Emissions
Test Report

EUT Name: Hand Held Interrogator

EUT Model: 52808K500

FCC Part 90

Prepared for:

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Report/Issue Date: 13 June 2006
Report Number: 30660708.001

Statement of Compliance

Manufacturer:	AMCO Automated Systems, Inc. 201 S. Rogers Lane Raleigh, NC 27610 919 250-5440
Requester / Applicant:	John Casaer
Name of Equipment:	Hand Held Interrogator Model No. 52808K500
Type of Equipment:	Itentional Radiator
Class of Equipment:	N/A
Application of Regulations:	FCC Part 90
Test Dates:	20 March 2006 to 21 March 2006

Guidance Documents:

Emissions: FCC 47 CFR Part 90

Test Methods:

Emissions: ANSI/TIA-603-B-2002

The electromagnetic compatibility test and documented data described in this report has been performed and recorded by TUV Rheinland of North America, in accordance with the standards and procedures listed herein. As the responsible authorized agent of the EMC laboratory, I hereby declare that a sample of one, of the equipment described above, has been shown to be compliant with the EMC requirements of the stated regulations and standards based on these results. If any special accessories and/or modifications were required for compliance, they are listed in the Executive Summary of this report.

This report must not be used to claim product endorsement by NVLAP or any agency of the U.S. Government. This report contains data that are not covered by NVLAP accreditation. This report shall not be reproduced except in full, without the written authorization of the laboratory.

Digitally signed by Al Servais
Reason: I attest to the accuracy and integrity of this document
Location: TUV Raleigh
Date: 2006.06.13 21:04:02 -04'00'

[signature]	13 June 2006	[signature]	13 June 2006
Test Engineer	Date	NVLAP Signatory	Date

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1 Executive Summary

1.1 Scope

This report is intended to document the status of conformance with the requirements of the FCC Part 90 based on the results of testing performed on *20 March* 2006 through *21 March* 2006 on the *Hand Held Interrogator* Model No. *52808K500* manufactured by AMCO Automated Systems, Inc.. This report only applies to the specific samples tested under the stated test conditions. It is the responsibility of the manufacturer to assure that additional production units of this model are manufactured with identical or EMI equivalent electrical and mechanical components. This report is further intended to document changes and modifications to the EUT throughout its life cycle. All documentation will be included as a supplement.

1.2 Purpose

Testing was performed to evaluate the EMC performance of the EUT in accordance with the applicable requirements, procedures, and criteria defined in the application of regulations and application of standards listed in this report.

2 Laboratory Information

2.1 Accreditations & Endorsements

2.1.1 US Federal Communications Commission

TUV Rheinland of North America at the 762 Park Ave. Youngsville, N.C 27596 address is accredited by the commission for performing testing services for the general public on a fee basis. This laboratory test facilities have been fully described in reports submitted to and accepted by the FCC (Registration No 90552 and 100881). The laboratory scope of accreditation includes: Title 47 CFR Part 15, 18, and 90. The accreditation is updated every 3 years.

2.1.2 NIST / NVLAP

TUV Rheinland of North America is accredited by the National Voluntary Laboratory Accreditation Program, which is administered under the auspices of the National Institute of Standards and Technology. The laboratory has been assessed and accredited in accordance with ISO Guide 17025:1999 and ISO 9002 (Lab code 200094-0). The scope of laboratory accreditation includes emission and immunity testing. The accreditation is updated annually.

2.1.3 Japan - VCCI

The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) is a group that consists of Information Technology Equipment (ITE) manufacturers and EMC test laboratories. The purpose of the Council is to take voluntary control measures against electromagnetic interference from Information Technology Equipment, and thereby contribute to the development of a socially beneficial and responsible state of affairs in the realm of Information Technology Equipment in Japan. TUV Rheinland of North America at the 762 Park Ave. Youngsville, N.C 27596 address has been assessed and approved in accordance with the Regulations for Voluntary Control Measures. (Registration No. R-1174, R-1679, C-1790 and C-1791).

2.1.4 Acceptance By Mutual Recognition Arrangement

The United States has an established agreement with specific countries under the Asia Pacific Laboratory Accreditation Corporation (APLAC) Mutual Recognition Arrangement. Under this agreement, all TUV Rheinland of North America at the 762 Park Ave. Youngsville, N.C 27596 address test results and test reports within the scope of the laboratory NIST / NVLAP accreditation will be accepted by each member country.

2.2 Test Facilities

All of the test facilities are located at 762 Park Ave., Youngsville, North Carolina 27596, USA.

2.2.1 Emission Test Facility

The Open Area Test Site and AC Line Conducted measurement facility used to collect the radiated and conducted data has been constructed in accordance with ANSI C63.7:1992. The site has been measured in accordance with and verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4:1992, at a test distance of 3 and 10 meters. This site has been described in reports dated May 12, 1997, submitted to the FCC, and accepted by letter dated June 25, 1997 (31040/SIT 1300F2). The site is listed with the FCC and accredited by NVLAP (code 200094-0). The 5m semi-anechoic chamber used to collect the radiated data has been verified to comply with the theoretical normalized site attenuation requirements of ANSI C63.4:1992, at a test distance of 3 meters. A report detailing this site can be obtained from TUV Rheinland of North America.

