

LABORATORY TEST REPORT

RADIO PERFORMANCE MEASUREMENTS

for the

TPDK5A Handportable Transceiver

Tested in accordance with:

FCC 47 CFR Parts 2 & 27

Report Revision: 1

Issue Date: 16 September 2016

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Test Technician

CHECKED & APPROVED BY: M. C. James


Laboratory Technical Manager



OATS FCC LISTING REGISTRATION: 837095

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.

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REVISION

| Date | Revision | Comments |
|-------------------|-----------------|---------------------|
| 16 September 2016 | 1 | Initial test report |
| | | |

INTRODUCTION

Type approval testing of the Handportable, 3 Watt, TPDK5A transceiver. This is a class 2 permissive change to expand the radio's operation into the 757-758MHz/787-788MHz band in accordance with:

FCC 47 CFR Part 2 & Part 27

The original test report for this product is TARF 3425c

REPORT PREPARED FOR

Tait Ltd
245 Wooldridge Road
Harewood
Christchurch 8051
New Zealand

DESCRIPTION OF SAMPLE

Manufacturer: Tait Limited
Equipment: Handportable Transceiver
Type: TPDK5A
Serial number: 25790616
Quantity: 1

HARDWARE & SOFTWARE Details:

| Type | Code and Version |
|-------------------|------------------------|
| Hardware ID | TPDB1X-K500_0006 |
| Boot Code | QPD1B_S00_3.01.03.0001 |
| DSP | QPD1A_E00_2.10.01.0061 |
| Radio Application | QPD1F_E00_2.10.01.0061 |
| FPGA Image | QPD1G_S01_1.10.00.0003 |

TEST CONDITIONS

All testing was performed between 1 → 15 September 2016, and under the following conditions:

Ambient temperature: 15°C → 30°C
Relative Humidity: 20% → 75%
Standard Test Voltage 7.5 V_{DC}


STATEMENT OF COMPLIANCE

We, TELTEST LABORATORIES of 558 Wairakei Road, Christchurch, New Zealand, declare under our sole responsibility that the product:

Equipment: Handportable Transceiver
Type: TPK5A
Serial Number: 25790616
Quantity: 1

to which this declaration relates, is in conformity with the following standards:

FCC 47 CFR Part 2 & Part 27

Signature: 

Mike James
Technical Manager

Date: 26 September 2016

MODULATION TYPES, NECESSARY BANDWIDTH & EMISSION DESIGNATORS

MODULATION TYPES:

| | | | |
|-----|-----------------------------|------------------|----------|
| F3E | FM Analogue Voice | - | - |
| F2D | Fast Frequency Shift Keying | 1200 symbols/sec | 1200 bps |
| | | 2400 symbols/sec | 2400 bps |
| FXW | Digital Voice / Data | 4800 symbols/sec | 9600 bps |
| FXD | Digital Data | 4800 symbols/sec | 9600 bps |

EMISSION DESIGNATORS:

| | 12.5 kHz Channel Spacing | 25.0 kHz Channel Spacing |
|--------------------------|--------------------------|--------------------------|
| Analogue Voice | 11K0F3E | 16K0F3E |
| FFSK 1200 baud | 6K60F2D | 9K60F2D |
| FFSK 2400 baud | 7K80F2D | 10K8F2D |
| DMR Digital Voice / Data | 7K60FXW | - |
| DMR Digital Data | 7K60FXD | - |

Equation: $B_n = 2M + 2Dk$

(M is highest modulating frequency; D is peak allowable deviation; k is a constant of 1 for FM)

Analogue Voice 12.5 kHz Channel Spacing

Necessary bandwidth

M = 3.0 kHz

D = 2.5 kHz

$$B_n = (2 \times 3.0) + (2 \times 2.5) \times 1$$

$$= 11.0 \text{ kHz}$$

Emission Designator

11K0F3E

F3E represents an FM voice transmission

Analogue Voice 25.0 kHz Channel Spacing

Necessary bandwidth

M = 3.0 kHz

D = 5.0 kHz

$$B_n = (2 \times 3.0) + (2 \times 5.0) \times 1$$

$$= 16.0 \text{ kHz}$$

Emission Designator

16K0F3E

F3E represents an FM voice transmission

Fast Frequency Shift Keying (FFSK – 1200 bps) 12.5 kHz Channel Spacing

Necessary bandwidth

M = 1.8 kHz

D = 1.5 kHz

$$B_n = (2 \times 1.8) + (2 \times 1.5) \times 1$$

$$= 6.6 \text{ kHz}$$

Emission Designator

6K60F2D

F2D represents a FM data transmission with the use of a modulating sub carrier

Fast Frequency Shift Keying (FFSK – 1200 bps) 25.0 kHz Channel Spacing

Necessary bandwidth

M = 1.8 kHz

D = 3.0 kHz

$$B_n = (2 \times 1.8) + (2 \times 3.0) \times 1$$

$$= 9.6 \text{ kHz}$$

Emission Designator

9K60F2D

F2D represents a FM data transmission with the use of a modulating sub carrier

Fast Frequency Shift Keying (FFSK – 2400 bps) 12.5 kHz Channel Spacing

Necessary bandwidth

M = 2.4 kHz

D = 1.5 kHz

$$B_n = (2 \times 2.4) + (2 \times 1.5) \times 1$$

Emission Designator

7K80F2D

F2D represents a FM data transmission with the use of a modulating sub carrier

FCC ID: CASTPDK5A

IC : 737A-TPDK5A

= 7.8 kHz

Fast Frequency Shift Keying (FFSK – 2400 bps) 25.0 kHz Channel Spacing

Necessary bandwidth

M = 2.4 kHz

D = 3.0 kHz

$$B_n = (2 \times 2.4) + (2 \times 3.0) \times 1 \\ = 10.8 \text{ kHz}$$

Emission Designator

10K8F2D

F2D represents a FM data transmission with the use of a modulating sub carrier

Digital Mobile Radio (DMR)

4 level FSK (as per ETSI TS 102 361-1)

4800 symbols/sec 9600 bps

Digital Data 12.5 kHz Channel Spacing

99% bandwidth = 7.6 kHz

Emission Designator

7K60FXW

FXW represents FM combination of data & telephony.

Digital Data 12.5 kHz Channel Spacing

99% bandwidth = 7.6 kHz

Emission Designator

7K60FXD

FXD represents FM of data only transmission.

TEST RESULTS

TRANSMITTER OUTPUT POWER (CONDUCTED)

SPECIFICATION: FCC 47 CFR 2.1046
FCC 47 CFR 27.50

GUIDE: TIA-102.CAAA-C 2.2.1

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment set up.
2. The coaxial attenuator has an impedance of 50 Ohms.
3. The unmodulated output power was measured with an RF Power meter.

MEASUREMENT RESULTS:

Manufacturer's Rated Output Power:

Switchable: 3 W and 1 W

| Tx 787.5 MHz | Nominal 3 W | Nominal 1 W |
|---------------------------------------|----------------|----------------|
| Measured | 2.6 | 0.8 |
| Variation (%) | -12.1 | -15.2 |
| Variation (dB) | -0.6 | -0.7 |
| Measurement Uncertainty: ± 0.6 dB | | |

LIMIT CLAUSES:

Subpart C Section 27.50 (b) (10): Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP.

Therefore the gain of any antenna system attached to this transmitter shall not exceed 0.6 dBd.

TRANSMITTER AUDIO FREQUENCY RESPONSE - PRE-EMPHASIS

SPECIFICATION: FCC 47 CFR 2.1047 (a)

GUIDE: TIA/EIA-603E 2.2.6

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment set up.
2. An audio input tone of 1000 Hz was applied with the level set to obtain 20% of maximum deviation. This was used as the 0 dB reference point.
3. The AF was varied while the audio level was held constant.
4. The response in dB relative to 1000 Hz was measured.

MEASUREMENT RESULTS:

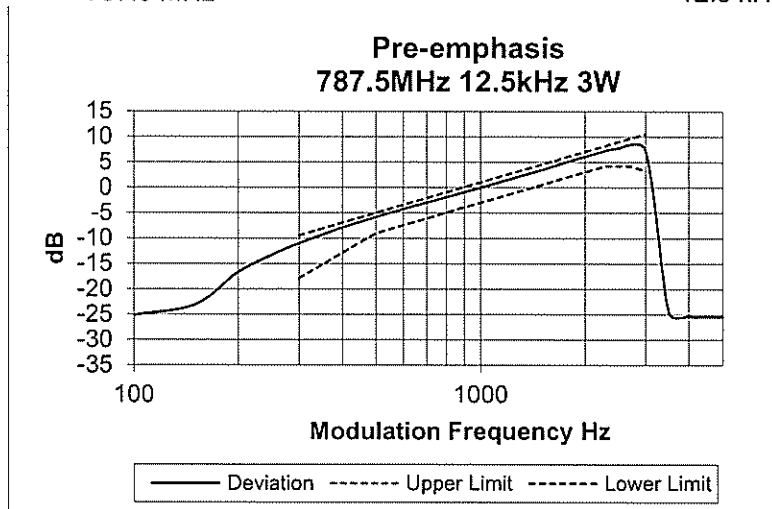
See the plots below for 12.5 kHz & 25.0 kHz channel spacings tested at 3 W transmit power.

LIMIT CLAUSE: TIA/EIA-603E 3.2.6

SPECIFICATION: FCC CFR 2.1047 (a)

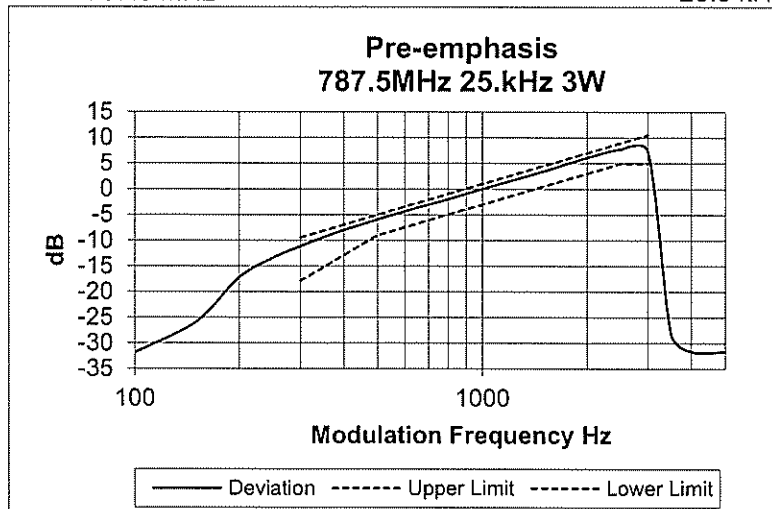
Tx FREQUENCY: 787.5 MHz

12.5 kHz Channel Spacing



Tx FREQUENCY: 787.5 MHz

25.0 kHz Channel Spacing



TRANSMITTER MODULATION LIMITING

SPECIFICATION: FCC 47 CFR 2.1047 (b)

GUIDE: TIA/EIA-603E 2.2.3

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment set up.
2. The modulation response was measured at three audio frequencies while varying the input level.
3. Measurements were made for both Positive and Negative Deviation.

