



Measurement of RF Interference from an ADX2FD Digitally Modulated Handheld Microphone Transmitter

For	Shure Incorporated 5800 West Touhy Avenue Niles, IL 60714
P.O. Number	4500380857
Date Received	November 13, 2017
Date Tested	November 17, 2017 through November 29, 2017
Test Personnel	Mark Longinotti
Specification	FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.207 and 15.247 for Digital Modulation Intentional Radiators Operating within the band 2400-2483.5MHz FCC "Code of Federal Regulations" Title 47, Part 15, Subpart 15B, Section 15.107 and 15.109 for Receivers

Test Report By: **MARK E. LONGINOTTI**
Mark Longinotti
EMC Engineer

Requested By: Alex Stelmaszczyk
Shure Incorporated

Approved By: **Raymond J. Klouda**
Raymond J. Klouda
Registered Professional
Engineer of Illinois - 44894

Elite Electronic Engineering Inc.

1516 CENTRE CIRCLE
DOWNERS GROVE, IL 60515

TEL: 630 - 495 - 9770

FAX: 630 - 495 - 9785

www.elitetest.com

TABLE OF CONTENTS

PARAGRAPH	DESCRIPTION OF CONTENTS	PAGE NO.
1.	INTRODUCTION	5
1.1	Scope of Tests	5
1.2	Purpose	5
1.3	Deviations, Additions and Exclusions	5
1.4	EMC Laboratory Identification	5
1.5	Laboratory Conditions	5
2.	APPLICABLE DOCUMENTS	5
3.	EUT SET-UP AND OPERATION	6
3.1	General Description	6
3.1.1	Power Input	6
3.1.2	Peripheral Equipment	6
3.1.3	Interconnect Cables	6
3.1.4	Grounding	6
3.1.5	Frequency of EUT	6
3.2	Software	6
3.3	Operational Mode	6
3.4	EUT Modifications	7
4.	TEST FACILITY AND TEST INSTRUMENTATION	7
4.1	Shielded Enclosure	7
4.2	Test Instrumentation	7
4.3	Calibration Traceability	7
4.4	Measurement Uncertainty	7
5.	TEST PROCEDURES	7
5.1	Receiver	7
5.2	Transmitter	7
5.2.1	Powerline Conducted Emissions	7
5.2.1.1	Requirements	7
5.2.2	6dB (DTS) Bandwidth	8
5.2.2.1	Requirements	8
5.2.2.2	Procedures	8
5.2.2.3	Results	8
5.2.3	Conducted Peak Output Power	8
5.2.3.1	Requirements	8
5.2.3.2	Procedures	8
5.2.3.3	Results	9
5.2.4	EIRP	9
5.2.4.1	Requirements	9
5.2.4.2	Procedures	9
5.2.4.3	Results	9
5.2.5	Duty Cycle Factor Measurements	9
5.2.5.1	Requirements	9
5.2.5.2	Procedures	10
5.2.5.3	Results	10
5.2.6	Radiated Spurious Emissions Measurements	10
5.2.6.1	Requirements	10
5.2.6.2	Procedures	11
5.2.6.3	Results	12
5.2.7	Band Edge Compliance	12

THIS REPORT SHALL NOT BE REPRODUCED, EXCEPT IN FULL, WITHOUT THE
WRITTEN APPROVAL OF ELITE ELECTRONIC ENGINEERING INCORPORATED.

5.2.7.1	Requirements	12
5.2.7.2	Procedures	12
5.2.7.2.1	Low Band Edge	12
5.2.7.2.2	High Band Edge.....	13
5.2.7.3	Results.....	13
5.2.8	Power Spectral Density	13
5.2.8.1	Requirement	13
5.2.8.2	Procedures	14
5.2.8.3	Results.....	14
6.	CONCLUSIONS	14
7.	CERTIFICATION	14
8.	ENDORSEMENT DISCLAIMER	14
9.	EQUIPMENT LIST	15
Table 9-1 Equipment List.....		15

REVISION HISTORY

Revision	Date	Description
—	07 Dec 2017	Initial release

Measurement of RF Emissions from a Digitally Modulated Handheld Microphone Transmitter, Part No. ADX2FD

1. INTRODUCTION

1.1 Scope of Tests

This document represents the results of the series of radio interference measurements performed on a Shure Incorporated Digitally Modulated Handheld Microphone Transmitter, Part No. ADX2FD (hereinafter referred to as the EUT). The EUT was manufactured and submitted for testing by Shure Incorporated located in Niles, IL.

The EUT contained a digital modulation Zigbee transceiver. The transceiver was designed to transmit and receive in the 2400-2483.5 MHz band using an integral, non-removable antenna.

The EUT also contained a transmitter that was designed to either transmit on a single frequency (non-diversity mode) or transmit simultaneously (diversity mode) on two independent channels in the following band using an integral, non-removable antenna:

Band	Frequency (MHz)	Serial No. Used for Antenna Port Tests	Serial No. Used for Radiated Emissions Tests	FCC Rule Part	Mode	Output Power (mW)
G57	470.125 – 607.875	292	307	74.861	Non-Diversity	2,10, 50
G57	470.125 – 607.875	292	307	74.861	Diversity	2,10, 20

See Elite Electronic Engineering, Inc. Engineering Test Report No. 1703407-01 for compliance testing on the UHF transmitter and the intermodulation testing on the UHF transmitter and Zigbee transmitter.

1.2 Purpose

The test series was performed to determine if the EUT meets the conducted RF emission requirements, radiated RF emissions requirements, and additional provisions of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart B, Sections 15.107 and 15.109, for receivers and Subpart C, Sections 15.207 and 15.249 for Intentional Radiators Operating within the 2400-2483.5 MHz band.

Testing was performed in accordance with ANSI C63.4-2014 and ANSI 63.10-2013.

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 23%.

2. APPLICABLE DOCUMENTS

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

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

- ANSI C63.4-2014, "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"
- ANSI C63.10-2013, "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices"
- Federal Communications Commission Office of Engineering and Technology Laboratory Division, Guidance For Performing Compliance Measurements On Digital Transmissions Systems (DTS) Operating Under §15.247
April 5, 2017

3. EUT SET-UP AND OPERATION

3.1 General Description

The EUT is a Digitally Modulated Handheld Microphone Transmitter, Part No. ADX2FD. A block diagram of the EUT setup is shown as Figure 1 and Figure 2. A photograph of the EUT is shown as Figure 3.

3.1.1 Power Input

The EUT was powered by 3.6VDC from a removable, rechargeable Li-ion Battery Pack, Shure Model No.: SB920.

3.1.2 Peripheral Equipment

The following peripheral equipment was submitted with the EUT:

Item	Description
Shure SM58 Microphone	Connected to the microphone port of the EUT for all radiated emissions tests.

3.1.3 Interconnect Cables

No interconnect cables were submitted with the EUT.

3.1.4 Grounding

The EUT was not grounded.

3.1.5 Frequency of EUT

The EUT was equipped with a Zigbee transmitter that operated in the 2400MHz to 2483.5MHz band. Per CFR Title 47, Part 15, Section 15.33 (a)(1), for an intentional radiator, the spectrum shall be investigated up to the tenth harmonic of the highest fundamental frequency.

3.2 Software

For all tests, the EUT had Firmware Version 1.0.14 loaded onto the device to provide correct load characteristics.

3.3 Operational Mode

The EUT and all peripheral equipment were energized. The EUT was programmed to operate in one of the following modes:

Transmit at 2405MHz, mid-power, txmod mode (modulated signal with 100% duty cycle)
Transmit at 2445MHz, mid-power, txmod mode (modulated signal with 100% duty cycle)
Transmit at 2480MHz, mid-power, txmod mode (modulated signal with 100% duty cycle)

Note – mid-power is the highest power setting for the Zigbee transmitter.

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 utilizing 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 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

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

5.2 Transmitter

5.2.1 Powerline Conducted Emissions

5.2.1.1 Requirements

Since the EUT is powered by internal batteries and has no connections for AC power, no conducted emissions

tests are required.

5.2.2 6dB (DTS) Bandwidth

5.2.2.1 Requirements

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

5.2.2.2 Procedures

- a) The antenna port of the EUT was connected to the DUT 1 port of the Rohde & Schwarz OSP 120/OSP-B157 system via a coaxial cable and RF attenuator.
- b) The Rohde & Schwarz OSP 120 RF switches were used to connect the inputs of the DUT 1 port to the inputs of the ESW 44 EMI Test Receiver via a coaxial cable.
- c) The EUT was powered up and set to Transmit at 2405MHz, mid-power.
- d) The following settings were employed on the EMI Test Receiver:

Center Frequency	= Transmit frequency of the EUT
Frequency Span	= 3MHz
RBW	= 100kHz
VBW	= 3 x RBW
Detector Mode	= Peak
Trace Mode	= Max Hold
- e) Allow the trace to stabilize.
- f) Find the maximum peak value of the trace.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission
- h) Use the 99 % bandwidth function of the EMI Test Receiver to measure the Occupied Channel Bandwidth of the EUT.
- i) Steps (d) through (h) were repeated for the remaining modes listed in paragraph 3.3.

5.2.2.3 Results

The data on pages 22 through 24 show that the minimum 6 dB bandwidth was 1.5MHz which is greater than minimum allowable 6dB bandwidth requirement of 500kHz for systems using digital modulation techniques. The 99% bandwidth was measured to be 2.71MHz.

5.2.3 Conducted Peak Output Power

5.2.3.1 Requirements

Per section 15.247(b)(3), for systems using digital modulation the maximum peak output conducted power shall not be greater than 1.0W (30dBm).

5.2.3.2 Procedures

- a) The antenna port of the EUT was connected to the DUT 1 port of the Rohde & Schwarz OSP 120/OSP-B157 system via a coaxial cable and RF attenuator.
- b) The Rohde & Schwarz OSP 120 RF switches were used to connect the inputs of the DUT 1 port to the inputs of the ESW 44 EMI Test Receiver via a coaxial cable.
- c) The EUT was powered up and set to Transmit at 2405MHz, mid-power.

d) The following settings were employed on the EMI Test Receiver:

Center Frequency	= Transmit frequency of the EUT
Frequency Span	= 0Hz
RBW	= 2MHz
VBW	= 2MHz
Sweep Points	= 101
Sweep Time	= 2 sec
Detector Mode	= Peak
Trace Mode	= Max Hold

e) Find the maximum peak value of the trace.

f) Steps (d) and (e) were repeated for the remaining modes listed in paragraph 3.3.

5.2.3.3 Results

The results are presented on pages 25 through 27. The maximum peak conducted output power from the transmitter was 7.8mW (8.9 dBm) which is below the 1 Watt limit.

5.2.4 EIRP

5.2.4.1 Requirements

Per section 15.247(b)(3), for systems using digital modulation the maximum peak output conducted power shall not be greater than 1.0W (30dBm). Per section 15.247(b)(4), this limit is based on the use of antennas with directional gains that do not exceed 6dBi. Since the limit allows for a 6dBi antenna gain, the maximum EIRP can be increased by 6dB to 4 Watt (36dBm).

5.2.4.2 Procedures

The EUT was placed on a 1.5 meter high non-conductive stand and set to transmit. A double ridged waveguide antenna was placed at a test distance of 3 meters from the EUT. The resolution bandwidth (RBW) of the spectrum analyzer was set to greater than the 6dB bandwidth. The EUT was maximized for worst case emissions (or maximum output power) at the measuring antenna. The maximum meter reading was recorded. The peak power output was measured for the low, middle and high channels.

The equivalent power was determined from the field intensity levels measured at 3 meters using the substitution method. To determine the emission power, a second double ridged waveguide antenna was then set in place of the EUT and connected to a calibrated signal generator. The output of the signal generator was adjusted to match the received level at the spectrum analyzer. The signal level was recorded. The reading was then corrected to compensate for cable loss and antenna gain, as required. The peak power output was calculated for low, middle, and high frequencies.

5.2.4.3 Results

The results are presented on page 28. The maximum EIRP measured from the transmitter was 14.4dBm or 27.5mW which is below the 4 Watt limit.

5.2.5 Duty Cycle Factor Measurements

5.2.5.1 Requirements

Per CFR Title 47, Part 15, Section 15.35(c), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

Per Federal Communications Commission Office of Engineering and Technology Laboratory Division, Guidance

For Performing Compliance Measurements On Digital Transmissions Systems (DTS) Operating Under §15.247, dated April 5, 2017, section 12.2.5.2, the duty cycle reduction factor expressed in Section 15.35(c) can be utilized for determining the unwanted emissions (including spurious emissions) in the 2483.5-2500 MHz restricted band for a DTS device (e.g., ZigBee devices) approved under Section 15.247, if the following conditions are met:

- i) The unwanted emission is temporally related to the fundamental emission (i.e., the skirt of the fundamental falls into the 2483.5-2500 MHz restricted frequency band);
- ii) The unwanted emission falls into a restricted frequency band (e.g., 2483.5-2500 MHz); and
- iii) The maximum duty cycle used in determining the reduction factor is “hardwired” such that under no condition can it be changed or modified by either the device or the end user; and iv) A documented justification for use of Section 15.35(c), including the measurements used to determine the worst-case duty cycle, must be included in the test report.

5.2.5.2 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.

The duty cycle calculation was provided in Shure document “Duty Cycle Measurement of Shure AXT610 Wireless Access Point for FCC Regulatory Approval”, dated December 6, 2010.

This test was performed with the AXT610 communicating with 16 portables. Ten (10) consecutive measurements were taken in 2 second intervals and the amount of captured packets in each 2 second interval was counted. The mean number of packets for the ten 2 second intervals was calculated. The standard deviation was then calculated. For “worst case” duty cycle, 3 standard deviations were added to the mean number of packets for the ten 2 second intervals (# packets = Mean + (3 x STDEV)).

5.2.5.3 Results

From the Shure document, “Duty Cycle Measurement of Shure AXT610 Wireless Access Point for FCC Regulatory Approval”, December 6, 2010, the pulse width is 0.46 msec and 2.636 pulses will be transmitted in a 100msec period. The duty cycle factor was calculated to be $20 \cdot \log(0.46 \text{ pulse width} \times 2.636 \text{ pulses} / 100\text{msec}) = -38.3\text{dB}$.

5.2.6 Radiated Spurious Emissions Measurements

5.2.6.1 Requirements

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

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

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

5.2.6.2 Procedures

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

Preliminary radiated emissions tests were performed to determine the emission characteristics of the EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 30MHz to 25GHz was investigated using a peak detector function.

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

- 1) For all harmonics not in the restricted bands, the following procedure was used:
 - a) The field strength of the fundamental was measured using a double ridged waveguide antenna. The double ridged 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 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 1 GHz were measured using a bi-log antenna. The bi-log antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on an 80cm high non-conductive stand. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.
 - b) The field strengths of all emissions above 1 GHz were measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on a 1.5 meter high non-conductive stand. A peak detector with a resolution bandwidth of 1 MHz was used on the spectrum analyzer.
 - c) To ensure that maximum or worst case emission levels were measured, the following steps were taken when taking all measurements:
 - i) The EUT was rotated so that all of its sides were exposed to the receiving antenna.
 - ii) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were

measured.

- iii) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.
- iv) In instances where it was necessary to use a shortened cable between the measuring antenna and the spectrum analyzer. The measuring antenna was not raised or lowered to ensure maximized readings, instead the EUT was rotated through all axis to ensure the maximum readings were recorded for the EUT.
- d) For all radiated emissions measurements below 1 GHz, if the peak reading is below the limits listed in 15.209(a), no further measurements are required. If however, the peak readings exceed the limits listed in 15.209(a), then the emissions are remeasured using a quasi-peak detector.
- e) For all radiated emissions measurements above 1 GHz, the peak readings must comply with the 15.35(b) limits. 15.35(b) states that when average radiated emissions measurements are specified, there also is a limit on the peak level of the radiated emissions. The limit on the peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. Therefore, all peak readings above 1 GHz must be no greater than 20 dB above the limits specified in 15.209(a).
- f) Next, for all radiated emissions measurements above 1GHz, the resolution bandwidth was set to 1MHz. The analyzer was set to linear mode with a 10Hz video bandwidth in order to simulate an average detector. An average reading was taken.

5.2.6.3 Results

5.2.6.3.1 Transmit at 2405MHz:

Preliminary radiated emissions plots are shown on pages 29 through 36. Final radiated emissions data are presented on data pages 37 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 on Figures 4 through 6.

5.2.6.3.2 Transmit at 2445MHz:

Preliminary radiated emissions plots are shown on pages 40 through 47. Final radiated emissions data are presented on data pages 48 through 50. As can be seen from the data, all emissions measured from the EUT were within the specification limits. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown on Figures 4 through 6.

5.2.6.3.3 Transmit at 2480MHz:

Preliminary radiated emissions plots are shown on pages 51 through 58. Final radiated emissions data are presented on data pages 59 through 61. As can be seen from the data, all emissions measured from the EUT were within the specification limits. Photographs of the test configuration which yielded the highest, or worst case, radiated emission levels are shown on Figures 4 through 6.

5.2.7 Band Edge Compliance

5.2.7.1 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).

5.2.7.2 Procedures

5.2.7.2.1 Low Band Edge

- a) The antenna port of the EUT was connected to the DUT 1 port of the Rohde & Schwarz OSP 120/OSP-B157 system via a coaxial cable and RF attenuator.
- b) The Rohde & Schwarz OSP 120 RF switches were used to connect the inputs of the DUT 1 port to the inputs of the ESW 44 EMI Test Receiver via a coaxial cable.
- c) The EUT was powered up and set to Transmit at 2405MHz, mid-power.
- d) The following settings were employed on the EMI Test Receiver:

Center Frequency	= 2400MHz
Frequency Span	= 173.5MHz
RBW	= 100kHz
VBW	= 300kHz
Sweep Points	= 1670
Sweep Time	= 1.67msec
Detector Mode	= Peak
Trace Mode	= Max Hold
- e) Find the maximum peak value of the trace.
- f) The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
- g) The marker was set on the peak of the in-band emissions. A display line was placed 20dB down from the peak of the in-band emissions. All emissions which fall outside of the authorized band of operation must be below the 20dB down display line. (All emissions to the left of the center frequency (band-edge) must be below the display line.

5.2.7.2.2 High Band Edge

- 1) The EUT was set to transmit continuously at the channel closest to the high band-edge.
- 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.
- 8) The duty cycle correction factor was added to the average reading.

5.2.7.3 Results

Pages 62 through 64 show the band-edge compliance results. As can be seen from these plots, the conducted emissions at the low end band-edge are within the 20 dB down limits. The radiated emissions at the high end band-edge are within the general limits.

5.2.8 Power Spectral Density

5.2.8.1 Requirement

Per section 15.247(e), the peak power spectral density from the intentional radiator shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

5.2.8.2 Procedures

- a) The antenna port of the EUT was connected to the DUT 1 port of the Rohde & Schwarz OSP 120/OSP-B157 system via a coaxial cable and RF attenuator.
- b) The Rohde & Schwarz OSP 120 RF switches were used to connect the inputs of the DUT 1 port to the inputs of the ESW 44 EMI Test Receiver via a coaxial cable.
- c) The EUT was powered up and set to transmit at 2405MHz, mid-power.
- d) The following settings were employed on the EMI Test Receiver:

Center Frequency	= Transmit frequency of the EUT
Frequency Span	= 2.25MHz
RBW	= 3kHz
VBW	= 10kHz
Sweep Points	= 1500
Sweep Time	= 50 sec
Detector Mode	= Peak
Trace Mode	= Max Hold

- e) Find the maximum peak value of the trace.
- f) Steps (d) and (e) were repeated for the remaining modes listed in paragraph 3.3.

5.2.8.3 Results

Pages 65 through 67 show the power spectral density results. As can be seen from these plots, the peak power density is less than 8dBm in a 3kHz band during any time interval of continuous transmission.

