NRSC REPORT

NATIONAL RADIO SYSTEMS COMMITTEE

NRSC-R37
FM Receiver Interference Tests - Laboratory Test Report
July 27, 1999

Part II – Receiver Test Reports

NAB: 1771 N Street, N.W.
Washington, DC 20036
Tel: (202) 429-5356 Fax: (202) 775-4981

CEA: 1919 South Eads Street
Arlington, VA 22202
Tel: (703) 907-7660 Fax: (703) 907-8113

Co-sponsored by the Consumer Electronics Association and the National Association of Broadcasters
http://www.nrscstandards.org

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

FOREWORD

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 AI

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.
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

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 Separa
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: .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 _____	**Vrms**	= 0dB	**Level** _____	**Vrms**
THD _____	**%**		**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** (@ 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%)

AM Rejection: _____ 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 _____ dBm (S/N Ratio = 30dB)
RF Lev2 _____ dBm (21.4MHz + 94.1MHz = 115.5MHz)
Image Rejection: 0.00 dB (RF Lev1 - RF Lev2)

140

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

	Mono (L)		Stereo (L)			Separation L->R		
RF Level dBm	Signal dB	Noise dB	Signal dB	ift. Nois dB	Noise dB	Left dB	Right dB	RF Level dBm
-130								-130
-125								-125
-120								-120
-115								-115
-110								-110
-105								-105
-100								-100
-95								-95
-90								-90
-85								-85
-80								-80
-75								-75
-70								-70
-65								-65
-60								-60
-55								-55
-50								-50
-45								-45

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 Uppe

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 Low

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev		-55.00		-55.00	
Undesired Lower Lev		-55.00		-55.00	
Selectivity, 1st Adj.:		-55.00		-55.00	(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 Uppe

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 Low

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev		-55.00		-55.00	
Undesired Lower Lev		-55.00		-55.00	
Selectivity, 2nd Adj.:		-55.00		-55.00	(RF D/U Up + RF D/U Lo)/2

142

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 Uppe

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

	Mono 50dB		Stereo 50dB	
	dBm	D/U	dBm	D/U
Desired Lev	-55.00		-55.00	
Undesired Upper Lev		-55.00		-55.00
Undesired Lower Lev		-55.00		-55.00
Selectivity, 1st Adj.:		-55.00		-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 Uppe

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

	Mono 50dB		Stereo 50dB	
	dBm	D/U	dBm	D/U
Desired Lev	-55.00		-55.00	
Undesired Upper Lev		-55.00		-55.00
Undesired Lower Lev		-55.00		-55.00
Selectivity, 2nd Adj.:		-55.00		-55.00

(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 Uppe

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

	Mono 50dB		Stereo 50dB	
	dBm	D/U	dBm	D/U
Desired Lev	-55.00		-55.00	
Undesired Upper Lev		-55.00		-55.00
Undesired Lower Lev		-55.00		-55.00
Selectivity, 3rd Adj.:		-55.00		-55.00

(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 _____ dBm
RF Lev 2 _____ dBm EOC
D/U 0.00 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

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

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

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

EOC:

144

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.
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
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:**

Left Channel		THD		Right Channel		THD	
0	Vrms	0.00	%	0	Vrms	0.00	%

3 **RF Input Overload:**
0.00 dBm 0

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

5 **Image Rejection:**
0.00 dB

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

7 **Capture Ratio:**
0.00 dB

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

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

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

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

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

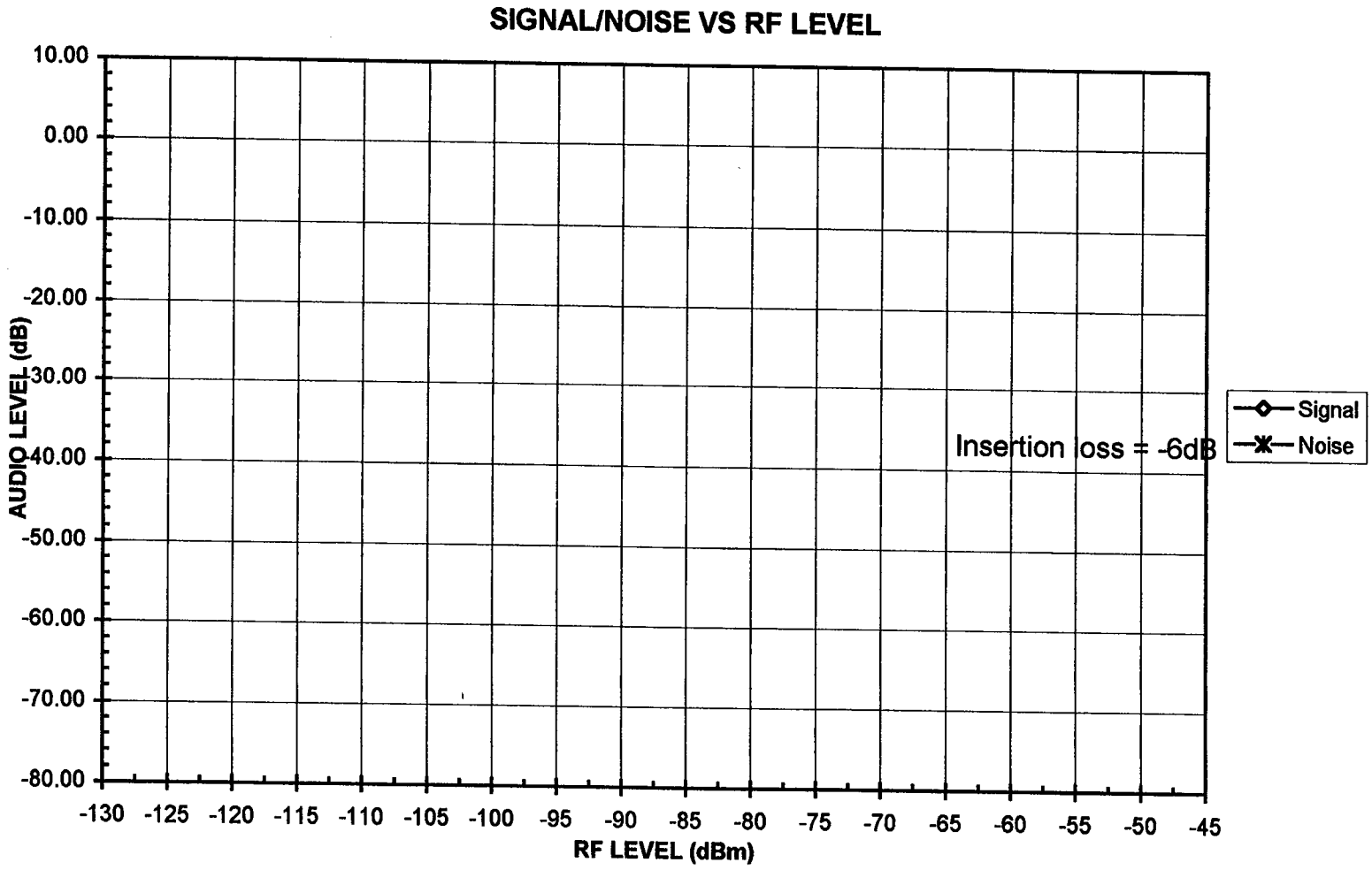
13 **10.7MHz Rejection**
0.00 dB 0

14 **10.7MHz IM**
-45.00 dB (10.6) Max RF 0
-45.00 dB (10.7) Max RF 0

15 **10.7MHz Spurious (Local Osc. Interference)**
-45.00 dB (10.6) Max RF 0
-45.00 dB (10.7) Max RF 0

146

FM Receiver Test Laboratory



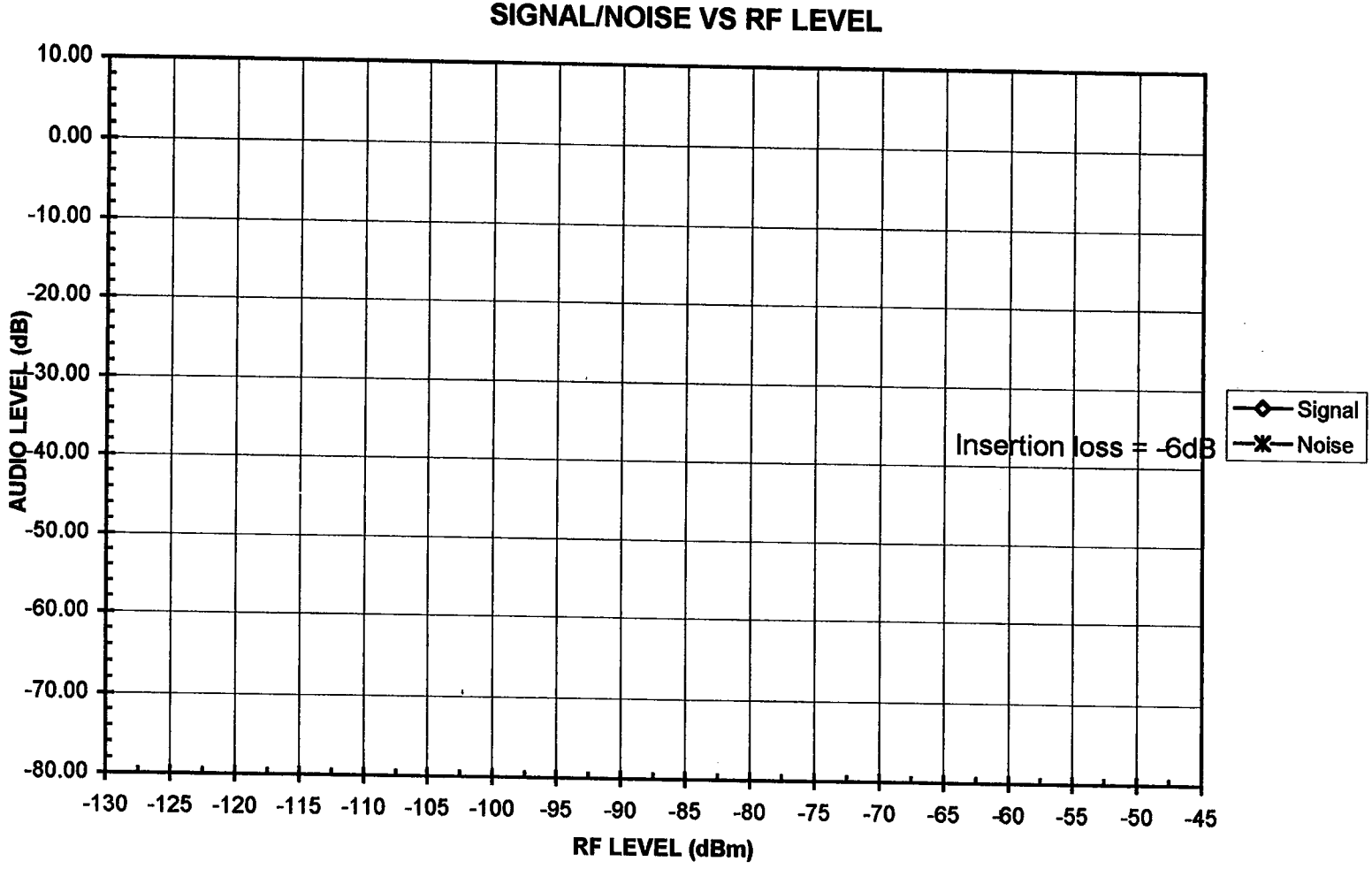
0 0

147

File Name: !c_temp

FM Mono Plot

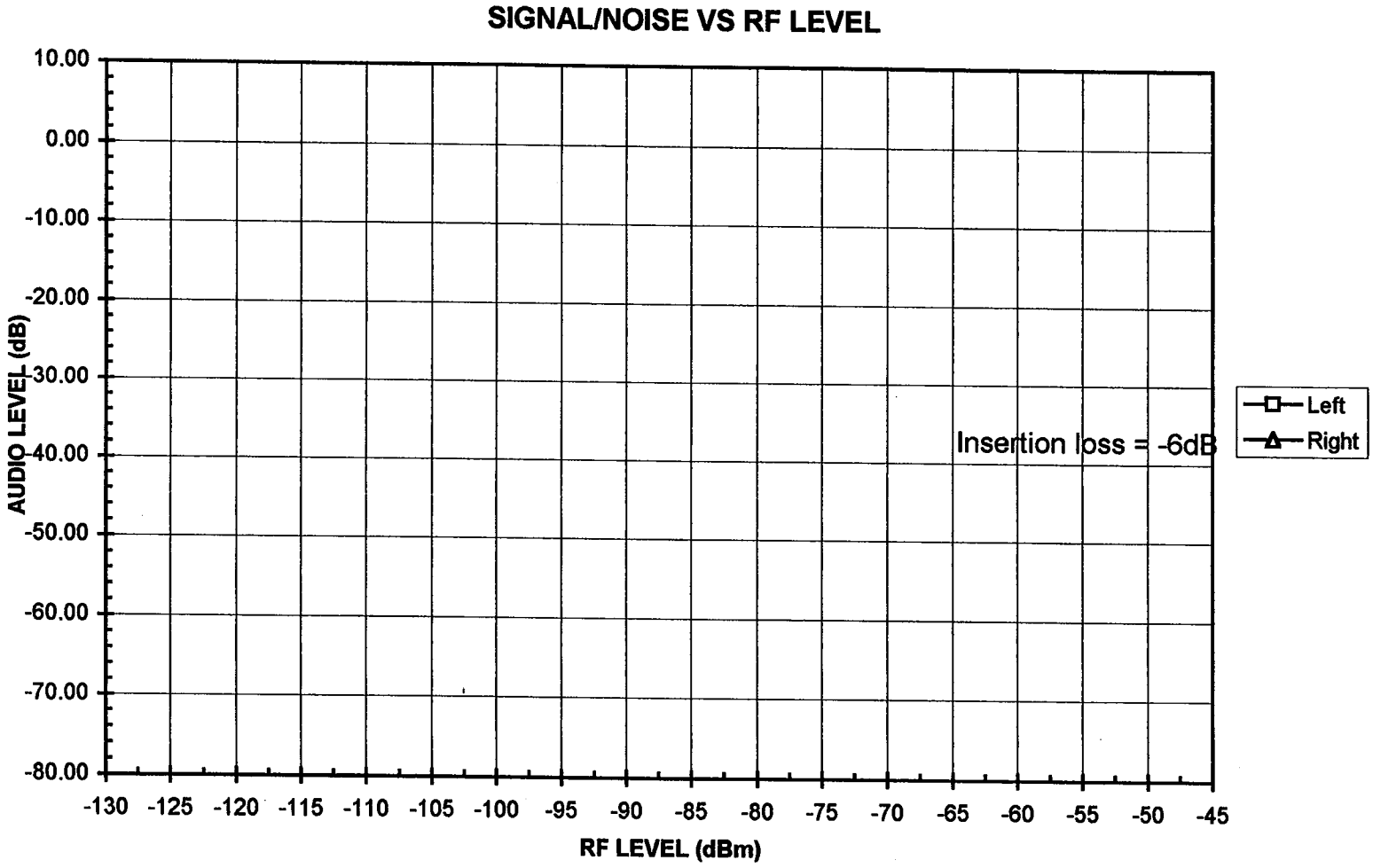
FM Receiver Test Laboratory



0 0

File Name: !c_temp

FM Stereo Plot



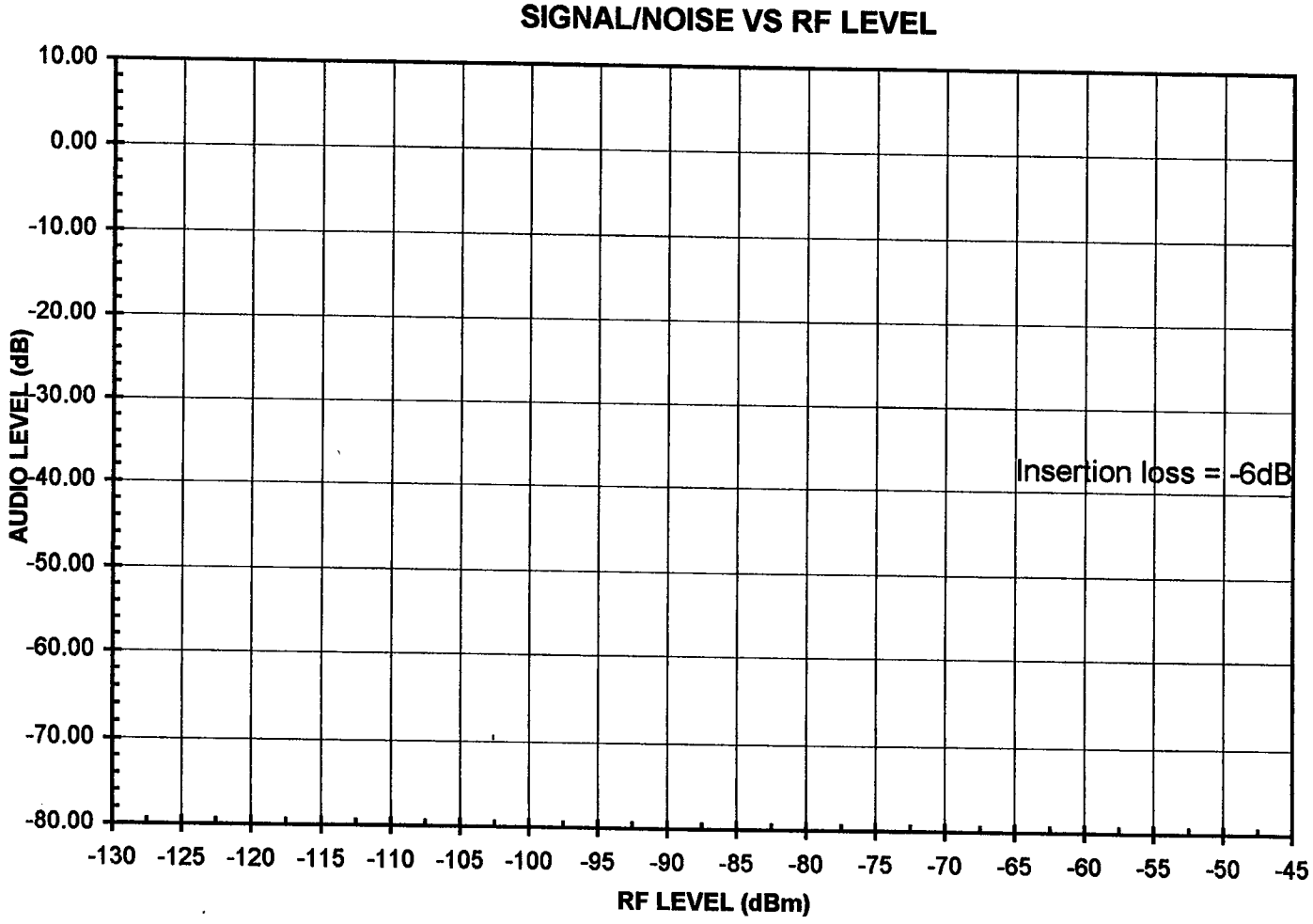
0 0

149

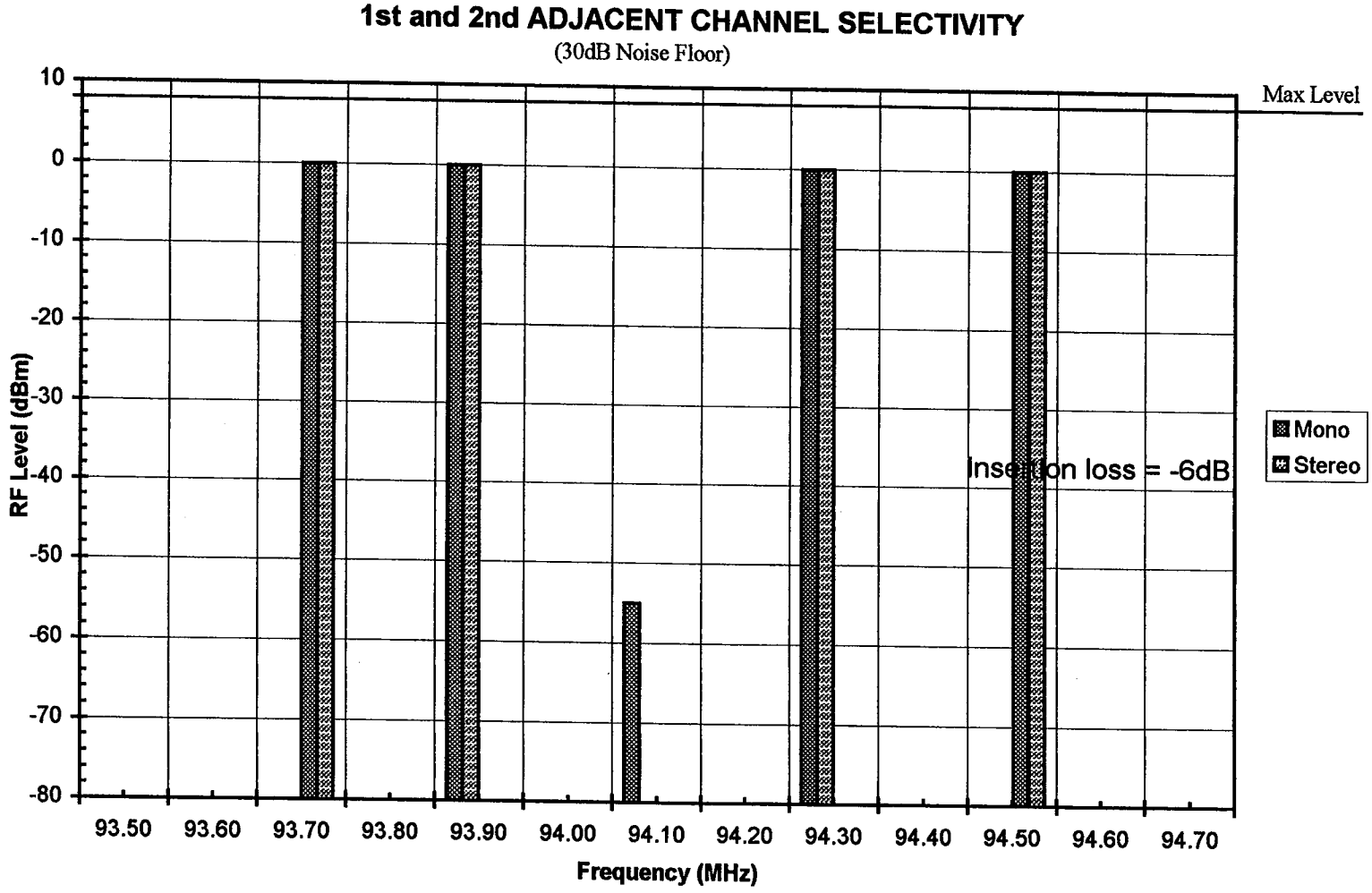
File Name: !c temp

FM Stereo Separation Plot

FM Receiver Test Laboratory



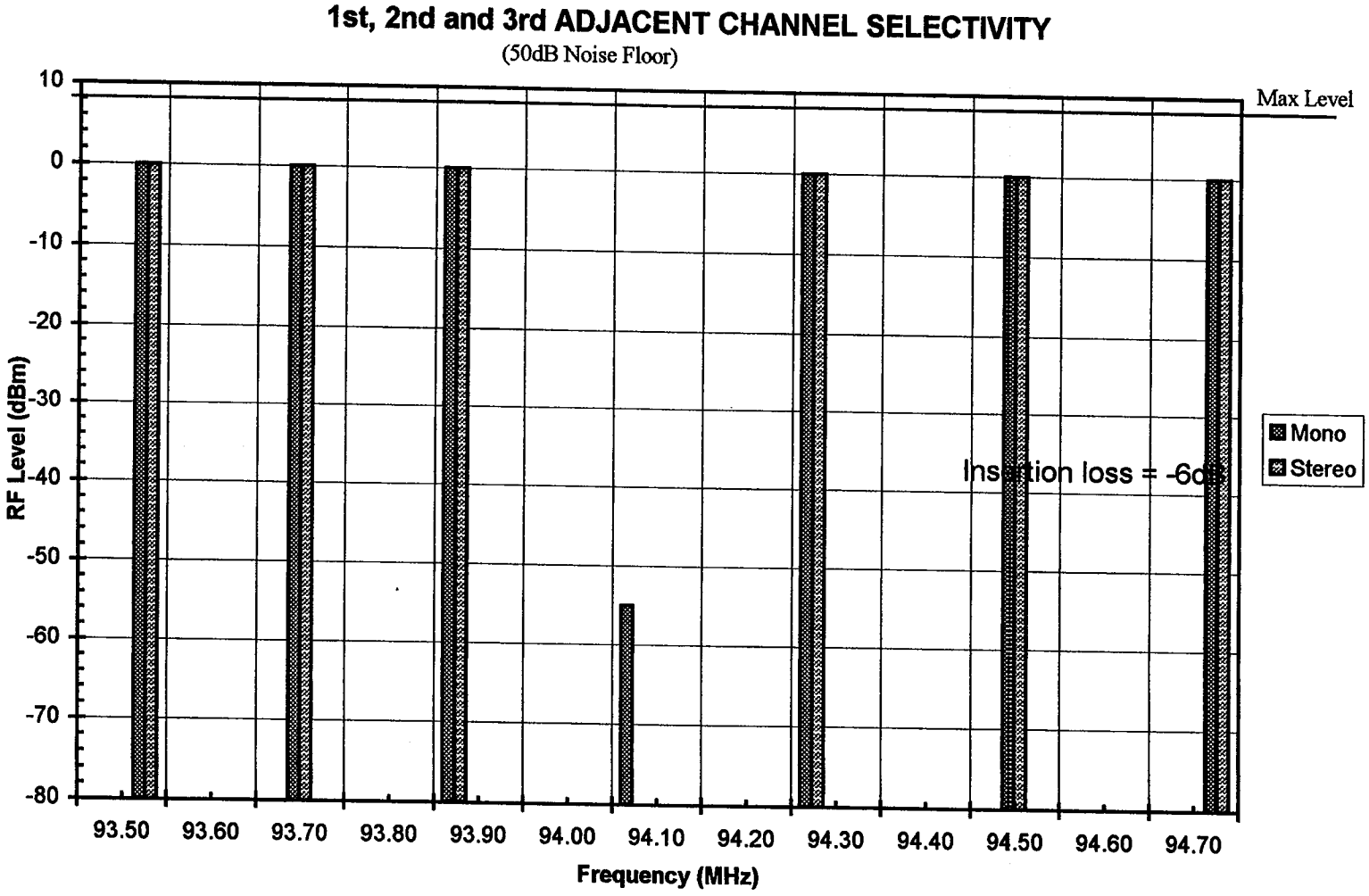
0 0


1st and 2nd ADJACENT CHANNEL SELECTIVITY
(30dB Noise Floor)
Max Level
RF Level (dBm)
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Insertion loss = -6dB
Mono
Stereo
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)

0 0

151

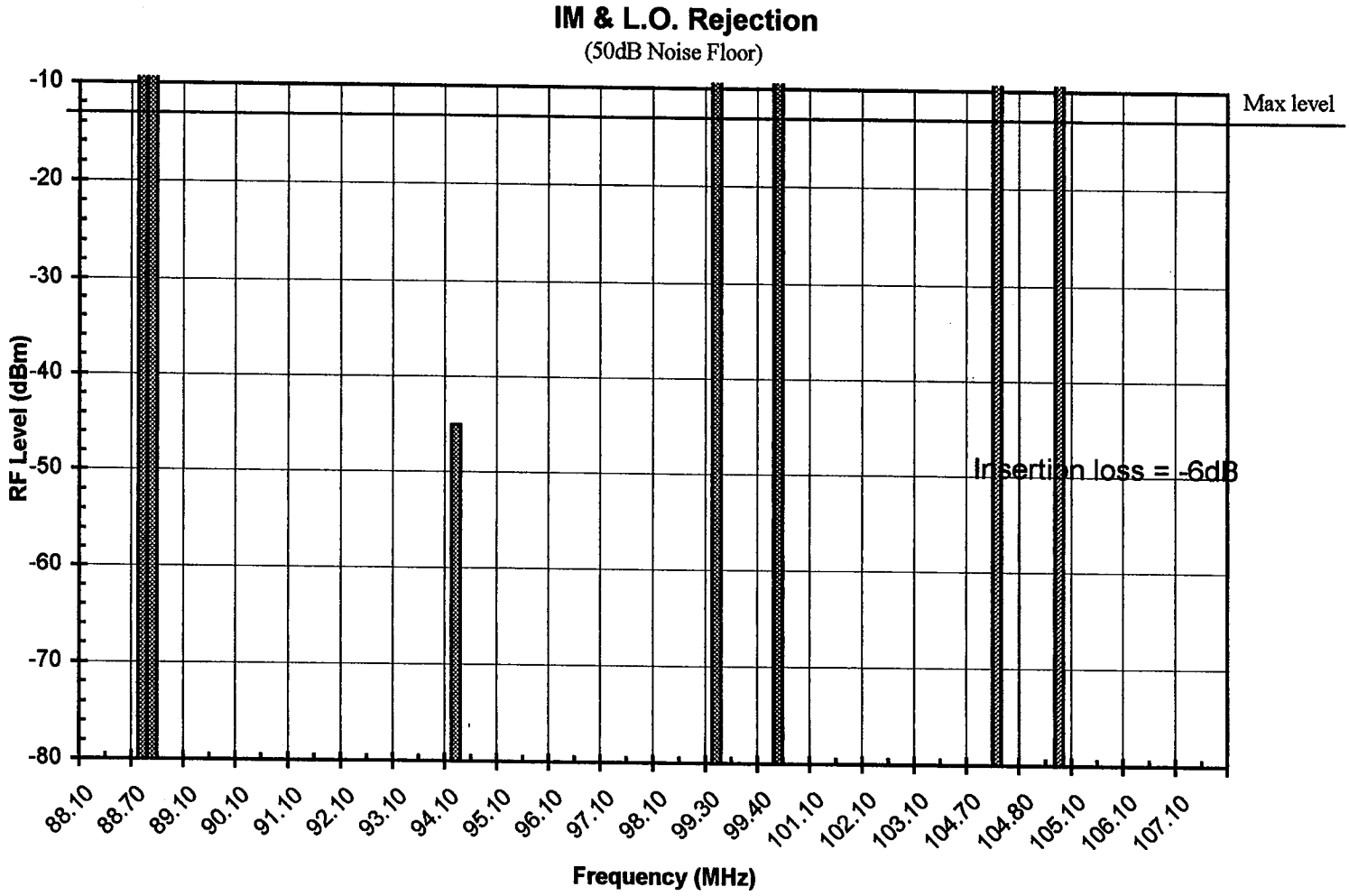
FM Receiver Test Laboratory



0 0

File Name: !c_temp

Selectivity 50dB


IM & L.O. Rejection
(50dB Noise Floor)
-10
-20
-30
-40
-50
-60
-70
-80
RF Level (dBm)
Max level
Insertion loss = -6dB
88.10
88.70
89.10
90.10
91.10
92.10
93.10
94.10
95.10
96.10
97.10
98.10
99.30
99.40
101.10
102.10
103.10
104.70
104.80
105.10
106.10
107.10
Frequency (MHz)

0 0

Receiver #1

Delco

Auto

FM Receiver Test Laboratory

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

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)

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				Right Ch		
Level	2	**Vrms**	= 0dB	**Level**	2	**Vrms**
THD	.64	**%**		**THD**	.45	**%**

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	0.64	%	=	-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 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	-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)

156

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

RF Level dBm	Mono (L)		Stereo (L)			Separation L->R		RF Level dBm
	Signal dB	Noise dB	Signal dB	Filt. Noise dB	Noise dB	Left dB	Right dB	
-130	-23.00	-23.00	-23.00	-23.00		-23.00	-23.00	-130
-125	-23.00	-23.00	-23.00	-23.00		-23.00	-23.00	-125
-120	-21.00	-24.00	-22.00	-23.50		-22.50	-22.50	-120
-115	-16.00	-25.00	-17.00	-24.50		-20.50	-20.50	-115
-110	-8.00	-27.00	-9.00	-26.50		-14.00	-14.00	-110
-105	-2.50	-35.50	-3.20	-34.00		-9.00	-9.00	-105
-100	-0.50	-50.00	-0.80	-47.00		-7.00	-6.50	-100
-95	0.00	-58.00	-0.50	-54.50		-6.00	-7.00	-95
-90	0.00	-62.00	-0.40	-55.00		-5.00	-8.00	-90
-85	0.00	-62.00	-0.30	-55.00		-4.00	-9.50	-85
-80	0.00	-62.00	0.00	-55.00		-2.00	-13.00	-80
-75	0.00	-62.00	0.00	-57.00		-1.20	-17.00	-75
-70	0.00	-62.00	0.00	-58.50		-0.50	-32.50	-70
-65	0.00	-62.00	0.00	-60.00		0.00	-38.00	-65
-60	0.00	-62.00	0.00	-61.00		0.00	-38.00	-60
-55	0.00	-62.00	0.00	-61.00		0.00	-38.00	-55
-50	0.00	-62.00	0.00	-61.00		0.00	-38.00	-50
-45	0.00	-62.00	0.00	-61.00	-52.50	0.00	-38.00	-45

157

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 -60.00 dBm
RF Lev 2 -50.00 dBm

Capture Ratio: -5.00 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 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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-36.42	-18.58	-36.92	-18.08	
Undesired Lower Lev	-35.32	-19.68	-35.92	-19.08	
Selectivity, 1st Adj.:		-19.13		-18.58	(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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	8.00	-63.00	8.00	-63.00	
Undesired Lower Lev	8.00	-63.00	8.00	-63.00	
Selectivity, 2nd Adj.:	Max RF	-63.00	Max RF	-63.00	(RF D/U Up + RF D/U Lo)/2

158

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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-59.12	4.12	-60.92	5.92	
Undesired Lower Lev	-62.82	7.82	-63.92	8.92	
Selectivity, 1st Adj.:		5.97		7.42	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	0.08	-55.08	-1.92	-53.08	
Undesired Lower Lev	-0.92	-54.08	-2.92	-52.08	
Selectivity, 2nd Adj.:		-54.58		-52.58	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	3.08	-58.08	1.08	-56.08	
Undesired Lower Lev	0.08	-55.08	-1.92	-53.08	
Selectivity, 3rd Adj.:		-56.58		-54.58	(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 -105.00 dBm
RF Lev 2 _____ dBm EOC
D/U 105.00 dB 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)

10.6MHz Spacing		10.7MHz Spacing	
dBm	D/U	dBm	D/U
-45.00		-45.00	
-13.07	-31.93	-13.07	-31.93
Max RF	-31.93	Max RF	-31.93

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

10.6MHz Spacing		10.7MHz Spacing	
dBm	D/U	dBm	D/U
-45.00		-45.00	
-13.07	-31.93	-13.07	-31.93
Max RF	-31.93	Max RF	-31.93

EOC: There was enough interference to raise the noise floor to -54dB - beat note type noise

160

FM Receiver Test Laboratory

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

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		THD		Right Channel		THD	
2	Vrms	.64	%	2	Vrms	.45	%

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)**
-19.13 dB Mono
-18.58 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)**
5.97 dB Mono
7.42 dB Stereo

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

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

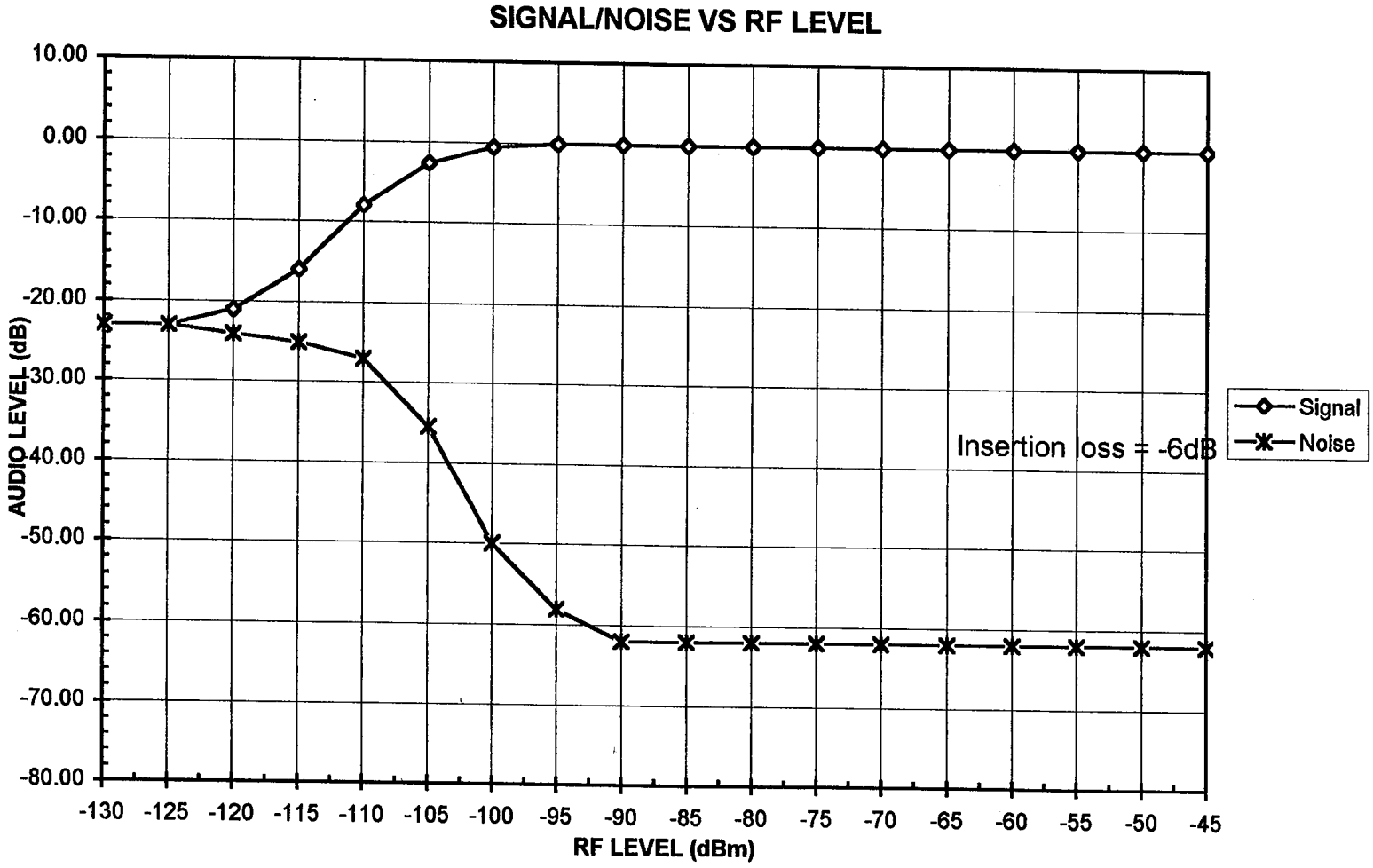
13 **10.7MHz Rejection**
105.00 dB Could not attain a reading for this test

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

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

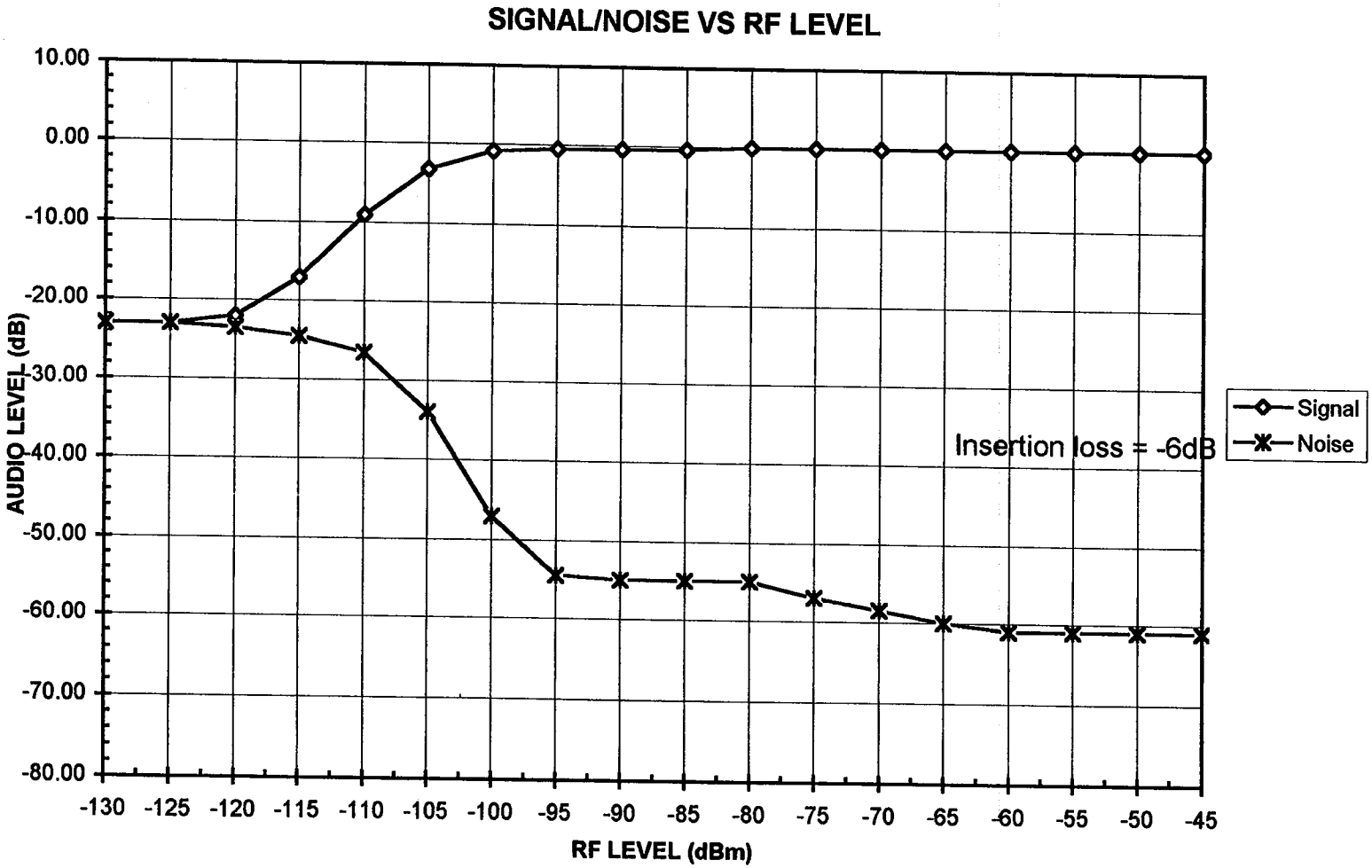
162

FM Receiver Test Laboratory



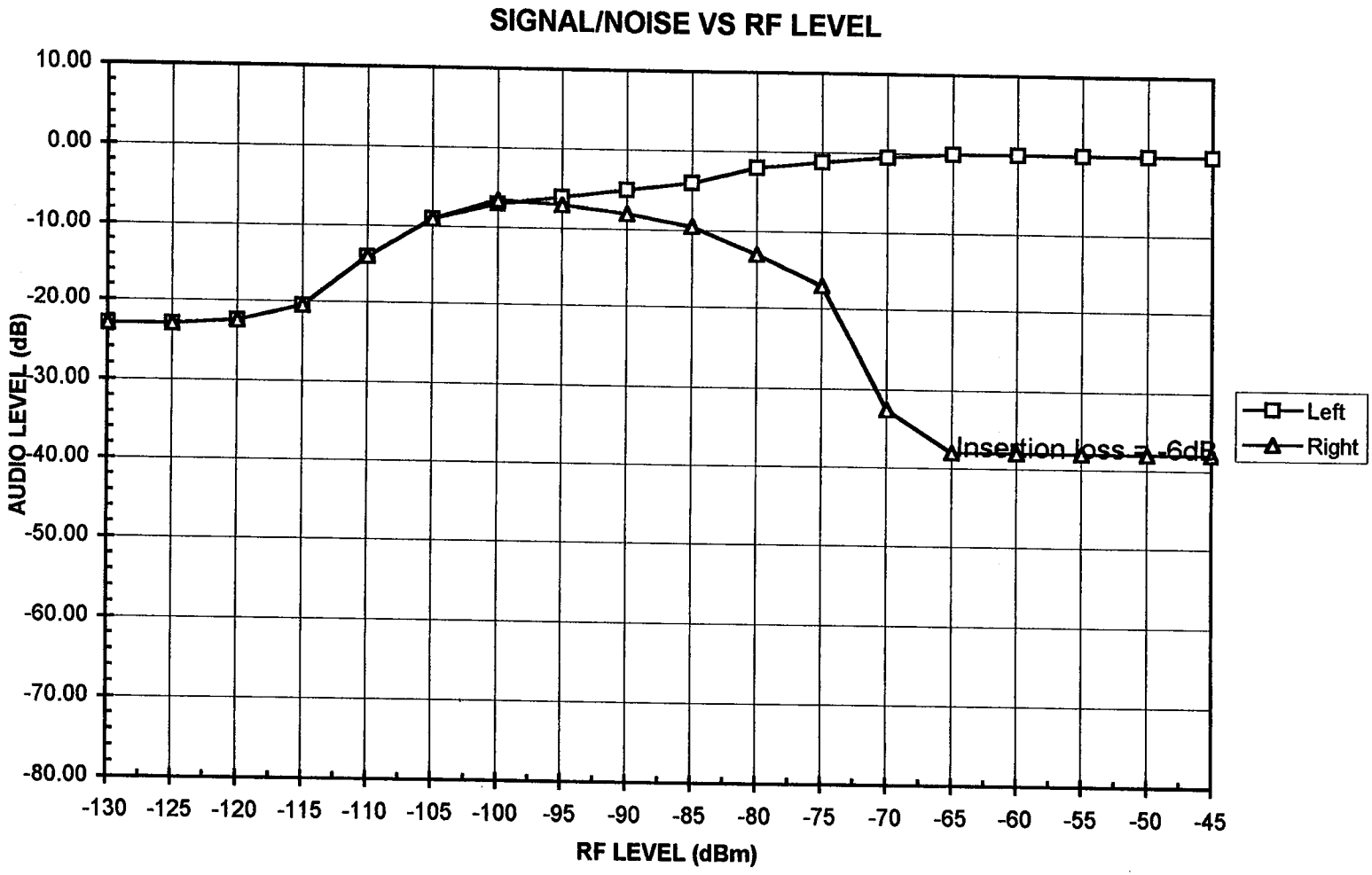
Delco 16192463

FM Receiver Test Laboratory



Delco 16192463

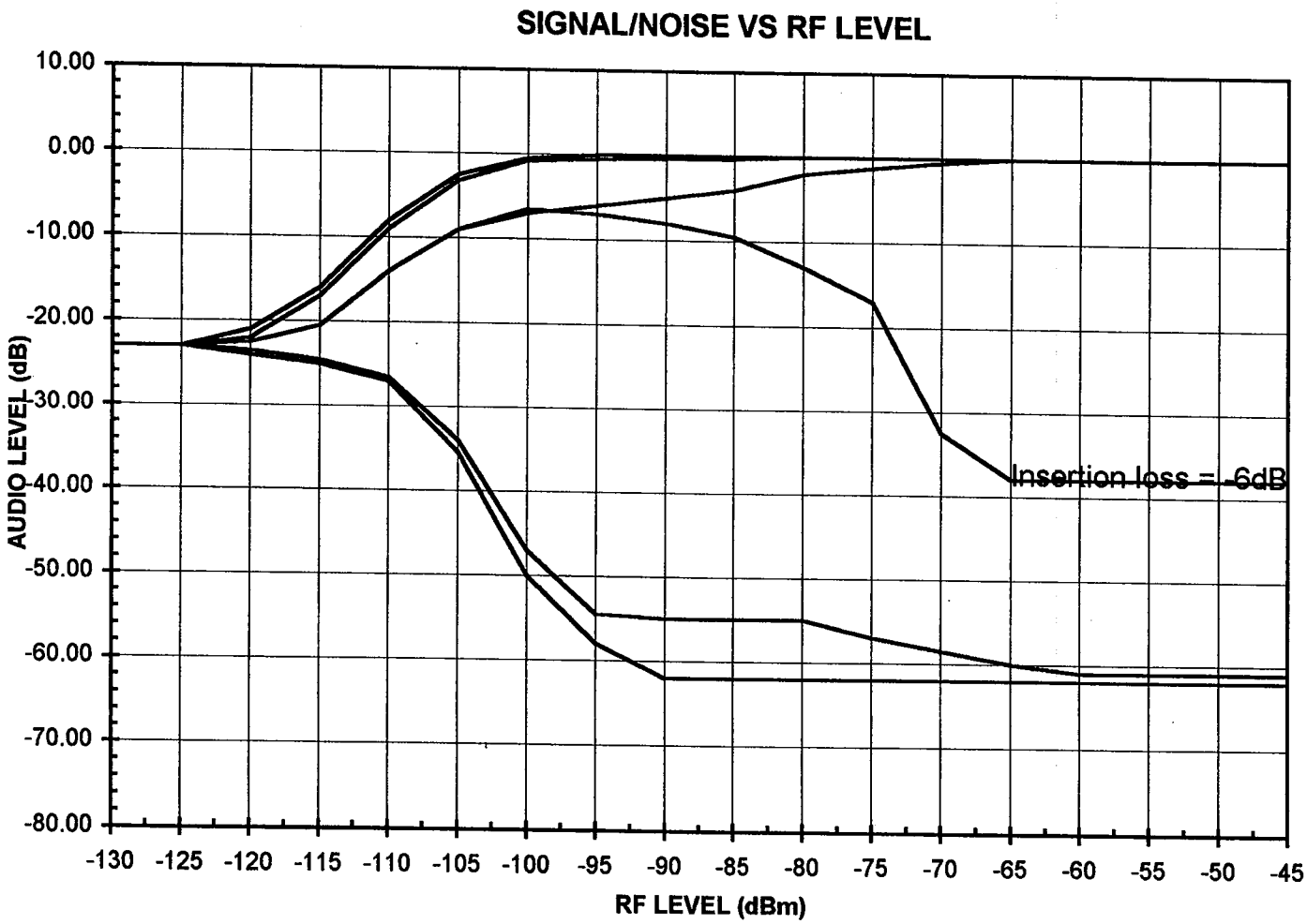
FM Receiver Test Laboratory



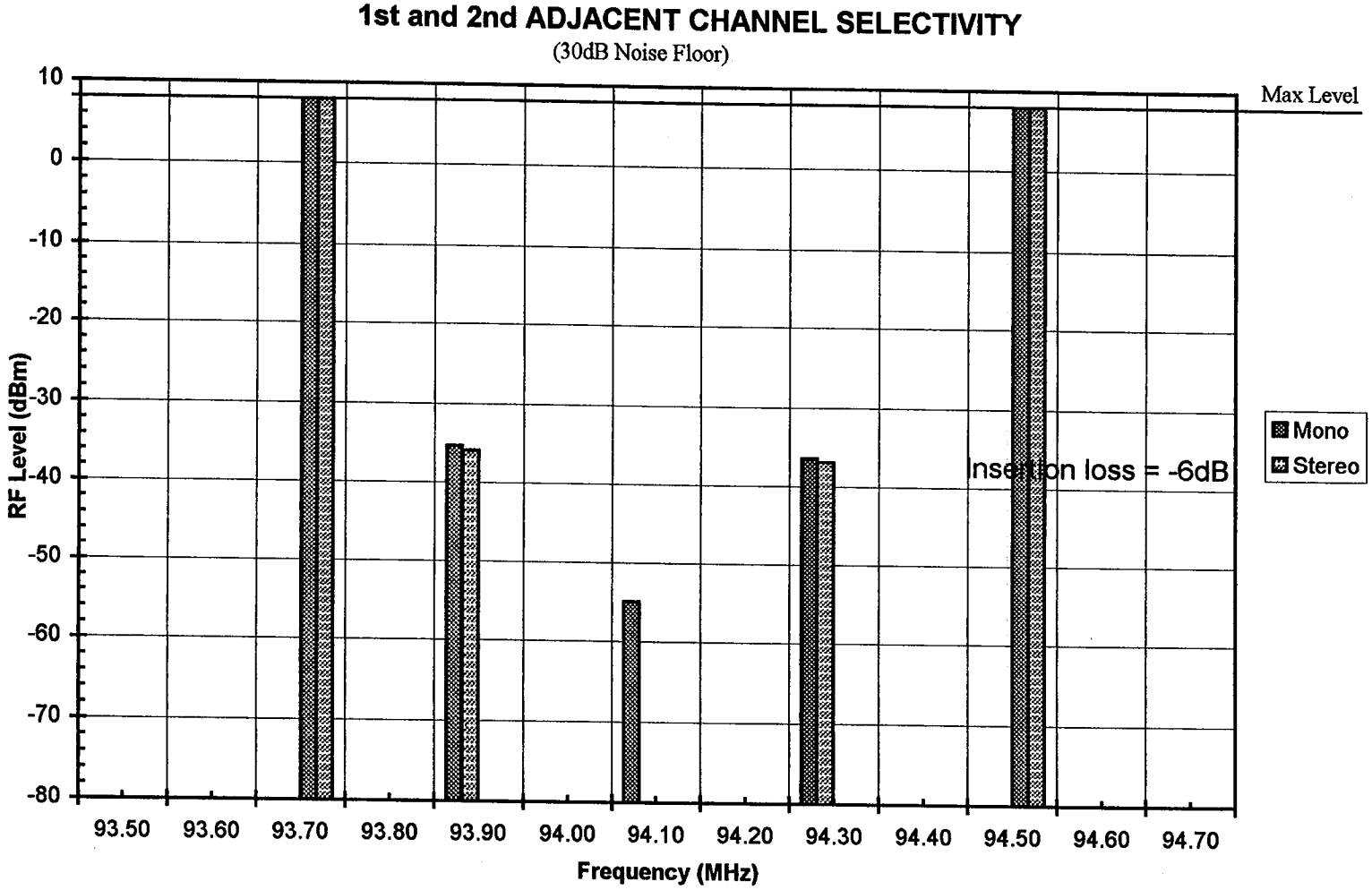
Delco 16192463

File Name: C_delco

FM Receiver Test Laboratory

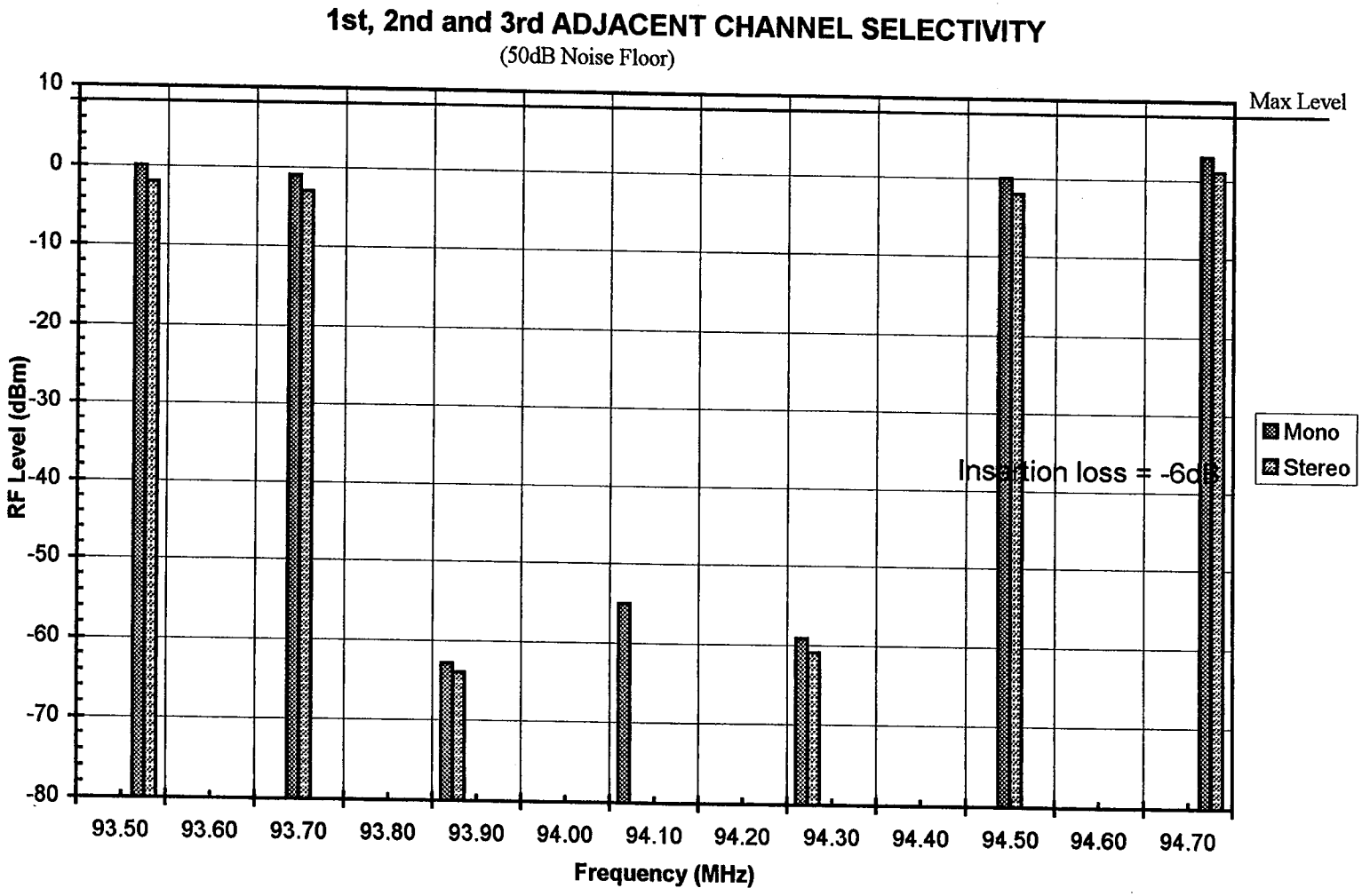


Delco 16192463

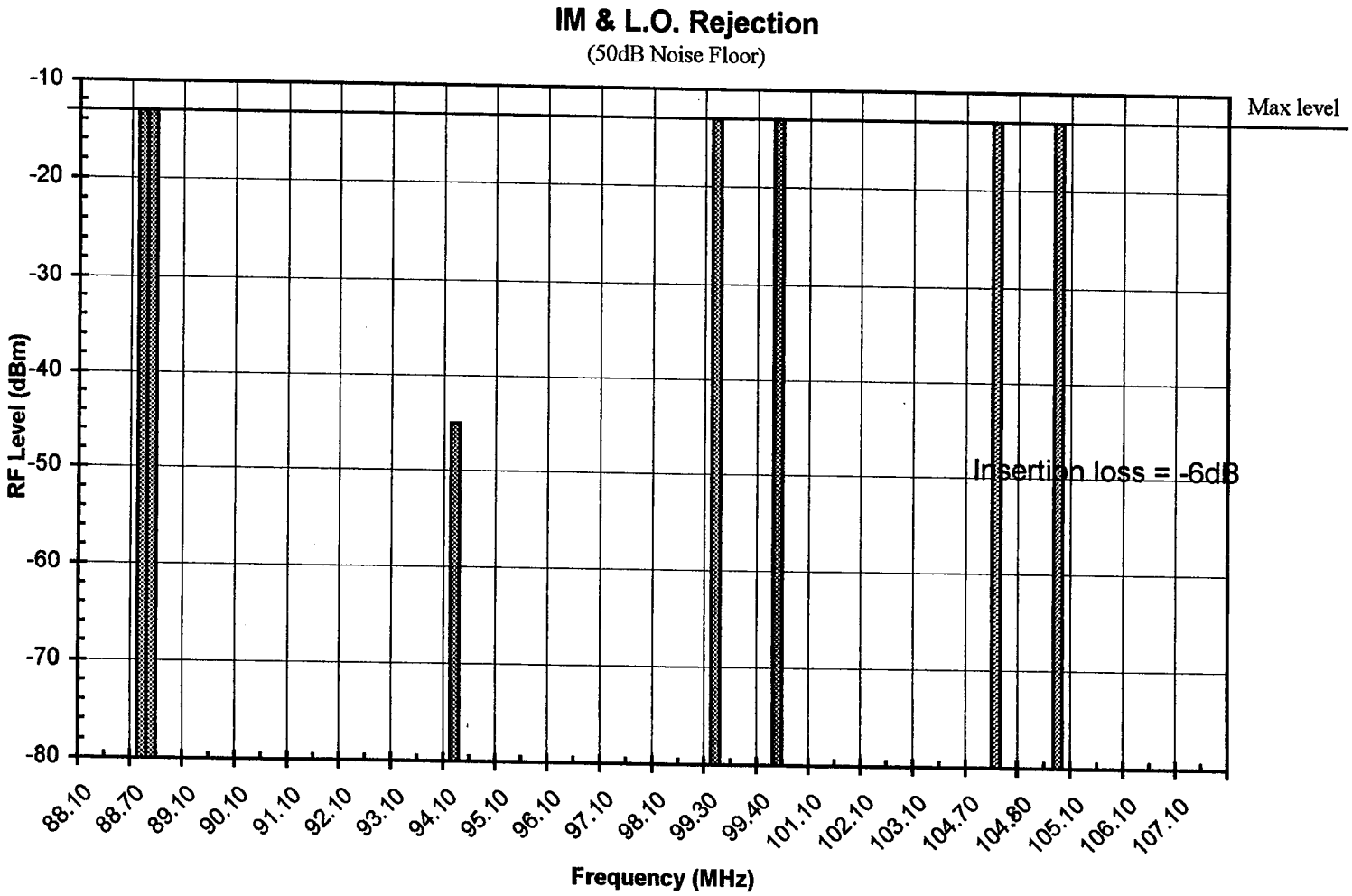


Delco 16192463

FM Receiver Test Laboratory



Delco 16192463



Delco 16192463

Receiver #2

Denon

Home HiFi

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
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 Atten; Off
Auto/Manual switch; Manual for Mono tests
Auto/Manual switch; Auto for Stereo tests

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)

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:

Left Ch				Right Ch		
Level	0.775	**Vrms**	= 0dB	**Level**	0.780	**Vrms**
THD	0.16	**%**		**THD**	0.16	**%**

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:

THD	0.16	%	=	-55.92 dB	(FM Only)
THD	0.16	%	=	-55.92 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 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	-106.0	dBm	(S/N Ratio = 30dB)
RF Lev2	-53.0	dBm	(21.4MHz + 94.1MHz = 115.5MHz)
Image Rejection:	-53.00	dB	(RF Lev1 - RF Lev2)

172

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

RF Level dBm	Mono (L) Signal dB	Mono (L) Noise dB	Stereo (L) Signal dB	Stereo (L) Filt. Noise dB	Stereo (L) Noise dB	Separation L=>R Left dB	Separation L=>R Right dB	RF Level dBm
-130	-14.50	-14.50	-77.00	-77.00		-77.00	-77.00	-130
-125	-14.50	-14.50	-77.00	-77.00		-77.00	-77.00	-125
-120	-14.50	-15.00	-77.00	-77.00		-77.00	-77.00	-120
-115	-12.00	-16.50	-77.00	-77.00		-77.00	-77.00	-115
-110	-6.50	-21.00	-77.00	-77.00		-77.00	-77.00	-110
-105	-2.00	-35.50	-77.00	-77.00		-77.00	-77.00	-105
-100	-0.25	-49.00	-77.00	-77.00		-77.00	-77.00	-100
-95	0.00	-54.50	-77.00	-77.00		-77.00	-77.00	-95
-90	0.00	-60.00	0.00	-36.00		0.00	-31.50	-90
-85	0.00	-65.50	0.00	-41.00		0.00	-34.00	-85
-80	0.00	-71.00	0.00	-46.00		0.00	-35.00	-80
-75	0.00	-76.00	0.00	-51.00		0.00	-35.50	-75
-70	0.00	-78.00	0.00	-55.50		0.00	-35.50	-70
-65	0.00	-78.00	0.00	-60.50		0.00	-36.00	-65
-60	0.00	-78.00	0.00	-65.00		0.00	-36.00	-60
-55	0.00	-78.00	0.00	-69.00		0.00	-36.00	-55
-50	0.00	-78.00	0.00	-71.50		0.00	-37.00	-50
-45	0.00	-78.00	0.00	-72.50	-70.50	0.00	-37.50	-45

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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-40.22	-14.78	-40.22	-14.78	
Undesired Lower Lev	-50.52	-4.48	-50.82	-4.18	
Selectivity, 1st Adj.:		-9.63		-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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	8.08	-63.08	7.70	-62.70	
Undesired Lower Lev	8.08	-63.08	8.08	-63.08	
Selectivity, 2nd Adj.:	Max RF	-63.08		-62.89	(RF D/U Up + RF D/U Lo)/2

174

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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-41.42	-13.58	-58.92	3.92	
Undesired Lower Lev	-52.42	-2.58	-69.92	14.92	
Selectivity, 1st Adj.:		**8.08**		**9.42**	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-6.92	-48.08	-21.92	-33.08	
Undesired Lower Lev	8.08	-63.08	8.08	-63.08	
Selectivity, 2nd Adj.:		**-55.58**		**-48.08**	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	7.90	-62.90	-9.92	-45.08	
Undesired Lower Lev	8.08	-63.08	-12.92	-42.08	
Selectivity, 3rd Adj.:		**-62.99**		**-43.58**	(RF D/U Up + RF D/U Lo)/2

175

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 -104.70 dBm
RF Lev 2 -17.00 dBm EOC
D/U -87.70 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)

10.6MHz Spacing		10.7MHz Spacing	
dBm	D/U	dBm	D/U
-45.00		-45.00	
-24.37	-20.63	-25.37	-19.63
	-20.63		-19.63

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

10.6MHz Spacing		10.7MHz Spacing	
dBm	D/U	dBm	D/U
-45.00		-45.00	
-13.37	-31.63	-26.37	-18.63
Mic Rf	-31.63		-18.63

EOC: Objectionable beat notes

176

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
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)

177

Test Results:

1 **Local Oscillator Frequency:**
104.794 MHz

2 **Standard Audio Output:**

Left Channel		THD		Right Channel		THD	
0.775	Vrms	0.16	%	0.78	Vrms	0.16	%

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)**
-9.63 dB Mono
-9.48 dB Stereo

