

## C2PC Laboratory Test Report

For the

**TMAD1C Mobile Transceiver  
fitted with a TA2453-20 Mobile Utility Radio Modem**

Tested In accordance with

**FCC 47 CFR Parts 80 and 90T**

Report Revision: 1  
Issue Date: 22-Mar-2007  
FCC ID: CASTMAD1C

PREPARED BY: Garry Pringle \_\_\_\_\_  
Test Technician

CHECKED & APPROVED BY: Steve Crompton \_\_\_\_\_  
Laboratory Manager



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

This document must not be reproduced except in full, without the written permission of the Compliance Laboratory Manager.

## TABLE OF CONTENTS

REVISION HISTORY .....	3
INTRODUCTION .....	4
REPORT PREPARED FOR .....	4
DESCRIPTION OF SAMPLE .....	4
STATEMENT OF COMPLIANCE .....	4
TEST CONDITIONS .....	4
NECESSARY BANDWIDTH AND EMISSION DESIGNATORS .....	5
TEST RESULTS .....	6
OCCUPIED BANDWIDTH .....	6
C4FM .....	7
SPURIOUS EMISSIONS (CONDUCTED) .....	11
SPURIOUS EMISSIONS (RADIATED) .....	14
TEST EQUIPMENT USED .....	17
ANNEX A .....	18
TEST SETUP DETAILS .....	18

## REVISION HISTORY

Date	Revision	Comments
22-Mar-2007	1	Initial test report

## INTRODUCTION

The purpose of this report is to add C4FM modulation to the original test report TARF 2060.

Type Approval Testing of the TMAB22-D100A (Serial No 19172525) fitted with a TA2453-20 Mobile Utility Radio Modem, in accordance with:

FCC CFR 47 Parts 80 & 90T

## REPORT PREPARED FOR

Tait Electronics Ltd  
PO Box 1645  
558 Wairakei Rd  
Christchurch  
New Zealand

## DESCRIPTION OF SAMPLE

Equipment:	Mobile Transceiver
Type:	TMAD1C
Product code:	TMAB22-D100A
Serial Numbers:	19172525
Quantity:	1

## STATEMENT OF COMPLIANCE

The TMAB22-D100A Mobile transceiver as tested in this report was found to conform to the following standards:

**FCC CFR 47 Parts 80 & 90T**

## TEST CONDITIONS

All testing was performed at the following conditions.

Ambient Temperature	15°C → 30°C
Relative Humidity	20% → 75%
Standard Test Voltage	13.8 Vdc

## NECESSARY BANDWIDTH AND EMISSION DESIGNATORS

SPECIFICATION: FCC 47 CFR 2.202

The Necessary Bandwidth is the minimum value of the occupied bandwidth sufficient to ensure the transmission of information at the rate and with the quality required for the system employed.

### 99 % Bandwidth Measurement Results

219.1 MHz		
Channel Spacing	Power	99% BW C4FM
12.5 kHz	25W	4.04 kHz
12.5 kHz	1W	4.03 kHz
221.5 MHz		
Channel Spacing	Power	99% BW C4FM
12.5 kHz	25W	4.11 kHz
12.5 kHz	1W	4.10 kHz

## TEST RESULTS

### OCCUPIED BANDWIDTH

SPECIFICATION: FCC 47 CFR 2.1049 (c)

GUIDE: TIA/EIA-603C 2.2.11

#### MEASUREMENT PROCEDURE:

1. Refer Annex A for Equipment Set up.
2. For analogue measurements: The EUT was modulated by a 2500Hz tone at an input level 16dB above a level that produced 50% deviation. The input level was established at the frequency of maximum response of the audio modulating circuit.  
For Data measurements: The EUT was modulated with an internally generated pseudo random bit sequence at the appropriate Baud rates.
3. The Occupied Bandwidth was measured on the Spectrum Analyser, with bandwidth settings as follows.

Emission Mask D	– Resolution Bandwidth = 100Hz, Video Bandwidth = 1 kHz
Emission Mask F	– Resolution bandwidth = 300Hz, Video Bandwidth = 3 kHz

#### MEASUREMENT RESULTS:

See the plots on the following pages for 12.5 kHz channel spacing.

