Receiver Characterization - For AM

THD vs. Audio Output Level

Receiver : **DELCO**
Model # : **16192463**
Serial # : **1000039**
Date Tested : 03/31/99

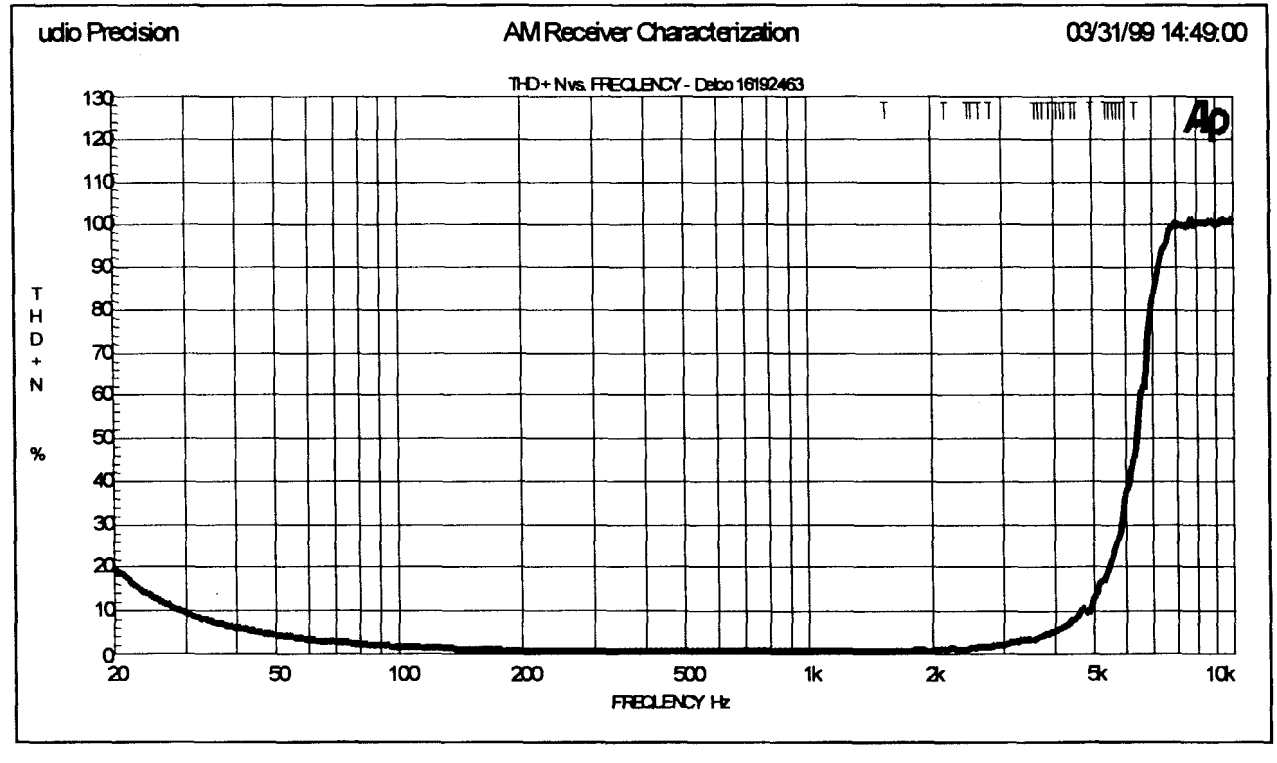
Receiver Settings: Balance, Bass and Treble set to center positions
Graphic Equalizer set to center positions
AM Stereo set to OFF position
Loudness set to OFF position

Audio Frequency = 400 Hz
80% Modulation
RF Level : -47dBm
Load impedance: 4 ohms

Volume Settings (Watts)	THD (%)
0.1	0.8
1.1	0.7
3.0	0.5
7.5	9.6

Maximum Power Output: 7.5 Watts

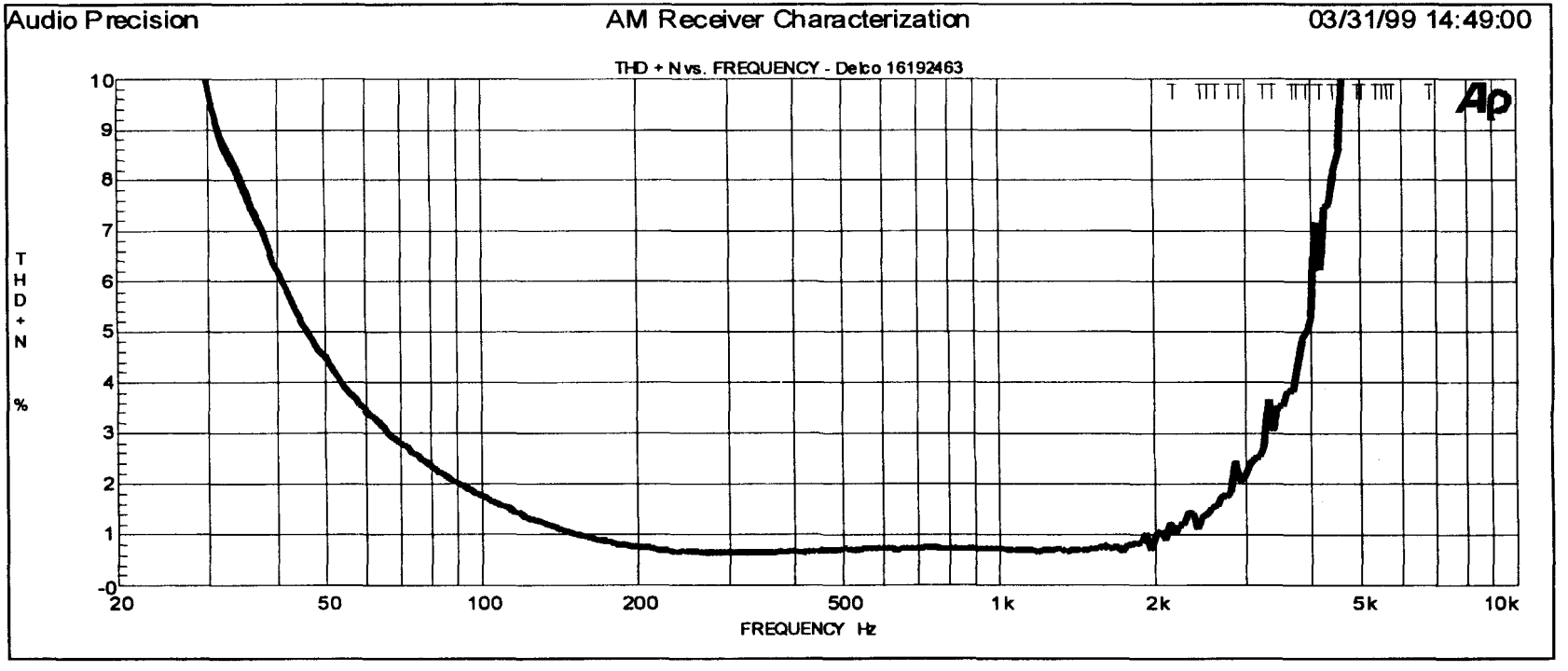
Audio output power level for plots: 1.2 Watts



Receiver Characterization - For AM

THD vs. Audio Output Level

Receiver : **DELCO**
Model # : **16192463**
Serial # : **1000039**
Date Tested : 03/31/99



Receiver Characterization - For AM

THD vs. Audio Output Level

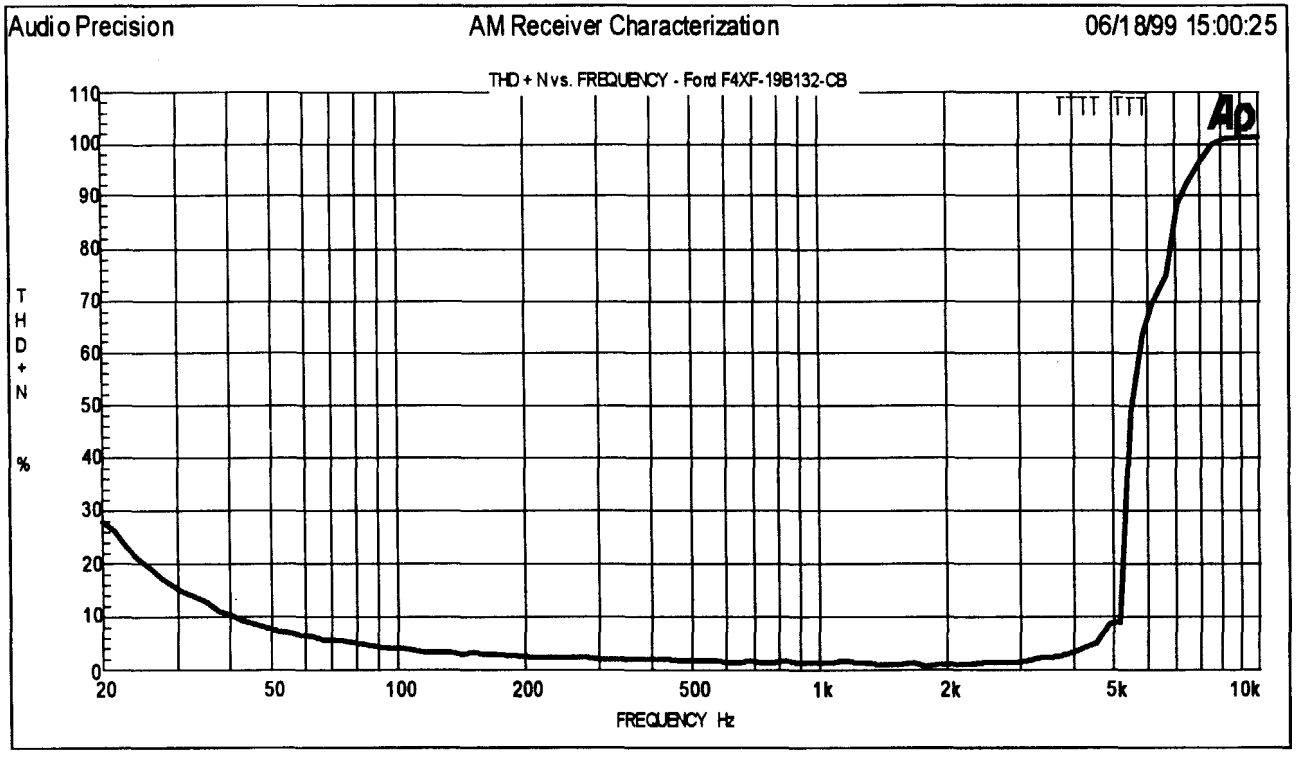
Receiver : **FORD**
Model # : **F4XF-19B132-CB**
Serial # : **28115 0B700**
Date Tested : 06/18/99