2.2.2 Immunity Test Facility

ESD, EFT, Surge, PQF: These tests are performed in an environmentally controlled room with a 3.7m x 3.7m x 3.175mm thick aluminum floor connected to PE ground. For ESD testing, tabletop equipment is placed on an insulated mat with a surface resistivity of 10^9 Ohms/square on a 1.6m x 0.8m x 0.8m high non-conductive table with a 3.175mm aluminum top (Horizontal Coupling Plane). The HCP is connected to the main ground plane via a low impedance ground strap through two 470 kΩ resistors. The Vertical Coupling Plane consists of an aluminum plate 50cm x 50cm x 3.175mm thick. The VCP is connected to the main ground plane via a low impedance ground strap through two 470 kΩ resistors. For each of the other tests, the HCP is removed.

RF Field Immunity testing is performed in a 7.3m x 3.7m x 3.2m anechoic chamber.

RF Conducted and Magnetic Field Immunity testing is performed on a 4.9m x 3.7m x 3.175mm thick aluminum ground plane which is connected to one end of the anechoic chamber.

All test areas allow a minimum distance of 1 meter from the EUT to walls or conducting objects.

2.3 Measurement Uncertainty

Two types of measurement uncertainty are expressed in this report, per *ISO Guide To The Expression Of Uncertainty In Measurement*, 1st addition, 1995.

The Combined Standard Uncertainty is the standard uncertainty of the result of a measurement when that result is obtained from the values of a number of other quantities, equal to the positive square root of a sum of terms, the terms being the variances or co-variances of these other quantities weighted according to how the measurement result varies with changes in these quantities. The term standard uncertainty is the result of a measurement expressed as a standard deviation.

The Expanded Uncertainty defines an interval about the result of a measurement that may be expected to encompass a large fraction of the distribution of values that could reasonably be attributed to the measurand. The fraction may be viewed as the coverage probability or level of confidence of the interval.

The test system for conducted emissions is defined as the LISN, spectrum analyzer, coaxial cables, and pads. The test system for radiated emissions is defined as the antenna, spectrum analyzer, pre-amplifier, coaxial cables, and pads. The test system for radiated immunity is defined as the antenna, amplifier, cables, signal generator field probe and spectrum analyzer. The test system for conducted immunity is defined as the coupling/decoupling device, amplifier, cables, signal generator and spectrum analyzer. The test system for voltage variations and interruptions immunity is defined as the AC power source and the interruptions generator. The test system for electrical fast transient immunity is defined as the AC power output source and the fast transient generator. The test system for lightning surge immunity is defined as the AC power output source and the lightning surge generator. The test system for electrostatic discharge immunity is defined as the air and contact discharge generators. The test system for power frequency magnetic field immunity is defined as the AC voltage source. The test system for the damped oscillatory wave immunity is defined as the AC power output source and the oscillatory wave generator. The test system for harmonic current and voltage flicker test is defined as the AC power source and the detection devices. The conducted emissions test system has a combined standard uncertainty of ± 1.2 dB. The radiated emissions test system has a combined standard uncertainty of ± 1.6 dB. The radiated immunity test system has a combined standard uncertainty of ± 2.7 dB. The conducted immunity test system has a combined standard uncertainty of ± 1.5 dB. The voltage variations and interruptions immunity test system has a combined standard uncertainty of ± 4.3 dB. The electrical fast transients immunity test system has a combined standard uncertainty of ± 5.8 dB. The lightning surge immunity test system has a combined standard uncertainty of ± 8.0 dB. The electrostatic discharge immunity test system has a combined standard uncertainty of ± 4.1 dB. The power frequency magnetic field immunity test system has a combined standard uncertainty of ± 0.58 dB. The damped oscillatory wave immunity test system has a combined standard uncertainty of ± 8.7 dB. The harmonic current and voltage flicker test system has a combined standard uncertainty of ± 11.6 dB. The expanded uncertainty at a level of 95% confidence is obtained by multiplying the combined standard uncertainty by a coverage factor of 2. Compliance criteria are not based on measurement uncertainty.

2.4 Calibration Traceability

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Measurement method complies with ANSI/NCSL Z540-1-1994 and ISO Guide 17025:1999.

3 Test Report Information

3.1 2.1033 Application for Certification Information

2.1033 (c) TECHNICAL DESCRIPTION

2.1033 (3) User Manual – Included in the Exhibits.

2.1033

Type of Emission: A3D
Necessary Bandwidth and Emission Bandwidth Calculation
The 12.5 kHz Analog Modulation Bandwidth = 6K00A3D
Calculation:
Max modulation (M) in kHz: 1
Max deviation for (D) in kHz for (12.5 kHz channel spacing): 2
Constant factor (K): 1
B_n = 2xM+2xDK = (2x1) + (2x2x1) = 6 kHz

2.1033 (5) Frequency Range: 451.36 MHz

(6) Power Range and Controls: There are NO user Power controls.

(7) Maximum Output Power Rating:
0.933 Watts, into a 50 ohm resistive load.

(8) DC Voltages and Current into Final Amplifier:
INPUT POWER: (7.4V)(0.781A) = 5.78 Watts

(9) Tune-up procedure. The tune-up procedure is given in the Exhibits.

