Measurement of RF Interference from a Model No. CDMRAA0101E3 (ARQ2-UGDO) Automotive Transceiver for Garage Door Control Transceiver

For	The Chamberlain Group, Inc. 300 Windsor Dr. Oak Brook, IL 60523
P.O. Number	4900067654
Date Received	November 16, 2020
Date Tested	November 17 – December 1, 2020
Test Personnel	Tylar Jozefczyk
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 within the band 902-928MHz FCC “Code of Federal Regulations” Title 47, Part15, Subpart 15B, Section 15.107 and 15.109 for Receivers Industry Canada RSS-247 Industry Canada RSS-GEN

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REVISION HISTORY

Revision	Date	Description
-	19 JAN 2021	Initial release
A	25 JAN 2021 By TMJ	- Report number updated from 2004380-02 to 2004380-02 Rev. A throughout test report. - Section 3.1: updated ISED UPN from “266A-9757” to “2666A-9757”.
B	01 FEB 2021 By TMJ	- Report number updated from 2004380-02 Rev. A to 2004380-02 Rev. B throughout test report. - Section 3.1: updated and edited “EUT Identification” table with the following: o Corrected value in “Conducted Output Power” row from “10dBm (set in firmware); 3.5dBm after filtering and loss” to 16.77dBm (0.0475W). o Corrected value in “Rated Output Power” row from -0.59dBi to 17.30dBm (0.0537W).
C	02 FEB 2021 By TMJ	- Report number updated from 2004380-02 Rev. B to 2004380-02 Rev. C throughout test report. - Revision History Table: Updated second row for Revision A (showed incorrectly as “Report number updated from 2004380-02 to 2004380-02 Rev. B throughout test report”; has been updated to the correct “Report number updated from 2004380-02 to 2004380-02 Rev. A throughout test report”).

Measurement of RF Emissions from an Automotive Transceiver for Garage Door Control, Model No. CDMRAA0101E3 (ARQ2-UGDO) Transceiver

1. INTRODUCTION

1.1 Scope of Tests

This document represents the results of the series of radio interference measurements performed on The Chamberlain Group, Inc. Automotive Transceiver for Garage Door Control, Model No. CDMRAA0101E3 (ARQ2-UGDO), transceiver (hereinafter referred to as the EUT). The EUT is a frequency hopping spread spectrum transceiver. The transceiver was designed to transmit and receive in the 902-928MHz band using an integral antenna. The EUT was manufactured and submitted for testing by The Chamberlain Group, Inc. located in Oak Brook, IL.

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, Section 15.109, for receivers and Subpart C, Section 15.247 for Intentional Radiators Operating within the 902-928MHz 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 5 and 7 for receivers and Industry Canada Radio Standards Specification RSS-Gen Section 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

No deviations, additions, or exclusions were implemented 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 21.3°C and the relative humidity was 15%.

2. APPLICABLE DOCUMENTS

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

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subparts B and 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 C63.10-2014, "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices”
- FCC Public Notice, DA 00-705, "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems", Released March 30, 2000
- Industry Canada RSS-247, Issue 2, February 2017, “Digital Transmission Systems (DTSs),

Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices"

- Industry Canada RSS-GEN, Issue 5, March 2019, "General Requirements for Compliance of Radio Apparatus"

3. EUT SETUP AND OPERATION

3.1 General Description

The EUT was identified as follows:

EUT Identification	
Product Description	ARQ2 Automotive Transceiver for Garage Door Control
Model Number	CDMRAA0101E3 (ARQ2-UGDO)
Serial Number	SMP-77482
Device Type	Frequency Hopping Spread Spectrum Device
Band of Operation	902 – 928MHz
Firmware Version	0.26
Conducted Output Power	16.77dBm (0.0475W)
Rated Output Power	17.30dBm (0.0537W)
Antenna Type	Copper trace monopole; Chip
Antenna Gain (dBi)	0.5dBi
20dB Bandwidth	209.8kHz
Occupied Bandwidth (99% CBW)	681.4kHz
Size of EUT	1.75" x 1.5"
Product FCC ID and ISED UPN	FCC ID: HBW9757 ISED UPN: 2666A-9757

3.1.1 Power Input

The EUT obtained 12VDC power via a 2-wire, 1m, wire harness.

3.1.2 Peripheral Equipment

The following peripheral equipment was submitted with the EUT:

Item	Description
Elite Laptop	Used to place the EUT in test mode.

3.1.3 Interconnect Cables

The following interconnect cables were submitted with the EUT:

Item	Description
Wire Harness	1 meter
USB to Serial Cable	Used to connect EUT to test laptop to control modes.

3.1.4 Grounding

The EUT was not grounded.

3.2 Operational Mode

The EUT and all peripheral equipment were energized. The cables were manually maximized during the preliminary emissions sweeps. The cable arrangement which resulted in the worst-case emissions was utilized.

Mode	Description
Tx	The EUT was powered on and set to transmit at one of the following frequencies: - 902.25MHz - 914.75MHz - 926.75MHz
Rx	The EUT was powered on and set to receive at one of the following frequencies: - 902.25MHz - 914.75MHz - 926.75MHz
FHSS	The EUT was powered on and set to transmit in a frequency hopping mode across the 902 – 928MHz band.

3.3 EUT Modifications

No modifications were required for compliance.

4. TEST FACILITY AND TEST INSTRUMENTATION

4.1 Shielded Enclosure

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. With the exception of the floor, the reflective surfaces of the shielded chamber are lined with ferrite tiles on the walls and ceiling. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2014 for site attenuation.

4.2 Test Instrumentation

The test instrumentation and auxiliary equipment used during the tests are listed in Table 9-1. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

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

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.

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 Receiver

5.1.1 Powerline Conducted Emissions

5.1.1.1 Requirements

Since the EUT is DC powered and has no provisions for AC power, no conducted emissions tests are required.

5.1.2 Radiated Measurements

5.1.2.1 Requirements

Per the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Section 15.109(a), all radio frequency emissions from a receiver shall be below the limits shown in the following table:

RADIATION LIMITS FOR A RECEIVER

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

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

5.1.2.2 Procedures

Testing was performed separately on a low, middle, and high channel. The emissions in the frequency range of 30MHz to 10GHz were measured and plotted using a ‘screen-dump’ utility. Testing was performed with the antenna of the EUT in place.

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.

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

The broadband measuring antenna was positioned at a 3-meter distance from the EUT. The EUT was placed on an 80cm high non-conductive stand. The frequency range from 30MHz to 1GHz was investigated using a peak detector function with the bilog antenna at several heights, horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The frequency range from 1GHz to 10GHz was investigated using a peak detector function with the double ridged waveguide antenna at several heights, horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The maximum levels for each antenna polarization were plotted.

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

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

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

   a) The EUT was rotated so that all its sides were exposed to the receiving antenna.
   b) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
   c) The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.
   d) For hand-held or body-worn devices, the EUT was rotated through three orthogonal axes to determine which orientation produces the highest emission relative to the limit.

5.1.2.1 Results

Radiated emissions plots are shown on pages 22 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 4 and 5.

5.2 Transmitter

5.2.1 Powerline Conducted Emissions

5.2.1.1 Requirements

Since the EUT was DC powered and has no provisions for AC power, no conducted emissions tests are required.

5.2.2 20dB Bandwidth

5.2.2.1 Requirements

Per 15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Per section 15.247(a)(1)(i), for frequency hopping systems operating in the 902-928MHz band, the 20dB bandwidth shall be measured for determination of the carrier frequency separation limits and must not exceed 500 kHz. If the 20dB bandwidth of the hopping channel is less than 250kHz, the system shall use at least 50 hopping channels. If the 20dB bandwidth of the hopping channel is 250kHz or greater (but not greater than 500kHz), the system shall use at least 25 hopping channels.

5.2.2.2 Procedures

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

With the hopping function disabled, the EUT was allowed to transmit continuously. The frequency hopping channel was set separately to low, middle, and high hopping channels. The resolution bandwidth (RBW) was set to ≥ 1% of the 20dB BW. The span was set to approximately 2 to 3 times the 20dB bandwidth.

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

5.2.2.3 Results

The plots on pages 40 through 45 show that the maximum 20dB bandwidth was 209.8kHz. The 99% bandwidth was measured to be 681.4kHz.

Therefore, since the 20dB bandwidth of the hopping channel is less than 250kHz, the system shall use at least 50 hopping channels.

5.2.3 Carrier Frequency Separation

5.2.3.1 Requirements

Per section 15.247 (a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

5.2.3.2 Procedures

The antenna port of the EUT was connected to the spectrum analyzer through 40dB of attenuation. With the hopping function enabled, the EUT was allowed to transmit continuously.

The resolution bandwidth (RBW) was set to > 1% of the span. The peak detector and 'Max-Hold' function were engaged. The span was set wide enough to capture the peaks of at least two adjacent channels.
When the trace had stabilized after multiple scans, the marker-delta function was used to determine the separation between the peaks of the adjacent channels. The analyzer's display was plotted using a 'screen dump' utility.

5.2.3.3 Results

Page 46 shows the carrier frequency separation. As can be seen from this plot, the carrier frequency separation is 500.5kHz, which is greater than the 20dB bandwidth (209.8kHz).

5.2.4 Number of Hopping Frequencies

5.2.4.1 Requirements

Per section 15.247(a)(1)(i), for frequency hopping systems operating in the 902-928MHz band, the 20dB bandwidth shall be measured for determination of the carrier frequency separation limits and must not exceed 500 kHz. If the 20dB bandwidth of the hopping channel is less than 250kHz, the system shall use at least 50 hopping channels. If the 20dB bandwidth of the hopping channel is 250kHz or greater (but not greater than 500kHz), the system shall use at least 25 hopping channels.

5.2.4.2 Procedures

The antenna port of the EUT was connected to the spectrum analyzer through 40dB of attenuation. With the hopping function enabled, the EUT was allowed to transmit continuously.

The resolution bandwidth (RBW) was set to ≥ 1% of the span. The peak detector and 'Max-Hold' function were engaged. The span was set wide enough to capture the entire frequency band of operation.

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

5.2.4.3 Results

Page 47 shows the number of hopping frequencies. As can be seen from this plot, the number of hopping frequencies is 50, which is equal to the minimum number of required hopping frequencies for systems with a 20dB bandwidth less than 250kHz.

5.2.5 Time of Occupancy

5.2.5.1 Requirements

Per section 15.247(a)(1)(i), for frequency hopping systems operating in the 902-928MHz band, if the 20dB bandwidth of the hopping channel is less than 250kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

5.2.5.2 Procedures

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

hopping function enabled, the EUT was allowed to transmit continuously.

The resolution bandwidth (RBW) was set to 1MHz. The peak detector and 'Max-Hold' function were engaged. With the span set to 0Hz, the sweep time was adjusted to capture a single event in order to measure the dwell time per hop. The analyzer's display was plotted using a 'screen dump' utility. Then, the sweep time was expanded to 20 seconds to capture the number of hops in the appropriate sweep time. A single sweep was made. The analyzer's display was plotted using a 'screen dump' utility.

The dwell time in the specified time period was then calculated from dwell time per hop multiplied by the number of hops in the specified time period.

5.2.5.3 Results

Pages 48 and 49 show the plots for the time of occupancy (dwell time). As can be seen from the plots, the time of occupancy can be determined by 1.27ms multiplied by 22 and further multiplied by 10. This calculated value is equal to 0.279s seconds, which is less than the 0.4 seconds maximum allowed.

5.2.6 Peak Output Power

5.2.6.1 Requirements

Per section 15.247(b)(2), 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 15.247(b)(4), this limit is based on the use of antennas with directional gains that do not exceed 6dBi. Since the limit allows for a 6dBi antenna gain, the maximum EIRP can be increased by 6dB to 4 Watt (36dBm).

If transmitting antennas of directional gain greater than 6dBi 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 6dBi.

5.2.6.2 Procedures

For the antenna conducted emissions method, the antenna port of the EUT was connected to the spectrum analyzer through 40dB of attenuation. With the hopping function disabled, the EUT was allowed to transmit continuously. The frequency hopping channel was set separately to low, middle, and high hopping channels. The resolution bandwidth (RBW) was set to greater than the 20dB bandwidth. The span was set to approximately 5 times the 20 dB 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 hopping frequencies.

For the radiated emissions method, 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 20dB bandwidth. The span was set to approximately 5 times the 20 dB bandwidth. The EUT was maximized for worst case emissions (or maximum output power) at the measuring antenna. The maximum meter reading was recorded. The peak power output was measured for the low, middle, and high hopping frequencies.

The equivalent power was determined from the field intensity levels measured at 3 meters using the substitution method. To determine the emission power, a 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, as required. The peak power output was calculated for low, middle, and high hopping frequencies.

5.2.6.3 Results

For the antenna conducted emissions method, the results are presented on pages 50 through 52. The maximum peak conducted output power from the transmitter was 0.047W (16.77dBm), which is below the 1W limit.

For the radiated emissions method, the results are presented on page 53. The maximum EIRP measured from the transmitter was 0.053W (17.30dBm), which is below the 4W limit.

5.2.7 Duty Cycle Factor Measurements

5.2.7.1 Procedures

The duty cycle factor is used to convert peak detected readings to average readings. This factor is computed from the time domain trace of the pulse modulation signal.

With the transmitter set up to transmit for maximum pulse density, the time domain trace is displayed on the spectrum analyzer. This trace is obtained by tuning center frequency to the transmitter frequency and then setting a zero span width with 1msec/div. The amplitude settings are adjusted so that the on/off transitions clear the 4th division from the bottom of the display. The markers are set at the beginning and end of the “on-time”. The trace is recorded.

Next the spectrum analyzer center frequency is set to the transmitter frequency with a zero span width and 10msec/div. This shows if the word is longer than 100msec or shorter than 100msec. If the word period is less than 100msec, the display is set to show at least one word. The on-time and off-time are then measured. The on-time is total time signal level exceeds the 4th division. Off-time is time under for the word period. The duty cycle is then computed as the (On-time/ word period) where the word period = (On-time + Off-time).

5.2.7.2 Results

The plots of the duty cycle are shown on data pages 54 and 55. The EUT transmits a 3.02ms pulse. Since a word is greater than 100ms long, the duty cycle factor was computed over a 100msec interval. The duty cycle correction factor was calculated to be -9.57dB (see page 55 for calculation).

5.2.8 Radiated Spurious Emissions Measurements

5.2.8.1 Requirements

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

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

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

5.2.8.2 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 10GHz was investigated using a peak detector function.

The final open field emission tests were then manually performed over the frequency range of 30MHz to 10GHz.

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 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 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 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 20dB 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 1GHz 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 1GHz 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 its sides were exposed to the receiving antenna.
      ii) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.
      iii) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.
   d) For all radiated emissions measurements below 1GHz, 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 1GHz, 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 20dB

above the maximum permitted average emission limit applicable to the equipment under test. Therefore, all peak readings above 1GHz must be no greater than 20dB above the limits specified in 15.209(a).

f) Next, for all radiated emissions measurements above 1GHz, the resolution bandwidth was set to 1MHz. The analyzer was set to linear mode with a 10Hz video bandwidth in order to simulate an average detector. An average reading was taken.

If the dwell time per channel of the hopping signal is less than 100msec, then the reading obtained with the 10Hz video bandwidth may be further adjusted by a “duty cycle correction factor”, derived from 20*log(dwell time/100msec). These readings must be no greater than the limits specified in 15.209(a).

5.2.8.3 Results

Preliminary radiated emissions plots with the EUT transmitting are shown on pages 56 through 67. Final radiated emissions data are presented on data pages 68 through 76. As can be seen from the data, all emissions measured from the EUT were within the specification limits. The emissions level closest to the limit (worst case) occurred at 3609MHz. The emissions level at this frequency was 17.13dB within the limit.

Photographs of the test configuration which yielded the highest or worst case radiated emission levels are shown in Figures 4 and 6.

5.2.9 Band Edge Compliance

5.2.9.1 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.

5.2.9.2 Procedures

5.2.9.2.1 Low 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 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.

5.2.9.2.2 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.

5.2.9.3 Results

Pages 77 through 80 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 20dB down limits.

6. CONCLUSIONS

It was determined that The Chamberlain Group, Inc. Automotive Transceiver for Garage Door Control, Model No. CDMRAA0101E3 (ARQ2-UGDO) frequency hopping spread spectrum transceiver 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 902-928MHz band, when tested per ANSI C63.4-2014.

It was also determined that The Chamberlain Group, Inc. Automotive Transceiver for Garage Door Control, Model No. CDMRAA0101E3 (ARQ2-UGDO) frequency hopping spread spectrum transceiver 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
APW3	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-35-120-5R0-10-12	PL2924	1GHZ-20GHZ	3/23/2020	3/23/2021
CDZ3	LAB WORKSTATION	ELITE	LWS-10		WINDOWS 10	CNR	
NDQ0	TUNED DIPOLE ANTENNA	EMCO	3121C-DB4	311	400-1000MHZ	5/8/2020	5/8/2022
NSDS1	UNIVERSAL SPHERICAL DIPOLE SOURCE	AET	USDS-H	AET-1116		NOTE 1	
NTA3	BILOG ANTENNA	TESEQ	6112D	32853	25-1000MHz	10/20/2020	10/20/2021
NWQ0	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66657	1GHZ-18GHZ	5/13/2020	5/13/2022
RBG0	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101533	10HZ-44GHZ	2/19/2020	2/19/2021
RBG2	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101591	2HZ-44GHZ	3/23/2020	3/23/2021
SES0	24VDC POWER SUPPLY	P-TRANS	FS-32024-1M	001	18-27VDC	NOTE 1	
SMAW	DC POWER SUPPLY	VOLTEQ	HY3020EX	02177910	30VDC/20A	NOTE 1	
VBV2	CISPR EN FCC ICES RE.EXE	ELITE	CISPR EN FCC ICES RE.EXE	---	---	N/A	
WKA1	SOFTWARE, UNIVERSAL RCV EMI	ELITE	UNIV_RCV_EMI	1	---	I/O	
XPQ2	HIGH PASS FILTER	K&L MICROWAVE	4IH30-1804/T10000-0	3	1.8-10GHZ	9/6/2019	9/6/2021

I/O: Initial Only N/A: Not Applicable CNR: Calibration Not Required
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.

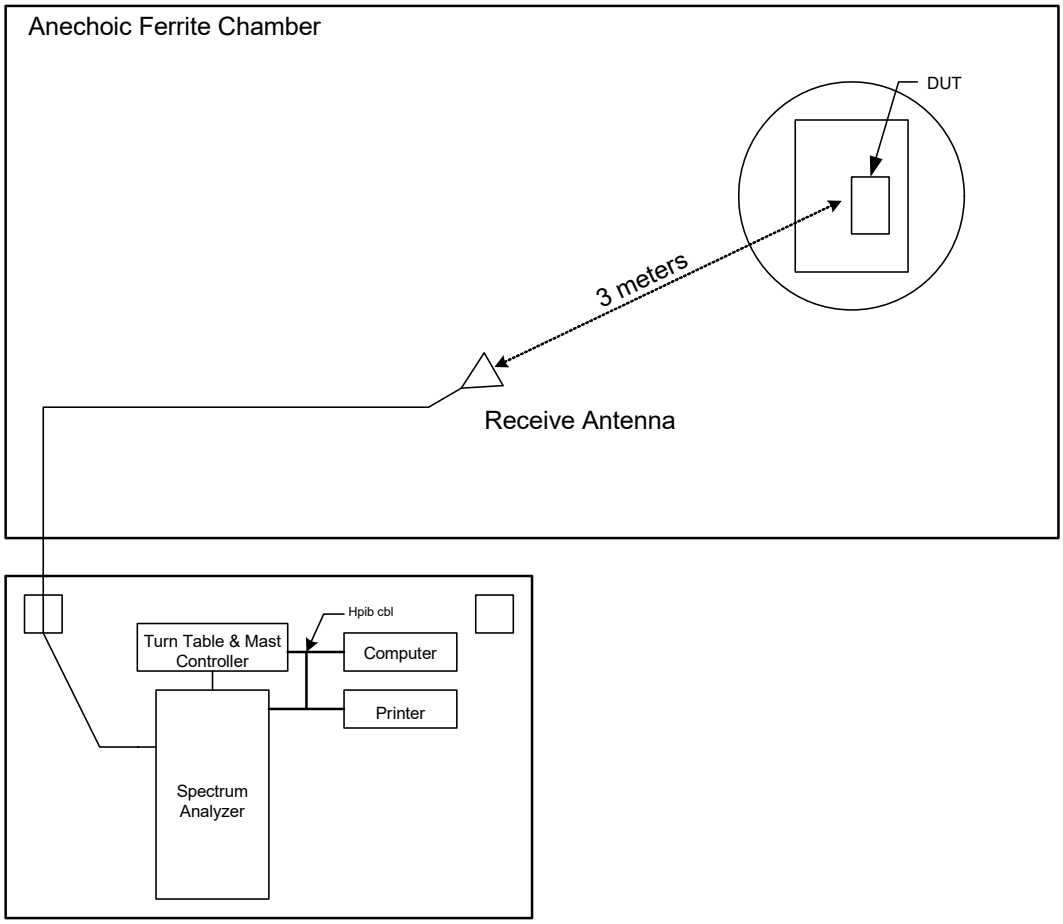
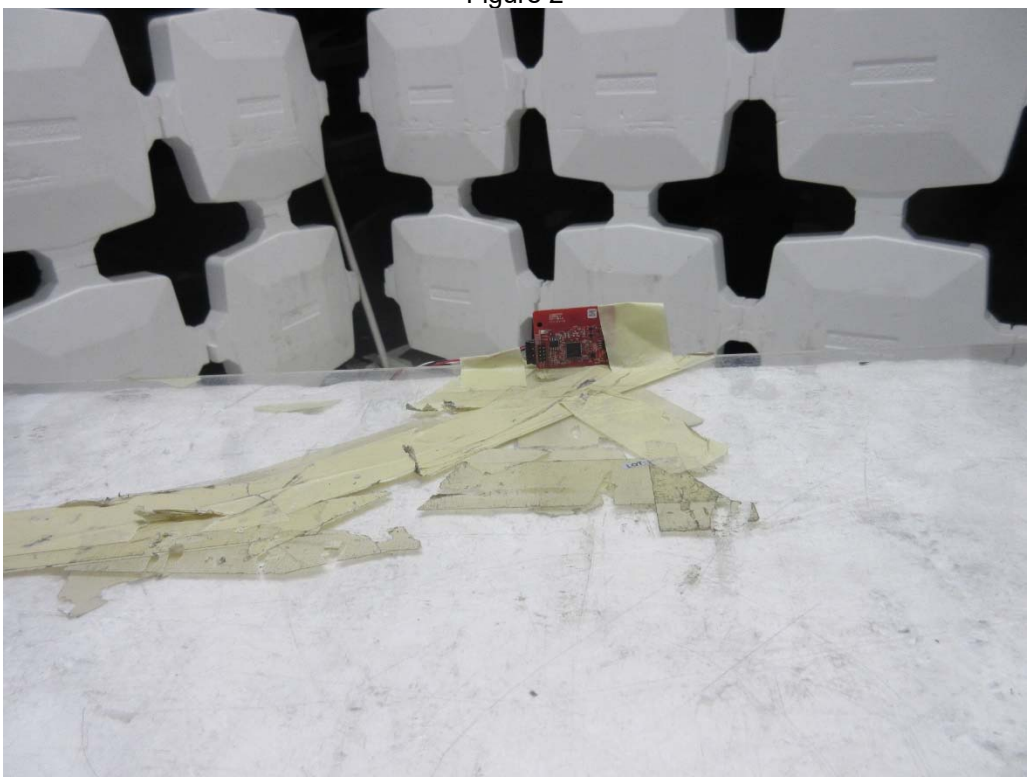


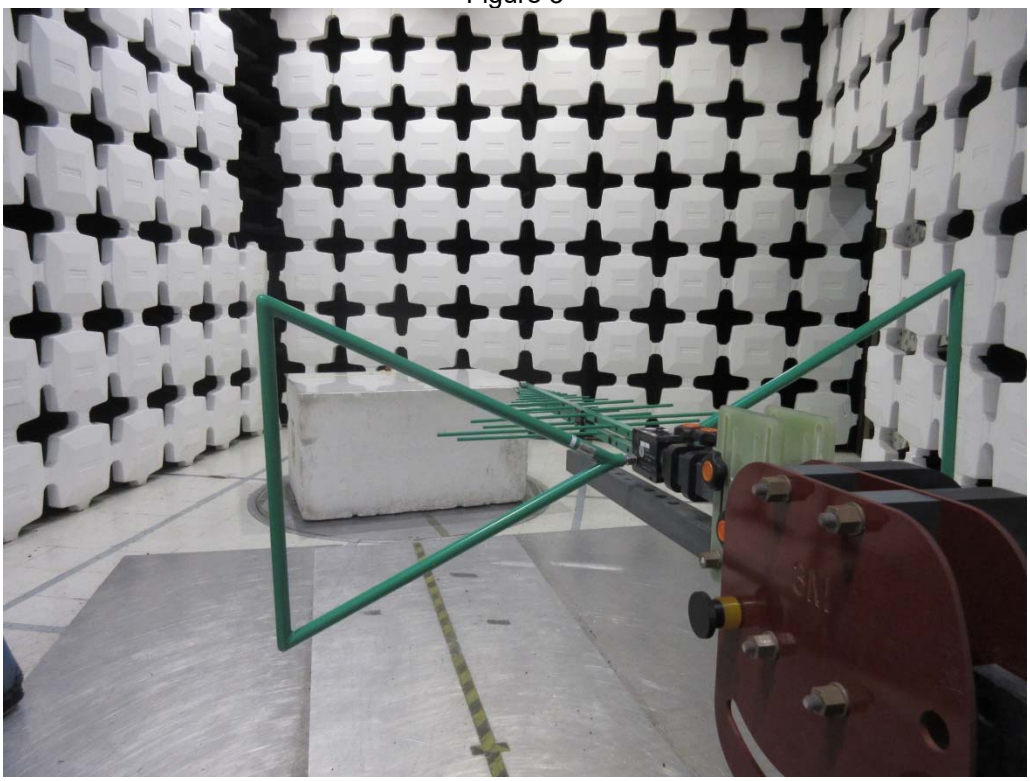
FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

