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FCC PART 80 TEST REPORT

| | |
|-----------------------------|--|
| APPLICANT | TAIT LIMITED |
| | 535 Wairakei Road P.O. Box 1645 Christchurch, 8140 New Zealand |
| FCC ID | CASTPDC0A |
| MODEL NUMBER | TPDC0A |
| PRODUCT DESCRIPTION | VHF 5W PORTABLE TRANSCEIVER |
| DATE SAMPLE RECEIVED | 11/15/2017 |
| FINAL TEST DATE | 01/05/2018 |
| TESTED BY | Franklin Rose |
| APPROVED BY | Tim Royer |
| TEST RESULTS | <input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL |

| Report Number | Version Number | Description | Issue Date |
|---------------------|----------------|----------------------|------------|
| 1977UT17TestReport_ | Rev1 | Initial Issue | 01/03/2018 |
| 1977UT17TestReport_ | Rev2 | Clerical Updates | 01/25/2018 |
| 1977UT17TestReport_ | Rev3 | Clerical corrections | 02/19/2018 |

**THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL
WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.**



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GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

Summary

The device under test does:

- Fulfill the general approval requirements as identified in this test report and was selected by the customer.
- Not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that the necessary measurements were made at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, FL 32669



Tested by:

Name and Title: Franklin Rose, Project Manager/Testing Technician

Date: 01/02/2018



Reviewed and approved by:

Name and Title: Tim Royer, Engineer

Date: 1/15/2018

Applicant: TAIT LIMITED
FCC ID: CASTPDC0A
Report: 1977UT17TestReport_Rev2

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GENERAL INFORMATION

EUT Specification

| | |
|--------------------------------|--|
| EUT Description | VHF 5W PORTABLE TRANSCEIVER |
| FCC ID | CASTPDC0A |
| Model Number | TPDC0A |
| Operating Frequency | 217 – 220 MHz |
| Maritime Device Type | AMTS band Private Mobile Radio Service Device (per FCC CFR 47 Part 80.475(c)(d)) |
| Test Frequencies | 217.5, 219.5 MHz |
| Type of Emission | 11K0F3E, 7K60F2D, 7K60FXD, 7K60FXW |
| Modulation | FM |
| EUT Power Source | <input type="checkbox"/> 110–120Vac/50– 60Hz |
| | <input type="checkbox"/> DC Power (13.8 V) |
| | <input checked="" type="checkbox"/> Battery Operated Exclusively |
| Test Item | <input type="checkbox"/> Prototype |
| | <input type="checkbox"/> Pre-Production |
| | <input checked="" type="checkbox"/> Production |
| Type of Equipment | <input type="checkbox"/> Fixed |
| | <input type="checkbox"/> Mobile |
| | <input checked="" type="checkbox"/> Portable |
| Antenna Connector | BNC |
| Test Conditions | The temperature was 26°C Relative humidity of 50%. |
| Modification to the EUT | None |
| Test Exercise | The EUT was placed in continuous transmit mode. The EUT was operated in “Test Mode” for digital emissions tests. |
| Applicable Standards | ANSI/TIA 603-E:2016, FCC CFR 47 Part 2, Part 80 |
| Test Facility | Timco Engineering Inc. at 849 NW State Road 45 Newberry, FL 32669 USA. |

EUT Specification, Con't.

| Equip. Type | Type Code | FCC ID | Product code | Serial Number |
|-------------|-----------|-----------|----------------|---------------|
| Portable | TPDC0A | CASTPDC0A | T03-00043-CJDB | 25905515 |

| Type | Code and Version | Target Hardware |
|-------------------|------------------------|-----------------|
| Hardware ID | TPDB1X-C000_0007 | Portable |
| Boot Code | QPD1B_S00_3.01.03.0001 | Portable |
| DSP | QPD1A_E00_2.15.01.0062 | Portable |
| Radio Application | QPD1F_E00_2.15.01.0062 | Portable |
| Firmware Package | QI93P_E00_2.15.01.0062 | Portable |
| FPGA Image | QPD1G_S01_1.10.00.0003 | Portable |

RESULTS SUMMARY

| Rule Part No. | Test Item | Results |
|---|---|---------|
| 80.203(c) | < 5 min. Tx maximum | PASS |
| 2.1046(a), 80.215(e)(2) | RF Power Output < 25 W | PASS |
| 2.1033(c)(4), 80.205(b), 80.213(a), 80.207 | Modulation Characteristics | PASS |
| 2.1047(a)(b) | Audio Frequency Response and Low Filter | PASS |
| 2.1047(b), 80.213 (b) | Audio Input Vs Modulation | PASS |
| 2.1049(c), 80.211 (f)(1)(2) | Occupied Bandwidth | PASS |
| 2.1051(a), 80.211(f)(3) | Spurious Emissions at Antenna Terminals | PASS |
| 2.1053(a), 80.211(f)(3) | Field Strength of Spurious Emissions | PASS |
| 2.1055(a)(2), 80.209(a) | Frequency Stability < 5 ppm | PASS |

TECHNICAL DATA

80.203 (c) Five minutes continuous transmission test. The antenna was connected to a dummy load and the radio was locked in a transmit PTT mode. An external timer digital clock was used to observe the duration of the Un-modulated transmission. The transmitter turned off and the radio went to receive mode at **5 minutes, 0 seconds** as displayed by the external digital clock.

RF POWER OUTPUT

FCC Rule Parts: FCC Part 2.1046(a), 80.215(e)(2)

Test Requirements: The maximum power must not exceed the values listed below.

(e) Ship stations frequencies above 27500 kHz. The maximum power must not exceed the values listed below.

(2) Ship stations 216-220 MHz—25W⁷

⁷[Reserved]

Method of Measurement: ANSI/TIA-603-E

Test Data: Power Measurement Table

| Peak Output Power | | | | |
|-------------------|-------|-------|-------|------|
| Tuned Freq. MHz | dBm | | Watts | |
| | High | Low | High | Low |
| 217.5000 | 36.70 | 29.95 | 4.68 | 0.99 |
| 219.5000 | 36.70 | 29.92 | 4.68 | 0.98 |

80.211(f)(3) – 250% of the Authorized Bandwidth may not exceed $43 + 10 \log(\text{Mean Power in Watts})$. The Mean Power Output has been measured below:

| Mean Output Power | | | | |
|-------------------|-------|-------|-------|------|
| Tuned Freq. MHz | dBm | | Watts | |
| | High | Low | High | Low |
| 217.5000 | 36.70 | 29.95 | 4.68 | 0.99 |
| 219.5000 | 36.70 | 29.91 | 4.68 | 0.98 |

Part 2.1033 (c)(8) DC Input into Final Amplifier

FOR LOW POWER SETTING INPUT POWER: (7.5 V) (0.65 A) = **4.875 Watts**

FOR HIGH POWER SETTING INPUT POWER: (7.5 V) (1.35 A) = **10.125 Watts**

Result: Meets Requirements

MODULATION CHARACTERISTICS (11K0F3E & 7K60F2D)

FCC Rule Parts: Part 2.1033(c)(4), 80.205(a), 80.207, 80.213(a)

Test Data: 11K0F3E Bandwidth Calculation

$$B_n = 2M + 2DK$$

$$B_n = 2(3.0 \text{ kHz}) + 2(2.5 \text{ kHz})(1) = \mathbf{11.0 \text{ kHz}}$$

Where:

M = 3.0 (Highest Modulation Frequency, kHz)
 D = 2.5 kHz (Peak Deviation, kHz)
 K = 1 (FM Constant)

Test Data: 7K60F2D Bandwidth Calculation

$$B_n = 2M + 2DK$$

$$B_n = 2(1.8 \text{ kHz}) + 2(2.0 \text{ kHz})(1) = \mathbf{7.6 \text{ kHz}}$$

Where:

M = 1.8 (Highest Modulation Frequency, kHz)
 D = 2.0 kHz (Peak Deviation, kHz)
 K = 1 (FM Constant)

| Class of emission | Emission designator | Authorized bandwidth (kHz) |
|-------------------|---------------------|----------------------------|
| F2D ¹² | 16K0F2D | 20.0 |
| F3E ⁸ | 16K0F3E | 20.0 |

Note 12 – Not applicable to this band.