6. CONCLUSIONS

It was determined that the Shure Incorporated Digitally Modulated Handheld Microphone Transmitter, Part No. ADX2FD digital modulation 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 2400-2483.5 MHz band, when tested per ANSI C63.4-2014 and 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

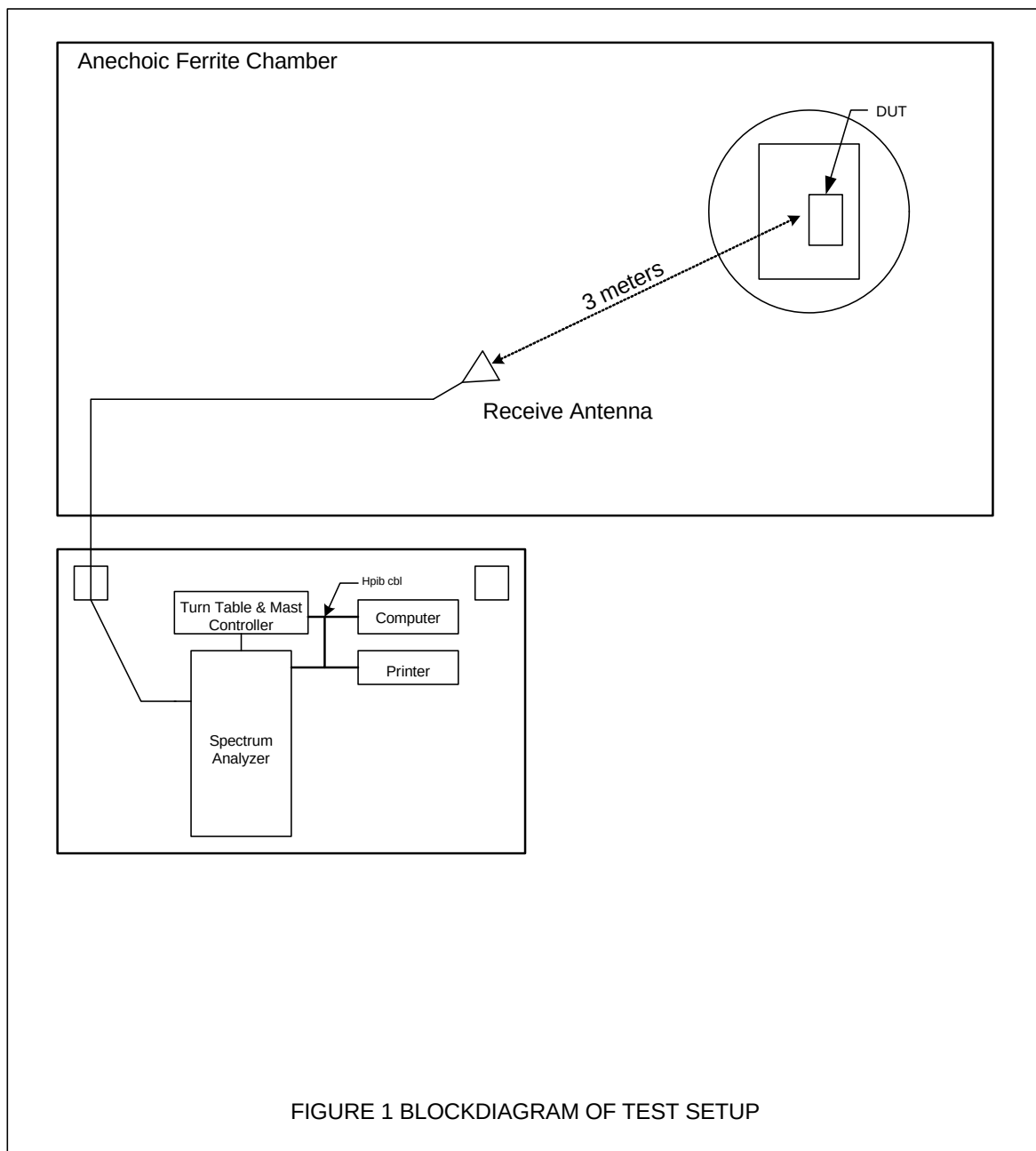
Table 9-1 Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
APW0	PREAMPLIFIER	PLANAR ELECTRONICS	PE2-30-20G20R6G	PL2926/0646	20GHZ-26.5GHZ	3/22/2017	3/22/2018
APW11	PREAMPLIFIER	PMI	PE2-35-120-5R0-10-12-SFF	PL11685/1241	1GHZ-20GHZ	3/22/2017	3/22/2018
CDU2	LAPTOP COMPUTER	DELL	PRECISION	---	---	N/A	
GRE2	SIGNAL GENERATOR	AGILENT	E4438C	MY42081749	250KHZ-6GHZ	3/21/2017	3/21/2018
GSFA	OSP-B157 OSP MODULE	ROHDE & SCHWARZ	OSP-B157	100867		10/10/2017	10/10/2018
GSFB	OSP120 BASE UNIT	ROHDE & SCHWARZ	OSP120	101246	---	10/10/2017	10/10/2018
NHG0	STANDARD GAIN HORN ANTENNA	NARDA	638	---	18-26.5GHZ	NOTE 1	
NTA3	BILOG ANTENNA	TESEQ	6112D	32853	25-1000MHz	9/11/2017	9/11/2018
NWQ0	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66657	1GHZ-18GHZ	5/18/2016	5/18/2018
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	4/4/2016	4/4/2018
RBG0	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101533	10HZ-44GHZ	11/10/2016	12/10/2017
RBG2	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101591	2HZ-44GHZ	11/22/2016	12/22/2017
SHC2	Power Supplies	HENGFU	HF60W-SL-24	A11372702	24V	NOTE 1	
XOB2	ADAPTER	HEWLETT PACKARD	K281C.012	09407	18-26.5GHZ	NOTE 1	
XPR0	HIGH PASS FILTER	K&L MICROWAVE	11SH10-4800/X20000	001	4.8-20GHZ	9/12/2017	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.



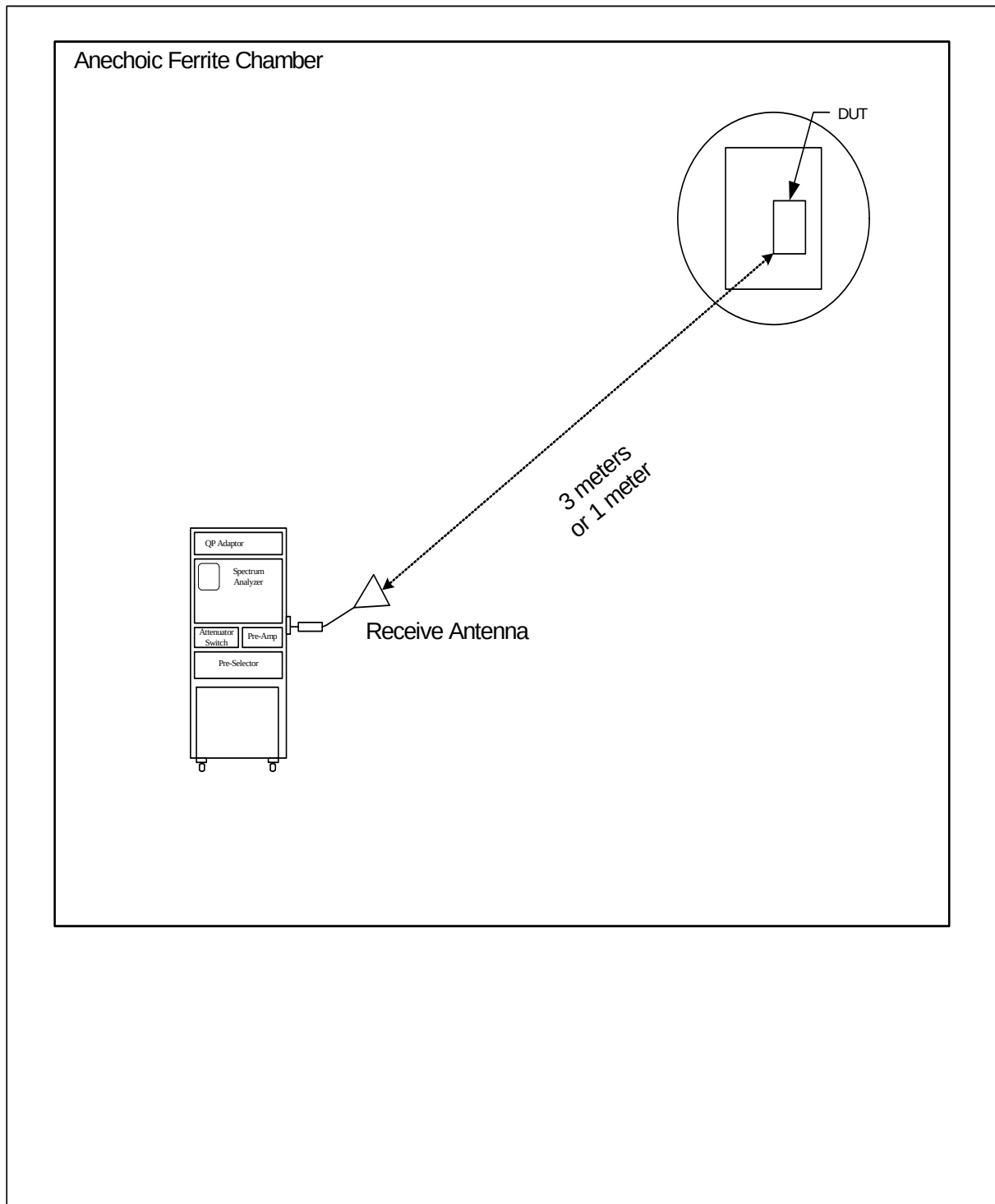


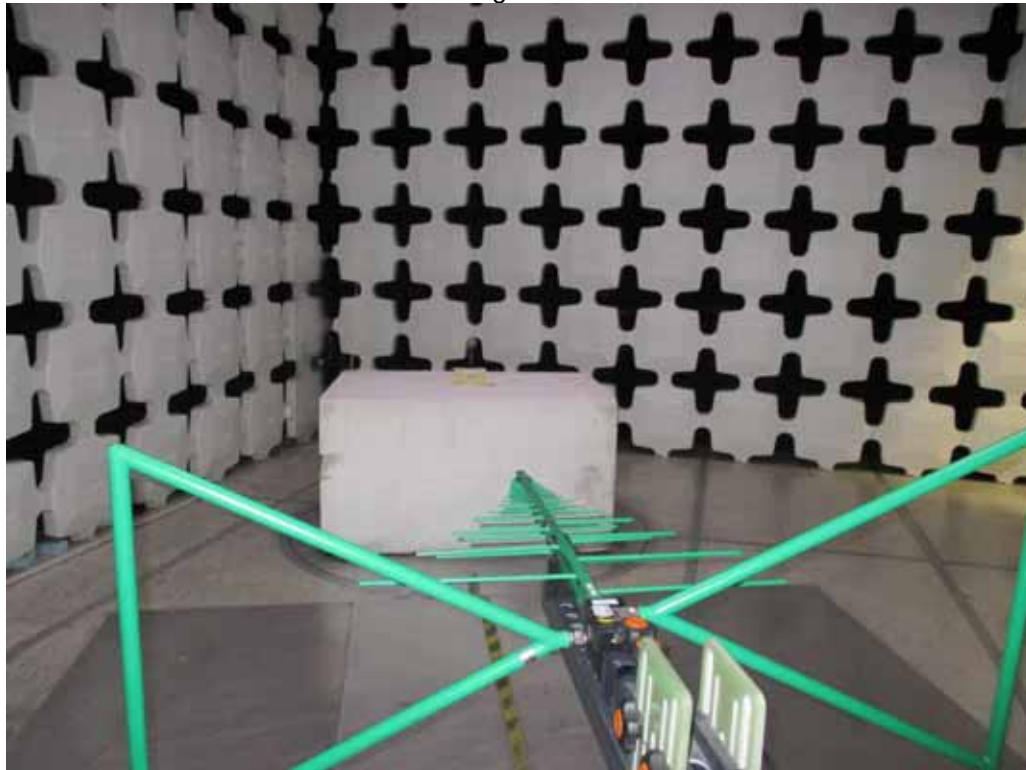
Figure 2: BLOCK DIAGRAM OF TEST SETUP FOR RADIATED EMISSIONS ABOVE 18GHZ

Figure 3

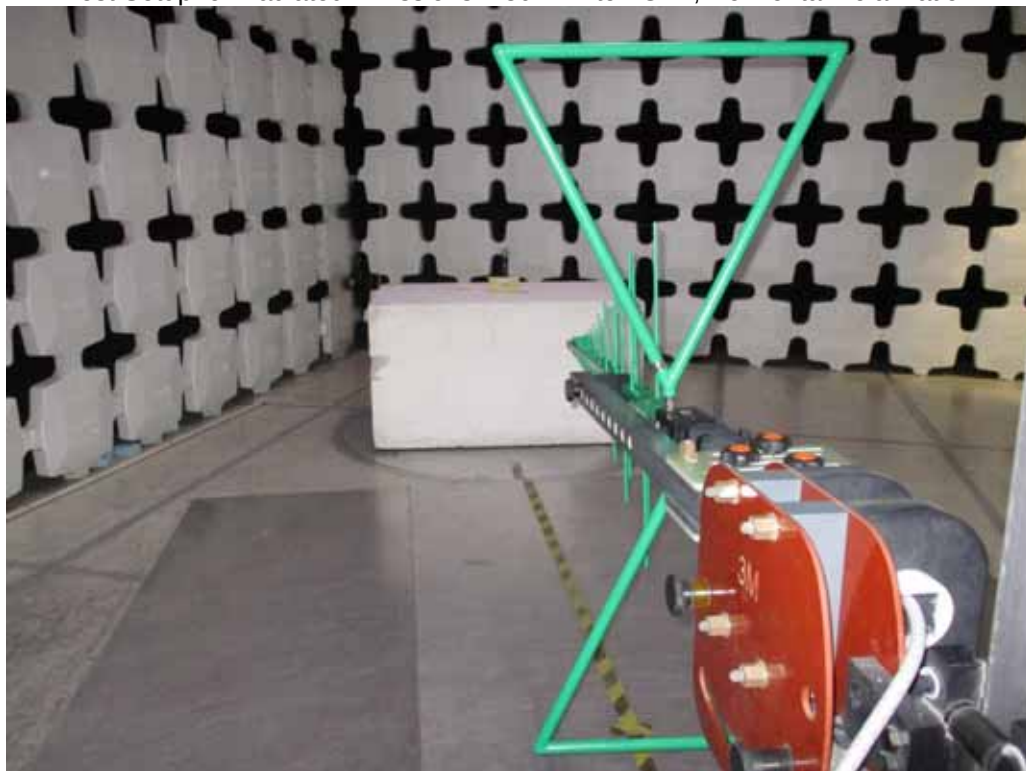


Photograph of EUT

Figure 4

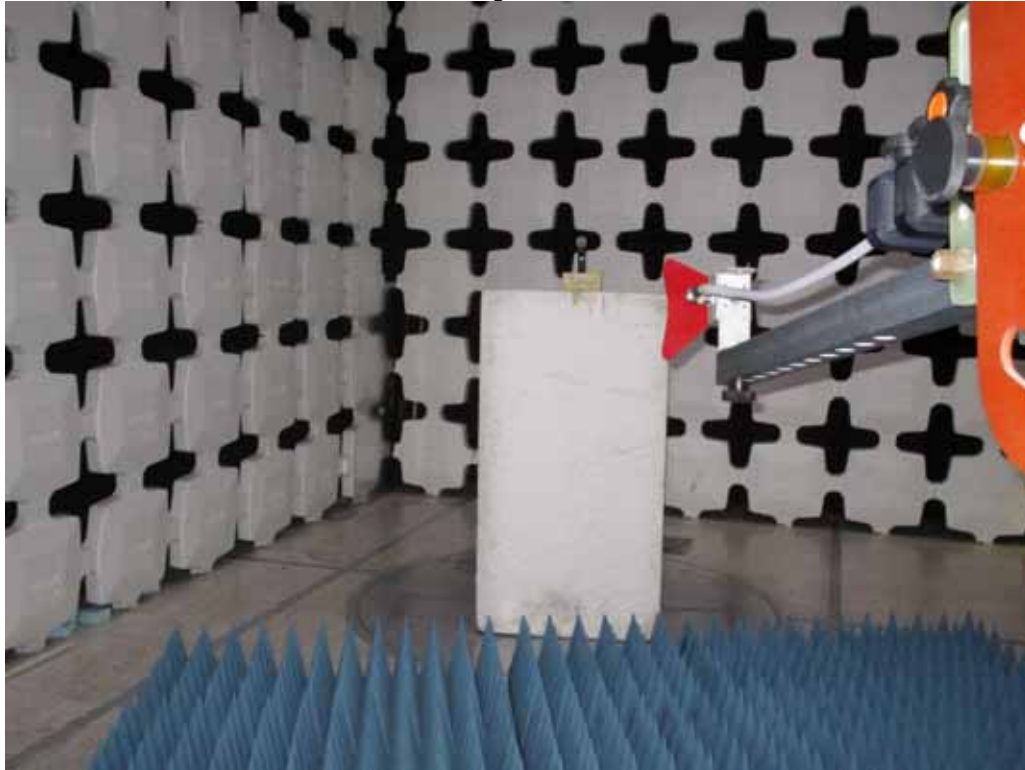


Test Setup for Radiated Emissions – 30MHz to 1GHz, Horizontal Polarization



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

Figure 5

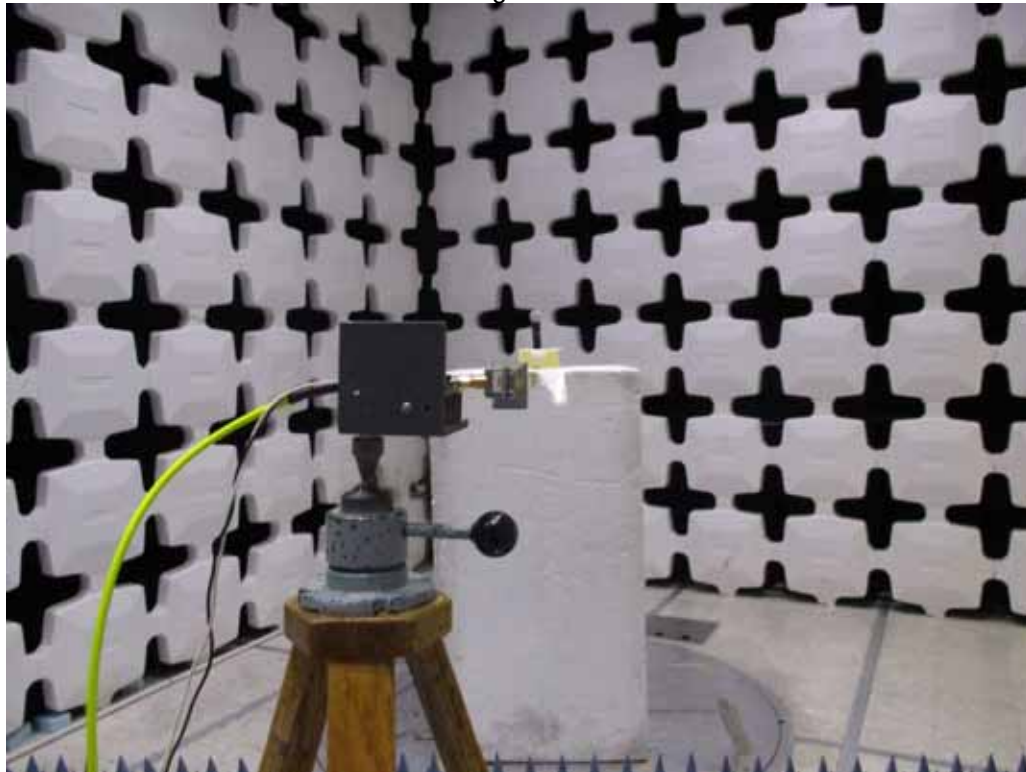


Test Setup for Radiated Emissions – 1GHz to 18GHz, Horizontal Polarization

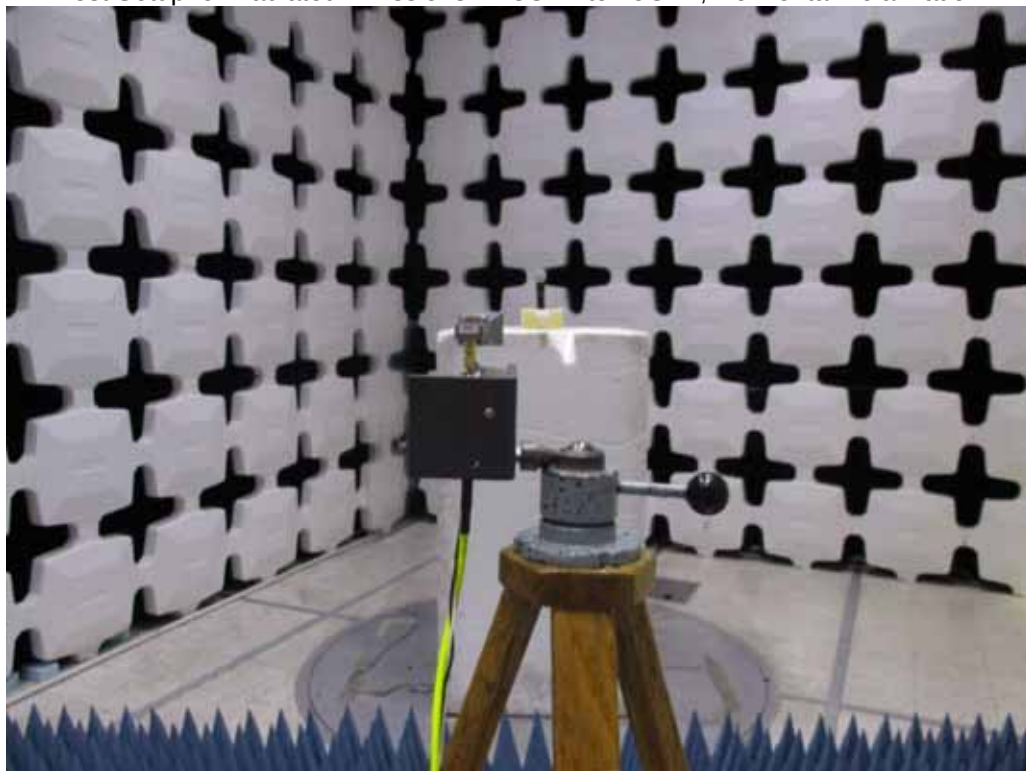


Test Setup for Radiated Emissions – 1GHz to 18GHz, Vertical Polarization

Figure 6



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

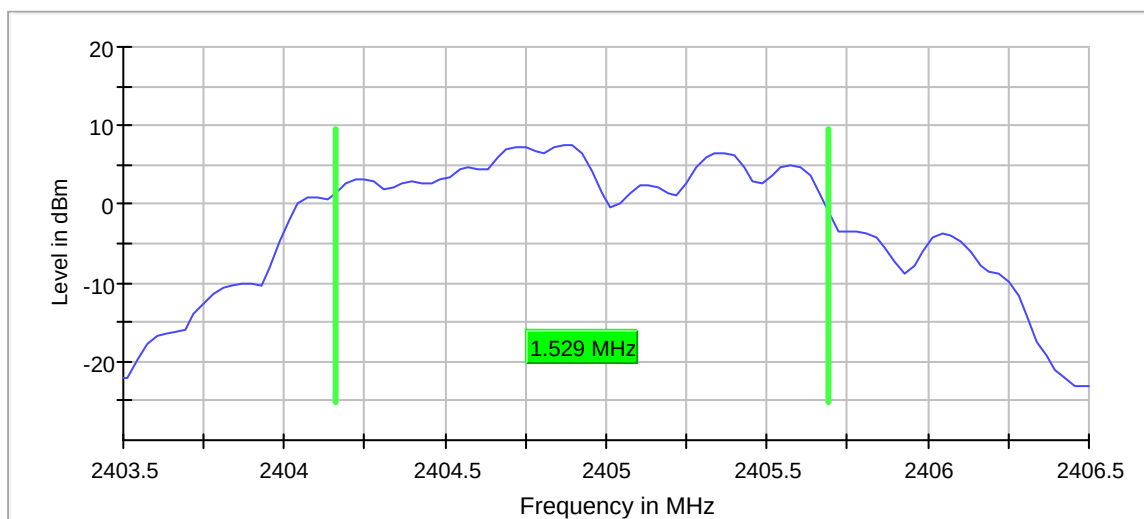


Test Setup for Radiated Emissions – 18GHz to 25GHz, Vertical Polarization

Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 292
 Mode : Zigbee Transmit at 2405MHz (Channel 11), mid power
 Test Specification : FCC-15.247, 6dB bandwidth
 Date : November 20, 2017
 Notes : RF Mute On

