Measurement of RF Emissions from a Model No. 27213 TouchPad Transceiver

For	Master Lock Company PO Box 927 Oak Creek, WI 53154
P.O. Number	
Date Tested	March 6-7, 2017
Test Personnel	Richard E. King
Test Specification	FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.247 for Digital Modulation Intentional Radiators Operating within 2400-2483.5MHz Industry Canada RSS-GEN Industry Canada RSS-247

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REVISION HISTORY

Revision	Date	Description
—	22 Mar 2017	Initial release

Measurement of RF Emissions from a TouchPad Transceiver, Model No. 27213

1. INTRODUCTION

1.1. Scope of Tests

This report represents the results of the series of radio interference measurements performed on a Master Lock Company TouchPad Transceiver, Model No. 27213, no serial number assigned, transmitter (hereinafter referred to as the EUT). The EUT is a digital modulation spread spectrum transmitter. The transmitter was designed to transmit in the 2400-2483.5 MHz band using an integral antenna. The EUT was manufactured and submitted for testing by Master Lock Company located in Oak Creek, WI.

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, Sections 15.207 and 15.247 for Intentional Radiators. The test series was also performed to determine if the EUT meets the conducted RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 7.2.4 and the radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-247, Annex 8 for transmitters. Testing was performed in accordance with ANSI C63.4-2014.

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 23°C and the relative humidity was 15%.

2. APPLICABLE DOCUMENTS

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

a) Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subparts B and C, dated 1 October 2016.

b) ANSI C63.4-2014, "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".

c) Federal Communications Commission Office of Engineering Technology Laboratory Division Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating under § 15.247, April 8, 2016.

d) Industry Canada RSS-247, Issue 2, February 2017, “Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices”.

- Industry Canada RSS-GEN, Issue 4, November 2014, “Spectrum Management and Telecommunications Radio Standards Specification, General Requirements and Information for the Certification of radio communication equipment”.

- ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices".

3. EUT Setup and Operation

3.1. General Description

The EUT is a Master Lock Company, TouchPad Transceiver, Model No. 27213. A block diagram of the EUT setup is shown as Figure 1.

3.1.1. Power Input

The EUT was powered by 3VDC from an external power supply.

3.1.2. Peripheral Equipment

No peripheral equipment was submitted with the EUT.

3.1.3. Signal Input/Output Leads

No interconnect cables were submitted with the EUT.

3.1.4. Grounding

The EUT was ungrounded during the tests.

3.1.5. Firmware/Software

No firmware version was assigned to this EUT.

3.2. Operational Mode

For all tests the EUT and all peripheral equipment were placed on an 80cm high non-conductive stand below a 1000MHz and a 150cm high non-conductive stand above 1000MHz. The EUT was energized.

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

Transmit at 2402MHz
Transmit at 2440MHHz
Transmit at 2480MHHz

3.3. EUT Modifications

No modifications were required for compliance to the specifications 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 C63.4-2014 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 with a calibration interval not greater than two

years. 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. Powerline Conducted Emissions

5.1.1.Requirements

Since the EUT was powered by internal batteries and has not connections for AC power, no conducted emissions tests are required.

5.2. DTS (6dB) Bandwidth

5.2.1.Requirement

Per 15.247(a)(2),the minimum 6dB bandwidth shall be at least 500kHz for all systems using digital modulation techniques.

5.2.2.Procedures

The EUT was allowed to transmit continuously. The transmit channel was set separately to low, middle, and high channels. The resolution bandwidth (RBW) was set to 100kHz and the span was set to greater than the RBW.

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.

5.2.3.Results

The plots on pages 20 through 22 show that the minimum DTS (6 dB) bandwidth was 823.53kHz which is greater than minimum allowable 6dB bandwidth requirement of 500kHz for systems using digital modulation techniques. The 99% bandwidth was measured to be 1.711MHz.

5.3. Peak Output Power

5.3.1.Requirements

Per section 15.247(b)(3), for systems using digital modulation the maximum peak output conducted power shall not be greater than 1.0W (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).

Per 15.247(b)(4)(i) Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

5.3.2. Procedures

The EUT was placed on the non-conductive stand and set to transmit. A dipole antenna (double ridged waveguide antenna for all measurements above 1GHz) 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 6dB 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 channels.

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 dipole antenna (double ridged waveguide antenna for all measurements above 1GHz) 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 for all measurements above 1GHz), as required. The peak power output was calculated for low, middle, and high hopping frequencies.

5.3.3. Results

The results are presented on pages 23 through 25. The maximum EIRP measured from the transmitter was -4 dBm or .004 mW which is below the 4 Watt limit.

5.4. Duty Cycle Measurements

5.4.1. Requirements

The duty cycle refers to the fraction of time over which the transmitter is on and is transmitting at its maximum power control level. The duty cycle is considered to be constant if variations are less than ± 2 percent, otherwise the duty cycle is considered to be non-constant. Preferably, the EUT shall be transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%). When continuous transmission cannot be achieved a duty cycle correction will be required.

5.4.2. Procedures

The antenna port of the EUT was connected to the spectrum analyzer through 10 dB of attenuation.

1. Set center frequency to the transmit frequency of the EUT.
2. Set span to 0Hz
3. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value.
4. Set detector = peak or average.
5. Measure the fraction of time over which the transmitter is on and is transmitting at its maximum power control level.

5.4.3. Results

For the duty cycle measurement, the result is presented on page 26. The EUT was programmed to run at 100% duty cycle. The duty cycle results are 100%. Since the duty cycle is greater than 98%, no duty cycle correction factor (0dB) will be added to the emission measurements where average detection is used to correct for the maximum power control level.

5.5. Radiated Spurious Emissions Measurements

5.5.1. 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).

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

5.5.2. 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 C63.4-2014 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 used for 2400 - 2483.5Mhz range 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 used for 2400 - 2483.5Mhz range.

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:

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

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:

1. The EUT was rotated so that all of its sides were exposed to the receiving antenna.
2. Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
3. The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.
4. 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 axes 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 duty cycle is less than 98% , a duty cycle correction factor of 20 log (1/x) where x is the duty cycle is added to the measurement results prior to comparing to the emissions limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle.

5.5.3. Results

Preliminary radiated emissions plots with the EUT transmitting at Low Frequency, Middle Frequency, and High Frequency are shown on pages 27 through 50 Final radiated emissions data are presented on data pages 51 through 59.

Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown in Figures 2 through 4.

5.6. Band Edge Compliance

5.6.1. 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).

5.6.2. Procedures

Low Band Edge

a) The EUT was set up inside the test chamber on a non-conductive stand.
b) A broadband measuring antenna was placed at a test distance of 3 meters from the EUT.
c) The EUT was set to transmit continuously at the channel closest to the low band-edge.
d) The EUT was maximized for worst case emissions at the measuring antenna. The maximum meter reading was recorded.
e) To determine the bandedge compliance, the following spectrum analyzer settings were used:

    1. Center frequency = low band-edge frequency.
    2. 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.
    3. Resolution bandwidth (RBW) ≥ 1% of the span.

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

High Band Edge

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

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

2. Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
3. The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.

f) The highest measured peak reading was recorded.
g) The highest measured average reading was recorded.
h) The output of the EUT was connected to the spectrum analyzer through 40dB of attenuation.
i) The EUT was set to transmit continuously at the channel closest to the high band-edge
j) To determine the band-edge compliance, the following spectrum analyzer settings were used:

1. Center frequency = high band-edge frequency.
2. 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.
3. Resolution bandwidth (RBW) ≥ 1% of the span.

k) The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
l) 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 right of the center frequency (band-edge) must be below the display line.)
m) The analyzer's display was plotted using a 'screen dump' utility.

5.6.3. Results

Pages 60 through 62 show the radiated band-edge compliance results. As can be seen from these plots, the radiated emissions at the low end band-edge are within the 20 dB down limits. The radiated emissions at the high end band edge are within the general limits.

5.7. Power Spectral Density

5.7.1. 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.

5.7.2. Procedures

1. The EUT was placed on the non-conductive stand and set to transmit at a mid-channel.
2. A broadband measuring antenna was placed near the EUT.
3. To determine the power spectral density, the following spectrum analyzer settings were used:

   a. Center frequency = transmit frequency
   b. Resolution bandwidth (RBW) greater than the 20dB bandwidth.
   c. Sweep time = auto

4. The peak detector and 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
5. The analyzer's display was plotted using a 'screen dump' utility.
6. This reading corresponds to the peak EIRP measured for the mid channel.
7. Turn on Display Line 1 and place it at the peak of the measured level. Turn on Display Line 2 and place it at the corresponding +8dBm level (e.g. if the peak output power is +18dBm then the +8dBm level will be 10dB down from the radiated level and if the peak output power is +6dBm then the +8dBm level will be 2dB above the radiated level.)
8. The EUT was then placed in the normal operation mode.

9. To determine the power spectral density, the following spectrum analyzer settings were used:

   a. Center frequency = transmit frequency
   b. Span =1.5times the channel bandwidth
   c. Resolution bandwidth (RBW) ≥3kHz
   d. Video bandwidth (VBW) ≥ 3 x RBW
   e. Sweep time = auto couple

10. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined. The peak detector and 'Max-Hold' function was engaged.
11. The analyzer's display was plotted using a 'screen dump' utility.
12. If the measured value exceeds the +8dBm limit, reduce the RBW (no less than 3kHz) and repeat step 7.

5.7.3. Results

Pages 63 and 65 show the power spectral density results. As can be seen from the plots, 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

All tests were performed by qualified personnel from Elite Electronic Engineering Incorporated. The test series was witnessed by Master Lock Company personnel.

6.2. Disposition of the EUT

The EUT and all associated equipment were returned to Master Lock Company upon completion of the tests.

7. Conclusions

It was determined that the Master Lock Company TouchPad Transceiver, Model No. 27213, digital modulation transmitter, no serial number, 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 2400-2483.5 MHz band, when tested per ANSI C63.4-2014.

It was also determined that the Master Lock Company TouchPad Transceiver, Model No. 27213, digital modulation transmitter, no serial number, did fully meet the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen Section 7.2.4 and RSS-247 Annex 8, for transmitters, when tested per ANSI C63.4-2014.

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 date as operated by Master Lock Company personnel. 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 certification, approval, or endorsement by NVLAP, NIST or any agency of the Federal 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	3/2/2016	4/2/2017
APW3	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-35-120-5R0-10-12	PL2924	1GHZ-20GHZ	9/28/2016	9/28/2017
CDX8	COMPUTER	ELITE	WORKSTATION			N/A	
GSE0	SIGNAL GENERATOR (40GHZ)	ROHDE & SCHWARZ	SMB100A	175137	100KHZ-40GHZ	3/3/2017	3/3/2018
GSFA	OSP-B157 OSP MODULE	ROHDE & SCHWARZ	OSP-B157	100867		9/9/2016	9/9/2017
GSFB	OSP120 BASE UNIT	ROHDE & SCHWARZ	OSP120	101246	---	9/9/2016	9/9/2017
NHG1	STANDARD GAIN HORN ANTENNA	NARDA	638	---	18-26.5GHZ	NOTE 1	
NTA3	BILOG ANTENNA	TESEQ	6112D	32853	25-1000MHz	3/23/2016	3/23/2017
NWQ0	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66657	1GHZ-18GHZ	5/18/2016	5/18/2018
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	4/4/2016	4/4/2018
RBA0	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB26	100145	20HZ-26.5GHZ	3/2/2016	4/2/2017
RBG0	EMI ANALYZER	ROHDE & SCHWARZ	ESW500	101533	10HZ-44GHZ	11/10/2016	11/10/2017
RBJ2	EMI RECEIVER	ROHDE & SCHWARZ	ESW8	100987	2HZ-8GHZ	12/6/2016	12/6/2017
SBA0	DC POWER SUPPLY	APLAB	ZS3205	99071030	0-32VDC; 0-5A	NOTE 1	
XOB1	ADAPTER	HEWLETT PACKARD	K281C	10422	18-26.5GHZ	NOTE 1	
XPQ4	HIGH PASS FILTER	K&L MICROWAVE	11SH10-4800/X20000-O/O	1	4.8-20GHZ	9/14/2016	9/14/2017

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.

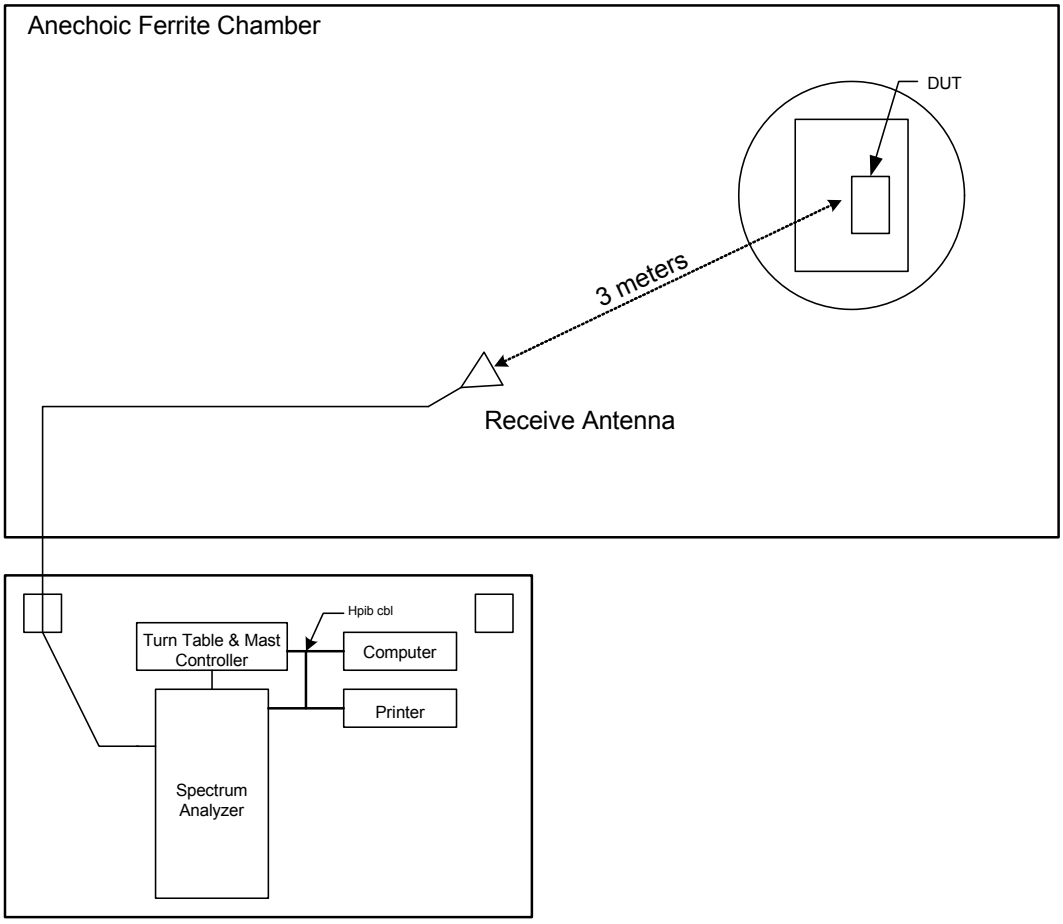


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

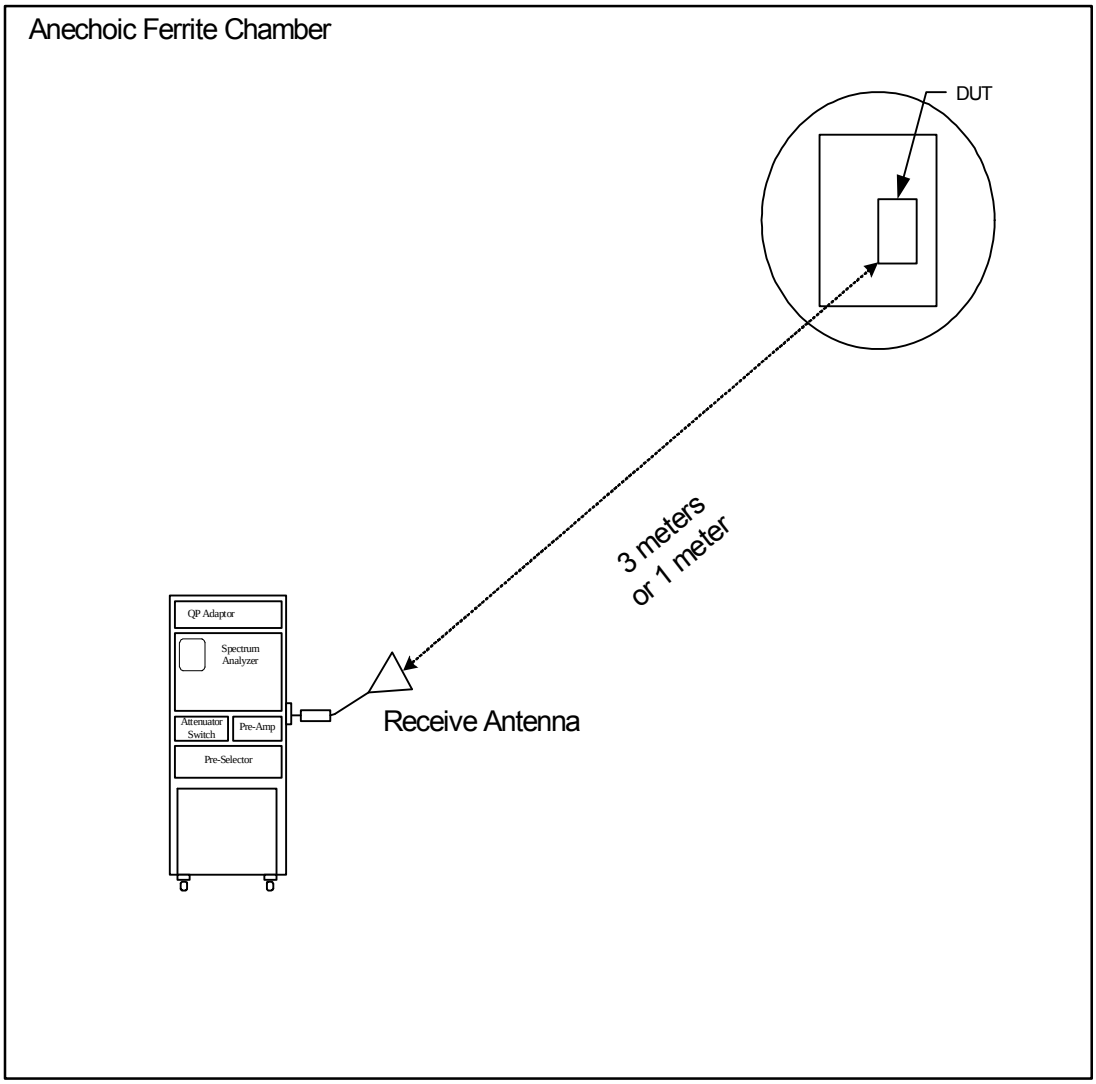
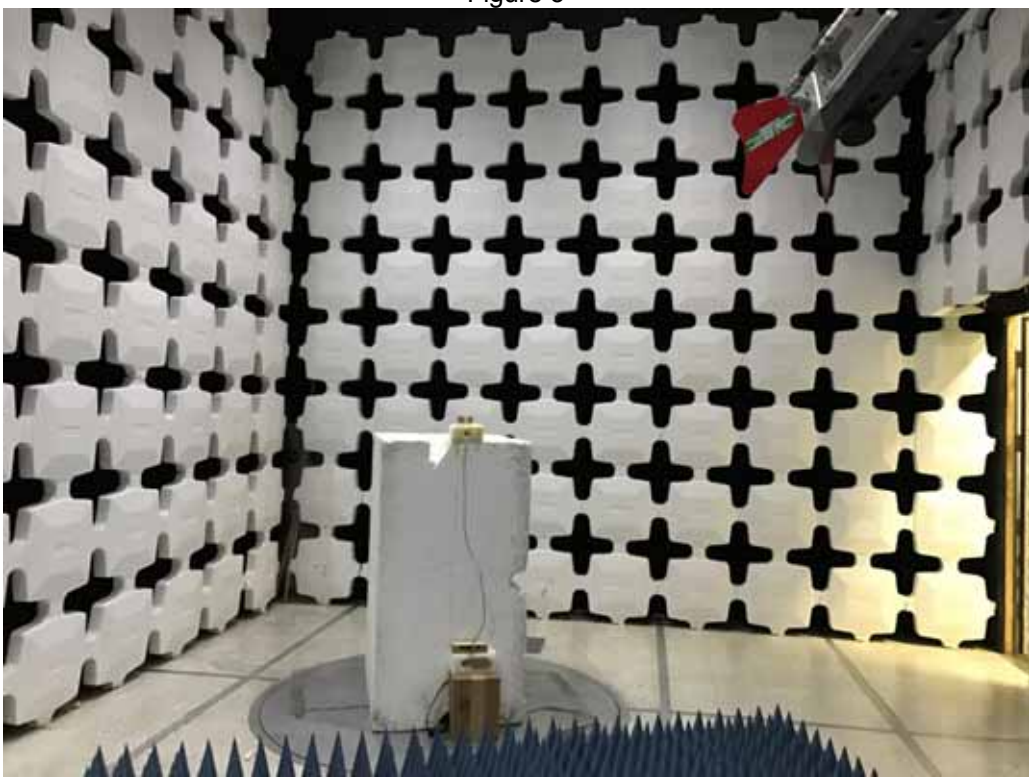

