



Certelecom Laboratories Inc.

Safety - EMI - Telecom - ISO Guide 25

ENGINEERING TEST REPORT

**ON:
THE AML WIRELESS SYSTEMS
"MMDS MODEL MBRP-400 INDOOR REPEATER"**

FCC ID: D0063QAMLMBRP-400

**IN ACCORDANCE WITH:
FCC PART 21, SUBPART K
MULTIPOINT DISTRIBUTION SERVICE**

PROJECT NO.: 7AM600-7H

TESTED FOR:

AML WIRELESS SYSTEMS
260 SAULTEAUX CRESCENT
WINNIPEG, MANITOBA R3J 3T2

TESTED BY:

CERTELECOM LABORATORIES INC.
3325 RIVER ROAD, R.R. 5
OTTAWA, ONTARIO K1V 1H2

JANUARY 1998

This document contains 59 pages including this one.

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This report applies only to the items tested.

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FCC PART 21, SUBPART K
MULTIPOINT DISTRIBUTION SERVICE
PROJECT NO.: 7AM600-7H

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"

FCC ID: D0063QAMLMBRP-400

MODEL NO.: MBRP-400, Comprising of the following:

<u>Equipment</u>	<u>Part Number</u>	<u>Serial Number</u>
Power Amplifier (A)	2015027-001	100
Power Amplifier (B)	2015012-001	101
Power Amplifier (C)	2015014-001	100

GENERAL:

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 21, Subpart K.

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE
TEST SPECIFICATIONS HAVE BEEN MADE. - None

TESTED BY: Kevin Carr DATE: 14 May 98
Kevin Carr, Technologist

APPROVED BY: W. Waterhouse DATE: 14th May 1998
W. Waterhouse, RF Engineering Lab Manager

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"**FCC ID: D0063QAMLMBRP-400**

SUMMARY OF TEST DATA

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT	PAGE NO.
Modulation Characteristics	NONE	NONE	N/A	N/A	N/A
RF Power Output	2.985	2000W EIRP	15.85W	Complies	10
Occupied Bandwidth	2.989	21.908(b) Mask	Plot	Complies	13
Spurious Emissions at Antenna Terminals	2.991	- 60 dBc	-63.3 dBc	Complies	20
Field Strength of Spurious Radiation	2.993	- 60 dBc	-71.7 dBc	Complies	38
Frequency Stability	2.995	+/- 1 kHz	N/A	N/A	47

FOOTNOTES FOR N/A'S:

The equipment contains no modulation circuitry, therefore baseband tests were not performed

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"
FCC ID: D0063QAMLMBRP-400

GENERAL EQUIPMENT SPECIFICATION

Power Input:	120 VAC, 60 Hz
Frequency Range:	2500 MHz to 2686 MHz
Type of Modulation:	VSB, 16 QAM, 64-QAM
Emission Designator:	6M0C3F (VSB), 6M0D7W(QAM)
Output Impedance:	50 ohms
Gain:	70 dB Nominal
RF Power Output (rated):	Per Carrier: 5.25 W / 3 Signal Composite: 15.85 W
Duty Cycle:	Continuous

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"
FCC ID: D0063QAMLMBRP-400

THEORY OF OPERATION

The MMDS signal enters the Preamplifier with PIN attenuator A7, controlled by the ALC (auto level control) circuit, and additionally amplified by amplifier A6. The signal then enters the feed forward circuit.

The feed forward circuit contains two loops. Each loop must balance for proper operation of the feed forward. The first loop, which starts at the 10 dB coupler, C2, and ends at the coupler hybrid C3, provides for the main power amplification and error detection. The second loop, which starts at the coupler-hybrid C3, provides error correction.

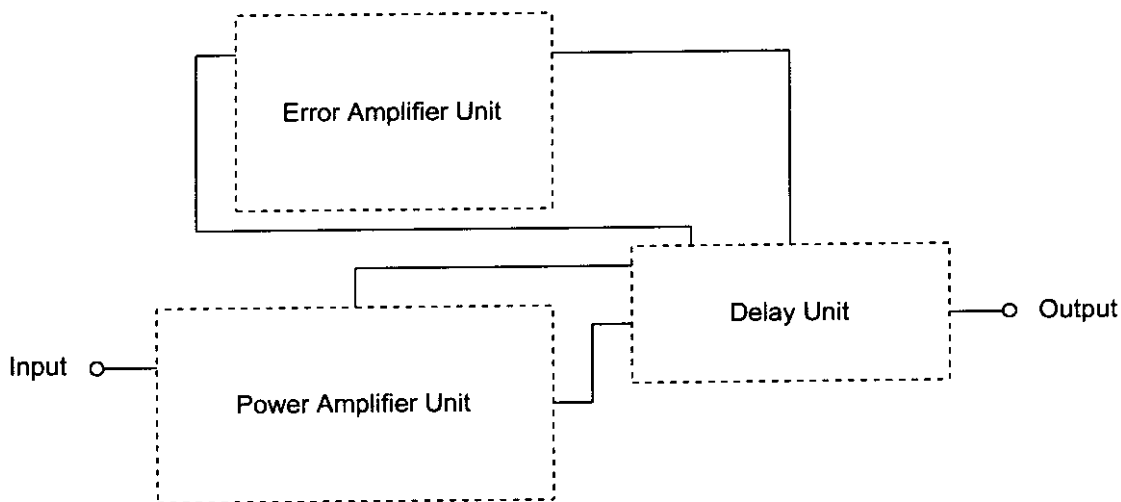
Coupler C2 splits the signal into two paths. The lower path passes through the predistortion circuit, a 7 dB attenuator, and then the power amplifier A4. The predistortion circuit consists of a 3 dB hybrid H1, that splits the signal into two paths - a linear path and a non-linear path. The linear path consists of a phase shifter P1 and a linear amplifier A2. The non-linear path is composed of a distortion amplifier A8, a variable attenuator R1, a second distortion amplifier A3 and 10 dB attenuator. The signals from these paths are combined by another 3 dB hybrid H2, resulting in a predistorted signal that drives the power amplifier A4. A built-in 40 dB coupler at the output of A4 samples the outgoing signal. The ALC uses this sample to control the level of the input to the feed forward circuit. At the high operating levels, the intermodulation distortions are serious and must be corrected. This is necessary not only for compliance with the FCC out-of-band radiation regulations, but also to avoid overloading the error amplifier in the second loop. The signal, along with the distortions generated by A4, is sampled by the coupler-hybrid C3.

At the same time, the reference signal passes through the top path, which includes attenuator R2 and phase shifter P1. The signal then goes to port 2 of the coupler-hybrid, C3. At port 4 of C3, the signals passing through the two paths are again combined together. Signal cancellation is achieved by adjusting attenuator R2 and phase shifter P2 to make the non-distorted portion of the signal equal in amplitude and opposite in phase at the output of coupler-hybrid C3. This constitutes the first loop balance. While perfect cancellation over a wide band is not possible in a practical circuit, a signal cancellation of 20 dB over a 186 MHz band can be achieved in the MBRP-400. Thus the residual signal at the input of the second loop is almost as small as the sampled distortion components. The combined signal passes through attenuator R3, phase shifter P3 and amplifier A5 (100 W amplifier). Since the level of the distortion components and the residual signal is relatively low, A5, will not introduce excessive distortion.

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"
FCC ID: D0063QAMLMBRP-400

THEORY OF OPERATION, continued

In the arm of the second loop, the main signal with serious distortions passes through an isolator, 16, with a 100W load, and the low loss delay line T2. It is then combined with the amplified distortion in coupler C4. Adjusting the attenuator R3 and the phase shifter P3 makes the residual distortion components from the two paths equal in amplitude and opposite in phase at port 3 of C4. The residual distortion components will be cancelled to a great degree and a much cleaner signal can be obtained at the repeater output port. A 30 dB directional coupler, C5, is used to sample a small portion of the output signal at the test point. Finally, the signal passes through a pass band filter to remove the out of band intermodulation products.

BLOCK DIAGRAM

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"
FCC ID: D0063QAMLMBRP-400

Modulation Characteristics

16-QAM

BITE RATE: 20.255 Mbps
DATA RATE: 18.67 Mbps
SYMBOL RATE: 5.06383 Mbps
BASEBAND FILTER: $\sqrt{\cos}$; $\alpha = 0.15$

64-QAM

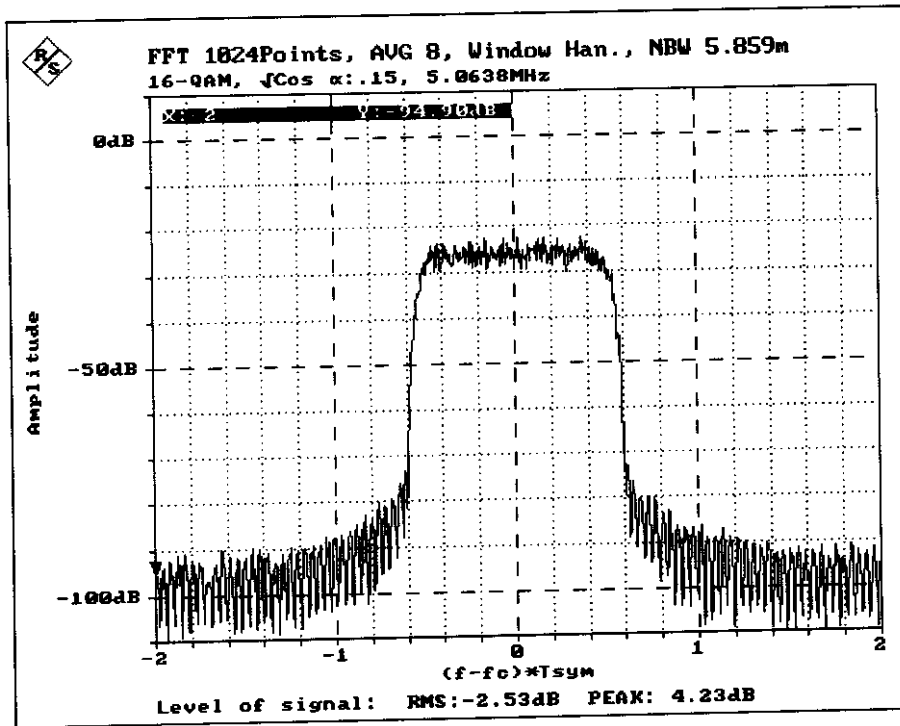
BITE RATE: 30.38298 Mbps
DATA RATE: 28 Mbps
SYMBOL RATE: 5.06383 Mbps
BASEBAND FILTER: $\sqrt{\cos}$; $\alpha = 0.15$

VSB

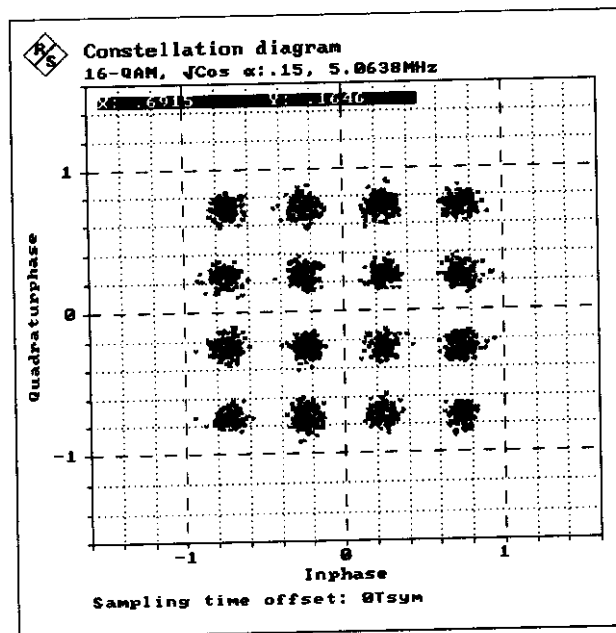
Visual Carrier: NTSC color transmission, Amplitude Modulation to 95% depth. Carrier frequency set to 1.25 MHz above channel edge.

Aural Carrier: 2.5 kHz sine wave, Frequency Modulation +/- 50 kHz deviation. Carrier frequency set to 4.5 MHz above visual carrier. Carrier level set to 14 dB below visual carrier.

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"
FCC ID: D0063QAMLMBRP-400

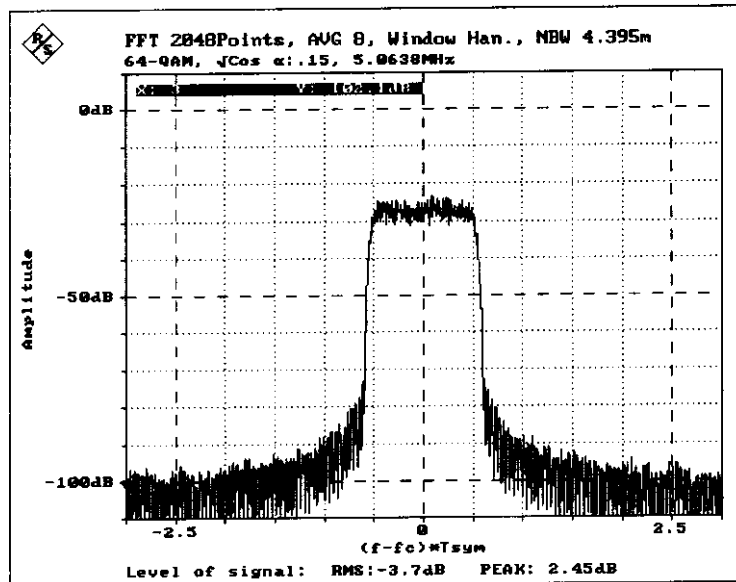


MMDS 16-QAM FFT

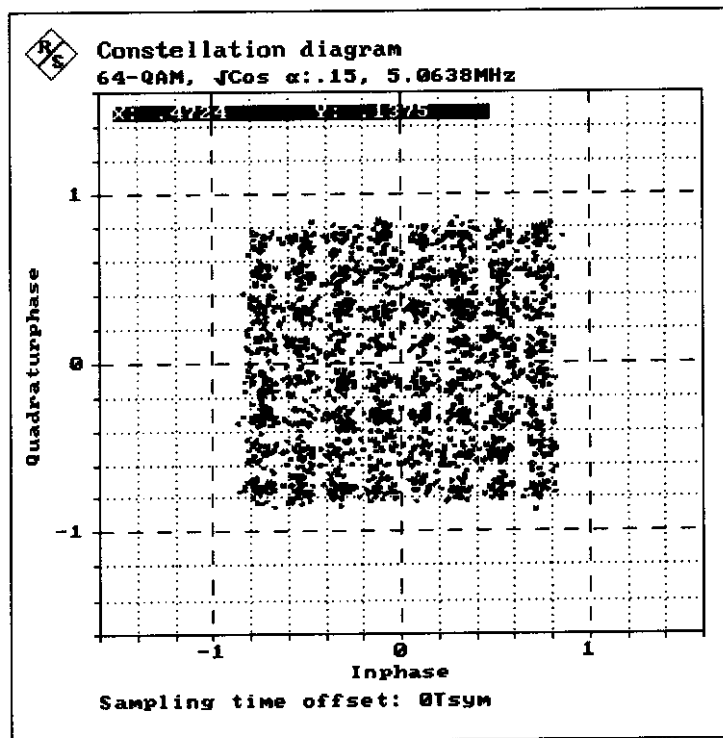


MMDS 16-QAM CONSTELLATION DIAGRAM

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"
FCC ID: D0063QAMLMRP-400



MMDS 64-QAM FFT



MMDS 64-QAM CONSTELLATION DIAGRAM

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FCC PART 21, SUBPART K
MULTIPOINT DISTRIBUTION SERVICE
PROJECT NO.: 7AM600-7H

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"
FCC ID: D0063QAMLMBRP-400

NAME OF TEST: RF Power Output

PARA. NO.: 2.985

TESTED BY: Kevin Carr

DATE: October 9, 1997

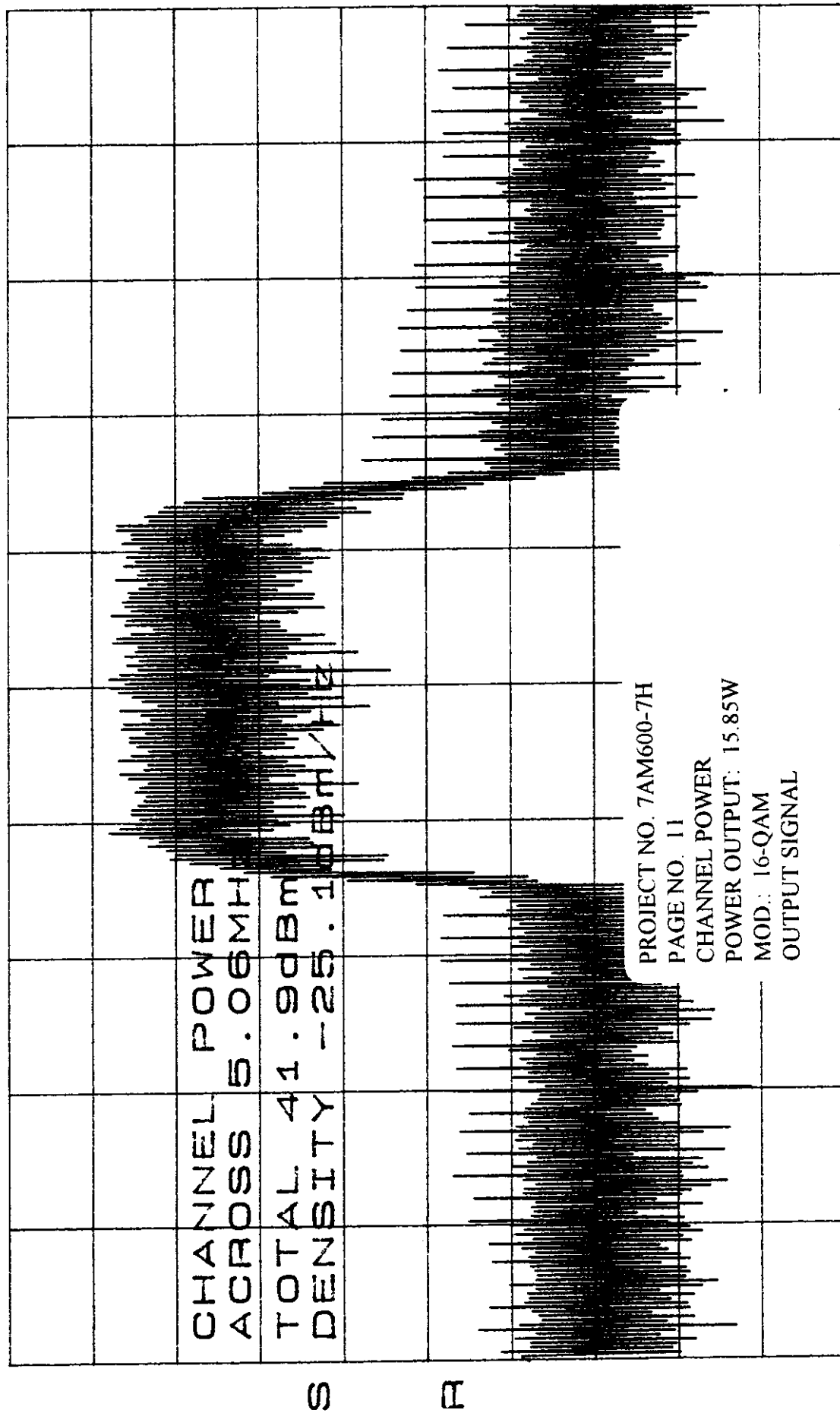
TEST RESULTS: Complies

MEASUREMENT DATA: See graphs.

