**TEST REPORT ON**
**Park Air**

VHF AM Transmitter

FCC Authorization Procedures
Part 2 subpart J and part 87

**TEST REPORT NUMBER**
**CTMS 2000/1221**
**January 2000**

**Prepared for:**

**Park Air Electronics Ltd.**
**Bleheim Way,**
**Northfields,**
**Market Deeping,**
**Peterborough,**
**Lincolnshire**
**PE6 8UE**

This results in this report refer to the tested unit only

# Certificate of Application

Cambridge Test and Measurement Services Ltd., certifies that the product tested was fully compliant with the requirements of Parts 2 & 87 of the FCC Code of Regulations 47CFR, the results of which are contained in this test report No: CTMS 2000/1221A

I certify that the application was prepared under my supervision and that to the best of my knowledge and belief, the facts set forth in this application and technical data, are true and correct.

Signature :

Date : 8/2/2000

Name : David Fisher

Title : Radio Technical Manager

I certify that to the best of my knowledge and belief, the facts set forth in this application and accompanying technical data, are true and correct.

Signature :

Date : 8/2/2000

Name : Alan Parrish

Title : Director.

## General Test Information

| | | |
|---|---|---|
| Date Test Sample Received | : | 18th January 2000 |
| Date Testing Started | : | 19th January 2000 |
| Date Testing Finished | : | 20th January 2000 |
| Equipment Serial Number | : | 2003 |
| CTMS Project Number | : | 2000/1221 |
| Test Engineer | : | M. Billis |

Report Copy No

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## 2.1033 **Application for Certification**

For use in accordance with FCC Rules and Regulations 47 CFR parts 2 and parts 87.

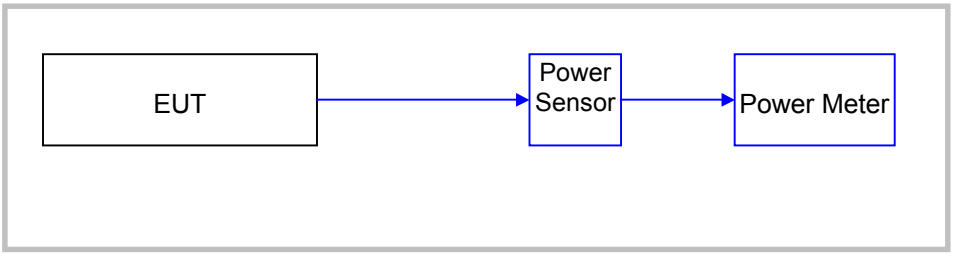
| | | | |
|---|---|---|---|
| 2.1033 (c) (1) | Name of applicant | : | Park Air Electronics Ltd. |
| | Address of applicant | : | Bleheim Way,<br>Northfields,<br>Market Deeping,<br>Peterborough,<br>Lincolnshire<br>PE6 8UE |
| | Contact | : | Mr. A. Horsfield |
| 2.1033 (c) (2) | FCC Identifier | : | C8L B6350 |
| | Model Type Number | : | T6T/B6350 |
| 2.1033 (c) (3) | Installation and operating instructions | : | User Guide, see exhibit D |
| 2.1033 (c) (4) | Type(s) of emission | : | Amplitude Modulated<br>6K80A3EJN,5K00A3EJN |
| 2.1033 (c) (5) | Frequency range | : | 118 -136.975 MHz |
| 2.1033 (c) (6) | Output power range | : | 50 W |
| 2.1033 (c) (7) | Maximum power rating (part 87) | : | 50 W |
| 2.1033 (c) (8) | dc voltage applied to power amplifier | : | 26.0 V |
| | dc current to power amplifier | : | 7.5 A |
| 2.1033 (c) (9) | Tune-up procedure for RF power | : | n/a |
| 2.1033 (c) (10) | Schematic and description of circuit/devices for : | | see exhibit D & E |
| | Stabilizing frequency | : | see exhibit D & E |
| | Suppression of spurious radiation | : | see exhibit D & E |
| | Limiting modulation | : | see exhibit D & E |
| | Limiting Power | : | see exhibit D & E |
| 2.1033 (c) (11) | Photograph of identification plate / label | : | See exhibit ‘A’ |
| 2.1033 (c) (12) | Photographs of equipment | : | See pages 17-25 |

**RF Power Output at terminals - 47 CFR 2.1046**

The transmitter is operated under standard test conditions, using the standard test voltage, the transmitter, tuned in accordance with the procedure described in the accompanying documentation, was keyed in an unmodulated condition and the output was connected to a RF Power Meter via an attenuator of normal impedance matching that of the transmitter. The RF Power Output was observed and recorded.

The RF Power Output was measured in accordance with the following test configuration, using the test instruments listed.

(Calibrated items are indicated in Blue)




Test instruments used :

RF Power Meter : Hewlett Packard Type HP 435B
RF Power Sensor : Hewlett Packard Type HP 8481B

Results in accordance with Part 2.1046 and 87.131 Power and emissions

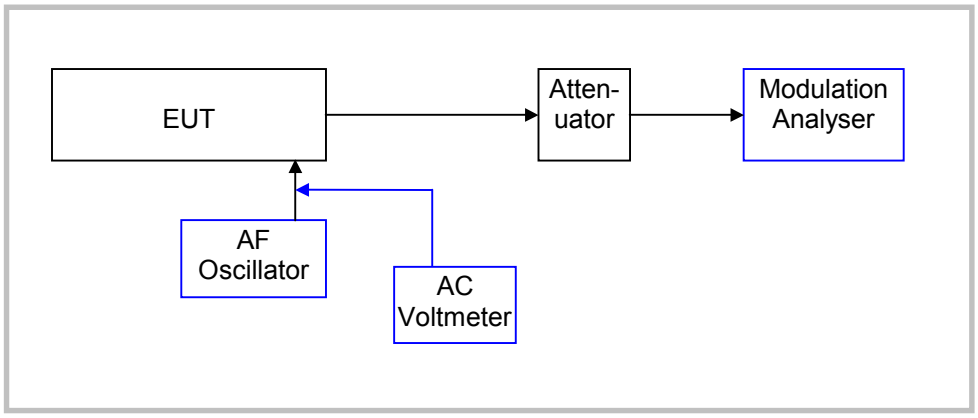
| TRANSMITTER POWER (Watts) | | |
|---|---|---|
| 118.0 MHz | 127.5 MHz | 136.975 MHz |
| 52.5 W | 55.5 W | 56.0 W |

**Modulation Characteristics - 47 CFR 2.1047 (a)**

The transmitter is operated under standard test conditions and the output monitored with a modulation analyzer via an attenuator of normal impedance matching that of the transmitter. A test signal of 1000Hz sine wave is applied to the normal input to the modulation circuit to the audio processing circuits, the level adjusted to give 30% depth of modulation. Ensuring the audio input level is maintained constant, the modulation frequency is varied from 100Hz to 10,000Hz. The variation in the depth of modulation is observed and recorded.

