



FCC PART 74, SUBPART H

TEST REPORT

For

Lectrosonics, Inc

581 Laser Rd NE Rio Rancho NM 87124

Model: SMWB-C1, SMDWB-C1
FCC ID: DBZSMWBC1

| | |
|--|---|
| Report Type: Original Report | Product Type: Wireless Microphone Transmitter |
| Test Engineer: <u>David Hsu</u> | |
| Report Number: <u>RTWU170504004-00</u> | |
| Report Date: <u>2017-08-11</u> | |
| Reviewed By: <u>Jerry Chang</u> | |
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Taiwan)

REVISION HISTORY

| Revision Number | Report Number | Description of Revision | Date of Revision |
|-----------------|------------------|-------------------------|------------------|
| 0 | RTWU170504004-00 | Original Report | 2017-06-27 |
| 1 | RTWU170504004-00 | Updated page 22, 29, 30 | 2017-08-01 |
| 2 | RTWU170504004-00 | Updated Page 15 | 2017-08-11 |

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1 General Information

1.1 Product Description for Equipment Under Test (EUT)

Applicant: Lectrosonics, Inc
581 Laser Rd NE Rio Rancho NM 87124

Manufacturer: Lectrosonics, Inc
581 Laser Rd NE Rio Rancho NM 87124

Product: Wireless Microphone Transmitter

Model: SMWB-C1, SMDWB-C1

Operating Frequency: 614.400 - 691.175 MHz

Rate Voltage: SMWB-C1: DC 1.5V for battery.
SMDWB-C1: DC 1.5V for battery.

Date of Test: May. 04, 2017 ~ May. 15, 2017

**All measurement and test data in this report was gathered from production sample serial number: 170504004*

(Assigned by BACL, Taiwan) The EUT supplied by the applicant was received on 2017-05-04.

1.2 Objective

The report is prepared on behalf of *Lectrosonics, Inc.* in accordance with Part 74, Subparts H of the Federal Communications Commission rules.

The objective is to determine compliance with Part 74 of the FCC Rules, limits for RF output power, Modulation characteristics, Emission bandwidth, Field strength of spurious radiation and Frequency stability for license-exempt, low-power radio apparatus operating in the television bands.

1.3 Related Submittal(s)/Grant(s)

No related submittal(s).

1.4 Test Methodology

All measurements contained in this report were conducted in accordance with TIA 603-D Land Mobile FM or PM Communications Equipment Measurement and Performance Standards. ANSI C63.10-2013, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9kHz to 40GHz.

1.5 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Taiwan) to collect test data is located on the 70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

Test site at Bay Area Compliance Laboratories Corp. (Taiwan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on December 06, 2014. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.10.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 431084. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

2 System Test Configuration

2.1 Description of Test Configuration

The EUT was configured for testing according to TIA 603-D and ANSI C63.10-2013 Standards.

2.2 Equipment Modifications

Conducted antenna port was enabled by adding additional RF cable from SMA.

2.3 Support Equipment List and Details

| Description | Manufacturer | Model Number | S/N |
|-------------|--------------|--------------|-----|
| N/A | N/A | N/A | N/A |

2.4 External Cable List and Details

| Cable Description | Length (m) | From | To |
|-------------------|------------|------|-----|
| N/A | N/A | N/A | N/A |

3 Summary of Test Results

| FCC Rules | Description of Test | Results |
|-----------------------|--|------------|
| FCC §2.1093, | RF Exposure | Compliant* |
| FCC §74.861(e)(1), | RF output power | Compliant |
| FCC §74.861(e)(3), | Modulation characteristics | Compliant |
| FCC §74.861(e)(5)(6), | Emission bandwidth & Emission Mask | Compliant |
| FCC §74.861(e)(6), | Spurious radiation at the antenna port | Compliant |
| FCC §74.861(e)(6), | Field strength of spurious radiation | Compliant |
| FCC §74.861(e)(4), | Frequency stability | Compliant |

Compliant*: please refer to the SAR report number [R1704199-SAR](#).

4 FCC §74.861(e)(1) - RF Output Power

4.1 Applicable Standard

According to FCC §74.861 (e) (1): the power of the measured unmodulated carrier power at the output of the transmitter power amplifier (antenna input power) may not exceed the following:

- (i) 54-72, 76-88, and 174-216 MHz bands—50 mW
- (ii) 470-608 and 614-698 MHz bands—250 mW

4.2 Test Procedure

Connect the EUT to spectrum analyzer and set the spectrum analyzer as following:

- Center frequency: channel frequency under test
- RBW: 1 MHz
- VBW: 3 MHz
- Detector mode: peak
- Span: 1 MHz

Max hold the trace and record the peak value once the trace stabilized.

4.3 Test Equipment List and Details

| Descriptions | Manufacturers | Models | Serial Numbers | Calibration Date | Calibration Due Date |
|-------------------|-----------------|--------|----------------|------------------|----------------------|
| Spectrum Analyzer | Rohde & Schwarz | FSV40 | 101203 | 2016/11/10 | 2017/11/9 |
| Cable | WOKEN | SFL402 | 00100A1F6A192S | 2017/2/22 | 2018/2/21 |

* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed according to TAF requirements, traceable to the ETC.

4.4 Test Environmental Conditions

| | |
|---------------------------|------------|
| Temperature: | 22 °C |
| Relative Humidity: | 50 % |
| ATM Pressure: | 101.68 kPa |

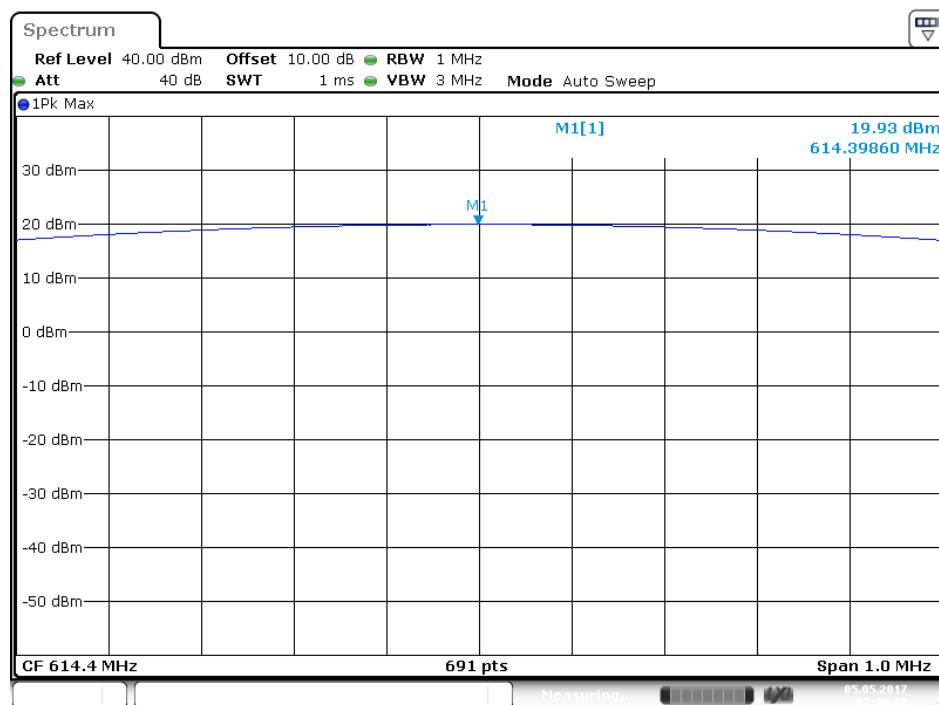
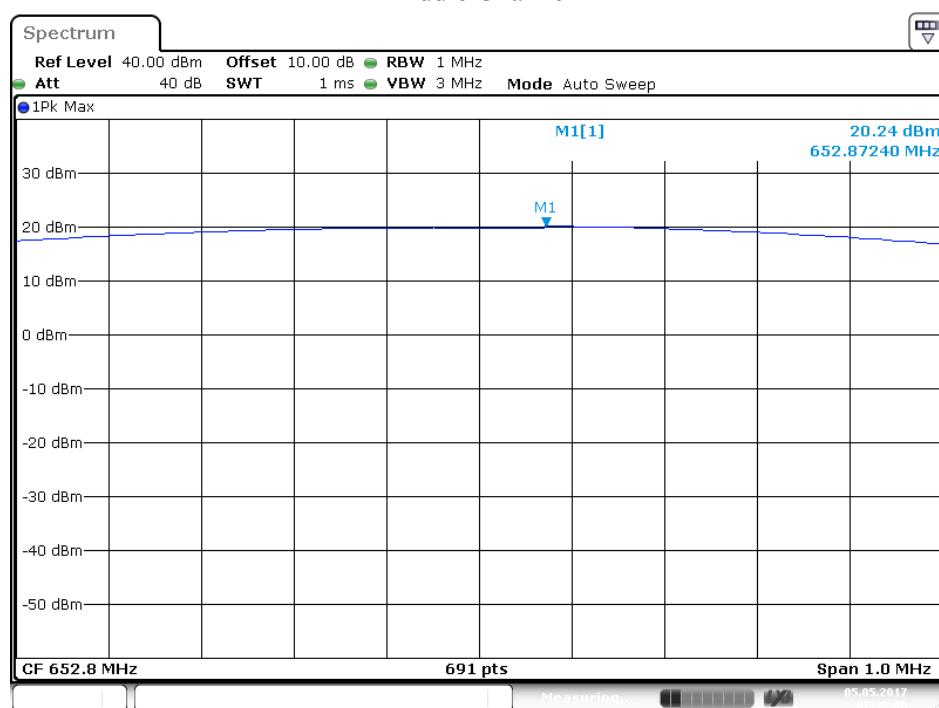
The testing was performed by David Hsu on 2016-05-05

