ELITE ELECTRONIC ENGINEERING COMPANY
1516 CENTRE CIRCLE
DOWNERS GROVE, ILLINOIS 60515-1082

ELITE PROJECT: 27503 DATES TESTED: March 13, 1999

TEST PERSONNEL: Daniel E. Crowder

TEST SPECIFICATION: Federal Communication Commission (FCC) Part 22

ENGINEERING TEST REPORT NO. 21518

MEASUREMENT OF RF INTERFERENCE FROM

A MODEL NO. A180100882B 180 WATT AMPLIFIER

FOR: TRL Technologies
Hoffman Estates, Illinois

PURCHASE ORDER NO: 98-128

Report By:
Daniel E. Crowder

Approved By:
Raymond J. Klouda
Registered Professional
Engineer of Illinois - 44894

ENGINEERING TEST REPORT NO. 21518

ADMINISTRATIVE DATA AND SUMMARY OF TESTS

DESCRIPTION OF TEST ITEM: 180 Watt Amplifier for single channel operation

MODEL NO: A180100882B

SERIAL NO: None Assigned

FCC ID: OEUPA882M180W

MANUFACTURER: TRL Technologies

APPLICABLE SPECIFICATIONS: FCC Parts 2 and 22

QUANTITY OF ITEMS TESTED: One (1)

TEST PERFORMED BY: ELITE ELECTRONIC ENGINEERING COMPANY
Radio Interference Consultants
Downers Grove, Illinois 60515

DATES TESTED: March 13, 1999

PERSONNEL (OPERATORS, OBSERVERS, AND CO-ORDINATORS):
CUSTOMER: Hiep Lam of TRL Technologies personnel were present for all testing.
ELITE ELECTRONIC: Daniel E. Crowder

ELITE JOB NO.: 27503

ABSTRACT: The Model No. A180100882B, 180 Watt Amplifier complies with the occupied bandwidth, spurious emissions at the antenna terminals and spurious radiated emissions requirements in FCC PART 22. See test results and data pages for more details.

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ENGINEERING TEST REPORT NO. 21518

MEASUREMENT OF RF INTERFERENCE FROM

A MODEL NO. A180100882B 180 WATT AMPLIFIER

1.0 INTRODUCTION:

1.1 DESCRIPTION OF TEST ITEM: This report present the results of the radio interference measurements were performed on a 180 Watt Amplifier for single channel cellular applications, Model No. A180100882B, (hereinafter referred to as the test item). No serial number was assigned to the test item. The tests were performed for TRL Technologies of Hoffman Estates, Illinois.

1.2 PURPOSE: The test series was performed to determine if the test item meets the occupied bandwidth, spurious emissions at antenna terminals and spurious radiated emissions requirements of the FCC Part 22 for 869-894MHz Amplifiers.

1.3 DEVIATIONS, ADDITIONS AND EXCLUSIONS: There were no deviations, additions to, or exclusions from the test specification during this test series.

1.4 APPLICABLE DOCUMENTS: The following documents of the exact issue designated form part of this document to the extent specified herein:

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 22
- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 2
- ANSI C63.4-1992, "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"

1.5 SUBCONTRACTOR IDENTIFICATION: This series of tests was performed by the Elite Electronic Engineering Company, radio

interference consultants of Downers Grove, Illinois.

2.0 TEST ITEM SETUP AND OPERATION:

2.1 SETUP: The test item was powered with 26VDC from a power supply.

An input signal from a Hewlett Packard model 8648C signal generator (used in conjunction with a Hewlett Packard 8111A function generator) was fed into a Ophir model GRF5064 RF power amplifier. The 15 Watt output of the Ophir amplifier was used to drive the test item. The level of the input signal was adjusted until the power output was at the maximum level.

2.2 MODULATION: The test signal was frequency modulated (FM) with a 6.5 kHz audio tone at 12.0kHz deviation which is a typical modulation for 869-894MHz radio services.

2.3 FREQUENCY SELECTION: A single frequency in the center of the frequency band was selected.

The specific test frequencies are designated as follows:

Modulation Type	Frequency (MHz)
FM	881.5

3.0 TEST EQUIPMENT:

A list of the test equipment used can be found on Table I. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

4.0 REQUIREMENTS, PROCEDURES AND RESULTS:

4.1 OCCUPIED BANDWIDTH MEASUREMENTS:

4.1.1 REQUIREMENTS: In accordance with Paragraph 22.917(b),

the peak power of any emission shall be attenuated below the unmodulated carrier power (P) in accordance with the following schedule:

(1) On any frequency removed from the carrier frequency by more than 20kHz but not more than 45kHz: At least 26 dB.

(2) On any frequency removed from the carrier frequency by more than 45kHz, up to the first multiple of the carrier frequency: st least 60dB or 43 + 10log (P) dB, whichever is the lesser attenuation.

4.1.2 PROCEDURES:

(a) The input signal was set to 881.5MHz. The input signal level was adjusted to provide the maximum level at the test item output.

(b) The input signal was FM modulated.

(c) A spectrum analyzer was connected to the output of the test item. With a bandwidth of the spectrum analyzer set to 1kHz, the output of the test item was measured and recorded.

(d) The input signal from the driving amplifier was measured with the spectrum analyzer and recorded over the same frequency range.

4.1.3 RESULTS: The plots of the occupied bandwidth measured with the FM modulation of the carrier are presented on data pages 101 through 105.

The limits, shown on the plots, are referenced to the power measured from the unmodulated carrier.

As can be seen from the data, the test item output met the occupied bandwidth requirements with the FM modulation of the carrier. The sideband emissions measured at the test item output were similar to the sideband emissions measured from the input signals.

4.2 SPURIOUS EMISSIONS AT ANTENNA TERMINAL:

4.2.1 REQUIREMENTS: This test determines whether the test item produces excessive spurious emissions at the antenna terminals.

In accordance with paragraph FCC 22.917, the mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency twice or more than twice the fundamental frequency by at least 43 + 10 Log (P). The peak power of the emissions shall be measured at the antenna terminal from 30MHz up to the 10th harmonic of the fundamental frequency.

4.2.2 PROCEDURES:

In general, this test will measure spurious emissions at the antenna terminals.

(a) The test item was setup per para 2.0.

(b) The frequency span was adjusted to cover 30 MHz up to 1000 MHz. The emission levels over this frequency range were measured and recorded.

(c) Next, the emissions over the frequency range from 1000 MHz up to 9000 MHz were measured and recorded. This range covers up through the 10th harmonic.