The modulation characteristic was measured in accordance with the following test configuration, using the test instruments listed.

(Calibrated items are indicated in Blue)

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Test instruments used :

| | | |
|---|---|---|
| RF Attenuator | : | Bird 30dB, 100W Type 8323 |
| AF Oscillator | : | Hewlett Packard Audio Analyser Type HP 8903B |
| AC Voltmeter | : | Hewlett Packard Audio Analyser Type HP 8903B |
| Modulation Analyzer | : | Hewlett Packard Modulation Analyser Type HP 8901B |

Results in accordance with Part 2.1047(a) and 87.141 Modulation Requirements : see attachment 1

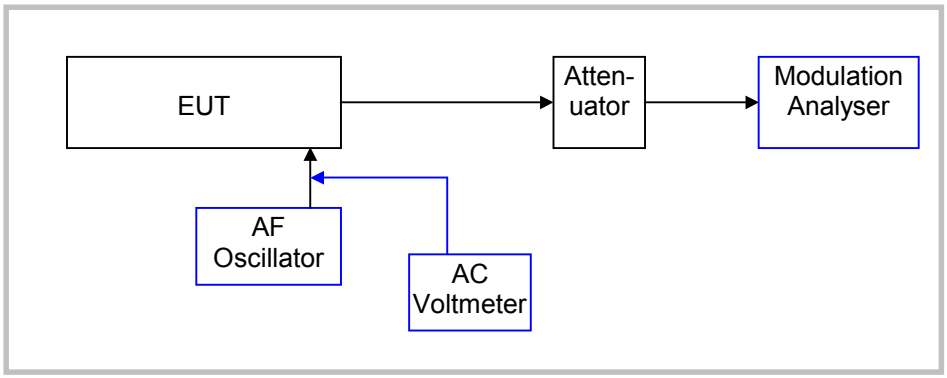
**Modulation Limiting Characteristics - 47 CFR 2.1047 (b)**

The transmitter is operated under standard test conditions and the output monitored with a modulation analyzer via an attenuator of normal impedance matching that of the transmitter. A test signal of 1000Hz sine wave is applied to the normal input to the modulation circuit to the audio processing circuits, the input level is varied between -50dBm to + 10dBm and the variation in the depth of modulation is observed and recorded.

The test was repeated with the test modulation frequency of 300Hz and 3000Hz.

The modulation limiting characteristic was measured in accordance with the following test configuration, using the test instruments listed.

(Calibrated items are indicated in Blue)




Test instruments used :

| | | |
|---|---|---|
| RF Attenuator | : | Bird 30dB, 100W Type 8323 |
| AF Oscillator | : | Hewlett Packard Audio Analyser Type HP 8903B |
| AC Voltmeter | : | Hewlett Packard Audio Analyser Type HP 8903B |
| Modulation Analyzer | : | Hewlett Packard Modulation Analyser Type HP 8901B |

Results in accordance with Part 2.1047 (b) and 87.141 Modulation Requirements : see attachment 2

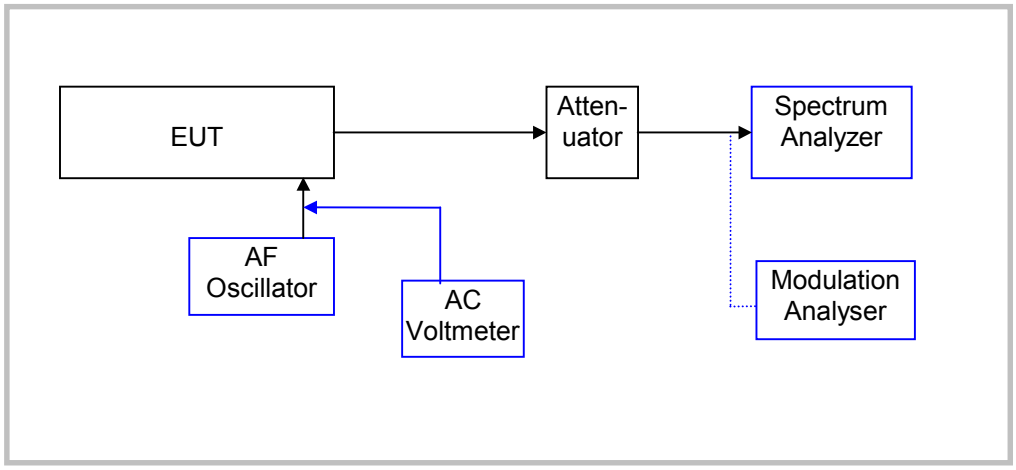
**Occupied Bandwidth - 47 CFR 2.1049 (1)**

The transmitter is operated under standard test conditions. A test signal of 2500Hz sine wave is applied to the normal input to the modulation circuit to the audio processing circuits, the input level is at a level of +16dB above that which produces a modulation depth of 50%.

The output of the transmitter is connected to a spectrum analyzer, via an attenuator of normal impedance matching that of the transmitter. The occupied bandwidth is observed and recorded.

The occupied bandwidth was measured in accordance with the following test configuration, using the test instruments listed.

(Calibrated items are indicated in Blue)




Test instruments used :

RF Attenuator : Bird 30dB, 100W Type 8323
AF Oscillator : Hewlett Packard Audio Analyser Type HP 8903B
AC Voltmeter : Hewlett Packard Audio Analyser Type HP 8903B
Modulation Analyzer : Hewlett Packard Modulation Analyser Type HP 8901B
Spectrum Analyzer : Anritsu Type MS 2602A

