Measurement of RF Emissions from a Model PMLN5712A R1.2 Wireless Dongle Transceiver

For	Motorola, Inc. 1301 E. Algonquin Road Schaumburg, IL 60196
P.O. Number	NP5258168
Date Tested	November 29, 2010 through December 8, 2010
Test Personnel	Richard King
Test Specification	FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.247 for Frequency Hopping Spread Spectrum Intentional Radiators Operating within the band 2400-2483.5MHz Industry Canada RSS-GEN Industry Canada RSS-210
Test Report By:	Richard King EMC Engineer
Requested By:	Larry Larsen Motorola, Inc.
Approved By:	Raymond J. Klouda Registered Professional Engineer of Illinois - 44894

Elite Electronic Engineering, Inc.
1516 Centre Circle
Downers Grove, IL 60515
Tel : (630) 495-9770
Fax: (630) 495-9785
www.elitetest.com

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REVISION HISTORY

Revision	Date	Description
—	12/16/2010	Initial release

Measurement of RF Emissions from a R1.2 Wireless Dongle, Model No. PMLN5712A Transceiver

1 INTRODUCTION

1.1 Scope of Tests

This report represents the results of the series of radio interference measurements performed on a Motorola, Inc. R1.2 Wireless Dongle, Model No. PMLN5712A, Serial No. none assigned, transceiver (hereinafter referred to as the EUT). The EUT is a Bluetooth hybrid frequency hopping spread spectrum transceiver. The transmitter was designed to transmit and receive in the 2400-2483.5 MHz band using an internal antenna. The EUT was manufactured and submitted for testing by Motorola, Inc. located in Schaumburg, IL.

1.2 Purpose

The test series was performed to determine if the EUT 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 Operating within the 2400-2483.5 MHz band.

The test series was also performed to determine if the EUT meets the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen and the Industry Canada Radio Standards Specification RSS-210 Annex 8, section A8.1 for transmitters.

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 American Association for Laboratory Accreditation (A2LA). A2LA Certificate Number: 1786.01.

1.5 Laboratory Conditions

The temperature at the time of the test was 21.5^{o}C and the relative humidity was 33%.

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, Subparts B and C, dated 1 October 2010
- 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"
- FCC Public Notice, DA 00-705, "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems", Released March 30, 2000
- Industry Canada Radio Standards Specification, RSS-Gen, “General Requirements and Information for the Certification of Radiocommunication Equipment”, Issue 3, December 2010
- Industry Canada Radio Standards Specification, RSS-210, “Low-power License-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment”, Issue 8, June 2010

3 EUT SETUP AND OPERATION

3.1 General Description

The EUT is a Motorola, Inc., R1.2 Wireless Dongle, Model No. PMLN5712A. The EUT was submitted for testing with a Motorola XPR6350 UHF mobile radio.

A block diagram of the EUT setup is shown as Figure 1.

3.1.1 Power Input

The EUT obtained 5VDC from the Motorola XPR6350 UHF radio.

3.1.2 Peripheral Equipment

The following peripheral equipment was submitted with the EUT:

Item	Description
Motorola XPR6350 UHF Radio	Portable radio

3.1.3 Signal Input/Output Leads

No interconnect cables were submitted with the EUT for testing.

3.1.4 Grounding

The EUT was ungrounded during the tests.

3.2 Operational Mode

For all tests, the EUT was placed on an 80cm high non-conductive stand. The EUT was energized. The unit was programmed to operate in one of the following modes:

- Transmit at 2402 MHz
- Transmit at 2441 MHz
- Transmit at 2480 MHz
- Receive at 2441 MHz
- Frequency Hopping Enabled
- Inquiry Mode

3.3 EUT Modifications

No modifications were required for compliance.

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 Table 9-1.

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

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

5 TEST PROCEDURES

5.1 Receiver

5.1.1 Radiated Measurements

5.1.1.1 Requirements

Per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Section 15.101(b), receivers operating above 960MHz are exempt from complying with the technical provisions of part 15.

Per Industry Canada RSS-Gen all radio frequency emissions from a receiver shall be below the limits shown on the following table:

RADIATION LIMITS FOR A RECEIVER

Frequency MHz	Distance between EUT And Antenna in Meters	Field Strength uV/m	Field Strength dBuV/m
30-88	3	100	40
88-216	3	150	43.5
216-960	3	200	46
Above 960	3	500	54

Note: The tighter limit shall apply at the edge between the two frequency bands.

5.1.1.2 Procedures

Per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Section 15.101(b), receivers operating above 960MHz are exempt from complying with the technical provisions of part 15.

For Industry Canada, testing was performed on a middle channel. The emissions in the frequency range of 30MHz to 3 times the highest tunable or local oscillator frequency, whichever is the higher, were measured and plotted.

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. The walls and ceiling of the shielded chamber are lined with ferrite tiles. 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.

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.

Since a quasi-peak detector and an average detector require long integration times, it is not practical to automatically sweep through the quasi-peak and average levels. Therefore, radiated emissions from the EUT were first scanned using a peak detector and automatically plotted. The frequencies where significant emission levels were noted were then remeasured using the quasi-peak detector or average detector.

Preliminary radiated emissions tests were performed to determine the emission characteristics of the EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 30MHz to 7.5GHz was investigated using a peak detector function.

Final radiated emissions were performed on all significant broadband and narrowband emissions found in the preliminary sweeps using the following methods:

1) Measurements from 30MHz to 1GHz were made using a quasi-peak detector and a broadband bilog antenna. Measurements above 1GHz were made using an average detector and a broadband double ridged waveguide antenna.

2) To ensure that maximum or worst case, emission levels were measured, the following steps were taken:

    a) The EUT was rotated so that all of its sides were exposed to the receiving antenna.

    b) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.

    c) The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.

    d) For hand-held or body-worn devices, the EUT was rotated through three orthogonal axes to determine which orientation produces the highest emission relative to the limit.

5.1.1.3 Results

The preliminary plots are presented on pages 20 through 23. The plots are presented for a reference only, and are not used to determine compliance. The final radiated levels are presented on page 24. As can be seen from the data, all emissions measured from the EUT were within the specification limits. Photographs of the test configuration for radiated emission levels are shown in Figure 2.

5.2 Transmitter

5.2.1 20dB Bandwidth

5.2.1.1 Requirement

Per section 15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. 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 20dB bandwidth of the hopping channel, whichever is greater, provided the systems operate within an output power no greater than 125mW.

5.2.1.2 Procedures

The EUT was setup inside the chamber. With the hopping function disabled, the EUT 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 span was set to approximately 2 to 3 times the 20 dB bandwidth.

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.

5.2.1.3 Results

The plots on pages 25 through 27 show that the maximum 20 dB bandwidth was 893.78kHz. The 99% bandwidth was measured to be 846.7kHz.

5.2.2 Carrier Frequency Separation

5.2.2.1 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.

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 20dB bandwidth of the hopping channel, whichever is greater, provided the systems operate within an output power no greater than 125mW.

5.2.2.2 Procedures

The EUT was setup inside the chamber. With the hopping function enabled, the EUT 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

5.2.2.3 Results

Page 28 shows the carrier frequency separation. As can be seen from this plot, the carrier frequency separation is 1MHz which is greater than the 20dB bandwidth of the hopping channel (893.78kHz).

5.2.3 Number of Hopping Frequencies

5.2.3.1 Requirements

Per section 15.247(a)(1)(iii), frequency hopping systems operating in the 2400-2483.5MHz band that employ

at least 15 hopping channels must have a maximum peak conducted output power that does not exceed 0.125W (21dBm).

Per 15.247(b)(1), frequency hopping systems operating in the 2400- 2483.5MHz band that employ at least 75 non-overlapping hopping channels must have a maximum peak conducted output power that does not exceed 1W (30dBm).

5.2.3.2 Procedures

The EUT was setup inside the chamber. With the hopping function enabled, the EUT 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 EUT'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.

5.2.3.3 Results

Page 29 shows the number of hopping frequencies. As can be seen from this plot, the number of hopping frequencies is 79 which is greater than 75 which is the minimum number of required hopping frequencies for systems operating in the 2400-2483.5MHz band that have a maximum peak conducted output power that does not exceed 1W (30dBm).

5.2.4 Time of Occupancy

5.2.4.1 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.

5.2.4.2 Procedures

The EUT was setup inside the chamber. With the hopping function enabled, the EUT 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 0Hz, 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 0.4 seconds multiplied by the number of hopping channels employed to capture the number of hops in the appropriate sweep time. A single sweep was made. The analyzer's display was plotted using a 'screen dump' utility. The dwell time in the specified time period was then calculated from dwell time per hop multiplied by the number of hops in the specified time period.

5.2.4.3 Results

Pages 31 and 32 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 417usec/hop multiplied by 324 hops. This calculated value is equal to 0.135 seconds which is less than the 0.4 seconds maximum allowed.

5.2.5 Peak Output Power

5.2.5.1 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 1W (30dBm). 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 6dBi antenna gain, the maximum EIRP

can be increased by 6dB to 4 Watt (36dBm).

If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below 30dBm by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.2.5.2 Procedures

The EUT 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 EUT. The resolution bandwidth (RBW) of the spectrum analyzer was set to greater than the 20dB bandwidth. The span was set to approximately 5 times the 20 dB bandwidth. The EUT 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 low, middle and high 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 double ridged waveguide antenna was then set in place of the EUT 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 low, middle, and high hopping frequencies.

5.2.5.3 Results

The results are presented on page 33. The maximum EIRP measured from the transmitter was 2.9dBm or 0.002W which is below the 4 Watt limit.

5.2.6 Radiated Spurious Emissions Measurements

5.2.6.1 Requirements

Per section 15.247(d), in any 100kHz 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 100kHz 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

5.2.6.2 Procedures

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. The walls and ceiling of the shielded chamber are lined with ferrite tiles. 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.

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 EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 30MHz to 25GHz was investigated using a peak detector function.

The final open field emission tests were then manually performed over the frequency range of 30MHz to 25GHz.

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 EUT. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.
b) The field strengths 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 EUT. 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 at the fundamental and harmonics were measured, the following steps were taken when measuring the fundamental emissions and the spurious emissions:
    i) The EUT 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.
    iv) In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer, the measuring antenna was not raised or lowered to ensure maximized readings. Instead the EUT was rotated through all axis to ensure the maximum readings were recorded for the EUT.
d) All harmonics not in the restricted bands must be at least 20 dB below levels 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 strengths 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 EUT. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.
    b) The field strengths 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 EUT. 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 EUT 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.
        iv) In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer, the measuring antenna was not raised or lowered to ensure maximized readings. Instead the EUT was rotated through all axis to ensure the maximum readings were recorded for the EUT.
    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).

f) Next, for all radiated emissions measurements above 1GHz, the resolution bandwidth was set to 1MHz. The analyzer was set to linear mode with a 10Hz video bandwidth in order to simulate an average detector. An average reading was taken. If the dwell time per channel of the hopping signal is less than 100msec, then the reading obtained with the 10 Hz video bandwidth may be further adjusted by a “duty cycle correction factor”, derived from 20*log(dwell time/100msec). These readings must be no greater than the limits specified in 15.209(a).

5.2.6.3 Results

Preliminary radiated emissions plots with the EUT transmitting at 2402MHz, 2441MHz, 2480MHz are shown on pages 34 through 51. Final radiated emissions data are presented on data pages 52 through 57. As can be seen from the data, all emissions measured from the EUT were within the specification limits. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown on Figure 2.

5.2.7 Band Edge Compliance

5.2.7.1 Requirement

Per section 15.247(d), the emissions at the band-edges must be at least 20dB 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).

5.2.7.2 Procedures

5.2.7.2.1 Low Band Edge

1) The EUT was setup on a non-conductive stand.
2) The EUT was set to transmit continuously at the channel closest to the low band-edge (hopping function disabled).
3) 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 band-edge, as well as any modulation products which fall outside of the authorized band of operation.
    c. Resolution bandwidth (RBW) ≥ 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 20dB down from the peak of the in-band emissions. All emissions which fall outside of the authorized band of operation must be below the 20dB down display line. (All emissions to the left of the center frequency (band-edge) must be below the display line.)
    f. The analyzer's display was plotted using a 'screen dump' utility.

4) Step 5) was repeated with the frequency hopping function enabled.

5.2.7.2.2 High Band Edge

1) The EUT was set to transmit continuously at the channel closest to the high band-edge (hopping function disabled).
2) A double ridged waveguide was placed 3 meters away from the EUT. The antenna was connected to the input of a spectrum analyzer.
3) The center frequency of the analyzer was set to the high band edge (2483.5MHz)
4) The resolution bandwidth was set to 1MHz.
5) To ensure that the maximum or worst case emission level was measured, the following steps were taken:

    a. The EUT was rotated so that all of its sides were exposed to the receiving antenna.
    b. Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
    c. The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.

6) The highest measured peak reading was recorded.
7) The highest measured average reading was recorded.

5.2.7.3 Results

Pages 58 through 59 show the radiated band-edge results at the low frequency band-edge. Pages 60 through 61 show the radiated band-edge results at the high frequency band-edge. As can be seen from these plots, the radiated emissions at the low frequency band edge are within the 20 dB down limits. The radiated emissions at the high frequency band edge are within the general limits.

5.2.8 Power Spectral Density

5.2.8.1 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.

5.2.8.2 Procedures

1) The EUT was placed on the non-conductive stand and set to transmit at a mid channel.
2) A probe was placed near the EUT.
3) To determine the power spectral density, the following spectrum analyzer settings were used for Channel 1:
    a. Center frequency = transmit frequency
    b. Span = 1MHz
    c. Resolution bandwidth (RBW) greater than the 20dB bandwidth.
    d. Sweep time = auto
    e. The peak detector and 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
    f. Channel 1 of the spectrum analyzer was placed in ‘View’ mode.
4) This reading corresponds to the peak output power measured for the mid channel.
5) The EUT was then placed in the inquiry mode.
6) To determine the power spectral density, the following spectrum analyzer settings were used for Channel 2:
    a. Center frequency = transmit frequency
    b. Span = 1MHz
    c. Resolution bandwidth (RBW) = 3kHz
    d. Sweep time = span divided by RBW = (for example :1MHz/3kHz = 333 seconds)
    e. The peak detector and 'Max-Hold' function was engaged.
    f. The analyzer's display was plotted using a 'screen dump' utility.

