

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

ELITE PROJECT: 31382

DATES TESTED: September 11 through 13, 2002

TEST PERSONNEL: Richard E. King

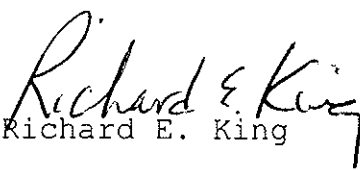
TEST SPECIFICATION: FCC "Code of Federal Regulations" Title 47 Part 15,
Subpart C, Section 15.247 for Frequency Hopping
Spread Spectrum Intentional Radiators Operating
within the 2400-2483.5MHz band

ENGINEERING TEST REPORT NO. 31382-01
MEASUREMENTS OF RF EMISSIONS
FROM THE IN-VEHICLE BLUETOOTH MODULE


FOR: Motorola
Rolling Meadows, Illinois

PURCHASE ORDER NO.: NP515234

Report By:


Richard E. King

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. : SYN9592A **SERIAL NO.:** D20020

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: September 11 through 13, 2002

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

WITNESS: No Motorola personnel were present during the testing.

ELITE ELECTRONIC: Richard E. King

ELITE JOB NO.: 31382

ABSTRACT: The model 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, and 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.

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	5
2.0 TEST ITEM SETUP AND OPERATION	5
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	8
4.6 Peak Output Power	8
4.7 Band-edge Compliance	9
4.8 Spurious Emissions	10
4.9 Power Spectral Density	11
5.0 CONCLUSION	13
6.0 CERTIFICATION	13
EQUIPMENT LIST	14

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 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 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 12VDC was supplied to the test item from a 12VDC HP 6033A power supply . 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 receives 12.0VDC 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. 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 15 shows the carrier frequency separation. As can be seen from this plot, the separation is greater than 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 16 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 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 17 and 18 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 396.9 usec burst every 100 msec's multiplied by a 30 second period. This calculated value is equal to .0119 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 19 through 21 show that the maximum 20 dB bandwidth was 0.940 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 22. The maximum EIRP measured from the transmitter was -4.6 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 pages 23 and 24 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 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 25 through 33. 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 34 through 36. 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 37 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.

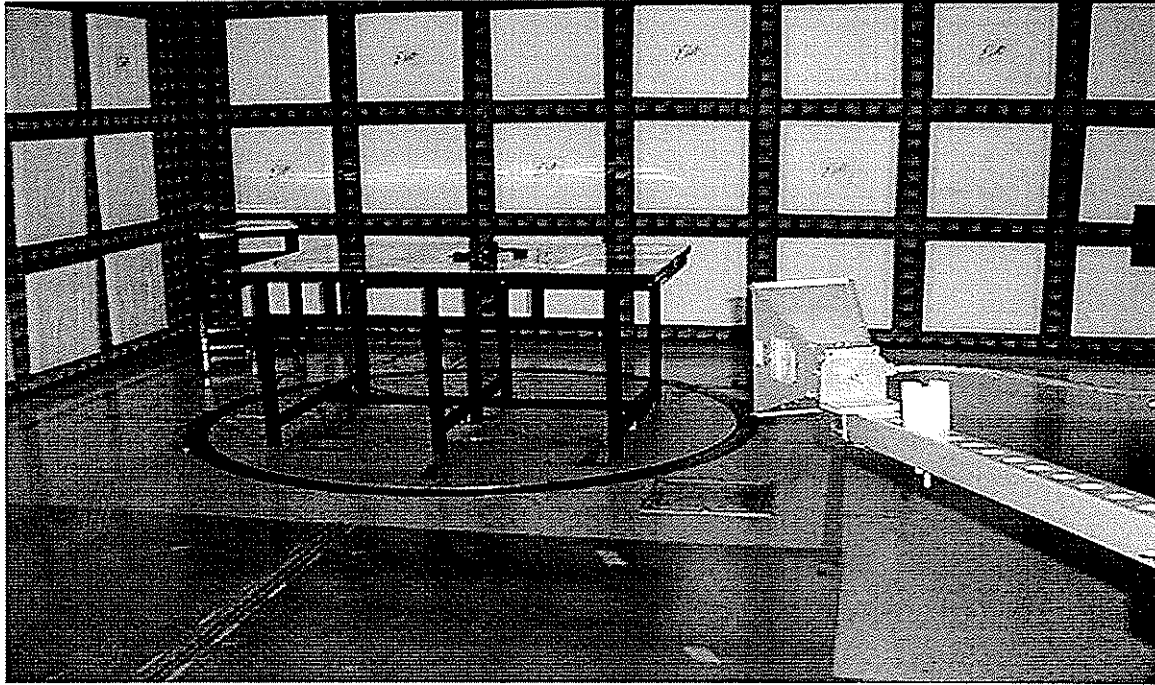
6.0 CERTIFICATION:

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.

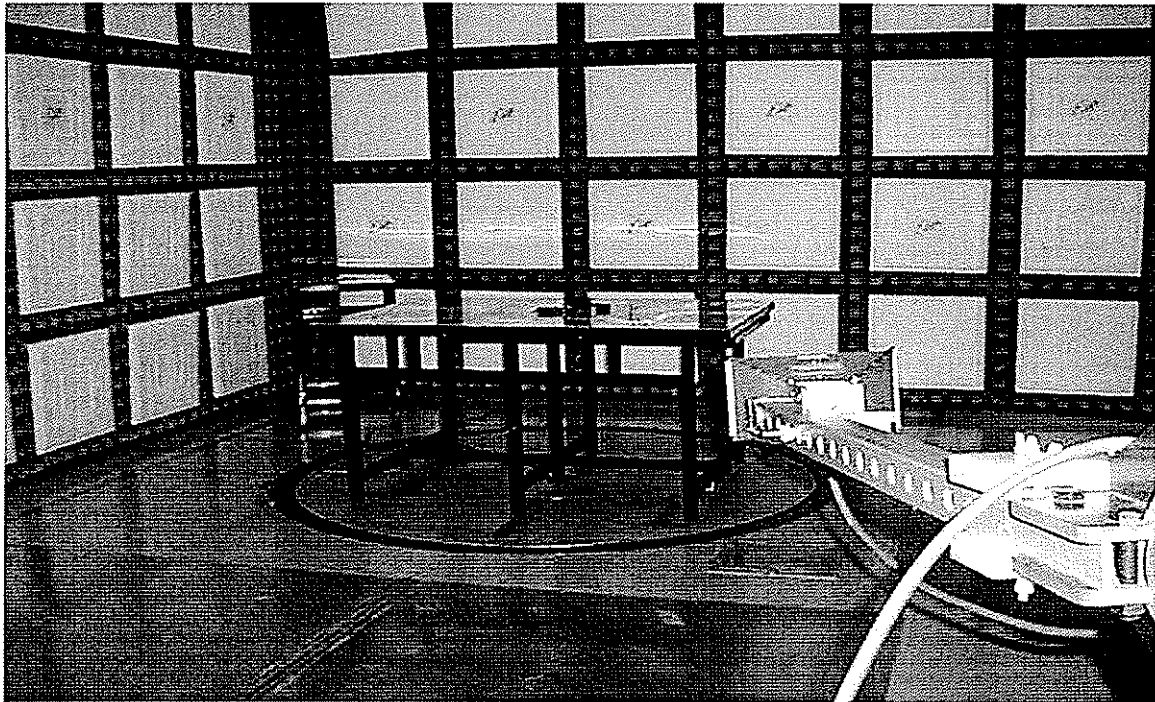
The data presented in this test report pertains to the test item at the test date. Any electrical or mechanical modification made to the test item subsequent to the specified test date will serve to invalidate the data and void this certification.

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

ETR 31382-01
Figure 1



Radiated Emissions Worst Case Horizontal Polarization



Radiated Emissions Worst Case Vertical Polarization

ENGINEERING TEST REPORT NO. 31382-01

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								
XZG2	ATTENUATOR/SWITCH DRIVER	HEWLETT PACKARD	11713A	2223A01751	---			N/A
Equipment Type: AMPLIFIERS								
APH0	POWER AMPLIFIER	HEWLETT PACKARD	11975A	2304A00322	2-8GHZ			NOTE 1
APK2	PREAMPLIFIER	AGILENT TECHNOL	8449B	3008A01595	1-26.5GHZ	05/15/02	12	05/15/03
Equipment Type: ANTENNAS								
NHG0	STANDARD GAIN HORN ANTENNA	NARDA	638	---	18-26.5GHZ			NOTE 1
NWHO	RIDGED WAVE GUIDE	TENSOR	4105	2081	1-12.4GHZ	08/25/02	12	08/25/03
Equipment Type: CONTROLLERS								
CDD2	COMPUTER	HEWLETT PACKARD	D4171A#ABA	US61654645	---			N/A
CDG5	COMPUTER	HEWLETT PACKARD	D7949T	US9160519	---			N/A
CDL2	LAPTOP COMPUTER	HEWLETT PACKARD	N5150	TW04410848	600 MHZ			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								
RAC0	SPECTRUM ANALYZER	HEWLETT PACKARD	85660B	2449A01117	100HZ-22GHZ	02/20/02	12	02/20/03
RACA	RF PRESELECTOR	HEWLETT PACKARD	85685A	2926A00980	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
RAF1	QUASIPeAK ADAPTER	HEWLETT PACKARD	85650A	2043A00271	0.01-1000MHZ	02/21/02	12	02/21/03
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.

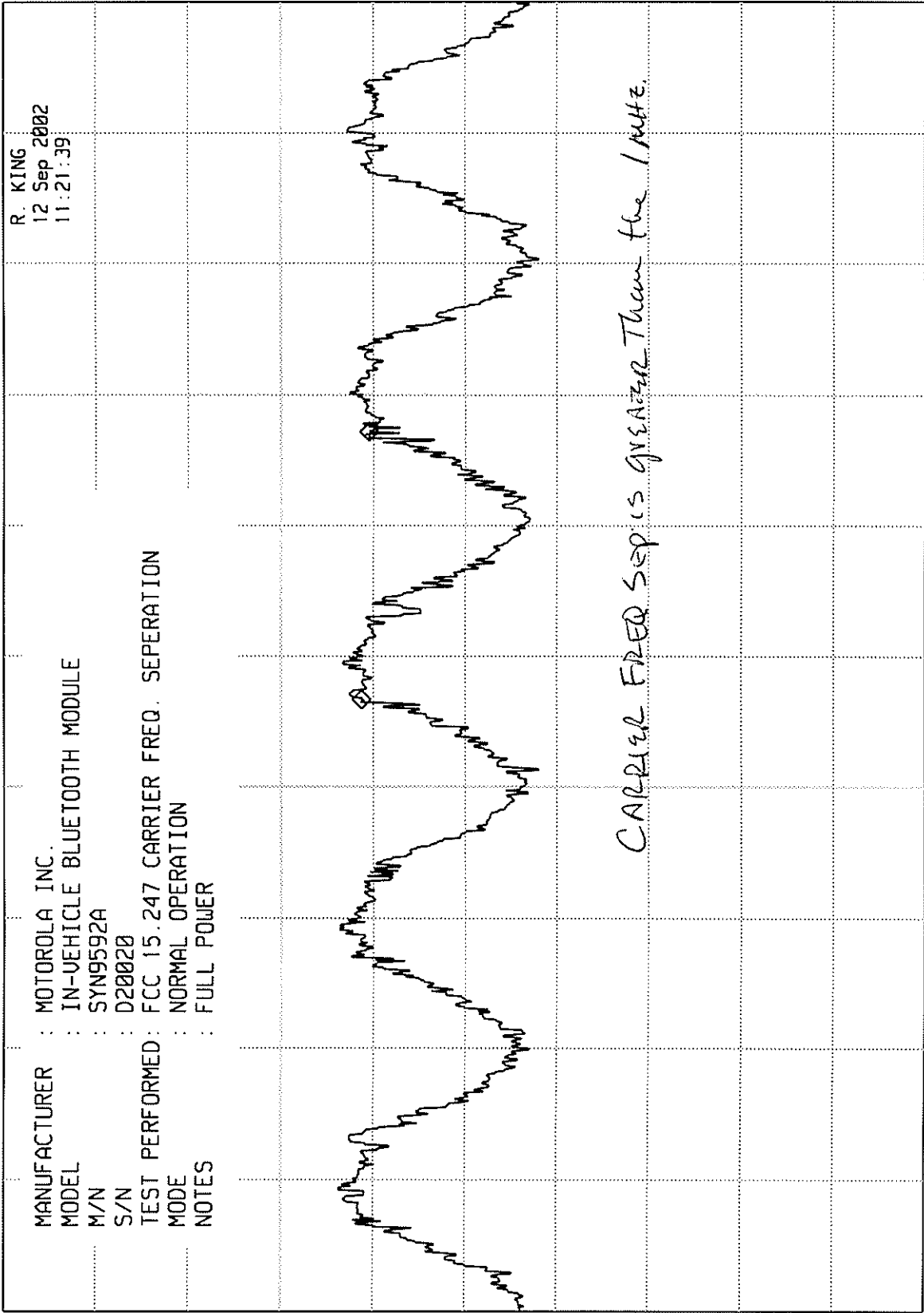
ELITE ELECTRONIC ENGINEERING Inc.