Results in accordance with Part 2.1049 and 87.139 : see attachment 3

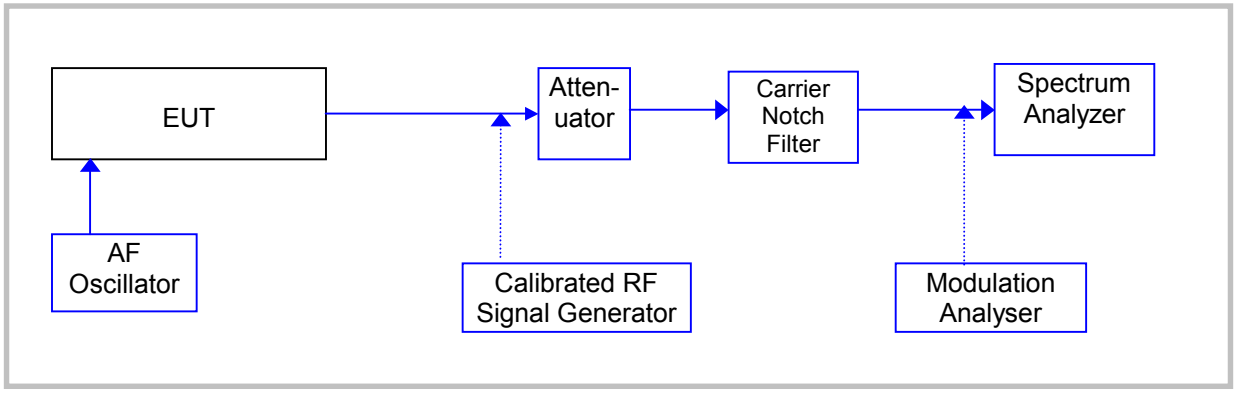
**Spurious emissions at antenna terminals - 47 CFR 2.1051**

The transmitter is operated under standard test conditions. The transmitter was modulated with normal test modulation being a sine wave of 1000Hz and a modulation depth of 50%. The output of the transmitter was connected to a spectrum analyzer, via an attenuator of normal impedance matching that of the transmitter. The spurious emissions, including harmonics of the fundamental carrier frequency, were observed

A carrier notch filter was inserted between the attenuator and spectrum analyzer to ensure the spectrum analyzer was not overloaded and maintaining linearity. The spurious emissions, including harmonics of the fundamental carrier frequency, were measured and recorded.

A calibrated RF signal generator replaced the EUT and the level of the signal generator was adjusted to achieve the same level as that measured on the spectrum analyzer. The level on the signal generator was recorded as being the level of the spurious emission measured by the substitution method. This method was used to as to ensure any non-linearities and unknown responses of the notch filter were taken into full account.

(Calibrated items are indicated in Blue)




Test instruments used :

| | | |
|---|---|---|
| RF Attenuator | : | Bird 30dB, 100W Type 8323 |
| AF Oscillator | : | Hewlett Packard Audio Analyser Type HP 8903B |
| RF Signal Generator | : | Marconi Type 2032 |
| Modulation Analyzer | : | Hewlett Packard Modulation Analyser Type HP 8901B |
| Spectrum Analyzer | : | Anritsu Type MS 2602A |
| Carrier Notch Filter | : | Telonic Altair Type TTR 190-3EE |

Results in accordance with Part 2.1051 and 87.139 Emission Limits

Note: Emissions 20dB below limit are not required to be listed

Carrier Frequency (Fc) : 127.5 MHz

| | | **Absolute Level** | **Level (relative to RF Power 50W) dB w.r.t limit of 43+10 log power** | |
|---|---|---|---|---|
| **Frequency** | **Identity** | **dBm** | **dBc** | **Remarks** |
| **(MHz)** | | **limit - 13** | **limit - 60** | |
| 255.00 | 2Fc | -48dBm | -95dBc | All greater than |
| 382.50 | 3FC | -43dBm | -90dBc | 20dB within |
| 637.50 | 4Fc | -65dBm | -112dBc | Specification |
| | | | | Limit. |

## Field Strength of Spurious radiation - 47 CFR 2.1053

The transmitter (the EUT) was placed on a wooden table with cables suitably dressed. The output of the EUT was connected to a dummy, non-radiating, load of normal impedance matching that of the transmitter. At a distance of 30 (10m) feet from the transmitter (EUT) the radiated field for each spurious radiation, including harmonics from the carrier frequency, were detected and measured on a calibrated receiver which was fed from a calibrated log-periodic antenna. The antenna was oriented in horizontal polarisation plane and was raised and lowered so as to ensure the maximum level of the spurious emission was detached.

The EUT was rotated through 360°, the emission levels for each spurious, including harmonics of the carrier frequency, were observed on the receiver and recorded .

The test above was repeated with the receiving antenna in the vertical polarisation plane.

The EUT was replaced by a calibrated half-wave dipole, the substitution antenna, which was fed from a calibrated signal generator. The level of the signal generator was adjusted to achieve the same level as that detected on the calibrated receiver. The level on the signal generator was recorded as being the level of the spurious emission measured by the substitution method.

For each of the emissions detected the EUT was switched off to determine the emission was that of the EUT.

The measurement facilities at Cambridge Test and Measurement Services LTD, are in accordance with ANCI C63.4 and lodged with the FCC under rule 2.948, a letter from the FCC recognising compliance with the requirements was dated March 02,1999 with the registration number 93385.

Test instruments used :

RF Signal Generator : Marconi Type 2032
Receiver(s) : Rohde & Schwarz Type(s) ESVS 10, ESHS 10
Antenna(s) : Schaffner Type CB2614A & EMCO Type 6502

