

Test of Terralite XPS / TX100 Transmit  
Station

To: FCC 47 CFR Part 90, Subpart I

Test Report Serial No.: TUV75-A1 Rev B





Test of Terralite™ XPS / TX100 Transmit Station

To FCC 47 CFR Part 90, Subpart I

Test Report Serial No.: TUV75-A1 Rev B

This report supersedes TUV75-A1 Rev A

**Manufacturer:** Novariant, Inc.  
1350 Willow Road, Suite 202  
Menlo Park, California 94025  
USA

**Product Function:** High-precision Global Positioning System  
(GPS)

**Copy No:** pdf      **Issue Date:** 2nd February '06

**This Test Report is Issued Under the Authority of:**

**MiCOM Labs, Inc.**  
3922 Valley Avenue, Suite B  
Pleasanton, CA 94566 USA  
Phone: +1 (925) 462-0304  
Fax: +1 (925) 462-0306  
[www.micomlabs.com](http://www.micomlabs.com)



CERTIFICATE #2381.01

**MiCOM Labs is an ISO 17025 Accredited Testing Laboratory**

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NOTE: MiCOM Labs accreditation does not cover the measurement data in Section 5.1.5 'Radiated Spurious Emissions'.

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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](http://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 14<sup>th</sup> day of September 2005.



  
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.

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## **LISTINGS**

MiCOM Labs test facilities are listed by the following organizations;

### **North America**

#### **United States of America**

Federal Communications Commission (FCC) Listing #: 102167

#### **Canada**

Industry Canada (IC) Listing #: 4143

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## DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft		
Rev A	27 <sup>th</sup> September '05	
Rev B	2 <sup>nd</sup> February '06	TUV Rheinland added spurious emissions data > 6.5 GHz

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## 1. TEST RESULT CERTIFICATE

Manufacturer:	Novariant, Inc. 1350 Willow Road, Suite 202, Menlo Park, California 94025 USA	Tested By:	MiCOM Labs, Inc. 3922 Valley Avenue 'B' Pleasanton California, 94566, USA
EUT:	Portable ground-based real-time GPS positioning	Telephone:	+1 925 462 0304
Model:	Terralite™ XPS / TX100	Fax:	+1 925 462 0306
S/N:	188534/1310786		
Test Date(s):	9th-12th September '05	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC 47 CFR Part 90, Subpart I	EQUIPMENT COMPLIES

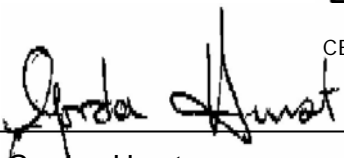
MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

### 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.

Approved & Released for MiCOM Labs, Inc. by:

  
\_\_\_\_\_  
Graeme Grieve  
Quality Manager MiCOM Labs,

  
\_\_\_\_\_  
Gordon Hurst  
President & CEO MiCOM Labs, Inc.



CERTIFICATE #2381.01

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## 2. REFERENCES AND MEASUREMENT UNCERTAINTY

### 2.1. Normative References

Ref.	Publication	Year	Title
(i)	FCC 47 CFR Part 90	2004	Code of Federal Regulations
(ii)	FCC 47 CFR Part 90 Sect 90.210 Sect 90.1215	18 <sup>th</sup> May 2005	90.210 Emission Masks (Revised requirements) 90.1215 Power Limits (Revised requirements)
(iii)	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
(iv)	CISPR 22/ EN 55022	1997 1998	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
(v)	M 3003	Edition 1 Dec. 1997	Expression of Uncertainty and Confidence in Measurements
(vi)	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
(vii)	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
(viii)	A2LA	14 <sup>th</sup> September 2005	Reference to A2LA Accreditation Status – A2LA Advertising Policy
(ix)	TIA/EIA-603-A	2003	Land Mobile FM or PM communications Equipment Measurement and Performance Standards

### 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.

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### 3. PRODUCT DETAILS AND TEST CONFIGURATIONS

#### 3.1. Technical Details

Details	Description
Purpose:	Test of the Terralite XPS / TX100 Transmit Station to FCC 47 CFR Part 90 Subpart I regulations.
Applicant:	TUV Rheinland of North America 1279 Quarry Lane, Suite 'A' Pleasanton, California 94566 , USA
Manufacturer:	Novariant, Inc. 1350 Willow Road, Suite 202 Menlo Park, California 94025, USA
Laboratory performing the tests:	MiCOM Labs, Inc. 3922 Valley Avenue, Suite "B" Pleasanton, California 94566 USA
Test report reference number:	TUV75-A1
Date EUT received:	8 <sup>th</sup> September '05
Dates of test (from - to):	9th-12th September '05
Standard(s) applied:	FCC 47 CFR Part 90, Subpart I
No of Units Tested:	1
Type of Equipment:	Portable ground-based real-time GPS positioning
Manufacturers Trade Name:	Terralite™ XPS
Model:	TX100
Location for use:	Outdoor use only
Declared Frequency Range(s):	9.752 GHz (single channel operation)
Type of Modulation:	DSSS
Declared Maximum Output Power:	+28.0 dBm
EUT Modes of Operation:	Single channel modulated RF bursts
ITU Emission Designator:	433M0W7D
Transmit/Receive Operation:	Transmits modulated RF bursts (no receive) – Duty Cycle (maximum) 12.5% Receives GPS
Rated Input Voltage and Current:	Nominal 12 Vdc, Current 2.25 A Maximum: 13.8 Vdc Minimum: 10.2 Vdc
Operating Temperature Range:	-30°C to +60°C
Frequency Stability:	± 1 E-6%
Equipment Dimensions:	24" L X 24" W x 10.5" H
Weight:	24.3 lb (11 Kg)
Primary function of equipment:	High-precision Global Positioning System (GPS) for positioning and managing equipment in open-pit mining

