

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

ELITE PROJECT: 31197

DATES TESTED: July 15 through 19, 2002

TEST PERSONNEL: Richard E. King

TEST SPECIFICATION: FCC "Code of Federal Regulations" Title 47 Part 15,
Subpart C, Section 15.247 for Frequency Hopping
Spread Spectrum Intentional Radiators Operating
within the 2400-2483.5MHz band

ENGINEERING TEST REPORT NO. 31197-01
MEASUREMENTS OF RF EMISSIONS
FROM THE ZEUS OPTION BLUETOOTH BOARD

FOR: Motorola
Rolling Meadows, Illinois

PURCHASE ORDER NO.: NP454241

Report By:

Richard E. King
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Approved By:

Raymond J. Klouda
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Registered Professional
Engineer of Illinois - 44894

ENGINEERING TEST REPORT NO. 31197-01

ADMINISTRATIVE DATA AND SUMMARY OF TESTS

DESCRIPTION OF TEST ITEM: Frequency Hopping Spread Spectrum
Transmitter

MODEL NO. : Zeus Option Bluetooth Board **SERIAL NO.:** None Assigned

FCC ID NO. : None given.

MANUFACTURER: Motorola

APPLICABLE

SPECIFICATION: FCC "Code of Federal Regulations", Title 47, Part 15,
Subpart C, Sec. 15.247

TEST PERFORMED BY: ELITE ELECTRONIC ENGINEERING INC.
Downers Grove, Illinois 60515

DATES TESTED: July 15 through 19, 2002

PERSONNEL (OPERATORS, OBSERVERS, AND CO-ORDINATORS) :

WITNESS: No Motorola personnel were present during the testing.

ELITE ELECTRONIC: Richard E. King

ELITE JOB NO.: 31197

ABSTRACT: The model Zeus Option Bluetooth Board Transmitter meets the requirements of the FCC "Code of Federal Regulations", Title 47, Part 15, Subpart C, Section 15.247 for bluetooth spread spectrum transmitters. The carrier frequency separation, number of hopping frequencies, time of occupancy (dwell time), 20 dB bandwidth, peak output power, band-edge compliance, and spurious emissions, power spectral density, and processing gain were measured and found to comply with the requirements.

See the test results and data pages for more details.

TABLE OF CONTENTS

	PAGE
1.0 INTRODUCTION	4
1.1 Description of Test Item	4
1.2 Purpose	4
1.3 Deviations, Additions and Exclusions	4
1.4 Applicable Documents	4
1.5 Subcontractor Identification	4
2.0 TEST ITEM SETUP AND OPERATION	4
3.0 TEST SITE AND INSTRUMENTATION	5
3.1 Test Site	5
3.2 Test Instrumentation	5
4.0 REQUIREMENTS, PROCEDURES AND RESULTS	5
4.1 Power Line Conducted Emissions	5
4.2 Carrier Frequency Separation	5
4.3 Number of Hopping Frequencies	6
4.4 Time of Occupancy (Dwell Time)	7
4.5 20 dB Bandwidth	7
4.6 Peak Output Power	8
4.7 Band-edge Compliance	9
4.8 Spurious Emissions	9
4.9 Power Spectral Density	11
5.0 CONCLUSION	12
6.0 CERTIFICATION	12
EQUIPMENT LIST	13

MEASUREMENT OF RF EMISSIONS

FROM A Zeus Option Bluetooth Board TRANSMITTER

1.0 INTRODUCTION:

1.1 DESCRIPTION OF TEST ITEM: This report presents the results of the RF emissions measurements performed for the model Zeus Option Bluetooth Board spread spectrum transmitter, (hereinafter referred to as the test item). The tests were performed for Motorola located in Rolling Meadows, Illinois.

The test item is a frequency hopping spread spectrum transceiver used for bluetooth applications with the Remote Speaker Microphone. It operates in the frequency band 2400 to 2483.5MHz.

1.2 PURPOSE: The test series was performed to determine if the test item would meet the selected requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.247 for intentional radiators.

1.3 DEVIATIONS, ADDITIONS AND EXCLUSIONS: There were no deviations from the test requirements.

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 (FCC) "Code of Federal Regulations", Title 47, Part 15, dated 1 October 2001

FCC Public Notice, DA 00-705, "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems", Released March 30, 2000

1.5 SUBCONTRACTOR IDENTIFICATION: This series of tests was performed by the Elite Electronic Engineering Inc., of Downers Grove, Illinois.

2.0 TEST ITEM SETUP AND OPERATION:

For all tests the test item was placed on a 0.8 meter high non-

conductive table. The test item was attached to a Motorola CDM1250 mobile radio. The 12VDC was supplied to the test item from the host radio. The test item is supplied with an internal antenna.

3.0 TEST SITE AND INSTRUMENTATION:

3.1 TEST SITE: All tests were performed at Elite's facility in Downers Grove, Illinois. All tests were performed in a hybrid anechoic/ferrite tile shielded enclosure.

3.2 TEST INSTRUMENTATION: 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 POWER LINE CONDUCTED EMISSIONS:

4.1.1 REQUIREMENT: This requirement does not apply since the test item is battery operated. There are no operation modes where the transmitter can be connected to the AC power public utilities, and therefore, the conducted emissions test are not required.

4.2 CARRIER FREQUENCY SEPARATION:

4.2.1 REQUIREMENTS: Per section 15.247 (a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

4.2.2 PROCEDURES: The test item was setup inside the chamber. With the hopping function enabled, the test item was allowed to transmit continuously.

The resolution bandwidth (RBW) was set to $\geq$ to 1% of the span. The peak detector and 'Max-Hold' function was engaged. The span was set wide

enough to capture the peaks of at least two adjacent channels. When the trace had stabilized after multiple scans. The marker-delta function was used to determine the separation between the peaks of the adjacent channels. The analyzer's display was plotted using a 'screen dump' utility.

4.2.3 RESULTS: Data page 16 shows the carrier frequency separation. As can be seen from this plot, the separation is 1MHz which is the 20dB bandwidth.

4.3 NUMBER OF HOPPING FREQUENCIES:

4.3.1 REQUIREMENTS: Per section 15.247(a)(1)(ii), frequency hopping systems shall use at least 75 hopping frequencies.

4.3.2 PROCEDURE: The test item was setup inside the chamber. With the hopping function enabled, the test item was allowed to transmit continuously.

The resolution bandwidth (RBW) was set to $\geq$ to 1% of the span. The peak detector and 'Max-Hold' function was engaged. The span was set wide enough to capture the entire frequency band of operation.

When the trace had stabilized after multiple scans. The number of hopping frequencies was counted. The analyzer's display was plotted using a 'screen dump' utility.

4.3.3 RESULTS: Data page 17 shows the number of hopping frequencies. As can be seen from this plot, the number of frequencies is 79 which is greater than the minimum required of 75.

4.4 TIME OF OCCUPANCY (DWELL TIME):

4.4.1 REQUIREMENTS: Per section 15.247(a)(1)(ii), the average time of occupancy on any frequency shall not be greater than 0.4 seconds

within a 30 second period.

4.4.2 PROCEDURE: The test item was setup inside the chamber. With the hopping function enabled, the test item was allowed to transmit continuously.

The resolution bandwidth (RBW) was set to 1 MHz. The peak detector and 'Max-Hold' function was engaged. With the span was to 0Hz, the sweep time was adjusted to capture a single event in order to measure the dwell time per hop. Then, the sweep time was expanded to capture the average time between hops. When the trace had stabilized after multiple scans, the time between hops was measured. The analyzer's display was plotted using a 'screen dump' utility.

The dwell time in a 30 second period was then calculated from dwell time per hop divided by time between hops then multiplied by 30 seconds. The dwell time in a 30 second period was then divided by the number of frequency hopping channels to give the dwell time of a single frequency hopping channel.

4.4.3 RESULTS: Data pages 18 and 19 show the plots for the time of occupancy (dwell time). As can be seen from the plots, the time of occupancy can be determined by a 200 usec burst every 1.34 msec in a 30 Second period divided by the number of the hopping frequencies. This calculated value is equal to .0576 seconds which is less than the 0.4 seconds allowed.

4.5 20 dB BANDWIDTH:

4.5.1 REQUIREMENTS: Per section 15.247(a)(1)(ii), the maximum 20dB bandwidth of the hopping channel is 1MHz.

4.5.2 PROCEDURE: The test item was setup inside the chamber.

With the hopping function disabled, the test item was allowed to transmit continuously. The frequency hopping channel was set separately to low, middle, and high hopping channels. The resolution bandwidth (RBW) was set to $\geq$ to 1% of the 20 dB BW.

The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined. The analyzer's display was plotted using a 'screen dump' utility.

4.5.3 RESULTS: The plots on pages 20 through 22 show that the maximum 20 dB bandwidth was 0.995 MHz. The 20 dB bandwidth was less than the 1.0MHz maximum requirement.

4.6 PEAK OUTPUT POWER:

4.6.1 REQUIREMENTS: This requirement applies only to the transmit mode of operation. Per section 15.247(b) the maximum peak output power of the transmitter shall not exceed 1 Watt. If transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

4.6.2 PROCEDURES: Since the antenna was an integrated antenna the equivalent isotropic radiated power (EIRP) was computed from the radiated field strength measurements at 3 meters.

The spectrum analyzer bandwidth was set to 3 MHz which is greater than the 20dB bandwidth of the transmitter. A double ridged waveguide antenna was positioned 3 meters from the test item. The maximum meter reading was recorded for the vertical and horizontal receiver antenna polarity while rotating the test item through 360 degrees. The EIRP was calculated for the low, middle and high hopping frequencies.

4.6.3 RESULTS: The results are presented on data page 23. The

maximum EIRP measured from the transmitter was -14.5 dBm. Therefore, the transmitter meets the De Facto 36 dBm limit. Only one type of antenna is supplied with the test item.

4.7 BAND-EDGE COMPLIANCE:

4.7.1 REQUIREMENTS: Per section 15.247(c), the emissions at the band-edges must be at least 20dB below the highest level measured within the band. In addition, the radiated emissions which fall in the restricted band beginning at 2483.5 MHz, must meet the general limits of 15.209

4.7.2 PROCEDURE: The same data recorded for the low and high hopping frequencies from the 20 dB bandwidth measurements was used to demonstrate compliance with the 20 dB band-edge requirements.

For the radiated emissions which fall in the restricted band the "marker-delta" method described in Public Notice DA 00-705 was used. Initially radiated measurements were performed at the fundamentals of the highest hopping frequencies using 1 MHz bandwidth. For the measurements the "delta" required to meet the general limit was calculated.

Next, the band-edge emissions were plotted using peak detector and 100 kHz bandwidth. The "delta" limit was applied to this plot to determine compliance at the band-edge.

4.7.3 RESULTS: Data page 24 and 25 show the band-edge compliance results using the marker-delta method. As can be seen from this plot, the emissions at the band-edge in the restricted band are within the general limits.

4.8 SPURIOUS EMISSIONS:

4.8.1 REQUIREMENTS: Per section 15.247(c), the spurious

emissions in any 100 kHz BW outside the frequency band must be at least 20dB below the highest 100 kHz BW level measured within the band. In addition, the radiated emissions which fall in the restricted bands must meet the general limits of 15.209.

4.8.2 PROCEDURES: Since the test item was supplied with a permanently attached antenna, the spurious emissions compliance was evaluated against the radiated emissions levels for unrestricted bands as well as the restricted bands.

The radiated tests were performed in a 32ft. x 20ft. x 18ft. hybrid absorber lined semi-anechoic 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. 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 with 100 kHz BW. This data was then automatically plotted up through 18 GHz. Frequency range 18 to 24 GHz was checked manually but not plotted.

Next, the harmonic or spurious emissions falling in the restricted bands were measured up through the 10th harmonic. For these measurements, the measurement bandwidths were set to 1 MHz RBW. The analyzer was set to **linear mode** with 10 Hz VBW in order to simulate an average detector. A pre-amplifier was used to increase the receiver sensitivity.

4.8.3 RESULTS: The preliminary emissions levels were plotted. These plots are presented on Data Pages 26 through 34. This plot shows that the spurious emissions were at least 20 dB below the level of the fundamental.

The harmonics and any other emissions that fall in the restricted frequency bands were then re-measured manually. This data is shown in the tables on data Pages 35 through 37. The field intensities levels for the harmonics in the restricted band were within the limit.

A block diagram of the test item orientation position is shown in Figure 1.