MEASUREMENT RESULTS:

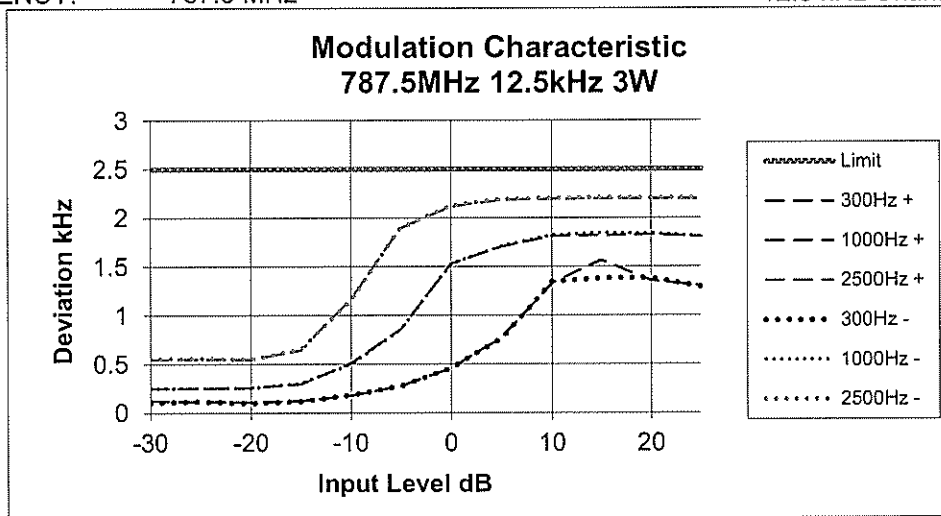
See the plots below for 12.5 kHz & 25.0 kHz channel spacings tested at 3 W transmit power.

LIMIT CLAUSE: TIA/EIA-603E 1.3.4.4

SPECIFICATION: FCC CFR 2.1047 (b)

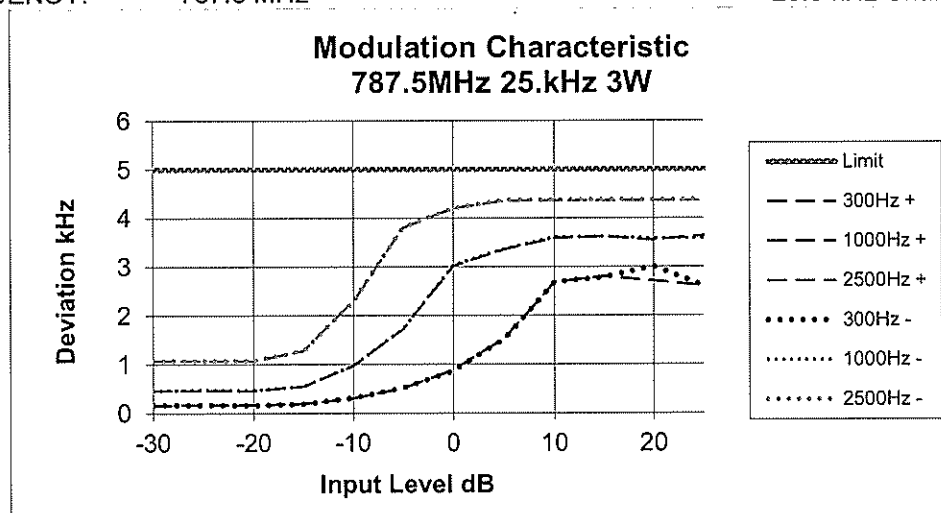
Tx FREQUENCY: 787.5 MHz

12.5 kHz Channel Spacing



Tx FREQUENCY: 787.5 MHz

25.0 kHz Channel Spacing



TRANSMITTER OCCUPIED BANDWIDTH

SPECIFICATION: FCC 47 CFR 2.1049 (c)

GUIDE: TIA/EIA-603E 2.2.11 (Analog)
TIA-102.CAAA-C 2.2.5 (Digital)

MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment Set up.
The EUT was modulated with an internally generated pseudo random bit sequence at the appropriate Baud rates.
2. The Occupied Bandwidth was measured on the Spectrum Analyzer, with bandwidth settings as follows.
Resolution Bandwidth = 300 Hz, Video Bandwidth = 910 Hz

MEASUREMENT RESULTS:

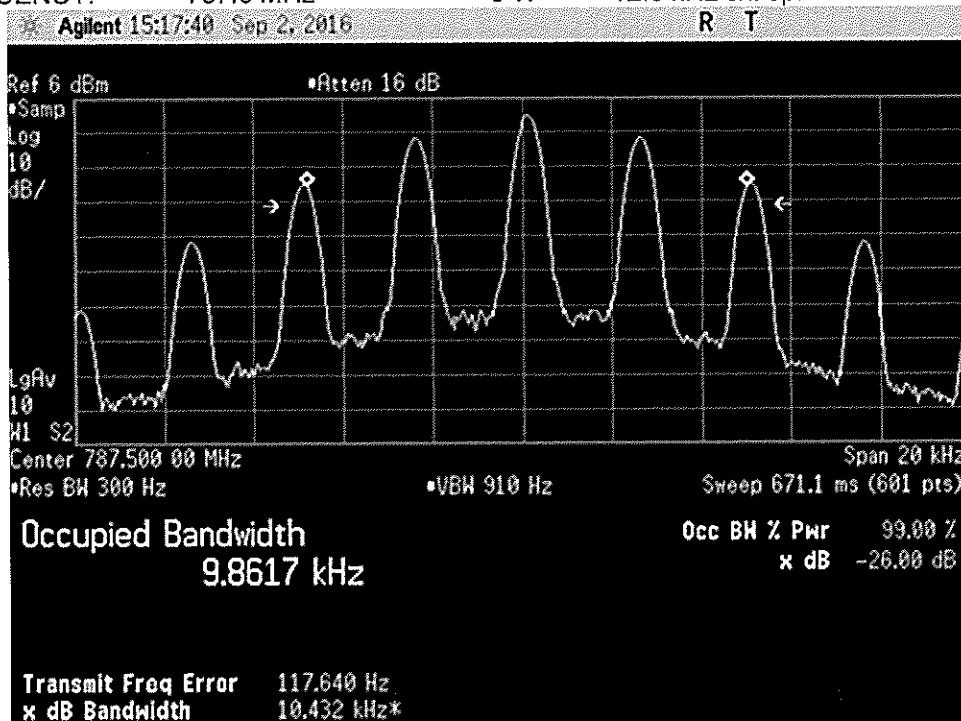
See the plots on the following pages

Tx FREQUENCY: 787.5 MHz

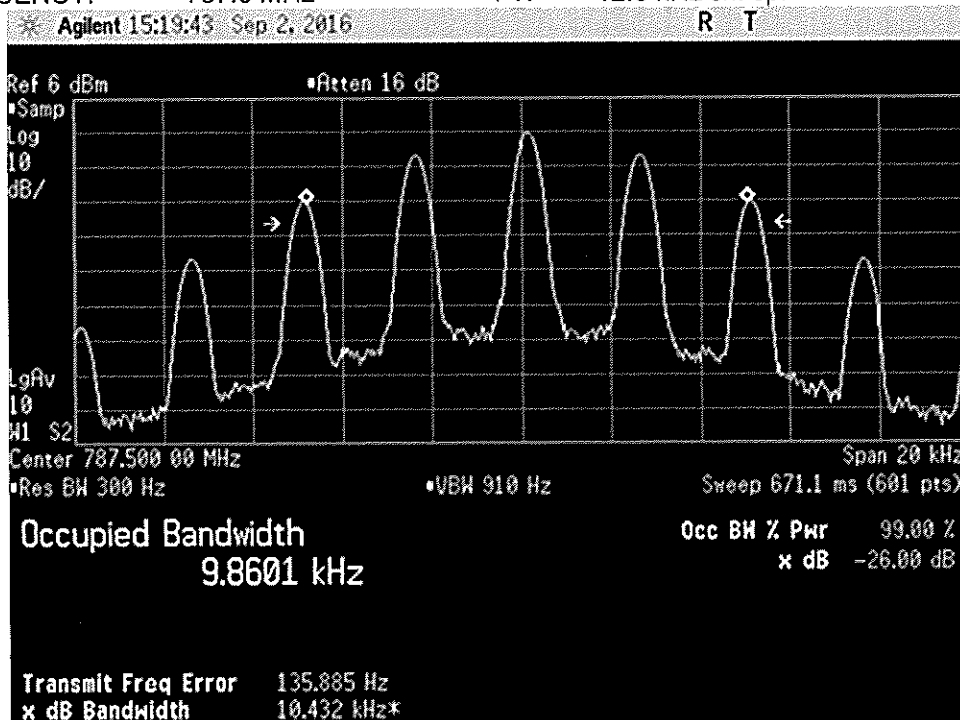
| Modulation | Channel Spacing (kHz) | Power (W) | Occupied Bandwidth (kHz) |
|----------------|-----------------------|-----------|--------------------------|
| Analogue FM | 12.5 | 3 | 9.86 |
| | 12.5 | 1 | 9.86 |
| | 25.0 | 3 | 14.89 |
| | 25.0 | 1 | 14.88 |
| FFSK 1200 baud | 12.5 | 3 | 5.70 |
| | 12.5 | 1 | 5.75 |
| | 25.0 | 3 | 9.50 |
| | 25.0 | 1 | 9.45 |
| FFSK 2400 baud | 12.5 | 3 | 5.34 |
| | 12.5 | 1 | 5.37 |
| | 25.0 | 3 | 9.70 |
| | 25.0 | 1 | 9.71 |
| DMR | 12.5 | 3 | 7.45 |
| | 12.5 | 1 | 7.43 |

