



Certelecom Laboratories Inc.

Safety - EMI - Telecom - ISO Guide 25

ENGINEERING TEST REPORT

**ON:
THE COMMUNICATIONS COMPONENTS INC.
"BI-DIRECTIONAL AMPLIFIER"**

FCC ID: NT3BDA8087

**IN ACCORDANCE WITH:
FCC PART 90, SUBPART I**

PROJECT NO.: 7R00506

TESTED FOR:

**COMMUNICATION COMPONENTS INC.
299 FOREST AVENUE
PARAMUS, NEW JERSEY
07652
USA**

TESTED BY:

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

FEBRUARY 1998

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This report applies only to the items tested.

EQUIPMENT: *The Communications Components Inc. "Bi-Directional Amplifier"*
FCC ID: NT3BDA8087

MODEL NO.: BDA-8087-52

SERIAL NO.: None

GENERAL:

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 90, Subpart I.

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: 16 Mar 98
Kevin Carr, Technologist

APPROVED BY: W. Waterhouse DATE: 17 April 1998
W. Waterhouse, RF Engineering Lab Manager

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"

FCC ID: NT3BDA8087

SUMMARY OF TEST DATA

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT	PAGE NO.
RF Power Output	90.205	<500W	Plot	Complies	7
Audio Frequency Response	TIA/IEA-603.3.2.6	N/A	N/A	N/A	8
Audio Low-Pass Filter Response	N/A	N/A	N/A	N/A	9
Modulation Limiting	N/A	N/A	N/A	N/A	10
Occupied Bandwidth	90.210	Input vs Output	Plot	Complies	11
Spurious Emissions at Antenna Terminals	90.210	-13dBm	Plot	Complies	19
Field Strength of Spurious Emissions	90.210	-13dBm	Plot	Complies	31
Frequency Stability	90.213	N/A	N/A	N/A	33
Transient Frequency Behaviour	90.214	N/A	N/A	N/A	N/A

FOOTNOTES FOR N/A'S:

The E.U.T. has no modulation circuitry.

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"
FCC ID: NT3BDA8087

GENERAL EQUIPMENT SPECIFICATION

TRANSMITTER

Power Input: 120 VAC, 60 Hz

Frequency Range: Uplink: 806 MHz to 821 MHz
Downlink: 851 MHz to 866 MHz

Tunable Bands: Not Applicable

Type of Modulation: F.M., IDEN

Emission Designator: F3E, D7W

Output Impedance: 50 ohm

Gain: 55 dB Nominal

RF Power Output (rated)		<u>Uplink</u>	<u>Downlink</u>
F3E	Single:	460.26 mW	380.19 mW
	Composite:	152.41mW/3 Carriers	125.89 mW/3 Carriers
D7W	Single:	249.46 mW	230.67 mW
	Composite:	82.60mW/3 Carriers	76.38mW/3 Carriers

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"
FCC ID: NT3BDA8087

GENERAL EQUIPMENT SPECIFICATION

RECEIVER

Frequency Range:

Tunable Bands:

Local LO:

1st IF:

2nd IF:

Bandwidth:

Type of modulation:

Operator Selection of
Operating Frequency:

NOT APPLICABLE

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"
FCC ID: NT3BDA8087

THEORY OF OPERATION

The BDA-830-52 is a bi-directional amplifier. The E.U.T. is designed to exchange radio communications in buildings, basements, tunnels and other shielded environments. It improves sensitivity of base stations in indoor locations where there is a significant amount of cable loss in RF distribution systems.

It contains two amplifiers providing amplification of RF signals in up-link and down-link frequency bands. They are connected to the external cables via frequency selective duplexers in order to attenuate all signals that are not in the designated bands.

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"

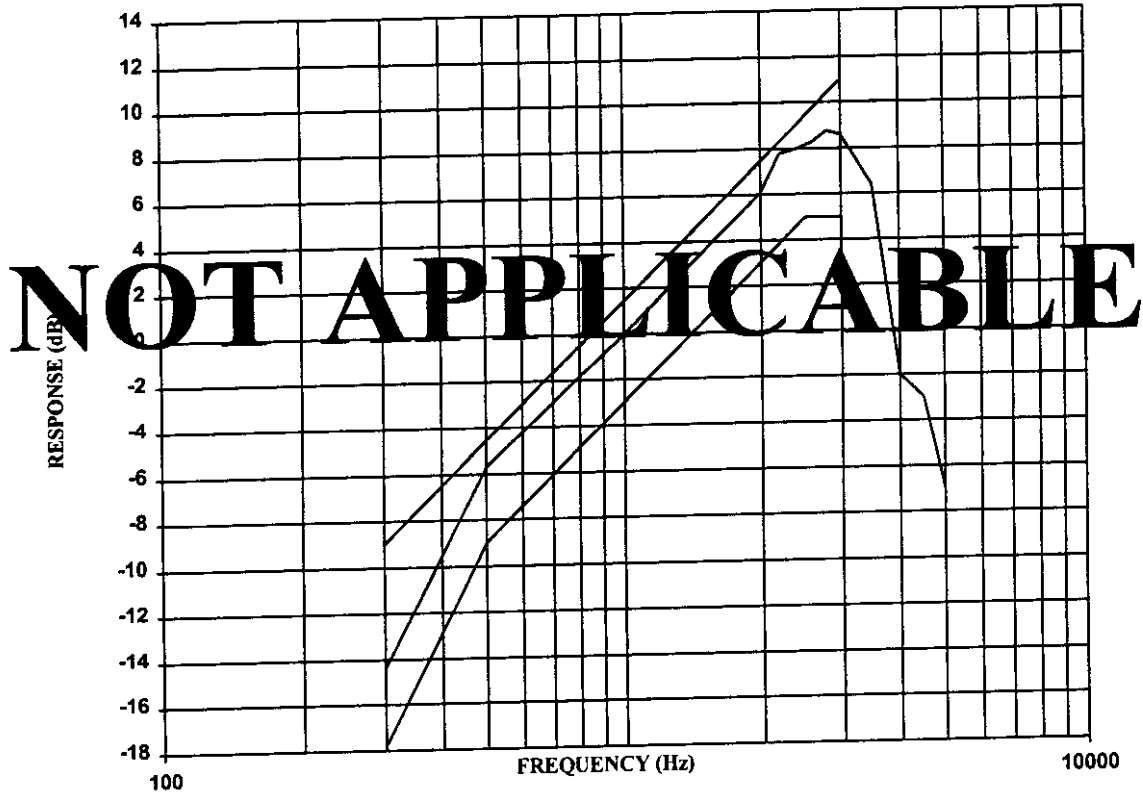
FCC ID: NT3BDA8087

NAME OF TEST: RF Power Output	PARA.NO.: 2.985
TESTED BY: Kevin Carr	DATE: February 20, 1998

Frequency (MHz)	Measured Power (dBm)	Rated Power (dBm)	Measured/Rated (dB)
Uplink	26.63	27.0	-0.37
Downlink	25.8	27.0	-1.2

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"
FCC ID: NT3BDA8087

NAME OF TEST: Audio Frequency Response PARA.NO.: 2.987(a)



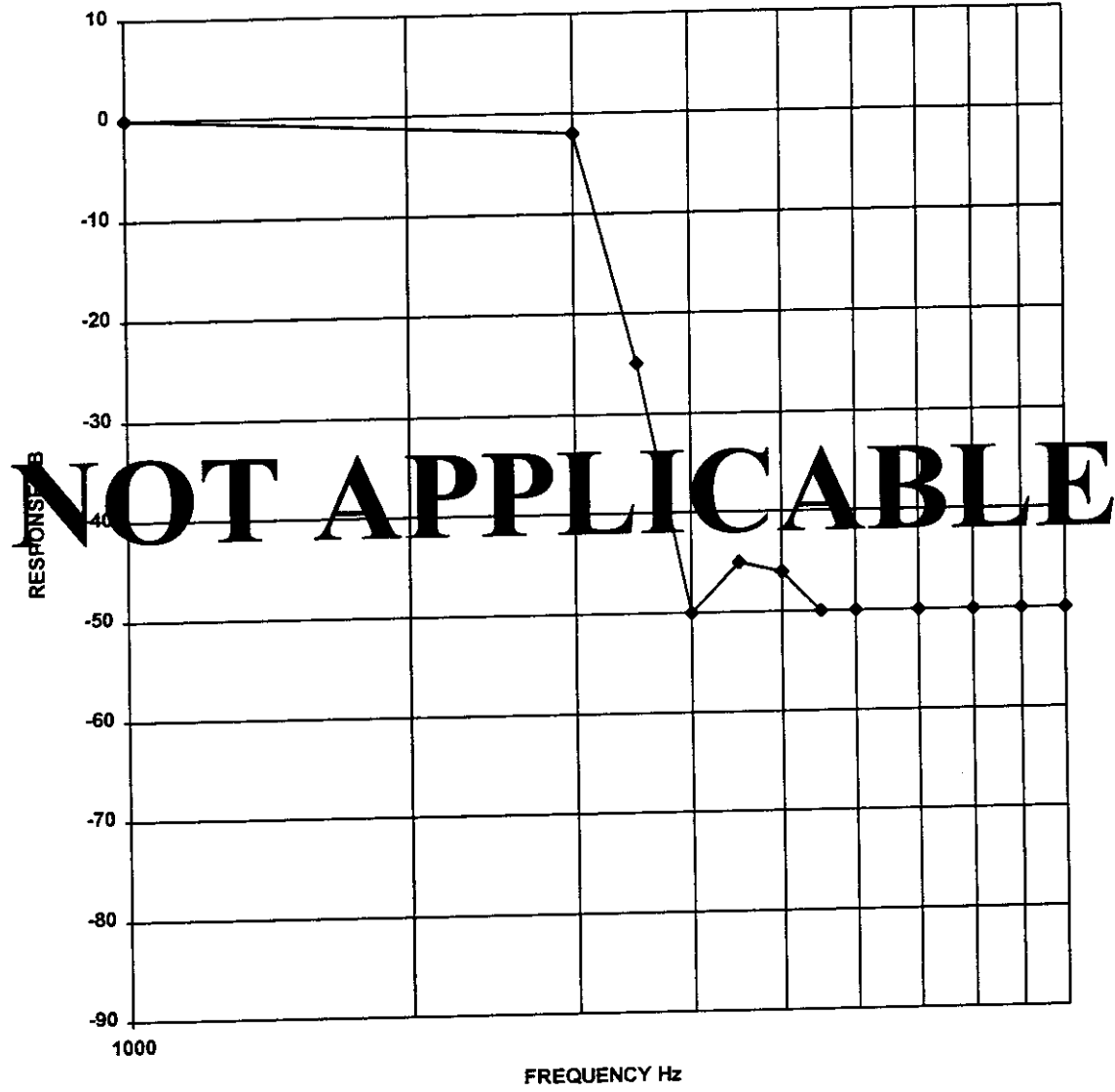
AUDIO FREQUENCY RESPONSE

Frequency	300	600	900	1.2 k	1.5 k	1.8 k	2.1k	2.3 k	2.6 k	3.0 k	3.5 k	4 k

Frequency	4.5 k	5 k	5.5 k	6 k	6.5 k	7 k	7.5 k	8 k	8.5 k	9 k	9.5 k	10 k

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"
FCC ID: NT3BDA8087

NAME OF TEST: Audio Low-Pass Filter Frequency Response PARA.NO.: 2.987(a)