4.9 POWER SPECTRAL DENSITY:

4.9.1 REQUIREMENTS: Per section 15.247(d), the peak power spectral density from the intentional radiator shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

4.9.2 PROCEDURE: The test item was setup inside the chamber. The test item was put into acquisition mode.

The resolution bandwidth (RBW) was initially set to 3MHz to set the EIRP reference level. Knowing the EIRP peak level, the result of this plot was used to determine the 8dBm limit.

The resolution bandwidth (RBW) was set to 3kHz, the sweep time was set to the span divided by 3kHz ($1\text{MHz}/3\text{kHz} = 333$ seconds). The peak detector and 'Max-Hold' function was engaged. The analyzer's display was plotted using a 'screen dump' utility.

4.9.3 RESULTS: Data page 38 shows the power spectral density results. As can be seen from this plot, the peak power density is less

than 8dBm in a 3kHz band during any time interval of continuous transmission.

5.0 CONCLUSION:

The Motorola model Zeus Option Bluetooth Board does meet the limits imposed by the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.247 for bluetooth spread spectrum transmitters.

6.0 CERTIFICATION:

Elite Electronic Engineering Inc. 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. 31197-01

TABLE I: TEST EQUIPMENT LIST

ELITE ELECTRONIC ENG. INC.

Page: 1

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Cal Inv	Due Date
Equipment Type: ACCESSORIES, MISCELLANEOUS								
XLJJ	5W, 50 OHM TERMINATION	JFW INDUSTRIES	50T-052	20	DC-2GHZ	06/12/02	12	06/12/03
XLJL	5W, 50 OHM TERMINATION	JFW INDUSTRIES	50T-052	22	DC-2GHZ	06/12/02	12	06/12/03
XLJN	5W, 50 OHM TERMINATION	JFW INDUSTRIES	50T-052	24	DC-2GHZ	06/12/02	12	06/12/03
XLQ6	5W, 50 OHM TERMINATION	JFW INDUSTRIES	50T-052	41	DC-2GHZ	11/12/01	12	11/12/02
XYV1	RELAY ACTUATOR (DCC-CEM1)	HEWLETT PACKARD	59306A	1920A06008			N/A	
XZG1	ATTENUATOR/SWITCH DRIVER	HEWLETT PACKARD	11713A	3439A02724	---		N/A	
XZG3	ATTENUATOR/SWITCH DRIVER	HEWLETT PACKARD	11713A	2421A03059	---		N/A	
Equipment Type: AMPLIFIERS								
APH0	POWER AMPLIFIER	HEWLETT PACKARD	11975A	2304A00322	2-8GHZ		NOTE 1	
APK1	PRE-AMPLIFIER	HEWLETT PACKARD	8449B	3008A01243	1-26.5GHZ	02/22/02	12	02/22/03
APK3	PREAMPLIFIER	AGILENT TECHNOL	8449B	3008A01593	1-26.5GHZ	05/09/02	12	05/09/03
Equipment Type: ANTENNAS								
NHG1	STANDARD GAIN HORN ANTENNA	NARDA	638	---	18-26.5GHZ		NOTE 1	
NTA0	BILOG ANTENNA	CHASE EMC LTD.	BILOG CBL611	2057	0.03-2GHZ	06/25/02	12	06/25/03
NWF0	RIDGED WAVE GUIDE	EMCO	3105	2035	1-12.4GHZ	09/08/01	12	09/08/02
NWF2	RIDGED WAVE GUIDE	ELECTRO-METRICS	RGA 180	2521	1-12.4GHZ	08/03/01	12	08/03/02
NW11	RIDGED WAVE GUIDE	AEL	H1498	154	2-18GHZ	09/18/01	12	09/18/02
Equipment Type: CONTROLLERS								
CDD2	COMPUTER	HEWLETT PACKARD	D4171A#ABA	US61654645	---		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	02/21/02	12	02/21/03
RACC	RF PRESELECTOR	HEWLETT PACKARD	85685A	2648A00507	20HZ-2GHZ	01/17/02	12	01/17/03
RACD	RF PRESELECTOR	HEWLETT PACKARD	85685A	3010A01205	20HZ-2GHZ	02/21/02	12	02/21/03
RAE1	SPECTRUM ANALYZER (DCC-CEM	HEWLETT PACKARD	85660A	2209A01336	100HZ-22GHZ	02/14/02	12	02/14/03
RAE5	SPECTRUM ANALYZER	HEWLETT PACKARD	85660B	2532A02136	100HZ-22GHZ	05/09/02	12	05/09/03
RAF4	QUASIPeAK ADAPTER	HEWLETT PACKARD	85650A	2043A00320	0.01-1000MHZ	06/13/02	12	06/13/03

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.

ENGINEERING TEST REPORT NO. 31197-01

TABLE 1: TEST EQUIPMENT LIST

ELITE ELECTRONIC ENG. INC.

Page: 2

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Cal Inv	Due Date
Equipment Type: SIGNAL GENERATORS								
GBLO	SYNTHESIZED GENERATOR (DCC HEWLETT PACKARD 8656B			2523A01727	0.1-990MHZ	10/25/01	12	10/25/02

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.

ETR 31197-01

Figure 1



Radiated Emissions Worst Case Horizontal Polarization



Radiated Emissions Worst Case Vertical Polarization

ELITE ELECTRONIC ENGINEERING Inc.

MKR ~ 1.005 MHz
0.00 dB

hp

10 dB/

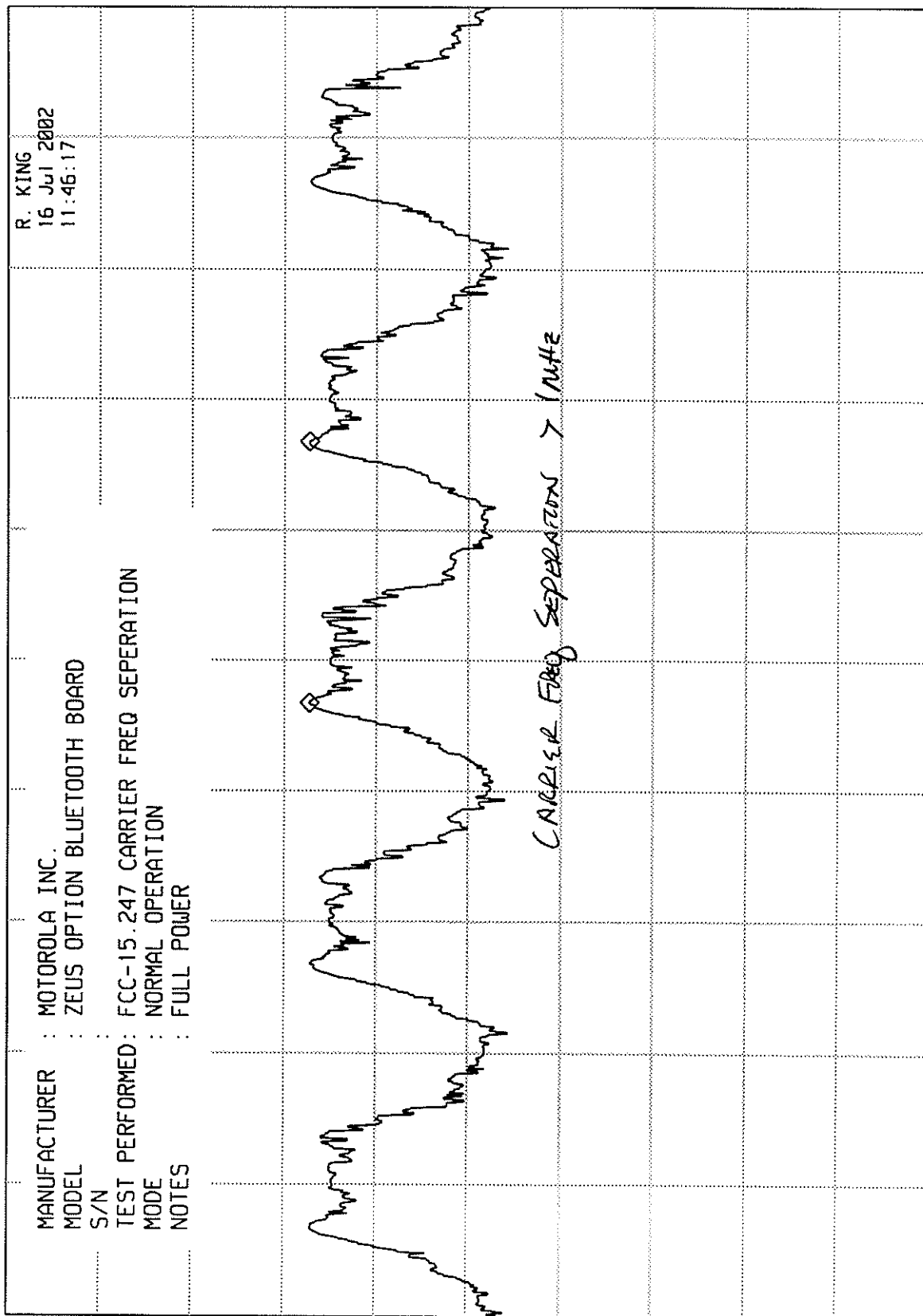
ATTEN 20 dB

REF 10.0 dBm

MANUFACTURER : MOTOROLA INC.
MODEL : ZEUS OPTION BLUETOOTH BOARD
S/N :

TEST PERFORMED : FCC-15.247 CARRIER FREQ SEPERATION
MODE : NORMAL OPERATION
NOTES : FULL POWER

R. KING
16 Jul 2002
11:46:17



SPAN 5.00 MHz
SWP 20.0 msec

VBW 1 MHz

CENTER 2.445 00 GHz
RES BW 100 kHz(i)

ETR 31197-01

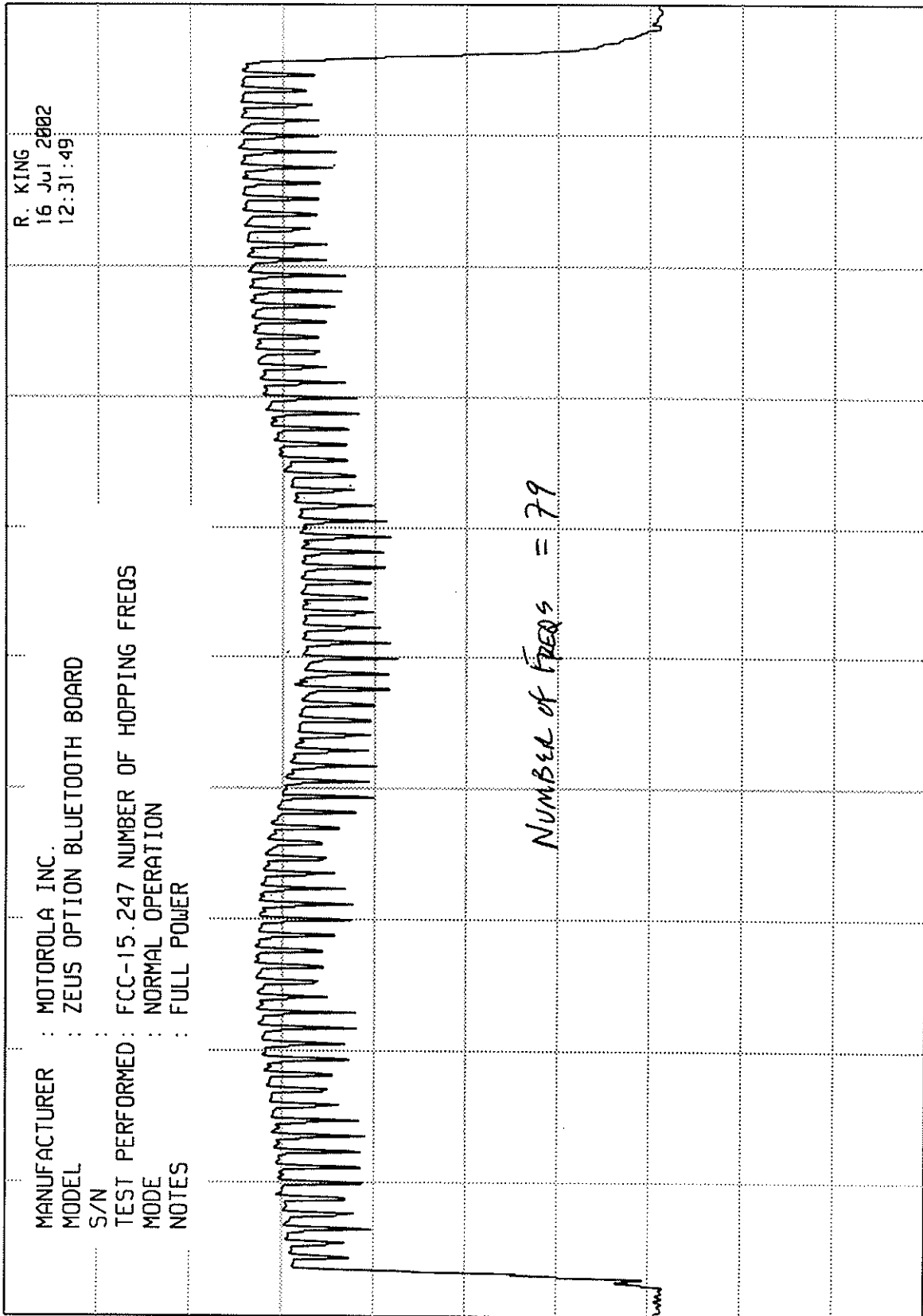
ELITE ELECTRONIC ENGINEERING Inc.