Occupied Bandwidth

Tx FREQUENCY: 787.5 MHz 3 W 12.5 kHz ch. sp. Analogue FM

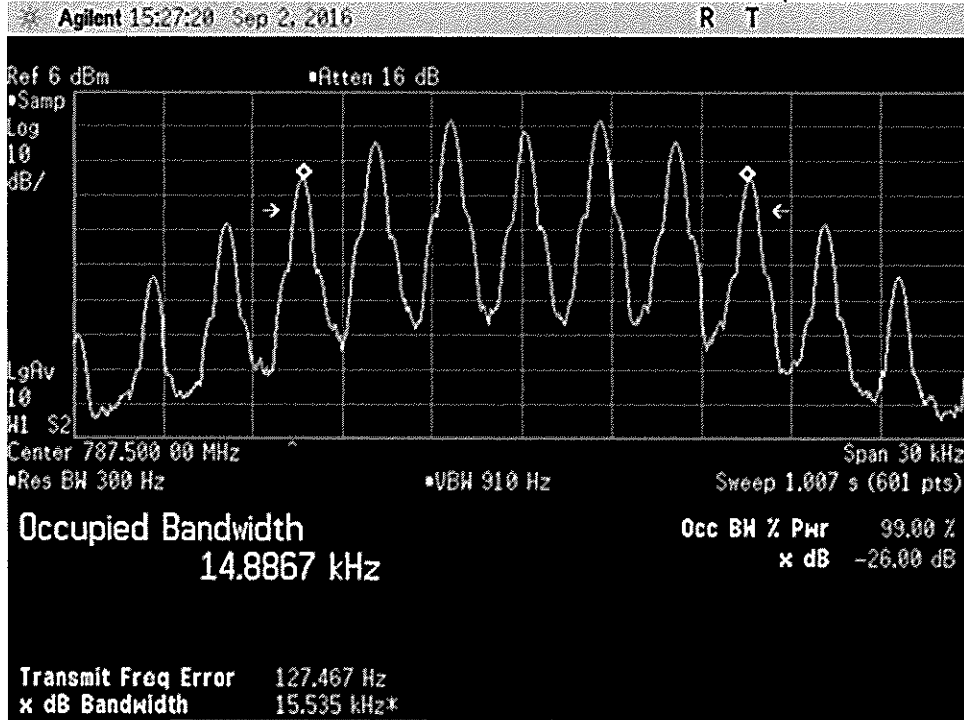


Tx FREQUENCY: 787.5 MHz 1 W 12.5 kHz ch. sp. Analogue FM

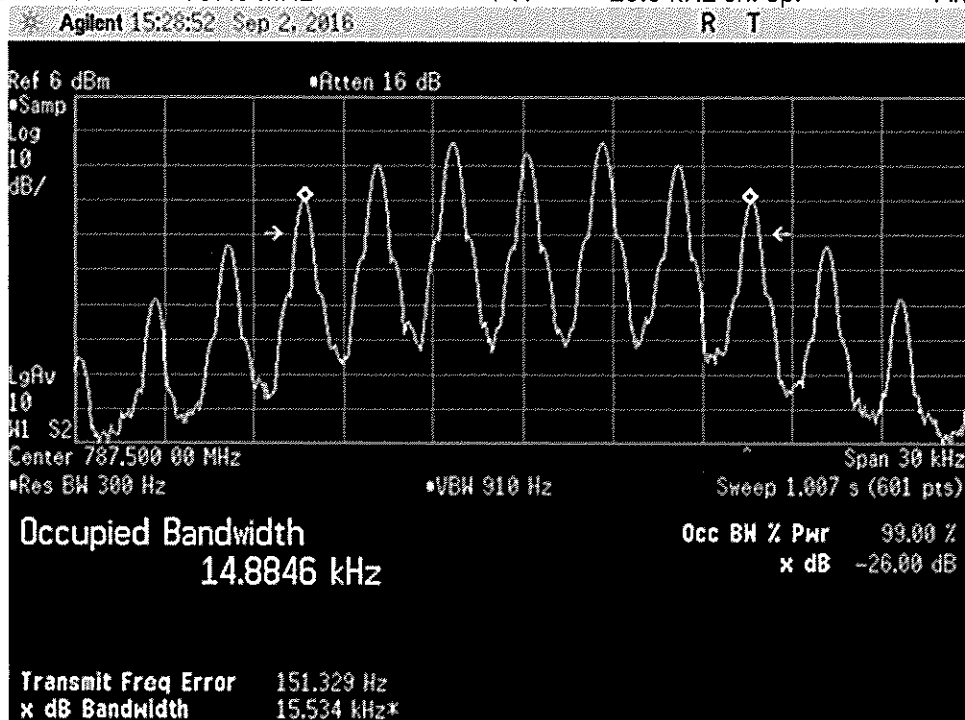


Occupied Bandwidth

Tx FREQUENCY: 787.5 MHz 3 W 25.0 kHz ch. sp. Analogue FM



Tx FREQUENCY: 787.5 MHz 1 W 25.0 kHz ch. sp. Analogue FM



Occupied Bandwidth

Tx FREQUENCY: 787.5 MHz 3 W 12.5 kHz ch. sp, FFSK 1200 baud

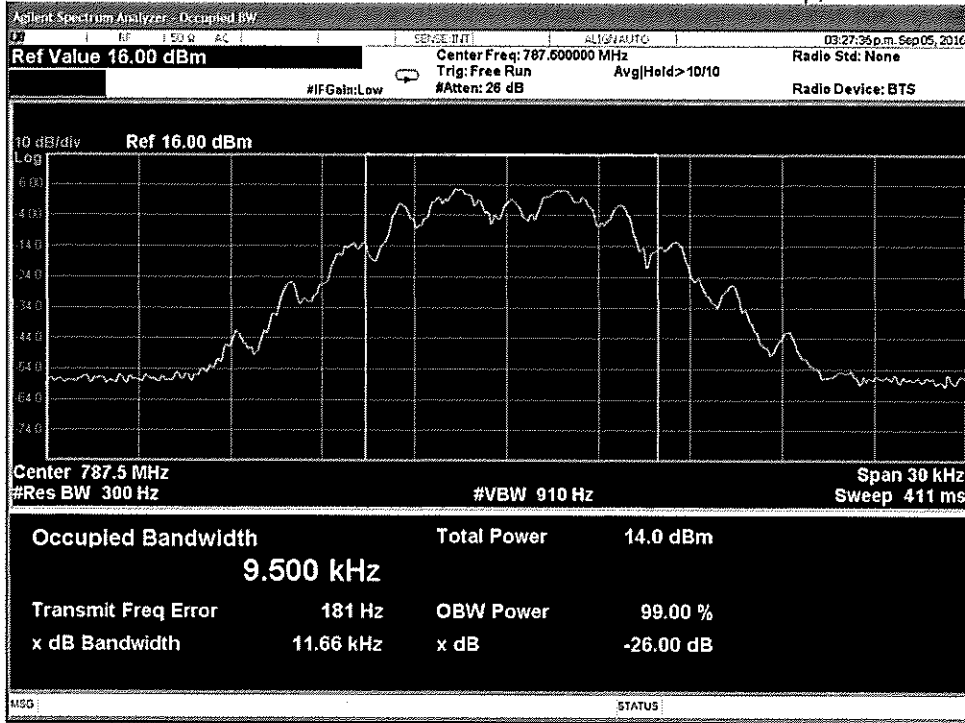


Tx FREQUENCY: 787.5 MHz 1 W 12.5 kHz ch. sp. FFSK 1200 baud

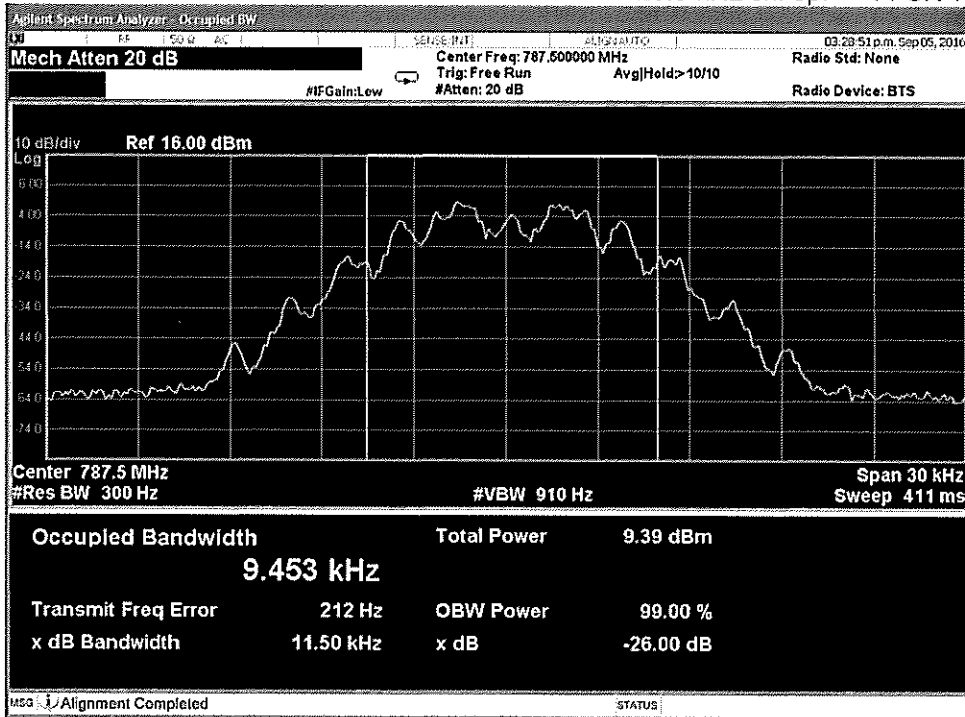


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 Report Number 3781
 Occupied Bandwidth