Audio Frequency = 400 Hz
80% Modulation
RF Level : -47dBm
Load impedance: 4 ohms

Volume Settings (Watts)	THD (%)
0.05	1.3
1.3	1.4
2.1	1.4
3.4	9.9

Maximum Power Output: 3.4 Watts

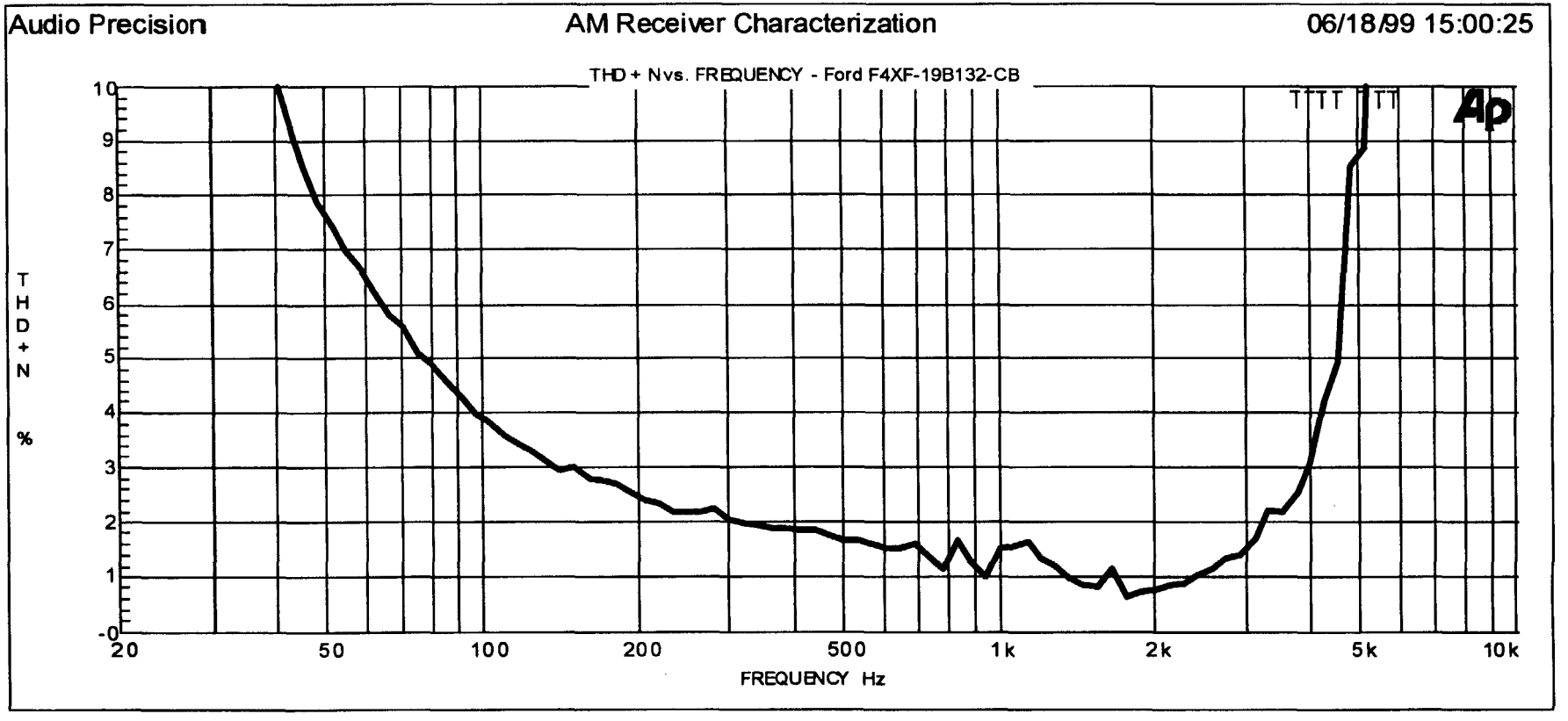
Audio output power level for plots: 1.2 Watts



Receiver Characterization - For AM

THD vs. Audio Output Level

Receiver : **FORD**
Model # : **F4XF-19B132-CB**
Serial # : **28115 0B700**
Date Tested : 06/18/99



Receiver Characterization - For AM

THD vs. Audio Output Level

Receiver : **PANASONIC**
Model # : **RX-FS430**
Serial # : **WP8JE52506**
Date Tested : 06/18/99

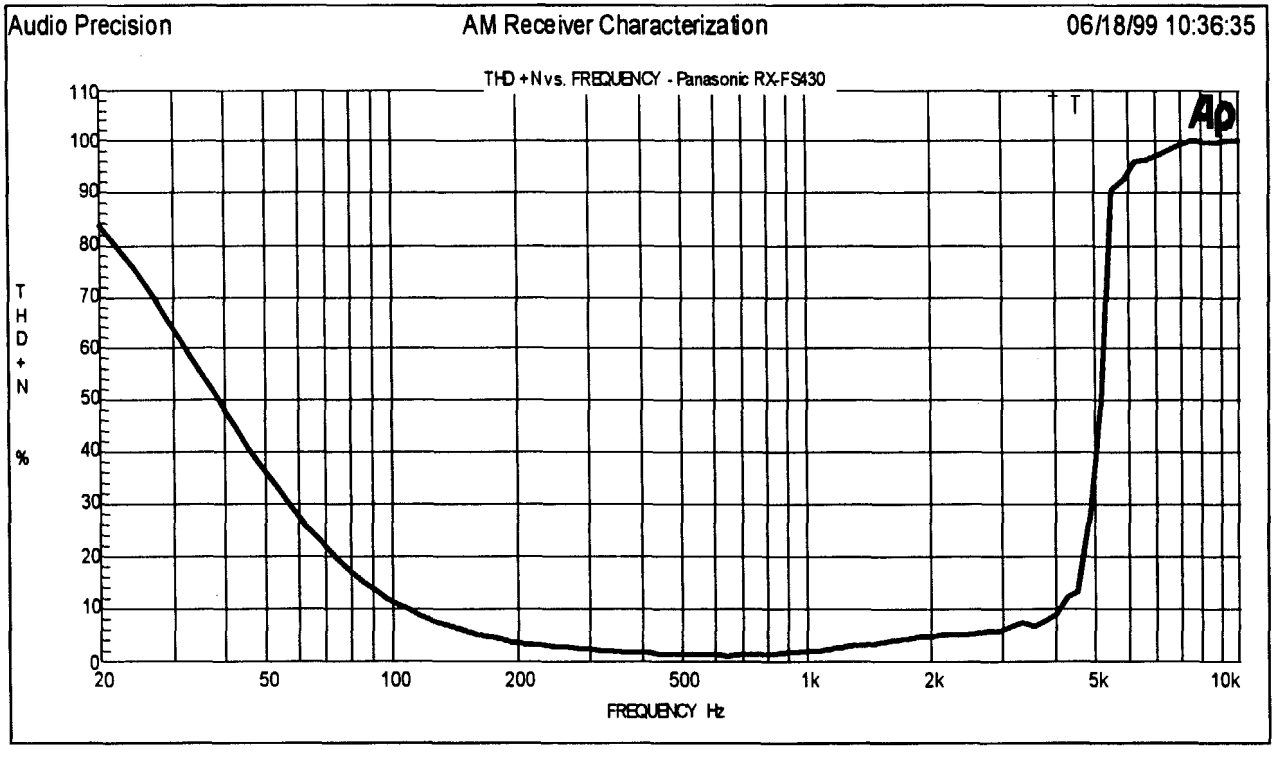
Receiver Settings: Tone Control set to center position
Tuning adjusted until minimum distortion obtained at RF level

