

EMC Technologies (NZ) Ltd

Test Report No 20922.1
Report date: 3 October 2002

TEST REPORT

Tait TOP-I2410-T0 Handheld Portable Transceiver

tested to

47 Code of Federal Regulations

Part 22 – Public Mobile Services

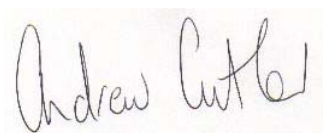
Part 90 – Private Land Mobile Service

Part 15 - Radio Frequency Devices

for

Tait Electronics Ltd

This Test Report is issued with the authority of:



Andrew Cutler - General Manager

Prepared By:



Karen Miller - Office Administrator



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Test Report No 20922.1

Report date: 3 October 2002

Table of Contents

1.	STATEMENT OF COMPLIANCE	3
2.	RESULTS SUMMARY	3
3.	CLIENT INFORMATION	4
4.	DESCRIPTION OF TEST SAMPLE	4
5.	TEST SAMPLE SPECIFICATIONS	5
6.	ATTESTATION	6
7.	TEST RESULTS	7
8.	TEST EQUIPMENT USED	15
9.	ACCREDITATIONS	15
10.	PHOTOGRAPH(S)	16

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Test Report No 20922.1

Report date: 3 October 2002

1. STATEMENT OF COMPLIANCE

The Tait TOP-I2410-T0 Handheld Portable Transceiver complies with:

- FCC Part 15 Sections 15.107, 15.109, 15.111 when tested in accordance with ANSI C63.4 – 1992
- FCC Part 22 Section 22.359 when tested in accordance with FCC Part 2 Section 2.1053
- FCC Part 90 Section 90.210 when tested in accordance with FCC Part 2 Section 2.1053

2. RESULTS SUMMARY

The results from testing are summarised in the following table:

Section	Result
15.107(f) – Conducted limits.	Complies with a 17.96 dB margin at 466.000 kHz (Quasi Peak).
15.109(f) – Radiated emission limits.	Complies with a 30.1 dB margin at 435.000 MHz (Vertical) when tuned to 480.100 MHz.
15.111(a) – Antenna power conduction limits for receivers.	Complies with a 28.6 dB margin at 474.100 MHz when tuned to 519.600 MHz.
22.359 and 90.210 when tested to 2.1053 – Radiated spurious emissions	Complies with a 20.6 dB margin at 960.200 MHz (Vertical) when transmitting on 480.100 MHz.

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Test Report No 20922.1

Report date: 3 October 2002

3. CLIENT INFORMATION

Company Name	Tait Electronics Ltd
Address	PO Box 1645
City	Christchurch
Country	New Zealand
Contact	Mr Des Fox

4. DESCRIPTION OF TEST SAMPLE

Brand Name	Tait
Model Number	TOP-I2410-T0
Product	Handheld Portable Transceiver
Manufacturer	Tait Electronics Ltd
Country of Origin	New Zealand
Serial Number	14155062
FCC ID	CASTEL0062

EMC Technologies (NZ) Ltd

Test Report No 20922.1

Report date: 3 October 2002

5. TEST SAMPLE SPECIFICATIONS

The sample tested is a Handheld Portable transmitter with the following specifications:

Transmit frequency

The transmitter was fitted with the following frequencies.

Chl	Frequency
1, 2, 3, 4	480.100 MHz
5, 6	519.200 MHz
7, 8	459.075 MHz
9, 10	498.700 MHz
11, 12	519.200 MHz
13, 14	480.100 MHz

Testing was carried out on 480.100 MHz.

Limited testing was also carried out at 519.200 MHz and 459.075 MHz.

Transmitter frequency range

450 – 530 MHz

FCC Bands

Part 90: 421 – 512 MHz

Power Supply

Internal 7.5 Vdc Ni Cad Battery

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Test Report No 20922.1

Report date: 3 October 2002

6. ATTESTATION

This report describes the tests and measurements performed for the purpose of determining compliance with the specification with the following conditions:

The client selected the test sample.

The report relates only to the sample tested.

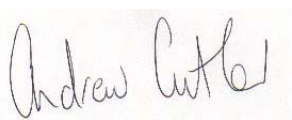
This report does not contain corrections or erasures.

Measurement uncertainties with statistical confidence intervals of 95% are shown below test results. Both Class A and Class B uncertainties have been accounted for, as well as influence uncertainties where appropriate.

In addition this equipment has been tested in accordance with the requirements contained in the appropriate Commission regulations.