5.2.8.3 Results

Page 62 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.

6 OTHER TEST CONDITIONS

6.1 Test Personnel and Witnesses

Qualified personnel from Elite Electronic Engineering Incorporated performed all tests. The test series was partially witnessed by Motorola, Inc. personnel.

6.2 Disposition of the EUT

The EUT and all associated equipment were returned to Motorola, Inc. upon completion of the tests.

7 CONCLUSIONS

It was determined that the Motorola, Inc. R1.2 Wireless Dongle Transceiver, Model No. PMLN5712A, Serial No. none assigned, did fully meet the radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.247 for Intentional Radiators Operating within the 2400-2483.5 MHz band when tested per ANSI C63-4:2003.

It was also determined that the Motorola, Inc. R1.2 Wireless Dongle Transceiver, Model No. PMLN5712A, Serial No. none assigned, did fully meet the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen and the Industry Canada Radio Standards Specification RSS-210 Annex 8, section A8.1 for transmitters when tested per ANSI C63-4-2003.

8 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 EUT at the test. Any electrical or mechanical modification made to the EUT 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.

9 EQUIPMENT LIST

Table 9-1 Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW0	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-30-20G20R6G	PL2926/0646	20GHZ-26.5GHZ	8/27/2010	8/27/2011
APW2	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-35-120-5R0-10	PL2925	1GHZ-20GHZ	8/27/2010	8/27/2011
CDS2	COMPUTER	GATEWAY	MFATXPNT NMZ 500L	0028483108	1.8GHZ	N/A	
CDW4	DESKTOP COMPUTER	ELITE	PENTIUM 4	005	3.8GHZ	N/A	
CMA1	Controllers	EMCO	2090	9701-1213	---	N/A	
GRE0	SIGNAL GENERATOR	AGILENT TECHNOLOGIES	E4438C	MY42083127	250KHZ-6GHZ	2/16/2010	2/16/2011
NHG0	STANDARD GAIN HORN ANTENNA	NARDA	638	---	18-26.5GHZ	NOTE 1	
NTA2	BILOG ANTENNA	TESEQ	6112D	28040	25-1000MHz	6/7/2010	6/7/2011
NWH0	RIDGED WAVE GUIDE	TENSOR	4105	2081	1-12.4GHZ	8/31/2010	8/31/2011
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	12/5/2009	2/5/2011
PHA0	MAGNETIC FIELD PROBE	ELECTRO-METRICS	EM-6882	134	22-230MHZ	NOTE 1	
RBB0	EMI TEST RECEIVER 20HZ TO 40 GHZ.	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	3/16/2010	3/16/2011
RBD0	EMI TEST RECIEVER	ROHDE & SCHWARZ	ESU40	100010	20Hz-40GHz	3/11/2010	3/11/2011
SES1	24VDC POWER SUPPLY	P TRANS	FS-32024-1M	002	18-27VDC	NOTE 1	
T1N3	10DB 20W ATTENUATOR	NARDA	766-10	---	DC-4GHZ	8/9/2010	8/9/2011
XLJ1	5W, 50 OHM TERMINATION	JFW INDUSTRIES	50T-052	2	DC-2GHZ	8/11/2010	8/11/2011
XLQJ	5W, 50 OHM TERMINATION	JFW INDUSTRIES	50T-052	56	DC-2GHZ	8/11/2010	8/11/2011
XOB1	ADAPTER	HEWLETT PACKARD	K281C	10422	18-26.5GHZ	NOTE 1	

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.

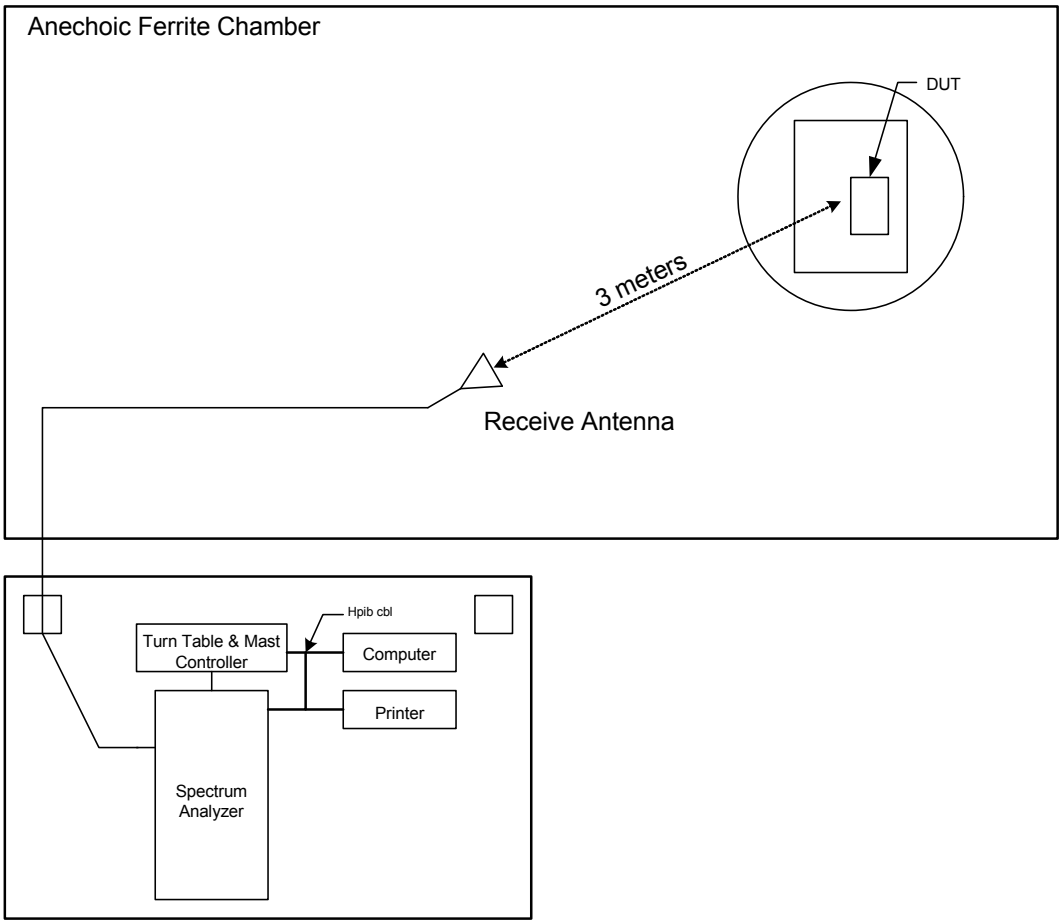


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

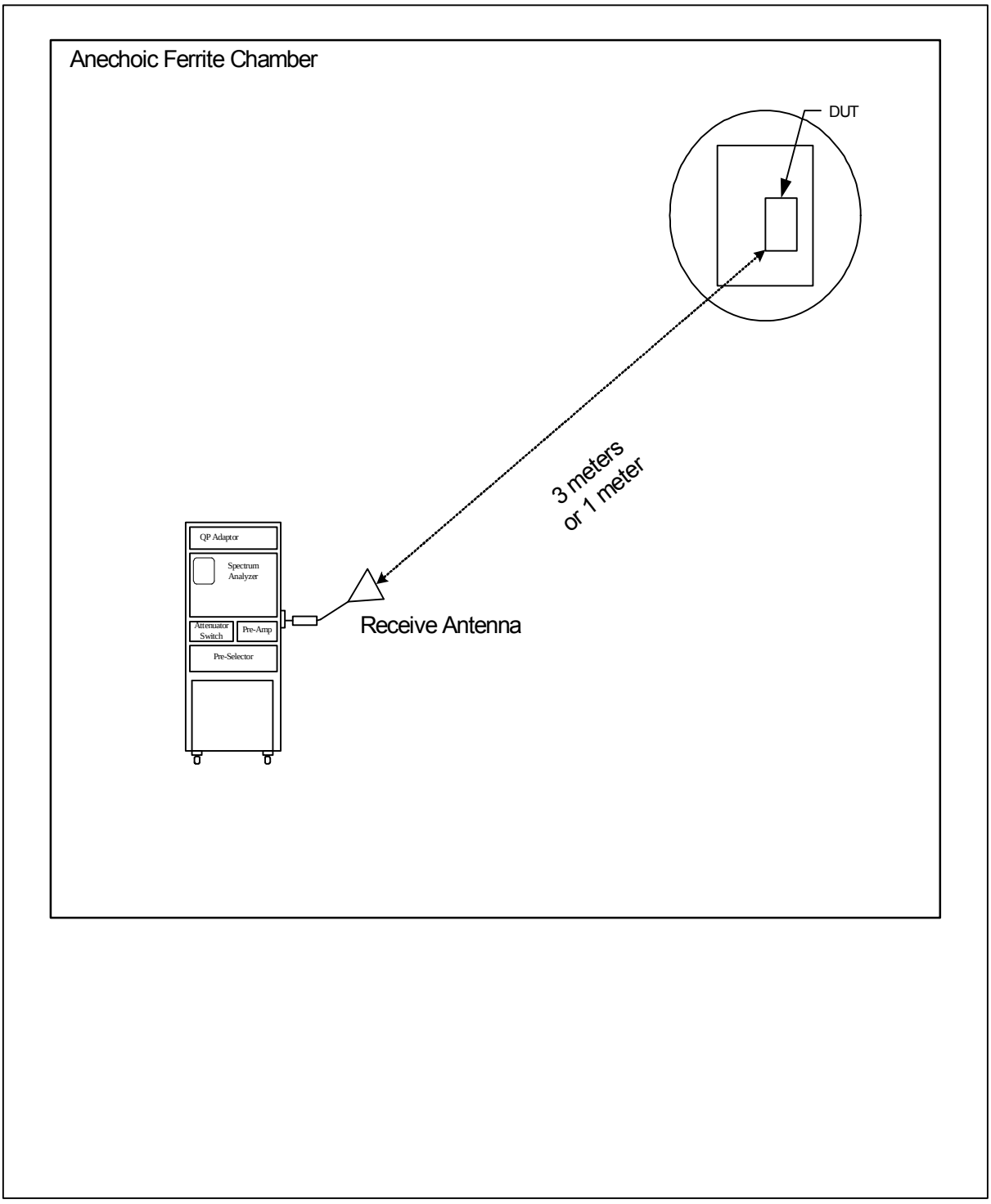
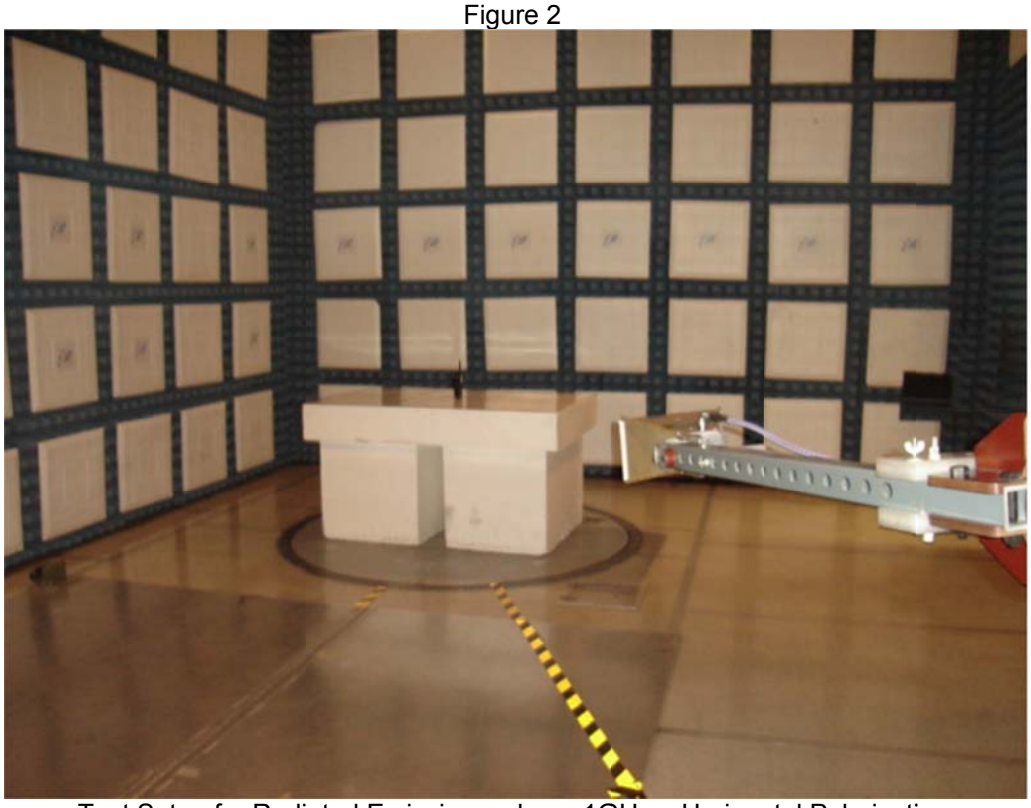
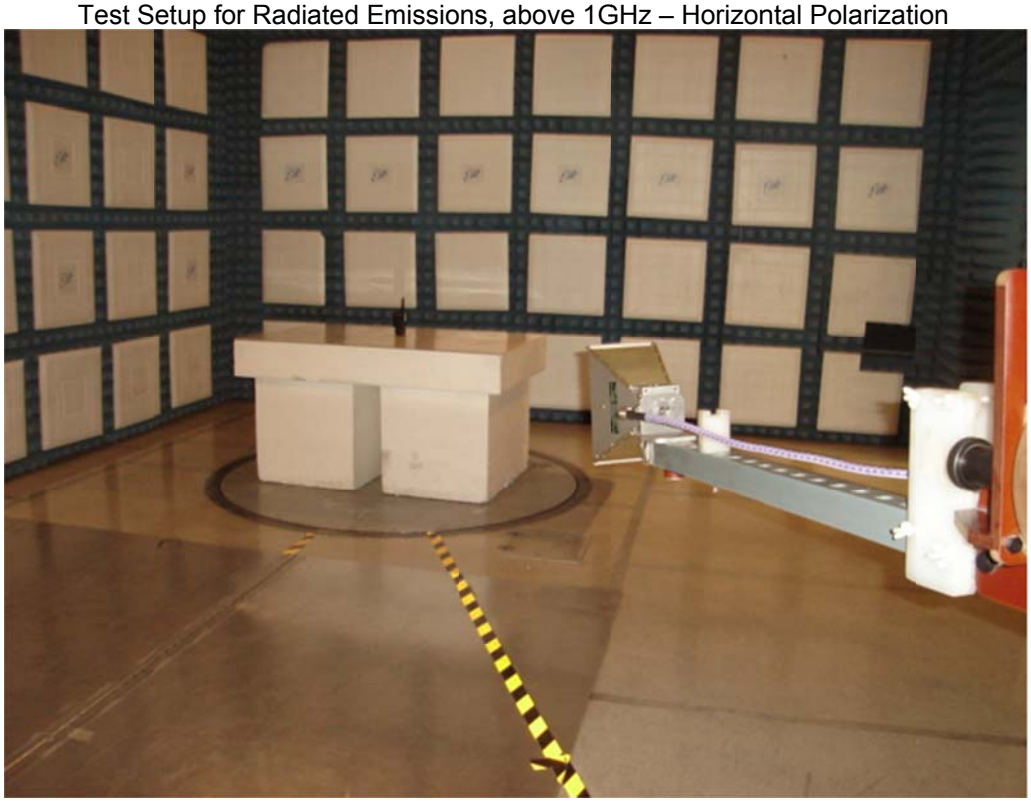