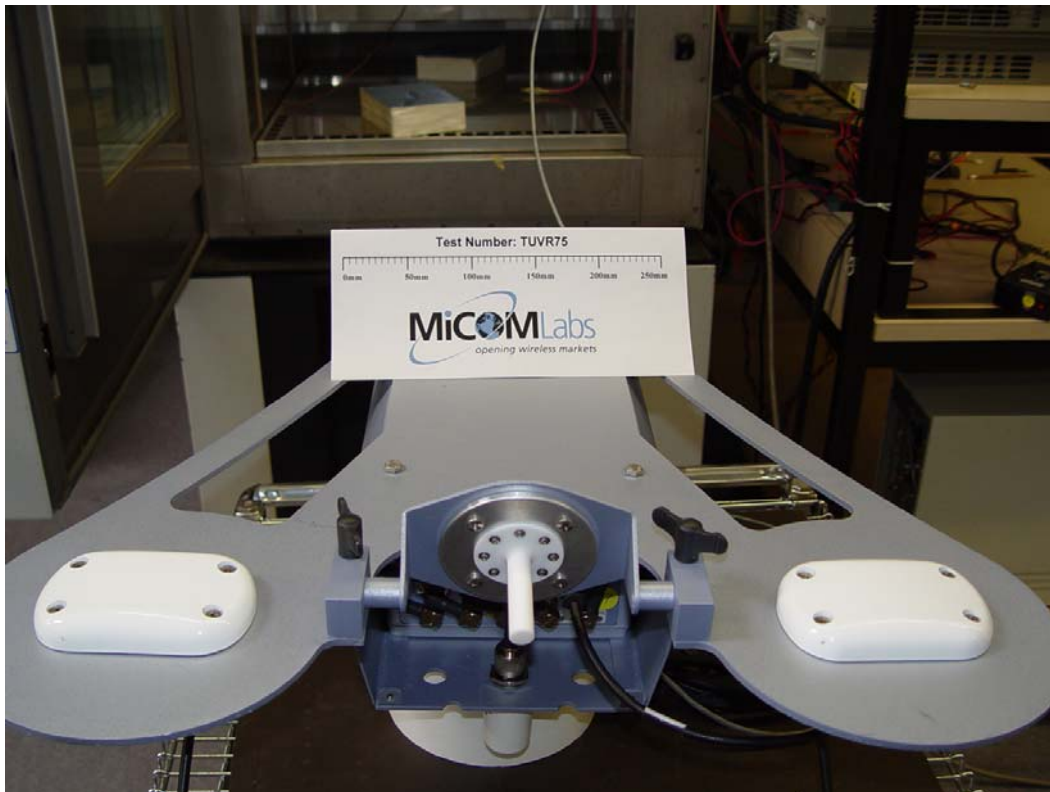
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### 3.2. Scope of Test Program

The scope of the test program was to test the Terralite XPS / TX100 Transmit Station for compliance against:-

FCC 47 CFR Part 90, Subpart I General Technical Requirements.

#### Terralite™ XPS



#### ***FCC Defined Limits***

As there was no specific technical direction or defined limits for this product the FCC defined the following;

FCC Part 90, Subpart I technical requirements

Maximum Output Power: +30 dBm

Operational Bandwidth: 400 MHz

Spectrum Mask: 90.210 (b)

Frequency Stability: 1E-6% (maximum 97.52 Hz drift for a 9.752 GHz transmitter)

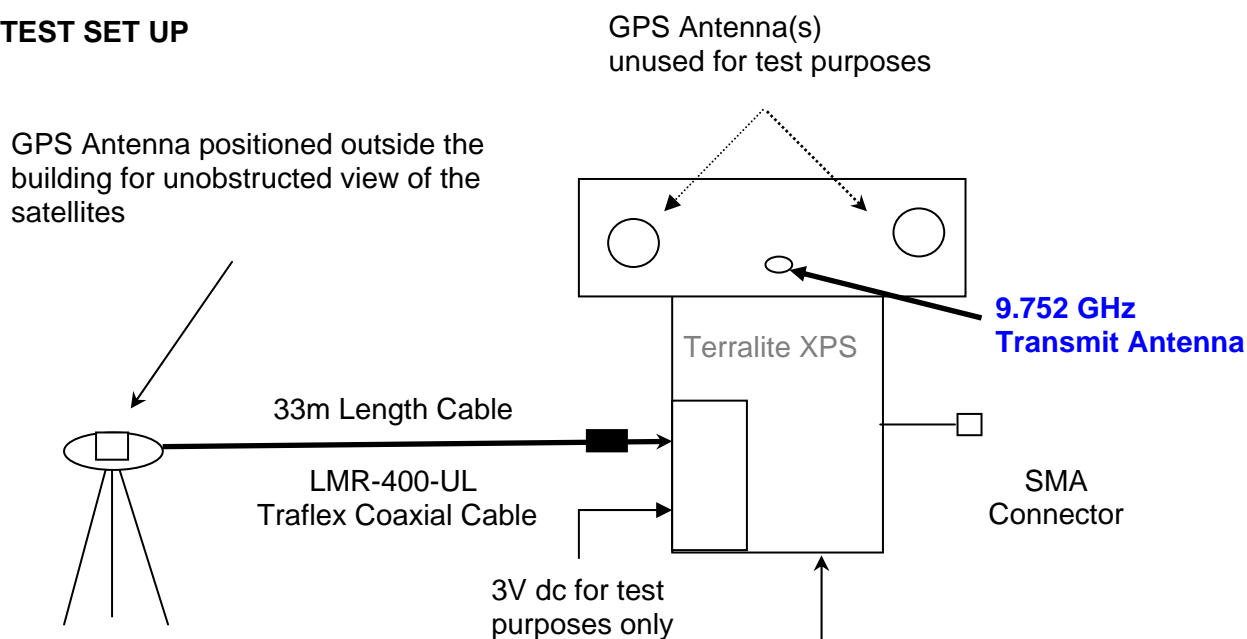
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### 3.3. Equipment Model(s) and Serial Number(s)

EUT/ Support	Name	Manufacturer	Model No.	Serial No.
EUT	Terralite XPS / TX100 Transmit Station	Novariant	TX100	188534/1310786
Support	GPS antenna	AeroAntenna Technology	AT2775-41W-TNCF-000-RG-36-NM	6496

### TEST SET UP



**Note:** As the test set up was situated inside an environmental chamber the two GPS antennas on the Terralite™ TX100 were immobilized. An external GPS antenna mounted on a tripod situated outside the building brought a GPS signal direct to the EUT via 33m length of cable.

A 3Vdc signal was applied to achieve system test mode i.e. 100% duty cycle



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### 3.4. Antenna Details

Antenna Type	Gain (dBi)	Manufacturer	Model No.	Serial No.

