# Electromagnetic Compatibility Laboratory Test Report

| | |
|---|---|
| Test Report Title: | Electromagnetic Compatibility Tests for Shure P10T – X55 Transmitter |
| Test Item Description: | P10T is a full-rack, dual channel wireless transmitter housed in a touring-grade, all-metal chassis. The system operates in the X55 band (941 to 960 MHz) and is networkable over Ethernet connection. The P10T operates on AC power. |
| For: | Shure Incorporated<br>5800 West Touhy Avenue<br>Niles, IL 60714 |
| Project ID Number: | SEL-037 |
| Dates Tested: | 07/25/2018 to 09/23/2018 |
| Test Personnel: | Tom Braxton, Juan Castrejon, Hannah Hart, Jamal Qureshi |
| Test Specification: | FCC Part 74 : Subpart H |

| | | | |
|---|---|---|---|
| TEST REPORT BY: | | Compliance Engineer | 2/1/2019 |
| | SIGNATURE | POSITION | DATE |
| APPROVED BY: | | GC Project Engineer | 2/1/2019 |
| | SIGNATURE | POSITION | DATE |

SAFETY ENVIRONMENT TEST EDUCATE APPROVE GLOBAL COMPLIANCE

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a. The EUT's RF Out 1 was connected to an artificial antenna at ambient temperature. 24
b. The EUT's frequency was set at the lowest frequency (941.625 MHz) and the lowest switchable power level (10mW). 24
c. The power level was measured and recorded. 24
d. Step b) was repeated at all power levels (10mW, 50mW, and 100mW) and at medium (954.550 MHz) and high (959.725 MHz) frequencies. 24
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a. The temperature chamber was set to -30°C with the EUT inside and powered on. 27
b. The EUT was allowed to soak for ~20 minutes after the temperature chamber reached the set temperature. 27
c. The measured frequency of the transmitter was then recorded in the spreadsheet in section D.7. 27
d. The temperature chamber was incremented +10°C with the EUT inside and powered on. 27
e. Steps c. through e. were repeated until the device reached +50°C. 27
f. Steps a. through e. were repeated for representative low, mid and high frequencies within the EUT's operational bands. 27
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# List of Appendices

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|---|---|
| **A** | Radiated Emissions |
| **B** | Necessary Bandwidth |
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| **D** | Frequency Stability |

# Report Revision History

| Revision | Date | Description |
|---|---|---|
| **0** | 11/21/2018 | Released for use |
| **1** | 2/1/2019 | Updated to remove RSS210 certification information |

# Report Summary

## 1. Introduction

### 1.1. Scope of Tests

This document presents the results of a series of electromagnetic compatibility (EMC) tests performed on the Shure P10T – X55 Transmitter. The test items were manufactured and submitted for testing by Shure Incorporated located in Niles, IL. The data was taken following the measurement methods as described in the test specifications listed on page 1 of this document. Provided is the data for the test samples which also includes a summary of the measurements made and a description of the measurement setup.

### 1.2. Purpose

This series of tests was performed to determine if the test item would meet the selected requirements of the following specifications:

FCC Part 74 : Subpart H

### 1.3. Deviations, Additions, and Exclusions

None

### 1.4. EMC Laboratory Identification

The electromagnetic compatibility tests were performed at the Shure Electromagnetic Laboratory, Shure Incorporated, 5800 West Touhy Ave, Niles, Illinois 60714-4608. This laboratory is registered with ISED Canada as Site # 616A-1. The Shure Electromagnetic Laboratory is accredited by the National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP). The NVLAP Lab Code is: 200946-0.

### 1.5. Summary of Tests Performed

The following electromagnetic compatibility tests were performed on the test item in accordance with the specifications as stated in the following:

FCC Part 74 : Subpart H

**Table 1-1: Summary of tests performed**

| Test Specifications | Description | Tested Range | Described in Appendix | Test Results |
|---|---|---|---|---|
| **FCC Part 74.861 RSS 210.9 Annex G.3.4** | Field Strength Spurious Emissions | 941.625 MHz – 959.725 MHz | A | PASS |
| **FCC Part 74.861 RSS 210.9 Annex G.3.1** | Necessary Bandwidth | 941.625 MHz – 959.725 MHz | B | PASS |
| **FCC Part 74.861 RSS 210.9 Annex G.3.1** | RF Output Power | 941.625 MHz – 959.725 MHz | C | PASS |
| **FCC Part 74.861 RSS 210.9 Annex G.3.1** | Frequency Stability | 941.625 MHz – 959.725 MHz | D | PASS |

## 2. Applicable Documents

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

- RSS 210.9 Annex G
- FCC Part 74

## 3. EUT Set-Up and Operation

### 3.1. General Description

### 3.2. Test Samples

The following Shure P10T – X55 Transmitter samples were tested:

**Table 3-1: Transmitter Samples**

| Frequency Band | RF Power Output In mW | EUT Serial Number |
|---|---|---|
| X55 | 100 | 2PK1854782 |

### 3.3. Test Setup

#### 3.3.1. Power Input

The EUT obtained power through internal power supply.

#### 3.3.2. Signal Input /Output Leads

#### 3.3.3. Grounding Considerations

#### 3.3.4. Operational Mode

## 4. Test Instrumentation

A list of the test equipment used can be found in Table 10-1. All equipment is calibrated on an annual/semiannual basis depending on component critical status. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

## 5. Test Procedures

The specific test procedures are presented in the individual appendices.

## 6. Other Test Conditions

### 6.1. Test Personnel

All EMC tests were performed by qualified personnel from the Shure EMC Laboratory.

### 6.2. Disposition of the EUT

The EUTs and all associated equipment were returned to Shure Incorporated upon completion of the tests.

## 7. Results

The results are presented in the individual test appendices. It was found that the EUT met the requirements of the following:

FCC Part 74 : Section 74.861
RSS 210.9 Annex G

## 8. Conclusions

It was determined that the Shure P10T – X55 Transmitter did fully comply with the requirements of the following:

FCC Part 74 : Subpart H

## 9. Certification

Shure EMC Laboratory 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 EUTs at the test date. Any electrical or mechanical modification made to the EUTs subsequent to the specified test date will serve to invalidate the data and void this certification.

This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

## 10. Equipment List

## 11.

**Table 10-1: Test Equipment**

| L# or ID | Description | Manufacturer | Model # | Serial # | Frequency Range | Cal Date | Due Date |
|---|---|---|---|---|---|---|---|
| L05-068-02 | Modulation Analyzer | Boonton | 8200 | 46410-1223 | 100KHz-2GHz | 5/30/2018 | 5/30/2020 |
| L19-012-01 | Temperature Chamber | Espec | N/A | 1712251 | N/A | 4/3/2018 | 4/3/2019 |
| L23-011-38 | 1340 MHz High-pass Filter | K&L | 11SH10 | 13401-X1000-o/O | N/A | 4/25/2018 | 4/25/2020 |
| L23-021-01 | Audio Signal Generator/Analyzer | Audio Precision | SYS-2722 | 48254-1041 | N/A | 4/26/2018 | 4/26/2020 |
| L23-022-01 | Spectrum Analyzer | Rhode & Schwarz | FSU26 | 201043 | 2Hz-26.5GHz | 8/23/2017 | 8/23/2019 |
| L23-022-02 | Spectrum Analyzer | Rhode & Schwarz | FSW26 | 103788 | 2Hz-26.5GHz | 4/24/2018 | 4/24/2020 |
| L23-023-01 | Signal Generator | Rhode & Schwarz | SMF 100A | 48254-151 | 100kHz-22GHz | 8/23/2017 | 8/23/2019 |
| L23-024-01 | Frequency Counter | Agilent | 53220A | MY50006485 | 100MHz-6GHz | 7/24/2018 | 7/24/2020 |
| L23-040-03 | 20dB Signal Attenuator | Mini-Circuits | BW-N20W5+ | 0952 | 18GHz | 5/31/2018 | 5/30/2020 |
| L23-040-22 | ETSI Noise Filter | Shure | N/A | N/A | N/A | 5/24/2017 | 5/24/2019 |
| L23-040-30 | ETSI Noise Filter | Shure | N/A | N/A | N/A | 5/24/2017 | 5/24/2019 |
| L23-041-56 | SMA-N-type Coaxial Cable | Florida RF Labs | N/A | 46410-1080 | 100kHz-22GHz | 5/30/2018 | 5/30/2019 |
| L23-045-36 | RF Power Meter | EMPower | 7002-006 | 00151071 | 18GHz | 1/31/2018 | 1/31/2020 |

# Appendix A: Radiated Emissions Measurements

## A.1. Purpose:

This test was performed to determine if the EUT (Shure P10T X55 Transmitter) meets the Radiated Emissions requirements of FCC Part 74.861 (d)(4)(i).

