

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

ELITE PROJECT: 31521

DATES TESTED: October 28 through  
November 1, 2002

TEST PERSONNEL: Richard E. King EMC Engineer

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. 31521-01

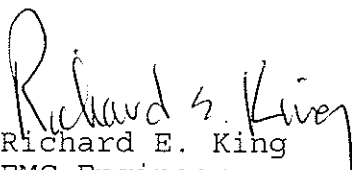
MEASUREMENTS OF RF EMISSIONS

FROM THE MODEL BT0206AH09 IN-VEHICLE BLUETOOTH MODULE


FOR: Motorola  
Rolling Meadows, Illinois

PURCHASE ORDER NO.: NP551155

Report By:

  
Richard E. King  
EMC Engineer

Approved By:

  
Raymond J. Klouda  
Registered Professional  
Engineer of Illinois - 44894

ADMINISTRATIVE DATA AND SUMMARY OF TESTS

DESCRIPTION OF TEST ITEM: Frequency Hopping Spread Spectrum  
Transmitter

MODEL NO. : BT0206AH09 SERIAL NO.: 00E00C4934A3

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: October 28 through November 1, 2002

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

WITNESS: No Motorola personnel were present during the testing.

ELITE ELECTRONIC: Richard E. King

ELITE JOB NO.: 31521

ABSTRACT: The model BT0206AH09 In-vehicle Bluetooth Module 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, antenna conducted and radiated spurious emissions and power spectral density were measured and found to comply with the requirements.

See the test results and data pages for more details.

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MEASUREMENT OF RF EMISSIONS

FROM A IN-VEHICLE BLUETOOTH MODULE TRANSMITTER

1.0 INTRODUCTION:

1.1 DESCRIPTION OF TEST ITEM: This report presents the results of the RF emissions measurements performed for the model BT0206AH09 In-Vehicle Bluetooth Module spread spectrum transmitter, (hereinafter referred to as the test item). The tests were performed for Motorola located in Elk Grove Village, Illinois.

The test item is a frequency hopping spread spectrum transceiver used for in-vehicle bluetooth applications. 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 7.0VDC was supplied to the test item from a power supply. The test item is supplied with an external 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 receives 7.0VDC from the vehicle's power supply. 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. The output of the test item was connected to the spectrum

analyzer through a 20dB pad. 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 1.030MHz which is greater than the 20dB bandwidth (925kHz).

#### **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. The output of the test item was connected to the spectrum analyzer through a 20dB pad. 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. The output of the test item was connected to the spectrum analyzer through a 20dB pad. 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 set 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 330.0 usec burst every 101.4 msec's multiplied by a 30 second period. This calculated value is

equal to 0.097 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. The output of the test item was connected to the spectrum analyzer through a 20dB pad. 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 0.925 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:** The output of the test item was connected to the power meter through a 20dB pad. The maximum meter reading was recorded. The peak power output was calculated for the low, middle and

high hopping frequencies.

4.6.3 RESULTS: The results are presented on data page 23. The maximum antenna conducted output power measured from the transmitter was 8.8 dBm which meets the 30 dBm limit. The maximum EIRP measured from the transmitter was -2.6 dBm which meets the De Facto 36 dBm limit.

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 pages 24 through 27 show the band-edge compliance results using the marker-delta method. As can be seen from

this plots, the emissions at the band-edge in the restricted band are within the general limits.

#### 4.8 SPURIOUS EMISSIONS:

##### 4.8.1 ANTENNA CONDUCTED EMISSIONS

4.8.1.1 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.

4.8.1.2 PROCEDURES: The measuring equipment was connected to the test item's antenna port. The emissions in the frequency range from 30MHz to 18GHz were observed and plotted separately with the test item transmitting at 2402.0MHz, 2441.0MHz, and 2480.0MHz.

4.8.1.3 RESULTS: The results of the antenna conducted emissions levels were plotted. These plots are presented on Data Pages 28 through 36. This plot shows that the spurious emissions were at least 20 dB below the level of the fundamental.

##### 4.8.2 RADIATED SPURIOUS EMISSIONS:

4.8.2.1 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.

##### 4.8.2.2 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.

**4.8.2.3 RESULTS:** The preliminary emissions levels were plotted. These plots are presented on Data Pages 37 through 45. This plot shows that the spurious emissions were at least 20 dB below the level of the fundamental as transmitted through a -10dBi gain external antenna.

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 46 through 48. 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 output of the test item was connected to the power meter through a 20dB pad. The test item was put into inquiry 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 49 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 In-Vehicle Bluetooth Module 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. 31521-01

TABLE 1: TEST EQUIPMENT LIST

ELITE ELECTRONIC ENG. INC.

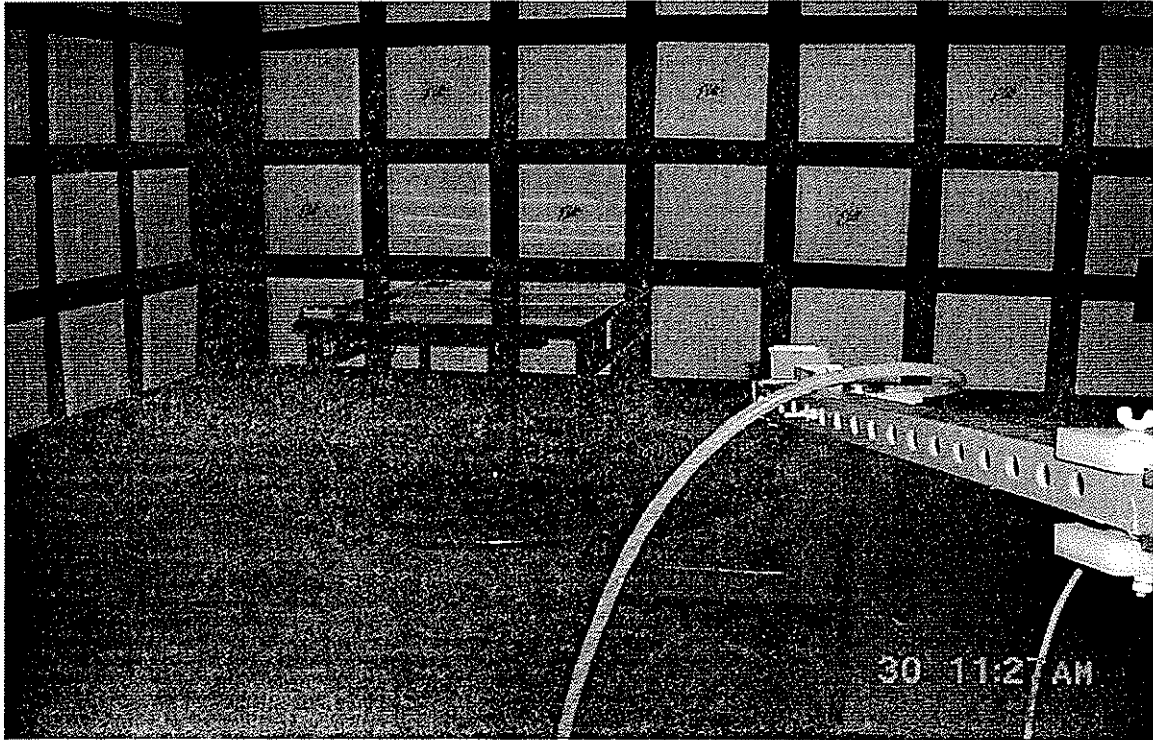
Page: 1

| Eq ID                                      | Equipment Description                | Manufacturer    | Model No.    | Serial No. | Frequency Range | Cal Date | Cal Inv | Due Date |
|--|--------------------------------------|-----------------|--------------|------------|-----------------|----------|---------|----------|
| Equipment Type: ACCESSORIES, MISCELLANEOUS |                                      |                 |              |            |                 |          |         |          |
| XZG0                                       | ATTENUATOR/SWITCH DRIVER             | HEWLETT PACKARD | 11713A       | 3439A02724 | ---             |          | N/A     |          |
| Equipment Type: AMPLIFIERS                 |                                      |                 |              |            |                 |          |         |          |
| APH0                                       | POWER AMPLIFIER                      | HEWLETT PACKARD | 11975A       | 2304A00322 | 2-8GHZ          |          | NOTE 1  |          |
| APK0                                       | PRE-AMPLIFIER                        | HEWLETT PACKARD | 8449B        | 3008A00662 | 1-26.5GHZ       | 02/22/02 | 12      | 02/22/03 |
| Equipment Type: ANTENNAS                   |                                      |                 |              |            |                 |          |         |          |
| NTA0                                       | BILOG ANTENNA                        | CHASE EMC LTD.  | BILOG CBL611 | 2057       | 0.03-2GHZ       | 06/25/02 | 12      | 06/25/03 |
| NW10                                       | RIDGED WAVE GUIDE                    | AEL             | H1498        | 153        | 2-18GHZ         | 08/09/02 | 12      | 08/09/03 |
| Equipment Type: ATTENUATORS                |                                      |                 |              |            |                 |          |         |          |
| T2D6                                       | 20DB, 25W ATTENUATOR - ESD WEINSCHEL |                 | 46-20-43     | AY9245     | DC-18GHZ        | 02/04/02 | 12      | 02/04/03 |
| Equipment Type: CONTROLLERS                |                                      |                 |              |            |                 |          |         |          |
| CDD2                                       | COMPUTER                             | HEWLETT PACKARD | D4171A#ABA   | US61654645 | ---             |          | N/A     |          |
| CDG1                                       | COMPUTER                             | HEWLETT PACKARD | D5893T       | US91465296 | ---             |          | N/A     |          |
| CDS0                                       | COMPUTER                             | GATEWAY         | MFATXPNT NMZ | 0028483109 | 1.8 GHZ         |          | N/A     |          |
| CMA0                                       | MULTI-DEVICE CONTROLLER              | EMCO            | 2090         | 9701-1213  | ---             |          | N/A     |          |
| Equipment Type: METERS                     |                                      |                 |              |            |                 |          |         |          |
| MAA0                                       | AC AMMETER                           | WESTON          | 904          | 14562      | 750MA           | 05/11/02 | 12      | 05/11/03 |
| MPAA                                       | THERMISTOR MOUNT                     | HEWLETT PACKARD | 8478B        | 1144A08340 | 0.01-18GHZ      | 09/04/02 | 12      | 09/04/03 |
| Equipment Type: PRINTERS AND PLOTTERS      |                                      |                 |              |            |                 |          |         |          |
| HRE1                                       | LASER JET 5P                         | HEWLETT PACKARD | C3150A       | USHB061052 | ---             |          | N/A     |          |
| HRG1                                       | LASERJET 2100XI                      | HEWLETT PACKARD | C4170A       | USCD047809 | ---             |          | N/A     |          |
| HRLO                                       | PRINTER LASERJET 2200D               | HEWLETT PACKARD | C7058A       | CNGRG86288 | ---             |          | N/A     |          |
| Equipment Type: RECEIVERS                  |                                      |                 |              |            |                 |          |         |          |
| RAC1                                       | SPECTRUM ANALYZER                    | HEWLETT PACKARD | 85660B       | 3407A08369 | 100HZ-22GHZ     | 01/18/02 | 12      | 01/18/03 |
| RACB                                       | RF PRESELECTOR                       | HEWLETT PACKARD | 85685A       | 3506A01491 | 20HZ-2GHZ       | 01/18/02 | 12      | 01/18/03 |
| RAE1                                       | SPECTRUM ANALYZER (DCC-CEM           | HEWLETT PACKARD | 85660A       | 2209A01336 | 100HZ-22GHZ     | 02/14/02 | 12      | 02/14/03 |
| RAF3                                       | QUASISPEAK ADAPTER                   | HEWLETT PACKARD | 85650A       | 3303A01775 | 0.01-1000MHZ    | 01/18/02 | 12      | 01/18/03 |
| =====                                      |                                      |                 |              |            |                 |          |         |          |
| Eq ID                                      | Equipment Description                | Manufacturer    | Model No.    | Serial No. | Frequency Range | Cal Date | Cal Inv | Due Date |
| RAH0                                       | FREQUENCY MIXER                      | HEWLETT PACKARD | 11970K       | 2332A00270 | 18-26GHZ        |          | N/A     |          |

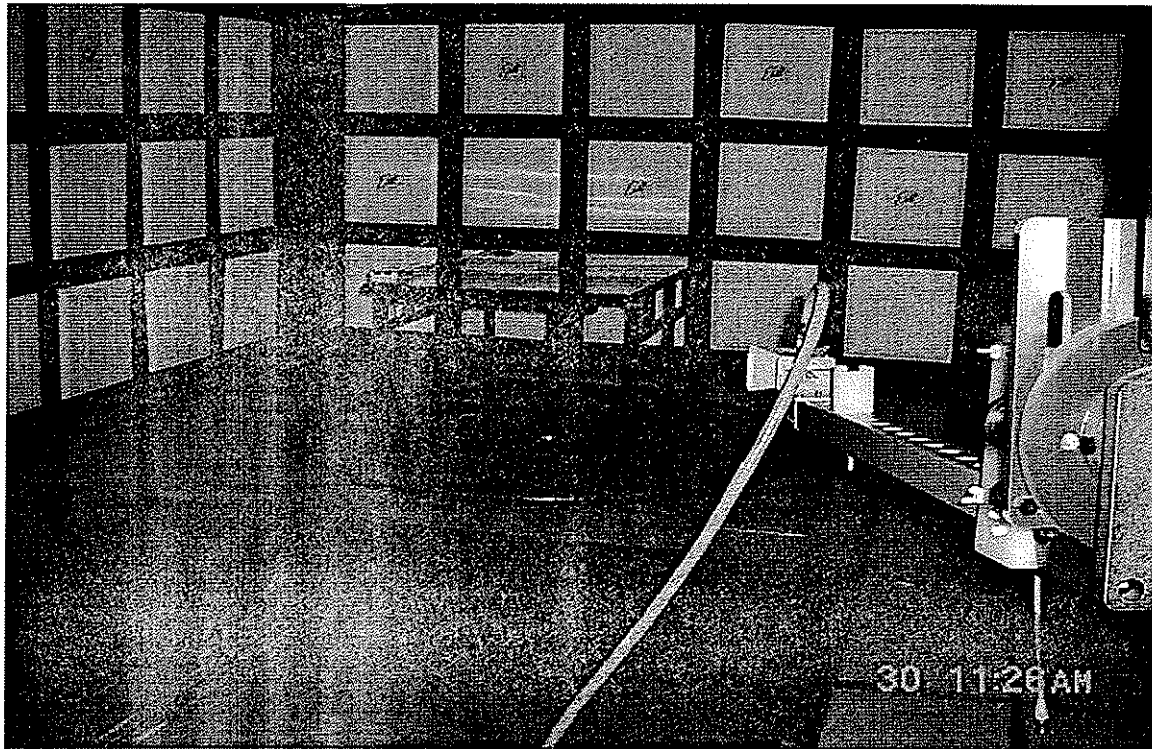
Cal. Interval: Listed in Months I/O: Initial Only N/A: Not Applicable

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 31521-01  
Figure 1



Radiated Emissions Worst Case Horizontal Polarization



Radiated Emissions Worst Case Vertical Polarization

ELITE ELECTRONIC ENGINEERING Inc.