No antennas were submitted for testing

### 3.5. Cabling and I/O Ports

Number and type of I/O ports

1. Ethernet port
2. Auxiliary port
3. User port

### 3.6. Test Configurations

Matrix of test configurations

Parameter	Operational Mode	Test Conditions
26 dB Occupied BW & Emission Mask	Modulated	Ambient
CW & Average Output Power	Unmodulated	Ambient
Frequency Stability	Unmodulated	Ambient, Temperature and Voltage Variation
Conducted Spurious Emissions	Unmodulated	Ambient
Radiated Spurious Emissions	Modulated	Ambient

Only worst case plots are provided for each test parameter identified within this report. Plots not included are held on file by the test laboratory and available upon request with client permission.

### 3.7. Equipment Modifications

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

1. NONE

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### **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. Radiated Spurious Emission data (30MHz – 40 GHz) was provided by the following third party;

TUV Rheinland of North America  
1279 Quarry Lane, Suite 'A'

Pleasanton, California 94566 , USA

Tel: +1 (925) 249 9123  
Attention: Kent Chesley

---

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#### 4. TEST SUMMARY

##### List of Measurements

The following table represents the list of measurements required under the **FCC CFR47 Part 90, Subpart I**.

Section(s)	Test Items	Description	Condition	Result	Test Report Section
<b>2.1049</b> <b>2.1047(d)</b> <b>90.209</b> <b>90.210 (b)</b>	26 dB Occupied BW & Emission Mask	Modulated Output	Conducted	Complies	5.1.1
<b>2.1046</b> <b>90.205</b>	Average Power	Power Measurement (CW & modulated)	Conducted	Complies	5.1.2
<b>2.1055(a)(1)</b> <b>90.213</b>	Frequency Stability	Includes temperature and voltage variations	Conducted	Complies	5.1.3
<b>2.1051</b> <b>90.210 (b)</b>	Conducted Spurious Emissions at Antenna Port	Emissions from the antenna port  30 MHz – 40 GHz	Conducted	Complies	5.1.4
<b>2.1053</b> <b>90.210 (b)</b>	Radiated Spurious Emissions	Spurious emissions 30 MHz – 40 GHz	Radiated	Complies	5.1.5

**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

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## 5. TEST RESULTS

### 5.1. Device Characteristics

#### 5.1.1. 26 dB Occupied Bandwidth and Emission Mask

**FCC 47 CFR Part 90, Subpart I; 2.1047; 2.1049; §90.210(b)**

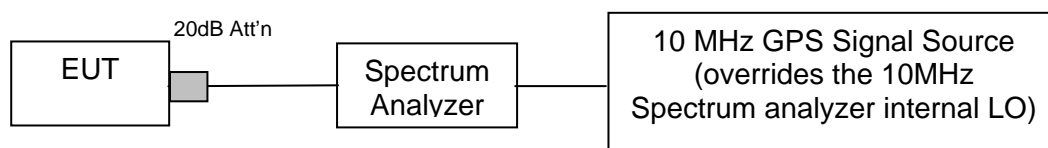
##### **Test Procedure**

The transmitter terminal of EUT was connected to the input of the spectrum analyzer set to measure the 26 dB occupied bandwidth and emission mask. An external 3Vdc supply was utilized to switch the transmitter into 100% duty cycle i.e. continuous operation at all times which also provided access to a modulated signal or unmodulated single tone (CW). A single power level was available which was set for maximum power at all times..

For emission masks the zero dB reference is measured relative to the unmodulated signal. A 1 MHz resolution and video bandwidth was utilized for the measurement(s).

This is not an audio modulated device. The device was tested under conditions of maximum modulation consistent with intended operation. The device characteristics will be submitted at time of licensing

##### **Test Measurement Set up**



Test set up for 26 dB Occupied Bandwidth and Emission Mask measurement

Ambient conditions.

Temperature: 19 to 26 °C      Relative humidity: 31 to 57 %      Pressure: 999 to 1009 mbar

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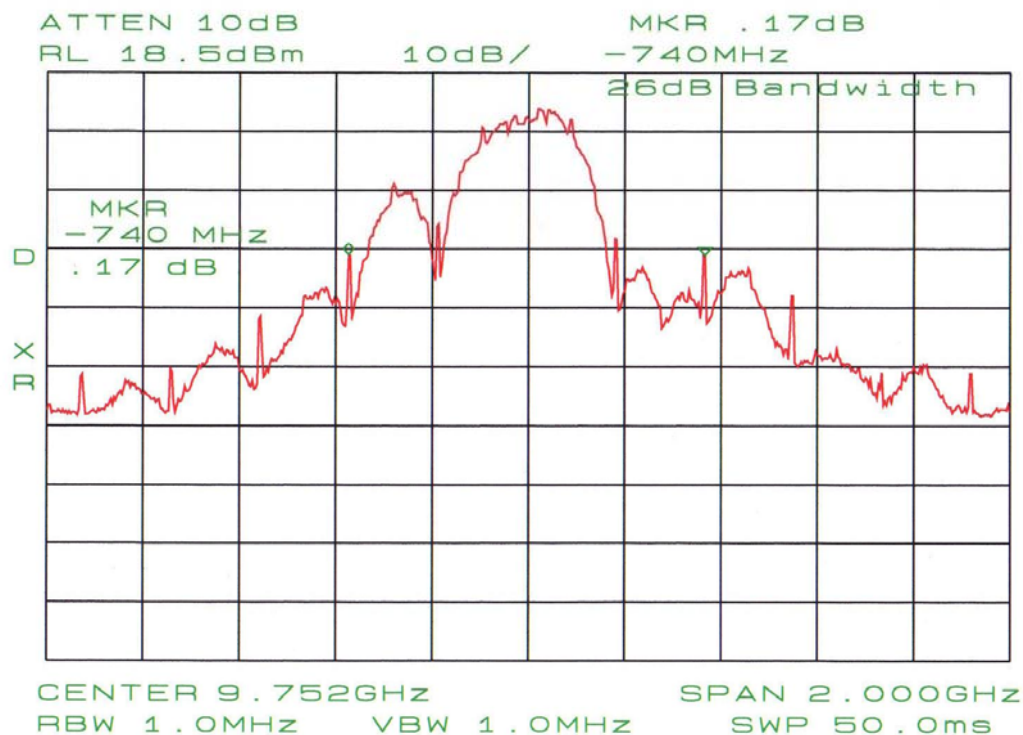




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TABLE OF RESULTS – 26 dB Bandwidth