ETR 31197-01

hp

10 dB/

REF 10.0 dBm ATTEN 20 dB



START 2.399 0 GHz

RES BW 300 kHz(i)

VBW 3 MHz

STOP 2.485 0 GHz

SWP 20.0 msec

ELITE ELECTRONIC ENGINEERING Inc.

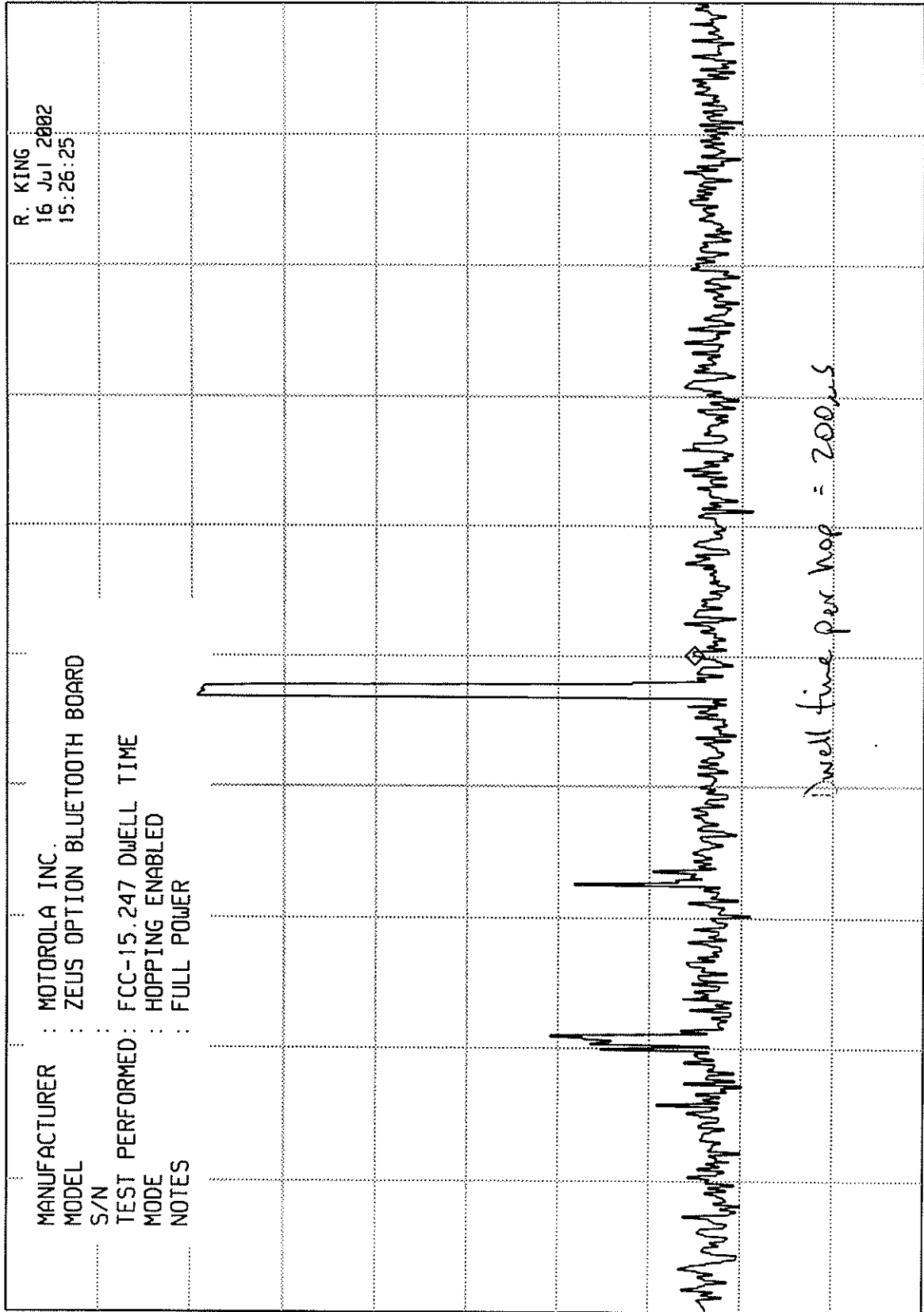
hp 10 dB/

REF 0.0 dBm

ATTEN 10 dB

MKR 10.00 msec

-74.90 dBm



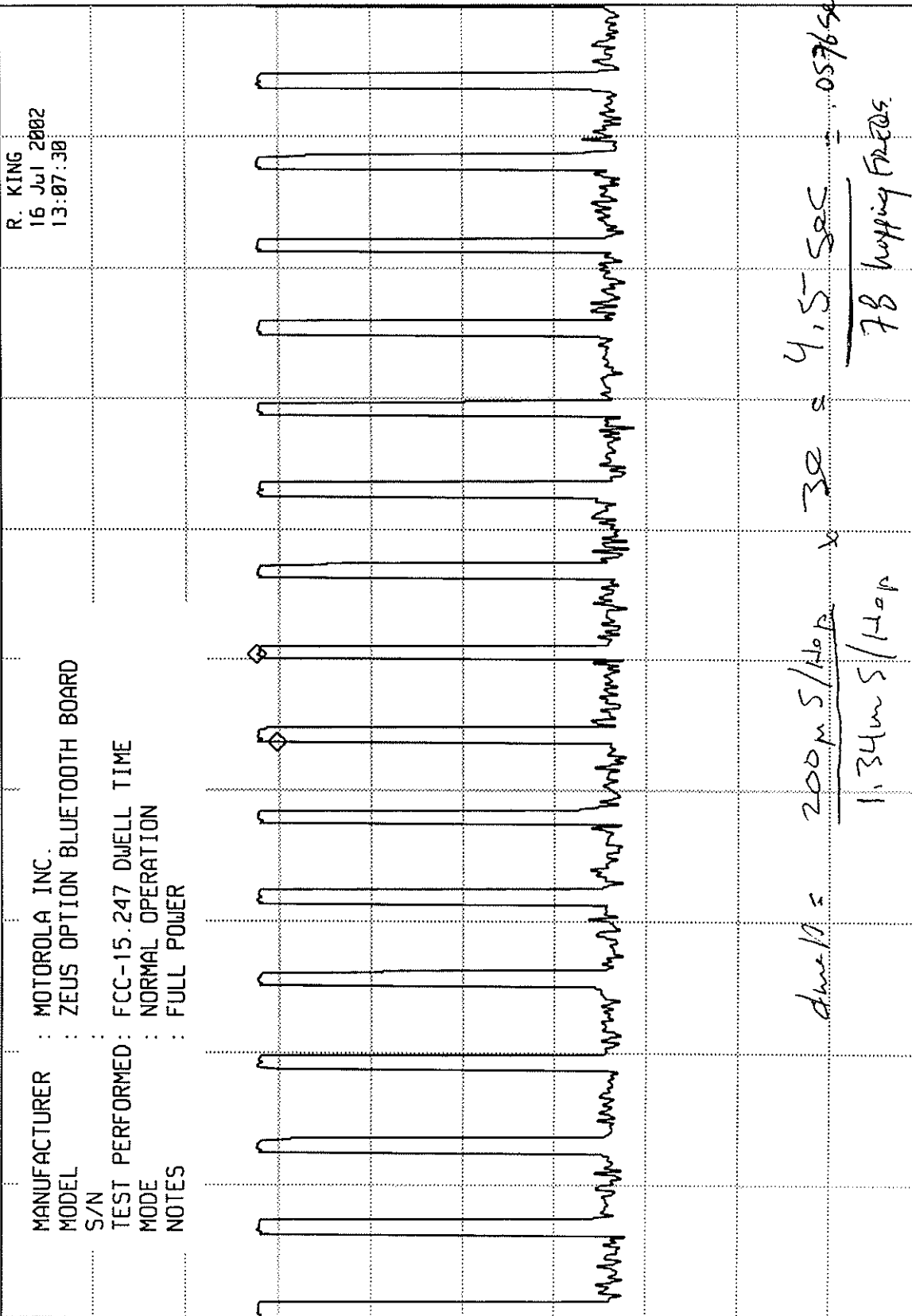
ETR 31197-01

ELITE ELECTRONIC ENGINEERING Inc.

hp REF 0.0 dBm ATTN 10 dB MKR ^ 1.340 msec 2.20 dB

10 dB/

MANUFACTURER : MOTOROLA INC.
 MODEL : ZEUS OPTION BLUETOOTH BOARD
 S/N :
 TEST PERFORMED : FCC-15.247 DWELL TIME
 MODE : NORMAL OPERATION
 NOTES : FULL POWER



CENTER 2.441 000 000 GHz
 RES BW 1 MHz (1)

VBW 3 MHz

SPAN 0 Hz
 SWP 20.0 msec

ETR 31197-01

ELITE ELECTRONIC ENGINEERING Inc.

MKR ^ 995 kHz
1.30 dB

hp

10 dB/

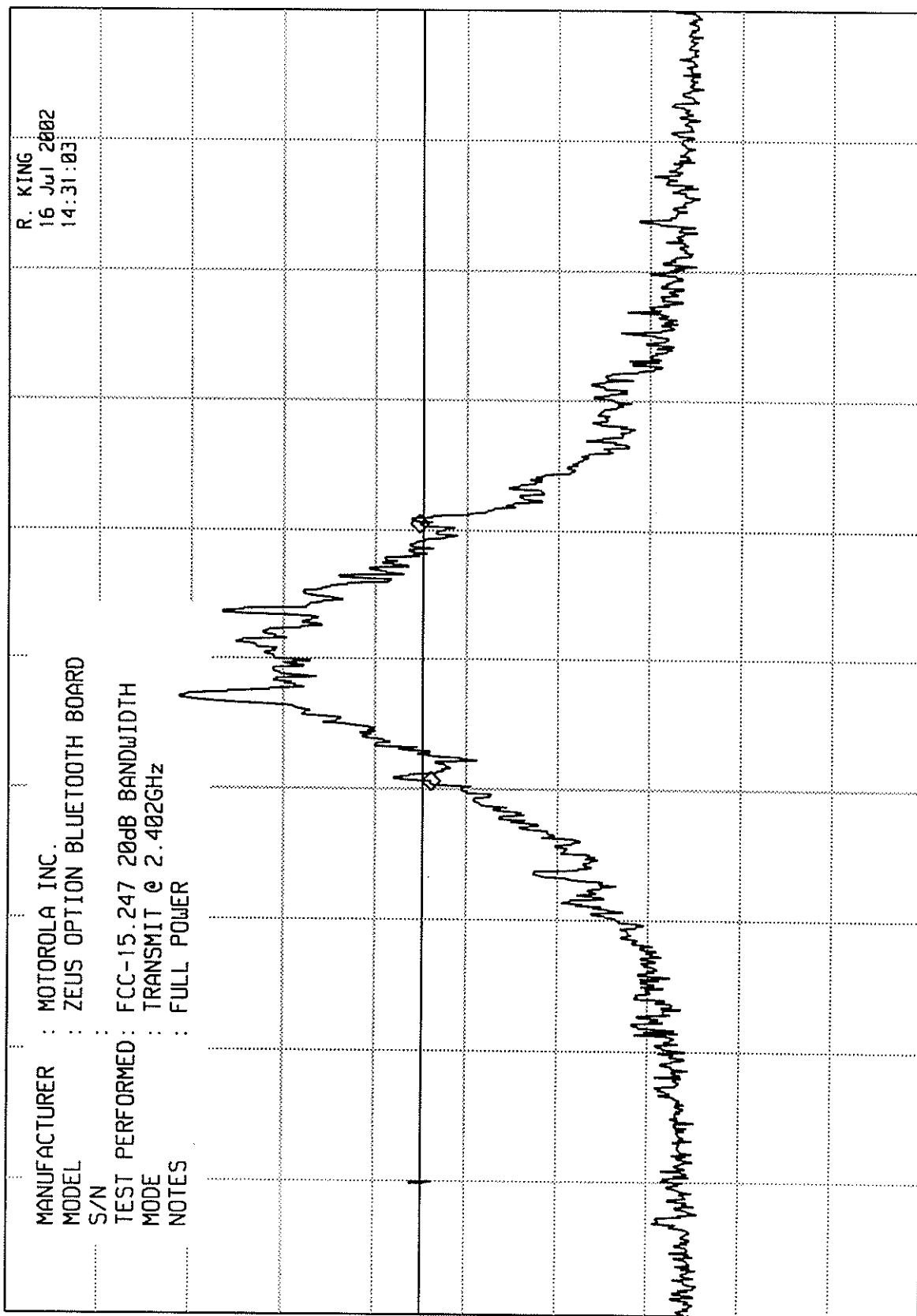
DL -55.3
dBm

REF -10.0 dBm

ATTEN 10 dB

MANUFACTURER : MOTOROLA INC.
MODEL : ZEUS OPTION BLUETOOTH BOARD
S/N :
TEST PERFORMED : FCC-15.247 20dB BANDWIDTH
MODE : TRANSMIT @ 2.402GHz
NOTES : FULL POWER

R. KING
16 Jul 2002
14:31:03



SPAN 5.00 MHz
SWP 375 msec

UBW 100 kHz

CENTER 2.402 00 GHz
RES BW 10 kHz (i)

ELITE ELECTRONIC ENGINEERING INC.