6 dB Bandwidth

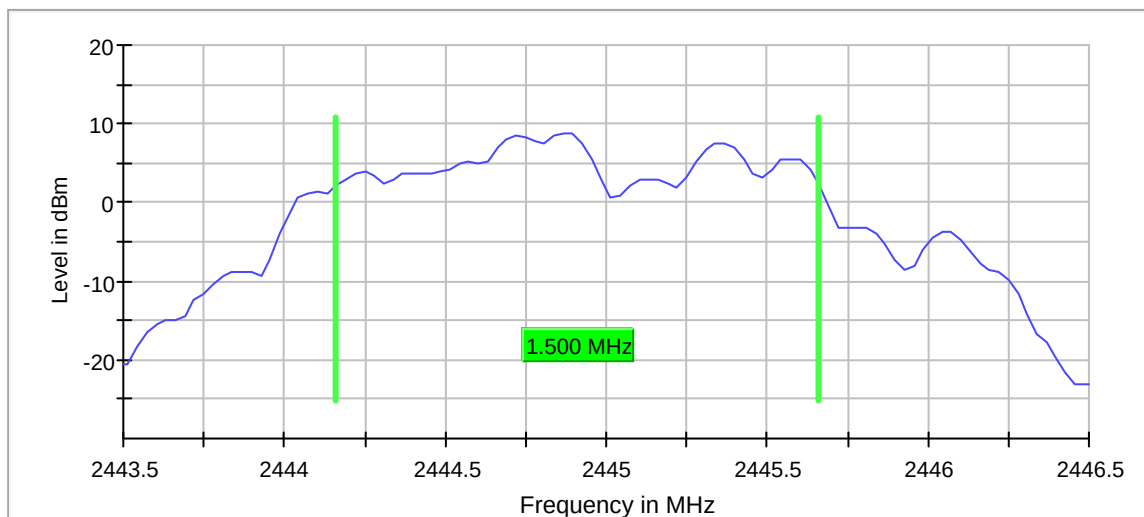
DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2405.000000	1.529411	0.500000	---	2404.161765	2405.691176	7.6	PASS



Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 292
 Mode : Zigbee Transmit at 2445MHz (Channel 19), mid power
 Test Specification : FCC-15.247, 6dB bandwidth
 Date : November 20, 2017
 Notes : RF Mute On

6 dB Bandwidth

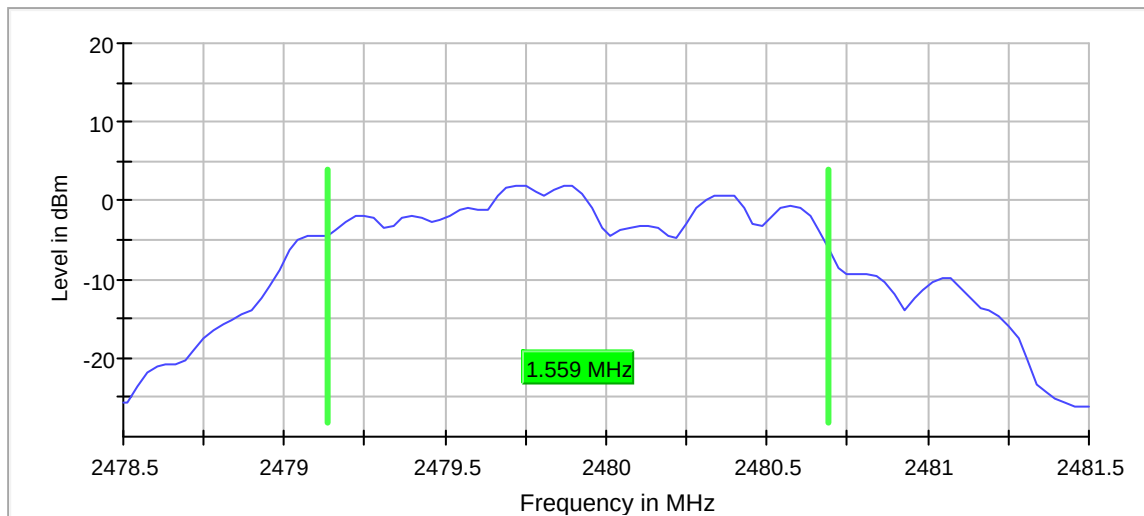
DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2445.000000	1.500000	0.500000	---	2444.161765	2445.661765	8.9	PASS



Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 292
 Mode : Zigbee Transmit at 2480MHz (Channel 26), mid power
 Test Specification : FCC-15.247, 6dB bandwidth
 Date : November 20, 2017
 Notes : RF Mute On

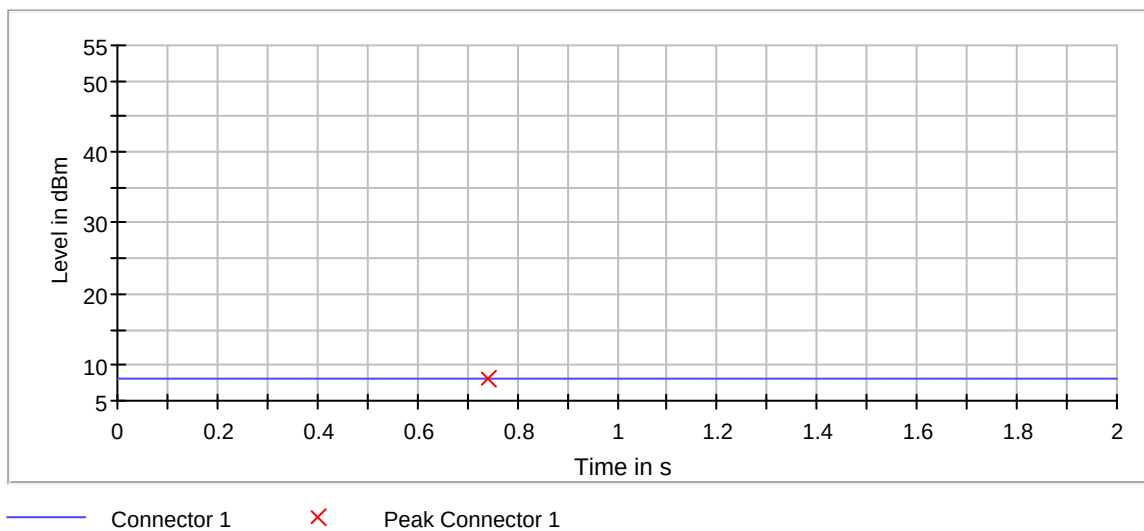
6 dB Bandwidth

DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
2480.000000	1.558823	0.500000	---	2479.132353	2480.691176	2.0	PASS



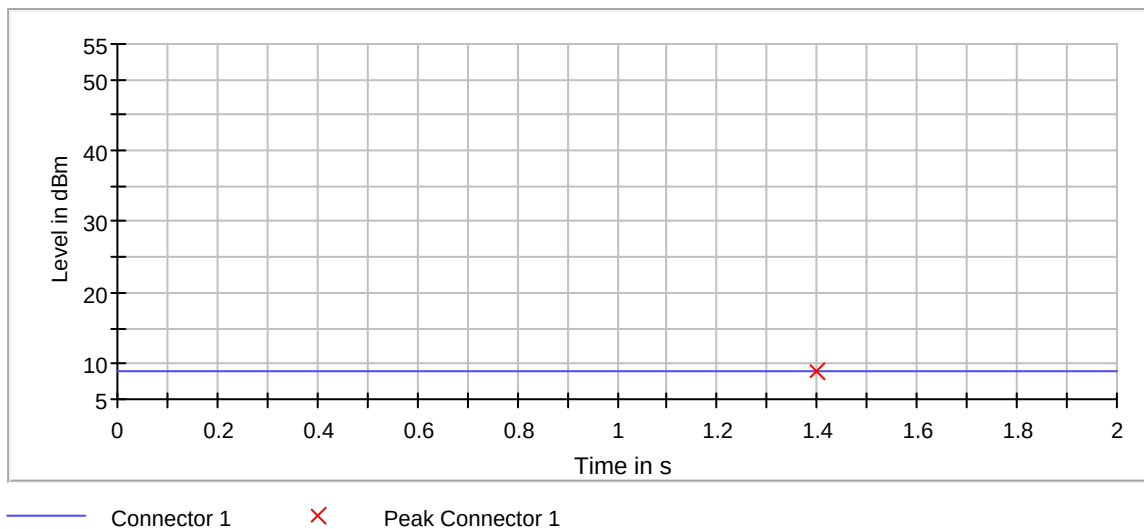
Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 292
 Mode : Zigbee Transmit at 2405MHz (Channel 11), mid power
 Test Specification : FCC-15.247, Peak Conducted Output Power
 Date : November 20, 2017
 Notes : RF Mute On

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2405.000000	8.1	30.0	PASS



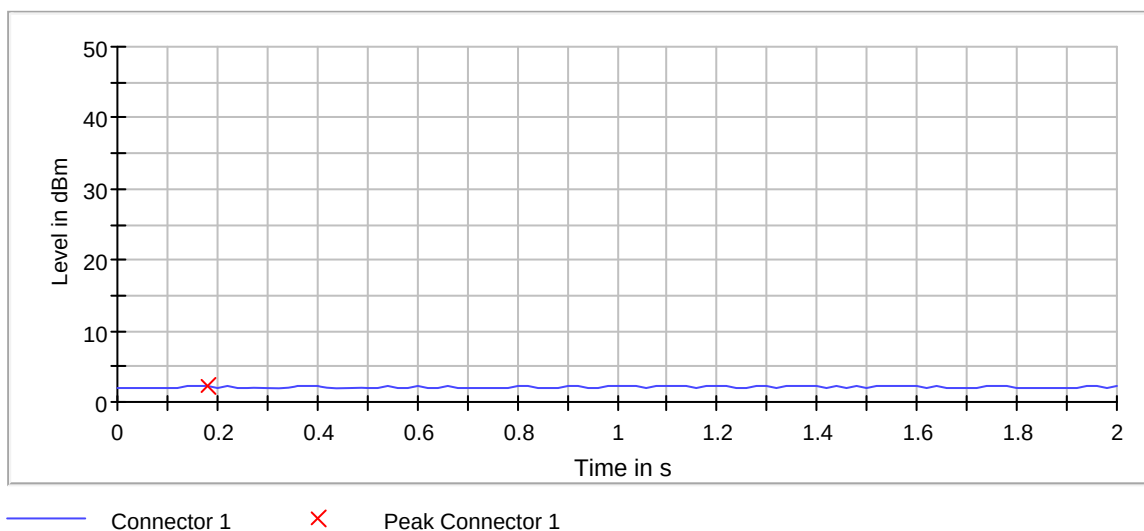
Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 292
 Mode : Zigbee Transmit at 2445MHz (Channel 19), mid power
 Test Specification : FCC-15.247, Peak Conducted Output Power
 Date : November 20, 2017
 Notes : RF Mute On

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2445.000000	8.9	30.0	PASS



Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 292
 Mode : Zigbee Transmit at 2480MHz (Channel 26), mid power
 Test Specification : FCC-15.247, Peak Conducted Output Power
 Date : November 20, 2017
 Notes : RF Mute On

DUT Frequency (MHz)	Peak Power (dBm)	Limit Max (dBm)	Result
2480.000000	2.2	30.0	PASS



Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 292
 Mode : See Below
 Test Specification : FCC-15.247, EIRP
 Date : November 21, 2017
 Test Distance : 3 meters
 Notes :

Transmit at 2405MHz, Medium power

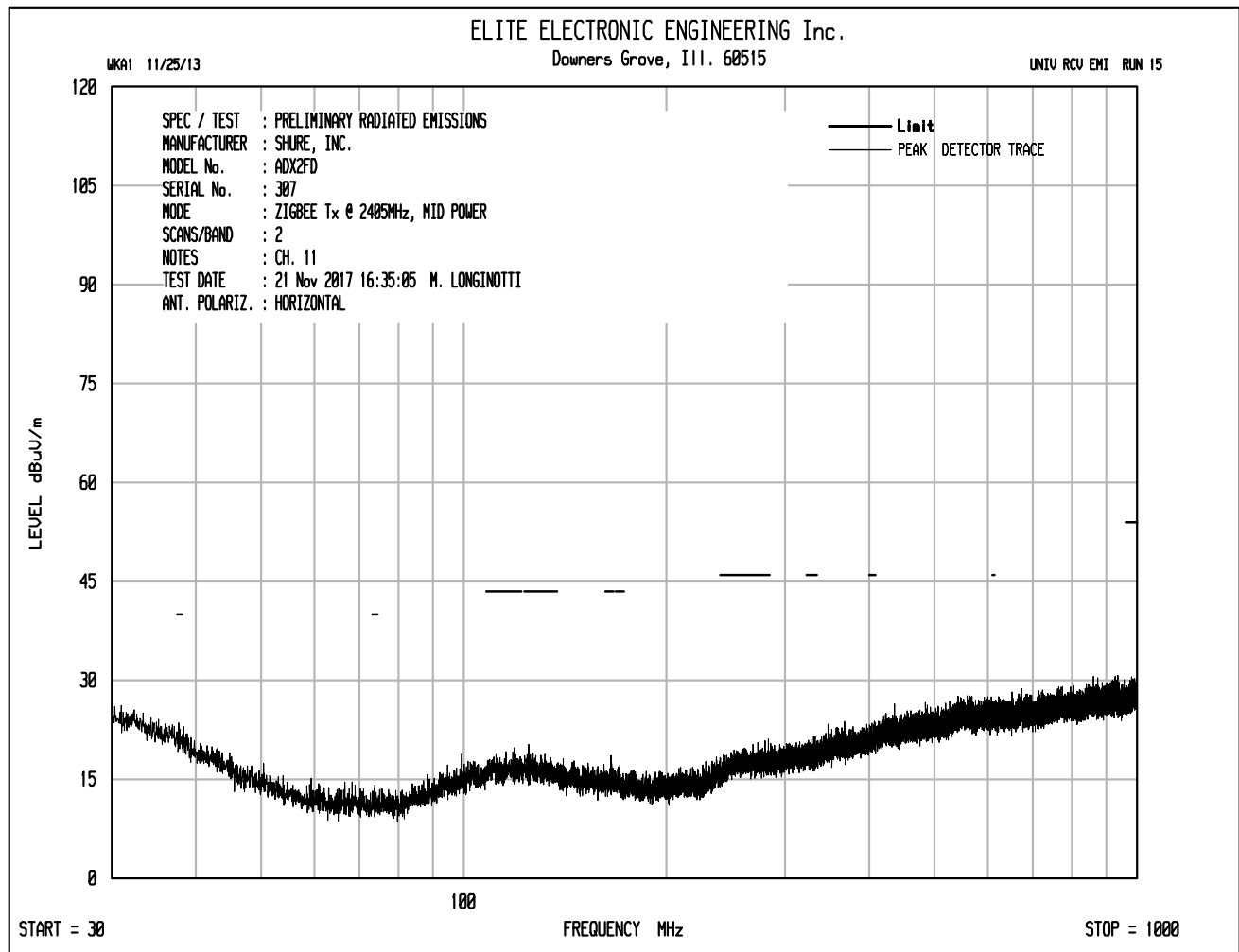
Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2405.00	H	63.1	0.8	5.9	3.4	3.2	36.0	-32.8
2405.00	V	72.6	10.8	5.9	3.4	13.2	36.0	-22.8