Anechoic Ferrite Chamber
DUT
3 meters
or 1 meter
QP Adaptor
Spectrum
Analyzer
Attenuator
Switch
Pre-Amp
Pre-Selector
Receive Antenna

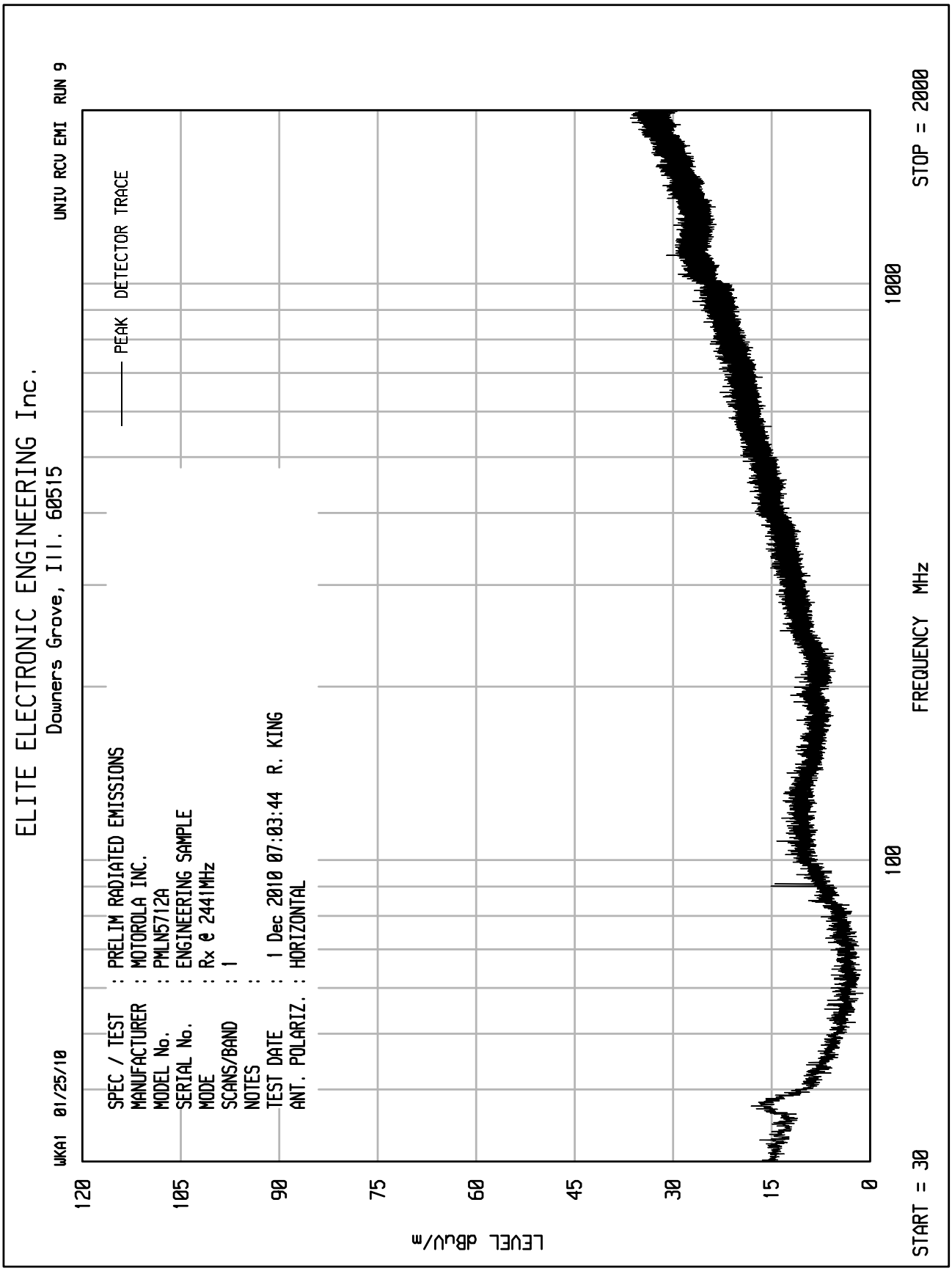
Figure 2

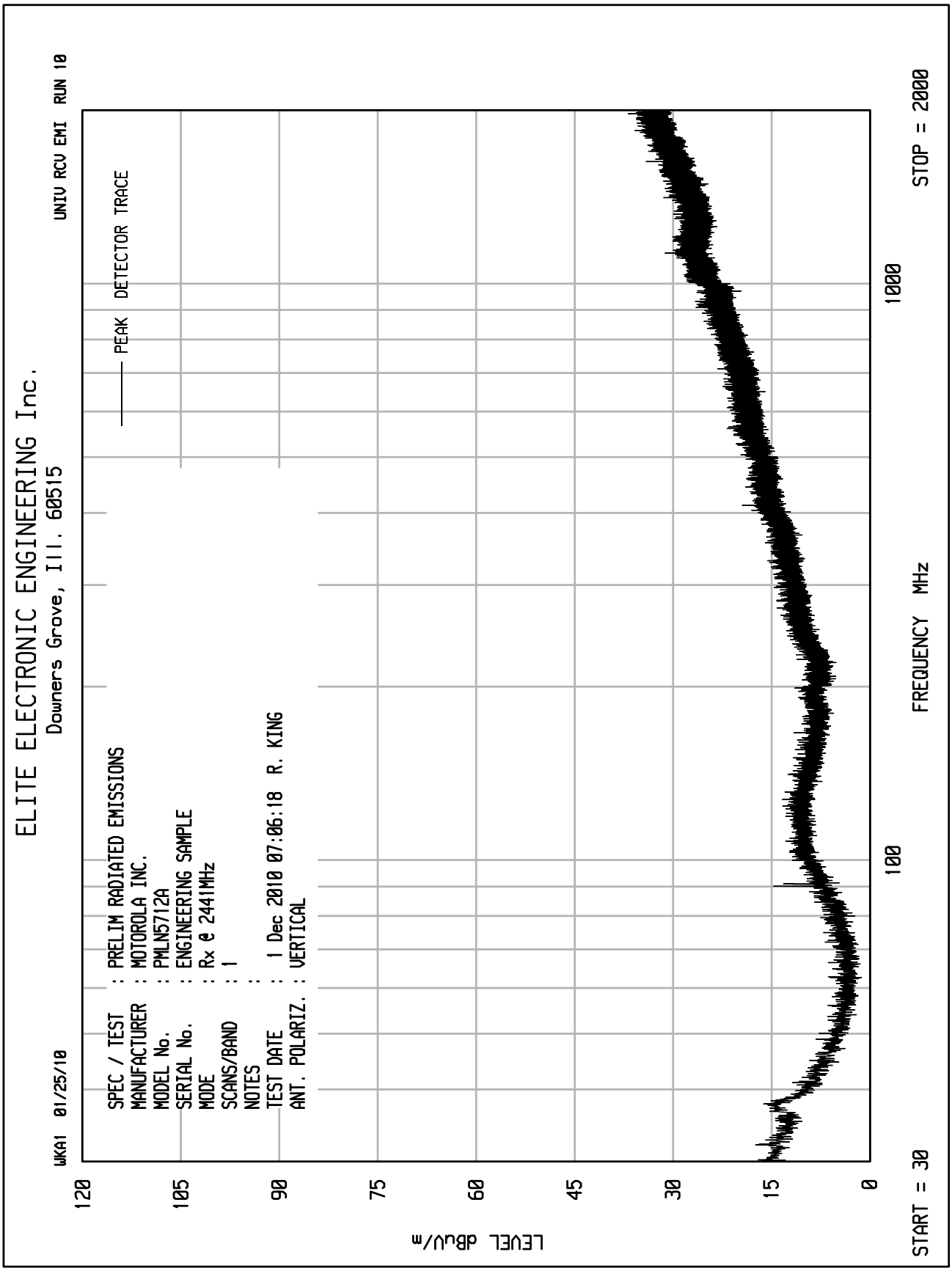


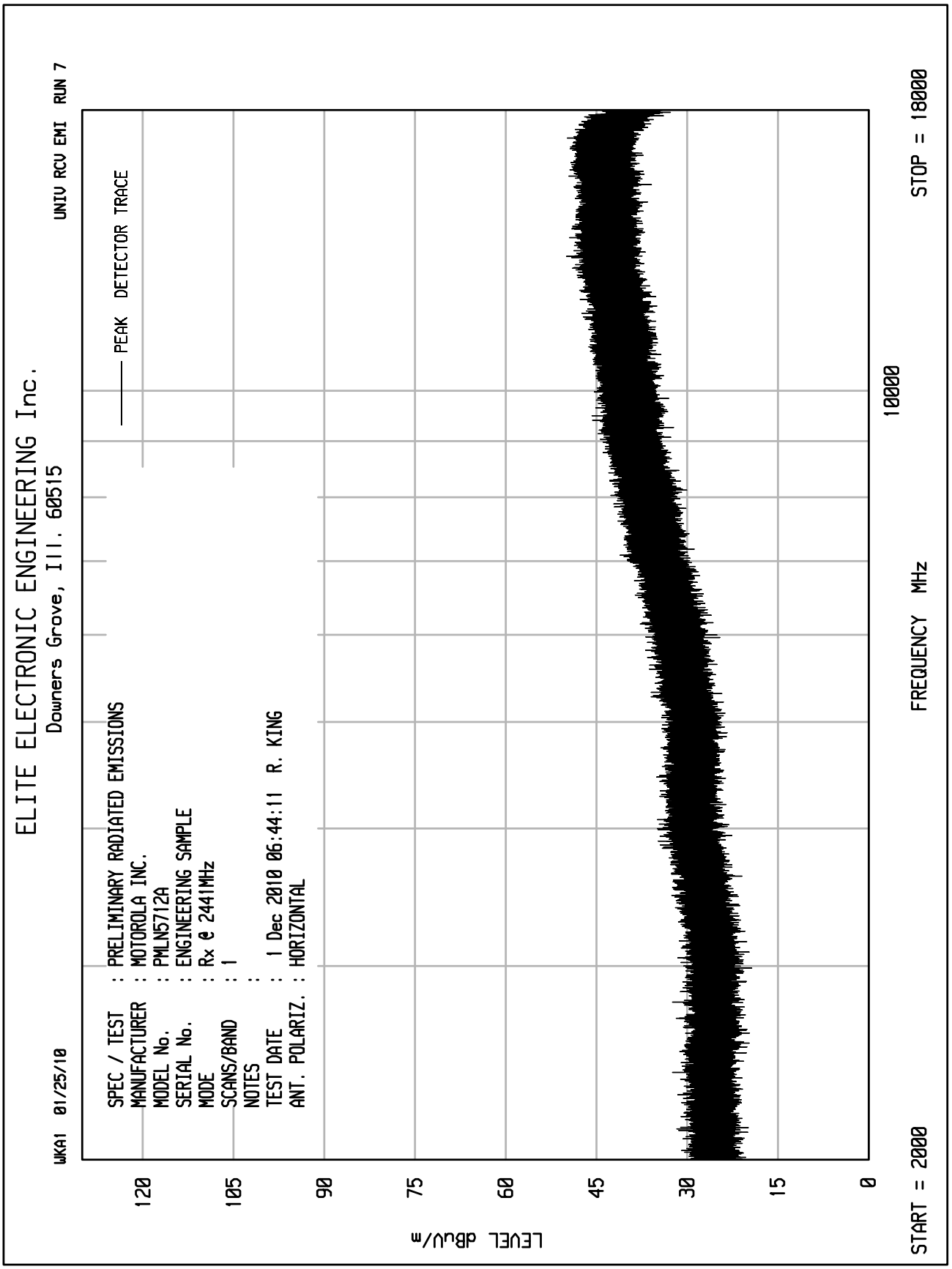
Test Setup for Radiated Emissions, above 1GHz – Horizontal Polarization