Note 8 – Not applicable to deviations below 5 kHz.

RESULT: 80.205(a) AUTHORIZED BANDWIDTH = 20.00 kHz

AUDIO FREQUENCY RESPONSE & LOW PASS FILTER RESPONSE

FCC Rule Parts: FCC Part 2.1047(a) (b)

Test Requirements: A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 – 5000Hz shall be submitted.

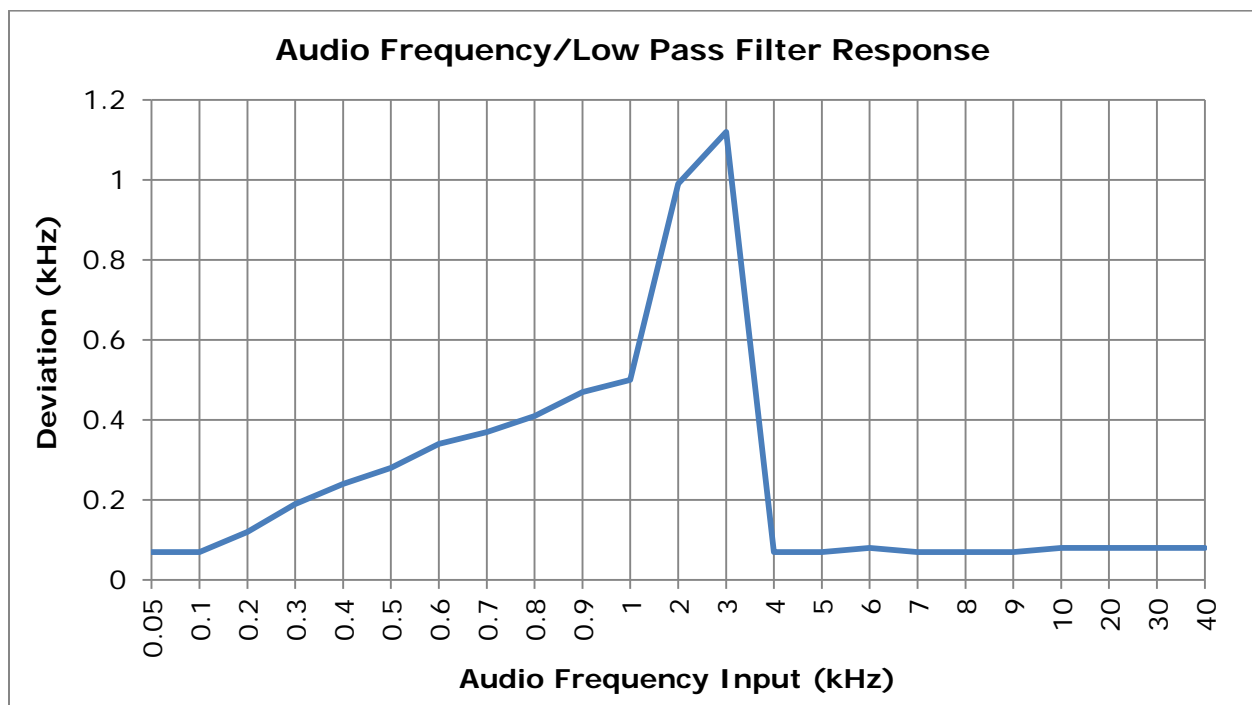
Method of Measurement: ANSI/TIA-603-E

FCC Rule Parts: 2.1047(a)

Test Requirements: For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter or of all the circuitry installed between the modulation limiter and the modulated stage shall be submitted.

Method of Measurement: ANSI/TIA-603-E

Test Data: **Audio Frequency & Low Pass Filter Response**



Frequency of Maximum Response: 3 kHz

RESULT: Meets Requirements

AUDIO INPUT VERSUS MODULATION

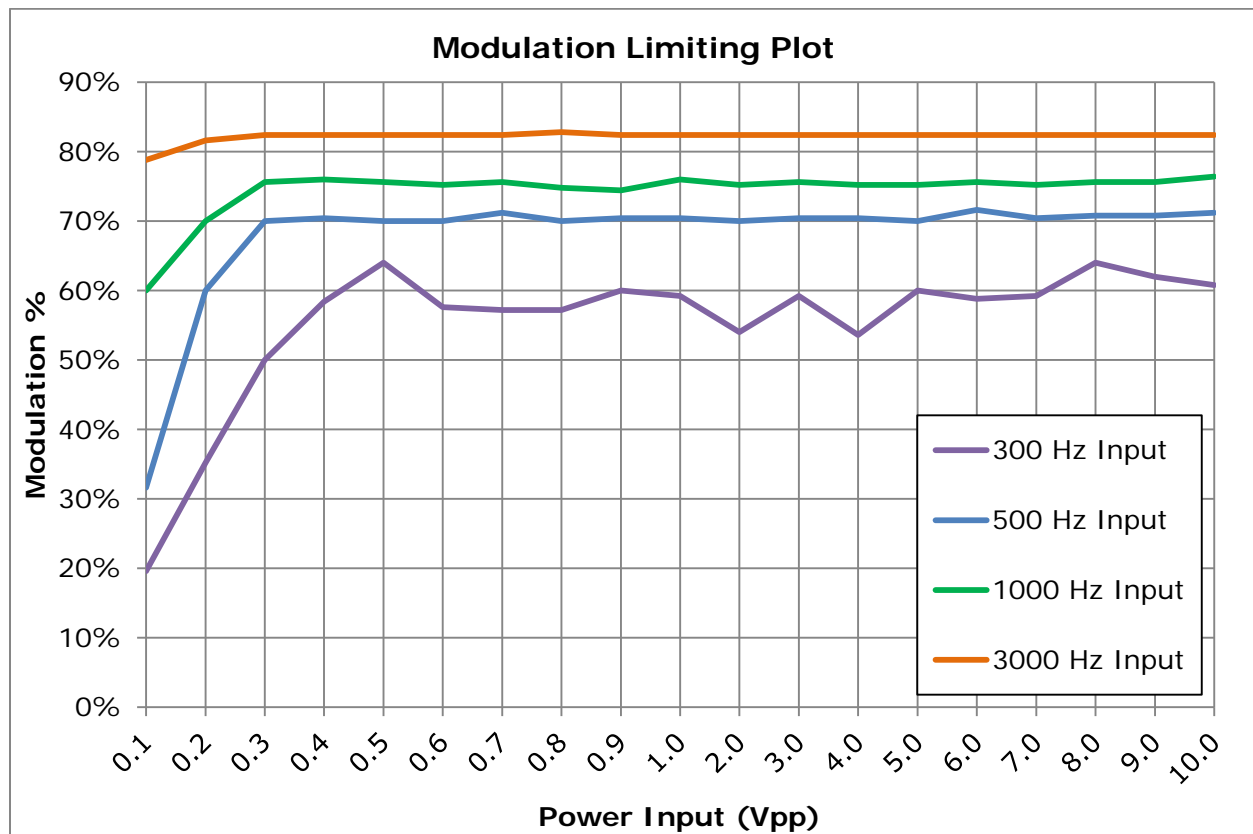
FCC Rule Parts: FCC Part 2.1047(b) & 80.213(b)

Test Requirements: The peak modulation must be maintained between 75 and 100 percent. A frequency deviation of ± 5 kHz is defined as 100 percent peak modulation.