Tx FREQUENCY: 787.5 MHz 3 W 25.0 kHz ch. sp, FFSK 1200 baud



Tx FREQUENCY: 787.5 MHz 1 W 25.0 kHz ch. sp, FFSK 1200 baud



TELTEST Laboratories
Tait Ltd
Report Number 3781
Occupied Bandwidth

Tx FREQUENCY: 787.5 MHz 3 W 12.5 kHz ch. sp., FFSK 2400 baud

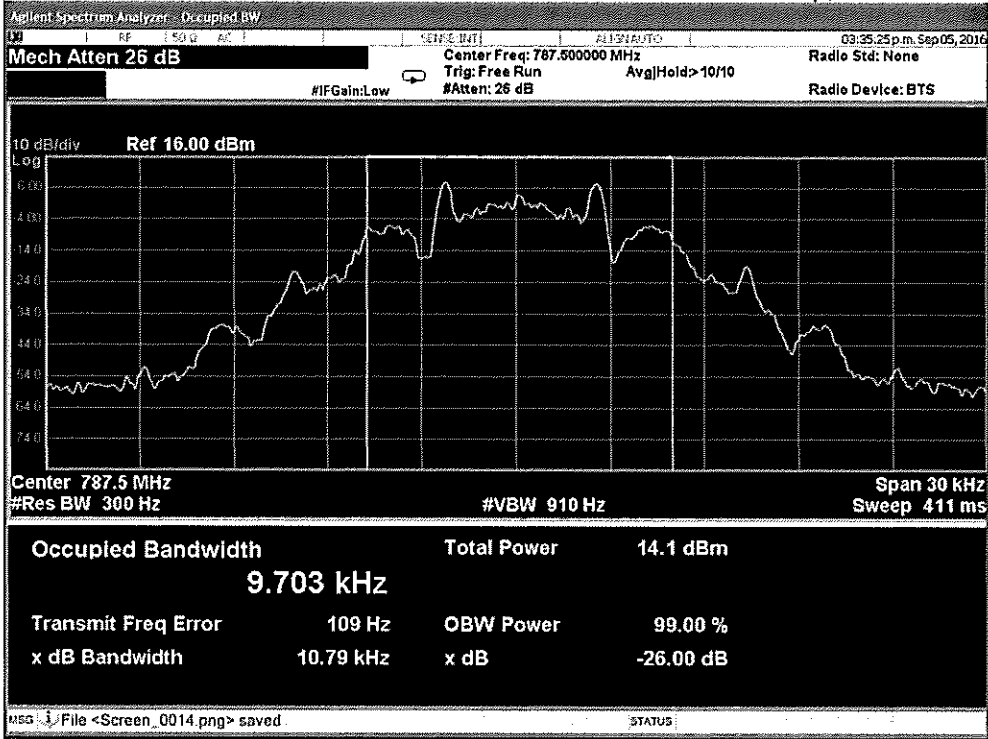


Tx FREQUENCY: 787.5 MHz 1 W 12.5 kHz ch. sp., FFSK 2400 baud



TELTEST Laboratories
 Tait Ltd
 Report Number 3781
 Occupied Bandwidth

Tx FREQUENCY: 787.5 MHz 3 W 25.0 kHz ch. sp, FFSK 2400 baud

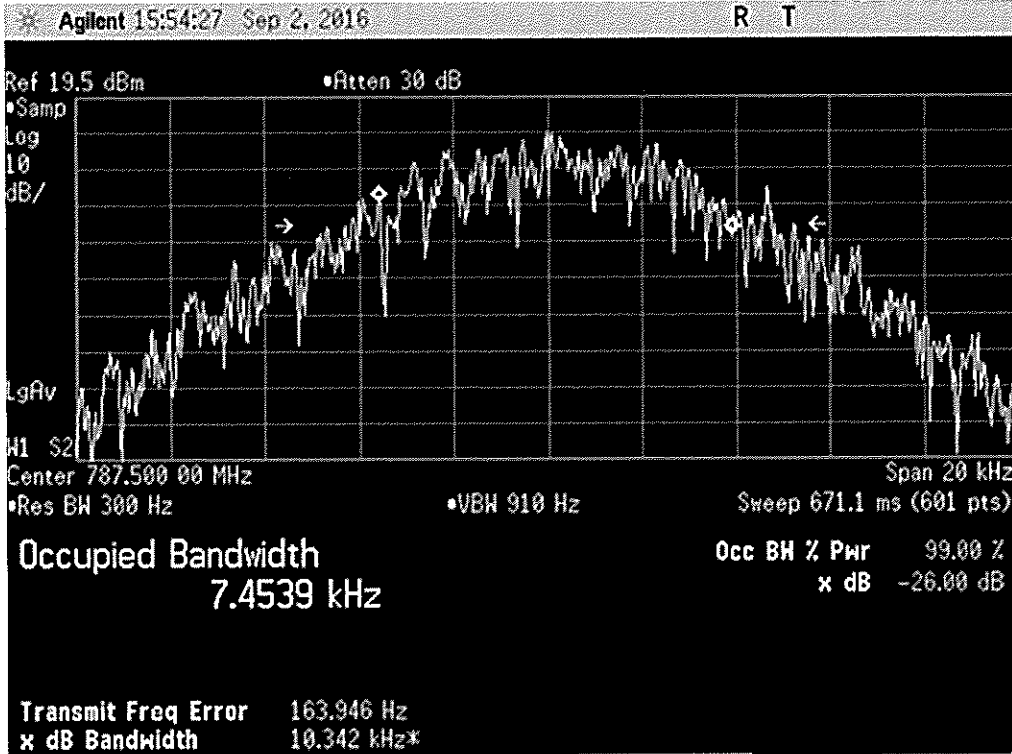


Tx FREQUENCY: 787.5 MHz 1 W 25.0 kHz ch. sp, FFSK 2400 baud

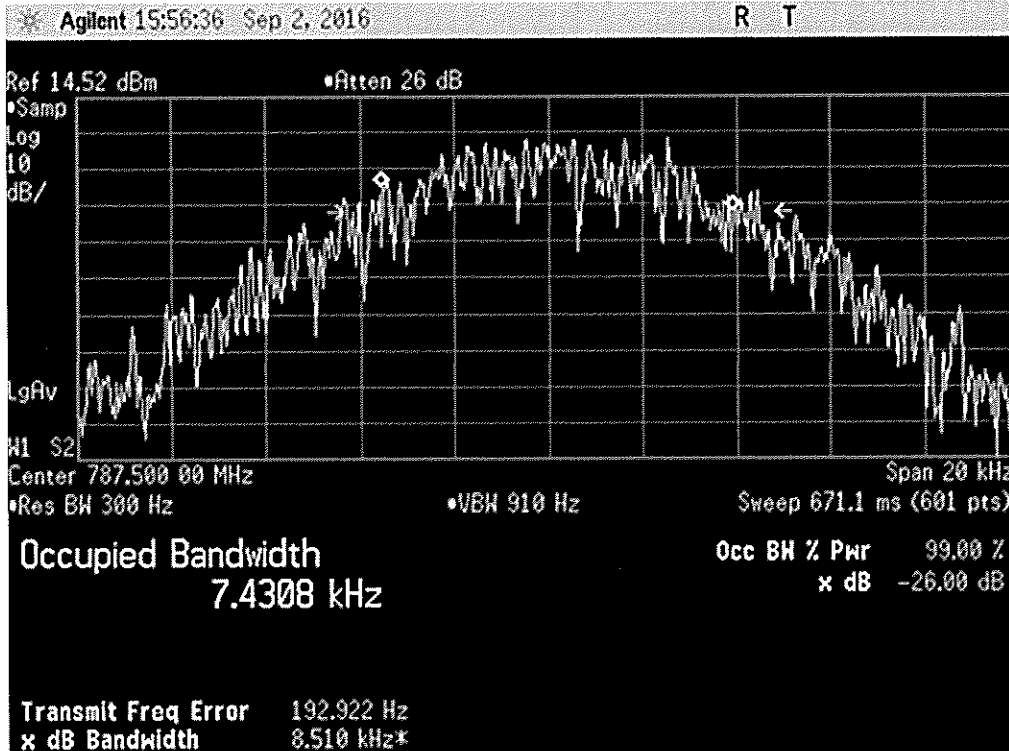


TELTEST Laboratories
 Tait Ltd
 Report Number 3781
 Occupied Bandwidth

Tx FREQUENCY: 787.5 MHz 3 W 12.5 kHz ch. sp. DMR



Tx FREQUENCY: 787.5 MHz 1 W 12.5 kHz ch. sp. DMR



TRANSMITTER SPURIOUS EMISSIONS (CONDUCTED) Part 1

SPECIFICATIONS: FCC 47 CFR 2.1051
GUIDE: TIA-102.CAAA-C 2.2.7

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. The frequency range examined was from the lowest frequency generated within the EUT, to a frequency higher than the 10th Harmonic: 100 kHz to Fc-BW
Fc+ BW to 10Fc GHz
3. A Pre-scan is performed with a resolution bandwidth of 1 kHz, and a video bandwidth of 3 kHz. If any emissions are found to be within 20 dB of the limit a second measurement is made with the carrier modulated, and a resolution bandwidth of 10 kHz, and a video bandwidth of 30 kHz.

Spurious emissions which were attenuated by more than 20 dB below the limit were not recorded.

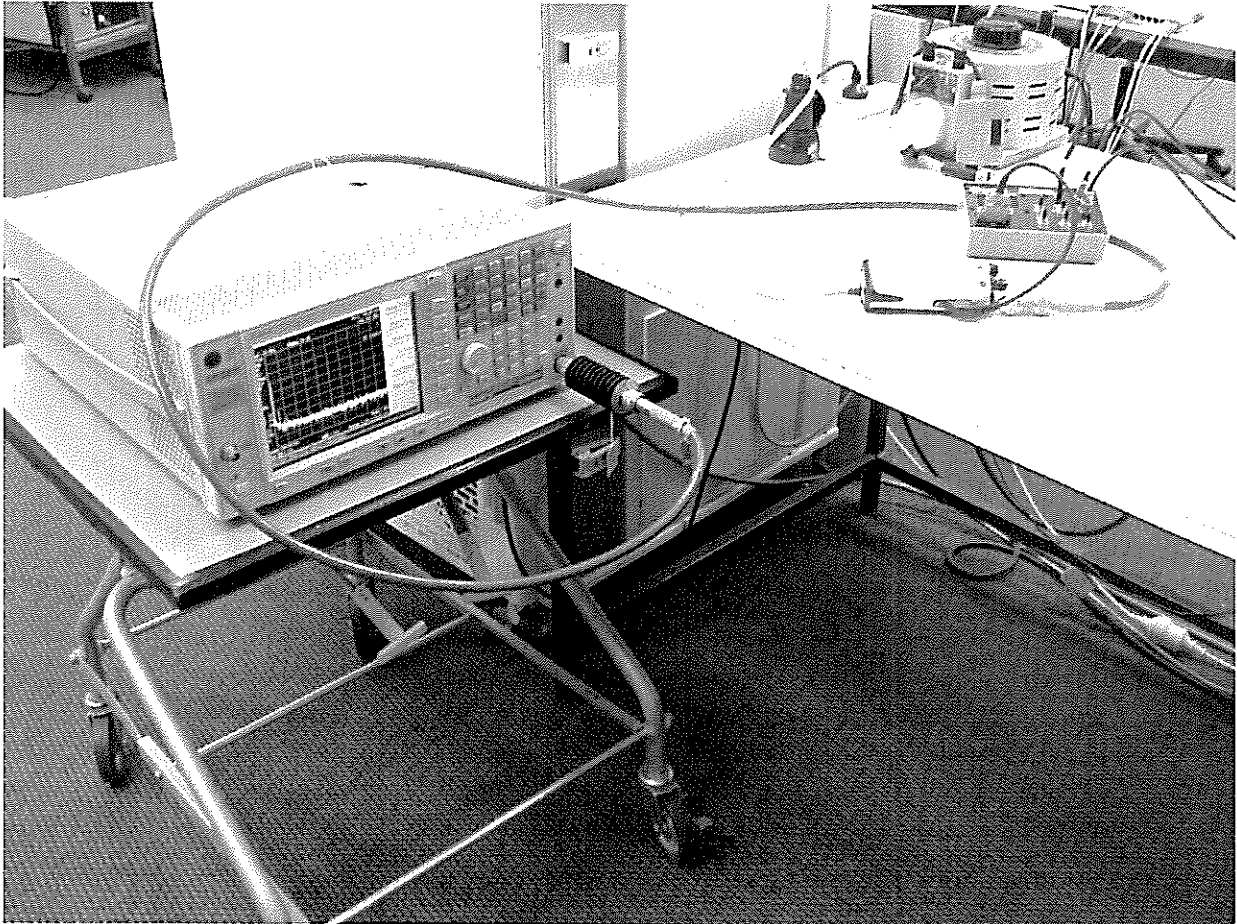
A photograph of the test set-up is included below.

MEASUREMENT RESULTS:

See the tables on the following pages.