LIMIT CLAUSE: FCC 47 CFR 90.210

#### EMISSION MASKS

Emission Mask D	12.5 kHz Channel Spacing	C4FM
-----------------	--------------------------	------

Emission Mask F	12.5 kHz Channel Spacing	C4FM
-----------------	--------------------------	------

#### DATA SPEED

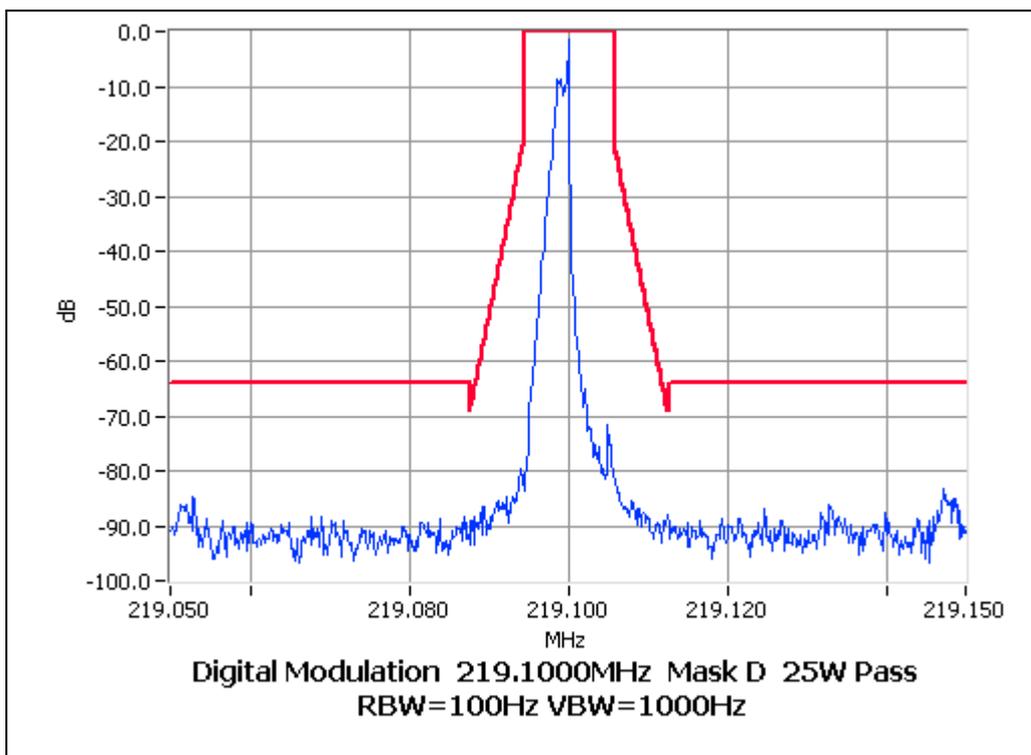
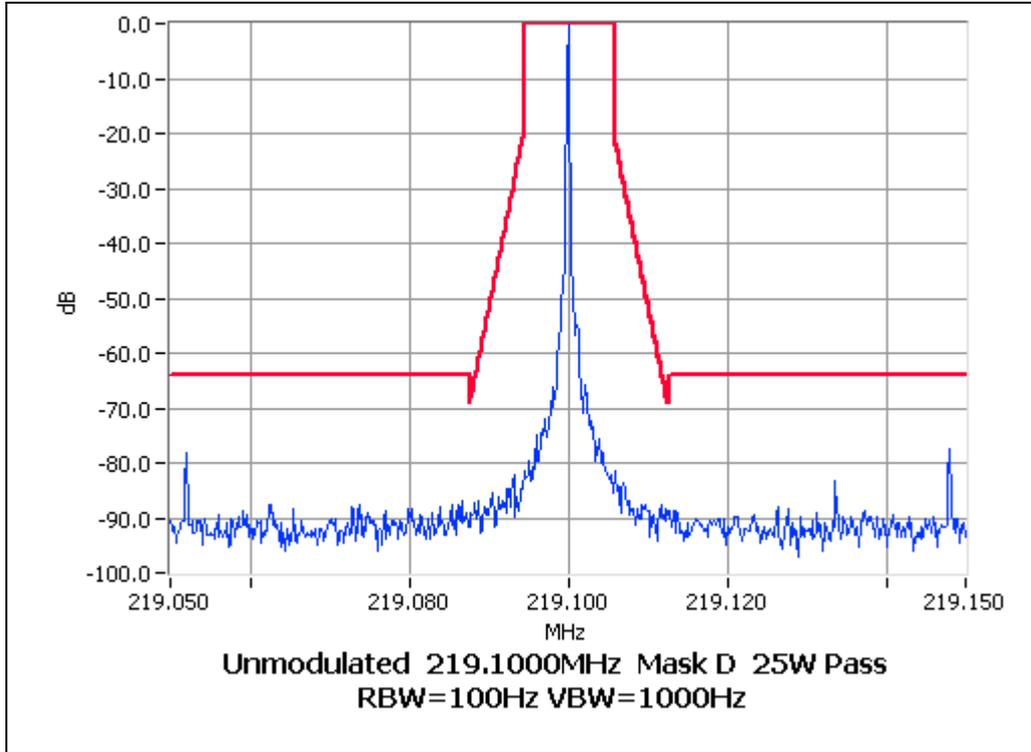
C4FM	12.5 kHz Channel Spacing	4800 bps
------	--------------------------	----------

