Measurement of RF Interference from an 8 Push-Button Wall-Mount Switch, Model No. TSS1204,Transmitter

For	Ideal Industries, Inc. 1375 Park Avenue Sycamore, IL 60178
P.O. Number	AWS101119EEE
Date Received	October 16, 2019
Date Tested	October 16, 2019 and October 17, 2019
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 902-928MHz ISED Canada RSS-247 ISED Canada RSS-GEN

Test Report By: MARK E. LONGINOTTI

Mark Longinotti
EMC Engineer

Requested By: Tim Tunnell
Ideal Industries, Inc.

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 SETUP 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
3.2	Software	6
3.3	Operational Mode	6
3.4	EUT Modifications	6
4.	**TEST FACILITY AND TEST INSTRUMENTATION**	6
4.1	Shielded Enclosure	6
4.2	Test Instrumentation	7
4.3	Calibration Traceability	7
4.4	Measurement Uncertainty	7
5.	**TEST PROCEDURES**	7
5.1	Transmitter	7
5.1.1	6dB Bandwidth	7
5.1.1.1	Requirements	7
5.1.1.2	Procedures	7
5.1.1.3	Results	7
5.1.2	Peak Conducted Output Power	8
5.1.2.1	Requirements	8
5.1.2.2	Procedures	8
5.1.2.3	Results	8
5.1.3	EIRP	8
5.1.3.1	Requirements	8
5.1.3.2	Procedures	8
5.1.3.3	Results	8
5.1.4	Antenna Conducted Spurious Emissions	8
5.1.4.1	Requirements	8
5.1.4.2	Procedures	9
5.1.4.3	Results	9
5.1.5	Radiated Spurious Emissions Measurements	9
5.1.5.1	Requirements	9
5.1.5.2	Procedures	9
5.1.5.3	Results	10
5.1.6	Band Edge Compliance	11
5.1.6.1	Requirements	11
5.1.6.2	Procedures	11
5.1.6.2.1	Low Band Edge	11
5.1.6.2.2	High Band Edge	11

5.1.6.3 Results 12
5.1.7 Power Spectral Density 12
5.1.7.1 Requirement 12
5.1.7.2 Procedures 12
Results 12
6. CONCLUSIONS 12
7. CERTIFICATION 12
8. ENDORSEMENT DISCLAIMER 13
9. EQUIPMENT LIST 14
Table 9-1 Equipment List 14

REVISION HISTORY

Revision	Date	Description
—	10/18/2019	Initial release

Measurement of RF Emissions from an 8 Push-Button Wall-Mount Switch, Model No. TSS1204 Transmitter

1. INTRODUCTION

1.1 Scope of Tests

This document represents the results of the series of radio interference measurements performed on an Ideal Industries, Inc. 8 Push-Button Wall-Mount Switch, Model No. TSS1204, (hereinafter referred to as the EUT). Serial No. 32000001 was assigned to the EUT used for antenna port conducted tests. Serial No. 32000002 was assigned to the EUT used for EIRP and spurious radiated emissions tests. The EUT is a digital modulation transmitter. The EUT was designed to transmit in the 902-928 MHz band using a non-removable, trace antenna. The EUT was manufactured and submitted for testing by Ideal Industries, Inc. located in Sycamore, 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 C, Sections 15.207 and 15.247 for Intentional Radiators Operating within the 902-928 MHz band.

The test series was also performed to determine if the EUT meets the conducted RF emission requirements, radiated RF emissions requirements, and additional provisions of the Innovation, Science, and Economic Development Canada Radio Standards Specification RSS-Gen Section 8.8 and Innovation, Science, and Economic Development Canada Radio Standards Specification RSS-247 for Transmitters.

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

1.3 Deviations, Additions and Exclusions

There were no deviations, additions to, or exclusions from the test specification during this test series

1.4 EMC Laboratory Identification

This series of tests was performed by Elite Electronic Engineering Incorporated of Downers Grove, Illinois. The laboratory is accredited by the American Association for Laboratory Accreditation (A2LA), A2LA Lab Code: 1786-01.

1.5 Laboratory Conditions

The temperature at the time of the test was 24°C and the relative humidity was 22%.

2. APPLICABLE DOCUMENTS

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

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 15, Subpart C
- ANSI C63.4-2014, "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz”
- ANSI C63.10-2013, "American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices”
- Federal Communications Commission Office of Engineering and Technology Laboratory Division, Guidance For Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section15.247 of the FCC Rules
  April 2, 2019

- Innovation, Science, and Economic Development Canada RSS-247, Issue 2, February 2017, “Spectrum Management and Telecommunications Radio Standards Specification, Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs), and License-Exempt Local Area Network (LE-LAN) Devices”

- Innovation, Science, and Economic Development Canada RSS-GEN, Issue 5, March 2019, “Spectrum Management and Telecommunications Radio Standards Specification, General Requirements for Compliance of Radio Apparatus”

3. EUT SETUP AND OPERATION

3.1 General Description

The EUT is an 8 Push-Button Wall-Mount Switch, Model No. TSS1204. A block diagram of the EUT setup is shown as Figure 1. A photograph of the EUT is shown as Figure 2.

3.1.1 Power Input

The EUT was powdered by 3.6VDC from an internal Tadiran lithium battery.

3.1.2 Peripheral Equipment

The EUT was submitted for testing with no peripheral equipment.

3.1.3 Interconnect Cables

The EUT was submitted for testing with no interconnect cables.

3.1.4 Grounding

The EUT was not grounded.

3.2 Software

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

3.3 Operational Mode

The EUT was energized. The unit was programmed to operate in one of the following modes:

- Transmit at 902.72MHz, power setting = 5dBm
- Transmit at 915.00MHHz, power setting = 5dBm
- Transmit at 927.32MHHz, power setting = 5dBm

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.

4.3 Calibration Traceability

Test equipment is maintained and calibrated on a regular basis with a calibration interval not greater than two years. All calibrations are traceable to the International System Units (SI) through 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 Transmitter

5.1.1 6dB Bandwidth

5.1.1.1 Requirements

Per 15.247(a)(2) and ISED Canada RSS-247 Section 5.2, the minimum 6dB bandwidth shall be at least 500kHz for all systems using digital modulation techniques.

5.1.1.2 Procedures

The antenna port of the EUT was connected to the spectrum analyzer through 20dB of attenuation. The EUT was allowed to transmit continuously. The transmit channel was set separately to low, middle, and high channels. The resolution bandwidth (RBW) was set to 100kHz, the video bandwidth (VBW) was set to the same as or 3 times greater than the RBW, and the span was set to 3 times the RBW.

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

5.1.1.3 Results

The plots on pages 19 through 21 show that the minimum 6 dB bandwidth was 658.65kHz which is greater than the minimum allowable 6dB bandwidth requirement of 500kHz for systems using digital modulation techniques. The 99% bandwidth was measured to be 759.6kHz. Plots of the 99% bandwidths are shown on pages 22 through 24.

5.1.2 Peak Conducted Output Power

5.1.2.1 Requirements

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

5.1.2.2 Procedures

The antenna port of the EUT was connected to the spectrum analyzer through 20dB of attenuation. The EUT was set to transmit separately at the low, middle, and high channels. The resolution bandwidth (RBW) was set to greater than the 6dB bandwidth. The 'Max-Hold' function was engaged. The maximum meter reading was recorded. The peak power output was calculated for the low, middle and high channels.

5.1.2.3 Results

The results are presented on pages 25 through 27. The maximum peak conducted output power from the transmitter was 2.14mW (3.3dBm) which is below the 1 Watt limit.

5.1.3 EIRP

5.1.3.1 Requirements

Per section FCC 15.247(b)(2) and ISED Canada RSS-247 section 5.4, for systems using digital modulation operating in the 902-928MHz band, the maximum peak output conducted power shall not be greater than 1W (30dBm). Per section FCC 15.247(b)(4) and ISED Canada RSS-247 section 5.4, 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 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below 30dBm by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.1.3.2 Procedures

The EUT was placed on an 80cm high, non-conductive stand and set to transmit. A bilog antenna was placed at a test distance of 3 meters from the EUT. The resolution bandwidth (RBW) of the spectrum analyzer was set to greater than the 6dB bandwidth. The 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 channels.

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

5.1.3.3 Results

The results are presented on pages 28 through 30. The maximum EIRP measured from the transmitter was 5.13mW (7.1dBm) which is below the 4 Watt limit.

5.1.4 Antenna Conducted Spurious Emissions

5.1.4.1 Requirements

Per section FCC 15.247(d) and ISED Canada RSS-247 section 5.5, the spurious emissions in any 100 kHz BW outside the frequency band must be at least 20dB below the highest 100 kHz BW level measured within the band.

5.1.4.2 Procedures

The antenna port of the EUT was connected to the spectrum analyzer through 20dB of attenuation. The resolution bandwidth (RBW) was set to 100kHz. The peak detector and 'Max-Hold' function were engaged. The emissions in the frequency range from 30MHz to 9.5GHz were observed and plotted separately with the EUT transmitting at low, middle and high channels.

5.1.4.3 Results

The results of the antenna conducted emissions levels were plotted. These plots are presented on pages 31 through 33. These plots show that the spurious emissions were at least 20 dB below the level of the fundamental.

5.1.5 Radiated Spurious Emissions Measurements

5.1.5.1 Requirements

Per section 15.247(d) and ISED Canada section 5.5, in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated emissions measurement. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must comply with the radiated emission limits specified in §15.209(a).

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

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

5.1.5.2 Procedures

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

Preliminary radiated emissions tests were performed to determine the emission characteristics of the EUT. For the preliminary test, a broadband measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 30MHz to 10.0GHz was investigated using a peak detector function.

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

1) For all harmonics not in the restricted bands, the following procedure was used:

   a) The field strength of the fundamental was measured using a bilog antenna. The bilog antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on an 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 of the harmonics not in the restricted band were then measured using a double-ridged waveguide antenna. The waveguide antenna was positioned at a 3 meter distance from the EUT. The EUT was placed on a 1.5 meter high non-conductive stand. A peak detector with a resolution bandwidth of 100 kHz was used on the spectrum analyzer.

c) To ensure that maximum or worst case emission levels at the fundamental and harmonics were measured, the following steps were taken when measuring the fundamental emissions and the spurious emissions:

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

ii) Since the measuring antenna is linearly polarized, both horizontal and vertical field components were measured.

iii) The measuring antenna was raised and lowered for each antenna polarization to maximize the readings.

d) All harmonics not in the restricted bands must be at least 20 dB below levels measured at the fundamental. However, attenuation below the general limits specified in §15.209(a) is not required.

2) For all emissions in the restricted bands, the following procedure was used:

a) The field strengths of all emissions below 1 GHz were measured using a 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.

d) For all radiated emissions measurements below 1 GHz, if the peak reading is below the limits listed in 15.209(a), no further measurements are required. If however, the peak readings exceed the limits listed in 15.209(a), then the emissions are remeasured using a quasi-peak detector.

e) For all radiated emissions measurements above 1 GHz, the peak readings must comply with the 15.35(b) limits. 15.35(b) states that when average radiated emissions measurements are specified, there also is a limit on the peak level of the radiated emissions. The limit on the peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. Therefore, all peak readings above 1 GHz must be no greater than 20 dB above the limits specified in 15.209(a).

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

5.1.5.3 Results

5.1.5.3.1 Transmit at 902.72MHz:

Preliminary radiated emissions plots are shown on pages 34 through 37. Final radiated emissions data are

presented on data pages 38 through 40. As can be seen from the data, all emissions measured from the EUT were within the specification limits.

5.1.5.3.2 Transmit at 915.00MHz:

Preliminary radiated emissions plots are shown on pages 41 through 44. Final radiated emissions data are presented on data pages 45 through 47. As can be seen from the data, all emissions measured from the EUT were within the specification limits.

5.1.5.3.3 Transmit at 927.32MHz:

Preliminary radiated emissions plots are shown on pages 48 through 51. Final radiated emissions data are presented on data pages 52 through 54. 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 Figure 3 and Figure 4.

5.1.6 Band Edge Compliance

5.1.6.1 Requirements

Per FCC section 15.247(d) and ISED Canada RSS-247 section 5.5, the emissions at the band edges must be at least 20dB below the highest level measured within the band but attenuation below the general limits listed in 15.209(a) is not required.

5.1.6.2 Procedures

5.1.6.2.1 Low Band Edge

1) The antenna port of the EUT was connected to the spectrum analyzer through 20dB of attenuation.
2) The EUT was set to transmit continuously at the channel closest to the low band edge.
3) To determine the band edge compliance, the following spectrum analyzer settings were used:

    a. Center frequency = low band edge frequency.
    b. Span = Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
    c. Resolution bandwidth (RBW) = 100kHz.
    d. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
    e. The marker was set on the peak of the in-band emissions. A display line was placed 20dB down from the peak of the in-band emissions. All emissions which fall outside of the authorized band of operation must be below the 20dB down display line. (All emissions to the left of the center frequency (band edge) must be below the display line.)
    f. The analyzer's display was plotted using a 'screen dump' utility.

5.1.6.2.2 High Band Edge

1) The antenna port of the EUT was connected to the spectrum analyzer through 20dB of attenuation.
2) The EUT was set to transmit continuously at the channel closest to the high band edge.
3) To determine the band edge compliance, the following spectrum analyzer settings were used:

    g. Center frequency = high band edge frequency.
    h. 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.

i. Resolution bandwidth (RBW) = 100kHz.
j. The 'Max-Hold' function was engaged. The analyzer was allowed to scan until the envelope of the transmitter bandwidth was defined.
k. 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.)
l. The analyzer's display was plotted using a 'screen dump' utility.

5.1.6.3 Results

Pages 55 and 56 show the conducted band edge compliance results. As can be seen from these plots, the emissions at the low end band edge and the high end band edge are within the 20 dB down limits.

5.1.7 Power Spectral Density

5.1.7.1 Requirement

Per section 15.247(e) and ISED Canada RSS-247 section 5.2(b), the peak power spectral density from the intentional radiator shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

5.1.7.2 Procedures

1) The antenna port of the EUT was connected to the spectrum analyzer through a 20dB pad.
2) The EUT was set to transmit separately at the low, middle, and high channels.
3) To determine the power spectral density, the following spectrum analyzer settings were used:
    a. Center frequency = transmit frequency
    b. Span = 1.5 times the DTS (6 dB) bandwidth
    c. Resolution bandwidth (RBW): 3kHz ≤ RBW ≤ 100kHz
    d. Sweep time = auto
    e. The peak detector and 'Max-Hold' function was engaged.
    f. The display line represents the 8 dBm limit
    g. The analyzer's display was plotted using a 'screen dump' utility.
4) If measured value exceeds limit, reduce RBW (no less than 3kHz) and repeat.

5.1.8 Results

Pages 57 through 59 show the power spectral density results. As can be seen from these plots, the peak power spectral density is less than 8dBm in a 3kHz band during any time interval of continuous transmission.

6. CONCLUSIONS

It was determined that the Ideal Industries, Inc. 8 Push-Button Wall-Mount Switch, Model No. TSS1204 digital modulation transmitter, did fully meet the conducted and radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Sections 15.207 and 15.247 for Intentional Radiators Operating within the 902-928 MHz, band, when tested per ANSI C63.10-2013.

It was also determined that the Ideal Industries, Inc. 8 Push-Button Wall-Mount Switch, Model No. TSS1204, digital modulation transmitter did fully meet the conducted and radiated RF emission requirements of the Innovation, Science, and Economic Development Canada Radio Standards Specification, RSS-Gen Section 8.8 and Radio Standards Specification RSS-247 for transmitters, when tested per 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
APW14	PREAMPLIFIER	PLANAR	PE2-35-120-5R0-10-12-SFF	PL22671	1-20GHz	9/25/2019	9/25/2020
CDY0	WORKSTATION	ELITE	WORKSTATION		WINDOWS 7	N/A	
GRE1	SIGNAL GENERATOR	AGILENT	E4438C	MY42081749	250KHZ-6GHZ	2/22/2019	2/22/2020
NDQ0	TUNED DIPOLE ANTENNA	EMCO	3121C-DB4	311	400-1000MHZ	5/8/2018	5/8/2020
NTA2	BILOG ANTENNA	TESEQ	6112D	28040	25-1000MHz	12/20/2018	12/20/2019
NWQ0	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS LINDGREN	3117	66657	1GHZ-18GHZ	5/31/2018	5/31/2020
RBE2	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU26	100160	20Hz-26GHz	3/8/2019	3/8/2020
RBG3	EMI ANALYZER	ROHDE & SCHWARZ	ESW44	101592	2HZ-44GHZ	2/20/2019	2/20/2020
SHC2	Power Supplies	HENGFU	HF60W-SL-24	A11372702	24V	NOTE 1	
T2DP	20DB, 25W ATTENUATOR	WEINSCHEL	46-20-34	BS0921	DC-18GHZ	4/23/2018	4/23/2020
WKA1	SOFTWARE, UNIVERSAL RCV EMI	ELITE	UNIV_RCV_EMI	1	---	I/O	
XPQ3	HIGH PASS FILTER	K&L MICROWAVE	4IH30-1804/T10000-0	4	1.8GHZ-10GHZ	9/6/2019	9/6/2021

N/A: Not Applicable
I/O: Initial Only
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.

