



Measurement of RF Interference from an 302211-X01 Media System Transmitter

For : Bose Corporation
: 688 Great Road
: Stowe, MA

P.O. No. : S3314669 (V)
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Test Personnel : Richard E. King
Specification : FCC "Code of Federal Regulations" Title 47, Part 15,
: Subpart C, Section 15.247 for Frequency Hopping
: Spread Spectrum Intentional Radiators within
: The 2400-2483.5MHz band.
: Industry Canada RSS-210

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REVISION HISTORY

Revision	Date	Description
—	March 21, 2007	Initial release

Measurement of RF Emissions from a Bose Corporation Media System, Part No. 302211-X01 transmitter

1 INTRODUCTION

1.1 Scope of Tests

This document represents the results of the series of radio interference measurements performed on a Media System, Part No. 302211-X01, no serial number was assigned, transmitter (hereinafter referred to as the test item). The test item is a frequency hopping spread spectrum transmitter. The transmitter was designed to transmit in 2400-2483.5 MHz, band using an internal antenna. The test item was manufactured and submitted for testing by Bose Corporation located in Stowe, MA.

1.2 Purpose

The test series was performed to determine if the test item meets the conducted and radiated RF emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.247 for Intentional Radiators. Testing was performed in accordance with ANSI C63.4-2003.

1.3 Deviations, Additions and Exclusions

There were no deviations, additions to, or exclusions from the test specification during this test series

1.4 EMC Laboratory Identification

This series of tests was performed by Elite Electronic Engineering Incorporated of Downers Grove, Illinois. The laboratory is accredited by the National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP). NVLAP Lab Code: 100278-0.

1.5 Laboratory Conditions

The temperature at the time of the test was 23°C and the relative humidity was 31%.

2 APPLICABLE DOCUMENTS

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

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subpart C, dated 1 October 2006
- ANSI C63.4-2003, "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
- Industry Canada RSS-210, Issue 6, September 2005, "Spectrum Management and Telecommunications Radio Standards Specification, Low-power License-exempt radio communication devices (All Frequency Bands): Category I Equipment"
- Industry Canada RSS-GEN, Issue 1, September 2005, "Spectrum Management and Telecommunications Radio Standards Specification, General Requirements and Information for the Certification of radio communication equipment"

3 TEST ITEM SET-UP AND OPERATION

3.1 General Description

The test item is a Media System, Part No. 302211-X01. A block diagram of the test item setup is shown as Figure 1.

3.1.1 Power Input

The test item obtained 13.5 VDC from an external power supply simulating the typical power input from an automotive battery.

3.1.2 Peripheral Equipment

The following peripheral equipment was submitted with the test item.

Item	Description
Simulation box	A load box used to simulate typical operation in the vehicle.

3.1.3 Interconnect Cables

The following interconnect cables were submitted with the test item:

Item	Description
cable harness	6 foot long wiring harness from the load box to the test item.

3.1.4 Grounding

The test item was ungrounded through the return lead of the power supply simulating typical input power in an automobile.

3.2 Operational Mode

For all tests the test item and all peripheral equipment were placed on an 80cm high non-conductive stand. The test item and all peripheral equipment were energized. The test item could be programmed to operate in one of the following modes: transmit at 2402.0 MHz, 2441.0 MHz and 2480.0 MHz, or frequency hopping enabled.

3.3 Test Item Modifications

No modifications were required for compliance to the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.247 requirements.

4 TEST FACILITY AND TEST INSTRUMENTATION

4.1 Shielded Enclosure

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. With the exception of the floor, the reflective surfaces of the shielded chamber are lined with ferrite tiles on the walls and ceiling. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2003 for site attenuation.

4.2 Test Instrumentation

The test instrumentation and auxiliary equipment used during the tests are listed in equipment list shown in Table 10. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

Conducted emission tests were performed with a spectrum analyzer in conjunction with a quasi-peak adapter. Radiated emissions were performed with a spectrum analyzer. This receiver allows measurements with the bandwidths specified by the FCC and with the quasi-peak detector function. The receiver bandwidth was 120 kHz for the 30 MHz to 1000 MHz radiated emissions data.

4.3 Calibration Traceability

Test equipment is maintained and calibrated on a regular basis. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

4.4 Measurement Uncertainty

All measurements are an estimate of their true value. The measurement uncertainty characterizes, with a specified confidence level, the spread of values which may be possible for a given measurement system.

The measurement uncertainty for these tests is presented below:

Conducted Emission Measurements		
Combined Standard Uncertainty	1.07	-1.07
Expanded Uncertainty (95% confidence)	2.1	-2.1

Radiated Emission Measurements		
Combined Standard Uncertainty	2.26	-2.18
Expanded Uncertainty (95% confidence)	4.5	-4.4

5 TEST PROCEDURES

5.1 Powerline Conducted Emissions

5.1.1 Requirements

Since the test item is typically powered with 13.5 VDC from an automotive battery, no conducted emissions tests were performed.

5.2 Antenna Conducted Emissions

5.2.1 Requirements

Per section 15.247(c), in any 100 kHz bandwidth outside of the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power based on either an RF conducted or a radiated emissions measurement. Attenuation below the general limits specified in 15.209(a) is not required.

5.2.2 Procedures

The antenna port of the test item was connected to a spectrum analyzer through a 20 dB attenuator. The resolution bandwidth was set to 100 kHz with a video bandwidth of 1 MHz. Conducted emissions plots were made from 30 MHz to 24 GHz with the test item transmitting at 2402.0 MHz, 2441.0 MHz or 2480.0 MHz. The display line on the plots represents the 20 dB down point from the transmit frequency.

5.2.3 Results

The antenna conducted emissions plots are shown on data pages 18 through 23. As can be seen by the data, the test item did meet the antenna conducted emissions limits of 15.247(c).

5.3 Radiated Measurements

5.3.1 Requirements

Per section 15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated emissions measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

Paragraph 15.209(a) has the following radiated emission limits:

Frequency MHz	Field Strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	3
30.0-88.0	100	3
88.0-216.0	150	3
216.0-960.0	200	3
Above 960	500	3

5.3.2 Procedures

Radiated measurements were performed in a 32ft. x 20ft. x 14ft. high shielded enclosure. The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

Preliminary radiated emissions tests were performed to determine the emission characteristics of the test item. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the test item. The entire frequency range from 30 MHz to 24.0 GHz was investigated using a peak detector function.

The final open field emission tests were then manually performed over the frequency range of 30 MHz to 24.0 GHz.

- 1) For all harmonics not in the restricted bands, the following procedure was used:
 - a) The field strength of the fundamental was measured using a double ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the test item. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.
 - b) The field strength of all of the harmonics not in the restricted band were then measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the test item. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.
 - c) To ensure that maximum or worst case emission levels were measured, the following steps were taken when measuring the fundamental emissions and the spurious emissions:
 - i) The test item was rotated so that all of its sides were exposed to the receiving antenna.
 - ii) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
 - iii) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.

- d) All harmonics not in the restricted bands must be at least 20 dB below level measured at the fundamental. However, attenuation below the general limits specified in §15.209(a) is not required.
- 2) For all emissions in the restricted bands, the following procedure was used:
- a) The field strength of all emissions below 1 GHz were measured using a bi-log antenna. The bi-log antenna was positioned at a 3 meter distance from the test item. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.
 - b) The field strength of all emissions above 1 GHz were measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the test item. A peak detector with a resolution bandwidth of 1 MHz was used on the spectrum analyzer.
 - c) To ensure that maximum or worst case emission levels were measured, the following steps were taken when taking all measurements:
 - i) The test item was rotated so that all of its sides were exposed to the receiving antenna.
 - ii) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
 - iii) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.
 - d) For all radiated emissions measurements below 1 GHz, if the peak reading is below the limits listed in 15.209(a), no further measurements are required. If however, the peak readings exceed the limits listed in 15.209(a), then the emissions are remeasured using a quasi-peak detector.
 - e) For all radiated emissions measurements above 1 GHz, the peak readings must comply with the 15.35(b) limits. 15.35(b) states that when average radiated emissions measurements are specified, there also is a limit on the peak level of the radiated emissions. The limit on the peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. Therefore all peak readings above 1 GHz must be no greater than 20 dB above the limits specified in 15.209(a).

5.3.3 Results

Preliminary radiated emissions plots with the test item transmitting at 2402.0 MHz, 2441.0 MHz, and 2480.0 MHz are shown on pages 24 through 35. Final radiated emissions data are presented on data pages 36 through 38. As can be seen from the data, all emissions measured from the test item were within the specification limits. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown as Figures 2.

5.4 20 dB Bandwidth

5.4.1 Requirements

Per section 15.247(a)(1), frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate within an output power no greater than 125mW.

5.4.2 Procedures

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 > 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.

5.4.3 Results

The plots on pages 39 through 41 show that the maximum 20 dB bandwidth was 1.002MHz. The 99% bandwidth measurement was 870 kHz.

5.5 Carrier Frequency Separation

5.5.1 Requirements

Per section 15.247(a)(1), alternatively, frequency hopping systems operating in the 2400-2483.5MHz band may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate within an output power no greater than 125mW.

5.5.2 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 > to 1% of the span. The peak detector and 'Max-Hold' function were 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.

5.5.3 Results

Page 42 shows the carrier frequency separation. As can be seen from this plot, the carrier frequency separation is 1.04 MHz which is greater than the 20 dB bandwidth of the hopping channel (1.002 MHz).

5.6 Number of Hopping Frequencies

5.6.1 Requirements

Per section 15.247(a)(1)(iii), frequency hopping systems operating in the 2400-2483.5MHz band shall use at least 15 hopping channels.

5.6.2 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 > to 1% of the span. The peak detector and 'Max-Hold' function were engaged. The span was set wide enough to capture the entire frequency band of operation.

The test item's signal was allowed to stabilize after multiple scans. The number of hopping frequencies was counted. The analyzer's display was plotted using a 'screen dump' utility.

5.6.3 Results

Page 43 shows the number of hopping frequencies. As can be seen from this plot, the number of hopping frequencies is 79 which is greater than the minimum number of required hopping frequencies for systems operating in the 2400-2483.5 MHz band.

5.7 Time of Occupancy

5.7.1 Requirements

Per section 15.247(a)(1)(iii), for frequency hopping systems operating in the 2400-2483.5MHz band, the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

5.7.2 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 1 MHz. The peak detector and 'Max-Hold' function were engaged. With the span set to 0 Hz, the sweep time was adjusted to capture a single event in order to measure the dwell time per hop. The analyzer's display was plotted using a 'screen dump' utility. Then, the sweep time was expanded to greater than 0.4 seconds multiplied by the number of hopping channels employed (.4 seconds *79 hops = 31.6 seconds).

5.7.3 Results

Pages 44 and 45 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 140 uS multiplied by 12 hops within a 35 second sweep. This calculated value is equal to 1.68 mS seconds which is less than the 0.4 seconds maximum allowed.

5.8 Peak Output Power

5.8.1 Requirements

Per section 15.247(b)(1), for frequency hopping systems operating in the 2400-2483.5MHz band and employing at least 75 non-overlapping hopping channels, the maximum peak output conducted power shall not be greater than 1 W (30 dBm). Per section 15.247(b)(4), this limit is based on the use of antennas with directional gains that do not exceed 6dBi. Since the limit allows for a 6 dBi antenna gain, the maximum EIRP can be increased by 6 dB to 4 Watt (36 dBm).

5.8.2 Procedures

The test item was placed on the non-conductive stand and set to transmit. A double ridged waveguide antenna was placed at a test distance of 3 meters from the test item. The test item was maximized for worst case emissions (or maximum output power) at the measuring antenna. The maximum meter reading was recorded. The peak power output was measured for the 2402.0 MHz, 2441.0 MHz and 2480.0 MHz hopping frequencies.

The equivalent power was determined from the field intensity levels measured at 3 meters using the substitution method. To determine the emission power, a second double ridged waveguide antenna was then set in place of the test item and connected to a calibrated signal generator. The output of the signal generator was adjusted to match the received level at the spectrum analyzer. The signal level was recorded. The reading was then corrected to compensate for cable loss and antenna gain, as required. The peak power output was calculated for 2402.0 MHz, 2441.0 MHz and 2480.0 MHz hopping frequencies.

5.8.3 Results

The results are presented on Pages 46 and 47. The maximum conducted measurement was -4.87 dBm or 0.33 mW which is below the 1 W (30 dBm) limit. The maximum EIRP measured from the transmitter was 1.4 dBm or 1.4 mW which is below the 4 Watt (36 dBm) limit.

5.9 Bandedge Compliance

5.9.1 Requirements

Per section 15.247(d), the emissions at the bandedges must be at least 20 dB below the highest level measured within the band but attenuation below the general limits listed in 15.209(a) is not required. In addition, the radiated emissions which fall in the restricted band beginning at 2483.5 MHz must meet the general limits of 15.209(a).

5.9.2 Procedures

- 1) The test item was connected to the spectrum analyzer through 20 dB of attenuation.
- 2) The test item was set to transmit continuously at the channel closest to the low band-edge (hopping function disabled).
- 3) The meter reading was recorded.
- 4) To determine the bandedge compliance, the following spectrum analyzer settings were used:
 - a) Center frequency = low band-edge frequency.
 - b) Span = Wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation.
 - c) Resolution bandwidth (RBW) = 300 kHz (at least 1% of the span).
 - d) The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
 - e) The marker was set on the peak of the in-band emissions. A display line was placed 20 dB down from the peak of the in-band emissions. All emissions which fall outside of the authorized band of operation must be below the 20 dB down display line. (All emissions to the left of the center frequency (bandedge) must be below the display line.)
 - f) The analyzer's display was plotted using a 'screen dump' utility.
- 5) Step 5) was repeated with the frequency hopping function enabled.
- 6) The test item was set to transmit continuously at the channel closest to the high band-edge (hopping function disabled).
- 7) The test item was maximized for worst case emissions at the measuring antenna. A peak reading was taken with a resolution bandwidth of 1 MHz and a video bandwidth of 1 MHz or greater. An average reading was then taken with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz. The maximum peak and average meter readings were recorded.
- 8) To determine the bandedge compliance, the following spectrum analyzer settings were used:
 - a) Center frequency = high band-edge frequency.
 - b) Span = Wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation.
 - c) Resolution bandwidth (RBW) = 300 kHz (at least 1% of the span).

- d) The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
 - e) The marker was set on the peak of the in-band emissions. This level corresponds to the maximized peak reading previously taken. The "marker-delta" method described in Public Notice DA 00-705 was then used to determine bandedge compliance. The delta between the marker and the general limit (54 dBuV/m) was calculated by subtracting the general limit (54 dBuV/m) from the maximum reading taken with a 1 MHz bandwidth. This delta represents how far below the marker the emissions outside of the authorized band of operation must be. A display line was placed at this level. All emissions which fall outside of the authorized band of operation must be below the display line. (All emissions to the right of the center frequency (band-edge) must be below the display line.)
 - f) The analyzer's display was plotted using a 'screen dump' utility.
- 9) The previous step was repeated with the frequency hopping function enabled.

5.9.3 Results

Pages 48 through 51 show the radiated band-edge compliance results. As can be seen from these plots, the emissions at the low end bandedge are within the 20 dB down limits. The emissions at the high end bandedge are within the general limits..

5.10 Power Spectral Density

5.10.1 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.

5.10.2 Procedures

The output of the test item was connected to the power meter through a 20 dB pad. The test item was put into inquiry mode. The resolution bandwidth (RBW) was initially set to 3MHz to set the reference level. Knowing the 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 MHz/3kHz = 333 seconds). The peak detector and 'Max-Hold' function was engaged. The analyzer's display was plotted using a 'screen dump' utility.

5.10.3 Results

Data page 52 shows the power spectral density results. As can be seen from this plot, the peak power density is less than 8 dBm in a 3 kHz band during any time interval of continuous transmission.

6 CONCLUSIONS

It was determined that the Bose Corporation. 302211-X01, Serial No. none assigned, did fully meet the conducted and radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.207 and 15.247 for Intentional Radiators Operating within the 2400-2483.5MHz band, when tested per ANSI C63.4-2003.

7 CERTIFICATION

Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the test specifications.

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.



8 ENDORSEMENT DISCLAIMER

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



9 EQUIPMENT LIST

Table 9-1 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								
XPRO	HIGH PASS FILTER	K&L MICROWAVE	11SH10-4800/	001	4.8-20GHZ	07/27/06	12	07/27/07
XZGO	ATTENUATOR/SWITCH DRIVER	HEWLETT PACKARD	11713A	3439A02724	---		N/A	
Equipment Type: AMPLIFIERS								
APK0	PRE-AMPLIFIER	HEWLETT PACKARD	8449B	3008A00662	1-26.5GHZ	03/16/07	12	03/16/08
APW0	PREAMPLIFIER	PLANAR ELECTRON	PE2-30-20G20	PL2926/0646	20GHZ-26.5GHZ	11/27/06	12	11/27/07
APW3	PREAMPLIFIER	PLANAR ELECTRON	PE2-35-120-5	PL2924	1GHZ-20GHZ	11/27/06	12	11/27/07
Equipment Type: ANTENNAS								
NHGO	STANDARD GAIN HORN ANTENNA	NARDA	638	---	18-26.5GHZ			NOTE 1
NTAO	BILOG ANTENNA	CHASE EMC LTD.	BILOG CBL611	2057	0.03-2GHZ	08/21/06	12	08/21/07
NWIO	RIDGED WAVE GUIDE	AEL	H1498	153	2-18GHZ	10/09/06	12	10/09/07
Equipment Type: ATTENUATORS								
T2DJ	25W 20DB ATTENUATOR	WEINSCHEL	46-20-34	BS0923	DC-18GHZ	12/04/06	12	12/04/07
Equipment Type: CONTROLLERS								
CMA0	MULTI-DEVICE CONTROLLER	EMCO	2090	9701-1213	---			N/A
Equipment Type: RECEIVERS								
RAC1	SPECTRUM ANALYZER	HEWLETT PACKARD	85660B	3407A08369	100HZ-22GHZ	02/21/07	12	02/21/08
RACB	RF PRESELECTOR	HEWLETT PACKARD	85685A	3506A01491	20HZ-2GHZ	02/21/07	12	02/21/08
RAF3	QUASISPEAK ADAPTER	HEWLETT PACKARD	85650A	3303A01775	0.01-1000MHZ	02/21/07	12	02/21/08
RAKG	RF SECTION	HEWLETT PACKARD	85462A	3549A00284	0.009-6500MHZ	11/27/06	12	11/27/07
RAKH	RF FILTER SECTION	HEWLETT PACKARD	85460A	3448A00324	---	11/27/06	12	11/27/07
RBB0	EMI TEST RECEIVER 20HZ TO	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	09/29/06	12	09/29/07

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.