To the best of my knowledge, these tests were performed using measurement procedures that are consistent with industry or Commission standards and demonstrate that the equipment complies with the appropriate standards.

I further certify that the necessary measurements were made by EMC Technologies NZ Ltd, 47 MacKelvie Street, Grey Lynn, Auckland, New Zealand.



Andrew Cutler
General Manager
EMC Technologies NZ Ltd

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Test Report No 20922.1

Report date: 3 October 2002

7. TEST RESULTS

Conducted Emissions

Conducted emissions testing was carried out over the frequency range of 150 kHz to 30 MHz.

Testing for conducted emissions was carried out at the laboratory's MacKelvie Street premises in a screened room.

The device was placed 0.8 m away from the closest edge of the artificial mains terminal network on the emissions test table which is 1 m x 1.5 m, and is 0.8 m above the screened room floor which acts as the horizontal ground plane and is 0.6 m away from the screened room wall, which acts as the vertical ground plane.

The device was powered at 110 V AC from the mains using a representative AC / DC adaptor in accordance with section 15.107(f).

Measurements were made using a Quasi Peak detector with a 10 kHz bandwidth.

Measurement uncertainty with a confidence interval of 95% is:

- Mains terminal tests (0.15 - 30 MHz) $\pm$ 2.2 dB

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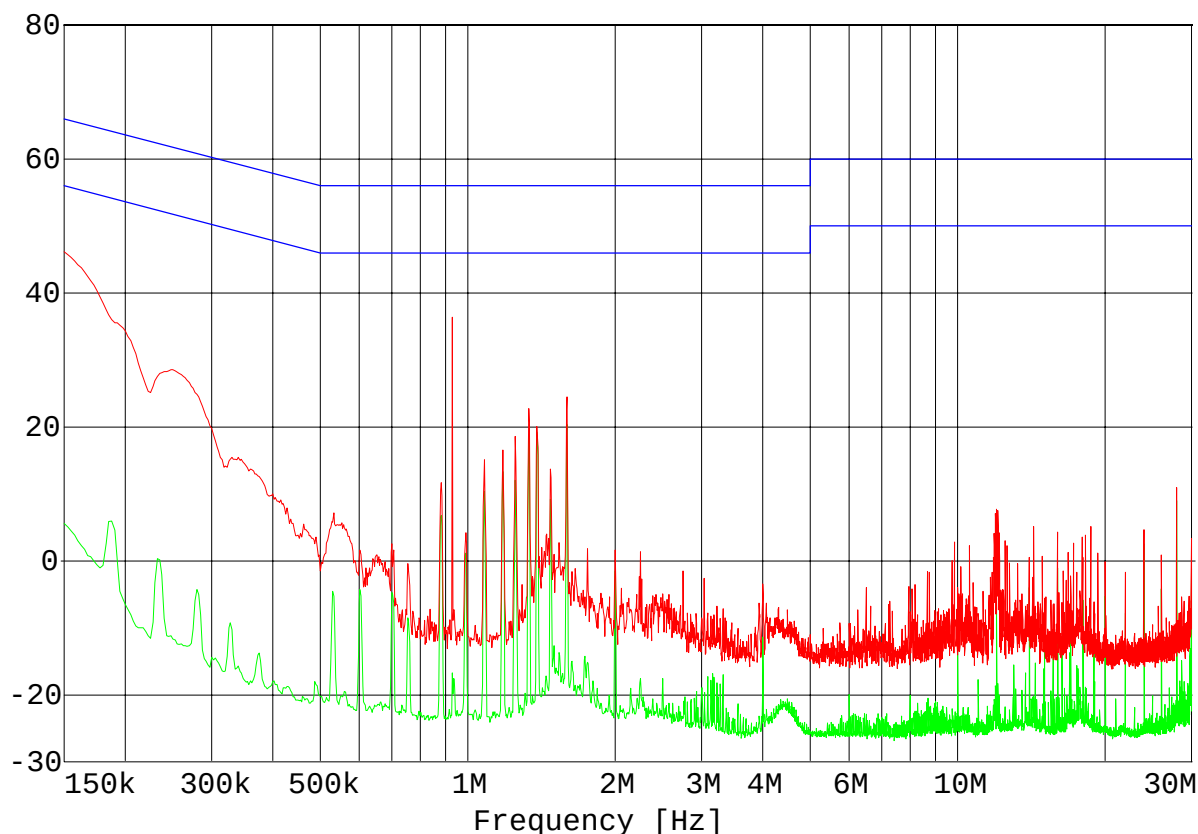
Test Report No 20922.1