9 **Selectivity, Second Adjacent, 30dB Noise Floor (Ave. D/U)**
-63.08 dB Mono Max RF
-62.89 dB Stereo

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

11 **Selectivity, Second Adjacent, 50dB Noise Floor (Ave. D/U)**
-55.58 dB Mono
-48.08 dB Stereo

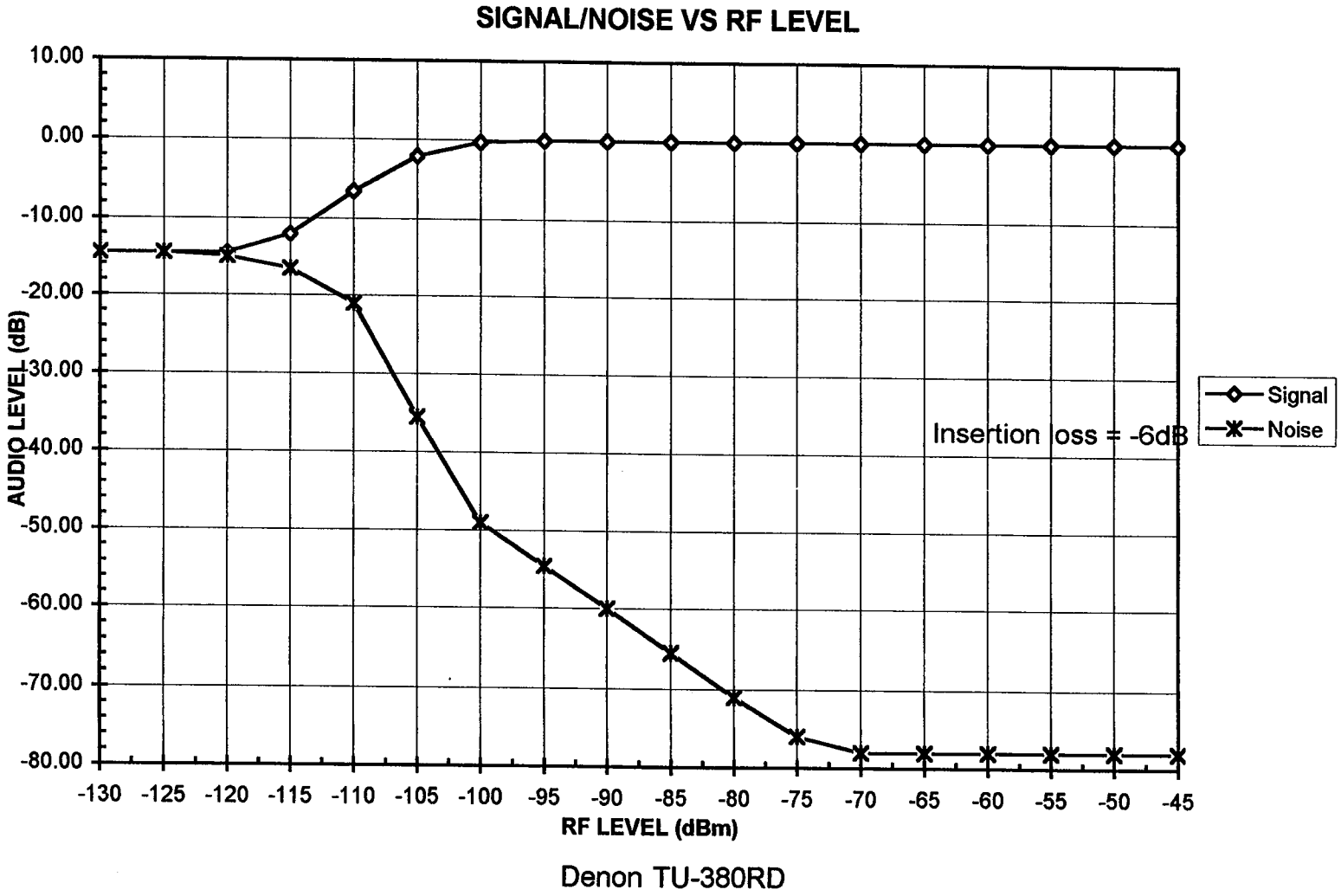
12 **Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)**
-62.99 dB Mono
-43.58 dB Stereo

13 **10.7MHz Rejection**
-87.70 dB 0

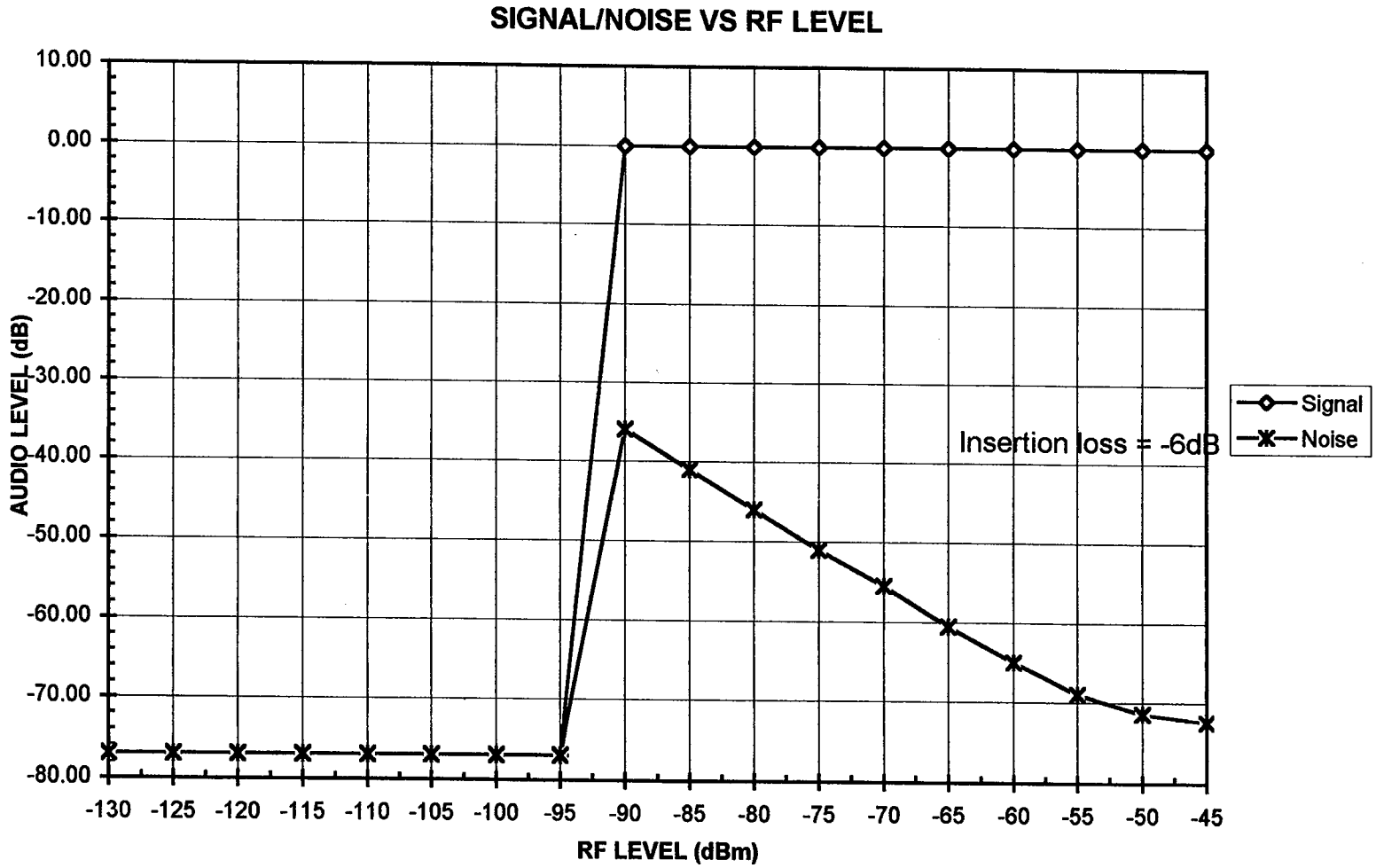
14 **10.7MHz IM**
-20.63 dB (10.6) 0
-19.63 dB (10.7) 0

15 **10.7MHz Spurious (Local Osc. Interference)**
-31.63 dB (10.6) Max RF Objectionable beat notes
-18.63 dB (10.7) 0

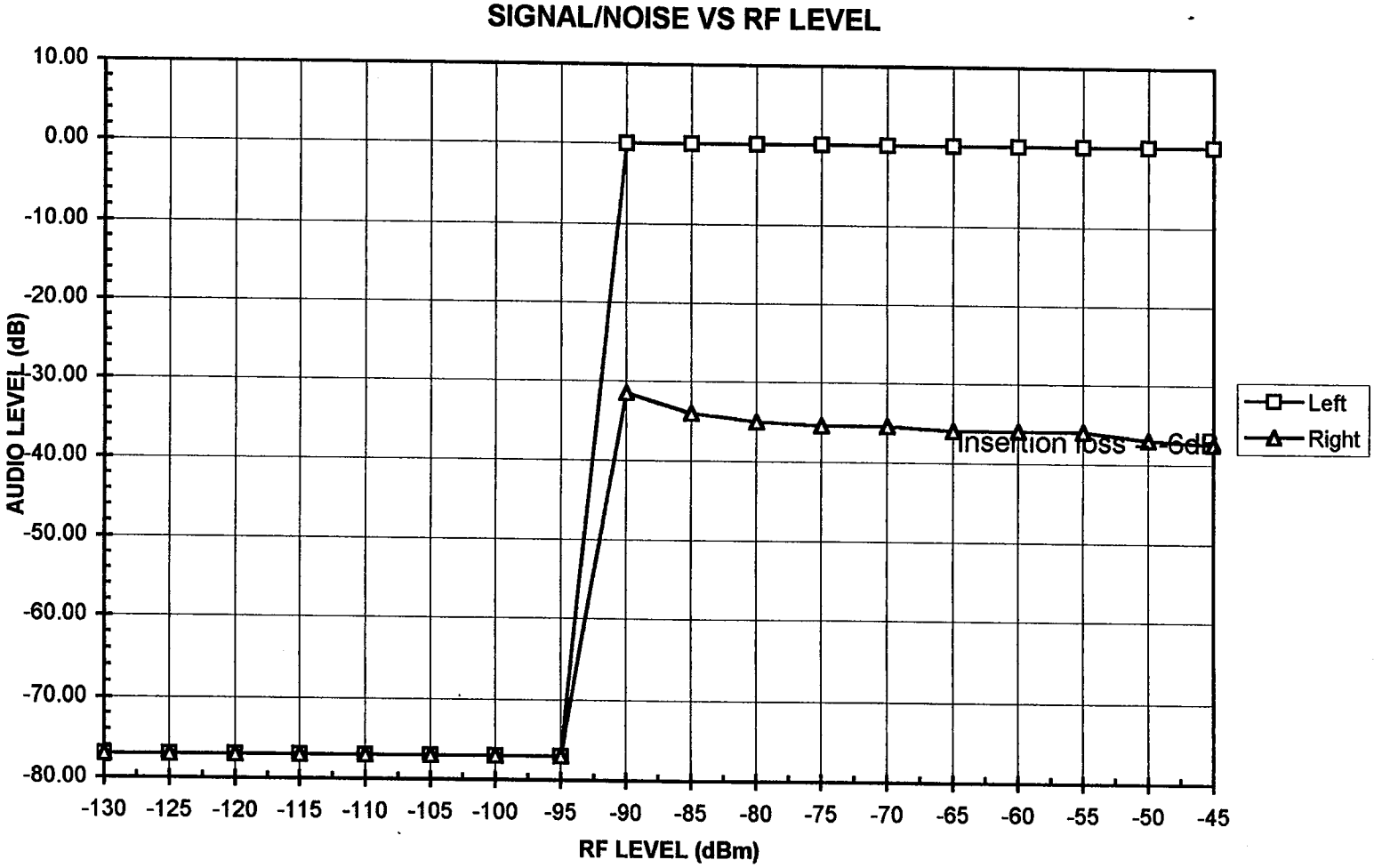
178



Denon TU-380RD

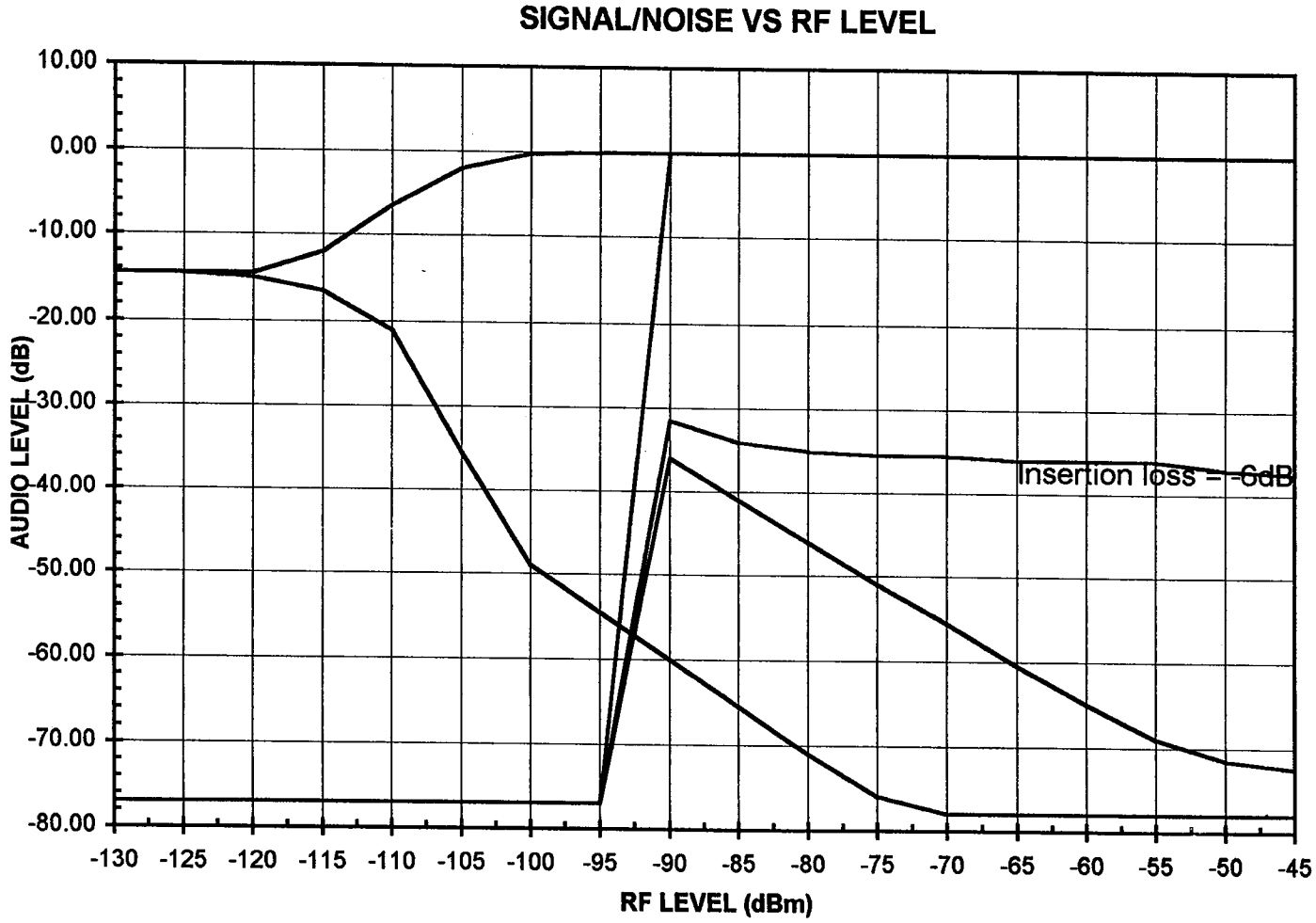


Denon TU-380RD

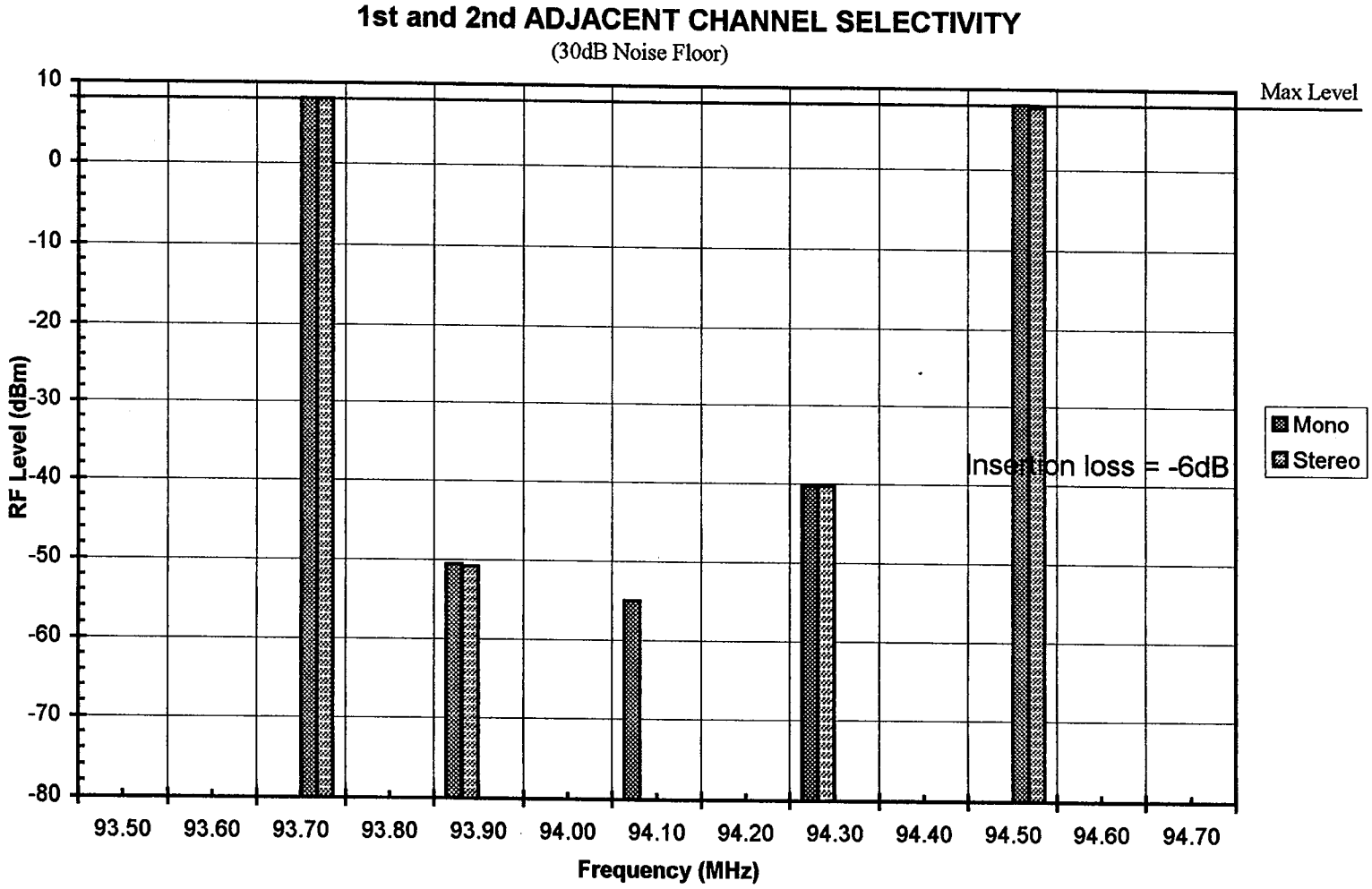


Denon TU-380RD

181



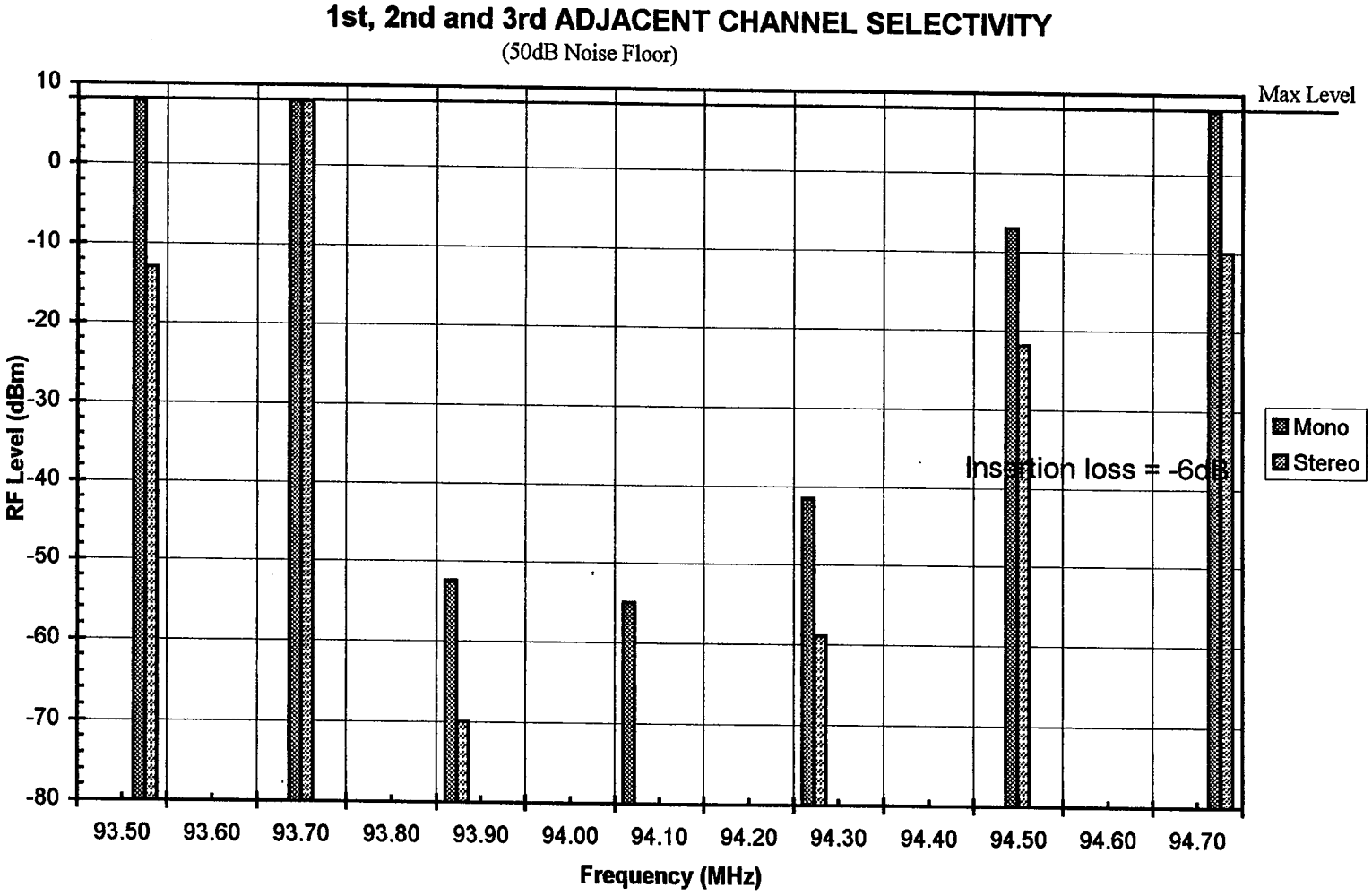
Denon TU-380RD



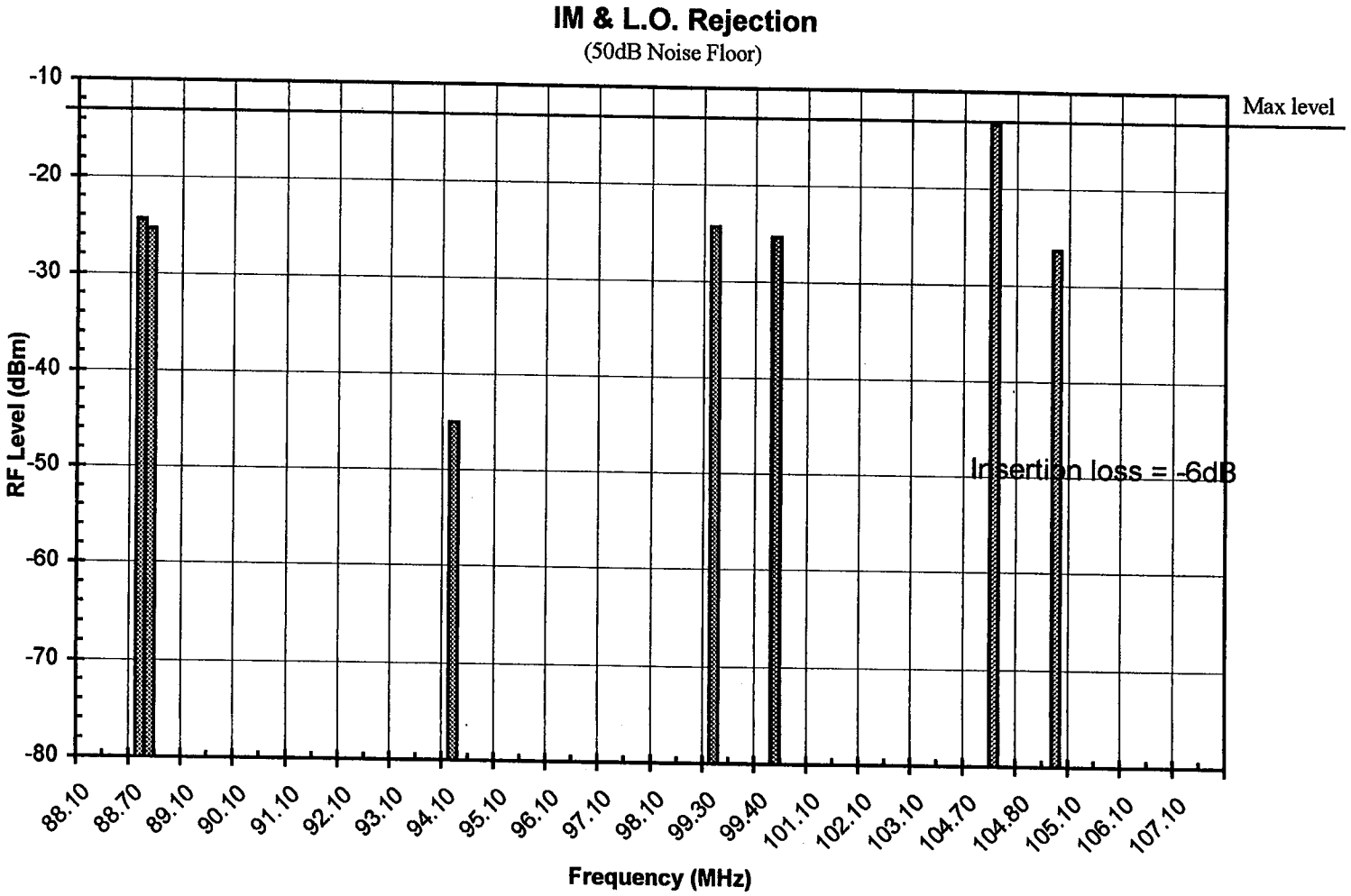
Denon TU-380RD

183

FM Receiver Test Laboratory



Denon TU-380RD



Denon TU-380RD

Receiver #3

Panasonic

Portable

FM Receiver Test Laboratory

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: GR3JA01184

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

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

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 Levl
Tune RF Gen to; Desired Freq. +/- 2 X IF Freq.
Adjust RF Level until S/N Ratio = 30dB, record RF Lev2

Measurement:			
RF Levl	-101.0 dBm	(S/N Ratio = 30dB)	
RF Lev2	-65.0 dBm	(21.4MHz + 94.1MHz = 115.5MHz)	
Image Rejection:	-36.00 dB	(RF Levl - RF Lev2)	

188

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

	Mono (L)		Stereo (L)			Separation L->R		
RF Level dBm	Signal dB	Noise dB	Signal dB	Filt. Noise dB	Noise dB	Left dB	Right dB	RF Level dBm
-130	-30.00	-30.00	-29.50	-29.50		-29.50	-29.50	-130
-125	-30.00	-30.00	-29.50	-29.50		-29.50	-29.50	-125
-120	-30.00	-30.00	-29.00	-29.50		-29.00	-29.50	-120
-115	-26.50	-30.00	-26.00	-29.00		-28.00	-28.50	-115
-110	-18.50	-30.00	-18.00	-29.00		-23.00	-24.00	-110
-105	-10.00	-31.00	-10.00	-29.50		-15.50	-16.00	-105
-100	-3.50	-36.00	-3.25	-27.00		-3.50	-26.00	-100
-95	-0.75	-47.00	-0.50	-32.50		-0.50	-29.50	-95
-90	0.00	-58.00	0.00	-38.00		0.00	-32.00	-90
-85	0.00	-64.00	0.00	-43.00		0.00	-33.50	-85
-80	0.00	-68.50	0.00	-48.00		0.00	-34.50	-80
-75	0.00	-70.50	0.00	-53.00		0.00	-34.50	-75
-70	0.00	-71.00	0.00	-57.50		0.00	-35.00	-70
-65	0.00	-71.50	0.00	-62.00		0.00	-35.00	-65
-60	0.00	-71.80	0.00	-65.00		0.00	-35.00	-60
-55	0.00	-72.00	0.00	-67.20		0.00	-35.00	-55
-50	0.00	-72.00	0.00	-68.00		0.00	-35.50	-50
-45	0.00	-72.00	0.00	-68.50	-36.20	0.00	-37.00	-45

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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-50.92	-4.08	-51.92	-3.08	
Undesired Lower Lev	-50.52	-4.48	-50.92	-4.08	
Selectivity, 1st Adj.:		-4.28		-3.58	(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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-35.12	-19.88	-35.12	-19.88	
Undesired Lower Lev	-20.42	-34.58	-20.92	-34.08	
Selectivity, 2nd Adj.:		-27.23		-26.98	(RF D/U Up + RF D/U Lo)/2

190

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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-53.52	-1.48	-72.42	17.42	
Undesired Lower Lev	-54.92	-0.08	-66.92	11.92	
Selectivity, 1st Adj.:		-0.78		14.67	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-38.32	-16.68	-44.92	-10.08	
Undesired Lower Lev	-33.92	-21.08	-33.92	-21.08	
Selectivity, 2nd Adj.:		-18.88		-15.58	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-30.92	-24.08	-30.92	-24.08	
Undesired Lower Lev	-17.92	-37.08	-21.92	-33.08	
Selectivity, 3rd Adj.:		-30.58		-28.58	(RF D/U Up + RF D/U Lo)/2

191

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	-100.00	dBm	
RF Lev 2	-32.00	dBm	EOC
D/U	-68.00	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	D/U	dBm	D/U
-45.00		-45.00	
-24.37	-20.63	-29.37	-15.63
	-20.63		-15.63

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

10.6MHz Spacing		10.7MHz Spacing	
dBm	D/U	dBm	D/U
-45.00		-45.00	
-29.37	-15.63	-51.37	6.37
	-15.63		6.37

EOC: Objectionable beat notes

192

FM Receiver Test Laboratory

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: GR3JA01184

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
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)

193

Test Results:

1 **Local Oscillator Frequency:**
104.898 MHz

2 **Standard Audio Output:**

Left Channel		THD		Right Channel		THD	
1	Vrms	0.56	%	0.95	Vrms	0.54	%

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)**
-4.28 dB Mono
-3.58 dB Stereo

9 **Selectivity, Second Adjacent, 30dB Noise Floor (Ave. D/U)**
-27.23 dB Mono
-26.98 dB Stereo

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

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

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

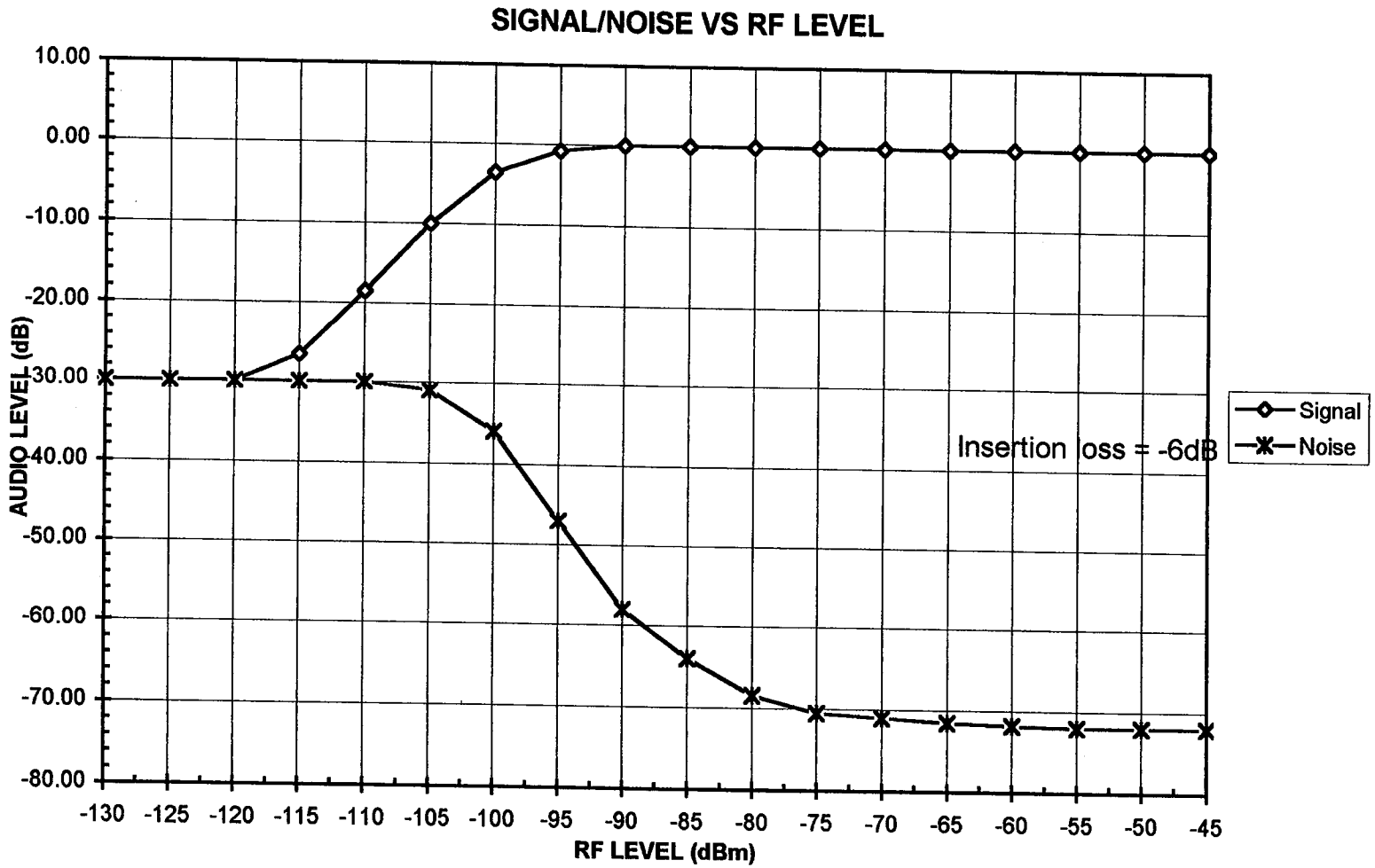
13 **10.7MHz Rejection**
-68.00 dB 0

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

15 **10.7MHz Spurious (Local Osc. Interference)**
-15.63 dB (10.6) Objectionable beat notes
6.37 dB (10.7) 0

194

FM Receiver Test Laboratory



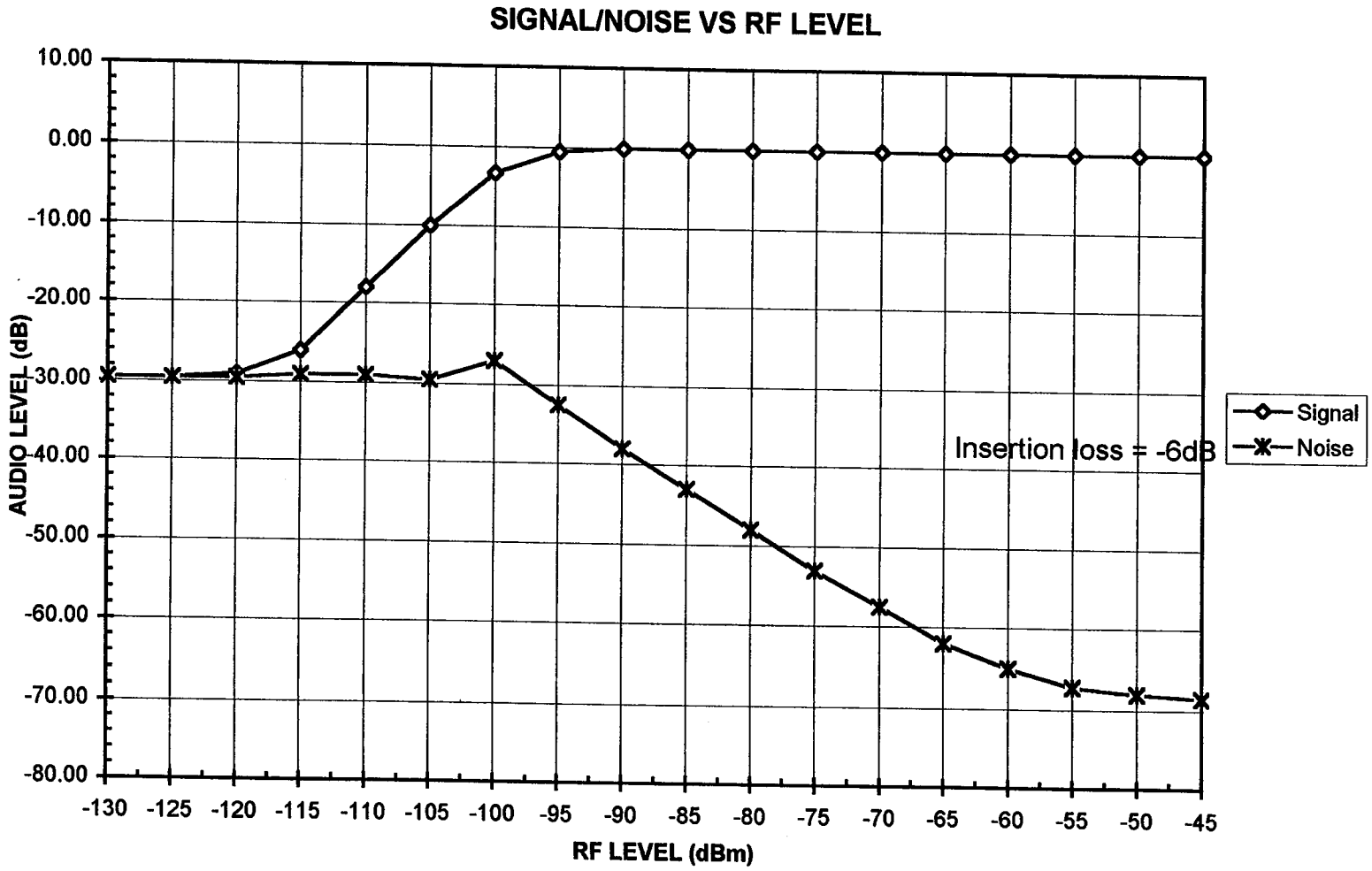
Panasonic RX-FS430

S61

File Name: C_pana

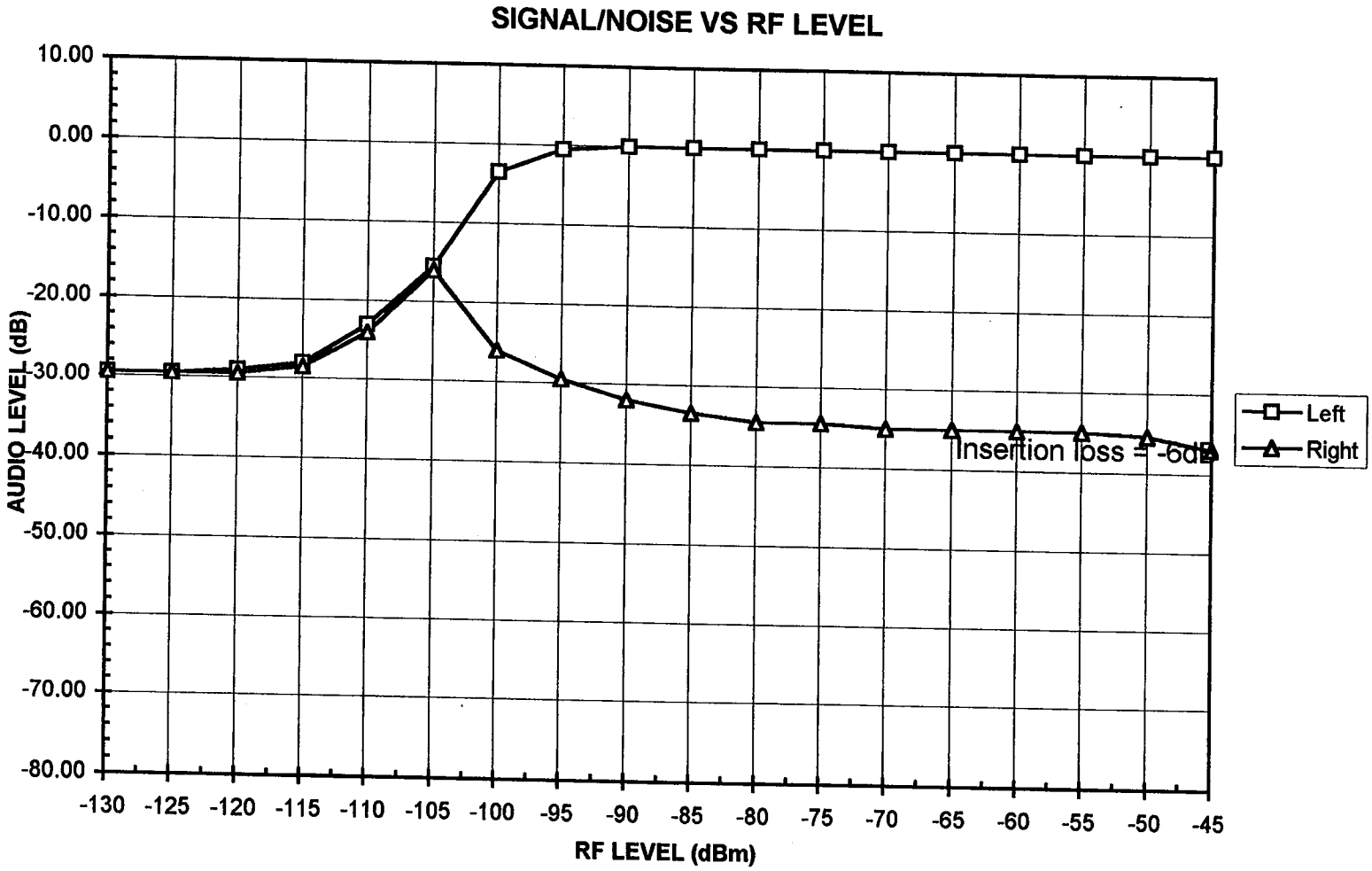
FM Mono Plot

FM Receiver Test Laboratory



Panasonic RX-FS430

FM Receiver Test Laboratory

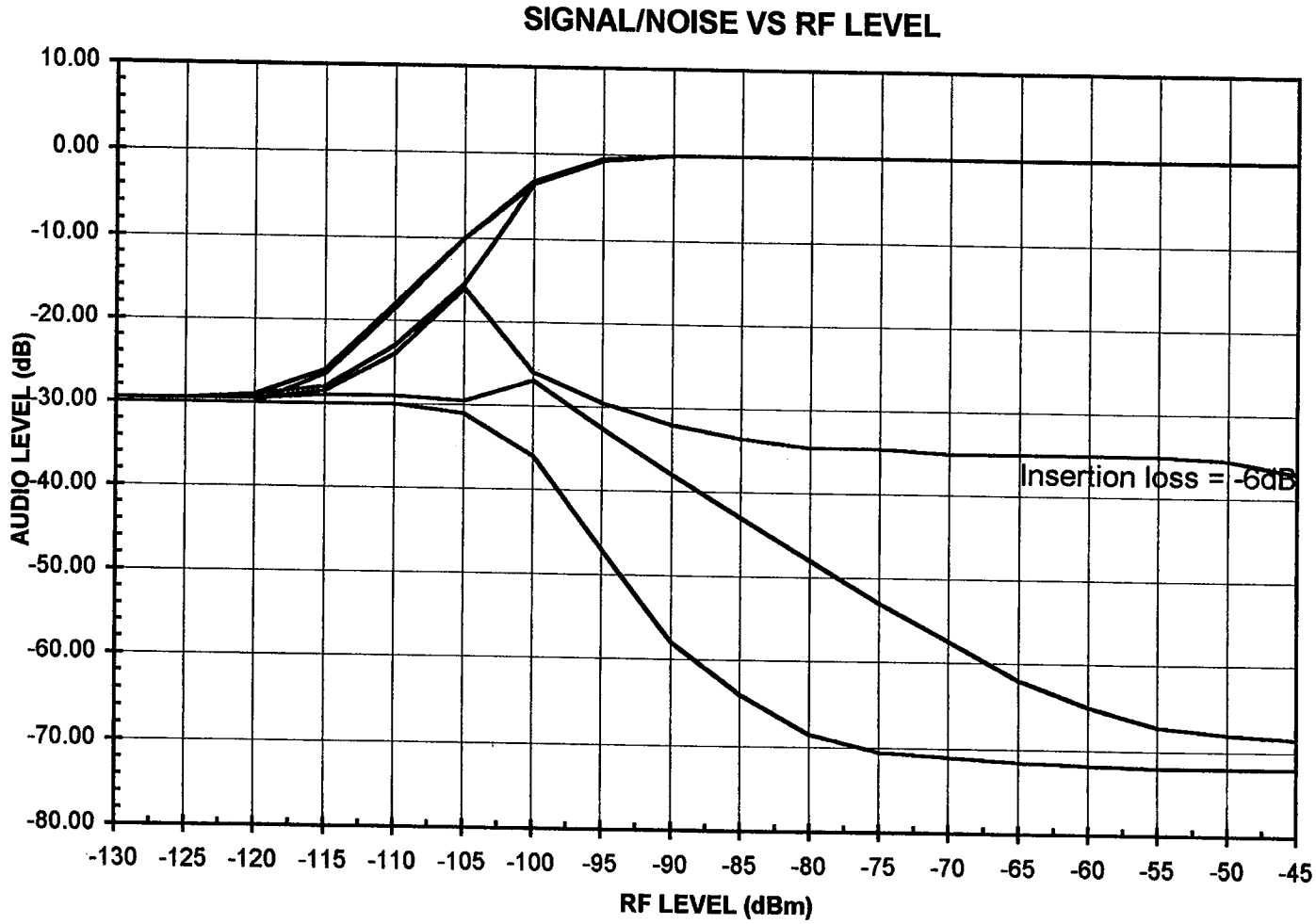


Panasonic RX-FS430

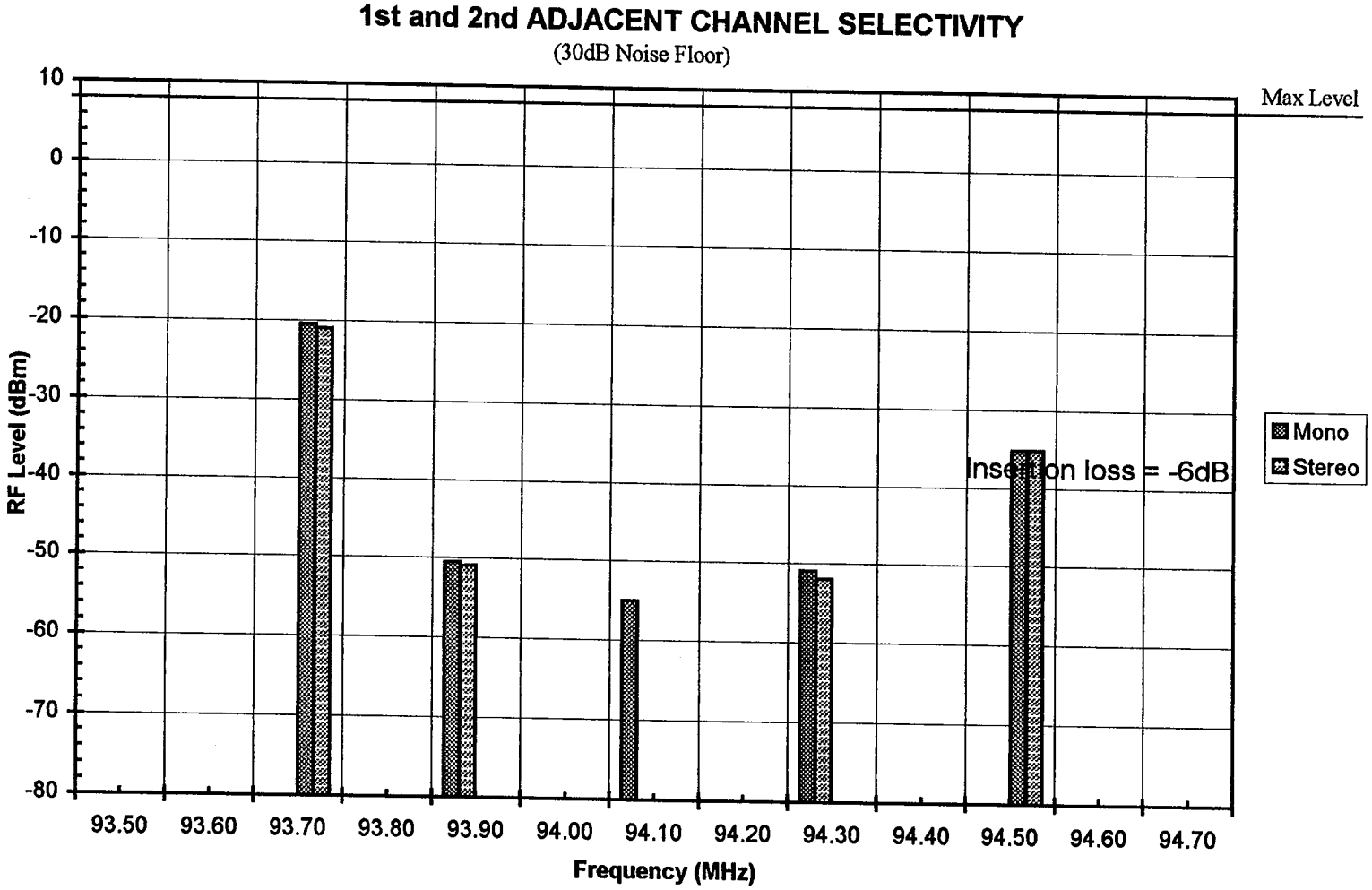
L61

File Name: C_pana

FM Receiver Test Laboratory



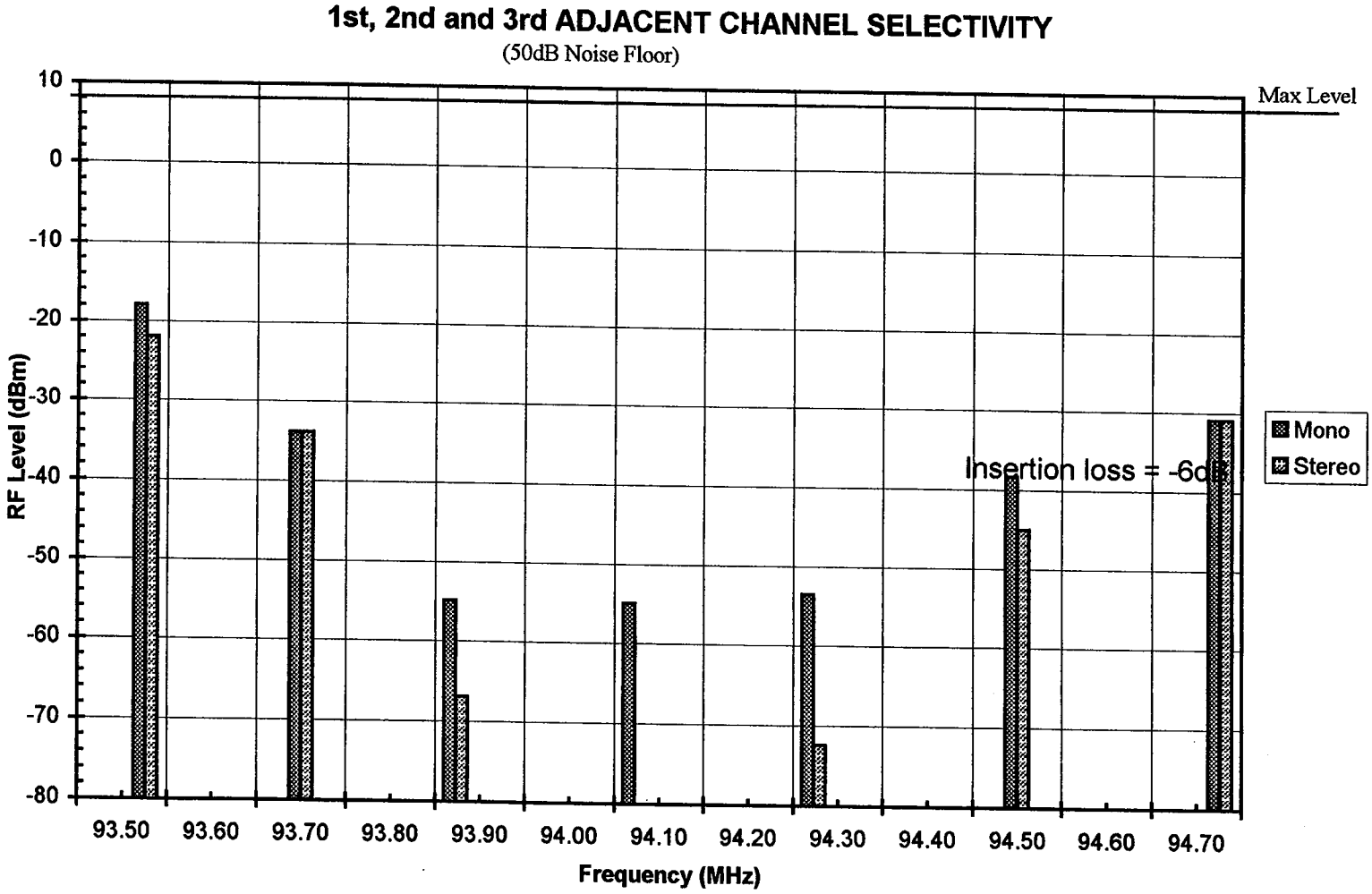
Panasonic RX-FS430



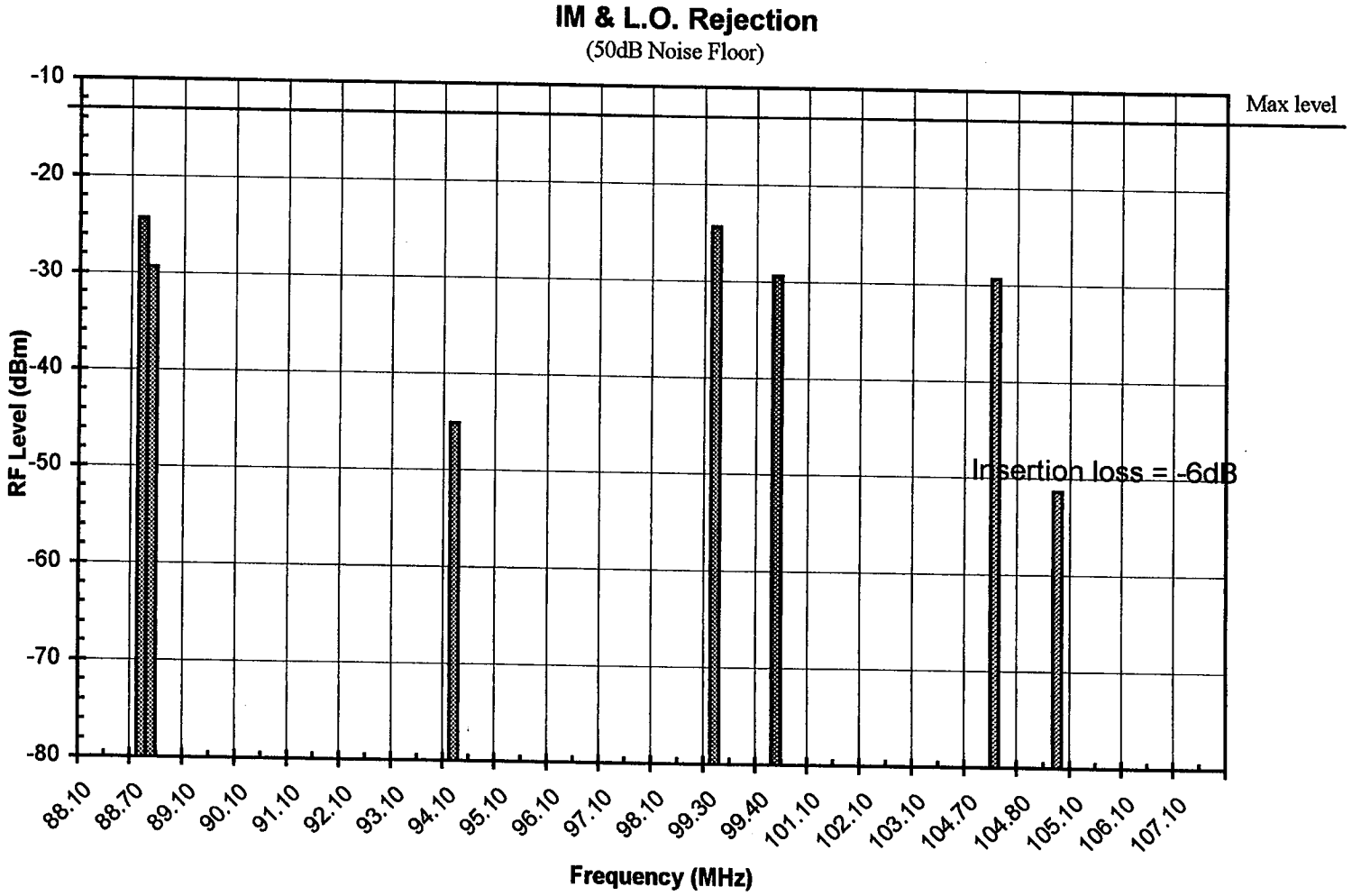
Panasonic RX-FS430

661

FM Receiver Test Laboratory



Panasonic RX-FS430



Panasonic RX-FS430

201

Receiver #4

Pioneer

Home HiFi

FM Receiver Test Laboratory

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

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

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			Right Ch	
Level	0.710	**Vrms**	= 0dB	**Level** 0.710	**Vrms**
THD	0.95	**%**		**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)

204

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

RF Level dBm	Mono (L)		Stereo (L)			Separation L->R		RF Level dBm
	Signal dB	Noise dB	Signal dB	Filt. Noise dB	Noise dB	Left dB	Right dB	
-130	-16.00	-16.00	-15.00	-15.00		-15.00	-15.00	-130
-125	-16.00	-16.00	-15.00	-15.00		-15.00	-15.00	-125
-120	-14.50	-16.50	-14.00	-15.50		-15.00	-15.00	-120
-115	-9.50	-18.00	-9.00	-17.00		-15.00	-15.00	-115
-110	-3.00	-24.00	-3.00	-23.00		-10.00	-10.00	-110
-105	-0.50	-45.50	-0.50	-44.00		-6.00	-6.00	-105
-100	0.00	-52.50	0.00	-51.50		-6.00	-6.00	-100
-95	0.00	-58.00	0.00	-57.00		-6.00	-6.00	-95
-90	0.00	-63.00	0.00	-62.00		-6.00	-6.00	-90
-85	0.00	-68.00	0.00	-67.00		-6.00	-6.00	-85
-80	0.00	-73.00	0.00	-50.00		0.00	-34.50	-80
-75	0.00	-75.00	0.00	-55.00		0.00	-35.00	-75
-70	0.00	-75.00	0.00	-60.00		0.00	-35.00	-70
-65	0.00	-75.00	0.00	-64.50		0.00	-35.50	-65
-60	0.00	-75.00	0.00	-68.00		0.00	-35.50	-60
-55	0.00	-75.00	0.00	-70.00		0.00	-36.00	-55
-50	0.00	-75.00	0.00	-72.00		0.00	-36.00	-50
-45	0.00	-75.00	0.00	-72.00	-33.00	0.00	-36.00	-45

205

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 (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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-46.72	-8.28	-47.72	-7.28	
Undesired Lower Lev	-53.22	-1.78	-57.22	2.22	
Selectivity, 1st Adj.:		-5.03		-2.53	(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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-7.62	-47.38	-7.62	-47.38	
Undesired Lower Lev	-9.22	-45.78	-9.52	-45.48	
Selectivity, 2nd Adj.:		-46.58		-46.43	(RF D/U Up + RF D/U Lo)/2

206

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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-51.92	-3.08	-67.12	12.12	
Undesired Lower Lev	-54.72	-0.28	-76.92	21.92	
Selectivity, 1st Adj.:		**-1.68**		**17.02**	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-26.92	-28.08	-27.92	-27.08	
Undesired Lower Lev	-23.92	-31.08	-26.92	-28.08	
Selectivity, 2nd Adj.:		**-29.58**		**-27.58**	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	3.08	-58.08	3.08	-58.08	
Undesired Lower Lev	-24.92	-30.08	-24.92	-30.08	
Selectivity, 3rd Adj.:		**-44.08**		**-44.08**	(RF D/U Up + RF D/U Lo)/2

207

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 -106.30 dBm
RF Lev 2 -18.00 dBm EOC
D/U -88.30 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	D/U	dBm	D/U
-45.00		-45.00	
-33.37	-11.63	-35.37	-9.63
	-11.63		-9.63

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

10.6MHz Spacing		10.7MHz Spacing	
dBm	D/U	dBm	D/U
-45.00		-45.00	
-29.14	-15.86	-38.14	-6.86
	-15.86		-6.86

EOC: Objectionable beat noise

209

FM Receiver Test Laboratory

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
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:**
104.806 MHz

2 **Standard Audio Output:**

Left Channel		THD		Right Channel		THD	
0.71	Vrms	0.95	%	0.71	Vrms	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 Plots)

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
-27.58 dB Stereo

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

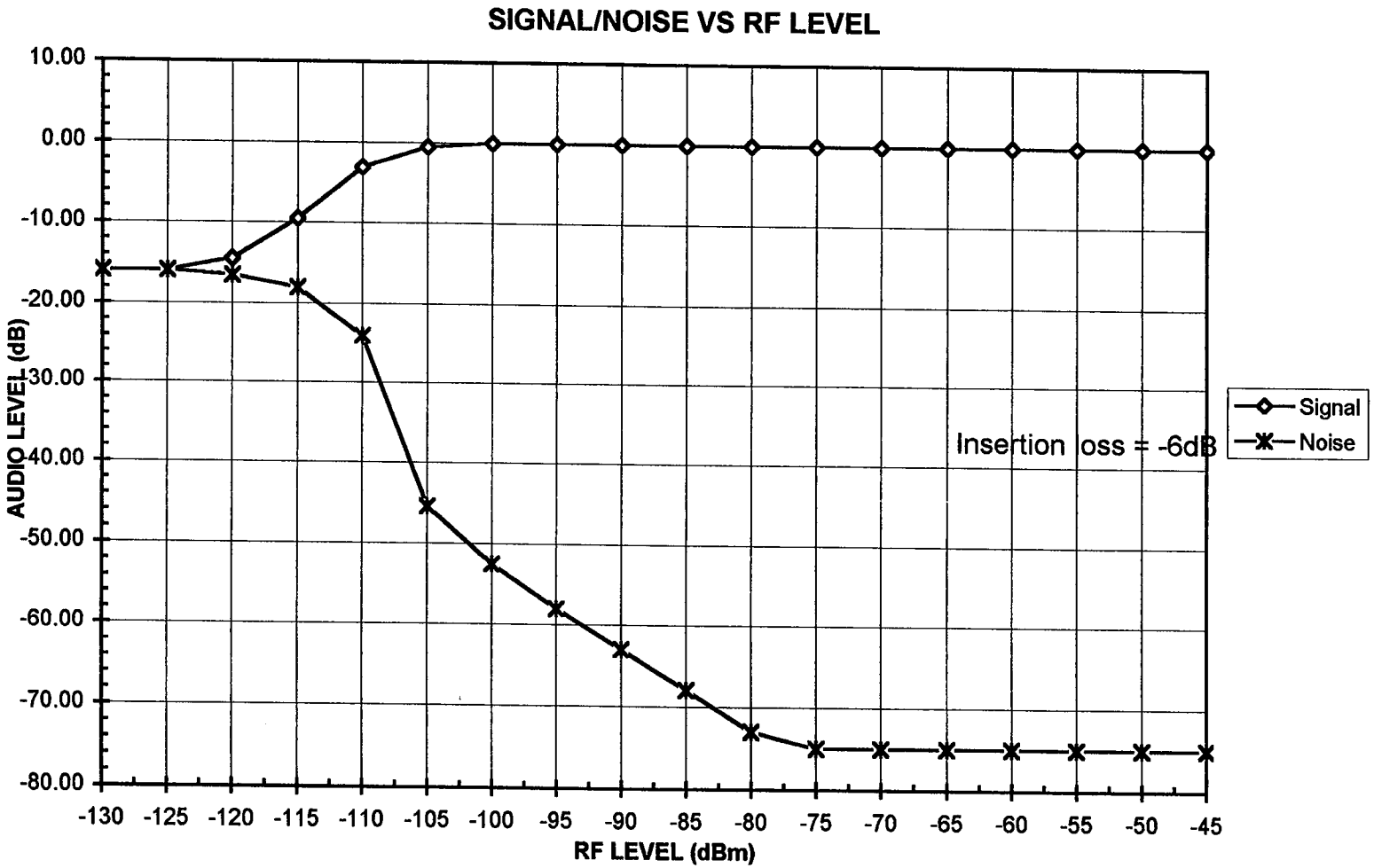
13 **10.7MHz Rejection**
-88.30 dB 0

14 **10.7MHz IM**
-11.63 dB (10.6) Hiss
-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