Anechoic Ferrite Chamber
DUT
3 meters
or 1 meter
QP Adaptor
Spectrum
Analyzer
Attenuator
Switch
Pre-Amp
Pre-Selector
Receive Antenna

Figure 2

Test Setup for Radiated Emissions, 30MHz to 1GHz – Horizontal Polarization

Test Setup for Radiated Emissions, 30MHz to 1GHz – Vertical Polarization

Figure 3



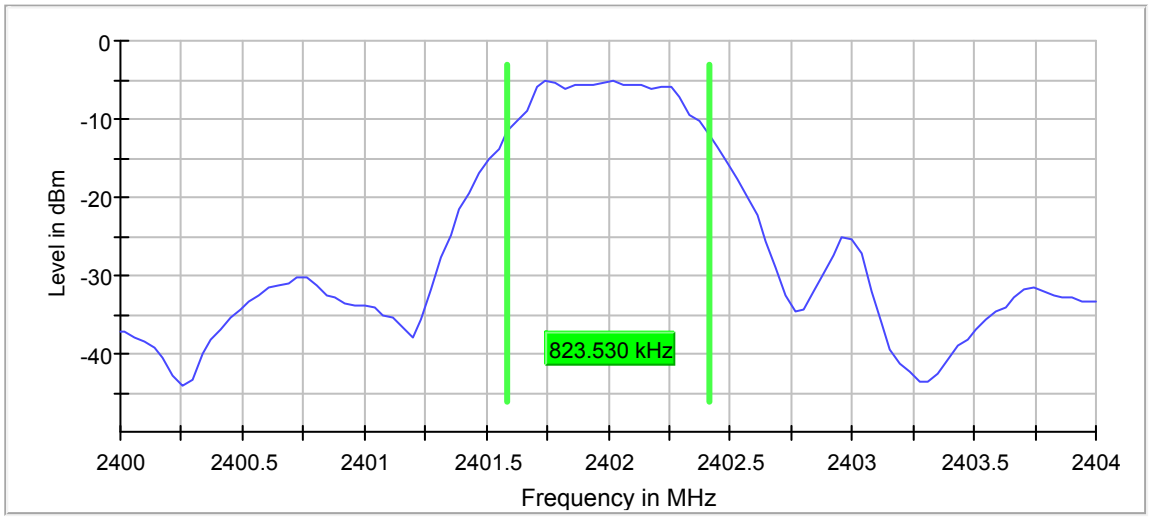
Test Setup for Radiated Emissions, 1GHz to 18GHz – Horizontal Polarization

Test Setup for Radiated Emissions, 1GHz to 18GHz – Vertical Polarization

Figure 4

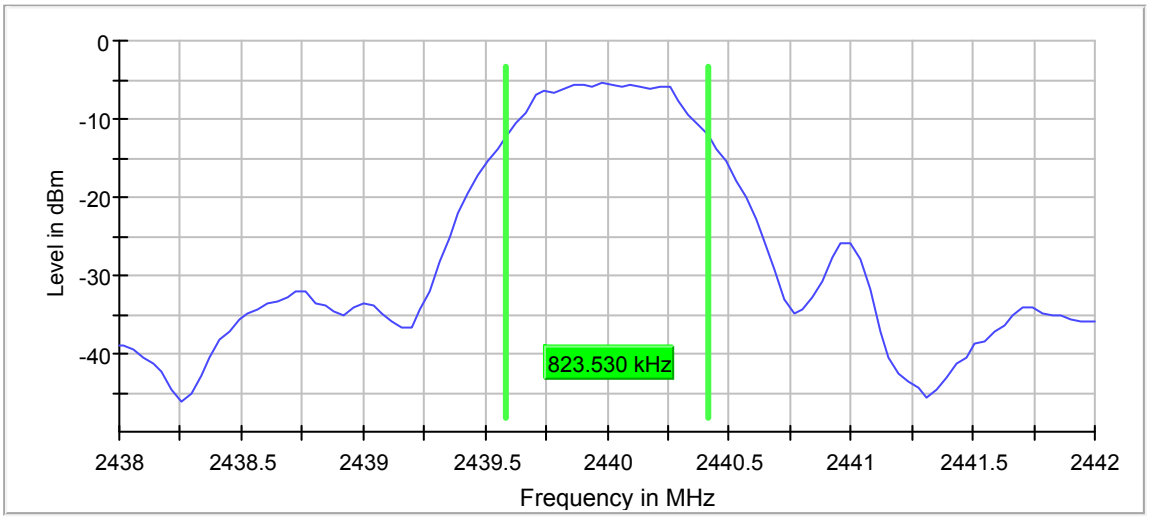
Test Setup for Radiated Emissions, 18GHz to 25GHz – Horizontal Polarization

Test Setup for Radiated Emissions, 18GHz to 25GHz – Vertical Polarization



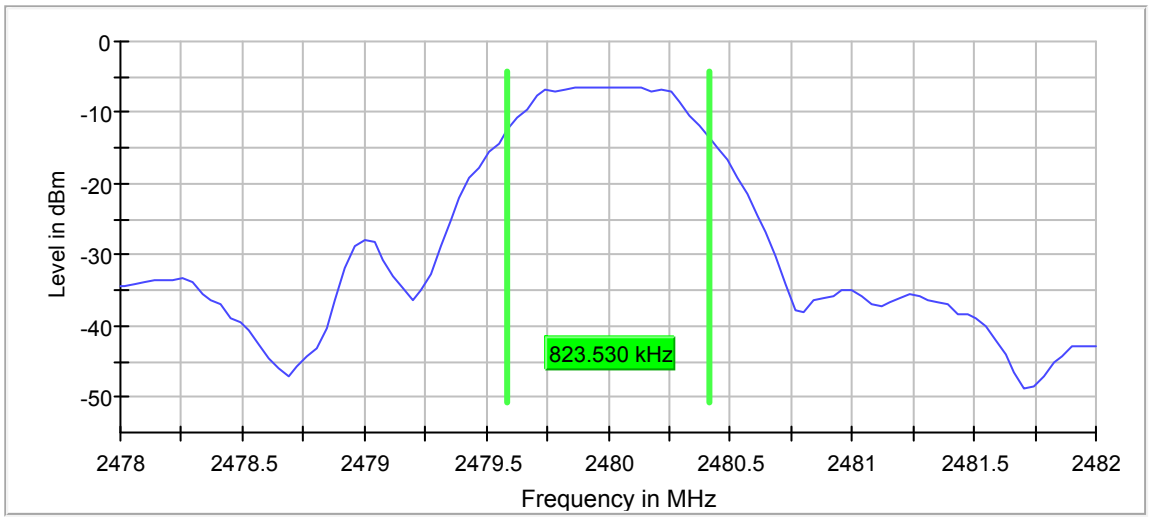
FCC 15.247 DTS (6 dB) Bandwidth

Manufacturer	:	Master Lock
Model Number	:	27213
Mode	:	Tx @ 2402MHz
Parameters	:	6 dB BW = 823.53kHz
Date	:	3/7/2017
Notes	:	



FCC 15.247 DTS (6 dB) Bandwidth

Manufacturer	:	Master Lock
Model Number	:	27213
Mode	:	Tx 2440 MHz
Parameters	:	6 dB BW = 823.53kHz
Date	:	3/7/2017
Notes	:	



FCC 15.247 DTS (6 dB) Bandwidth

Manufacturer	:	Master Lock
Model Number	:	27213
Mode	:	Tx 2480 MHz
Parameters	:	6 dB BW = 823.53kHz
Date	:	3/7/2017
Notes	:	

MANUFACTURER : Master Lock
MODEL NUMBER : 27213
TEST PERFORMED : EIRP
TEST DATE : March 6, 2017
TEST MODE : Transmit at 2402MHz
NOTES :
TEST DISTANCE : 3 meters

Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2402.00	H	53.1	-12.2	4.8	4.1	-11.5	36.0	-47.5
2402.00	V	59.7	-4.7	4.8	4.1	-4.0	36.0	-40.0

EIRP(dBm) = Sig. Gen. Reading (dBm) + Equivalent Antenna Gain (dB) – Cable Loss (dB)

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Master Lock
MODEL NUMBER : 27213
TEST PERFORMED : EIRP
TEST DATE : March 6, 2017
TEST MODE : Transmit at 2440MHz
NOTES :
TEST DISTANCE : 3 meters

Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2440.00	H	50.9	-14.3	4.8	4.2	-13.6	36.0	-49.6
2440.00	V	58.1	-6.3	4.8	4.2	-5.6	36.0	-41.6

EIRP(dBm) = Sig. Gen. Reading (dBm) + Equivalent Antenna Gain (dB) – Cable Loss (dB)

Checked BY Richard E. King :

Richard E. King

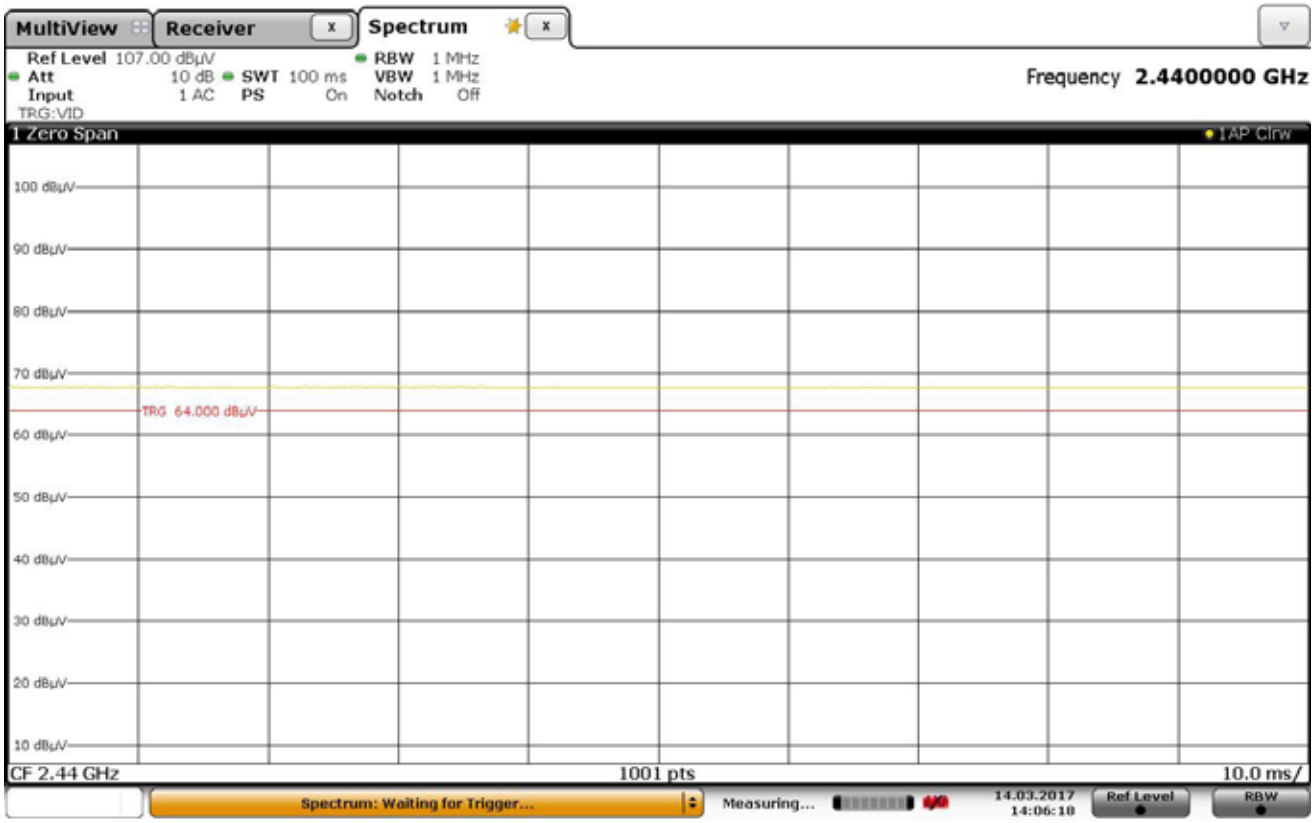
MANUFACTURER : Master Lock
MODEL NUMBER : 27213
TEST PERFORMED : EIRP
TEST DATE : March 6, 2017
TEST MODE : Transmit at 2480MHz
NOTES :
TEST DISTANCE : 3 meters

Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2480.00	H	50.0	-15.2	4.9	4.2	-14.5	36.0	-50.5
2480.00	V	58.6	-5.7	4.9	4.2	-5.0	36.0	-41.0

EIRP(dBm) = Sig. Gen. Reading (dBm) + Equivalent Antenna Gain (dB) – Cable Loss (dB)

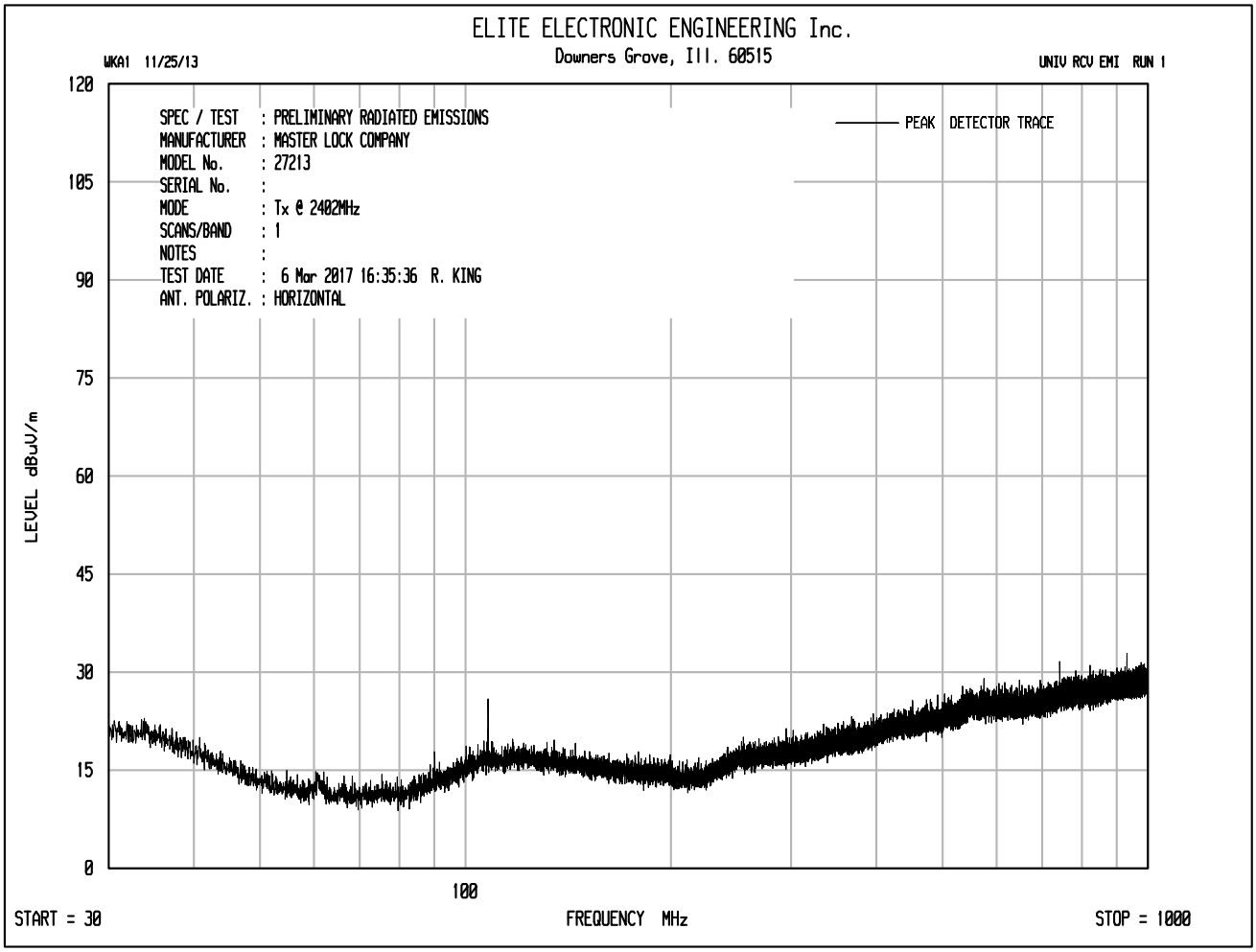
Checked BY Richard E. King :