4.5 Test Results

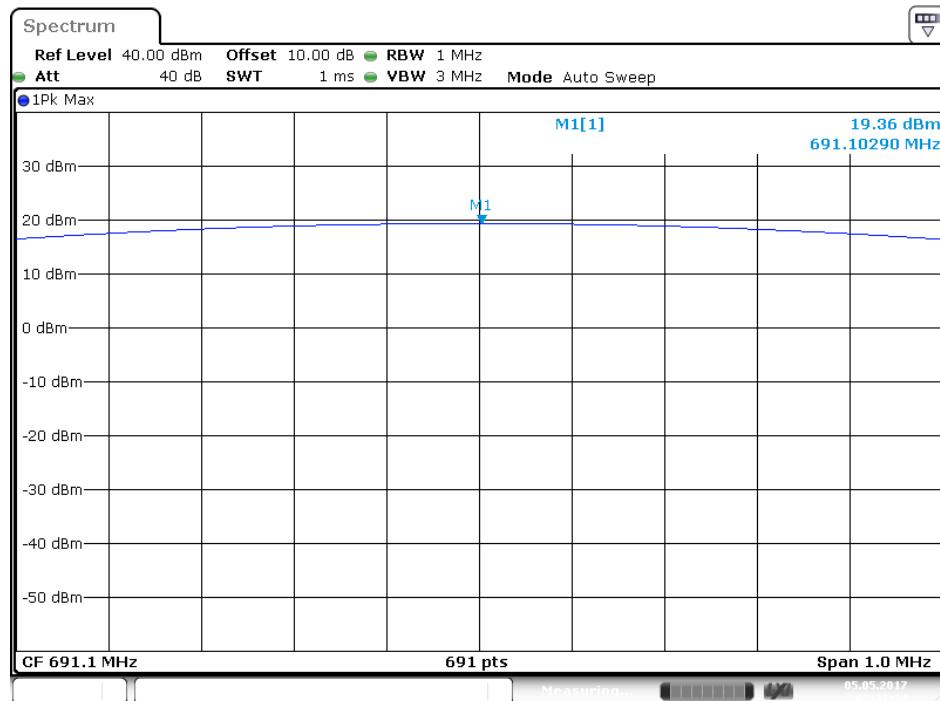
Conducted Power

| Channel | Frequency (MHz) | Conducted Output Power (dBm) | Limits (dBm) | Margin (dB) | Rated Power (mW/dBm) |
|---------|-----------------|------------------------------|--------------|-------------|----------------------|
| Low | 614.4 | 19.93 | 24 | -4.07 | 100/20 |
| | | 13.69 | 24 | -10.31 | 25/14 |
| Middle | 652.8 | 20.24 | 24 | -3.76 | 100/20 |
| | | 13.26 | 24 | -10.74 | 25/14 |
| High | 691.1 | 19.36 | 24 | -4.64 | 100/20 |
| | | 13.38 | 24 | -10.62 | 25/14 |

Please refer to the following plots for detailed test results

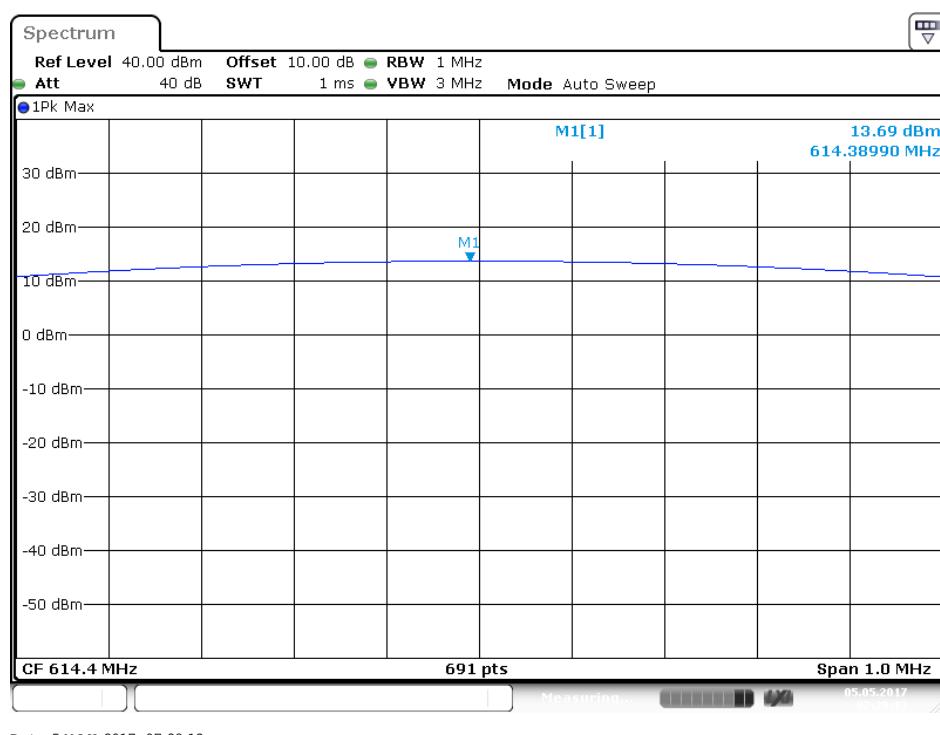
100mW Power Setting:**Low Channel****Middle Channel**

