Measurement of RF Interference from an TM100 & TM110 BLE Transmitter

For	The Chamber Manufacturing Group 845 Larch Ave Elmhurst, IL 60126
P.O. Number	4900037120
Date Tested	May 11 and 13, 2016
Test Personnel	Richard King
Specification	FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.207 and 15.247 for Digital Modulation Intentional Radiators Operating within the band 2400-2483.5MHz FCC “Code of Federal Regulations” Title 47, Industry Canada RSS-247 Industry Canada RSS-GEN

Test Report By:

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Requested By: Adil Ahmed
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REVISION HISTORY

Revision	Date	Description
—	08/04/2016	Initial release

Measurement of RF Emissions from a BLE Transmitter, Part Nos. TM100 & TM110

1. INTRODUCTION

1.1 Scope of Tests

This document represents the results of the series of radio interference measurements performed on The Chamber Manufacturing Group BLE Transmitter, Part Nos. TM100 & TM110, Serial No. No serial number was supplied, transmitter (hereinafter referred to as the EUT). The EUT is a digital modulation transmitter. The transceiver was designed to transmit in the 2400-2483.5 MHz band using an integral antenna. The EUT was manufactured and submitted for testing by The Chamber Manufacturing Group located in Elmhurst, IL.

The EUT is a single device with two model numbers. An additional EUT was submitted for testing purposes only that was equipped with and RF antenna port. No serial number was associated with this EUT.

1.2 Purpose

The test series was performed to determine if the EUT meets the conducted RF emission requirements, radiated RF emissions requirements, and additional provisions of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Sections 15.107 and 15.109, for receivers and Subpart C, Sections 15.207 and 15.249 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 RF emission requirements, radiated RF emissions requirements, and additional provisions of the Industry Canada Radio Standards Specification RSS-Gen Section 8.8 and Section 7.1.2 for receivers and Industry Canada Radio Standards Specification RSS-Gen Section 8.8 and Industry Canada Radio Standards Specification RSS-247 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 Lab Code: 1786-01.

1.5 Laboratory Conditions

The temperature at the time of the test was 23C and the relative humidity was 29%.

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 2015

- 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”

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

- Federal Communications Commission Office of Engineering and Technology Laboratory Division,

Guidance For Performing Compliance Measurements On Digital Transmissions Systems (DTS) Operating Under §15.247
January 7, 2016

- Industry Canada RSS-247, Issue 1, May 2015, "Spectrum Management and Telecommunications Radio Standards Specification, 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 for Compliance of Radio Apparatus"

3. EUT SET-UP AND OPERATION

3.1 General Description

The EUT is a BLE Transmitter, Part No. TM100 & TM110. A block diagram of the EUT setup is shown as Figure 1 and Figure 2.

3.1.1 Power Input

The EUT obtained 3V from a 3V Lithium battery.

3.1.2 Peripheral Equipment

No peripheral equipment was submitted with the EUT.

3.1.3 Interconnect Cables

No interconnect cables were submitted with the EUT.

3.1.4 Grounding

The EUT was ungrounded during the tests.

3.2 Software

For all tests the EUT had Firmware Version FCC_test_code_v1.0 loaded onto the device to provide correct load characteristics.

3.3 Operational Mode

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

3.4 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 C63.4-2014 for site attenuation.

4.2 Test Instrumentation

The test instrumentation and auxiliary equipment used during the tests are listed in Table 9-1.

Radiated emission tests were performed with an EMI receiver utilizes the bandwidths and detectors specified by the requirements.

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	1.06	-1.06
Expanded Uncertainty (95% confidence)	2.12	-2.12

Radiated Emissions Measurements		
Combined Standard Uncertainty	2.09	-2.09
Expanded Uncertainty (95% confidence)	4.19	-4.19

5. TEST PROCEDURES

5.1 Transmitter

5.1.1 6dB Bandwidth

5.1.1.1 Requirements

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

5.1.1.2 Procedures

The antenna port of the EUT was connected to the spectrum analyzer through 40dB of attenuation.

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, the video bandwidth (VBW) was set to the same as or 3 times greater than the RBW, and the span was set to 3 times 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.

5.1.1.3 Results

The plots on pages 19 through 21 show that the minimum 6 dB bandwidth was 717.43kHz which is greater than minimum allowable 6dB bandwidth requirement of 500kHz for systems using digital modulation techniques. The 99% bandwidth was measured to be 1.074MHz.

5.1.2 Peak Output Power

5.1.2.1 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).

5.1.2.2 Procedures

The antenna port of the EUT was connected to the spectrum analyzer through 40dB of attenuation. The maximum meter reading was recorded. The peak power output was calculated for the low, middle and high channels.

The antenna port of the EUT was connected to the spectrum analyzer through 40dB of attenuation. The EUT was set to transmit separately at the low, middle, and high channels. The resolution bandwidth (RBW) was set to greater than the 6dB bandwidth. The 'Max-Hold' function was engaged. The maximum meter reading was recorded. The peak power output was calculated for the low, middle and high channels.

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 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 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 for all measurements above 1GHz), as required. The peak power output was calculated for low, middle, and high hopping frequencies.

5.1.2.3 Results

The results are presented on page 22. The maximum peak conducted output power from the transmitter was 0.000273W (-5.64 dBm) which is below the 1 Watt limit.

The results are presented on page 23. The maximum EIRP measured from the transmitter was -0.8 dBm or 0.000832W which is below the 4 Watt limit.

5.1.3 Antenna Conducted Spurious Emissions

5.1.3.1 Requirements

Per section 15.247(c), the spurious emissions in any 100 kHz BW outside the frequency band must be at least 20dB below the highest 100 kHz BW level measured within the band.

5.1.3.2 Procedures

The antenna port of the EUT was connected to the spectrum analyzer through 40dB of attenuation. The resolution bandwidth (RBW) was set to 100kHz. The peak detector and 'Max-Hold' function were engaged. The emissions in the frequency range from 30MHz to 25GHz were observed and plotted separately with the EUT transmitting at low, middle and high channels.

5.1.3.3 Results

The results of the antenna conducted emissions levels were plotted. These plots are presented on pages 24 through 35. These plots show that the spurious emissions were at least 20 dB below the level of the fundamental.

5.1.4 Radiated Spurious Emissions Measurements

5.1.4.1 Requirements

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

5.1.4.2 Procedures

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

Preliminary radiated emissions tests were performed to determine the emission characteristics of the 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.

1) 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. The EUT was placed on an 80cm high non-conductive stand. 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. The EUT was placed on a 1.5 meter high non-conductive stand. 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.

5.1.4.3 Results

Preliminary radiated emissions plots with the EUT transmitting at Low Frequency, Middle Frequency, and High Frequency are shown on pages 36 through 59. Final radiated emissions data are presented on data pages 60 through 65. 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 Figures 3 through 6.

5.1.5 Band Edge Compliance

5.1.5.1 Requirements

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).

5.1.5.2 Procedures

5.1.5.2.1 Low Band Edge

1) The antenna port of the EUT was connected to the spectrum analyzer through 40dB of attenuation.
2) The EUT was set to transmit continuously at the channel closest to the low band-edge.
3) To determine the band edge 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.

5.1.5.2.2 High Band Edge

1) The EUT was set to transmit continuously at the channel closest to the high band-edge.
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.

5.1.5.3 Results

Pages 66 through 68show the band-edge compliance results. As can be seen from these plots, the conducted 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.

5.1.6 Power Spectral Density

5.1.6.1 Requirement

Per section 15.247(e), 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.

5.1.6.2 Procedures

1) The antenna port of the EUT was connected to the spectrum analyzer through a 40dB pad.
2) The EUT was then placed in the normal operation mode (for DTS devices)
3) To determine the power spectral density, the following spectrum analyzer settings were used:
    a. Center frequency = transmit frequency
    b. Span = 1.5 times the DTS (6 dB) bandwidth
    c. Resolution bandwidth (RBW): 3kHz ≤ RBW ≤ 100kHz
    d. Sweep time = auto
    e. The peak detector and 'Max-Hold' function was engaged.
    f. The display line represents the 8 dBm limit
    g. The analyzer's display was plotted using a 'screen dump' utility.

4) If measured value exceeds limit, reduce RBW (no less than 3kHz) and repeat.

5.1.6.3 Results

Pages 69 through 71 show 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. CONCLUSIONS

It was determined that The Chamber Manufacturing Group BLE Transmitter, Part No. TM100 & TM110 digital modulation transmitter, did fully meet the conducted and radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Sections 15.107 and 15.109 for receivers and 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 Chamber Manufacturing Group BLE Transmitter, Part No. TM100 & TM110 digital modulation transmitter, did fully meet the conducted and radiated RF emission requirements of the Industry Canada Radio Standards Specification, RSS-Gen, Section 8.8 and Section 7.1.2 for receivers and the Industry Canada Radio Standards Specification RSS-Gen Section 8.8 and Radio Standards Specification RSS-247 for transmitters, when tested per ANSI C63.4-2014.

7. CERTIFICATION

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

The data presented in this test report pertains to the EUT at the test date. 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.

8. ENDORSEMENT DISCLAIMER

This report must not be used to claim product certification, approval, or endorsement by A2LA, 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
APW11	PREAMPLIFIER	PMI	PE2-35-120-5R0-10-12-SFF	PL11685/1241	1GHZ-20GHZ	4/18/2016	4/18/2017
CDX8	COMPUTER	ELITE	WORKSTATION			N/A	
MPW0	POWER METER	KEYSIGHT	8990B	MY51000388		2/5/2016	2/5/2017
NHG1	STANDARD GAIN HORN ANTENNA	NARDA	638	---	18-26.5GHZ	NOTE 1	
NTA2	BILOG ANTENNA	TESEQ	6112D	28040	25-1000MHz	10/27/2015	10/27/2016
NTA3	BILOG ANTENNA	TESEQ	6112D	32853	25-1000MHz	3/23/2016	3/23/2017
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	4/4/2016	4/4/2018
NWQ2	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66659	1GHZ-18GHZ	3/2/2016	3/2/2018
RAKG	RF SECTION	HEWLETT PACKARD	85462A	3549A00284	0.009-6500MHZ	2/22/2016	2/22/2017
RAKH	RF FILTER SECTION	HEWLETT PACKARD	85460A	3448A00324	---	2/22/2016	2/22/2017
RBA1	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB26	100146	20HZ-26.5GHZ	2/12/2016	2/12/2017
RBB0	EMI TEST RECEIVER 20HZ TO 40 GHZ.	ROHDE & SCHWARZ	ESIB40	100250	20 HZ TO 40GHZ	2/16/2016	2/16/2017
T1P0	10dB ATTENUATOR (40GHz)	WEINSCHEL	89-10-12	254	DC-40GHz	3/3/2016	3/3/2018
T2D5	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-43	AY9244	DC-18GHZ	7/7/2016	7/7/2018
T2DE	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-34	BN1032	DC-18GHZ	10/19/2015	10/19/2016
T2Q1	20DB/20W ATTENUATOR	AEROFLEX/WEINSCHEL	89-20-21	335	DC-40GHZ	8/20/2015	8/20/2017
WKA1	SOFTWARE, UNIVERSAL RCV EMI	ELITE	UNIV_RCV_EMI	1	---	I/O	
WQC0	HF_8546A						
XOB2	ADAPTER	HEWLETT PACKARD	K281C,012	09407	18-26.5GHZ	NOTE 1	
XPR0	HIGH PASS FILTER	K&L MICROWAVE	11SH10-4800/X20000	001	4.8-20GHZ	9/22/2015	9/22/2016

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.

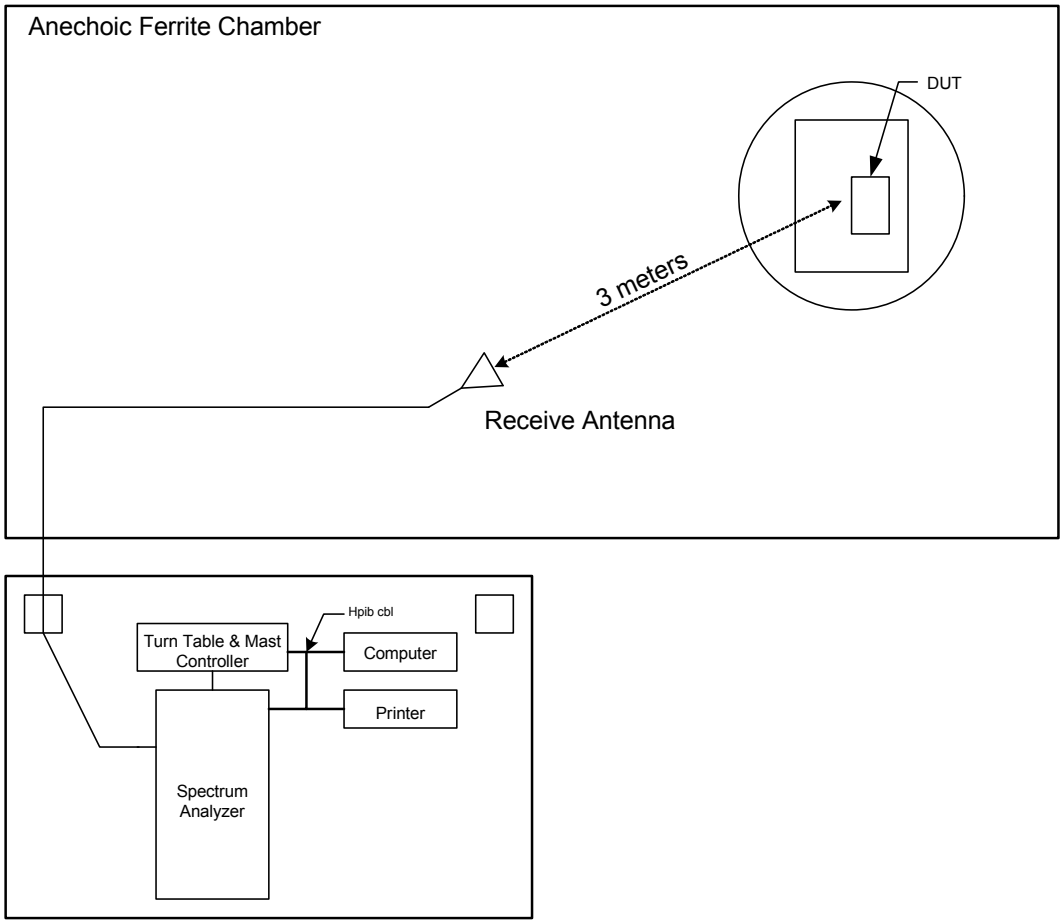


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

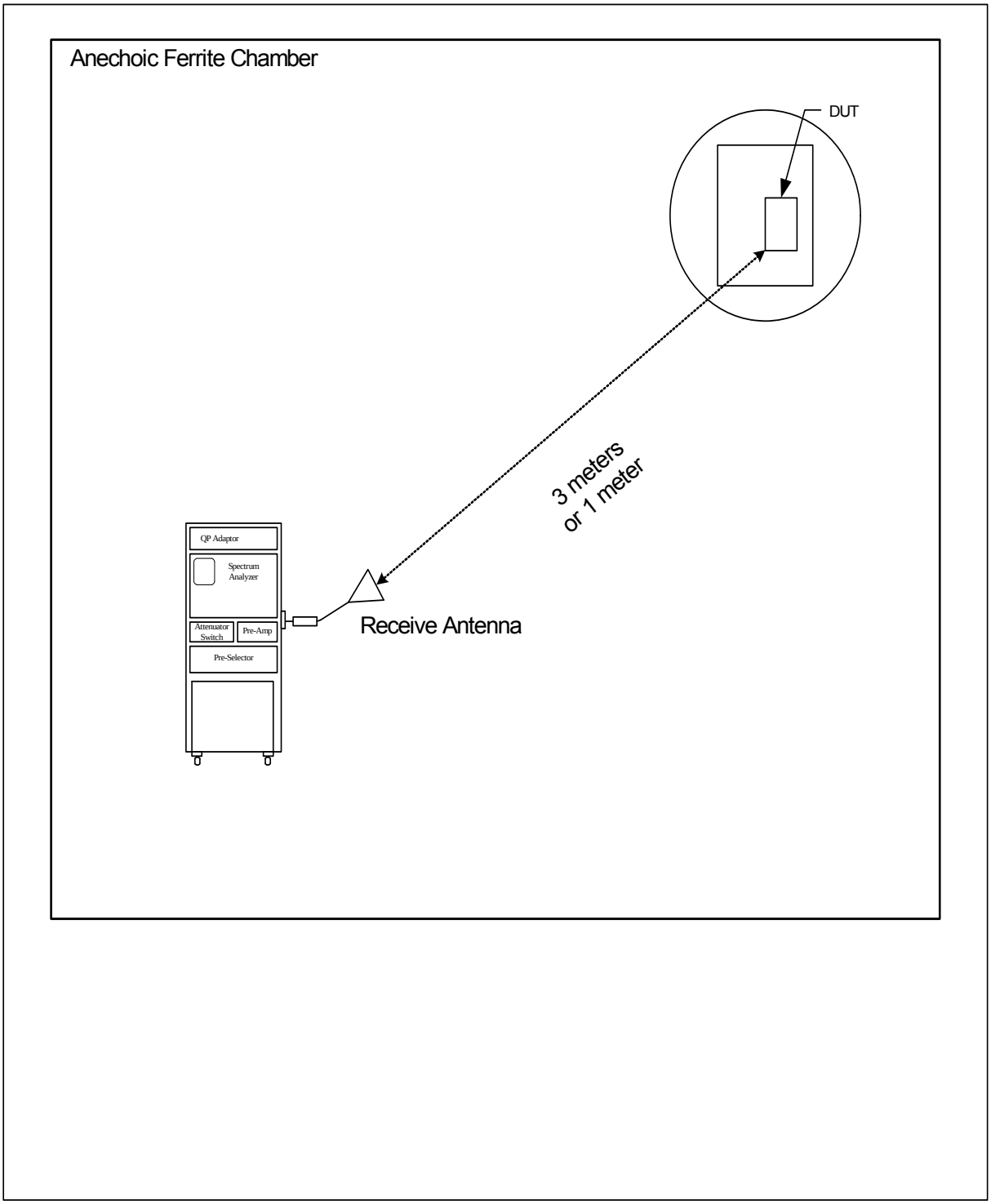
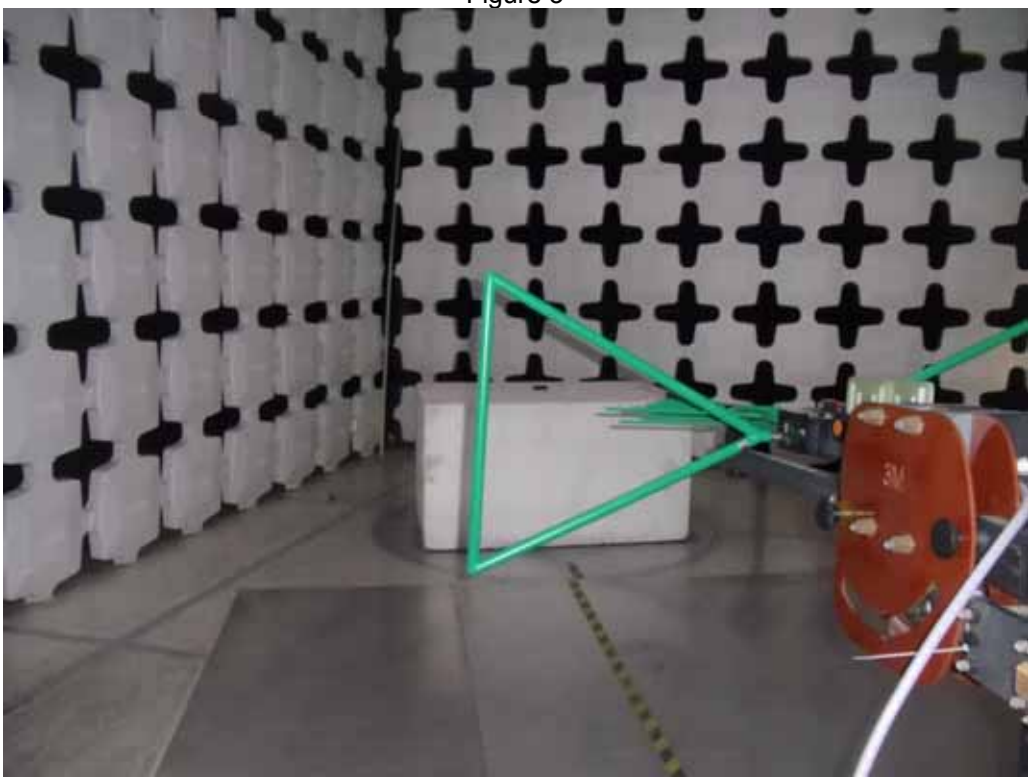


Figure 2: BLOCK DIAGRAM OF TEST SETUP FOR RADIATED EMISSIONS ABOVE 18GHZ

Figure 3



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

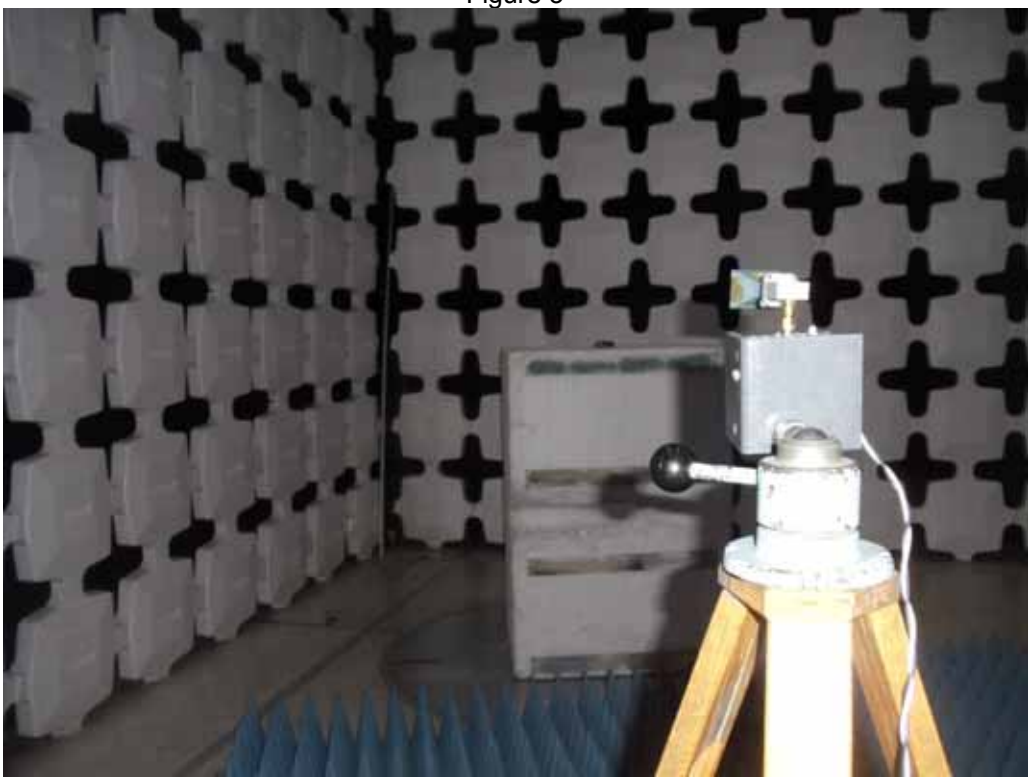
Test Setup for Radiated Emissions – 30MHz to 1GHz, Vertical Polarization