Radiotelephone transmitters using A3E, F3E and G3E emission must have a modulation limiter to prevent any modulation over 100 percent.

Method of Measurement: ANSI/TIA-603-E

Test data: Modulation Limiting Plot



Frequency of Maximum Response: 3 kHz

RESULT: Meets Requirements

MODULATION CHARACTERISTICS (7K60FXD/FXW)

FCC Rule Parts: Part 2.1033(c)(4), 80.481, 80.211(f)(1)(2)(3)

Test Data: 7K60FXD/FXW Bandwidth Calculation

80.481

In lieu of the technical parameters set forth in this part, AMTS transmitters may utilize any modulation or channelization scheme so long as emissions are attenuated in accordance with §80.211 at the band edges of each station's assigned channel group or groups.

[65 FR 77827, Dec. 13, 2000]

80.211

(f) The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:

(1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;

(2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and

(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus $10\log_{10}$ (mean power in watts) dB.

Note: Please refer to Occupied Bandwidth for data showing compliance with 80.211(f)(1) & (2), and Spurious Emissions at Antenna Terminals & Field Strength of Spurious Emissions for compliance with 80.211(f)(3).

RESULT: FXD/FXW - 99% Occupied Bandwidth = 7.61 kHz

OCCUPIED BANDWIDTH

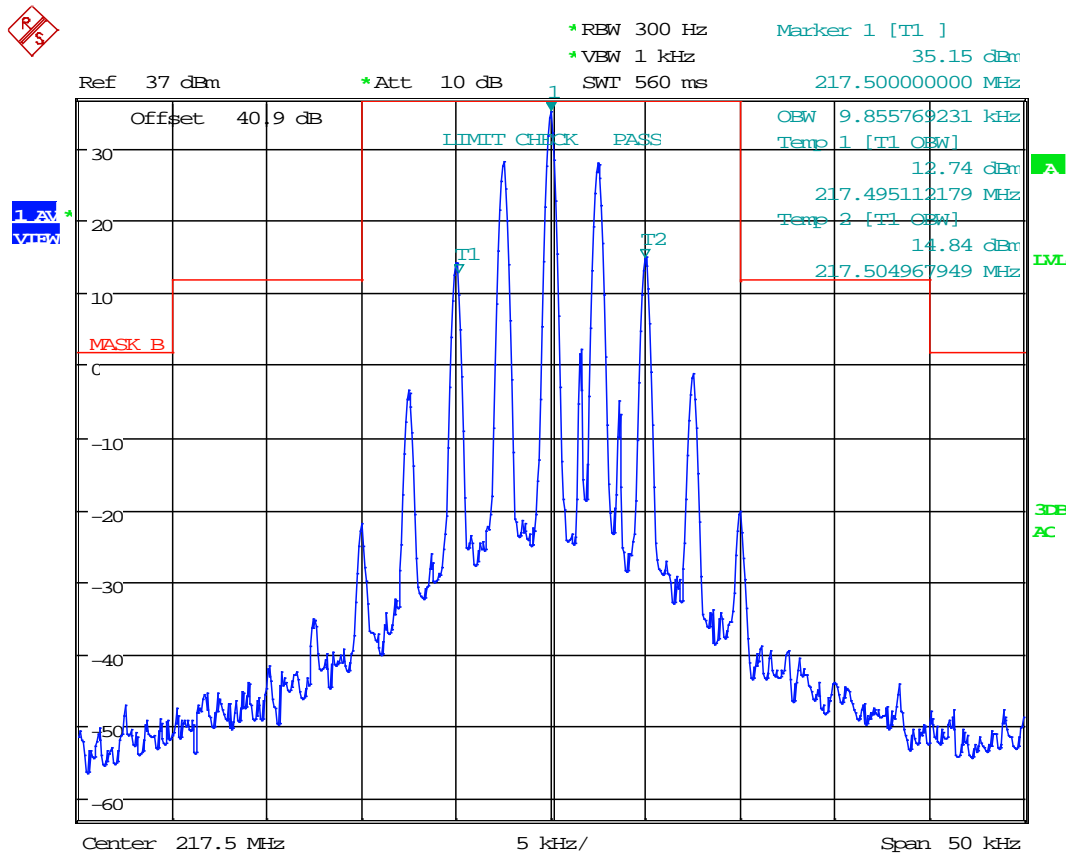
FCC Rule Parts: 2.1049 (c), 80.211(f)(1)(2)

- Requirements:**
- (1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;
 - (2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 Db

Note: The emission mask specified is identical to FCC Pt. 90.210(b)