Audio Frequency = 400 Hz
80% Modulation
RF Level : -47dBm
Load impedance: 4 ohms

Volume Settings (Watts)	THD (%)
0.003	3.3
0.06	3.6
0.45	40.1
0.89	73.0

Maximum Power Output: 0.89 Watts

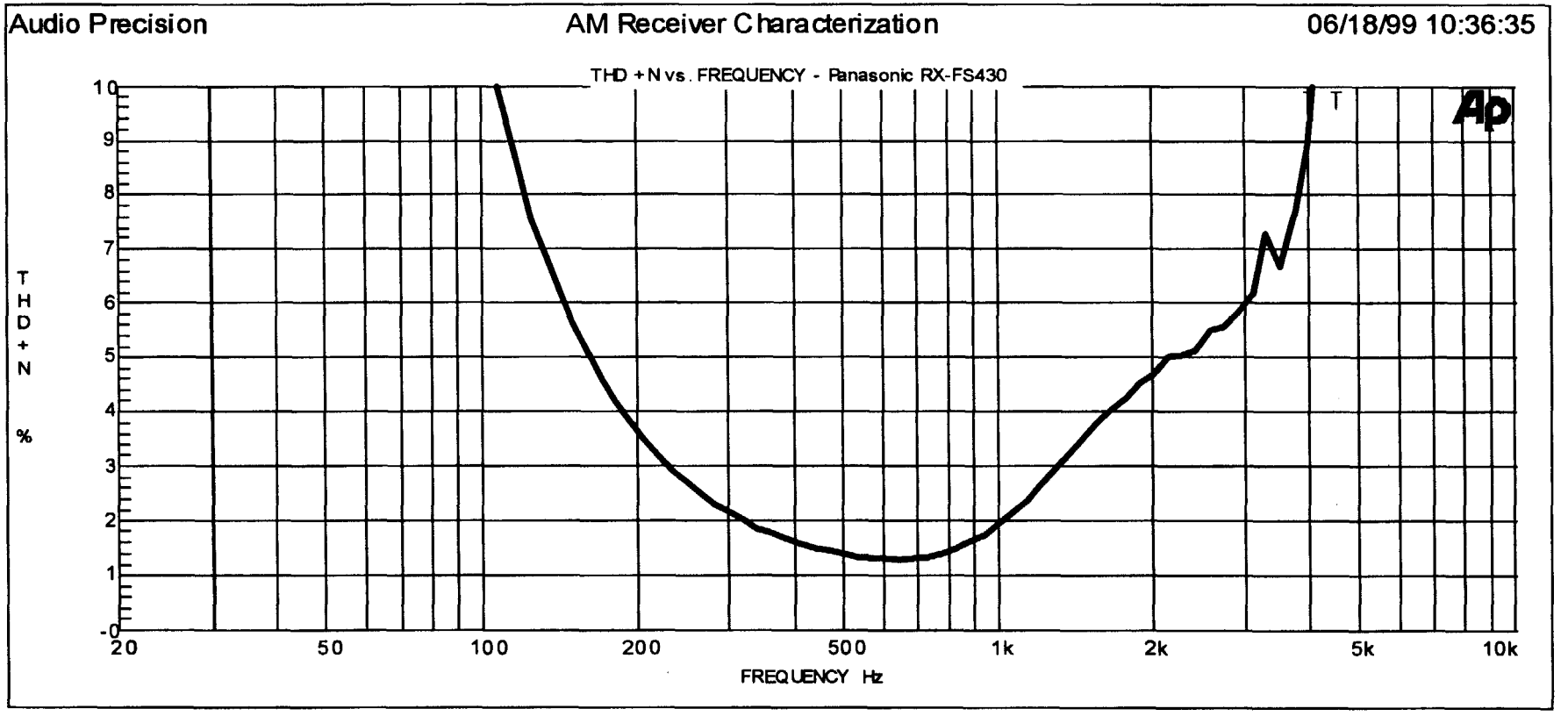
Audio output power level for plots: 0.06 Watts



Receiver Characterization - For AM

THD vs. Audio Output Level

Receiver : **PANASONIC**
Model # : **RX-FS430**
Serial # : **WP8JE52506**
Date Tested : 06/18/99



Receiver Characterization - For AM

THD vs. Audio Output Level

Receiver : **PIONEER**
Model # : **VSX-D307**
Serial # : **SKDI083167US**
Date Tested : 04/30/99

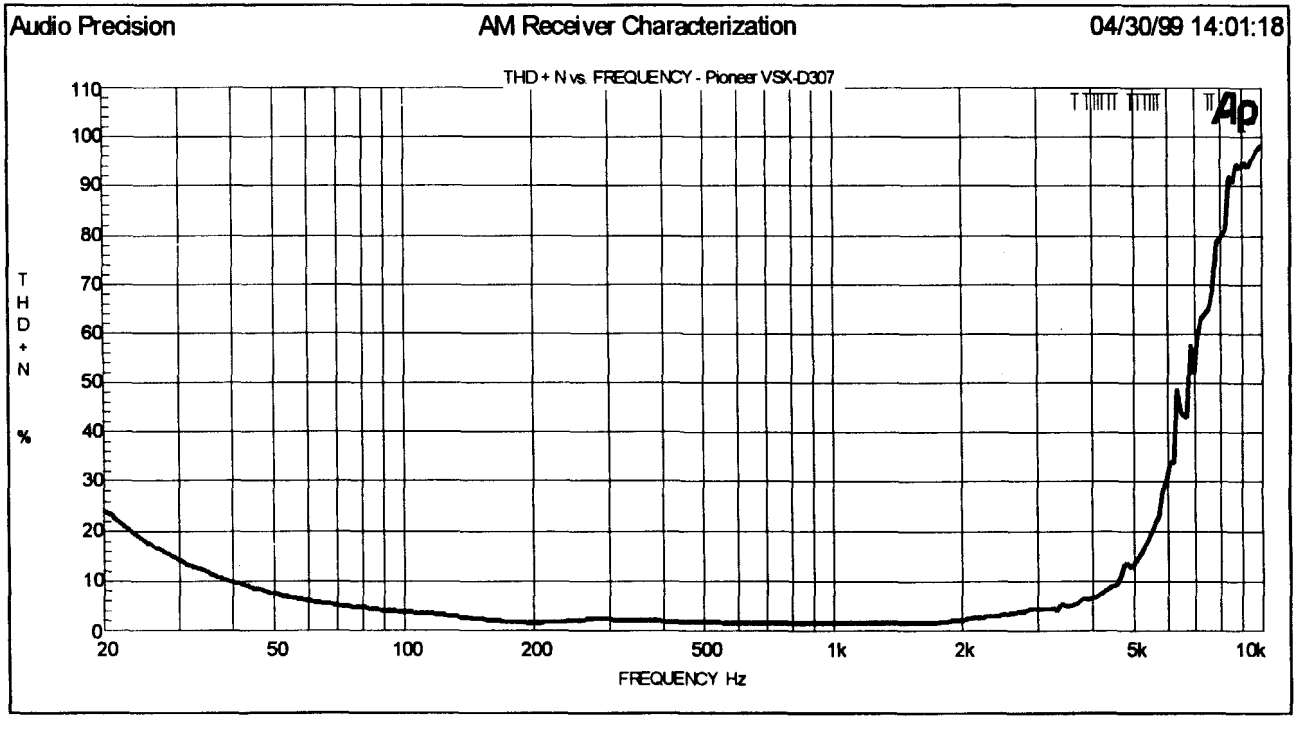
Receiver Settings: Balance, Bass and Treble set to center positions
Dolby Pro-Logic set to OFF position
Dolby Virtual set to OFF position
Surround Sound set to OFF position
DSP mode set to OFF position
Loudness set to OFF position
MPX mode turned ON to "mono" for AM and mono FM testing
MPX mode turned OFF to "stereo" for stereo FM testing

Audio Frequency = 400 Hz
80% Modulation
RF Level : -47dBm
Load impedance: 8 ohms

Volume Settings (Watts)	THD (%)
0.1	1.8
1.0	1.8
5.1	1.8
50.1	1.8

Maximum Power Output: 50.1 Watts

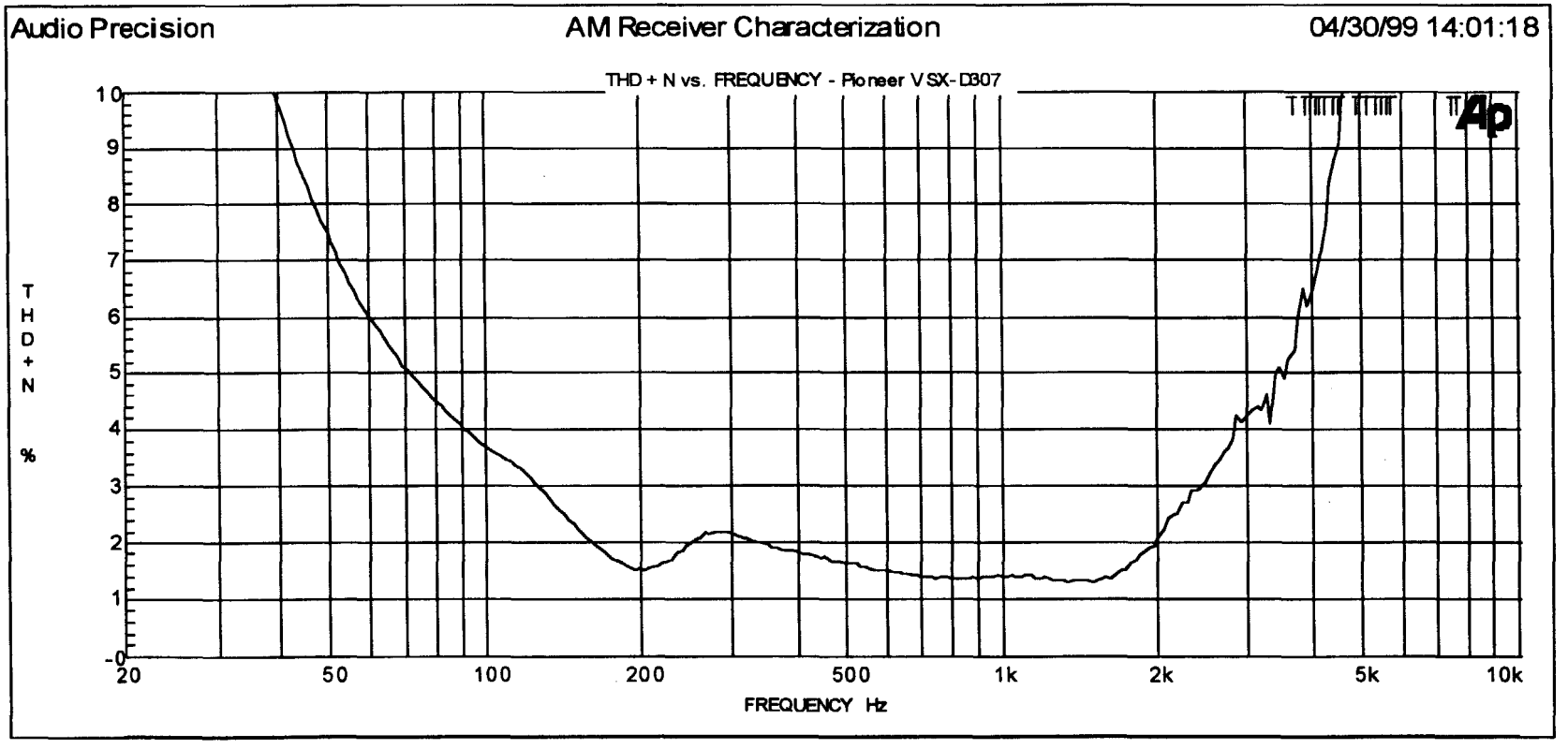
Audio output power level for plots: 1.0 Watts



Receiver Characterization - For AM

THD vs. Audio Output Level

Receiver : **PIONEER**
Model # : **VSX-D307**
Serial # : **SKDI083167US**
Date Tested : **04/30/99**



Receiver Characterization - For AM

THD vs. Audio Output Level

Receiver : **SONY**
Model # : **STR-DE425**
Serial # : **8839190**
Date Tested : 04/01/99

