REPORT OF MEASUREMENTS
PART 15C - INTENTIONAL RADIATORS

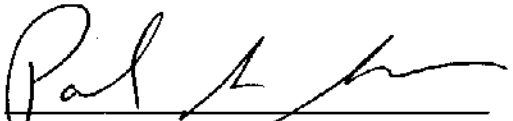
DEVICE: 2.4GHz VIDEO TRANSMITTER

MODEL: VST2500

MANUFACTURER: TRANGO SYSTEMS

ADDRESS: 9939 VIA PASAR
SAN DIEGO CA 92126

THE DATA CONTAINED IN THIS REPORT WAS
COLLECTED ON 14 FEBRUARY 2000 AND COMPILED BY:



PAUL G. SLAVENS
CHIEF EMC ENGINEER

1. General

1.1 Purpose

The purpose of this report is to show compliance to the FCC requirements for an Intentional Radiator under Part 15.

1.2 Manufacturer

Company Name:	Trango Systems
Contact:	Chris Gustaf
Street Address:	9939 Via Pasar
City/State/Zip:	San Diego CA 92126
Telephone:	858 653-3900
Fax:	858 621-2725
E-mail:	chrisg@zcomm.com

1.3 Test location

Company:	Acme Testing Inc.
Street Address:	2002 Valley Highway
Mailing Address:	PO Box 3
City/State/Zip:	Acme WA 98220-0003
Laboratory:	Test Site 2
Telephone:	888 226-3837
Fax:	360 595-2722
E-mail:	acmetest@acmetesting.com
Web:	www.acmetesting.com
Receipt of EUT:	11 February 2000

1.4 Test Personnel

Paul G. Slavens

2. Test Results Summary

Summary of Test Results

Test Specification	Test Description	Compliance Criteria	Status
FCC CFR 47, PART 15C, 15.249	**Radiated Emissions** 30 MHz - 22GHz	**15.249**	**Pass**
FCC CFR 47, PART 15C, 15.207(a)	**Conducted Emissions** 0.45 MHz - 30 MHz	**15.207(a)**	**Pass**

The signed original of this report, supplied to the client, represents the only "official" copy. Retention of any additional copies (electronic or non-electronic media) is at Acme Testing's discretion to meet internal requirements only. The client has made the determination that EUT Condition, Characterization, and Mode of Operation are representative of production units, and meet the requirements of the specifications referenced herein.

Consistent with Industry practice, measurement and test equipment not directly involved in obtaining measurement results but having an impact on measurements (such as cable loss, antenna factors, etc.) is factored into the "Correction Factor" documented in certain test results. Instrumentation employed for testing meets tolerances consistent with known Industry Standards and Regulations.

The measurements contained in this report were made in accordance with the procedure ANSI C63.4 - 1992 and all applicable Public Notices received prior to the date of testing. All emissions from the device were found to be within the limits outlined in this report. Acme Testing assumes responsibility only for the accuracy and completeness of this data as it pertains to the sample tested.

Paul G. Slavens
Chief EMC Engineer

03 MARCH 2000
Date of Issuance

2.1 Manufacturer's Statement of Responsibility

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 consistent with industry or Commission standards and demonstrate that the equipment complies with the appropriate standards. Each unit manufactured, imported or marketed, as defined in the Commission's regulations, will conform to the sample(s) tested within the variations that can be expected due to quantity production and testing on a statistical basis. I further certify that the necessary measurements were made by:

Acme Testing
2002 Valley Highway
P.O. Box 3, Acme
Washington 98220-0003
360-595-2785

_____
Signature

_____
Title

3. Description of Equipment and Peripherals

3.1 Equipment Under Test (EUT)

Device:	2.4GHz Video Transmitter
Model Number:	VST2500
Serial Number:	None
FCC ID:	NCYVST2500
Power:	120V/60Hz
Grounding:	Local

3.2 EUT Peripherals

Device	Manufacturer	Model No.	FCC ID
Video Generator	Tektronix	TS695	None

3.3 Description of Interface Cables for Emissions

EUT/VIDEO GENERATOR

Shielded	Unshielded	Flat	Round	Length	Ferrite
Yes	No	No	Yes	1 m	No

ARRANGEMENT OF INTERFACE CABLES: All interface cables were positioned for worst case maximum emissions within the manner assumed to be a typical operating condition (please reference photographs).

3.4 The Mode of Operation During Tests for Emissions

The EUT was exercised by constantly transmitting. The EUT was modulated with input from video generator outputting standard FCC composite signal and a 1 kHz tone. The EUT was also tested without any modulating signal.

3.5 Modifications Required for Compliance

The EUT required the following modifications during testing to bring the product into compliance.