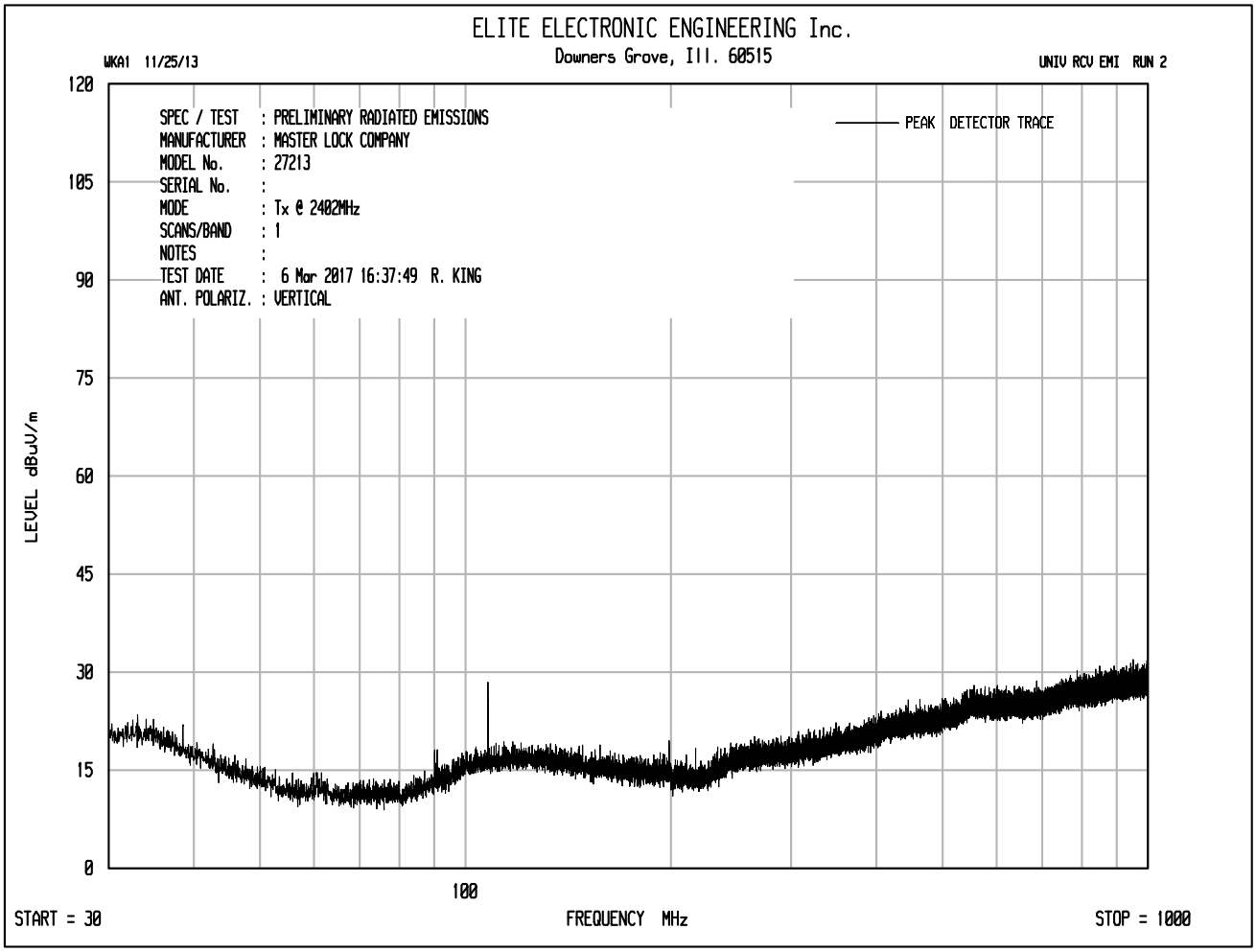
Richard E. King

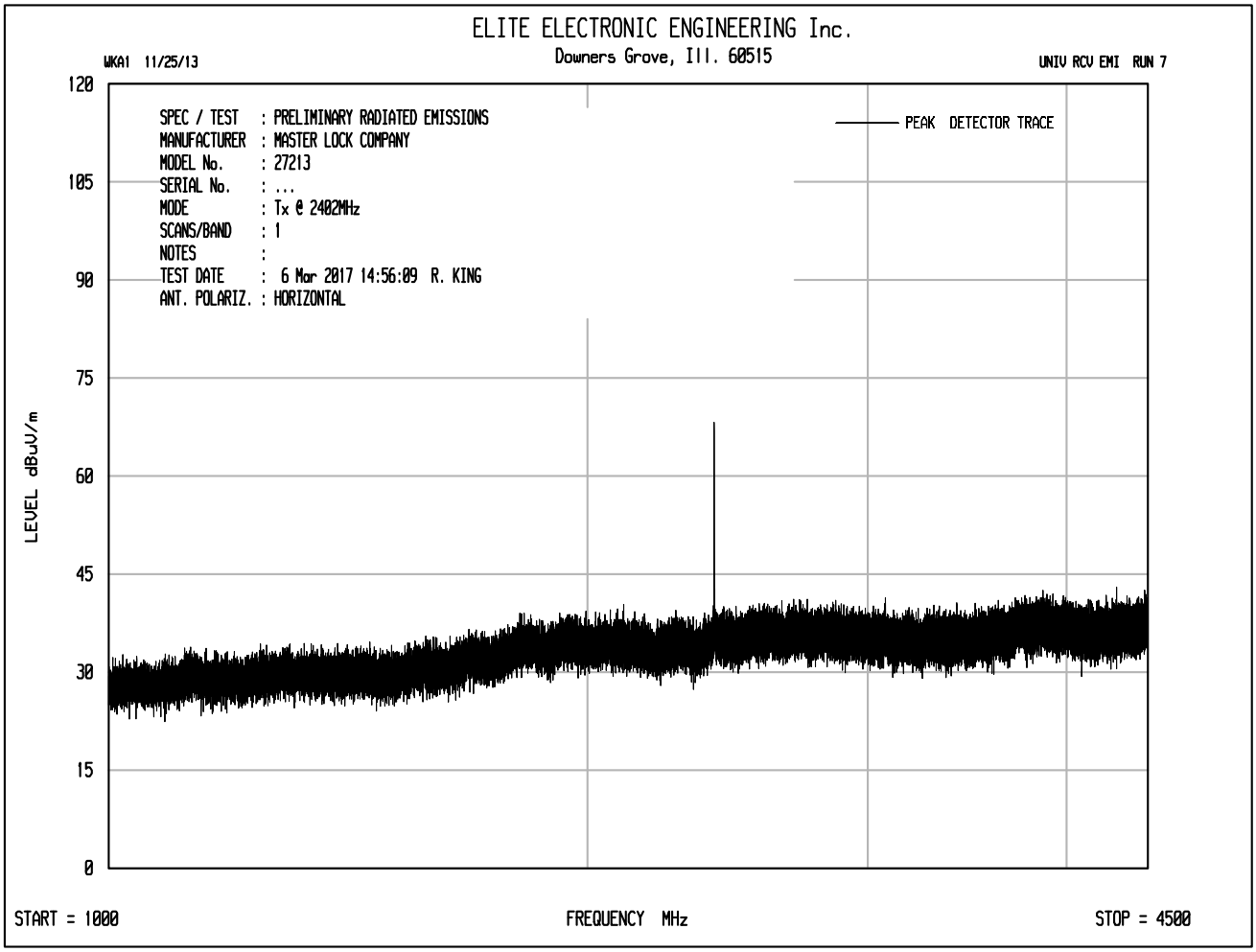


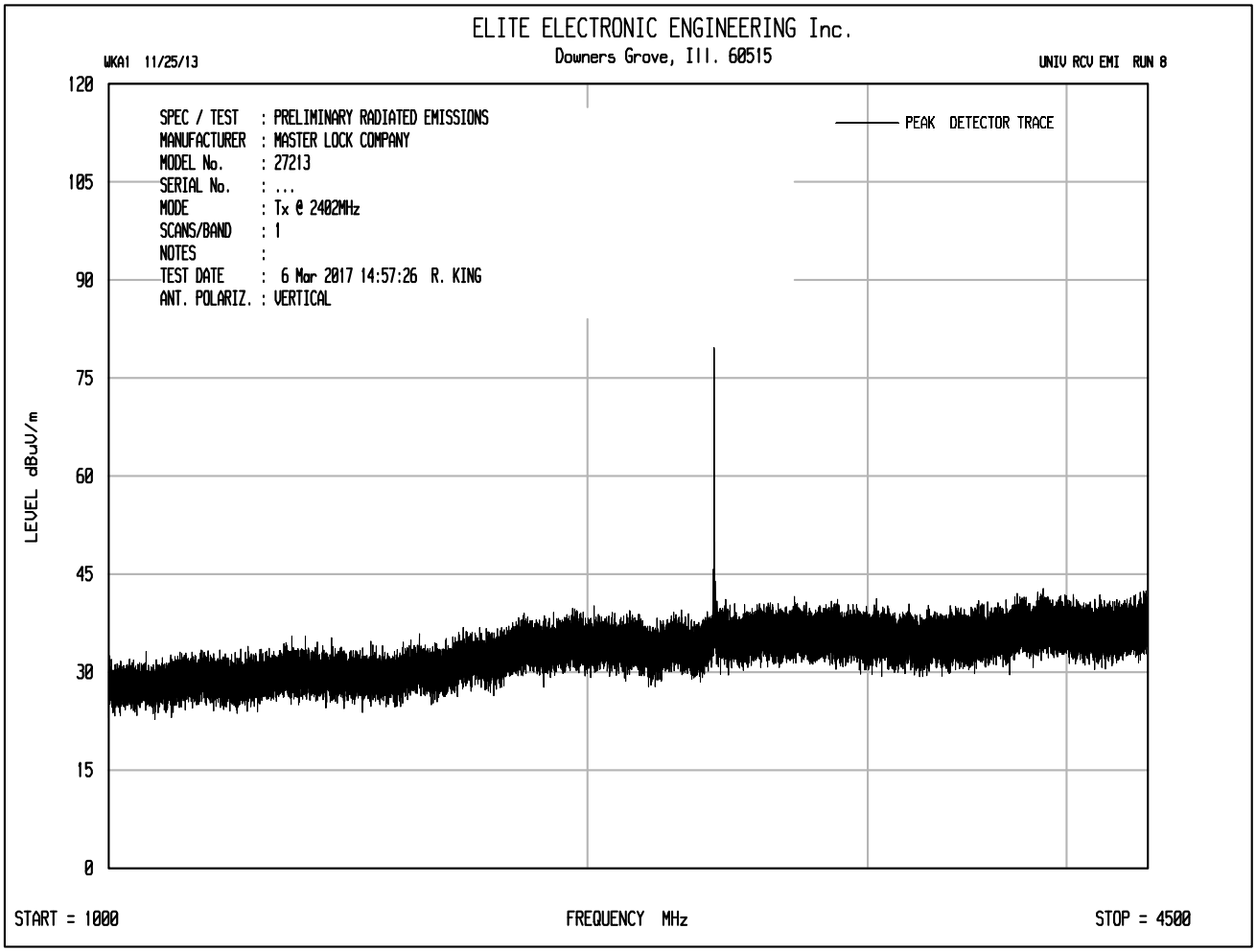
FCC 15.247 Duty Cycle Measurement

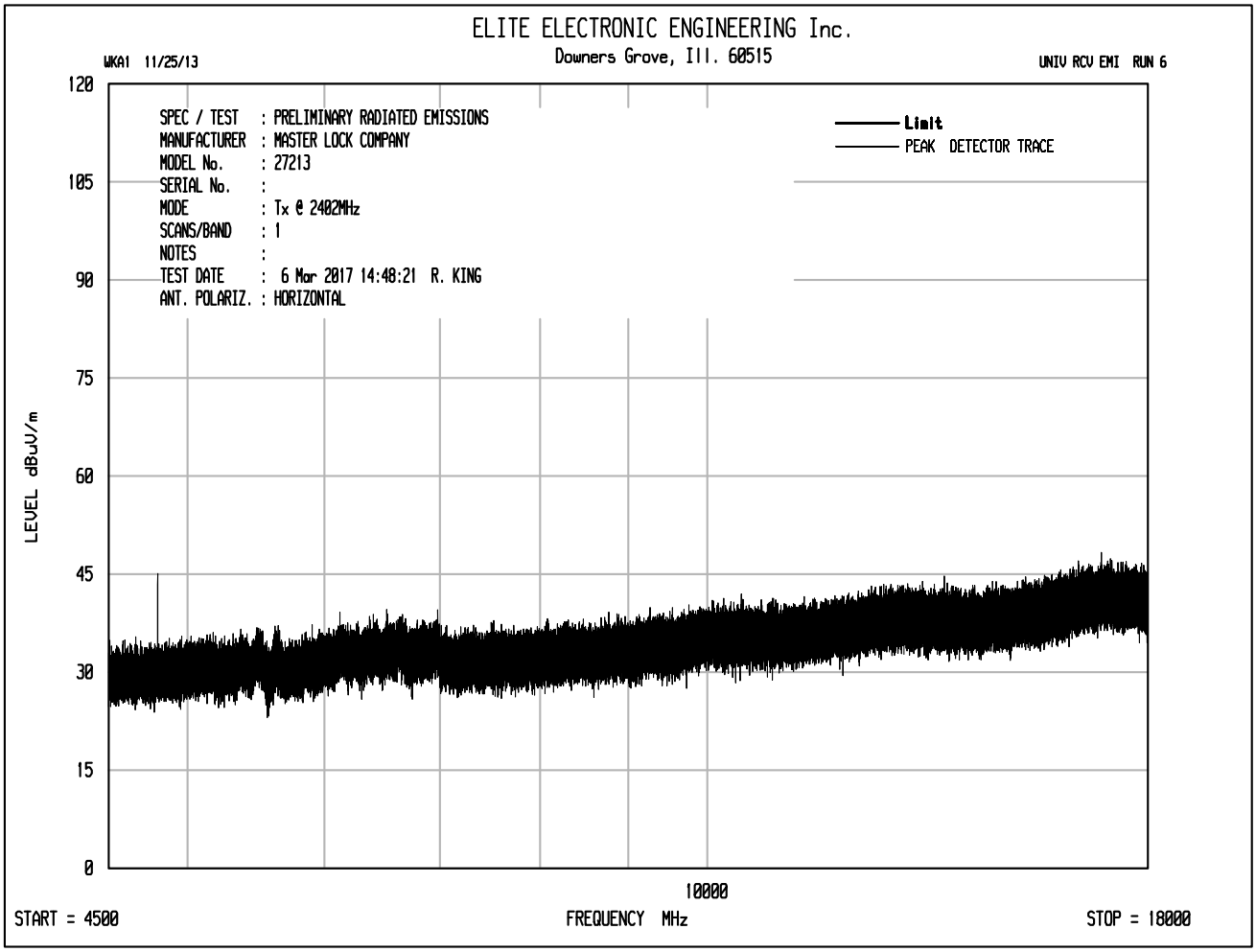
Manufacturer : Master Lock
Model Number : 27213
Mode : Tx 2440 MHz
Parameters : Tx is constantly on
Date : 3/14/2017
Notes :

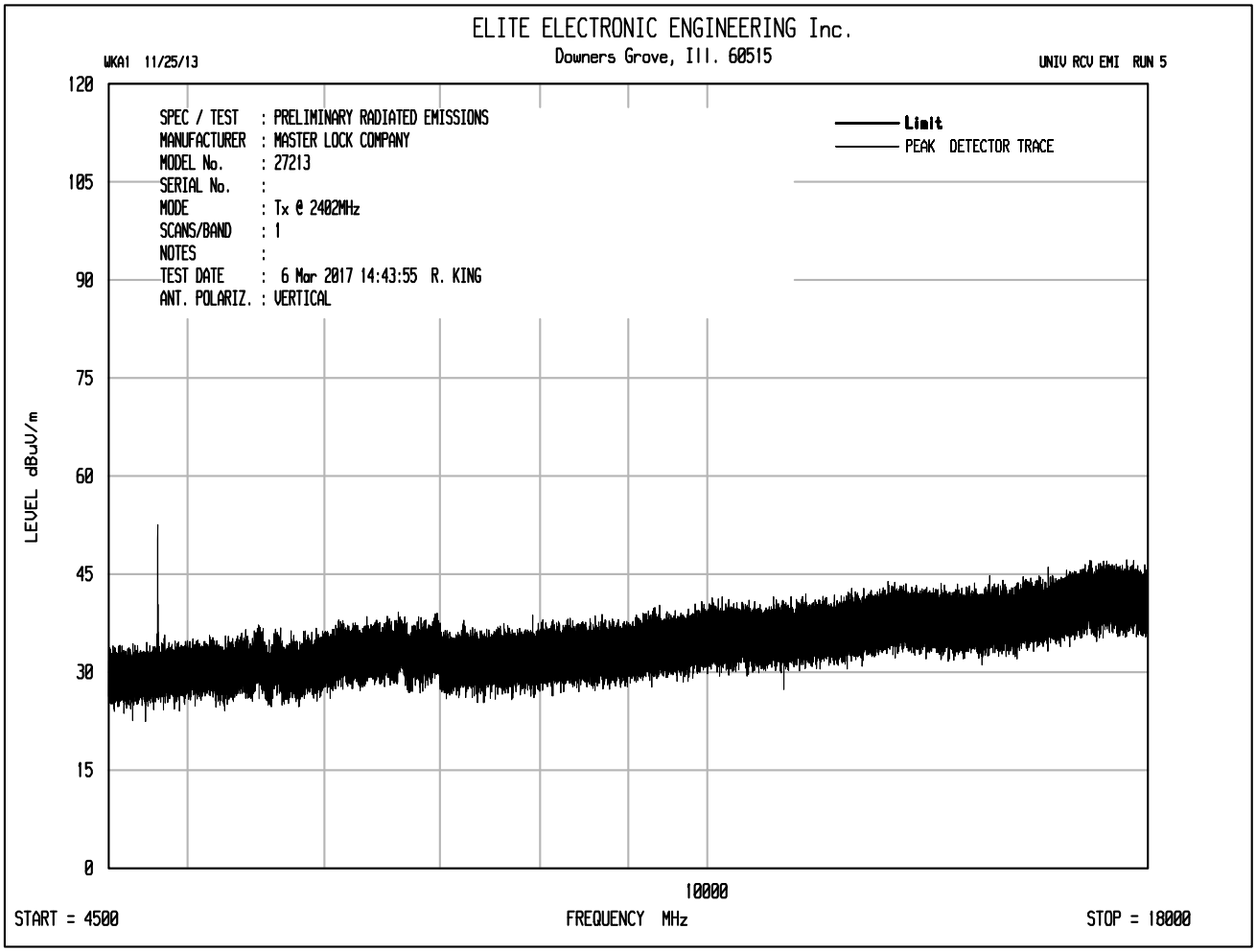

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 1
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. :
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 6 Mar 2017 16:35:36 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

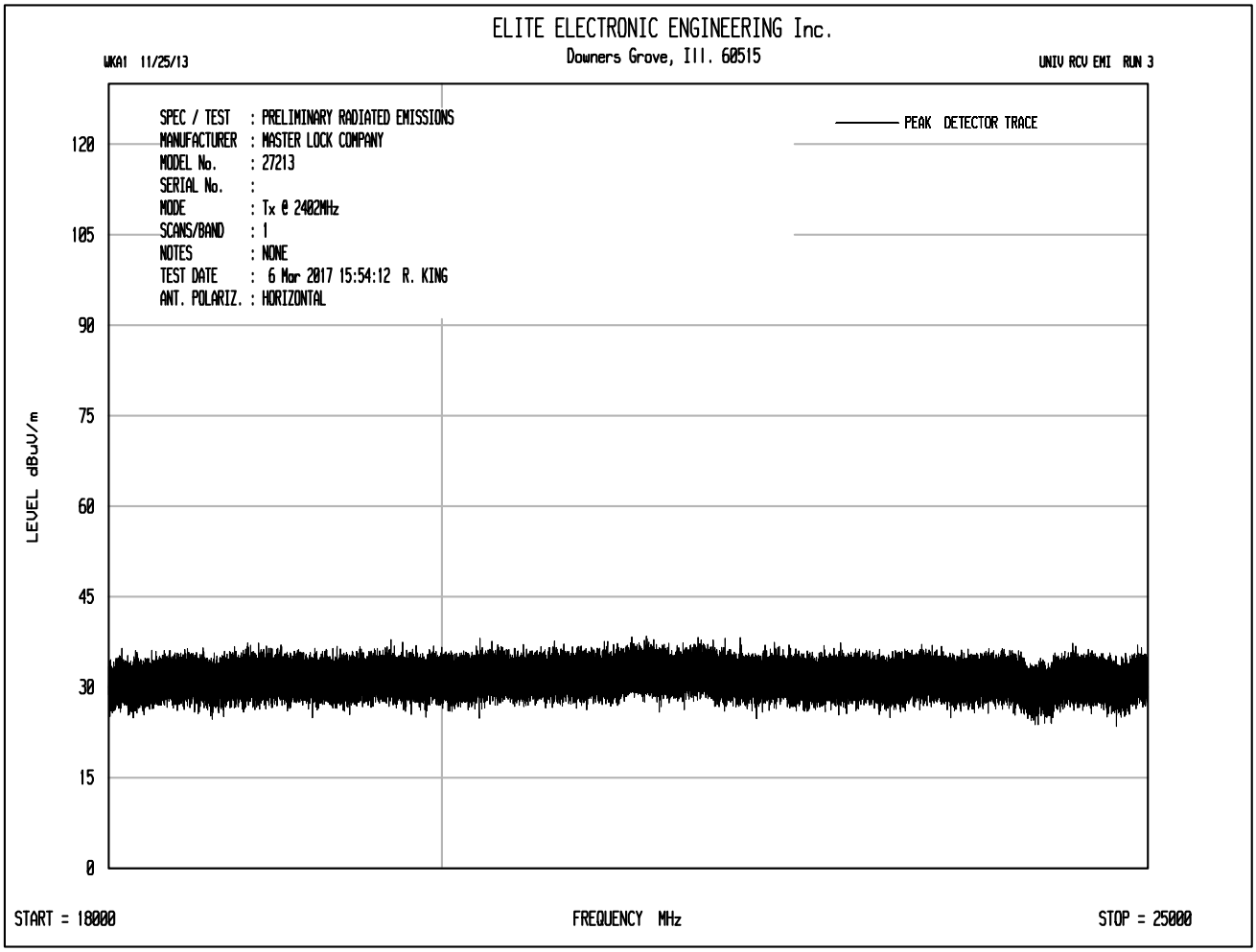

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. :
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 6 Mar 2017 16:37:49 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