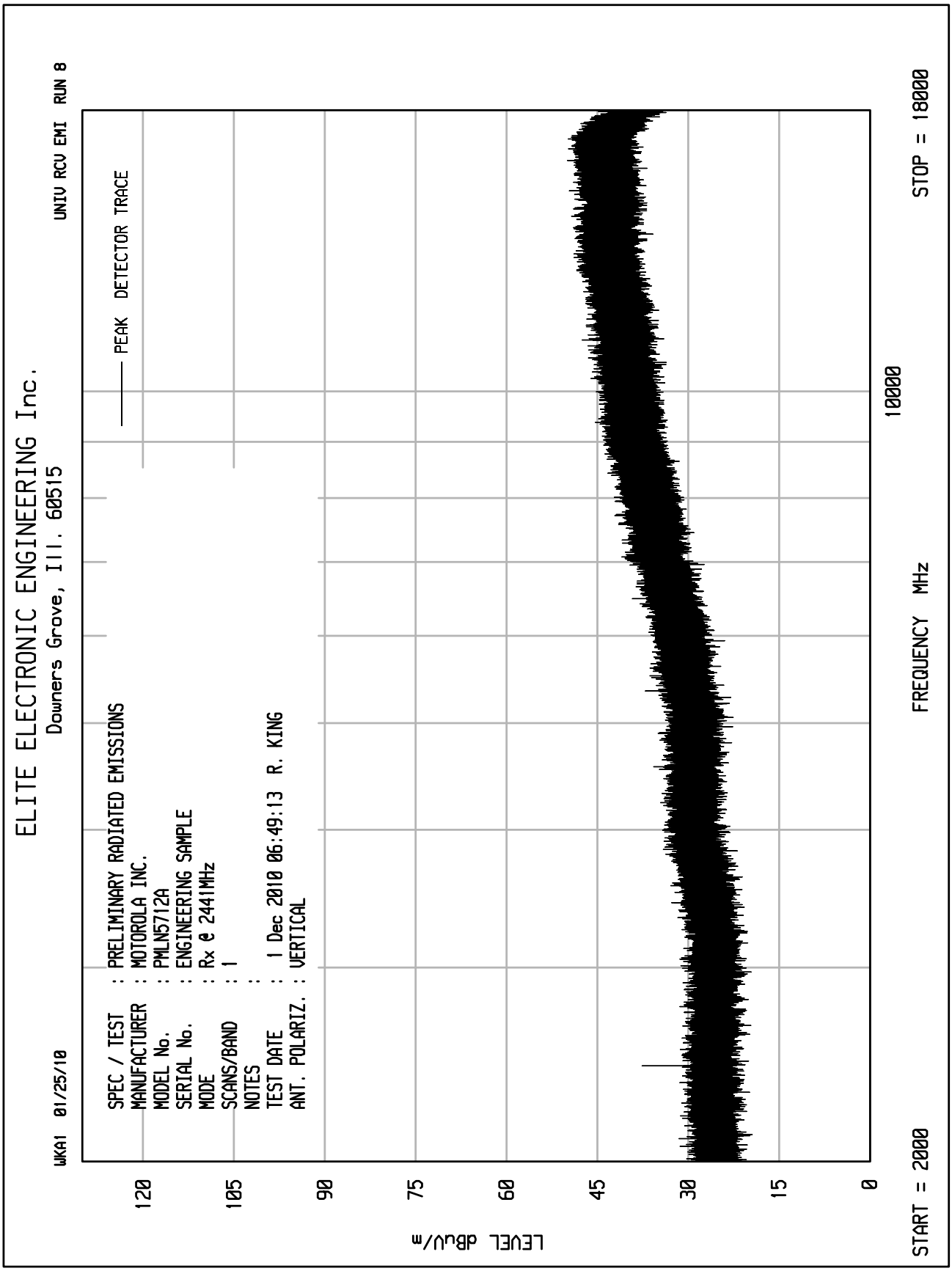


Test Setup for Radiated Emissions, above 1GHz – Vertical Polarization


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 9
WKA1 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : MOTOROLA INC.
MODEL No. : PMLN5712A
SERIAL No. : ENGINEERING SAMPLE
MODE : Rx @ 2441MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 1 Dec 2010 07:03:44 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 30
100
1000
STOP = 2000
FREQUENCY MHz


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 10
WKA1 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : MOTOROLA INC.
MODEL No. : PMLN5712A
SERIAL No. : ENGINEERING SAMPLE
MODE : Rx @ 2441MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 1 Dec 2010 07:06:18 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 30
100
1000
STOP = 2000
FREQUENCY MHz


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 7
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MOTOROLA INC.
MODEL No. : PMLN5712A
SERIAL No. : ENGINEERING SAMPLE
MODE : Rx @ 2441MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 1 Dec 2010 06:44:11 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 2000
10000
STOP = 18000
FREQUENCY MHz


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 8
WKA1 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MOTOROLA INC.
MODEL No. : PMLN5712A
SERIAL No. : ENGINEERING SAMPLE
MODE : Rx @ 2441MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 1 Dec 2010 06:49:13 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 2000
10000
STOP = 18000
FREQUENCY MHz

MANUFACTURER : Motorola
EUT : R1.2 Wireless Dongle
MODEL NUMBER : PMLN5712A
SERIAL NUMBER : none assigned
TEST MODE : Receive at 2441MHz
TEST DATE : November 30, 2010
TEST PARAMETERS : Industry Canada RSS-Gen Spurious Radiated Emissions
NOTES : Tested with Motorola XPR6350 UHF Radio

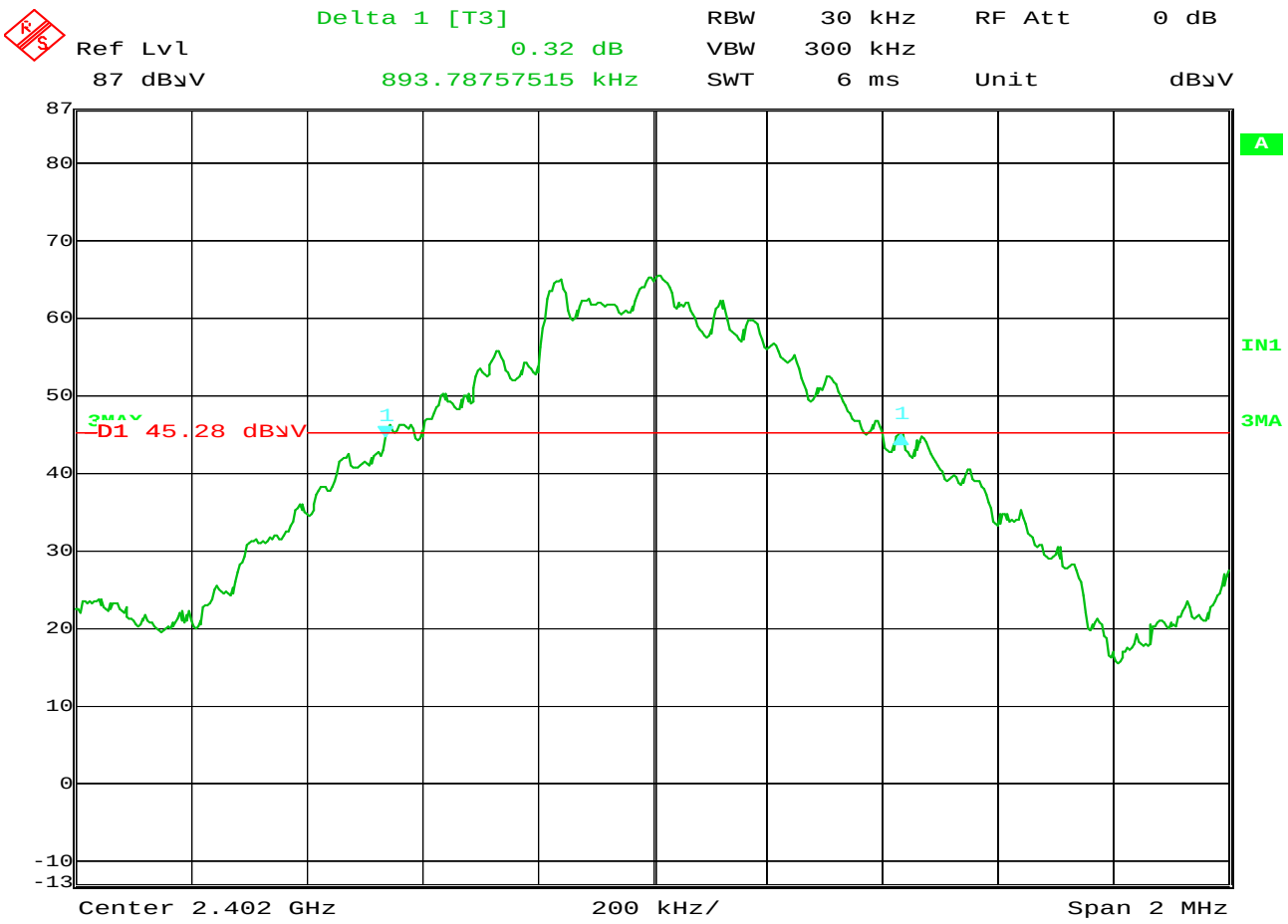
Frequency MHz	Ant Pol	Meter Reading dBuV	Ambient	Cbl Fac dB	Ant Fac dB	Pre Amp Gain dB	Total dBuV/m at 3 m	Total uV/m at 3 m	Limit uV/m at 3 m	Margin dB
2442.500	H	38.9		3.8	29.3	-39.7	32.2	40.9	500	-21.7
2442.500	V	32.0	*	3.8	29.3	-39.7	25.4	18.5	500	-28.6
4885.000	H	29.9	*	5.8	34.5	-38.3	31.9	39.3	500	-22.1
4885.000	V	29.8	*	5.8	34.5	-38.3	31.8	38.9	500	-22.2
7327.500	H	31.0	*	7.7	37.8	-38.4	38.1	79.9	500	-15.9
7327.500	V	31.1	*	7.7	37.8	-38.4	38.1	80.8	500	-15.8

H – Horizontal V – Vertical

Total (dBuV/m) = Meter Reading (dBuV) + Cbl Fac (dB) + Ant Fac (dB) + Pre Amp Gain (dB)

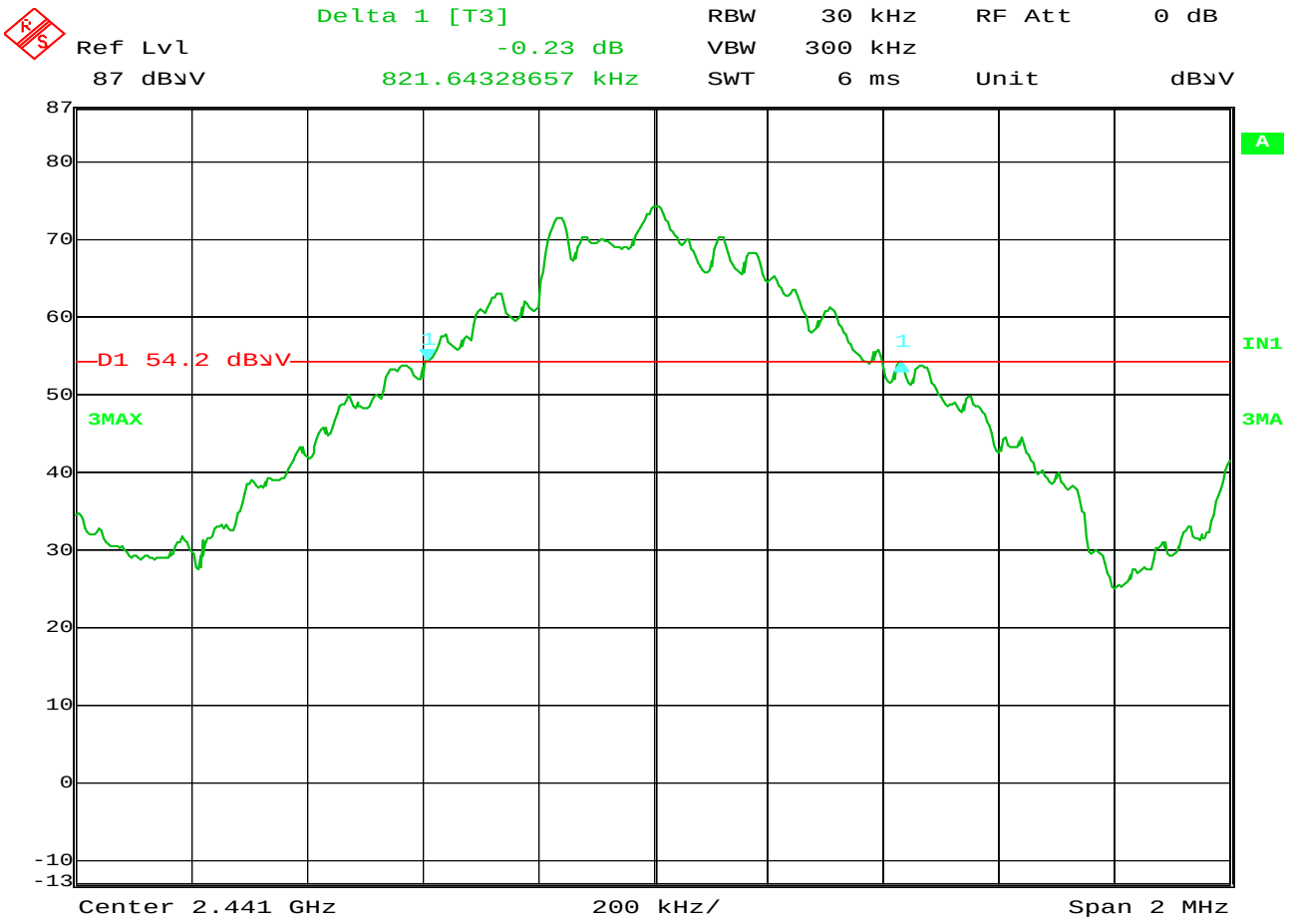
Checked BY Richard E. King :

