Test of RF Code Sign Post 433

To FCC 47 CFR Part 15.231

Test Report Serial No.: TUVR100-A1 Rev A

TEST REPORT

FROM

Test of Sign Post 433

To FCC 47 CFR Part15.231

Test Report Serial No.: TUVR100-A1 Rev A

Note: This report was created as a result of product development and falls into an FCC Class II Permissive Change. The original test report MiCOM Labs TUVR72-A1 contains the complete set of test data.

This report supersedes None

Manufacturer: RF Code Inc.
1250 S. Clearview Ave.
Mesa, Arizona 85208
USA

Product Function: RFID Tag

Copy No: pdf **Issue Date:** 1st May '06

This Test Report is Issued Under the Authority of;

MiCOM Labs, Inc.
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CERTIFICATE #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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ACCREDITATION & LISTINGS

MiCOM Labs, Inc. an accredited laboratory complies with the international standard BS EN ISO/IEC 17025. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-01.pdf

THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

MICOM LABS
Pleasanton, CA

for technical competence in the field of

Electrical Testing

The accreditation covers the specific tests and types of tests listed on the agreed scope of accreditation. This laboratory meets the requirements of ISO/IEC 17025 - 1999 "General Requirements for the Competence of Testing and Calibration Laboratories" and any additional program requirements in the identified field of testing.

Presented this 14th day of September 2005.

American Association for Laboratory Accreditation
Corporate SEAL 1978 District of Columbia
A2LA

President
For the Accreditation Council
Certificate Number 2381.01
Valid to: November 30, 2007

For tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

LISTINGS

MiCOM Labs test facilities are listed by the following organizations;

North America

United States of America

Federal Communications Commission (FCC) Listing #: 102167

DOCUMENT HISTORY

Document History		
Revision	**Date**	**Comments**
Draft		
Rev A	1st May 2006	First Issue.

1. TEST RESULT CERTIFICATE

Manufacturer:	RF Code Inc. 1250 S. Clearview Ave. Mesa, Arizona 85208 USA	Tested By:	MiCOM Labs, Inc. 3922 Valley Avenue 'B' Pleasanton California, 94566, USA
EUT:	RFID Tag	Telephone:	+1 925 462 0304
Model:	433	Fax:	+1 925 462 0306
S/N:	Not Available		
Test Date(s):	12th April '06	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC 47 CFR Part15.231	EQUIPMENT COMPLIES

MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Notes:

1. This document reports conditions under which testing was conducted and the results of testing performed.
2. Details of test methods used have been recorded and kept on file by the laboratory.
3. Test results apply only to the item(s) tested.

ACCREDITED
CERTIFICATE #2381.01

Approved & Released for MiCOM Labs, Inc. by:

Graeme Grieve
Quality Manager MiCOM Labs,

Gordon Hurst
President & CEO MiCOM Labs, Inc.

2. REFERENCES AND MEASUREMENT UNCERTAINTY

2.1. Normative References

Ref.	Publication	Year	Title
(i)	FCC 47 CFR Part 15.231	Sept 2005	Code of Federal Regulations
(ii)	ANSI C63.4	2003	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
(iii)	CISPR 22/ EN 55022	1997 1998	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
(iv)	M 3003	Edition 1 Dec. 1997	Expression of Uncertainty and Confidence in Measurements
(v)	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
(vi)	ETSI TR 100 028	2001	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
(vii)	A2LA	14th September 2005	Reference to A2LA Accreditation Status – A2LA Advertising Policy

2.2. Test and Uncertainty Procedures

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.