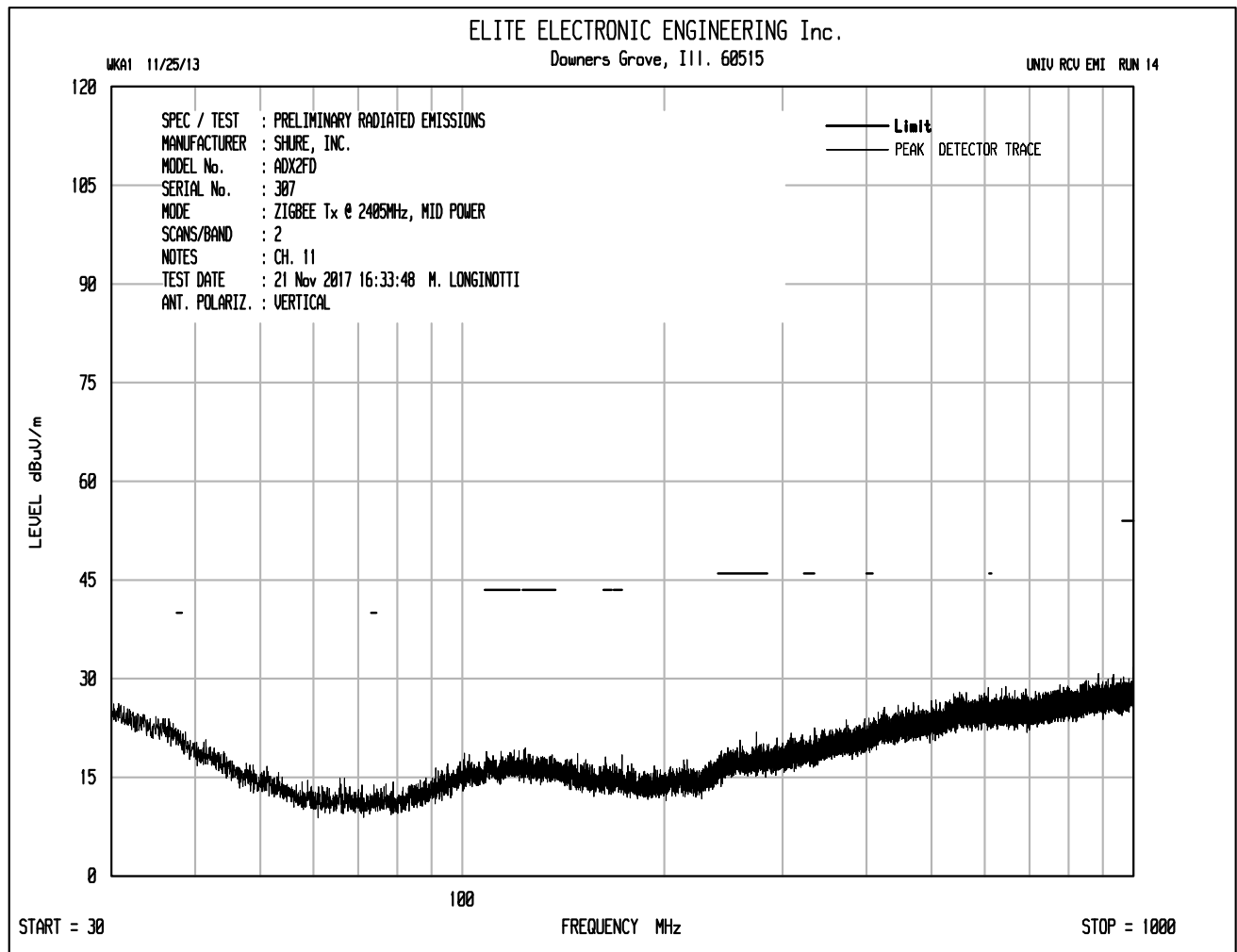
Transmit at 2445MHz, Medium power

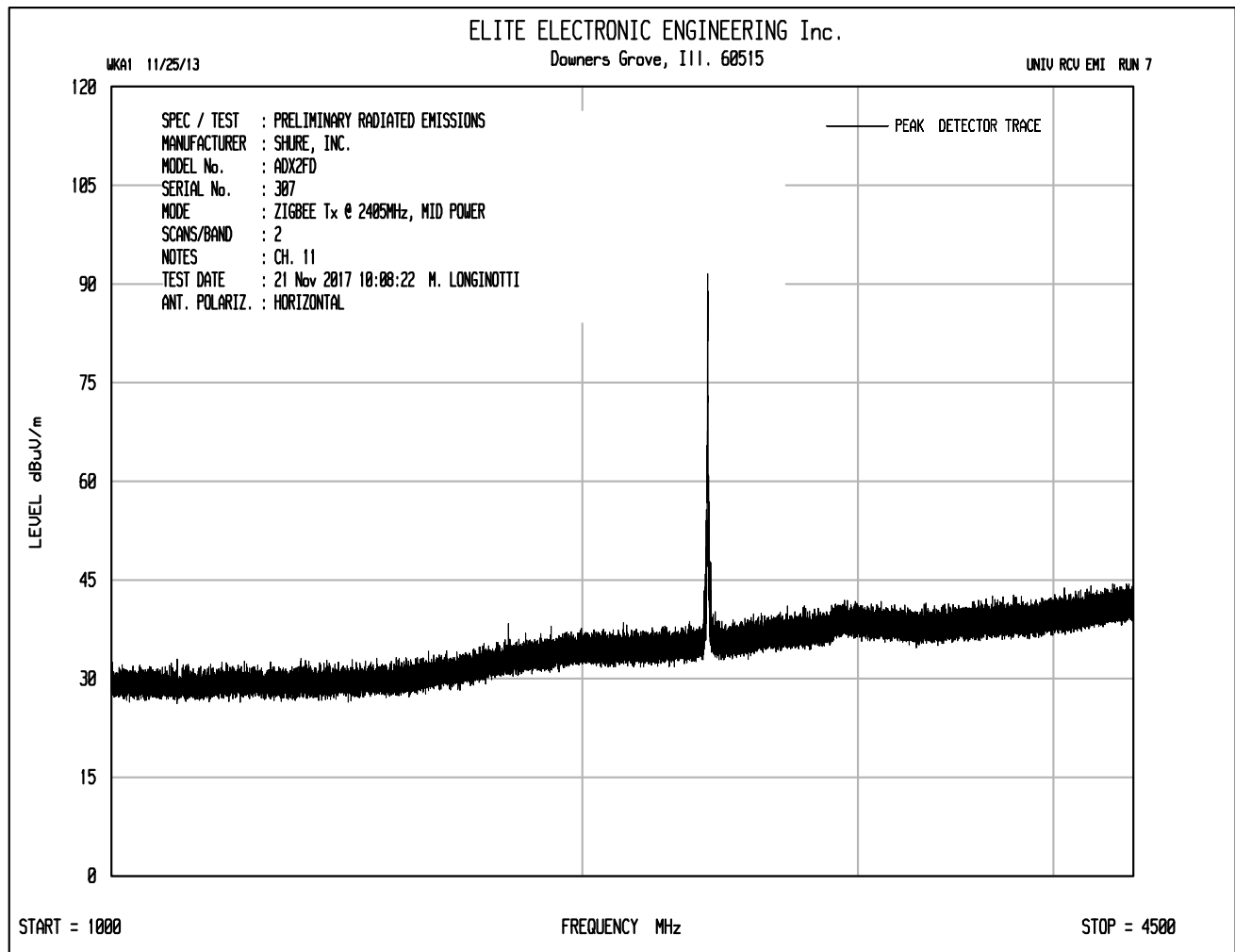
Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2445.00	H	62.7	0.3	5.9	3.5	2.7	27.0	-24.3
2445.00	V	73.9	12.0	5.9	3.5	14.4	27.0	-12.6

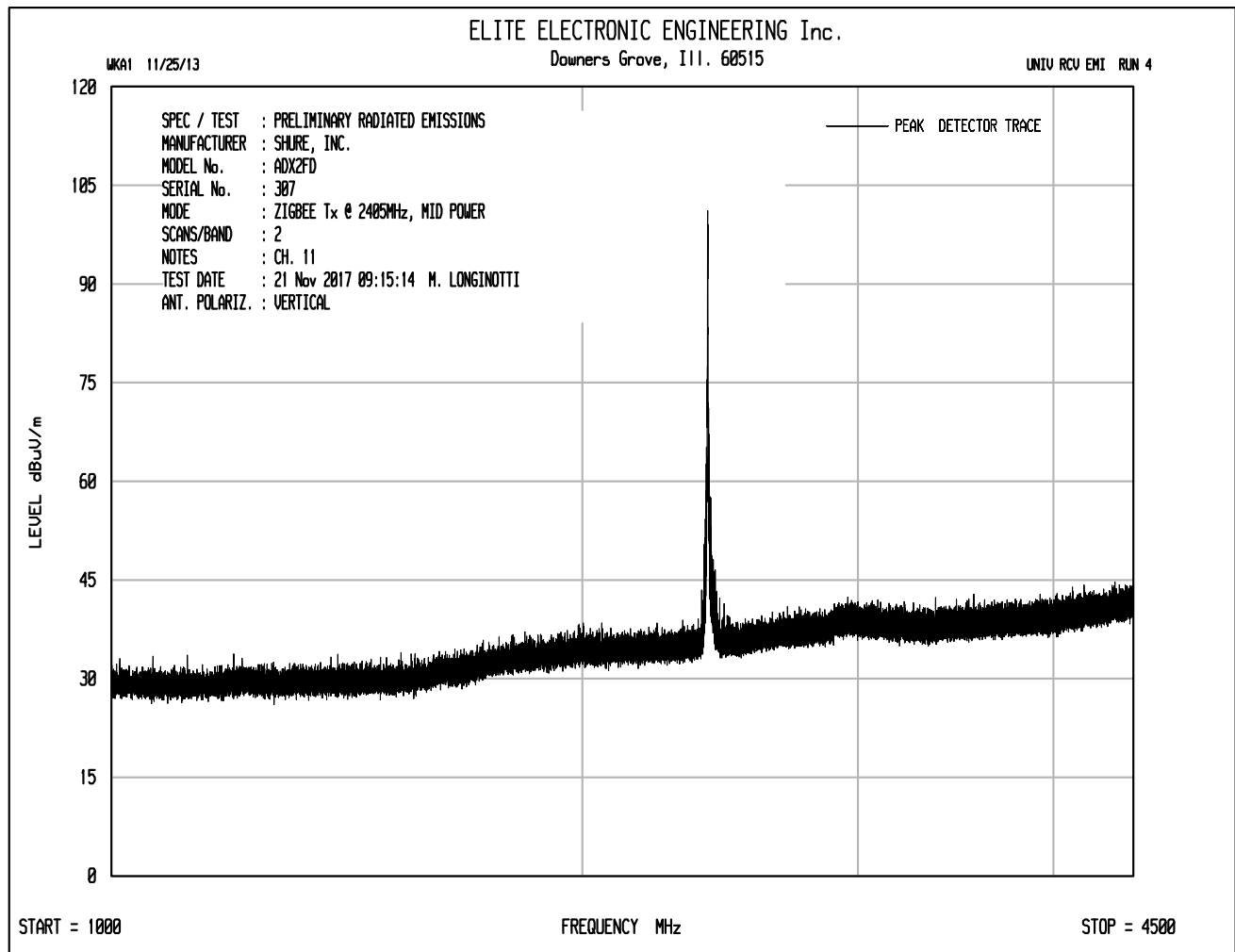
Transmit at 2480MHz, Medium power

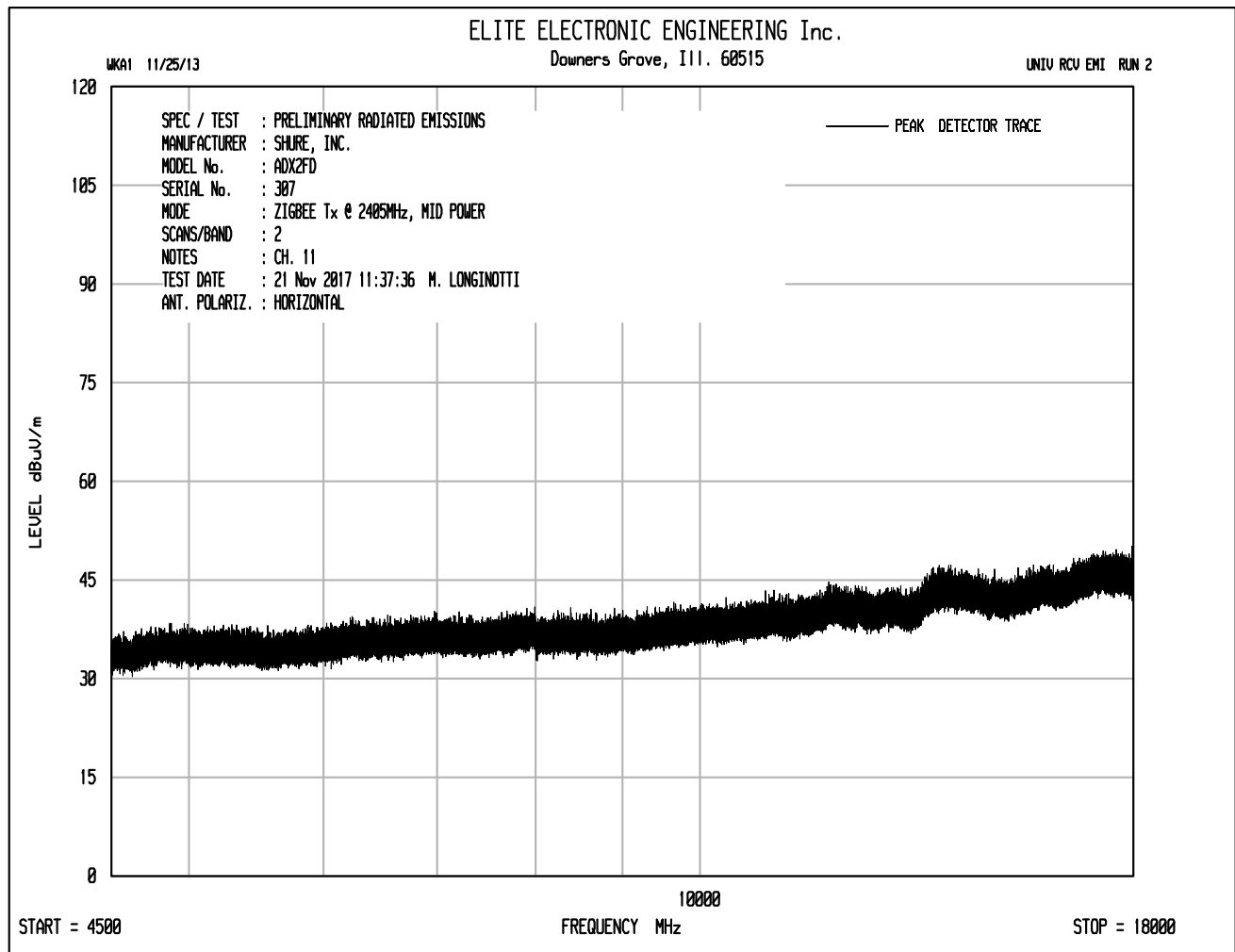
Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
2480.00	H	56.3	-5.8	5.9	2.7	-2.5	27.0	-29.5
2480.00	V	66.6	4.5	5.9	2.7	7.8	27.0	-19.2