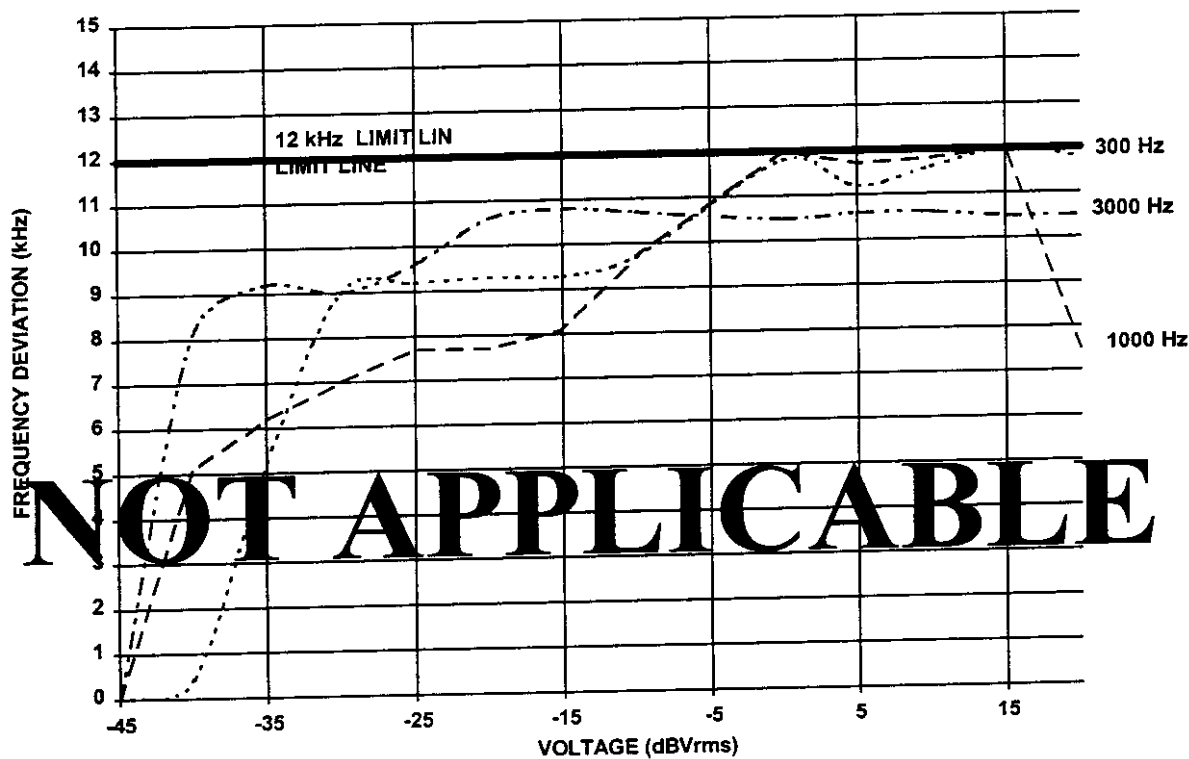


AUDIO LOW PASS FILTER RESPONSE

Frequency	1k	3k	3.5k	4k	4.5k	5k	5.5k	6k	7k	8k	9k	10k

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"
FCC ID: NT3BDA8087

NAME OF TEST: Modulation Limiting	PARA.NO.: 2.987(b)
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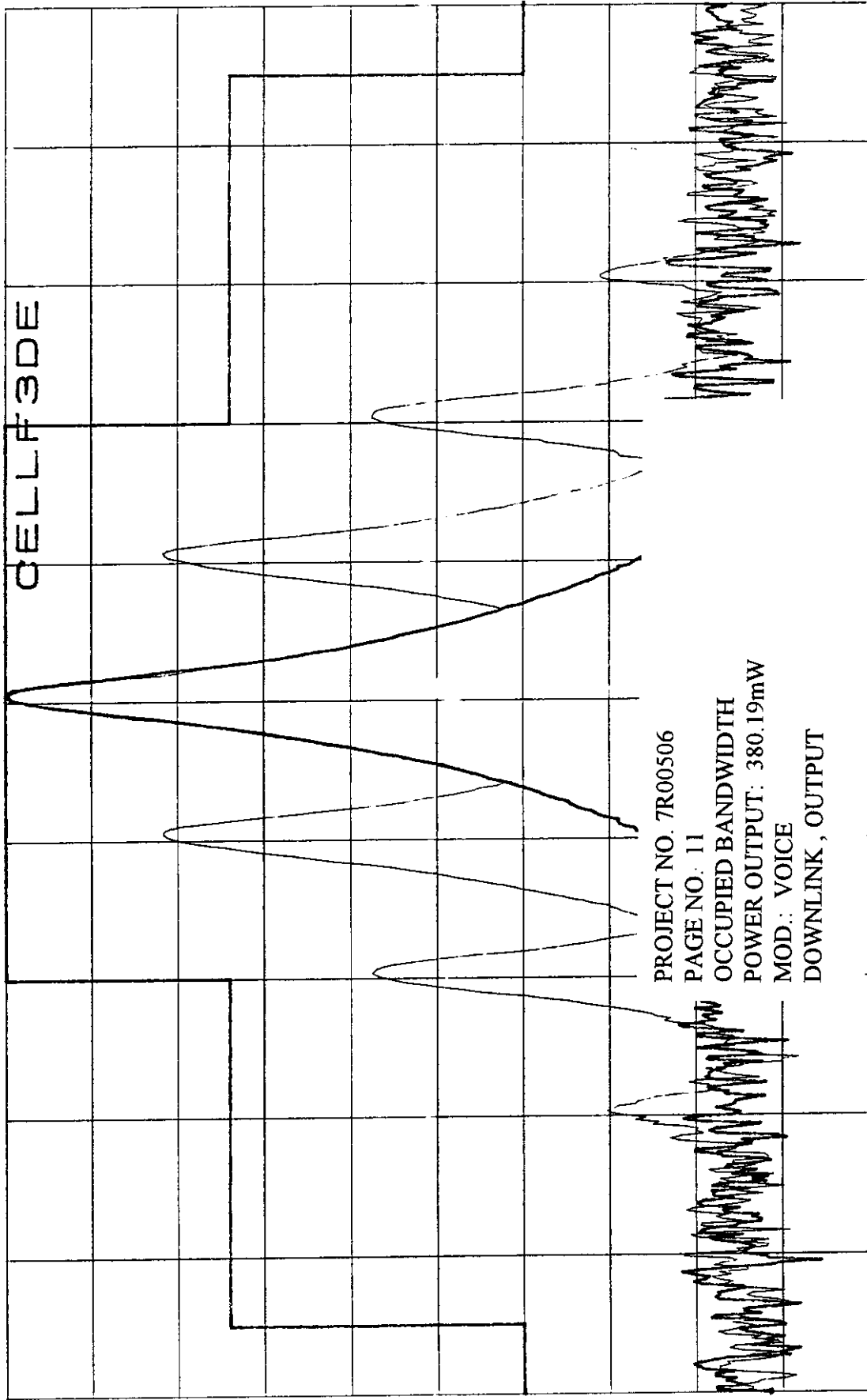


MODULATION LIMITING

Input	-45	-40	-35	-30	-25	-20	-15	-10	0	5	10	15	20
300 Hz	0	0.452	5.2	9	9.2	9.3	9.3	9.7	11.8	11.2	11.6	12	11.8
1k Hz Limit	0	5.1	6.2	7	7.7	7.7	8.1	9.7	12	11.7	11.8	12	7.5
3k Hz	0	8.1	9.2	9	9.6	10.6	10.8	10.7	10.5	10.6	10.6	10.5	10.5

*ATTEN 10dB
RL 25.8dBm

10dB/



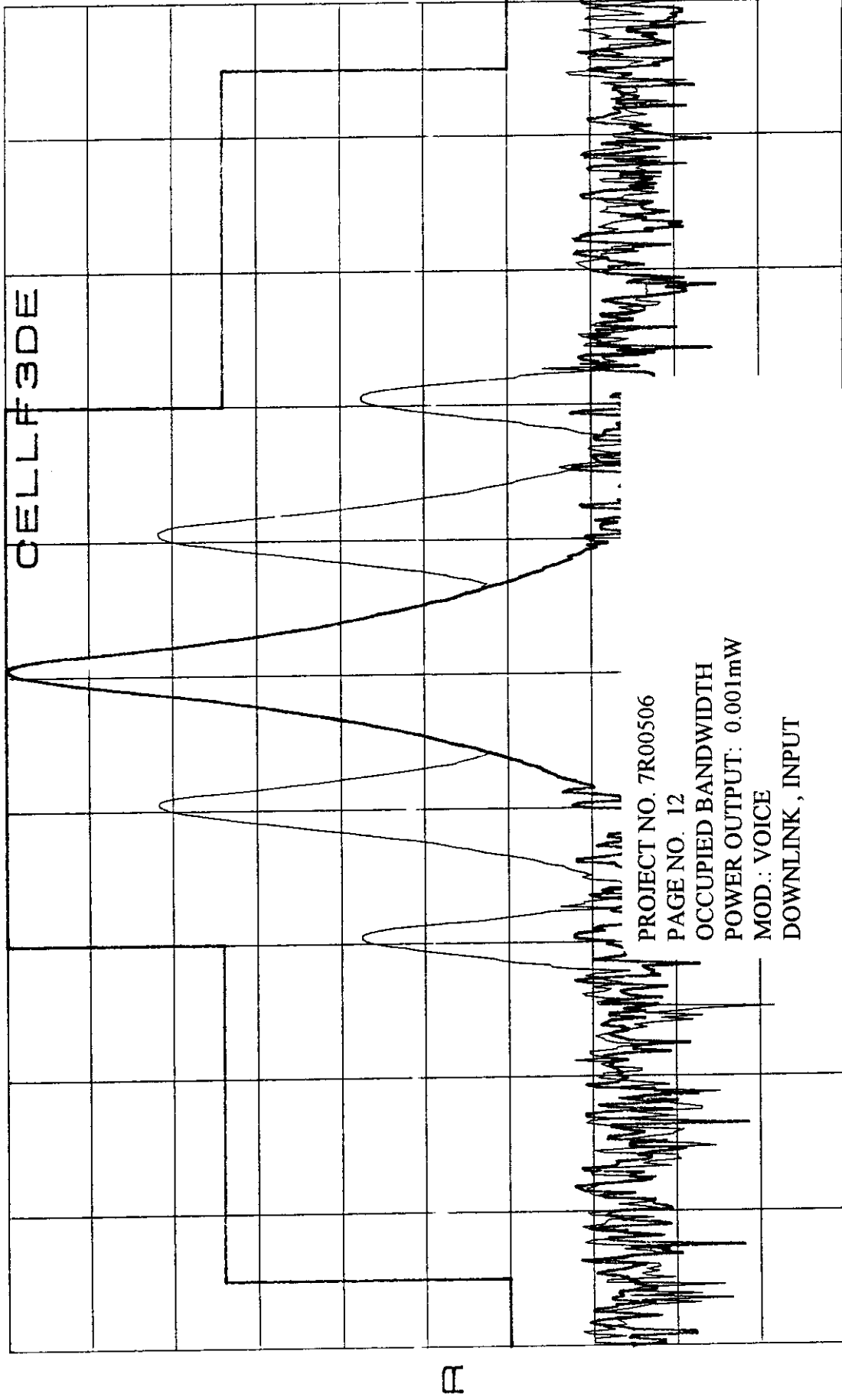
R

CENTER 859.0000MHZ SPAN 100.0KHZ
*RBW 1.0KHZ VBW 1.0KHZ SWP 250ms

*ATTEN 0dB

RL -30.2dBm

10dB/



R

PROJECT NO. 7R00506

PAGE NO. 12

OCCUPIED BANDWIDTH

POWER OUTPUT: 0.001mW

MOD.: VOICE

DOWNLINK, INPUT

CENTER 859.0000MHZ

SPAN 100.0KHZ

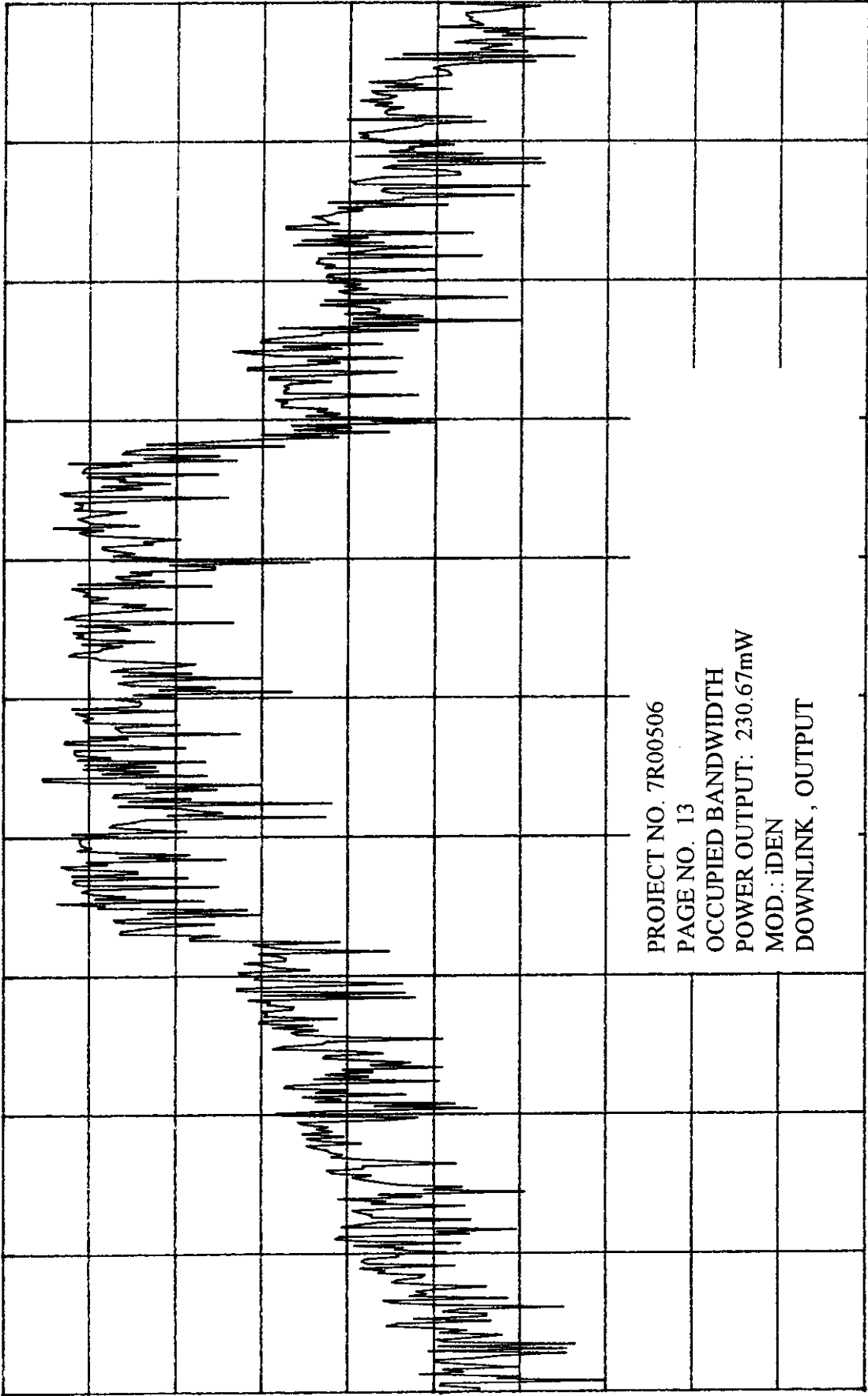
*RBW 1.0KHZ

VBW 1.0KHZ

SWP 250ms

ATTEN 10dB
RL 20.0dBm

10dB/



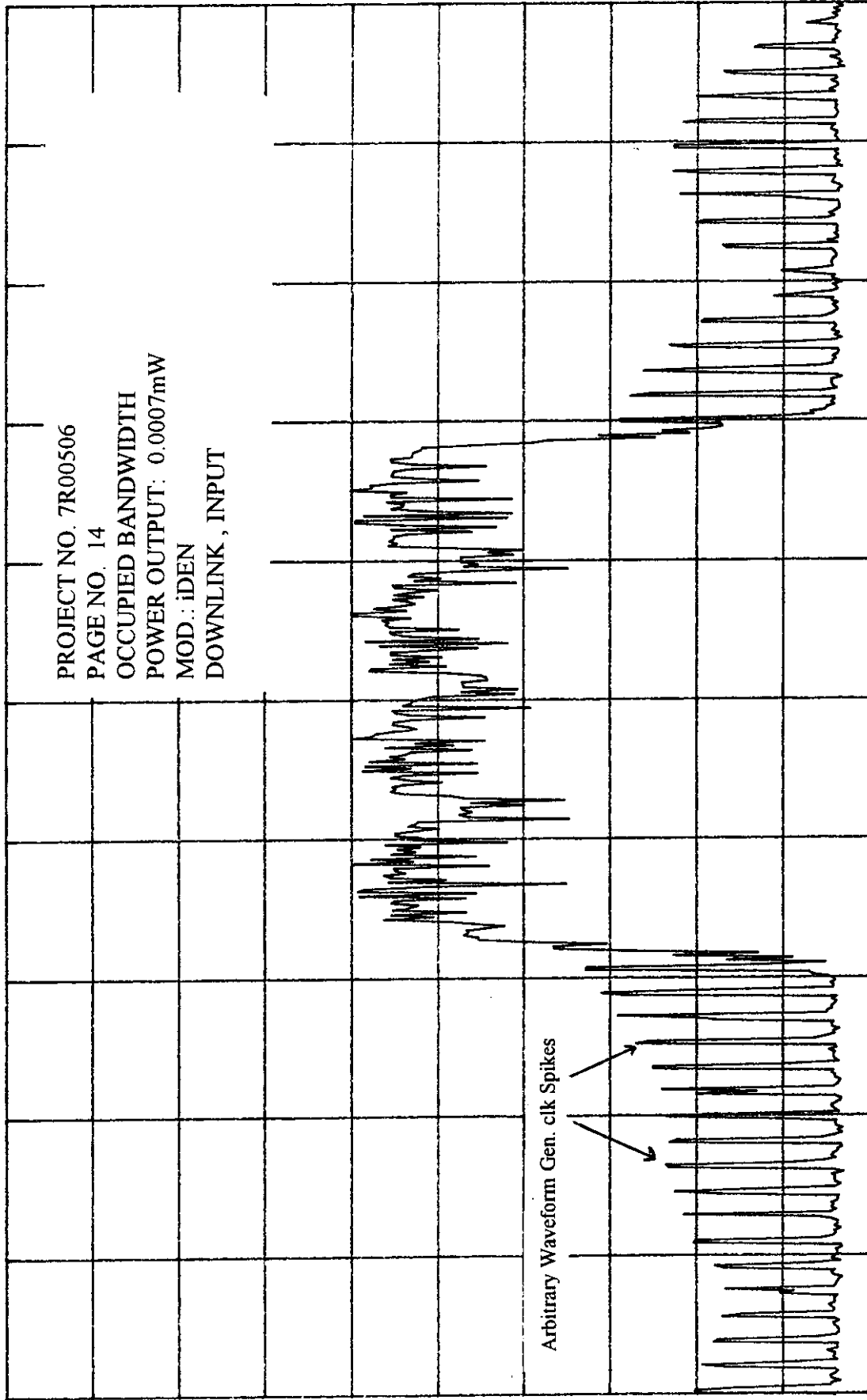
PROJECT NO. 7R00506
PAGE NO. 13
OCCUPIED BANDWIDTH
POWER OUTPUT: 230.67mW
MOD.: iDEN
DOWNLINK, OUTPUT