Figure 2

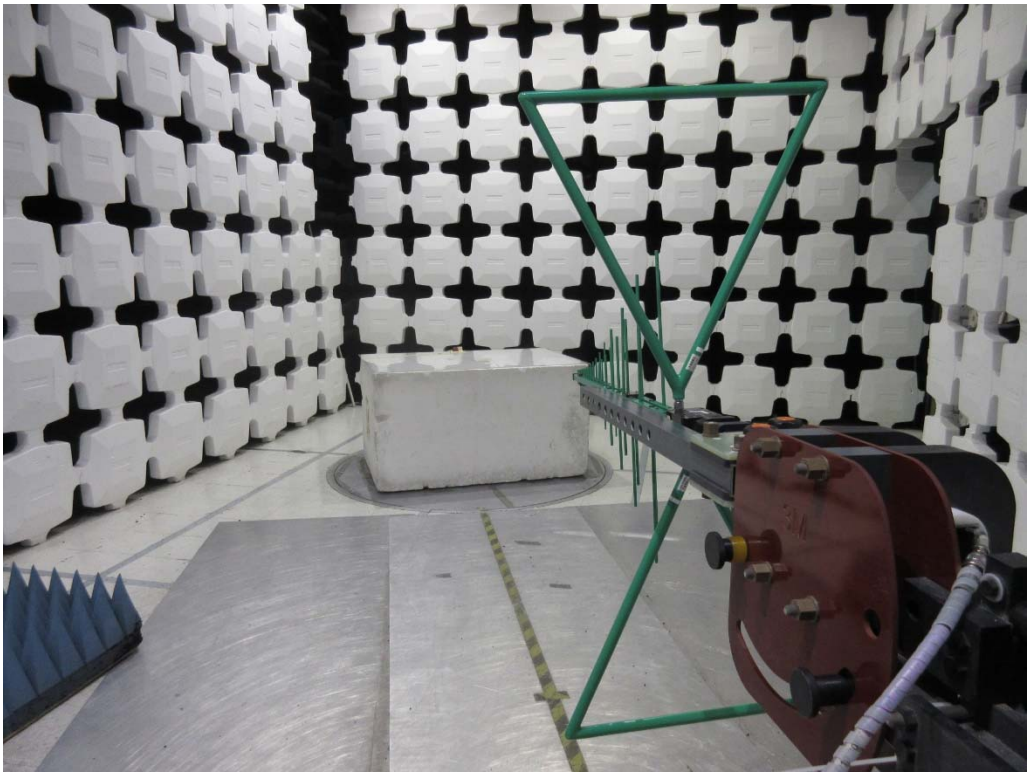


EUT Setup

Figure 3

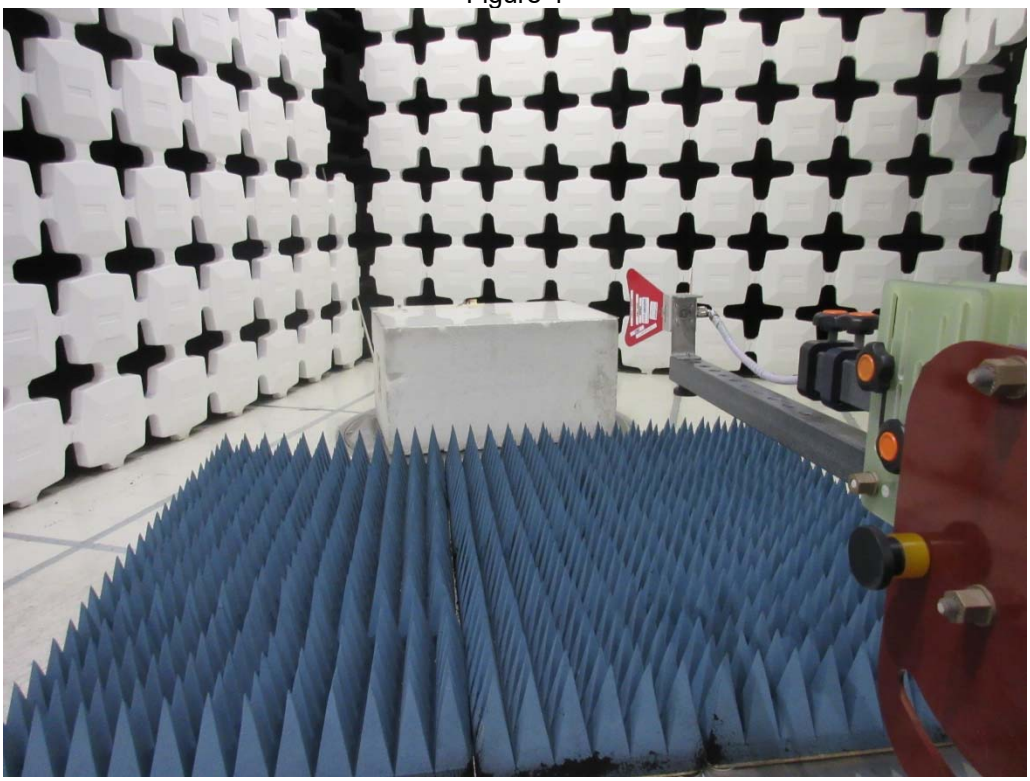


Test Setup for Radiated Emissions – 30MHz to 1GHz, Horizontal Polarization

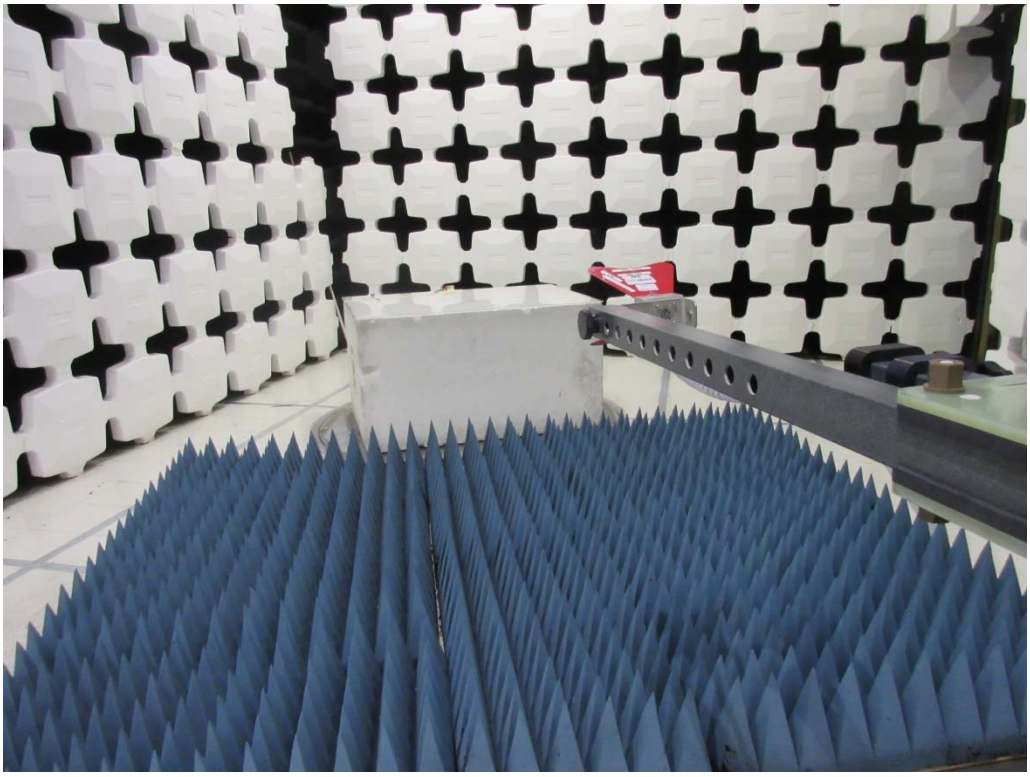


Test Setup for Radiated Emissions – 30MHz to 1GHz, Vertical Polarization

Figure 4

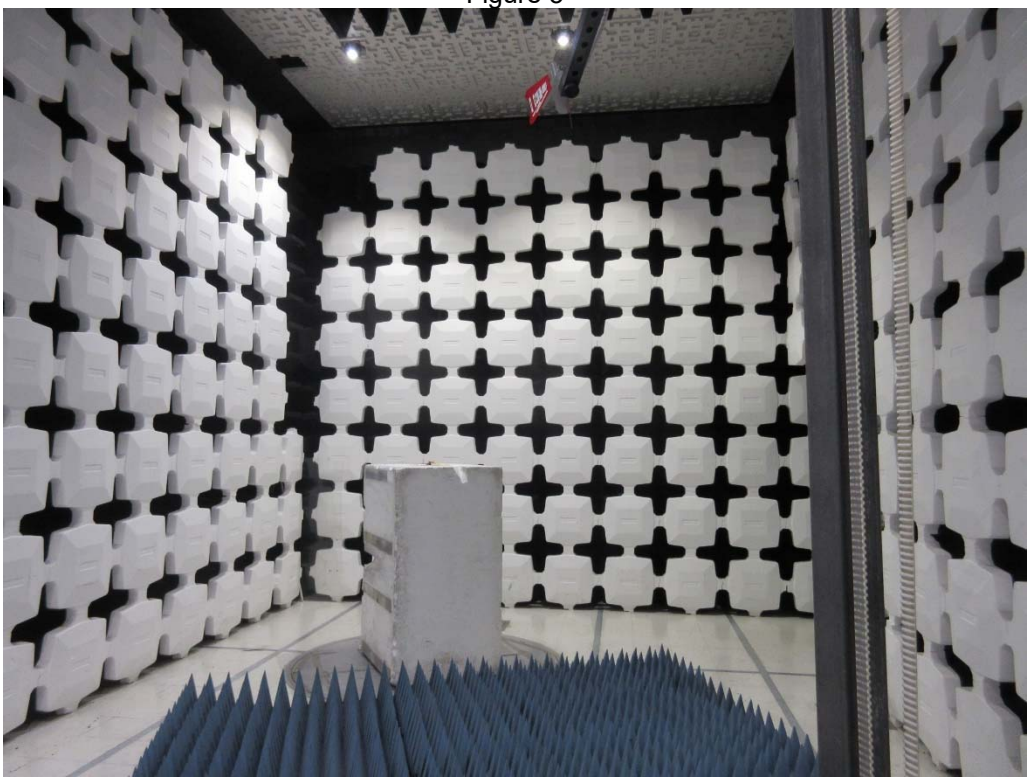


Test Setup for Radiated Emissions (Receiver) – 1 to 10GHz, Horizontal Polarization

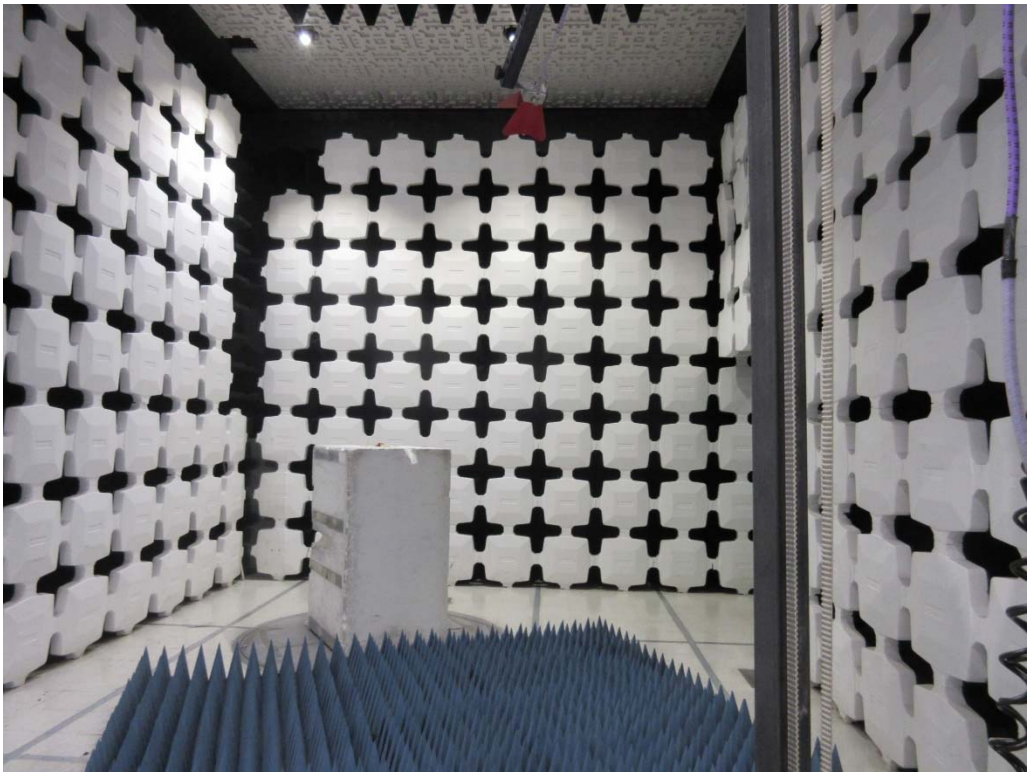


Test Setup for Radiated Emissions (Receiver) – 1 to 10GHz, Vertical Polarization

Figure 5



Test Setup for Radiated Emissions (Transmitter) – 1 to 10GHz, Horizontal Polarization

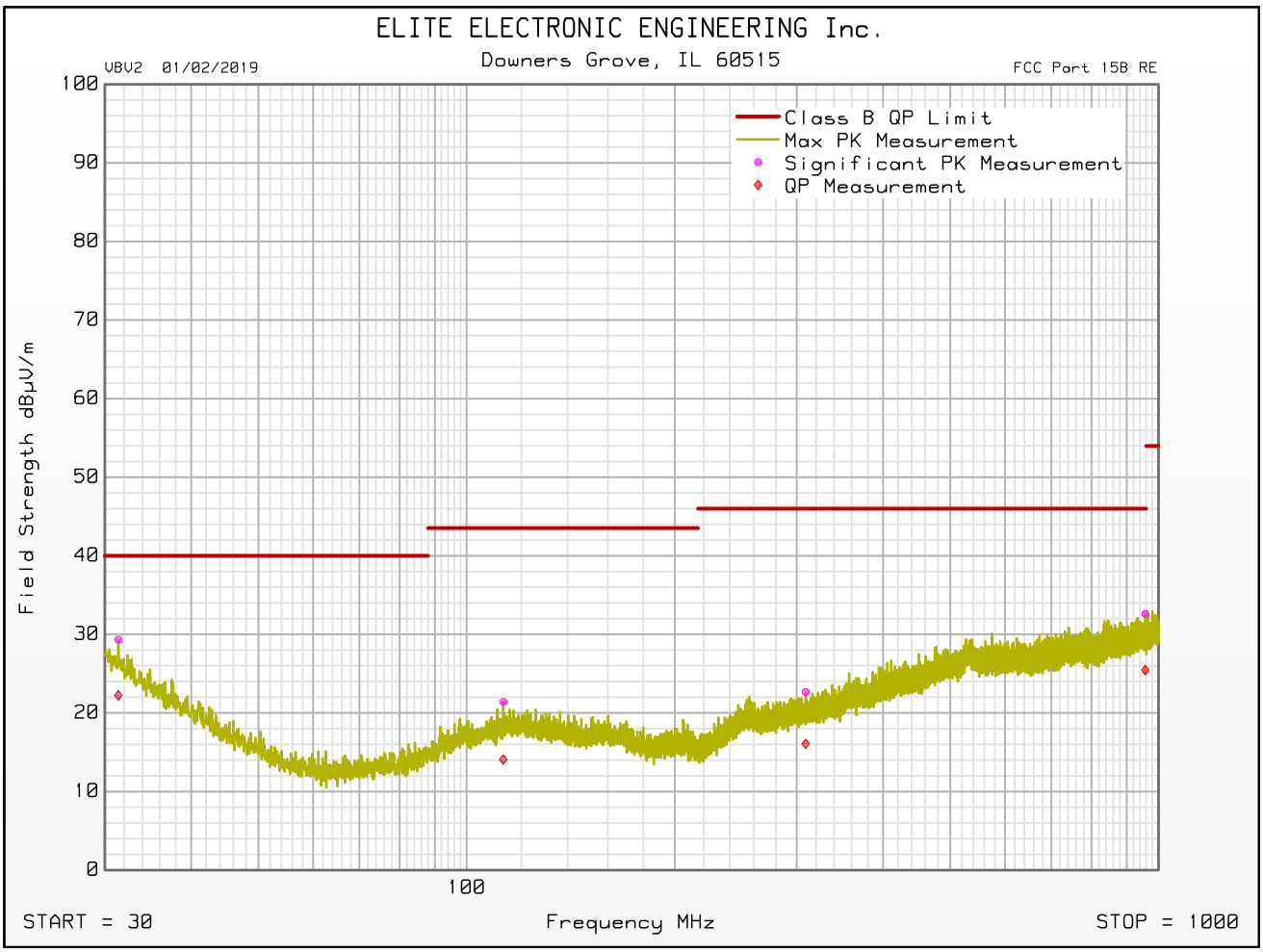


Test Setup for Radiated Emissions (Transmitter) – 1 to 10GHz, Vertical Polarization

FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

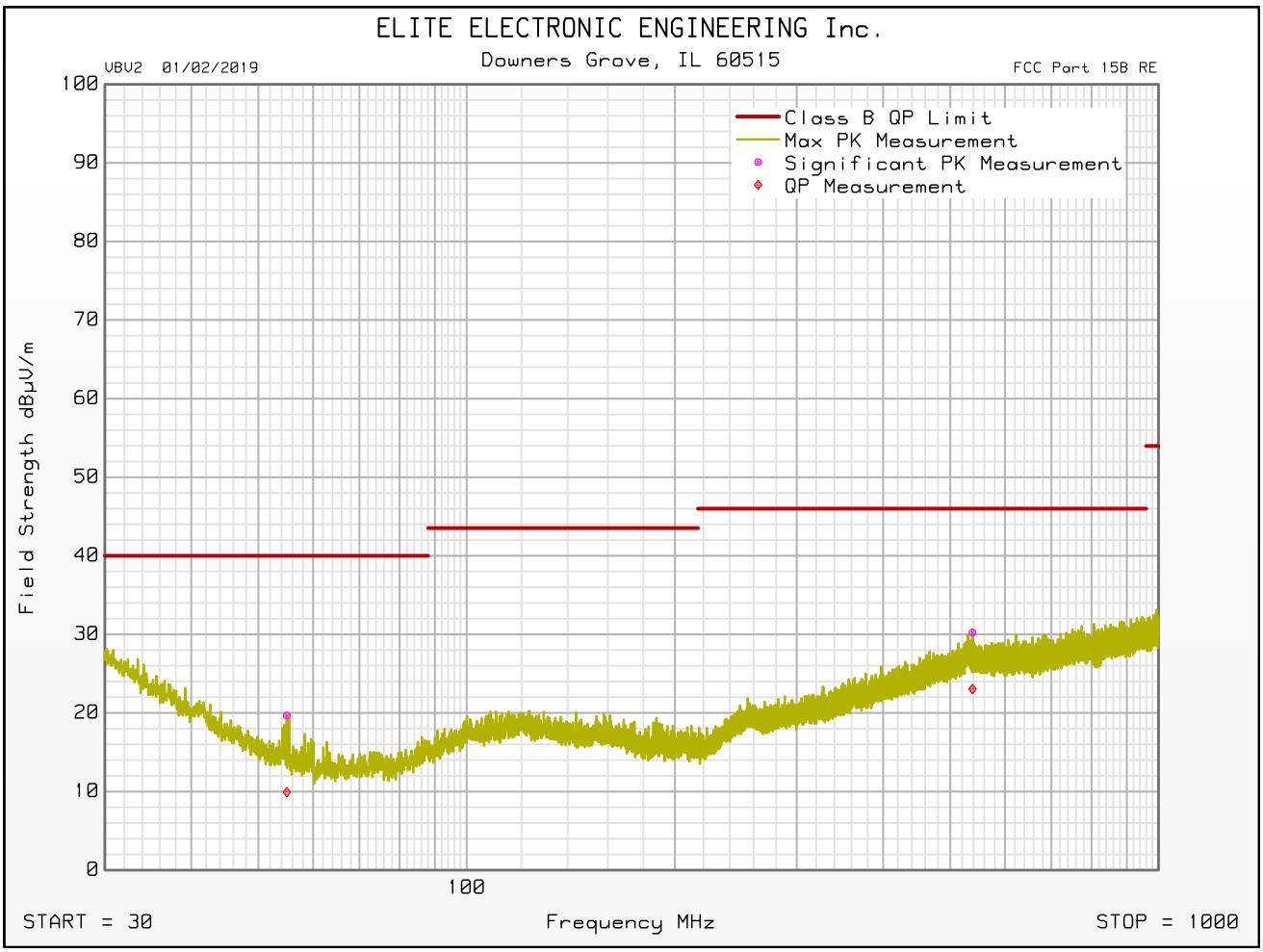
Manufacturer	:	CHAMBERLAIN
Model	:	SMP-77750
Serial Number	:	
DUT Mode	:	RX @ 902.25MHZ
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Ant. Polarization(s)	:	H
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	T. Jozefczyk
Test Date	:	Nov 19, 2020 04:26:07 PM



FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

Manufacturer	:	CHAMBERLAIN
Model	:	SMP-77750
Serial Number	:	
DUT Mode	:	RX @ 902.25MHZ
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Ant. Polarization(s)	:	V
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	T. Jozefczyk
Test Date	:	Nov 19, 2020 04:26:07 PM



FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

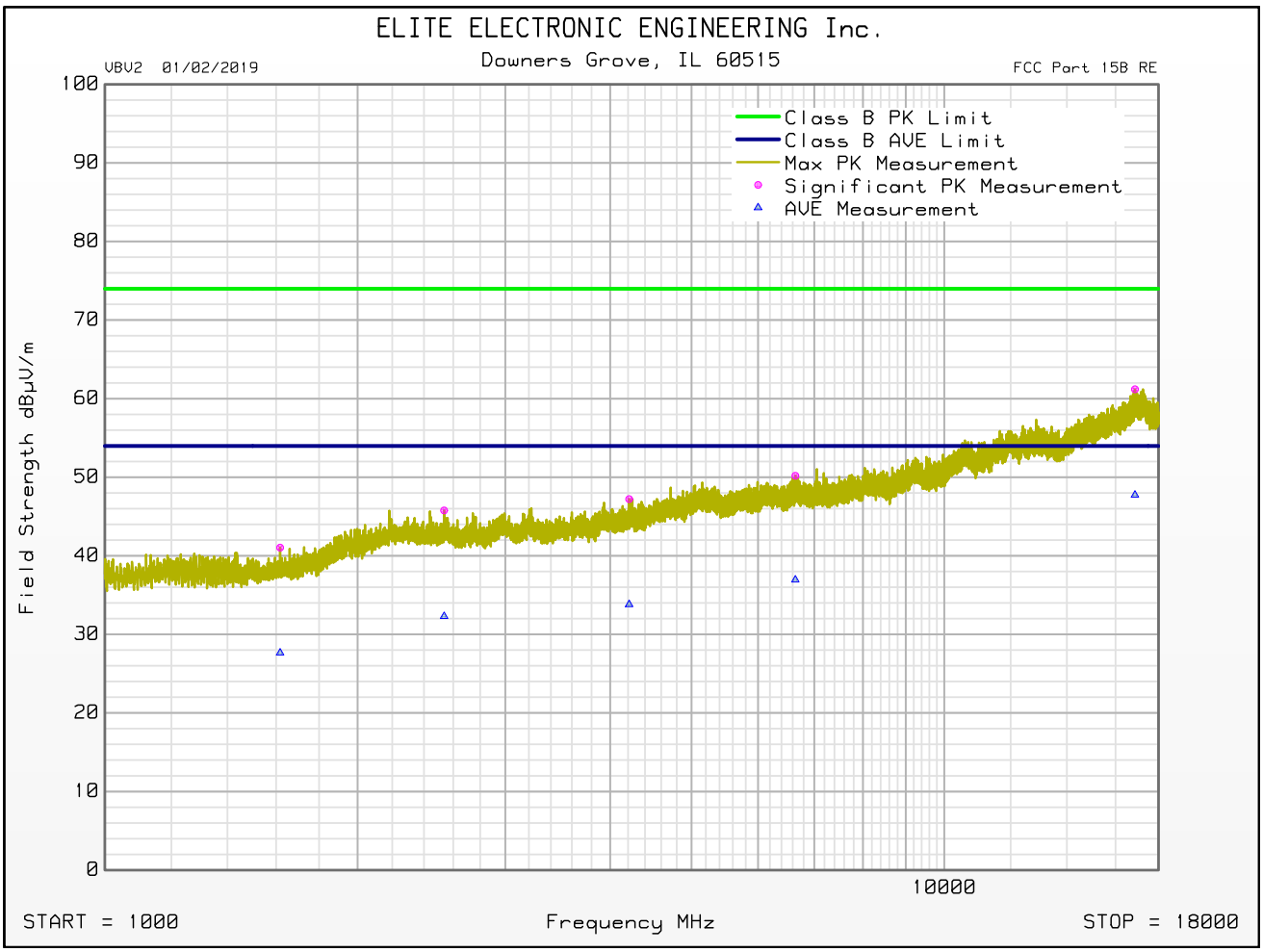
Manufacturer	:	CHAMBERLAIN
Model	:	SMP-77750
Serial Number	:	
DUT Mode	:	RX @ 902.25MHZ
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	T. Jozefczyk
Test Date	:	Nov 19, 2020 04:26:07 PM

Freq MHz	Peak Mtr Rdg dBuV	QP Mtr Rdg dBuV	Ant Fac dB	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	QP Total dBµV/m	QP Limit dBµV/m	QP Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °
31.380	4.8	-2.2	24.1	0.0	0.4	0.0	29.3	22.3	40.0	-17.7	H	120	90
54.960	5.9	-3.9	13.3	0.0	0.5	0.0	19.7	9.9	40.0	-30.1	V	120	135
112.960	2.9	-4.5	17.9	0.0	0.7	0.0	21.4	14.1	43.5	-29.5	H	340	225
309.000	2.3	-4.3	19.3	0.0	1.1	0.0	22.7	16.1	46.0	-29.9	H	200	45
538.440	4.0	-3.2	24.8	0.0	1.5	0.0	30.2	23.0	46.0	-23.0	V	120	315
957.180	3.6	-3.6	27.1	0.0	1.9	0.0	32.6	25.5	46.0	-20.5	H	120	180

FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

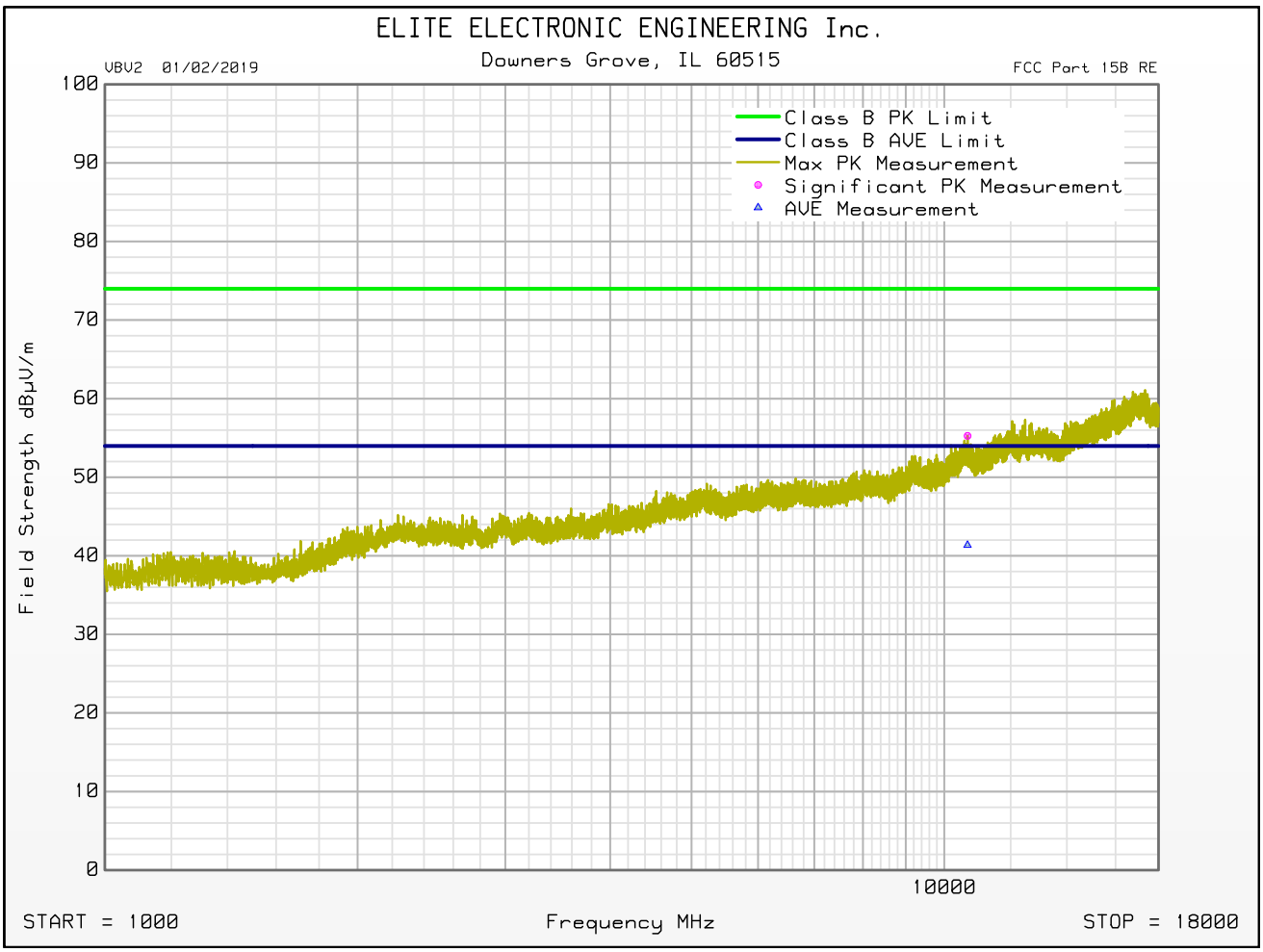
Manufacturer	:	CHAMBERLAIN
Model	:	SMP-77750
Serial Number	:	
DUT Mode	:	RX @ 902.25MHZ
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Ant. Polarization(s)	:	H
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	T. Jozefczyk
Test Date	:	Nov 30, 2020 04:10:27 PM



FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

Manufacturer	:	CHAMBERLAIN
Model	:	SMP-77750
Serial Number	:	
DUT Mode	:	RX @ 902.25MHZ
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Ant. Polarization(s)	:	V
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	T. Jozefczyk
Test Date	:	Nov 30, 2020 04:10:27 PM



FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

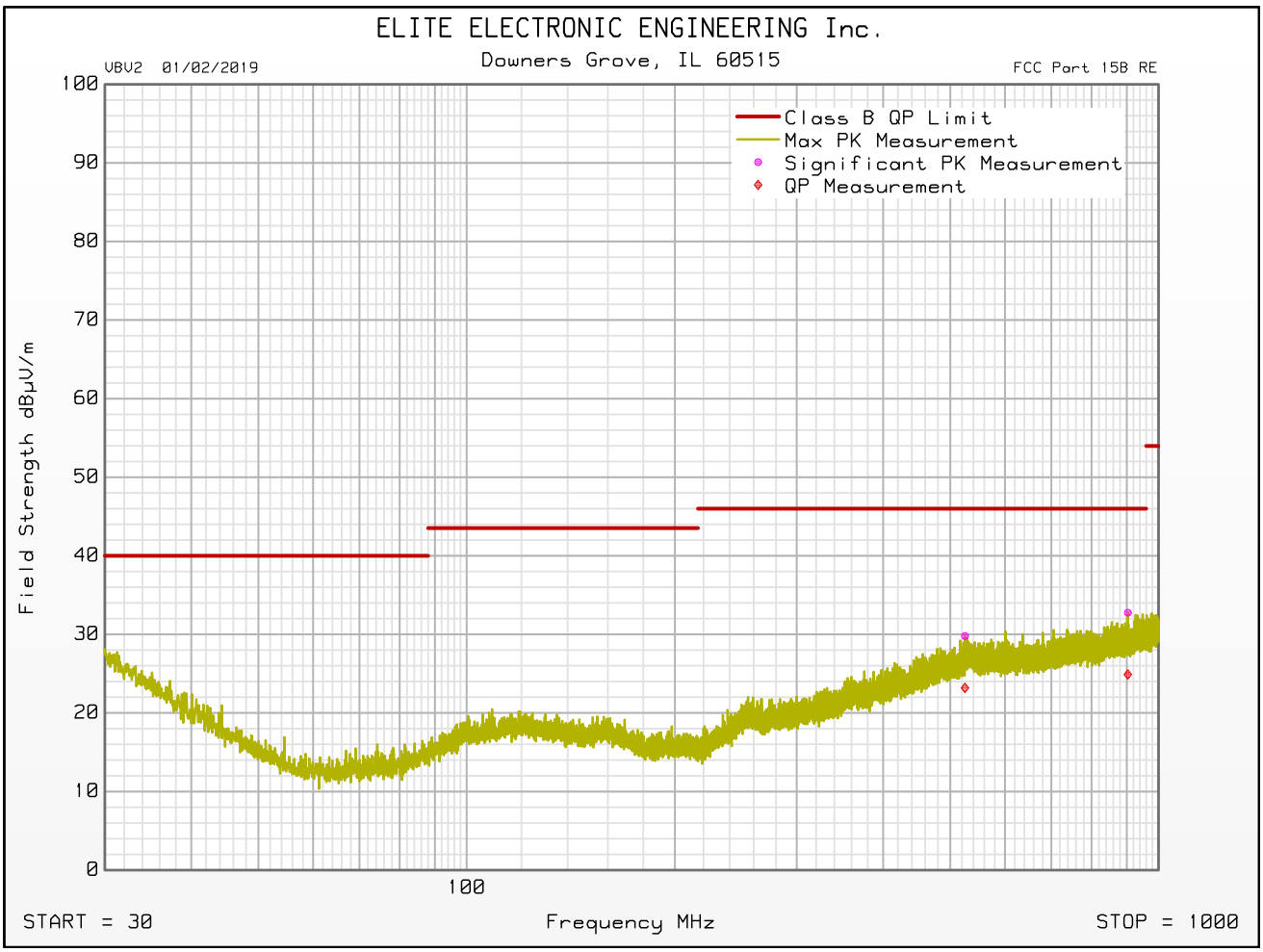
Manufacturer	:	CHAMBERLAIN
Model	:	SMP-77750
Serial Number	:	
DUT Mode	:	RX @ 902.25MHZ
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	T. Jozefczyk
Test Date	:	Nov 30, 2020 04:10:27 PM

Freq GHz	Peak Mtr Rdg dBuV	Ave. Mtr Rdg dBuV	Ant Fac dB	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	Peak Limit dBµV/m	Peak Lim Mrg dB	Ave. Total dBµV/m	Ave. Limit dBµV/m	Ave. Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °
1.6175	50.2	36.8	29.4	-41.1	2.5	0.0	41.0	74.0	-32.9	27.6	54.0	-26.3	H	120	315
2.536	50.0	36.6	33.9	-41.3	3.1	0.0	45.8	74.0	-28.2	32.3	54.0	-21.7	H	120	45
4.2135	48.2	34.8	35.4	-40.3	3.9	0.0	47.2	74.0	-26.8	33.8	54.0	-20.2	H	200	0
6.6475	47.5	34.3	38.6	-40.7	4.8	0.0	50.2	74.0	-23.8	36.9	54.0	-17.0	H	340	270

FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

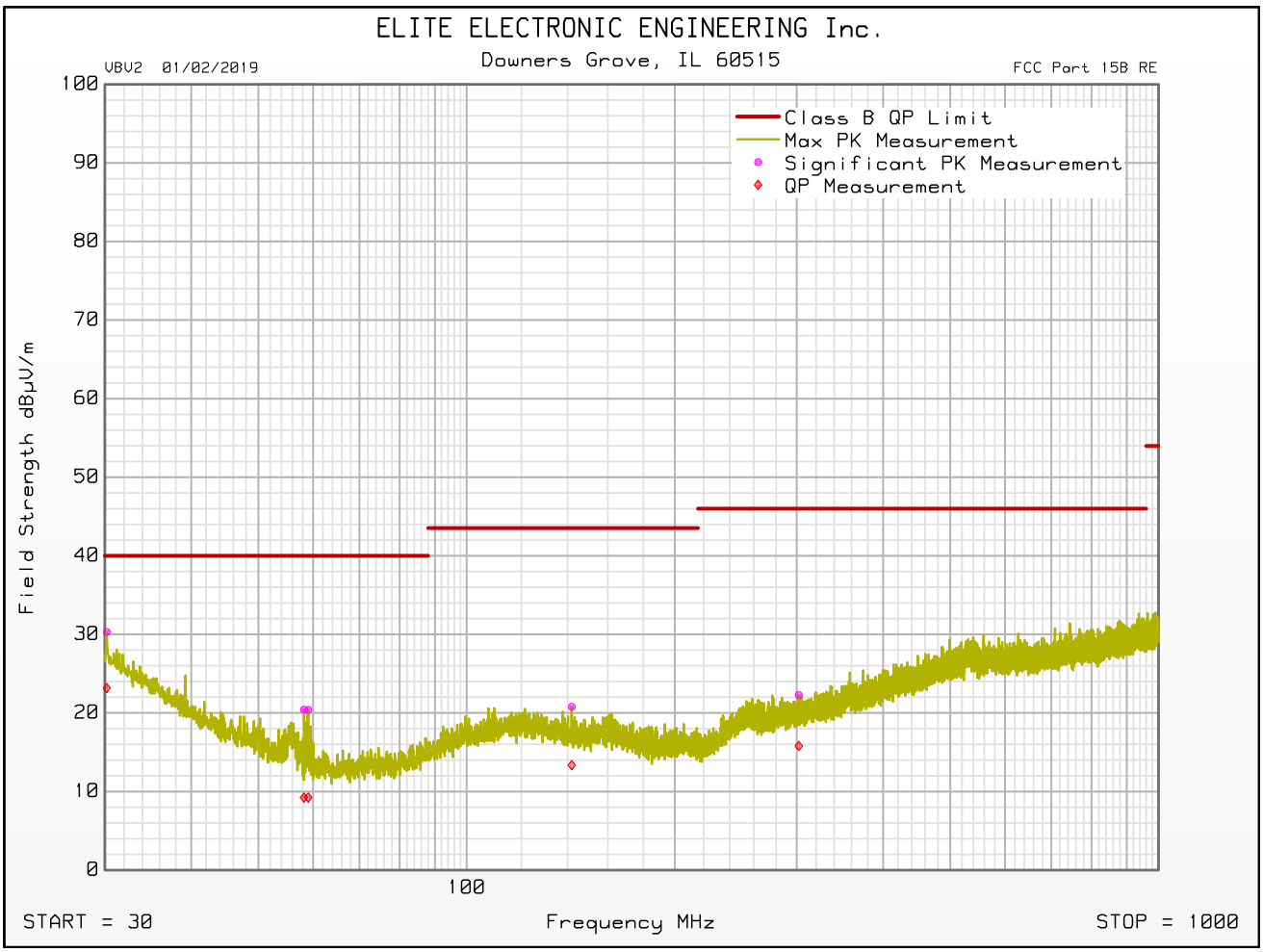
Manufacturer	:	CHAMBERLAIN
Model	:	SMP-77750
Serial Number	:	
DUT Mode	:	RX @ 914.75MHZ
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Ant. Polarization(s)	:	H
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	T. Jozefczyk
Test Date	:	Nov 20, 2020 01:36:41 PM



FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

Manufacturer	:	CHAMBERLAIN
Model	:	SMP-77750
Serial Number	:	
DUT Mode	:	RX @ 914.75MHZ
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Ant. Polarization(s)	:	V
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	T. Jozefczyk
Test Date	:	Nov 20, 2020 01:36:41 PM



FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

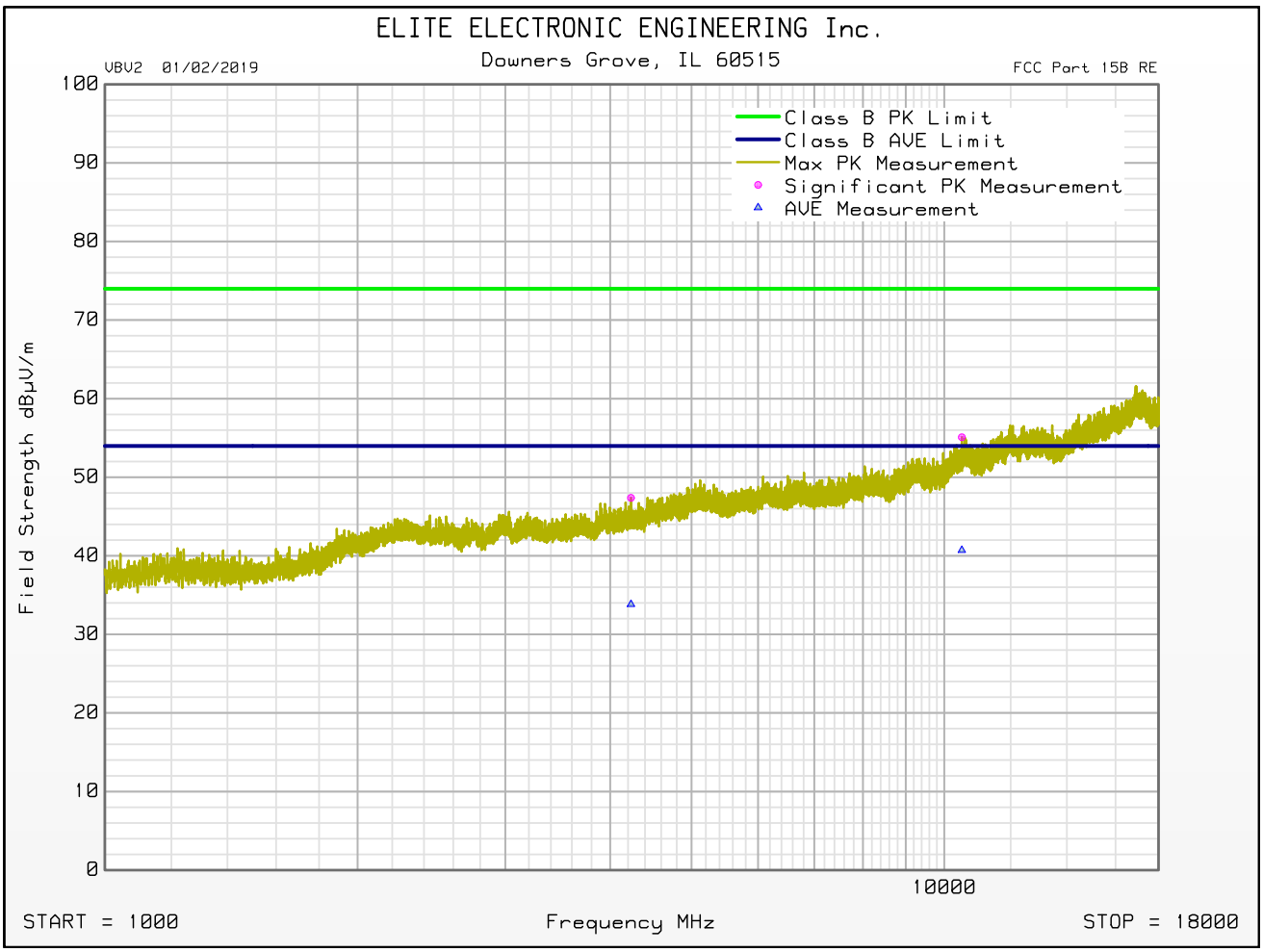
Manufacturer	:	CHAMBERLAIN
Model	:	SMP-77750
Serial Number	:	
DUT Mode	:	RX @ 914.75MHZ
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	T. Jozefczyk
Test Date	:	Nov 20, 2020 01:36:41 PM

Freq MHz	Peak Mtr Rdg dBuV	QP Mtr Rdg dBuV	Ant Fac dB	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	QP Total dBµV/m	QP Limit dBµV/m	QP Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °
30.180	5.1	-2.1	24.9	0.0	0.3	0.0	30.3	23.2	40.0	-16.8	V	340	90
58.200	7.2	-4.0	12.7	0.0	0.5	0.0	20.4	9.2	40.0	-30.8	V	120	270
59.040	7.3	-3.8	12.6	0.0	0.5	0.0	20.4	9.2	40.0	-30.8	V	120	270
141.880	2.9	-4.5	17.1	0.0	0.8	0.0	20.8	13.4	43.5	-30.2	V	340	0
302.040	2.0	-4.4	19.2	0.0	1.1	0.0	22.3	15.8	46.0	-30.2	V	200	225
525.120	3.6	-3.0	24.7	0.0	1.5	0.0	29.8	23.2	46.0	-22.8	H	340	225
903.060	4.4	-3.5	26.5	0.0	1.9	0.0	32.8	24.9	46.0	-21.1	H	340	0

FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

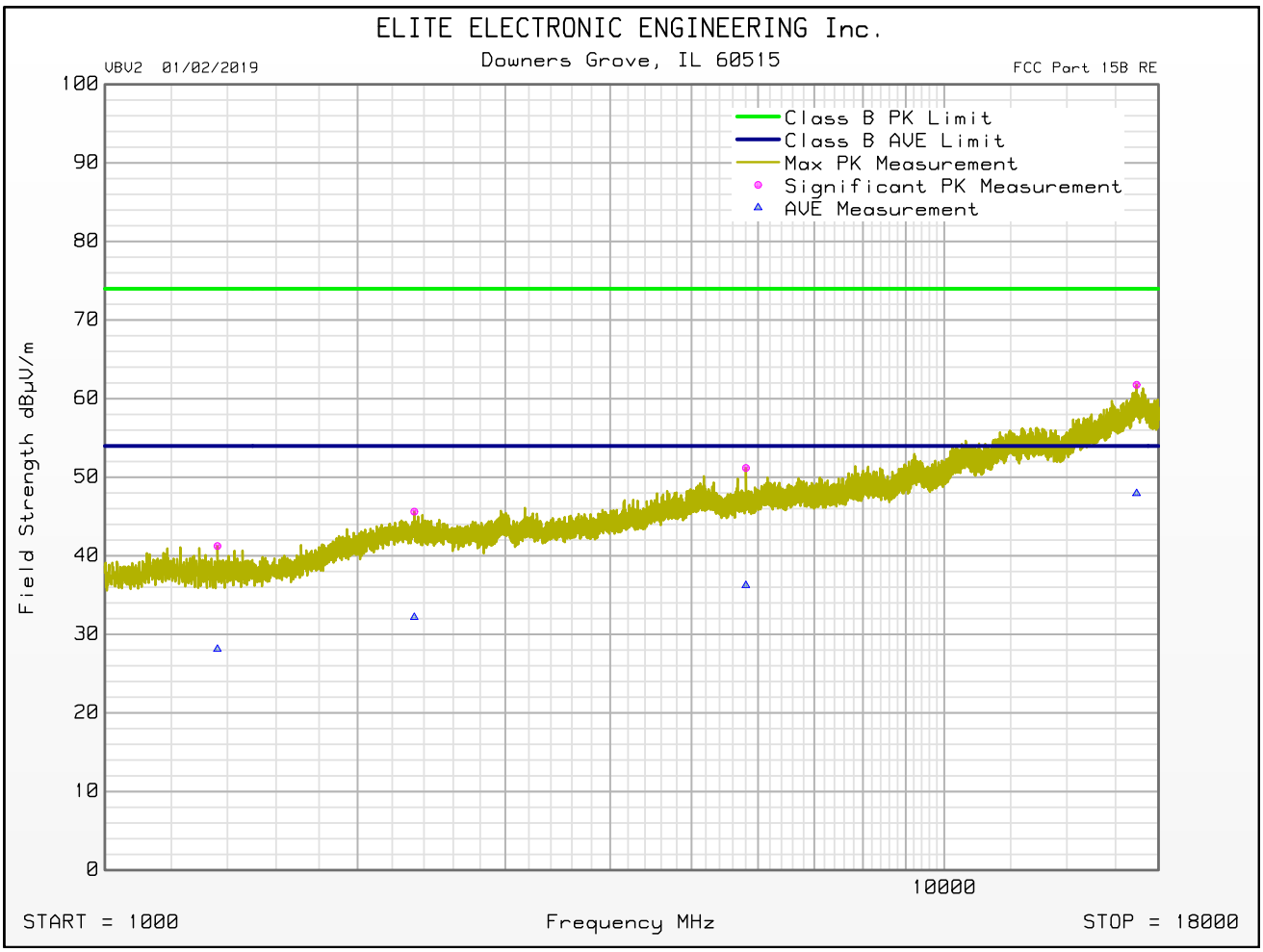
Manufacturer	:	CHAMBERLAIN
Model	:	SMP-77750
Serial Number	:	
DUT Mode	:	RX @ 914.75MHZ
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Ant. Polarization(s)	:	H
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	T. Jozefczyk
Test Date	:	Nov 30, 2020 04:52:23 PM



FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

Manufacturer	:	CHAMBERLAIN
Model	:	SMP-77750
Serial Number	:	
DUT Mode	:	RX @ 914.75MHZ
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Ant. Polarization(s)	:	V
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	T. Jozefczyk
Test Date	:	Nov 30, 2020 04:52:23 PM



FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

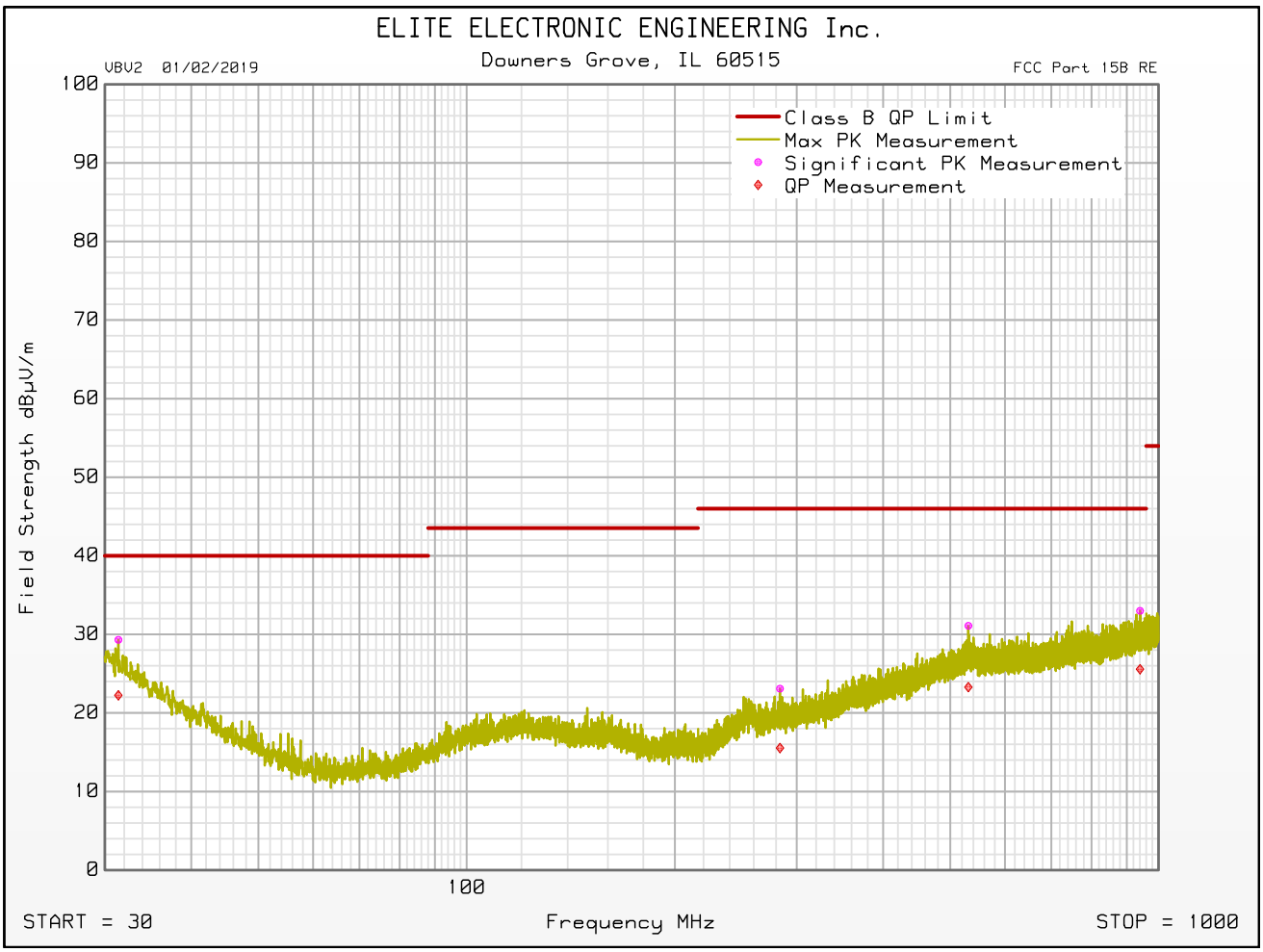
Manufacturer	:	CHAMBERLAIN
Model	:	SMP-77750
Serial Number	:	
DUT Mode	:	RX @ 914.75MHZ
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	T. Jozefczyk
Test Date	:	Nov 30, 2020 04:52:23 PM

Freq GHz	Peak Mtr Rdg dBuV	Ave. Mtr Rdg dBuV	Ant Fac dB	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	Peak Limit dBµV/m	Peak Lim Mrg dB	Ave. Total dBµV/m	Ave. Limit dBµV/m	Ave. Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °
1.362	50.8	37.7	29.7	-41.5	2.3	0.0	41.2	74.0	-32.7	28.1	54.0	-25.9	V	340	180
2.337	49.8	36.4	33.8	-41.0	3.0	0.0	45.6	74.0	-28.4	32.2	54.0	-21.8	V	120	45
4.234	48.3	34.7	35.4	-40.2	3.9	0.0	47.4	74.0	-26.6	33.8	54.0	-20.2	H	120	90
5.8045	49.4	34.5	37.8	-40.5	4.5	0.0	51.2	74.0	-22.8	36.2	54.0	-17.7	V	120	0

FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

Manufacturer	:	CHAMBERLAIN
Model	:	SMP-77750
Serial Number	:	
DUT Mode	:	RX @ 926.75MHZ
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Ant. Polarization(s)	:	H
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	T. Jozefczyk
Test Date	:	Nov 20, 2020 02:15:53 PM



FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

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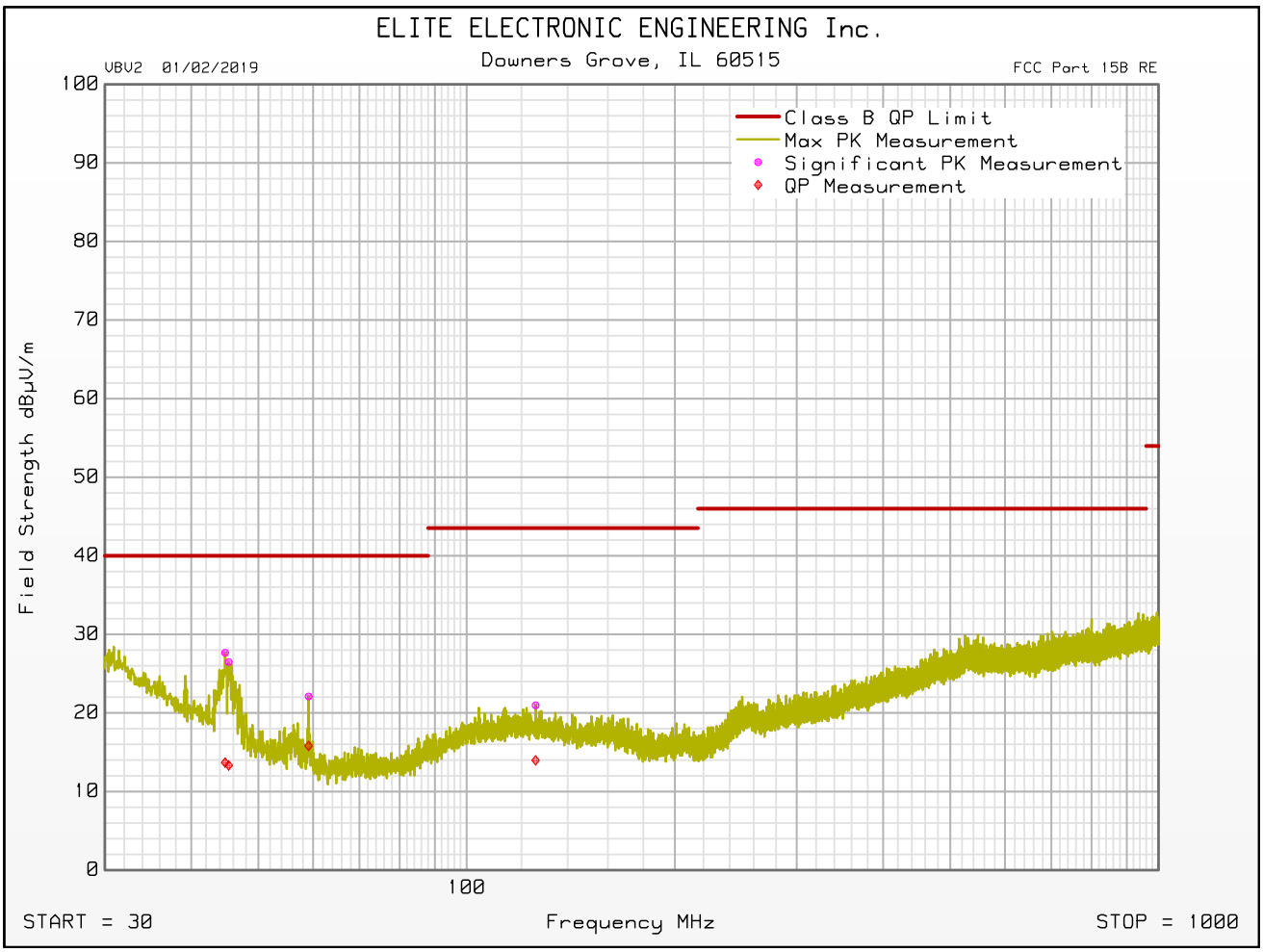
Model	:	SMP-77750
Serial Number	:	
DUT Mode	:	RX @ 926.75MHZ
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Ant. Polarization(s)	:	V
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	T. Jozefczyk
Test Date	:	Nov 20, 2020 02:15:53 PM



FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

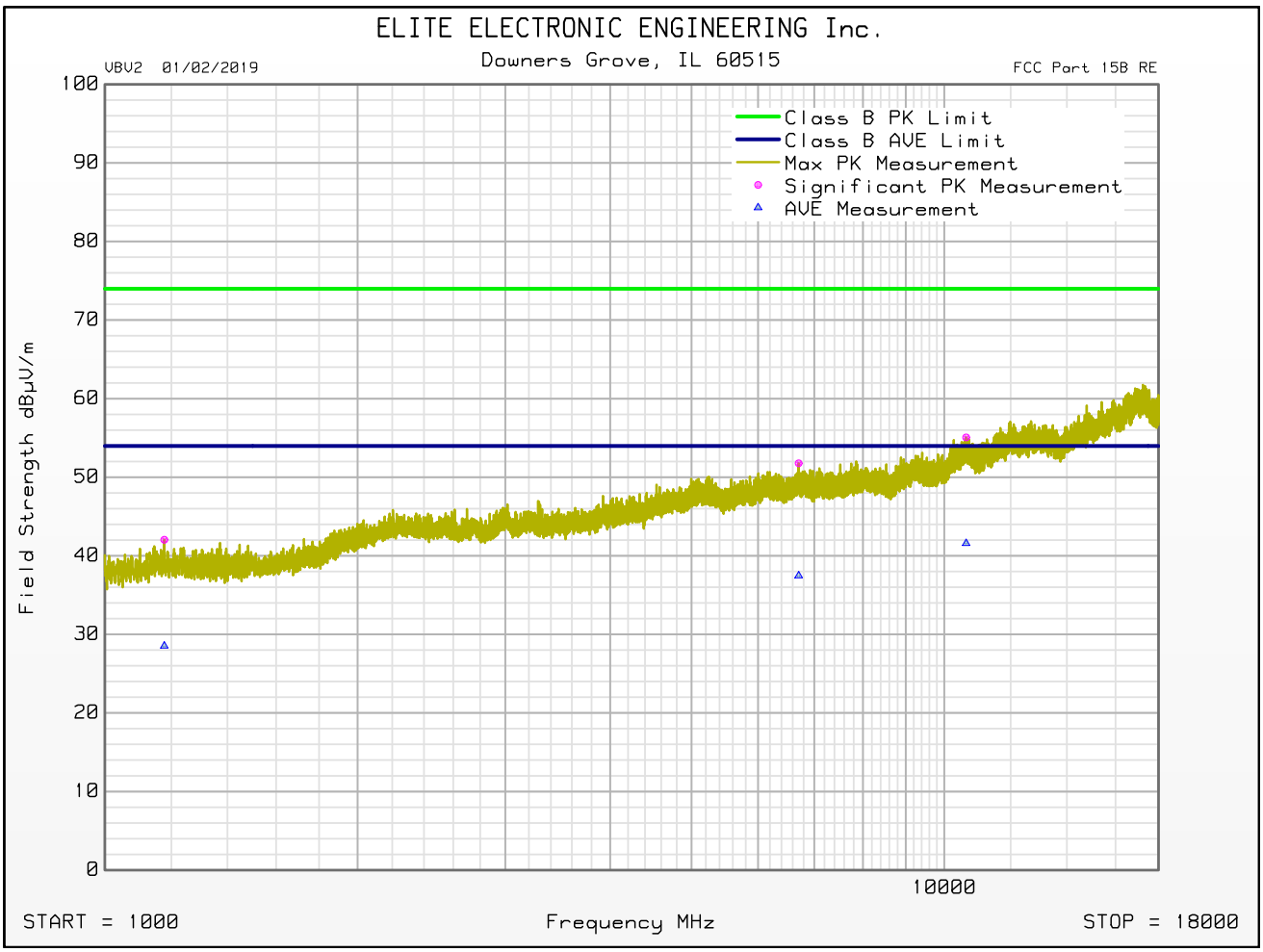
Manufacturer	:	CHAMBERLAIN
Model	:	SMP-77750
Serial Number	:	
DUT Mode	:	RX @ 926.75MHZ
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	120 kHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	T. Jozefczyk
Test Date	:	Nov 20, 2020 02:15:53 PM

Freq MHz	Peak Mtr Rdg dBuV	QP Mtr Rdg dBuV	Ant Fac dB	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	QP Total dBµV/m	QP Limit dBµV/m	QP Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °
31.380	4.8	-2.2	24.1	0.0	0.4	0.0	29.3	22.2	40.0	-17.8	H	120	315
44.760	10.1	-3.9	17.1	0.0	0.4	0.0	27.7	13.7	40.0	-26.3	V	120	270
45.300	9.1	-4.0	16.9	0.0	0.4	0.0	26.5	13.3	40.0	-26.7	V	200	270
59.100	9.0	2.8	12.5	0.0	0.5	0.0	22.1	15.8	40.0	-24.2	V	120	135
125.800	2.2	-4.8	18.1	0.0	0.7	0.0	21.0	14.0	43.5	-29.6	V	200	45
283.740	3.3	-4.3	18.8	0.0	1.0	0.0	23.1	15.5	46.0	-30.5	H	340	0
531.120	4.8	-3.0	24.8	0.0	1.5	0.0	31.1	23.3	46.0	-22.7	H	120	225
940.260	4.1	-3.3	27.0	0.0	1.9	0.0	33.0	25.6	46.0	-20.4	H	120	135

FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

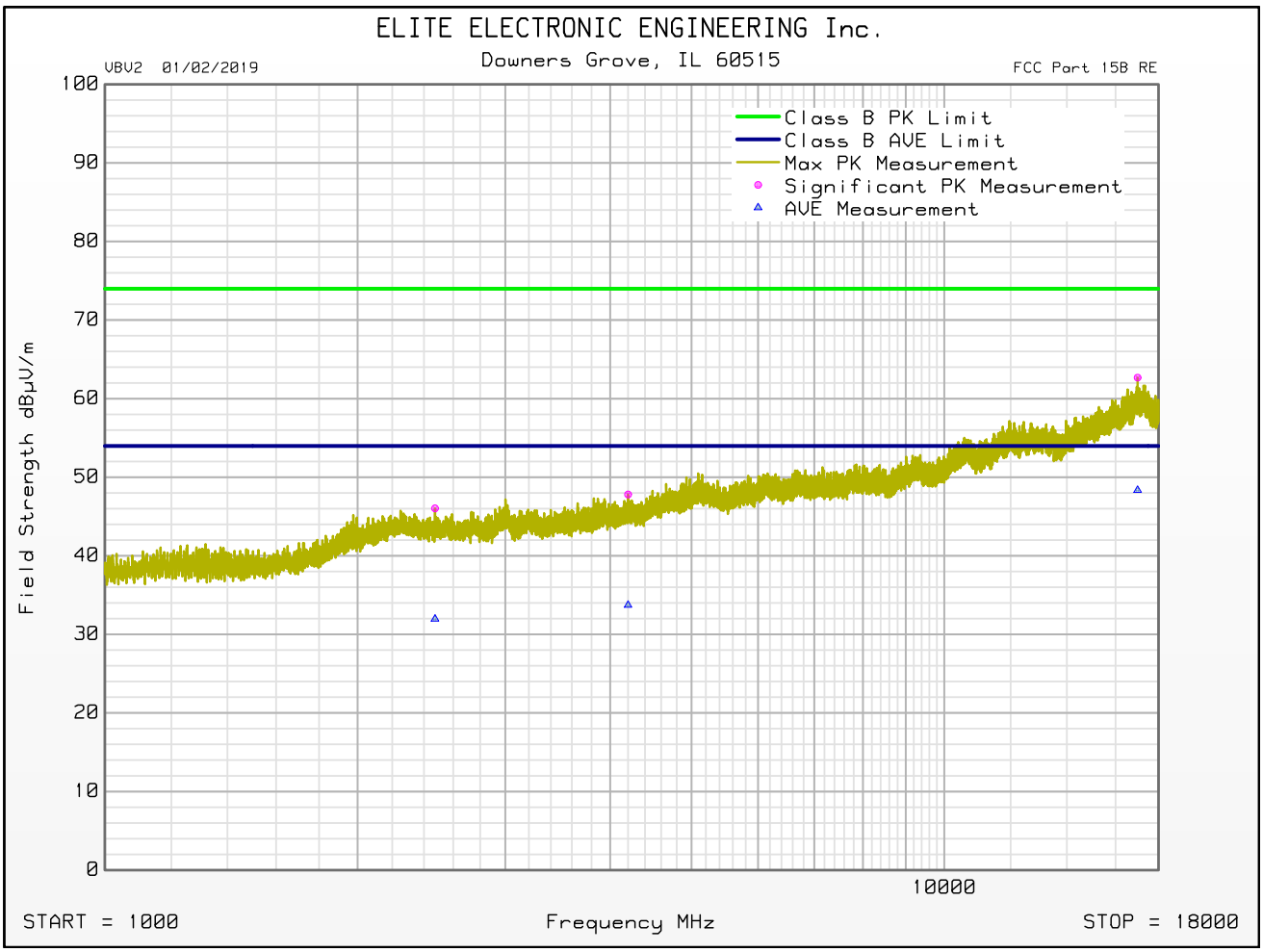
Manufacturer	:	CHAMBERLAIN
Model	:	SMP-77750
Serial Number	:	
DUT Mode	:	RX @ 926.75MHZ
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Ant. Polarization(s)	:	H
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	T. Jozefczyk
Test Date	:	Dec 01, 2020 08:55:16 AM



FCC Part 15B Class B Radiated RF Emissions Test

SW ID/Rev: VBV2 01/02/2019

Manufacturer	:	CHAMBERLAIN
Model	:	SMP-77750
Serial Number	:	
DUT Mode	:	RX @ 926.75MHZ
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Ant. Polarization(s)	:	V
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	T. Jozefczyk
Test Date	:	Dec 01, 2020 08:55:16 AM



FCC Part 15B Class B Radiated RF Emissions Test

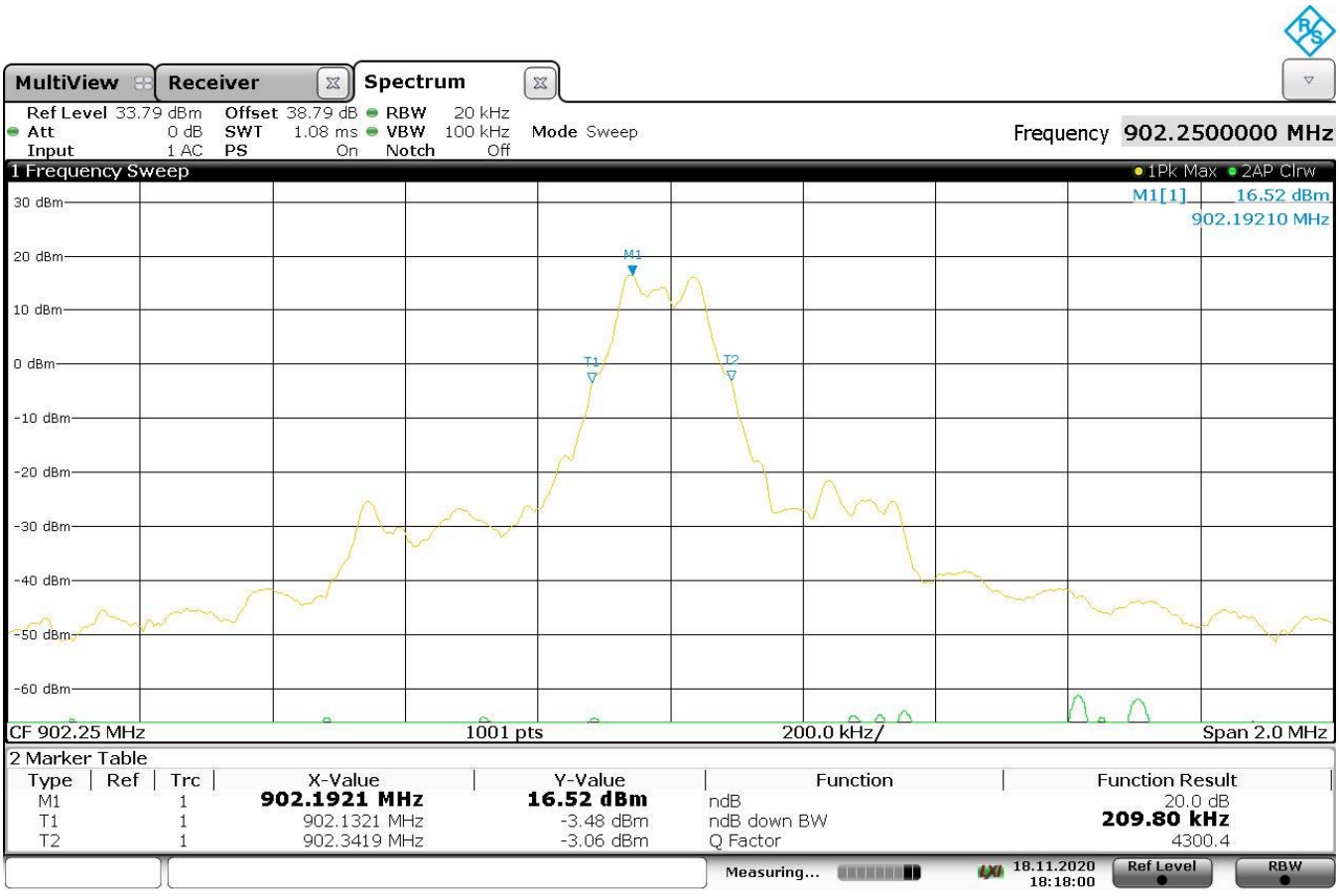
SW ID/Rev: VBV2 01/02/2019

Manufacturer	:	CHAMBERLAIN
Model	:	SMP-77750
Serial Number	:	
DUT Mode	:	RX @ 926.75MHZ
Turntable Step Angle (°)	:	45
Mast Positions (cm)	:	120, 200, 340
Scan Type	:	Stepped Scan
Test RBW	:	1 MHz
Prelim Dwell Time (s)	:	0.0001
Notes	:	
Test Engineer	:	T. Jozefczyk
Test Date	:	Dec 01, 2020 08:55:16 AM

Freq GHz	Peak Mtr Rdg dBuV	Ave. Mtr Rdg dBuV	Ant Fac dB	Amp Fac dB	Cbl Fac dB	Dist Corr dB	Peak Total dBµV/m	Peak Limit dBµV/m	Peak Lim Mrg dB	Ave. Total dBµV/m	Ave. Limit dBµV/m	Ave. Lim Mrg dB	Ant Pol	Mast Ht cm	Azim °
1.177	52.3	38.8	29.8	-42.2	2.1	0.0	42.0	74.0	-31.9	28.5	54.0	-25.5	H	120	0
2.4735	50.5	36.5	33.6	-41.2	3.1	0.0	46.0	74.0	-27.9	32.0	54.0	-22.0	V	200	135
4.2005	48.8	34.7	35.4	-40.3	3.9	0.0	47.8	74.0	-26.2	33.7	54.0	-20.2	V	200	0
6.7075	49.0	34.7	38.5	-40.5	4.8	0.0	51.8	74.0	-22.2	37.5	54.0	-16.5	H	120	45

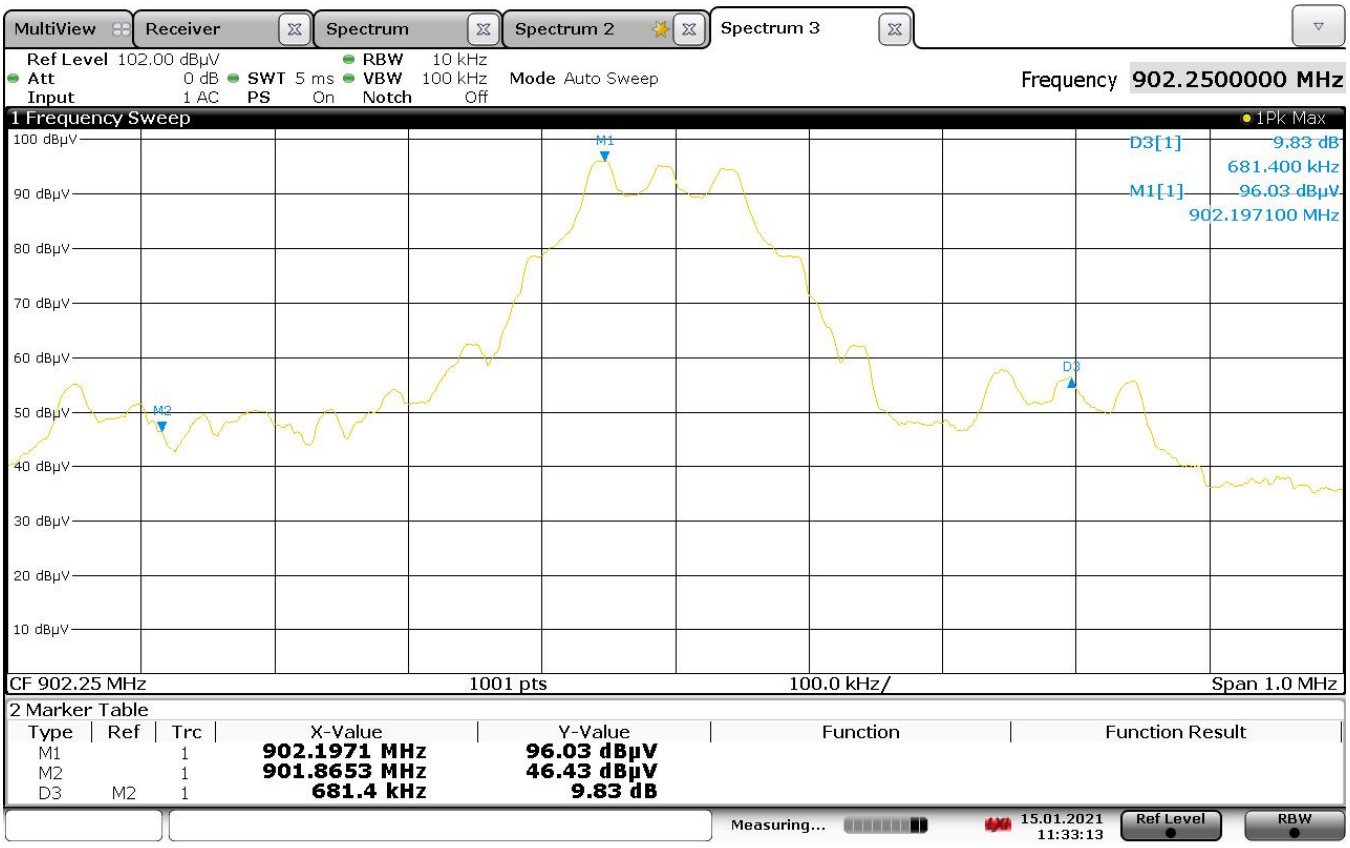
DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Occupied Bandwidth - Conducted
MODE	Tx – 902.25MHz
DATE TESTED	November 18, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	20dB BW = 209.8kHz

OCCUPIED BANDWIDTH – 20DB BW



DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Occupied Bandwidth - Conducted
MODE	Tx – 902.25MHz
DATE TESTED	November 18, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	99% BW = 681.4kHz

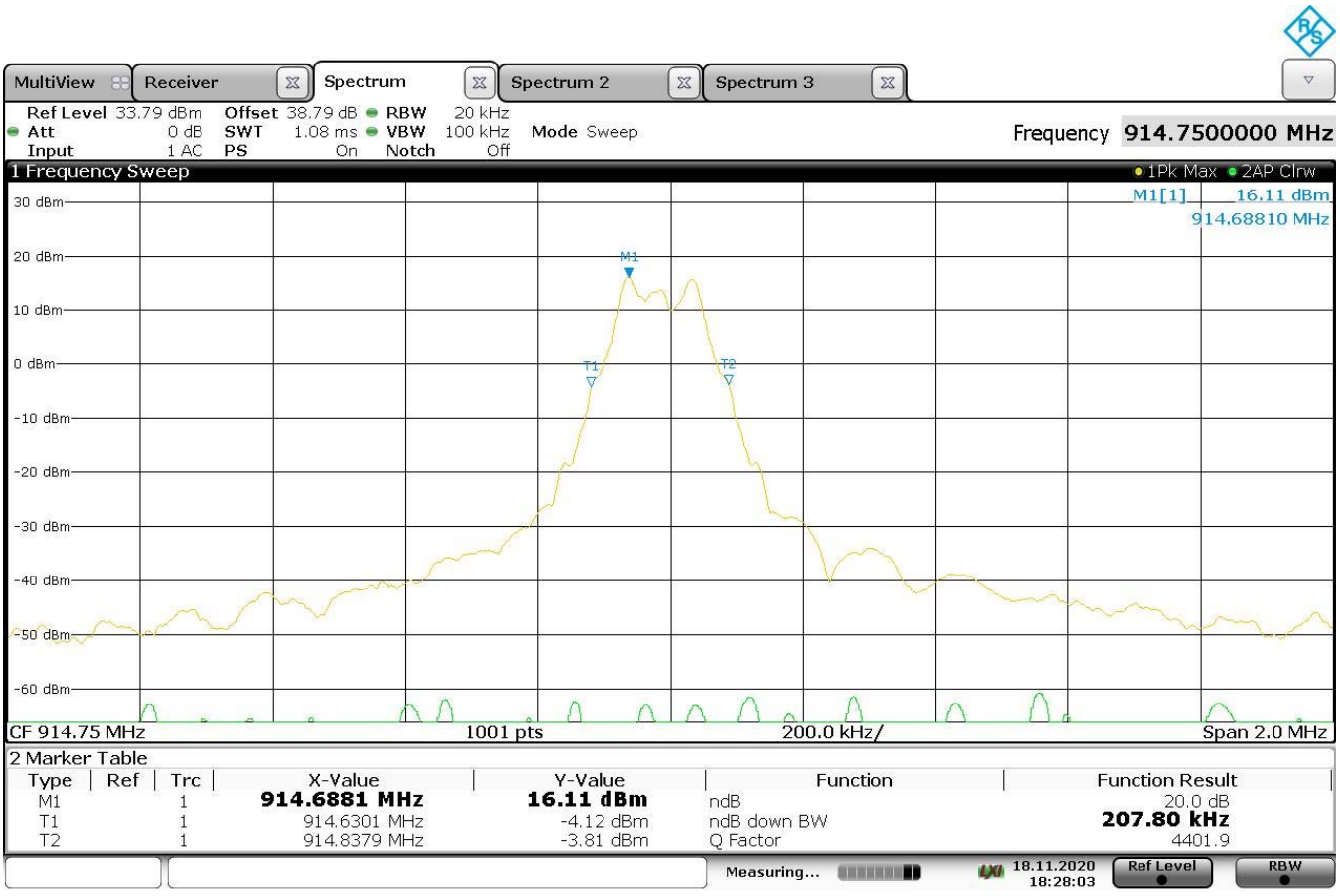
OCCUPIED BANDWIDTH – 99% BW



11:33:14 15.01.2021

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Occupied Bandwidth - Conducted
MODE	Tx – 914.75MHz
DATE TESTED	November 18, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	20dB BW = 207.8kHz

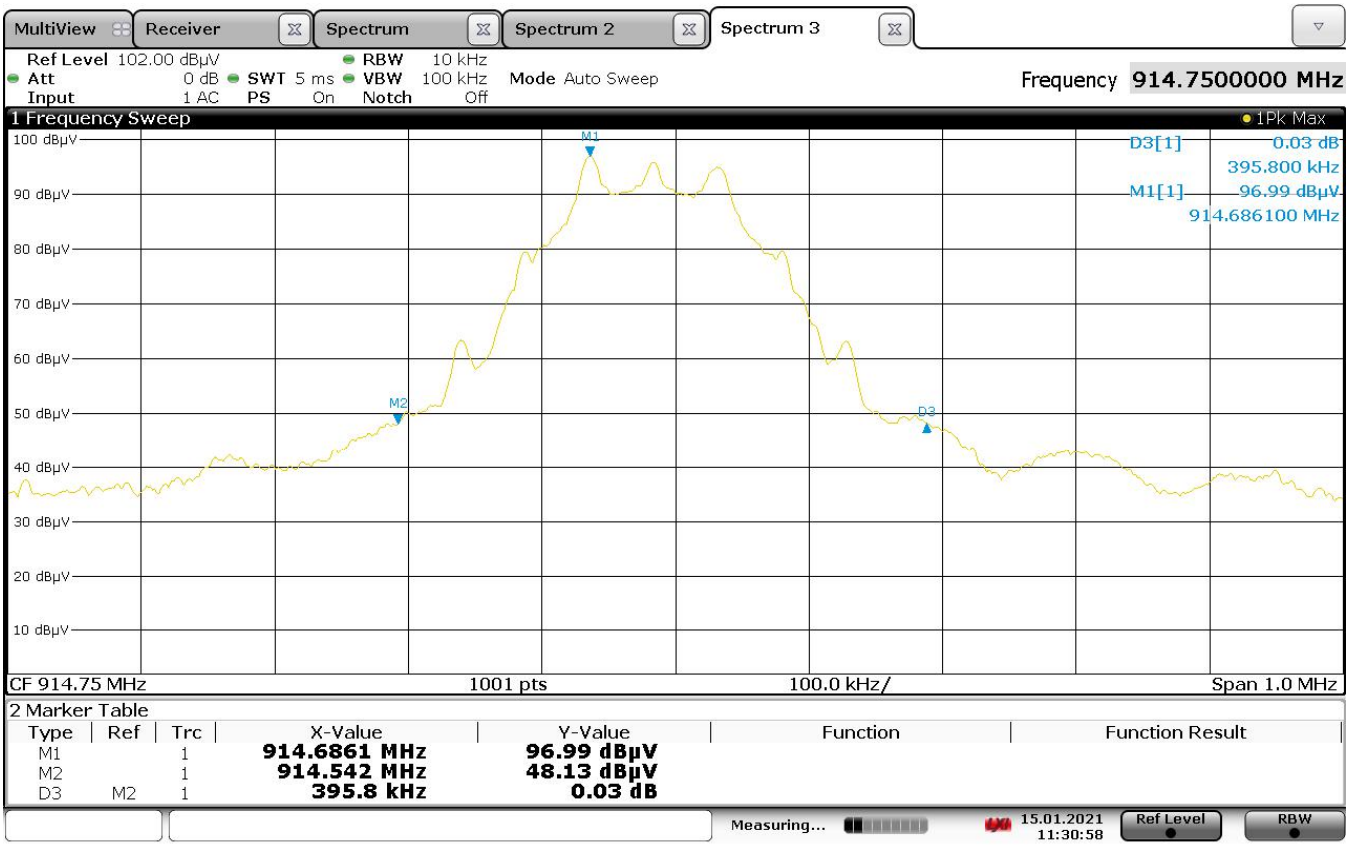
OCCUPIED BANDWIDTH – 20DB BW



18:28:04 18.11.2020

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Occupied Bandwidth - Conducted
MODE	Tx – 914.75MHz
DATE TESTED	November 18, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	99% BW = 395.8kHz

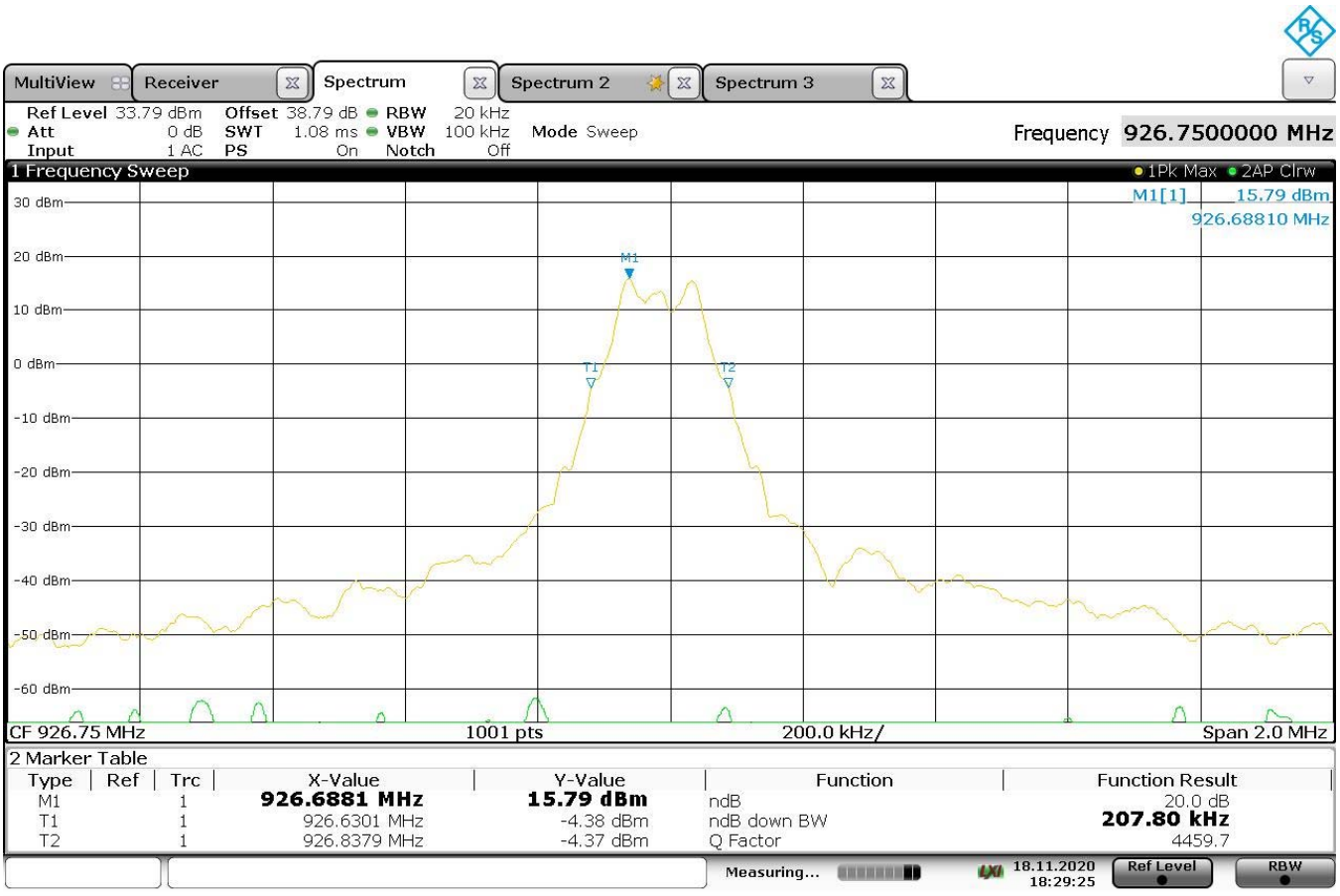
OCCUPIED BANDWIDTH – 99% BW



11:30:59 15.01.2021

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Occupied Bandwidth - Conducted
MODE	Tx – 926.75MHz
DATE TESTED	November 18, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	20dB BW = 207.8kHz