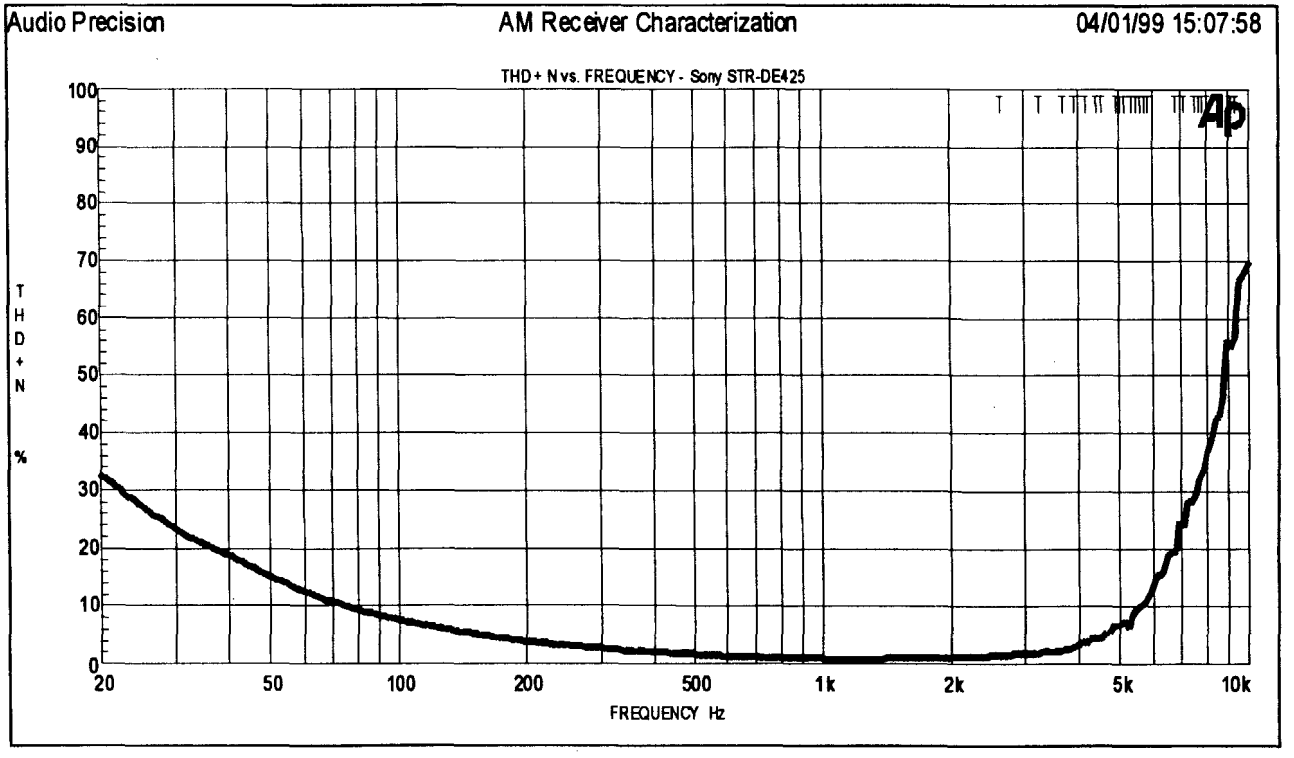
Receiver Settings: Balance, Bass and Treble set to center positions
5.1 DVD input set to OFF position
Bass Boost set to OFF position
Surround Sound set to OFF position
Setup mode set to NORMAL

Audio Frequency = 400 Hz
80% Modulation
RF Level : -47dBm
Load Impedance: 8 ohms

Volume Settings (Watts)	THD (%)
0.1	2.1
1.0	2.1
5.0	2.1
50.3	2.2

Maximum Power Output: 50.3 Watts

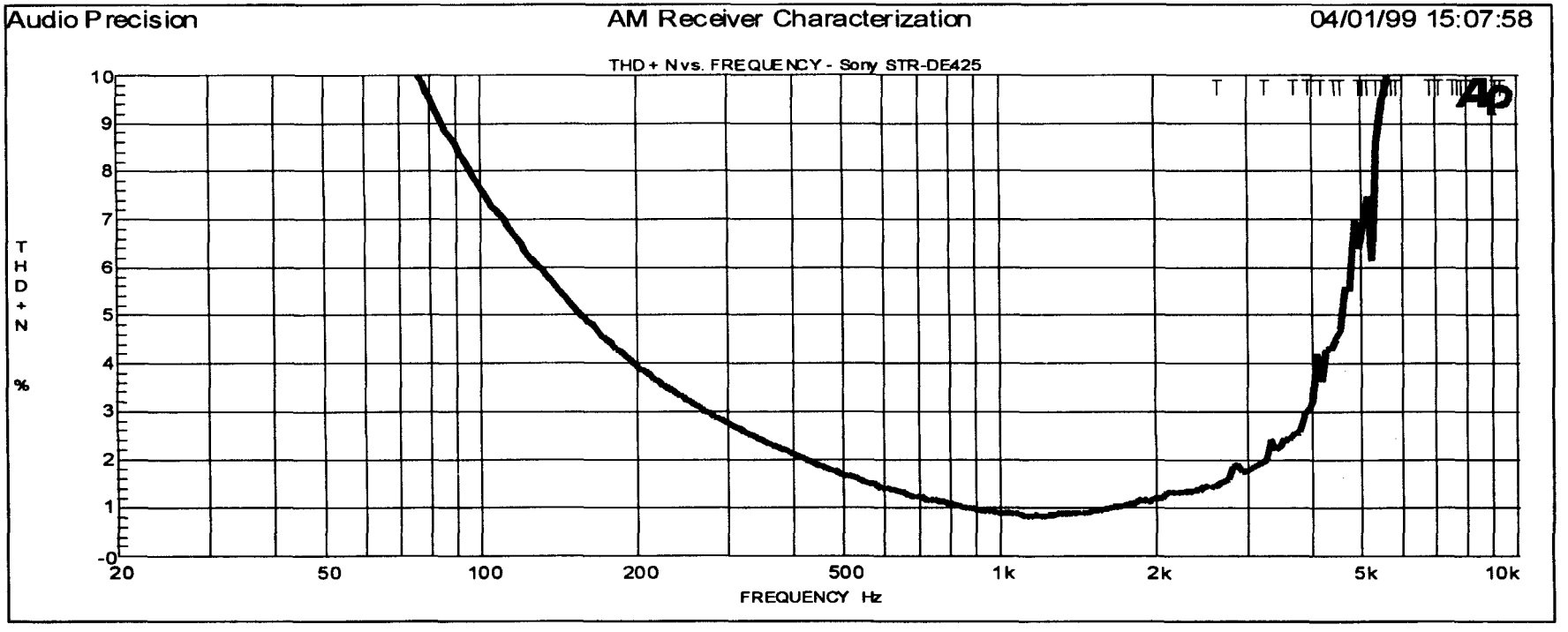
Audio output power level for plots: 1.0 Watts



Receiver Characterization - For AM

THD vs. Audio Output Level

Receiver : **SONY**
Model # : **STR-DE425**
Serial # : **8839190**
Date Tested : 04/01/99



Receiver Characterization - For AM

SNR vs. RF Level

Receiver : **DELCO**
Model # : **16192463**
Serial # : **1000039**
Date Tested : 06/18/99

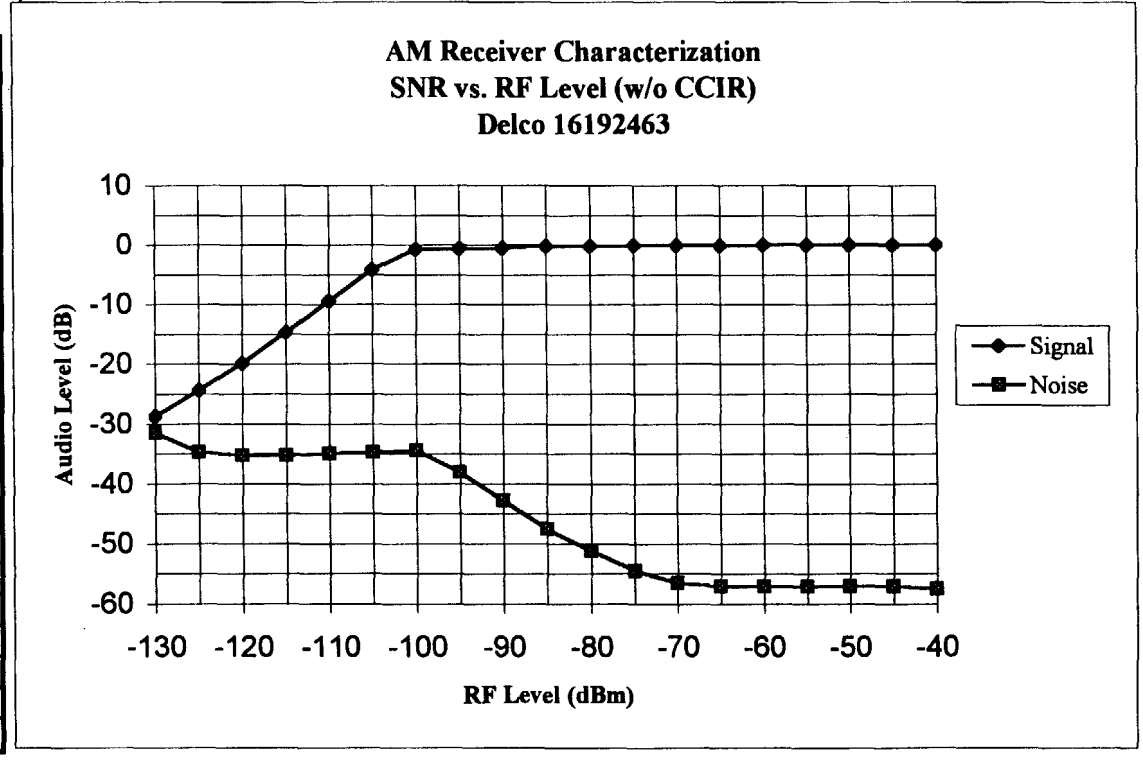
Receiver Settings: Balance, Bass and Treble set to center positions
Graphic Equalizer set to center positions
AM Stereo set to OFF position
Loudness set to OFF position