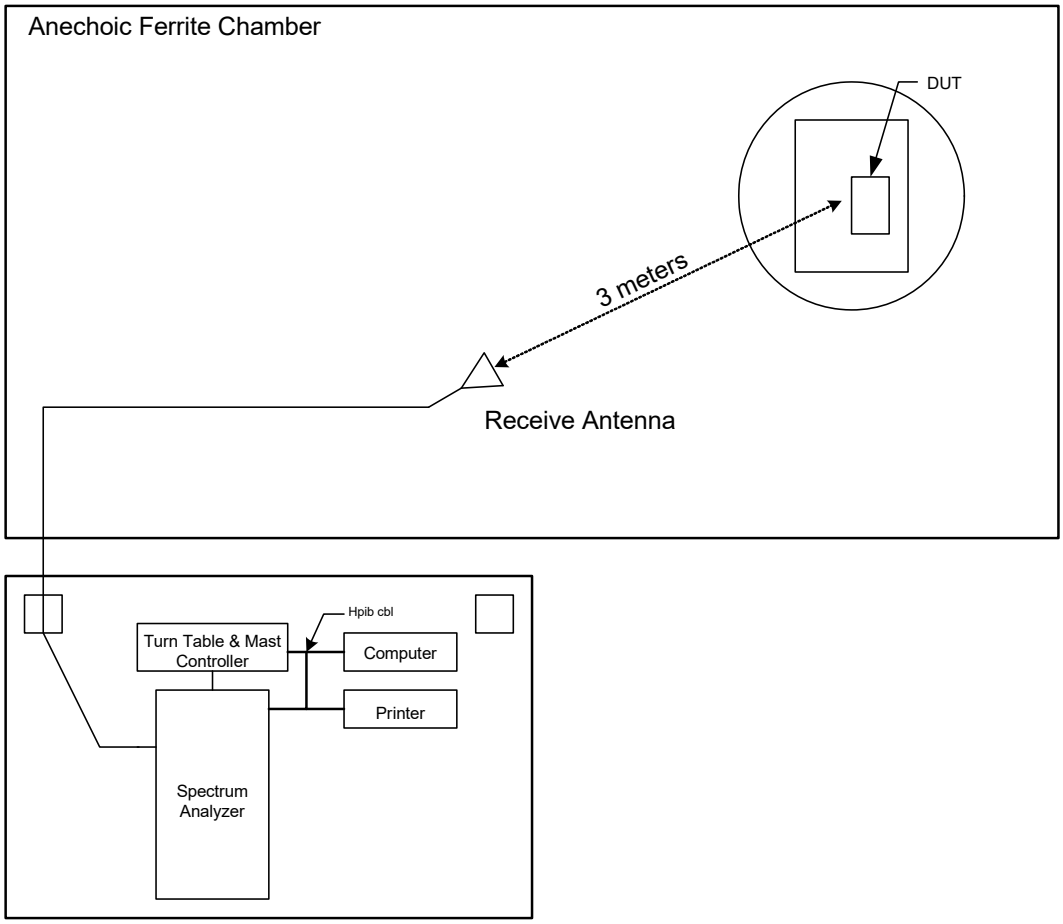


FIGURE 1 BLOCKDIAGRAM OF TEST SETUP

Figure 2

Photograph of EUT

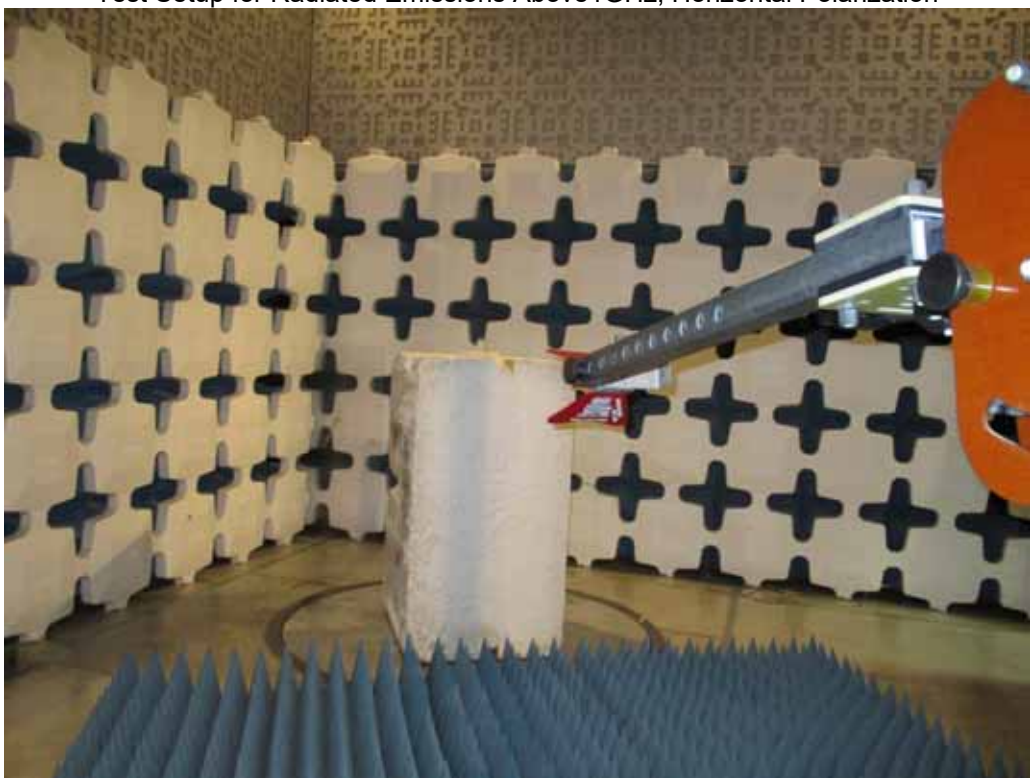
Figure 3

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

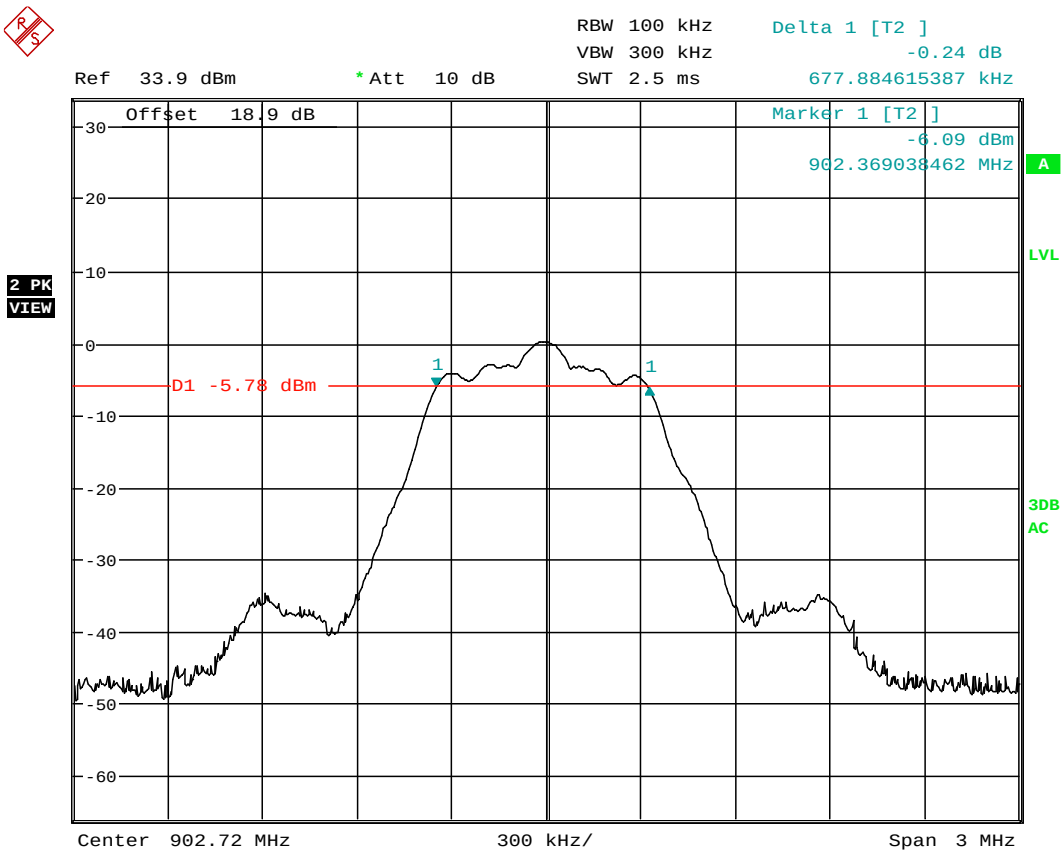
Test Setup for Radiated Emissions – 30MHz to 1GHz, Vertical Polarization

Figure 4

Test Setup for Radiated Emissions Above1GHz, Horizontal Polarization

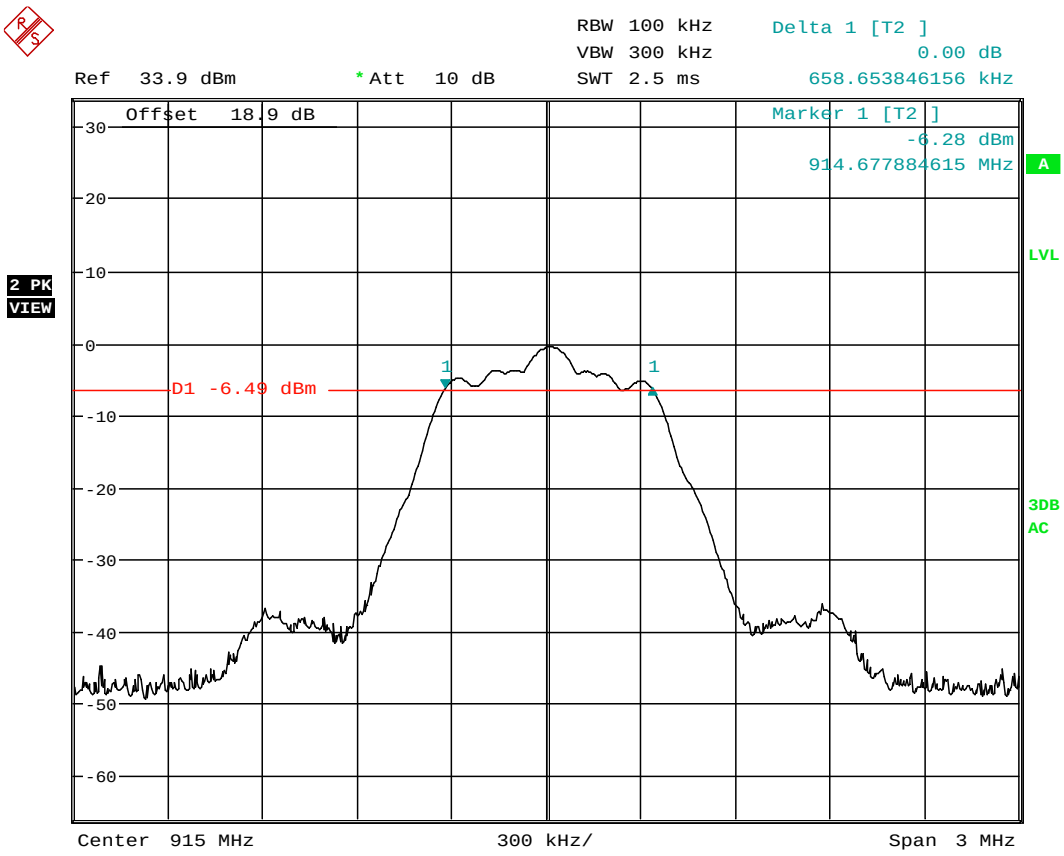


Test Setup for Radiated Emissions Above 1GHz, Vertical Polarization



DTS Bandwidth (6 dB Bandwidth)

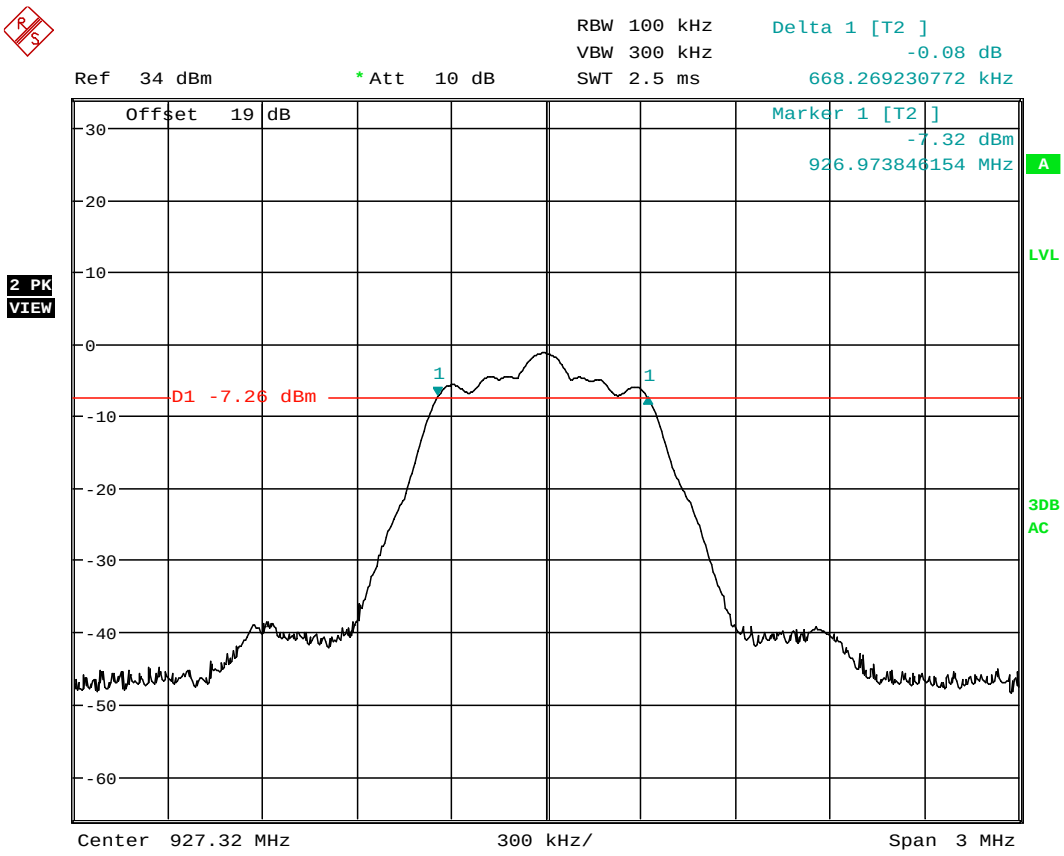
Manufacturer	:	Ideal Industries
Model Number	:	TSS1204
Serial Number	:	320000001
Mode	:	Transmit at 902.72
Line Tested	:	Antenna Port
Date	:	10/16/2019 9:04:02 AM
Notes	:	6 dB bandwidth = 677.88kHz



Date: 16.OCT.2019 10:23:26

DTS Bandwidth (6 dB Bandwidth)

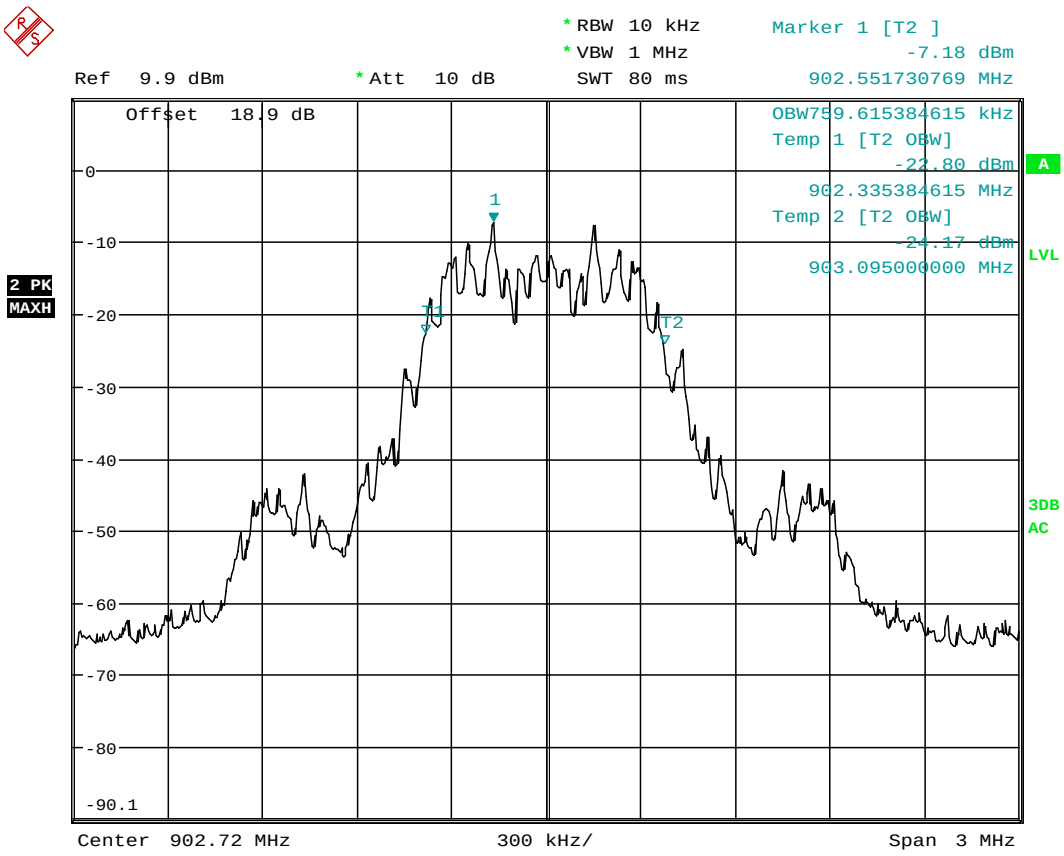
Manufacturer	:	Ideal Industries
Model Number	:	TSS1204
Serial Number	:	32000001
Mode	:	Transmit at 915MHz
Line Tested	:	Antenna Port
Date	:	10/16/2019 9:11:18 AM
Notes	:	6 dB bandwidth = 658.65kHz



Date: 16.OCT.2019 10:28:40

DTS Bandwidth (6 dB Bandwidth)