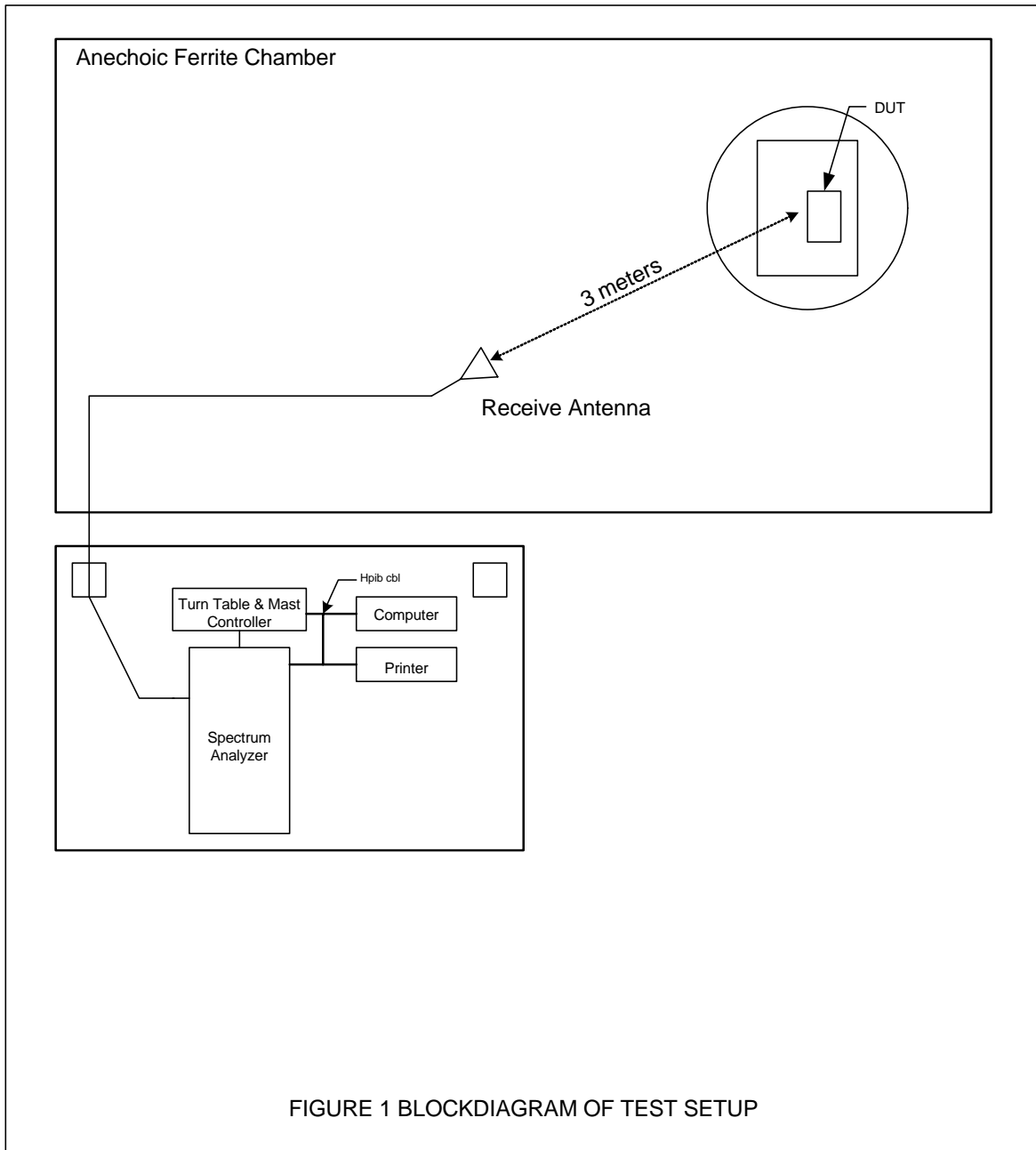
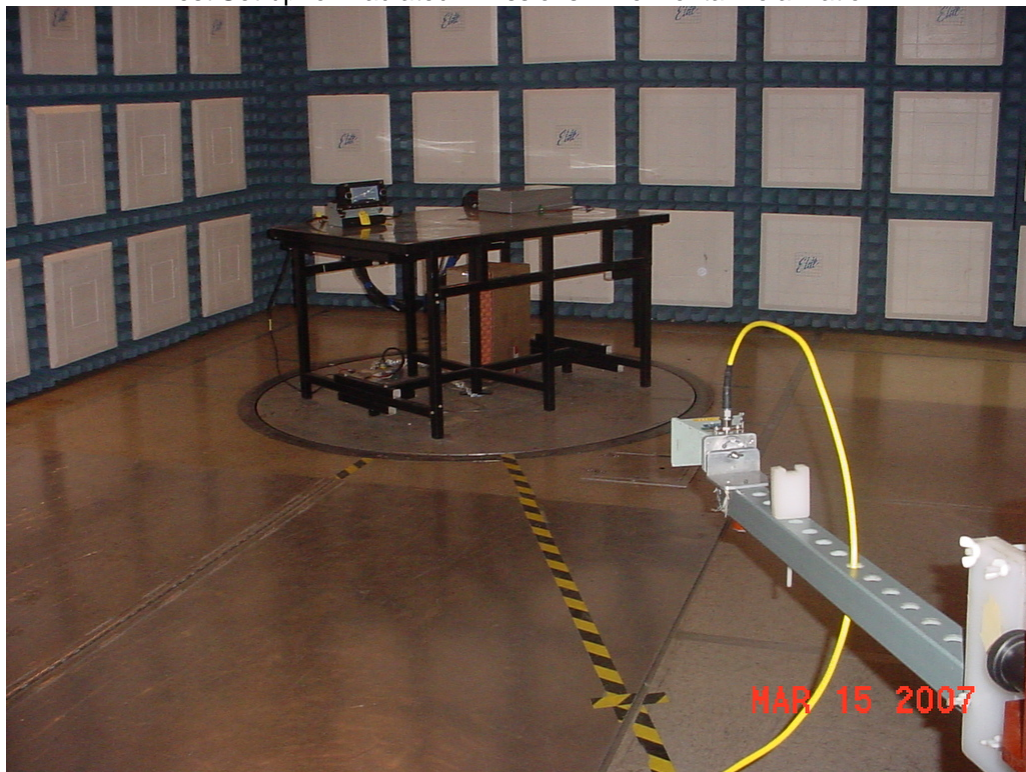


Figure 2



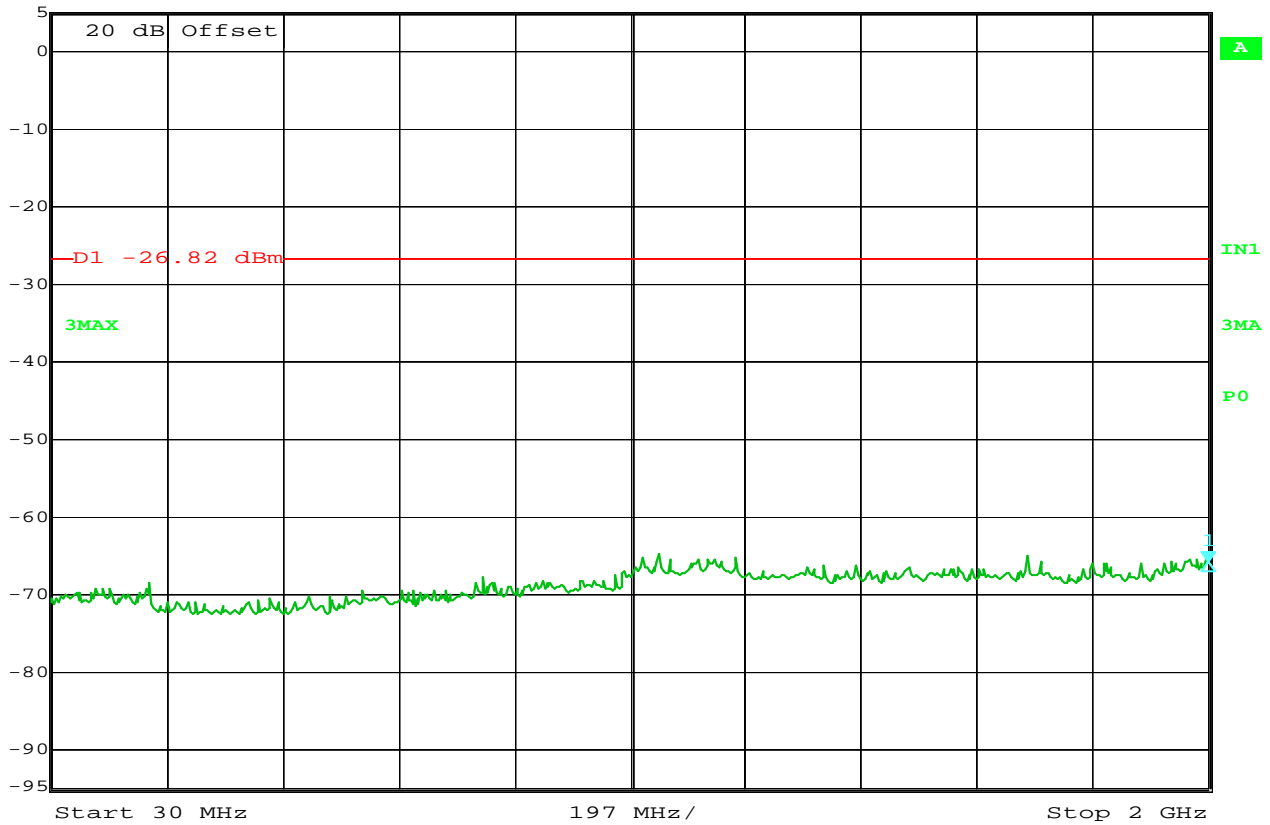
Test Set-up for Radiated Emissions – Horizontal Polarization



Test Set-up for Radiated Emissions – Vertical Polarization



Marker 1 [T3] RBW 100 kHz RF Att 0 dB
 -65.77 dBm VBW 3 MHz
 2.00000000 GHz SWT 560 ms Unit dBm
 Ref Lvl 5 dBm



Date: 16.MAR.2007 19:42:09

FCC 15.247 Antenna Conducted Emissions

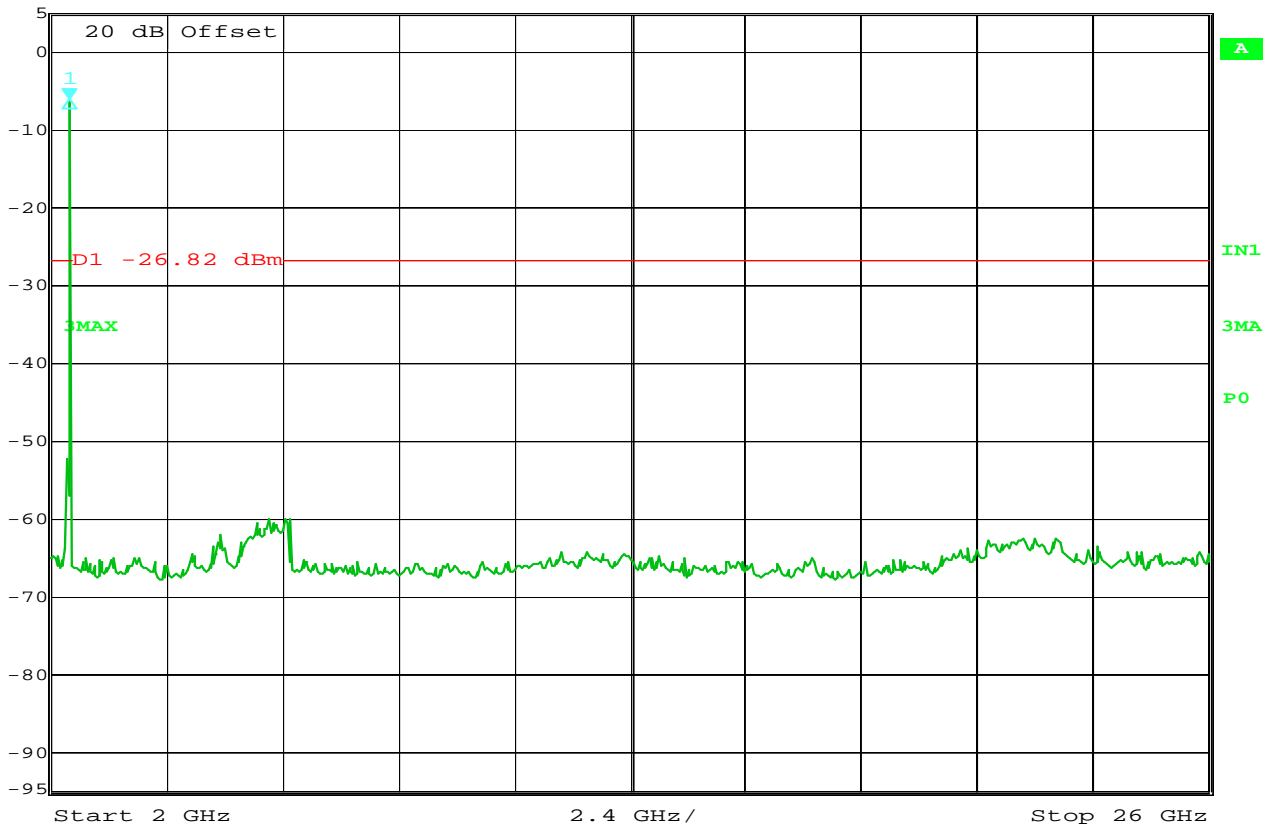
MANUFACTURER : Bose Corporation
 TEST ITEM : Media System
 MODEL NUMBER : 302211-X01
 TEST MODE : Transmit @ 2402.0 MHz
 NOTES :

Checked BY : RICHARD E. KING

Richard E. King



Ref Lvl 5 dBm
 Marker 1 [T3] -6.18 dBm
 2.38476954 GHz
 RBW 100 kHz
 VBW 3 MHz
 SWT 6 s
 RF Att 0 dB
 Unit dBm



Date: 16.MAR.2007 19:40:53

FCC 15.247 Antenna Conducted Emissions

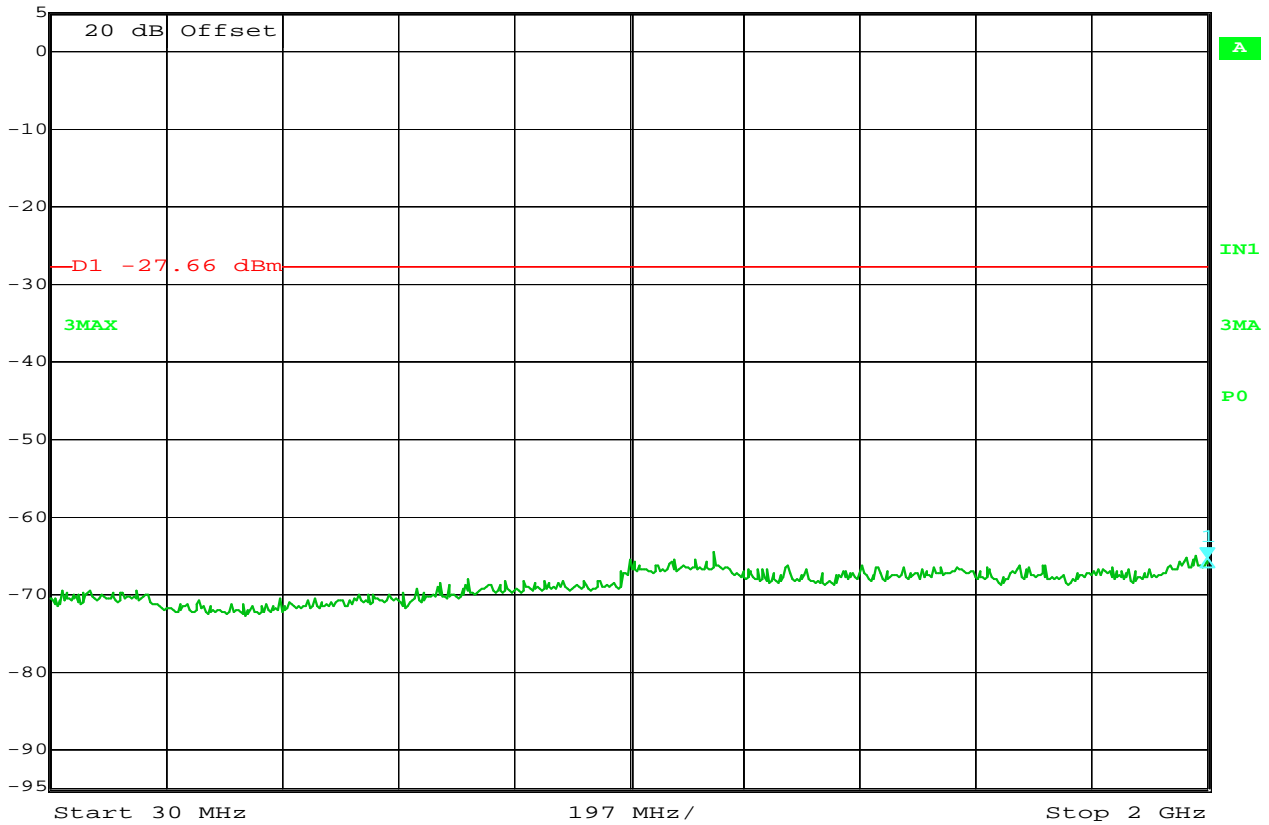
MANUFACTURER : Bose Corporation
 TEST ITEM : Media System
 MODEL NUMBER : 302211-X01
 TEST MODE : Transmit @ 2402.0 MHz
 NOTES :

Checked BY : RICHARD E. KING

Richard E. King



Marker 1 [T3] RBW 100 kHz RF Att 0 dB
 Ref Lvl -65.47 dBm VBW 3 MHz
 5 dBm 2.00000000 GHz SWT 560 ms Unit dBm



