Emissions Testing
Performed
on the
Tunstall Telecom Ltd.
AMIE Trigger
Model: Telecom 4000D
To
FCC Part 15, Subpart C, Section 231

Date of Test: July 31, 2002

Project: 3029474

Contact: Mr. Richard Nadin

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I – Introduction and Summary

TO: Mr. Rik Nadin
FROM: Vathana F. Ven
DATE: September 24, 2002
Project #: 3032146

RE: Emissions Testing Performed on the AMIE Trigger, Model No. Telecom 4000D

On July 31, 2002, we tested the AMIE Trigger, Model No. Telecom 4000D to determine if it was in compliance with the FCC Part 15, Subpart C, Section 15.231 emission requirements. We found that the unit met the FCC Part 15, Subpart C, Section 15.231 emission requirements when tested as received.

A prototype version of the sample was received on July 29, 2002 in good condition.

The following Table summarizes the results of testing.

Test	Frequency (MHz)	Measurement	Requirement	Pass/Fail	Section of FCC Rules	Section of Test Report
Fundamental Field Strength	312.000	62.9 dBµV/m	75.4 dBµV/m	Pass	§15.231	II
Restricted Band & Spurious Emissions	1248.000	42.9 dBµV/m	55.4 dBµV/m	Pass	§15.205 & §15.209	II
Line-conducted	Line-conducted emission testing was not performed on the unit as it is battery powered.					
Bandwidth	312.000	365.0 kHz	<780 kHz	Pass	§15.231	XI
Duty Cycle	N/A			N/A	§15.231	
Antenna Conducted Emissions	Measurements were not performed as the device does not have the ability to connect to an external antenna.				N/A	

N/A-Not applicable

In summary, this report confirms that the AMIE Trigger, Model No. Telecom 4000D is compliant with the FCC Part 15, Subpart C, Section15.231 emission requirements when production units conform to the initial sample. Please address all questions and comments concerning this report to Scott M. Lambert.

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II – Technical Requirements

15.1 Scope

The AMIE Trigger is the pendant used to activate the emergency call. The device is an intentional radiator intended to operate in accordance with 15.231 "Operation in the band 40.66-40.70 Mhz above 70 MHz.".

15.15 General Technical Requirements

The product is a AMIE Trigger. The AMIE Trigger is powered by a replaceable battery and transmits at 312 MHz. The base unit receives RF signals and makes the emergency call to the monitoring station.

15.27 Special Accessories

No special accessories are necessary to meet the compliance requirements.

15.31 Measurement Standards

The measurement procedures as specified by ANSI C63.4:1992 were used to test this device. See Section IV of the test report for a detailed description of the test site and the measurement equipment.
A new battery for the transmitter was used during testing. The device was mounted to cardboard box, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

15.33 Frequency range of measurement

The device was scanned for spurious and harmonic emissions from 30 MHz to the 10th harmonic of the fundamental emission.

15.35 Measurement detector functions and bandwidth

The following table illustrates the detector functions and bandwidth used to test the device.

Frequency Range	Measurement Detector	Measurement Bandwidth
450 kHz to 30 MHz	Quasi-Peak	9 kHz
30 MHz to 1000 MHz	Quasi-Peak	120 kHz
1000 MHz to 10th harmonic	Average	1 MHz

The quasi-peak detector meets the requirements of CISPR 16.

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15.201 Certification

The device is required to be certified in accordance with Part 2 of the FCC rules, Subpart J.

15.203 Antenna Requirements

The antennas are a part of the PC board and cannot be readily removed from the device.

15.205 Restricted bands of operation

All unwanted emissions from the transmitter that fall in 15.205 restricted bands were compared to the general limits in 15.209.

Below 1000 MHz a quasi-peak detector was employed to measure emissions.
Above 1000 MHz an average detector was employed to measure emissions. Peak measurements were also performed above 1000 MHz to insure that they were not greater than 20 dB of the average.