210

FM Receiver Test Laboratory



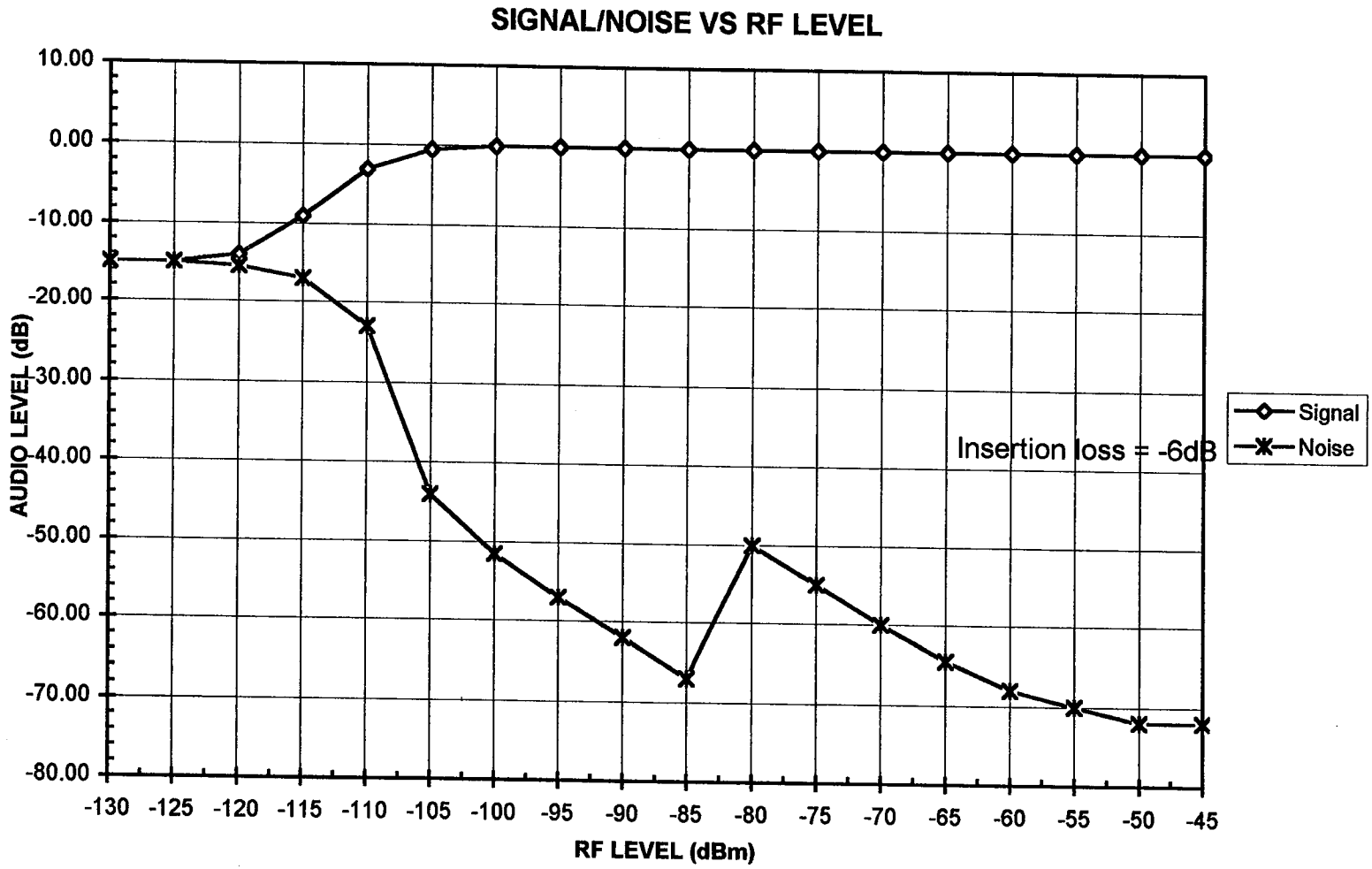
Pioneer SX-201

211

File Name: C_pioner

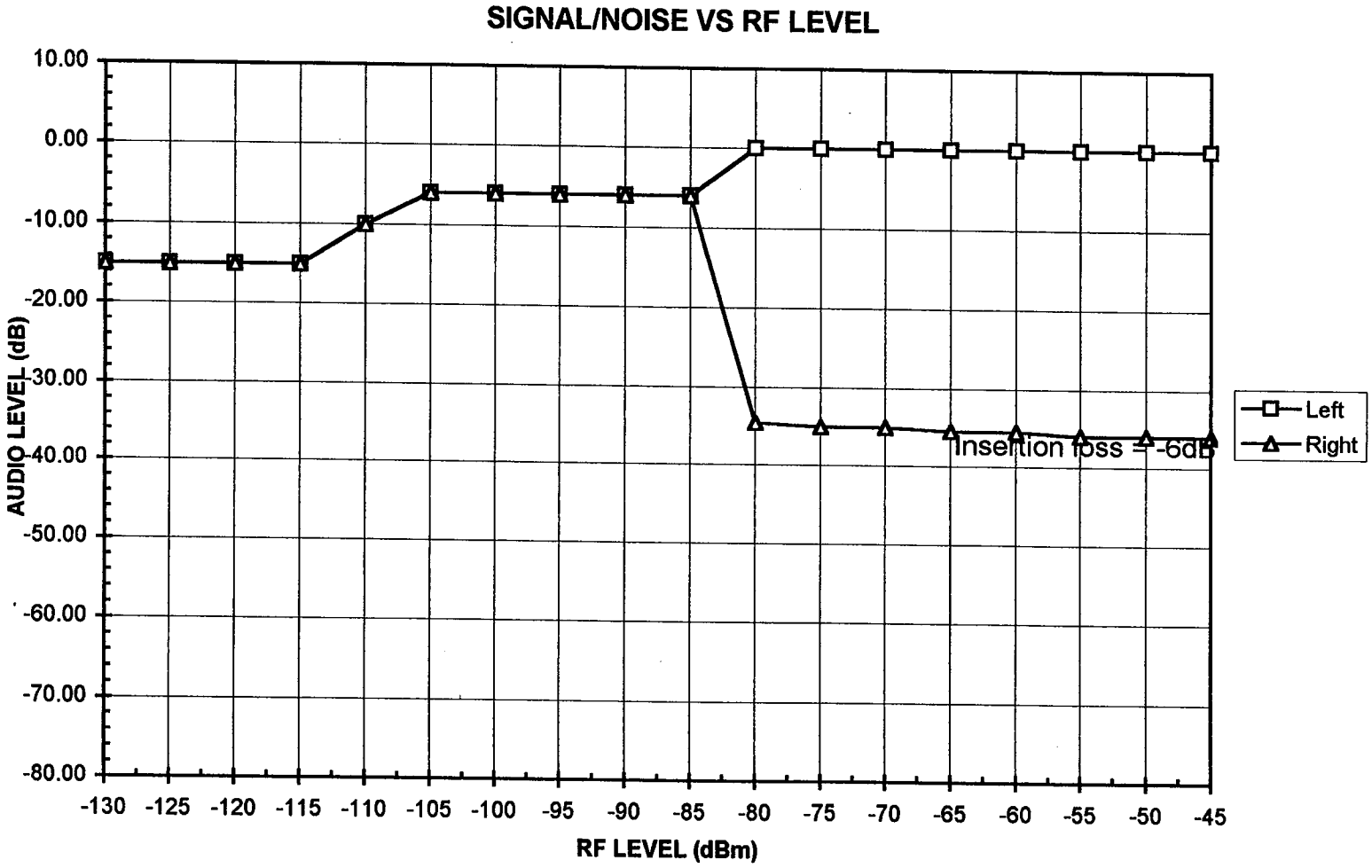
FM Mono Plot

FM Receiver Test Laboratory



Pioneer SX-201

FM Receiver Test Laboratory



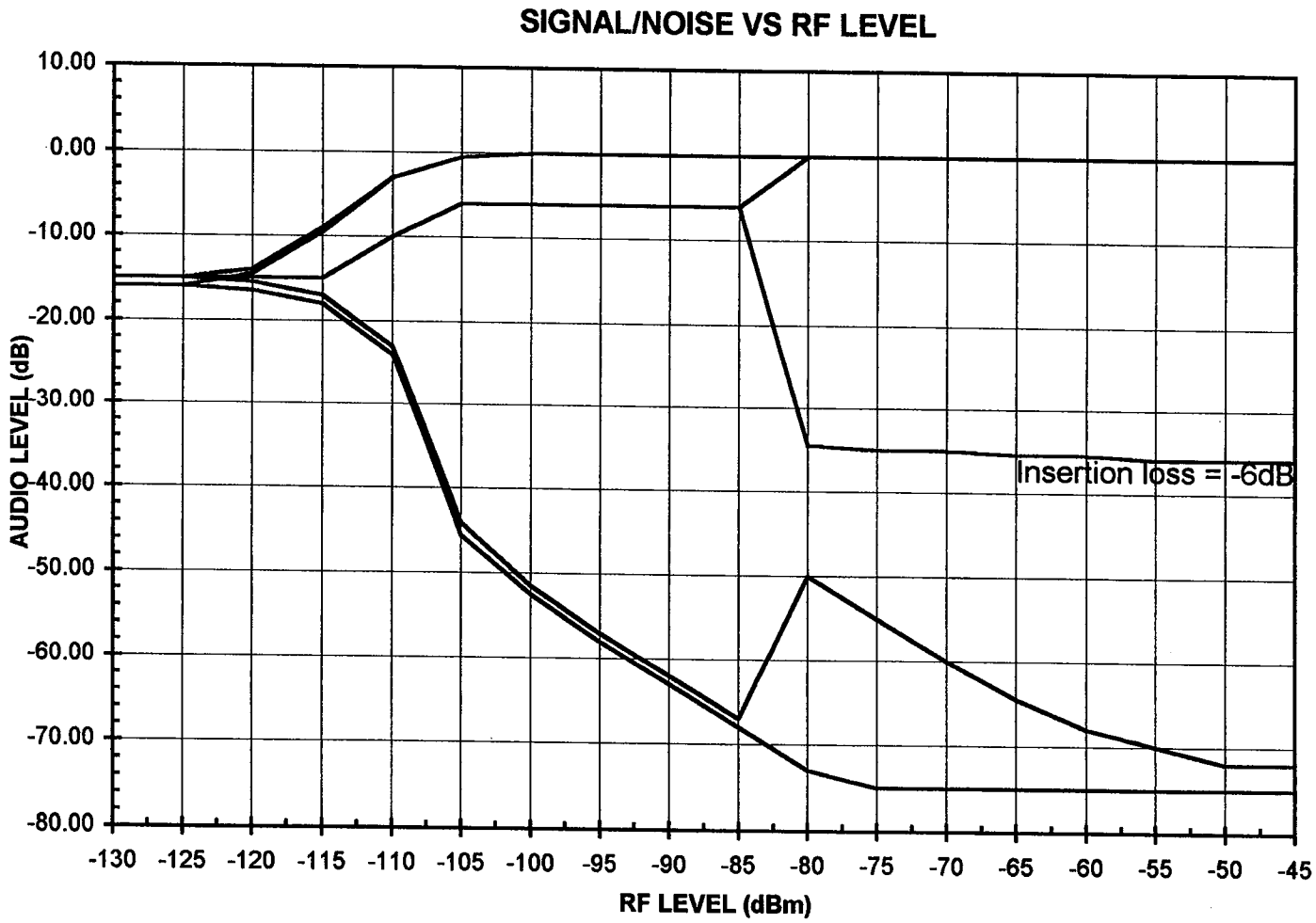
Pioneer SX-201

213

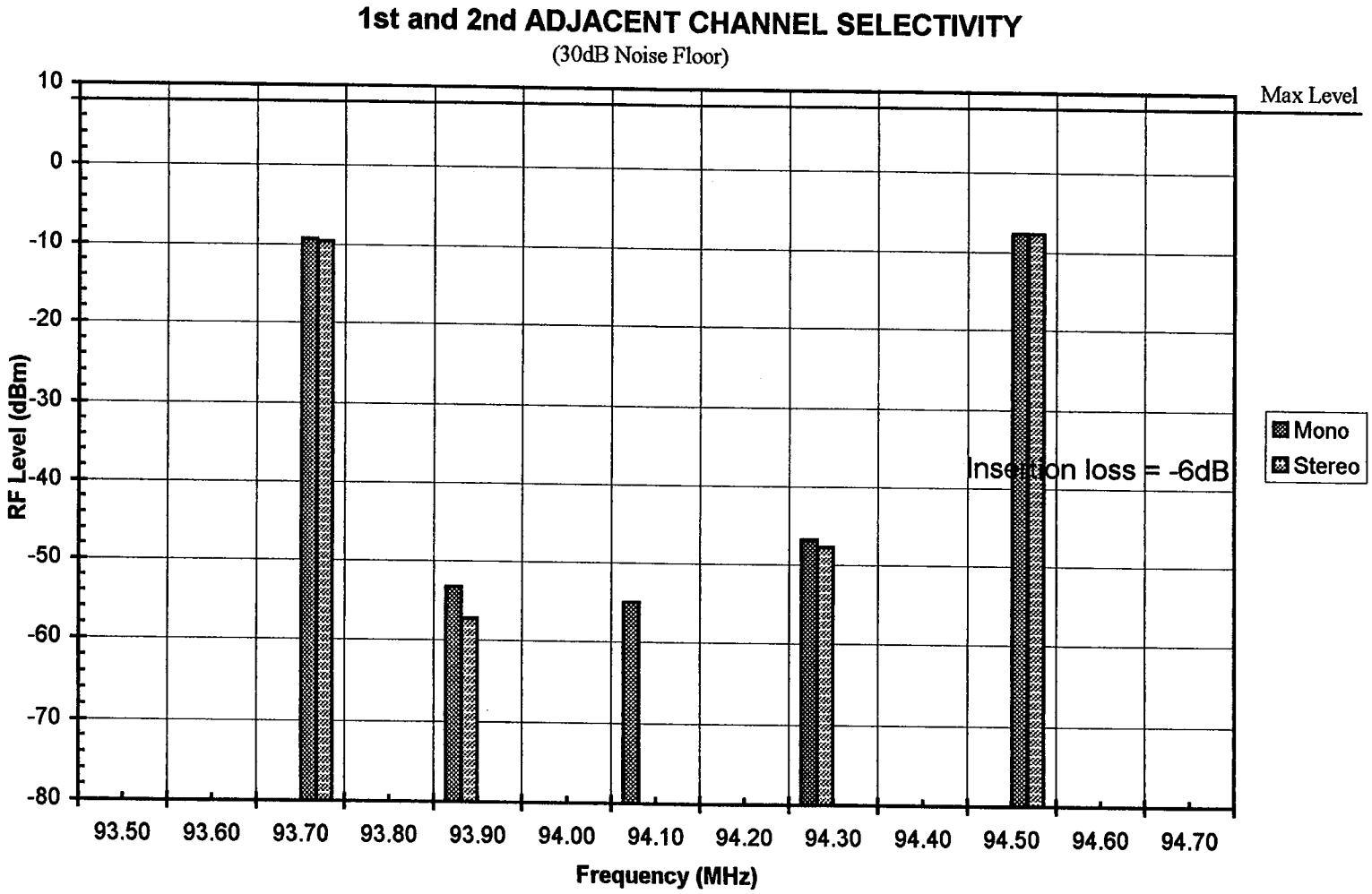
File Name: C_pioner

FM Stereo Separation Plot

FM Receiver Test Laboratory



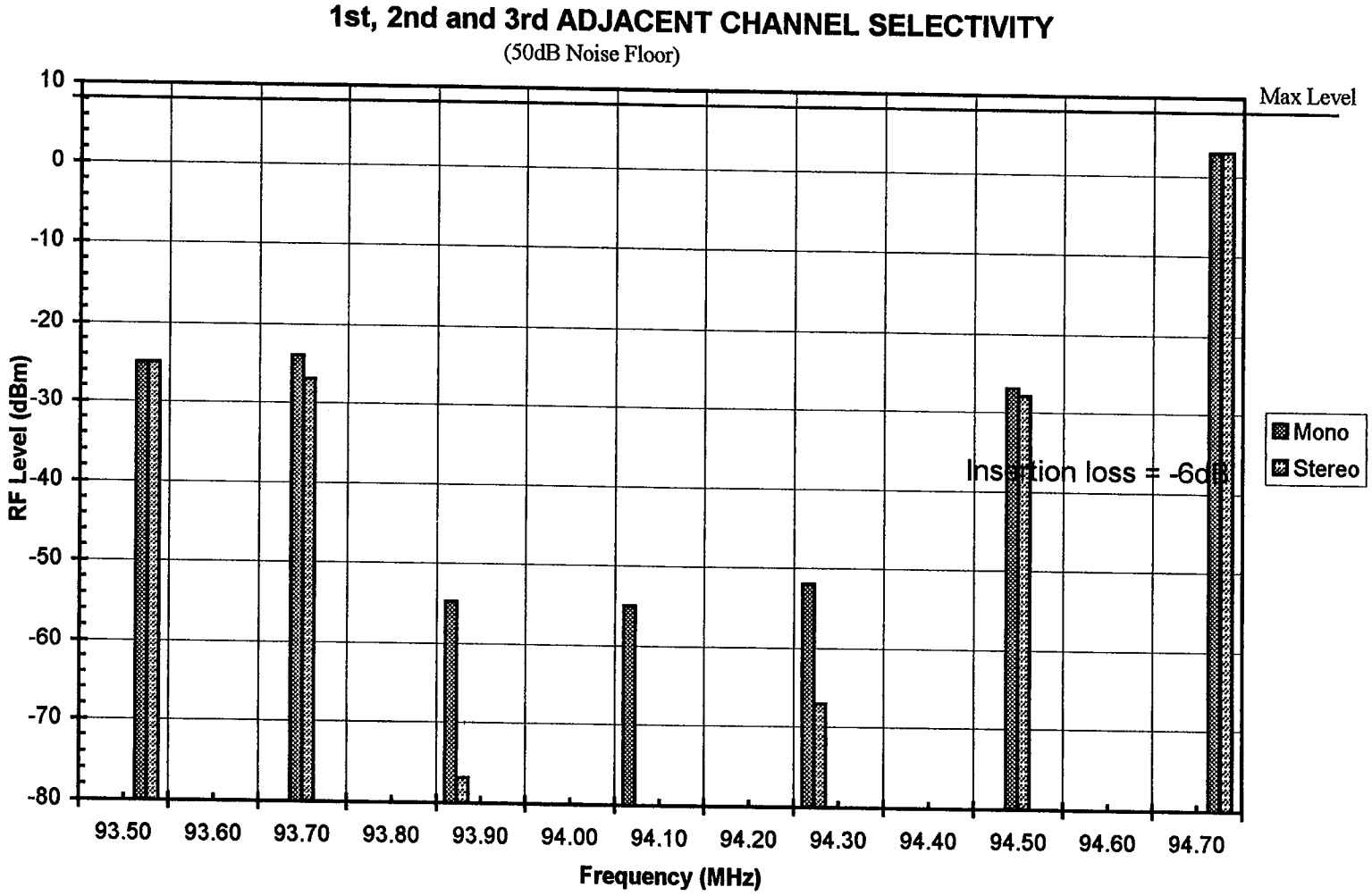
Pioneer SX-201



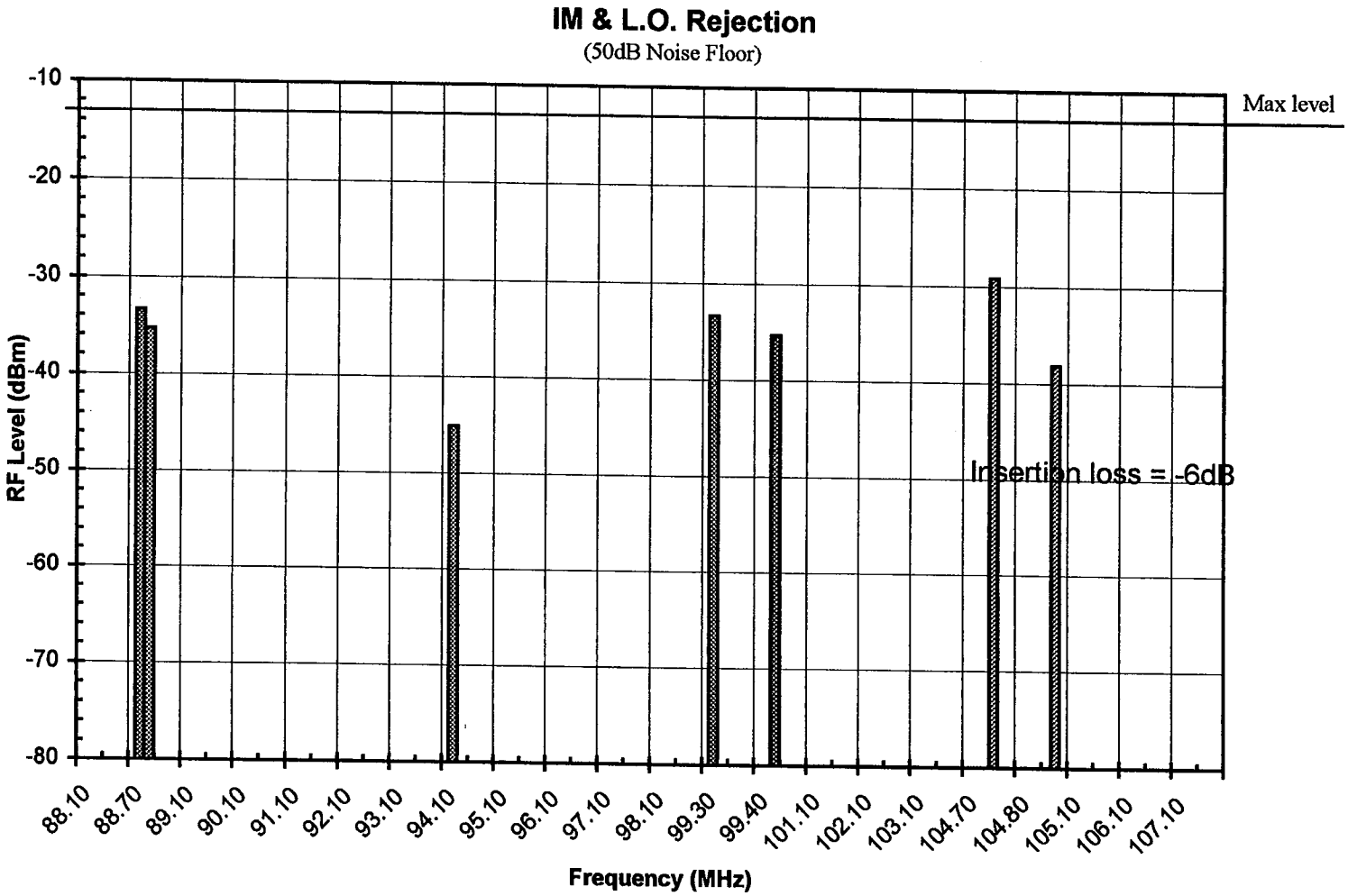
Pioneer SX-201

215

FM Receiver Test Laboratory



Pioneer SX-201



Pioneer SX-201

Receiver #5

Ford

Auto

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
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

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)

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			Right Ch	
Level	1.70	**Vrms**	= 0dB	**Level** 1.70	**Vrms**
THD	1.00	**%**		**THD** 1.00	**%**

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)

220

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

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

Two RF Tone Tests

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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-30.92	-24.08	-30.92	-24.08	
Undesired Lower Lev	-38.02	-16.98	-38.02	-16.98	
Selectivity, 1st Adj.:		-20.53		-20.53	(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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	8.08	-63.08	8.08	-63.08	
Undesired Lower Lev	8.08	-63.08	8.08	-63.08	
Selectivity, 2nd Adj.:	Max RF	-63.08	Max RF	-63.08	(RF D/U Up + RF D/U Lo)/2

222

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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-33.92	-21.08	-33.92	-21.08	
Undesired Lower Lev	-39.52	-15.48	-39.52	-15.48	
Selectivity, 1st Adj.:		-18.28		-18.28	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-27.92	-27.08	-27.92	-27.08	
Undesired Lower Lev	-26.92	-28.08	-26.92	-28.08	
Selectivity, 2nd Adj.:		-27.58		-27.58	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-25.92	-29.08	-25.92	-29.08	
Undesired Lower Lev	-20.92	-34.08	-20.92	-34.08	
Selectivity, 3rd Adj.:		-31.58		-31.58	(RF D/U Up + RF D/U Lo)/2

223

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 EOC
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)

10.6MHz Spacing dBm	D/U	10.7MHz Spacing dBm	D/U
-45.00		-45.00	
-13.07	-31.93	-13.07	-31.93
Max RF	-31.93	Max RF	-31.93

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

10.6MHz Spacing dBm	D/U	10.7MHz Spacing dBm	D/U
-45.00		-45.00	
-16.07	-28.93	-30.07	-14.93
	-28.93		-14.93

EOC:

224

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
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:**
104.800 MHz

2 **Standard Audio Output:**

Left Channel		THD		Right Channel		THD	
1.7	Vrms	1.00	%	1.7	Vrms	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 Plots)

7 **Capture Ratio:**
-3.50 dB

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

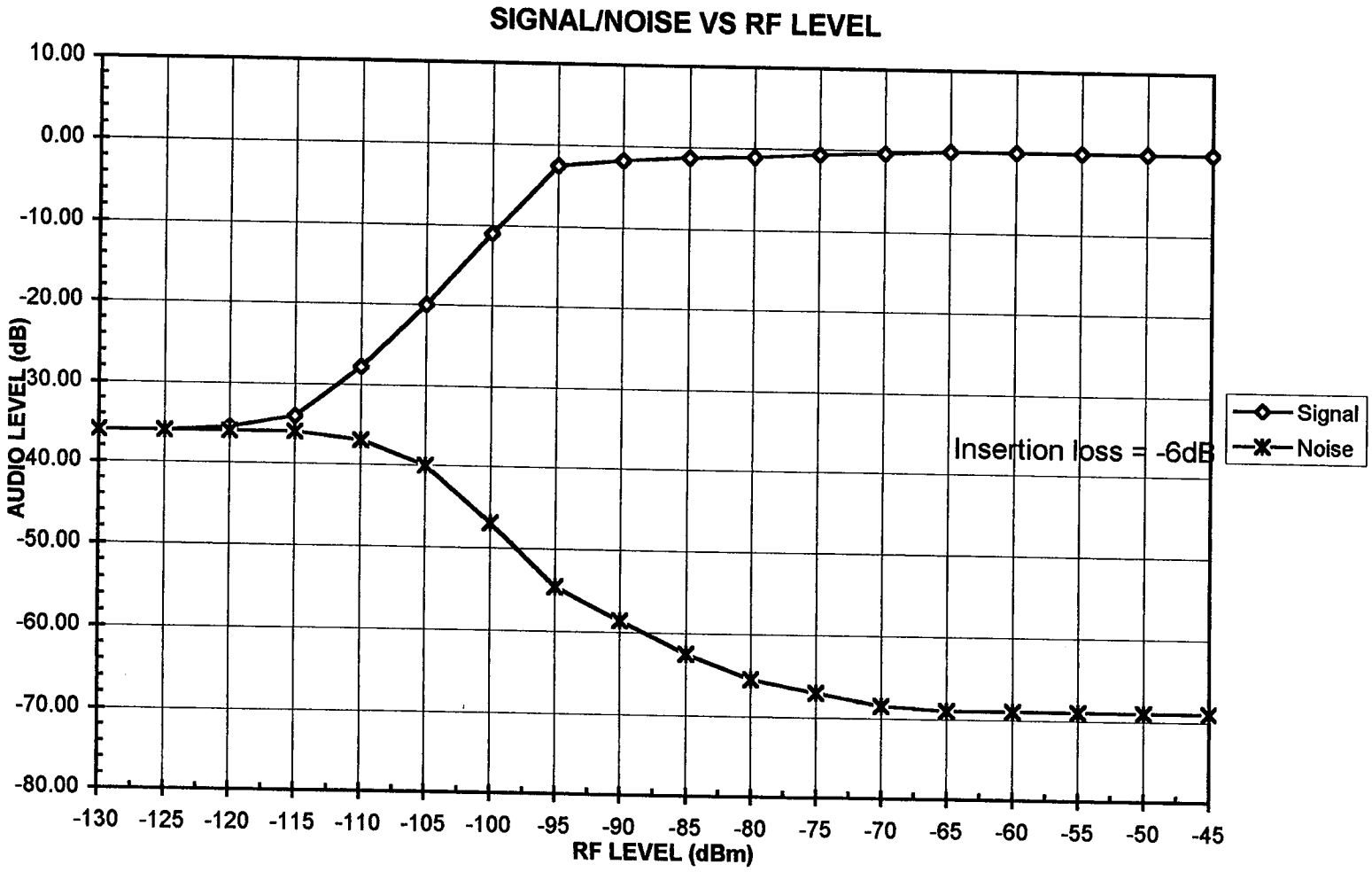
12 **Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)**
-31.58 dB Mono
-31.58 dB Stereo

13 **10.7MHz Rejection**
-77.70 dB 0

14 **10.7MHz IM**
-31.93 dB (10.6) Max RF 0
-31.93 dB (10.7) Max RF 0

15 **10.7MHz Spurious (Local Osc. Interference)**
-28.93 dB (10.6) 0
-14.93 dB (10.7) 0

226



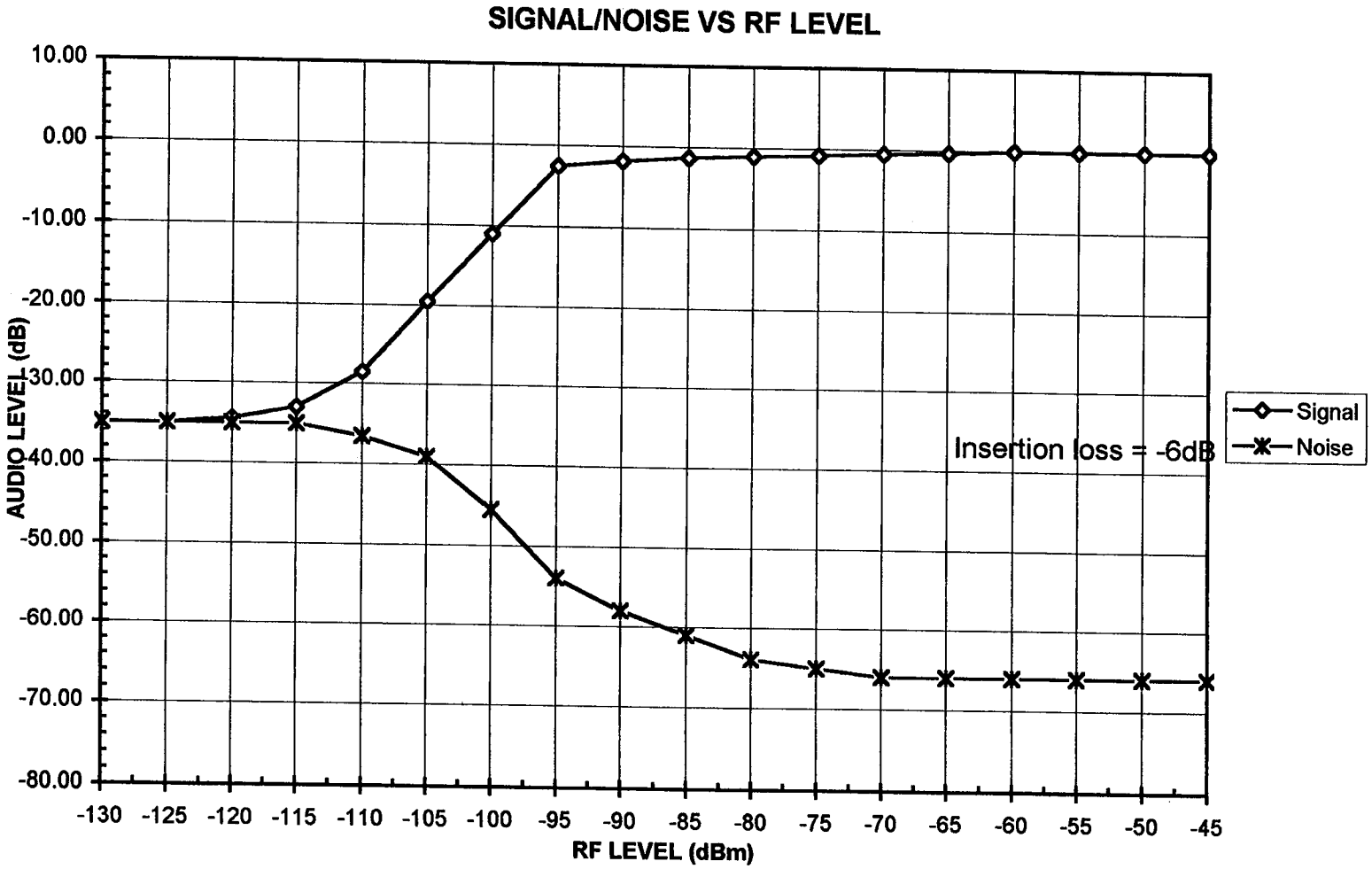
Ford F4XF-19B132-CB

227

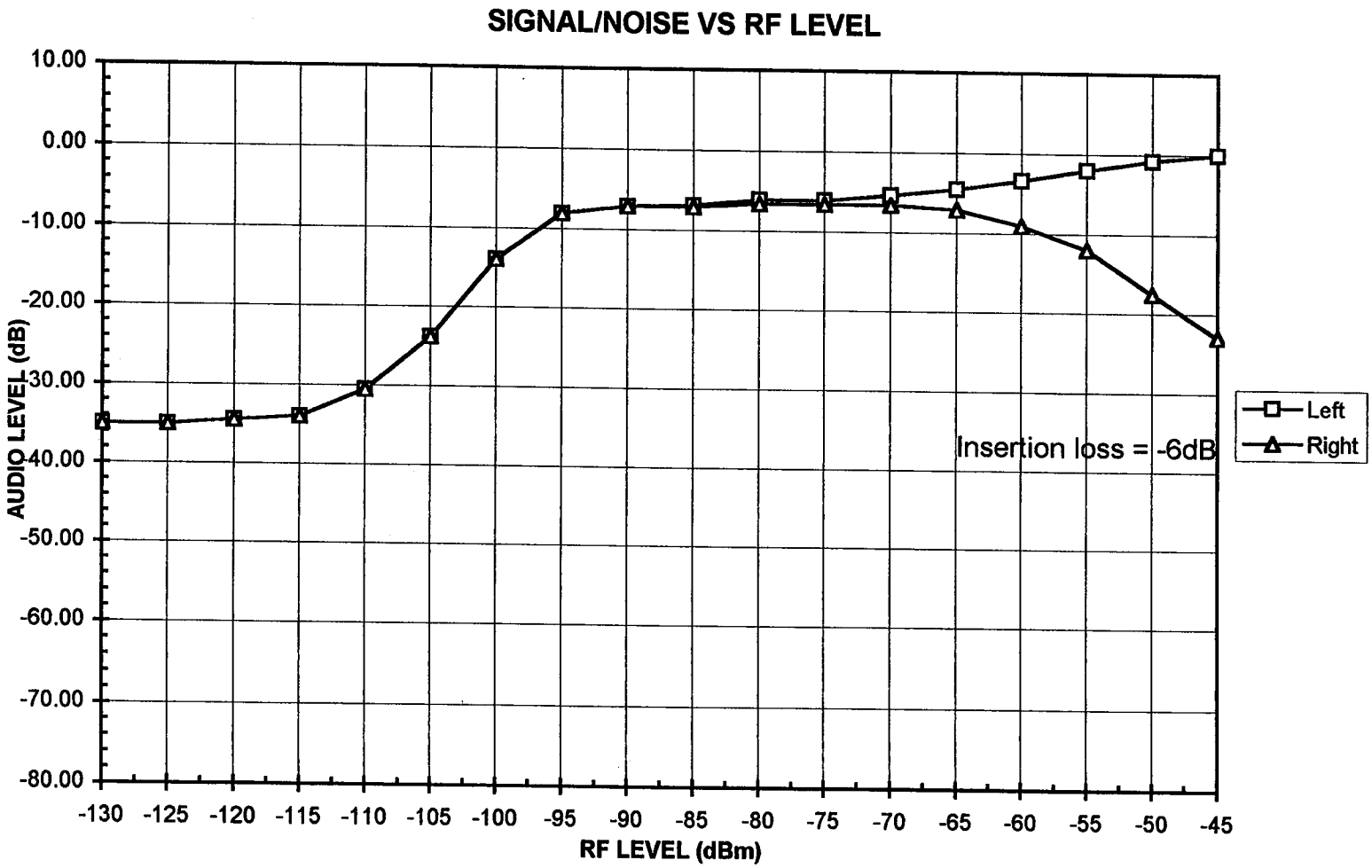
File Name: C_ford

FM Mono Plot

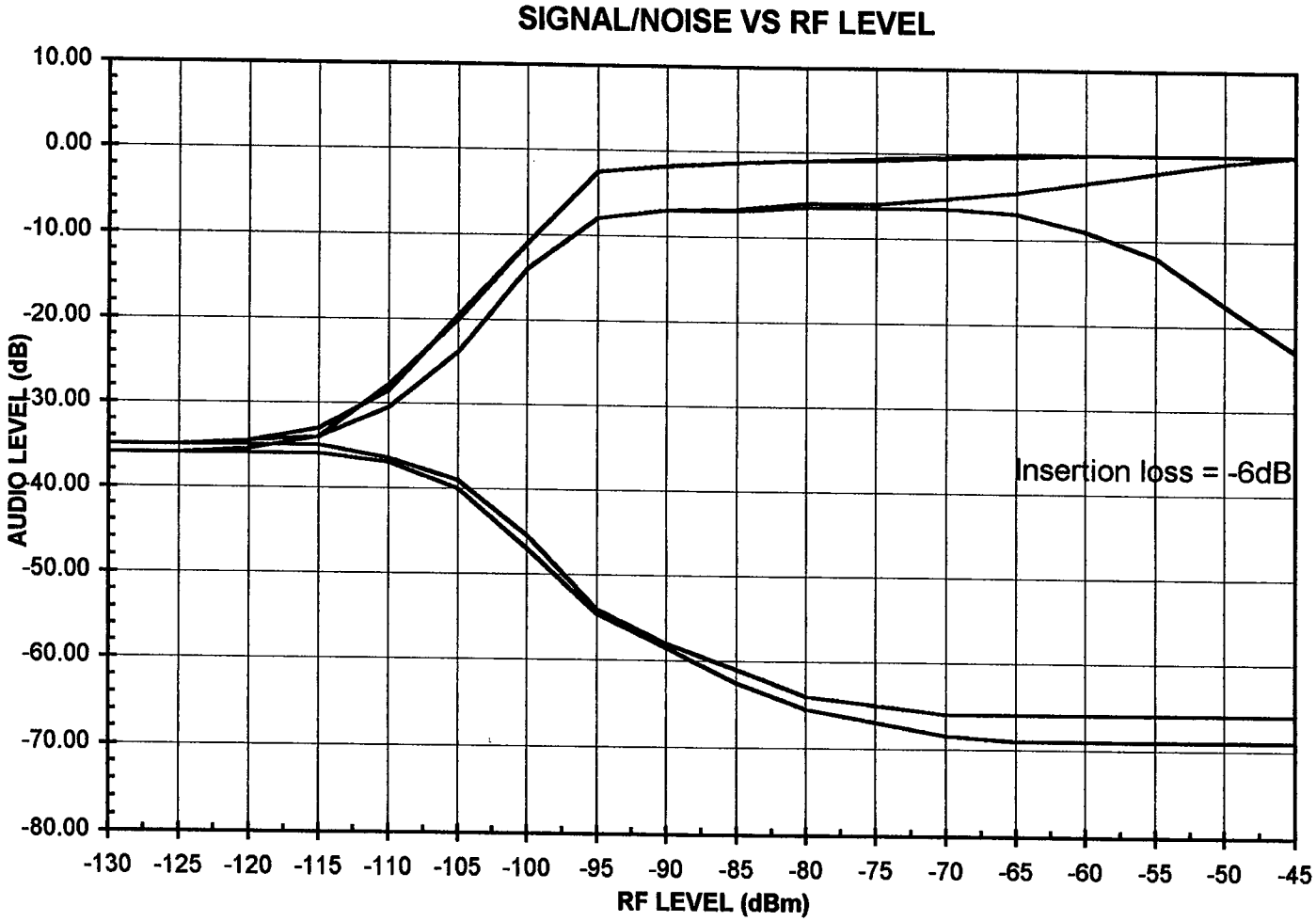
FM Receiver Test Laboratory



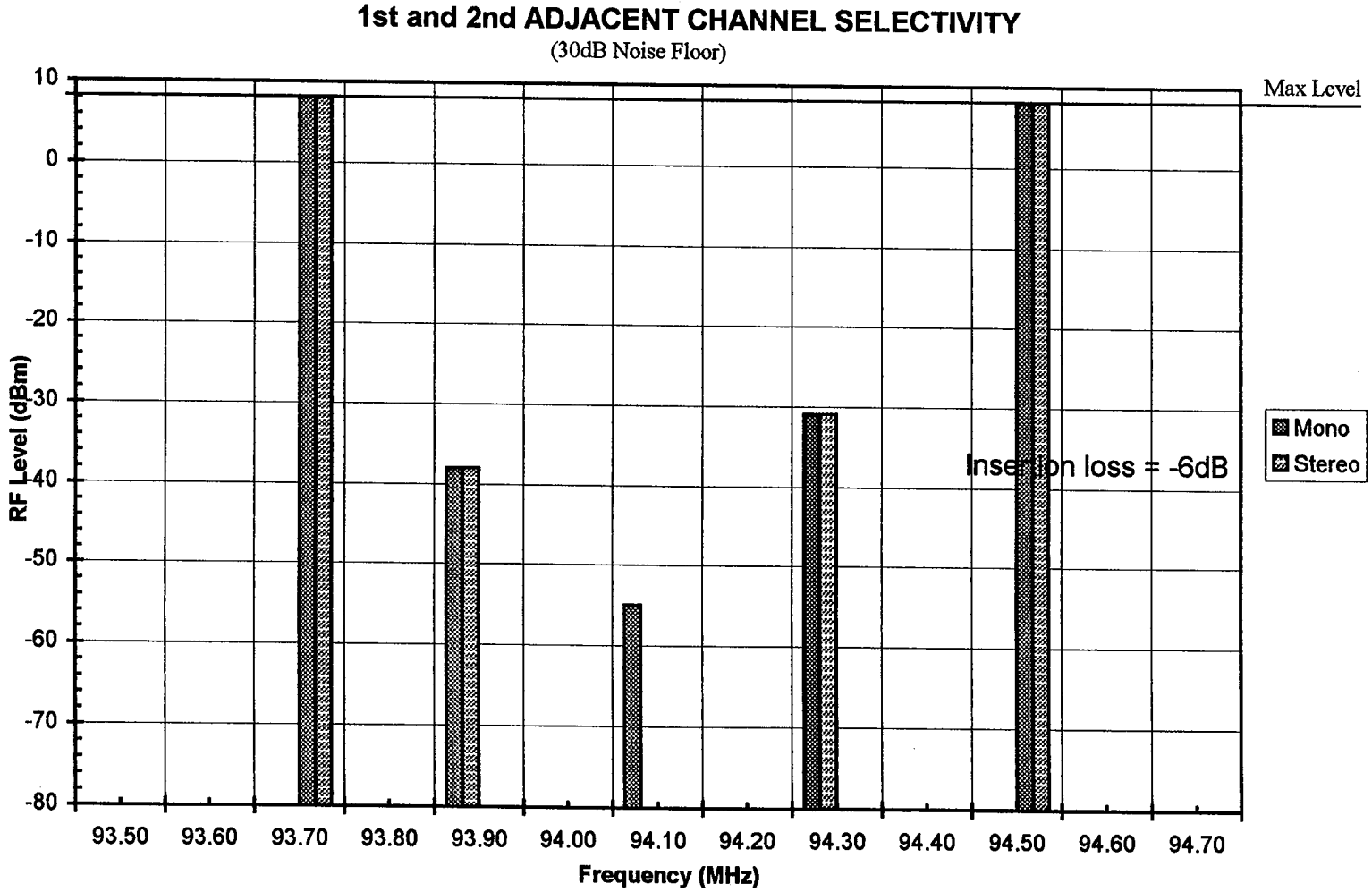
Ford F4XF-19B132-CB



Ford F4XF-19B132-CB



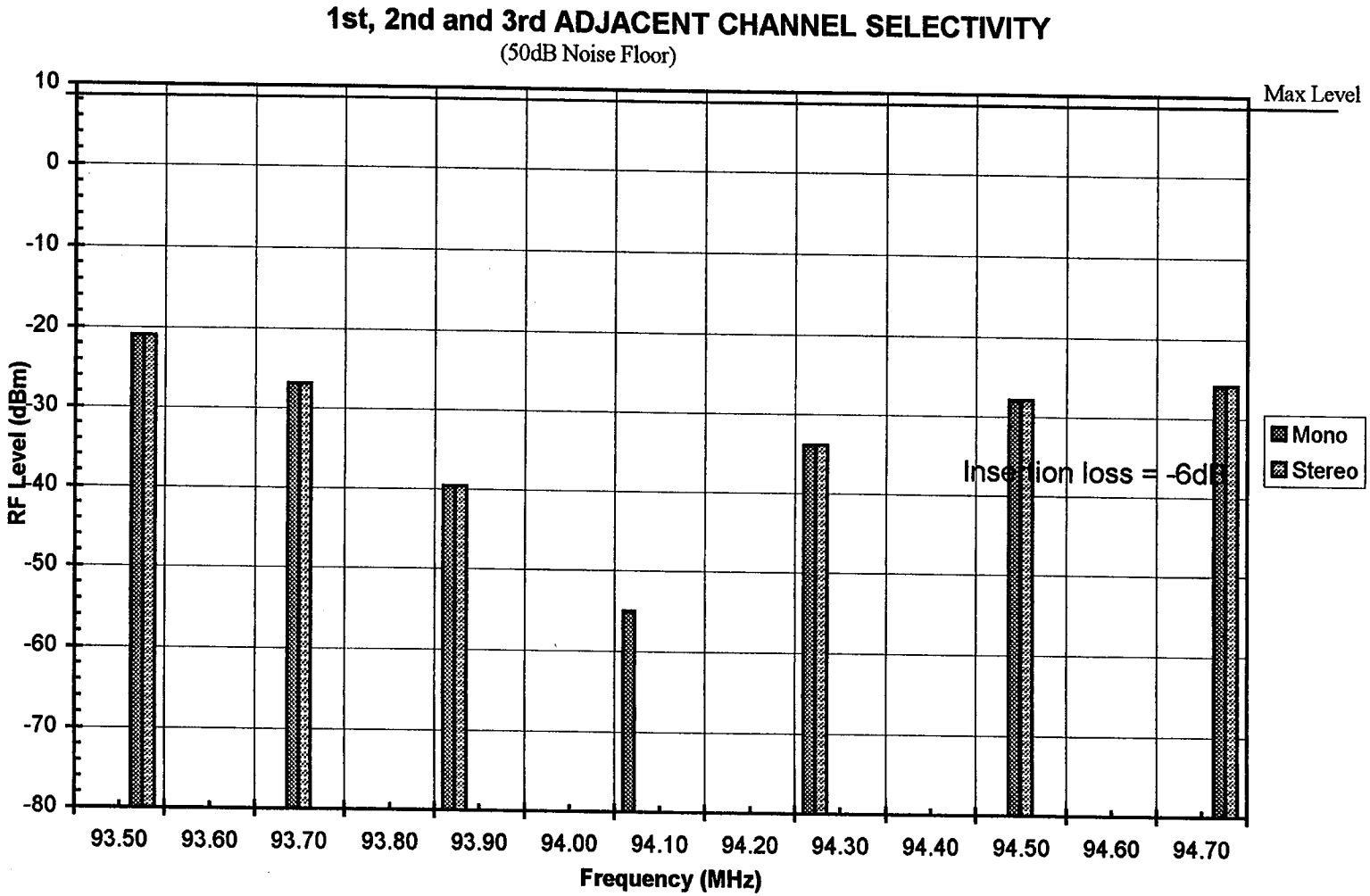
Ford F4XF-19B132-CB



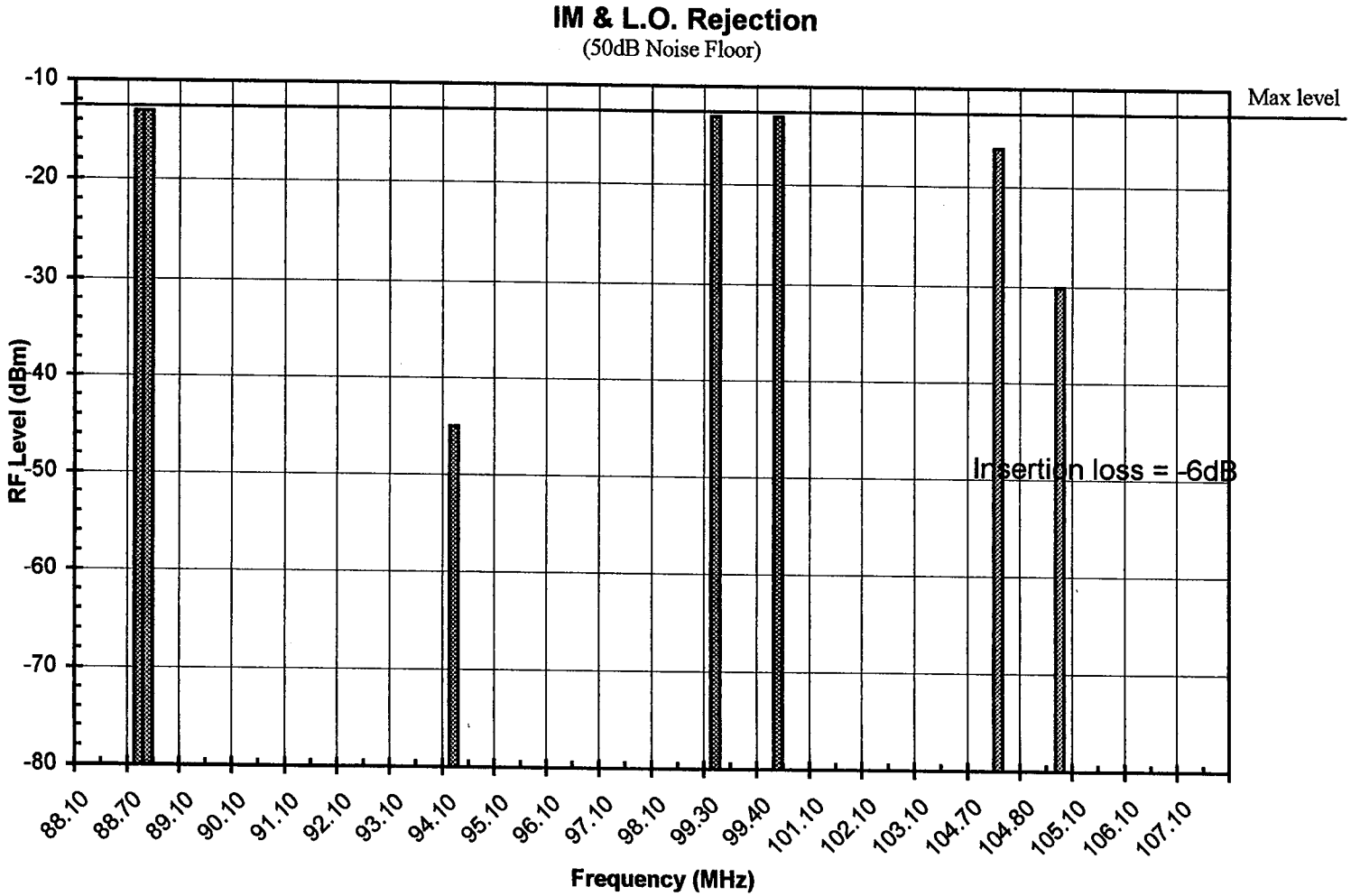
Ford F4XF-19B132-CB

231

FM Receiver Test Laboratory



Ford F4XF-19B132-CB



Ford F4XF-19B132-CB

233

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/NB 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
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 1 104.800 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			Right Ch	
Level	0.58	**Vrms**	= 0dB	**Level** 0.56	**Vrms**
THD	0.047	**%**		**THD** 0.055	**%**

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:					
THD	0.06	% =	-64.44	dB	(FM Only)
THD	0.06	% =	-64.44	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	-108	dBm	(S/N Ratio = 30dB)
RF Lev2	-26.68	dBm	(21.4MHz + 94.1MHz = 115.5MHz)
Image Rejection:	-81.3	dB	(RF Lev1 - RF Lev2)

(Within 0.5dB of max test bed RF level)

236

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

	Mono (L)		Stereo (L)			Separation L->R		
RF Level dBm	Signal dB	Noise dB	Signal dB	Filt. Noise dB	Noise dB	Left dB	Right dB	RF Level dBm
-130	-14.00	-14.00	-74.00	-74.00		-74.00	-74.00	-130
-125	-14.00	-14.00	-74.00	-74.00		-74.00	-74.00	-125
-120	-13.00	-15.00	-74.00	-74.00		-74.00	-74.00	-120
-115	-9.00	-17.00	-74.00	-74.00		-74.00	-74.00	-115
-110	-3.50	-24.00	-74.00	-74.00		-74.00	-74.00	-110
-105	-1.00	-43.50	-74.00	-74.00		-74.00	-74.00	-105
-100	0.00	-53.50	-74.00	-74.00		-74.00	-74.00	-100
-95	0.00	-59.00	-74.00	-74.00		-74.00	-74.00	-95
-90	0.00	-64.50	0.00	-41.50		0.00	-38.50	-90
-85	0.00	-70.00	0.00	-46.50		0.00	-40.00	-85
-80	0.00	-74.00	0.00	-51.50		0.00	-40.50	-80
-75	0.00	-74.00	0.00	-56.00		0.00	-40.50	-75
-70	0.00	-74.00	0.00	-61.50		0.00	-40.50	-70
-65	0.00	-74.00	0.00	-66.00		0.00	-40.50	-65
-60	0.00	-74.00	0.00	-69.00		0.00	-40.50	-60
-55	0.00	-74.00	0.00	-71.00		0.00	-40.50	-55
-50	0.00	-74.00	0.00	-71.00		0.00	-40.50	-50
-45	0.00	-74.00	0.00	-71.00	-71.00	0.00	-40.50	-45

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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-42.22	-12.78	-42.42	-12.58	
Undesired Lower Lev	-54.22	-0.78	-54.42	-0.58	
Selectivity, 1st Adj.:		-6.78		-6.58	(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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	2.68	-57.68	2.68	-57.68	
Undesired Lower Lev	-9.52	-45.48	-9.52	-45.48	
Selectivity, 2nd Adj.:		-51.58		-51.58	(RF D/U Up + RF D/U Lo)/2

238

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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-46.42	-8.58	-46.42	-8.58	
Undesired Lower Lev	-58.52	3.52	-58.92	3.92	
Selectivity, 1st Adj.:		-2.53		-2.33	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-16.92	-38.08	-17.32	-37.68	
Undesired Lower Lev	-12.52	-42.48	-16.92	-38.08	
Selectivity, 2nd Adj.:		-40.28		-37.88	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-14.42	-40.58	-14.42	-40.58	
Undesired Lower Lev	-19.92	-35.08	-19.92	-35.08	
Selectivity, 3rd Adj.:		-37.83		-37.83	(RF D/U Up + RF D/U Lo)/2

239

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	EOC
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	D/U	dBm	D/U
-45.00		-45.00	
-13.37	-31.63	-13.37	-31.63
Max RF	-31.63	Max RF	-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	D/U	dBm	D/U
-45.00		-45.00	
-13.37	-31.63	-15.37	-29.63
Max RF	-31.63		-29.63

EOC: Objectionable beat notes

240

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

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/NB switch set to Off

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)

241

Test Results:

1 **Local Oscillator Frequency:**
104.800 MHz

2 **Standard Audio Output:**

Left Channel		THD		Right Channel		THD	
0.58	Vrms	0.047	%	0.56	Vrms	0.055	%

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

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

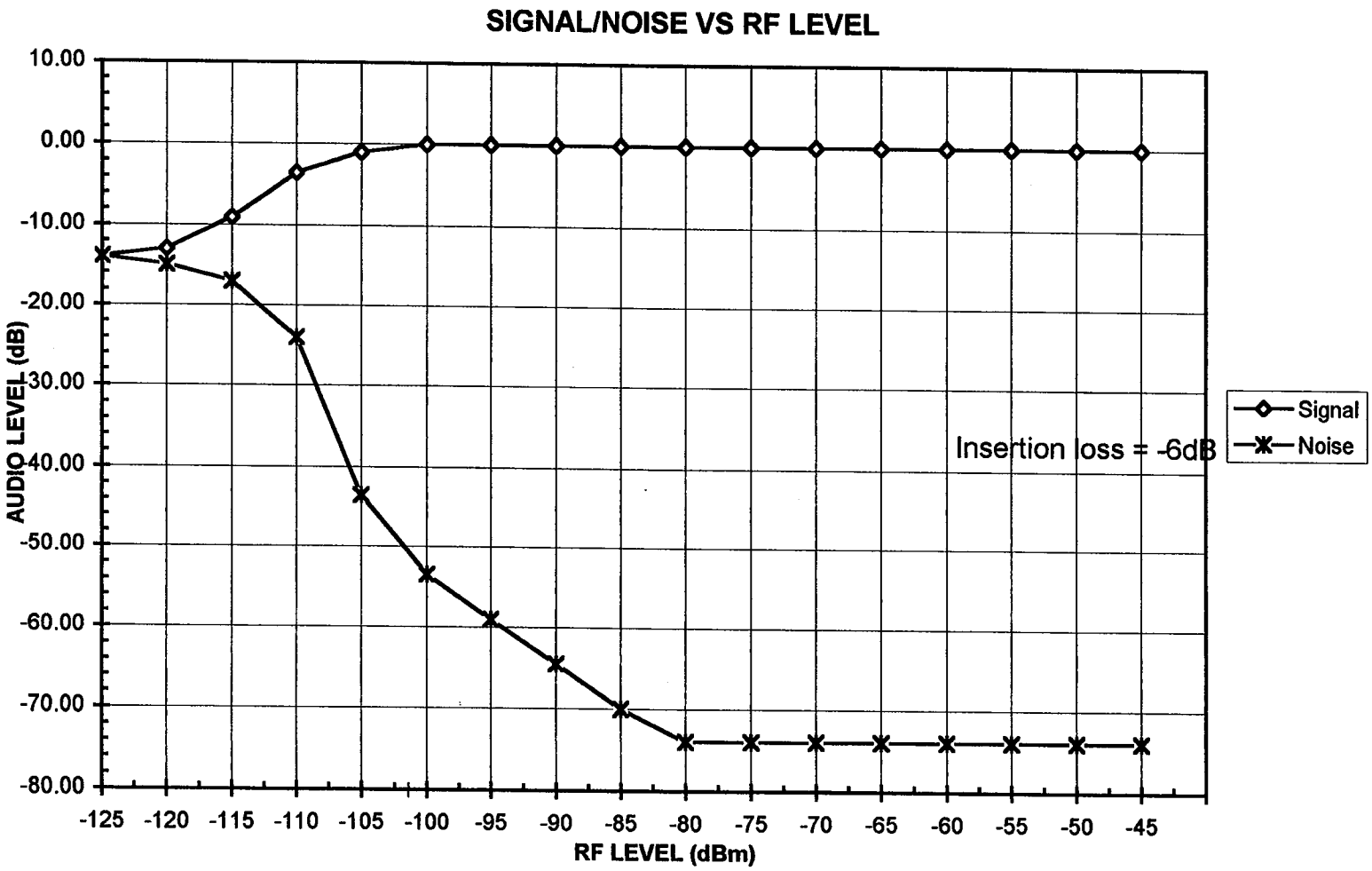
12 **Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)**
-37.83 dB Mono
-37.83 dB Stereo