MKR ^ 1.031 MHz
-0.80 dB

hp

REF 20.0 dBm ATTN 30 dB

10 dB/



R. KING
12 Sep 2002
11:21:39

MANUFACTURER : MOTOROLA INC.
MODEL : IN-VEHICLE BLUETOOTH MODULE
M/N : SYN9592A
S/N : D20020

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

CARRIER FREQ SEP IS GREATER THAN THE 1 MHz.

CENTER 2.445 00 GHz SPAN 5.03 MHz
RES BW 100 kHz(i) VBW 1 MHz SWP 20.0 msec

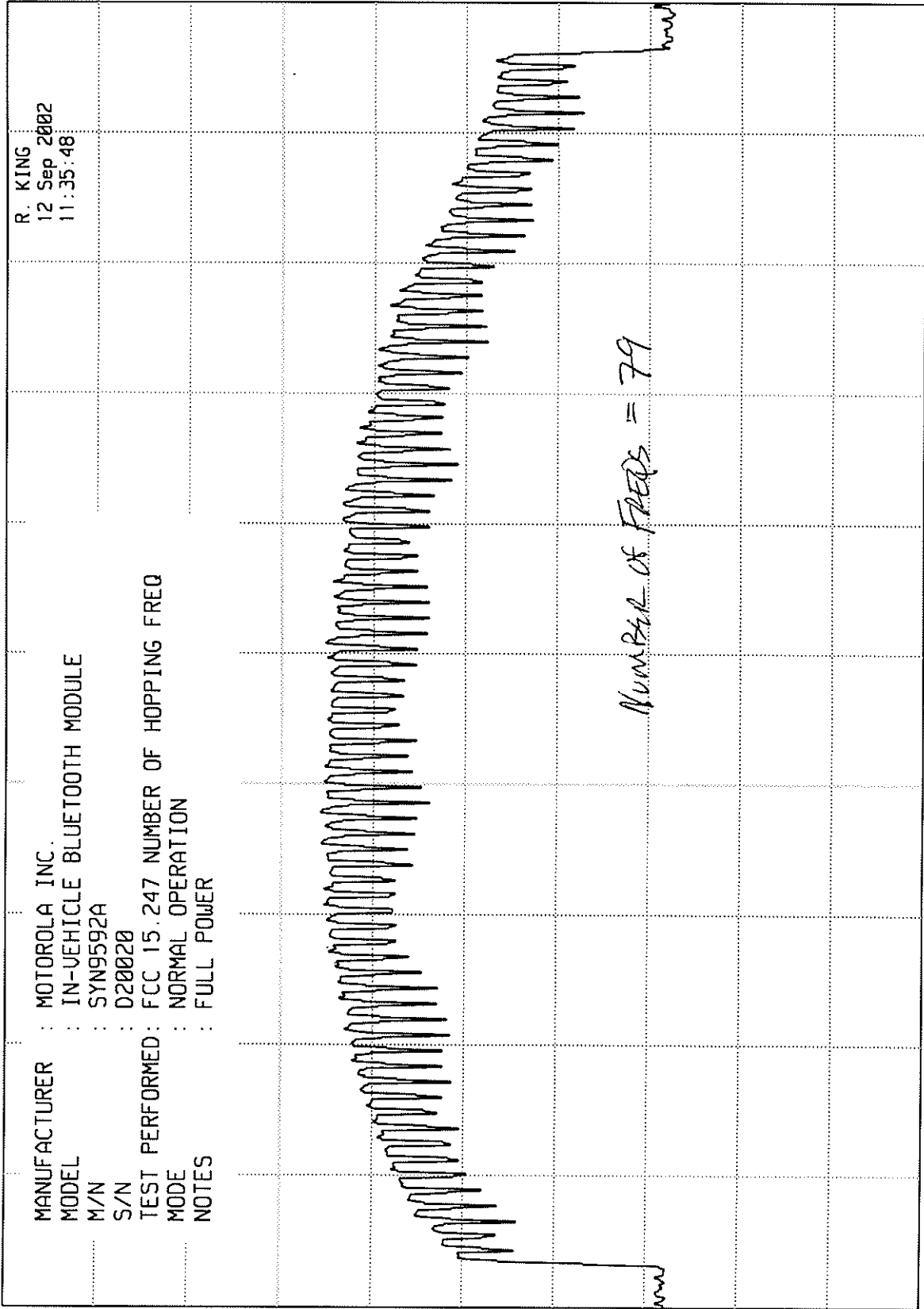
ETR 31382-01

ELITE ELECTRONIC ENGINEERING Inc.

ETR 31382-01

hp
 10 dB/
 OFFSET
 -20.0
 dB

REF 0.0 dBm ATTN 30 dB



MANUFACTURER : MOTOROLA INC.
 MODEL : IN-VEHICLE BLUETOOTH MODULE
 M/N : SYN9592A
 S/N : D20020
 TEST PERFORMED : FCC 15.247 NUMBER OF HOPPING FREQ
 MODE : NORMAL OPERATION
 NOTES : FULL POWER

START 2.399 0 GHz STOP 2.485 0 GHz
 RES BW 300 kHz(i) VBW 3 MHz
 SWP 20.0 msec

ELITE ELECTRONIC ENGINEERING Inc.

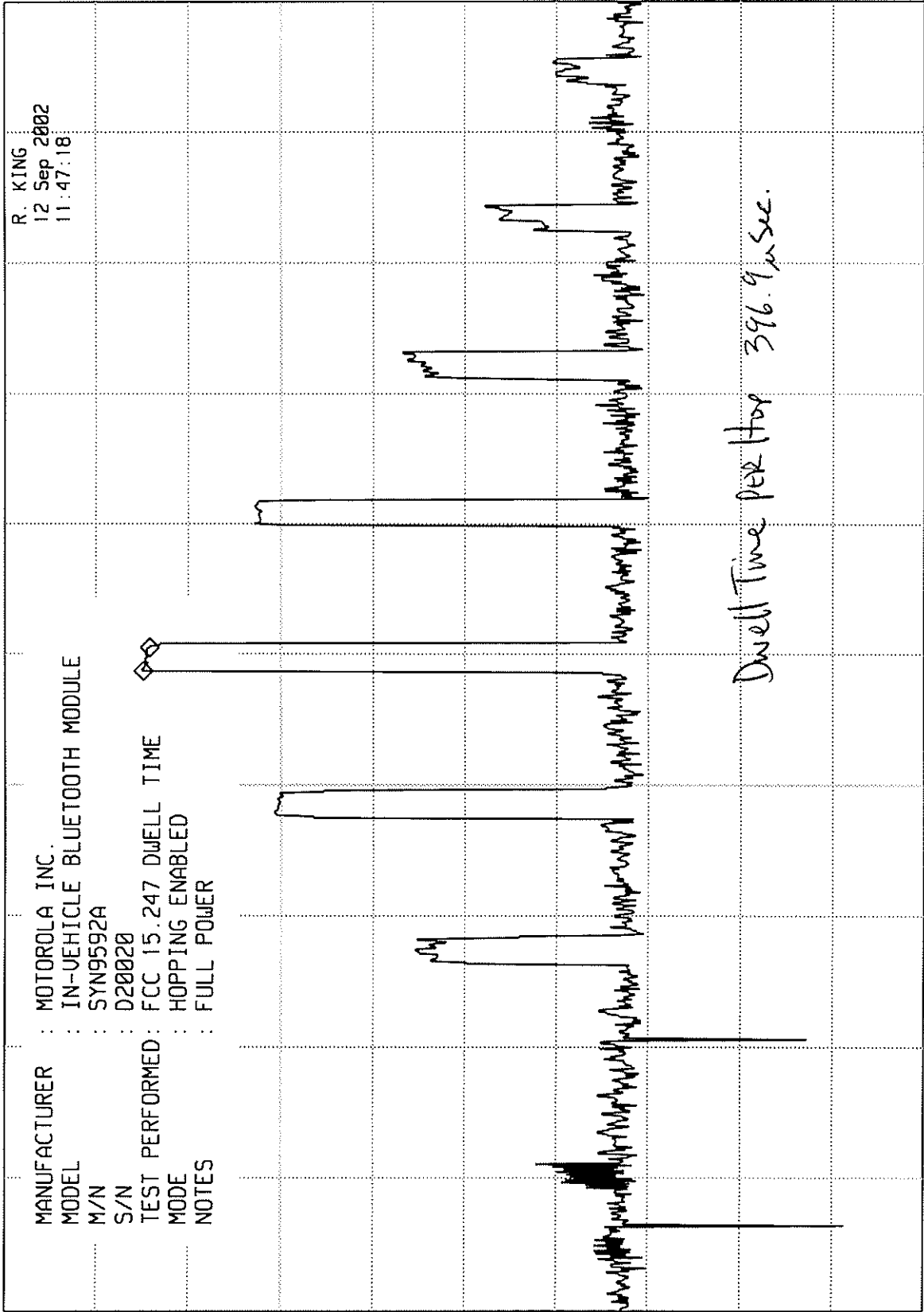
MKR ^ 396.9 usec
-0.70 dB

hp REF 0.0 dBm ATTEN 10 dB

10 dB/

MANUFACTURER : MOTOROLA INC.
MODEL : IN-VEHICLE BLUETOOTH MODULE
M/N : SYN9592A
S/N : D20020
TEST PERFORMED : FCC 15.247 DWELL TIME
MODE : HOPPING ENABLED
NOTES : FULL POWER

R. KING
12 Sep 2002
11:47:18



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

VBW 3 MHz

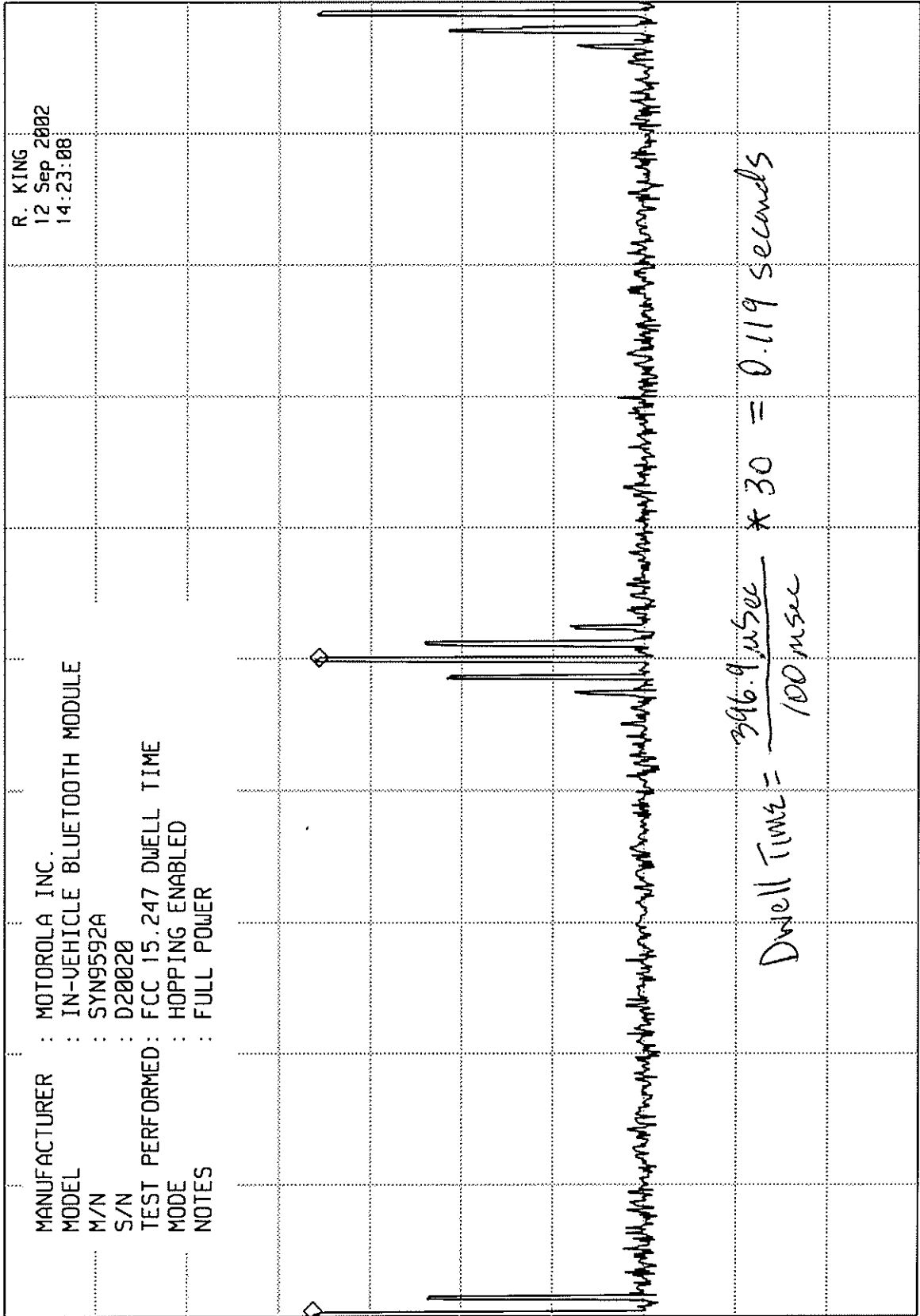
SPAN 0 Hz
SWP 22.1 msec

ETR 31382-01

ELITE ELECTRONIC ENGINEERING Inc.