OCCUPIED BANDWIDTH

C4FM

SPECIFICATION: FCC CFR 2.1049 (h)

Tx FREQUENCY: 219.1 MHz 25 W 12.5 kHz Channel Spacing

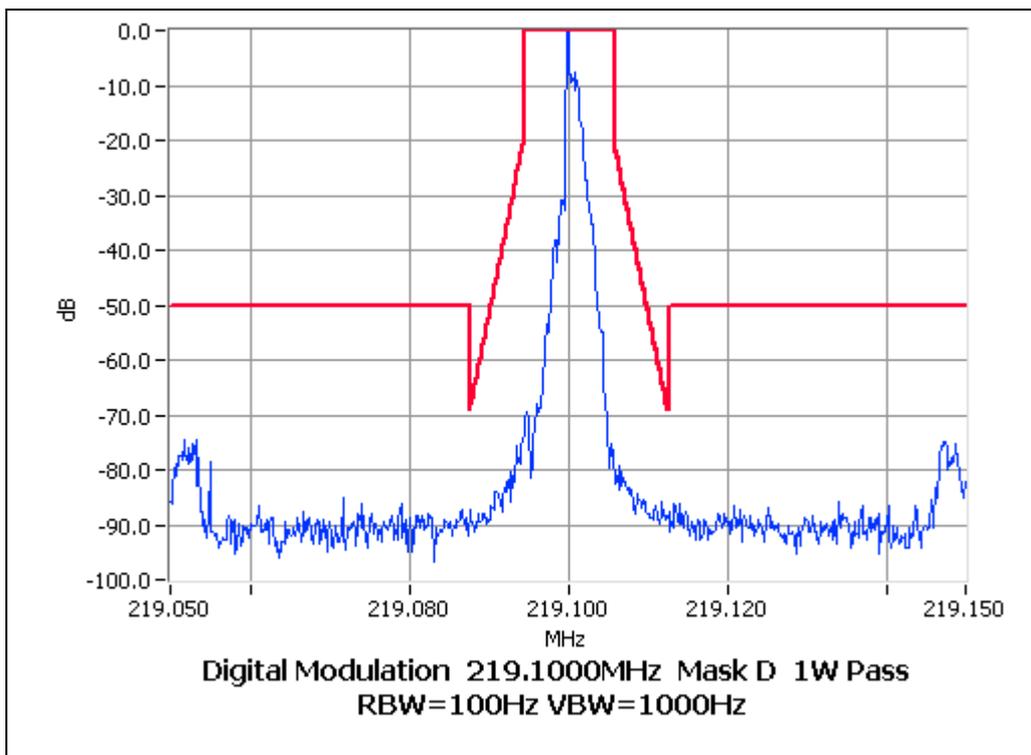
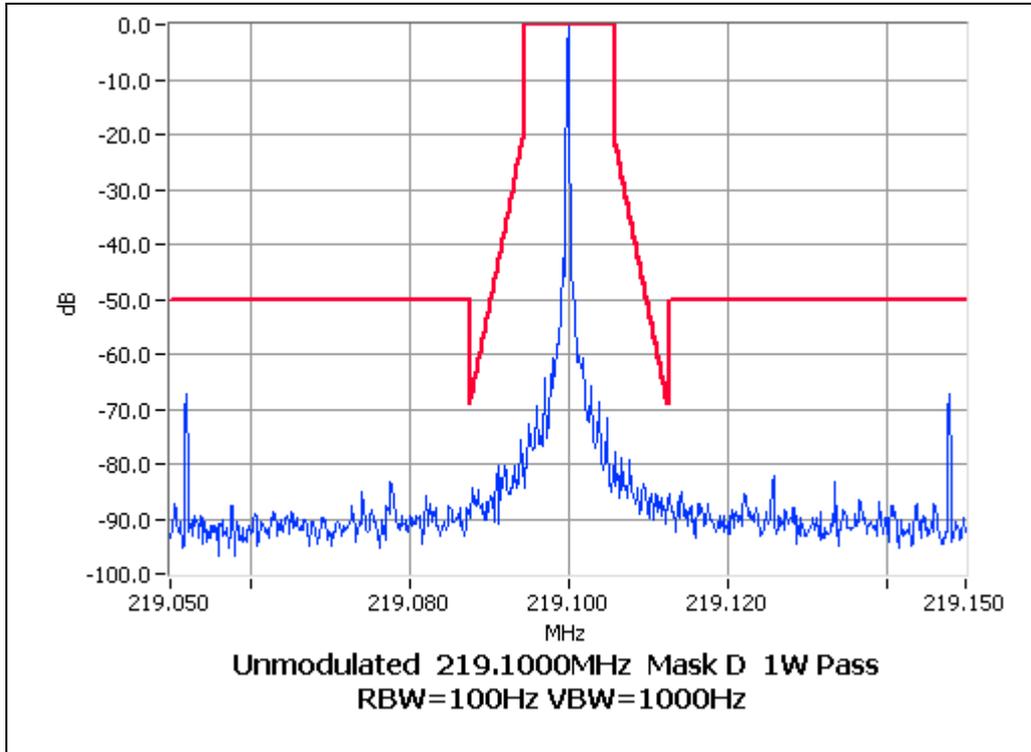


