>
</tbody>
</table>

(RF D/U Up + RF D/U Lo)/2

## 11 Selectivity - 2nd Adjacent 50dB S/N (Upper and Lower)

### Upper 2nd

Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono

Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

### Lower 2nd

Set Up:
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono

Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-16.92</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-12.52</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.</td>
<td>-40.28</td>
</tr>
</tbody>
</table>

(RF D/U Up + RF D/U Lo)/2

## 12 Selectivity - 3rd Adjacent 50dB S/N (Upper and Lower)

### Upper 3rd

Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 +600kHz, -130dBm, 1kHz, 75kHz Dev, Mono

Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

### Lower 3rd

Set Up:
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 -600kHz, -130dBm, 1kHz, 75kHz Dev, Mono

Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-19.92</td>
</tr>
<tr>
<td>Selectivity, 3rd Adj.</td>
<td>-37.83</td>
</tr>
</tbody>
</table>

(RF D/U Up + RF D/U Lo)/2

---

File Name: C_den680

FM TESTS

Page 5 of 15
Additional Tests

13 10.7MHz Rejection
   Using Test Set Up 1 at the desired frequency of 94.1MHz,
   Set generator to 1kHz, 75kHz dev. / CW
   Reduce RF level to obtain 30dB S/N ratio.
   Record RF Level as RF Lev 1
   Set RF generator to 10.7MHz
   Adjust RF level to obtain 30dB S/N ratio
   Record RF Level as RF Lev 2
   Calculate the difference between the two RF levels

   | RF Lev 1 | -106.50 dBm |
   | RF Lev 2 | -22.00 dBm  |
   | D/U      | -128.50 dB  |

14 10.7 IM Test
   Using the three generator set up, set generators as follows;
   Set Up:  Desired: 94.1MHz, -45dBm, Pilot only
   Lower Undesired: 88.7MHz, 1kHz, 75kHz dev
   Upper Undesired: 99.3MHz, 400Hz, 75kHz dev
   Adjust: Undesired RF level to obtain -50dB noise floor, record RF lev 10.6MHz Spacing
   Set upper undesired generator to 99.4MHz. Adjust RF lev for -50dB noise floor. (RF lev 10.7MHz Spacing)

   | 10.6MHz Spacing | 10.7MHz Spacing |
   | dBm            | dBm            | dBm    | D/U |
   | -45.00         | -45.00         |
   | Max RF         | -31.63         | -31.63 |

   EOC: No impact on noise floor
   No impact on noise floor

15 10.7MHz (10.6MHz) Local Osc Interference Test
   Set Up: Desired: 94.1MHz, -45dBm, Pilot only
   Set upper interferer generator to 104.7MHz (94.1MHz + 10.6MHz), 400Hz, 75kHz dev
   a) Increase level of undesired signals until noise floor is -50dB (+/- 2dB). Record RF Lev for 10.6MHz Spacing
   b) Re-adjust upper interfering generator to 104.8MHz (94.1MHz + 10.7MHz)
   Re-adjust RF level for -50dB and record RF lev for 10.7MHz spacing

   | 10.6MHz Spacing | 10.7MHz Spacing |
   | dBm            | dBm            | dBm    | D/U |
   | -45.00         | -45.00         |
   | -13.37         | -15.37         |
   | Max RF         | -31.63         | -29.63 |

   EOC: Objectionable beat notes
FM Receiver Test Laboratory

Date: 2/28/99
Engineers: EMc
Project: FM Receiver Test A1

Receiver Test No.: 6
Class: Home Hi Fi Tuner
Radio Mfg.: Denon
Model: TT-680NAB
Serial: 2092400103

Antenna Network: 50/75 Ohm Trans. FM

Audio load: 10K Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms

Comments: Auto Mute/Mann switch set to Auto for Stereo tests
Auto Mute/Mann switch set to Man for Mono tests
Bandwidth switch set to Wide
NR/NB switch set to Off

Standard RF Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>-45</td>
</tr>
<tr>
<td>Medium</td>
<td>-55</td>
</tr>
<tr>
<td>Weak</td>
<td>-65</td>
</tr>
</tbody>
</table>

Standard FM Test Frequencies

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>94.1MHz</td>
<td></td>
</tr>
</tbody>
</table>

Standard Set Ups

1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

Standard Tests

1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF Input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
6. Curve Tests (plots of RF Level Vs Audio Output)
7. Capture Ratio
8. Selectivity; 1st Adjacent (30dB noise figure)
9. Selectivity; 2nd Adjacent (30dB noise figure)
10. Selectivity; 1st Adjacent (50dB noise figure)
11. Selectivity; 2nd Adjacent (50dB noise figure)
12. Selectivity; 3rd Adjacent (50dB noise figure)
13. 10.7MHz Rejection
14. 10.7MHz Intermodulation
15. 10.7MHz Spurious (Local Osc. Interference)
Test Results:

1. Local Oscillator Frequency:
   - 104.800 MHz

2. Standard Audio Output:
<table>
<thead>
<tr>
<th>Left Channel</th>
<th>THD</th>
<th>Right Channel</th>
<th>THD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.58 Vrms</td>
<td>0.047 %</td>
<td>0.56 Vrms</td>
<td>0.055 %</td>
</tr>
</tbody>
</table>

3. RF Input Overload:
   - 22.00 dBm
   - Worst case THD: 0.13%

4. AM Rejection:
   - 0.00 dB

5. Image Rejection:
   - -81.32 dB

6. Curve Tests:
   (See Plots)

7. Capture Ratio:
   - -1.15 dB

8. Selectivity, First Adjacent, 30dB Noise Floor (Ave. D/U)
   - -6.78 dB Mono
   - -6.58 dB Stereo

   - -51.58 dB Mono
   - -51.58 dB Stereo

10. Selectivity, First Adjacent, 50dB Noise Floor (Ave D/U)
    - -2.53 dB Mono
    - -2.33 dB Stereo

11. Selectivity, Second Adjacent, 50dB Noise Floor (Ave. D/U)
    - -40.28 dB Mono
    - -37.88 dB Stereo

12. Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)
    - -37.83 dB Mono
    - -37.83 dB Stereo

13. 10.7MHz Rejection
    - -128.50 dB

14. 10.7MHz IM
    - -31.63 dB (10.6) Max RF No impact on noise floor
    - -31.63 dB (10.7) Max RF No impact on noise floor

15. 10.7MHz Spurious (Local Osc. Interference)
    - -31.63 dB (10.6) Max RF Objectionable beat notes
    - -29.63 dB (10.7)

FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6 dB

Denon TU-680NAB
SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

RF LEVEL (dBm)

Denon TU-680NAB
SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

RF LEVEL (dBm)

Denon TU-680NAB
SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

RF LEVEL (dBm)

Denon TU-680NAB
1st and 2nd ADJACENT CHANNEL SELECTIVITY
(30dB Noise Floor)

Frequency (MHz)

RF Level (dBm)

Max Level

Insertion loss = -6dB

Mono
Stereo

Denon TU-680NAB
1st, 2nd and 3rd ADJACENT CHANNEL SELECTIVITY
(50dB Noise Floor)

Insertion loss = -6dB

Denon TU-680NAB
FM Receiver Test Laboratory

IM & L.O. Rejection
(50dB Noise Floor)

Insertion loss = -6dB

Denon TU-680NAB
Receiver #7

Audiovox

Auto
FM Receiver Test Laboratory

Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 7
Class: Automotive
Radio Mfg.: Audvox
Model: AV-220
Serial: 30901807N

Antenna Network: JFW 50MN-001 FM
AM

Audio load: 4 Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off. Balance and Fader controls centered (set to mid position). Volume set to Standard Output Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms

Comments: Tone control at detent position
Balance control at detent for test 2, re-adjusted for proper balance for subsequent tests

<table>
<thead>
<tr>
<th>Standard RF Levels</th>
<th>Standard FM Test Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong: -45 dBM</td>
<td>Low: 94.1 MHz</td>
</tr>
<tr>
<td>Medium: -55 dBM</td>
<td></td>
</tr>
<tr>
<td>Weak: -65 dBM</td>
<td></td>
</tr>
</tbody>
</table>

Standard Test Set Ups
1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

Standard Tests
1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF Input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
7. Capture Ratio
8. Selectivity; 1st Adjacent (30dB noise figure)
9. Selectivity; 2nd Adjacent (30dB noise figure)
10. Selectivity; 1st Adjacent (50dB noise figure)
11. Selectivity; 2nd Adjacent (50dB noise figure)
1. **Local Oscillator Frequency (Tuning Error)**
Set Up: Connect Spectrum Analyzer to Radio Antenna input
Adjust: Tune radio to Test Freq. 1, measure L.O. Freq 1
Tune radio to Test Freq. 2, measure L.O. Freq 2

Measurement:
- L.O. Freq 1: 104.800 MHz
- L.O. Freq 2: ______ MHz

2. **Standard Audio Output**
Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio Volume to Std. Ref. Level, record Left and Right channel audio level and THD

Measurement:

<table>
<thead>
<tr>
<th>Left Ch</th>
<th>Right Ch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1.9 Vrms</td>
<td>Level 1.2 Vrms</td>
</tr>
<tr>
<td>THD 0.74%</td>
<td>THD 0.73%</td>
</tr>
</tbody>
</table>

Note: Due to L/R imbalance, Balance control adjusted to L=R for subsequent tests

3. **RF Input Overload**
Set Up: Test Set Up 1, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level
Increase RF Level until 5% THD at Radio output, record RF Level

Measurement:
- **RF Lev. 22 dBm** (@ 5% THD)
- Max Test Bed RF level - no change in level or THD

4. **AM Rejection**
Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level, record THD
Set modulation mode to FM (75kHz), AM (30%), record THD

Measurement:
- THD 0.74% = -42.62 dB (FM Only)
- THD 0.74% = -42.62 dB (FM + AM 30%)

AM Rejection: 0.00 dB

5. **Image Rejection**
Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Decrease RF Level until S/N Ratio = 30dB, record RF Lev1
Tune RF Gen to: Desired Freq. +/- 2 X IF Freq.
Adjust RF Level until S/N Ratio = 30dB, record RF Lev2

Measurement:
- **RF Lev1 -107 dBm** (S/N Ratio = 30dB)
- RF Lev2 -52 dBm (21.4MHz + 94.1MHz = 115.5MHz)
- **Image Rejection: -55.0 dB** (RF Lev1 - RF Lev2)
**Curve Tests**

Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
Adjust: Set Radio audio to Std. Ref. Level (0dB) for both Mono and Stereo set ups.

Plot: Signal, Noise Vs RF Level (Mono)
Signal, Noise Vs RF Level (L+R, Stereo)
Stereo Separation Vs RF Level (L only, Stereo)
Record: Noise floor at -45dBm without Low Pass Filter as a measure of pilot rejection

### CURVE DATA

#### SIGNAL, NOISE & SEPARATION VS RF LEVEL

<table>
<thead>
<tr>
<th>RF Level dBm</th>
<th>Mono (L)</th>
<th>Stereo (L)</th>
<th>Separation L--&gt;R</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Signal dB</td>
<td>Noise dB</td>
<td>Signal dB</td>
</tr>
<tr>
<td>-130</td>
<td>-28.00</td>
<td>-28.00</td>
<td>-27.00</td>
</tr>
<tr>
<td>-125</td>
<td>-28.00</td>
<td>-28.00</td>
<td>-27.00</td>
</tr>
<tr>
<td>-120</td>
<td>-26.50</td>
<td>-29.00</td>
<td>-25.50</td>
</tr>
<tr>
<td>-115</td>
<td>-22.50</td>
<td>-30.00</td>
<td>-22.00</td>
</tr>
<tr>
<td>-110</td>
<td>-15.50</td>
<td>-35.00</td>
<td>-15.00</td>
</tr>
<tr>
<td>-105</td>
<td>-9.00</td>
<td>-49.00</td>
<td>-8.50</td>
</tr>
<tr>
<td>-100</td>
<td>-4.50</td>
<td>-57.00</td>
<td>-4.00</td>
</tr>
<tr>
<td>-95</td>
<td>-2.20</td>
<td>-62.00</td>
<td>-2.00</td>
</tr>
<tr>
<td>-90</td>
<td>-1.80</td>
<td>-64.00</td>
<td>-1.80</td>
</tr>
<tr>
<td>-85</td>
<td>-1.50</td>
<td>-65.00</td>
<td>-1.50</td>
</tr>
<tr>
<td>-80</td>
<td>-0.60</td>
<td>-65.50</td>
<td>-0.50</td>
</tr>
<tr>
<td>-75</td>
<td>-0.20</td>
<td>-66.50</td>
<td>0.00</td>
</tr>
<tr>
<td>-70</td>
<td>0.00</td>
<td>-67.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-65</td>
<td>0.00</td>
<td>-67.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-60</td>
<td>0.00</td>
<td>-67.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-55</td>
<td>0.00</td>
<td>-67.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-50</td>
<td>0.00</td>
<td>-67.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-45</td>
<td>0.00</td>
<td>-67.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>
FM Receiver Test Laboratory

Two RF Tone Tests

7 Capture Ratio
Set Up: Test Set Up 3
Desired: Test Freq. 1, -55dBm, 1kHz, 22.5kHz dev, Mono
Undesired: Test Freq. 1, -130dBm, CW
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Increase Undesired signal until audio level drops 1dB, record Undesired RF level as RF Lev 1
Increase Undesired signal until audio level drops 30dB, record Undesired RF level as RF Lev 2

Measurement:
RF Lev 1 __-59.91__ dBm
RF Lev 2 __-55.41__ dBm

Capture Ratio: __-2.25__ dB (RF Lev 1 - RF Lev 2)/2

8 Selectivity - 1st Adjacent 30dB S/N (Upper and Lower)
Upper 1st
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>dBm</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-27.12</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-46.22</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.</td>
<td>-18.33</td>
</tr>
</tbody>
</table>

(RF D/U Up + RF D/U Lo)/2

9 Selectivity - 2nd Adjacent 30dB S/N (Upper and Lower)
Upper 2nd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>dBm</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>8.08</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>8.08</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.</td>
<td>Max RF</td>
</tr>
</tbody>
</table>

(RF D/U Up + RF D/U Lo)/2
Selectivity - 1st Adjacent 50dB S/N (Upper and Lower)
Upper 1st
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mono 50dB</td>
</tr>
<tr>
<td>-55.00 dBm</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
</tr>
<tr>
<td>-27.92 dBm</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
</tr>
<tr>
<td>-51.82 dBm</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.</td>
</tr>
<tr>
<td>-15.13 dBm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>D/U</td>
<td>D/U</td>
</tr>
</tbody>
</table>

(RF D/U Up + RF D/U Lo)/2

Selectivity - 2nd Adjacent 50dB S/N (Upper and Lower)
Upper 2nd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mono 50dB</td>
</tr>
<tr>
<td>-55.00 dBm</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
</tr>
<tr>
<td>1.08 dBm</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
</tr>
<tr>
<td>6.38 dBm</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.</td>
</tr>
<tr>
<td>-58.73 dBm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>D/U</td>
<td>D/U</td>
</tr>
</tbody>
</table>

(RF D/U Up + RF D/U Lo)/2

Selectivity - 3rd Adjacent 50dB S/N (Upper and Lower)
Upper 3rd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 3rd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mono 50dB</td>
</tr>
<tr>
<td>-55.00 dBm</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
</tr>
<tr>
<td>8.08 dBm</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
</tr>
<tr>
<td>5.08 dBm</td>
</tr>
<tr>
<td>Selectivity, 3rd Adj.</td>
</tr>
<tr>
<td>-61.58 dBm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>D/U</td>
<td>D/U</td>
</tr>
</tbody>
</table>

(RF D/U Up + RF D/U Lo)/2
Additional Tests

13 10.7MHz Rejection
Using Test Set Up 1 at the desired frequency of 94.1MHz;
Set generator to 1kHz, 75kHz dev. / CW
Reduce RF level to obtain 30dB S/N ratio.
Record RF Level as RF Lev 1
Set RF generator to 10.7MHz
Adjust RF level to obtain 30dB S/N ratio
Record RF Level as RF Lev 2
Calculate the difference between the two RF levels

<table>
<thead>
<tr>
<th>RF Lev 1</th>
<th>-105.50  dBm</th>
<th>EOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Lev 2</td>
<td>-15.50  dBm</td>
<td></td>
</tr>
<tr>
<td>D/U</td>
<td>90.00  dB</td>
<td></td>
</tr>
</tbody>
</table>

14 10.7 IM Test
Using the three generator set up, set generators as follows;
Set Up:   Desired: 94.1MHz, -45dBm, Pilot only
Lower Undesired: 88.7MHz, 1kHz, 75kHz dev
Upper Undesired: 99.3MHz, 400Hz, 75kHz dev
Adjust:   Undesired RF level to obtain -50dB noise floor, record RF lev 10.6MHz Spacing
Set upper undesired generator to 99.4MHz. Adjust RF lev for -50dB noise floor. (RF lev 10.7MHz Spacing)

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm D/U</td>
<td>dBm D/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EOC:

15 10.7MHz (10.6MHz) Local Osc Interference Test
Set Up:   Desired: 94.1MHz, -45dBm, Pilot only
Set upper interferer generator to 104.7MHz (94.1MHz + 10.6MHz), 400Hz, 75kHz dev
a) Increase level of undesired signals until noise floor is -50dB (+/- 2dB). Record RF Lev for 10.6MHz Spacing
b) Re-adjust upper interfering generator to 104.8MHz (94.1MHz + 10.7MHz)
Re-adjust RF level for -50dB and record RF lev for 10.7MHz spacing

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm D/U</td>
<td>dBm D/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EOC: These figures represent RF levels at 83.4MHz
Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 7
Class: Automotive
Radio Mfg.: Audiovox
Model: AV-220
Serial: 30901807N

Antenna Network: JFW 50MN-001 FM

Audio load: 4 Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output
Any other control settings unique to the radio under test shall be noted in the Comments section.
Left channel shall be used for all Signal (and S/N ratio) measurements.
15kHz Low Pass filter shall be used on the output of the left channel for all measurements.
Right channel shall be used for Noise measurements - Stereo Separation test only.
All level measurements are rms

Comments: Tone control at detent position
Balance control at detent for test 2, re-adjusted for proper balance for subsequent tests

Standard RF Levels
Strong: -45 dBm
Medium: -55 dBm
Weak: -65 dBm

Standard Test Set Ups
1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

Standard Tests
1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF Input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
6. Curve Tests (plots of RF Level Vs Audio Output)
7. Capture Ratio
8. Selectivity, 1st Adjacent (30dB noise figure)
9. Selectivity, 2nd Adjacent (30dB noise figure)
10. Selectivity, 1st Adjacent (50dB noise figure)
11. Selectivity, 2nd Adjacent (50dB noise figure)
12. Selectivity, 3rd Adjacent (50dB noise figure)

Standard FM Test Frequencies
94.1MHz

10.7MHz Rejection
10.7MHz Intermodulation
10.7MHz Spurious (Local Osc. Interference)

File Name: C_audvox
FM RESULTS
Page 7 of 15
Test Results:

1 Local Oscillator Frequency:
   104.800 MHz

2 Standard Audio Output:
<table>
<thead>
<tr>
<th>Channel</th>
<th>THD</th>
<th>Right Channel</th>
<th>THD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left</td>
<td>Vrms</td>
<td>0.74 %</td>
<td></td>
</tr>
<tr>
<td>1.9 Vrms</td>
<td></td>
<td>1.2 Vrms</td>
<td>0.73 %</td>
</tr>
</tbody>
</table>

3 RF Input Overload:
   22.00 dBm
   Max Test Bed RF level - no change in level or THD

4 AM Rejection:
   0.00 dB

5 Image Rejection:
   -55.00 dB

6 Curve Tests:
   (See Plots)

7 Capture Ratio:
   -2.25 dB

8 Selectivity, First Adjacent, 30dB Noise Floor (Ave. D/U)
   -18.33 dB Mono
   -14.73 dB Stereo

9 Selectivity, Second Adjacent, 30dB Noise Floor (Ave. D/U)
   -63.08 dB Mono
   -63.08 dB Stereo

10 Selectivity, First Adjacent, 50dB Noise Floor (Ave D/U)
    -15.13 dB Mono
    2.17 dB Stereo

11 Selectivity, Second Adjacent, 50dB Noise Floor (Ave. D/U)
   -58.73 dB Mono
   -54.08 dB Stereo

12 Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)
   -61.58 dB Mono
   -54.08 dB Stereo

13 10.7MHz Rejection
   90.00 dB

14 10.7MHz IM (D/U)
    -26.63 dB (10.6)
    -24.63 dB (10.7)

15 10.7MHz Spurious - Local Osc. Interference (D/U)
    -30.63 dB (10.6)
    -30.63 dB (10.7)
    These figures represent RF levels at 83.4MHz
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

Audiovox AV-220
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

Audiovox AV-220

File Name: C_audvox

FM Stereo Plot
SIGNAL/NOISE VS RF LEVEL

Audiovox AV-220

Insertion loss = -6dB
SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

Audiovox AV-220
1st and 2nd ADJACENT CHANNEL SELECTIVITY
(30dB Noise Floor)

Audiovox AV-220

Insertion loss = -6dB
1st, 2nd and 3rd ADJACENT CHANNEL SELECTIVITY
(50dB Noise Floor)

Insertion loss = -6dB

Audiovox AV-220
IM & L.O. Rejection
(50dB Noise Floor)

Insertion loss = -6dB

Audiovox AV-220
Receiver #8

Sony

Home HiFi
FM Receiver Test Laboratory

Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 8
Class: Home Hi Fi Receiver
Radio Mfg.: Sony
Model: STR-AV21
Serial: 802086

Antenna Network: 50/75 Ohm Trans. FM

Audio load: 10K Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are r.m.s.