13 **10.7MHz Rejection**
-128.50 dB 0

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) 0

242

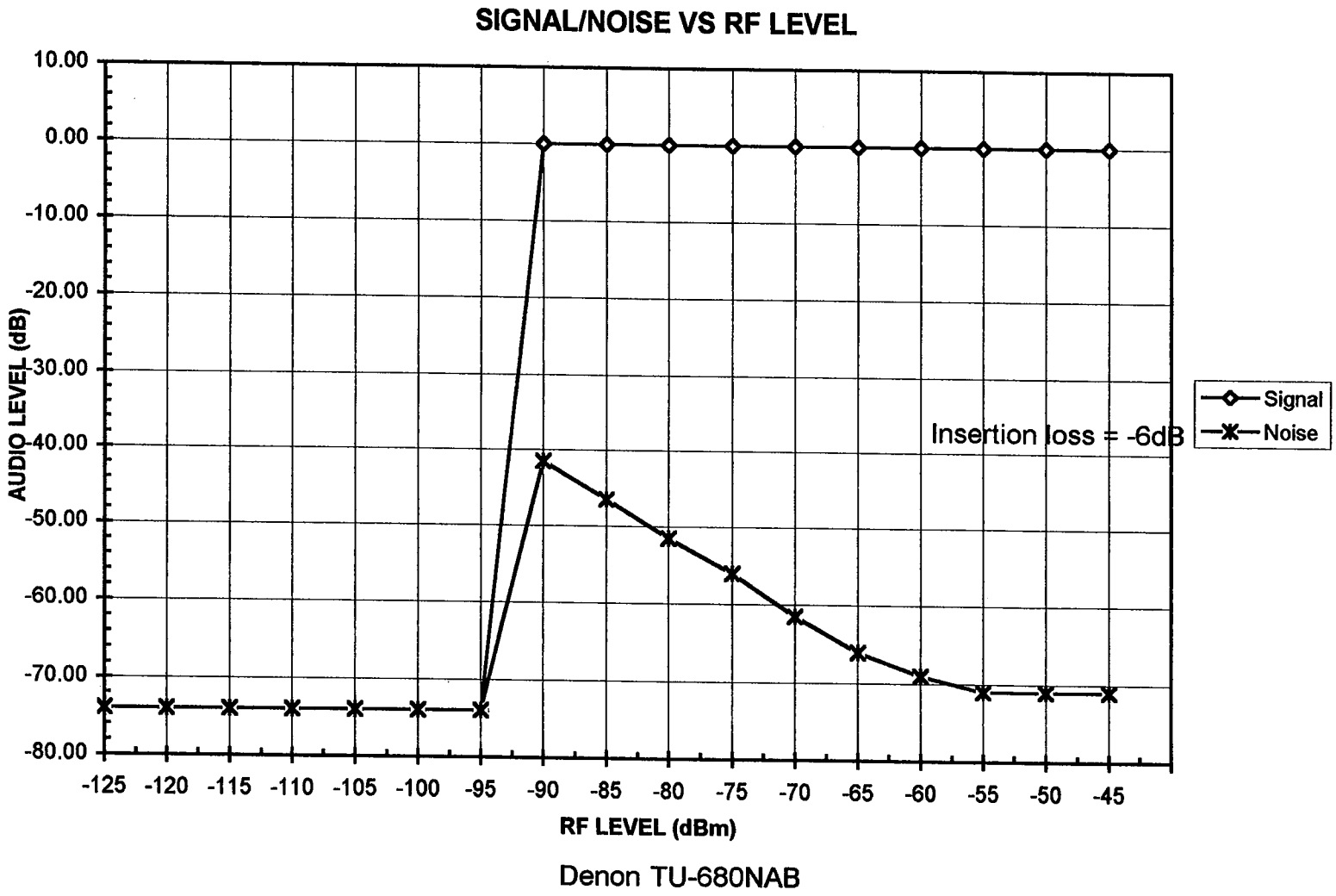


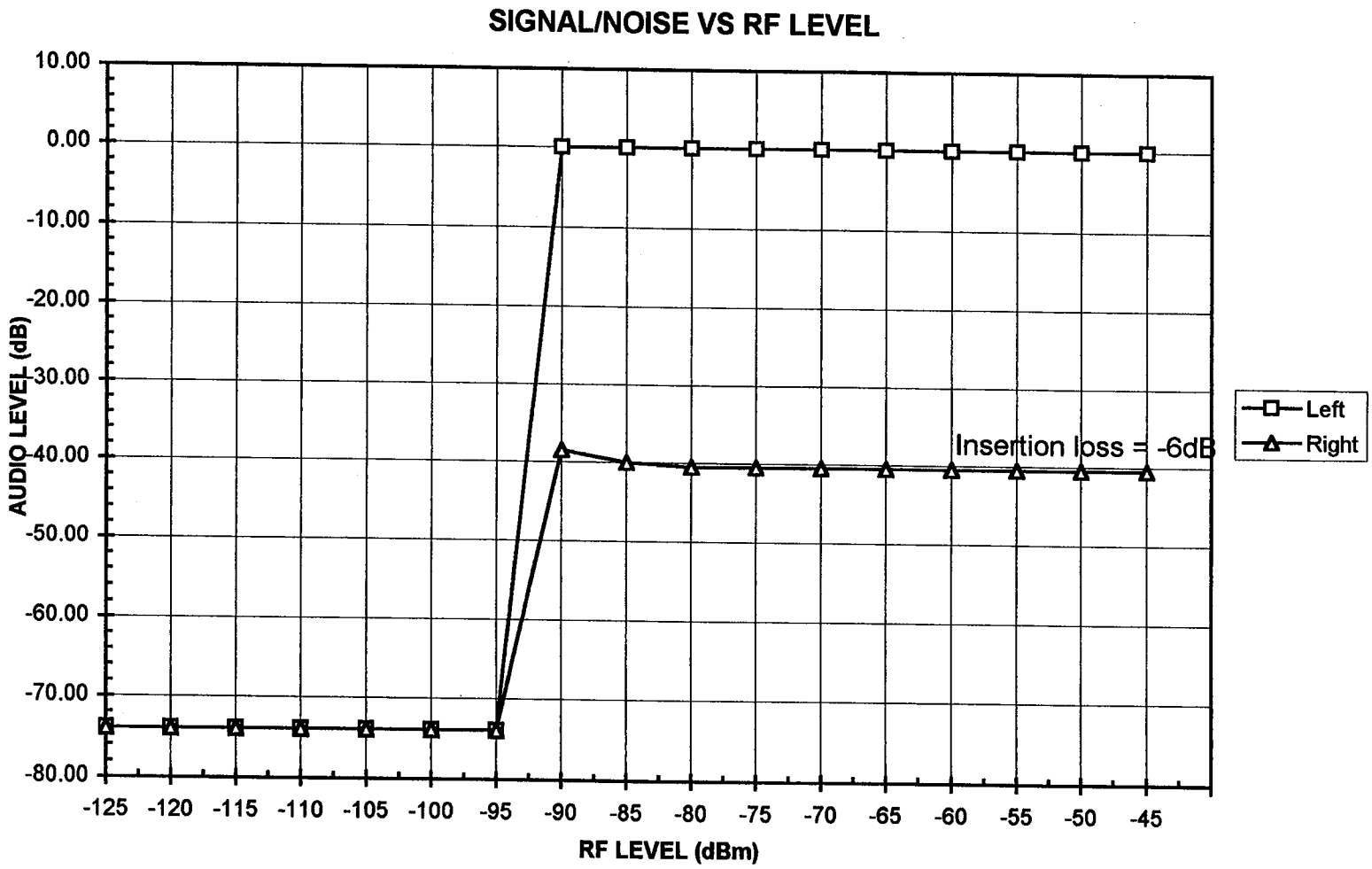
Denon TU-680NAB

243

243a

FM Receiver Test Laboratory



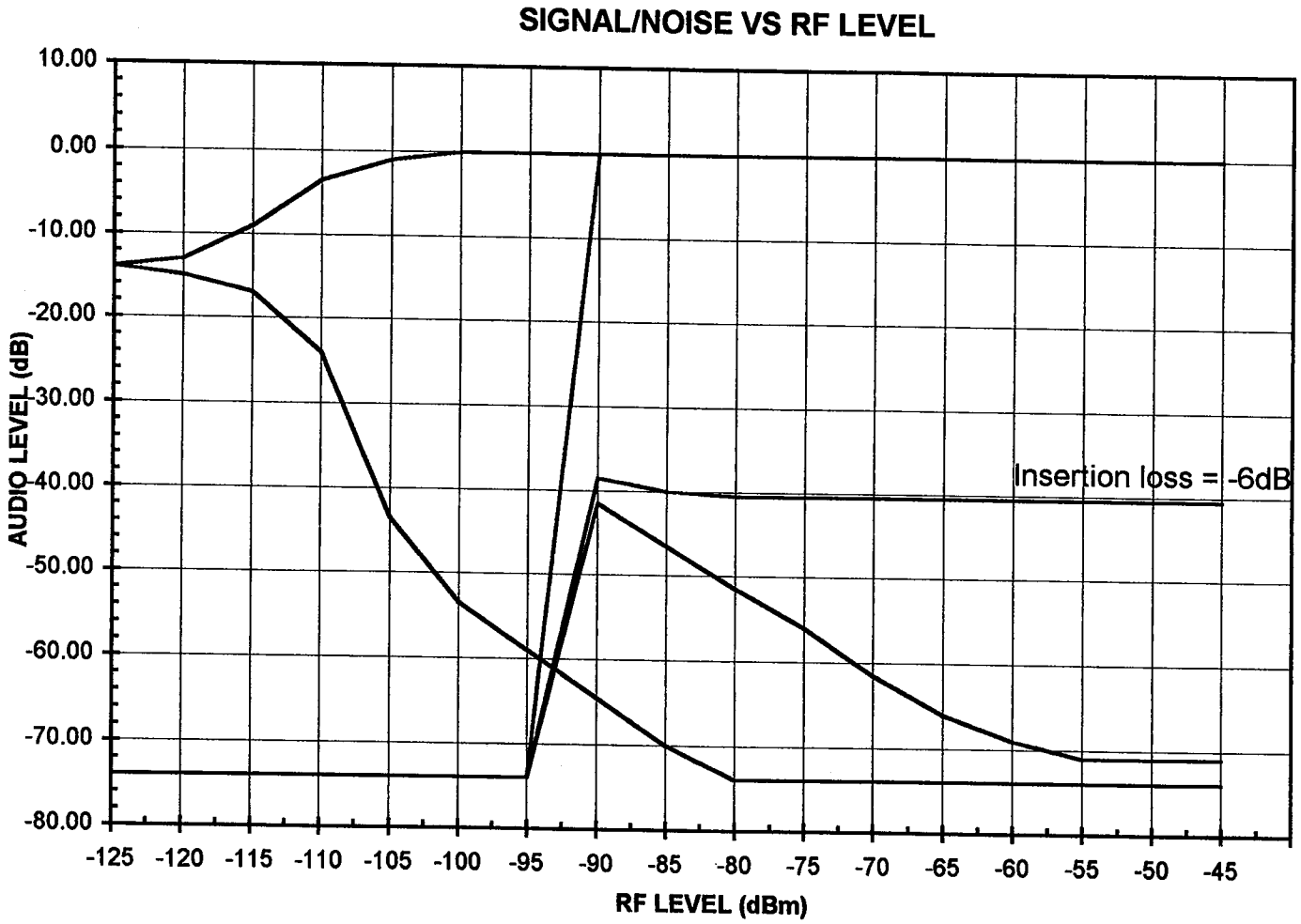


Denon TU-680NAB

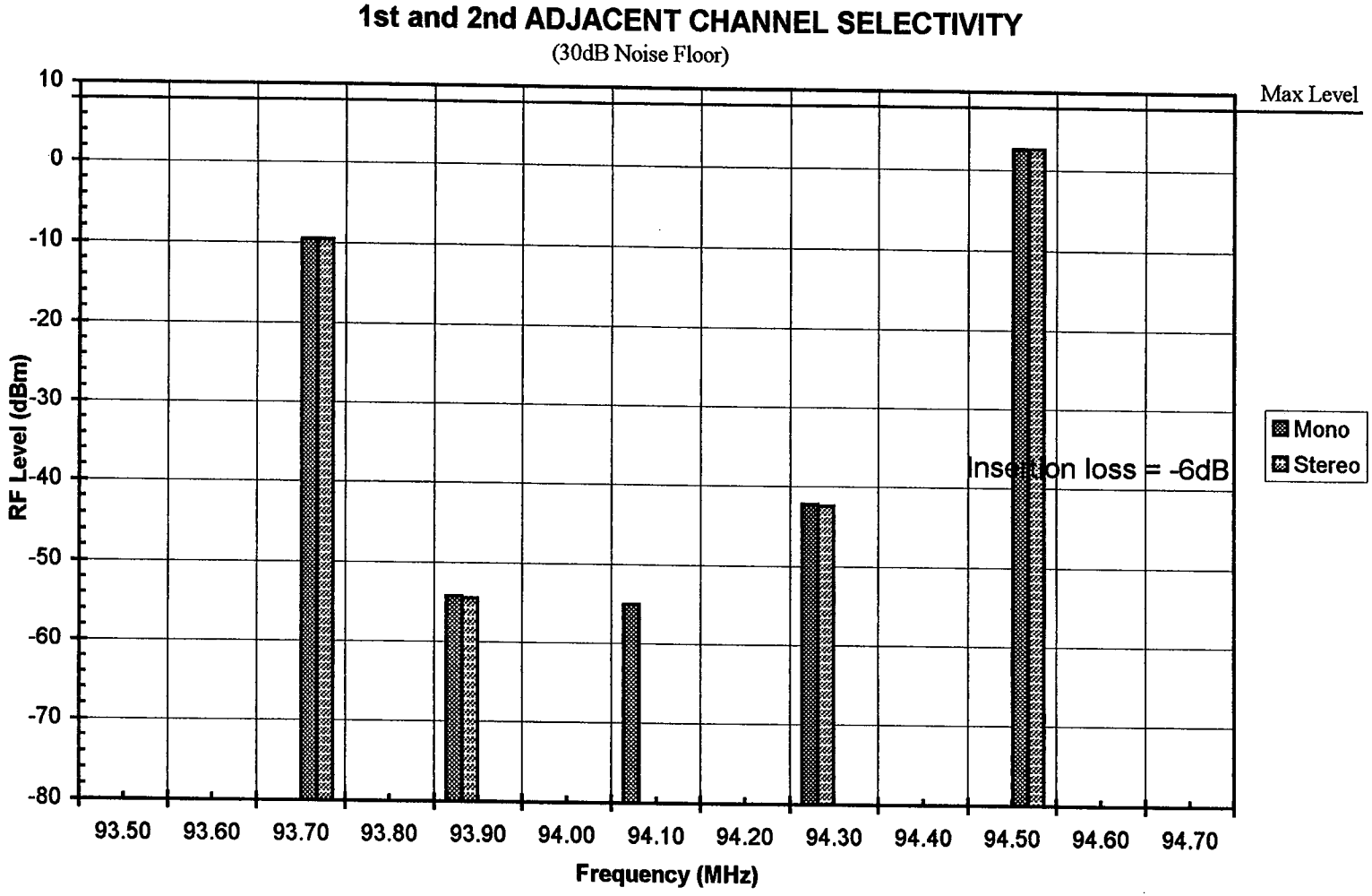
2446

File Name: C_den680

FM Receiver Test Laboratory



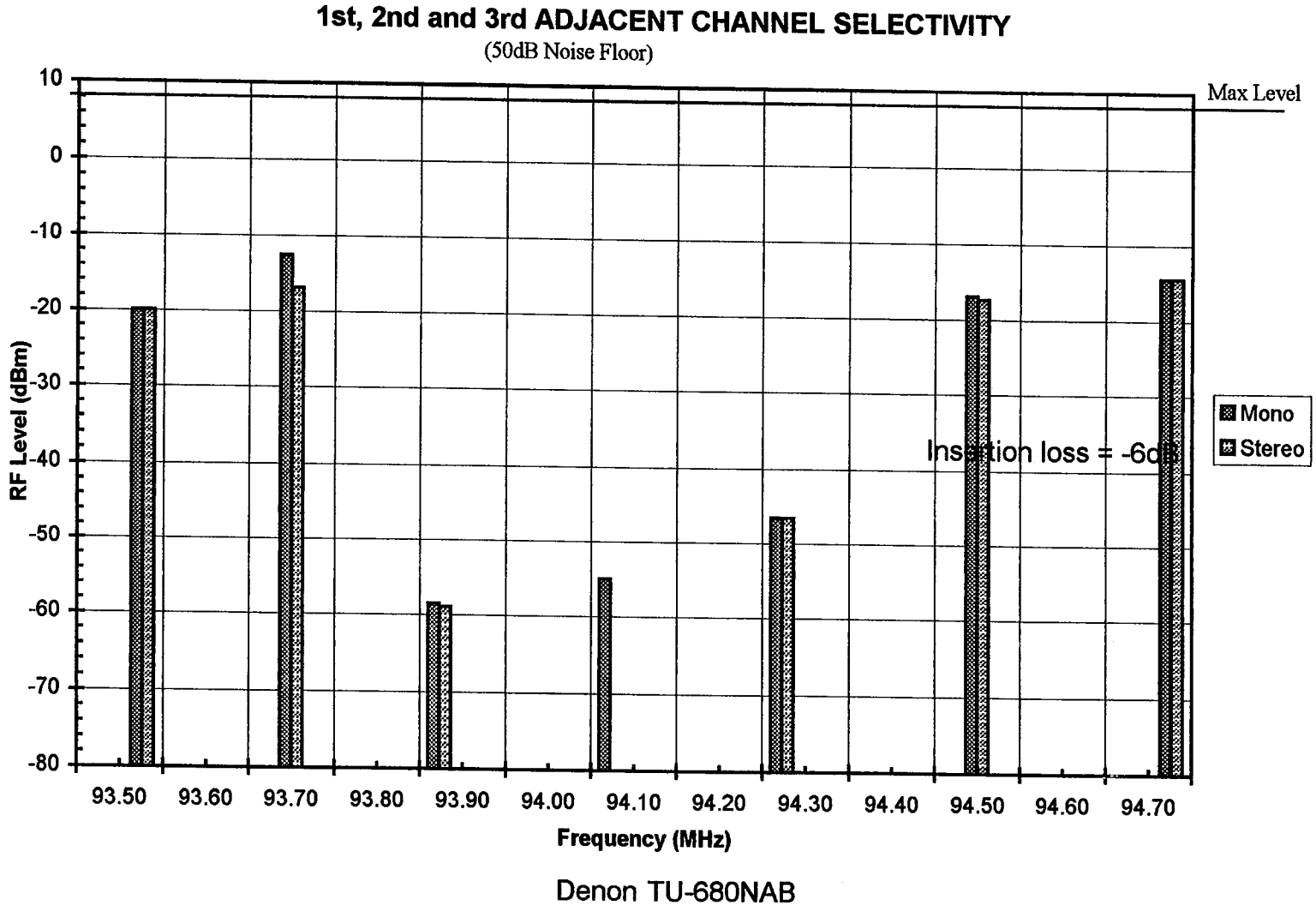
Denon TU-680NAB



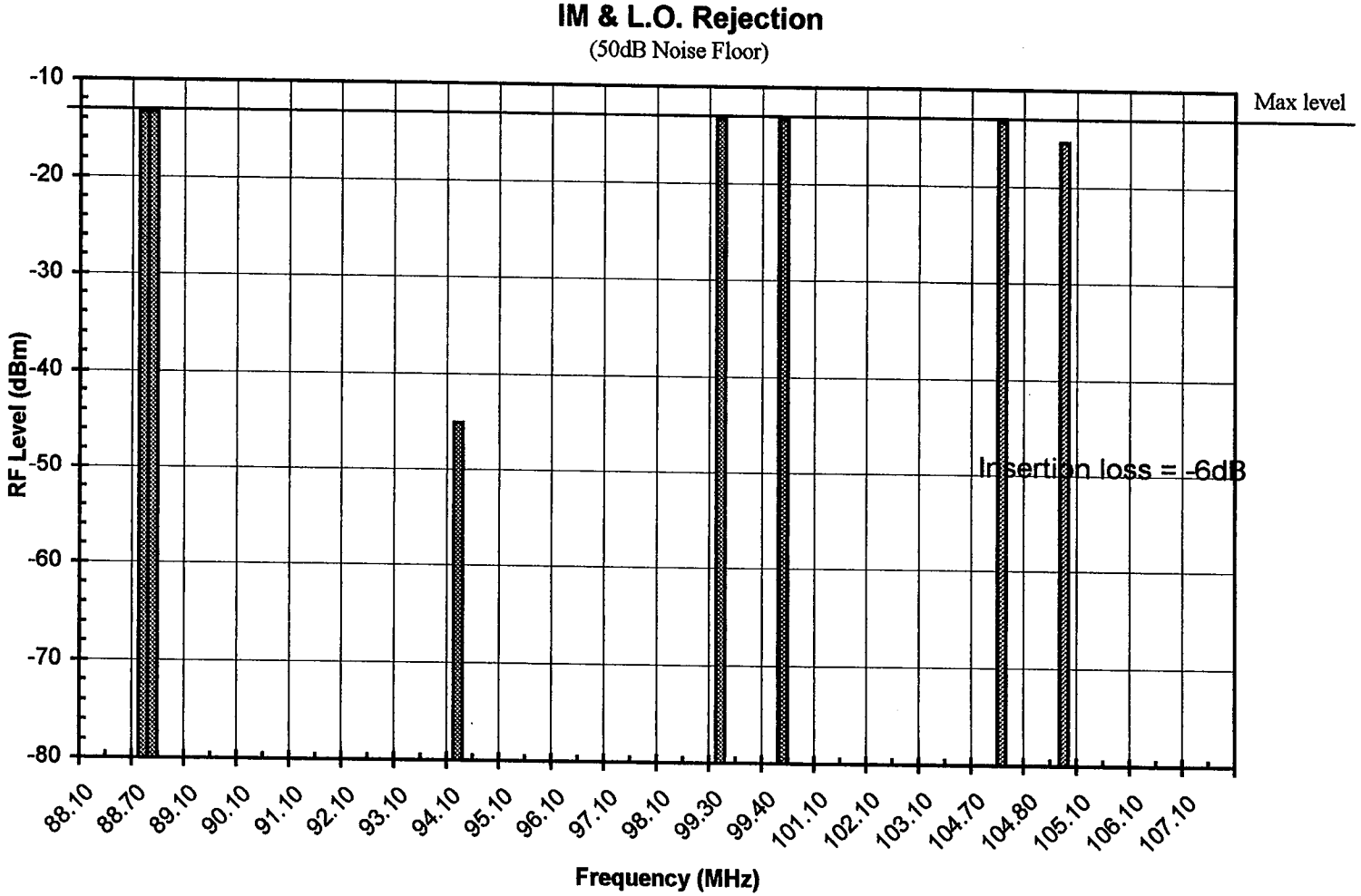
Denon TU-680NAB

245

FM Receiver Test Laboratory



Denon TU-680NAB



Denon TU-680NAB

247

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.: Audiovox
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

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)

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				Right Ch	
Level	1.9	**Vrms**	= 0dB	**Level**	1.2	**Vrms**
THD	0.74	**%**		**THD**	0.73	**%**

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)

250

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

RF Level dBm	Mono (L)		Stereo (L)			Separation L->R		RF Level dBm
	Signal dB	Noise dB	Signal dB	Filt. Noise dB	Noise dB	Left dB	Right dB	
-130	-28.00	-28.00	-27.00	-27.00		-26.50	-27.00	-130
-125	-28.00	-28.00	-27.00	-27.00		-26.50	-27.00	-125
-120	-26.50	-29.00	-25.50	-28.00		-26.00	-26.50	-120
-115	-22.50	-30.00	-22.00	-28.50		-23.50	-24.00	-115
-110	-15.50	-35.00	-15.00	-33.00		-17.80	-18.00	-110
-105	-9.00	-49.00	-8.50	-46.50		-12.00	-12.50	-105
-100	-4.50	-57.00	-4.00	-56.00		-9.00	-9.00	-100
-95	-2.20	-62.00	-2.00	-57.50		-7.80	-8.00	-95
-90	-1.80	-64.00	-1.80	-51.00		-6.00	-9.50	-90
-85	-1.50	-65.00	-1.50	-51.00		-4.50	-11.00	-85
-80	-0.60	-65.50	-0.50	-51.00		-2.00	-14.00	-80
-75	-0.20	-66.50	0.00	-53.00		-0.80	-19.50	-75
-70	0.00	-67.00	0.00	-56.00		-0.50	-23.00	-70
-65	0.00	-67.00	0.00	-58.00		0.00	-24.50	-65
-60	0.00	-67.00	0.00	-59.00		0.00	-25.50	-60
-55	0.00	-67.00	0.00	-59.50		0.00	-26.00	-55
-50	0.00	-67.00	0.00	-59.50		0.00	-26.50	-50
-45	0.00	-67.00	0.00	-59.50	-54.00	0.00	-26.50	-45

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.

	Mono 30dB		Stereo 30dB	
	dBm	D/U	dBm	D/U
Desired Lev	-55.00		-55.00	
Undesired Upper Lev	-27.12	-27.88	-33.92	-21.08
Undesired Lower Lev	-46.22	-8.78	-46.62	-8.38
Selectivity, 1st Adj.:		-18.33		-14.73

(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.

	Mono 30dB		Stereo 30dB	
	dBm	D/U	dBm	D/U
Desired Lev	-55.00		-55.00	
Undesired Upper Lev	8.08	-63.08	8.08	-63.08
Undesired Lower Lev	8.08	-63.08	8.08	-63.08
Selectivity, 2nd Adj.:	Max RF	-63.08	Max RF	-63.08

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

252

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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-27.92	-27.08	-54.92	-0.08	
Undesired Lower Lev	-51.82	-3.18	-59.42	4.42	
Selectivity, 1st Adj.:		-15.13		2.17	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	1.08	-56.08	-7.92	-47.08	
Undesired Lower Lev	6.38	-61.38	6.08	-61.08	
Selectivity, 2nd Adj.:		-58.73		-54.08	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	8.08	-63.08	-6.92	-48.08	
Undesired Lower Lev	5.08	-60.08	5.08	-60.08	
lectivity, 3rd Adj.:		-61.58		-54.08	(RF D/U Up + RF D/U Lo)/2

253

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 -105.50 dBm
RF Lev 2 -15.50 dBm EOC
D/U 90.00 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 dBm	D/U	10.7MHz Spacing dBm	D/U
-45.00		-45.00	
-18.37	-26.63	-20.37	-24.63
	-26.63		-24.63

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

10.6MHz Spacing dBm	D/U	10.7MHz Spacing dBm	D/U
-45.00		-45.00	
-14.37	-30.63	-14.37	-30.63
	-30.63		-30.63

EOC: These figures represent RF levels at 83.4MHz

254

FM Receiver Test Laboratory

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
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		THD		Right Channel		THD	
1.9	Vrms	0.74	%	1.2	Vrms	0.73	%

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 Max RF
-63.08 dB Stereo Max RF

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

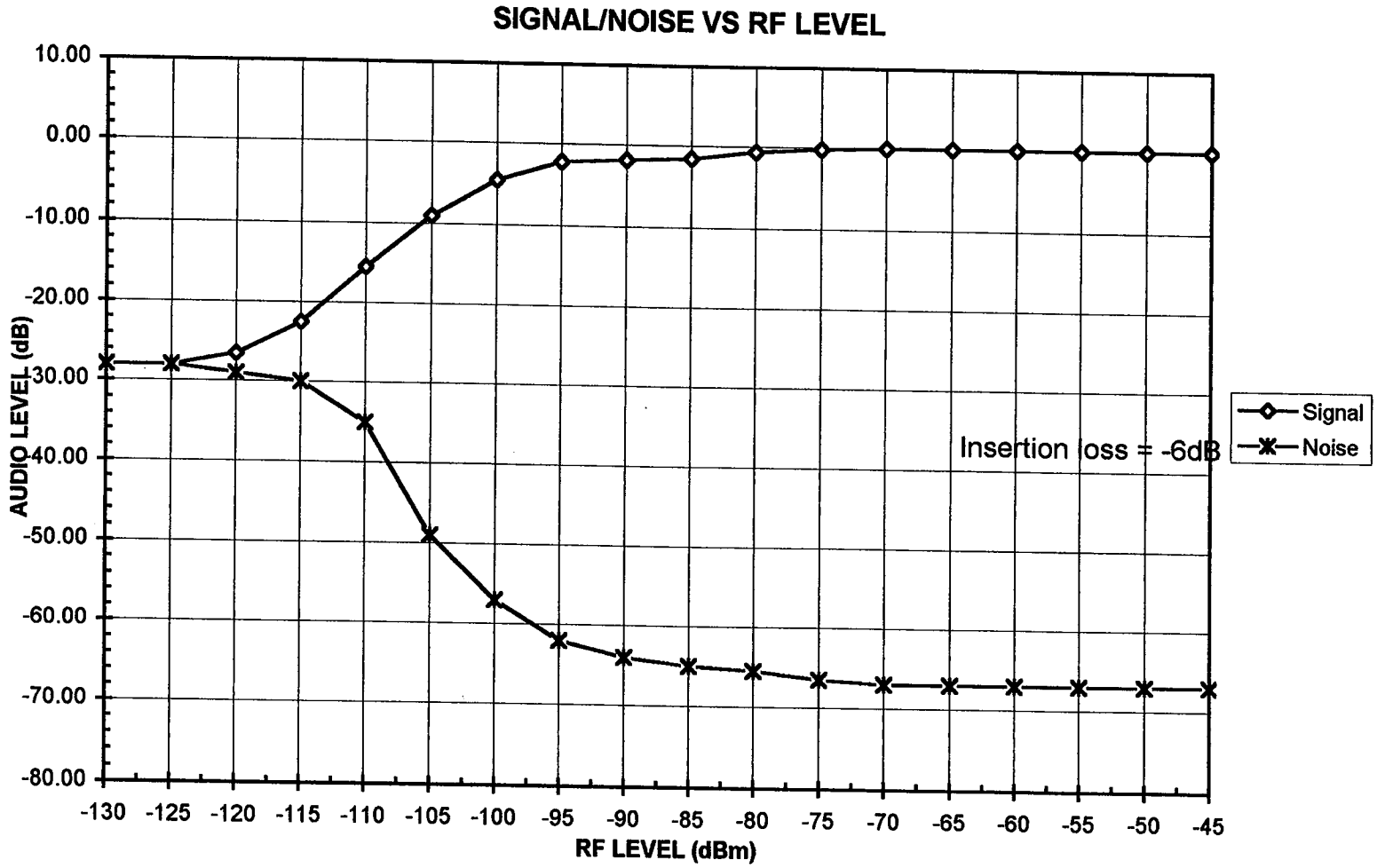
12 **Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)**
-61.58 dB Mono
-54.08 dB Stereo

13 **10.7MHz Rejection**
90.00 dB 0

14 **10.7MHz IM (D/U)**
-26.63 dB (10.6) 0
-24.63 dB (10.7) 0

15 **10.7MHz Spurious - Local Osc. Interference (D/U)**
-30.63 dB (10.6) These figures represent RF levels at 83.4MHz
-30.63 dB (10.7) 0

256



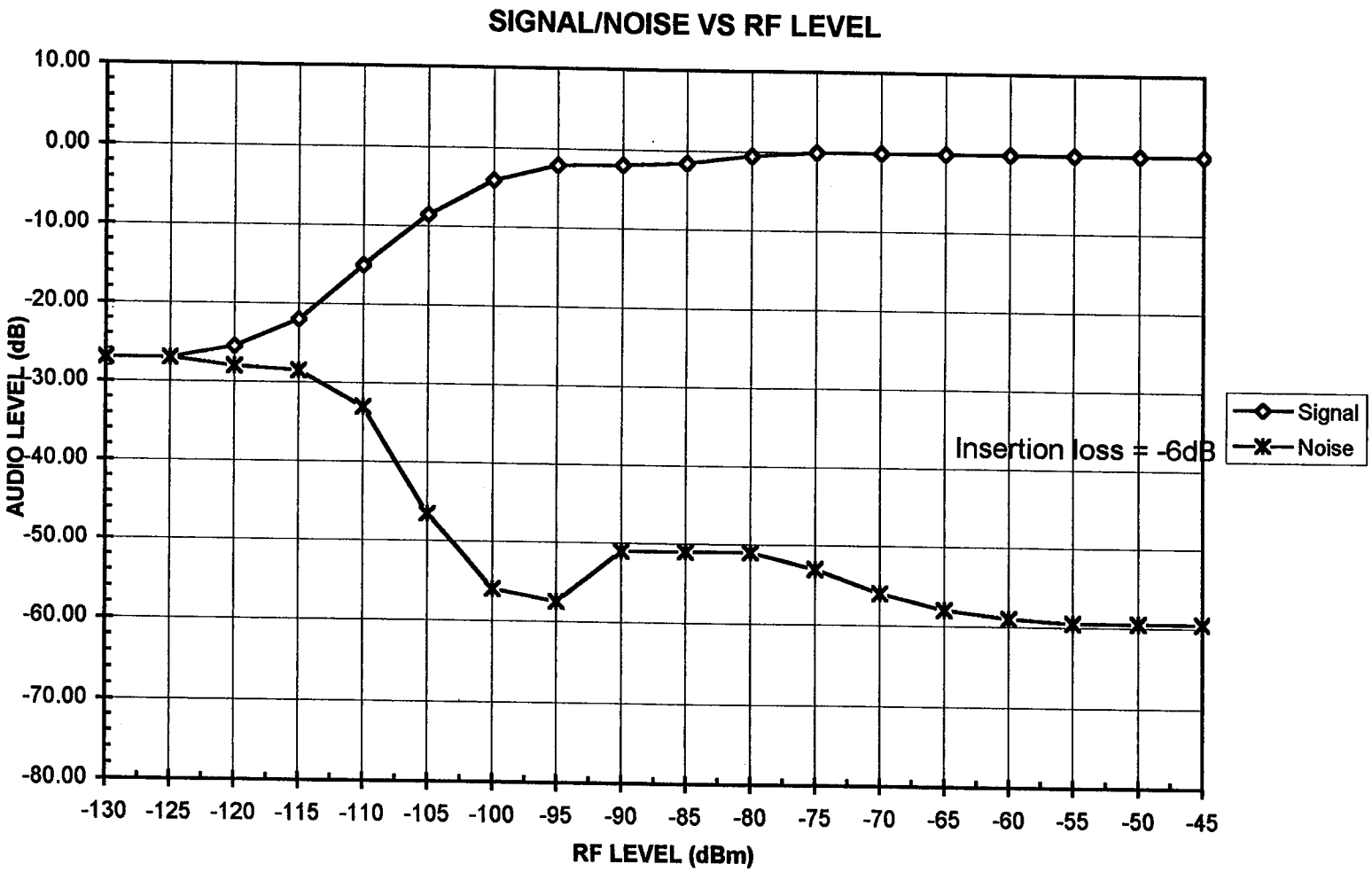
Audiovox AV-220

257

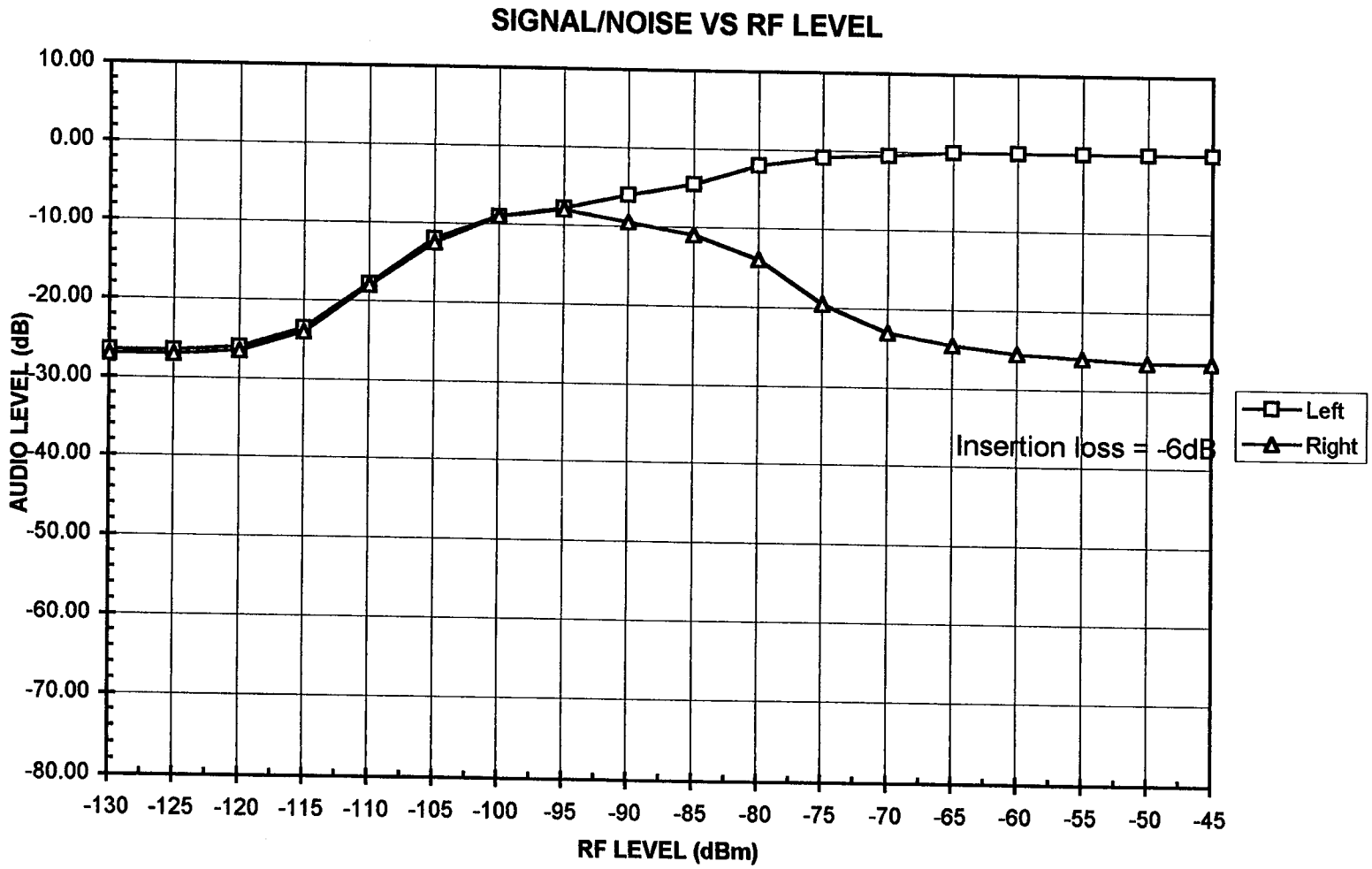
File Name: C_audvox

FM Mono Plot

FM Receiver Test Laboratory



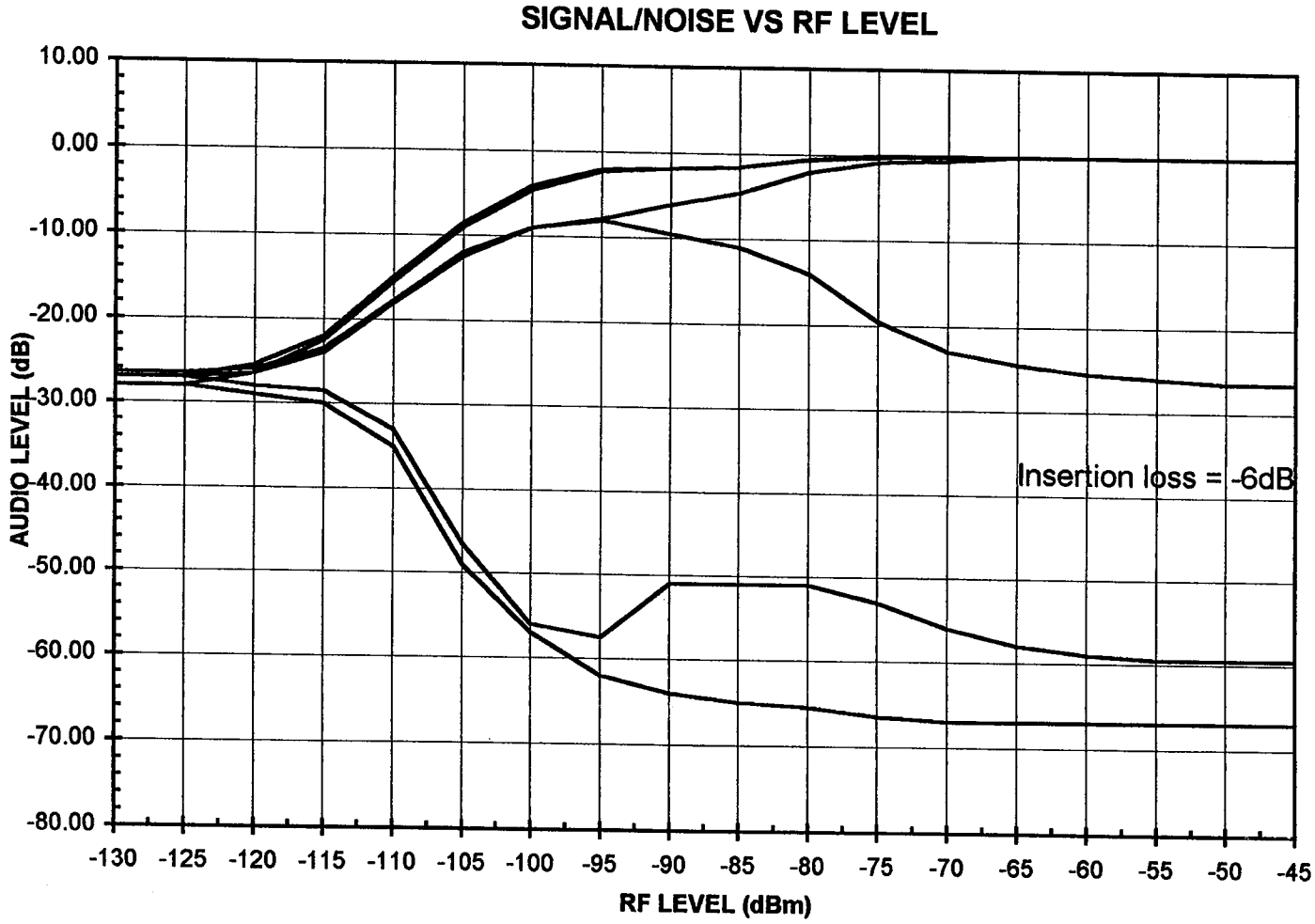
Audiovox AV-220



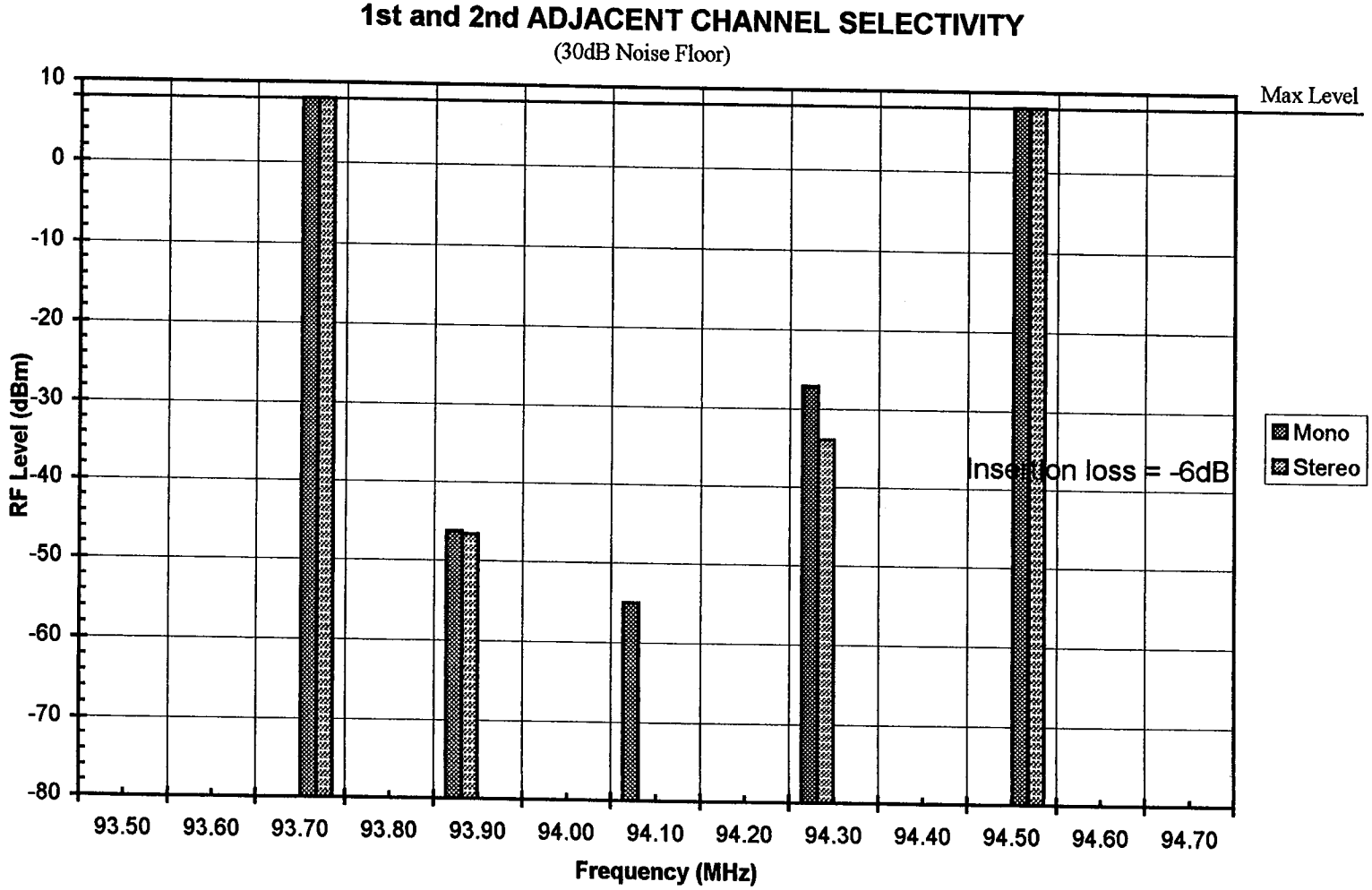
Audiovox AV-220

259

FM Receiver Test Laboratory

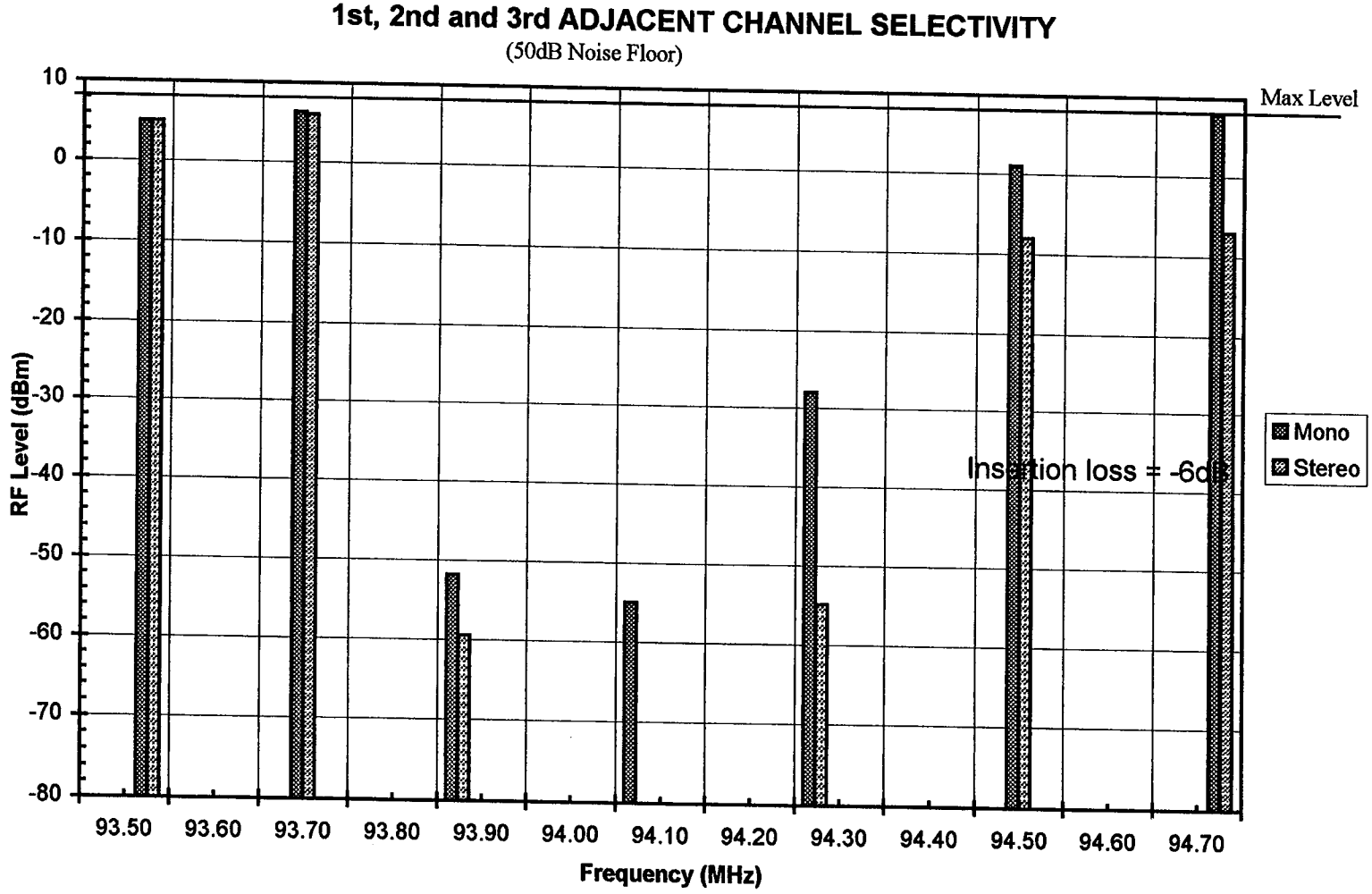


Audiovox AV-220

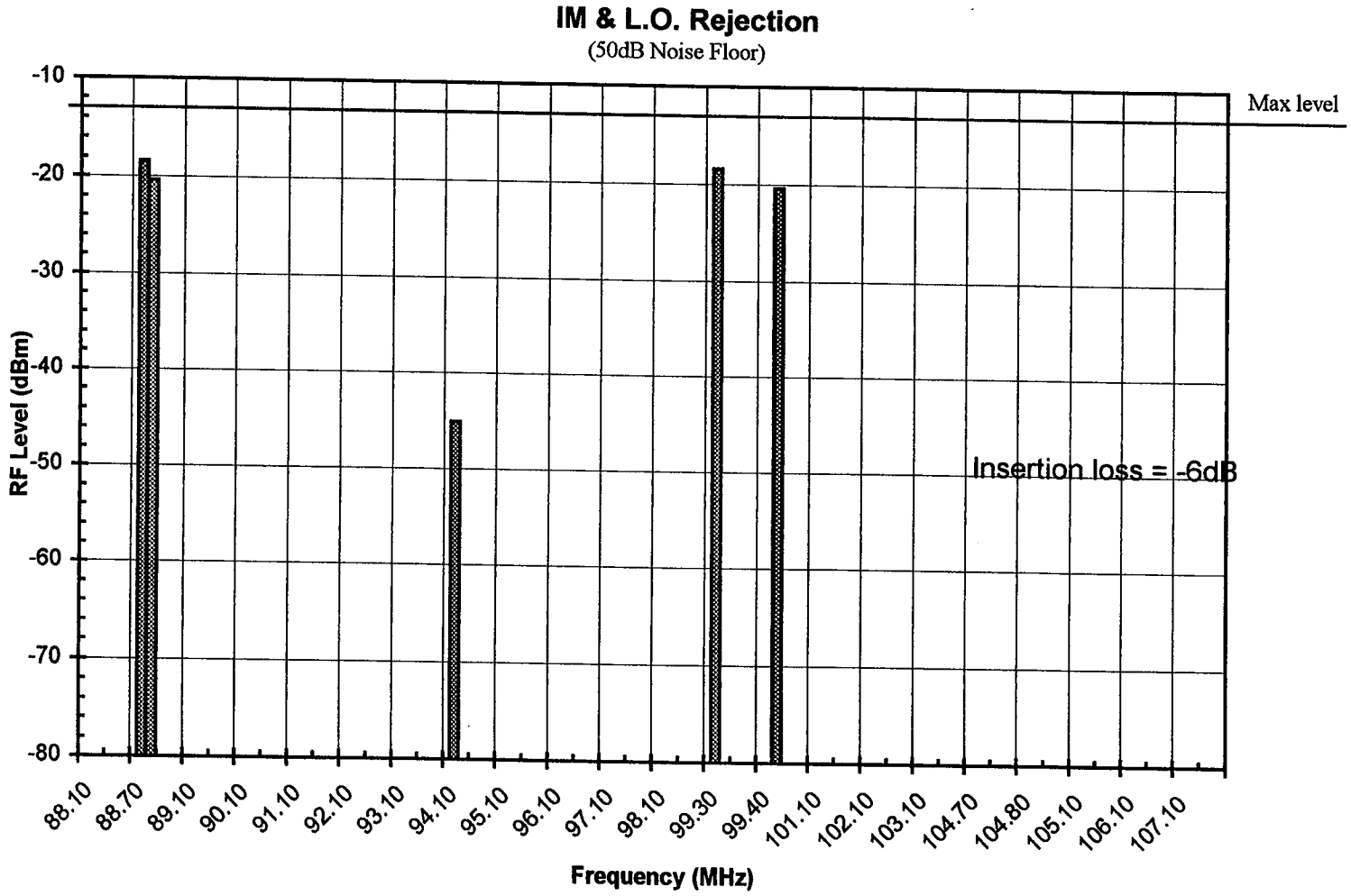


Audiovox AV-220

2.4.1



Audiovox AV-220



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 rms

Comments: Audio Output: Tape Rec line output

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)

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				Right Ch		
Level	0.325	**Vrms**	= 0dB	**Level**	0.330	**Vrms**
THD	0.22	**%**		**THD**	0.22	**%**

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 (0.26%)

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 Levl
Tune RF Gen to; Desired Freq. +/- 2 X IF Freq.
Adjust RF Level until S/N Ratio = 30dB, record RF Lev2

Measurement:

RF Levl	-109.0 dBm	(S/N Ratio = 30dB)
RF Lev2	-63.0 dBm	(21.4MHz + 94.1MHz = 115.5MHz)
Image Rejection:	-46.00 dB	(RF Levl - RF Lev2)

266

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

RF Level dBm	Mono (L)		Stereo (L)			Separation L->R		RF Level dBm
	Signal dB	Noise dB	Signal dB	Filt. Noise dB	Noise dB	Left	Right dB	
-130	-19.00	-19.00	-18.50	-18.50		-18.50	-18.50	-130
-125	-18.50	-19.50	-18.00	-19.00		-18.50	-18.50	-125
-120	-16.00	-20.00	-16.00	-19.50		-18.00	-18.00	-120
-115	-10.00	-22.50	-10.00	-22.00		-14.50	-14.50	-115
-110	-4.00	-30.00	-4.00	-29.00		-9.50	-9.50	-110
-105	-0.50	-44.00	-0.50	-43.00		-6.50	-6.50	-105
-100	0.00	-51.50	0.00	-50.50		-6.00	-6.00	-100
-95	0.00	-58.00	0.00	-57.00		-6.00	-6.00	-95
-90	0.00	-64.00	0.00	-63.00		-6.00	-6.00	-90
-85	0.00	-69.00	0.00	-45.00		0.00	-37.00	-85
-80	0.00	-70.00	0.00	-50.00		0.00	-37.50	-80
-75	0.00	-70.00	0.00	-55.00		0.00	-38.00	-75
-70	0.00	-70.00	0.00	-60.00		0.00	-38.00	-70
-65	0.00	-70.00	0.00	-64.50		0.00	-38.00	-65
-60	0.00	-70.00	0.00	-68.00		0.00	-38.00	-60
-55	0.00	-70.00	0.00	-70.00		0.00	-38.00	-55
-50	0.00	-70.00	0.00	-70.00		0.00	-38.00	-50
-45	0.00	-70.00	0.00	-70.00	-36.00	0.00	-38.00	-45

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: -2.85 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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-41.72	-13.28	-41.82	-13.18	
Undesired Lower Lev	-49.62	-5.38	-51.22	-3.78	
Selectivity, 1st Adj.:		-9.33		-8.48	(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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	8.08	-63.08	8.08	-63.08	
Undesired Lower Lev	8.08	-63.08	8.08	-63.08	
Selectivity, 2nd Adj.:	Max RF	-63.08	Max RF	-63.08	(RF D/U Up + RF D/U Lo)/2

268

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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-43.62	-11.38	-61.22	6.22	
Undesired Lower Lev	-52.22	-2.78	-71.22	16.22	
Selectivity, 1st Adj.:		-7.08		11.22	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-24.22	-30.78	-24.22	-30.78	
Undesired Lower Lev	-24.22	-30.78	-24.22	-30.78	
Selectivity, 2nd Adj.:		-30.78		-30.78	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	8.08	-63.08	8.08	-63.08	
Undesired Lower Lev	-22.22	-32.78	-22.22	-32.78	
Selectivity, 3rd Adj.:		-47.93		-47.93	(RF D/U Up + RF D/U Lo)/2

269

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	EOC
D/U	-131.00	dB	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)

10.6MHz Spacing		10.7MHz Spacing	
dBm	D/U	dBm	D/U
-45.00		-45.00	
-20.37	-24.63	-22.37	-22.63
	-24.63		-22.63

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

10.6MHz Spacing		10.7MHz Spacing	
dBm	D/U	dBm	D/U
-45.00		-45.00	
-14.37	-30.63	-22.37	-22.63
	-30.63		-22.63

EOC: Slight tone at 10.6MHz, objectionable beat noise at 10.7MHz

270

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 rms

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

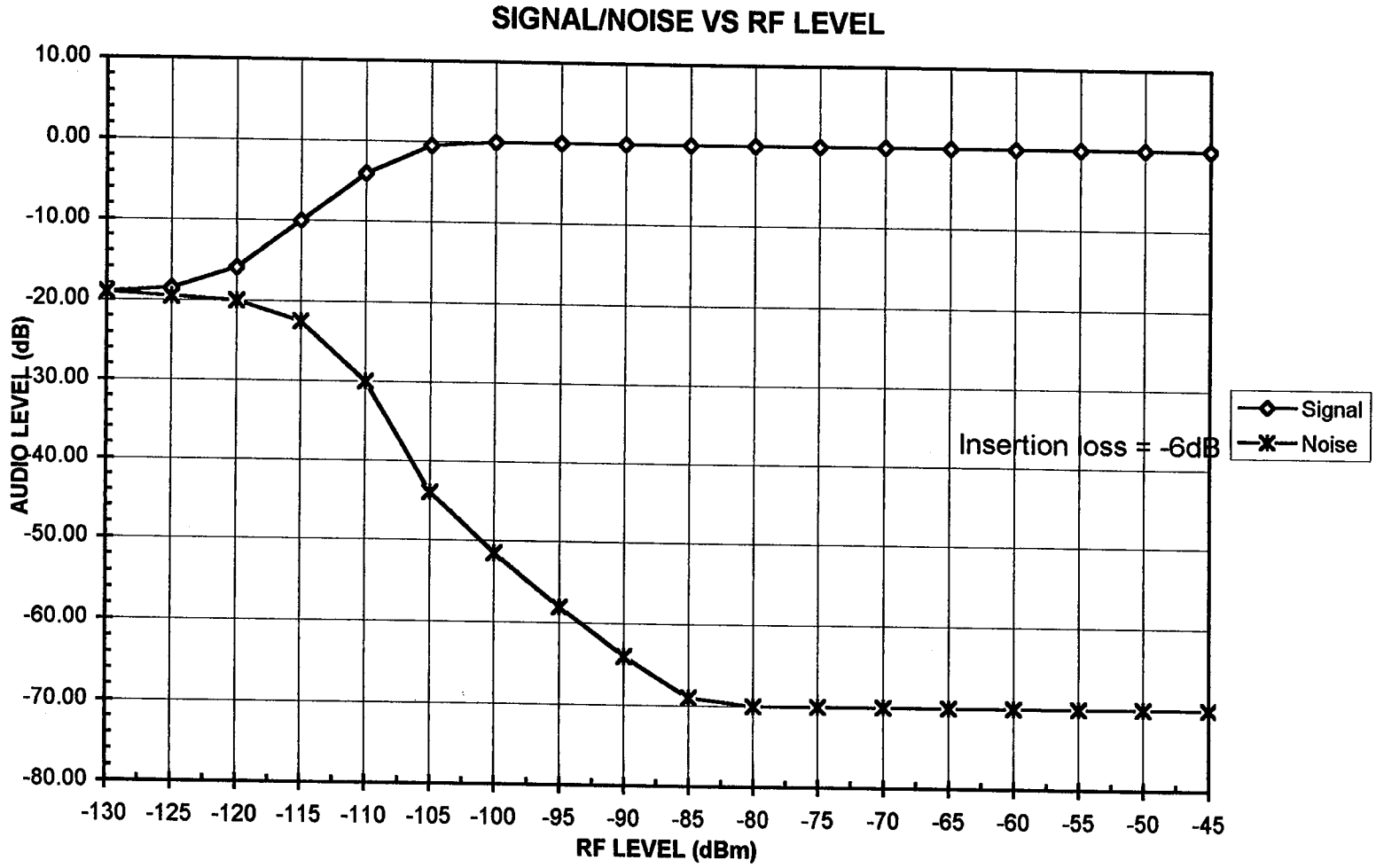
13 **10.7MHz Rejection**
-131.00 dB Could not attain 30dB S/N - only slight impact of 10.7MHz at 22dBm