*ATTEN 0dB

RL 43.0dBm

10dB/



CENTER 2.61807GHz

*RBW 100kHz

*VBW 100kHz

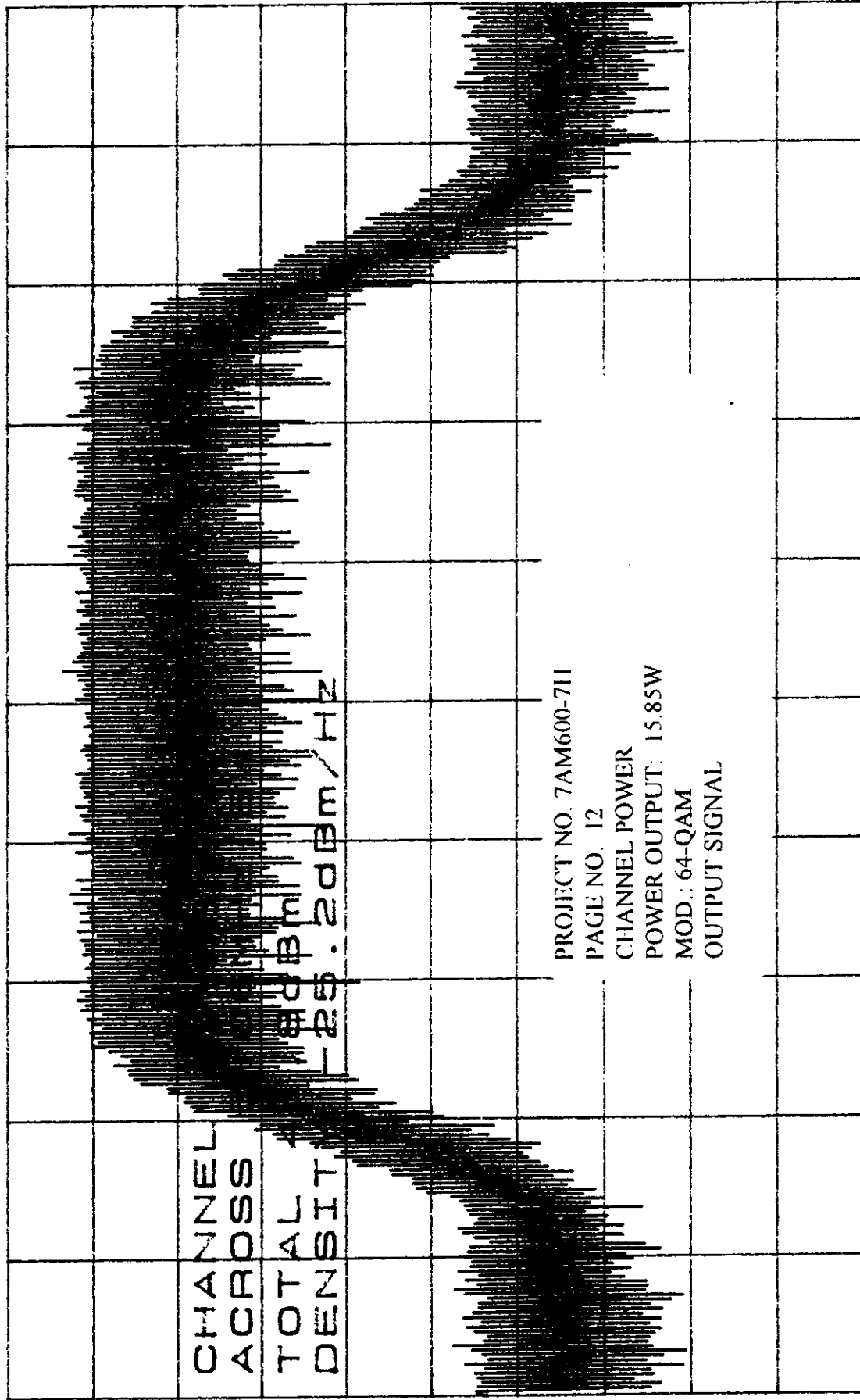
SPAN 20.00MHz

SWP 50.0ms

*ATTEN 10dB

RL 42.0dBm

10dB/



CENTER 2.59905GHZ

SPAN 10.00MHZ

*RBW 300KHZ

VBW 300KHZ

SWP 50.0ms

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FCC PART 21, SUBPART K
MULTIPOINT DISTRIBUTION SERVICE
PROJECT NO.: 7AM600-7H

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"
FCC ID: D0063QAMLMBRP-400

NAME OF TEST: Occupied Bandwidth

PARA. NO.: 2.989

TESTED BY: Kevin Carr

DATE: October 9, 1997

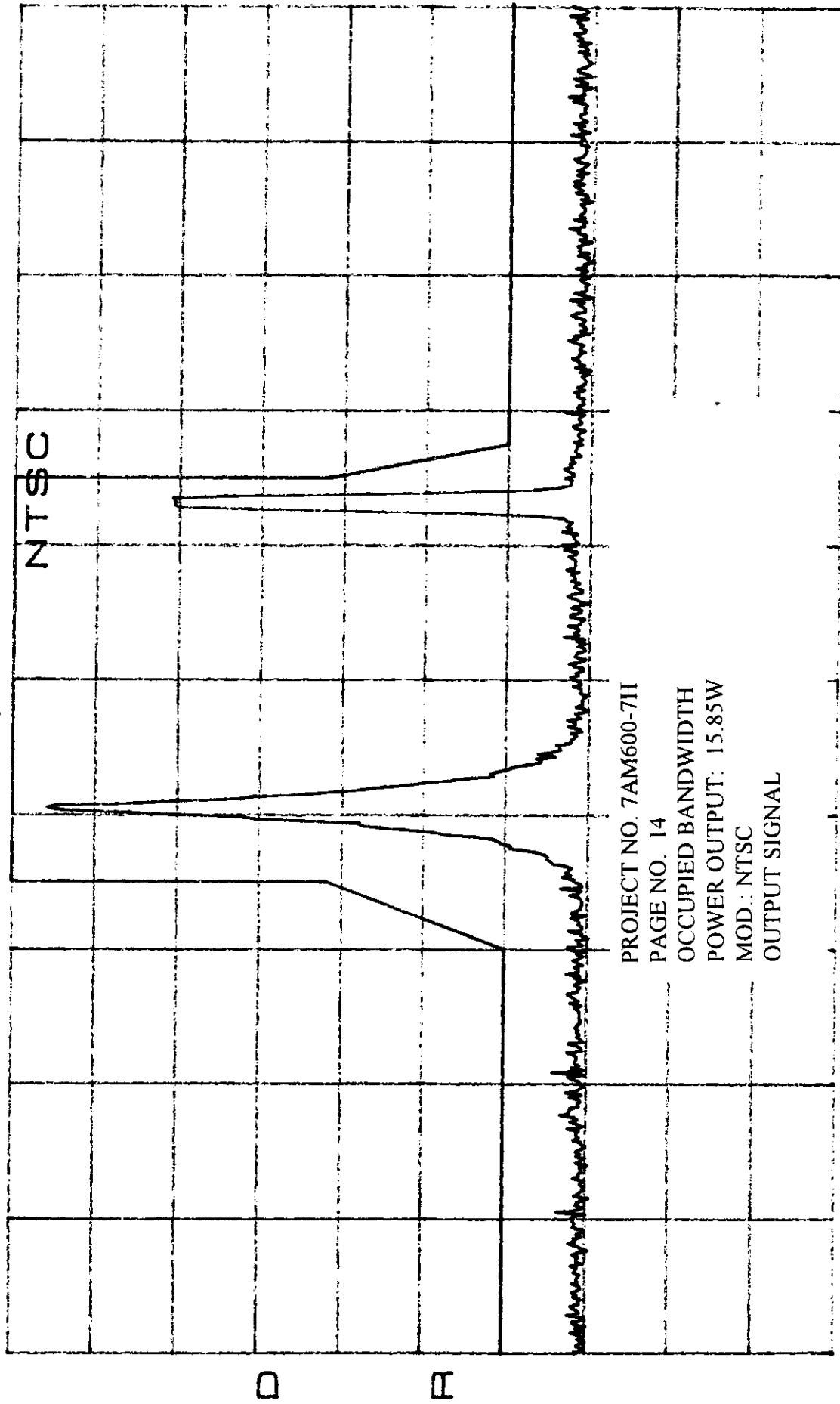
TEST RESULTS: Complies

MEASUREMENT DATA: See graphs.