Richard E. King



20dB Bandwidth

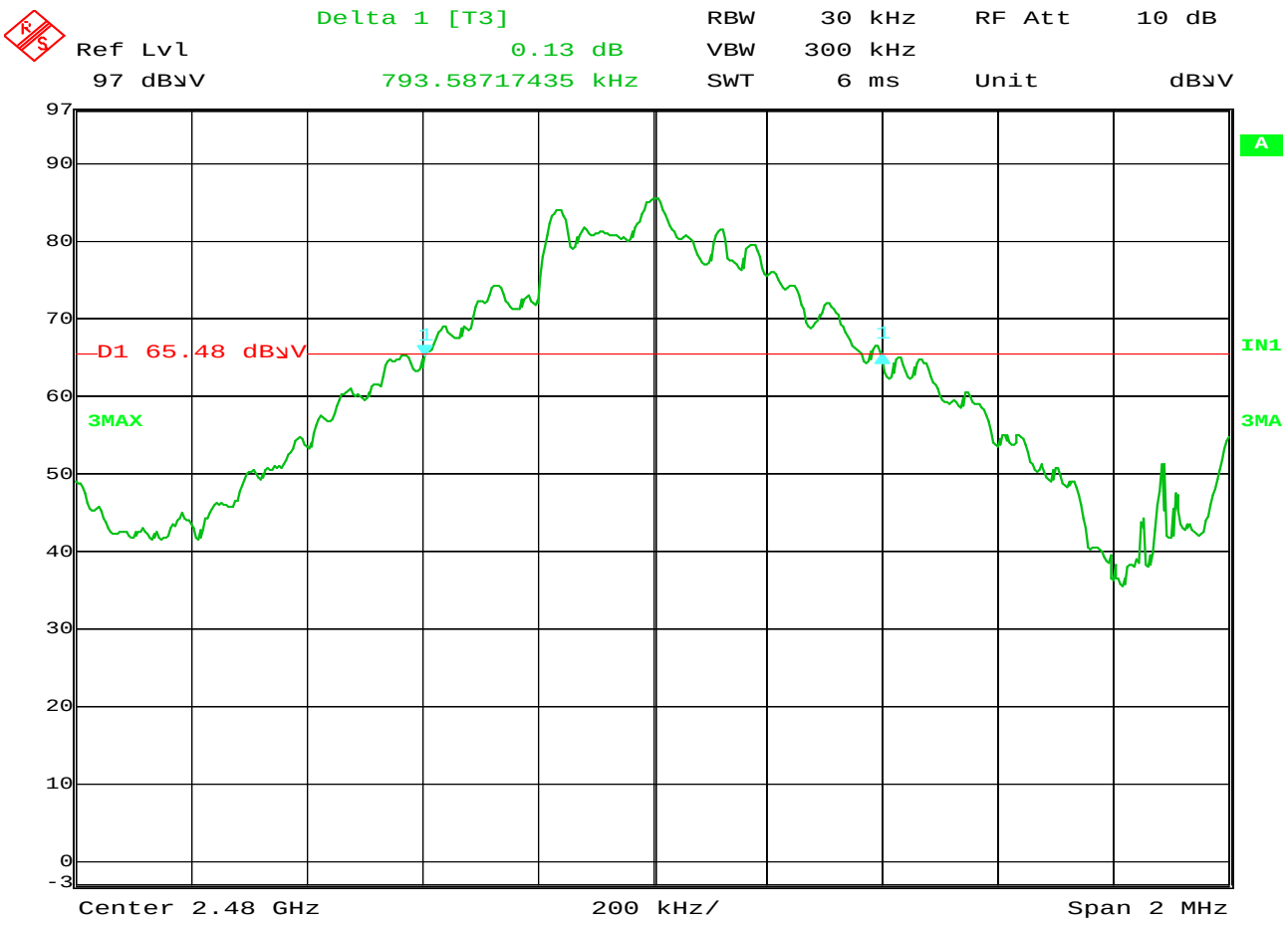
MANUFACTURER	:	Motorola Inc.
MODEL NUMBER	:	PMLN5712A
TEST SPEC.	:	15.247 20dB Bandwidth
TEST PARAMETERS	:	20dBc
EUT FREQUENCY	:	2402MHz
NOTES	:	20dB BW = 893.78 kHz
	:	



Date: 6.DEC.2010 06:21:56

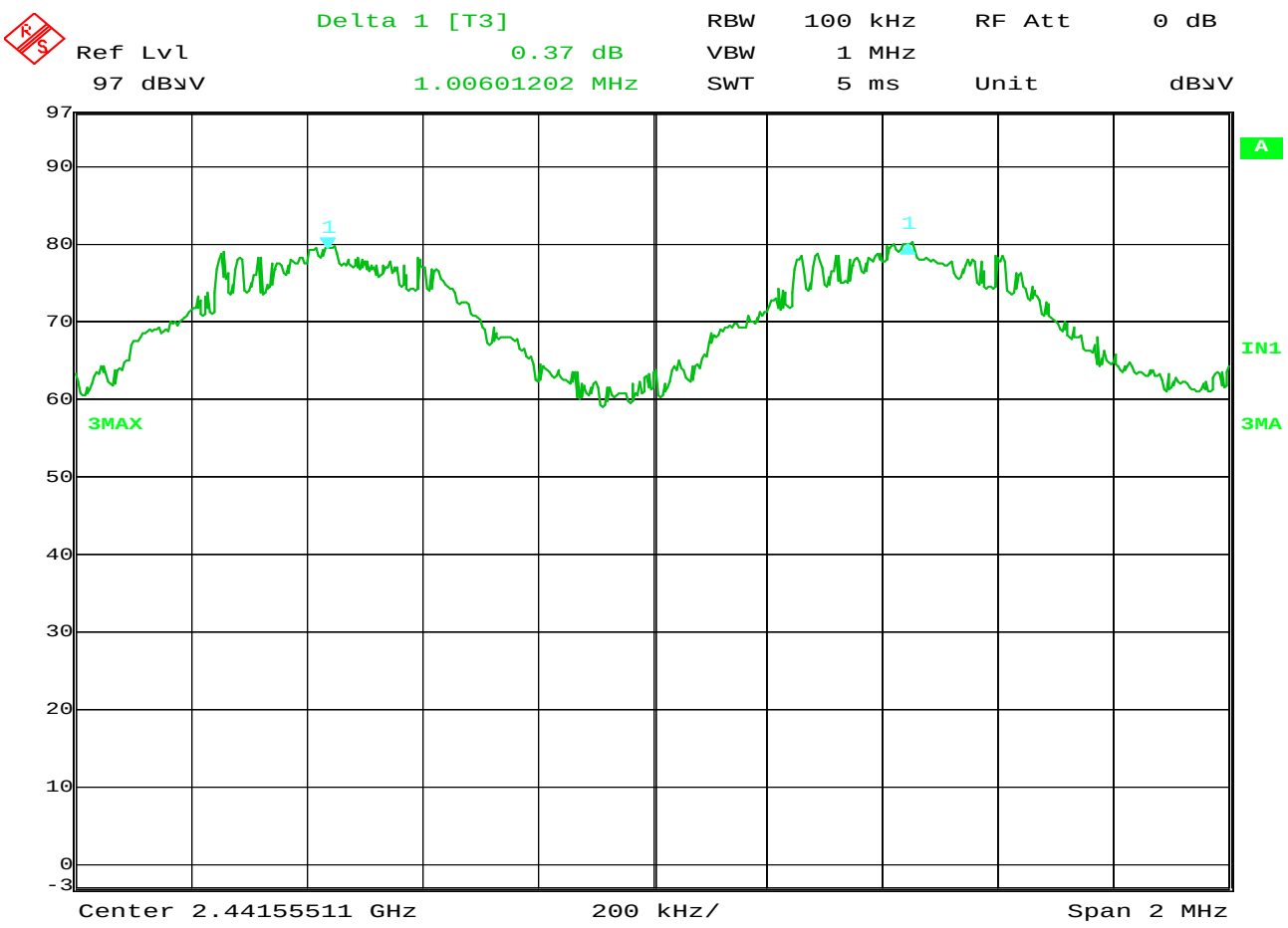
20dB Bandwidth

MANUFACTURER	:	Motorola Inc.
MODEL NUMBER	:	PMLN5712A
TEST SPEC.	:	15.247 20dB Bandwidth
TEST PARAMETERS	:	20dBc
EUT FREQUENCY	:	2441MHz
NOTES	:	20dB BW = 821.64 kHz
	:	



20dB Bandwidth

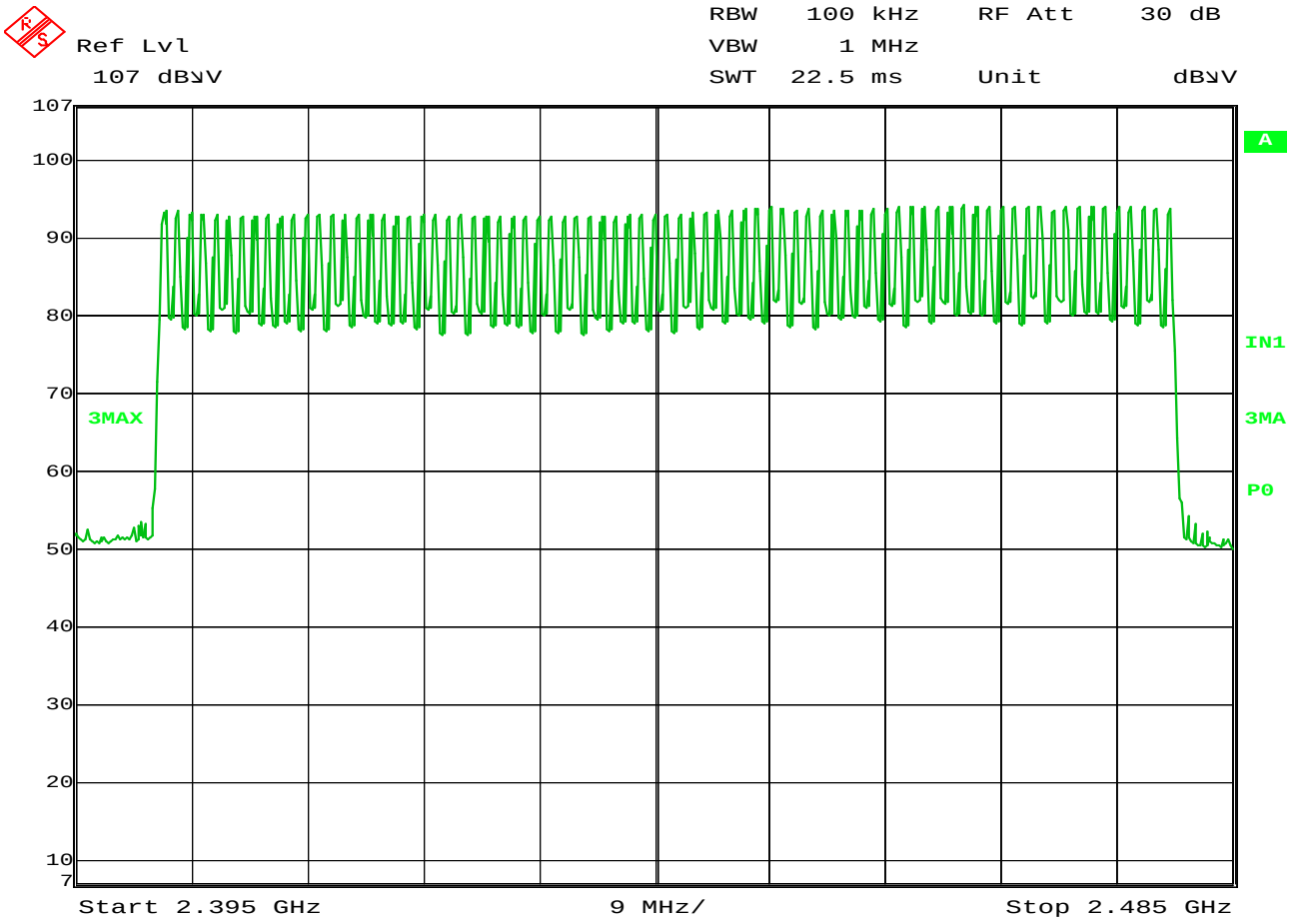
MANUFACTURER	:	Motorola Inc.
MODEL NUMBER	:	PMLN5712A
TEST SPEC.	:	15.247 20dB Bandwidth
TEST PARAMETERS	:	20dBc
EUT FREQUENCY	:	2480MHz
NOTES	:	20dB BW = 793.58 kHz
	:	