CENTER 859.80000MHZ SPAN 50.00KHZ
*RBW 300HZ VBW 300HZ SWP 1.40sec

*ATTEN 0dB

RL 0dBm

10dB/



R

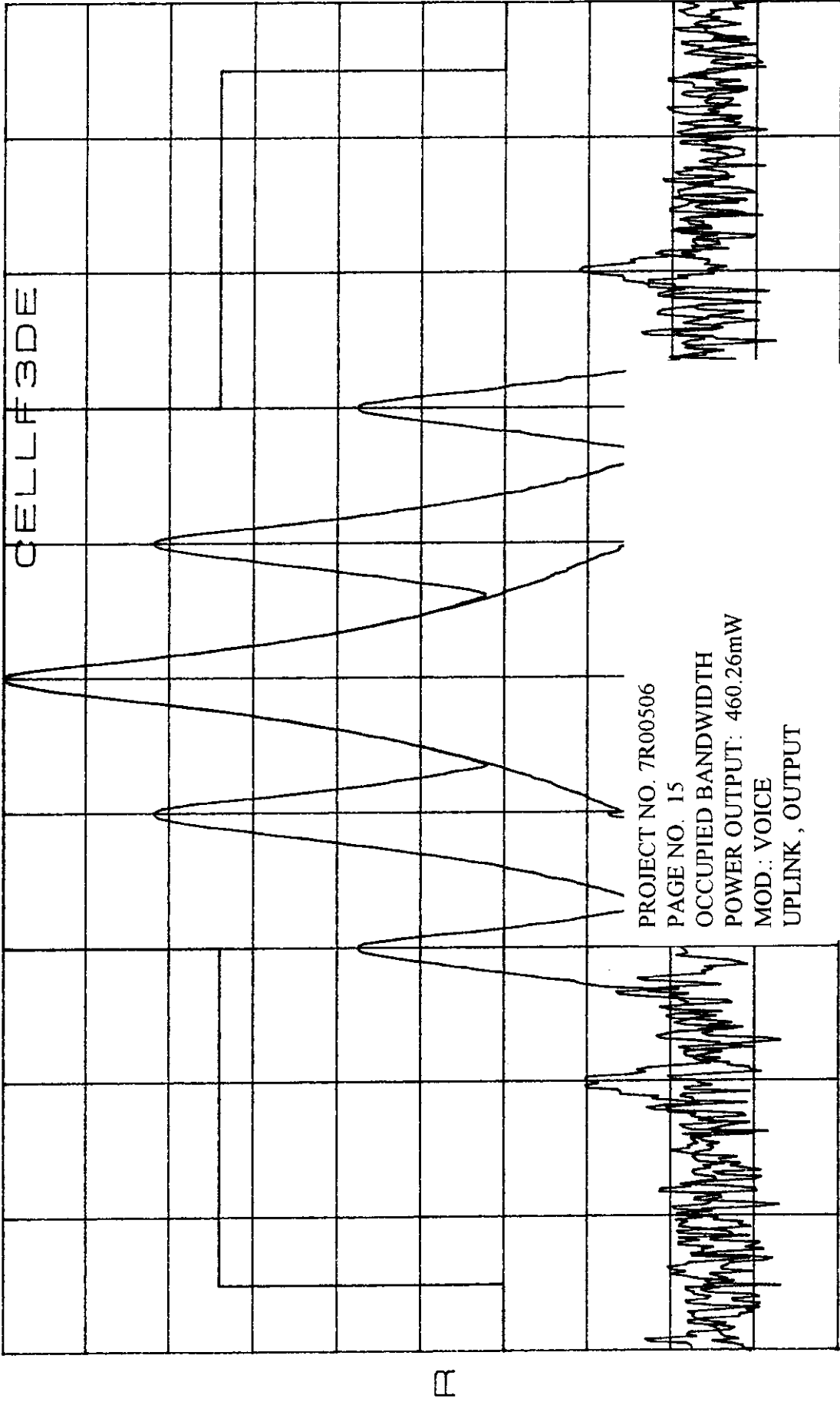
*RBW 300HZ
CENTER 859.80000MHZ
VBW 300HZ

SPAN 50.00KHZ
SWP 1.40sec

*ATTEN 10dB

RL 26.6dBm

10dB/



CENTER 814.00003MHZ

SPAN 100.0KHZ

*RBW 1.0KHZ

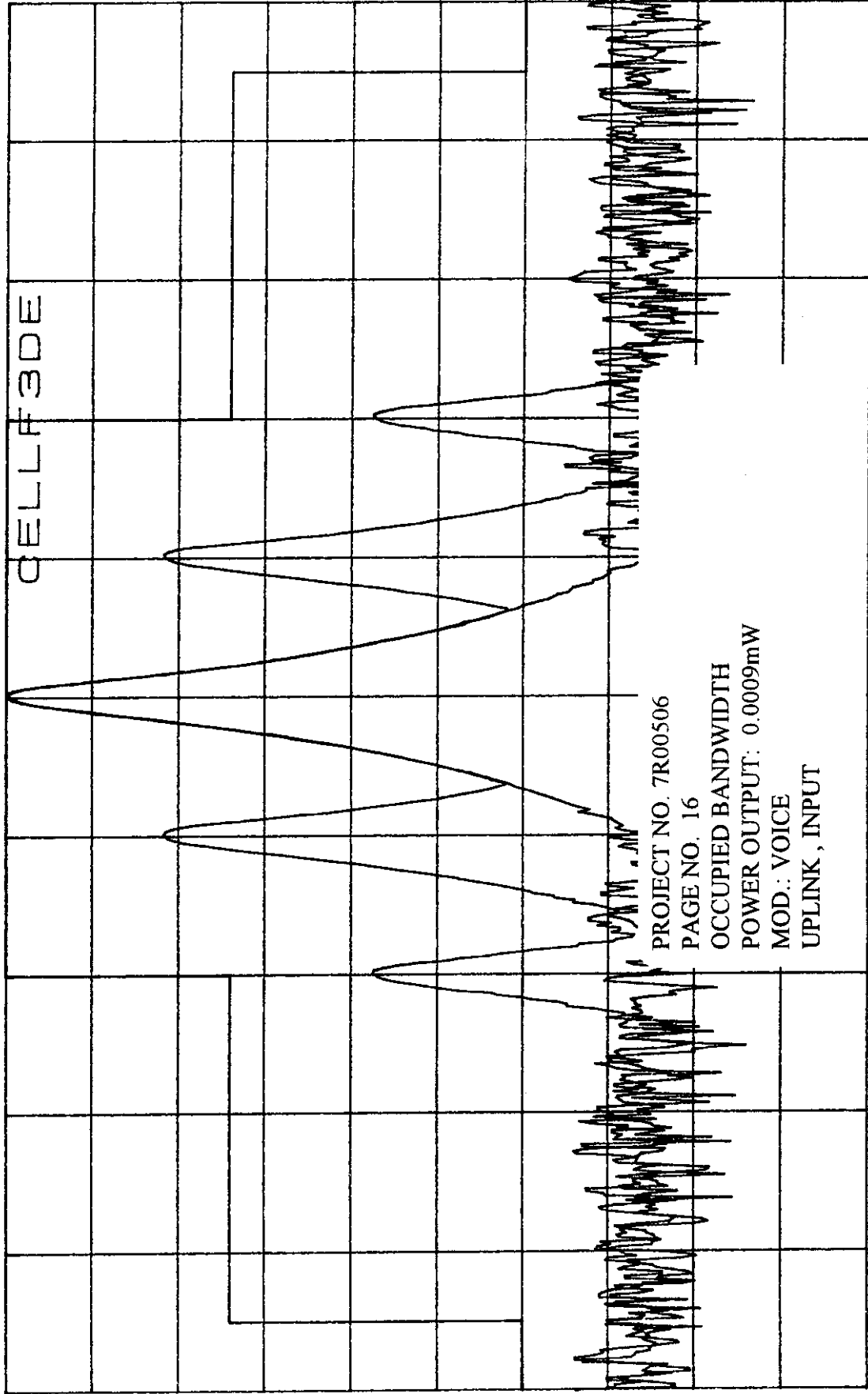
VBW 1.0KHZ

SWP 250ms

*ATTEN 0dB

RL -30.3dBm

10dB/



R

CENTER 814.0002MHz

SPAN 100.0kHz

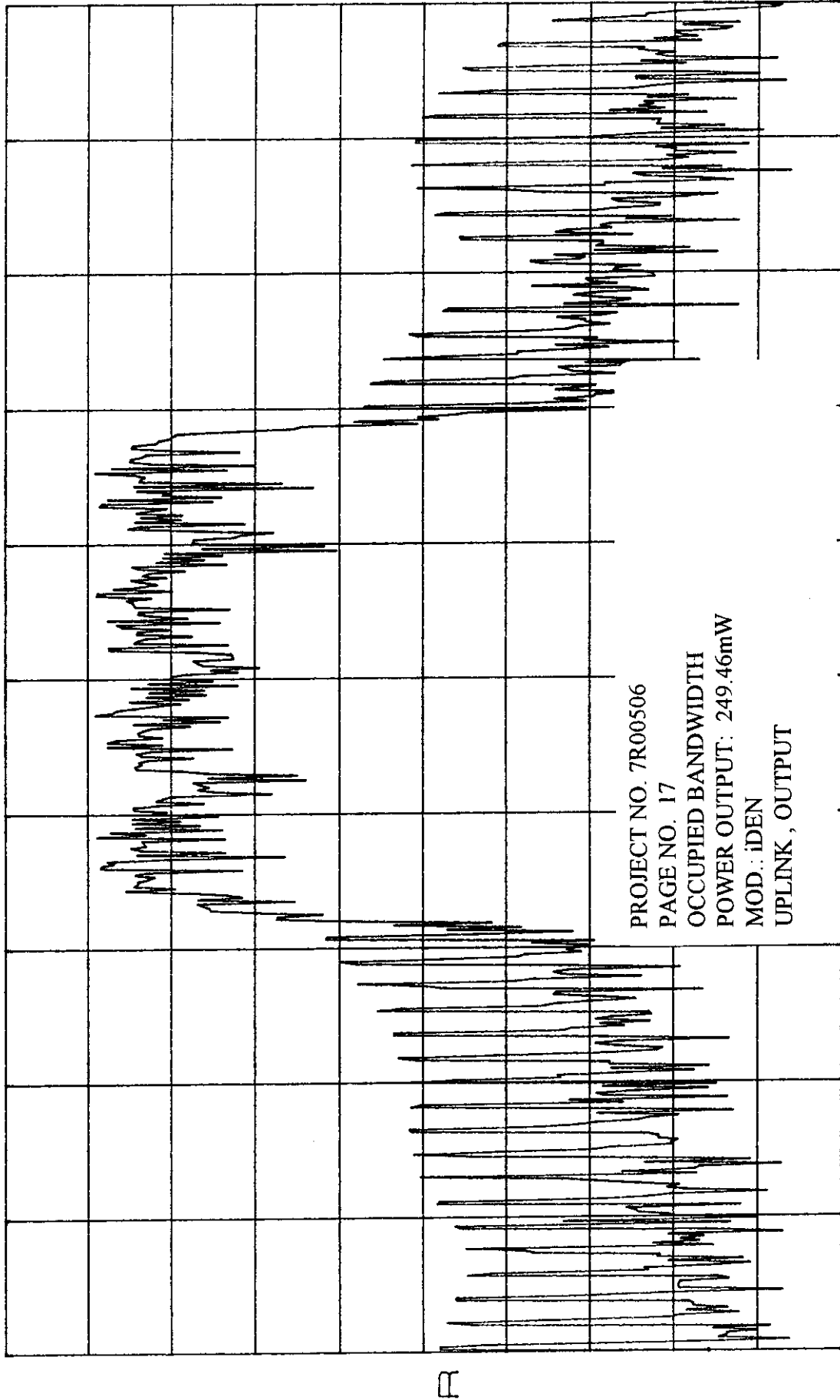
*RBW 1.0kHz

VBW 1.0kHz

SWP 250ms

ATTEN 10dB
RL 20.0dBm

10dB/



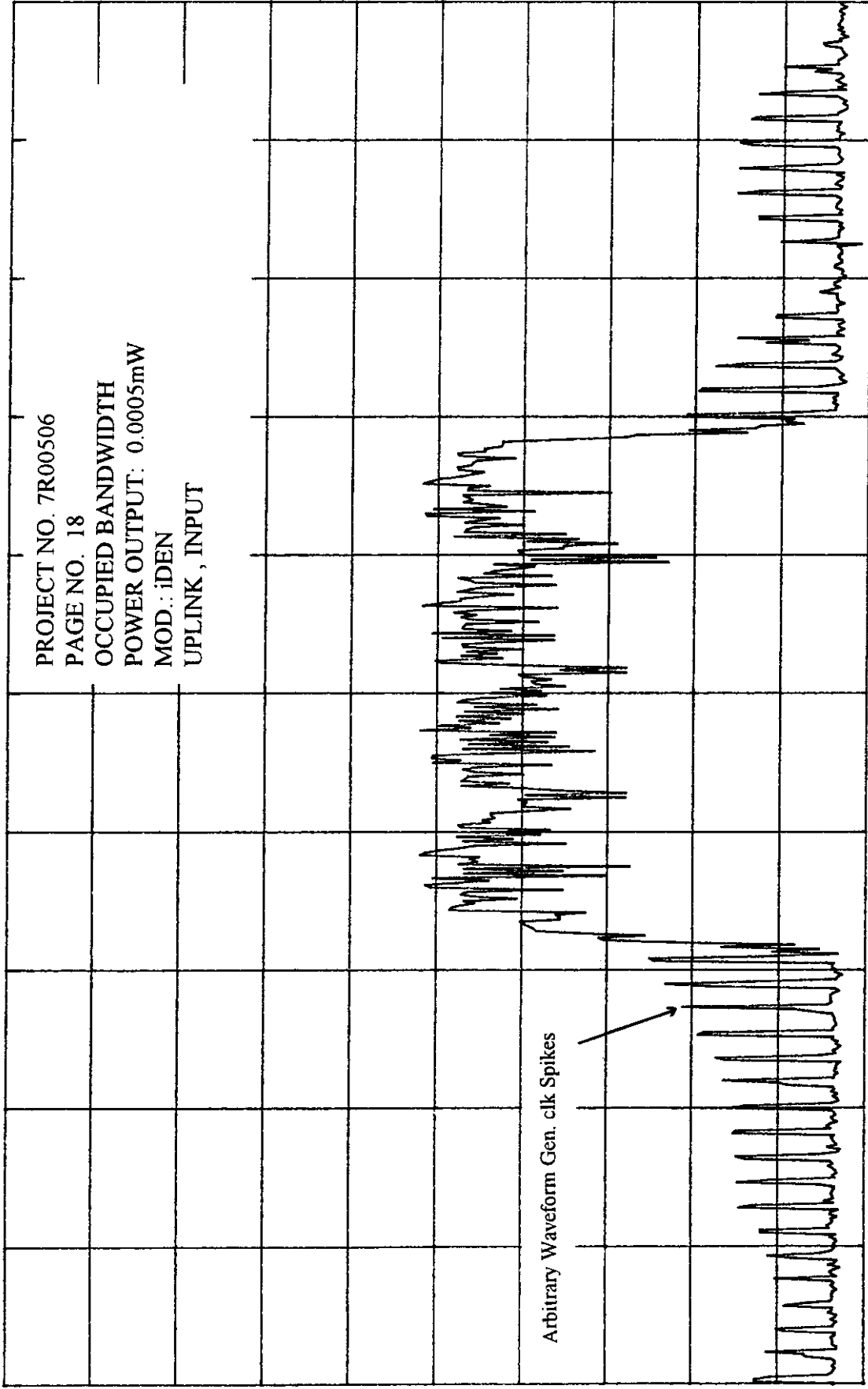
PROJECT NO. 7R00506
PAGE NO. 17
OCCUPIED BANDWIDTH
POWER OUTPUT: 249.46mW
MOD.: iDEN
UPLINK, OUTPUT