Report date: 3 October 2002

Conducted Emissions

Comments:	Device tested using a representative 110 Vac / 12 Vdc AC Adaptor, while charging a UHF portable transceiver.
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Level [dB μ V]



Peak -----	Average -----	Quasi Peak X	Average +
------------	---------------	--------------	-----------

Quasi-Peak Measurements

Frequency MHz	Level dB μ V	Limit dB μ V	Margin dB	Exceed	Phase	Rechecks dB μ V
No results recorded						

Average Measurements

Frequency MHz	Level dB μ V	Limit dB μ V	Margin dB	Exceed	Phase	Rechecks dB μ V
No results recorded						

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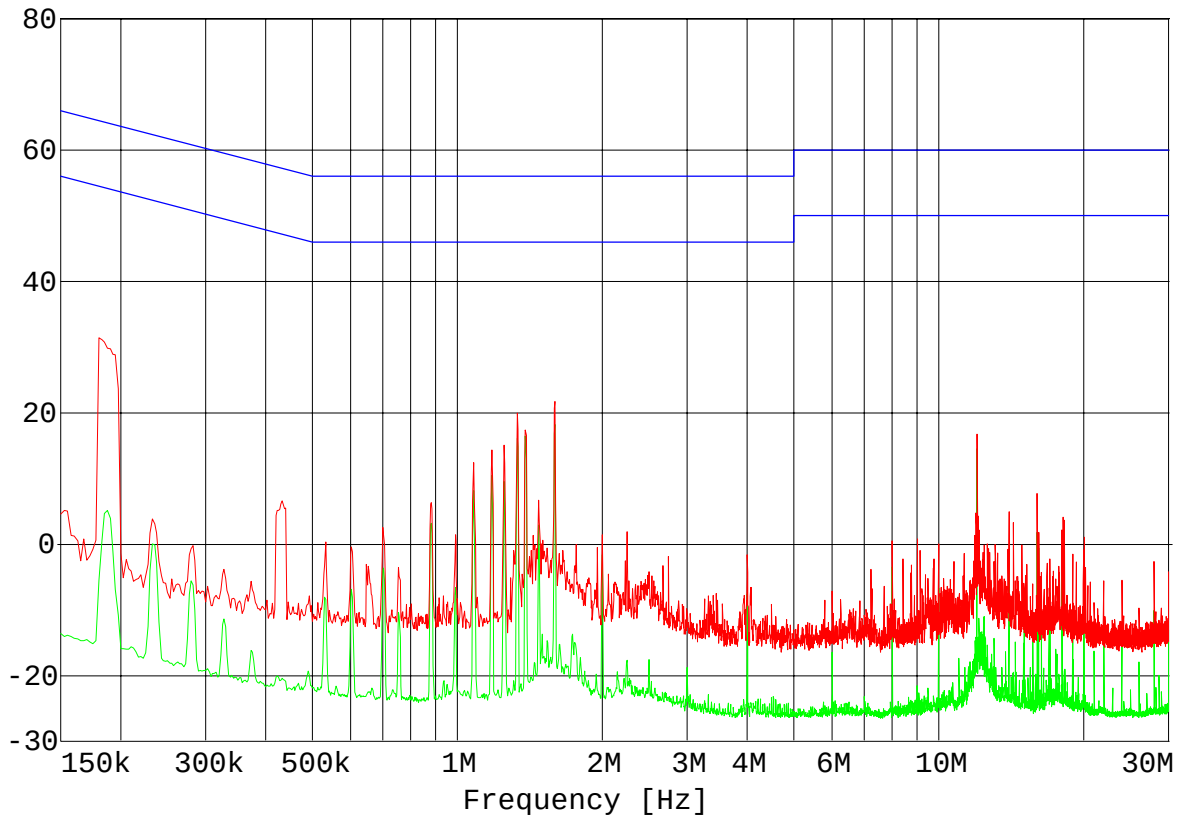
Test Report No 20922.1

Report date: 3 October 2002

Conducted Emissions

Comments:	Device tested using a representative 110 Vac / 12 Vdc AC Adaptor, while receiving a signal on 480.100 MHz.
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Level [dB μ V]



Peak -----	Average -----	Quasi Peak X	Average +
------------	---------------	--------------	-----------

Quasi-Peak Measurements

Frequency MHz	Level dB μ V	Limit dB μ V	Margin dB	Exceed	Phase	Rechecks dB μ V
No results recorded						

Average Measurements

Frequency MHz	Level dB μ V	Limit dB μ V	Margin dB	Exceed	Phase	Rechecks dB μ V
No results recorded						

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Test Report No 20922.1

Report date: 3 October 2002

Antenna Power Conduction Limits for Receivers

In accordance with Section 15.109(f), the receiver has terminals for an external antenna and measurements have been carried out in accordance with Section 15.111(a).