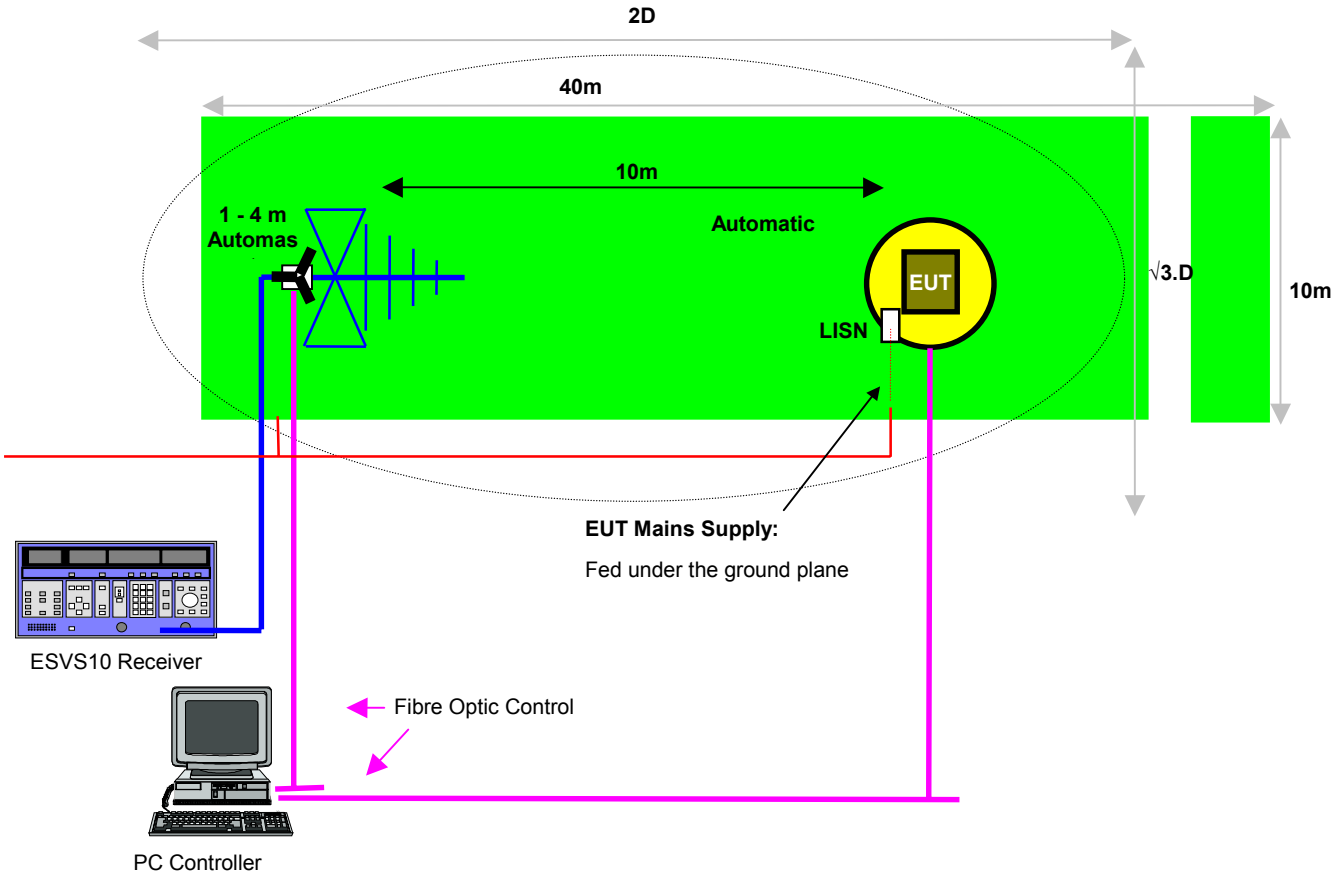
Results in accordance with Part 2.1053 and 87.139 Emission Limits

Notes: 1 Emissions 20dB below limit are not required to be listed
2 Following a pre-scan below 30MHz, no emissions detected greater than 20dB above specification limits

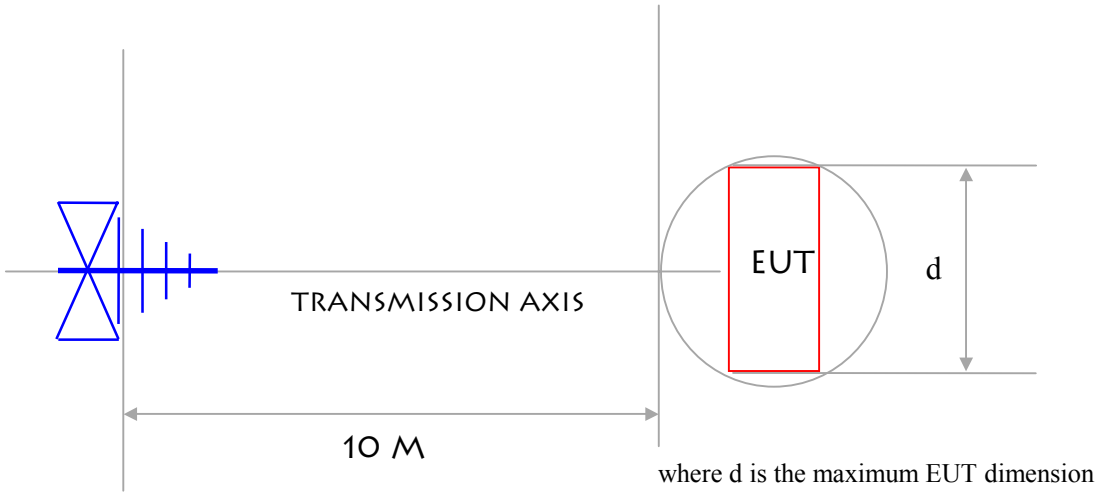
Carrier Frequency (Fc) : 127.5 MHz

| Frequency (MHz) | Identity | Absolute Level dBm | Level (relative to RF Power 50W) dB w.r.t limit of 43+10 log power | |
|---|---|---|---|---|
| | | limit - 13 | limit -60 dBc | Remarks |
| 225.00 | 2Fc | -64 | -111 | All greater than 20dB |
| 510.00 | 4Fc | -68 | -116 | within Specification Limit. |

## Open Area Test Site (OATS)




*Equipment Test Set Up*




*Antenna to EUT Distance*

**Frequency Stability with Temperature Variation - 47 CFR 2.1055 (a) (1)**

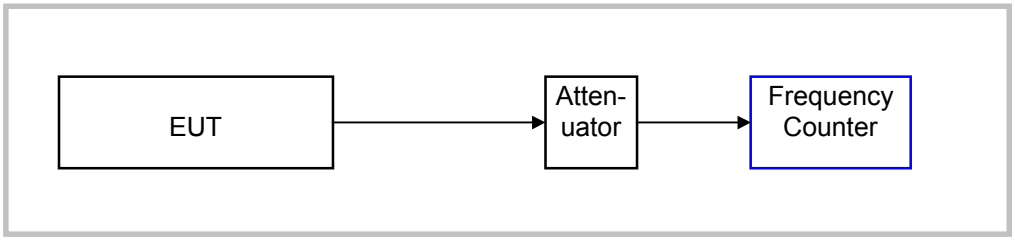
The transmitter is operated under standard test conditions, using the standard test voltage, the transmitter, tuned in accordance with the procedure described in the accompanying documentation, was keyed in an unmodulated condition and the output was connected to a RF Frequency Counter via an attenuator of normal impedance matching that of the transmitter.

The temperature was measured over the range of -30° C to + 50 ° C in steps of 10°

The Frequency drift of the EUT was observed and recorded.

The frequency drift was measured in accordance with the following test configuration, using the test instruments listed.

(Calibrated items are indicated in Blue)




The attenuator was at the nominal impedance of the transmitter.