Audio Frequency = 400Hz
80% Modulation
Load impedance: 4 ohms

Audio Output Power level at RF Level of -40dBm: 1.0 Watts (= 0dB)

Without CCIR

	Audio Output Power Level (dB relative to output power when RF level is -40dBm)	
RF Level (dBm)	**Signal (dB)**	**Noise (dB)**
-40	0.0	-57.5
-45	0.0	-57.1
-50	0.0	-57.1
-55	0.0	-57.1
-60	0.0	-57.1
-65	0.0	-57.1
-70	0.0	-56.6
-75	-0.1	-54.5
-80	-0.2	-51.2
-85	-0.2	-47.5
-90	-0.5	-42.8
-95	-0.7	-38.1
-100	-0.7	-34.5
-105	-4.2	-34.8
-110	-9.5	-35.0
-115	-14.7	-35.3
-120	-19.9	-35.3
-125	-24.4	-34.8
-130	-28.8	-31.5



Receiver Characterization - For AM

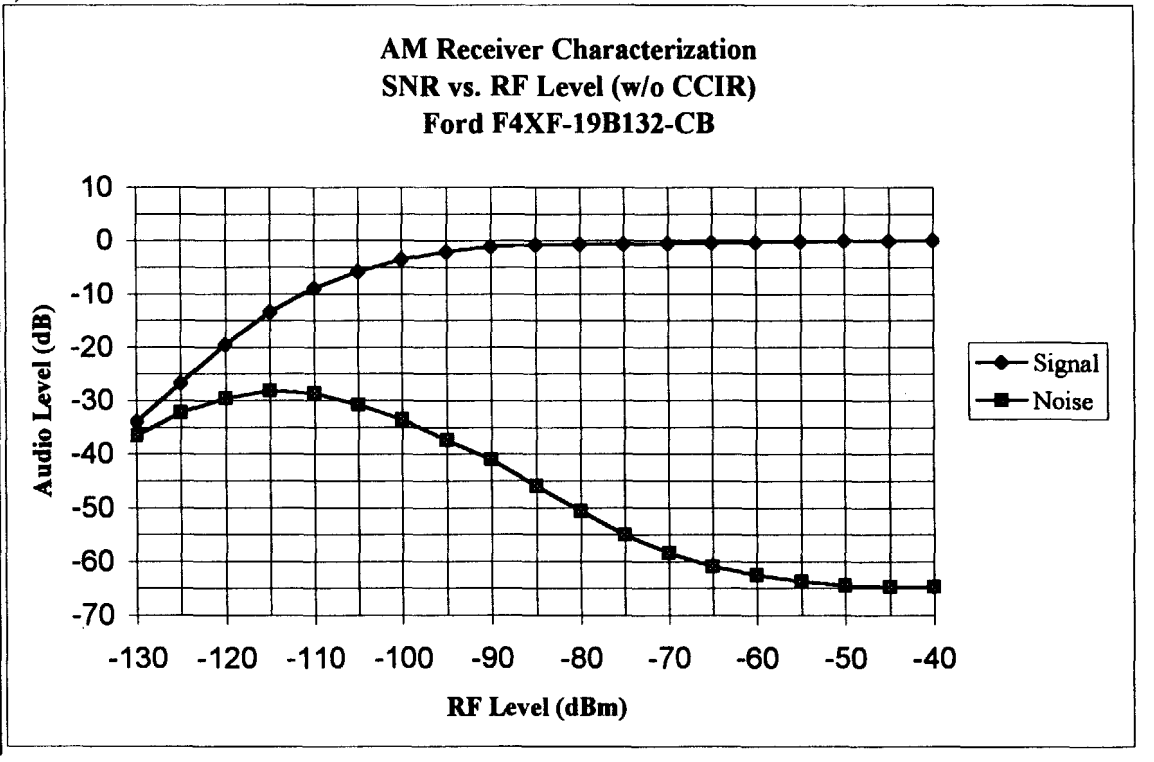
SNR vs. RF Level

Receiver : **FORD**
Model # : **F4XF-19B132-CB**
Serial # : **28115 0B700**
Date Tested : 06/18/99

Audio Frequency = 400Hz
80% Modulation
Load impedance: 4 ohms

Audio Output Power level at RF Level of -40dBm: 1.4 Watts (= 0dB)

Without CCIR	Audio Output Power Level (dB relative to output power when RF level is -40dBm)	
RF Level (dBm)	**Signal (dB)**	**Noise (dB)**
-40	0.0	-64.7
-45	-0.1	-64.7
-50	-0.1	-64.5
-55	-0.2	-63.7
-60	-0.4	-62.5
-65	-0.5	-61.0
-70	-0.6	-58.5
-75	-0.7	-55.1
-80	-0.7	-50.7
-85	-0.8	-46.0
-90	-1.2	-41.1
-95	-2.2	-37.5
-100	-3.6	-33.6
-105	-5.8	-30.9
-110	-9.0	-28.7
-115	-13.4	-28.2
-120	-19.5	-29.6
-125	-26.7	-32.3
-130	-34.0	-36.6



Receiver Characterization - For AM

SNR vs. RF Level

Receiver : **PANASONIC**
Model # : **RX-FS430**
Serial # : **WP8JE52506**
Date Tested : 06/18/99

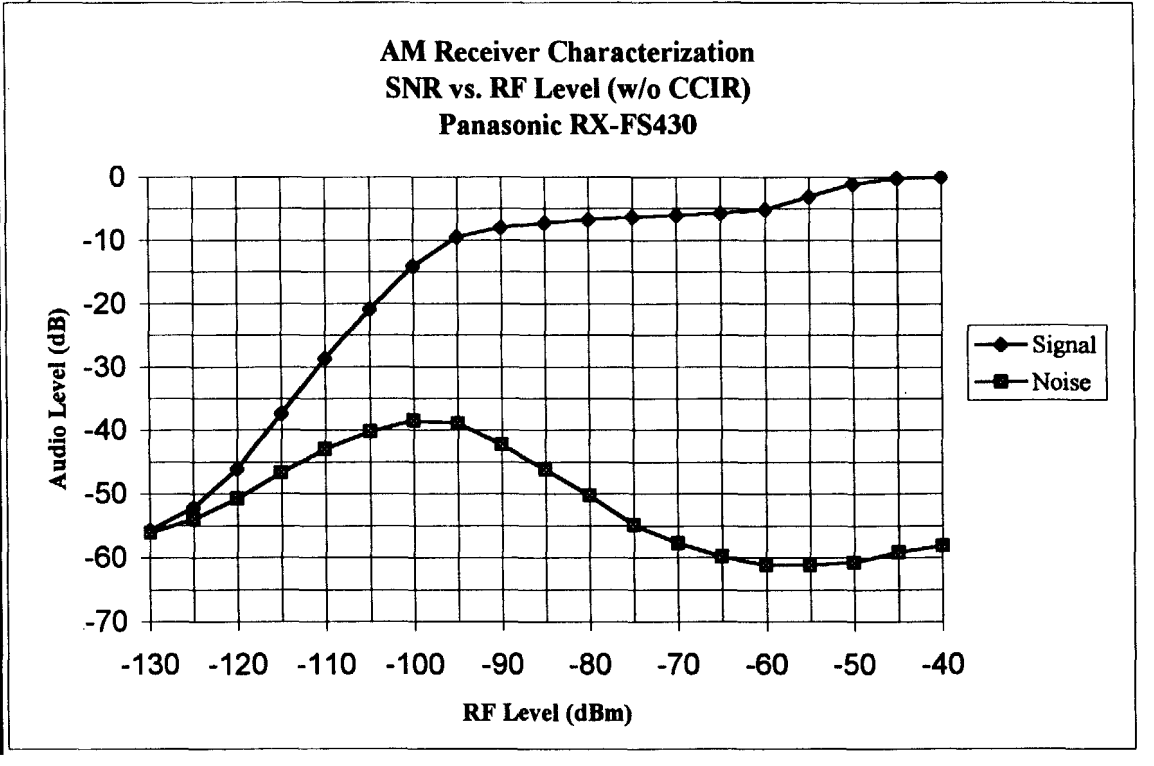
Receiver Settings: Tone Control set to center position
Tuning adjusted until minimum distortion obtained at RF level

Audio Frequency = 400Hz
80% Modulation
Load impedance: 4 ohms

Audio Output Power level at RF Level of -40dBm: 0.25 Watts (= 0dB)

Without CCIR

RF Level (dBm)	Audio Output Power Level (dB relative to output power when RF level is -40dBm) Signal (dB)	Noise (dB)
-40	0.0	-58.2
-45	-0.3	-59.2
-50	-1.1	-60.8
-55	-3.2	-61.2
-60	-5.2	-61.2
-65	-5.7	-59.9
-70	-6.1	-57.8
-75	-6.4	-54.9
-80	-6.8	-50.3
-85	-7.3	-46.2
-90	-8.0	-42.3
-95	-9.5	-38.9
-100	-14.2	-38.5
-105	-20.9	-40.3
-110	-28.7	-43.0
-115	-37.4	-46.7
-120	-46.1	-50.8
-125	-52.2	-54.0
-130	-55.7	-56.1



Receiver Characterization - For AM

SNR vs. RF Level

Receiver : **PIONEER**
Model # : **VSX-D307**
Serial # : **SKDI083167US**
Date Tested : 06/18/99