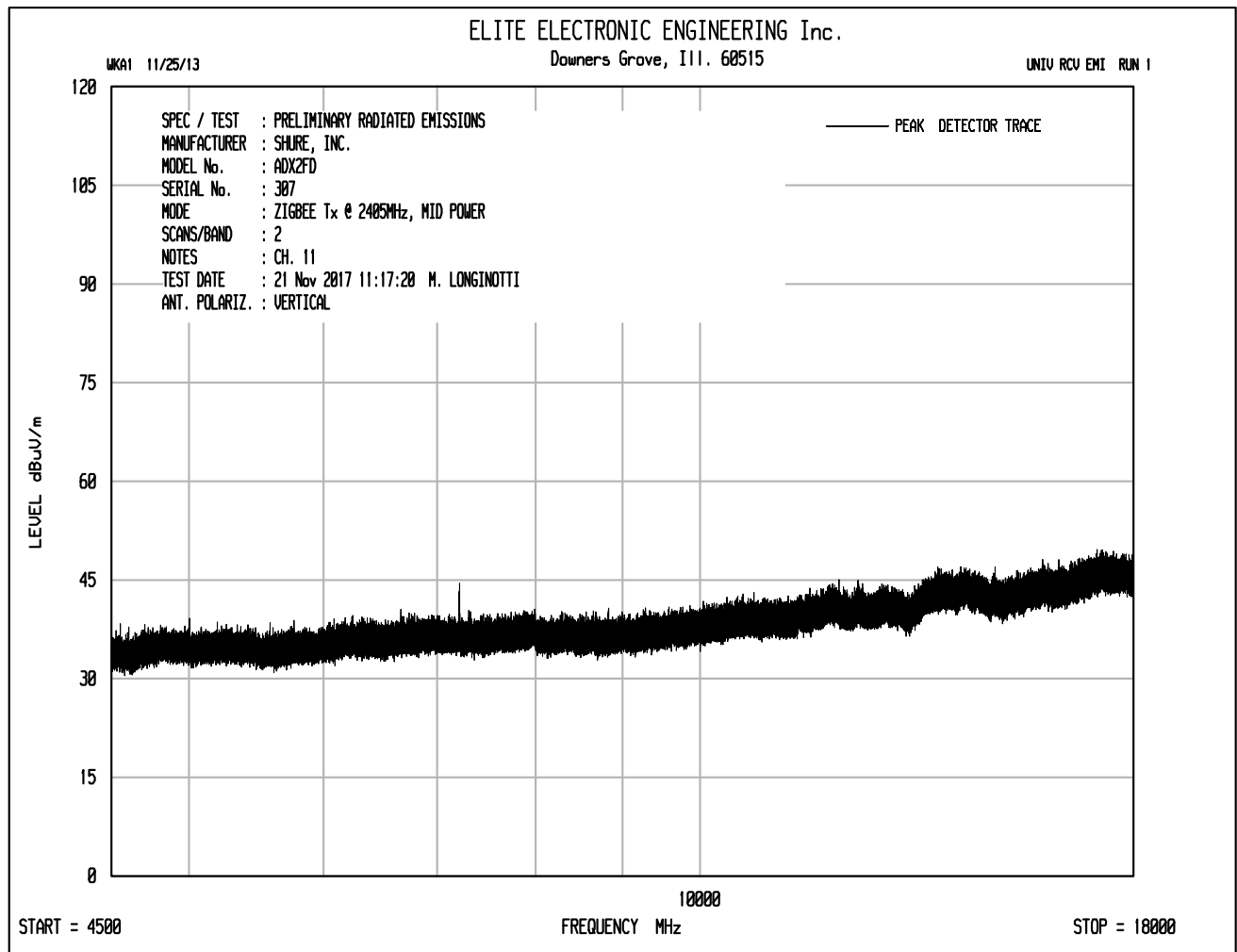


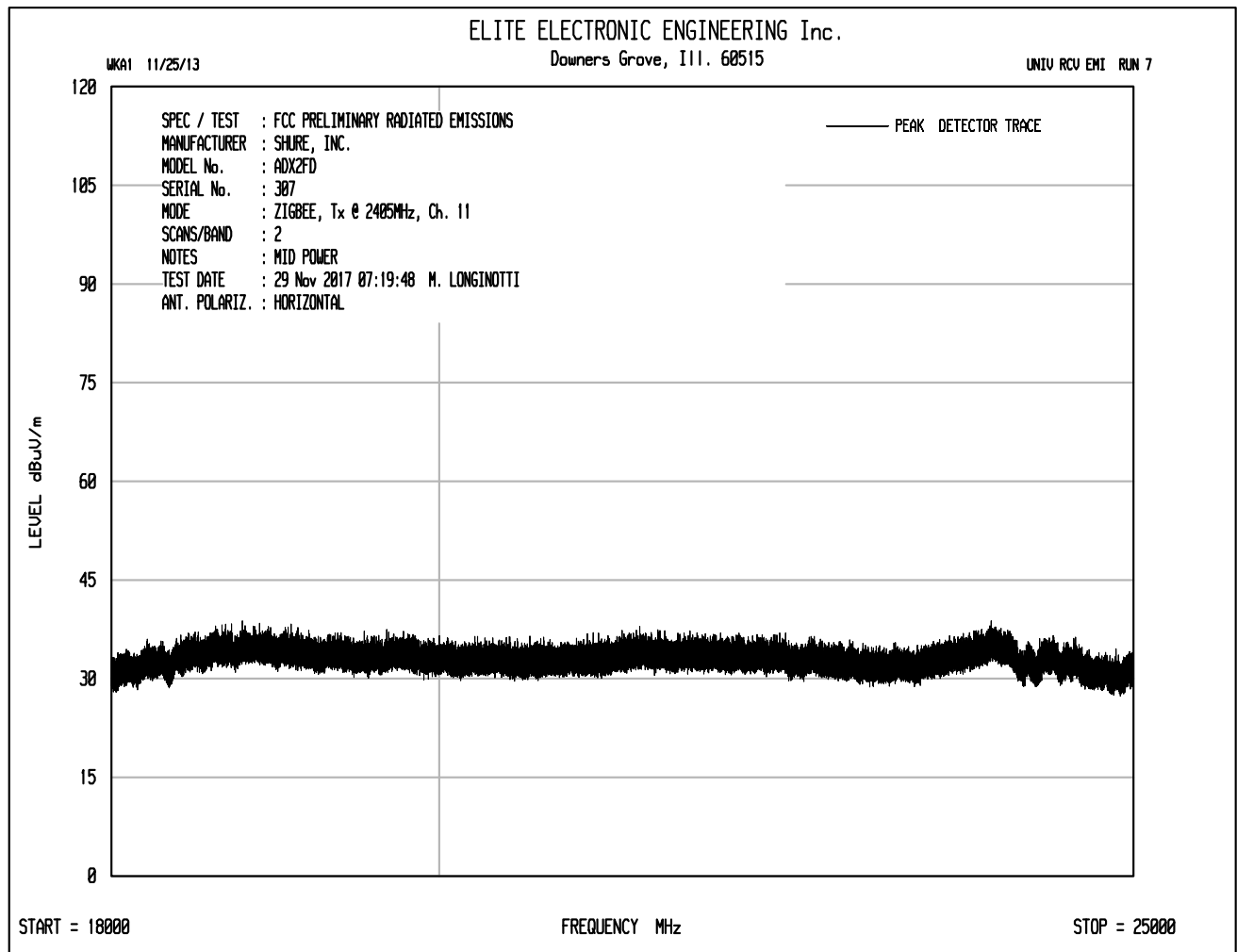


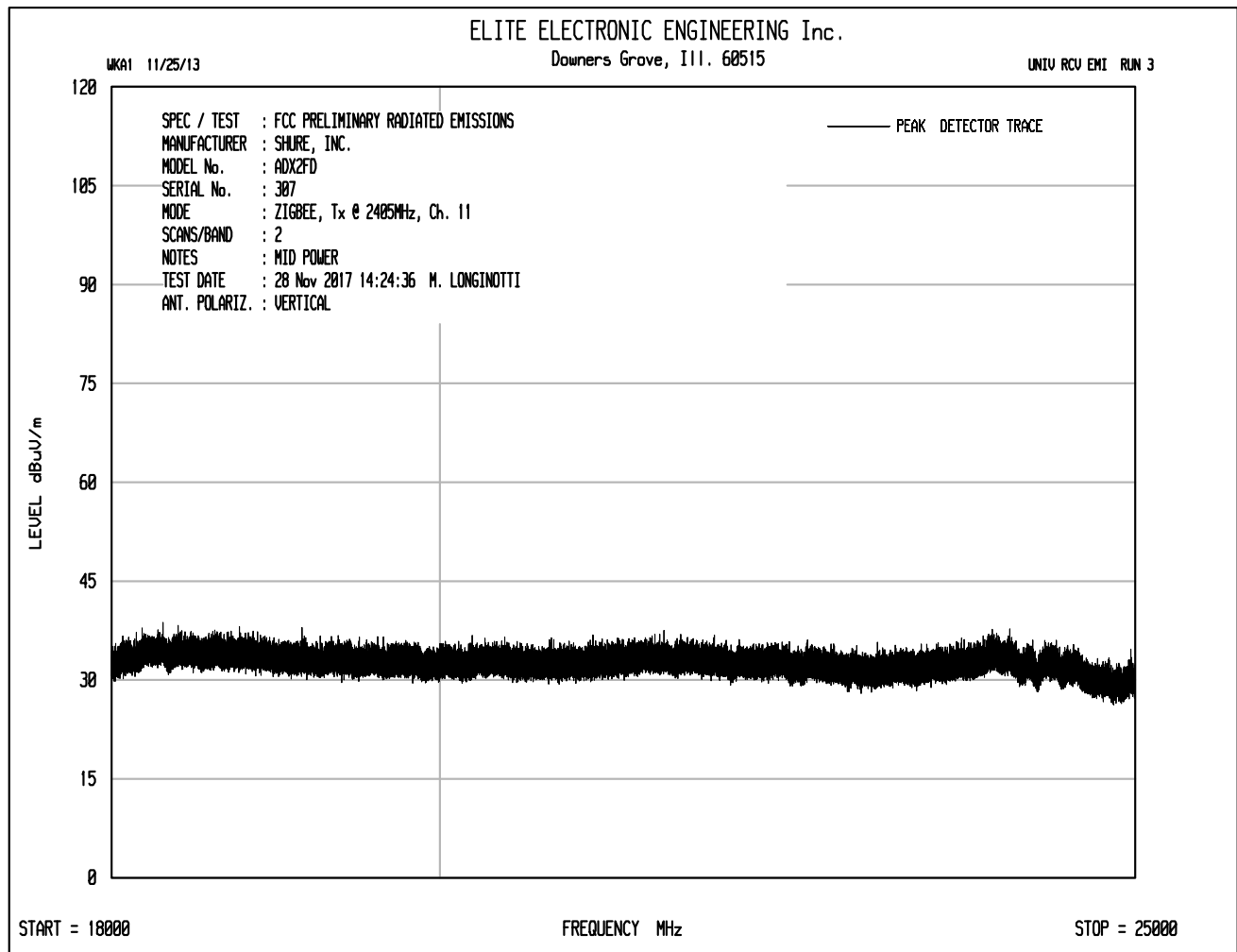












Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 307
 Mode : Transmit at 2405MHz, (Ch. 11) mid power
 Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions in Restricted Bands
 Date : November 21, 2017 through November 28, 2017
 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)
4810.00	H	50.5	Ambient	3.7	36.8	-39.3	51.7	384.4	5000.0	-22.3
4810.00	V	49.8	Ambient	3.7	36.8	-39.3	51.0	354.6	5000.0	-23.0
12025.00	H	49.4	Ambient	6.1	41.9	-39.2	58.2	811.2	5000.0	-15.8
12025.00	V	49.3	Ambient	6.1	41.9	-39.2	58.1	801.9	5000.0	-15.9
19240.00	H	34.1	Ambient	2.2	40.4	-28.7	48.0	250.6	5000.0	-26.0
19240.00	V	32.7	Ambient	2.2	40.4	-28.7	46.6	213.3	5000.0	-27.4

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

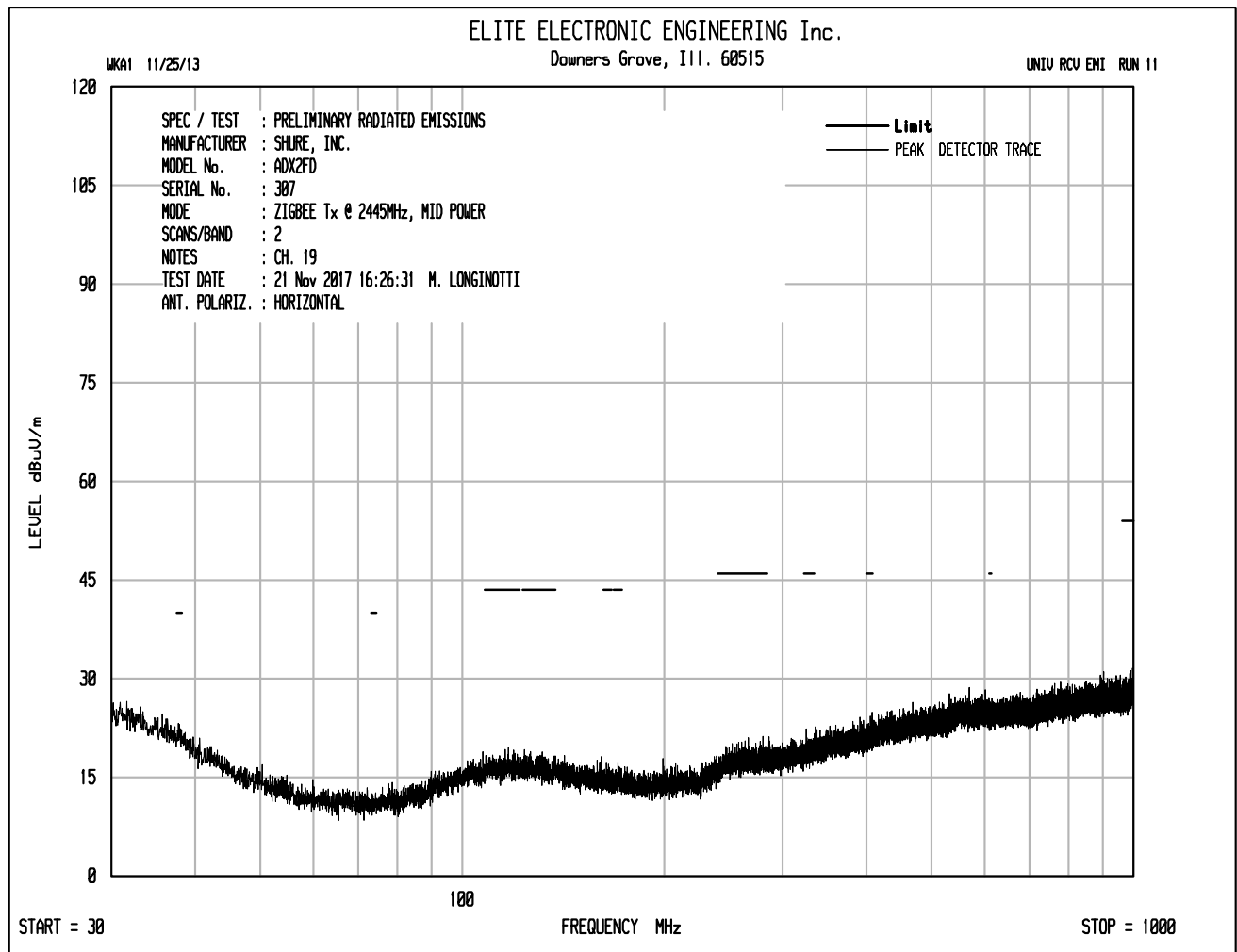
Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 307
 Mode : Transmit at 2405MHz, (Ch. 11) mid power
 Test Specification : FCC-15.247, RSS-247 Average Radiated Emissions in Restricted Bands
 Date : November 21, 2017 through November 28, 2017
 Test Distance : 3 meters
 Notes : Average Detector with 1MHz Resolution Bandwidth

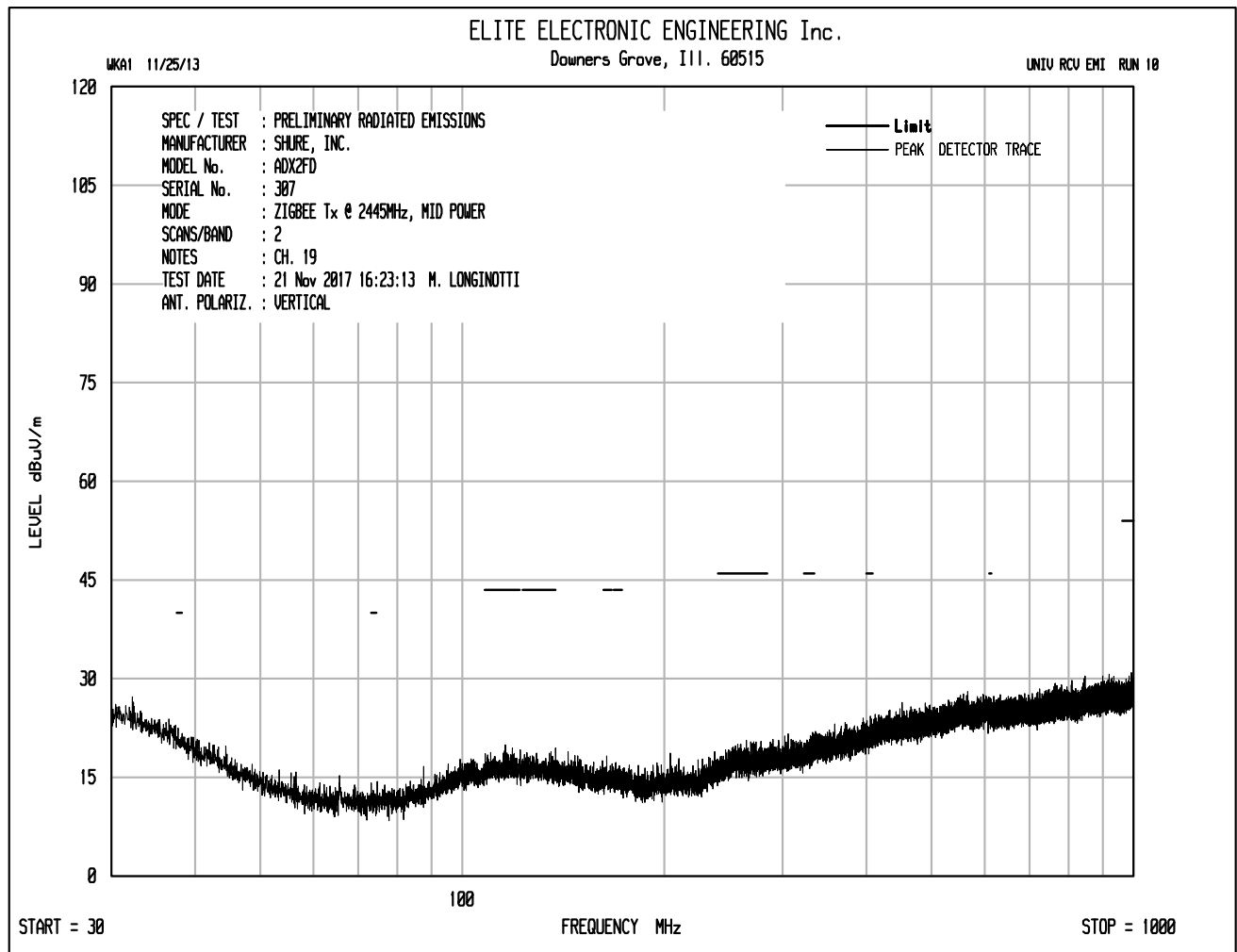
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
4810.00	H	35.0	Ambient	3.7	36.8	-39.3	0.0	36.2	64.5	500.0	-17.8
4810.00	V	35.1	Ambient	3.7	36.8	-39.3	0.0	36.3	65.3	500.0	-17.7
12025.00	H	33.7	Ambient	6.1	41.9	-39.2	0.0	42.5	133.1	500.0	-11.5
12025.00	V	34.1	Ambient	6.1	41.9	-39.2	0.0	42.9	139.4	500.0	-11.1
19240.00	H	19.7	Ambient	2.2	40.4	-28.7	0.0	33.6	47.8	500.0	-20.4
19240.00	V	18.6	Ambient	2.2	40.4	-28.7	0.0	32.5	42.1	500.0	-21.5

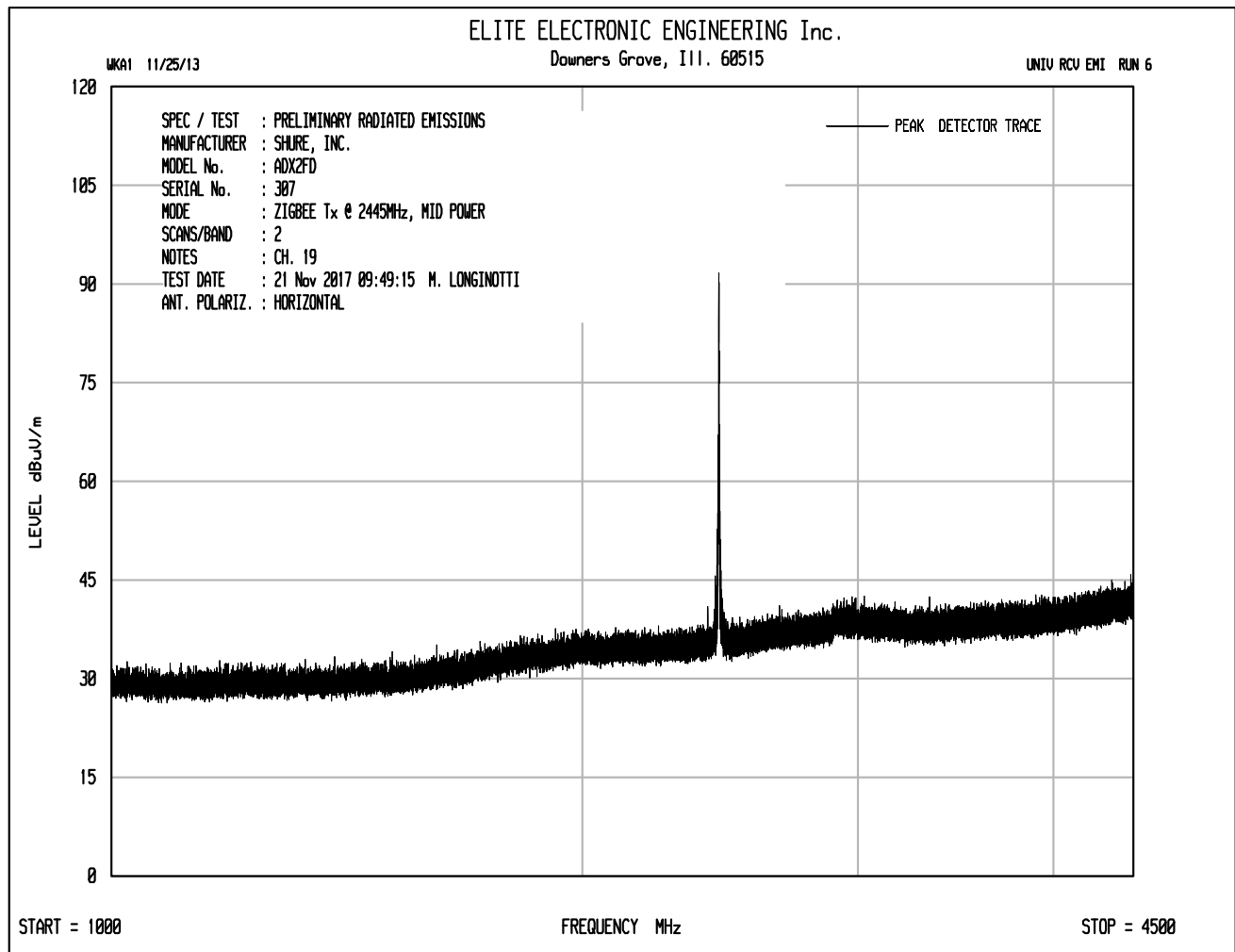
Total (dBuV/m) = Meter Reading + CBL FAC + Ant Fac + Pre Amp + Duty Cycle

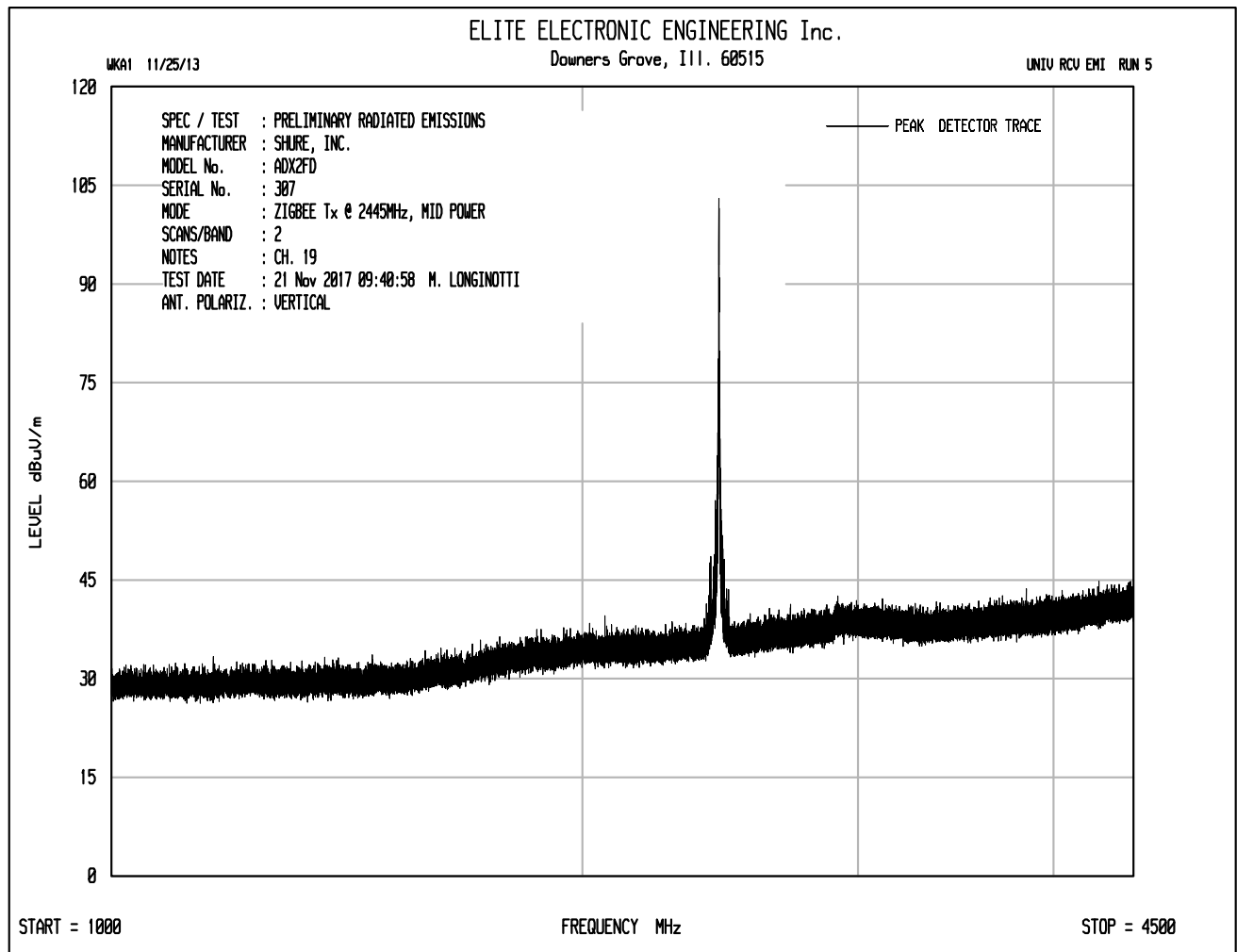
Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 307
 Mode : Transmit at 2405MHz, (Ch. 11) mid power
 Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions not in Restricted Bands
 Date : November 21, 2017 through November 28, 2017
 Test Distance : 3 meters
 Notes : Peak Detector with 100kHz Resolution Bandwidth