15.207 Conducted limits

(a) For an intentional radiator designed to be connected to the AC mains network, the radio frequency voltage that is conducted back onto the AC power line between the frequencies 450 kHz and 30 MHz shall not exceed 250 uV, or 48 dBuV.
(b) If the proper measuring techniques are used, and the quasi-peak value of an emission exceeds its average value by 6 dB or more, that emission is broadband and the quasi-peak value may be reduced by 13 dB and compared to the limits.
(d) Devices powered from a battery are not subject to these limits unless there are provisions for connecting to a charger while the device is operating. Devices that obtain power through an AC adapter or through another device which is connected to the AC mains network are subject to these limits.

15.209 Radiated emission limits; general requirements

(a) Field Strength Requirements

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Frequency Range (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

(b) In the emission table above, the tighter limit applies at the band edges.
(c) The level of any spurious emissions must be lower than that of the fundamental emission of the intentional radiator. The limits in the above table are based on the frequency of the spurious emission, not the frequency of the fundamental frequency.
(d) See 15.35 for a description of measurement detector functions and bandwidth.
(e) See 15.33 for a description of the frequency range of measurement.
(f) If the frequency range of measurement must extend beyond the 10^{th} harmonic because of a digital device in the intentional radiator, the emissions found above the 10^{th} harmonic are to be compared with the general limits for radiated emissions from unintentional radiators set forth in 15.109.

15.231 Periodic operation in the band 40.66-40.70 Mhz and above 70 MHz

The field strength limit for the device was based on the operating frequency of 312 MHz:

Field Strength of Fundamental

Frequency (MHz)	Emission Limit (μV/m)	Emission Limit (dBμV/m)	Test Distance (meters)
312.000	5888.4	75.4	3

Field strength of Spurious Emissions

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Frequency (MHz)	Emission Limit (μV/m)	Emission Limit (dBμV/m)	Test Distance (meters)
312.000	588.8	55.4	3

The fundamental emission was measured with a peak detector. For above 1000 MHz, measurements were made with both a peak and average detector to insure that peak measurements did not exceed the average by more than 20 dB.

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III - Attestation

LABORATORY MEASUREMENTS

Pursuant To
Part 15, Subpart C
For
Intentional Radiators

Company Name:	Tunstall Electronics Limited
Address:	Whitley Lodge, Whitley Bridge Yorkshire DN14 0HR, UK
Model:	Telecom 4000D
Date(s) of Test:	July 31, 2002
Test Site Location:	INTERTEK TESTING SERVICES NA INC. 70 Codman Hill Road Boxborough, MA 01719
Site(s):	2C

We attest to the accuracy of this report:

Signature	Signature
Vathana F. Ven	Michael F. Murphy
Testing Performed By:	Reviewer
Senior Project Engineer	EMC Staff Engineer
Title	Title

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IV - Site Description and Measurement Equipment

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under Part 15, Subpart C, General Requirements.

A. **Test Set-Up**: The test set-up and procedures described below are designed to meet the requirements of ANSI C63.4 (1992).

1. The test site is a Plastic/Fiberglass structure with a groundplane. The site has attenuation characteristics which meet the requirements of ANSI C63.4 (1992). Information on the site has been filed with the FCC as required by Rule 2.948. The address of the site is 70 Codman Hill Road, Boxborough, MA 01719.

2. Power to the site is nominal line voltage of 117 V_{AC} and 230 V_{AC}, 60 Hz.

3. The equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately one meter in height above the groundplane. During the radiated emissions test, the turntable is rotated 360 degrees and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The antenna height and polarization are also varied during the search for maximum signal levels. The height of the antenna is varied from one meter to four meters. Body-worn, hand-held and small portable devices are mounted on a non-conductive box and emissions are investigated on three orthogonal axis.

4. Detector function for radiated emissions is in peak or quasi-peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings according to the following formula:

   Averaging Factor in dB = 20 LOG (duty cycle)

   The time period over which the duty cycle is measured is 100 msec. The worst-case (highest percentage on) duty cycle is used and described specifically in the data section. The duty cycle is measured by placing the spectrum analyzer in zero scan (receiver mode) and linear mode at maximum bandwidth (3 MHz at 3 dB down) and viewing the resulting time domain signal output from the analyzer on a Tektronix 465 Oscilloscope. The oscilloscope is used because of its superior time base and triggering facilities.