Figure 4

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

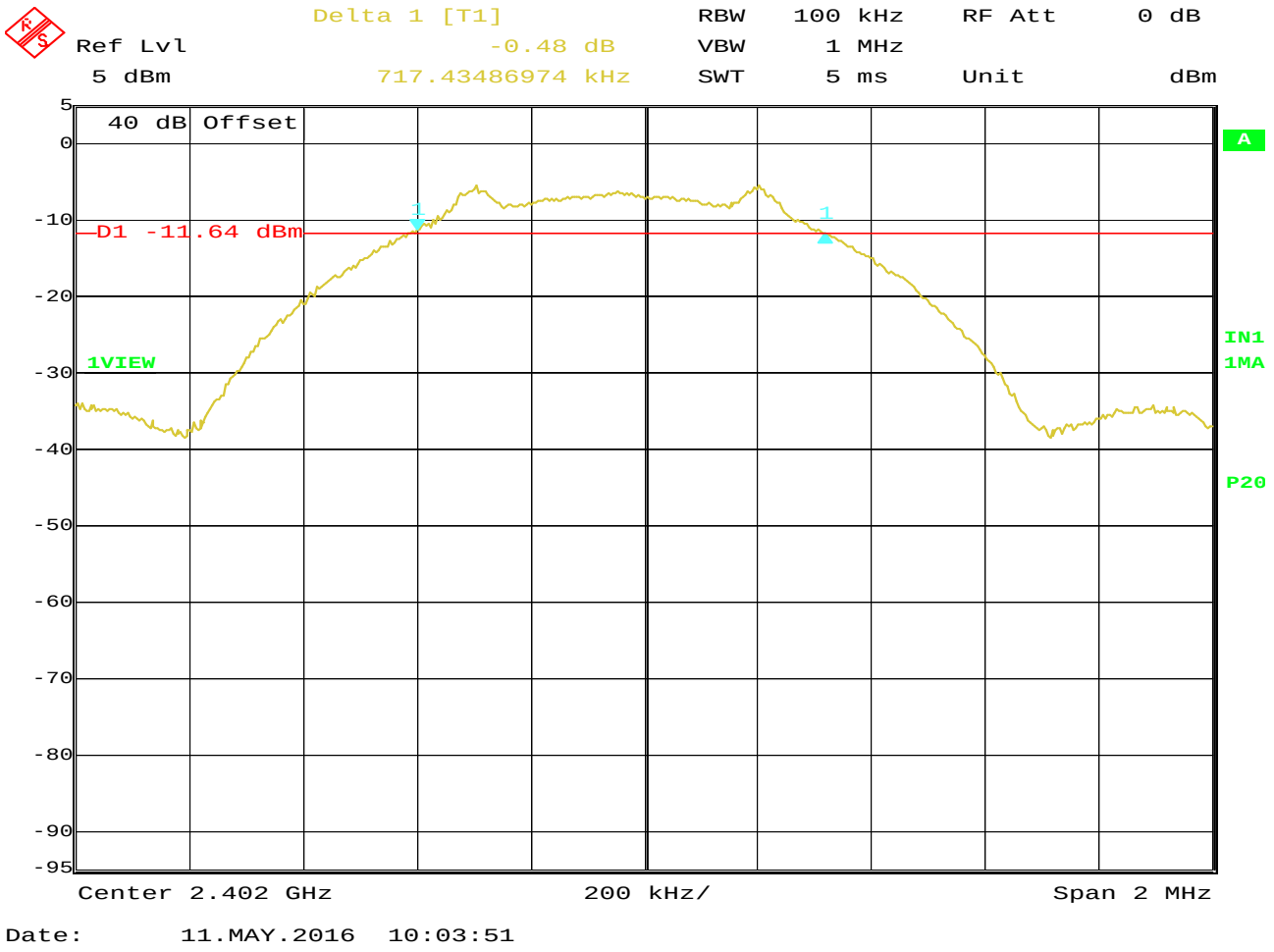
Test Setup for Radiated Emissions – 1GHz to 18GHz, Vertical Polarization

Figure 5



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

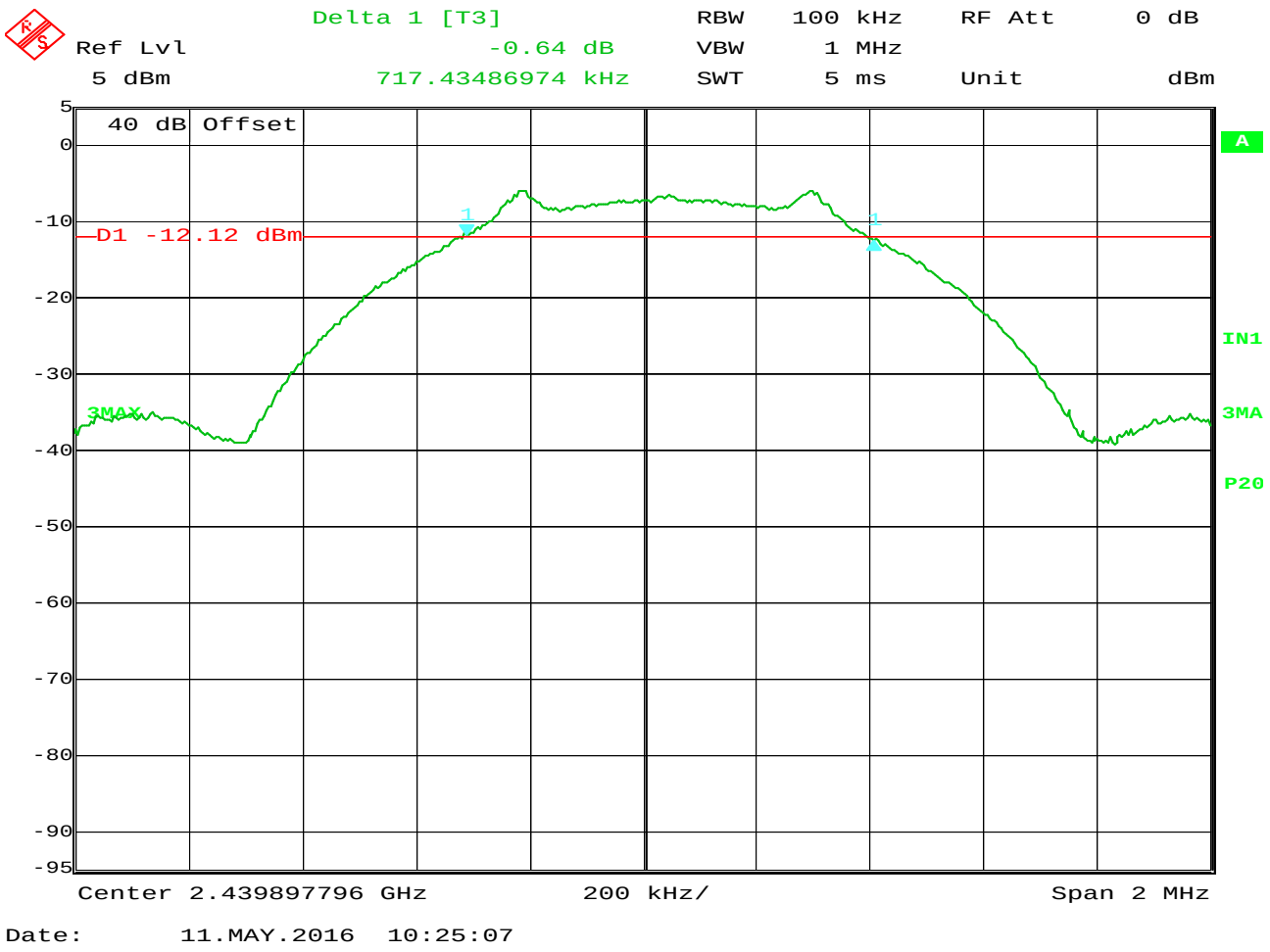
Test Setup for Radiated Emissions – 18GHz to 25GHz, Vertical Polarization



FCC 15C 15.247 / DTS Bandwidth

MANUFACTURER : The Chamberlain Group
MODEL NUMBER : TM100 & TM110
TEST MODE : Tx @ 2402MHz
: Peak detector
NOTES : DTS (6dB) BW = 717.43 kHz

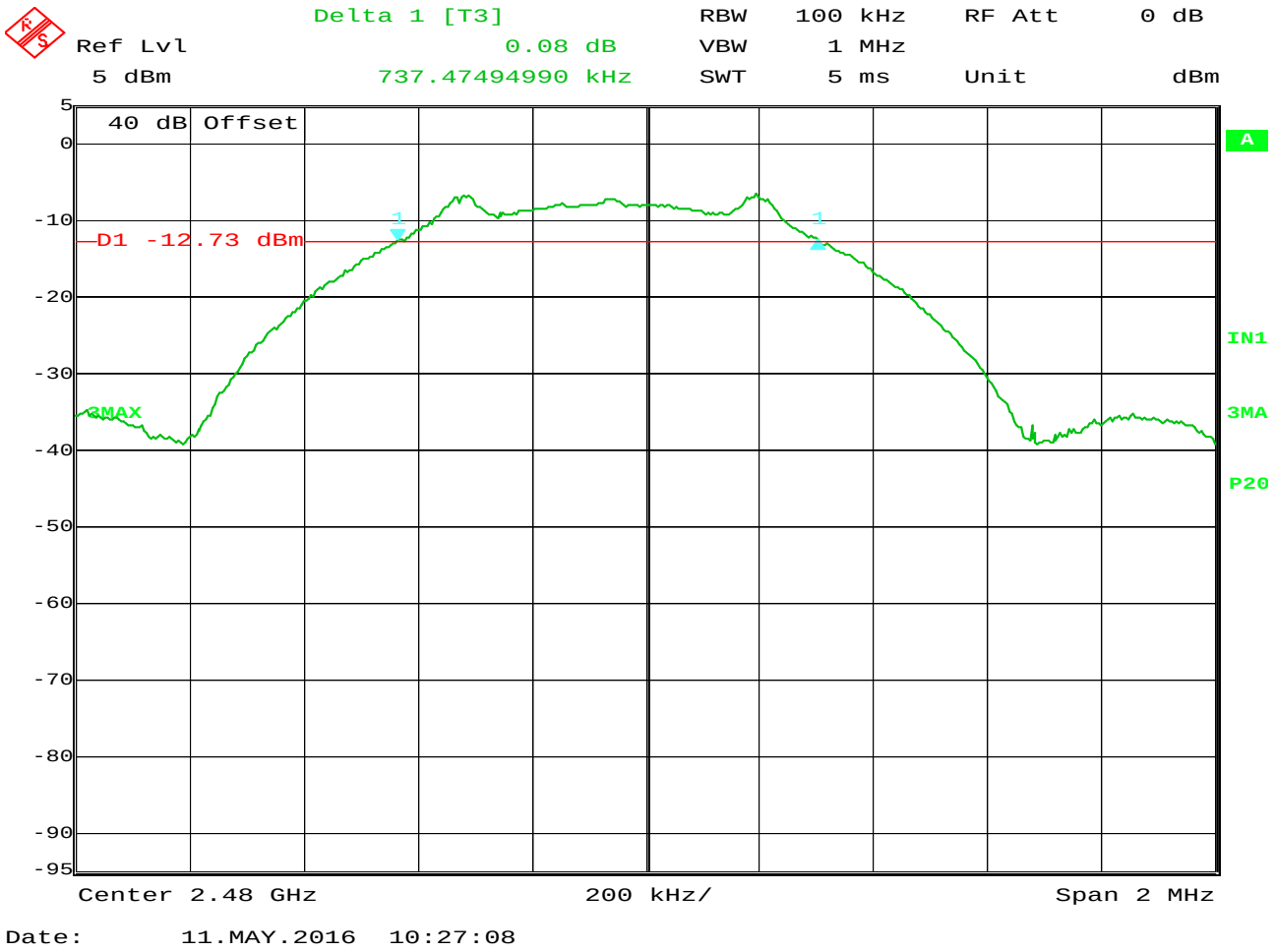
NOTES



FCC 15C 15.247 / DTS Bandwidth

MANUFACTURER : The Chamberlain Group
MODEL NUMBER : TM100 & TM110
TEST MODE : Tx @ 2439MHz
: Peak detector
NOTES : DTS (6dB) BW = 717.43 kHz

NOTES



FCC 15C 15.247 / DTS Bandwidth

MANUFACTURER : The Chamberlain Group
MODEL NUMBER : TM100 & TM110
TEST MODE : Tx @ 2480MHz
: Peak detector
NOTES : DTS (6dB) BW = 717.43 kHz

NOTES

Manufacturer : The Chamber Manufacturing Group
Test Item : BLE Transmitter
Model No. : TM100 & TM110
Mode : Transmitting
Test Specification : FCC-15.247, RSS-247 Peak Output Power
Date : June , 2016
Notes :

Frequency (MHz)	Meter Reading (dBm)	Total Loss (Watts)	Limit (dBm)	Limit (Watts)
2402.00	-5.64	0.000273	30	1
2440.00	-6.12	0.000224	30	1
2480.00	-6.73	0.000212	30	1

Checked BY Richard E. King :

Richard E. King

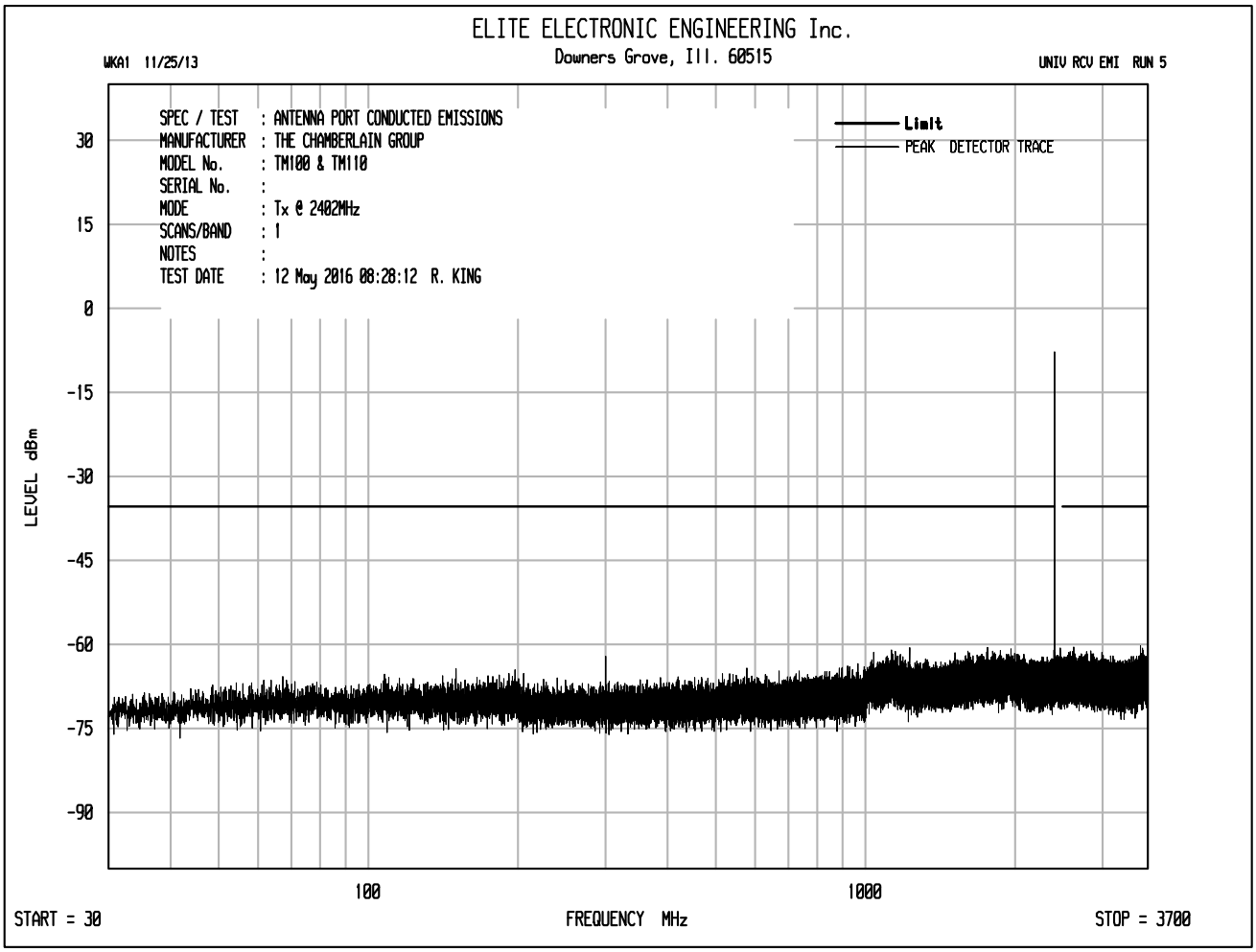
Manufacturer : The Chamber Manufacturing Group
Model Number : BLE Transmitter - BLE
Specification : FCC-15.247 Effective Isotropic Radiated Power (EIRP)
Date : May 12, 2016
Notes : Test Distance is 3 meters

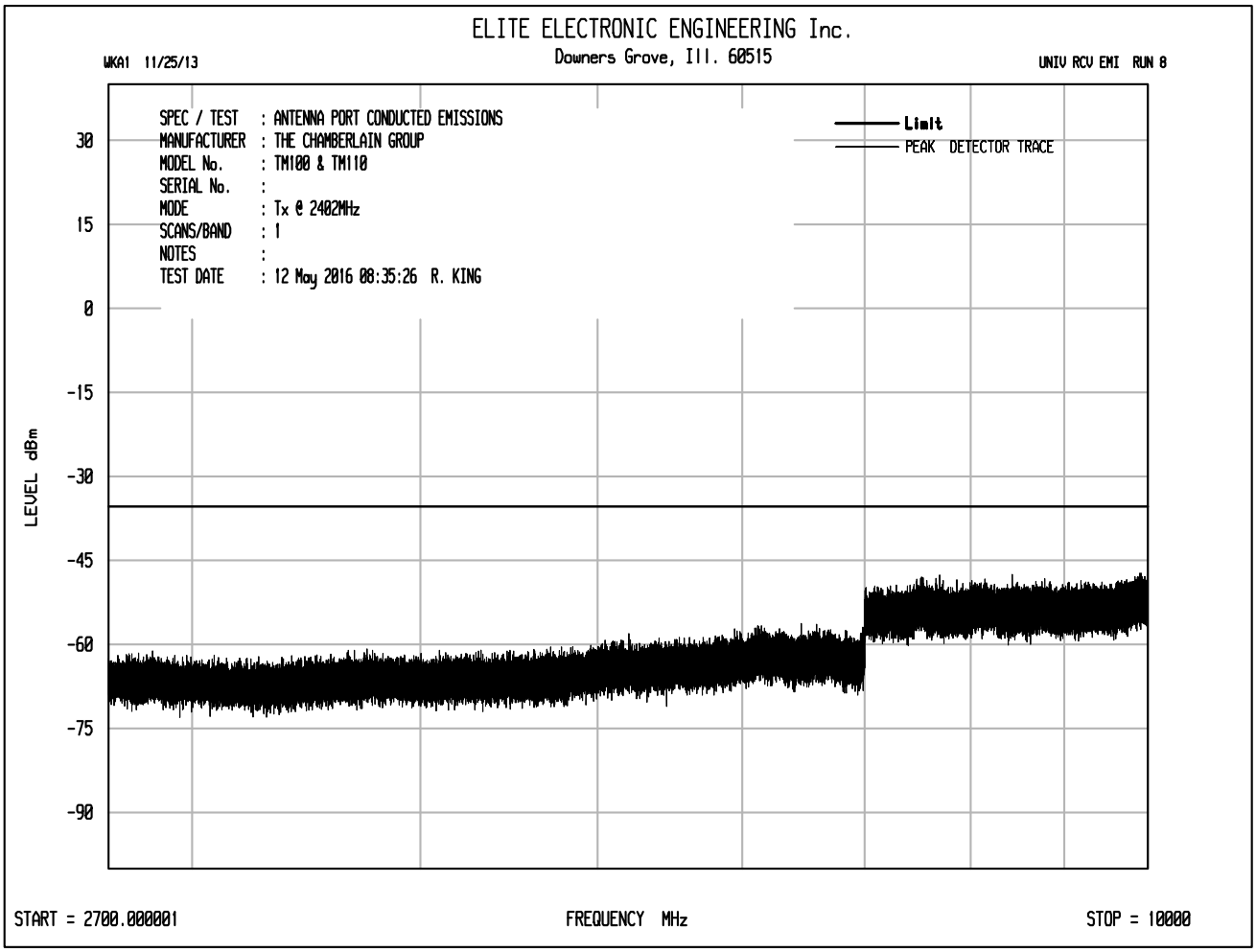
Freq (MHz)	Ant Pol	Meter Reading (dBuV)	Matched SIG. GEN. (dBm)	Equivalent Ant Gain (dB)	Cable Loss (dB)	EIRP Total (dBm)	Limit dBm
2402.00	H	58.8	-2.8	5.4	3.4	-0.8	36.0
2402.00	V	50.3	-10.9	5.4	3.4	-8.9	36.0
2440.00	H	56.2	-4.6	5.6	3.5	-2.5	36.0
2440.00	V	53.5	-7.8	5.6	3.5	-5.7	36.0
2480.00	H	54.6	-7.0	5.5	3.5	-5.0	36.0
2480.00	V	45.9	-13.4	5.5	3.5	-11.4	36.0

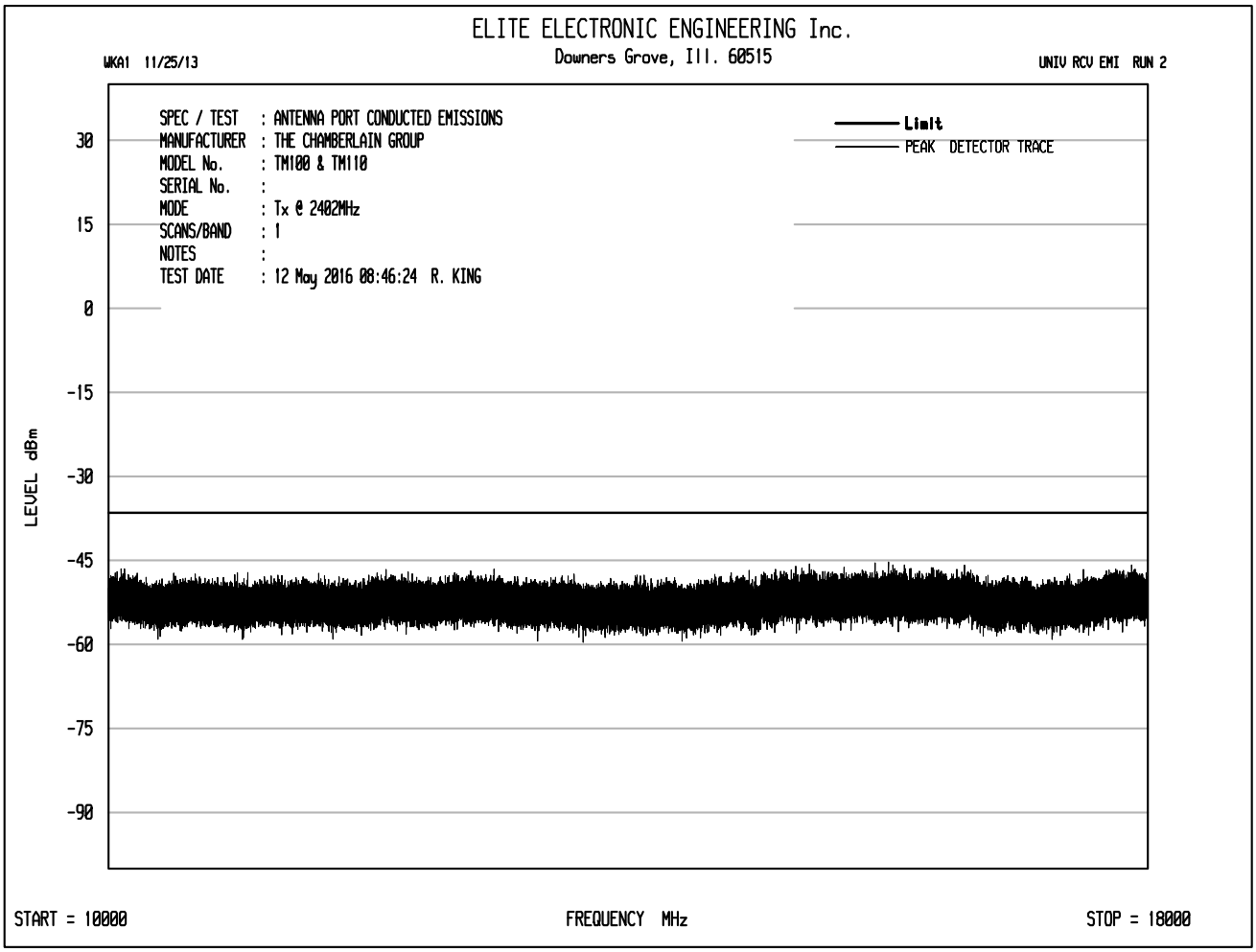
EIRP (dBm) = Matched Signal Generator (dBm) + Antenna Gain (dB) – Cable Loss (dB)