Date: 6.DEC.2010 06:39:02

Carrier Frequency Seperation

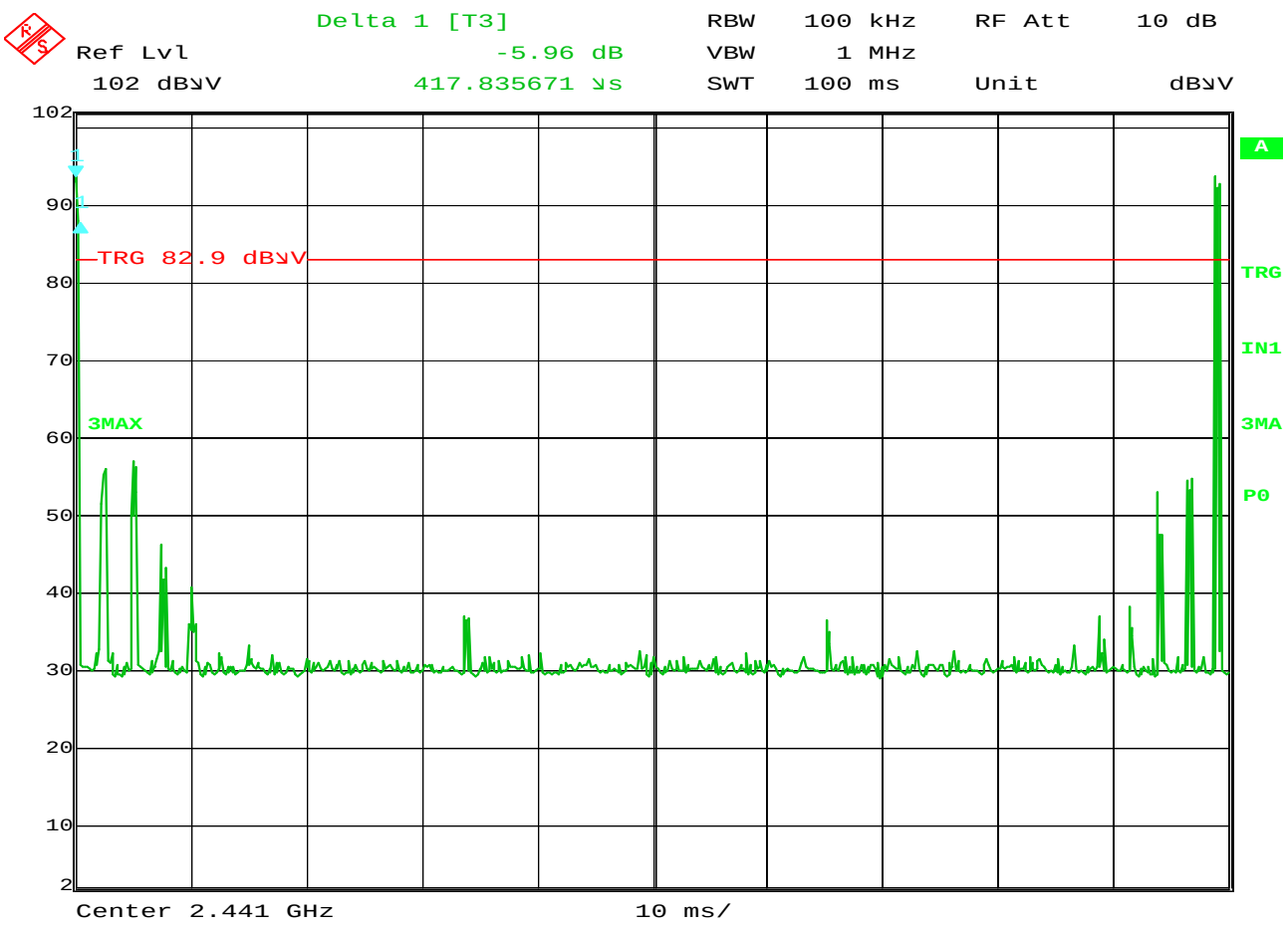
MANUFACTURER	:	Motorola inc.
MODEL NUMBER	:	PMLN5712A
TEST SPEC.	:	15.247 Carrier Frequency Speration
TEST PARAMETERS	:	
EUT FREQUENCY	:	Frequency Hopping Enabled
NOTES	:	20dBc at 2400MHz
	:	



Number of Hopping Frequencies

MANUFACTURER : Motorola Inc.
MODEL NUMBER : PMLN5712A
TEST MODE : Number of Hopping Frequencies
TEST PARAMETERS : Number of Hopping Frequencies = 79
:

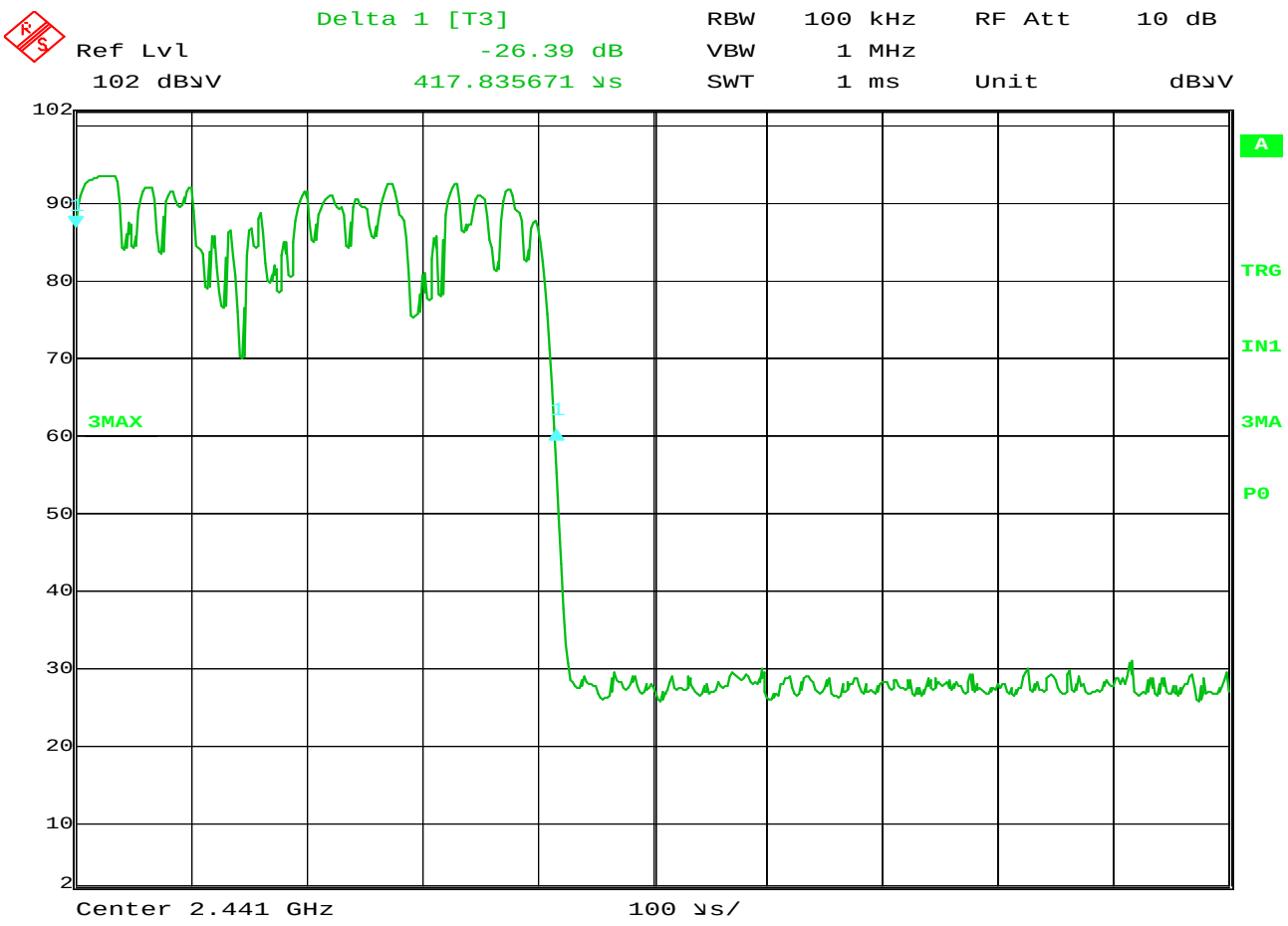
NOTES



Dwell Time

MANUFACTURER : Motorola Inc.
MODEL NUMBER : PMLN5712A
TEST MODE : Dwell Time
TEST PARAMETERS : Number of pulses in 100mS
: Two pulses in 100mS. 1 pulse width equals 417.8uS.
: Duty Cycle Factor = 20*log((417.8uS*2)/100mS) = -41.56 dB

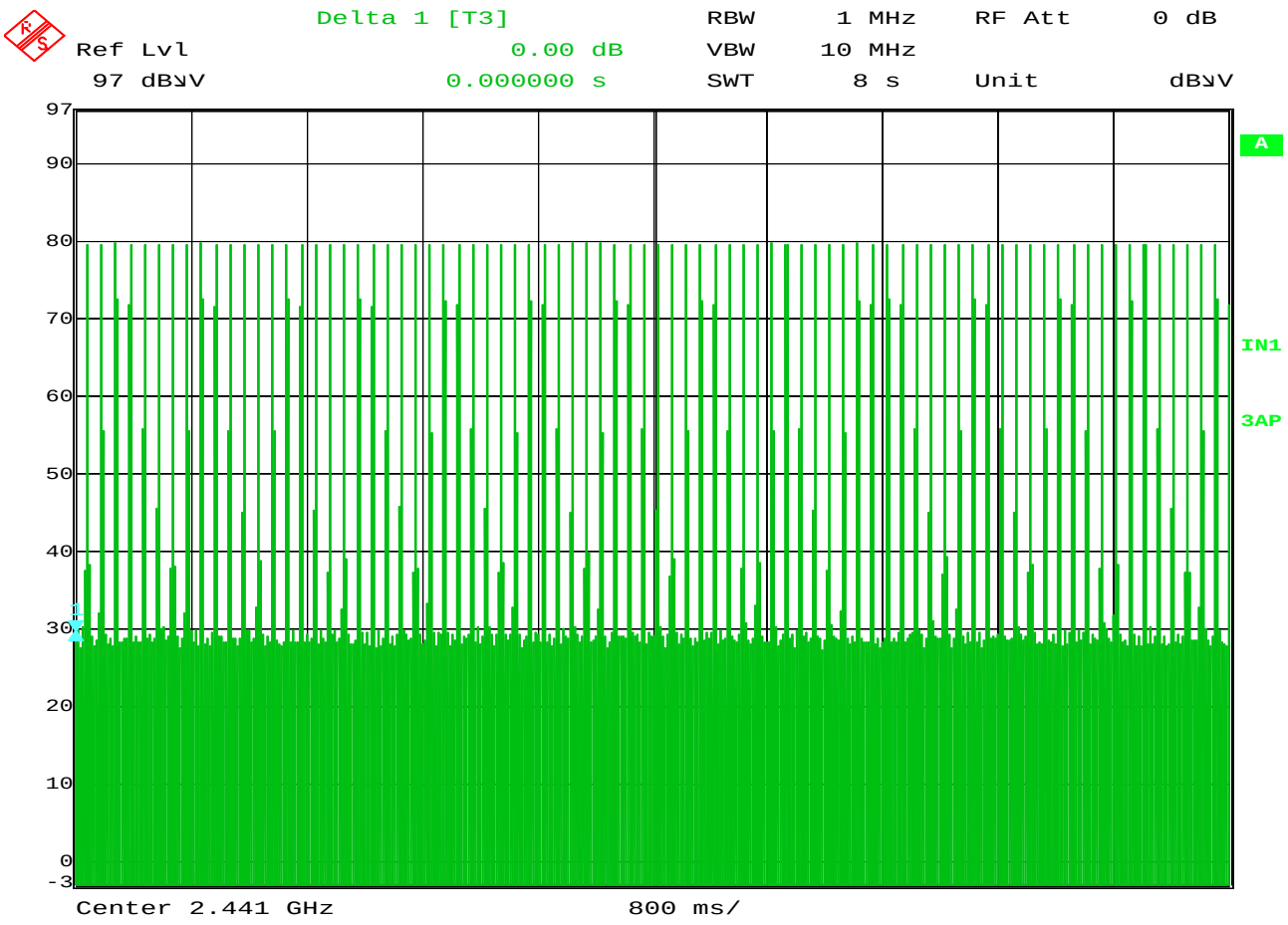
NOTES



Time of Occupancy

MANUFACTURER	:	Motorola Inc.
MODEL NUMBER	:	PMLN5712A
TEST MODE	:	Frequency Hopping Enabled
TEST PARAMETERS	:	Time of Occupancy
NOTES	:	1 pulse = 417.83uS
	:	