3. PRODUCT DETAILS AND TEST CONFIGURATIONS

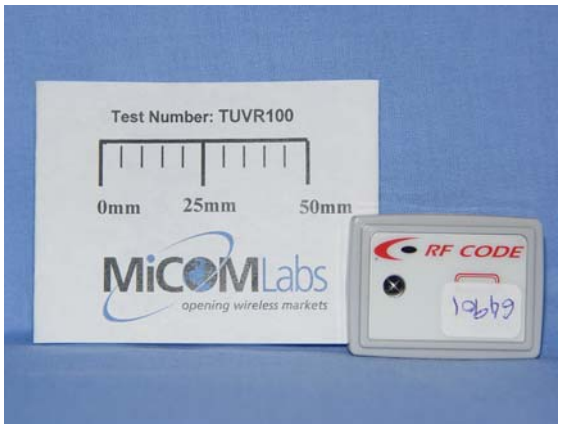
3.1. Technical Details

Details	Description
Purpose:	Test of the Sign Post 433 to FCC regulation Part 15.231.
Applicant:	TUV Rheinland of N. America 1279 Quarry Lane, Suite A Pleasanton, California 94566, USA
Manufacturer:	RF Code Inc. 1250 S. Clearview Ave. Mesa, Arizona 85208, USA
Laboratory performing the tests:	MiCOM Labs, Inc. 3922 Valley Avenue, Suite "B" Pleasanton, California 94566 USA
Test report reference number:	TUVR100-A1 Rev A
Date EUT received:	29th April '05
Standard(s) applied:	FCC 47 CFR Part15.231
Dates of test (from - to):	12th April '06
No of Units Tested:	Two
Type of Equipment:	RFID Tag
Manufacturers Trade Name:	Sign Post
Model:	433 MHz
Location for use:	Indoor and Outdoor use
Declared Frequency Range(s):	Single Frequency 433.92 MHz
Type of Modulation:	OOK
Declared Nominal Output Power:	66 dBµV/m
EUT Modes of Operation:	Transmit only (no receive function)
Rated Input Voltage and Current:	3Vdc, 0.003 mA (Lithium Battery)
Operating Temperature Range:	-10ºC to +70 ºC
ITU Emission Designator:	320KA1DEN
Microprocessor(s) Model:	TIMSP430
Clock/Oscillator(s):	32.768 KHz, 50KHz
Frequency Stability:	-120KHz / +100KHz
Equipment Dimensions:	75x45x15mm approximately
Weight:	2.7 oz
Primary function of equipment:	Track and locate assets

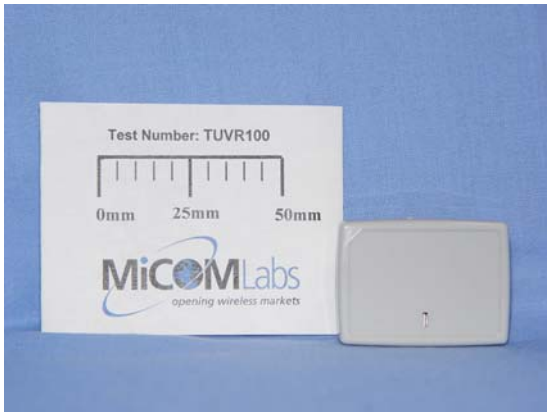
3.2. Scope of Test Program

The primary objective was to prove that the Sign Post 433 MHz RFID continued to comply with the following FCC regulations after changing the case style and pcb layout. Client declared that no critical components have been changed.

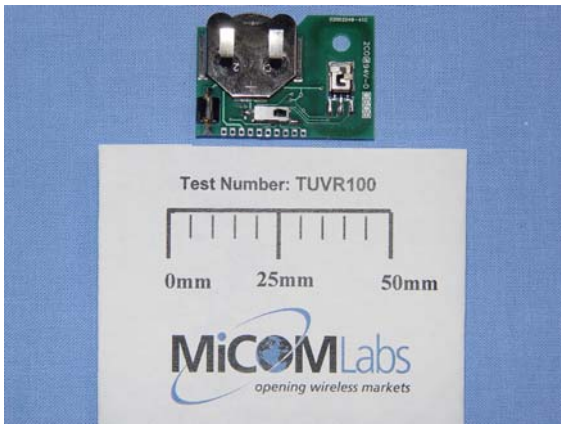
As a result of the change in case style and pcb layout the scope of the test program was to test spurious emissions above and below 1 GHz indicating continued compliance with the regulation.