High Channel

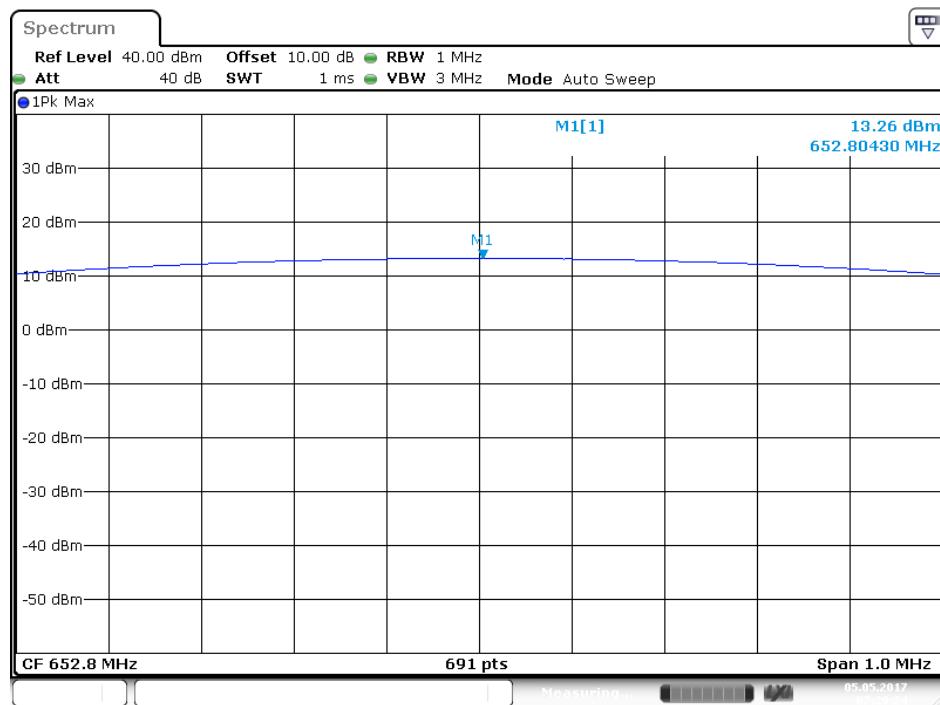


25mW Power Setting:

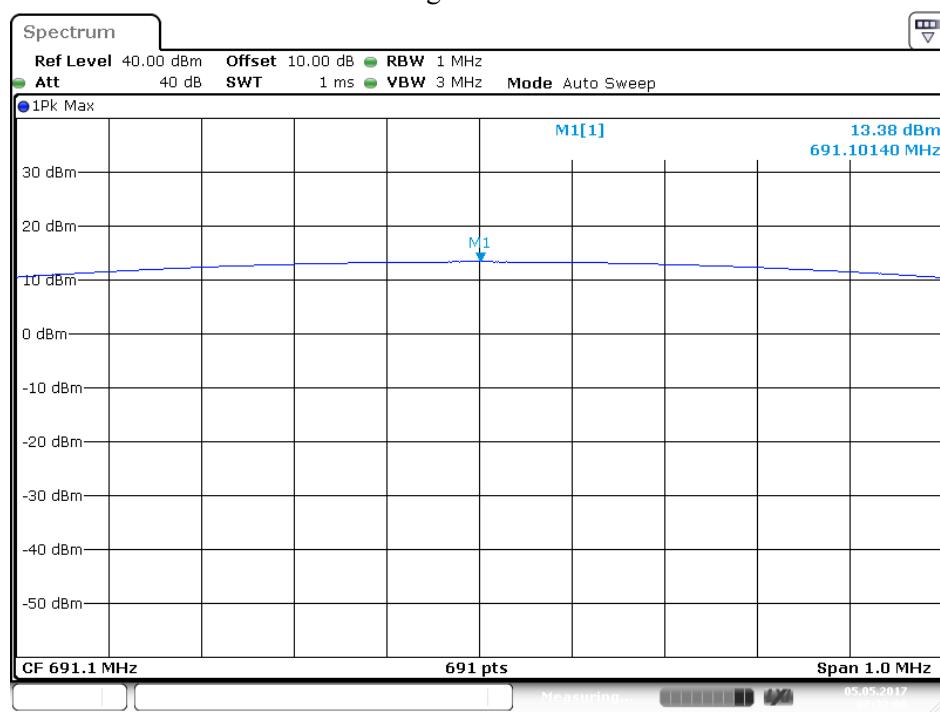
Low Channel



Middle Channel



High Channel



5 FCC 74.861(e)(3) - MODULATION CHARACTERISTIC

5.1 Applicable Standard

According to FCC §74.861 (e) (3):

Any form of modulation may be used. A maximum deviation of ± 75 kHz is permitted when frequency modulation is employed.

5.2 Test Procedure

According to ANSI/TIA-603-D 2010 section 2.2.3, modulation limiting is the transmitter circuit's ability to limit the transmitter from producing deviation in excess of a rated system deviation.

Connect the modulation analyzer to EUT and EUT to test receiver. Apply a 1000 Hz modulating signal to the transmitter from the modulation analyzer, and adjust the level to obtain 60% of full rated system deviation. Increase the level from the modulation analyzer by 5dB in one step, record the deviation obtained from the receiver.

Decrease the level from the modulation analyzer by 5dB in one step, record the deviation obtained from the receiver.

With the level from the modulation analyzer held constant at each level, vary frequency from 300 Hz to 15000 Hz. Record the deviation.

5.3 Test Equipment List and Details

| Descriptions | Manufacturers | Models | Serial Numbers | Calibration Date | Calibration Due Date |
|---------------------------|-----------------|-----------|----------------|------------------|----------------------|
| Spectrum Analyzer | Rohde & Schwarz | FSV40 | 101140 | 2016/11/10 | 2017/11/9 |
| RF Communication test set | HP Agilent | 8920A | 3325U00859 | 2016/6/7 | 2017/6/6 |
| Attenuator | MINI-CIRCUITS | BW-S10W5+ | ----- | 2017/3/16 | 2018/3/15 |
| Cable | WOKEN | SFL402 | S02-160323-07 | 2017/2/22 | 2018/2/21 |

* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed according to TAF requirements, traceable to the ETC.

5.4 Test Environmental Conditions

| | |
|--------------------|------------|
| Temperature: | 22 °C |
| Relative Humidity: | 50 % |
| ATM Pressure: | 101.68 kPa |

The testing was performed by David. Hsu on 2017-05-12

Test Result: Compliance. Please refer to the following tables and plots.