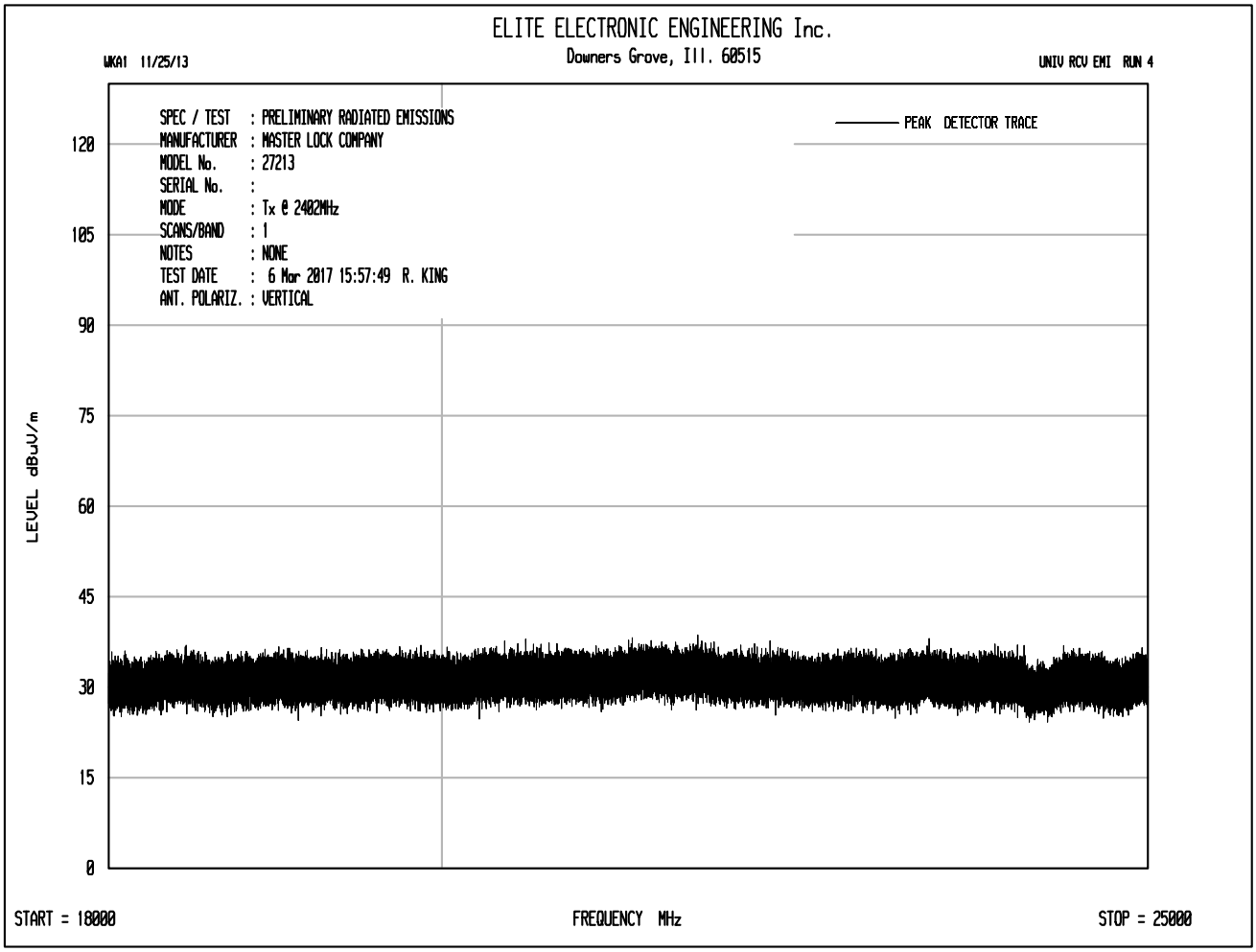

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 7
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. : ...
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 6 Mar 2017 14:56:09 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 4500

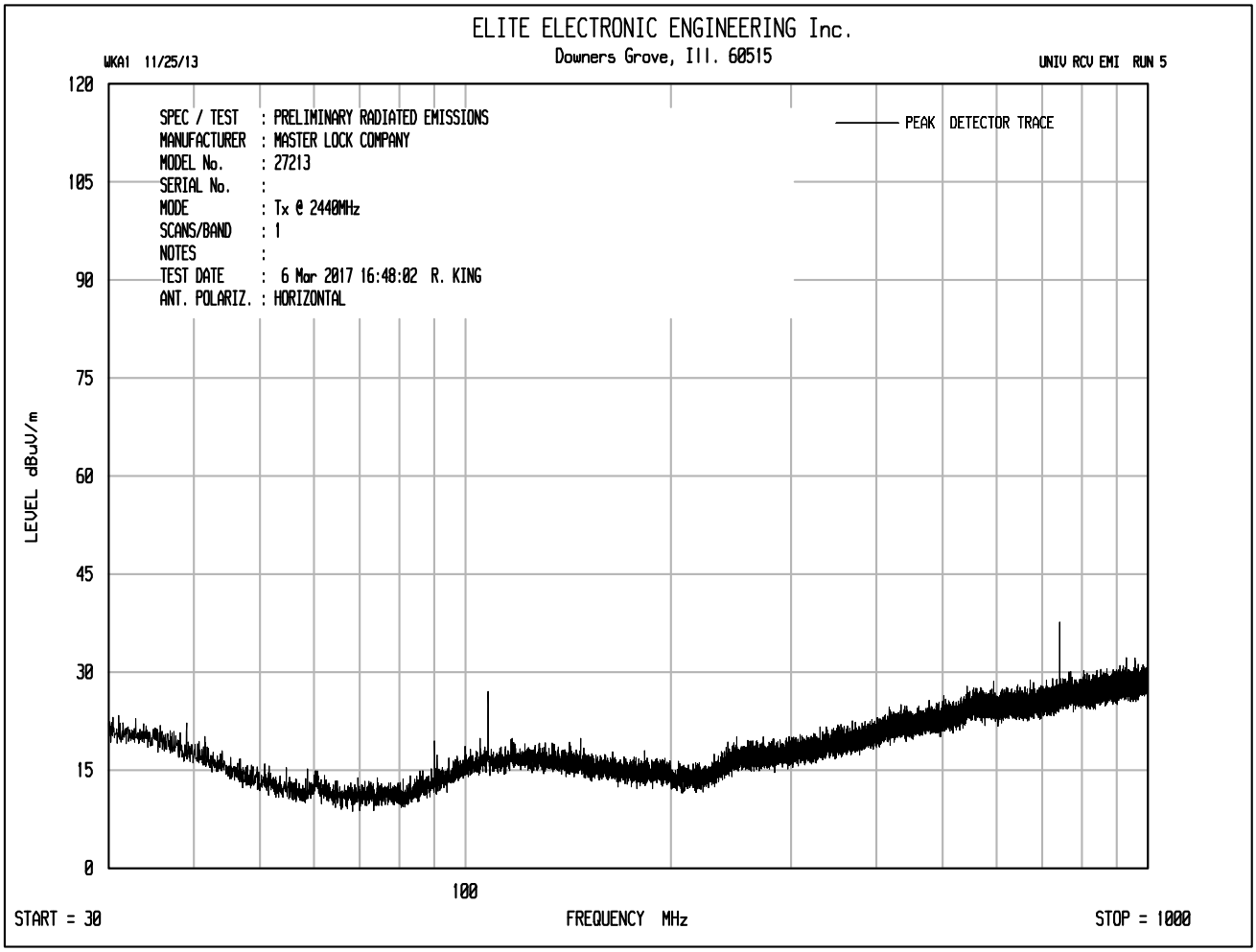

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 8
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. : ...
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 6 Mar 2017 14:57:26 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 4500

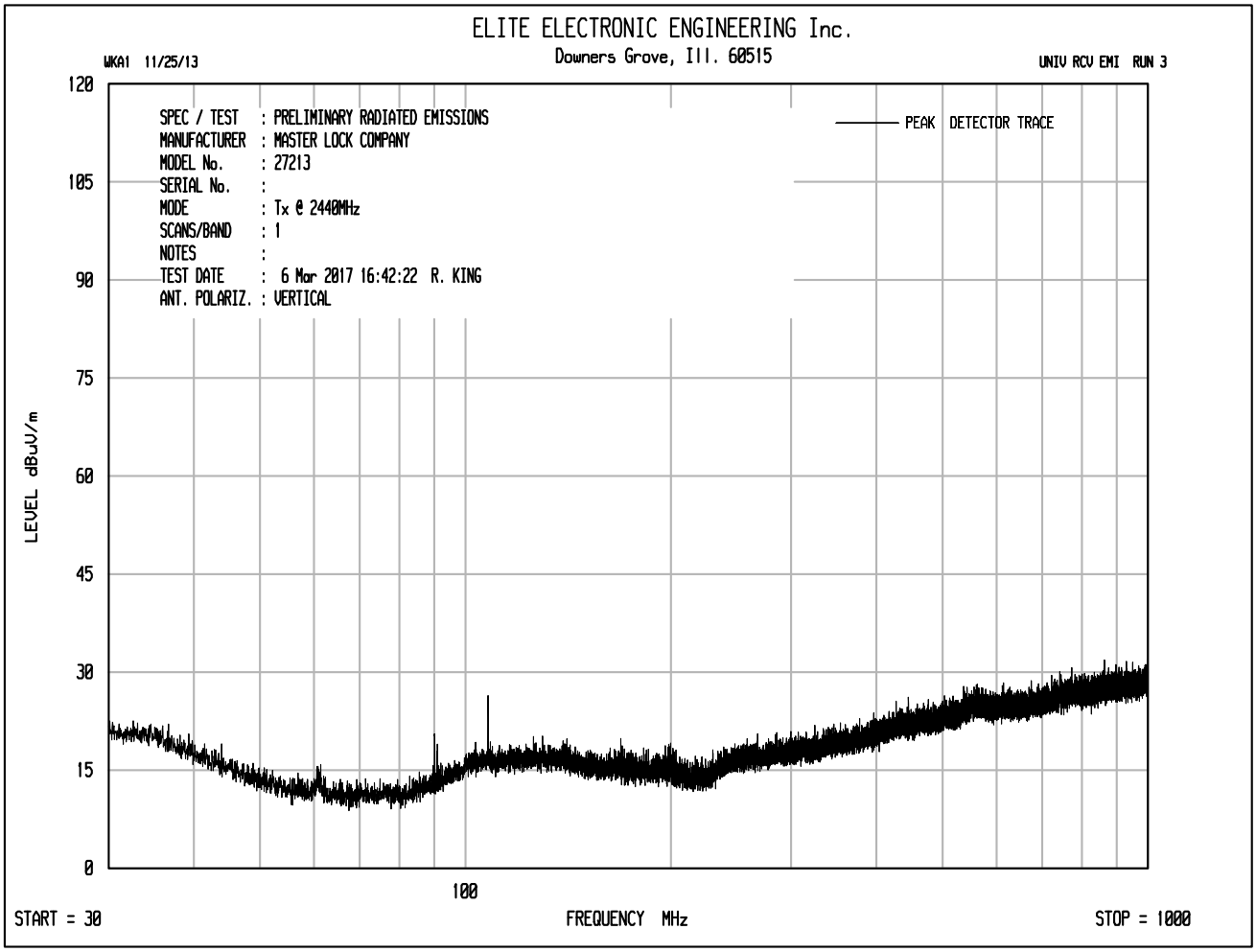

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 6
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. :
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 6 Mar 2017 14:48:21 R. KING
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 4500
FREQUENCY MHz
STOP = 18000

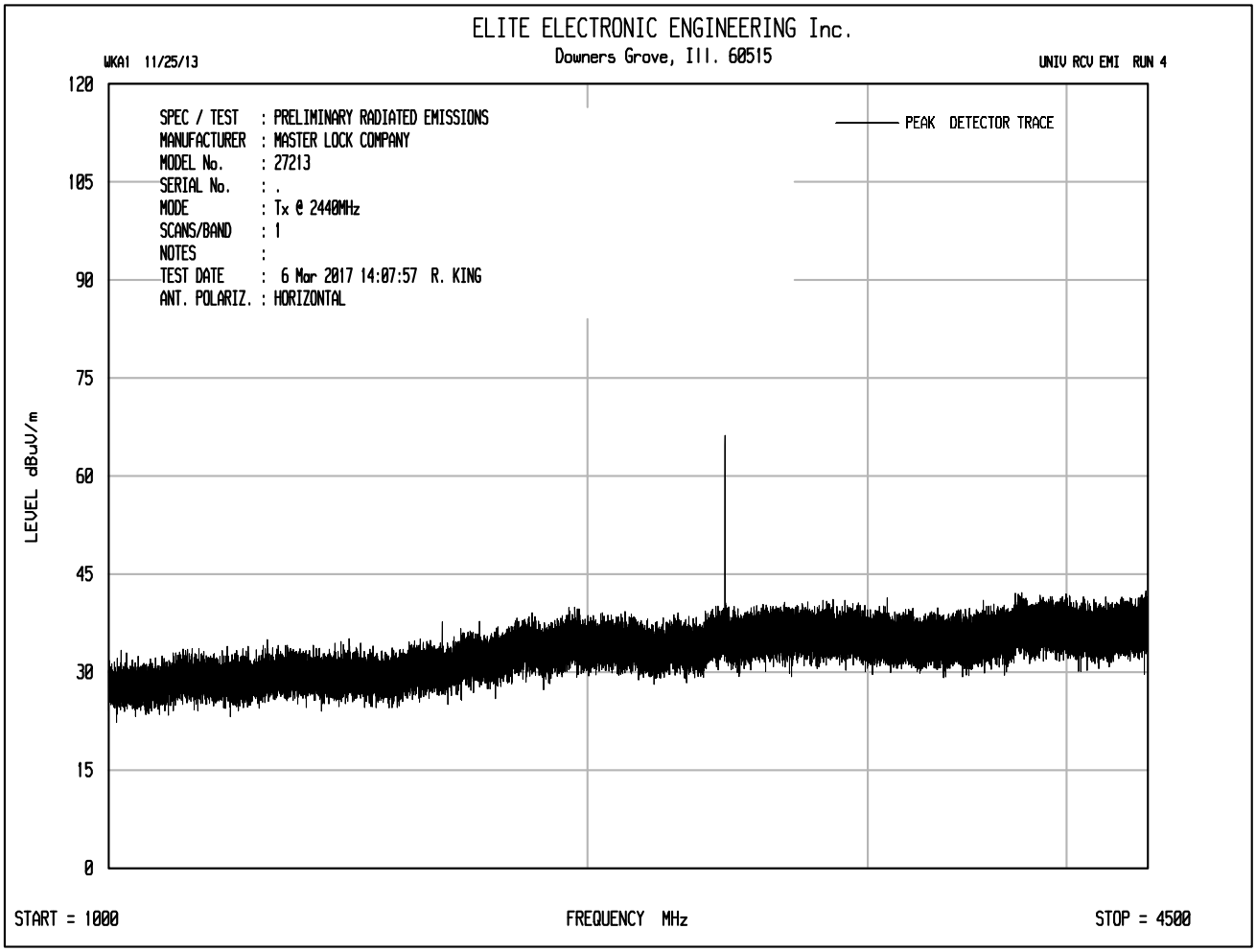

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 5
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. :
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 6 Mar 2017 14:43:55 R. KING
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 4500
FREQUENCY MHz
STOP = 18000

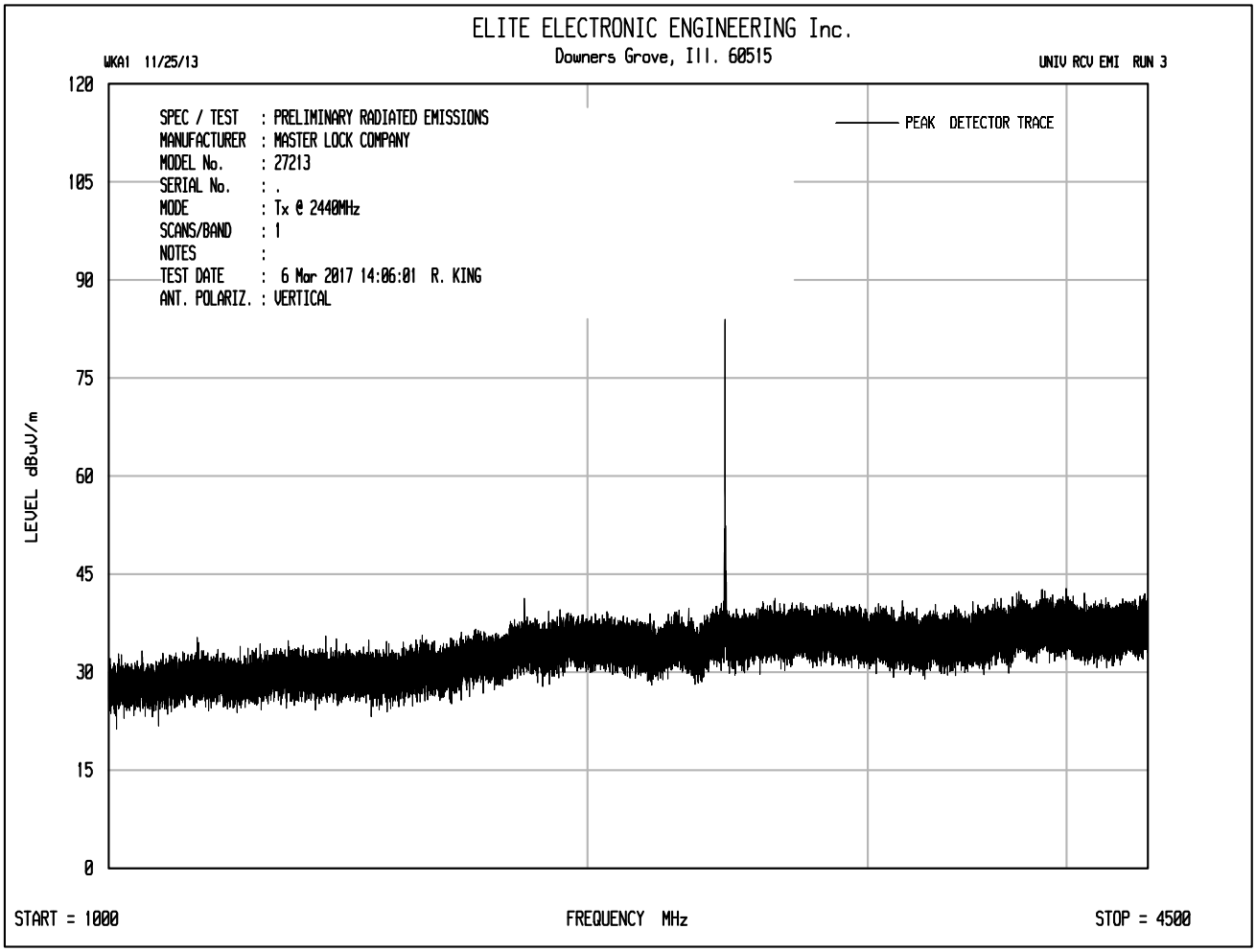

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. :
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 6 Mar 2017 15:54:12 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 25000