MKR ^ 1.030 MHz  
0.00 dB

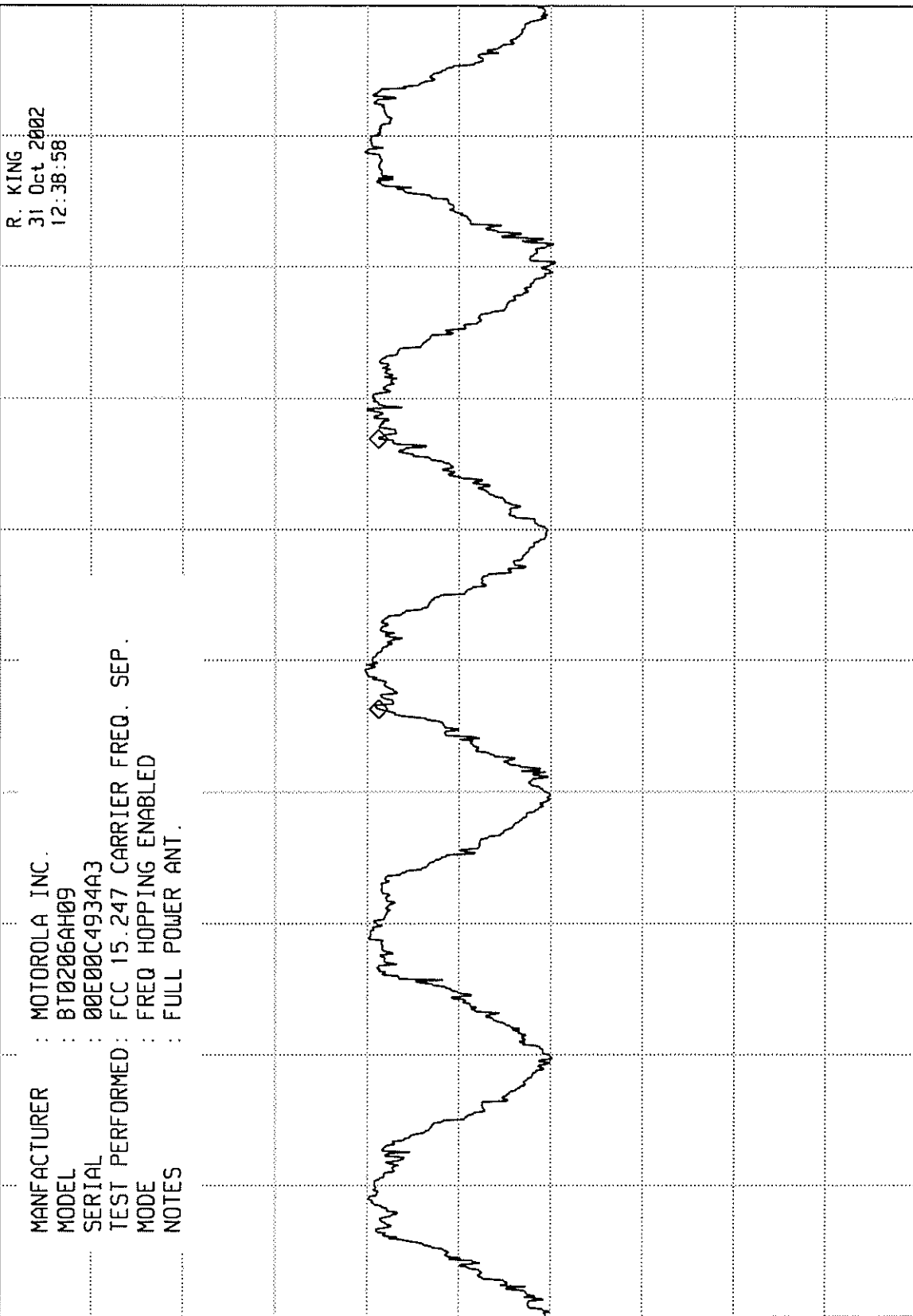
hp

REF 117.0 dBu

ATTEN 20 dB + 20dB ext.

10 dB/

MANUFACTURER : MOTOROLA INC.  
MODEL : BT0206AH09  
SERIAL : 00E00C4934A3  
TEST PERFORMED : FCC 15.247 CARRIER FREQ. SEP.  
MODE : FREQ HOPPING ENABLED  
NOTES : FULL POWER ANT.



CENTER 2.441 00 GHz

RES BW 100 kHz(i)

VBW 1 MHz

SPAN 5.00 MHz

SWP 20.0 msec

ELITE ELECTRONIC ENGINEERING Inc.

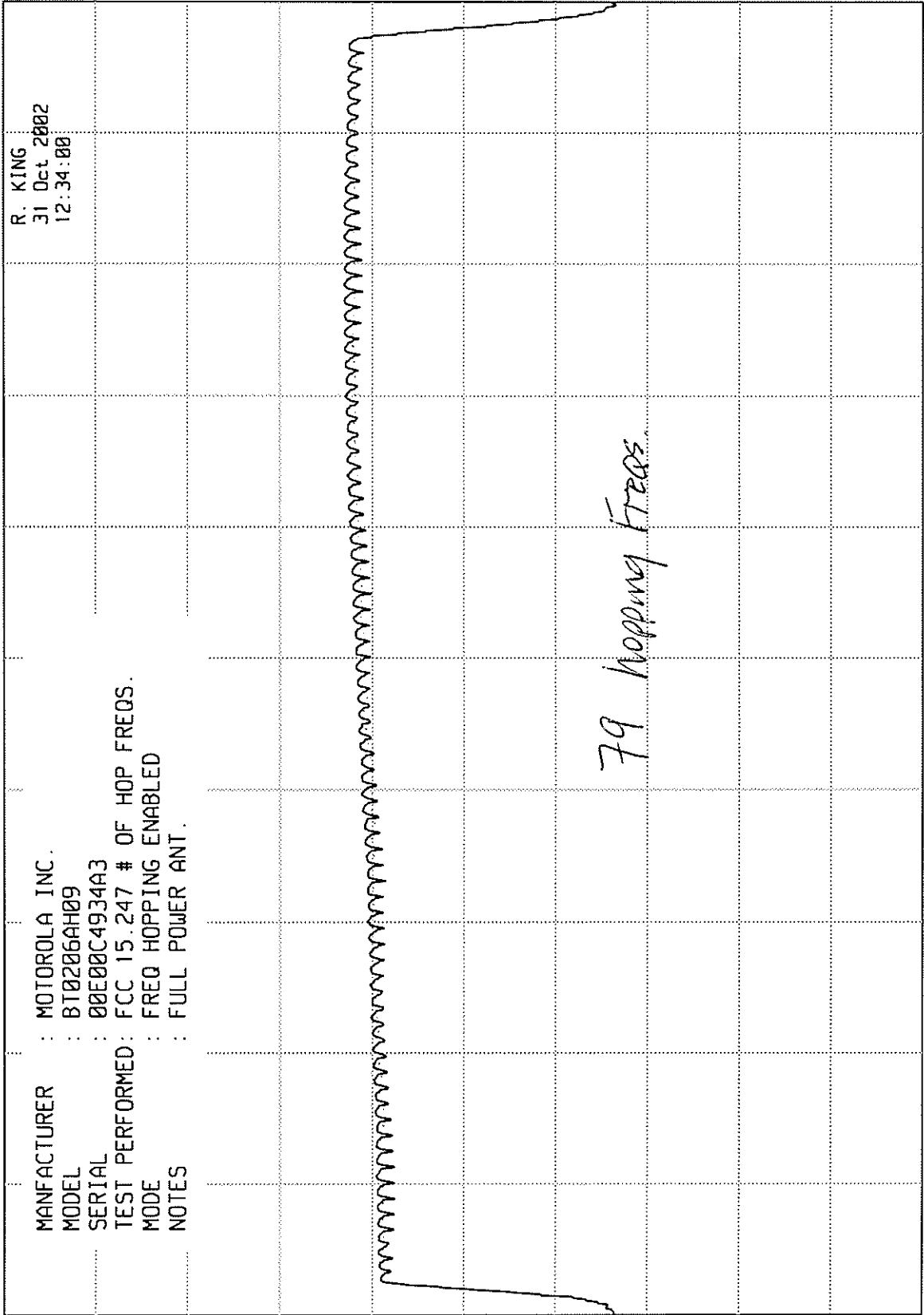
hp

REF 117.0 dBuV      ATTN 20 dB + 20 dB ext.

10 dB/

MANUFACTURER : MOTOROLA INC.  
MODEL : BT0206AH09  
SERIAL : 00E00C4934A3  
TEST PERFORMED : FCC 15.247 # OF HOP FREQS.  
MODE : FREQ HOPPING ENABLED  
NOTES : FULL POWER ANT.

R. KING  
31 Oct 2002  
12:34:00



START 2.400 0 GHz  
RES BW 1 MHz(i)

VBW 3 MHz

STOP 2.483 5 GHz  
SWP 20.0 msec



ELITE ELECTRONIC ENGINEERING Inc.

MKR ^ 101.4 msec  
0.00 dB

ATTEN 20 dB + 20dB ext.

REF 117.0 dBu

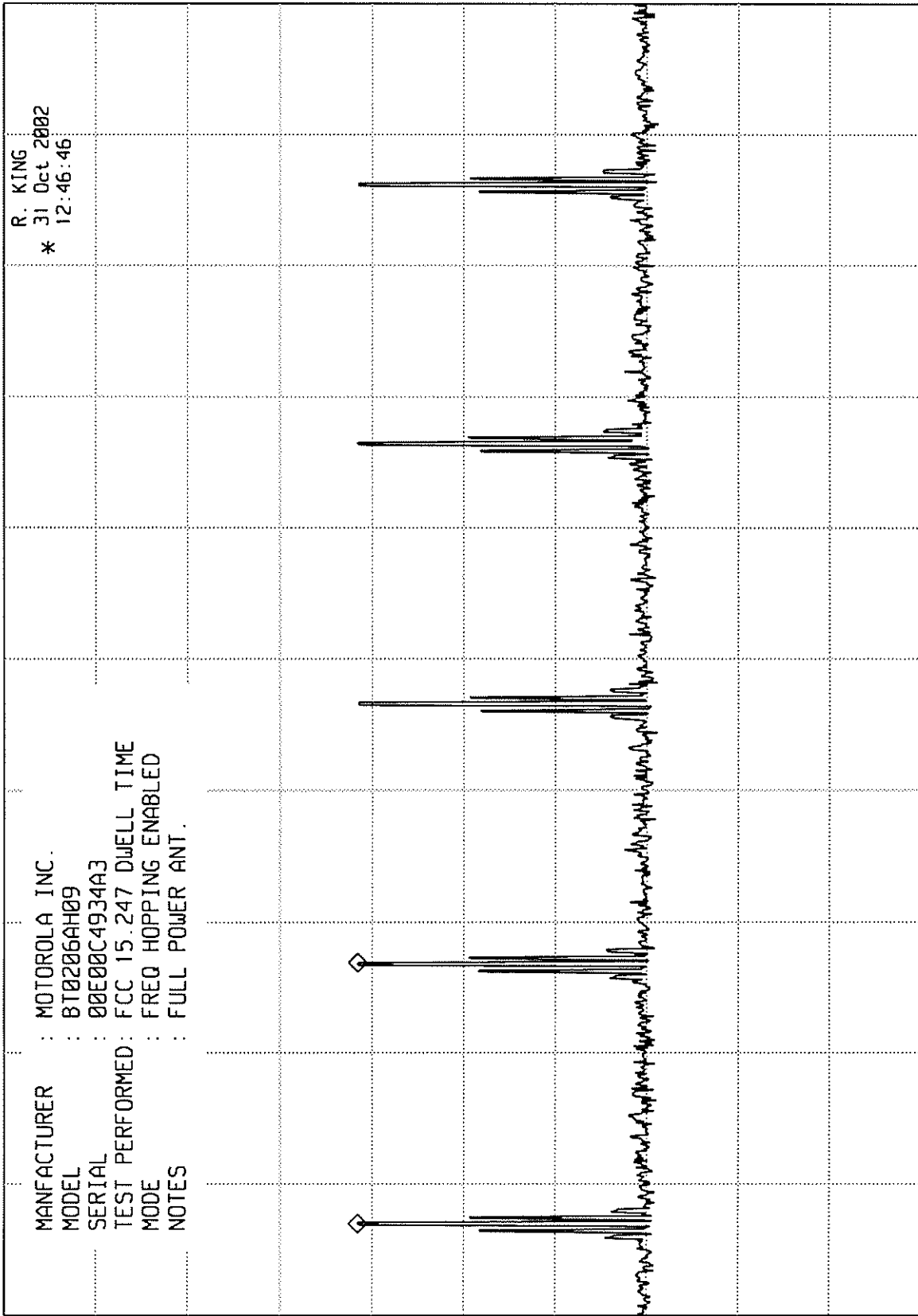
hp

10 dB/

MANUFACTURER : MOTOROLA INC.  
 MODEL : BT0206AH09  
 SERIAL : 00E00C4934A3  
 TEST PERFORMED : FCC 15.247 DWELL TIME  
 MODE : FREQ HOPPING ENABLED  
 NOTES : FULL POWER ANT.

R. KING  
 \* 31 Oct 2002  
 12:46:46

ETR 31S21-01



CENTER 2.41 000 000 GHz  
 RES BW 1 MHz(i)

VBW 3 MHz

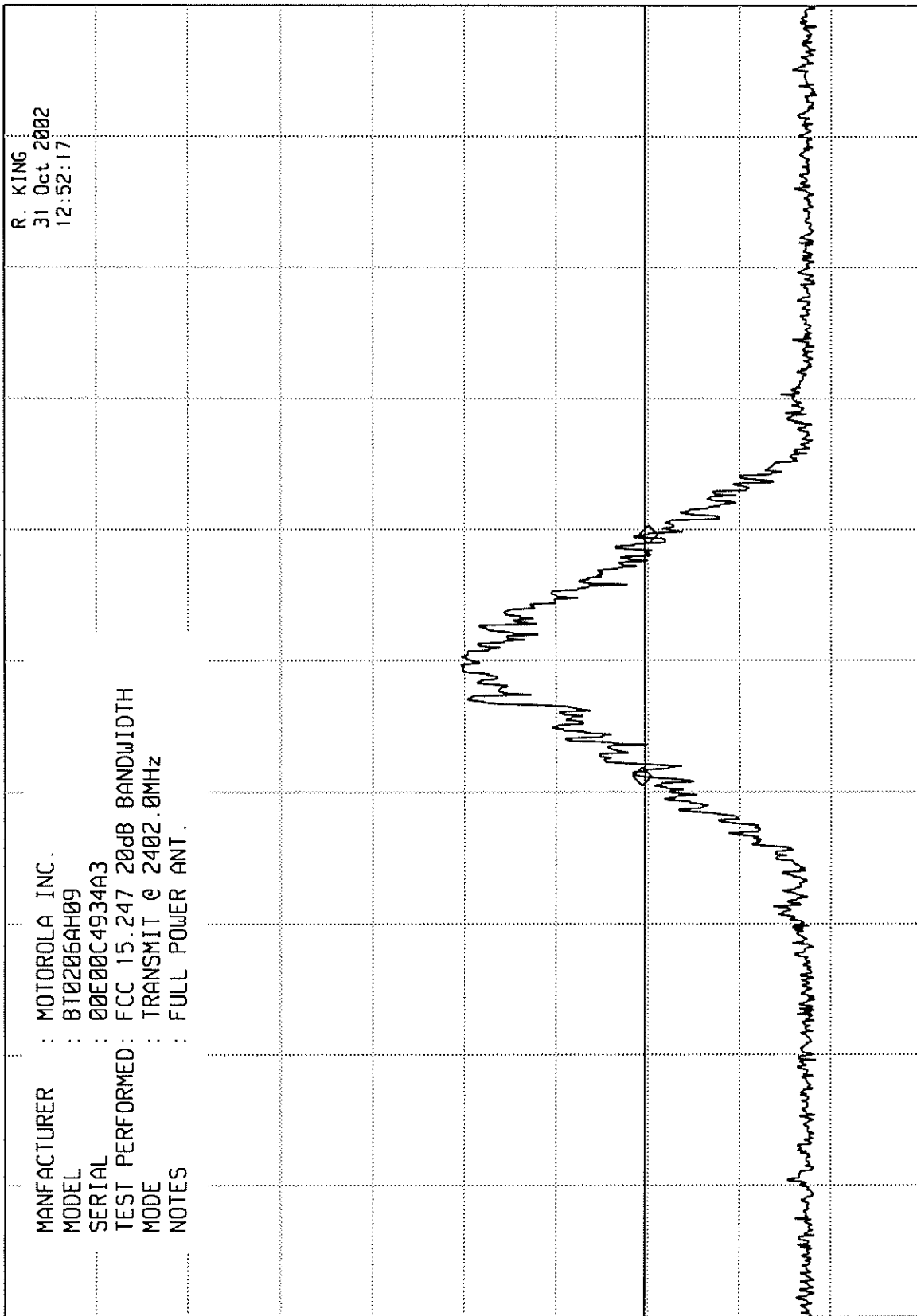
SPAN 0 Hz  
 SWP 510 msec

ELITE ELECTRONIC ENGINEERING Inc.