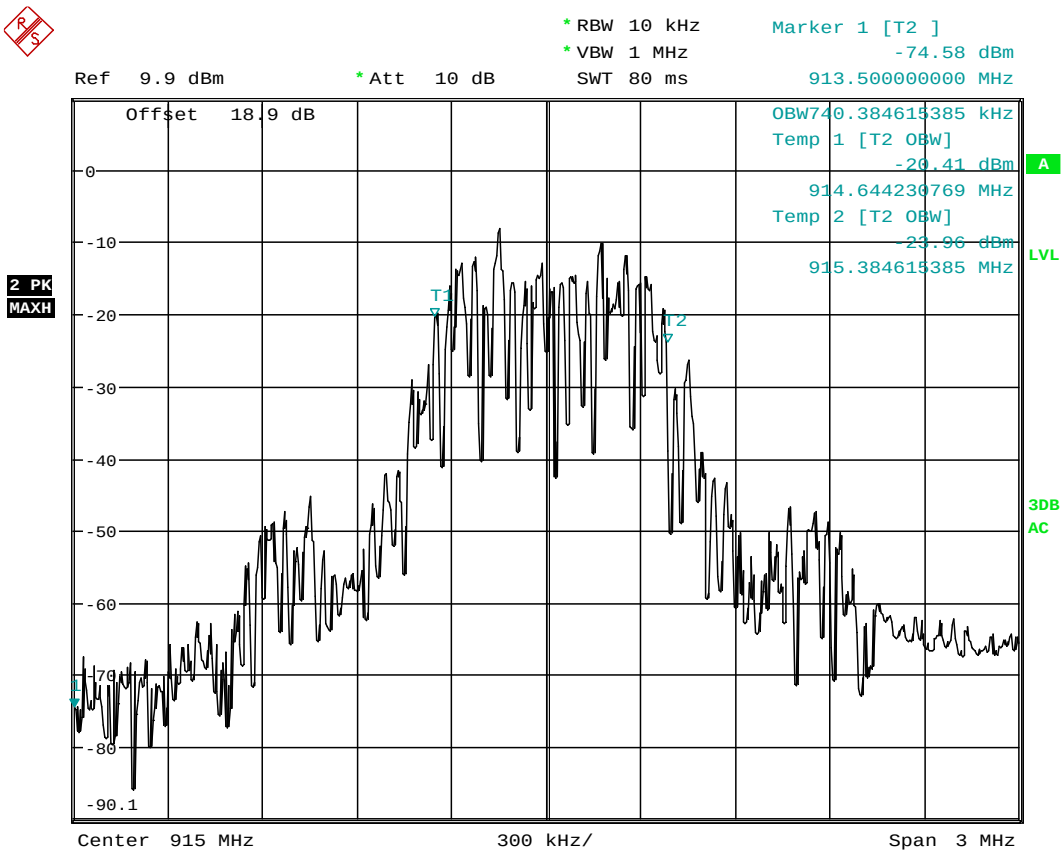
Manufacturer	:	Ideal Industries
Model Number	:	TSS1204
Serial Number	:	32000001
Mode	:	Transmit at 927.32MHz
Line Tested	:	Antenna Port
Date	:	10/16/2019 9:16:32 AM
Notes	:	6 dB bandwidth = 668.27kHz



Date: 16.OCT.2019 11:07:45

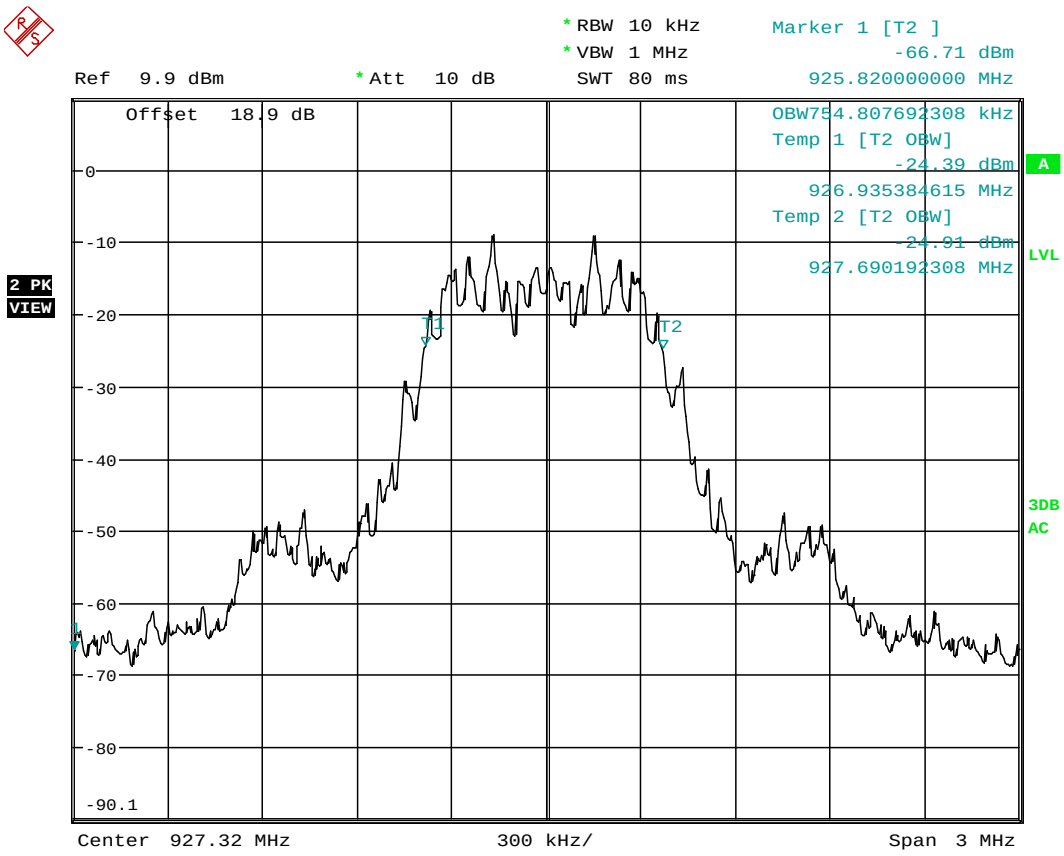
99% Bandwidth

Manufacturer	:	Ideal Industries
Model Number	:	TSS1204
Serial Number	:	32000001
Mode	:	Transmit at 902.72
Line Tested	:	Antenna Port
Date	:	10/16/2019 9:55:39 AM
Notes	:	99% bandwidth = 759.6kHz



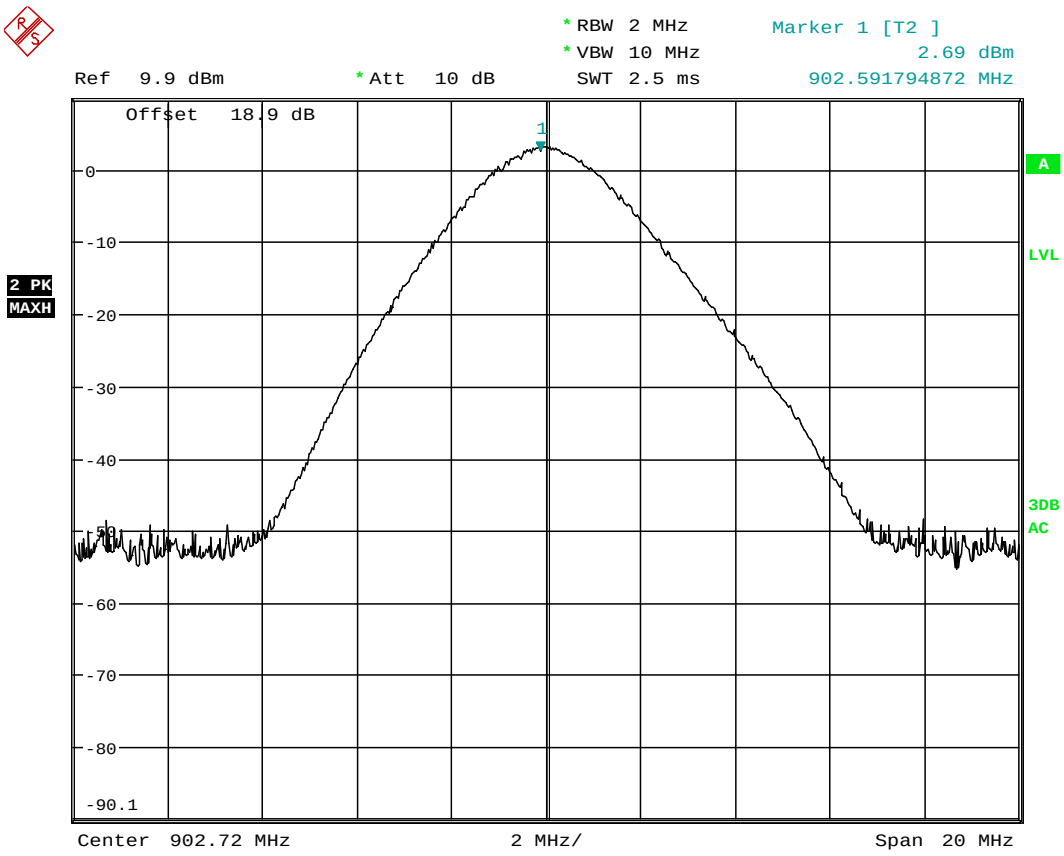
99% Bandwidth

Manufacturer	:	Ideal Industries
Model Number	:	TSS1204
Serial Number	:	32000001
Mode	:	Transmit at 915MHz
Line Tested	:	Antenna Port
Date	:	10/16/2019 9:57:49 AM
Notes	:	99% bandwidth = 759.6kHz



99% Bandwidth

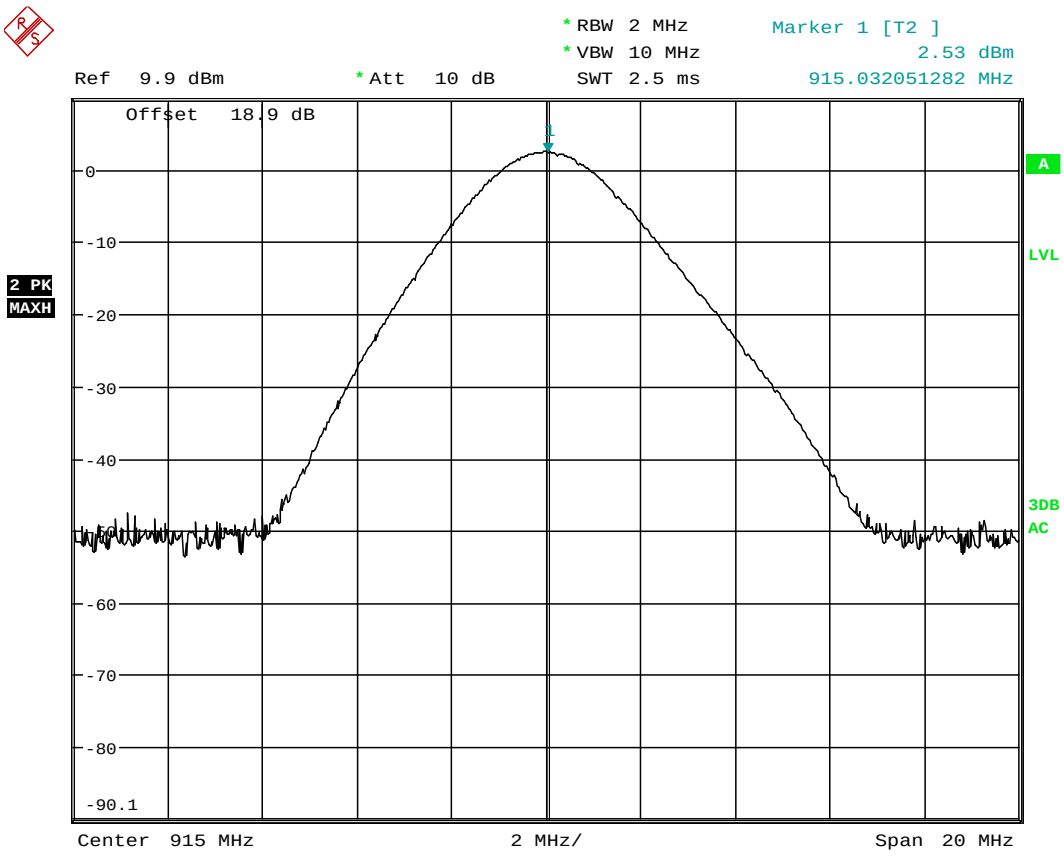
Manufacturer	:	Ideal Industries
Model Number	:	TSS1204
Serial Number	:	32000001
Mode	:	Transmit at 927.32MHz
Line Tested	:	Antenna Port
Date	:	10/16/2019 9:59:30 AM
Notes	:	99% bandwidth = 754.8kHz



Date: 16.OCT.2019 10:34:41

Peak Conducted Output Power

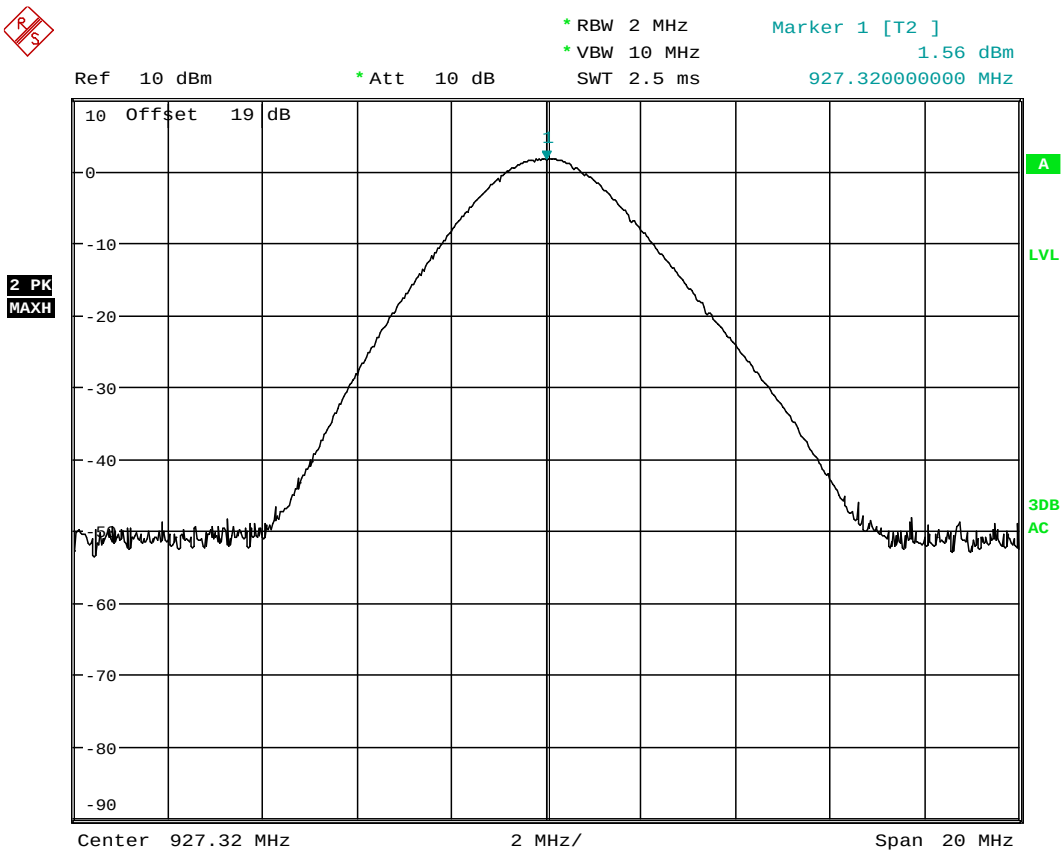
Manufacturer	:	Ideal Industries
Model Number	:	TSS1204
Serial Number	:	32000001
Mode	:	Transmit at 902.72MHz
Line Tested	:	Antenna Port
Date	:	10/16/2019 9:22:33 AM
Notes	:	Peak Conducted Output Power = 3.3dBm



Date: 16.OCT.2019 10:36:19

Peak Conducted Output Power

Manufacturer	:	Ideal Industries
Model Number	:	TSS1204
Serial Number	:	32000001
Mode	:	Transmit at 915MHz
Line Tested	:	Antenna Port
Date	:	10/16/2019 9:24:10 AM
Notes	:	Peak Conducted Output Power = 2.62dBm



Date: 16.OCT.2019 10:32:24

Peak Conducted Output Power

Manufacturer	:	Ideal Industries
Model Number	:	TSS1204
Serial Number	:	32000001
Mode	:	Transmit at 927.32MHz
Line Tested	:	Antenna Port
Date	:	10/16/2019 9:20:15 AM
Notes	:	Peak Conducted Output Power = 1.85dBm

Manufacturer : Ideal Industries, Inc.
Test Item : 8 Push-Button Wall-Mount Switch
Model No. : TSS1204
Serial No. : 32000002
Mode : Transmit at 902.72MHz
Test Specification : FCC-15.247, RSS-247 Peak EIRP
Date : October 17, 2019
Test Distance : 3 meters
Notes :

Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
902.72	H	56.2	-15.1	2.2	1.6	-14.6	36.0	-50.6
902.72	V	73.8	6.6	2.2	1.6	7.1	36.0	-28.9

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

Manufacturer : Ideal Industries, Inc.
Test Item : 8 Push-Button Wall-Mount Switch
Model No. : TSS1204
Serial No. : 32000002
Mode : Transmit at 915.00MHz
Test Specification : FCC-15.247, RSS-247 Peak EIRP
Date : October 17, 2019
Test Distance : 3 meters
Notes :

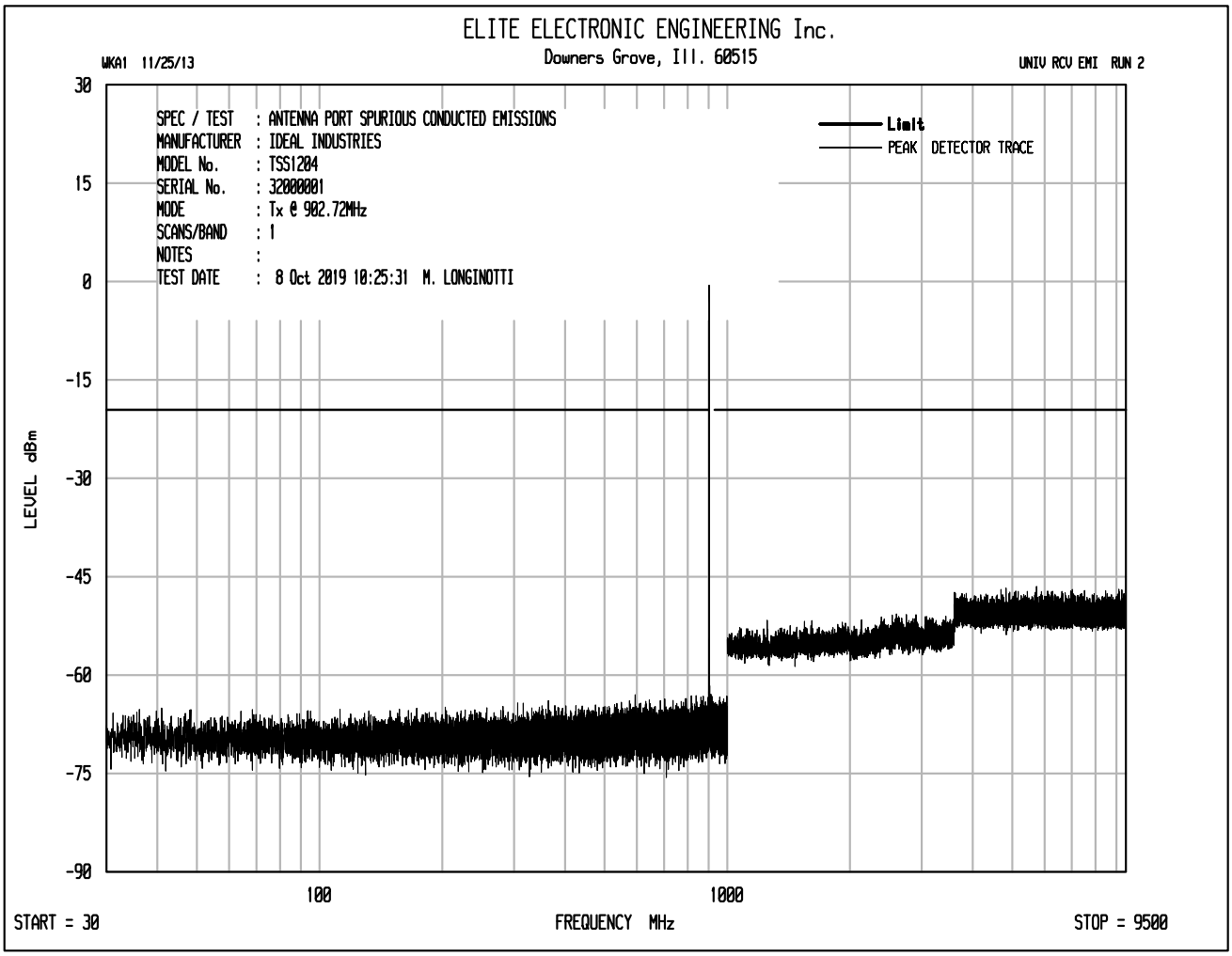
Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
915.00	H	55.6	-15.5	2.2	1.6	-15.0	36.0	-51.0
915.00	V	73.0	5.7	2.2	1.6	6.2	36.0	-29.8