LIMIT CLAUSES: FCC 47 CFR 27.53 c (1)

Photo: Conducted Emissions Test Setup



Spurious Emissions (Tx Conducted)

SPECIFICATION: FCC 47 CFR 27.53 c(1)

Tx FREQUENCY: 787.5 MHz

12.5 kHz Channel Spacing 787.5 MHz @ 3 W

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|-------------|-------------|
| ~ | ~ | ~ |
| No emissions were detected at a level greater than -40 dBm. | | |

12.5 kHz Channel Spacing 787.5 MHz @ 1 W

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|-------------|-------------|
| ~ | ~ | ~ |
| No emissions were detected at a level greater than -40 dBm. | | |

LIMITS: FCC 47 CFR 27.53 c (1)

| Carrier Output Power | $43 + 10 \text{ Log}_{10} (P_{\text{Watts}})$ | |
|----------------------|---|---------|
| 3 W | -13 dBm | -48 dBc |
| 1 W | -13 dBm | -43 dBc |

TRANSMITTER SPURIOUS EMISSIONS (CONDUCTED) Part 2

SPECIFICATIONS: FCC 47 CFR 27.53 c (3) & (6)
GUIDE: TIA-102.CAAA-C 2.2.7

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. The frequency range examined was from 763-775MHz and 793-805MHz.
3. A Scan is performed with a resolution bandwidth of 6.25 kHz, and a video bandwidth of 6.25 kHz.

MEASUREMENT RESULTS:

See the tables and plots on the following pages.

LIMIT CLAUSES: FCC 47 CFR 27.53 c (3) & (6)

Tx FREQUENCY: 787.5 MHz

12.5 kHz Channel Spacing 787.5 MHz @ 3 W

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|-------------|-------------|
| ~ | ~ | ~ |
| No emissions were detected exceeding the limit. | | |

12.5 kHz Channel Spacing 787.5 MHz @ 1 W

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|-------------|-------------|
| ~ | ~ | ~ |
| No emissions were detected exceeding the limit. | | |

25.0 kHz Channel Spacing 787.5 MHz @ 3 W

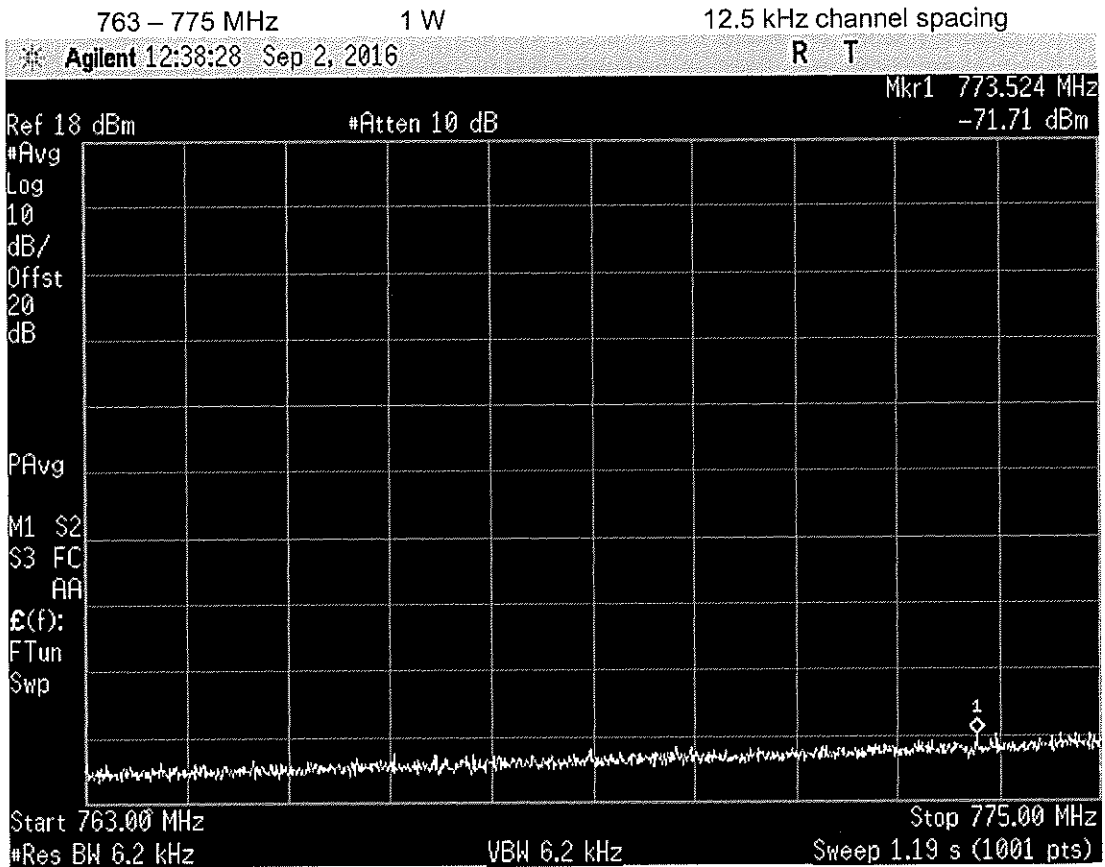
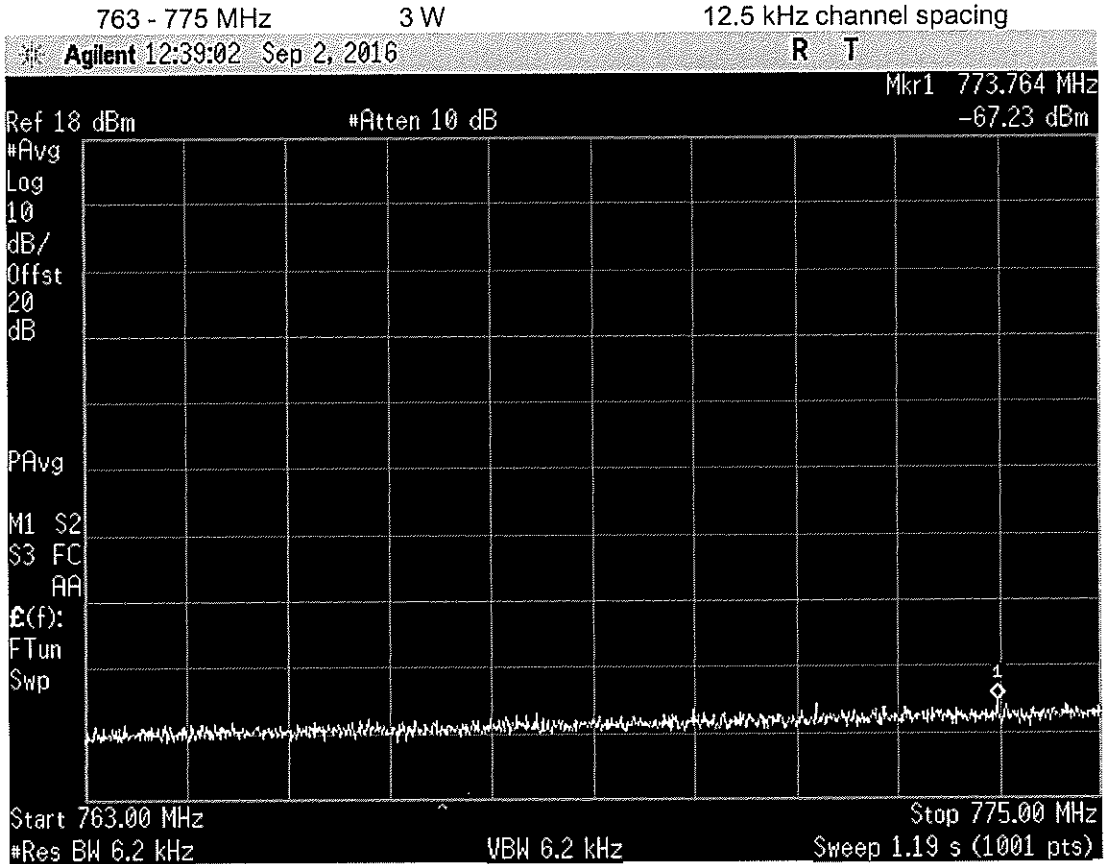
| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|-------------|-------------|
| ~ | ~ | ~ |
| No emissions were detected exceeding the limit. | | |

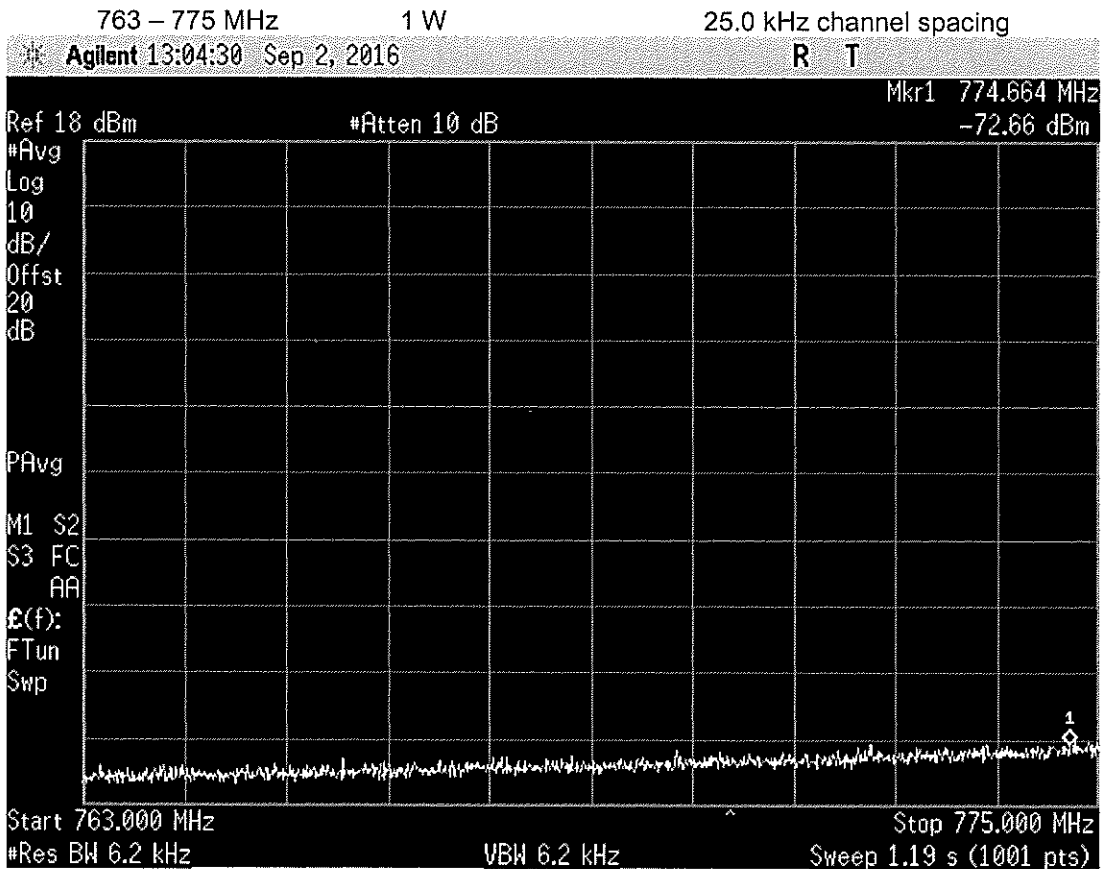
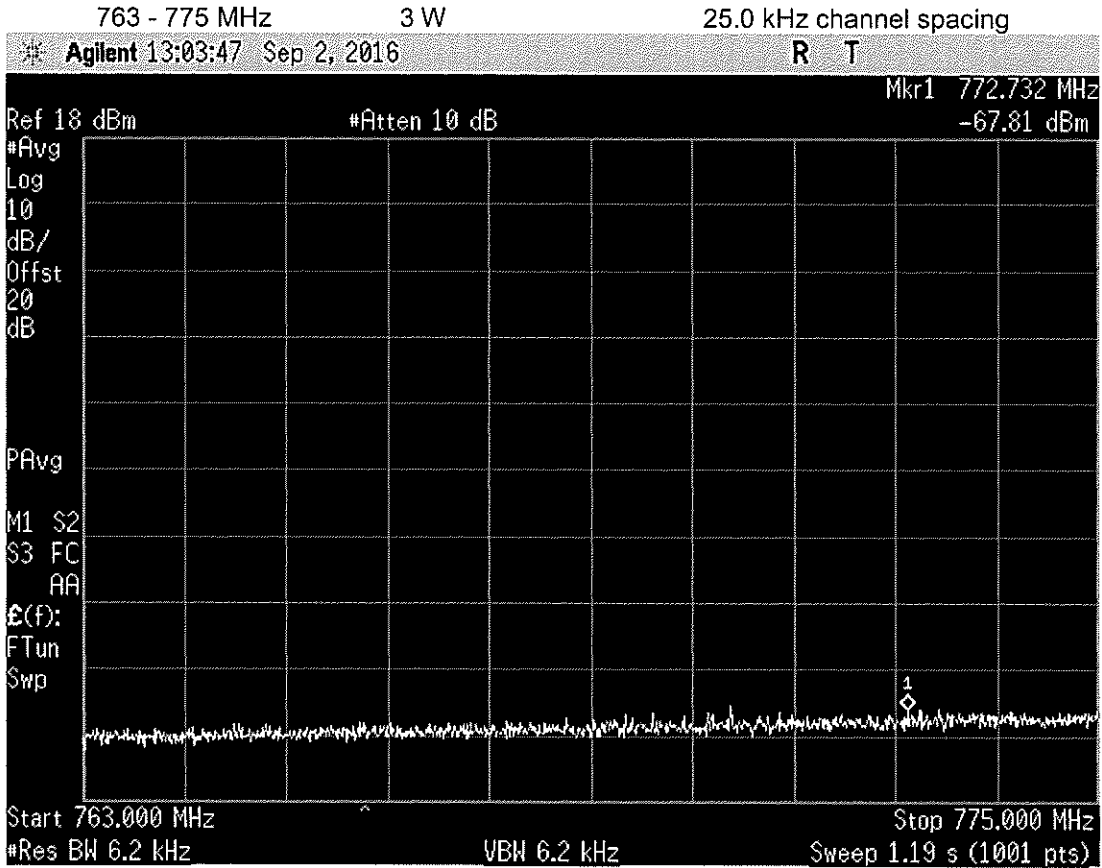
25.0 kHz Channel Spacing 787.5 MHz @ 1 W