4.2.3 RESULTS: The plots of the antenna conducted output measurements are presented on data pages 106 through 109.

As can be seen from the data, the test item did not produce spurious emissions in excess of 65 dB below unmodulated carrier level with the nominal output power of 180 Watts.

4.3 FIELD STRENGTH OF SPURIOUS EMISSIONS:

4.3.1 REQUIREMENTS: In accordance with Paragraph 22.917, on any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: by at least 43 + 10 log(P)dB.

This requirement translates to a field strength limit of -13dBm (ERP). The emissions shall be measured from 30MHz up to the 10th harmonic of the fundamental frequency.

4.3.2 PROCEDURES: The radiated tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. With the exception of the floor, the reflective surfaces of the shielded chamber are lined with ferrite tiles on the walls and ceiling. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI 63.4 and CISPR 16 requirements for site attenuation.

Preliminary radiated measurements are performed to determine the frequencies where the significant emissions might be found. With the test item at one set position and the measurement antenna at a set height (i.e. without maximizing), the radiated emissions were measured using peak detection. This data was then automatically plotted. The frequencies where significant emission levels found were remeasured taking the extra pains to maximize the emission levels.

Measurements were performed with the input signal modulated.

(a) The test item was placed on a 0.8 meter high non-conductive stand at a 3 meter test distance from the receive antenna.

(b) The input frequency was set to 881.5MHz with (CW) no modulation. The level was adjusted for 180 Watts output. The output was terminated in 50 Ohm load. The modulation was reapplied.

(c) Preliminary emission levels were measured over the frequency range from 30MHz to 9GHz. These preliminary levels were then plotted. The readings were taken with a peak detector function. The measurement

BW was 100kHz up to 1GHz and 1MHz up to 9GHz.

(d) Significant emissions were maximized at each frequency by rotating the test item and adjusting the receive antenna height and polarization. The maximum meter reading was recorded. Measurement BW was 1MHz for frequencies above 1GHz and 100kHz for frequencies 1GHz or less. Peak reading were recorded. No averaging methods or corrections were applied. As a minimum measurements were made at each harmonic of the transmit frequency up through the tenth harmonic. If no signal was detected above the noise floor, the noise level was recorded and noted as ambient.

4.3.3 RESULTS: The preliminary plots are presented on data pages 110 and 111. This data is only presented for a reference, and is not used as to determine compliance. All significant radiated emissions were subsequently remeasured manually maximizing the level.

The final radiated levels are presented on data page 112. The radiated emissions were measured through the 10th harmonic. Field strength levels are presented as equivalent radiated power from a standard tuned dipole.

The radiated emission levels for the harmonics were below the specification limit.

5.0 CONCLUSION:

The Model No. A180100882B 180 Watt Amplifier for 869-894MHz, complies with the Occupied Bandwidth, Spurious Emissions at Antenna Terminals and the Field Strength of Spurious Emissions requirements of the FCC Part 22 and 2.

6.0 CERTIFICATION:

Elite Electronic Engineering Company certifies that the

information contained in this report was obtained under conditions which meet or exceed those specified in the test specification.

The data presented in this test report pertains to the test item at the test date. Any electrical or mechanical modification made to the test item subsequent to the specified test date will serve to invalidate the data and void this certification.

This report must not be used to claim product endorsement by NVLAP or any agency of the US Government.

ENGINEERING TEST REPORT NO. 21518

TABLE I: TEST EQUIPMENT LIST

ELITE ELECTRONIC ENG. INC.

Page:

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Cal Inv	Due Date
Equipment Type: ANTENNAS								
NTA0	BILOG ANTENNA	CHASE EMC LTD.	BILOG CBL611	2057	.03-2GHZ	03/18/98	12	03/18/99
NWH0	DOUBLE RIDGED WAVEGUIDE	TENSOR	4105	2081	1-12.4GHZ	08/26/98	12	08/26/99
Equipment Type: ATTENUATORS								
T2F1	20DB, 100W ATTENUATOR	WEINSCHEL	48-20-33	AZ0083	DC-18GHZ	02/20/98	12	02/20/99
T2F2	20DB, 100W ATTENUATOR	WEINSCHEL	48-20-33	AZ0084	DC-18GHZ	02/20/98	12	02/20/99
Equipment Type: CONTROLLERS								
CDD2	COMPUTER	HEWLETT PACKARD	D4171A#ABA	SUS61654645	N/A		N/A	
CMA0	MULTI-DEVICE CONTROLLER	EMCO	2090	9701-1213	---		N/A	
Equipment Type: PRINTERS AND PLOTTERS								
HRE1	LASER JET 5P	HEWLETT PACKARD	C3150A	USHB061052	---		N/A	
Equipment Type: RECEIVERS								
RAC2	SPECTRUM ANALYZER	HEWLETT PACKARD	85660B	3638A08770	100HZ-22GHZ	10/30/98	12	10/30/99
RACC	RF PRESELECTOR	HEWLETT PACKARD	85685A	2648A00507	20HZ-2GHZ	02/01/99	12	02/01/00
RAF4	QUASIPEAK ADAPTER	HEWLETT PACKARD	85650A	2043A00320	.01-1000MHZ	02/01/99	12	02/01/00

Cal. Interval: Listed in Months I/O: Initial Only N/A: Not Applicable

Note 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.