OCCUPIED BANDWIDTH

C4FM

SPECIFICATION: FCC CFR 2.1049 (h)

Tx FREQUENCY: 219.1 MHz 1 W 12.5 kHz Channel Spacing

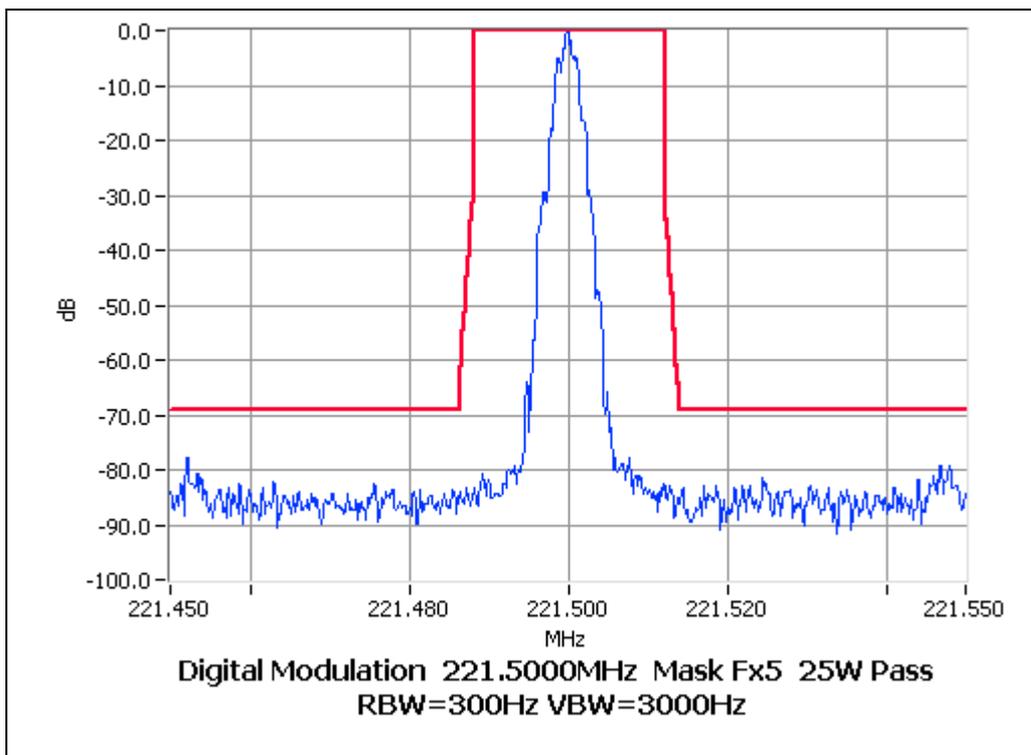
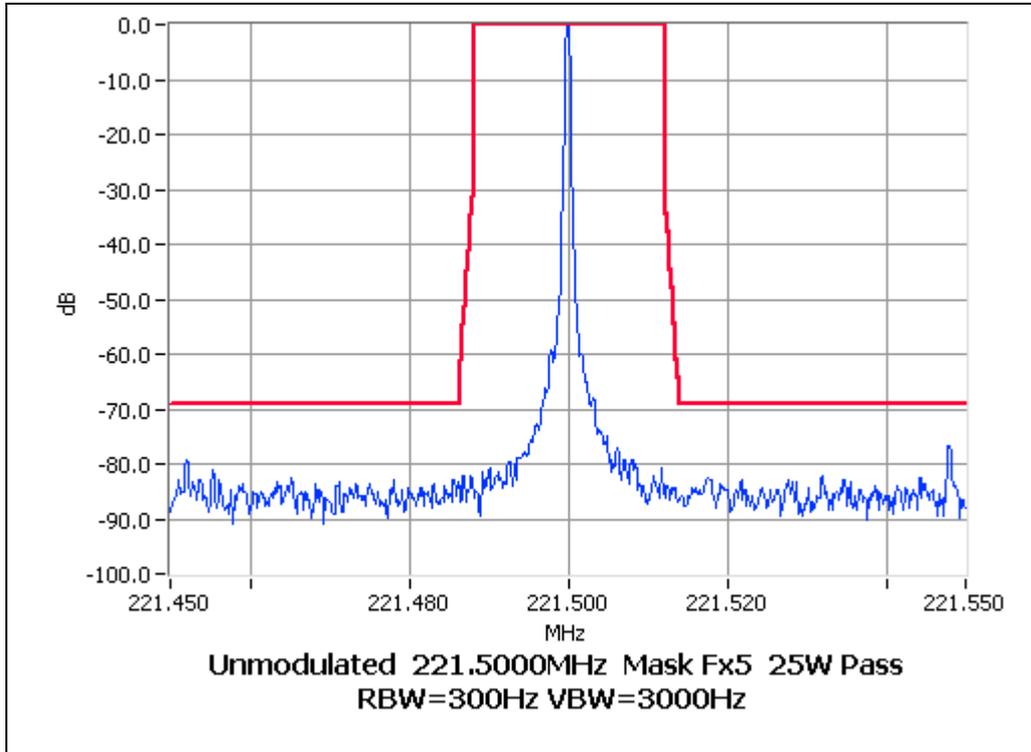