MKR ~ 100.0 msec
-0.60 dB

hp REF 30.0 dBm ATTEN 40 dB



MANUFACTURER : MOTOROLA INC.
 MODEL : IN-VEHICLE BLUETOOTH MODULE
 M/N : SYN9592A
 S/N : D20020
 TEST PERFORMED: FCC 15.247 DWELL TIME
 MODE : HOPPING ENABLED
 NOTES : FULL POWER

R. KING
 12 Sep 2002
 14:23:08

ETR 31382-01

CENTER 2.441 000 000 GHz RES BW 1 MHz(i) UBW 3 MHz SPAN 0 Hz SWP 200 msec

ELITE ELECTRONIC ENGINEERING Inc.

MKR ^ 930 kHz
-0.60 dB

hp REF -10.0 dBm

ATTEN 30 dB

10 dB/

OFFSET

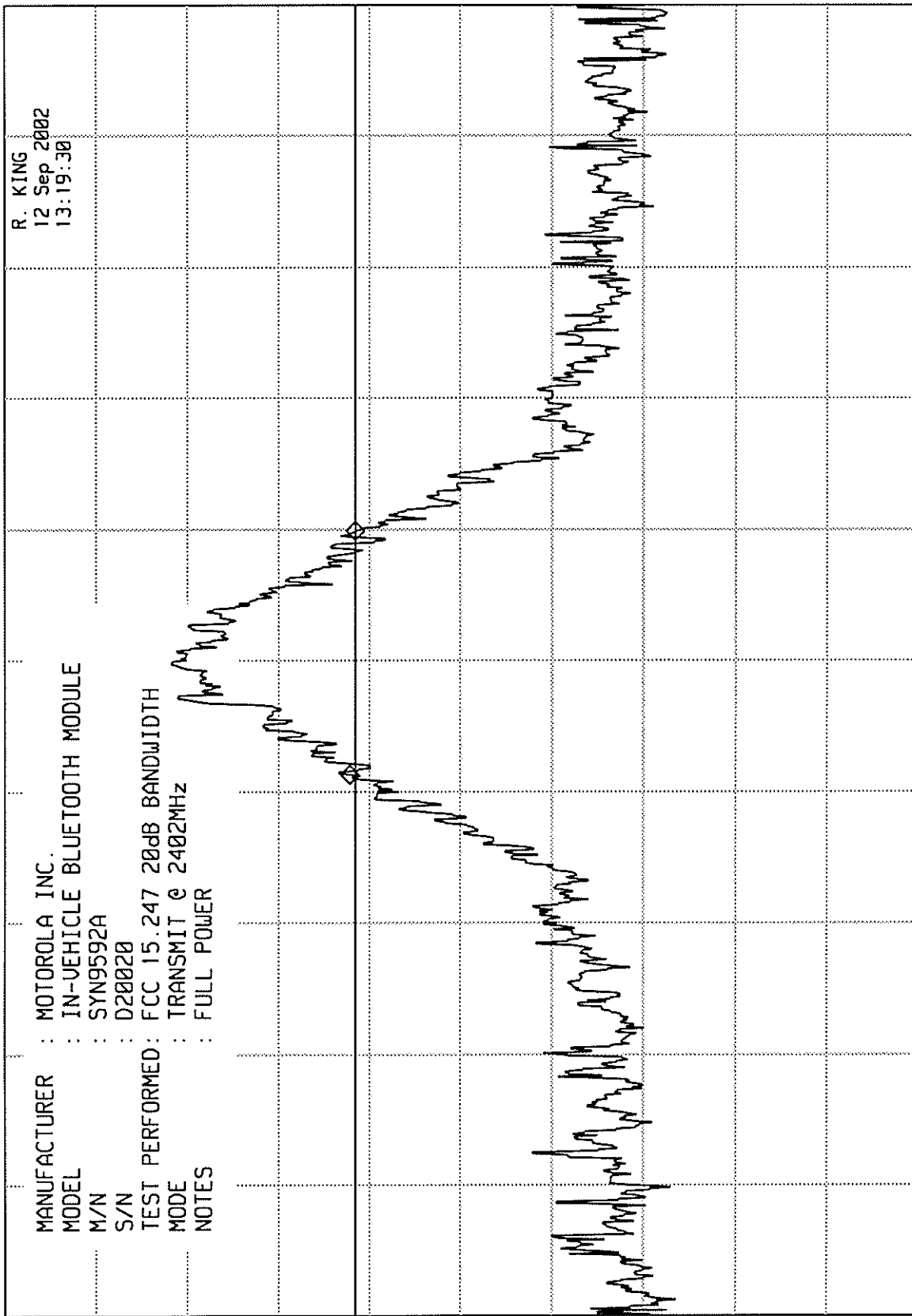
-20.0

dB

DL

-48.4

dBm



R. KING
12 Sep 2002
13:19:30

MANUFACTURER : MOTOROLA INC.
MODEL : IN-VEHICLE BLUETOOTH MODULE
M/N : SYN9592A
S/N : D20020
TEST PERFORMED: FCC 15.247 20dB BANDWIDTH
MODE : TRANSMIT @ 2402MHz
NOTES : FULL POWER

ETR 31382-01

CENTER 2.402 00 GHz
RES BW 10 kHz(i)

SPAN 5.00 MHz
SWP 375 msec

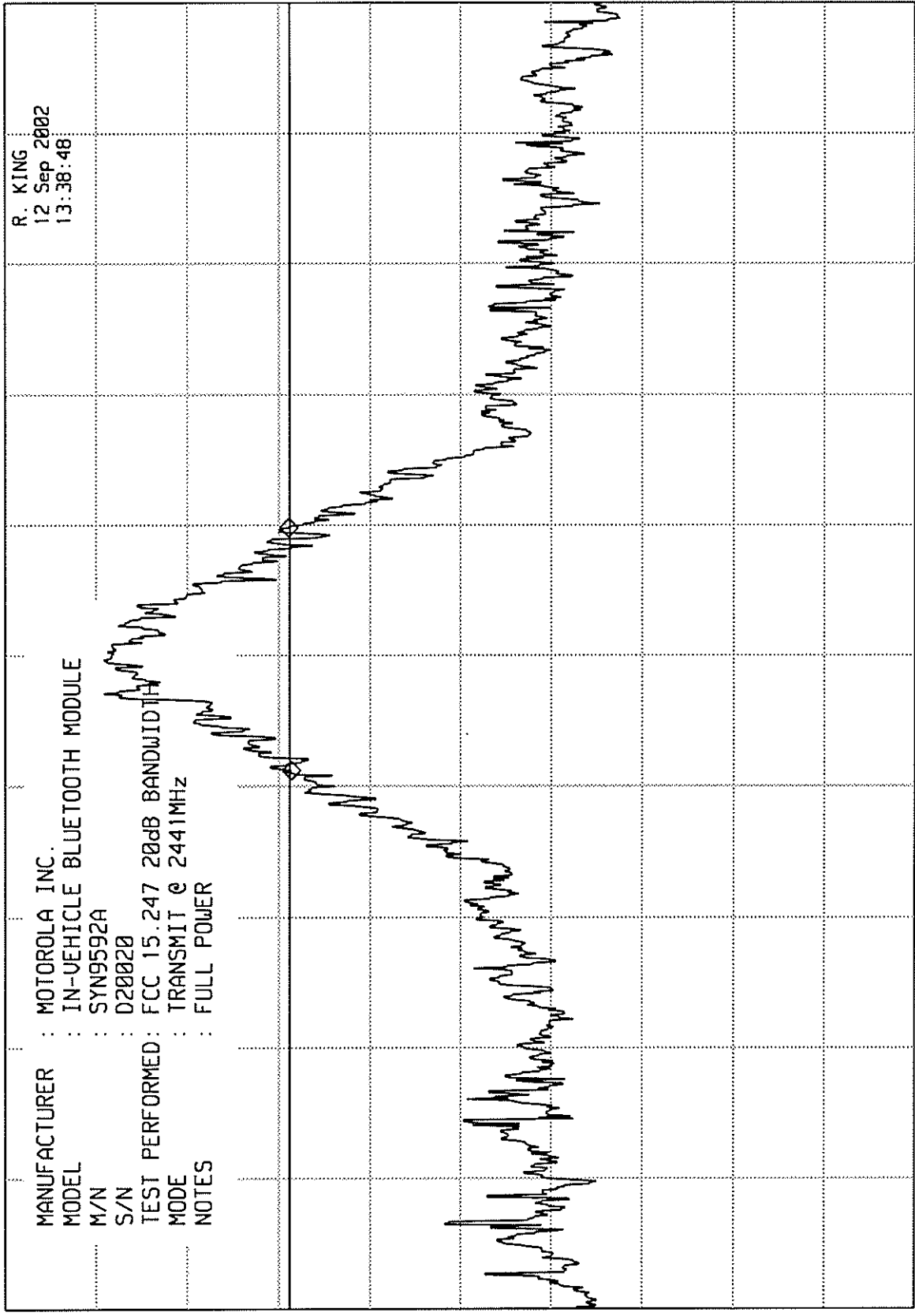
UBW 100 kHz

ETR 31382-01

ELITE ELECTRONIC ENGINEERING Inc.