Method of Measurement: ANSI/TIA-603-E

Test Data: 11K0F3E (FM Voice) – 217.5 MHz High Power



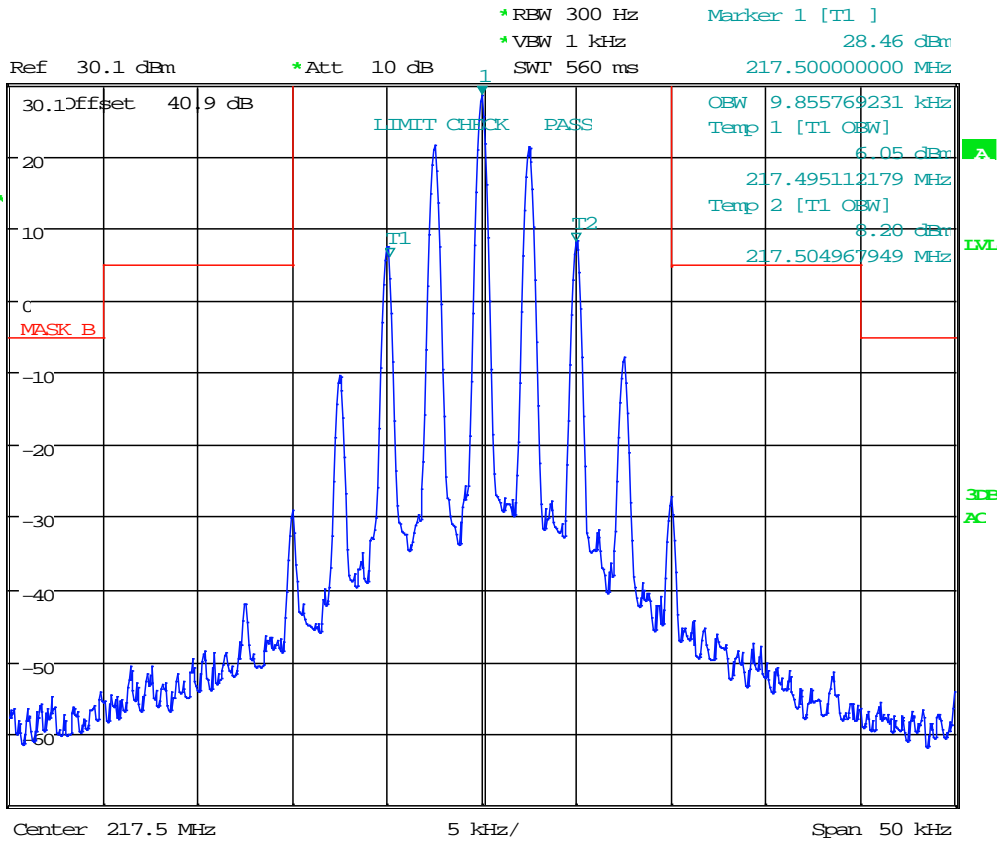
Date: 3.JAN.2018 15:24:05

Applicant: TAIT LIMITED
 FCC ID: CASTPDC0A
 Report: 1977UT17TestReport_Rev3

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OCCUPIED BANDWIDTH

Test Data: 11KOF3E (FM Voice) – 217.5 MHz Low Power



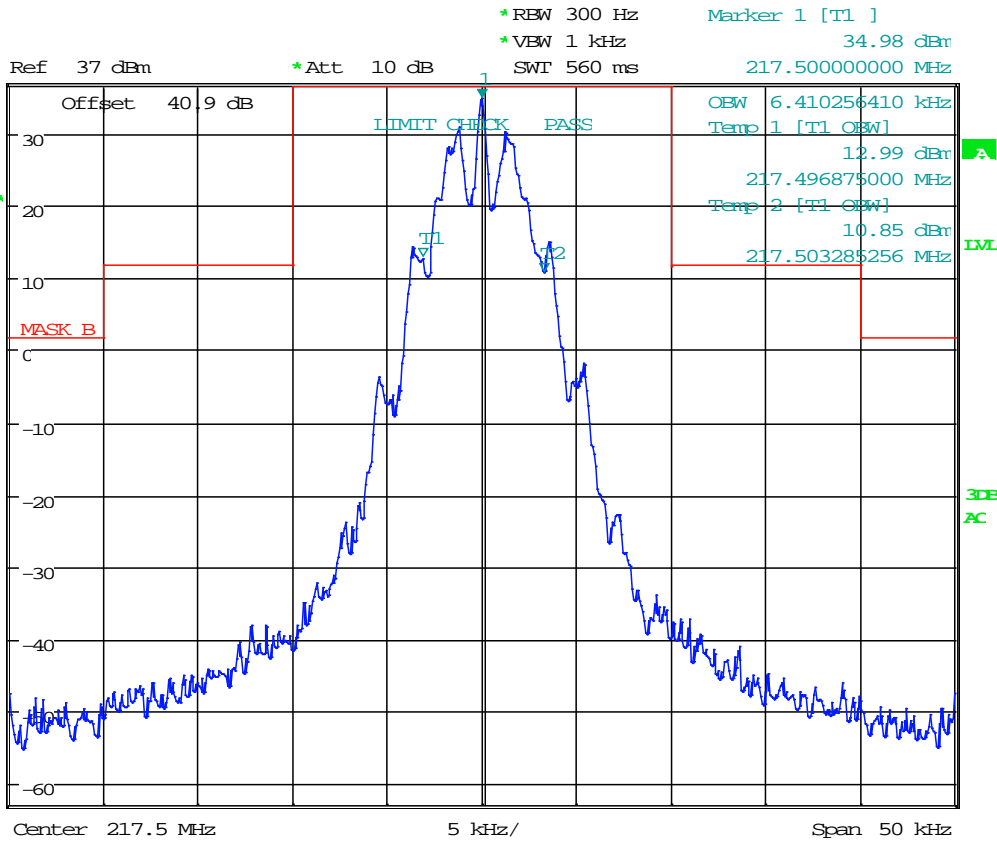
Date: 3.JAN.2018 15:28:08

11KOF3E 99% OBW: 9.86 kHz

Result: Meets Requirements

OCCUPIED BANDWIDTH

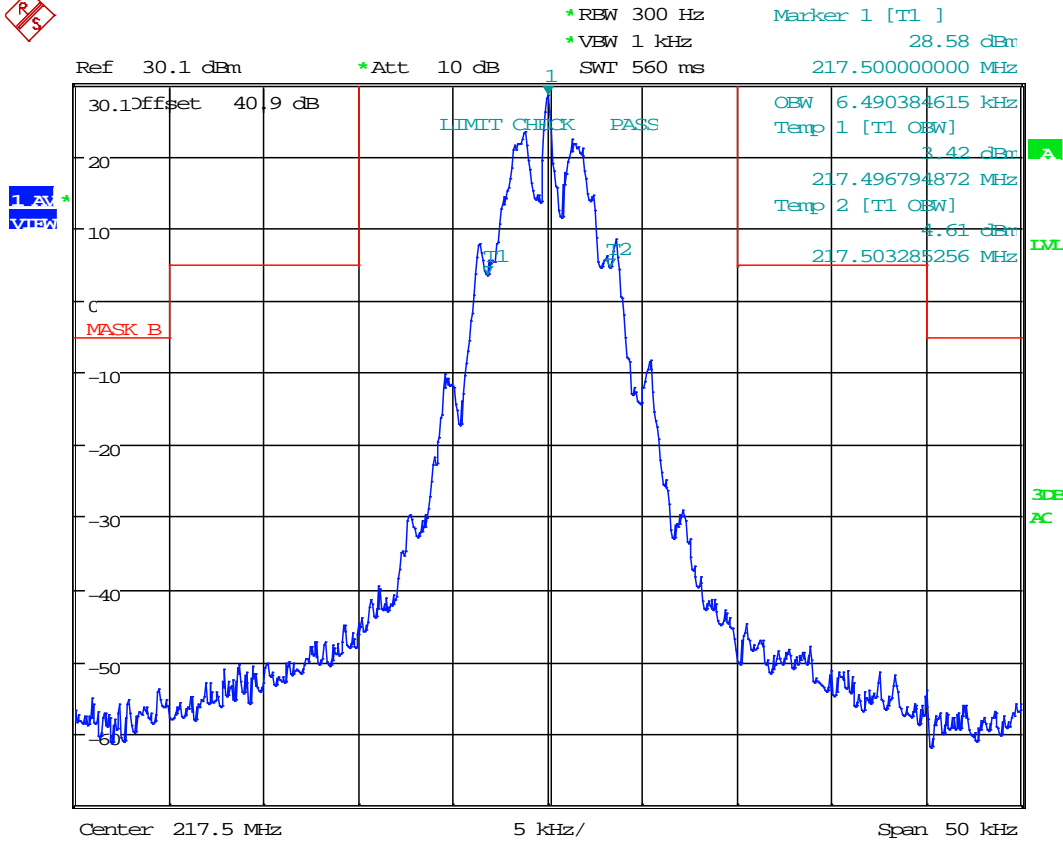
Test Data: 7K60F2D (FM Data) – 217.5 MHz High Power