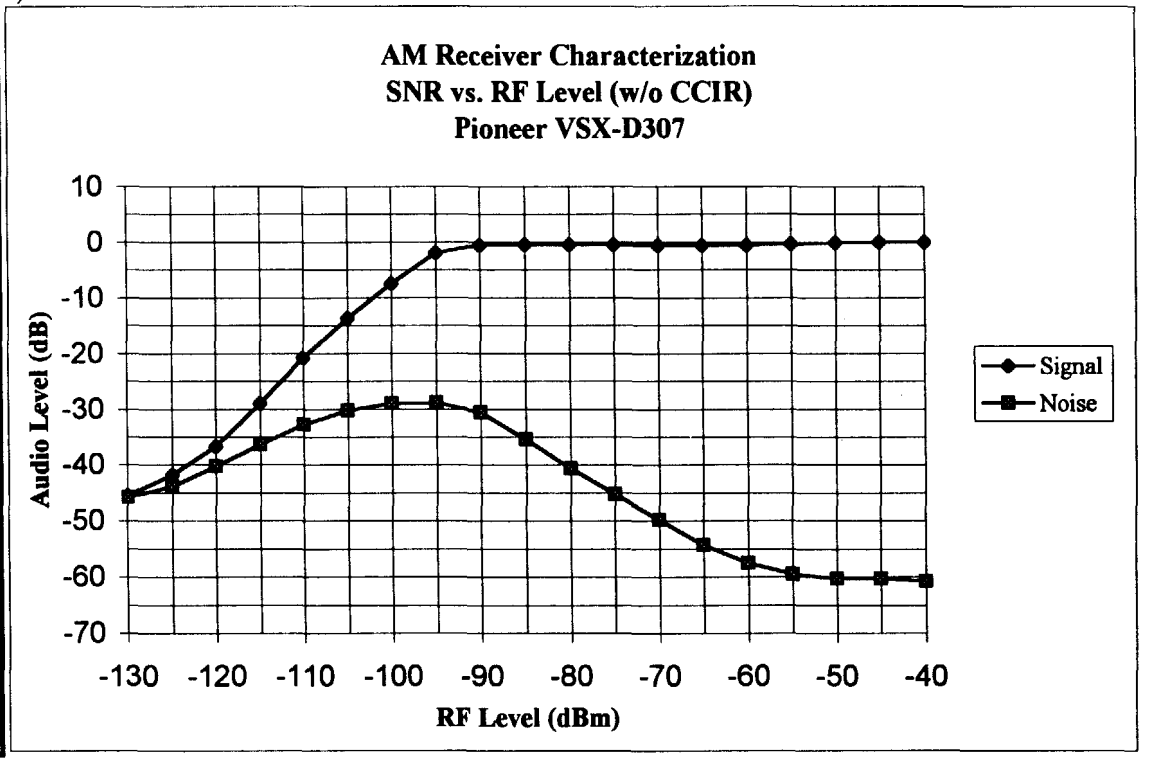
Audio Frequency = 400Hz
80% Modulation
Load impedance: 8 ohms

Receiver Settings: Balance, Bass and Treble set to center positions
Dolby Pro-Logic set to OFF position
Dolby Virtual set to OFF position
Surround Sound set to OFF position
DSP mode set to OFF position
Loudness set to OFF position
MPX mode turned ON to "mono" for AM and mono FM testing
MPX mode turned OFF to "stereo" for stereo FM testing

Audio Output Power level at RF Level of -40dBm: 1.1 Watts (= 0dB)

Without CCIR

	Audio Output Power Level (dB relative to output power when RF level is -40dBm)	
RF Level (dBm)	**Signal (dB)**	**Noise (dB)**
-40	0.0	-60.8
-45	0.0	-60.3
-50	-0.1	-60.3
-55	-0.4	-59.5
-60	-0.5	-57.6
-65	-0.5	-54.3
-70	-0.5	-49.8
-75	-0.5	-45.2
-80	-0.5	-40.6
-85	-0.5	-35.5
-90	-0.6	-30.6
-95	-2.0	-28.9
-100	-7.5	-29.0
-105	-13.7	-30.3
-110	-20.8	-32.8
-115	-29.0	-36.4
-120	-36.7	-40.3
-125	-41.8	-43.9
-130	-45.5	-45.8



Receiver Characterization - For AM

SNR vs. RF Level

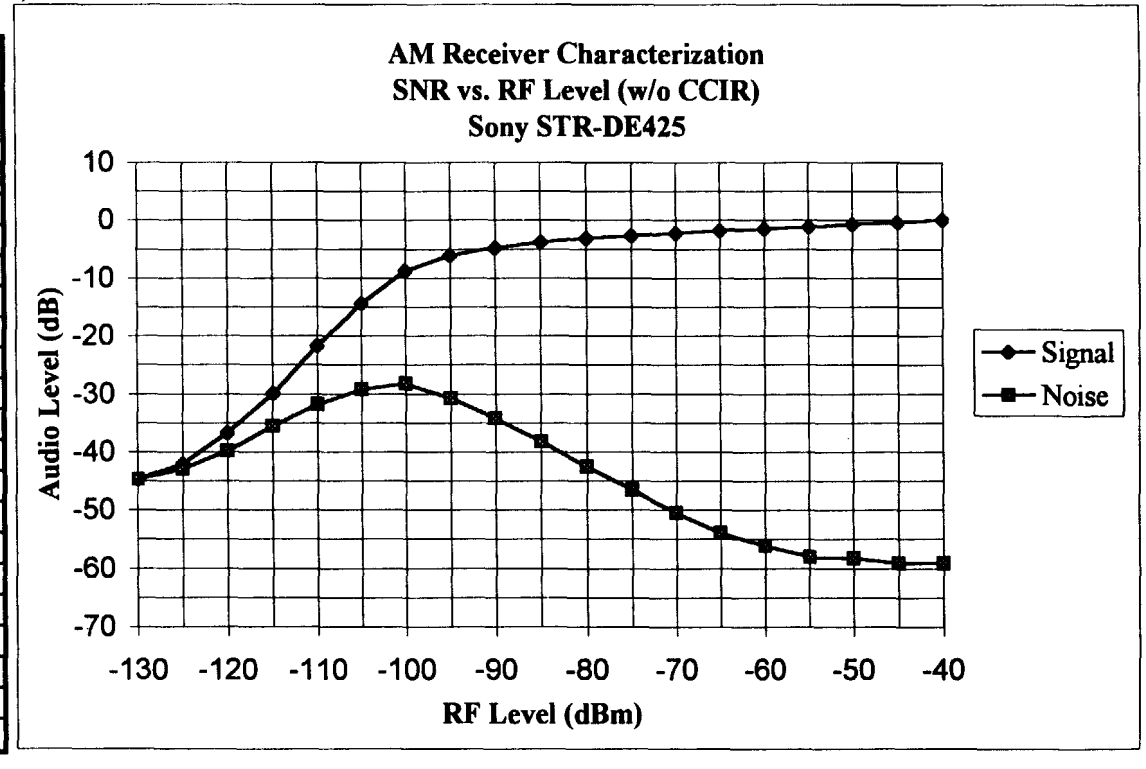
Receiver : **SONY**
Model # : **STR-DE425**
Serial # : **8839190**
Date Tested : 06/18/99

Receiver Settings: Balance, Bass and Treble set to center positions
5.1 DVD input set to OFF position
Bass Boost set to OFF position
Surround Sound set to OFF position
Setup mode set to NORMAL

Audio Frequency = 400Hz
80% Modulation
Load impedance: 8 ohms

Audio Output Power level at RF Level of -40dBm: 1.0 Watts (= 0dB)

Without CCIR	Audio Output Power Level (dB relative to output power when RF level is -40dBm)	
RF Level (dBm)	**Signal (dB)**	**Noise (dB)**
-40	0.0	-59.2
-45	-0.4	-59.2
-50	-0.8	-58.3
-55	-1.2	-58.0
-60	-1.5	-56.2
-65	-1.9	-54.0
-70	-2.3	-50.5
-75	-2.7	-46.5
-80	-3.2	-42.6
-85	-3.9	-38.2
-90	-4.8	-34.3
-95	-6.2	-30.8
-100	-8.8	-28.3
-105	-14.5	-29.3
-110	-21.8	-31.8
-115	-29.9	-35.6
-120	-36.8	-39.9
-125	-42.1	-43.0
-130	-44.8	-44.8



Receiver Characterization - For AM

SNR vs. RF Level

Receiver : **DELCO**
Model # : **16192463**
Serial # : **1000039**
Date Tested : 06/18/99

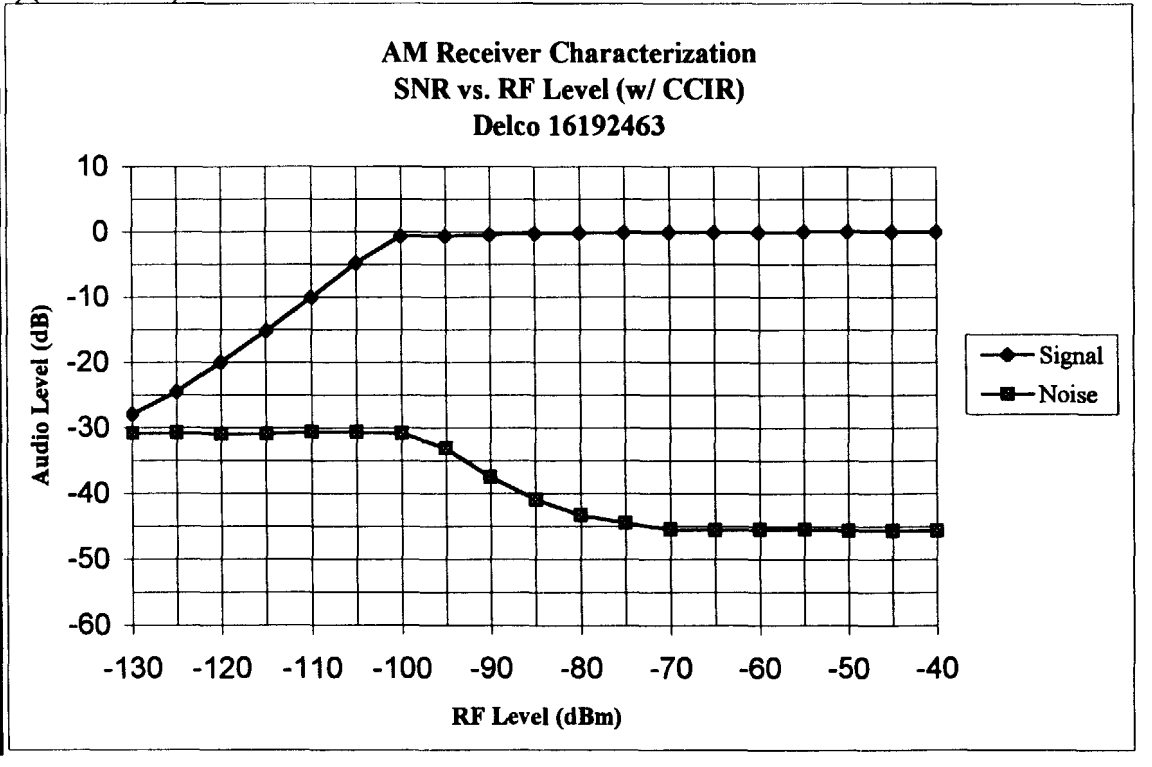
Receiver Settings: Balance, Bass and Treble set to center positions
Graphic Equalizer set to center positions
AM Stereo set to OFF position
Loudness set to OFF position