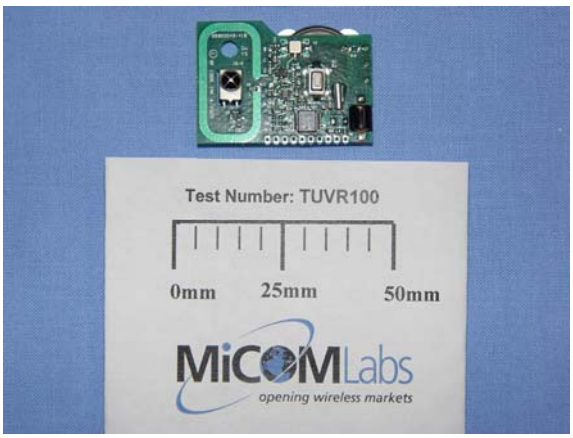
433 MHz Sign Post – case top



433 MHz Sign Post – case underside



433 MHz Sign Post – pcb top



433 MHz Sign Post – pcb underside

3.3. Equipment Model(s) and Serial Number(s)

Name	Manufacturer	Model No.	Serial No.
Sign Post	RF Code	433 MHz (CW Operation)	None Available
Sign Post	RF Code	433 MHz (10 sec Duty Cycle)	None Available

3.4. Antenna Details

Antenna Type	Gain (dBi)	Manufacturer	Model No.	Serial No.
Integral	Not Available	RF Code	433	None Available

3.5. Cabling and I/O Ports

Number and type of I/O ports

1. NONE

3.6. Test Configurations

Matrix of test configurations for a single channel output. Tests were performed in a 3m and 10 m anechoic chamber.

Mode	Operation
Test Mode Only	CW
Actual Field Operational Mode	Modulated (10 sec Duty Cycle)

The client equipment was placed on a 0.8 meter high table and positioned consecutively in the X, Y and Z axis and rotated through 360 degrees to determine the orientation of the EUT for maximum emissions. Worst case emission profile was used to measure the emission data reported in this report.

3.7. Equipment Modifications

The following modifications were required to bring the equipment into compliance:

1. NONE

3.8. Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:

1. NONE

3.9. Subcontracted Testing or Third Party Data

1. NONE

4. TEST SUMMARY

List of Measurements

The following table represents the list of measurements required under the **FCC CFR47 Part 15.231(e)**.

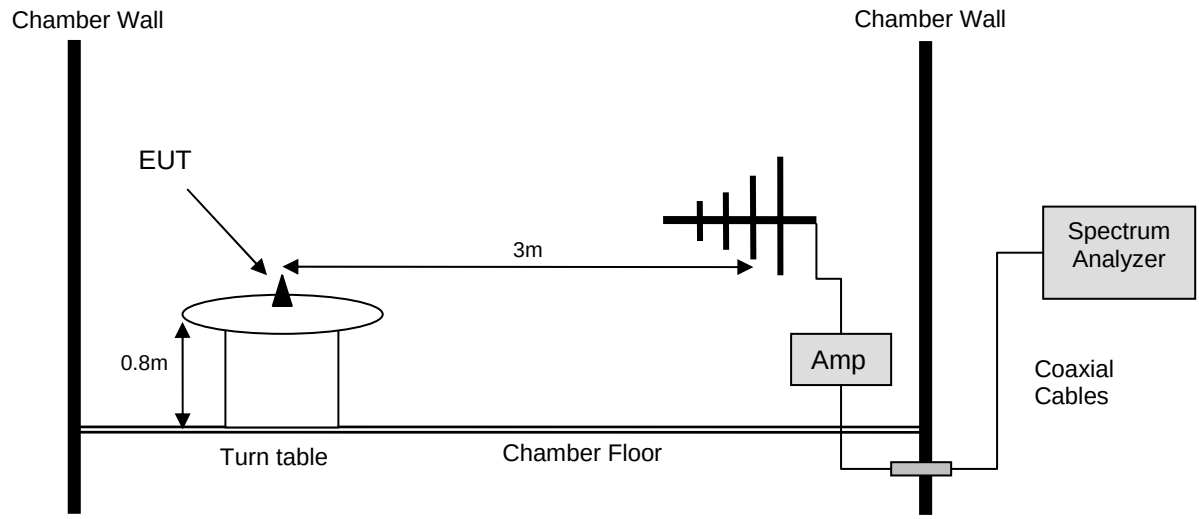
Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.231(e) **15.35(c)**	Transmitter and Spurious Emission Field Strength	Fundamental Frequency & Spurious Emissions 30M – 1 GHz 1 GHz – 6 GHz	Radiated	Complies	5.1.1