1. None.

4. Antenna requirement FCC CFR 47, Part 15C, 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

4.1 Test Results

The antenna is integral to the transmitter.

5. Radiated Emissions Tests

Test Requirement: FCC CFR 47, PART 15C, 15.249

Test Procedure: ANSI C63.4:1992

5.1 Test Equipment

⇒ Spectrum Analyzer: Hewlett-Packard 8566B, Serial Number 2410A-00168, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

⇒ RF Preselector: Hewlett-Packard 85685, Serial Number 2648A-00519, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

⇒ Quasi Peak Adapter: Hewlett-Packard 85650A, Serial Number 2043A-00327, Calibrated: 17 March 1999, Calibration due Date: 17 March 2000

⇒ Line Impedance Stabilization Network: Rhode & Schwarz ESH2-Z5, Serial Number ACMERS1, Calibrated: 1 September 1999, Calibration due Date: 01 September 2000

⇒ Broadband Biconical Antenna (20 MHz to 200 MHz): EMCO 3110, Serial Number 1115, Calibrated: 28 December 1999, Calibration due Date: 28 December 2000

⇒ Broadband Log Periodic Antenna (200 MHz to 1000 MHz): EMCO 3146, Serial Number 2853, Calibrated: 28 December 1999, Calibration due Date: 28 December 2000

⇒ Double Ridge Guide Horn Antenna: EMCO 3115, Serial Number 9807-5534, Calibrated: 30 December 1999, Calibration due Date: 30 December 2000

⇒ Pyramidal Horn Antenna: EMCO 3160-09, Serial Number 9701-1071, Calibration Not Required.

⇒ EUT Turntable Position Controller: EMCO 1061-3M, Serial Number 9003-1441, No Calibration Required

⇒ Antenna Mast: EMCO 1051, Serial Number 9002-1457, No Calibration Required

⇒ 2 GHz to 10 GHz Low Noise Preamplifier: Milliwave 593-2898, Serial Number 2494, No Calibration Required

⇒ 8 GHz to 22 GHz Low Noise Preamplifier: Miteq AFS4-35LN, Serial Number 484280, Calibrated: 28 December 1999, Calibration due Date: 28 December 2000

5.2 Purpose

The purpose of this test is to evaluate the radiated electromagnetic interference characteristics of the EUT.

5.3 Test Procedures

For tabletop equipment, the EUT is placed on a 1 meter by 1.5 meters wide and 0.8 meter high nonconductive table that sits on a flush mounted metal turntable. Floor standing equipment is placed directly on the flush mounted metal turntable. The EUT is connected to its associated peripherals with any excess I/O cabling bundled to approximately 1 meter.

Preview tests are performed to determine the "worst case" mode of operation. With the EUT operating in "worst case" mode, emissions from the unit are maximized by adjusting the polarization and height of the receive antenna and rotating the EUT on the turntable. EUT emissions are also maximized by manipulating the system cables.

Radiated Emissions Test Characteristics	
Frequency range	30MHz - 22GHz
Test distance	3 meters
Test instrumentation resolution bandwidth	120 kHz (30MHz-1GHz) 1MHz (1GHz - 22GHz)
Receive antenna scan height	1 - 4 meters
Receive antenna polarization	Vertical/Horizontal

5.4 Test Results

PRODUCT EMISSIONS
ALL DETECTED EMISSIONS FROM 30 MHz TO 22 GHz
AVERAGE DETECTION WITH VIDEO AND AUDIO INPUT

No	EMISSION FREQUENCY MHz	SPEC LIMIT dBuV/m	MEASUREMENTS ABS	dlim dB	MODE	POL	SITECORR FACTOR dB	COMMENTS
1	2412.07	94.0	87.1	-6.9	AVERAGE	V	5.6	CHANNEL 1 FUND.
2	4825.87	54.0	40.4	-13.6	AVERAGE	V	10.1	CHANNEL 1 SPUR.
3	2450.01	94.0	85.0	-9.0	AVERAGE	V	5.7	CHANNEL 3 FUND.
4	4904.20	54.0	45.8	-8.2	AVERAGE	V	10.4	CHANNEL 3 SPUR.
5	2469.07	94.0	84.6	-9.4	AVERAGE	V	5.7	CHANNEL 4 FUND.
6	4937.74	54.0	41.2	-12.8	AVERAGE	V	10.5	CHANNEL 4 SPUR.