MKR ^ 945 kHz
1.10 dB

hp

10 dB/

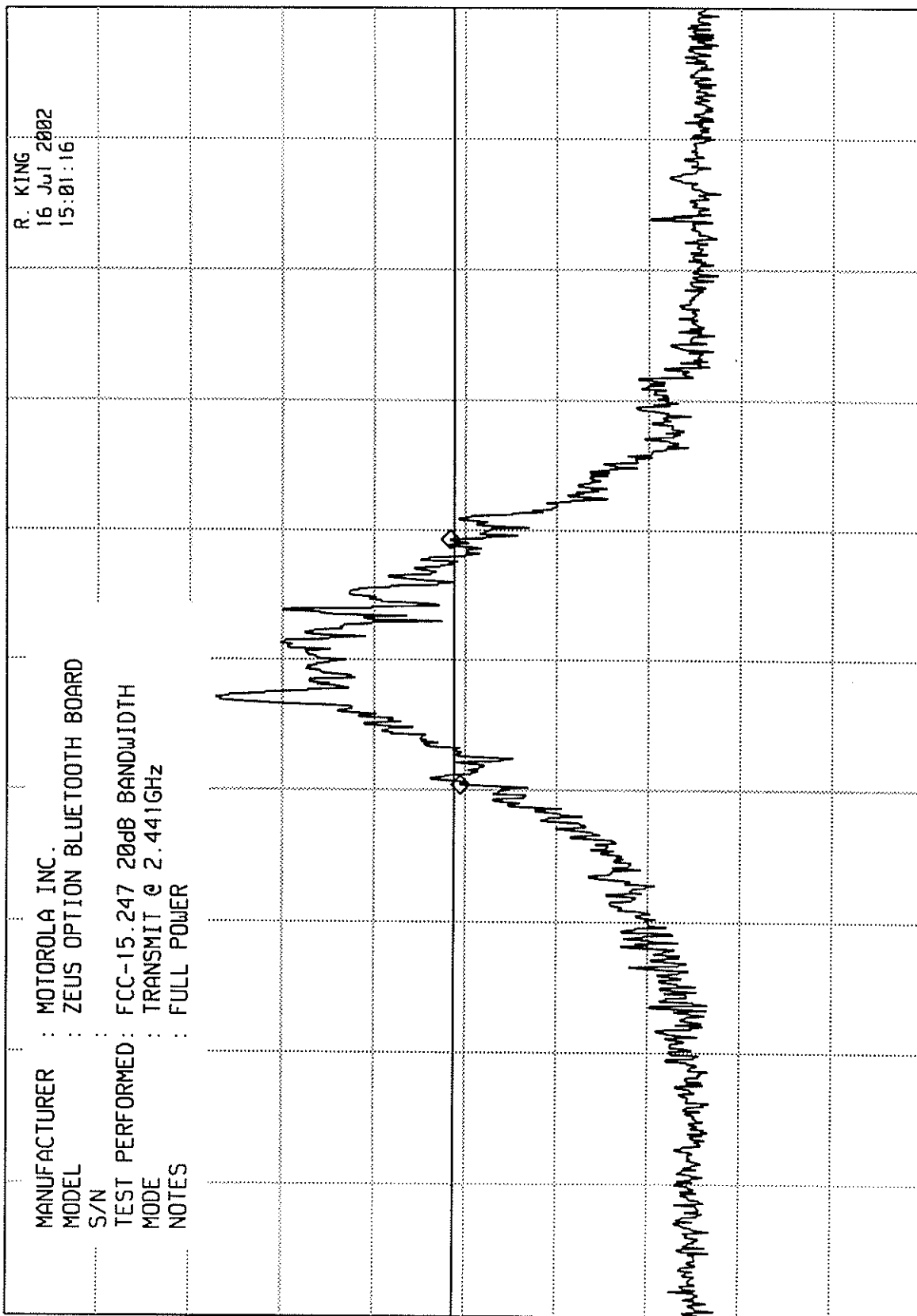
DL
-58.8
dBm

REF -10.0 dBm

ATTEN 10 dB

MANUFACTURER : MOTOROLA INC.
MODEL : ZEUS OPTION BLUETOOTH BOARD
S/N :
TEST PERFORMED : FCC-15.247 20dB BANDWIDTH
MODE : TRANSMIT @ 2.441GHz
NOTES : FULL POWER

R. KING
16 Jul 2002
15:01:16



CENTER 2.441 00 GHz
RES BW 10 kHz (i)

VBW 100 kHz

SPAN 5.00 MHz
SWP 375 msec

ETR 311097-01

ELITE ELECTRONIC ENGINEERING INC.

MKR ^-975 kHz
1.20 dB

hp

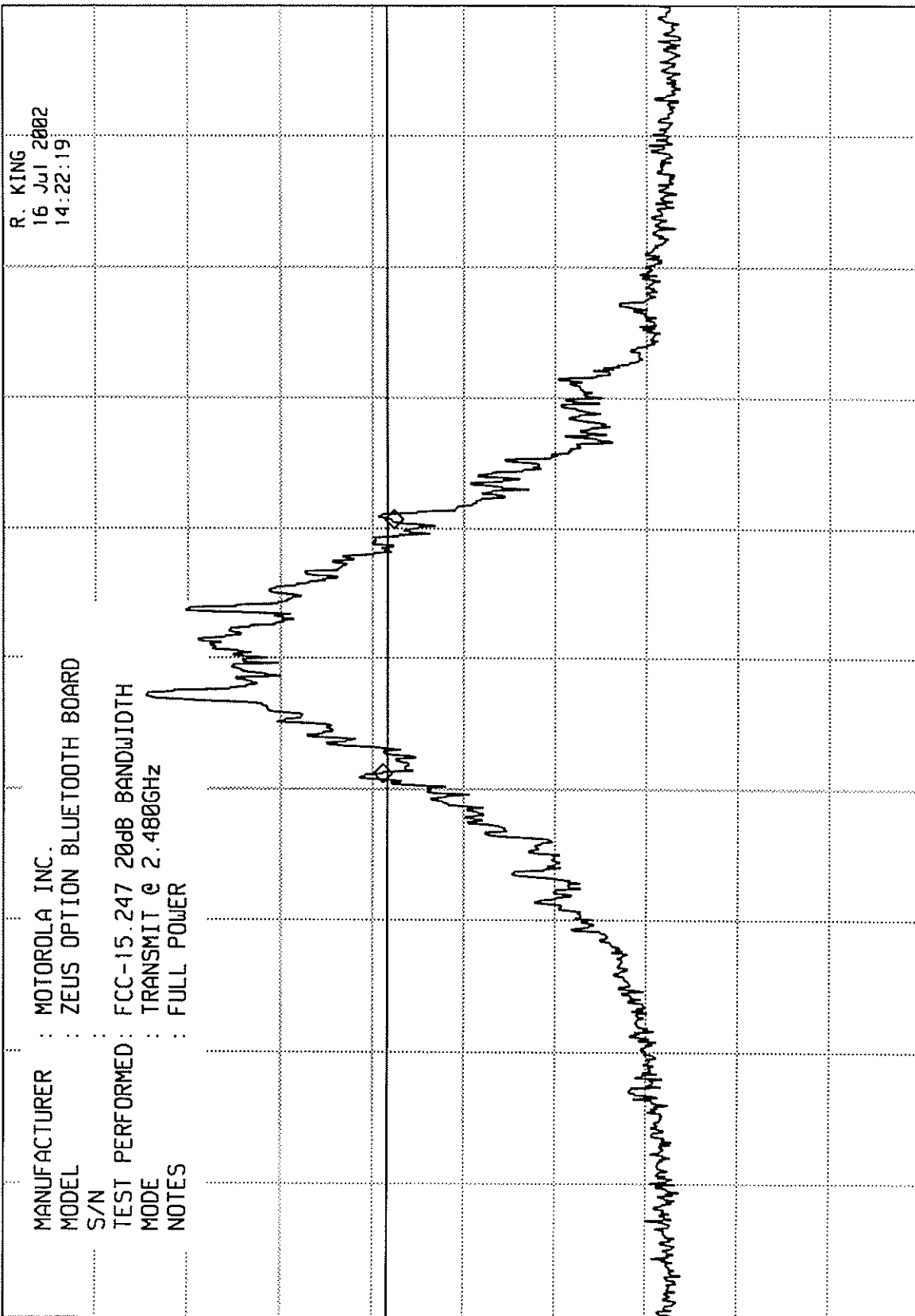
10 dB/

DL
-51.7
dBm

REF -10.0 dBm

ATTEN 10 dB

MANUFACTURER : MOTOROLA INC.
MODEL : ZEUS OPTION BLUETOOTH BOARD
S/N :
TEST PERFORMED : FCC-15.247 20dB BANDWIDTH
MODE : TRANSMIT @ 2.480GHz
NOTES : FULL POWER



R. KING
16 Jul 2002
14:22:19

SPAN 5.00 MHz
SWP 375 msec

VBW 100 kHz

CENTER 2.480 00 GHz
RES BW 10 kHz (1)

ETR 31197-01



ETR No. 31197-01
DATA SHEET

PEAK OUTPUT POWER

SPECIFICATION : FCC-15C (15.247)
MANUFACTURER : MOTOROLA
MODEL NO. : ZEUS OPTION BLUETOOTH BOARD
SERIAL NO. : NONE ASSIGNED
NOTES : TRANSMITTING AT FULL POWER
TEST DATE : July 16, 2002
TEST DISTANCE : 3m

Freq. (MHz)	Ant. Pol.	F.I. (dBuV/m)	Conv. FI to EIRP	EIRP Total (dBm)	EIRP Limit (dBm)
2402.0	H	76.0	95	-19.0	36
	V	77.3	95	-17.7	36
2441.0	H	80.5	95	-14.5	36
	V	79.3	95	-15.7	36
2480.0	H	79.5	95	-15.5	36
	V	75.5	95	-19.5	36

CHECKED BY: Richard King
page 23 of 38

ELITE ELECTRONIC ENGINEERING Inc.