Test instruments used :

| | | |
|---|---|---|
| RF Frequency Counter | : | Hewlett Packard Modulation Analyser Type HP 8901B |
| RF Attenuator | : | Bird 30dB, 100W Type 8323 |
| Climatic Chamber | : | Heraeus Votsch Type VMT/04/240 |
| Off Air Frequency Standard: | | Radio Spares Type 2A |

Results in accordance with Part 2.1053 (a) (1) and 87.133 Frequency Stability : see attachment 4

**Frequency Stability with primary voltage variation - 47 CFR 2.1055 (d) (1)**

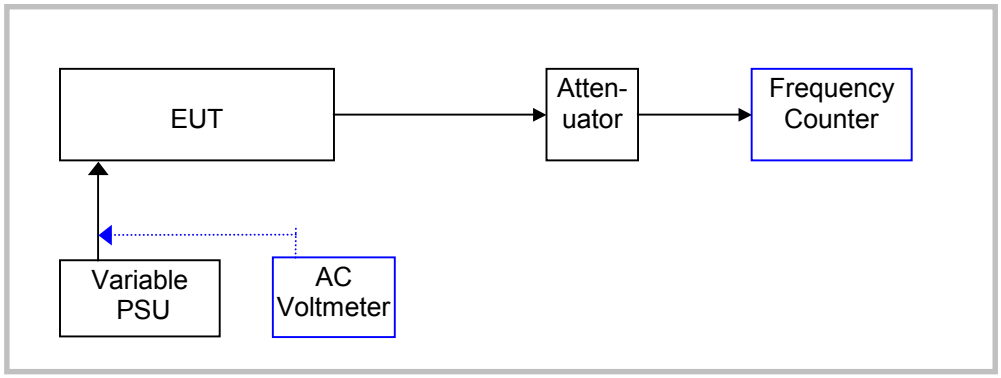
The transmitter is operated under standard test conditions, using the standard test voltage, the transmitter, tuned in accordance with the procedure described in the accompanying documentation, was keyed in an unmodulated condition and the output was connected to a RF Frequency Counter via an attenuator of normal impedance matching that of the transmitter.

The primary voltage was varied from 85 % to 115% of the nominal.

The Frequency drift of the EUT was observed and recorded.

The frequency drift was measured in accordance with the following test configuration, using the test instruments listed.

(Calibrated items are indicated in Blue)




The attenuator was at the nominal impedance of the transmitter.

Test instruments used :

| | | |
|---|---|---|
| RF Frequency Counter | : | Hewlett Packard Modulation Analyser Type HP 8901B |
| RF Attenuator | : | Bird 30dB, 100W Type 8323 |
| Variable Power Supply | : | Mains Variac |
| AC Voltmeter | : | Philips Type PM 2534 |
| Off Air Frequency Standard: | | Radio Spares Type 2A |

Results in accordance with Part 2.1053 (d) (1) and 87.133 Frequency Stability : see attachment 5

**Frequency spectrum to be investigated - 47 CFR 2.1057**

The level of frequency search was from the lowest radio frequency generated to the 10$^{th}$ Harmonic of the fundamental frequency, the highest carrier frequency.

**General Test Conditions**

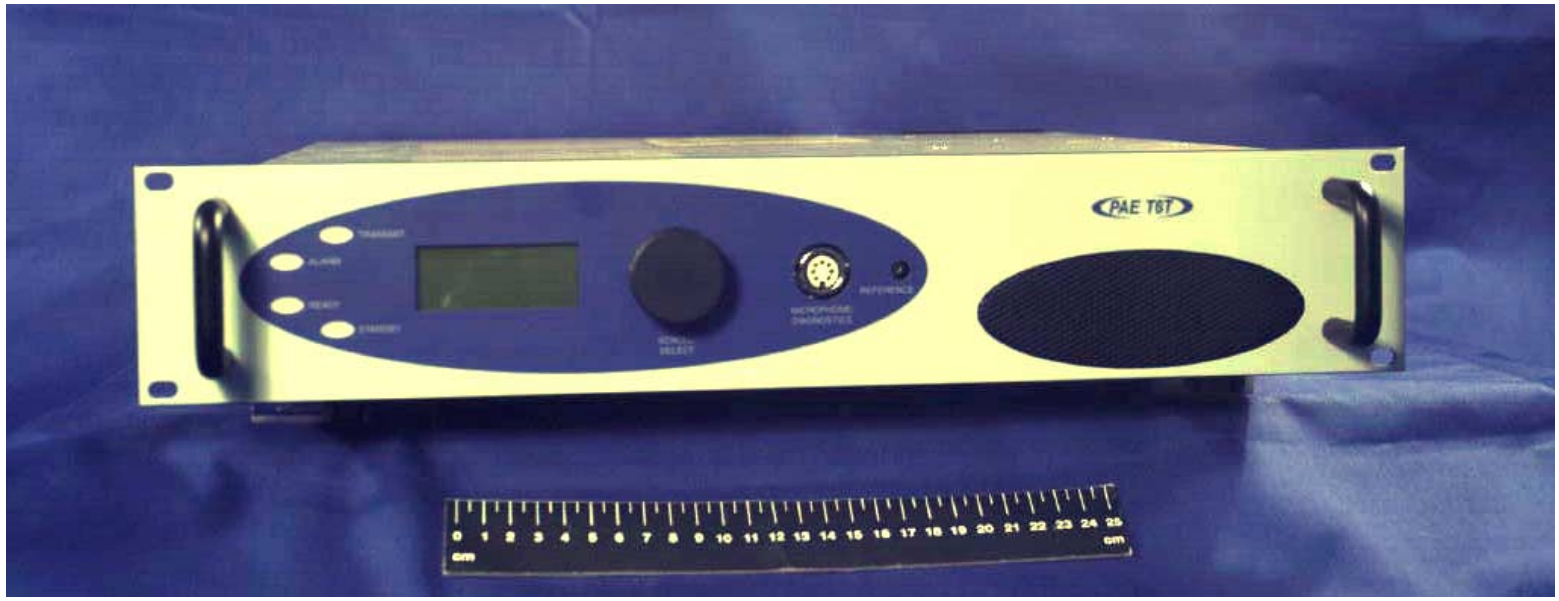
Laboratory environment .