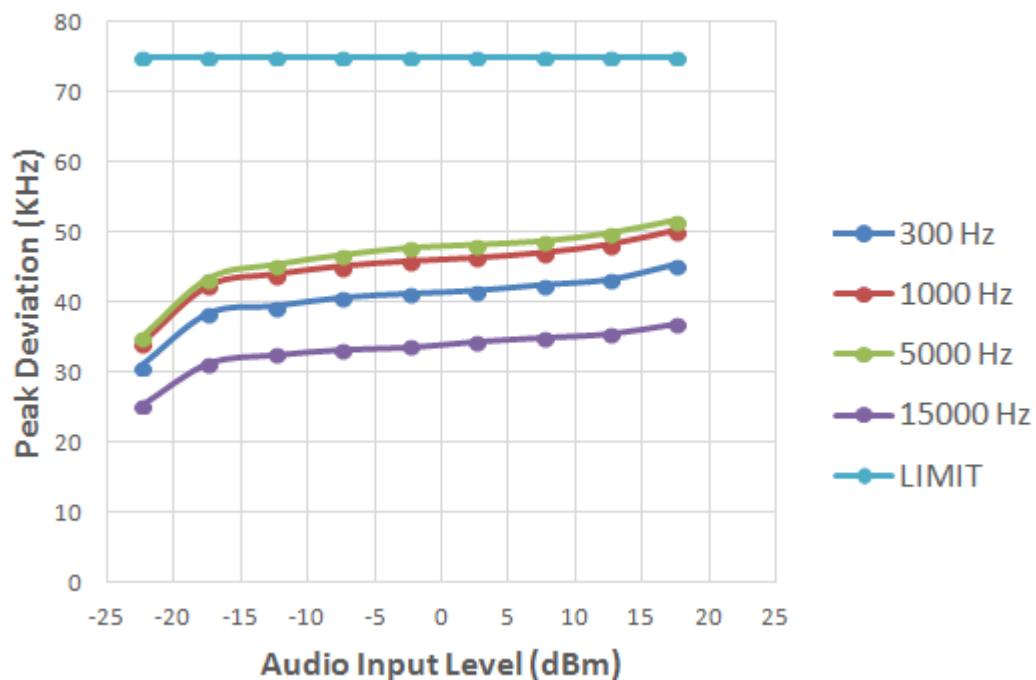
5.5 Test Results

Modulation Limiting

Carrier Frequency: 652.8 MHz

| AF Level (dBm) | AF Frequency (Hz)/Peak Deviation (kHz) | | | | Limit (kHz) |
|-------------------|--|---------|---------|----------|----------------|
| | 300 Hz | 1000 Hz | 5000 Hz | 15000 Hz | |
| 17.6 | 45.39 | 50.19 | 51.72 | 36.93 | ±75 |
| 12.6 | 43.16 | 48.14 | 49.87 | 35.48 | ±75 |
| 7.6 | 42.39 | 46.95 | 48.7 | 34.92 | ±75 |
| 2.6 | 41.58 | 46.21 | 48.18 | 34.35 | ±75 |
| -2.4 | 41.11 | 45.73 | 47.75 | 33.51 | ±75 |
| -7.4 | 40.58 | 45.03 | 46.74 | 33.18 | ±75 |
| -12.4 | 39.37 | 43.87 | 45.37 | 32.43 | ±75 |
| -17.4 | 38.29 | 42.21 | 43.39 | 31.19 | ±75 |
| -22.4 | 30.81 | 33.95 | 34.99 | 25.13 | ±75 |

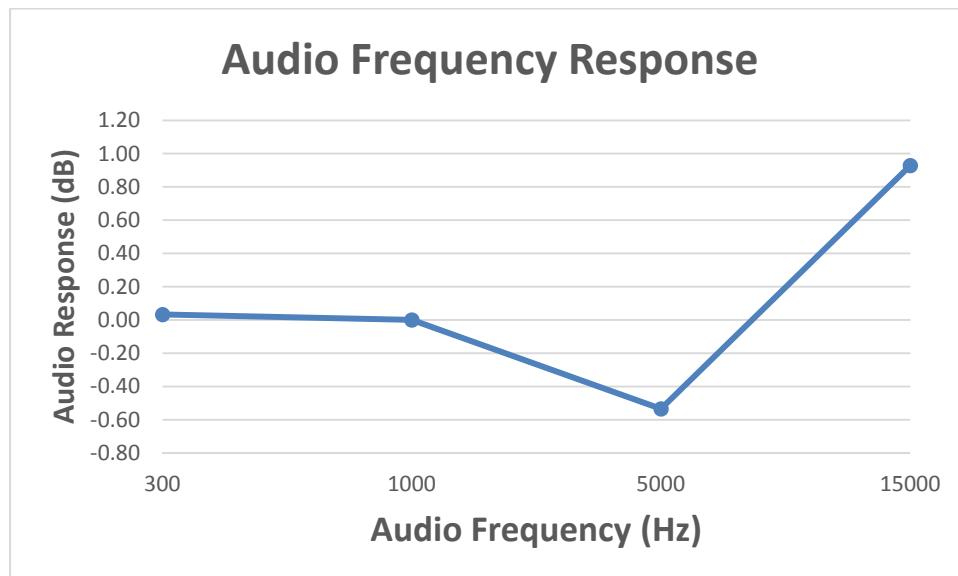
Modulation Characteristics



Audio Frequency Response
Carrier Frequency: 652.8 MHz

| AF Frequency (Hz) | AF Level (uV) | AF Response (dB) |
|-------------------|---------------|------------------|
| 300 | 45.39 | 0.03 |
| 1000 | 45.73 | 0.00 |
| 5000 | 51.72 | -0.53 |
| 15000 | 36.93 | 0.93 |

Note: AF Response = $10 \log (\text{AF Level of 1 kHz}/\text{AF Level})$



6 FCC § 74.861(e) (5) (6) – OCCUPIED BANDWIDTH & EMISSION MASK

6.1 Applicable Standard

According to FCC §74.861 (e) (5) (6): The operating bandwidth shall not exceed 200 kHz. The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

On any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB;

On any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB;

On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least $43+10\log_{10}$ (mean output power in watts) dB.

6.2 Test Procedure

According to TIA-603-D the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately $3 \times \text{RBW}$

Note: Video averaging is not permitted.

A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.

The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

The difference between the two recorded frequencies is the 99% occupied bandwidth.

6.3 Test Equipment List and Details

| Descriptions | Manufacturers | Models | Serial Numbers | Calibration Date | Calibration Due Date |
|---------------------------|-----------------|-----------|----------------|------------------|----------------------|
| Spectrum Analyzer | Rohde & Schwarz | FSV40 | 101140 | 2016/11/10 | 2017/11/9 |
| RF Communication test set | HP Agilent | 8920A | 3325U00859 | 2016/6/7 | 2017/6/6 |
| Attenuator | MINI-CIRCUITS | BW-S10W5+ | ----- | 2017/3/16 | 2018/3/15 |
| Cable | WOKEN | SFL402 | S02-160323-07 | 2017/2/22 | 2018/2/21 |

* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed according to TAF requirements, traceable to the ETC.

6.4 Test Environmental Conditions

| | |
|--------------------|------------|
| Temperature: | 22 °C |
| Relative Humidity: | 50 % |
| ATM Pressure: | 101.68 kPa |

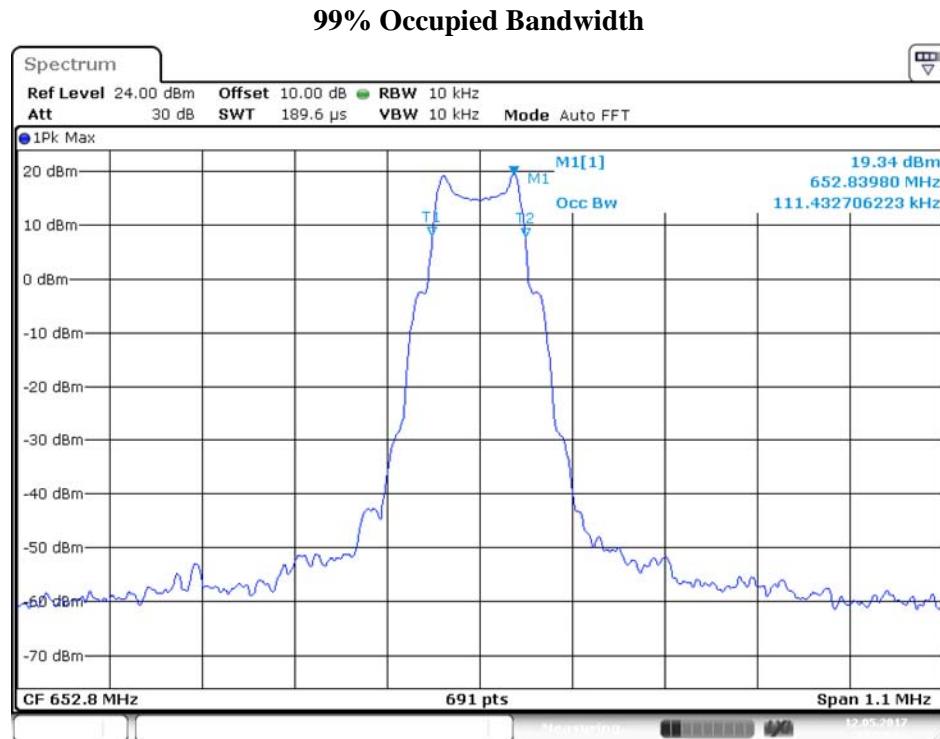
The testing was performed by David. Hsu on 2017-05-12