5. Antennas used below 1000 MHz were EMCO Model 3142 Biconolog. For measurements above 1 GHz, an EMCO Model: 3115 Horn Antenna is used. The Antennas used are listed in the Test Equipment Summary in Section 6.

6. The field strength measuring equipment used included:

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The following equipment was used to make measurements for emissions testing:

Description	Manufacturer	Model	Serial #	Cal Due
RECEIVER	HEWLETT PACKARD	8542E	3520A00125	12/7/02
Spectrum Analyzer	Agilent	E7405A	US40240205	11/2/02
BICONOLOG	EMCO	3142	9711-1223	10/8/02
Horn Antenna	EMCO	3115	9602-4675	6/6/03
Cable, SMA-SMA <18GHz	Sucoflex (Huber + Suhner)	104PE	CBLSHF101	4/1/03

7. The frequency range to be scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency, or 40 GHz, whichever is lower. For line-conducted emissions, the range scanned is 450 kHz to 30 MHz.

8. The EUT is warmed up for 15 minutes prior to the test. AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new battery is used.

9. Conducted measurements were made as described in ANSI C63.4 (1992). An IF bandwidth of 9 kHz is used, and peak or quasi-peak detection is employed.

10. The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application No. 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report. Above 1000 MHz, a bandwidth of 1 MHz is generally used.

11. Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the forbidden bands and above 1 GHz (where no preamplifier is used), signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, but those measurements taken at a closer distance are so marked.

12. For measurements made in the 9 kHz to 30 MHz range, a distance of 30 meters was used unless a good signal-to-noise ratio could not be obtained. In that case, a closer distance was used and that distance is so marked in the data table.

V – Summary of Equipment Under Test

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1	**Manufacturer**:	Tunstall Electronics Limited Whitley Lodge, Whitley Bridge Yorkshire DN14 0HR, UK Contact: Richard Nadin
2	**Grantee**:	Tunstall Electronics Limited Whitley Lodge, Whitley Bridge Yorkshire DN14 0HR, UK Contact: Richard Nadin
3	**Model No.**:	Telecom 4000D
4	**Trade Name**:	None
5	**Serial No.**:	58433020904
6	**Date of Test**:	July 31, 2002
7	**Frequencies to which device can be tuned**:	None
8	**Can customer tune device?**	No
9	**Detailed description of operation pursuant to 15.231**:	See 15.231
10	**Applicable emissions limits**:	15.105, 15.109, 15.205, 15.207,15.209 and 15.231

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VI - Configuration Information

Equipment Under Test: AMIE Trigger

Model: Telecom 4000D

Serial No.: 58433020904

FCC Identifier: None

Support Equipment:

Description: Tunstall RF Receiver
Manufacturer: Tunstall Telecom Ltd.
Part No.: Telecom 4000D
Serial No.: 12345600212103600441 0A0

Cables:

QTY	Description	Shield Description	Hood Description	Length (m)

Battery Powered

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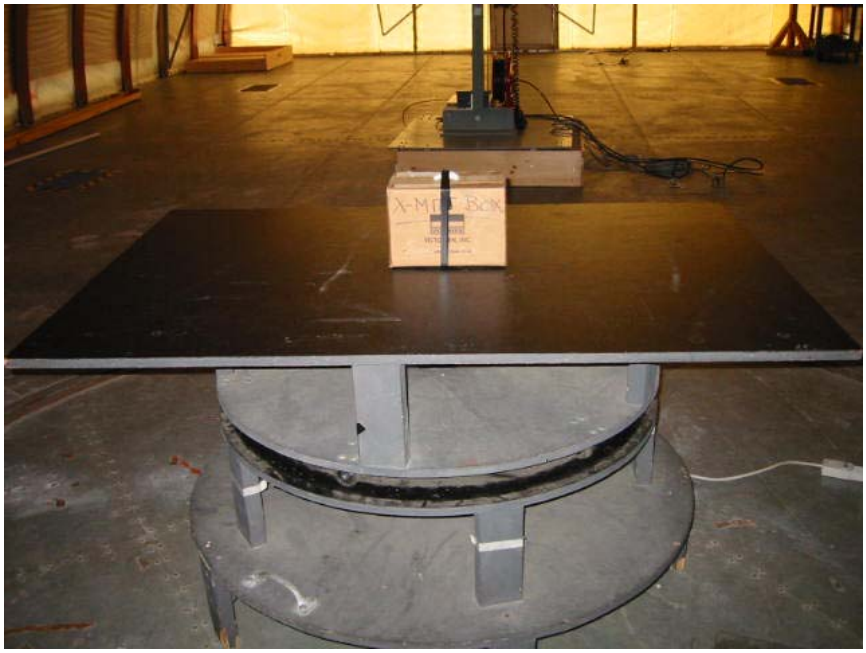
VII - Configuration Photographs