Center Frequency (MHz)	26 dB Bandwidth (MHz)
9,752.00	740.00

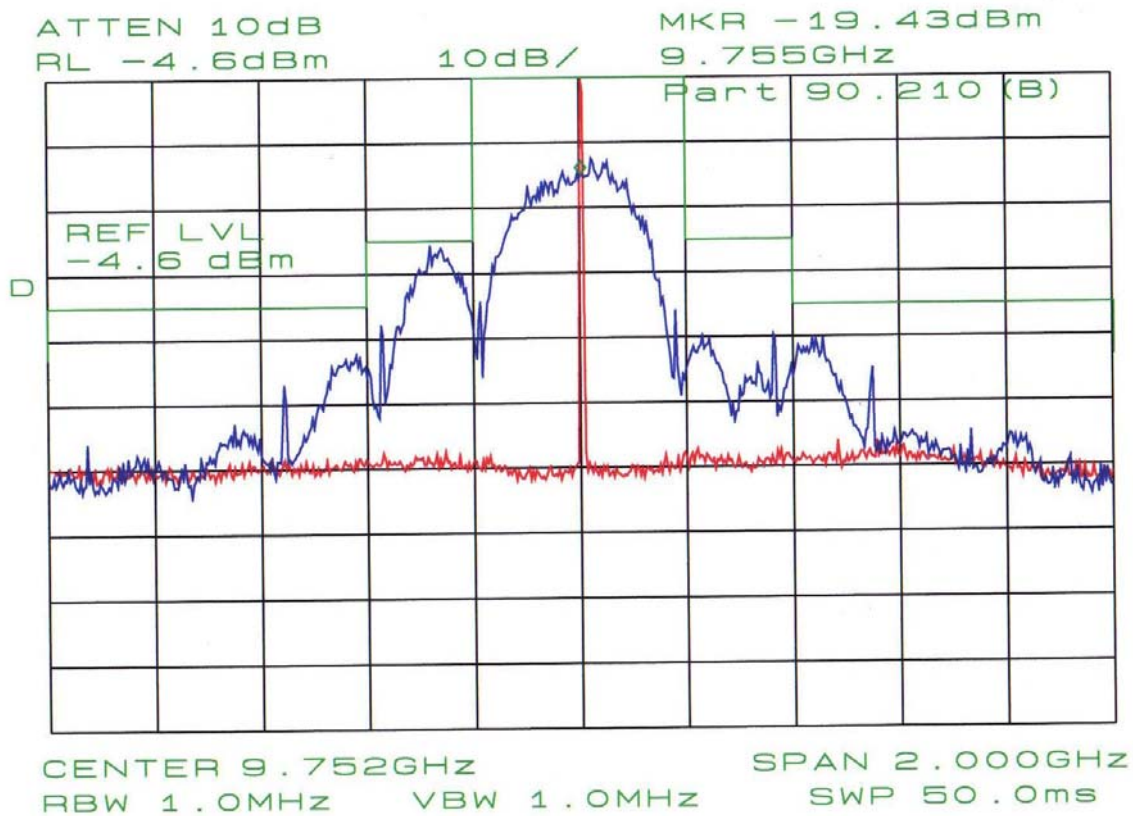


26 dB Bandwidth 9,752.00 MHz

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### Emission Mask 9,752.00 MHz

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**Specification Limits**  
**FCC Part §90.210 (b)**

**Permissible Authorized Bandwidth Limits**

<b>Spectrum Mask with Audio Filter (MHz)</b>
400

**Limits Emission Masks 90.210(b)**

- (b) Emission Mask b. For transmitters equipped with an audio low-pass 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.

**Laboratory Measurement Uncertainty for Spectral Masks**

Measurement uncertainty	$\pm 2.81$ dB
-------------------------	---------------

**Traceability**

<b>Method</b>	<b>Test Equipment Used</b>
Measurements were made per work instruction WI-03 'Measurement of RF Spectrum Mask'	0088, 0158, 0197, 0206, SMA CBL05, ClientPSU

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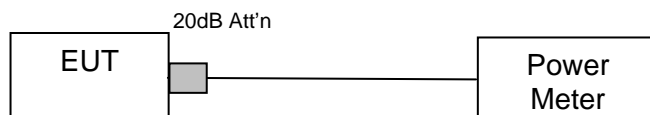
### 5.1.2. Output Power

#### FCC 47 CFR Part 90, Subpart I; 2.1046; §90.1215

##### Test Procedure

Average power measurements were measured with the use of an average power head. System power setting was selected with modulation ON and OFF and duty cycle set for 100% i.e. continuous operation at all times.

##### Test Measurement Set up



Test set up for modulated/unmodulated output power measurement

Ambient conditions.

Temperature: 19 to 26 °C      Relative humidity: 31 to 57 %      Pressure: 999 to 1009 mbar

##### TABLE OF RESULTS

Temperature	Center Frequency (MHz)	Unmodulated Average Power (dBm)	Modulated Average Power (dBm)
Ambient	9,752.00	+27.97	+27.95
-30°C	9,752.00	+29.55	--
+60°C	9,752.00	+26.45	--



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## Specification Limits

### FCC Part §90.1215(a)

#### Permissible Power Limits

Power Limit (dBm)
+30

#### Laboratory Measurement Uncertainty for Power Measurement

Measurement uncertainty	$\pm 1.33$ dB
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#### Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of RF Output Power'	0070, 0116, 0158, 0197, 0206, SMA CBL05, ClientPSU

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### **5.1.3. Frequency Stability; Temperature Variations, and Voltage Variations**

#### **FCC 47 CFR Part 90, Subpart I; 2.1055(a)(1); §90.213**

##### **Test Procedure**

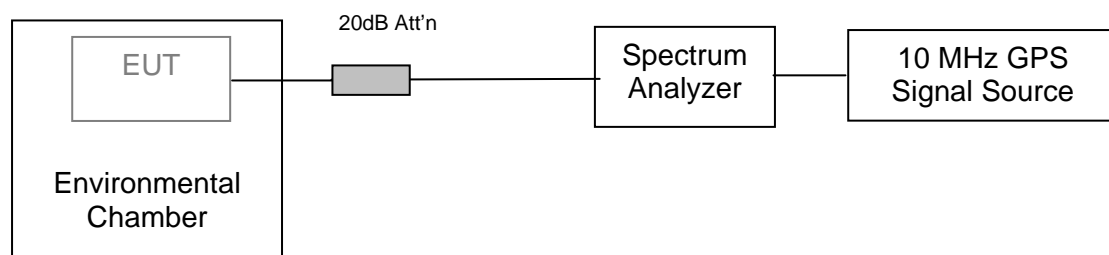
The transmitter output was connected to a spectrum analyzer and the frequency stability was measured in the unmodulated mode at ambient and extremes of temperature every 10°C. Before measurements were taken at each temperature, thermal equilibrium was obtained.