## A.2. Requirements:

FCC Part 74.861 (d)(4)(i) states:

"Beyond one megahertz below and above the carrier frequency, emissions shall comply with the limits specified in section 8.4 of ETSI EN 300 422-1 v1.4.2 (2011-08)."

The limits for spurious emissions from a transmitter as stated by EN 300 422-1 v1.4.2 section 8.4 are shown below.

| State | Frequency | | |
|---|---|---|---|
| | 47 MHz to 74 MHz<br>87,5 MHz to 137 MHz<br>174 MHz to 230 MHz<br>470 MHz to 862 MHz | Other Frequencies below 1 000 MHz | Frequencies above 1 000 MHz |
| Operation | 4 nW | 250 nW | 1 µW |
| Standby | 2 nW | 2 nW | 20 nW |

*Figure 1: Table - Limits for Spurious Emissions*

## A.3. 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):

| Measurement Type | $U_{LAB}$ | $U_{FCC}$ |
|---|---|---|
| Radiated disturbance (electric field strength on an open area test site or alternative test site) (30 MHz – 1000 MHz) | 4.24dB | 6dB |
| Radiated disturbance (electric field strength on an open area test site or alternative test site) (1 GHz – 12.75 GHz) | 4.60dB | 6dB |

$U_{LAB}$ = Determined for Shure EMC Laboratory
$U_{FCC}$ = From FCC EN 300 422-1 Table 10: Measurement uncertainty
Since $U_{LAB}$ is less than or equal to $U_{FCC}$:

- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- Non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

## A.4. Test Setup and Instrumentation:

Photographs of the test setup are shown below. The test instrumentation can be determined from Table 10-1.

## A.5. EUT Operation:

All ports were terminated on the EUT. The device was powered up and the frequency was set using the buttons on the front panel, with TX1 RF turned on and TX2 RF turned on. Testing was conducted with the EUT set to the Low, Mid, and High frequencies chosen within the operating frequency range. These frequencies were set as 941.625MHz, 954.55MHz, and 959.725MHz, respectively. The device was plugged into power from an outlet in the floor of the Shure EMC Lab anechoic chamber.

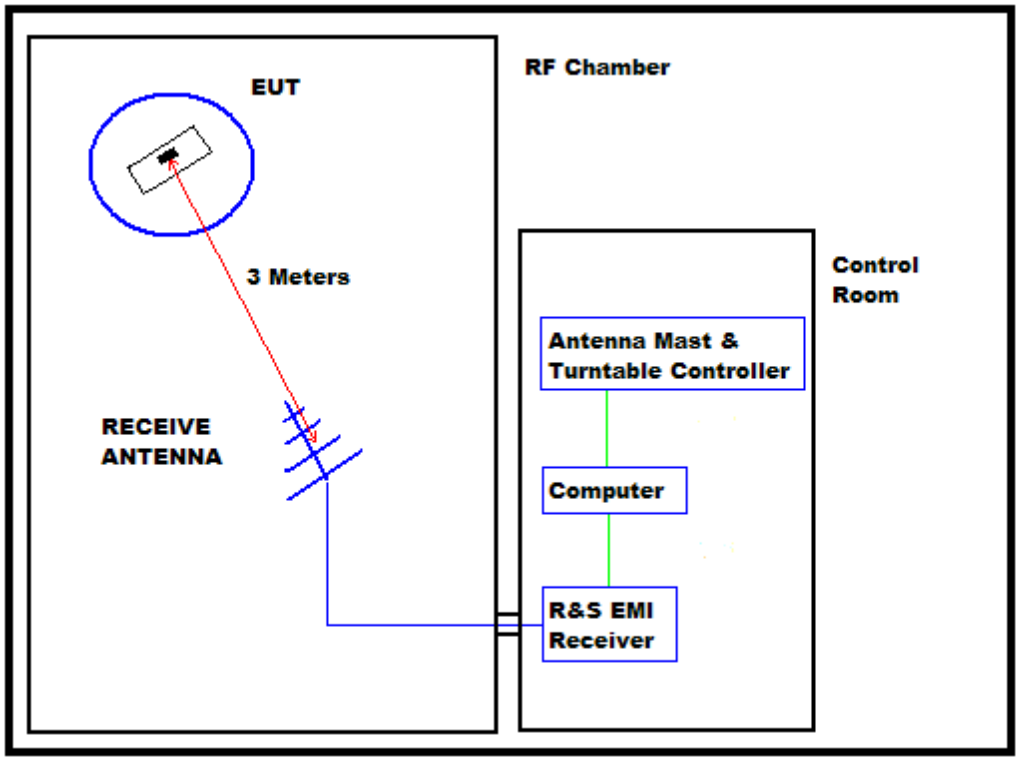
For the tests above 1GHz, a high-pass filter with a cutoff frequency of 1340MHz (L23-011-38) was used to clean up the signal. It was attached immediately after the antenna.

## A.6. Specific Test Procedures:

All tests were performed in a 28ft. x 20ft. x 18.5ft. 3m semi-anechoic test chamber. The walls and ceiling of the shielded chamber are lined with ferrite tiles. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The chamber complies with ANSI C63.4-2003 for site attenuation.

The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All power lines and signal lines entering the enclosure pass through filters on the enclosure wall. The power line filters prevent extraneous signals from entering

the enclosure on these leads.




**BLOCK DIAGRAM OF SHIELDED ENCLOSURE**

Preliminary radiated measurements were performed to determine the frequencies where the significant emissions might be found. The broadband measuring antenna was positioned at a 3 meter distance from the EUT. The frequency range from 25MHz to 1GHz was investigated using a peak detector function with the BiConiLog antenna at horizontal and vertical polarization, and with several different orientations of the EUT with respect to the antenna. The maximum levels measured for each antenna polarization were then automatically plotted. The resultant field strength (FS) is a summation in decibels (dB) of the EMI receiver measurement (ERM), the antenna correction factor (AF), and the cable loss factor (CF). If an external pre-amplifier is used, the total is reduced by its gain (-PA).

Formula 1: FS (dBµV/m) = MTR (dBµV) + AF (dB/m) + CF (dB) + (- PA (dB))

To convert the Field Strength dBµV/m term to µV/m, the dBµV/m is first divided by 20. The Base 10 AntiLog is taken of this quotient. The result is the Field Strength value in µV/m terms.

Formula 2: FS (µV/m) = AntiLog [(FS (dBµV/m))/20]

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

1) Measurements of all significant broadband and narrowband signals from 25MHz to 1GHz were made using a quasi-peak detector and a BiConiLog antenna. Measurements above 1GHz were made using an average detector and a broadband double ridged waveguide antenna.

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

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 from 1 to 4 meters for each antenna polarization to maximize the readings.

Results:

The plots of the radiated spurious emission levels are presented on the following pages.