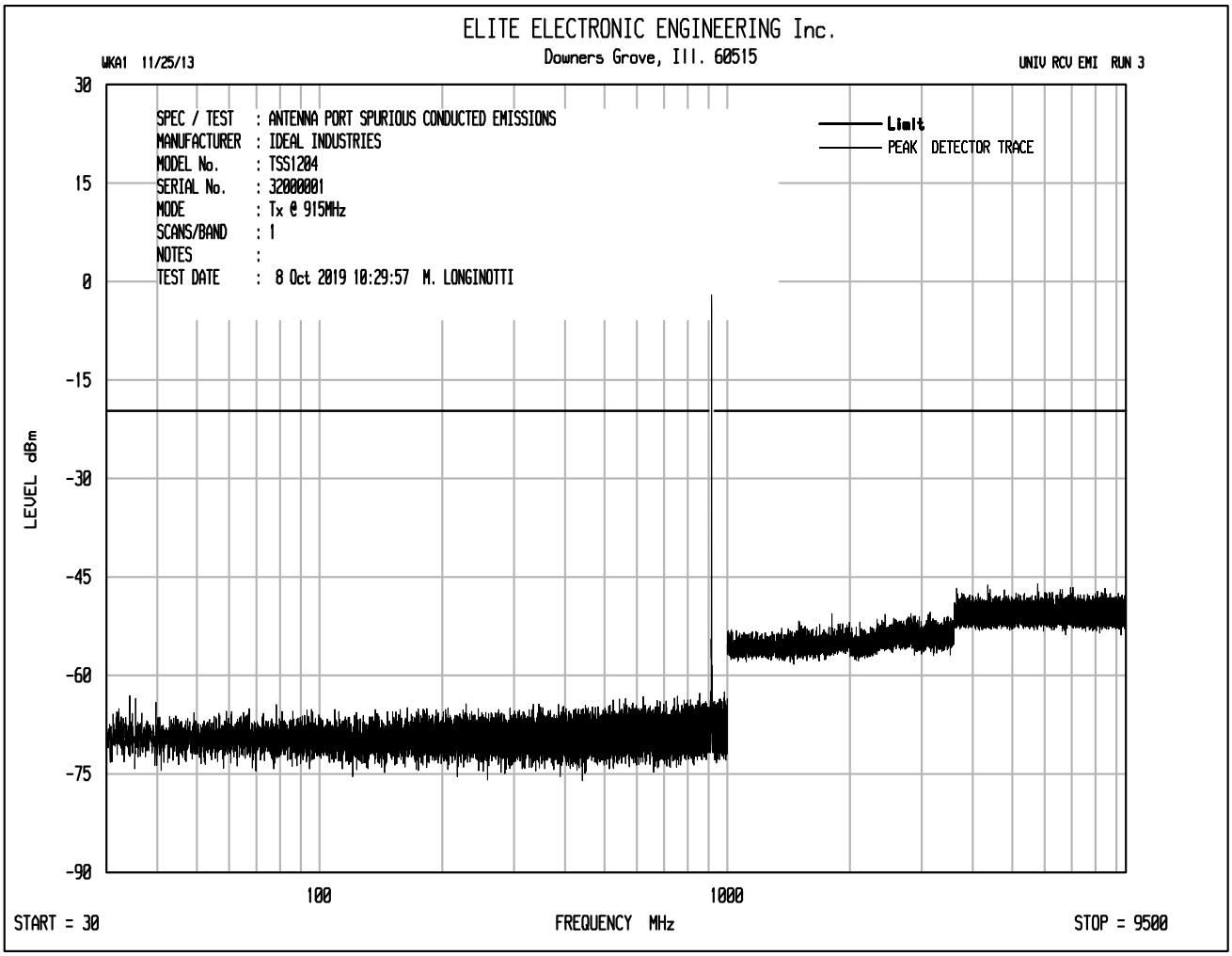
EIRP(dBm) = Sig. Gen. Reading (dBm) + Antenna Gain (dB) – Cable Loss (dB)

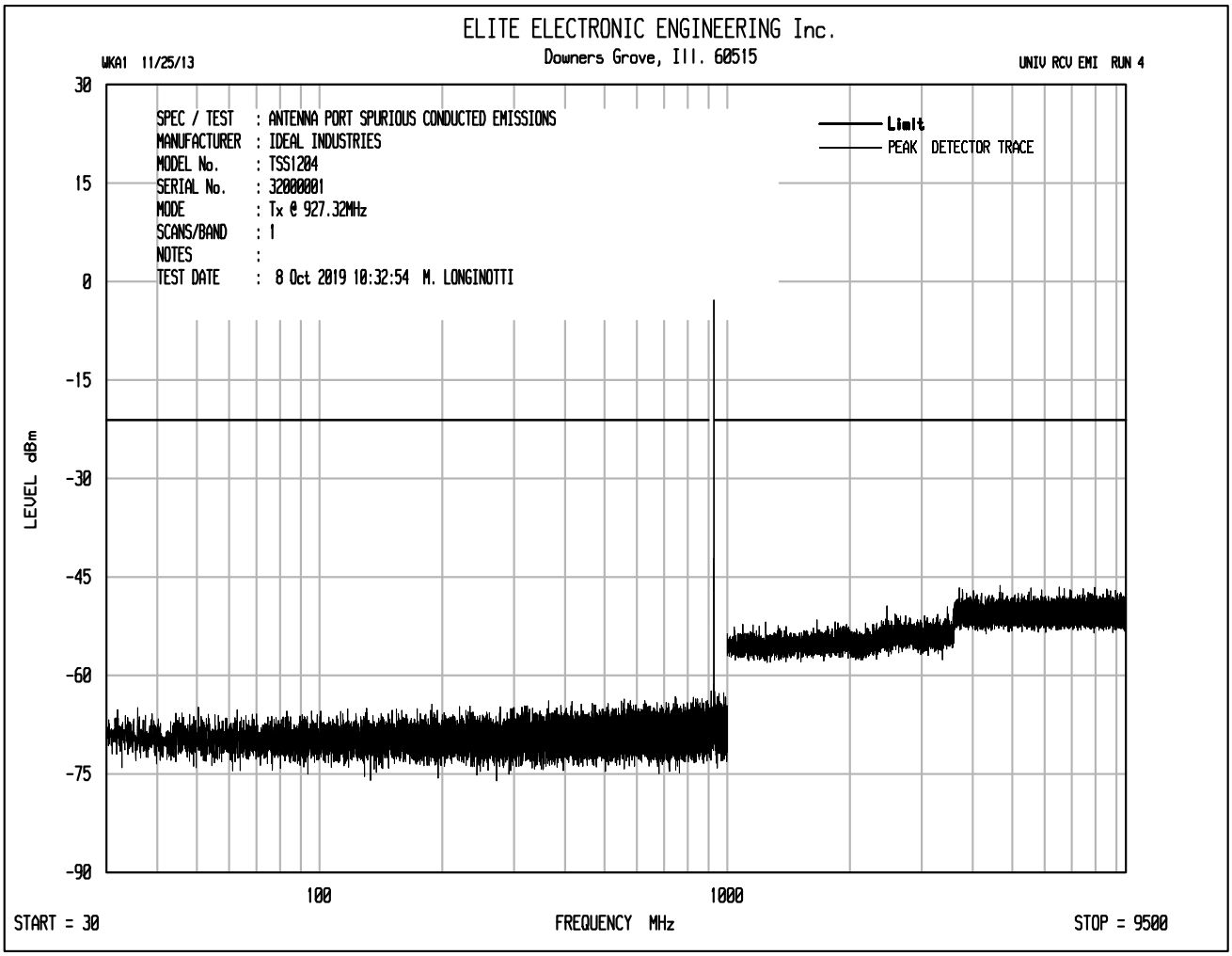
Manufacturer : Ideal Industries, Inc.
Test Item : 8 Push-Button Wall-Mount Switch
Model No. : TSS1204
Serial No. : 32000002
Mode : Transmit at 927.32MHz
Test Specification : FCC-15.247, RSS-247 Peak EIRP
Date : October 17, 2019
Test Distance : 3 meters
Notes :

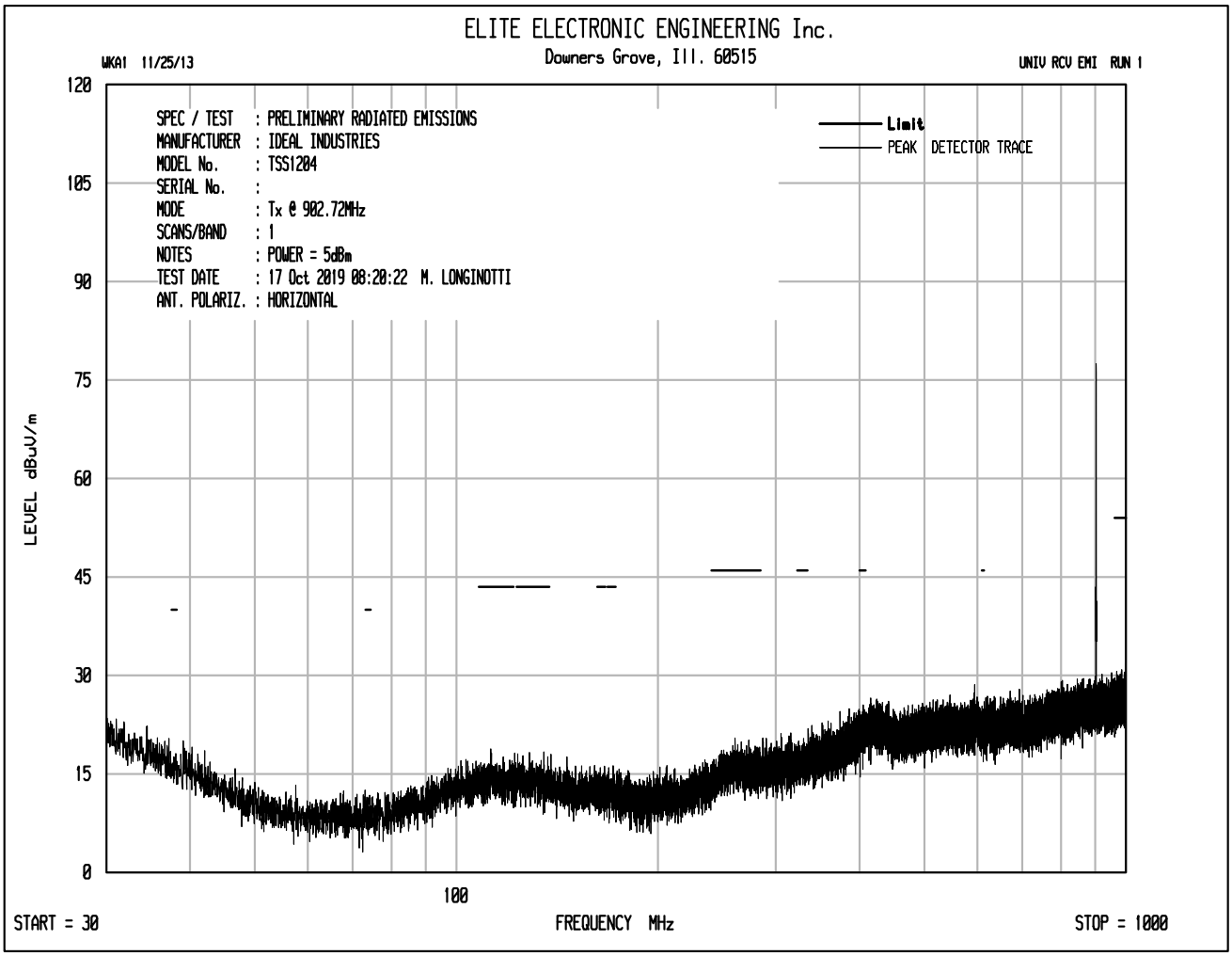
Freq. (MHz)	Ant Pol	Wide BW Meter Reading (dBuV)	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	EIRP (dBm)	Limit (dBm)	Margin (dB)
927.32	H	53.9	-17.1	2.2	1.7	-16.6	36.0	-52.6
927.32	V	71.2	3.6	2.2	1.7	4.1	36.0	-31.9

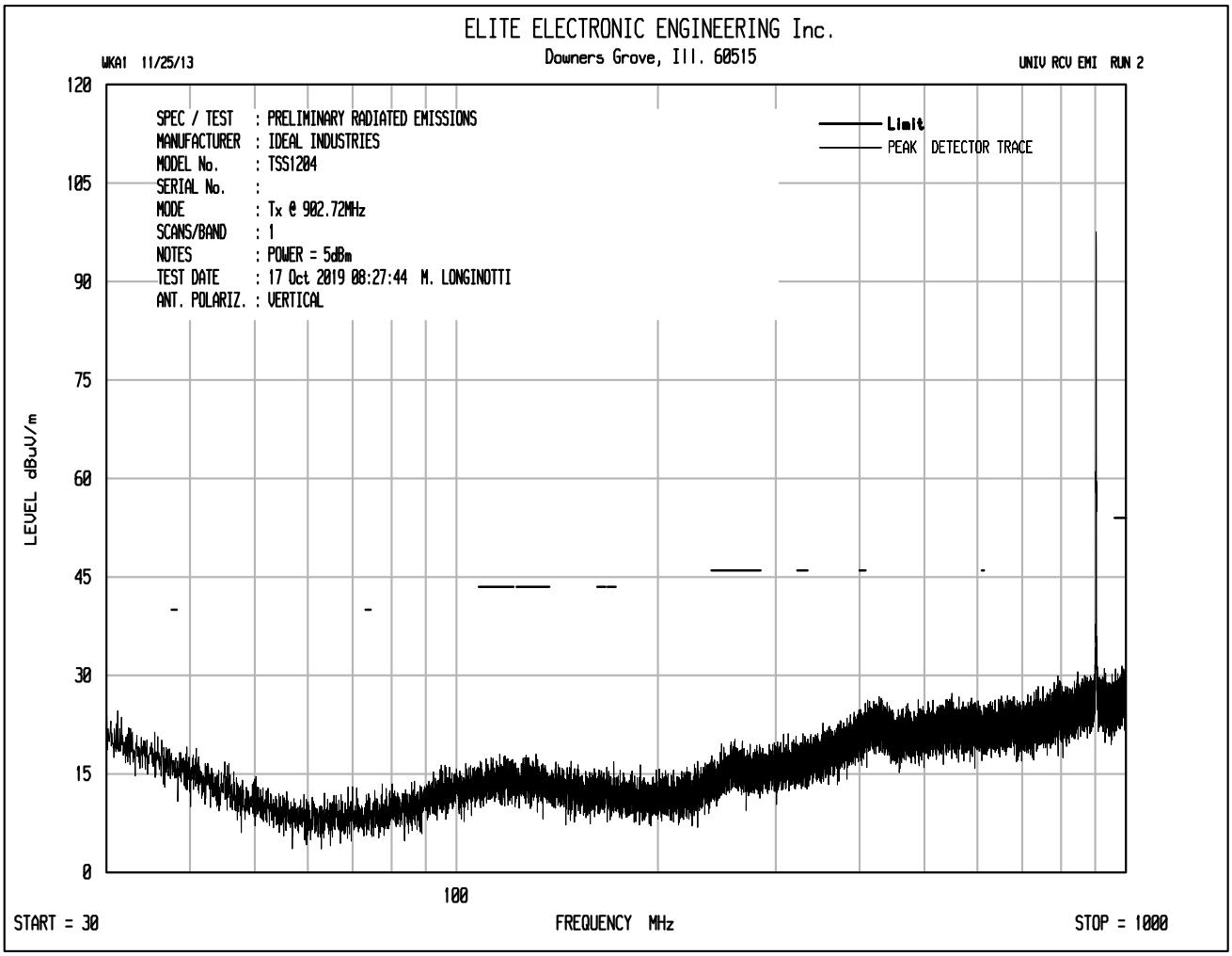
EIRP(dBm) = Sig. Gen. Reading (dBm) + Antenna Gain (dB) – Cable Loss (dB)