CENTER 814.00000MHZ SPAN 50.00KHZ
*RBW 300HZ VBW 300HZ SWP 1.40sec

*ATTEN 0dB

RL 0dBm

10dB/



R

CENTER 814.00000MHZ

SPAN 50.00KHZ

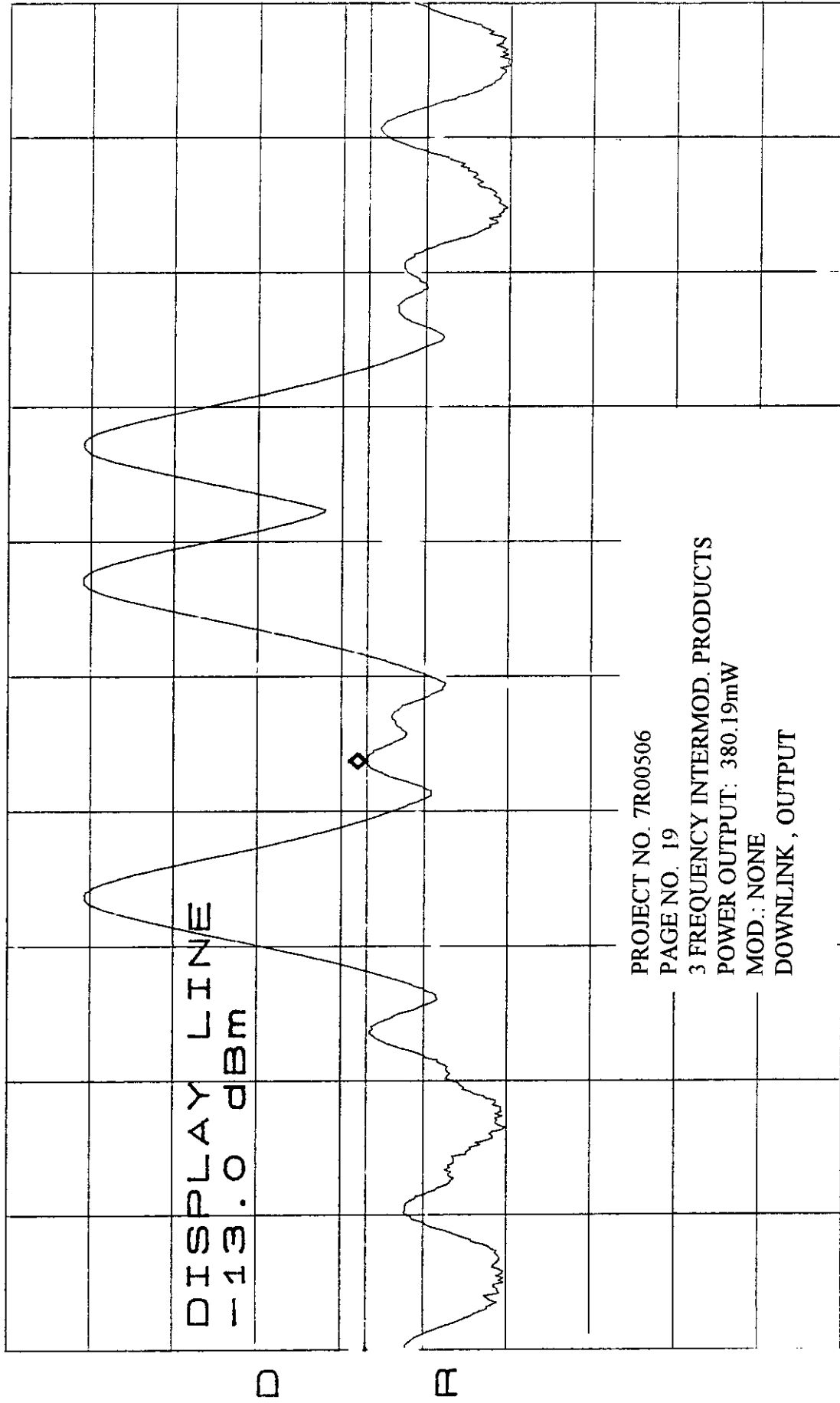
*RBW 300HZ

VBW 300HZ

SWP 1.40sec

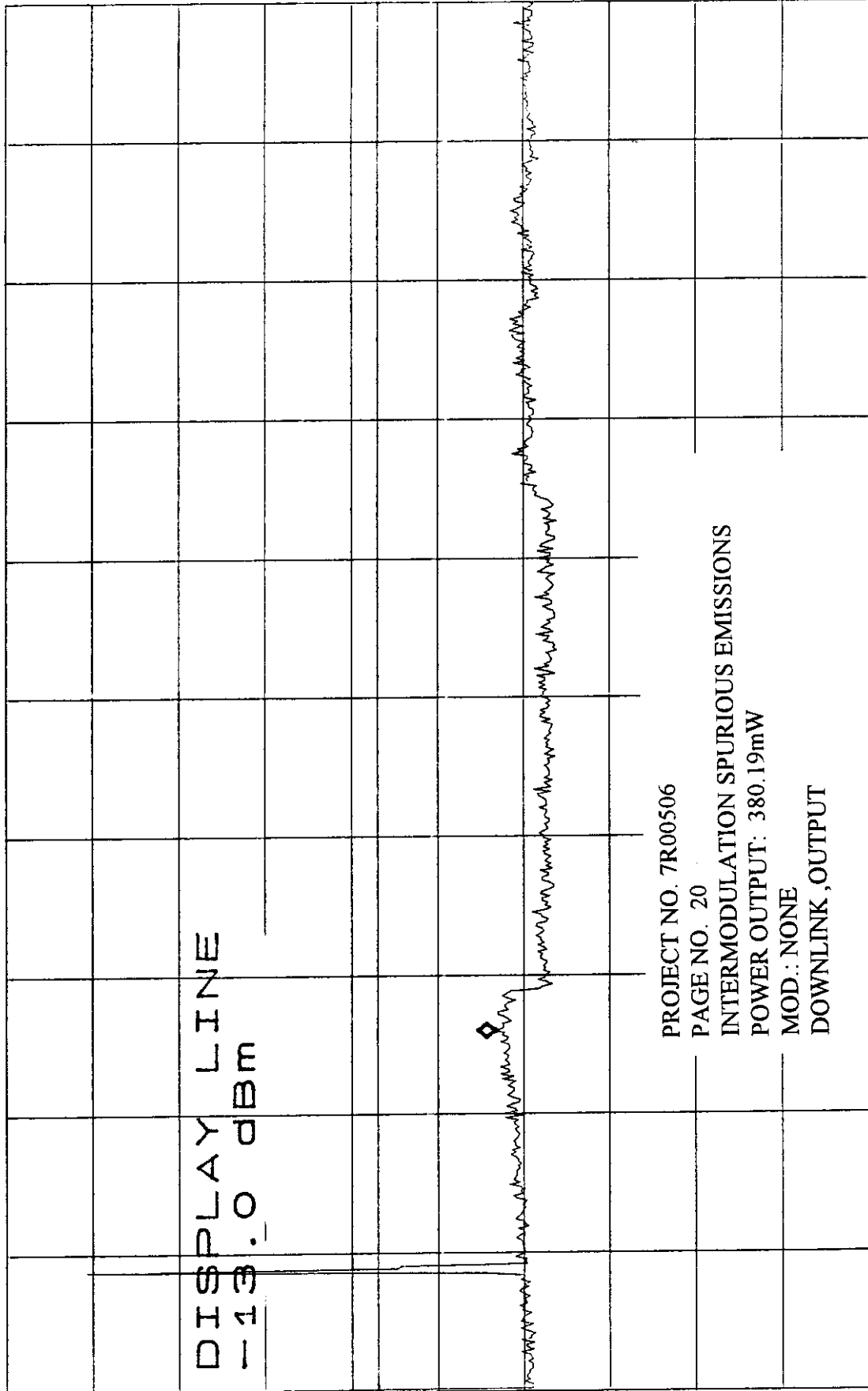
*ATTEN 10dB
RL 30.0dBm

MKR -13.00dBm
857.55MHz



START 851.00MHz STOP 866.00MHz
*RBW 300kHz VBW 300kHz SWP 50.0ms

*ATTEN 10dB
RL 30.0dBm
MKR -26.67dBm
2.60GHZ



DISPLAY LINE
-13.0 dBm

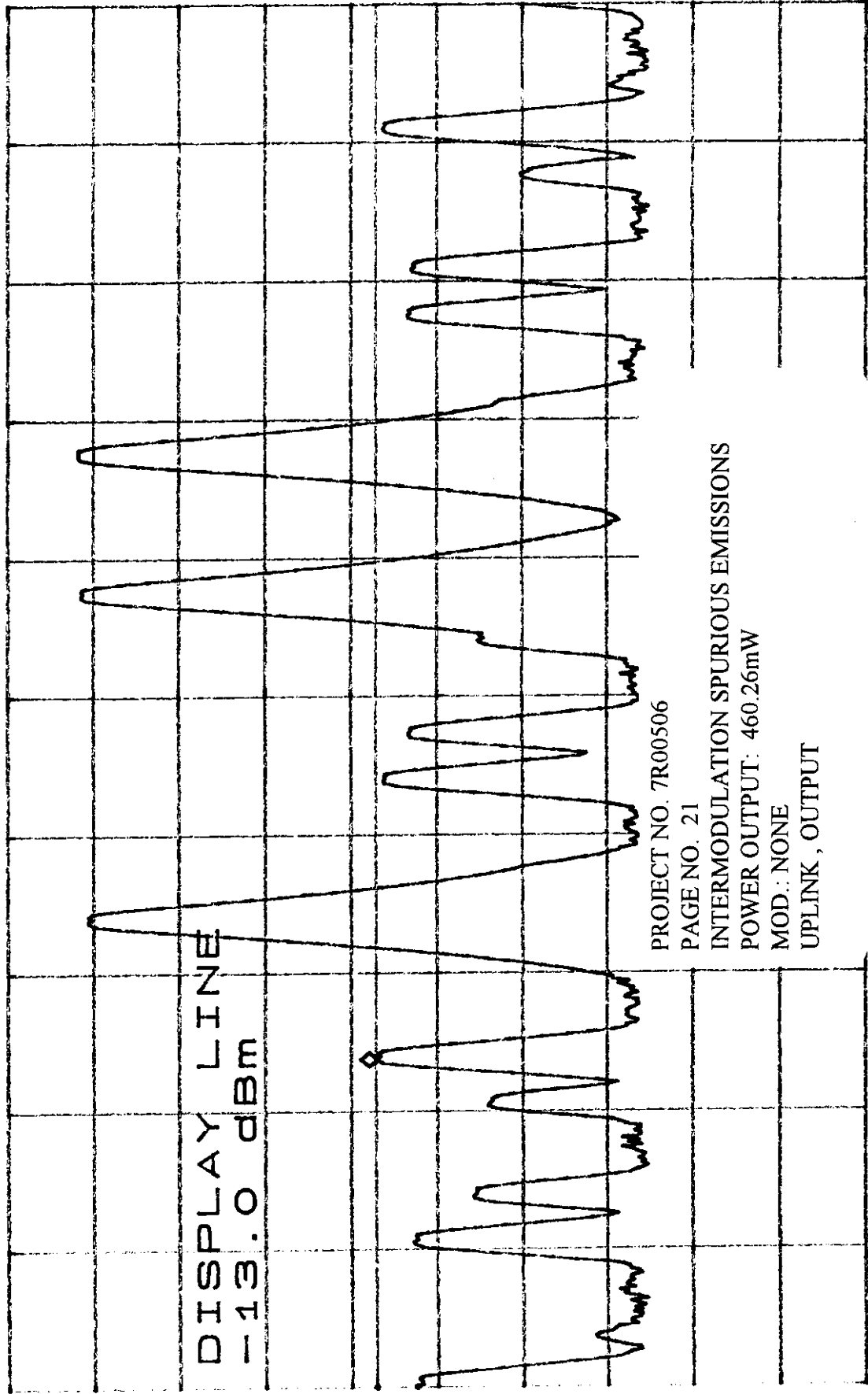
PROJECT NO. 7R00506
PAGE NO. 20
INTERMODULATION SPURIOUS EMISSIONS
POWER OUTPUT: 380.19mW
MOD.: NONE
DOWNLINK, OUTPUT