To obtain the accuracy required by the FCC for frequency stability a 10 MHz GPS signal source was required to override the internal spectrum analyzer 10 MHz clock source.

Prior to measurement at all temperatures the spectrum analyzer was placed in a max hold condition for two minutes to show the frequency wander of the carrier. This technique was used for all plots.

Frequency stability was also measured at extremes of voltage ( $\pm 10\%$ ) at ambient temperature only.

##### **Test Measurement Set up**



Measurement set up for Frequency Stability

Ambient conditions.

Temperature: 19 to 26 °C      Relative humidity: 31 to 57 %      Pressure: 999 to 1009 mbar

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TABLE OF RESULTS Frequency Stability;-

Input voltage 12 Vdc

Temperature(°C)	FREQUENCY (MHz)
-30	9,751.999997
-20	9,752.000003
-10	9,752.000004
0	9,752.000000
+10	9,751.999998
+20	9,751.999996
+30	9,751.999990
+40	9,752.000010
+50	9,752.000003
+60	9,752.000008
Maximum Frequency Drift	-10 Hz (1.025E-9%)

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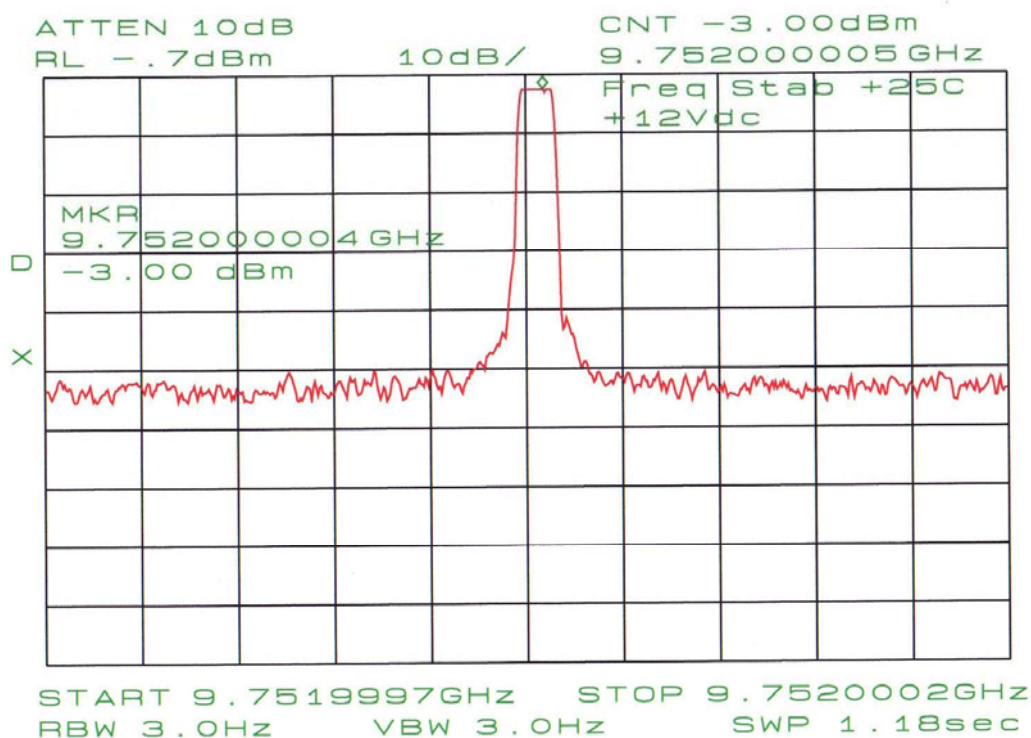


**Title:** Terralite XPS / TX100 Transmit Station  
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# TABLE OF RESULTS Frequency Stability;-

Voltage Variations at Ambient for 20MHz Bandwidth

Temperature	Voltage (Vdc)	FREQUENCY (MHz)
25°C	+12.0	9,752.000005
	+10.2	9,751.999999
	+13.8	9,751.999999
Maximum Frequency Drift		+5 Hz (0.513E-9%)