ELITE ELECTRONIC ENGINEERING CO

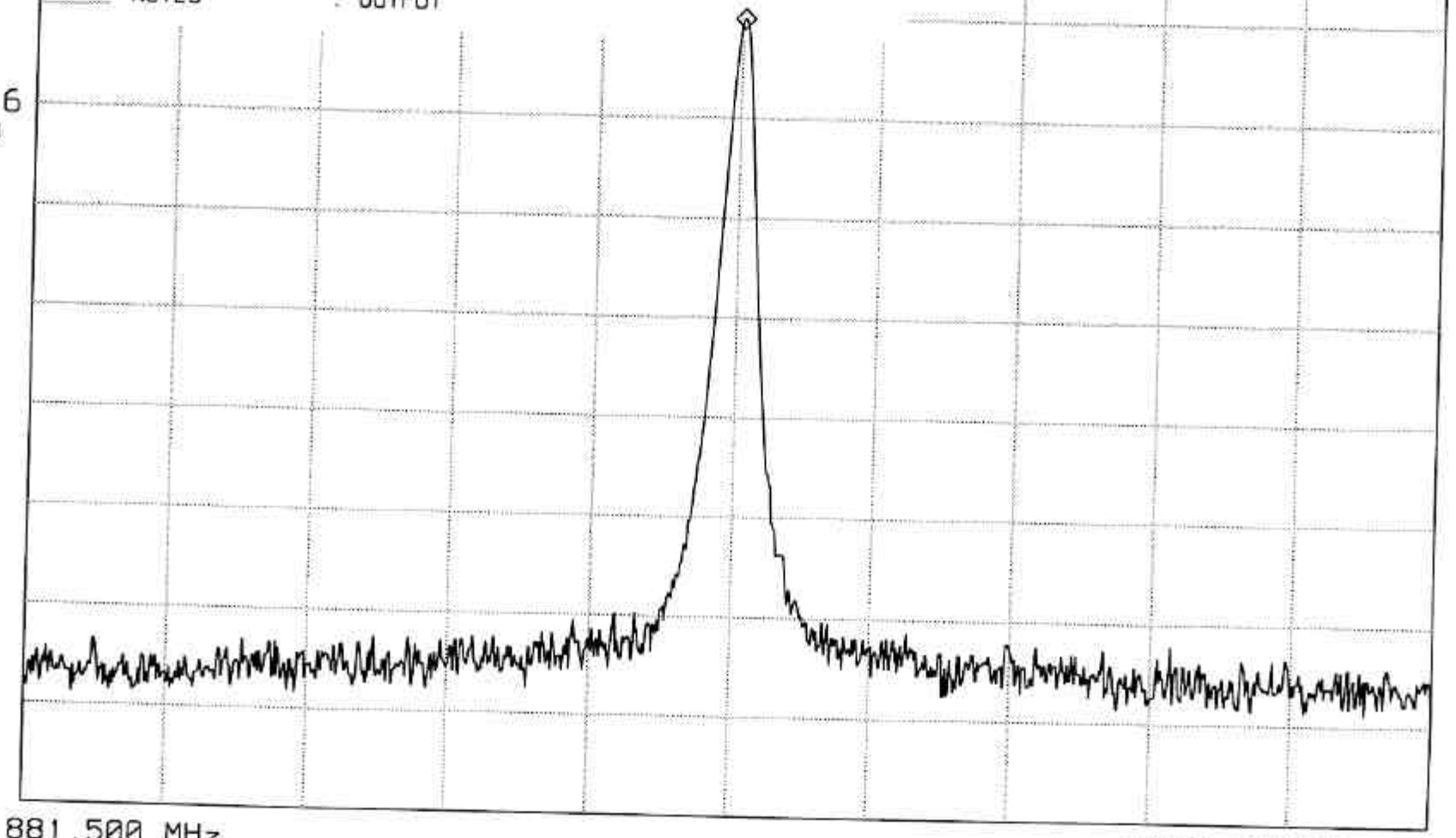
REF 115.5 dBuV ATTEN 30 dB + 60dB Ext + CABLE LOSS MKR 881.500 1 MHz 95.40 dBuV

dB/

106.6 dBuV

MANUFACTURER : TRL TECHNOLOGIES
MODEL : A180100 882B
SERIAL No. : NONE ASSIGNED
TEST PERFORMED: FCC-22 OCCUPIED BANDWIDTH
MODE : Tx CW @ 881.5MHz 180W (FULL POWER)
NOTES : OUTPUT

D. CROWDER
13 Mar 1999
21:57:43



TER 881.500 MHz
RES BW 1 kHz(i) VBW 10 kHz SPAN 100 kHz

ETR 21518

ELITE ELECTRONIC ENGINEERING CO

REF 115.5 dBuV ATTEN 30 dB + 60 dB EXT + CABLE LOSS MKR 881.500 1 MHz 93.20 dBuV

dB/

MANUFACTURER : TRL TECHNOLOGIES
MODEL : A180100882B
SERIAL No. : NONE ASSIGNED
TEST PERFORMED: FCC-22 OCCUPIED BANDWIDTH
MODE : Tx FM @ 881.5MHz 180W (FULL POWER)
NOTES : OUTPUT

D. CROWDER
13 Mar 1999
21:59:03

106.6 dBuV

26 dB down

ETR 21518

ITER 881.500 MHz
RES BW 1 kHz(i) VBW 10 kHz SPAN 100 kHz
SWP 750 msec

ELITE ELECTRONIC ENGINEERING CO

MKR 881.500 3 MHz
93.20 dBuV

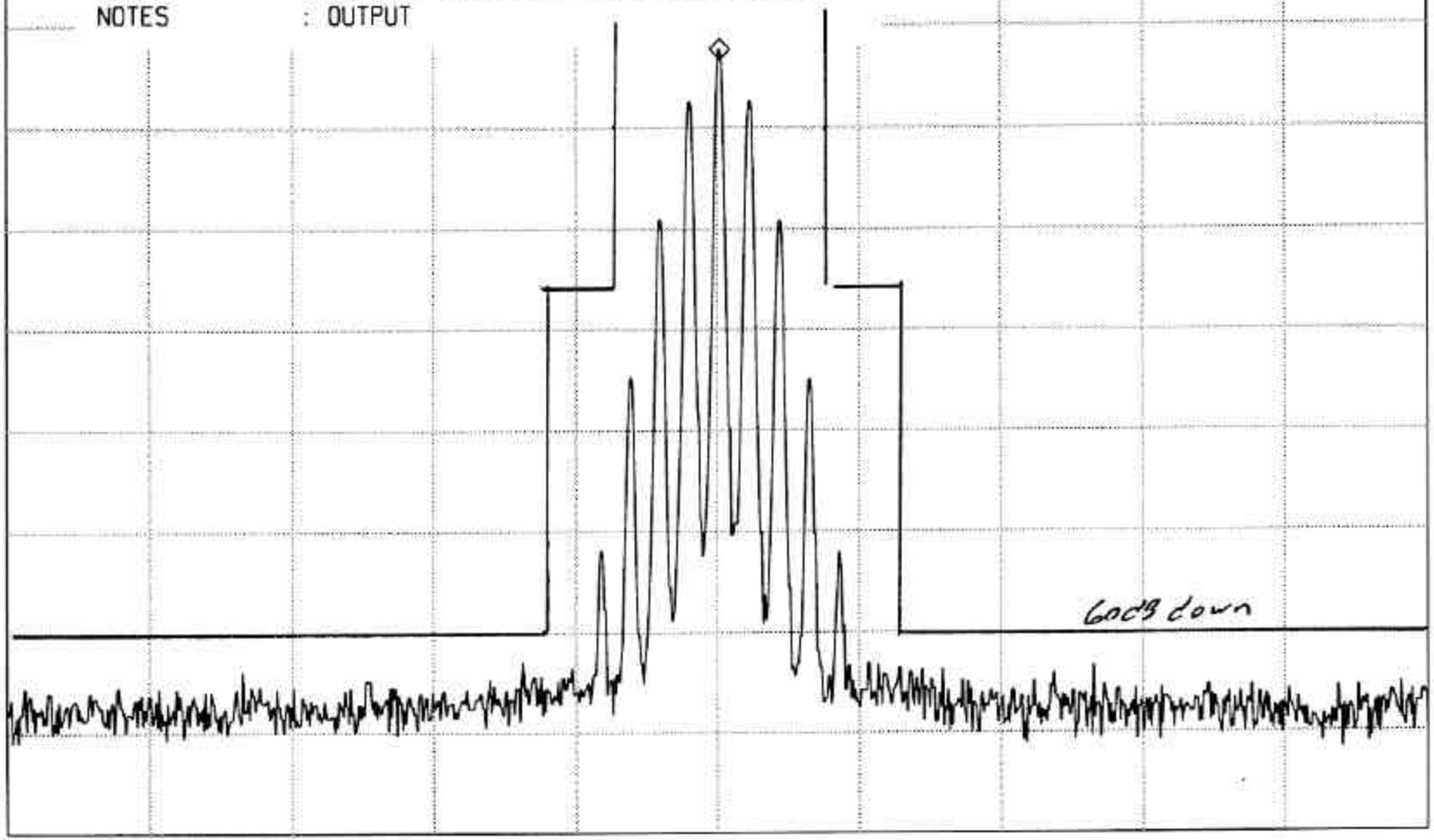
REF 115.5 dBuV ATTEN 30 dB + 60dB EXT + CABLE LOSS