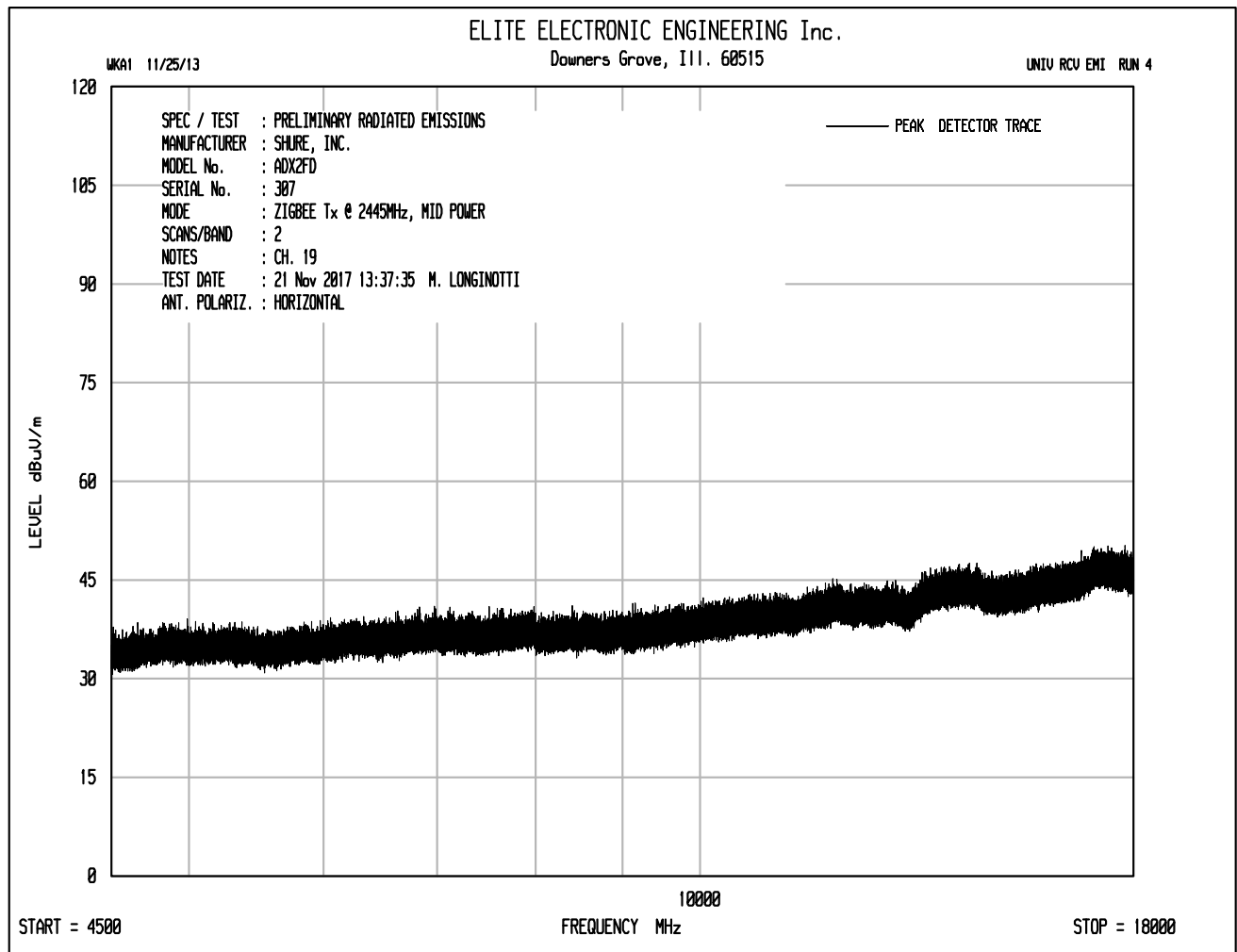
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2405.00	H	57.6		2.6	33.0	0.0	93.3	45997.5		
2405.00	V	67.2		2.6	33.0	0.0	102.9	138910.3		
7215.00	H	40.1		4.6	38.3	-39.4	43.6	152.1	13891.0	-39.2
7215.00	V	44.3		4.6	38.3	-39.4	47.8	246.7	13891.0	-35.0
9620.00	H	41.3		5.2	39.4	-39.3	46.6	213.2	13891.0	-36.3
9620.00	V	39.3		5.2	39.4	-39.3	44.6	169.3	13891.0	-38.3
14430.00	H	37.8	Ambient	6.6	43.1	-38.3	49.3	290.2	13891.0	-33.6
14430.00	V	38.2	Ambient	6.6	43.1	-38.3	49.7	303.9	13891.0	-33.2
16835.00	H	37.6	Ambient	7.2	43.9	-37.5	51.2	361.8	13891.0	-31.7
16835.00	V	37.8	Ambient	7.2	43.9	-37.5	51.4	370.2	13891.0	-31.5
21645.00	H	24.2	Ambient	2.2	40.6	-28.9	38.1	80.6	13891.0	-44.7
21645.00	V	22.2	Ambient	2.2	40.6	-28.9	36.1	64.0	13891.0	-46.7
24050.00	H	24.8	Ambient	2.2	40.6	-30.3	37.4	74.0	13891.0	-45.5
24050.00	V	24.4	Ambient	2.2	40.6	-30.3	37.0	70.6	13891.0	-45.9

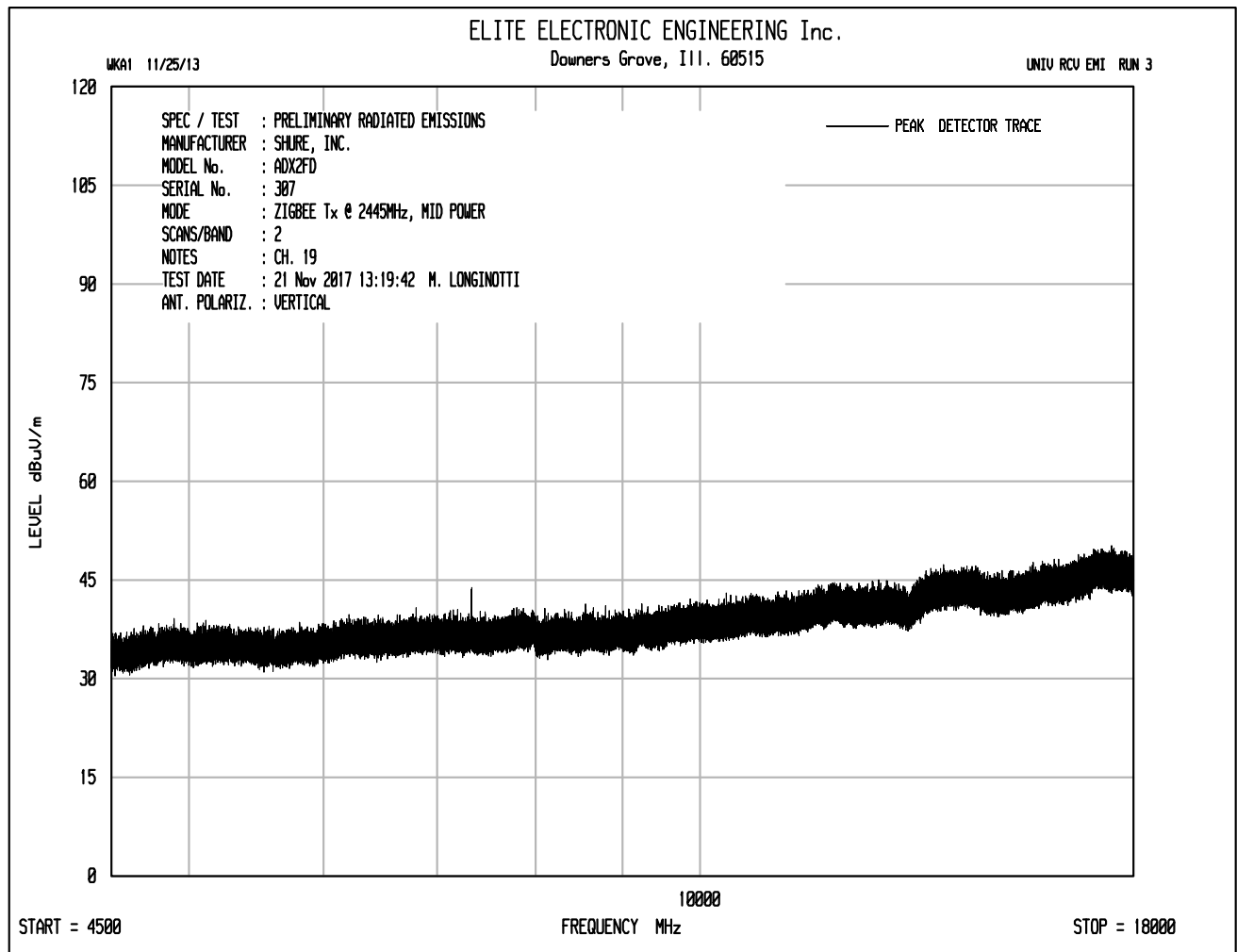


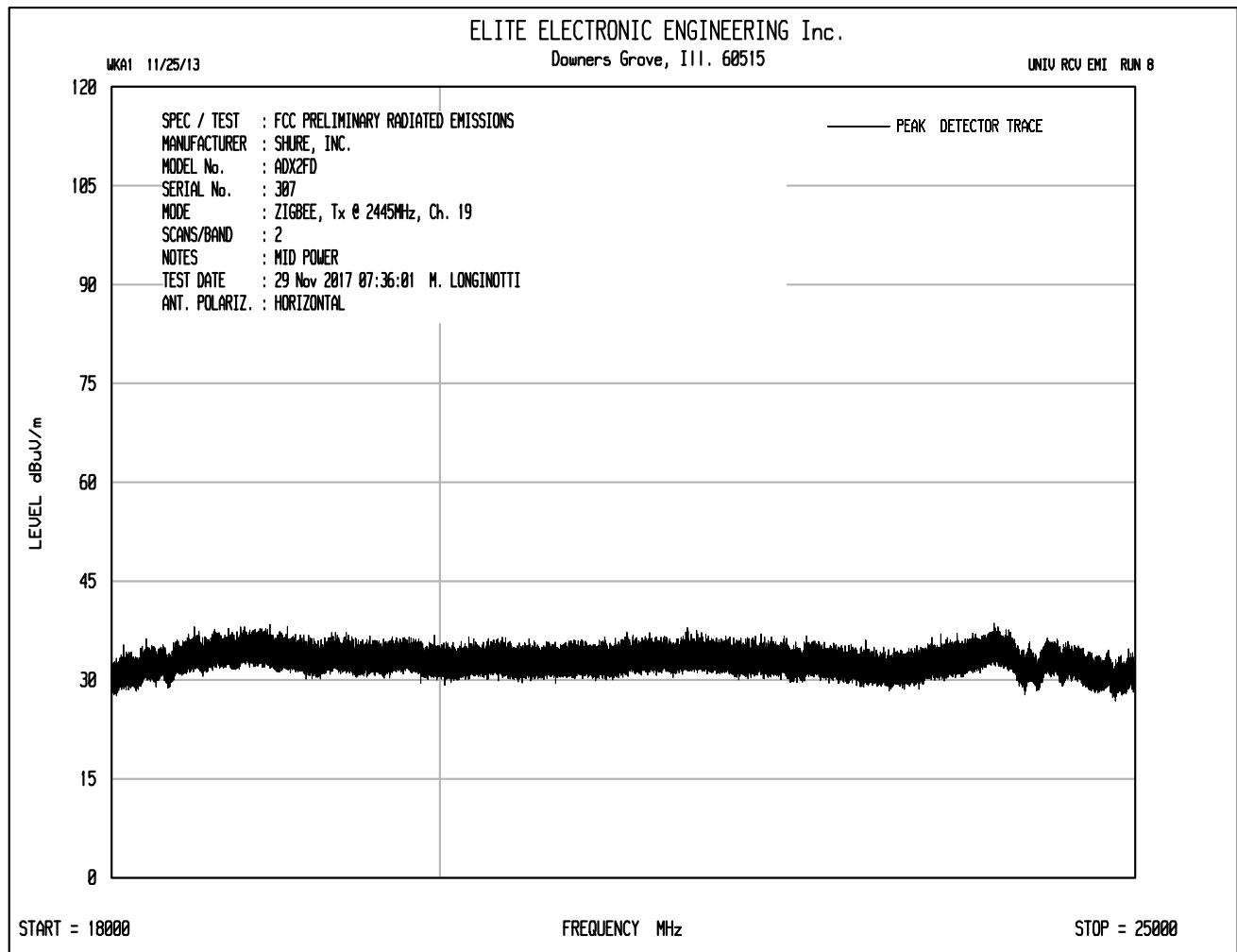


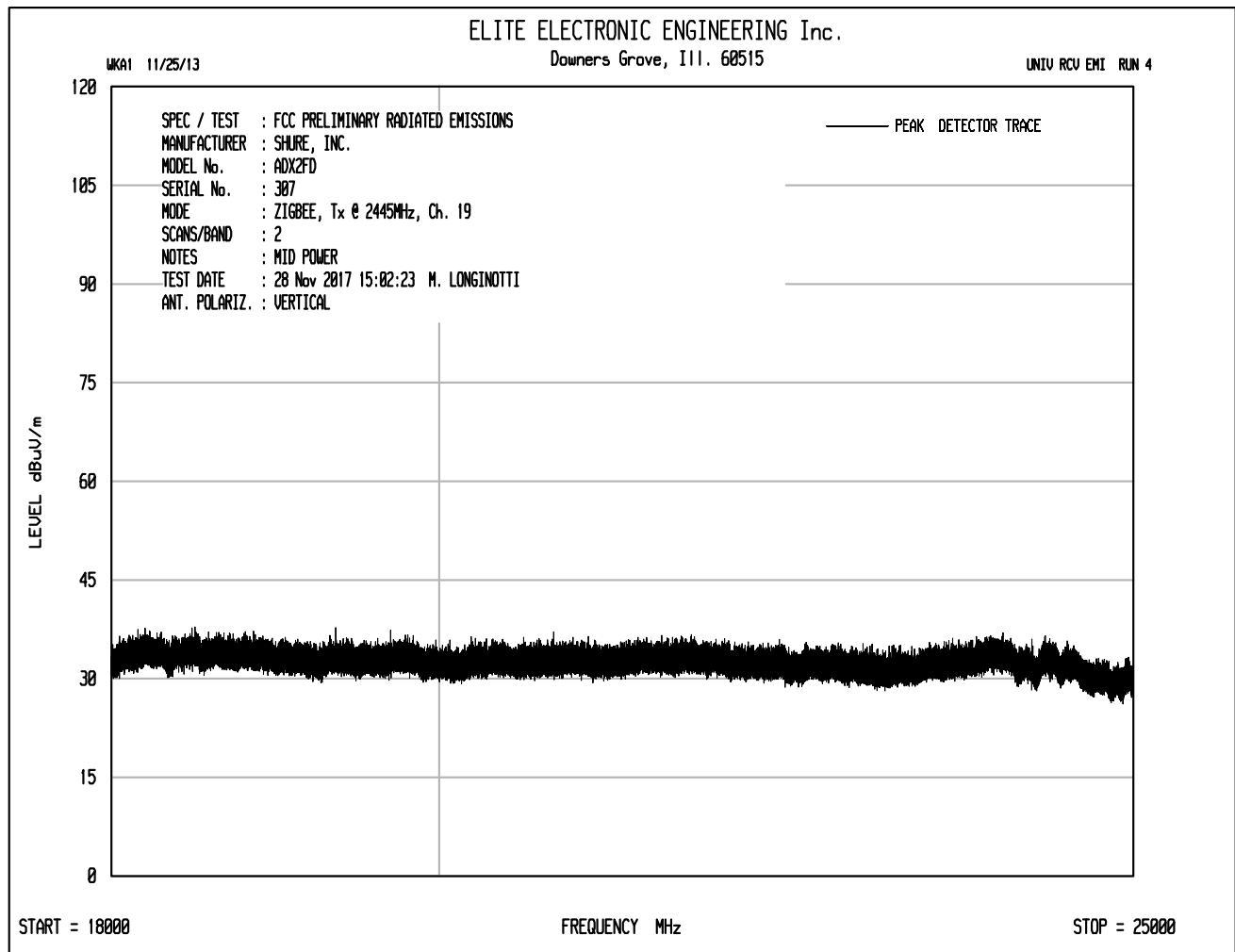












Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 307
 Mode : Transmit at 2445MHz (Ch. 19) mid power
 Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions in Restricted Bands
 Date : November 21, 2017 through November 29, 2017
 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)
4890.00	H	49.7	Ambient	3.7	36.7	-39.3	50.7	343.9	5000.0	-23.3
4890.00	V	49.8	Ambient	3.7	36.7	-39.3	50.8	347.9	5000.0	-23.2
7335.00	H	49.0		4.7	38.2	-39.4	52.5	421.0	5000.0	-21.5
7335.00	V	52.0		4.7	38.2	-39.4	55.5	594.6	5000.0	-18.5
12225.00	H	48.8	Ambient	6.1	41.7	-39.1	57.5	747.7	5000.0	-16.5
12225.00	V	48.5	Ambient	6.1	41.7	-39.1	57.2	722.3	5000.0	-16.8
19560.00	H	33.9	Ambient	2.2	40.4	-28.6	47.9	248.9	5000.0	-26.1
19560.00	V	33.9	Ambient	2.2	40.4	-28.6	47.9	248.9	5000.0	-26.1

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

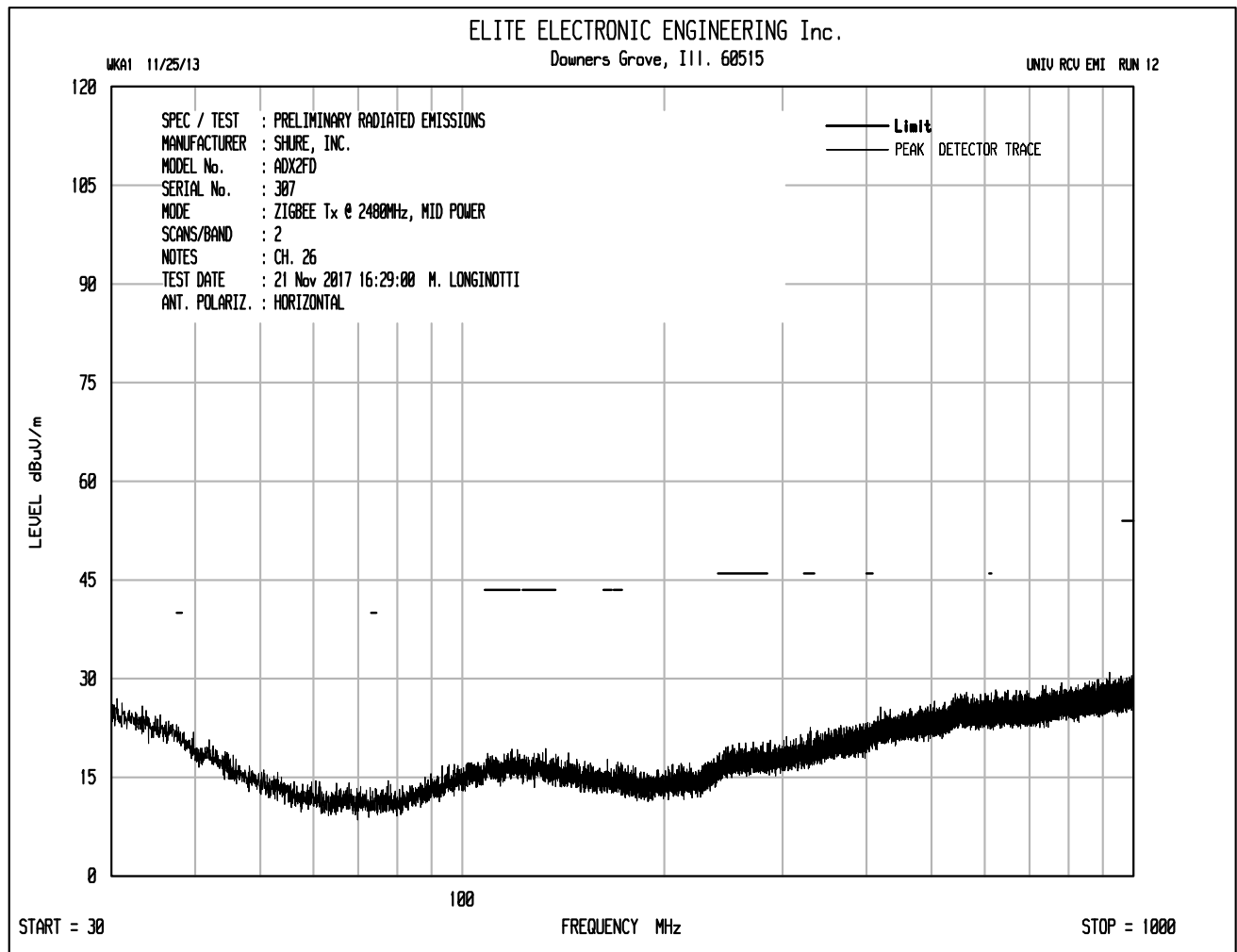
Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 307
 Mode : Transmit at 2445MHz (Ch. 19) mid power
 Test Specification : FCC-15.247, RSS-247 Average Radiated Emissions in Restricted Bands
 Date : November 21, 2017 through November 29, 2017
 Test Distance : 3 meters
 Notes : Average Detector with 1MHz Resolution Bandwidth