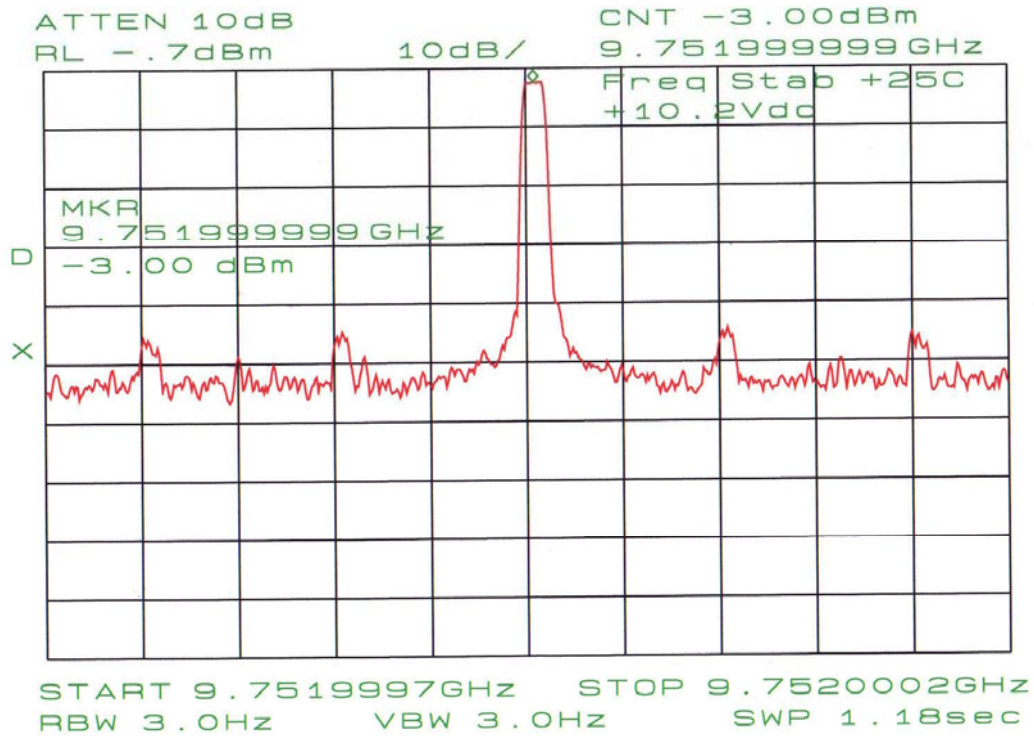
## Frequency Stability Ambient, 12 Vdc

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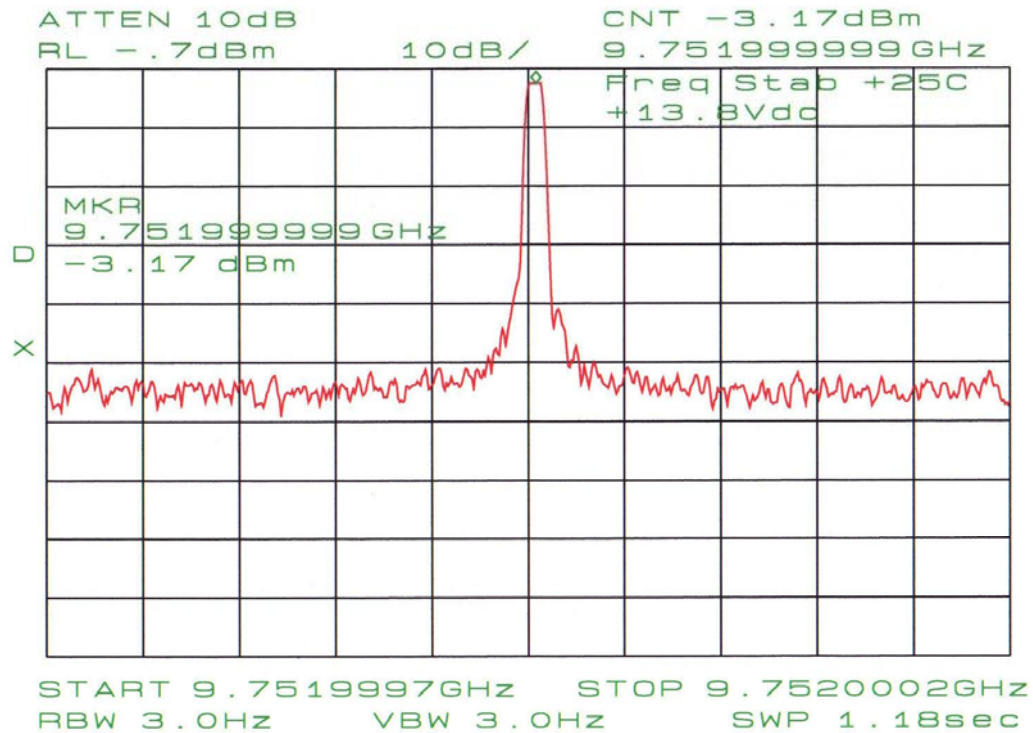


### Frequency Stability Ambient, 10.2 Vdc

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### Frequency Stability Ambient, 13.8 Vdc

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## Frequency Stability Limits

The FCC declared frequency stability limits 1E-6% (97.52 Hz)

## Laboratory Measurement Uncertainty for Frequency Stability

Measurement uncertainty	$\pm 1\text{E}-11$
-------------------------	--------------------

Note: The specification for the Fluke 910 declares an accuracy of  $\pm 1\text{E}-12$  however only  $\pm 1\text{E}-11$  is quoted; justification of the  $\pm 1\text{E}-12$  frequency stability is difficult and unnecessary in this case

## Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-02 'Frequency Measurement'	0075, 0158, 0088, 0197, 0206, 0231, SMA CBL05, ClientPSU

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#### 5.1.4. Conducted Spurious Emissions at Antenna Terminals - Transmitter

##### **FCC 47 CFR Part 90, Subpart I; 2.1051; §90.210(b)**

##### **Test Procedure**

Transmitter conducted spurious emissions were measured while the EUT was operating in an unmodulated transmit mode of operation with 100% duty cycle and maximum power. Conducted spurious emissions were measured to 40 GHz.

Limits were calculated on the unmodulated transmit power level(s).

See test report Section 5.1.2 for average power level measurements  
Average power: + 27.95 dBm (0.624 Watts)

From FCC Part 90.210 (b)  
Section (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.

Attenuation

$43 + 10 \log (P) \text{ dB} = 40.95 \text{ dB attenuation (P is in Watts)}$

Limit:  $+27.95 - 40.95 = -13.0 \text{ dBm}$

##### **Test Measurement Set up**



Conducted spurious emission test configuration

Ambient conditions.

Temperature: 19 to 26 °C

Relative humidity: 31 to 57 %

Pressure: 999 to 1009 mbar

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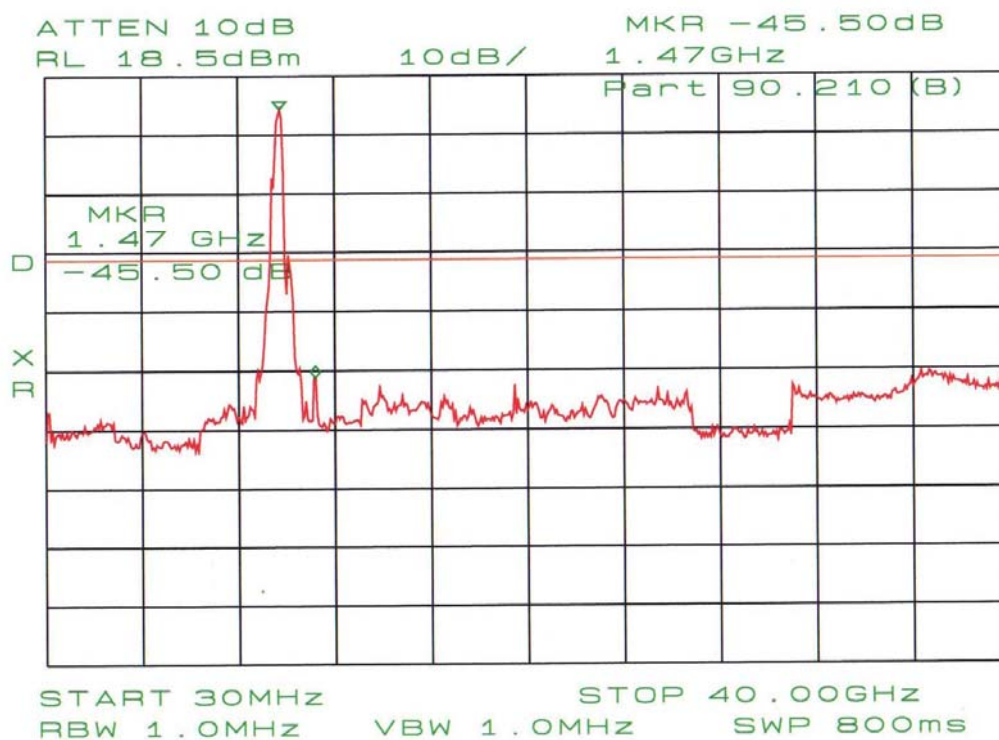