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

272

FM Receiver Test Laboratory



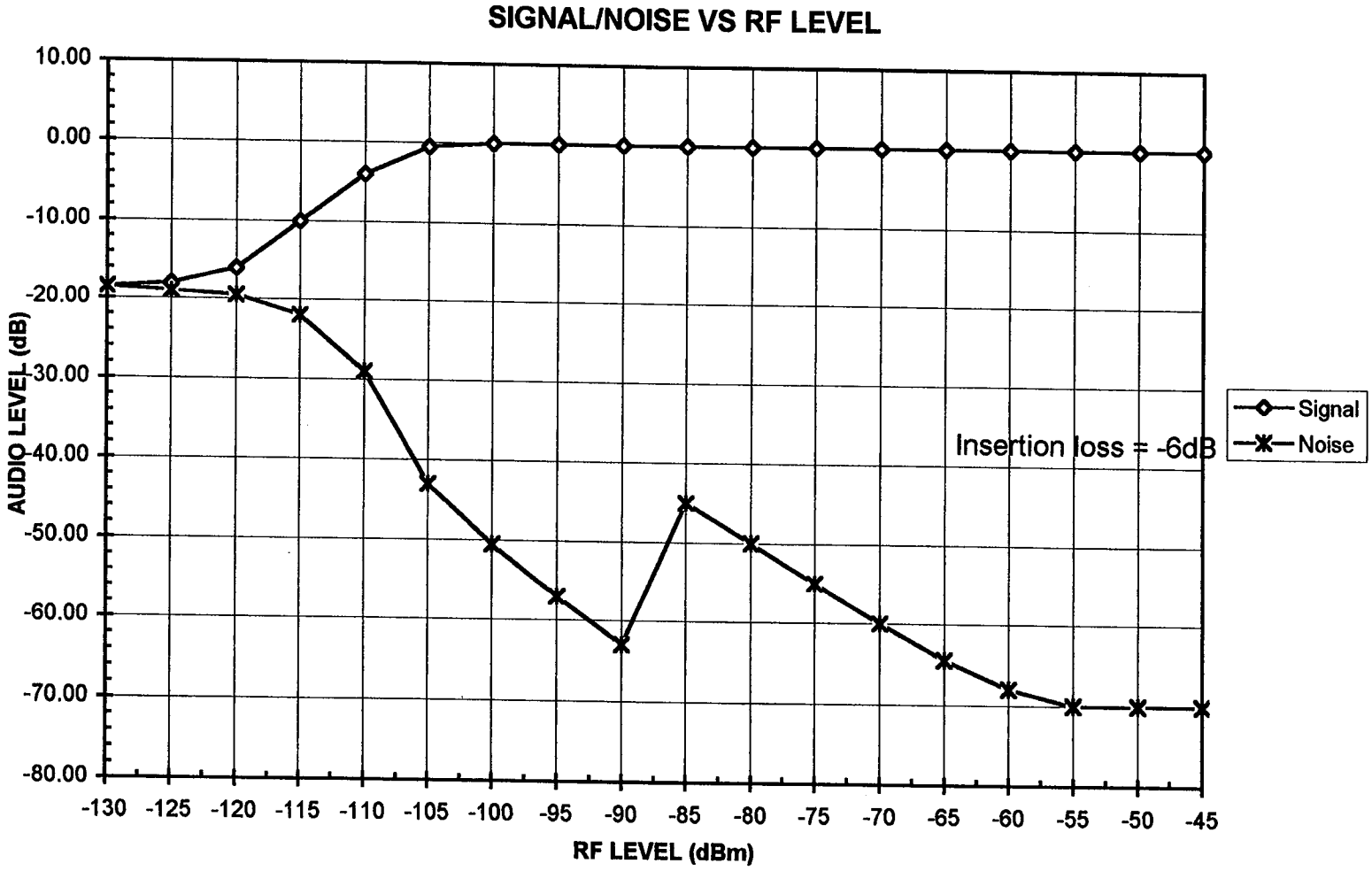
Sony STR-AV21

4 273

File Name: C_sonyhf

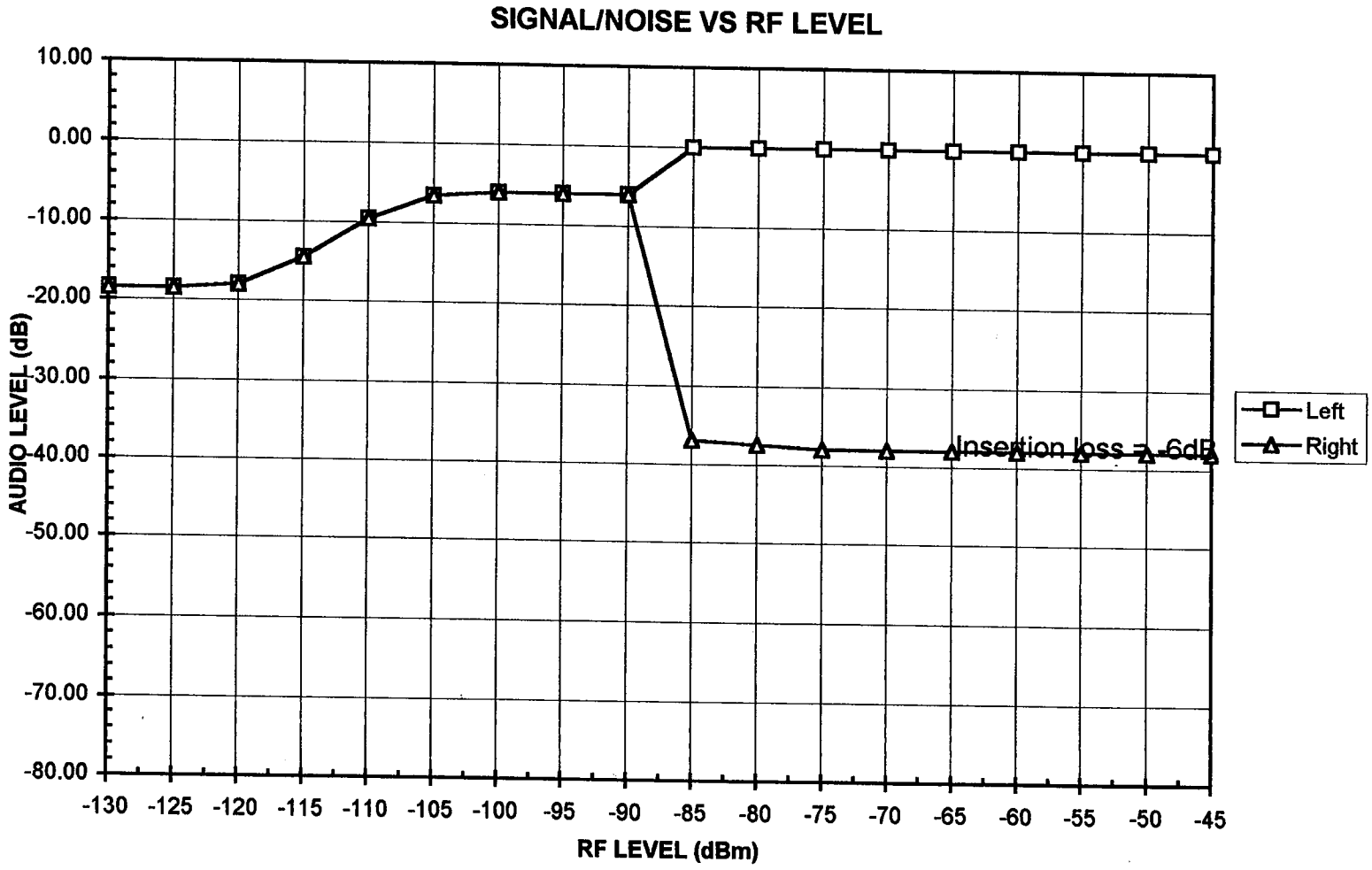
FM Mono Plot

FM Receiver Test Laboratory



Sony STR-AV21

FM Receiver Test Laboratory

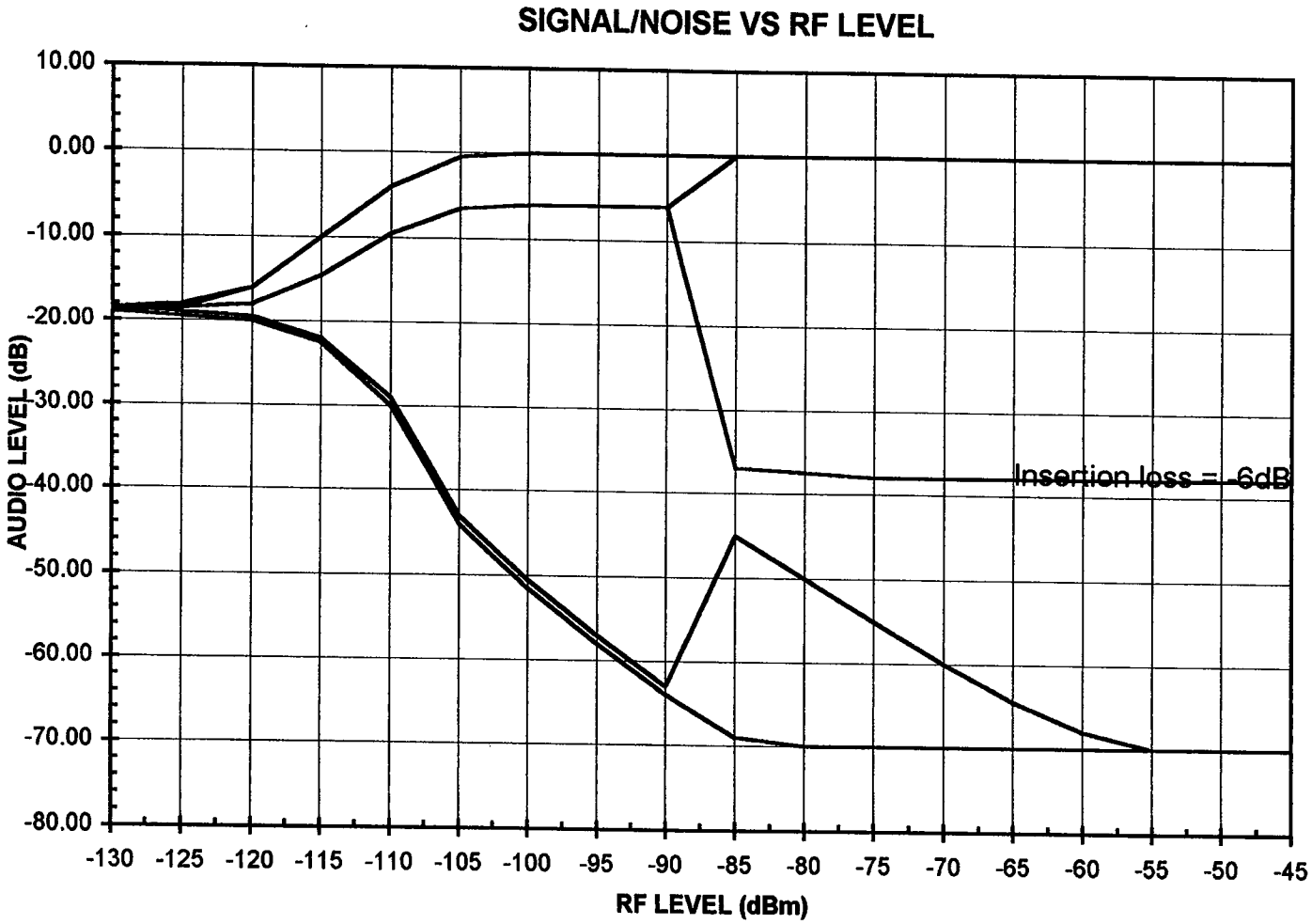


Sony STR-AV21

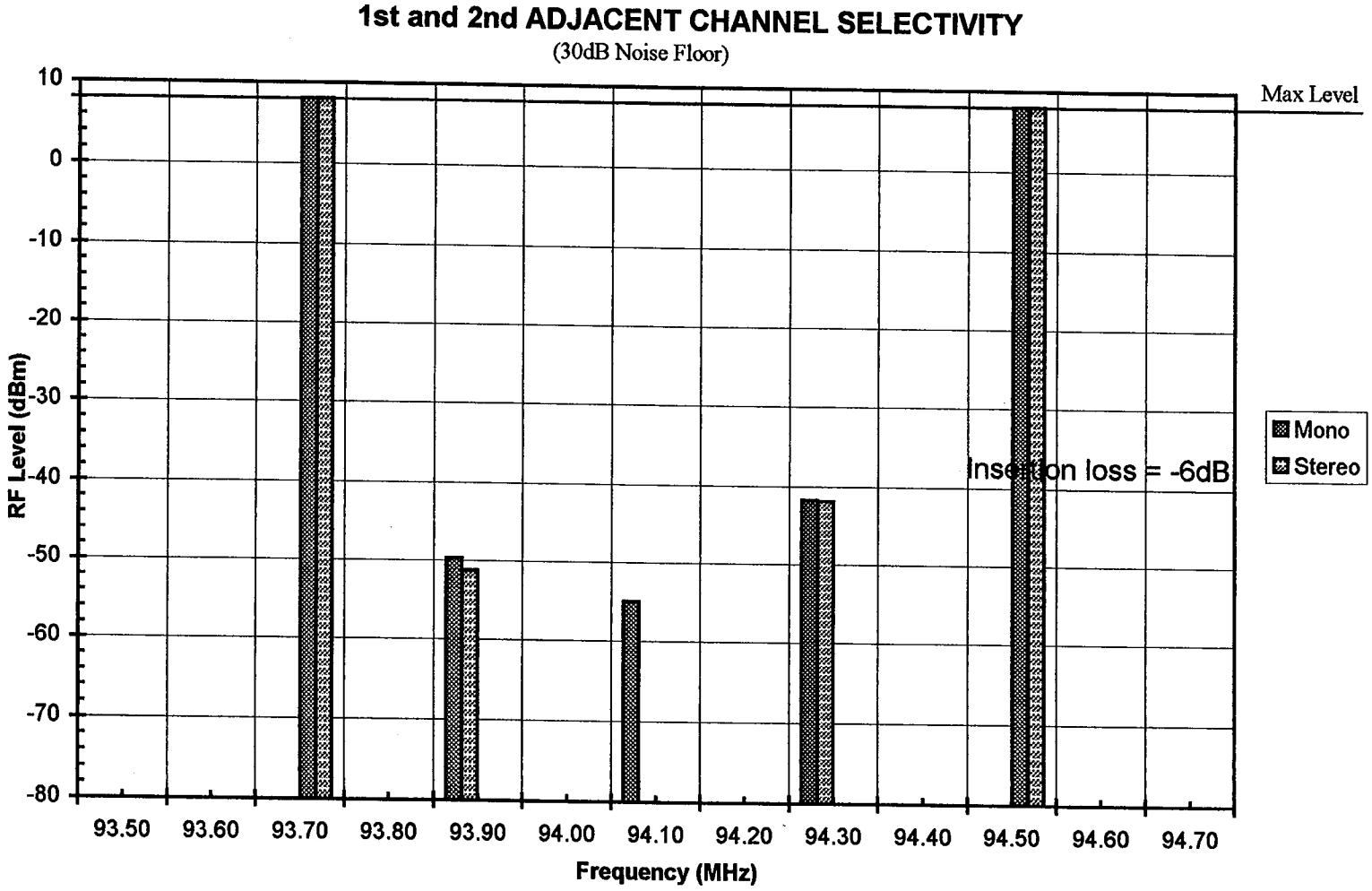
2 7 5

File Name: C_sonyhf

FM Receiver Test Laboratory



Sony STR-AV21



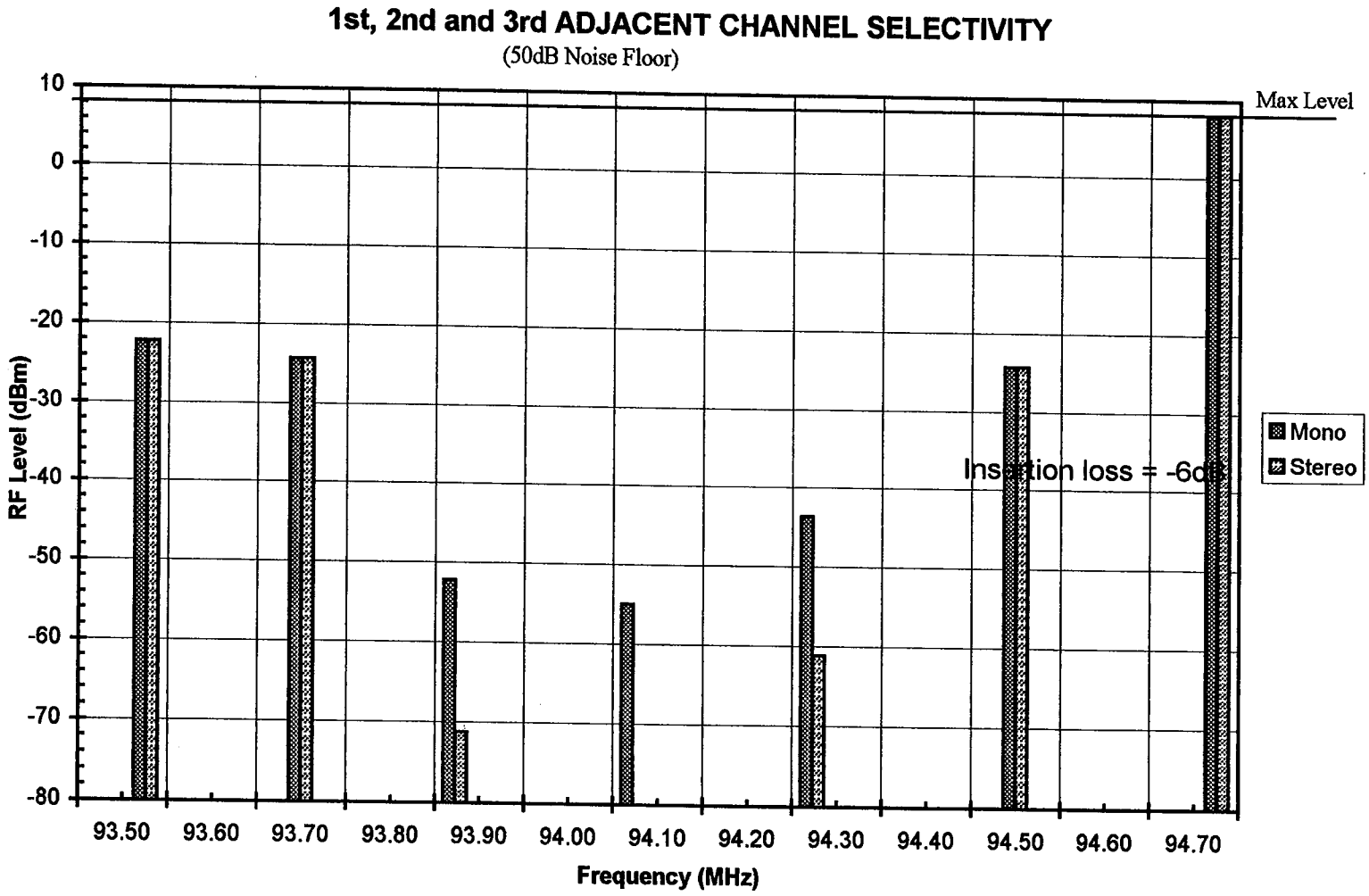
Sony STR-AV21

271

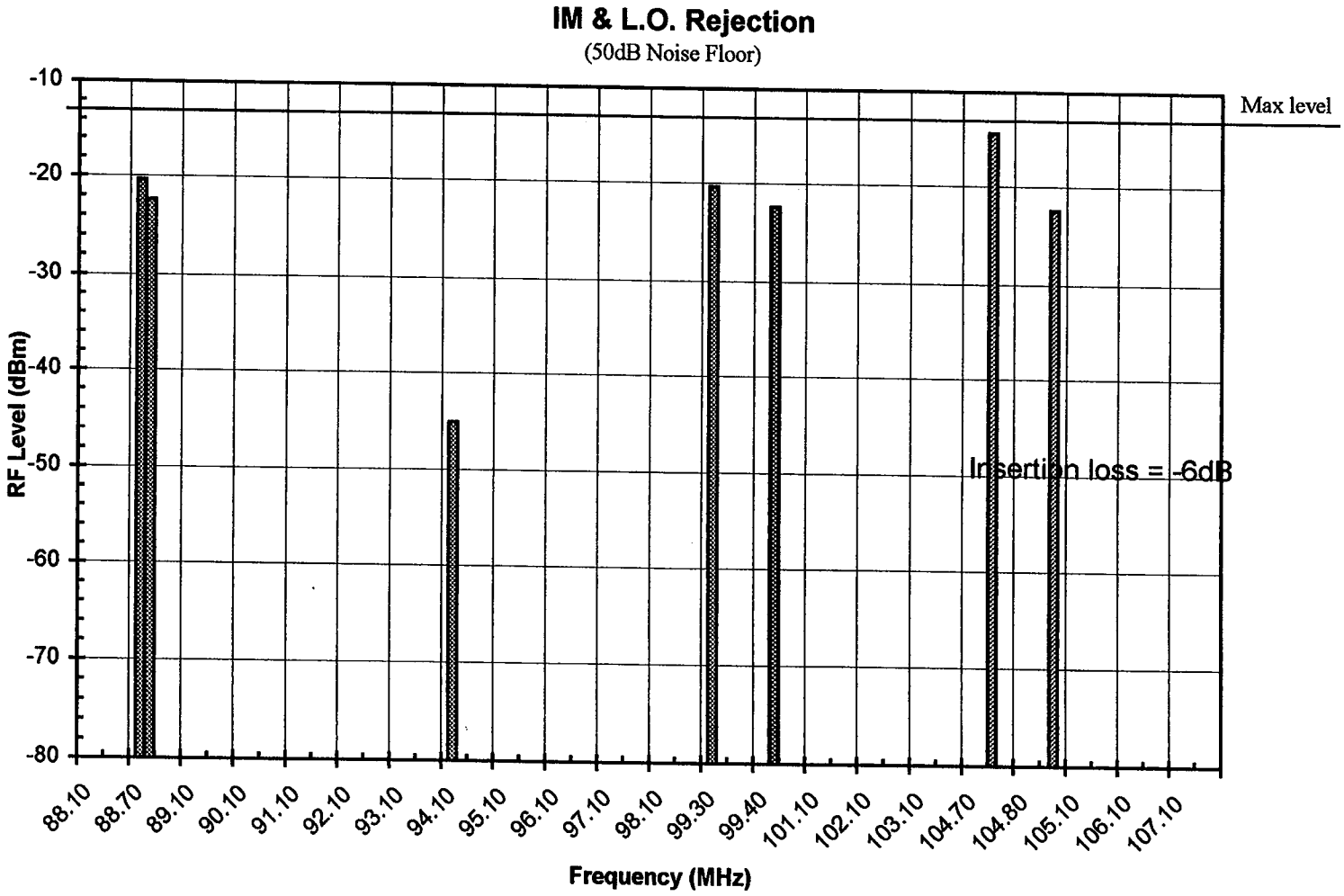
File Name: C_sonyhf

Selectivity 30dB

FM Receiver Test Laboratory



Sony STR-AV21



Sony STR-AV21

Receiver #9

Sony

Portable

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
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

Standard RF Levels

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

Standard FM Test Frequencies

Low:	94.1	MHz
High:	103.5	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)

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)	

282

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

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

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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-54.92	-0.08	-53.92	-1.08	
Undesired Lower Lev	-51.72	-3.28	-51.72	-3.28	
Selectivity, 1st Adj.:		-1.68		-2.18	(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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-18.22	-36.78	-18.22	-36.78	
Undesired Lower Lev	-27.12	-27.88	-27.12	-27.88	
Selectivity, 2nd Adj.:		-32.33		-32.33	(RF D/U Up + RF D/U Lo)/2

284

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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-64.92	9.92	-69.92	14.92	
Undesired Lower Lev	-60.52	5.52	-68.52	13.52	
Selectivity, 1st Adj.:		7.72		14.22	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-25.12	29.88	-28.22	26.78	
Undesired Lower Lev	-28.02	26.98	-30.92	24.08	
Selectivity, 2nd Adj.:		28.43		25.43	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-22.92	32.08	-22.92	32.08	
Undesired Lower Lev	-19.32	35.68	-19.92	35.08	
Selectivity, 3rd Adj.:		33.88		33.58	(RF D/U Up + RF D/U Lo)/2

285

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	-99.30	dBm	
RF Lev 2	19.20	dBm	EOC
D/U	-118.50	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	D/U	dBm	D/U
-45.00		-45.00	
-35.37	-9.63	-40.37	-4.63
	-9.63		-4.63

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

10.6MHz Spacing		10.7MHz Spacing	
dBm	D/U	dBm	D/U
-45.00		-45.00	
-18.37	-26.63	-39.70	-5.30
	-26.63		-5.30

EOC: Objectionable beat notes

286

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.
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
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:**
104.850 MHz

2 **Standard Audio Output:**

Left Channel		THD		Right Channel		THD	
.46	Vrms	1.7	%	.42	Vrms	1.7	%

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

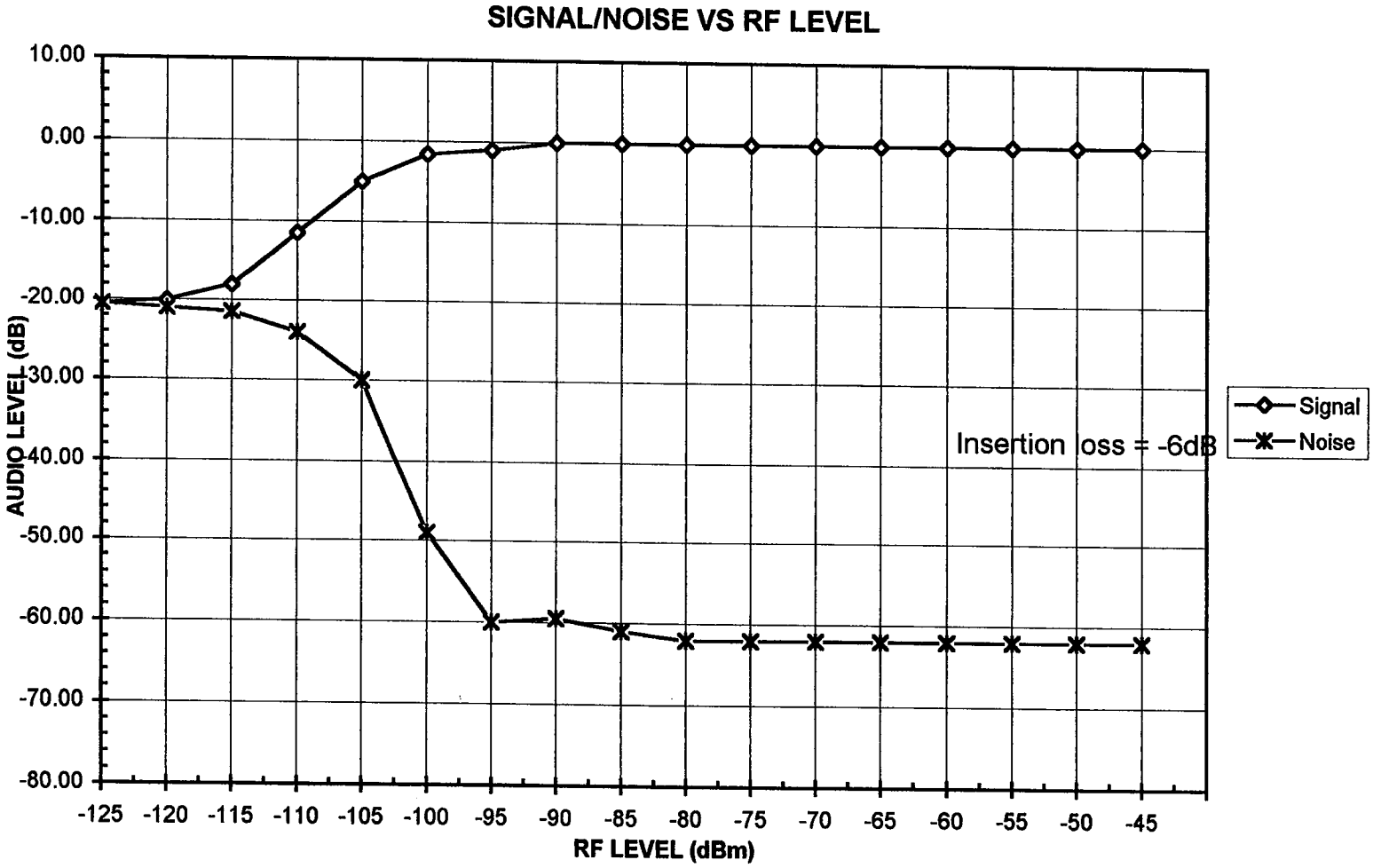
12 **Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)**
-33.88 dB Mono
-33.58 dB Stereo

13 **10.7MHz Rejection**
-118.50 dB 0

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

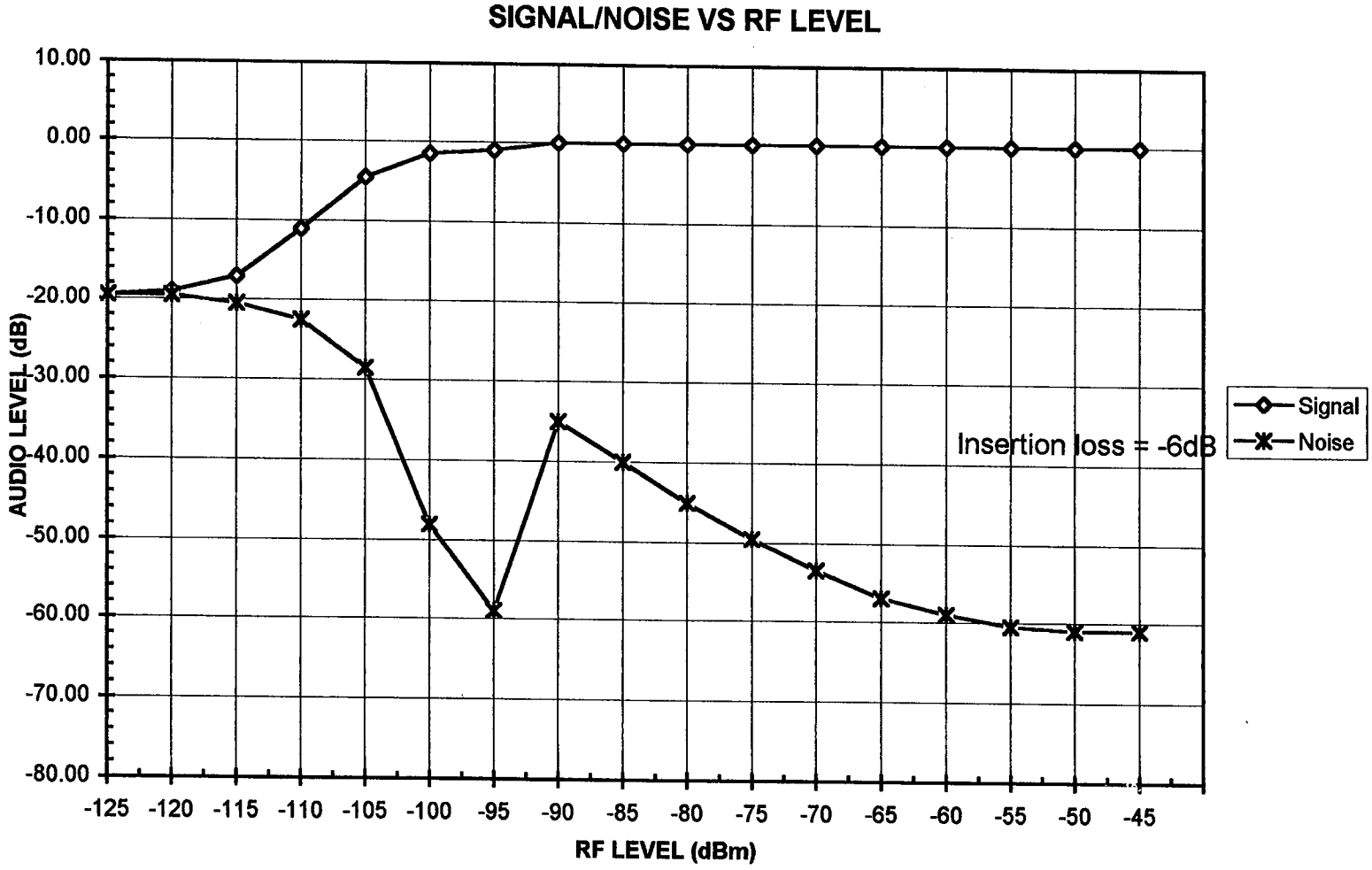
15 **10.7MHz Spurious (Local Osc. Interference)**
-26.63 dB (10.6) Objectionable beat notes
-5.30 dB (10.7) 0

288

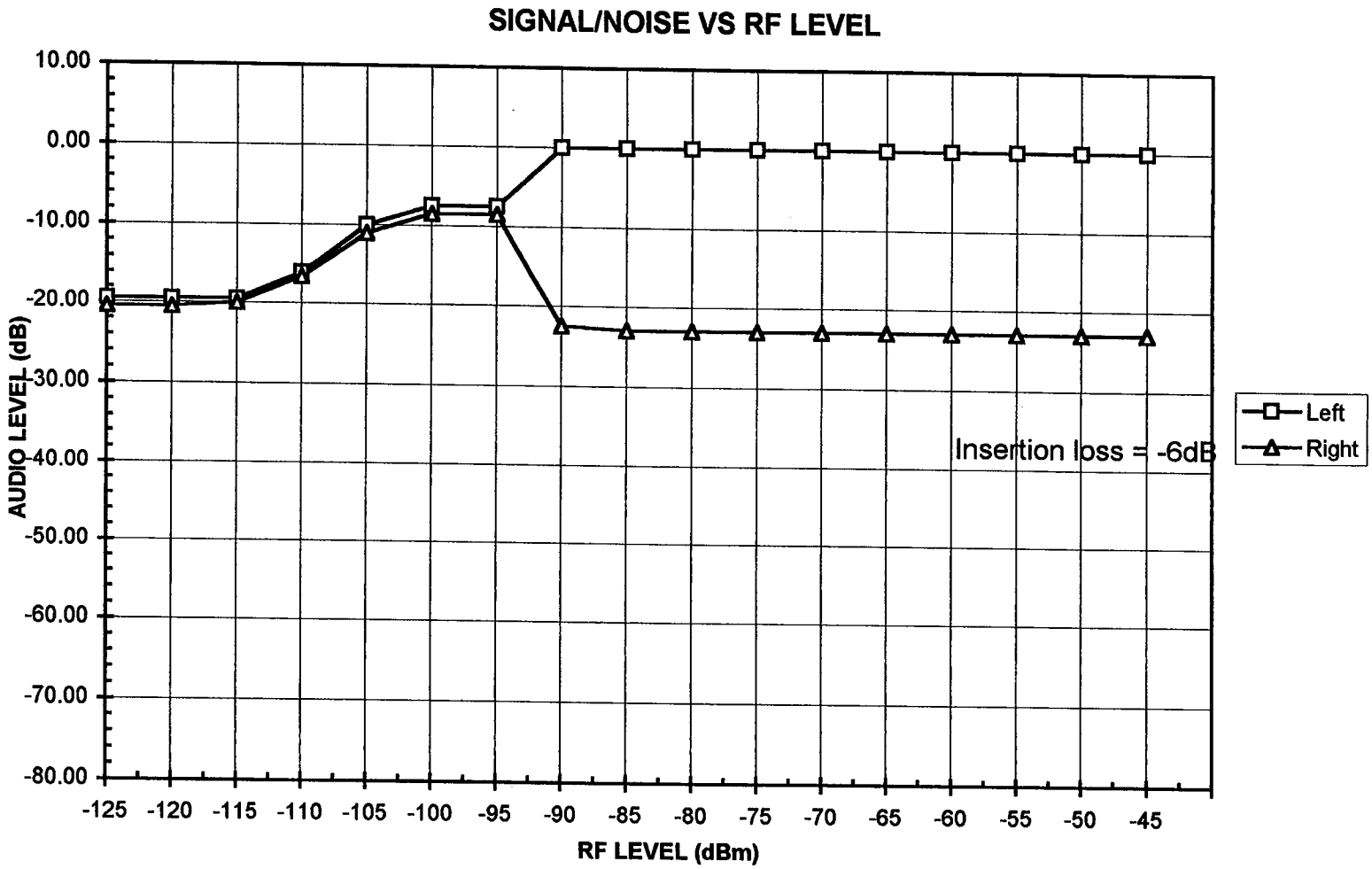


Sony SRF-M40W

FM Receiver Test Laboratory



Sony SRF-M40W



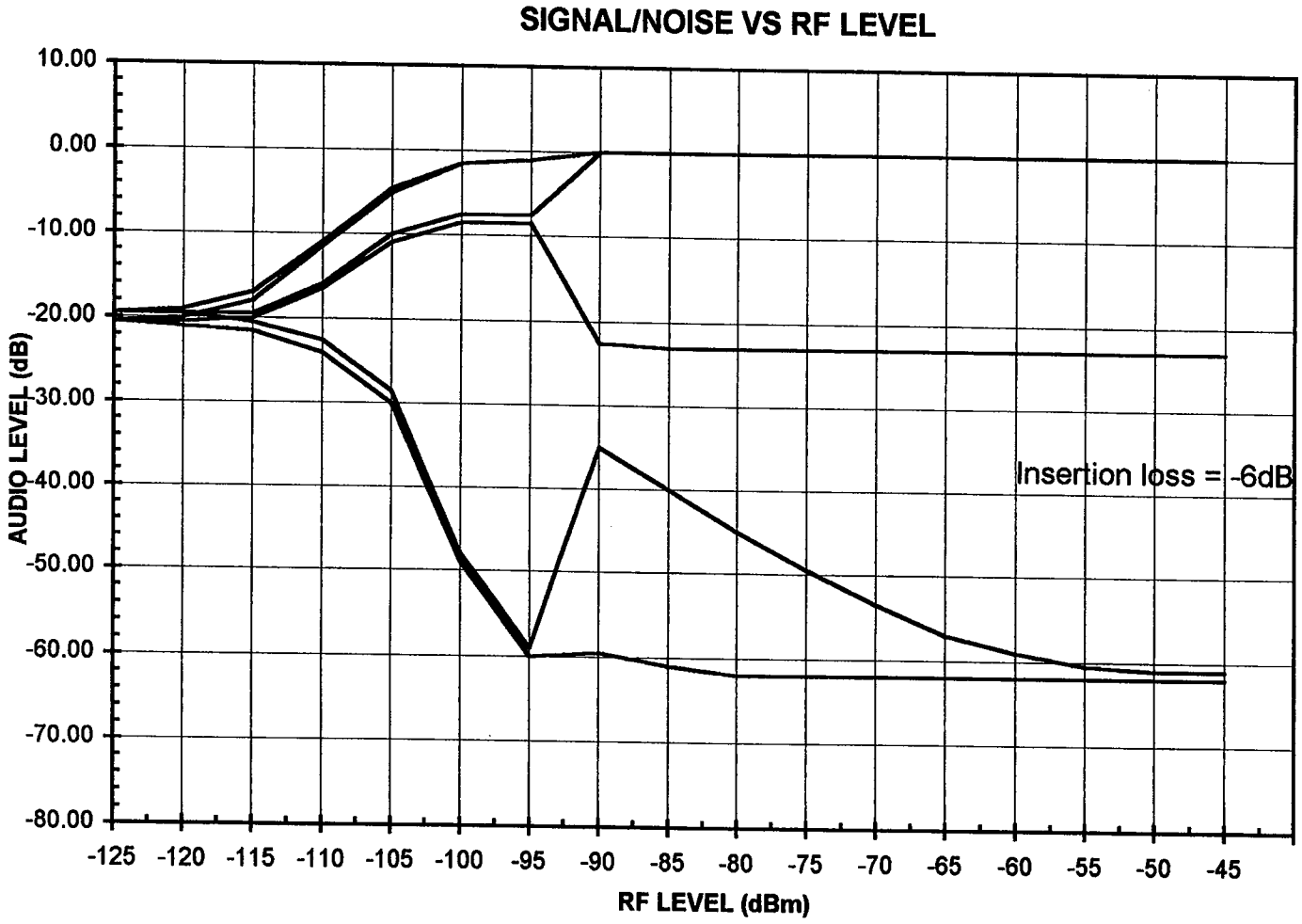
Sony SRF-M40W

291

File Name: C_sonywm

FM Stereo Separation Plot

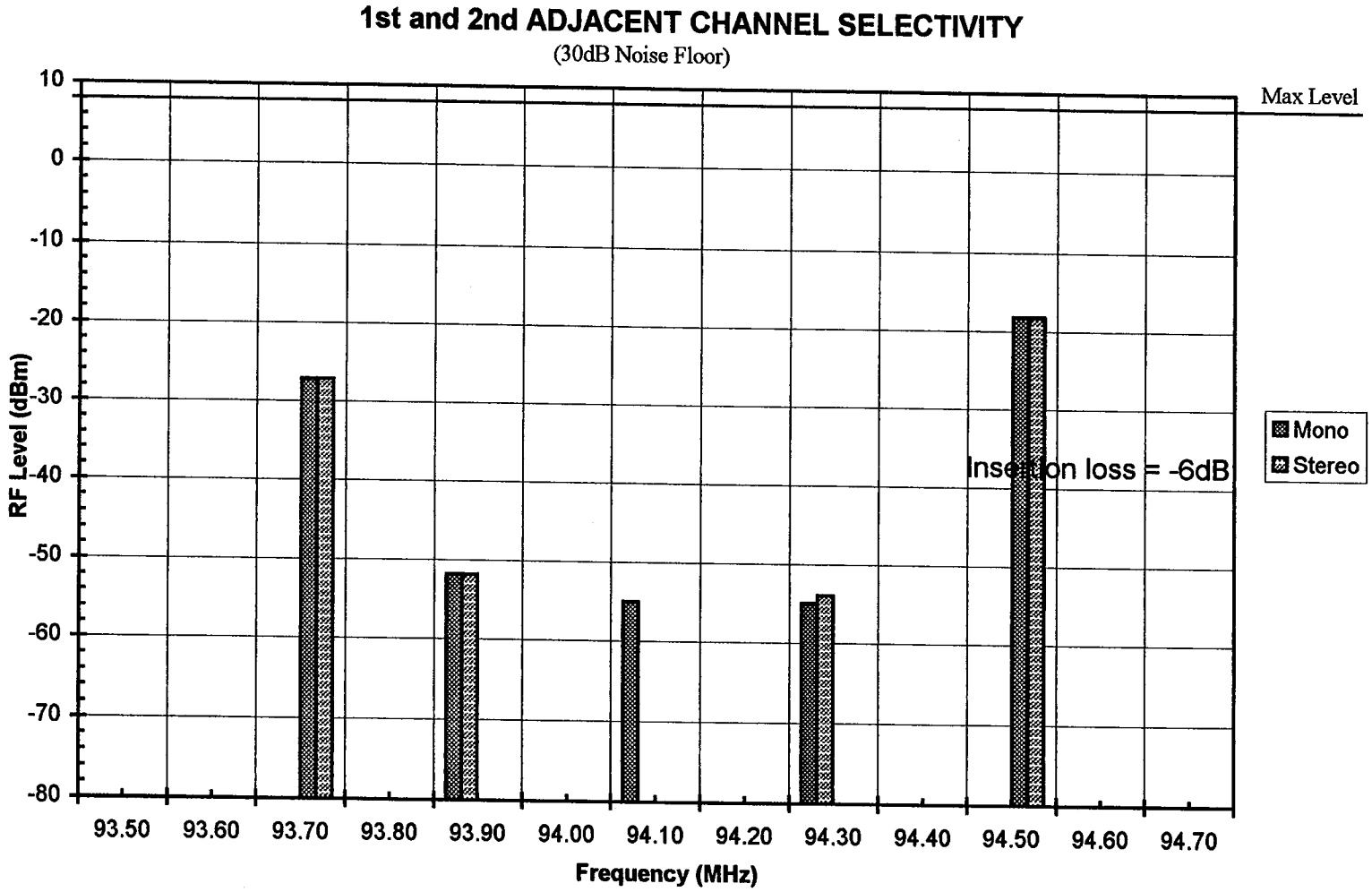
FM Receiver Test Laboratory



Sony SRF-M40W

File Name: C_sonywm

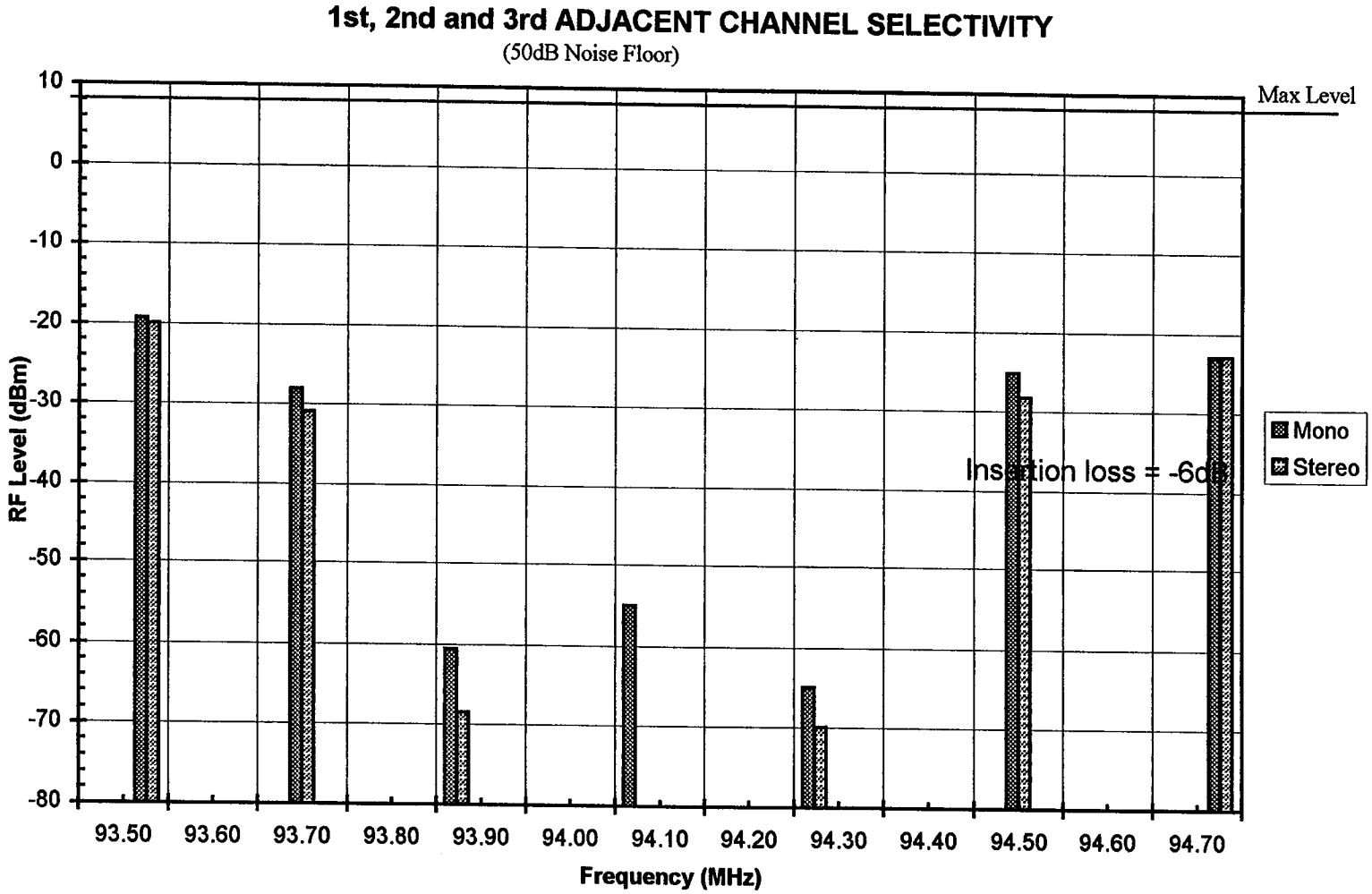
FM COMPOSITE



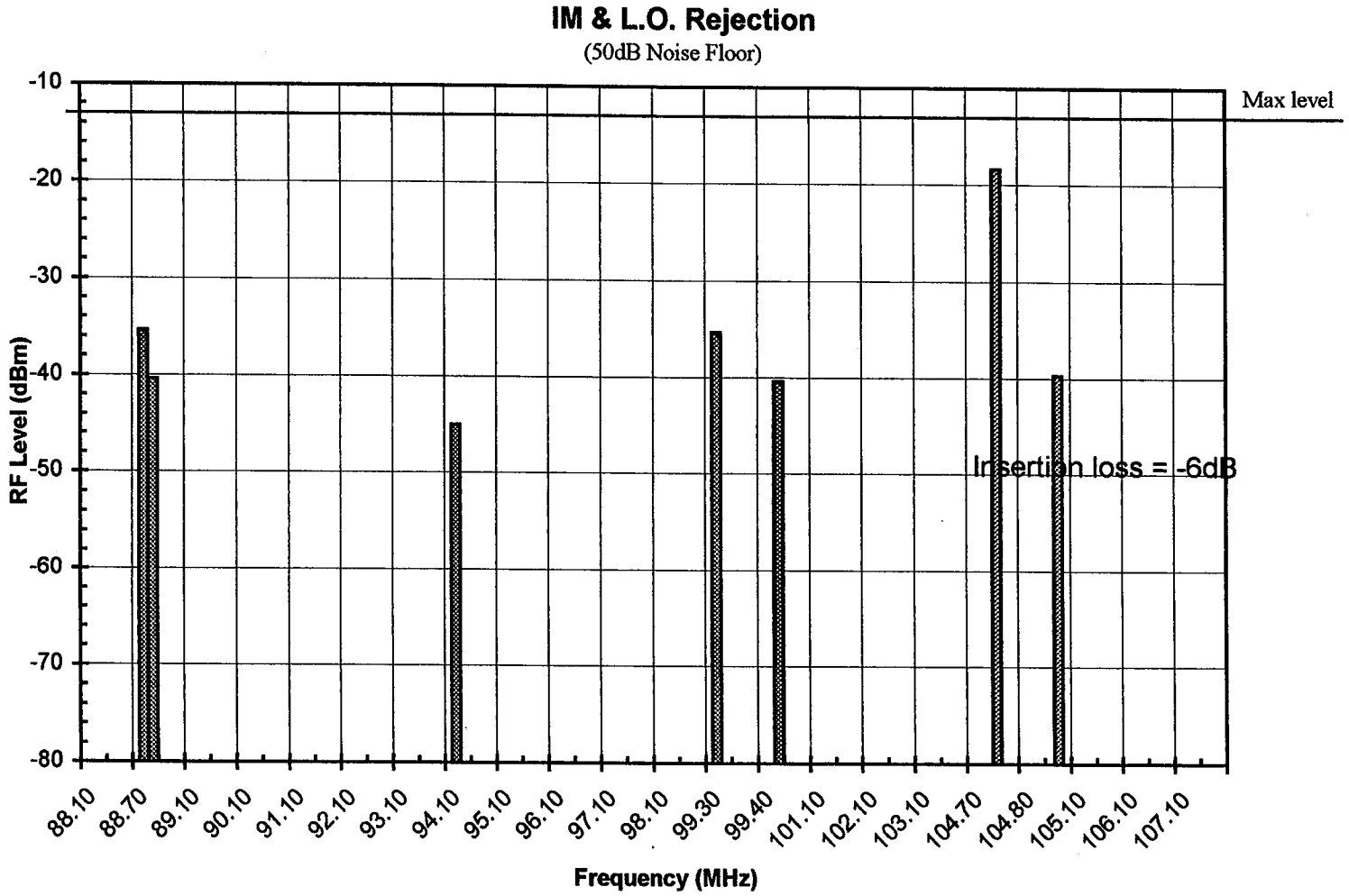
Sony SRF-M40W

293

FM Receiver Test Laboratory



Sony SRF-M40W



Sony SRF-M40W

295

Receiver #10

Technics

Home HiFi

FM Receiver Test Laboratory

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
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

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)

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 _____ 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	0.315	**Vrms**	= 0dB	**Level**	0.310	**Vrms**
THD	0.26	**%**		**THD**	0.26	**%**

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 0.4

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	0.26	%	=	-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, 1kHz, 75kHz Dev, Mono
Adjust: Set Radio audio to Std. Ref. Level (0dB)
Decrease RF Level until S/N Ratio = 30dB, record RF Levl
Tune RF Gen to; Desired Freq. +/- 2 X IF Freq.
Adjust RF Level until S/N Ratio = 30dB, record RF Lev2

Measurement:

RF Levl	-110.0	dBm	(S/N Ratio = 30dB)
RF Lev2	-66.0	dBm	(21.4MHz + 94.1MHz = 115.5MHz)
Image Rejection:	-44.00	dB	(RF Levl - RF Lev2)

298

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

RF Level dBm	Mono (L)		Stereo (L)			Separation L->R		RF Level dBm
	Signal dB	Noise dB	Signal dB	Filt. Noise dB	Noise dB	Left dB	Right dB	
-130	-20.00	-20.00	-19.00	-19.50		-19.00	-19.50	-130
-125	-19.50	-20.50	-19.00	-19.50		-19.00	-19.50	-125
-120	-17.00	-21.50	-17.00	-20.50		-18.00	-18.50	-120
-115	-11.00	-25.00	-11.00	-23.00		-14.00	-14.50	-115
-110	-4.00	-34.00	-4.00	-31.50		-8.50	-9.00	-110
-105	0.00	-47.00	0.00	-45.50		-6.00	-6.00	-105
-100	0.00	-53.00	0.00	-52.00		-6.00	-6.00	-100
-95	0.00	-58.00	0.00	-57.00		-6.00	-6.00	-95
-90	0.00	-64.00	0.00	-40.50		0.00	-35.00	-90
-85	0.00	-68.00	0.00	-45.50		0.00	-35.00	-85
-80	0.00	-68.00	0.00	-50.50		0.00	-35.00	-80
-75	0.00	-68.00	0.00	-55.00		0.00	-35.00	-75
-70	0.00	-68.00	0.00	-60.00		0.00	-35.50	-70
-65	0.00	-68.00	0.00	-65.00		0.00	-36.00	-65
-60	0.00	-68.00	0.00	-67.00		0.00	-36.00	-60
-55	0.00	-68.00	0.00	-68.00		0.00	-36.00	-55
-50	0.00	-68.00	0.00	-68.00		0.00	-36.00	-50
-45	0.00	-68.00	0.00	-68.00	-36.50	0.00	-36.00	-45

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 -52.00 dBm

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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-50.32	-4.68	-50.32	-4.68	
Undesired Lower Lev	-47.92	-7.08	-47.92	-7.08	
Selectivity, 1st Adj.:		-5.88		-5.88	(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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	8.08	-63.08	7.08	-62.08	
Undesired Lower Lev	8.08	-63.08	5.08	-60.08	
Selectivity, 2nd Adj.:	Max RF	-63.08		-61.08	(RF D/U Up + RF D/U Lo)/2

300

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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-50.92	-4.08	-64.92	9.92	
Undesired Lower Lev	-51.12	-3.88	-61.92	6.92	
Selectivity, 1st Adj.:		-3.98		8.42	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	3.38	-58.38	-7.92	-47.08	
Undesired Lower Lev	3.08	-58.08	-8.92	-46.08	
Selectivity, 2nd Adj.:		-58.23		-46.58	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	8.08	-63.08	-7.92	-47.08	
Undesired Lower Lev	-5.62	-49.38	-8.92	-46.08	
Selectivity, 3rd Adj.:		-56.23		-46.58	(RF D/U Up + RF D/U Lo)/2

301

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 -25.50 dBm EOC
D/U -83.50 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	D/U	dBm	D/U
-45.00		-45.00	
-27.37	-17.63	-27.37	-17.63
	-17.63		-17.63

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

10.6MHz Spacing		10.7MHz Spacing	
dBm	D/U	dBm	D/U
-45.00		-45.00	
-30.37	-14.63	-34.37	-10.63
	-14.63		-10.63

EOC:

302

FM Receiver Test Laboratory

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 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:**
104.756 MHz

2 **Standard Audio Output:**

Left Channel		THD		Right Channel		THD	
0.315	Vrms	0.26	%	0.31	Vrms	0.26	%

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

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

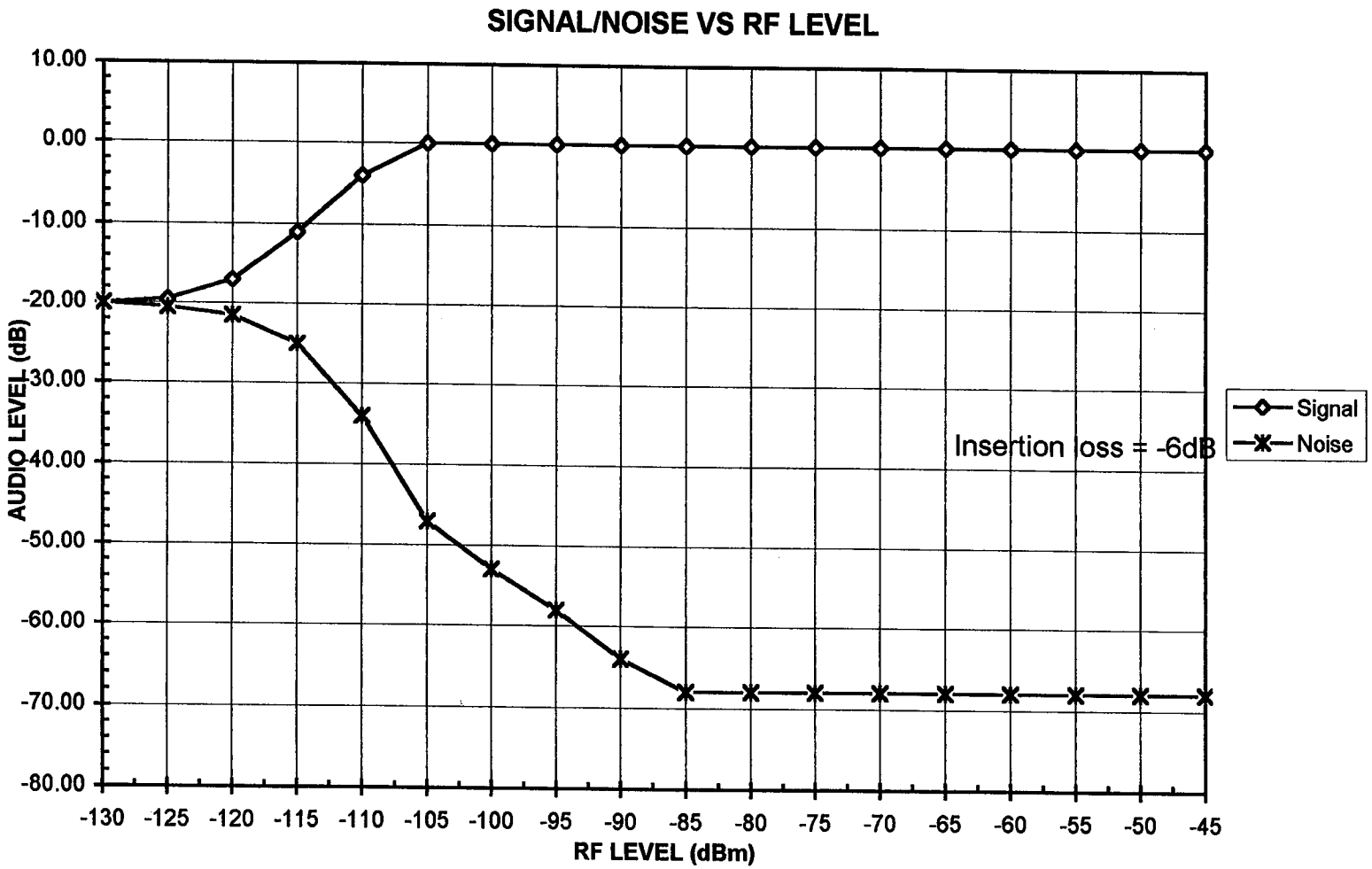
12 **Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)**
-56.23 dB Mono
-46.58 dB Stereo

13 **10.7MHz Rejection**
-83.50 dB 0

14 **10.7MHz IM**
-17.63 dB (10.6) Raspy noise
-17.63 dB (10.7) 0

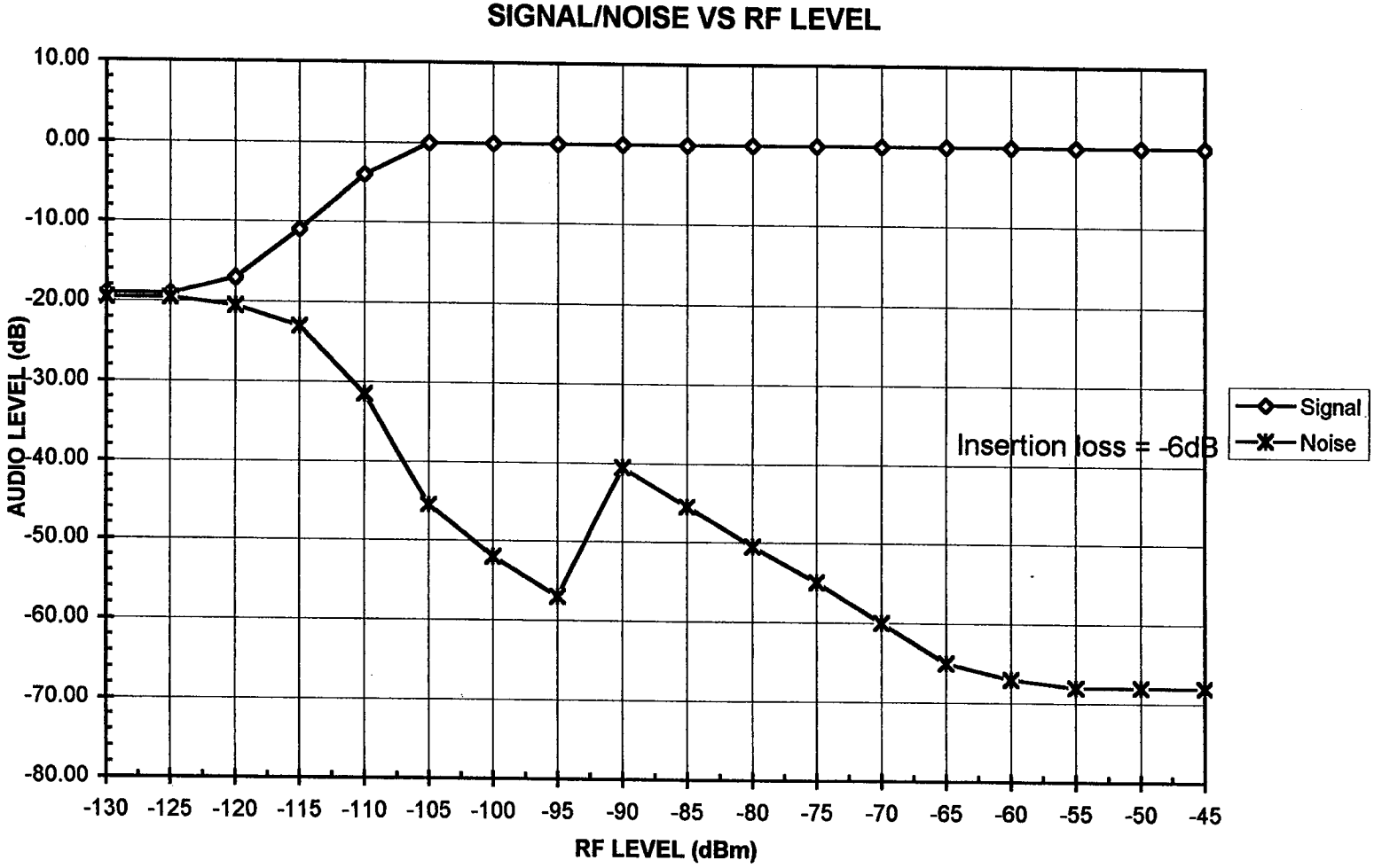
15 **10.7MHz Spurious (Local Osc. Interference)**
-14.63 dB (10.6) 0
-10.63 dB (10.7) 0

304



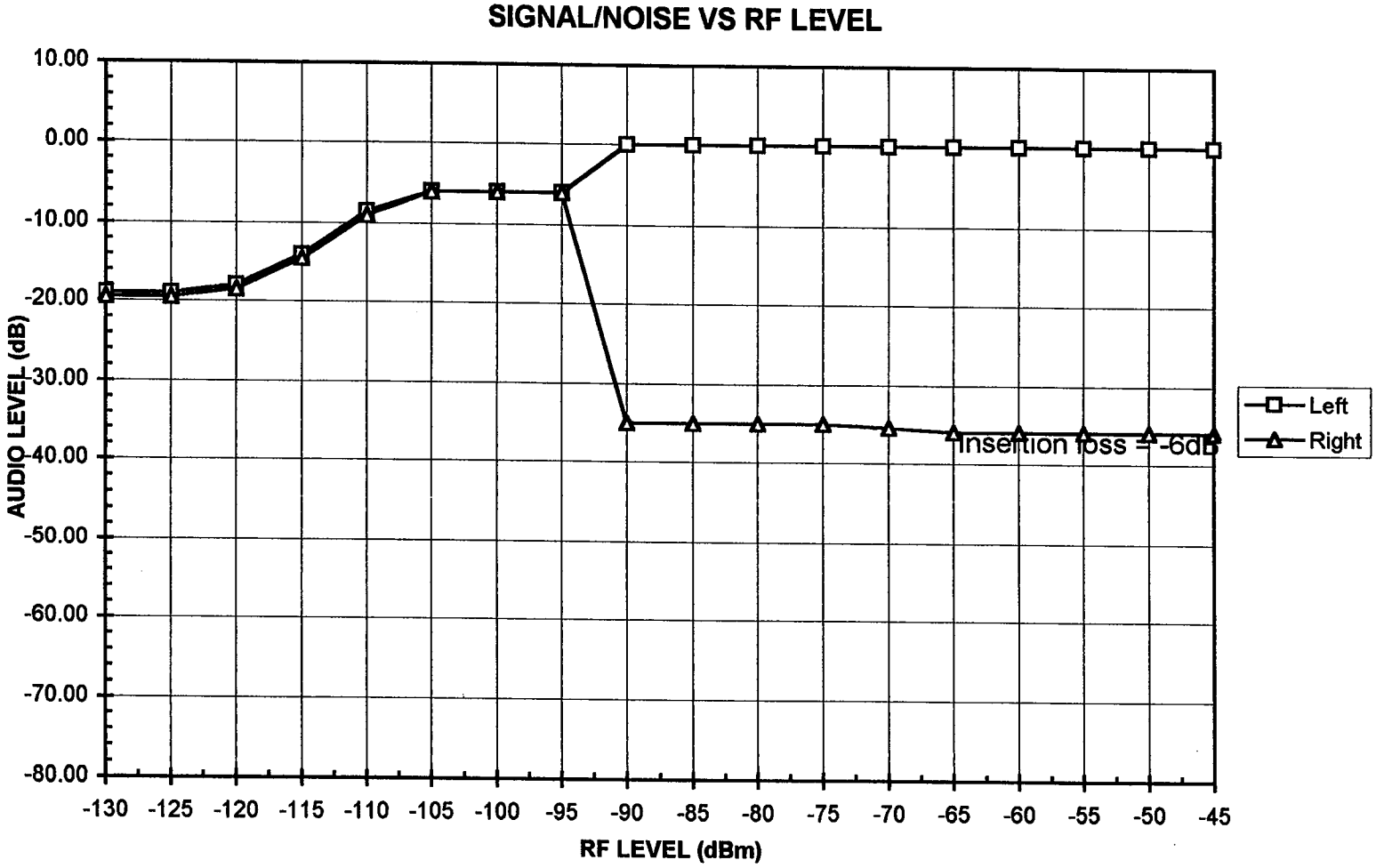
Technics SA-EX110

FM Receiver Test Laboratory



Technics SA-EX110

FM Receiver Test Laboratory



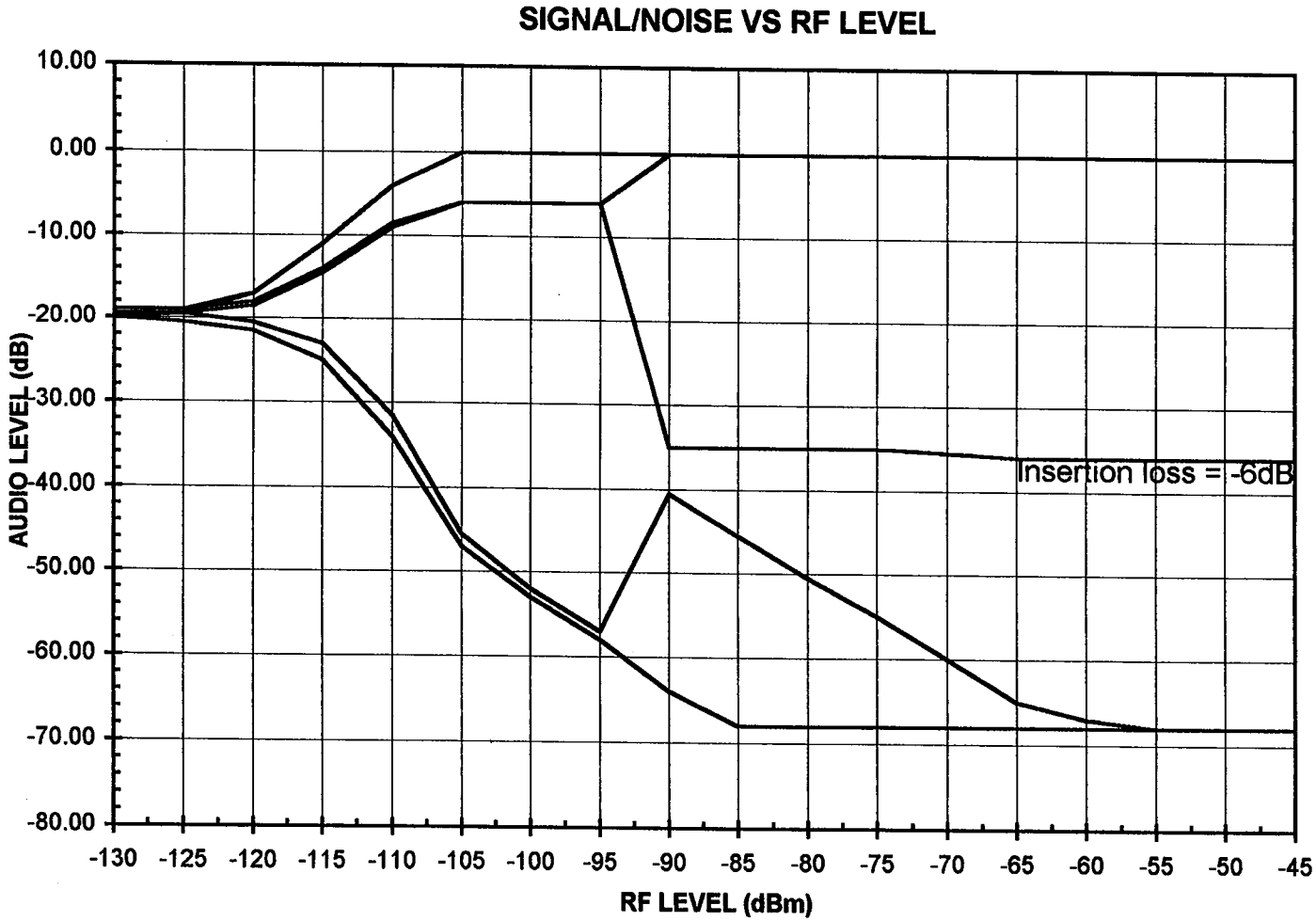
Technics SA-EX110

Lot

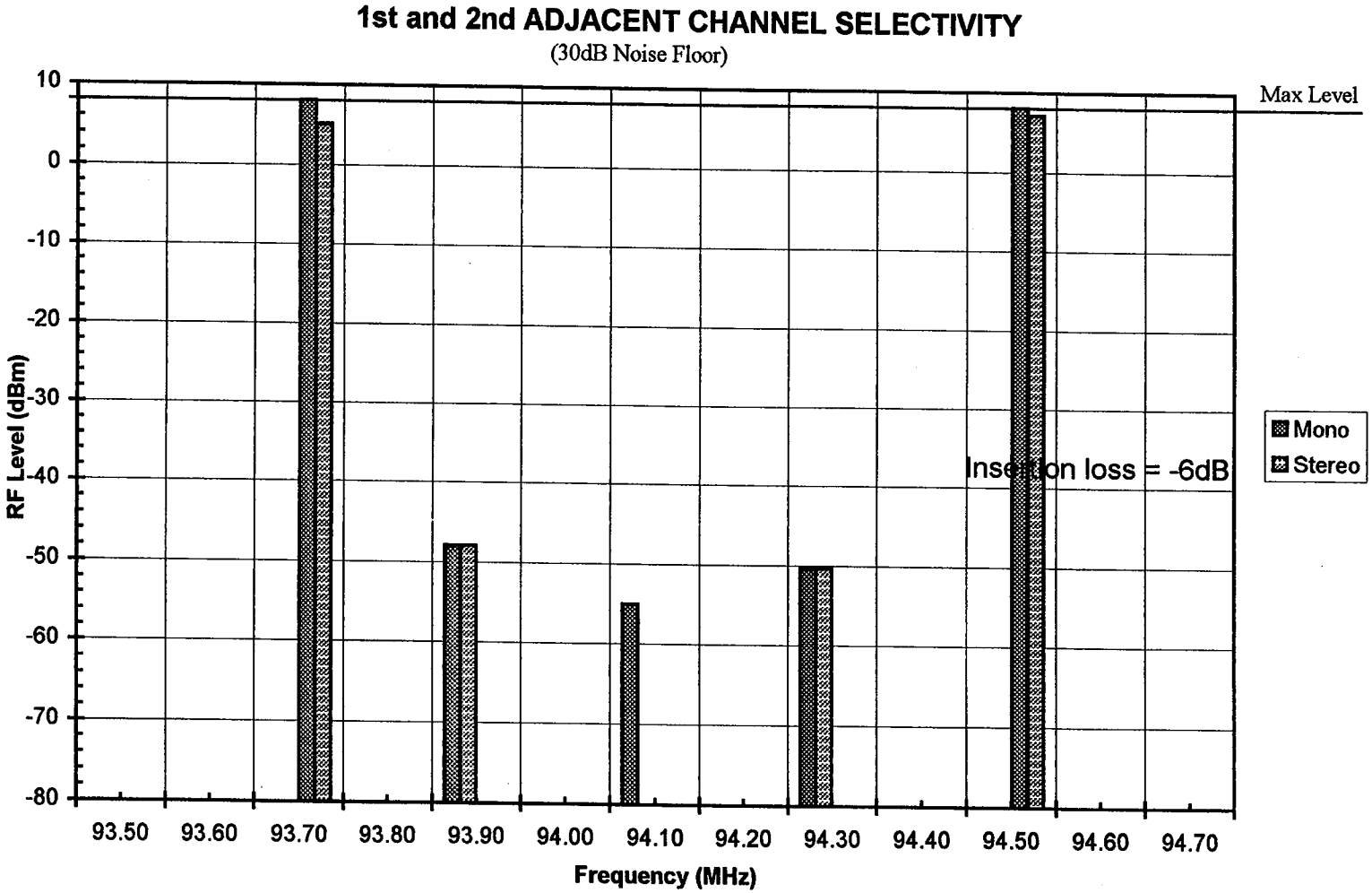
File Name: C_tech

FM Stereo Separation Plot

FM Receiver Test Laboratory

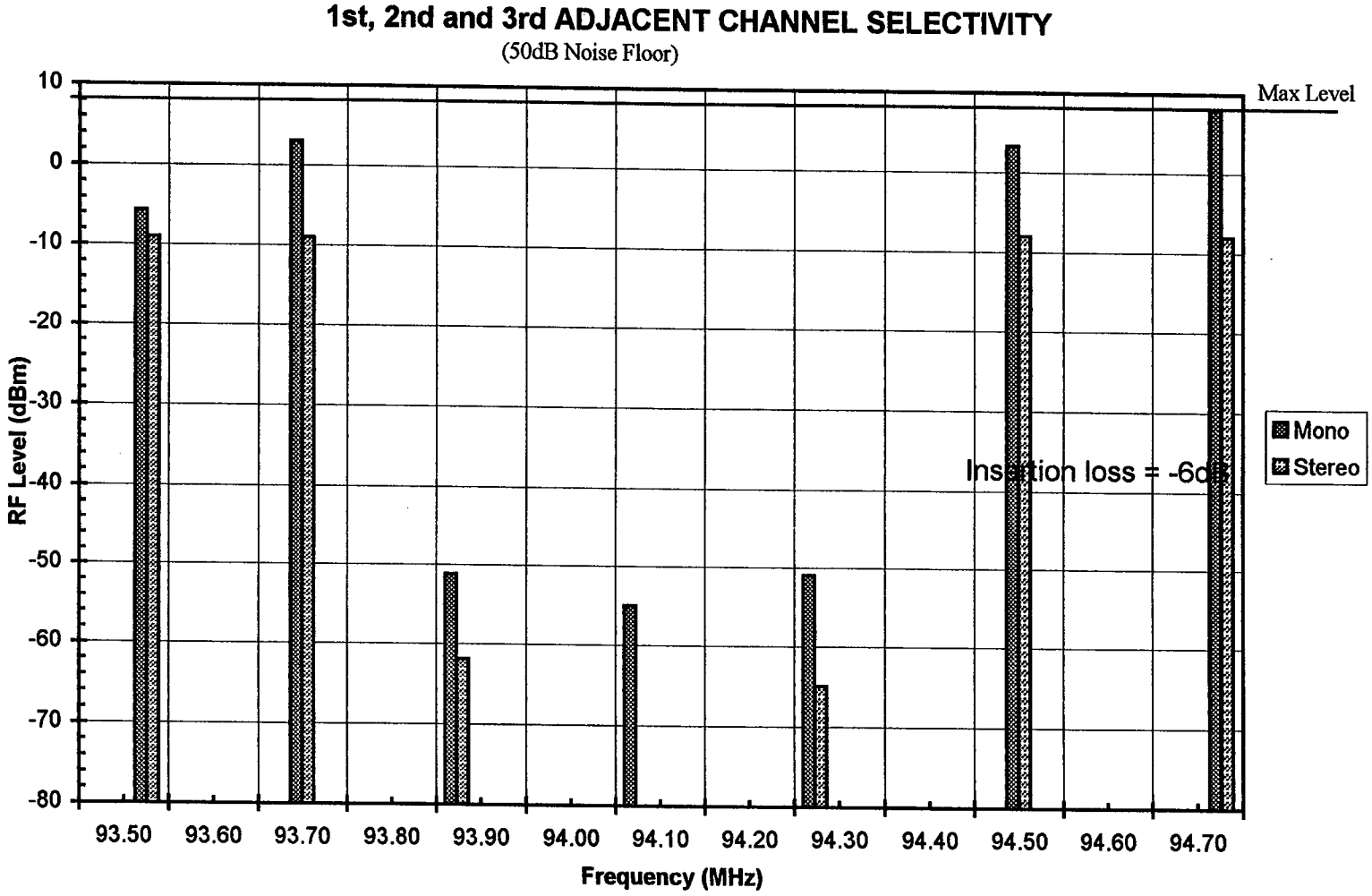


Technics SA-EX110

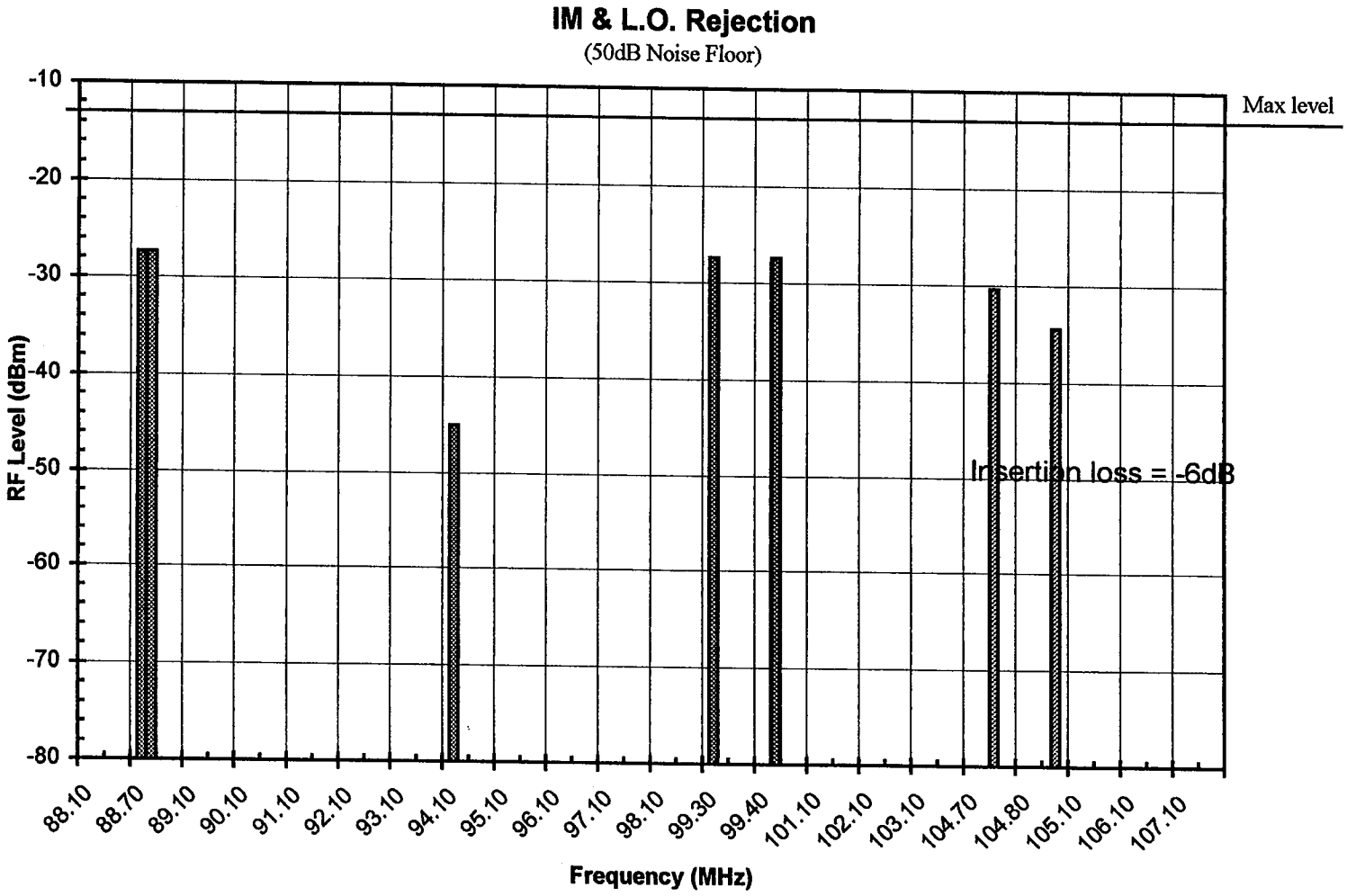


Technics SA-EX110

FM Receiver Test Laboratory



Technics SA-EX110



Technics SA-EX110

Receiver #11

Sanyo

Portable

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-S736
Serial: 8701316

Antenna Network: 50/75 Ohm Trans. FM
AM

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

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

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 _____ 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	0.84	**Vrms**	= 0dB	**Level**	0.84	**Vrms**
THD	0.4	**%**		**THD**	0.35	**%**