2.1033 (10) A schematic diagram and a description of all circuitry and devices for determining and stabilizing frequency, for suppression of spurious radiation, and for limiting power is included in the Exhibits.

2.1033(c) (11) A photograph or drawing of the equipment identification label is shown in the Exhibits.

2.1033(c) (12) Photographs of the equipment of sufficient clarity to reveal equipment construction and layout and label locations are shown in the Exhibits.

2.1033(c) (14) data required for 2.1046. See Below.

3.2 2.1046 RF Power Output

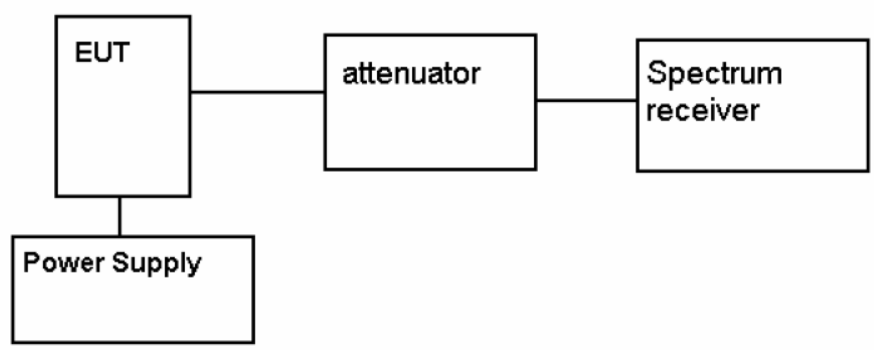
RF power output.

RF power is measured by connecting a 50-ohm, Resistive wattmeter to the RF output connector. with a nominal battery voltage of 7.4 VDC, and the transmitter properly adjusted the RF output measures:

POWER OUTPUT

OUTPUT POWER: 0.933 Watts

METHOD OF MEASURING RF POWER OUTPUT



3.3 90.210 Emission Mask

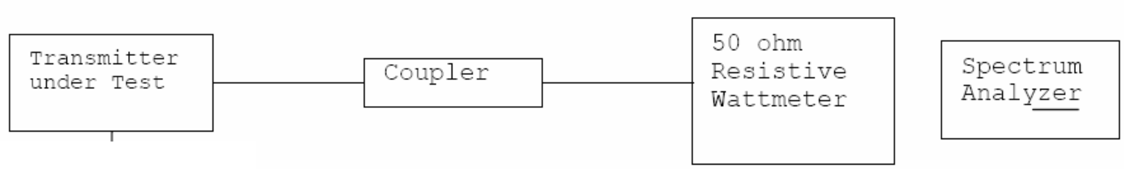
90.210 (b)
(b) *Emission Mask B.* For transmitters that are equipped with an audio lowpass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.
(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.
(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth:
At least 43 + 10 log (P) dB.

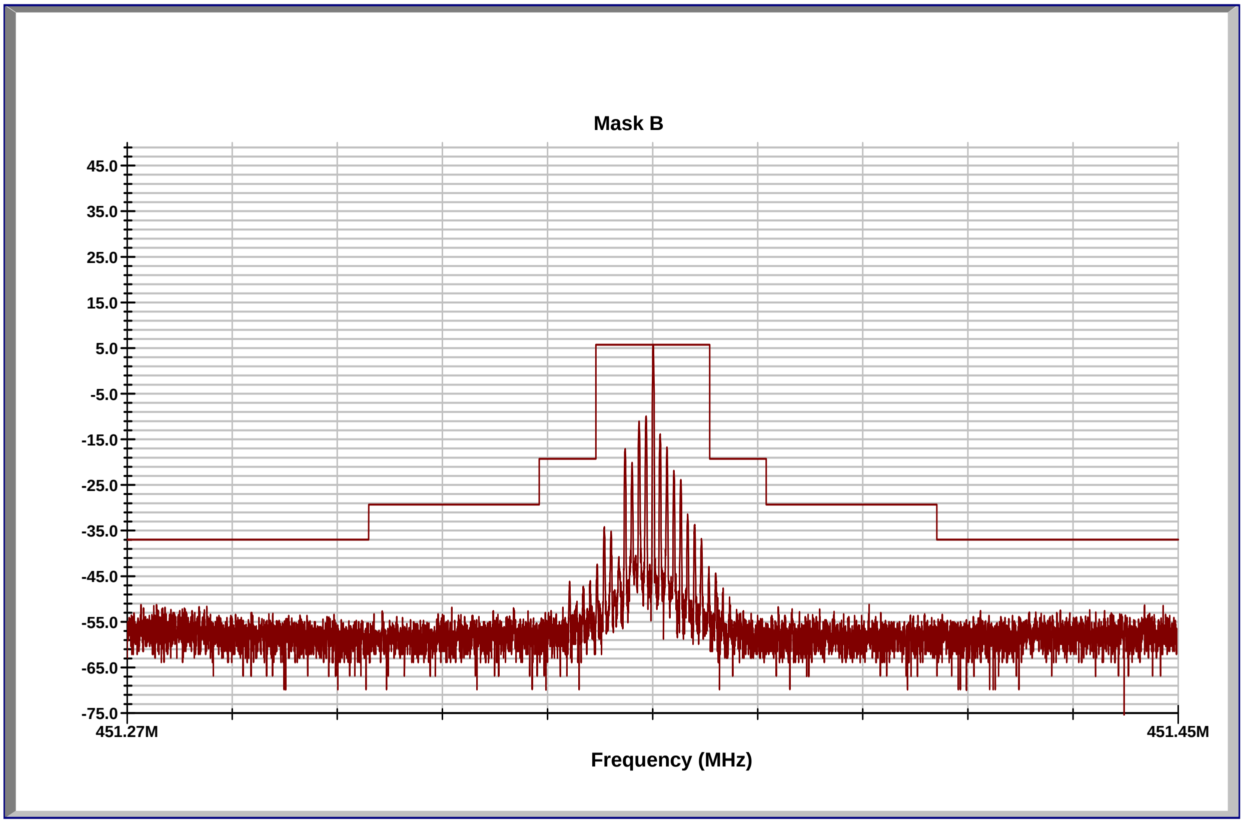
Test procedure: TIA/EIA-603 para 2.2.11, with the exception that various tones were used.