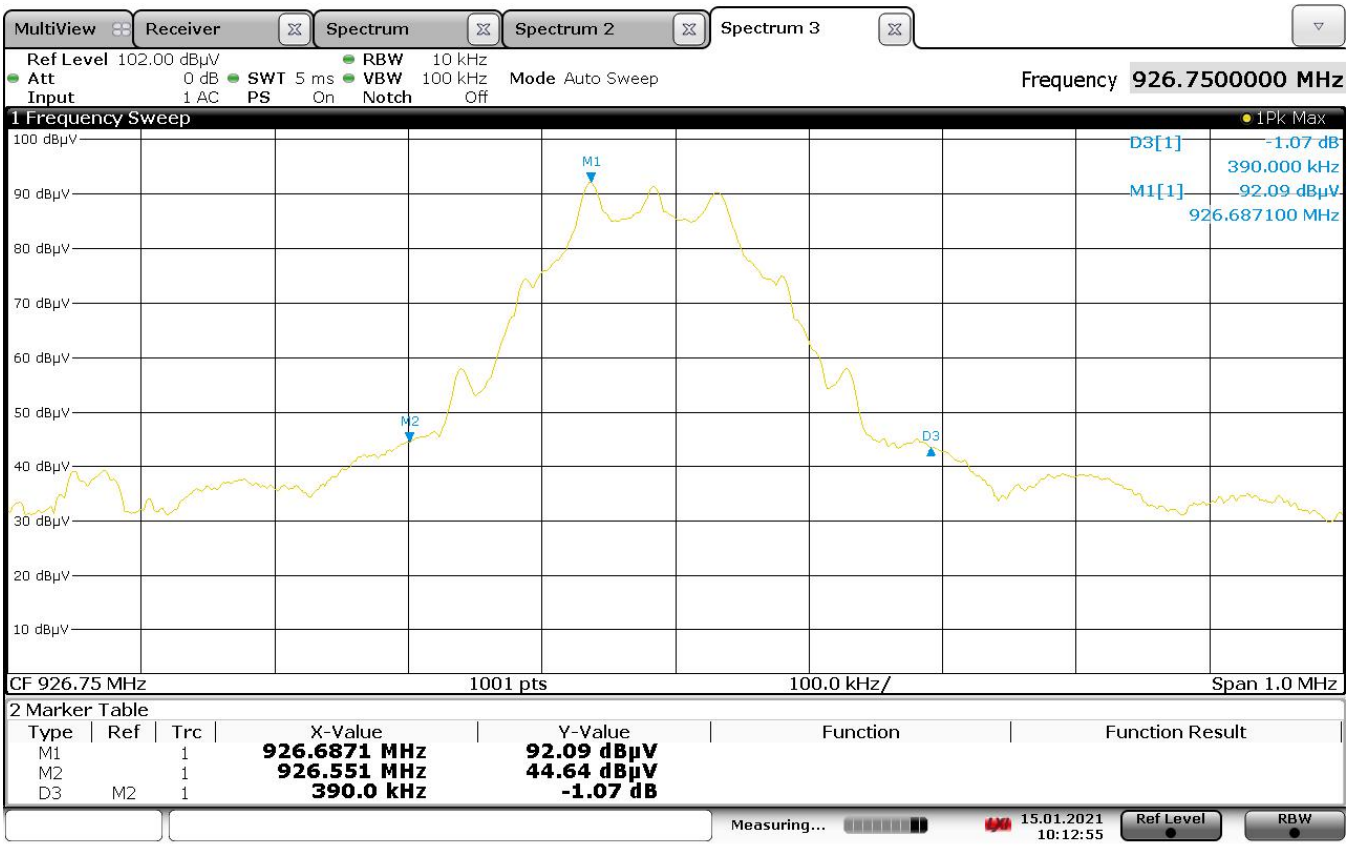
OCCUPIED BANDWIDTH – 20DB BW



18:29:26 18.11.2020

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Occupied Bandwidth - Conducted
MODE	Tx – 926.75MHz
DATE TESTED	November 18, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	99% BW = 390.0kHz

OCCUPIED BANDWIDTH – 99% BW



10:12:56 15.01.2021

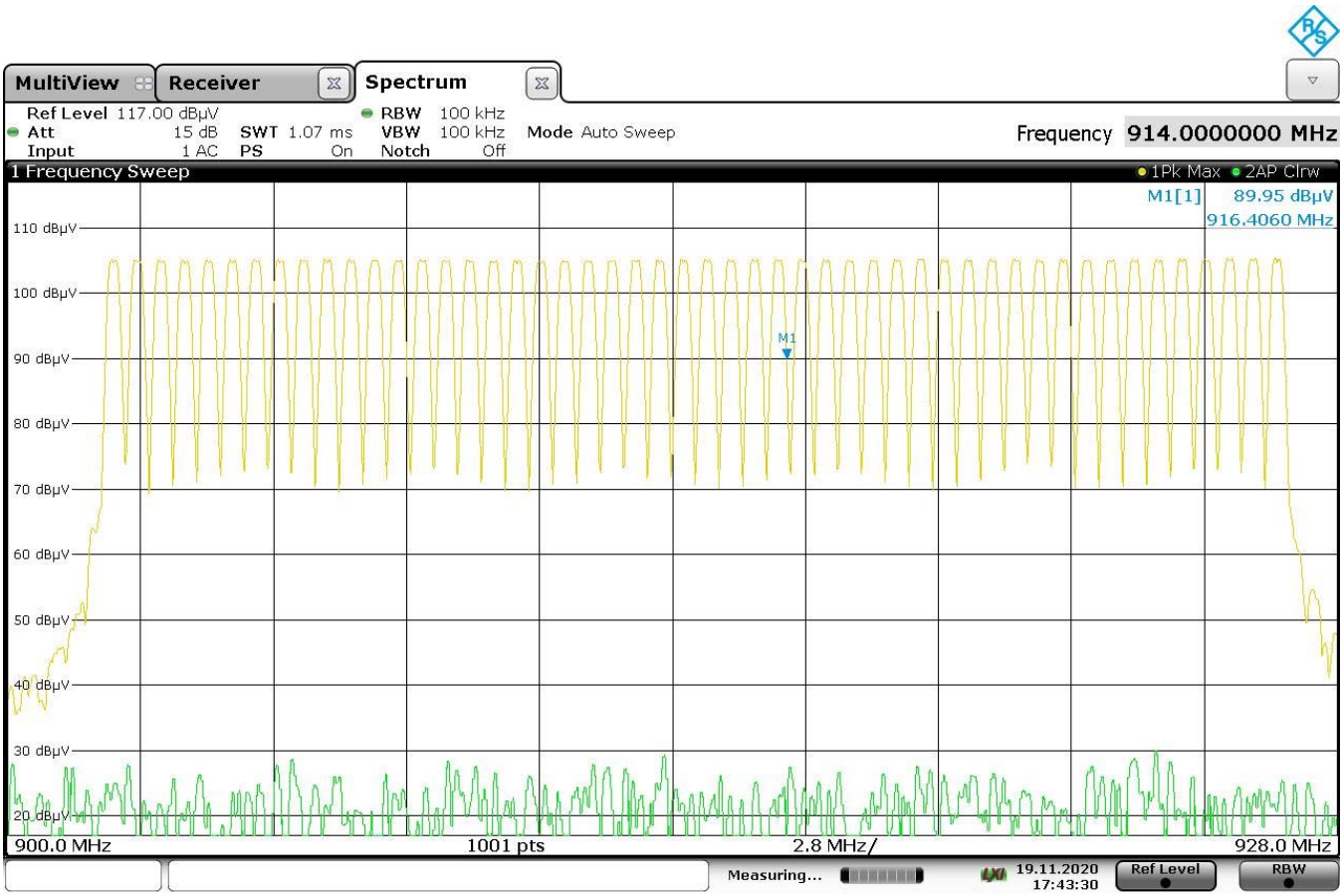
DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Carrier Frequency Separation
MODE	FHSS
DATE TESTED	November 19, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	Separation = 500.5kHz

CARRIER FREQUENCY SEPARATION

17:52:52 19.11.2020

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Number of Hopping Channels
MODE	FHSS
DATE TESTED	November 19, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	# of Hopping Channels = 50

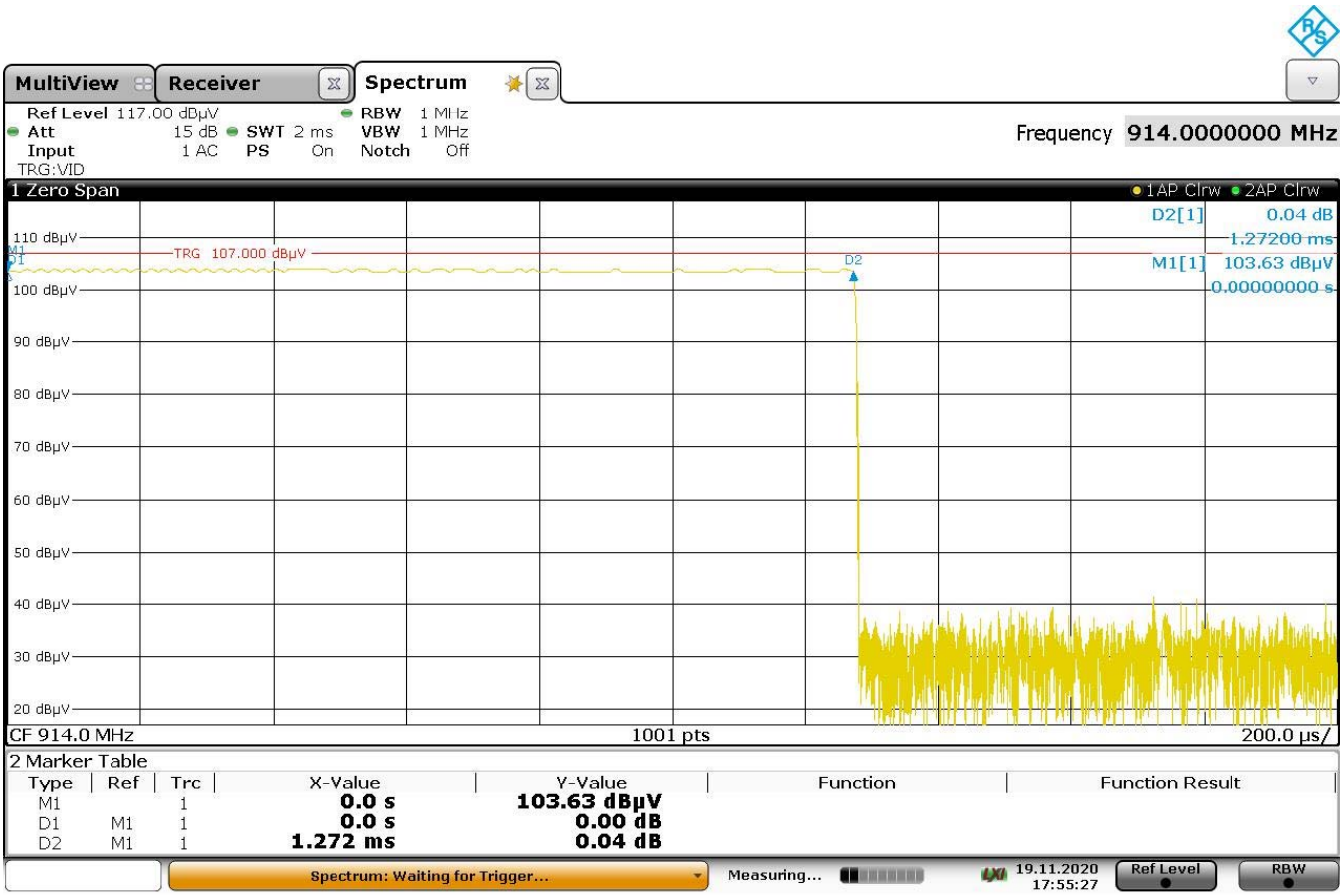
NUMBER OF HOPPING CHANNELS



17:43:31 19.11.2020

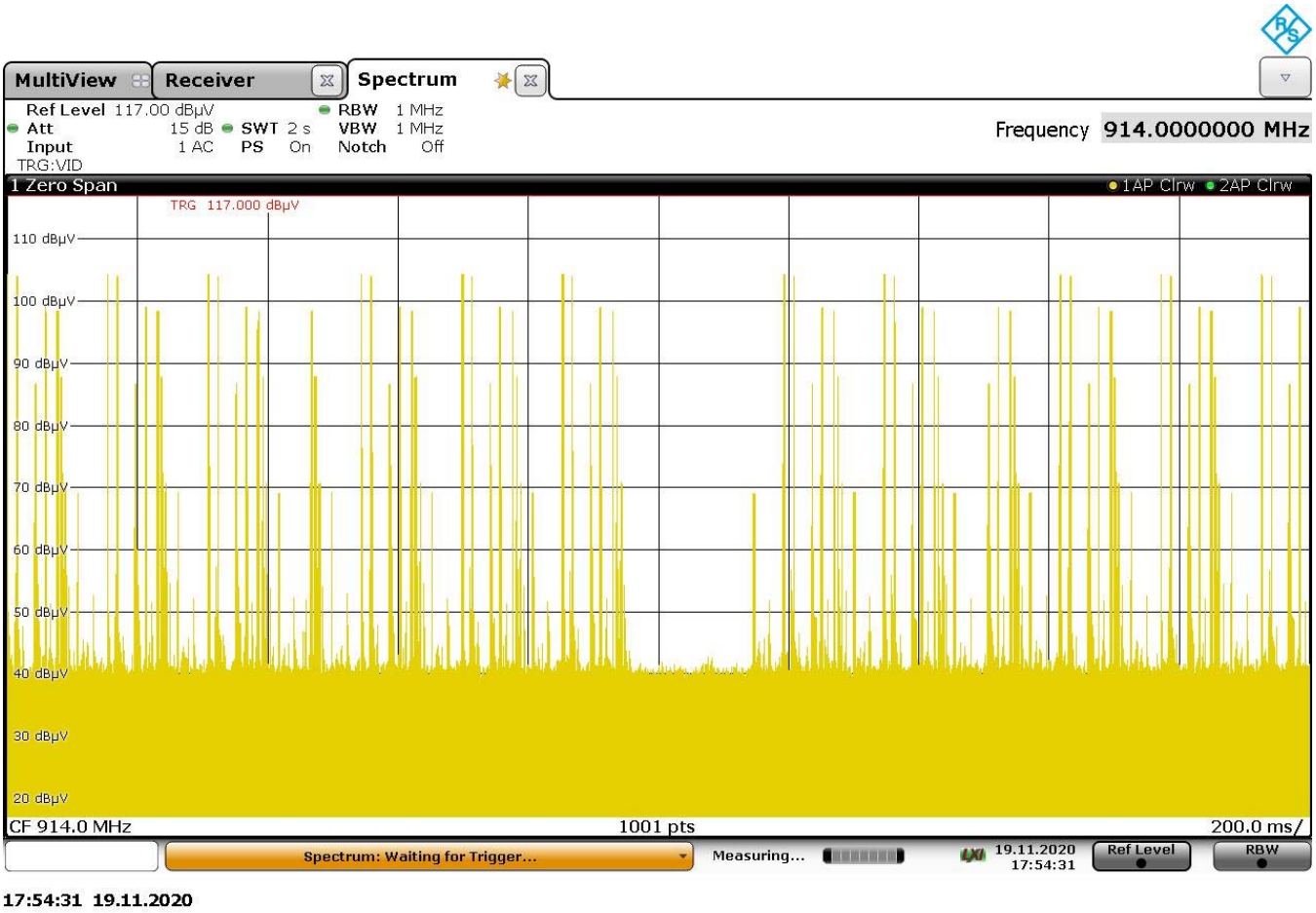
DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Time of Occupancy
MODE	FHSS
DATE TESTED	November 19, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	Burst = 1.272ms

TIME OF OCCUPANCY



DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Time of Occupancy
MODE	FHSS
DATE TESTED	November 19, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	Time of Occupancy = # of bursts × burst duration × 10 where: (x 10 is needed to convert from 2 seconds to 20 seconds) = (22)×(1.27)x(10) = 279.4ms = 0.279s

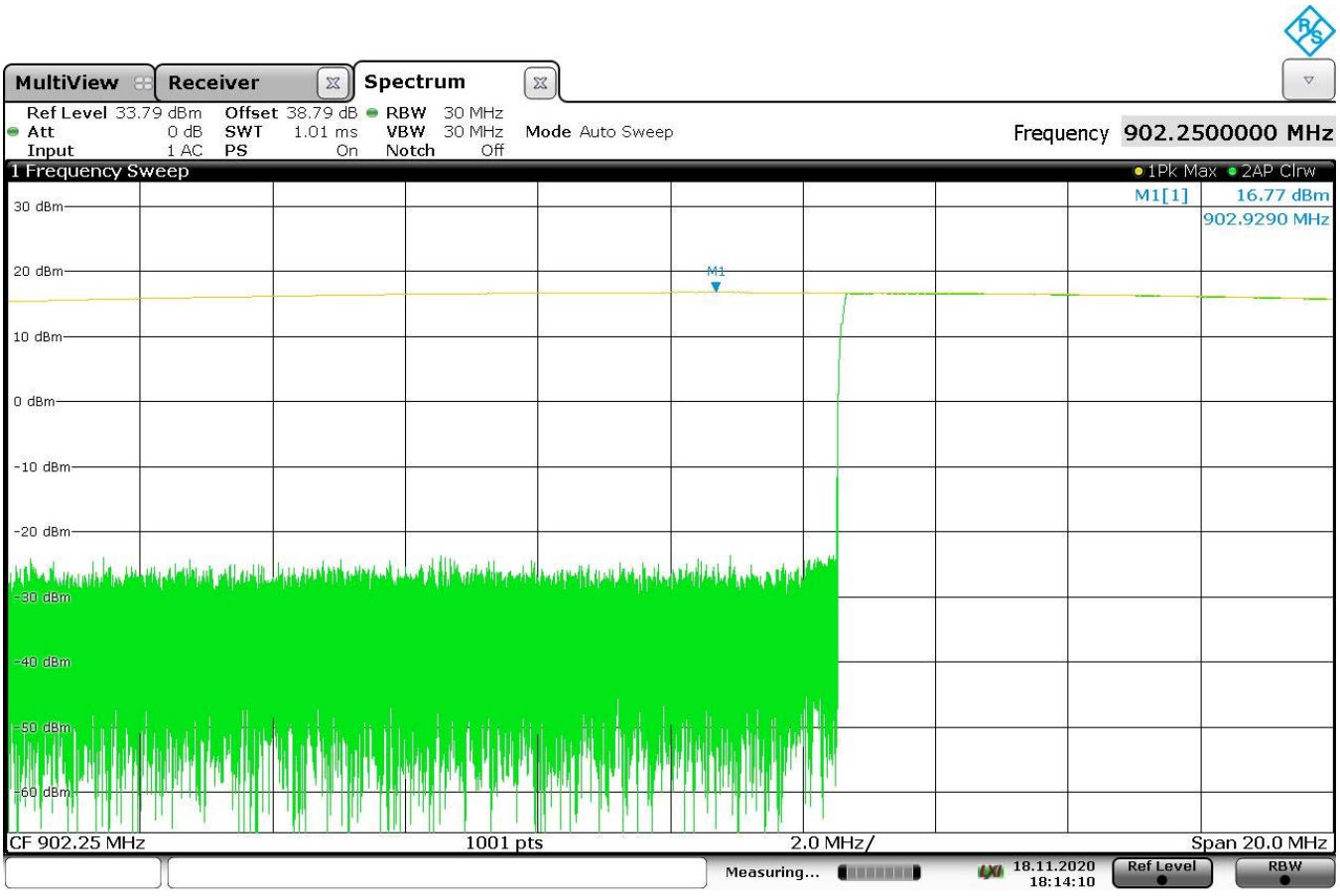
TIME OF OCCUPANCY



17:54:31 19.11.2020

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – RF Output Power - Conducted
MODE	Tx – 902.25MHz
DATE TESTED	November 18, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	RF Output Power = 16.77dBm

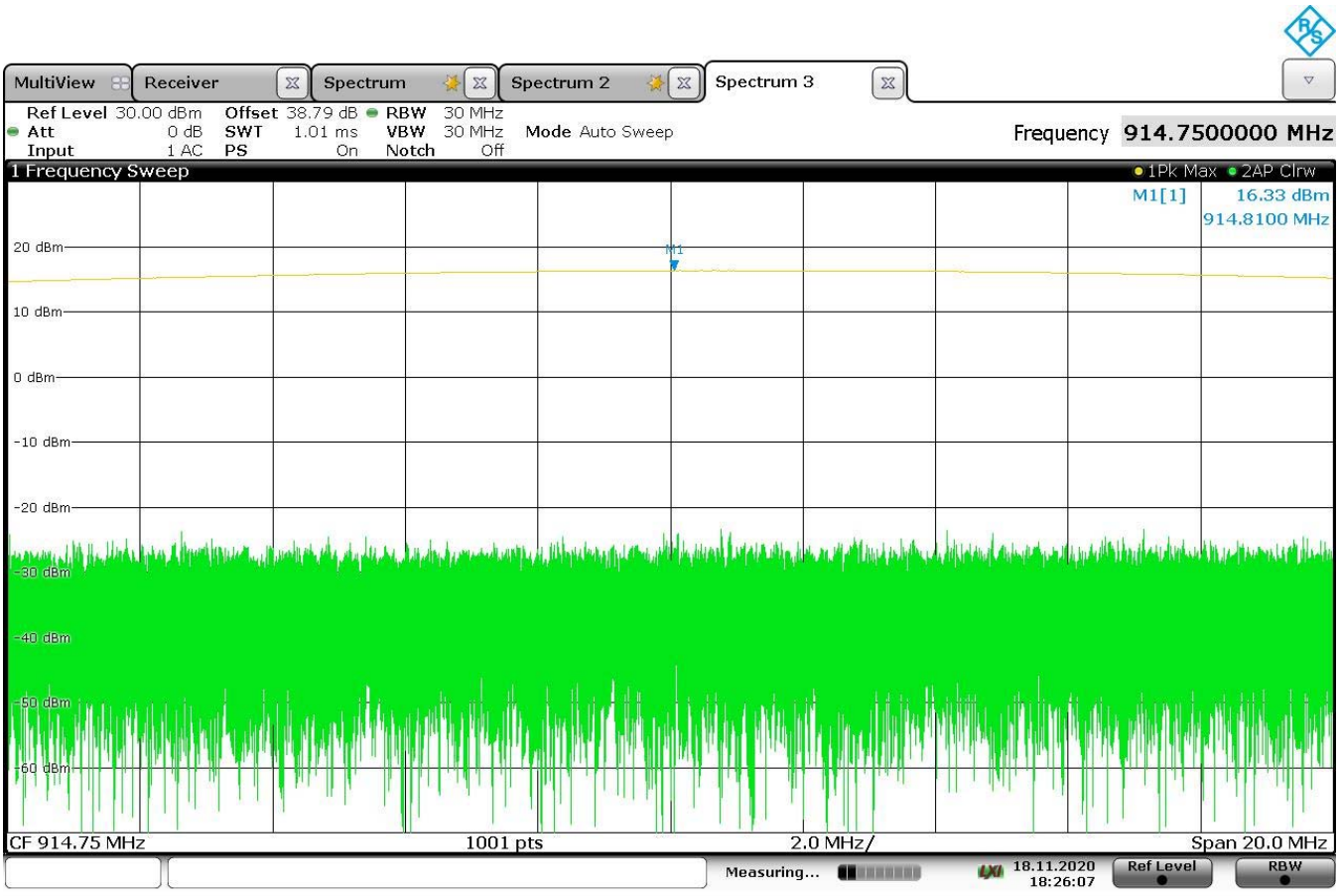
RF OUTPUT POWER - CONDUCTED



18:14:10 18.11.2020

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – RF Output Power - Conducted
MODE	Tx – 914.75MHz
DATE TESTED	November 18, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	RF Output Power = 16.33dBm

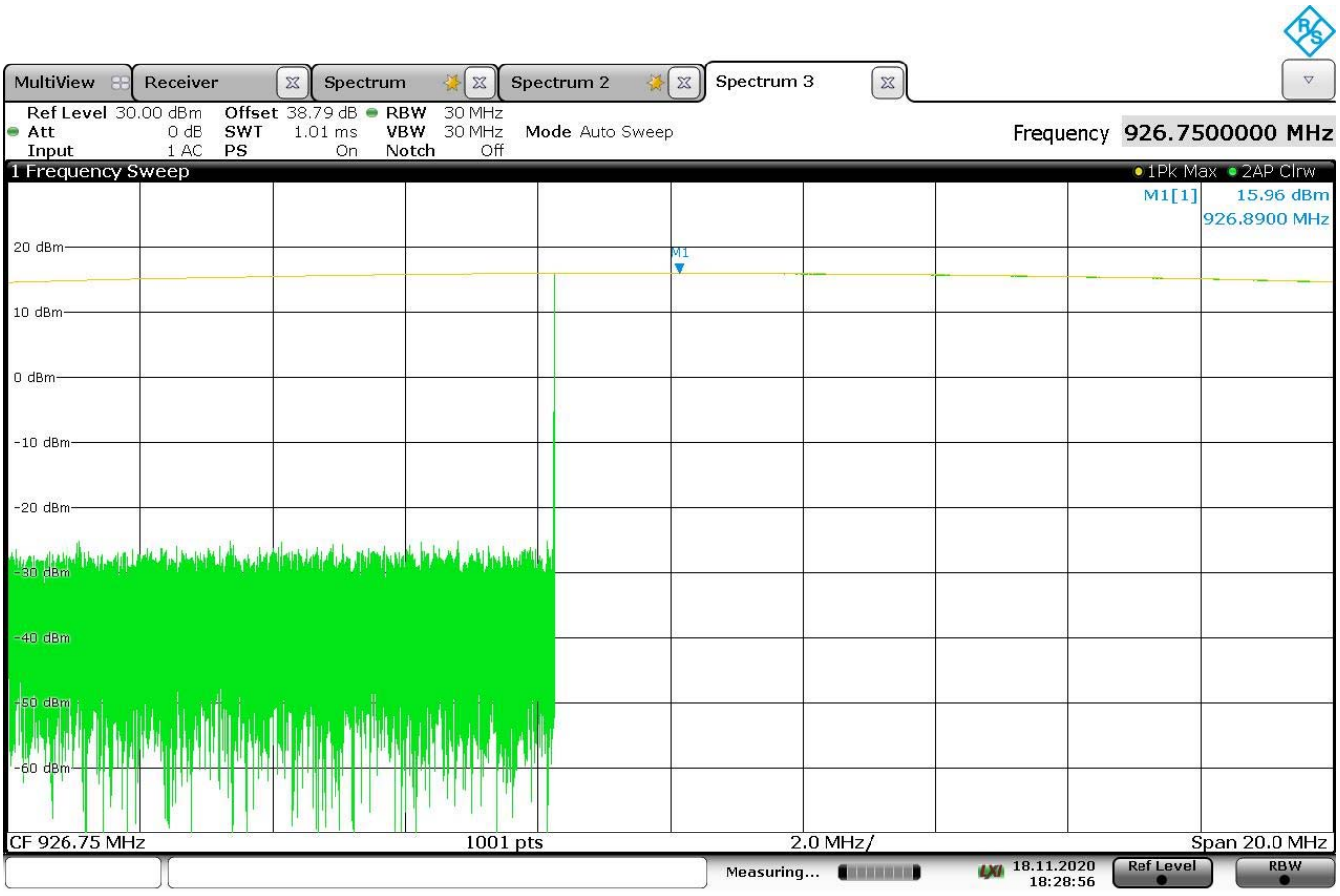
RF OUTPUT POWER - CONDUCTED



18:26:07 18.11.2020

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – RF Output Power - Conducted
MODE	Tx – 926.75MHz
DATE TESTED	November 18, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	RF Output Power = 15.936Bm

RF OUTPUT POWER - CONDUCTED



18:28:57 18.11.2020

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – RF Output Power - Radiated
MODE	Tx
DATE TESTED	November 19, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	

