Measurement of RF Interference from a DDO8900W Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module Transmitter

For	Chamberlain Group, Inc. 300 Windsor Dr. Oak Brook, IL 60126
P.O. Number	4900058842
Date Received	March 26, 2019
Date Tested	March 26, 2019 and March 27, 2019
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Specification	FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.207 and 15.247 for Frequency Hopping Spread Spectrum Intentional Radiators operating within the band 902-928MHz and Digital Modulation Intentional Radiators Operating within the band 2400-2483.5MHz Industry Canada RSS-247 Industry Canada RSS-GEN

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REVISION HISTORY

Revision	Date	Description
—	4/18/2019	Initial release
A	5/6/2019 By TMJ	- Changed test report number from 1805132-01 to 1805132-01 Rev. A throughout report. - Changed Test Item description from Light-Duty Series Jackshaft Door Operator for Sectional Doors with Marvell MW300 WiFi module to Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module throughout report.

Measurement of RF Emissions from a Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module, Model No. DDO8900W Transmitter

1. INTRODUCTION

1.1 Scope of Tests

This document represents the results of the series of radio interference measurements performed on a Chamberlain Group, Inc. Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module, Model No. DDO8900W, transmitter (hereinafter referred to as the EUT). The EUT contains a frequency hopping spread spectrum transmitter that was designed to transmit in the 902 – 928MHz range (FCC ID: HBW8551, IC ID: 2666A-8551) using an internal antenna. The EUT also contains a digital modulation transmitter that was designed to transmit in the 2400 – 2483.5MHz range (Marvell MW300 WiFi module, FCC ID: HBW8522, IC ID: 2666A-8522) using an internal antenna. The EUT was manufactured and submitted for testing by Chamberlain Group, Inc. located in Oak Brook, IL.

1.2 Purpose

The test series was performed to determine if the EUT meets the following:

- Class II permissive change requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, 15.247 for a Frequency Hopping Spread Spectrum Intentional Radiator Operating within the 902-928 MHz band.
- Class II permissive change requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, 15.247 for a Digital Modulation Intentional Radiator Operating within the 2400 – 2483.5MHz band.
- Class II permissive change requirements of the Innovation, Science, and Economic Development Canada, RSS-247 for a Frequency Hopping Spread Spectrum Intentional Radiator Operating within the 902-928 MHz band.
- Class II permissive change requirements of the Innovation, Science, and Economic Development Canada, RSS-247 for a Digital Modulation Intentional Radiator Operating within the 2400 – 2483.5MHz band.
- Intermodulation case spurious radiated emissions requirements of the FCC “Code of Federal Regulations” Title 47, Part 15, Subpart C, Section 15.247.

Testing was performed in accordance with ANSI C63.10-2013.

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 21C and the relative humidity was 18%.

2. APPLICABLE DOCUMENTS

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

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subpart C

- 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 Compliance Measurements On Digital Transmissions Systems, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under section 15.247 of the FCC Rules
  February 11, 2019

- Industry Canada RSS-247, Issue 2, March 2017, "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 5, March 2019, "Spectrum Management and Telecommunications Radio Standards Specification, General Requirements for Compliance of Radio Apparatus"

3. EUT SETUP AND OPERATION

3.1 General Description

The EUT is a Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module, Part No. DDO8900W. A block diagram of the EUT setup is shown as Figure 1.

3.1.1 Power Input

The EUT obtained 115V 60Hz power via a 3 wire, 6 foot long, unshielded power cord.

3.1.2 Peripheral Equipment

The following peripheral equipment was submitted with the EUT:

Item	Description
Cable Tension Monitor	Connected to the EUT via a 10ft. long 2 wire cable
Photo Eyes	Connected to the EUT via a 33.5ft. long 2 wire cable
LMI5 Interface Box	Connected to the EUT via a 33.5ft. long 2 wire cable

3.1.3 Grounding

The EUT was grounded only through the third wire of its input power cord.

3.2 Software

For all tests, the EUT had Firmware Version 2.6 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:

Frequency Hopping Spread Spectrum Transmitter Operating in the 902-928MHz Band (FCC ID: HBW8551, IC ID: 2666A-8551):

- Transmit at 902.25MHz (mode 6)
- Transmit at 914.75MHz (mode 7)
- Transmit at 926.75MHz (mode 8)
- Frequency Hopping Enabled (mode 9) used for band edge testing

Digital Transmission System Transmitter Operating in the 2400 – 2483.5MHz Band (FCC ID: HBW8522, IC ID:

2666A-8522):

- Transmit at 2412MHz, 802.11g, 54Mbps, power = 15, Duty cycle > 98%
- Transmit at 2437MHz, 802.11n, MCS7, power = 14, Duty cycle > 98%
- Transmit at 2462MHz, 802.11b, 1Mbps, power = 13, Duty cycle > 98%
- Transmit at 2462MHz, 802.11g, 54Mbps, power = 11 (for high frequency band edge test only), Duty cycle > 98%

Intermodulation Case Spurious Radiated Measurements:

- Transmit at 914.75MHz, WiFi Transmit at 2437MHz, 802.11b, 1Mbps, power = 15
- Transmit at 914.75MHz, WiFi Transmit at 2437MHz, 802.11g, 54Mbps, power = 15
- Transmit at 914.75MHz, WiFi Transmit at 2437MHz, 802.11n, MCS7, power = 14

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. .

Conducted and radiated emission tests were performed with an EMI receiver utilizes the bandwidths and detectors specified by the FCC.

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 International System Units (SI).

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.

Values of Expanded Measurement Uncertainty (95% Confidence) are presented below:

Measurement Type	Expanded Measurement Uncertainty
Conducted disturbance (mains port) (150 kHz – 30 MHz)	2.7
Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz)	4.3
Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 6 GHz)	3.1
Radiated disturbance (electric field strength on an open area test site or alternative test site) (6 GHz – 18 GHz)	3.2

5. TEST PROCEDURES

5.1 Frequency Hopping Spread Spectrum Transmitter Operating in the 902-928MHz Band (FCC ID: HBW8551, IC ID: 2666A-8551)

5.1.1 Peak EIRP

5.1.1.1 Requirements

Per FCC 15.247(b)(2) and ISED RSS-247 section 5.4(a), for frequency hopping systems operating in the 902-928MHz band and employing at least 50 hopping channels, the maximum peak output conducted power shall not be greater than 1W (30dBm). Per section FCC 15.247(b)(4) and ISED RSS-247 section 5.4(a), this limit is based on the use of antennas with directional gains that do not exceed 6dBi. Since the limit allows for a 6dBi antenna gain, the maximum EIRP can be increased by 6dB to 4 Watt (36dBm).

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

5.1.1.2 Procedures

The EUT was placed on the non-conductive stand and set to transmit. A bilog 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 dipole 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 channels.

5.1.1.3 Results

The results are presented on pages 22 and 24. The maximum EIRP measured from the transmitter was 13.3dBm or 21.4mW which is below the 4 Watt limit.

5.1.2 Radiated Spurious Emissions Measurements

5.1.2.1 Requirements

Per section 15.247(d) (and RSS-247 section 5.5), 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 a radiated emissions measurement. Attenuation below the general limits specified in §15.209(a) (and RSS-Gen Table 5) is not required.

Radiated emissions which fall in the restricted bands, as defined in §15.205(a) (and RSS-Gen, Table 7) must comply with the radiated emission limits specified in §15.209(a) (and RSS-Gen, Table 5).

Paragraph 15.209(a) (and RSS-Gen, Table 5 and Table 6) 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

5.1.2.2 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 10.0GHz was investigated using a peak detector function.

The final emission tests were then manually performed over the frequency range of 30MHz to 10.0GHz.

1) For all harmonics not in the restricted bands, the following procedure was used:
   a) The field strength of the fundamental was measured using a bilog antenna. The bilog antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on an 80 cm 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 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. The EUT was placed on a 1.5 meter high non-conductive stand. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.
   c) To ensure that maximum or worst case emission levels at the fundamental and harmonics were measured, the following steps were taken when measuring the fundamental emissions and the spurious emissions:
      i) The EUT was rotated so that all of its sides were exposed to the receiving antenna.
      ii) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
      iii) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.
   d) All harmonics not in the restricted bands must be at least 20 dB below levels measured at the fundamental. However, attenuation below the general limits specified in §15.209(a) is not required.
2) For all emissions in the restricted bands, the following procedure was used:
   a) The field strengths of all emissions below 1 GHz were measured using a bilog 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 re-measured 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.

5.1.2.3 Results

Transmit at 902.25MHz:

Preliminary radiated emissions plots and final radiated emissions data are presented on pages 25 through 29. As can be seen from the data, all emissions measured from the EUT were within the specification limits.

Transmit at 914.75MHz:

Preliminary radiated emissions plots and final radiated emissions data are presented on pages 30 through 34. As can be seen from the data, all emissions measured from the EUT were within the specification limits.

Transmit at 926.75MHz:

Preliminary radiated emissions plots and final radiated emissions data are presented on pages 35 through 39. 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 in Figures 2 and 3.

5.1.3 Band Edge Compliance

5.1.3.1 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.

5.1.3.2 Procedures

5.1.3.2.1 Low Band Edge

1) The EUT was setup inside the test chamber on a non-conductive stand.
2) A broadband measuring antenna was placed at a test distance of 3 meters from the EUT.
3) The EUT was set to transmit continuously at the channel closest to the low band-edge, hopping function disabled.
4) The EUT was maximized for worst case emissions at the measuring antenna. The maximum meter reading was recorded.
5) 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.

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

5.1.3.2.2 High Band Edge

1) The EUT was set up inside the test chamber on a non-conductive stand.
2) A broadband measuring antenna was placed at a test distance of 3 meters from the EUT.
3) The EUT was set to transmit continuously at the channel closest to the high band-edge, hopping function disabled.
4) The EUT was maximized for worst case emissions at the measuring antenna.
5) To determine the band edge compliance, the following spectrum analyzer settings were used:

    a. Center frequency = high band-edge frequency.
    b. Span = Wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation.
    c. Resolution bandwidth (RBW) ≥ 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 right of the center frequency (band-edge) must be below the display line.)
    f. The analyzer's display was plotted using a 'screen dump' utility.

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

5.1.3.3 Results

Pages 40 through 43 show the radiated band-edge compliance results. As can be seen from these plots, the emissions at the low end band-edge and the high end band-edge are within the 20 dB down limits.

5.2 Digital Transmission System Transmitter Operating in the 2400 – 2483.5MHz Band (FCC ID: HBW8522, IC ID: 2666A-8522)

5.2.1 Average EIRP

5.2.1.1 Requirements

Per FCC15.247(b)(3) and ISED RSS-247 section 5.4(d) , for systems using digital modulation the maximum peak output conducted power shall not be greater than 1.0W (30dBm). Per FCC 15.247(b)(4) and ISED RSS-247 section 5.4(d), 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).

Alternatively, per FCC 15.247(b)(3) and ISED RSS-247 section 5.4(d), compliance with the 1 Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

5.2.1.2 Procedures

The EUT was placed on the non-conductive stand and set to transmit. A double ridged waveguide antenna was placed at a test distance of 3 meters from the EUT. The EUT was maximized for worst case emissions (or maximum output power) at the measuring antenna. Method AVGSA-1 of IEEE C63.10 was used to measure maximum average output power. 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 average power output was calculated for low, middle, and high hopping frequencies.

5.2.1.3 Results

The results are presented on pages 44 through 46. The maximum average EIRP measured from the transmitter was 14.6 dBm or 28.8 mW which is below the 4 Watt limit.

5.2.2 Radiated Spurious Emissions Measurements

5.2.2.1 Requirements

Per section FCC 15.247(d) and ISED RSS-247 section 5.5, 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. If the transmitter complies with the conducted power limits based on the use of averaging over a time interval the attenuation required under this paragraph shall be 30 dB instead of 20 dB. 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) and RSS-Gen, Table 7, must comply with the radiated emission limits specified in §15.209(a) and RSS-Gen Table 5.
Paragraph 15.209(a) and RSS-Gen Table 5 and Table 6 have the following radiated emission limits:

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

5.2.2.2 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 frequency range from 1GHz to 18GHz was investigated using a peak detector function.

The final emission tests were then manually performed over the frequency range of 1GHz to 18GHz

1) For all harmonics not in the restricted bands, the following procedure was used:
   a) The field strength of the fundamental was measured using a double ridged waveguide. 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 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. The EUT was placed on a 1.5 meter high non-conductive stand. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.
   c) To ensure that maximum or worst case emission levels at the fundamental and harmonics were measured, the following steps were taken when measuring the fundamental emissions and the spurious emissions:
      i) The EUT was rotated so that all of its sides were exposed to the receiving antenna.
      ii) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
      iii) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.
      iv) In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer. The measuring antenna was not raised or lowered to ensure maximized readings, instead the EUT was rotated through all axis to ensure the maximum readings were recorded for the EUT.
   d) All harmonics not in the restricted bands must be at least 30 dB below levels measured at the fundamental. However, attenuation below the general limits specified in §15.209(a) is not required.
2) For all emissions in the restricted bands, the following procedure was used:
   a) The field strengths of all emissions below 1 GHz were measured using a bi-log antenna. The bi-log antenna was positioned at a 3 meter distance from the EUT. 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 re-measured 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.

5.2.2.3 Results

Transmit at 2412MHz, 802.11g, 54Mbps, power = 15:

Preliminary radiated emissions plots and final radiated emissions data are presented on pages 47 through 52. As can be seen from the data, all emissions measured from the EUT were within the specification limits.

Transmit at 2437MHz, 802.11n, MCS7, power = 14:

Preliminary radiated emissions plots and final radiated emissions data are presented on pages 53 through 58. As can be seen from the data, all emissions measured from the EUT were within the specification limits.

Transmit at 2412MHz, 802.11g, 54Mbps, power = 15:

Preliminary radiated emissions plots and final radiated emissions data are presented on pages 59 through 64. 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 in Figures 2 and 3.

5.2.3 Band-Edge Compliance

5.2.3.1 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).

5.2.3.2 Procedures

5.2.3.2.1 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.

5.2.3.3 Results

Pages 65 and 66 show the radiated band-edge compliance results. As can be seen from these plots, the radiated emissions at the high end band-edge are within the general limits.

5.3 Intermodulation Case Spurious Radiated Measurements

5.3.1 Requirements

Per FCC KDB 996369 section VII and footnote 9, a transmitter module capable of transmitting simultaneously with another transmitter must be tested by following the simultaneous test procedures described in 15.31(k).

15.31(k) states that composite systems (i.e., systems that incorporate different devices contained in a single enclosure or in separate enclosures connected by wire or cable) shall be measured for compliance with the technical standards in accordance with the procedures in §2.947(f).

2.947(f) states that if the individual devices in a composite system are subject to different technical standards, each such device must comply with its specific standards. In no event may the measured emissions of the composite system exceed the highest level permitted for an individual component. Testing for compliance with the different standards shall be performed with all of the devices in the system functioning.

FCC 15.247:

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

5.3.2 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.

1. Preliminary radiated measurements were performed to determine the frequencies where the significant emissions might be found. With the EUT at one set position and the measurement antenna at a set height (i.e. without maximizing), the radiated emissions were measured using a peak detector and automatically plotted. The broadband measuring antenna was positioned at a 3 meter distance from the EUT. This data was then automatically plotted from 10MHz through 25GHz. All preliminary tests were performed separately with the EUT operating in the intermodulation mode listed in Paragraph 3.3.

2. All significant broadband and narrowband signals found in the preliminary sweeps were then measured using a peak detector at a test distance of 3 meters. The measurements were made with a bilog antenna from 30MHz to 1GHz, and a double ridged waveguide antenna over the frequency range of 1GHz to 18GHz.

3. To ensure that maximum emission levels were measured, the following steps were taken:

    a. The EUT was rotated so that all of its sides were exposed to the receiving antenna.
    b. Since the measuring antennas are 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.

5.3.3 Results

Transmit at 914.75MHz, WiFi Transmit at 2437MHz, 802.11b, 1Mbps, power = 15:

The plots of the peak preliminary spurious radiated emissions are presented on pages 67 through 72. As can be seen from the data, the intermodulation product of simultaneous transmissions from the EUT did not generate additional spurious radiated emissions that were above the limits.

Transmit at 914.75MHz, WiFi Transmit at 2437MHz, 802.11g, 54Mbps, power = 15:

The plots of the peak preliminary spurious radiated emissions are presented on pages 73 through 78. As can be seen from the data, the intermodulation product of simultaneous transmissions from the EUT did not generate additional spurious radiated emissions that were above the limits.

Transmit at 914.75MHz, WiFi Transmit at 2437MHz, 802.11n, MCS7, power = 14:

The plots of the peak preliminary spurious radiated emissions are presented on pages 79 through 84. As can be seen from the data, the intermodulation product of simultaneous transmissions from the EUT did not generate additional spurious radiated emissions that were above the limits.

Photographs of the test setup are shown in Figure 2 and Figure 3.

6. CONCLUSIONS

Chamberlain Group, Inc. Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module, Part No. DDO8900W did fully meet the following:

- Class II permissive change requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, 15.247 for a Frequency Hopping Spread Spectrum Intentional Radiator Operating within the 902-928 MHz band.
- Class II permissive change requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, 15.247 for a Digital Modulation Intentional Radiator Operating within the 2400 – 2483.5MHz band.
- Class II permissive change requirements of the Innovation, Science, and Economic Development Canada, RSS-247 for a Frequency Hopping Spread Spectrum Intentional Radiator Operating within the 902-928 MHz band.
- Class II permissive change requirements of the Innovation, Science, and Economic Development Canada, RSS-247 for a Digital Modulation Intentional Radiator Operating within the 2400 – 2483.5MHz band.
- Intermodulation case spurious radiated emissions requirements of the FCC “Code of Federal Regulations” Title 47, Part 15, Subpart C, Section 15.247.

Testing was performed in accordance with ANSI C63.10-2013.

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
APW3	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-35-120-5R0-10-12	PL2924	1GHZ-20GHZ	4/12/2018	4/12/2019
CDY0	WORKSTATION	ELITE	WORKSTATION		WINDOWS 7	N/A	
NDQ0	TUNED DIPOLE ANTENNA	EMCO	3121C-DB4	311	400-1000MHZ	5/8/2018	5/8/2020
NTA3	BILOG ANTENNA	TESEQ	6112D	32853	25-1000MHz	10/3/2018	10/3/2019
NWQ0	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66657	1GHZ-18GHZ	5/31/2018	5/31/2020
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	4/10/2018	4/10/2020
RBG3	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101592	2HZ-44GHZ	2/20/2019	2/20/2020
SHC2	Power Supplies	HENGFU	HF60W-SL-24	A11372702	24V	NOTE 1	
XPQ3	HIGH PASS FILTER	K&L MICROWAVE	4IH30-1804/T10000-0	4	1.8GHZ-10GHZ	9/12/2017	9/12/2019
XPQ4	HIGH PASS FILTER	K&L MICROWAVE	11SH10-4800/X20000-O/O	1	4.8-20GHZ	9/12/2017	9/12/2019

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.

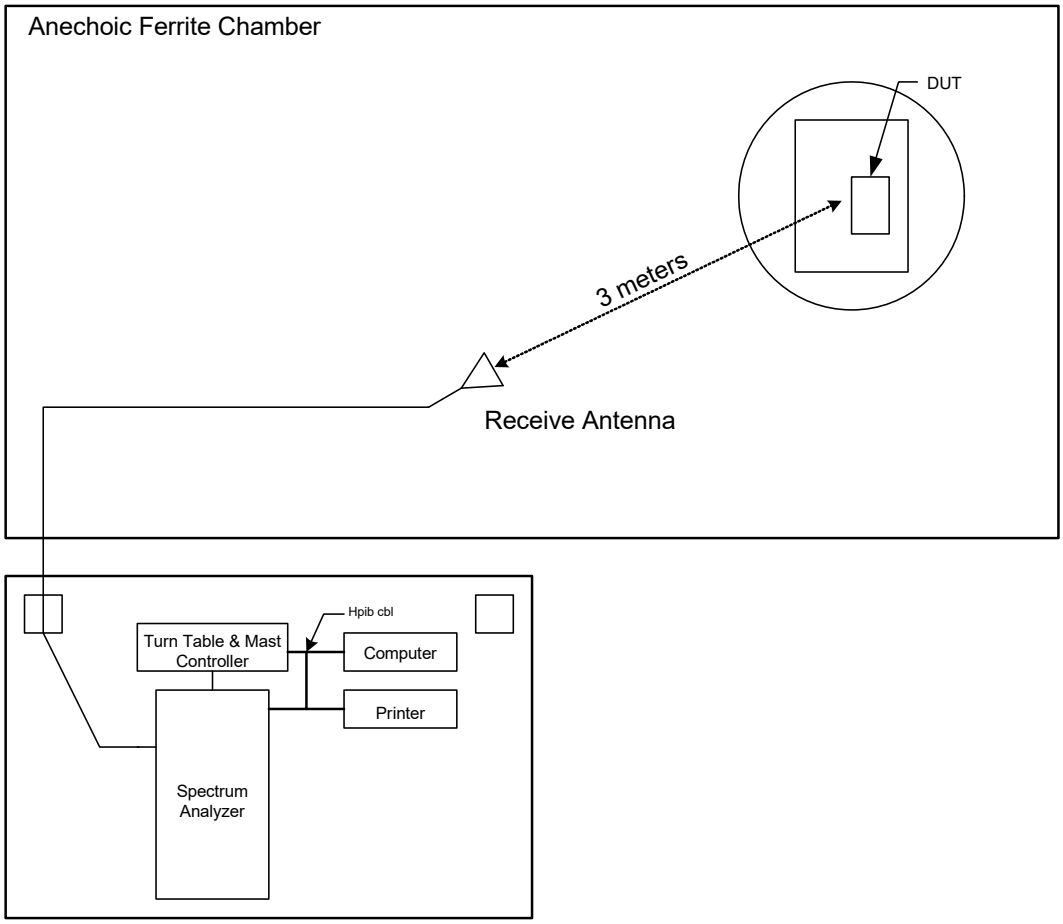


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

Figure 2

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 above1GHz, Horizontal Polarization

Test Setup for Radiated Emissions above 1GHz, Vertical Polarization

Manufacturer : Chamberlain Group, Inc.
Test Item : Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No. : DDO8900W
Mode : Transmit at 902.25MHz
Test Specification : FCC-15.247, RSS-247 Peak EIRP
Date : March 26, 2019
Test Distance : 3 meters
Notes :

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)
902.25	H	79.8	9.6	2.2	1.6	10.1	30.0	-19.9
902.25	V	76.4	8.3	2.2	1.6	8.8	30.0	-21.2

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

Manufacturer : Chamberlain Group, Inc.
Test Item : Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No. : DDO8900W
Mode : Transmit at 914.75MHz
Test Specification : FCC-15.247, RSS-247 Peak EIRP
Date : March 26, 2019
Test Distance : 3 meters
Notes :

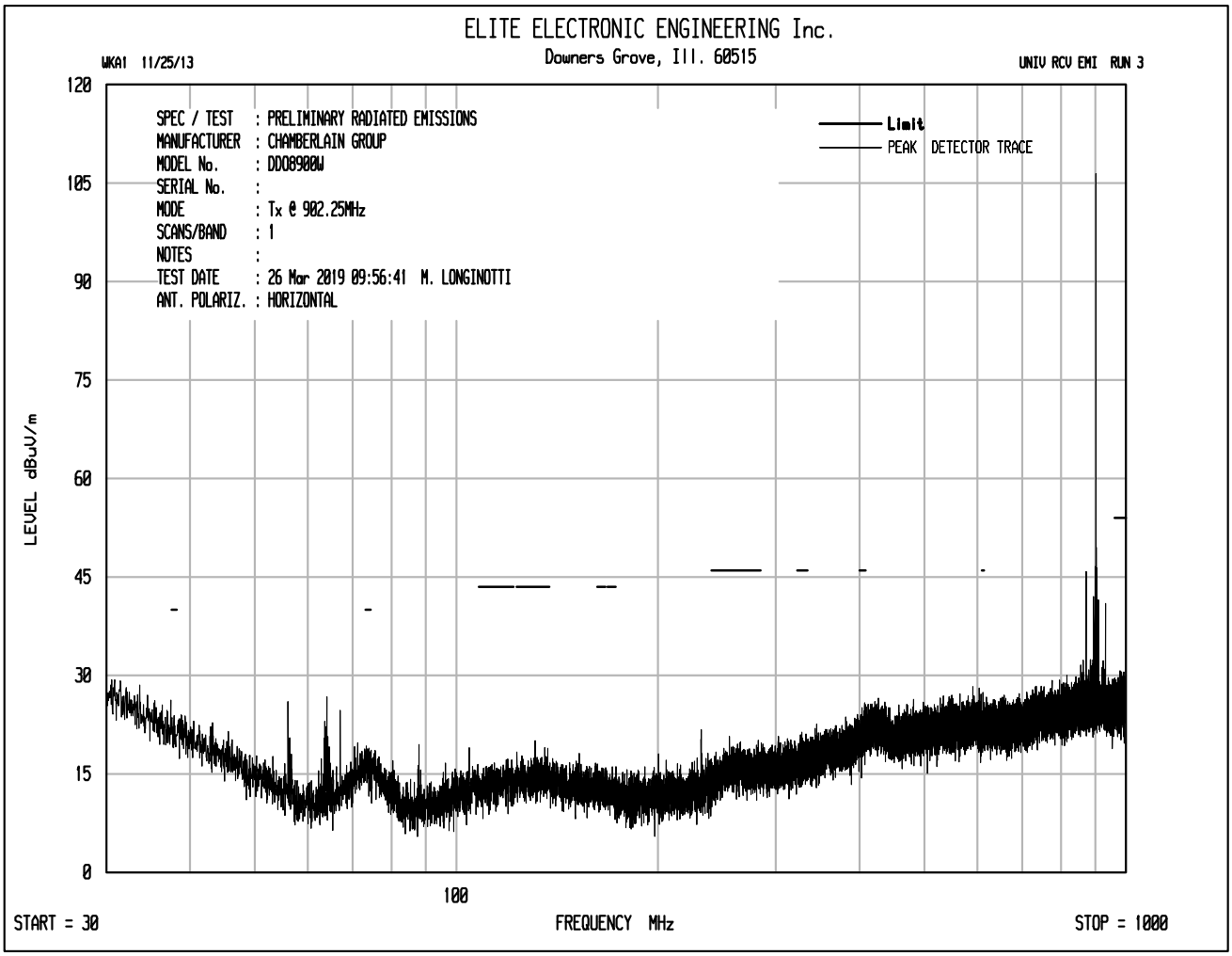
Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
914.75	H	79.8	9.6	2.2	1.6	10.1	30.0	-19.9
914.75	V	78.5	9.9	2.2	1.6	10.4	30.0	-19.6