Test procedure diagram

OCCUPIED BANDWIDTH AND MASK MEASUREMENT



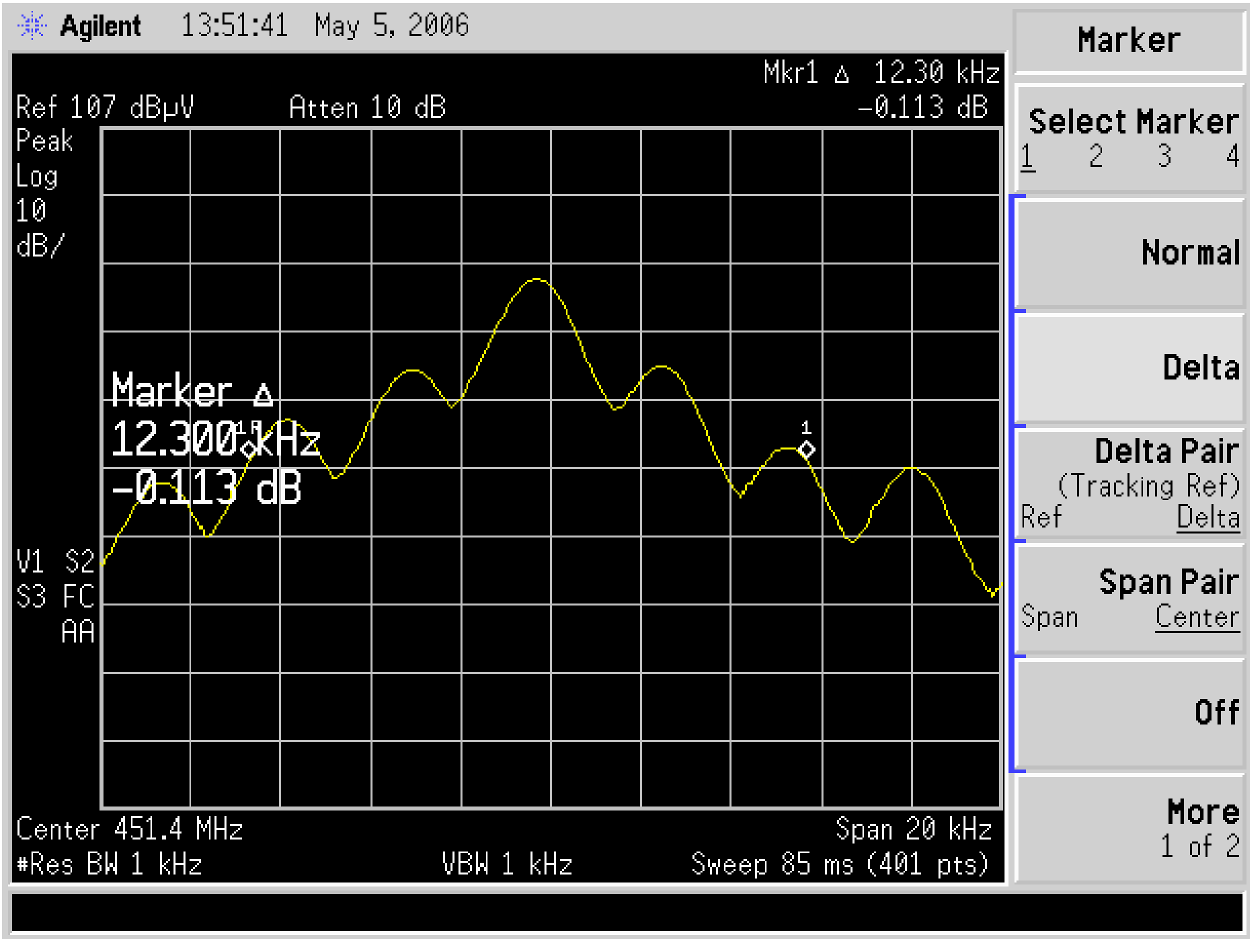
Emission Mask B PLOT 451.36 MHz



RBW=200 Hz

VBW=300 Hz

Occupied Bandwidth PLOT 451.36 MHz



2.1051 Spurious Emissions at Antenna Terminals

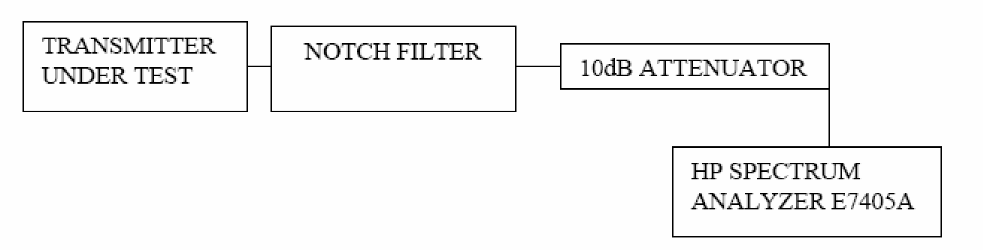
Data provided below shows the level of conducted spurious responses. The transmitter under test was programmed to generate a continuous wave (CW) carrier signal at peak power to measure carrier and harmonic conducted emissions. The output of the transmitter was connected to a standard load and from the standard load through a pre-selector filter of the HP model E7405A spectrum analyzer used. The spectrum was scanned from 0 to at least the 10^{th} harmonic of the fundamental. The measurements were made in accordance with standard TIA/EIA-603.

REQUIREMENTS: Emissions must be 43 + 101og (Po) dB below the mean power output of the transmitter.

For 25 kHz: 43 + 10log(0.933) = 42.7 dBc

EMISSION FREQUENCY MHz	dB BELOW CARRIER	Margin