MKR ^ 930 kHz
0.30 dB

hp REF 0.0 dBm
ATTEN 10 dB



R. KING
12 Sep 2002
13:38:48

MANUFACTURER : MOTOROLA INC.
 MODEL : IN-VEHICLE BLUETOOTH MODULE
 M/N : SYN9592A
 S/N : 020020
 TEST PERFORMED : FCC 15.247 20dB BANDWIDTH
 MODE : TRANSMIT @ 2441MHz
 NOTES : FULL POWER

DL -31.2 dBm

SPAN 5.00 MHz
SWP 375 msec

VBW 100 kHz

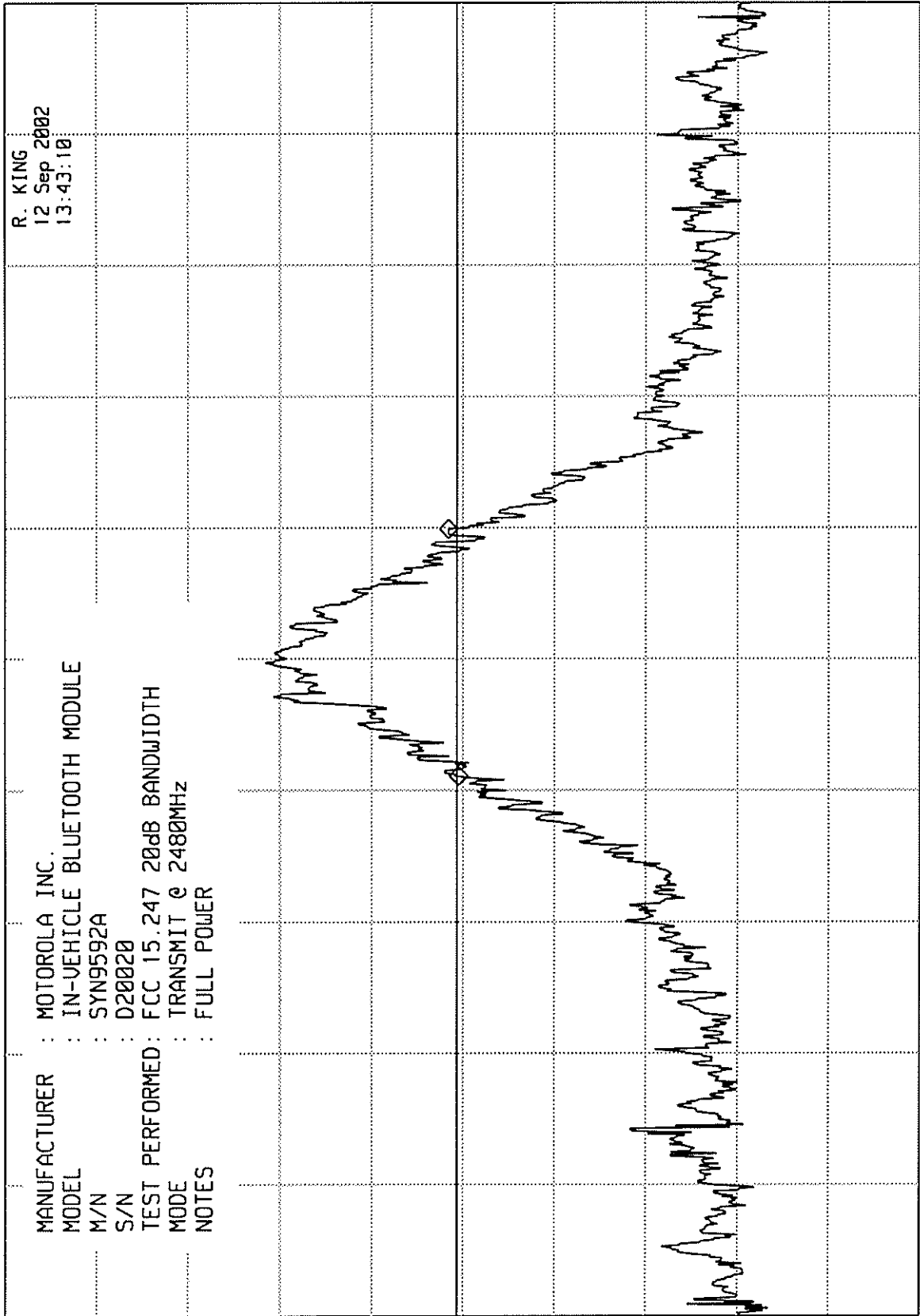
CENTER 2.441 00 GHz
RES BW 10 kHz(i)

ELITE ELECTRONIC ENGINEERING Inc.

MKR ^ 940 kHz
1.10 dB

REF 0.0 dBm
ATTEN 30 dB

hp



R. KING
12 Sep 2002
13:43:10

ETR 31382-01



ETR No. 31382-01
DATA SHEET

PEAK OUTPUT POWER

SPECIFICATION : FCC-15C (15.247)
MANUFACTURER : MOTOROLA
MODEL NO. : IN-VEHICLE BLUETOOTH MODULE
SERIAL NO. : D20020
NOTES : TRANSMITTING AT FULL POWER
TEST DATE : SEPTEMBER 13, 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	97.8	95	-2.8	36
	V	98.4	95	-3.4	36
2441.0	H	102.7	95	-7.7	36
	V	99.1	95	-4.1	36
2480.0	H	97.2	95	-2.2	36
	V	95.3	95	-0.3	36

CHECKED BY: Richard E. King

ELITE ELECTRONIC ENGINEERING Inc.

MKR 2.402 03 GHz
103.60 dBuV

hp REF 107.0 dBuV ATTN 10 dB

10 dB/

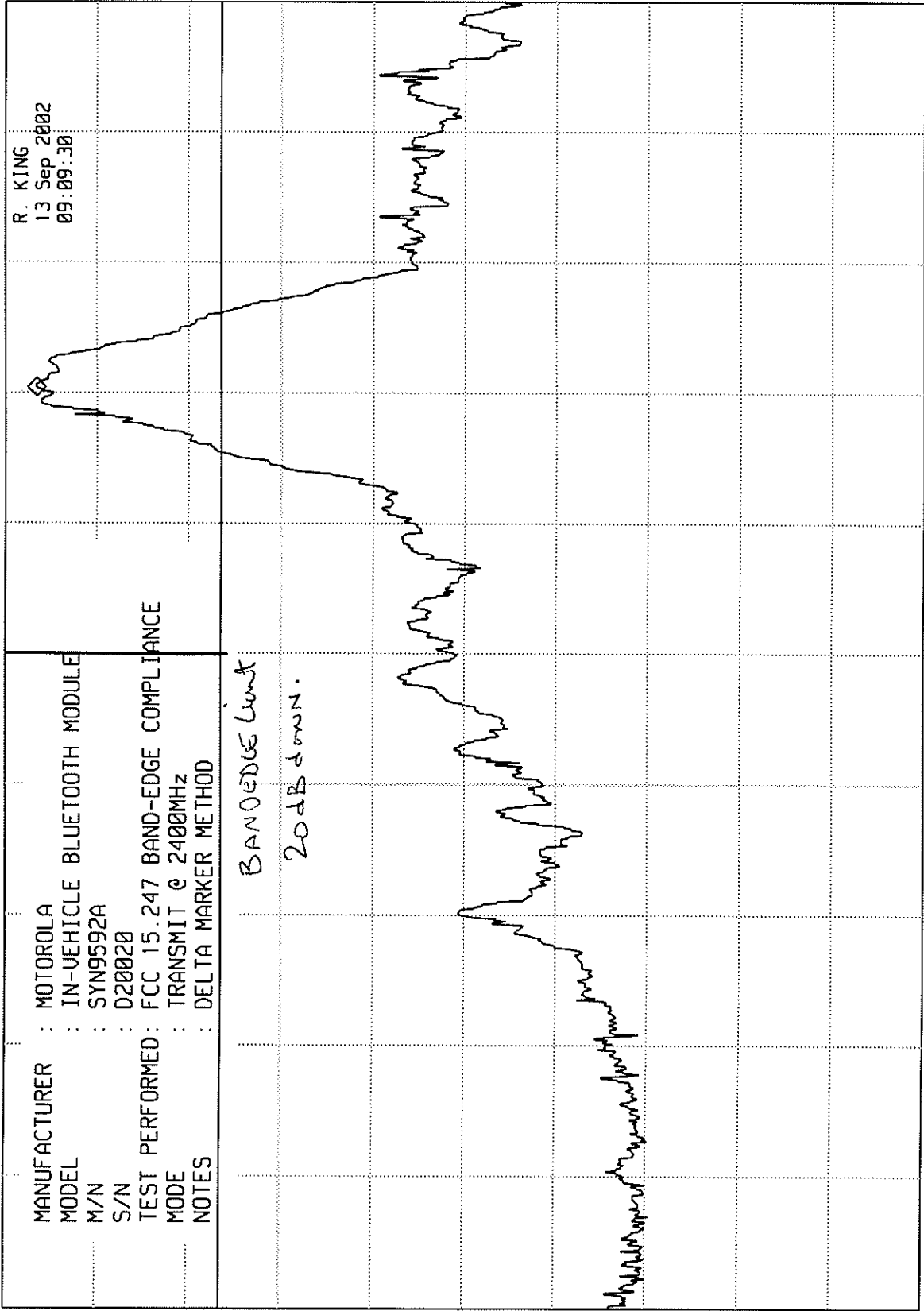
MANUFACTURER : MOTOROLA
MODEL : IN-VEHICLE BLUETOOTH MODULE
M/N : SYN9592A
S/N : D20020
TEST PERFORMED : FCC 15.247 BAND-EDGE COMPLIANCE
MODE : TRANSMIT @ 2400MHz
NOTES : DELTA MARKER METHOD

R. KING
13 Sep 2002
09:09:30

DL 83.5
dBuV

BAND EDGE Limit
20dB down.

ETR 31382-01



SPAN 10.0 MHz
SWP 20.0 msec

VBW 1 MHz

CENTER 2.400 0 GHz
RES BW 100 kHz (i)

ELITE ELECTRONIC ENGINEERING Inc.

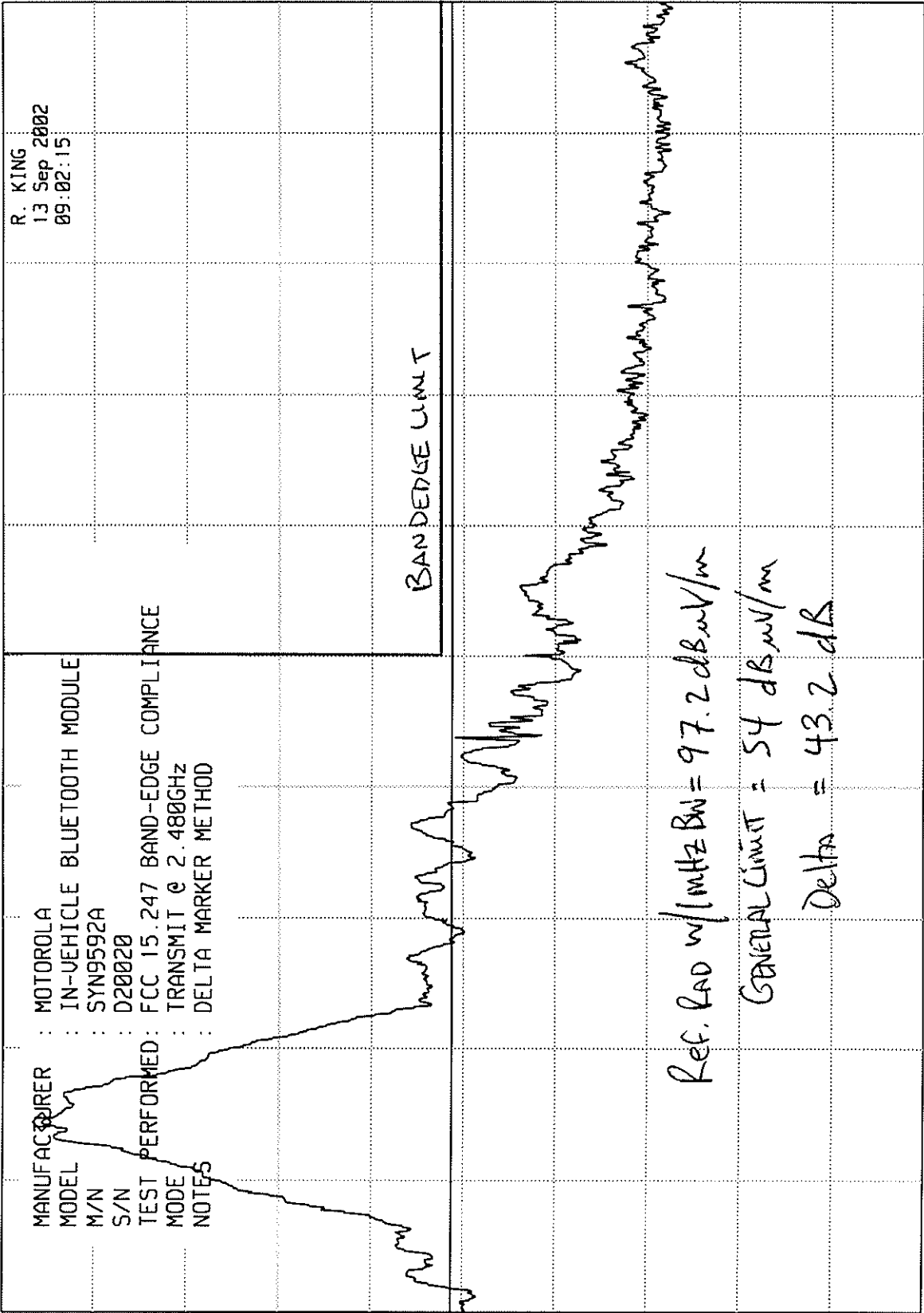
MKR 2.479 93 GHz
102.70 dBuV

hp

REF 107.0 dBuV ATTEN 10 dB

10 dB/

MANUFACTURER : MOTOROLA
 MODEL : IN-VEHICLE BLUETOOTH MODULE
 M/N : SYN9592A
 S/N : D20020
 TEST PERFORMED : FCC 15.247 BAND-EDGE COMPLIANCE
 MODE : TRANSMIT @ 2.480GHz
 NOTES : DELTA MARKER METHOD