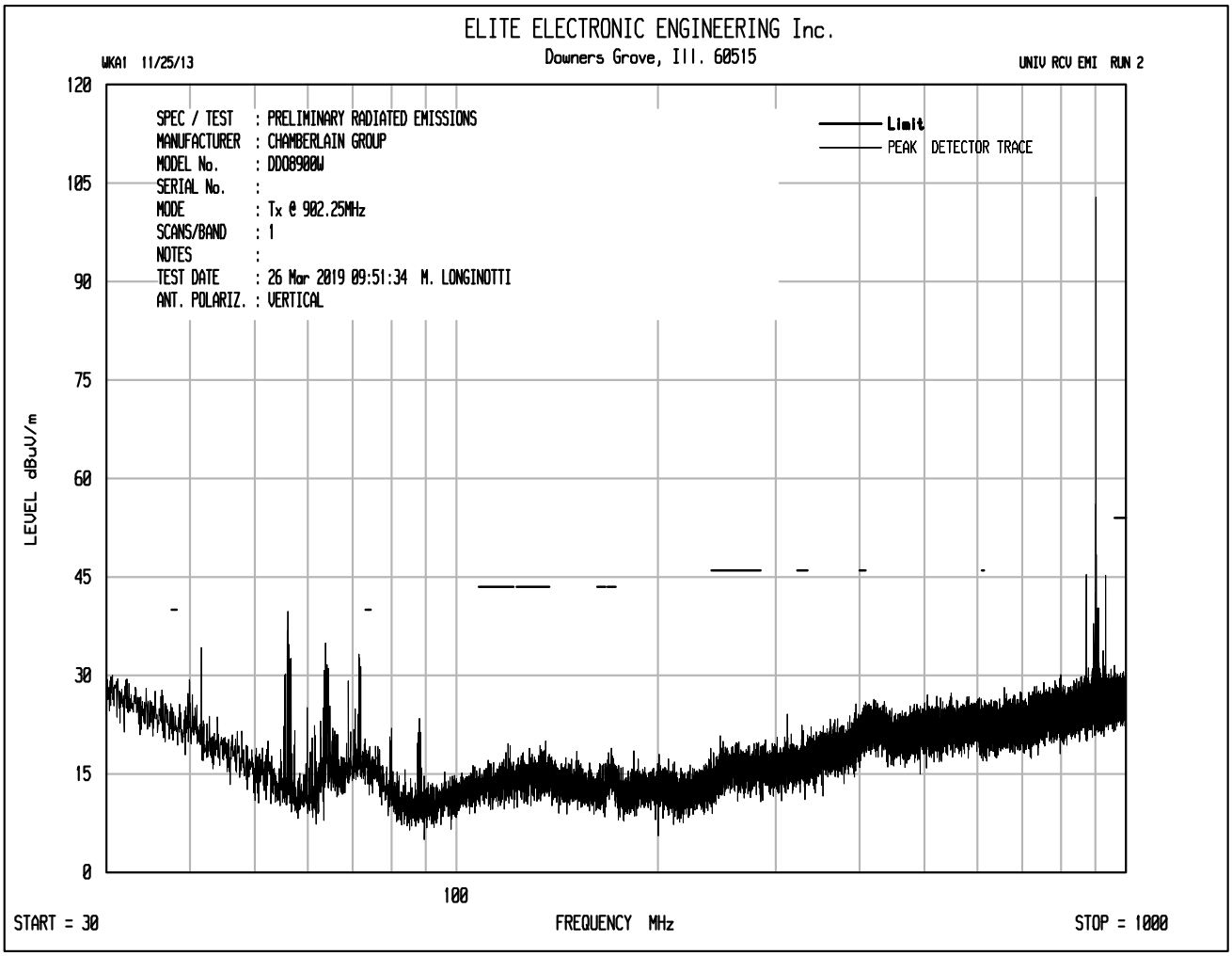
EIRP (dBm) = Matched Sig. Gen. Reading (dBm) + Antenna Gain (dB) – Cable Loss (dB)

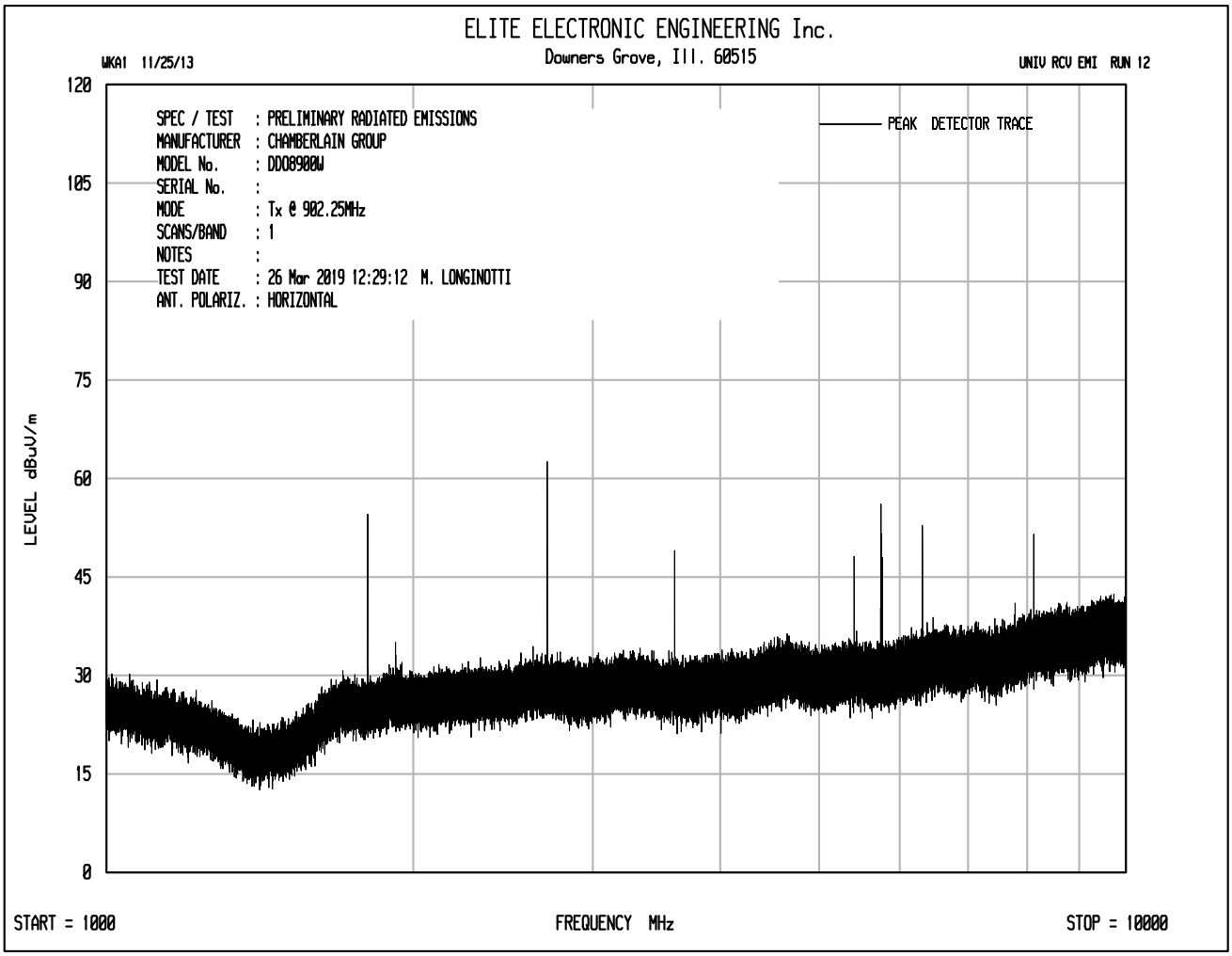
Manufacturer : Chamberlain Group, Inc.
Test Item : Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No. : DDO8900W
Mode : Transmit at 926.75MHz
Test Specification : FCC-15.247, RSS-247 Peak EIRP
Date : March 26, 2019
Test Distance : 3 meters
Notes :

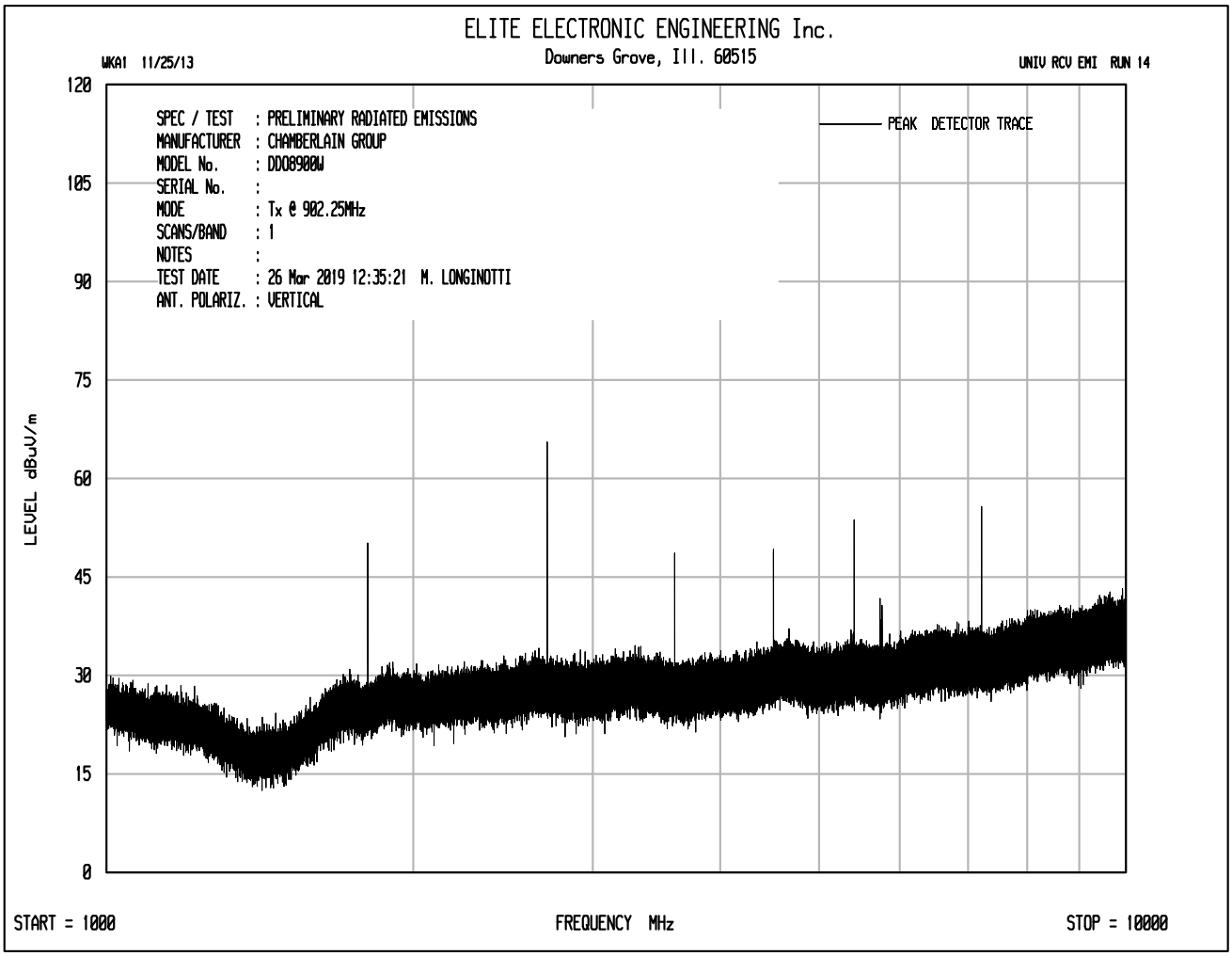
Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
926.75	H	79.4	12.5	2.2	1.7	13.0	30.0	-16.7
926.75	V	80.3	12.4	2.2	1.7	12.9	30.0	-17.1

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


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDO8900W
SERIAL No. :
MODE : Tx @ 902.25MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 26 Mar 2019 09:56:41 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
Limit
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 : CHAMBERLAIN GROUP
MODEL No. : DDO8900W
SERIAL No. :
MODE : Tx @ 902.25MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 26 Mar 2019 09:51:34 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

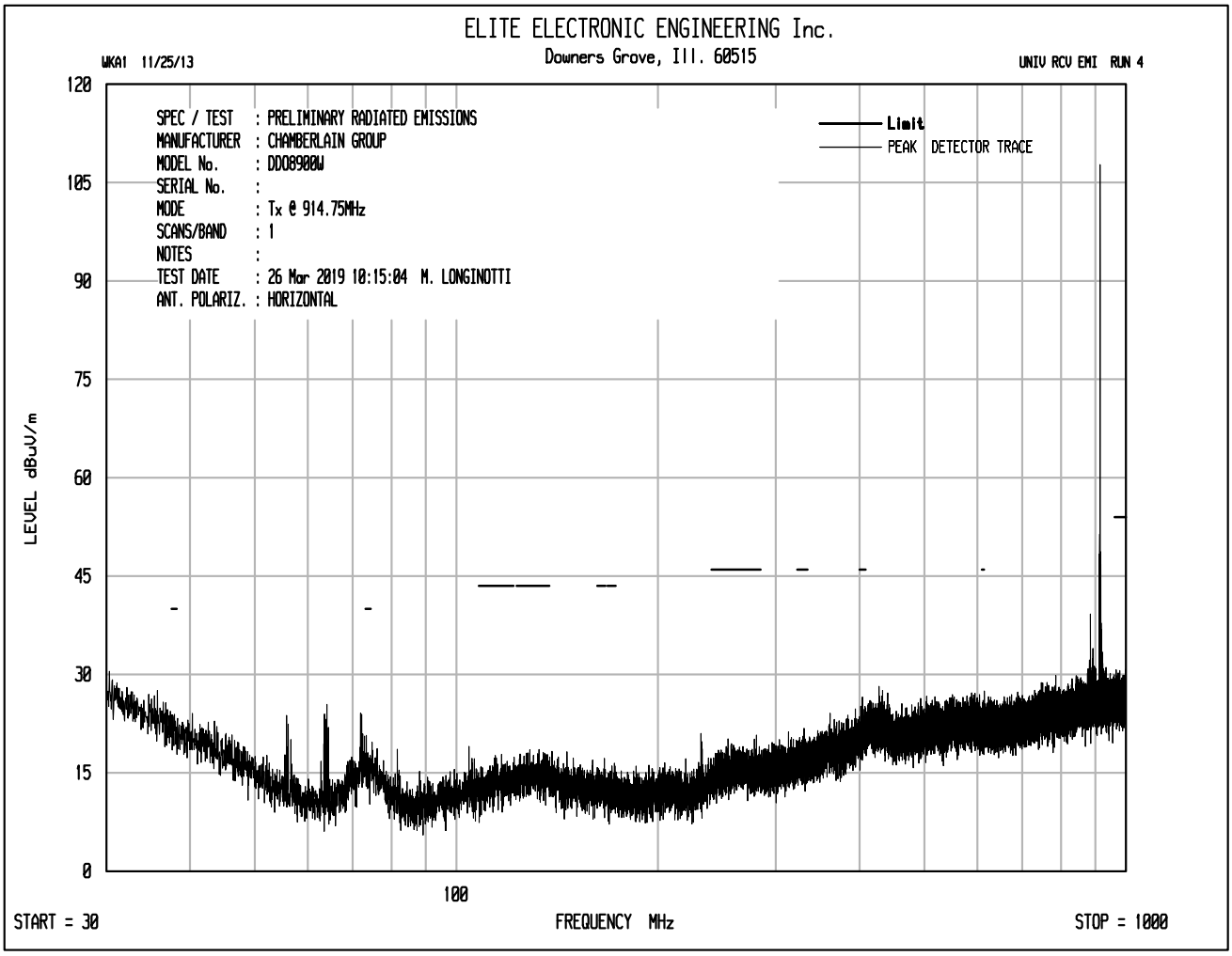

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 12
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDO8980W
SERIAL No. :
MODE : Tx @ 902.25MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 26 Mar 2019 12:29:12 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

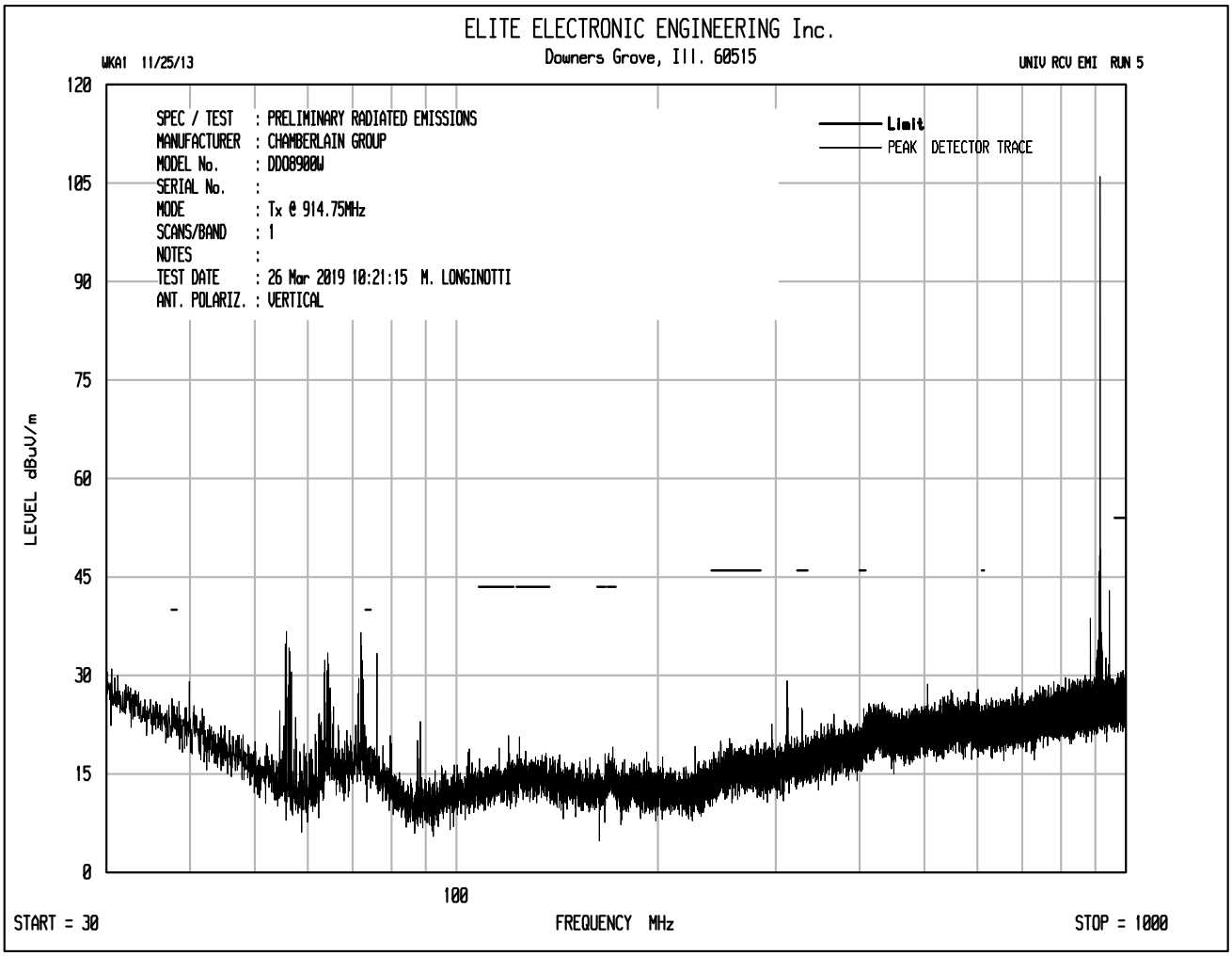

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 14
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDO8980W
SERIAL No. :
MODE : Tx @ 902.25MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 26 Mar 2019 12:35:21 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

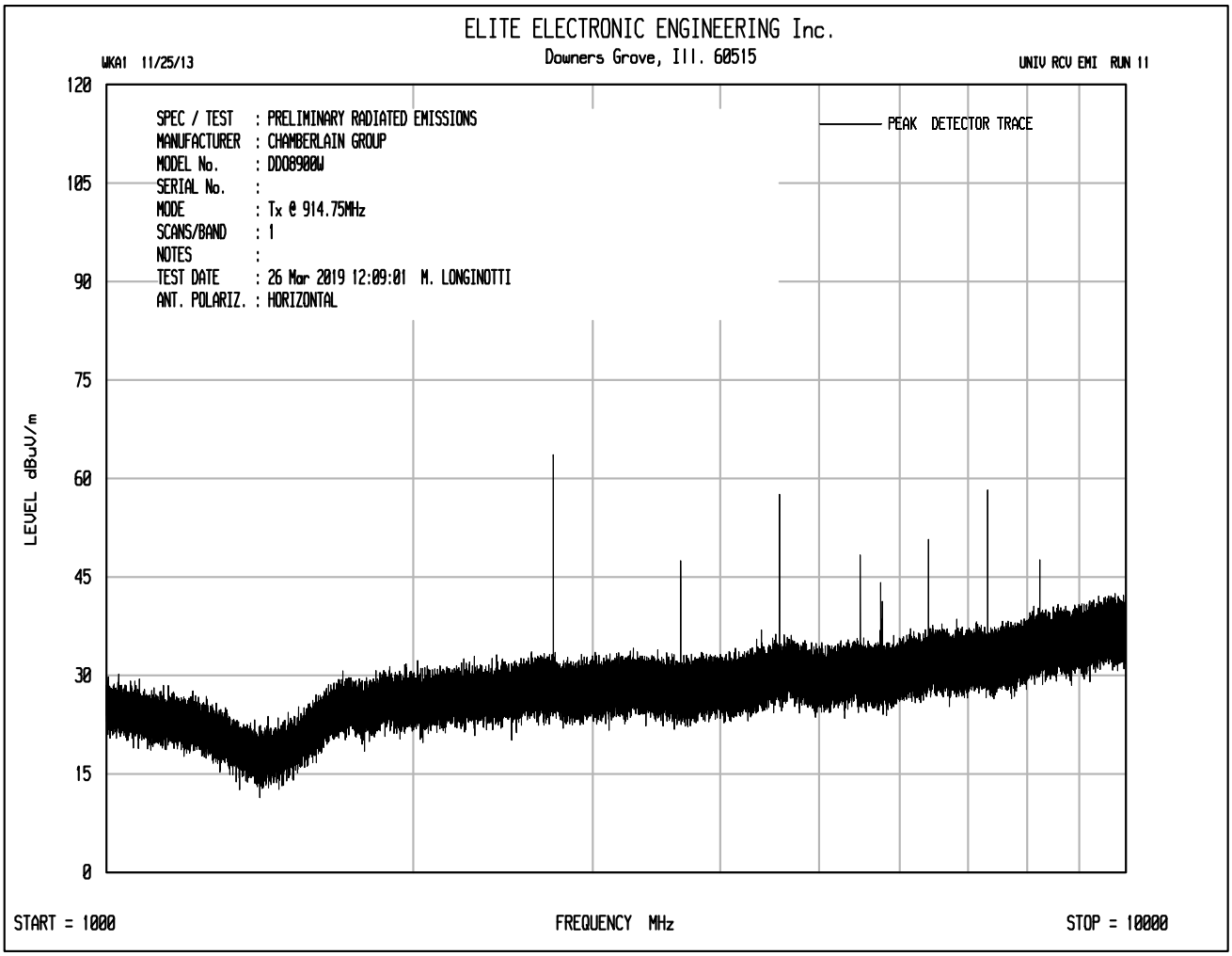
Manufacturer : Chamberlain Group, Inc.
Test Item : Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No. : DDO8900W
Mode : Transmit at 902.25MHz
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions in Restricted Bands
Date : March 26, 2019
Test Distance : 3 meters
Notes : Peak Detector with 1MHz Resolution Bandwidth