451.36	N/a	
902.7	65.51	-22.81
1354	63.9	-21.2
1805.42	86.38	-43.68
2256.78	92.36	-49.66
2708.13	93.88	-51.18
3159.49	78.78	-36.08
3610.84	80.05	-37.35
4062.24	80.18	-37.48
4513.55	70.99	-28.29

Method of Measuring Conducted Spurious Emissions



METHOD OF MEASUREMENT: The transmitter under test was programmed to generate a continuous wave (CW) carrier signal at peak power to measure carrier and harmonic conducted emissions. The output of the transmitter was connected to a standard load and from the standard load through a pre-selector filter of the HP model E7405A spectrum analyzer used. The spectrum was scanned from 0 to at least the 10^{th} harmonic of the fundamental. The measurements were made in accordance with standard TIA/EIA-603.

3.4 2.1053 Field Strength of Spurious Radiation

NAME OF TEST: RADIATED SPURIOUS EMISSIONS

REQUIREMENTS: Emissions must be 43 + 10log(Po) dB below the mean power output of the transmitter.

43 + 101og(29.7) = 42.7 dBc

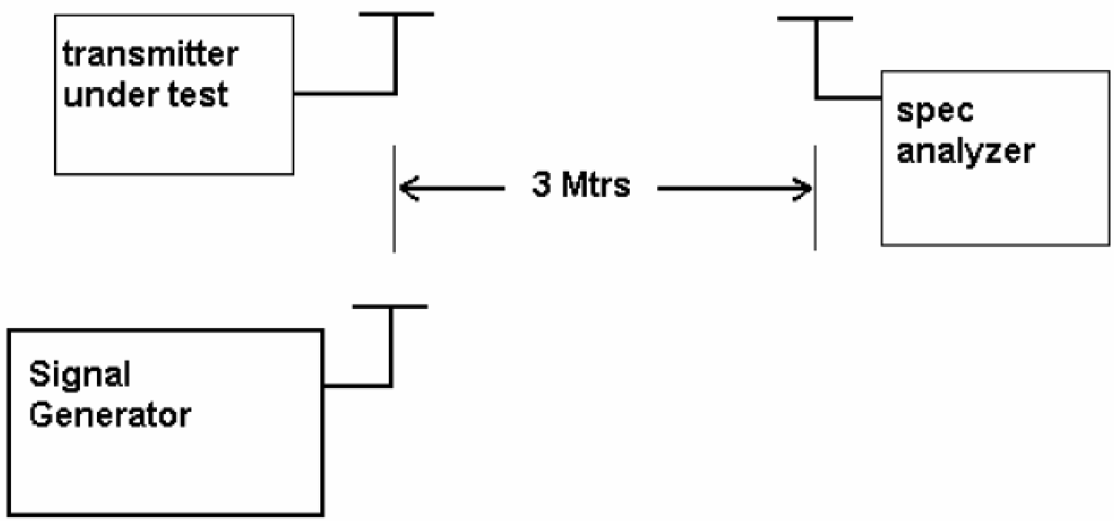
DATA:

Emission Freq (MHz)	ANT Polar (H/V)	ANT Pos (m)	Table Pos (deg)	Raw Value (dBm Pk)	Sig. Gen Reading (dBm)	Cable loss dB	Ant Gain dBd	Corrected Level (dBc)	Spec Limit (dBc)	Spec Margin (dB)
902.7	H	1.68	152	-65.93	-26.0	4.16	-1.04	60.9	42.7	-18.2
902.7	V	1.42	267	-67.81	-28.8	4.16	-1.04	63.7	42.7	-21
1354	V	1.0	38	-34.08	-35.5	5.17	5.26	65.11	42.7	-22.41
1805.42	V	1.0	356	-40.17	-38.6	6.01	6.56	67.75	42.7	-25.05
2256.78	V	1.0	349	-55.98	-53.4	6.71	7.16	82.65	42.7	-39.95
2708.13	V	1.66	350	-55.74	-49.9	7.43	7.46	79.57	42.7	-36.87
3159.49	V	1.78	7	-59.23	-51.1	8.11	7.46	81.45	42.7	-38.75
3610.84	V	1.5	59	-63.44	-56.6	8.74	7.56	87.48	42.7	-44.78
1354	H	1.63	154	-35.08	-35.9	5.17	5.36	65.41	42.7	-22.71
1805.42	H	1.12	129	-44.92	-42.0	6.01	6.46	71.25	42.7	-28.55
2256.78	H	1.0	49	-52.90	-50.7	6.71	7.06	80.05	42.7	-37.35
2708.13	H	1.71	191	-57.20	-52.4	7.43	7.26	82.27	42.7	-39.57
3159.49	H	1.40	188	-55.42	-47.6	8.11	7.36	78.05	42.7	-35.35
3610.84	H	1.19	159	-60.95	-52.9	8.74	7.46	83.88	42.7	-41.18
4513.55	H	1.0	151	-67.30	-65.3	9.85	8.66	96.19	42.7	-53.49

Spec Margin = Spec Limit – Corrected Level

Corrected Level = Sig. Gen Reading – Cable Loss + Antenna Gain -29.7 (TX in dBm)

Method of Measuring Radiated Spurious Emissions



Method of Measurements: The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from 30 MHz to at least the tenth harmonic of the fundamental. This test was conducted per TIA/EIA STANDARD 603 using the substitution method.

3.5 2.1055 Frequency Stability

The transmitter was placed in the temperature chamber at 25° C and allowed to stabilize for one hour. The transmitter was keyed ON for ten minutes during which four frequency readings were recorded at 1 minute intervals to provide the reference frequency. The worse case number was taken for temperature plotting. The assigned channel frequency was considered to be the reference frequency. The temperature was then reduced to -30°C after which the transmitter was again allowed to stabilize for one hour. The transmitter was keyed ON for ten minutes, and again frequency readings were noted at one minute intervals. The worst-case number was recorded for temperature plotting. This procedure was repeated in 10° increments up to + 50 degrees C. Readings were also taken at 6.17 VDC which is the battery endpoint and 8.51 VDC.

3.5.1 Limit

The minimum frequency stability shall be 5ppm.

3.5.2 Results

Temp. (deg. C)	Frequency observed (MHz)			
Reference	**451.360875**			**ppm**
-30	451.361937			2.35
-20	451.361837			2.13
-10	451.362900			4.49
0	451.362943			4.58
10	451.362962			4.62
20	451.362025			2.55
30	451.361375			1.11
40	451.360437			-0.97
50	451.359650			-2.71

Voltage	Frequency observed (MHz)			
Reference at 7.4	**451.360875**			**ppm**
6.17	451.362375			3.32
8.51	451.362469			3.53

3.6 90.214 Transient Frequency Behavior

REQUIREMENTS: Transmitters designed to operate in the 150–174 MHz and 421–512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

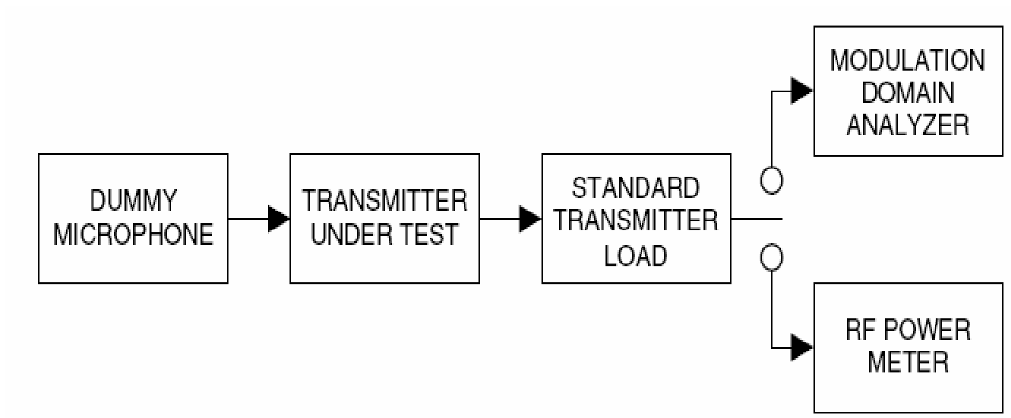
25 kHz Channel spacing

Time Interval	Maximum Frequency	421-512 MHz
t1	+ 25.0 kHz	10.0 ms
t2	+ 12.5 kHz	25.0 ms
T3	+ 25.0 kHz	10.0 ms