Note 1: *Test results reported in this document relate only to the items tested*
Note 2: *The required tests demonstrated compliance as per client declaration of test configuration, monitoring methodology and associated pass/fail criteria*

5. TEST RESULTS

5.1. Device Characteristics

Test Measurement Set up for all tests



Two tags were provided by the client;

- 10 second periodic tag
- CW operational mode

Client declared there were no technical differences between the above tags. The 10 second periodic tag was the EUT however in order to fully capture and maximize both the fundamental and harmonics of the transmitter the tag emitting the CW tone was used to find the worst case emission profile through changing the tag orientation. The worst case profile was used for the data in this report. Duty cycle information was utilized from the previous MiCOM Labs test report TUVR72-A1.

The client equipment was placed on a 0.8 meter high polystyrene table and positioned consecutively in the X, Y and Z axis and rotated through 360 degrees to determine the orientation of the EUT for maximum emissions.

The photograph in Section 6.1 “Field Strength Measurements” shows the positioning of the EUT where maximum emissions were observed.

5.1.1. Field Strength Measurements

FCC, Part 15 Subpart C §15.231(e); §15.35

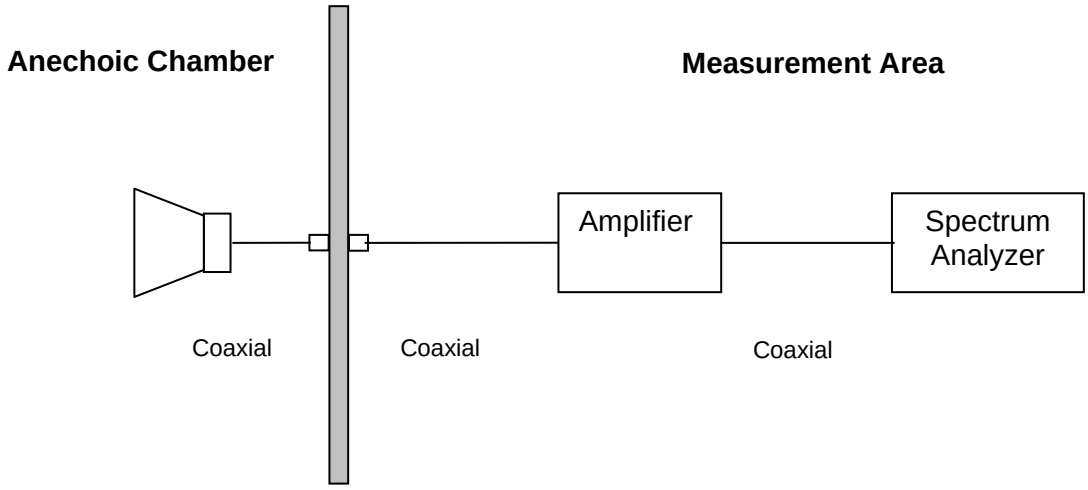
Transmitter & Spurious Field Strength

Test Procedure

Field strength measurements and radiated emissions were measured in an anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities on a modulated carrier. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. The fundamental and highest spurious emissions relative to the limit are listed for each frequency spanned.

Measurements on any frequency or frequencies less than 1 GHz were based on the use of measurement instrumentation employing a peak detector with a 100 KHz bandwidth. Measurements above 1 GHz were performed using a resolution bandwidth of 1 MHz.

Test Measurement Set up



Measurement set up for Radiated Emission Test

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.