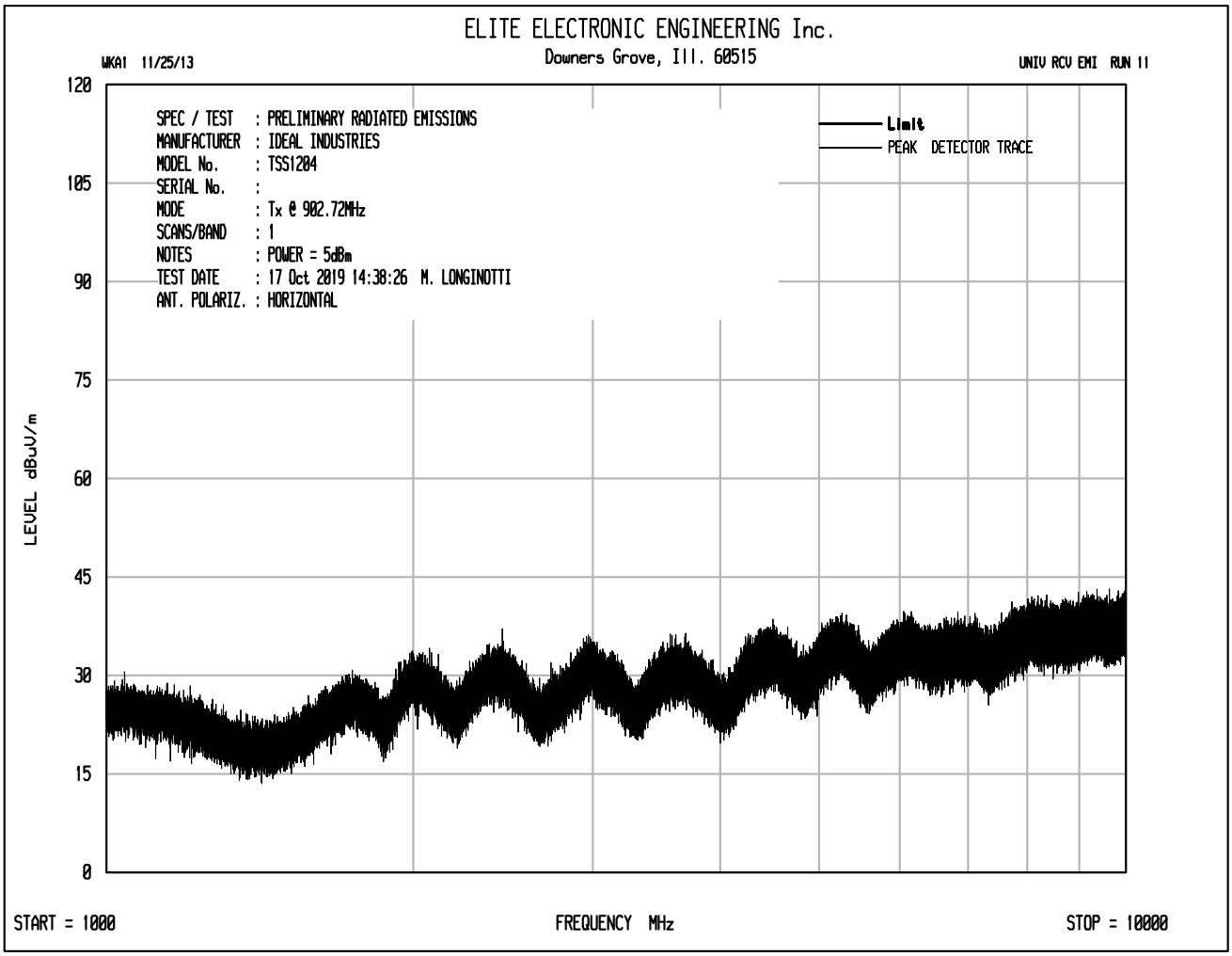

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : ANTENNA PORT SPURIOUS CONDUCTED EMISSIONS
MANUFACTURER : IDEAL INDUSTRIES
MODEL No. : TSS1204
SERIAL No. : 32000001
MODE : Tx @ 902.72MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 8 Oct 2019 10:25:31 M. LONGINOTTI
Limit
PEAK DETECTOR TRACE
LEVEL dBm
30
15
0
-15
-30
-45
-60
-75
-90
100
1000
START = 30
FREQUENCY MHz
STOP = 9500

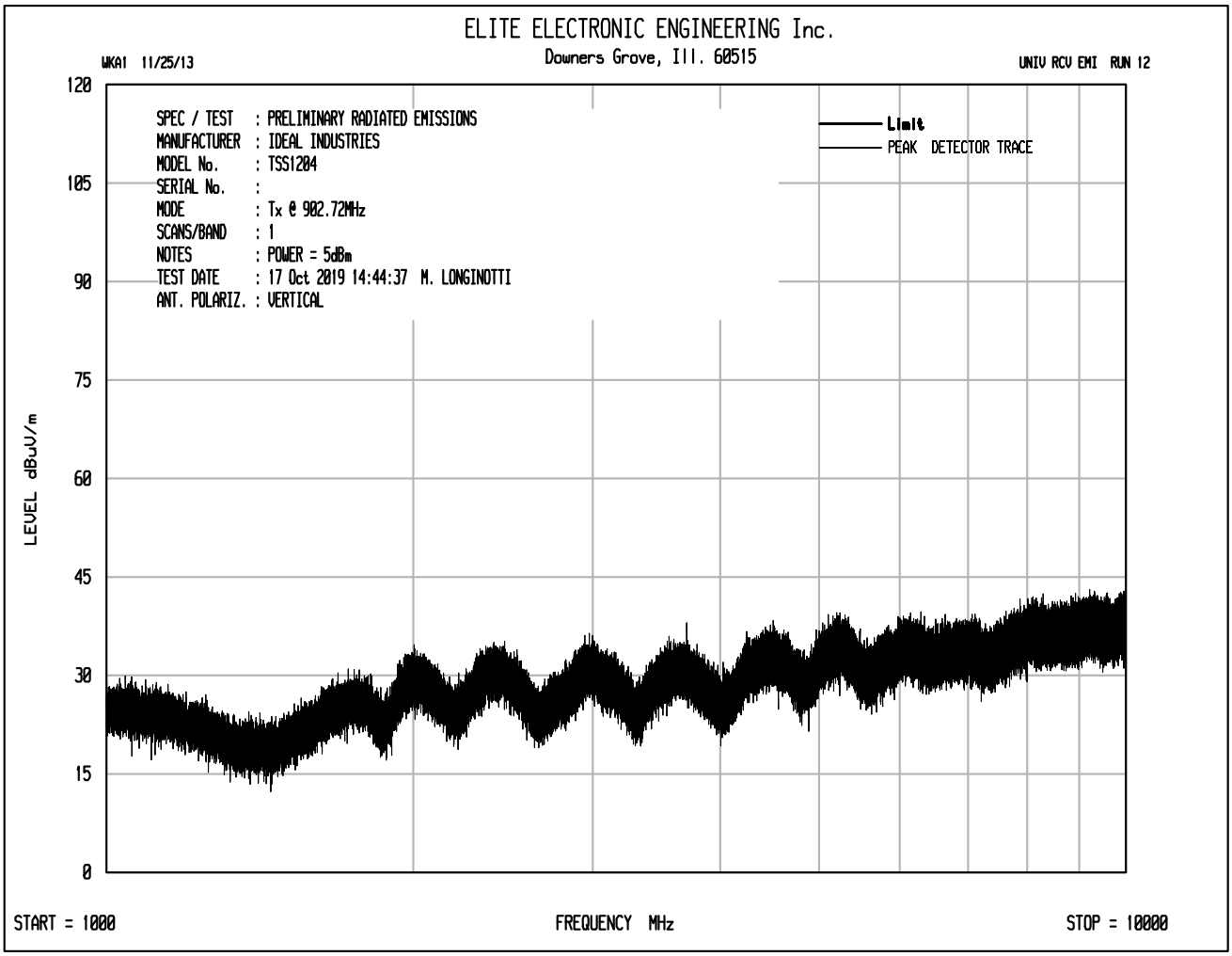

ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : ANTENNA PORT SPURIOUS CONDUCTED EMISSIONS
MANUFACTURER : IDEAL INDUSTRIES
MODEL No. : TSS1204
SERIAL No. : 32000001
MODE : Tx @ 915MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 8 Oct 2019 10:29:57 M. LONGINOTTI
Limit
PEAK DETECTOR TRACE
LEVEL dBm
30
15
0
-15
-30
-45
-60
-75
-90
100
1000
START = 30
FREQUENCY MHz
STOP = 9500


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : ANTENNA PORT SPURIOUS CONDUCTED EMISSIONS
MANUFACTURER : IDEAL INDUSTRIES
MODEL No. : TSS1204
SERIAL No. : 32000001
MODE : Tx @ 927.32MHz
SCANS/BAND : 1
NOTES :
TEST DATE : 8 Oct 2019 10:32:54 M. LONGINOTTI
Limit
PEAK DETECTOR TRACE
LEVEL dBm
30
15
0
-15
-30
-45
-60
-75
-90
100
1000
START = 30
FREQUENCY MHz
STOP = 9500


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 1
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : IDEAL INDUSTRIES
MODEL No. : TSS1204
SERIAL No. :
MODE : Tx @ 902.72MHz
SCANS/BAND : 1
NOTES : POWER = 5dBm
TEST DATE : 17 Oct 2019 08:20:22 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 2
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : IDEAL INDUSTRIES
MODEL No. : TSS1204
SERIAL No. :
MODE : Tx @ 902.72MHz
SCANS/BAND : 1
NOTES : POWER = 5dBm
TEST DATE : 17 Oct 2019 08:27:44 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 11
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : IDEAL INDUSTRIES
MODEL No. : TSS1204
SERIAL No. :
MODE : Tx @ 902.72MHz
SCANS/BAND : 1
NOTES : POWER = 5dBm
TEST DATE : 17 Oct 2019 14:38:26 M. LONGINOTTI
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 11/25/13
UNIV RCV EMI RUN 12
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : IDEAL INDUSTRIES
MODEL No. : TSS1204
SERIAL No. :
MODE : Tx @ 902.72MHz
SCANS/BAND : 1
NOTES : POWER = 5dBm
TEST DATE : 17 Oct 2019 14:44:37 M. LONGINOTTI
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

Manufacturer : Ideal Industries, Inc.
Test Item : 8 Push-Button Wall-Mount Switch
Model No. : TSS1204
Serial No. : 32000002
Mode : Transmit at 902.72MHz
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions in Restricted Bands
Date : October 17, 2019
Test Distance : 3 meters
Notes : Peak Detector with 1MHz Resolution Bandwidth

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	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)
2708.16	H	46.8	Ambient	3.7	33.5	-40.2	43.8	154.9	5000.0	-30.2
2708.16	V	46.8	Ambient	3.7	33.5	-40.2	43.8	154.9	5000.0	-30.2
3610.88	H	51.0	Ambient	4.3	34.2	-39.5	49.9	314.2	5000.0	-24.0
3610.88	V	51.2	Ambient	4.3	34.2	-39.5	50.1	321.6	5000.0	-23.8
4513.60	H	50.7	Ambient	4.7	36.0	-39.6	51.8	388.6	5000.0	-22.2
4513.60	V	51.0	Ambient	4.7	36.0	-39.6	52.1	402.3	5000.0	-21.9
5416.32	H	48.8	Ambient	5.1	36.8	-39.5	51.3	366.9	5000.0	-22.7
5416.32	V	49.1	Ambient	5.1	36.8	-39.5	51.6	379.8	5000.0	-22.4
8124.48	H	50.4	Ambient	6.5	38.4	-39.6	55.7	611.6	5000.0	-18.3
8124.48	V	50.3	Ambient	6.5	38.4	-39.6	55.6	604.6	5000.0	-18.4
9027.20	H	50.1	Ambient	6.5	38.9	-39.4	56.1	635.7	5000.0	-17.9
9027.20	V	50.5	Ambient	6.5	38.9	-39.4	56.5	665.7	5000.0	-17.5

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

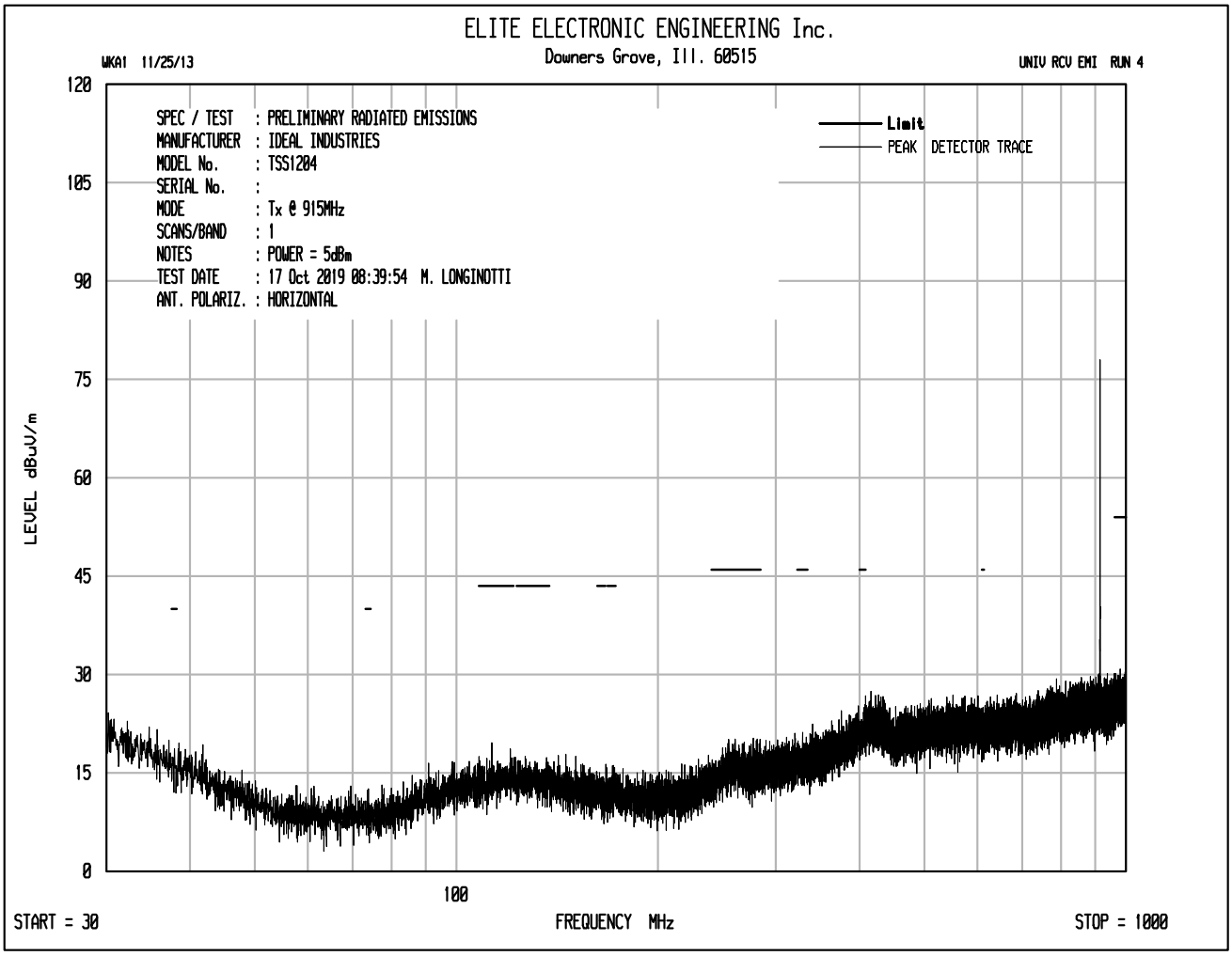
Manufacturer : Ideal Industries, Inc.
Test Item : 8 Push-Button Wall-Mount Switch
Model No. : TSS1204
Serial No. : 32000002
Mode : Transmit at 902.72Mhz
Test Specification : FCC-15.247, RSS-247 Average Radiated Emissions in Restricted Bands
Date : October 17, 2019
Test Distance : 3 meters
Notes : Average Detector with 1MHz Resolution Bandwidth

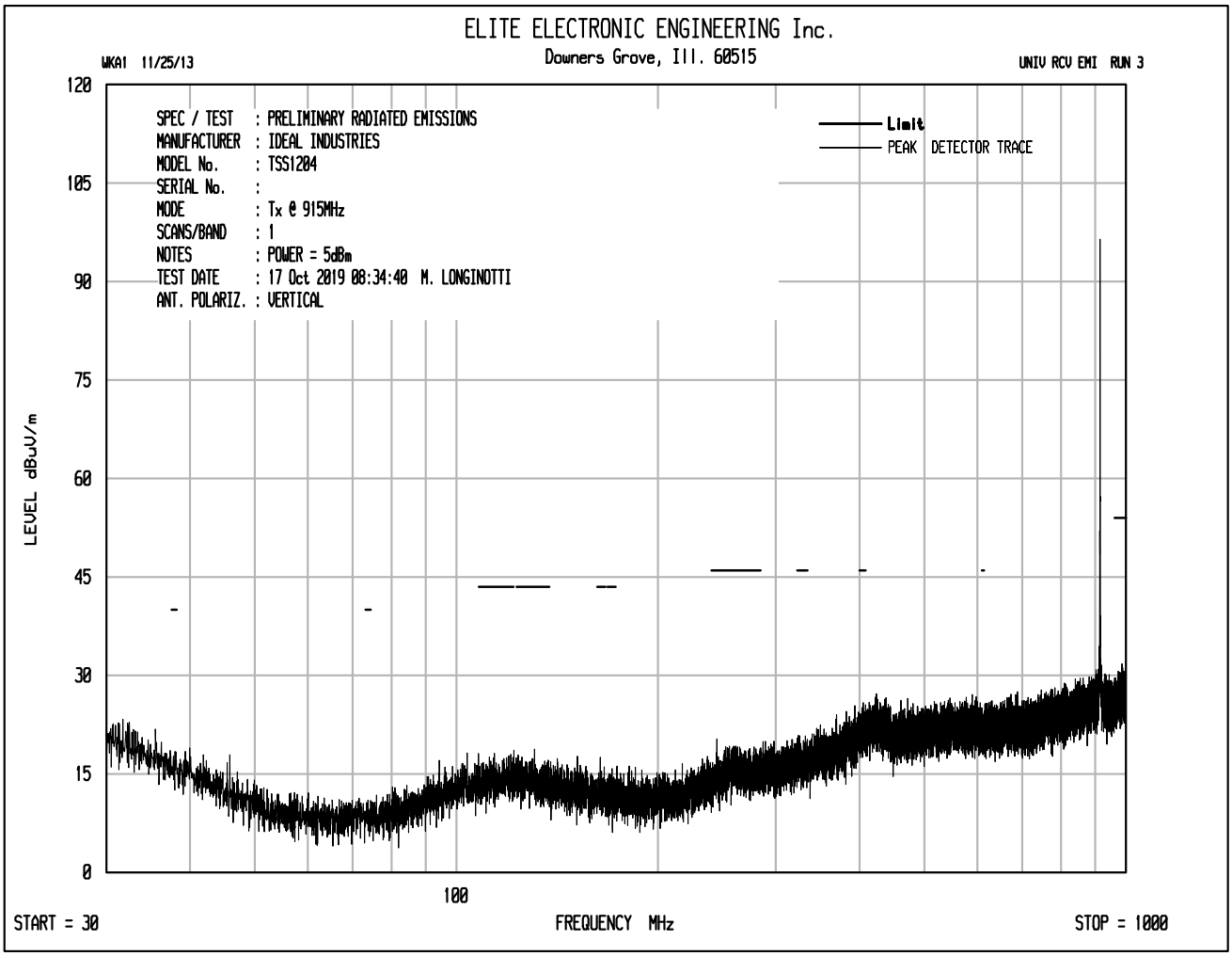
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
2708.16	H	31.20	Ambient	3.7	33.5	-40.2	28.2	25.7	500.0	-25.8
2708.16	V	31.2	Ambient	3.7	33.5	-40.2	28.2	25.7	500.0	-25.8
3610.88	H	35.4	Ambient	4.3	34.2	-39.5	34.3	52.2	500.0	-19.6
3610.88	V	35.5	Ambient	4.3	34.2	-39.5	34.4	52.8	500.0	-19.5
4513.60	H	35.2	Ambient	4.7	36.0	-39.6	36.3	65.2	500.0	-17.7
4513.60	V	35.2	Ambient	4.7	36.0	-39.6	36.3	65.2	500.0	-17.7
5416.32	H	33.5	Ambient	5.1	36.8	-39.5	36.0	63.0	500.0	-18.0
5416.32	V	33.6	Ambient	5.1	36.8	-39.5	36.1	63.8	500.0	-17.9
8124.48	H	34.7	Ambient	6.5	38.4	-39.6	40.0	99.8	500.0	-14.0
8124.48	V	34.7	Ambient	6.5	38.4	-39.6	40.0	100.3	500.0	-14.0
9027.20	H	34.5	Ambient	6.5	38.9	-39.4	40.5	105.5	500.0	-13.5
9027.20	V	34.5	Ambient	6.5	38.9	-39.4	40.5	105.5	500.0	-13.5