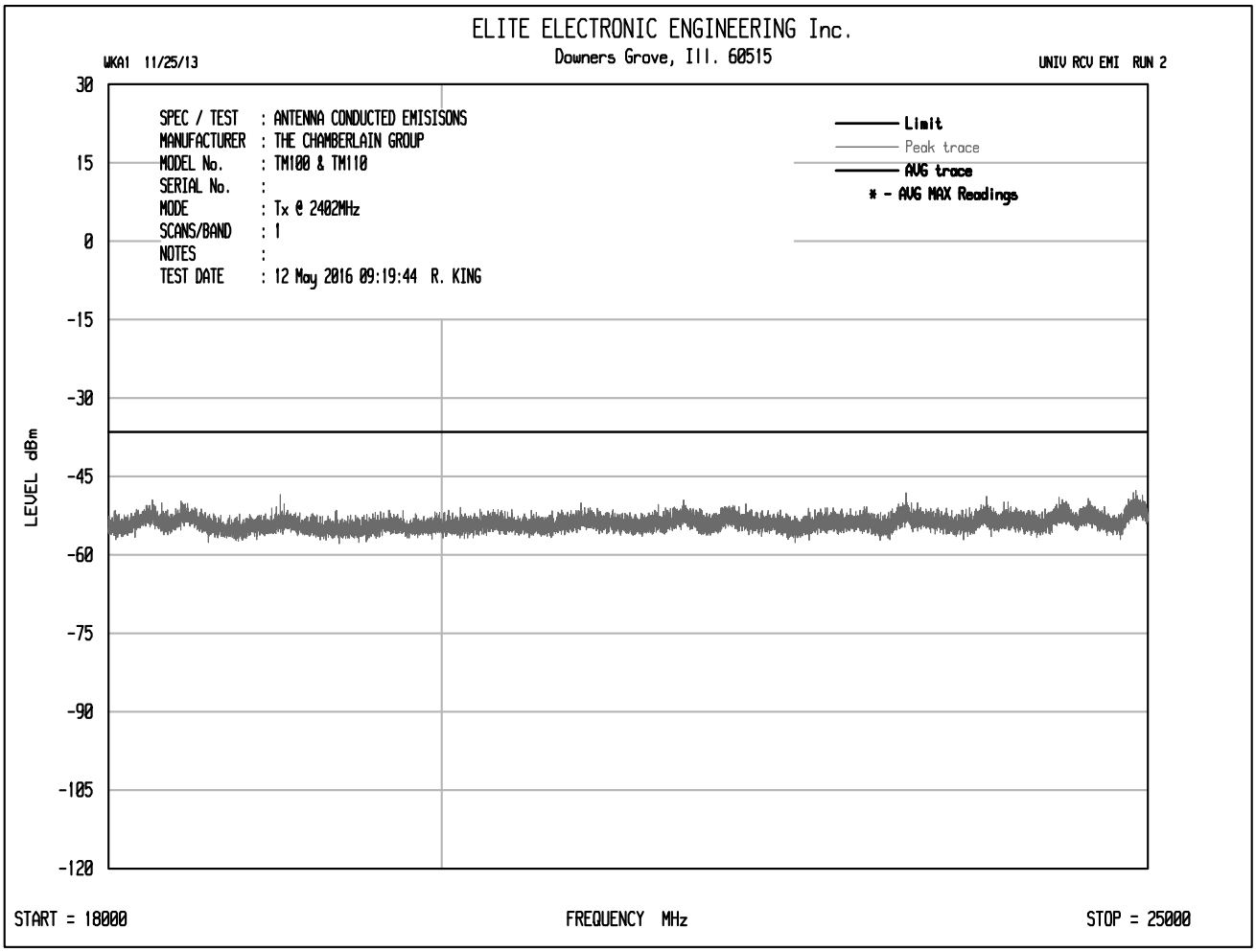
Checked BY Richard E. King :

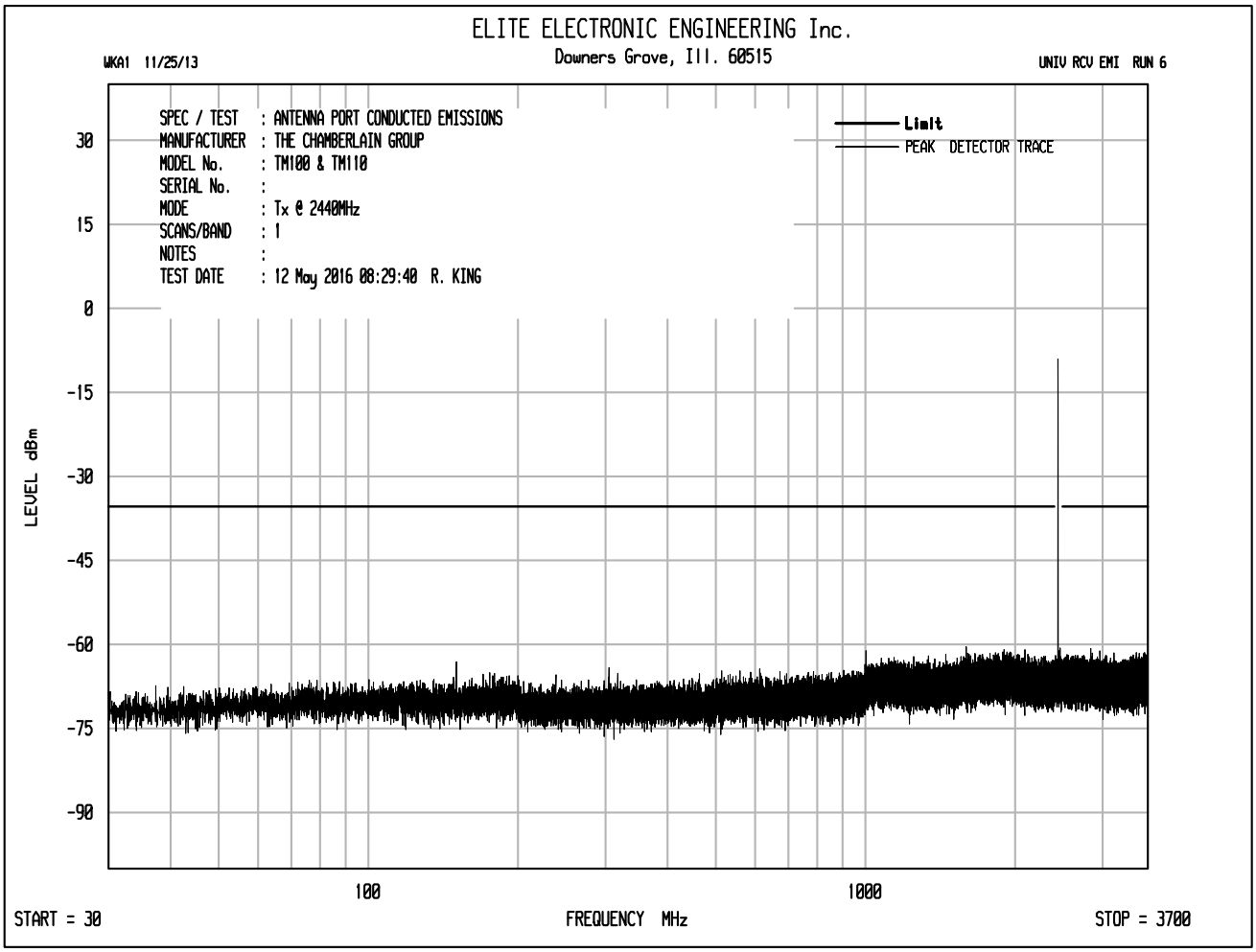
Richard E. King

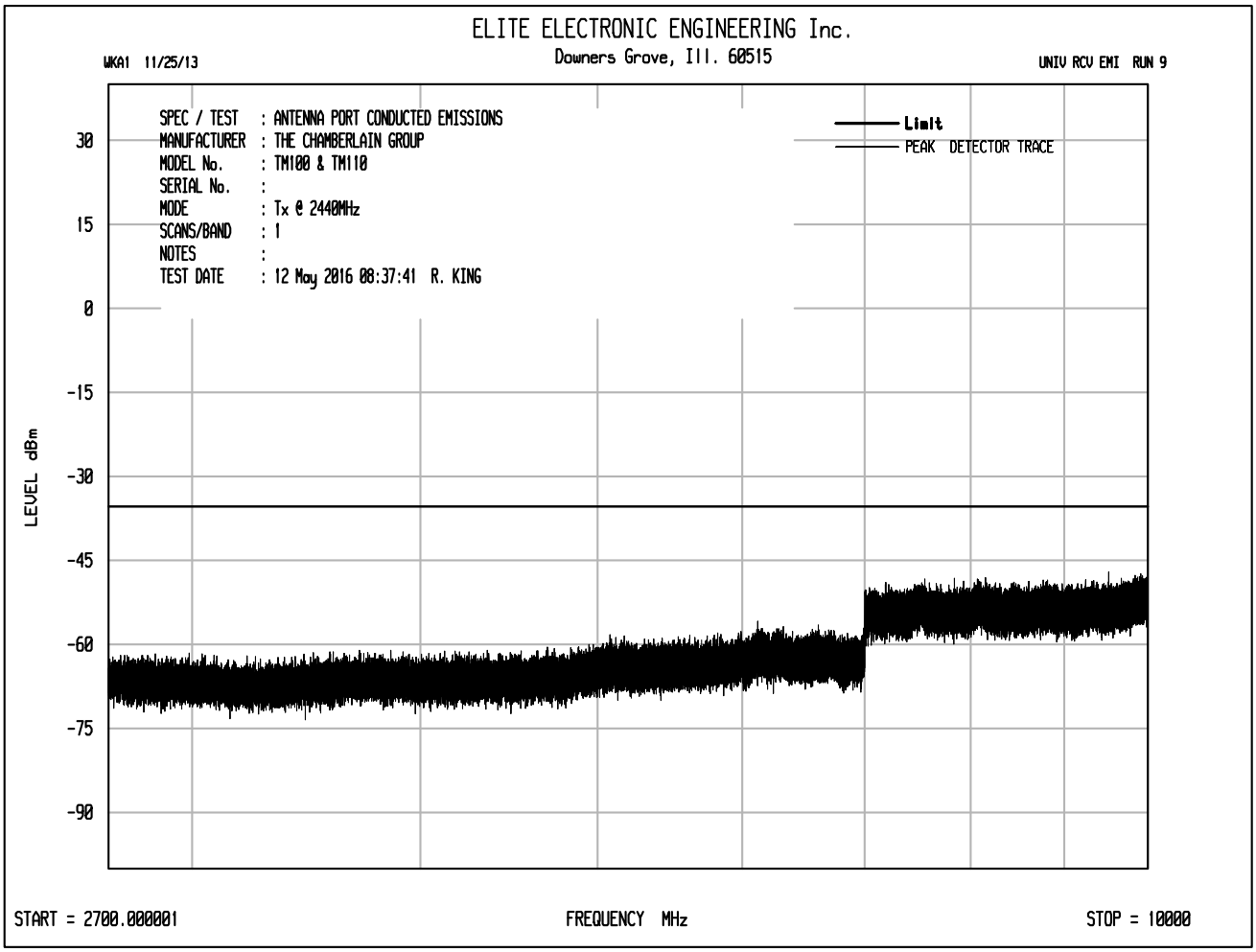

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 5
SPEC / TEST : ANTENNA PORT CONDUCTED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 12 May 2016 08:28:12 R. KING
Limit
PEAK DETECTOR TRACE
LEVEL dBm
30
15
0
-15
-30
-45
-60
-75
-90
100
1000
START = 30
FREQUENCY MHz
STOP = 3700

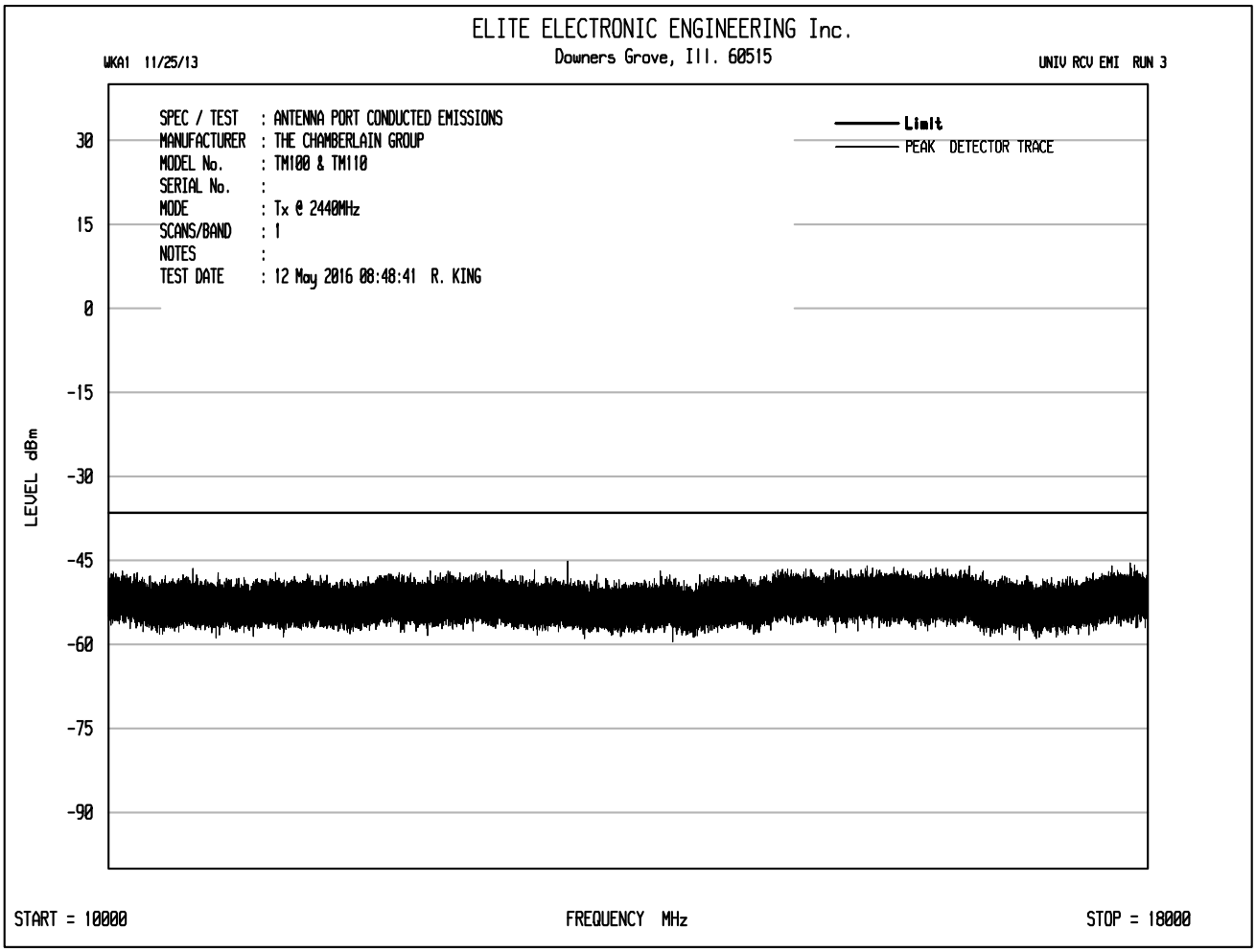

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 8
SPEC / TEST : ANTENNA PORT CONDUCTED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 12 May 2016 08:35:26 R. KING
Limit
PEAK DETECTOR TRACE
30
15
0
-15
-30
-45
-60
-75
-90
LEVEL dBm
START = 2700.000001
FREQUENCY MHz
STOP = 10000

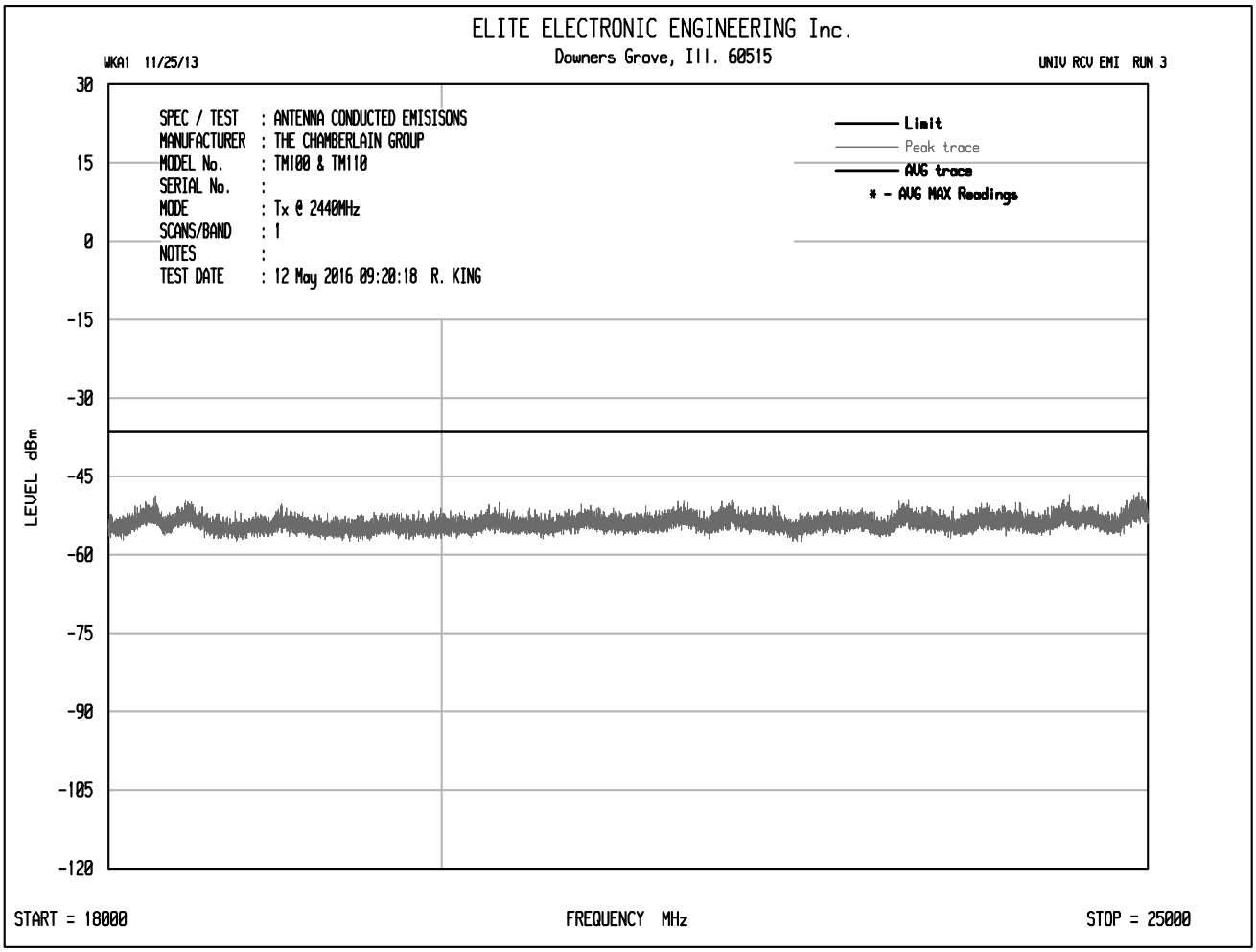

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : ANTENNA PORT CONDUCTED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 12 May 2016 08:46:24 R. KING
Limit
PEAK DETECTOR TRACE
30
15
0
-15
-30
-45
-60
-75
-90
LEVEL dBm
START = 10000
FREQUENCY MHz
STOP = 18000

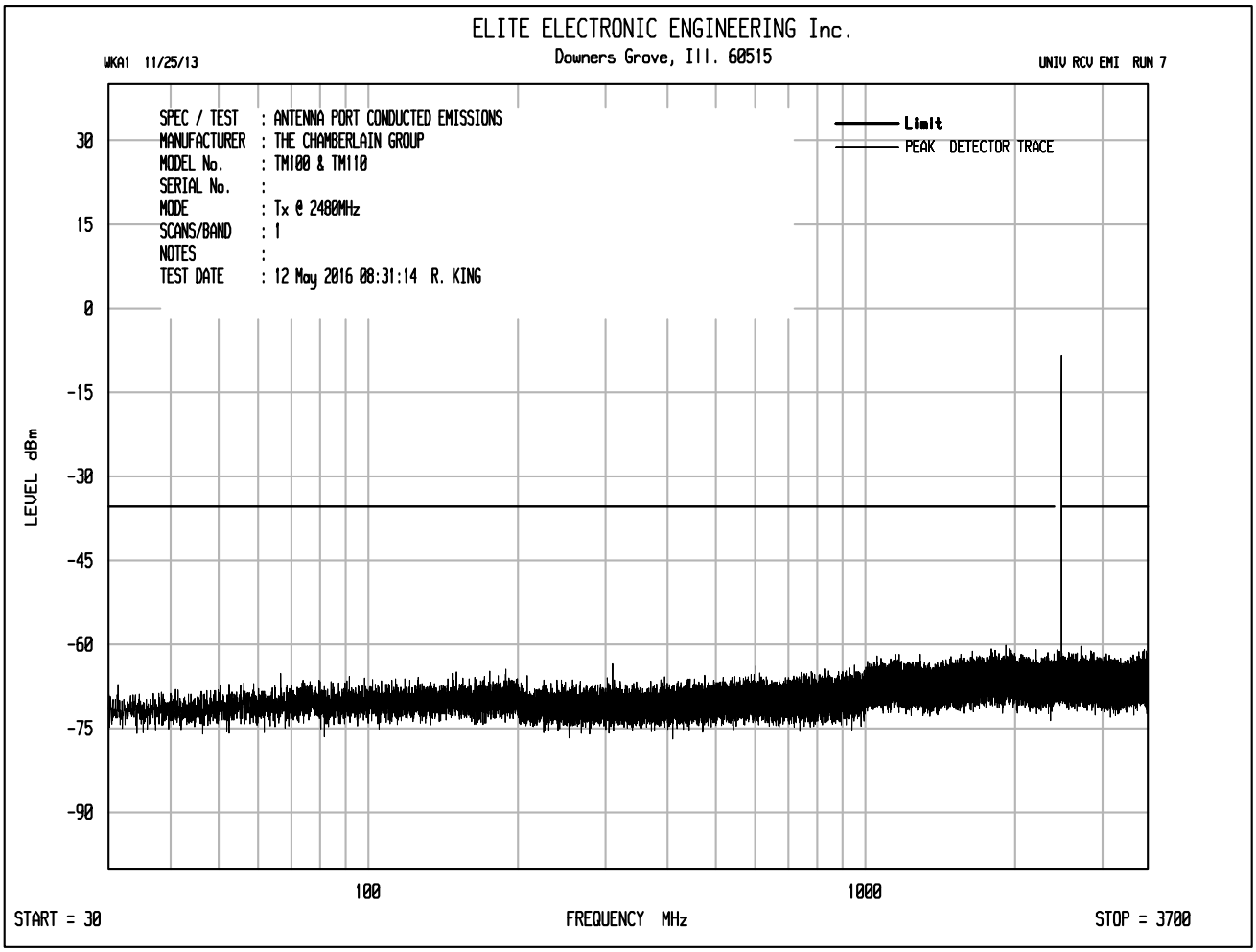

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : ANTENNA CONDUCTED EMISISONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 12 May 2016 09:19:44 R. KING
Limit
Peak trace
AVG trace
* - AVG MAX Readings
30
15
0
-15
-30
-45
-60
-75
-90
-105
-120
LEVEL dBm
START = 18000
FREQUENCY MHz
STOP = 25000

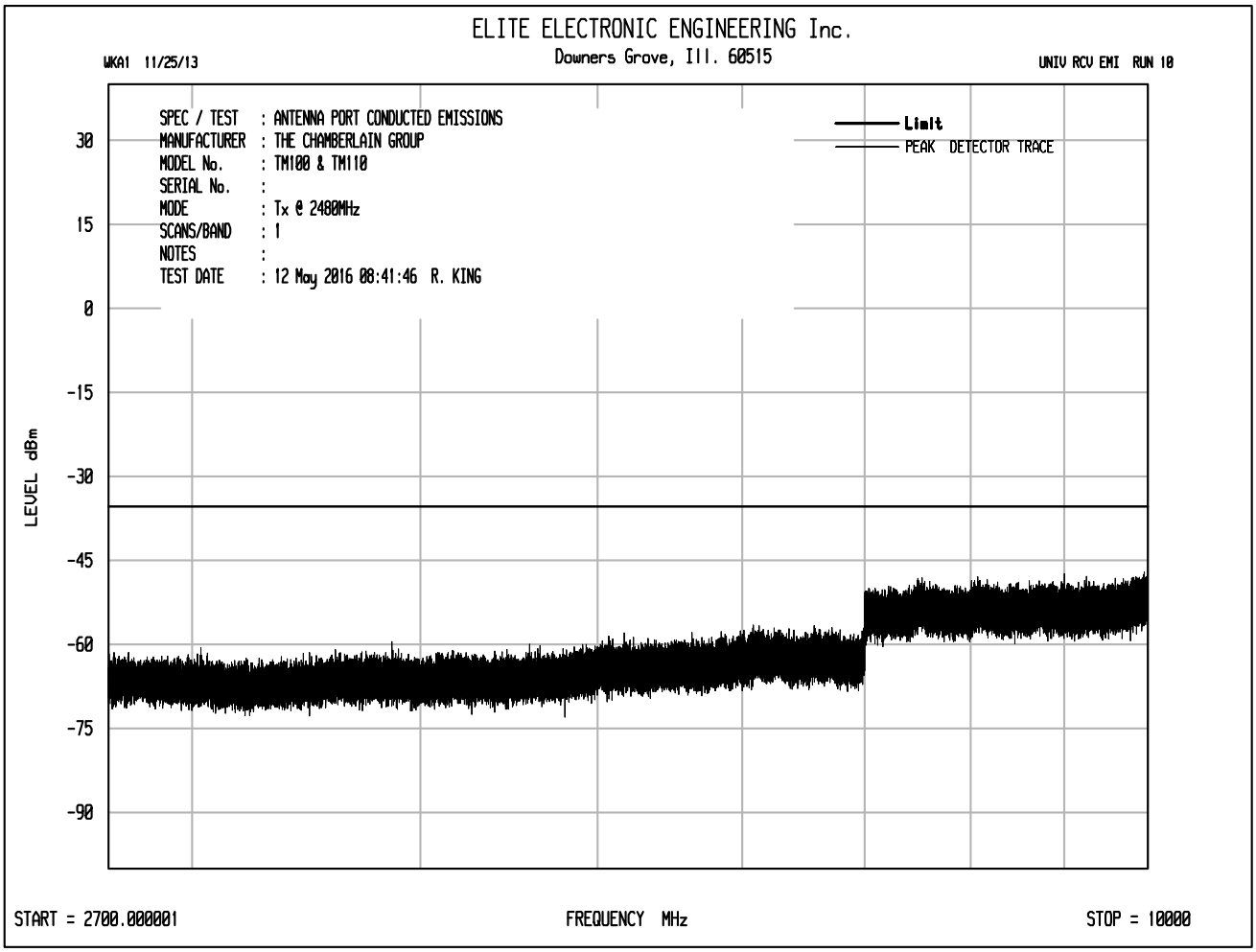

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 6
SPEC / TEST : ANTENNA PORT CONDUCTED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 12 May 2016 08:29:40 R. KING
Limit
PEAK DETECTOR TRACE
LEVEL dBm
30
15
0
-15
-30
-45
-60
-75
-90
100
1000
START = 30
FREQUENCY MHz
STOP = 3700