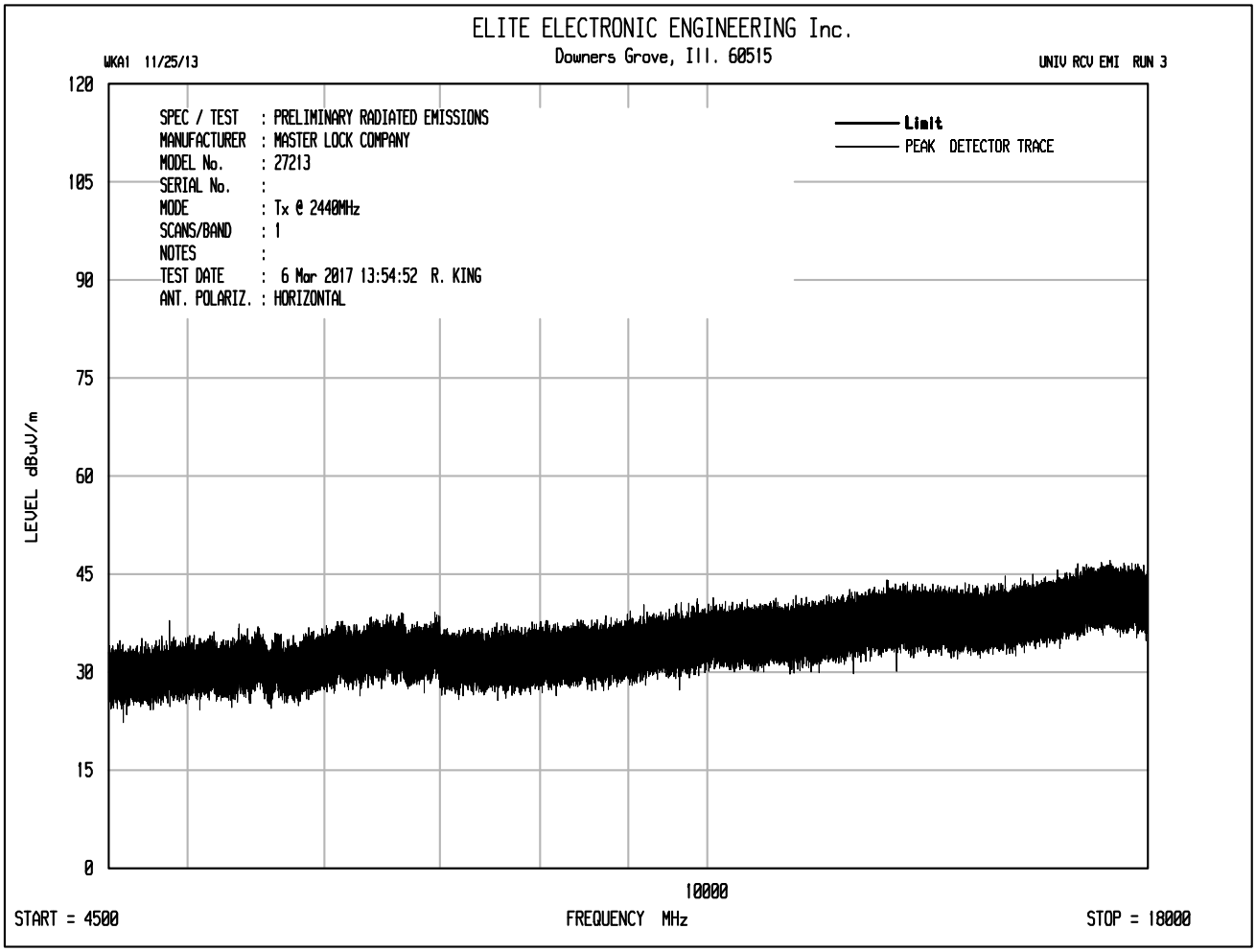

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. :
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 6 Mar 2017 15:57:49 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 25000

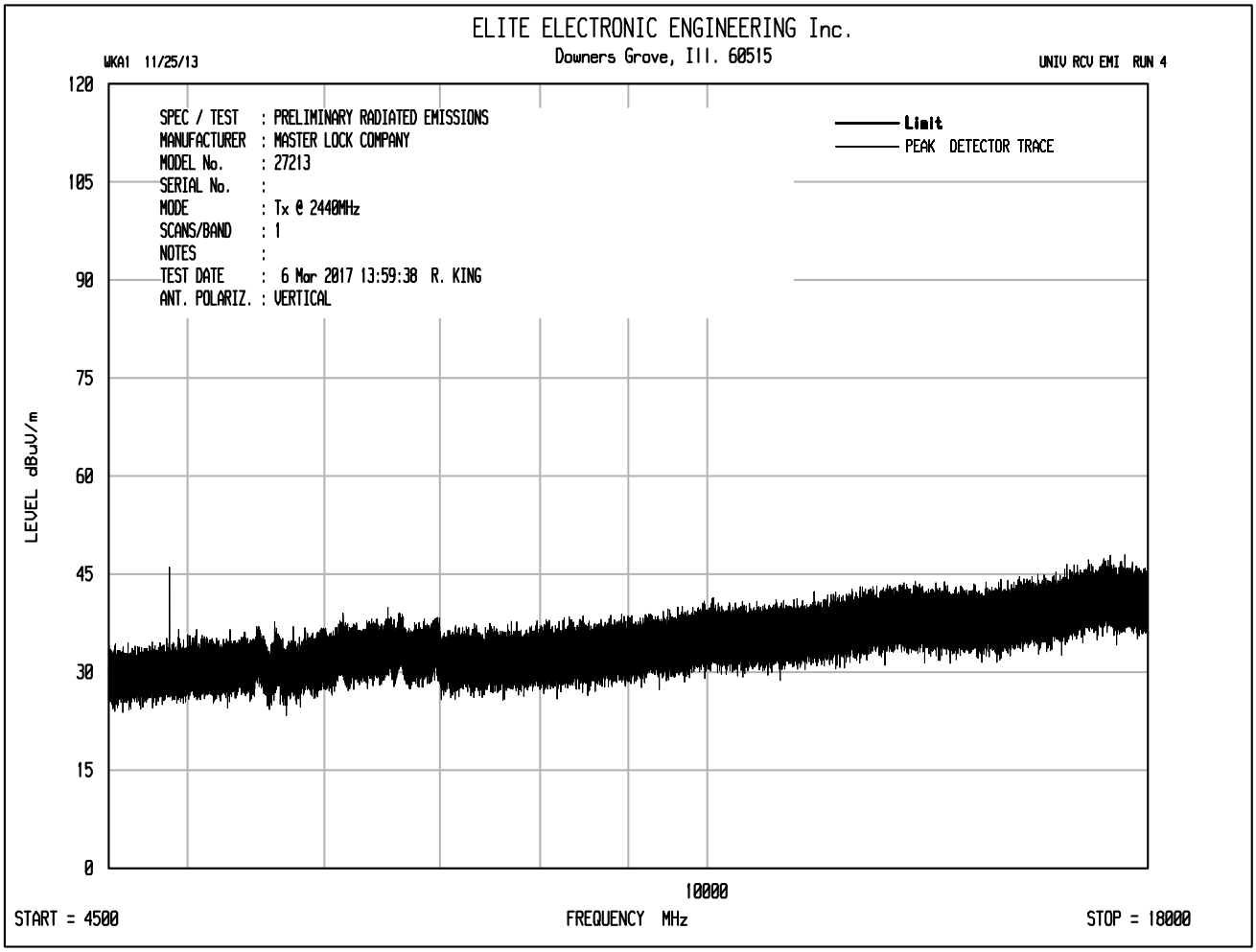

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 5
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. :
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 6 Mar 2017 16:48:02 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

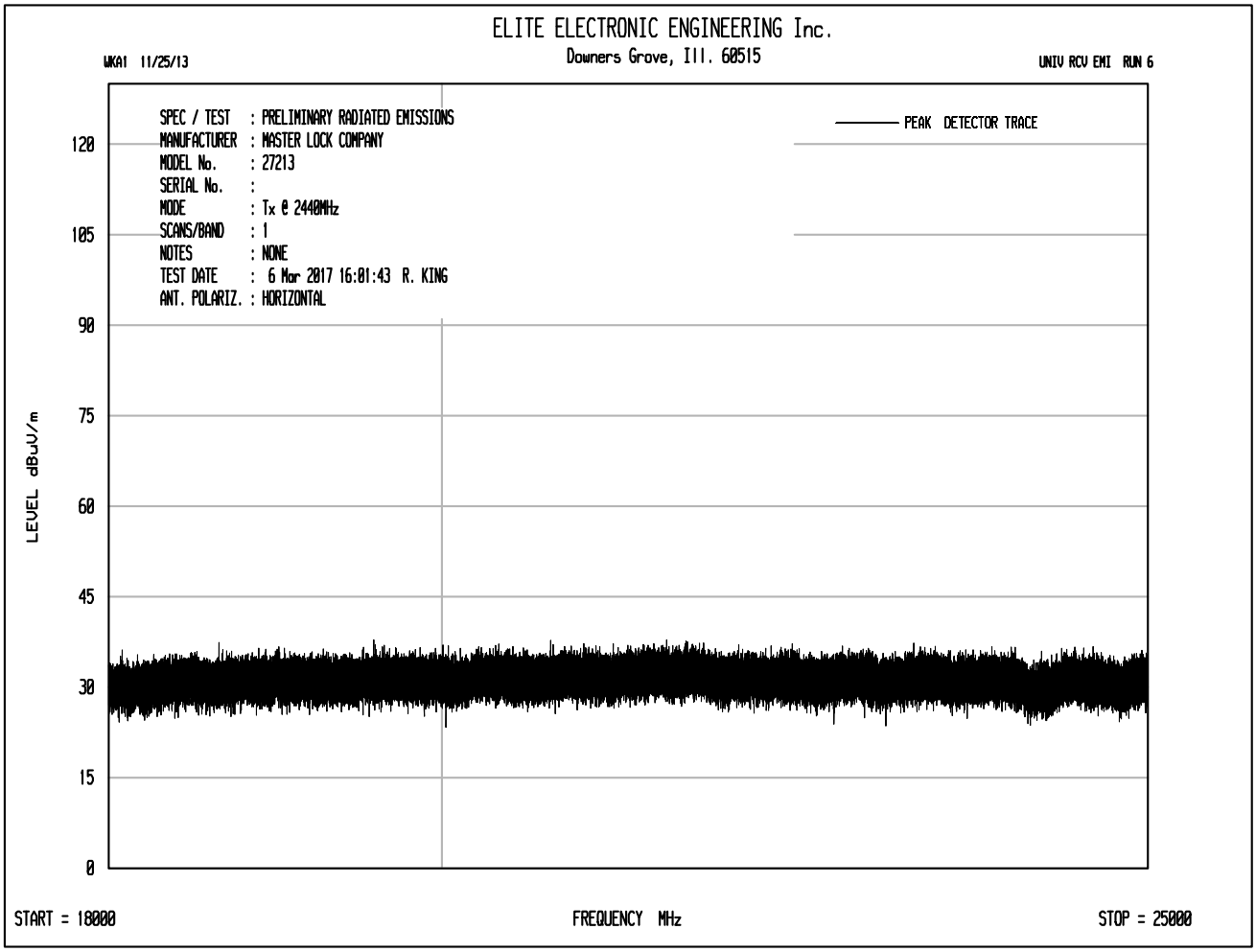

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. :
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 6 Mar 2017 16:42:22 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

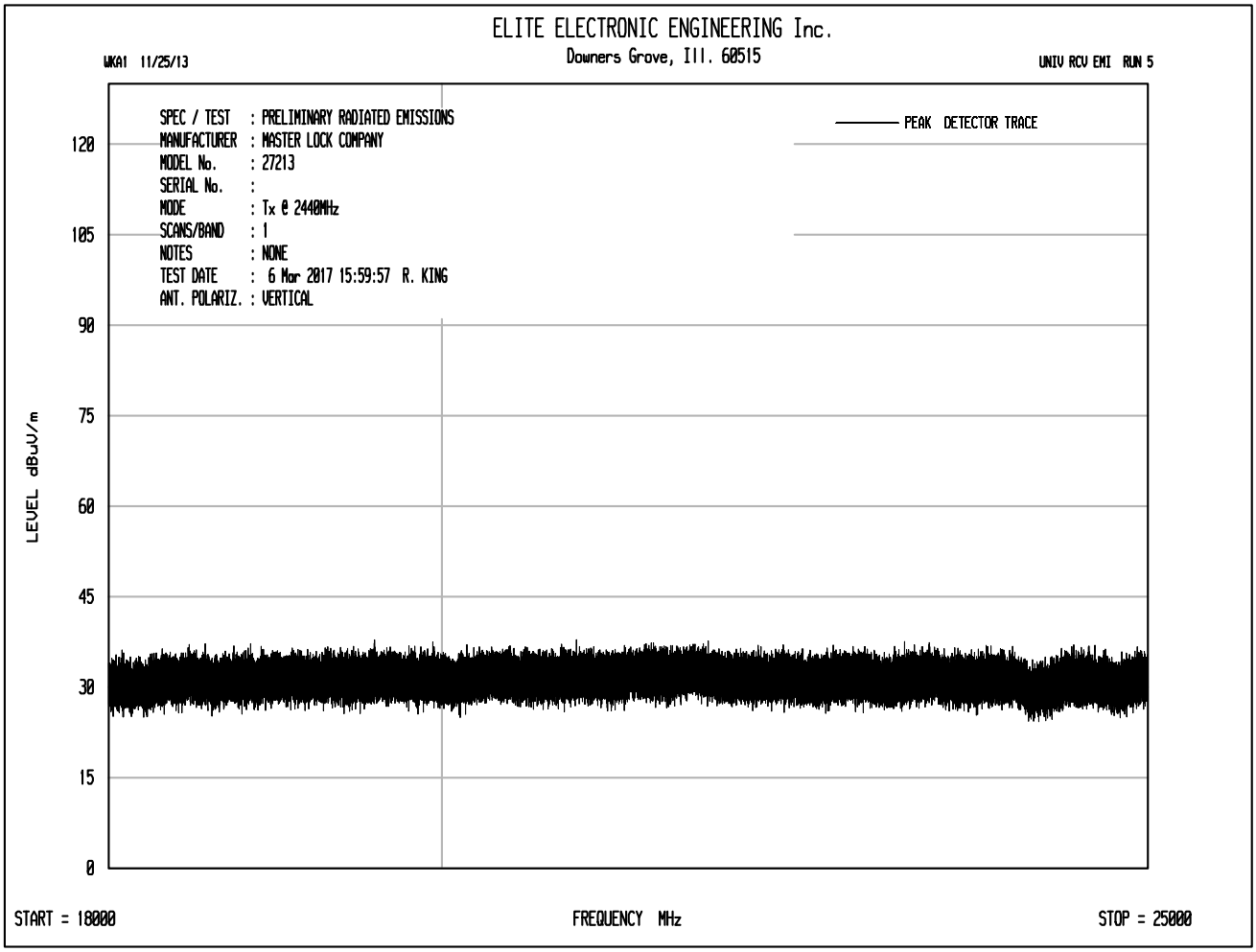

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. : .
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 6 Mar 2017 14:07:57 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 4500

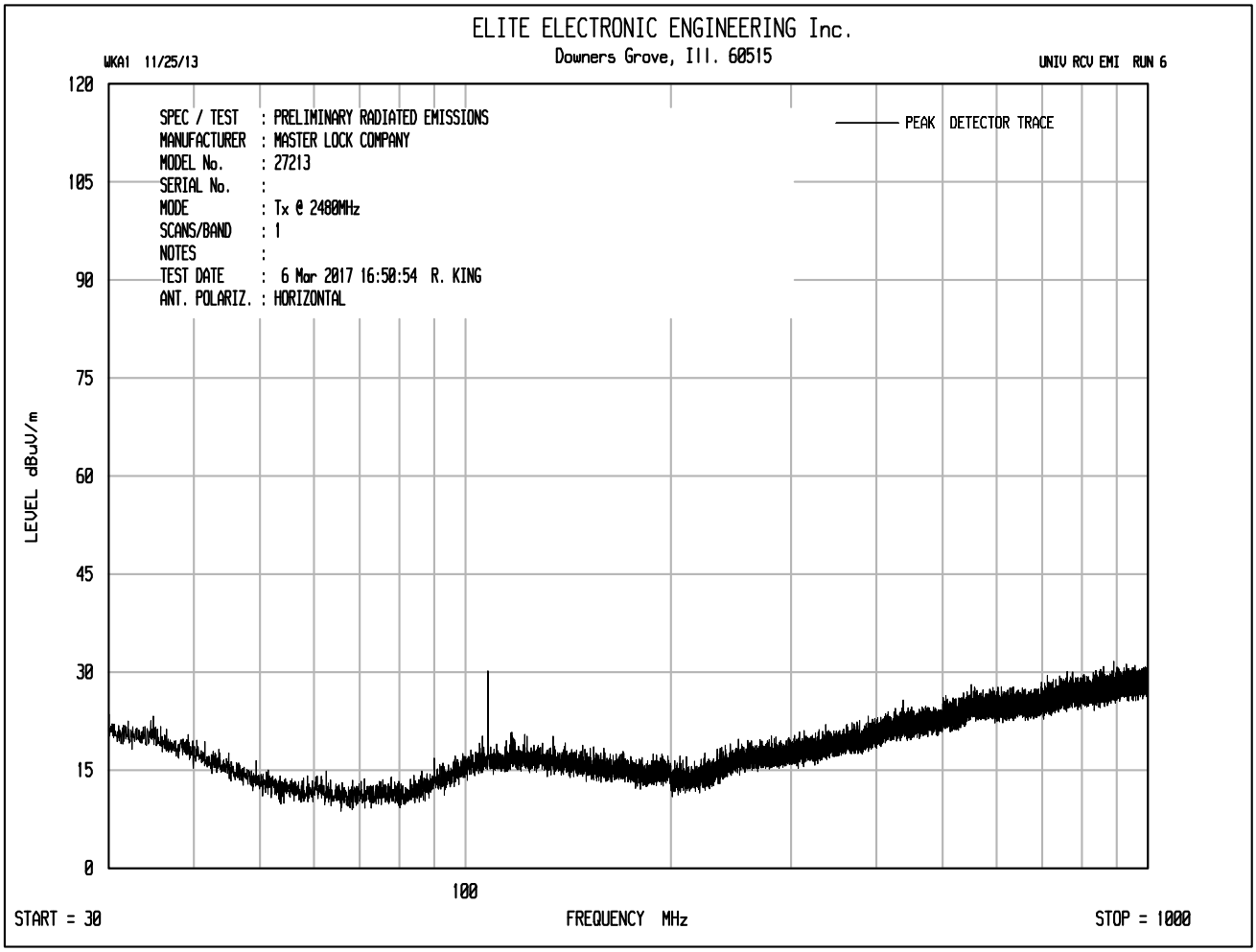

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. : .
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 6 Mar 2017 14:06:01 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 4500