Date: 16.MAR.2007 20:03:24

FCC 15.247 Antenna Conducted Emissions

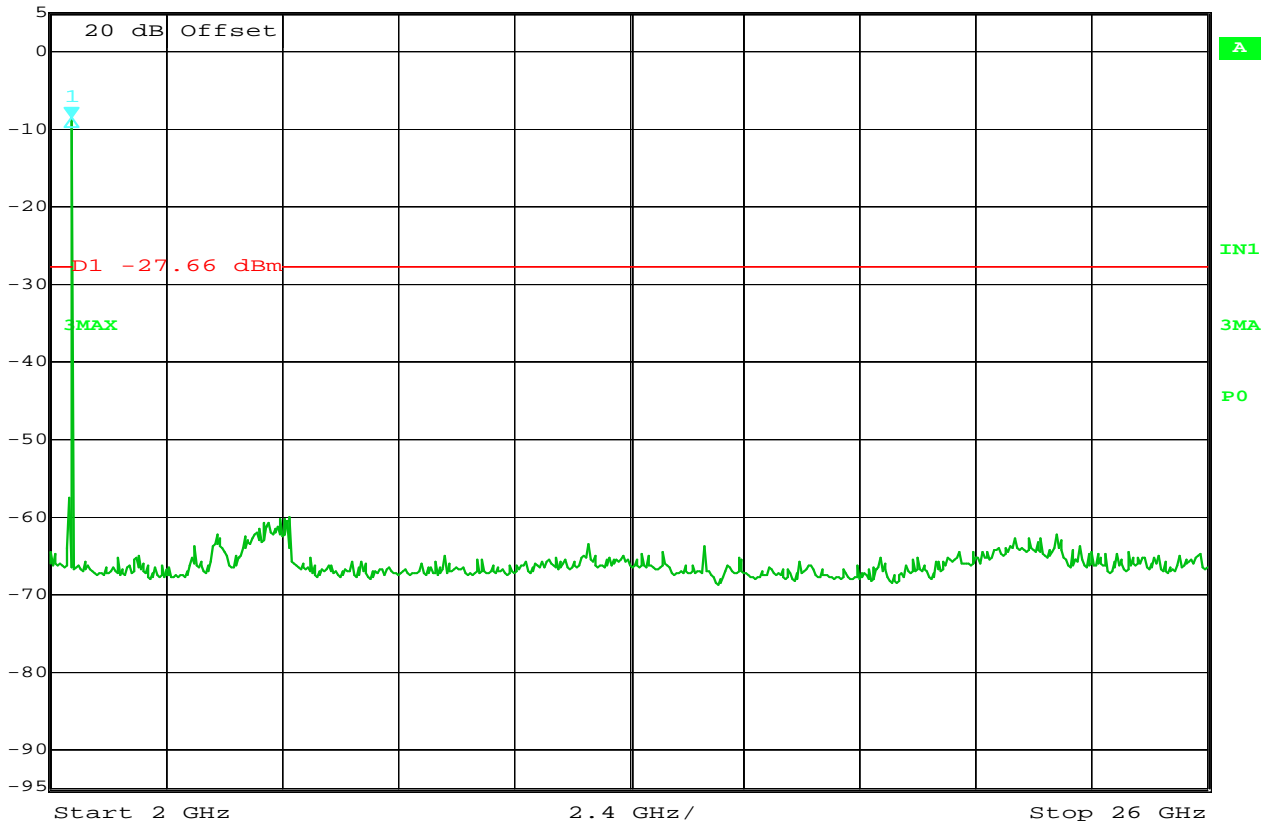
MANUFACTURER : Bose Corporation
 TEST ITEM : Media System
 MODEL NUMBER : 302211-X01
 TEST MODE : Transmit @ 2441.0 MHz
 NOTES :

Checked BY : *RICHARD E. KING*

Richard E. King



Ref Lvl 5 dBm
 Marker 1 [T3] -8.63 dBm
 2.43286573 GHz
 RBW 100 kHz
 VBW 3 MHz
 SWT 6 s
 RF Att 0 dB
 Unit dBm



Date: 16.MAR.2007 20:00:29

FCC 15.247 Antenna Conducted Emissions

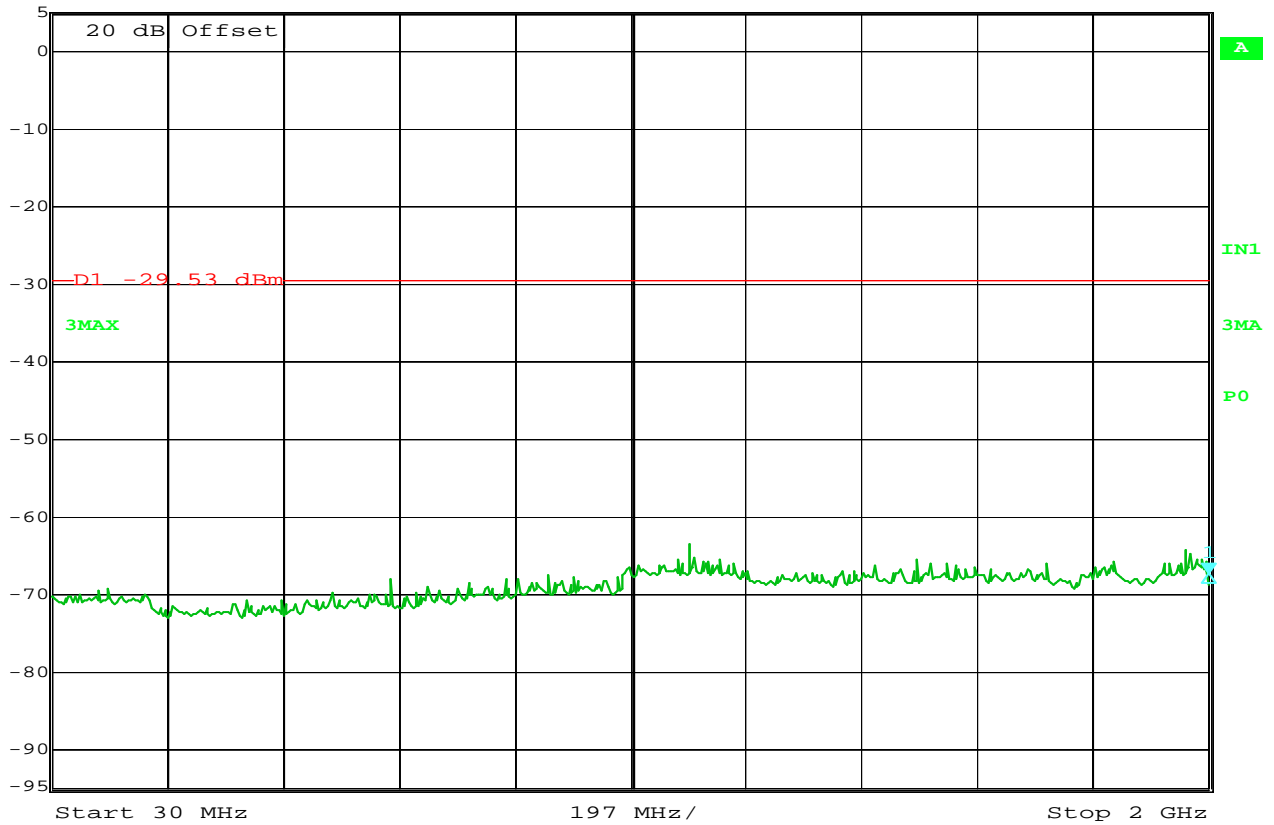
MANUFACTURER : Bose Corporation
 TEST ITEM : Media System
 MODEL NUMBER : 302211-X01
 TEST MODE : Transmit @ 2441.0 MHz
 NOTES :

Checked BY : RICHARD E. KING

Richard E. King



Ref Lvl 5 dBm
 Marker 1 [T3] 2.00000000 GHz
 RBW 100 kHz
 RF Att 0 dB
 VBW 3 MHz
 SWT 560 ms
 Unit dBm



Date: 16.MAR.2007 20:22:27

FCC 15.247 Antenna Conducted Emissions

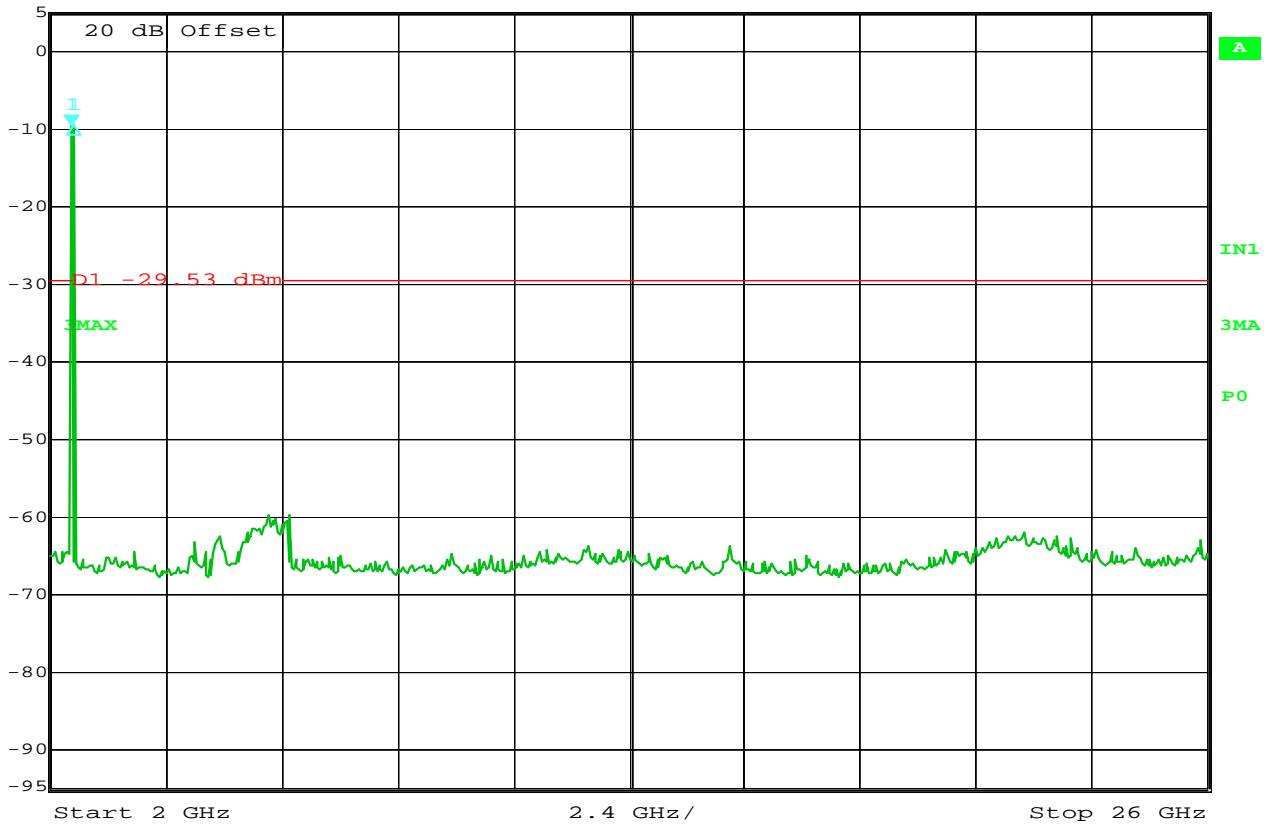
MANUFACTURER : Bose Corporation
 TEST ITEM : Media System
 MODEL NUMBER : 302211-X01
 TEST MODE : Transmit @ 2480.0 MHz
 NOTES :

Checked BY : *RICHARD E. KING*

Richard E. King



Ref Lvl 5 dBm
 Marker 1 [T3] -9.53 dBm
 2.43286573 GHz
 RBW 100 kHz
 VBW 3 MHz
 SWT 6 s
 RF Att 0 dB
 Unit dBm