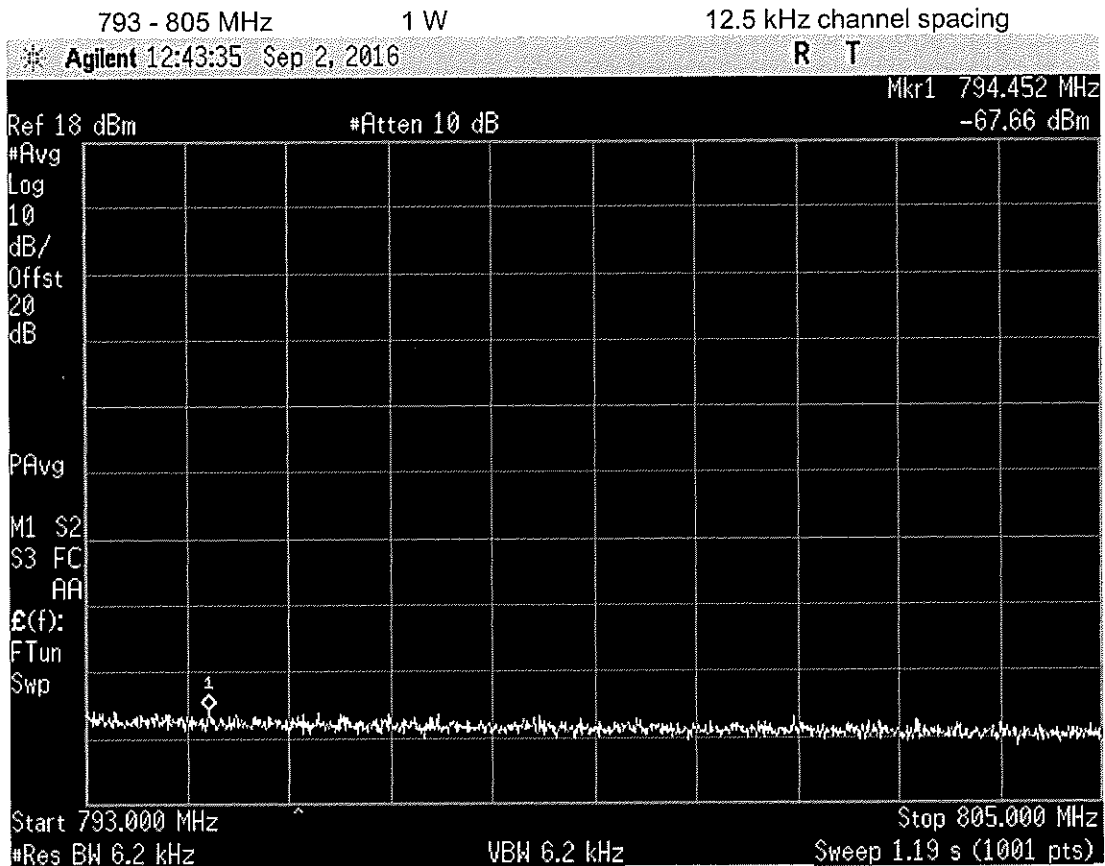
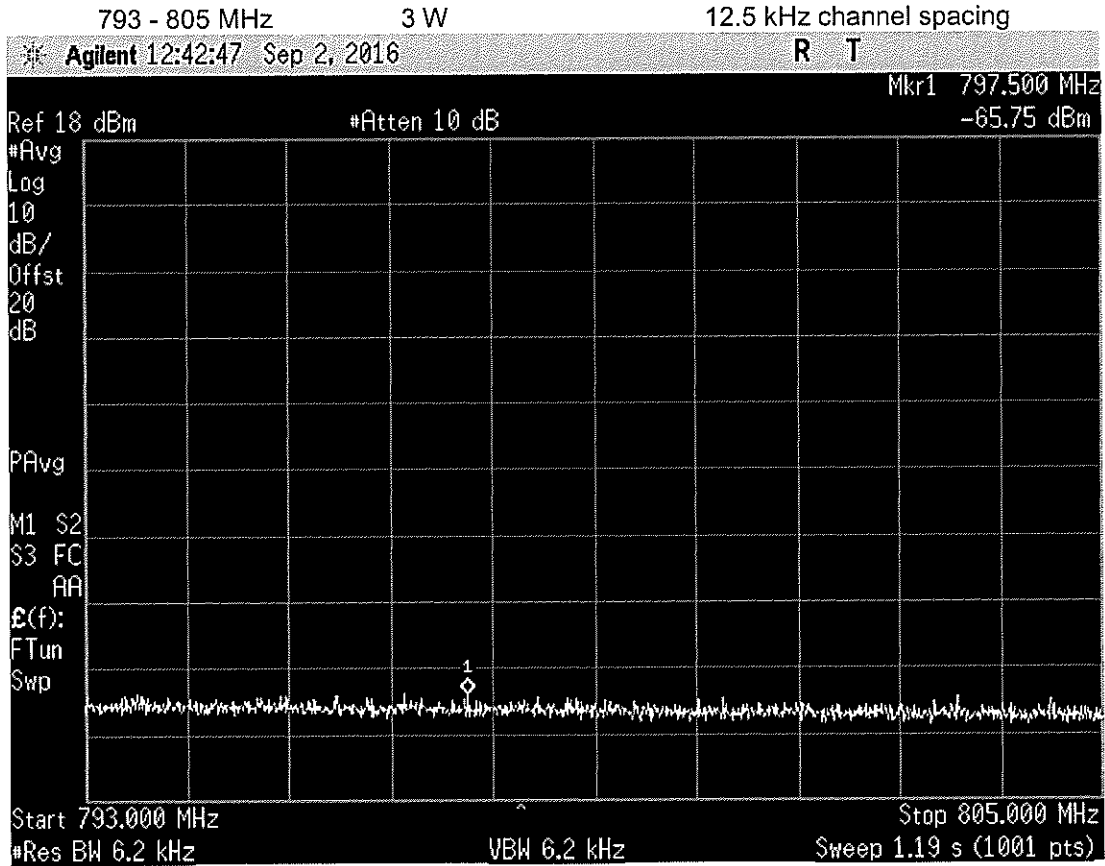
| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|-------------|-------------|
| ~ | ~ | ~ |
| No emissions were detected exceeding the limit. | | |