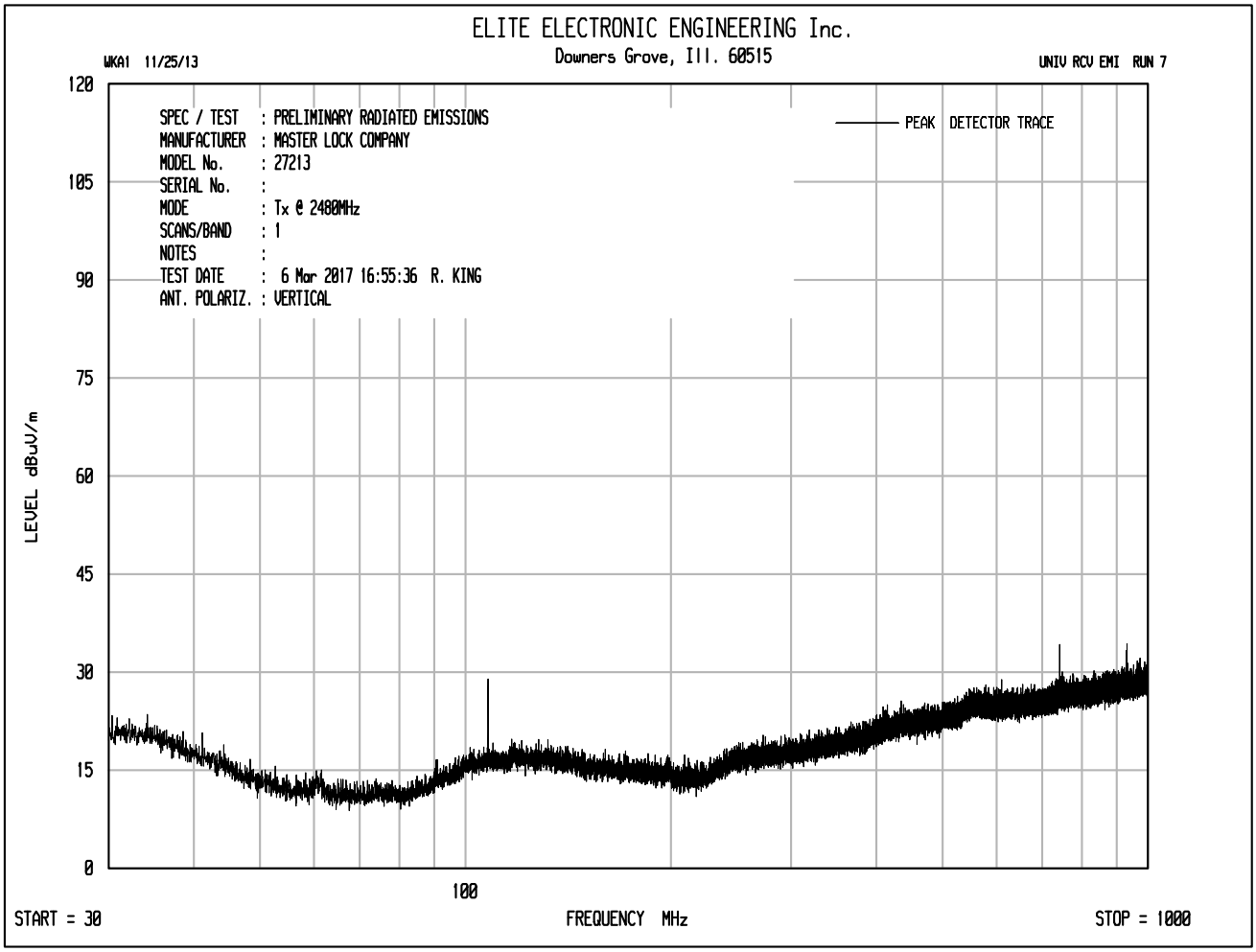

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. :
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 6 Mar 2017 13:54:52 R. KING
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 4500
FREQUENCY MHz
STOP = 18000

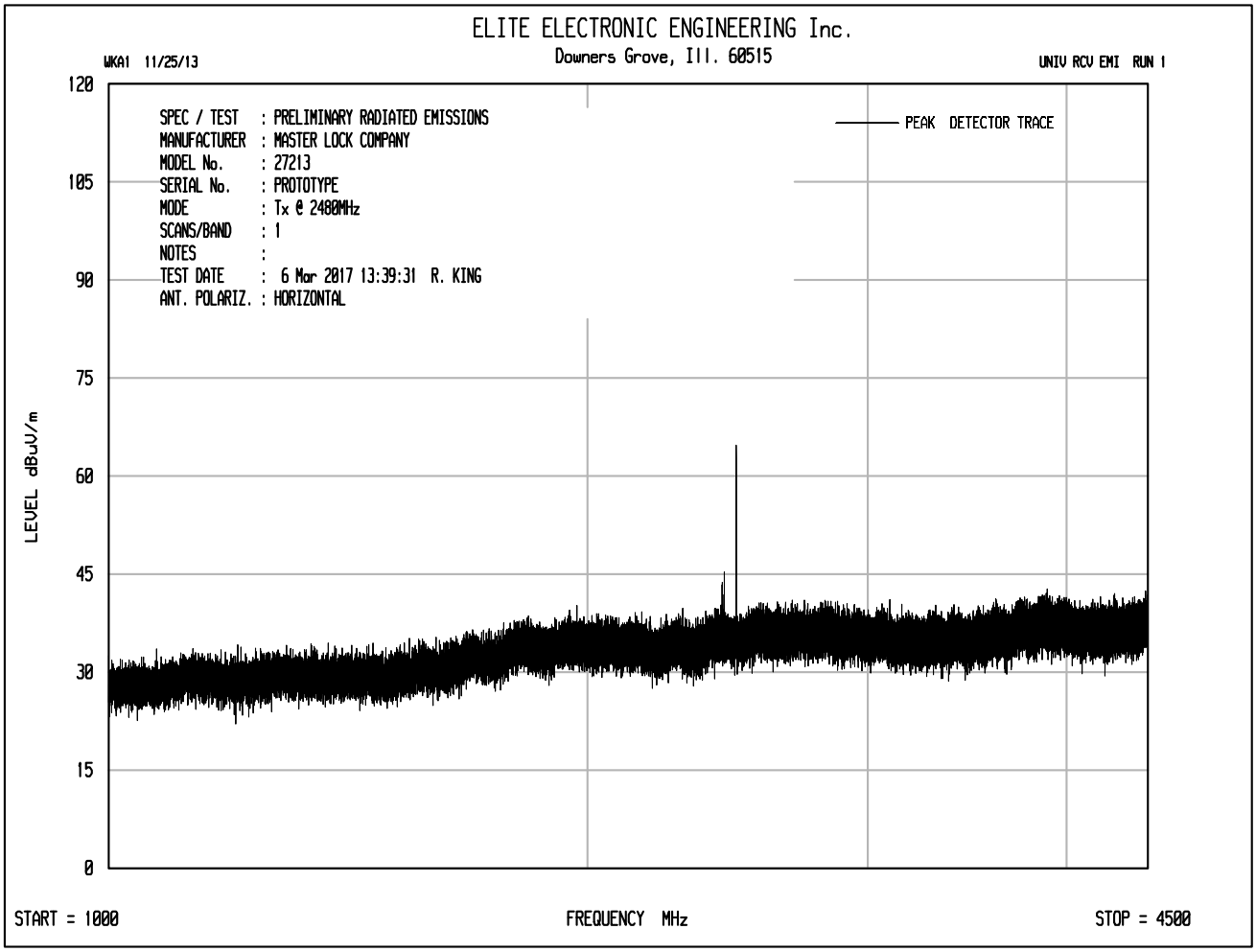

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. :
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 6 Mar 2017 13:59:38 R. KING
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 4500
FREQUENCY MHz
STOP = 18000

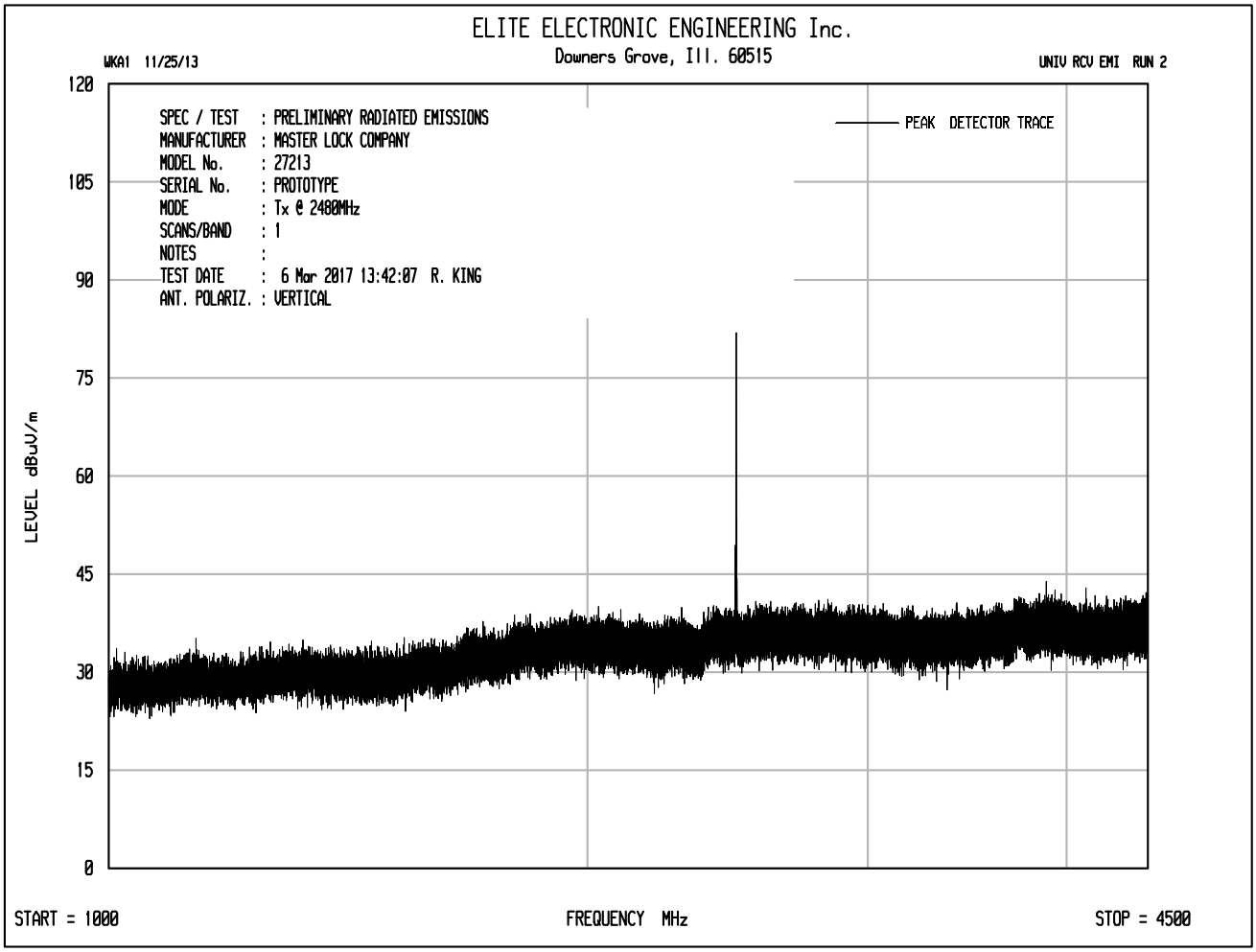

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 6
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. :
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 6 Mar 2017 16:01:43 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 25000

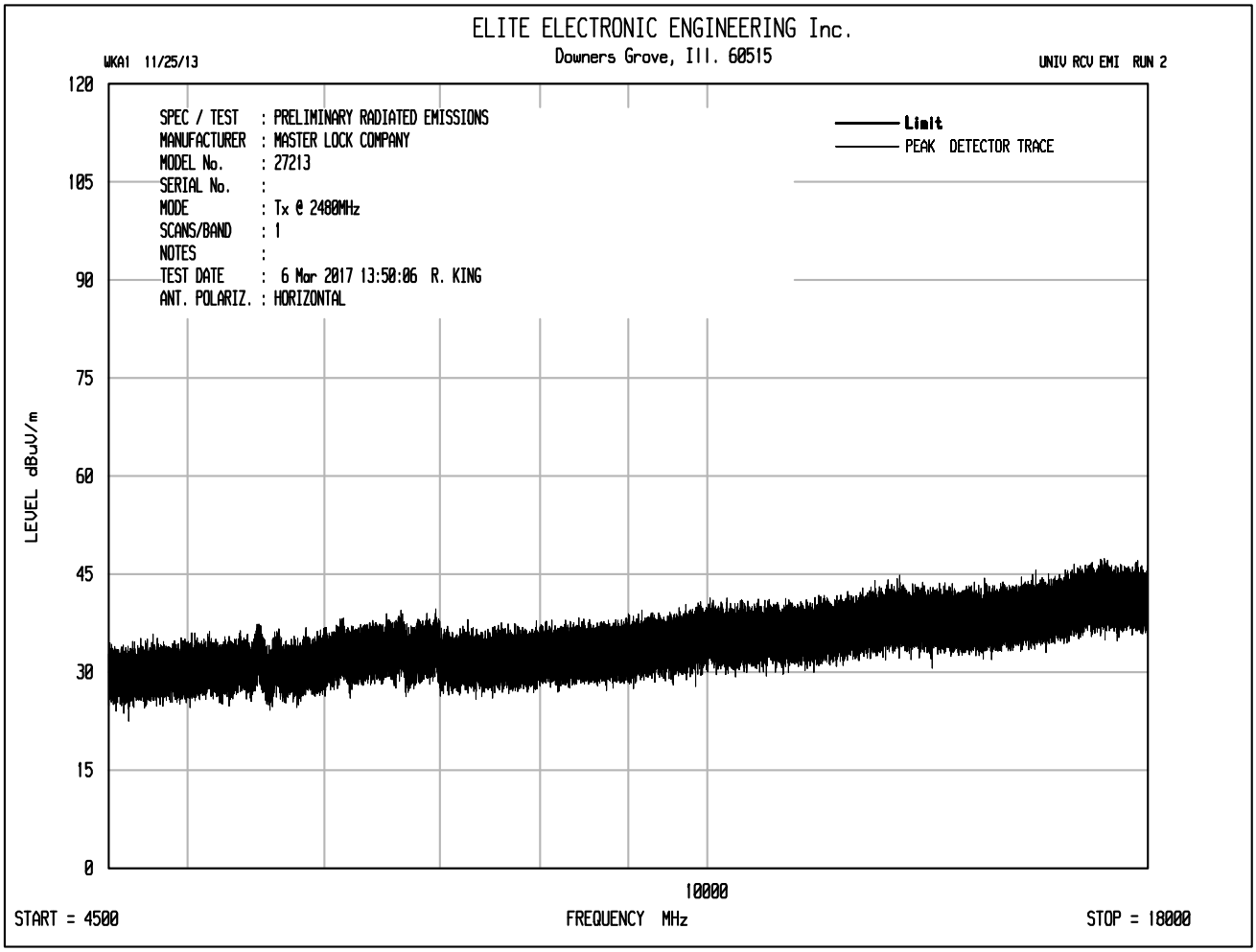

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 5
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. :
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 6 Mar 2017 15:59:57 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 25000

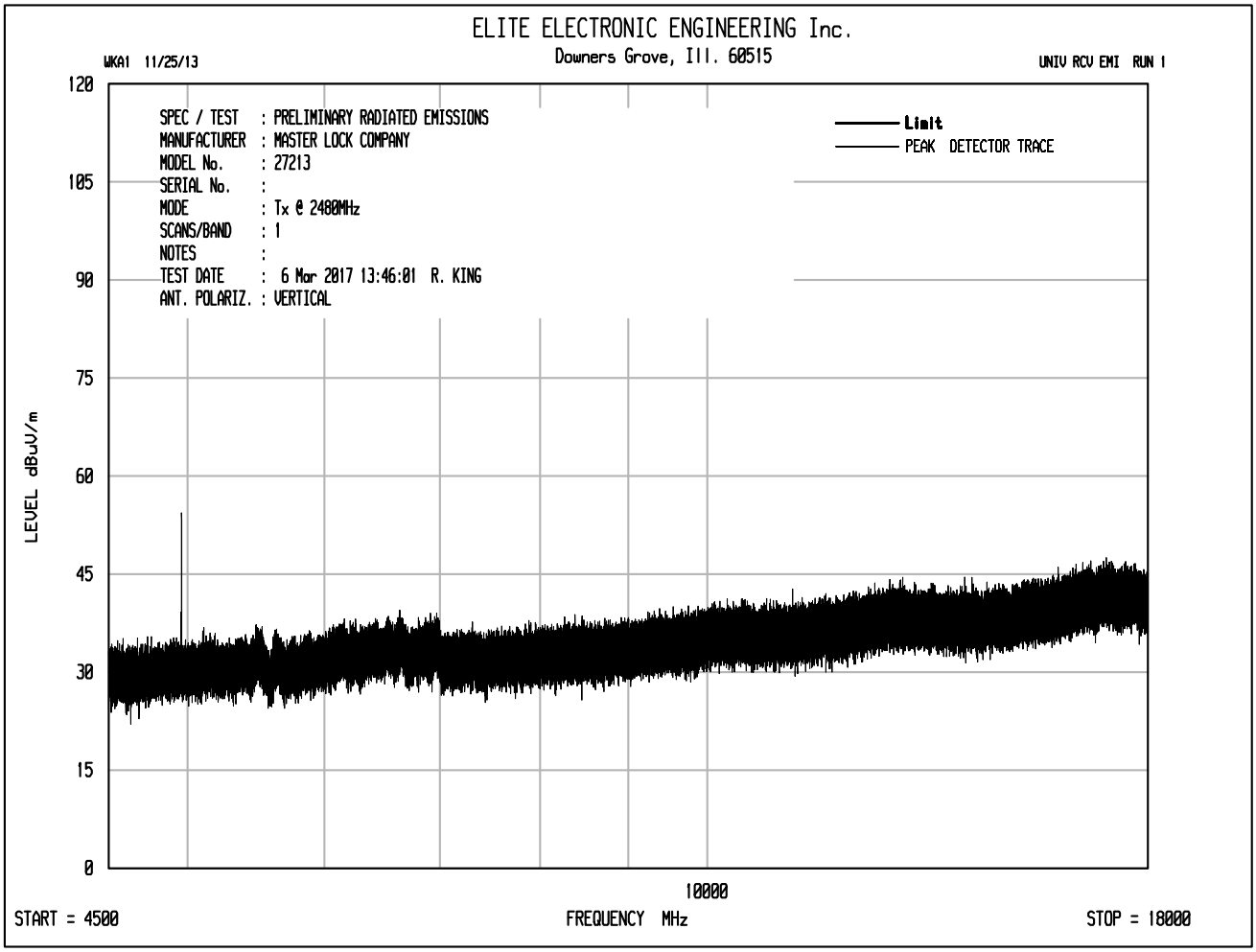

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 6
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. :
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 6 Mar 2017 16:50:54 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