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VIII - Sample Calculation

The following is how net field strength readings were determined:

NF = RF + AF + CF + PF + DF

Where,

NF = Net Reading in dBμV/m
RF = Reading from receiver in dBμV
AF = Antenna Correction Factor in dB(1/m)
CF = Cable Correction Factor in dB
PF = Preamplifier Correction Factor in dB
DF = Distance Factor in dB (using 20 dB/decade), from 3 to 1 meters 10.5 dB was added for measurements performed at 1 meter

To convert from dBμV/m to μV/m or mV/m the following was used:

$UF = 10^{(NF / 20)}$

Where,

UF = Net Reading in μV/m

Example:

For the fundamental field strength measurement at 8.4 (distance = 3 meters) see table [1].

NF = RF + AF + CF + PF + DF = 61.6 + 27.7 + 3.9 + 0.0 + 0.0 = 89.8 dBμV/m

$UF = 10^{(89.8\ dB\mu V / 20)} = 30{,}902\ \mu V/m$

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IX - Data Tables

Radiated Emissions / Interference

Table: 1

Company: Tunstall Telecom Ltd. | Model #: Telecom 4000D
Engineer: Vathana Ven | Location: EMI Site 2 | Serial #: 58433020904
Project #: 3029474 | Pressure: N/A | Detector: HP 8542E & Agilent E7405A
Date: 07/31/02 | Temp: 25.1C | Antenna: LOG2 & Horn 2
Standard: FCC Part 15 Subpart C | Humidity: 47% | PreAmp: None
Class: None | Group: None | Cable(s): 2C, 3MPRIME & CBLSHF 101
Limit Distance: 3 meters | Test Distance: 3 meters
Voltage/Frequency: Battery Powered | Frequency Range: 30 Mhz-3120 Mhz
! - value over limit * - value that is within the margin of measurement uncertainty of +/-4 dB

Notes #	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	
Peak Readings											
1	V	104.000	25.0	7.8	1.4	0.0	0.0	34.3	56.2	-21.9	
2	V	104.000	27.0	7.8	1.4	0.0	0.0	36.3	56.2	-19.9	
3	V	104.000	27.1	7.8	1.4	0.0	0.0	36.4	56.2	-19.8	
1	H	208.000	16.3	10.5	2.1	0.0	0.0	28.9	56.2	-27.3	
2	H	208.000	19.8	10.5	2.1	0.0	0.0	32.4	56.2	-23.8	
3	H	208.000	15.7	10.5	2.1	0.0	0.0	28.3	56.2	-27.9	
1	H	312.000	44.0	14.5	2.8	0.0	0.0	61.3	76.2	-14.9	
2	V	312.000	44.3	14.5	2.8	0.0	0.0	61.6	76.2	-14.6	
3	V	312.000	45.6	14.5	2.8	0.0	0.0	62.9	76.2	-13.3	
1	V	624.000	12.0	21.3	4.3	0.0	0.0	37.6	56.2	-18.6	
2	H	624.000	13.6	21.3	4.3	0.0	0.0	39.2	56.2	-17.0	
3	V	624.000	10.9	21.3	4.3	0.0	0.0	36.5	56.2	-19.7	
1	V	936.000	8.8	24.2	5.6	0.0	0.0	38.6	56.2	-17.6	
2	H	936.000	6.8	24.2	5.6	0.0	0.0	36.6	56.2	-19.6	
3	V	936.000	7.9	24.2	5.6	0.0	0.0	37.7	56.2	-18.5	
1	H	1248.000	15.0	26.7	0.2	0.0	0.0	41.9	56.2	-14.3	
2	H	1248.000	16.0	26.7	0.2	0.0	0.0	41.9	56.2	-14.3	
3	H	1248.000	16.0	26.7	0.2	0.0	0.0	41.9	56.2	-14.3	