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## TABLE OF RESULTS

Limit: -13.0 dBm

Channel (MHz)	Frequency (MHz)		Freq of Maximum Emission (MHz)	Emission Amplitude (dBm)	Margin (dB)
	Start (MHz)	Stop (MHz)			
9,752.00	30	40,000	11,222.00	-28.3	-15.28
9,752.00	30	40,000	19,504.00	-29.5	-16.46

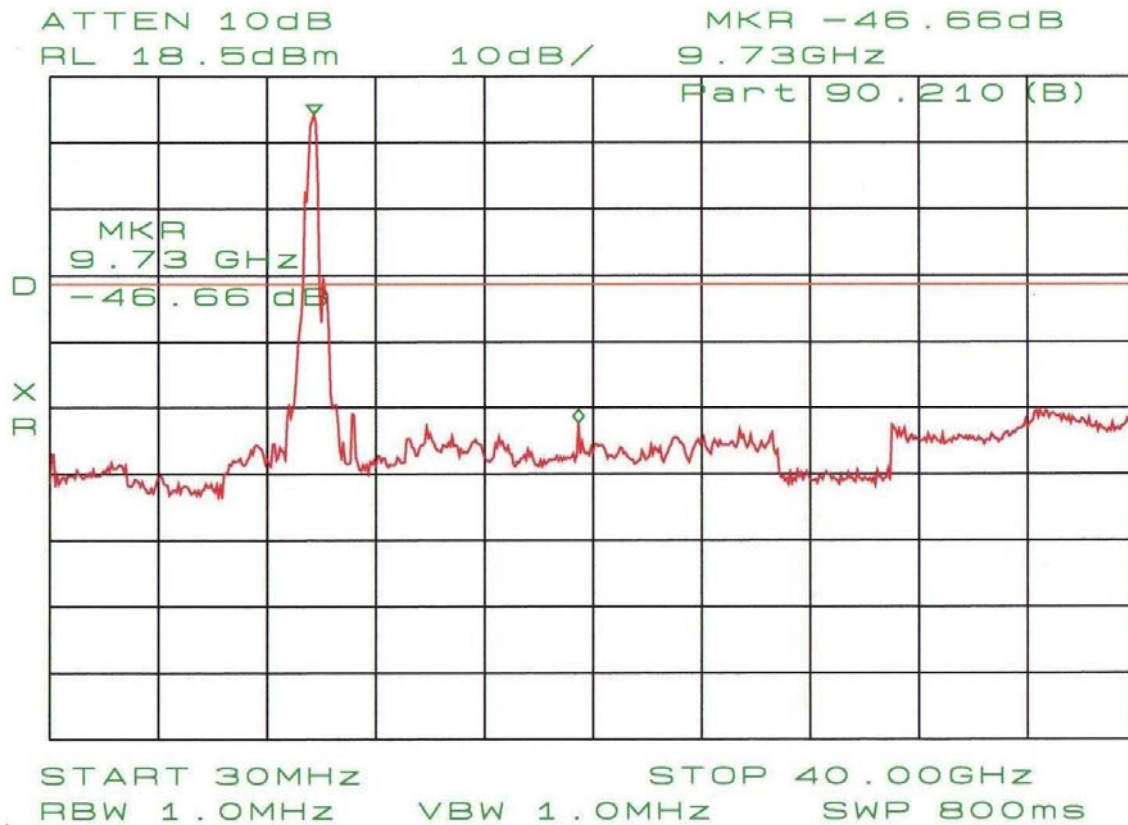


## Conducted Emissions – Emission Close To Carrier

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### Conducted Emissions – 2<sup>nd</sup> Harmonic

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## Specification Limits

### Conducted Spurious Emission at Antenna Terminals – Transmitter Limits **FCC Part §90.210(b)**

Emission Mask (m)
-------------------

On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB.
--

## Laboratory Measurement Uncertainty for Conducted Spurious Emissions

Measurement uncertainty
-------------------------

$\pm 2.37$ dB
---------------

## Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-05 'Measurement of Spurious Emissions'	0158, 0088, 0197, 0206, SMA CBL05, ClientPSU

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#### **5.1.5. Radiated Spurious Emissions**

**FCC 47 CFR Part 90, Subpart I; 2.1053; §90.210(b)**

**MiCOM Labs accreditation does not cover this Section of the report. Radiated Spurious Emission testing was performed by TUV Rheinland of North America, see Section 3.9 Subcontracted Testing or Third Party Data**

#### **Test Procedure**

Company: Novariant  
Product : BaseStation & Terralite™ (Spurious Emissions)  
Objective: Class A Final  
Model: TX100  
S/N: 188534 / 1310786

As per TIA/EIA-603-A 2.2.12 the EUT Transmitter was set up on a turntable on our FCC listed 10m Semi-Anechoic Chamber with the transmitter connected to a standard transmitter load with the connecting RF cable of minimum length.

The Transmitter was placed in transmit mode.

For emissions below 1 GHz the spectrum analyzer resolution bandwidth was set for 10 KHz and the video bandwidth was set to 300 KHz.

For emissions above 1 GHz the spectrum analyzer resolution bandwidth was set for 1 MHz and the video bandwidth was set to 1 MHz.

Sweep time on the spectrum analyzer was kept low enough to maintain measurement calibration.

For emissions below 1 GHz a calibrated biconnilog antenna was used so no adjustments of antenna length were necessary.

For emissions above 1 GHz an appropriate size and type horn antenna was used so no antenna adjustment was necessary.