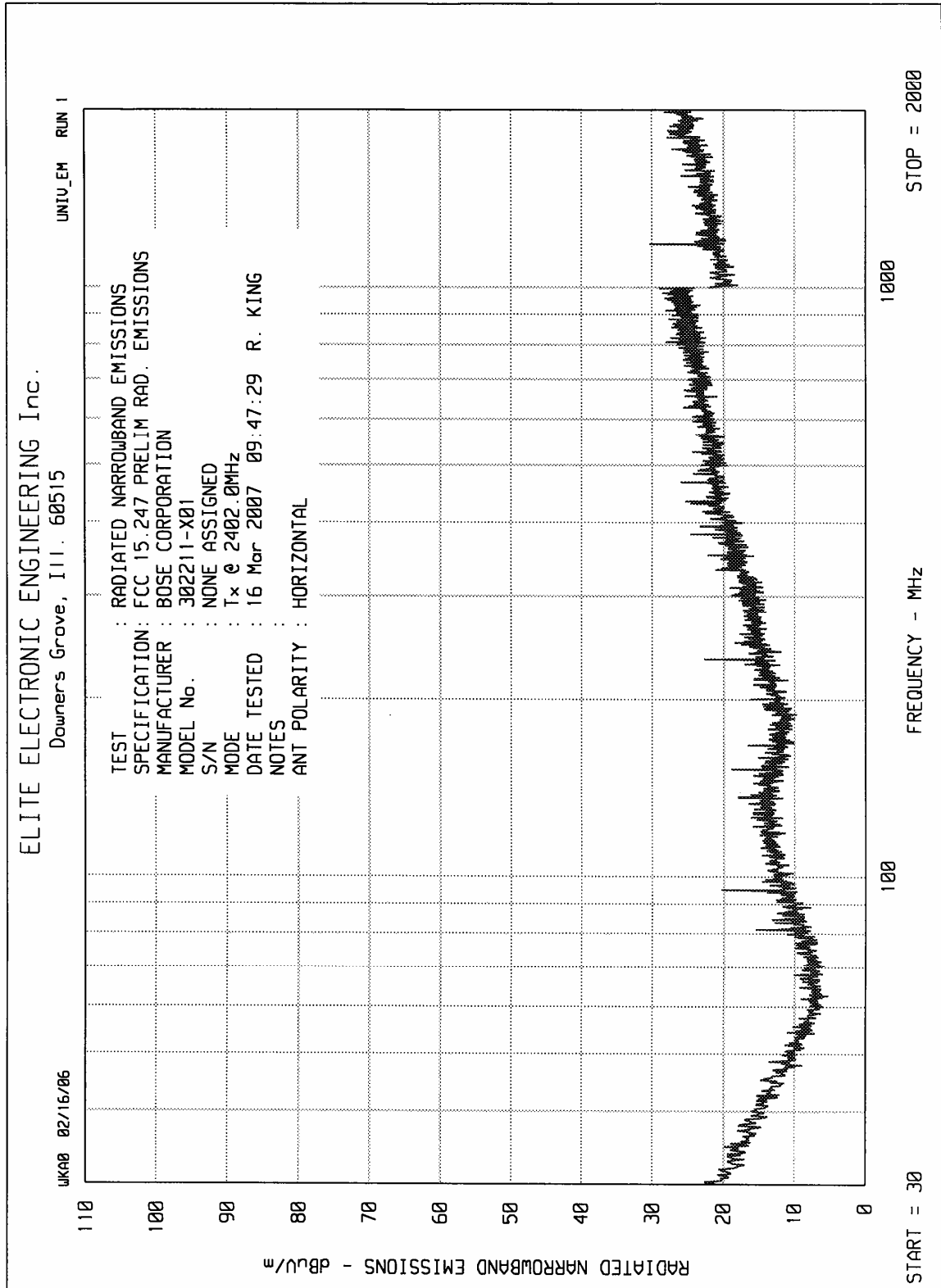
Date: 16.MAR.2007 20:19:00

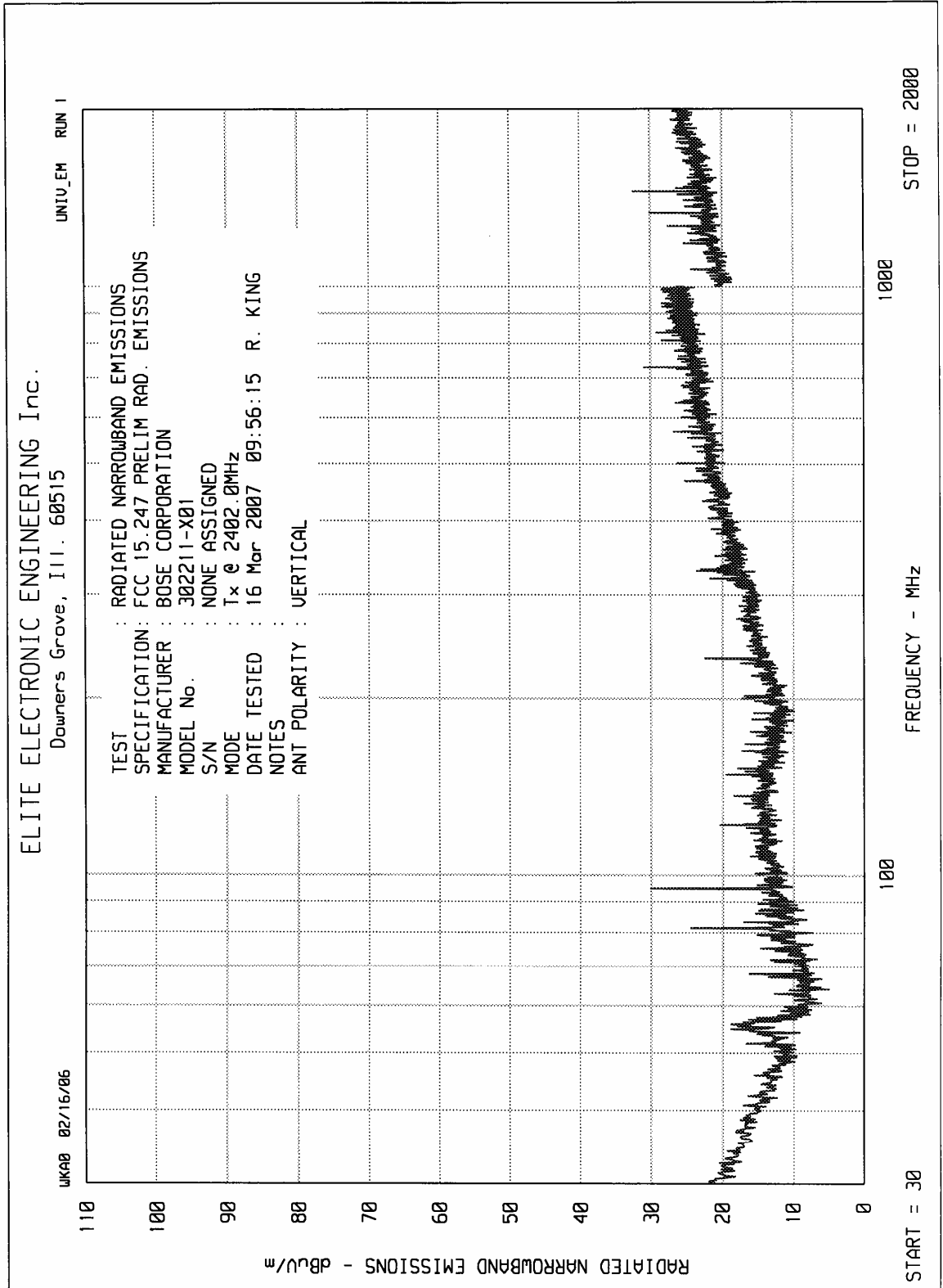
FCC 15.247 Antenna Conducted Emissions

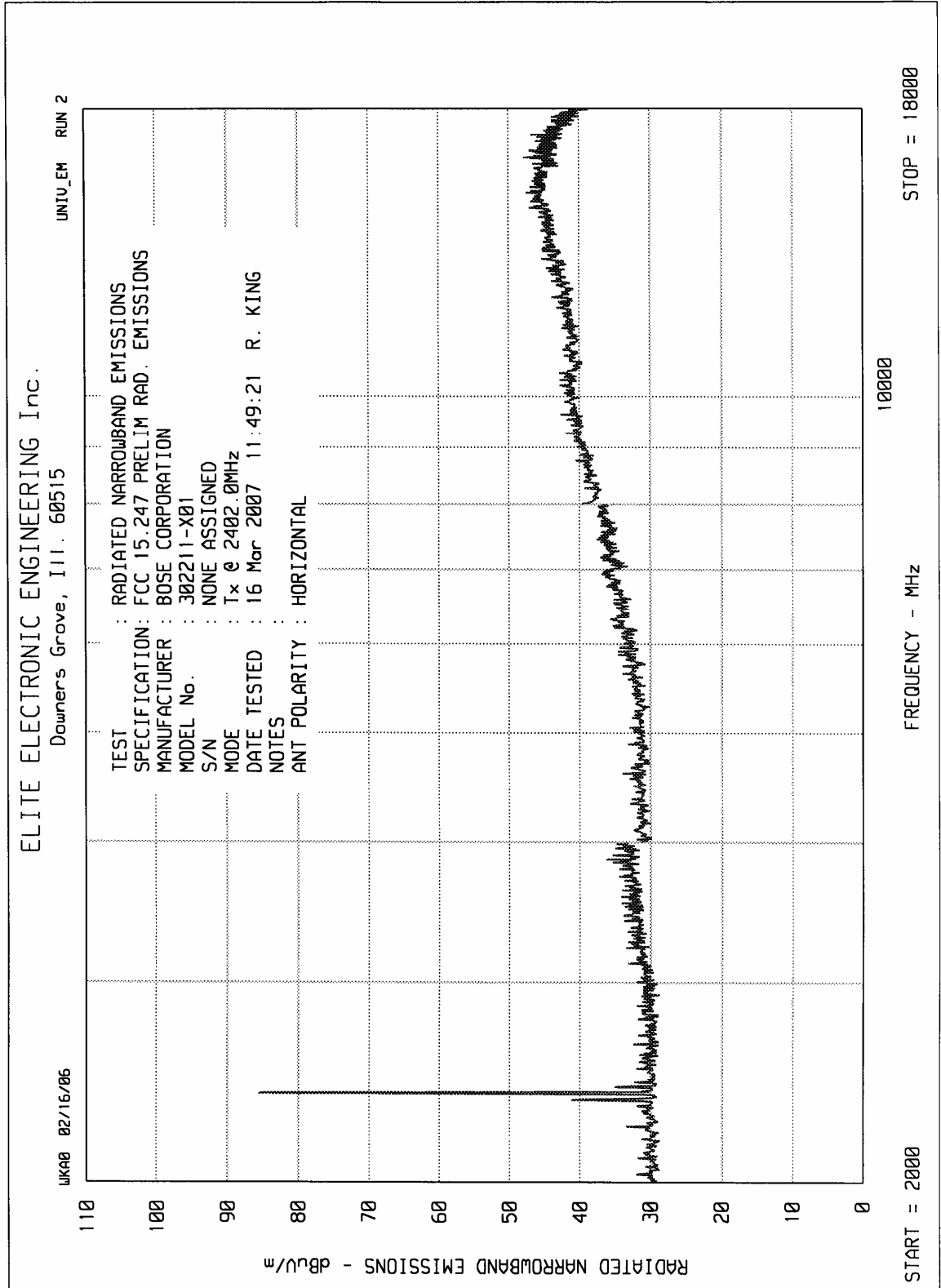
MANUFACTURER : Bose Corporation
 TEST ITEM : Media System
 MODEL NUMBER : 302211-X01
 TEST MODE : Transmit @ 2480.0 MHz
 NOTES :