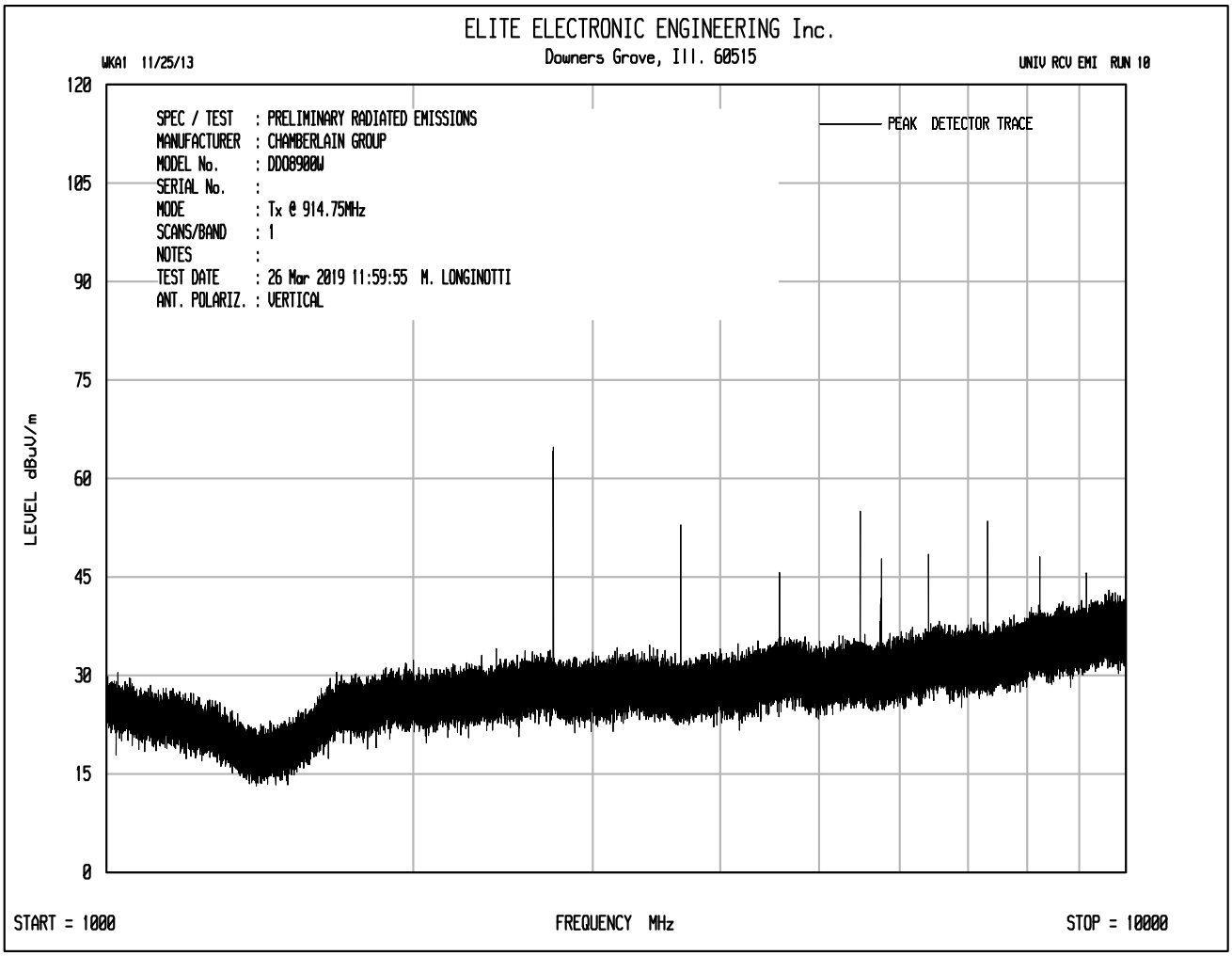
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2706.75	H	68.7		3.7	32.5	-40.4	64.5	1669.8	5000.0	-9.5
2706.75	V	71.0		3.7	32.5	-40.4	66.8	2176.0	5000.0	-7.2
3609.00	H	56.8		4.3	33.0	-40.3	53.7	485.3	5000.0	-20.3
3609.00	V	58.5		4.3	33.0	-40.3	55.4	590.2	5000.0	-18.6
4511.25	H	63.4		4.7	34.0	-40.1	62.0	1265.9	5000.0	-11.9
4511.25	V	60.7		4.7	34.0	-40.1	59.3	927.7	5000.0	-14.6

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


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DD08900W
SERIAL No. :
MODE : Tx @ 914.75MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 26 Mar 2019 10:15:04 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
Limit
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 : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDO8900W
SERIAL No. :
MODE : Tx @ 914.75MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 26 Mar 2019 10:21:15 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

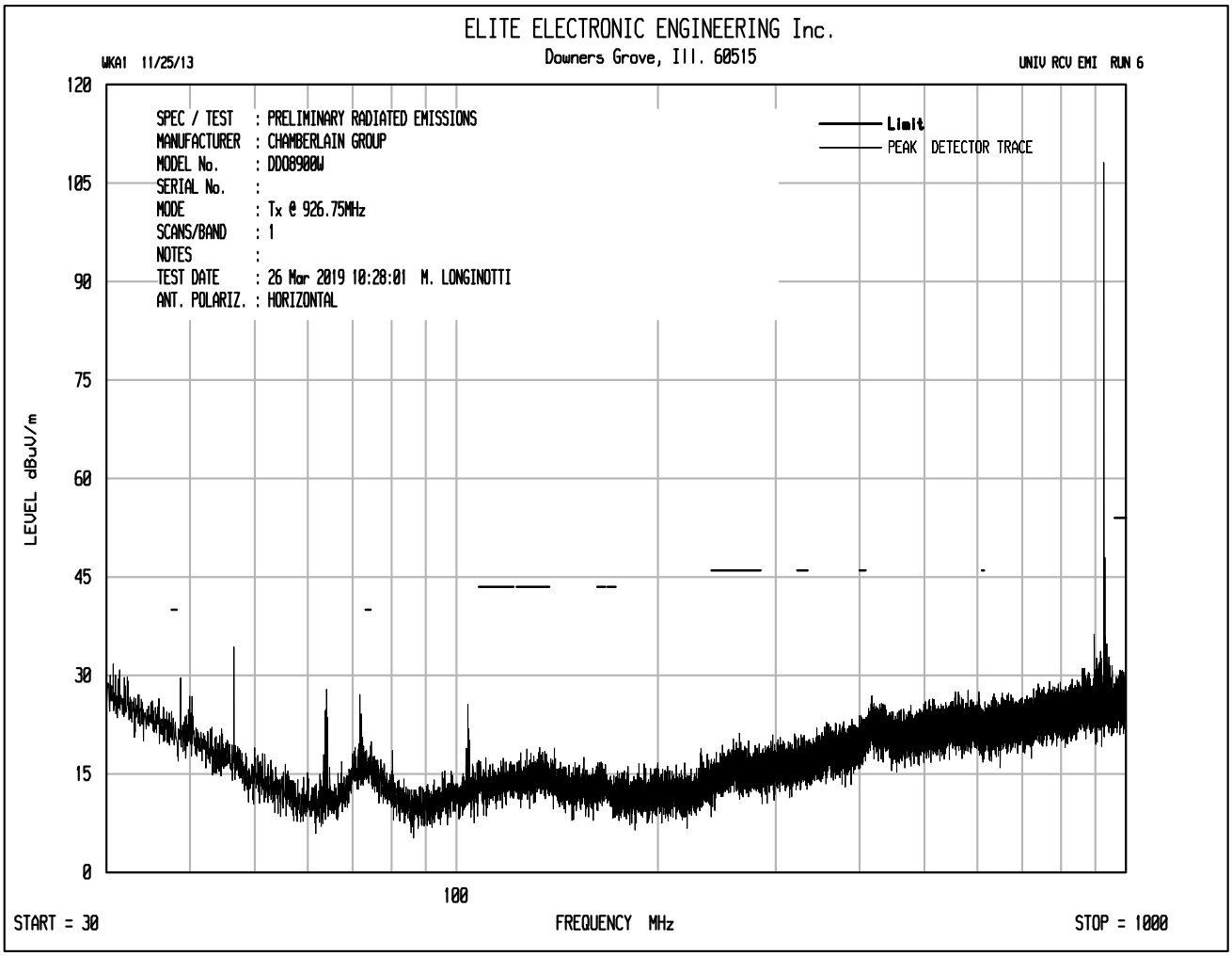

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 11
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDO8900W
SERIAL No. :
MODE : Tx @ 914.75MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 26 Mar 2019 12:09:01 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

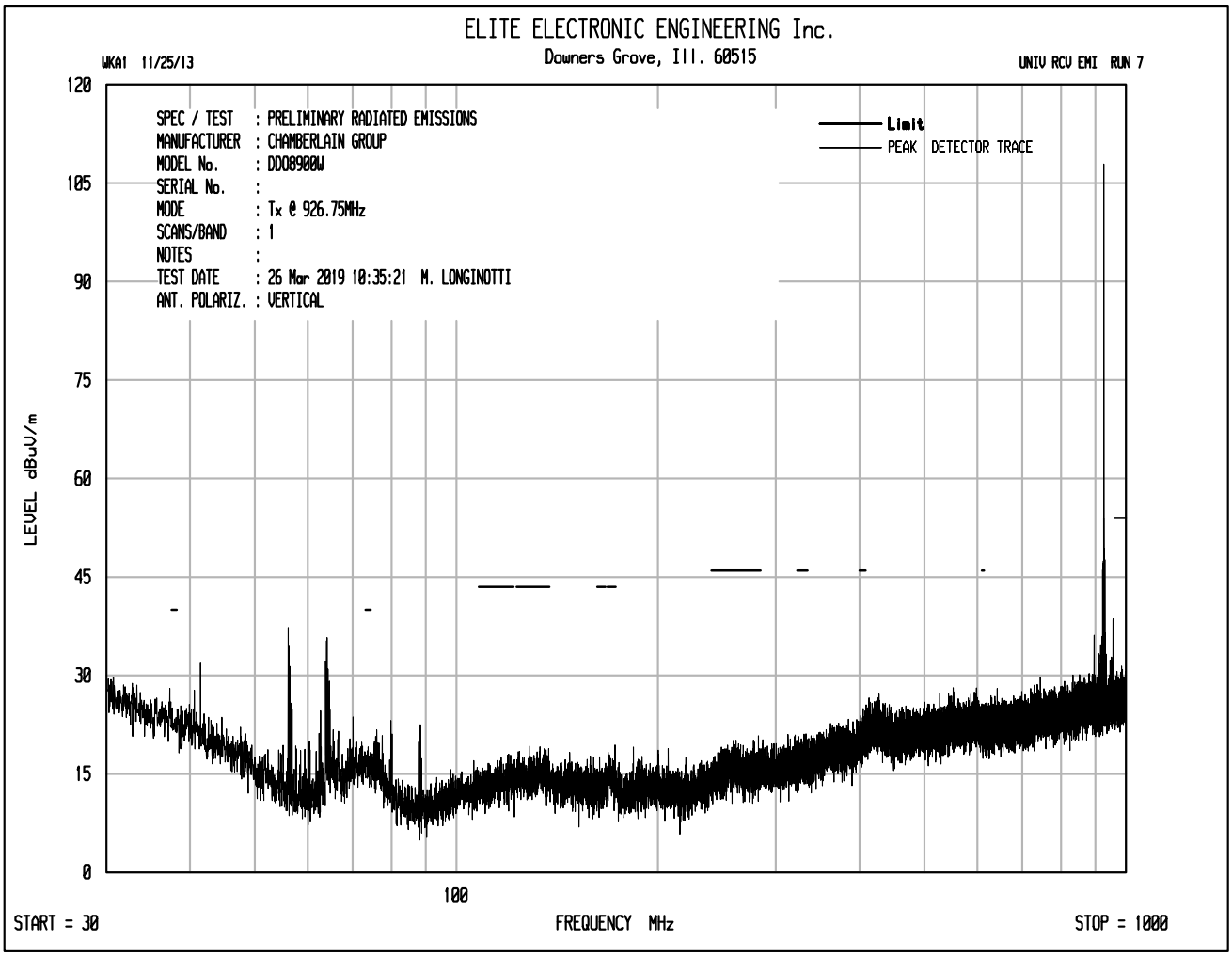

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDO8980W
SERIAL No. :
MODE : Tx @ 914.75MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 26 Mar 2019 11:59:55 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

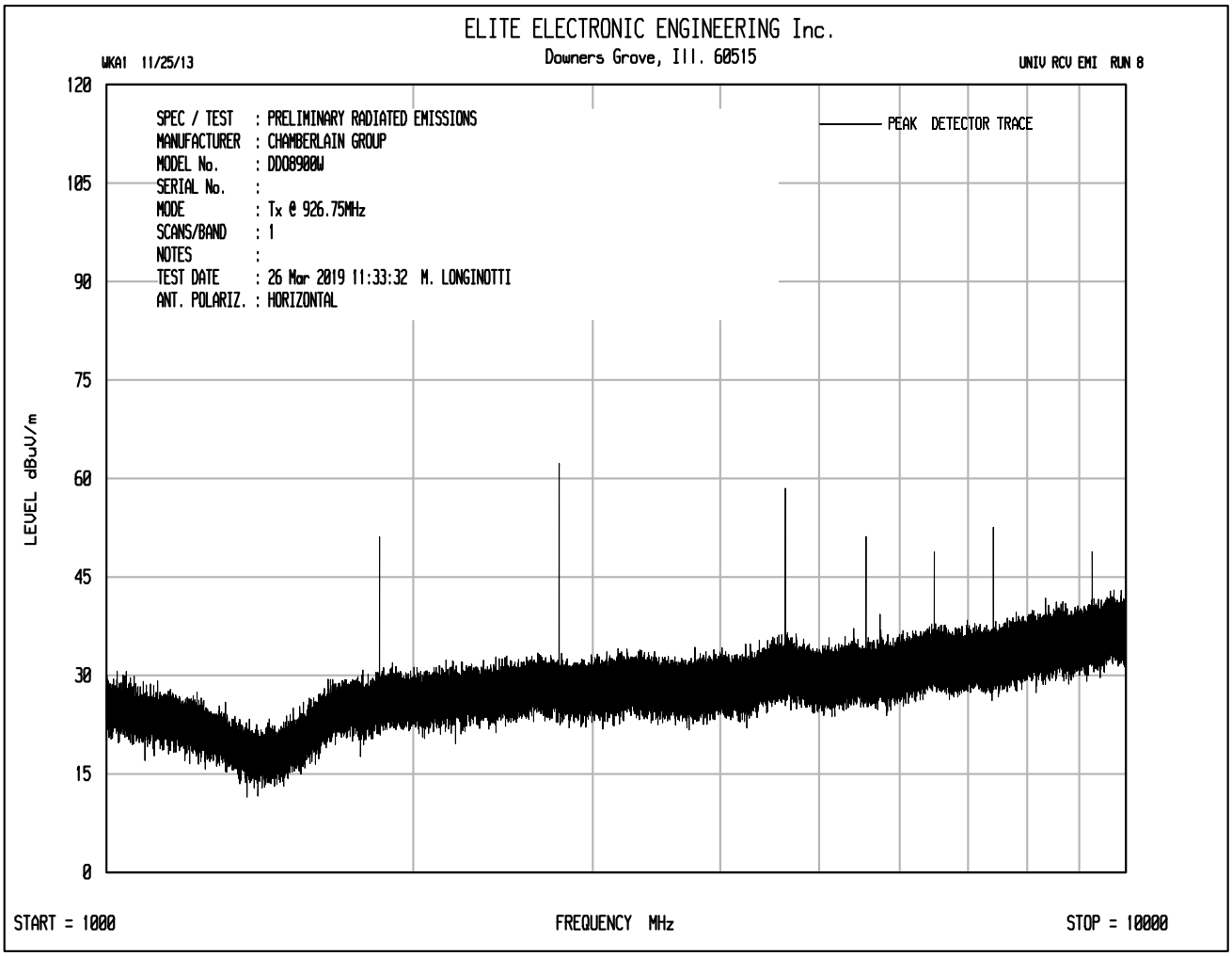
Manufacturer : Chamberlain Group, Inc.
Test Item : Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No. : DDO8900W
Mode : Transmit at 914.75MHz
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions in Restricted Bands
Date : March 26, 2019
Test Distance : 3 meters
Notes : Peak Detector with 1MHz Resolution Bandwidth

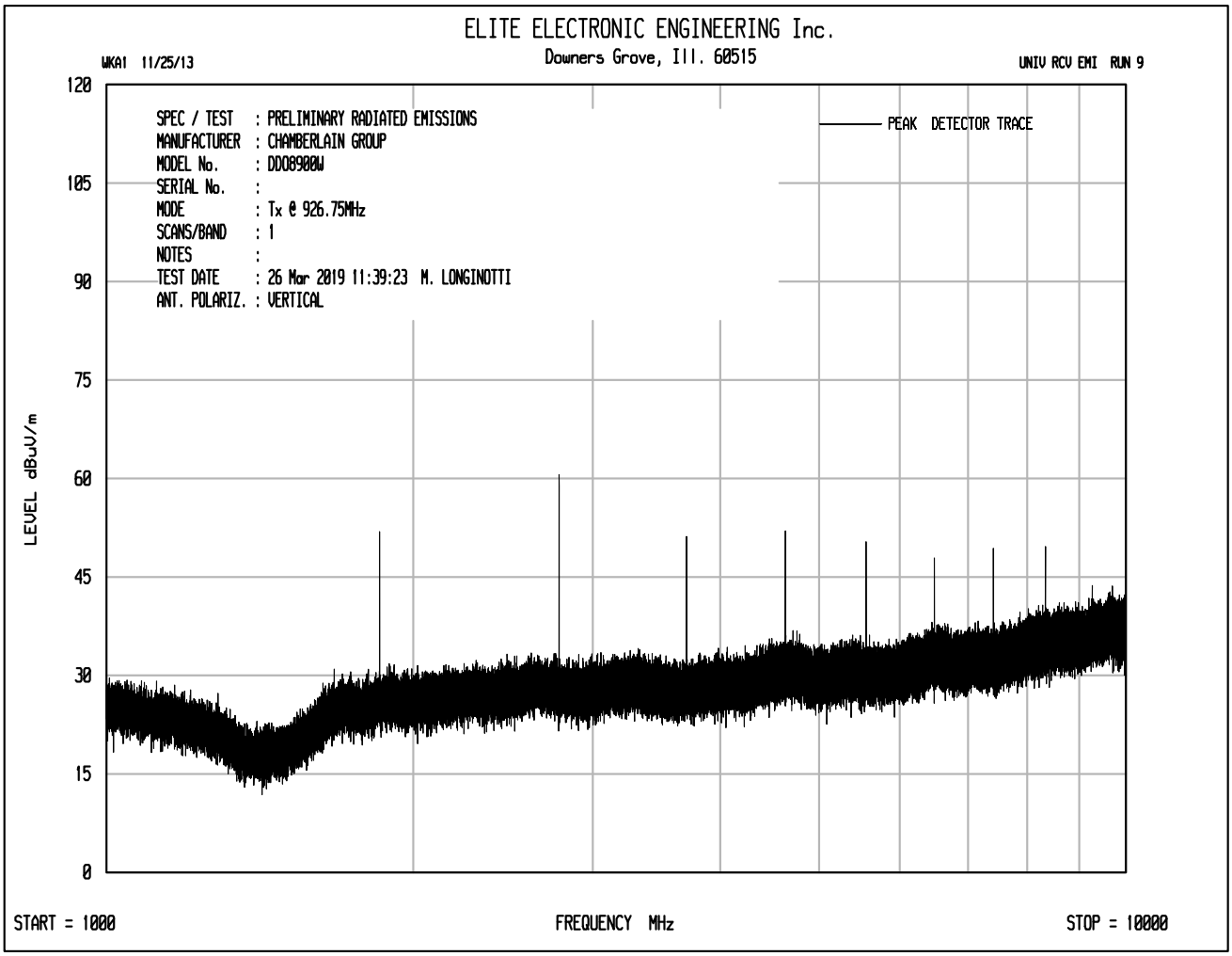
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2744.25	H	69.0		3.7	32.6	-40.4	64.9	1750.3	5000.0	-9.1
2744.25	V	71.0		3.7	32.6	-40.4	66.9	2203.4	5000.0	-7.1
3659.00	H	57.8		4.3	33.0	-40.3	54.8	549.1	5000.0	-19.2
3659.00	V	57.9		4.3	33.0	-40.3	54.9	555.4	5000.0	-19.1
4573.75	H	61.7		4.7	34.2	-40.1	60.5	1059.7	5000.0	-13.5
4573.75	V	60.1		4.7	34.2	-40.1	58.9	881.5	5000.0	-15.1

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


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 6
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDO8900W
SERIAL No. :
MODE : Tx @ 926.75MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 26 Mar 2019 10:28:01 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
Limit
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 : CHAMBERLAIN GROUP
MODEL No. : DDO8900W
SERIAL No. :
MODE : Tx @ 926.75MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 26 Mar 2019 10:35:21 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

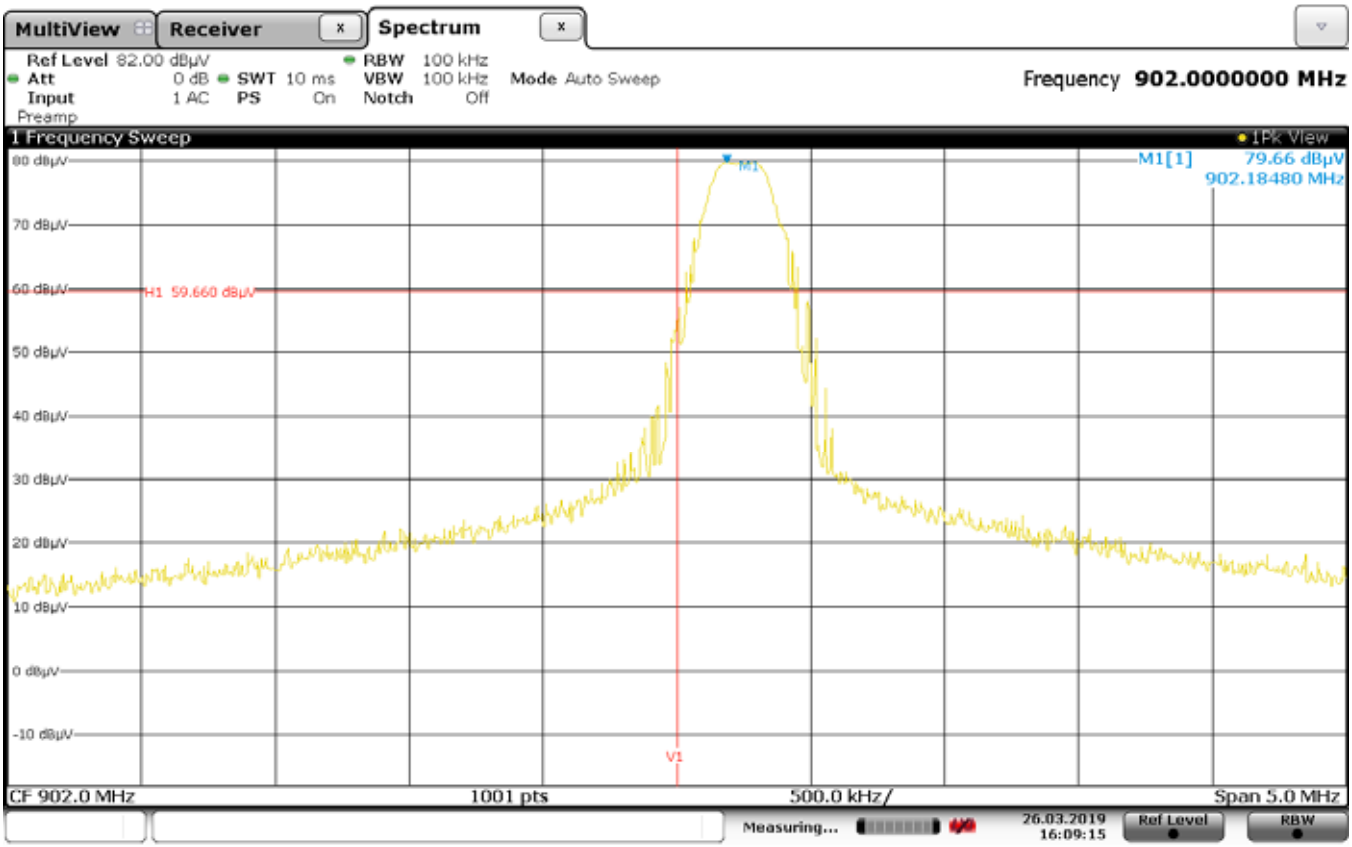

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 8
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDO8980W
SERIAL No. :
MODE : Tx @ 926.75MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 26 Mar 2019 11:33:32 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 9
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDO8980W
SERIAL No. :
MODE : Tx @ 926.75MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 26 Mar 2019 11:39:23 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

Manufacturer : Chamberlain Group, Inc.
Test Item : Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No. : DDO8900W
Mode : Transmit at 926.75MHz
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions in Restricted Bands
Date : March 26, 2019
Test Distance : 3 meters
Notes : Peak Detector with 1MHz Resolution Bandwidth

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)
2780.25	H	69.0		3.7	32.5	-40.4	64.8	1737.5	5000.0	-9.2
2780.25	V	69.6		3.7	32.5	-40.4	65.4	1861.8	5000.0	-8.6
3707.00	H	57.8		4.3	33.0	-40.2	54.8	552.5	5000.0	-19.1
3707.00	V	60.0		4.3	33.0	-40.2	57.0	711.8	5000.0	-16.9
4633.75	H	61.8		4.8	34.3	-40.2	60.7	1089.9	5000.0	-13.2
4633.75	V	60.8		4.8	34.3	-40.2	59.7	971.4	5000.0	-14.2

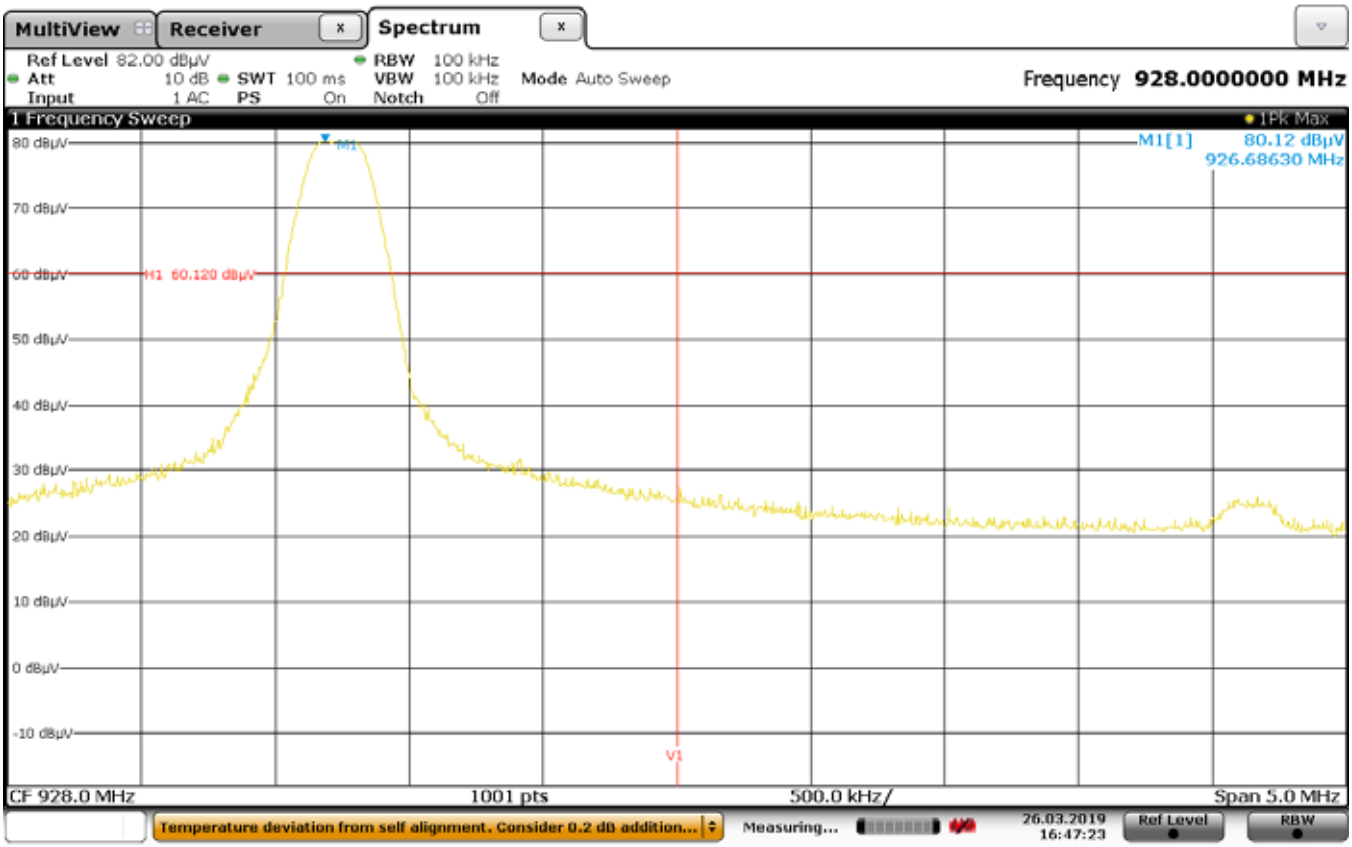
Total (dBuV/m) = Meter Reading + CBL FAC + Ant Fac + Pre Amp