6.5 Test Results

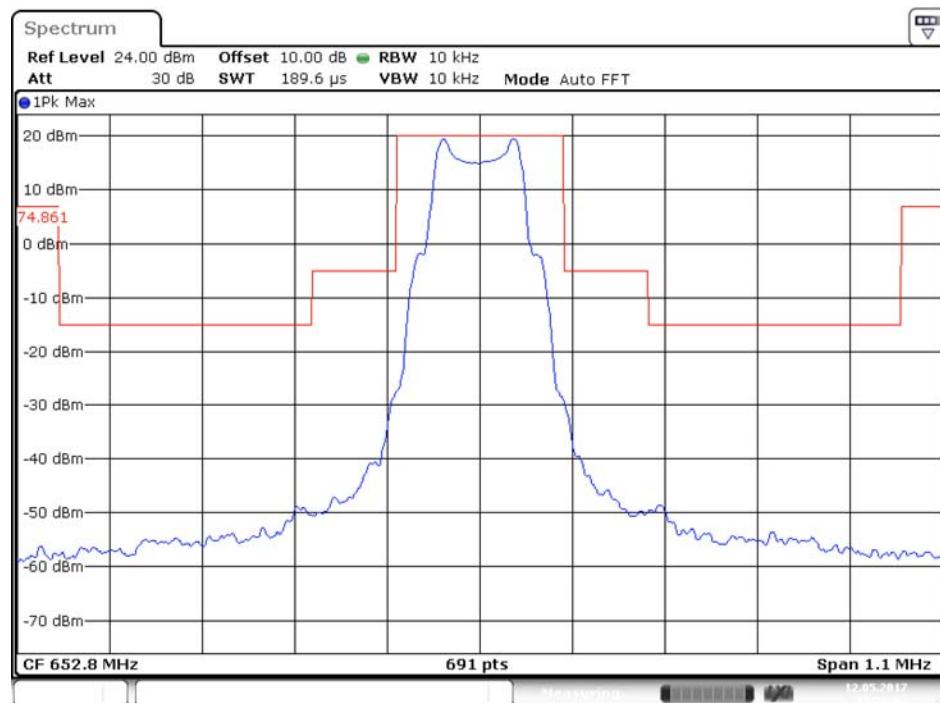
Test Mode: Transmitting

| Center Frequency (MHz) | 99% Bandwidth (kHz) | Limit (kHz) | Result | Power Setting |
|------------------------|---------------------|-------------|--------|---------------|
| 652.8 | 111.43 | 200 | PASS | High (100 mW) |
| 652.8 | 113.02 | 200 | PASS | Low (25 mW) |

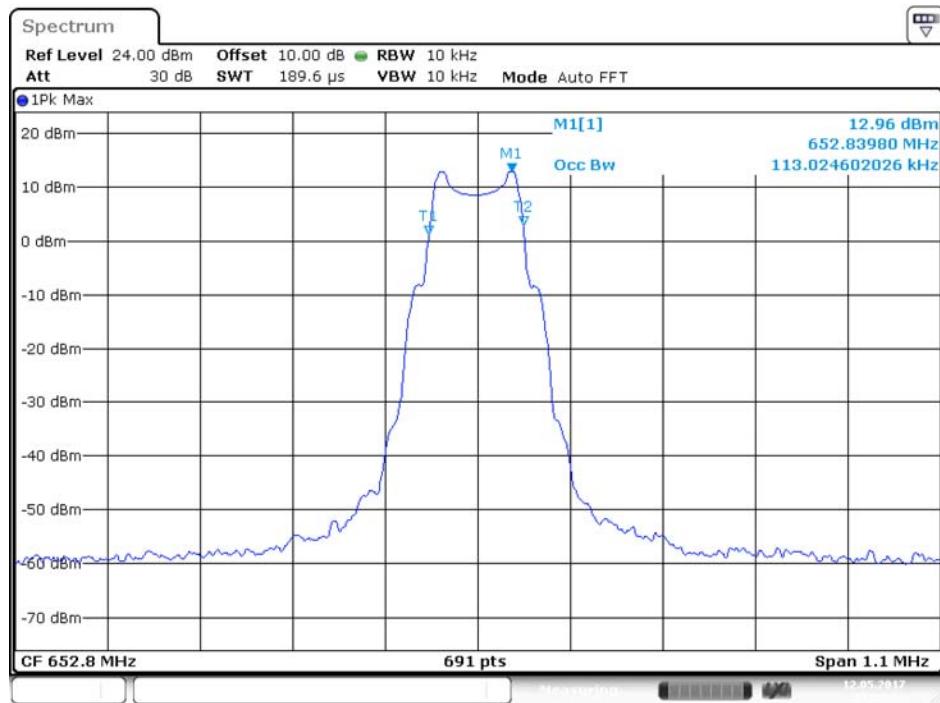
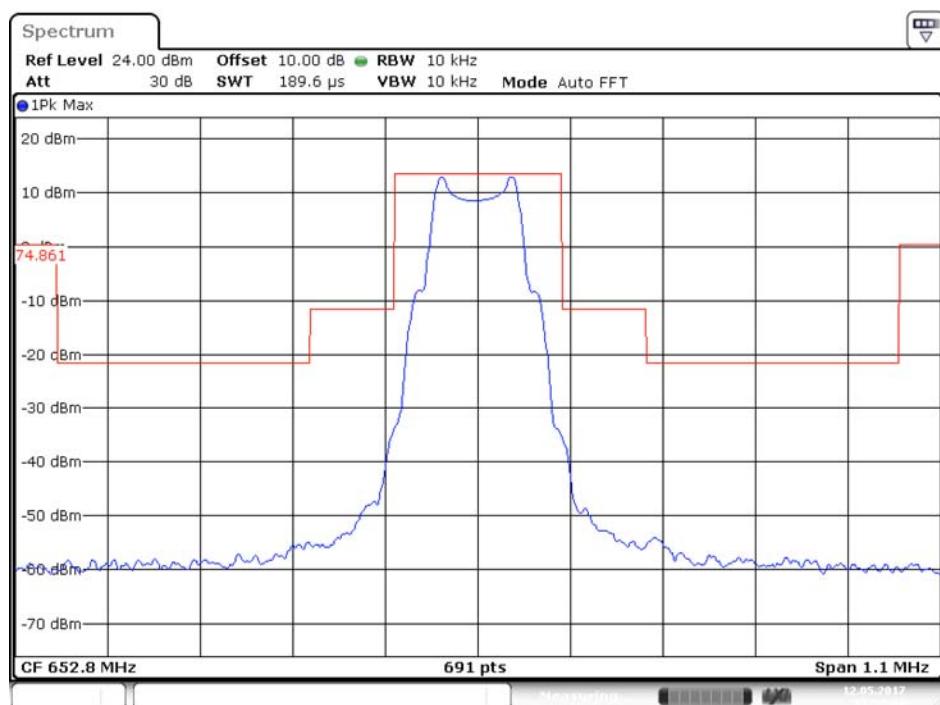
Please refer to the following plots for detailed test results

100mW Power Setting:

Date: 12.MAY.2017 17:55:02

Emission Mask

Date: 12.MAY.2017 17:56:07

25mW Power Setting:**99% Occupied Bandwidth****Emission Mask**

7 FCC § 74.861(e) (6) (iii) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

7.1 Applicable Standard

According to FCC §74.861 (e) (6) (iii):

On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least $43 + 10\log$ (mean output power in watts) dB.