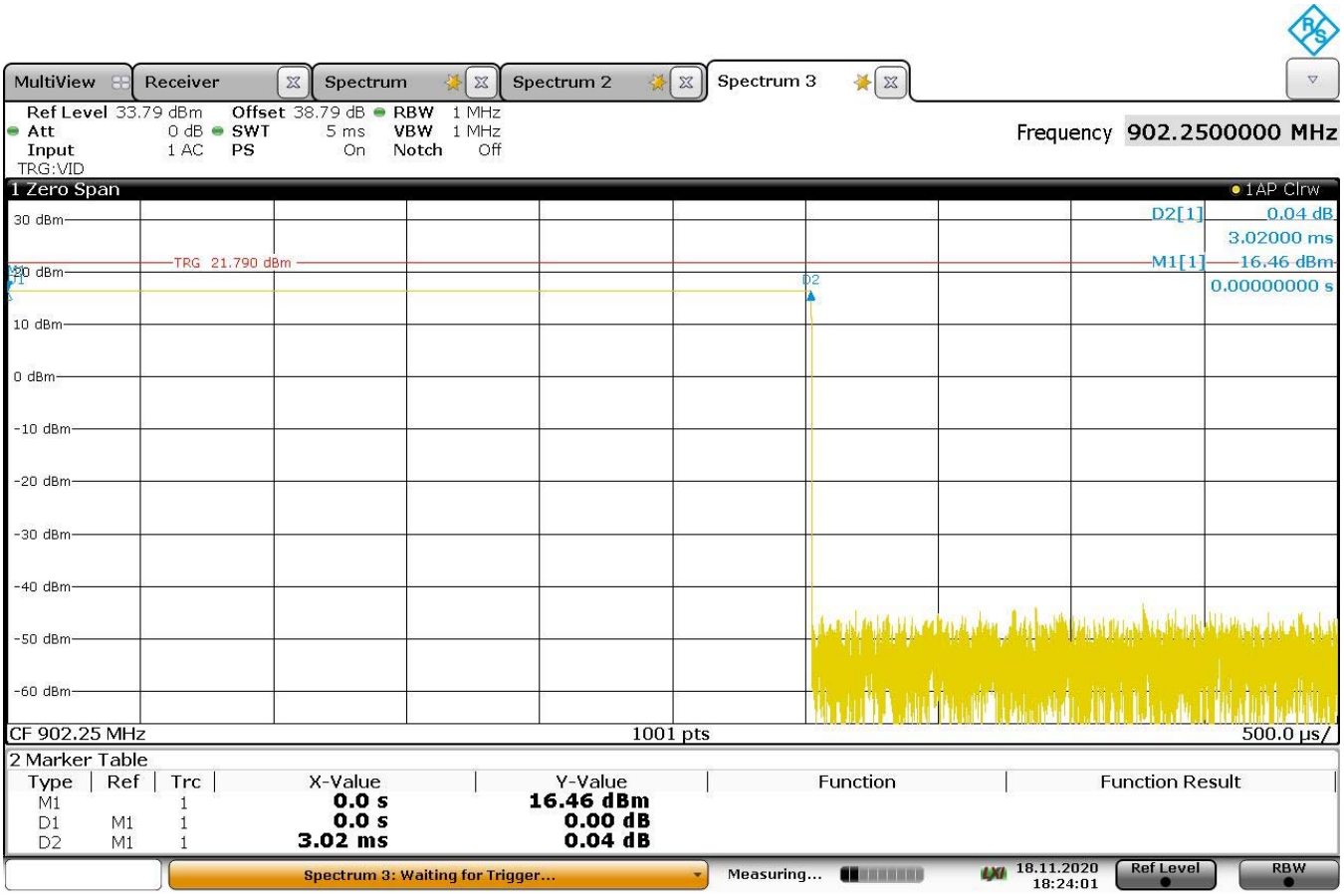
RF OUTPUT POWER

Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBµV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP Total (dBm)	Limit (dBm)	Margin (dB)
902.25	H	84.90	14.76	2.15	1.63	15.28	36.00	-20.72
902.25	V	85.25	16.78	2.15	1.63	17.30	36.00	-18.70
914.75	H	84.09	14.08	2.15	1.64	14.59	36.00	-21.41
914.75	V	82.74	13.60	2.15	1.64	14.11	36.00	-21.89
926.75	H	82.61	12.44	2.15	1.65	12.94	36.00	-23.06
926.75	V	81.66	12.26	2.15	1.65	12.76	36.00	-23.24

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

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Duty Cycle
MODE	Tx
DATE TESTED	November 18, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	Burst Duration = 3.02ms

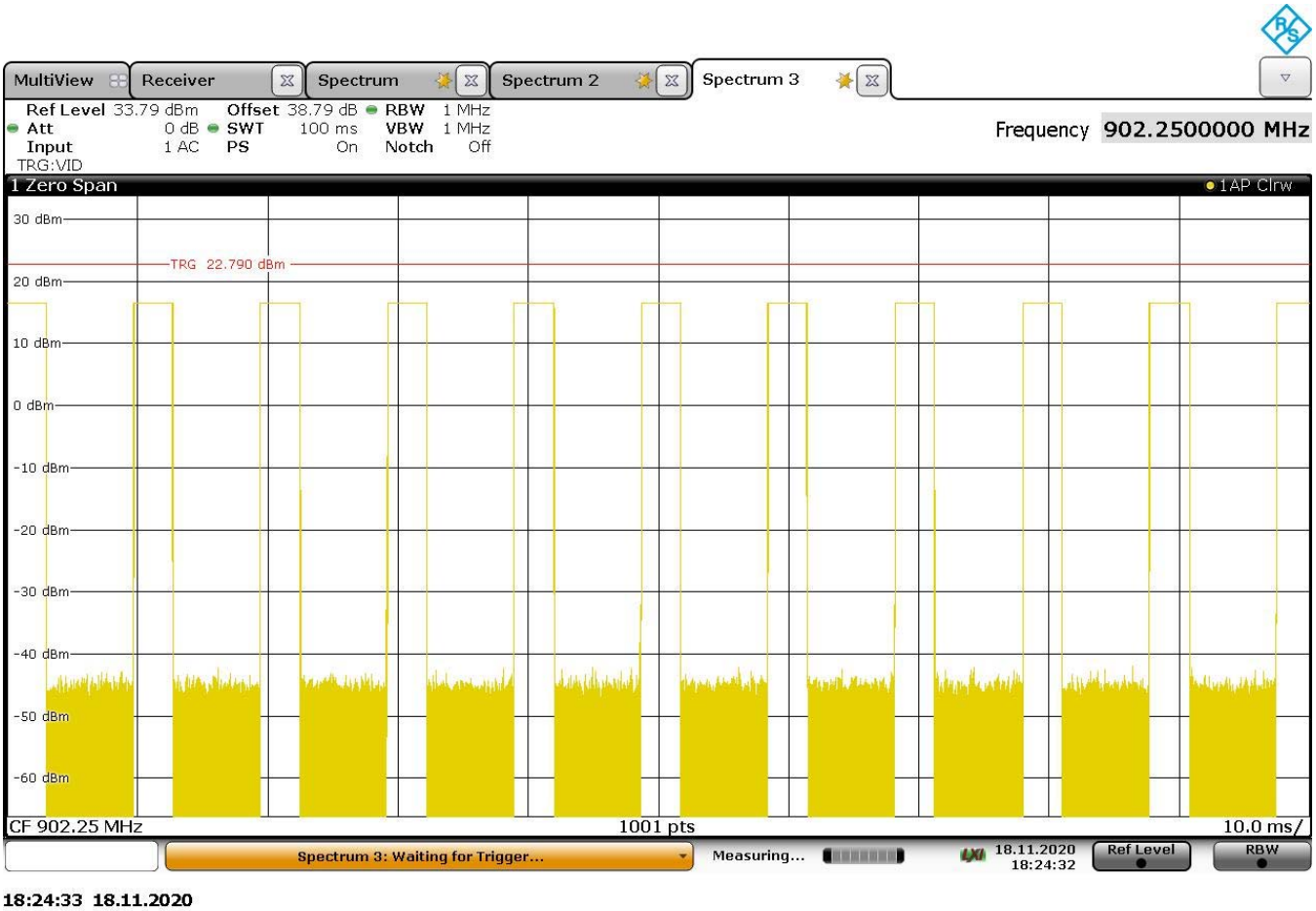
DUTY CYCLE - BURST

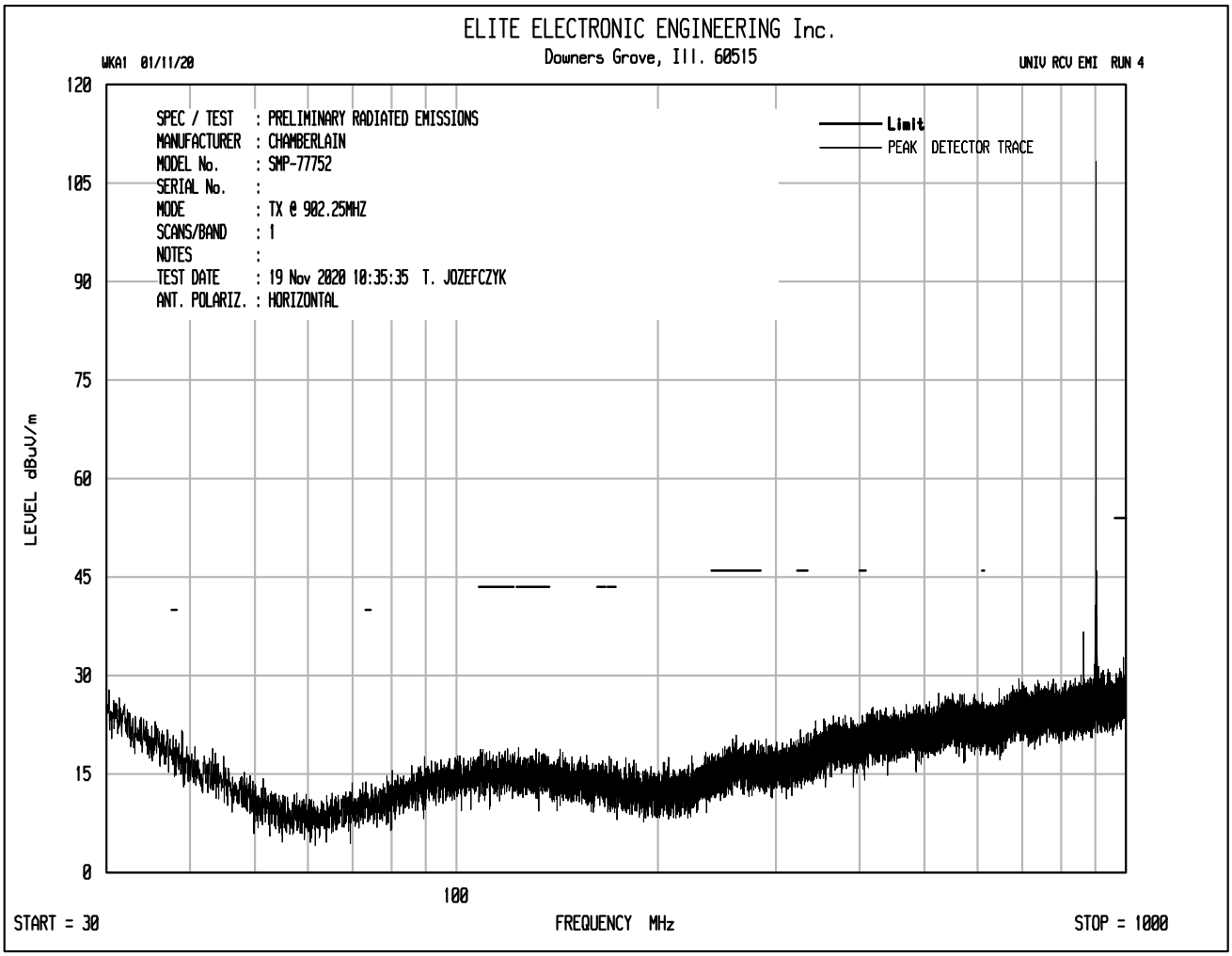


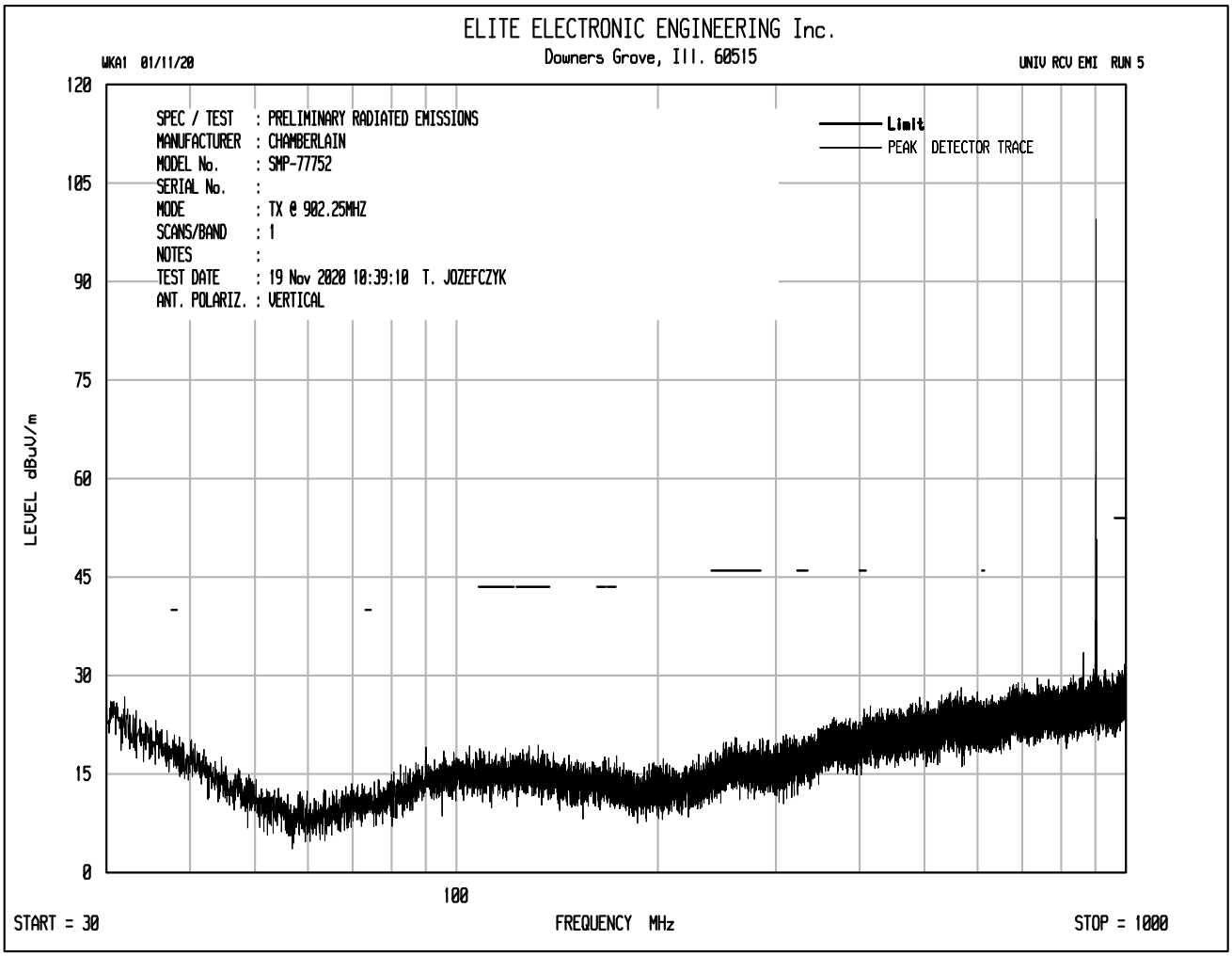
18:24:01 18.11.2020

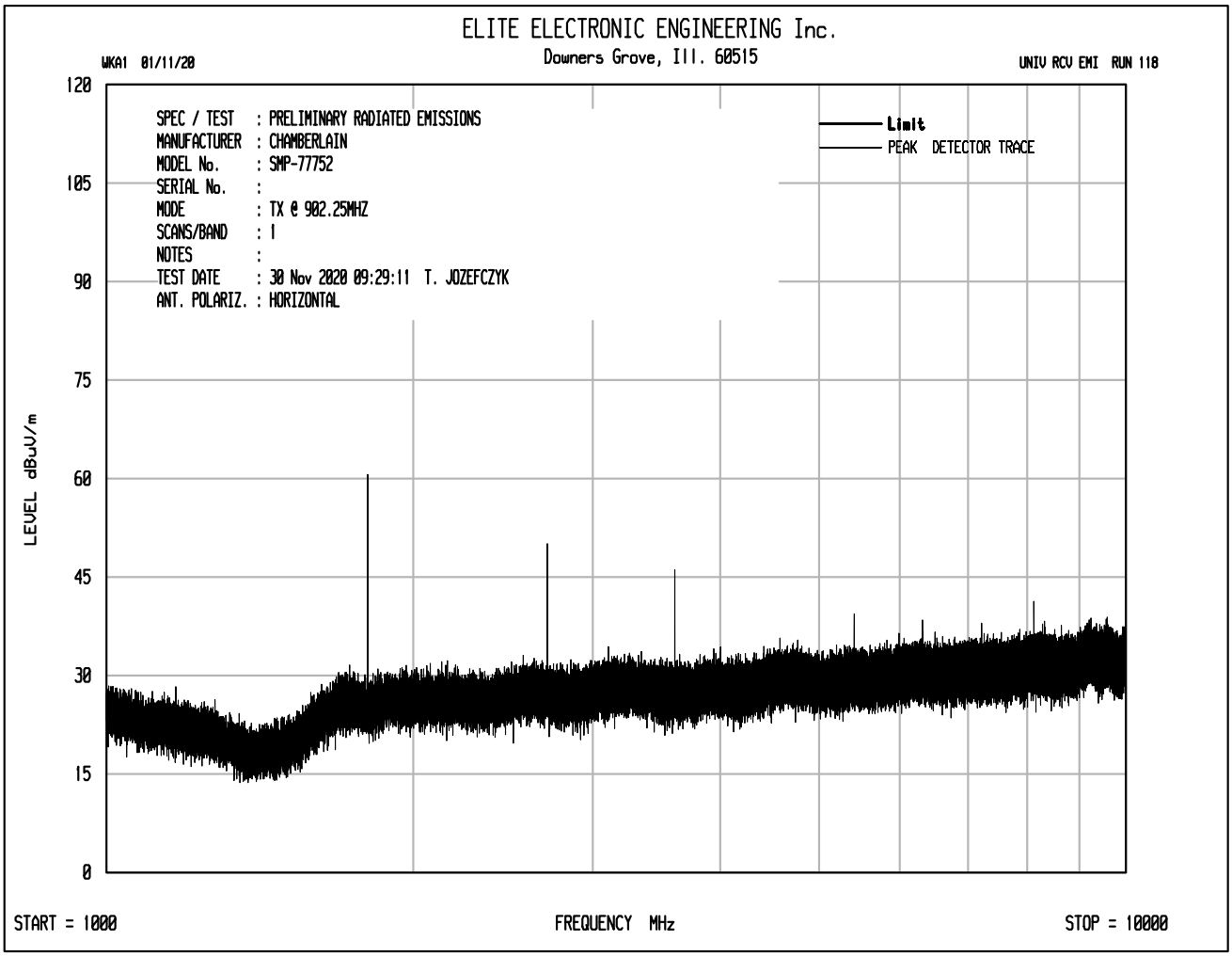
DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Duty Cycle
MODE	Tx
DATE TESTED	November 18, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	Duty Cycle = $20\log\left(\frac{(\#\ of\ bursts)\times(burst\ duration)}{100ms}\right)$ = $20\log\left(\frac{(11)\times(3.02ms)}{100ms}\right)$ = $20(-0.4786)$= **-9.57dB**

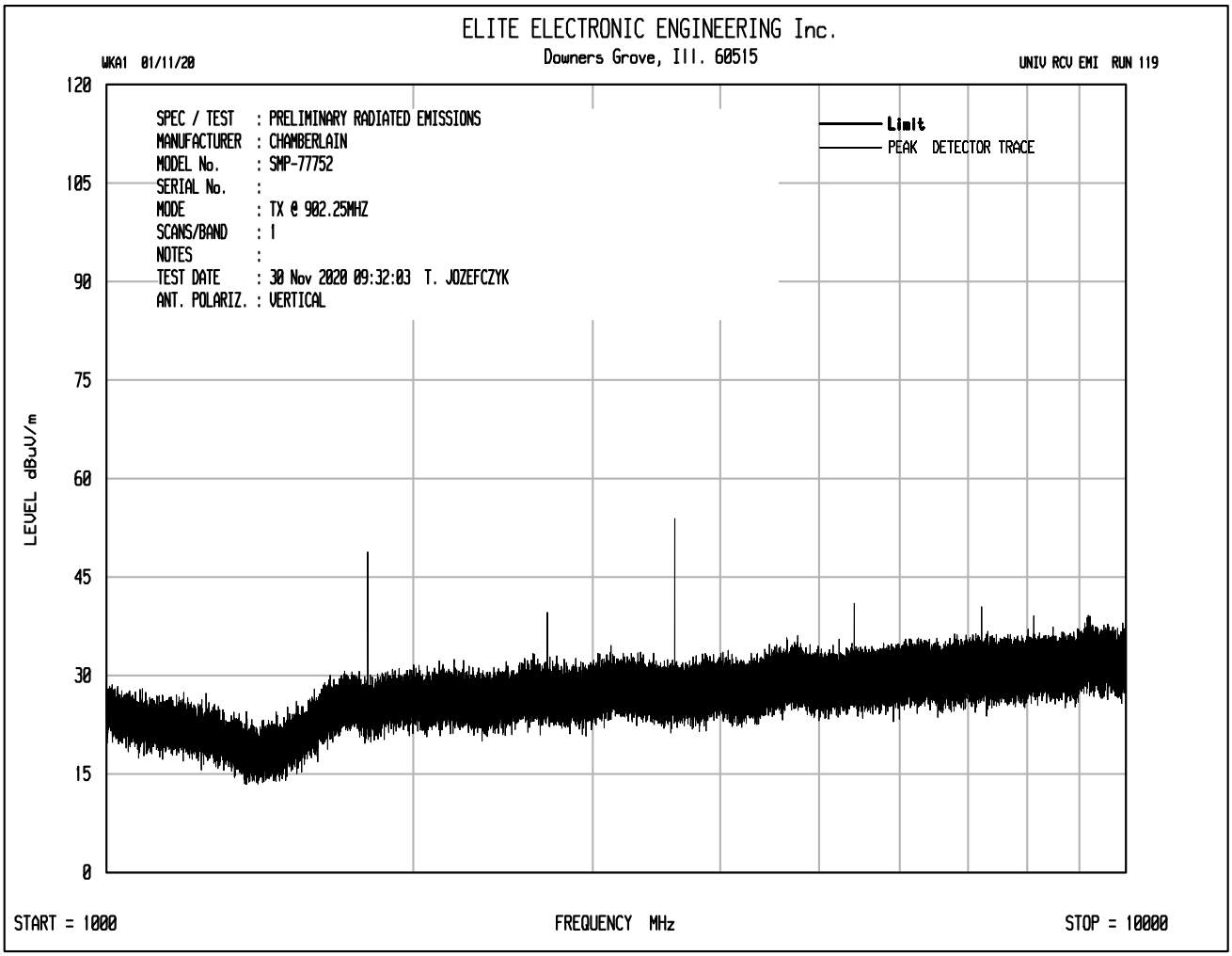
DUTY CYCLE

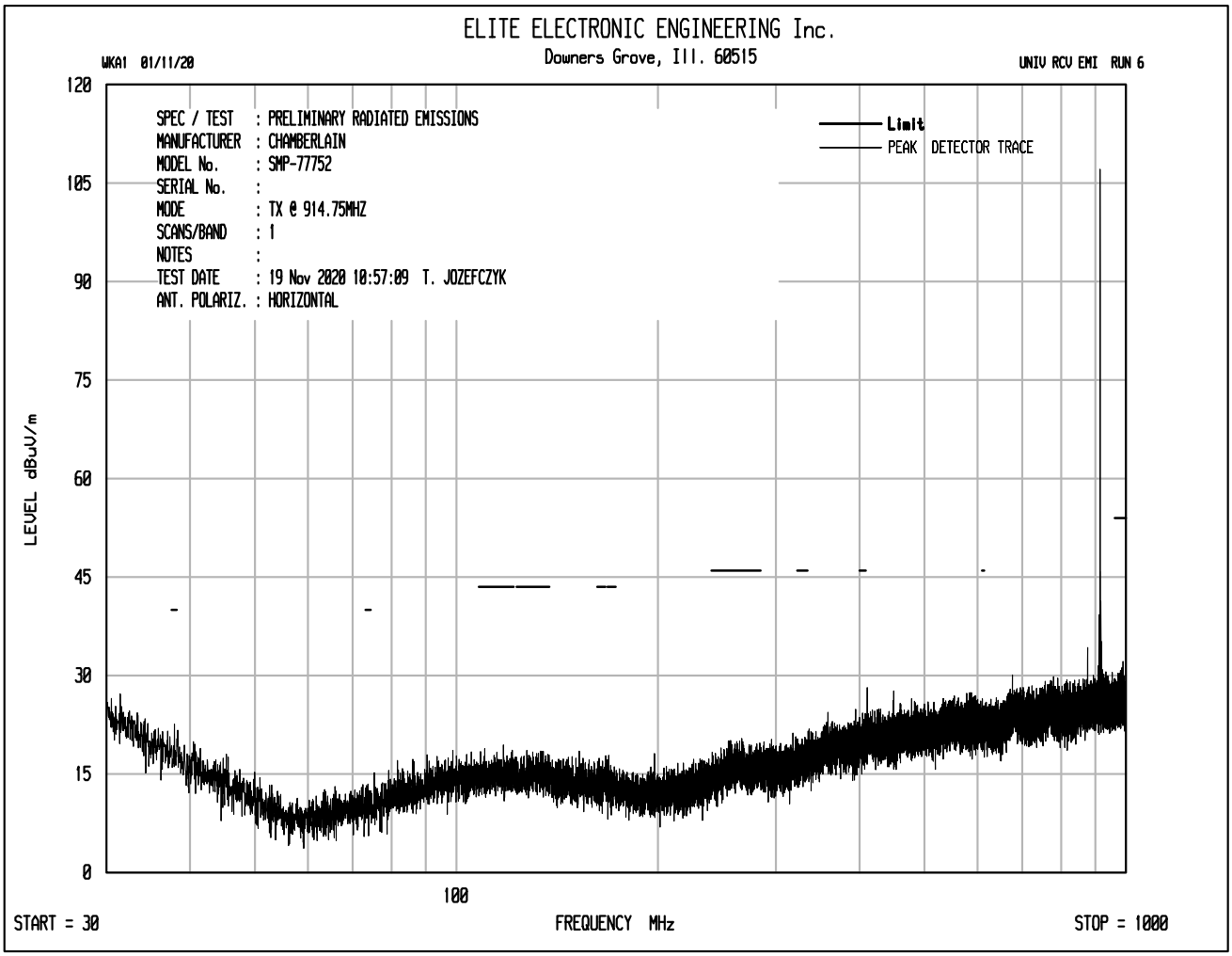


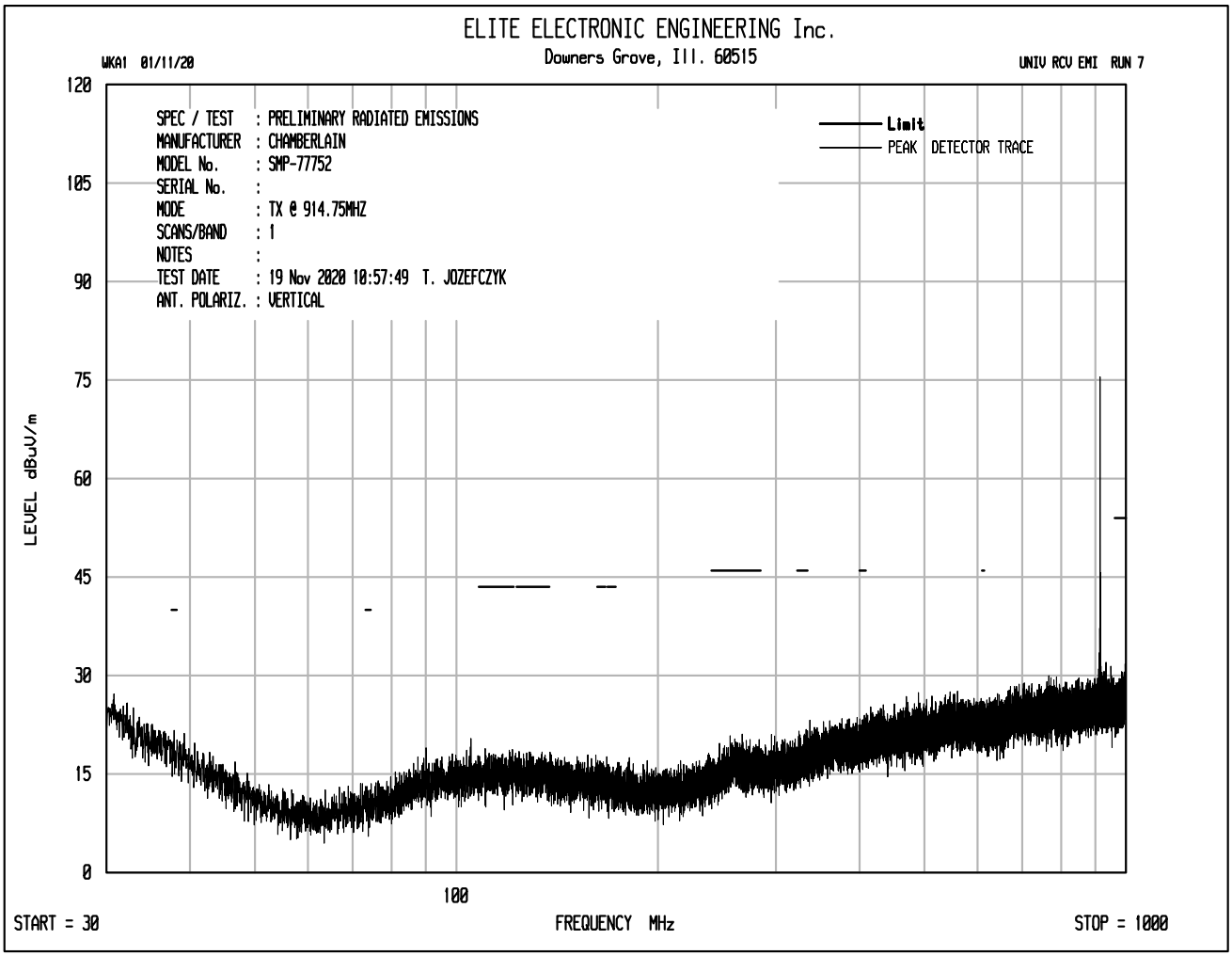

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 01/11/20
UNIV RCV EMI RUN 4
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN
MODEL No. : SMP-77752
SERIAL No. :
MODE : TX @ 902.25MHZ
SCANS/BAND : 1
NOTES :
TEST DATE : 19 Nov 2020 10:35:35 T. JOZEFCZYK
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