Manufacturer	: Chamberlain Group, Inc.
Test Item	: Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No.	: DDO8900W
Mode	: Transmit at 926.75MHz
Test Specification	: FCC-15.247, RSS-247 Peak Radiated Emissions at Low Band Edge
Date	: March 26, 2019
Test Distance	: 3 meters

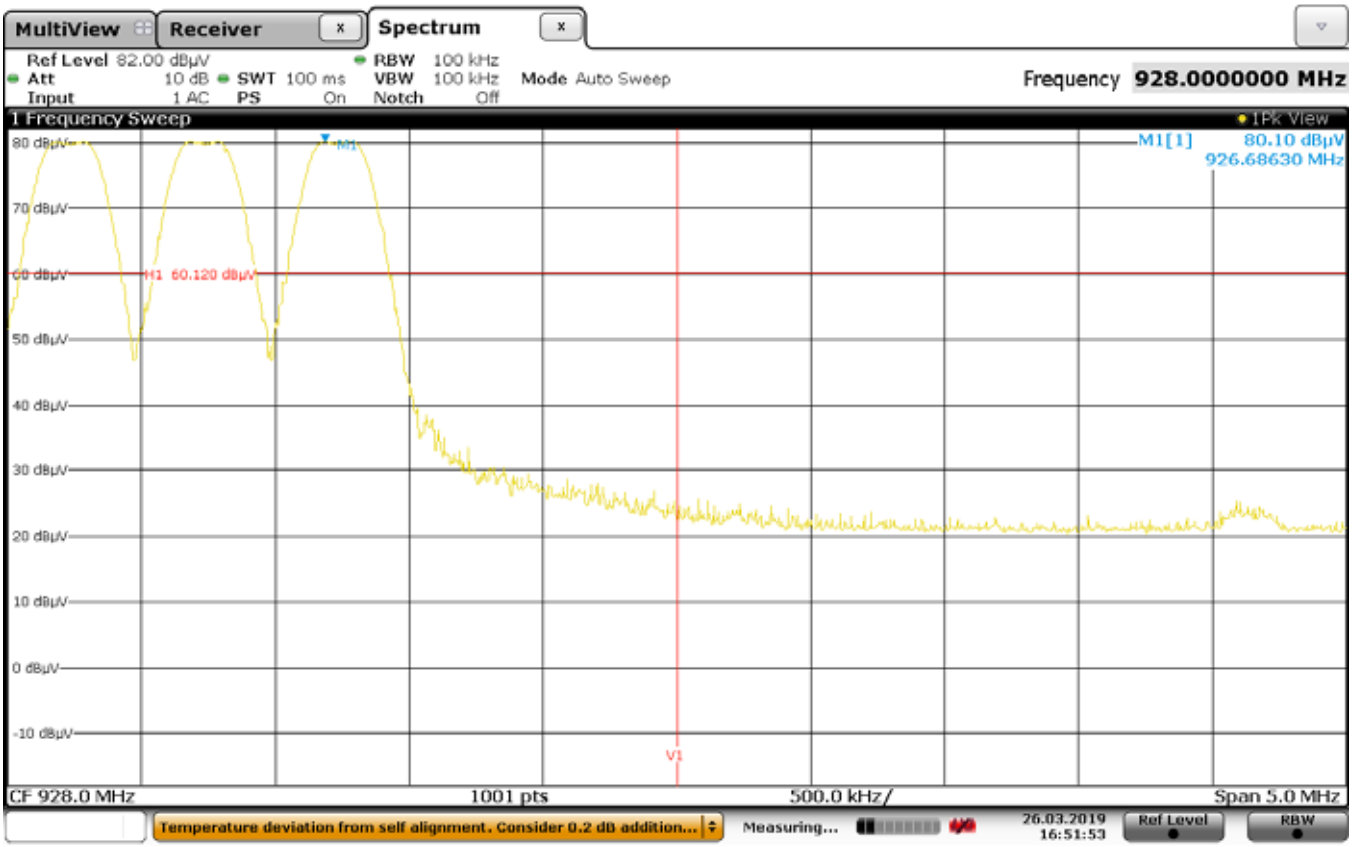
Date: 26.MAR.2019 16:15:47

Manufacturer	: Chamberlain Group, Inc.
Test Item	: Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No.	: DDO8900W
Mode	: Hopping Enabled
Test Specification	: FCC-15.247, RSS-247 Peak Radiated Emissions at Low Band Edge
Date	: March 26, 2019
Test Distance	: 3 meters



Date: 26.MAR.2019 16:47:23

Manufacturer	: Chamberlain Group, Inc.
Test Item	: Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No.	: DDO8900W
Mode	: Transmit at 926.75MHz
Test Specification	: FCC-15.247, RSS-247 Peak Radiated Emissions at High Band Edge
Date	: March 26, 2019
Test Distance	: 3 meters



Date: 26.MAR.2019 16:51:52

Manufacturer	: Chamberlain Group, Inc.
Test Item	: Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No.	: DDO8900W
Mode	: Hopping Enabled
Test Specification	: FCC-15.247, RSS-247 Peak Radiated Emissions at High Band Edge
Date	: March 26, 2019
Test Distance	: 3 meters

Manufacturer : Chamberlain Group, Inc.
Test Item : Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No. : DDO8900W
Mode : Transmit at 2412MHz, 802.11g 54Mbps, power = 15
Test Specification : FCC-15.247, RSS-247 Average EIRP
Date : March 27, 2019
Test Distance : 3 meters
Notes :

Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBm)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2412.00	H	-34.4	12.2	4.3	2.8	13.7	36.0	-22.3
2412.00	V	-33.1	12.8	4.3	2.8	14.3	36.0	-21.7

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

Manufacturer : Chamberlain Group, Inc.
Test Item : Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No. : DDO8900W
Mode : Transmit at 2437MHz, 802.11n MCS7, power = 14
Test Specification : FCC-15.247, RSS-247 Average EIRP
Date : March 27, 2019
Test Distance : 3 meters
Notes :

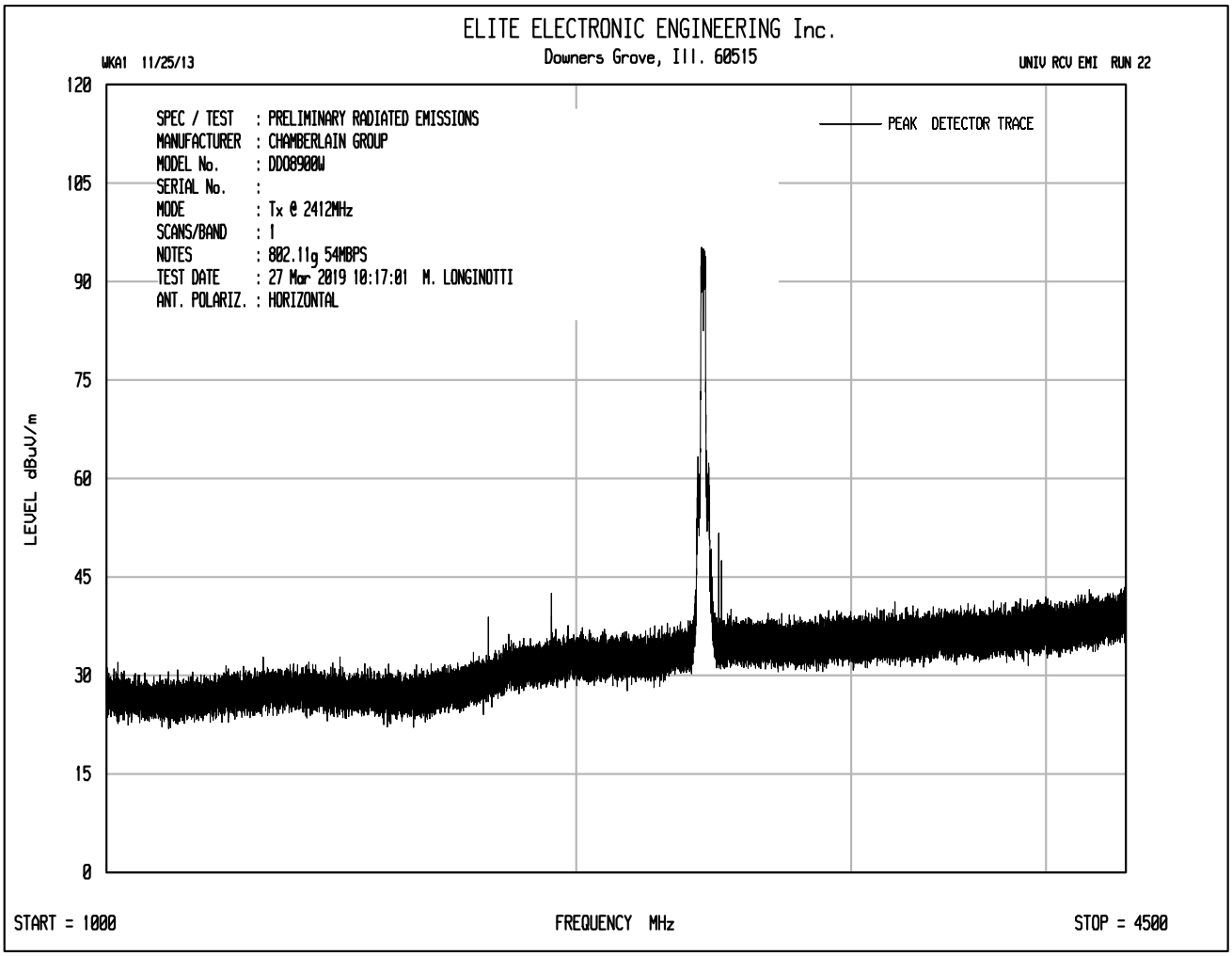
Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBm)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2437.00	H	-33.3	13.0	4.4	2.8	14.6	36.0	-21.4
2437.00	V	-35.1	11.2	4.4	2.8	12.8	36.0	-23.2

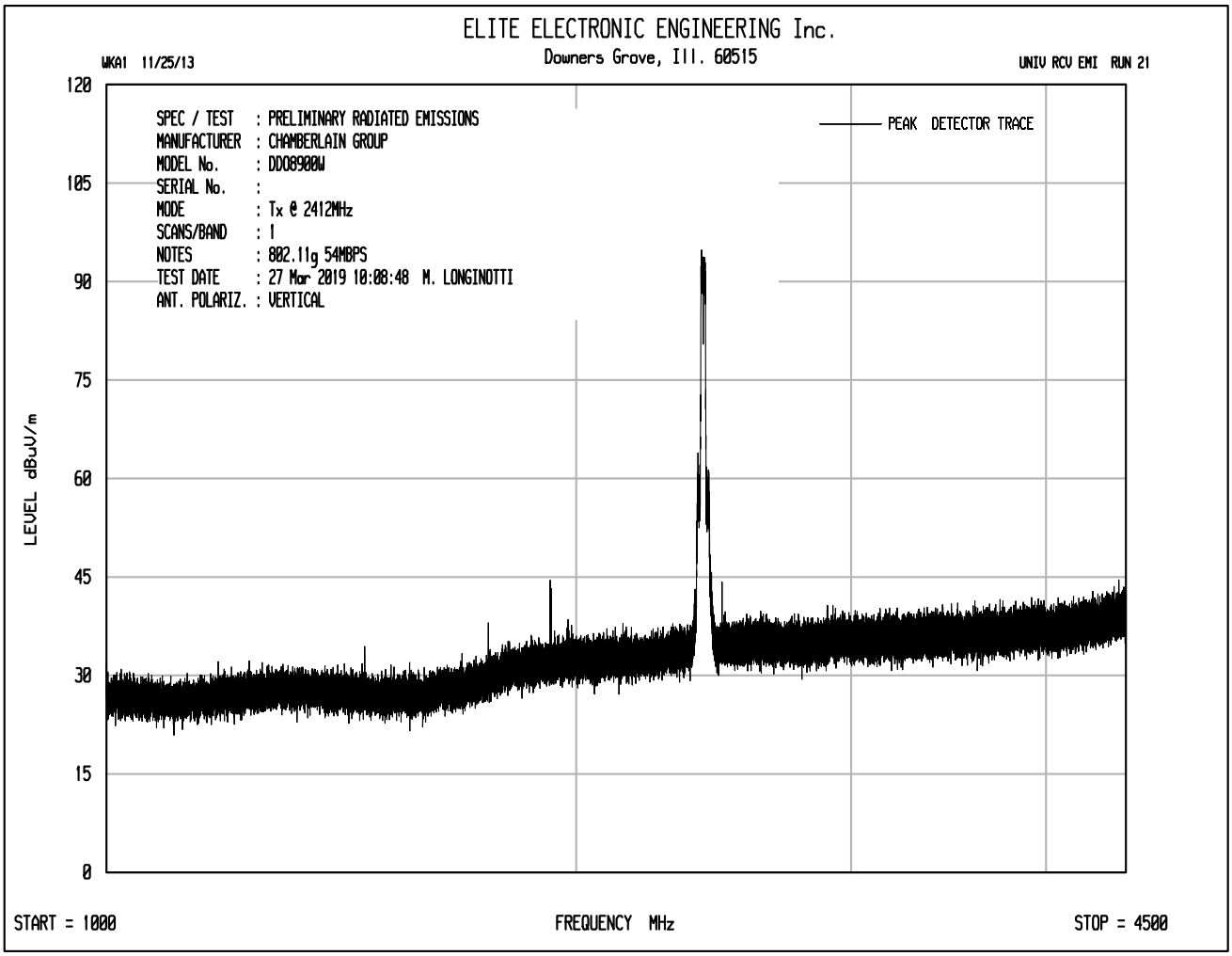
EIRP (dBm) = Matched Sig. Gen. Reading (dBm) + Antenna Gain (dB) – Cable Loss (dB)

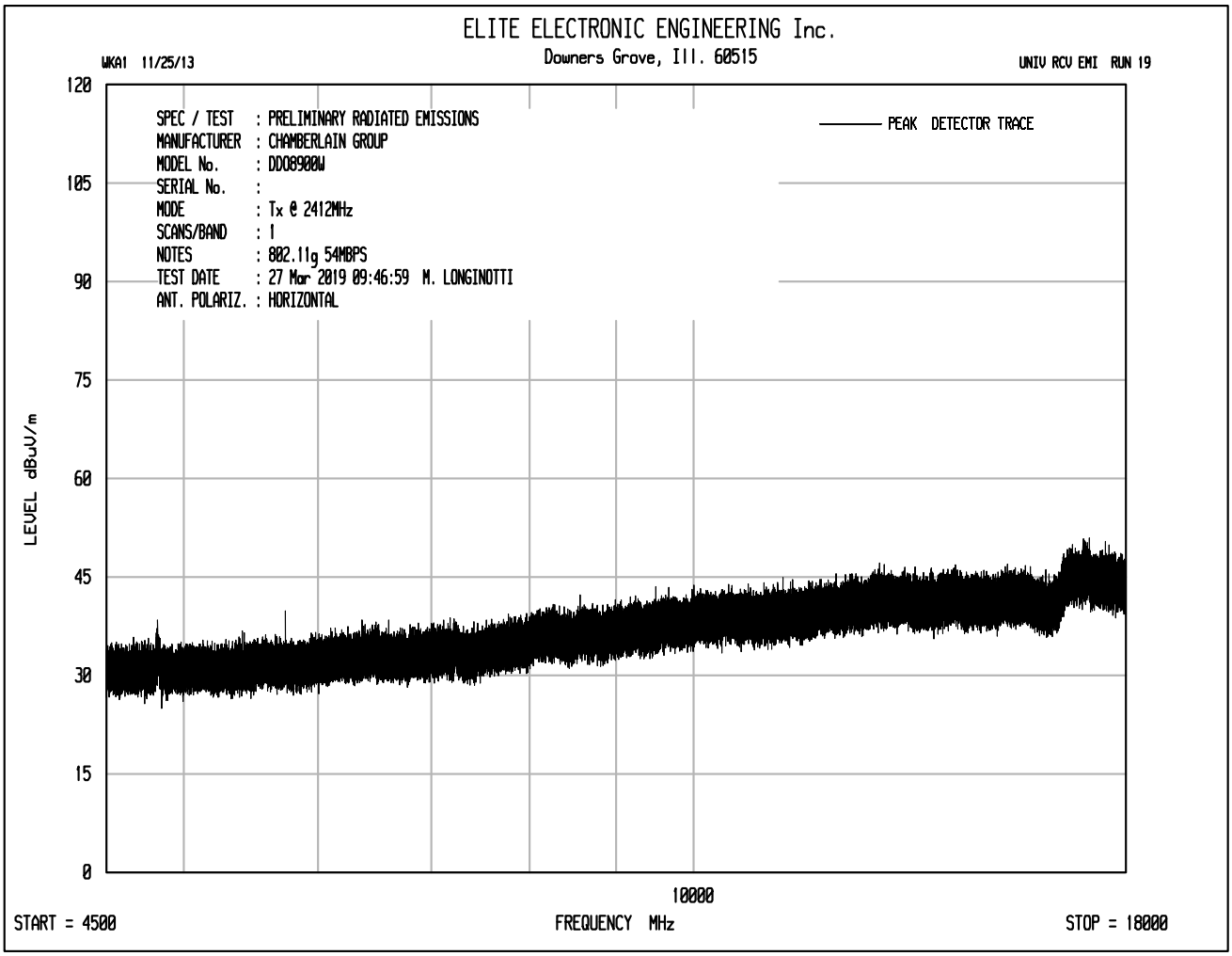
Manufacturer : Chamberlain Group, Inc.
Test Item : Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No. : DDO8900W
Mode : Transmit at 2462MHz, 802.11b 1Mbps, power = 13
Test Specification : FCC-15.247, RSS-247 Average EIRP
Date : March 27, 2019
Test Distance : 3 meters
Notes :

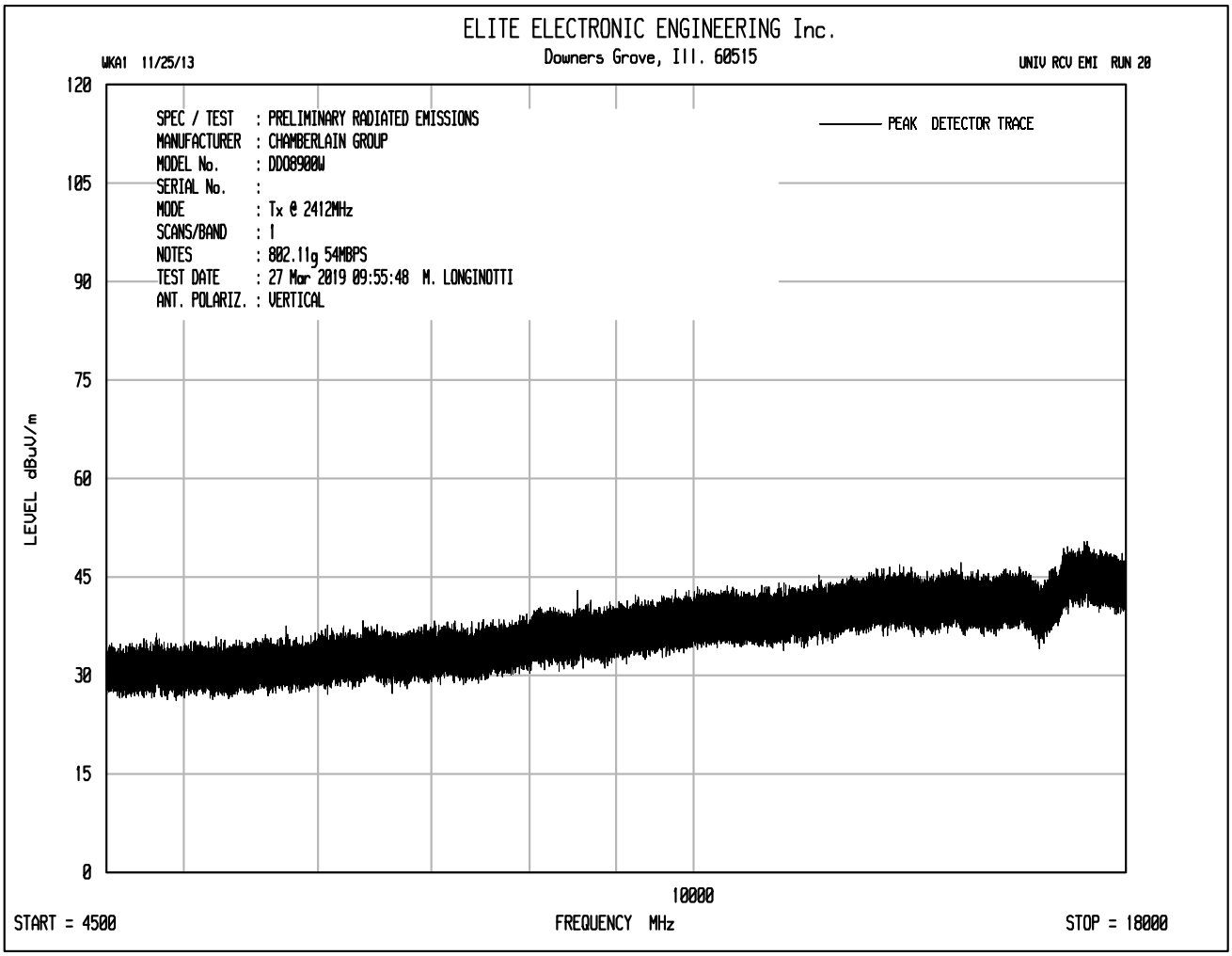
Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBm)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2462.00	H	-36.6	10.0	4.4	2.8	11.7	36.0	-24.3
2462.00	V	-37.5	8.6	4.4	2.8	10.3	36.0	-25.7

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


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 22
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDC8900W
SERIAL No. :
MODE : Tx @ 2412MHz
SCANS/BAND : 1
NOTES : 802.11g 54MBPS
TEST DATE : 27 Mar 2019 10:17:01 M. LONGINOTTI
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 21
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDO8900W
SERIAL No. :
MODE : Tx @ 2412MHz
SCANS/BAND : 1
NOTES : 802.11g 54MBPS
TEST DATE : 27 Mar 2019 10:08:48 M. LONGINOTTI
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 19
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDC8900W
SERIAL No. :
MODE : Tx @ 2412MHz
SCANS/BAND : 1
NOTES : 802.11g 54MBPS
TEST DATE : 27 Mar 2019 09:46:59 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
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 20
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDC8900W
SERIAL No. :
MODE : Tx @ 2412MHz
SCANS/BAND : 1
NOTES : 802.11g 54MBPS
TEST DATE : 27 Mar 2019 09:55:48 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 4500
FREQUENCY MHz
STOP = 18000

Manufacturer : Chamberlain Group, Inc.
Test Item : Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No. : DDO8900W
Mode : Transmit at 2412MHz 802.11g 54Mbps, power = 15
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions in Restricted Bands
Date : March 27, 2019
Test Distance : 3 meters
Notes : Peak Detector with 1MHz Resolution Bandwidth

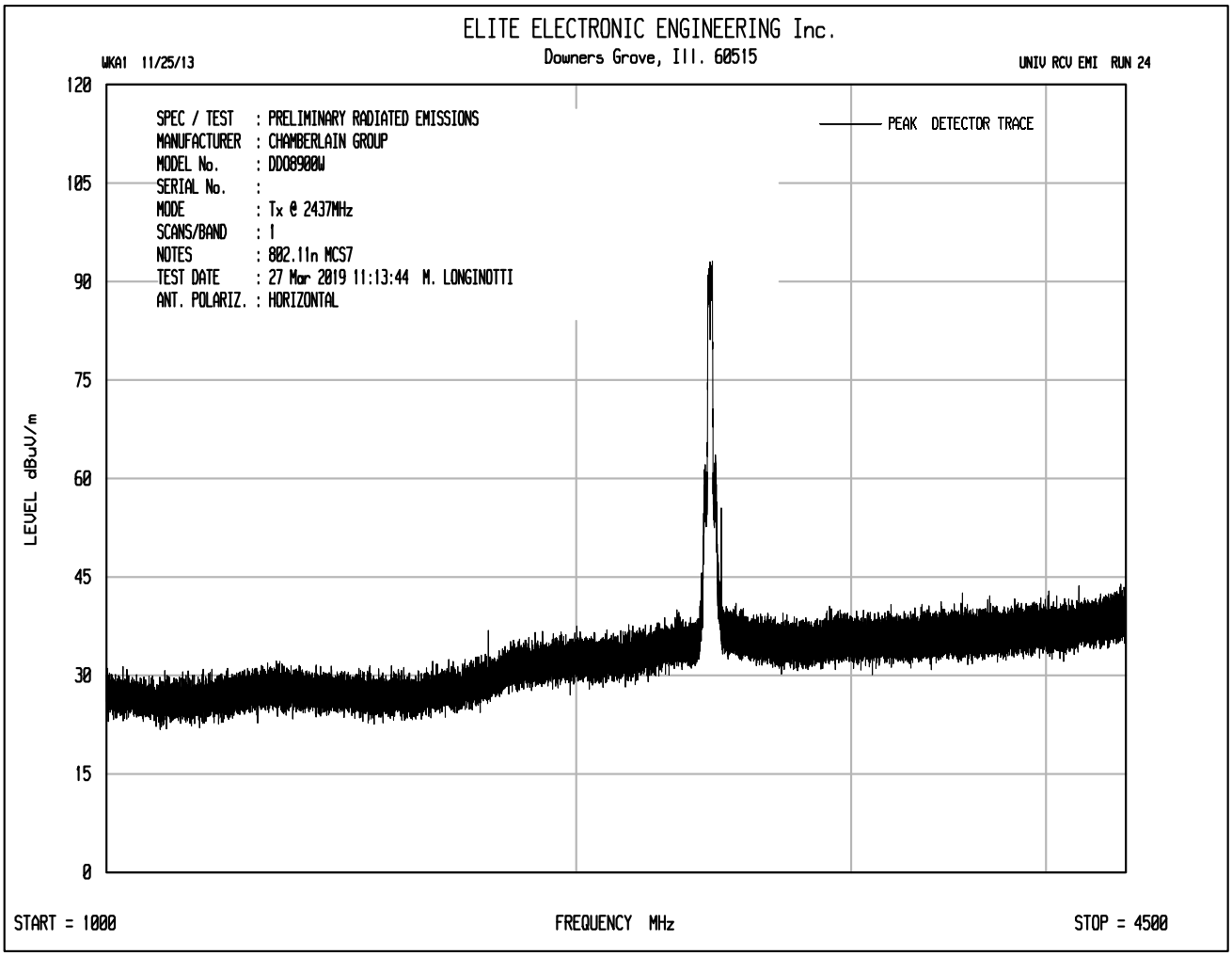
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
4824.00	H	52.1	Ambient	4.8	34.5	-40.2	51.2	364.0	5000.0	-22.8
4824.00	V	50.2	Ambient	4.8	34.5	-40.2	49.3	292.4	5000.0	-24.7