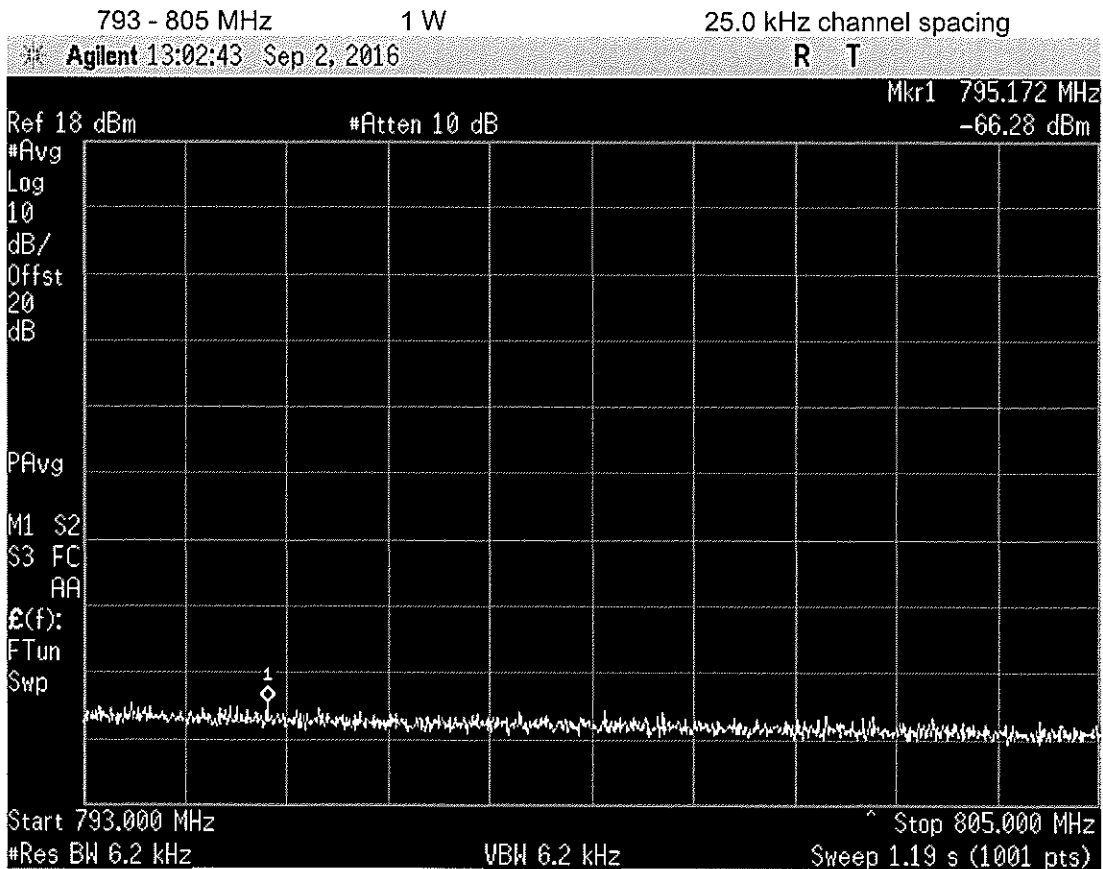
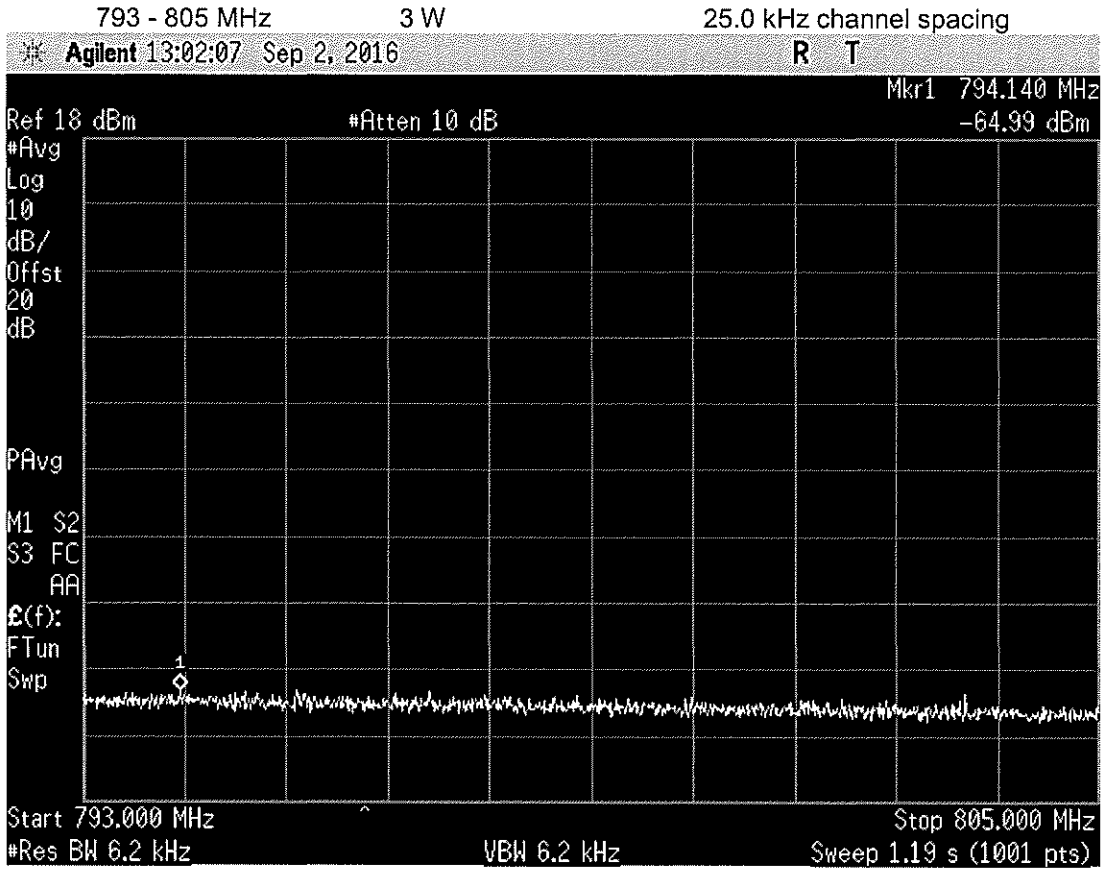
LIMITS: FCC 47 CFR 27.53 c (3) & (6)

| Carrier Output Power | $76 + 10 \text{ Log}_{10} (P_{\text{Watts}})$ | |
|----------------------|---|---------|
| 3 W | -46 dBm | -81 dBc |
| 1 W | -46 dBm | -76 dBc |









TRANSMITTER SPURIOUS EMISSIONS (RADIATED) Part 1

SPECIFICATION: FCC 47 CFR 2.1053

GUIDE: TIA-102.CAAA-C 2.2.6

MEASUREMENT PROCEDURE:

Initial Scan:

1. The EUT is placed in the S-Line TEM cell and emissions are measured from 30 MHz to 800 MHz. Any emission within 20 dB of the limit is then re-tested on the OATS.
2. The EUT is placed in the reverberation chamber and emissions are measured from 800 MHz to the upper frequency required. Any emission within 20 dB of the limit is then re-tested on the OATS.
3. The harmonics emissions up to the 6th harmonic of the fundamental frequency are measured on the OATS

OATS Measurement:

1. The EUT is placed on a wooden turntable at a distance of three metres from the test antenna. The output terminal is connected to an RF dummy load.
2. The test antenna is raised from 1 m to 4 m to obtain a maximum reading; the turntable is then rotated through 360° to obtain the maximum response of each spurious emission. Valid emissions are determined by switching the EUT on and off.
3. The EUT is then replaced by a signal generator and substitution antenna to make measurements by the substitution method.

MEASUREMENT RESULTS:

See the tables on the following pages

LIMIT CLAUSE: FCC 47 CFR 27.53 c (1)

Spurious Emissions (Tx Radiated)

SPECIFICATION: FCC CFR 2.1053

12.5 kHz Channel Spacing 787.5 MHz @ 3 W

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|-------------|-------------|
| ~ | ~ | ~ |
| No emissions were detected at a level greater than -40dBm | | |

12.5 kHz Channel Spacing 787.5 MHz @ 1 W

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|-------------|-------------|
| ~ | ~ | ~ |
| No emissions were detected at a level greater than -40dBm | | |

LIMITS: FCC 47 CFR 27.53 c (1)

| Carrier Output Power | $43 + 10 \text{ Log}_{10} (P_{\text{Watts}})$ | |
|----------------------|---|---------|
| 3 W | -13 dBm | -48 dBc |
| 1 W | -13 dBm | -43 dBc |

Tx Radiated Emissions - Continued

Open Area Test Site Results for first six harmonics:

12.5 kHz Channel Spacing

787.5 MHz @ 3 W

| Harmonics Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---------------------------------------|-------------|-------------|
| 1575.0 | -46.31 | -81.31 |
| 2362.5 | -53.90 | -88.90 |
| 3150.0 | -62.05 | -97.05 |
| 3937.5 | -59.94 | -94.94 |
| 4725.0 | -58.45 | -93.45 |
| 5512.5 | -53.00 | -88.00 |

Photo: OATS Setup



TRANSMITTER SPURIOUS EMISSIONS (RADIATED) Part 2

SPECIFICATIONS: FCC 47 CFR 27.53 c (3) & (6)
GUIDE: TIA-102.CAAA-C 2.2.7

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. The frequency range examined was from 763-775MHz and 793-805MHz.
3. A Scan is performed with a resolution bandwidth of 6.25 kHz, and a video bandwidth of 6.25kHz.

MEASUREMENT RESULTS:

See the tables below.

LIMIT CLAUSES: FCC 47 CFR 27.53 c (3) & (6)

Tx FREQUENCY: 787.5 MHz

12.5 kHz Channel Spacing 787.5 MHz @ 3 W

| Emission Frequency (MHz) | Level (dBm) | Level (dBc) |
|---|-------------|-------------|
| ~ | ~ | ~ |
| No emissions were detected exceeding the limit. | | |

LIMITS: FCC 47 CFR 27.53 c (3) & (6)

| Carrier Output Power | 12.5 kHz Channel Spacing $76 + 10 \text{ Log}_{10} (P_{\text{Watts}})$ | |
|----------------------|---|---------|
| | 3 W | -46 dBm |
| 1 W | -46 dBm | -76 dBc |

TRANSMITTER SPURIOUS EMISSIONS (RADIATED) Part 3

SPECIFICATIONS: FCC 47 CFR 27.53 (f)
GUIDE: TIA-102.CAAA-C 2.2.7

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. The frequency range examined was from 1559-1610 MHz.
3. A Scan is performed with a resolution bandwidth of 1MHz and 1kHz respectively.

MEASUREMENT RESULTS:

787.5 MHz 3 W 12.5 kHz Channel Spacing

| Sweep Band (MHz) | Maximum Observed Level (dBuV/m) | Limit (dBuV/m) | Polarity | RBW |
|------------------|---------------------------------|----------------|------------|-------|
| 1559 – 1610 | 31.8 | 55.2 | Horizontal | 1 MHz |
| 1559 – 1610 | 31.8 | 55.2 | Vertical | 1 MHz |
| 1559 – 1610 | 30.8 | 45.2 | Horizontal | 1 kHz |
| 1559 – 1610 | 30.8 | 45.2 | Vertical | 1 kHz |

LIMIT CLAUSES: FCC 47 CFR 27.53 (f)

For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

Measurements were attempted at a distance of 3 metres which gave the following limits using the formula:

$$\text{Field strength (V/m)} = (\text{square root } (30 * \text{power (watts)}) / \text{distance (metres)})$$

This gave limits of 55.2 dBuV/m for wideband emissions and 45.2 dBuV/m for discrete emissions.

TRANSMITTER FREQUENCY STABILITY - TEMPERATURE

SPECIFICATION: FCC 47 CFR 2.1055 (a) (1)

GUIDE: TIA-102.CAAA-C 2.2.2

MEASUREMENT PROCEDURE:

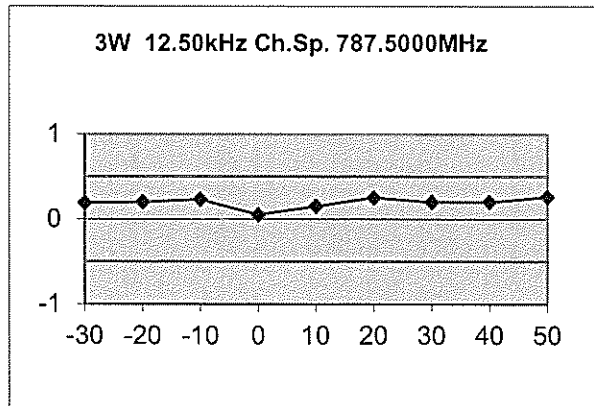
1. Refer Annex A for equipment set up.
2. The EUT was tested for frequency error from -30° C to +50° C in 10° C increments
3. The frequency error was recorded in parts per million (ppm).