Comments: Audio Output: Tape Rec line output

<table>
<thead>
<tr>
<th>Standard RF Levels</th>
<th>Standard FM Test Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong: -45 dBm</td>
<td>Low: 94.1 MHz</td>
</tr>
<tr>
<td>Medium: -55 dBm</td>
<td></td>
</tr>
<tr>
<td>Weak: -65 dBm</td>
<td></td>
</tr>
</tbody>
</table>

Standard Test Set Ups

1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

Standard Tests

1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF Input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
7. Capture Ratio
8. Selectivity, 1st Adjacent (30dB noise figure)
9. Selectivity, 2nd Adjacent (30dB noise figure)
10. Selectivity, 1st Adjacent (50dB noise figure)
11. Selectivity, 2nd Adjacent (50dB noise figure)
**Single RF Tone Tests**

1. **Local Oscillator Frequency (Tuning Error)**
   - Set Up: Connect Spectrum Analyzer to Radio Antenna input
   - Adjust: Tune radio to Test Freq. 1, measure L.O. Freq 1
     - Tune radio to Test Freq. 2, measure L.O. Freq 2

   Measurement:
   - L.O. Freq 1: 104.800 MHz
   - L.O. Freq 2: _______ MHz

2. **Standard Audio Output**
   - Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   - Adjust: Set Radio Volume to Std. Ref. Level, record Left and Right channel audio level and THD

   Measurement:
<table>
<thead>
<tr>
<th>Left Ch</th>
<th>Right Ch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>Vrms</td>
</tr>
<tr>
<td>0.325</td>
<td>dB</td>
</tr>
</tbody>
</table>

3. **RF Input Overload**
   - Set Up: Test Set Up 1, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   - Adjust: Set audio to Std. Ref. Level
     - Increase RF Level until 5% THD at Radio output, record RF Level

   Measurement: RF Lev. 22.00 dBm (at 5% THD)
   - Max Test Bed RF level - slight increase in THD (0.26%)

4. **AM Rejection**
   - Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   - Adjust: Set Radio audio to Std. Ref. Level, record THD
     - Set modulation mode to FM (75kHz), AM (30%), record THD

   Measurement:
   - THD 0.22 % = -53.15 dB (FM Only)
   - THD 0.22 % = -53.15 dB (FM + AM 30%)

   AM Rejection: 0.00 dB

5. **Image Rejection**
   - Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   - Adjust: Set Radio audio to Std. Ref. Level (0dB)
     - Decrease RF Level until S/N Ratio = 30dB, record RF Lev1
     - Tune RF Gen to Desired Freq. +/- 2 X IF Freq.
     - Adjust RF Level until S/N Ratio = 30dB, record RF Lev2

   Measurement:
   - RF Lev1: -109.0 dBm (S/N Ratio = 30dB)
   - RF Lev2: -63.0 dBm (21.4MHz + 94.1MHz = 115.5MHz)

   Image Rejection: -46.00 dB (RF Lev1 - RF Lev2)
Curve Tests

Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
Adjust: Set Radio audio to Std. Ref. Level (0dB) for both Mono and Stereo set ups.

Plot:
- Signal, Noise Vs RF Level (Mono)
- Signal, Noise Vs RF Level (L+R, Stereo)
- Stereo Separation Vs RF Level (L only, Stereo)

Record: Noise floor at -45dBm without Low Pass Filter as a measure of pilot rejection

**CURVE DATA**

**SIGNAL, NOISE & SEPARATION VS RF LEVEL**

<table>
<thead>
<tr>
<th>RF Level dBM</th>
<th>Mono (L)</th>
<th>Stereo (L)</th>
<th>Separation L-&gt;R</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Signal dB</td>
<td>Noise dB</td>
<td>Signal dB</td>
</tr>
<tr>
<td>-130</td>
<td>-19.00</td>
<td>-19.00</td>
<td>-18.50</td>
</tr>
<tr>
<td>-125</td>
<td>-18.50</td>
<td>-19.50</td>
<td>-18.00</td>
</tr>
<tr>
<td>-120</td>
<td>-16.00</td>
<td>-20.00</td>
<td>-16.00</td>
</tr>
<tr>
<td>-115</td>
<td>-10.00</td>
<td>-22.50</td>
<td>-10.00</td>
</tr>
<tr>
<td>-110</td>
<td>-4.00</td>
<td>-30.00</td>
<td>-4.00</td>
</tr>
<tr>
<td>-105</td>
<td>-0.50</td>
<td>-44.00</td>
<td>-0.50</td>
</tr>
<tr>
<td>-100</td>
<td>0.00</td>
<td>-51.50</td>
<td>0.00</td>
</tr>
<tr>
<td>-95</td>
<td>0.00</td>
<td>-58.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-90</td>
<td>0.00</td>
<td>-64.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-85</td>
<td>0.00</td>
<td>-69.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-80</td>
<td>0.00</td>
<td>-70.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-75</td>
<td>0.00</td>
<td>-70.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-70</td>
<td>0.00</td>
<td>-70.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-65</td>
<td>0.00</td>
<td>-70.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-60</td>
<td>0.00</td>
<td>-70.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-55</td>
<td>0.00</td>
<td>-70.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-50</td>
<td>0.00</td>
<td>-70.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-45</td>
<td>0.00</td>
<td>-70.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Two RF Tone Tests

7 Capture Ratio
Set Up: Test Set Up 3
Desired: Test Freq. 1, -55dBm, 1kHz, 22.5kHz Dev, Mono
Undesired: Test Freq. 1, -130dBm, CW
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Increase Undesired signal until audio level drops 1dB, record Undesired RF level as RF Lev 1
Increase Undesired signal until audio level drops 30dB, record Undesired RF level as RF Lev 2
Measurement:
RF Lev 1 -56.20 dBm
RF Lev 2 -50.50 dBm
Capture Ratio: -5.95 dB (RF Lev 1 - RF Lev 2)/2

8 Selectivity - 1st Adjacent 30dB S/N (Upper and Lower)
Upper 1st
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.
Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev Mono 30dB</th>
<th>Desired Lev Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-55.00</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev Mono 30dB</td>
<td>Undesired Upper Lev Stereo 30dB</td>
</tr>
<tr>
<td>-41.72</td>
<td>-41.28</td>
</tr>
<tr>
<td>Undesired Lower Lev Mono 30dB</td>
<td>Undesired Lower Lev Stereo 30dB</td>
</tr>
<tr>
<td>-49.62</td>
<td>-51.22</td>
</tr>
<tr>
<td>Selectivity, 1st Adj. Mono 30dB</td>
<td>Selectivity, 1st Adj. Stereo 30dB</td>
</tr>
<tr>
<td>-9.33</td>
<td>-3.78</td>
</tr>
</tbody>
</table>

(56 D/U Up + 56 D/U Lo)/2

9 Selectivity - 2nd Adjacent 30dB S/N (Upper and Lower)
Upper 2nd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.
Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev Mono 30dB</th>
<th>Desired Lev Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-55.00</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev Mono 30dB</td>
<td>Undesired Upper Lev Stereo 30dB</td>
</tr>
<tr>
<td>8.08</td>
<td>8.08</td>
</tr>
<tr>
<td>Undesired Lower Lev Mono 30dB</td>
<td>Undesired Lower Lev Stereo 30dB</td>
</tr>
<tr>
<td>8.08</td>
<td>8.08</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj. Mono 30dB</td>
<td>Selectivity, 2nd Adj. Stereo 30dB</td>
</tr>
<tr>
<td>Max RF</td>
<td>Max RF</td>
</tr>
</tbody>
</table>

(56 D/U Up + 56 D/U Lo)/2
### Selectivity - 1st Adjacent 50dB S/N (Upper and Lower)

**Upper 1st**
- **Set Up:** Test Set Up 3
  - Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
  - Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
- **Adjust:** Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
  - Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-43.62</td>
<td>-11.36</td>
<td>-61.22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-52.22</td>
<td>-2.78</td>
<td>-71.22</td>
</tr>
</tbody>
</table>

**Selectivity, 1st Adj.:** -5.08 + (RF D/U Up + RF D/U Lo)/2

**Lower 1st**
- **Set Up:**
  - Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
  - Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
- **Adjust:** Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
  - Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-43.62</td>
<td>-11.36</td>
<td>-61.22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-52.22</td>
<td>-2.78</td>
<td>-71.22</td>
</tr>
</tbody>
</table>

**Selectivity, 1st Adj.:** -7.08 + (RF D/U Up + RF D/U Lo)/2

### Selectivity - 2nd Adjacent 50dB S/N (Upper and Lower)

**Upper 2nd**
- **Set Up:** Test Set Up 3
  - Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
  - Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
- **Adjust:** Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
  - Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-24.22</td>
<td>-30.78</td>
<td>-24.22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-24.22</td>
<td>-30.78</td>
<td>-24.22</td>
</tr>
</tbody>
</table>

**Selectivity, 2nd Adj.:** -30.78 + (RF D/U Up + RF D/U Lo)/2

**Lower 2nd**
- **Set Up:**
  - Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
  - Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
- **Adjust:** Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
  - Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-24.22</td>
<td>-30.78</td>
<td>-24.22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-24.22</td>
<td>-30.78</td>
<td>-24.22</td>
</tr>
</tbody>
</table>

**Selectivity, 2nd Adj.:** -30.78 + (RF D/U Up + RF D/U Lo)/2

### Selectivity - 3rd Adjacent 50dB S/N (Upper and Lower)

**Upper 3rd**
- **Set Up:** Test Set Up 3
  - Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
  - Undesired: Test Freq. 1 +600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
- **Adjust:** Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
  - Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.08</td>
<td>-63.08</td>
<td>8.08</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-22.22</td>
<td>-32.78</td>
<td>-22.22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-47.93</td>
<td></td>
<td>-47.93</td>
</tr>
</tbody>
</table>

**Selectivity, 3rd Adj.:** -47.93 + (RF D/U Up + RF D/U Lo)/2

**Lower 3rd**
- **Set Up:**
  - Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
  - Undesired: Test Freq. 1 -600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
- **Adjust:** Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
  - Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.08</td>
<td>-63.08</td>
<td>8.08</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-22.22</td>
<td>-32.78</td>
<td>-22.22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desired Lev dBm</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>-47.93</td>
<td></td>
<td>-47.93</td>
</tr>
</tbody>
</table>

**Selectivity, 3rd Adj.:** -47.93 + (RF D/U Up + RF D/U Lo)/2
Additional Tests

13 10.7MHz Rejection
Using Test Set Up 1 at the desired frequency of 94.1MHz;
Set generator to 1kHz, 75kHz dev. / CW
Reduce RF level to obtain 30dB S/N ratio.
Record RF Level as RF Lev 1
Set RF generator to 10.7MHz
Adjust RF level to obtain 30dB S/N ratio
Record RF Level as RF Lev 2
Calculate the difference between the two RF levels

| RF Lev 1   |  -109.00 dBm |
| RF Lev 2   |  22.00 dBm   |
| D/U        |  -131.00 dB  |

EOC: Could not attain 30dB S/N - only slight impact of 10.7MHz at 22dBm

14 10.7 IM Test
Using the three generator set up, set generators as follows;
Set Up:
Desired: 94.1MHz, -45dBm, Pilot only
Lower Undesired: 88.7MHz, 1kHz, 75kHz dev
Upper Undesired: 99.3MHz, 400Hz, 75kHz dev
Adjust:
Undesired RF level to obtain -50dB noise floor, record RF lev 10.6MHz Spacing
Set upper undesired generator to 99.4MHz. Adjust RF lev for -50dB noise floor. (RF lev 10.7MHz Spacing)

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>d/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td>-20.37</td>
<td>-24.63</td>
</tr>
<tr>
<td></td>
<td>-22.37</td>
</tr>
</tbody>
</table>

EOC:

15 10.7MHz (10.6MHz) Local Osc Interference Test
Set Up:
Desired: 94.1MHz, -45dBm, Pilot only
Set upper interferer generator to 104.7MHz (94.1MHz + 10.6MHz), 400Hz, 75kHz dev
a) Increase level of undesired signals until noise floor is -50dB (+/- 2dB). Record RF Lev for 10.6MHz Spacing
b) Re-adjust upper interfering generator to 104.8MHz (94.1MHz + 10.7MHz)
Re-adjust RF level for -50dB and record RF lev for 10.7MHz spacing

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>d/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td>-14.37</td>
<td>-30.63</td>
</tr>
<tr>
<td></td>
<td>-22.37</td>
</tr>
</tbody>
</table>

EOC: Slight tone at 10.6MHz, objectionable beat noise at 10.7MHz
**FM Receiver Test Laboratory**

Date: 2/28/99  
Engineers: RMc  
Project: FM Receiver Test A1

Receiver Test No.: 8  
Class: Home Hi Fi Receiver  
Radio Mfg.: Sony  
Model: STR-AV21  
Serial: 802086

Antenna Network: 50/75 Ohm Trans.  
Audio load: 10K Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section.

Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms.

Comments: Audio Output: Tape Rec line output  
0  
0  
0

<table>
<thead>
<tr>
<th>Standard RF Levels</th>
<th>Standard FM Test Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strong:</strong> -45 dBm</td>
<td>94.1MHz</td>
</tr>
<tr>
<td><strong>Medium:</strong> -55 dBm</td>
<td></td>
</tr>
<tr>
<td><strong>Weak:</strong> -65 dBm</td>
<td></td>
</tr>
</tbody>
</table>

Standard Test Set Ups

1. Strong Signal Overload  
2. Single RF Tone Tests  
3. Two RF Tone Tests  
4. Measurement Set up

**Standard Tests**

1. Local Oscillator Frequency (Tuning Error)  
2. Standard Audio Output (Audio level and distortion)  
3. RF Input Overload (RF level required for 5% THD)  
4. AM Rejection  
5. Image Rejection  
6. Curve Tests (plots of RF Level Vs Audio Output)  
7. Capture Ratio  
8. Selectivity; 1st Adjacent (30dB noise figure)  
9. Selectivity; 2nd Adjacent (30dB noise figure)  
10. Selectivity; 1st Adjacent (50dB noise figure)  
11. Selectivity; 2nd Adjacent (50dB noise figure)  
12. Selectivity; 3rd Adjacent (50dB noise figure)  
13. 10.7MHz Rejection  
14. 10.7MHz Intermodulation  
15. 10.7MHz Spurious (Local Osc. Interference)
Test Results:

1 Local Oscillator Frequency:
   104.800 MHz

2 Standard Audio Output:
   | Left Channel | THD | Right Channel | THD |
   | 0.325 Vrms   | 0.22%| 0.33 Vrms     | 0.22% |

3 RF Input Overload:
   22.00 dBm Max Test Bed RF level - slight increase in THD (0.26%)

4 AM Rejection:
   0.00 dB

5 Image Rejection:
   -46.00 dB

6 Curve Tests:
   (See Plots)

7 Capture Ratio:
   -2.85 dB

8 Selectivity, First Adjacent, 30dB Noise Floor (Ave. D/U)
   -9.33 dB Mono
   -8.48 dB Stereo

9 Selectivity, Second Adjacent, 30dB Noise Floor (Ave. D/U)
   -63.08 dB Mono Max RF
   -63.08 dB Stereo Max RF

10 Selectivity, First Adjacent, 50dB Noise Floor (Ave D/U)
    -7.08 dB Mono
    11.22 dB Stereo

11 Selectivity, Second Adjacent, 50dB Noise Floor (Ave. D/U)
    -30.78 dB Mono
    -30.78 dB Stereo

12 Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)
    -47.93 dB Mono
    -47.93 dB Stereo

13 10.7MHz Rejection
    -131.00 dB Could not attain 30dB S/N - only slight impact of 10.7MHz at 22dBm

14 10.7MHz IM
    -24.63 dB (10.6) 0
    -22.63 dB (10.7) 0

15 10.7MHz Spurious (Local Osc. Interference)
    -30.63 dB (10.6) Slight tone at 10.6MHz, objectionable beat noise at 10.7MHz
    -22.63 dB (10.7) 0
FM Receiver Test Laboratory

**SIGNAL/NOISE VS RF LEVEL**

**Insertion loss = -6dB**

Sony STR-AV21

File Name: C_sonyhf

FM Stereo Plot
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = 6 dB

Sony STR-AV21
FM Receiver Test Laboratory

1st, 2nd and 3rd ADJACENT CHANNEL SELECTIVITY
(50dB Noise Floor)

Insertion loss = -6dB

Sony STR-AV21
FM Receiver Test Laboratory

IM & L.O. Rejection
(50dB Noise Floor)

Insertion loss = -6dB

Sony STR-AV21
Receiver #9

Sony

Portable
Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 9
Class: Walkman Type
Radio Mfg.: Sony
Model: SRF-M40W
Serial: 194352

Antenna Network: 33pf (see diagram) FM
________________________________________ AM

Audio load: 16 Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms

Comments: Function switch set to FM Stereo

<table>
<thead>
<tr>
<th>Standard RF Levels</th>
<th>Standard FM Test Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong: -45 dBm</td>
<td>Low: 94.1 MHz</td>
</tr>
<tr>
<td>Medium: -55 dBm</td>
<td>High: 103.5 MHz</td>
</tr>
<tr>
<td>Weak: -65 dBm</td>
<td></td>
</tr>
</tbody>
</table>

Standard Test Set Ups

1 Strong Signal Overload
2 Single RF Tone Tests
3 Two RF Tone Tests
4 Measurement Set up

Standard Tests

1 Local Oscillator Frequency (Tuning Error)
2 Standard Audio Output (Audio level and distortion)
3 RF Input Overload (RF level required for 5% THD)
4 AM Rejection
5 Image Rejection
6 Curve Tests (plots of RF Level Vs Signal - Mono & Stereo, Noise - Mono & Stereo, Stereo Separation
7 Capture Ratio
8 Selectivity; 1st Adjacent (30dB noise figure)
9 Selectivity; 2nd Adjacent (30dB noise figure)
10 Selectivity; 1st Adjacent (50dB noise figure)
11 Selectivity; 2nd Adjacent (50dB noise figure)
Single RF Tone Tests

1 Local Oscillator Frequency (Tuning Error)
   Set Up: Connect Spectrum Analyzer to Radio Antenna input
   Adjust: Tune radio to Test Freq. 1, measure L.O. Freq 1
   Tune radio to Test Freq. 2, measure L.O. Freq 2

Measurement: L.O. Freq 1  104.850 MHz
             L.O. Freq 2     MHz

2 Standard Audio Output
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio Volume to Std. Ref. Level, record Left and Right channel audio level and THD

Measurement: Left Ch       Right Ch
             Level  .46   Vrms  = 0dB   Level  .42   Vrms
             THD  1.7%               THD  1.7%               %

3 RF Input Overload
   Set Up: Test Set Up 1, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level
   Increase RF Level until 5% THD at Radio output, record RF Level

Measurement: RF Lev. 15.7 dBm  (@ 5% THD)
             (Sudden threshold, THD greater than 10%)

4 AM Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level, record THD
   Set modulation mode to FM (75kHz), AM (30%), record THD

Measurement: THD  1.7%  =  -35.39 dB  (FM Only)
             THD  1.7%  =  -35.39 dB  (FM + AM 30%)

AM Rejection: 0.00 dB

5 Image Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level (0dB)
   Decrease RF Level until S/N Ratio = 30dB, record RF Lev1
   Tune RF Gen to; Desired Freq. +/- 2 X IF Freq.
   Adjust RF Level until S/N Ratio = 30dB, record RF Lev2

Measurement: RF Lev1 -104 dBm  (S/N Ratio = 30dB)
             RF Lev2 -66 dBm  (21.4MHz + 94.1MHz = 115.5MHz)
             Image Rejection: -38.0 dB  (RF Lev1 - RF Lev2)
**Curve Tests**

Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
Adjust: Set Radio audio to Std. Ref. Level (0dB) for both Mono and Stereo set ups.