dB/

106.6
dBuV

MANUFACTURER : TRL TECHNOLOGIES
MODEL : A180100882B
SERIAL No. : NONE ASSIGNED
TEST PERFORMED: FCC-22 OCCUPIED BANDWIDTH
MODE : Tx FM @ 881.5MHz 180W (FULL POWER)
NOTES : OUTPUT

D. CROWDER
13 Mar 1999
22:00:58



NTER 881.500 MHz
RES BW 1 kHz(i) VBW 10 kHz

SPAN 300 kHz
SWP 2.25 sec

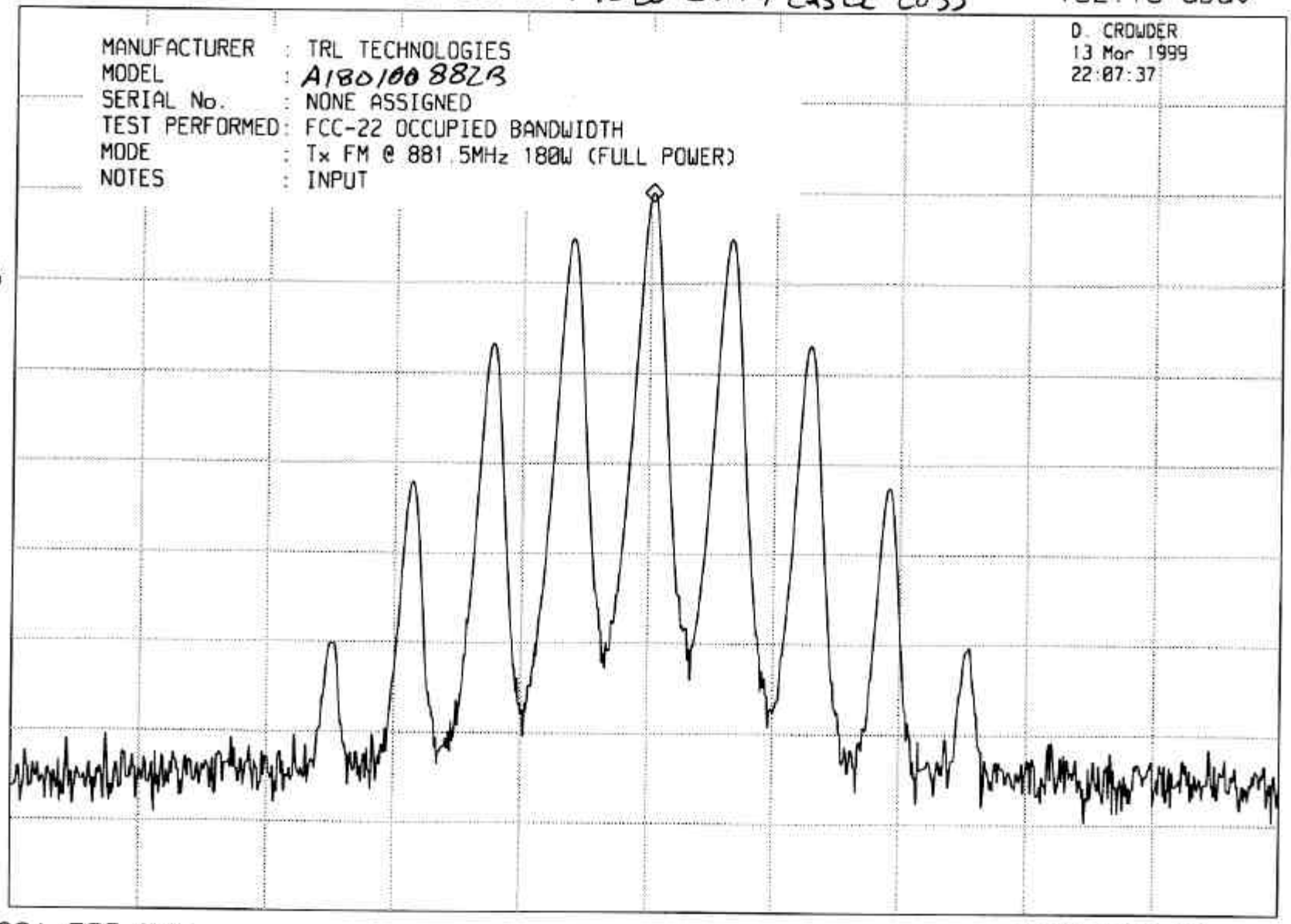
ETR 21518

ELITE ELECTRONIC ENGINEERING CO

MKR 881.500 1 MHz

REF 122.1 dBuV ATTEN 30 dB +40 dB EXT. + CABLE LOSS 102.10 dBuV

1 dB/



106.6 dBuV

ETR 21518

NTER 881.500 MHz

RES BW 1 kHz(i) VBW 10 kHz SPAN 100 kHz

SWP 750 msec

ELITE ELECTRONIC ENGINEERING CO

REF 122.1 dBuV ATTEN 30 dB +40 dB Ext. + CABLE LOSS

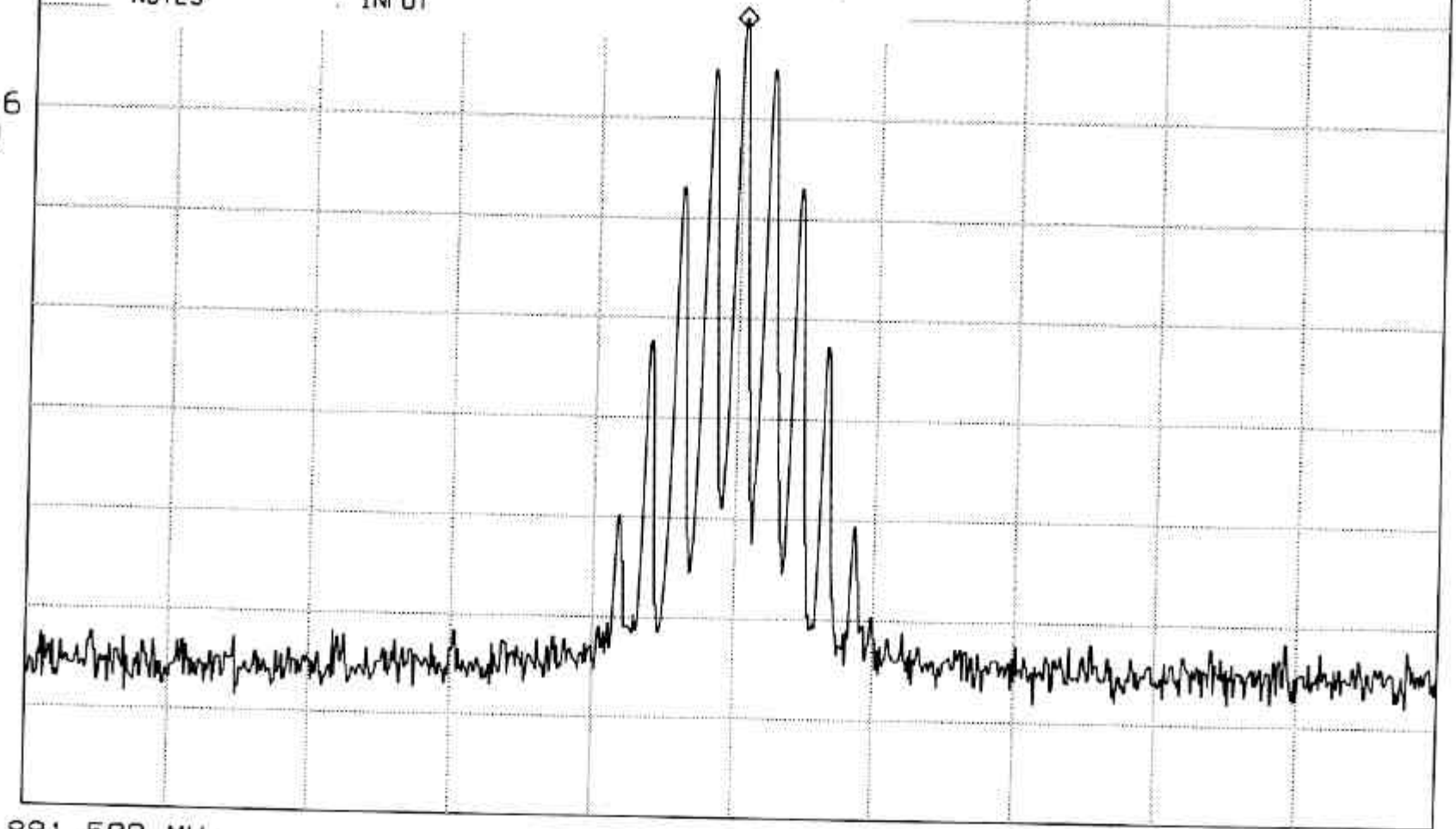
MKR 881.500 3 MHz
102.10 dBuV

1 dB/

106.6
dBuV

MANUFACTURER : TRL TECHNOLOGIES
MODEL : A180/0882B
SERIAL No. : NONE ASSIGNED
TEST PERFORMED: FCC-22 OCCUPIED BANDWIDTH
MODE : Tx FM @ 881.5MHz 180W (FULL POWER)
NOTES : INPUT

D. CROWDER
13 Mar 1999
22:06:34



TER 881.500 MHz
RES BW 1 kHz(i)
VBW 10 kHz