START OHZ STOP 10.00GHZ
*RBW 300KHZ VBW 300KHZ SWP 280ms

ATTEN 10dB
RL 30.0dBm

MKR -13.00dBm
809.55MHZ

10dB/



DISPLAY LINE
-13.0 dBm

PROJECT NO. 7R00506

PAGE NO. 21

INTERMODULATION SPURIOUS EMISSIONS

POWER OUTPUT: 460.26mW

MOD.: NONE

UPLINK, OUTPUT

START 806.00MHZ

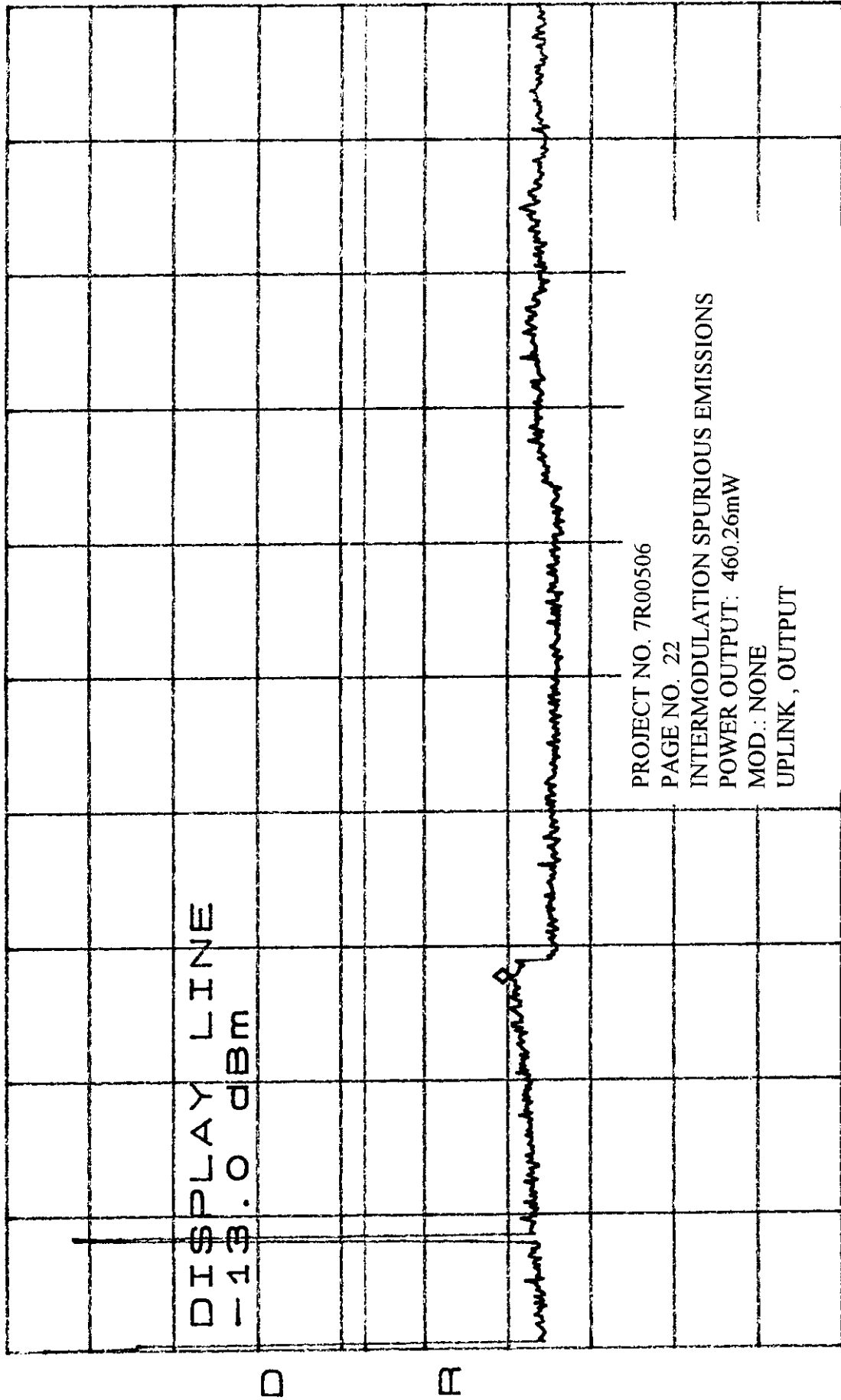
STOP 821.00MHZ

*RBW 100KHZ

VBW 100KHZ

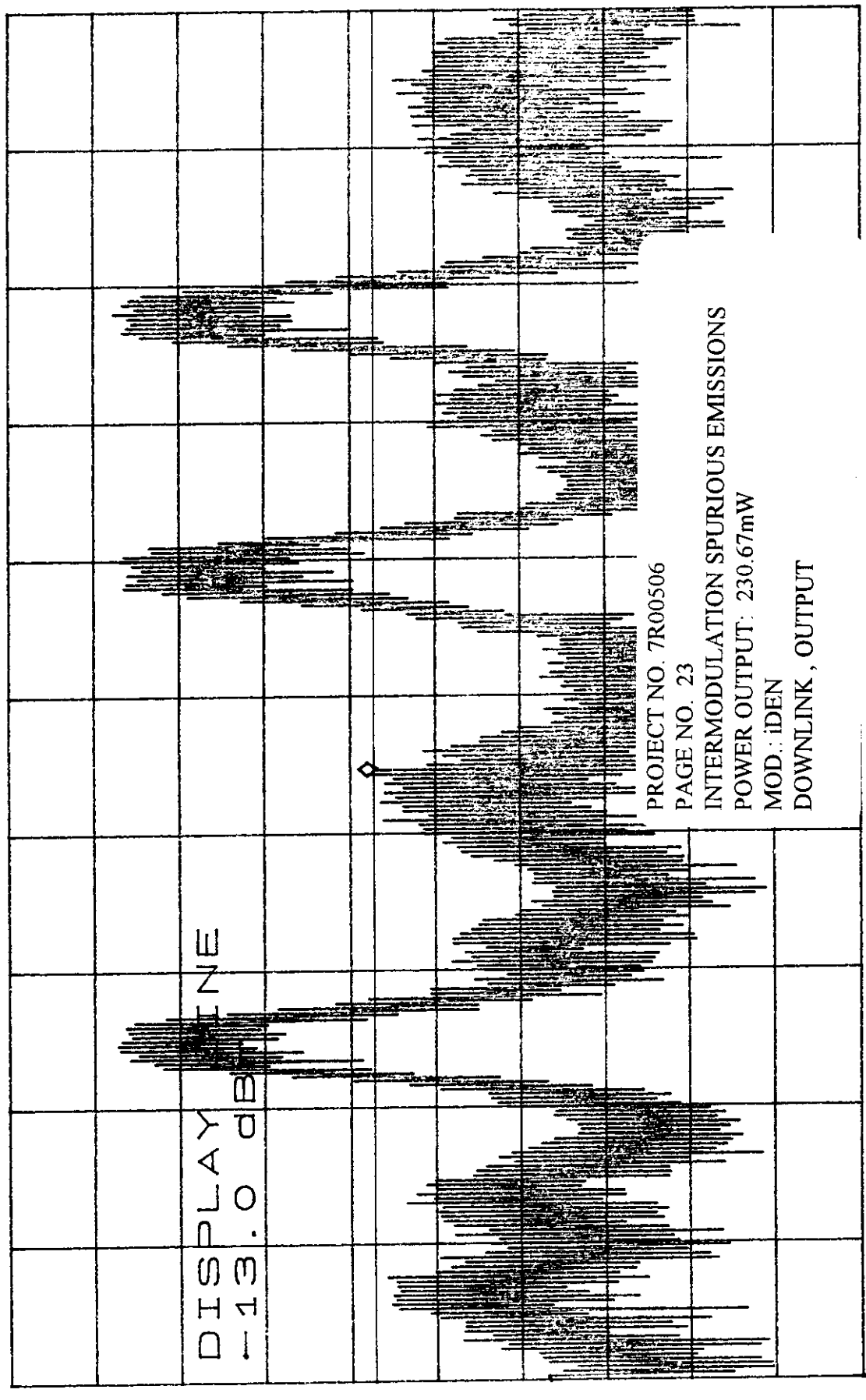
SWP 50.0ms

ATTEN 10dB MKR -30.33dBm
RL 30.0dBm 2.77GHz
10dB/



START OHZ STOP 10.00GHz
*RBW 1.0MHz VBW 1.0MHz SWP 200ms

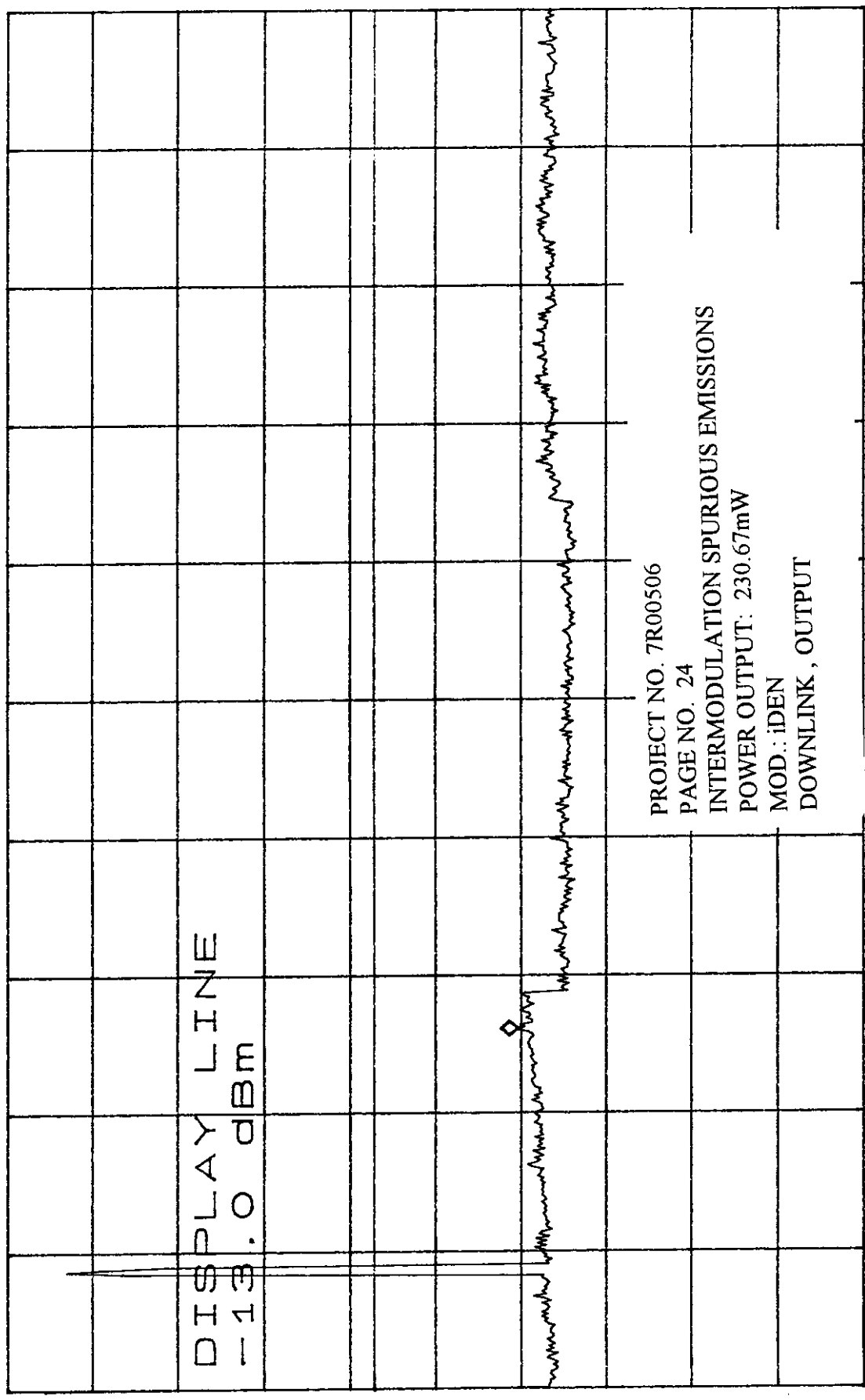
ATTEN 10dB MKR -13.00dBm
RL 30.00dBm 857.70MHz
10dB/



R

START 851.00MHz STOP 866.00MHz
*RBW 100kHz VBW 100kHz SWP 50.0ms

ATTEN 10dB MKR -29.67dBm
RL 30.0dBm 2.62GHz
10dB/



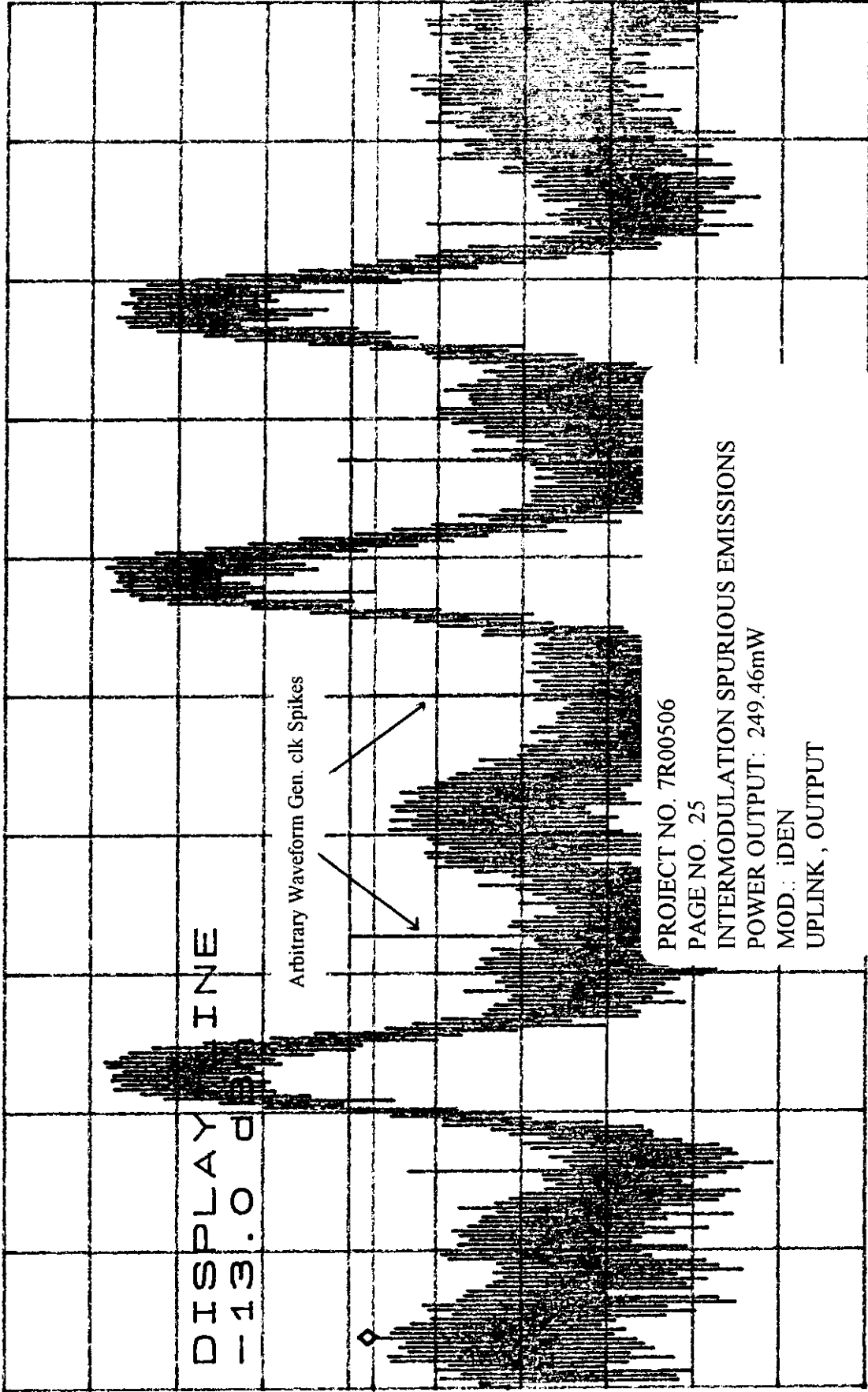
PROJECT NO. 7R00506
PAGE NO. 24
INTERMODULATION SPURIOUS EMISSIONS
POWER OUTPUT: 230.67mW
MOD.: iDEN
DOWNLINK, OUTPUT