NOTES



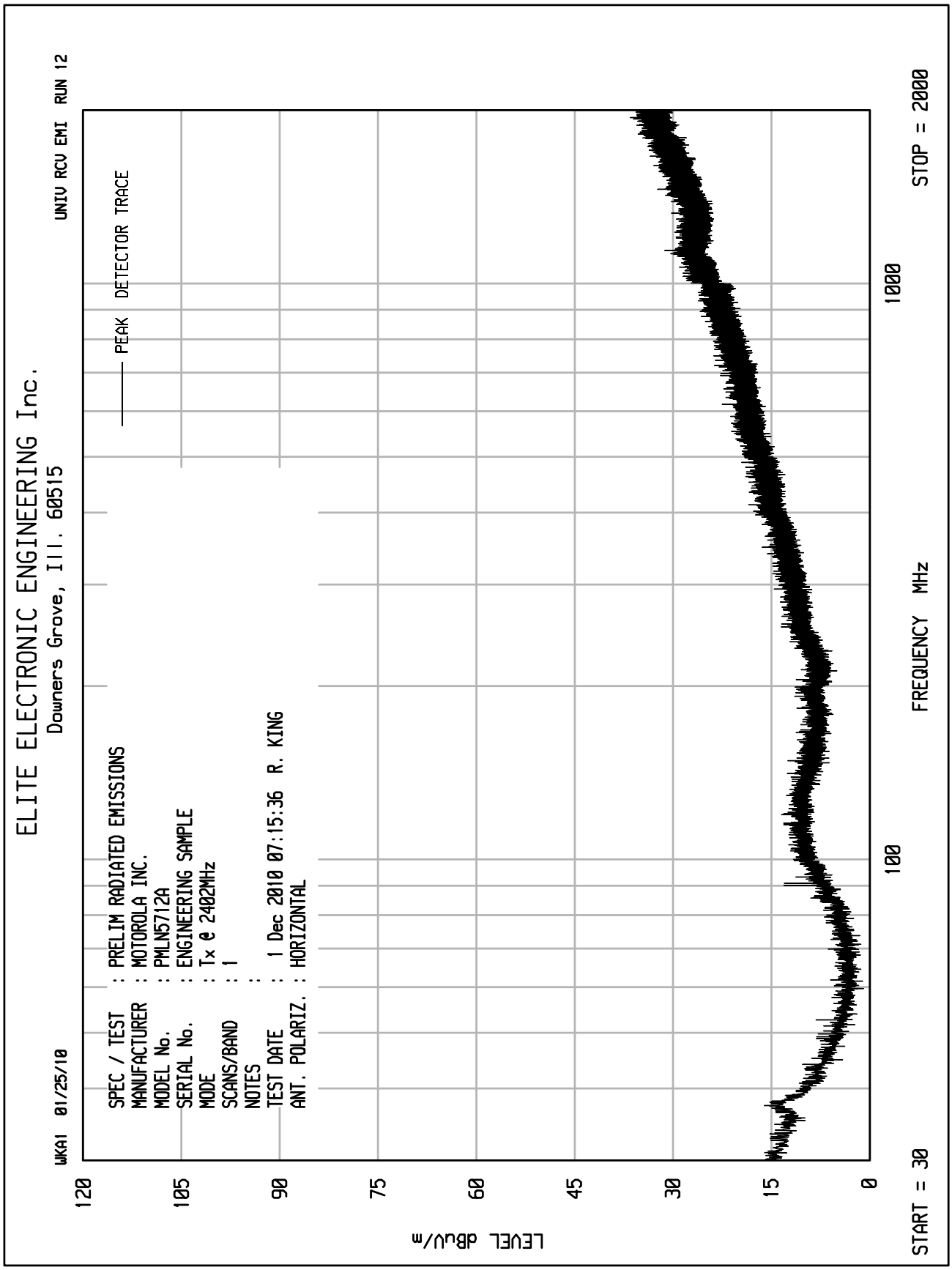
Date: 6.DEC.2010 06:48:14

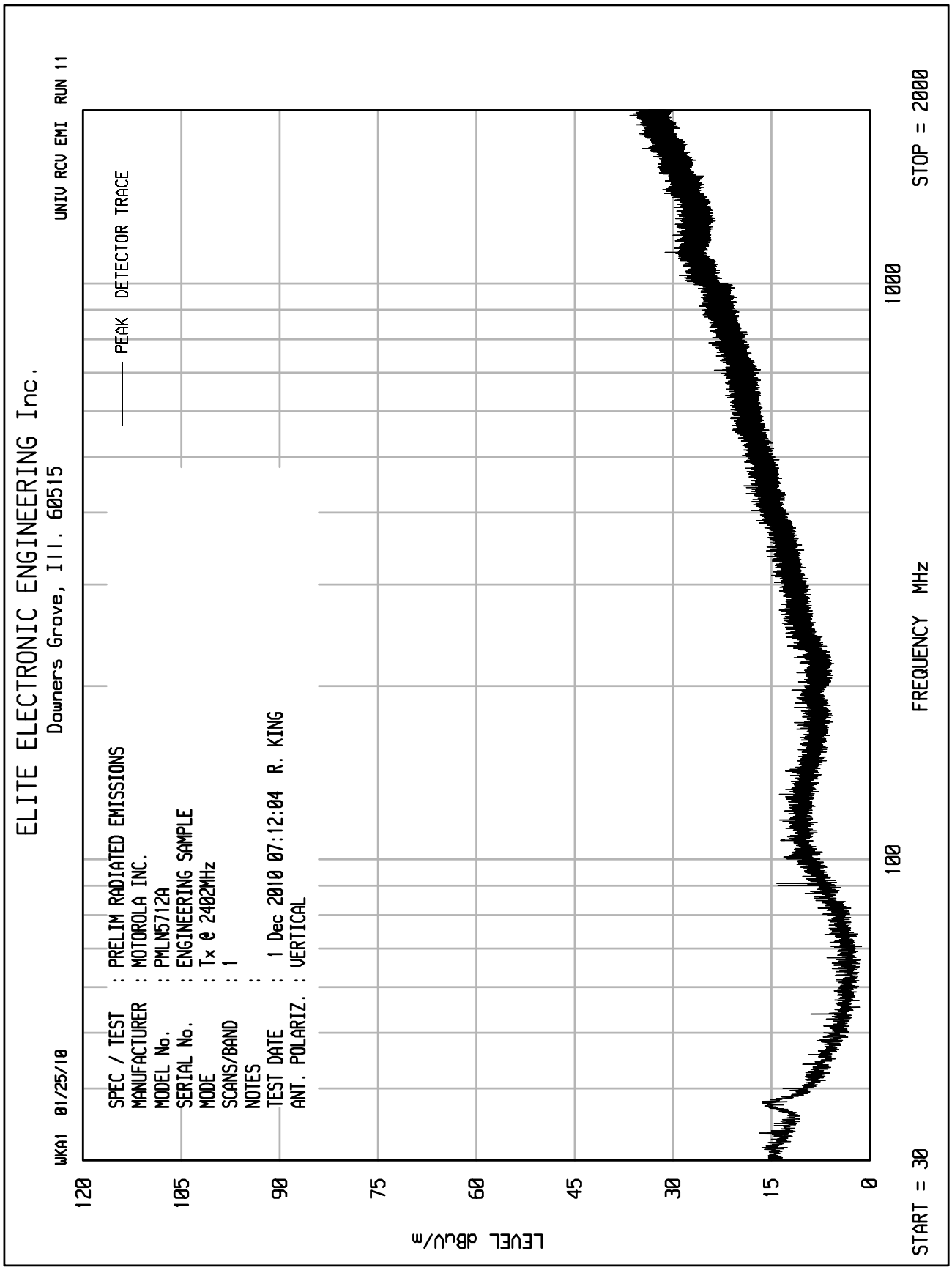
Time of Occupancy

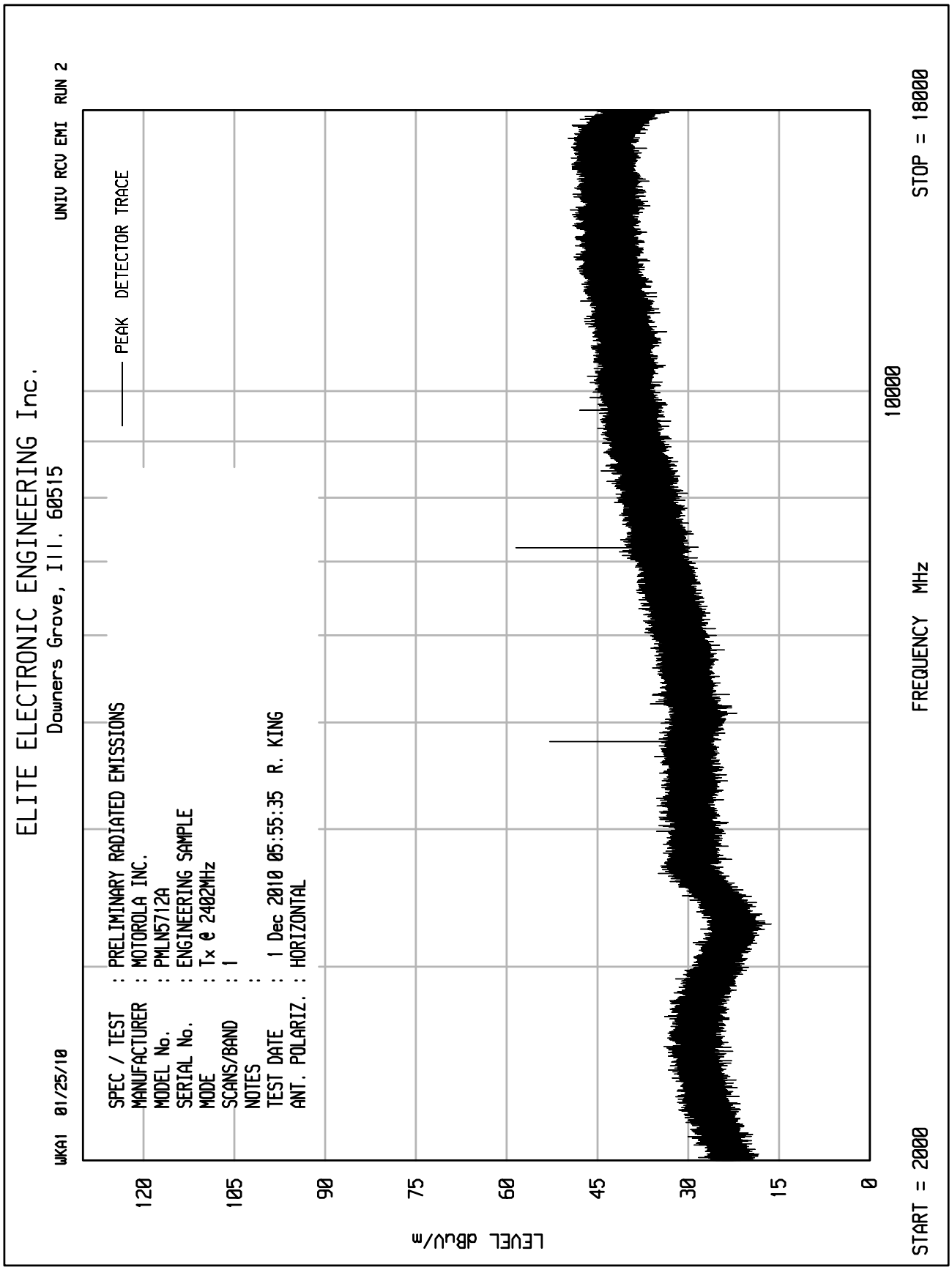
MANUFACTURER	:	Motorola inc.
MODEL NUMBER	:	PMLN5712A
TEST SPEC.	:	15.247 Time of Occupancy
TEST MODE	:	Frequency Hopping Enabled
TEST PARAMETERS	:	For frequency hopping systems operating in the 2400-2483.5MHz band, the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Number of hopping channels = 79. 79 x 0.4 = 31.6 sec.
NOTES	:	Number of pulses in 8 seconds = 82. Therefore the number of pulses in 31.6 seconds = 82 x ((31.6)/8) = 324 pulses. Each pulse is 417usec. Therefore time of occupancy = 417.8usec x 324 pulses = 0.135 sec.

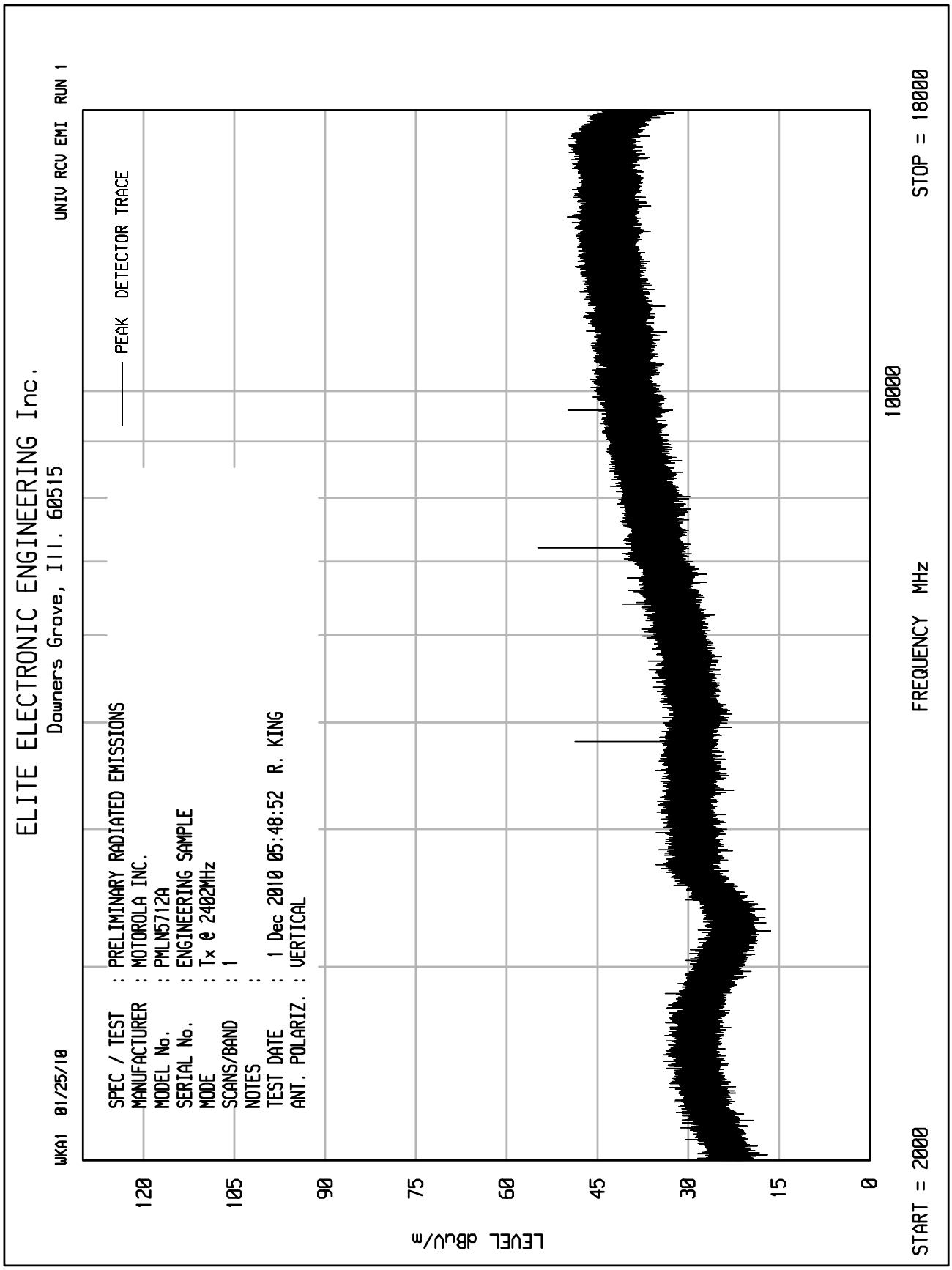
MANUFACTURER : Motorola, Inc.
EUT : R1.2 Wireless Dongle
MODEL NUMBER : PMLN5712A
TEST MODE : See Below
TEST DATE : November 30, 2010
TEST PARAMETERS : Peak EIRP
NOTES :