ETR 31382-01

DL 58.2 dBuV

Ref. P40 w/1MHz BW = 97.2 dBuV/m
 GENERAL LIMIT = 54 dBuV/m
 Delta = 43.2 dB

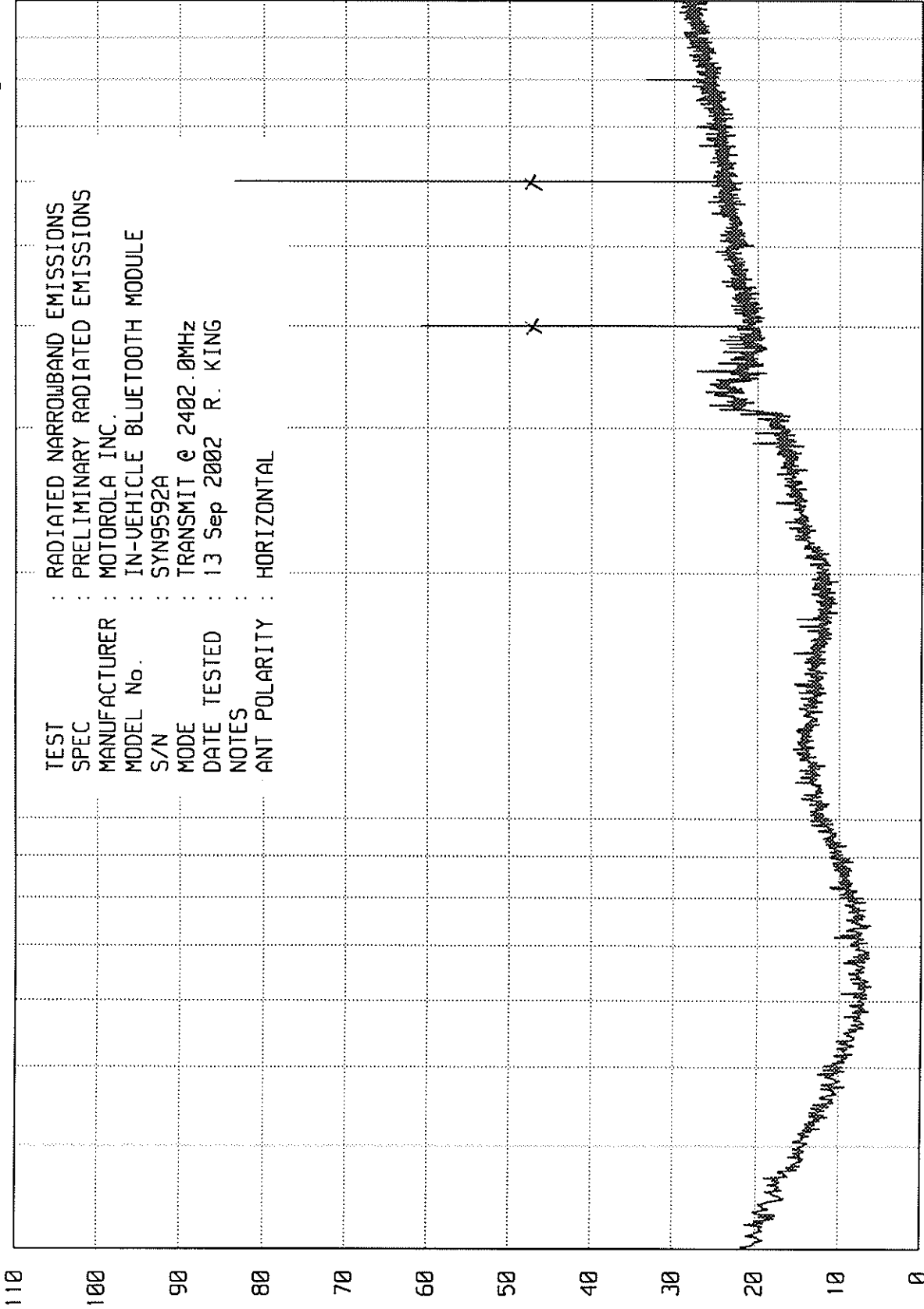
CENTER 2.483 5 GHz RES BW 100 kHz(i) UBW 1 MHz SPAN 10.0 MHz
 SWP 20.0 msec

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIU_EH_RUN RUN 4

UKA0 06/18/02



TEST : RADIATED NARROWBAND EMISSIONS
 SPEC : PRELIMINARY RADIATED EMISSIONS
 MANUFACTURER : MOTOROLA INC.
 MODEL No. : IN-VEHICLE BLUETOOTH MODULE
 S/N : SYN9592A
 MODE : TRANSMIT @ 2402.0MHz
 DATE TESTED : 13 Sep 2002 R. KING
 NOTES :
 ANT POLARITY : HORIZONTAL

RADIATED NARROWBAND EMISSIONS - dBu/m

Page 25 of 37

START = 30

FREQUENCY - MHz

100

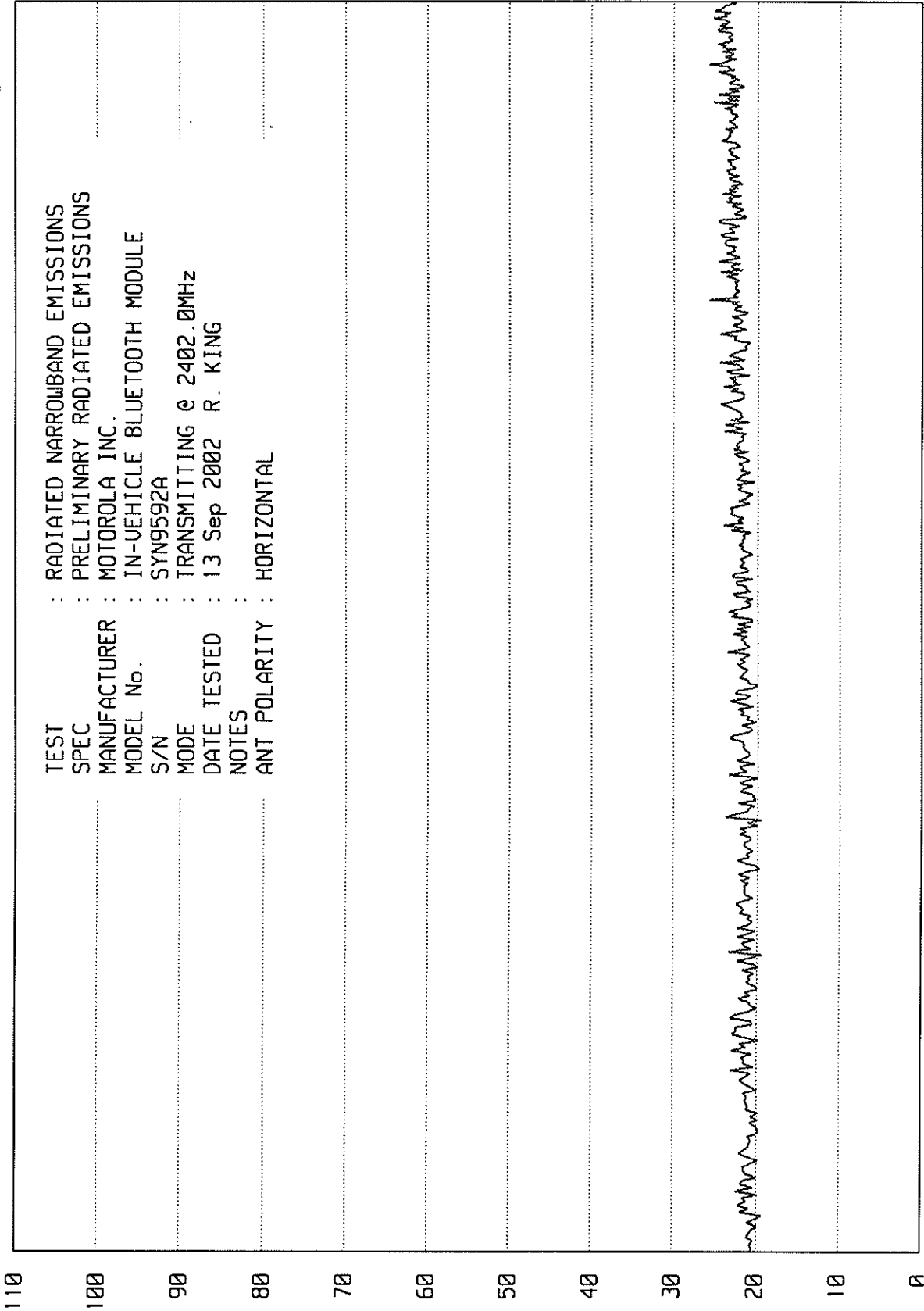
STOP = 1000

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIU_EM RUN RUN 1

WKA0 06/18/02



TEST : RADIATED NARROWBAND EMISSIONS
 SPEC : PRELIMINARY RADIATED EMISSIONS
 MANUFACTURER : MOTOROLA INC.
 MODEL No. : IN-VEHICLE BLUETOOTH MODULE
 S/N : SYN9592A
 MODE : TRANSMITTING @ 2402.0MHz
 DATE TESTED : 13 Sep 2002 R. KING
 NOTES :
 ANT POLARITY : HORIZONTAL

RADIATED NARROWBAND EMISSIONS - dBu/m

Page 26 of 37

START = 1000

FREQUENCY - MHz

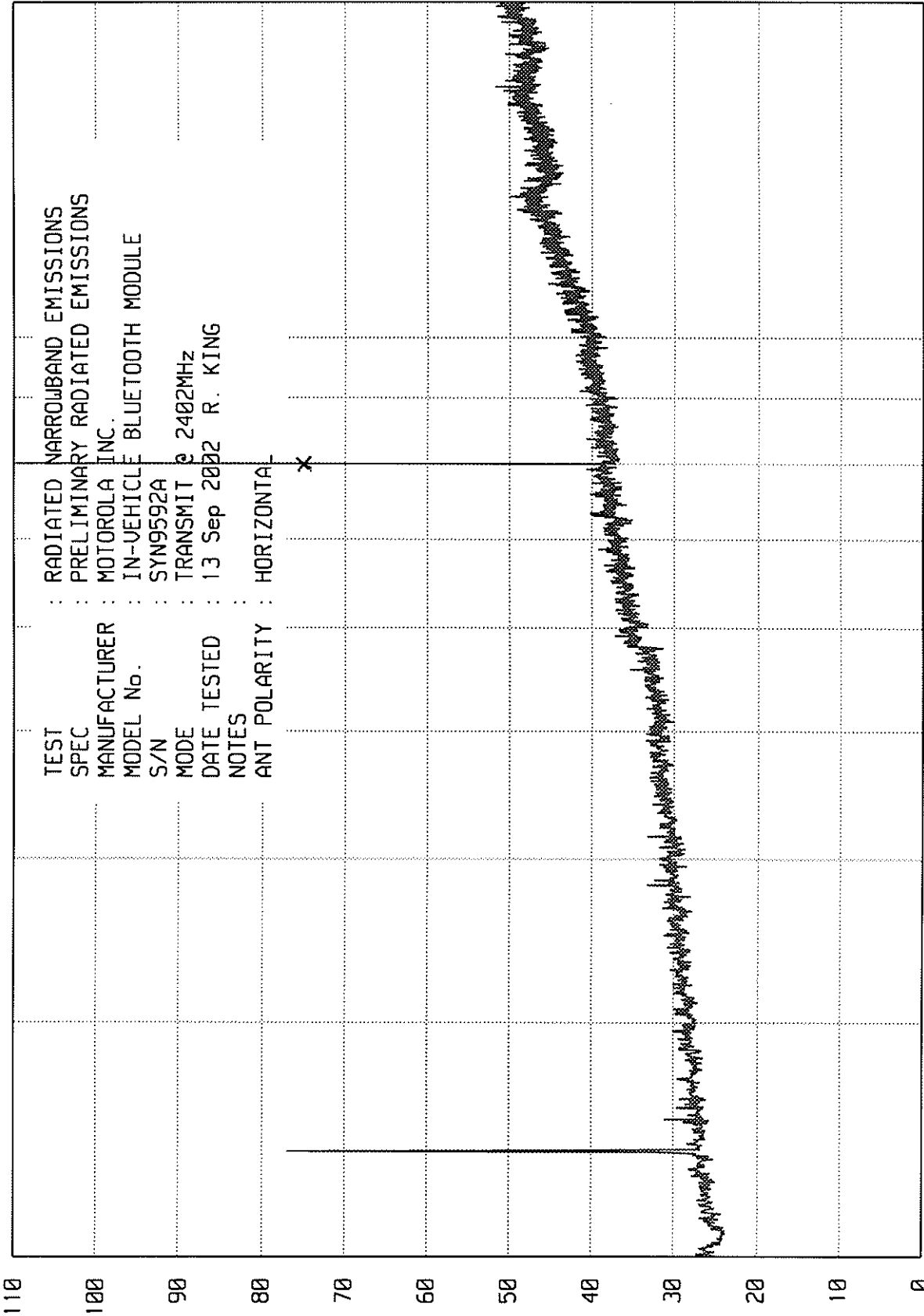
STOP = 2000

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIV_EM RUN RUN 3

WKA0 06/18/02



TEST : RADIATED NARROWBAND EMISSIONS
 SPEC : PRELIMINARY RADIATED EMISSIONS
 MANUFACTURER : MOTOROLA INC.
 MODEL No. : IN-VEHICLE BLUETOOTH MODULE
 S/N : SYN9592A
 MODE : TRANSMIT @ 2402MHz
 DATE TESTED : 13 Sep 2002 R. KING
 NOTES :
 ANT POLARITY : HORIZONTAL