MKR ^ 920 kHz  
-0.70 dB

REF 117.0 dBuV

ATTEN 20 dB + 20dB ext.



hp

10 dB/

DL 47.3  
dBuV

MANUFACTURER : MOTOROLA INC.  
MODEL : BT0206AH09  
SERIAL : 00E00C4934A3  
TEST PERFORMED : FCC 15.247 20dB BANDWIDTH  
MODE : TRANSMIT @ 2402.0MHz  
NOTES : FULL POWER ANT.

R. KING  
31 Oct 2002  
12:52:17

ETR 31521-01

SPAN 5.00 MHz  
SWP 375 msec

VBW 100 kHz

CENTER 2.402 00 GHz  
RES BW 10 kHz(i)

ELITE ELECTRONIC ENGINEERING Inc.

MKR ^ 925 kHz  
-1.00 dB

hp REF 107.0 dBuV ATTN 10 dB + 20dB ext.

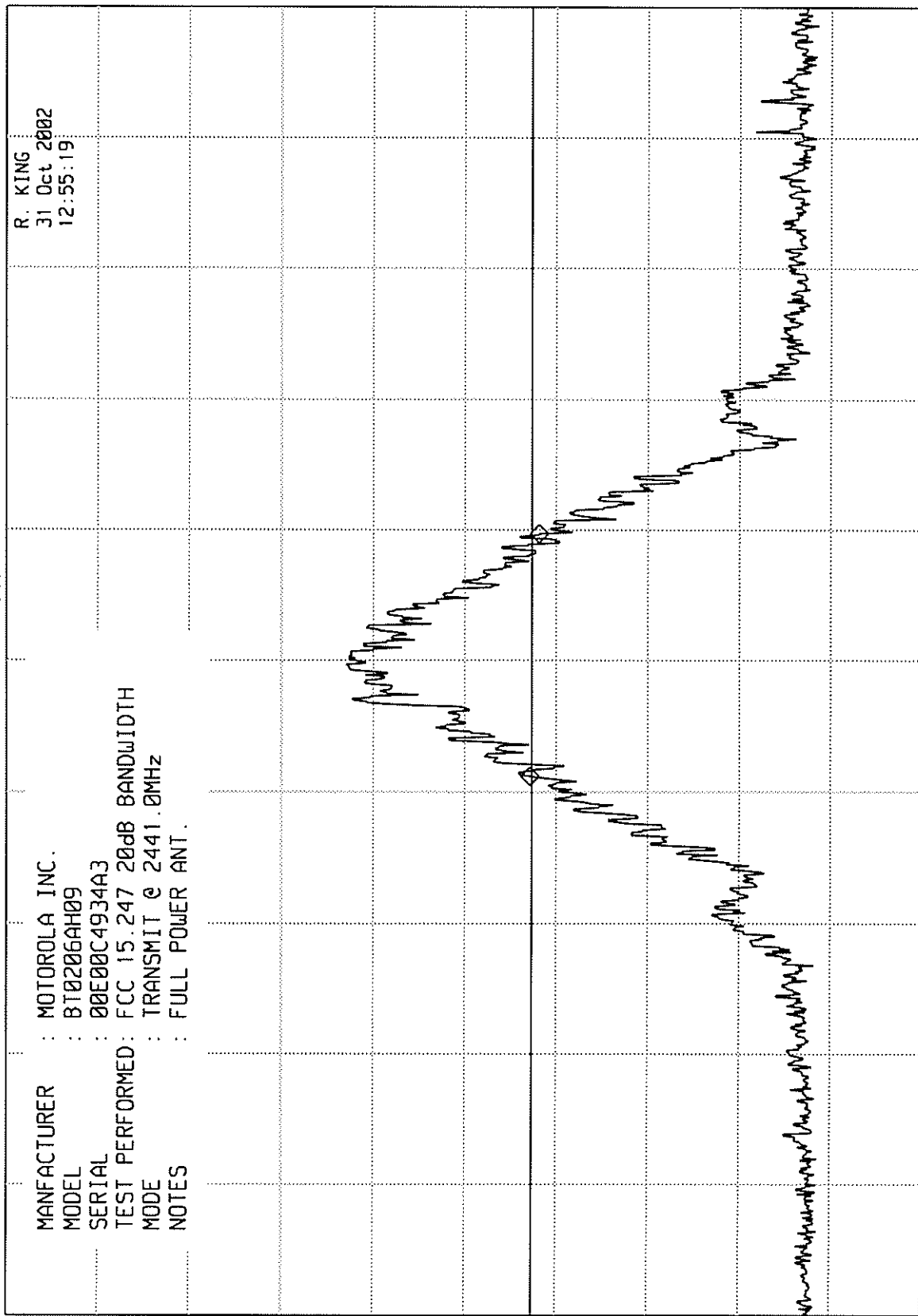
10 dB/

MANUFACTURER : MOTOROLA INC.  
MODEL : BT0206AH09  
SERIAL : 00E00C4934A3  
TEST PERFORMED : FCC 15.247 20dB BANDWIDTH  
MODE : TRANSMIT @ 2441.0MHz  
NOTES : FULL POWER ANT.

R. KING  
31 Oct 2002  
12:55:19

DL 49.6 dBuV

ETR 31521.-01



CENTER 2.441 00 GHz RES BW 10 kHz(i) SPAN 5.00 MHz  
UBW 100 kHz SWP 375 msec

ELITE ELECTRONIC ENGINEERING Inc.

MKR ^ 920 kHz  
-0.50 dB

REF 107.0 dBuV ATTN 10 dB + 20dB ext.

hp

10 dB/

MANUFACTURER : MOTOROLA INC.

MODEL : BT0206AH09

SERIAL : 00E00C4934A3

TEST PERFORMED : FCC 15.247 20dB BANDWIDTH

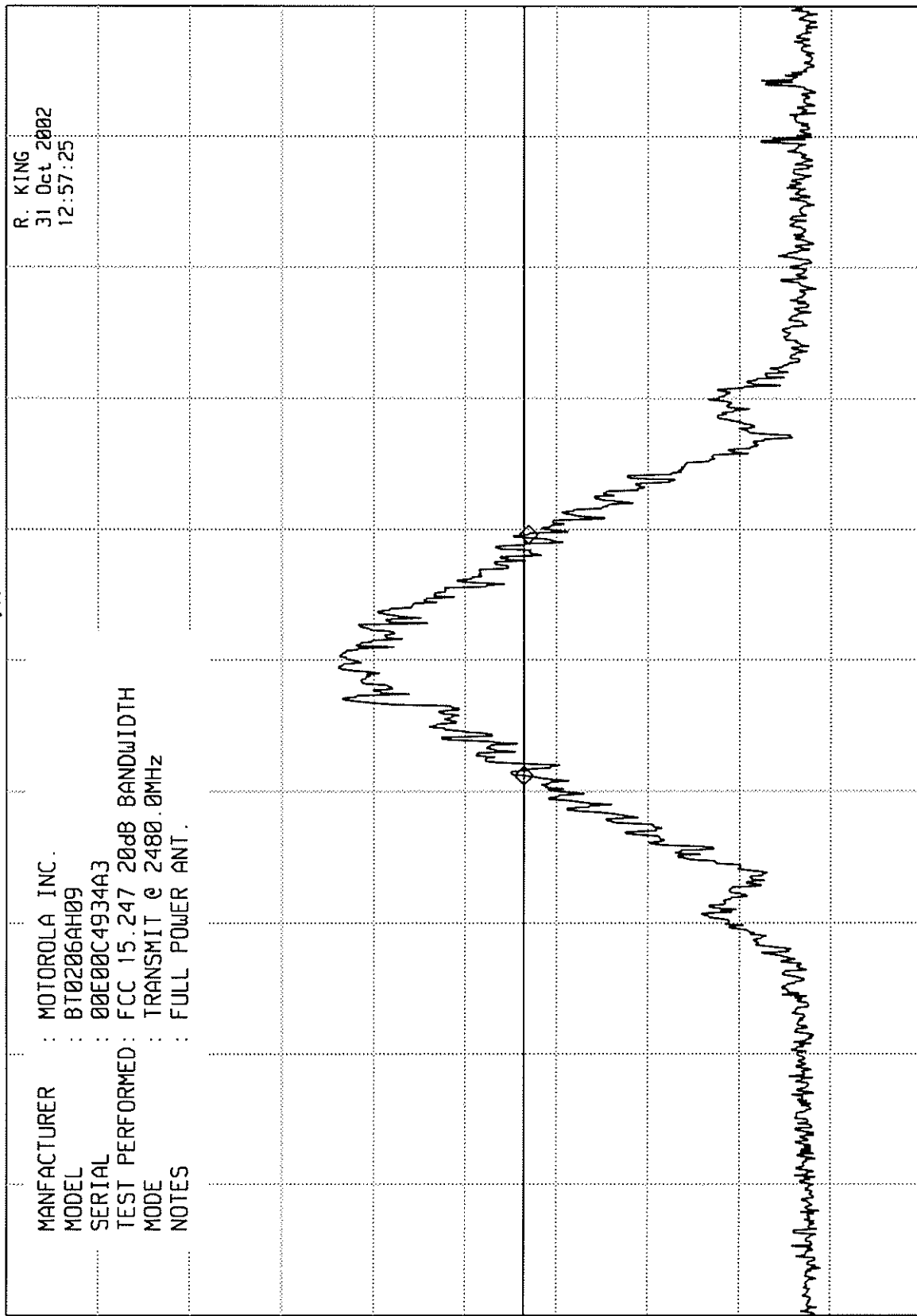
MODE : TRANSMIT @ 2480.0MHz

NOTES : FULL POWER ANT.

R. KING  
31 Oct 2002  
12:57:25

DL  
50.5  
dBuV

ETR 31S21-01



SPAN 5.00 MHz  
SWP 375 msec

UBW 100 kHz

CENTER 2.480 00 GHz  
RES BW 10 kHz (i)



ETR No. 31521-01  
DATA SHEET

PEAK OUTPUT POWER

SPECIFICATION : FCC 15C (15.247)  
 MANUFACTURER : MOTOROLA INC.  
 MODEL No. : BT0206AH09  
 SERIAL No. : 00E00C4934A3  
 NOTES : ANTENNA CONDUCTED W/ 20dB pad  
 TEST DATE : OCTOBER 31, 2002

ANTENNA CONDUCTED W/ 20dB pad

| Freq.<br>(MHz) | Mtr. Rdg<br>dBm | Pads<br>dB | Total (dBm) | Limit (dBm) |
|----------------|-----------------|------------|-------------|-------------|
| 2402.0         | -16.2           | 20         | 3.8         | 30          |
| 2441.0         | -11.2           | 20         | 8.8         | 30          |
| 2480.0         | -11.8           | 20         | 8.2         | 30          |

RADIATED W/ -10dBi ANTENNA GAIN

| Freq.<br>(MHz) | Ant.<br>Pol. | F.I.<br>(dBuV/m) | Conv.<br>FI to EIRP | EIRP<br>Total (dbm) | EIRP.<br>Limit (dBm) |
|----------------|--------------|------------------|---------------------|---------------------|----------------------|
| 2402           | H            | 88.1             | 95                  | -6.9                | 36                   |
|                | V            | 91.8             | 95                  | -3.2                | 36                   |
| 2441           | H            | 89.4             | 95                  | -5.6                | 36                   |
|                | V            | 92.4             | 95                  | -2.6                | 36                   |
| 2480           | H            | 88.6             | 95                  | -6.4                | 36                   |
|                | V            | 90.6             | 95                  | -4.4                | 36                   |

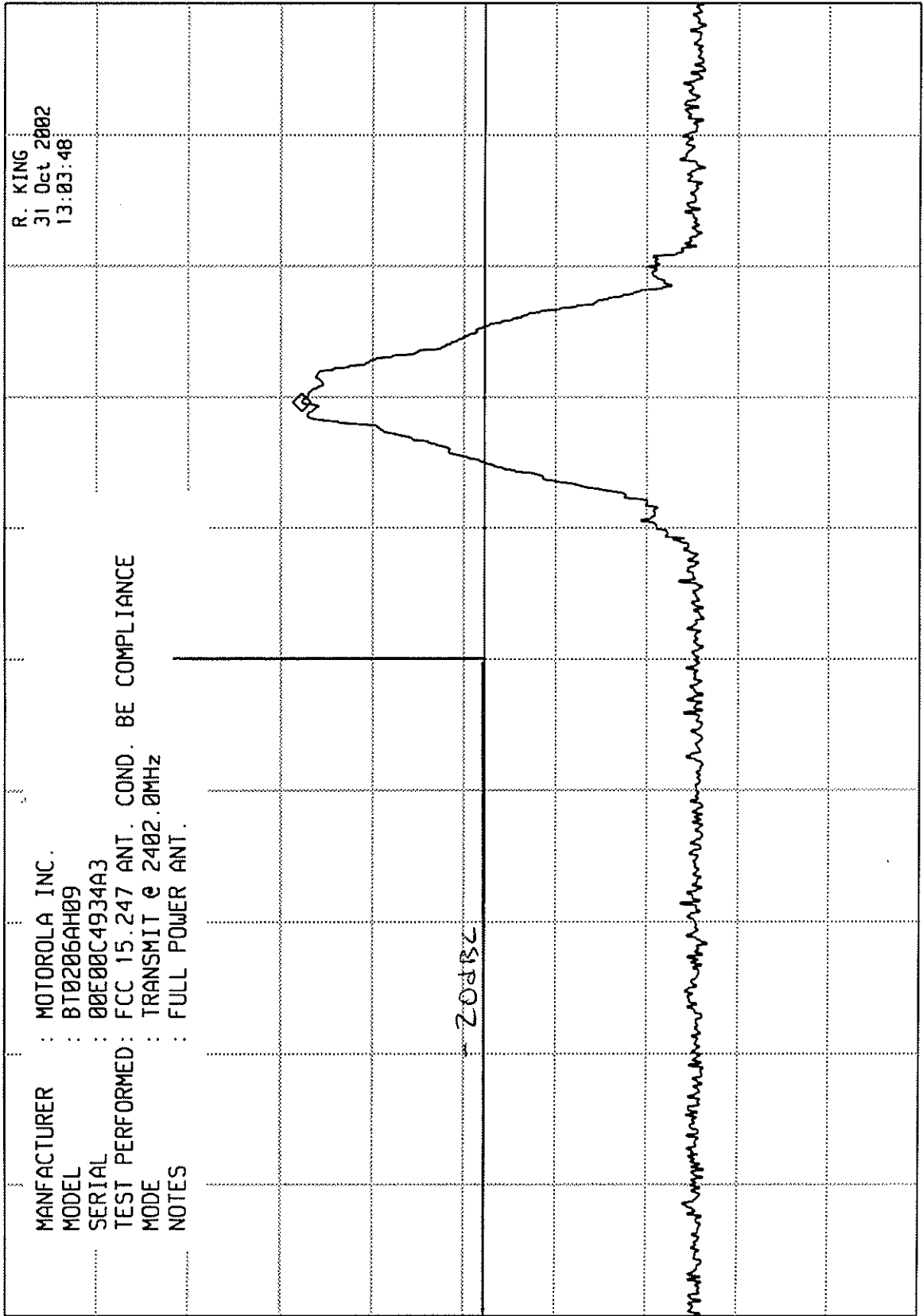
CHECKED BY: Richard E. King  
Richard E. King

ETR 31521-01

ELITE ELECTRONIC ENGINEERING Inc.