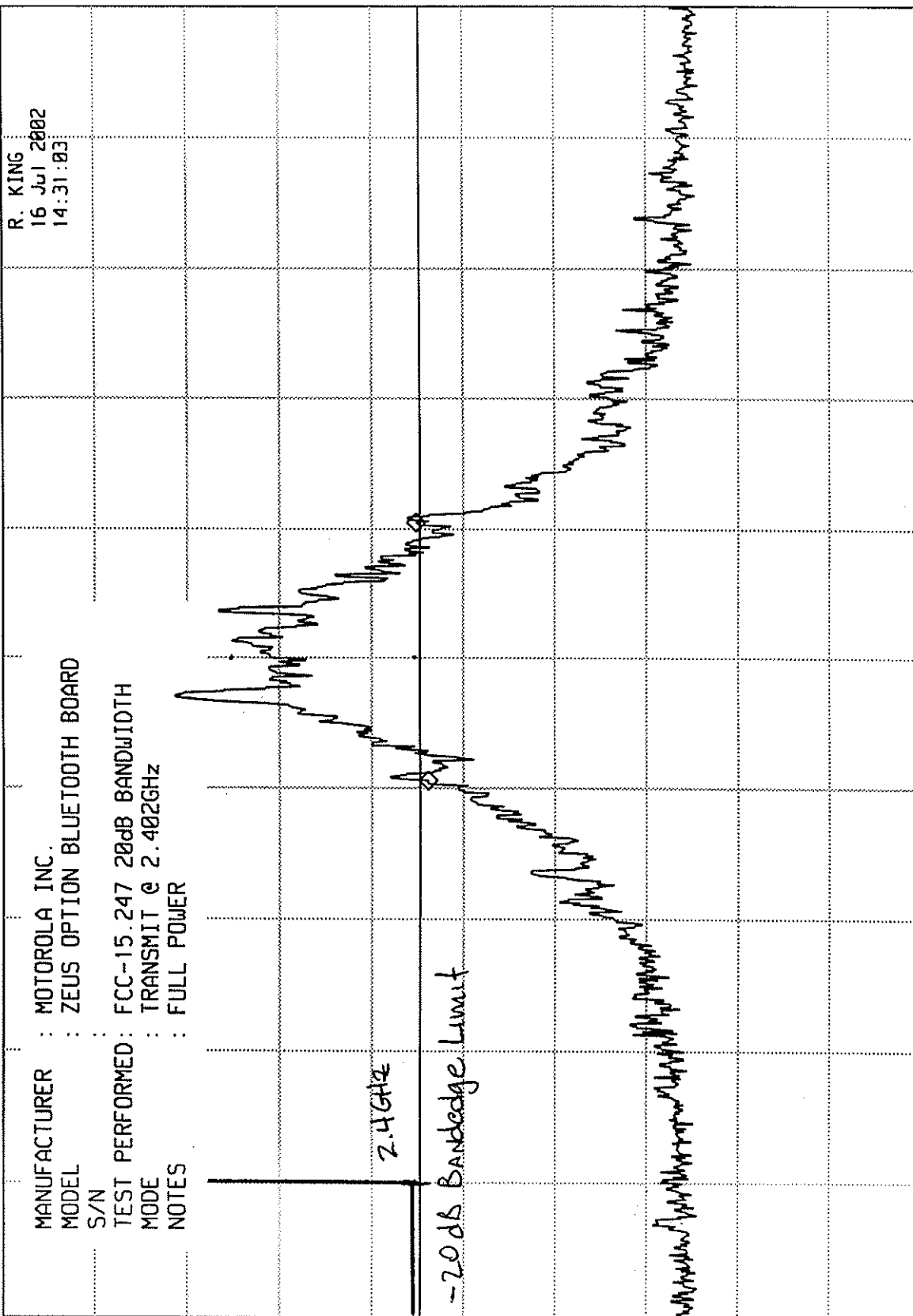
MKR ^ 995 kHz
1.30 dB

hp

10 dB/

DL -55.3
dBm

REF -10.0 dBm ATTN 10 dB



SPAN 5.00 MHz
SWP 375 msec

VBW 100 kHz

CENTER 2.402 00 GHz
RES BW 10 kHz(i)

ELITE ELECTRONIC ENGINEERING Inc.

MRK 2.479 83 GHz
100.40 dBuV

hp

REF 117.0 dBuV

ATTEN 20 dB

10 dB/

MANUFACTURER

: MOTOROLA INC.

MODEL

: ZEUS OPTION BLUETOOTH BOARD

S/N

TEST PERFORMED:

FCC-15.247(C) BAND-EDGE COMPLIANCE

MODE

: TRANSMIT @ 2.480GHz

NOTES

: MARKER DELTA METHOD

R. KING

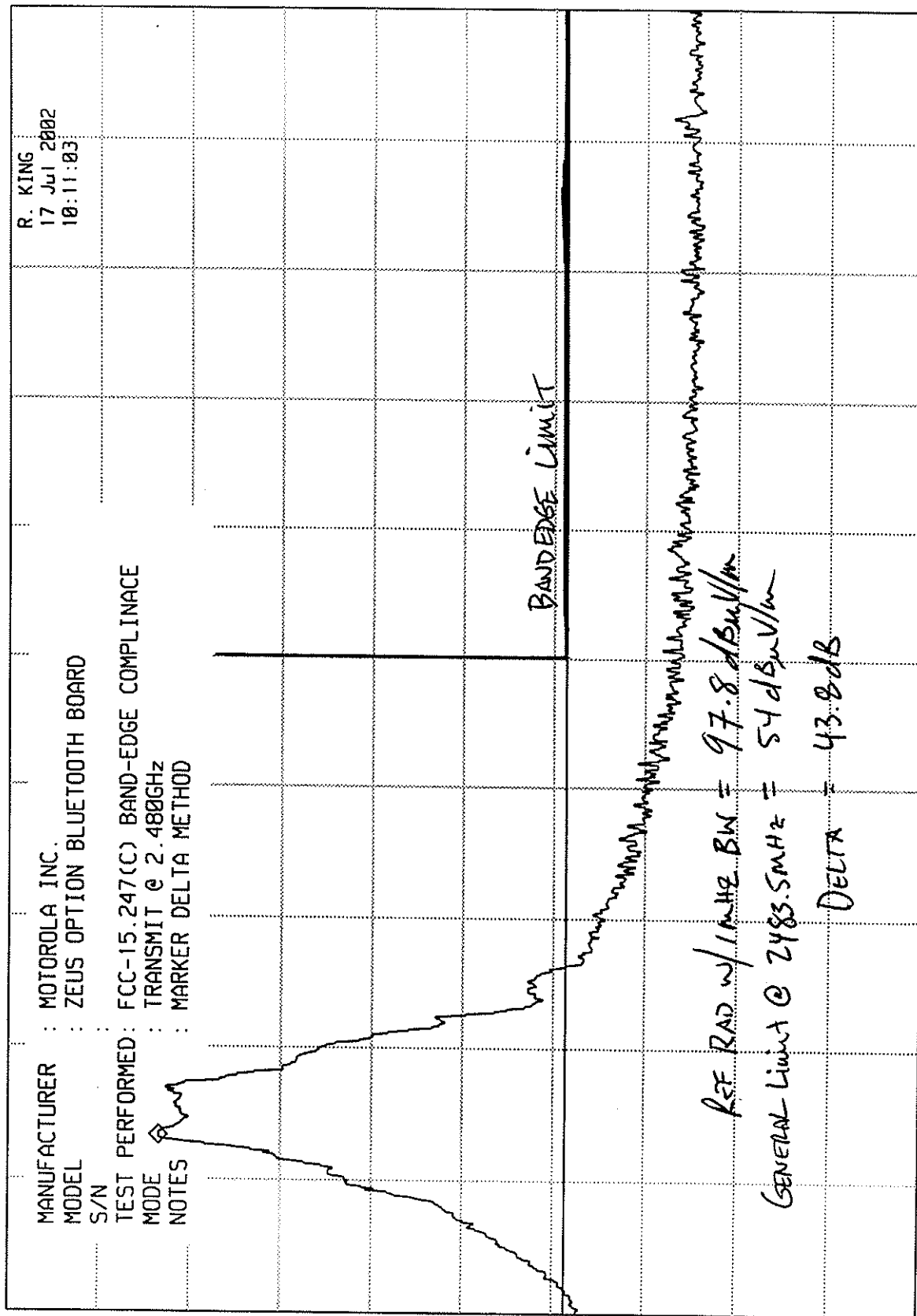
17 Jul 2002

10:11:03

DL

55.6
dBuV

ETR 31197-01



CENTER 2.483 5 GHz

RES BW 100 kHz (i)