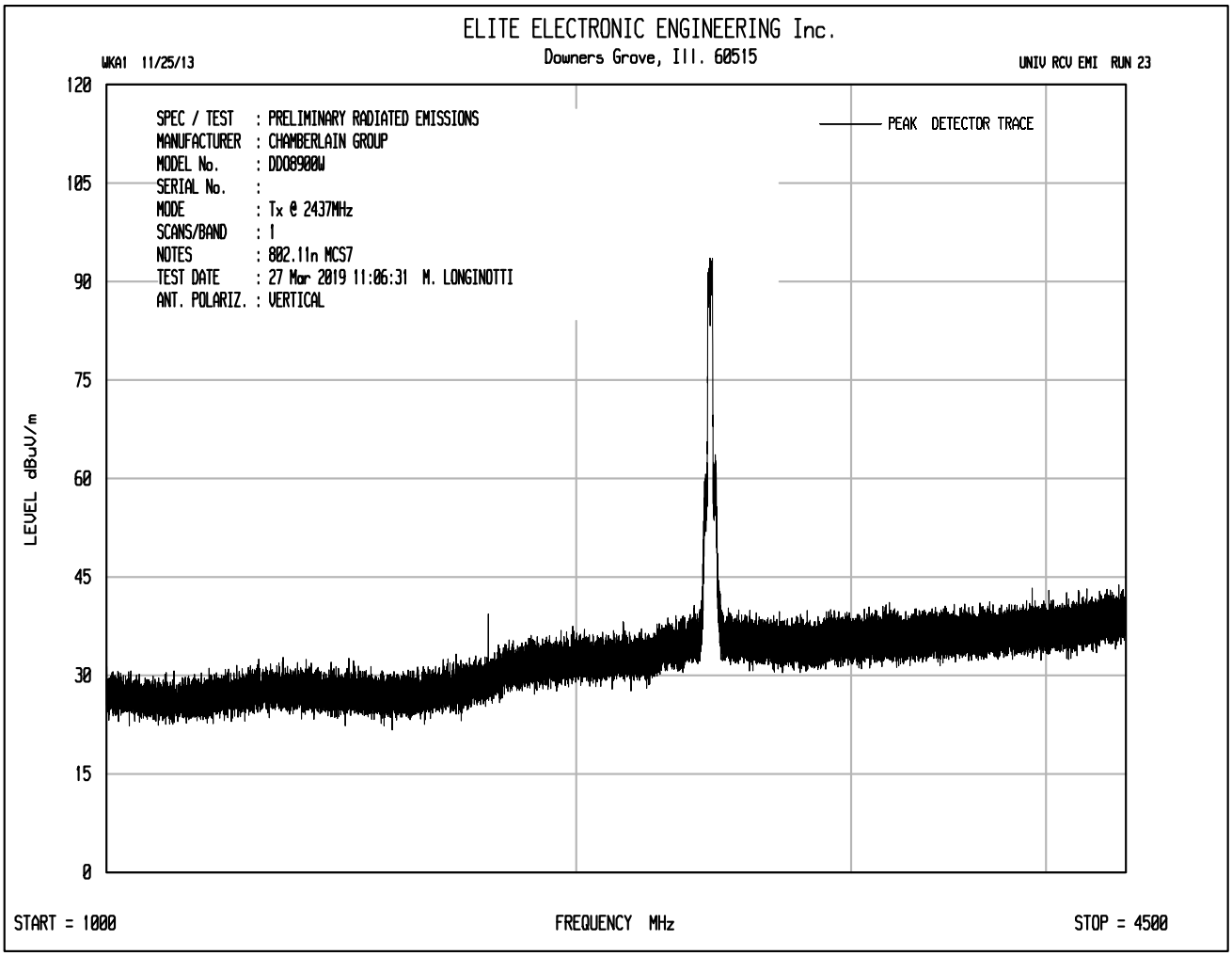
Total (dBuV/m) = Meter Reading + CBL FAC + Ant Fac + Pre Amp

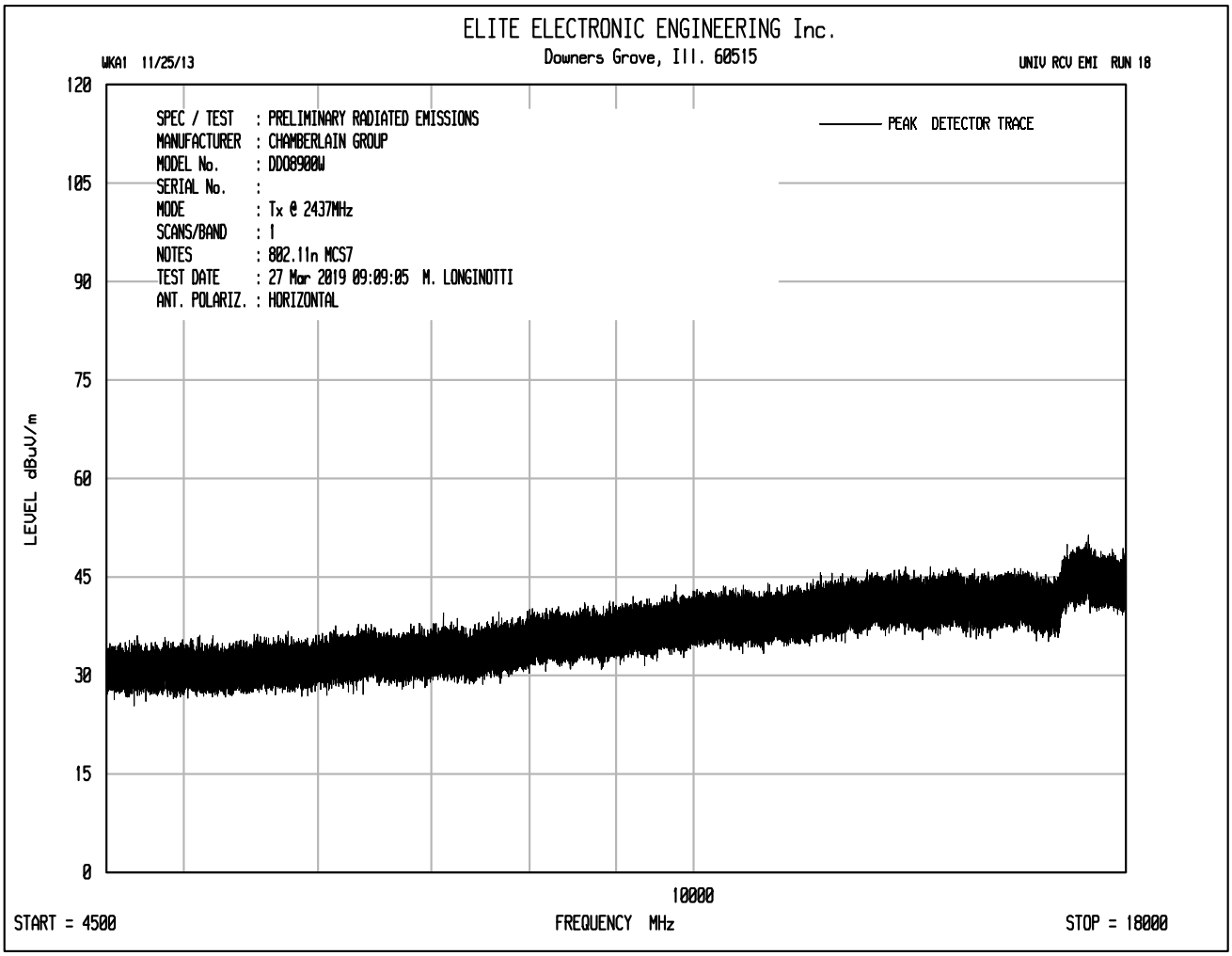
Manufacturer : Chamberlain Group, Inc.
Test Item : Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No. : DDO8900W
Mode : Transmit at 2412MHz 802.11g 54Mbps, power = 15
Test Specification : FCC-15.247, RSS-247 Average Radiated Emissions in Restricted Bands
Date : March 27, 2019
Test Distance : 3 meters
Notes : Average Detector with 1MHz Resolution Bandwidth

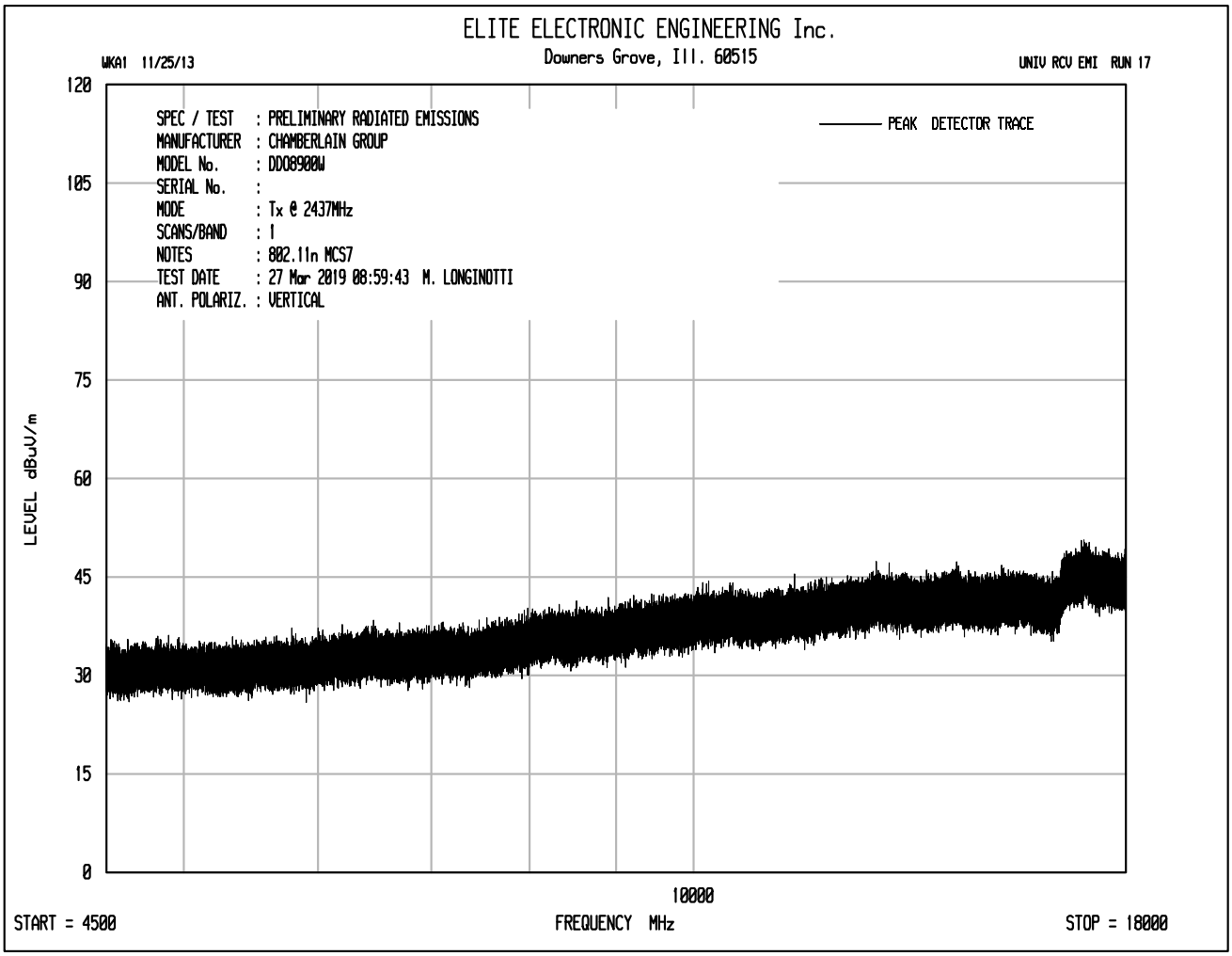
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
4824.00	H	38.1	Ambient	4.8	34.5	-40.2	0.0	37.2	72.6	500.0	-16.8
4824.00	V	35.7	Ambient	4.8	34.5	-40.2	0.0	34.8	55.1	500.0	-19.2

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


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 24
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDO8900W
SERIAL No. :
MODE : Tx @ 2437MHz
SCANS/BAND : 1
NOTES : 802.11n MCS7
TEST DATE : 27 Mar 2019 11:13:44 M. LONGINOTTI
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 23
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDC8900W
SERIAL No. :
MODE : Tx @ 2437MHz
SCANS/BAND : 1
NOTES : 802.11n MCS7
TEST DATE : 27 Mar 2019 11:06:31 M. LONGINOTTI
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 18
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDC8900W
SERIAL No. :
MODE : Tx @ 2437MHz
SCANS/BAND : 1
NOTES : 802.11n MCS7
TEST DATE : 27 Mar 2019 09:09:05 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
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 17
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDO8900W
SERIAL No. :
MODE : Tx @ 2437MHz
SCANS/BAND : 1
NOTES : 802.11n MCS7
TEST DATE : 27 Mar 2019 08:59:43 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 4500
FREQUENCY MHz
STOP = 18000

Manufacturer : Chamberlain Group, Inc.
Test Item : Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No. : DDO8900W
Mode : Transmit at 2437MHz 802.11n MCS7, power = 14
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions in Restricted Bands
Date : March 27, 2019
Test Distance : 3 meters
Notes : Peak Detector with 1MHz Resolution Bandwidth

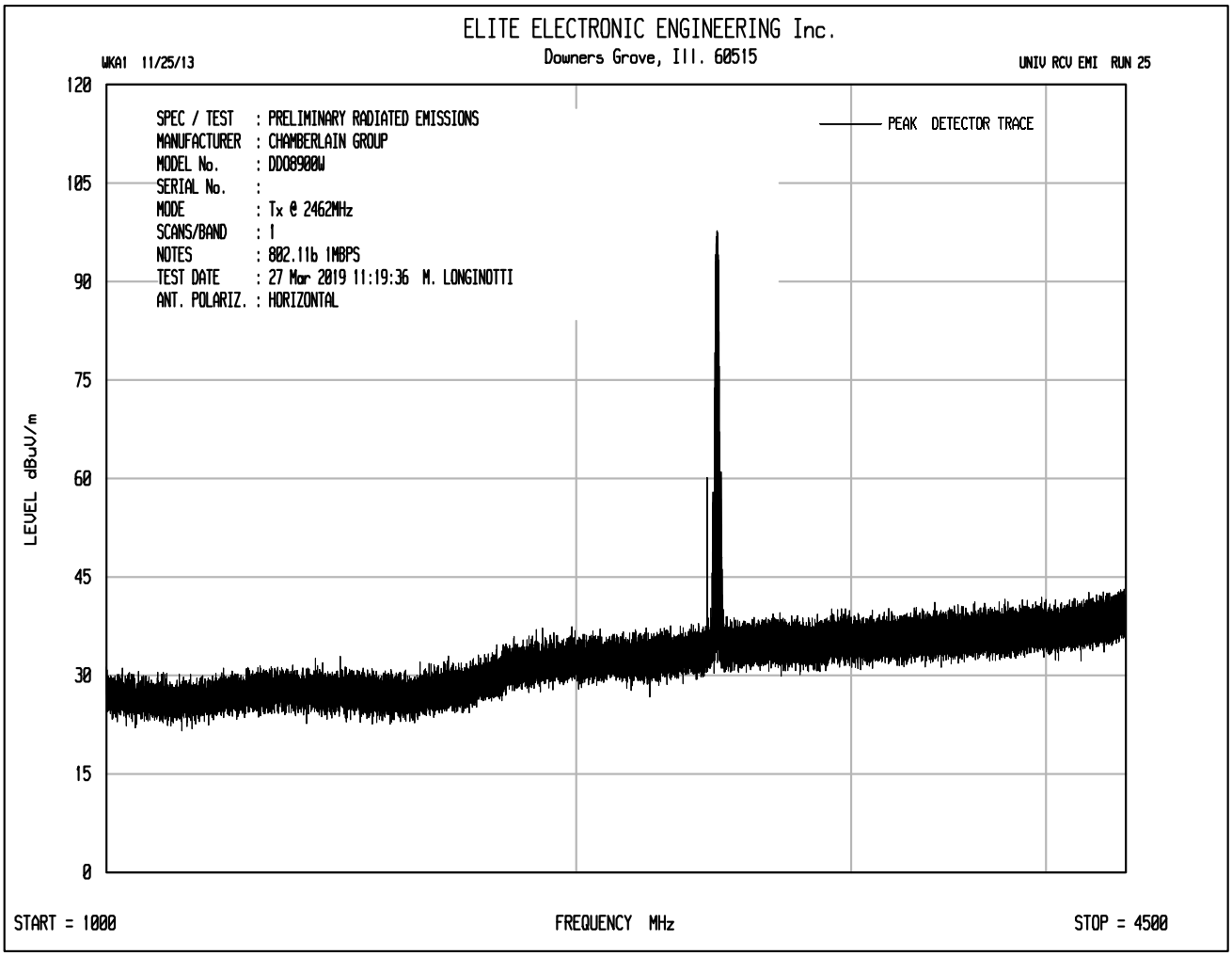
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
4874.00	H	49.1	Ambient	4.9	34.5	-40.3	48.2	256.2	5000.0	-25.8
4874.00	V	50.1	Ambient	4.9	34.5	-40.3	49.2	287.5	5000.0	-24.8
7311.00	H	49.8	Ambient	6.2	35.6	-40.1	51.6	378.0	5000.0	-22.4
7311.00	V	51.3	Ambient	6.2	35.6	-40.1	53.1	449.3	5000.0	-20.9

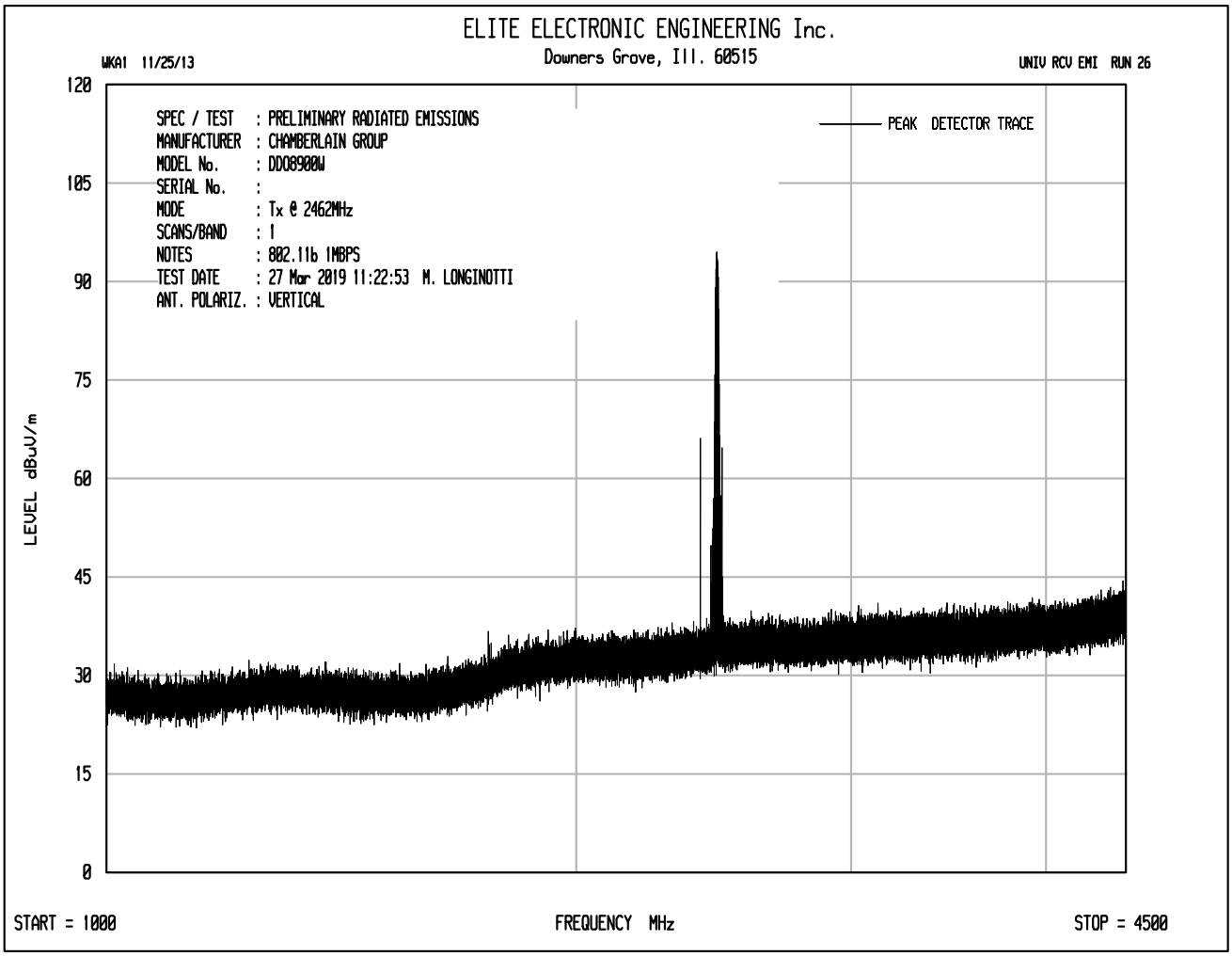
Total (dBuV/m) = Meter Reading + CBL FAC + Ant Fac + Pre Amp

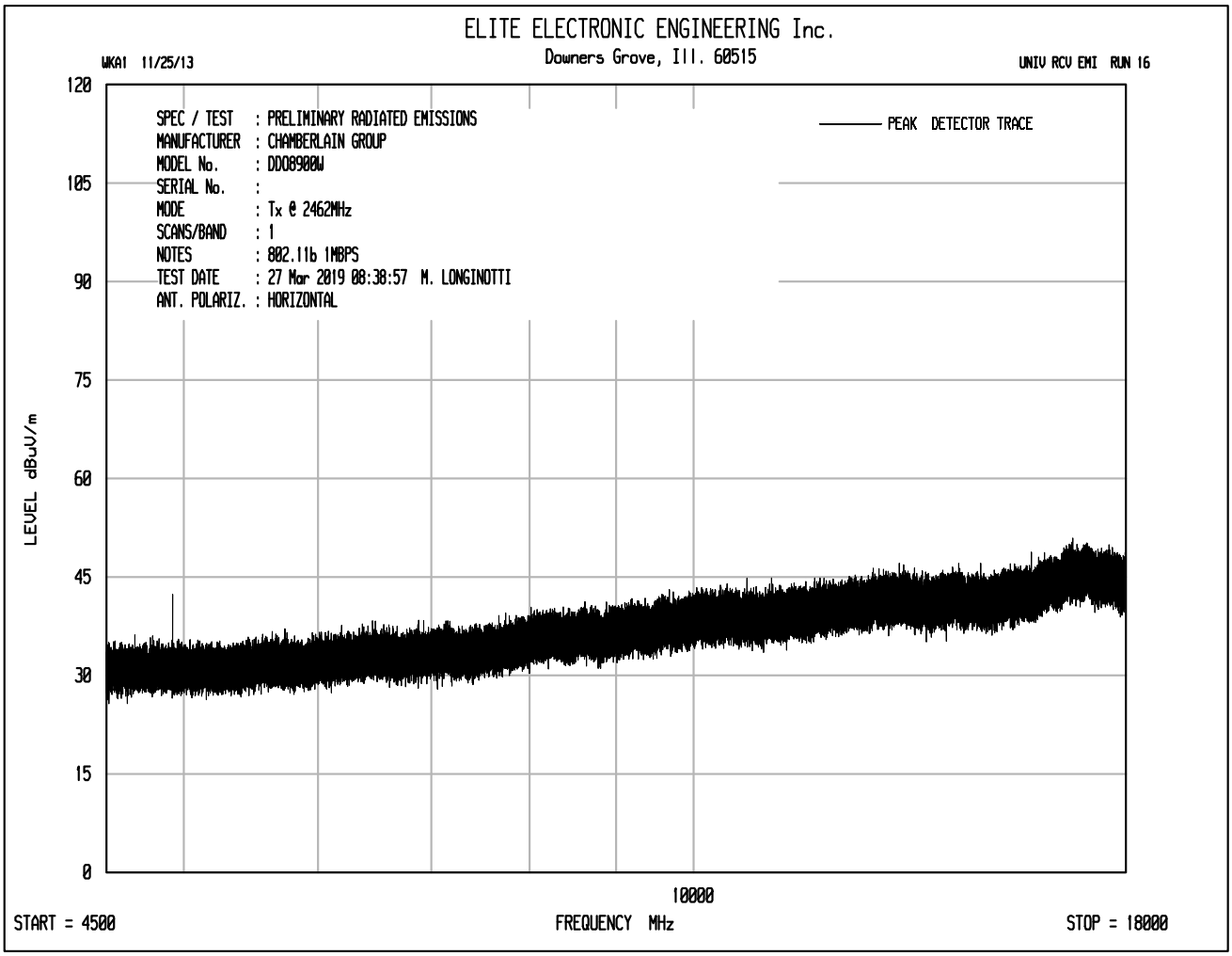
Manufacturer : Chamberlain Group, Inc.
Test Item : Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No. : DDO8900W
Mode : Transmit at 2437MHz 802.11n MCS7, power = 14
Test Specification : FCC-15.247, RSS-247 Average Radiated Emissions in Restricted Bands
Date : March 27, 2019
Test Distance : 3 meters
Notes : Average Detector with 1MHz Resolution Bandwidth