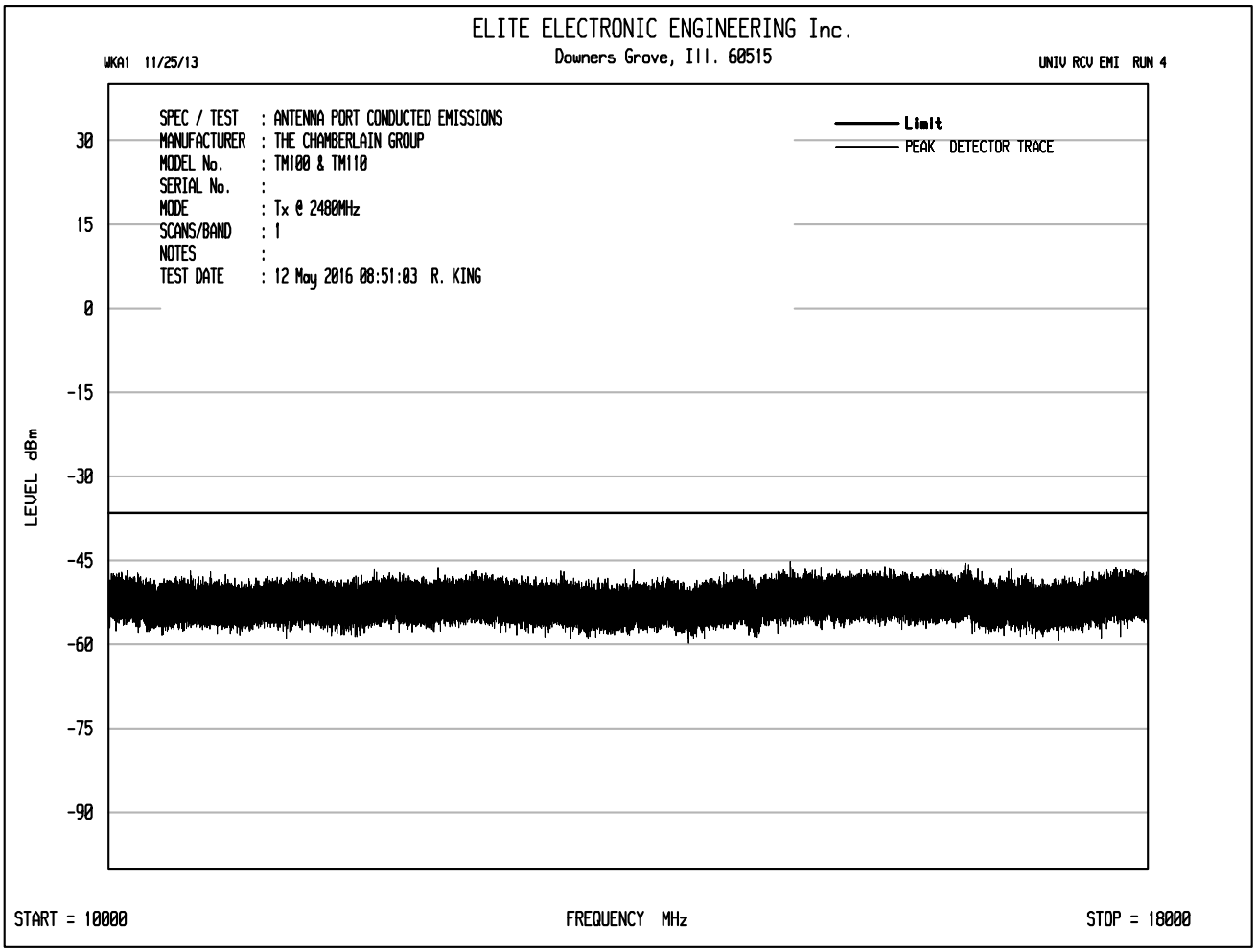

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 9
SPEC / TEST : ANTENNA PORT CONDUCTED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 12 May 2016 08:37:41 R. KING
Limit
PEAK DETECTOR TRACE
30
15
0
-15
-30
-45
-60
-75
-90
LEVEL dBm
START = 2700.000001
FREQUENCY MHz
STOP = 10000

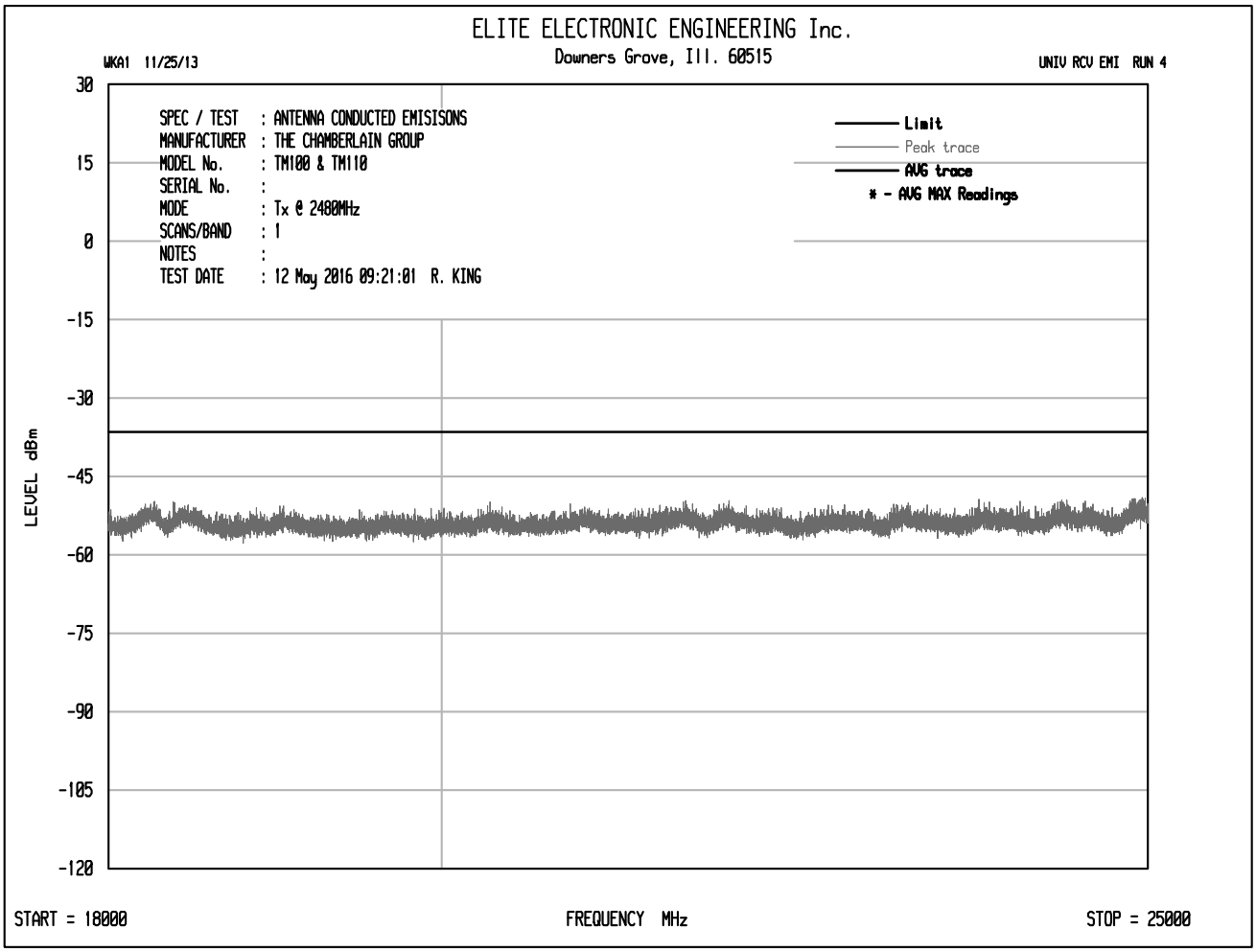

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : ANTENNA PORT CONDUCTED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 12 May 2016 08:48:41 R. KING
Limit
PEAK DETECTOR TRACE
30
15
0
-15
-30
-45
-60
-75
-90
LEVEL dBm
START = 10000
FREQUENCY MHz
STOP = 18000

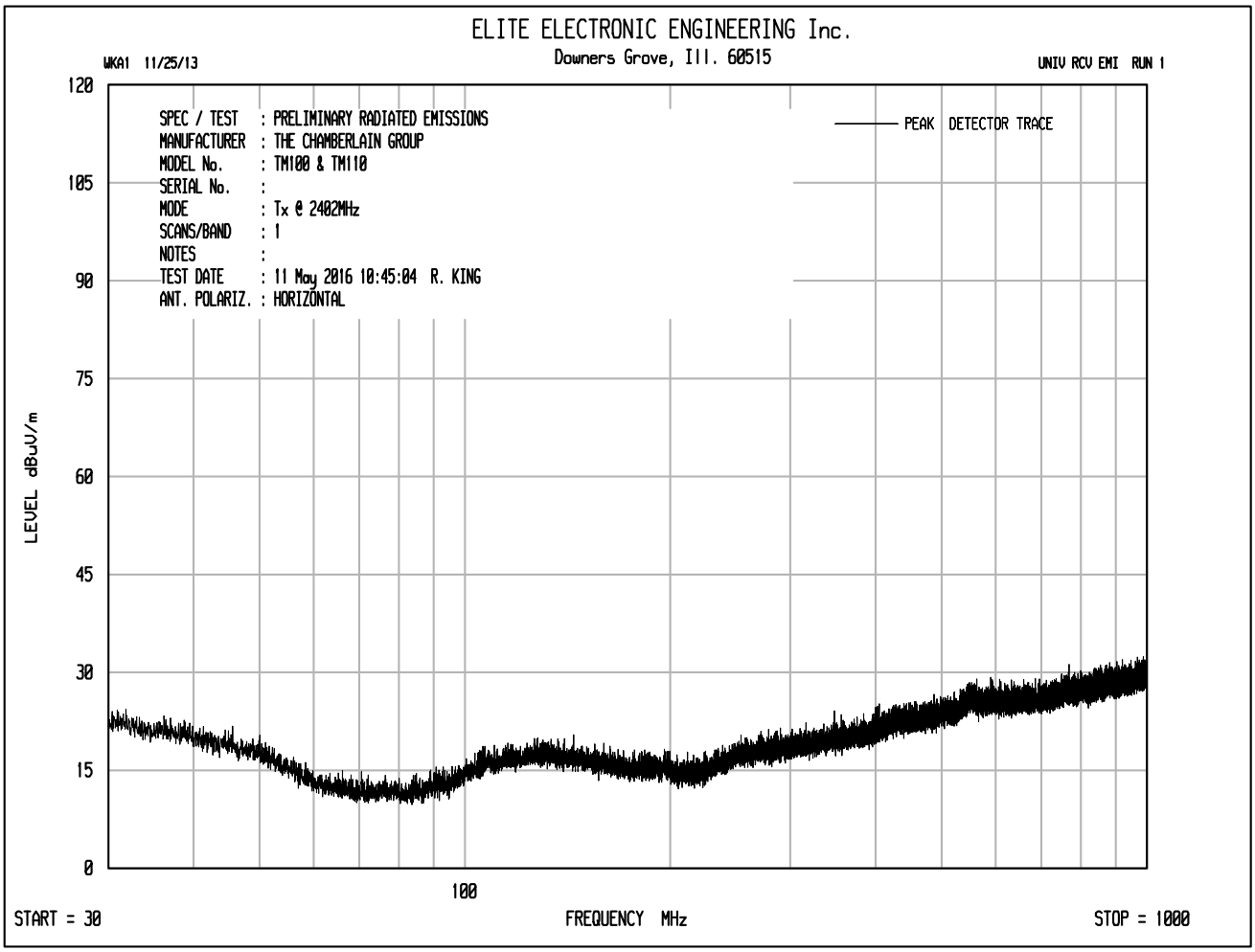

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : ANTENNA CONDUCTED EMISISONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 12 May 2016 09:20:18 R. KING
Limit
Peak trace
AVG trace
* - AVG MAX Readings
30
15
0
-15
-30
-45
-60
-75
-90
-105
-120
LEVEL dBm
START = 18000
FREQUENCY MHz
STOP = 25000

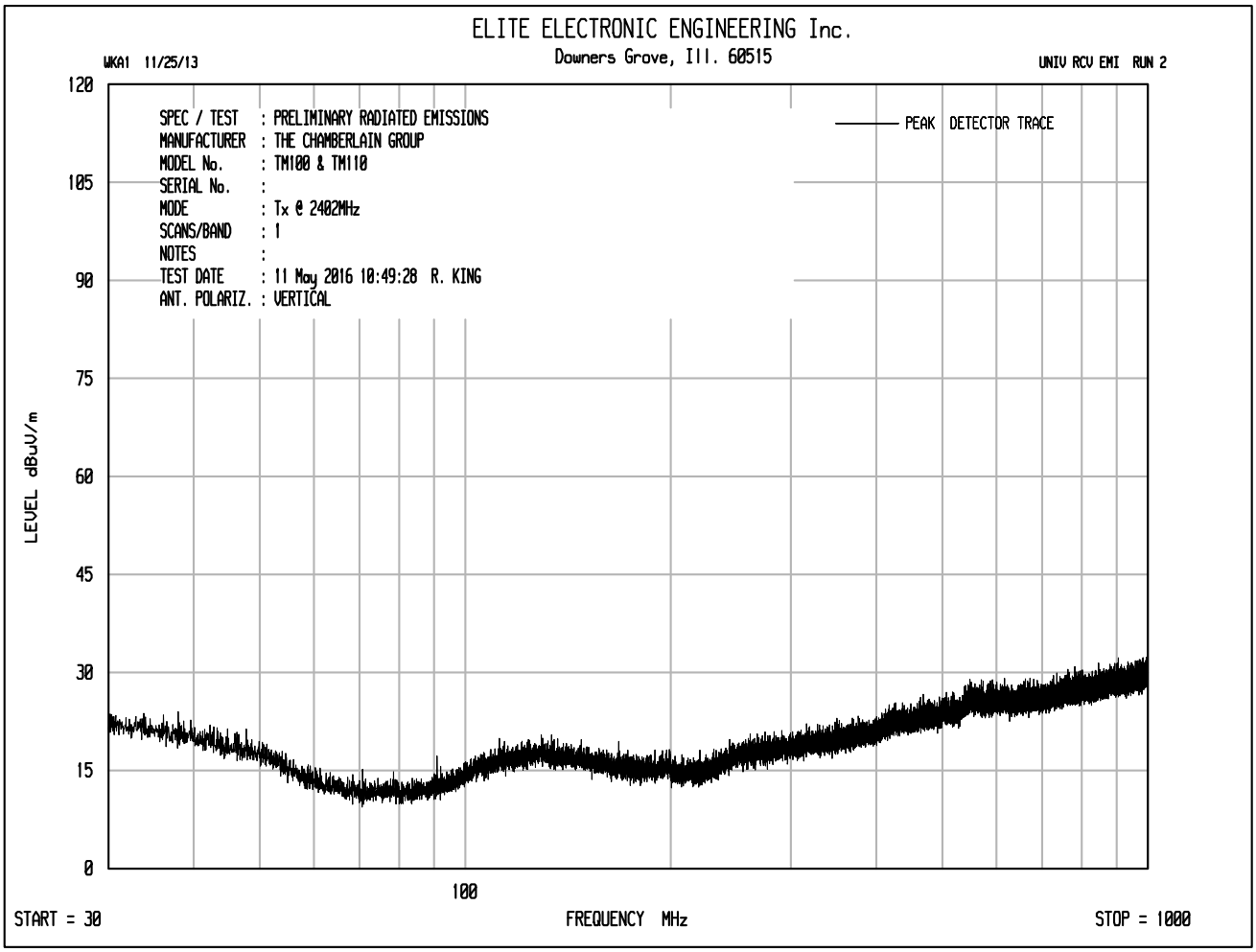

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 7
SPEC / TEST : ANTENNA PORT CONDUCTED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 12 May 2016 08:31:14 R. KING
Limit
PEAK DETECTOR TRACE
LEVEL dBm
30
15
0
-15
-30
-45
-60
-75
-90
100
1000
START = 30
FREQUENCY MHz
STOP = 3700

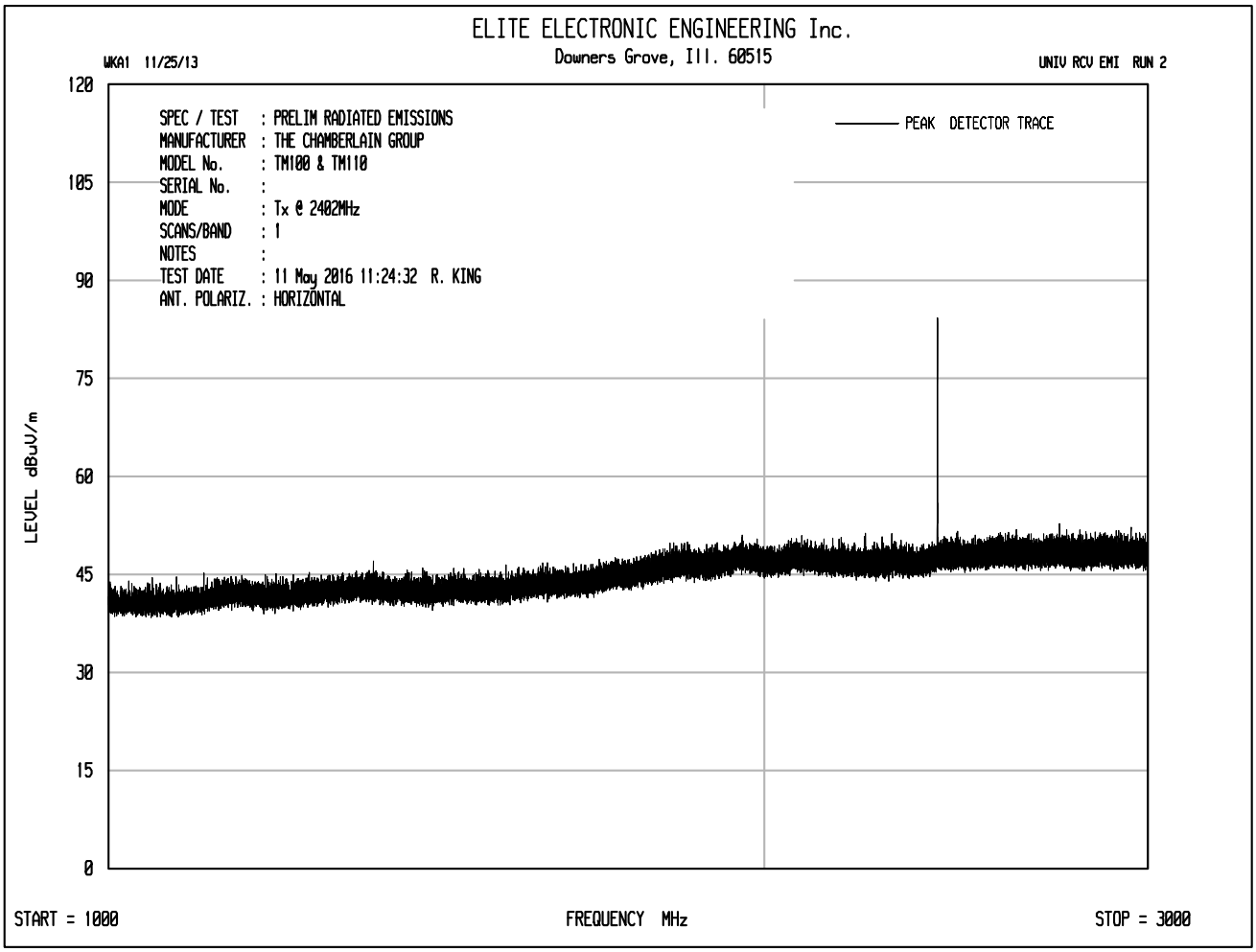

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 10
SPEC / TEST : ANTENNA PORT CONDUCTED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 12 May 2016 08:41:46 R. KING
Limit
PEAK DETECTOR TRACE
30
15
0
-15
-30
-45
-60
-75
-90
LEVEL dBm
START = 2700.000001
FREQUENCY MHz
STOP = 10000

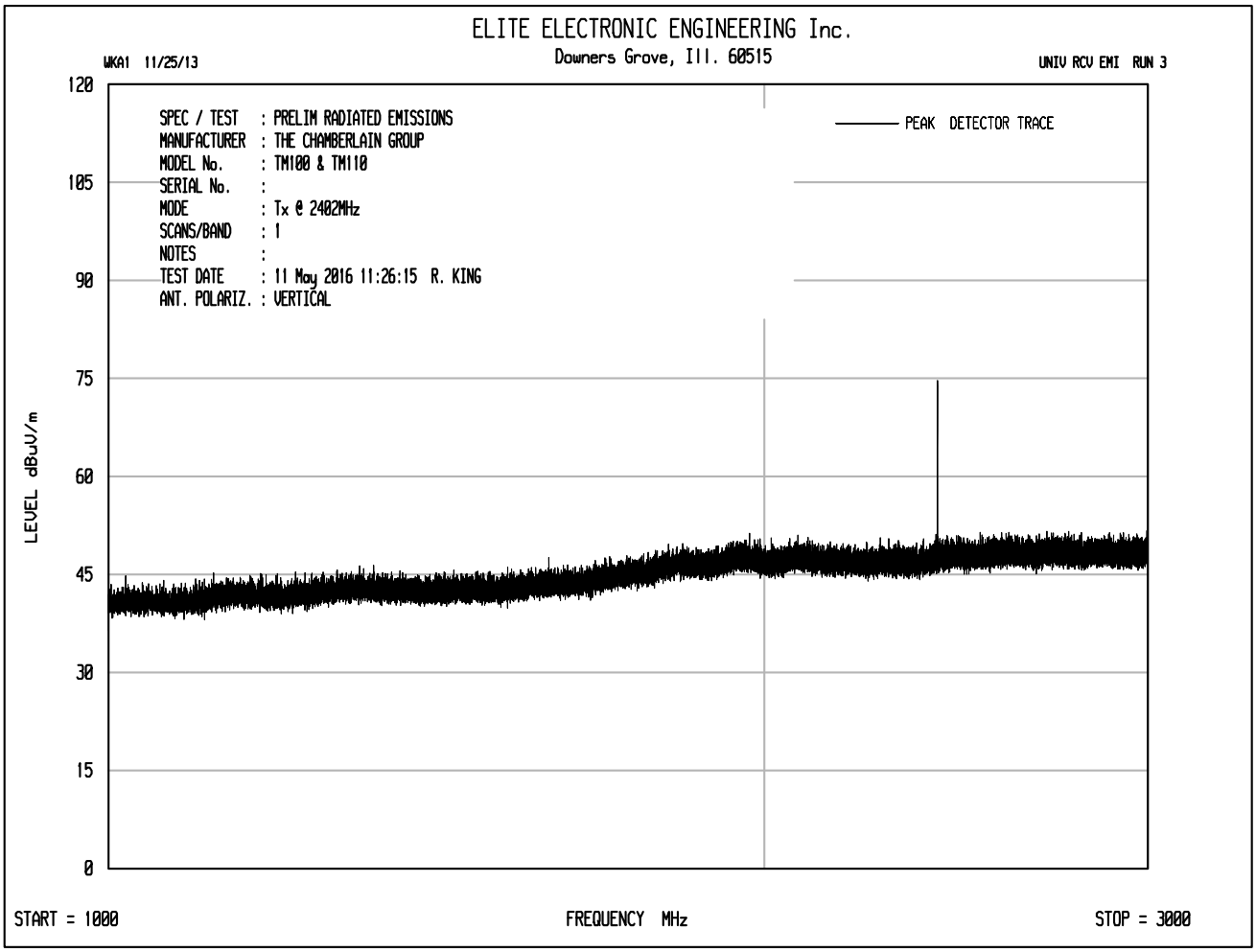

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : ANTENNA PORT CONDUCTED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 12 May 2016 08:51:03 R. KING
Limit
PEAK DETECTOR TRACE
LEVEL dBm
30
15
0
-15
-30
-45
-60
-75
-90
START = 10000
FREQUENCY MHz
STOP = 18000