SPAN 300 kHz
SWP 2.25 sec

ETR 21518

ELITE ELECTRONIC ENGINEERING CO

REF 95.2 dBuV ATTEN 10 dB + 60 dB Ext + CABLE LOSS MKR 882.6 MHz 94.50 dBuV

dB/
FSET
3.0
3

106.6
dBuV

MANUFACTURER : TRL TECHNOLOGIES
MODEL : A180/00882B
SERIAL No. : NONE ASSIGNED
TEST PERFORMED : FCC-22 ANTENNA CONDUCTED EMISSIONS
MODE : Tx FM @ 881.5MHz 180W (FULL POWER)
NOTES : OUTPUT

D. CROWDER
13 Mar 1999
22:37:29

65 dB down (-13 dBm)

ETK 21518

RT 30 MHz
RES BW 100 kHz(i) VBW 1 MHz STOP 1.000 GHz

ELITE ELECTRONIC ENGINEERING CO

REF 85.2 dBuV ATTEN 0 dB +60dB EXT. + CABLE LOSS MKR 1.879 GHz 14.00 dBuV

dB/

FSET
0.0
B

106.6
dBuV

MANUFACTURER : TRL TECHNOLOGIES
MODEL : A180100882B
SERIAL No. : NONE ASSIGNED
TEST PERFORMED: FCC-22 ANTENNA CONDUCTED EMISSIONS
MODE : Tx FM @ 881.5MHz 180W (FULL POWER)
NOTES : OUTPUT

D. CROWDER
13 Mar 1999
22:39:53

65 dB down (-13dBm)

RT 1.00 GHz
RES BW 100 kHz(i) VBW 1 MHz STOP 2.00 GHz

FTR 21518

ELITE ELECTRONIC ENGINEERING CO

REF 85.2 dBuV ATTEN 0 dB + 60 dB EXT.