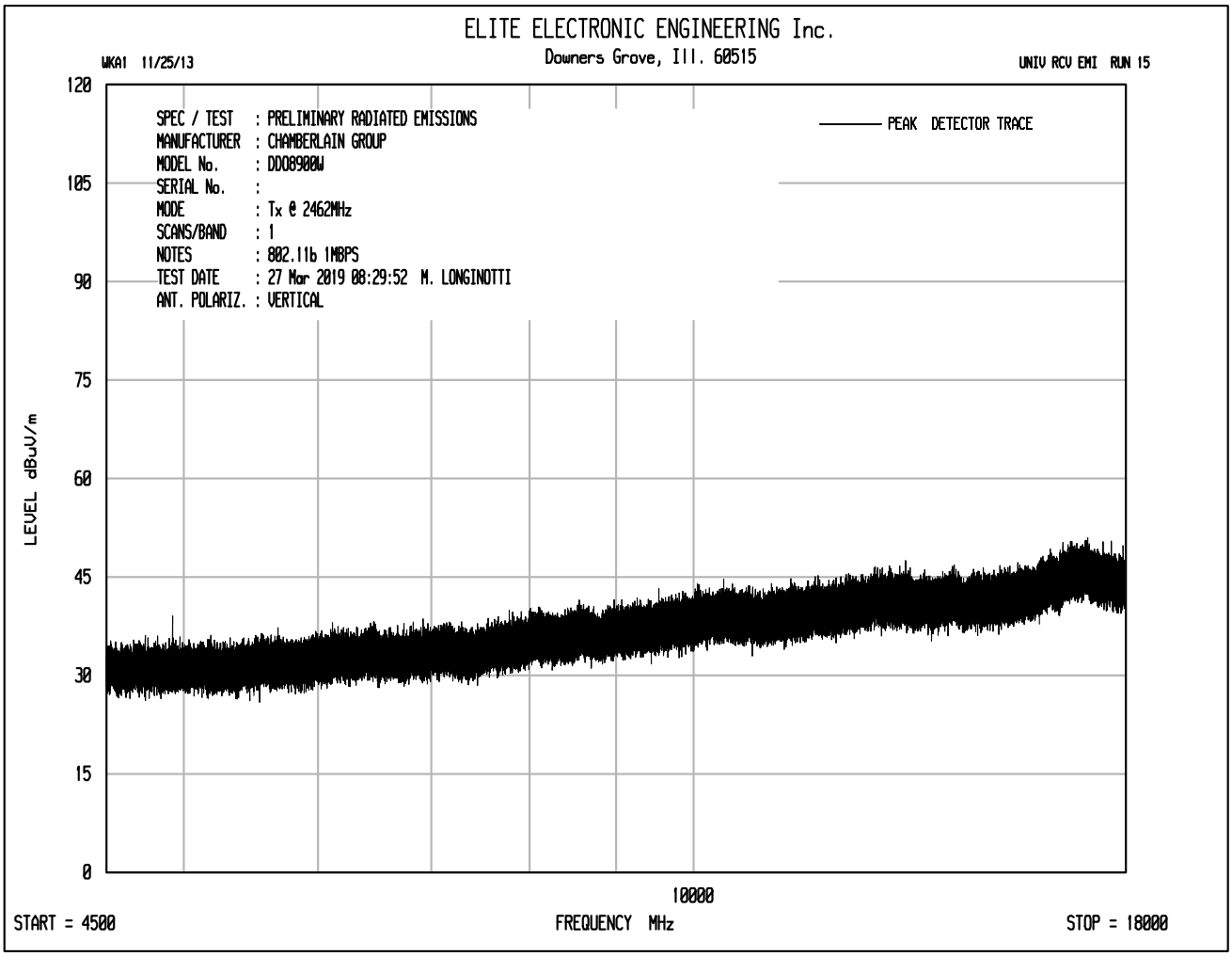
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
4874.00	H	34.4	Ambient	4.9	34.5	-40.3	0.0	33.5	47.2	500.0	-20.5
4874.00	V	35.7	Ambient	4.9	34.5	-40.3	0.0	34.8	54.8	500.0	-19.2
7311.00	H	35.50	Ambient	6.2	35.6	-40.1	0.0	37.3	72.9	500.0	-16.7
7311.00	V	35.4	Ambient	6.2	35.6	-40.1	0.0	37.2	72.0	500.0	-16.8

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


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 25
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDC8900W
SERIAL No. :
MODE : Tx @ 2462MHz
SCANS/BAND : 1
NOTES : 802.11b 1MBPS
TEST DATE : 27 Mar 2019 11:19:36 M. LONGINOTTI
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 26
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDC8900W
SERIAL No. :
MODE : Tx @ 2462MHz
SCANS/BAND : 1
NOTES : 802.11b 1MBPS
TEST DATE : 27 Mar 2019 11:22:53 M. LONGINOTTI
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 16
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDO8900W
SERIAL No. :
MODE : Tx @ 2462MHz
SCANS/BAND : 1
NOTES : 802.11b 1MBPS
TEST DATE : 27 Mar 2019 08:38:57 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
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 15
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN GROUP
MODEL No. : DDO8900W
SERIAL No. :
MODE : Tx @ 2462MHz
SCANS/BAND : 1
NOTES : 802.11b 1MBPS
TEST DATE : 27 Mar 2019 08:29:52 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
10000
START = 4500
FREQUENCY MHz
STOP = 18000

Manufacturer : Chamberlain Group, Inc.
Test Item : Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No. : DDO8900W
Mode : Transmit at 2462MHz 802.11b 1Mbps, power = 11
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions in Restricted Bands
Date : March 27, 2019
Test Distance : 3 meters
Notes : Peak Detector with 1MHz Resolution Bandwidth

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)
4924.00	H	51.0		4.9	34.4	-40.3	50.0	316.3	5000.0	-24.0
4924.00	V	50.8		4.9	34.4	-40.3	49.8	309.1	5000.0	-24.2
7386.00	H	48.5	Ambient	6.2	35.7	-40.1	50.3	327.8	5000.0	-23.7
7386.00	V	49.1	Ambient	6.2	35.7	-40.1	50.9	351.3	5000.0	-23.1

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

Manufacturer : Chamberlain Group, Inc.
Test Item : Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No. : DDO8900W
Mode : Transmit at 2462MHz 802.11b, 1Mbps, power = 11
Test Specification : FCC-15.247, RSS-247 Average Radiated Emissions in Restricted Bands
Date : March 27, 2019
Test Distance : 3 meters
Notes : Average Detector with 1MHz Resolution Bandwidth

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)
4924.00	H	40.7		4.9	34.4	-40.3	0.0	39.7	96.6	500.0	-14.3
4924.00	V	39.3		4.9	34.4	-40.3	0.0	38.3	82.3	500.0	-15.7
7386.00	H	34.10	Ambient	6.2	35.7	-40.1	0.0	35.9	62.5	500.0	-18.1
7386.00	V	34.0	Ambient	6.2	35.7	-40.1	0.0	35.8	61.8	500.0	-18.2

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

Manufacturer : Chamberlain Group, Inc.
Test Item : Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No. : DDO8900W
Mode : Transmit at 2462MHz 802.11g 54Mbps, power = 11
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions at High Band Edge
Date : March 27, 2019
Test Distance : 3 meters
Notes : Peak Detector with 1MHz Resolution Bandwidth

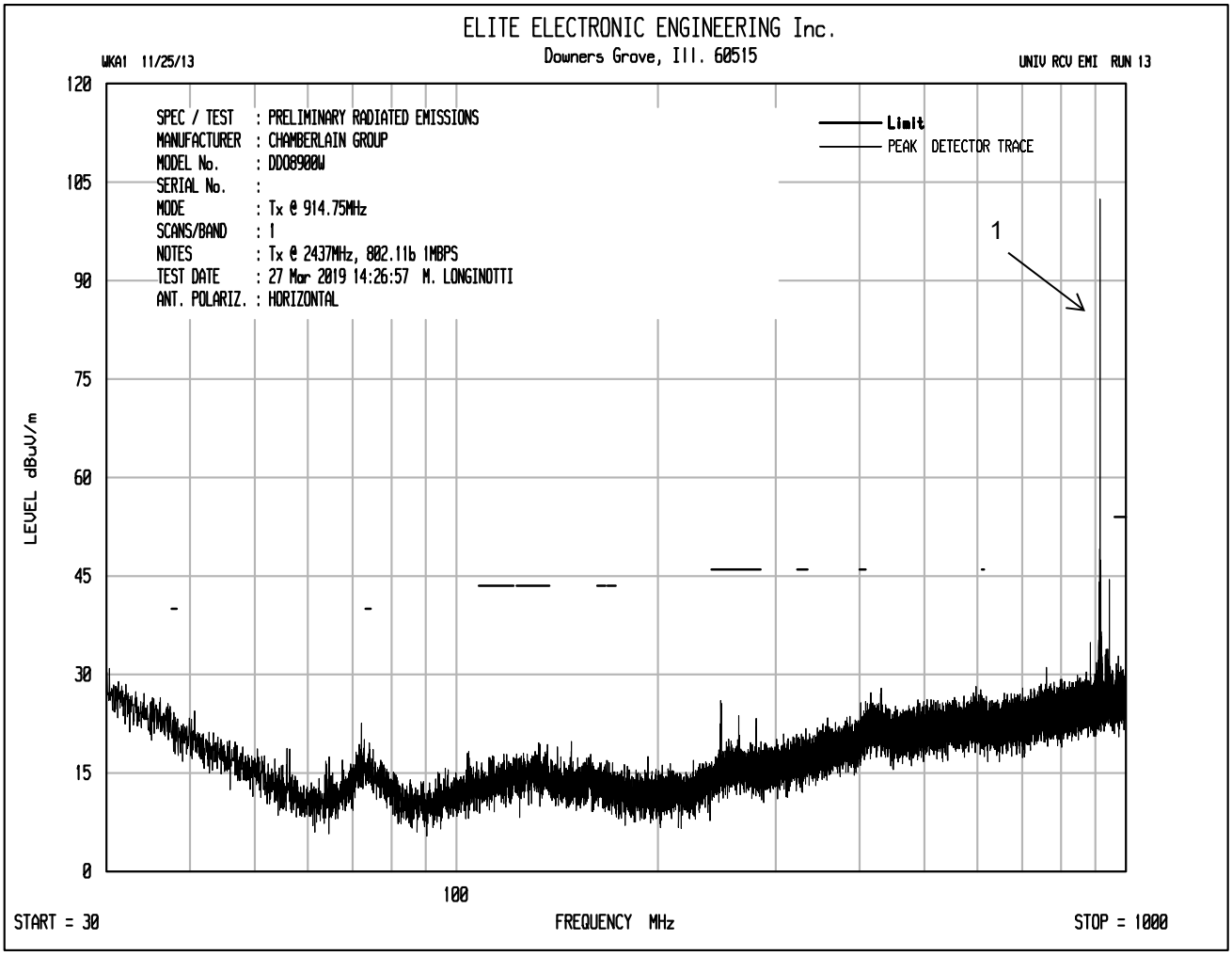
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2483.50	H	33.5		3.5	32.5	0.0	69.5	2984.4	5000.0	-4.5
2483.50	V	33.4		3.5	32.5	0.0	69.4	2950.2	5000.0	-4.6

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

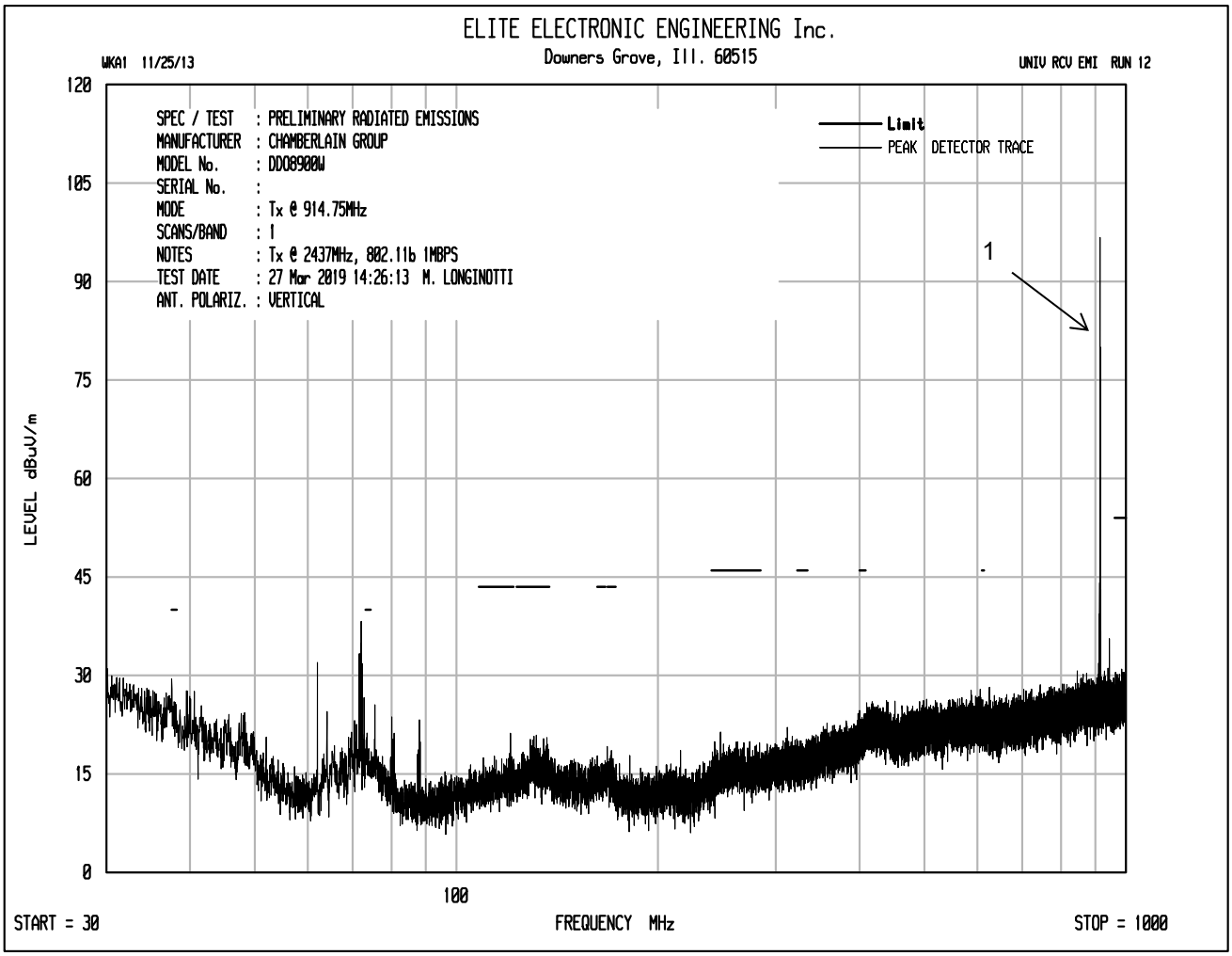
Manufacturer : Chamberlain Group, Inc.
Test Item : Light-Duty Series Jackshaft Dock Door Operator for Sectional Doors with Marvell MW300 WiFi module
Model No. : DDO8900W
Mode : Transmit at 2462MHz 802.11g 54Mbps, power = 11
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions at High Band Edge
Date : March 27, 2019
Test Distance : 3 meters
Notes : Average Detector with 1MHz Resolution Bandwidth

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)
2483.50	H	16.7		3.5	32.5	0.0	0.0	52.7	431.4	500.0	-1.3
2483.50	V	16.3		3.5	32.5	0.0	0.0	52.3	412.0	500.0	-1.7

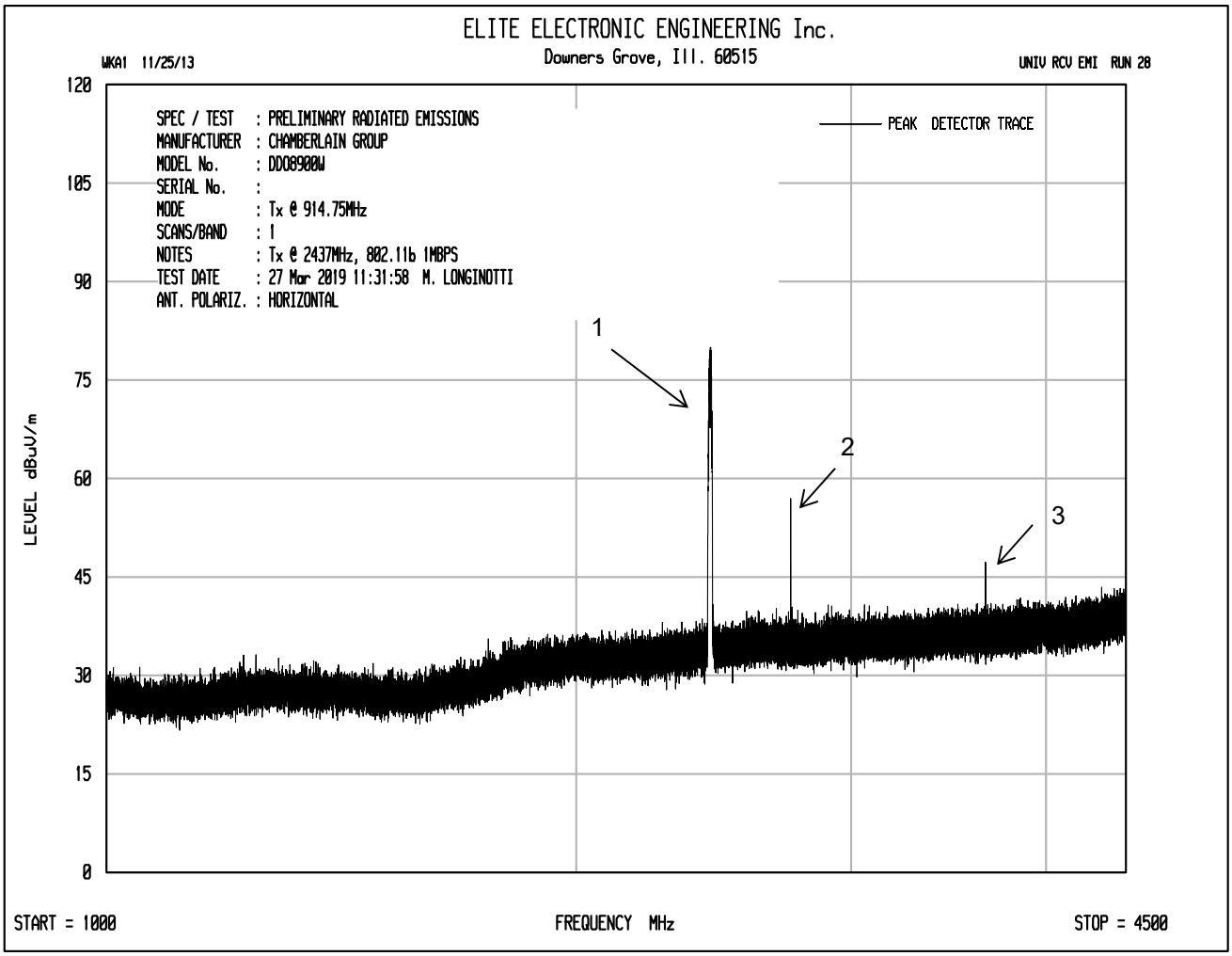
Total (dBuV/m) = Meter Reading + CBL FAC + Ant Fac + Pre Amp + Duty Cycle