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	0.4	%	=	-47.96	dB	(FM Only)
THD	0.4	%	=	-47.96	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 Levl
Tune RF Gen to; Desired Freq. +/- 2 X IF Freq.
Adjust RF Level until S/N Ratio = 30dB, record RF Lev2

Measurement:

RF Levl	-95	dBm	(S/N Ratio = 30dB)
RF Lev2	-75	dBm	(21.4MHz + 94.1MHz = 115.5MHz)
Image Rejection:	-20.0	dB	(RF Levl - RF Lev2)

714

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

RF Level dBm	Mono (L)		Stereo (L)			Separation L->R		RF Level dBm
	Signal dB	Noise dB	Signal dB	Filt. Noise dB	Noise dB	Left dB	Right dB	
-130	-29.50	-29.50	-29.00	-29.00		-28.50	-28.50	-130
-125	-29.50	-29.50	-29.00	-29.00		-28.50	-28.50	-125
-120	-29.50	-29.50	-28.50	-29.00		-28.50	-28.50	-120
-115	-28.00	-28.00	-27.50	-28.00		-27.50	-27.50	-115
-110	-24.00	-27.00	-23.50	-26.50		-25.00	-25.50	-110
-105	-16.00	-25.50	-16.00	-24.50		-20.00	-20.00	-105
-100	-8.00	-26.00	-8.00	-25.00		-13.00	-13.00	-100
-95	-2.00	-33.00	-2.00	-32.00		-7.50	-8.00	-95
-90	-0.25	-47.50	-0.25	-30.50		0.00	-29.00	-90
-85	0.00	-55.00	0.00	-35.50		0.00	-34.00	-85
-80	0.00	-58.50	0.00	-40.50		0.00	-37.00	-80
-75	0.00	-60.00	0.00	-45.50		0.00	-39.00	-75
-70	0.00	-61.50	0.00	-50.00		0.00	-39.50	-70
-65	0.00	-62.00	0.00	-54.00		0.00	-40.00	-65
-60	0.00	-62.00	0.00	-57.50		0.00	-40.00	-60
-55	0.00	-62.00	0.00	-59.00		0.00	-40.00	-55
-50	0.00	-62.00	0.00	-60.00		0.00	-40.00	-50
-45	0.00	-61.00	0.00	-59.50	-33.00	0.00	-40.00	-45

315

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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-54.92	-0.08	-55.92	0.92	
Undesired Lower Lev	-46.92	-8.08	-47.92	-7.08	
Selectivity, 1st Adj.:		-4.08		-3.08	(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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-30.12	-24.88	-30.12	-24.88	
Undesired Lower Lev	-25.92	-29.08	-25.92	-29.08	
Selectivity, 2nd Adj.:		-26.98		-26.98	(RF D/U Up + RF D/U Lo)/2

316

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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-57.42	2.42	-76.92	21.92	
Undesired Lower Lev	-48.02	-6.98	-69.92	14.92	
Selectivity, 1st Adj.:		**-2.28**		**18.42**	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-31.42	-23.58	-45.92	-9.08	
Undesired Lower Lev	-33.02	-21.98	-33.32	-21.68	
Selectivity, 2nd Adj.:		**-22.78**		**-15.38**	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-25.82	-29.18	-26.22	-28.78	
Undesired Lower Lev	-29.32	-25.68	-29.42	-25.58	
Selectivity, 3rd Adj.:		**-27.43**		**-27.18**	(RF D/U Up + RF D/U Lo)/2

317

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 -94.00 dBm
RF Lev 2 -0.60 dBm EOC
D/U -93.40 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	D/U	dBm	D/U
-45.00		-45.00	
-25.37	-19.63	-27.37	-17.63
	-19.63		-17.63

Desired: -55.00
RF Lev 1 -29.37
RF Lev 2 -30.37

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

10.6MHz Spacing		10.7MHz Spacing	
dBm	D/U	dBm	D/U
-45.00		-45.00	
-58.14	13.14	-62.14	17.14
	13.14		17.14

Desired: -55.00
RF Lev 1 -58.14

EOC: Objectionable beat notes

318

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-S736
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
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:**
104.821 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 Plots)

7 **Capture Ratio:**
-6.50 dB

8 **Selectivity, First Adjacent, 30dB Noise Floor (Ave. D/U)**
-4.08 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

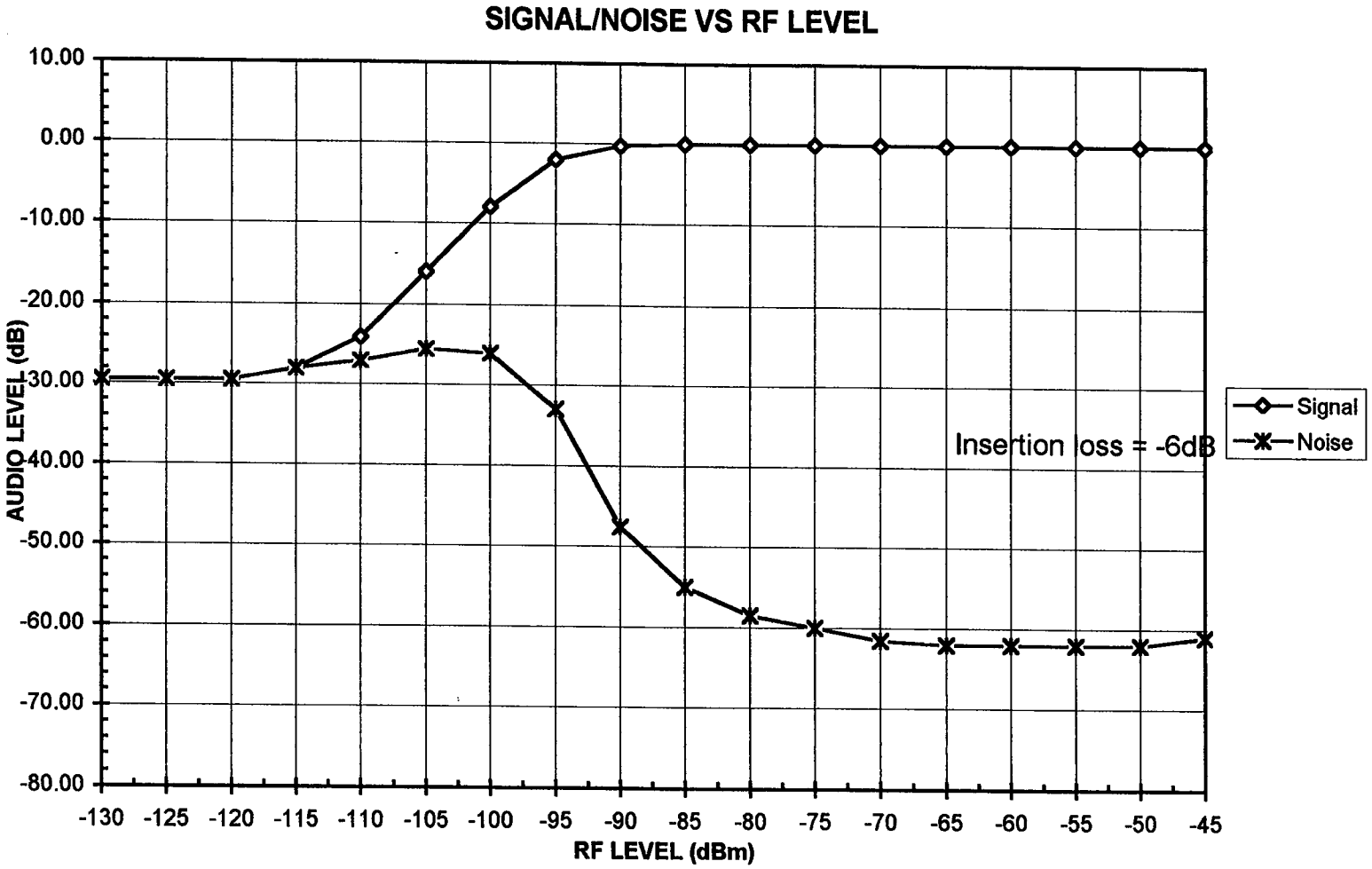
13 **10.7MHz Rejection**
-93.40 dB 0

14 **10.7MHz IM**
-19.63 dB (10.6) Hiss
-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

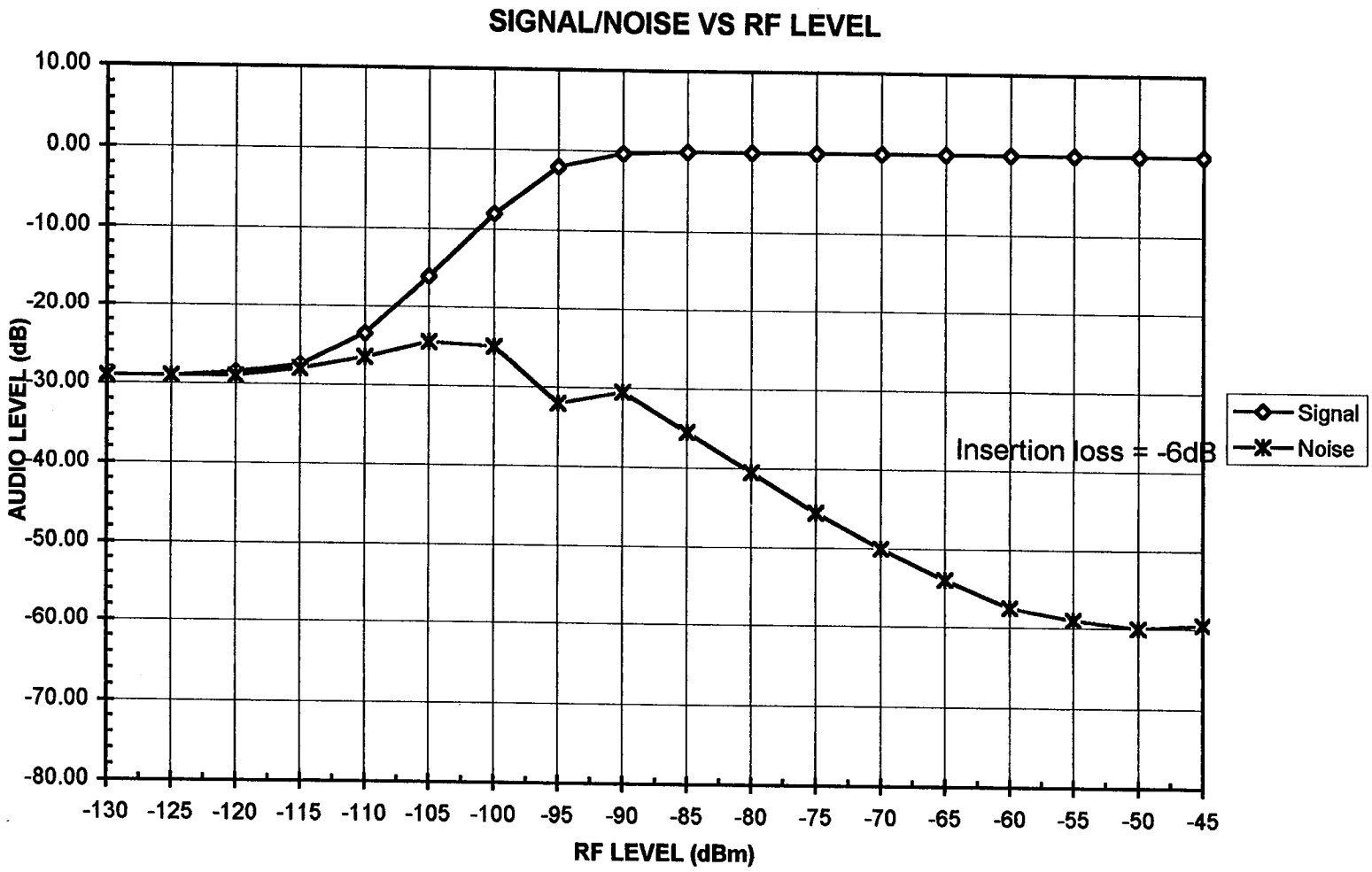
320

FM Receiver Test Laboratory



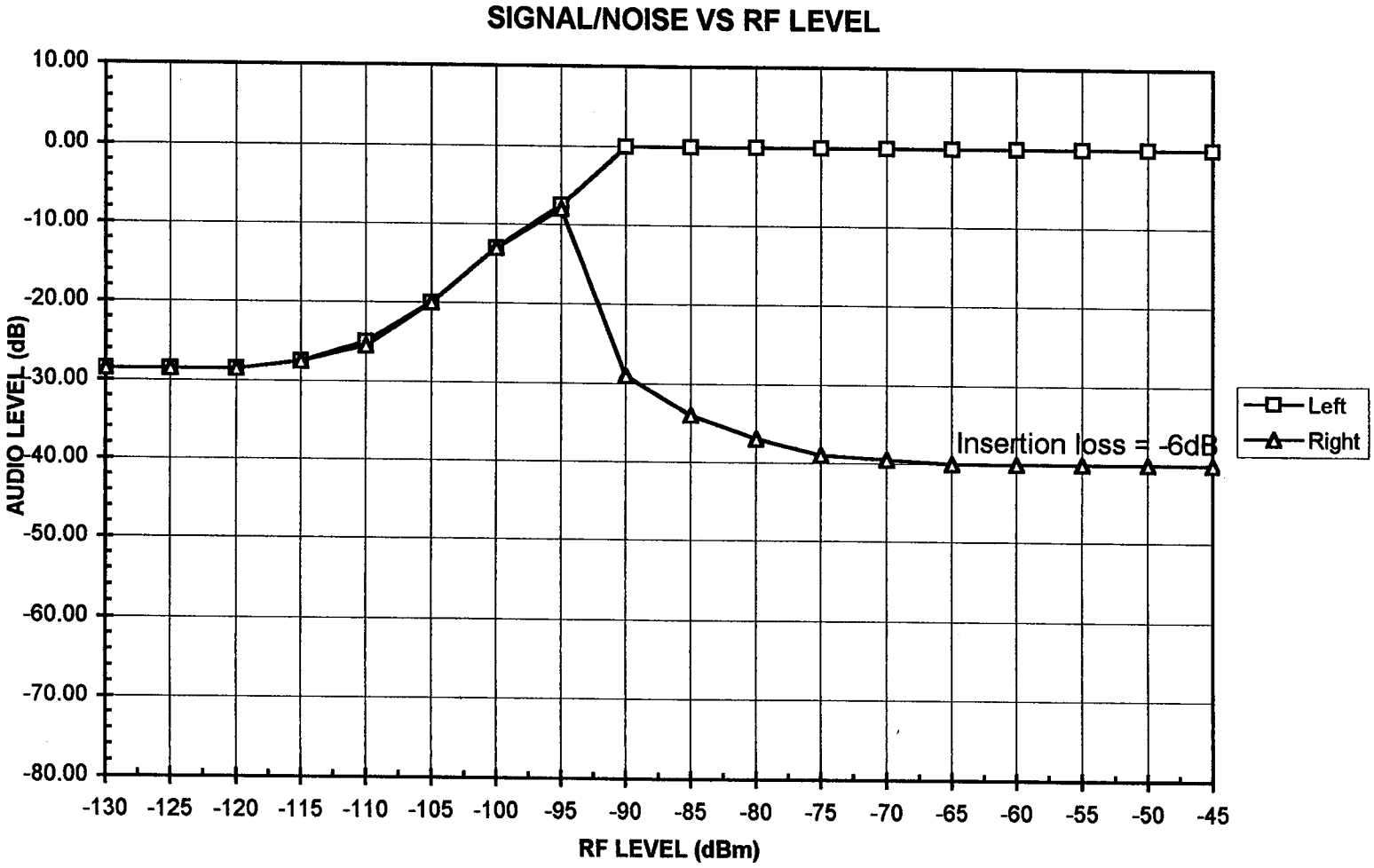
Sanyo MCD-S736

FM Receiver Test Laboratory



Sanyo MCD-S736

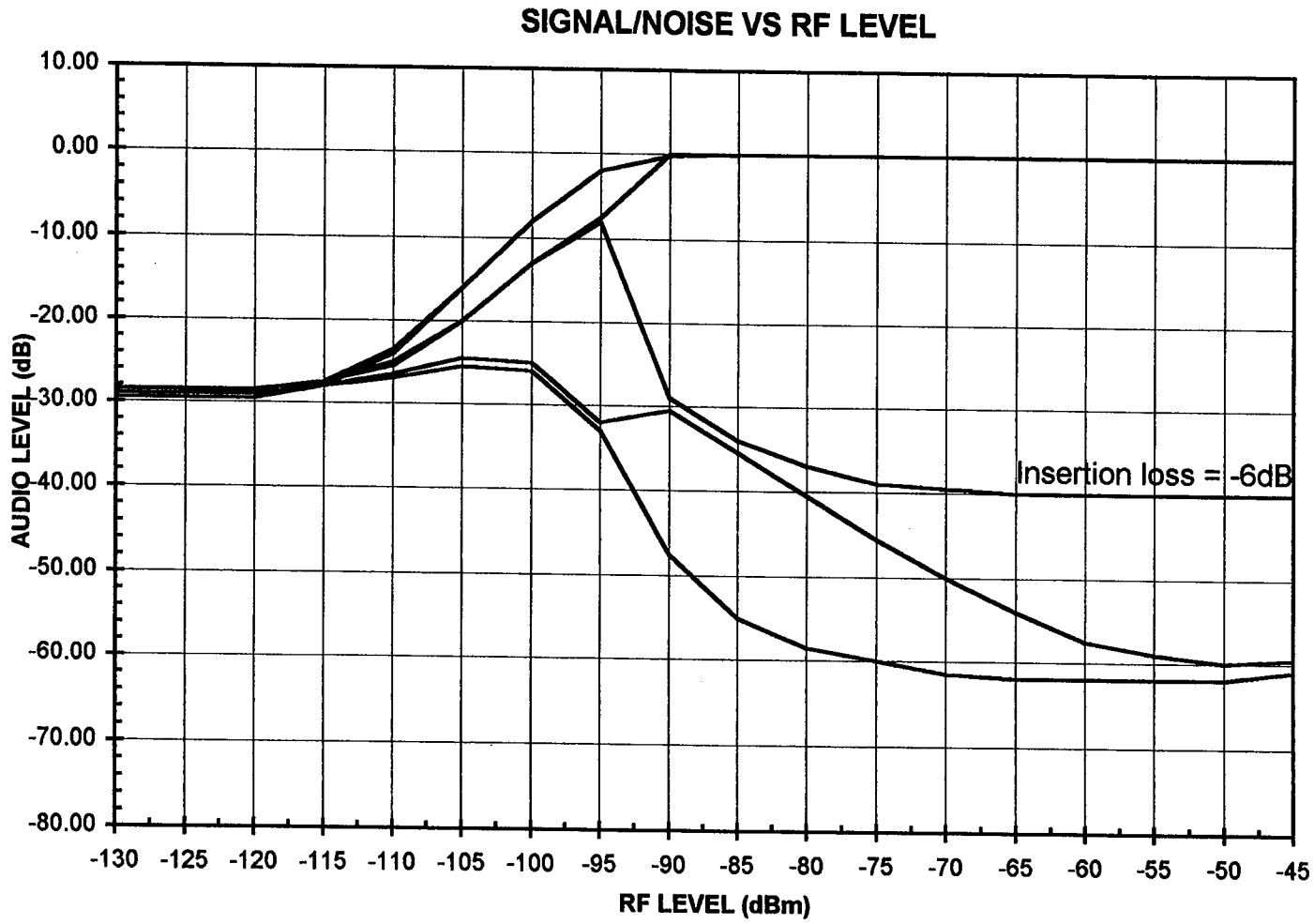
FM Receiver Test Laboratory



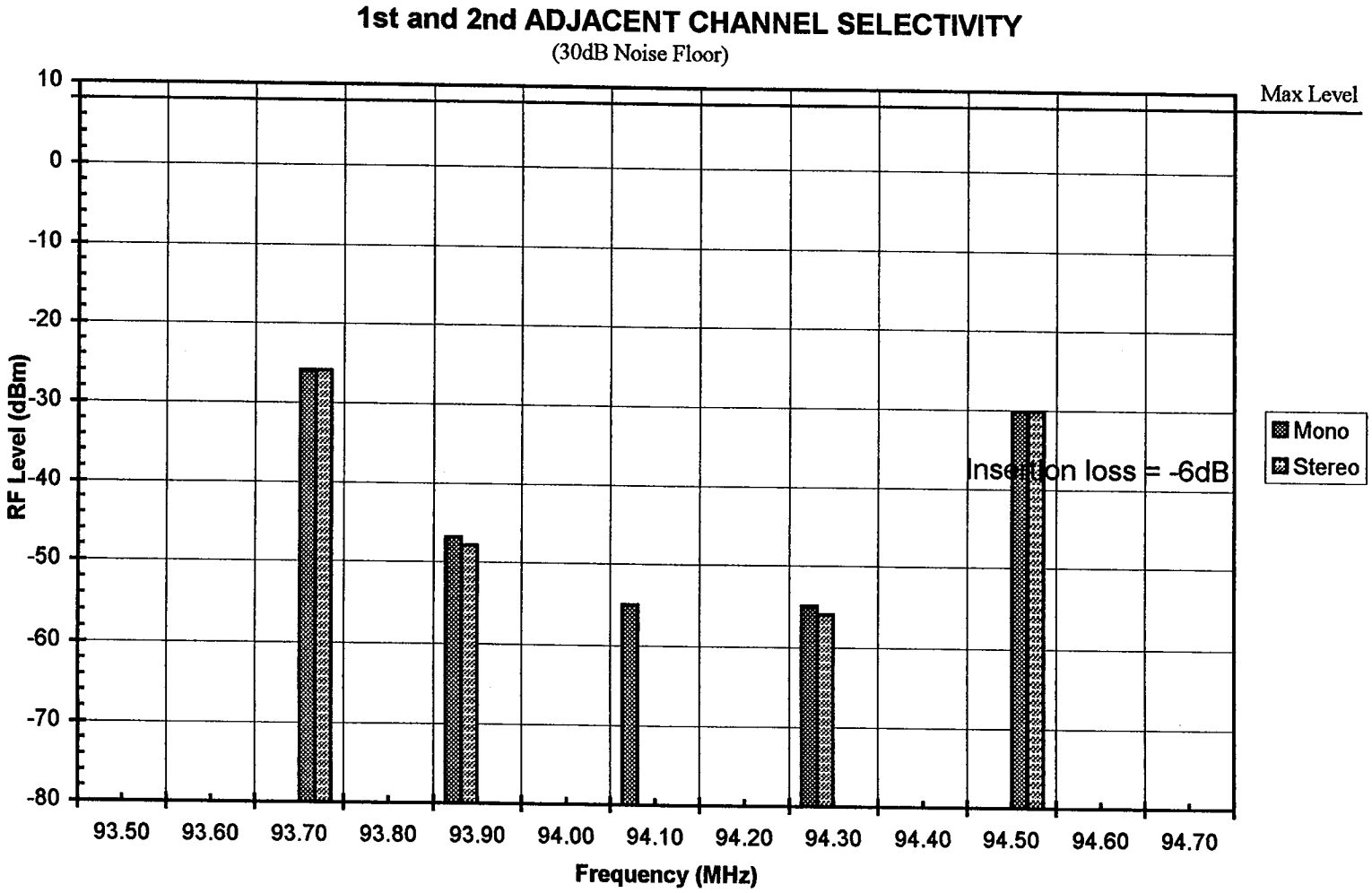
Sanyo MCD-S736

323

FM Receiver Test Laboratory

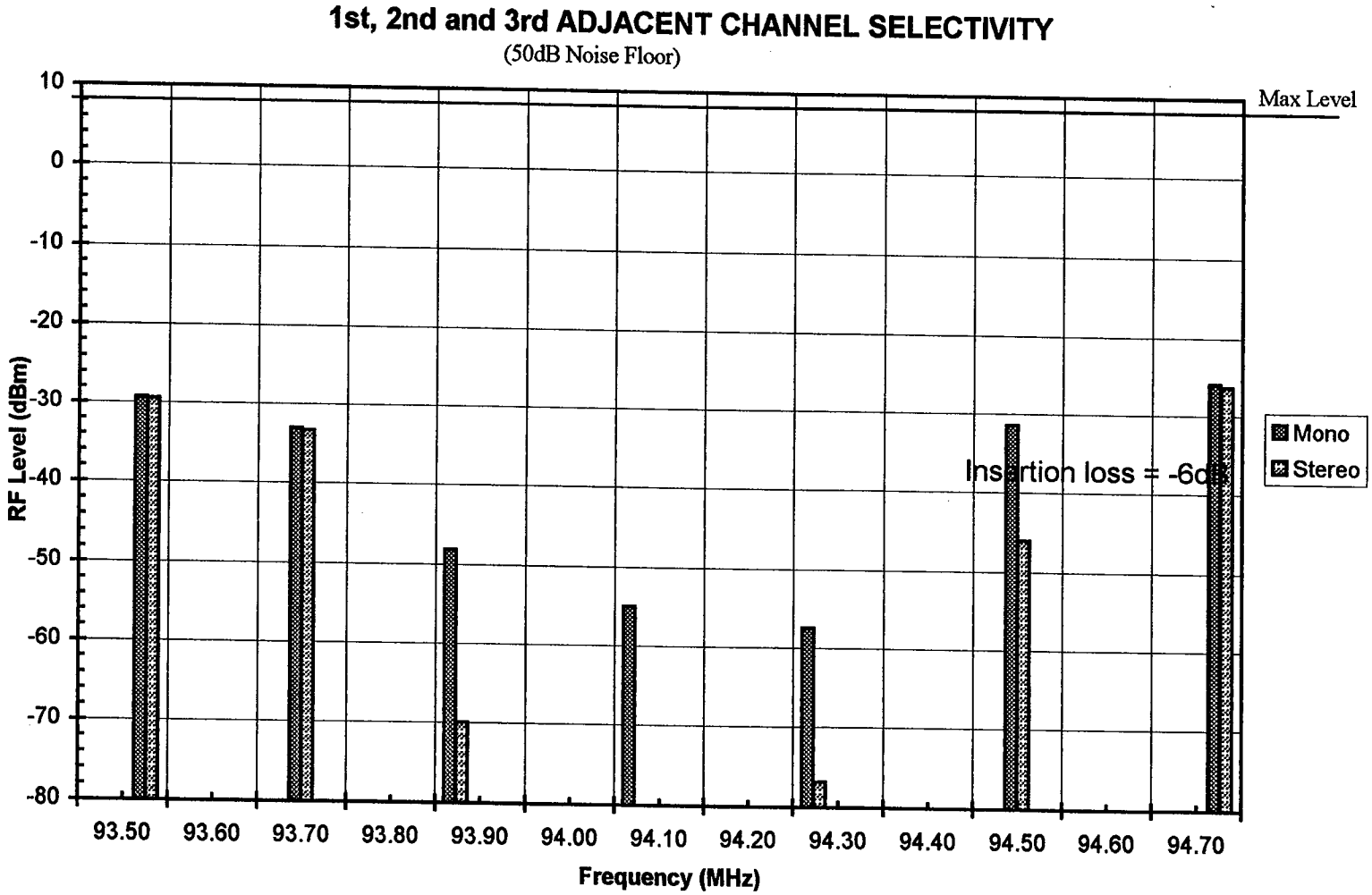


Sanyo MCD-S736

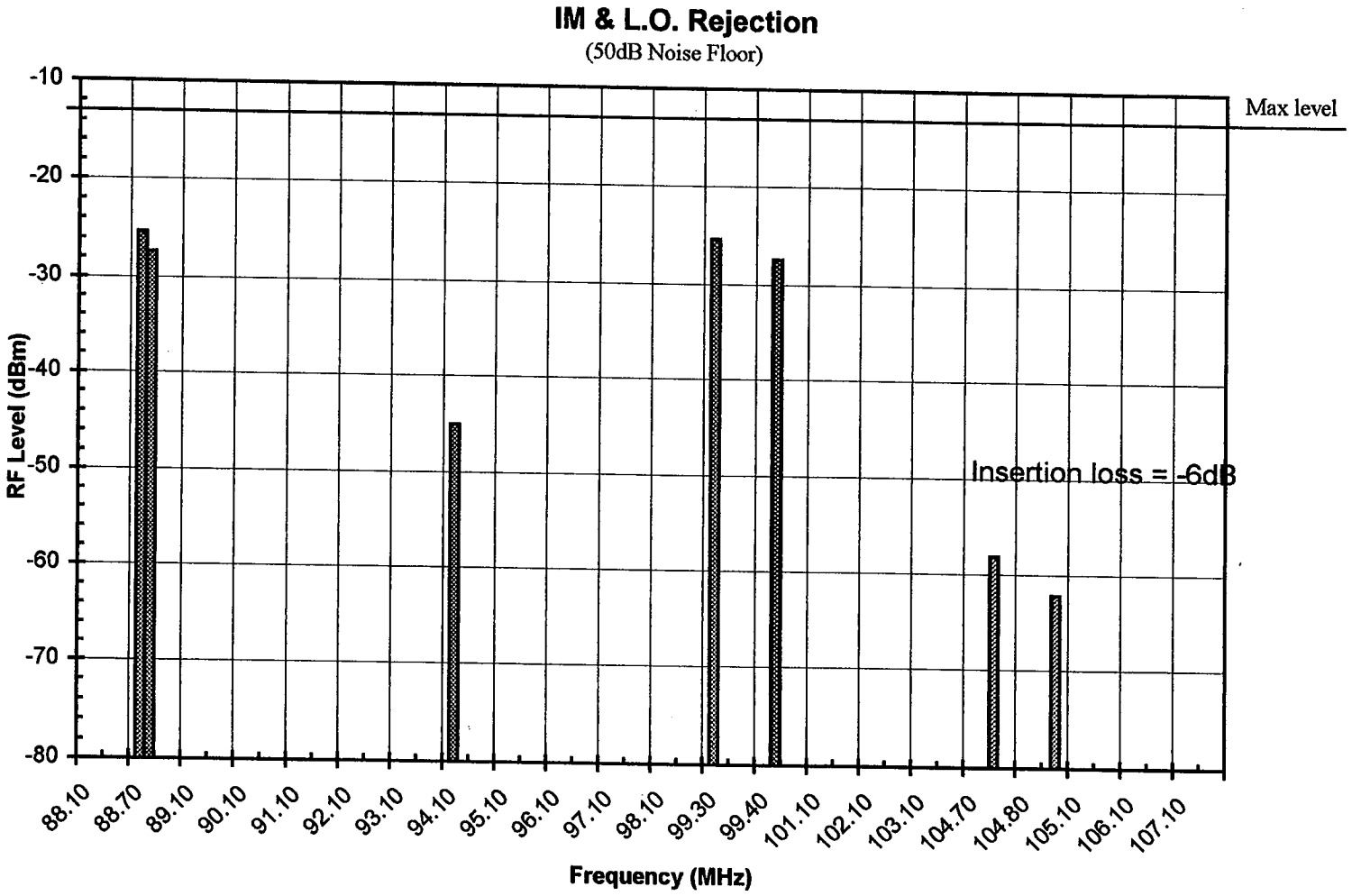


Sanyo MCD-S736

S26



Sanyo MCD-S736



Sanyo MCD-S736

Receiver #12

Sony

Portable

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
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: Modified with F connector antenna input
Mono/Stereo switch in Stereo
Audio output; Headphone output

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

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			Right Ch	
Level	0.745	**Vrms**	= 0dB	**Level** 0.765	**Vrms**
THD	3.40	**%**		**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)

3.30

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

RF Level dBm	Mono (L) Signal dB	Mono (L) Noise dB	Stereo (L) Signal dB	Stereo (L) Filt. Noise dB	Stereo (L) Noise dB	Separation L->R Left dB	Separation L->R Right dB	RF Level dBm
-130	-36.00	-36.00	-35.00	-35.00		-35.00	-34.50	-130
-125	-36.00	-36.00	-35.00	-35.00		-35.00	-34.50	-125
-120	-35.00	-36.00	-34.00	-35.00		-35.00	-34.50	-120
-115	-31.00	-35.50	-30.50	-34.50		-33.00	-32.50	-115
-110	-23.00	-35.00	-22.50	-34.00		-27.00	-26.50	-110
-105	-14.00	-34.50	-13.50	-33.50		-19.00	-18.50	-105
-100	-6.50	-35.50	-6.00	-34.50		-12.00	-11.50	-100
-95	-2.00	-42.00	-1.50	-41.50		-7.50	-7.00	-95
-90	-0.30	-54.00	-0.20	-36.00		-0.20	-32.50	-90
-85	0.00	-59.00	0.00	-40.50		0.00	-33.00	-85
-80	0.00	-61.00	0.00	-45.50		0.00	-34.00	-80
-75	0.00	-61.50	0.00	-50.00		0.00	-34.20	-75
-70	0.00	-61.50	0.00	-54.00		0.00	-34.50	-70
-65	0.00	-61.50	0.00	-57.00		0.00	-35.00	-65
-60	0.00	-61.50	0.00	-59.00		0.00	-35.00	-60
-55	0.00	-61.50	0.00	-59.50		0.00	-35.00	-55
-50	0.00	-61.50	0.00	-59.50		0.00	-35.00	-50
-45	0.00	-61.00	0.00	-59.50	-34.00	0.00	-35.00	-45

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 -57.94 dBm
RF Lev 2 -49.94 dBm

Capture Ratio: -4.00 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 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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-58.32	3.32	-58.92	3.92	
Undesired Lower Lev	-54.72	0.28	-54.92	-0.08	
Selectivity, 1st Adj.:		1.52		1.92	(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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-15.92	-39.08	-16.92	-38.08	
Undesired Lower Lev	-15.52	-39.48	-16.12	-38.88	
Selectivity, 2nd Adj.:		-39.28		-38.48	(RF D/U Up + RF D/U Lo)/2

332

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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-66.72	11.72	-75.92	20.92	
Undesired Lower Lev	-66.22	11.22	-73.92	18.92	
Selectivity, 1st Adj.:		**11.47**		**19.92**	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-24.92	-30.08	-30.92	-24.08	
Undesired Lower Lev	-20.92	-34.08	-31.92	-23.08	
Selectivity, 2nd Adj.:		**-32.08**		**-23.58**	(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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-11.22	-43.78	-22.42	-32.58	
Undesired Lower Lev	-19.62	-35.38	-27.92	-27.08	
Selectivity, 3rd Adj.:		**-39.58**		**-29.83**	(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 -98.50 dBm
RF Lev 2 -47.00 dBm EOC
D/U -51.50 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	D/U	dBm	D/U
-45.00		-45.00	
-32.37	-12.63	-35.37	-9.63
	-12.63		-9.63

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

10.6MHz Spacing		10.7MHz Spacing	
dBm	D/U	dBm	D/U
-45.00		-45.00	
-52.37	7.37	-54.37	9.37
	7.37		9.37

EOC:

334

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 rms

Comments: Modified with F connector antenna input
Mono/Stereo switch in Stereo
Audio output; Headphone output
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		THD		Right Channel		THD	
0.745	Vrms	3.40	%	0.765	Vrms	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)**
1.52 dB Mono
1.92 dB Stereo

9 **Selectivity, Second Adjacent, 30dB Noise Floor (Ave. D/U)**
-39.28 dB Mono
-38.48 dB Stereo

10 **Selectivity, First Adjacent, 50dB Noise Floor (Ave D/U)**
11.47 dB Mono
19.92 dB Stereo

11 **Selectivity, Second Adjacent, 50dB Noise Floor (Ave. D/U)**
-32.08 dB Mono
-23.58 dB Stereo

12 **Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)**
-39.58 dB Mono
-29.83 dB Stereo

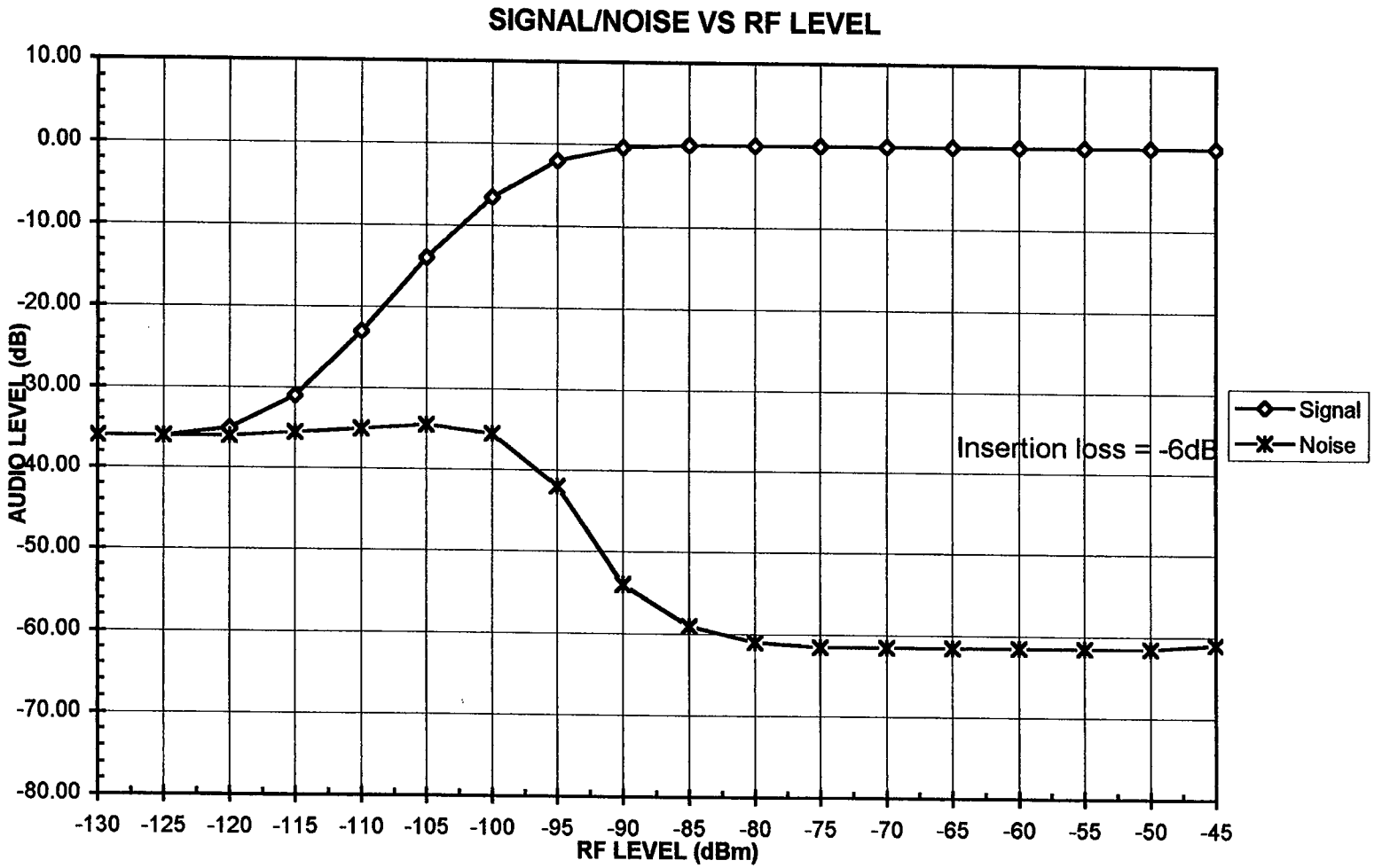
13 **10.7MHz Rejection**
-51.50 dB 0

14 **10.7MHz IM**
-12.63 dB (10.6) Hiss
-9.63 dB (10.7) 0

15 **10.7MHz Spurious (Local Osc. Interference)**
7.37 dB (10.6) 0
9.37 dB (10.7) 0

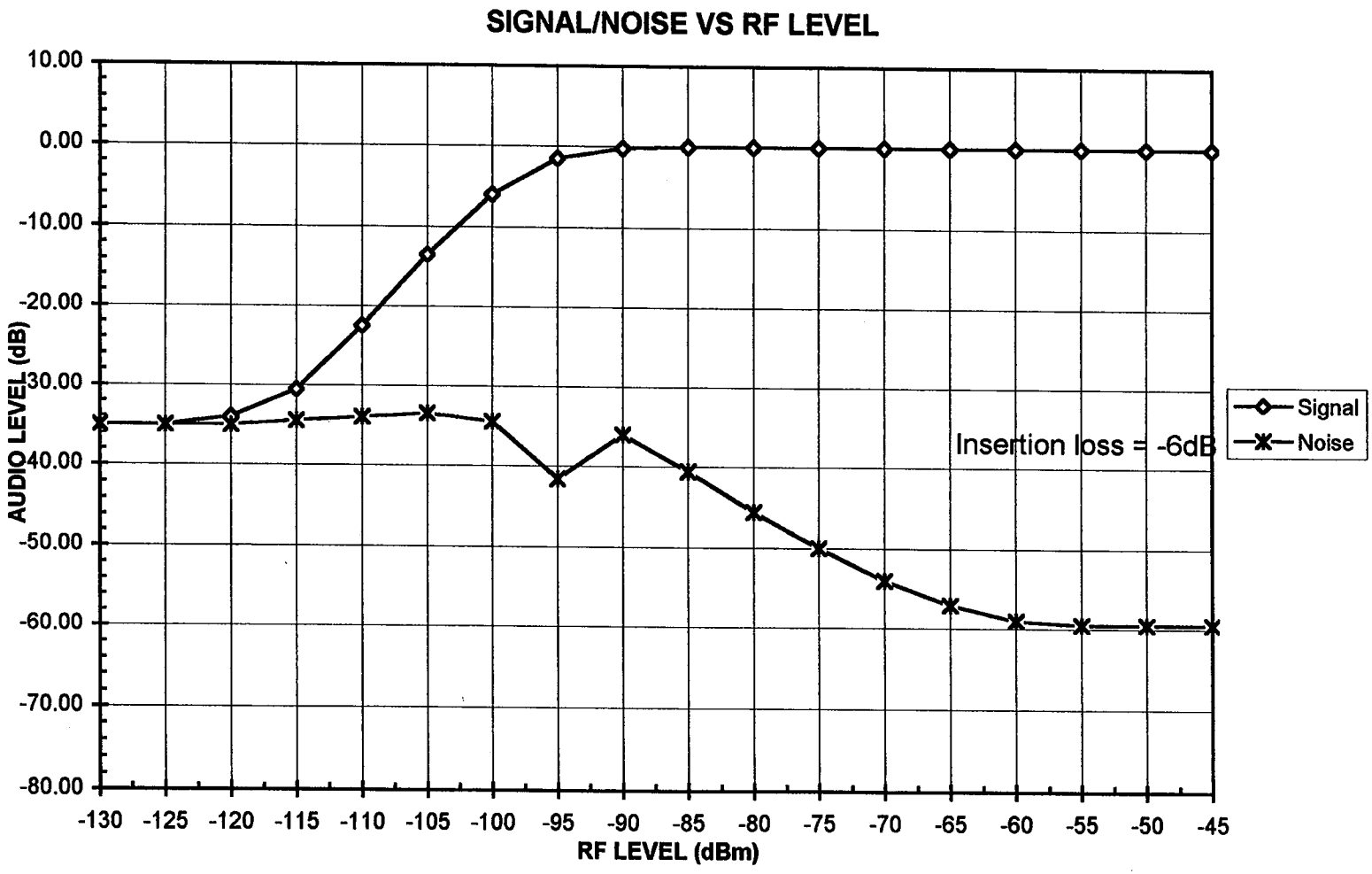
336

FM Receiver Test Laboratory

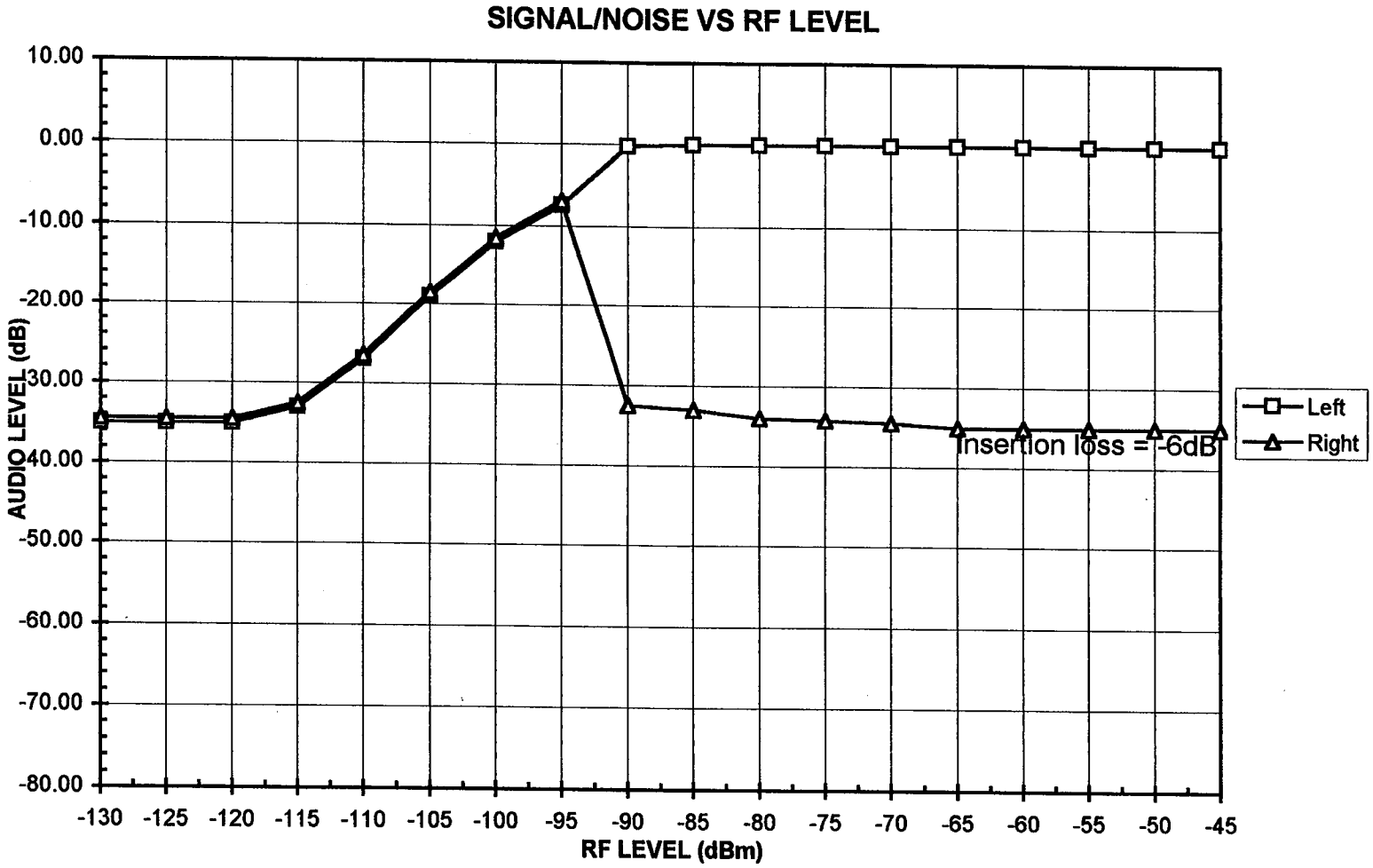


Sony CFD-S33

FM Receiver Test Laboratory

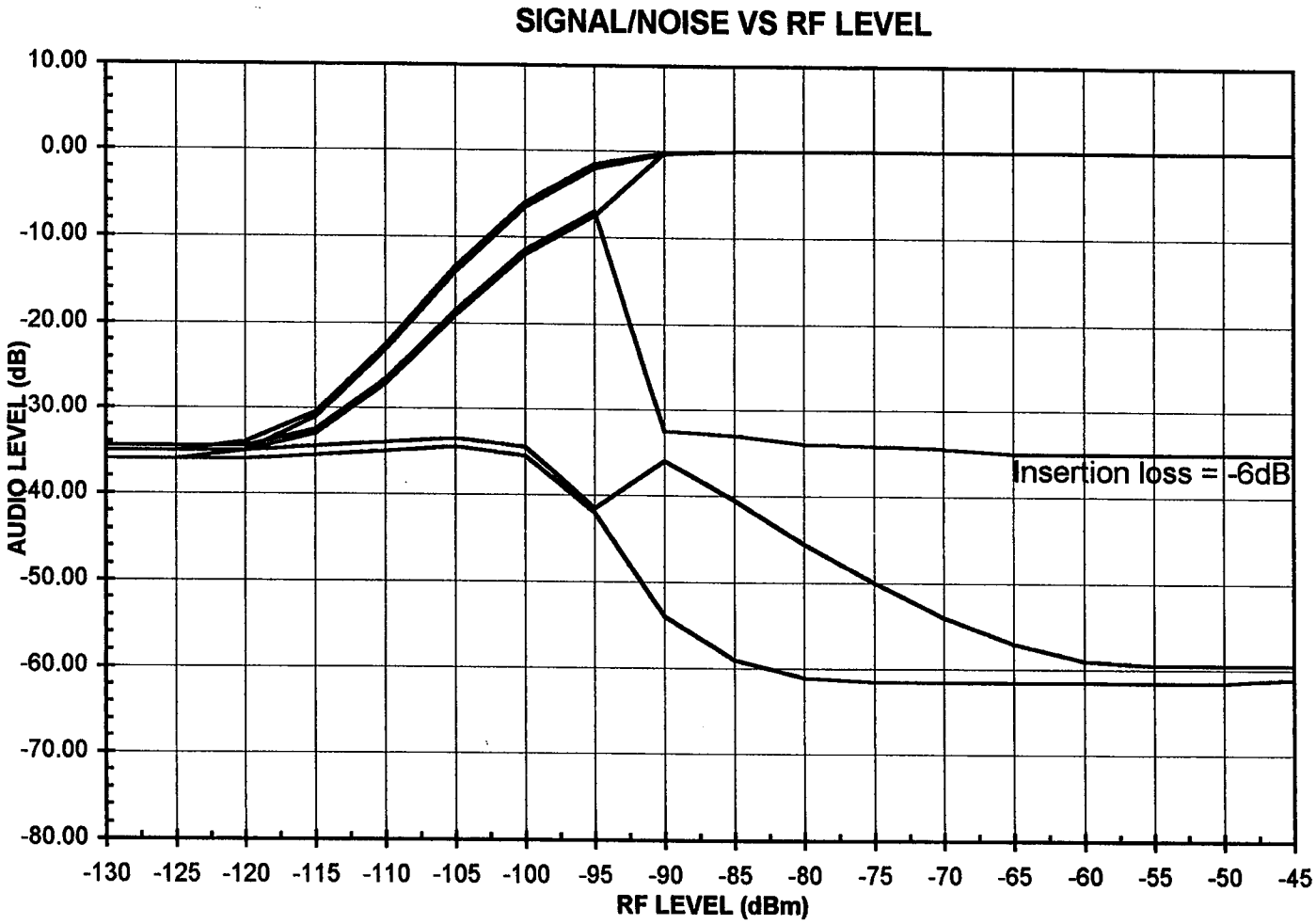


Sony CFD-S33

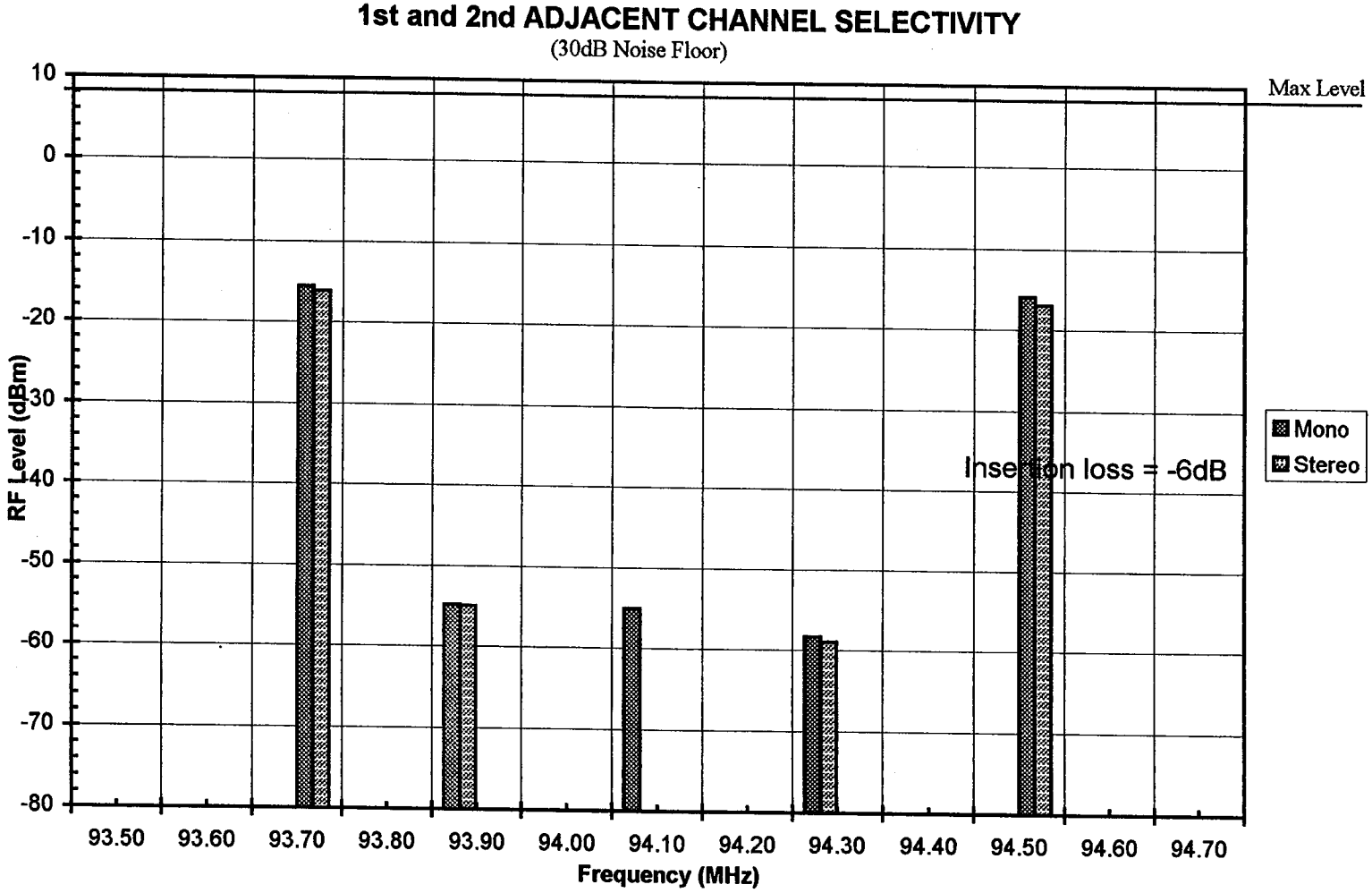


Sony CFD-S33

339

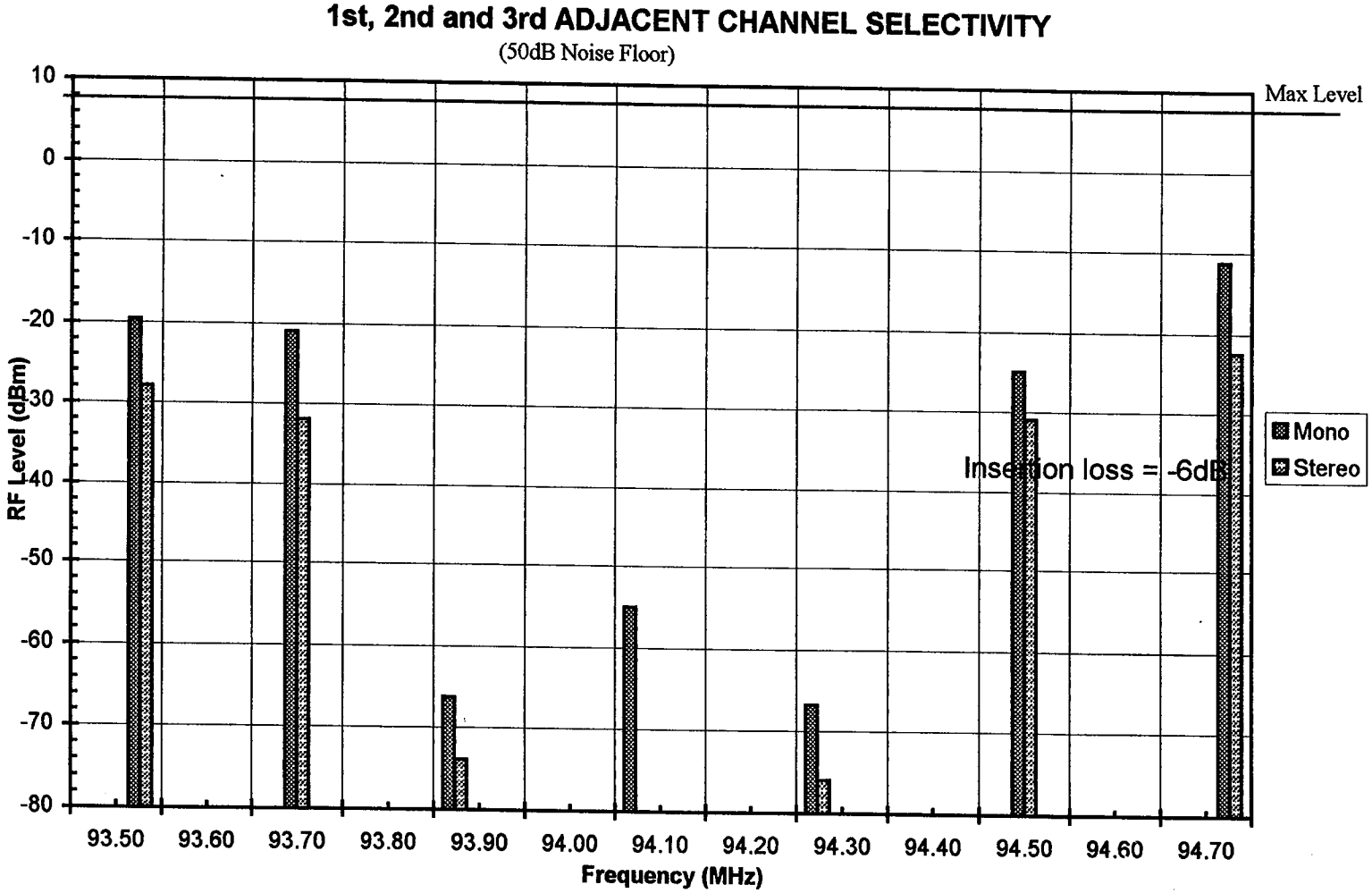

SIGNAL/NOISE VS RF LEVEL
AUDIO LEVEL (dB)
10.00
0.00
-10.00
-20.00
-30.00
-40.00
-50.00
-60.00
-70.00
-80.00
-130 -125 -120 -115 -110 -105 -100 -95 -90 -85 -80 -75 -70 -65 -60 -55 -50 -45
RF LEVEL (dBm)
Insertion loss = -6dB

Sony CFD-S33

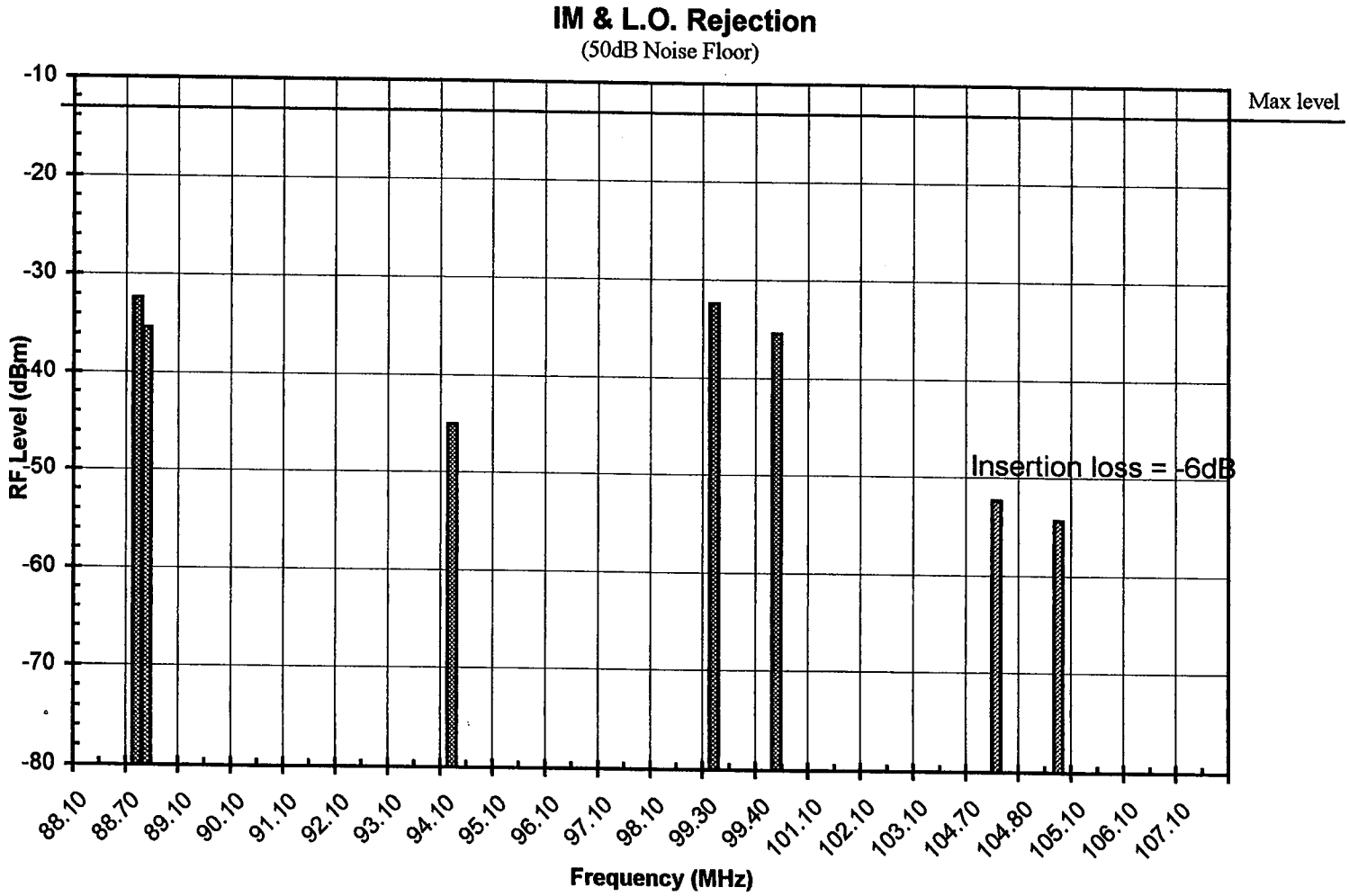


Sony CFD-S33

74


1st, 2nd and 3rd ADJACENT CHANNEL SELECTIVITY
(50dB Noise Floor)
Max Level
Insertion loss = -6dB
Mono
Stereo
RF Level (dBm)
10
0
-10
-20
-30
-40
-50
-60
-70
-80
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)

Sony CFD-S33



Sony CFD-S33

943

Receiver #13

Koss

Auto

FM Receiver Test Laboratory

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

Receiver Test No.: 13
Class: Automobile
Radio Mfg.: Koss
Model: MS-457
Serial: 3805003200

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

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

345

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	0.500	**Vrms**	= 0dB	**Level** 0.520	**Vrms**
THD	0.95	**%**		**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)

346

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

	Mono (L)		Stereo (L)			Separation L->R		
RF Level dBm	Signal dB	Noise dB	Signal dB	Filt. Noise dB	Noise dB	Left dB	Right dB	RF Level dBm
-130	-46.50	-46.50	-46.00	-46.00		-46.00	-46.00	-130
-125	-46.50	-46.50	-46.00	-46.00		-46.00	-46.00	-125
-120	-46.50	-46.50	-46.00	-46.00		-46.00	-46.00	-120
-115	-45.00	-45.50	-45.00	-45.00		-45.00	-45.00	-115
-110	-40.50	-43.50	-40.50	-43.00		-42.50	-42.00	-110
-105	-31.50	-40.50	-31.00	-40.00		-35.50	-35.00	-105
-100	-17.50	-38.00	-17.00	-36.50		-23.00	-22.50	-100
-95	-4.50	-43.50	-3.00	-29.00		-4.00	-27.50	-95
-90	0.00	-59.00	0.00	-33.50		0.00	-31.50	-90
-85	0.00	-64.50	0.00	-38.50		0.00	-36.00	-85
-80	0.00	-69.00	0.00	-43.50		0.00	-38.00	-80
-75	0.00	-71.00	0.00	-48.00		0.00	-39.00	-75
-70	0.00	-72.00	0.00	-53.00		0.00	-39.50	-70
-65	0.00	-72.00	0.00	-57.00		0.00	-40.00	-65
-60	0.00	-72.00	0.00	-61.00		0.00	-40.00	-60
-55	0.00	-72.00	0.00	-63.00		0.00	-40.00	-55
-50	0.00	-72.00	0.00	-63.50		0.00	-40.00	-50
-45	0.00	-72.00	0.00	-64.00	-45.00	0.00	-40.00	-45

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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-35.28	-19.72	-35.38	-19.62	
Undesired Lower Lev	-47.38	-7.62	-47.38	-7.62	
Selectivity, 1st Adj.:		-13.67		-13.62	(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/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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	8.02	-63.02	8.02	-63.02	
Undesired Lower Lev	8.02	-63.02	8.02	-63.02	
Selectivity, 2nd Adj.:	Max RF	-63.02	Max RF	-63.02	(RF D/U Up + RF D/U Lo)/2

348

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.