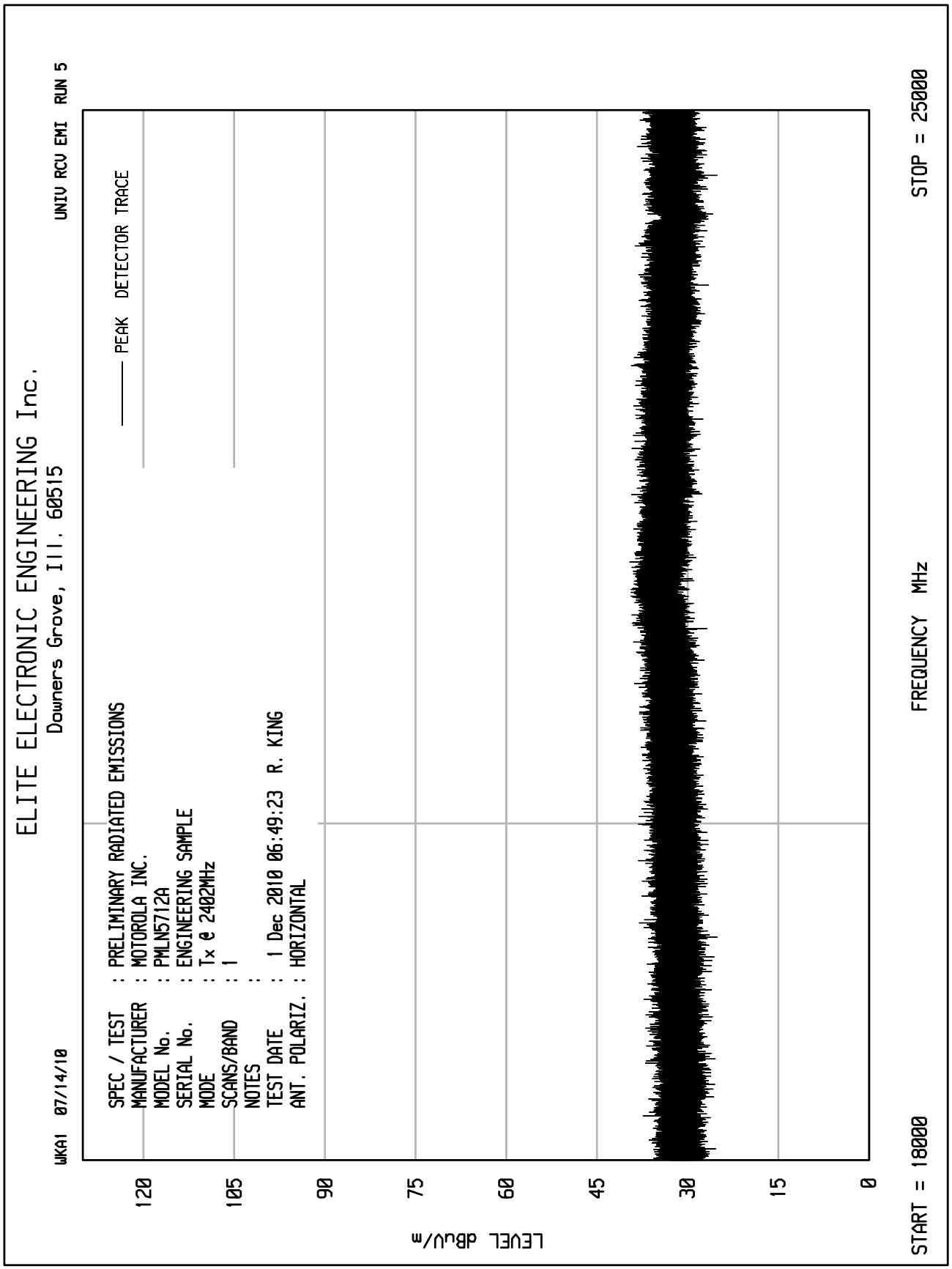
Freq MHz	Ant Pol	Meter Reading dBuV	Matched Signal Generator dB	Ant Gain dB	Cable Factor dB	EIRP Total dBm	Limit dBm
2402.0	H	64.0	-8.7	6.5	3.0	-5.2	36.0
2402.0	V	69.2	-1.3	6.5	3.0	2.1	36.0
2441.0	H	65.0	-7.6	6.6	3.1	-4.0	36.0
2441.0	V	69.7	-0.6	6.6	3.1	2.9	36.0
2480.0	H	63.0	-9.5	6.7	3.1	-5.8	36.0
2480.0	V	69.0	-1.1	6.7	3.1	2.5	36.0

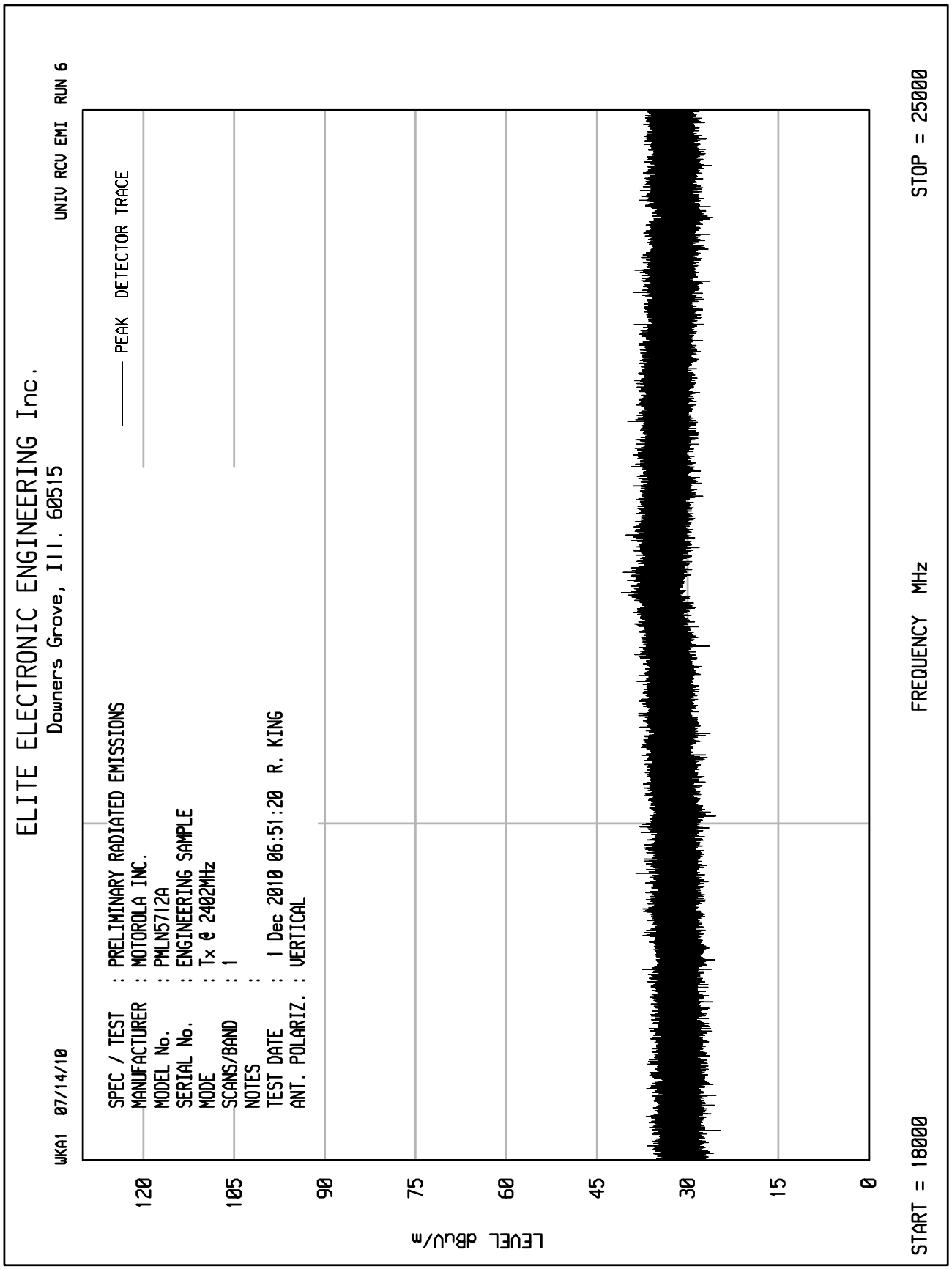

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 12
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : MOTOROLA INC.
MODEL No. : PMLN5712A
SERIAL No. : ENGINEERING SAMPLE
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 1 Dec 2010 07:15:36 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 30
100
1000
STOP = 2000
FREQUENCY MHz

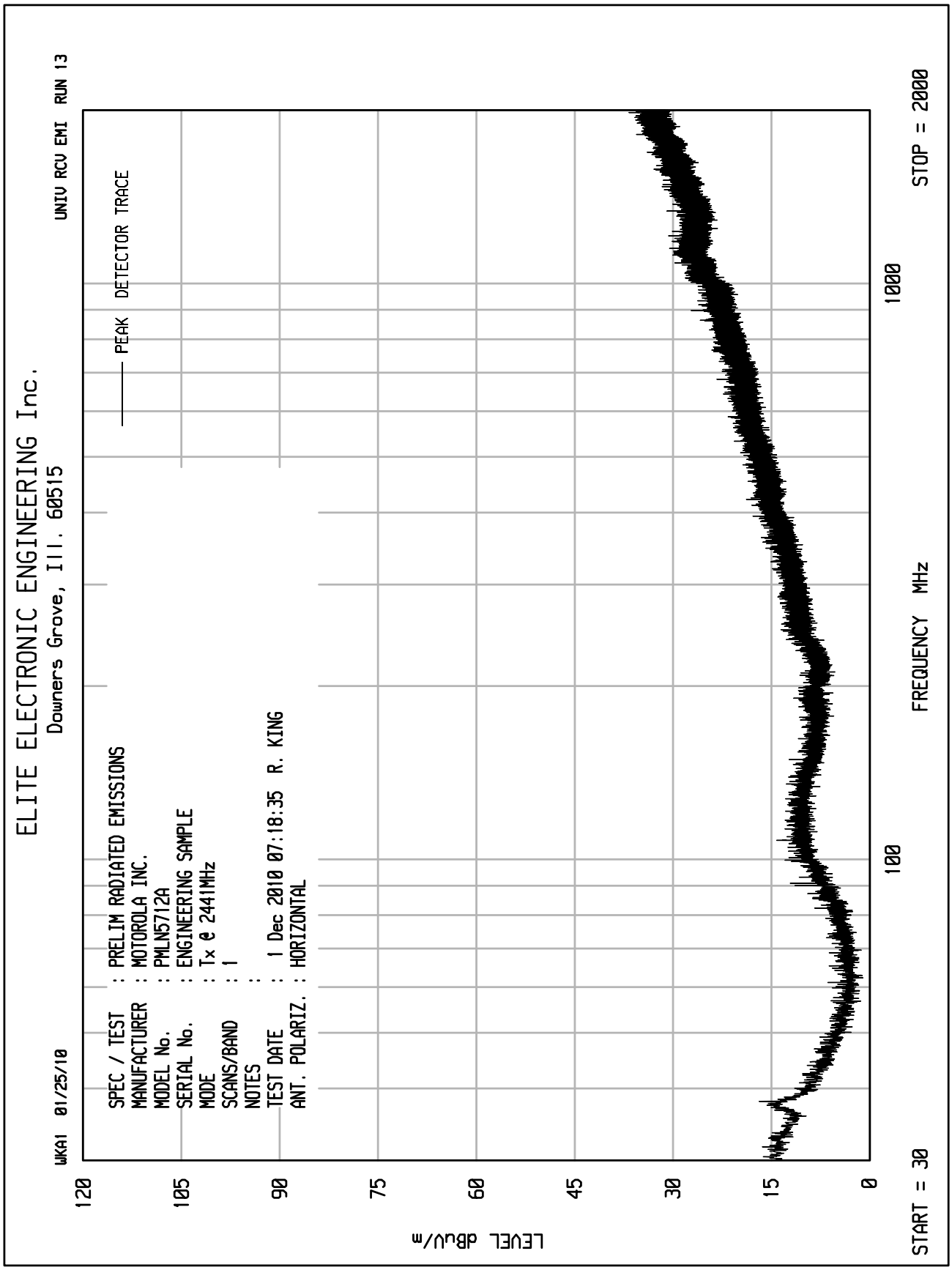

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 11
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : MOTOROLA INC.
MODEL No. : PMLN5712A
SERIAL No. : ENGINEERING SAMPLE
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 1 Dec 2010 07:12:04 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 30
100
1000
STOP = 2000
FREQUENCY MHz


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 2
WKAI 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MOTOROLA INC.
MODEL No. : PMLN5712A
SERIAL No. : ENGINEERING SAMPLE
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 1 Dec 2010 05:55:35 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 2000
10000
STOP = 18000
FREQUENCY MHz


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 1
WKAI 01/25/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MOTOROLA INC.
MODEL No. : PMLN5712A
SERIAL No. : ENGINEERING SAMPLE
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 1 Dec 2010 05:48:52 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 2000
10000
STOP = 18000
FREQUENCY MHz


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 5
WKA1 07/14/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MOTOROLA INC.
MODEL No. : PMLN5712A
SERIAL No. : ENGINEERING SAMPLE
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 1 Dec 2010 06:49:23 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 25000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 6
WKA1 07/14/10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MOTOROLA INC.
MODEL No. : PMLN5712A
SERIAL No. : ENGINEERING SAMPLE
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 1 Dec 2010 06:51:20 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 25000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
UNIV RCV EMI RUN 13
WKAI 01/25/10
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : MOTOROLA INC.
MODEL No. : PMLN5712A
SERIAL No. : ENGINEERING SAMPLE
MODE : Tx @ 2441MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 1 Dec 2010 07:18:35 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 30
100
1000
STOP = 2000
FREQUENCY MHz