MKR 2.401 95 GHz  
-32.30 dBm

ATTEN 10 dB + 20dB<sub>ext.</sub>



hp

10 dB/

DL -52.3  
dBm

MANUFACTURER : MOTOROLA INC.  
 MODEL : BT0206AH09  
 SERIAL : 00E00C4934A3  
 TEST PERFORMED : FCC 15.247 ANT. COND. BE COMPLIANCE  
 MODE : TRANSMIT @ 2402.0MHz  
 NOTES : FULL POWER ANT.

R. KING  
 31 Oct 2002  
 13:03:48

24 of 49

CENTER 2.400 0 GHz  
 RES BW 100 kHz(i)      VBW 1 MHz      SPAN 10.0 MHz  
 SWP 20.0 msec

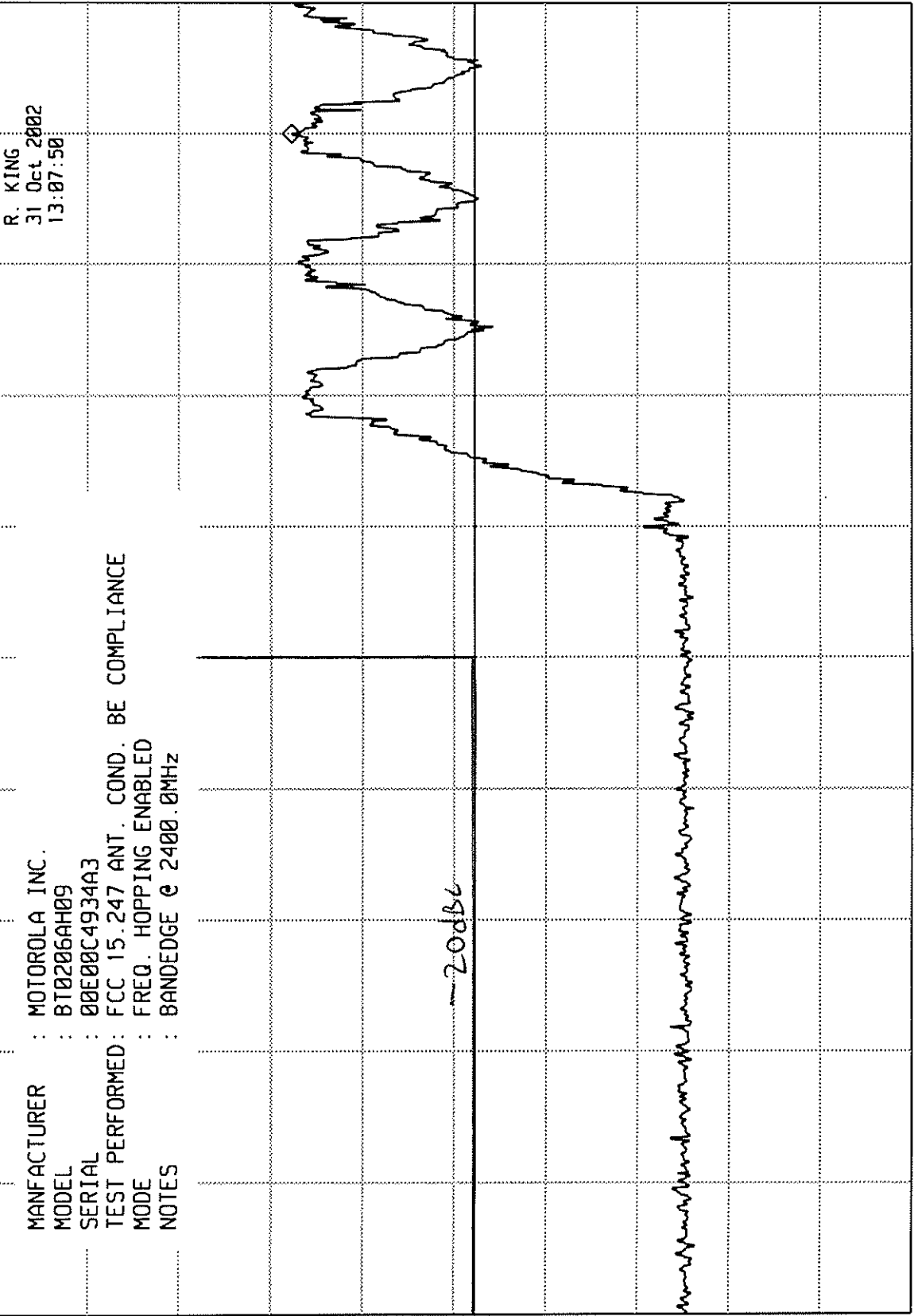
ELITE ELECTRONIC ENGINEERING Inc.

MKR 2.403 99 GHz  
-32.30 dBm

ATTEN 10 dB + 20 dB ext.

REF 0.0 dBm

hp



SPAN 10.0 MHz  
SWP 20.0 msec

UBW 1 MHz

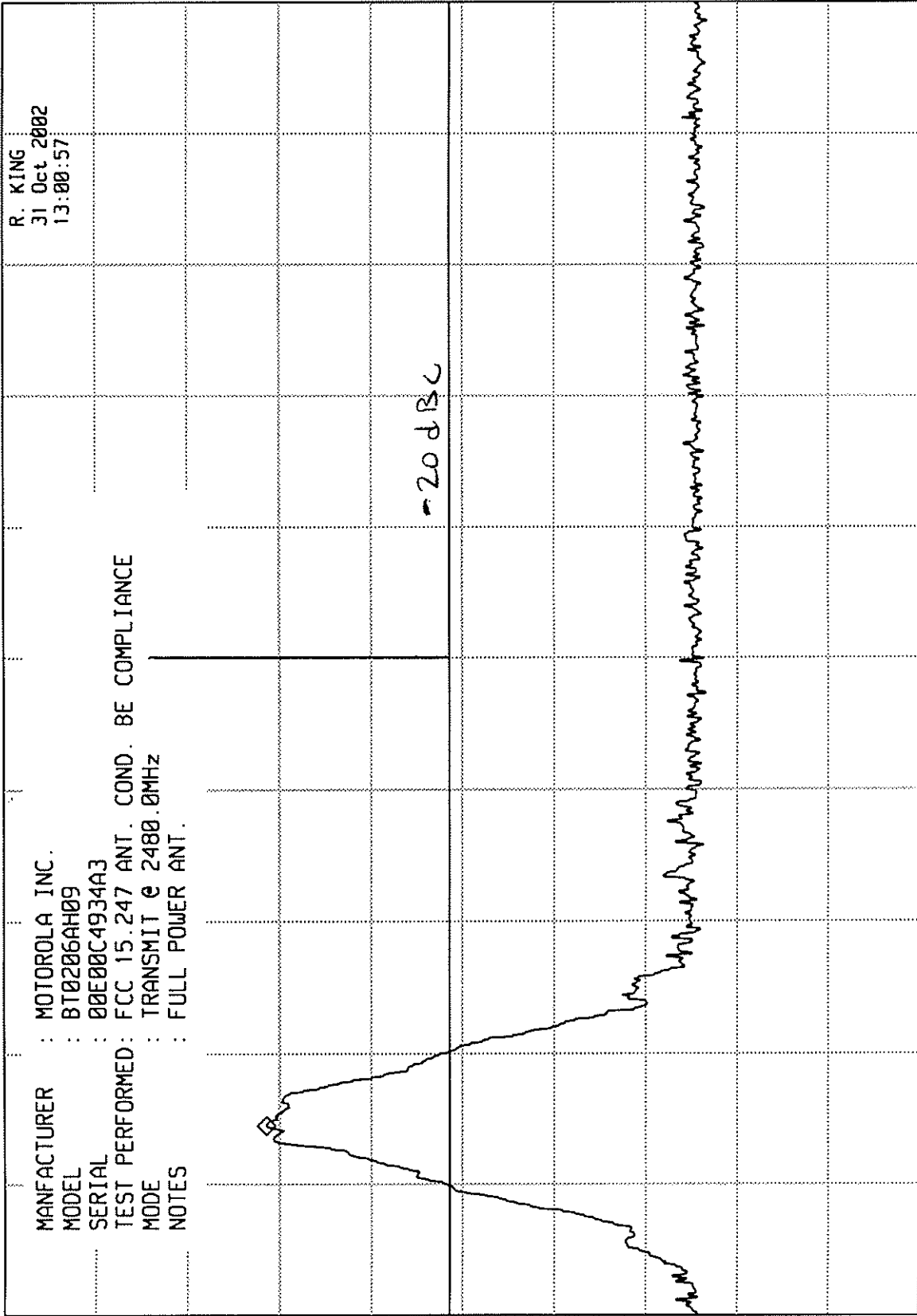
CENTER 2.400 0 GHz  
RES BW 100 kHz(i)

ELITE ELECTRONIC ENGINEERING Inc.

MKR 2.479 94 GHz  
-28.60 dBm

hp REF 0.0 dBm

ATTEN 10 dB + 20 dB ext.



R. KING  
31 Oct 2002  
13:00:57

ETR 31521-01

SPAN 10.0 MHz  
SWP 20.0 msec

VBW 1 MHz

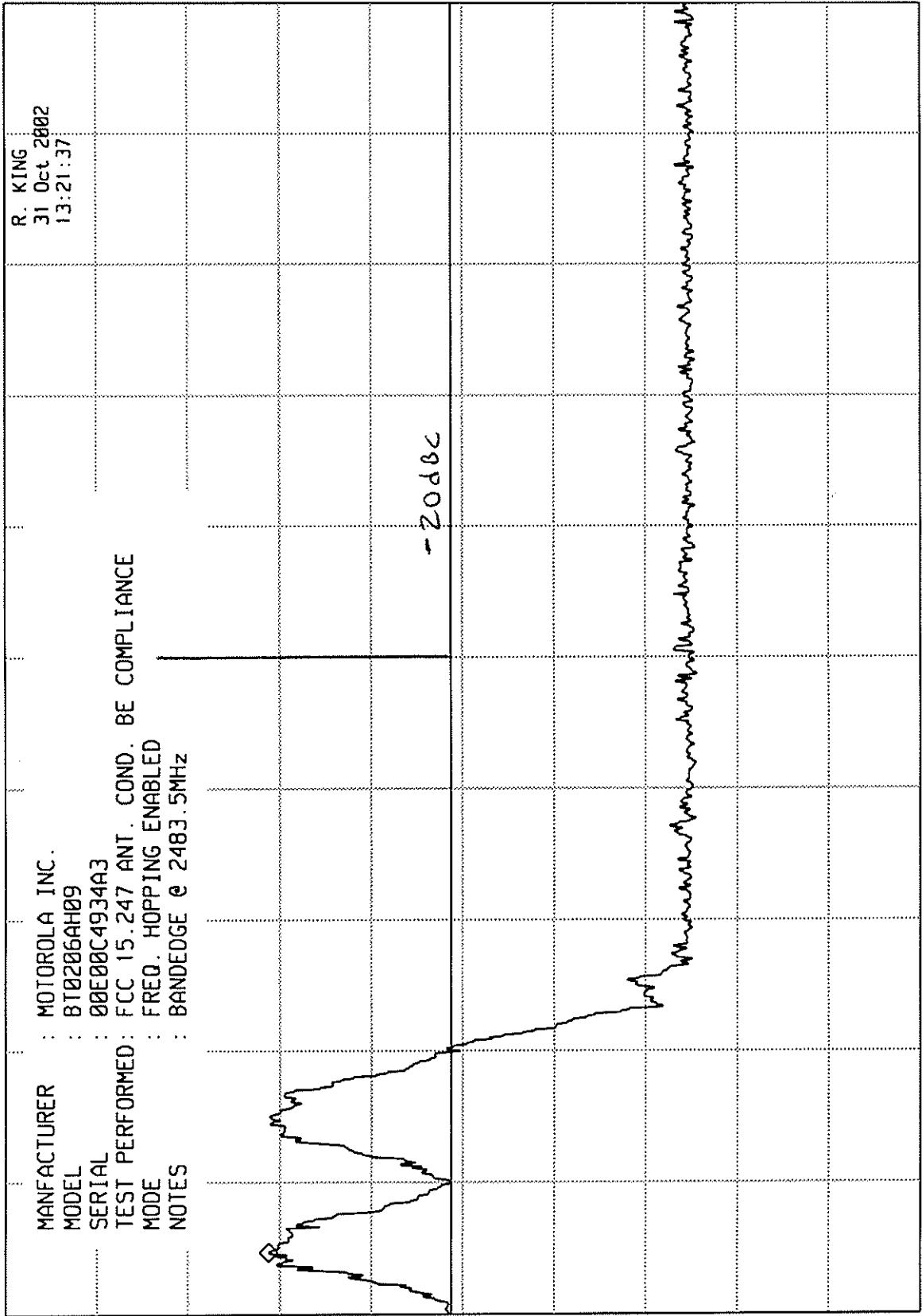
CENTER 2.483 5 GHz  
RES BW 100 kHz (i)

ELITE ELECTRONIC ENGINEERING INC.

MKR 2.478 96 GHz  
-28.80 dBm

REF 0.0 dBm

ATTEN 10 dB + 20dBEXT



ETR 31521-01

hp

10 dB/

DL  
-48.8  
dBm

27 of 49

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.

MKR 1.496 GHz  
31.50 dBuV

REF 107.0 dBuV    ATTN 10 dB + 20dB ext.

hp

10 dB/

MANUFACTURER : MOTOROLA INC.  
MODEL : BT0206AH09  
SERIAL NUMBER : 00E00C4934A3  
TEST PERFORMED : FCC 15.247 CONDUCTED RF SPURIOUS  
MODE : TRANSMIT @ 2402.0MHz  
NOTES : ANTENNA CONDUCTED

R. KING  
1 Nov 2002  
15:44:25

DL 54.5  
dBuV

ETR 31521-01

-20dBc

*[Handwritten notes in the right margin of the grid, including "20dBc" and other illegible text.]*

START 1.00 GHz    RES BW 100 kHz(i)    VBW 1 MHz    STOP 2.00 GHz  
SWP 750 msec

ELITE ELECTRONIC ENGINEERING Inc.