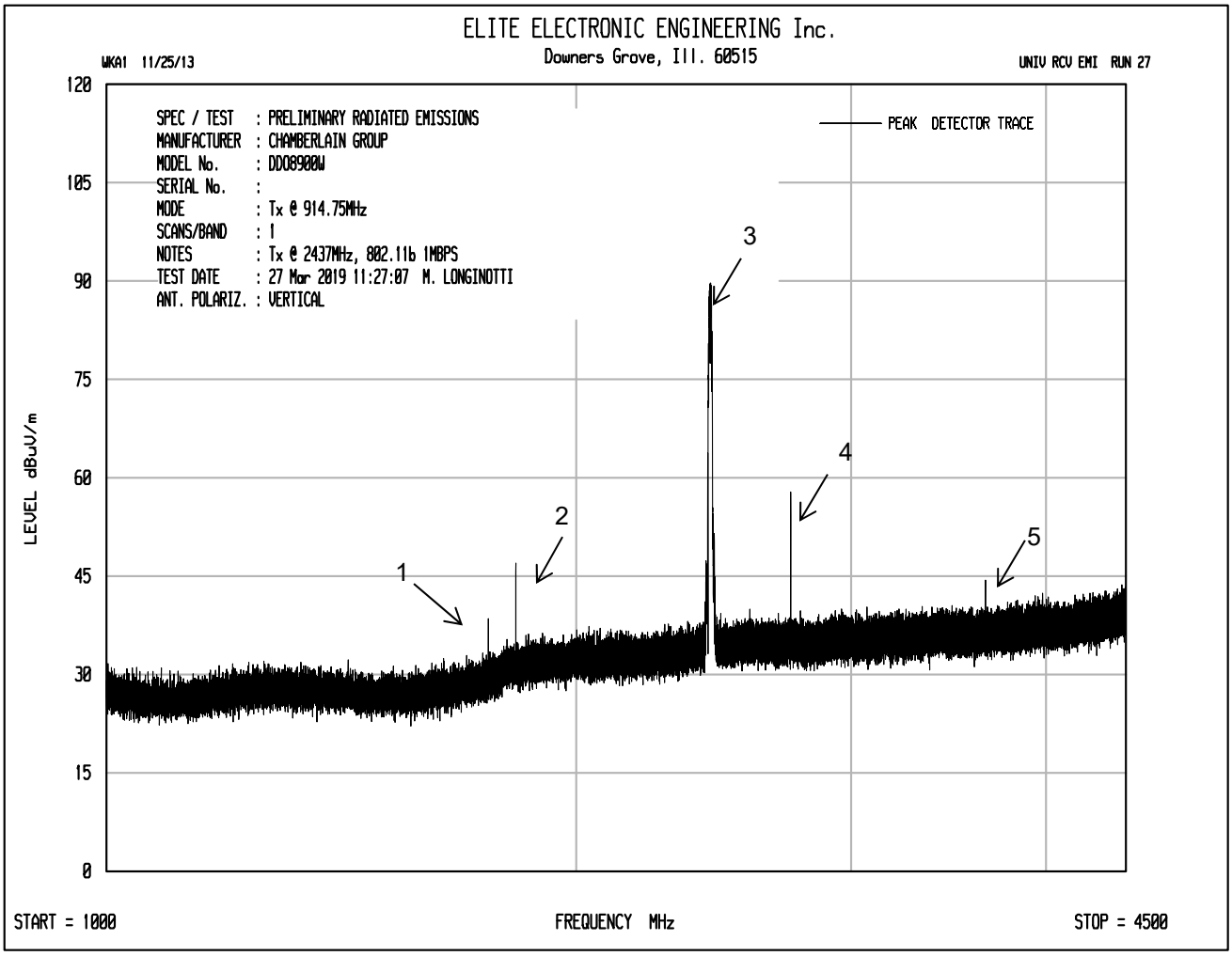
1 – Transmit at 914.75MHz



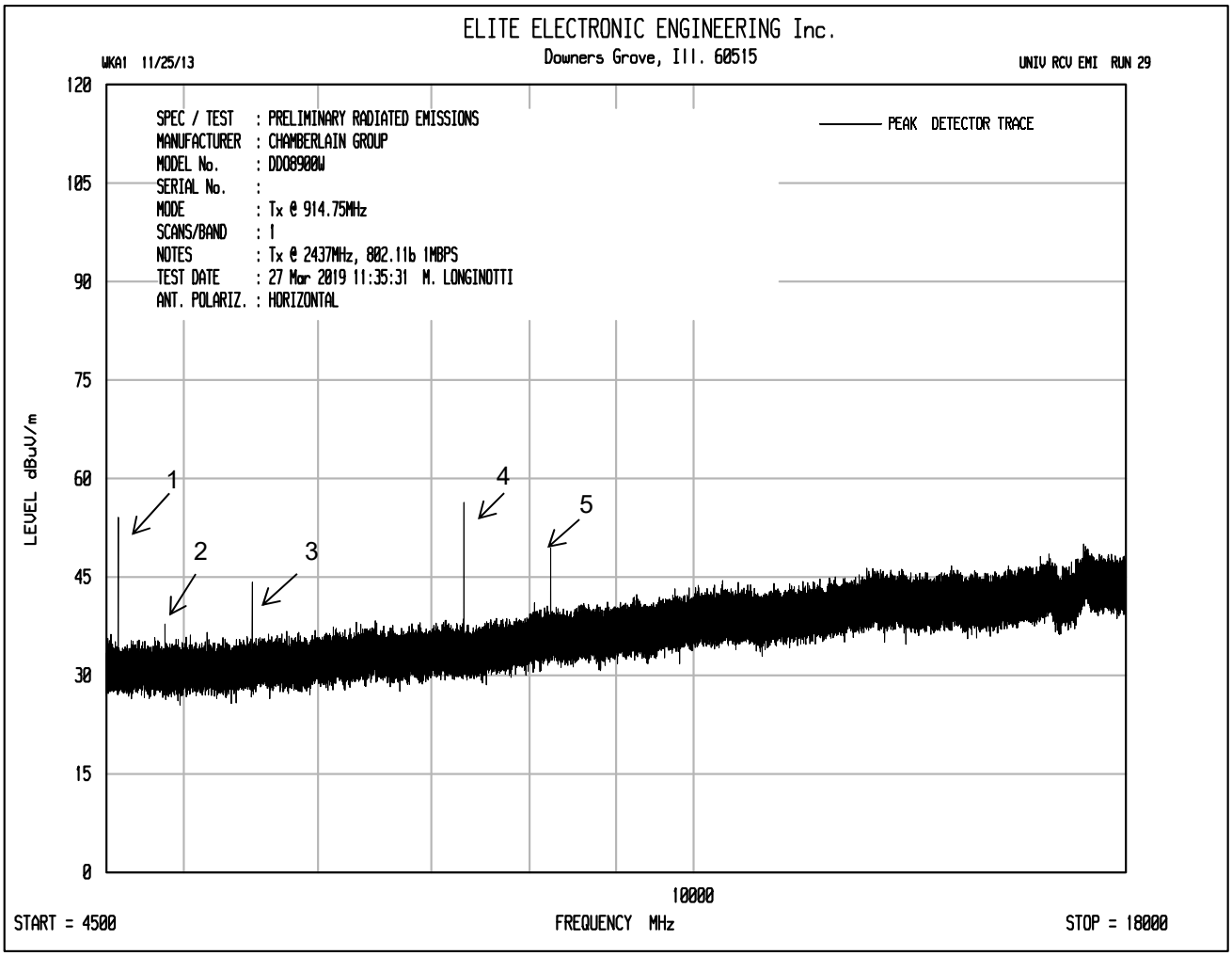
1 – Transmit at 914.75MHz



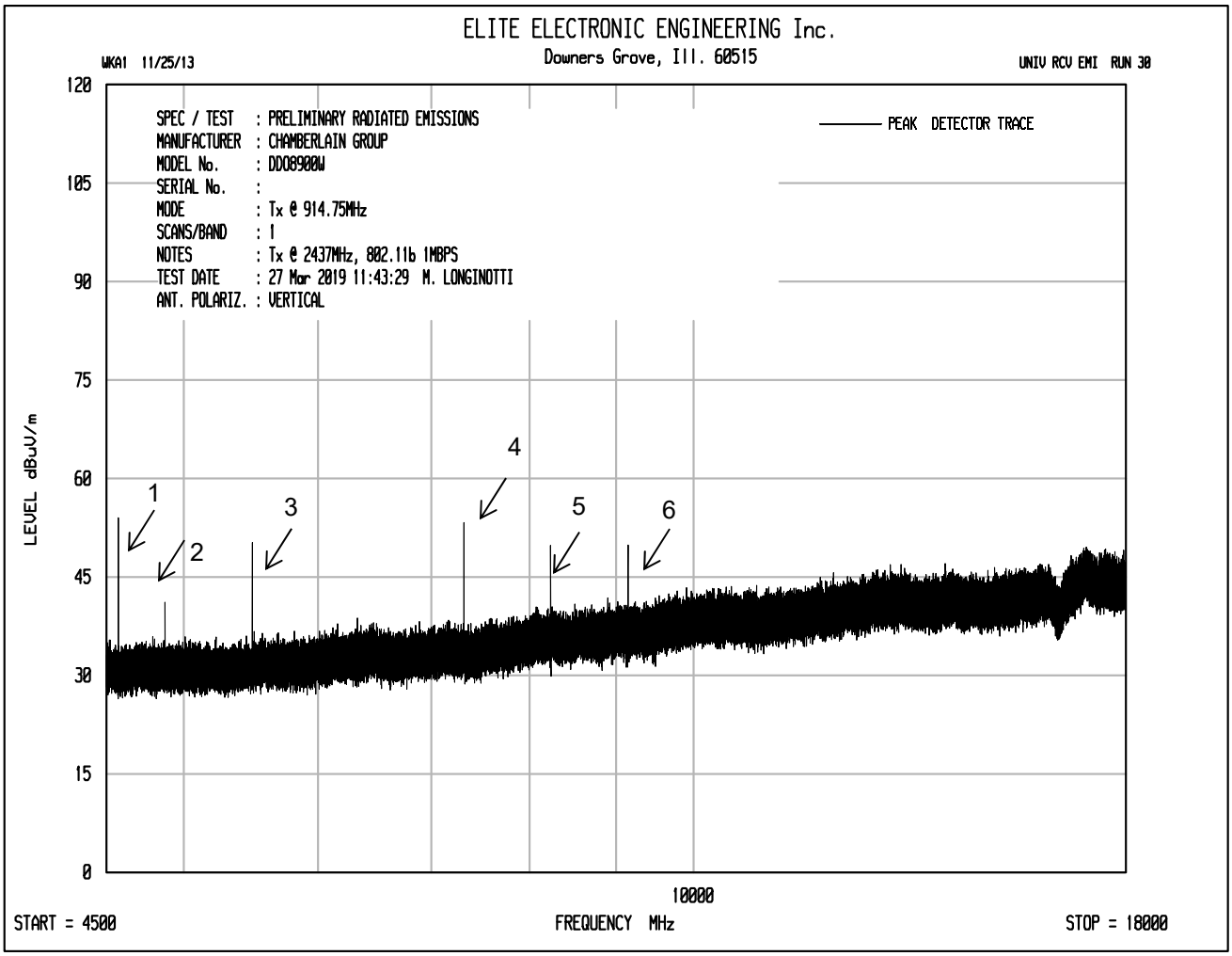
1 – Transmit at 2437MHz
2 – 2744.25MHz (3rd harmonic of 914.75MHz)
3 – 3659.0MHz (4th harmonic of 914.75MHz)



1 – 1756.8MHz (12th harmonic of 146.4MHz)
2 – 1829.5MHz (2nd harmonic of 914.75MHz)
3 – Transmit at 2437MHz
4 – 2744.25MHz (3rd harmonic of 914.75MHz)
5 – 3659MHz (4th harmonic of 914.75MHz)



1 – 4573.75MHz (5th harmonic of 914.75MHz)
2 – 4874MHz (2nd harmonic of 2437MHz)
3 – 5488.5MHz (6th harmonic of 914.75MHz)
4 – 7318MHz (8th harmonic of 914.75MHz)
5 – 8232.75MHz (9th harmonic of 914.75MHz)



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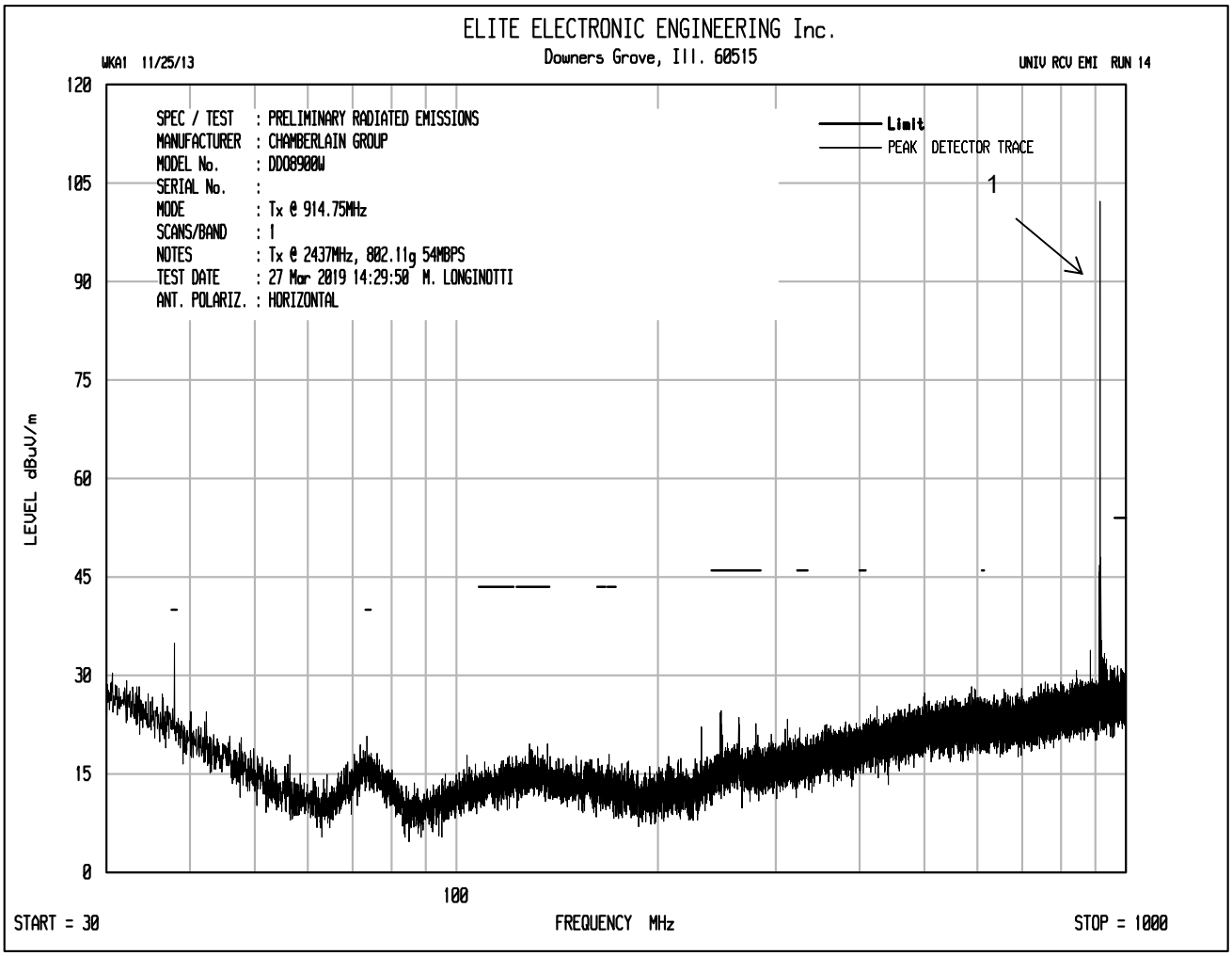
2 – 4874MHz (2nd harmonic of 2437MHz)
3 – 5488.5MHz (6th harmonic of 914.75MHz)
4 – 7318MHz (8th harmonic of 914.75MHz)
5 – 8232.75MHz (9th harmonic of 914.75MHz)
6 – 9147.5MHz (10th harmonic of 914.75MHz)



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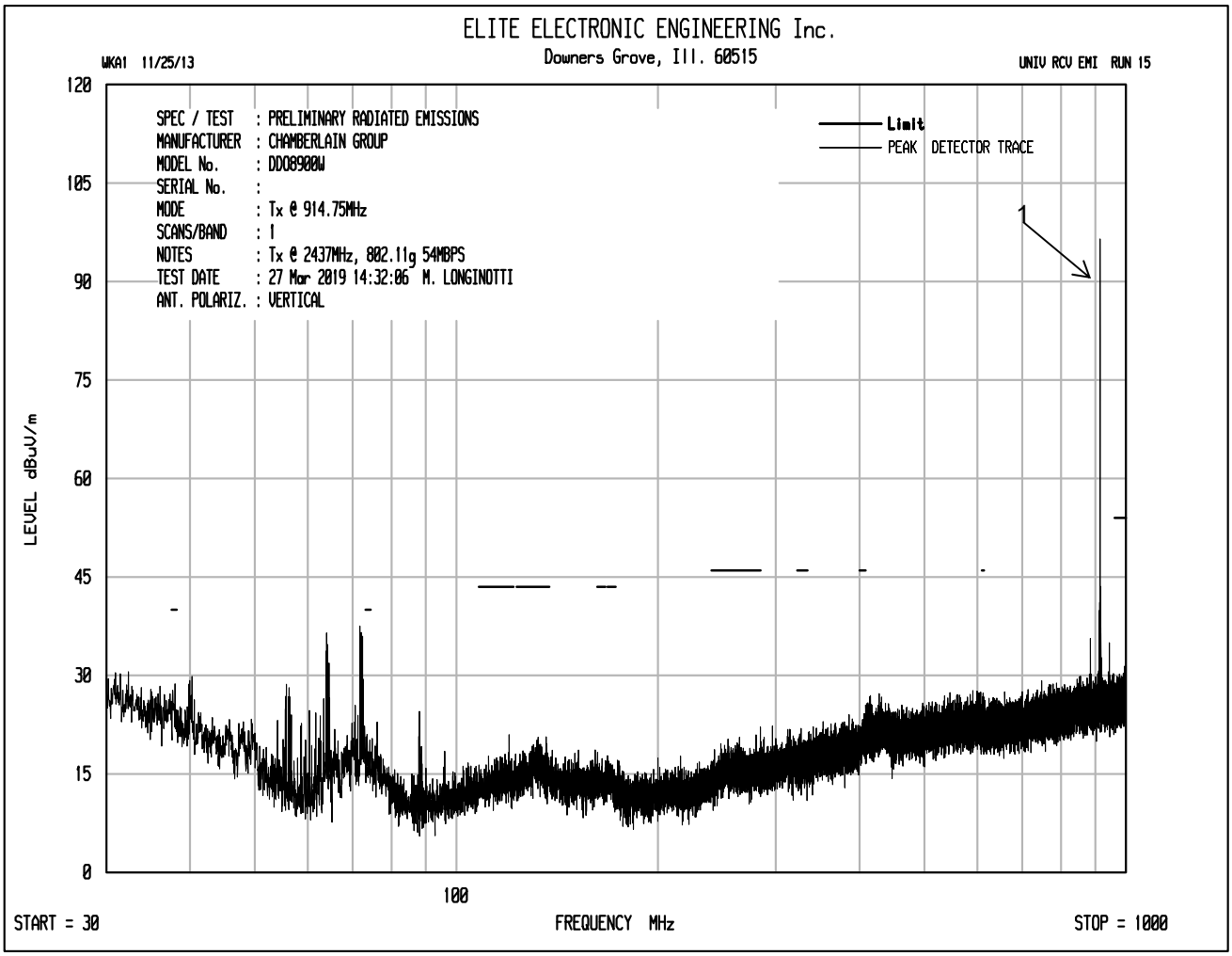
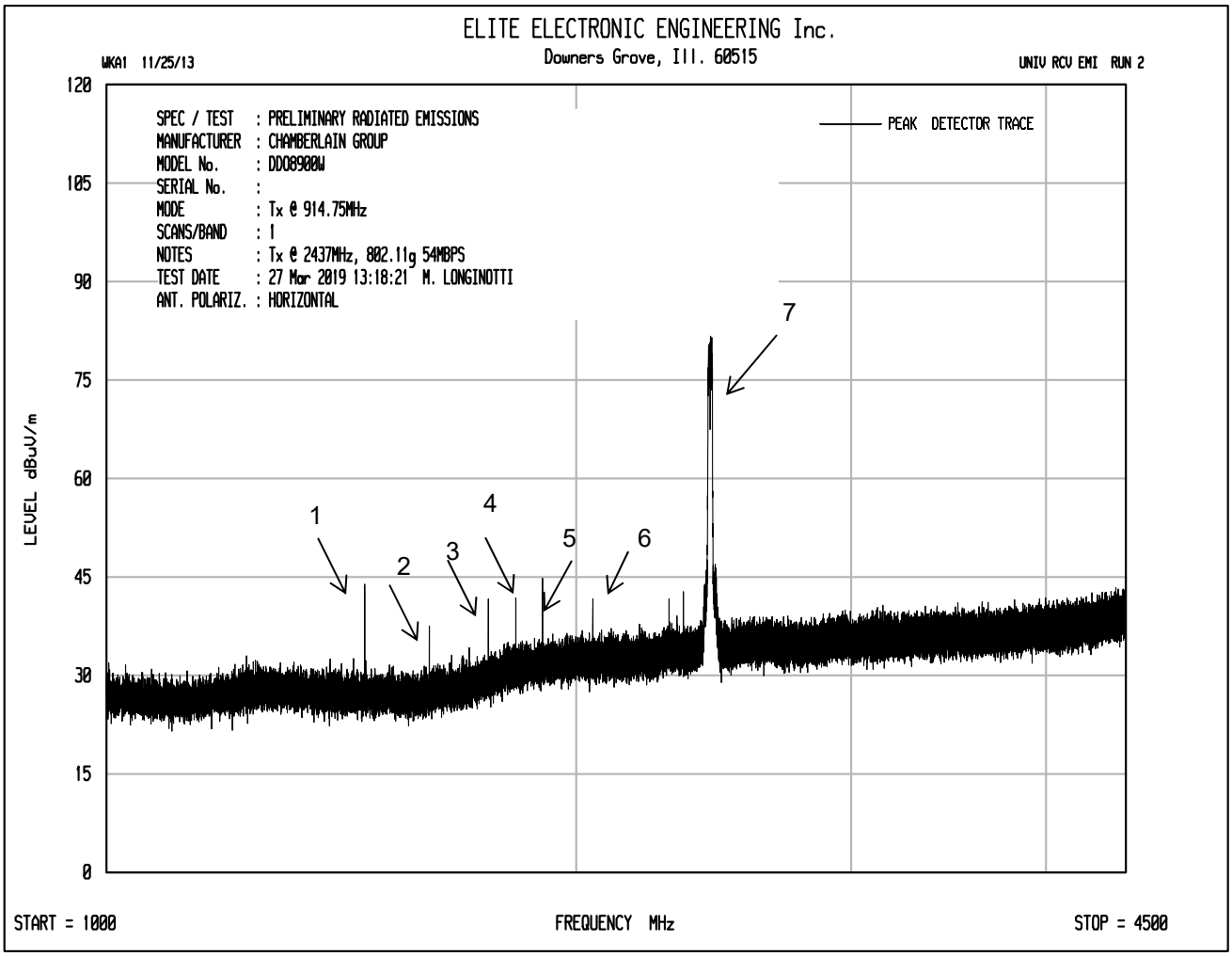
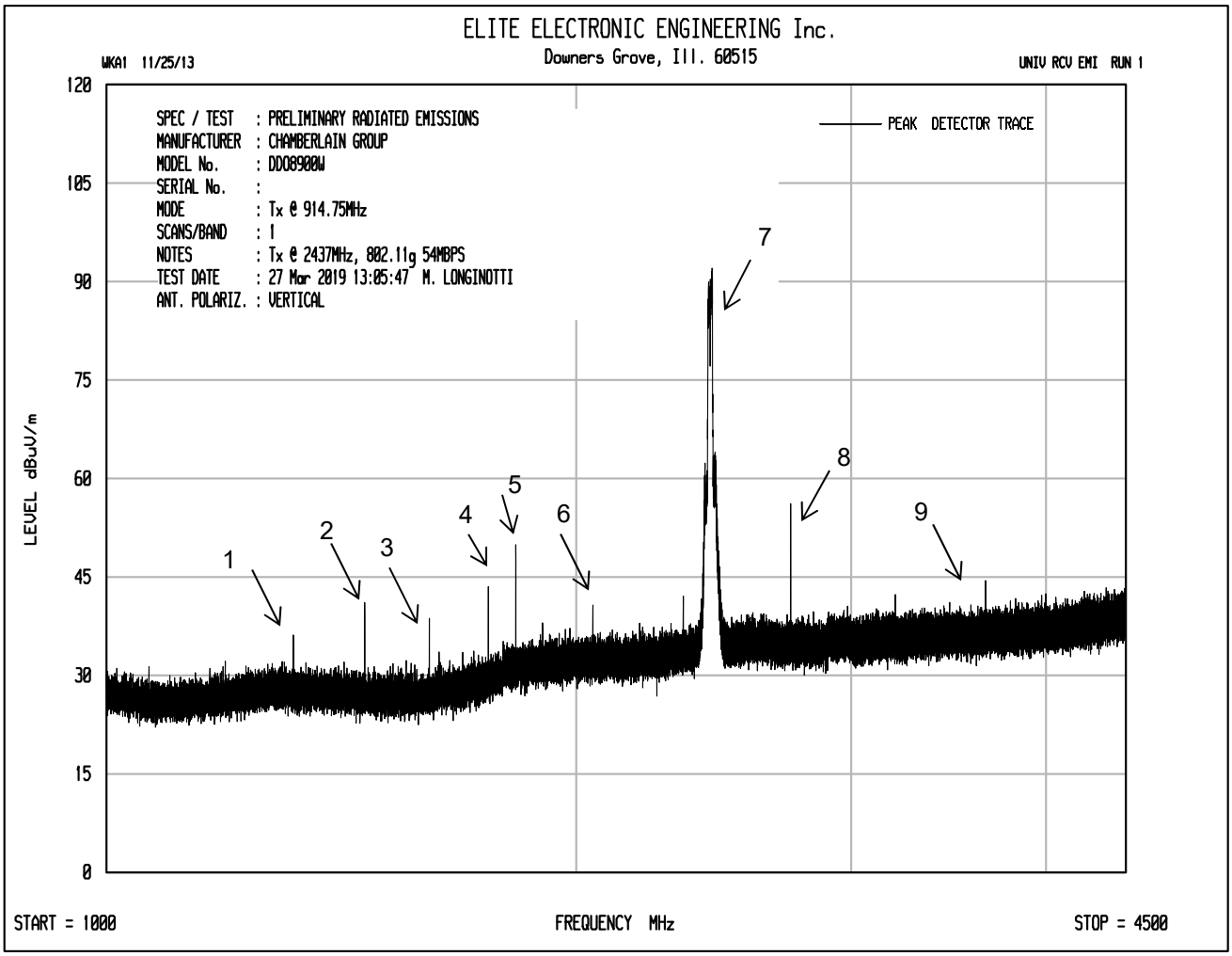


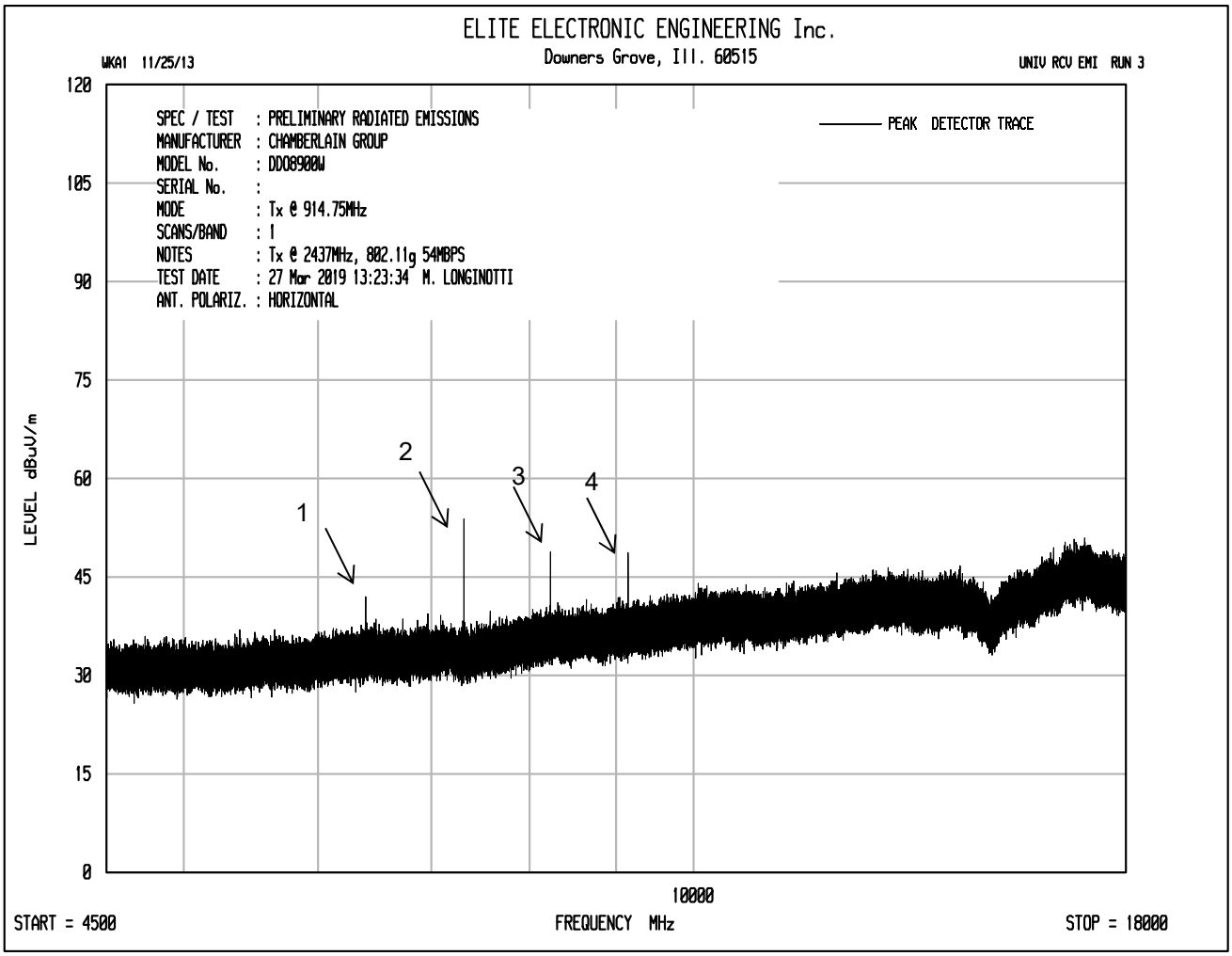
1 – Transmit at 914.75MHz



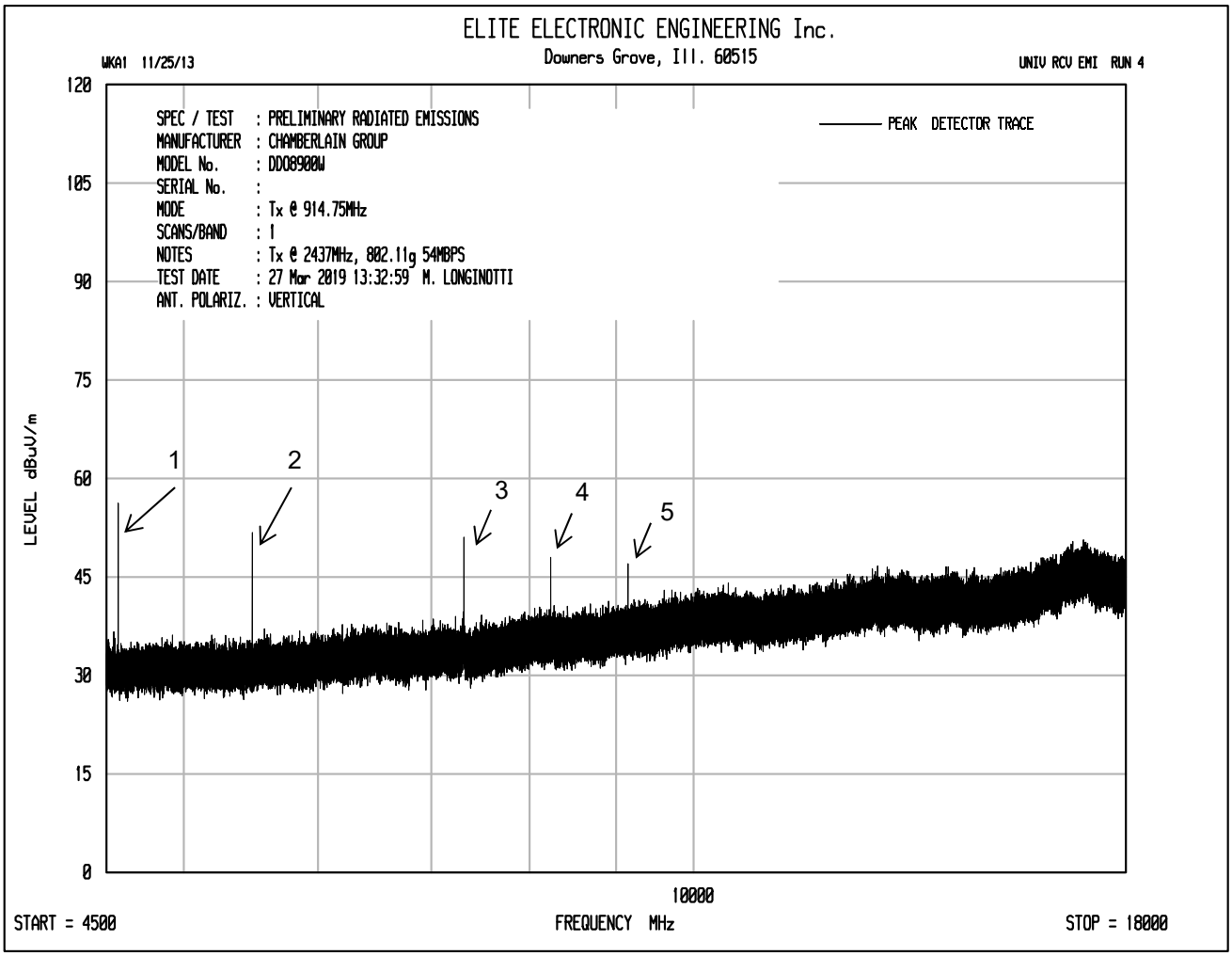
1 – 1464MHz (10th harmonic of 146.4MHz)
2 – 1610.4MHz (11th harmonic of 146.4MHz)
3 – 1756.8MHz (12th harmonic of 146.4MHz)
4 – 1829.5MHz (3rd harmonic of 914.75MHz)
5 – 1903.2MHz (13th harmonic of 146.4MHz)
6 – 2049.6MHz (14th harmonic of 146.4MHz)
7 – Transmit at 2437MHz