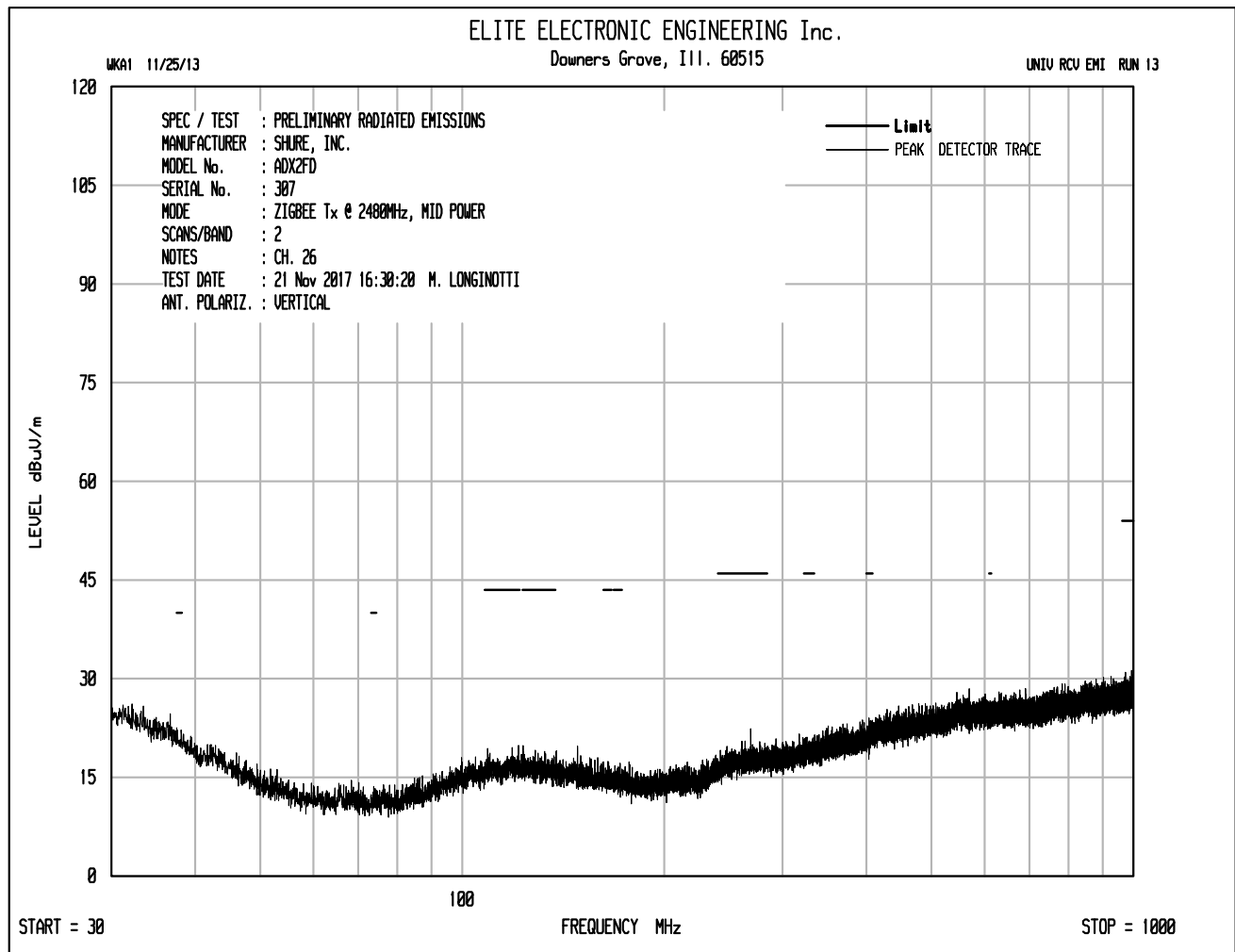
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Duty Cycle (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
4890.00	H	35.4	Ambient	3.7	36.7	-39.3	0.0	36.4	66.3	500.0	-17.6
4890.00	V	35.6	Ambient	3.7	36.7	-39.3	0.0	36.6	67.8	500.0	-17.4
7335.00	H	35.50		4.7	38.2	-39.4	0.0	39.0	89.0	500.0	-15.0
7335.00	V	40.4		4.7	38.2	-39.4	0.0	43.9	156.4	500.0	-10.1
12225.00	H	33.4	Ambient	6.1	41.7	-39.1	0.0	42.1	127.0	500.0	-11.9
12225.00	V	33.3	Ambient	6.1	41.7	-39.1	0.0	42.0	125.5	500.0	-12.0
19560.00	H	19.5	Ambient	2.2	40.4	-28.6	0.0	33.5	47.4	500.0	-20.5
19560.00	V	19.0	Ambient	2.2	40.4	-28.6	0.0	33.0	44.8	500.0	-21.0

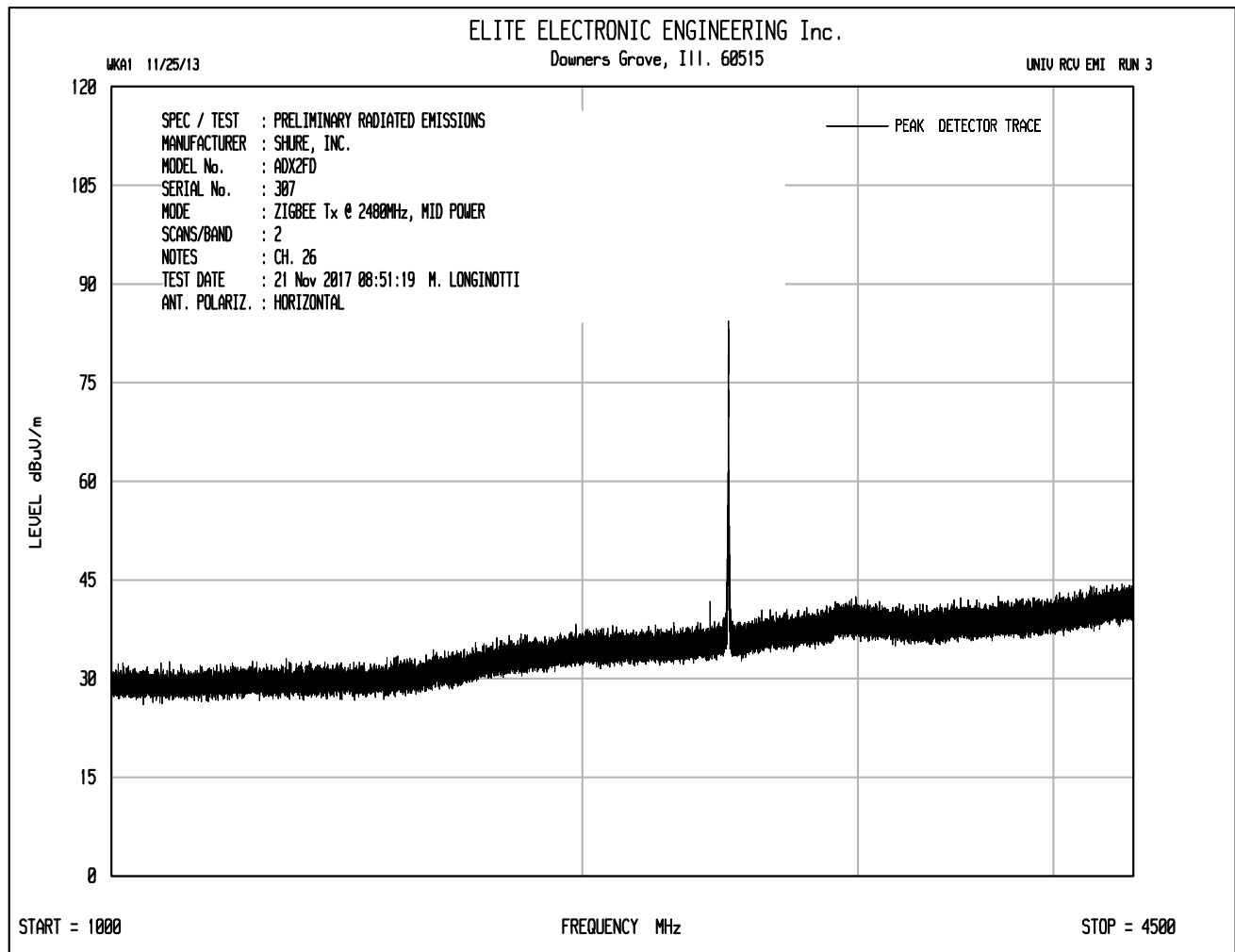
Total (dBuV/m) = Meter Reading + CBL FAC + Ant Fac + Pre Amp + Duty Cycle

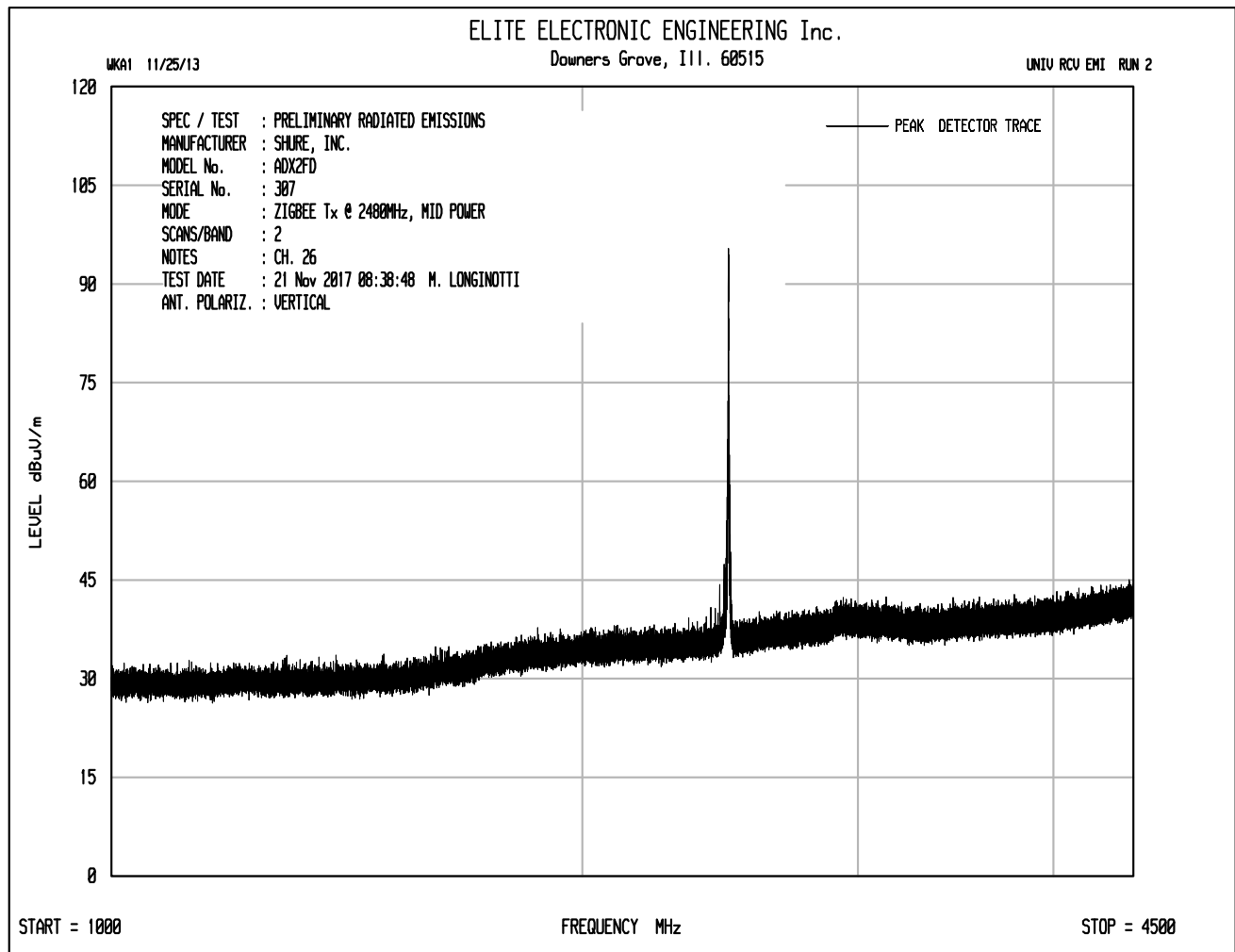
Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 307
 Mode : Transmit at 2445MHz (Ch. 19) mid power
 Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions not in Restricted Bands
 Date : November 21, 2017 through November 29, 2017
 Test Distance : 3 meters
 Notes : Peak Detector with 100kHz Resolution Bandwidth

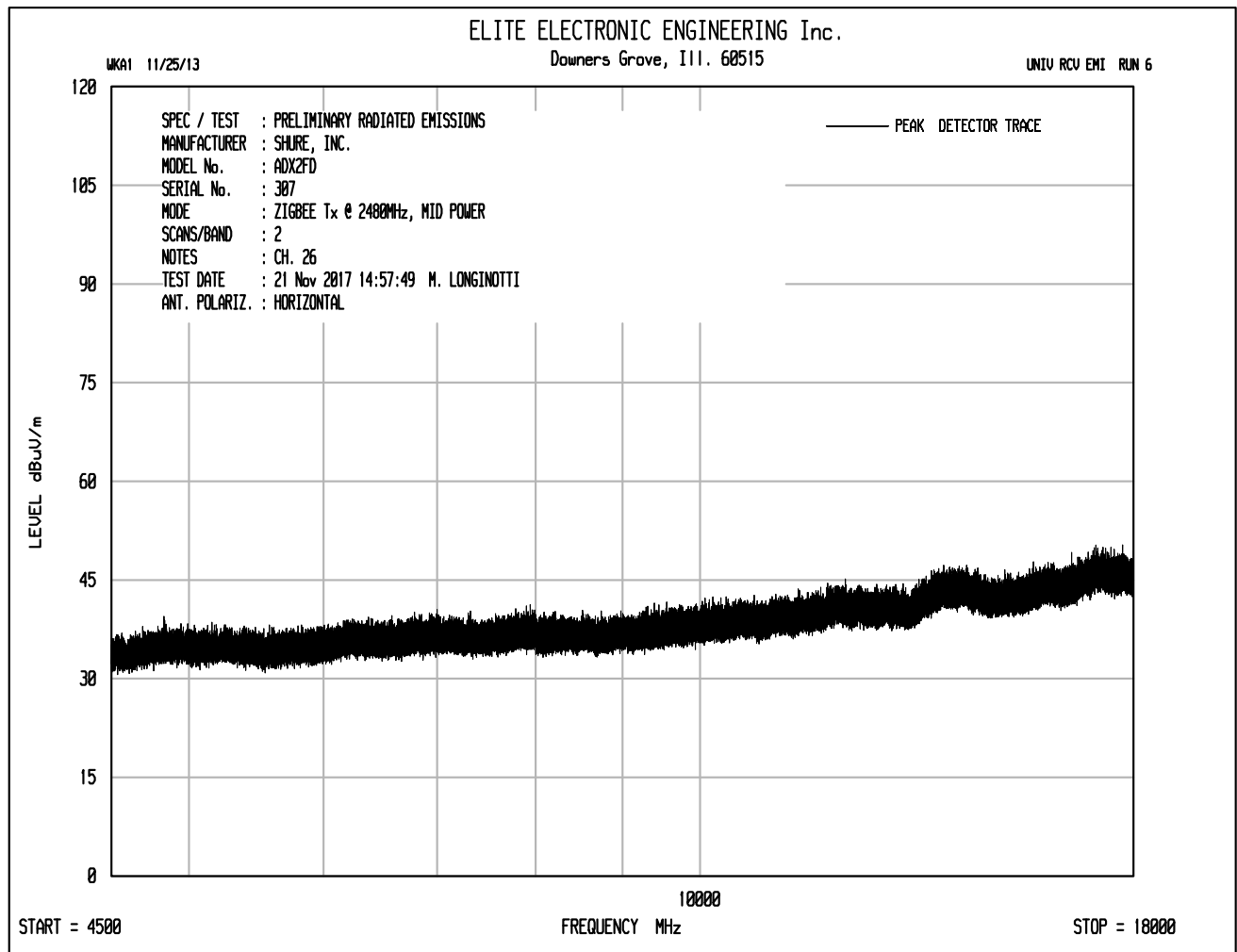
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
2445.00	H	57.8		2.6	33.1	0.0	93.6	47657.0		
2445.00	V	69.1		2.6	33.1	0.0	104.9	175035.7		
9780.00	H	39.6		5.2	39.5	-39.3	45.1	179.8	17503.6	-39.8
9780.00	V	38.6	Ambient	5.2	39.5	-39.3	44.1	160.2	17503.6	-40.8
14670.00	H	37.6	Ambient	6.7	42.6	-38.2	48.7	272.0	17503.6	-36.2
14670.00	V	37.7	Ambient	6.7	42.6	-38.2	48.8	275.2	17503.6	-36.1
17115.00	H	37.8	Ambient	7.3	44.8	-37.6	52.2	409.4	17503.6	-32.6
17115.00	V	38.4	Ambient	7.3	44.8	-37.6	52.8	438.7	17503.6	-32.0
22005.00	H	23.6	Ambient	2.2	40.6	-29.4	37.0	70.4	17503.6	-47.9
22005.00	V	22.8	Ambient	2.2	40.6	-29.4	36.2	64.2	17503.6	-48.7
24450.00	H	23.4	Ambient	2.2	40.6	-30.4	35.8	61.9	17503.6	-49.0
24450.00	V	23.9	Ambient	2.2	40.6	-30.4	36.3	65.6	17503.6	-48.5