FS = R + AF + CORR - FO

where: FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG
CL = Cable Loss
AG = Amplifier Gain
FO = Distance Falloff Factor

For example:
Given receiver input reading of 51.5 dBμV; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB. The Field Strength of the measured emission is:

FS = 51.5 + 8.5 + 1.3 - 26.0 = 35.3 dBμV/m

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

Level (dBμV/m) = 20 * Log (level (μV/m))

40 dBμV/m = 100 μV/m
48 dBμV/m = 250 μV/m

Measurement Results for Transmitter & Spurious Field Strength

Ambient conditions.
Temperature: 16 to 24 °C Relative humidity: 33 to 58 % Pressure: 1000 to 1010 mbar

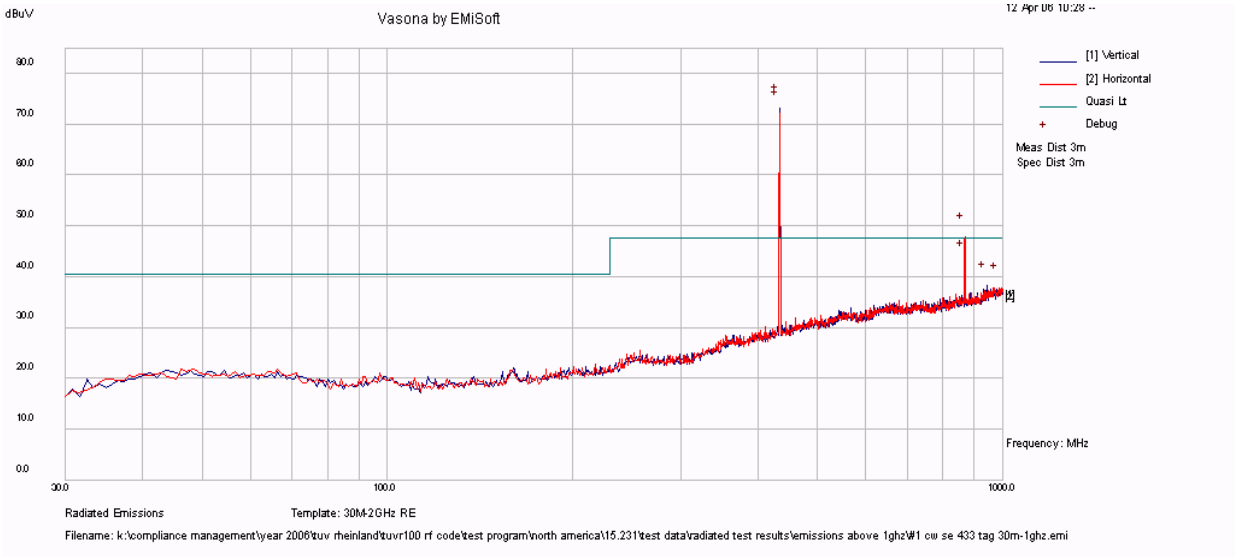
TABLE OF RESULTS

Frequency (MHz)	Peak Value (dBμV/m)	Average Value (dBμV/m)	Ave. Limit (dBμV/m)	Margin (dB)
Fundamental	73.13	37.06	72.59	-35.53
869.05	47.88	11.81	46.00	-34.19
1301.823	50.75	14.68	54.00	-39.32