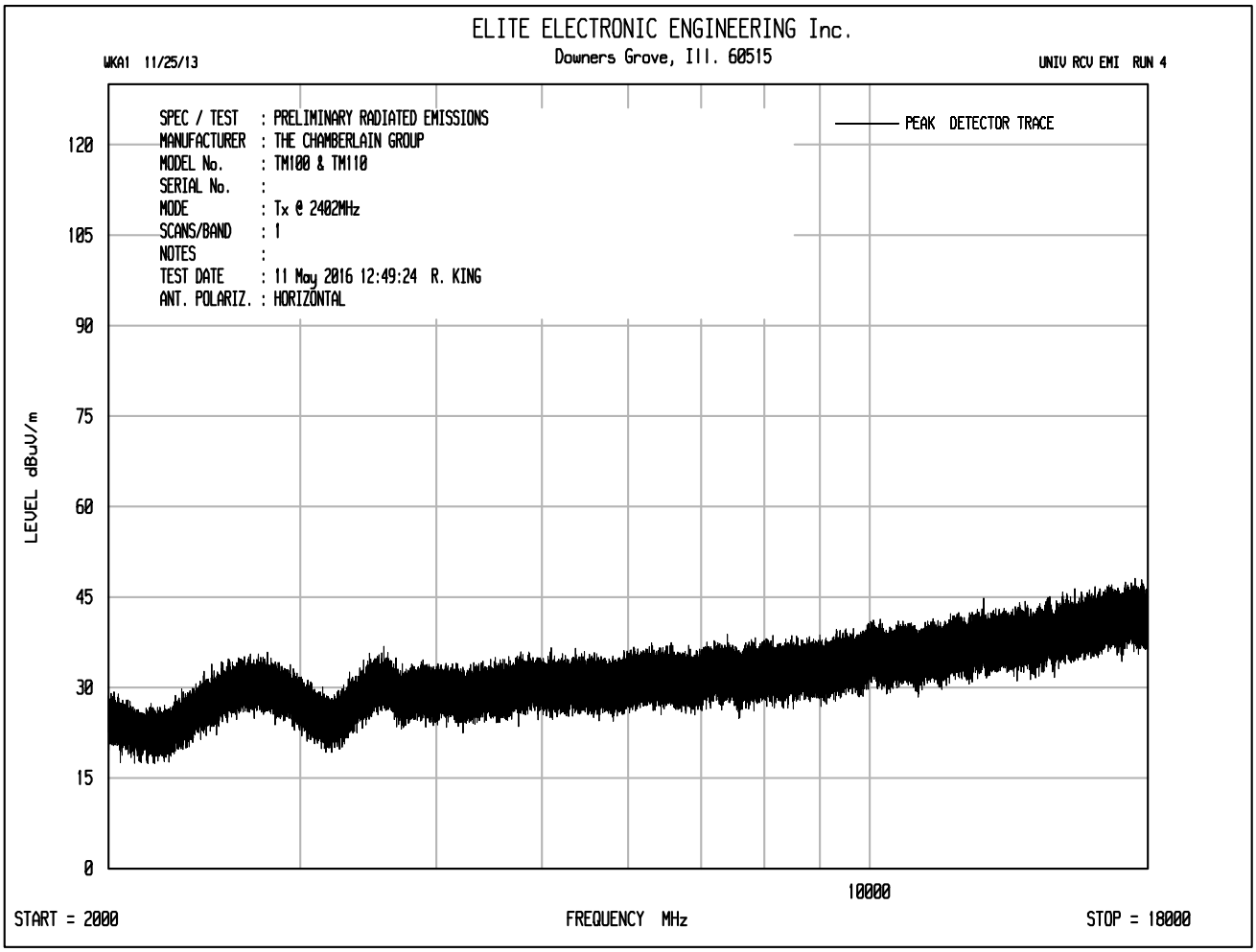

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : ANTENNA CONDUCTED EMISISONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 12 May 2016 09:21:01 R. KING
Limit
Peak trace
AVG trace
* - AVG MAX Readings
30
15
0
-15
-30
-45
-60
-75
-90
-105
-120
LEVEL dBm
START = 18000
FREQUENCY MHz
STOP = 25000

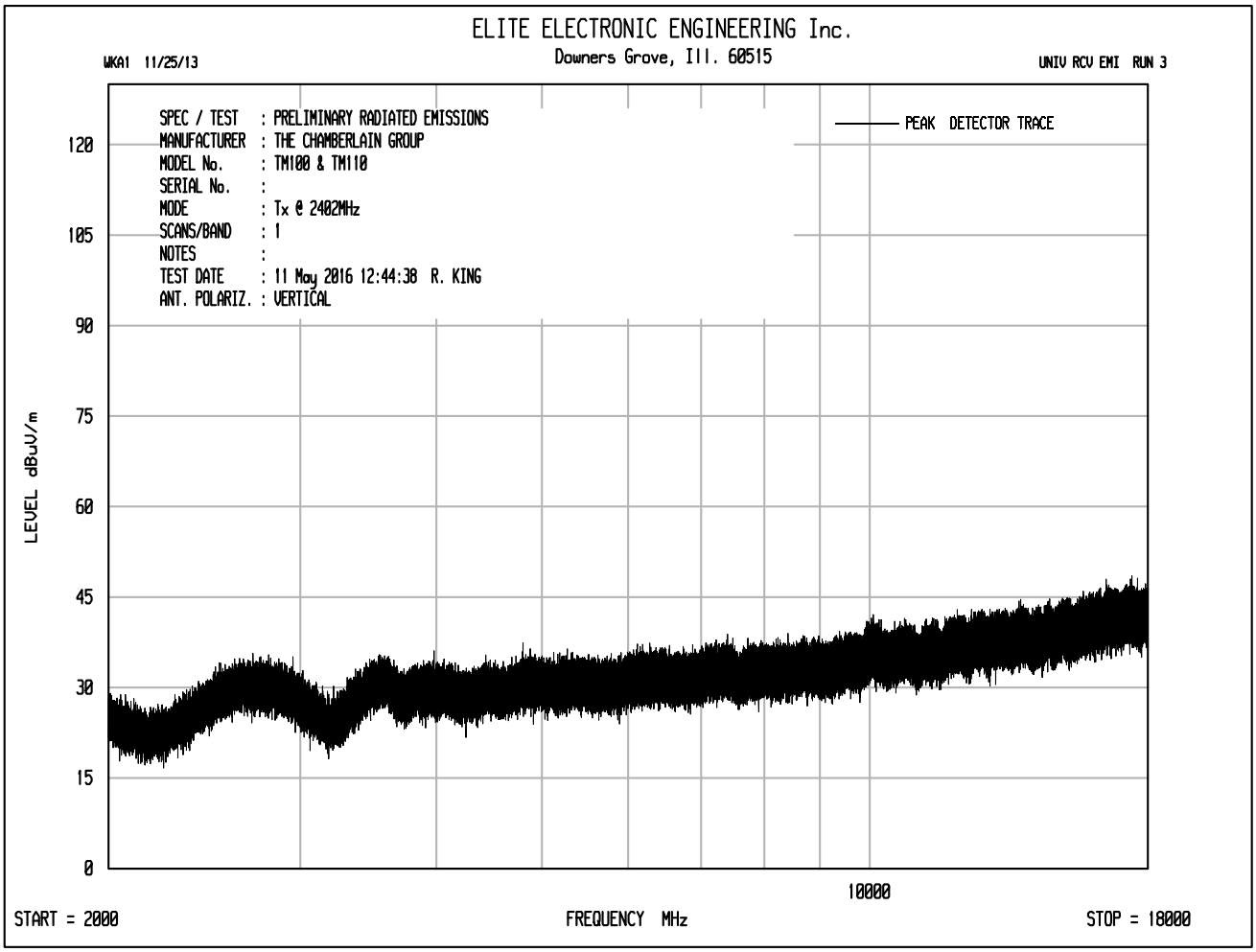

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 1
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 11 May 2016 10:45:04 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

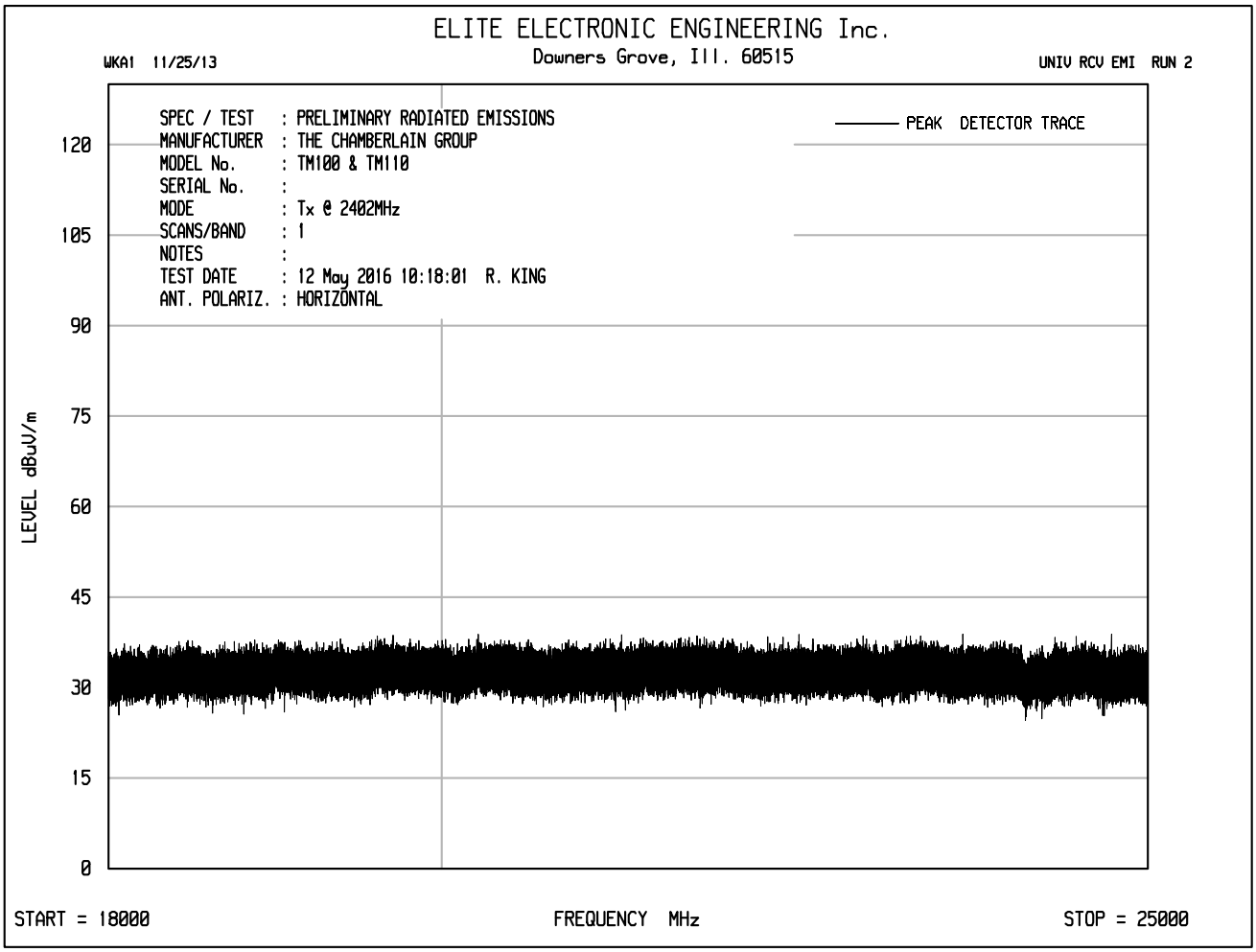

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 11 May 2016 10:49:28 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

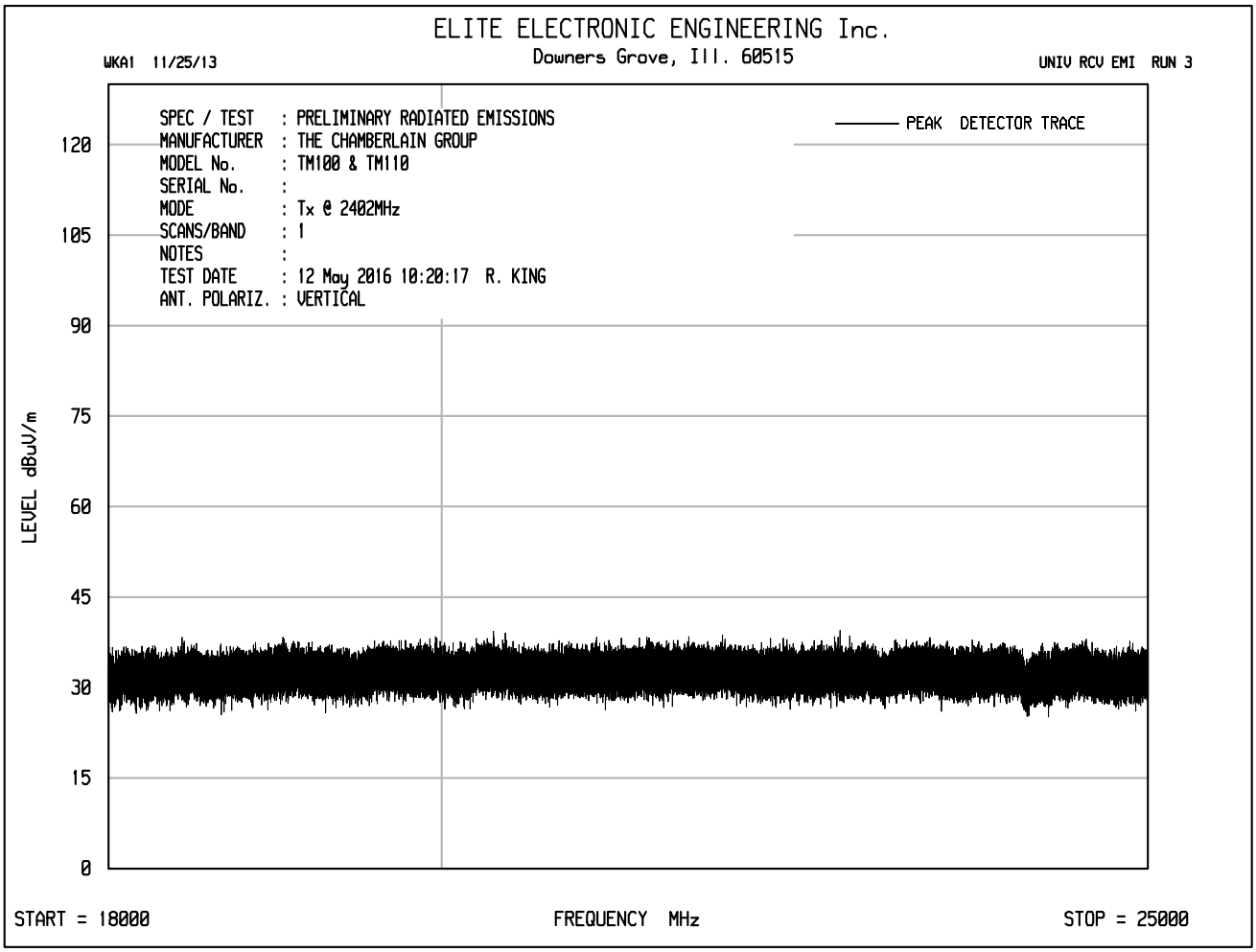

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 11 May 2016 11:24:32 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 3000

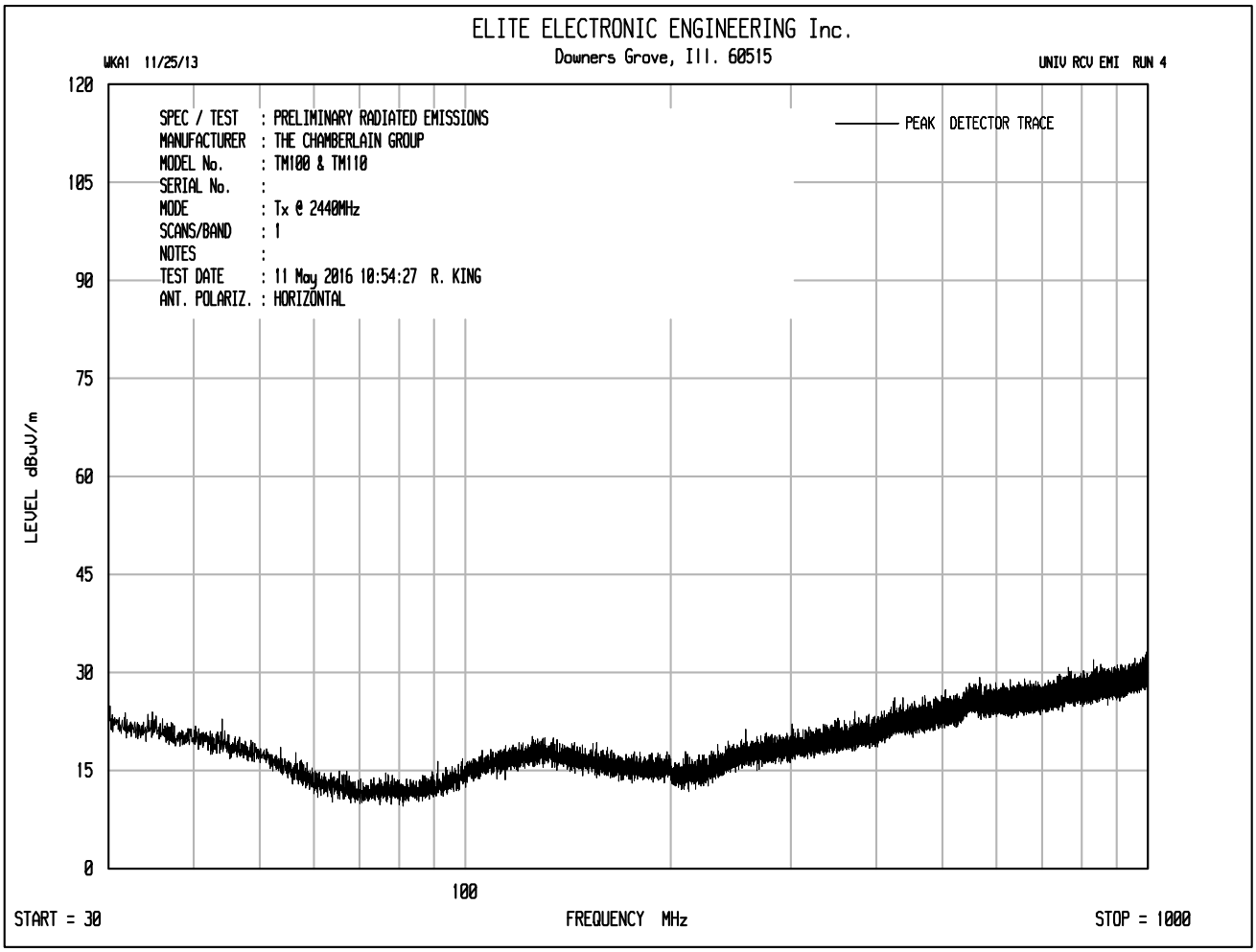

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 11 May 2016 11:26:15 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 3000

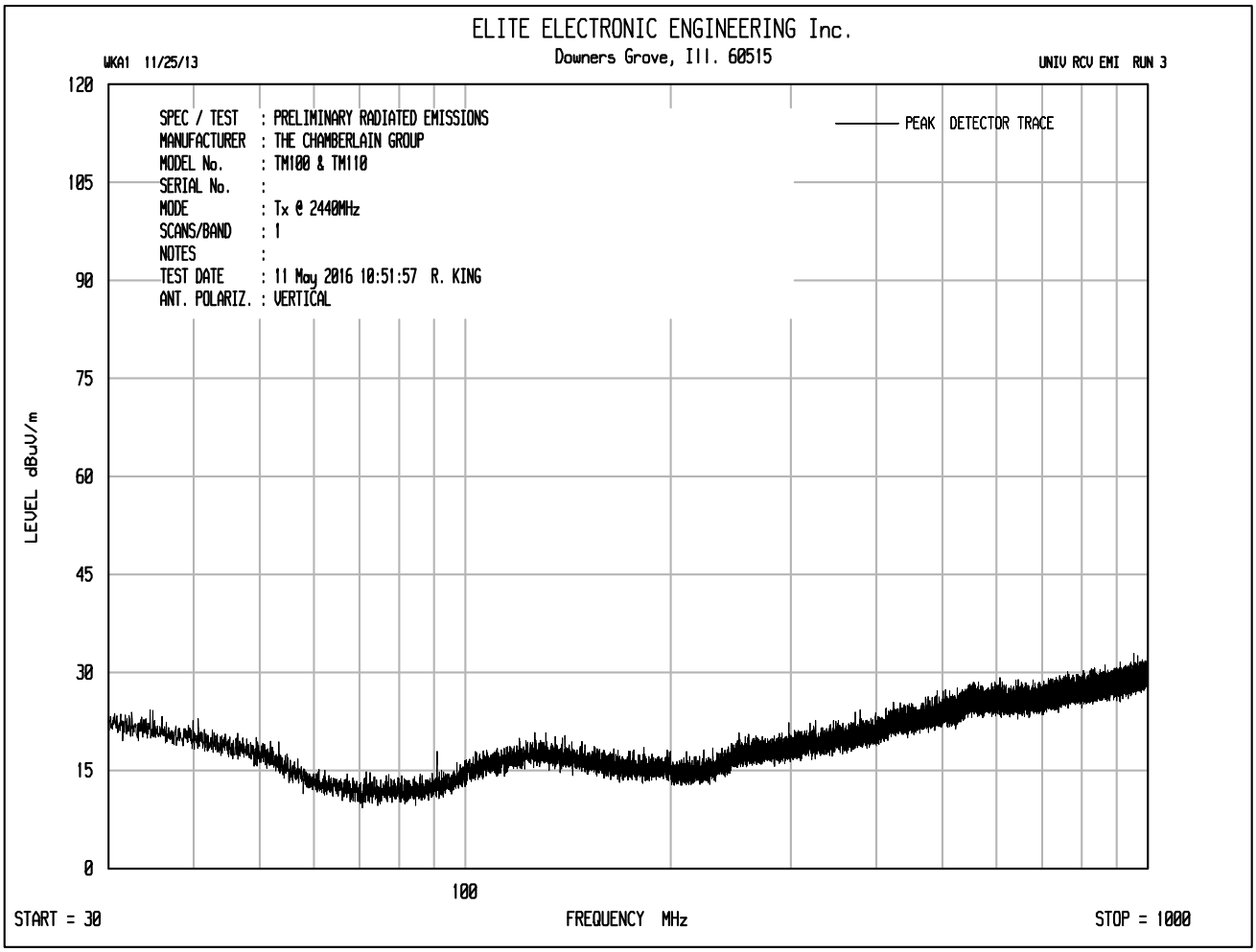

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 11 May 2016 12:49:24 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 2000
FREQUENCY MHz
STOP = 18000

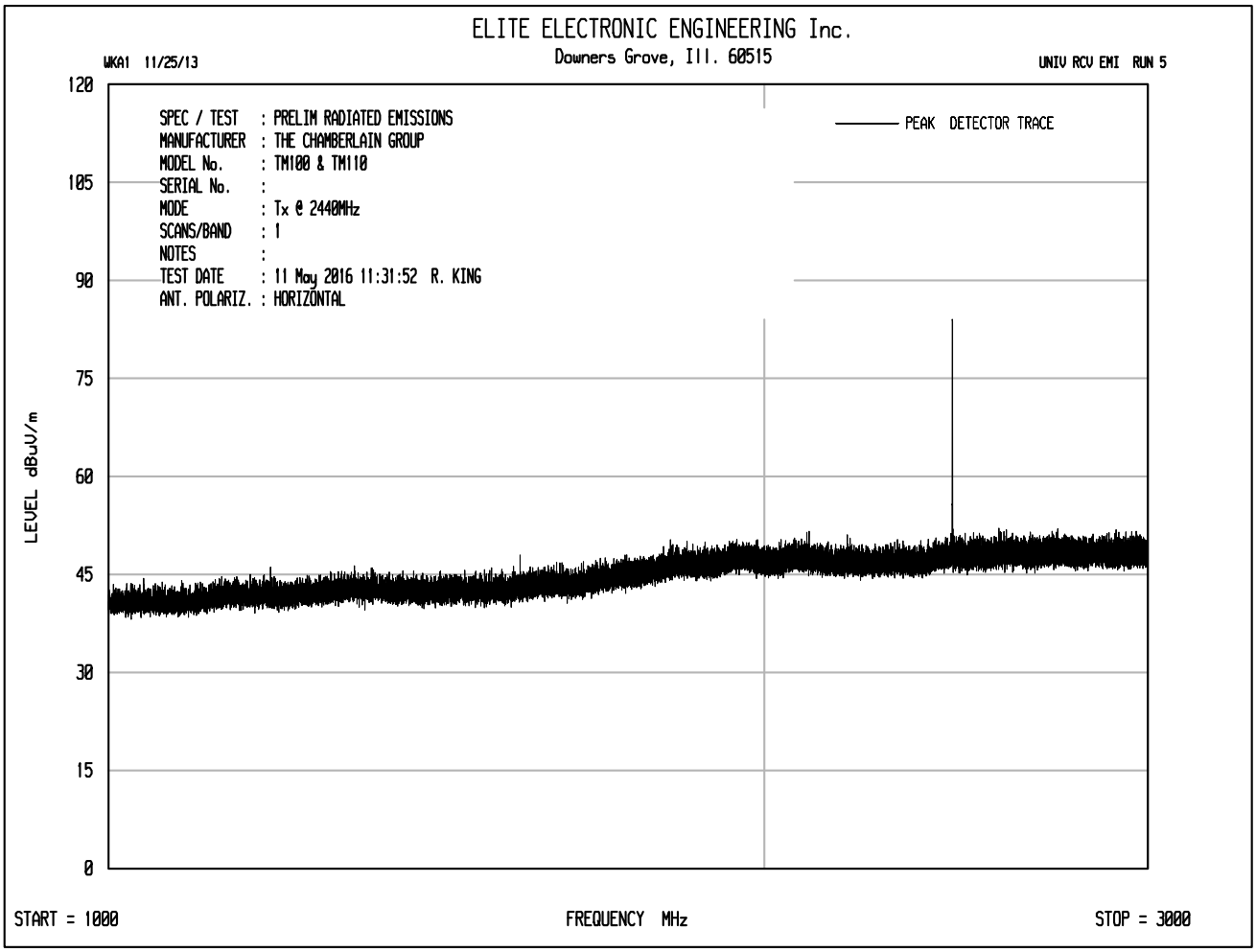

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 11 May 2016 12:44:38 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 2000
FREQUENCY MHz
STOP = 18000