12 kHz Channel spacing

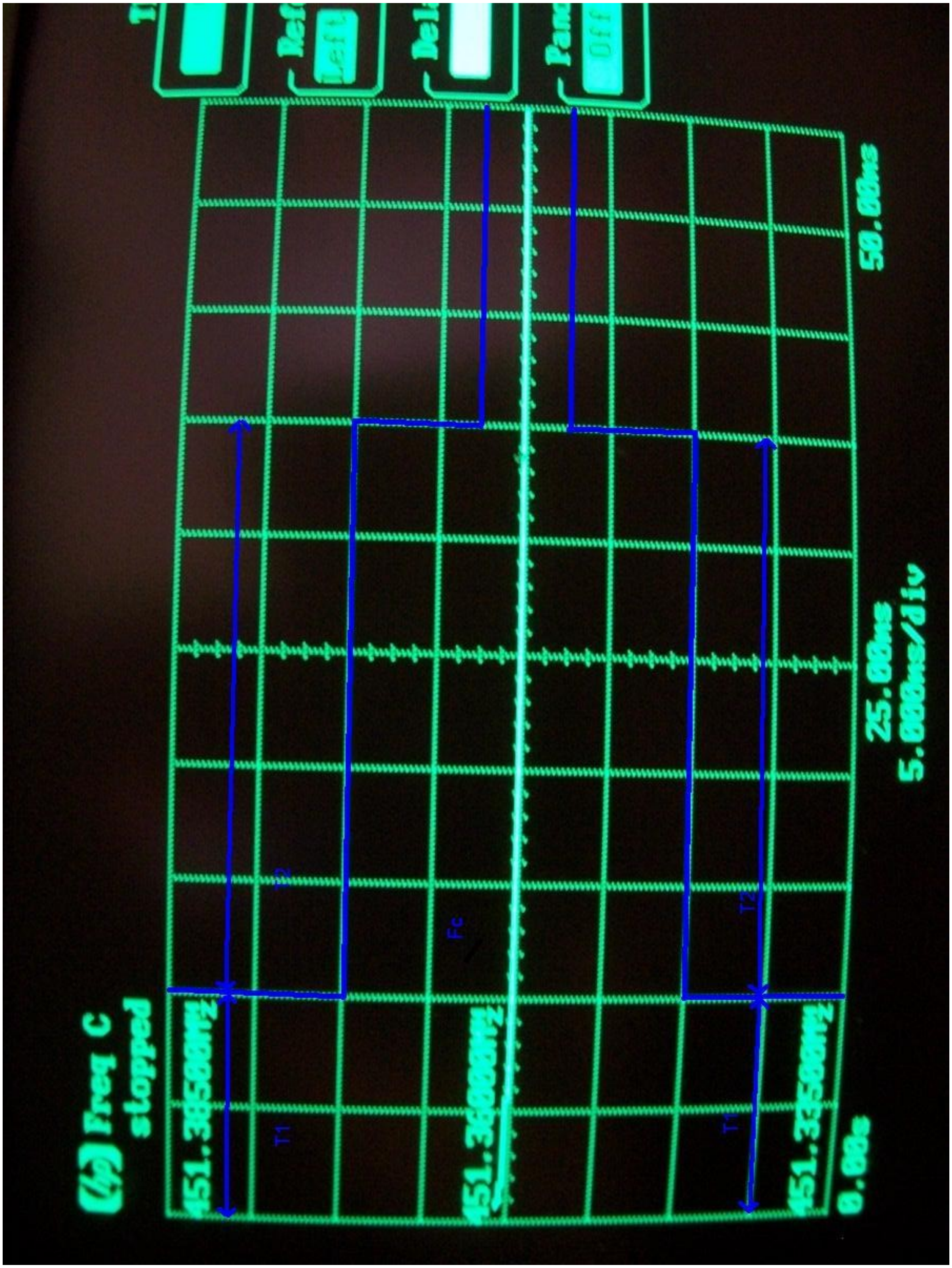
Time Interval	Maximum Frequency	421-512 MHz
t1	+ 12.5 kHz	10.0 ms
t2	+ 6.25 kHz	25.0 ms
T3	+ 12.5 kHz	10.0 ms