*ATTEN 10dB

RL 42.0dBm

10dB/



PROJECT NO. 7AM600-7H

PAGE NO. 14

OCCUPIED BANDWIDTH

POWER OUTPUT: 15.85W

MOD: NTSC

OUTPUT SIGNAL

CENTER 2.59300GHZ

*RBW 30KHZ

VBW 30KHZ

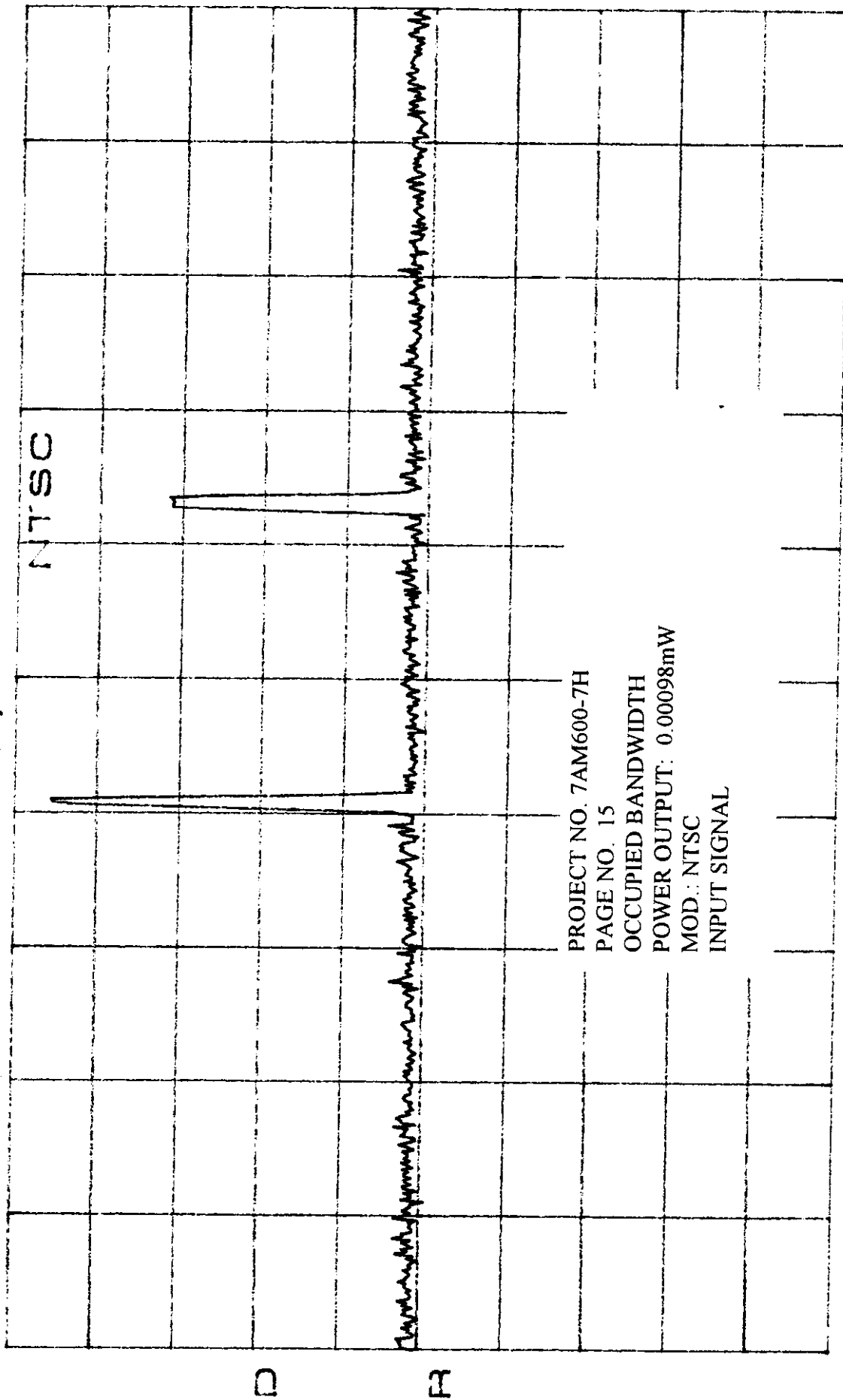
SPAN 20.00MHZ

SWP 56.0ms

*ATTEN 0dB

RL -30.1dBm

10dB/



CENTER 2.59300GHZ

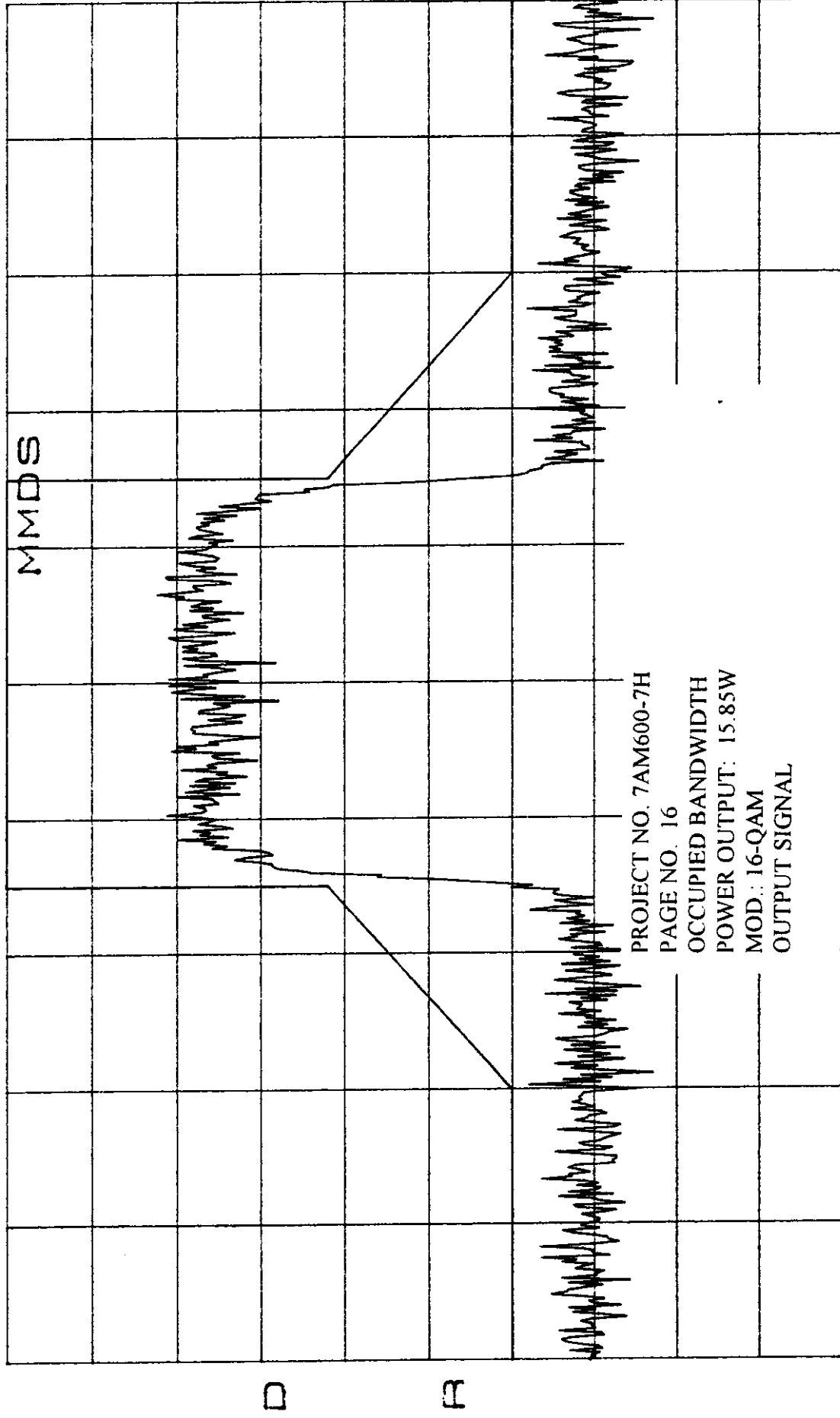
*RBW 30KHZ

VBW 30KHZ

SPAN 20.00MHZ

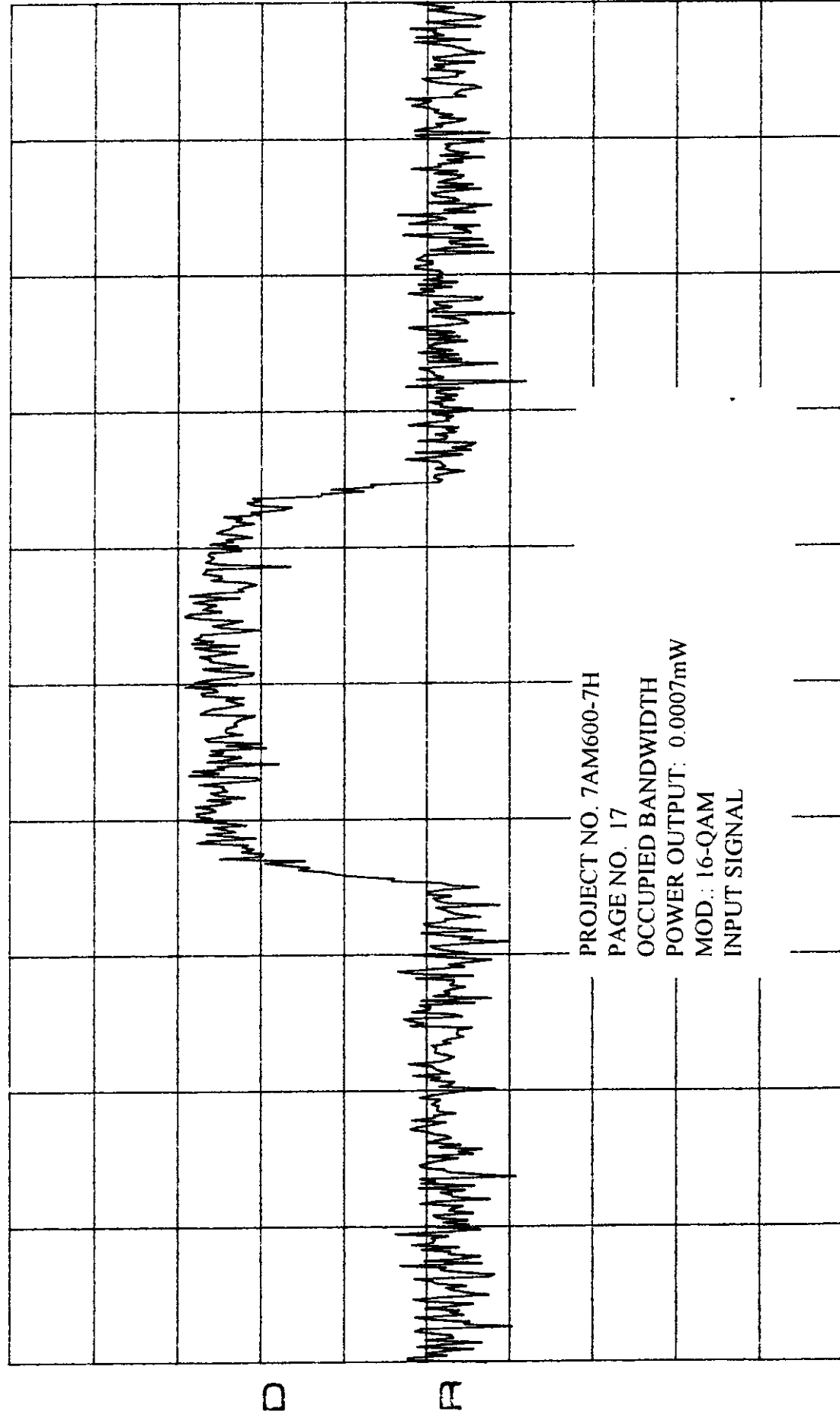
SWP 56.0ms

ATTEN 10dB VAVG 1
RL 42.0dBm 10dB/



CENTER 2.61807GHz SPAN 20.00MHz
*RBW 100kHz *VBW 100kHz SWP 50.0ms

*ATTEN 0dB VAVG 1
RL -31.7dBm 10dB/

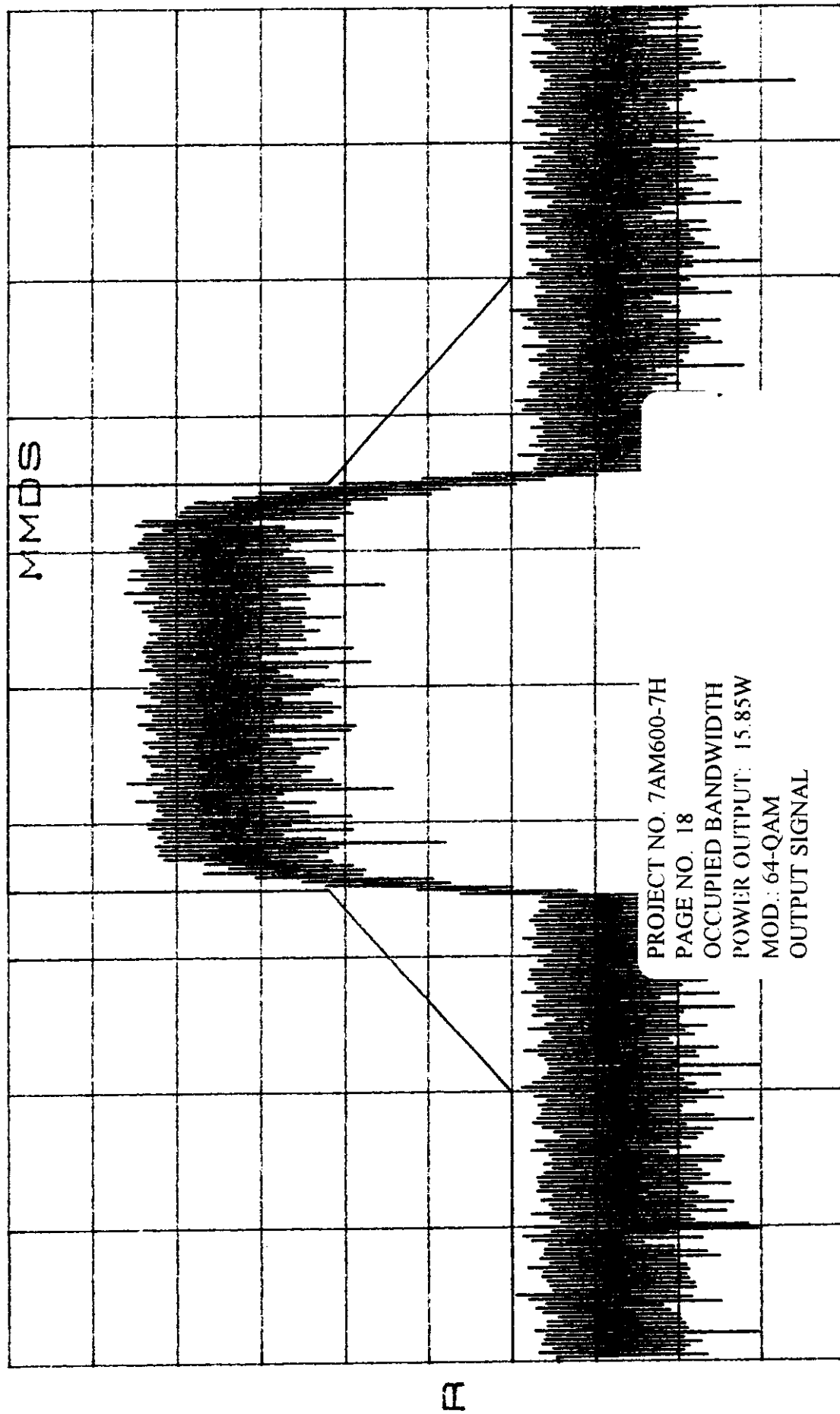


CENTER 2.61807GHZ SPAN 20.00MHZ
*RBW 100KHZ *VBW 100KHZ SWP 50.0ms

*ATTEN 10dB

RL 42.0dBm

10dB/



CENTER 2.59905GHz

*RBW 100kHz

VBW 100kHz

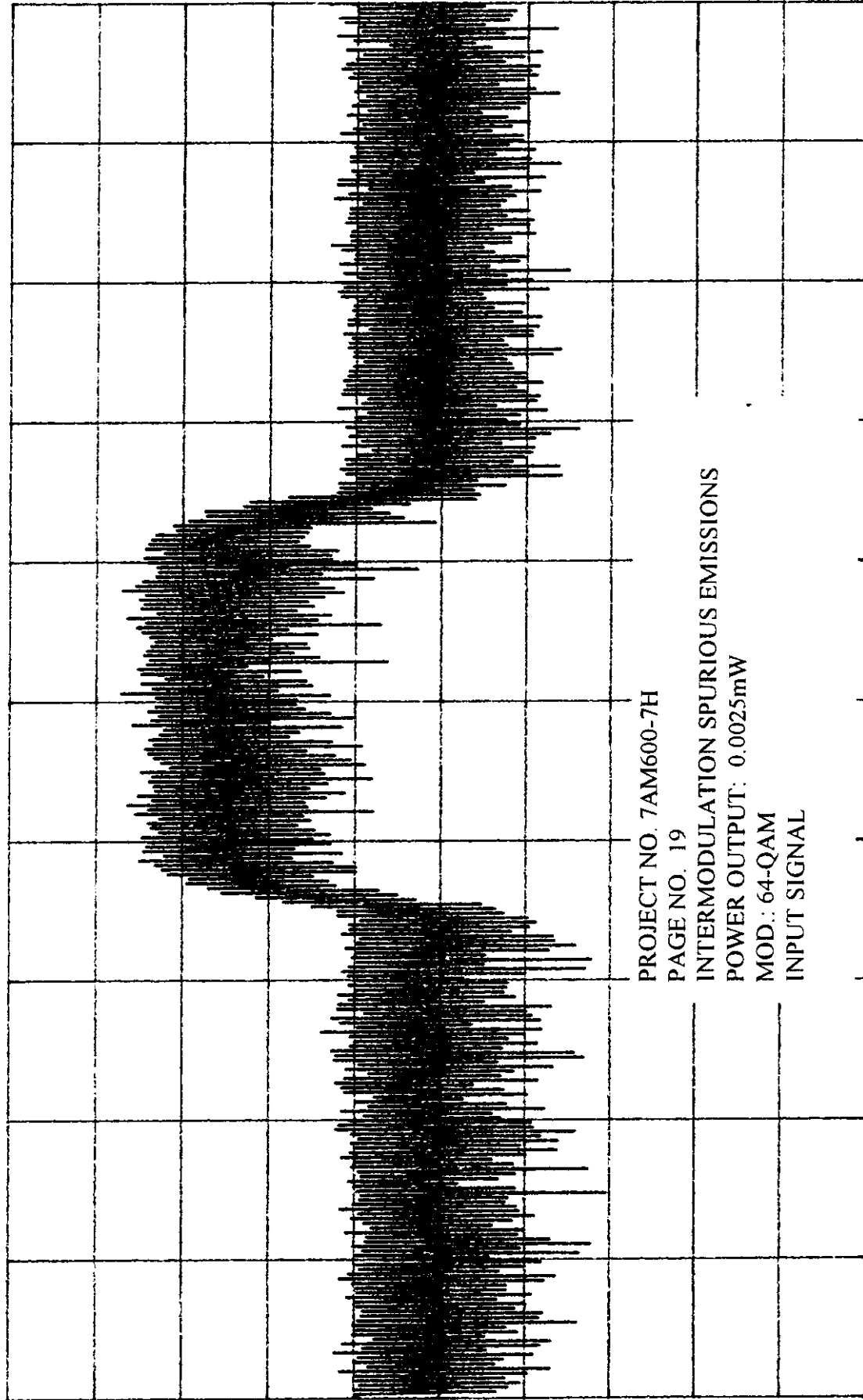
SPAN 20.00MHz

SWP 50.0ms

*ATTEN 10dB

PL -26.1dBm

10dB/



1

PROJECT NO. 7AM600-7H

PAGE NO. 19

INTERMODULATION SPURIOUS EMISSIONS

POWER OUTPUT: 0.0025mW

MOD.: 64-QAM

INPUT SIGNAL

CENTER 2.59905GHZ

SPAN 20.00MHZ

*RBW 100KHZ

VBW 100KHZ

SWP 50.0ms

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FCC PART 21, SUBPART K
MULTIPOINT DISTRIBUTION SERVICE
PROJECT NO.: 7AM600-7H

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"

FCC ID: D0063QAMLMBRP-400

NAME OF TEST: Spurious Emissions at Antenna Terminals

PARA. NO.: 2.991

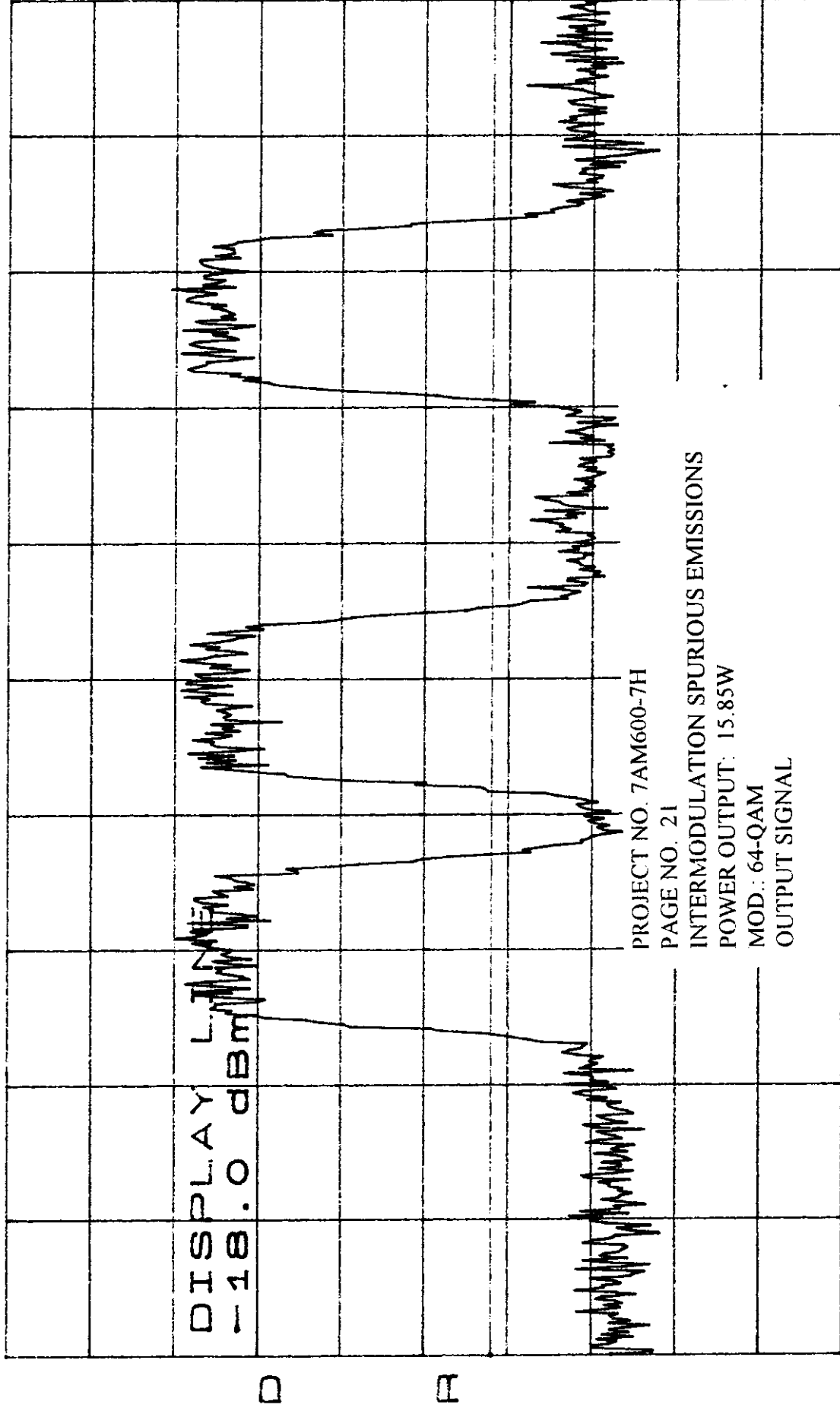
TESTED BY: Kevin Carr

DATE: October 9, 1997

TEST RESULTS: Complies

MEASUREMENT DATA: See graphs.