Ambient Temperature : 23 °C

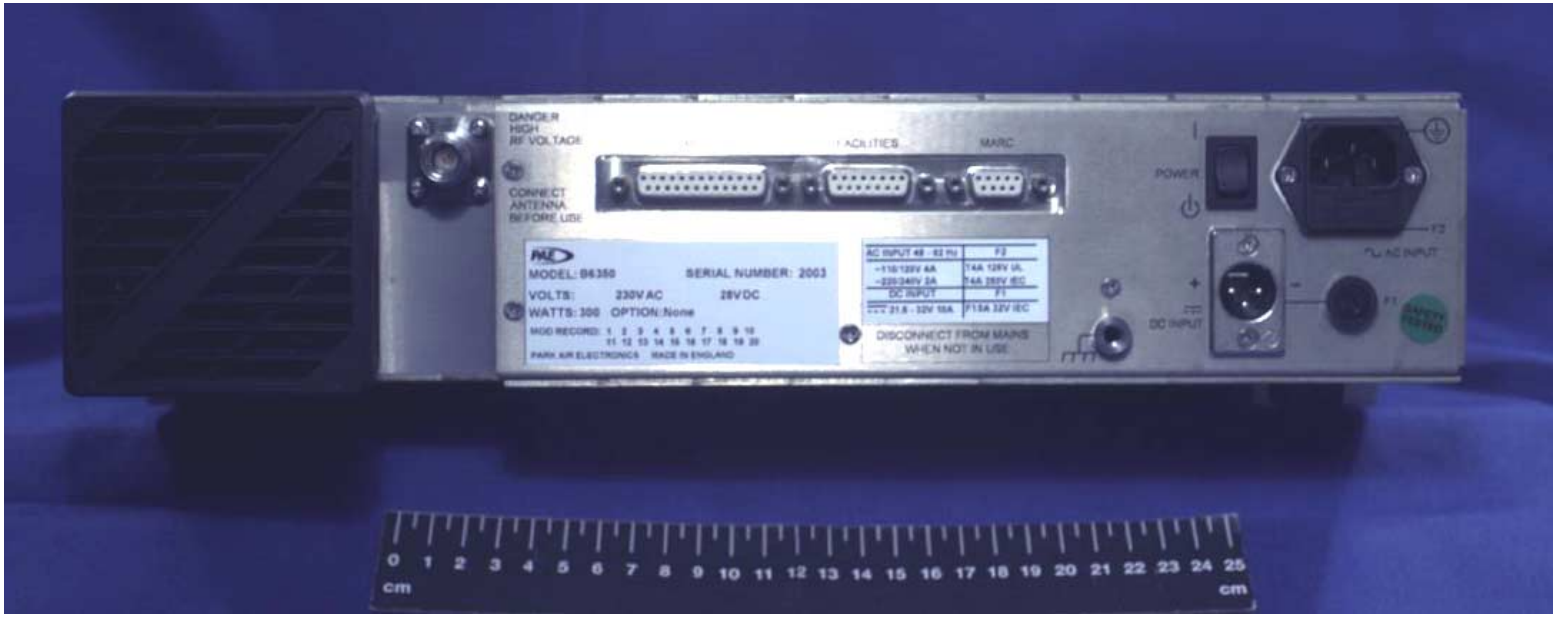
Relative Humidity : 22 %

Open Area test Site : 12 °C

# PHOTOGRAPHS OF EQUIPMENT

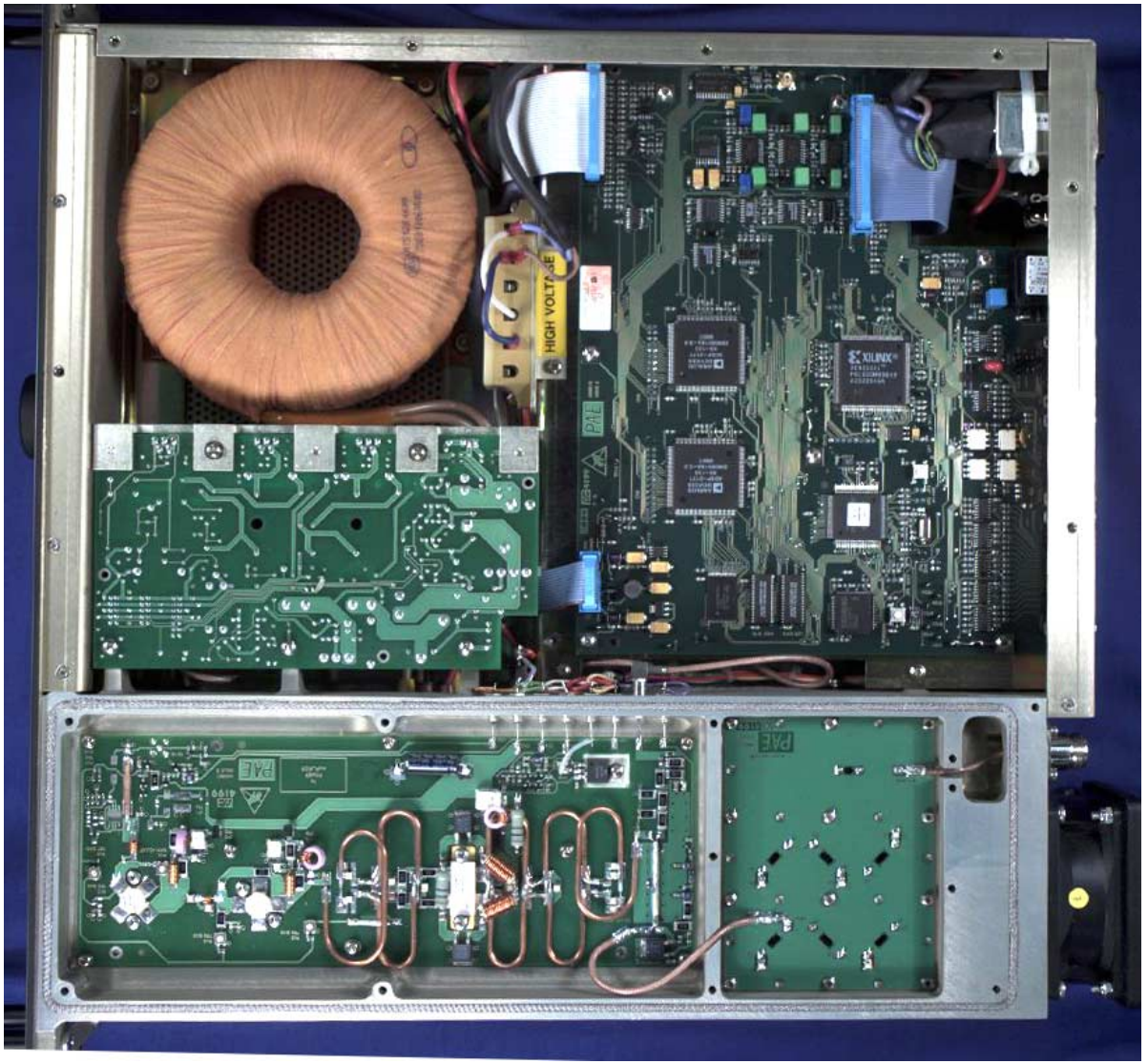


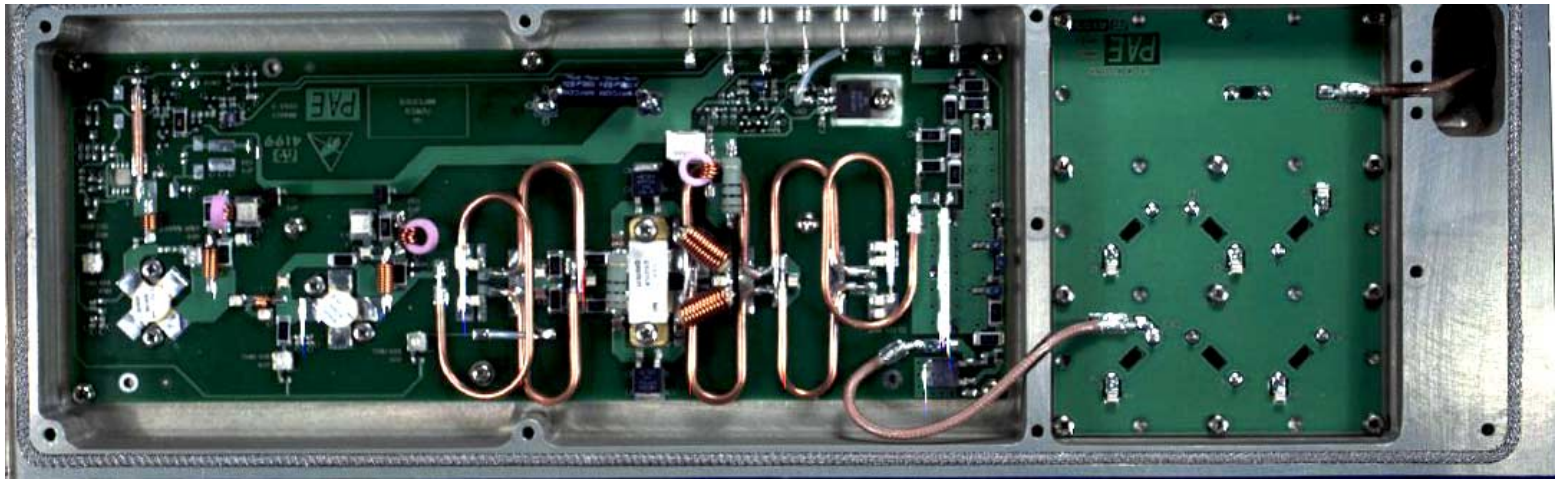