7.2 Test Procedure

According to ANSI/TIA-603-D 2010 section 2.2.13, conducted spurious emissions are emissions at the antenna terminals on a frequency or frequencies that are outside a band sufficient to ensure transmission of information of required quality for the class of communication desired. The method of measurement is as following:

- Set the center frequency of the spectrum analyzer to the assigned transmitter frequency, key the transmitter, and set the level of the carrier to the full scale reference line.
- Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation. The input level shall be established at the frequency of maximum response of the audio modulating circuit.
- Adjust the spectrum analyzer for the following setting:
 1. Resolution bandwidth = 100 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1 GHz.
 2. Video bandwidth \geq 3 times the resolution bandwidth.
 3. Sweep speed \leq 2000 Hz per second
 4. Detector mode = mean or average power.
- Record the frequencies and level of spurious emissions.

In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz, up to at least the frequency given in (a) and (b):

- a) If the equipment operated below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
- b) If the equipment operates at or above 10 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

Particular attention should be paid to harmonics and sub-harmonics of the carrier frequency, as well as to those frequencies removed from the carrier by multiple of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value need not be reported.

When limits are expressed in absolute terms, compliance with the emission limits shall be demonstrated using a CISPR quasi-peak detector and the related measurement bandwidth for emissions below 1000 MHz as an alternative to CISPR quasi-peak measurement, compliance with the emission limits can be demonstrated using

measuring equipment employing a peak detector function properly adjusted for factors such as pulse desensitization as required, with an equal or greater measurement bandwidth relative to the applicable CISPR quasi-peak bandwidth.

Above 1000 MHz, compliance with the emission limits shall be demonstrated using an average detector with a minimum resolution bandwidth of 1 MHz.

7.3 Test Equipment List and Details

| Descriptions | Manufacturers | Models | Serial Numbers | Calibration Date | Calibration Due Date |
|---------------------------|-----------------|--------|----------------|------------------|----------------------|
| Spectrum Analyzer | Rohde & Schwarz | FSV40 | 101140 | 2016/11/10 | 2017/11/9 |
| RF Communication test set | HP Agilent | 8920A | 3325U00859 | 2016/6/7 | 2017/6/6 |
| Cable | WOKEN | SFL402 | S02-160323-07 | 2017/2/22 | 2018/2/21 |

* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed according to TAF requirements, traceable to the ETC.

7.4 Test Environmental Conditions

| | |
|--------------------|------------|
| Temperature: | 22 °C |
| Relative Humidity: | 50 % |
| ATM Pressure: | 101.68 kPa |

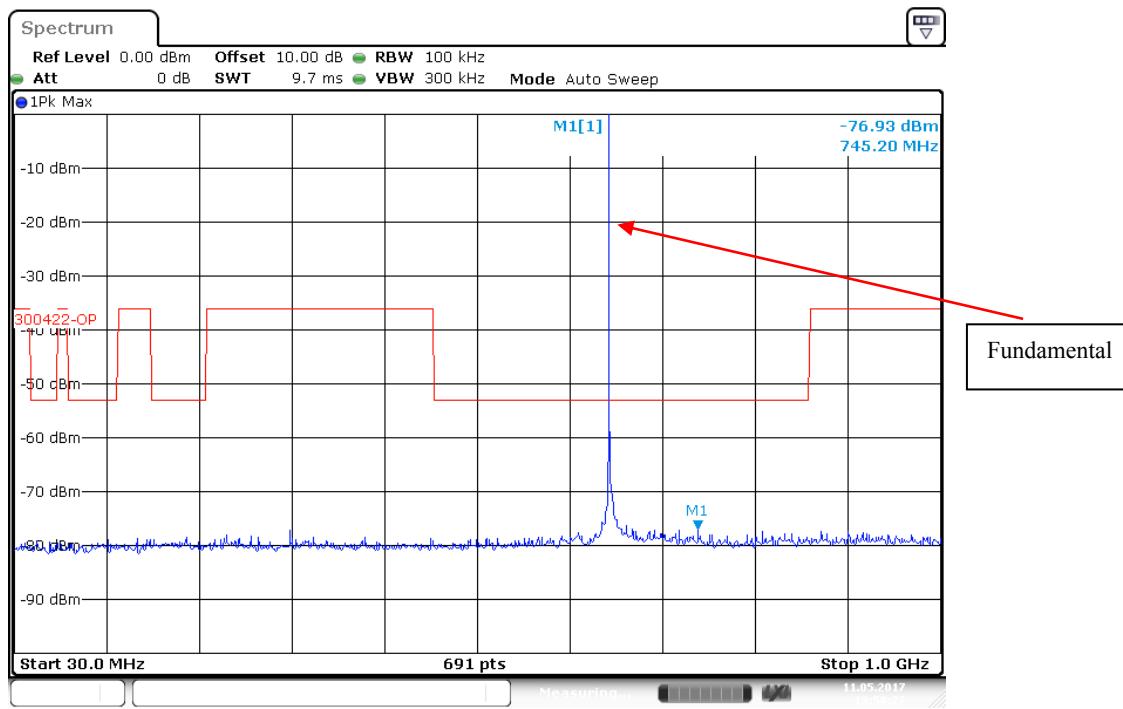
The testing was performed by David. Hsu on 2017-05-11 to 2017-05-15

EUT operation mode: Transmitting

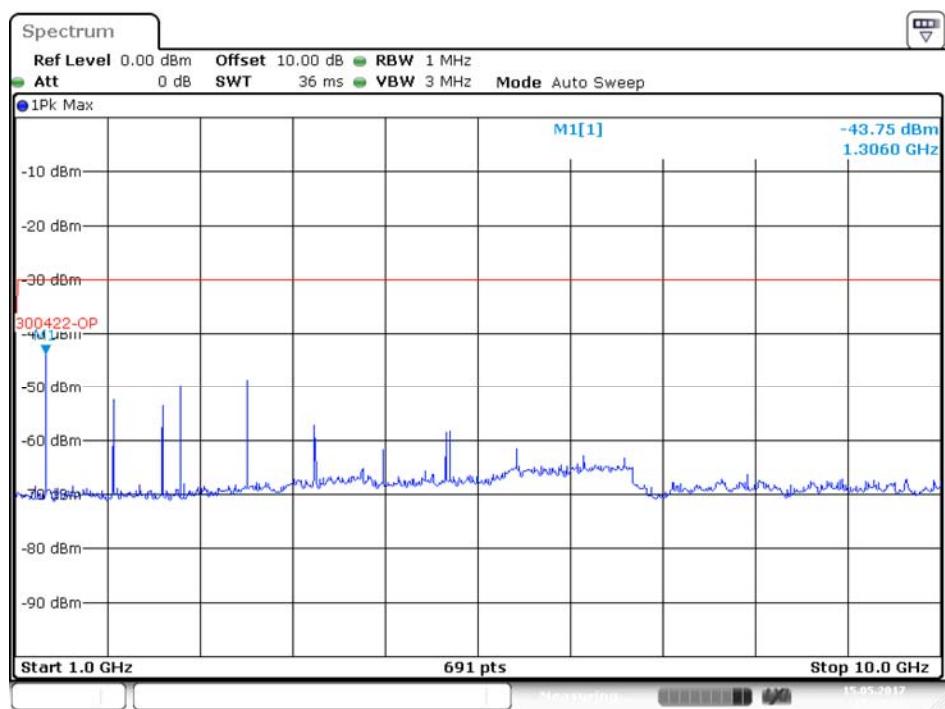
7.5 Test Results

100 mW Power Setting:

30MHz-1GHz



1GHz-10GHz



Note: The limit line in above plots is based on EN 300 422 limit; however, FCC limit line is -13 dBm. Plots comply with both FCC requirements

8 FCC § 74.861(e) (6) (iii) - RADIATED SPURIOUS EMISSIONS

8.1 Applicable Standard

According to FCC §74.861 (e) (6) (iii):

On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least $43 + 10\log$ (mean output power in watts) dB.