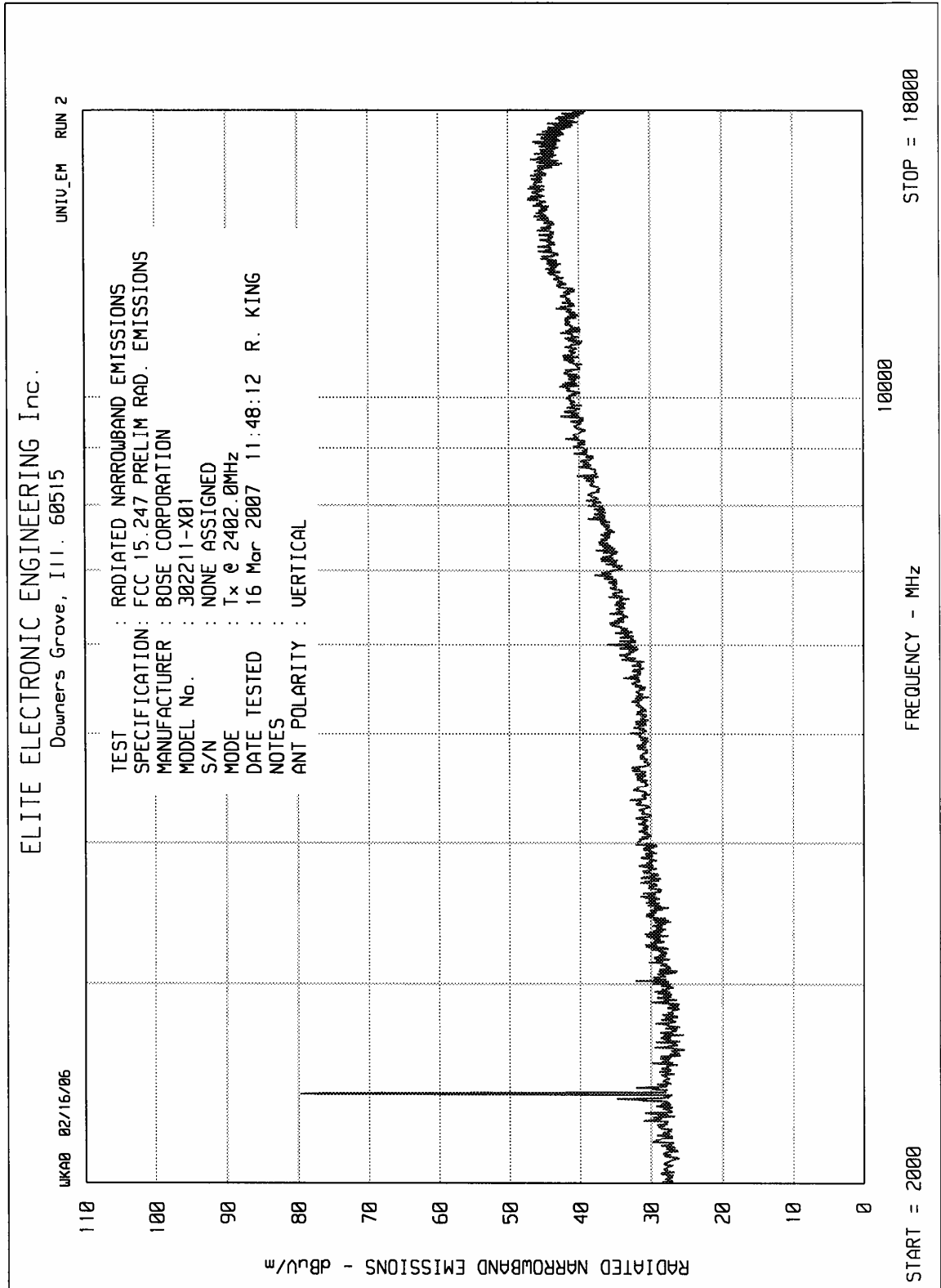
Checked BY : RICHARD E. KING

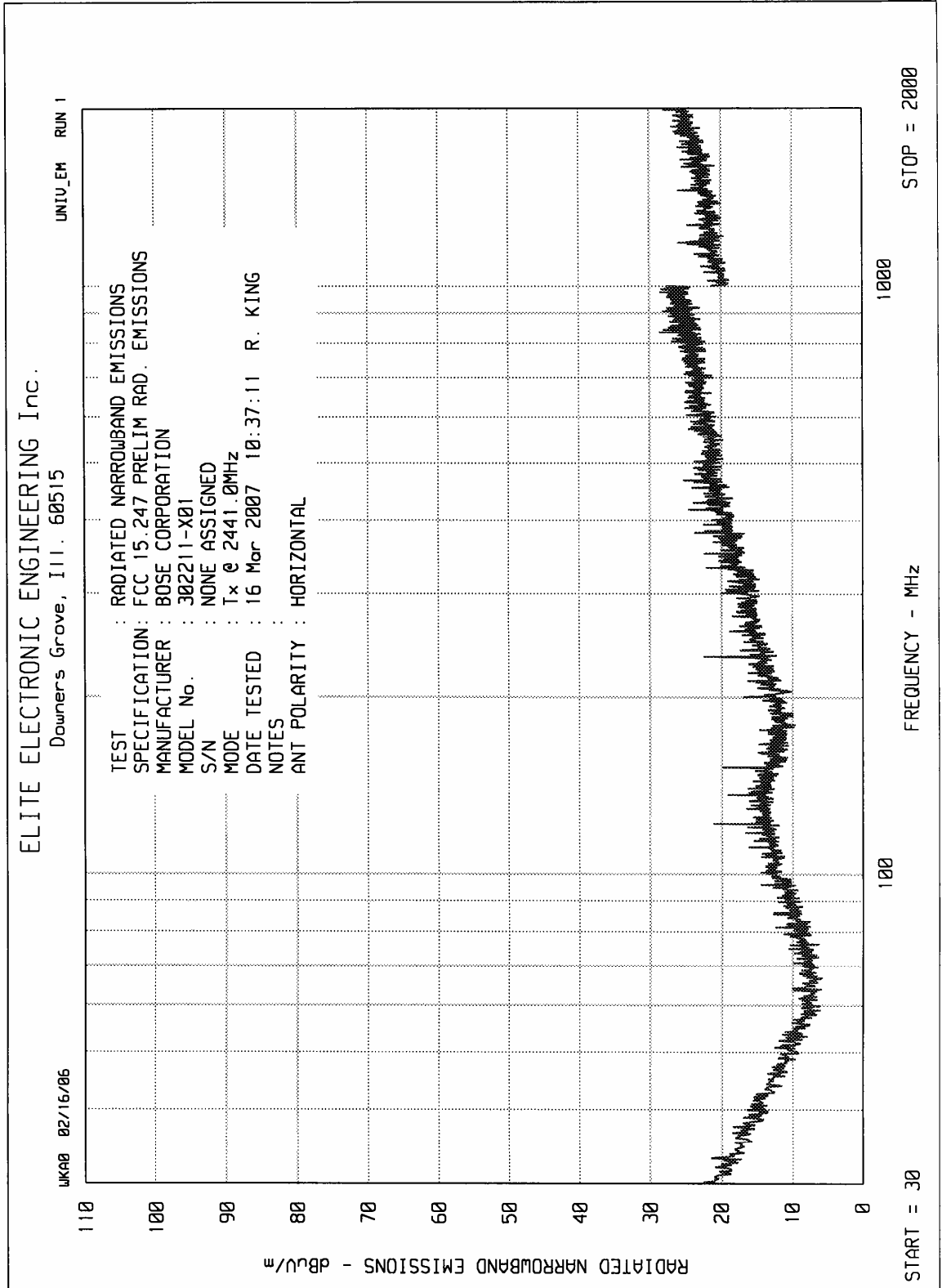
Richard E. King

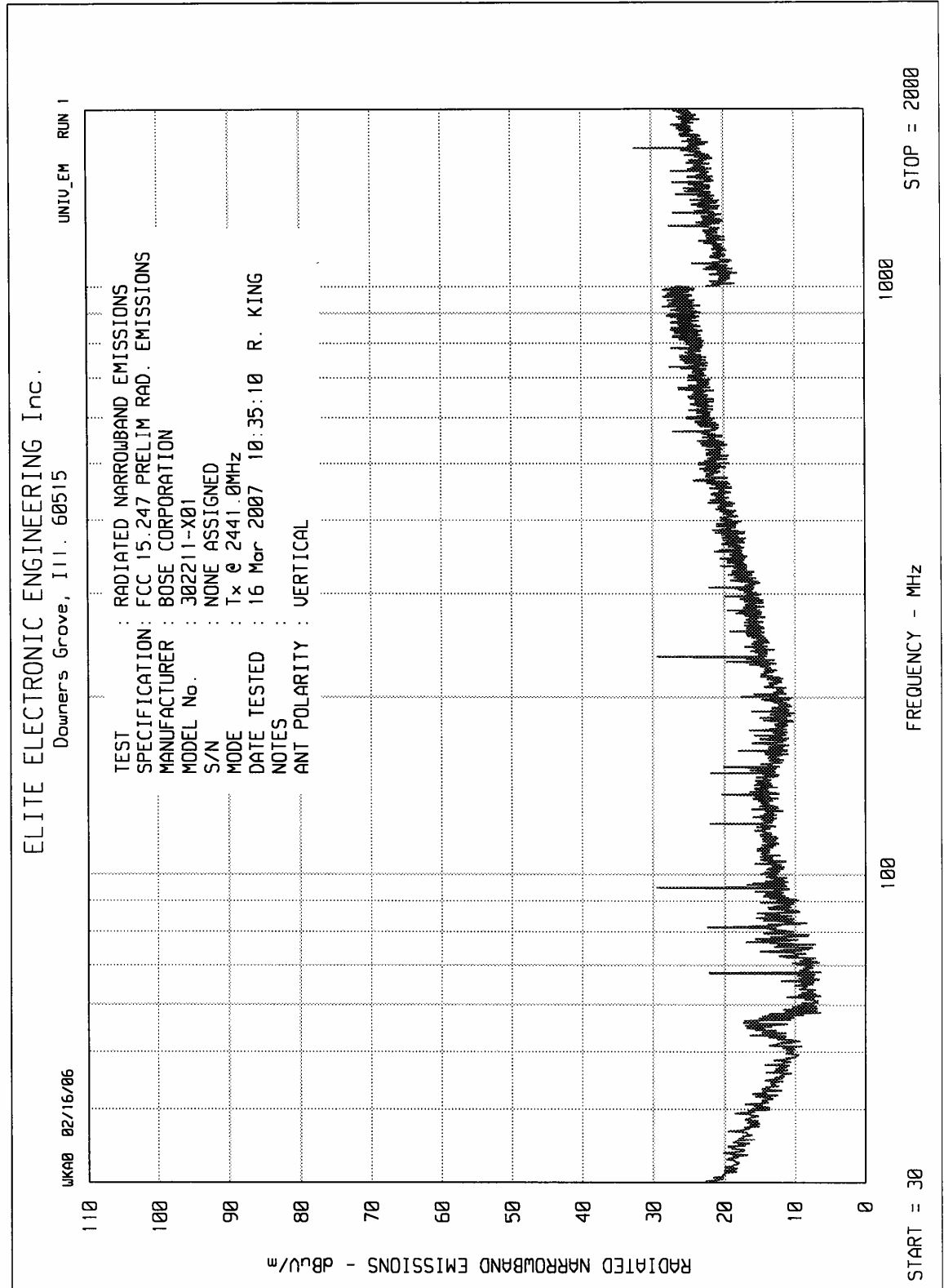


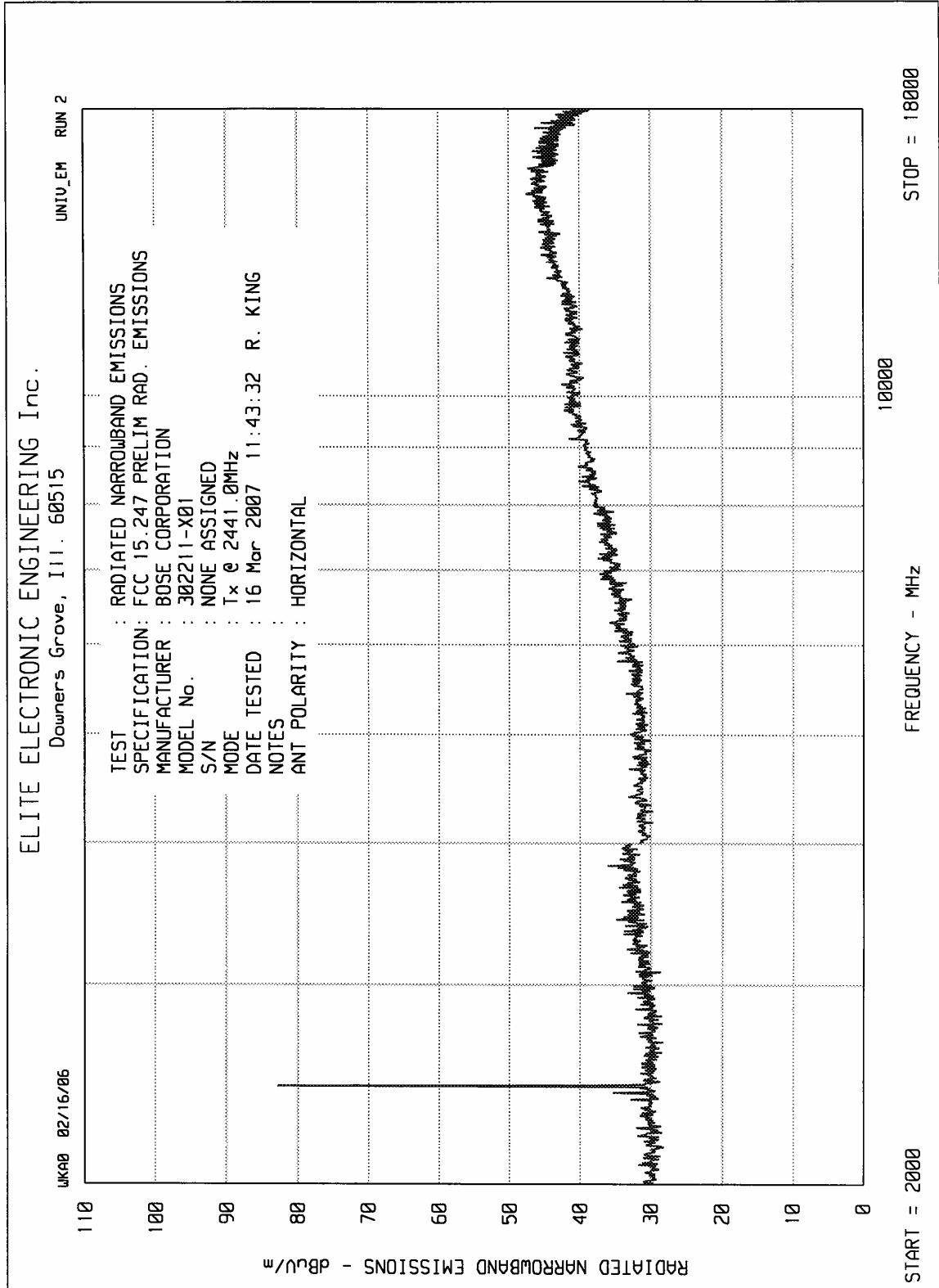


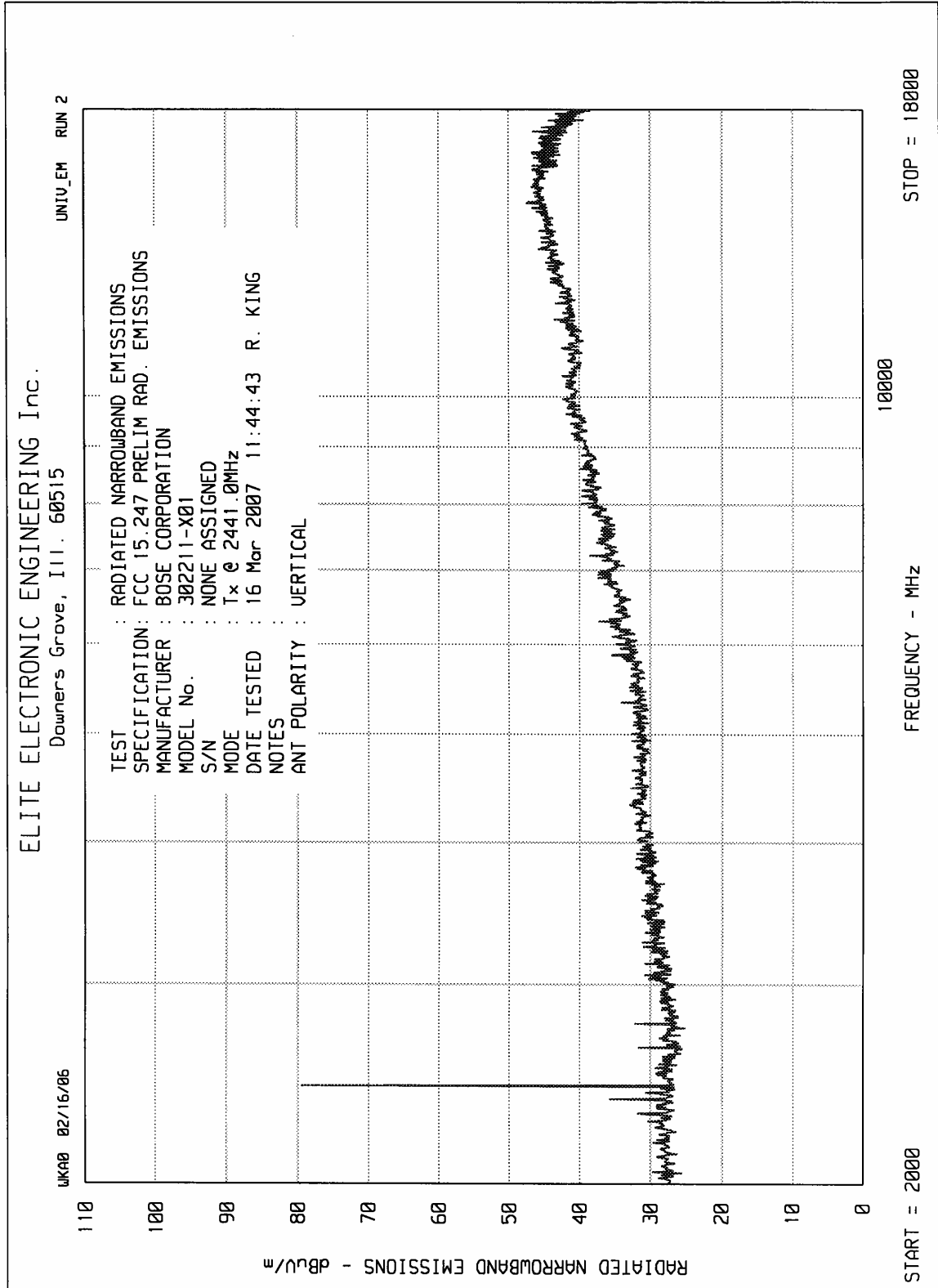


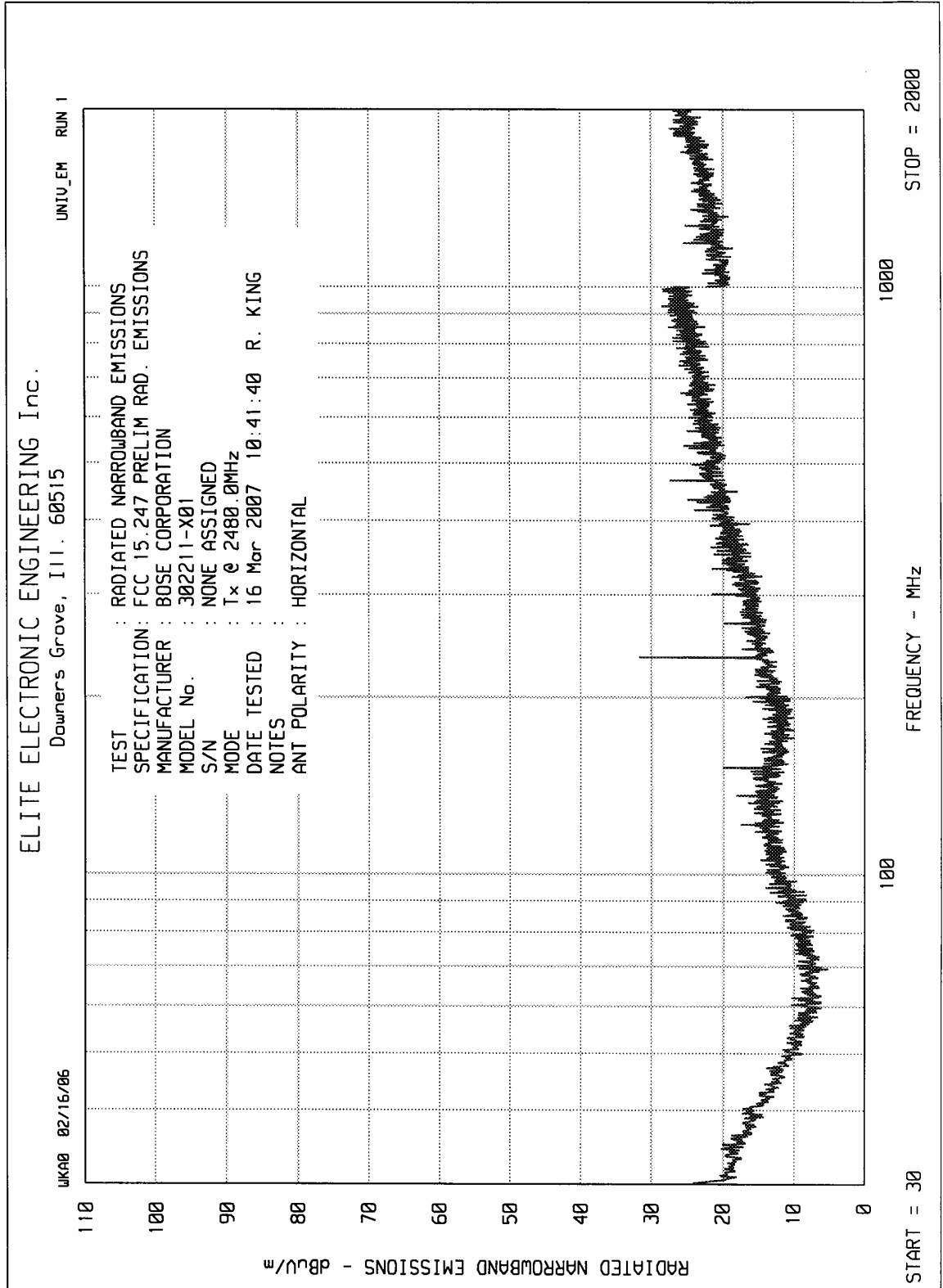


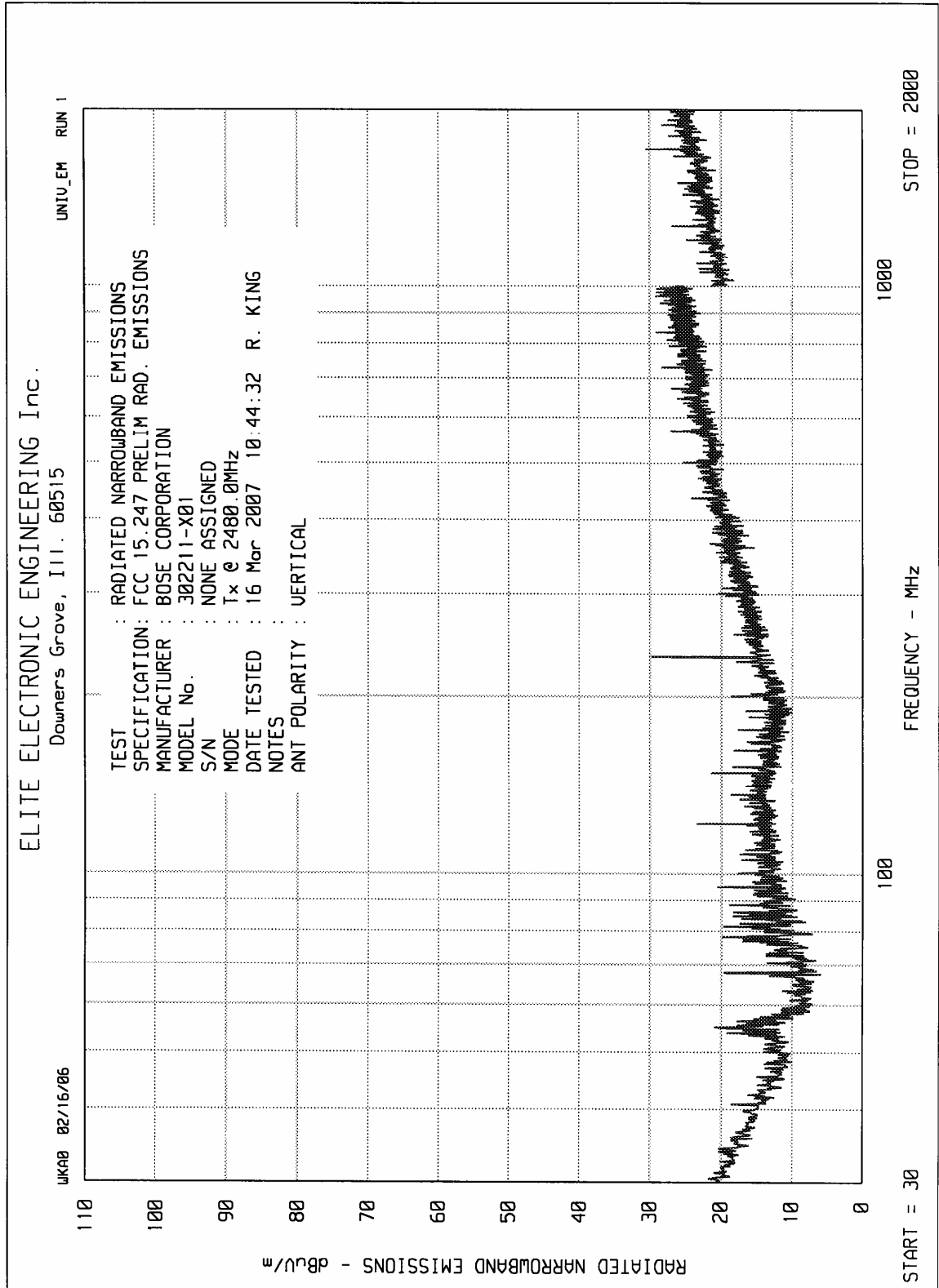


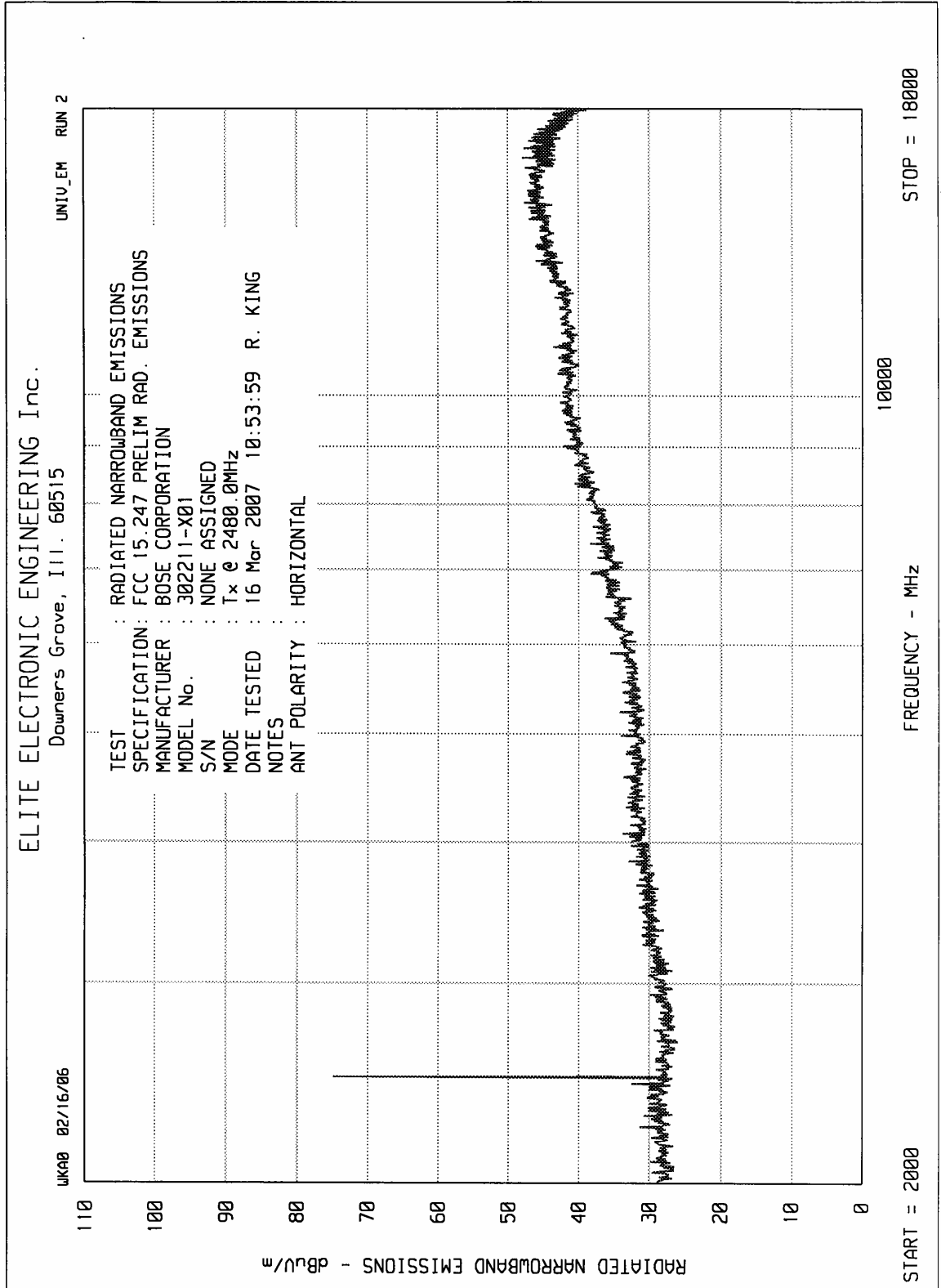


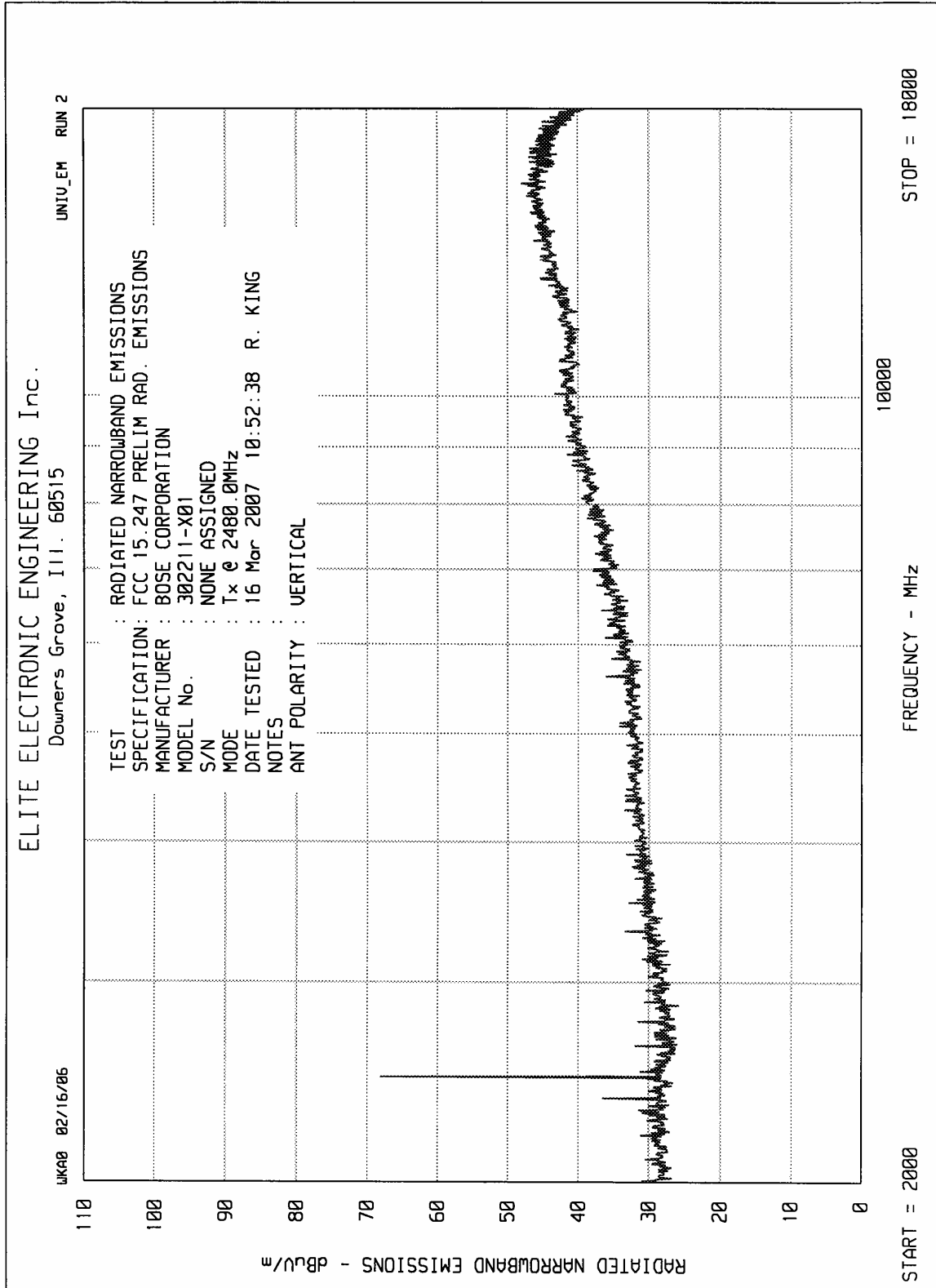














Manufacturer : Bose Corporation
 Model No. : 302211-X01
 Serial No. : none assigned
 Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
 Date : March 15, 2007
 Mode : Transmit @ 2402.0 MHz
 Test Distance : 3 meters
 Notes : Gray rows indicate restricted bands which must meet the general limits
 : Peak measurements meet the average limits.

Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Loss dB	Antenna Factor dB	Pre Amp Gain dB	Total dBuV/m	Total uV/m	Limit uV/m
2402.00	H	61.6		3.5	31.4	0.0	96.4	66332.3	
2402.00	V	59.5		3.5	31.4	0.0	94.3	51906.9	
4804.00	H	45.2	*	0.6	34.5	-40.1	40.2	102.5	500.0
4804.00	V	44.7	*	0.6	34.5	-40.1	39.7	96.7	500.0
7206.00	H	43.4	*	0.8	38.0	-39.8	42.4	132.6	6633.2
7206.00	V	43.3	*	0.8	38.0	-39.8	42.3	130.6	6633.2
9608.00	H	43.8	*	0.9	39.7	-38.8	45.6	190.8	6633.2
9608.00	V	44.0	*	0.9	39.7	-38.8	45.9	196.4	6633.2
12010.00	H	45.6	*	1.0	41.4	-39.6	48.3	260.8	500.0
12010.00	V	44.8	*	1.0	41.4	-39.6	47.5	238.1	500.0
14412.00	H	46.5	*	1.2	43.7	-39.9	51.5	374.0	6633.2
14412.00	V	44.6	*	1.2	43.7	-39.9	49.6	300.8	6633.2
16814.00	H	44.5	*	1.2	44.6	-38.8	51.6	381.4	6633.2
16814.00	V	44.4	*	1.2	44.6	-38.8	51.6	378.8	6633.2
19216.00	H	44.5	*	2.2	40.4	-40.2	46.9	221.4	500.0
19216.00	V	44.4	*	2.2	40.4	-40.2	46.8	219.8	500.0
21618.00	H	35.0	*	2.2	40.6	-26.2	51.7	382.5	6633.2
21618.00	V	35.0	*	2.2	40.6	-26.2	51.7	382.5	6633.2
24020.00	H	34.3	*	2.2	40.6	-27.4	49.8	308.5	6633.2
24020.00	V	34.3	*	2.2	40.6	-27.4	49.7	306.4	6633.2

Checked BY : *RICHARD E. KING*

Richard E. King



Manufacturer : Bose Corporation
 Model No. : 302211-X01
 Serial No. : none assigned
 Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
 Date : March 15, 2007
 Mode : Transmit @ 2441.0 MHz
 Test Distance : 3 meters
 Notes : Gray rows indicate restricted bands which must meet the general limits
 : Peak measurements meet the average limits.

Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Loss dB	Antenna Factor dB	Pre Amp Gain dB	Total dBuV/m	Total uV/m	Limit uV/m
2441.00	H	60.9		3.5	31.4	0.0	95.8	61418.3	
2441.00	V	56.8		3.5	31.4	0.0	91.6	38220.6	
4882.00	H	45.9	*	0.6	34.5	-40.1	40.9	110.9	500.0
4882.00	V	45.2	*	0.6	34.5	-40.1	40.2	102.2	500.0
7323.00	H	29.2	*	0.8	38.1	-39.7	28.3	25.9	6141.8
7323.00	V	28.6	*	0.8	38.1	-39.7	27.7	24.3	6141.8
9764.00	H	27.7	*	0.9	39.9	-38.7	29.7	30.7	6141.8
9764.00	V	44.6	*	0.9	39.9	-38.7	46.7	216.5	6141.8
12205.00	H	44.0	*	1.0	40.3	-39.4	45.8	195.7	500.0
12205.00	V	44.2	*	1.0	40.3	-39.4	46.1	201.5	500.0
14646.00	H	45.0	*	1.2	42.9	-40.1	49.0	282.5	6141.8
14646.00	V	44.3	*	1.2	42.9	-40.1	48.4	262.1	6141.8
17087.00	H	44.7	*	1.3	44.0	-38.7	51.2	364.5	6141.8
17087.00	V	46.3	*	1.3	44.0	-38.7	52.8	438.7	6141.8
19528.00	H	44.7	*	2.2	40.4	-40.2	47.1	227.1	500.0
19528.00	V	46.3	*	2.2	40.4	-40.2	48.7	273.4	500.0
21969.00	H	35.2	*	2.2	40.6	-26.2	51.8	390.0	6141.8
21969.00	V	35.3	*	2.2	40.6	-26.2	51.9	395.0	6141.8
24410.00	H	32.9	*	2.2	40.6	-27.4	48.4	261.8	6141.8
24410.00	V	32.9	*	2.2	40.6	-27.4	48.4	262.4	6141.8

Checked BY : *RICHARD E. KING*

Richard E. King



Manufacturer : Bose Corporation
 Model No. : 302211-X01
 Serial No. : none assigned
 Test Specification : FCC Part 15, Subpart C, Section 15.247, Radiated Emissions
 Date : March 15, 2007
 Mode : Transmit @ 2480.0 MHz
 Test Distance : 3 meters
 Notes : Gray rows indicate restricted bands which must meet the general limits
 : Peak measurements meet the average limits.

Total = Meter Reading + Cable Loss + Antenna Factor + Preamp Gain

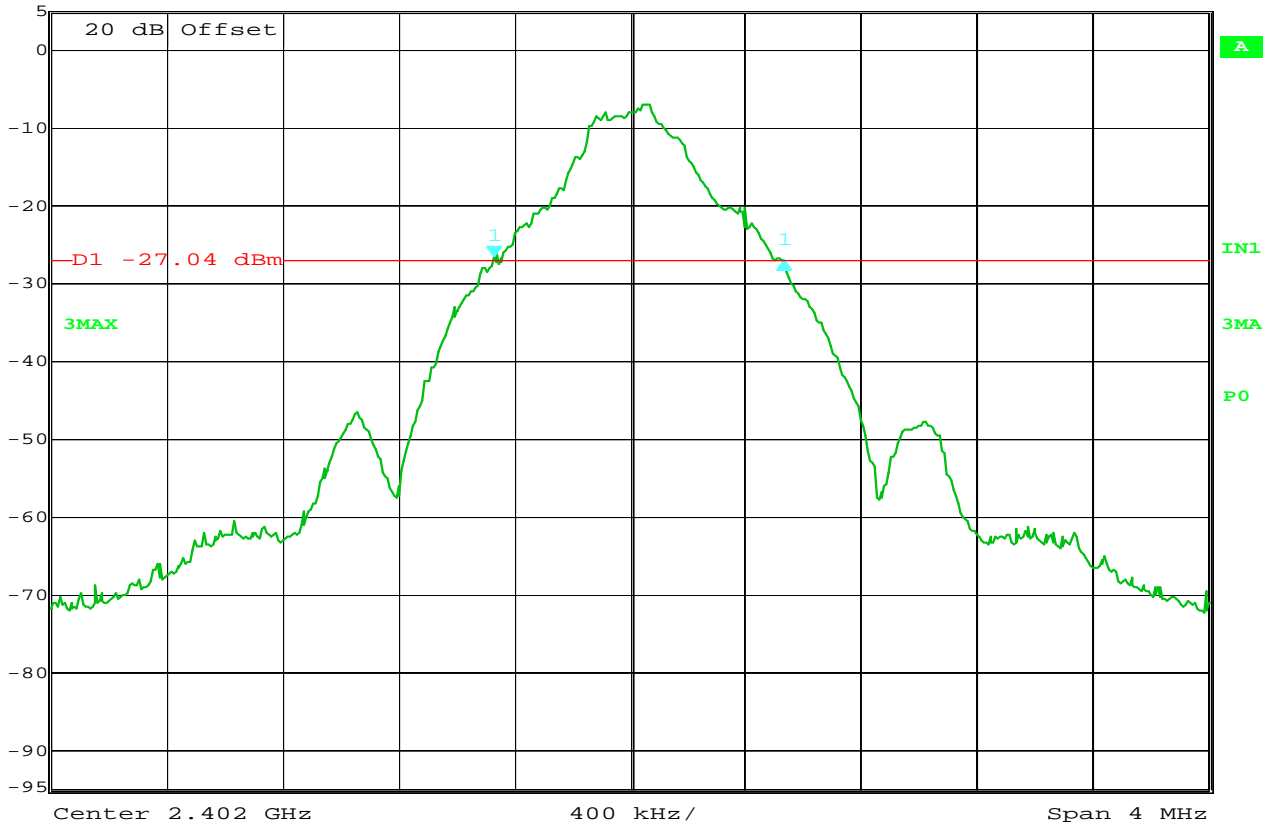
Frequency MHz	Antenna Polarity	Meter Reading dBuV	Ambient	Cable Loss dB	Antenna Factor dB	Pre Amp Gain dB	Total dBuV/m	Total uV/m	Limit uV/m
2480.00	H	53.6		3.5	31.4	0.0	88.6	26780.6	
2480.00	V	49.0		3.5	31.4	0.0	83.9	15715.2	
4960.00	H	43.7	*	0.8	34.5	-40.2	38.9	87.8	500.0
4960.00	V	43.7	*	0.8	34.5	-40.2	38.8	87.4	500.0
7440.00	H	43.7	*	1.1	38.1	-39.7	43.2	144.3	500.0
7440.00	V	43.5	*	1.1	38.1	-39.7	43.0	141.0	500.0
9920.00	H	44.2	*	1.2	40.0	-38.6	46.8	219.1	2678.1
9920.00	V	44.6	*	1.2	40.0	-38.6	47.2	230.0	2678.1
12400.00	H	44.0	*	1.4	41.3	-39.3	47.5	236.3	500.0
12400.00	V	44.2	*	1.4	41.3	-39.3	47.7	243.2	500.0
14880.00	H	45.0	*	1.6	44.5	-40.3	50.8	347.3	2678.1
14880.00	V	44.3	*	1.6	44.5	-40.3	50.2	322.2	2678.1
17360.00	H	44.7	*	1.7	44.4	-39.0	51.8	387.4	2678.1
17360.00	V	46.3	*	1.7	44.4	-39.0	53.4	466.3	2678.1
19840.00	H	44.7	*	2.2	40.4	-40.2	47.2	228.0	500.0
19840.00	V	46.3	*	2.2	40.4	-40.2	48.8	274.4	500.0
22320.00	H	34.3	*	2.2	40.6	-26.2	51.0	353.8	500.0
22320.00	V	33.7	*	2.2	40.6	-26.2	50.3	328.7	500.0
24800.00	H	33.1	*	2.2	40.7	-27.4	48.6	268.4	2678.1
24800.00	V	33.2	*	2.2	40.7	-27.4	48.7	273.1	2678.1

Checked BY : RICHARD E. KING

Richard E. King



Delta 1 [T3] RBW 30 kHz RF Att 0 dB
 Ref Lvl 5 dBm -0.68 dB VBW 3 MHz
 1.00200401 MHz SWT 11.5 ms Unit dBm



Date: 16.MAR.2007 19:37:49

FCC 15.247 20 dB Bandwidth Measurement

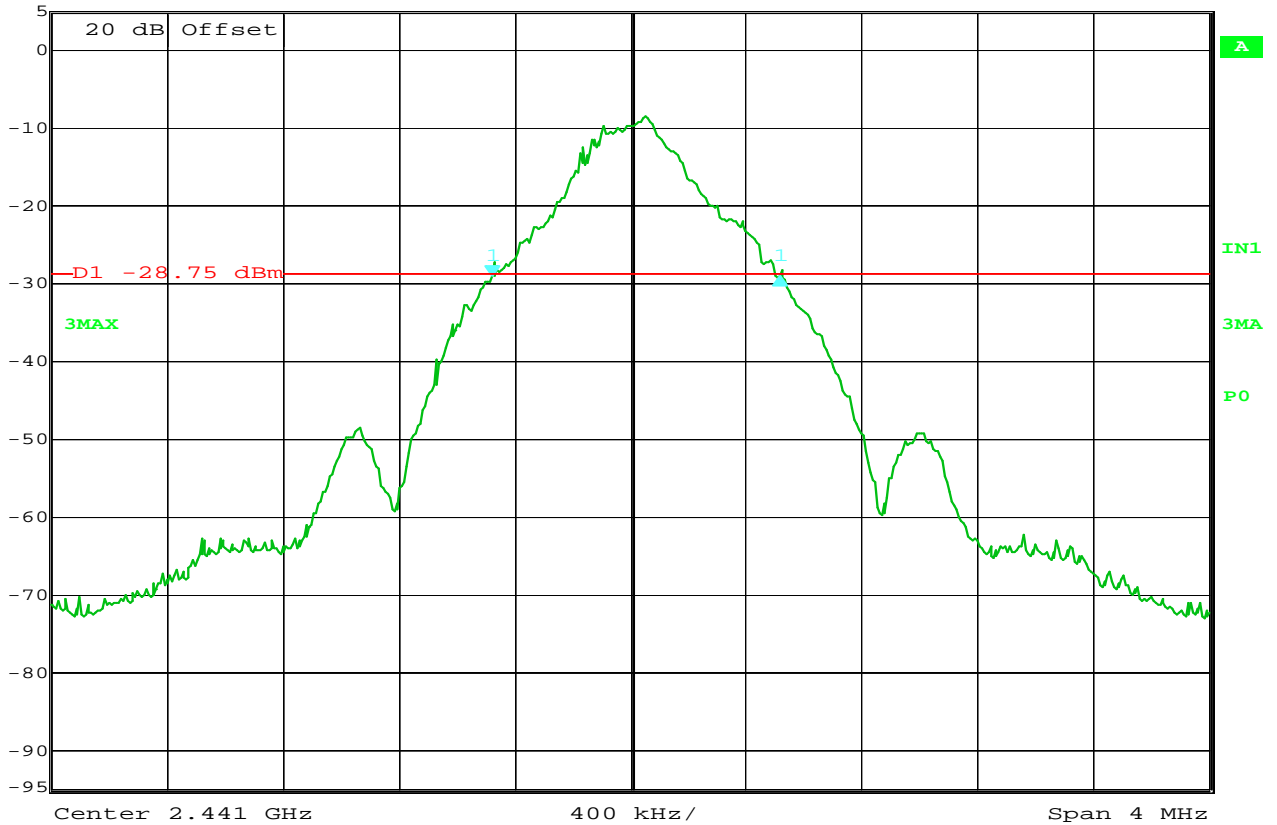
MANUFACTURER : Bose Corporation
 TEST ITEM : Media System
 MODEL NUMBER : 302211-X01
 TEST MODE : Transmit @ 2402.0 MHz
 NOTES :

Checked BY : RICHARD E. KING

Richard E. King



Delta 1 [T3] RBW 30 kHz RF Att 0 dB
 Ref Lvl -0.02 dB VBW 3 MHz
 5 dBm 993.98797595 kHz SWT 11.5 ms Unit dBm



Date: 16.MAR.2007 20:08:05

FCC 15.247 20 dB Bandwidth Measurement

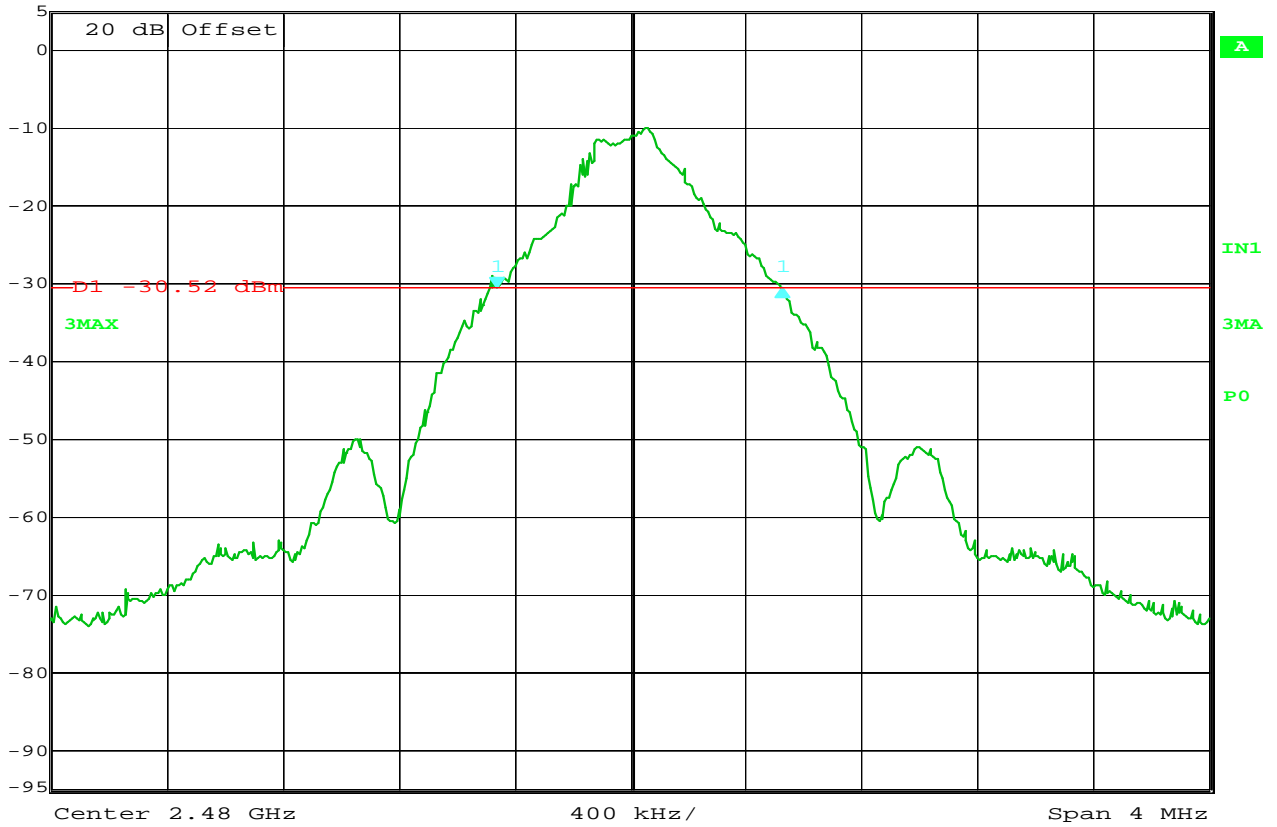
MANUFACTURER : Bose Corporation
 TEST ITEM : Media System
 MODEL NUMBER : 302211-X01
 TEST MODE : Transmit @ 2441.0 MHz
 NOTES :