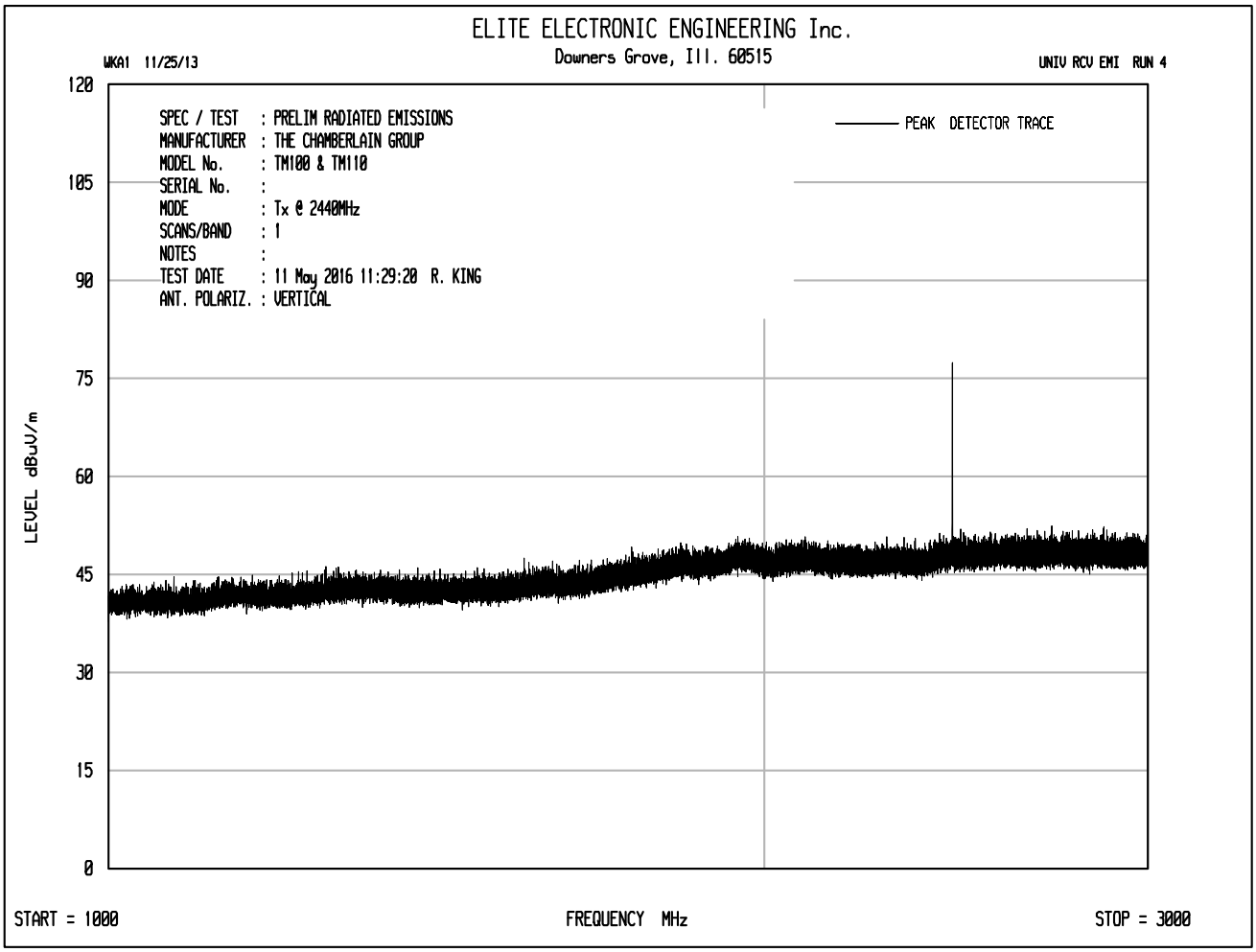

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 12 May 2016 10:18:01 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 25000

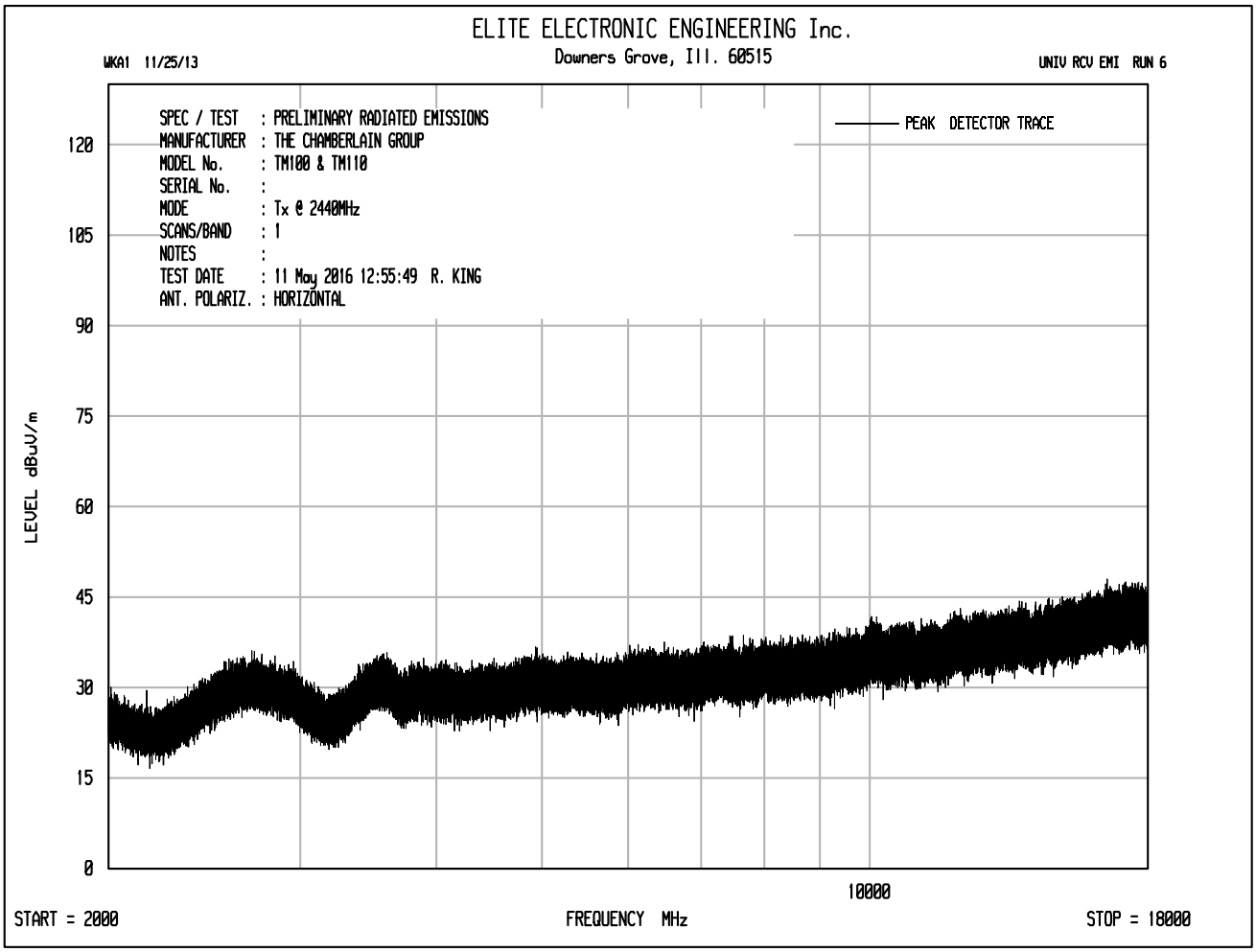

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2402MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 12 May 2016 10:20:17 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 25000

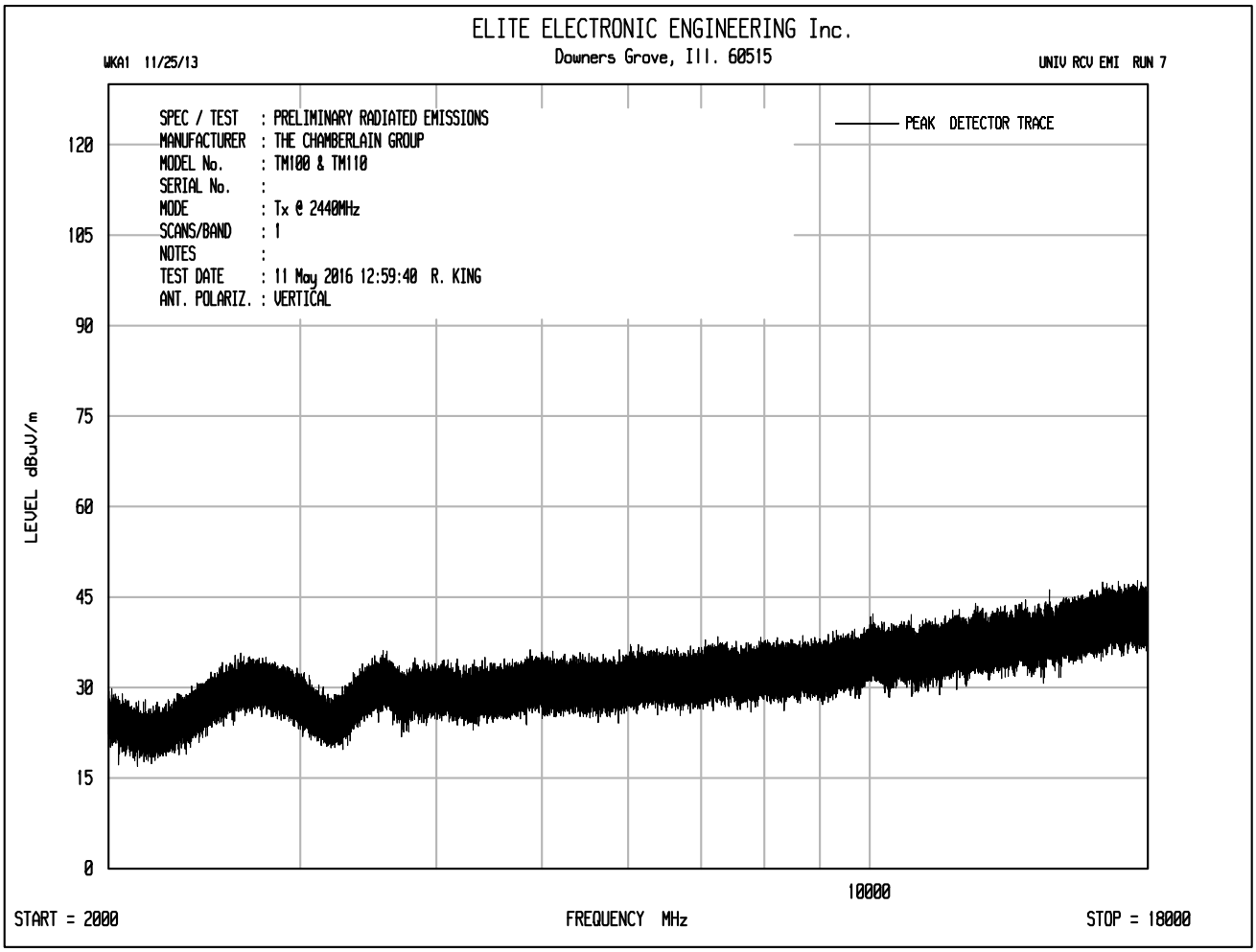

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 11 May 2016 10:54:27 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

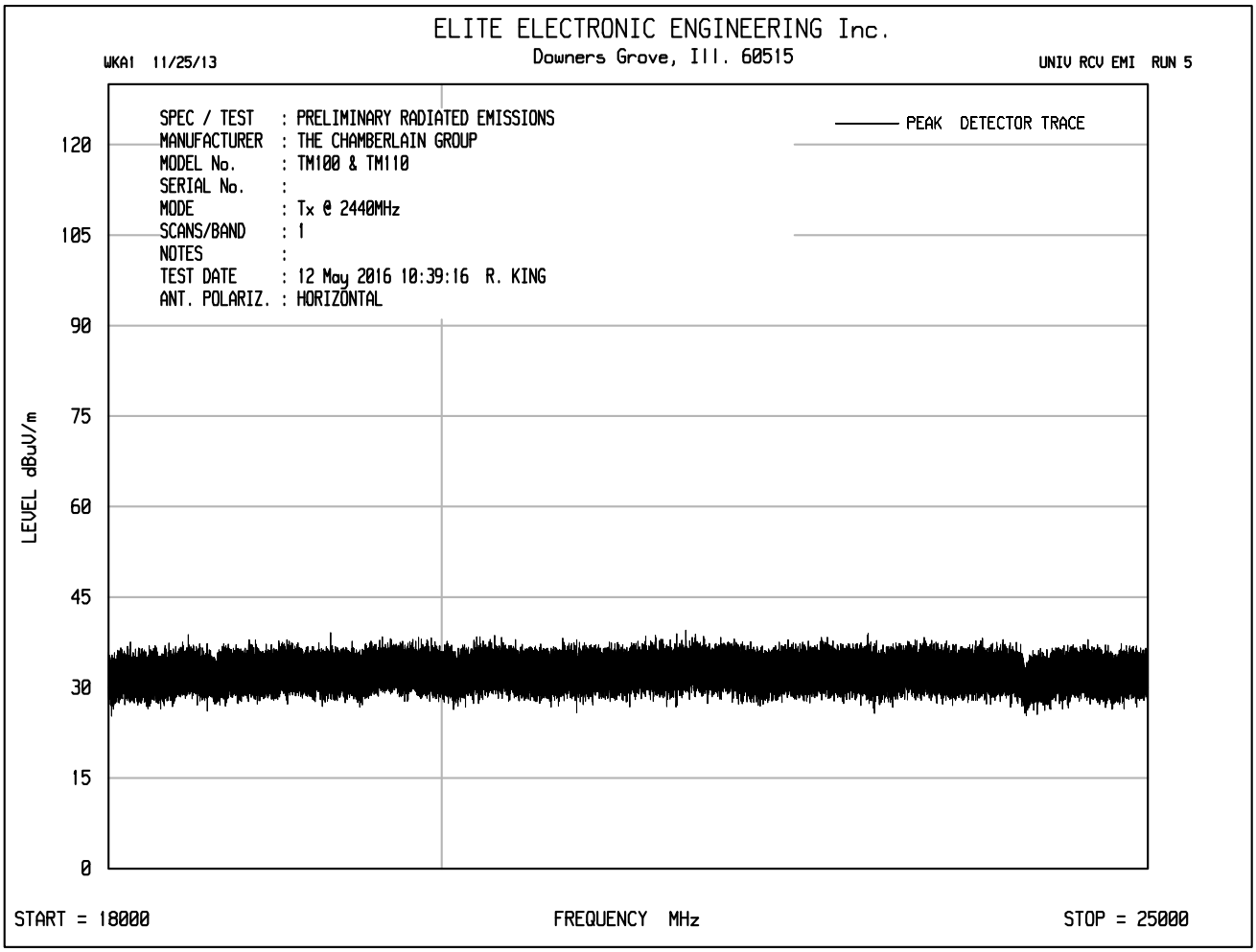

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 11 May 2016 10:51:57 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

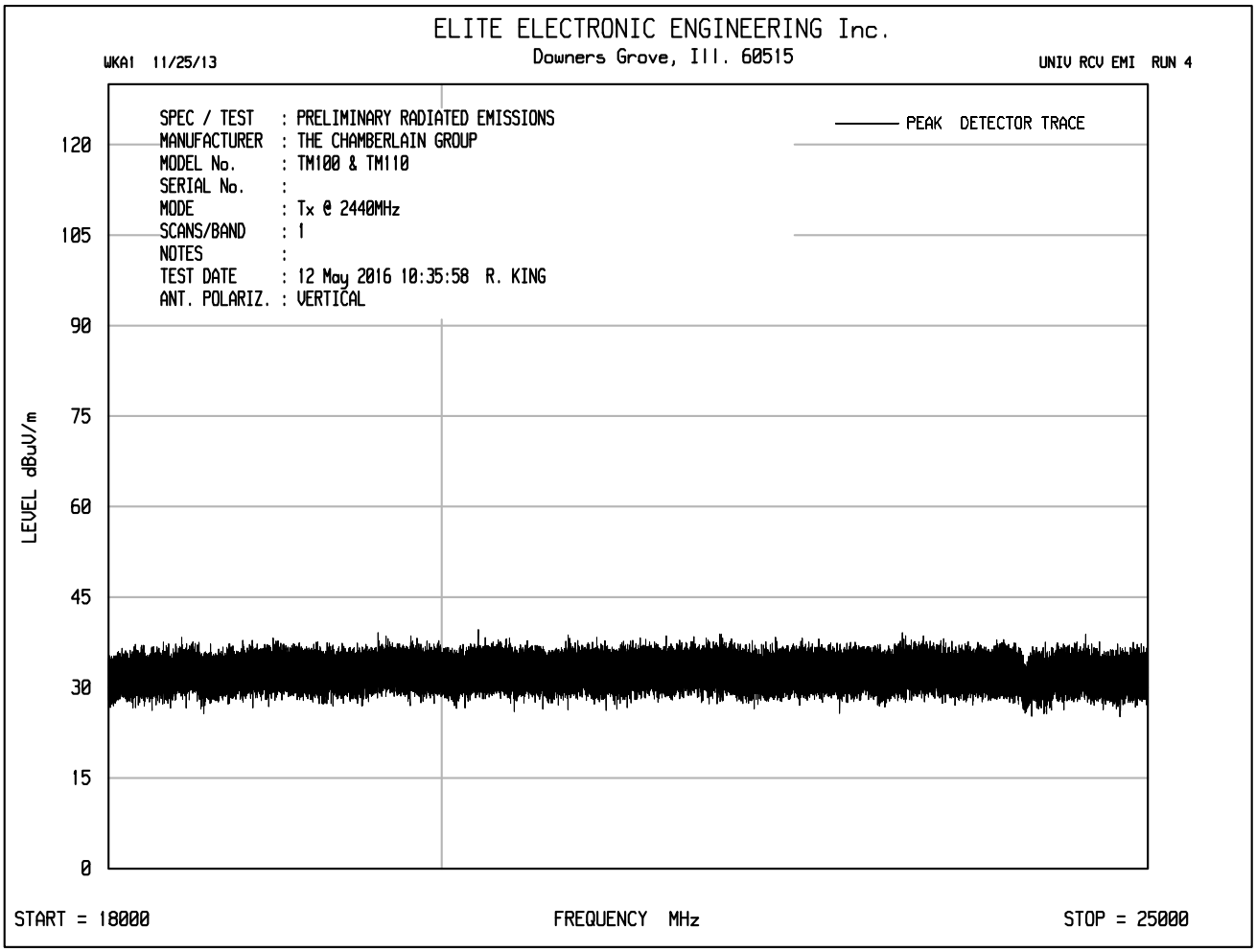

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 5
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 11 May 2016 11:31:52 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 3000

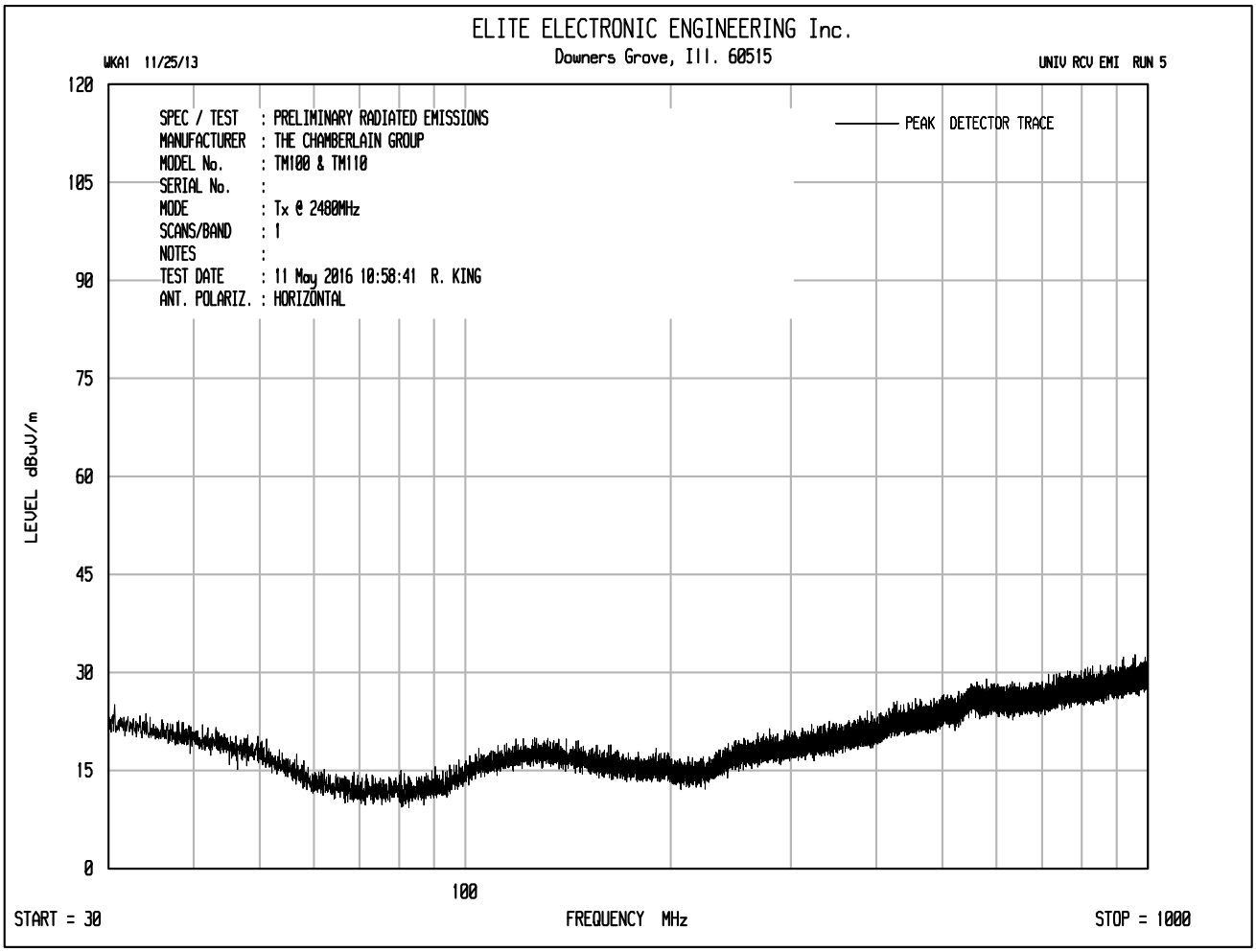

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 11 May 2016 11:29:20 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 3000