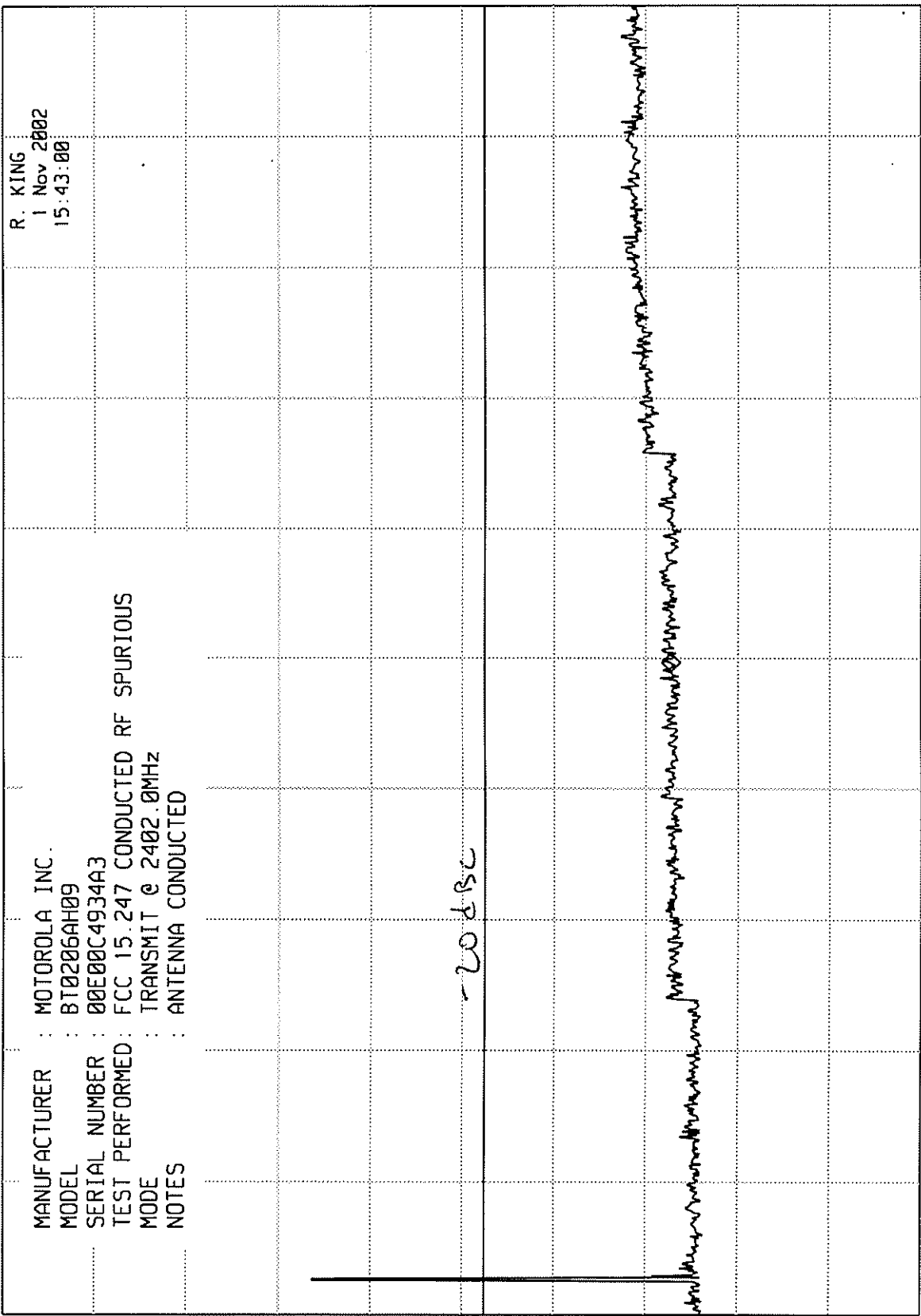
MKR 9.94 GHz  
34.20 dBuV

REF 107.0 dBuV    ATTEN 10 dB + 20 dB ext.

hp

10 dB/

MANUFACTURER : MOTOROLA INC.  
 MODEL : BT0206AH09  
 SERIAL NUMBER : 00E00C4934A3  
 TEST PERFORMED : FCC 15.247 CONDUCTED RF SPURIOUS  
 MODE : TRANSMIT @ 2402.0MHz  
 NOTES : ANTENNA CONDUCTED



DL 54.5  
dBuV

ETR 31521-01

START 2.0 GHz    RES BW 100 kHz(i)    VBW 1 MHz    STOP 18.0 GHz  
 SWP 12.0 sec





ELITE ELECTRONIC ENGINEERING Inc.

MKR 9.98 GHz  
32.30 dBuV

REF 107.0 dBuV    ATTEN 10 dB + 20dB

hp

10 dB/

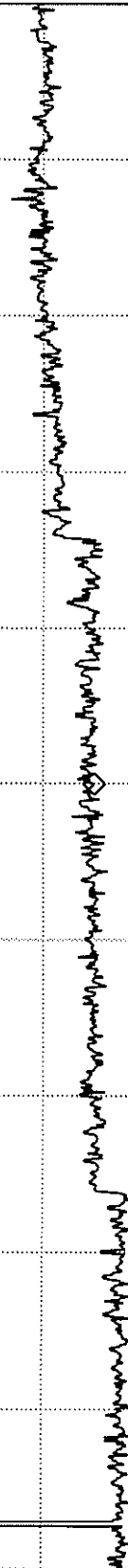
MANUFACTURER : MOTOROLA INC.  
 MODEL : BT0206AH09  
 SERIAL NUMBER : 00E00C4934A3  
 TEST PERFORMED : FCC 15.247 CONDUCTED RF SPURIOUS  
 MODE : TRANSMIT @ 2441.0MHz  
 NOTES : ANTENNA CONDUCTED

R. KING  
1 Nov 2002  
15:49:06

DL 57.2  
dBuV

ETD 31521-01

-20dBc



START 2.0 GHz    RES BW 100 kHz(i)    UBW 100 kHz    STOP 18.0 GHz  
SWP 12.0 sec



ELITE ELECTRONIC ENGINEERING Inc.

MKR 1.495 GHz  
30.10 dBuV

REF 107.0 dBuV    ATTEN 10 dB + 20dB ext

hp  
10 dB/

MANUFACTURER : MOTOROLA INC.  
MODEL : BT0206AH09  
SERIAL NUMBER : 00E00C4934A3  
TEST PERFORMED: FCC 15.247 CONDUCTED RF SPURIOUS  
MODE : TRANSMIT @ 2402.0MHz 2480  
NOTES : ANTENNA CONDUCTED

R. KING  
1 Nov 2002  
15:55:14

DL  
54.8  
dBuV

-20dBc

ETR 31521-01

*[Handwritten notes in the plot area, including a vertical line of text: "Spurious emissions from the transmitter at 2402.0 MHz"]*

START 1.00 GHz    RES BW 100 kHz (i)    UBW 1 MHz    STOP 2.00 GHz  
SWP 750 msec

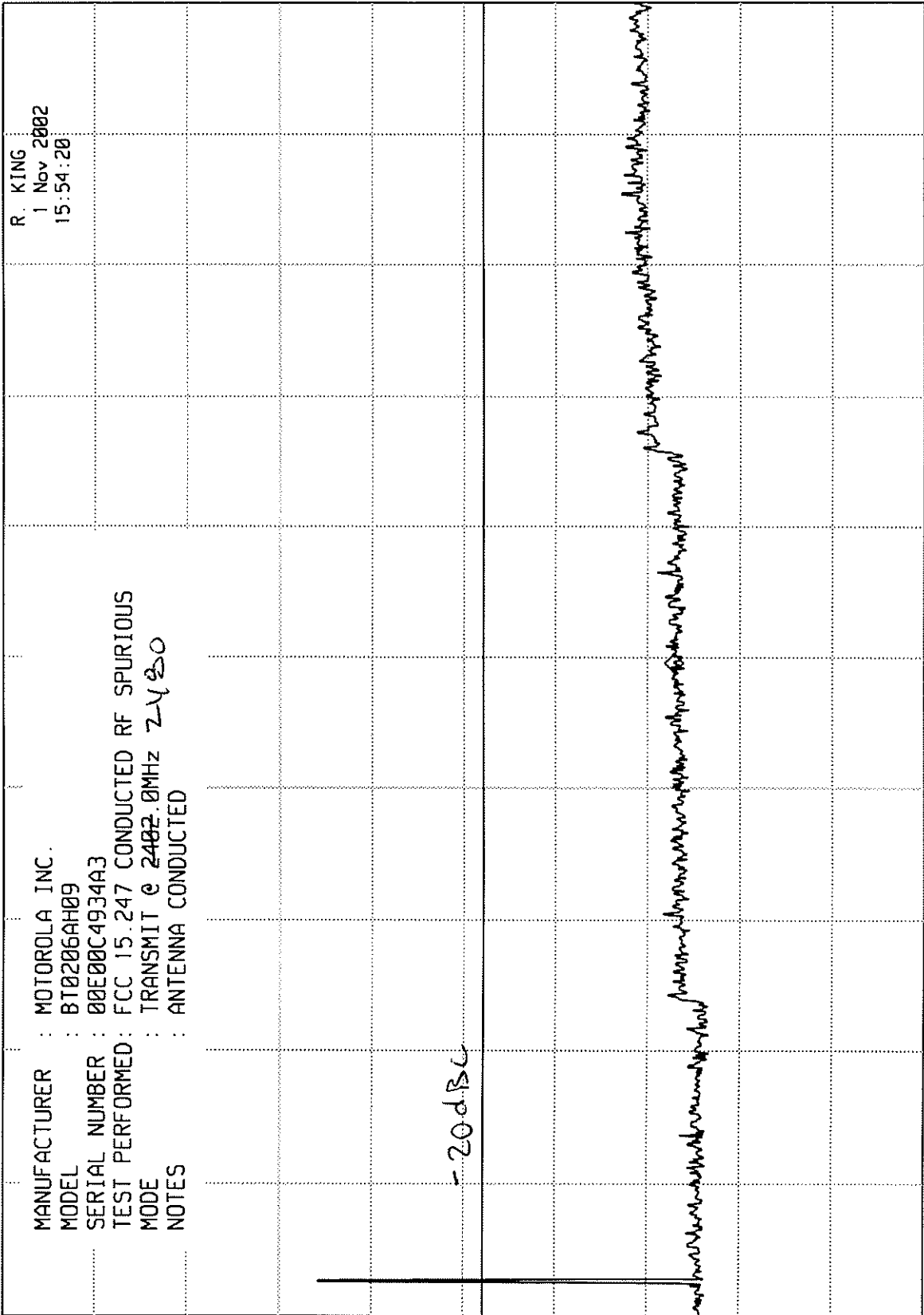
ELITE ELECTRONIC ENGINEERING Inc.

MKR 9.92 GHz  
34.10 dBuV

REF 107.0 dBuV    ATTEN 10 dB + 20dB

hp  
10 dB/

DL  
54.8  
dBuV



EM 31S21-01

START 2.0 GHz    RES BW 100 kHz(i)    VBW 1 MHz    STOP 18.0 GHz  
SWP 12.0 sec

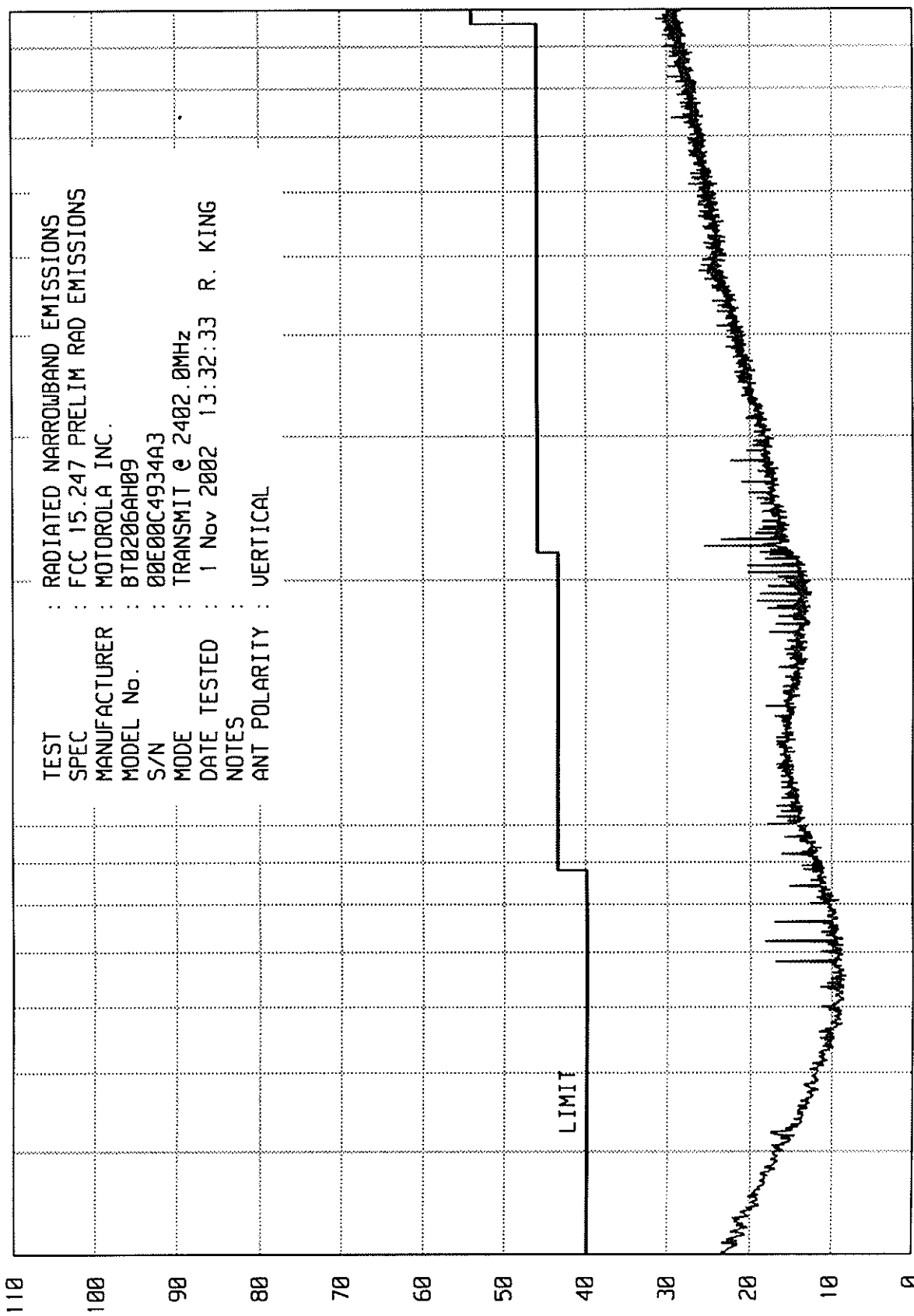
ETR 31521-01

# ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIU\_EH RUN RUN 4

UKA0 07/18/02



TEST : RADIATED NARROWBAND EMISSIONS  
 SPEC : FCC 15.247 PRELIM RAD EMISSIONS  
 MANUFACTURER : MOTOROLA INC.  
 MODEL No. : BT0206AH09  
 S/N : 00E00C4934A3  
 MODE : TRANSMIT @ 2402.0MHz  
 DATE TESTED : 1 Nov 2002 13:32:33 R. KING  
 NOTES :  
 ANT POLARITY : VERTICAL