**T6T/B6350 Transmitter Front View**




**T6T/B6350 Transmitter Back View**

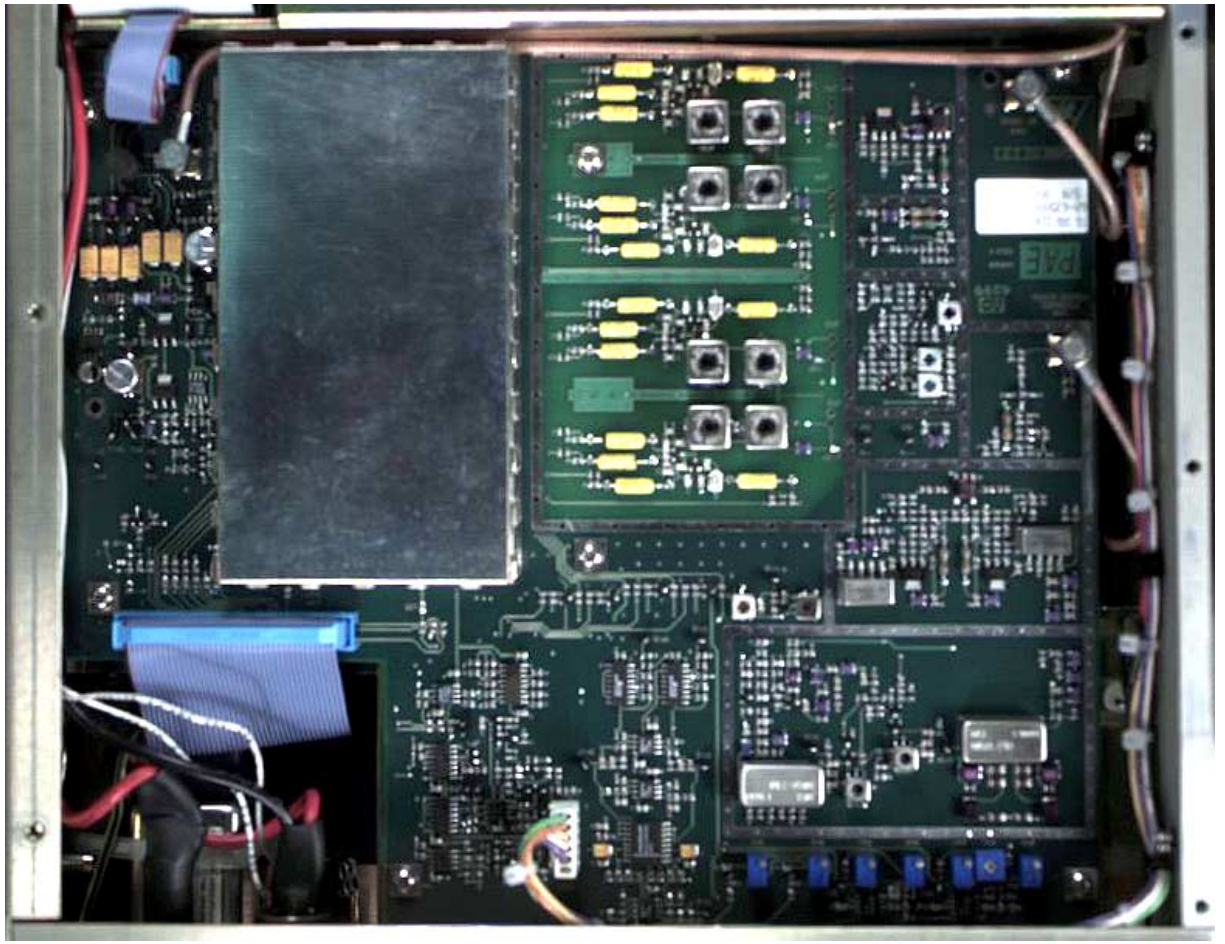
**T6T/B6350**
**Internal View**



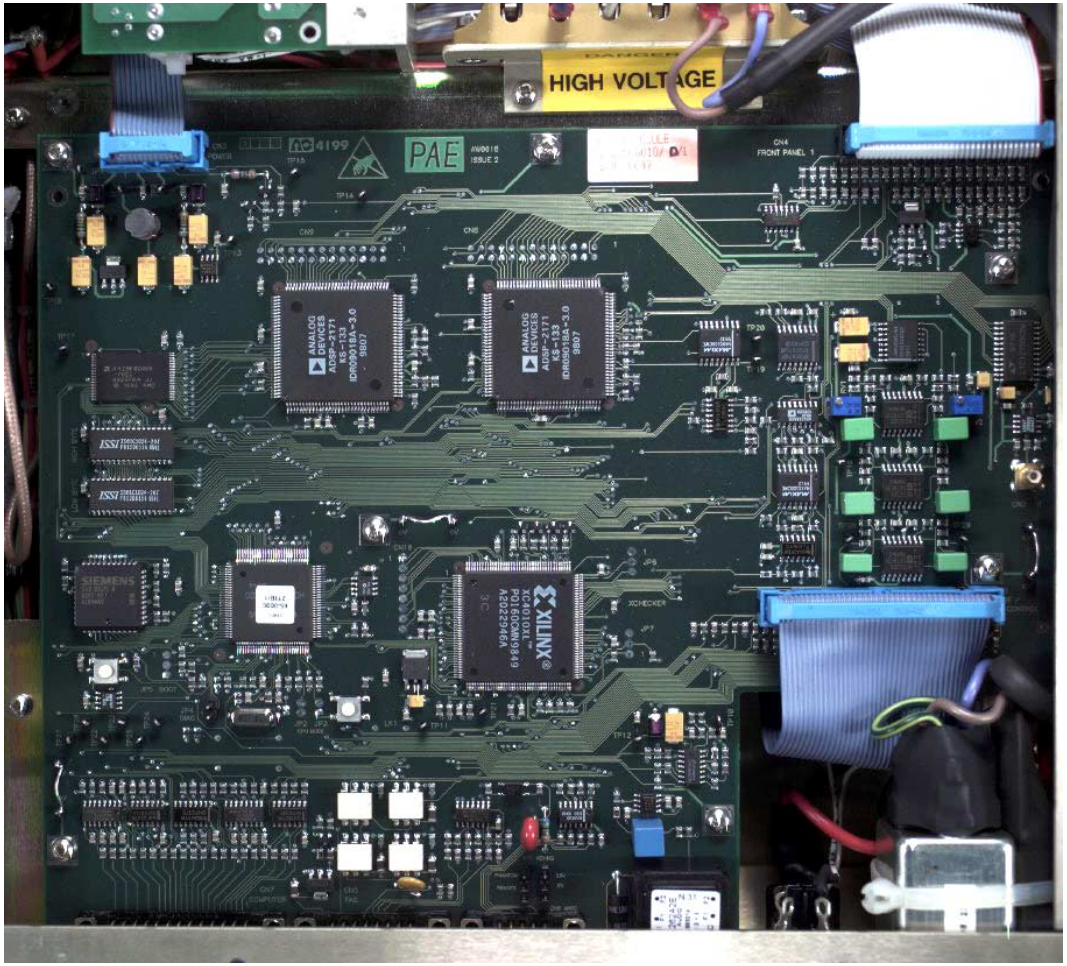


**T6T/B6350 Transmitter RF Power Amplifier PCB View**

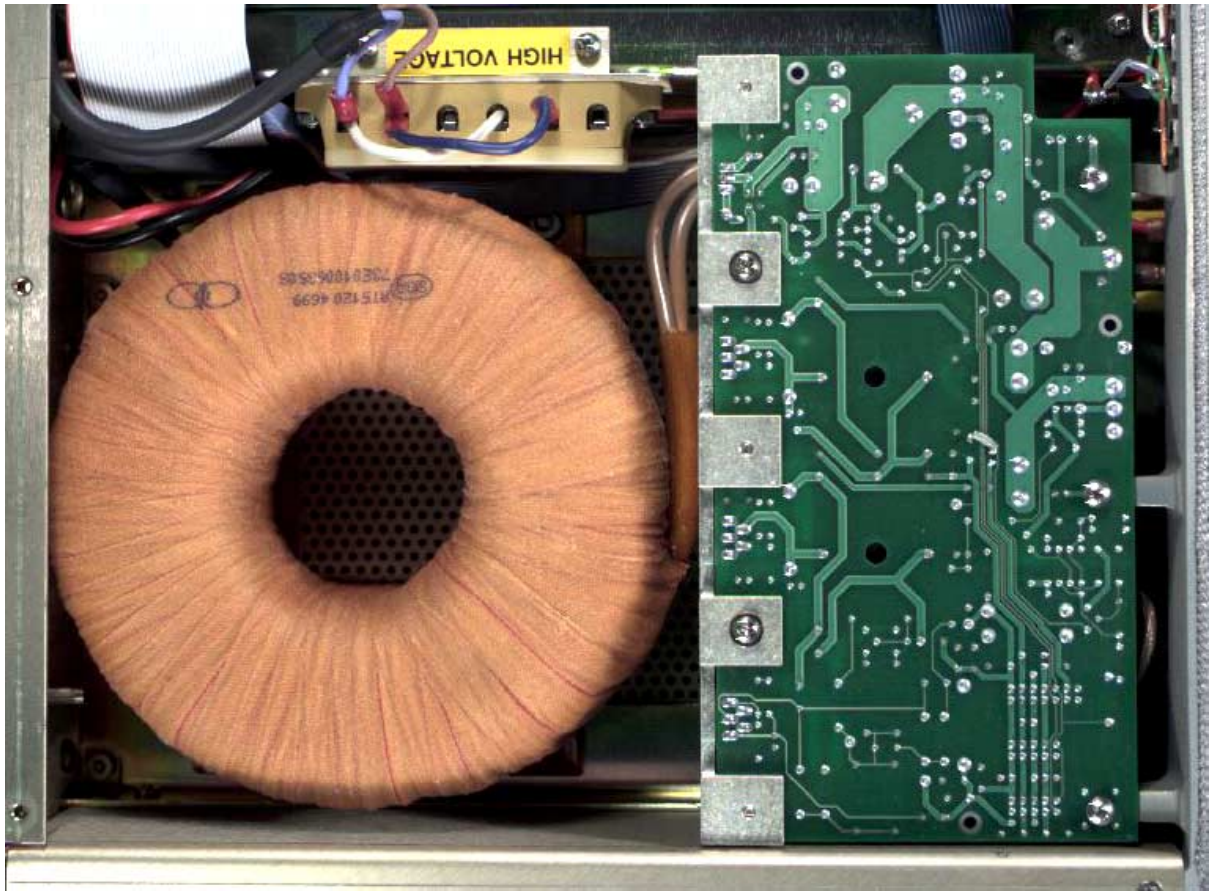
**T6T/B6350**
**RF Power Amplifier**
**Control PCB View**



**T6T/B6350**
**DSP PCB View**



**T6T/B6350**
**Power Supply**
**PCB View**




**T6T/B6350 Transmitter Label View**

**CTMS LTD, Company Accreditations & Credentials**

Appendix