Date: 3.JAN.2018 15:36:10

OCCUPIED BANDWIDTH

Test Data: 7K60F2D (FM Data) – 217.5 MHz Low Power



Date: 3.JAN.2018 15:33:32

7K60F2D 99% OBW: 6.49 kHz

Result: Meets Requirements

Applicant: TAIT LIMITED
 FCC ID: CASTPDC0A
 Report: 1977UT17TestReport_Rev3

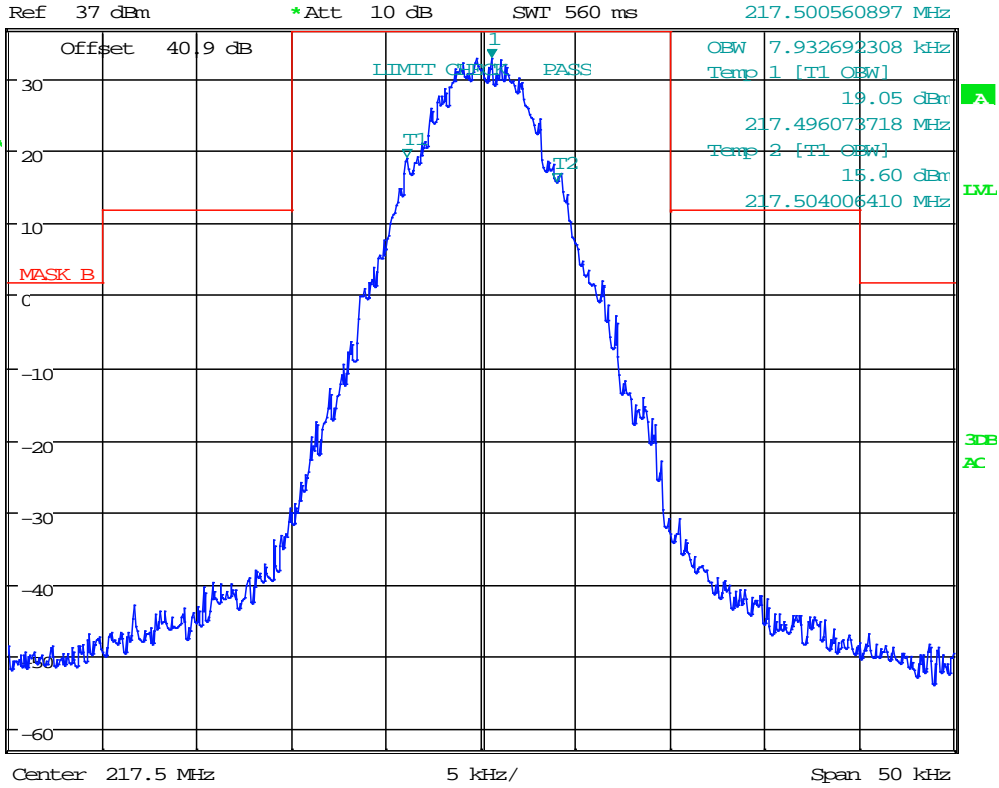
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OCCUPIED BANDWIDTH

Test Data: 7K60FXD/FXW (FM Data/Telephony) – 217.5 MHz High Power



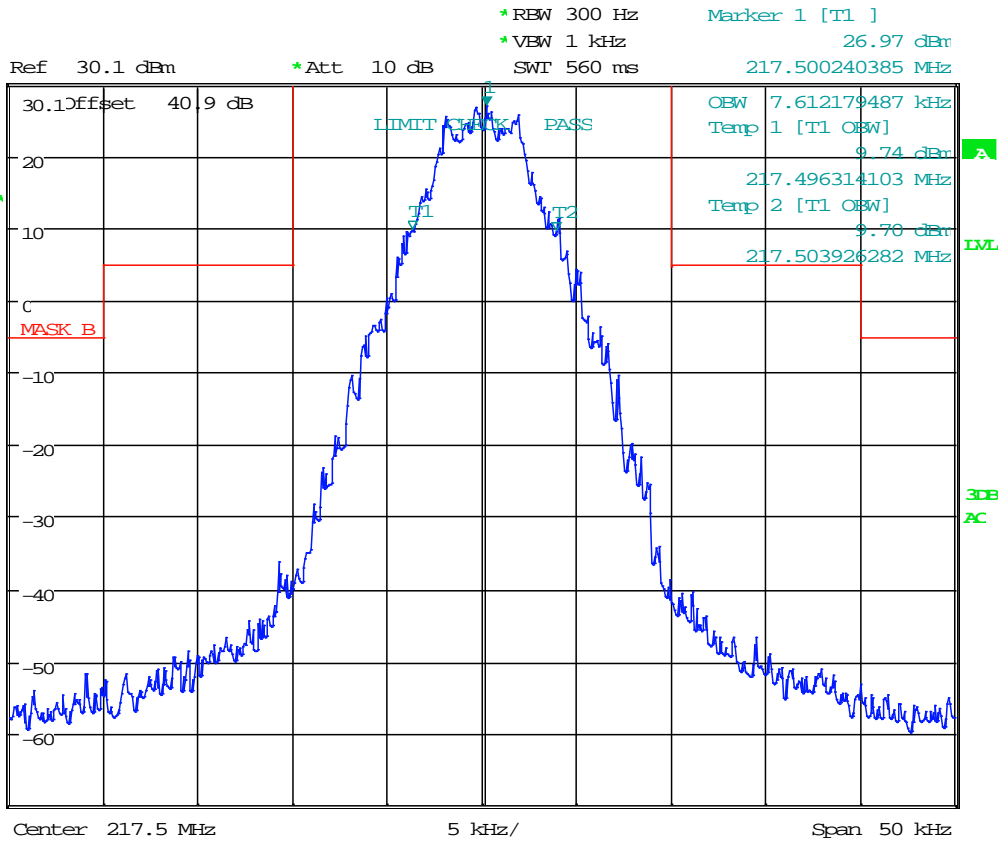
*RBW 300 Hz Marker 1 [T1]
 *VEW 1 kHz 32.96 dBm
 *Att 10 dB 217.500560897 MHz
 SWT 560 ms



Date: 3.JAN.2018 15:37:52

OCCUPIED BANDWIDTH

Test Data: 7K60FXD/FXW (FM Data/Telephony) – 217.5 MHz Low Power



Date: 3.JAN.2018 15:35:04

7K60FXD/FXW 99% OBW: 7.61 kHz

Result: Meets Requirements

Applicant: TAIT LIMITED
 FCC ID: CASTPDC0A
 Report: 1977UT17TestReport_Rev3

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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

FCC Rule Parts: FCC Part 2.1051(a), 80.211(f)(3)

Requirements: (3) On any frequency removed from the assigned frequency by more than 250% of the authorized bandwidth: At least $43 + 10 \log$ (Mean Power in Watts) dB

Method of Measurement: ANSI/TIA-603-E

Test Data: 11KOF3E (FM Voice) – 217.5 MHz

| | (dBm) | (Watts) | Limit (dBc) |
|-----------------------|-------|---------|-------------|
| Mean High Power (dBm) | 36.7 | 4.68 | 49.7 |
| Mean Low Power (dBm) | 29.95 | 0.99 | 42.95 |

| | | | High Power | | Low Power | |
|---------------|-----------|---|------------|-------------|------------|-------------|
| | Frequency | | Peak (dBm) | Margin (dB) | Peak (dBm) | Margin (dB) |
| (fundamental) | 217.500 | | 0.00 | 0.00 | 6.75 | 0.00 |
| 2nd Harmonic | 435.000 | | -45.09 | 32.09 | -48.25 | 35.25 |
| 3rd Harmonic | 652.500 | | -65.94 | 52.94 | -67.78 | 54.78 |
| 4th Harmonic | 870.000 | * | -65.52 | 52.52 | -70.82 | 57.82 |
| 5th Harmonic | 1087.500 | * | -65.41 | 52.41 | -70.53 | 57.53 |
| 6th Harmonic | 1305.000 | * | -65.63 | 52.63 | -69.40 | 56.40 |
| 7th Harmonic | 1522.500 | * | -64.38 | 51.38 | -68.51 | 55.51 |
| 8th Harmonic | 1740.000 | * | -62.85 | 49.85 | -66.99 | 53.99 |
| 9th Harmonic | 1957.500 | * | -63.17 | 50.17 | -66.57 | 53.57 |
| 10th Harmonic | 2175.000 | * | -56.37 | 43.37 | -58.94 | 45.94 |