Checked BY : RICHARD E. KING

Richard E. King



Delta 1 [T3] RBW 30 kHz RF Att 0 dB
 Ref Lvl 0.05 dB VBW 3 MHz
 5 dBm 983.96793587 kHz SWT 11.5 ms Unit dBm



Date: 16.MAR.2007 20:14:40

FCC 15.247 20 dB Bandwidth Measurement

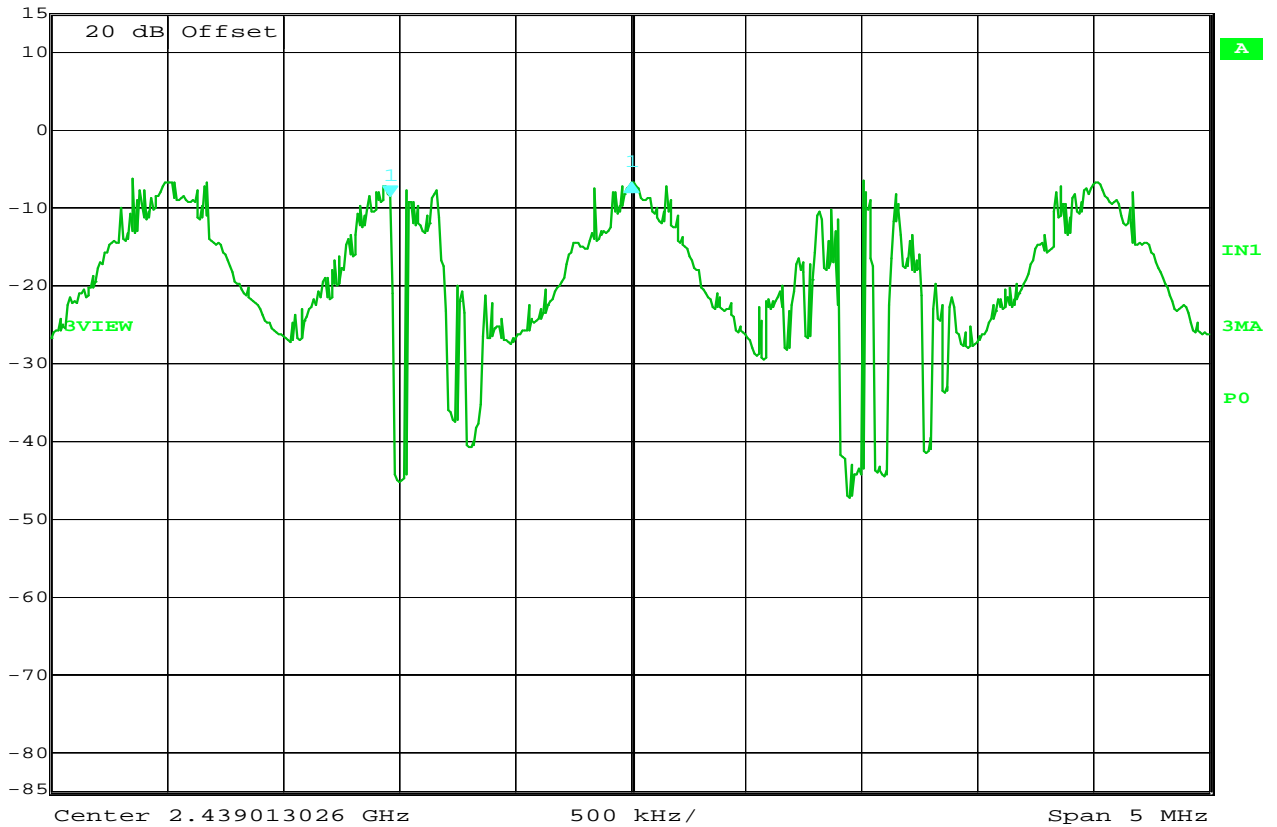
MANUFACTURER : Bose Corporation
 TEST ITEM : Media System
 MODEL NUMBER : 302211-X01
 TEST MODE : Transmit @ 2480.0 MHz
 NOTES :

Checked BY : RICHARD E. KING

Richard E. King



Delta 1 [T3] RBW 100 kHz RF Att 10 dB
 Ref Lvl 1.67 dB VBW 1 MHz
 15 dBm 1.04208417 MHz SWT 5 ms Unit dBm



Date: 21.MAR.2007 18:44:17

FCC 15.247 Carrier Frequency Separation

MANUFACTURER : Bose Corporation
 TEST ITEM : Media System
 MODEL NUMBER : 302211-X01
 TEST MODE : Frequency Hopping Enabled
 NOTES :

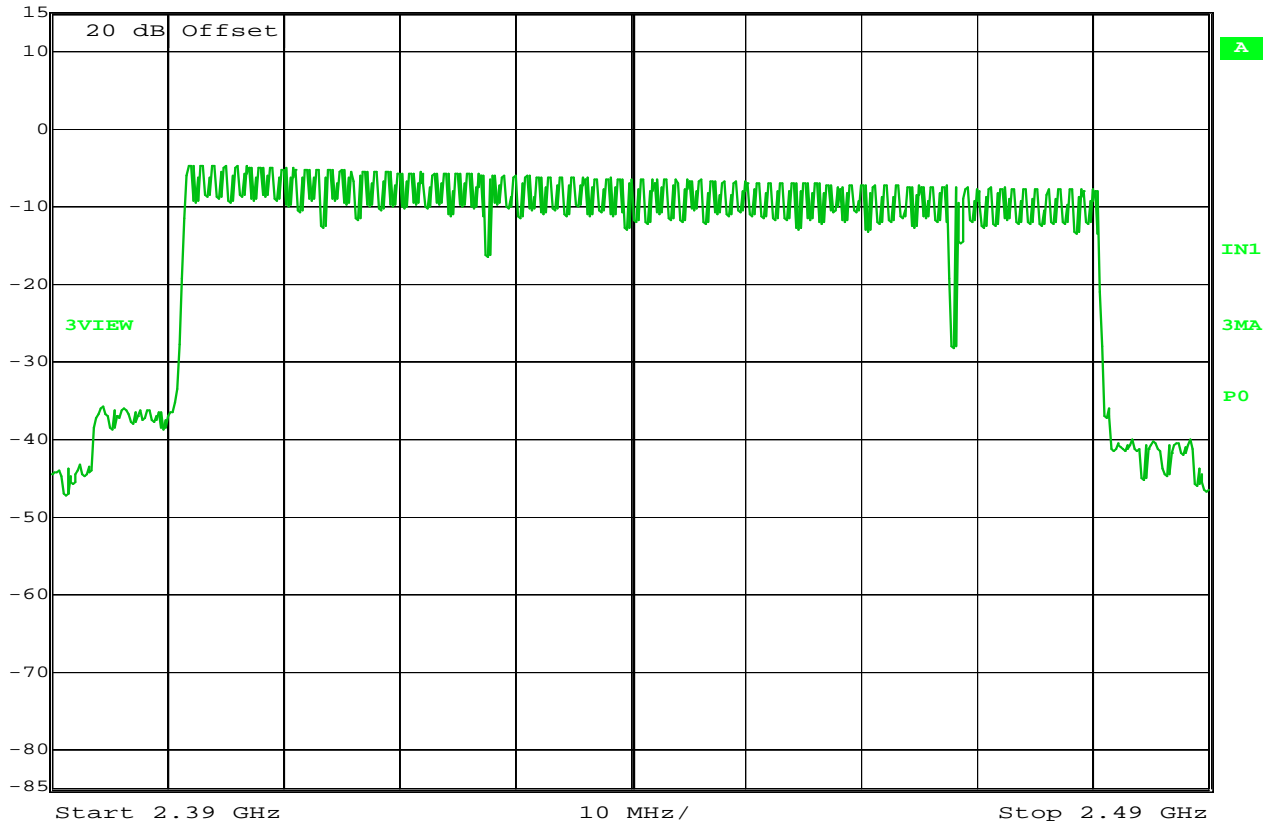
Checked BY : RICHARD E. KING

Richard E. King



Ref Lvl
15 dBm

RBW 500 kHz RF Att 10 dB
VBW 5 MHz
SWT 5 ms Unit dBm



Date: 21.MAR.2007 18:29:52

FCC 15.247 Number of Hopping Frequencies

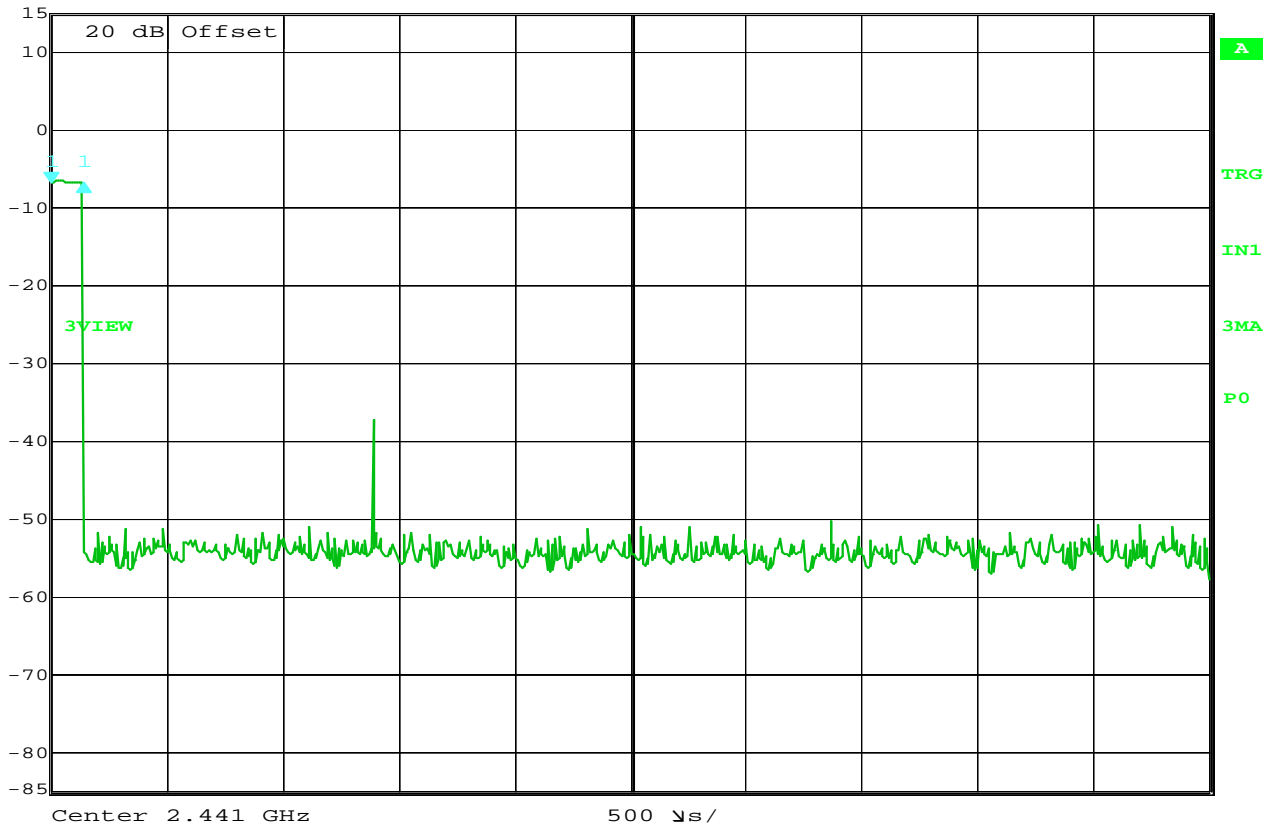
MANUFACTURER : Bose Corporation
 TEST ITEM : Media System
 MODEL NUMBER : 302211-X01
 TEST MODE : Frequency Hopping Enabled
 NOTES : Number of hopping channels = 79

Checked BY : *RICHARD E. KING*

Richard E. King



Delta 1 [T3] RBW 1 MHz RF Att 10 dB
 Ref Lvl 0.00 dB VBW 10 MHz
 15 dBm 140.280561 μ s SWT 5 ms Unit dBm



Date: 21.MAR.2007 14:51:41

FCC 15.247 Dwell Time

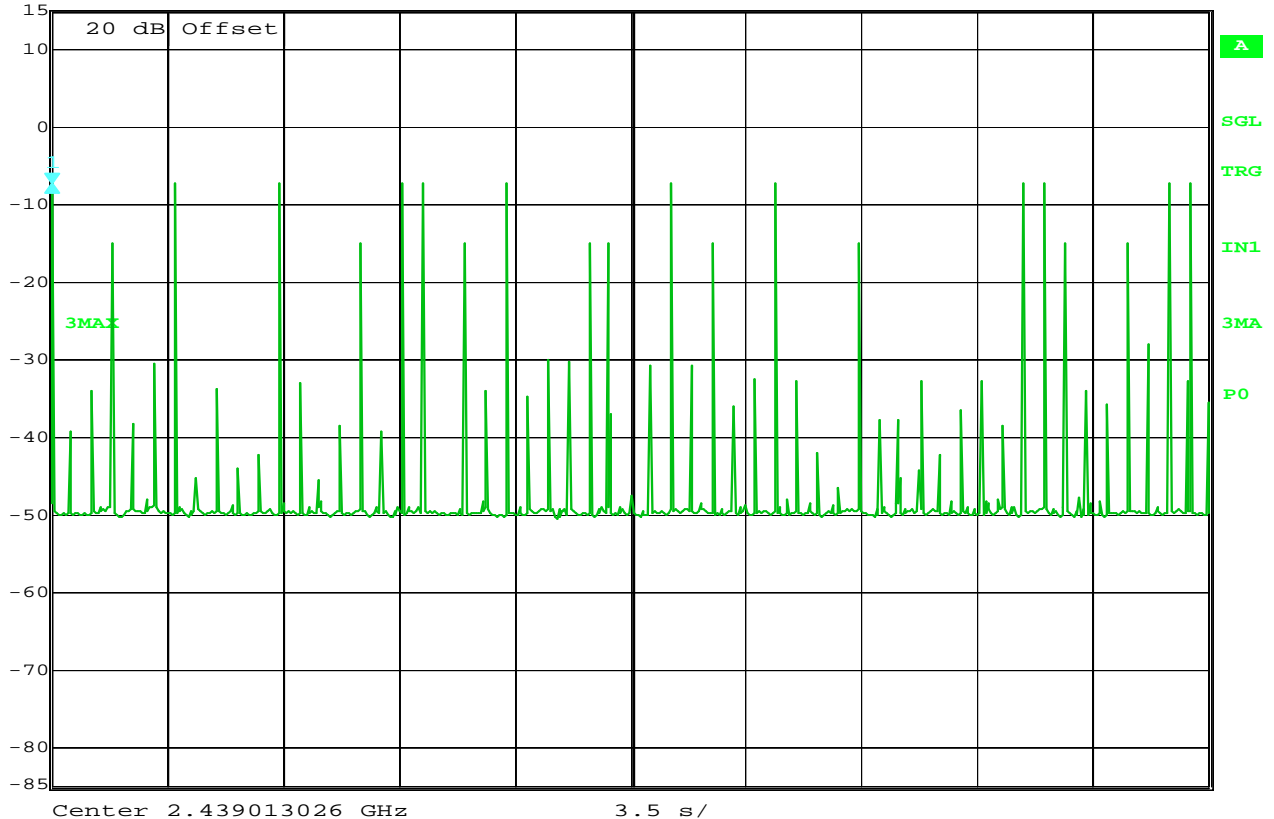
MANUFACTURER : Bose Corporation
 TEST ITEM : Media System
 MODEL NUMBER : 302211-X01
 TEST MODE : Frequency Hopping Enabled
 NOTES :

Checked BY : RICHARD E. KING

Richard E. King



Delta 1 [T3] RBW 1 MHz RF Att 10 dB
 Ref Lvl 0.00 dB VBW 10 MHz
 15 dBm 0.000000 s SWT 35 s Unit dBm



Date: 21.MAR.2007 18:47:38

FCC 15.247 Dwell Time

MANUFACTURER : Bose Corporation
 TEST ITEM : Media System
 MODEL NUMBER : 302211-X01
 TEST MODE : Frequency Hopping Enabled
 NOTES :

Checked BY : RICHARD E. KING

Richard E. King



Manufacturer : Bose Corporation
Model No. : 302211-X01
Serial No. : none assigned
Test Specification : FCC Part 15, Subpart C, 15.247, Output Power
: Conducted Measurement
Date : March 15, 2007
Notes :

Frequency MHz	Meter Reading dBm	Attenuation dB	Total dB	Limit dBm
2402.0	-24.87	20	-4.87	30
2441.0	-26.64	20	-6.64	30
2480.0	-28.00	20	-8.00	30

Checked BY : *RICHARD E. KING*

Richard E. King



Manufacturer : Bose Corporation
Model No. : 302211-X01
Serial No. : none assigned
Test Specification : FCC Part 15, Subpart C, 15.247, Peak Output Power
: Radiated Measurement
Date : March 15, 2007
Notes : Test Distance is 3 meters

Frequency MHz	Antenna Polarity	Meter Reading dBuV	Matched Signal Generator Reading dBm	Antenna Gain dB	Cable Loss dB	EIRP dBm	Limit dBm
2402.0	H	61.6	-2.9	6.4	2.1	1.4	36
2402.0	V	59.5	-5.0	6.4	2.1	-0.7	36
2441.0	H	60.9	-3.5	6.6	2.1	0.8	36
2441.0	V	56.8	-7.7	6.6	2.1	-3.4	36
2480.0	H	53.6	-11.0	6.7	2.1	-6.4	36
2480.0	V	49.0	-15.7	6.7	2.1	-11.1	36