MKR 8.153 GHz
21.00 dBuV

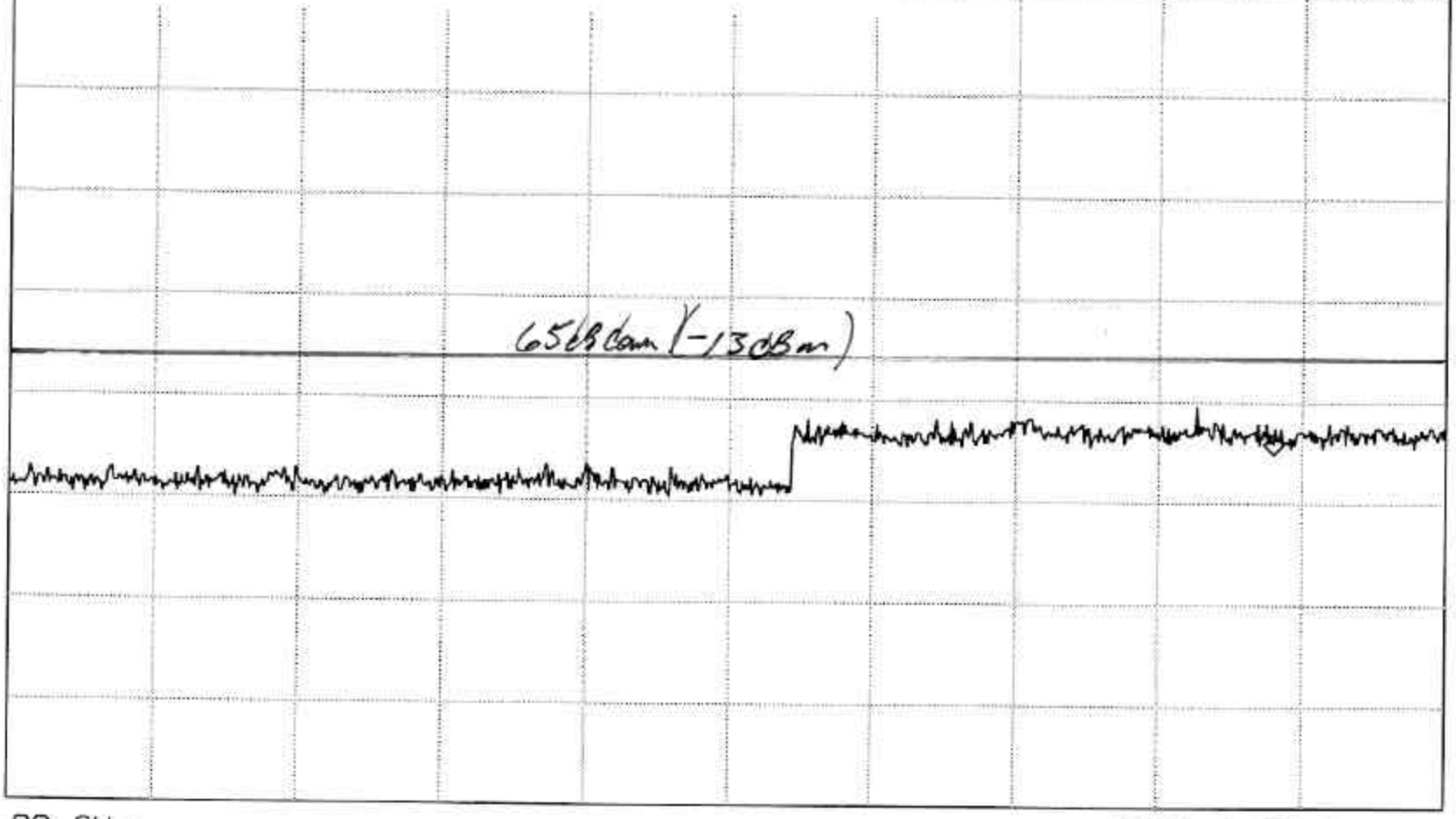
3 dB/
FSET
0.0
B

106.6
dBuV

MANUFACTURER : TRL TECHNOLOGIES
MODEL : A180100882B
SERIAL No. : NONE ASSIGNED
TEST PERFORMED : FCC-22 ANTENNA CONDUCTED EMISSIONS
MODE : Tx FM @ 881.5MHz 180W (FULL POWER)
NOTES : OUTPUT

D. CROWDER
13 Mar 1999
22:41:17

65dB down (-13dBm)