Plot: Signal, Noise Vs RF Level (Mono)
Signal, Noise Vs RF Level (L=R, Stereo)
Stereo Separation Vs RF Level (L only, Stereo)
Record: Noise floor at -45dBm without Low Pass Filter as a measure of pilot rejection

**CURVE DATA**

**SIGNAL, NOISE & SEPARATION VS RF LEVEL**

<table>
<thead>
<tr>
<th>RF Level dBm</th>
<th>Mono (L)</th>
<th></th>
<th>Stereo (L)</th>
<th></th>
<th>Separation L-&gt;R</th>
<th></th>
<th>RF Level dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Signal dB</td>
<td>Noise dB</td>
<td>Signal dB</td>
<td>Filt. Noise dB</td>
<td>Noise dB</td>
<td>Left dB</td>
<td>Right dB</td>
</tr>
<tr>
<td>-130</td>
<td>-20.50</td>
<td>-20.50</td>
<td>-19.50</td>
<td>-19.50</td>
<td>-19.50</td>
<td>-20.50</td>
<td>-130</td>
</tr>
<tr>
<td>-125</td>
<td>-20.50</td>
<td>-20.50</td>
<td>-19.50</td>
<td>-19.50</td>
<td>-19.50</td>
<td>-20.50</td>
<td>-125</td>
</tr>
<tr>
<td>-120</td>
<td>-20.00</td>
<td>-21.00</td>
<td>-19.00</td>
<td>-19.50</td>
<td>-19.50</td>
<td>-20.50</td>
<td>-120</td>
</tr>
<tr>
<td>-115</td>
<td>-18.00</td>
<td>-21.50</td>
<td>-17.00</td>
<td>-20.50</td>
<td>-19.50</td>
<td>-20.00</td>
<td>-115</td>
</tr>
<tr>
<td>-110</td>
<td>-11.50</td>
<td>-24.00</td>
<td>-11.00</td>
<td>-22.50</td>
<td>-16.00</td>
<td>-16.50</td>
<td>-110</td>
</tr>
<tr>
<td>-105</td>
<td>-5.00</td>
<td>-30.00</td>
<td>-4.50</td>
<td>-28.50</td>
<td>-10.00</td>
<td>-11.00</td>
<td>-105</td>
</tr>
<tr>
<td>-100</td>
<td>-1.50</td>
<td>-49.00</td>
<td>-1.50</td>
<td>-48.00</td>
<td>-7.50</td>
<td>-8.50</td>
<td>-100</td>
</tr>
<tr>
<td>-95</td>
<td>-1.00</td>
<td>-60.00</td>
<td>-1.00</td>
<td>-59.00</td>
<td>-7.50</td>
<td>-8.50</td>
<td>-95</td>
</tr>
<tr>
<td>-90</td>
<td>0.00</td>
<td>-59.50</td>
<td>0.00</td>
<td>-35.00</td>
<td>0.00</td>
<td>-22.50</td>
<td>-90</td>
</tr>
<tr>
<td>-85</td>
<td>0.00</td>
<td>-61.00</td>
<td>0.00</td>
<td>-40.00</td>
<td>0.00</td>
<td>-23.00</td>
<td>-85</td>
</tr>
<tr>
<td>-80</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-45.00</td>
<td>0.00</td>
<td>-23.00</td>
<td>-80</td>
</tr>
<tr>
<td>-75</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-49.50</td>
<td>0.00</td>
<td>-23.00</td>
<td>-75</td>
</tr>
<tr>
<td>-70</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-53.50</td>
<td>0.00</td>
<td>-23.00</td>
<td>-70</td>
</tr>
<tr>
<td>-65</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-57.00</td>
<td>0.00</td>
<td>-23.00</td>
<td>-65</td>
</tr>
<tr>
<td>-60</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-59.00</td>
<td>0.00</td>
<td>-23.00</td>
<td>-60</td>
</tr>
<tr>
<td>-55</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-60.50</td>
<td>0.00</td>
<td>-23.00</td>
<td>-55</td>
</tr>
<tr>
<td>-50</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-61.00</td>
<td>0.00</td>
<td>-23.00</td>
<td>-50</td>
</tr>
<tr>
<td>-45</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-61.00</td>
<td>-49.00</td>
<td>0.00</td>
<td>-45</td>
</tr>
</tbody>
</table>
Two RF Tone Tests

7 Capture Ratio
Set Up: Test Set Up 3
- Desired: Test Freq. 1, -55dBm, 1kHz, 22.5kHz dev, Mono
- Undesired: Test Freq. 1, -130dBm, CW
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Increase Undesired signal until audio level drops 1dB, record Undesired RF level as RF Lev 1
- Increase Undesired signal until audio level drops 30dB, record Undesired RF level as RF Lev 2

Measurement: RF Lev 1 _-55.71_ dBm
RF Lev 2 _-47.91_ dBm

Capture Ratio: _-3.90_ dB (RF Lev 1 - RF Lev 2)/2

8 Selectivity - 1st Adjacent 30dB S/N (Upper and Lower)
Upper 1st
Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up:
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>D/U</td>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-54.92</td>
<td>-53.92</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-51.72</td>
<td>-51.72</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.</td>
<td>-1.68</td>
<td>-2.18</td>
</tr>
</tbody>
</table>

Selectivity - 2nd Adjacent 30dB S/N (Upper and Lower)
Upper 2nd
Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up:
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>D/U</td>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-18.22</td>
<td>-18.22</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-27.12</td>
<td>-27.12</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.</td>
<td>-32.33</td>
<td>-32.33</td>
</tr>
</tbody>
</table>

(RF D/U Up + RF D/U Lo)/2
10 Selectivity - 1st Adjacent 50dB S/N (Upper and Lower)

Upper 1st
Set Up: Test Set Up 3

Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono

Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono

Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
<td>dBm</td>
</tr>
<tr>
<td>Desired Upper Lev</td>
<td>-64.92</td>
<td>9.92</td>
</tr>
<tr>
<td>Desired Lower Lev</td>
<td>-60.52</td>
<td>5.52</td>
</tr>
</tbody>
</table>

Selectivity, 1st Adj.: 7.72 (RF D/U Up + RF D/U Lo)²

11 Selectivity - 2nd Adjacent 50dB S/N (Upper and Lower)

Upper 2nd
Set Up: Test Set Up 3

Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono

Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono

Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
<td>dBm</td>
</tr>
<tr>
<td>Desired Lower Lev</td>
<td>-28.02</td>
<td>-26.98</td>
</tr>
</tbody>
</table>

Selectivity, 2nd Adj.: -28.43 (RF D/U Up + RF D/U Lo)²

12 Selectivity - 3rd Adjacent 50dB S/N (Upper and Lower)

Upper 3rd
Set Up: Test Set Up 3

Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +600kHz, -130dBm, 1kHz, 75kHz Dev, Mono

Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 3rd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +600kHz, -130dBm, 1kHz, 75kHz Dev, Mono

Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
<td>dBm</td>
</tr>
<tr>
<td>Desired Upper Lev</td>
<td>-65.00</td>
<td>-55.00</td>
</tr>
<tr>
<td>Desired Lower Lev</td>
<td>-22.92</td>
<td>-32.08</td>
</tr>
<tr>
<td>Selectivity, 3rd Adj.:</td>
<td>-33.88</td>
<td>-33.58</td>
</tr>
</tbody>
</table>

(RF D/U Up + RF D/U Lo)²
Additional Tests

13 10.7MHz Rejection
Using Test Set Up 1 at the desired frequency of 94.1MHz;
Set generator to 1kHz, 75kHz dev / CW
Reduce RF level to obtain 30dB S/N ratio.
Record RF Level as RF Lev 1
Set RF generator to 10.7MHz
Adjust RF level to obtain 30dB S/N ratio
Record RF Level as RF Lev 2
Calculate the difference between the two RF levels

<table>
<thead>
<tr>
<th>RF Lev 1</th>
<th>-99.30 dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Lev 2</td>
<td>19.20 dBm</td>
</tr>
<tr>
<td>D/U</td>
<td>-118.50 dB</td>
</tr>
</tbody>
</table>

14 10.7 IM Test
Using the three generator set up, set generators as follows;
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
        Lower Undesired: 88.7MHz, 1kHz, 75kHz dev
        Upper Undesired: 99.3MHz, 400Hz, 75kHz dev
Adjust: Undesired RF level to obtain -50dB noise floor, record RF lev 10.6MHz Spacing
        Set upper undesired generator to 99.4MHz, Adjust RF lev for -50dB noise floor. (RF lev 10.7MHz Spacing)


<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm D/U</td>
<td>dBm D/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td>-35.37</td>
<td>-9.63</td>
</tr>
<tr>
<td>-40.37</td>
<td>-4.63</td>
</tr>
<tr>
<td>-9.63</td>
<td>-4.63</td>
</tr>
</tbody>
</table>

EOC: Objectionable beat notes

15 10.7MHz (10.6MHz) Local Osc Interference Test
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
        Set upper interferer generator to 104.7MHz (94.1MHz + 10.6MHz), 400Hz, 75kHz dev
        a) Increase level of undesired signals until noise floor is -50dB (+/- 2dB). Record RF Lev for 10.6MHz Spacing
        b) Re-adjust upper interfering generator to 104.8MHz (94.1MHz + 10.7MHz)
        Re-adjust RF level for -50dB and record RF lev for 10.7MHz spacing


<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm D/U</td>
<td>dBm D/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td>-18.37</td>
<td>-26.63</td>
</tr>
<tr>
<td>-39.70</td>
<td>-5.30</td>
</tr>
<tr>
<td>-26.63</td>
<td>-5.30</td>
</tr>
</tbody>
</table>

EOC: Objectionable beat notes
FM Receiver Test Laboratory

Date: 2/28/99  
Engineers: RMc  
Project: FM Receiver Test A1

Receiver Test No.: 9  
Class: Walkman Type  
Radio Mfg.: Sony  
Model: SRF-M40W  
Serial: 194352

Antenna Network: 33pf (see diagram) FM

Audio load: 16 Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 1.9kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms.

Comments: Function switch set to FM Stereo

0

0

0

Standard RF Levels

Strong: -45 dBm  
Medium: -55 dBm  
Weak: -65 dBm

Standard FM Test Frequencies

94.1MHz

13  10.7MHz Rejection
14  10.7MHz Intermodulation
15  10.7MHz Spurious (Local Osc. Interference)

Standard Test Set Ups

1  Strong Signal Overload  
2  Single RF Tone Tests  
3  Two RF Tone Tests  
4  Measurement Set up

Standard Tests

1  Local Oscillator Frequency (Tuning Error)  
2  Standard Audio Output (Audio level and distortion)  
3  RF Input Overload (RF level required for 5% THD)  
4  AM Rejection  
5  Image Rejection  
6  Curve Tests (plots of RF Level Vs Audio Output)  
7  Capture Ratio  
8  Selectivity; 1st Adjacent (30dB noise figure)  
9  Selectivity; 2nd Adjacent (30dB noise figure)  
10  Selectivity; 1st Adjacent (50dB noise figure)  
11  Selectivity; 2nd Adjacent (50dB noise figure)  
12  Selectivity; 3rd Adjacent (50dB noise figure)
Test Results:

1  Local Oscillator Frequency:
   104.850 MHz

2  Standard Audio Output:
<table>
<thead>
<tr>
<th>Channel</th>
<th>THD</th>
<th>Right Channel</th>
<th>THD</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.46 Vrms</td>
<td>1.7%</td>
<td>0.42 Vrms</td>
<td>1.7%</td>
</tr>
</tbody>
</table>

3  RF Input Overload:
   15.70 dBm  (Sudden threshold, THD greater than 10%)

4  AM Rejection:
   0.00 dB

5  Image Rejection:
   -38.00 dB

6  Curve Tests:
   (See Plots)

7  Capture Ratio:
   -3.90 dB

8  Selectivity, First Adjacent, 30dB Noise Floor (Ave. D/U)
   -1.68 dB Mono
   -2.18 dB Stereo

9  Selectivity, Second Adjacent, 30dB Noise Floor (Ave. D/U)
   -32.33 dB Mono
   -32.33 dB Stereo

10 Selectivity, First Adjacent, 50dB Noise Floor (Ave D/U)
    7.72 dB Mono
    14.22 dB Stereo

11 Selectivity, Second Adjacent, 50dB Noise Floor (Ave. D/U)
    -28.43 dB Mono
    -25.43 dB Stereo

12 Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)
    -33.88 dB Mono
    -33.58 dB Stereo

13 10.7MHz Rejection
    -118.50 dB

14 10.7MHz IM
    -9.63 dB (10.6)  Objectionable beat notes
    -4.63 dB (10.7)  0

15 10.7MHz Spurious (Local Osc. Interference)
    -26.63 dB (10.6)  Objectionable beat notes
    -5.30 dB (10.7)  0
FM Receiver Test Laboratory

**SIGNAL/NOISE VS RF LEVEL**

Insertion loss = -6dB

Sony SRF-M40W
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

Sony SRF-M40W
FM Receiver Test Laboratory

**SIGNAL/NOISE VS RF LEVEL**

- **RF LEVEL (dBm)**
- **AUDIO LEVEL (dB)**

Insertion loss = -6dB

Sony SRF-M40W
1st and 2nd ADJACENT CHANNEL SELECTIVITY
(30dB Noise Floor)

Insertion loss = -6dB

Sony SRF-M40W
1st, 2nd and 3rd ADJACENT CHANNEL SELECTIVITY
(50dB Noise Floor)

Insertion loss = -6dB

Sony SRF-M40W
IM & L.O. Rejection

(50dB Noise Floor)

Insertion loss = -6dB

Sony SRF-M40W
Receiver #10

Technics

Home HiFi
FM Receiver Test Laboratory

Date: 2/28/99
Engineers: RMe
Project: FM Receiver Test Al

Receiver Test No.: 10
Class: Home Hi Fi Receiver
Radio Mfg.: Technics
Model: SA-EX110
Serial: GY8JA38798

Antenna Network: 50/75 Ohm Trans. FM
AM

Audio load: 10K Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15KHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms

Comments: FM Auto/Mono switch in FM Auto mode
Audio output, Tape Rec Out

<table>
<thead>
<tr>
<th>Standard RF Levels</th>
<th>Standard FM Test Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong: -45 dBm</td>
<td>Low: 94.1 MHz</td>
</tr>
<tr>
<td>Medium: -55 dBm</td>
<td></td>
</tr>
<tr>
<td>Weak: -65 dBm</td>
<td></td>
</tr>
</tbody>
</table>

Standard Test Set Ups
1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

Standard Tests
1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF Input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
7. Capture Ratio
8. Selectivity; 1st Adjacent (30dB noise figure)
9. Selectivity; 2nd Adjacent (30dB noise figure)
10. Selectivity; 1st Adjacent (50dB noise figure)
11. Selectivity; 2nd Adjacent (50dB noise figure)
Single RF Tone Tests

1 Local Oscillator Frequency (Tuning Error)
Set Up: Connect Spectrum Analyzer to Radio Antenna input
Adjust: Tune radio to Test Freq. 1, measure L.O. Freq 1
Tune radio to Test Freq. 2, measure L.O. Freq 2

Measurement: L.O. Freq 1 104.756 MHz
L.O. Freq 2 75 kHz

2 Standard Audio Output
Set Up: Test Set Up 2, Test Freq. 1, Medium, 1 kHz, 75kHz Dev, Mono
Adjust: Set Radio Volume to Std. Ref. Level, record Left and Right channel audio level and THD

Measurement: Left Ch
Level 0.315 Vrms
THD 0.26 %

Right Ch
Level 0.310 Vrms
THD 0.26 %

3 RF Input Overload
Set Up: Test Set Up 1, Test Freq. 1, Medium, 1 kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level
Increase RF Level until 5% THD at Radio output, record RF Level

Measurement: RF Lev. 22.00 dBm (@ 5% THD)
Max Test Bed RF level - slight increase in THD 0.4 dB

4 AM Rejection
Set Up: Test Set Up 2, Test Freq. 1, Medium, 1 kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level, record THD
Set modulation mode to FM (75kHz), AM (30%), record THD

Measurement: THD 0.26 % = -51.70 dB (FM Only)
THD 0.32 % = -49.90 dB (FM + AM 30%)

AM Rejection: -1.80 dB

5 Image Rejection
Set Up: Test Set Up 2, Test Freq. 1, Medium, 1 kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Decrease RF Level until S/N Ratio = 30dB, record RF Lev1
Tune RF Gen to; Desired Freq. +/- 2 X IF Freq.
Adjust RF Level until S/N Ratio = 30dB, record RF Lev2

Measurement: RF Lev1 -110.0 dBm (S/N Ratio = 30dB)
RF Lev2 -66.0 dBm (21.4MHz + 94.1MHz = 115.5MHz)
Image Rejection: -44.00 dB (RF Lev1 - RF Lev2)
FM Receiver Test Laboratory

6 Curve Tests
Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
Adjust: Set Radio audio to Std. Ref. Level (0dB) for both Mono and Stereo set ups.

Plot: Signal, Noise Vs RF Level (Mono)
Signal, Noise Vs RF Level (L+R, Stereo)
Stereo Separation Vs RF Level (L only, Stereo)

Record: Noise floor at -45dBm without Low Pass Filter as a measure of pilot rejection

**CURVE DATA**

<table>
<thead>
<tr>
<th>RF Level dBm</th>
<th>Mono (L)</th>
<th>Stereo (L)</th>
<th>Separation L&gt;R</th>
<th>RF Level dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Signal dB</td>
<td>Noise dB</td>
<td>Signal dB</td>
<td>Noise dB</td>
</tr>
<tr>
<td>-130</td>
<td>-20.00</td>
<td>-20.00</td>
<td>-19.00</td>
<td>-19.50</td>
</tr>
<tr>
<td>-125</td>
<td>-19.50</td>
<td>-20.50</td>
<td>-19.00</td>
<td>-19.50</td>
</tr>
<tr>
<td>-120</td>
<td>-17.00</td>
<td>-21.50</td>
<td>-17.00</td>
<td>-20.50</td>
</tr>
<tr>
<td>-115</td>
<td>-11.00</td>
<td>-25.00</td>
<td>-11.00</td>
<td>-23.00</td>
</tr>
<tr>
<td>-110</td>
<td>-4.00</td>
<td>-34.00</td>
<td>-4.00</td>
<td>-31.50</td>
</tr>
<tr>
<td>-105</td>
<td>0.00</td>
<td>-47.00</td>
<td>0.00</td>
<td>-45.50</td>
</tr>
<tr>
<td>-100</td>
<td>0.00</td>
<td>-53.00</td>
<td>0.00</td>
<td>-52.00</td>
</tr>
<tr>
<td>-95</td>
<td>0.00</td>
<td>-58.00</td>
<td>0.00</td>
<td>-57.00</td>
</tr>
<tr>
<td>-90</td>
<td>0.00</td>
<td>-64.00</td>
<td>0.00</td>
<td>-45.50</td>
</tr>
<tr>
<td>-85</td>
<td>0.00</td>
<td>-68.00</td>
<td>0.00</td>
<td>-50.50</td>
</tr>
<tr>
<td>-80</td>
<td>0.00</td>
<td>-68.00</td>
<td>0.00</td>
<td>-55.00</td>
</tr>
<tr>
<td>-75</td>
<td>0.00</td>
<td>-68.00</td>
<td>0.00</td>
<td>-60.00</td>
</tr>
<tr>
<td>-70</td>
<td>0.00</td>
<td>-68.00</td>
<td>0.00</td>
<td>-65.00</td>
</tr>
<tr>
<td>-65</td>
<td>0.00</td>
<td>-68.00</td>
<td>0.00</td>
<td>-67.00</td>
</tr>
<tr>
<td>-60</td>
<td>0.00</td>
<td>-68.00</td>
<td>0.00</td>
<td>-68.00</td>
</tr>
<tr>
<td>-55</td>
<td>0.00</td>
<td>-68.00</td>
<td>0.00</td>
<td>-68.00</td>
</tr>
<tr>
<td>-50</td>
<td>0.00</td>
<td>-68.00</td>
<td>0.00</td>
<td>-36.50</td>
</tr>
<tr>
<td>-45</td>
<td>0.00</td>
<td>-68.00</td>
<td>0.00</td>
<td>-36.00</td>
</tr>
</tbody>
</table>
FM Receiver Test Laboratory

**Two RF Tone Tests**

7 Capture Ratio

Set Up: Test Set Up 3

- Desired: Test Freq. 1, -55dBm, 1kHz, 22.5kHz Dev, Mono
- Undesired: Test Freq. 1, -130dBm, CW

Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Increase Undesired signal until audio level drops 1dB, record Undesired RF level as RF Lev 1
- Increase Undesired signal until audio level drops 30dB, record Undesired RF level as RF Lev 2

Measurement:

<table>
<thead>
<tr>
<th></th>
<th>RF Lev 1</th>
<th>RF Lev 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desired</td>
<td>-55.60 dBm</td>
<td>-52.00 dBm</td>
</tr>
</tbody>
</table>

Capture Ratio: **-1.80 dB** (RF Lev 1 - RF Lev 2)/2

8 Selectivity - 1st Adjacent 30dB S/N (Upper and Lower)

Upper 1st

Set Up: Test Set Up 3

- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono

Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st

Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono

- Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono

Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>dBm</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-50.32</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-47.92</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.</td>
<td>-5.88</td>
</tr>
</tbody>
</table>

(2RF D/U Up + RF D/U Lo)/2

9 Selectivity - 2nd Adjacent 30dB S/N (Upper and Lower)

Upper 2nd

Set Up: Test Set Up 3

- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono

Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd

Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono

- Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono

Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>dBm</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>8.08</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>8.08</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.</td>
<td>-61.08</td>
</tr>
</tbody>
</table>

(2RF D/U Up + RF D/U Lo)/2
## Selectivity - 1st Adjacent 50dB S/N (Upper and Lower)

**Upper 1st**
- **Set Up:** Test Set Up 3
  - Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
  - Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
- **Adjust:** Set Radio audio to Std. Ref. Level (0dB)
  - Set the modulation of the Desired signal to CW
  - Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
<td>dBm</td>
</tr>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
</tr>
</tbody>
</table>

**Lower 1st**
- **Set Up:** Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
  - Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
- **Adjust:** Set Radio audio to Std. Ref. Level (0dB)
  - Set the modulation of the Desired signal to CW
  - Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
<td>dBm</td>
</tr>
<tr>
<td>-95.02</td>
<td>-95.02</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desired Lower Lev</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
<td>dBm</td>
</tr>
<tr>
<td>-91.12</td>
<td>-91.12</td>
<td></td>
</tr>
</tbody>
</table>