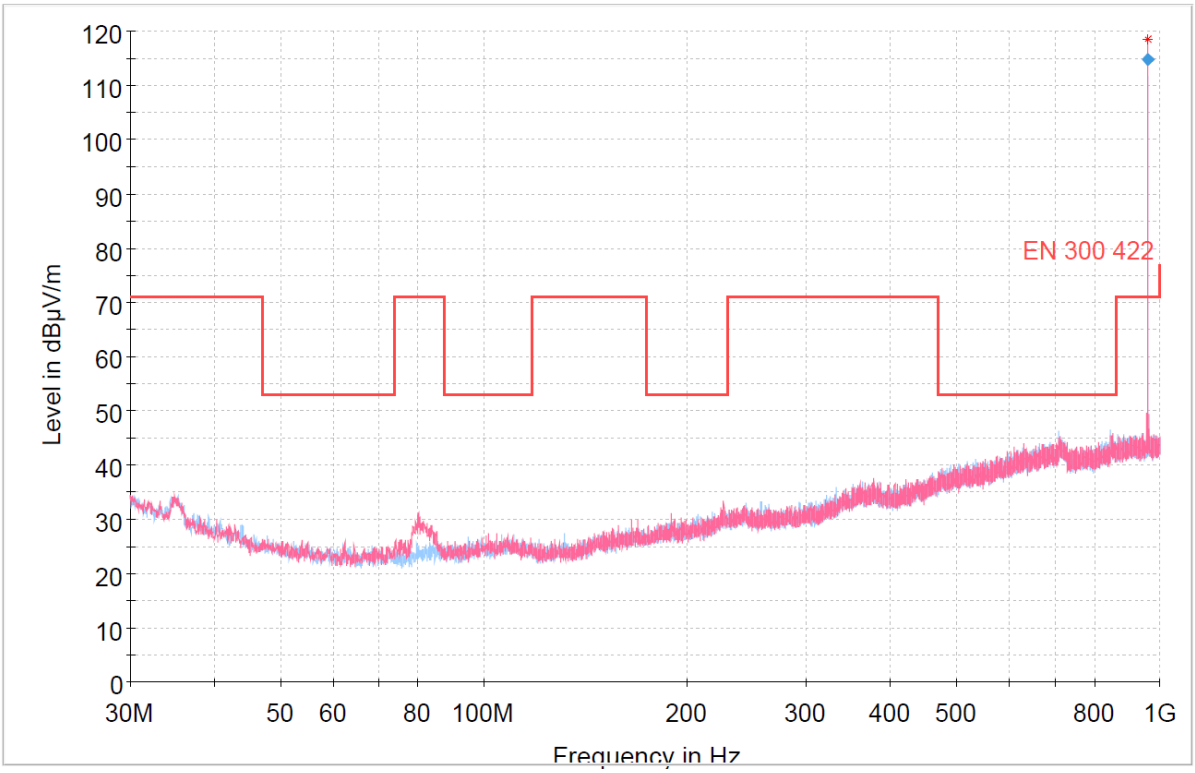



*Figure 2: P10T X55 959.725MHz - 30MHz to 1GHz*

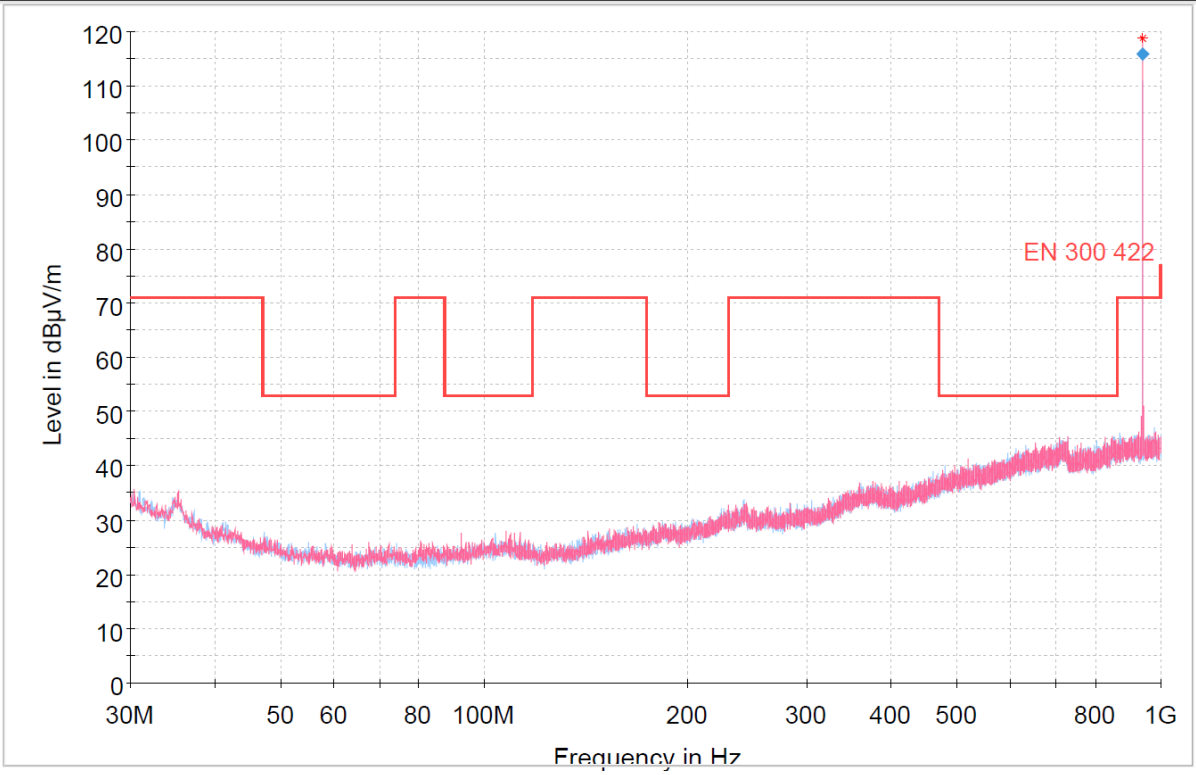



*Figure 3: P10T X55 941.625MHz - 30MHz to 1GHz*

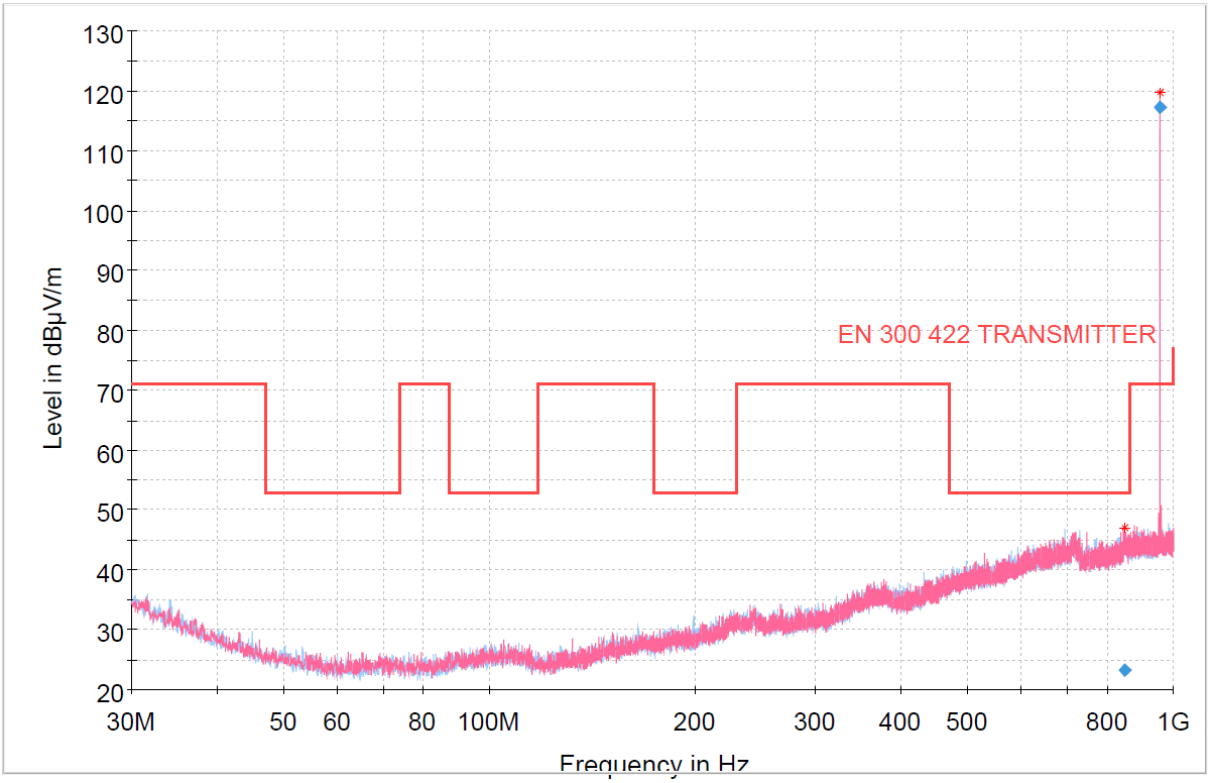



*Figure 4: P10T X55 954.550MHz - 30MHz to 1GHz*

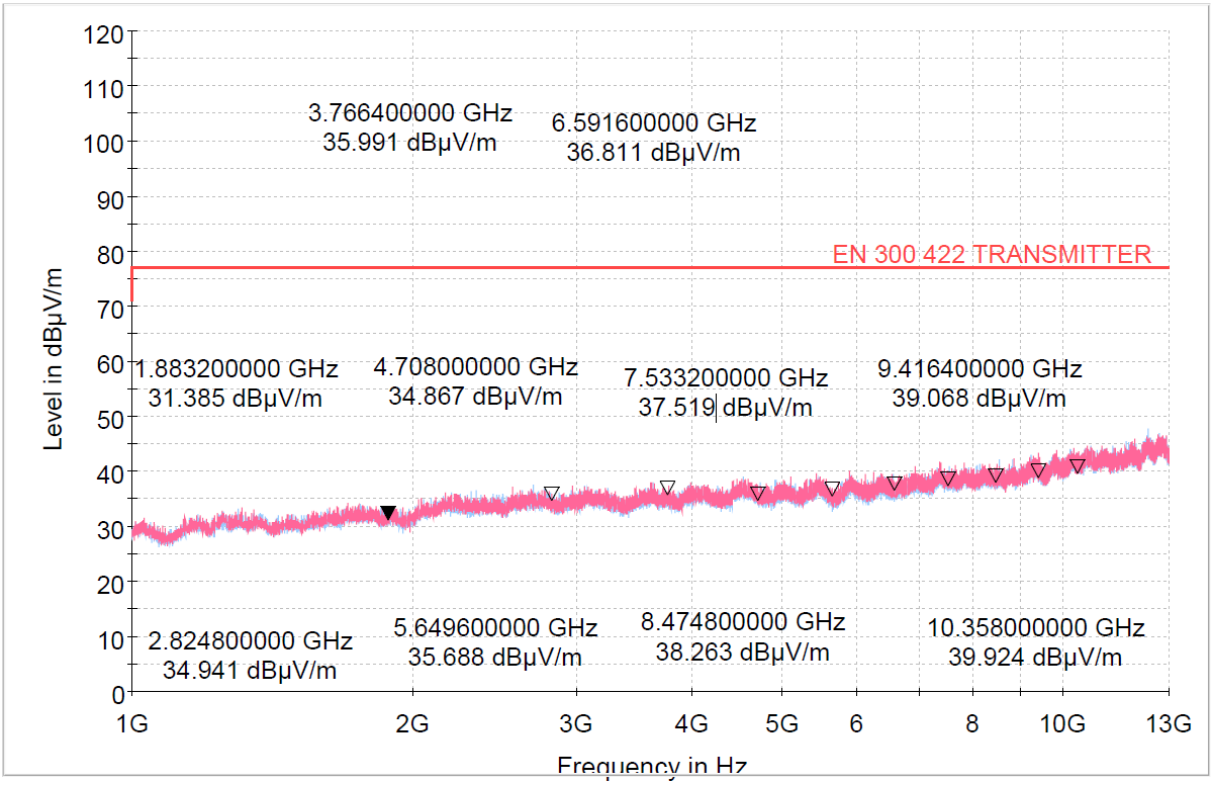



*Figure 5: P10T X55 941.625MHz - 1GHz to 13GHz*

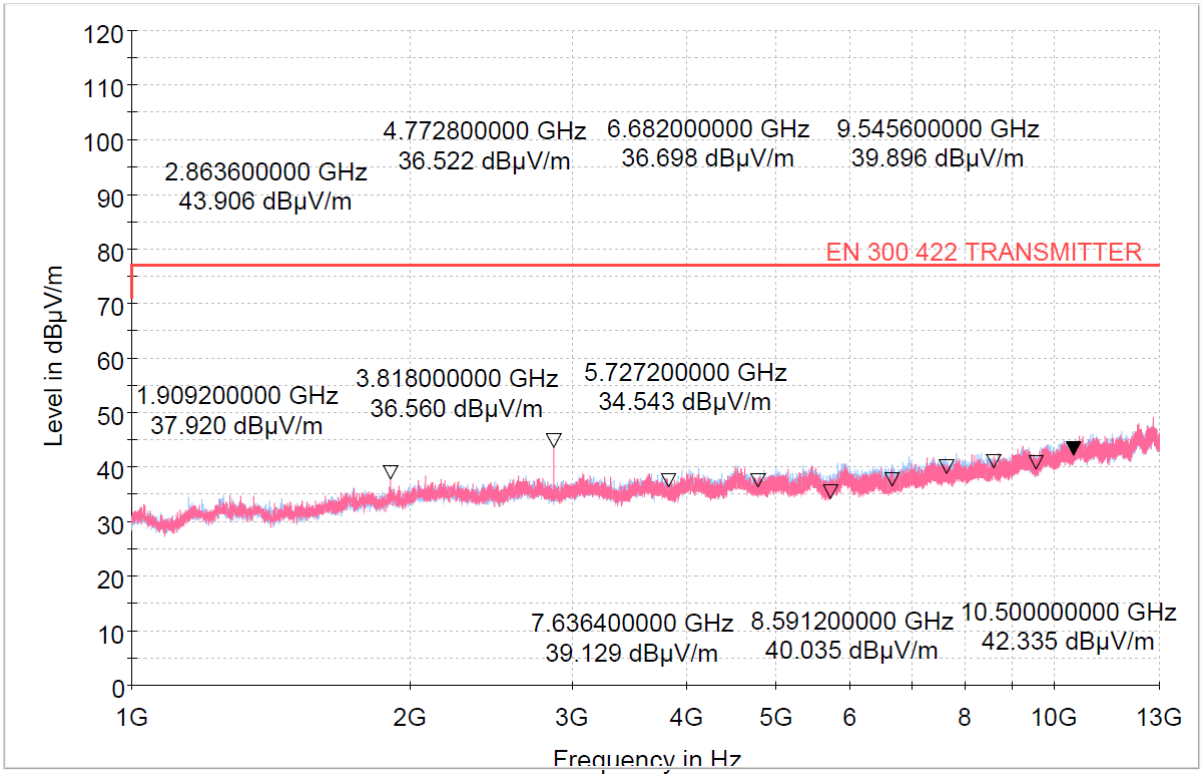



*Figure 6: P10T X55 954.550MHz - 1GHz to 13GHz*

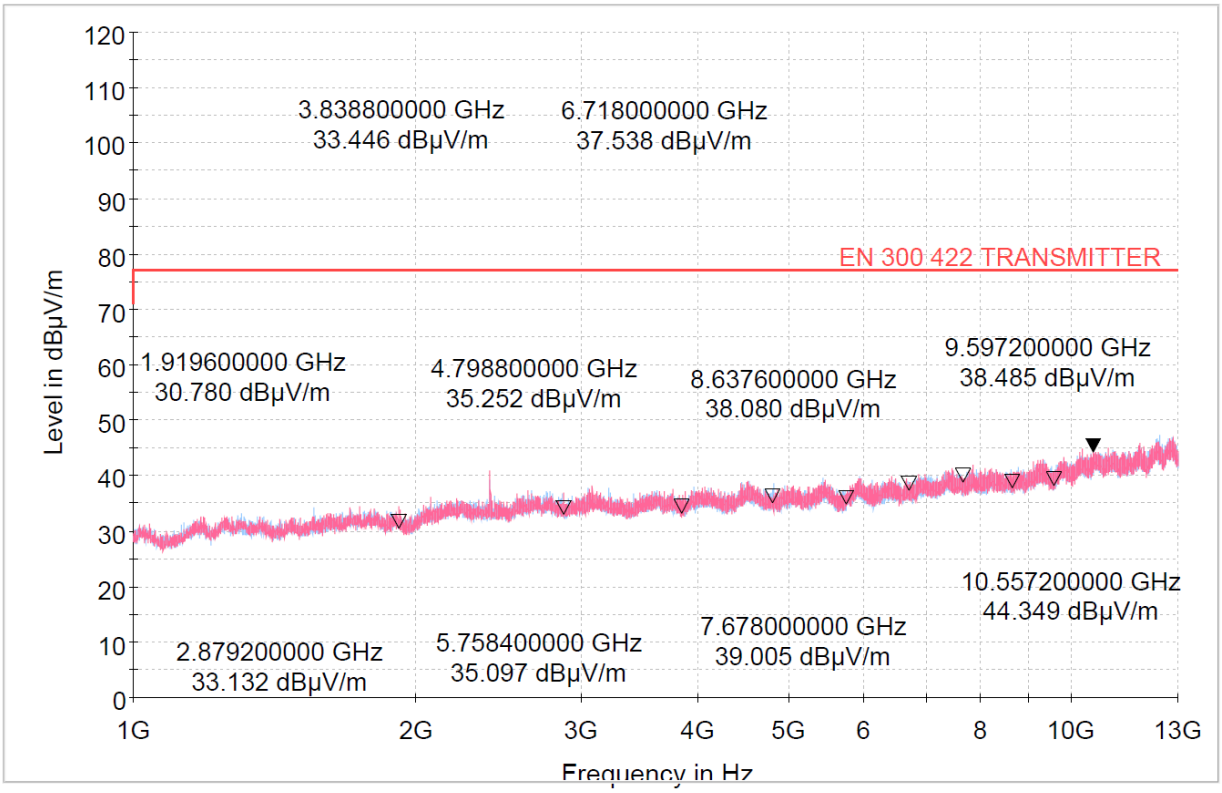



*Figure 7: P10T X55 959.725MHz - 1GHz to 13 GHz*

## A.7. Conclusion

It was shown by the test that the P10T X55 complies with both FCC Part 74.861(d)(4)(i).

# Appendix B: Necessary Bandwidth

## B.1. Purpose:

This test was performed to determine if the EUT meets the necessary bandwidth requirements of FCC Part 74.861(d)(4)(i).

## B.2. Requirements:

As stated in paragraph 74.861(7), for low power auxiliary stations operating in the bands allocated for TV broadcasting, the following technical requirements apply:

"Analog emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.1.2 of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08), Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; part 1: Technical characteristics and methods of measurement."

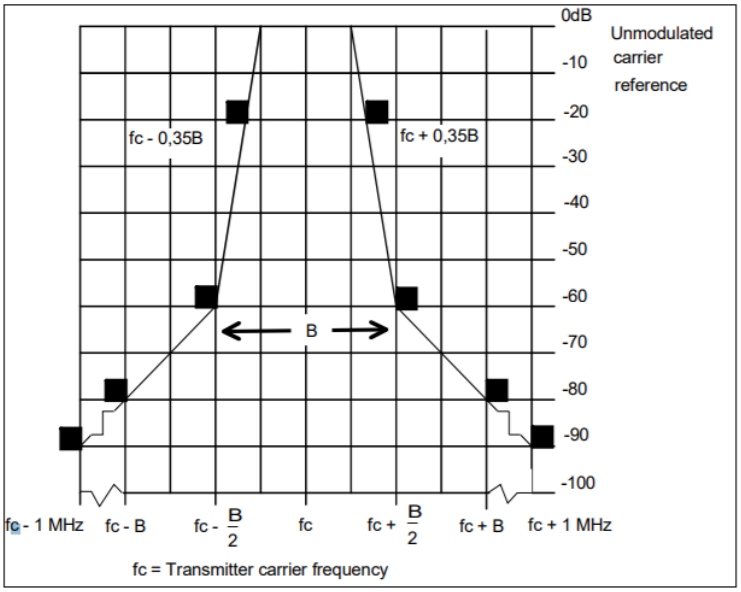



*Figure 8: Spectrum mask for analogue systems in all bands - ETSI EN 300 422-1*