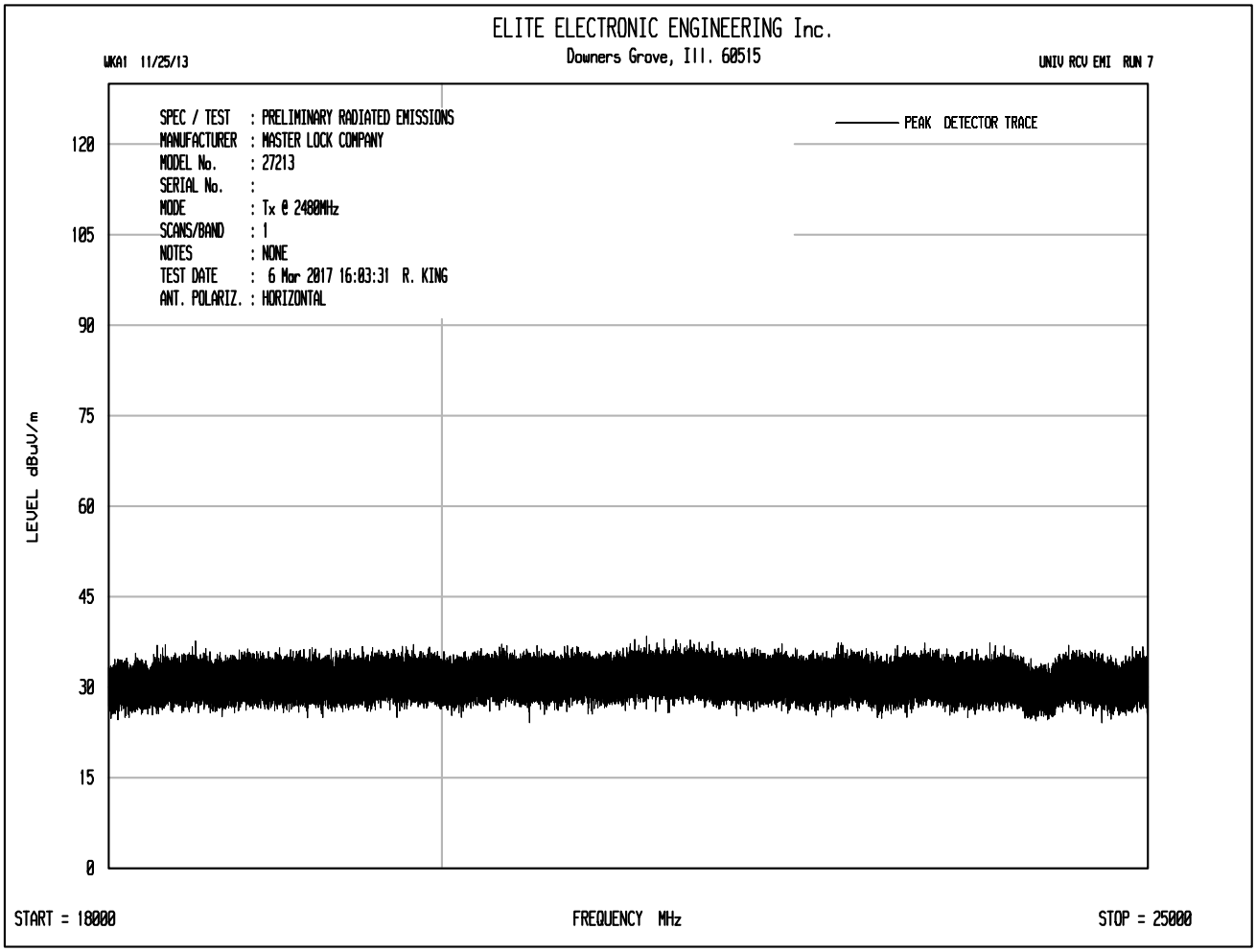

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 7
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. :
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 6 Mar 2017 16:55:36 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

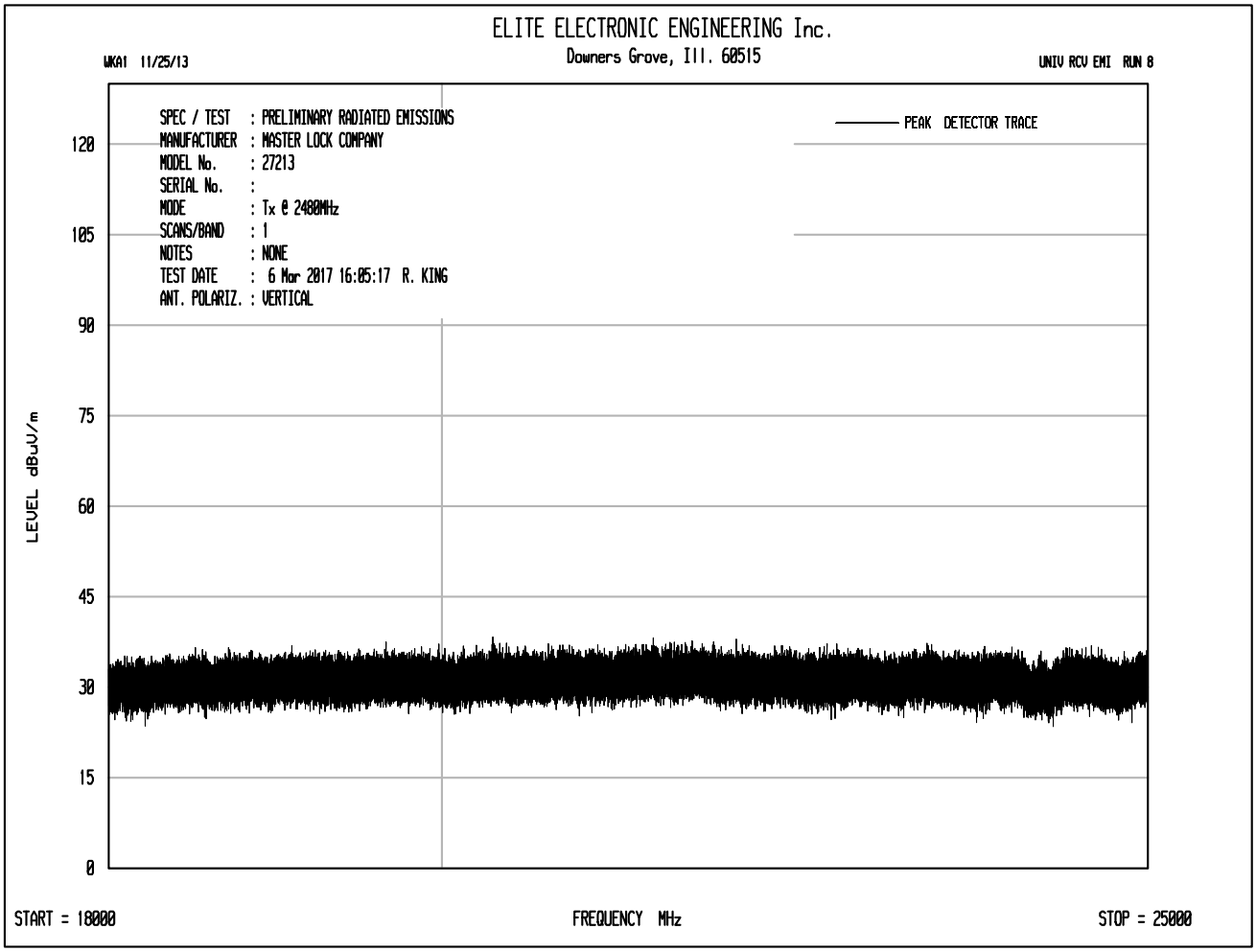

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 1
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. : PROTOTYPE
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 6 Mar 2017 13:39:31 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 4500


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. : PROTOTYPE
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 6 Mar 2017 13:42:07 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 4500


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. :
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 6 Mar 2017 13:50:06 R. KING
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 4500
FREQUENCY MHz
STOP = 18000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 1
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. :
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 6 Mar 2017 13:46:01 R. KING
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 4500
FREQUENCY MHz
STOP = 18000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 7
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. :
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 6 Mar 2017 16:03:31 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
WKA1 11/25/13
UNIV RCV EMI RUN 8
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : MASTER LOCK COMPANY
MODEL No. : 27213
SERIAL No. :
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES : NONE
TEST DATE : 6 Mar 2017 16:05:17 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

MANUFACTURER : Master Lock
MODEL NUMBER : 27213
TEST PERFORMED : Peak Radiated Emissions NOT in a restricted band
TEST DATE : March 6, 2017
TEST MODE : Transmit at 2402MHz
TEST DISTANCE : 3 meters
NOTES : Peak Readings with a 100kHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2402.00	H	52.6		2.6	32.0	0.0	87.2	22944.2		
2402.00	V	59.6		2.6	32.0	0.0	94.2	51365.8		
7206.00	H	38.7	*	4.6	35.7	-40.1	38.9	88.2	5136.6	-35.3
7206.00	V	38.7	*	4.6	35.7	-40.1	38.9	88.2	5136.6	-35.3
9608.00	H	38.7	*	5.2	36.6	-39.6	40.9	110.6	5136.6	-33.3
9608.00	V	39.4	*	5.2	36.6	-39.6	41.6	119.9	5136.6	-32.6
14412.00	H	39.0	*	6.6	39.6	-40.0	45.3	183.5	5136.6	-28.9
14412.00	V	39.1	*	6.6	39.6	-40.0	45.4	185.6	5136.6	-28.8
16814.00	H	38.3	*	7.2	41.7	-38.9	48.3	259.6	5136.6	-25.9
16814.00	V	38.3	*	7.2	41.7	-38.9	48.3	259.6	5136.6	-25.9
21618.00	H	24.7	*	2.2	40.6	-28.7	38.8	87.6	5136.6	-35.4
21618.00	V	24.7	*	2.2	40.6	-28.7	38.8	87.6	5136.6	-35.4
24020.00	H	24.8	*	2.2	40.6	-30.0	37.7	76.5	5136.6	-36.5
24020.00	V	24.8	*	2.2	40.6	-30.0	37.7	76.5	5136.6	-36.5

FS (dBuV/m) = MTR (dBuV) + CF + AF (dB/m) + (- PA (dB))

FS (uV/m) = AntiLog [(FS (dBuV/m))/20]

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Master Lock
MODEL NUMBER : 27213
TEST PERFORMED : Peak Radiated Emissions in a restricted band
TEST DATE : March 6, 2017
TEST MODE : Transmit at 2402MHz
TEST DISTANCE : 3 meters
NOTES : Peak Readings with a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2402.00	H	52.6		2.6	32.0	0.0	87.2	22944.2		
2402.00	V	59.6		2.6	32.0	0.0	94.2	51365.8		
4804.00	H	59.4		3.7	34.6	-40.2	57.4	741.4	5000.0	-16.6
4804.00	V	58.4		3.7	34.6	-40.2	56.5	666.2	5000.0	-17.5
12010.00	H	50.6	*	6.1	38.7	-39.7	55.7	606.6	5000.0	-18.3
12010.00	V	49.7	*	6.1	38.7	-39.7	54.7	545.6	5000.0	-19.2

FS (dBuV/m) = MTR (dBuV) + CF + AF (dB/m) + (- PA (dB))

FS (uV/m) = AntiLog [(FS (dBuV/m))/20]

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Master Lock
MODEL NUMBER : 27213
TEST PERFORMED : Average Radiated Emissions in a restricted band
TEST DATE : March 6, 2017
TEST MODE : Transmit at 2402MHz
TEST DISTANCE : 3 meters
NOTES : Avg Readings with a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
4804.00	H	53.4		3.7	34.6	-40.2	0.0	51.4	373.3	500.0	-2.5
4804.00	V	52.3		3.7	34.6	-40.2	0.0	50.3	328.2	500.0	-3.7
12010.00	H	36.2	*	6.1	38.7	-39.7	0.0	41.3	116.0	500.0	-12.7
12010.00	V	36.2	*	6.1	38.7	-39.7	0.0	41.3	116.0	500.0	-12.7
19216.00	H	20.9	*	2.2	40.4	-28.6	0.0	34.9	55.8	500.0	-19.0
19216.00	V	20.9	*	2.2	40.4	-28.6	0.0	34.9	55.8	500.0	-19.0

FS (dBuV/m) = MTR (dBuV) + CF + AF (dB/m) + (- PA (dB)) + D.C. (dB)

FS (uV/m) = AntiLog [(FS (dBuV/m))/20]

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Master Lock
MODEL NUMBER : 27213
TEST PERFORMED : Peak Radiated Emissions NOT in a restricted band
TEST DATE : March 6, 2017
TEST MODE : Transmit at 2440MHz
TEST DISTANCE : 3 meters
NOTES : Peak Readings with a 100kHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2440.00	H	48.5		2.6	32.1	0.0	83.2	14449.4		
2440.00	V	56.2		2.6	32.1	0.0	90.9	35225.0		
9760.00	H	38.6	*	5.2	36.9	-39.6	41.1	113.9	3522.5	-29.8
9760.00	V	36.2	*	5.2	36.9	-39.6	38.8	87.3	3522.5	-32.1
14640.00	H	36.3	*	6.7	39.6	-40.2	42.4	131.4	3522.5	-28.6
14640.00	V	38.2	*	6.7	39.6	-40.2	44.3	164.5	3522.5	-26.6
17080.00	H	37.9	*	7.3	41.6	-38.8	48.0	252.3	3522.5	-22.9
17080.00	V	37.7	*	7.3	41.6	-38.8	47.8	246.0	3522.5	-23.1
21960.00	H	24.9	*	2.2	40.6	-29.2	38.5	84.3	3522.5	-32.4
21960.00	V	24.9	*	2.2	40.6	-29.2	38.5	84.3	3522.5	-32.4
24400.00	H	24.8	*	2.2	40.6	-30.2	37.4	74.5	3522.5	-33.5
24400.00	V	24.8	*	2.2	40.6	-30.2	37.4	74.5	3522.5	-33.5

FS (dBuV/m) = MTR (dBuV) + CF + AF (dB/m) + (- PA (dB))

FS (uV/m) = AntiLog [(FS (dBuV/m))/20]

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Master Lock
MODEL NUMBER : 27213
TEST PERFORMED : Peak Radiated Emissions in a restricted band
TEST DATE : March 6, 2017
TEST MODE : Transmit at 2440MHz
TEST DISTANCE : 3 meters
NOTES : Peak Readings with a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
4880.00	H	61.4		3.7	34.5	-40.3	59.4	929.5	5000.0	-14.6
4880.00	V	59.3		3.7	34.5	-40.3	57.3	735.8	5000.0	-16.6
7320.00	H	46.2	*	4.7	35.7	-40.1	46.5	211.2	5000.0	-27.5
7320.00	V	45.8	*	4.7	35.7	-40.1	46.1	201.7	5000.0	-27.9
12200.00	H	46.1	*	6.1	38.8	-39.6	51.3	367.4	5000.0	-22.7
12200.00	V	47.2	*	6.1	38.8	-39.6	52.5	419.4	5000.0	-21.5
19520.00	H	35.0	*	2.2	40.4	-28.5	49.1	285.2	5000.0	-24.9
19520.00	V	35.0	*	2.2	40.4	-28.5	49.1	285.2	5000.0	-24.9

FS (dBuV/m) = MTR (dBuV) + CF + AF (dB/m) + (- PA (dB))

FS (uV/m) = AntiLog [(FS (dBuV/m))/20]

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Master Lock
MODEL NUMBER : 27213
TEST PERFORMED : Average Radiated Emissions in a restricted band
TEST DATE : March 6, 2017
TEST MODE : Transmit at 2440MHz
TEST DISTANCE : 3 meters
NOTES : Avg Readings with a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
4880.00	H	55.4		3.7	34.5	-40.3	0.0	53.4	469.6	500.0	-0.5
4880.00	V	53.0		3.7	34.5	-40.3	0.0	51.0	356.3	500.0	-2.9
7320.00	H	34.40		4.7	35.7	-40.1	0.0	34.7	54.3	500.0	-19.3
7320.00	V	34.4		4.7	35.7	-40.1	0.0	34.7	54.3	500.0	-19.3
12200.00	H	34.3	*	6.1	38.8	-39.6	0.0	39.5	94.4	500.0	-14.5
12200.00	V	34.3	*	6.1	38.8	-39.6	0.0	39.6	95.2	500.0	-14.4
19520.00	H	20.8	*	2.2	40.4	-28.5	0.0	34.9	55.6	500.0	-19.1
19520.00	V	20.8	*	2.2	40.4	-28.5	0.0	34.9	55.6	500.0	-19.1

FS (dBuV/m) = MTR (dBuV) + CF + AF (dB/m) + (- PA (dB)) + D.C. (dB)

FS (uV/m) = AntiLog [(FS (dBuV/m))/20]

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Master Lock
MODEL NUMBER : 27213
TEST PERFORMED : Peak Radiated Emissions NOT in a restricted band
TEST DATE : March 6, 2017
TEST MODE : Transmit at 2480MHz
TEST DISTANCE : 3 meters
NOTES : Peak Readings with a 100kHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2480.00	H	48.1		2.7	32.2	0.0	82.9	14035.6		
2480.00	V	55.8		2.7	32.2	0.0	90.6	33785.6		
9920.00	H	38.6	*	5.3	37.0	-39.5	41.3	116.0	3378.6	-29.3
9920.00	V	36.2	*	5.3	37.0	-39.5	39.0	88.9	3378.6	-31.6
14880.00	H	36.3	*	6.8	39.7	-40.4	42.3	130.4	3378.6	-28.3
14880.00	V	38.2	*	6.8	39.7	-40.4	44.3	163.2	3378.6	-26.3
17360.00	H	37.9	*	7.4	41.4	-39.1	47.6	239.5	3378.6	-23.0
17360.00	V	37.7	*	7.4	41.4	-39.1	47.4	233.5	3378.6	-23.2
24800.00	H	24.8	*	2.2	40.6	-30.9	36.7	68.2	3378.6	-33.9
24800.00	V	24.8	*	2.2	40.6	-30.9	36.7	68.2	3378.6	-33.9

FS (dBuV/m) = MTR (dBuV) + CF + AF (dB/m) + (- PA (dB))

FS (uV/m) = AntiLog [(FS (dBuV/m))/20]

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Master Lock
MODEL NUMBER : 27213
TEST PERFORMED : Peak Radiated Emissions in a restricted band
TEST DATE : March 6, 2017
TEST MODE : Transmit at 2480MHz
TEST DISTANCE : 3 meters
NOTES : Peak Readings with a 1MHz RBW

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
4960.00	H	62.6		3.7	34.5	-40.3	60.5	1065.1	5000.0	-13.4
4960.00	V	60.3		3.7	34.5	-40.3	58.2	816.4	5000.0	-15.7
7440.00	H	47.2	*	4.7	35.6	-40.0	47.5	237.7	5000.0	-26.5
7440.00	V	46.9	*	4.7	35.6	-40.0	47.3	230.4	5000.0	-26.7
12400.00	H	46.1	*	6.1	38.8	-39.5	51.4	371.7	5000.0	-22.6
12400.00	V	47.2	*	6.1	38.8	-39.5	52.6	424.3	5000.0	-21.4
19840.00	H	35.0	*	2.2	40.4	-28.2	49.5	297.3	5000.0	-24.5
19840.00	V	35.0	*	2.2	40.4	-28.2	49.5	297.6	5000.0	-24.5
22320.00	H	35.0	*	2.2	40.6	-29.1	48.7	273.8	5000.0	-25.2
22320.00	V	35.0	*	2.2	40.6	-29.1	48.7	273.8	5000.0	-25.2

FS (dBuV/m) = MTR (dBuV) + CF + AF (dB/m) + (- PA (dB))

FS (uV/m) = AntiLog [(FS (dBuV/m))/20]

Checked BY Richard E. King :

Richard E. King

MANUFACTURER : Master Lock
MODEL NUMBER : 27213
TEST PERFORMED : Average Radiated Emissions in a restricted band
TEST DATE : March 6, 2017
TEST MODE : Transmit at 2480MHz
TEST DISTANCE : 3 meters
NOTES : Avg Readings with a 1MHz RBW