**Selectivity, 1st Adj.:**
- (-95.02 - (-91.12)) / 2 = 1.95 dB

## Selectivity - 2nd Adjacent 50dB S/N (Upper and Lower)

**Upper 2nd**
- **Set Up:** Test Set Up 3
  - Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
  - Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
- **Adjust:** Set Radio audio to Std. Ref. Level (0dB)
  - Set the modulation of the Desired signal to CW
  - Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
<td>dBm</td>
</tr>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
</tr>
</tbody>
</table>

**Lower 2nd**
- **Set Up:** Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
  - Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
- **Adjust:** Set Radio audio to Std. Ref. Level (0dB)
  - Set the modulation of the Desired signal to CW
  - Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
<td>dBm</td>
</tr>
<tr>
<td>3.38</td>
<td>-3.38</td>
<td>-7.92</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Undesired Lower Lev</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
<td>dBm</td>
</tr>
<tr>
<td>3.08</td>
<td>-3.08</td>
<td>-8.92</td>
</tr>
</tbody>
</table>

**Selectivity, 2nd Adj.:**
- (3.38 - 3.08) / 2 = 0.15 dB

## Selectivity - 3rd Adjacent 50dB S/N (Upper and Lower)

**Upper 3rd**
- **Set Up:** Test Set Up 3
  - Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
  - Undesired: Test Freq. 1 +600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
- **Adjust:** Set Radio audio to Std. Ref. Level (0dB)
  - Set the modulation of the Desired signal to CW
  - Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
<td>dBm</td>
</tr>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
</tr>
</tbody>
</table>

**Lower 3rd**
- **Set Up:** Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
  - Undesired: Test Freq. 1 -600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
- **Adjust:** Set Radio audio to Std. Ref. Level (0dB)
  - Set the modulation of the Desired signal to CW
  - Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
<td>dBm</td>
</tr>
<tr>
<td>8.08</td>
<td>-8.08</td>
<td>-7.92</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Undesired Lower Lev</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
<td>dBm</td>
</tr>
<tr>
<td>5.62</td>
<td>-5.62</td>
<td>-8.92</td>
</tr>
</tbody>
</table>

**Selectivity, 3rd Adj.:**
- (8.08 - 5.62) / 2 = 1.23 dB
13 10.7MHz Rejection
Using Test Set Up 1 at the desired frequency of 94.1MHz;
Set generator to 1kHz, 75kHz dev. / CW
Reduce RF level to obtain 30dB S/N ratio.
Record RF Level as RF Lev 1
Set RF generator to 10.7MHz
Adjust RF level to obtain 30dB S/N ratio
Record RF Level as RF Lev 2
Calculate the difference between the two RF levels

<table>
<thead>
<tr>
<th>RF Lev 1</th>
<th>-109.00 dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Lev 2</td>
<td>-25.50 dBm</td>
</tr>
<tr>
<td>D/U</td>
<td>-83.50 dB</td>
</tr>
</tbody>
</table>

14 10.7 IM Test
Using the three generator set up, set generators as follows;
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
Lower Undesired: 88.7MHz, 1kHz, 75kHz dev
Upper Undesired: 99.3MHz, 400Hz, 75kHz dev
Adjust: Undesired RF level to obtain -50dB noise floor, record RF lev 10.6MHz Spacing
Set upper undesired generator to 99.4MHz. Adjust RF lev for -50dB noise floor. (RF lev 10.7MHz Spacing)

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EOC: Raspy noise

15 10.7MHz (10.6MHz) Local Osc Interference Test
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
Set upper interferer generator to 104.7MHz (94.1MHz + 10.6MHz), 400Hz, 75kHz dev
a) Increase level of undesired signals until noise floor is -50dB (+/- 2dB). Record RF Lev for 10.6MHz Spacing
b) Re-adjust upper interfering generator to 104.8MHz (94.1MHz + 10.7MHz)
Re-adjust RF level for -50dB and record RF lev for 10.7MHz spacing

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EOC:
Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 10
Class: Home Hi Fi Receiver
Radio Mfg.: Technics
Model: SA-EX110
Serial: GY8JA38798

Antenna Network: 50/75 Ohm Trans. FM

Audio load: 10K Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms

Comments: FM Auto/Mono switch in FM Auto mode
Audio output: Tape Rec Out
0
0

Standard RF Levels
Strong: -45 dBm
Medium: -55 dBm
Weak: -65 dBm

Standard Test Set Ups
1 Strong Signal Overload
2 Single RF Tone Tests
3 Two RF Tone Tests
4 Measurement Set up

Standard Tests
1 Local Oscillator Frequency (Tuning Error)
2 Standard Audio Output (Audio level and distortion)
3 RF Input Overload (RF level required for 5% THD)
4 AM Rejection
5 Image Rejection
6 Curve Tests (plots of RF Level Vs Audio Output)
7 Capture Ratio
8 Selectivity; 1st Adjacent (30dB noise figure)
9 Selectivity; 2nd Adjacent (30dB noise figure)
10 Selectivity; 1st Adjacent (50dB noise figure)
11 Selectivity; 2nd Adjacent (50dB noise figure)
12 Selectivity; 3rd Adjacent (50dB noise figure)
13 10.7MHz Rejection
14 10.7MHz Intermodulation
15 10.7MHz Spurious (Local Osc. Interference)
Test Results:

1. Local Oscillator Frequency: 104.756 MHz

2. Standard Audio Output:

<table>
<thead>
<tr>
<th>Left Channel</th>
<th>Vrms</th>
<th>THD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.315</td>
<td>0.26%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Right Channel</th>
<th>Vrms</th>
<th>THD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.31</td>
<td>0.26%</td>
</tr>
</tbody>
</table>

3. RF Input Overload:

22.00 dBm Max Test Bed RF level - slight increase in THD

4. AM Rejection:

-1.80 dB

5. Image Rejection:

-44.00 dB

6. Curve Tests:

(See Plots)

7. Capture Ratio:

-1.80 dB

8. Selectivity, First Adjacent, 30dB Noise Floor (Ave. D/U)

-5.88 dB Mono

-5.88 dB Stereo


-63.08 dB Mono Max RF

-61.08 dB Stereo

10. Selectivity, First Adjacent, 50dB Noise Floor (Ave D/U)

-3.98 dB Mono

8.42 dB Stereo

11. Selectivity, Second Adjacent, 50dB Noise Floor (Ave. D/U)

-58.23 dB Mono

-46.58 dB Stereo

12. Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)

-56.23 dB Mono

-46.58 dB Stereo

13. 10.7MHz Rejection

-83.50 dB

14. 10.7MHz IM

-17.63 dB (10.6) Raspy noise

-17.63 dB (10.7)

15. 10.7MHz Spurious (Local Osc. Interference)

-14.63 dB (10.6)

-10.63 dB (10.7)
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

Technics SA-EX110
FM Receiver Test Laboratory

**SIGNAL/NOISE VS RF LEVEL**

Insertion loss = -6dB

Technics SA-EX110
FM Receiver Test Laboratory

**SIGNAL/NOISE VS RF LEVEL**

![Graph](image)

- **Left**
- **Right**

Insertion loss = -6dB

**Technics SA-EX110**
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

Technics SA-EX110
1st and 2nd ADJACENT CHANNEL SELECTIVITY
(30dB Noise Floor)

Insertion loss = -6dB

Technics SA-EX110
FM Receiver Test Laboratory

1st, 2nd and 3rd ADJACENT CHANNEL SELECTIVITY
(50dB Noise Floor)

Insertion loss = -6dB

Technics SA-EX110
FM Receiver Test Laboratory

IM & L.O. Rejection
(50dB Noise Floor)

Insertion loss = -6dB

Technics SA-EX110
Receiver #11

Sanyo

Portable
Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 11
Class: Bookshelf/Port. All-in-One
Radio Mfg.: Sanyo
Model: MCD-S736
Serial: 87013116

Antenna Network: 50/75 Ohm Trans. FM
Audio load: 8 Ohms

Initial Set Up:
Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output
Any other control settings unique to the radio under test shall be noted in the Comments section.
Left channel shall be used for all Signal (and S/N ratio) measurements.
15kHz Low Pass filter shall be used on the output of the left channel for all measurements.
Right channel shall be used for Noise measurements - Stereo Separation test only.
All level measurements are rms

Comments: Modified with F connector antenna input
Tone control full right (high)
BASSXPANDER control off

<table>
<thead>
<tr>
<th>Standard RF Levels</th>
<th>Standard FM Test Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong: -45 dBm</td>
<td>Low: 94.1 MHz</td>
</tr>
<tr>
<td>Medium: -55 dBm</td>
<td></td>
</tr>
<tr>
<td>Weak: -65 dBm</td>
<td></td>
</tr>
</tbody>
</table>

Standard Test Set Ups
1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

Standard Tests
1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF Input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
7. Capture Ratio
8. Selectivity; 1st Adjacent (30dB noise figure)
9. Selectivity; 2nd Adjacent (30dB noise figure)
10. Selectivity; 1st Adjacent (50dB noise figure)
11. Selectivity; 2nd Adjacent (50dB noise figure)
12. Selectivity; 3rd Adjacent (50dB noise figure)
13 - 15. Additional 10.7MHz Tests
Single RF Tone Tests

1 Local Oscillator Frequency (Tuning Error)
   Set Up: Connect Spectrum Analyzer to Radio Antenna input
   Adjust: Tune radio to Test Freq. 1, measure L.O. Freq 1
          Tune radio to Test Freq. 2, measure L.O. Freq 2

   Measurement: L.O. Freq 1 104.821 MHz
               L.O. Freq 2 104.821 MHz

2 Standard Audio Output
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio Volume to Std. Ref. Level, record Left and Right channel audio level and THD

   Measurement:
               | Left Ch | Right Ch |
               | Level   | Vrms | THD | Level   | Vrms | THD |
               | 0.84    | 0     | 0.4 | 0.84    | 0     | 0.35 |
               = 0dB     | %       | %    | %   | 0dB     | %    | %    |

3 RF Input Overload
   Set Up: Test Set Up 1, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level
          Increase RF Level until 5% THD at Radio output, record RF Level

   Measurement: RF Lev. 22 dBm (@ 5% THD)
                Max Test Bed RF level - increase in THD: (2%)

4 AM Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level, record THD
          Set modulation mode to FM (75kHz), AM (30%), record THD

   Measurement:
               | THD | %     | THD | %     |
               | 0.4 | -47.96 dB | 0.4 | -47.96 dB |
               = 30% (FM Only)    = 30% (FM + AM 30%)

   AM Rejection: 0.00 dB

5 Image Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level (0dB)
          Decrease RF Level until S/N Ratio = 30dB, record RF Lev1
          Tune RF Gen to, Desired Freq. +/- 2 x IF Freq.
          Adjust RF Level until S/N Ratio = 30dB, record RF Lev2

   Measurement:
               | RF Lev1 | 95 dBm | S/N Ratio = 30dB
               | RF Lev2 | 75 dBm | 21.4MHz + 94.1MHz = 115.5MHz
               | Image Rejection | -20.0 dB | RF Lev1 - RF Lev2

   (S/N Ratio = 30dB)
Curve Tests
- Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
- Adjust: Set Radio audio to Std. Ref. Level (0dB) for both Mono and Stereo set ups.
- Plot: Signal, Noise Vs RF Level (Mono)
  Signal, Noise Vs RF Level (L->R, Stereo)
  Stereo Separation Vs RF Level (L only, Stereo)
- Record: Noise floor at -45dBm without Low Pass Filter as a measure of pilot rejection

**CURVE DATA**

**SIGNAL, NOISE & SEPARATION VS RF LEVEL**

<table>
<thead>
<tr>
<th>RF Level dBm</th>
<th>Mono (L)</th>
<th></th>
<th></th>
<th>Stereo (L)</th>
<th></th>
<th></th>
<th></th>
<th>Separation L-&gt;R</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Signal dB</td>
<td>Noise dB</td>
<td>Signal dB</td>
<td>Filt Noise dB</td>
<td>Noise dB</td>
<td>Left dB</td>
<td>Right dB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-130</td>
<td>-29.50</td>
<td>-29.50</td>
<td>-29.00</td>
<td>-29.00</td>
<td>-28.50</td>
<td>-28.50</td>
<td>-130</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-125</td>
<td>-29.50</td>
<td>-29.50</td>
<td>-29.00</td>
<td>-29.00</td>
<td>-28.50</td>
<td>-28.50</td>
<td>-125</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-120</td>
<td>-29.50</td>
<td>-29.50</td>
<td>-28.50</td>
<td>-29.00</td>
<td>-28.50</td>
<td>-28.50</td>
<td>-120</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-115</td>
<td>-28.00</td>
<td>-28.00</td>
<td>-27.50</td>
<td>-28.00</td>
<td>-27.50</td>
<td>-27.50</td>
<td>-115</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-110</td>
<td>-24.00</td>
<td>-27.00</td>
<td>-23.50</td>
<td>-26.50</td>
<td>-25.00</td>
<td>-25.00</td>
<td>-110</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-105</td>
<td>-16.00</td>
<td>-25.50</td>
<td>-16.00</td>
<td>-24.50</td>
<td>-20.00</td>
<td>-20.00</td>
<td>-105</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-100</td>
<td>-8.00</td>
<td>-26.00</td>
<td>-8.00</td>
<td>-25.00</td>
<td>-13.00</td>
<td>-13.00</td>
<td>-100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-95</td>
<td>-2.00</td>
<td>-33.00</td>
<td>-2.00</td>
<td>-32.00</td>
<td>-7.50</td>
<td>-8.00</td>
<td>-95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-90</td>
<td>-0.25</td>
<td>-47.50</td>
<td>-0.25</td>
<td>-30.50</td>
<td>0.00</td>
<td>-29.00</td>
<td>-90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-85</td>
<td>0.00</td>
<td>-55.00</td>
<td>0.00</td>
<td>-35.50</td>
<td>0.00</td>
<td>-34.00</td>
<td>-85</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-80</td>
<td>0.00</td>
<td>-58.50</td>
<td>0.00</td>
<td>-40.50</td>
<td>0.00</td>
<td>-37.00</td>
<td>-80</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-75</td>
<td>0.00</td>
<td>-60.00</td>
<td>0.00</td>
<td>-45.50</td>
<td>0.00</td>
<td>-39.00</td>
<td>-75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-70</td>
<td>0.00</td>
<td>-61.50</td>
<td>0.00</td>
<td>-50.00</td>
<td>0.00</td>
<td>-39.50</td>
<td>-70</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-65</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-54.00</td>
<td>0.00</td>
<td>-40.00</td>
<td>-65</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-60</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-57.50</td>
<td>0.00</td>
<td>-40.00</td>
<td>-60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-55</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-59.00</td>
<td>0.00</td>
<td>-40.00</td>
<td>-55</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-50</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-60.00</td>
<td>0.00</td>
<td>-40.00</td>
<td>-50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-45</td>
<td>0.00</td>
<td>-61.00</td>
<td>0.00</td>
<td>-59.50</td>
<td>-33.00</td>
<td>-40.00</td>
<td>-45</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
FM Receiver Test Laboratory

Two RF Tone Tests

7 Capture Ratio
Set Up: Test Set Up 3
Desired: Test Freq. 1, -55dBm, 1kHz, 22.5kHz dev, Mono
Undesired: Test Freq. 1, -130dBm, CW
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Increase Undesired signal until audio level drops 1dB, record Undesired RF level as RF Lev 1
Increase Undesired signal until audio level drops 30dB, record Undesired RF level as RF Lev 2

Measurement: RF Lev 1 -55.94 dBm
RF Lev 2 -42.94 dBm

Capture Ratio: -6.50 dB (RF Lev 1 - RF Lev 2)/2

8 Selectivity - 1st Adjacent 30dB S/N (Upper and Lower)
Upper 1st
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up:
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
<td>dBm</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-54.92</td>
<td>-55.92</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-46.92</td>
<td>-47.92</td>
</tr>
</tbody>
</table>

Selectivity, 1st Adj.: -4.08 dB (RF D/U Up + RF D/U Lo)/2

9 Selectivity - 2nd Adjacent 30dB S/N (Upper and Lower)
Upper 2nd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up:
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
<td>dBm</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-30.12</td>
<td>-30.12</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-25.92</td>
<td>-25.92</td>
</tr>
</tbody>
</table>

Selectivity, 2nd Adj.: -26.98 dB (RF D/U Up + RF D/U Lo)/2
10 Selectivity - 1st Adjacent 50dB S/N (Upper and Lower)

Upper 1st
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Channel to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Channel to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB dBm</th>
<th>DB U</th>
<th>Desired Lev</th>
<th>Stereo 50dB dBm</th>
<th>DB U</th>
</tr>
</thead>
<tbody>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>57.42 dBm</td>
<td>2.42</td>
<td>Undesired Upper Lev</td>
<td>-76.92 dBm</td>
<td>21.92</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-48.02 dBm</td>
<td>-6.98</td>
<td>Undesired Lower Lev</td>
<td>-69.92 dBm</td>
<td>14.92</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.</td>
<td>-2.28 dBm</td>
<td>18.42</td>
<td>(RF D/U Up + RF D/U Lo)²</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11 Selectivity - 2nd Adjacent 50dB S/N (Upper and Lower)

Upper 2nd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Channel to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Channel to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB dBm</th>
<th>DB U</th>
<th>Desired Lev</th>
<th>Stereo 50dB dBm</th>
<th>DB U</th>
</tr>
</thead>
<tbody>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-31.42 dBm</td>
<td>-23.58</td>
<td>Undesired Upper Lev</td>
<td>-45.92 dBm</td>
<td>-9.08</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-33.02 dBm</td>
<td>-21.98</td>
<td>Undesired Lower Lev</td>
<td>-33.32 dBm</td>
<td>-21.68</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.</td>
<td>-22.78 dBm</td>
<td>15.38</td>
<td>(RF D/U Up + RF D/U Lo)²</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

12 Selectivity - 3rd Adjacent 50dB S/N (Upper and Lower)

Upper 3rd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Channel to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 3rd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Channel to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB dBm</th>
<th>DB U</th>
<th>Desired Lev</th>
<th>Stereo 50dB dBm</th>
<th>DB U</th>
</tr>
</thead>
<tbody>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-25.82 dBm</td>
<td>-29.18</td>
<td>Undesired Upper Lev</td>
<td>-26.22 dBm</td>
<td>-28.78</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-29.32 dBm</td>
<td>-25.68</td>
<td>Undesired Lower Lev</td>
<td>-29.42 dBm</td>
<td>-25.58</td>
</tr>
<tr>
<td>Selectivity, 3rd Adj.</td>
<td>-27.43 dBm</td>
<td>27.18</td>
<td>(RF D/U Up + RF D/U Lo)²</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Additional Tests

13 **10.7MHz Rejection**

Using Test Set Up 1 at the desired frequency of 94.1MHz;  
Set generator to 1kHz, 75kHz dev. / CW  
Reduce RF level to obtain 30dB S/N ratio;  
Record RF Level as RF Lev 1  
Set RF generator to 10.7MHz  
Adjust RF level to obtain 30dB S/N ratio  
Record RF Level as RF Lev 2  
Calculate the difference between the two RF levels

<table>
<thead>
<tr>
<th>RF Lev 1</th>
<th>-94.00 dBm</th>
<th>EOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Lev 2</td>
<td>-0.60 dBm</td>
<td></td>
</tr>
<tr>
<td>D/U</td>
<td>-93.40 dB</td>
<td></td>
</tr>
</tbody>
</table>

14 **10.7 IM Test**

Using the three generator set up, set generators as follows;
Set Up:  
Desired: 94.1MHz, -45dBm, Pilot only  
Lower Undesired: 88.7MHz, 1kHz, 75kHz dev  
Upper Undesired: 99.3MHz, 400Hz, 75kHz dev  
Adjust:  
Undesired RF level to obtain -50dB noise floor, record RF lev 10.6MHz Spacing  
Set upper undesired generator to 99.4MHz. Adjust RF lev for -50dB noise floor. (RF lev 10.7MHz Spacing)

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
</tbody>
</table>

EOC: His

15 **10.7MHz (10.6MHz) Local Osc Interference Test**

Set up:  
Desired: 94.1MHz, -45dBm, Pilot only  
Set upper interfering generator to 104.7MHz (94.1MHz + 10.6MHz), 400Hz, 75kHz dev  
a) Increase level of undesired signals until noise floor is -50dB (+/- 2dB). Record RF Lev for 10.6MHz Spacing  
b) Re-adjust upper interfering generator to 104.8MHz (94.1MHz + 10.7MHz)  
Re-adjust RF level for -50dB and record RF lev for 10.7MHz spacing

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EOC: Objectionable beat notes
FM Receiver Test Laboratory

Date: 2/28/99  
Engineers: RMc  
Project: FM Receiver Test A1

Receiver Test No.: 11  
Class: Bookshelf/Port. All-in-One  
Radio Mfg.: Sanyo  
Model: MCD-5736  
Serial: 8701316

Antenna Network: 50/75 Ohm Trans. FM  
Audio load: 8 Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms

Comments: Modified with F connector antenna input  
Tone control full right (high)  
BASSXPANDER control off

<table>
<thead>
<tr>
<th>Standard RF Levels</th>
<th>Standard FM Test Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong: -45 dBm</td>
<td>94.1MHz</td>
</tr>
<tr>
<td>Medium: -55 dBm</td>
<td></td>
</tr>
<tr>
<td>Weak: -65 dBm</td>
<td></td>
</tr>
</tbody>
</table>