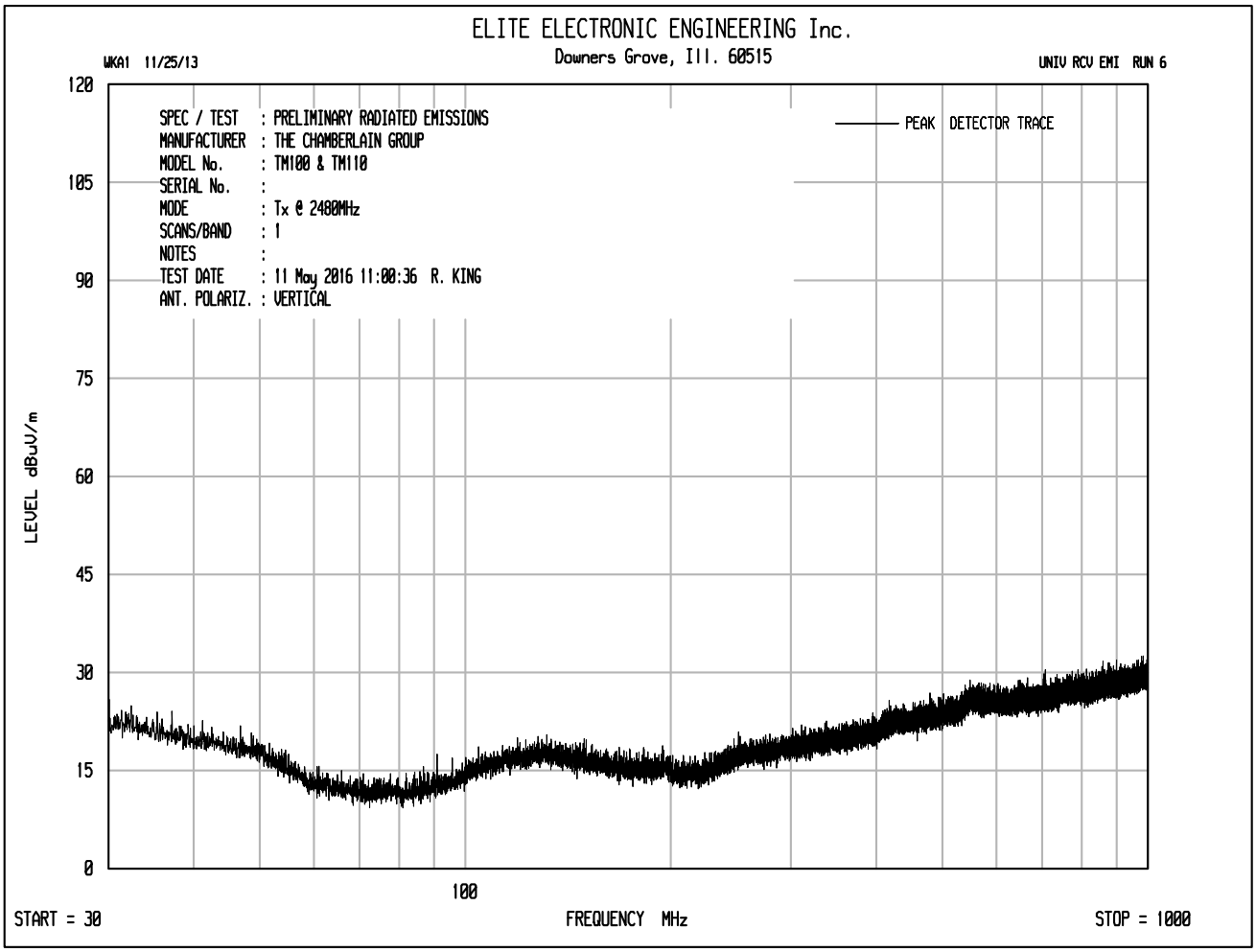

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 6
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 11 May 2016 12:55:49 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 2000
FREQUENCY MHz
STOP = 18000

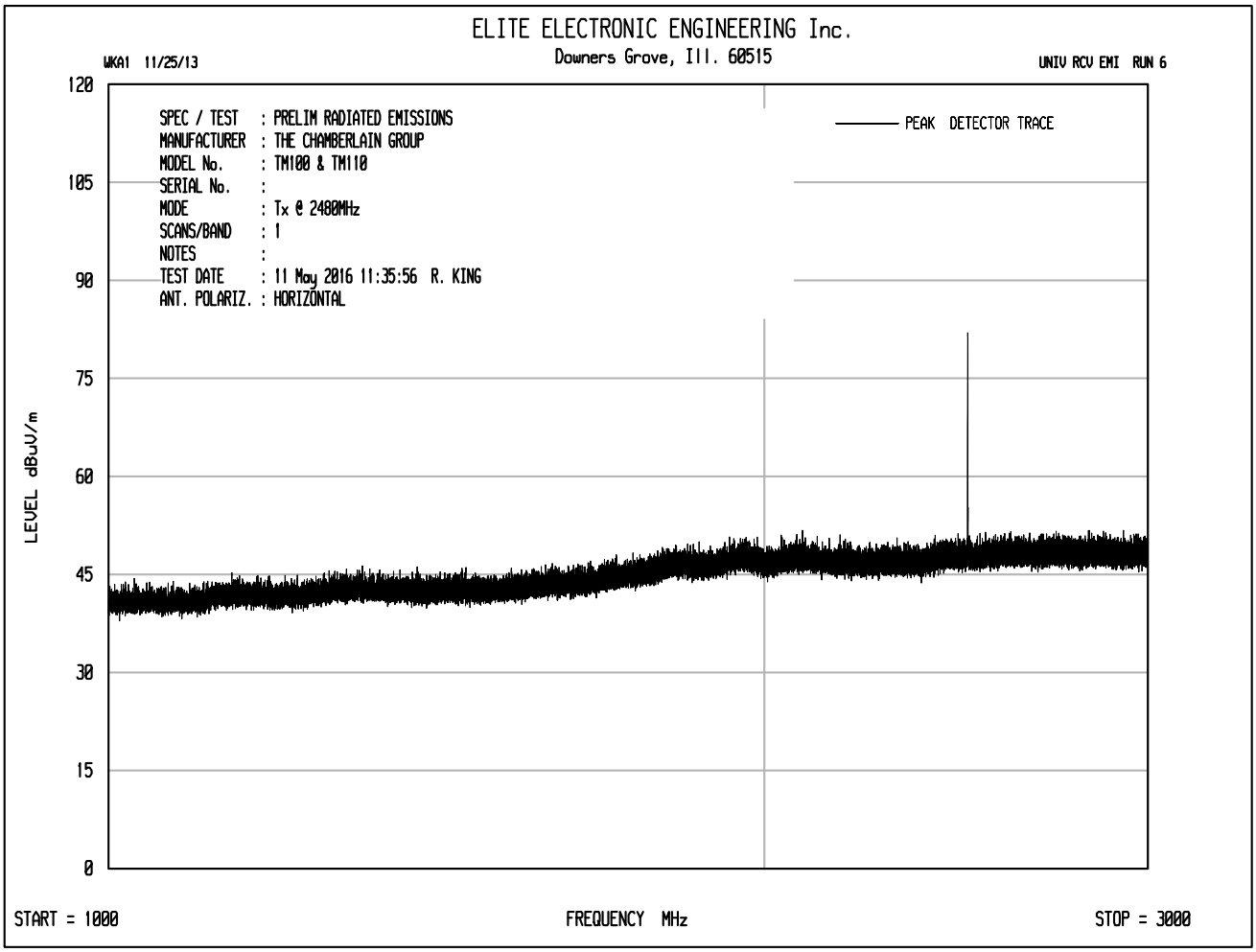

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 7
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 11 May 2016 12:59:40 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 2000
FREQUENCY MHz
STOP = 18000

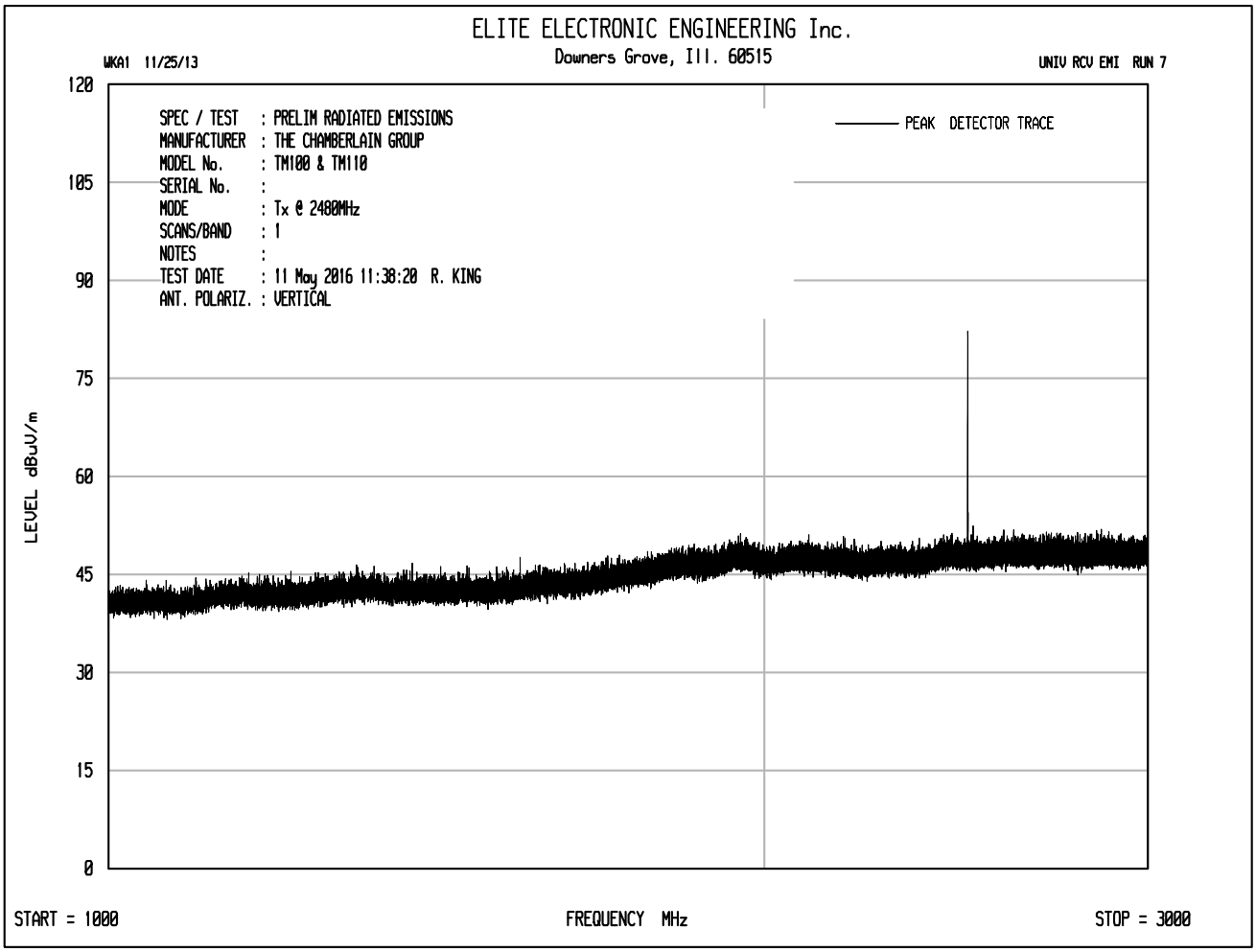

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 5
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 12 May 2016 10:39:16 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 25000

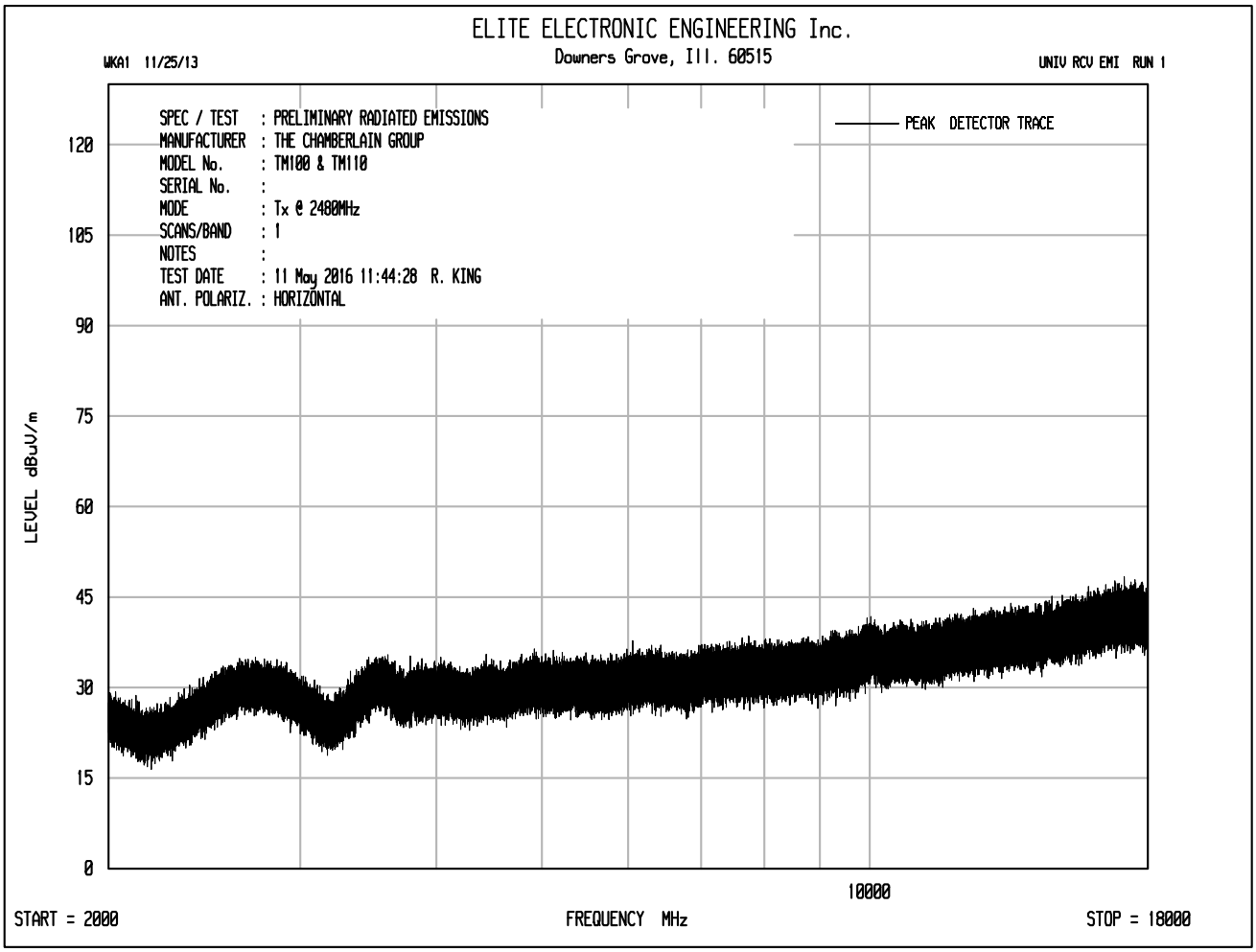

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2440MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 12 May 2016 10:35:58 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 18000
FREQUENCY MHz
STOP = 25000

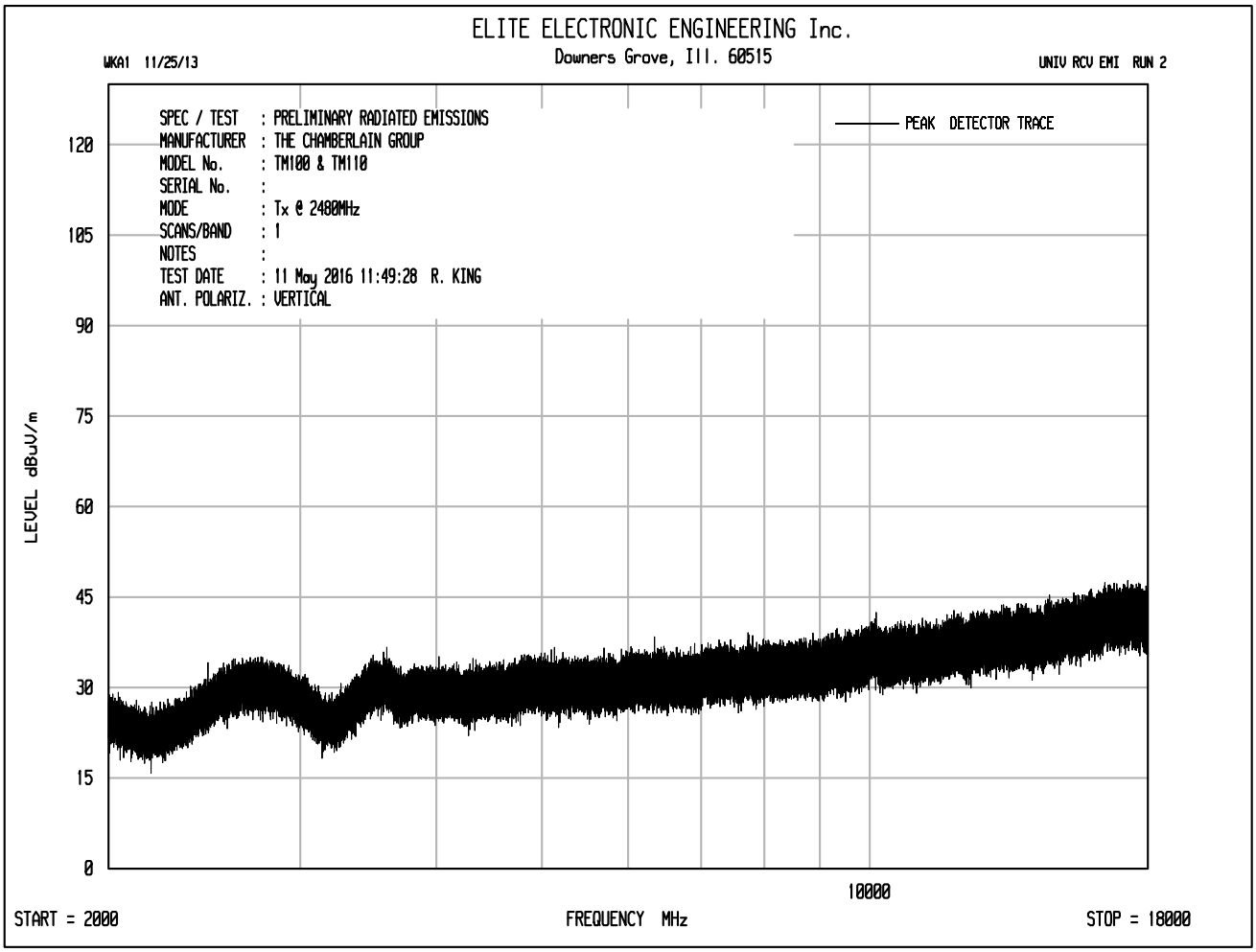

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 5
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 11 May 2016 10:58:41 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

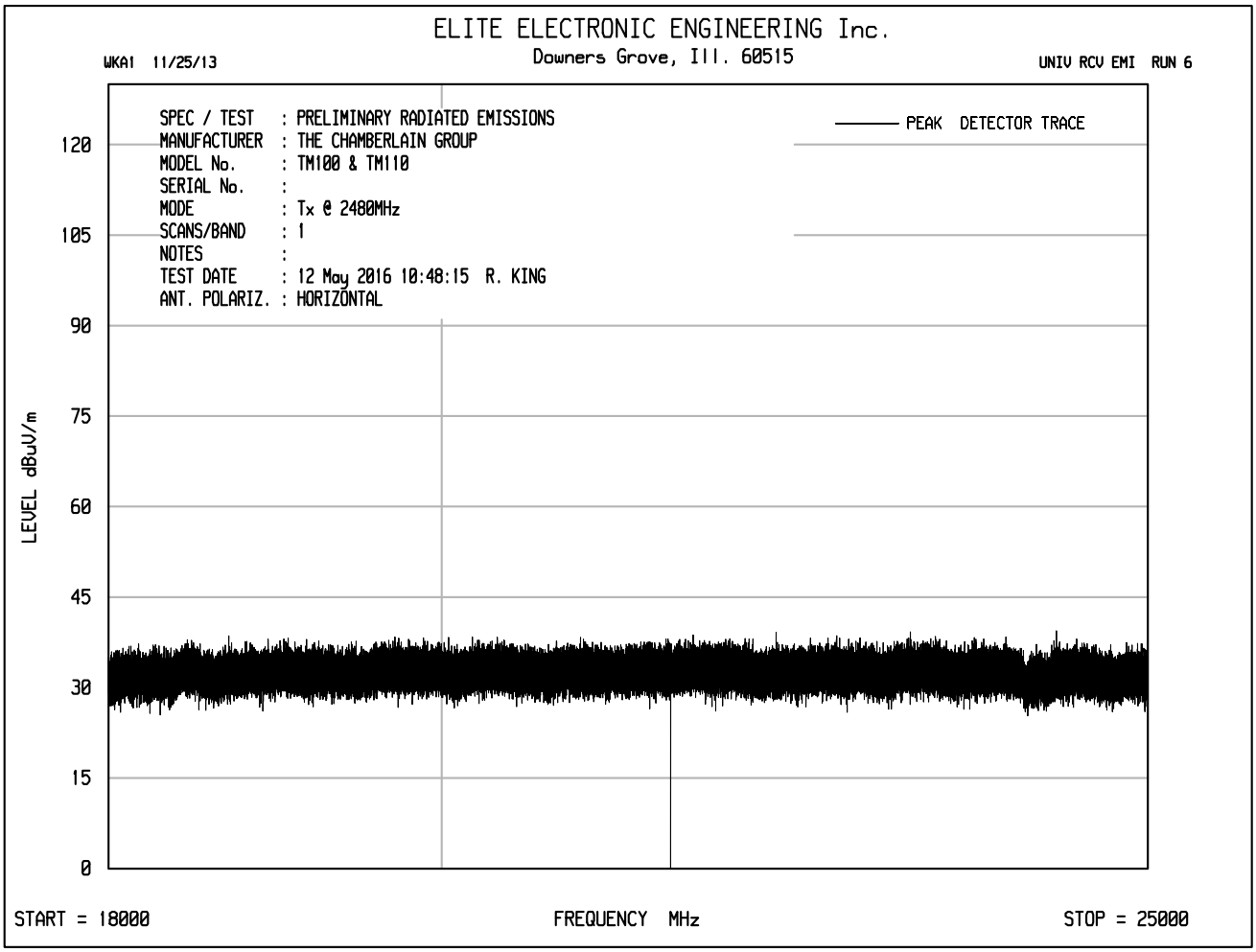

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 6
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 11 May 2016 11:00:36 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

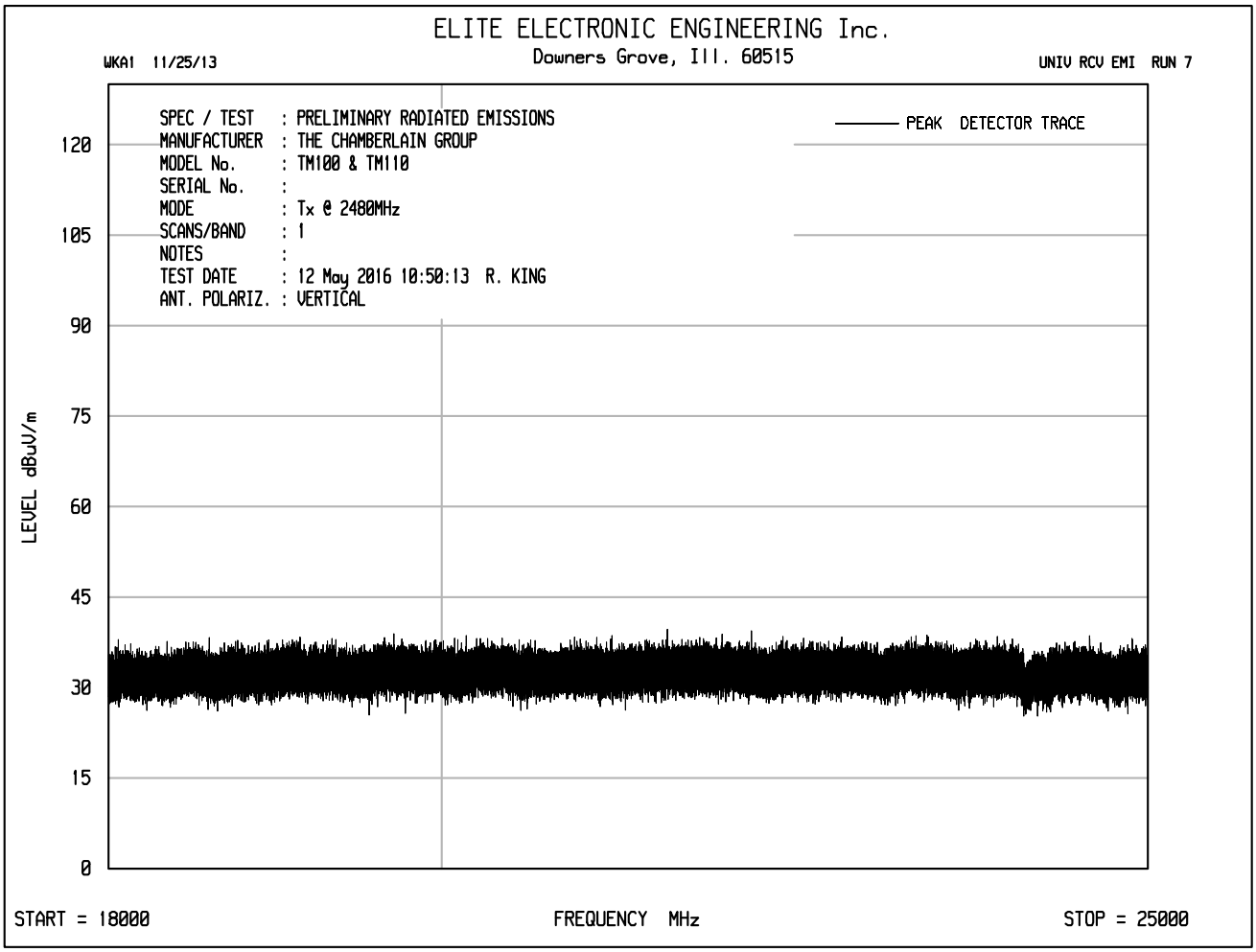

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 6
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 11 May 2016 11:35:56 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 3000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 7
SPEC / TEST : PRELIM RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 11 May 2016 11:38:20 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 = 3000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 1
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 11 May 2016 11:44:28 R. KING
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 2000
FREQUENCY MHz
STOP = 18000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 11 May 2016 11:49:28 R. KING
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 2000
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 : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 12 May 2016 10:48:15 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 7
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : THE CHAMBERLAIN GROUP
MODEL No. : TM100 & TM110
SERIAL No. :
MODE : Tx @ 2480MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 12 May 2016 10:50:13 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 : The Chamber Manufacturing Group
Test Item : BLE Transmitter
Model No. : TM100 & TM110
Mode : Tx @ 2402MHz
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions in Restricted Bands
Date : May 12, 2016
Test Distance : 3 Meters
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)
4804.00	H	48.9		3.7	34.8	-39.3	48.1	254.3	5000.0	-25.9
4804.00	V	49.0		3.7	34.8	-39.3	48.2	258.1	5000.0	-25.7
12010.00	H	48.0	*	6.1	38.8	-39.2	53.8	487.3	5000.0	-20.2
12010.00	V	48.3	*	6.1	38.8	-39.2	54.0	501.6	5000.0	-20.0
19216.00	H	33.1	*	2.2	40.4	-28.6	47.1	226.3	5000.0	-26.9
19216.00	V	33.1	*	2.2	40.4	-28.6	47.1	227.4	5000.0	-26.8