START 0HZ STOP 10.00GHZ
*RBW 1.0MHZ VBW 1.0MHZ SWP 200ms

ATTEN 10dB
RL 30.0dBm
MKR -13.17dBm
806.55MHz

10dB/

START 806.00MHz
*RBW 100kHz



DISPLAY LINE
-13.0 dB

Arbitrary Waveform Gen. clk Spikes

PROJECT NO. 7R00506
PAGE NO. 25
INTERMODULATION SPURIOUS EMISSIONS
POWER OUTPUT: 249.46mW
MOD.: IDEN
UPLINK, OUTPUT

STOP 821.00MHz
VBW 100kHz SWP 50.0ms

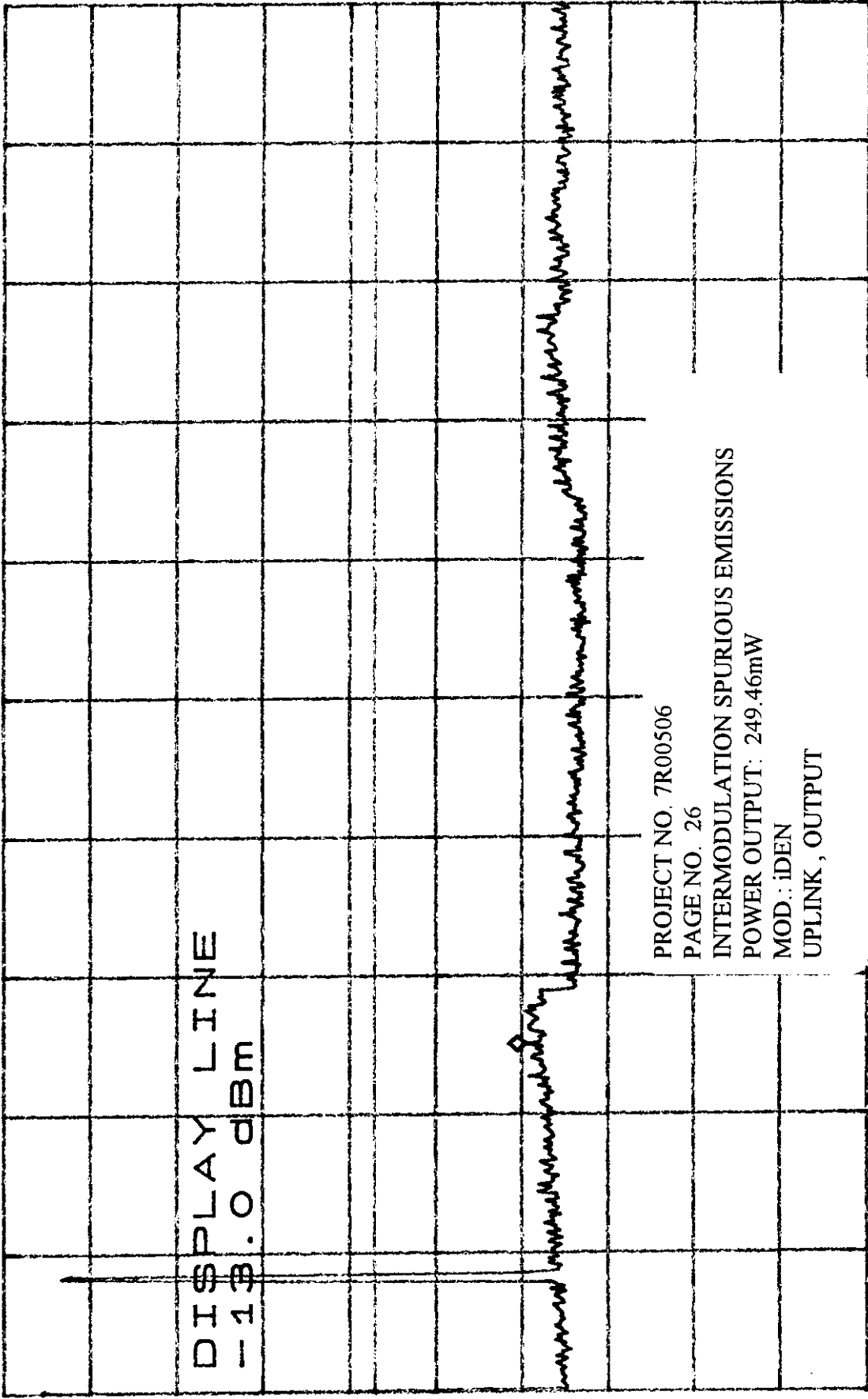
R

ATTEN 10dB

RL 30.0dBm

MKR -30.50dBm

10dB / 2.50GHZ



D

R

PROJECT NO. 7R00506

PAGE NO. 26

INTERMODULATION SPURIOUS EMISSIONS

POWER OUTPUT: 249.46mW

MOD.: iDEN

UPLINK, OUTPUT

START 0HZ

STOP 10.00GHZ

*RBW 1.0MHZ

VBW 1.0MHZ

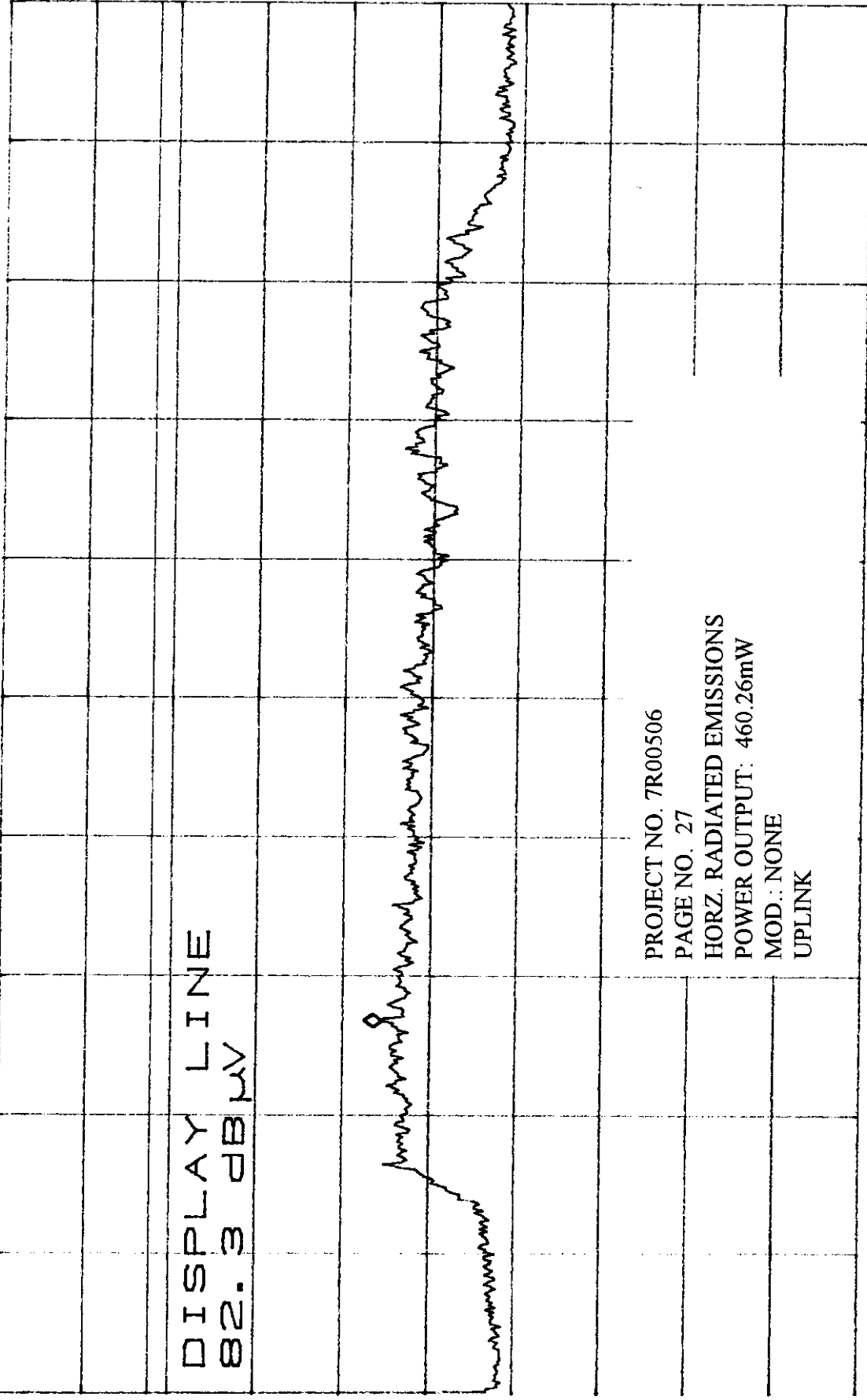
SWP 200ms

*ATTEN 0dB

MKR 55.50dBμV

RL 100.0dBμV

2.68GHz



DISPLAY LINE
82.3 dBμV

D

R

PROJECT NO. 7R00506

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HORZ. RADIATED EMISSIONS

POWER OUTPUT: 460.26mW

MOD.: NONE

UPLINK

START 0Hz

STOP 10.00GHz

*RBW 1.0MHz

VBW 1.0MHz

SWP 200ms

*ATTEN 0dB

RL 100.0dBμV

10dB/

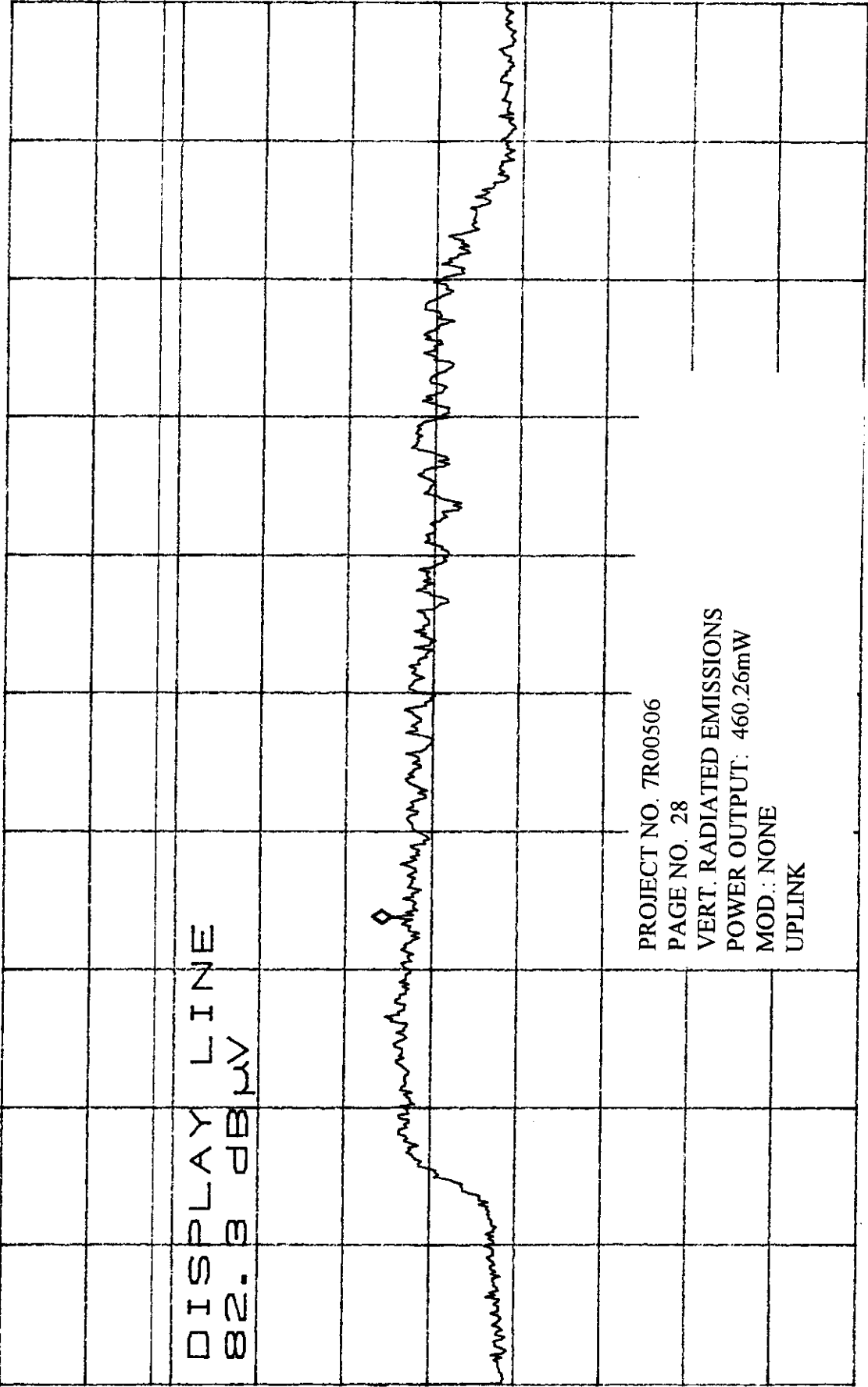
MKR 54.83dBμV

3.38GHz

DISPLAY LINE
82.3 dBμV

D

R



PROJECT NO. 7R00506

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VERT. RADIATED EMISSIONS

POWER OUTPUT: 460.26mW

MOD.: NONE

UPLINK

START 0HZ

STOP 10.00GHz

*RBW 1.0MHz

VBW 1.0MHz

SWP 200ms

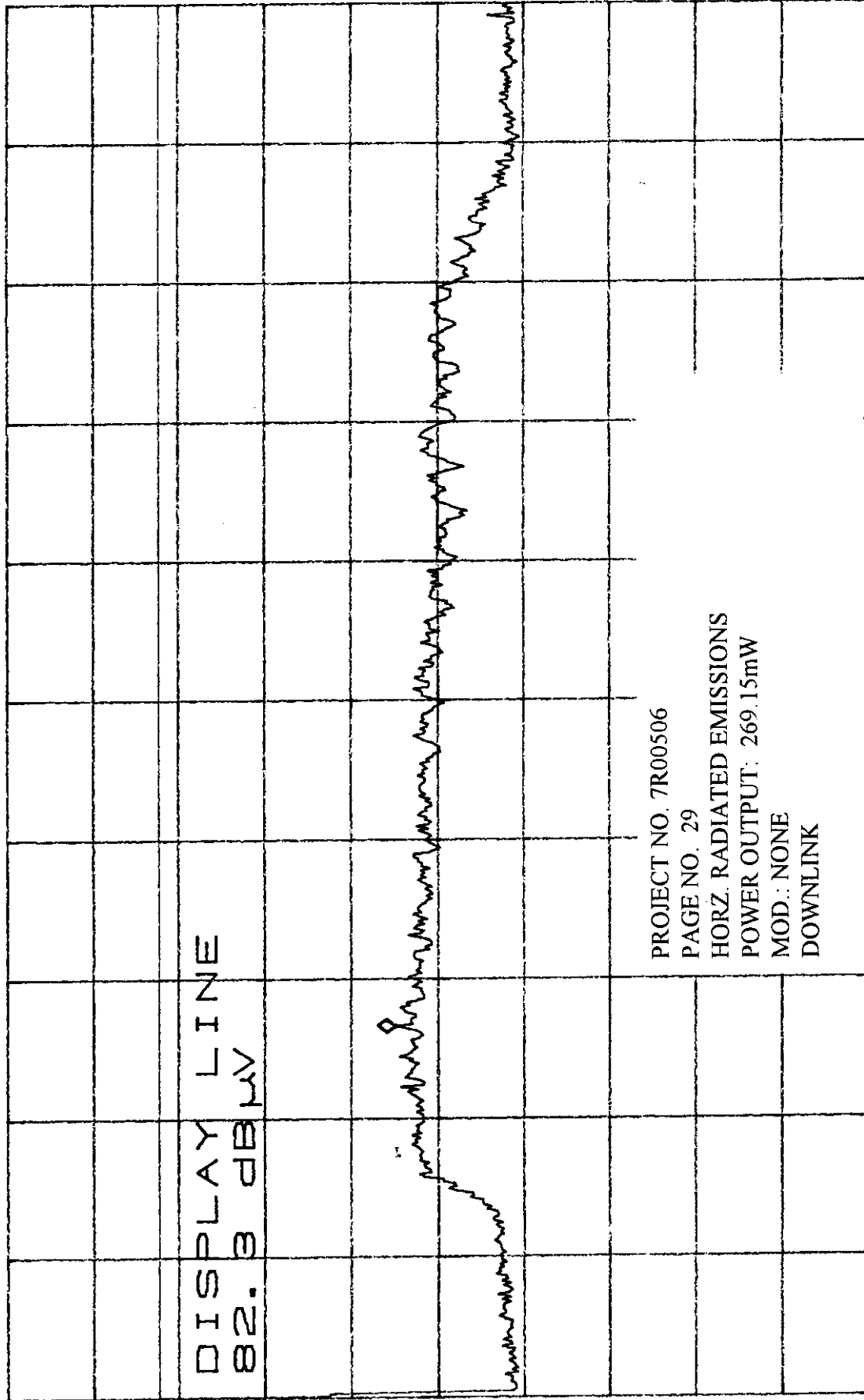
*ATTEN 0dB

MKR 55.00dBμV

RL 100.0dBμV

10dB/

2.67GHZ



DISPLAY LINE

D

R

PROJECT NO. 7R00506

PAGE NO. 29

HORZ. RADIATED EMISSIONS

POWER OUTPUT: 269.15mW

MOD.: NONE

DOWNLINK

START 0HZ

STOP 10.00GHZ

*RBW 1.0MHZ

VBW 1.0MHZ

SWP 200ms

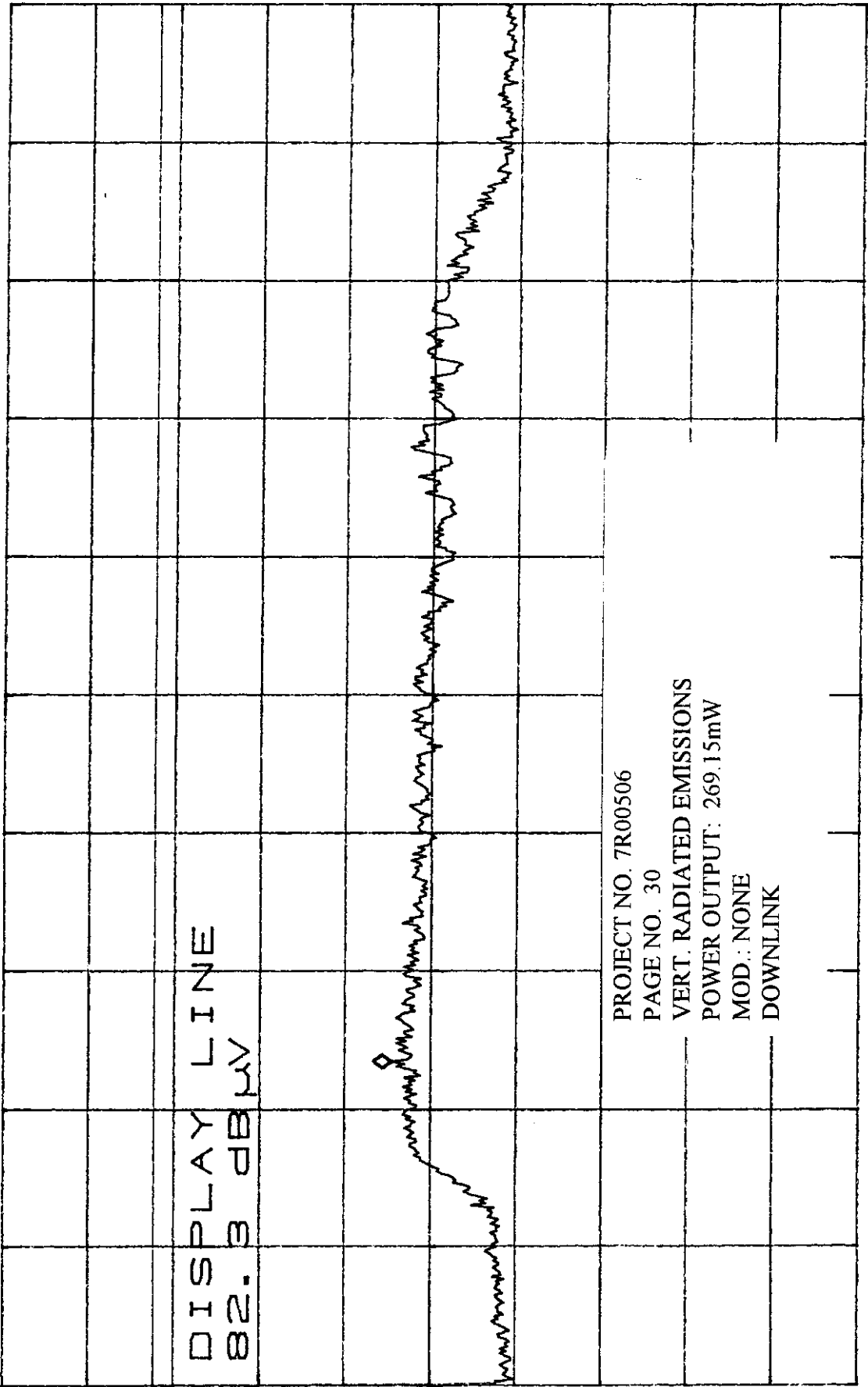
*ATTEN 0dB

MKR 54.67dBμV

RL 100.0dBμV

10dB/

2.35GHz



DISPLAY LINE
82.3 dBμV

D

R

PROJECT NO. 7R00506

PAGE NO. 30

VERT. RADIATED EMISSIONS

POWER OUTPUT: 269.15mW

MOD.: NONE

DOWNLINK

START 0HZ

STOP 10.00GHz

*RBW 1.0MHz

VBW 1.0MHz

SWP 200ms

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"

FCC ID: NT3BDA8087

Test Data - Radiated Emissions-Uplink

Test Distance (meters) : 3		Range: Shield Room		Receiver: 8565E		RBW(kHz): 1000		Detector: PEAK			
Standard: FCC Part 90, Subpart I			E.U.T. Model No.: BDA-8087-52			Date: February 23, 1998		Tested By: Kevin Carr			
Freq. (MHz)	Ant. *	Pol. (V/H)	Ant. HGT. (m)	Table (deg.)	RCVD Signal (dBμV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Dist. Corr. (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1628	Horn 2	H			N.D.	+25.0	-43.2		36.5	82.3	45.8
1628	Horn 2	V			N.D.	+25.0	-43.2		37.3	82.3	45.0
2442	Horn 2	H			N.D.	+28.7	-46.4		37.0	82.3	45.3
2442	Horn 2	V			N.D.	+28.7	-46.4		37.8	82.3	44.5
3256	Horn 2	H			N.D.	+32.0	-45.3		41.4	82.3	40.9
3256	Horn 2	V			N.D.	+32.0	-45.3		42.2	82.3	40.1
4070	Horn 2	H			N.D.	+32.2	-44.6		42.3	82.3	40.0
4070	Horn 2	V			N.D.	+32.2	-44.6		43.1	82.3	39.2
4884	Horn 2	H			N.D.	+33.9	-45.9		42.69	82.3	39.61
4884	Horn 2	V			N.D.	+33.9	-45.9		43.5	82.3	38.8
5698	Horn 2	H			N.D.	+34.8	-45.6		43.9	82.3	38.4
5698	Horn 2	V			N.D.	+34.8	-45.6		44.7	82.3	37.6
6512	Horn 2	H			N.D.	+35.3	-45.1		44.9	82.3	37.4
6512	Horn 2	V			N.D.	+35.3	-45.1		45.7	82.3	36.6
7326	Horn 2	H			N.D.	+36.8	-45.72		45.78	82.3	36.52
7326	Horn 2	V			N.D.	+36.8	-45.72		46.58	82.3	35.72
8140	Horn 2	H			N.D.	+37.5	-45.3		46.9	82.3	35.4
8140	Horn 2	V			N.D.	+37.5	-45.3		47.7	82.3	34.6

Notes: Worst case noise floor as measured on the Spectrum Analyzer with Amp in.
Circuit: Horizontal = 54.7 dBμV/m
Vertical = 55.5 dBμV/m

- * B/C = biconical, B/L biconilog, L/P = log-periodic, H = horn, D/P = dipole
- ** Includes cable loss when amplifier is not used
- *** Includes cable loss
- () Denotes failing emission level.

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"
FCC ID: NT3BDA8087

Test Data - Radiated Emissions-Downlink

Test Distance (meters) : 3		Range: Shield Room		Receiver: 8565E		RBW(kHz): 1000		Detector: PEAK			
Standard: FCC Part 90, Subpart I			E.U.T. Model No.: BDA-8087-52			Date: February 23, 1998		Tested By: Kevin Carr			
Freq. (MHz)	Ant. *	Pol. (V/H)	Ant. HGT. (m)	Table (deg.)	RCVD Signal (dBμV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Dist. Corr. (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1720	Horn 2	H			N.D.	+25.0	-45.2		34.5	82.3	47.8
1720	Horn 2	V			N.D.	+25.0	-45.2		35.3	82.3	47.0
2580	Horn 2	H			N.D.	+28.7	-46.4		37.0	82.3	45.3
2580	Horn 2	V			N.D.	+28.7	-46.4		37.8	82.3	44.5
3440	Horn 2	H			N.D.	+32.0	-45.1		41.6	82.3	40.7
3440	Horn 2	V			N.D.	+32.0	-45.1		42.4	82.3	39.9
4300	Horn 2	H			N.D.	+32.2	-45.3		41.6	82.3	40.7
4300	Horn 2	V			N.D.	+32.2	-45.3		42.4	82.3	39.9
5160	Horn 2	H			N.D.	+33.9	-46.1		42.5	82.3	39.8
5160	Horn 2	V			N.D.	+33.9	-46.1		45.3	82.3	37.0
6020	Horn 2	H			N.D.	+35.3	-44.7		45.3	82.3	37.0
020	Horn 2	V			N.D.	+35.3	-44.7		46.1	82.3	36.2
6880	Horn 2	H			N.D.	+36.1	-46.3		44.5	82.3	37.8
6880	Horn 2	V			N.D.	+36.1	-46.3		45.3	82.3	37.0
7740	Horn 2	H			N.D.	+36.8	-45.5		46.0	82.3	36.3
7740	Horn 2	V			N.D.	+36.8	-45.5		46.8	82.3	35.5
8600	Horn 2	H			N.D.	+38.3	-45.3		47.7	82.3	34.6
8600	Horn 2	V			N.D.	+38.3	-45.3		48.5	82.3	33.8

Notes: Worst case noise floor as measured on the Spectrum Analyzer with Amp in.
Circuit: Horizontal = 54.7 dBμV/m
Vertical = 55.5 dBμV/m

- * B/C = biconical, B/L biconilog, L/P = log-periodic, H = horn, D/P = dipole
- ** Includes cable loss when amplifier is not used