37 of 49

START = 30

FREQUENCY - MHz

STOP = 1000

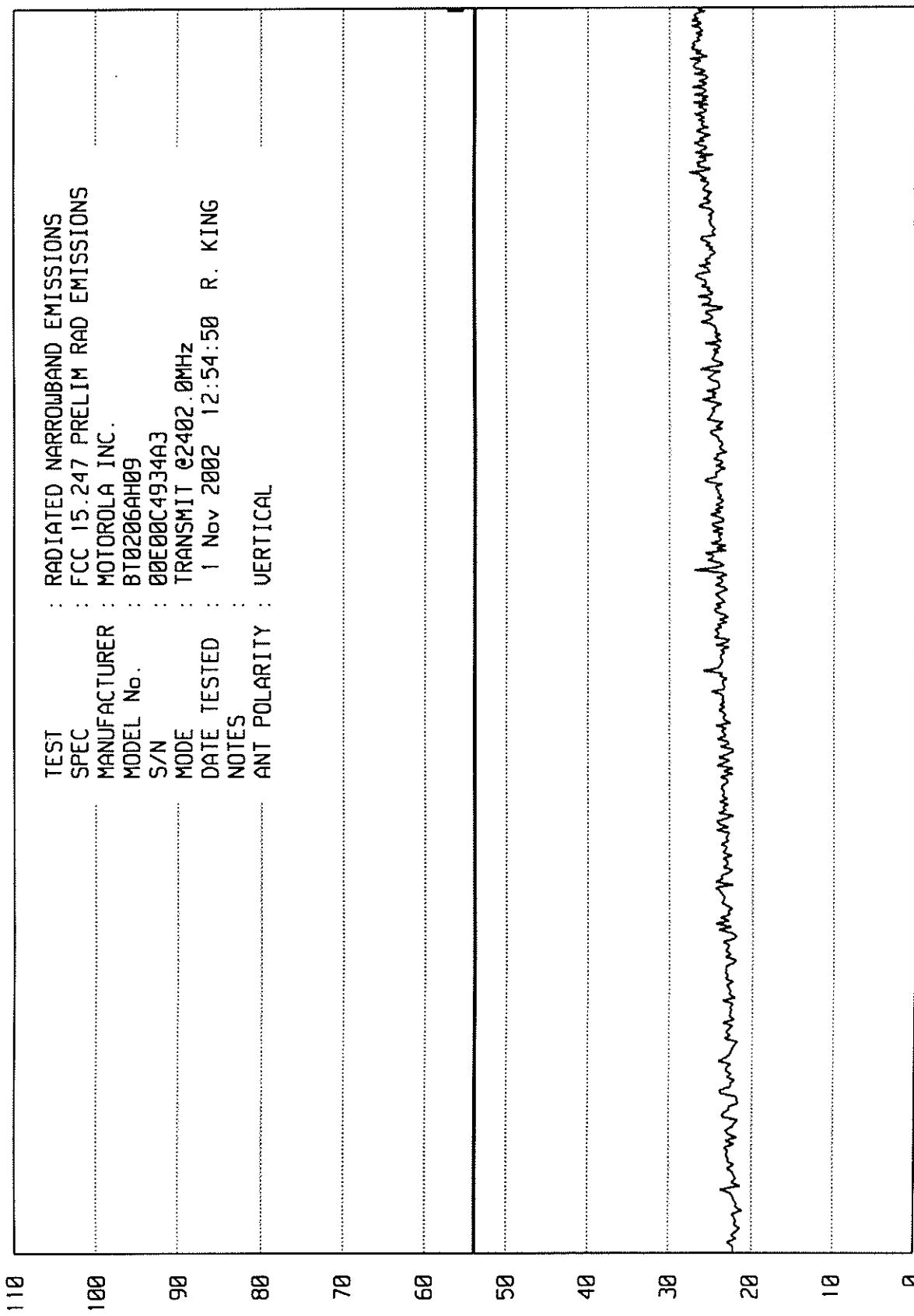
ETR 31521-01

# ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIU\_EM RUN RUN 3

UKA00 07/18/02



TEST : RADIATED NARROWBAND EMISSIONS  
 SPEC : FCC 15.247 PRELIM RAD EMISSIONS  
 MANUFACTURER : MOTOROLA INC.  
 MODEL No. : BT0206AH09  
 S/N : 00E00C4934A3  
 MODE : TRANSMIT @2402.0MHz  
 DATE TESTED : 1 Nov 2002 12:54:50 R. KING  
 NOTES :  
 ANT POLARITY : VERTICAL

RADIATED NARROWBAND EMISSIONS - dBu/m

38 of 49

START = 1000

FREQUENCY - MHz

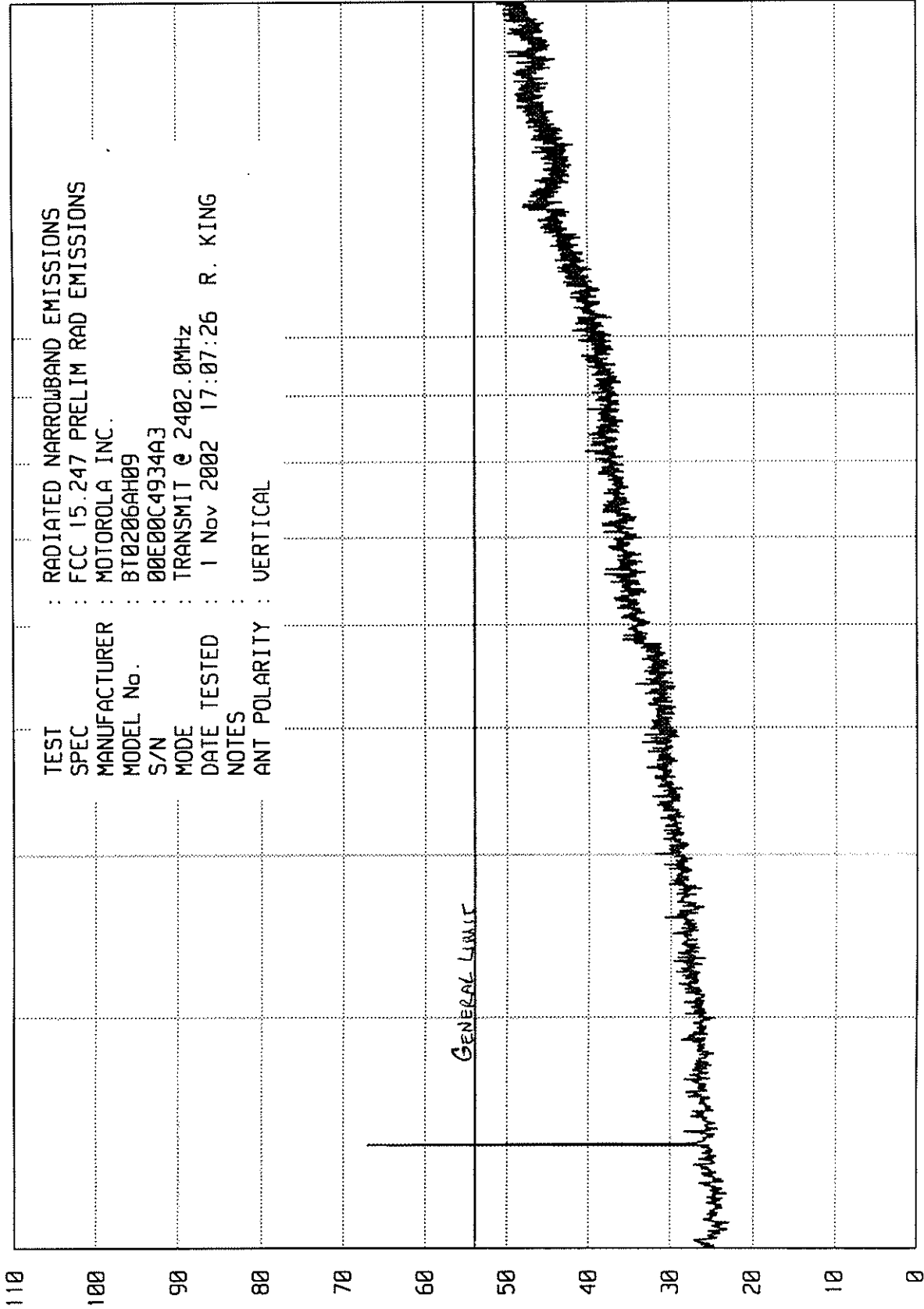
STOP = 2000

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIV\_EH RUN RUN 1

WKAB 07/18/02



TEST : RADIATED NARROWBAND EMISSIONS  
 SPEC : FCC 15.247 PRELIM RAD EMISSIONS  
 MANUFACTURER : MOTOROLA INC.  
 MODEL No. : BT0206AH09  
 S/N : 00E00C4934A3  
 MODE : TRANSMIT @ 2402.0MHz  
 DATE TESTED : 1 Nov 2002 17:07:26 R. KING  
 NOTES :  
 ANT POLARITY : VERTICAL

RADIATED NARROWBAND EMISSIONS - dBu/m

39 of 49

START = 2000

FREQUENCY - MHz

10000

STOP = 18000

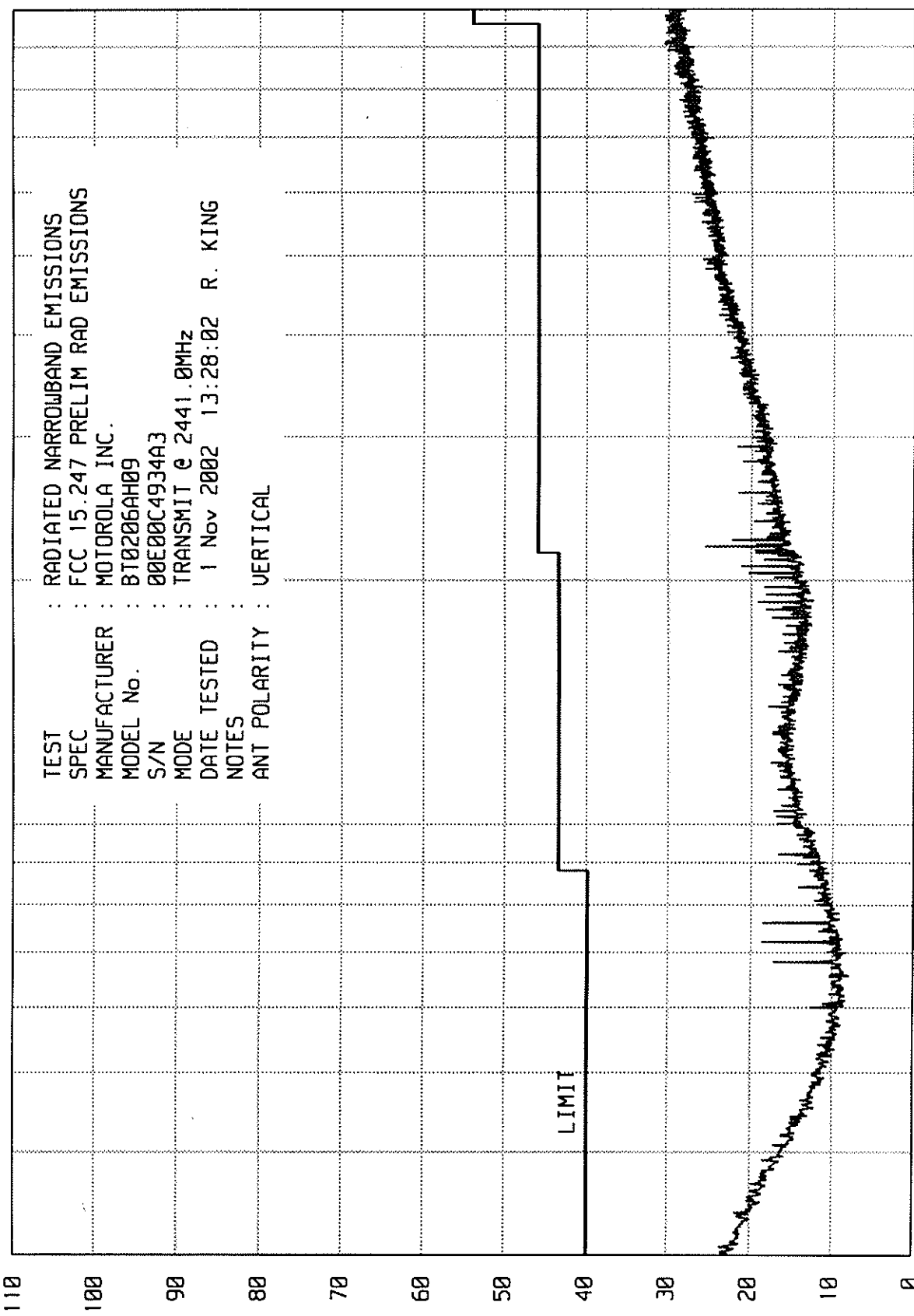
# ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIV\_EH RUN RUN 4

UKA0 07/16/02

TEST : RADIATED NARROWBAND EMISSIONS  
 SPEC : FCC 15.247 PRELIM RAD EMISSIONS  
 MANUFACTURER : MOTOROLA INC.  
 MODEL No. : BT0206AH09  
 S/N : 00E00C4934A3  
 MODE : TRANSMIT @ 2441.0MHZ  
 DATE TESTED : 1 Nov 2002 13:28:02 R. KING  
 NOTES :  
 ANT POLARITY : VERTICAL



RADIATED NARROWBAND EMISSIONS - dBu/m

40 of 79

START = 30

100

FREQUENCY - MHz

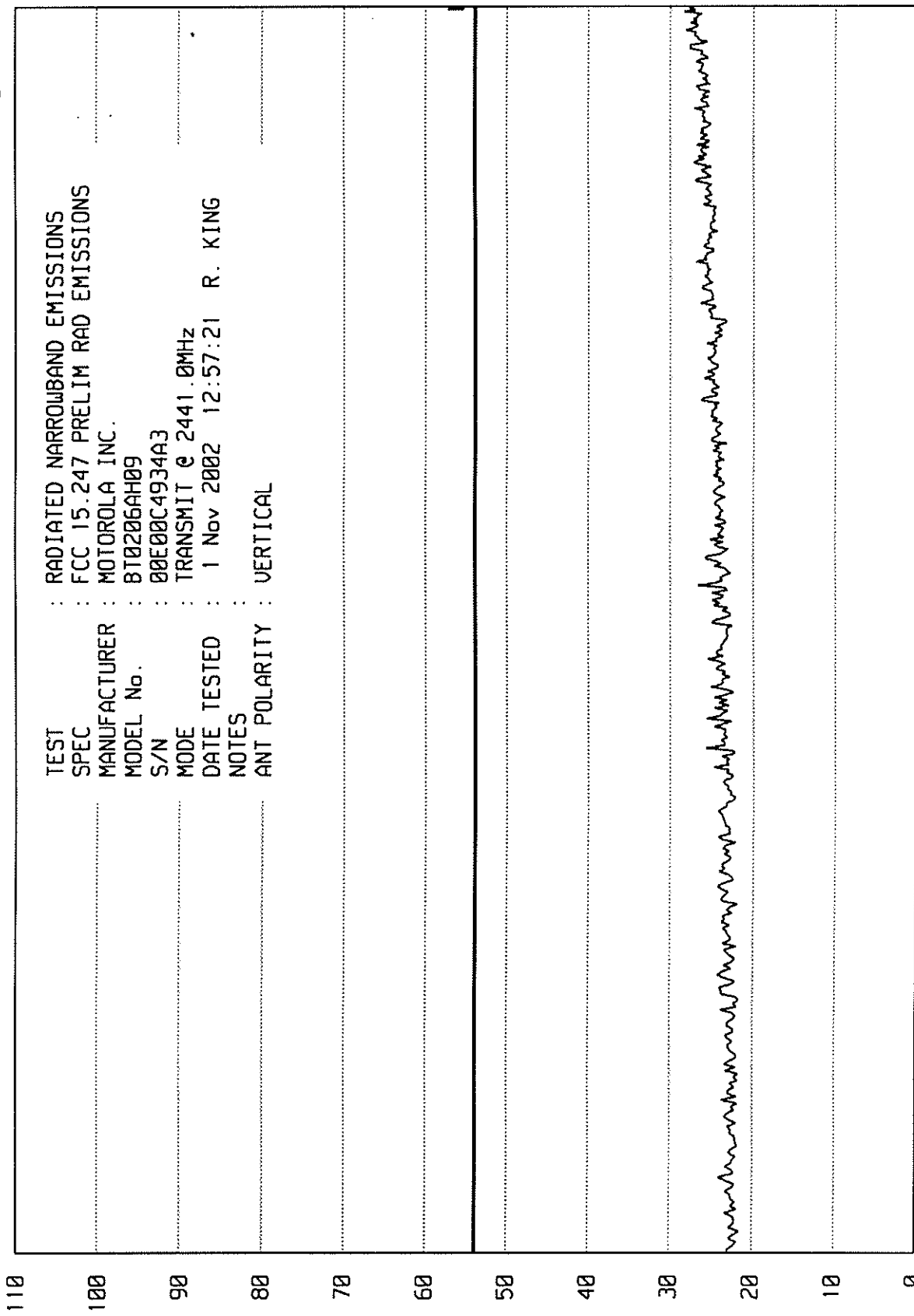
STOP = 1000

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UKA08 07/18/82

UNITV\_EM RUN RUN 3



TEST : RADIATED NARROWBAND EMISSIONS  
 SPEC : FCC 15.247 PRELIM RAD EMISSIONS  
 MANUFACTURER : MOTOROLA INC.  
 MODEL No. : BT0206AH09  
 S/N : 00E00C4934A3  
 MODE : TRANSMIT @ 2441.0MHz  
 DATE TESTED : 1 Nov 2002 12:57:21 R. KING  
 NOTES :  
 ANT POLARITY : VERTICAL