OCCUPIED BANDWIDTH

C4FM

SPECIFICATION: FCC CFR 2.1049 (h)

Tx FREQUENCY: 221.5 MHz 25 W 12.5 kHz Channel Spacing

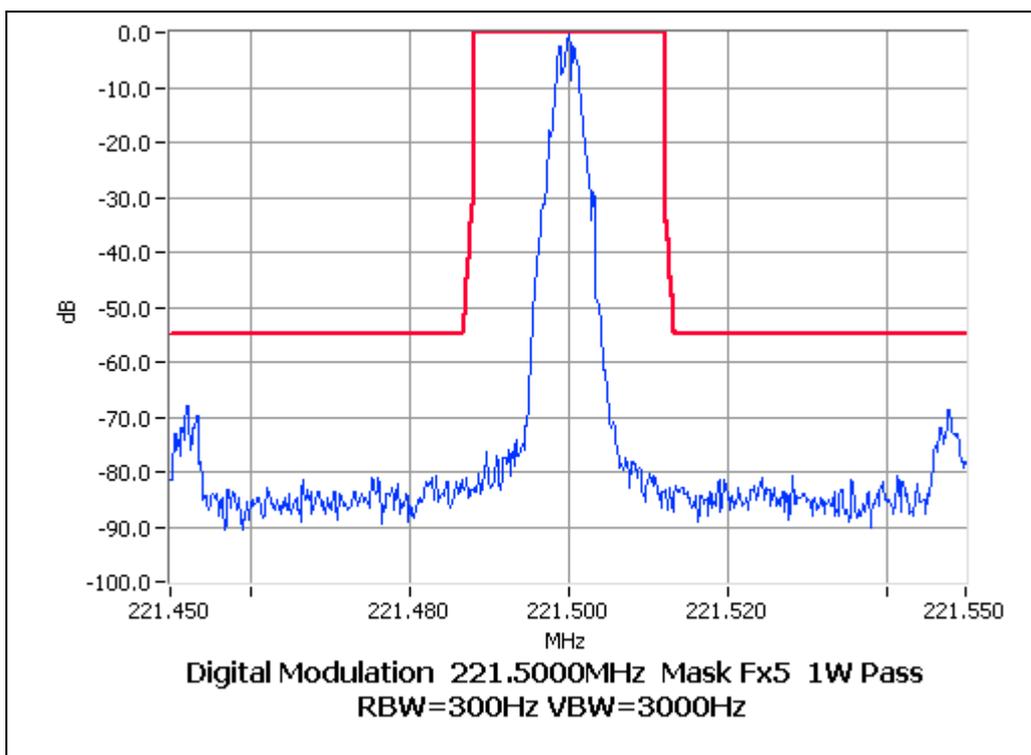
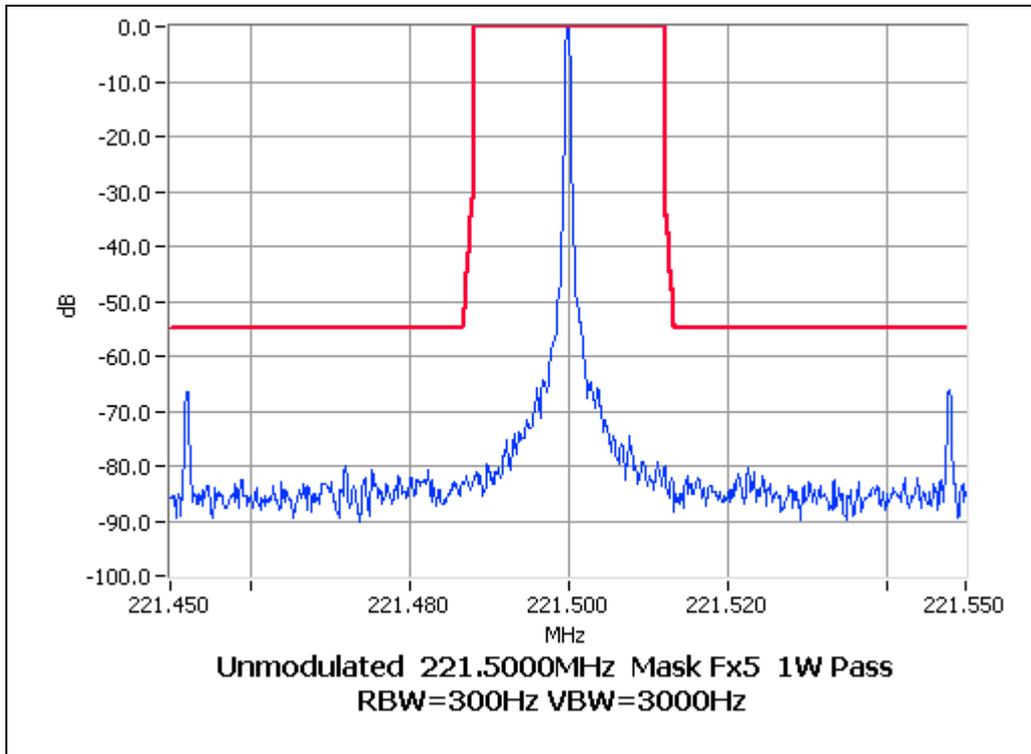


OCCUPIED BANDWIDTH

C4FM

SPECIFICATION: FCC CFR 2.1049 (c)

Tx FREQUENCY: 221.5 MHz 1 W 12.5 kHz Channel Spacing



**SPURIOUS EMISSIONS (CONDUCTED)**

SPECIFICATION: FCC 47 CFR 2.1051

GUIDE: TIA/EIA-603C 2.2.13

**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 10<sup>th</sup> Harmonic: 100kHz 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 20dB 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.

**MEASUREMENT RESULTS:**

See the tables on the following pages for 12.5 kHz channel spacing.

LIMIT CLAUSE: FCC 47 CFR 90.210

**TELTEST Laboratories**  
Tait Electronics Limited  
Report Number 2567

**SPURIOUS EMISSIONS (CONDUCTED)**

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 219.1 MHz

12.5 kHz Channel Spacing		219.1 MHz @ 25 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)	
219.0513	-36.3	80.3	
219.1478	-34.1	78.1	
No other emissions were detected at a level greater than 20 dB below the limit.			

12.5 kHz Channel Spacing		219.1 MHz @ 1 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)	
219.0513	-37.0	67.0	
219.1478	-36.6	66.6	
No other emissions were detected at a level greater than 20 dB below the limit.			