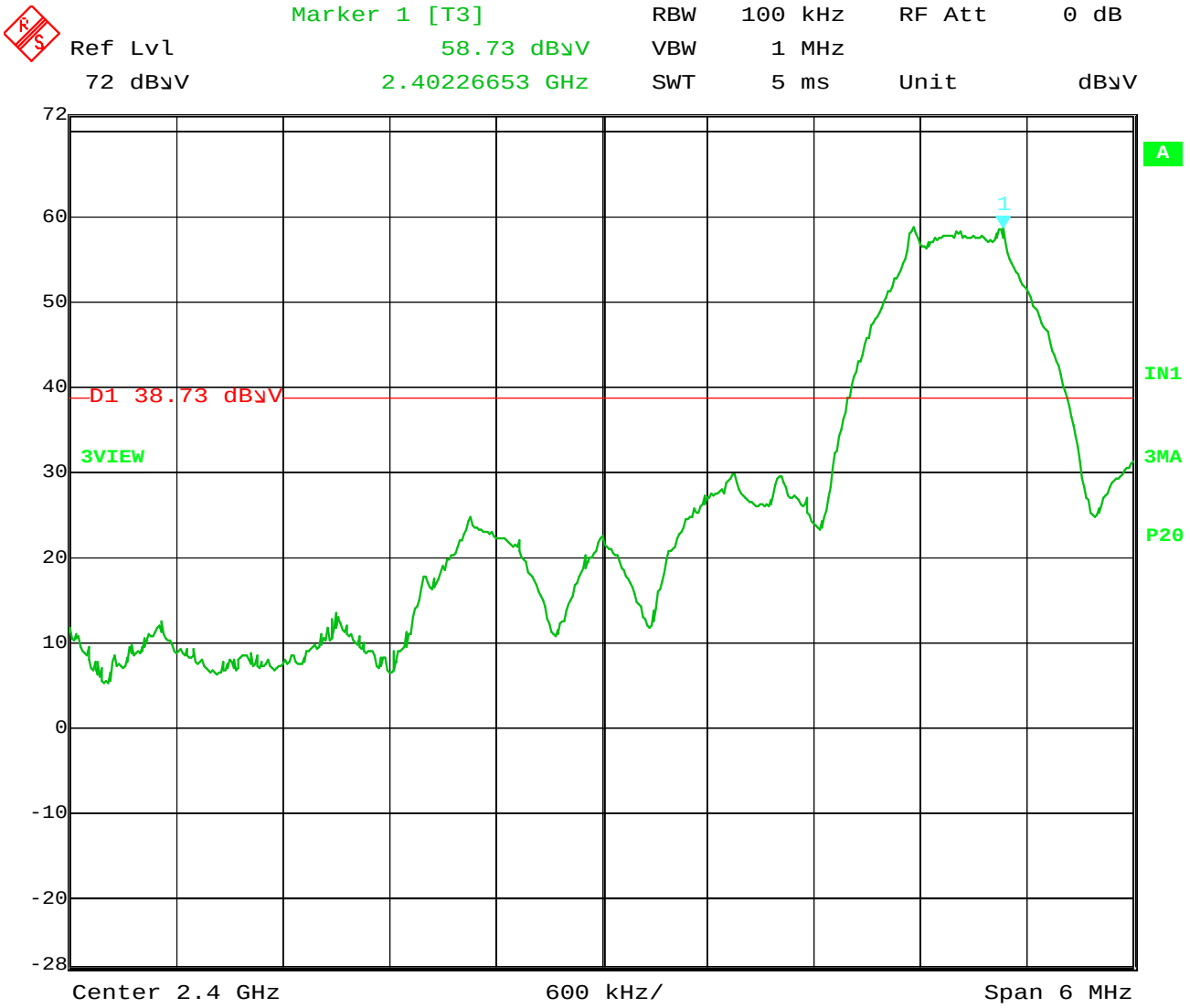
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
4960.00	H	55.0		3.7	34.5	-40.3	0.0	53.0	444.5	500.0	-1.0
4960.00	V	54.7		3.7	34.5	-40.3	0.0	52.7	429.9	500.0	-1.3
7440.00	H	34.19		4.7	35.6	-40.0	0.0	34.5	53.1	500.0	-19.5
7440.00	V	34.2		4.7	35.6	-40.0	0.0	34.5	53.1	500.0	-19.5
12400.00	H	34.3	*	6.1	38.8	-39.5	0.0	39.6	95.5	500.0	-14.4
12400.00	V	34.3	*	6.1	38.8	-39.5	0.0	39.7	96.3	500.0	-14.3
19840.00	H	20.9	*	2.2	40.4	-28.2	0.0	35.4	58.7	500.0	-18.6
19840.00	V	20.9	*	2.2	40.4	-28.2	0.0	35.4	58.7	500.0	-18.6
22320.00	H	22.2	*	2.2	40.6	-29.1	0.0	35.9	62.7	500.0	-18.0
22320.00	V	22.2	*	2.2	40.6	-29.1	0.0	35.9	62.7	500.0	-18.0

FS (dBuV/m) = MTR (dBuV) + CF + AF (dB/m) + (- PA (dB)) + D.C. (dB)

FS (uV/m) = AntiLog [(FS (dBuV/m))/20]

Checked BY Richard E. King :

Richard E. King



FCC 15.247 Band edge Compliance

Manufacturer	:	Master lock
Model Number	:	27213
Serial Number	:	
Mode	:	Tx @ 2402MHz
Parameters	:	D1 = -20dBc Limit
Date	:	3/6/2017 10:02:27 AM
Notes	:	

Manufacturer : Master Lock Company
Test Item : TouchPad Transceiver
Model No. : 27213
Mode : Tx @ 2480MHz High Channel
Date : March 6, 2017
Notes : Peak Detector with 1MHz Resolution Bandwidth

Total (dBuV/m) = Meter Reading + CBL FAC + Ant Fac + Pre Amp.

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2483.00	H	11.4		2.7	32.2	0.0	46.2	204.5	3378.6	-24.4
2483.00	V	18.6		2.7	32.2	0.0	53.4	469.5	3378.6	-17.1

Checked BY Richard E. King :

Richard E. King

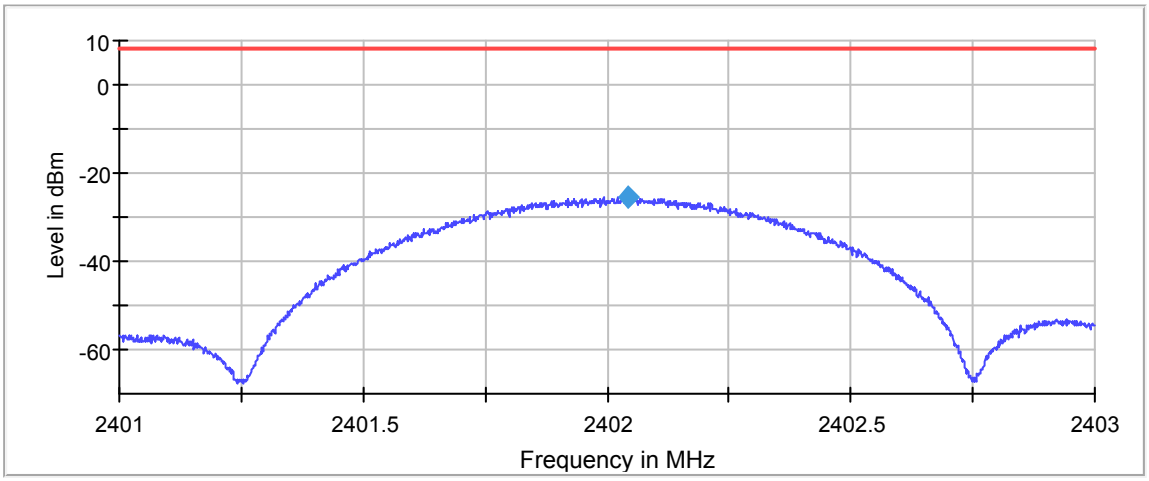
Manufacturer : Master Lock Company
Test Item : TouchPad Transceiver
Model No. : 27213
Mode : Tx @ 2480MHz High Channel
Date : 12/9/2016
Notes : Average Measurement with 1MHz Resolution Bandwidth

Total (dBuV/m) = Meter Reading + CBL FAC + Ant Fac + Pre Amp

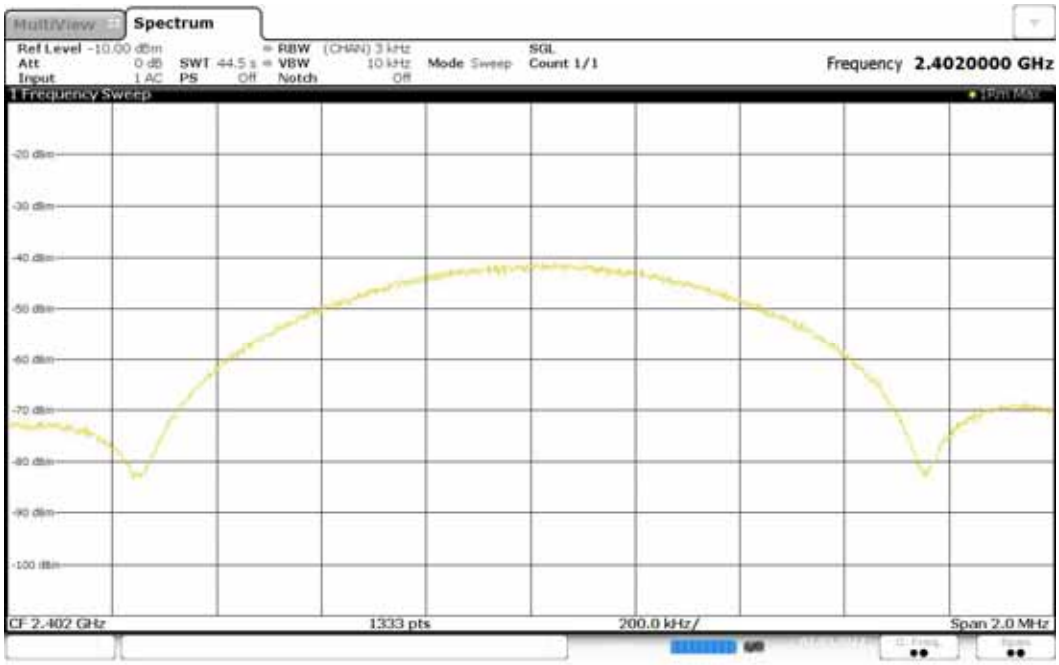
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
2483.00	H	1.7		2.7	32.2	0.0	0.0	36.5	67.2	500.0	-17.4
2483.00	V	10.5		2.7	32.2	0.0	0.0	45.3	184.4	500.0	-8.7

Checked BY Richard E. King :

Richard E. King

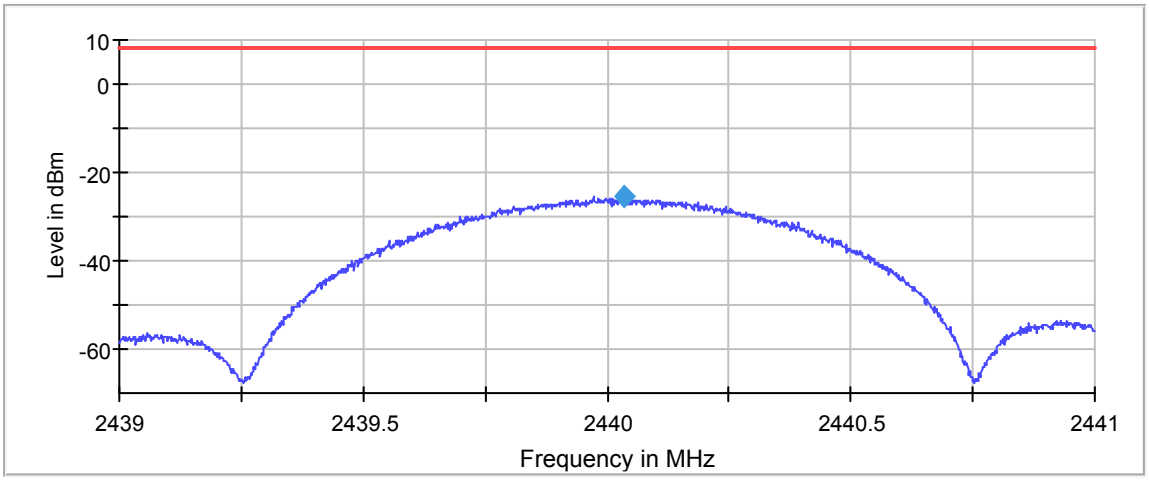


Limit Sum Level PSD

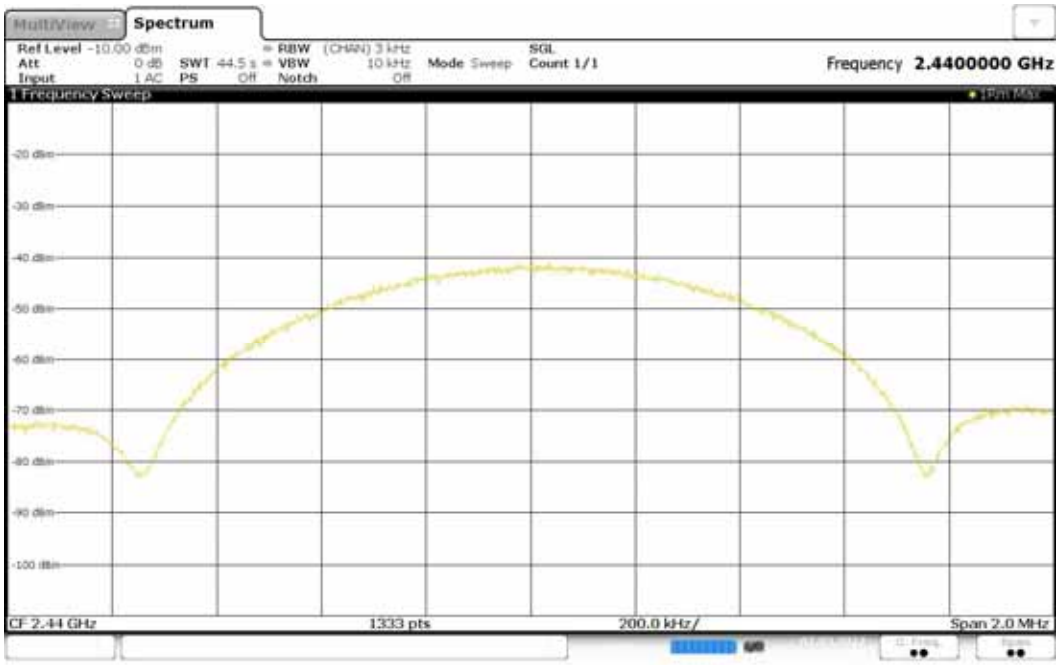


FCC 15.247 Power Spectral Density

Manufacturer : Master Lock
Model Number : 27213
Mode : Tx 2402MHz
Parameters : D1 = 8dBm limit
Date : 3/7/2017

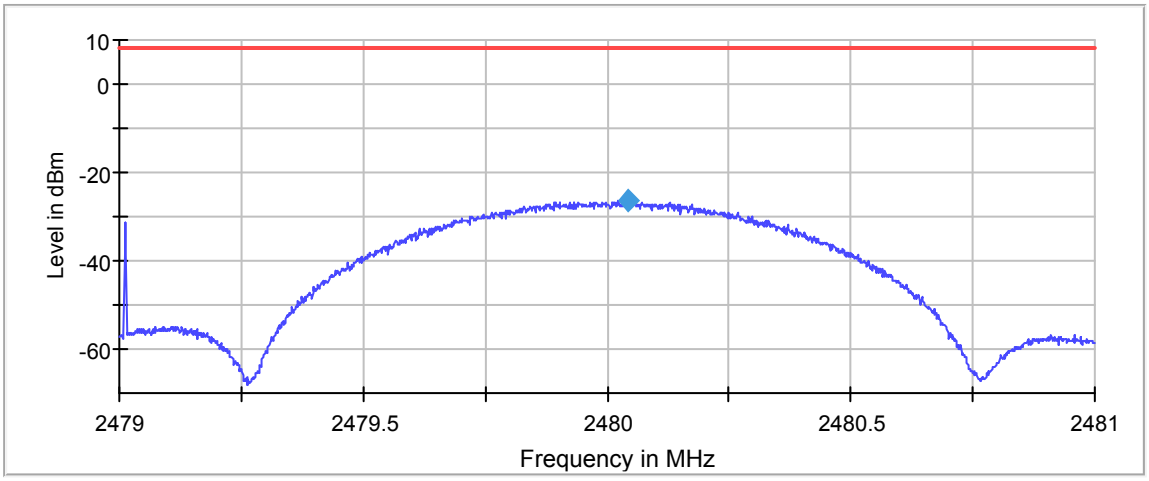


Limit Sum Level PSD

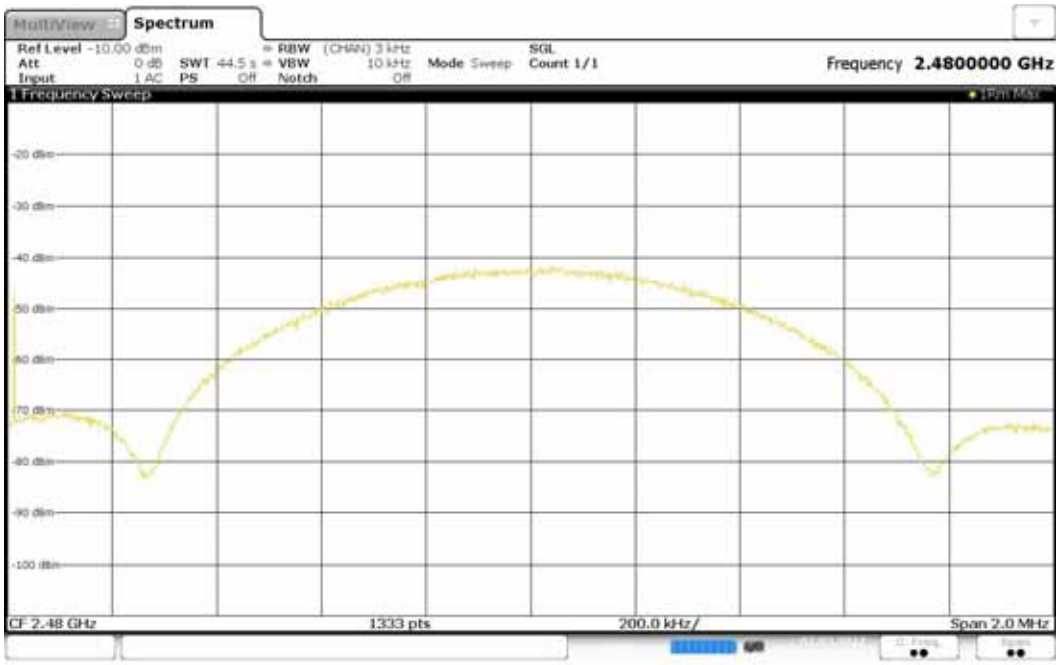


FCC 15.247 Power Spectral Density

Manufacturer : Master Lock
Model Number : 27213
Mode : Tx 2440MHz
Parameters : D1 = 8dBm limit
Date : 3/7/2017



Limit Sum Level PSD



FCC 15.247 Power Spectral Density

Manufacturer : Master Lock
Model Number : 27213
Mode : Tx 2480MHz
Parameters : D1 = 8dBm limit
Date : 3/7/2017