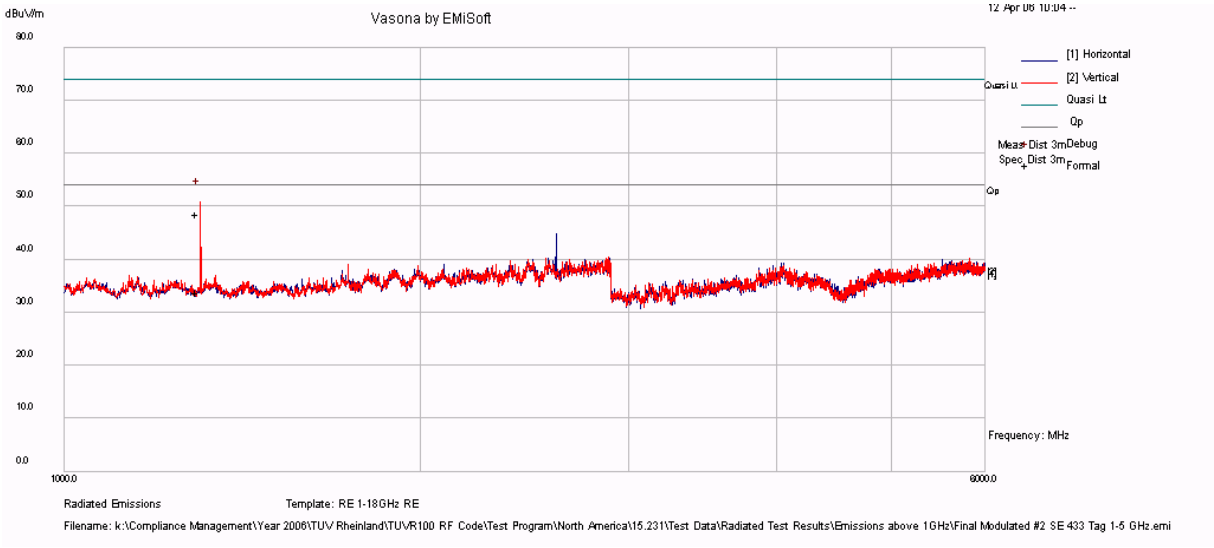
Average value of the fundamental frequency was calculated using **FCC, Part §15.35(c)**

Pulse Train = 89 mSeconds.
Duty Cycle = 1.573 %

Sample Calculation to find Average Value
Peak 72.46dBμV/m = 4,534.19 μV/m
Average Value = 4,534.19 * 1.573 % = 71.32 μV/m = 37.06 dBμV/m



Emissions below 1 GHz (30M – 1 GHz)



Emissions above 1 GHz (1 – 6 GHz)

Specification

Limits

Fundamental Frequency (MHz)	Field Strength of Fundamental (µvolts/meter)	Field Strength of Spurious Emissions (µvolts/meter)
40.66 – 40.70	2,250	225
70 - 130	1,250	125
130 - 174	[1]1,250 – 3,750	[1]125 – 375
174 - 260	3,750	375
260 -470	[1]3,750 – 12,500	[1]375 – 1,250
Above 470	12,500	1,250

[1] Linear Interpolation

FCC §15.231 (e) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges. Intentional radiators operating under the provision of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions.

FCC §15.35 (c)
Unless otherwise specified, e.g. Section 15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

Laboratory Measurement Uncertainty for Radiated Measurements

Measurement uncertainty	+5.6/ -4.5 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions'	0078, 0104, 0134, 0156, 0184, 0193, 0213, 0310, 0312.

6. TEST SET-UP PHOTOGRAPHS

6.1. Field Strength Measurement

7. TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Part #	Serial #
0078	Antenna (30M-2GHz)	Schaffner and Chase	CBLG140A	1195
0104	1-18GHz Horn Antenna	The Electro-Mechanics Company	3115	9205-3882
0134	Amplifier	Com Power	PA 122	181910
0156	Barometer /Thermometer	Control Co.	4196	E2844
0184	Pulse Limiter	Rhode & Schwartz	ESH3Z2	357.8810.52
0193	EMI Receiver	Rhode & Schwartz	ESI 7	838496/007
0213	20-300MHz Antenna	Schwarzbeck	VHBB 9124	9124/0257
0250	230MHz-1GHz Antenna	Schwarzbeck	VUSLP9111	186
0252	SMA Cable	Megaphase	Sucoflex 104	Unknown
0307	BNC Cable	Megaphase	Unknown	Unknown
0310	2m SMA Cable	Micro-Coax	UFA210A-0-0787-3G03G0	209089-001
0312	3m SMA Cable	Micro-Coax	UFA210A-1-1181-3G0300	209092-001
0313	Coupler	Hewlett Packard	86205A	1623

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