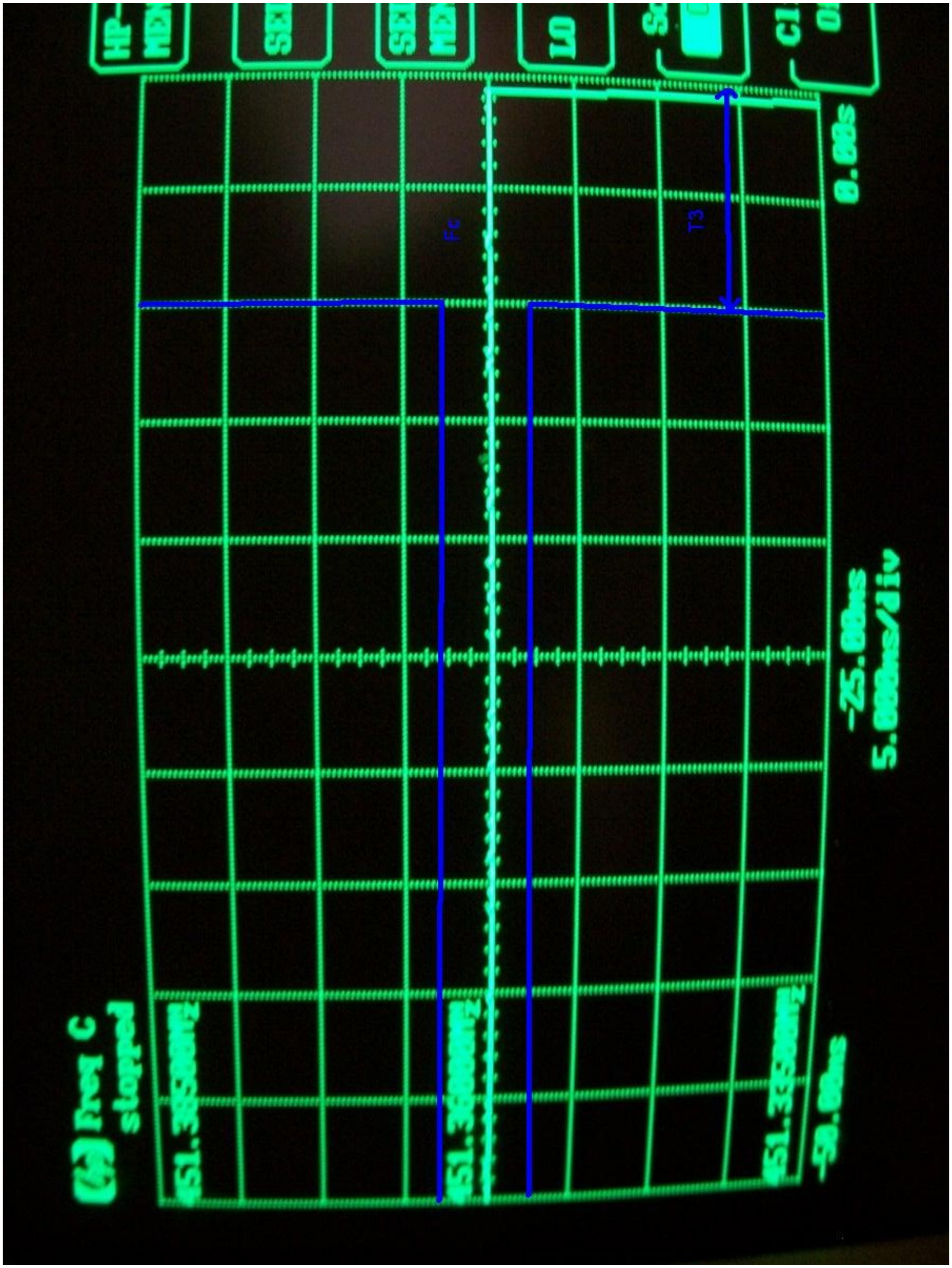
TEST PROCEDURE: TIA/EIA TS603 PARA 2.2.19.2;



TRANSIENT FREQUENCY RESPONSE GRAPH

TUV Rheinland of North America
762 Park Ave., Youngsville, NC 27596
Tel: (919) 554-3668, Fax: (919) 554-3542




Fc
T3
0.00s
-25.00ms
5.000ms/div
Freq C
stopped

4 Test Equipment Use List

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal dd/mm/yy	Next Cal dd/mm/yy
Amplifier, preamp	Agilent Technologies	8449B	3008A01480	5-Aug-05	10-May-06
Ant. BiconiLog	EMCO	3142	1006	13-Apr-05	13-Apr-06
Antenna Horn 1-18GHz	EMCO	3115	2236	29-Dec-05	29-Dec-06
Antenna Horn 1-18GHz	EMCO	3115	5770	11-Apr-05	11-Apr-06
Cable, Coax	Andrew	FSJ1-50A	031	18-Jan-06	18-Jan-07
Cable, Coax	Andrew	FSJ1-50A	034	18-Jan-06	18-Jan-07
Cable, Coax	Thermax	RG 142 B/U	035	18-Jan-06	18-Jan-07
Cable, Coax	Andrew	FSJ1-50A	041	18-Jan-06	18-Jan-07
Cable, Coax	Andrew	FSJ1-50A	042	18-Jan-06	18-Jan-07
Cable, Coax	Andrew	FSJ1-50A	045	18-Jan-06	18-Jan-07
Chamber, Semi-Anechoic	Braden Shielding	5 meter	A67631	27-Jan-06	27-Jan-07
Generator, Signal	Hewlett Packard	83630A	3420A00649	4-Aug-05	4-Aug-06
Ant. Dipole Set TDS-200	AH Systems	TDS-200/535-1	154	1-Sep-05	1-Sep-06
Ant. Dipole Set TDS-200	AH Systems	TDS-200/535-2	154	1-Sep-05	1-Sep-06
Ant. Dipole Set TDS-200	AH Systems	TDS-200/535-3	154	1-Sep-05	1-Sep-06
Ant. Dipole Set TDS-200	AH Systems	TDS-200/535-4	154	1-Sep-05	1-Sep-06
Receiver, EMI	Rohde & Schwarz	ESIB40	100043	22-Dec-05	22-Dec-06
Meter, Multi	Fluke	79-3	69200606	5-Aug-05	5-Aug-06
Meter, RF Power	Boonton	4231A	66801	17-Sep-05	17-Sep-06
Meter, Temp/Humid/Barom	Fisher	02-400	01	24-Oct-05	24-Oct-06
Modulation Domain Analyzer	Hewlett Packard	HP 53310A	MY40000185	9-Sep-05	9-Sep-06
Temperature Chamber	Russells Technical Products	GD-16-3-3	10972720S	13-Mar-06	13-Sep-06

* Calibration of equipment past due for re-calibration will be performed expeditiously. If any equipment is found to be out of tolerance at that time, affected customers will be notified accordingly.