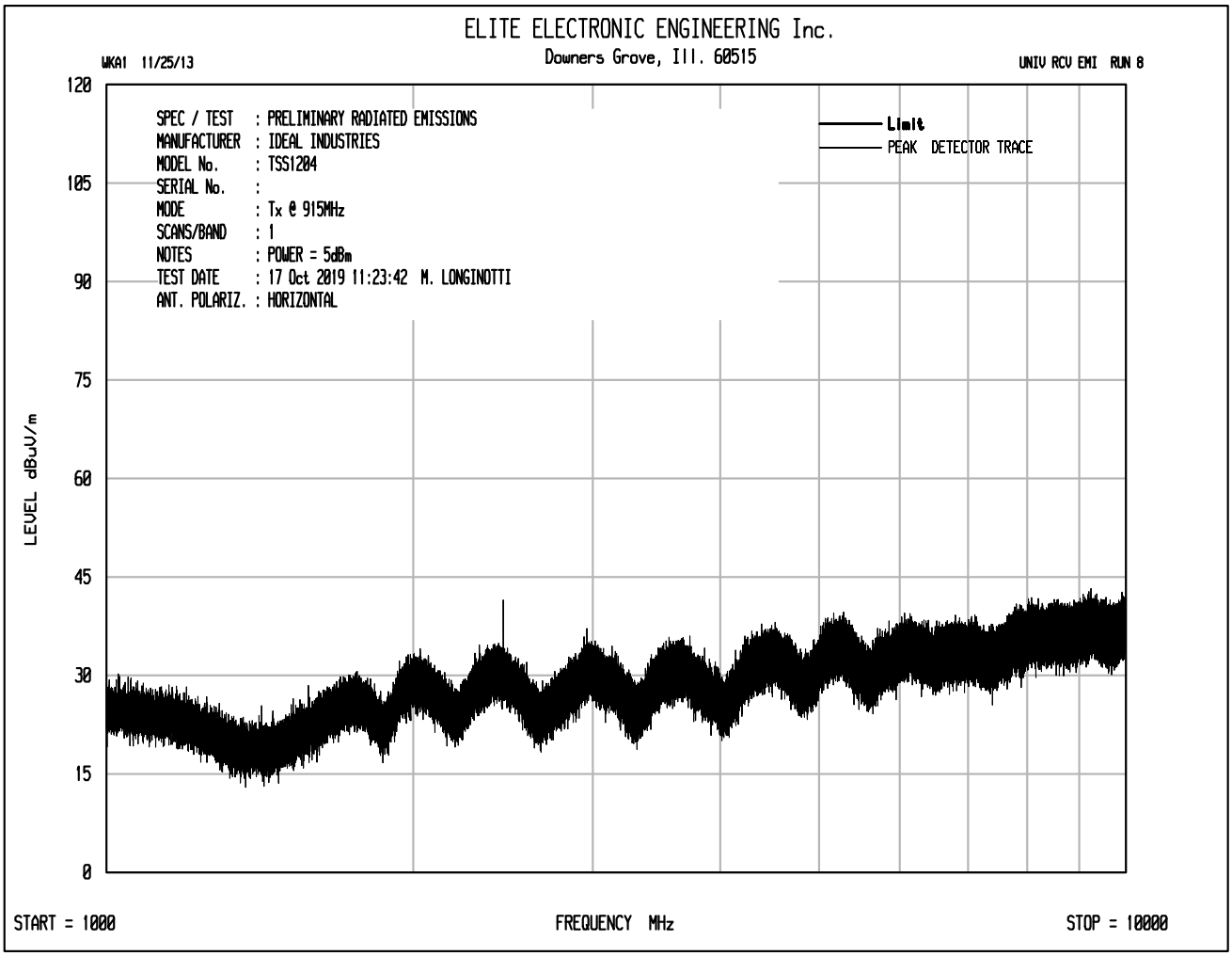
Total (dBuV/m) = Meter Reading + CBL FAC + Ant Fac + Pre Amp + Duty Cycle

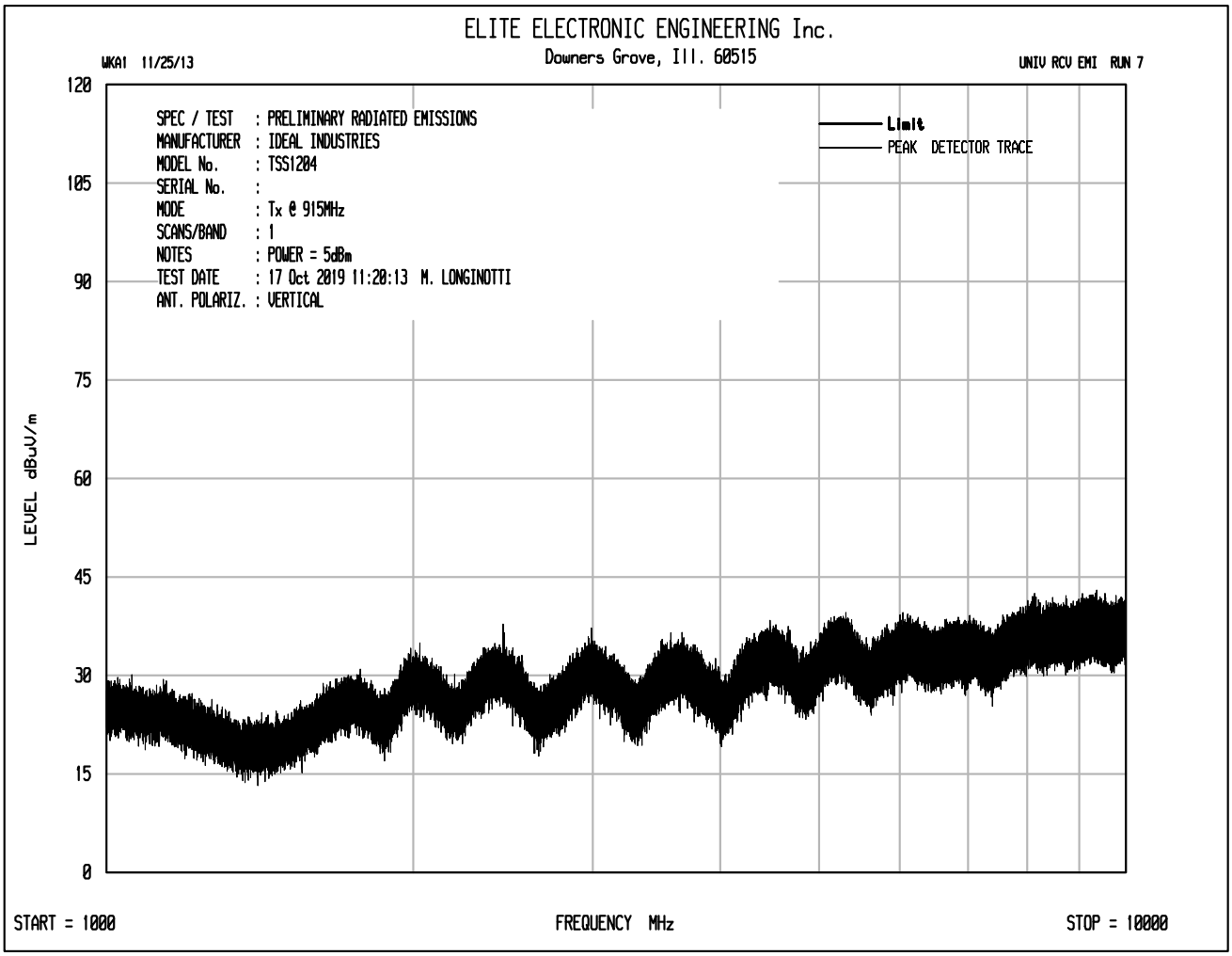
Manufacturer : Ideal Industries, Inc.
Test Item : 8 Push-Button Wall-Mount Switch
Model No. : TSS1204
Serial No. : 32000002
Mode :
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions not in Restricted Bands
Date :
Test Distance :
Notes : Peak Detector with 100kHz Resolution Bandwidth

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	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)
902.72	H	53.2		2.0	26.6	0.0	81.8	12296.4		
902.72	V	71.0		2.0	26.6	0.0	99.6	95450.8		
1805.44	H	39.7	Ambient	2.9	30.9	-40.1	33.4	46.7	9545.1	-46.2
1805.44	V	39.2	Ambient	2.9	30.9	-40.1	32.9	44.1	9545.1	-46.7
6319.04	H	37.6	Ambient	5.6	38.3	-39.6	41.9	124.2	9545.1	-37.7
6319.04	V	37.4	Ambient	5.6	38.3	-39.6	41.7	121.4	9545.1	-37.9
7221.76	H	37.2	Ambient	6.1	38.1	-39.7	41.8	122.7	9545.1	-37.8
7221.76	V	37.6	Ambient	6.1	38.1	-39.7	42.2	128.4	9545.1	-37.4


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 4
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : IDEAL INDUSTRIES
MODEL No. : TSS1204
SERIAL No. :
MODE : Tx @ 915MHz
SCANS/BAND : 1
NOTES : POWER = 5dBm
TEST DATE : 17 Oct 2019 08:39:54 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 3
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : IDEAL INDUSTRIES
MODEL No. : TSS1204
SERIAL No. :
MODE : Tx @ 915MHz
SCANS/BAND : 1
NOTES : POWER = 5dBm
TEST DATE : 17 Oct 2019 08:34:40 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 8
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : IDEAL INDUSTRIES
MODEL No. : TSS1204
SERIAL No. :
MODE : Tx @ 915MHz
SCANS/BAND : 1
NOTES : POWER = 5dBm
TEST DATE : 17 Oct 2019 11:23:42 M. LONGINOTTI
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 11/25/13
UNIV RCV EMI RUN 7
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : IDEAL INDUSTRIES
MODEL No. : TSS1204
SERIAL No. :
MODE : Tx @ 915MHz
SCANS/BAND : 1
NOTES : POWER = 5dBm
TEST DATE : 17 Oct 2019 11:20:13 M. LONGINOTTI
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

Manufacturer : Ideal Industries, Inc.
Test Item : 8 Push-Button Wall-Mount Switch
Model No. : TSS1204
Serial No. : 32000002
Mode : Transmit at 915MHz
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions in Restricted Bands
Date : October 17, 2019
Test Distance : 3 meters
Notes : Peak Detector with 1MHz Resolution Bandwidth

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	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)
2745.00	H	47.8	Ambient	3.7	33.7	-40.2	45.1	179.4	5000.0	-28.9
2745.00	V	47.9	Ambient	3.7	33.7	-40.2	45.2	181.5	5000.0	-28.8
3660.00	H	51.6	Ambient	4.3	34.6	-39.5	50.9	351.6	5000.0	-23.1
3660.00	V	50.7	Ambient	4.3	34.6	-39.5	50.0	317.0	5000.0	-24.0
4575.00	H	49.6	Ambient	4.7	36.2	-39.7	50.8	346.9	5000.0	-23.2
4575.00	V	49.5	Ambient	4.7	36.2	-39.7	50.7	342.9	5000.0	-23.3
7320.00	H	47.6	Ambient	6.2	38.1	-39.6	52.3	410.5	5000.0	-21.7
7320.00	V	47.2	Ambient	6.2	38.1	-39.6	51.9	392.1	5000.0	-22.1
8235.00	H	49.5	Ambient	6.5	38.6	-39.5	55.0	565.3	5000.0	-18.9
8235.00	V	49.3	Ambient	6.5	38.6	-39.5	54.8	552.4	5000.0	-19.1
9150.00	H	49.9	Ambient	6.6	38.9	-39.4	55.9	627.0	5000.0	-18.0
9150.00	V	50.4	Ambient	6.6	38.9	-39.4	56.4	664.1	5000.0	-17.5

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

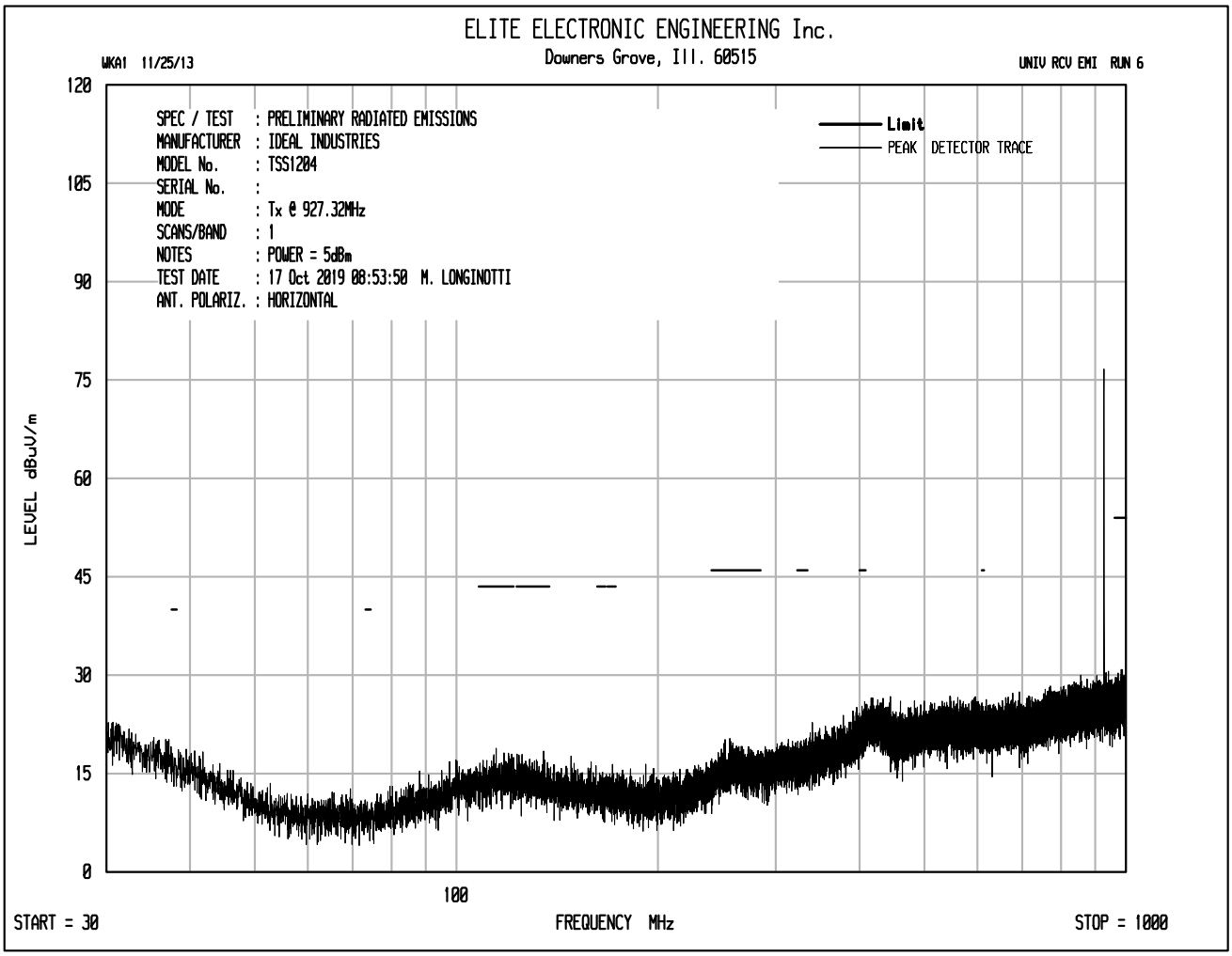
Manufacturer : Ideal Industries, Inc.
Test Item : 8 Push-Button Wall-Mount Switch
Model No. : TSS1204
Serial No. : 32000002
Mode : Transmit at 915MHz
Test Specification : FCC-15.247, RSS-247 Average Radiated Emissions in Restricted Bands
Date : October 17, 2019
Test Distance : 3 meters
Notes : Average Detector with 1MHz Resolution Bandwidth