UBW 1 MHz

SPAN 10.0 MHz

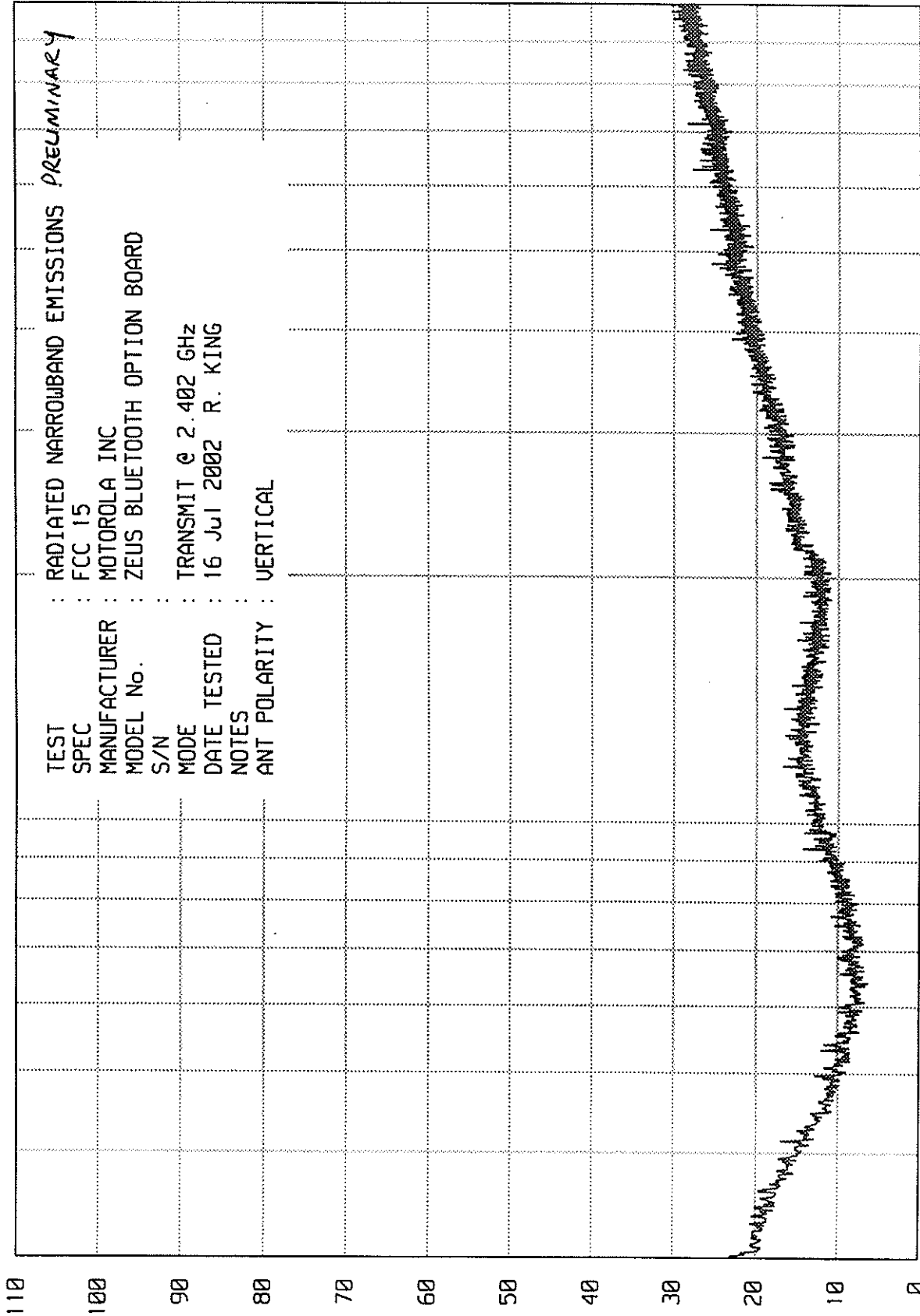
SWP 20.0 msec

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UKA00 06/18/02

UNITU_EM RUN RUN 5



RADIATED NARROWBAND EMISSIONS - dBuV/m

Page 26 of 38

START = 30

FREQUENCY - MHz

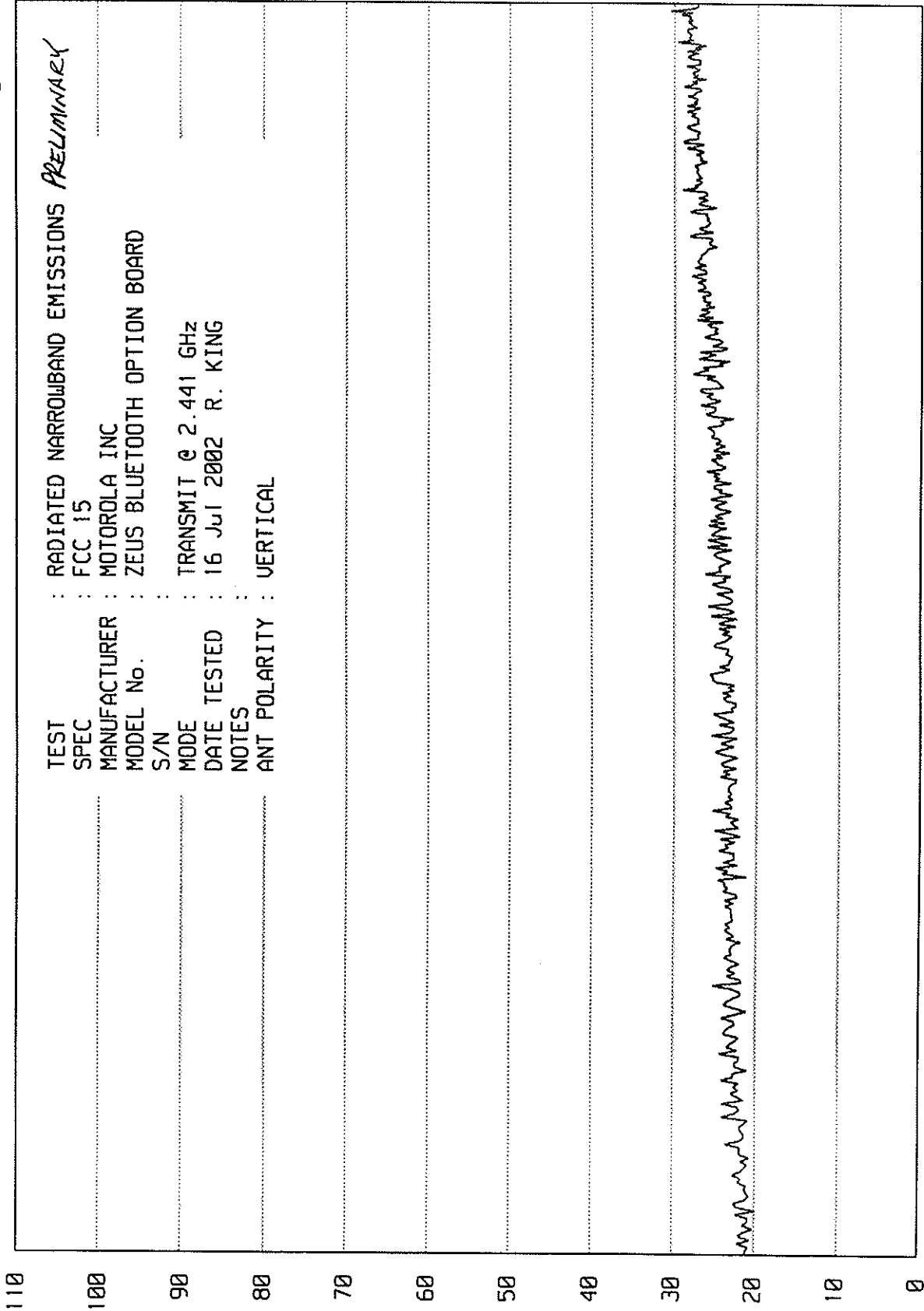
STOP = 1000

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UK98 06/18/82

UNITU_EM RUN RUN 6



RADIATED NARROWBAND EMISSIONS - dBu/m

Page 27 of 38

START = 1000

FREQUENCY - MHz

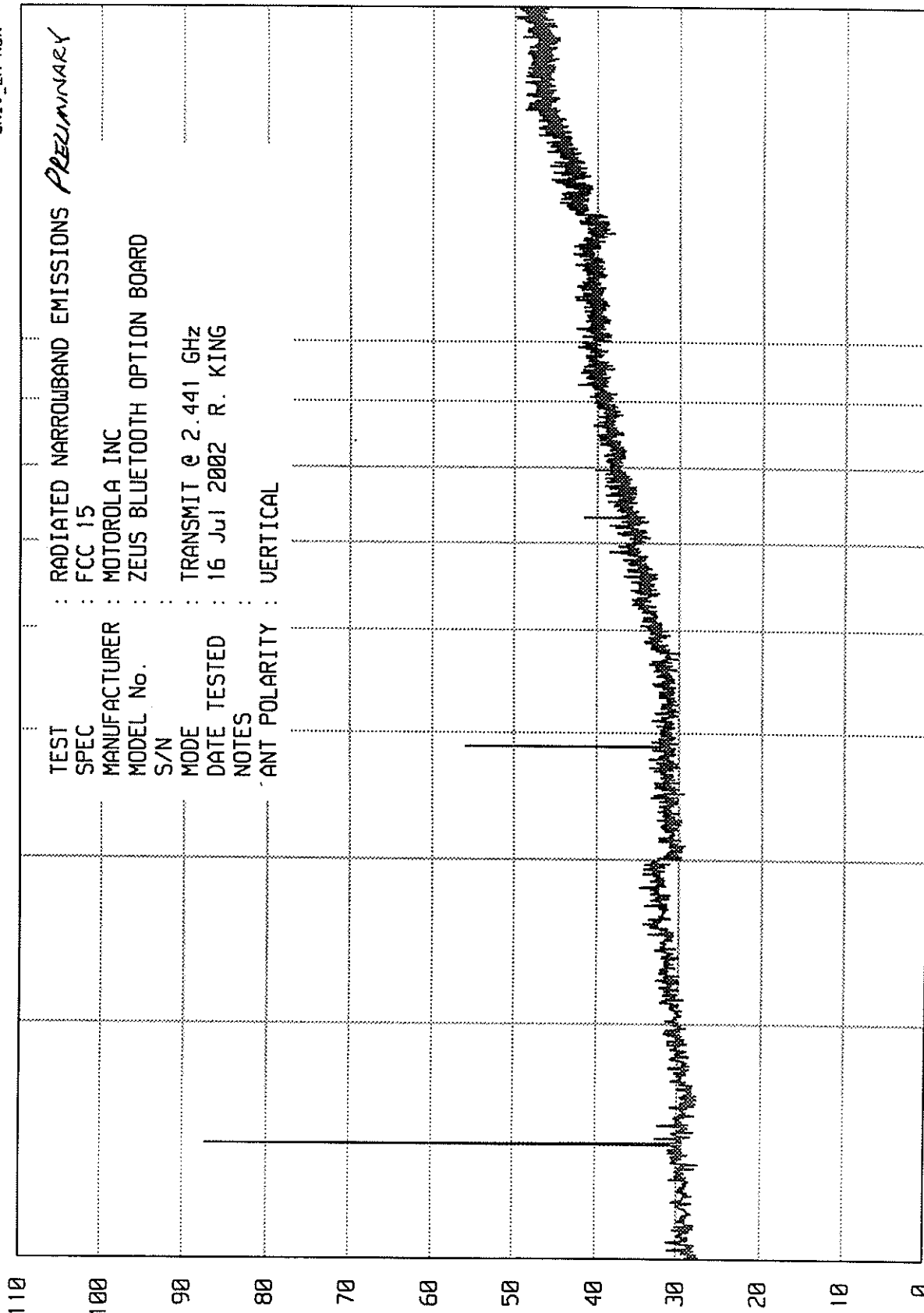
STOP = 2000

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

WKA0 06/18/02

UNIU_EM RUN RUN 7



RADIATED NARROWBAND EMISSIONS - dBu/m

Page 28 of 38

START = 2000

FREQUENCY - MHz

10000

STOP = 18000

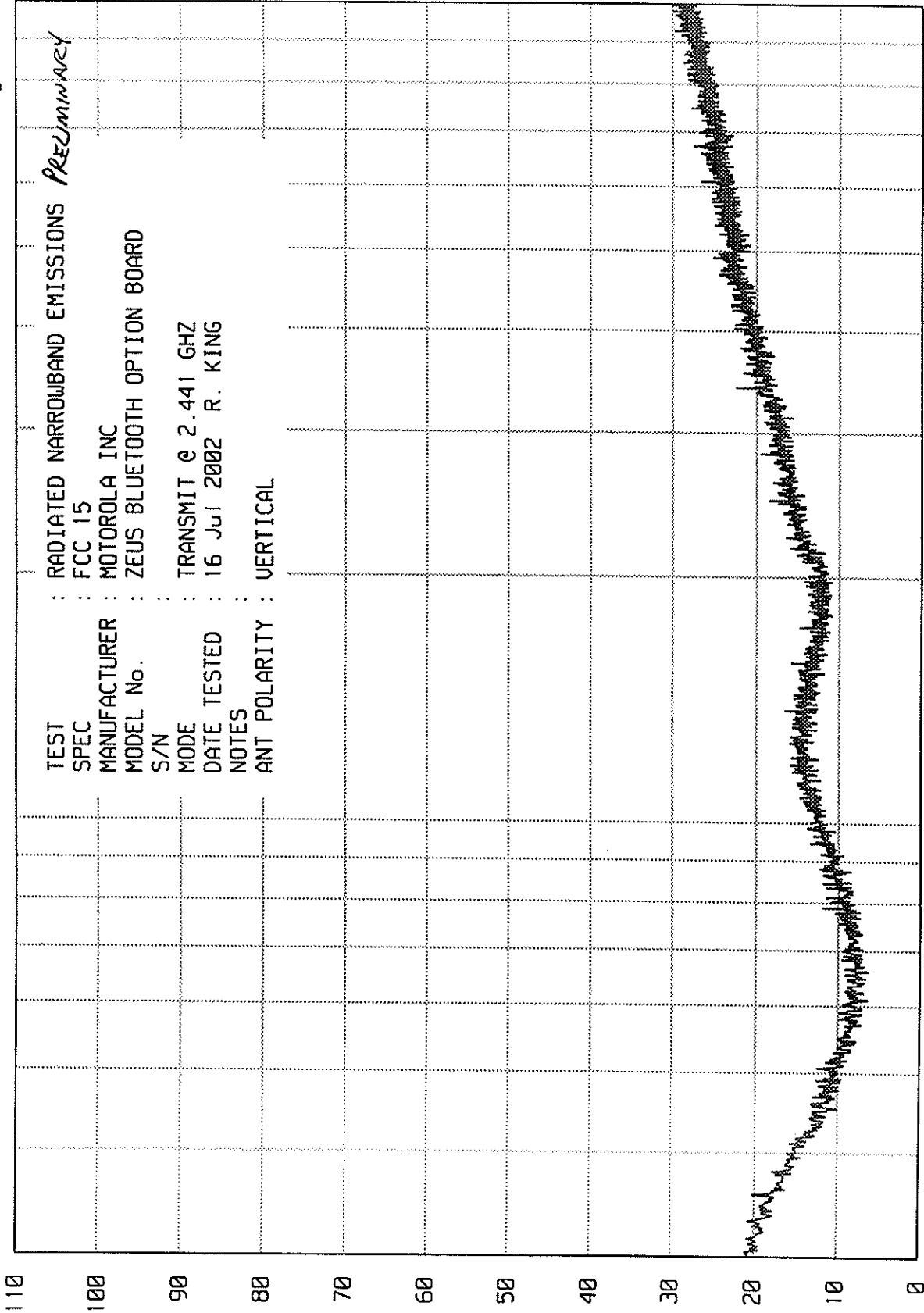
ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

WKA08 06/18/02

UNITV_EM RUN RUN 5

TEST : RADIATED NARROWBAND EMISSIONS *PRELIMINARY*
SPEC : FCC 15
MANUFACTURER : MOTOROLA INC
MODEL No. : ZEUS BLUETOOTH OPTION BOARD
S/N :
MODE : TRANSMIT @ 2.441 GHZ
DATE TESTED : 16 Jul 2002 R. KING
NOTES :
ANT POLARITY : VERTICAL