Audio Frequency = 400Hz
80% Modulation
Load impedance: 4 ohms

Audio Output Power level at RF Level of -40dBm: 1.0 Watts (= 0dB) (set w/o CCIR)

With CCIR

RF Level (dBm)	Audio Output Power Level (dB relative to output power when RF level is -40dBm) Signal (dB)	Noise (dB)
-40	0.0	-45.7
-45	0.0	-45.7
-50	0.0	-45.7
-55	0.0	-45.5
-60	-0.1	-45.5
-65	-0.1	-45.6
-70	-0.1	-45.5
-75	-0.1	-44.5
-80	-0.2	-43.3
-85	-0.3	-41.0
-90	-0.5	-37.5
-95	-0.6	-33.1
-100	-0.7	-30.9
-105	-4.8	-30.7
-110	-10.1	-30.7
-115	-15.2	-31.0
-120	-20.0	-31.0
-125	-24.5	-30.8
-130	-27.9	-30.9



Receiver Characterization - For AM

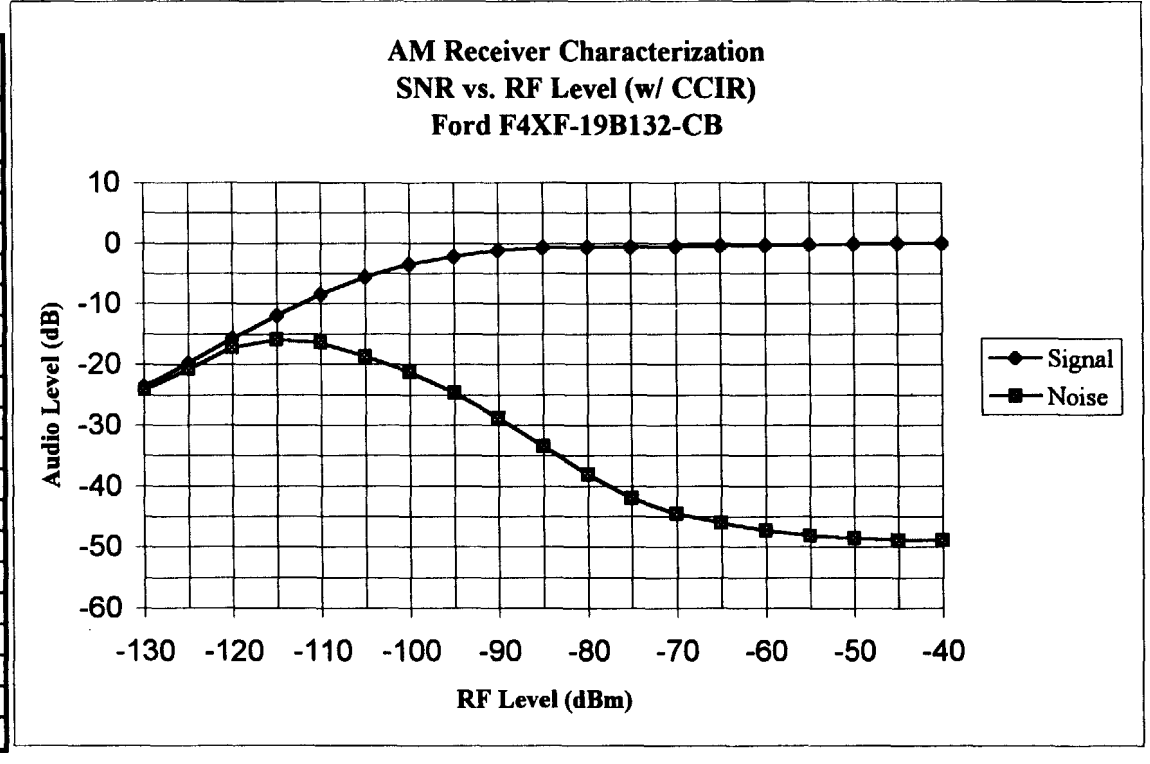
SNR vs. RF Level

Receiver : **FORD**
Model # : **F4XF-19B132-CB**
Serial # : **28115 0B700**
Date Tested : 06/18/99

Audio Frequency = 400Hz
80% Modulation
Load impedance: 4 ohms

Audio Output Power level at RF Level of -40dBm: 1.4 Watts (= 0dB) (set w/o CCIR)

With CCIR	Audio Output Power Level (dB relative to output power when RF level is -40dBm)	
RF Level (dBm)	**Signal (dB)**	**Noise (dB)**
-40	0.0	-48.9
-45	-0.1	-48.9
-50	-0.1	-48.6
-55	-0.2	-48.2
-60	-0.4	-47.3
-65	-0.5	-46.1
-70	-0.6	-44.6
-75	-0.7	-42.0
-80	-0.7	-38.1
-85	-0.8	-33.5
-90	-1.2	-28.9
-95	-2.2	-24.7
-100	-3.6	-21.4
-105	-5.6	-18.7
-110	-8.5	-16.5
-115	-12.0	-16.0
-120	-15.8	-17.2
-125	-19.8	-20.8
-130	-23.7	-24.2



Receiver Characterization - For AM

SNR vs. RF Level

Receiver : **PANASONIC**
Model # : **RX-FS430**
Serial # : **WP8JE52506**
Date Tested : 06/18/99

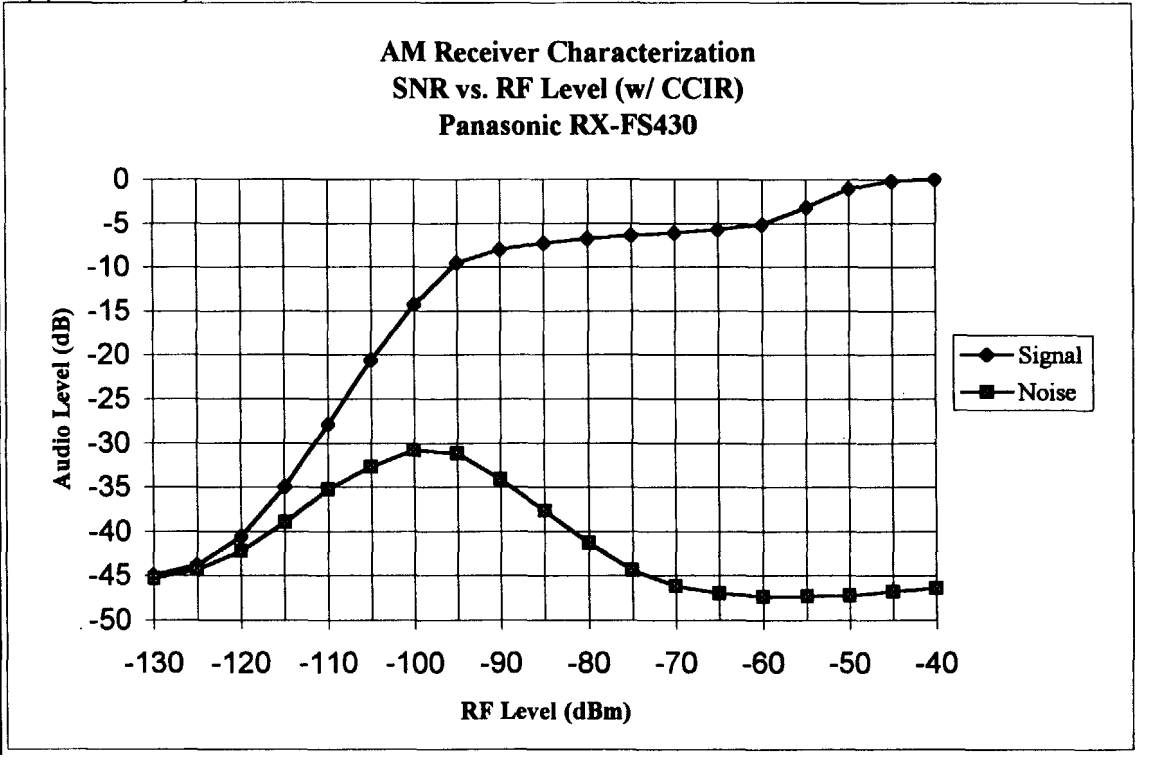
Receiver Settings: Tone Control set to center position
Tuning adjusted until minimum distortion obtained at RF level

Audio Frequency = 400Hz
80% Modulation
Load impedance: 4 ohms

Audio Output Power level at RF Level of -40dBm: 0.25 Watts (= 0dB) (set w/o CCIR)

With CCIR

RF Level (dBm)	Audio Output Power Level (dB relative to output power when RF level is -40dBm) Signal (dB)	Noise (dB)
-40	0.0	-46.4
-45	-0.3	-46.8
-50	-1.1	-47.2
-55	-3.2	-47.3
-60	-5.2	-47.4
-65	-5.8	-47.0
-70	-6.1	-46.2
-75	-6.4	-44.4
-80	-6.8	-41.3
-85	-7.3	-37.7
-90	-8.0	-34.1
-95	-9.6	-31.2
-100	-14.3	-30.8
-105	-20.6	-32.7
-110	-27.9	-35.3
-115	-35.0	-39.0
-120	-40.6	-42.3
-125	-43.8	-44.3
-130	-45.0	-45.3



Receiver Characterization - For AM

SNR vs. RF Level

Receiver : **PIONEER**
Model # : **VSX-D307**
Serial # : **SKDI083167US**
Date Tested : 06/18/99