Standard Test Set Ups

1. Strong Signal Overload  
2. Single RF Tone Tests  
3. Two RF Tone Tests  
4. Measurement Set up

Standard Tests

1. Local Oscillator Frequency (Tuning Error)  
2. Standard Audio Output (Audio level and distortion)  
3. RF Input Overload (RF level required for 5% THD)  
4. AM Rejection  
5. Image Rejection  
6. Curve Tests (plots of RF Level Vs Audio Output)  
7. Capture Ratio  
8. Selectivity; 1st Adjacent (30dB noise figure)  
9. Selectivity; 2nd Adjacent (30dB noise figure)  
10. Selectivity; 1st Adjacent (50dB noise figure)  
11. Selectivity; 2nd Adjacent (50dB noise figure)  
12. Selectivity; 3rd Adjacent (50dB noise figure)  
13. 10.7MHz Rejection  
14. 10.7MHz Intermodulation  
15. 10.7MHz Spurious (Local Osc. Interference)
FM Receiver Test Laboratory

Test Results:

1 Local Oscillator Frequency:
   104.821 MHz

2 Standard Audio Output:
   Left Channel  THD  Right Channel  THD
   0.84 Vrms  0.4 %  0.84 Vrms  0.35 %

3 RF Input Overload:
   22.00 dBm  Max Test Bed RF level - increase in THD: (2 %)

4 AM Rejection:
   0.00 dB

5 Image Rejection:
   -20.00 dB

6 Curve Tests:
(See Flots)

7 Capture Ratio:
   -6.50 dB

8 Selectivity, First Adjacent, 30dB Noise Floor (Ave. D/U)
   -4.05 dB Mono
   -3.08 dB Stereo

9 Selectivity, Second Adjacent, 30dB Noise Floor (Ave. D/U)
   -26.98 dB Mono
   -26.98 dB Stereo

10 Selectivity, First Adjacent, 50dB Noise Floor (Ave D/U)
   -2.28 dB Mono
   18.42 dB Stereo

11 Selectivity, Second Adjacent, 50dB Noise Floor (Ave. D/U)
   -22.78 dB Mono
   -15.38 dB Stereo

12 Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)
   -27.43 dB Mono
   -27.18 dB Stereo

13 10.7MHz Rejection
   -93.40 dB

14 10.7MHz IM
   -19.63 dB (10.6)  His
   -17.63 dB (10.7)  0

15 10.7MHz Spurious (Local Osc. Interference)
   13.14 dB (10.6)  Objectionable beat notes
   17.14 dB (10.7)  0
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

- Insertion loss = -6dB

RF LEVEL (dBm)

Sanyo MCD-S736
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6 dB

Sanyo MCD-S736
1st and 2nd ADJACENT CHANNEL SELECTIVITY
(30dB Noise Floor)

Max Level

Insertion loss = -6dB

RF Level (dBm)
93.50 93.60 93.70 93.80 93.90 94.00 94.10 94.20 94.30 94.40 94.50 94.60 94.70

Frequency (MHz)

Sanyo MCD-S736

File Name: C_SANYOj
Selectivity 30dB
Page 13 of 15
1st, 2nd and 3rd ADJACENT CHANNEL SELECTIVITY
(50dB Noise Floor)

Insertion loss = -6dB

Frequency (MHz)

Sanyo MCD-S736
FM Receiver Test Laboratory

IM & L.O. Rejection
(50dB Noise Floor)

Max level

Insertion loss = -6dB

Sanyo MCD-S736
Receiver #12

Sony

Portable
Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 12
Class: Bookshelf/Port. All-in-One
Radio Mfg.: Sony
Model: CFD-S33
Serial: 11323161

Antenna Network: 50/75 Ohm Trans. FM
________________________________________ AM

Audio load: 10K Ohms

Initial Setup: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms

Comments: Modified with F connector antenna input
Mono/Stereo switch in Stereo
Audio output, Headphone output

Standard RF Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>Standard RF Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>-45 dBm</td>
</tr>
<tr>
<td>Medium</td>
<td>-55 dBm</td>
</tr>
<tr>
<td>Weak</td>
<td>-65 dBm</td>
</tr>
</tbody>
</table>

Standard FM Test Frequencies

<table>
<thead>
<tr>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low: 94.1 MHz</td>
</tr>
</tbody>
</table>

Standard Test Set Ups

1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

Standard Tests

1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF Input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
7. Capture Ratio
8. Selectivity, 1st Adjacent (30dB noise figure)
9. Selectivity, 2nd Adjacent (30dB noise figure)
10. Selectivity, 1st Adjacent (50dB noise figure)
11. Selectivity, 2nd Adjacent (50dB noise figure)
12. Selectivity, 3rd Adjacent (50dB noise figure)
13 - 15. Additional 10.7MHz Tests
Single RF Tone Tests

1 Local Oscillator Frequency (Tuning Error)
   Set Up: Connect Spectrum Analyzer to Radio Antenna input
   Adjust: Tune radio to Test Freq. 1, measure L.O. Freq 1
   Tune radio to Test Freq. 2, measure L.O. Freq 2

   Measurement:  L.O. Freq 1  104.800 MHz
                 L.O. Freq 2  __________ MHz

2 Standard Audio Output
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio Volume to Std. Ref. Level, record Left and Right channel audio level and THD

   Measurement:  Left Ch  0.745 Vrms
                 Left Ch  THD  3.40 %  = 0dB
                 Right Ch Level  0.765 Vrms
                 Right Ch THD  3.60 %

3 RF Input Overload
   Set Up: Test Set Up 1, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level
   Increase RF Level until 5% THD at Radio output, record RF Level

   Measurement:  RF Lev.  17.00 dBm (@ 5% THD)

4 AM Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level, record THD
   Set modulation mode to FM (75kHz), AM (30%), record THD

   Measurement:  THD  3.6 %  = -28.87 dB  (FM Only)
                 THD  3.6 %  = -28.87 dB  (FM + AM 30%)%

   AM Rejection:  0.00 dB

5 Image Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level (0dB)
   Decrease RF Level until S/N Ratio = 30dB, record RF Lev1
   Tune RF Gen to; Desired Freq. +/- 2 X IF Freq.
   Adjust RF Level until S/N Ratio = 30dB, record RF Lev2

   Measurement:  RF Lev1  -99.0 dBm  (S/N Ratio = 30dB)
                 RF Lev2  -74.0 dBm  (21.4MHz + 94.1MHz = 115.5MHz)
                 Image Rejection:  -25.00 dB  (RF Lev1 - RF Lev2)
FM Receiver Test Laboratory

6 Curve Tests
Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
Adjust: Set Radio audio to Std. Ref. Level (0dB) for both Mono and Stereo set ups.

Plot: Signal, Noise Vs RF Level (Mono)
      Signal, Noise Vs RF Level (L+R, Stereo)
      Stereo Separation Vs RF Level (L only, Stereo)
Record: Noise floor at -45dBm without Low Pass Filter as a measure of pilot rejection

CURVE DATA

<table>
<thead>
<tr>
<th>RF Level dBm</th>
<th>Monaural (L)</th>
<th>Stereophonic (L)</th>
<th>Separation L&gt;R</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Signal dB</td>
<td>Noise dB</td>
<td>Signal dB</td>
</tr>
<tr>
<td>-130</td>
<td>-36.00</td>
<td>-36.00</td>
<td>-35.00</td>
</tr>
<tr>
<td>-125</td>
<td>-36.00</td>
<td>-36.00</td>
<td>-35.00</td>
</tr>
<tr>
<td>-120</td>
<td>-35.00</td>
<td>-36.00</td>
<td>-34.00</td>
</tr>
<tr>
<td>-115</td>
<td>-31.00</td>
<td>-35.50</td>
<td>-30.50</td>
</tr>
<tr>
<td>-110</td>
<td>-23.00</td>
<td>-35.00</td>
<td>-22.50</td>
</tr>
<tr>
<td>-105</td>
<td>-14.00</td>
<td>-34.50</td>
<td>-13.50</td>
</tr>
<tr>
<td>-100</td>
<td>-6.50</td>
<td>-35.50</td>
<td>-6.00</td>
</tr>
<tr>
<td>-95</td>
<td>-2.00</td>
<td>-42.00</td>
<td>-1.50</td>
</tr>
<tr>
<td>-90</td>
<td>-0.30</td>
<td>-54.00</td>
<td>-0.20</td>
</tr>
<tr>
<td>-85</td>
<td>0.00</td>
<td>-59.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-80</td>
<td>0.00</td>
<td>-61.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-75</td>
<td>0.00</td>
<td>-61.50</td>
<td>0.00</td>
</tr>
<tr>
<td>-70</td>
<td>0.00</td>
<td>-61.50</td>
<td>0.00</td>
</tr>
<tr>
<td>-65</td>
<td>0.00</td>
<td>-61.50</td>
<td>0.00</td>
</tr>
<tr>
<td>-60</td>
<td>0.00</td>
<td>-61.50</td>
<td>0.00</td>
</tr>
<tr>
<td>-55</td>
<td>0.00</td>
<td>-61.50</td>
<td>0.00</td>
</tr>
<tr>
<td>-50</td>
<td>0.00</td>
<td>-61.50</td>
<td>0.00</td>
</tr>
<tr>
<td>-45</td>
<td>0.00</td>
<td>-61.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Two RF Tone Tests

Capture Ratio
Set Up: Test Set Up 3
- Desired: Test Freq. 1, -55dBm, 1kHz, 22.5kHz dev, Mono
- Undesired: Test Freq. 1, -130dBm, CW
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Increase Undesired signal until audio level drops 1dB, record Undesired RF level as RF Lev 1
- Increase Undesired signal until audio level drops 30dB, record Undesired RF level as RF Lev 2
Measurement:
- RF Lev 1: -57.94 dBm
- RF Lev 2: -49.94 dBm
Capture Ratio: -4.00 dB (RF Lev 1 - RF Lev 2)/2

Selectivity - 1st Adjacent 30dB S/N (Upper and Lower)
Upper 1st
Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1, +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1, -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dbm</td>
<td>D/U</td>
</tr>
<tr>
<td>D/U</td>
<td></td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-58.32</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-54.72</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.:</td>
<td>1.52</td>
</tr>
</tbody>
</table>

Selectivity - 2nd Adjacent 30dB S/N (Upper and Lower)
Upper 2nd
Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1, +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1, -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dbm</td>
<td>D/U</td>
</tr>
<tr>
<td>D/U</td>
<td></td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-15.92</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-15.52</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.:</td>
<td>-39.28</td>
</tr>
</tbody>
</table>
Selectivity - 1st Adjacent 50dB S/N (Upper and Lower)

**Upper 1st**
Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

**Lower 1st**
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
<td>dBm</td>
</tr>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>66.72</td>
<td>11.22</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>66.22</td>
<td>11.22</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.:</td>
<td>11.47</td>
<td>19.52</td>
</tr>
</tbody>
</table>

**Selectivity - 2nd Adjacent 50dB S/N (Upper and Lower)**

**Upper 2nd**
Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

**Lower 2nd**
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
<td>dBm</td>
</tr>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-24.92</td>
<td>-30.08</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-20.92</td>
<td>-34.08</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.:</td>
<td>-32.08</td>
<td>-23.58</td>
</tr>
</tbody>
</table>

**Selectivity - 3rd Adjacent 50dB S/N (Upper and Lower)**

**Upper 3rd**
Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 +600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

**Lower 3rd**
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 +600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
<td>dBm</td>
</tr>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-11.22</td>
<td>-43.78</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-19.62</td>
<td>-35.38</td>
</tr>
<tr>
<td>Selectivity, 3rd Adj.:</td>
<td>-39.58</td>
<td>-29.83</td>
</tr>
</tbody>
</table>

(RF D/U Up + RF D/U Lo)/2
Additional Tests

13 10.7MHz Rejection
Using Test Set Up 1 at the desired frequency of 94.1MHz;
Set generator to 1kHz, 75kHz dev. / CW
Reduce RF level to obtain 30dB S/N ratio.
Record RF Level as RF Lev 1
Set RF generator to 10.7MHz;
Adjust RF level to obtain 30dB S/N ratio
Record RF Level as RF Lev 2
Calculate the difference between the two RF levels

<table>
<thead>
<tr>
<th>RF Lev 1</th>
<th>-98.50 dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Lev 2</td>
<td>-47.00 dBm</td>
</tr>
<tr>
<td>D/U</td>
<td>-51.50 dB</td>
</tr>
</tbody>
</table>

EOC

14 10.7 IM Test
Using the three generator set up, set generators as follows;
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
Lower Undesired: 88.7MHz, 1kHz, 75kHz dev
Upper Undesired: 99.3MHz, 400Hz, 75kHz dev
Adjust: Undesired RF level to obtain -50dB noise floor, record RF lev 10.6MHz Spacing
Set upper undesired generator to 99.4MHz, Adjust RF lev for -50dB noise floor. (RF lev 10.7MHz Spacing)

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>----------------</td>
<td>-------</td>
</tr>
<tr>
<td>-45.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EOC: Hiss

15 10.7MHz (10.6MHz) Local Osc Interference Test
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
Set upper interferer generator to 104.7MHz (94.1MHz + 10.6MHz), 400Hz, 75kHz dev
a) Increase level of undesired signals until noise floor is -50dB (+/- 2dB), Record RF Lev for 10.6MHz Spacing
b) Re-adjust upper interfering generator to 104.8MHz (94.1MHz + 10.7MHz)
Re-adjust RF level for -50dB and record RF lev for 10.7MHz spacing

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>-45.00</td>
<td></td>
</tr>
<tr>
<td>-52.37</td>
<td>7.37</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EOC:
FM Receiver Test Laboratory

Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 12
Class: Bookshelf/Port. All-in-One
Radio Mfg.: Sony
Model: CFD-S33
Serial: 1132161

Antenna Network: 50/75 Ohm Trans. FM

Audio load: 10K Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output
Any other control settings unique to the radio under test shall be noted in the Comments section.
Left channel shall be used for all Signal (and S/N ratio) measurements.
15kHz Low Pass filter shall be used on the output of the left channel for all measurements.
Right channel shall be used for Noise measurements - Stereo Separation test only.
All level measurements are ras

Comments: Modified with F connector antenna input

Mono/Sterio switch in Stereo
Audio output; Headphone output
0

Standard RF Levels

<table>
<thead>
<tr>
<th></th>
<th>Strong</th>
<th>Medium</th>
<th>Weak</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>-45</td>
<td>-55</td>
<td>-65</td>
</tr>
</tbody>
</table>

Standard FM Test Frequencies

<table>
<thead>
<tr>
<th>dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>94.1MHz</td>
</tr>
</tbody>
</table>

Standard Test Set Ups

1 Strong Signal Overload
2 Single RF Tone Tests
3 Two RF Tone Tests
4 Measurement Set up

Standard Tests

<table>
<thead>
<tr>
<th>Standard Tests</th>
<th>13</th>
<th>14</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Oscillator Frequency</td>
<td>10.7MHz Rejection</td>
<td>10.7MHz Intermodulation</td>
<td>10.7MHz Spurious (Local Osc. Interference)</td>
</tr>
<tr>
<td>Standard Audio Output</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Audio level and distortion)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RF Input Overload</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(RF level required for 5% THD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AM Rejection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Image Rejection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Curve Tests (plots of RF Level Vs Audio Output)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capture Ratio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selectivity; 1st Adjacent (30dB noise figure)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selectivity; 2nd Adjacent (30dB noise figure)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selectivity; 1st Adjacent (50dB noise figure)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selectivity; 2nd Adjacent (50dB noise figure)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Selectivity; 3rd Adjacent (50dB noise figure)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Test Results:

1. **Local Oscillator Frequency:**
   - 104.800 MHz

2. **Standard Audio Output:**
   - Left Channel: 0.745 Vrms, THD: 3.40%
   - Right Channel: 0.765 Vrms, THD: 3.60%

3. **RF Input Overload:**
   - 17.00 dBm, 0

4. **AM Rejection:**
   - 0.00 dB

5. **Image Rejection:**
   - -25.00 dB

6. **Curve Tests:**
   - (See Plots)

7. **Capture Ratio:**
   - -4.00 dB

8. **Selectivity, First Adjacent, 30dB Noise Floor (Ave. D/U):**
   - Mono: 1.52 dB
   - Stereo: 1.92 dB

9. **Selectivity, Second Adjacent, 30dB Noise Floor (Ave. D/U):**
   - Mono: -39.28 dB
   - Stereo: -38.48 dB

10. **Selectivity, First Adjacent, 50dB Noise Floor (Ave D/U):**
    - Mono: 11.47 dB
    - Stereo: 19.92 dB

11. **Selectivity, Second Adjacent, 50dB Noise Floor (Ave. D/U):**
    - Mono: -32.08 dB
    - Stereo: -23.58 dB

12. **Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U):**
    - Mono: -39.58 dB
    - Stereo: -29.83 dB

13. **10.7MHz Rejection:**
    - -51.50 dB

14. **10.7MHz IM:**
    - Mono: -12.63 dB (10.6) His
    - Stereo: -9.63 dB (10.7)

15. **10.7MHz Spurious (Local Osc. Interference):**
    - Mono: 7.37 dB (10.6)
    - Stereo: 9.37 dB (10.7)
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

Sony CFD-S33
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

Sony CFD-S33
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

RF LEVEL (dBm)

AUDIO LEVEL (dB)

Insertion loss = -6dB

Left

Right

Sony CFD-S33

File Name: C_sonytr

FM Stereo Separation Plot
1st, 2nd and 3rd ADJACENT CHANNEL SELECTIVITY
(50dB Noise Floor)

Insertion loss = -6dB

Sony CFD-S33
IM & L.O. Rejection
(50dB Noise Floor)

Insertion loss = -6dB

Sony CFD-S33
Receiver #13

Koss

Auto
Date: 2/28/99  
Engineers: RMc  
Project: FM Receiver Test A1  

Receiver Test No.: 13  
Class: Automobile  
Radio Mfg.: Koss  
Model: MS-457  
Serial: 380503200  
Antenna Network: JFW50MN-001  

Audio load: 10K Ohms  

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms.

Comments: Audio output: Line Out connectors  
Mono/Stereo switch in Stereo  
Local/Distant switch in Distant

Standard RF Levels  
Strong: -45 dBm  
Medium: -55 dBm  
Weak: -65 dBm  

Standard FM Test Frequencies  
Low: 94.1 MHz

Standard Test Set Ups

1 Strong Signal Overload  
2 Single RF Tone Tests  
3 Two RF Tone Tests  
4 Measurement Set up

Standard Tests

1 Local Oscillator Frequency (Tuning Error)  
2 Standard Audio Output (Audio level and distortion)  
3 RF Input Overload (RF level required for 5% THD)  
4 AM Rejection  
5 Image Rejection  
6 Curve Tests (plots of RF Level Vs Signal - Mono & Stereo, Noise - Mono & Stereo, Stereo Separation)  
7 Capture Ratio  
8 Selectivity; 1st Adjacent (30dB noise figure)  
9 Selectivity; 2nd Adjacent (30dB noise figure)  
10 Selectivity; 1st Adjacent (50dB noise figure)  
11 Selectivity; 2nd Adjacent (50dB noise figure)  
12 Selectivity; 3rd Adjacent (50dB noise figure)  
13 - 15 Additional 10.7MHz Tests
FM Receiver Test Laboratory

Single RF Tone Tests

1 Local Oscillator Frequency (Tuning Error)
   Set Up: Connect Spectrum Analyzer to Radio Antenna input
   Adjust: Tune radio to Test Freq. 1, measure L.O. Freq 1
   Tune radio to Test Freq. 2, measure L.O. Freq 2

   Measurement:
   L.O. Freq 1  _____ MHz
   L.O. Freq 2  _____ MHz

2 Standard Audio Output
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio Volume to Std. Ref. Level, record Left and Right channel audio level and THD

   Measurement:
   Left Ch: Level 0.500 Vrms = 0dB
            THD 0.95%  
   Right Ch: Level 0.520 Vrms
            THD 0.80% 

3 RF Input Overload
   Set Up: Test Set Up 1, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level
   Increase RF Level until 5% THD at Radio output, record RF Level

   Measurement:
   RF Lev. 22.00 dBm (@ 5% THD)
   Max Test Bed RF level - no increase in THD

4 AM Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level, record THD
   Set modulation mode to FM (75kHz), AM (30%), record THD

   Measurement:
   THD 0.95%  = -40.45 dB  (FM Only)
   THD 0.95%  = -40.45 dB  (FM + AM 30%)

   AM Rejection: 0.00 dB

5 Image Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level (0dB)
   Decrease RF Level until S/N Ratio = 30dB, record RF Lev1
   Tune RF Gen to: Desired Freq. +/- 2 X IF Freq.
   Adjust RF Level until S/N Ratio = 30dB, record RF Lev2

   Measurement:
   RF Lev1 -97.0 dBm  (S/N Ratio = 30dB)
   RF Lev2 -51.0 dBm  (21.4MHz + 94.1MHz = 115.5MHz)
   Image Rejection: -46.00 dB  (RF Lev1 - RF Lev2)
Curve Tests

Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
Adjust: Set Radio audio to Std. Ref. Level (0dB) for both Mono and Stereo set ups.