1- Pendant was positioned horizontally
2- Pendant was positioned sideway
3- Pendant was positioned vertically

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X - Duty Cycle (Average Factor)

Average factor is subtracted from peak readings to compare emissions readings to average limits. The average factor is calculated from duty cycle measurements from the following plots.

The average factor is 20 Log (ON-TIME/PERIOD) of the emission. If the period is longer than 100 milliseconds then 100 milliseconds is used for the period. Average factor is determined using the worst-case duty cycle.

		Plot
A) Period of a "Word"	ms	
B) ON-TIME of a "Word"	ms	
C) Period of one "Bit"	ms	
D) ON-TIME of one "Bit" (worst-case)	ms	

E) Percent ON-TIME of a "Word" (A/B)	%
F) Percent ON-TIME of a "Bit" (C/D)	%
20 LOG (A * B)	

Not tested-All measurements were made with peak detector.

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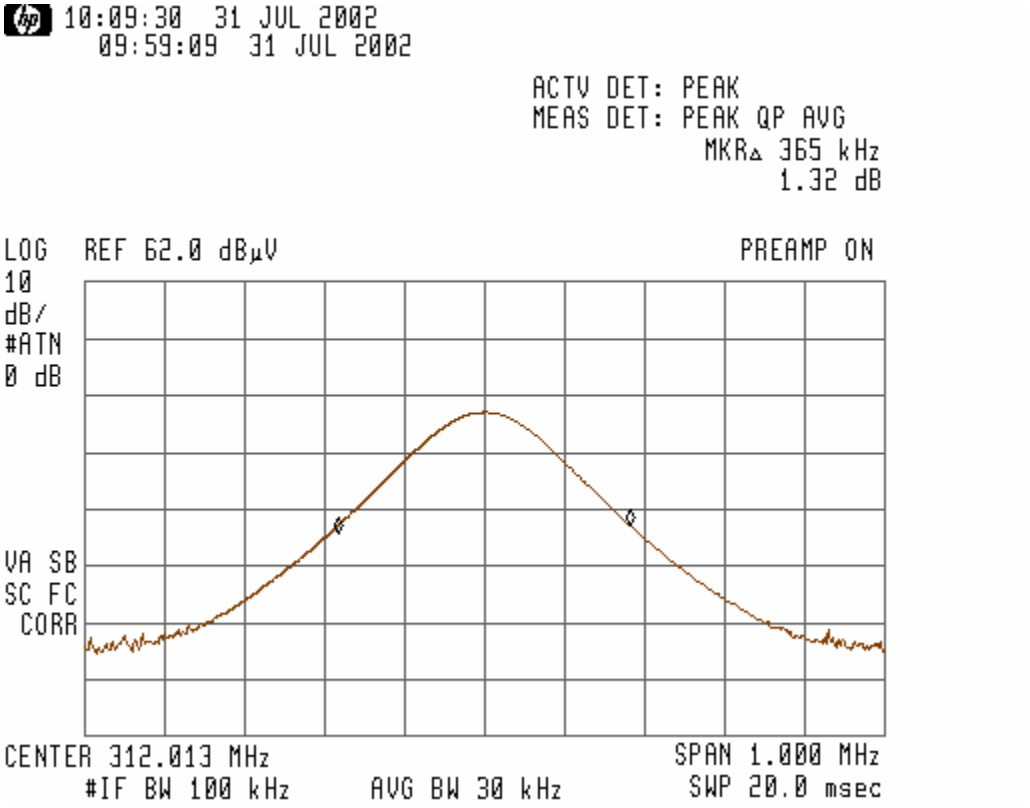
XI - Bandwidth

The following plot(s) show bandwidth measurements made.



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