* Indicates Noise Floor of Measurement

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: 7K60F2D (FM Data) – 217.5 MHz

| | (dBm) | (Watts) | Limit (dBc) |
|-----------------------|-------|---------|-------------|
| Mean High Power (dBm) | 36.7 | 4.68 | 49.7 |
| Mean Low Power (dBm) | 29.95 | 0.99 | 42.95 |

| | | | High Power | | Low Power | |
|---------------|---|----------|------------|-------------|------------|-------------|
| Frequency | | | Peak (dBm) | Margin (dB) | Peak (dBm) | Margin (dB) |
| (fundamental) | | 217.500 | 0.00 | 0.00 | 6.75 | 0.00 |
| 2nd Harmonic | | 435.000 | -31.87 | 18.87 | -48.93 | 35.93 |
| 3rd Harmonic | | 652.500 | -42.79 | 29.79 | -63.66 | 50.66 |
| 4th Harmonic | * | 870.000 | -65.93 | 52.93 | -66.15 | 53.15 |
| 5th Harmonic | * | 1087.500 | -65.82 | 52.82 | -66.04 | 53.04 |
| 6th Harmonic | * | 1305.000 | -66.04 | 53.04 | -66.26 | 53.26 |
| 7th Harmonic | * | 1522.500 | -64.79 | 51.79 | -65.01 | 52.01 |
| 8th Harmonic | * | 1740.000 | -63.26 | 50.26 | -63.48 | 50.48 |
| 9th Harmonic | * | 1957.500 | -63.58 | 50.58 | -63.80 | 50.80 |
| 10th Harmonic | * | 2175.000 | -56.78 | 43.78 | -57.00 | 44.00 |

* Indicates Noise Floor of Measurement

Test Data: 7K60FXD/FXW (FM Data/Telephony) – 217.5 MHz

| | (dBm) | (Watts) | Limit (dBc) |
|-----------------------|-------|---------|-------------|
| Mean High Power (dBm) | 36.7 | 4.68 | 49.7 |
| Mean Low Power (dBm) | 29.95 | 0.99 | 42.95 |

| | | | High Power | | Low Power | |
|---------------|---|----------|------------|-------------|------------|-------------|
| Frequency | | | Peak (dBm) | Margin (dB) | Peak (dBm) | Margin (dB) |
| (fundamental) | | 217.500 | 0.00 | 0.00 | 6.75 | 0.00 |
| 2nd Harmonic | | 435.000 | -52.85 | 39.85 | -48.76 | 35.76 |
| 3rd Harmonic | | 652.500 | -60.88 | 47.88 | -63.81 | 50.81 |
| 4th Harmonic | | 870.000 | -65.62 | 52.62 | -65.39 | 52.39 |
| 5th Harmonic | | 1087.500 | -65.51 | 52.51 | -65.28 | 52.28 |
| 6th Harmonic | * | 1305.000 | -65.73 | 52.73 | -65.50 | 52.50 |
| 7th Harmonic | * | 1522.500 | -64.48 | 51.48 | -64.25 | 51.25 |
| 8th Harmonic | * | 1740.000 | -62.95 | 49.95 | -62.72 | 49.72 |
| 9th Harmonic | * | 1957.500 | -63.27 | 50.27 | -63.04 | 50.04 |
| 10th Harmonic | * | 2175.000 | -56.47 | 43.47 | -56.24 | 43.24 |

* Indicates Noise Floor of Measurement

Applicant: TAIT LIMITED
 FCC ID: CASTPDC0A
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SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: 11K0F3E (FM Voice) – 219.5 MHz

| | (dBm) | (Watts) | Limit (dBc) |
|-----------------------|-------|---------|-------------|
| Mean High Power (dBm) | 36.7 | 4.68 | 49.7 |
| Mean Low Power (dBm) | 29.91 | 0.98 | 42.91 |

| | | | High Power | |
|---------------|---|----------|------------|-------------|
| Frequency | | | Peak (dBm) | Margin (dB) |
| (fundamental) | | 219.500 | 0.00 | 0.00 |
| 2nd Harmonic | | 439.000 | -45.22 | 32.22 |
| 3rd Harmonic | | 658.500 | -65.15 | 52.15 |
| 4th Harmonic | * | 878.000 | -65.87 | 52.87 |
| 5th Harmonic | * | 1097.500 | -65.76 | 52.76 |
| 6th Harmonic | * | 1317.000 | -65.98 | 52.98 |
| 7th Harmonic | * | 1536.500 | -64.73 | 51.73 |
| 8th Harmonic | * | 1756.000 | -63.20 | 50.20 |
| 9th Harmonic | * | 1975.500 | -63.52 | 50.52 |
| 10th Harmonic | * | 2195.000 | -56.72 | 43.72 |

| Low Power | |
|------------|-------------|
| Peak (dBm) | Margin (dB) |
| 6.79 | 0.00 |
| -47.98 | 34.98 |
| -64.50 | 51.50 |
| -65.03 | 52.03 |
| -64.92 | 51.92 |
| -65.14 | 52.14 |
| -63.89 | 50.89 |
| -62.36 | 49.36 |
| -62.68 | 49.68 |
| -55.88 | 42.88 |

* Indicates Noise Floor of Measurement

Test Data: 7K60F2D (FM Data) – 219.5 MHz

| | (dBm) | (Watts) | Limit (dBc) |
|-----------------------|-------|---------|-------------|
| Mean High Power (dBm) | 36.7 | 4.68 | 49.7 |
| Mean Low Power (dBm) | 29.91 | 0.98 | 42.91 |

| | | | High Power | |
|---------------|---|----------|------------|-------------|
| Frequency | | | Peak (dBm) | Margin (dB) |
| (fundamental) | | 219.500 | 0.00 | 0.00 |
| 2nd Harmonic | | 439.000 | -45.31 | 32.31 |
| 3rd Harmonic | | 658.500 | -64.26 | 51.26 |
| 4th Harmonic | * | 878.000 | -65.53 | 52.53 |
| 5th Harmonic | * | 1097.500 | -65.42 | 52.42 |
| 6th Harmonic | * | 1317.000 | -65.64 | 52.64 |
| 7th Harmonic | * | 1536.500 | -64.39 | 51.39 |
| 8th Harmonic | * | 1756.000 | -62.86 | 49.86 |
| 9th Harmonic | * | 1975.500 | -63.18 | 50.18 |
| 10th Harmonic | * | 2195.000 | -56.38 | 43.38 |

| Low Power | |
|------------|-------------|
| Peak (dBm) | Margin (dB) |
| 6.79 | 0.00 |
| -47.96 | 34.96 |
| -65.60 | 52.60 |
| -66.06 | 53.06 |
| -65.95 | 52.95 |
| -66.17 | 53.17 |
| -64.92 | 51.92 |
| -63.39 | 50.39 |
| -63.71 | 50.71 |
| -56.91 | 43.91 |