LIMITS:

Carrier Output Power Watts	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \text{ Log}_{10} (P_{\text{Watts}})$	
25 W	-20 dBm	64.0 dBc
1 W	-20 dBm	50.0 dBc

**TELTEST Laboratories**  
Tait Electronics Limited  
Report Number 2567

**SPURIOUS EMISSIONS (CONDUCTED)**

SPECIFICATION: FCC CFR 2.1051

Tx FREQUENCY: 221.5 MHz

12.5 kHz Channel Spacing		221.5 MHz @ 25 W	Emission Mask F
Emission Frequency (MHz)	Level (dBm)	Level (dBc)	
221.4513	-35.9	79.9	
221.5478	-34.3	78.3	
No other emissions were detected at a level greater than 20 dB below the limit.			

12.5 kHz Channel Spacing		221.5 MHz @ 1 W	Emission Mask F
Emission Frequency (MHz)	Level (dBm)	Level (dBc)	
221.4513	-37.4	67.4	
221.5478	-36.9	66.9	
No other emissions were detected at a level greater than 20 dB below the limit.			

LIMITS:

Carrier Output Power Watts	Emission Mask F 12.5 kHz Channel Spacing $55 + 10 \text{ Log}_{10} (P_{\text{Watts}})$	
25 W	-25 dBm	69.0 dBc
1 W	-25 dBm	55.0 dBc

**SPURIOUS EMISSIONS (RADIATED)**

SPECIFICATION: FCC 47 CFR 2.1053

GUIDE: TIA/EIA-603C 2.2.12

MEASUREMENT PROCEDURE:  
Refer Annex A for Equipment set up.

Initial Scan:

1. The EUT is placed in the S-Line TEM cell and emissions are measured from 30MHz to 1000MHz. Any emission within 10dB of the limit is then re-tested on the OATS along with measurements from 1000MHz to the 10<sup>th</sup> harmonic of the fundamental frequency.
2. The EUT is then placed on a wooden turntable at a distance of 1 metre from the test antenna and emissions are measured from 1000MHz to the upper frequency required. Any emission within 10 dB of the limit is then re-tested 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 1m to 4m 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 90.210

**TELTEST Laboratories**  
Tait Electronics Limited  
Report Number 2567

**SPURIOUS EMISSIONS (RADIATED)**

SPECIFICATION: FCC CFR 2.1053

Tx FREQUENCY: 219.1 MHz

12.5 kHz Channel Spacing		219.1 MHz @ 25 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)	
~	~	~	
No emissions were detected at a level greater than 20 dB below the limit.			

12.5 kHz Channel Spacing		219.1 MHz @ 1 W	Emission Mask D
Emission Frequency (MHz)	Level (dBm)	Level (dBc)	
~	~	~	
No emissions were detected at a level greater than 20 dB below the limit.			

LIMITS:

Carrier Output Power Watts	Emission Mask D 12.5 kHz Channel Spacing $50 + 10 \text{ Log}_{10} (P_{\text{Watts}})$	
25 W	-20 dBm	64.0 dBc
1 W	-20 dBm	50.0 dBc

**SPURIOUS EMISSIONS (RADIATED)**

SPECIFICATION: FCC CFR 2.1053

Tx FREQUENCY: 221.5 MHz

12.5 kHz Channel Spacing		221.5 MHz @ 25 W	Emission Mask F
Emission Frequency (MHz)	Level (dBm)	Level (dBc)	
~	~	~	
No emissions were detected at a level greater than 20 dB below the limit.			

12.5 kHz Channel Spacing		221.5 MHz @ 1 W	Emission Mask F
Emission Frequency (MHz)	Level (dBm)	Level (dBc)	
~	~	~	
No emissions were detected at a level greater than 20 dB below the limit.			

LIMITS:

Carrier Output Power Watts	Emission Mask F 12.5 kHz Channel Spacing $55 + 10 \text{ Log}_{10} (P_{\text{Watts}})$	
25 W	-25 dBm	69.0 dBc
1 W	-25 dBm	55.0 dBc