- *** Includes cable loss
- () Denotes failing emission level.

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"
FCC ID: NT3BDA8087

NAME OF TEST: Frequency Stability	PARA.NO.: 2.995
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MEASUREMENT DATA:

Standard test frequency: _____ MHz

Standard test voltage: _____ Vdc

TIME (MIN)	Frequency (MHz)			
	-30°C	-20°C	-10°C	0°C
0				
0.5				
1.0				
1.5				
2.0				
2.5				
3.0				

TIME (MIN)	Frequency (MHz)			
	+10°C	+20°C	+40°C	+50°C
0				
0.5				
1.0				
1.5				
2.0				
2.5				
3.0				

NOT APPLICABLE

FREQUENCY VERSUS SUPPLY VOLTAGE

TIME (MIN)	Frequency (MHz)		
	-10% Vdc	Vdc	+10% Vdc
0			
0.5			
1.0			
1.5			
2.0			
2.5			
3.0			

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"
FCC ID: NT3BDA8087

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	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	
2 Year	Horn Antenna	EMCO #2	3115	4336	Oct. 30/97	Oct. 30/99	
1 Year	50 ohm Combiner Pad	Mini Circuits	ZFC-3-4	922603	Dec. 5/97	Dec. 5/98	
1 Year	Low Noise Amplifier	Avantek	AWT-8035	1005	Oct. 24/97	Oct. 24/98	
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	
3 Year	Signal Generator	Rhode & Schwarz	SME03	DE14439	June 20/96	June 20/96	
3 Year	Signal Generator	Rhode & Schwarz	SME03	DE14510	June 20/96	June 20/96	

NA: Not Applicable
NCR: No Cal Required

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"
FCC ID: NT3BDA8087

ANNEX A

TEST METHODOLOGIES

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"
FCC ID: NT3BDA8087

NAME OF TEST:	RF Power Output	PARA.NO.: 2.985
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TEST CONDITIONS: Standard Temperature & Humidity: +20°C, 30%
Standard Test Voltage: 13.8 VDC
Unmodulated

MINIMUM STANDARD: Para. No. 90.205(d). The maximum allowable station effective radiated power (ERP) is dependent upon the stations HAAT and required service area and will be authorized in accordance with Table I of 90.205(d).

NAME OF TEST:	Audio Frequency Response	PARA.NO.: 2.987(a)
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TEST CONDITIONS: Standard Temperature & Humidity: +20°C, 30%
Standard Test Voltage: 13.8 VDC
Modulated

MINIMUM STANDARD TIA/E1A-603, Para. No. 3.2.6 from 300 Hz to 3000 Hz. The transmitter audio frequency response shall have a nominal 6 dB per octave pre-emphasis characteristic.

NAME OF TEST:	Audio Low-Pass Filter Frequency Response	PARA.NO.: 2.987(a)
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TEST CONDITIONS: Standard Temperature & Humidity: +20°C, 30%
Standard Test Voltage: 13.8 VDC

MINIMUM STANDARD: N/A

NAME OF TEST:	Modulation Limiting	PARA.NO.: 2.987(b)
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TEST CONDITIONS: Standard Temperature & Humidity: ±20°C, 30%
Standard Test Voltage: 13.8 VDC

TEST EQUIPMENT: As per block diagram and equipment list attached.

MINIMUM STANDARD: N/A

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"
 FCC ID: NT3BDA8087

NAME OF TEST: Occupied Bandwidth	PARA.NO.: 2.989
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TEST CONDITIONS: Standard Temperature & Humidity: +20°C, 30%
 Standard Test Voltage: 13.8 VDC

MINIMUM STANDARD: Para. No. 90.210, see table 1 below for applicable mask.

Frequency Band (MHz)	Mask for equipment with Low Pass Filter	Mask for equipment without Low Pass Filter
Below 25	A or B	A or C
25 - 50	B	C
72 - 76	B	C
150 - 174	B, D or E	C, D or E
150 Paging only	B	C
220 - 222	F	F
421 - 512	B, D or E	C, D or E
450 paging only	B	H
806 - 821/ 851 - 866	B	G
821 - 824/ 866 - 869	B	H
896 - 901/ 935 - 940	I	J
902 - 928	K	K
929 - 930	B	G
Above 940	B	C
All other bands	B	C

Table 1

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

TEST CONDITIONS: Standard Temperature & Humidity: +20°C, 30%
 Standard Test Voltage: 13.8 VDC
 Modulated: 2500 Hz @ 16 dB overdrive

MINIMUM STANDARD: Para. No. 90.210, see table 1 above for applicable mask.

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"
 FCC ID: NT3BDA8087

NAME OF TEST: Field Strength of Spurious Radiation	PARA.NO.: 2.993
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TEST CONDITIONS: Outdoor Range: +14°C, 30%
 Standard Test Voltage: 13.8 VDC

MINIMUM STANDARD: Para. No. 90.210 see table 1 for applicable mask.

CALCULATION OF FIELD STRENGTH LIMIT

An example of attenuation requirement of $50 + 10 \text{ Log } P$ is equivalent to -20 dBm (1×10^{-5} Watts) at the antenna terminal. We determine the field strength limit by using the plane wave relation.

$$GP/4\pi R^2 = E^2/120\pi$$

For emissions ≤ 1 GHz:

$G = 1.64$ (Dipole Gain)

$P = 10^{-5}$ Watts (Maximum spurious output power)

$R = 3\text{m}$ (Measurement Distance)

$$E = \frac{\sqrt{30GP}}{R} = E = \frac{\sqrt{30 \times 1.64 \times 10^{-5}}}{3} = 0.00739 \text{ V/m} = 77.4 \text{ dB}_{\mu\text{V}}/\text{m}$$

For emissions > 1 GHz:

$G = 1$ (Isotropic Gain)

$P = 1 \times 10^{-5}$ Watts (Maximum spurious output power)

$R = 3\text{m}$ (Measurement Distance)

$$E = 77.4 - 20\text{Log}\sqrt{1.64} = 75.3\text{dB}_{\mu\text{V}}/\text{m}@3\text{m}$$

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"
 FCC ID: NT3BDA8087

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

MINIMUM STANDARD: Para. No. 90.213. The transmitter carrier frequency shall remain within the assigned frequency below in ppm.