8.2 Test Procedure

According to ANSI/TIA-603-D 2010 section 2.2.13, conducted spurious emissions are emissions at the antenna terminals on a frequency or frequencies that are outside a band sufficient to ensure transmission of information of required quality for the class of communication desired. The method of measurement is as following:

- Set the center frequency of the spectrum analyzer to the assigned transmitter frequency, key the transmitter, and set the level of the carrier to the full scale reference line.
- Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation. The input level shall be established at the frequency of maximum response of the audio modulating circuit.
- Adjust the spectrum analyzer for the following setting:
 5. Resolution bandwidth = 100 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1 GHz.
 6. Video bandwidth \geq 3 times the resolution bandwidth.
 7. Sweep speed \leq 2000 Hz per second
 8. Detector mode = mean or average power.
- Record the frequencies and level of spurious emissions.

In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz, up to at least the frequency given in (a) and (b):

- a) If the equipment operated below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
- b) If the equipment operates at or above 10 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.

Particular attention should be paid to harmonics and sub-harmonics of the carrier frequency, as well as to those frequencies removed from the carrier by multiple of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value need not be reported.

When limits are expressed in absolute terms, compliance with the emission limits shall be demonstrated using a CISPR quasi-peak detector and the related measurement bandwidth for emissions below 1000 MHz as an

alternative to CISPR quasi-peak measurement, compliance with the emission limits can be demonstrated using measuring equipment employing a peak detector function properly adjusted for factors such as pulse desensitization as required, with an equal or greater measurement bandwidth relative to the applicable CISPR quasi-peak bandwidth.

Above 1000 MHz, compliance with the emission limits shall be demonstrated using an average detector with a minimum resolution bandwidth of 1 MHz

8.3 Test Equipment List and Details

| Description | Manufacturer | Model | Serial Number | Calibration Date | Calibration Interval |
|---------------------------------|-----------------------|--------------------------|---------------------|------------------|----------------------|
| Broadband Antenna | Sunol Sciences | JB6 | A050115 | 2016/11/16 | 2017/11/15 |
| Amplifier | Sonoma | 310N | 130602 | 2016/7/15 | 2017/7/14 |
| EMI Test Receiver | Rohde & Schwarz | ESR7 | 101419 | 2016/11/3 | 2017/11/2 |
| Mircoflex Cable | UTIFLEX | UFB311A-Q-1440-300300 | 220490-006 | 2016/11/2 | 2017/11/1 |
| Mircoflex Cable | UTIFLEX | UFB197C-1-2362-70U-70U | 225757-001 | 2016/7/15 | 2017/7/14 |
| Mircoflex Cable | UTIFLEX | UFA210A-1-3149-300300 | MFR64639 226389-001 | 2016/11/29 | 2017/11/28 |
| Turn Table | Champro | TT-2000 | 060772-T | N.C.R | N.C.R |
| Antenna Tower | Champro | AM-BS-4500-B | 060772-A | N.C.R | N.C.R |
| Controller | Champro | EM1000 | 060772 | N.C.R | N.C.R |
| Software | Farad | EZ_EMC | BACL-03A1 | N.C.R | N.C.R |
| Horn Antenna | EMCO | 3115 | 9311-4158 | 2016/5/10 | 2017/5/9 |
| Preamplifier | EMEC | EM01G18G | 060657 | 2016/12/13 | 2017/12/12 |
| Spectrum Analyzer | Rohde & Schwarz | FSEK30 | 825084/006 | 2016/12/15 | 2017/12/14 |
| Mircoflex Cable | ROSNAL | K1K50-UP0264-K1K50-80CM | 160309-2 | 2017/1/18 | 2018/1/17 |
| Mircoflex Cable | ROSNAL | K1K50-UP0264-K1K50-450CM | 160309-1 | 2017/3/24 | 2018/3/23 |
| Sweep Signal Generator | Agilent | 83650B | 3420A00581 | 2016/7/7 | 2017/7/6 |
| Horn Antenna | EMCO | 3115 | 2171 | 2016/7/19 | 2017/7/18 |
| Bilog Antenna & 6 dB Attenuator | Sunol Sciences & EMEC | JB3 &EM-ATT18-6-NN | A061204 &ATT-06-001 | 2016/11/16 | 2017/11/15 |

8.4 Environmental Conditions

| | |
|---------------------------|------------|
| Temperature: | 22 °C |
| Relative Humidity: | 50 % |
| ATM Pressure: | 101.68 kPa |

The testing was performed by David. Hsu on 2016-05-09

8.5 Test Data

Test Result: Compliance. Please refer to the following plots.

EUT was configured to high power setting,

Test mode: middle channel

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Horizontal

| Frequency (MHz) | S.G. (dBm) | Cable loss(dB) | Ant. Gain (dBd)/(dBi) | Result (dBm) | Limit (dBm) | Margin (dB) | Height (cm) | Azimuth (°) | Remark |
|-----------------|------------|----------------|-----------------------|--------------|-------------|-------------|-------------|-------------|--------|
| 766.23 | -77.41 | 3.84 | 6.8 | -74.45 | -13 | -61.45 | 150 | 145 | peak |
| 1305.6 | -63.59 | 3.2 | 7.23 | -59.56 | -13 | -46.56 | 150 | 354 | peak |
| 1958.4 | -57.15 | 3.98 | 8.29 | -52.84 | -13 | -39.84 | 150 | 1 | peak |
| 2611.2 | -58.63 | 4.63 | 9.41 | -53.85 | -13 | -40.85 | 150 | 1 | peak |

Vertical

| Frequency (MHz) | S.G. (dBm) | Cable loss(dB) | Ant. Gain (dBd)/(dBi) | Result (dBm) | Limit (dBm) | Margin (dB) | Height (cm) | Azimuth (°) | Remark |
|-----------------|------------|----------------|-----------------------|--------------|-------------|-------------|-------------|-------------|--------|
| 261.83 | -80.71 | 2.2 | 5.84 | -77.07 | -13 | -64.07 | 150 | 261 | peak |
| 2611.2 | -55.83 | 4.63 | 9.41 | -51.05 | -13 | -38.05 | 150 | 2 | peak |
| 3264 | -50.76 | 5.16 | 9.15 | -46.77 | -13 | -33.77 | 150 | 359 | peak |

Note:

Result = SG Level - Cable loss + Antenna Gain

Margin = Result – Limit

The other emission levels were very low against the limit.

The unit of antenna gain is dBd for frequency below 1GHz and is dBi for frequency above 1GHz.