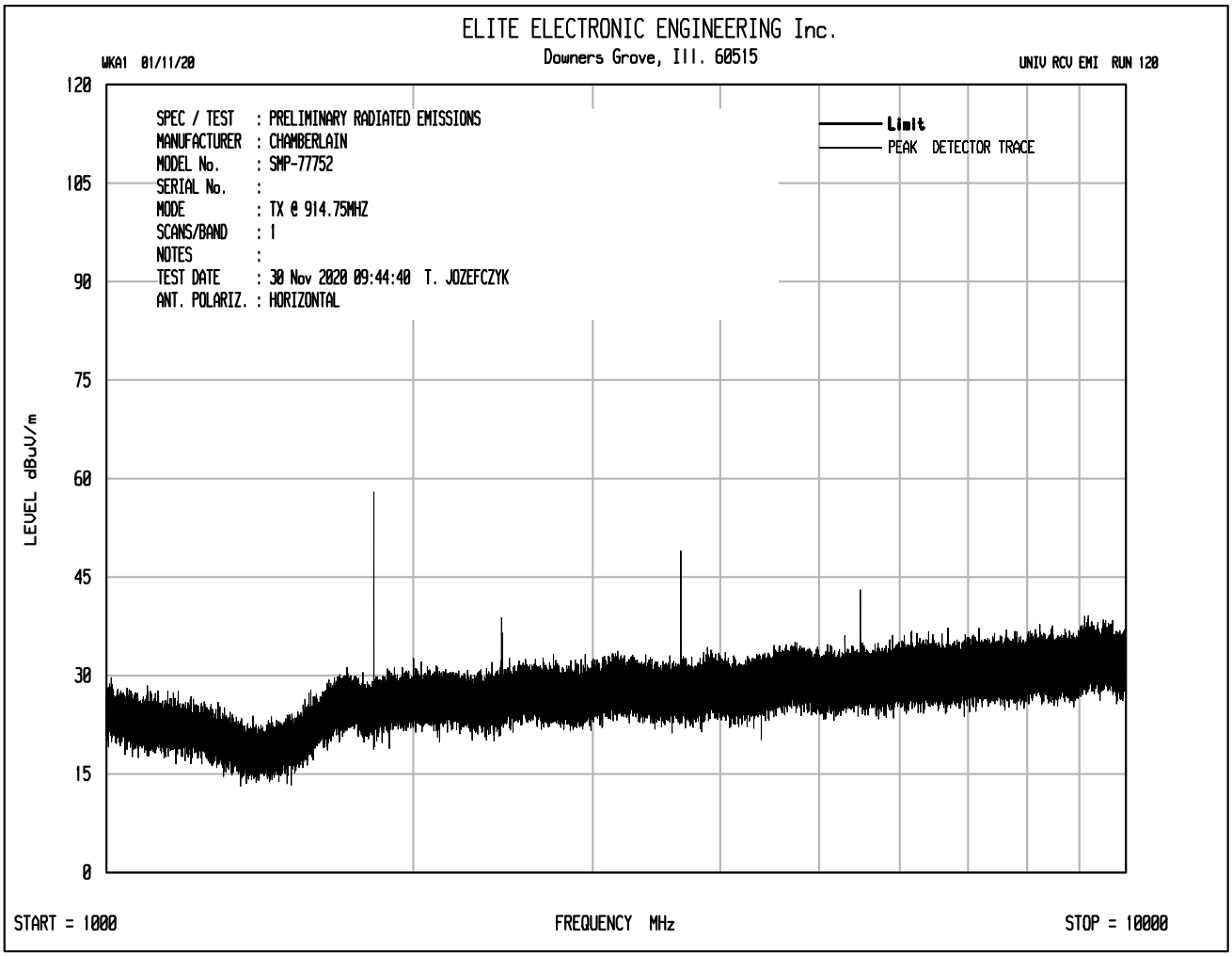

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 01/11/20
UNIV RCV EMI RUN 5
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN
MODEL No. : SMP-77752
SERIAL No. :
MODE : TX @ 902.25MHZ
SCANS/BAND : 1
NOTES :
TEST DATE : 19 Nov 2020 10:39:10 T. JOZEFCZYK
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

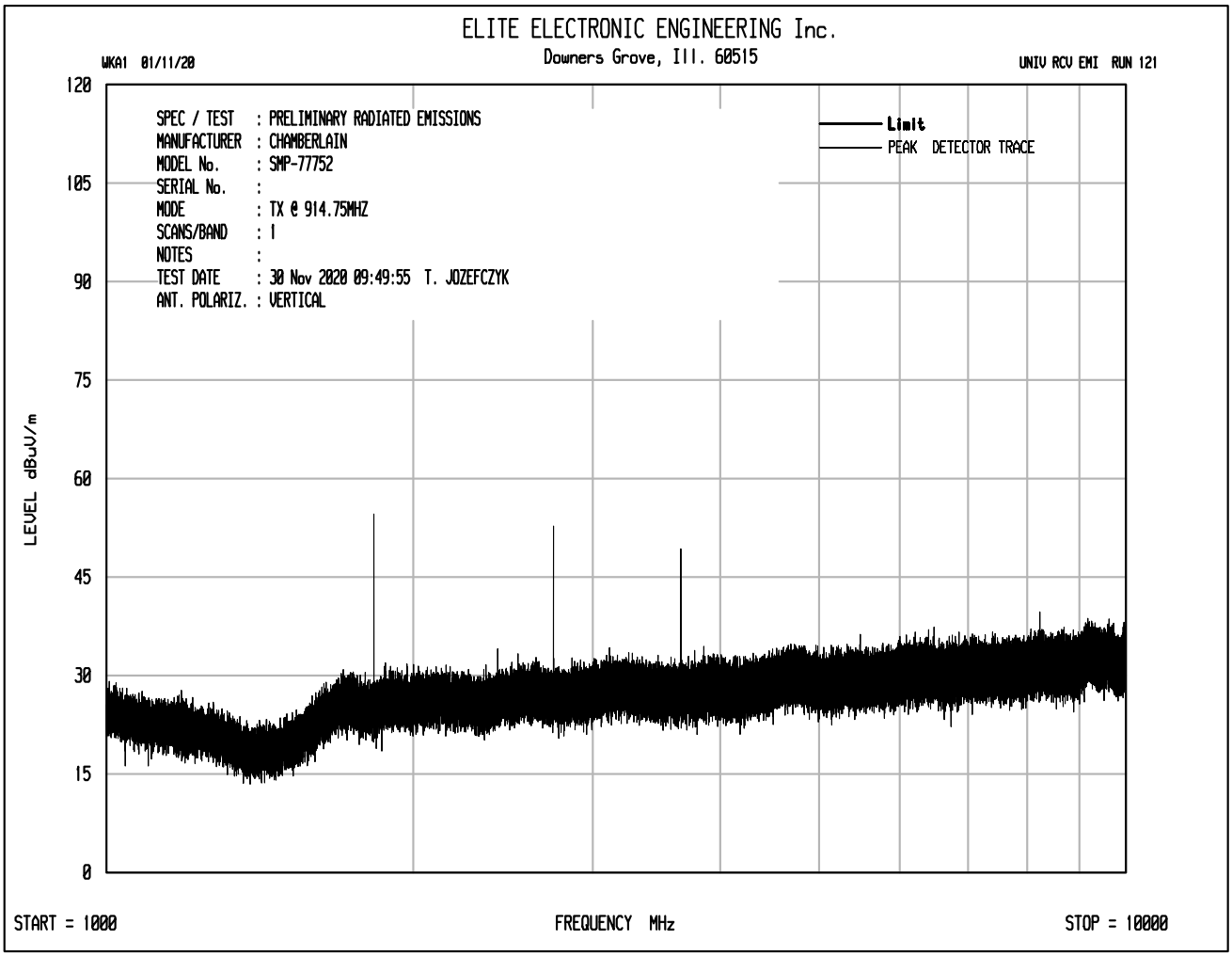

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 01/11/20
UNIV RCV EMI RUN 118
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN
MODEL No. : SMP-77752
SERIAL No. :
MODE : TX @ 902.25MHZ
SCANS/BAND : 1
NOTES :
TEST DATE : 30 Nov 2020 09:29:11 T. JOZEFCZYK
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

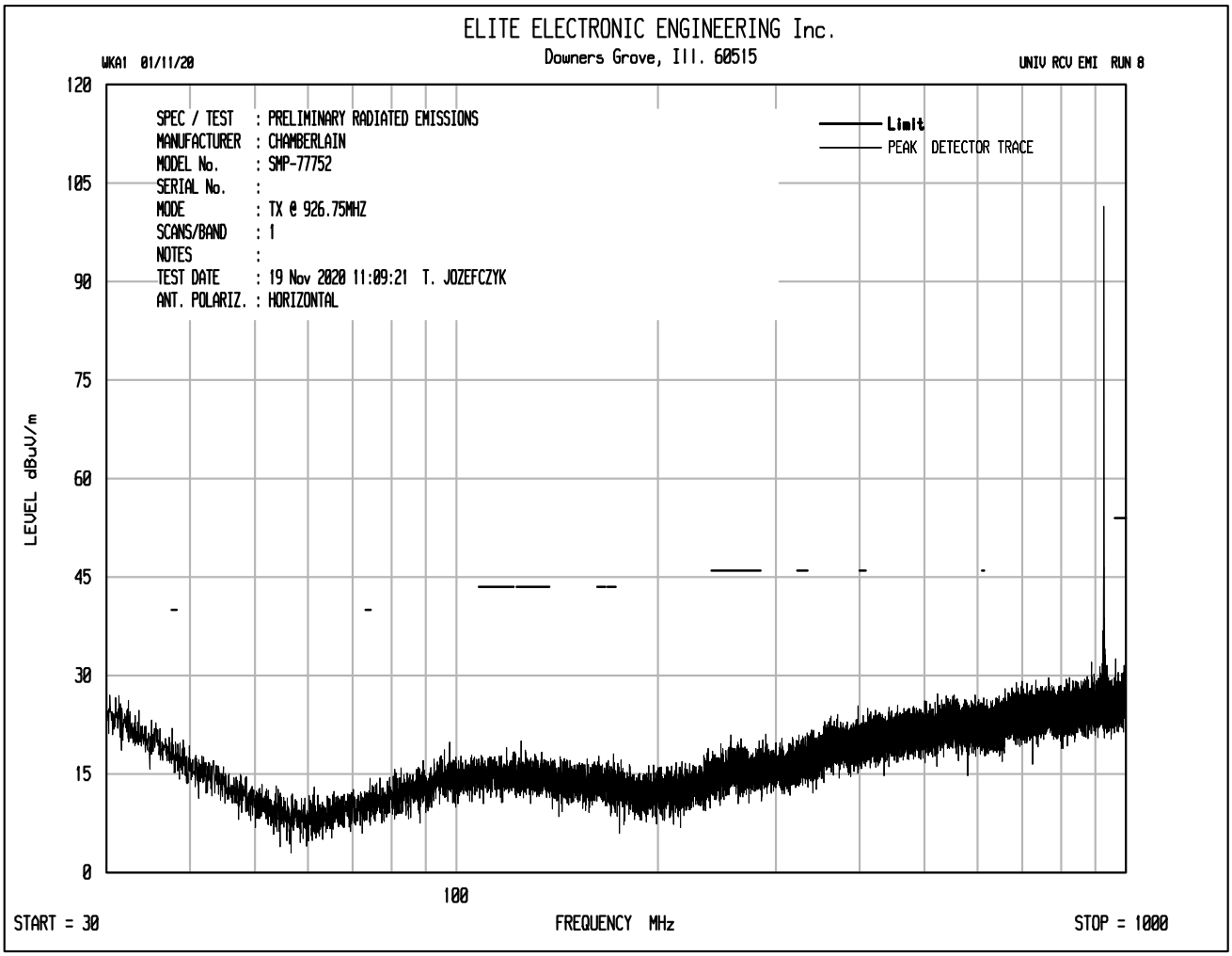

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 01/11/20
UNIV RCV EMI RUN 119
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN
MODEL No. : SMP-77752
SERIAL No. :
MODE : TX @ 902.25MHZ
SCANS/BAND : 1
NOTES :
TEST DATE : 30 Nov 2020 09:32:03 T. JOZEFCZYK
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

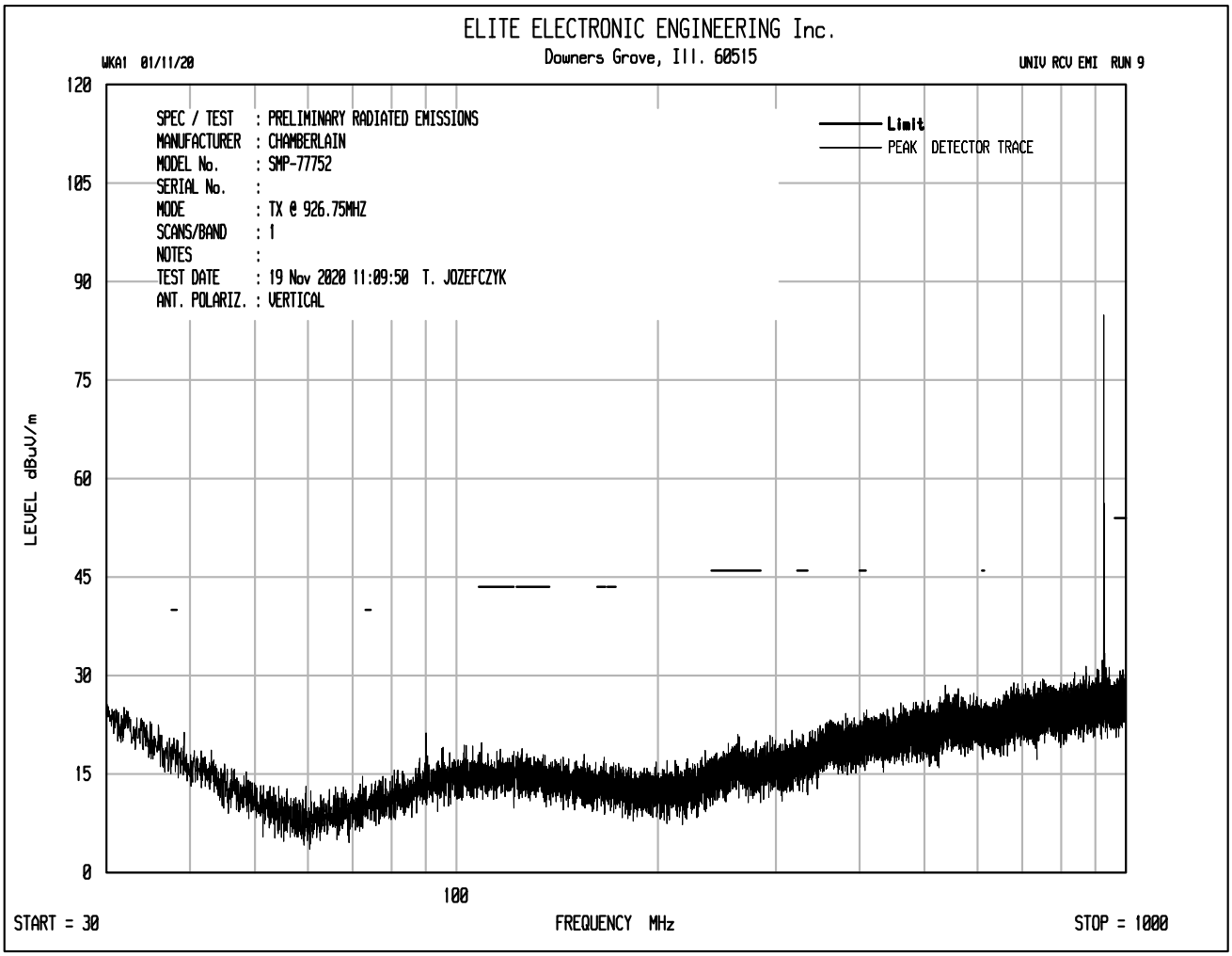

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 01/11/20
UNIV RCV EMI RUN 6
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN
MODEL No. : SMP-77752
SERIAL No. :
MODE : TX @ 914.75MHZ
SCANS/BAND : 1
NOTES :
TEST DATE : 19 Nov 2020 10:57:09 T. JOZEFCZYK
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

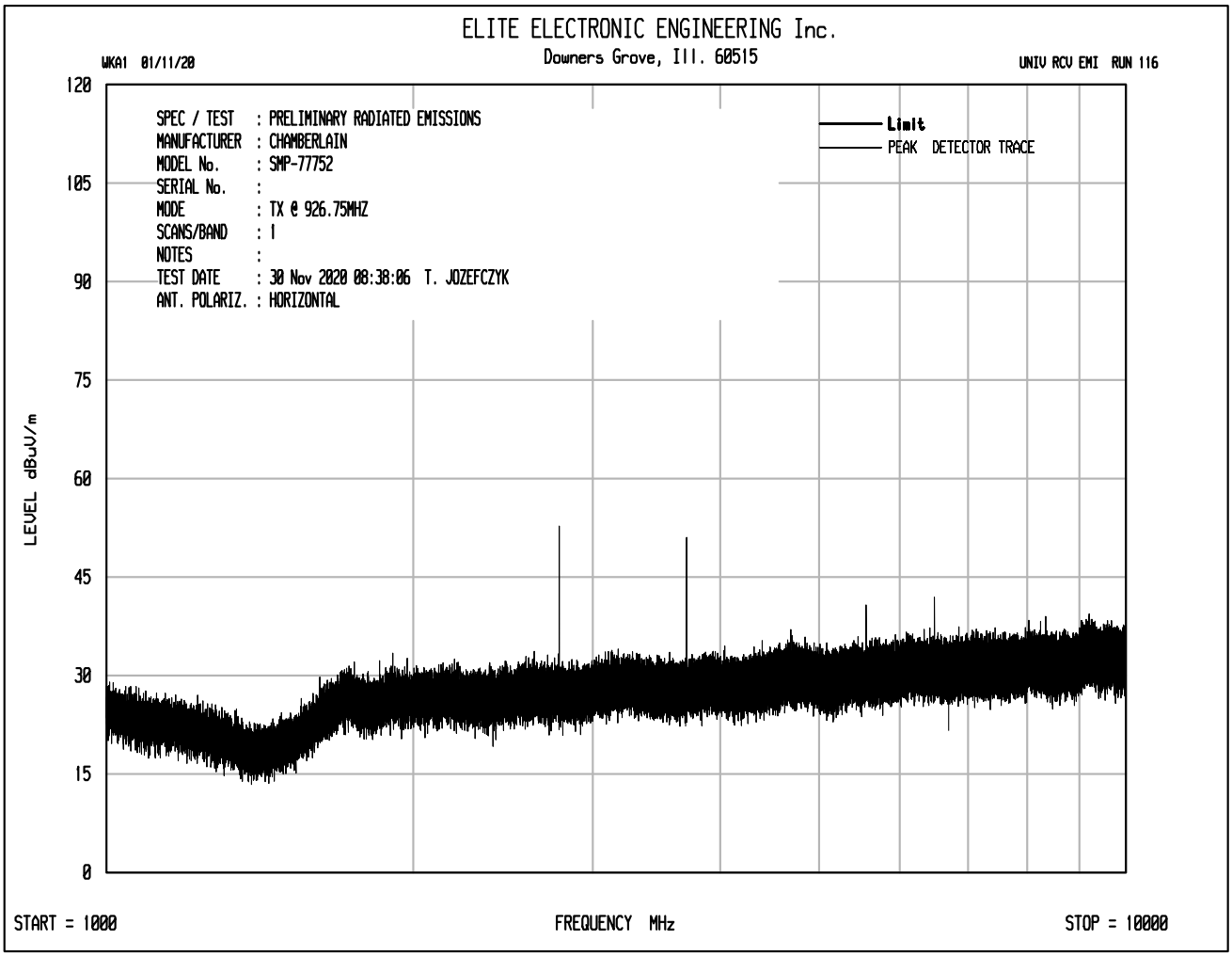

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 01/11/20
UNIV RCV EMI RUN 7
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN
MODEL No. : SMP-77752
SERIAL No. :
MODE : TX @ 914.75MHZ
SCANS/BAND : 1
NOTES :
TEST DATE : 19 Nov 2020 10:57:49 T. JOZEFCZYK
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000

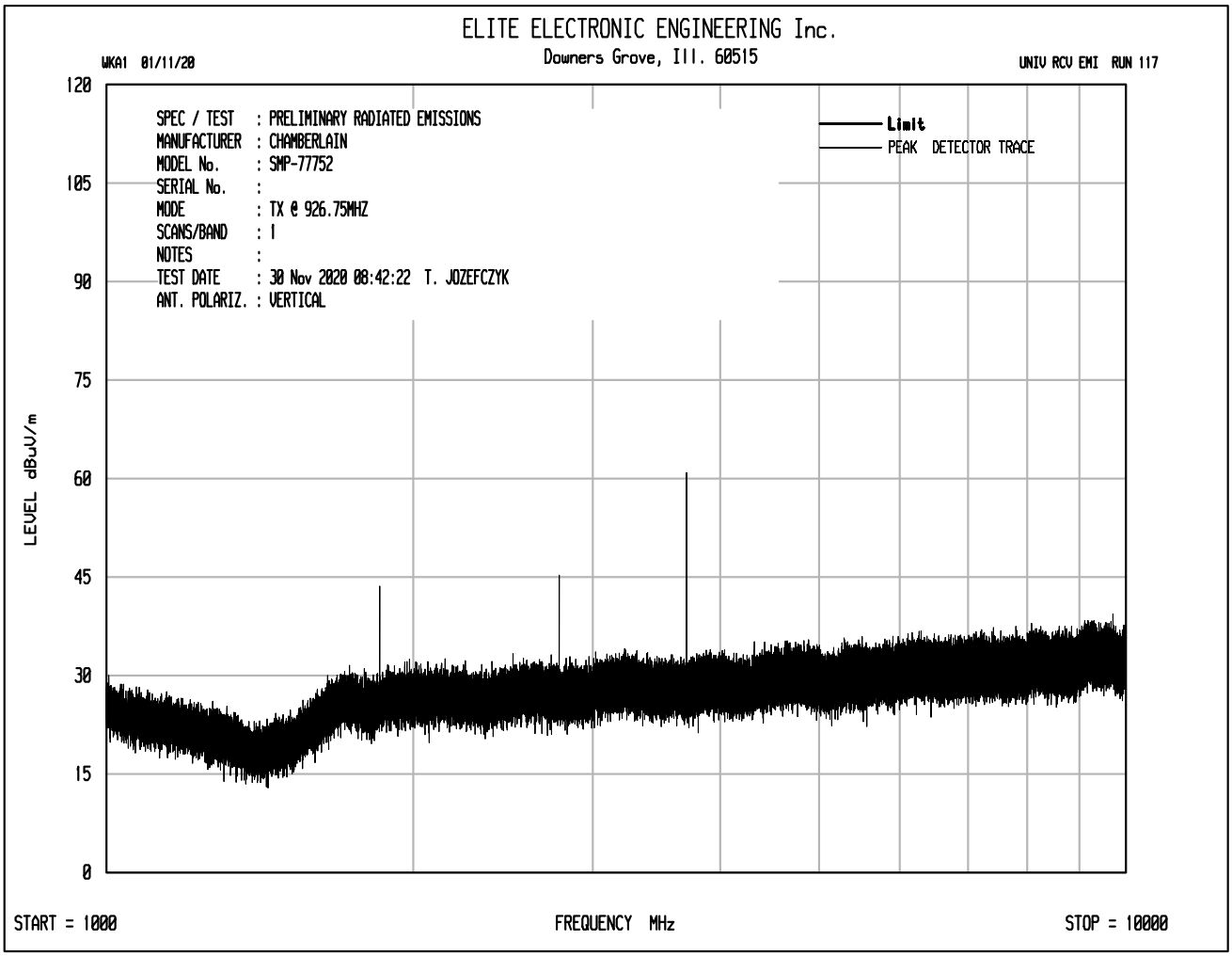

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 01/11/20
UNIV RCV EMI RUN 120
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN
MODEL No. : SMP-77752
SERIAL No. :
MODE : TX @ 914.75MHZ
SCANS/BAND : 1
NOTES :
TEST DATE : 30 Nov 2020 09:44:40 T. JOZEFCZYK
ANT. POLARIZ. : HORIZONTAL
Limit
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 01/11/20
UNIV RCV EMI RUN 121
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN
MODEL No. : SMP-77752
SERIAL No. :
MODE : TX @ 914.75MHZ
SCANS/BAND : 1
NOTES :
TEST DATE : 30 Nov 2020 09:49:55 T. JOZEFCZYK
ANT. POLARIZ. : VERTICAL
Limit
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 01/11/20
UNIV RCV EMI RUN 8
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN
MODEL No. : SMP-77752
SERIAL No. :
MODE : TX @ 926.75MHZ
SCANS/BAND : 1
NOTES :
TEST DATE : 19 Nov 2020 11:09:21 T. JOZEFCZYK
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 01/11/20
UNIV RCV EMI RUN 9
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN
MODEL No. : SMP-77752
SERIAL No. :
MODE : TX @ 926.75MHZ
SCANS/BAND : 1
NOTES :
TEST DATE : 19 Nov 2020 11:09:50 T. JOZEFCZYK
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 01/11/20
UNIV RCV EMI RUN 116
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN
MODEL No. : SMP-77752
SERIAL No. :
MODE : TX @ 926.75MHZ
SCANS/BAND : 1
NOTES :
TEST DATE : 30 Nov 2020 08:38:06 T. JOZEFCZYK
ANT. POLARIZ. : HORIZONTAL
Limit
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 01/11/20
UNIV RCV EMI RUN 117
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : CHAMBERLAIN
MODEL No. : SMP-77752
SERIAL No. :
MODE : TX @ 926.75MHZ
SCANS/BAND : 1
NOTES :
TEST DATE : 30 Nov 2020 08:42:22 T. JOZEFCZYK
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
START = 1000
FREQUENCY MHz
STOP = 10000

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Radiated Spurious Emissions – Harmonics in Non-Restricted Bands
MODE	Tx – 902.25MHz
DATE TESTED	November 19 & 30, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	

RADIATED SPURIOUS EMISSIONS

Freq. (MHz)	Ant. Pol.	Meter Reading (dBµV)	Ambient	CBL Fac. (dB)	Ant. Fac. (dB)	Pre Amp (dB)	Peak Total dBµV/m at 3m	Peak Total µV/m at 3m	Peak Limit µV/m at 3m	Margin (dB)
902.25	H	85.12		2.88	26.47	0.00	114.48	529415.55		
902.25	V	85.76		2.88	26.47	0.00	115.12	569897.42		
1804.50	H	72.41		3.25	30.91	-40.89	65.69	1924.24	56989.74	-29.43
1804.50	V	69.11		3.25	30.91	-40.89	62.39	1316.01	56989.74	-32.73
6315.75	H	47.60		5.53	35.48	-40.15	48.46	264.83	56989.74	-46.66
6315.75	V	47.48		5.53	35.48	-40.15	48.34	261.19	56989.74	-46.78
7218.00	H	39.09	Ambient	5.88	35.67	-40.07	40.58	106.93	56989.74	-54.53
7218.00	V	39.28	Ambient	5.88	35.67	-40.07	40.77	109.29	56989.74	-54.34

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Radiated Spurious Emissions – Harmonics in Restricted Bands
MODE	Tx – 902.25MHz
DATE TESTED	November 19 & 30, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	