*ATTEN 0dB VAVG 1
RL 40.0dBm 10dB/



CENTER 2.61636GHz

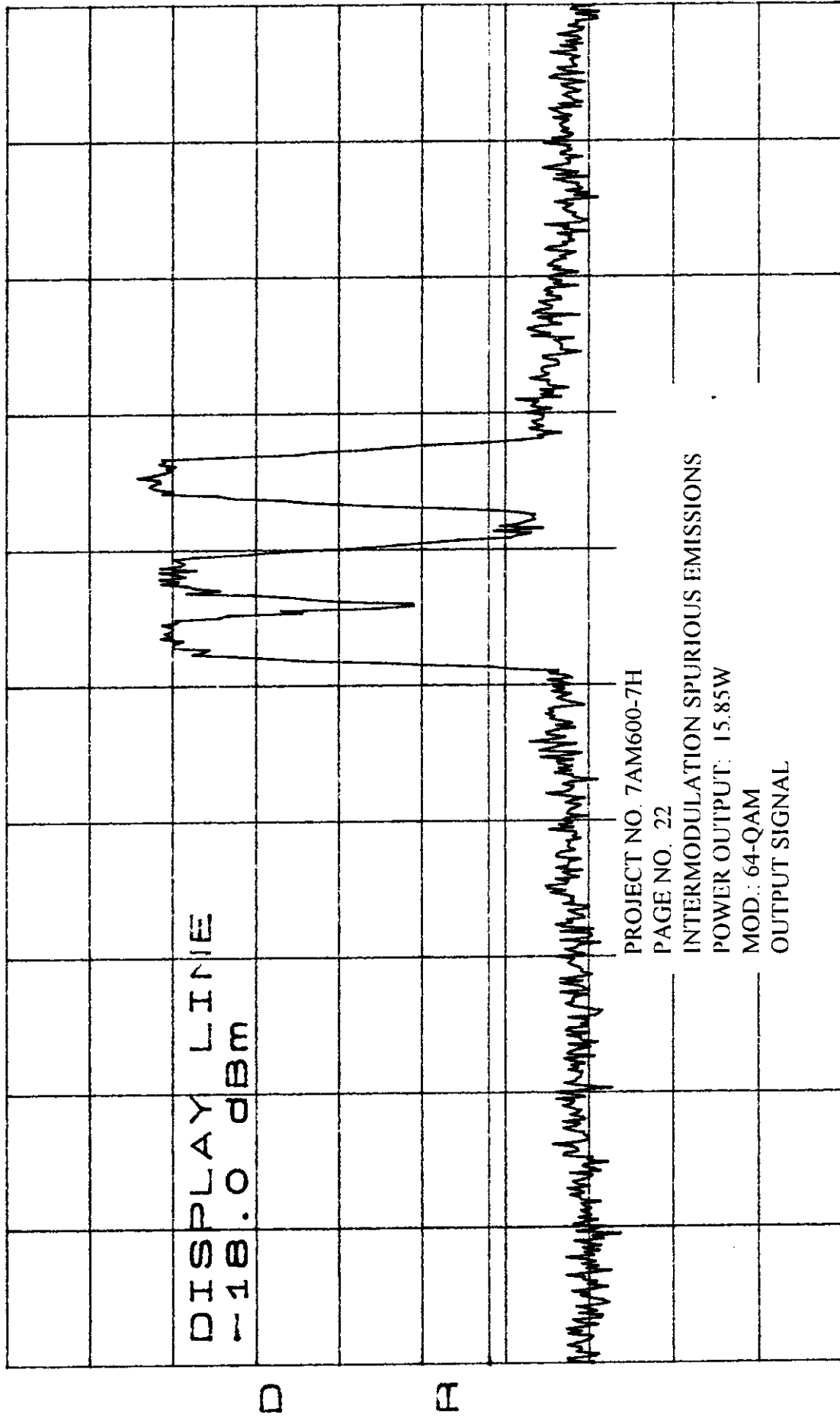
SPAN 50.00MHz

*RBW 300kHz

VBW 300kHz

SWP 50.0ms

*ATTEN 0dB VAVG 1
RL 40.0dBm 10dB/

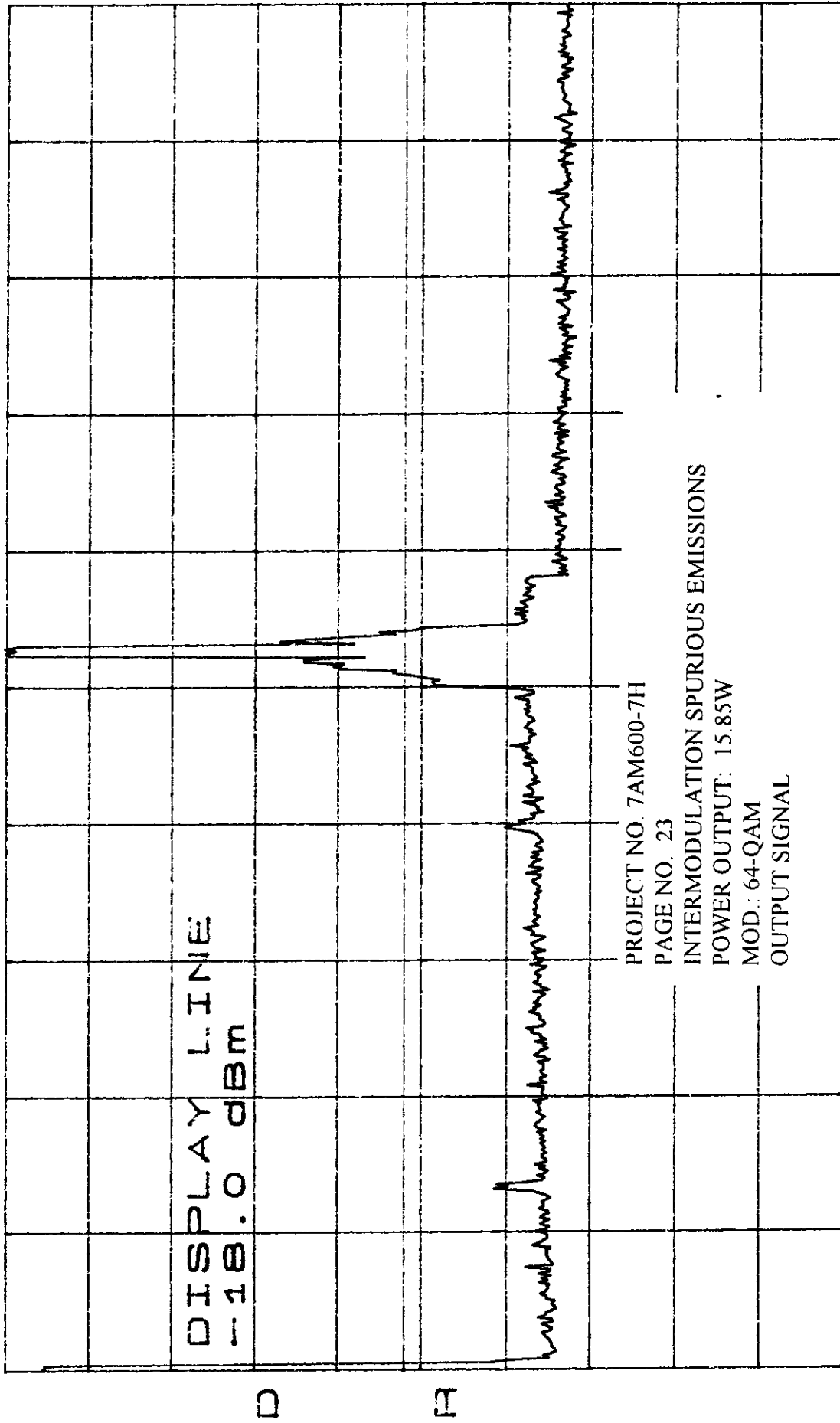


START 2.50000GHZ STOP 2.70000GHZ
*RBW 1.0MHZ VBW 1.0MHZ SWP 50.0ms

*ATTEN 0dB

PL 30.0dBm

10dB/



START 0Hz

STOP 5.000GHz

*RBW 1.0MHz

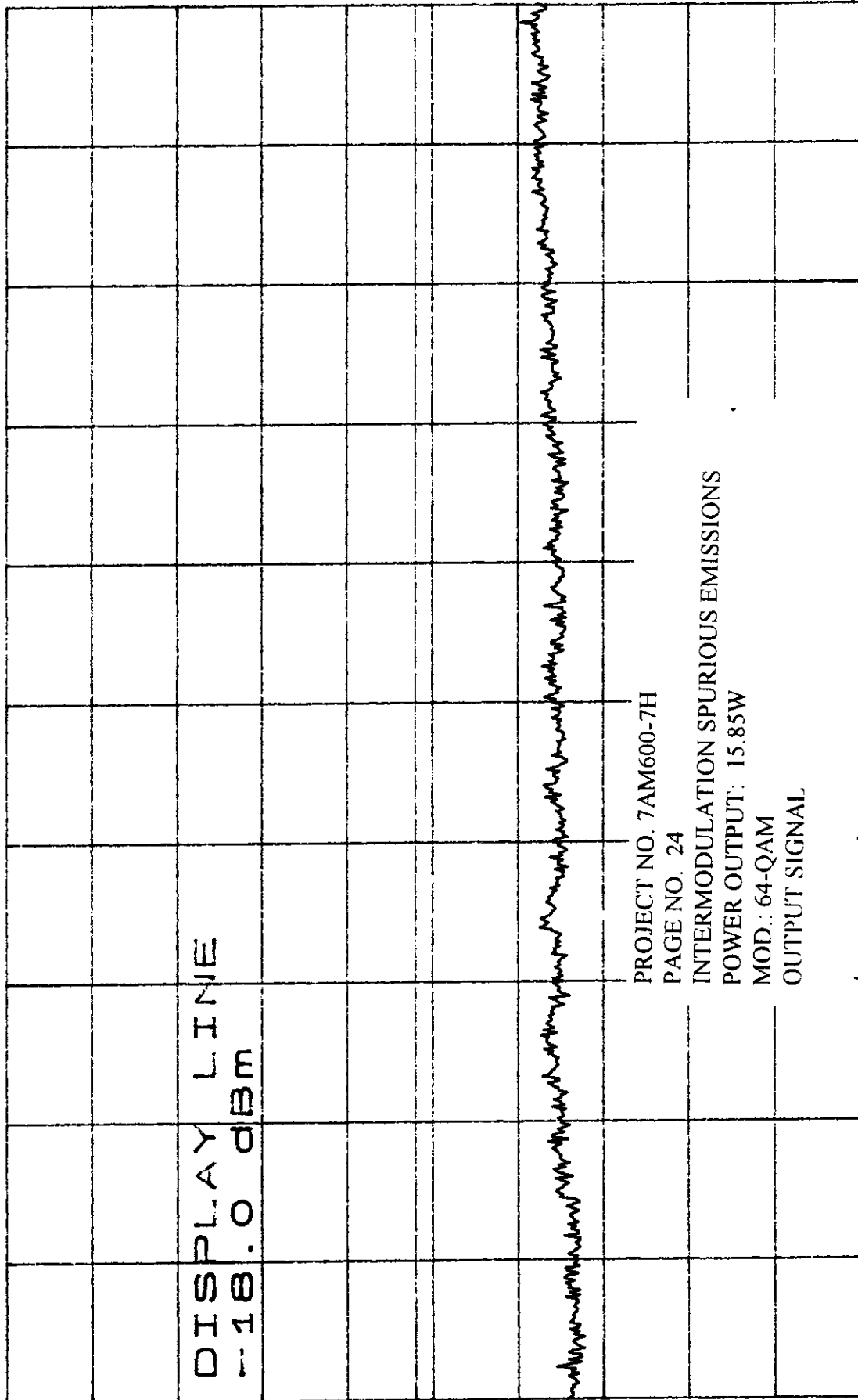
VBW 1.0MHz

SWP 100ms

*ATTEN 0dB

FL 30.0dBm

10dB/



START 5.00GHZ

STOP 15.00GHZ

*RBW 1.0MHZ

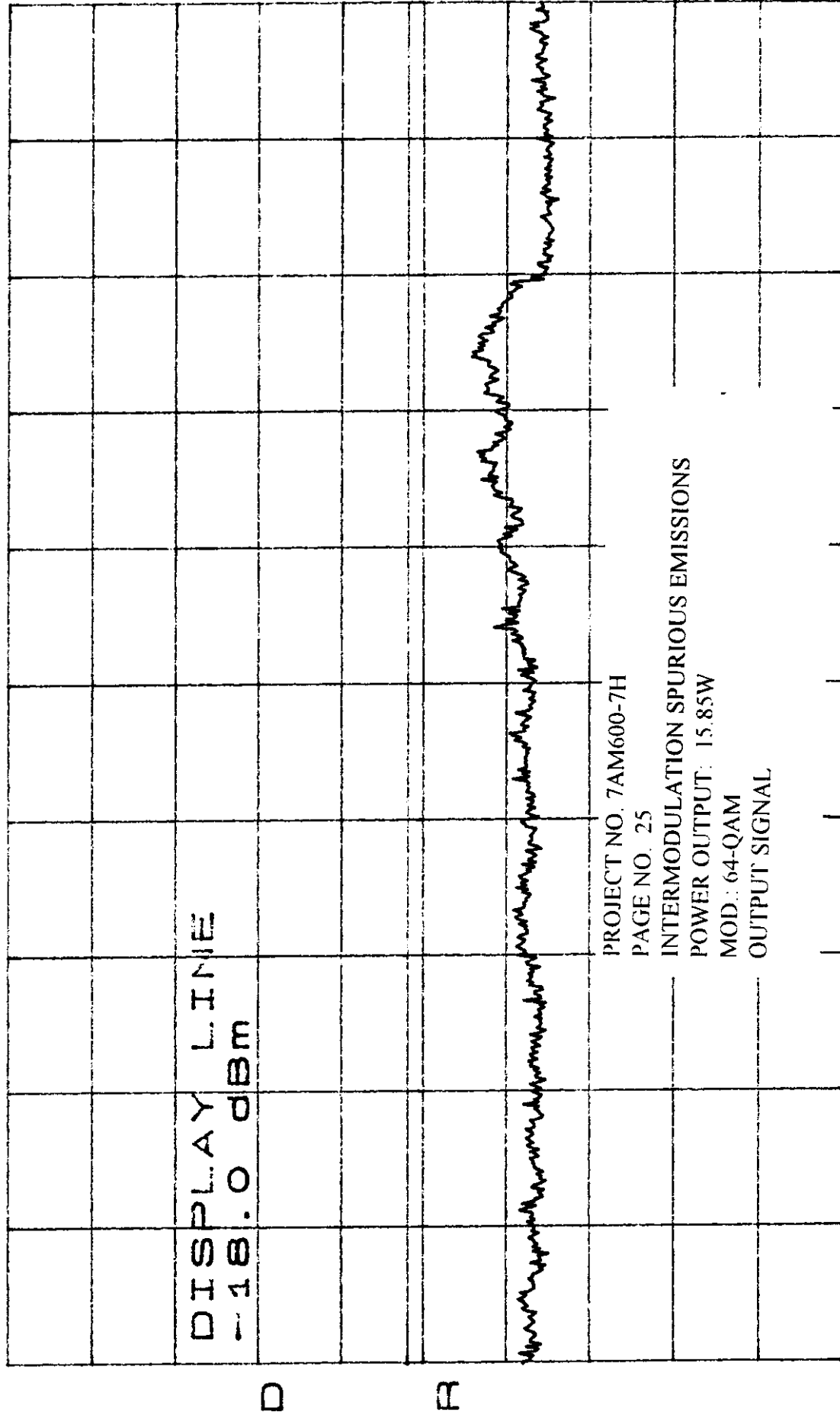
VBW 1.0MHZ

SWP 200ms

*ATTEN 0dB

RL 30.0dBm

10dB/

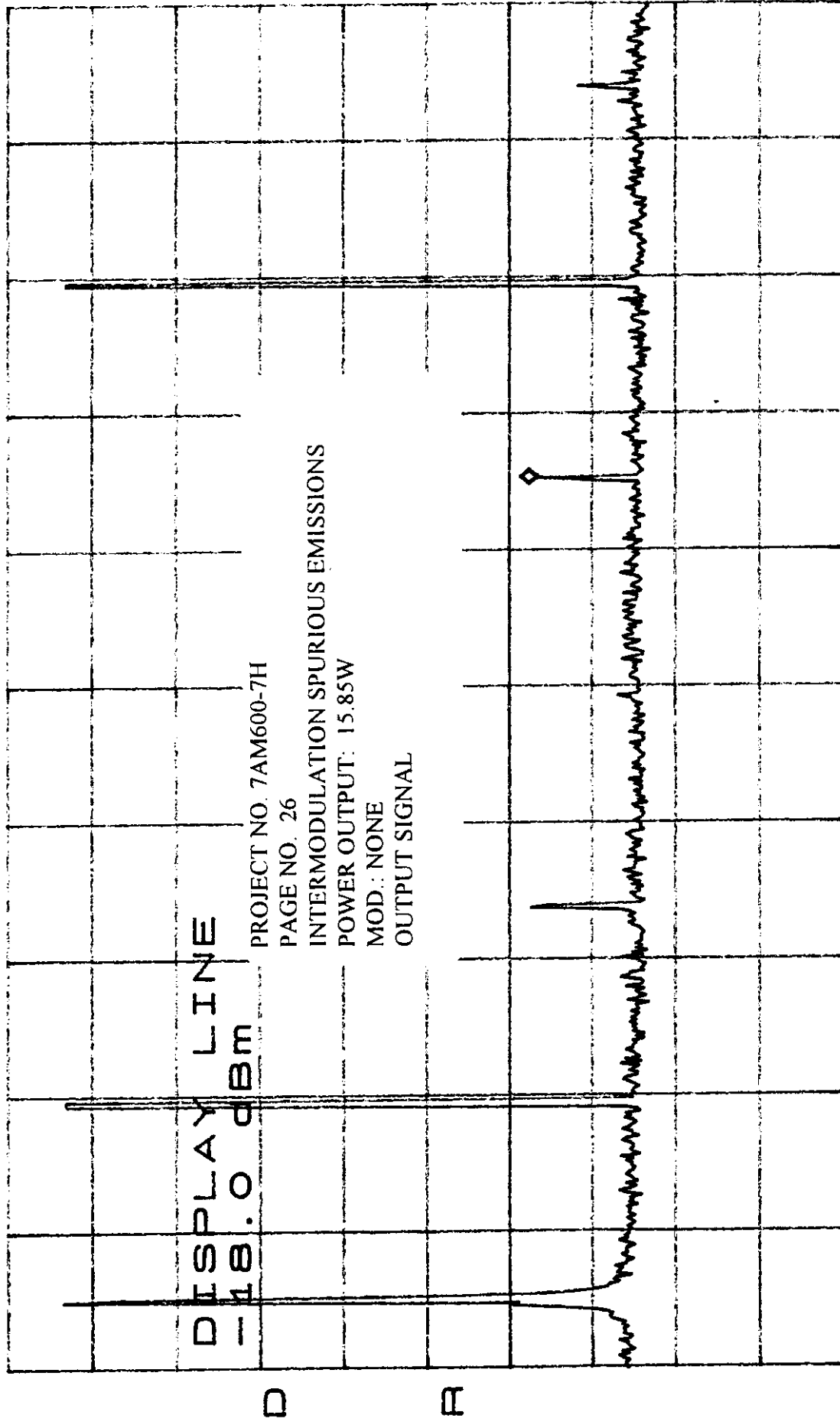


*ATTEN 0dB

MKR -21.33dBm

RL 42.0dBm

10dB/ 2.6272GHz



START 2.4900GHz

STOP 2.7000GHz

*RBW 30kHz

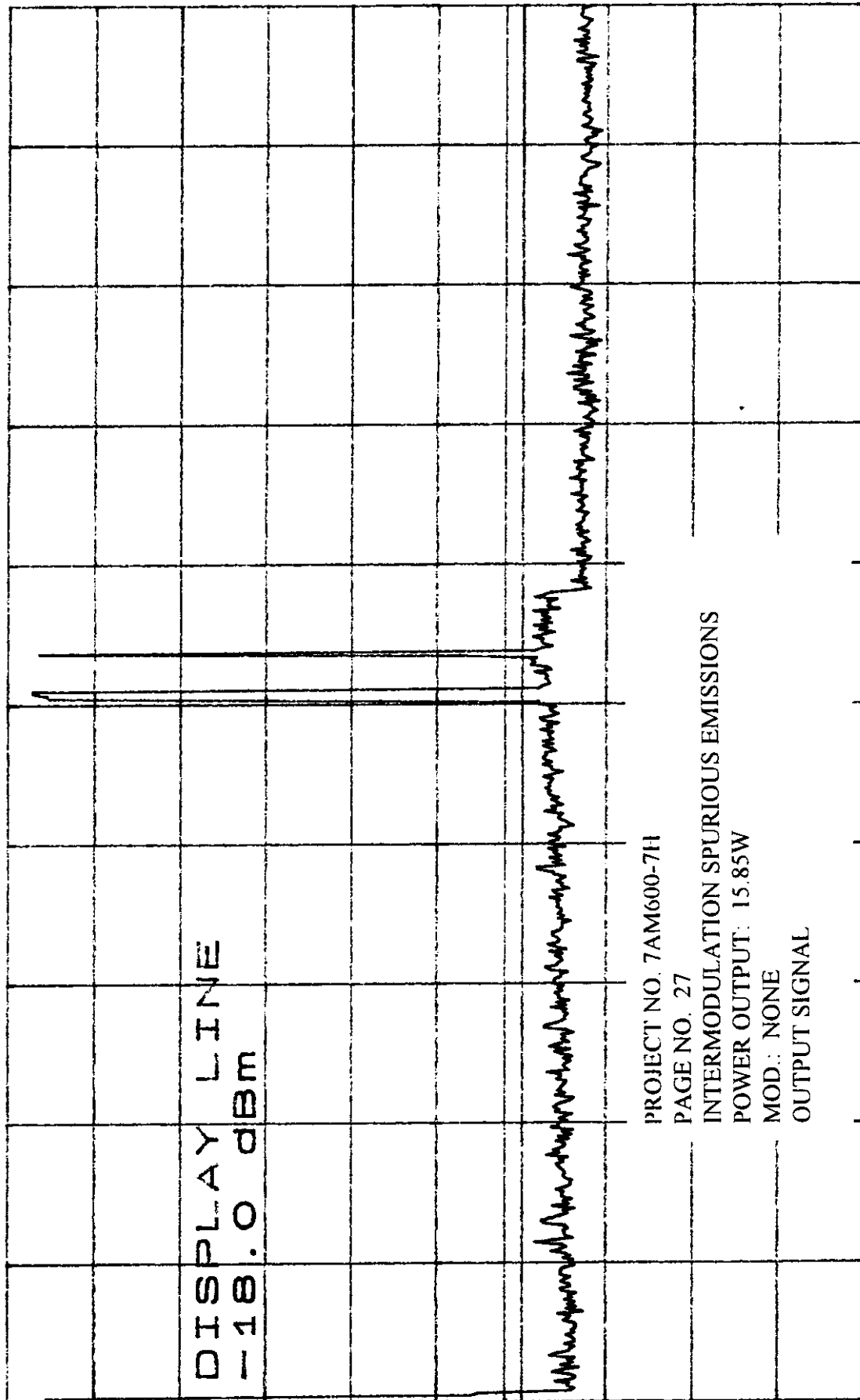
VBW 30kHz

SWP 590ms

*ATTEN 0dB

RL 40.0dBm

10dB/



PROJECT NO. 7AM600-7H

PAGE NO. 27

INTERMODULATION SPURIOUS EMISSIONS

POWER OUTPUT: 15.85W

MOD: NONE

OUTPUT SIGNAL

START 0HZ