ART 2.00 GHz
RES BW 1 MHz(i) VBW 3 MHz

STOP 9.00 GHz
SWP 175 msec

ETN 81518

ELITE ELECTRONIC ENGINEERING CO

REF 107.0 dBuV ATTEN 10 dB+40dB EXT. + CABLE LOSS MKR 882.6 MHz 103.70 dBuV

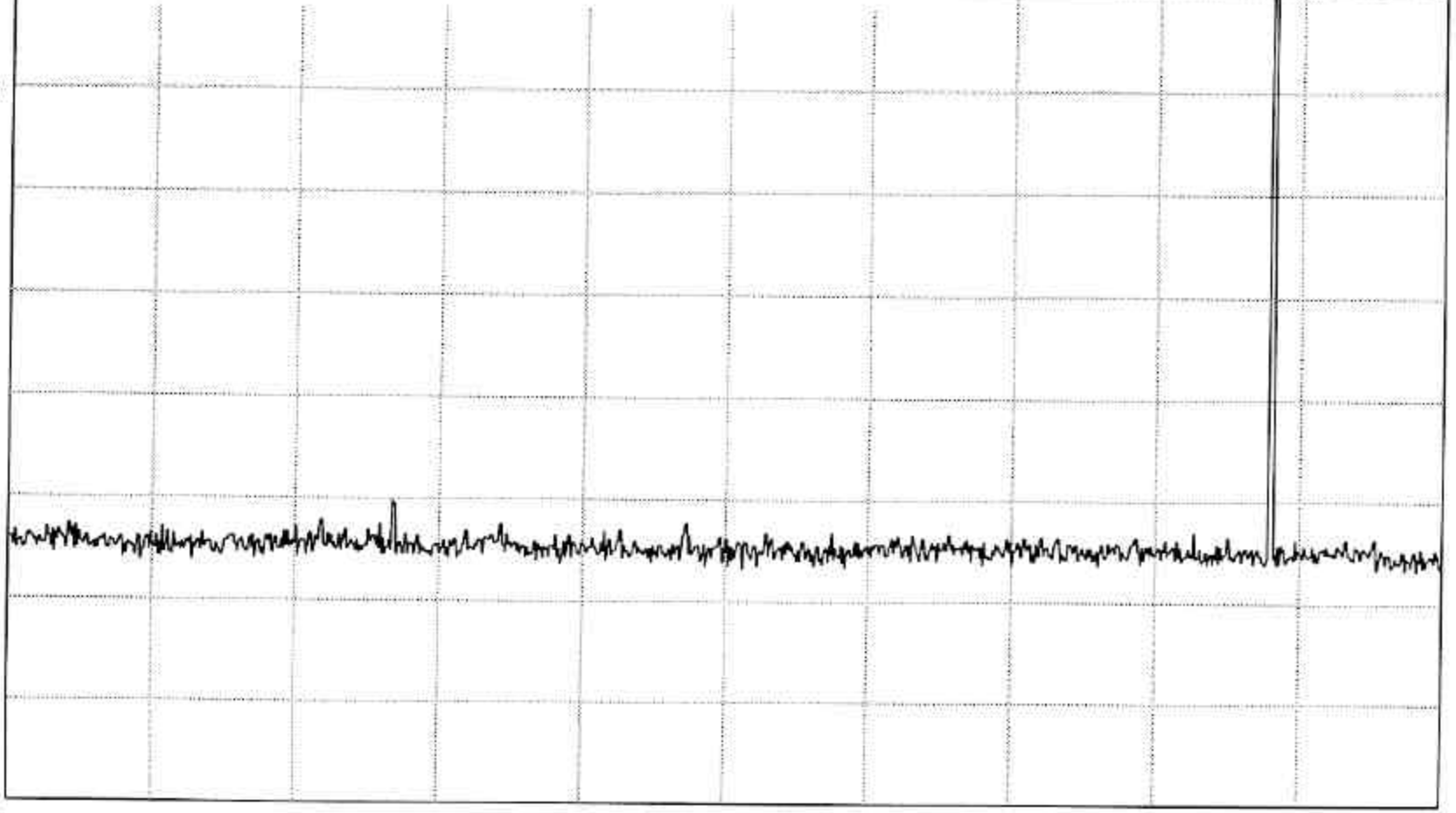
dB/

SET
1.0

06.6
BuV

MANUFACTURER : TRL TECHNOLOGIES
MODEL : A180/008828
SERIAL No. : NONE ASSIGNED
TEST PERFORMED : FCC-22 ANTENNA CONDUCTED EMISSIONS
MODE : Tx FM @ 881.5MHz 180W (FULL POWER)
NOTES : INPUT

D. CROWDER
13 Mar 1999
22:48:03



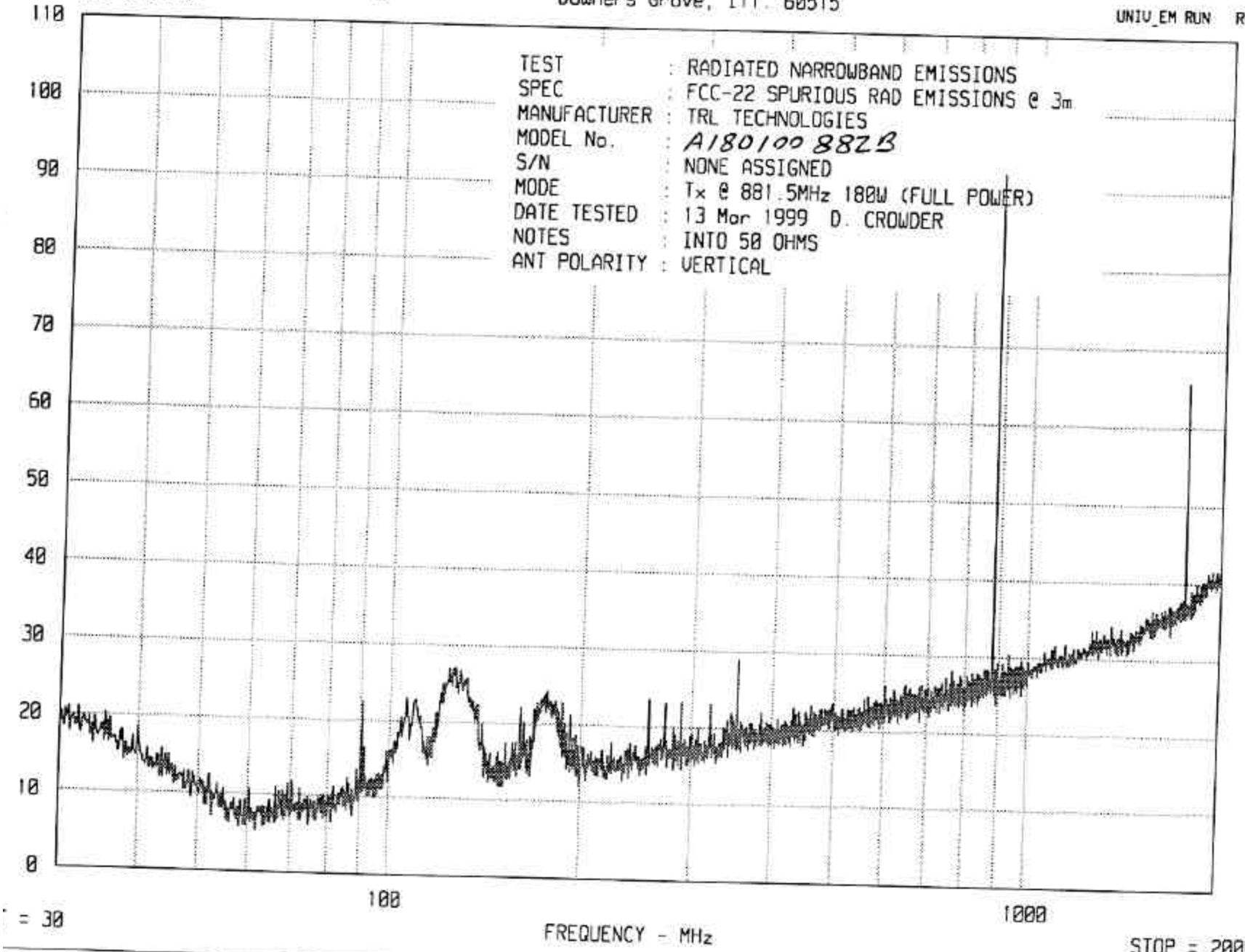
RT 30 MHz
RES BW 100 kHz(i) VBW 1 MHz
STOP 1.000 GHz
SWP 728 msec