Plot: Signal, Noise Vs RF Level (Mono)
Signal, Noise Vs RF Level (L+R, Stereo)
Stereo Separation Vs RF Level (L only, Stereo)

Record: Noise floor at -45dBm without Low Pass Filter as a measure of pilot rejection

### CURVE DATA

#### SIGNAL, NOISE & SEPARATION VS RF LEVEL

<table>
<thead>
<tr>
<th>RF Level dBm</th>
<th>Mono Signal dB</th>
<th>Noise dB</th>
<th>Stereo Signal dB</th>
<th>Filter Noise dB</th>
<th>Noise dB</th>
<th>Left dB</th>
<th>Right dB</th>
<th>Separation L&gt;R dB</th>
<th>RF Level dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>-130</td>
<td>-46.50</td>
<td>-46.50</td>
<td>-46.00</td>
<td>-46.00</td>
<td>-46.00</td>
<td>-46.00</td>
<td>-46.00</td>
<td>-130</td>
<td></td>
</tr>
<tr>
<td>-125</td>
<td>-46.50</td>
<td>-46.50</td>
<td>-46.00</td>
<td>-46.00</td>
<td>-46.00</td>
<td>-46.00</td>
<td>-46.00</td>
<td>-125</td>
<td></td>
</tr>
<tr>
<td>-120</td>
<td>-46.50</td>
<td>-46.50</td>
<td>-46.00</td>
<td>-46.00</td>
<td>-46.00</td>
<td>-46.00</td>
<td>-46.00</td>
<td>-120</td>
<td></td>
</tr>
<tr>
<td>-115</td>
<td>-45.00</td>
<td>-45.50</td>
<td>-45.00</td>
<td>-45.00</td>
<td>-45.00</td>
<td>-45.00</td>
<td>-45.00</td>
<td>-115</td>
<td></td>
</tr>
<tr>
<td>-110</td>
<td>-45.00</td>
<td>-45.50</td>
<td>-45.00</td>
<td>-45.00</td>
<td>-45.00</td>
<td>-45.00</td>
<td>-45.00</td>
<td>-110</td>
<td></td>
</tr>
<tr>
<td>-105</td>
<td>-40.50</td>
<td>-43.50</td>
<td>-40.50</td>
<td>-43.00</td>
<td>-42.50</td>
<td>-42.00</td>
<td>-41.00</td>
<td>-105</td>
<td></td>
</tr>
<tr>
<td>-100</td>
<td>-31.50</td>
<td>-40.50</td>
<td>-31.00</td>
<td>-40.00</td>
<td>-35.50</td>
<td>-35.00</td>
<td>-30.00</td>
<td>-100</td>
<td></td>
</tr>
<tr>
<td>-95</td>
<td>-17.50</td>
<td>-38.00</td>
<td>-17.00</td>
<td>-36.50</td>
<td>-23.00</td>
<td>-22.50</td>
<td>-13.00</td>
<td>-95</td>
<td></td>
</tr>
<tr>
<td>-90</td>
<td>-4.50</td>
<td>-43.50</td>
<td>-3.00</td>
<td>-29.00</td>
<td>-4.00</td>
<td>-27.50</td>
<td>-9.50</td>
<td>-90</td>
<td></td>
</tr>
<tr>
<td>-85</td>
<td>0.00</td>
<td>-59.00</td>
<td>0.00</td>
<td>-33.50</td>
<td>0.00</td>
<td>-31.50</td>
<td>-9.00</td>
<td>-85</td>
<td></td>
</tr>
<tr>
<td>-80</td>
<td>0.00</td>
<td>-64.50</td>
<td>0.00</td>
<td>-38.50</td>
<td>0.00</td>
<td>-36.00</td>
<td>-8.00</td>
<td>-80</td>
<td></td>
</tr>
<tr>
<td>-75</td>
<td>0.00</td>
<td>-71.00</td>
<td>0.00</td>
<td>-48.00</td>
<td>0.00</td>
<td>-39.00</td>
<td>-7.50</td>
<td>-75</td>
<td></td>
</tr>
<tr>
<td>-70</td>
<td>0.00</td>
<td>-72.00</td>
<td>0.00</td>
<td>-53.00</td>
<td>0.00</td>
<td>-39.50</td>
<td>-7.00</td>
<td>-70</td>
<td></td>
</tr>
<tr>
<td>-65</td>
<td>0.00</td>
<td>-72.00</td>
<td>0.00</td>
<td>-57.00</td>
<td>0.00</td>
<td>-40.00</td>
<td>-6.50</td>
<td>-65</td>
<td></td>
</tr>
<tr>
<td>-60</td>
<td>0.00</td>
<td>-72.00</td>
<td>0.00</td>
<td>-61.00</td>
<td>0.00</td>
<td>-40.00</td>
<td>-6.00</td>
<td>-60</td>
<td></td>
</tr>
<tr>
<td>-55</td>
<td>0.00</td>
<td>-72.00</td>
<td>0.00</td>
<td>-63.00</td>
<td>0.00</td>
<td>-40.00</td>
<td>-5.50</td>
<td>-55</td>
<td></td>
</tr>
<tr>
<td>-50</td>
<td>0.00</td>
<td>-72.00</td>
<td>0.00</td>
<td>-63.50</td>
<td>0.00</td>
<td>-40.00</td>
<td>-5.00</td>
<td>-50</td>
<td></td>
</tr>
<tr>
<td>-45</td>
<td>0.00</td>
<td>-72.00</td>
<td>0.00</td>
<td>-64.00</td>
<td>0.00</td>
<td>-40.00</td>
<td>-4.50</td>
<td>-45</td>
<td></td>
</tr>
</tbody>
</table>
Two RF Tone Tests

7 Capture Ratio
Set Up: Test Set Up 3
Desired: Test Freq. 1, -55dBm, 1kHz, 22.5kHz Dev, Mono
Undesired: Test Freq. 1, -130dBm, CW
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Increase Undesired signal until audio level drops 1dB, record Undesired RF level as RF Lev 1
Increase Undesired signal until audio level drops 30dB, record Undesired RF level as RF Lev 2

Measurement:
RF Lev 1  -55.98  dBm
RF Lev 2  -50.98  dBm

Capture Ratio:  -2.50  dB  (RF Lev 1 - RF Lev 2)/2

8 Selectivity - 1st Adjacent 30dB S/N (Upper and Lower)
Upper 1st
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th></th>
<th>Mono 30dB</th>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
<td>D/U</td>
<td>-55.00</td>
<td>D/U</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-35.28</td>
<td>-19.72</td>
<td>-35.38</td>
<td>-19.62</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-47.38</td>
<td>-7.62</td>
<td>-47.38</td>
<td>-7.62</td>
</tr>
</tbody>
</table>

9 Selectivity - 2nd Adjacent 30dB S/N (Upper and Lower)
Upper 2nd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th></th>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>8.02</td>
<td>-63.02</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>8.02</td>
<td>-63.02</td>
</tr>
</tbody>
</table>
| Selectivity, 2nd Adj. | Mes.KF | -63.02 | Mes.KF      | -63.02      | (RF D/U Up + RF D/U Lo)/2
10 Selectivity - 1st Adjacent 50dB S/N (Upper and Lower)
   Upper 1st
   Set Up: Test Set Up 3
   Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
   Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level (0dB)
   Set the modulation of the Desired signal to CW
   Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

   Lower 1st
   Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
   Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level (0dB)
   Set the modulation of the Desired signal to CW
   Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th></th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-36.78</td>
<td>-18.22</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-51.78</td>
<td>-3.22</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.</td>
<td>-19.72</td>
<td>1.48</td>
</tr>
</tbody>
</table>

11 Selectivity - 2nd Adjacent 50dB S/N (Upper and Lower)
   Upper 2nd
   Set Up: Test Set Up 3
   Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
   Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level (0dB)
   Set the modulation of the Desired signal to CW
   Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

   Lower 2nd
   Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
   Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level (0dB)
   Set the modulation of the Desired signal to CW
   Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th></th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>8.02</td>
<td>-65.02</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>0.98</td>
<td>-55.96</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.</td>
<td>-59.50</td>
<td>-41.02</td>
</tr>
</tbody>
</table>

12 Selectivity - 3rd Adjacent 50dB S/N (Upper and Lower)
   Upper 3rd
   Set Up: Test Set Up 3
   Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
   Undesired: Test Freq. 1 +600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level (0dB)
   Set the modulation of the Desired signal to CW
   Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

   Lower 3rd
   Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
   Undesired: Test Freq. 1 -600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level (0dB)
   Set the modulation of the Desired signal to CW
   Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th></th>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>8.02</td>
<td>-63.02</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>8.02</td>
<td>-63.02</td>
</tr>
<tr>
<td>Selectivity, 3rd Adj.</td>
<td>-63.02</td>
<td>-46.52</td>
</tr>
</tbody>
</table>
Additional Tests

13 10.7MHz Rejection
Using Test Set Up 1 at the desired frequency of 94.1MHz;
Set generator to 1kHz, 75kHz dev. / CW
Reduce RF level to obtain 30dB S/N ratio.
Record RF Level as RF Lev 1
Set RF generator to 10.7MHz
Adjust RF level to obtain 30 dB S/N ratio
Record RF Level as RF Lev 2
Calculate the difference between the two RF levels

| RF Lev 1 | -96.50 | dBm | RF Lev 2 | 4.00 | dBm | EOC |
| D/U | -100.50 | dB |

14 10.7 IM Test
Using the three generator set up, set generators as follows;
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
Lower Undesired: 88.7MHz, 1kHz, 75kHz dev
Upper Undesired: 99.3MHz, 400Hz, 75kHz dev
Adjust: Undesired RF level to obtain -50dB noise floor, record RF lev 10.6MHz Spacing
Set upper undesired generator to 99.4MHz, Adjust RF lev for -50dB noise floor, (RF lev 10.7MHz Spacing)

<p>| 10.6MHz Spacing | 10.7MHz Spacing |</p>
<table>
<thead>
<tr>
<th>dBM</th>
<th>D/U</th>
<th>dBM</th>
<th>D/U</th>
</tr>
</thead>
<tbody>
<tr>
<td>-45.00</td>
<td>-45.00</td>
<td>-45.00</td>
<td>-45.00</td>
</tr>
</tbody>
</table>

Max RF | -31.93 | Max RF | -31.93 |

EOC: Noise floor at Max RF: -55dB
Noise floor at Max RF: -52dB

15 10.7MHz (10.6MHz) Local Osc Interference Test
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
Set upper interferer generator to 104.7MHz (94.1MHz + 10.6MHz), 400Hz, 75kHz dev
a) Increase level of undesired signals until noise floor is -50dB (+/- 2dB), Record RF Lev for 10.6MHz Spacing
b) Re-adjust upper interfering generator to 104.8MHz (94.1MHz + 10.7MHz)
Re-adjust RF level for -50dB and record RF lev for 10.7MHz spacing

<p>| 10.6MHz Spacing | 10.7MHz Spacing |</p>
<table>
<thead>
<tr>
<th>dBM</th>
<th>D/U</th>
<th>dBM</th>
<th>D/U</th>
</tr>
</thead>
<tbody>
<tr>
<td>-45.00</td>
<td>-45.00</td>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td>-23.98</td>
<td>-21.02</td>
<td>-28.98</td>
<td>-16.02</td>
</tr>
</tbody>
</table>

EOC:
Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 13
Class: Automobile
Radio Mfg.: Koss
Model: MS-657
Serial: 3800503200
Antenna Network: JFW50MN-001 FM

Audio load: 10K Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms.

Comments: Audio output: Line Out connectors
Mono/Stereo switch in Stereo
Local/Distant switch in Distant

Standard RF Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>94.1MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>-45 dBm</td>
</tr>
<tr>
<td>Medium</td>
<td>-55 dBm</td>
</tr>
<tr>
<td>Weak</td>
<td>-65 dBm</td>
</tr>
</tbody>
</table>

Standard Test Set Ups

1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up
5. Standard Tests

1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF Input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
6. Curve Tests (plots of RF Level Vs Audio Output)
7. Capture Ratio
8. Selectivity, 1st Adjacent (30dB noise figure)
9. Selectivity, 2nd Adjacent (30dB noise figure)
10. Selectivity, 1st Adjacent (50dB noise figure)
11. Selectivity, 2nd Adjacent (50dB noise figure)
12. Selectivity, 3rd Adjacent (50dB noise figure)
Test Results:

1 Local Oscillator Frequency:
   0.000 MHz

2 Standard Audio Output:
   Left Channel  | THD  | Right Channel  | THD  |
                | 0.5  | 0.95 %        | 0.52 | 0.80 %

3 RF Input Overload:
   22.00 dBm  Max Test Bed RF level - no increase in THD

4 AM Rejection:
   0.00 dB

5 Image Rejection:
   -46.00 dB

6 Curve Tests:
   (See Plots)

7 Capture Ratio:
   -2.50 dB

8 Selectivity, First Adjacent, 30dB Noise Floor (Ave. D/U)

9 Selectivity, Second Adjacent, 30dB Noise Floor (Ave. D/U)
   -63.02 dB Mono  Max RF
   -63.02 dB Stereo  Max RF

10 Selectivity, First Adjacent, 50dB Noise Floor (Ave D/U)
    -10.72 dB Mono
    1.48 dB Stereo

11 Selectivity, Second Adjacent, 50dB Noise Floor (Ave D/U)
   -59.50 dB Mono
   -41.02 dB Stereo

12 Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)
   -63.02 dB Mono  Max RF
   -46.52 dB Stereo

13 10.7MHz Rejection
   -100.50 dB

14 10.7MHz IM
   -31.93 dB (10.6)  Max RF  Noise floor at Max RF: -55dB
   -31.93 dB (10.7)  Max RF  Noise floor at Max RF: -52dB

15 10.7MHz Spurious (Local Osc. Interference)
   -21.02 dB (10.6)
   -16.02 dB (10.7)
FM Receiver Test Laboratory

**SIGNAL/NOISE VS RF LEVEL**

Insertion loss = -6dB

Koss MS-457
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

Koss MS-457
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

RF LEVEL (dBm)

AUDI0 LEVEL (dB)

Insertion loss = -6dB

Koss MS-457
1st and 2nd ADJACENT CHANNEL SELECTIVITY
(30dB Noise Floor)

Insertion loss = -6dB

Koss MS-457
FM Receiver Test Laboratory

IM & L.O. Rejection
(50dB Noise Floor)

Insertion loss = -6dB

Koss MS-457
Receiver #14

Philips/Magnavox

Portable
FM Receiver Test Laboratory

Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 14
Class: Bookshelf/Port. All-in-One
Radio Mfg.: Philips/Magnavox
Model: AZ2700/17
Serial: KT019841120616

Antenna Network: 50/75 Ohm Trans. FM

Audio load: 8 Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms

Comments: Dynamic bass boost switch Off
Tone control Full Clockwise

Standard RF Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>-45</td>
</tr>
<tr>
<td>Medium</td>
<td>-55</td>
</tr>
<tr>
<td>Weak</td>
<td>-65</td>
</tr>
</tbody>
</table>

Standard FM Test Frequencies

<table>
<thead>
<tr>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low: 94.1 MHz</td>
</tr>
</tbody>
</table>

Standard Test Set Ups

1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

Standard Tests

1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
7. Capture Ratio
8. Selectivity; 1st Adjacent (30dB noise figure)
9. Selectivity; 2nd Adjacent (30dB noise figure)
10. Selectivity; 1st Adjacent (50dB noise figure)
11. Selectivity; 2nd Adjacent (50dB noise figure)
12. Selectivity; 3rd Adjacent (50dB noise figure)
13 - 15. Additional 10.7MHz Tests
Single RF Tone Tests

1 Local Oscillator Frequency (Tuning Error)
   Set Up: Connect Spectrum Analyzer to Radio Antenna input
   Adjust: Tune radio to Test Freq. 1, measure L.O. Freq 1
          Tune radio to Test Freq. 2, measure L.O. Freq 2
   Measurement: L.O. Freq 1 ________ MHz
                 L.O. Freq 2 ________ MHz

2 Standard Audio Output
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio Volume to Std. Ref. Level, record Left and Right channel audio level and THD
   Measurement: Left Ch
                 Level 1.000 Vrms = 0dB
                 THD 0.90 %
                 Right Ch
                 Level 1.200 Vrms
                 THD 0.90 %

3 RF Input Overload
   Set Up: Test Set Up 1, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
           Increase RF Level until 5% THD at Radio output, record RF Level
   Measurement: RF Lev. 22.00 dBm (@ 5% THD)
                 Max Test Bed RF level - increase in THD to: 2%

4 AM Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
           Set modulation mode to FM (75kHz), AM (30%), record THD
   Measurement: THD 0.96 % = -40.35 dB (FM Only)
                 THD 0.96 % = -40.35 dB (FM + AM 30%)
   AM Rejection: 0.00 dB

5 Image Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
           Decrease RF Level until S/N Ratio = 30dB, record RF Lev1
           Tune RF Gen to, Desired Freq. +/- 2 X IF Freq.
           Adjust RF Level until S/N Ratio = 30dB, record RF Lev2
   Measurement: RF Lev1 -99.0 dBm (S/N Ratio = 30dB)
                 RF Lev2 -58.0 dBm (21.4MHz + 94.1MHz = 115.5MHz)
   Image Rejection: -41.00 dB (RF Lev1 - RF Lev2)
   Very "mercurial" in nature. The reciever's AFC tends to make this measurement very slippery to find.
FM Receiver Test Laboratory

6 Curve Tests

Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo

Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB) for both Mono and Stereo set ups.

Plot: Signal, Noise Vs RF Level (Mono)
Signal, Noise Vs RF Level (L+R, Stereo)
Stereo Separation Vs RF Level (L only, Stereo)

Record: Noise floor at -45dBm without Low Pass Filter as a measure of pilot rejection

CURVE DATA

<table>
<thead>
<tr>
<th>RF Level dBm</th>
<th>Mono (L)</th>
<th>Stereo (L)</th>
<th>Separation L-&gt;R</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Signal dB</td>
<td>Noise dB</td>
<td>Signal dB</td>
</tr>
<tr>
<td>-115</td>
<td>-25.00</td>
<td>-25.50</td>
<td>-24.50</td>
</tr>
<tr>
<td>-110</td>
<td>-24.00</td>
<td>-25.50</td>
<td>-23.00</td>
</tr>
<tr>
<td>-105</td>
<td>-17.00</td>
<td>-28.00</td>
<td>-16.50</td>
</tr>
<tr>
<td>-100</td>
<td>-9.50</td>
<td>-36.00</td>
<td>-9.00</td>
</tr>
<tr>
<td>-95</td>
<td>-5.50</td>
<td>-47.00</td>
<td>-5.50</td>
</tr>
<tr>
<td>-90</td>
<td>-2.00</td>
<td>-49.50</td>
<td>-1.50</td>
</tr>
<tr>
<td>-85</td>
<td>0.50</td>
<td>-53.50</td>
<td>0.50</td>
</tr>
<tr>
<td>-80</td>
<td>-0.25</td>
<td>-58.00</td>
<td>-0.25</td>
</tr>
<tr>
<td>-75</td>
<td>0.00</td>
<td>-62.50</td>
<td>0.00</td>
</tr>
<tr>
<td>-70</td>
<td>0.00</td>
<td>-66.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-65</td>
<td>0.00</td>
<td>-68.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-60</td>
<td>0.00</td>
<td>-69.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-55</td>
<td>0.00</td>
<td>-69.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-50</td>
<td>0.00</td>
<td>-69.00</td>
<td>0.00</td>
</tr>
<tr>
<td>-45</td>
<td>0.00</td>
<td>-69.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Two RF Tone Tests

7 Capture Ratio
Set Up: Test Set Up 3
Desired: Test Freq. 1, -55dBm, 1kHz, 22.5kHz dev, Mono
Undesired: Test Freq. 1, -130dBm, CW
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
Increase Undesired signal until audio level drops 1dB, record Undesired RF level as RF Lev 1
Increase Undesired signal until audio level drops 30dB, record Undesired RF level as RF Lev 2

Measurement:
RF Lev 1 -56.00 dBm
RF Lev 2 -41.00 dBm

Capture Ratio: -7.50 dB  (RF Lev 1 - RF Lev 2)/2

8 Selectivity - 1st Adjacent 30dB S/N (Upper and Lower)
Upper 1st
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>dBm</td>
</tr>
<tr>
<td>D/U</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-12.00</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-7.80</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.</td>
<td>-9.90</td>
</tr>
</tbody>
</table>

(RF D/U Up + RF D/U Lo)/2

9 Selectivity - 2nd Adjacent 30dB S/N (Upper and Lower)
Upper 2nd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>dBm</td>
</tr>
<tr>
<td>D/U</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-63.00</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-63.00</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.</td>
<td>-63.00</td>
</tr>
</tbody>
</table>

Worst case noise floor, -35dB

File Name: C_mag
10 Selectivity - 1st Adjacent 50dB S/N (Upper and Lower)

Upper 1st
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB D/U</th>
<th>Stereo 50dB D/U</th>
</tr>
</thead>
<tbody>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-45.20</td>
<td>-9.80</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-48.60</td>
<td>-6.40</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.</td>
<td>-8.10</td>
<td>11.00</td>
</tr>
</tbody>
</table>

11 Selectivity - 2nd Adjacent 50dB S/N (Upper and Lower)

Upper 2nd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB D/U</th>
<th>Stereo 50dB D/U</th>
</tr>
</thead>
<tbody>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-13.00</td>
<td>-42.00</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-3.00</td>
<td>-52.00</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.</td>
<td>-47.00</td>
<td>-25.00</td>
</tr>
</tbody>
</table>