RADIATED NARROWBAND EMISSIONS - dBu/m

START = 2000

FREQUENCY - MHz

10000

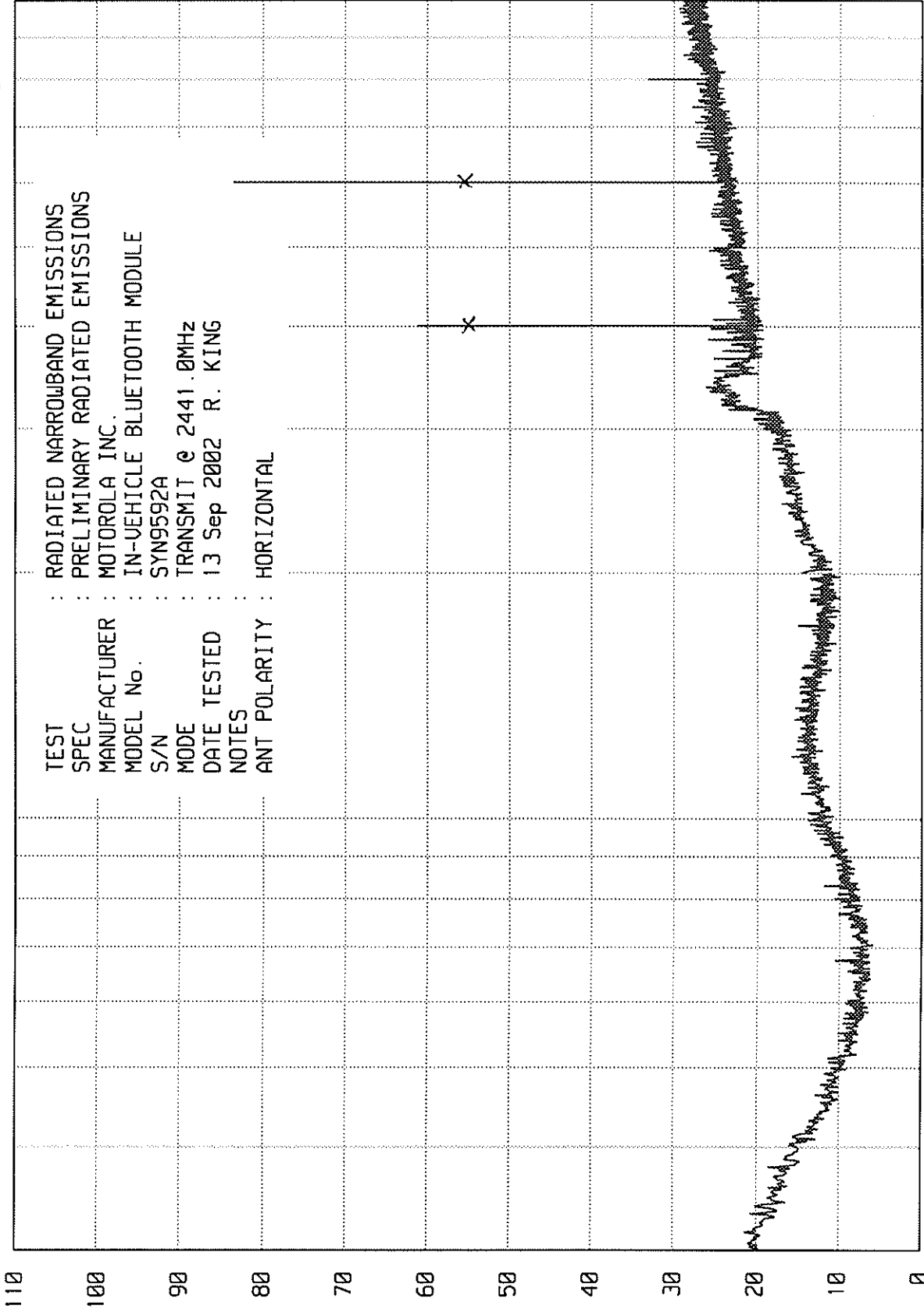
STOP = 18000

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIV_EM RUN RUN 4

WKA0 06/18/02



TEST : RADIATED NARROWBAND EMISSIONS
 SPEC : PRELIMINARY RADIATED EMISSIONS
 MANUFACTURER : MOTOROLA INC.
 MODEL No. : IN-VEHICLE BLUETOOTH MODULE
 S/N : SYN9592A
 MODE : TRANSMIT @ 2441.0MHz
 DATE TESTED : 13 Sep 2002 R. KING
 NOTES :
 ANT POLARITY : HORIZONTAL

STOP = 1000

FREQUENCY - MHz

100

START = 30

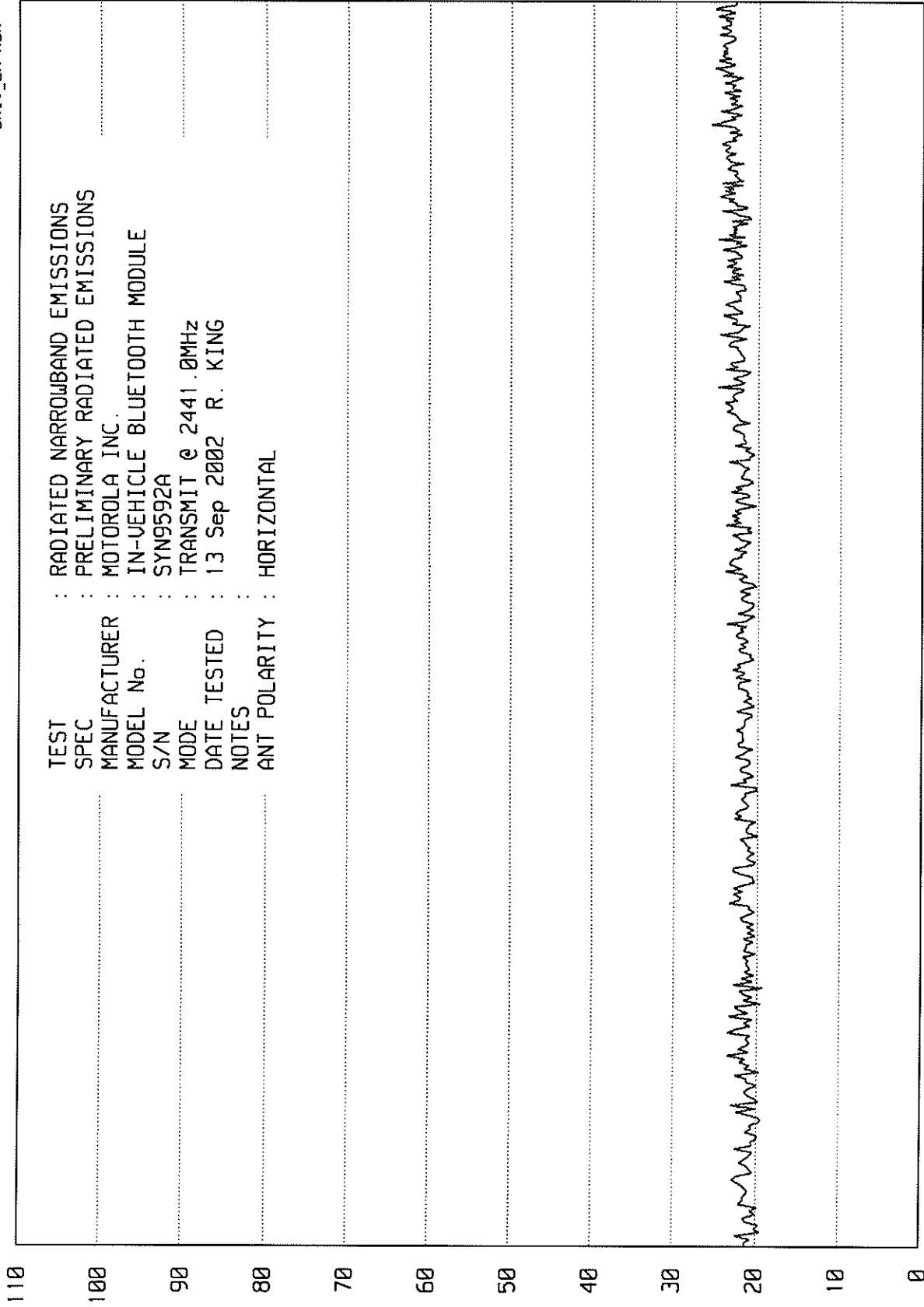
RADIATED NARROWBAND EMISSIONS - dBu/m

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIU_EM RUN RUN 1

UKA0 06/18/02



TEST : RADIATED NARROWBAND EMISSIONS
 SPEC : PRELIMINARY RADIATED EMISSIONS
 MANUFACTURER : MOTOROLA INC.
 MODEL No. : IN-VEHICLE BLUETOOTH MODULE
 S/N : SYN9592A
 MODE : TRANSMIT @ 2441.0MHz
 DATE TESTED : 13 Sep 2002 R. KING
 NOTES :
 ANT POLARITY : HORIZONTAL