1 – 1317.6MHz (9th harmonic of 146.4MHz)
2 – 1464MHz (10th harmonic of 146.4MHz)
3 - 1610.4MHz (11th harmonic of 146.4MHz)
4 – 1756.8MHz (12th harmonic of 146.4MHz)
5 – 1829.5MHz (3rd harmonic of 914.75MHz)
6 – 2049.6 (14th harmonic of 146.4MHz)
7 – Transmit at 2437MHz
8 – 2744.25MHz (3rd harmonic of 914.75MHz)
9 – 3659MHz (4th harmonic of 914.75MHz)



1 – 6403.25MHz (7th harmonic of 914.75MHz)
2 – 7318MHz (8th harmonic of 914.75MHz)
3 – 8232.75MHz (9th harmonic of 914.75MHz)
4 – 9147.5MHz (10th harmonic of 914.75MHz)



1 – 4573.75MHz (5th harmonic of 914.75MHz)
2 – 5488.5MHz (6th harmonic of 914.75MHz)
3 – 7318MHz (8th harmonic of 914.75MHz)
4 – 8232.75MHz (9th harmonic of 914.75MHz)
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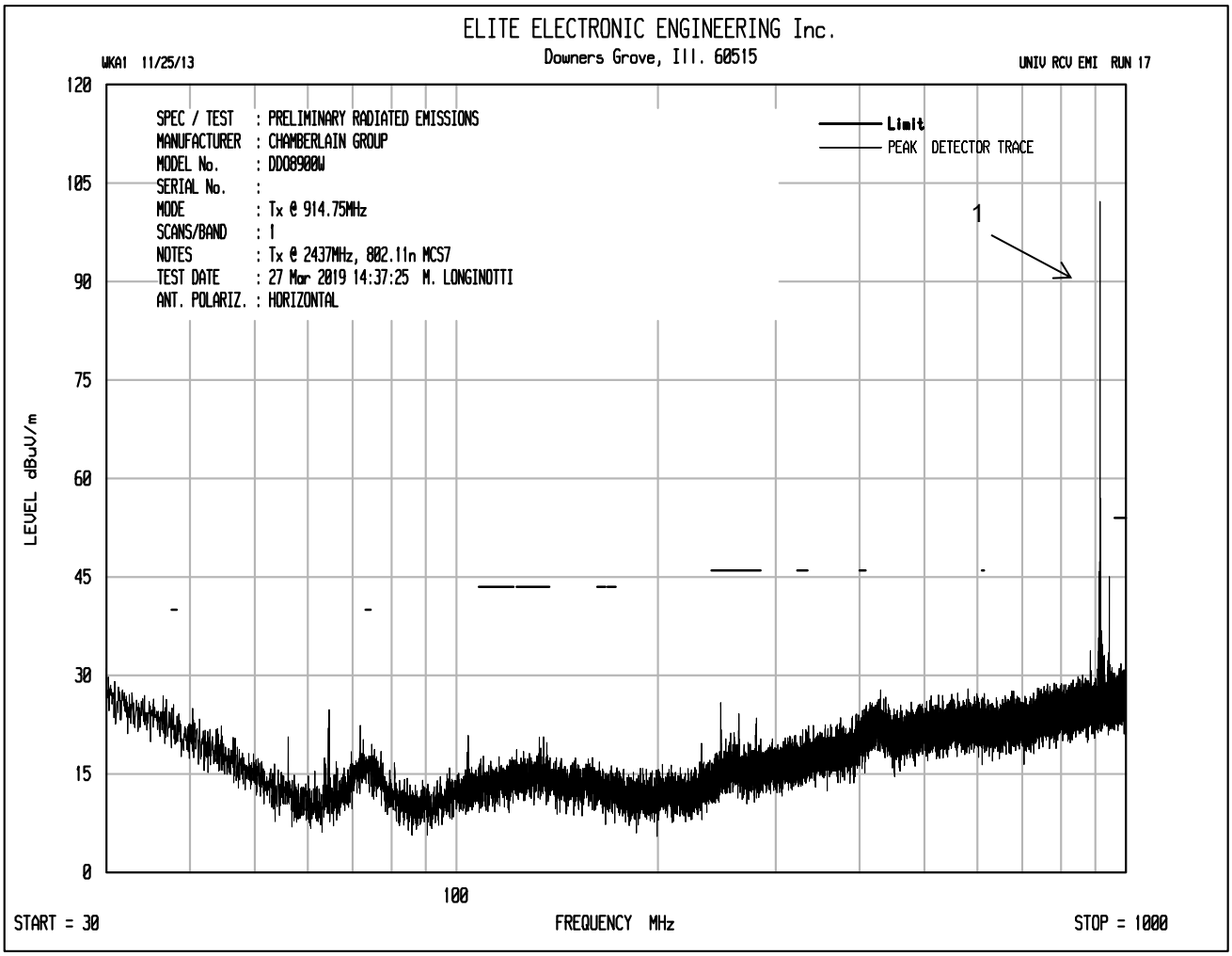

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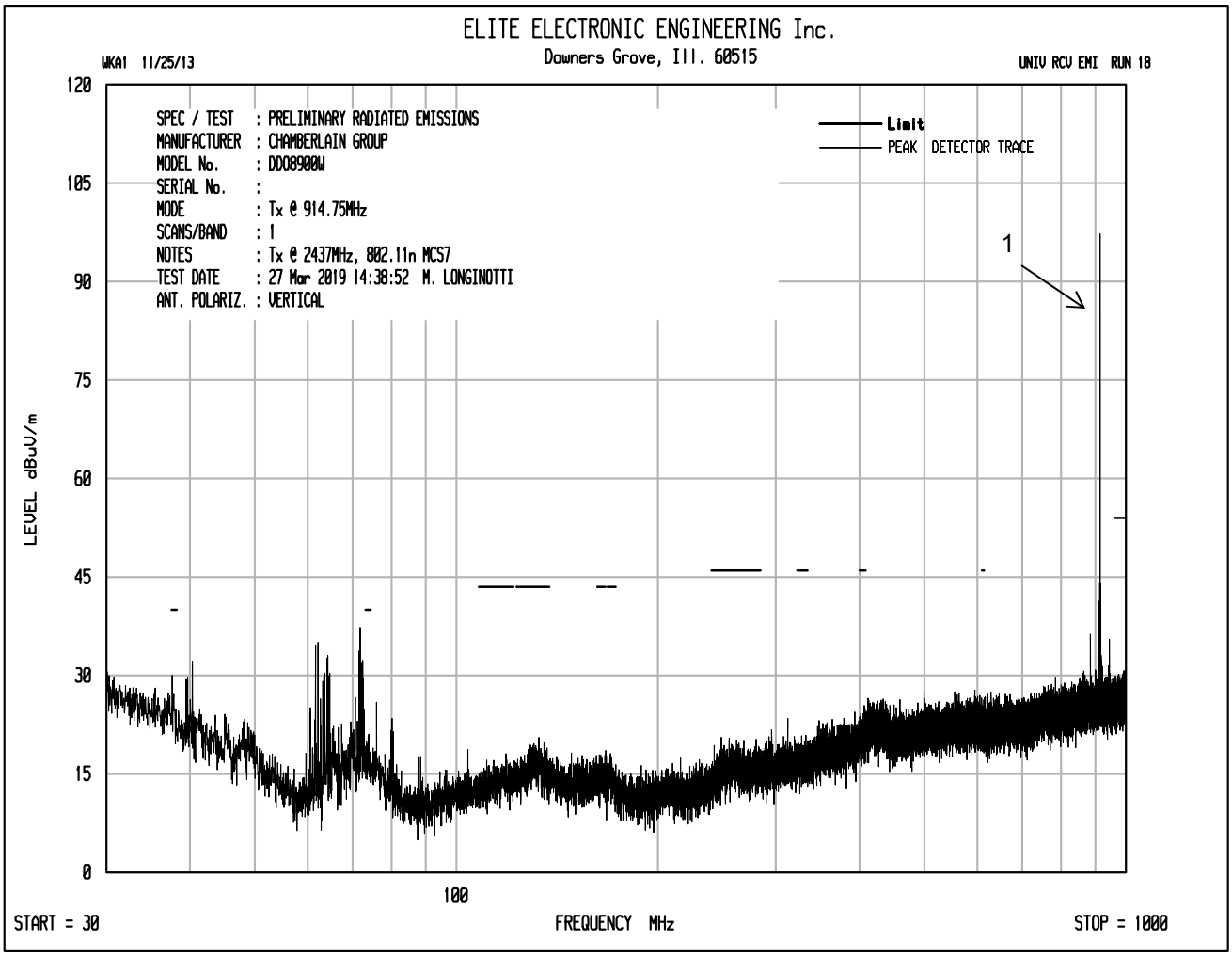

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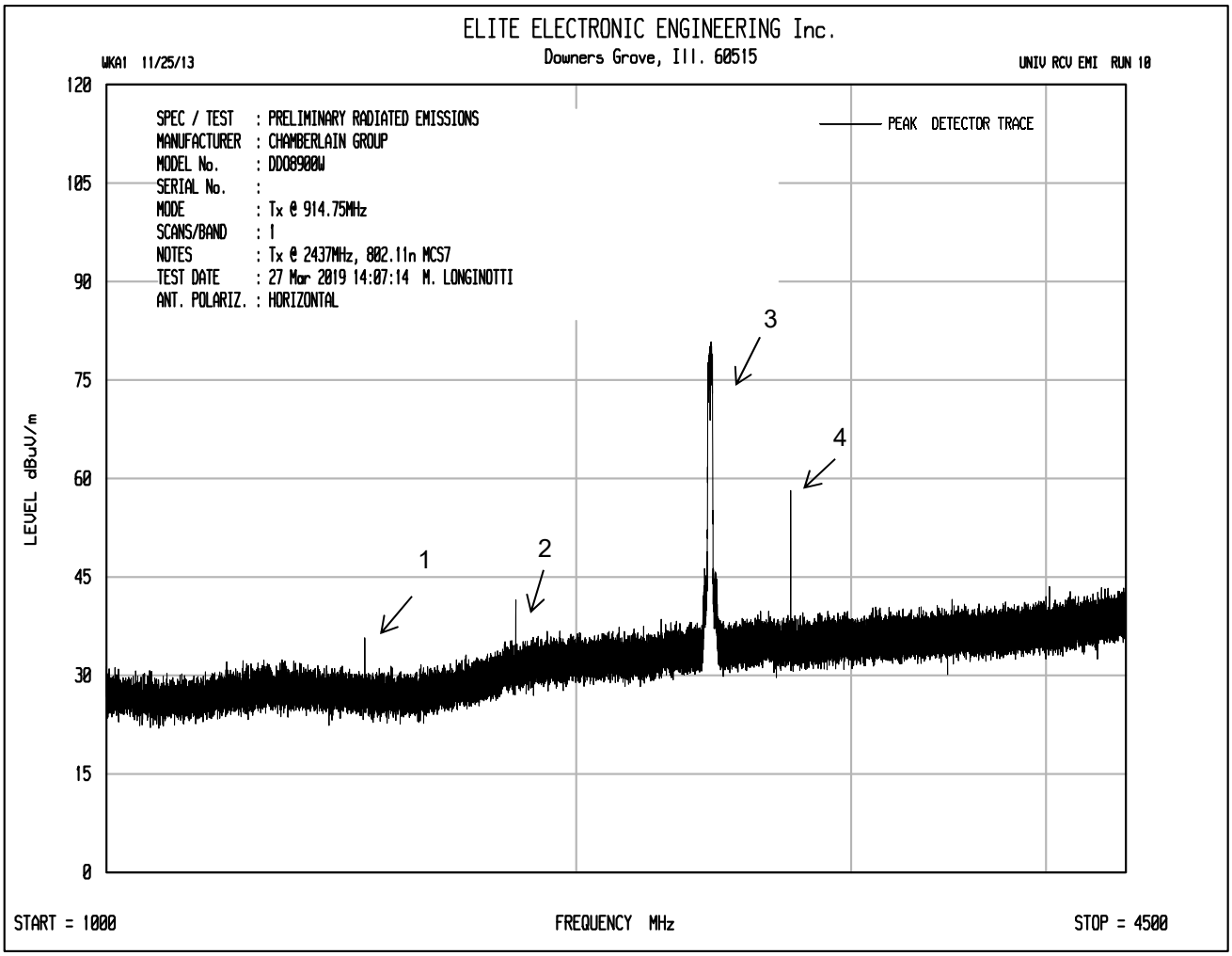

1 – 1464MHz (10th harmonic of 146.4MHz)
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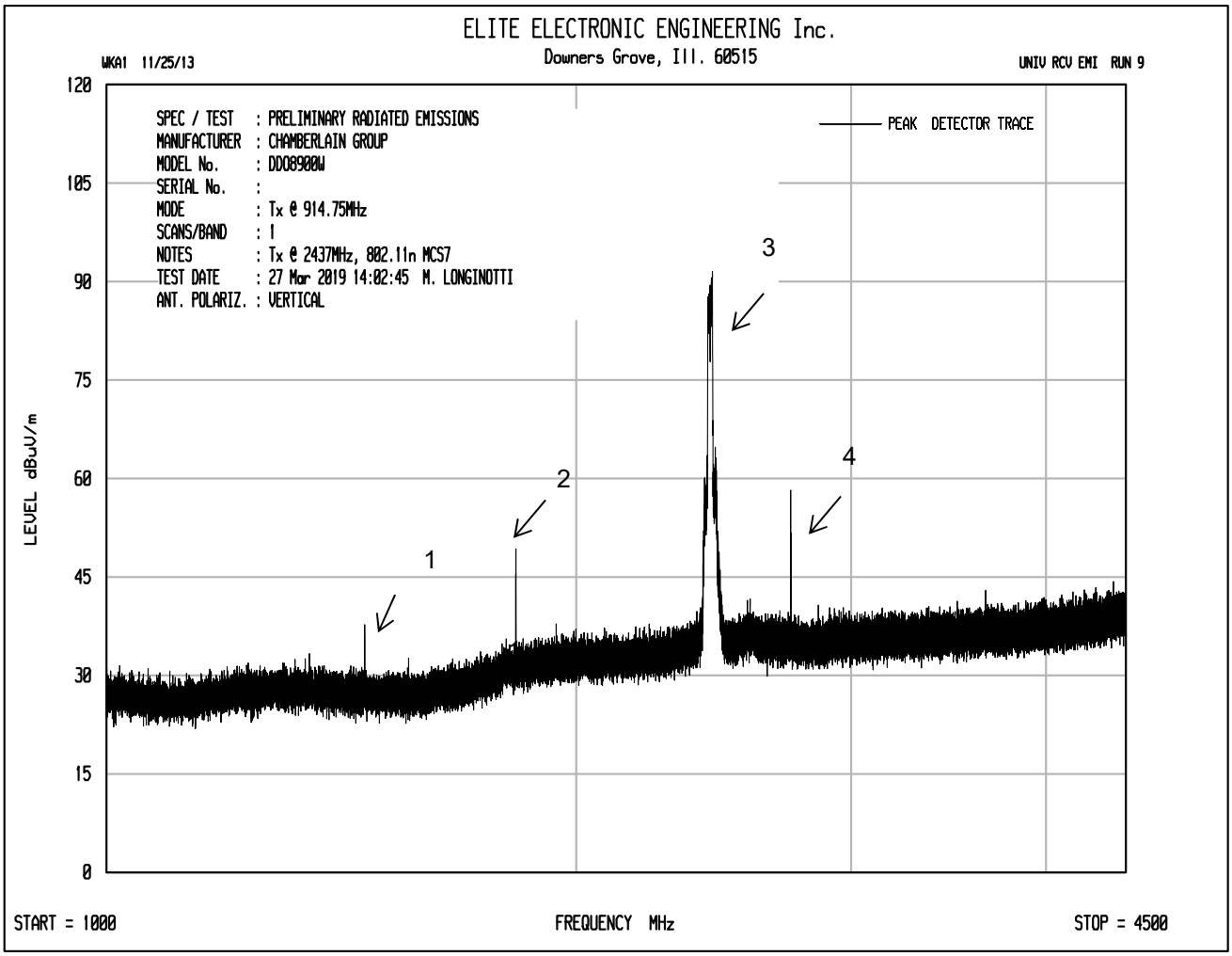
3 – Transmit at 2437MHz
4 – 2744.25MHz (3rd harmonic of 914.75MHz)



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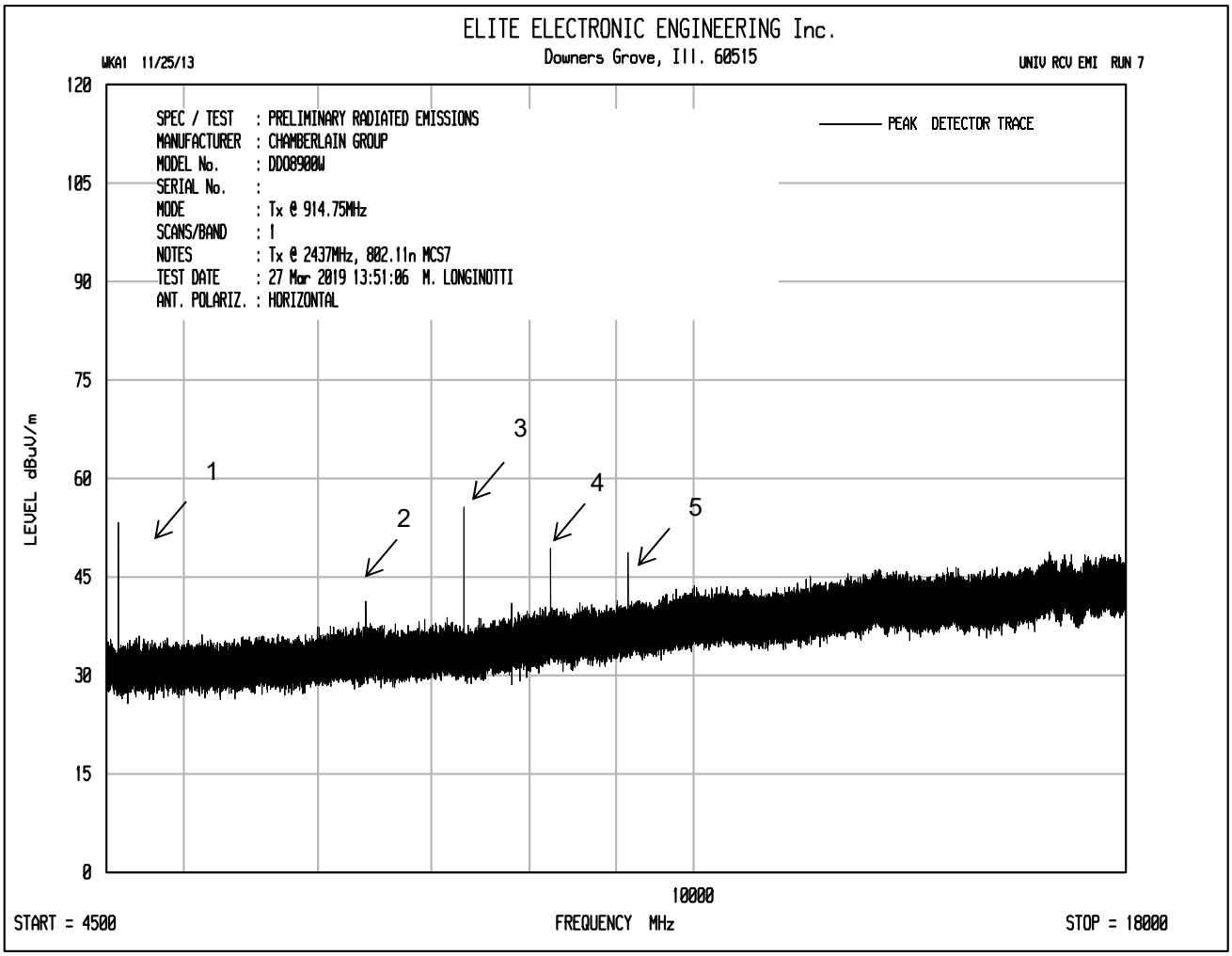

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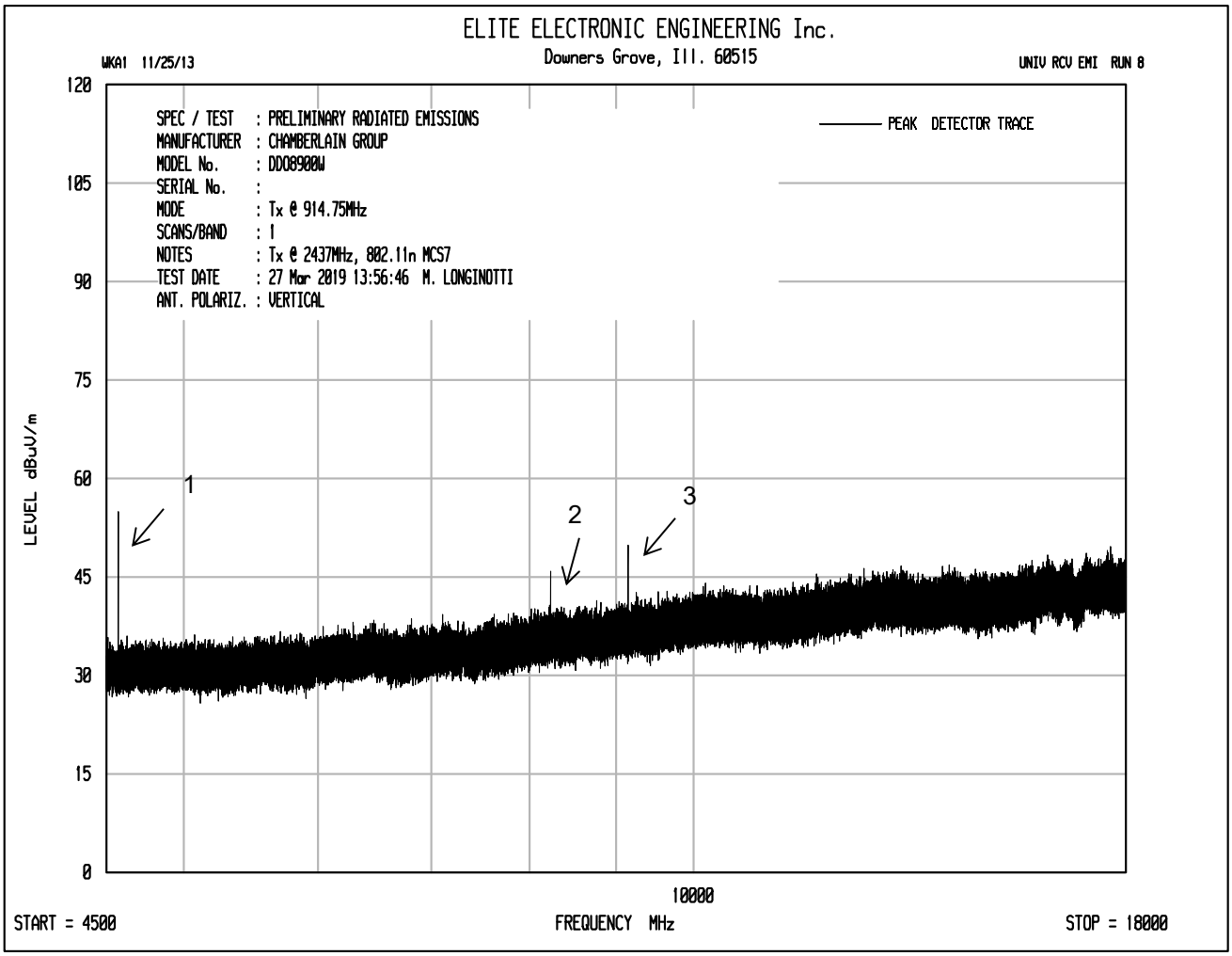

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