MEASUREMENT RESULTS:

See the plots below.

Tx Frequency: 787.5 MHz 3 W

| Temperature (°C) | Frequency (Hz) | Error (ppm) |
|------------------|----------------|-------------|
| -30 | 147 | 0.19 |
| -20 | 161 | 0.20 |
| -10 | 185 | 0.23 |
| 0 | 39 | 0.05 |
| 10 | 118 | 0.15 |
| 20 | 195 | 0.25 |
| 30 | 161 | 0.20 |
| 40 | 155 | 0.20 |
| 50 | 202 | 0.26 |



LIMIT: FCC 47 CFR 27.54

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

TRANSMITTER FREQUENCY STABILITY - VOLTAGE

SPECIFICATION: FCC 47 CFR 2.1055 (d) (1)

GUIDE: TIA-102.CAAA-C 2.2.2

MEASUREMENT PROCEDURE:

1. Refer Annex A for equipment set up.
2. The EUT was tested for frequency error at an input voltage to the radio of 85% to 100%.
3. The frequency error was recorded in parts per million (ppm).

MEASUREMENT RESULTS:

Tx Frequency: 787.5 MHz

| Voltage | FREQUENCY ERROR (ppm) | FREQUENCY ERROR (ppm) |
|-----------------------|--------------------------|--------------------------|
| | 3 W | 1 W |
| 7.5 V _{DC} | 0.11 | 0.12 |
| 6.375 V _{DC} | 0.12 | 0.13 |

LIMIT: FCC 47 CFR 27.54

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

TEST EQUIPMENT LIST

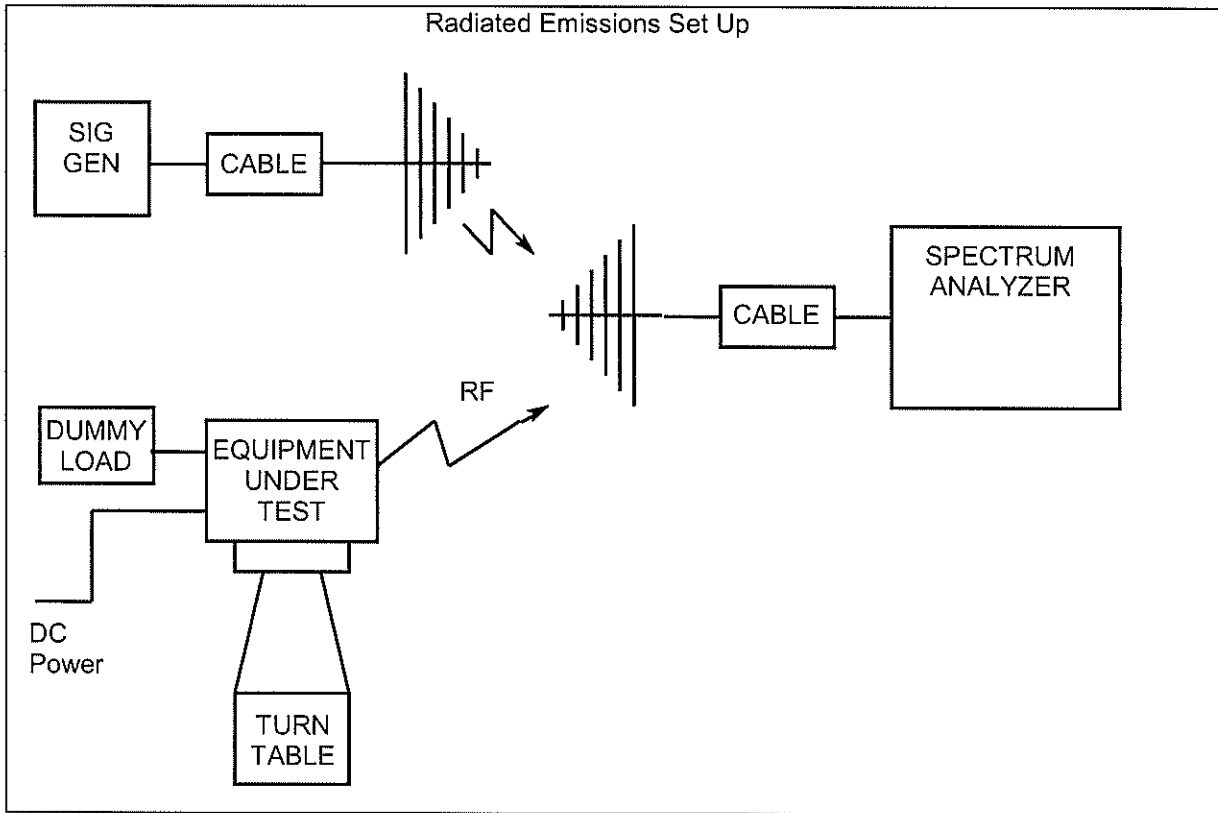
| Equipment Type | Information | Manufacturer | Model No | Serial No# | Tait ID | Cal Due |
|---------------------|------------------------------|-----------------|--------------------|---------------|---------|-----------|
| Antenna | Reference Dipoles | Emco | 3121C DB1 | 9510-1164 | E3559 | 14-Apr-19 |
| Antenna | 18GHz DRG | Emco | DRG3115 | 2084 | E3076 | 29-Apr-19 |
| Antenna | Log Periodic | Schwarzbeck | VUSLP | 9111-219 | E4617 | |
| Antenna | Reverb - 1-18GHz DRG | Schwarzbeck | BBHA 9120 D | 9120D-885 | E4857 | |
| Antenna | Reverb - 1-18GHz DRG | Schwarzbeck | BBHA 9120 D | 9120D-884 | E4858 | |
| Audio Analyser | TREVA1 | Hewlett Packard | HP8903A | 2437A04625 | E4986 | 21-Oct-16 |
| Coax Cable | 2m Black | Suhner | RG214HF/Nm/Nm/2000 | TeltestBlack2 | E4623 | 18-Oct-16 |
| Coax Cable | 2m Black | Suhner | RG214HF/Nm/Nm/2000 | TeltestBlack3 | E4624 | 18-Oct-16 |
| Coax Cable | 3m Blue | Suhner | Sucoflex 104A | 44611/4A | E4620 | 18-Oct-16 |
| Coax Cable | OATS Turntable Cable 1 | Intelcom | RG214 | OATS1 | E4621 | 20-Oct-16 |
| Coax Cable | OATS Tower Cable | Intelcom | RG214 | OATS2 | E4622 | 20-Oct-16 |
| Coax Cable | Reverb - 4.5m Multiflex 141 | TeltestBlue6 | MF 141 | TeltestBlue6 | E4843 | 20-Oct-16 |
| Coax Cable | Reverb - 2m Multiflex 141 | TeltestBlue5 | MF 141 | TeltestBlue5 | E4844 | 20-Oct-16 |
| Coax Cable | Reverb - 2m Multiflex 141 | TeltestBlue4 | MF 141 | TeltestBlue4 | E4845 | 20-Oct-16 |
| Coax Cable | Reverb - 1m Multiflex 141 | TeltestBlue3 | MF 141 | TeltestBlue3 | E4846 | 20-Oct-16 |
| Coax Cable | Reverb - 1m Multiflex 141 | TeltestBlue1 | MF 141 | TeltestBlue1 | E4848 | 20-Oct-16 |
| Coax Cable | 2.5m Blue | Suhner | Sucoflex 104A | 33449/4PEA | E4997 | 18-Oct-16 |
| Coax Cable | OATS Turntable Cable 2 | Intelcom | RG215 | OATS3 | E4995 | 20-Oct-16 |
| Environ. Chamber | Upright | Contherm | 5400 RHSLT.M | 1416 | E4051 | 1-Aug-17 |
| Filter High Pass | | Tait | 4 MHz | N/A | - | |
| Filter Notch | | Tait | | N/A | - | |
| Modulation Analyser | TREVA1 | Hewlett Packard | HP8901B (Opt 002) | 2441A00393 | E3073 | 21-Oct-16 |
| OATS | NSA | Tait | | | | 20-Apr-17 |
| OATS | Antenna Tower | Electrometrics | EM-4720-2 | 112 | E4447 | |
| OATS | Controller | Electrometrics | EM-4700 | 119 | E4445 | |
| OATS | Turntable | Electrometrics | EM-4704A | 105 | E4446 | |
| OATS | FCC Listing Registration | | | 837095 | | 8-May-19 |
| Power Meter | TREVA1 Power Head for HP8901 | Hewlett Packard | HP11722A | 3111A05573 | E7054 | 21-Oct-16 |
| Power Supply | TREVA1 | Hewlett Packard | HP6032A | 2441A00412 | E3075 | 13-Oct-17 |
| RF Amplifier | +21.7 dB 1GHz | Tait | ZFL-1000LN | E3660 | E3360 | 17-Jan-17 |
| RF Amplifier | Pre-amplifier | Agilent | 87405C | MY47010688 | E4941 | 20-Oct-16 |
| RF Attenuator | 10dB 50W | Weinschel | 24-10-34 | AZ0401 | E3388 | 18-Oct-16 |
| RF Attenuator | TREVA1 3dB | Weinschel | Model 1 | BL9958 | E4081 | |
| RF Chamber | S-LINE TEM CELL | Rohde & Schwarz | 1089.9296.02 | 338232/003 | E3636 | 29-Sep-16 |

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| Equipment Type | Information | Manufacturer | Model No | Serial No# | Tait ID | Cal Due |
|----------------------------|--|--------------|--------------------|------------|---------|-----------|
| RF Chamber | Reverb - Stirrer controller for reverb chamber | Teseq | Stirrer Controller | 29765.1 | E4854 | |
| RF Chamber | Reverb - 0.5 - 18GHz Reverberation Chamber | Teseq | RVC XS | 29765 | E4855 | |
| RF Combiner | TREVA1 | Minicircuits | ZFSC-4-1 | - | E4083 | |
| RF Load | 50W | Weinschel | F1426 | BF0487 | E3675 | 19-Oct-16 |
| Signal Generator | Analog 4GHz | Agilent | E4422B | GB40050320 | E3788 | 18-Oct-16 |
| Signal Generator | TREVA1 Analog 3.2GHz | Agilent | E8663D | MY50420224 | E4908 | 16-Oct-16 |
| Signal Generator | Digital 4GHz | Agilent | E4433B | US38440446 | E4147 | 22-Oct-16 |
| Spectrum Analyser | 26.5GHz | Agilent | PXA N9030A | MY49432161 | E4907 | 29-Oct-16 |
| Spectrum Analyser | 13.2GHz | Agilent | E4445A | MY42510072 | E4139 | 22-Oct-16 |
| Temp & Humidity datalogger | | Hobo | U21-011 | 10134276 | E4981 | 26-Oct-16 |

NOTE: Items without calibration dates are calibrated immediately before use, or set using calibrated instruments.

ANNEX A – TEST SETUP DETAILS



All other testing is performed using the Teltest Radio EVALuation system (TREVA), which is configured as shown below. The Spectrum Analyser is connected to the EUT via the attenuator network for Conducted Emissions testing, and Occupied Bandwidth.