Antenna power measurements have been carried out over the frequency range of 30.0 to 5000 MHz.

Testing for antenna power conduction was carried out at the laboratory's MacKelvie Street premises in a screened room.

The receiver operates in the band of 450 – 530 MHz.

In accordance with Section 15.33(b)(1) testing has been carried out up to 5000 MHz, as the highest frequency generated or used is in the band 500 - 1000 MHz.

Measurements have been made with the antenna terminals shielded and terminated with a resistive termination equal to the impedance specified for the antenna.

The antenna impedance is 50 Ω .

The limit of 2 nanowatts has been expressed in dBm as -57.0 dBm

Measurements have been made using a peak detector with a bandwidth of 120 kHz below 1000 MHz and a bandwidth of 1 MHz above 1000 MHz.

Measurement uncertainty with a confidence interval of 95% is:

- Antenna power conduction. (30 - 5000 MHz) $\pm$ 2.2 dB

EMC Technologies (NZ) Ltd

Test Report No 20922.1

Report date: 3 October 2002

Antenna Power Conduction

Receiver tuned to 519.200 MHz.

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)
474.100	-85.6	-57.0	28.6
948.200	-	-57.0	-
1422.300	-	-57.0	-
1896.400	-98.7	-57.0	41.7
2370.500	-	-57.0	-
2844.600	-	-57.0	-
3318.700	-	-57.0	-
3792.800	-91.7	-57.0	34.7
4266.900	-91.2	-57.0	34.2
4741.000	-	-57.0	-

Receiver tuned to 480.100 MHz.

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)
435.000	-91.5	-57.0	34.5
870.000	-	-57.0	-
1305.000	-	-57.0	-
1740.000	-	-57.0	-
2175.000	-	-57.0	-
2610.000	-	-57.0	-
3045.000	-	-57.0	-
3480.000	-91.6	-57.0	34.6
3915.000	-	-57.0	-
4350.000	-	-57.0	-

Receiver tuned to 459.075 MHz.

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)
413.975	-94.1	-57.0	37.1
827.950	-	-57.0	-
1241.930	-	-57.0	-
1655.900	-	-57.0	-
2069.880	-	-57.0	-
2483.860	-	-57.0	-
2897.830	-	-57.0	-
3311.800	-98.9	-57.0	41.9
3725.780	-96.7	-57.0	39.7
4139.750	-100.0	-57.0	43.0

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Field strength of receiver spurious emissions at antenna terminals

Intermediate Frequency: 45.1 MHz

Frequency: 480.1000 MHz

Emission frequency (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarity
435.000	15.5	46.0	30.5	Horizontal
870.000	-	46.0	-	Vert/Hort
1305.000	-	54.0	-	Vert/Hort
1740.000	-	54.0	-	Vert/Hort
2175.000	-	54.0	-	Vert/Hort
2610.000	-	54.0	-	Vert/Hort
3045.000	-	54.0	-	Vert/Hort
3480.000	-	54.0	-	Vert/Hort
3915.000	-	54.0	-	Vert/Hort
4350.000	-	54.0	-	Vert/Hort

Device was tested on an open area test site at a distance of 3 metres.

Testing was carried out at EMC Technologies NZ Ltd Open Area Test Site which is located at Driving Creek, Orere Point, Auckland. Details of this site have been filed with the Commission, Registration Number: 90838, which was last updated on March 20th, 2002.

The transceiver was tested operating in stand by / receive mode with a whip antenna, tuned to 480 MHz, attached to the antenna terminal.

Measurements have been made using a quasi peak detector with a bandwidth of 120 kHz below 1000 MHz and an average detector with a bandwidth of 1 MHz above 1000 MHz.

No measurements were made above the 10th harmonic of the receiver local oscillator frequency.