Checked BY Richard E. King :

Richard E. King

Manufacturer : The Chamber Manufacturing Group
Test Item : BLE Transmitter
Model No. : TM100 & TM110
Mode : Tx @ 2402MHz
Test Specification : FCC-15.247, RSS-247 Average Radiated Emissions in Restricted Bands
Date : May 12, 2016
Test Distance : 3 Meters
Notes : Average 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)	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	37.6		3.7	34.8	-39.3	36.8	69.3	500.0	-17.2
4804.00	V	36.8		3.7	34.8	-39.3	36.0	63.1	500.0	-18.0
12010.00	H	34.5	*	6.1	38.8	-39.2	40.3	103.4	500.0	-13.7
12010.00	V	34.5	*	6.1	38.8	-39.2	40.3	103.0	500.0	-13.7
19216.00	H	20.8	*	2.2	40.4	-28.6	34.9	55.4	500.0	-19.1
19216.00	V	20.8	*	2.2	40.4	-28.6	34.9	55.4	500.0	-19.1

Checked BY Richard E. King :

Richard E. King

Manufacturer : The Chamber Manufacturing Group
Test Item : BLE Transmitter
Model No. : TM100 & TM110
Mode : Tx @ 2440MHz
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions in Restricted Bands
Date : May 12, 2016
Test Distance : 3 Meters
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)
4880.00	H	49.8	*	3.7	34.8	-39.3	48.9	279.8	5000.0	-25.0
4880.00	V	50.1	*	3.7	34.8	-39.3	49.2	288.3	5000.0	-24.8
7320.00	H	47.8	*	4.7	35.6	-39.4	48.7	270.8	5000.0	-25.3
7320.00	V	48.5	*	4.7	35.6	-39.4	49.3	292.8	5000.0	-24.6
12200.00	H	46.9	*	6.1	39.0	-39.1	52.9	439.3	5000.0	-21.1
12200.00	V	47.1	*	6.1	39.0	-39.1	53.1	452.7	5000.0	-20.9
19520.00	H	33.4	*	2.2	40.4	-28.5	47.5	236.1	5000.0	-26.5
19520.00	V	33.1	*	2.2	40.4	-28.5	47.2	228.6	5000.0	-26.8

Checked BY Richard E. King :

Richard E. King

Manufacturer : The Chamber Manufacturing Group
Test Item : BLE Transmitter
Model No. : TM100 & TM110
Mode : Tx @ 2440MHz
Test Specification : FCC-15.247, RSS-247 Average Radiated Emissions in Restricted Bands
Date : May 12, 2016
Test Distance : 3 Meters
Notes : Average 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)	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	36.2	*	3.7	34.8	-39.3	35.4	58.7	500.0	-18.6
4880.00	V	36.2	*	3.7	34.8	-39.3	35.4	58.7	500.0	-18.6
7320.00	H	35.6	*	4.7	35.6	-39.4	36.3	65.3	500.0	-17.7
7320.00	V	34.6	*	4.7	35.6	-39.4	35.4	58.8	500.0	-18.6
12200.00	H	33.6	*	6.1	39.0	-39.1	39.6	95.3	500.0	-14.4
12200.00	V	33.6	*	6.1	39.0	-39.1	39.6	95.3	500.0	-14.4
19520.00	H	22.0	*	2.2	40.4	-28.5	36.1	63.7	500.0	-17.9
19520.00	V	22.0	*	2.2	40.4	-28.5	36.1	63.7	500.0	-17.9

Checked BY Richard E. King :

Richard E. King

Manufacturer : The Chamber Manufacturing Group
Test Item : BLE Transmitter
Model No. : TM100 & TM110
Mode : Tx @ 2480MHz
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions in Restricted Bands
Date : May 12, 2016
Test Distance : 3 Meters
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)
4960.00	H	48.0		3.7	34.7	-39.3	47.1	227.2	5000.0	-26.8
4960.00	V	47.5		3.7	34.7	-39.3	46.6	213.8	5000.0	-27.4
7440.00	H	47.5	*	4.7	35.6	-39.4	48.4	263.1	5000.0	-25.6
7440.00	V	47.8	*	4.7	35.6	-39.4	48.7	270.8	5000.0	-25.3
12400.00	H	47.0	*	6.1	39.1	-39.0	53.2	457.2	5000.0	-20.8
12400.00	V	48.0	*	6.1	39.1	-39.0	54.2	513.0	5000.0	-19.8
19840.00	H	33.6	*	2.2	40.4	-28.2	48.1	254.2	5000.0	-25.9
19840.00	V	33.6	*	2.2	40.4	-28.2	48.1	254.2	5000.0	-25.9
22320.00	H	33.5	*	2.2	40.6	-29.1	47.2	230.4	5000.0	-26.7
22320.00	V	33.5	*	2.2	40.6	-29.1	47.2	230.4	5000.0	-26.7

Checked BY Richard E. King :

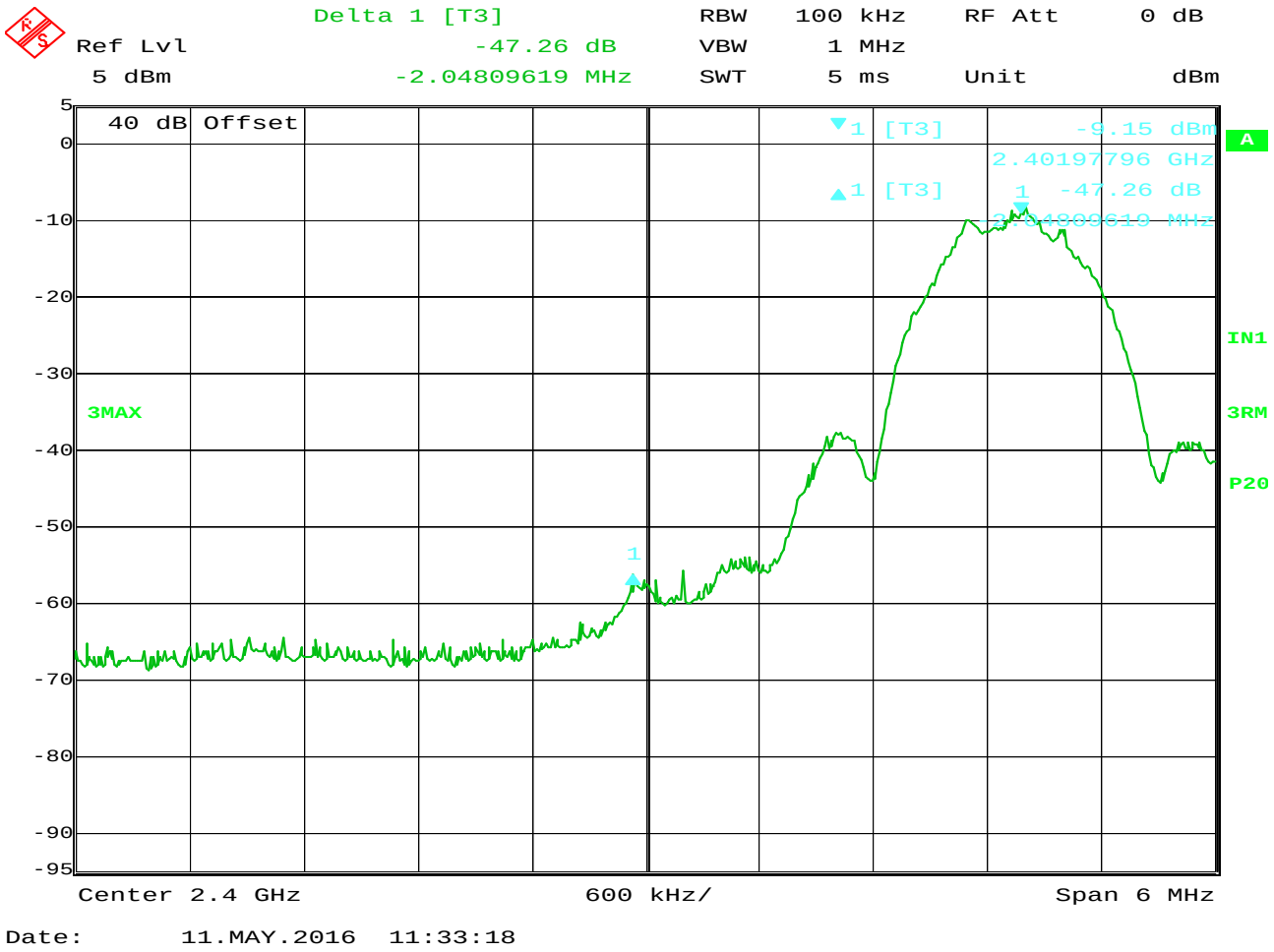
Richard E. King

Manufacturer : The Chamber Manufacturing Group
Test Item : BLE Transmitter
Model No. : TM100 & TM110
Mode : Tx @ 2440MHz
Test Specification : FCC-15.247, RSS-247 Average Radiated Emissions in Restricted Bands
Date : May 12, 2016
Test Distance : 3 Meters
Notes : Average 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)	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	34.5		3.7	34.7	-39.3	33.6	48.1	500.0	-20.3
4960.00	V	34.6		3.7	34.7	-39.3	33.7	48.5	500.0	-20.3
7440.00	H	34.39	*	4.7	35.6	-39.4	35.3	58.1	500.0	-18.7
7440.00	V	34.7	*	4.7	35.6	-39.4	35.6	60.3	500.0	-18.4
12400.00	H	34.0	*	6.1	39.1	-39.0	40.2	102.0	500.0	-13.8
12400.00	V	34.0	*	6.1	39.1	-39.0	40.2	102.0	500.0	-13.8
19840.00	H	22.3	*	2.2	40.4	-28.2	36.8	69.1	500.0	-17.2
19840.00	V	22.3	*	2.2	40.4	-28.2	36.8	69.1	500.0	-17.2
22320.00	H	20.9	*	2.2	40.6	-29.1	34.7	54.3	500.0	-19.3
22320.00	V	21.0	*	2.2	40.6	-29.1	34.7	54.4	500.0	-19.3

Checked BY Richard E. King :

Richard E. King



FCC 15.247 Bandedge Compliance

MANUFACTURER : The Chamberlain Group
MODEL NUMBER : TM100 & TM110
TEST MODE : Tx @ 2402MHz
: Peak detector
NOTES : Delta at the bandedge is -47.26dBc which is well below the -20dBc required.
NOTES :
NOTES :

NOTES

Manufacturer : The Chamber Manufacturing Group
Test Item : BLE Transmitter
Model No. : TM100 & TM110
Mode : Tx @ 2480MHz High Channel
Test Specification : FCC-15.247, RSS-247 Band-edge Compliance
Date : May 11, 2016
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)
2483.50	H	12.0		2.7	32.4	0.0	47.1	225.8	5000.0	-26.9
2483.50	V	14.5		2.7	32.4	0.0	49.6	300.8	5000.0	-24.4

Checked BY Richard E. King :

Richard E. King

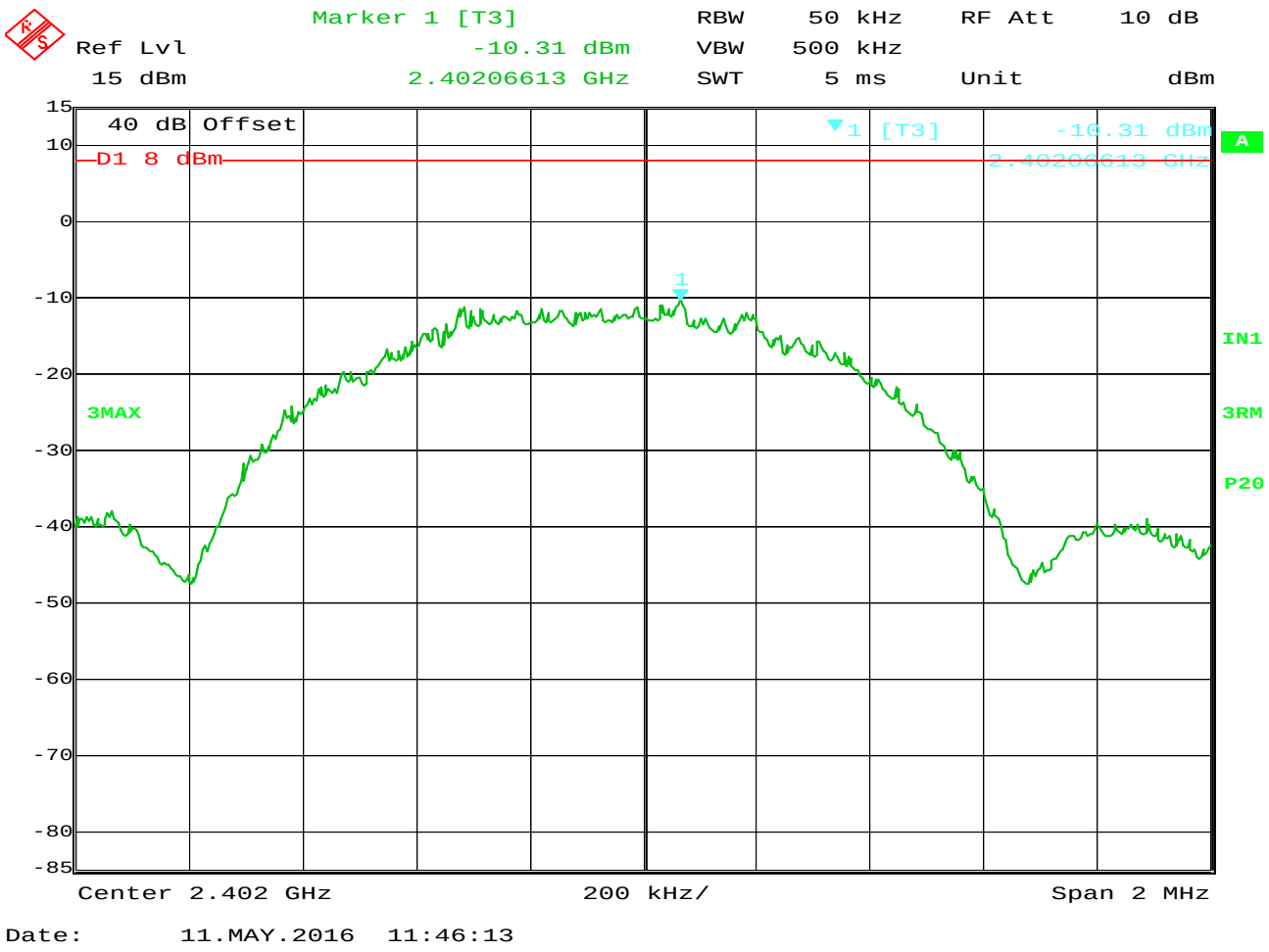
Manufacturer : The Chamber Manufacturing Group
Test Item : BLE Transmitter
Model No. : TM100 & TM110
Mode : Tx @ 2480MHz High Channel
Test Specification : FCC-15.247, RSS-247 Band-edge Compliance
Date : May 11, 2016
Notes : Average Measurement with 1MHz Resolution Bandwidth

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)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
2483.50	H	2.4		2.7	32.4	0.0	37.4	74.0	500.0	-16.6
2483.50	V	2.5		2.7	32.4	0.0	37.5	74.9	500.0	-16.5

Checked BY Richard E. King :

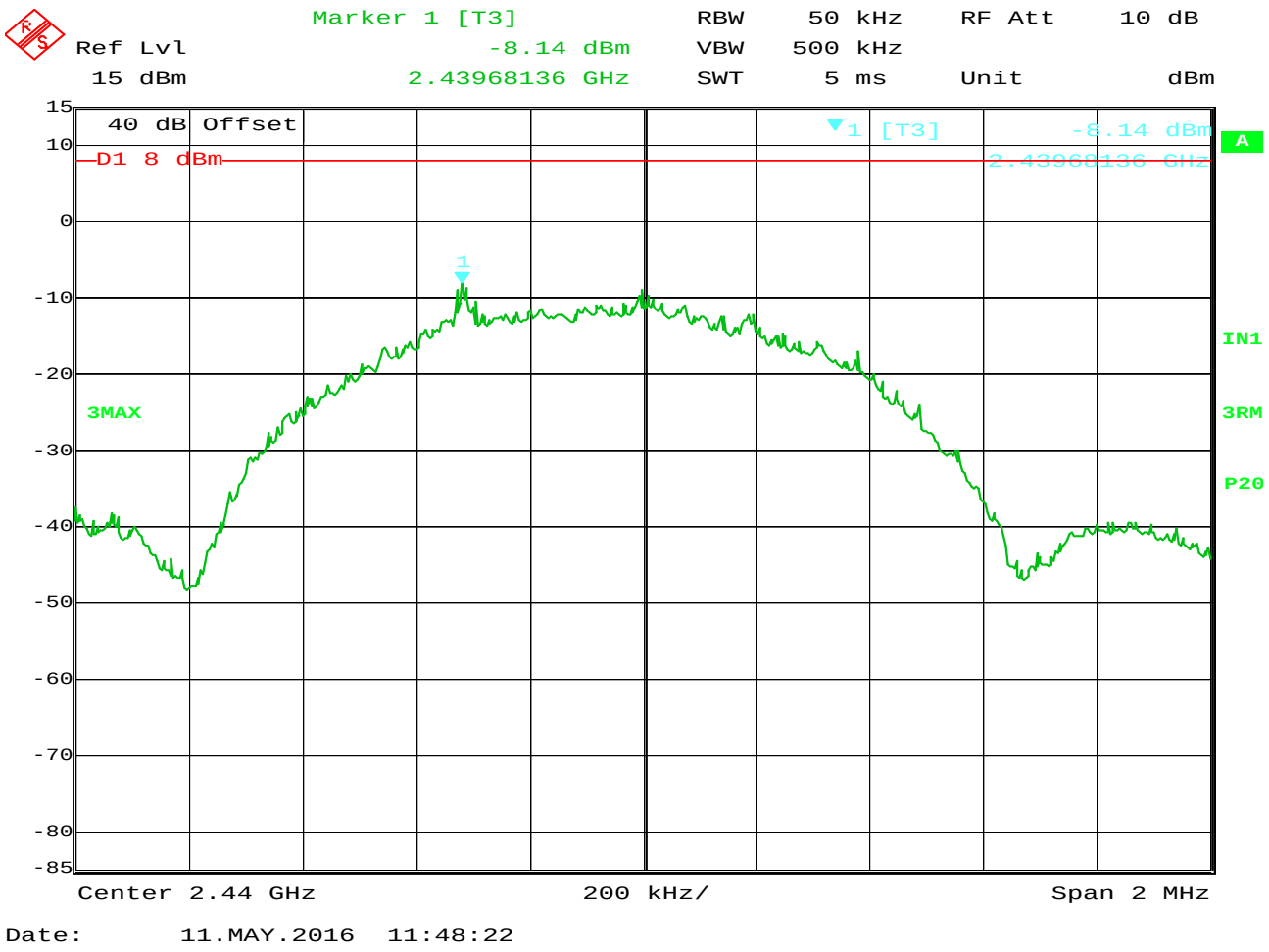
Richard E. King



FCC 15.247 Power Spectral Density

MANUFACTURER : The Chamberlain Group
MODEL NUMBER : TM100 & TM110
TEST MODE : Tx @ 2402MHz
: Peak detector
NOTES :

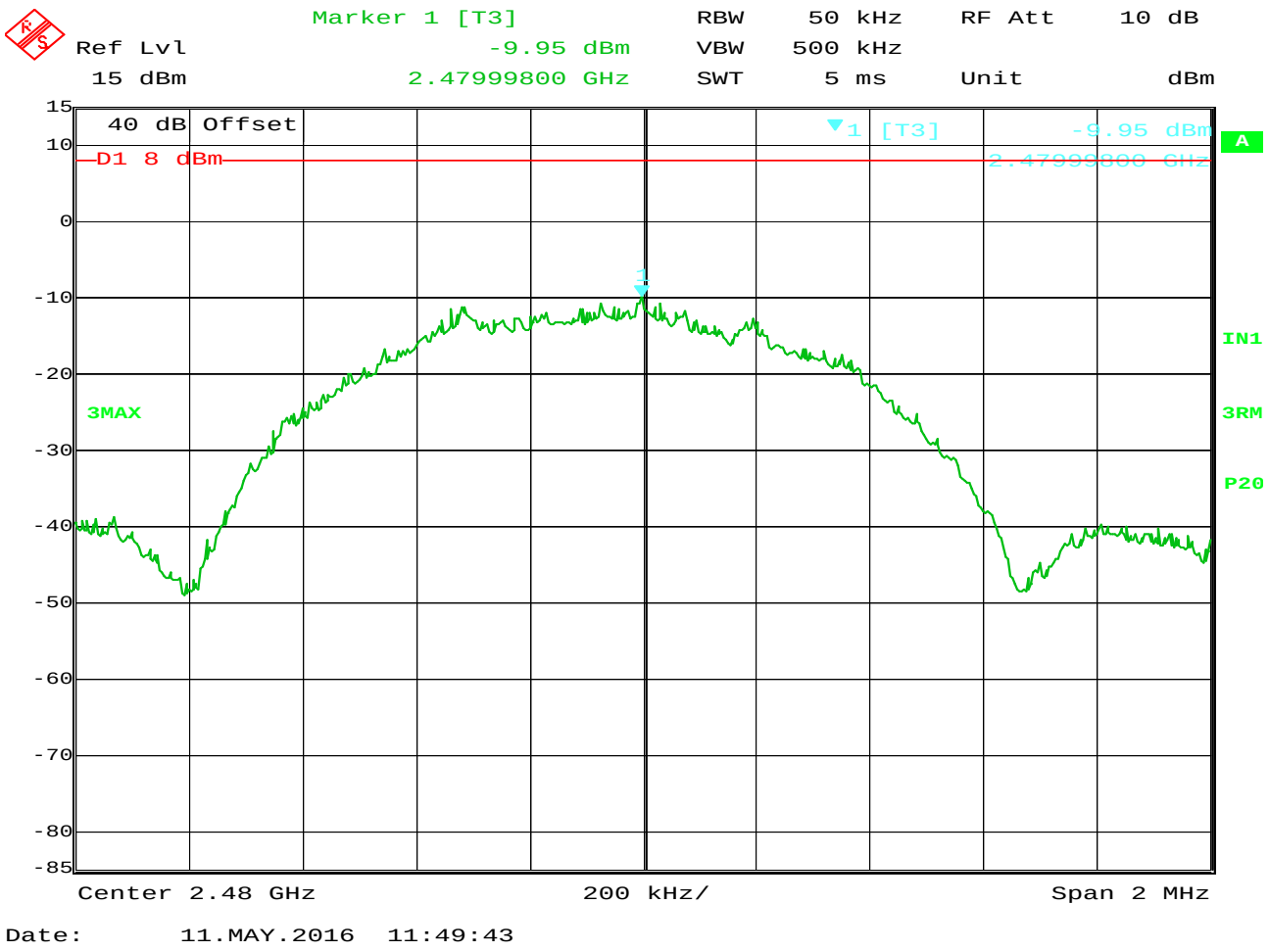
NOTES



FCC 15.247 Power Spectral Density

MANUFACTURER : The Chamberlain Group
MODEL NUMBER : TM100 & TM110
TEST MODE : Tx @ 2440MHz
: Peak detector
NOTES :

NOTES



FCC 15.247 Power Spectral Density

MANUFACTURER : The Chamberlain Group
MODEL NUMBER : TM100 & TM110
TEST MODE : Tx @ 2480MHz
: Peak detector
NOTES :