* Indicates Noise Floor of Measurement

SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Data: 7K60FXD/FXW (FM Data/Telephony) – 219.5 MHz

| | (dBm) | (Watts) | Limit (dBc) |
|-----------------------|-------|---------|-------------|
| Mean High Power (dBm) | 36.7 | 4.68 | 49.7 |
| Mean Low Power (dBm) | 29.91 | 0.98 | 42.91 |

| | | | High Power | | Low Power | |
|---------------|---|----------|------------|-------------|------------|-------------|
| Frequency | | | Peak (dBm) | Margin (dB) | Peak (dBm) | Margin (dB) |
| (fundamental) | | 219.500 | 0.00 | 0.00 | 6.79 | 0.00 |
| 2nd Harmonic | | 439.000 | -45.27 | 32.27 | -47.90 | 34.90 |
| 3rd Harmonic | | 658.500 | -65.59 | 52.59 | -65.29 | 52.29 |
| 4th Harmonic | * | 878.000 | -65.39 | 52.39 | -65.75 | 52.75 |
| 5th Harmonic | * | 1097.500 | -65.28 | 52.28 | -65.64 | 52.64 |
| 6th Harmonic | * | 1317.000 | -65.50 | 52.50 | -65.86 | 52.86 |
| 7th Harmonic | * | 1536.500 | -64.25 | 51.25 | -64.61 | 51.61 |
| 8th Harmonic | * | 1756.000 | -62.72 | 49.72 | -63.08 | 50.08 |
| 9th Harmonic | * | 1975.500 | -63.04 | 50.04 | -63.40 | 50.40 |
| 10th Harmonic | * | 2195.000 | -56.24 | 43.24 | -56.60 | 43.60 |

* Indicates Noise Floor of Measurement

Worst-Case Emission Settings

Analog: 11K0F3E (FM Voice) – 217.5 MHz, High Power
 Digital: 7K60F2D (FM Data) – 217.5 MHz, High Power

Result: Meets Requirements



FIELD STRENGTH OF SPURIOUS EMISSIONS

FCC Rule Parts: FCC Part 2.1053(a), 80.211(f)(3)

Requirements: (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10\log(\text{mean power in watts})$ dB.

Method of Measurement: ANSI/TIA-603-E

Note: The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from 9 KHz to at least the tenth harmonic of the fundamental. This test was conducted in accordance with the standard listed above using the substitution method. Measurements were made at the test site of TIMCO ENGINEERING, INC. located at 849 NW State Road 45, Newberry, FL 32669. The measurements below represent the worst case of all the frequencies tested.

Note: The six (6) highest emissions of each worst-case settings of both Analog (11K0F3E) and Digital (7K60FXD/FXW) are represented below. Emissions below 20 dB below the limit are not required to be reported.

Test Data: 11K0F3E (FM Voice) – 217.5 MHz

| 217.50 MHz, 11K0F3E High Power | | | | |
|--------------------------------|------------------|-----------|-------------|-------------|
| Emission Frequency (MHz) | Antenna Polarity | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 870.00 | H | -41.39 | -13.00 | 28.39 |
| 870.00 | V | -42.58 | -13.00 | 29.58 |
| 2175.00 | H | -44.57 | -13.00 | 31.57 |
| 1305.00 | H | -45.15 | -13.00 | 32.15 |
| 2175.00 | V | -46.42 | -13.00 | 33.42 |
| 1957.50 | H | -46.97 | -13.00 | 33.97 |

Test Data: 7K60FXD/FXW (FM Data/Telephony) – 217.5 MHz

| 217.50 MHz, 7K60FXD/FXW High Power | | | | |
|------------------------------------|------------------|-----------|-------------|-------------|
| Emission Frequency (MHz) | Antenna Polarity | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 1957.50 | H | -47.27 | -13.00 | 34.27 |
| 2175.00 | H | -47.42 | -13.00 | 34.42 |
| 2175.00 | V | -48.27 | -13.00 | 35.27 |
| 1957.50 | V | -48.87 | -13.00 | 35.87 |
| 1740.00 | H | -49.00 | -13.00 | 36.00 |
| 870.00 | V | -49.65 | -13.00 | 36.65 |

Test Data: 11K0F3E (FM Voice) – 219.5 MHz

| 219.50 MHz, 11K0F3E High Power | | | | |
|--------------------------------|------------------|-----------|-------------|-------------|
| Emission Frequency (MHz) | Antenna Polarity | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 878.00 | H | -41.06 | -13.00 | 28.06 |
| 878.00 | V | -42.68 | -13.00 | 29.68 |
| 1317.00 | H | -43.51 | -13.00 | 30.51 |
| 1317.00 | V | -45.19 | -13.00 | 32.19 |
| 2195.00 | H | -45.82 | -13.00 | 32.82 |
| 1975.50 | H | -46.39 | -13.00 | 33.39 |

Test Data: 7K60FXD/FXW (FM Data/Telephony) – 219.5 MHz

| 219.50 MHz, 7K60FXD/FXW High Power | | | | |
|------------------------------------|------------------|-----------|-------------|-------------|
| Emission Frequency (MHz) | Antenna Polarity | ERP (dBm) | Limit (dBm) | Margin (dB) |
| 878.00 | V | -43.83 | -13.00 | 30.83 |
| 878.00 | H | -44.22 | -13.00 | 31.22 |
| 2195.00 | H | -46.65 | -13.00 | 33.65 |
| 1975.50 | H | -47.39 | -13.00 | 34.39 |
| 1317.00 | H | -48.05 | -13.00 | 35.05 |
| 2195.00 | V | -48.56 | -13.00 | 35.56 |

RESULT: Meets Requirements

Applicant: TAIT LIMITED
 FCC ID: CASTPDC0A
 Report: 1977UT17TestReport_Rev3

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FREQUENCY STABILITY

FCC Rule Parts: FCC Part 2.1055(a)(2), Part 80.209(a)

Requirements: The frequency stability must remain within 5 ppm from -20 C to +50 C.

§80.209 Transmitter frequency tolerances.

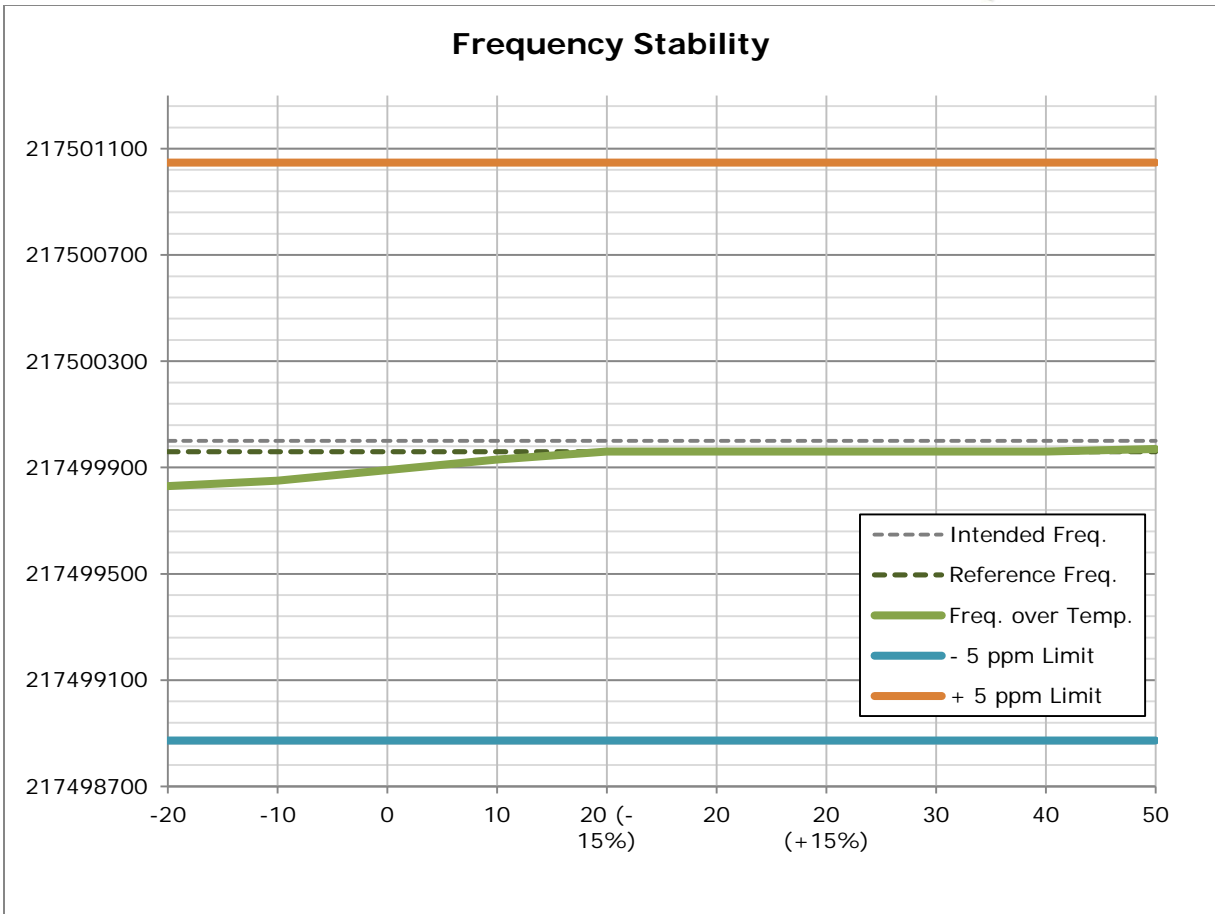
(a) The frequency tolerance requirements applicable to transmitters in the maritime services are shown in the following table. Tolerances are given as parts in 10^6 unless shown in Hz.