12 Selectivity - 3rd Adjacent 50dB S/N (Upper and Lower)

Upper 3rd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 +600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 3rd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 -600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Desired Lev</th>
<th>Mono 50dB D/U</th>
<th>Stereo 50dB D/U</th>
</tr>
</thead>
<tbody>
<tr>
<td>-55.00</td>
<td>-55.00</td>
<td></td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-0.00</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-0.00</td>
<td>-55.00</td>
</tr>
<tr>
<td>Selectivity, 3rd Adj.</td>
<td>-55.00</td>
<td>-38.50</td>
</tr>
</tbody>
</table>
Additional Tests

13 10.7MHz Rejection
Using Test Set Up 1 at the desired frequency of 94.1MHz,
Set generator to 1kHz, 75kHz dev. / CW
Reduce RF level to obtain 30dB S/N ratio.
Record RF Level as RF Lev 1
Set RF generator to 10.7MHz
Adjust RF level to obtain 30dB S/N ratio
Record RF Level as RF Lev 2
Calculate the difference between the two RF levels

<table>
<thead>
<tr>
<th>RF Lev 1</th>
<th>-97.00 dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Lev 2</td>
<td>-25.00 dBm</td>
</tr>
<tr>
<td>D/U</td>
<td>-72.00 dB</td>
</tr>
</tbody>
</table>

14 10.7 IM Test
Using the three generator set up, set generators as follows;
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
Lower Undesired: 88.7MHz, 1kHz, 75kHz dev
Upper Undesired: 99.3MHz, 400Hz, 75kHz dev
Adjust: Undesired RF level to obtain -50dB noise floor, record RF lev 10.6MHz Spacing
Set upper undesired generator to 99.4MHz. AdjustRF lev for -50dB noise floor. (RF lev 10.7MHz Spacing)

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td>-27.07</td>
<td>-17.93</td>
</tr>
<tr>
<td></td>
<td>-29.07</td>
</tr>
<tr>
<td></td>
<td>-15.93</td>
</tr>
<tr>
<td>EOC: Hiss</td>
<td></td>
</tr>
</tbody>
</table>

15 10.7MHz (10.6MHz) Local Osc Interference Test
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
Set upper interferer generator to 104.7MHz (94.1MHz + 10.6MHz), 400Hz, 75kHz dev
a) Increase level of undesired signals until noise floor is -50dB (+/- 2dB). Record RF Lev for 10.6MHz Spacing
b) Re-adjust upper interfering generator to 104.8MHz (94.1MHz + 10.7MHz)
Re-adjust RF level for -50dB and record RF lev for 10.7MHz spacing

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td>-54.07</td>
<td>-9.07</td>
</tr>
<tr>
<td></td>
<td>-56.07</td>
</tr>
<tr>
<td></td>
<td>11.07</td>
</tr>
<tr>
<td></td>
<td>-9.07</td>
</tr>
<tr>
<td></td>
<td>11.07</td>
</tr>
<tr>
<td>EOC: Objectionable beat notes</td>
<td></td>
</tr>
</tbody>
</table>
Date: 2/28/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 14
Class: Bookshelf/Port. All-in-One
Radio Mfg.: Philips/Magnavox
Model: AZ700/17
Serial: KT019841120616

Antenna Network: 50/75 Ohm Trans. FM

Audio load: 8 Ohms

**Initial Set Up:**
Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output

Any other control settings unique to the radio under test shall be noted in the Comments section.

Left channel shall be used for all Signal (and S/N ratio) measurements.

1.5KHz Low Pass filter shall be used on the output of the left channel for all measurements.

Right channel shall be used for Noise measurements - Stereo Separation test only.

All level measurements are rms

**Comments:**
Dynamic bass boost switch Off
Tone control Full Clockwise

0

0

<table>
<thead>
<tr>
<th>Standard RF Levels</th>
<th>Standard FM Test Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong: -45 dBm</td>
<td>94.1MHz</td>
</tr>
<tr>
<td>Medium: -55 dBm</td>
<td></td>
</tr>
<tr>
<td>Weak: -65 dBm</td>
<td></td>
</tr>
</tbody>
</table>

**Standard Test Set Ups**
1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

**Standard Tests**
1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF Input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
6. Curve Tests (plots of RF Level Vs Audio Output)
7. Capture Ratio
8. Selectivity, 1st Adjacent (30dB noise figure)
9. Selectivity, 2nd Adjacent (30dB noise figure)
10. Selectivity, 1st Adjacent (50dB noise figure)
11. Selectivity, 2nd Adjacent (50dB noise figure)
12. Selectivity, 3rd Adjacent (50dB noise figure)
13. 10.7MHz Rejection
14. 10.7MHz Intermodulation
15. 10.7MHz Spurious (Local Osc. Interference)
Test Results:

1 Local Oscillator Frequency:

0.000 MHz

2 Standard Audio Output:

<table>
<thead>
<tr>
<th>Left Channel</th>
<th>Vrms</th>
<th>THD</th>
<th>Right Channel</th>
<th>Vrms</th>
<th>THD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>0.90%</td>
<td>1.2</td>
<td></td>
<td>0.90%</td>
</tr>
</tbody>
</table>

3 RF Input Overload:

22.00 dBm Max Test Bed RF level - increase in THD to: 2%

4 AM Rejection:

0.00 dB

5 Image Rejection:

-41.00 dB

6 Curve Tests:

(See Plots)

7 Capture Ratio:

-7.50 dB

8 Selectivity, First Adjacent, 30dB Noise Floor (Ave. D/U)

-9.90 dB Mono

-9.00 dB Stereo

9 Selectivity, Second Adjacent, 30dB Noise Floor (Ave. D/U)

-63.00 dB Mono Max RF

-63.00 dB Stereo Max RF

10 Selectivity, First Adjacent, 50dB Noise Floor (Ave D/U)

-8.10 dB Mono

11.00 dB Stereo

11 Selectivity, Second Adjacent, 50dB Noise Floor (Ave. D/U)

-47.00 dB Mono

-35.00 dB Stereo

12 Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)

-55.00 dB Mono

-35.50 dB Stereo

13 10.7MHz Rejection

-72.00 dB

14 10.7MHz IM

-17.93 dB (10.6) Hiss

-15.93 dB (10.7)

15 10.7MHz Spurious (Local Osc. Interference)

9.07 dB (10.6) Objectionable beat notes

11.07 dB (10.7) 0
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

RF LEVEL (dBm)

AUDI0 LEVEL (dB)

Philips/Magnavox AZ2700/17
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

RF LEVEL (dBm)

Audio Level (dB)

Philips/Magnavox AZ2700/17
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

Philips/Magnavox AZ2700/17

File Name: C_mag

FM Stereo Separation Plot
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

Philips/Magnavox AZ2700/17
FM Receiver Test Laboratory

1st and 2nd ADJACENT CHANNEL SELECTIVITY
(30dB Noise Floor)

Insertion loss = -6dB

Philips/Magnavox AZ2700/17
1st, 2nd and 3rd ADJACENT CHANNEL SELECTIVITY
(50dB Noise Floor)

Insertion loss = -6dB

Philips/Magnavox AZ2700/17
FM Receiver Test Laboratory

IM & L.O. Rejection
(50dB Noise Floor)

Insertion loss = -6dB

Philips/Magnavox AZ2700/17
Receiver #15

Ford

Auto
Date: 5/14/99  
Engineers: RMc  
Project: FM Receiver Test A1  
Receiver Test No.: 15  
Class: Automotive  
Radio Mfg.: Ford  
Model: XF3F  
Serial: WANM000067  
Antenna Network: Ford  
Audio load: 4 Ohms  
Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms  
Comments: Bass, Treble, Balance, Fader are default power up detent position  
Standard RF Levels  
<table>
<thead>
<tr>
<th>Strength</th>
<th>dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>-45</td>
</tr>
<tr>
<td>Medium</td>
<td>-55</td>
</tr>
<tr>
<td>Weak</td>
<td>-65</td>
</tr>
</tbody>
</table>

Standard Test Set Ups  
1. Strong Signal Overload  
2. Single RF Tone Tests  
3. Two RF Tone Tests  
4. Measurement Set up  
Standard Tests  
1. Local Oscillator Frequency (Tuning Error)  
2. Standard Audio Output (Audio level and distortion)  
3. RF Input Overload (RF level required for 5% THD)  
4. AM Rejection  
5. Image Rejection  
7. Capture Ratio  
8. Selectivity; 1st Adjacent (30dB noise figure)  
9. Selectivity; 2nd Adjacent (30dB noise figure)  
10. Selectivity; 1st Adjacent (50dB noise figure)  
11. Selectivity; 2nd Adjacent (50dB noise figure)  
12. Selectivity; 3rd Adjacent (50dB noise figure)  
13 - 15. Additional 10.7MHz Tests  
16. IM (800kHz Channel Spacing)
Single RF Tone Tests

1 Local Oscillator Frequency (Tuning Error)
   Set Up: Connect Spectrum Analyzer to Radio Antenna input
   Adjust: Tune radio to Test Freq. 1, measure L.O. Freq 1
           Tune radio to Test Freq. 2, measure L.O. Freq 2

   Measurement: L.O. Freq 1 ________ MHz
                 L.O. Freq 2 ________ MHz

2 Standard Audio Output
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio Volume to Std. Ref. Level, record Left and Right channel audio level and THD

   Measurement: Left Ch  Right Ch
                 Level 1.980 Vrms = 0dB          Level 2.060 Vrms
                 THD   1.60%                    THD   1.60%

3 RF Input Overload
   Set Up: Test Set Up 1, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
           Increase RF Level until 5% THD at Radio output, record RF Level

   Measurement: RF Lev. 22.00 dBm (@ 5% THD)
                 Max limit of test bed - no change in THD

4 AM Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
           Set modulation mode to FM (75kHz), AM (30%), record THD

   Measurement: THD  1.6% = -35.92 dB (FM Only)
                 THD  1.6% = -35.92 dB (FM + AM 30%)

   AM Rejection: 0.00 dB

5 Image Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
           Decrease RF Level until S/N Ratio = 30dB, record RF Lev1
           Tune RF Gen to: Desired Freq. +/- 2 X IF Freq.
           Adjust RF Level until S/N Ratio = 30dB, record RF Lev2

   Measurement: RF Lev1 -100.0 dBm (S/N Ratio = 30dB)
                 RF Lev2 -55.0 dBm (21.4MHz + 94.1MHz = 115.5MHz)
                 Image Rejection: -45.00 dB (RF Lev1 - RF Lev2)
FM Receiver Test Laboratory

6 Curve Tests

Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (dBm) for both Mono and Stereo set ups.

Plot: Signal, Noise Vs RF Level (Mono)
Signal, Noise Vs RF Level (L+R, Stereo)
Stereo Separation Vs RF Level (L only, Stereo)

Record: Noise floor at -45dBm without Low Pass Filter as a measure of pilot rejection

<table>
<thead>
<tr>
<th>RF Level dBm</th>
<th>Mono (L) Signal dB</th>
<th>Mono (L) Noise dB</th>
<th>Stereo (L) Signal dB</th>
<th>Stereo (L) Noise dB</th>
<th>Stable Noise dB</th>
<th>Left dB</th>
<th>Right dB</th>
<th>Stereo Separation L+R dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>-120</td>
<td>-20.00</td>
<td>-20.10</td>
<td>-18.80</td>
<td>-19.00</td>
<td>-18.80</td>
<td>-19.00</td>
<td>-19.00</td>
<td>-120</td>
</tr>
<tr>
<td>-115</td>
<td>-19.20</td>
<td>-20.10</td>
<td>-17.80</td>
<td>-18.70</td>
<td>-18.00</td>
<td>-18.50</td>
<td>-115</td>
<td>-110</td>
</tr>
<tr>
<td>-105</td>
<td>-10.00</td>
<td>-22.40</td>
<td>-9.30</td>
<td>-21.00</td>
<td>-12.20</td>
<td>-12.40</td>
<td>-105</td>
<td>-100</td>
</tr>
<tr>
<td>-100</td>
<td>-3.80</td>
<td>-32.00</td>
<td>-3.40</td>
<td>-30.50</td>
<td>-7.80</td>
<td>-8.10</td>
<td>-95</td>
<td>-90</td>
</tr>
<tr>
<td>-95</td>
<td>-1.00</td>
<td>-48.00</td>
<td>-0.86</td>
<td>-46.50</td>
<td>-6.40</td>
<td>-6.70</td>
<td>-90</td>
<td>-85</td>
</tr>
<tr>
<td>-90</td>
<td>-0.32</td>
<td>-52.80</td>
<td>-0.32</td>
<td>-51.40</td>
<td>-6.17</td>
<td>-6.46</td>
<td>-85</td>
<td>-80</td>
</tr>
<tr>
<td>-85</td>
<td>-0.25</td>
<td>-57.00</td>
<td>-0.22</td>
<td>-55.40</td>
<td>-6.11</td>
<td>-6.40</td>
<td>-80</td>
<td>-75</td>
</tr>
<tr>
<td>-80</td>
<td>0.00</td>
<td>-59.50</td>
<td>0.00</td>
<td>-53.50</td>
<td>-5.55</td>
<td>-6.90</td>
<td>-75</td>
<td>-70</td>
</tr>
<tr>
<td>-75</td>
<td>0.00</td>
<td>-60.00</td>
<td>0.00</td>
<td>-52.00</td>
<td>-4.30</td>
<td>-8.30</td>
<td>-70</td>
<td>-65</td>
</tr>
<tr>
<td>-70</td>
<td>0.00</td>
<td>-61.00</td>
<td>0.00</td>
<td>-53.20</td>
<td>-3.40</td>
<td>-9.70</td>
<td>-65</td>
<td>-60</td>
</tr>
<tr>
<td>-65</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-55.00</td>
<td>-2.74</td>
<td>-11.10</td>
<td>-60</td>
<td>-55</td>
</tr>
<tr>
<td>-60</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-56.50</td>
<td>-2.10</td>
<td>-12.90</td>
<td>-55</td>
<td>-50</td>
</tr>
<tr>
<td>-55</td>
<td>0.00</td>
<td>-63.00</td>
<td>0.00</td>
<td>-57.75</td>
<td>-1.58</td>
<td>-15.00</td>
<td>-50</td>
<td>-45</td>
</tr>
<tr>
<td>-50</td>
<td>0.00</td>
<td>-62.00</td>
<td>0.00</td>
<td>-57.75</td>
<td>-1.00</td>
<td>-17.80</td>
<td>-45</td>
<td>-45</td>
</tr>
</tbody>
</table>

File Name: C_xGf_1
Two RF Tone Tests

7 Capture Ratio
Set Up: Test Set Up 3
- Desired: Test Freq. 1, -55dBm, 1kHz, 22.5kHz Dev, Mono
- Undesired: Test Freq. 1, -130dBm, CW
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
- Increase Undesired signal until audio level drops 1dB, record Undesired RF level as RF Lev 1
- Increase Undesired signal until audio level drops 30dB, record Undesired RF level as RF Lev 2

Measurement:
- RF Lev 1: -58.00 dBm
- RF Lev 2: -41.00 dBm

Capture Ratio: \(-8.50\) dB (RF Lev 1 - RF Lev 2)/2

8 Selectivity - 1st Adjacent 30dB S/N (Upper and Lower)
Upper 1st
Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1, -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev:</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev:</td>
<td>-34.00</td>
</tr>
<tr>
<td>Undesired Lower Lev:</td>
<td>-28.00</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.:</td>
<td>-24.00</td>
</tr>
</tbody>
</table>

(RF D/U Up + RF D/U Lo)/2

9 Selectivity - 2nd Adjacent 30dB S/N (Upper and Lower)
Upper 2nd
Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1, -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev:</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev:</td>
<td>8.00</td>
</tr>
<tr>
<td>Undesired Lower Lev:</td>
<td>8.00</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.:</td>
<td>Max RF</td>
</tr>
</tbody>
</table>

(RF D/U Up + RF D/U Lo)/2
10 Selectivity - 1st Adjacent 50dB S/N (Upper and Lower)

Upper 1st
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 –1200kHz, –130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 –1200kHz, –130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-34.00</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-30.00</td>
</tr>
<tr>
<td>Selectivity, 1st Adj.</td>
<td>-23.00</td>
</tr>
</tbody>
</table>

11 Selectivity - 2nd Adjacent 50dB S/N (Upper and Lower)

Upper 2nd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 –1200kHz, –130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 –1200kHz, –130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>8.00</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>8.00</td>
</tr>
<tr>
<td>Selectivity, 2nd Adj.</td>
<td>Max RF</td>
</tr>
</tbody>
</table>

12 Selectivity - 3rd Adjacent 50dB S/N (Upper and Lower)

Upper 3rd
Set Up: Test Set Up 3
Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 –1200kHz, –130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

Lower 3rd
Set Up: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
Undesired: Test Freq. 1 –1200kHz, –130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio/Analyzer audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>8.00</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>8.00</td>
</tr>
<tr>
<td>Selectivity, 3rd Adj.</td>
<td>Max RF</td>
</tr>
</tbody>
</table>
Additional Tests

13 10.7MHz Rejection
Using Test Set Up 1 at the desired frequency of 94.1MHz;
Set generator to 1kHz, 75kHz dev. / CW
Reduce RF level to obtain 30dB S/N ratio.
Record RF Level as RF Lev 1
Set RF generator to 10.7MHz
Adjust RF level to obtain 30dB S/N ratio
Record RF Level as RF Lev 2
Calculate the difference between the two RF levels

<table>
<thead>
<tr>
<th>RF Lev 1</th>
<th>-100.00</th>
<th>dBm</th>
<th>EOC</th>
<th>Radio is insensitive to 10.7MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Lev 2</td>
<td>22.00</td>
<td>dBm</td>
<td>D/U -122.00</td>
<td></td>
</tr>
</tbody>
</table>

14 10.7 IM Test
Using the three generator set up, set generators as follows;
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
Lower Undesired: 88.7MHz, 1kHz, 75kHz dev
Upper Undesired: 99.3MHz, 400Hz, 75kHz dev
Adjust: Undesired RF level to obtain -50dB noise floor, record RF lev 10.6MHz Spacing
Set upper undesired generator to 99.4MHz. Adjust RF lev for -50dB noise floor. (RF lev 10.7MHz Spacing)

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>dBM</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td>-1.00</td>
<td>-44.00</td>
</tr>
<tr>
<td></td>
<td>-44.00</td>
</tr>
</tbody>
</table>

EOC:

15 10.7MHz (10.6MHz) Local Osc Interference Test
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
Set upper interferer generator to 104.7MHz (94.1MHz + 10.6MHz), 400Hz, 75kHz dev
a) Increase level of undesired signals until noise floor is -50dB (+/- 2dB), Record RF Lev for 10.6MHz Spacing
b) Re-adjust upper interfering generator to 104.8MHz (94.1MHz + 10.7MHz)
Re-adjust RF level for -50dB and record RF lev for 10.7MHz spacing

<table>
<thead>
<tr>
<th>10.6MHz Spacing</th>
<th>10.7MHz Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>dBM</td>
</tr>
<tr>
<td>-45.00</td>
<td>-45.00</td>
</tr>
<tr>
<td>-33.00</td>
<td>-12.00</td>
</tr>
<tr>
<td>-12.00</td>
<td></td>
</tr>
</tbody>
</table>

EOC:
Date: 5/14/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 15
Class: Automotive
Radio Mfg.: Ford
Model: XF3F
Serial: WANK0000067

Antenna Network: Ford FM
Audio load: 4 Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms.