RADIATED NARROWBAND EMISSIONS - dBu/m

START = 1000

FREQUENCY - MHz

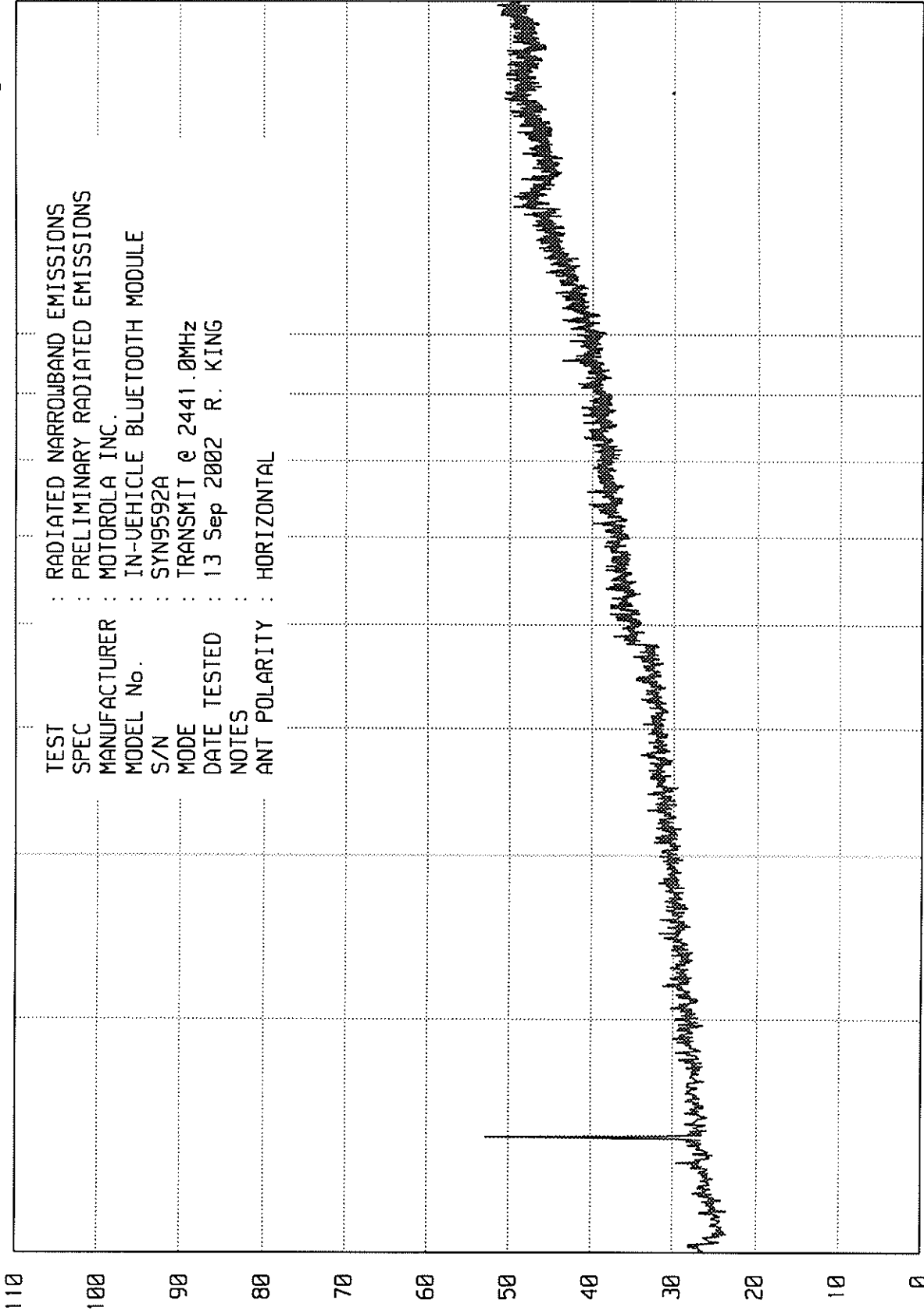
STOP = 2000

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNITU_EM RUN RUN 3

WKA0 06/18/02



TEST : RADIATED NARROWBAND EMISSIONS
 SPEC : PRELIMINARY RADIATED EMISSIONS
 MANUFACTURER : MOTOROLA INC.
 MODEL No. : IN-VEHICLE BLUETOOTH MODULE
 S/N : SYN9592A
 MODE : TRANSMIT @ 2441.0MHz
 DATE TESTED : 13 Sep 2002 R. KING
 NOTES :
 ANT POLARITY : HORIZONTAL

STOP = 18000

10000

FREQUENCY - MHz

START = 2000

50

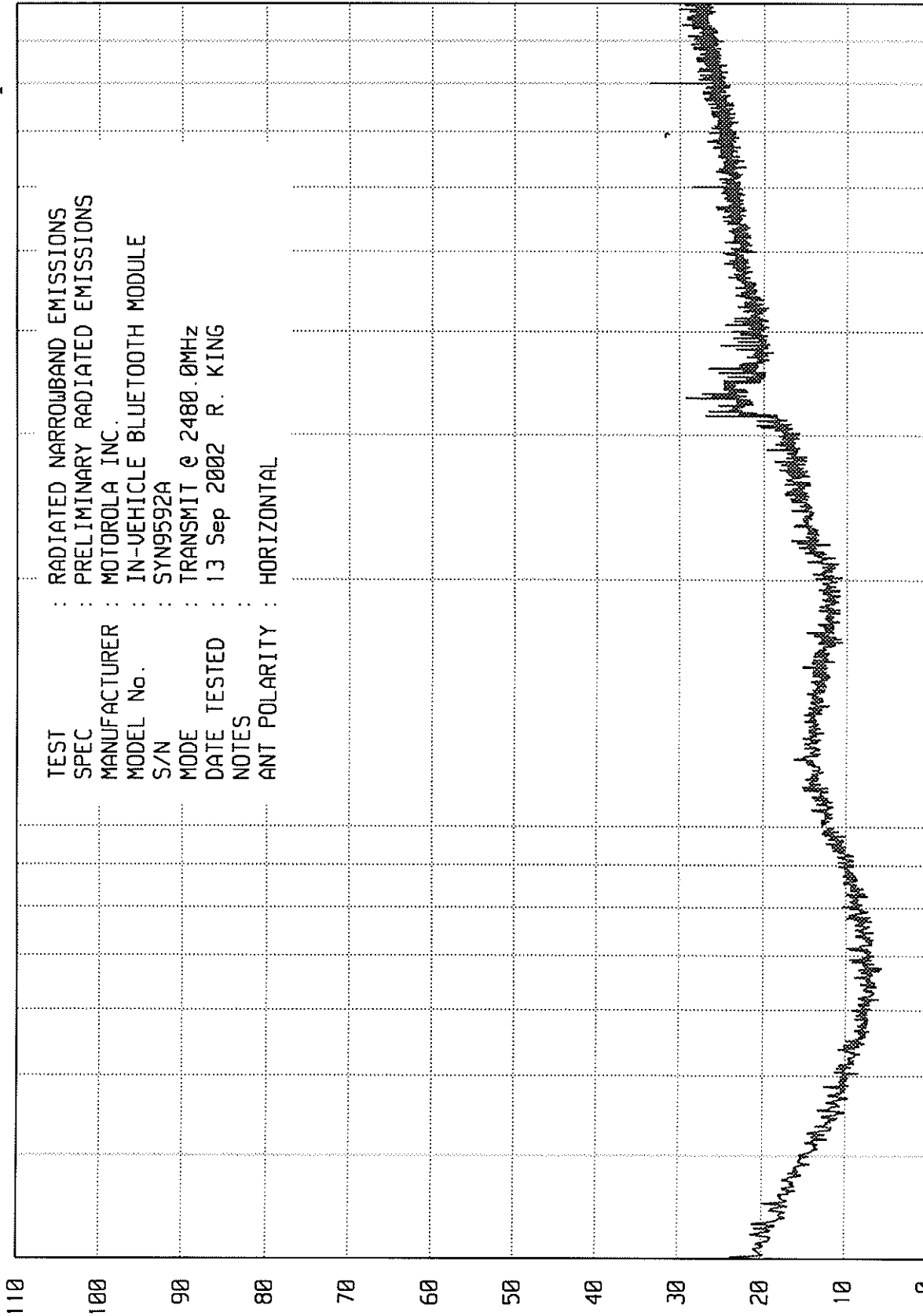
ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNIU_EH RUN RUN 4

UKA08 06/18/02

TEST : RADIATED NARROWBAND EMISSIONS
 SPEC : PRELIMINARY RADIATED EMISSIONS
 MANUFACTURER : MOTOROLA INC.
 MODEL No. : IN-VEHICLE BLUETOOTH MODULE
 S/N : SYN9592A
 MODE : TRANSMIT @ 2480.0MHz
 DATE TESTED : 13 Sep 2002 R. KING
 NOTES :
 ANT POLARITY : HORIZONTAL



RADIATED NARROWBAND EMISSIONS - dBuV/m

START = 30

FREQUENCY - MHz

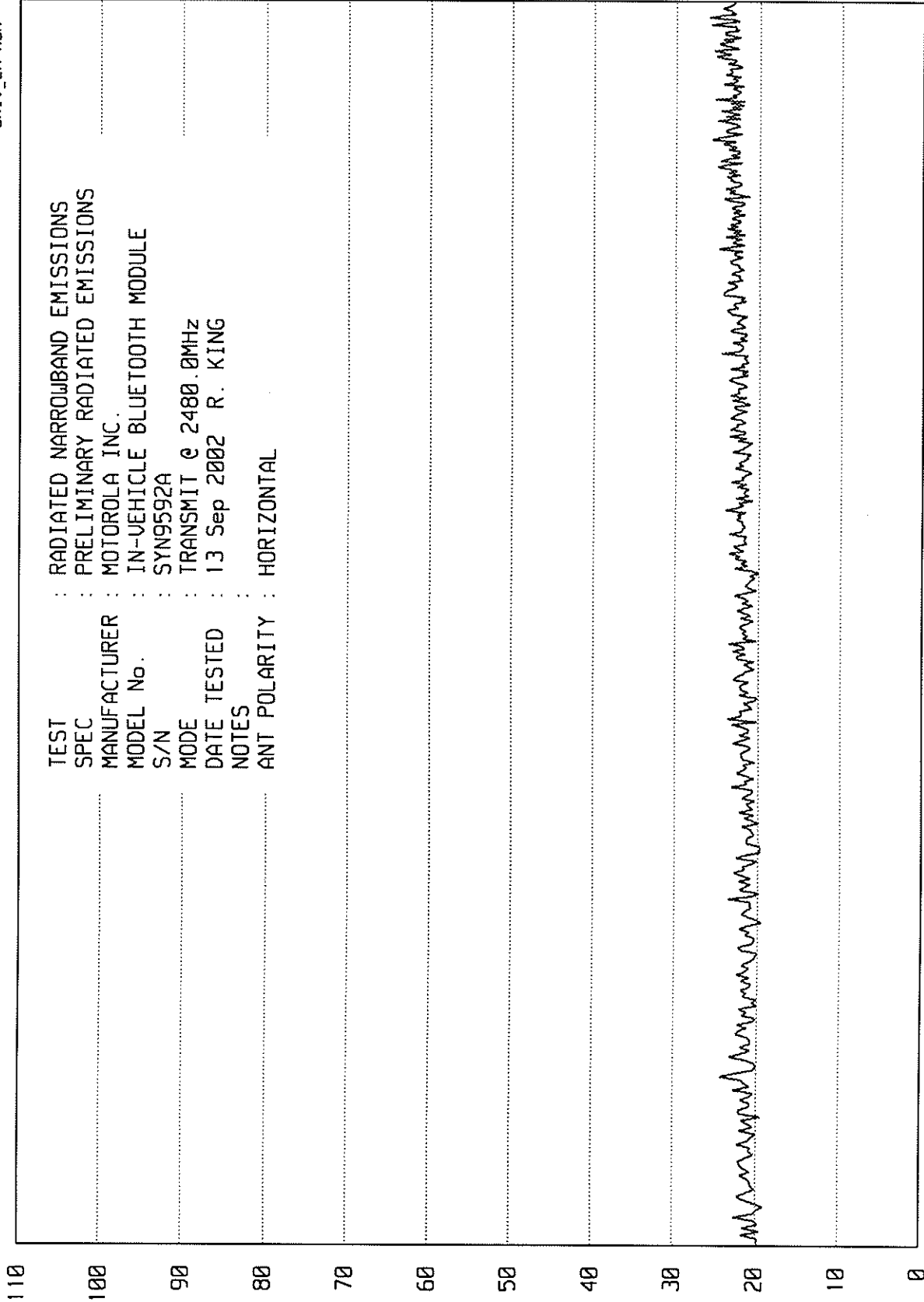
STOP = 1000

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNTU_EM RUN RUN 1

WKA0 06/18/02



TEST : RADIATED NARROWBAND EMISSIONS
 SPEC : PRELIMINARY RADIATED EMISSIONS
 MANUFACTURER : MOTOROLA INC.
 MODEL No. : IN-VEHICLE BLUETOOTH MODULE
 S/N : SYN9592A
 MODE : TRANSMIT @ 2480.0MHz
 DATE TESTED : 13 Sep 2002 R. KING
 NOTES :
 ANT POLARITY : HORIZONTAL