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Horizontal

| Frequency (MHz) | S.G. (dBm) | Cable loss(dB) | Ant. Gain (dBd)/(dBi) | Result (dBm) | Limit (dBm) | Margin (dB) | Height (cm) | Azimuth (°) | Remark |
|-----------------|------------|----------------|-----------------------|--------------|-------------|-------------|-------------|-------------|--------|
| 382.11 | -85.34 | 2.67 | 6.26 | -81.75 | -13 | -68.75 | 150 | 297 | peak |
| 1958.4 | -58.06 | 3.98 | 8.29 | -53.75 | -13 | -40.75 | 150 | 358 | peak |
| 2611.2 | -60.66 | 4.63 | 9.41 | -55.88 | -13 | -42.88 | 150 | 9 | peak |
| 3264 | -59.16 | 5.16 | 9.15 | -55.17 | -13 | -42.17 | 150 | 33 | peak |

Vertical

| Frequency (MHz) | S.G. (dBm) | Cable loss(dB) | Ant. Gain (dBd)/(dBi) | Result (dBm) | Limit (dBm) | Margin (dB) | Height (cm) | Azimuth (°) | Remark |
|-----------------|------------|----------------|-----------------------|--------------|-------------|-------------|-------------|-------------|--------|
| 166.77 | -75.63 | 1.74 | 2.47 | -74.9 | -13 | -61.9 | 150 | 360 | peak |
| 2611.2 | -58.25 | 4.63 | 9.41 | -53.47 | -13 | -40.47 | 150 | 358 | peak |
| 3264 | -52 | 5.16 | 9.15 | -48.01 | -13 | -35.01 | 150 | 3 | peak |

Note:

Result = SG Level - Cable loss + Antenna Gain

Margin = Result – Limit

The other emission levels were very low against the limit.

The unit of antenna gain is dBd for frequency below 1GHz and is dBi for frequency above 1GHz.

9 FCC § 74.861(e) (4) - FREQUENCY STABILITY

9.1 Applicable Standard

According to FCC §74.861 (e) (4):

The frequency tolerance of the transmitter shall be 0.005 percent

9.2 Test Procedure

According to ANSI/TIA-603-D 2010 section 2.2.2, the carrier frequency stability is the ability of the transmitter to maintain an assigned carrier frequency.

The measurement method is as following:

- Operate the equipment in standby conditions for 15 minutes before proceeding.
- Record the carrier frequency of the transmitter as MCF MHz.
- Calculate the ppm frequency error by the following:

$$\text{Ppm error} = (\text{MCF}/\text{ACF} - 1) * 10^6$$

Where

MCF is the Measured Carrier Frequency in MHz

ACF is the Assigned Carrier Frequency in MHz

- The value recorded above is the carrier frequency stability.

A hand-held device that is only capable of operating using internal batteries shall be tested using a new battery without any further requirement to vary the supply voltage. Alternatively, an external supply voltage can be used and set at the batter nominal voltage, and again at the battery operating end point voltage which must be specified by the equipment manufacturer.

The operating carrier frequency shall be set up in accordance with the manufacturer's published operation and instruction manual prior to the commencement of these tests. No adjustment of any frequency-determining circuit element shall be made subsequent to this initial set-up.

With the transmitter installed in an environment test chamber, the unmodulated carrier frequency shall be measured under the conditions specified below. A sufficient stabilization period at each temperature shall be used prior to each frequency measurement. The following temperatures and supply voltage ranges apply, unless specified otherwise in the applicable.

- a) At temperature of -30°C , $+20^{\circ}\text{C}$ and $+50^{\circ}\text{C}$, and at the manufacturer's rated supply voltage; and
- b) At a temperature of $+20^{\circ}\text{C}$ and at ± 15 percent of the manufacturer's rated supply voltage.

If the frequency stability limits are only met at a different temperature range than specified in (a), the frequency stability requirement will be deemed met if the transmitter is automatically inhibited from operating outside this different temperature range and the published equipment operating characteristics are revised to reflect this different temperature range.

If an unmodulated carrier is not available, the measurement method shall be described in the test report.

9.3 Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Interval |
|-------------------|-------------------------|---------|----------------|------------------|----------------------|
| Spectrum Analyzer | Rohde & Schwarz | FSV40 | 101140 | 2016/11/10 | 2017/11/9 |
| Cable | WOKEN | SFL402 | 00100A1F6A192S | N.C.R | N.C.R |
| BACL | Temp & Humidity Chamber | BTH-150 | 30028 | 2016/12/9 | 2017/12/8 |
| Topward | DC Power Supply | 6603D | 727374 | NCR | NCR |

9.4 Environmental Conditions

| | |
|--------------------|------------|
| Temperature: | 22 °C |
| Relative Humidity: | 50 % |
| ATM Pressure: | 101.68 kPa |

The testing was performed by David. Hsu on 2017-05-05

9.5 Test Data

EUT operation mode: Transmitting

Test Result: Compliance. Please refer to the following tables.

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Varying temperature:

| Temperature | Measured Frequency (MHz) | Channel Frequency (MHz) | Frequency Tolerance (%) | FCC Limit (%) |
|-------------|--------------------------|-------------------------|-------------------------|---------------|
| -20 | 652.8131 | 652.8 | 0.0020% | 0.005 |
| -10 | 652.8127 | 652.8 | 0.0019% | 0.005 |
| 0 | 652.8121 | 652.8 | 0.0019% | 0.005 |
| 10 | 652.8118 | 652.8 | 0.0018% | 0.005 |
| 20 | 652.8112 | 652.8 | 0.0017% | 0.005 |
| 30 | 652.8095 | 652.8 | 0.0015% | 0.005 |
| 40 | 652.8085 | 652.8 | 0.0013% | 0.005 |
| 50 | 652.8061 | 652.8 | 0.0009% | 0.005 |

Varying supply voltage:

| Temperature | Measured Frequency (MHz) | Channel Frequency (MHz) | Frequency Tolerance (%) | FCC Limit (%) |
|----------------|--------------------------|-------------------------|-------------------------|---------------|
| 1.35 V at 20°C | 652.8149 | 652.8 | 0.0023% | 0.005 |
| 1.5 V at 20°C | 652.8112 | 652.8 | 0.0017% | 0.005 |
| 1.65 V at 20°C | 652.8122 | 652.8 | 0.0019% | 0.005 |

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Varying temperature:

| Temperature | Measured Frequency (MHz) | Channel Frequency (MHz) | Frequency Tolerance (%) | FCC Limit (%) |
|-------------|--------------------------|-------------------------|-------------------------|---------------|
| -20 | 652.8121 | 652.8 | 0.0019% | 0.005 |
| -10 | 652.8117 | 652.8 | 0.0018% | 0.005 |
| 0 | 652.8111 | 652.8 | 0.0017% | 0.005 |
| 10 | 652.8108 | 652.8 | 0.0017% | 0.005 |
| 20 | 652.8099 | 652.8 | 0.0015% | 0.005 |
| 30 | 652.8099 | 652.8 | 0.0015% | 0.005 |
| 40 | 652.8091 | 652.8 | 0.0014% | 0.005 |
| 50 | 652.8077 | 652.8 | 0.0012% | 0.005 |

Varying supply voltage:

| Temperature | Measured Frequency (MHz) | Channel Frequency (MHz) | Frequency Tolerance (%) | FCC Limit (%) |
|----------------|--------------------------|-------------------------|-------------------------|---------------|
| 1.35 V at 20°C | 652.8088 | 652.8 | 0.0013% | 0.005 |
| 1.5 V at 20°C | 652.8099 | 652.8 | 0.0015% | 0.005 |
| 1.65 V at 20°C | 652.8112 | 652.8 | 0.0017% | 0.005 |

10 Appendix A Test Setup Photograph

Please refer to the Test Setup Photos exhibit.

11 Appendix B - EUT External Photograph

Please refer to the EUT External Photos exhibit.

12 Appendix C - EUT Internal Photograph

Please refer to the EUT Internal Photos exhibit.

******* END OF REPORT *******