## B.3. 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):

| | Std uncertainty | |
|---|---|---|
| | +u(%) | -u(%) |
| Expanded Uncertainty ($U_{95}$): | **0.130** | **0.130** |

These values can be found in the document titled ‘Occupied Bandwidth Max Input Freq Above 3kHz.xlsx’ located at *\\shure.com\organization\Quality\Product Conformance-Lab Services\Global Compliance\Shure EMC Lab\Controlled Documents\Measurement Uncertainties.*

## B.4. Test Setup and Instrumentation:

Photographs of the test setup are shown below. The test instrumentation can be determined from Table 10-1.

## B.5. EUT Operation:

The device was powered on and set to three frequencies using the buttons on the front of the device: 941.650MHz, 954.550MHz, and 959.725MHz.

## B.6. Specific Test Procedures:

The device was tested using procedures outlined in EN 300 422-1 part 8.3.2.1 as listed below.

> "The arrangement of test equipment as shown in figure B.1 shall be used. Note that the noise meter conforms to (quasi peak) without weighting filter (flat).
>
> With the Low Frequency (LF) audio signal generator set to 500 Hz, the audio input level to the DUT shall be adjusted to 8 dB below the limiting threshold (-8 dB (lim)) as declared by the manufacturer.
>
> The corresponding audio output level from the demodulator shall be measured and recorded.
>
> The input impedance of the noise meter shall be sufficiently high to avoid more than 0,1 dB change in input level when the meter is switched between input and output.
>
> The audio input level shall be increased by 20 dB, i.e. to +12 dB (lim), and the corresponding change in output level shall be measured.
>
> It shall be checked that the audio output level has increased by ≤ 10 dB.
>
> If this condition is not met, the initial audio input level shall be increased from -8 dB (lim) in 1 dB steps until the above condition is fulfilled, and the input level recorded in the test report. This level replaces the value derived from the manufacturer's declaration and is defined as -8 dB (lim).
>
> Measure the input level at the transmitter required to give +12 dB (lim).
>
> The LF generator shall be replaced with the weighted noise source to Recommendation ITU-R BS.559-2 [i.3], band-limited to 15 kHz as described in IEC 60244-13 [2], and the level shall be adjusted such that the measured input to the transmitter corresponds to +12 dB (lim).
>
> If the transmitter incorporates any ancillary coding or signalling channels (e.g. pilot-tones), these shall be enabled prior to any spectral measurements.

If the transmitter incorporates more than one audio input, e.g. stereo systems, the second and subsequent channels shall be simultaneously driven from the same noise source, attenuated to a level of -6 dB (lim).

The transmitter RF output spectrum shall be measured, using a spectrum analyser with the following settings:

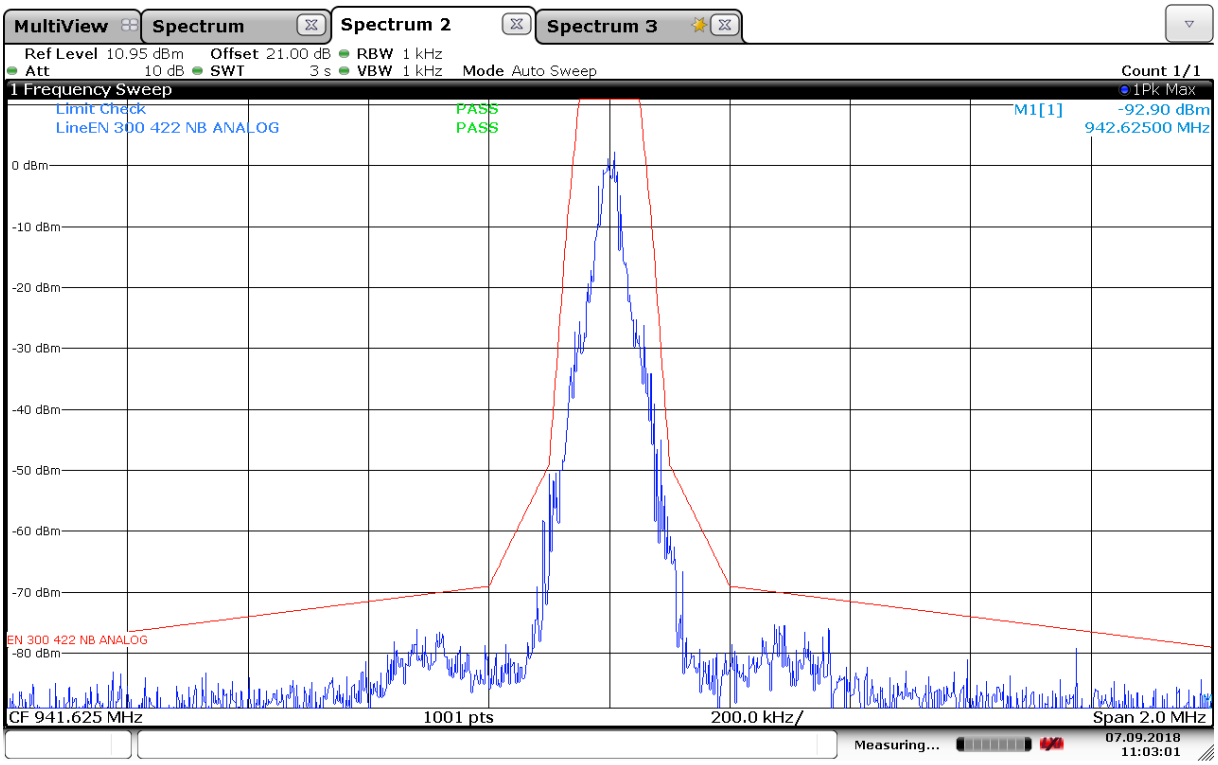
- centre frequency: fc: Transmitter (Tx) nominal frequency;
- dispersion (Span): fc - 1 MHz to fc + 1 MHz;
- Resolution BandWidth (RBW): 1 kHz;
- Video BandWidth (VBW): 1 kHz;
- detector: Peak hold.

Figure 8 shows the spectrum mask for all analogue systems in the band. The -90 dBc point shall be ±1 MHz from fc measured with an average detector. To comply, a measured value shall fall below the mask limit."

A +12dB level of -28dBV and a -8dB level of -48dBV were chosen using the first set of instructions, and the output RF power was measured with inputs of -28dBV for the +12dB level and -46dBV for the -6dB level.

## B.7. Results:

The necessary bandwidth data are presented on the following pages. Data are shown as the maximum relative level of the output level within the emission mask.




**11:03:01 07.09.2018**

*Figure 9: Necessary Bandwidth Measurement at 941.625MHz*

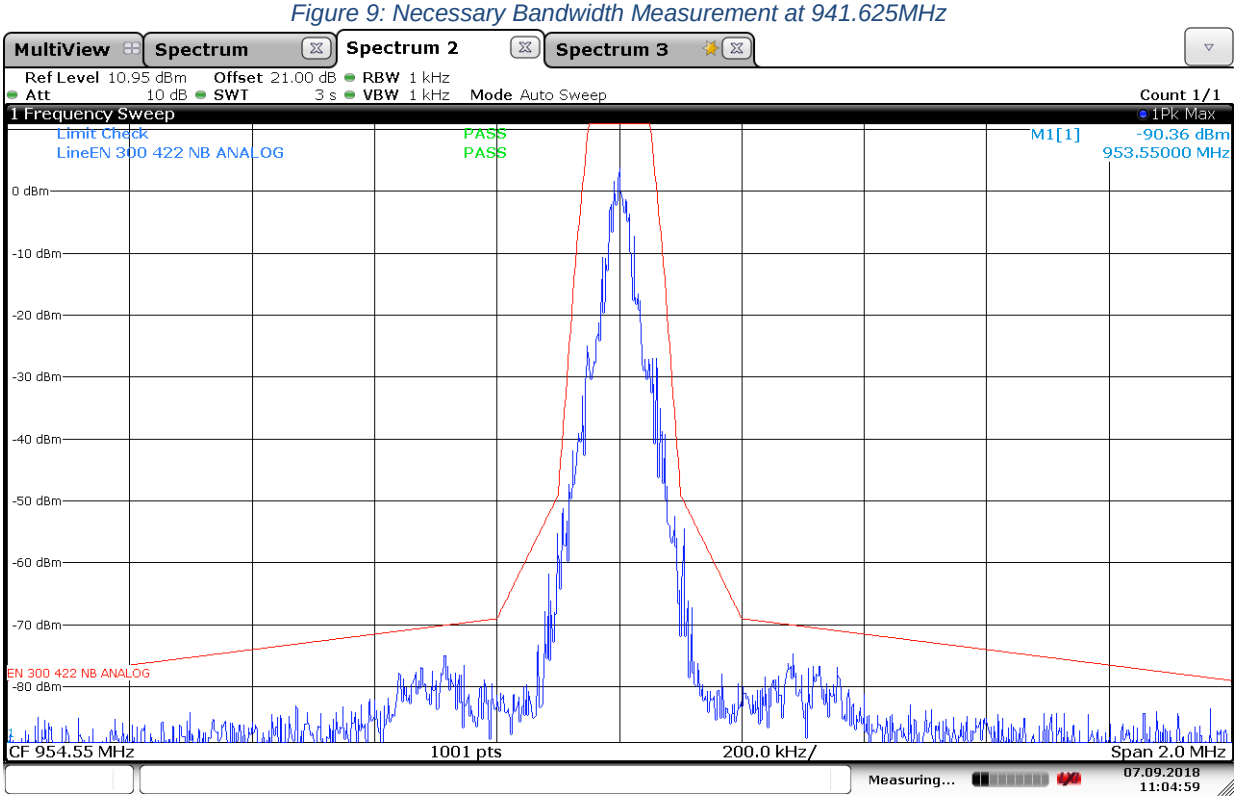



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*Figure 10: Necessary Bandwidth Measurement at 954.550MHz*

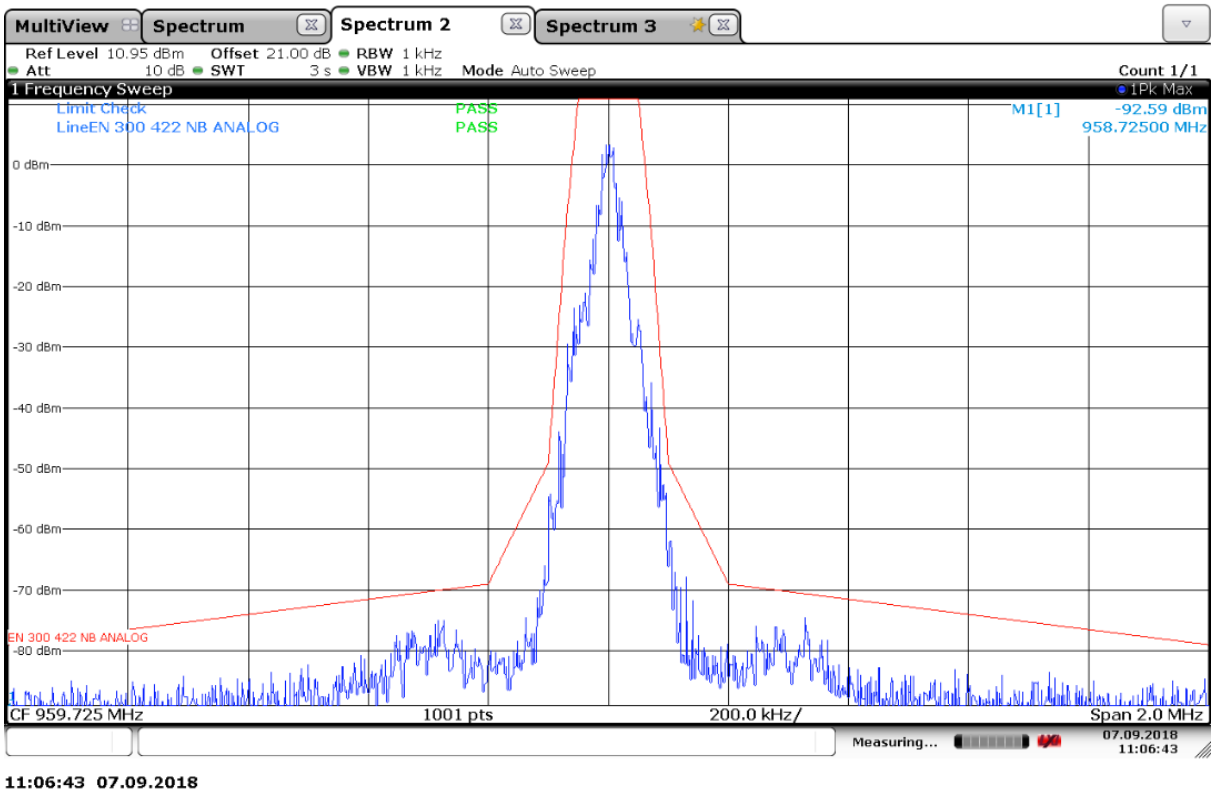



*Figure 11: : Necessary Bandwidth Measurement at 959.725MHz*

## B.8. Conclusion

As shown by the test data, the necessary bandwidth of the EUT meets the requirements of FCC Part 74.861(d)(4)(i).