ETR 21518

ELITE ELECTRONIC ENGINEERING Co.
Downers Grove, Ill. 60515

WKAB 02/24/98

UNIV_EM RUN RUN 1



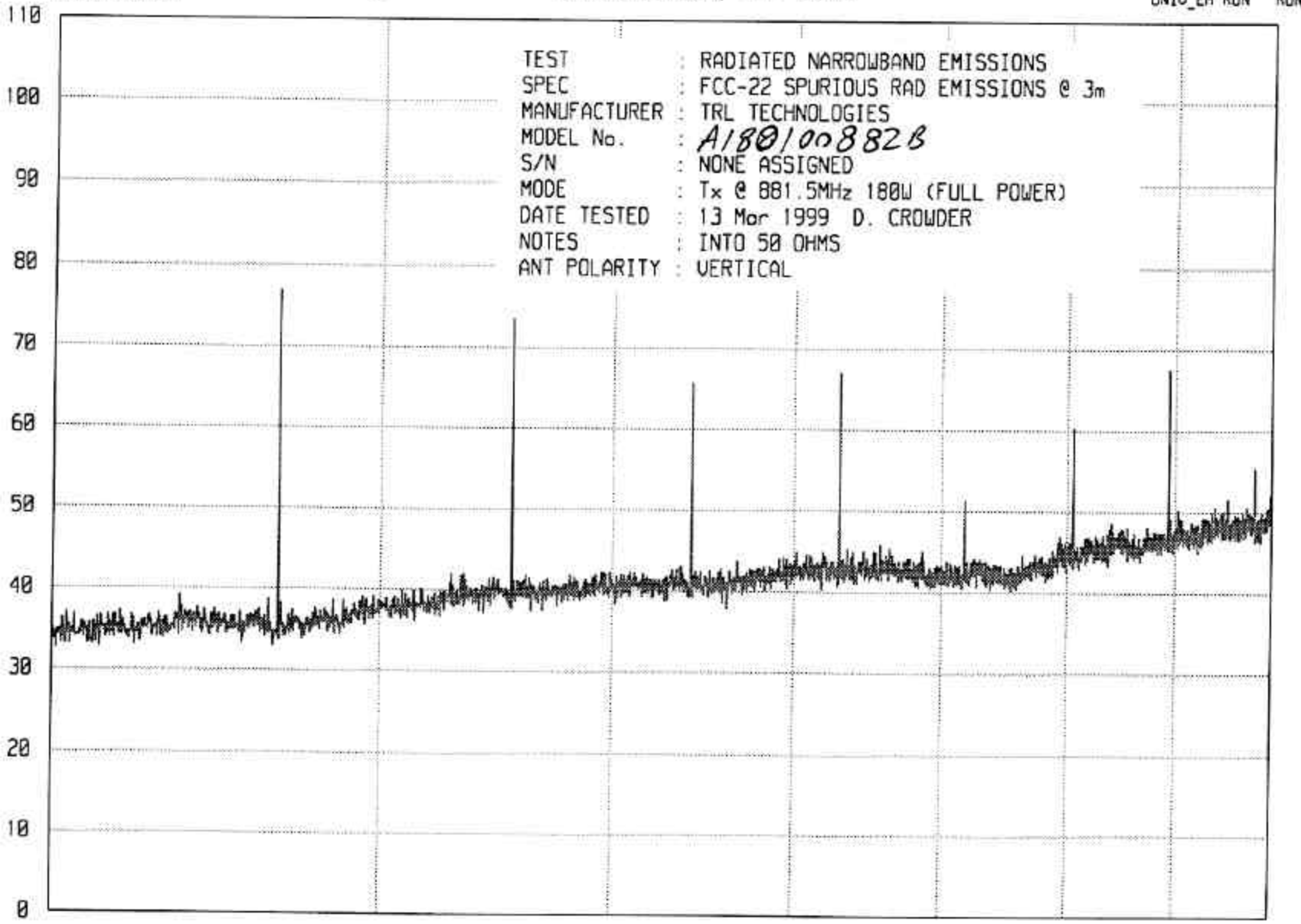
ETR 21518

ELITE ELECTRONIC ENGINEERING Co.

Downers Grove, Ill. 60515

UKA0 02/24/98

UNIV_EM RUN RUN 2



RT = 2000

FREQUENCY - MHz

STOP = 9000

ETR 21518

ENGINEERING TEST REPORT NO. 21518
ELITE ELECTRONIC ENGINEERING COMPANY

MANUFACTURER : TRL TECHNOLOGIES
MODEL : A180100882B
S/N : NONE ASSIGNED
SPECIFICATION : FCC-22 OPEN FIELD SPURIOUS RADIATED EMISSIONS
DATE : MARCH 13, 1999
NOTES : TRANSMIT AT 881.5MHz INTO 50 OHMS
: TEST DISTANCE IS 3 METERS

FREQ. (MHz)	ANT POL	MTR RDG (dBuV)	ANT FAC dB	CABLE FAC dB	PRE-AMP GAIN dB	CONV. F.I. to dBm(dipole)	TOTAL dBm	LIMIT dBm
1763.0	H	87.8	27.8	3.6	36.5	-97.2	-14.5	-13
	V	85.5	27.8	3.6	36.5	-97.2	-16.8	-13
2644.5	H	74.8	30.4	4.3	36.0	-97.2	-23.7	-13
	V	71.2	30.4	4.3	36.0	-97.2	-27.3	-13
3526.0	H	73.0	32.8	5.0	35.8	-97.2	-22.2	-13
	V	73.7	32.8	5.0	35.8	-97.2	-21.5	-13
4407.5	H	59.3	35.0	5.6	35.3	-97.2	-32.6	-13
	V	59.6	35.0	5.6	35.3	-97.2	-32.3	-13
5289.0	H	58.9	35.5	6.2	35.1	-97.2	-31.7	-13
	V	57.7	35.5	6.2	35.1	-97.2	-32.9	-13
6170.5	H	53.5	36.5	6.6	35.2	-97.2	-35.8	-13
	V	51.5	36.5	6.6	35.2	-97.2	-37.8	-13
7052.0	H	48.7	37.9	7.3	35.3	-97.2	-38.6	-13
	V	45.0	37.9	7.3	35.3	-97.2	-42.3	-13
7933.5	H	52.0	37.9	7.9	35.7	-97.2	-35.1	-13
	V	47.6	37.9	7.9	35.7	-97.2	-39.5	-13
8815.0	H	44.8	38.5	8.3	35.8	-97.2	-41.4	-13
	V	44.6	38.5	8.3	35.8	-97.2	-41.6	-13

CHECKED BY: DEC