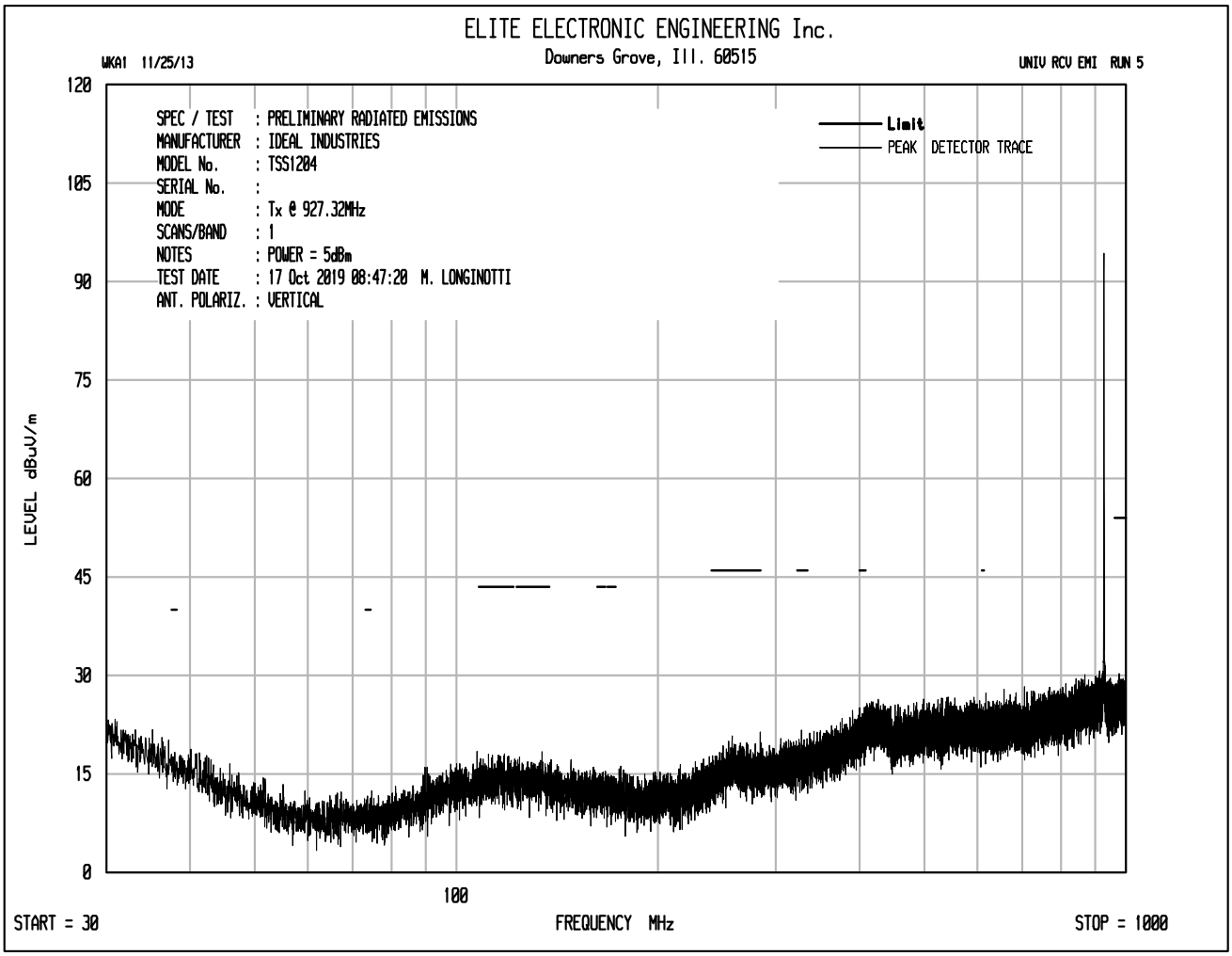
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
2745.00	H	32.10	Ambient	3.7	33.7	-40.2	0.0	29.4	29.4	500.0
2745.00	V	32.1	Ambient	3.7	33.7	-40.2	0.0	29.4	29.4	500.0
3660.00	H	35.5	Ambient	4.3	34.6	-39.5	0.0	34.8	55.1	500.0
3660.00	V	35.3	Ambient	4.3	34.6	-39.5	0.0	34.6	53.8	500.0
4575.00	H	34.0	Ambient	4.7	36.2	-39.7	0.0	35.2	57.6	500.0
4575.00	V	34.0	Ambient	4.7	36.2	-39.7	0.0	35.2	57.6	500.0
7320.00	H	31.7	Ambient	6.2	38.1	-39.6	0.0	36.4	65.8	500.0
7320.00	V	31.7	Ambient	6.2	38.1	-39.6	0.0	36.4	65.8	500.0
8235.00	H	34.2	Ambient	6.5	38.6	-39.5	0.0	39.7	97.1	500.0
8235.00	V	34.2	Ambient	6.5	38.6	-39.5	0.0	39.7	97.1	500.0
9150.00	H	34.6	Ambient	6.6	38.9	-39.4	0.0	40.6	107.7	500.0
9150.00	V	34.6	Ambient	6.6	38.9	-39.4	0.0	40.6	107.7	500.0

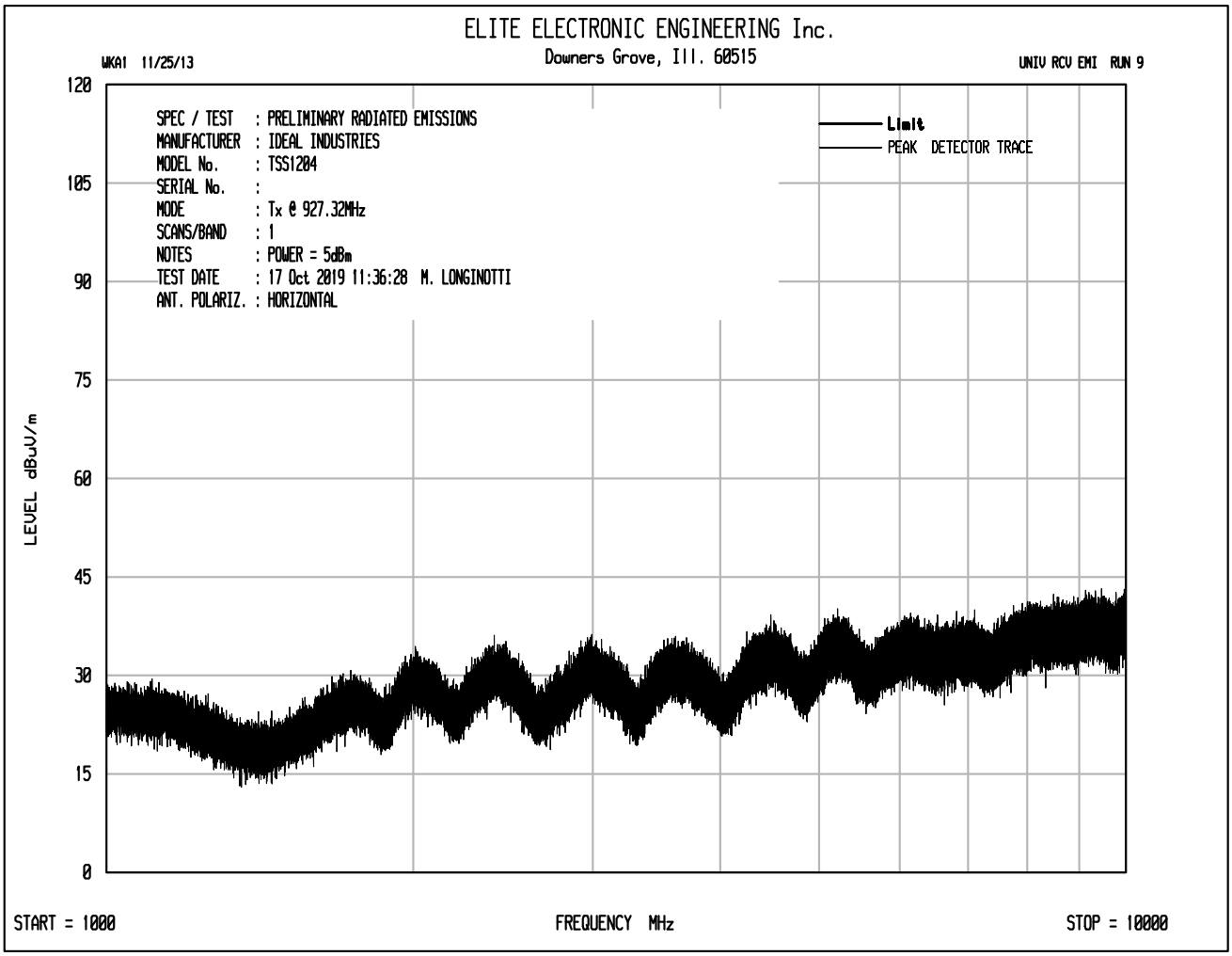
Total (dBuV/m) = Meter Reading + CBL FAC + Ant Fac + Pre Amp + Duty Cycle

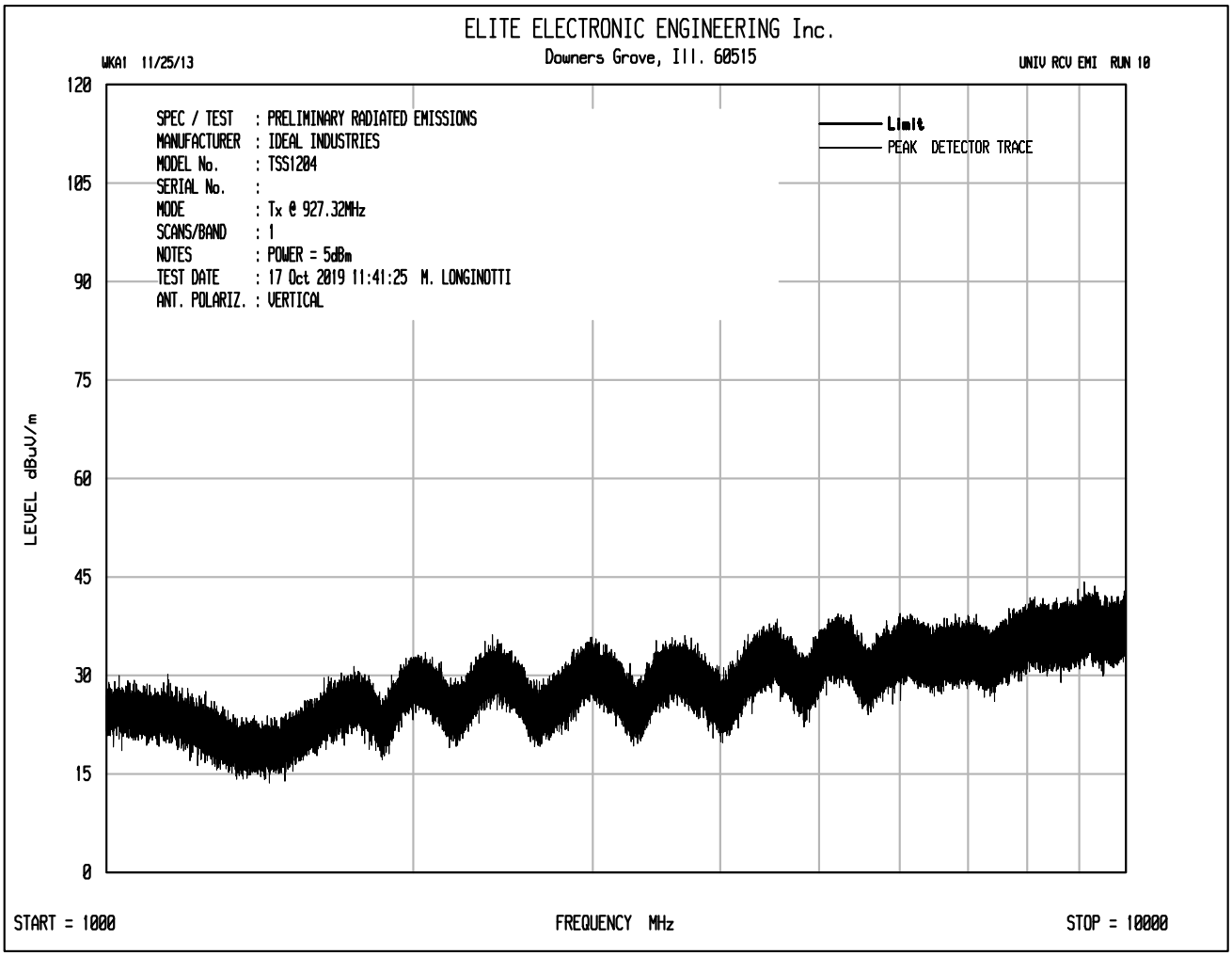
Manufacturer : Ideal Industries, Inc.
Test Item : 8 Push-Button Wall-Mount Switch
Model No. : TSS1204
Serial No. : 32000002
Mode : Transmit at 915MHz
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions not in Restricted Bands
Date : October 17, 2019
Test Distance : 3 meters
Notes : Peak Detector with 100kHz Resolution Bandwidth

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	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)
915.00	H	52.3		2.1	26.6	0.0	80.9	11114.3		
915.00	V	70.0		2.1	26.6	0.0	98.6	85286.8		
1830.00	H	38.7	Ambient	2.9	31.1	-40.1	32.7	43.0	8528.7	-45.9
1830.00	V	38.7	Ambient	2.9	31.1	-40.1	32.7	43.0	8528.7	-45.9
5490.00	H	37.5	Ambient	5.2	36.8	-39.4	40.0	100.2	8528.7	-38.6
5490.00	V	36.7	Ambient	5.2	36.8	-39.4	39.2	91.4	8528.7	-39.4
6405.00	H	37.6	Ambient	5.7	38.0	-39.5	41.7	121.6	8528.7	-36.9
6405.00	V	36.6	Ambient	5.7	38.0	-39.5	40.7	108.4	8528.7	-37.9
7320.00	H	47.6	Ambient	6.2	38.1	-39.6	52.3	410.5	5000.0	-21.7
7320.00	V	47.2	Ambient	6.2	38.1	-39.6	51.9	392.1	5000.0	-22.1
8235.00	H	49.5	Ambient	6.5	38.6	-39.5	55.0	565.3	5000.0	-18.9
8235.00	V	49.3	Ambient	6.5	38.6	-39.5	54.8	552.4	5000.0	-19.1
9150.00	H	49.9	Ambient	6.6	38.9	-39.4	55.9	627.0	5000.0	-18.0
9150.00	V	50.4	Ambient	6.6	38.9	-39.4	56.4	664.1	5000.0	-17.5


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 6
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : IDEAL INDUSTRIES
MODEL No. : TSS1204
SERIAL No. :
MODE : Tx @ 927.32MHz
SCANS/BAND : 1
NOTES : POWER = 5dBm
TEST DATE : 17 Oct 2019 08:53:50 M. LONGINOTTI
ANT. POLARIZ. : HORIZONTAL
Limit
PEAK DETECTOR TRACE
LEVEL dBµV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 5
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : IDEAL INDUSTRIES
MODEL No. : TSS1204
SERIAL No. :
MODE : Tx @ 927.32MHz
SCANS/BAND : 1
NOTES : POWER = 5dBm
TEST DATE : 17 Oct 2019 08:47:20 M. LONGINOTTI
ANT. POLARIZ. : VERTICAL
Limit
PEAK DETECTOR TRACE
LEVEL dBuV/m
120
105
90
75
60
45
30
15
0
100
START = 30
FREQUENCY MHz
STOP = 1000


ELITE ELECTRONIC ENGINEERING Inc.
Downers Grove, Ill. 60515
WKA1 11/25/13
UNIV RCV EMI RUN 9
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : IDEAL INDUSTRIES
MODEL No. : TSS1204
SERIAL No. :
MODE : Tx @ 927.32MHz
SCANS/BAND : 1
NOTES : POWER = 5dBm
TEST DATE : 17 Oct 2019 11:36:28 M. LONGINOTTI
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 11/25/13
UNIV RCV EMI RUN 10
SPEC / TEST : PRELIMINARY RADIATED EMISSIONS
MANUFACTURER : IDEAL INDUSTRIES
MODEL No. : TSS1204
SERIAL No. :
MODE : Tx @ 927.32MHz
SCANS/BAND : 1
NOTES : POWER = 5dBm
TEST DATE : 17 Oct 2019 11:41:25 M. LONGINOTTI
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

Manufacturer : Ideal Industries, Inc.
Test Item : 8 Push-Button Wall-Mount Switch
Model No. : TSS1204
Serial No. : 32000002
Mode : Transmit at 927.32MHz
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions in Restricted Bands
Date : October 17, 2019
Test Distance : 3 meters
Notes : Peak Detector with 1MHz Resolution Bandwidth

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	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)
2781.96	H	48.5	Ambient	3.7	33.4	-40.1	45.5	187.3	5000.0	-28.5
2781.96	V	49.0	Ambient	3.7	33.4	-40.1	46.0	198.4	5000.0	-28.0
3709.28	H	50.6	Ambient	4.3	34.5	-39.5	49.9	313.2	5000.0	-24.1
3709.28	V	50.7	Ambient	4.3	34.5	-39.5	50.0	316.9	5000.0	-24.0
4636.60	H	48.8	Ambient	4.8	36.4	-39.6	50.4	329.8	5000.0	-23.6
4636.60	V	48.5	Ambient	4.8	36.4	-39.6	50.1	318.6	5000.0	-23.9
7418.56	H	47.1	Ambient	6.2	38.2	-39.6	51.9	393.7	5000.0	-22.1
7418.56	V	47.1	Ambient	6.2	38.2	-39.6	51.9	393.7	5000.0	-22.1
8345.88	H	50.1	Ambient	6.5	38.7	-39.5	55.8	616.9	5000.0	-18.2
8345.88	V	50.5	Ambient	6.5	38.7	-39.5	56.2	646.0	5000.0	-17.8