# Appendix C: RF Output Power

## C.1. Purpose:

This test was performed to determine if the EUT meets the RF power output requirements of FCC Part 74.861(d)(1).

## C.2. Requirements:

As stated in FCC 74.861(d)(1), for all bands except the 1435-1525 MHz band, the maximum transmitter power which will be authorized is 1 watt.

## C.3. 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.

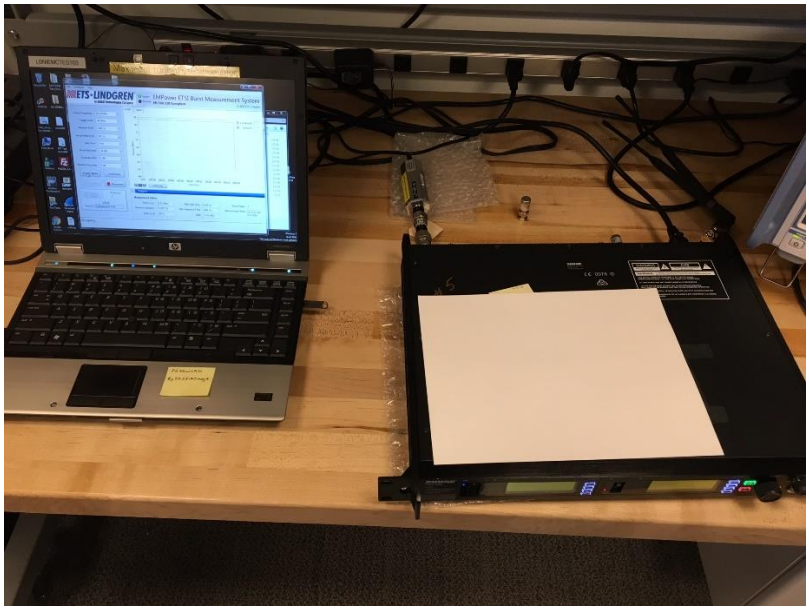
Values of Expanded Measurement Uncertainty (95% Confidence):

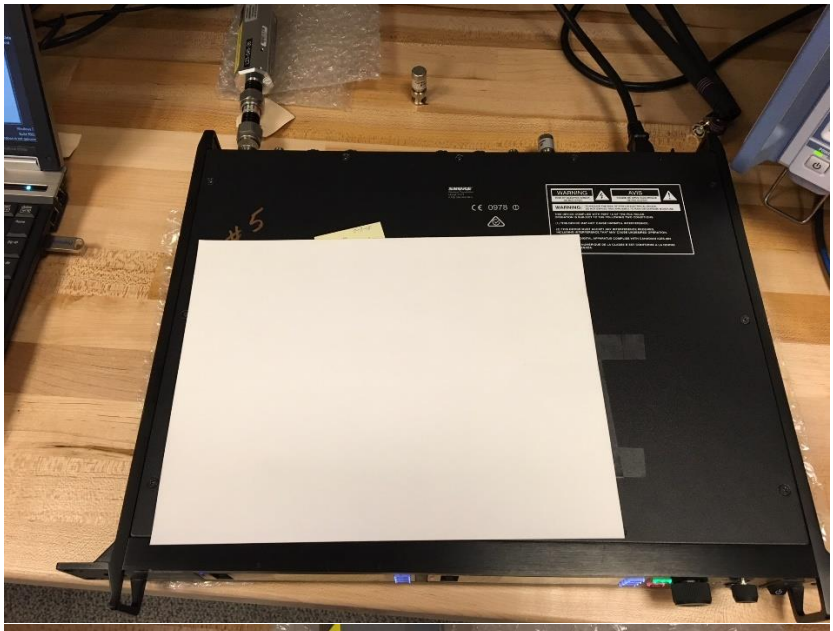
| | Std uncertainty +u(dB) | -u(dB) |
|---|---|---|
| Expanded Uncertainty ($U_{95}$): | **0.461** | **0.461** |

These values can be found in the document titled 'Carrier Power w ETS Power Meter (L23-045-36).xlsx' located at *\\shure.com\organization\Quality\Product Conformance-Lab Services\Global Compliance\Shure EMC Lab\Controlled Documents\Measurement Uncertainties.*

## C.4. Test Setup and Instrumentation:

Photographs of the test setup are shown below. The test instrumentation can be determined from Table 10-1.





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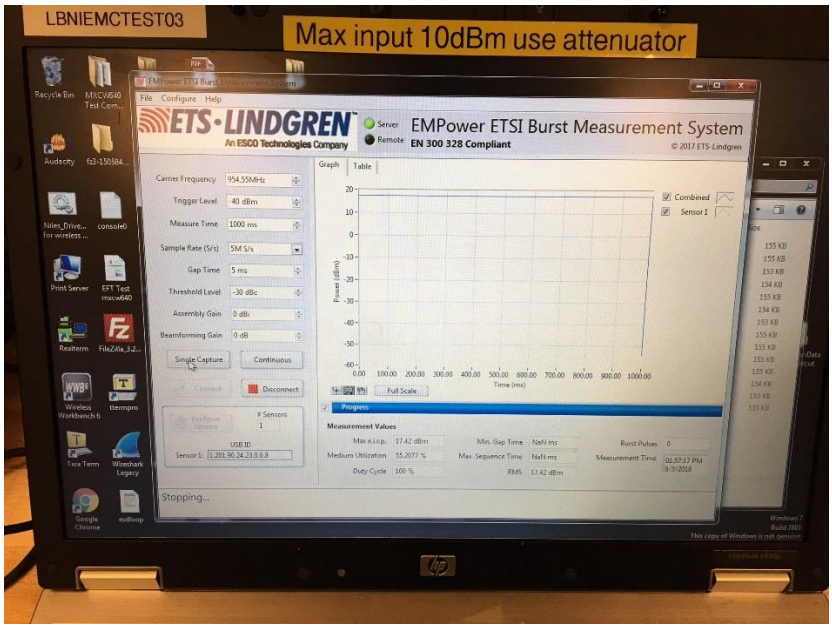


## C.5. EUT Operation:

The EUT was powered up and three transmit frequencies (941.650MHz, 954.550MHz, and 959.725MHz) and the power output level of the transmitter were selected using the front panel controls.

## C.6. Specific Test Procedures:

a. The EUT's RF Out 1 was connected to an artificial antenna at ambient temperature.
b. The EUT's frequency was set at the lowest frequency (941.625 MHz) and the lowest switchable power level (10mW).
c. The power level was measured and recorded.
d. Step b) was repeated at all power levels (10mW, 50mW, and 100mW) and at medium (954.550 MHz) and high (959.725 MHz) frequencies.
e. The above procedure was then repeated for the second RF output.