PRODUCT EMISSIONS
ALL DETECTED EMISSIONS FROM 30 MHz TO 22 GHz
PEAK* DETECTION WITH VIDEO AND AUDIO INPUT

No	EMISSION FREQUENCY MHz	SPEC LIMIT dBuV/m	MEASUREMENTS ABS	dlim dB	MODE	POL	SITECORR FACTOR dB	COMMENTS
1	2413.12	114.0	103.6	-9.4	PEAK	V	5.6	CHANNEL 1 FUND.
2	4823.45	74.0	54.9	-19.1	PEAK	V	10.1	CHANNEL 1 SPUR.
3	2450.08	114.0	101.5	-13.5	PEAK	V	5.7	CHANNEL 3 FUND.
4	4903.65	74.0	57.7	-16.3	PEAK	V	10.4	CHANNEL 3 SPUR.
5	2471.24	114.0	101.2	-12.8	PEAK	V	5.7	CHANNEL 4 FUND.
6	4938.86	74.0	50.3	-23.7	PEAK	V	10.5	CHANNEL 4 SPUR.

* Peak values are given for all emissions that were measured with an average detector to show compliance to CFR 47, Part 15, 15.35(d).

PRODUCT EMISSIONS
ALL DETECTED EMISSIONS FROM 30 MHz TO 22 GHz
AVERAGE AND PEAK DETECTION WITH **NO** VIDEO AND AUDIO INPUT

No	EMISSION FREQUENCY MHz	SPEC LIMIT dBuV/m	MEASUREMENTS ABS	dlim dB	MODE	POL	SITECORR FACTOR dB	COMMENTS
1	2449.17	114.0	102.1	-11.9	PEAK	V	5.6	CHANNEL 3 FUND.
2	2450.96	94.0	79.5	-14.5	AVERAGE	V	10.1	CHANNEL 3 FUND.
3	4900.50	74.0	56.5	-17.5	PEAK	V	5.7	CHANNEL 3 SPUR.
4	4901.82	54.0	50.0	-4.0	AVERAGE	V	10.5	CHANNEL 3 SPUR.

6. Conducted Emissions Tests

Test Requirement: CFR 47, Part 15C, 15.207(a)

Test Procedure: ANSI C63.4:1992

6.1 Test Equipment

⇒ Spectrum Analyzer: Hewlett-Packard 8566B, Serial Number 2410A-00168, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

⇒ RF Preselector: Hewlett-Packard 85685, Serial Number 2648A-00519, Calibrated: 12 March 1999, Calibration due Date: 12 March 2000

⇒ Quasi Peak Adapter: Hewlett-Packard 85650A, Serial Number 2043A-00327, Calibrated: 17 March 1999, Calibration due Date: 17 March 2000

⇒ Line Impedance Stabilization Network: Rhode & Schwarz ESH2-Z5, Serial Number ACMERS1, Calibrated: 1 September 1999, Calibration due Date: 01 September 2000

6.2 Purpose

The purpose of this test is to evaluate the level of conducted noise the EUT imposes on the A/C mains.

6.3 Test Procedures

For tabletop equipment, the EUT is placed on a 1 meter by 1.5 meters wide and 0.8 meter high nonconductive table that is placed above the groundplane. Floor standing equipment is placed directly on the groundplane. Any supplemental grounding mechanisms are connected, if appropriate. The EUT is connected to its associated peripherals, with any excess I/O cabling bundled to approximately 1 meter. The EUT is connected to a dedicated LISN and all peripherals are connected to a second separate LISN circuit. The LISNs are bonded to the groundplane.

Preview tests are performed to determine the “worst case” mode of operation. With the EUT operating in “worst case” mode, final conducted measurements are taken. Conducted measurements are made on each current carrying conductor with respect to ground.

Conducted Emissions Test Characteristics	
Frequency range	0.45 - 30.0 MHz
Test instrumentation resolution bandwidth	9 kHz
Lines Tested	Line 1/Line 2

6.4 Test Results

A summary of the highest amplitude emissions are listed below. For detailed plots of all emissions from 0.45 MHz - 30 MHz, please refer to the accompanying data in the list of attachments.

ENGINEER:	CHRIS GUSTAF
DEVICE:	2.4GHz VIDEO TRANSMITTER
PRODUCT MODEL #:	MODEL VTS2500

LINE 1

PEAK #	FREQ (MHz)	AMPL (dBuV)
1	1.068	32.5
2	16.81	30.2

LINE 2

PEAK #	FREQ (MHz)	AMPL (dBuV)
1	1.123	30.4
2	15.4	29.6

7. Measurement Notes

1) The EUT emissions were only investigated to 22GHz which is the upper frequency of the HP 8566B Spectrum Analyzer. However, per previous conversations with the engineers at the FCC, since there are no detectable emissions between the second harmonic at 4.9 GHz and 22GHz, good engineering logic dictates there are no detectable emissions from 22GHz to 24.9GHz.

8. List of Attachments

1. Plots of all conducted emissions. (6)
2. Plots of Band Edge emissions. (4)
3. Photographs of test set-ups. (4)