	Mono 50dB		Stereo 50dB	
	dBm	D/U	dBm	D/U
Desired Lev	-55.00		-55.00	
Undesired Upper Lev	-36.78	-18.22	-49.98	-5.02
Undesired Lower Lev	-51.78	-3.22	-62.98	7.98
Selectivity, 1st Adj.:		**-10.72**		**1.48** (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/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.

	Mono 50dB		Stereo 50dB	
	dBm	D/U	dBm	D/U
Desired Lev	-55.00		-55.00	
Undesired Upper Lev	8.02	-63.02	-11.98	-43.02
Undesired Lower Lev	0.98	-55.98	-15.98	-39.02
Selectivity, 2nd Adj.:		**-59.50**		**-41.02** (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/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.

	Mono 50dB		Stereo 50dB	
	dBm	D/U	dBm	D/U
Desired Lev	-55.00		-55.00	
Undesired Upper Lev	8.02	-63.02	-11.98	-43.02
Undesired Lower Lev	8.02	-63.02	-4.98	-50.02
Selectivity, 3rd Adj.:		**-63.02**		**-46.52** (RF D/U Up + RF D/U Lo)/2

349

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 -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)

10.6MHz Spacing		10.7MHz Spacing	
dBm	D/U	dBm	D/U
-45.00		-45.00	
-13.07	-31.93	-13.07	-31.93
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

10.6MHz Spacing		10.7MHz Spacing	
dBm	D/U	dBm	D/U
-45.00		-45.00	
-23.98	-21.02	-28.98	-16.02
	-21.02		-16.02

EOC:

350

FM Receiver Test Laboratory

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

Receiver Test No.: 13
Class: Automobile
Radio Mfg.: Koss
Model: MS-457
Serial: 3805003200

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
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)

FM Receiver Test Laboratory

Test Results:

1 **Local Oscillator Frequency:**
0.000 MHz

2 **Standard Audio Output:**

Left Channel		THD		Right Channel		THD	
0.5	Vrms	0.95	%	0.52	Vrms	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)**
-13.67 dB Mono
-13.62 dB Stereo

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

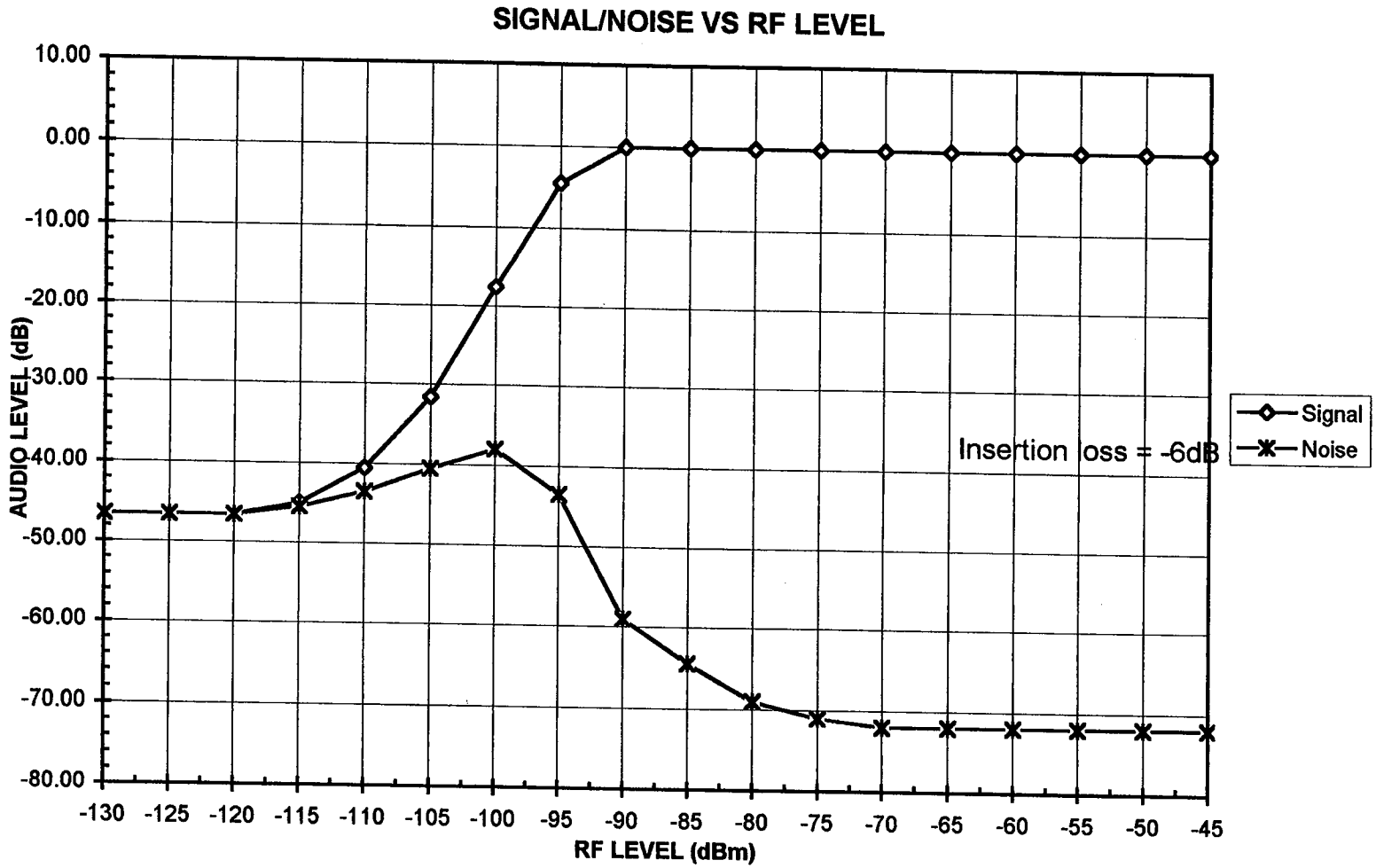
13 **10.7MHz Rejection**
-100.50 dB 0

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) 0
-16.02 dB (10.7) 0

352

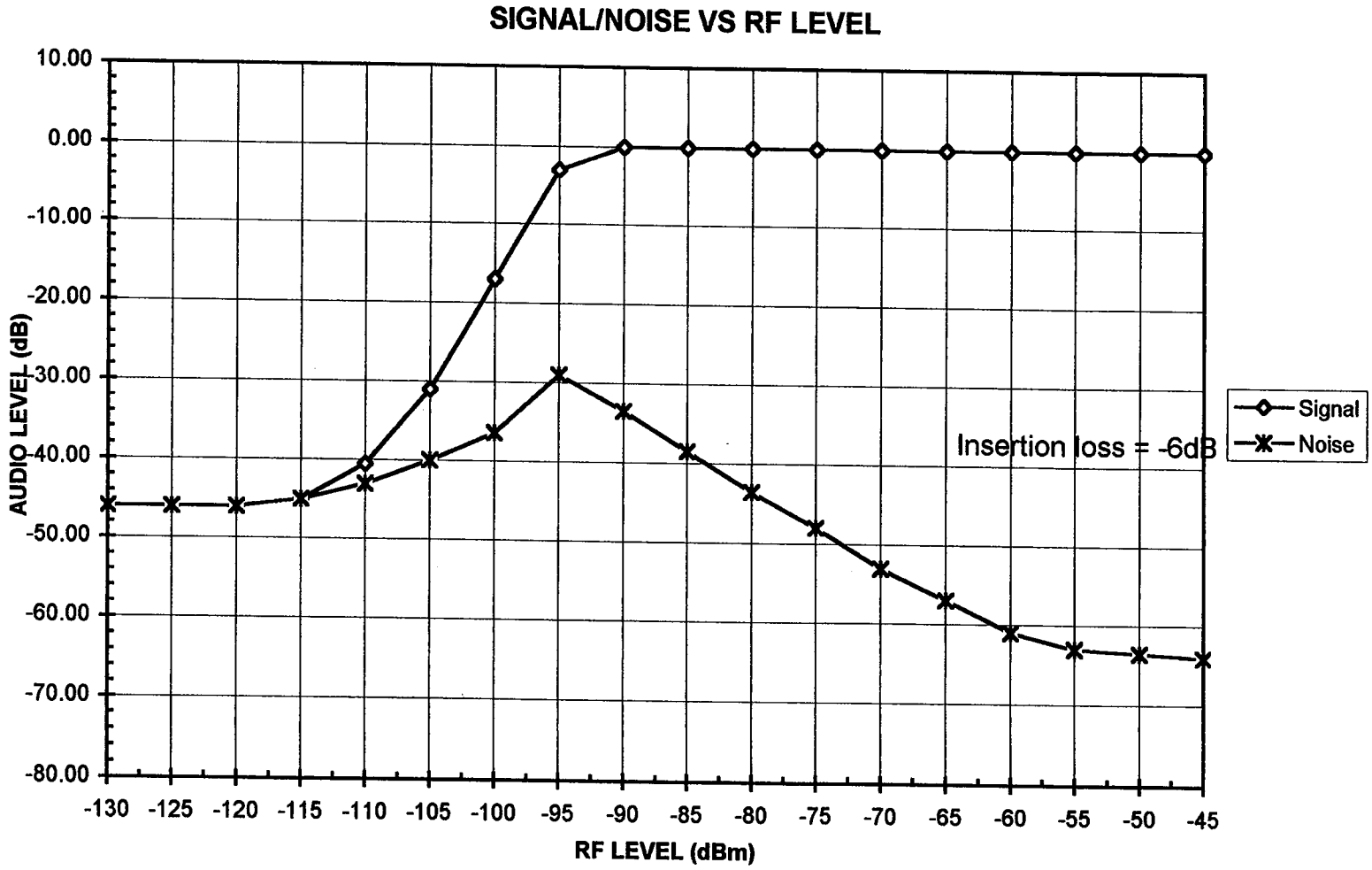
FM Receiver Test Laboratory



Koss MS-457

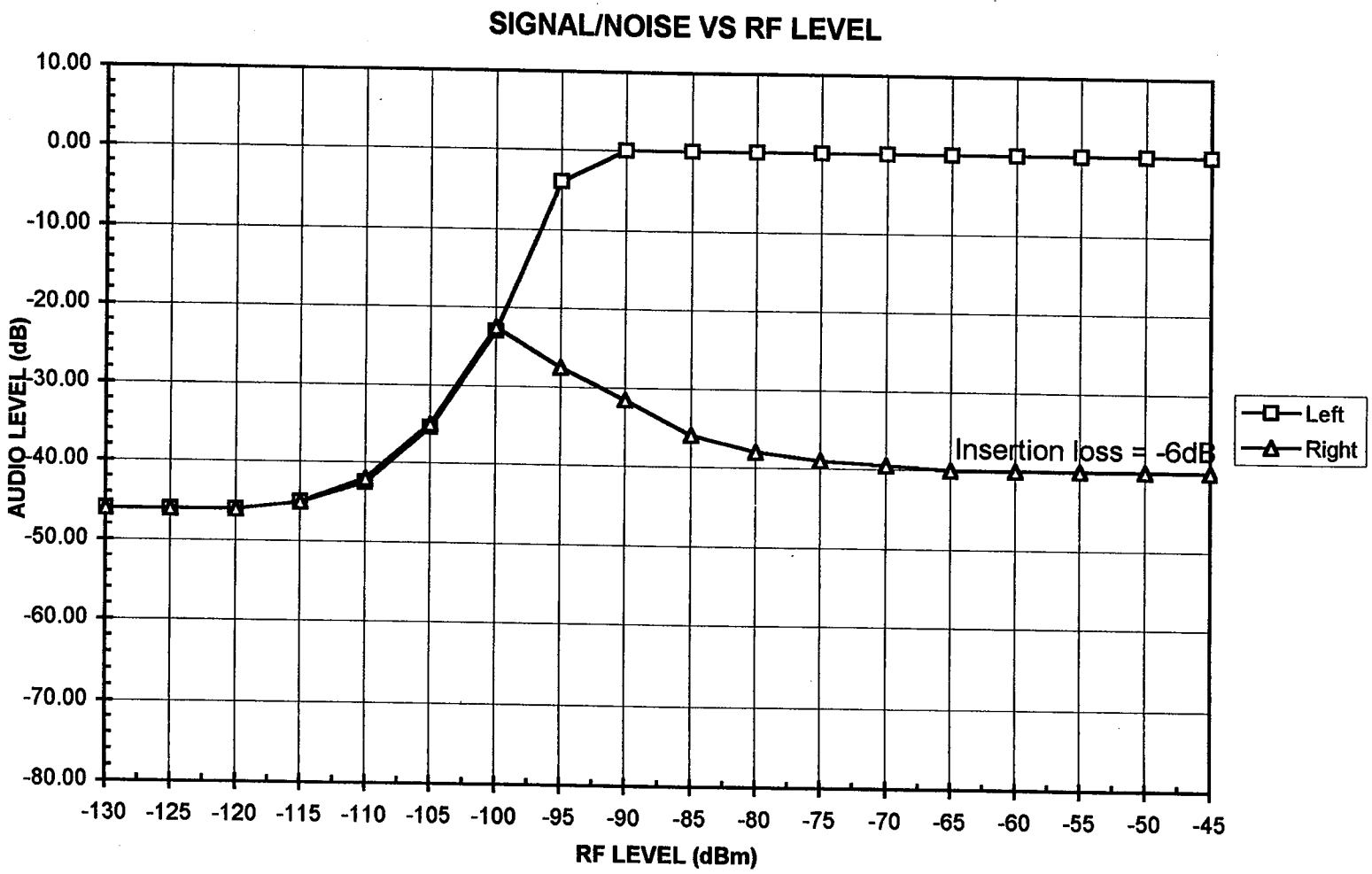
353

FM Receiver Test Laboratory



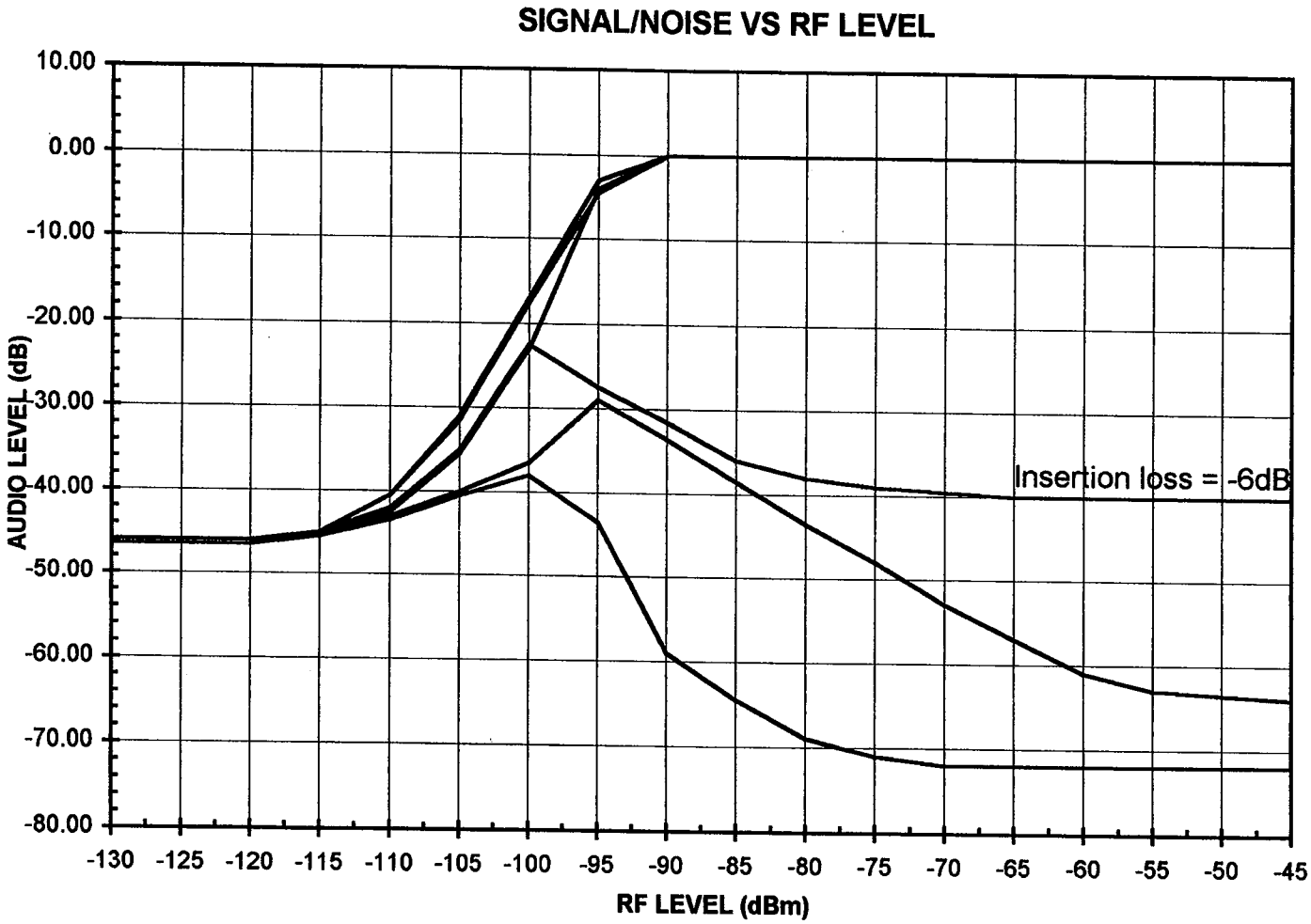
Koss MS-457

FM Receiver Test Laboratory

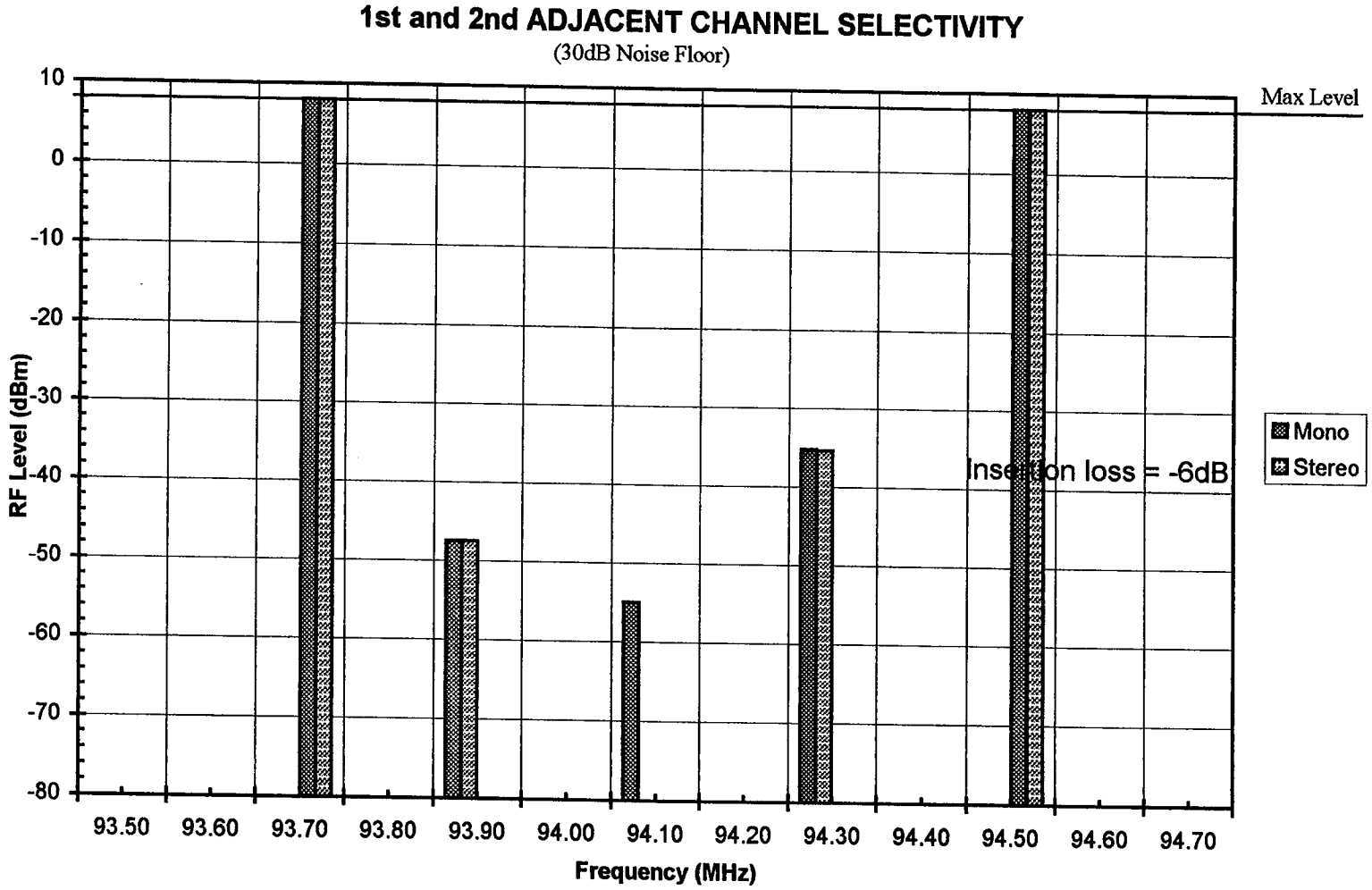


Koss MS-457

FM Receiver Test Laboratory

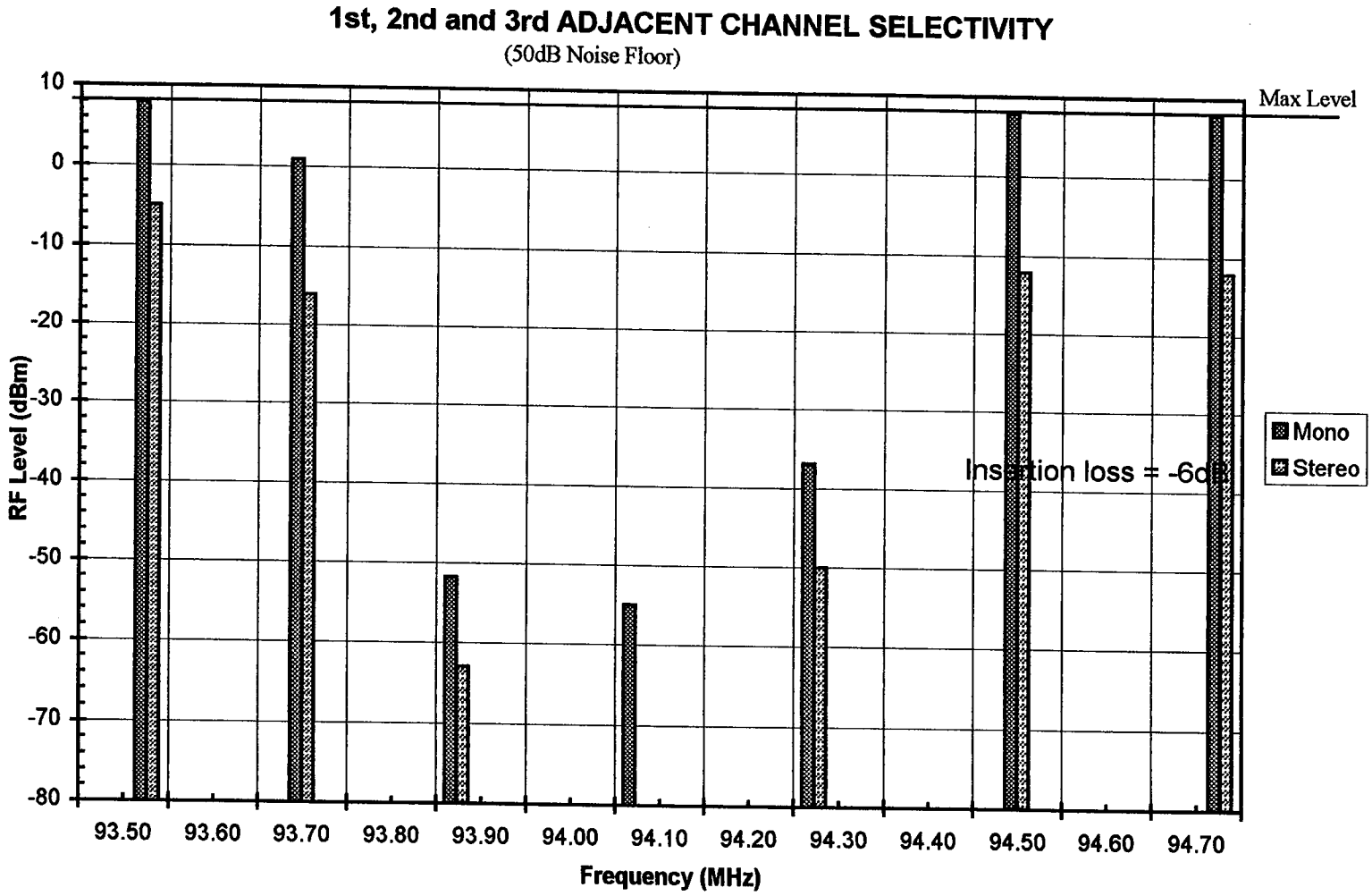


Koss MS-457


1st and 2nd ADJACENT CHANNEL SELECTIVITY
(30dB Noise Floor)
Max Level
Insertion loss = -6dB
Mono
Stereo
RF Level (dBm)
10
0
-10
-20
-30
-40
-50
-60
-70
-80
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)

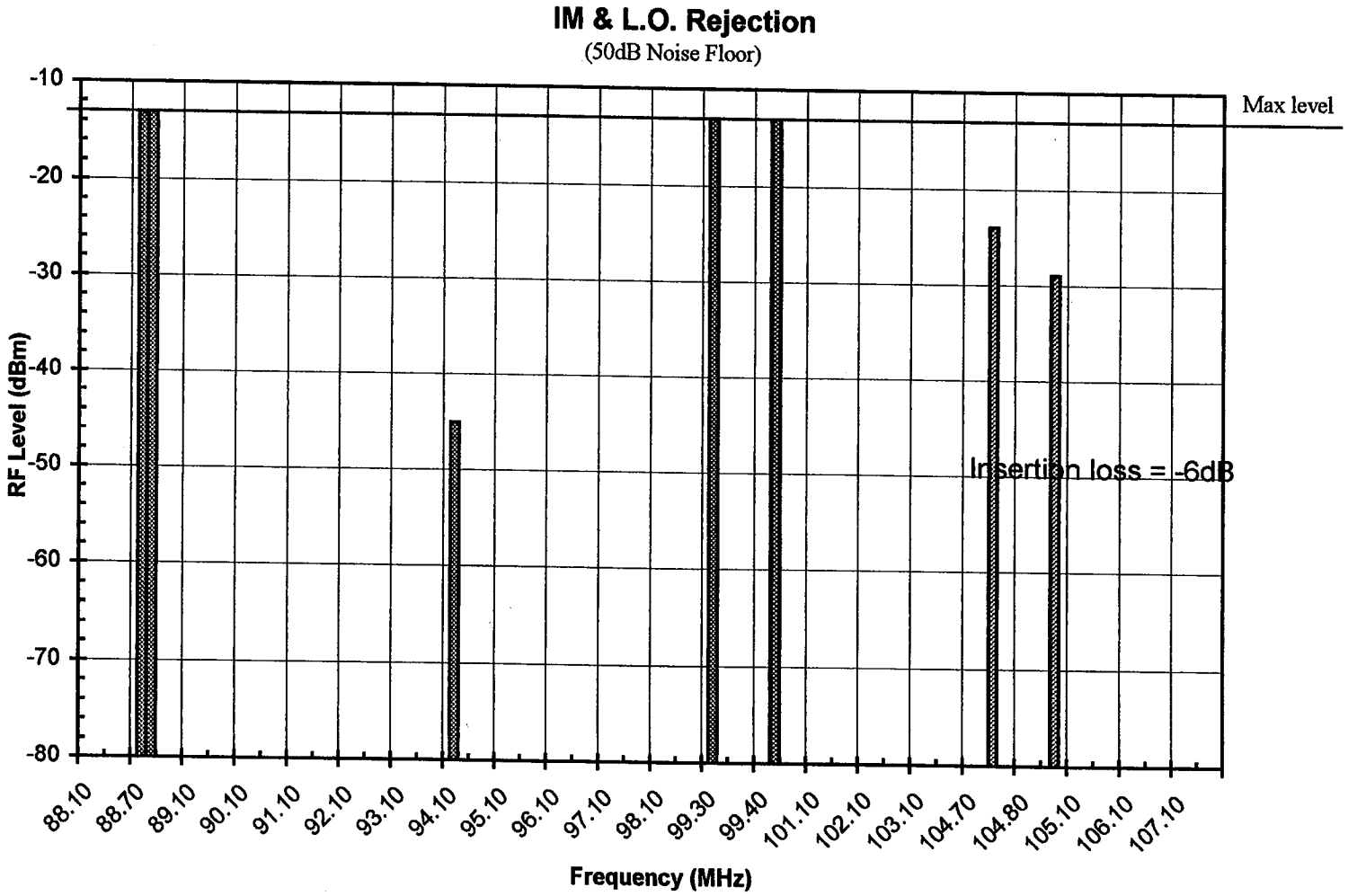
Koss MS-457

FM Receiver Test Laboratory



Koss MS-457

FM Receiver Test Laboratory



Koss MS-457

359

File Name: C_koss

IM & LO

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

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

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 1.000	**Vrms**	= 0dB	**Level** 1.200	**Vrms**
	THD 0.90	**%**		**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.

362

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

SIGNAL, NOISE & SEPARATION VS RF LEVEL

RF Level dBm	Mono (L)		Stereo (L)			Separation L->R		RF Level dBm
	Signal dB	Noise dB	Signal dB	Filt. Noise dB	Noise dB	Left dB	Right dB	
-130	-25.50	-25.50	-24.50	-24.50		-24.50	-24.50	-130
-125	-25.50	-25.50	-24.50	-24.50		-24.50	-24.50	-125
-120	-25.50	-25.50	-24.50	-24.50		-24.50	-24.50	-120
-115	-25.00	-25.50	-24.50	-24.50		-24.50	-24.50	-115
-110	-24.00	-25.50	-23.00	-25.00		-24.00	-24.00	-110
-105	-17.00	-28.00	-16.50	-27.00		-19.50	-19.50	-105
-100	-9.50	-36.00	-9.00	-35.00		-13.50	-13.50	-100
-95	-5.50	-47.00	-5.50	-46.00		-11.50	-11.50	-95
-90	-2.00	-49.50	-1.50	-48.50		-7.50	-7.00	-90
-85	0.50	-53.50	-0.50	-52.00		-6.00	-7.00	-85
-80	-0.25	-58.00	-0.25	-48.00		-4.00	-10.00	-80
-75	0.00	-62.50	0.00	-48.00		-2.00	-14.50	-75
-70	0.00	-66.00	0.00	-49.50		-0.50	-26.50	-70
-65	0.00	-68.00	0.00	-54.00		0.00	-33.50	-65
-60	0.00	-69.00	0.00	-57.50		0.00	-33.00	-60
-55	0.00	-69.00	0.00	-60.50		0.00	-33.00	-55
-50	0.00	-69.00	0.00	-62.00		0.00	-33.00	-50
-45	0.00	-69.00	0.00	-63.00	-24.00	0.00	-33.00	-45

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.

	Mono 30dB		Stereo 30dB	
	dBm	D/U	dBm	D/U
Desired Lev	-55.00		-55.00	
Undesired Upper Lev	-43.00	-12.00	-44.00	-11.00
Undesired Lower Lev	-47.20	-7.80	-48.00	-7.00
Selectivity, 1st Adj.:		-9.90		-9.00

(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/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.

	Mono 30dB		Stereo 30dB	
	dBm	D/U	dBm	D/U
Desired Lev	-55.00		-55.00	
Undesired Upper Lev	8.00	-63.00	8.00	-63.00
Undesired Lower Lev	8.00	-63.00	8.00	-63.00
Selectivity, 2nd Adj.:	Max RF	-63.00	Max RF	-63.00

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

Worst case noise floor; -35dB

364

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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-45.20	-9.80	-65.00	10.00	
Undesired Lower Lev	-48.60	-6.40	-67.00	12.00	
Selectivity, 1st Adj.:		**-8.10**		**11.00**	(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/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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-13.00	-42.00	-19.00	-36.00	
Undesired Lower Lev	-3.00	-52.00	-21.00	-34.00	
Selectivity, 2nd Adj.:		**-47.00**		**-35.00**	(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/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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	0.00	-55.00	-18.00	-37.00	
Undesired Lower Lev	0.00	-55.00	-21.00	-34.00	
Selectivity, 3rd Adj.:		**-55.00**		**-35.50**	(RF D/U Up + RF D/U Lo)/2

-365

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	-97.00	dBm	
RF Lev 2	-25.00	dBm	EOC
D/U	-72.00	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 dBm	D/U	10.7MHz Spacing dBm	D/U
-45.00		-45.00	
-27.07	-17.93	-29.07	-15.93
	-17.93		-15.93

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

10.6MHz Spacing dBm	D/U	10.7MHz Spacing dBm	D/U
-45.00		-45.00	
-54.07	9.07	-56.07	11.07
	9.07		11.07

EOC: Objectionable beat notes

366

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
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:**

Left Channel		THD		Right Channel		THD	
1	Vrms	0.90	%	1.2	Vrms	0.90	%

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

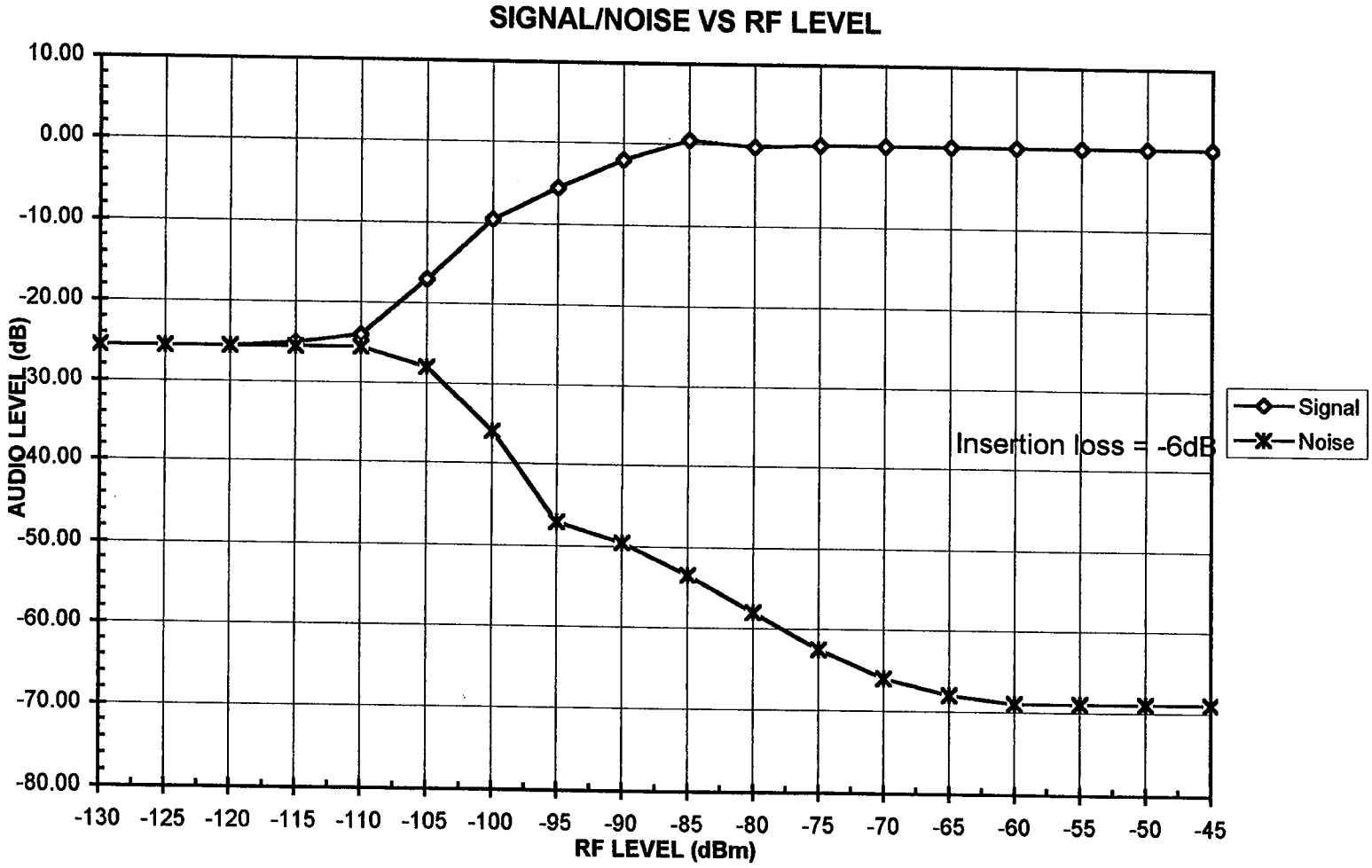
13 **10.7MHz Rejection**
-72.00 dB 0

14 **10.7MHz IM**
-17.93 dB (10.6) Hiss
-15.93 dB (10.7) 0

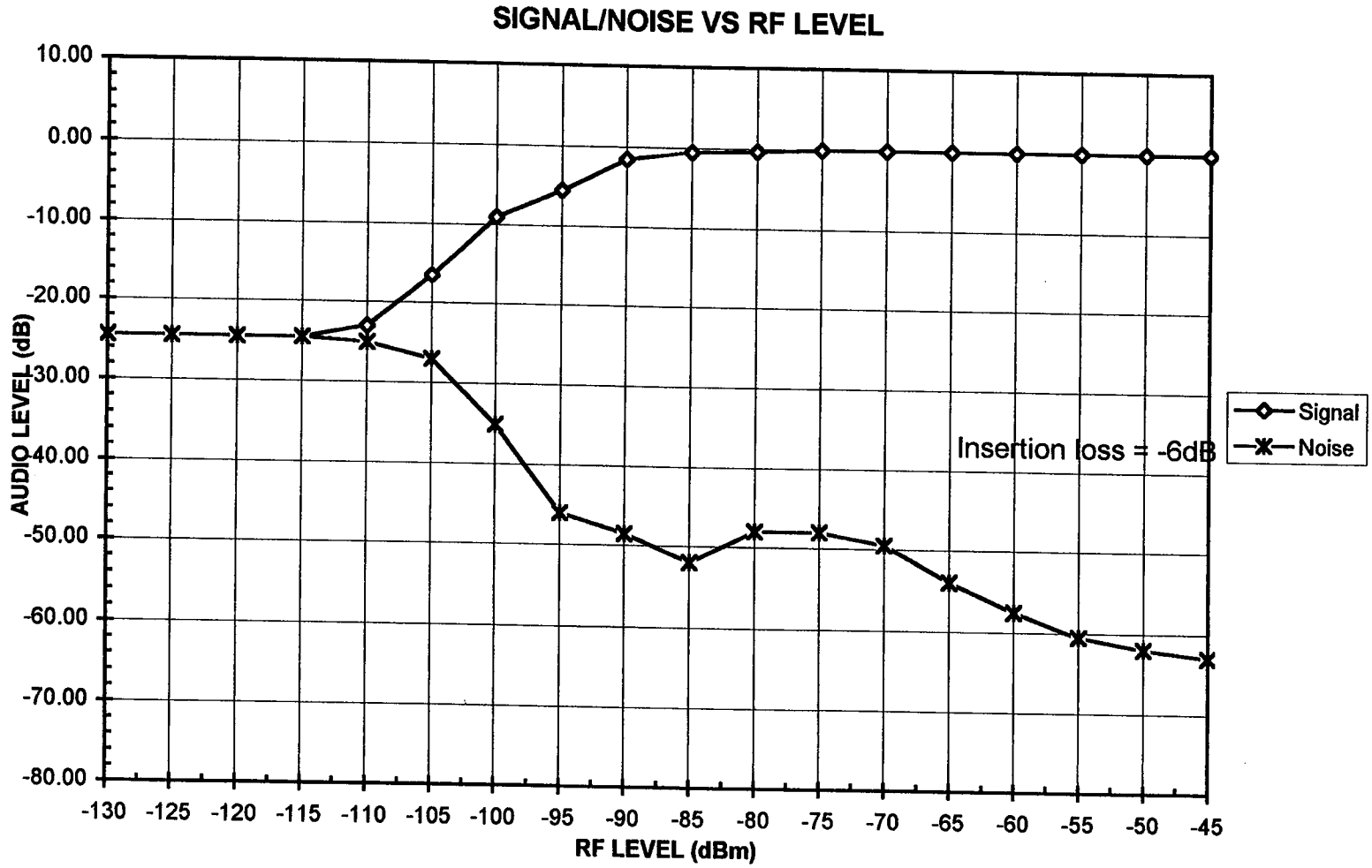
15 **10.7MHz Spurious (Local Osc. Interference)**
9.07 dB (10.6) Objectionable beat notes
11.07 dB (10.7) 0

368

FM Receiver Test Laboratory

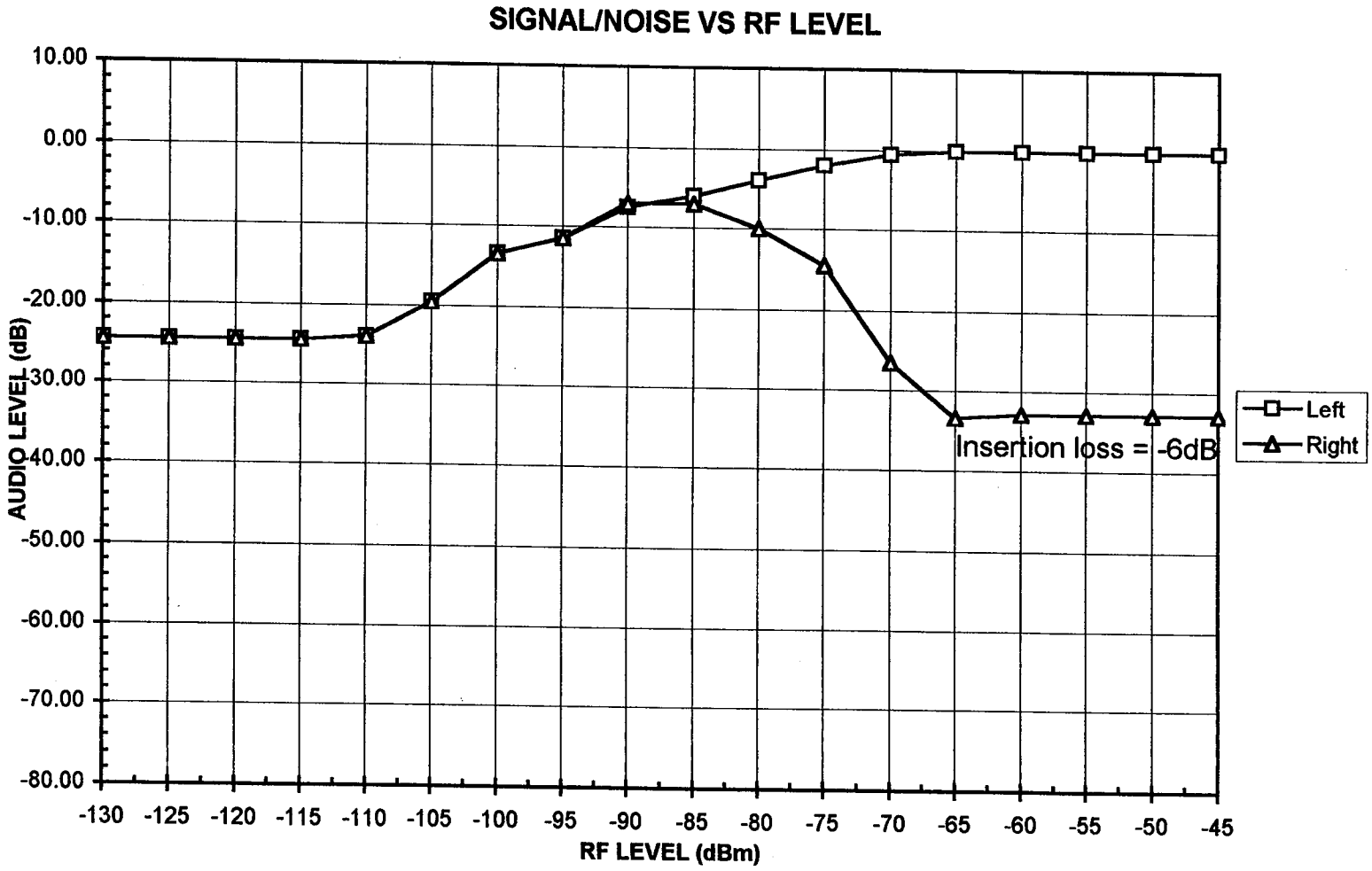


Philips/Magnavox AZ2700/17



Philips/Magnavox AZ2700/17

FM Receiver Test Laboratory

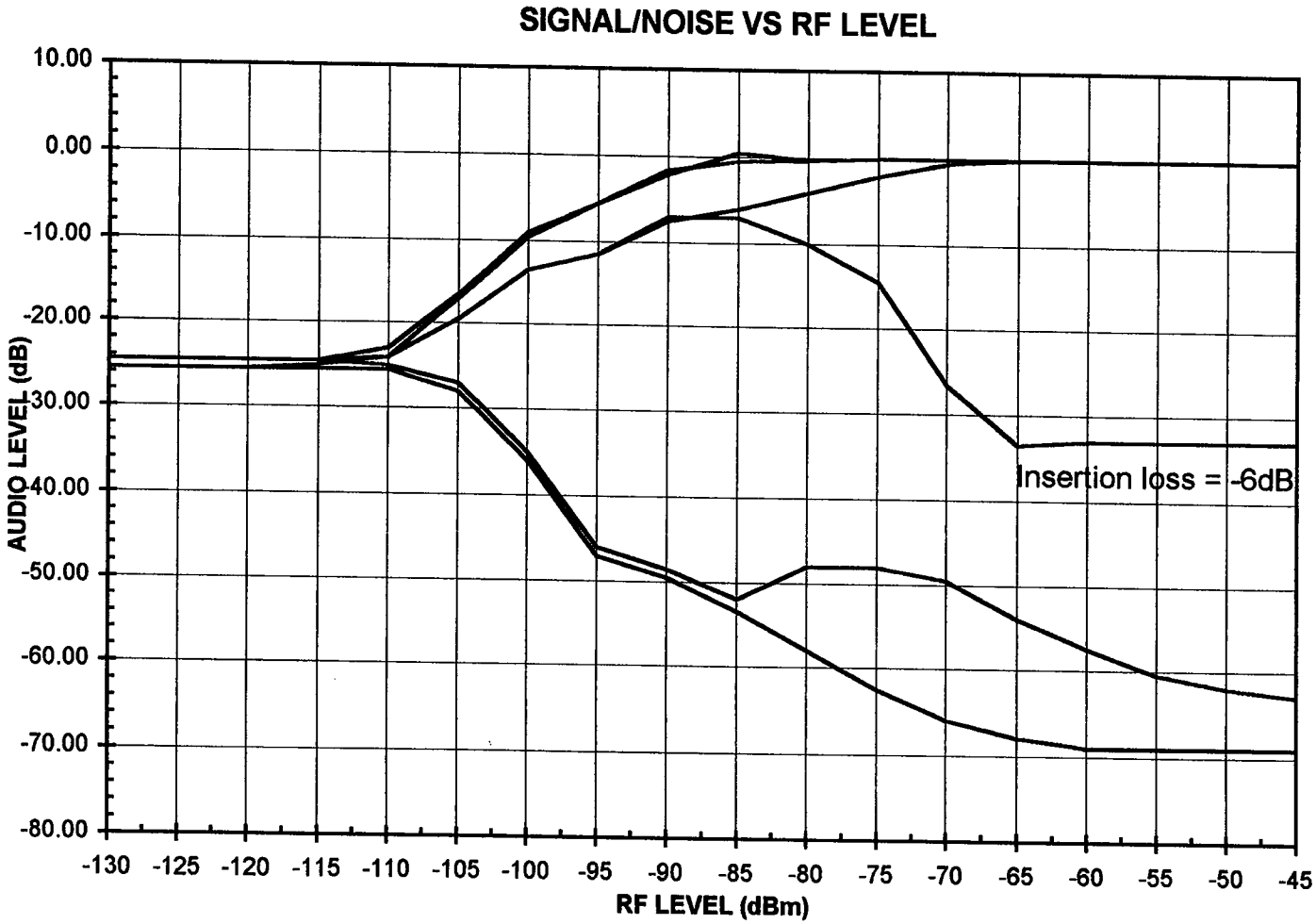


Philips/Magnavox AZ2700/17

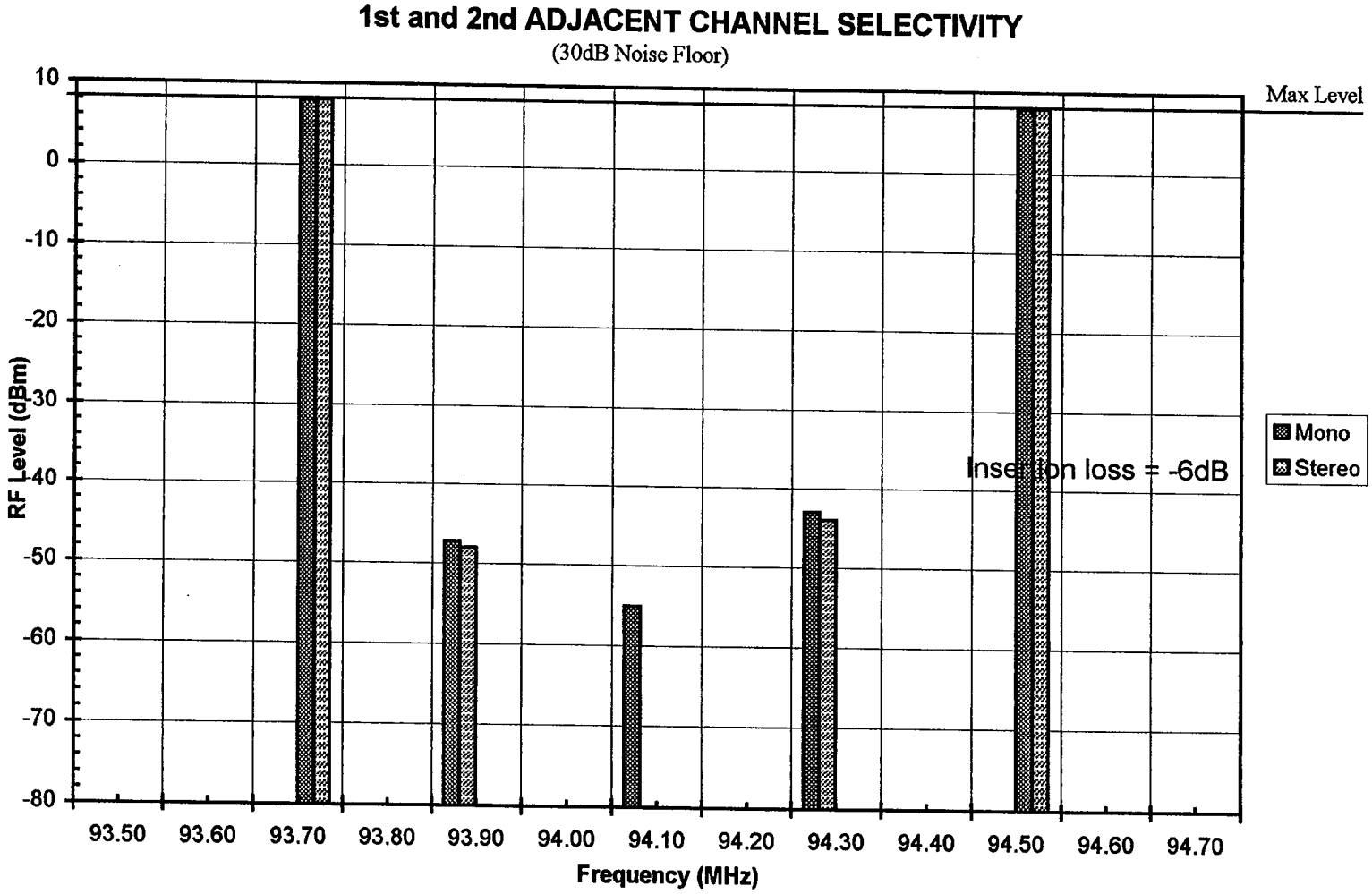
371

File Name: C_mag

FM Stereo Separation Plot

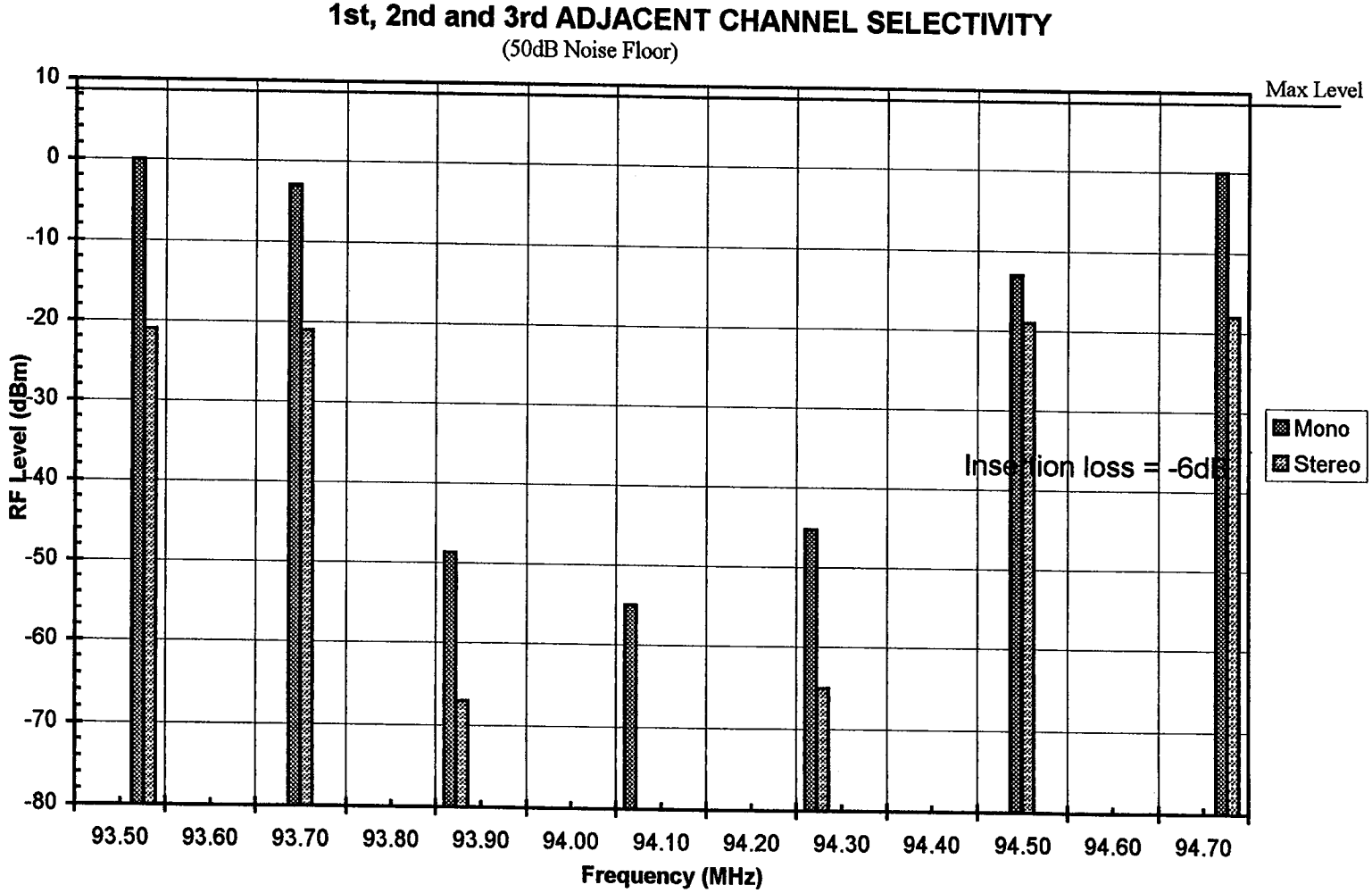


Philips/Magnavox AZ2700/17

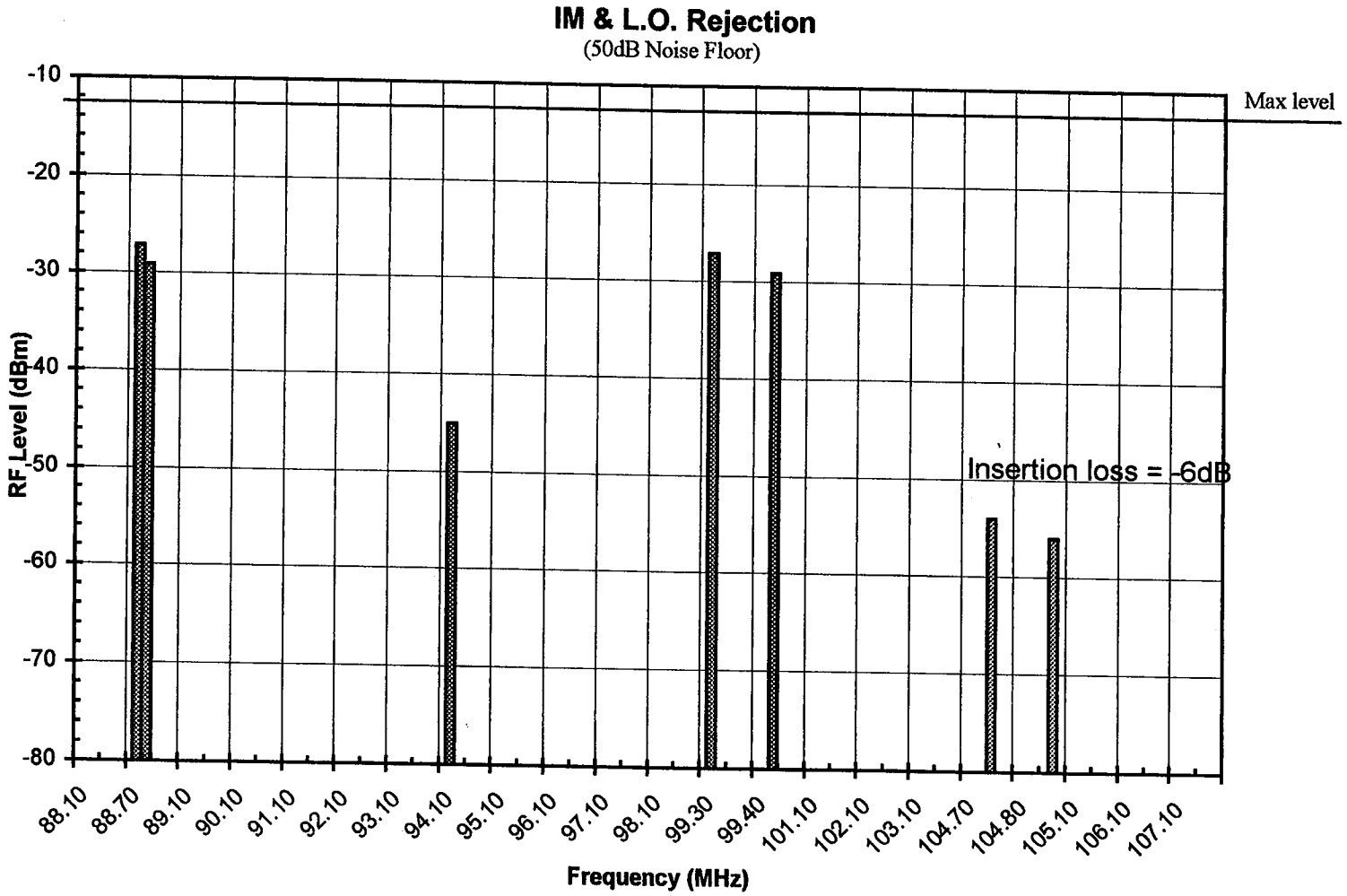


Philips/Magnavox AZ2700/17

373



Philips/Magnavox AZ2700/17



Philips/Magnavox AZ2700/17

375

File Name: C_mag

Receiver #15

Ford

Auto

FM Receiver Test Laboratory

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 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

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
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 Levl
Tune RF Gen to; Desired Freq. +/- 2 X IF Freq.
Adjust RF Level until S/N Ratio = 30dB, record RF Lev2

Measurement:			
RF Levl	-100.0 dBm	(S/N Ratio = 30dB)
RF Lev2	-55.0 dBm	(21.4MHz + 94.1MHz = 115.5MHz)
Image Rejection:	-45.00 dB	(RF Levl - RF Lev2)

378

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

SIGNAL, NOISE & SEPARATION VS RF LEVEL

	Mono (L)		Stereo (L)			Separation L->R		
RF Level dBm	Signal dB	Noise dB	Signal dB	Filt. Noise dB	Noise dB	Left dB	Right dB	RF Level dBm
-130	-20.20	-20.10	-19.10	-19.10		-19.10	-19.10	-130
-125	-20.20	-20.10	-19.10	-19.10		-19.00	-19.10	-125
-120	-20.00	-20.10	-18.80	-19.00		-18.80	-19.00	-120
-115	-19.20	-20.10	-17.80	-18.70		-18.00	-18.50	-115
-110	-16.50	-20.20	-15.20	-18.70		-16.40	-16.70	-110
-105	-10.00	-22.40	-9.30	-21.00		-12.20	-12.40	-105
-100	-3.80	-32.00	-3.40	-30.50		-7.80	-8.10	-100
-95	-1.00	-48.00	-0.86	-46.50		-6.40	-6.70	-95
-90	-0.32	-52.80	-0.32	-51.40		-6.17	-6.46	-90
-85	-0.25	-57.00	-0.22	-55.40		-6.11	-6.40	-85
-80	0.00	-59.50	0.00	-53.50		-5.55	-6.90	-80
-75	0.00	-60.00	0.00	-52.00		-4.30	-8.30	-75
-70	0.00	-61.00	0.00	-53.20		-3.40	-9.70	-70
-65	0.00	-62.00	0.00	-55.00		-2.74	-11.10	-65
-60	0.00	-62.00	0.00	-56.50		-2.10	-12.90	-60
-55	0.00	-62.00	0.00	-57.75		-1.58	-15.00	-55
-50	0.00	-62.00	0.00	-57.75		-1.00	-17.80	-50
-45	0.00	-62.00	0.00	-57.50	-57.00	-0.57	-22.10	-45

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.