Result: Complies

Measurement Uncertainty: ± 4.1 dB

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Field strength of transmitter spurious emissions at antenna terminals

Frequency: 480.100 MHz

Emission frequency (MHz)	Level (dBuV/m)	Power (dBm)	Limit (dBm)	Margin (dB)	Polarity
960.2	49.0	-46.2	-20.0	26.2	Horizontal
960.2	54.6	-40.6	-20.0	20.6	Vertical
1440.3	35.3	-59.9	-20.0	39.9	Horizontal
1440.3	41.8	-53.4	-20.0	33.4	Vertical
1920.4	49.7	-45.5	-20.0	25.5	Horizontal
1920.4	52.3	-42.9	-20.0	22.9	Vertical
2400.5	49.2	-46.0	-20.0	26.0	Horizontal
2400.5	47.3	-47.9	-20.0	27.9	Vertical
2880.6	45.5	-49.7	-20.0	29.7	Horizontal
2880.6	46.0	-49.2	-20.0	29.2	Vertical
3360.7	45.0	-50.2	-20.0	30.2	Horizontal
3360.7	45.7	-49.5	-20.0	29.5	Vertical
3840.8	-	-	-20.0	-	Horizontal
3840.8	-	-	-20.0	-	Vertical
4320.9	47.4	-47.8	-20.0	27.8	Horizontal
4320.9	46.5	-48.7	-20.0	28.7	Vertical
4801.0	-	-	-20.0	-	Horizontal
4801.0	-	-	-20.0	-	Vertical

Device was tested on an open area test site at a distance of 3 metres.

Testing was carried out at EMC Technologies NZ Ltd Open Area Test Site, which is located at Driving Creek, Orere Point, Auckland. Details of this site have been filed with the Commission, Registration Number: 90838, which was last updated on March 20th, 2002.

The transceiver was tested while transmitting with a whip antenna, tuned to 480 MHz, attached to the antenna terminal.

The power level of each emission was determined by replacing the transmitter with a dipole antenna that was connected to a signal generator.

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The signal generator output level was increased until the same field strength level was observed at each emission frequency.

The level recorded is the signal generator output level in dBm less any gains / losses due to the coax cable and the dipole antenna.

Limit:

All spurious emissions are to be attenuated by at least $50 + 10 \log (P)$.

This gives a limit of -20 dBm.

No measurements were made above the 10th harmonic.

Result: Complies

Measurement Uncertainty: ± 4.1 dB

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Test Report No 20922.1

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8. TEST EQUIPMENT USED

Instrument	Manufacturer	Model	Serial #	Asset
Aerial Controller	EMCO	1090	9112-1062	RFS 3710
Aerial Mast	EMCO	1070-1	9203-1661	RFS 3708
Turntable	EMCO	1080-1-2.1	9109-1578	RFS 3709
Biconical Antenna	Schwarzbeck	BBA 9106	-	RFS 3612
Log Periodic Antenna	Schwarzbeck	UHALP 9107	-	RFS 3702
UHF Dipole Antenna	Schwarzbeck	UHA 9105	-	RFS 3679
Horn Antenna	EMCO	3115	9511-4629	E1526
Horn Antenna	Electrometrics	RGA-60	6234	E1494
Coax Cable	Sucoflex	104PA	2736/4PA	-
Signal Generator	Rohde & Schwarz	SMHU.58	838923/028	E1493
Measurement Receiver	Rohde & Schwarz	ESCS 30	839873/1	
Measurement Receiver	Rohde & Schwarz	ESHS 10	828404/005	RFS 3728
Spectrum Analyzer	Hewlett Packard	E7405A	US39150142	3776
Modulation Analyzer	Hewlett Packard	8901B	2608A00782	E1090
Thermal chamber	Contherm	M180F	86025	E1129
Thermometer	DSIR	RT200	035	E1049
Artificial Mains Network	Rhode & Schwarz	ESH 2-Z5	881362/034	RFS 3628
Variac	General Radio	1592	-	RFS 3690

9. ACCREDITATIONS

Testing was carried out in accordance with EMC Technologies NZ Ltd registration with the Federal Communications Commission as a listed facility, Registration Number: 90838, which was updated on March 20th, 2002.

The tests were carried out in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025: 1999.

All measurement equipment has been calibrated in accordance with the terms of EMC Technologies (NZ) Ltd's International Accreditation New Zealand (IANZ) Accreditation to NZS/ISO/IEC 17025: 1999.

International Accreditation New Zealand has Mutual Recognition Arrangements for testing and calibration with 46 accreditation bodies in 34 economies. This includes NATA (Australia), UKAS (UK), SANAS (South Africa), NVLAP (USA), A2LA (USA), SWEDAC (Sweden). Further details can be supplied on request.

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10. PHOTOGRAPH(S)

Device under test



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Charger Unit



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Conducted Emissions Test Setup



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Radiated Emissions Test Set Up



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