RADIATED SPURIOUS EMISSIONS

Freq. (MHz)	Ant. Pol.	Meter Reading (dBµV)	Ambient	CBL Fac. (dB)	Ant. Fac. (dB)	Pre Amp (dB)	Peak Total dBµV/m at 3m	Peak Total µV/m at 3m	Peak Limit µV/m at 3m	Margin (dB)
2706.75	H	65.26		3.68	32.57	-40.41	61.09	1133.76	5000.00	-12.89
2706.75	V	64.21		3.68	32.57	-40.41	60.04	1004.67	5000.00	-13.94
3609.00	H	58.21		4.76	33.21	-40.31	55.88	622.11	5000.00	-18.10
3609.00	V	57.95		4.76	33.21	-40.31	55.62	603.77	5000.00	-18.36
4511.25	H	52.33	Ambient	4.80	34.18	-40.10	51.20	363.09	5000.00	-22.78
4511.25	V	51.69	Ambient	4.80	34.18	-40.10	50.56	337.30	5000.00	-23.42
5413.50	H	56.24		5.11	34.99	-40.25	56.09	637.79	5000.00	-17.89
5413.50	V	56.36		5.11	34.99	-40.25	56.21	646.67	5000.00	-17.77
8120.25	H	50.51	Ambient	6.08	35.79	-39.97	52.41	417.41	5000.00	-21.57
8120.25	V	50.13	Ambient	6.08	35.79	-39.97	52.03	399.54	5000.00	-21.95
9022.50	H	51.20	Ambient	6.30	36.28	-39.73	54.05	504.00	5000.00	-19.93
9022.50	V	51.31	Ambient	6.30	36.28	-39.73	54.16	510.42	5000.00	-19.82

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Radiated Spurious Emissions – Restricted Band Averages
MODE	Tx – 902.25MHz
DATE TESTED	November 19 & 30, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	

RADIATED SPURIOUS EMISSIONS

Freq. (MHz)	Ant. Pol.	Meter Reading (dBµV)	Ambient	CBL Fac. (dB)	Ant. Fac. (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBµV/m at 3m	Average Total µV/m at 3m	Average Limit µV/m at 3m	Margin (dB)
2706.75	H	44.54		3.68	32.57	-40.41	0.00	40.37	104.36	500.00	-13.61
2706.75	V	44.22		3.68	32.57	-40.41	0.00	40.05	100.58	500.00	-13.93
3609.00	H	43.43		4.76	33.21	-40.31	0.00	41.10	113.47	500.00	-12.88
3609.00	V	42.64		4.76	33.21	-40.31	0.00	40.31	103.60	500.00	-13.67
4511.25	H	36.51	Ambient	4.80	34.18	-40.10	0.00	35.38	58.75	500.00	-18.60
4511.25	V	36.52	Ambient	4.80	34.18	-40.10	0.00	35.39	58.82	500.00	-18.59
5413.50	H	37.88		5.11	34.99	-40.25	0.00	37.73	77.03	500.00	-16.25
5413.50	V	37.92		5.11	34.99	-40.25	0.00	37.77	77.39	500.00	-16.21
8120.25	H	35.29	Ambient	6.08	35.79	-39.97	0.00	37.19	72.37	500.00	-16.79
8120.25	V	35.30	Ambient	6.08	35.79	-39.97	0.00	37.20	72.45	500.00	-16.78
9022.50	H	36.12	Ambient	6.30	36.28	-39.73	0.00	38.97	88.80	500.00	-15.01
9022.50	V	36.10	Ambient	6.30	36.28	-39.73	0.00	38.95	88.60	500.00	-15.03

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Radiated Spurious Emissions – Harmonics in Non-Restricted Bands
MODE	Tx – 914.75MHz
DATE TESTED	November 19 & 30, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	

RADIATED SPURIOUS EMISSIONS

Freq. (MHz)	Ant. Pol.	Meter Reading (dBµV)	Ambient	CBL Fac. (dB)	Ant. Fac. (dB)	Pre Amp (dB)	Peak Total dBµV/m at 3m	Peak Total µV/m at 3m	Peak Limit µV/m at 3m	Margin (dB)
914.75	H	83.81		2.89	26.37	0.00	113.07	450491.14		
914.75	V	82.39		2.89	26.37	0.00	111.65	382548.28		
1829.50	H	73.40		3.25	30.94	-40.85	66.75	2174.39	45049.11	-26.33
1829.50	V	69.85		3.25	30.94	-40.85	63.20	1444.90	45049.11	-29.88
5488.50	H	52.96		5.08	34.99	-40.24	52.79	435.93	45049.11	-40.29
5488.50	V	51.63		5.08	34.99	-40.24	51.46	374.04	45049.11	-41.62
6403.25	H	47.68		5.56	35.54	-40.14	48.63	270.22	45049.11	-44.44
6403.25	V	47.60		5.56	35.54	-40.14	48.55	267.75	45049.11	-44.52

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Radiated Spurious Emissions – Harmonics in Restricted Bands
MODE	Tx – 914.75MHz
DATE TESTED	November 19 & 30, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	

RADIATED SPURIOUS EMISSIONS

Freq. (MHz)	Ant. Pol.	Meter Reading (dBµV)	Ambient	CBL Fac. (dB)	Ant. Fac. (dB)	Pre Amp (dB)	Peak Total dBµV/m at 3m	Peak Total µV/m at 3m	Peak Limit µV/m at 3m	Margin (dB)
2744.25	H	65.17		3.74	32.60	-40.40	61.11	1135.93	5000.00	-12.87
2744.25	V	64.59		3.74	32.60	-40.40	60.53	1062.55	5000.00	-13.45
3659.00	H	63.21		4.77	33.20	-40.27	60.90	1109.60	5000.00	-13.08
3659.00	V	62.78		4.77	33.20	-40.27	60.47	1056.01	5000.00	-13.51
4573.75	H	56.48		4.80	34.32	-40.13	55.47	593.62	5000.00	-18.51
4573.75	V	55.92		4.80	34.32	-40.13	54.91	556.55	5000.00	-19.07
7318.00	H	49.30	Ambient	5.84	35.69	-40.06	50.78	345.82	5000.00	-23.20
7318.00	V	49.73	Ambient	5.84	35.69	-40.06	51.21	363.37	5000.00	-22.77
8232.75	H	49.90	Ambient	6.22	35.88	-39.94	52.07	401.15	5000.00	-21.91
8232.75	V	50.20	Ambient	6.22	35.88	-39.94	52.37	415.24	5000.00	-21.61
9147.50	H	51.64	Ambient	6.31	36.32	-39.70	54.57	535.18	5000.00	-19.41
9147.50	V	51.70	Ambient	6.31	36.32	-39.70	54.63	538.89	5000.00	-19.35

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Radiated Spurious Emissions – Restricted Band Averages
MODE	Tx – 914.75MHz
DATE TESTED	November 19 & 30, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	

RADIATED SPURIOUS EMISSIONS

Freq. (MHz)	Ant. Pol.	Meter Reading (dBµV)	Ambient	CBL Fac. (dB)	Ant. Fac. (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBµV/m at 3m	Average Total µV/m at 3m	Average Limit µV/m at 3m	Margin (dB)
2744.25	H	45.26		3.74	32.60	-40.40	0.00	41.20	114.78	500.00	-12.78
2744.25	V	45.19		3.74	32.60	-40.40	0.00	41.13	113.85	500.00	-12.85
3659.00	H	42.59		4.77	33.20	-40.27	0.00	40.28	103.32	500.00	-13.70
3659.00	V	42.43		4.77	33.20	-40.27	0.00	40.12	101.43	500.00	-13.86
4573.75	H	38.25		4.80	34.32	-40.13	0.00	37.24	72.78	500.00	-16.74
4573.75	V	38.59		4.80	34.32	-40.13	0.00	37.58	75.68	500.00	-16.40
7318.00	H	34.43	Ambient	5.84	35.69	-40.06	0.00	35.91	62.42	500.00	-18.07
7318.00	V	34.42	Ambient	5.84	35.69	-40.06	0.00	35.90	62.35	500.00	-18.08
8232.75	H	35.06	Ambient	6.22	35.88	-39.94	0.00	37.23	72.66	500.00	-16.75
8232.75	V	35.10	Ambient	6.22	35.88	-39.94	0.00	37.27	73.00	500.00	-16.71
9147.50	H	36.16	Ambient	6.31	36.32	-39.70	0.00	39.09	90.05	500.00	-14.89
9147.50	V	36.14	Ambient	6.31	36.32	-39.70	0.00	39.07	89.85	500.00	-14.91

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Radiated Spurious Emissions – Harmonics in Non-Restricted Bands
MODE	Tx – 926.75MHz
DATE TESTED	November 19 & 30, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	

RADIATED SPURIOUS EMISSIONS

Freq. (MHz)	Ant. Pol.	Meter Reading (dBµV)	Ambient	CBL Fac. (dB)	Ant. Fac. (dB)	Pre Amp (dB)	Peak Total dBµV/m at 3m	Peak Total µV/m at 3m	Peak Limit µV/m at 3m	Margin (dB)
926.75	H	82.41		2.90	26.76	0.00	112.07	401317.50		
926.75	V	81.17		2.90	26.76	0.00	110.83	347926.97		
1853.50	H	70.08		3.26	31.00	-40.81	63.53	1501.83	40131.75	-28.54
1853.50	V	66.63		3.26	31.00	-40.81	60.08	1009.53	40131.75	-31.99
5560.50	H	51.40		5.11	34.96	-40.23	51.24	364.55	40131.75	-40.83
5560.50	V	46.61		5.11	34.96	-40.23	46.45	210.02	40131.75	-45.62
6487.25	H	46.47		5.60	35.57	-40.13	47.50	237.08	40131.75	-44.57
6487.25	V	43.13		5.60	35.57	-40.13	44.16	161.40	40131.75	-47.91
9267.50	H	40.23	Ambient	6.42	36.34	-39.67	43.31	146.42	40131.75	-48.76
9267.50	V	40.10	Ambient	6.42	36.34	-39.67	43.18	144.24	40131.75	-48.89

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Radiated Spurious Emissions – Harmonics in Restricted Bands
MODE	Tx – 926.75MHz
DATE TESTED	November 19 & 30, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	

RADIATED SPURIOUS EMISSIONS

Freq. (MHz)	Ant. Pol.	Meter Reading (dBµV)	Ambient	CBL Fac. (dB)	Ant. Fac. (dB)	Pre Amp (dB)	Peak Total dBµV/m at 3m	Peak Total µV/m at 3m	Peak Limit µV/m at 3m	Margin (dB)
2780.25	H	67.32		3.80	32.53	-40.38	63.26	1455.45	5000.00	-10.72
2780.25	V	62.29		3.80	32.53	-40.38	58.23	815.64	5000.00	-15.75
3707.00	H	65.15		4.77	33.19	-40.23	62.88	1393.50	5000.00	-11.10
3707.00	V	67.33		4.77	33.19	-40.23	65.06	1791.04	5000.00	-8.92
4633.75	H	53.67		4.80	34.47	-40.16	52.79	436.07	5000.00	-21.19
4633.75	V	53.41		4.80	34.47	-40.16	52.53	423.21	5000.00	-21.45
7414.00	H	50.28	Ambient	5.89	35.65	-40.05	51.76	387.42	5000.00	-22.22
7414.00	V	50.67	Ambient	5.89	35.65	-40.05	52.15	405.22	5000.00	-21.83
8340.75	H	51.27	Ambient	6.18	35.91	-39.91	53.46	471.01	5000.00	-20.52
8340.75	V	50.91	Ambient	6.18	35.91	-39.91	53.10	451.89	5000.00	-20.88

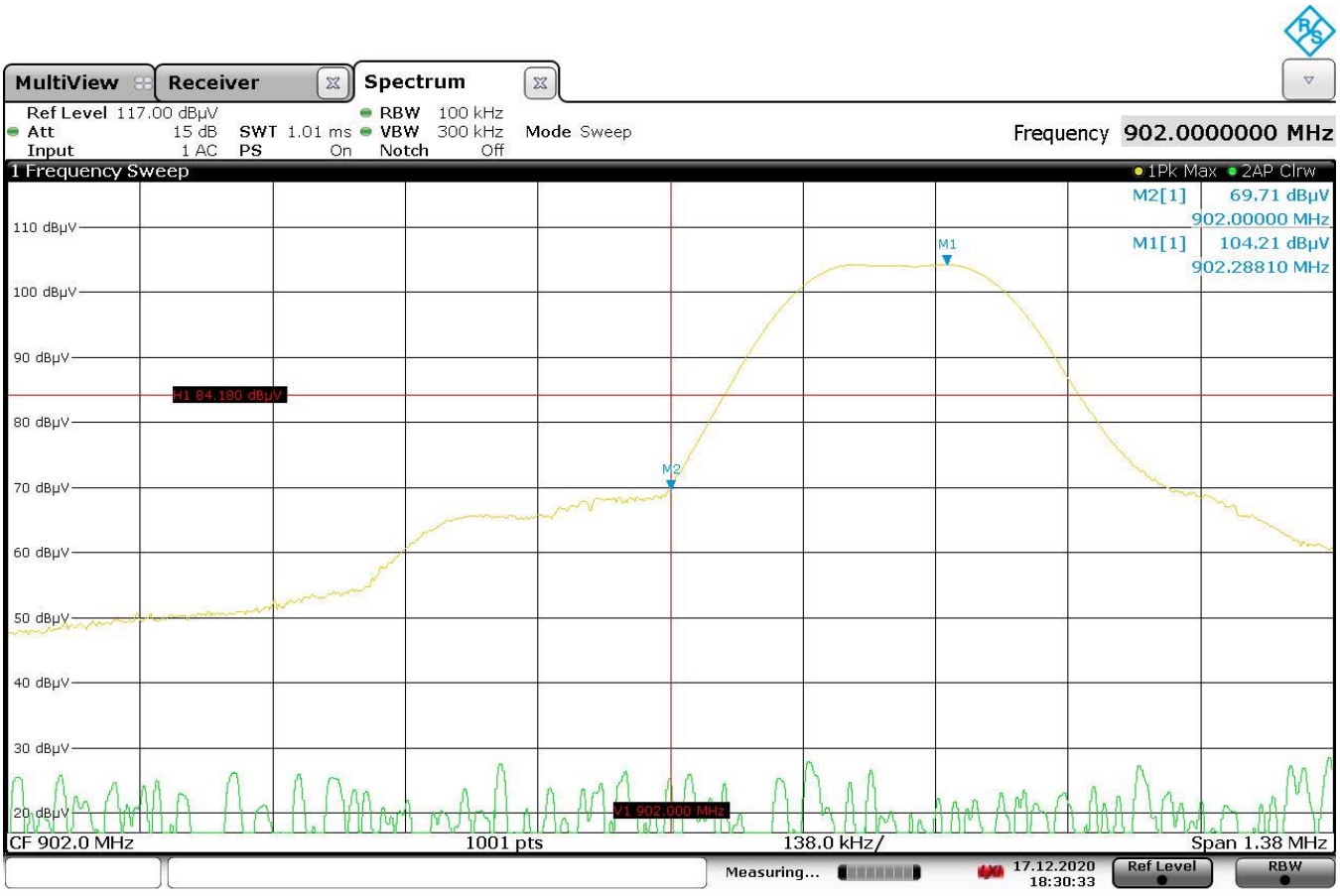
DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Radiated Spurious Emissions – Restricted Band Averages
MODE	Tx – 926.75MHz
DATE TESTED	November 19 & 30, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	

RADIATED SPURIOUS EMISSIONS

Freq. (MHz)	Ant. Pol.	Meter Reading (dBµV)	Ambient	CBL Fac. (dB)	Ant. Fac. (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBµV/m at 3m	Average Total µV/m at 3m	Average Limit µV/m at 3m	Margin (dB)
2780.25	H	47.48		3.80	32.53	-40.38	0.00	43.42	148.25	500.00	-10.56
2780.25	V	45.26		3.80	32.53	-40.38	0.00	41.20	114.81	500.00	-12.78
3707.00	H	45.50		4.77	33.19	-40.23	0.00	43.23	145.08	500.00	-10.75
3707.00	V	46.41		4.77	33.19	-40.23	0.00	44.14	161.10	500.00	-9.84
4633.75	H	38.95		4.80	34.47	-40.16	0.00	38.07	80.09	500.00	-15.91
4633.75	V	38.19		4.80	34.47	-40.16	0.00	37.31	73.38	500.00	-16.67
7414.00	H	34.89	Ambient	5.89	35.65	-40.05	0.00	36.37	65.87	500.00	-17.61
7414.00	V	35.76	Ambient	5.89	35.65	-40.05	0.00	37.24	72.81	500.00	-16.74
8340.75	H	35.96	Ambient	6.18	35.91	-39.91	0.00	38.15	80.82	500.00	-15.83
8340.75	V	35.75	Ambient	6.18	35.91	-39.91	0.00	37.94	78.89	500.00	-16.04

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Band Edge
MODE	Tx – 902.25MHz
DATE TESTED	February 10 – 14, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	

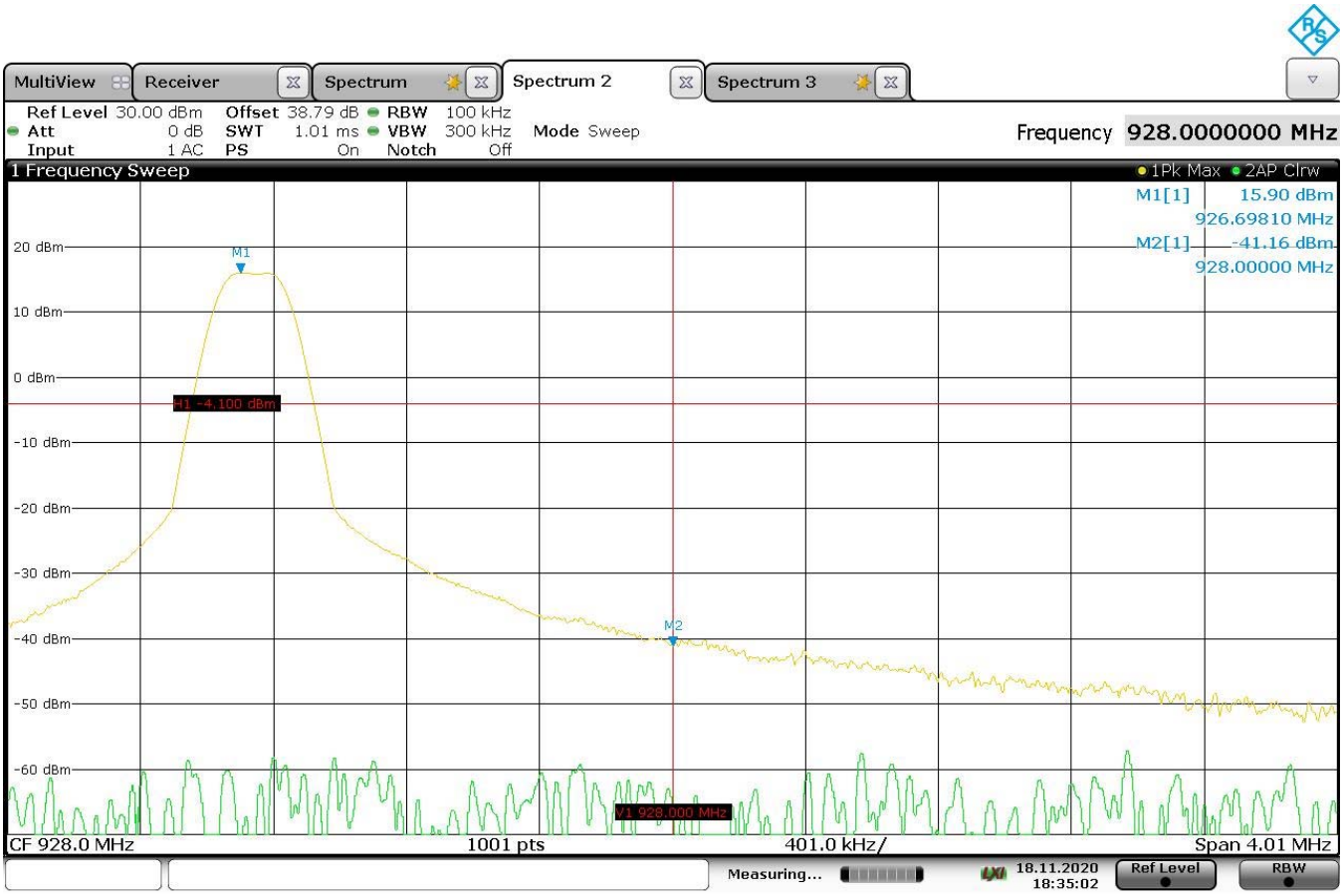
BAND EDGE – LOW



18:30:33 17.12.2020

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
SERIAL NO.	SMP-77482
TEST	FCC §15.247, RSS-247 – Band Edge
MODE	Tx – 926.75MHz
DATE TESTED	November 19, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	

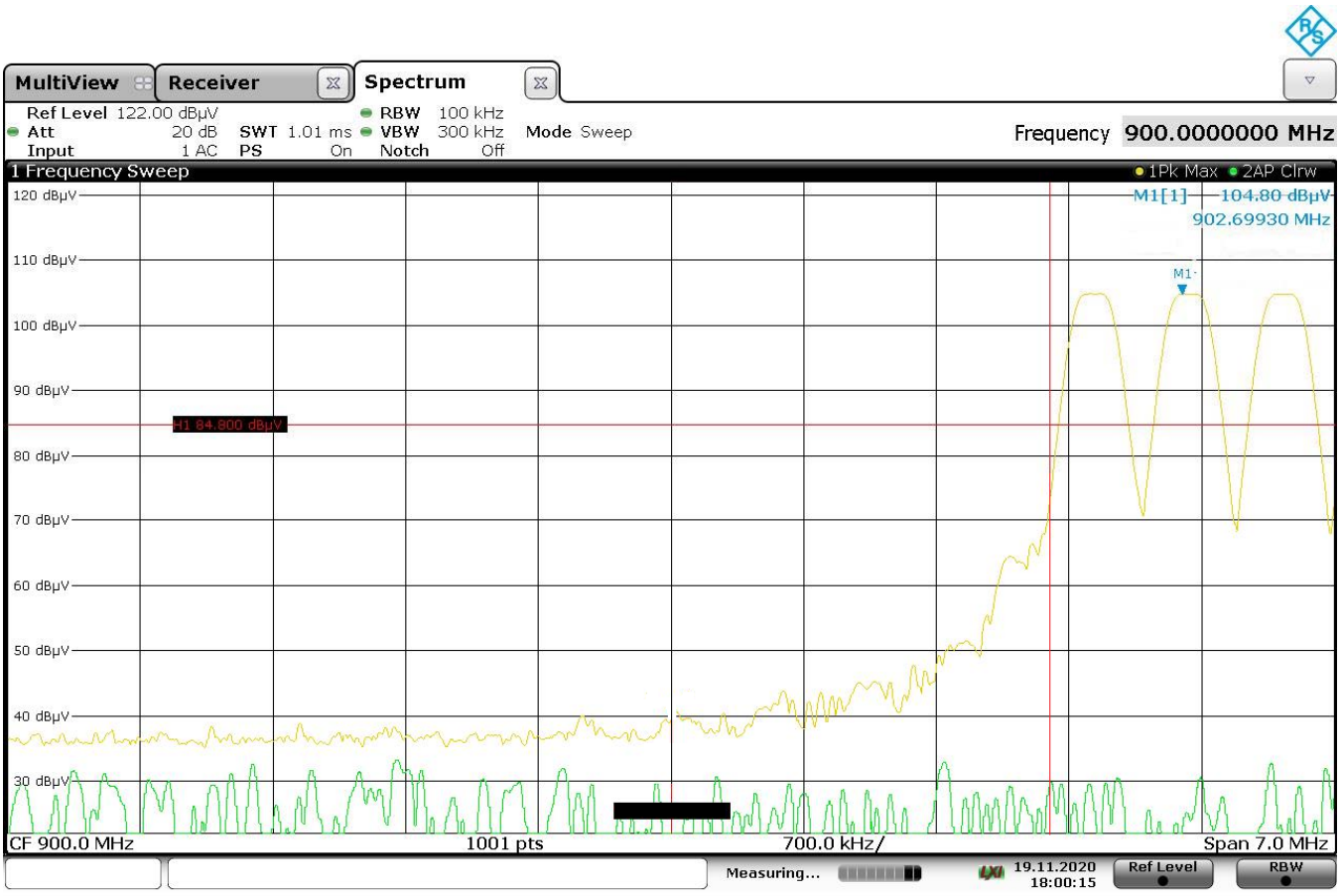
BAND EDGE – HIGH



18:35:03 18.11.2020

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Band Edge
MODE	FHSS
DATE TESTED	February 10 – 14, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	

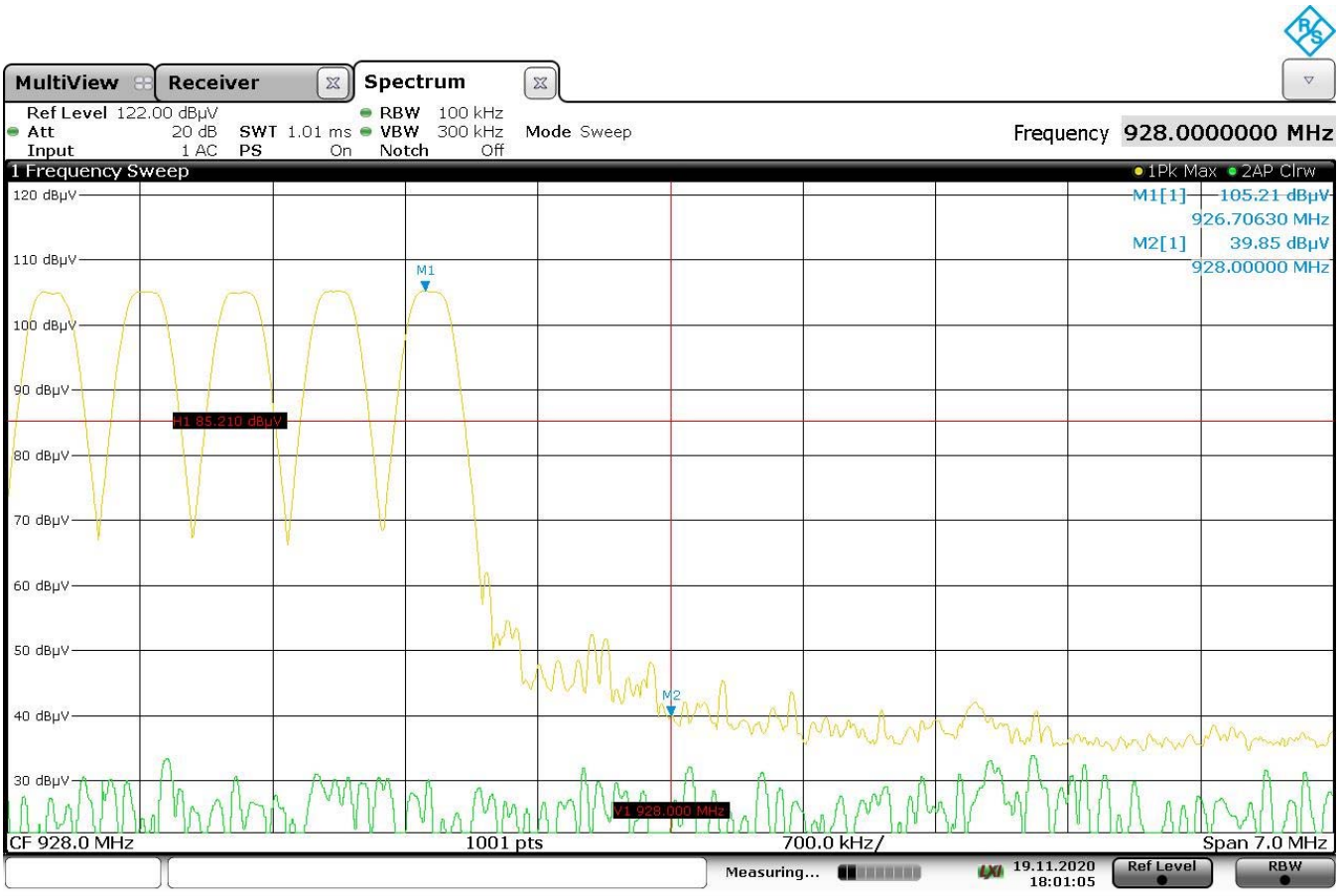
BAND EDGE – LOW



18:00:15 19.11.2020

DATA PAGE	
MANUFACTURER	The Chamberlain Group, Inc.
EUT	Automotive Transceiver for Garage Door Control
MODEL NO.	CDMRAA0101E3 (ARQ2-UGDO)
TEST	FCC §15.247, RSS-247 – Band Edge
MODE	FHSS
DATE TESTED	November 19, 2020
TEST PERFORMED BY	Tylar Jozefczyk
NOTES	

BAND EDGE – HIGH



18:01:06 19.11.2020