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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-34.00	-21.00	-34.00	-21.00	
Undesired Lower Lev	-28.00	-27.00	-28.00	-27.00	
Selectivity, 1st Adj.:		-24.00		-24.00	(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/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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	8.00	-63.00	8.00	-63.00	
Undesired Lower Lev	8.00	-63.00	8.00	-63.00	
Selectivity, 2nd Adj.:	Max RF	-63.00	Max RF	-63.00	(RF D/U Up + RF D/U Lo)/2

380

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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-34.00	-21.00	-34.00	-21.00	
Undesired Lower Lev	-30.00	-25.00	-30.00	-25.00	
Selectivity, 1st Adj.:		**-23.00**		**-23.00**	(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/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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	8.00	-63.00	8.00	-63.00	
Undesired Lower Lev	8.00	-63.00	8.00	-63.00	
Selectivity, 2nd Adj.:	Max RF	**-63.00**	Max RF	**-63.00**	(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/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.

	Mono 50dB		Stereo 50dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	8.00	-63.00	8.00	-63.00	
Undesired Lower Lev	8.00	-63.00	8.00	-63.00	
Selectivity, 3rd Adj.:	Max RF	**-63.00**	Max RF	**-63.00**	(RF D/U Up + RF D/U Lo)/2

381

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	-100.00	dBm		
RF Lev 2	22.00	dBm	EOC	Radio is insensitive to 10.7MHz
D/U	-122.00	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	D/U	dBm	D/U
-45.00		-45.00	
-1.00	-44.00	-6.00	-39.00
	-44.00		-39.00

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

10.6MHz Spacing		10.7MHz Spacing	
dBm	D/U	dBm	D/U
-45.00		-45.00	
-33.00	-12.00	-34.00	-11.00
	-12.00		-11.00

EOC:

3.02

FM Receiver Test Laboratory

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 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:**

Left Channel	THD	Right Channel	THD
1.98 Vrms	1.60 %	2.06 Vrms	1.60 %

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 Max RF
-63.00 dB Stereo Max RF

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 Max RF
-63.00 dB Stereo Max RF

12 **Selectivity, Third Adjacent, 50dB Noise Floor (Ave. D/U)**
-63.00 dB Mono Max RF
-63.00 dB Stereo Max RF

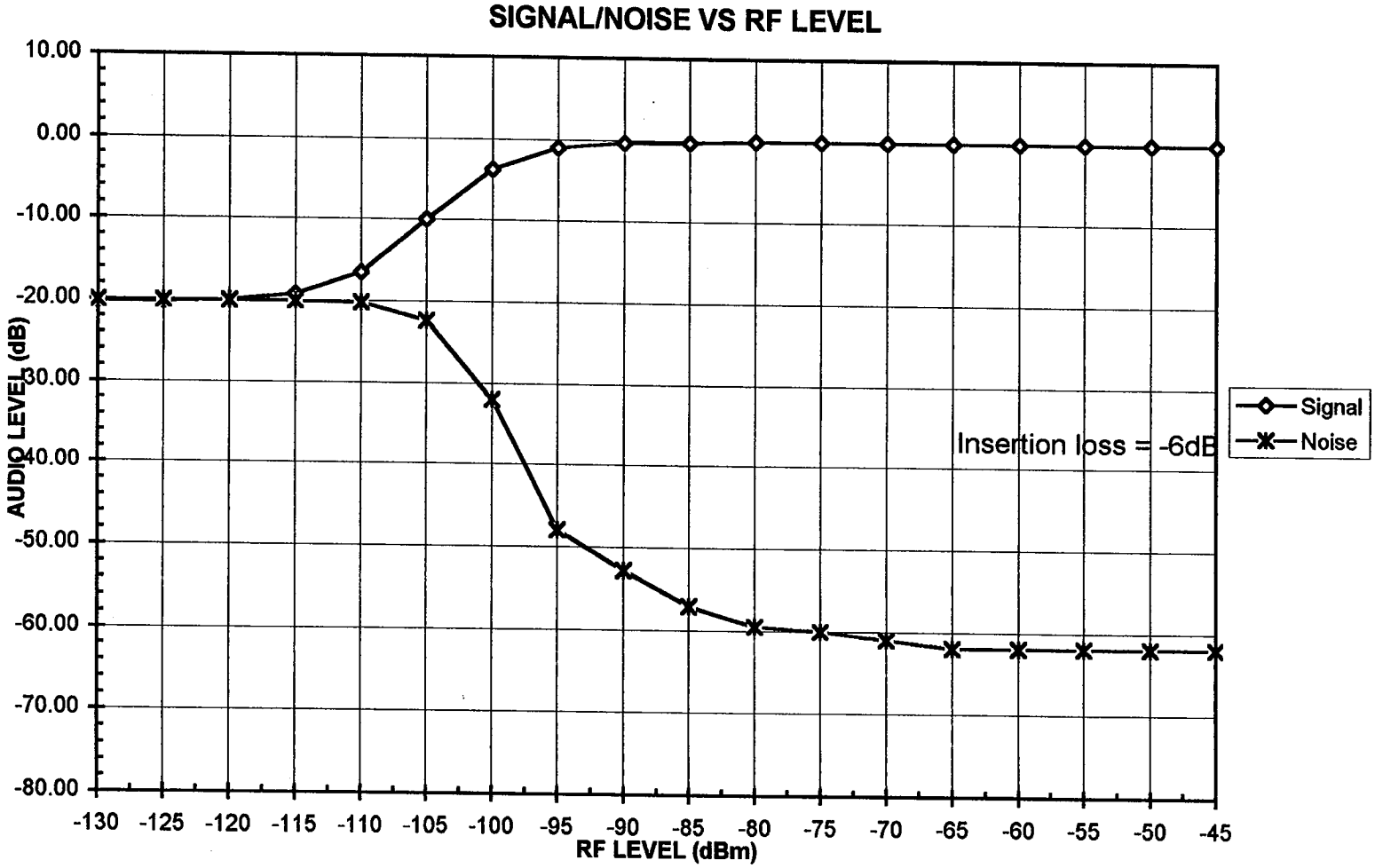
13 **10.7MHz Rejection**
-122.00 dB 0

14 **10.7MHz IM**
-44.00 dB (10.6) 0 0
-39.00 dB (10.7) 0 0

15 **10.7MHz Spurious (Local Osc. Interference)**
-12.00 dB (10.6) 0
-11.00 dB (10.7) 0

384

FM Receiver Test Laboratory



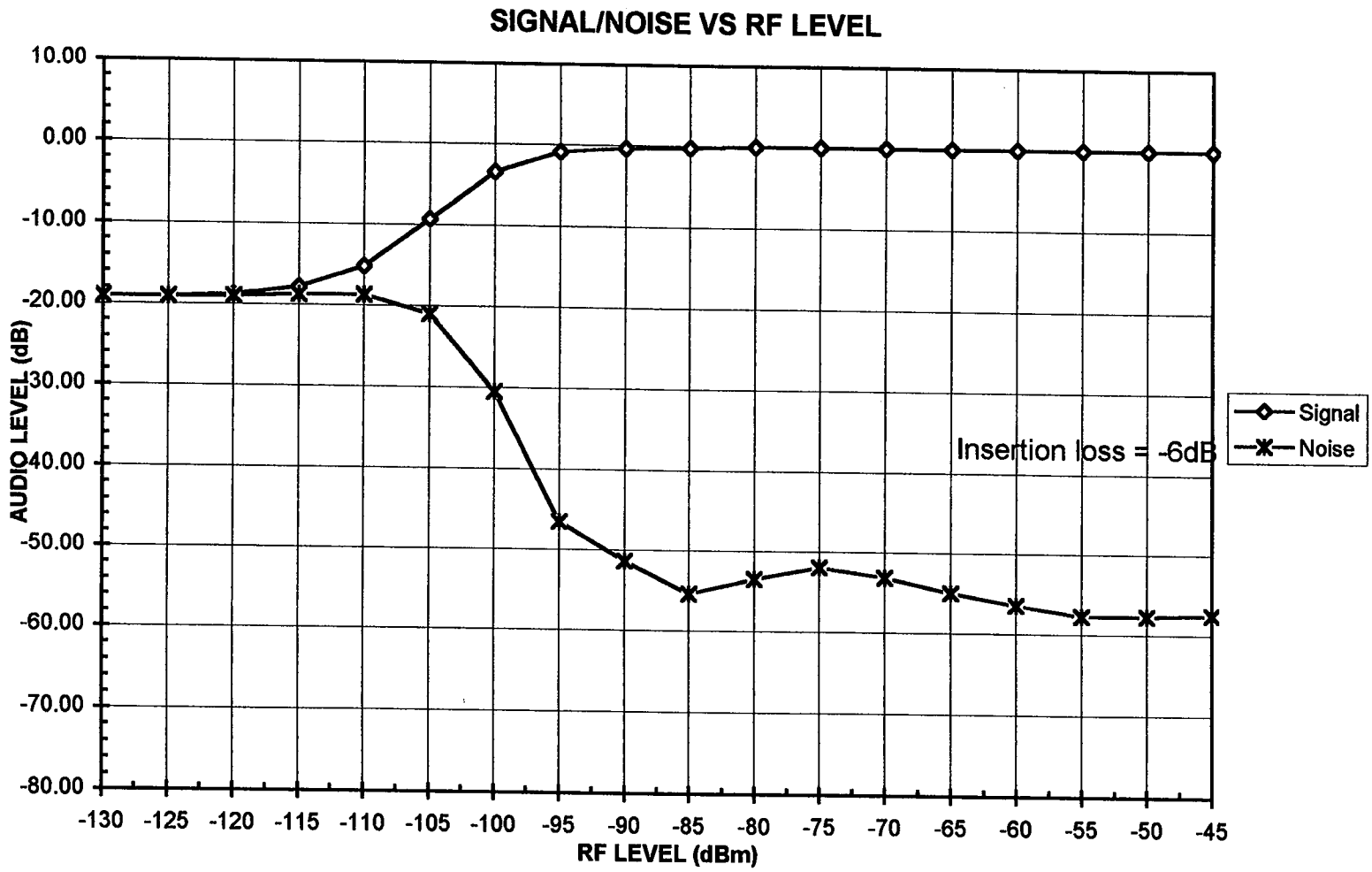
Ford XF3F

395

File Name: C_xf3f_1

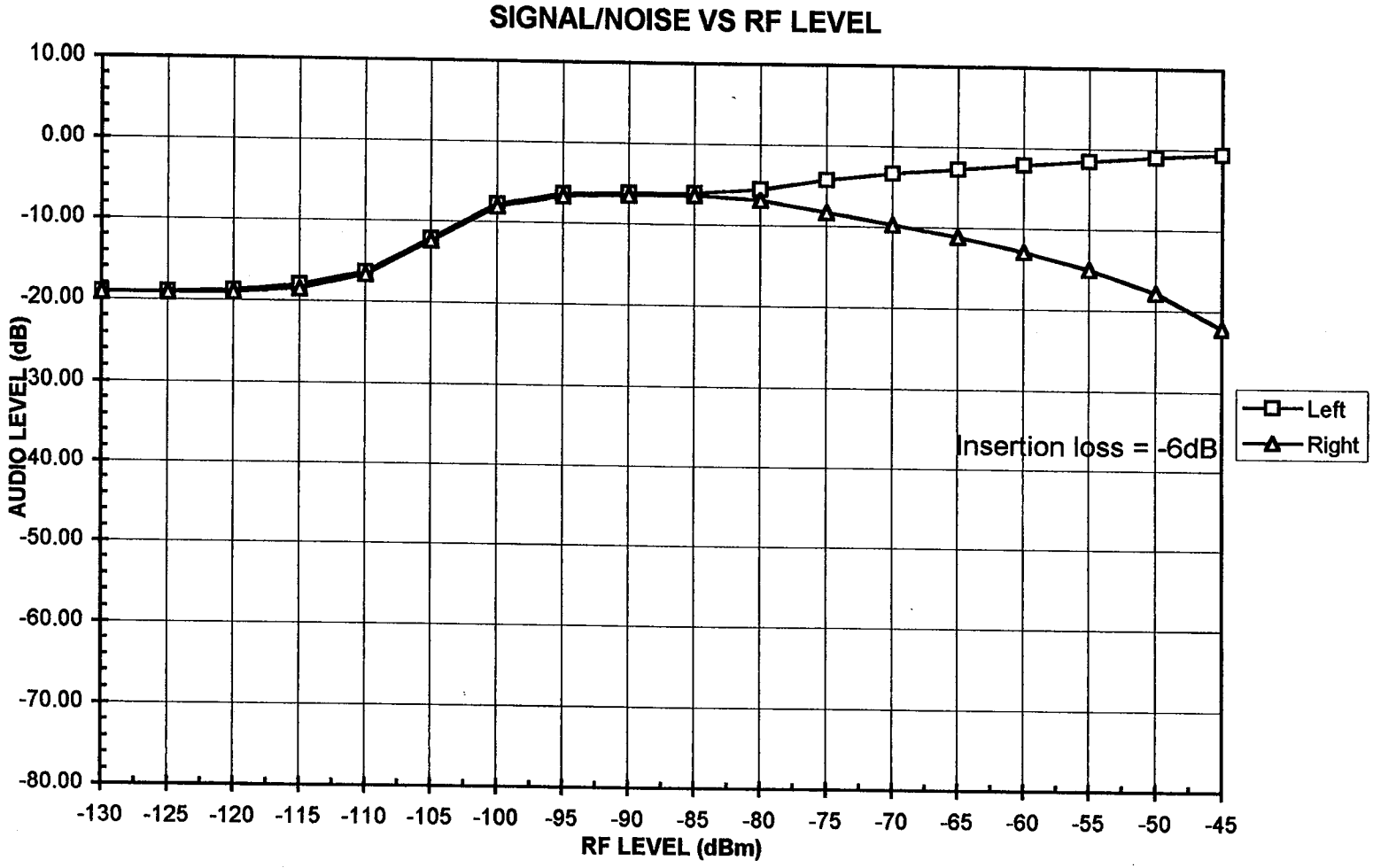
FM Mono Plot

FM Receiver Test Laboratory



Ford XF3F

FM Receiver Test Laboratory

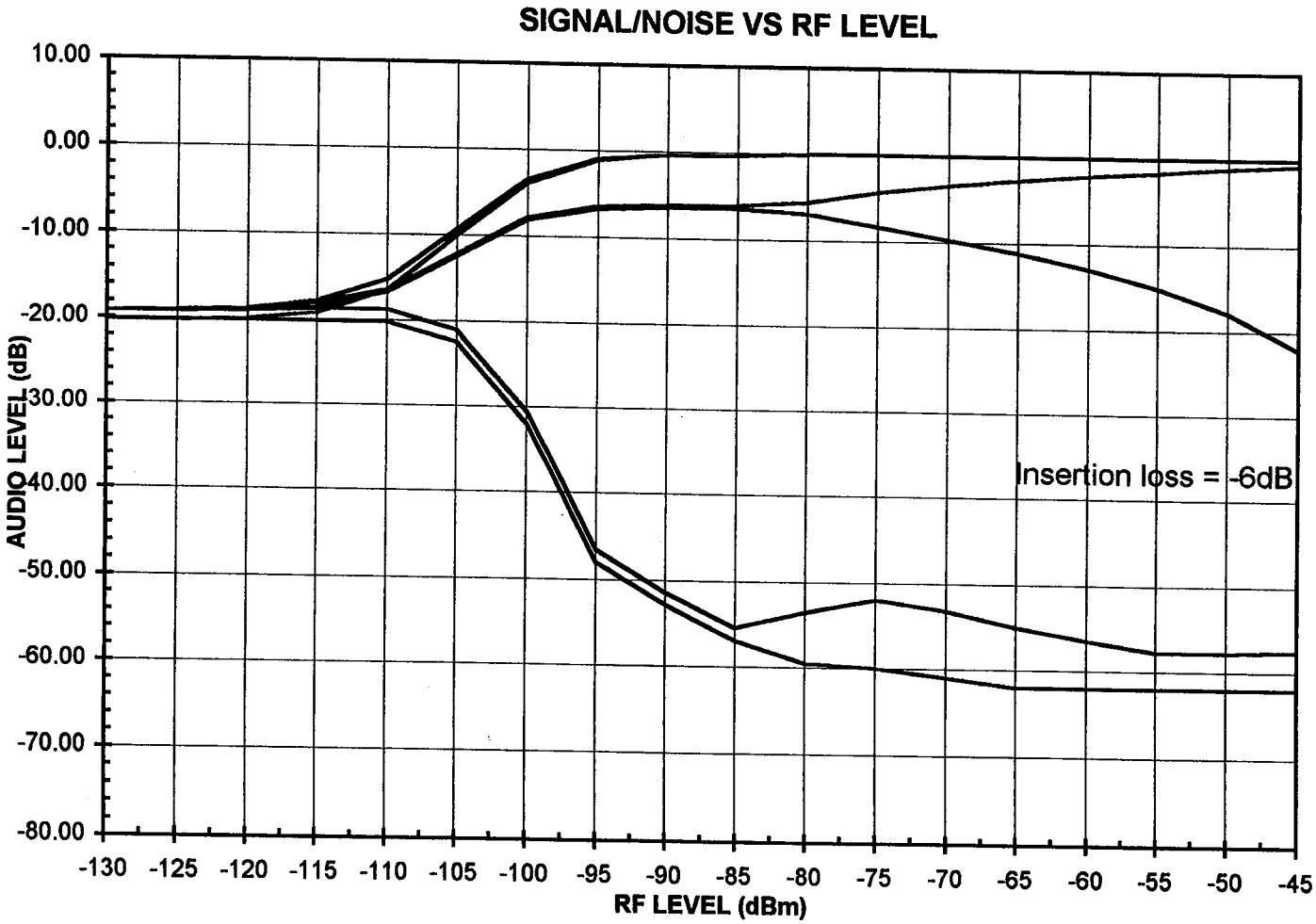


Ford XF3F

File Name: C_xf3f_1

FM Stereo Separation Plot

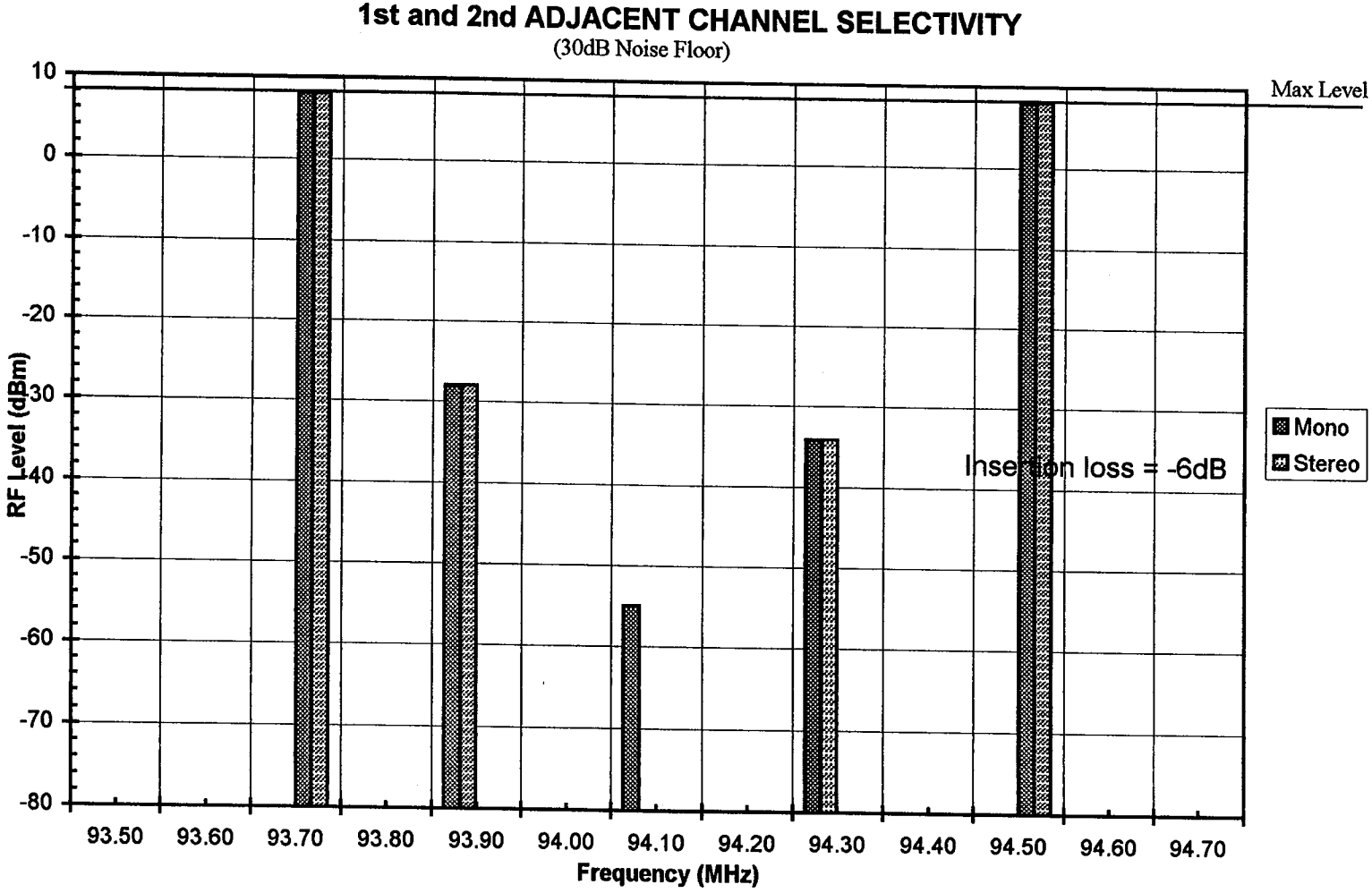
FM Receiver Test Laboratory



Ford XF3F

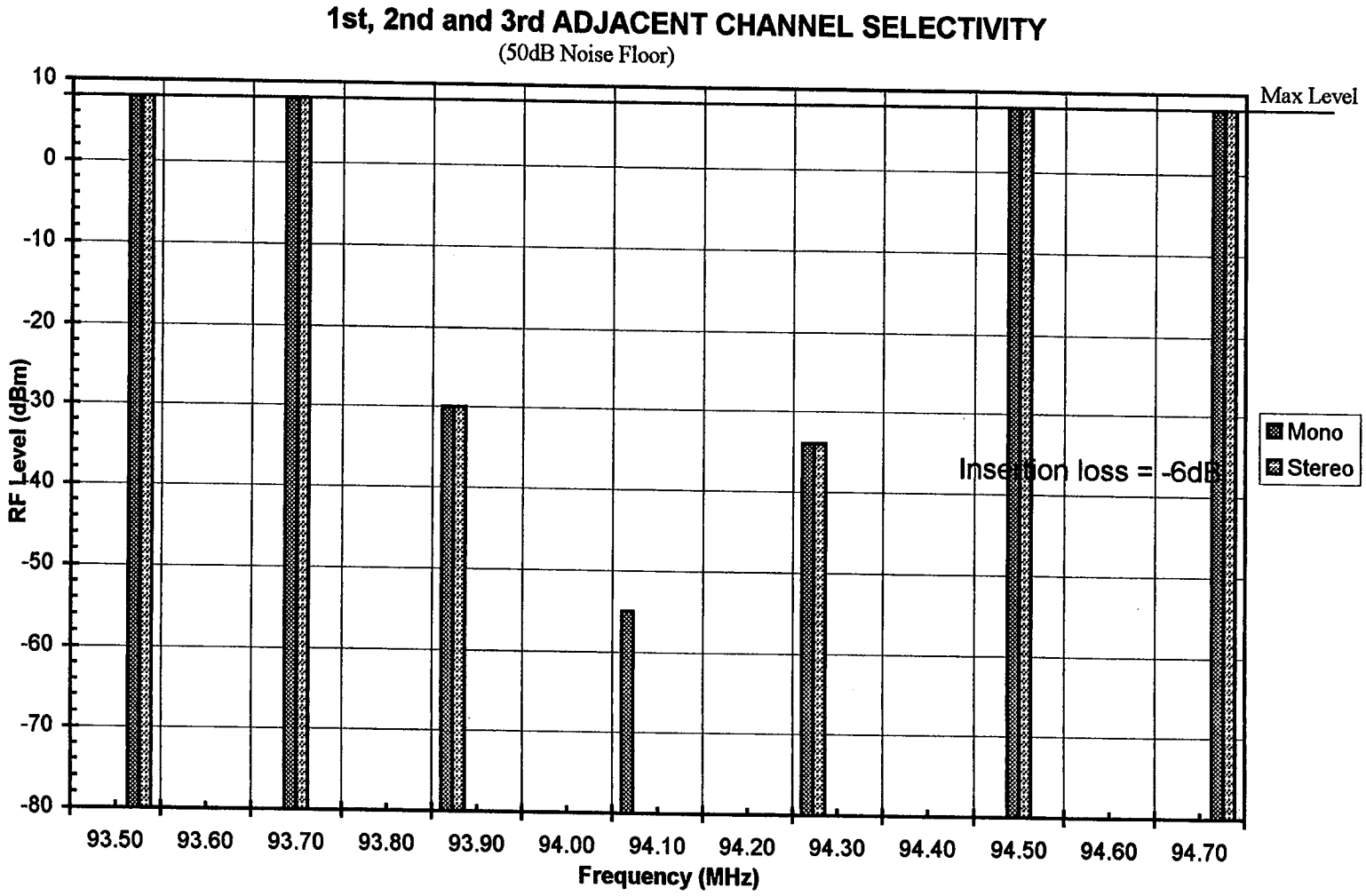
File Name: C_xf3f_1

FM COMPOSITE

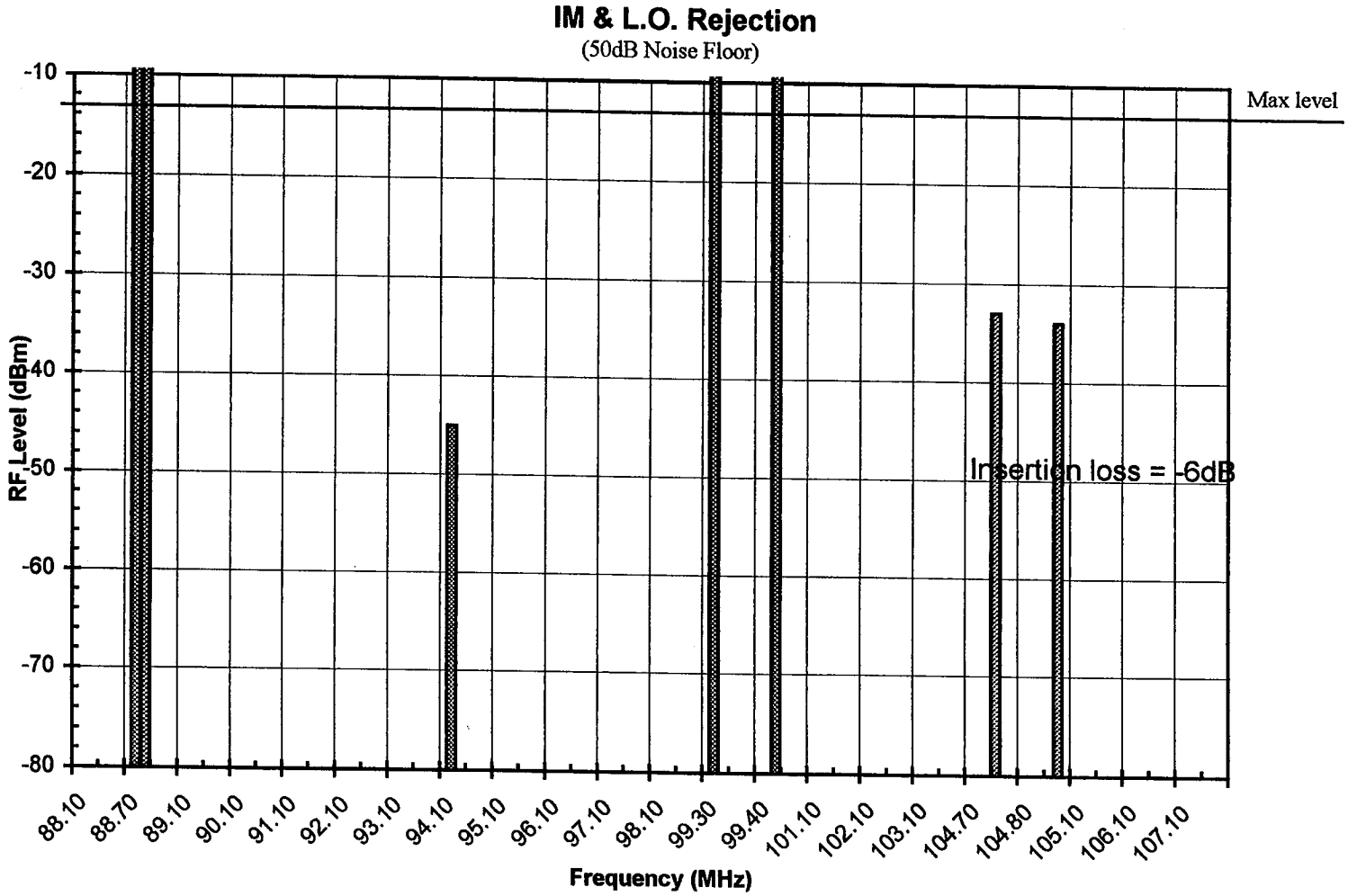

1st and 2nd ADJACENT CHANNEL SELECTIVITY
(30dB Noise Floor)
Max Level
RF Level (dBm)
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Insertion loss = -6dB
Mono
Stereo
93.50
93.60
93.70
93.80
93.90
94.00
94.10
94.20
94.30
94.40
94.50
94.60
94.70
Frequency (MHz)

Ford XF3F

FM Receiver Test Laboratory



Ford XF3F


IM & L.O. Rejection
(50dB Noise Floor)
Max level
Insertion loss = -6dB
RF Level (dBm)
-10
-20
-30
-40
-50
-60
-70
-80
88.10
88.70
89.10
90.10
91.10
92.10
93.10
94.10
95.10
96.10
97.10
98.10
99.30
99.40
101.10
102.10
103.10
104.70
104.80
105.10
106.10
107.10
Frequency (MHz)

Ford XF3F

Receiver #16

Radio Shack

Portable

FM Receiver Test Laboratory

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
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

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

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	0.502	**Vrms**	= 0dB	**Level**	0.479	**Vrms**
THD	0.34	**%**		**THD**	0.33	**%**

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)
THD increased to 0.0.6%

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:

THD	0.33	%	=	-49.63	dB	(FM Only)
THD	0.396	%	=	-48.05	dB	(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:

RF Lev1	-101.0	dBm	(S/N Ratio = 30dB)
RF Lev2	-23.0	dBm	(21.4MHz + 94.1MHz = 115.5MHz)
Image Rejection:	-78.00	dB	(RF Lev1 - RF Lev2)

394

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

	Mono (L)		Stereo (L)			Separation L->R		
RF Level dBm	Signal dB	Noise dB	Signal dB	Filt. Noise dB	Noise dB	Left dB	Right dB	RF Level dBm
-130	-29.00	-29.00	-28.30	-27.90		-27.50	-27.50	-130
-125	-29.00	-29.00	-28.30	-27.90		-27.50	-27.50	-125
-120	-29.00	-28.80	-28.30	-27.90		-27.50	-27.50	-120
-115	-28.80	-28.40	-28.00	-27.50		-27.30	-27.50	-115
-110	-27.30	-28.70	-26.70	-27.90		-26.20	-26.50	-110
-105	-18.00	-31.40	-17.00	-30.40		-19.80	-20.20	-105
-100	-5.00	-40.80	-4.00	-39.50		-8.20	-8.50	-100
-95	-0.30	-50.00	-0.32	-37.60		-3.00	-9.60	-95
-90	-0.22	-56.00	-0.20	-36.30		-0.20	-27.10	-90
-85	-0.13	-60.20	-0.15	-41.40		0.00	-27.70	-85
-80	0.00	-61.80	0.00	-46.50		0.00	-27.80	-80
-75	0.00	-62.40	0.00	-51.10		0.00	-27.80	-75
-70	0.00	-62.50	0.00	-55.10		0.00	-27.80	-70
-65	0.00	-62.60	0.00	-58.10		0.00	-27.90	-65
-60	0.00	-62.70	0.00	-59.60		0.00	-28.00	-60
-55	0.00	-62.80	0.00	-60.30		0.00	-28.30	-55
-50	0.00	-63.00	0.00	-60.40		0.00	-29.00	-50
-45	0.00	-63.00	0.00	-60.40	-34.60	0.00	-29.70	-45

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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-43.00	-12.00	-46.00	-9.00	
Undesired Lower Lev	-55.00	0.00	-60.00	5.00	
Selectivity, 1st Adj.:		-6.00		-2.00	(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.

	Mono 30dB		Stereo 30dB		
	dBm	D/U	dBm	D/U	
Desired Lev	-55.00		-55.00		
Undesired Upper Lev	-23.00	-32.00	-27.00	-28.00	
Undesired Lower Lev	-33.00	-22.00	-34.00	-21.00	
Selectivity, 2nd Adj.:		-27.00		-24.50	(RF D/U Up + RF D/U Lo)/2

396

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.

	Mono 50dB		Stereo 50dB	
	dBm	D/U	dBm	D/U
Desired Lev	-55.00		-55.00	
Undesired Upper Lev	-44.00	-11.00	-65.00	10.00
Undesired Lower Lev	-61.00	6.00	-80.00	25.00
Selectivity, 1st Adj.:		**-2.50**		**17.50**

(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.

	Mono 50dB		Stereo 50dB	
	dBm	D/U	dBm	D/U
Desired Lev	-55.00		-55.00	
Undesired Upper Lev	-30.00	-25.00	-45.00	-10.00
Undesired Lower Lev	-39.00	-16.00	-46.00	-9.00
Selectivity, 2nd Adj.:		**-20.50**		**-9.50**

(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.

	Mono 50dB		Stereo 50dB	
	dBm	D/U	dBm	D/U
Desired Lev	-55.00		-55.00	
Undesired Upper Lev	-35.00	-20.00	-38.00	-17.00
Undesired Lower Lev	-33.00	-22.00	-34.00	-21.00
Selectivity, 3rd Adj.:		**-21.00**		**-19.00**

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

397

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 -101.00 dBm
RF Lev 2 14.50 dBm EOC
D/U -115.50 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	D/U	dBm	D/U
-45.00		-45.00	
-43.00	-2.00	-45.00	0.00
	-2.00		0.00

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

10.6MHz Spacing		10.7MHz Spacing	
dBm	D/U	dBm	D/U
-45.00		-45.00	
-71.00	26.00	-71.00	26.00
	26.00		26.00

EOC:

396

FM Receiver Test Laboratory

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
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:**

Left Channel	THD	Right Channel	THD
0.502 Vrms	0.34 %	0.479 Vrms	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

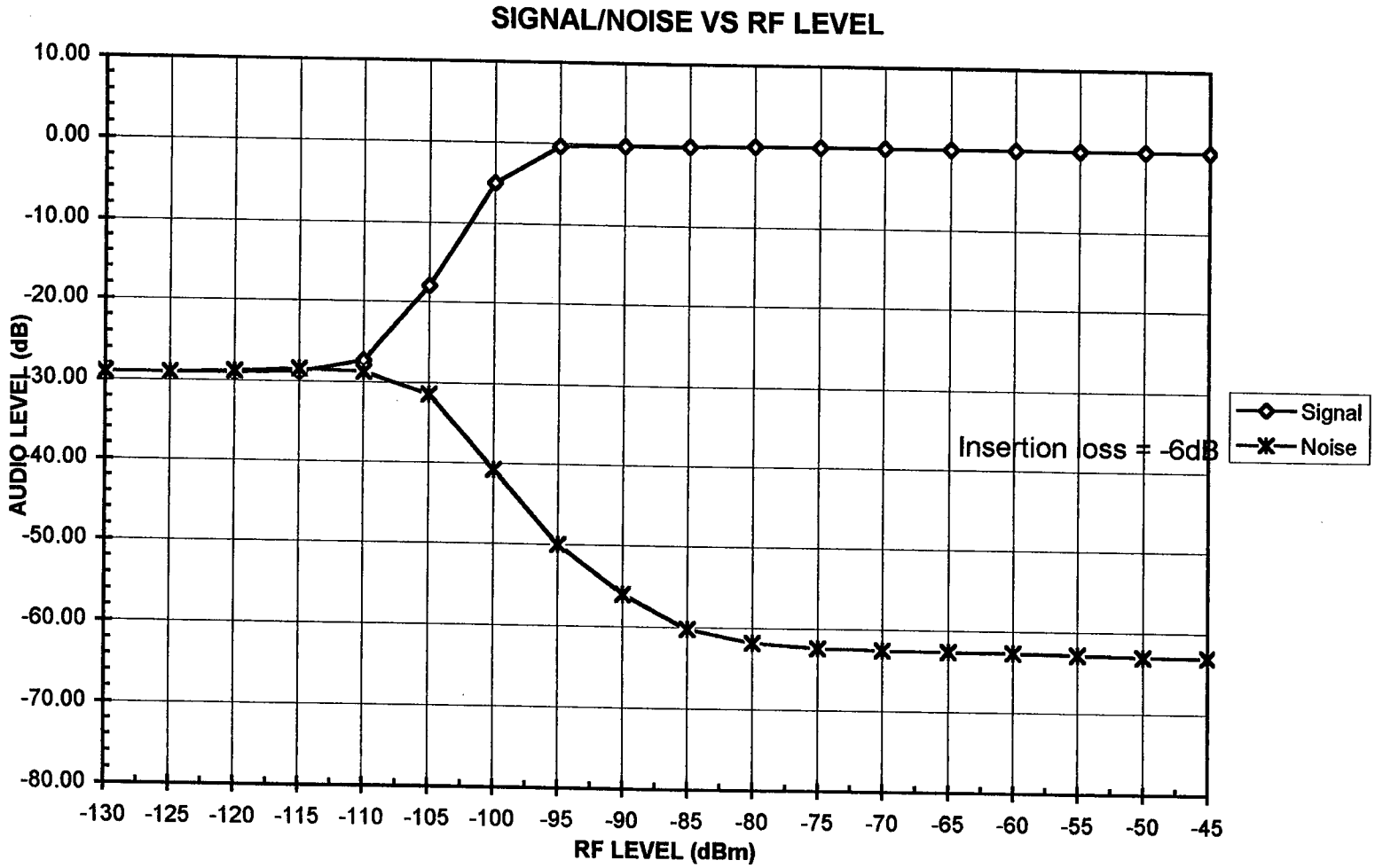
13 **10.7MHz Rejection**
-115.50 dB 0

14 **10.7MHz IM**
-2.00 dB (10.6) 0
0.00 dB (10.7) 0

15 **10.7MHz Spurious (Local Osc. Interference)**
26.00 dB (10.6) 0
26.00 dB (10.7) 0

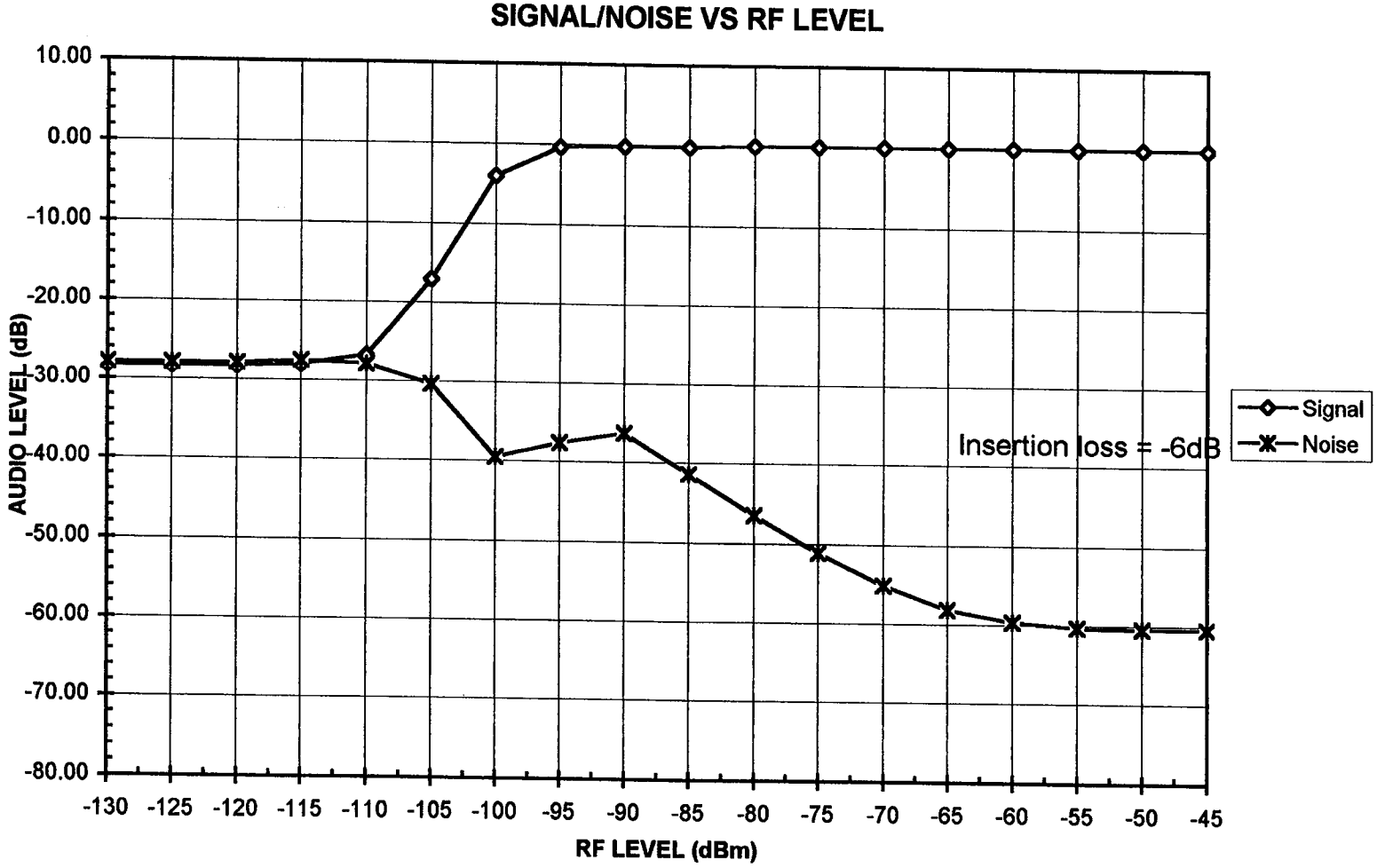
400

FM Receiver Test Laboratory



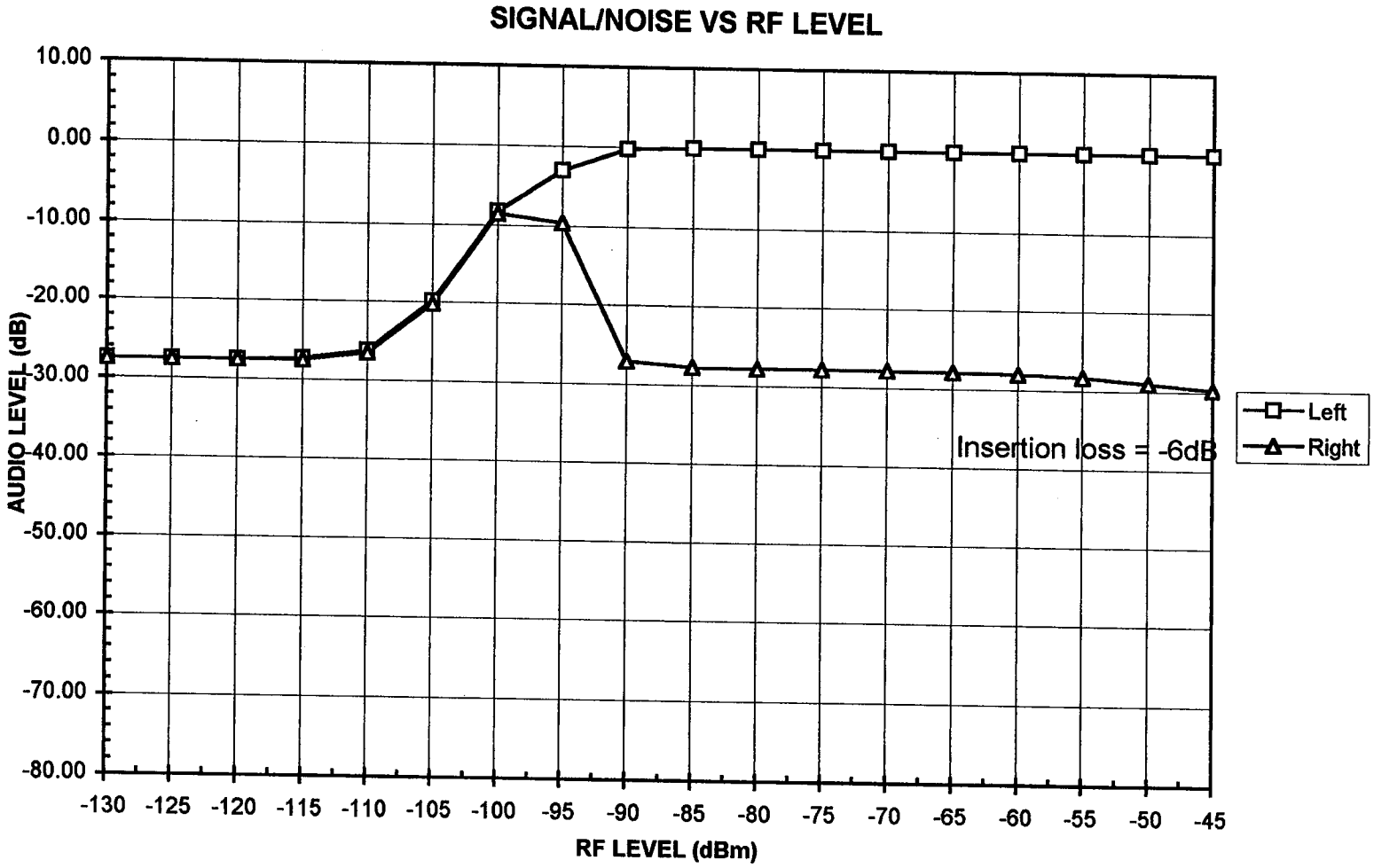
Radio Shack SCR-64 14-704

FM Receiver Test Laboratory



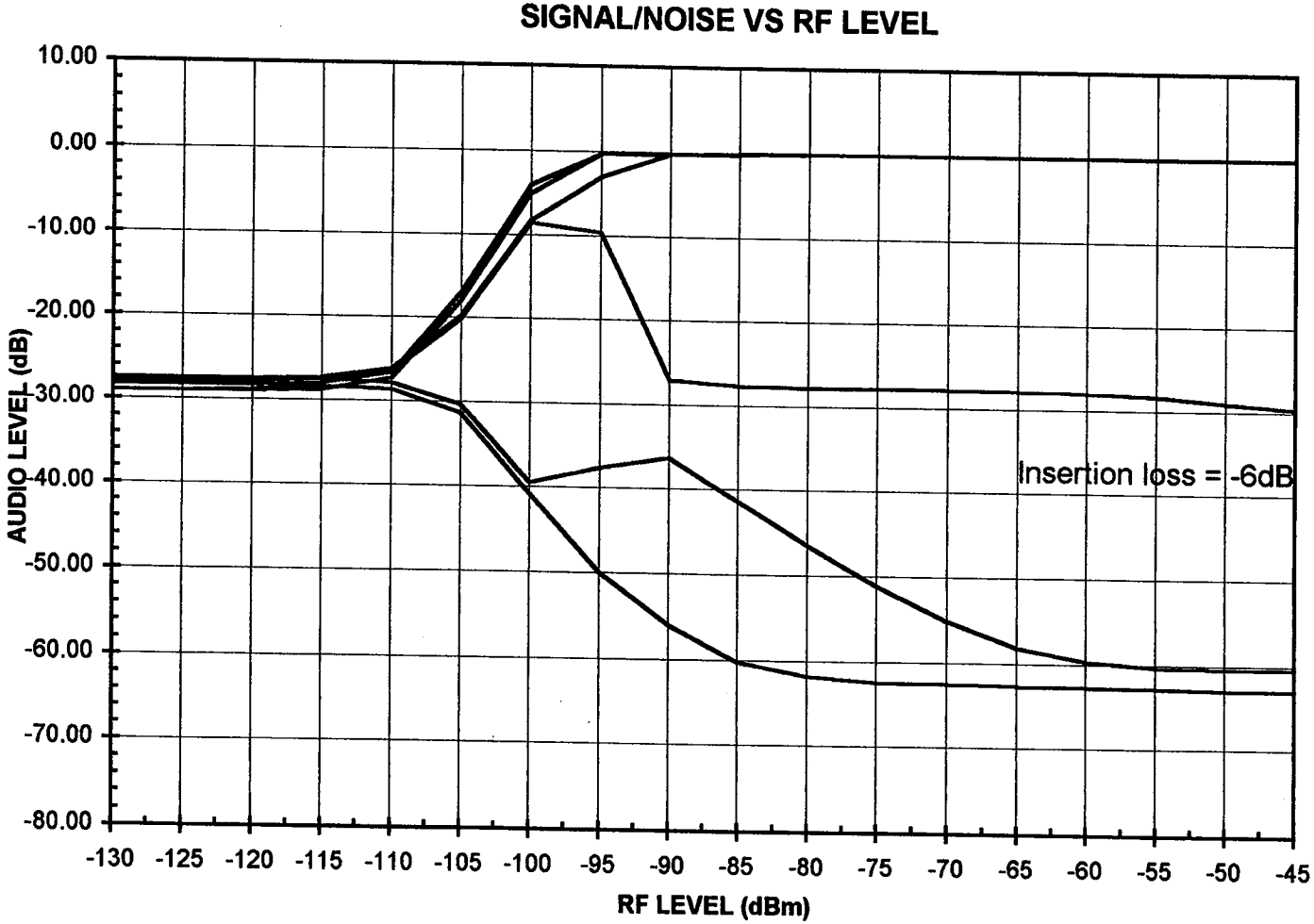
Radio Shack SCR-64 14-704

FM Receiver Test Laboratory

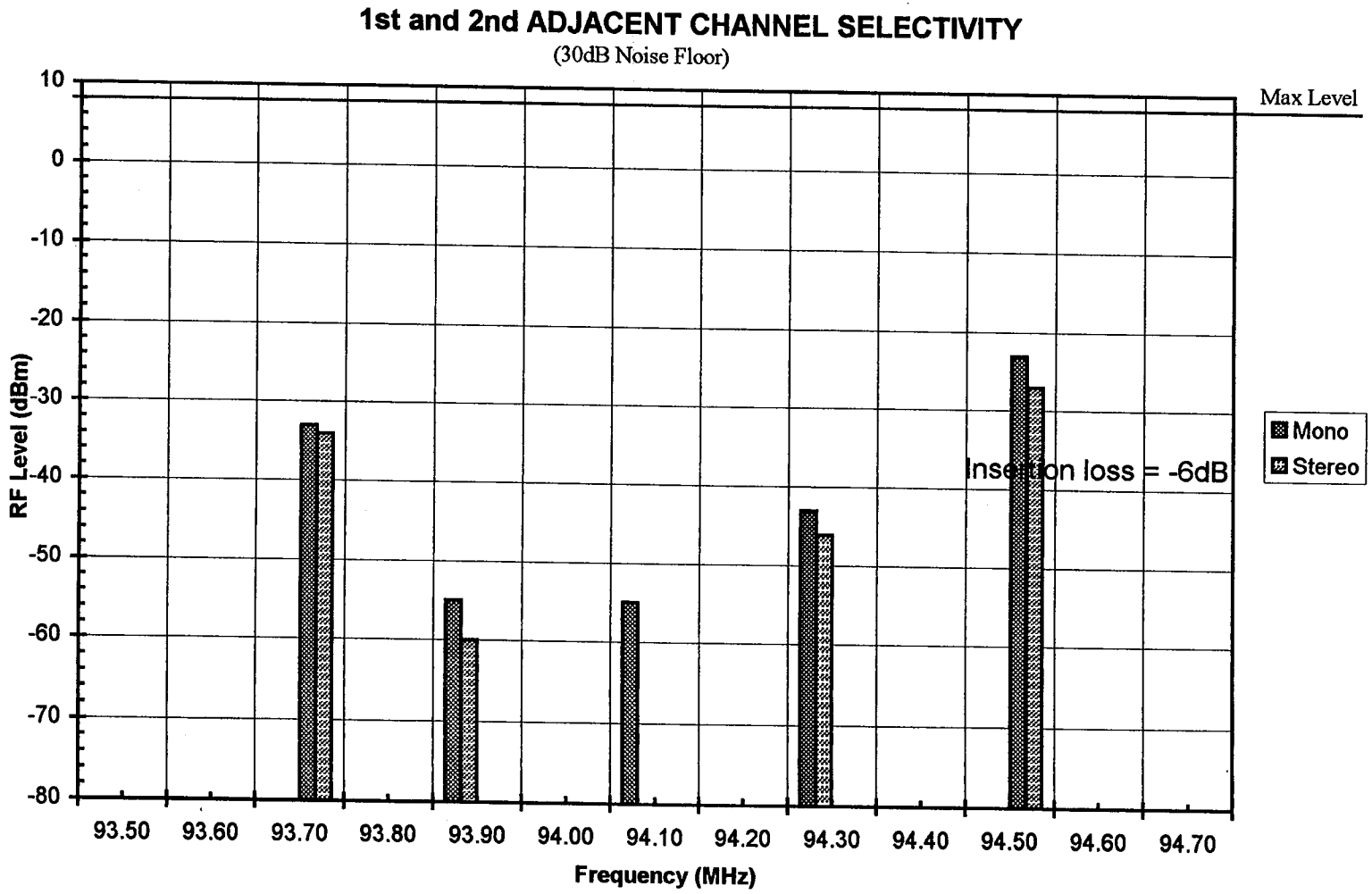


Radio Shack SCR-64 14-704

FM Receiver Test Laboratory



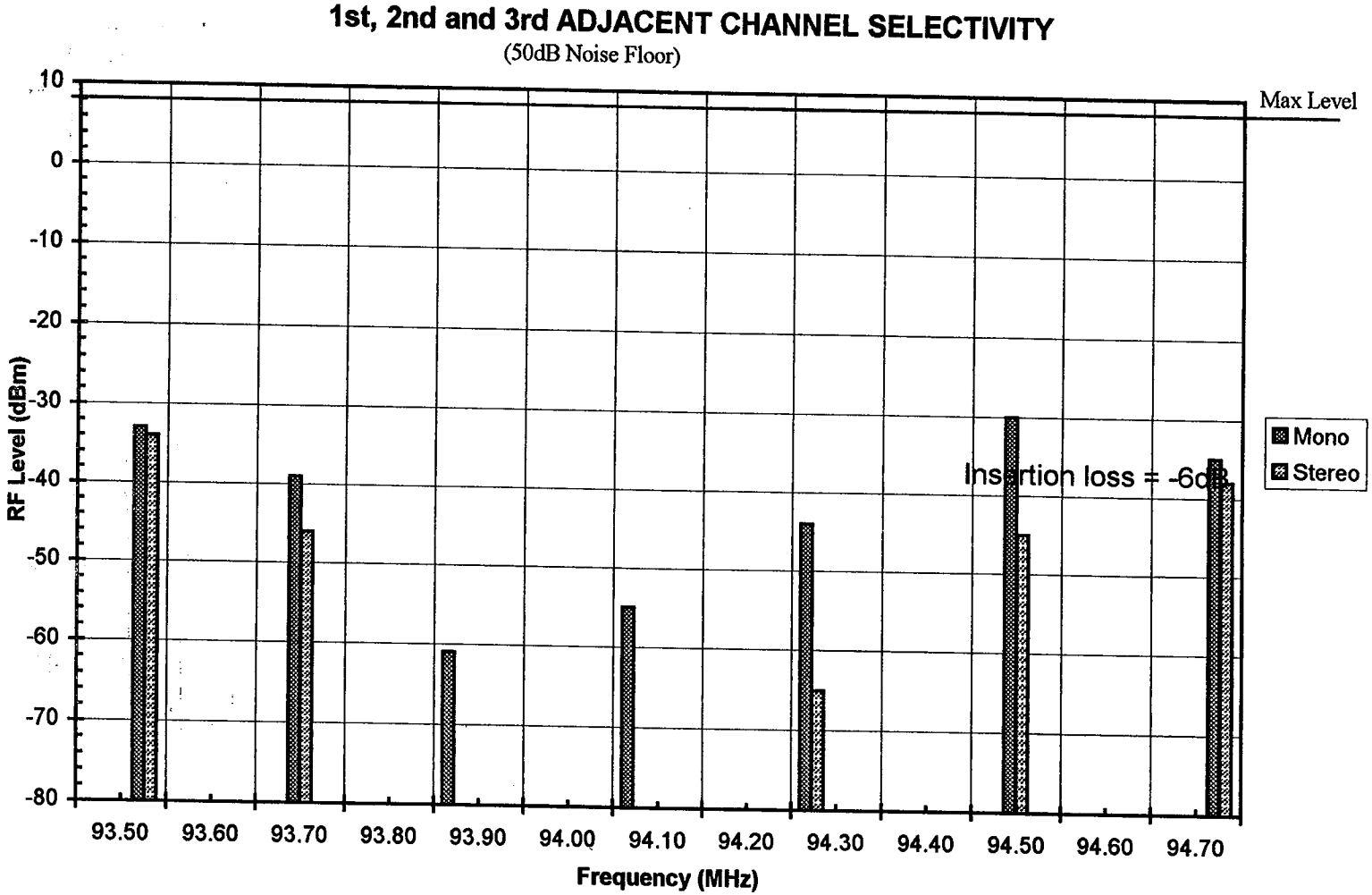
Radio Shack SCR-64 14-704



Radio Shack SCR-64 14-704

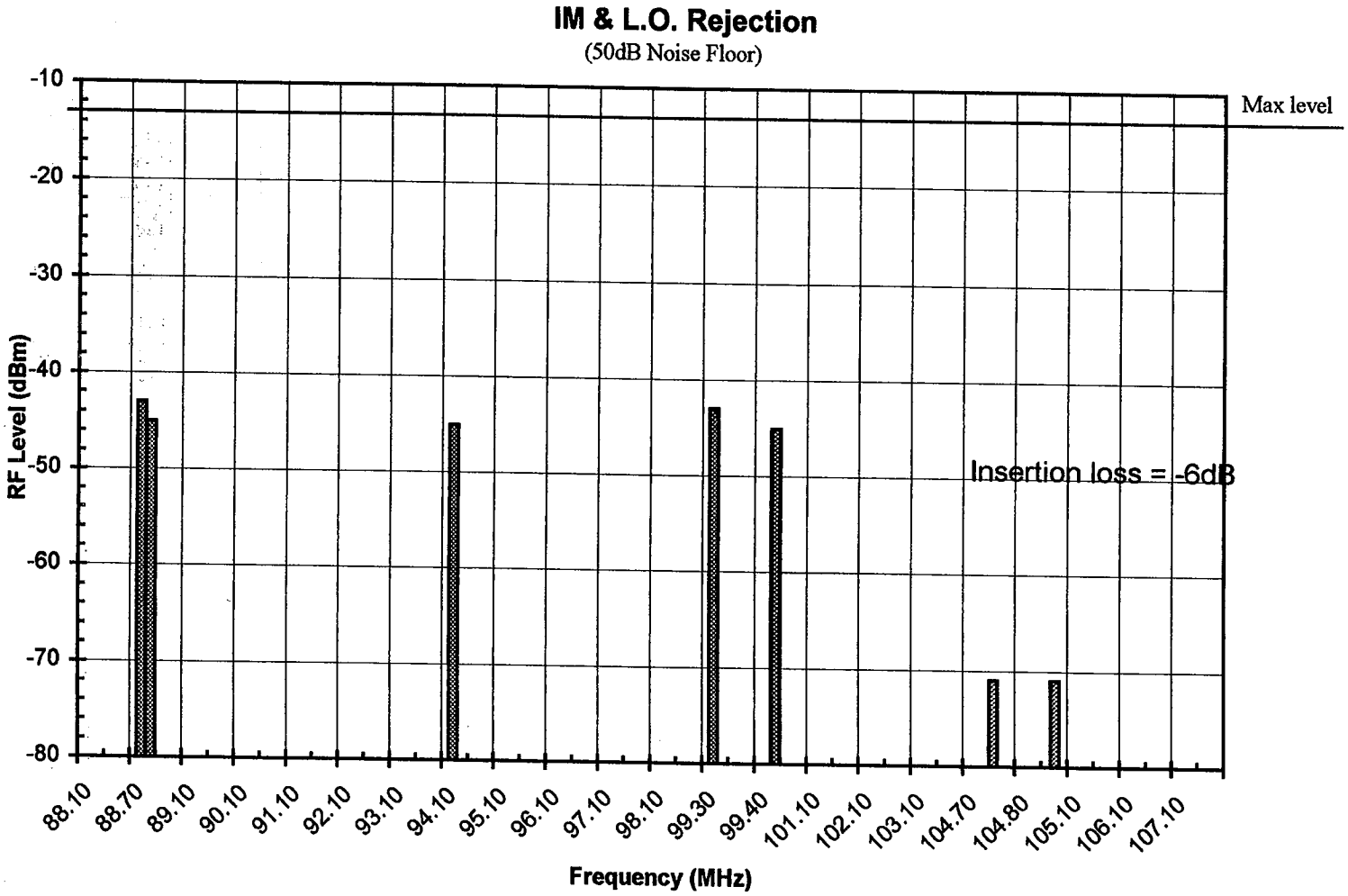
405

FM Receiver Test Laboratory



Radio Shack SCR-64 14-704

FM Receiver Test Laboratory



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

DOCUMENT NO.	DOCUMENT TITLE:
SUBMITTER'S NAME: COMPANY:	TEL: FAX: EMAIL:
ADDRESS:	
URGENCY OF CHANGE: _____ Immediate _____ At next revision	
PROBLEM AREA (ATTACH ADDITIONAL SHEETS IF NECESSARY): a. Clause Number and/or Drawing: b. Recommended Changes: c. Reason/Rationale for Recommendation:	
ADDITIONAL REMARKS:	
SIGNATURE:	DATE:

FOR NRSC USE ONLY

Date forwarded to NAB S&T: _____
Responsible Committee: _____
Co-chairmen: _____
Date forwarded to co-chairmen: _____


CEA
Consumer Electronics Association


NAB
NATIONAL ASSOCIATION OF BROADCASTERS