## C.7. Results:

The device performed within the bounds set by FCC Part 74.861(d)(1). The following tables detail the output power at each frequency, tested at 10, 50, and 100mW compared to the FCC Limit. The first table shows the values for RF Output 1 and the second is for RF Output 2 on the stereo device.

| Unit# | | Frequency (MHz) | Nominal Power (mW) | Measured Power (dBm) | Measured Power (mW) | FCC Limit (mW) | Pass/Fail |
|---|---|---|---|---|---|---|---|
| RF Out1 | **X55** | 941.625 | 10 | 9.47 | 8.85 | 1000 | PASS |
| | | 954.550 | 10 | 10.44 | 11.07 | 1000 | PASS |
| | | 959.725 | 10 | 10.31 | 10.74 | 1000 | PASS |
| RF Out1 | **X55** | 941.625 | 50 | 16.48 | 44.46 | 1000 | PASS |
| | | 954.550 | 50 | 17.42 | 55.21 | 1000 | PASS |
| | | 959.725 | `1 | 17.29 | 53.58 | 1000 | PASS |
| RF Out1 | **X55** | 941.625 | 100 | 19.38 | 86.70 | 1000 | PASS |
| | | 954.550 | 100 | 20.31 | 107.40 | 1000 | PASS |
| | | 959.725 | 100 | 20.30 | 107.15 | 1000 | PASS |

| Unit# | | Frequency (MHz) | Nominal Power (mW) | Measured Power (dBm) | Measured Power (mW) | FCC Limit (mW) | Pass/Fail |
|---|---|---|---|---|---|---|---|
| RF Out2 | **X55** | 941.625 | 10 | 9.14 | 8.20 | 1000 | PASS |
| | | 954.550 | 10 | 10.13 | 10.30 | 1000 | PASS |
| | | 959.725 | 10 | 10.05 | 10.12 | 1000 | PASS |
| RF Out2 | **X55** | 941.625 | 50 | 16.13 | 41.02 | 1000 | PASS |
| | | 954.550 | 50 | 17.12 | 51.52 | 1000 | PASS |
| | | 959.725 | 50 | 17.04 | 50.58 | 1000 | PASS |
| RF Out2 | **X55** | 941.625 | 100 | 19.05 | 80.35 | 1000 | PASS |
| | | 954.550 | 100 | 20.03 | 100.69 | 1000 | PASS |
| | | 959.725 | 100 | 19.96 | 99.08 | 1000 | PASS |

# Appendix D: Frequency Stability

## D.1. Purpose:

This test was performed to determine if the EUT meets the frequency stability requirements of FCC Part 74.861(e)(4).

## D.2. Requirements:

As stated in FCC Part 74.861(e)(4), the tolerance of the transmitter shall be 0.005%, or 50 ppm.

## D.3. 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):

| | Std uncertainty ±u(error) |
|---|---|
| Expanded Uncertainty ($U_{95}$): | **5.83E-08** |

These values can be found in the document titled 'Frequency Error_Stability – 2018_09_24.xlsx' located at *\\shure.com\organization\Quality\Product Conformance-Lab Services\Global Compliance\Shure EMC Lab\Controlled Documents\Measurement Uncertainties.*

- Compliance is deemed to occur if no measured disturbance exceeds the disturbance limit;
- Non-compliance is deemed to occur if any measured disturbance exceeds the disturbance limit.

## D.4. Test Setup and Instrumentation:

The EUT was heated and cooled in an Espec temperature chamber over a temperature range of -30°C to +50°C. The temperature around the EUT was measured and monitored by the built-in thermometer. The EUT's frequency was measured with a spectrum analyzer set to measure signal count at 0.1Hz resolution. The center frequency of the spectrum analyzer was set to the selected transmit frequency of the EUT (Low, Mid or High). Photographs of the test setup are shown below. The test instrumentation can be determined from Table 10-1.

## D.5. EUT Operation:

The device was powered on with RF TX 1 switched on. The three frequencies tested were set using the buttons on the front panel of the device.

## D.6. Specific Test Procedures:

a. The temperature chamber was set to -30°C with the EUT inside and powered on.
b. The EUT was allowed to soak for ~20 minutes after the temperature chamber reached the set temperature.
c. The measured frequency of the transmitter was then recorded in the spreadsheet in section D.7.
d. The temperature chamber was incremented +10°C with the EUT inside and powered on.
e. Steps c. through e. were repeated until the device reached +50°C.
f. Steps a. through e. were repeated for representative low, mid and high frequencies within the EUT's operational bands.

## D.7. Results:

| Temperature (°C) | Voltage | Nominal Frequency (MHz) | Measured Frequency (MHz) | Deviation (%) | FCC Limit (%) | Deviation (ppm) |
|---|---|---|---|---|---|---|
| **941.625MHz, 100mW** | | | | | | |
| -30 | 120VAC, 60Hz | 941.625 | 941.625296 | 0.000031 | 0.005 | 0.314 |
| -20 | 120VAC, 60Hz | 941.625 | 941.625349 | 0.000037 | 0.005 | 0.371 |
| -10 | 120VAC, 60Hz | 941.625 | 941.625366 | 0.000039 | 0.005 | 0.389 |
| 0 | 120VAC, 60Hz | 941.625 | 941.625322 | 0.000034 | 0.005 | 0.342 |
| 10 | 120VAC, 60Hz | 941.625 | 941.625224 | 0.000024 | 0.005 | 0.238 |
| 20 | 120VAC, 60Hz | 941.625 | 941.625141 | 0.000015 | 0.005 | 0.15 |
| 30 | 120VAC, 60Hz | 941.625 | 941.625110 | 0.000012 | 0.005 | 0.117 |
| 40 | 120VAC, 60Hz | 941.625 | 941.625122 | 0.000013 | 0.005 | 0.13 |
| 50 | 120VAC, 60Hz | 941.625 | 941.625054 | 0.000006 | 0.005 | 0.057 |
| | | | | | | |
| **954.550MHz, 100mW** | | | | | | |
| -30 | 120VAC, 60Hz | 954.550 | 954.550302 | 0.000032 | 0.005 | 0.316 |
| -20 | 120VAC, 60Hz | 954.550 | 954.550352 | 0.000037 | 0.005 | 0.369 |
| -10 | 120VAC, 60Hz | 954.550 | 954.550368 | 0.000039 | 0.005 | 0.386 |
| 0 | 120VAC, 60Hz | 954.550 | 954.550326 | 0.000034 | 0.005 | 0.342 |
| 10 | 120VAC, 60Hz | 954.550 | 954.550235 | 0.000025 | 0.005 | 0.246 |
| 20 | 120VAC, 60Hz | 954.550 | 954.550146 | 0.000015 | 0.005 | 0.153 |
| 30 | 120VAC, 60Hz | 954.550 | 954.550113 | 0.000012 | 0.005 | 0.118 |
| 40 | 120VAC, 60Hz | 954.550 | 954.550123 | 0.000013 | 0.005 | 0.129 |
| 50 | 120VAC, 60Hz | 954.550 | 954.550059 | 0.000006 | 0.005 | 0.062 |
| | | | | | | |
| **959.725MHz, 100mW** | | | | | | |
| -30 | 120VAC, 60Hz | 959.725 | 959.725304 | 0.000032 | 0.005 | 0.317 |
| -20 | 120VAC, 60Hz | 959.725 | 959.725353 | 0.000037 | 0.005 | 0.368 |
| -10 | 120VAC, 60Hz | 959.725 | 959.725371 | 0.000039 | 0.005 | 0.387 |
| 0 | 120VAC, 60Hz | 959.725 | 959.725327 | 0.000034 | 0.005 | 0.341 |
| 10 | 120VAC, 60Hz | 959.725 | 959.725237 | 0.000025 | 0.005 | 0.247 |
| 20 | 120VAC, 60Hz | 959.725 | 959.725147 | 0.000015 | 0.005 | 0.153 |
| 30 | 120VAC, 60Hz | 959.725 | 959.725115 | 0.000012 | 0.005 | 0.12 |
| 40 | 120VAC, 60Hz | 959.725 | 959.725123 | 0.000013 | 0.005 | 0.128 |
| 50 | 120VAC, 60Hz | 959.725 | 959.725053 | 0.000006 | 0.005 | 0.055 |

## D.8. Conclusion

The P10T X55 fulfilled the requirements of FCC part 74.