Frequency Band (MHz)	Fixed and base stations	Mobile Stations	
		> 2 Watts o/p pwr	< 2 Watts o/p pwr
Below 25	100	100	200
25 - 50	20	20	50
72 - 76	5	-	50
150 - 174	5	5	5
220 - 222	0.1	1.5	1.5
421 - 512	2.5	5	5
806 - 821	1.5	2.5	2.5
821 - 824	1.0	1.5	15
851 - 866	1.5	2.5	2.5
866 - 869	1.0	1.5	1.5
869 - 901	0.1	1.5	1.5
902 - 928	2.5	2.5	2.5
929 - 930	1.5	-	-
935 - 940	0.1	1.5	1.5
1427 - 1435	300	300	300
above 2450	-	-	-

Table 2

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"
 FCC ID: NT3BDA8087

NAME OF TEST: Transient Frequency Behaviour	PARA.NO.: 90.214
--	-------------------------

TEST CONDITIONS: Standard Temperature & Humidity: +20°C, 30%
 Standard Test Voltage: 13.8 VDC

MINIMUM STANDARD:

Transient Frequency Behaviour for Equipment Designed to Operate on 25 kHz Channels

Time intervals ^{1,2}	Maximum Frequency difference ³ (kHz)	Frequency ranges (MHz) All equipment					
		Base station and portable radios			Mobile Radios		
		150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)	150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)
t ₁ ⁴	± 25	5.0	10.0	20.0	5.0	10.0	5.0
t ₂	± 12	20.0	25.0	50.0	20.0	25.0	20.0
t ₃ ⁴	± 25	5.0	10.0	10.0	5.0	10.0	5.0

Transient Frequency Behaviour for Equipment Designed to Operate on 12.5 kHz & 6.25 kHz Channels

Time intervals ^{1,2}	Maximum Frequency difference ³ (kHz)	Frequency ranges (MHz) All equipment		
		150 - 174 (ms)	450 - 500 (ms)	500 - 512 (ms)
t ₁ ⁴	± 12.5 / ± 6.25	5.0	10.0	20.0
t ₂	± 6.25 / ± 3.125	20.0	25.0	50.0
t ₃ ⁴	± 12.5 / ± 6.25	5.0	10.0	10.0

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"

FCC ID: NT3BDA8087

ANNEX B

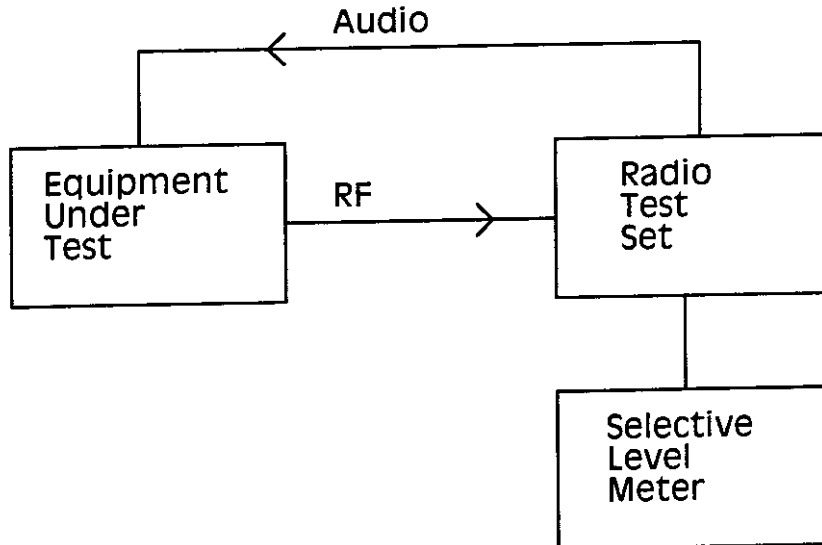
TEST METHODOLOGIES

EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"
FCC ID: NT3BDA8087

PARA. NO. 2.985 RF POWER OUTPUT



PARA. NO. 2.987(a) AUDIO FREQUENCY RESPONSE

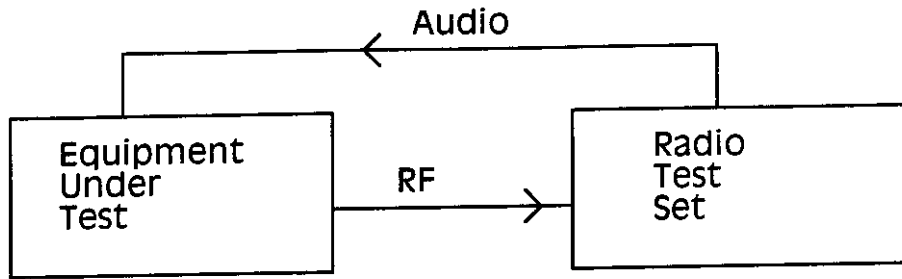


PARA. NO. 2.987(a) AUDIO LOW-PASS FILTER FREQUENCY RESPONSE

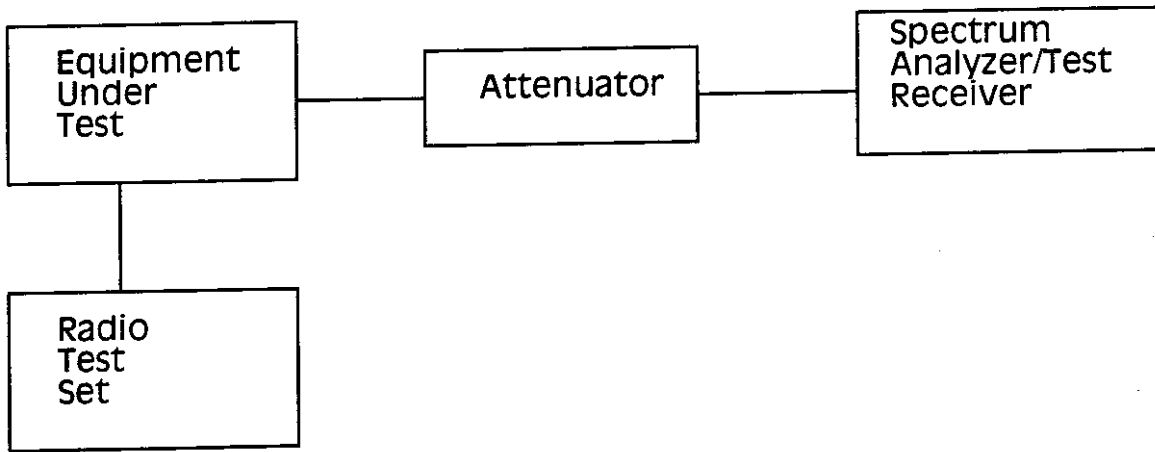


EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"
FCC ID: NT3BDA8087

PARA. NO. 2.987(b) MODULATION LIMITING



PARA. NO. 2.989 OCCUPIED BANDWIDTH



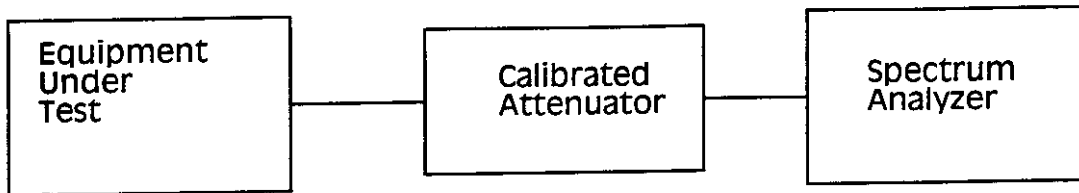
The transmitter was modulated with a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50% modulation.

Spectrum Analyzer settings as per measurement data.

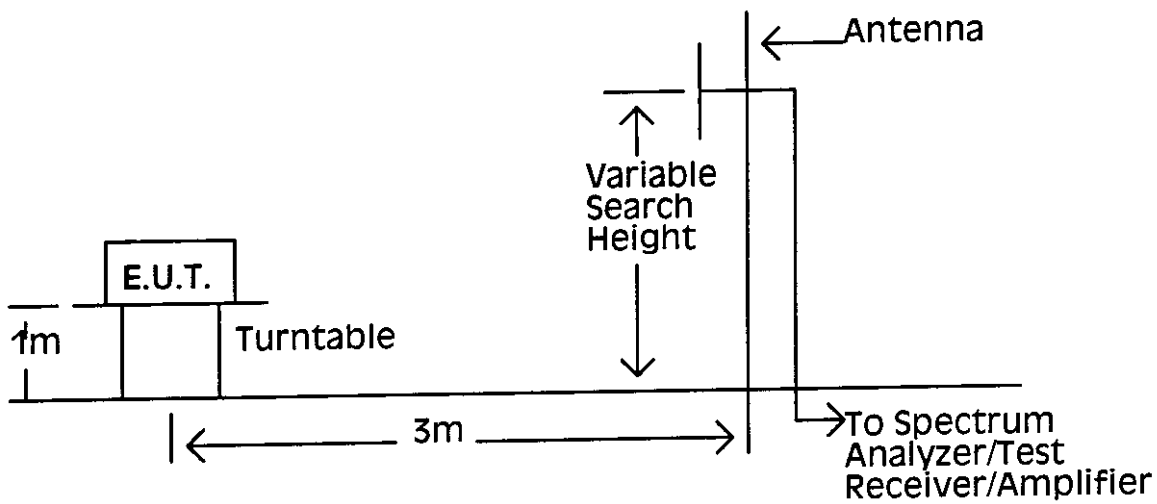
EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"

FCC ID: NT3BDA8087

PARA. NO. 2.991 SPURIOUS EMISSIONS AT ANTENNA TERMINALS



PARA. NO. 2.993 FIELD STRENGTH OF SPURIOUS RADIATION



Frequency Range

<1300 MHz

Test Receiver Settings

120 kHz BW

Peak Detector

>1300 MHz

Spectrum Analyzer Settings

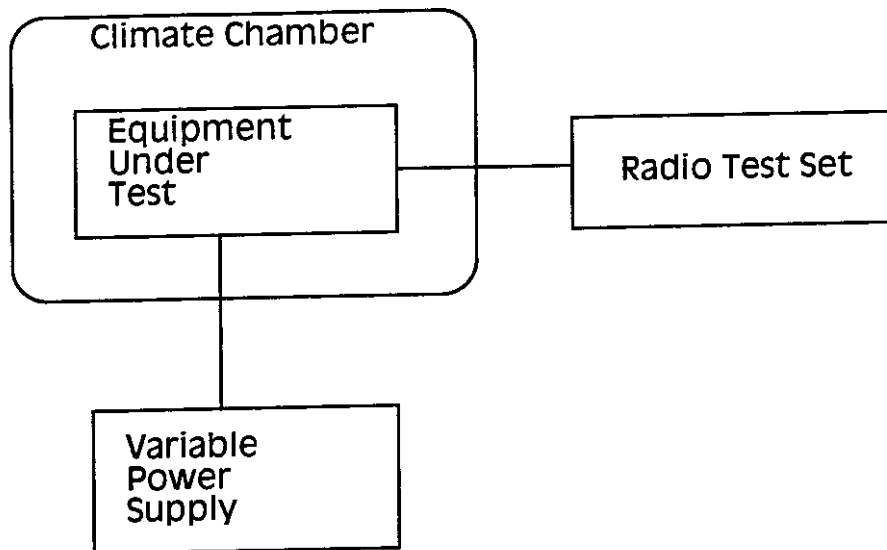
30 kHz RBW

200 kHz Span

20 mS Sweep Rate

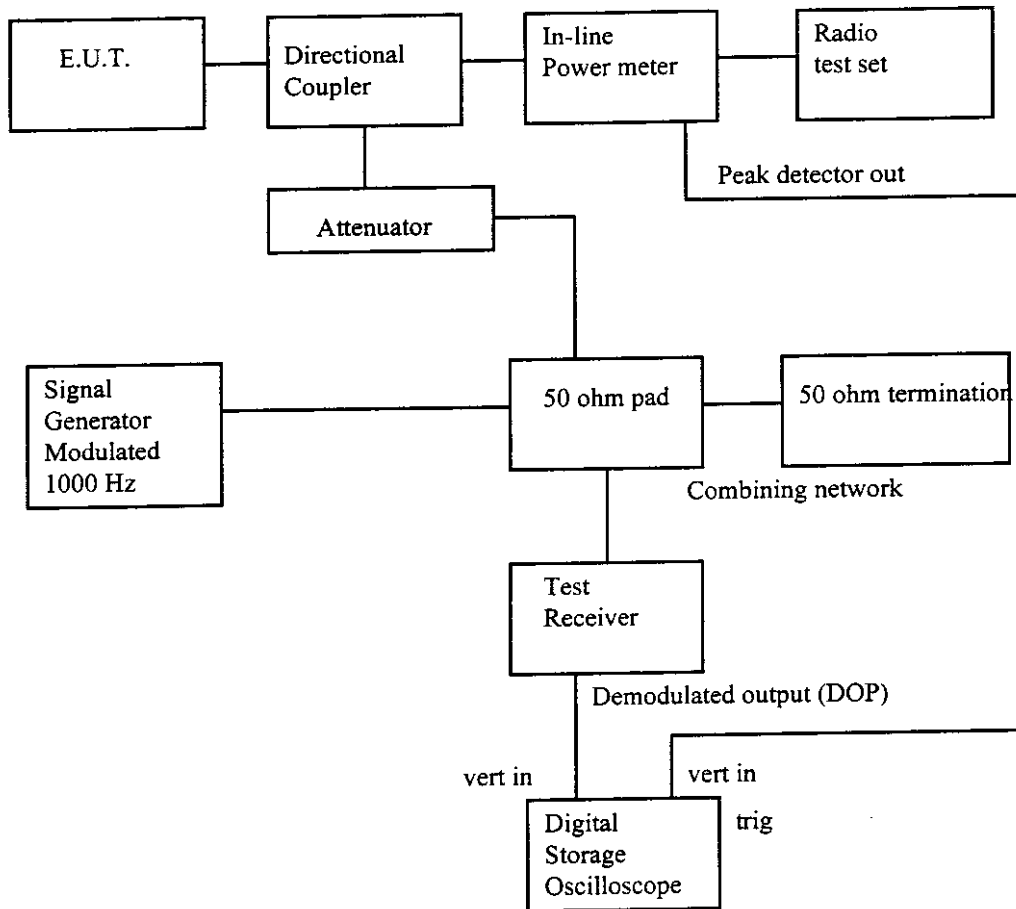
EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"
FCC ID: NT3BDA8087

PARA. NO. 2.995 FREQUENCY STABILITY



EQUIPMENT: The Communications Components Inc. "Bi-Directional Amplifier"
 FCC ID: NT3BDA8087

PARA. NO. 90.214 TRANSIENT FREQUENCY BEHAVIOUR



Voice

This measurement was made using measurement procedure TIA/EIA Land Mobile FM or PM Communications Equipment Measurement and Performance Standards TIA/EIA-603 February 1993 Telecommunications Industry Association (American National Standard ANSI/TIA/EIA-603-1992 Approved: October 27, 1992) Para. no. 2.2 Methods of Measurement for Transmitters Para. no. 2.2.19 Transient Frequency Behaviour (page no. 83).

Data

This measurement was made using measurement procedure TIA/EIA Digital C4FM/CQPSK Transceiver Measurement Methods TSB102.CAAA Para. no. 2.2.17 Transient Frequency Behaviour (page no. 74).