RADIATED NARROWBAND EMISSIONS - dBu/m

Page 29 of 38

START = 30

FREQUENCY - MHz

100

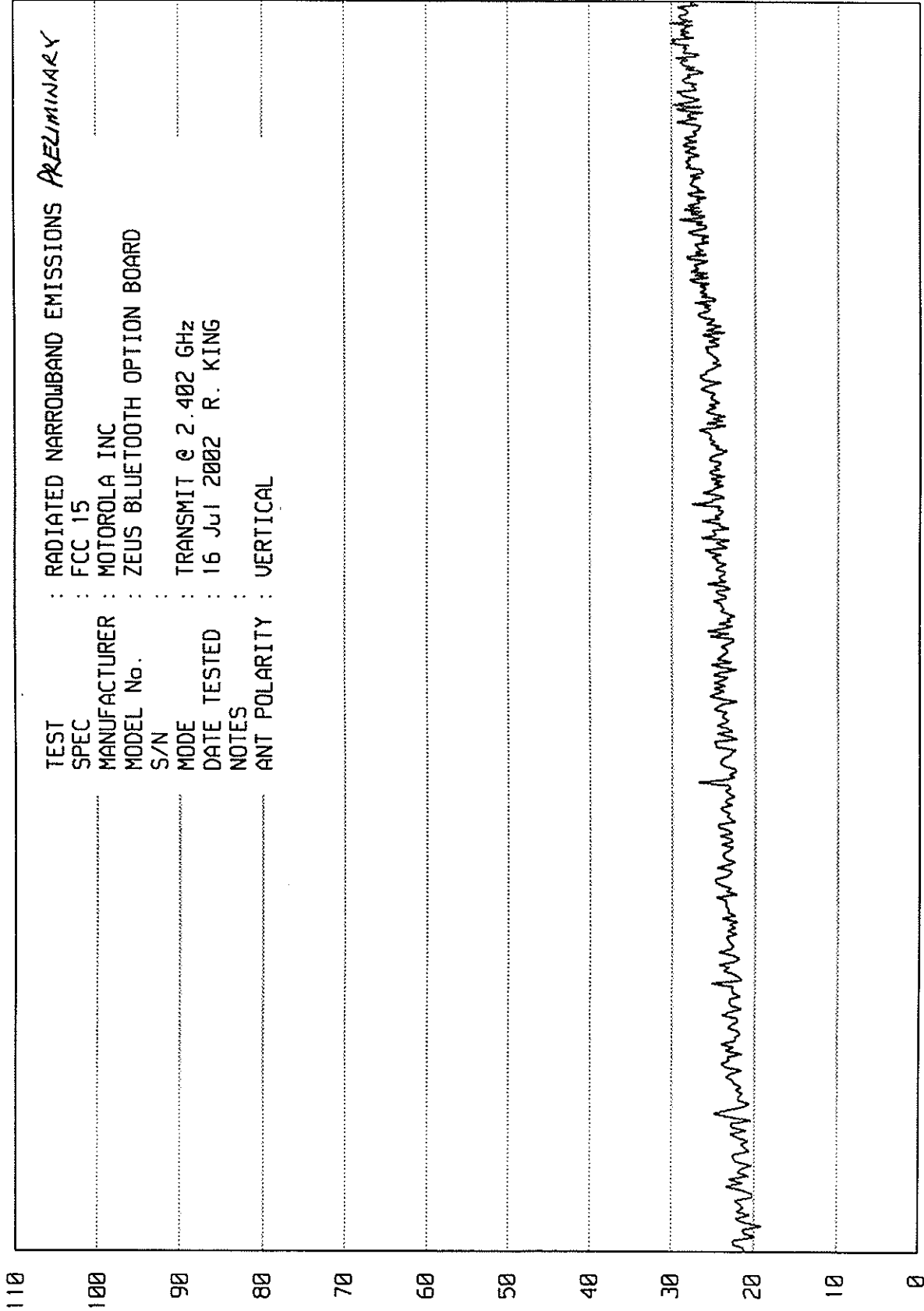
STOP = 1000

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UKA00 06/18/02

UNIT EM RUN RUN 4



RADIATED NARROWBAND EMISSIONS - dBu/m

Page 30 of 38

START = 1000

FREQUENCY - MHz

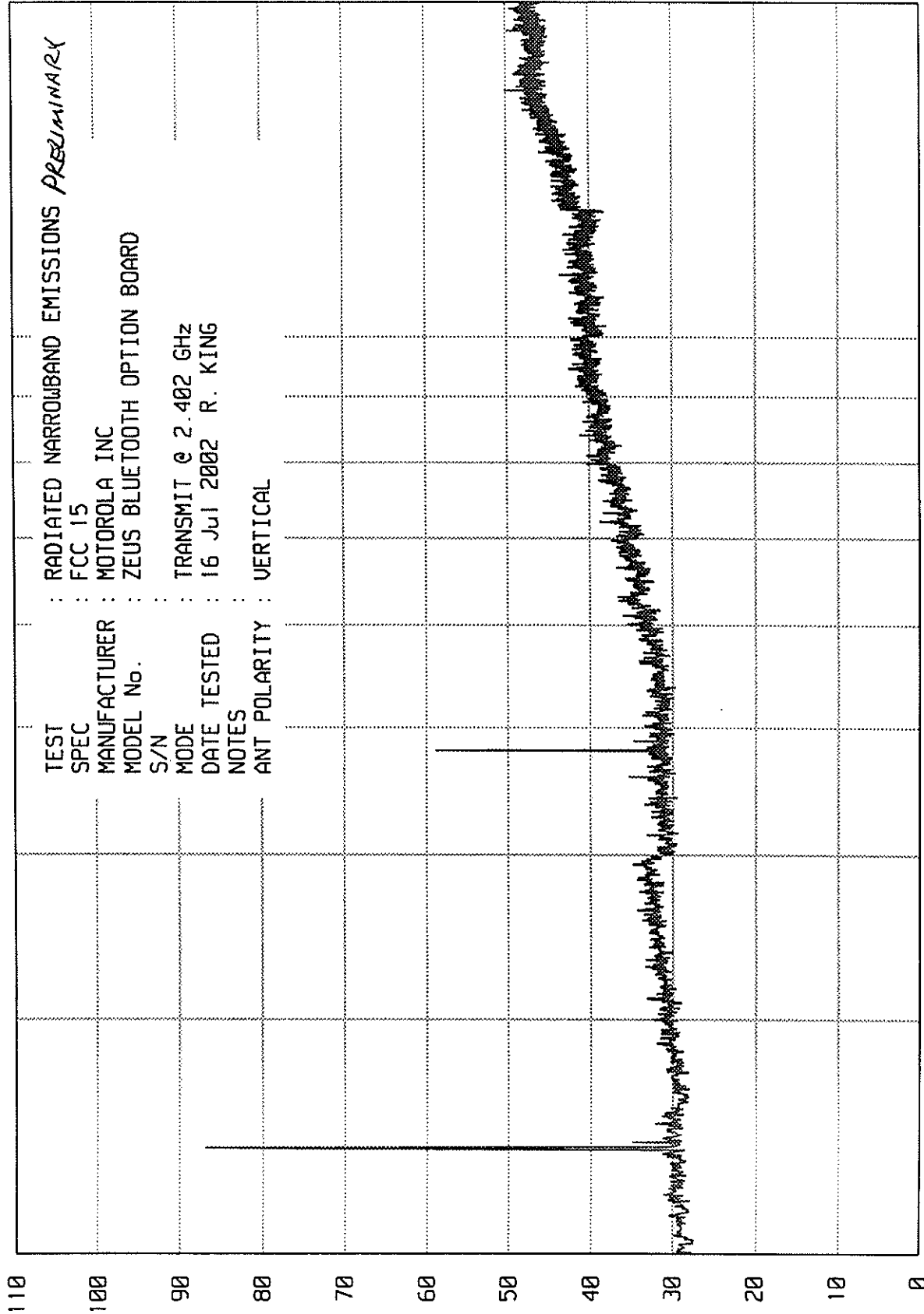
STOP = 2000

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIT_ EM RUN RUN 7

UKA00 06/18/02



TEST : RADIATED NARROWBAND EMISSIONS *PRELIMINARY*
SPEC : FCC 15
MANUFACTURER : MOTOROLA INC
MODEL No. : ZEUS BLUETOOTH OPTION BOARD
S/N :
MODE : TRANSMIT @ 2.402 GHz
DATE TESTED : 16 Jul 2002 R. KING
NOTES :
ANT POLARITY : VERTICAL

RADIATED NARROWBAND EMISSIONS - dBu/m

Page 31 of 38

START = 2000

FREQUENCY - MHz

10000

STOP = 18000

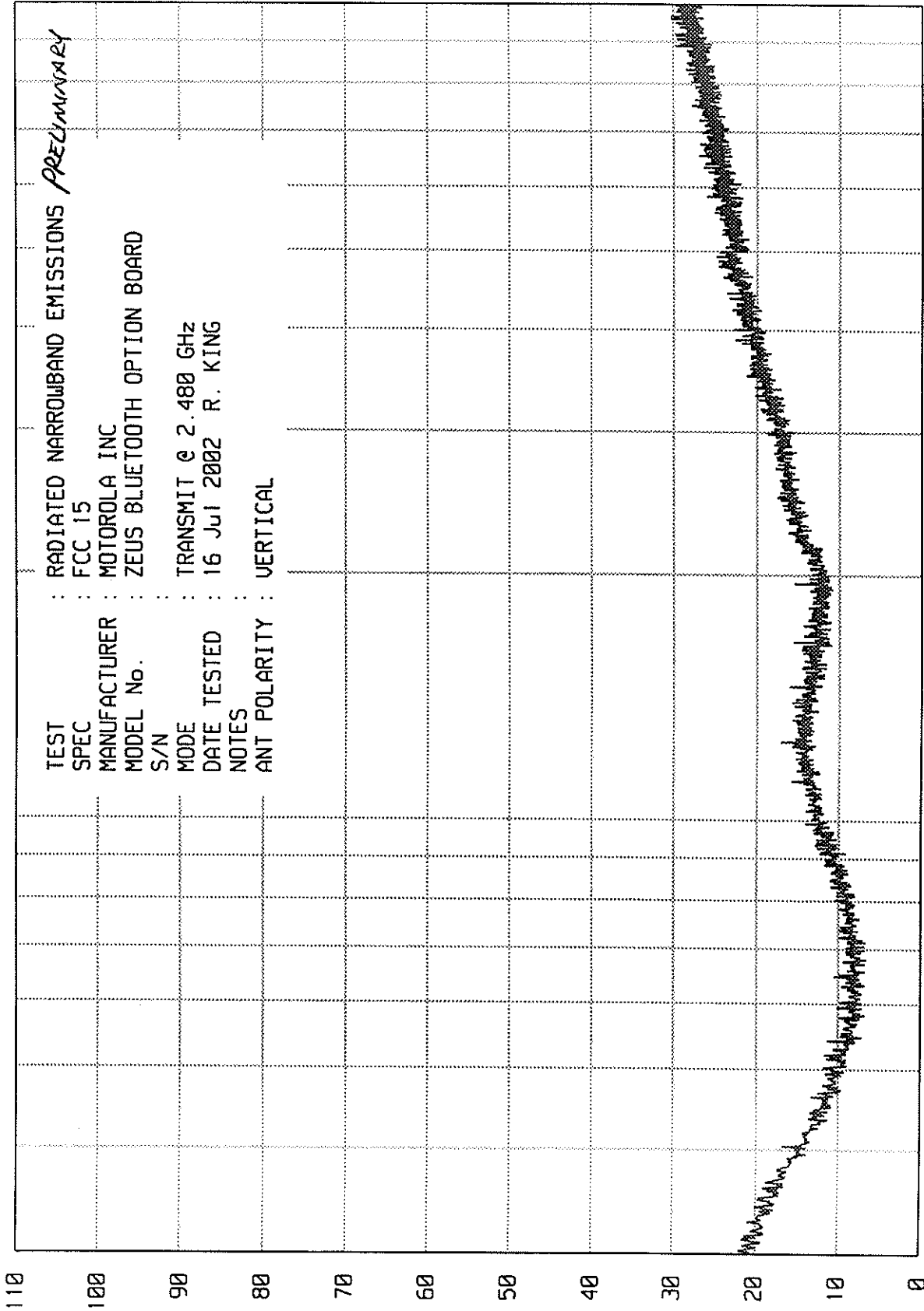
ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

WKA08 06/18/02

UNITU_EM RUN RUN 5

TEST : RADIATED NARROWBAND EMISSIONS *PRELIMINARY*
SPEC : FCC 15
MANUFACTURER : MOTOROLA INC
MODEL No. : ZEUS BLUETOOTH OPTION BOARD
S/N :
MODE : TRANSMIT @ 2.480 GHz
DATE TESTED : 16 Jul 2002 R. KING
NOTES :
ANT POLARITY : VERTICAL



RADIATED NARROWBAND EMISSIONS - dBuV/m

Page 32 to 38

START = 30

FREQUENCY - MHz

100

STOP = 1000

ELITE ELECTRONIC ENGINEERING INC.