STOP 5.000GHZ

*RBW 1.0MHZ

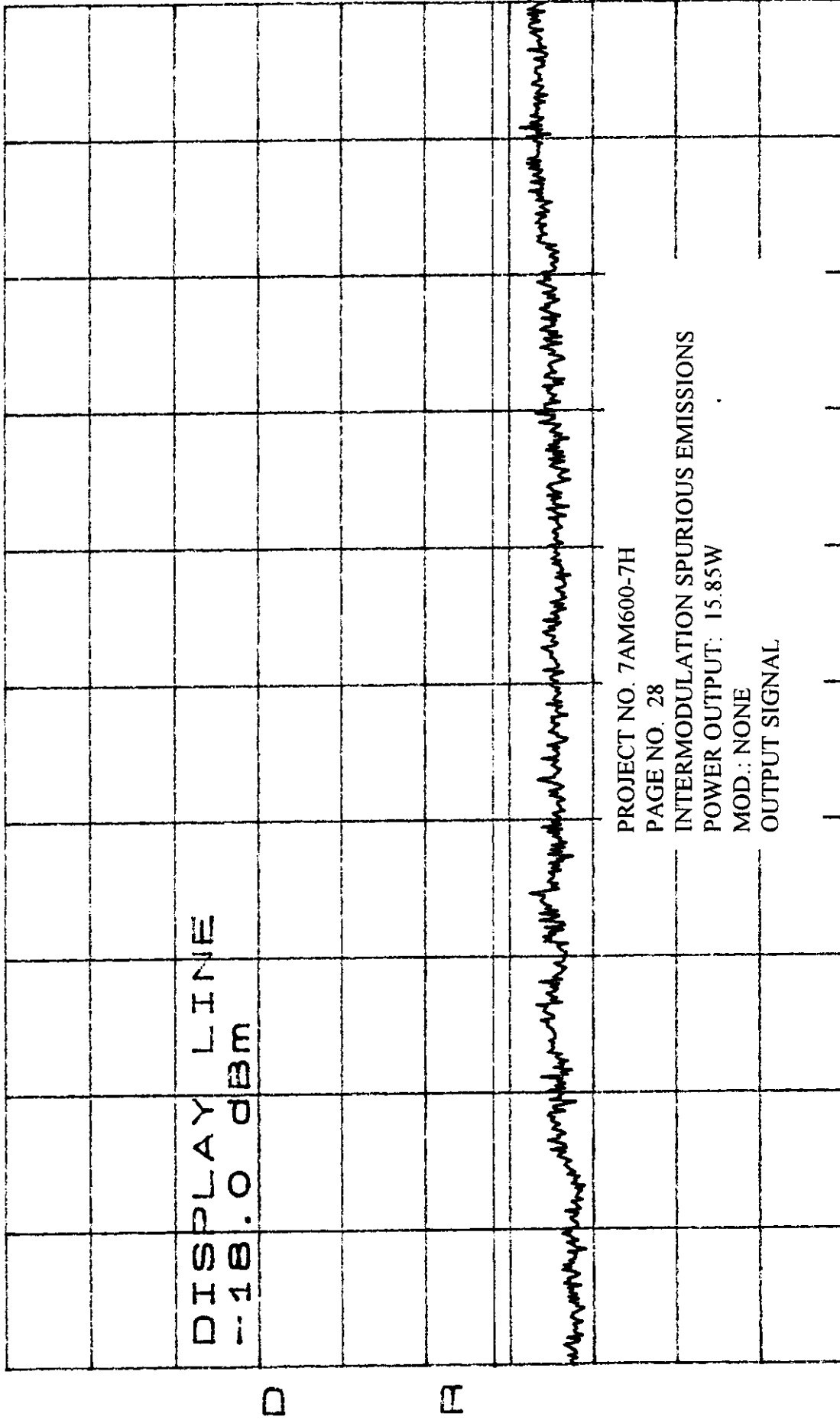
VBW 1.0MHZ

SWP 100ms

*ATTEN 0dB

PL 40.0dBm

10dB/



START 5.000GHZ

STOP 15.000GHZ

*RBW 1.0MHZ

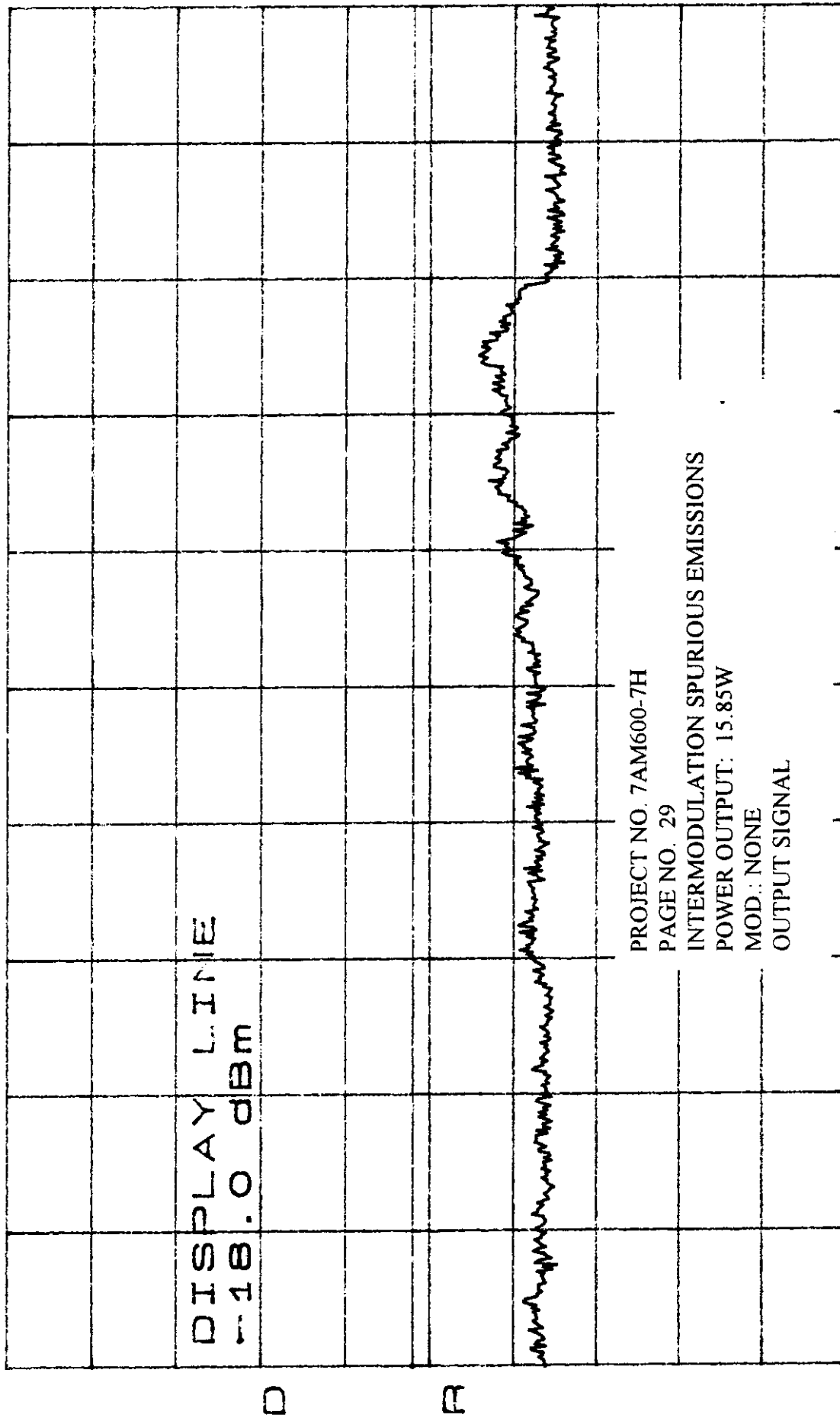
VBW 1.0MHZ

SWP 200ms

*ATTEN 0dB

PL 30.0dBm

10dB/



START 15.00GHZ

STOP 30.00GHZ

*RBW 1.0MHZ

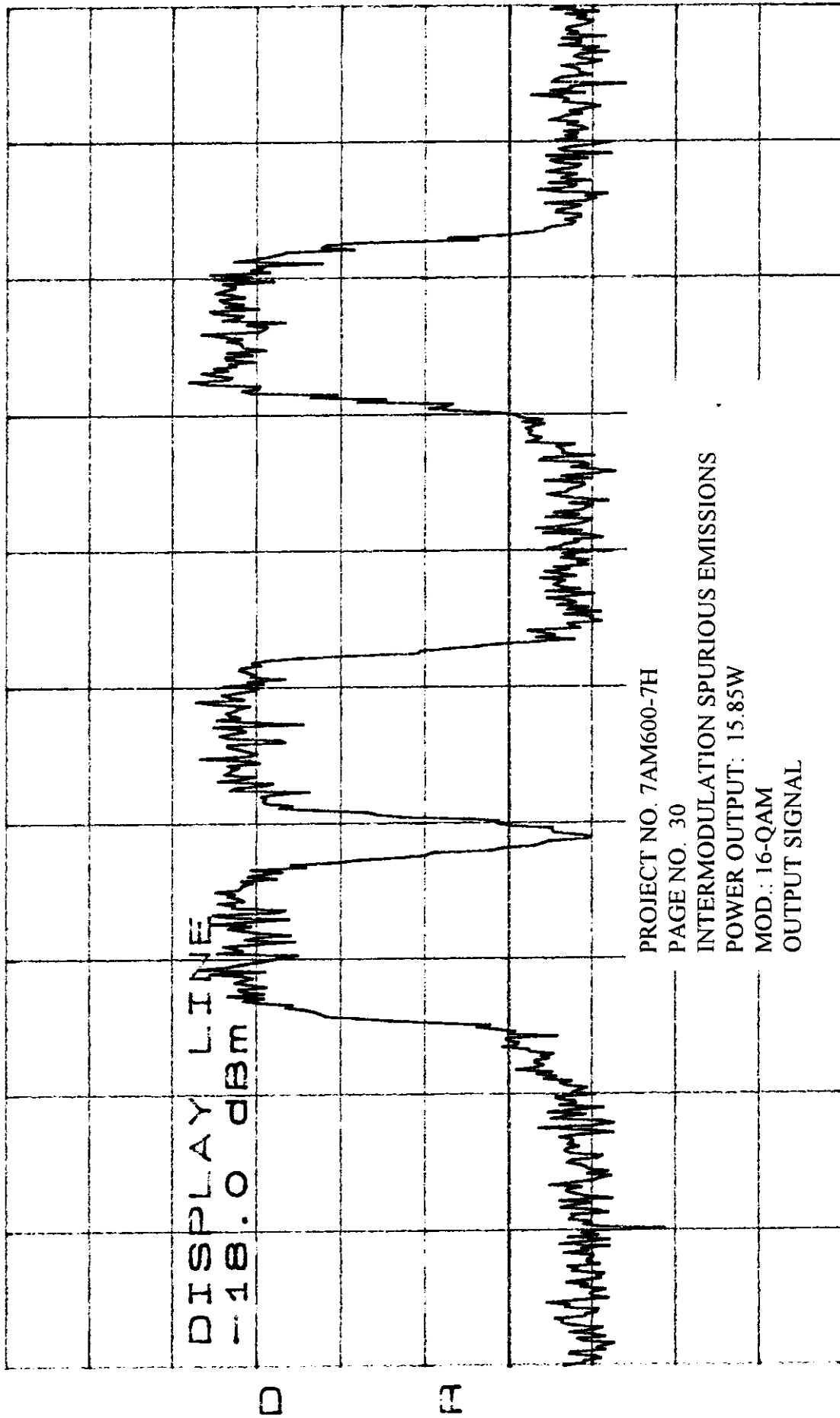
VBW 1.0MHZ

SWP 300ms

ATTEN 10dB
RL 42.0dBm

VAVG 1
10dB/

DISPLAY LINE
-18.0 dBm



CENTER 2.600000GHZ

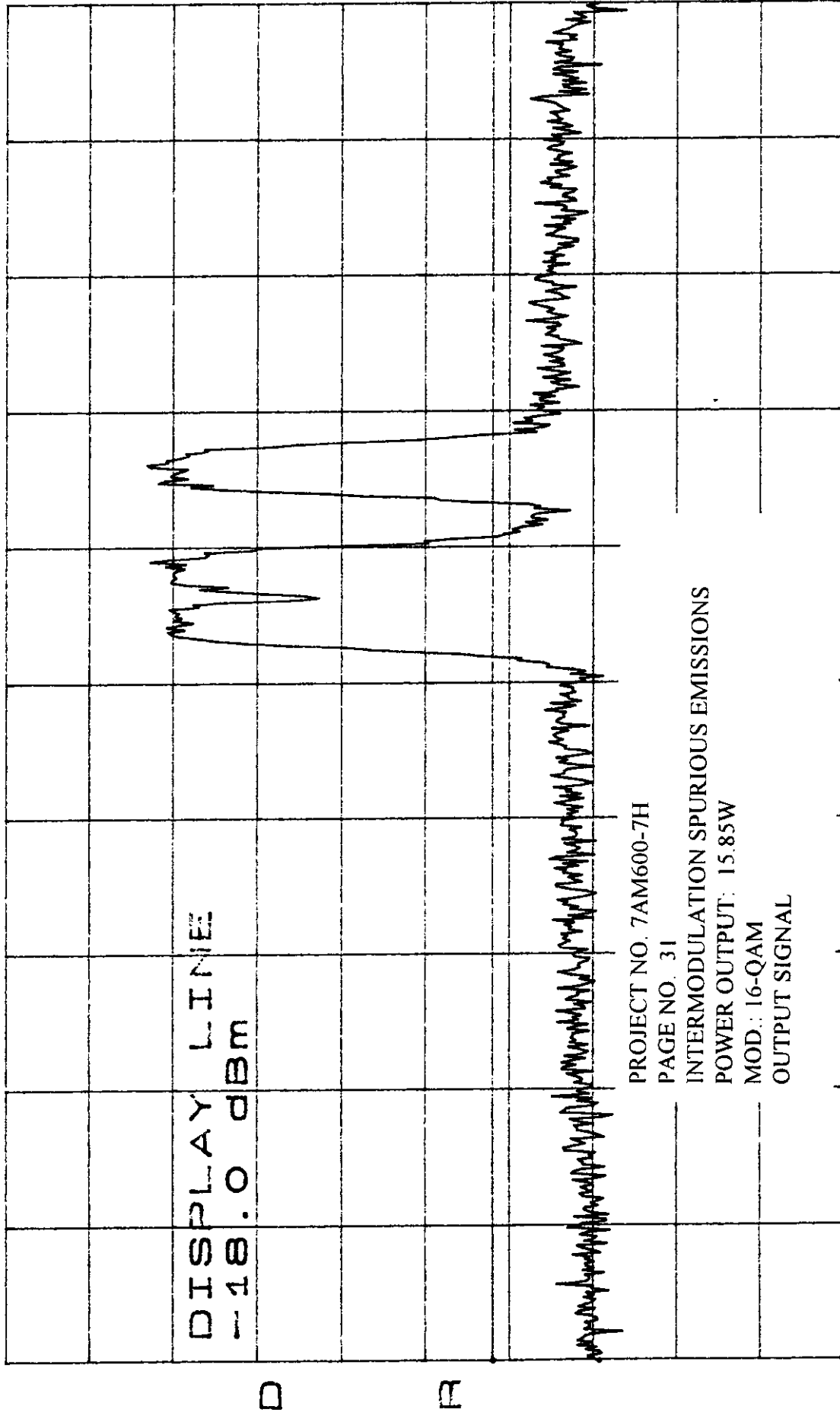
SPAN 50.00MHZ

*RBW 300KHZ

VBW 300KHZ

SWP 50.0ms

*ATTEN 0dB VAVG 1
RL 40.0dBm 10dB/

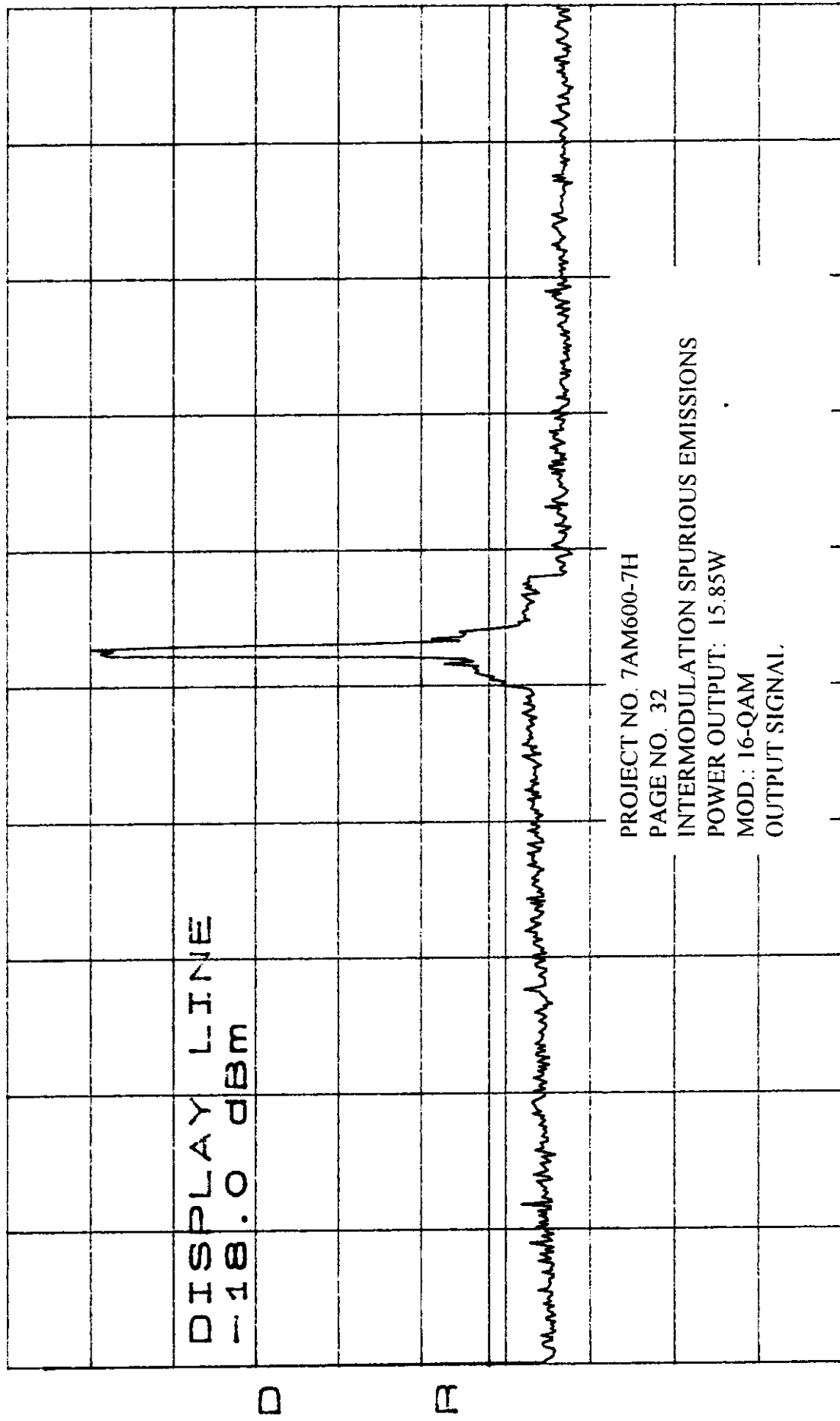


START 2.5000GHZ STOP 2.7000GHZ
*RBW 1.0MHZ VBW 1.0MHZ SWP 50.0ms

*ATTEN 0dB

RL 40.0dBm

10dB/



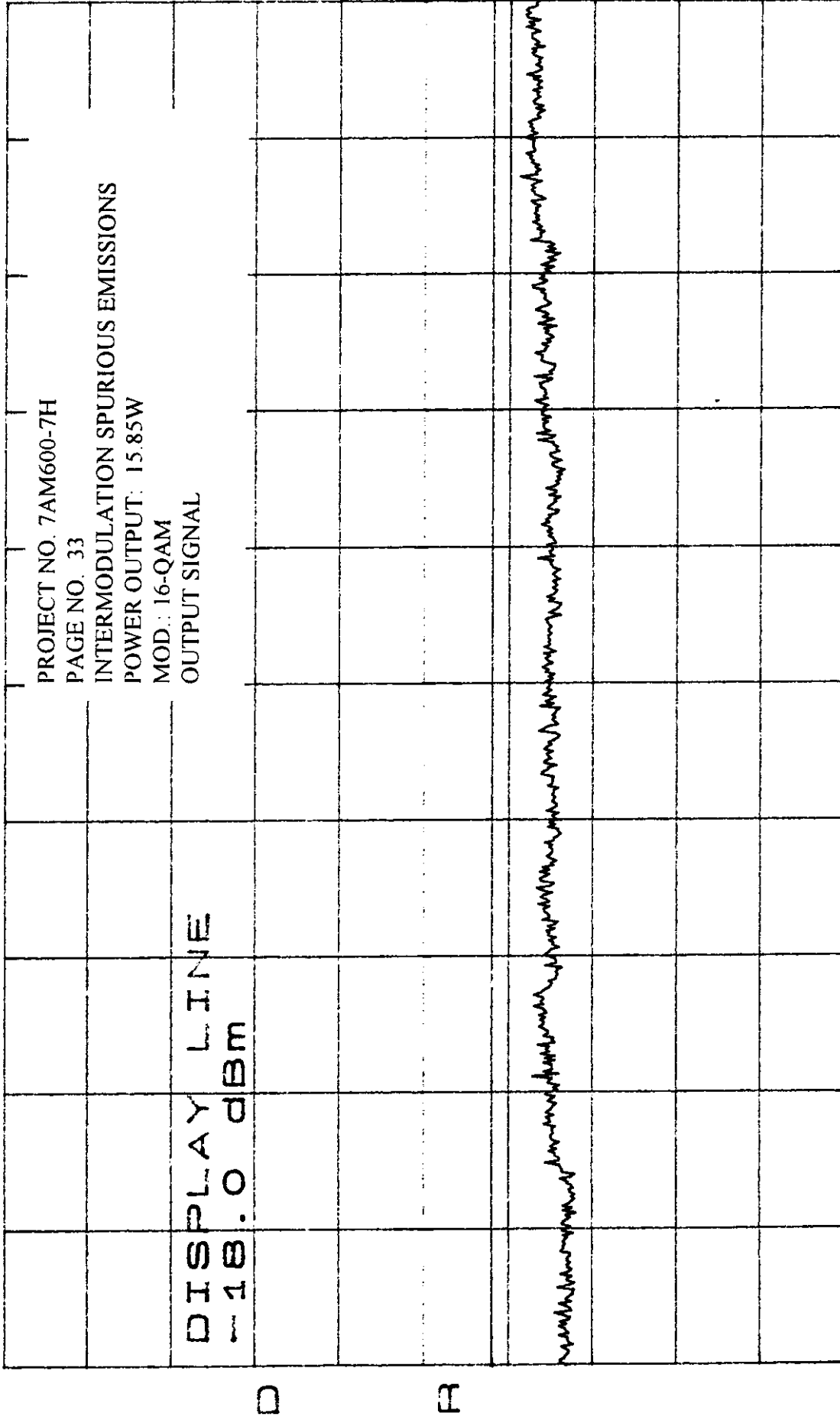
START 0HZ
*RBW 1.0MHZ

STOP 5.000GHZ
VBW 1.0MHZ SWP 100ms

*ATTEN 0dB

RL 40.0dBm

10dB/



START 5.00GHZ

STOP 15.00GHZ

*RBW 1.0MHZ

VBW 1.0MHZ

SWP 200ms

*ATTEN 0dB

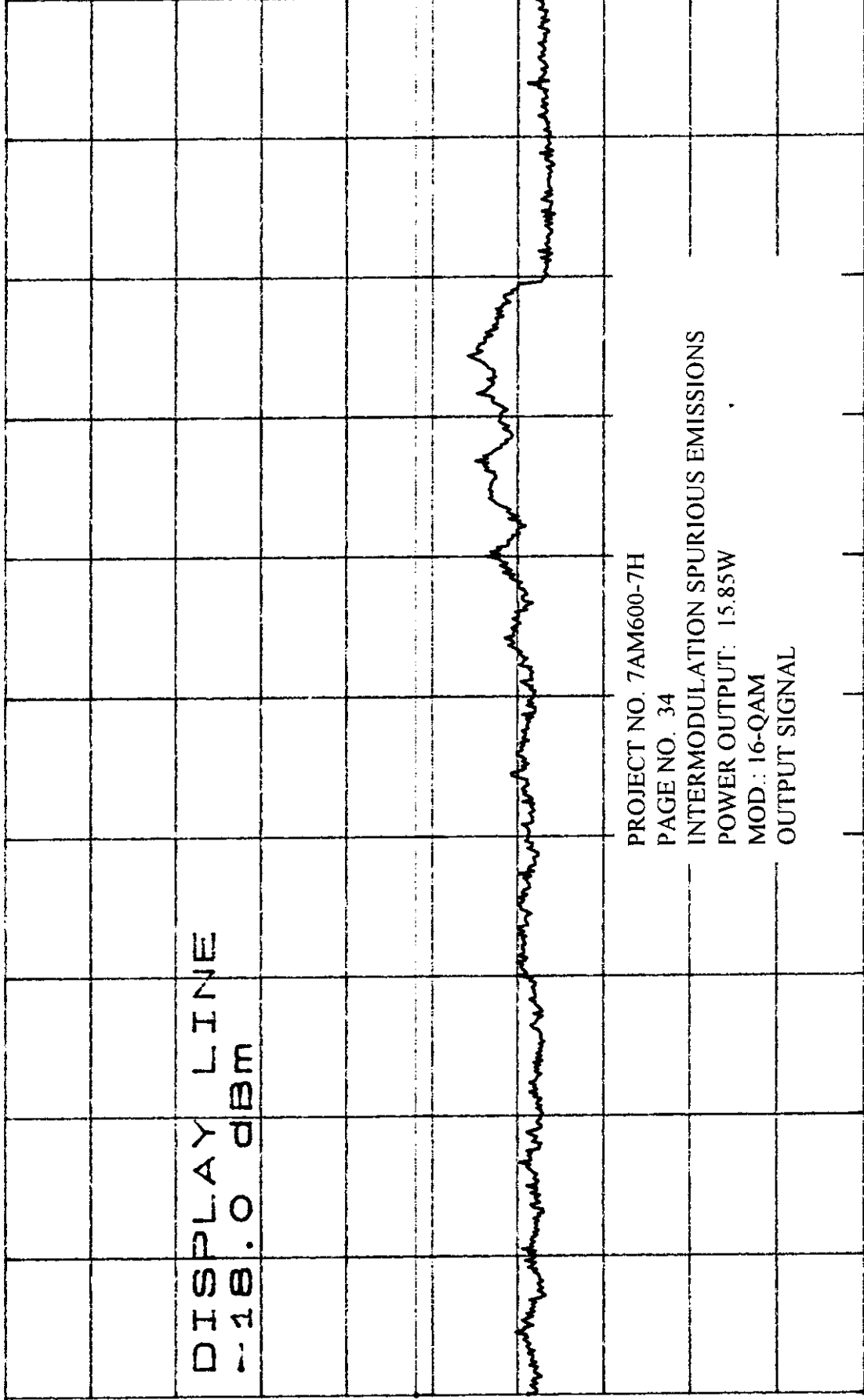