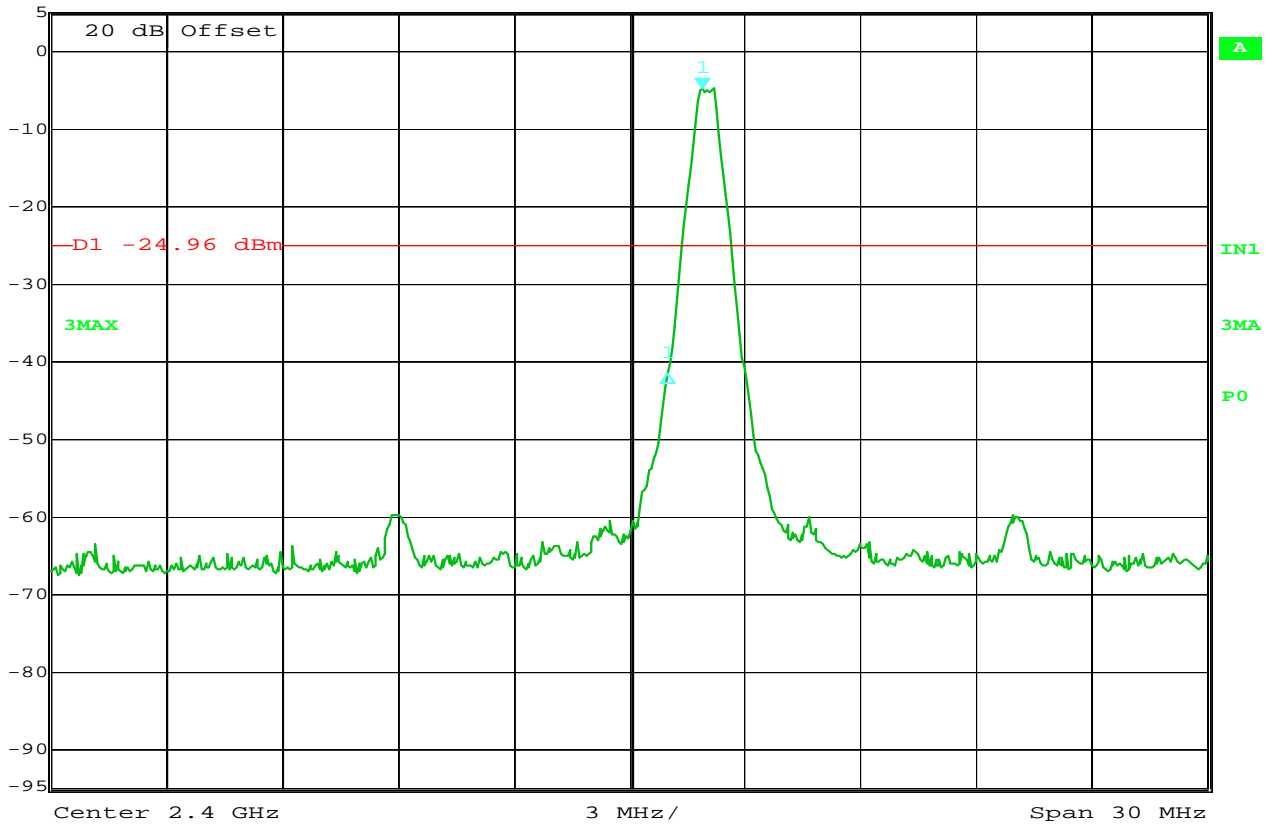
EIRP = Sig. Gen. Reading + Antenna Gain – Cable Loss

Checked BY : *RICHARD E. KING*

Richard E. King



Ref Lvl 5 dBm
 Marker 1 [T3] 2.40189379 GHz
 RBW 300 kHz
 VBW 3 MHz
 RF Att 0 dB
 SWT 5 ms
 Unit dBm



Date: 16.MAR.2007 19:53:03

FCC 15.247 Bandedge Compliance

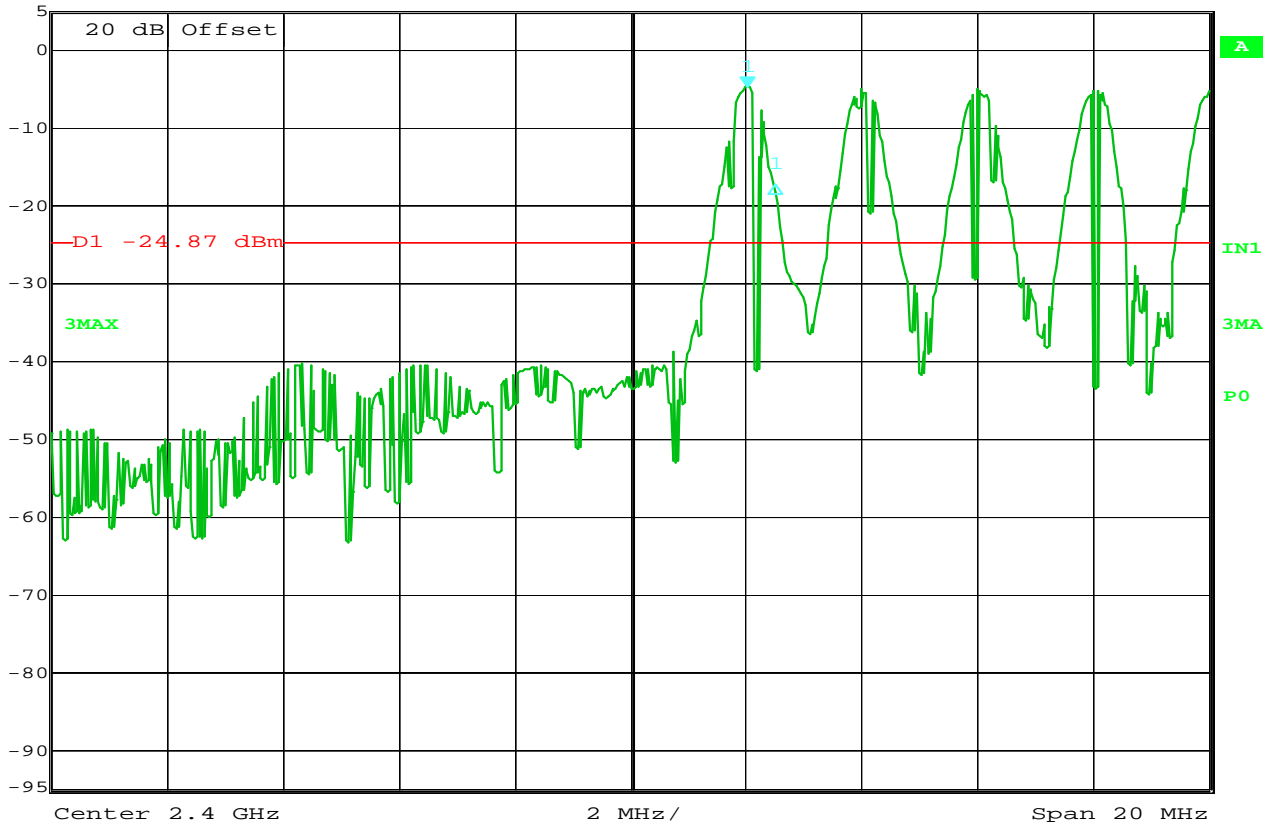
MANUFACTURER : Bose Corporation
 TEST ITEM : Media System
 MODEL NUMBER : 302211-X01
 TEST MODE : Transmit @ 2402.0 MHz
 NOTES :

Checked BY : RICHARD E. KING

Richard E. King



Marker 1 [T3] RBW 300 kHz RF Att 0 dB
 Ref Lvl -4.87 dBm VBW 3 MHz
 5 dBm 2.40202405 GHz SWT 5 ms Unit dBm



Date: 16.MAR.2007 19:17:14

FCC 15.247 Bandedge Compliance

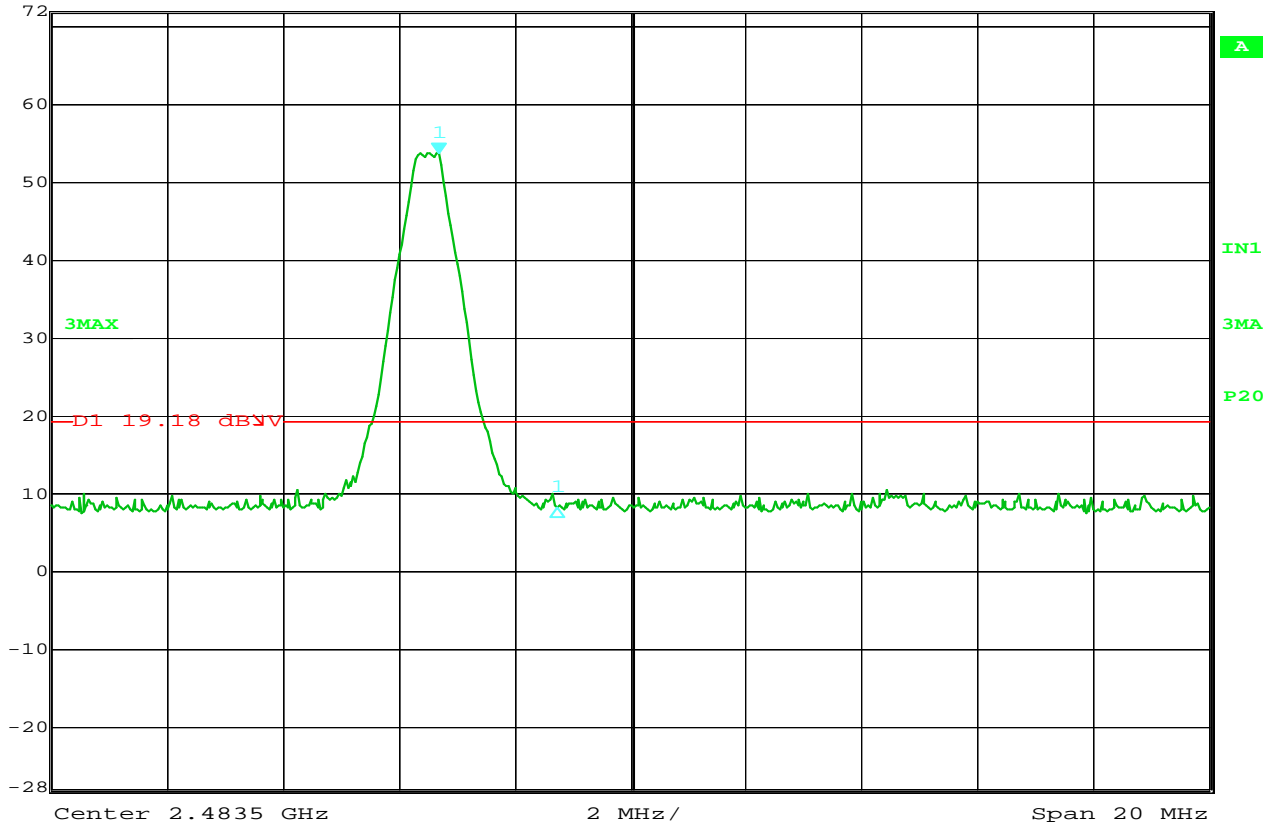
MANUFACTURER : Bose Corporation
 TEST ITEM : Media System
 MODEL NUMBER : 302211-X01
 TEST MODE : Frequency Hopping Enabled
 NOTES :

Checked BY : RICHARD E. KING

Richard E. King



Ref Lvl	Marker 1 [T3]	RBW	300 kHz	RF Att	0 dB
72 dBuV	53.58 dBuV	VBW	3 MHz		
	2.48019339 GHz	SWT	5 ms	Unit	dBuV



Date: 15.MAR.2007 15:58:37

FCC 15.247 Bandedge Compliance

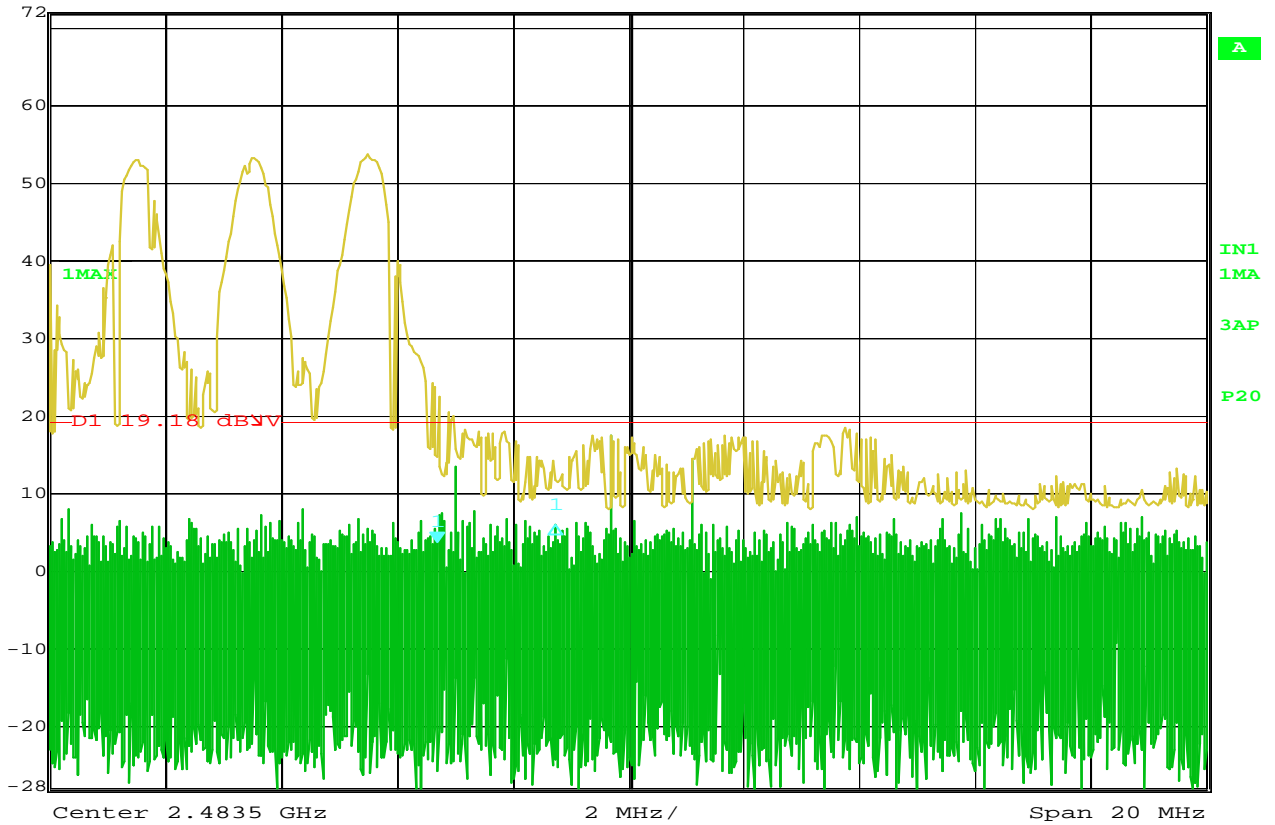
MANUFACTURER : Bose Corporation
 TEST ITEM : Media System
 MODEL NUMBER : 302211-X01
 TEST MODE : Transmit @ 2480.0.0 MHz
 NOTES : Delta Marker Method
 : 88.6dBuV/m – 54 dBuV = 34.6 dBc

Checked BY : RICHARD E. KING

Richard E. King



Marker 1 [T3] RBW 300 kHz RF Att 0 dB
 Ref Lvl 72 dBuV 3.61 dBuV VBW 3 MHz
 2.48019339 GHz SWT 5 ms Unit dBuV



Date: 15.MAR.2007 16:27:30

FCC 15.247 Bandedge Compliance

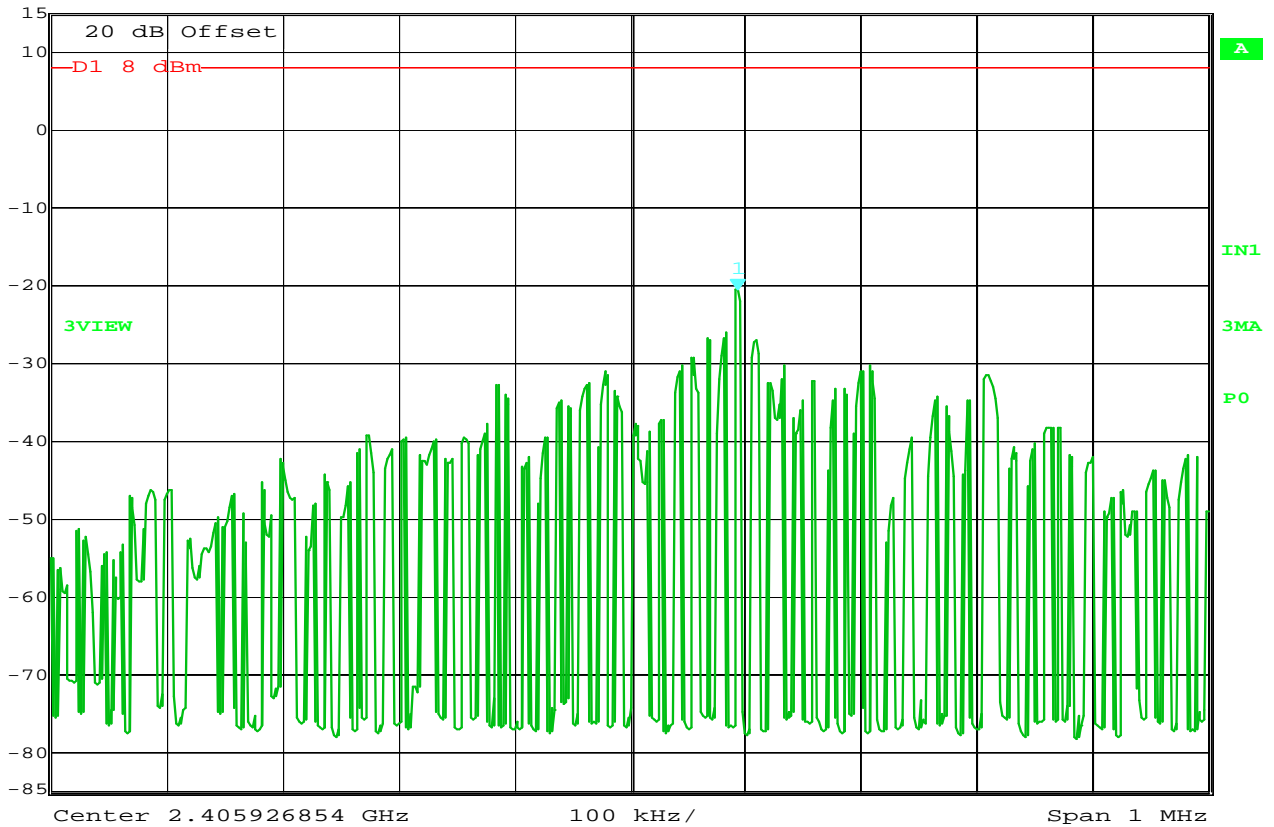
MANUFACTURER : Bose Corporation
 TEST ITEM : Media System
 MODEL NUMBER : 302211-X01
 TEST MODE : Frequency Hopping Enabled
 NOTES : Delta Marker Method
 : 88.6dBuV/m – 54 dBuV = 34.6 dBc

Checked BY : RICHARD E. KING

Richard E. King



Marker 1 [T3] RBW 3 kHz RF Att 10 dB
 -20.63 dBm VBW 30 kHz
 2.40602004 GHz SWT 340 s Unit dBm
 Ref Lvl 15 dBm



Date: 21.MAR.2007 17:39:03

FCC 15.247 Power Spectral Density

MANUFACTURER : Bose Corporation
 TEST ITEM : Media System
 MODEL NUMBER : 302211-X01
 TEST MODE : Frequency Hopping Enabled
 NOTES :

Checked BY : RICHARD E. KING

Richard E. King