**TELTEST Laboratories**  
Tait Electronics Limited  
Report Number 2567

---

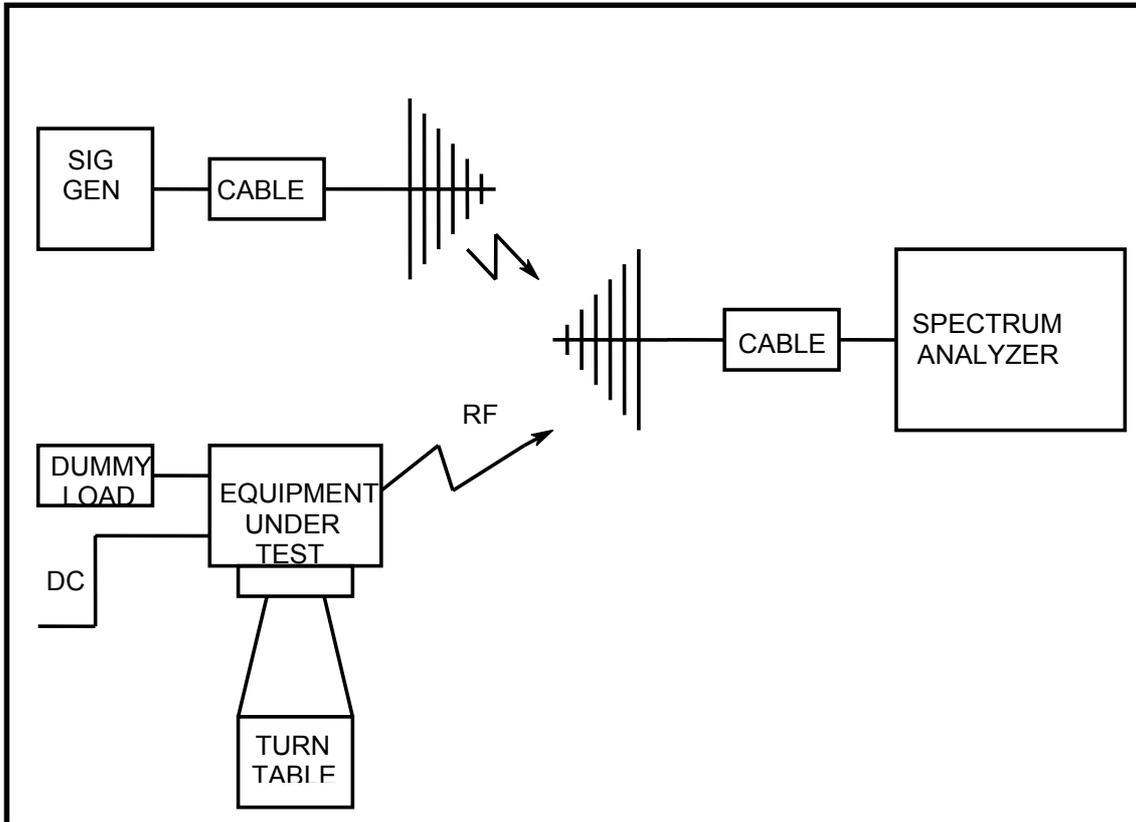
**TEST EQUIPMENT USED**

<b>No#</b>	<b>Equipment</b>	<b>Manufacturer</b>	<b>Model No</b>	<b>Serial No#</b>	<b>Tait ID</b>	<b>Cal Due</b>
11	Modulation Analyser	Hewlett Packard	HP8901B (Opt 002)	2441A00393	E3073	02-Nov-07
13	Audio Analyser	Hewlett Packard	HP8903A	2308A02597	E3074	02-Nov-07
20	Power Supply Reference Horn	Hewlett Packard	HP6032A	2441A00412	E3075	21-Nov-07
42	Antenna	Emco	DRG3115	9512-4638	E3560	16-Nov-09
46	S-LINE TEM CELL	Rohde & Schwarz	1089.9296.02	338232/003	E3636	20-Mar-09
52	Amplifier +21.7 dB	Tait	ZFL-1000LN	E3660	E3360	
65	RF Attenuator 50W	Weinschel	24-20-44	AW1266	E3562	31-Oct-07
72	RF Load 50W	Weinschel	F1426	AE2490	E3624	31-Oct-07
83	1m Coax Cable (BLUE)	Suhner	Sucoflex 104A	25006/4A	E3693	30-Oct-07
88	Spectrum Analyser	Hewlett Packard	HP8562E	3821A00779	E3715	31-Oct-07
90	Power Supply	Hewlett Packard	HP6012B	2524A00616	E3712	30-Oct-07
123	Spectrum Analyser	Agilent	E4445A	MY42510072	E4139	04-Jul-07
135	Attenuator	Weinschel	67-30-33	BR0531	E4280	10-Jan-08
137	1m Multiflex Cable	Suhner	MF141	TT007	E4443	30-Oct-07
138	1m Multiflex Cable	Suhner	MF141	TT086	E4444	30-Oct-07

ANNEX A

TEST SETUP DETAILS

Radiated Emissions Set up.



**TELTEST Laboratories**  
Tait Electronics Limited  
Report Number 2567

All other testing is performed using the Teltest Radio **EVAL**uation 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.