RL 30.0dBm

10dB/

DISPLAY LINE
--18.0 dBm

D

F



START 15.00GHz

STOP 30.00GHz

*RBW 1.0MHz

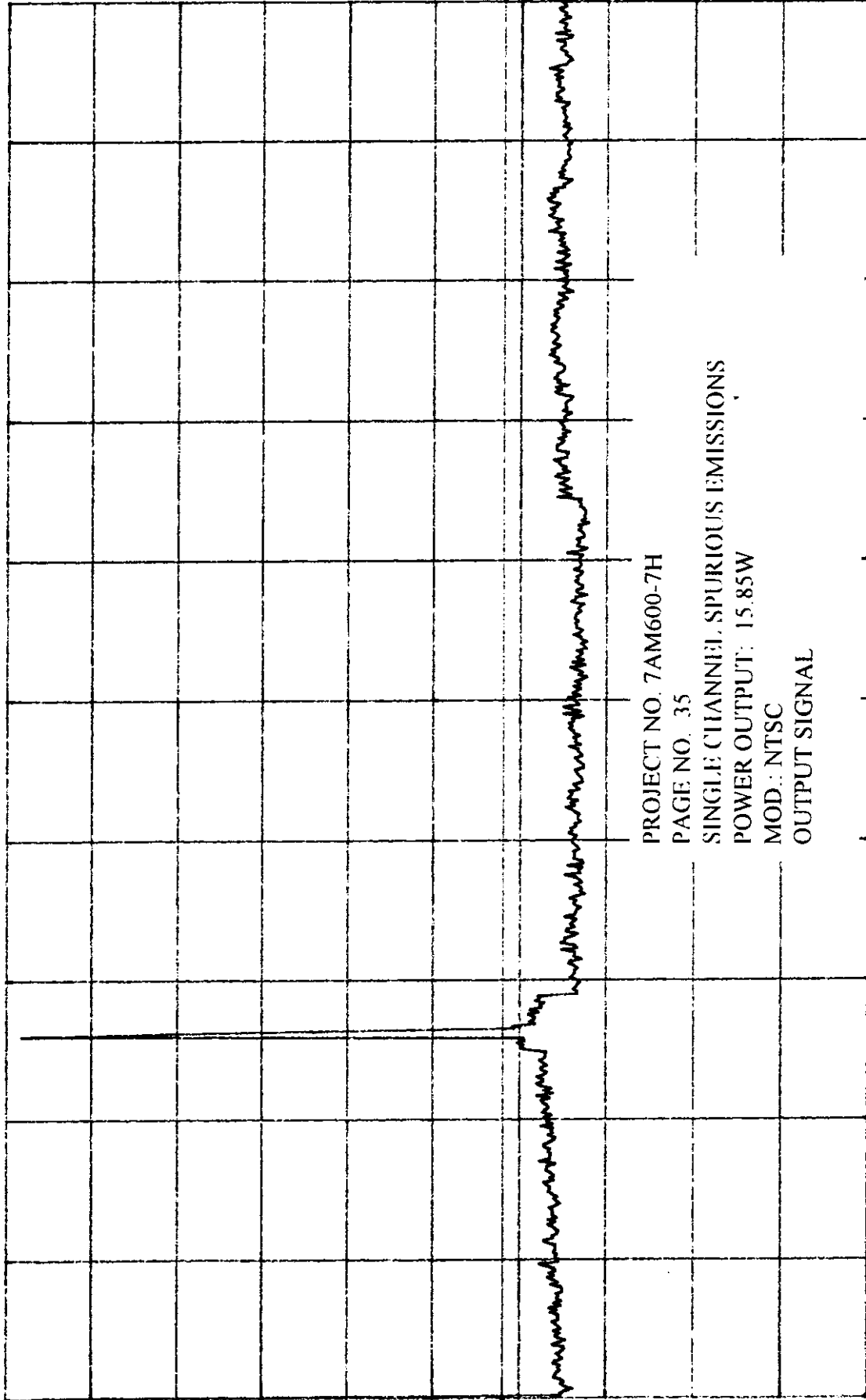
VBW 1.0MHz

SWP 300ms

*ATTEN 0dB

RL 40.0dBm

10dB/



START 0HZ

STOP 10.00GHZ

*RBW 1.0MHZ

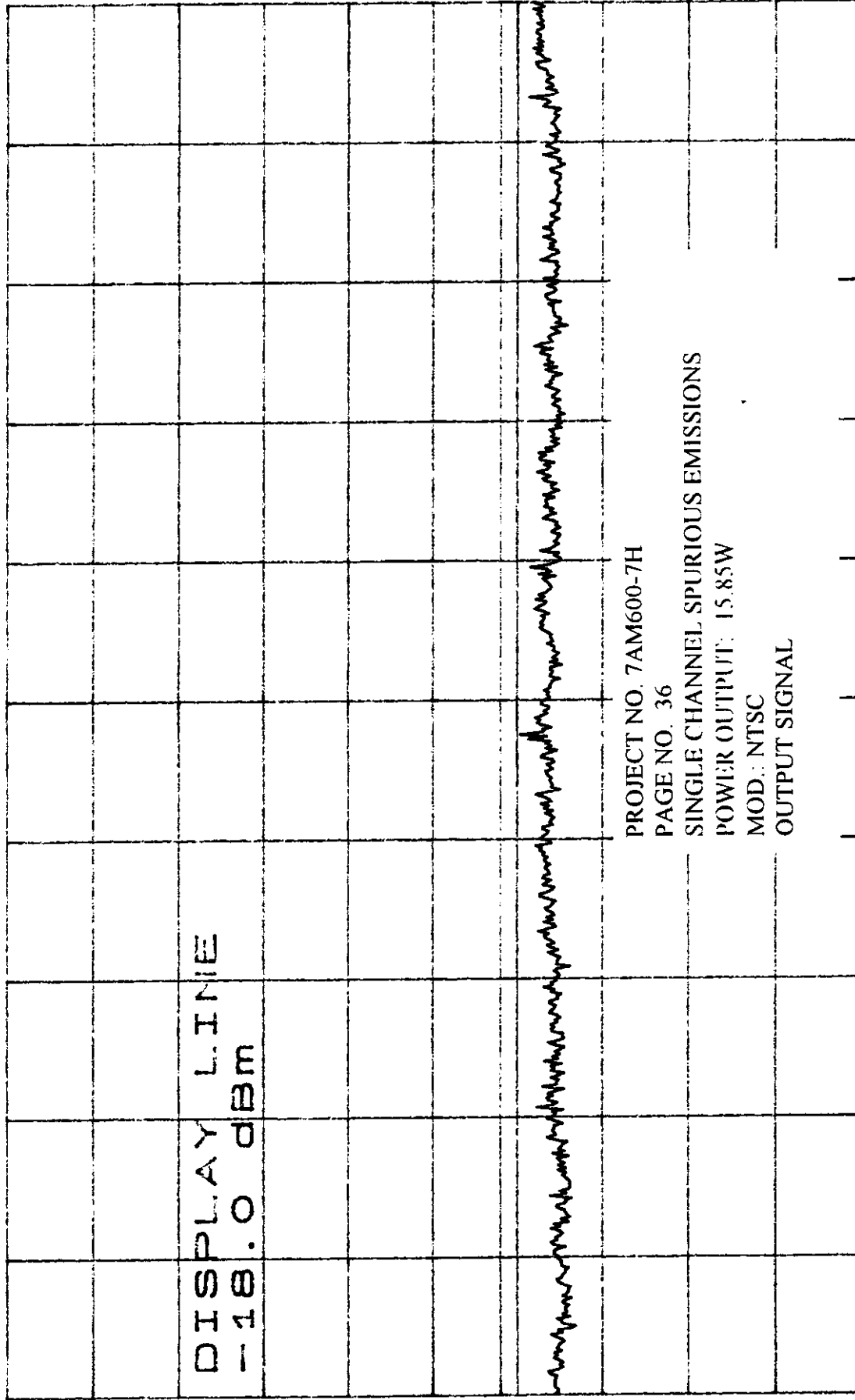
*VBW 1.0MHZ

SWP 200ms

*ATTEN 0dB

RL 40.0dBm

10dB/



START 10.00GHZ

STOP 20.00GHZ

*RBW 1.0MHZ

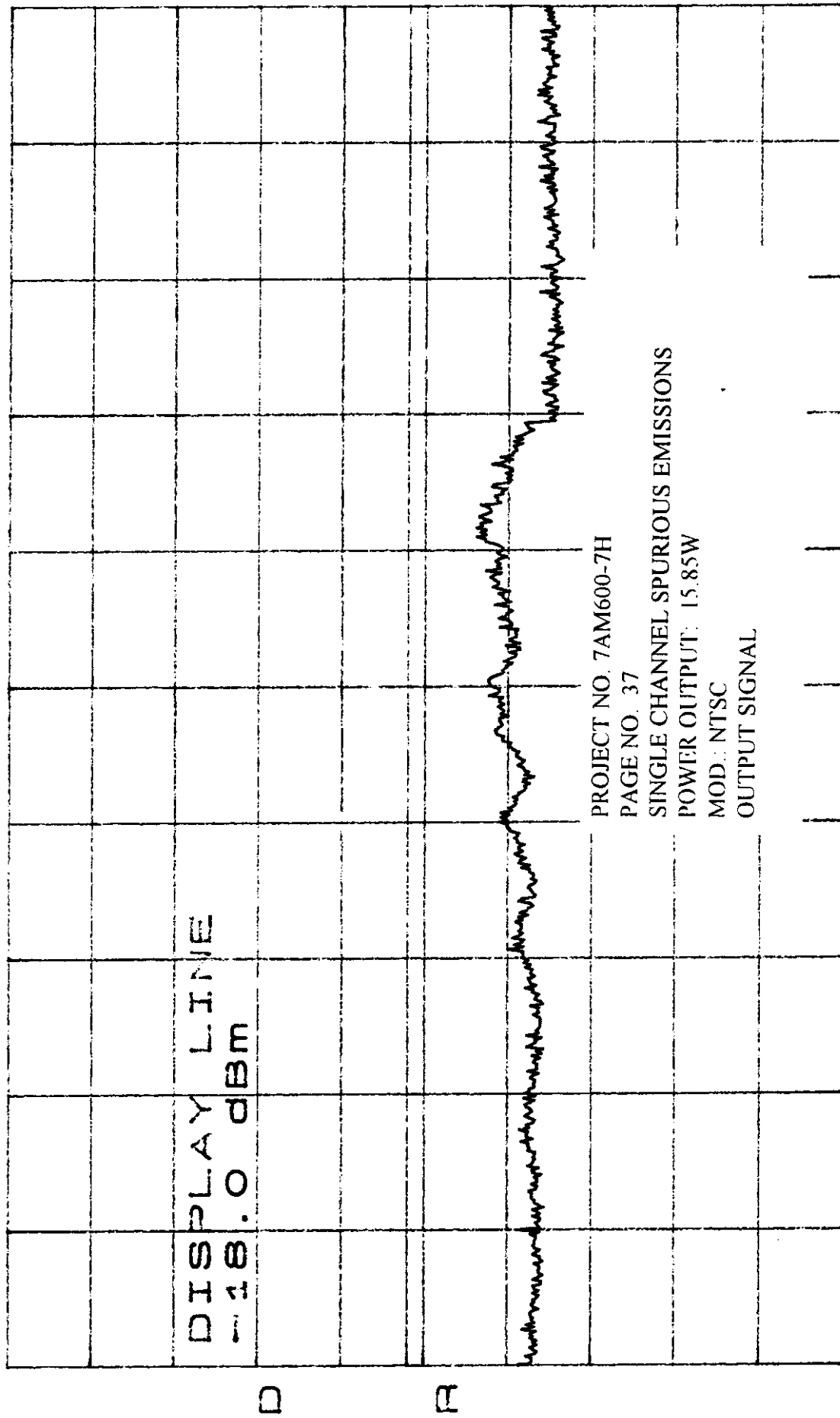
*VBW 1.0MHZ

SWP 200ms

*ATTEN 0dB

RL 30.0dBm

10dB/



START 20.00GHZ

STOP 30.00GHZ

*RBW 1.0MHZ

*VBW 1.0MHZ

SWP 200ms

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FCC PART 21, SUBPART K
MULTIPOINT DISTRIBUTION SERVICE
PROJECT NO.: 7AM600-7H

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"

FCC ID: D0063QAMLMBRP-400

NAME OF TEST: Field Strength of Spurious Radiation

PARA. NO.: 2.993

TESTED BY: Kevin Carr

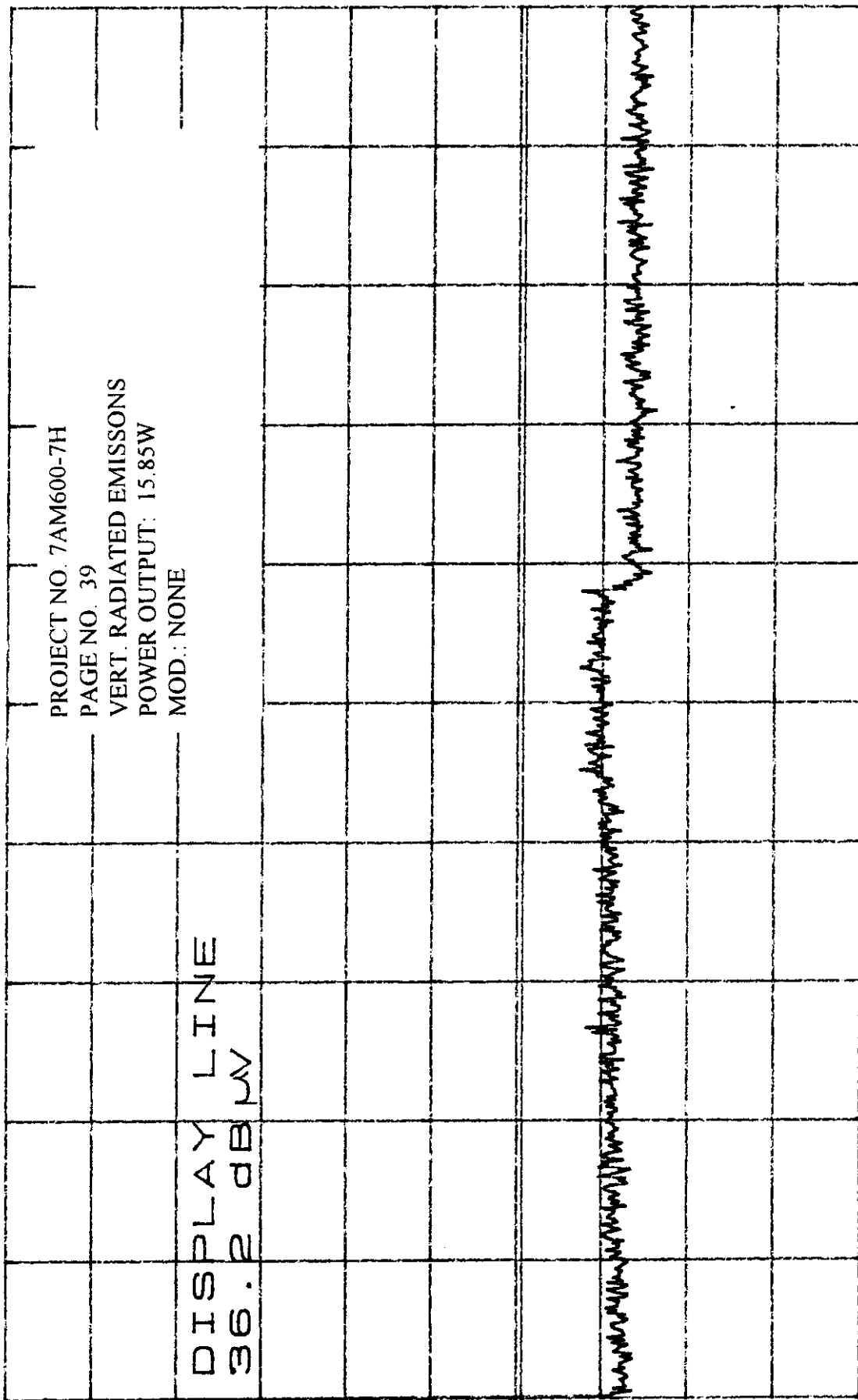
DATE: January 22, 1998

TEST RESULTS: Complies

MEASUREMENT DATA: See graphs.