Comments: Bass, Treble, Balance, Fader are default power up detent position
0
0
0

Standard RF Levels
Strong: -45 dBm
Medium: -55 dBm
Weak: -65 dBm

Standard FM Test Frequencies
94.1MHz

Standard Test Set Ups
1 Strong Signal Overload
2 Single RF Tone Tests
3 Two RF Tone Tests
4 Measurement Set up

Standard Tests
1 Local Oscillator Frequency (Tuning Error)
2 Standard Audio Output (Audio level and distortion)
3 RF Input Overload (RF level required for 5% THD)
4 AM Rejection
5 Image Rejection
6 Curve Tests (plots of RF Level Vs Audio Output)
7 Capture Ratio
8 Selectivity; 1st Adjacent (30dB noise figure)
9 Selectivity; 2nd Adjacent (30dB noise figure)
10 Selectivity; 1st Adjacent (50dB noise figure)
11 Selectivity; 2nd Adjacent (50dB noise figure)
12 Selectivity; 3rd Adjacent (50dB noise figure)

13 10.7MHz Rejection
14 10.7MHz Intermodulation
15 10.7MHz Spurious (Local Osc. Interference)
Test Results:

1. **Local Oscillator Frequency:**
   - 0.000 MHz

2. **Standard Audio Output:**
<table>
<thead>
<tr>
<th>Left Channel</th>
<th>THD</th>
<th>Right Channel</th>
<th>THD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.98 Vrms</td>
<td>1.60%</td>
<td>2.06 Vrms</td>
<td>1.60%</td>
</tr>
</tbody>
</table>

3. **RF Input Overload:**
   - 22.00 dBm
   - Max limit of test bed - no change in THD

4. **AM Rejection:**
   - 0.00 dB

5. **Image Rejection:**
   - -45.00 dB

6. **Curve Tests:**
   (See Plots)

7. **Capture Ratio:**
   - -8.50 dB

8. **Selectivity, First Adjacent, 30dB Noise Floor (Ave. D/U):**
   - -24.00 dB Mono
   - -24.00 dB Stereo

9. **Selectivity, Second Adjacent, 30dB Noise Floor (Ave. D/U):**
   - -63.00 dB Mono
   - -63.00 dB Stereo

10. **Selectivity, First Adjacent, 50dB Noise Floor (Ave D/U):**
    - -23.00 dB Mono
    - -23.00 dB Stereo

11. **Selectivity, Second Adjacent, 50dB Noise Floor (Ave. D/U):**
    - -63.00 dB Mono
    - -63.00 dB Stereo

12. **Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U):**
    - -63.00 dB Mono
    - -63.00 dB Stereo

13. **10.7MHz Rejection**
    - -122.00 dB

14. **10.7MHz IM**
    - -44.00 dB (10.6)
    - -39.00 dB (10.7)

15. **10.7MHz Spurious (Local Osc. Interference)**
    - -12.00 dB (10.6)
    - -11.00 dB (10.7)
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

Ford XF3F

File Name: C_xf3f_1

FM Stereo Plot  Page 10 of 15
1st and 2nd ADJACENT CHANNEL SELECTIVITY
(30dB Noise Floor)

Insertion loss = -6dB

Ford XF3F
1st, 2nd and 3rd ADJACENT CHANNEL SELECTIVITY
(50dB Noise Floor)

Insertion loss = -6dB

Ford XF3F

Selectivity 50dB
IM & L.O. Rejection
(50dB Noise Floor)

Insertion loss = -6dB

Max level

RF Level (dBm)

88.10 88.70 90.10 90.70 92.10 92.70 94.10 94.70 96.10 96.70 98.10 98.70 100.10 100.70 102.10 102.70 104.10 104.70 106.10 106.70 108.10 108.70 110.10

Frequency (MHz)

Ford XF3F

File Name: C_xf3f_1
Receiver #16

Radio Shack

Portable
Date: 6/12/99

Engineers: RMc

Project: FM Receiver Test A1

Receiver Test No.: 16

Class: AM/FM/Cass Portable

Radio Mfg.: Radio Shack

Model: SCR-64 14-704

Serial: 12A98

Antenna Network: 50/75 Ohm Trans. FM

Audio load: 10K Ohms AM

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output. Any other control settings unique to the radio under test shall be noted in the Comments section. Left channel shall be used for all Signal (and S/N ratio) measurements. 15kHz Low Pass filter shall be used on the output of the left channel for all measurements. Right channel shall be used for Noise measurements - Stereo Separation test only. All level measurements are rms.

Comments: Tone control full clockwise

Band switch in FM Stereo

<table>
<thead>
<tr>
<th>Standard RF Levels</th>
<th>Standard FM Test Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong: -45 dBm</td>
<td>Low: 94.1 MHz</td>
</tr>
<tr>
<td>Medium: -55 dBm</td>
<td></td>
</tr>
<tr>
<td>Weak: -65 dBm</td>
<td></td>
</tr>
</tbody>
</table>

Standard Test Set Ups

1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

Standard Tests

1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF Input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
7. Capture Ratio
8. Selectivity, 1st Adjacent (30dB noise figure)
9. Selectivity, 2nd Adjacent (30dB noise figure)
10. Selectivity, 1st Adjacent (50dB noise figure)
11. Selectivity, 2nd Adjacent (50dB noise figure)
12. Selectivity, 3rd Adjacent (50dB noise figure)
13 - 15. Additional 10.7MHz Tests
Single RF Tone Tests

1 Local Oscillator Frequency (Tuning Error)
   Set Up: Connect Spectrum Analyzer to Radio Antenna input
   Adjust: Tune radio to Test Freq. 1, measure L.O. Freq 1
   Tune radio to Test Freq. 2, measure L.O. Freq 2

   Measurement: L.O. Freq 1 _______ MHz
                L.O. Freq 2 _______ MHz

2 Standard Audio Output
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio Volume to Std. Ref. Level, record Left and Right channel audio level and THD

   Measurement:

   \[
   \begin{array}{ccc}
   \text{Left Ch} & \text{Right Ch} \\
   \text{Level} & 0.502 & 0.479 \\
   \text{Vrms} & 0.35 & 0.03 \\
   \text{THD} & 3.4 & 3.3 \\
   \end{array}
   \]

3 RF Input Overload
   Set Up: Test Set Up 1, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio to Std. Ref. Level
   Increase RF Level until 5% THD at Radio output, record RF Level

   Measurement: RF Lev. 22.00 dBm (@ 5% THD)
                 THD increased to 0.6%

4 AM Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level, record THD
   Set modulation mode to FM (75kHz), AM (30%), record THD

   Measurement:

   \[ \text{THD} 0.33 \% = -49.63 \text{ dB} \quad \text{(FM Only)} \]
   \[ \text{THD} 0.39 \% = -48.05 \text{ dB} \quad \text{(FM + AM 30\%)} \]

   AM Rejection: -1.58 dB

5 Image Rejection
   Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
   Adjust: Set Radio audio to Std. Ref. Level (0dB)
   Decrease RF Level until S/N Ratio = 30dB, record RF Lev1
   Tune RF Gen to; Desired Freq. +/- 2 X IF Freq.
   Adjust RF Level until S/N Ratio = 30dB, record RF Lev2

   Measurement:

   \[ \text{RF Lev1} -101.0 \text{ dBm} \quad \text{(S/N Ratio = 30dB)} \]
   \[ \text{RF Lev2} -23.0 \text{ dBm} \quad \text{(21.4MHz + 94.1MHz = 115.5MHz)} \]
   \[ \text{Image Rejection: -78.00 dB} \quad \text{(RF Lev1 - RF Lev2)} \]
Curve Tests
Set Up: Test Set Up 2, Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono/Stereo
Adjust: Set Radio audio to Std. Ref. Level (0dB) for both Mono and Stereo set ups.

Plot: Signal, Noise Vs RF Level (Mono)
      Signal, Noise Vs RF Level (L+R, Stereo)
      Stereo Separation Vs RF Level (L only, Stereo)
Record: Noise floor at -45dBm without Low Pass Filter as a measure of pilot rejection

**CURVE DATA**

**SIGNAL, NOISE & SEPARATION VS RF LEVEL**

<table>
<thead>
<tr>
<th>RF Level dBm</th>
<th>Mono (L)</th>
<th></th>
<th></th>
<th></th>
<th>Stereo (L)</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Separation L-R</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>RF Level dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Signal dB</td>
<td>Noise dB</td>
<td>Signal dB</td>
<td>Filt. Noise dB</td>
<td>Noise dB</td>
<td>Left dB</td>
<td>Right dB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-130</td>
<td>-29.00</td>
<td>-29.00</td>
<td>-28.30</td>
<td>-27.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-125</td>
<td>-29.00</td>
<td>-29.00</td>
<td>-28.30</td>
<td>-27.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-120</td>
<td>-29.00</td>
<td>-28.80</td>
<td>-28.30</td>
<td>-27.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-110</td>
<td>-27.50</td>
<td>-28.70</td>
<td>-26.70</td>
<td>-27.90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-105</td>
<td>-18.00</td>
<td>-31.40</td>
<td>-17.00</td>
<td>-30.40</td>
<td>-19.80</td>
<td>-20.20</td>
<td>-105</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-100</td>
<td>-5.00</td>
<td>-40.80</td>
<td>-4.00</td>
<td>-39.50</td>
<td>-8.20</td>
<td>-8.50</td>
<td>-100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-95</td>
<td>-0.30</td>
<td>-50.00</td>
<td>-0.32</td>
<td>-37.60</td>
<td>-3.00</td>
<td>-9.60</td>
<td>-95</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-90</td>
<td>-0.22</td>
<td>-56.00</td>
<td>-0.20</td>
<td>-36.30</td>
<td>-0.20</td>
<td>-27.10</td>
<td>-90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-85</td>
<td>-0.13</td>
<td>-60.20</td>
<td>-0.15</td>
<td>-41.40</td>
<td>0.00</td>
<td>-27.70</td>
<td>-85</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-80</td>
<td>0.00</td>
<td>-61.80</td>
<td>0.00</td>
<td>-46.50</td>
<td>0.00</td>
<td>-27.80</td>
<td>-80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-75</td>
<td>0.00</td>
<td>-62.40</td>
<td>0.00</td>
<td>-51.10</td>
<td>0.00</td>
<td>-27.80</td>
<td>-75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-70</td>
<td>0.00</td>
<td>-62.50</td>
<td>0.00</td>
<td>-55.10</td>
<td>0.00</td>
<td>-27.80</td>
<td>-70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-65</td>
<td>0.00</td>
<td>-62.60</td>
<td>0.00</td>
<td>-58.10</td>
<td>0.00</td>
<td>-27.90</td>
<td>-65</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-60</td>
<td>0.00</td>
<td>-62.70</td>
<td>0.00</td>
<td>-59.60</td>
<td>0.00</td>
<td>-28.00</td>
<td>-60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-55</td>
<td>0.00</td>
<td>-62.80</td>
<td>0.00</td>
<td>-60.30</td>
<td>0.00</td>
<td>-28.30</td>
<td>-55</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-50</td>
<td>0.00</td>
<td>-63.00</td>
<td>0.00</td>
<td>-60.40</td>
<td>0.00</td>
<td>-29.00</td>
<td>-50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-45</td>
<td>0.00</td>
<td>-63.00</td>
<td>0.00</td>
<td>-60.40</td>
<td>-34.60</td>
<td>0.00</td>
<td>-29.70</td>
<td>-45</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Two RF Tone Tests

7 Capture Ratio
Set Up: Test Set Up 3
- Desired: Test Freq. 1, -55dBm, 1kHz, 22.5kHz dev, Mono
- Undesired: Test Freq. 1, -130dBm, CW
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Increase Undesired signal until audio level drops 1dB, record Undesired RF level as RF Lev 1
- Increase Undesired signal until audio level drops 30dB, record Undesired RF level as RF Lev 2

Measurement:
- RF Lev 1: -52.00 dBm
- RF Lev 2: -45.00 dBm

Capture Ratio: -3.50 dB (RF Lev 1 - RF Lev 2)/2

8 Selectivity - 1st Adjacent 30dB S/N (Upper and Lower)
Upper 1st
Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1, 200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1, 200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>dBm</td>
</tr>
<tr>
<td>D/U</td>
<td>D/U</td>
</tr>
</tbody>
</table>

- Desired Lev: -55.00
- Undesired Upper Lev: -43.00
- Undesired Lower Lev: -55.00
- Selectivity, 1st Adj.: -5.00 (RF D/U Up + RF D/U Lo)/2

9 Selectivity - 2nd Adjacent 30dB S/N (Upper and Lower)
Upper 2nd
Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1, 400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Upper Lev.

Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1, 400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
- Set the modulation of the Desired signal to CW
- Increase Undesired signal until noise floor is -30dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 30dB</th>
<th>Stereo 30dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>dBm</td>
</tr>
<tr>
<td>D/U</td>
<td>D/U</td>
</tr>
</tbody>
</table>

- Desired Lev: -55.00
- Undesired Upper Lev: -23.00
- Undesired Lower Lev: -33.00
- Selectivity, 2nd Adj.: -27.00 (RF D/U Up + RF D/U Lo)/2
### Selectivity - 1st Adjacent 50dB S/N (Upper and Lower)

#### Upper 1st
Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

#### Lower 1st
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 -200kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-44.00</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-61.00</td>
</tr>
</tbody>
</table>
Selectivity, 1st Adj.: \( \text{(RF D/U Up + RF D/U Lo)}/2 \)

### Selectivity - 2nd Adjacent 50dB S/N (Upper and Lower)

#### Upper 2nd
Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

#### Lower 2nd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 -400kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-30.00</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-39.00</td>
</tr>
</tbody>
</table>
Selectivity, 2nd Adj.: \( \text{(RF D/U Up + RF D/U Lo)}/2 \)

### Selectivity - 3rd Adjacent 50dB S/N (Upper and Lower)

#### Upper 3rd
Set Up: Test Set Up 3
- Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 +600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Upper Lev.

#### Lower 3rd
Set Up: Desired: Test Freq. 1, Medium, 1kHz, 75kHz Dev, Mono
- Undesired: Test Freq. 1 -600kHz, -130dBm, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Set the modulation of the Desired signal to CW
Increase Undesired signal until noise floor is -50dB, record Undesired RF level as Undesired Lower Lev.

<table>
<thead>
<tr>
<th>Mono 50dB</th>
<th>Stereo 50dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>dBm</td>
<td>D/U</td>
</tr>
<tr>
<td>Desired Lev</td>
<td>-55.00</td>
</tr>
<tr>
<td>Undesired Upper Lev</td>
<td>-35.00</td>
</tr>
<tr>
<td>Undesired Lower Lev</td>
<td>-33.00</td>
</tr>
</tbody>
</table>
Selectivity, 3rd Adj.: \( \text{(RF D/U Up + RF D/U Lo)}/2 \)
Additional Tests

13  10.7MHz Rejection
Using Test Set Up 1 at the desired frequency of 94.1MHz;
Set generator to 1kHz, 75kHz dev. / CW
Reduce RF level to obtain 30dB S/N ratio.
Record RF Level as RF Lev 1
Set RF generator to 10.7MHz
Adjust RF level to obtain 30dB S/N ratio
Record RF Level as RF Lev 2
Calculate the difference between the two RF levels

<table>
<thead>
<tr>
<th>RF Lev 1</th>
<th>-101.00 dBm</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF Lev 2</td>
<td>14.50 dBm</td>
</tr>
<tr>
<td>D/U</td>
<td>-115.50 dB</td>
</tr>
</tbody>
</table>

14  10.7 IM Test
Using the three generator set up, set generators as follows;
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
        Lower Undesired: 88.7MHz, 1kHz, 75kHz dev
        Upper Undesired: 99.3MHz, 400Hz, 75kHz dev
Adjust: Undesired RF level to obtain -50dB noise floor, record RF lev 10.6MHz Spacing
        Set upper undesired generator to 99.4MHz. Adjust RF lev for -50dB noise floor. (RF lev 10.7MHz Spacing)

<table>
<thead>
<tr>
<th>10.6MHz Spacing (dBm)</th>
<th>D/U</th>
<th>10.7MHz Spacing (dBm)</th>
<th>D/U</th>
</tr>
</thead>
<tbody>
<tr>
<td>-45.00</td>
<td></td>
<td>-45.00</td>
<td></td>
</tr>
<tr>
<td>-43.00</td>
<td>-2.00</td>
<td>-45.00</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-2.00</td>
<td></td>
<td>0.60</td>
</tr>
</tbody>
</table>

EOC:

15  10.7MHz (10.6MHz) Local Osc Interference Test
Set Up: Desired: 94.1MHz, -45dBm, Pilot only
Set upper interferer generator to 104.7MHz (94.1MHz + 10.6MHz). 400Hz, 75kHz dev
a) Increase level of undesired signals until noise floor is -50dB (+/- 2dB). Record RF Lev for 10.6MHz Spacing
b) Re-adjust upper interfering generator to 104.8MHz (94.1MHz + 10.7MHz)
Re-adjust RF level for -50dB and record RF lev for 10.7MHz spacing

<table>
<thead>
<tr>
<th>10.6MHz Spacing (dBm)</th>
<th>D/U</th>
<th>10.7MHz Spacing (dBm)</th>
<th>D/U</th>
</tr>
</thead>
<tbody>
<tr>
<td>-45.00</td>
<td></td>
<td>-45.00</td>
<td></td>
</tr>
<tr>
<td>-71.00</td>
<td>26.00</td>
<td>-71.00</td>
<td>26.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>26.00</td>
<td></td>
<td>26.00</td>
</tr>
</tbody>
</table>

EOC:
Date: 6/12/99
Engineers: RMc
Project: FM Receiver Test A1

Receiver Test No.: 0
Class: AM/FM/Cass Portable
Radio Mfg.: Radio Shack
Model: SCR-64 14-704
Serial: 12A98

Antenna Network: 50/75 Ohm Trans. FM

Audio load: 10K Ohms

Initial Set Up: Radio under test shall have tone controls set to flat detent position, Loudness control off, Balance and Fader controls centered (set to mid position), Volume set to Standard Output
Any other control settings unique to the radio under test shall be noted in the Comments section.
Left channel shall be used for all Signal (and S/N ratio) measurements.
15kHz Low Pass filter shall be used on the output of the left channel for all measurements.
Right channel shall be used for Noise measurements - Stereo Separation test only.
All level measurements are rms

Comments: Tone control full clockwise
Band switch in FM Stereo

<table>
<thead>
<tr>
<th>Standard RF Levels</th>
<th>Standard FM Test Frequencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong: -45 dBm</td>
<td>94.1MHz</td>
</tr>
<tr>
<td>Medium: -55 dBm</td>
<td></td>
</tr>
<tr>
<td>Weak: -65 dBm</td>
<td></td>
</tr>
</tbody>
</table>

Standard Test Set Ups
1. Strong Signal Overload
2. Single RF Tone Tests
3. Two RF Tone Tests
4. Measurement Set up

Standard Tests
1. Local Oscillator Frequency (Tuning Error)
2. Standard Audio Output (Audio level and distortion)
3. RF Input Overload (RF level required for 5% THD)
4. AM Rejection
5. Image Rejection
6. Curve Tests (plots of RF Level Vs Audio Output)
7. Capture Ratio
8. Selectivity; 1st Adjacent (30dB noise figure)
9. Selectivity; 2nd Adjacent (30dB noise figure)
10. Selectivity; 1st Adjacent (50dB noise figure)
11. Selectivity; 2nd Adjacent (50dB noise figure)
12. Selectivity; 3rd Adjacent (50dB noise figure)
13. 10.7MHz Rejection
14. 10.7MHz Intermodulation
15. 10.7MHz Spurious (Local Osc. Interference)
Test Results:

1  **Local Oscillator Frequency:**
   0.000 MHz

2  **Standard Audio Output:**
   | Left Channel | Right Channel |
   | Vrms | THD  | Vrms | THD  |
   | 0.502 | 0.34% | 0.479 | 0.33% |

3  **RF Input Overload:**
   22.00 dBm  THD increased to 0.0.6%

4  **AM Rejection:**
   -1.58 dB

5  **Image Rejection:**
   -78.00 dB

6  **Curve Tests:**
   (See Plots)

7  **Capture Ratio:**
   -3.50 dB

8  **Selectivity, First Adjacent, 30dB Noise Floor (Ave. D/U)**
   -6.00 dB Mono  -2.00 dB Stereo

9  **Selectivity, Second Adjacent, 30dB Noise Floor (Ave. D/U)**
   -27.00 dB Mono  -24.50 dB Stereo

10 **Selectivity, First Adjacent, 50dB Noise Floor (Ave D/U)**
    -2.50 dB Mono  17.50 dB Stereo

11 **Selectivity, Second Adjacent, 50dB Noise Floor (Ave. D/U)**
    -20.50 dB Mono  -9.50 dB Stereo

12 **Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)**
    -21.00 dB Mono  -19.00 dB Stereo

13 **10.7MHz Rejection**
    -115.50 dB  0

14 **10.7MHz IM**
    -2.00 dB (10.6)  0
    0.00 dB (10.7)  0

15 **10.7MHz Spurious (Local Osc. Interference)**
    26.60 dB (10.6)  0
    26.60 dB (10.7)  0
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

Radio Shack SCR-64 14-704
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6 dB

Radio Shack SCR-64 14-704
FM Receiver Test Laboratory

SIGNAL/NOISE VS RF LEVEL

Insertion loss = -6dB

Radio Shack SCR-64 14-704
1st and 2nd ADJACENT CHANNEL SELECTIVITY
(30dB Noise Floor)

Insertion loss = -6dB

Radio Shack SCR-64 14-704
1st, 2nd and 3rd ADJACENT CHANNEL SELECTIVITY
(50dB Noise Floor)

Insertion loss = -6dB

Radio Shack SCR-64 14-704
IM & L.O. Rejection
(50dB Noise Floor)

Insertion loss = -6dB

Radio Shack SCR-64 14-704
NRSC Document Improvement Proposal

If in the review or use of this document a potential change appears needed for safety, health or technical reasons, please fill in the appropriate information below and email, mail or fax to:

National Radio Systems Committee  
c/o Consumer Electronics Association  
Technology & Standards Department  
1919 S. Eads St.  
Arlington, VA  22202  
FAX: 703-907-4190  
Email: standards@ce.org

<table>
<thead>
<tr>
<th>DOCUMENT NO.</th>
<th>DOCUMENT TITLE:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SUBMITTER’S NAME:</th>
<th></th>
<th>COMPANY:</th>
<th></th>
<th>TEL:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADDRESS:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>URGENCY OF CHANGE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____ Immediate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PROBLEM AREA (ATTACH ADDITIONAL SHEETS IF NECESSARY):</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Clause Number and/or Drawing:</td>
</tr>
<tr>
<td>b. Recommended Changes:</td>
</tr>
<tr>
<td>c. Reason/Rationale for Recommendation:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADDITIONAL REMARKS:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SIGNATURE:</th>
<th>DATE:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FOR NRSC USE ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date forwarded to NAB S&amp;T:</td>
</tr>
<tr>
<td>Responsible Committee:</td>
</tr>
<tr>
<td>Co-chairmen:</td>
</tr>
<tr>
<td>Date forwarded to co-chairmen:</td>
</tr>
</tbody>
</table>