RADIATED NARROWBAND EMISSIONS - dBuV/m

49 of 14

START = 1000

FREQUENCY - MHz

STOP = 2000

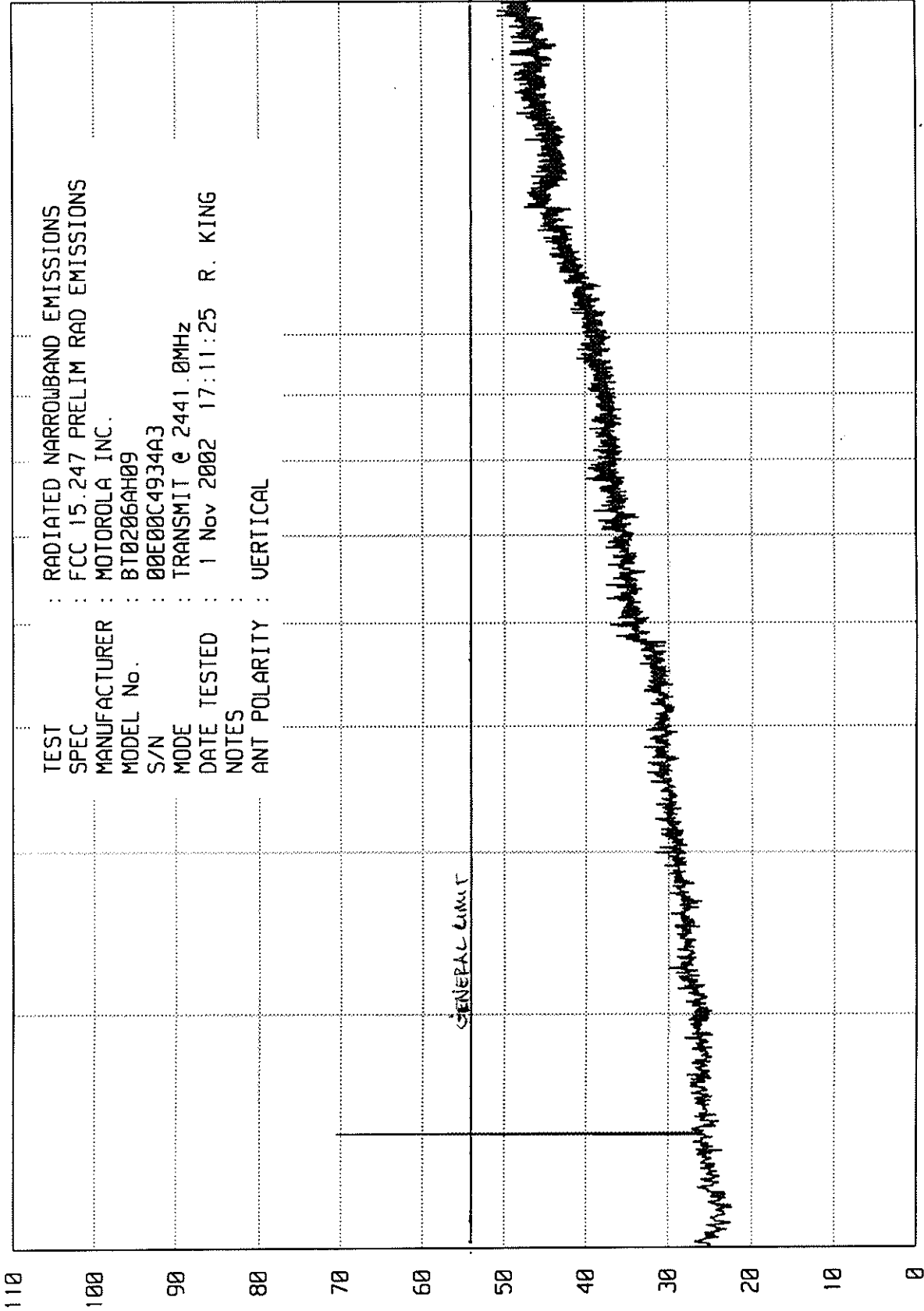
# ELITE ELECTRONIC ENGINEERING Inc.

Dawners Grove, Ill. 60515

UNITU\_EM\_RUN RUN 1

WKAB 07/18/02

TEST : RADIATED NARROWBAND EMISSIONS  
 SPEC : FCC 15.247 PRELIM RAD EMISSIONS  
 MANUFACTURER : MOTOROLA INC.  
 MODEL No. : BT0206AH09  
 S/N : 00E00C4934A3  
 MODE : TRANSMIT @ 2441.0MHz  
 DATE TESTED : 1 Nov 2002 17:11:25 R. KING  
 NOTES :  
 ANT POLARITY : VERTICAL



RADIATED NARROWBAND EMISSIONS - dBu/m

42 of 49

START = 2000

FREQUENCY - MHz

10000

STOP = 18000

ETD 31521-01

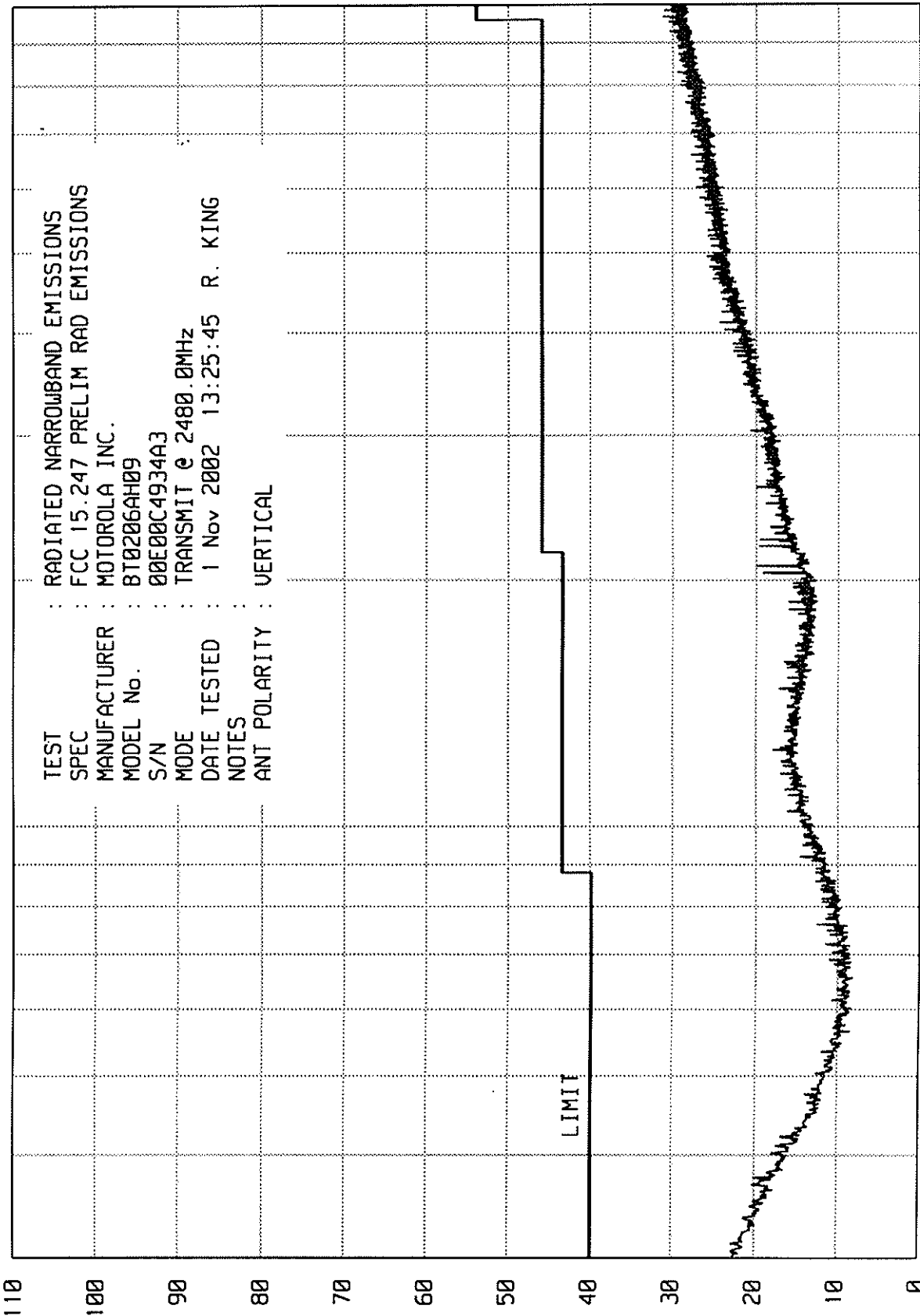
# ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNITV\_EM RUN RUN 4

UK98 07/18/02

TEST : RADIATED NARROWBAND EMISSIONS  
 SPEC : FCC 15.247 PRELIM RAD EMISSIONS  
 MANUFACTURER : MOTOROLA INC.  
 MODEL No. : BT0206AH09  
 S/N : 00E00C4934A3  
 MODE : TRANSMIT @ 2480.0MHz  
 DATE TESTED : 1 Nov 2002 13:25:45 R. KING  
 NOTES :  
 ANT POLARITY : VERTICAL



RADIATED NARROWBAND EMISSIONS - dBu/m

43 of 49

START = 30

FREQUENCY - MHz

STOP = 1000

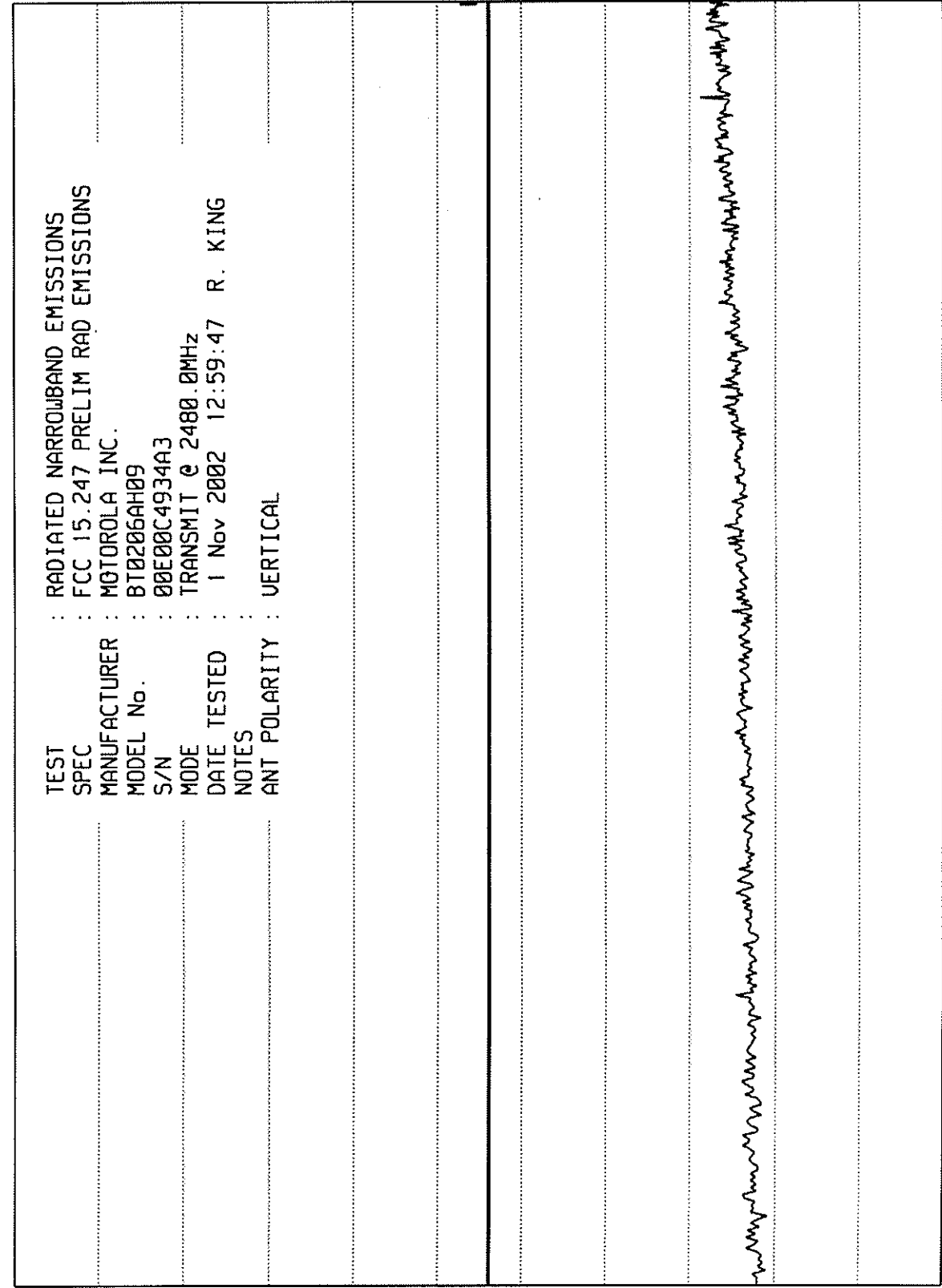
ETR 31S21-01

# ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNTU\_EH RUN RUN 3

JK90 07/18/02



TEST : RADIATED NARROWBAND EMISSIONS  
 SPEC : FCC 15.247 PRELIM RAD EMISSIONS  
 MANUFACTURER : MOTOROLA INC.  
 MODEL No. : BT0206AH09  
 S/N : 00E00C4934A3  
 MODE : TRANSMIT @ 2480.0MHz  
 DATE TESTED : 1 Nov 2002 12:59:47 R. KING  
 NOTES :  
 ANT POLARITY : VERTICAL