*ATTEN 0dB

RL 97.0dB V 10dB/



START 0HZ

STOP 5.000GHZ

*RBW 300KHZ

VBW 300KHZ

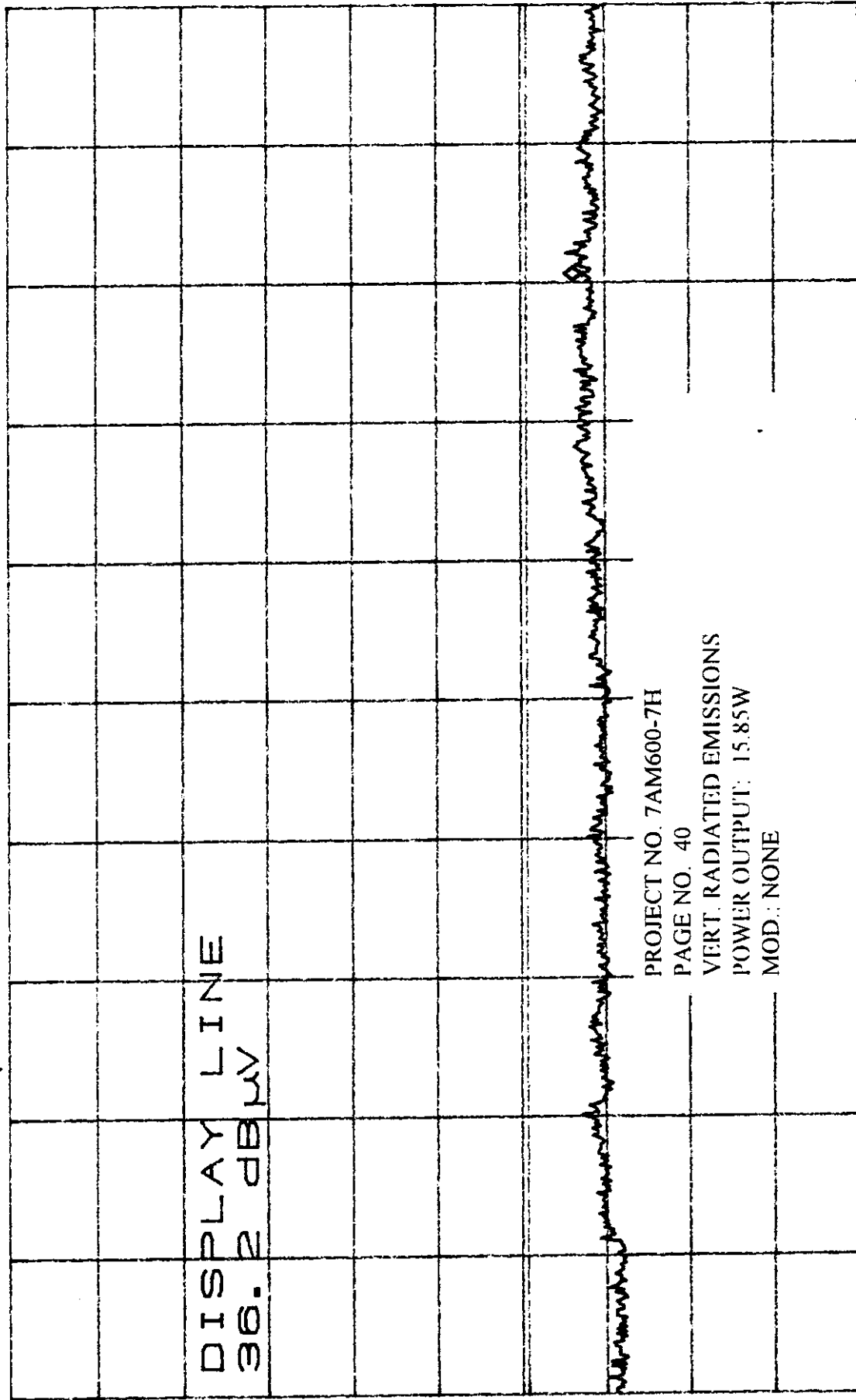
SWP 140ms

*ATTEN 0dB

MKR 29.83dBμV

RL 97.0dBμV

10dB/ 15.49GHz



D

PROJECT NO. 7AM600-7H

PAGE NO. 40

VERT. RADIATED EMISSIONS

POWER OUTPUT: 15.85W

MOD.: NONE

START 5.00GHz

STOP 18.00GHz

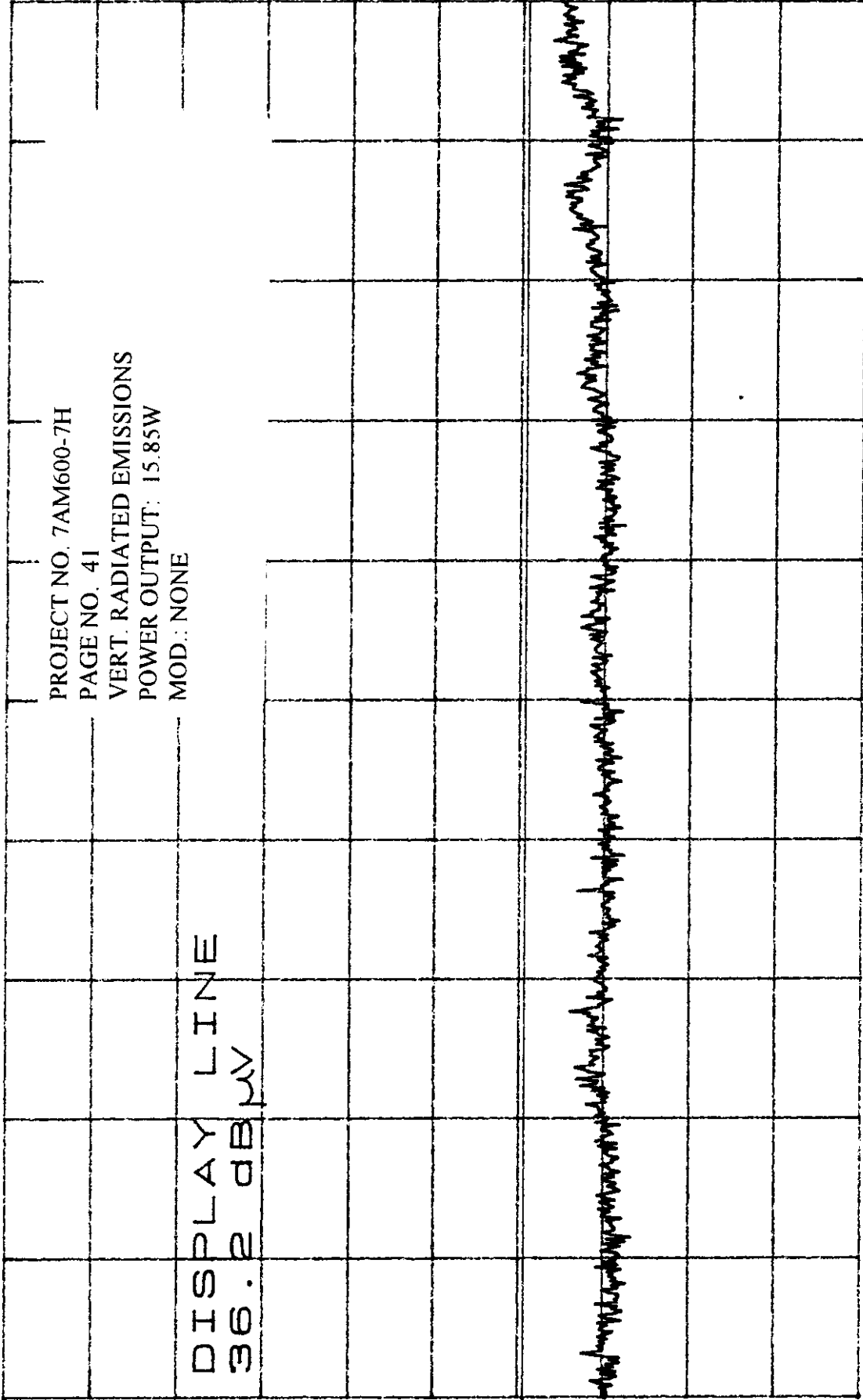
*RBW 300kHz

VBW 300kHz

SWP 370ms

*ATTEN 0dB

RL 97.0dB V 10dB/



START 18.000GHZ STOP 25.000GHZ
*RBW 300KHZ VBW 300KHZ SWP 200ms

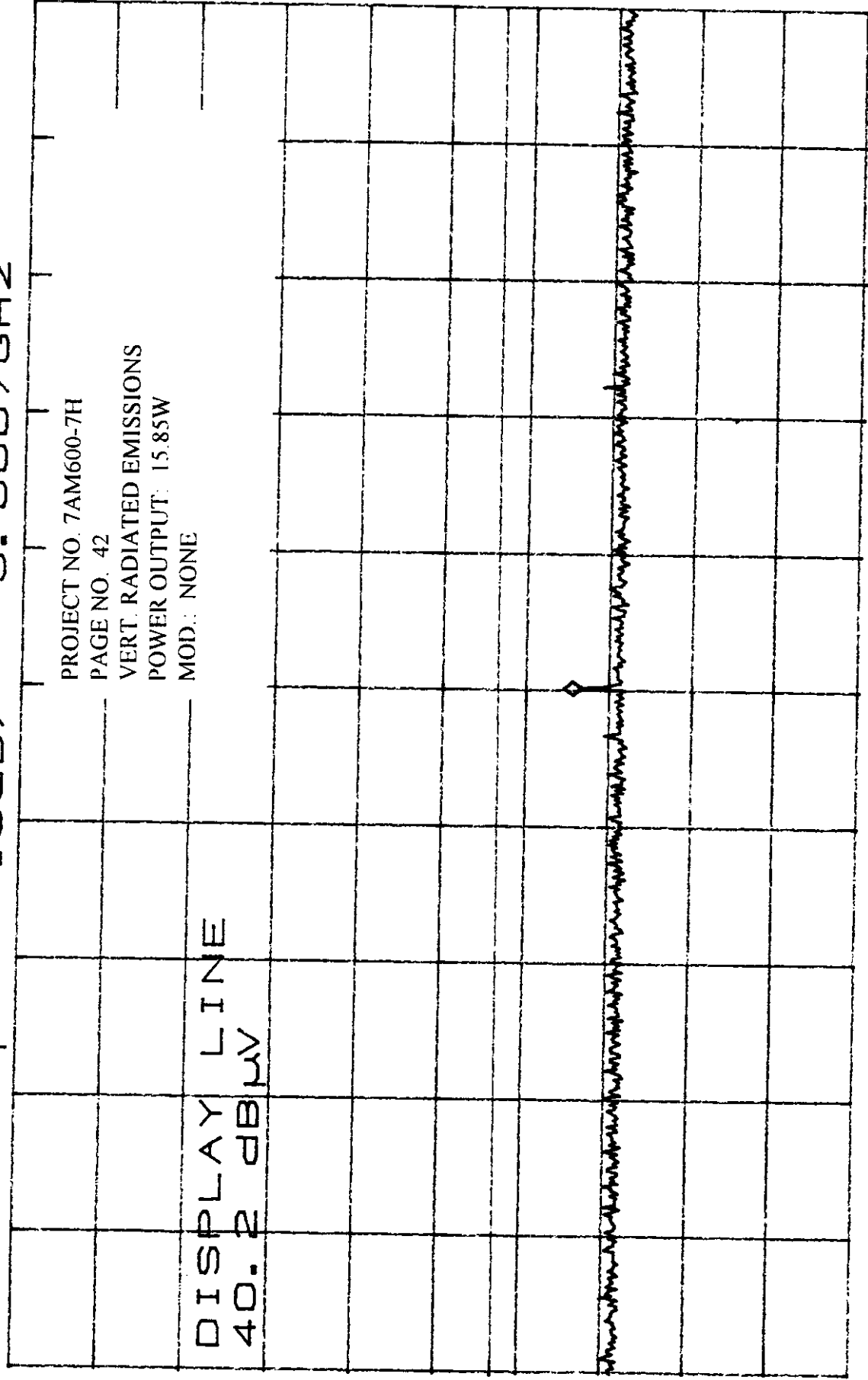
*ATTEN 0dB

MKR 30.33dB μ V

RL 97.0dB μ V

10dB/

5.0007GHz



D

CENTER 5.0000GHZ

SPAN 200.0MHZ

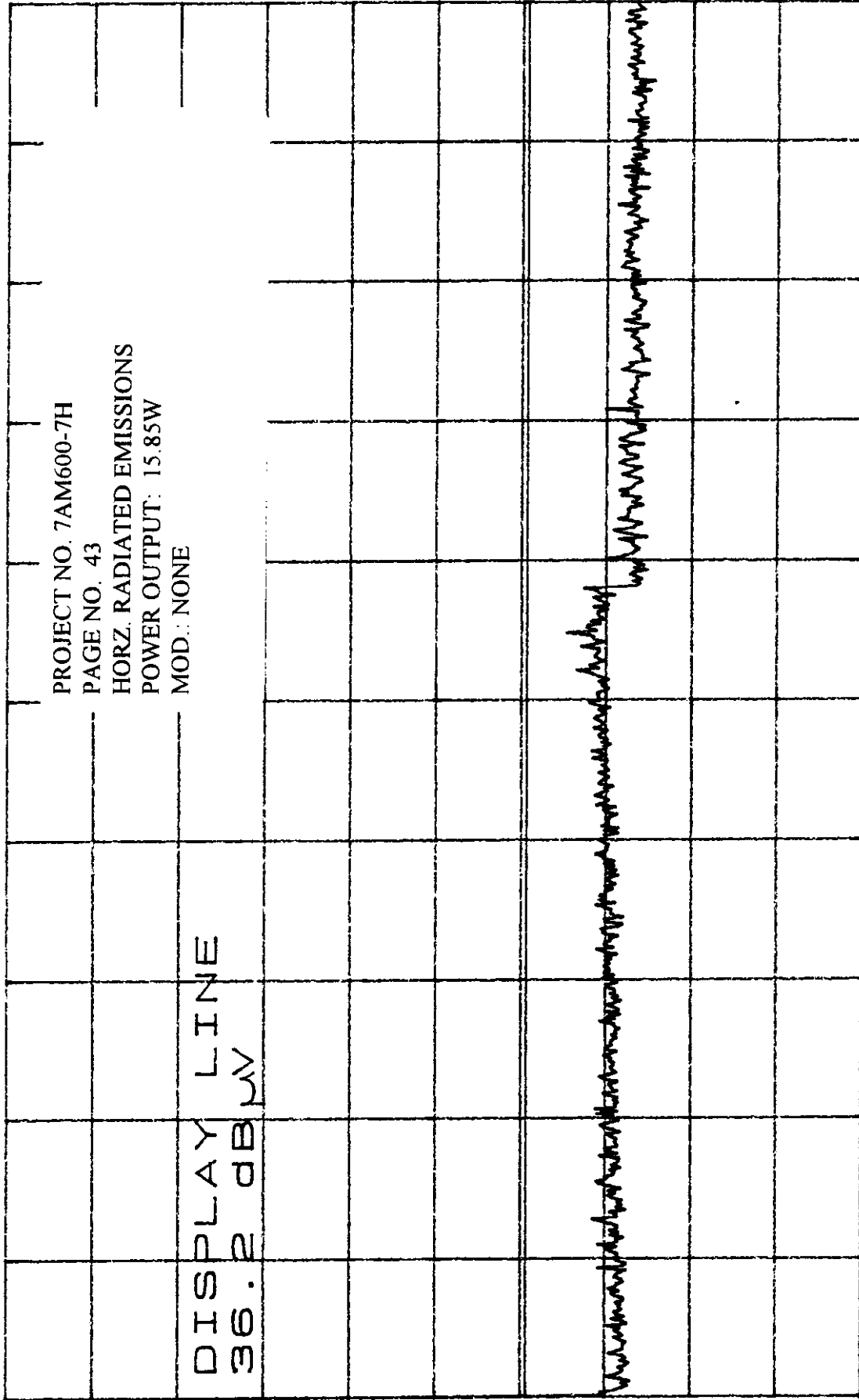
*RBW 300kHz

VBW 300kHz

SWP 50.0ms

*ATTEN 0dB

RL 97.0dB V 10dB/



START 0HZ

STOP 5.000GHZ

*RBW 300KHZ

VBW 300KHZ

SWP 140ms

*ATTEN 0dB

RL 97.0dBμV

10dB/

MKR 31.00dBμV

15.49GHz

PROJECT NO. 7AM600-7H

PAGE NO. 44

HORZ. RADIATED EMISSIONS

POWER OUTPUT: 15.85W

MOD.: NONE

DISPLAY LINE

36.2 dBμV

D

START 5.00GHz

STOP 18.00GHz

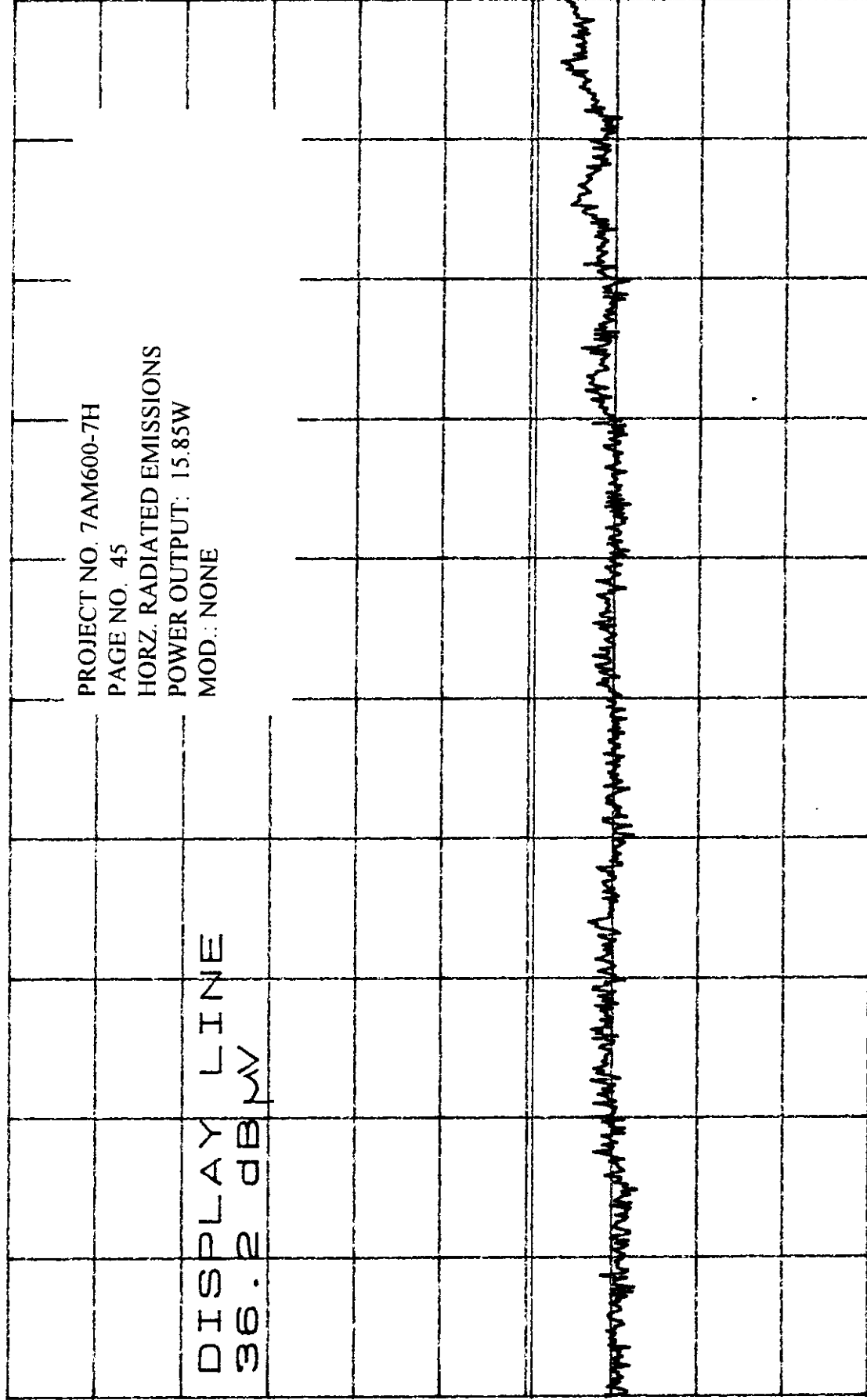
*RBW 300kHz

VBW 300kHz

SWP 370ms

*ATTEN 0dB

RL 97.0dB V 10dB/



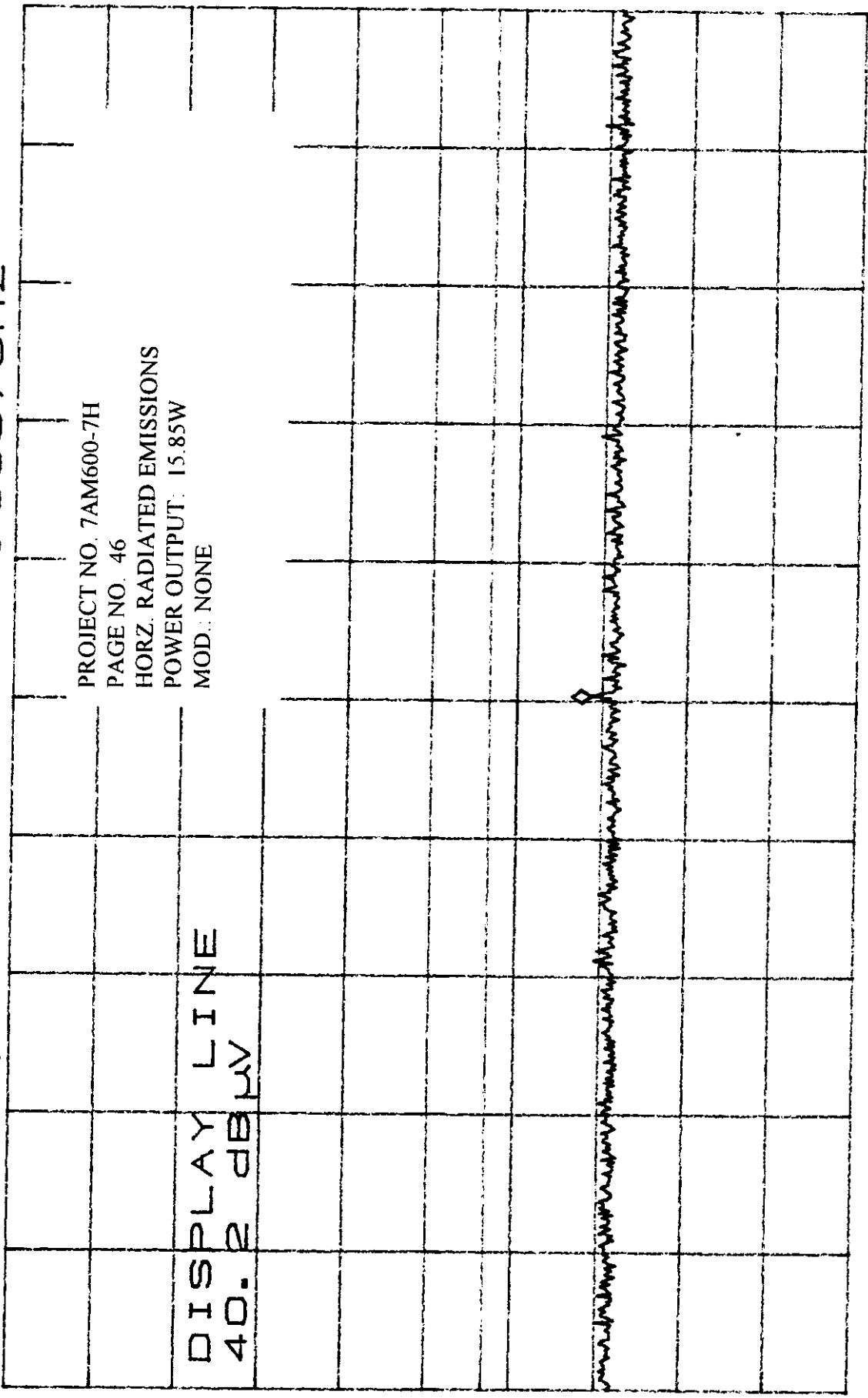
*ATTEN 0dB

RL 97.0dB μ V

10dB/

MKR 28.50dB μ V

5.0007GHz



CENTER 5.0000GHz

*RBW 300kHz

VBW 300kHz

SPAN 200.0MHz

SWP 50.0ms

KTL - Certelecom Laboratories Inc.

FCC PART 21, SUBPART K
MULTIPOINT DISTRIBUTION SERVICE
PROJECT NO.: 7AM600-7H

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"
FCC ID: D0063QAMLMBRP-400

NAME OF TEST: Frequency Stability

PARA. NO.: 2.995

TESTED BY:

DATE:

TEST RESULTS:

MEASUREMENT DATA: See next page.

Assigned Frequency:
STV:

NOT APPLICABLE

KTL - Certelem Laboratories Inc.

FCC PART 21, SUBPART K
MULTIPOINT DISTRIBUTION SERVICE
PROJECT NO.: 7AM600-7H
ANNEX A

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"

FCC ID: D0063QAMLMBRP-400

ANNEX A

TEST METHODOLOGIES

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"

FCC ID: D0063QAMLMBRP-400

NAME OF TEST:	RF Power Output	PARA. NO.: 2.985
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TEST CONDITIONS: Standard Temperature and Humidity
 Standard Test Voltage

MINIMUM STANDARD: Para. no. 21.904(a) The maximum equivalent isotropically radiated power (EIRP) of a transmitter station in this service shall not exceed 2000 watts (33 dBW) except as provided in paragraph (b) of this section.

Para. no. 21.904(b) If a station uses a transmitting antenna with non-omnidirectional horizontal plane radiation pattern, the maximum equivalent isotropically radiated power (EIRP) in dBW in a given direction shall be determined by the following formula: $EIRP = 3 \text{ dBW} + 10 \log (360/\text{beamwidth})$ where $10 \log (260/\text{beamwidth}) < 8 \text{ dB}$. Beamwidth is the total horizontal plane beamwidth of the transmitting antenna system in degrees, measured at the half-power points.

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"

FCC ID: D0063QAMLMBRP-400

NAME OF TEST:	Occupied Bandwidth	PARA. NO.: 2.989
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TEST CONDITIONS: Standard Temperature and Humidity
 Standard Test Voltage

MINIMUM STANDARD: Para. no. 21.908(b) On or after November 1, 1991, the maximum out-of-band power of a transmitter operating in the frequency bands 2150 - 2162 MHz and 2596 - 2644 MHz shall be attenuated 38 dB relative to the peak visual carrier at the channel edges and constant slope attenuation from this level to 60 dB relative to the peak visual carrier at 1 MHz below the lower band edge and 0.5 MHz above the upper band edge. All out-of-band emissions extending beyond these frequencies shall be attenuated at least 60 dB below the peak visual carrier.

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"

FCC ID: D0063QAMLMBRP-400

NAME OF TEST:	Spurious Emissions at Antenna Terminals	PARA. NO.: 2.991
---------------	---	------------------

TEST CONDITIONS: Standard Temperature and Humidity
 Standard Test Voltage

MINIMUM STANDARD: Para. no. 21.908(b) On or after November 1, 1991, the maximum out-of-band power of a transmitter operating in the frequency bands 2150 - 2162 MHz and 2596 - 2644 MHz shall be attenuated 38 dB relative to the peak visual carrier at the channel edges and constant slope attenuation from this level to 60 dB relative to the peak visual carrier at 1 MHz below the lower band edge and 0.5 MHz above the upper band edge. All out-of-band emissions extending beyond these frequencies shall be attenuated at least 60 dB below the peak visual carrier.

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"

FCC ID: D0063QAMLMBRP-400

NAME OF TEST:	Field Strength of Spurious Radiation	PARA. NO.: 2.993
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TEST CONDITIONS: Standard Temperature and Humidity
 Standard Test Voltage

MINIMUM STANDARD: Para. no. 21.908(b) On or after November 1, 1991, the maximum out-of-band power of a transmitter operating in the frequency bands 2150 - 2162 MHz and 2596 - 2644 MHz shall be attenuated 38 dB relative to the peak visual carrier at the channel edges and constant slope attenuation from this level to 60 dB relative to the peak visual carrier at 1 MHz below the lower band edge and 0.5 MHz above the upper band edge. All out-of-band emissions extending beyond these frequencies shall be attenuated at least 60 dB below the peak visual carrier.

KTL - Certelem Laboratories Inc.