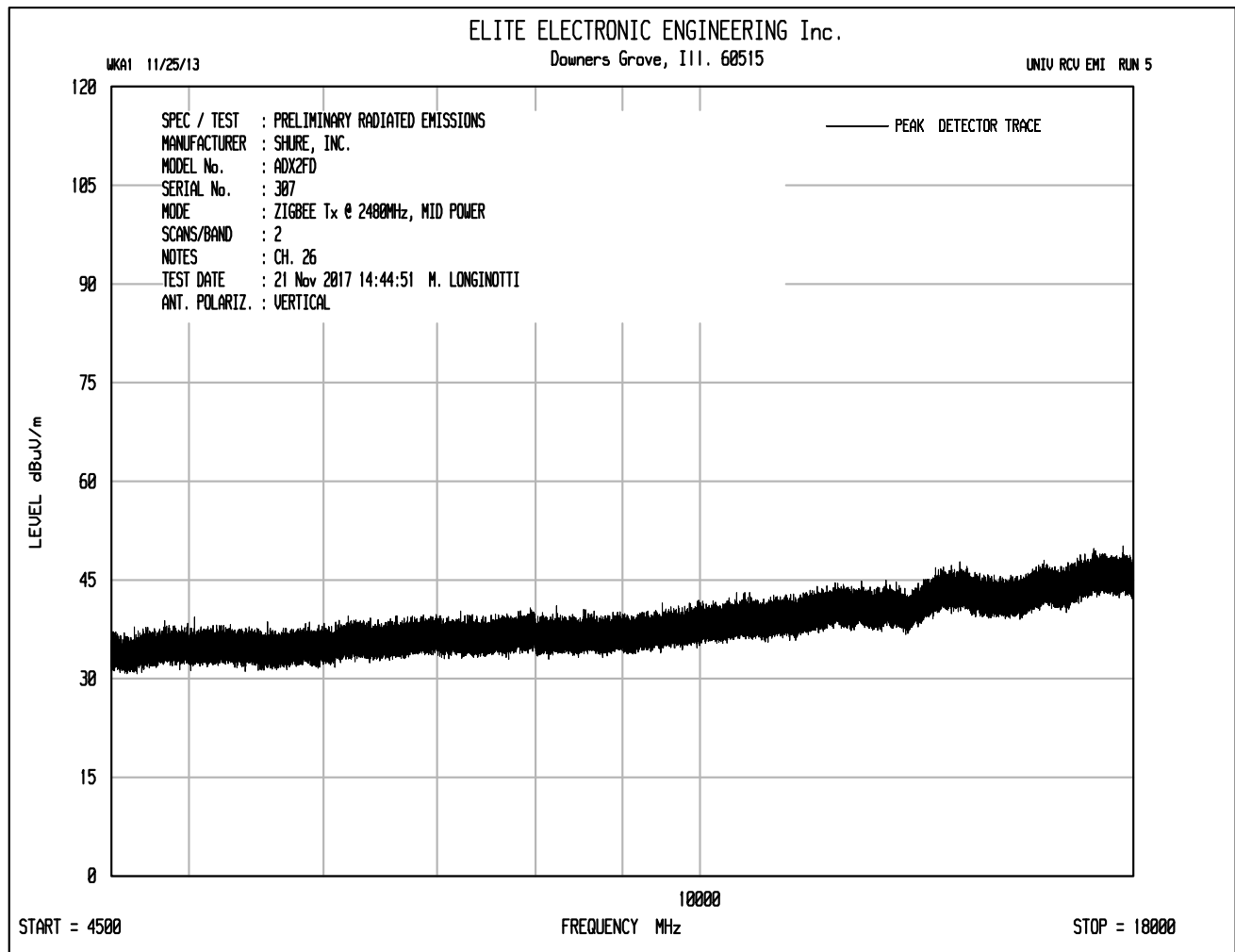


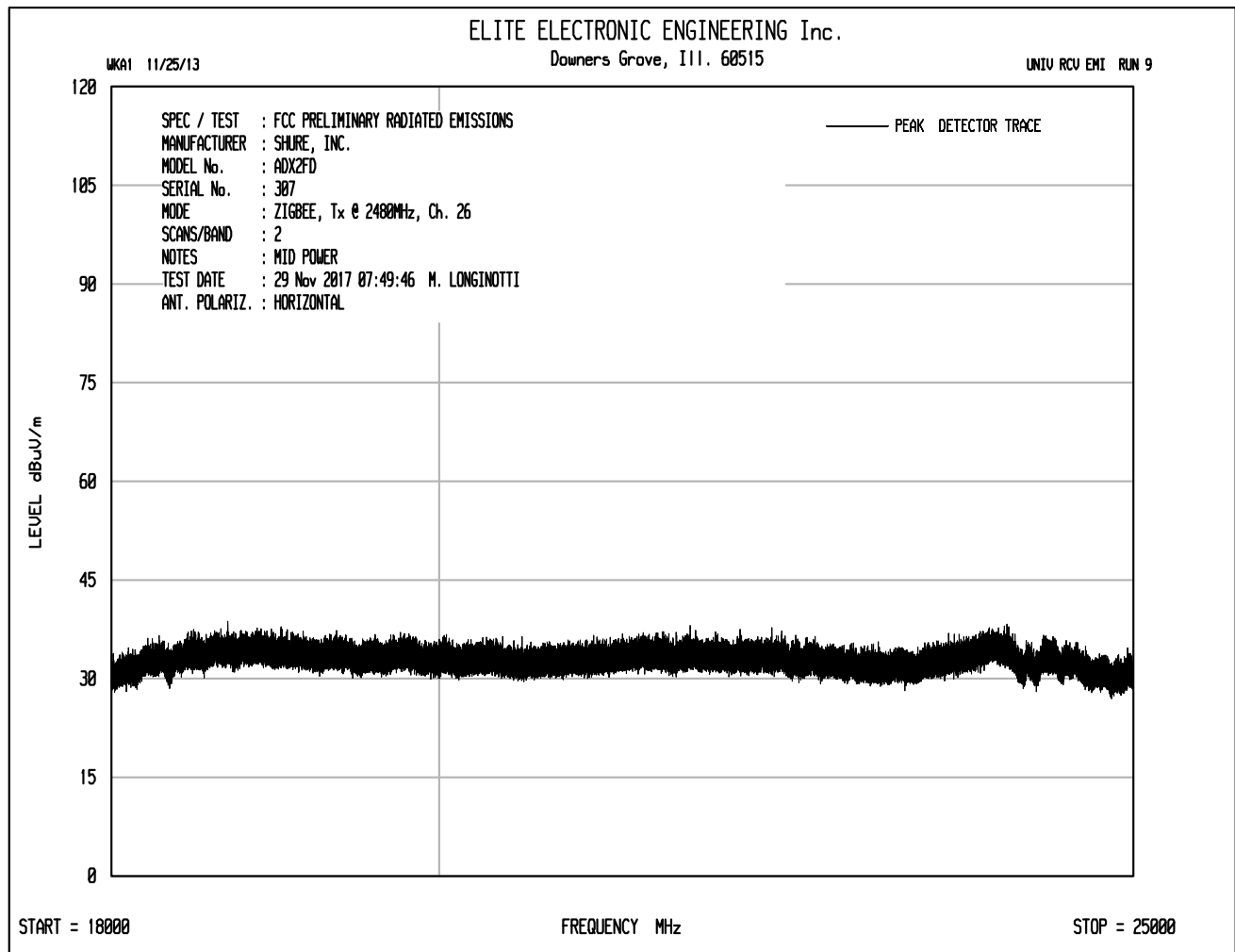


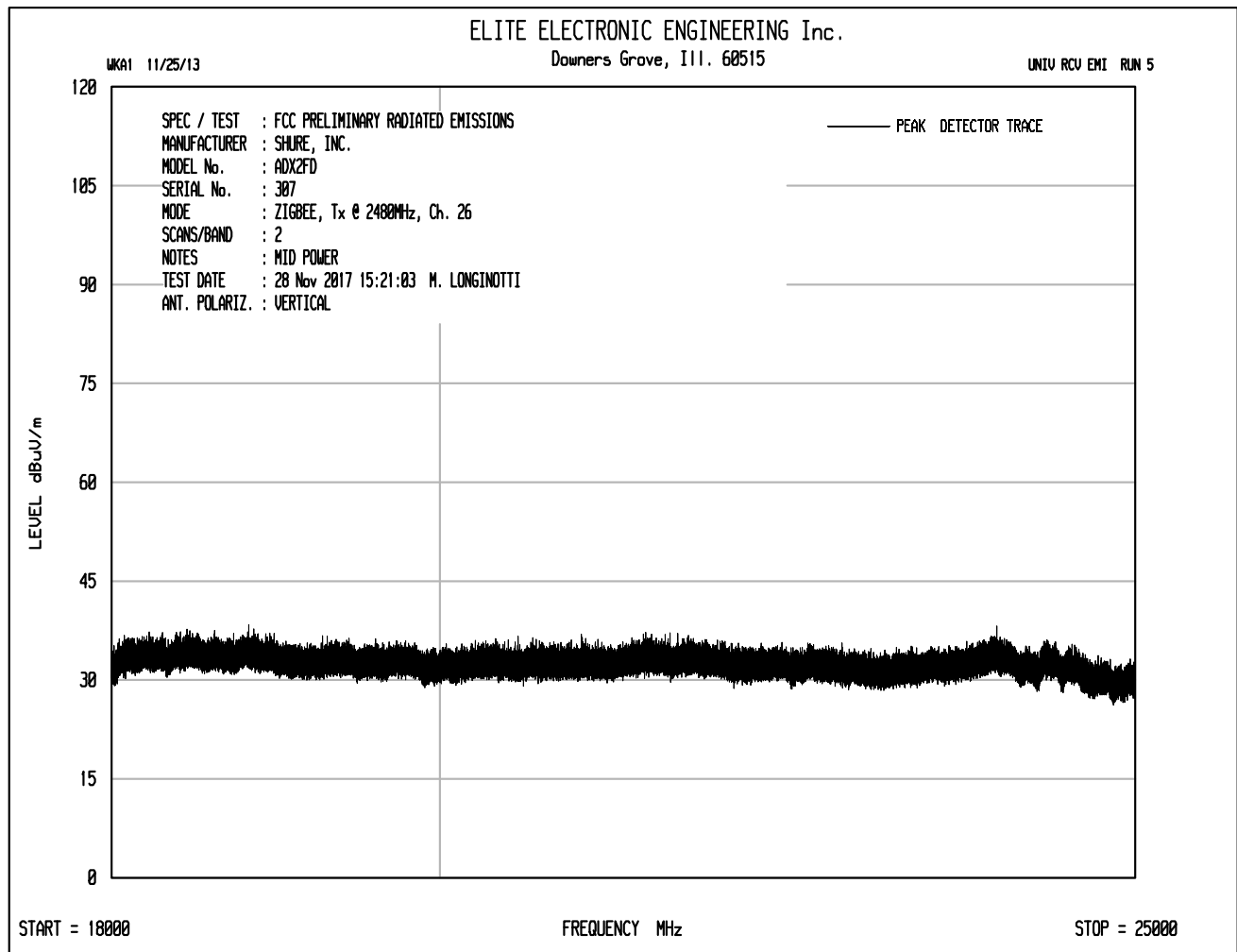












Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 307
 Mode : Transmit at 2480MHz, Ch. 26, mid power
 Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions in Restricted Bands
 Date : November 21, 2017 through November 29, 2017
 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)
4960.00	H	49.7	Ambient	3.7	36.5	-39.3	50.6	338.3	5000.0	-23.4
4960.00	V	49.6	Ambient	3.7	36.5	-39.3	50.5	334.4	5000.0	-23.5
7440.00	H	49.2	Ambient	4.7	38.1	-39.4	52.6	426.5	5000.0	-21.4
7440.00	V	49.4	Ambient	4.7	38.1	-39.4	52.8	436.5	5000.0	-21.2
12400.00	H	48.3	Ambient	6.1	41.5	-39.0	56.9	699.4	5000.0	-17.1
12400.00	V	47.9	Ambient	6.1	41.5	-39.0	56.5	668.0	5000.0	-17.5
19840.00	H	33.9	Ambient	2.2	40.4	-28.4	48.1	255.4	5000.0	-25.8
19840.00	V	33.3	Ambient	2.2	40.4	-28.4	47.5	238.3	5000.0	-26.4
22320.00	H	34.7	Ambient	2.2	40.6	-29.3	48.2	257.6	5000.0	-25.8
22320.00	V	33.6	Ambient	2.2	40.6	-29.3	47.1	226.9	5000.0	-26.9

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

Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 307
 Mode : Transmit at 2480MHz, Ch. 26, mid power
 Test Specification : FCC-15.247, RSS-247 Average Radiated Emissions in Restricted Bands
 Date : November 21, 2017 through November 29, 2017
 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)
4960.00	H	35.3	Ambient	3.7	36.5	-39.3	0.0	36.2	64.5	500.0	-17.8
4960.00	V	35.4	Ambient	3.7	36.5	-39.3	0.0	36.3	65.2	500.0	-17.7
7440.00	H	34.00	Ambient	4.7	38.1	-39.4	0.0	37.4	74.1	500.0	-16.6
7440.00	V	34.0	Ambient	4.7	38.1	-39.4	0.0	37.4	74.1	500.0	-16.6
12400.00	H	33.4	Ambient	6.1	41.5	-39.0	0.0	42.0	125.8	500.0	-12.0
12400.00	V	33.4	Ambient	6.1	41.5	-39.0	0.0	42.0	125.8	500.0	-12.0
19840.00	H	19.4	Ambient	2.2	40.4	-28.4	0.0	33.6	48.1	500.0	-20.3
19840.00	V	18.4	Ambient	2.2	40.4	-28.4	0.0	32.6	42.9	500.0	-21.3
22320.00	H	20.3	Ambient	2.2	40.6	-29.3	0.0	33.8	49.1	500.0	-20.2
22320.00	V	19.2	Ambient	2.2	40.6	-29.3	0.0	32.7	43.2	500.0	-21.3
2483.50	H	17.1		2.7	33.2	0.0	-38.3	14.7	5.4	500.0	-39.3
2483.50	V	24.2		2.7	33.2	0.0	-38.3	21.8	12.3	500.0	-32.2

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

Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 307
 Mode : Transmit at 2480MHz, Ch. 26, mid power
 Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions not in Restricted Bands
 Date : November 21, 2017 through November 29, 2017
 Test Distance : 3 meters
 Notes : Peak Detector with 100kHz 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)
2480.00	H	50.3		2.7	33.2	0.0	86.2	20312.9		
2480.00	V	61.4		2.7	33.2	0.0	97.3	72907.6		
9920.00	H	37.9	Ambient	5.3	39.8	-39.2	43.7	153.6	7290.8	-33.5
9920.00	V	38.4	Ambient	5.3	39.8	-39.2	44.2	162.8	7290.8	-33.0
14880.00	H	38.8	Ambient	6.8	42.2	-38.2	49.7	304.2	7290.8	-27.6
14880.00	V	37.1	Ambient	6.8	42.2	-38.2	48.0	250.1	7290.8	-29.3
17360.00	H	37.7	Ambient	7.4	44.8	-37.7	52.1	402.1	7290.8	-25.2
17360.00	V	38.2	Ambient	7.4	44.8	-37.7	52.6	425.9	7290.8	-24.7
24800.00	H	22.6	Ambient	2.2	40.6	-31.2	34.3	51.7	7290.8	-43.0
24800.00	V	21.5	Ambient	2.2	40.6	-31.2	33.2	45.6	7290.8	-44.1

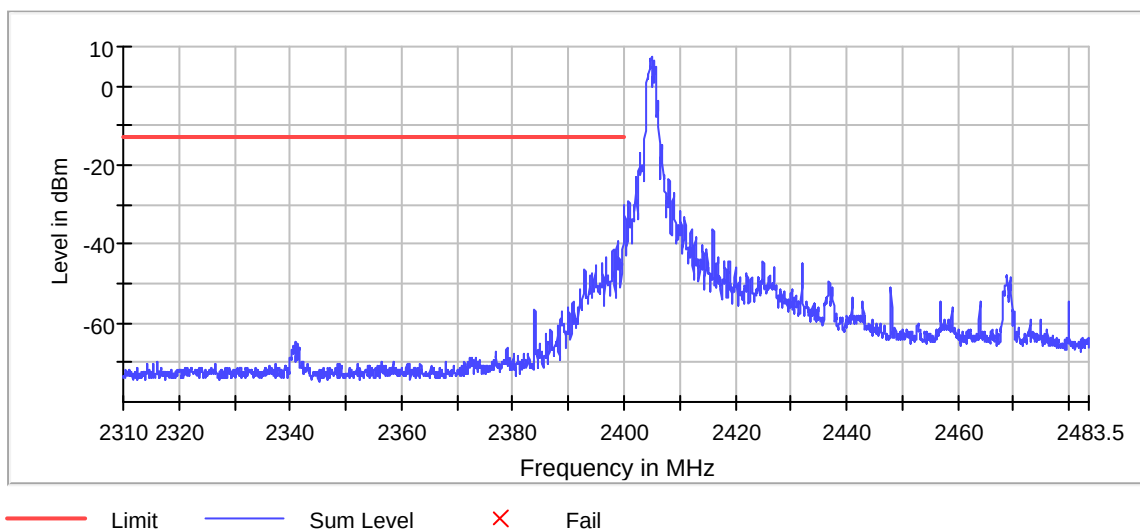
Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 292
 Mode : Transmit at 2405MHz, Ch. 11, mid power
 Test Specification : FCC-15.247, Low Frequency Band Edge
 Date : November 20, 2017
 Notes : Peak Detector with 100kHz Resolution Bandwidth

In-band Peak

Frequency (MHz)	Level (dBm)
2404.872083	7.3

Measurements

Frequency (MHz)	Level (dBm)	Margin (dB)	Limit (dBm)	Result
2399.925042	-34.8	22.0	-12.7	PASS
2399.875069	-37.2	24.5	-12.7	PASS
2398.825652	-39.5	26.8	-12.7	PASS
2399.825097	-39.8	27.1	-12.7	PASS
2398.775680	-39.9	27.2	-12.7	PASS
2398.875625	-40.4	27.6	-12.7	PASS
2398.026097	-41.5	28.8	-12.7	PASS
2399.775125	-41.6	28.8	-12.7	PASS
2398.725708	-41.6	28.9	-12.7	PASS
2398.675736	-41.7	29.0	-12.7	PASS
2398.076069	-41.8	29.1	-12.7	PASS
2397.976124	-41.9	29.1	-12.7	PASS
2399.725153	-42.6	29.9	-12.7	PASS
2398.925597	-42.8	30.0	-12.7	PASS
2398.625763	-43.0	30.3	-12.7	PASS





Manufacturer : Shure Incorporated
Test Item : Digitally Modulated Handheld Microphone Transmitter
Model No. : ADX2FD
Serial No. : 307
Mode : Transmit at 2480MHz, Ch. 26, mid power
Test Specification : FCC-15.247, High Frequency Band Edge Peak Radiated Emissions
Date : November 21, 2017
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	30.3		2.7	33.2	0.0	66.2	2033.5	5000.0	-7.8
2483.50	V	36.5		2.7	33.2	0.0	72.4	4151.8	5000.0	-1.6

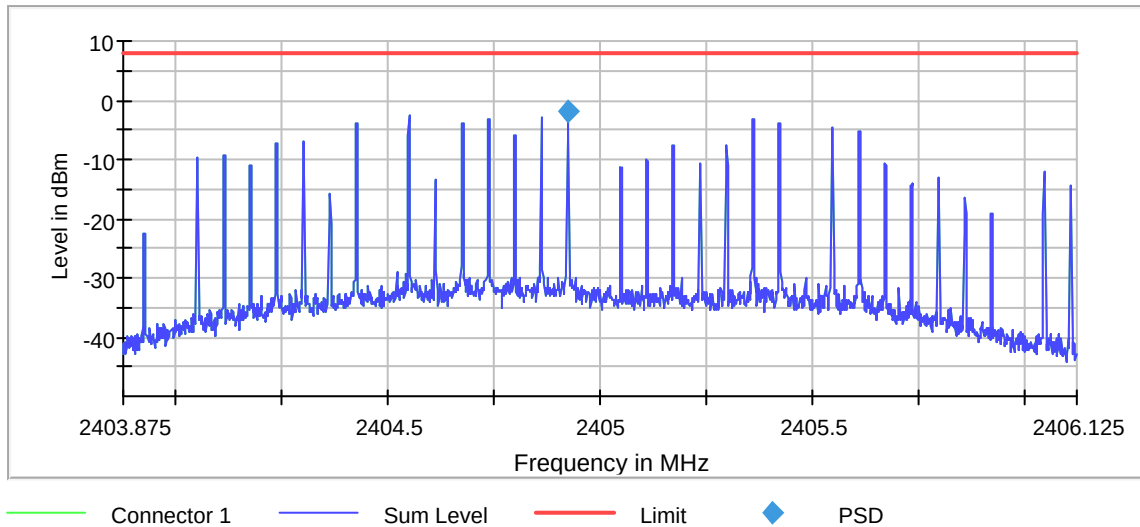


Manufacturer : Shure Incorporated
Test Item : Digitally Modulated Handheld Microphone Transmitter
Model No. : ADX2FD
Serial No. : 307
Mode : Transmit at 2480MHz, Ch. 26, mid power
Test Specification : FCC-15.247, High Frequency Band Edge Average Radiated Emissions
Date : November 21, 2017
Notes : Average 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	17.1		2.7	33.2	0.0	-38.3	14.7	5.4	500.0	-39.3
2483.50	V	24.2		2.7	33.2	0.0	-38.3	21.8	12.3	500.0	-32.2

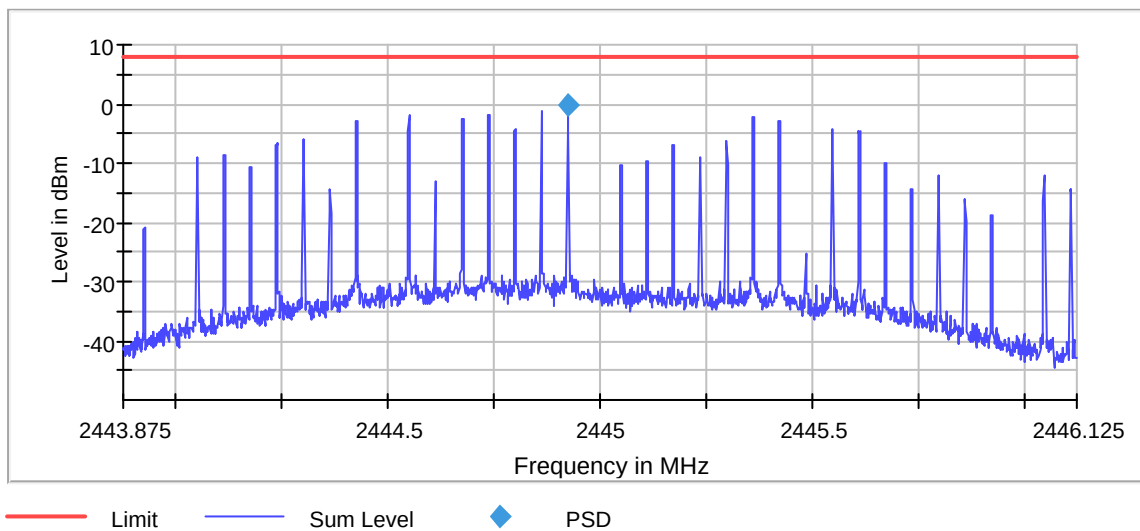
Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 292
 Mode : Transmit at 2405MHz, Ch. 11, mid power
 Test Specification : FCC-15.247, Peak Power Spectral Density
 Date : November 20, 2017
 Notes :

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2405.000000	2404.925050	-1.905	8.0	PASS



Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 292
 Mode : Transmit at 2445MHz, Ch. 19, mid power
 Test Specification : FCC-15.247, Peak Power Spectral Density
 Date : November 20, 2017
 Notes :

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2445.000000	2444.925050	-0.267	8.0	PASS



Manufacturer : Shure Incorporated
 Test Item : Digitally Modulated Handheld Microphone Transmitter
 Model No. : ADX2FD
 Serial No. : 292
 Mode : Transmit at 2480MHz, Ch. 26, mid power
 Test Specification : FCC-15.247, Peak Power Spectral Density
 Date : November 20, 2017
 Notes :

DUT Frequency (MHz)	Frequency (MHz)	PSD (dBm)	Limit Max (dBm)	Result
2480.000000	2479.926549	-7.033	8.0	PASS