RADIATED NARROWBAND EMISSIONS - dBu/m

44 of 49

START = 1000

FREQUENCY - MHz

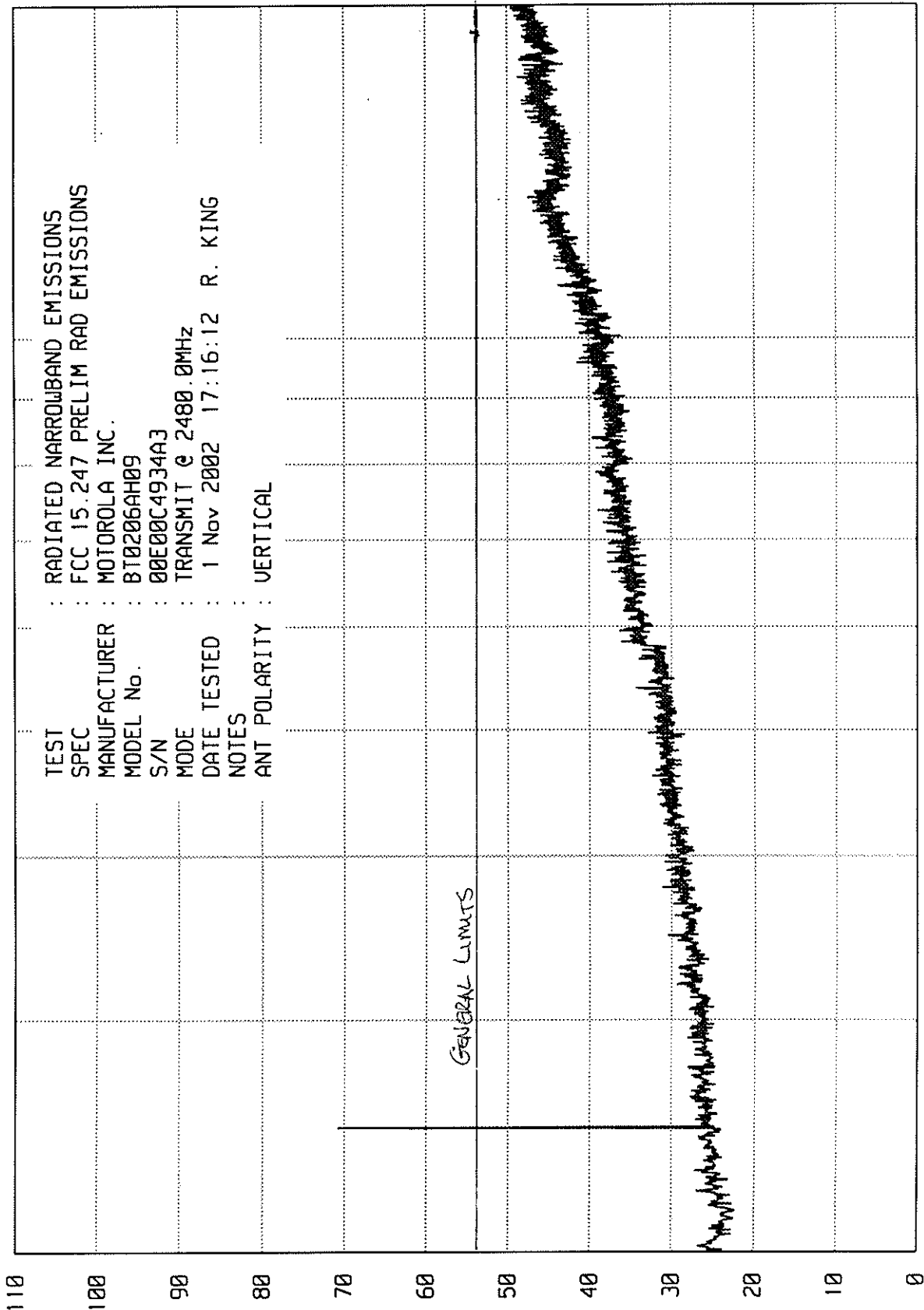
STOP = 2000

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIV\_EH\_RUN RUN 1

WKAB 07/16/02



TEST : RADIATED NARROWBAND EMISSIONS  
 SPEC : FCC 15.247 PRELIM RAD EMISSIONS  
 MANUFACTURER : MOTOROLA INC.  
 MODEL No. : BT0206AH09  
 S/N : 00E00C4934A3  
 MODE : TRANSMIT @ 2480.0MHz  
 DATE TESTED : 1 Nov 2002 17:16:12 R. KING  
 NOTES :  
 ANT POLARITY : VERTICAL

RADIATED NARROWBAND EMISSIONS - dBu/m

49 of 54

START = 2000

FREQUENCY - MHz

10000

STOP = 18000



ETR No. 31521-01  
DATA SHEET

MANUFACTURER : MOTORLOLA INC.  
MODEL : BT0206AH09  
S/N : 00E00C4934A3  
SPECIFICATION : FCC-15C Spurious Radiated Emissions  
DATE : OCTOBER 28, 2002  
NOTES :  
: TEST DISTANCE IS 3 METERS

| FREQ<br>MHz | ANT<br>POL | MTR<br>RDG dBuV |     | BW    | ANT<br>FAC | CABLE<br>LOSS | PRE<br>AMP | TOTAL<br>dBuV/m | TOTAL<br>uV/m | LIMIT<br>uV |
|-------------|------------|-----------------|-----|-------|------------|---------------|------------|-----------------|---------------|-------------|
| 2402.0      | H          | 89.9            |     | 1M/3M | 30.9       | 3.2           | -35.9      | 88.1            | 25527.0       |             |
|             | V          | 93.6            |     | 1M/3M | 30.9       | 3.2           | -35.9      | 91.8            | 39084.1       |             |
| 4804.0      | H          | 30.4            | AMB | 1M/10 | 33.8       | 5.8           | -35.1      | 34.9            | 55.3          | 500.0       |
|             | V          | 30.1            | AMB | 1M/10 | 33.8       | 5.8           | -35.1      | 34.6            | 53.5          | 500.0       |
| 12010.0     | H          | 33.4            | AMB | 1M/10 | 41.6       | 8.6           | -35.4      | 48.2            | 258.2         | 500.0       |
|             | V          | 33.1            | AMB | 1M/10 | 41.6       | 8.6           | -35.4      | 47.9            | 247.2         | 500.0       |
| 19216.0     | H          | 12.3            | AMB | 1M/10 | 40.3       | 0.0           | 0.0        | 52.6            | 426.6         | 500.0       |
|             | V          | 12.5            | AMB | 1M/10 | 40.3       | 0.0           | 0.0        | 52.8            | 436.5         | 500.0       |

CHECKED BY: Richard E. King  
Richard E. King



ETR No. 31521-01  
DATA SHEET

MANUFACTURER : MOTORLOLA INC.  
 MODEL : BT0206AH09  
 S/N : 00E00C4934A3  
 SPECIFICATION : FCC-15C Spurious Radiated Emissions  
 DATE : OCTOBER 28, 2002  
 NOTES : TRANSMITTING @ 2441.0 MHz  
 : TEST DISTANCE IS 3 METERS

| FREQ<br>MHz | ANT<br>POL | MTR<br>RDG dBuV |     | BW    | ANT<br>FAC | CABLE<br>LOSS | PRE<br>AMP | TOTAL<br>dBuV/m | TOTAL<br>uV/m | LIMIT<br>uV |
|-------------|------------|-----------------|-----|-------|------------|---------------|------------|-----------------|---------------|-------------|
| 2441.0      | H          | 91.2            |     | 1M/3M | 30.9       | 3.2           | -35.9      | 89.4            | 29648.3       |             |
|             | V          | 94.2            |     | 1M/3M | 30.9       | 3.2           | -35.9      | 92.4            | 41879.4       |             |
| 4882.0      | H          | 30.4            | AMB | 1M/10 | 33.8       | 5.8           | -35.1      | 34.9            | 55.3          | 500.0       |
|             | V          | 30.3            | AMB | 1M/10 | 33.8       | 5.8           | -35.1      | 34.8            | 54.6          | 500.0       |
| 7323.0      | H          | 32.6            | AMB | 1M/10 | 38.0       | 6.8           | -35.3      | 42.1            | 127.4         | 500.0       |
|             | V          | 32.5            | AMB | 1M/10 | 38.0       | 6.8           | -35.3      | 42.0            | 125.9         | 500.0       |
| 12205.0     | H          | 32.6            | AMB | 1M/10 | 41.6       | 8.6           | -34.9      | 47.9            | 249.5         | 500.0       |
|             | V          | 32.7            | AMB | 1M/10 | 41.6       | 8.6           | -34.9      | 48.0            | 251.2         | 500.0       |
| 19528.0     | H          | 12.8            | AMB | 1M/10 | 40.3       | 0.0           | 0.0        | 53.1            | 449.8         | 500.0       |
|             | V          | 12.8            | AMB | 1M/10 | 40.3       | 0.0           | 0.0        | 53.1            | 453.9         | 500.0       |

CHECKED BY: Richard E. King  
Richard E. King



ETR No. 31521-01  
DATA SHEET

MANUFACTURER : MOTORLOLA INC.  
 MODEL : BT0206AH09  
 S/N : 00E00C4934A3  
 SPECIFICATION : FCC-15C Spurious Radiated Emissions  
 DATE : OCTOBER 28, 2002  
 NOTES : TRANSMITTING @ 2480.0 MHz  
 : TEST DISTANCE IS 3 METERS

| FREQ<br>MHz | ANT<br>POL | MTR<br>RDG dBuV |     | BW    | ANT<br>FAC | CABLE<br>LOSS | PRE<br>AMP | TOTAL<br>dBuV/m | TOTAL<br>uV/m | LIMIT<br>uV |
|-------------|------------|-----------------|-----|-------|------------|---------------|------------|-----------------|---------------|-------------|
| 2480.0      | H          | 90.4            |     | 1M/3M | 30.9       | 3.2           | -35.9      | 88.6            | 27039.6       |             |
|             | V          | 92.4            |     | 1M/3M | 30.9       | 3.2           | -35.9      | 90.6            | 34040.8       |             |
| 4960.0      | H          | 29.9            | AMB | 1M/10 | 33.8       | 5.8           | -35.1      | 34.4            | 52.2          | 500.0       |
|             | V          | 29.8            | AMB | 1M/10 | 33.8       | 5.8           | -35.1      | 34.3            | 51.6          | 500.0       |
| 7440.0      | H          | 33.0            | AMB | 1M/10 | 38.0       | 6.8           | -34.4      | 43.4            | 147.9         | 500.0       |
|             | V          | 33.1            | AMB | 1M/10 | 38.0       | 6.8           | -34.4      | 43.5            | 149.6         | 500.0       |
| 12400.0     | H          | 32.4            | AMB | 1M/10 | 41.6       | 8.6           | -34.2      | 48.4            | 264.2         | 500.0       |
|             | V          | 32.5            | AMB | 1M/10 | 41.6       | 8.6           | -34.2      | 48.5            | 266.1         | 500.0       |
| 19840.0     | H          | 12.5            | AMB | 1M/10 | 40.3       | 0.0           | 0.0        | 52.8            | 436.5         | 500.0       |
|             | V          | 12.4            | AMB | 1M/10 | 40.3       | 0.0           | 0.0        | 52.7            | 431.5         | 500.0       |
| 22320.0     | H          | 12.2            | AMB | 1M/10 | 40.4       | 0.0           | 0.0        | 52.6            | 425.6         | 500.0       |
|             | V          | 12.4            | AMB | 1M/10 | 40.4       | 0.0           | 0.0        | 52.8            | 434.0         | 500.0       |

CHECKED BY: Richard E. King  
Richard E. King

ELITE ELECTRONIC ENGINEERING Inc.

MKR 2.441 013 GHz  
-43.30 dBm

REF 10.0 dBm      ATTEN 20 dB + 20dB ext.

hp

10 dB/

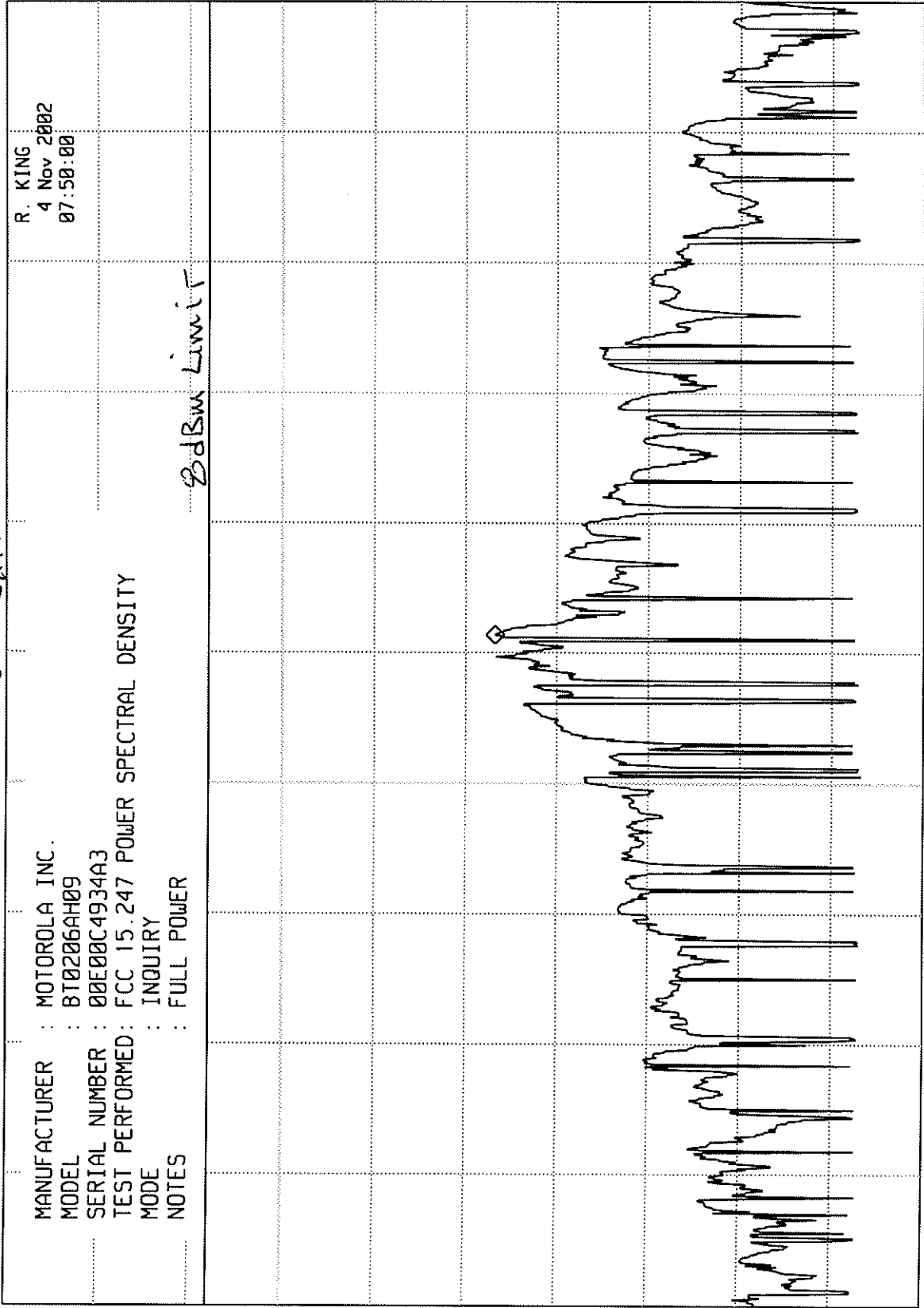
MANUFACTURER : MOTOROLA INC.  
MODEL : BT0206AH09  
SERIAL NUMBER : 00E00C4934A3  
TEST PERFORMED : FCC 15.247 POWER SPECTRAL DENSITY  
MODE : INQUIRY  
NOTES : FULL POWER

R. KING  
4 Nov 2002  
07:50:00

2dBm Limit

DL -12.0  
dBm

ETR 31521-01



SPAN 1.00 MHz  
SWP 333 sec

VBW 30 kHz

CENTER 2.441 00 GHz  
RES BW 3 kHz(i)