FCC PART 21, SUBPART K
MULTIPOINT DISTRIBUTION SERVICE
PROJECT NO.: 7AM600-7H
ANNEX A

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"
FCC ID: D0063QAMLMBRP-400

NAME OF TEST:	Frequency Stability	PARA. NO.: 2.995
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TEST CONDITIONS: As per measurement data

MINIMUM STANDARD: Para. no. 21.908 (a) Ref.: 73.687(c)(1) Automatic means shall be provided in the visual transmitter to maintain the carrier frequency within ± 1 kHz of the authorized frequency; automatic means shall be provided in the aural transmitter to maintain the carrier frequency 4.5 MHz above the actual visual carrier frequency ± 1 kHz.

KTL - Certelec Laboratories Inc.

FCC PART 21, SUBPART K
MULTIPOINT DISTRIBUTION SERVICE
PROJECT NO.: 7AM600-7H
ANNEX B

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"

FCC ID: D0063QAMLMBRP-400

ANNEX B

TEST EQUIPMENT

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"

FCC ID: D0063QAMLMBRP-400**RADIO TEST EQUIPMENT LIST**

CAL CYCLE	EQUIPMENT	MANUFACTURER	MODEL	SERIAL	LAST CAL.	NEXT CAL.	
1 Year	Spectrum Analyzer	Hewlett Packard	8565E	FA000981	May 9/97	May 9/98	
	Plotter	Hewlett Packard	7470A	2308A30807	NCR	NCR	
1 Year	Radio Test Set	Rohde & Schwarz	CMS 52	840.0009.52	July 23/97	July 23/98	
1 Year	Attenuator	Narda	765-20	9510	July 23/97	July 23/98	
1 Year	Attenuator	Narda	768-10	9704	Oct. 1/97	Oct. 1/98	
1 Year	Attenuator	Narda	768-10	9709	Oct. 1/97	Oct. 1/98	
1 Year	RF Millivoltmeter	Rohde & Schwarz	URV5	FA000420	July 23/97	July 23/98	
1 Year	Insertion Unit	Rohde & Schwarz	URV5-Z4	FA000905	July 23/97	July 23/98	
1 Year	Power Sensor	Rohde & Schwarz	URV5-Z5	FA000419	July 23/97	July 23/98	
2 Year	Horn Antenna	EMCO #1	3115	3132	Feb. 5/96	Feb. 5/98	
1 Year	50 ohm Combiner Pad	Mini Circuits	ZA3PD-2	9746	Dec. 12/97	Dec. 12/98	
1 Year	Signal Generator	Hewlett Packard	8660C	1818A01913	July 22/97	July 22/98	
1 Year	Signal Generator	Hewlett Packard	8660C	2044A03304	July 22/97	July 22/98	
1 Year	Signal Generator	Rohde & Schwarz	SM1Q03	1084-8004-03	Sept. 18/97	Sept. 18/98	
1 Year	Arbitrary Waveform Gen.	Sony/Tektronix	AWG2021	J310495	May 15/97	May 15/98	
1 Year	Plotter	Hewlett Packard	7550A	FA001129	NCR	NCR	

NA: Not Applicable

NCR: No Cal Required

KTL - Certelec.com Laboratories Inc.

FCC PART 21, SUBPART K
MULTIPOINT DISTRIBUTION SERVICE
PROJECT NO.: 7AM600-7H
ANNEX C

Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"

FCC ID: D0063QAMLMBRP-400

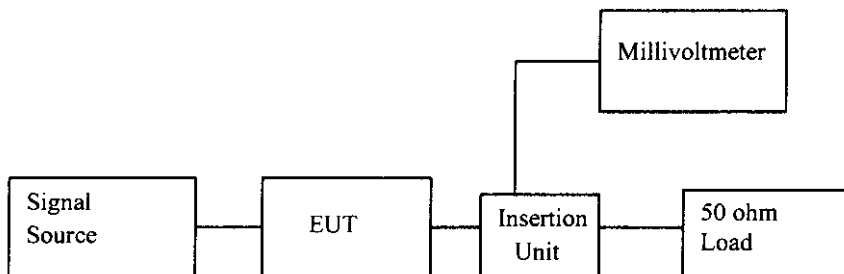
ANNEX C

TEST DIAGRAMS

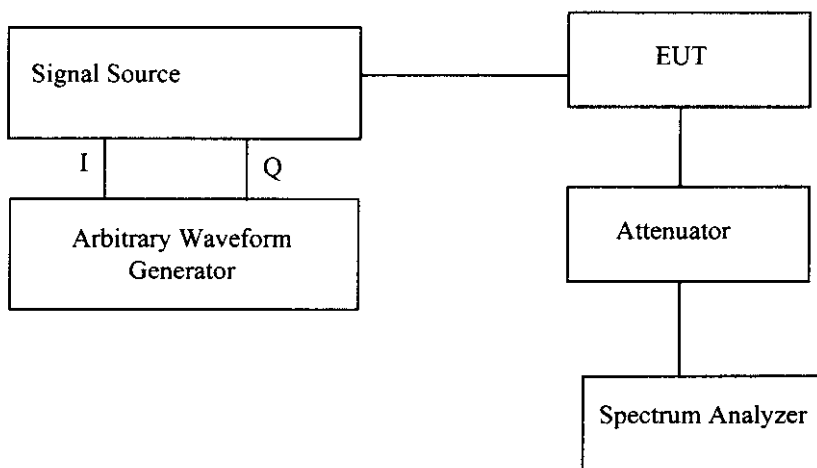
Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"

FCC ID: D0063QAMLMBRP-400

PARA. NO. 2.985 RF POWER OUTPUT



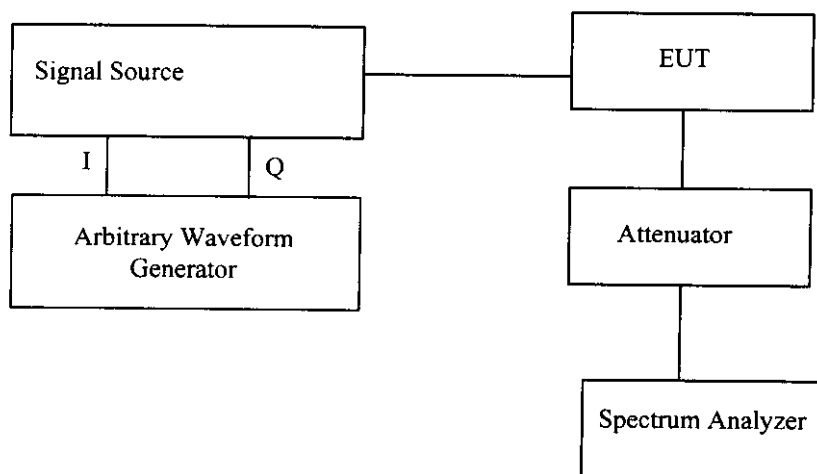
PARA. NO. 2.989 OCCUPIED BANDWIDTH



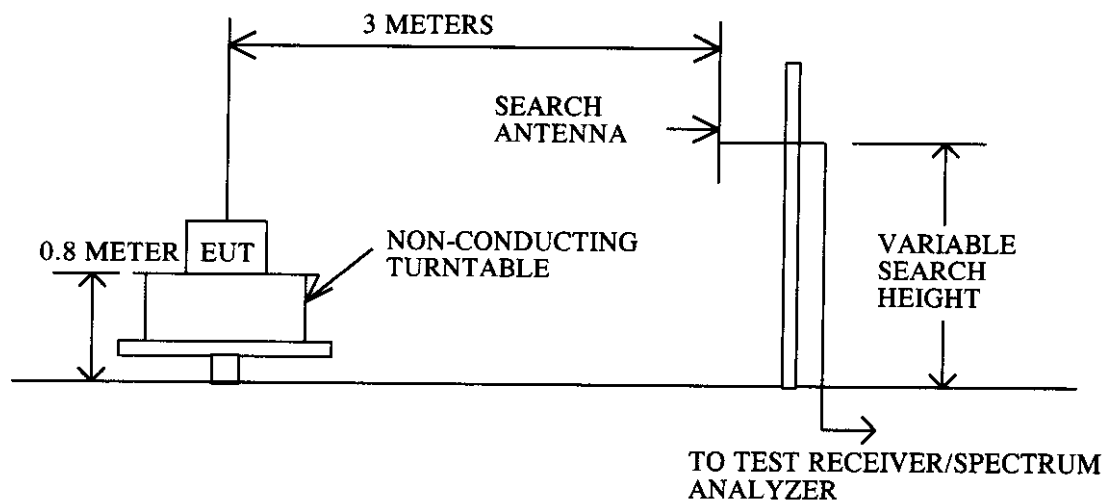
Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"

FCC ID: D0063QAMLMBRP-400

PARA. NO. 2.991 SPURIOUS EMISSIONS AT ANTENNA TERMINALS



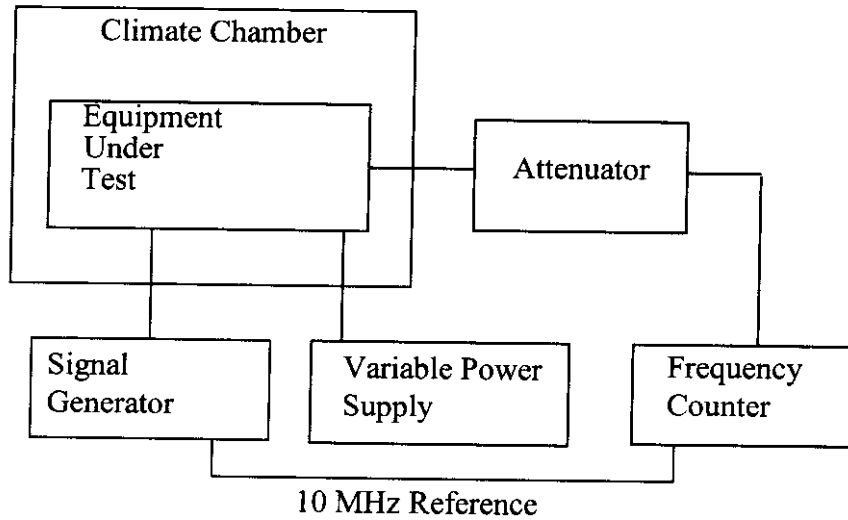
PARA. NO. 2.993 FIELD STRENGTH OF SPURIOUS RADIATION



Equipment: The AML Wireless Systems "MMDS Model MBRP-400 Indoor Repeater"

FCC ID: D0063QAMLMBRP-400

PARA. NO. 2.995 FREQUENCY STABILITY



MMDS Repeater Model MBRP-400.

Technical Specification①:

FCC ID: D00630A MLMBRP-400

1. MMDS Input

Frequency	2500 to 2686 Mhz
Level	See table 1
Impedance	50 Ohm
Return Loss	16 dB
Connector	"N" Type

2. MMDS Output

Frequency	2500 to 2686 MHz
Level	See table 1
Impedance	50 Ohm
Return Loss	16 dB
Connector	"N" Type

Table 1. Repeater Performance @ 31 Channels Load (CW Measurement)

Gain (dB)	Output Power (dBm/CH)	Carrier to Noise (dB)	C/CTB (dB)
75	27	59	51
75	25	57	55
75	23	55	59

② Specification subject to change without prior notice.

Repeater Frequency Response	± 0.7 dB @ 196 MHz or ± 0.25 dB @ each 6 MHz
Operating Temperature Range	15°C to 35°C 59°F to 95°F
Gain (Max)	75 dB
AGC Threshold Adjust Range	2 dB
Maximum AGC Range	10 dB
Humidity	to 95%
Primary Power	115/230 VAC 1600 VA, 1400 Watt
Dimensions without Rack	Power Amplifier Unit A 19" x 24" x 10.50" Power Amplifier Unit B 19" x 24" x 7.0" Power Amplifier Unit C 19" x 24" x 10.50"
Weight	Power Amplifier Unit A 25 kg (56 lb.) Power Amplifier Unit B 10 kg (22 lb.) Power Amplifier Unit C 25 kg (56 lb.)

NOTE: This device has not been approved by the Federal Communications Commission, and therefore is not and may not be offered for sale or lease, until approval of the FCC has been obtained.

① Specification subject to change without prior notice.
01/97

FCC ID: D0063QAMLMBRP-400

MMDS INDOOR REPEATER MODEL MBRP-400

The AML Wireless MBRP-400 Repeater series delivers multiple channels to rural regions, small communities, MDU's and areas with limited infrastructure in place. This system offers the opportunity to grow as it can be expanded in terms of power. Signal delivery for 20 miles radial coverage at 35 dB C/N digital threshold can be achieved. The repeaters are compatible with all popular encoding systems and standard downconverter receiver/decoder equipment can be interfaced directly with existing distribution systems. All AML MMDS repeaters can be upgraded to a higher power repeater within the MBRP line.

MAIN FEATURES

- 2500 TO 2686 MHz Operating Frequency Band
- An Automatic Level Control (ALC)
- Compatible with analog and digital signals NTSC, PAL, QAM-64
- Capacity for up to 31 NTSC Video Channels
- 19" Rack Mountable Chassis
- Over-Temperature Protection
- 115/230 VAC 60/50 Hz Power Supply
- Operating Temperature (15 to 35)°C, (59 to 95) °F

FRONT PANEL LED DISPLAY FEATURE

- Power Amplifier Operating Temperature
- Output RF Forward and Reflected Power
- Power Amplifier DC Supply Voltage and Current
- ALC Voltage

REPEATER DESCRIPTION

The MBRP-400 is a Broadband linear amplifier used to retransmit MMDS signals without changing their frequencies. An Automatic Level Control (ALC) circuit is provided to maintain the desired output level.

The primary application for the active repeater is to extend the coverage area by redirecting or bending the MMDS signals around obstructions. Total RF output power is equal to 16 Watt (42 dBm).

The MBRP-400 has low magnitude and phase error contribution making the repeater ready for digital video transmission.

①Specification subject to change without prior notice.
01/97

260 Sauhiaux Crescent, Winnipeg, MB R3J 3T1
Telephone: (204) 949-2400 Fax: (204) 949-5455
Toll Free: 1-800-663-7900

FCC Technical data requirement for type approval.

Paragraph 2.983(d)(1) - Type of Modulation

- Emission Designator : NTSC (VSB) 6M00 C3F QAM 6M00 D7W

	QAM 16	QAM 64
BIT RATE	20.255 Mbps	30.38298 Mbps
DATA RATE	18.67 Mbps	28 Mbps
SYMBOL RATE	5.06383 Mbps	5.06383 Mbps
BASEBAND FILTER $\sqrt{\text{COS}}$	$\alpha = 0.15$	$\alpha = 0.15$

Paragraph 2.983(d)(2) - Frequency Range

- 2500 MHz to 2686 MHz

Part 2.983(d)(3) - Power Output Range

- 24 dBm to 42.2 dBm (VSB)

Part 2.983(d)(3) - Power Output Variation

- MMDS input -51 dBm to -45 dBm RF output 41.8 dBm to 42.2 dBm (VSB)

Part 2.983(d)(4) - Maximum power rating

- 42.2 dBm (VSB)

Part 2.983(d)(5) - DC voltage applied to and DC current into the several elements of the final RF amplifier

- The final amplifier stage is A4 which is having the voltage of +12 Vdc and the current of 47 Amp.

Part 2.983(d)(6) - Function of each active device

- See the theory of operation (included block diagram)

Part 2.983 (d) (7) - Complete Circuit diagrams

Schematics:

- Temperature Sensor
- MMDS Repeater Display Panel

Part 2.983 (d)(9) - Tune up procedure

- Fans set up

- Setup the thresholds for the temperature control:
- Warm up the power amplifier up to 50° C, PA temperature reading.
- Read the voltage at TP1. Should be between 0.7 to 1V.
- Connect voltmeter to TP3, turn the potentiometer R3 clockwise until

LED3 is OFF, then setup threshold voltage at (TP1 voltage + 0.06) [V]
 - connect voltmeter to TP2, turn the potentiometer R2 counterclockwise until LED2 is ON, then setup threshold voltage at (TP1 voltage - 0.04) [V]
 - connect voltmeter to TP4, turn the potentiometer R4 counterclockwise until LED4 is ON, then setup threshold voltage at (TP1 voltage - 0.07) [V]
 At the room temperature fans #1, #2, #4 are on and fan #3 is off, when temperature drops fans #2 and #4 are turned off in sequence. On the other hand, if the temperature rises fan #3 is turned on.
 The temperature measured by the temperature sensor can be read at TP1 of the display panel.
 $T = (V - 0.5) * 100$
 Where:
 T - temperature °C
 V - voltage at TP1, volts

• ALC/MLC set up

- Setup ALC level
- Switch ALC/MLC switch to MLC position
- Tuning the MLC adjustment to get minimum attenuation (0 Vdc reading)
- Set the MLC voltage for 3 dB attenuation (approximately 1.2 Vdc)
- Switch ALC/MLC switch to ALC position
- by tuning ALC potentiometer at the front of the up converter setup MLC/ALC voltage same as for the MLC position
- Check ALC reaction, by changing VHF input level ± 3 dB, the output power should vary no more than ± 0.2 dB.

Part 2.983 (d)(10) - Description of frequency determining and stabilizing circuitry and devices

Not Available since this unit is a repeater

Part 2.983 (d)(11) - Description of spurious suppression, and power limiting circuitry and devices

• Power output versus ALC voltages.

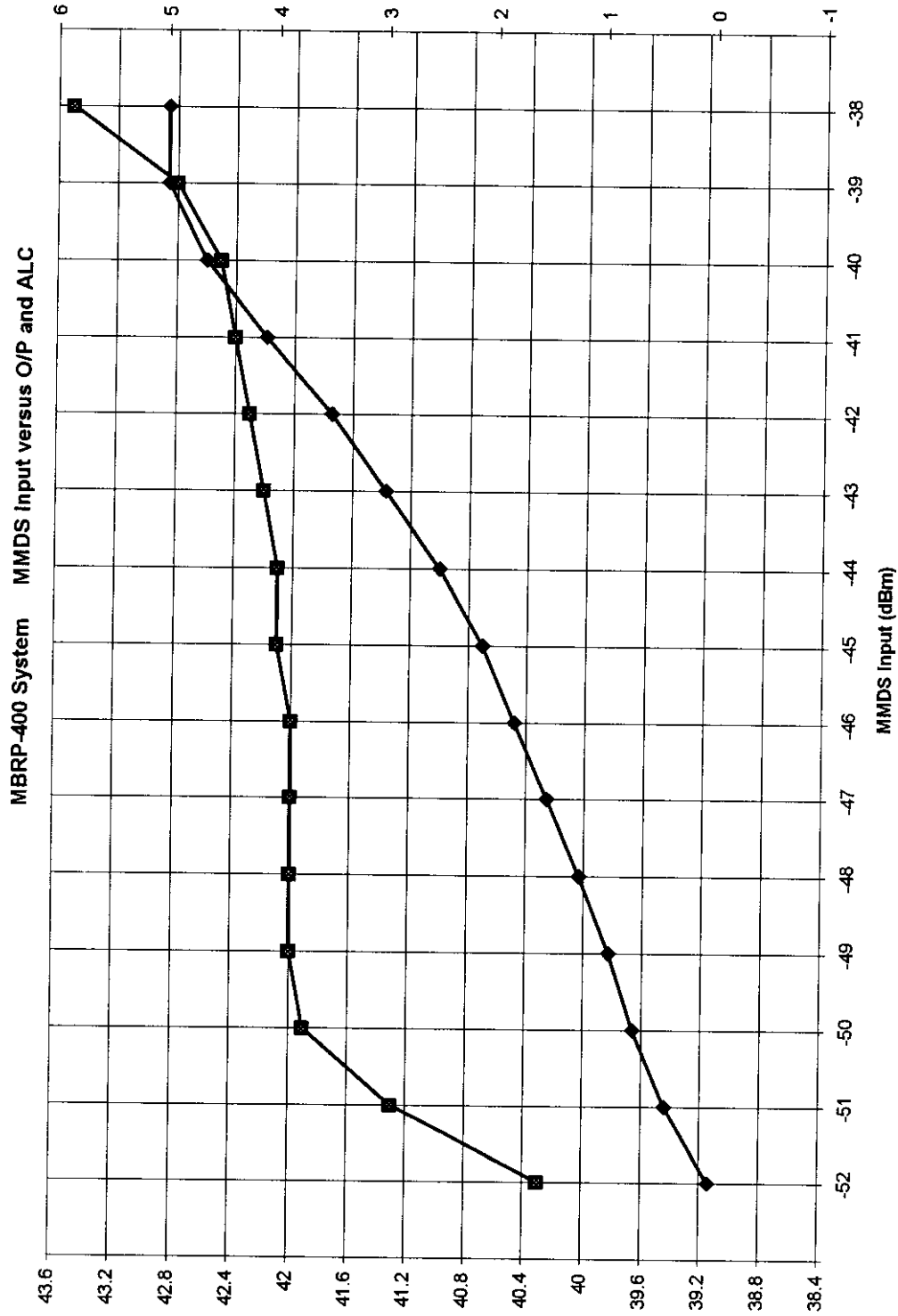
The ALC circuit will maintain the Output level within ± 0.2 dB for input level changes by ± 3 dB. See attached plot.

• Function of RF filter

Pass band: 2500 - 2686 MHz. Band Loss (flatness): 1.25 dB.
 The filter removed the out-of-band intermodulation products.
 Attached Plots.

Part 2.983 (d) (12) Description of digital modulation system including response of filters

- N/A since there is no modulation circuitry.



BAND PASS FILTER

FCC ID: D0063QAMLMBRP-400