Downers Grove, Ill. 60515

UNIV_EM RUN RUN 6

WKA0 06/18/02

110

TEST	:	RADIATED NARROWBAND EMISSIONS	PRELIMINARY
SPEC	:	FCC 15	
MANUFACTURER	:	MOTOROLA INC	
MODEL No.	:	ZEUS BLUETOOTH OPTION BOARD	
S/N	:		
MODE	:	TRANSMIT @ 2.480 GHz	
DATE TESTED	:	16 Jul 2002	R. KING
NOTES	:		
ANT POLARITY	:	VERTICAL	

PRELIMINARY

RADIATED NARROWBAND EMISSIONS - dBuV/m

Page 33 of 38

START = 1000

FREQUENCY - MHZ

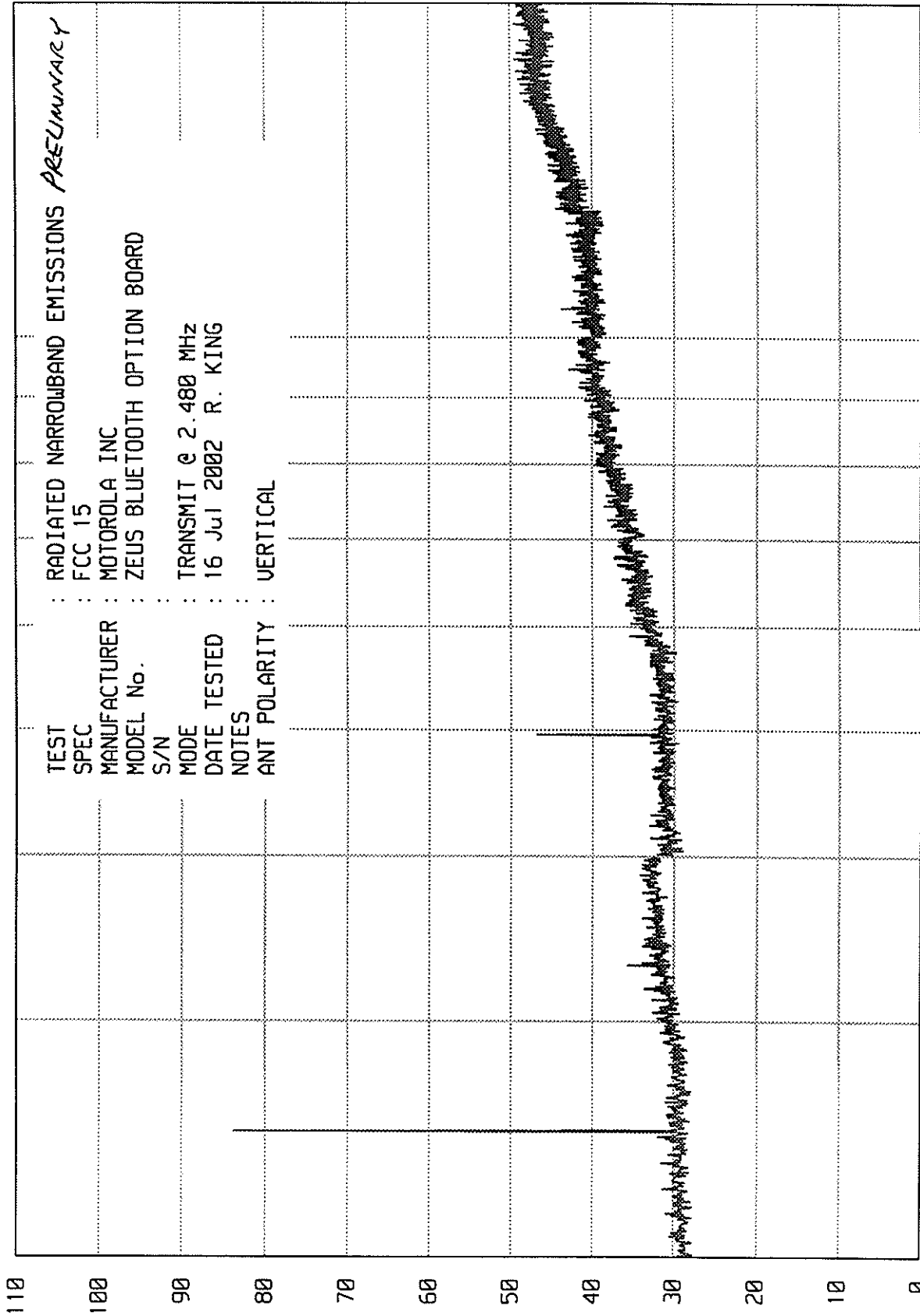
STOP = 2000

ELITE ELECTRONIC ENGINEERING Inc.

Dawners Grove, Ill. 60515

UNIT EM RUN RUN 7

UKA00 06/18/02



RADIATED NARROWBAND EMISSIONS - dBu/m

Page 34 of 38

START = 2000

FREQUENCY - MHz

10000

STOP = 18000

ETD 31197-01



ETR No. 31197-01
DATA SHEET

RADIATED EMISSION MEASUREMENTS IN A 3m ANECHOIC ROOM

SPECIFICATION : FCC-15C (15.247)
MANUFACTURER : MOTOROLA
MODEL NO. : ZEUS OPTION BLUETOOTH BOARD
SERIAL NO. : NONE ASSIGNED
NOTES : TRANSMIT AT LOW CHANNEL 2.402GHz
TEST DATE : July 16, 2002
TEST DISTANCE : 3m

FREQ	ANT	MTR			ANT	CABLE	PRE	TOTAL	TOTAL	LIMIT
MHz	POL	RDG dBuV		BW	FAC	LOSS	AMP	dBuV/m	uV/m	uV
2402.0	H	76.0		1M/3M	31.1	0.6	36.6	71.1	3589.2	
	V	77.3		1M/3M	31.1	0.6	36.6	72.4	4168.7	
2402.0	H	41.2		1M/10	31.1	0.6	36.6	36.3	65.3	
	V	41.0		1M/10	31.1	0.6	36.6	36.1	63.8	
4804.0	H	39.6		1M/10	35.1	0.8	36.3	39.2	91.2	500.0
	V	42.1		1M/10	35.1	0.8	36.3	41.7	121.3	500.0
12010.0	H	33.5	AMB	1M/10	41.4	1.5	36.2	40.2	102.3	500.0
	V	33.5	AMB	1M/10	41.4	1.5	36.2	40.2	102.3	500.0
19216.0	H	8.7	AMB	1M/10	40.3			49.0	281.8	500.0
	V	8.7	AMB	1M/10	40.3			49.0	281.8	500.0

CHECKED BY:

Richard King



ETR No. 31197-01
DATA SHEET

RADIATED EMISSION MEASUREMENTS IN A 3m ANECHOIC ROOM

SPECIFICATION : FCC-15C (15.247)
MANUFACTURER : MOTOROLA
MODEL NO. : ZEUS OPTION BLUETOOTH BOARD
SERIAL NO. : NONE ASSIGNED
NOTES : TRANSMIT AT MIDDLE CHANNEL 2.441GHz
TEST DATE : July 16, 2002
TEST DISTANCE : 3m

FREQ	ANT	MTR			ANT	CABLE	PRE	TOTAL	TOTAL	LIMIT
MHz	POL	RDG dBuV		BW	FAC	LOSS	AMP	dBuV/m	uV/m	uV
2441.0	H	80.5		1M/3M	31.1	0.6	36.6	75.6	6025.6	
	V	79.3		1M/3M	31.1	0.6	36.6	74.4	5248.1	
2441.0	H	57.8		1M/10	31.1	0.6	36.6	52.9	441.6	
	V	46.4		1M/10	31.1	0.6	36.6	41.5	118.3	
4882.0	H	45.2	AMB	1M/10	35.2	0.8	36.3	44.9	175.8	500.0
	V	37.6	AMB	1M/10	35.2	0.8	36.3	37.3	73.3	500.0
7323.0	H	33.8	AMB	1M/10	38.0	1.2	36.3	36.7	68.4	500.0
	V	29.3	AMB	1M/10	38.0	1.2	36.3	32.2	40.7	500.0
12205.0	H	33.3	AMB	1M/10	41.4	1.5	36.2	40.0	100.0	500.0
	V	33.3	AMB	1M/10	41.4	1.5	36.2	40.0	100.0	500.0
19528.0	H	9.1	AMB	1M/10	40.3			49.4	295.1	500.0
	V	9.1	AMB	1M/10	40.3			49.4	295.1	500.0

CHECKED BY: Richard King



ETR No. 31197-01
DATA SHEET

RADIATED EMISSION MEASUREMENTS IN A 3m ANECHOIC ROOM

SPECIFICATION : FCC-15C (15.247)
MANUFACTURER : MOTOROLA
MODEL NO. : ZEUS OPTION BLUETOOTH BOARD
SERIAL NO. : NONE ASSIGNED
NOTES : TRANSMIT AT HIGH CHANNEL 2.480GHz
TEST DATE : July 16, 2002
TEST DISTANCE : 3m

FREQ	ANT	MTR			ANT	CABLE	PRE	TOTAL	TOTAL	LIMIT
MHz	POL	RDG dBuV		BW	FAC	LOSS	AMP	dBuV/m	uV/m	uV
2480.0	H	79.5		1M/3M	31.8	0.6	36.6	75.3	5821.0	
	V	75.5		1M/3M	31.8	0.6	36.6	71.3	3672.8	
2480.0	H	43.5		1M/10	31.8	0.6	36.6	39.3	92.3	
	V	43.4		1M/10	31.8	0.6	36.6	39.2	91.2	
4960.0	H	42.1		1M/10	35.2	0.8	36.3	41.8	123.0	500.0
	V	41.7		1M/10	35.2	0.8	36.3	41.4	117.5	500.0
7440.0	H	33.1	AMB	1M/10	38.0	1.2	36.3	36.0	63.1	500.0
	V	32.7	AMB	1M/10	38.0	1.2	36.3	35.6	60.3	500.0
12400.0	H	34.5	AMB	1M/10	41.4	1.5	36.2	41.2	114.8	500.0
	V	34.5	AMB	1M/10	41.4	1.5	36.2	41.2	114.8	500.0
19840.0	H	8.9	AMB	1M/10	40.3			49.2	288.4	500.0
	V	8.8	AMB	1M/10	40.3			49.1	285.1	500.0
22320.0	H	6.4	AMB	1M/10	40.4			46.8	218.8	500.0
	V	6.5	AMB	1M/10	40.4			46.9	221.3	500.0

CHECKED BY: Richard King

page 37 of 38

ELITE ELECTRONIC ENGINEERING Inc.

MKR 2.440 846 GHz
64.30 dBuV

hp

REF 117.0 dBuV

ATTEN 20 dB

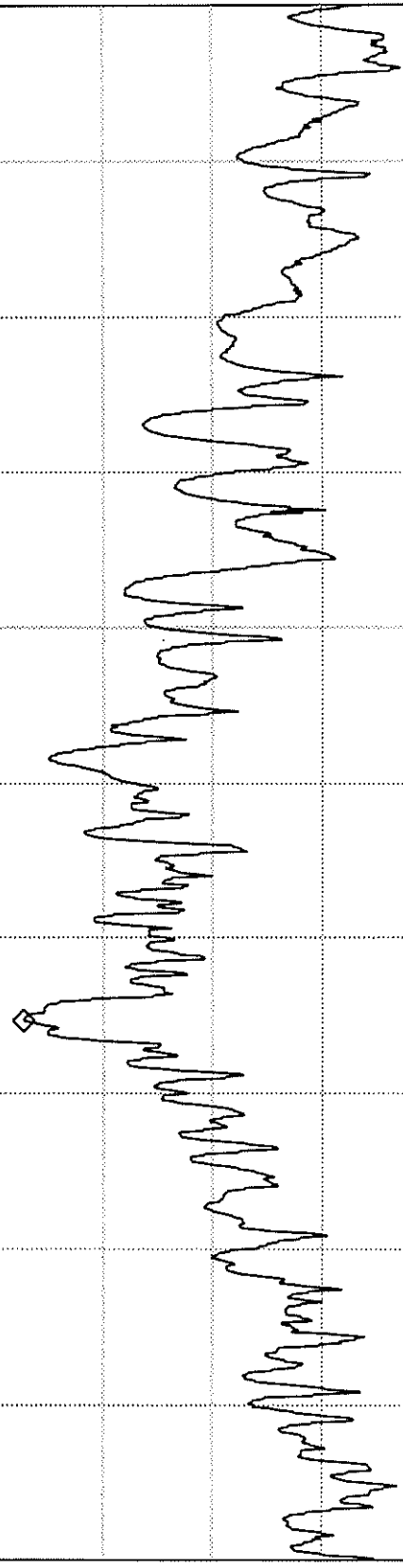
10 dB/

MANUFACTURER : MOTORLA INC.
MODEL : ZEUS OPTION BLUETOOTH BOARD
S/N :
TEST PERFORMED : FCC-15247 POWER SPECTRAL DENSITY
MODE : AQUISITION
NOTES : FULL POWER

R. KING
18 Jul 2002
09:47:14

8dBm Limit

ETR 31197-01



CENTER 2.441 00 GHz

RES BW 3 kHz(i)

VBW 30 kHz

SPAN 1.00 MHz

SWP 333 sec