RADIATED NARROWBAND EMISSIONS - dBu/m

START = 1000

FREQUENCY - MHz

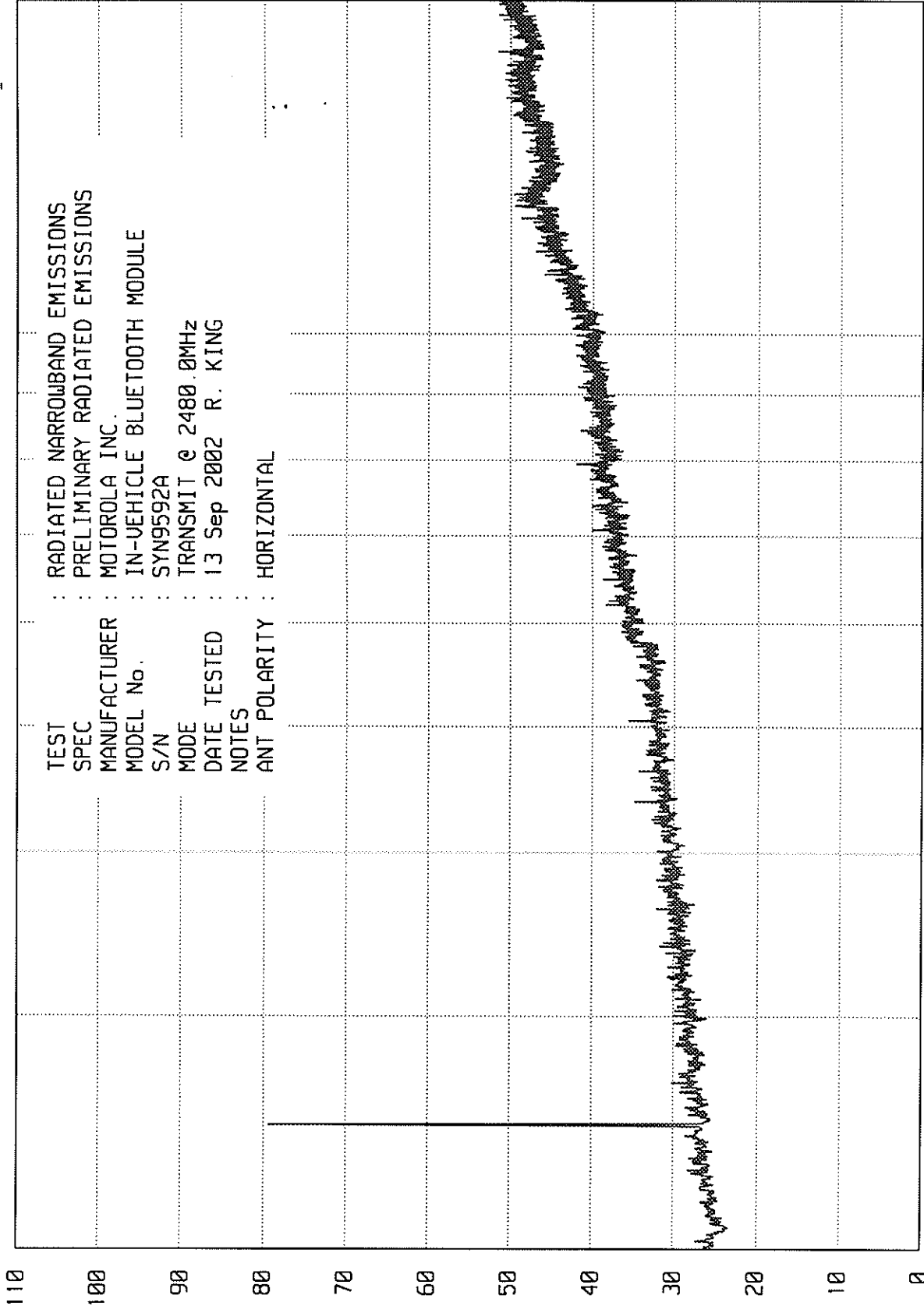
STOP = 2000

ELITE ELECTRONIC ENGINEERING Inc.

Downers Grove, Ill. 60515

UNTU_EM RUN RUN 3

UKAB 06/18/02



TEST : RADIATED NARROWBAND EMISSIONS
 SPEC : PRELIMINARY RADIATED EMISSIONS
 MANUFACTURER : MOTOROLA INC.
 MODEL No. : IN-VEHICLE BLUETOOTH MODULE
 S/N : SYN9592A
 MODE : TRANSMIT @ 2480.0MHz
 DATE TESTED : 13 Sep 2002 R. KING
 NOTES :
 ANT POLARITY : HORIZONTAL

RADIATED NARROWBAND EMISSIONS - dBu/m

Page 33 of 37

START = 2000

FREQUENCY - MHz

10000

STOP = 18000



ETR No. 31382-01
DATA SHEET

RADIATED EMISSION MEASUREMENTS IN A 3m ANECHOIC ROOM

SPECIFICATION : FCC-15C (15.247)
MANUFACTURER : MOTOROLA
MODEL NO. : IN-VEHICLE BLUETOOTH MODULE
SERIAL NO. : D20020
NOTES : TRANSMIT AT LOW CHANNEL 2.402GHZ
TEST DATE : September 13, 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	102.3		1M/3M	28.8	3.3	-36.6	97.8	77624.7	
	V	102.9		1M/3M	28.8	3.3	-36.6	98.4	83176.4	
2402.0	H	59.2		1M/10	28.8	3.3	-36.6	54.7	543.3	
	V	41.0		1M/10	28.8	3.3	-36.6	36.5	66.8	
4804.0	H	39.9		1M/10	33.8	4.8	-36.6	41.9	124.5	500.0
	V	43.2		1M/10	33.8	4.8	-36.6	45.2	182.0	500.0
12010.0	H	31.8	AMB	1M/10	40.4	8.6	-36.6	44.2	162.2	500.0
	V	27.9	AMB	1M/10	40.4	8.6	-36.6	40.3	103.5	500.0
19216.0	H	12.43	AMB	1M/10	40.3			52.7	433.0	500.0
	V	12.5	AMB	1M/10	40.3			52.8	436.5	500.0

CHECKED BY: Richard King



ETR No. 31382-01
DATA SHEET

RADIATED EMISSION MEASUREMENTS IN A 3m ANECHOIC ROOM

SPECIFICATION : FCC-15C (15.247)
 MANUFACTURER : MOTOROLA
 MODEL NO. : IN-VEHICLE BLUETOOTH MODULE
 SERIAL NO. : D20020
 NOTES : TRANSMIT AT MIDDLE CHANNEL 2.441GHz
 TEST DATE : September 13, 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	107.0		1M/3M	28.9	3.4	-36.6	102.7	135675.1	
	V	103.4		1M/3M	28.9	3.4	-36.6	99.1	89639.6	
2441.0	H	60.9		1M/10	28.9	3.4	-36.6	56.6	672.2	
	V	60.2		1M/10	28.9	3.4	-36.6	55.9	620.2	
4882.0	H	41.4		1M/10	34.1	4.9	-36.6	43.8	155.1	500.0
	V	42.9		1M/10	34.1	4.9	-36.6	45.3	183.0	500.0
7323.0	H	28.1	AMB	1M/10	37.2	6.8	-36.6	35.5	59.6	500.0
	V	27.7	AMB	1M/10	37.2	6.8	-36.6	35.1	56.7	500.0
12205.0	H	32.3	AMB	1M/10	40.8	8.6	-36.6	45.1	179.9	500.0
	V	32.2	AMB	1M/10	40.8	8.6	-36.6	45.0	178.4	500.0
19528.0	H	12.8	AMB	1M/10	40.3	0.0	0	53.1	449.8	500.0
	V	12.8	AMB	1M/10	40.3	0.0	0	53.1	453.9	500.0

CHECKED BY: Richard King
 page 35 of 37



ETR No. 31382-01
DATA SHEET

RADIATED EMISSION MEASUREMENTS IN A 3m ANECHOIC ROOM

SPECIFICATION : FCC-15C (15.247)
 MANUFACTURER : MOTOROLA
 MODEL NO. : IN-VEHICLE BLUETOOTH MODULE
 SERIAL NO. : D20020
 NOTES : TRANSMIT AT HIGH CHANNEL 2.480GHz
 TEST DATE : September 13, 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	101.5		1M/3M	29.0	3.3	-36.6	97.2	72778.0	
	V	99.6		1M/3M	29.0	3.3	-36.6	95.3	58479.0	
2480.0	H	59.6		1M/10	29.0	3.3	-36.6	55.3	584.8	
	V	77.2		1M/10	29.0	3.3	-36.6	72.9	4436.1	
4960.0	H	34.2		1M/10	34.2	5.0	-36.6	36.8	69.2	500.0
	V	40.8		1M/10	34.2	5.0	-36.6	43.4	148.3	500.0
7440.0	H	27.4	AMB	1M/10	37.4	6.9	-36.6	35.1	56.9	500.0
	V	26.5	AMB	1M/10	37.4	6.9	-36.6	34.2	51.3	500.0
12400.0	H	32.7	AMB	1M/10	41.1	8.7	-36.6	45.9	197.2	500.0
	V	32.2	AMB	1M/10	41.1	8.7	-36.6	45.4	186.2	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 King
 page 36 of 37

ELITE ELECTRONIC ENGINEERING Inc.

MKR 2.440 965 GHz
89.30 dBuV

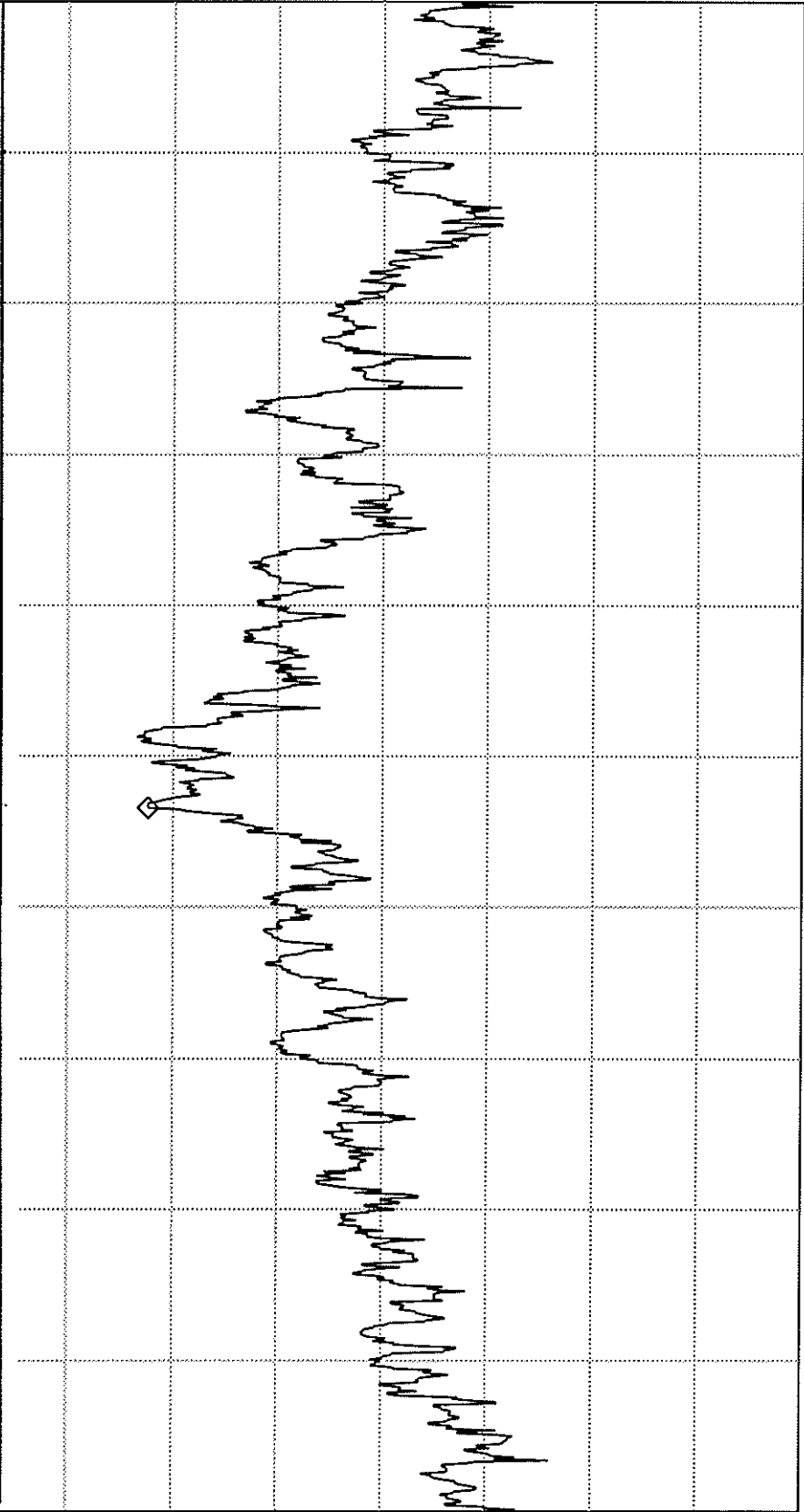
REF 127.0 dBuV ATTN 30 dB

hp
10 dB/

MANUFACTURER : MOTOROLA INC.
 MODEL : IN-VEHICLE BLUETOOTH MODULE
 M/N : SYN9592A
 S/N : D20020
 TEST PERFORMED: FCC 15.247 POWER SPECTRAL DENSITY
 MODE : INQUIRY
 NOTES : FULL POWER

R. KING
13 Sep 2002
14:37:04

8dBm Limit



ETR 31382-01

CENTER 2.441 00 GHz SPAN 1.00 MHz
 RES BW 3 kHz(i) UBW 30 kHz SWP 333 sec