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

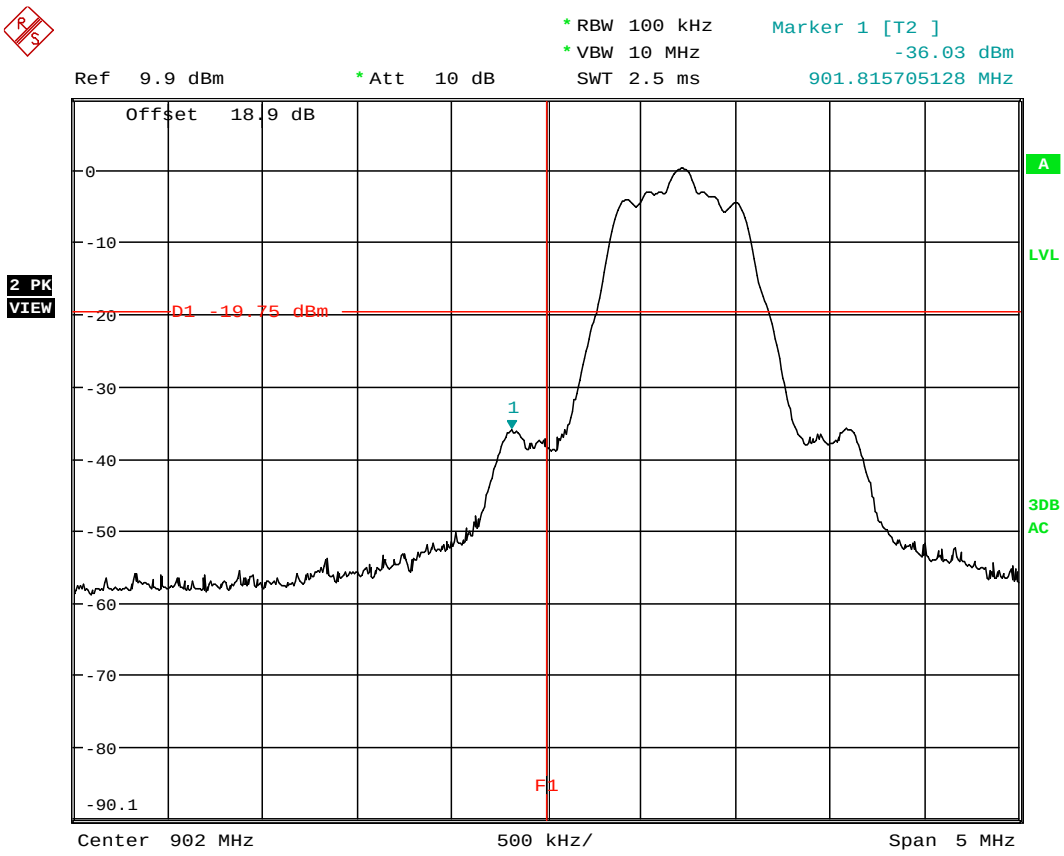
Manufacturer : Ideal Industries, Inc.
Test Item : 8 Push-Button Wall-Mount Switch
Model No. : TSS1204
Serial No. : 32000002
Mode : Transmit at 927.32MHz
Test Specification : FCC-15.247, RSS-247 Average Radiated Emissions in Restricted Bands
Date : October 17, 2019
Test Distance : 3 meters
Notes : Average Detector with 1MHz Resolution Bandwidth

Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Average Total dBuV/m at 3m	Average Total uV/m at 3 m	Average Limit uV/m at 3 m	Margin (dB)
2781.96	H	33.10	Ambient	3.7	33.4	-40.1	30.1	31.8	500.0	-23.9
2781.96	V	33.1	Ambient	3.7	33.4	-40.1	30.1	31.8	500.0	-23.9
3709.28	H	35.1	Ambient	4.3	34.5	-39.5	34.4	52.6	500.0	-19.6
3709.28	V	35.2	Ambient	4.3	34.5	-39.5	34.5	53.2	500.0	-19.5
4636.60	H	33.3	Ambient	4.8	36.4	-39.6	34.9	55.4	500.0	-19.1
4636.60	V	33.2	Ambient	4.8	36.4	-39.6	34.8	54.7	500.0	-19.2
7418.56	H	31.5	Ambient	6.2	38.2	-39.6	36.3	65.3	500.0	-17.7
7418.56	V	31.4	Ambient	6.2	38.2	-39.6	36.2	64.6	500.0	-17.8
8345.88	H	34.5	Ambient	6.5	38.7	-39.5	40.2	102.4	500.0	-13.8
8345.88	V	34.6	Ambient	6.5	38.7	-39.5	40.3	103.6	500.0	-13.7

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

Manufacturer : Ideal Industries, Inc.
Test Item : 8 Push-Button Wall-Mount Switch
Model No. : TSS1204
Serial No. : 32000002
Mode : Transmit at 927.32MHz
Test Specification : FCC-15.247, RSS-247 Peak Radiated Emissions not in Restricted Bands
Date : October 17, 2019
Test Distance : 3 meters
Notes : Peak Detector with 100kHz Resolution Bandwidth

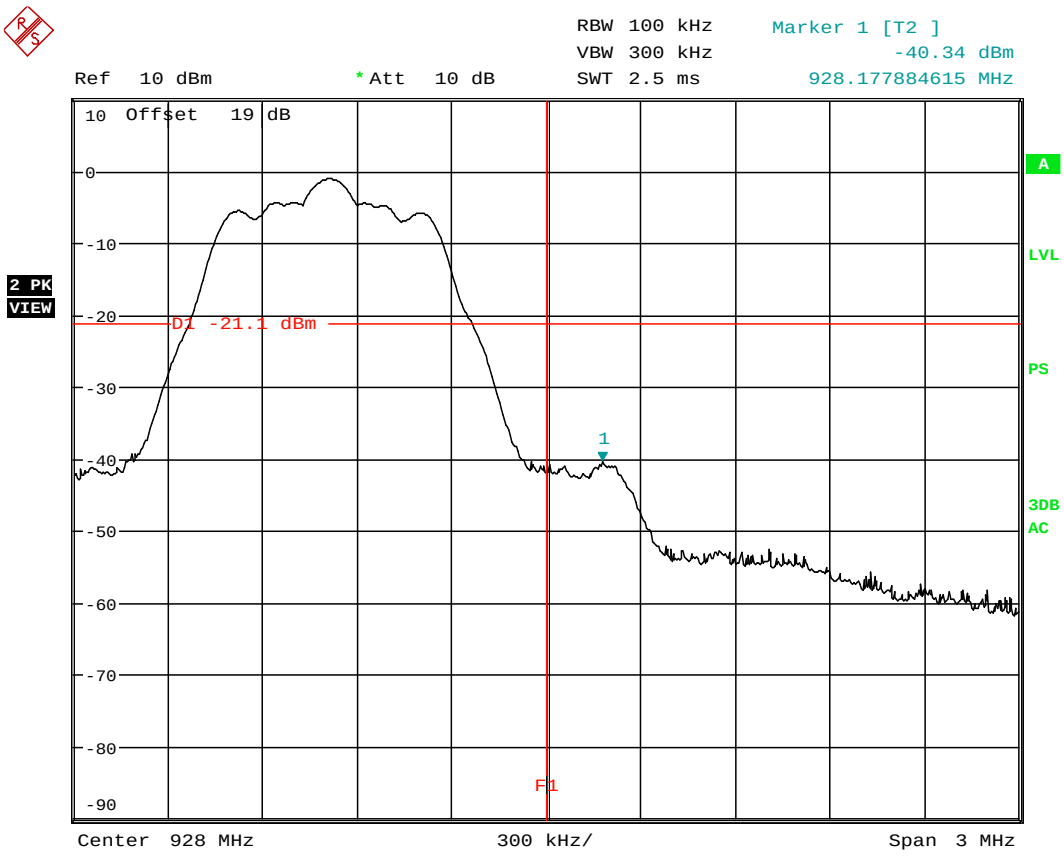
Freq. MHz	Ant Pol	Meter Reading (dBuV)	Ambient	CBL Fac (dB)	Ant Fac (dB/m)	Pre Amp (dB)	Peak Total dBuV/m at 3m	Peak Total uV/m at 3 m	Peak Limit uV/m at 3 m	Margin (dB)
927.32	H	50.7		2.1	26.7	0.0	79.5	9458.7		
927.32	V	68.5		2.1	26.7	0.0	97.3	73422.6		
1854.64	H	37.3	Ambient	3.0	31.4	-40.1	31.6	37.9	7342.3	-45.7
1854.64	V	37.4	Ambient	3.0	31.4	-40.1	31.7	38.4	7342.3	-45.6
5563.92	H	36.7	Ambient	5.2	37.0	-39.4	39.4	93.8	7342.3	-37.9
5563.92	V	36.7	Ambient	5.2	37.0	-39.4	39.4	93.8	7342.3	-37.9
6491.24	H	36.5	Ambient	5.7	37.8	-39.5	40.5	106.3	7342.3	-36.8
6491.24	V	36.4	Ambient	5.7	37.8	-39.5	40.4	105.1	7342.3	-36.9
9273.20	H	40.7	Ambient	6.6	39.1	-39.4	47.1	225.8	7342.3	-30.2
9273.20	V	40.3	Ambient	6.6	39.1	-39.4	46.7	215.7	7342.3	-30.6



Date: 16.OCT.2019 10:46:19

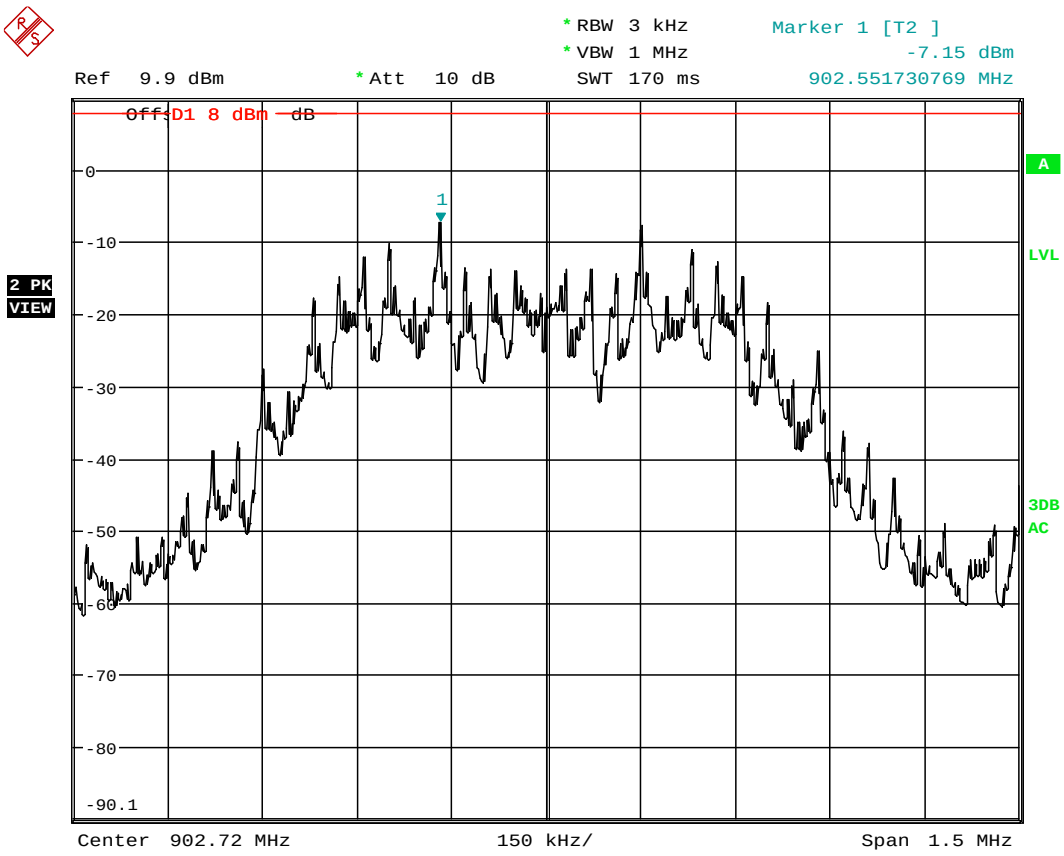
Low Band Edge

Manufacturer	:	Ideal Industries
Model Number	:	TSS1204
Serial Number	:	32000001
Mode	:	Transmit at 902.72
Line Tested	:	Antenna Port
Date	:	10/16/2019 9:34:11 AM
Notes	:	Display Line F1 represents the low band edge (902MHz). Display Line D1 represents the level 20dB down from the peak of the transmit frequency in a 100kHz bandwidth



High Band Edge

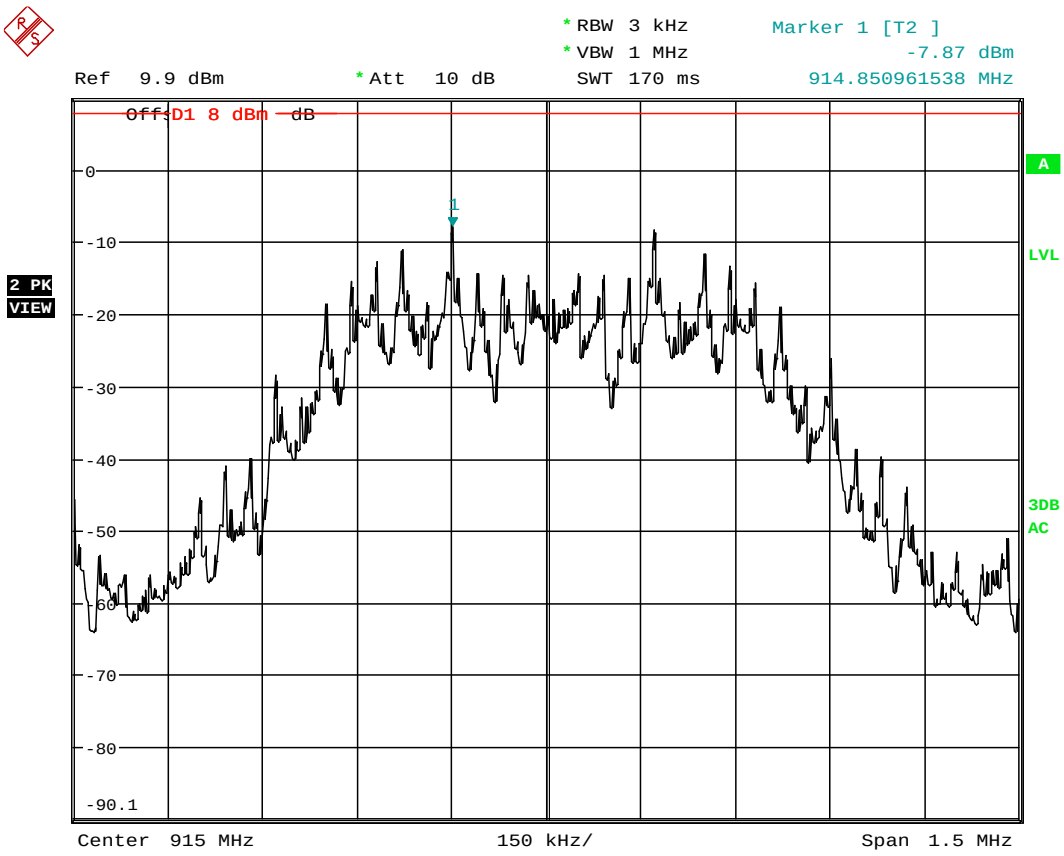
Manufacturer	:	Ideal Industries
Model Number	:	TSS1204
Serial Number	:	32000001
Mode	:	Transmit at 927.32MHz
Line Tested	:	Antenna Port
Date	:	10/16/2019 10:40:16 AM
Notes	:	Display Line F1 represents the high band edge (928MHz). Display Line D1 represents the level 20dB down from the peak of the transmit frequency in a 100kHz bandwidth



Date: 16.OCT.2019 11:16:48

Power Spectral Density

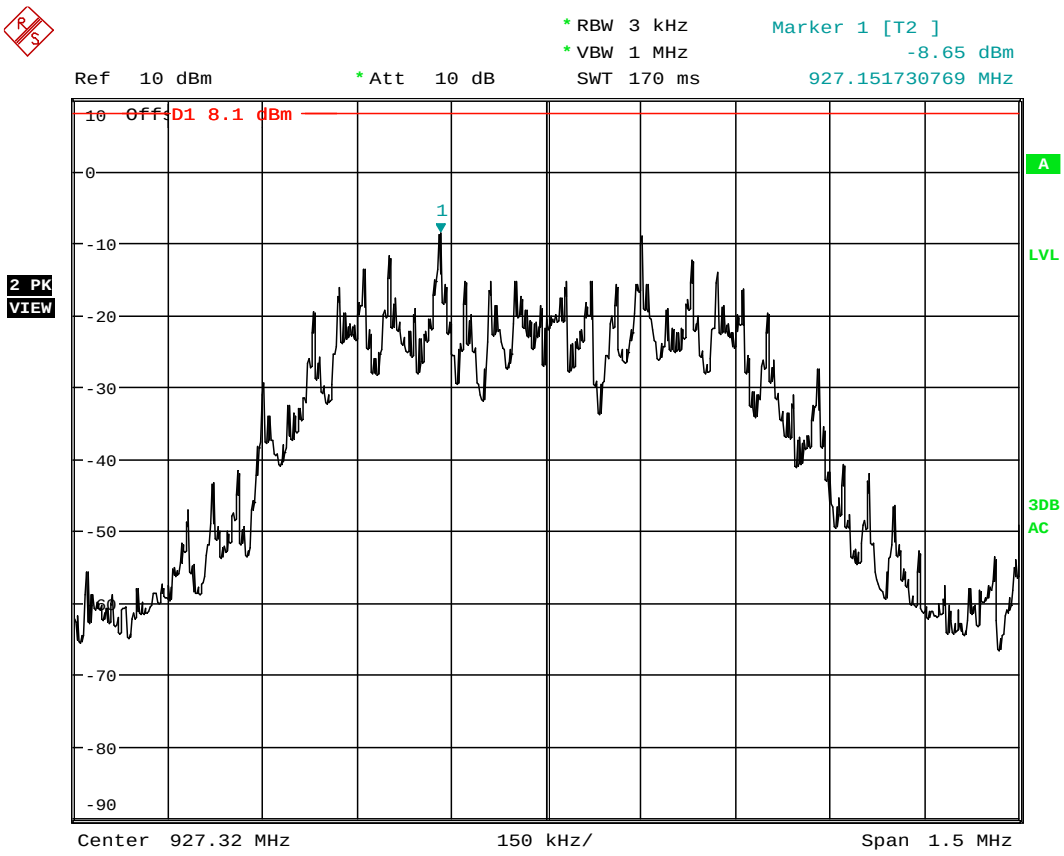
Manufacturer	:	Ideal Industries
Model Number	:	TSS1204
Serial Number	:	32000001
Mode	:	Transmit at 902.72MHz
Line Tested	:	Antenna Port
Date	:	10/16/2019 10:04:42 AM
Notes	:	PSD = -7.15dBm



Date: 16.OCT.2019 11:18:47

Power Spectral Density

Manufacturer	:	Ideal Industries
Model Number	:	TSS1204
Serial Number	:	32000001
Mode	:	Transmit at 915MHz
Line Tested	:	Antenna Port
Date	:	10/16/2019 10:06:41 AM
Notes	:	PSD = -7.87dBm



Date: 16.OCT.2019 11:21:23

Power Spectral Density

Manufacturer	:	Ideal Industries
Model Number	:	TSS1204
Serial Number	:	32000001
Mode	:	Transmit at 927.32MHz
Line Tested	:	Antenna Port
Date	:	10/16/2019 10:09:23 AM
Notes	:	PSD = -8.63dBm