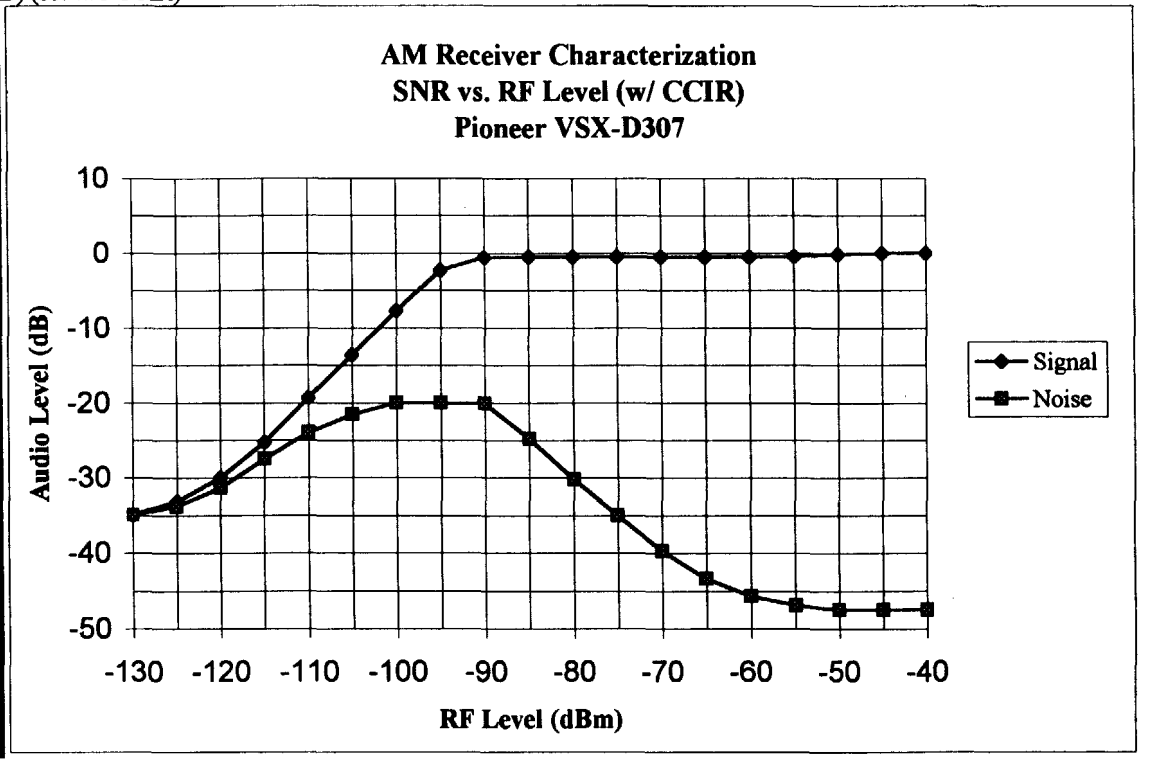
Audio Frequency = 400Hz
80% Modulation
Load impedance: 8 ohms

Receiver Settings: Balance, Bass and Treble set to center positions
Dolby Pro-Logic set to OFF position
Dolby Virtual set to OFF position
Surround Sound set to OFF position
DSP mode set to OFF position
Loudness set to OFF position
MPX mode turned ON to "mono" for AM and mono FM testing
MPX mode turned OFF to "stereo" for stereo FM testing

Audio Output Power level at RF Level of -40dBm: 1.1 Watts (= 0dB) (set w/o CCIR)

With CCIR

	Audio Output Power Level (dB relative to output power when RF level is -40dBm)	
RF Level (dBm)	**Signal (dB)**	**Noise (dB)**
-40	0.0	-47.5
-45	-0.1	-47.5
-50	-0.2	-47.5
-55	-0.4	-46.9
-60	-0.5	-45.7
-65	-0.5	-43.4
-70	-0.5	-39.7
-75	-0.5	-35.0
-80	-0.5	-30.2
-85	-0.5	-24.8
-90	-0.6	-20.1
-95	-2.4	-20.0
-100	-7.7	-20.0
-105	-13.6	-21.6
-110	-19.4	-24.0
-115	-25.3	-27.5
-120	-30.0	-31.3
-125	-33.1	-33.8
-130	-34.9	-34.9



Receiver Characterization - For AM

SNR vs. RF Level

Receiver : **SONY**
Model # : **STR-DE425**
Serial # : **8839190**
Date Tested : 06/18/99

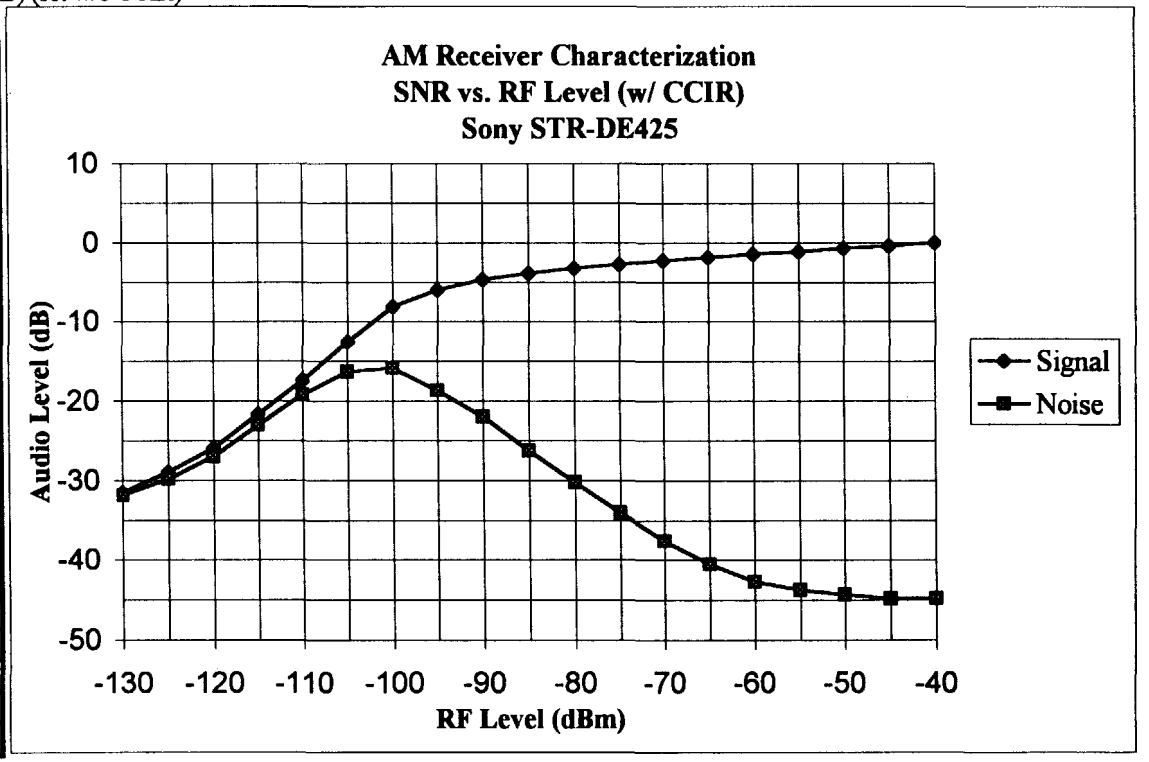
Receiver Settings: Balance, Bass and Treble set to center positions
5.1 DVD input set to OFF position
Bass Boost set to OFF position
Surround Sound set to OFF position
Setup mode set to NORMAL

Audio Frequency = 400Hz
80% Modulation
Load impedance: 8 ohms

Audio Output Power level at RF Level of -40dBm: 1.0 Watts (= 0dB) (set w/o CCIR)

With CCIR

	Audio Output Power Level (dB relative to output power when RF level is -40dBm)	
RF Level (dBm)	**Signal (dB)**	**Noise (dB)**
-40	0.0	-44.8
-45	-0.4	-44.8
-50	-0.8	-44.3
-55	-1.2	-43.8
-60	-1.5	-42.7
-65	-1.9	-40.5
-70	-2.3	-37.6
-75	-2.7	-34.1
-80	-3.3	-30.3
-85	-3.9	-26.3
-90	-4.7	-22.0
-95	-6.0	-18.7
-100	-8.2	-15.9
-105	-12.6	-16.4
-110	-17.4	-19.2
-115	-21.7	-23.1
-120	-26.0	-27.0
-125	-29.0	-29.9
-130	-31.6	-31.9



Appendix O

Appendix O

Explanation of Audio Reference Material

USADR has submitted three CDs with audio samples with this report. Each audio clip related to an appendix of this report has an associated user interface screen and listing of audio files on the CD. Copies of each screen and file listing are attached for reader convenience.

USA DIGITAL RADIO

usa DIGITAL RADIO

Appendix B

FM USADR IBOC DAB BLENDING

ACTION	Selection
Play	CD

Dire Straits - Pearl Jam - Suzanne Vega Looping

USA DIGITAL RADIO

usa DIGITAL RADIO

Appendix C

FM USADR IBOC DAB in an Impaired Channel

FM ANALOG ACTION	Type of Impairment	FM USADR IBOC DAB ACTION
Play	Guassian Noise	Play
Play	9 Ray Urban Fast	Play
Play	9 Ray Urban Slow	Play
Play	9 Ray Rural Fast	Play
Play	9 Ray Terrain Obstructed	Play
Play	1st Adj -6 Urban Fast	Play
Play	1st Adj -18 Urban Fast	Play
Play	1st Adj -24 Urban Fast	Play
Play	1st Adj -30 Urban Fast	Play
Play	2nd Adj +20 Urban Fast	Play
	Co-Channel -10 Urban Fast	Play
Play	Co-Channel -20 Urban Fast	Play

Dire Straits Looping

NOTE: Please use an audio player to play the other selections Pearl Jam and Suzanne Vega

USA DIGITAL RADIO

usa DIGITAL RADIO

Appendix E

Analog and Hybrid Interference on the Delco Receiver

Analog Interference ACTION	Type of Impairment	Hybrid Interference ACTION
Play	9 Ray Urban Fast strong signal	Play
Play	9 Ray Urban Fast moderate signal	Play
Play	9 Ray Urban Fast weak signal	Play
Play	Co-Channel +20 moderate signal	Play
Play	1st Adj +14 Urban Fast strong signal	Play
Play	1st Adj +6 Urban Fast mod signal	Play
Play	1st Adj -2 Urban Fast weak signal	Play
Play	Dual 1st Adj +14 Urban Fast strng sig	Play
	Dual 1st Adj +6 Urban Fast mod sig	Play
Play	Dual 1st Adj -2 Urban Fast weak sig	Play

NOTE: Shortened Eric Clapton sound clip, use a audio sound player to play the complete clip