| Frequency bands and categories of stations | Tolerances ¹ |
|--|-------------------------|
| (6) Band 216-220 MHz: | |
| (i) Coast stations: | |
| For all emissions | 5. |
| (ii) Ship stations: | |
| For all emissions | 5. |

¹Transmitters authorized prior to January 2, 1990, with frequency tolerances equal to or better than those required after this date will continue to be authorized in the maritime services provided they retain approval and comply with the applicable standards in this part.

Method of Measurements: ANSI/TIA 603-E

Test Data: Frequency Error Measurement Plot



FREQUENCY STABILITY

Test Data: Frequency Error Measurement Table

| 217.500 MHz High Power (Worst-case Settings) | | | | |
|--|------------------------|-------------------------|-----------------------------------|----------------|
| | | Limit: | 5 | ppm |
| Temperature (°C) | Supplied Voltage (VDC) | Intended Frequency (Hz) | Measured Reference Frequency (Hz) | Deviation (Hz) |
| 20°C (reference) | 7.5 | 217500000 | 217499960 | 40 |

| @ 20°C (reference) | | | | |
|----------------------|------------------------|----------------|----------------|-------|
| Supplied Voltage (%) | Supplied Voltage (VDC) | Frequency (Hz) | Deviation (Hz) | PPM |
| -15% | 6.38 | 217499960 | 0 | 0.000 |
| 15% | 8.63 | 217499960 | 0 | 0.000 |

| Temperature (°C) | Supplied Voltage (VDC) | Frequency (Hz) | Deviation (Hz) | PPM |
|------------------|------------------------|----------------|----------------|--------|
| 50 | 7.5 | 217499970 | -10 | -0.046 |
| 40 | 7.5 | 217499960 | 0 | 0.000 |
| 30 | 7.5 | 217499960 | 0 | 0.000 |
| 20 | 7.5 | 217499960 | 0 | 0.000 |
| 10 | 7.5 | 217499930 | 30 | 0.138 |
| 0 | 7.5 | 217499890 | 70 | 0.322 |
| -10 | 7.5 | 217499850 | 110 | 0.506 |
| -20 | 7.5 | 217499830 | 130 | 0.598 |

RESULT: Meets Requirements

STATEMENT OF MEASUREMENT UNCERTAINTY

The data and results referenced in this document are true and accurate. The measurement uncertainty was calculated for all measurements listed in this test report according To CISPR 16-4 or ENTR 100-028 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: “Uncertainty in EMC Measurements” and is documented in the Timco Engineering, Inc. quality system according to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Timco Engineering, Inc. is reported:

| Test Items | Measurement Uncertainty | Notes |
|---|-------------------------|-------|
| RF Frequency Accuracy | ± 49.5 Hz | (1) |
| RF Conducted Power | ±0.93dB | (1) |
| Conducted spurious emission of transmitter valid up to 40GHz | ±1.86dB | |
| Occupied Bandwidth | ±2.65% | |
| Audio Frequency Response | ±1.86dB | |
| Modulation limiting | ±1.88% | |
| Radiated RF Power | ±1.4dB | |
| Maximum frequency deviation: Within 300 Hz and 6kHz of audio freq. | ±1.88% | |
| Within 6kHz and 25kHz of audio Freq. | ±2.04% | |
| Rad Emissions Sub Meth up to 26.5GHz | ±2.14dB | |
| Adjacent channel power | ±1.47dB | (1) |
| Transient Frequency Response | ±1.88% | |
| Temperature | ±1.0°C | (1) |
| Humidity | ±5.0% | |

- (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

EMC EQUIPMENT LIST

| Device | Manufacturer | Model | Serial Number | Cal/Char Date | Due Date |
|--|--------------------|------------------------------|---|---------------|----------|
| Coaxial Cable - BMBM-0065-01 Black DC-2G | Belden | | BMBM-0065-01 | 07/18/16 | 07/18/18 |
| Antenna: Biconical 1096 | Eaton | 94455-1 | 1096 | 08/01/17 | 08/01/19 |
| Antenna: Log-Periodic 1122 | Electro-Metrics | LPA-25 | 1122 | 07/26/17 | 07/26/19 |
| Temperature Chamber LARGE | Tenney Engineering | TTRC | 11717-7 | 09/01/16 | 09/01/18 |
| Frequency Counter Small Chamber | HP | 5385A | 3242A07460 | 08/22/17 | 08/22/19 |
| Coaxial Cable - Chamber 3 cable set (backup) | Micro-Coax | Chamber 3 cable set (backup) | KMKM-0244-02 ; KMKM-0670-01; KFKF-0197-00 | N/A | N/A |
| CHAMBER | Panashield | 3M | N/A | 04/25/16 | 1/31/18 |
| Rohde & Schwarz Signal Generator SMU200A | Rohde & Schwarz | SMU200A | 103195 | 03/07/16 | 03/07/18 |
| Antenna: Double-Ridged Horn/ETS Horn 2 | ETS-Lindgren | 3117 | 00041534 | 03/01/17 | 03/01/19 |
| Software: Field Strength Program | Timco | N/A | Version 4.10.7.0 | N/A | N/A |
| Antenna: Passive Loop | EMCO | 6512 | 9706-1211 | 07/26/17 | 07/26/19 |
| Type K J Thermometer | Martel | 303 | 080504494 | 11/02/17 | 11/02/19 |
| EMI Test Receiver R & S ESU 40 Chamber | Rohde & Schwarz | ESU 40 | 100320 | 04/01/16 | 04/01/18 |
| Attenuator N 30dB 100W DC-6G | Pasternack | PE7214-30 | #109 | 05/24/17 | 05/24/19 |
| Attenuator BNC 10dB DC-2G | MiniCircuits | HAT-10+ | #54 | 07/14/17 | 07/14/19 |
| Bore-sight Antenna Positioning Tower | Sunol Sciences | TLT2 | N/A | N/A | N/A |
| Tuneable Notch Filter 15-30 MHz | Eagle | TNF-200 | 15-30 MHz | 11/19/17 | 11/19/19 |

*EMI RECEIVER SOFTWARE VERSION

The receiver firmware used was version 4.43 Service Pack 3

END OF TEST REPORT

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