Since the primary transmit frequency of the transmitter was 9.7 GHz only the first 3 harmonics could be measured (up to 40 GHz).

For each frequency band the table was rotated 360 degrees to find maximum orientation and the mast was raised and lowered from 1 to 4 m and the maximum peak emissions was recorded in both vertical and horizontal polarity of the antenna.

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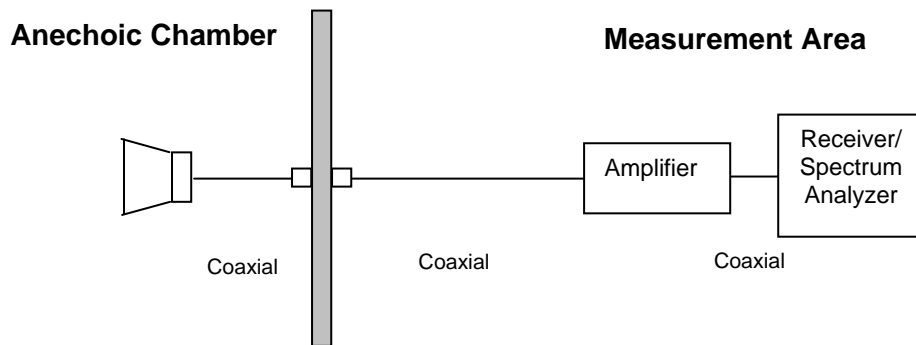
Type of test: Radiated Emissions Class b (10m)

Test Setup: Basestation on Turntable with cable connected to OUTSIDE GPS Antenna, 900 MHz transmitter connected to dummy load.

Terralite™ on Turntable with cable connected to Outside GPS Antenna, 9.752 GHz Transmitter

Test Date: April 29<sup>th</sup> 2005

### Test Measurement Set up



Measurement set up for Radiated Emission Test



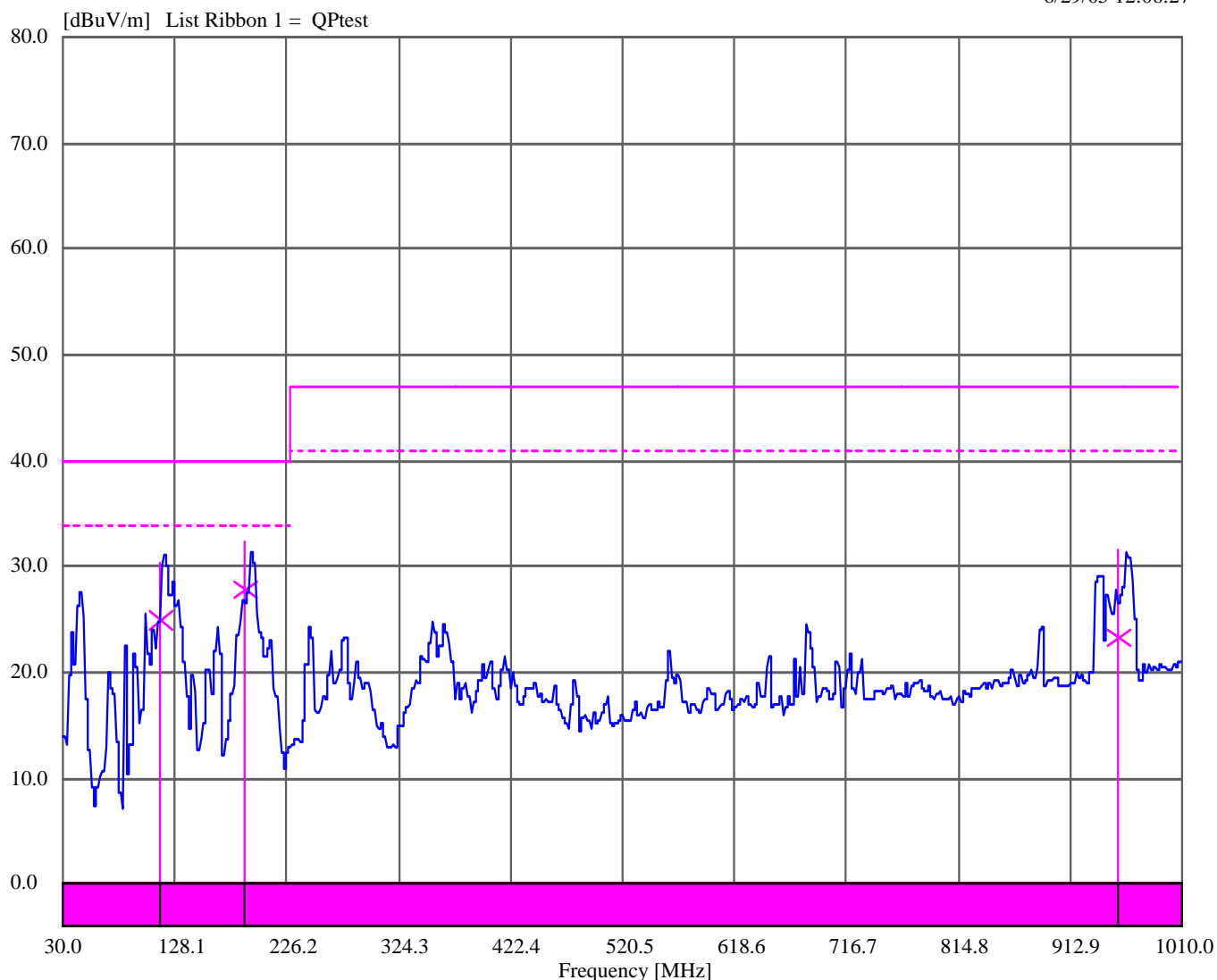
**Title:** Terralite XPS / TX100 Transmit Station  
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## Emissions below 1 GHz

Max and QP Terralite with Transmitter connected to 70 dB Attenuation into Dummy Load

Frequency	Peak	QP	QP Lmt	QP Margin	Angle	Hgt	Pol	Total Correction
MHz	dBuV/m	dBuV/m	dBuV/m	dB	deg	cm		Factor
115.013041	30.43	24.91	40.00	-15.09	175	103	Vert	-18.01
189.667378	32.45	27.91	40.00	-12.09	226	100	Vert	-20.02
955.099674	31.56	23.23	47.00	-23.77	285	194	Vert	-5.09

6/29/05 12:06:27



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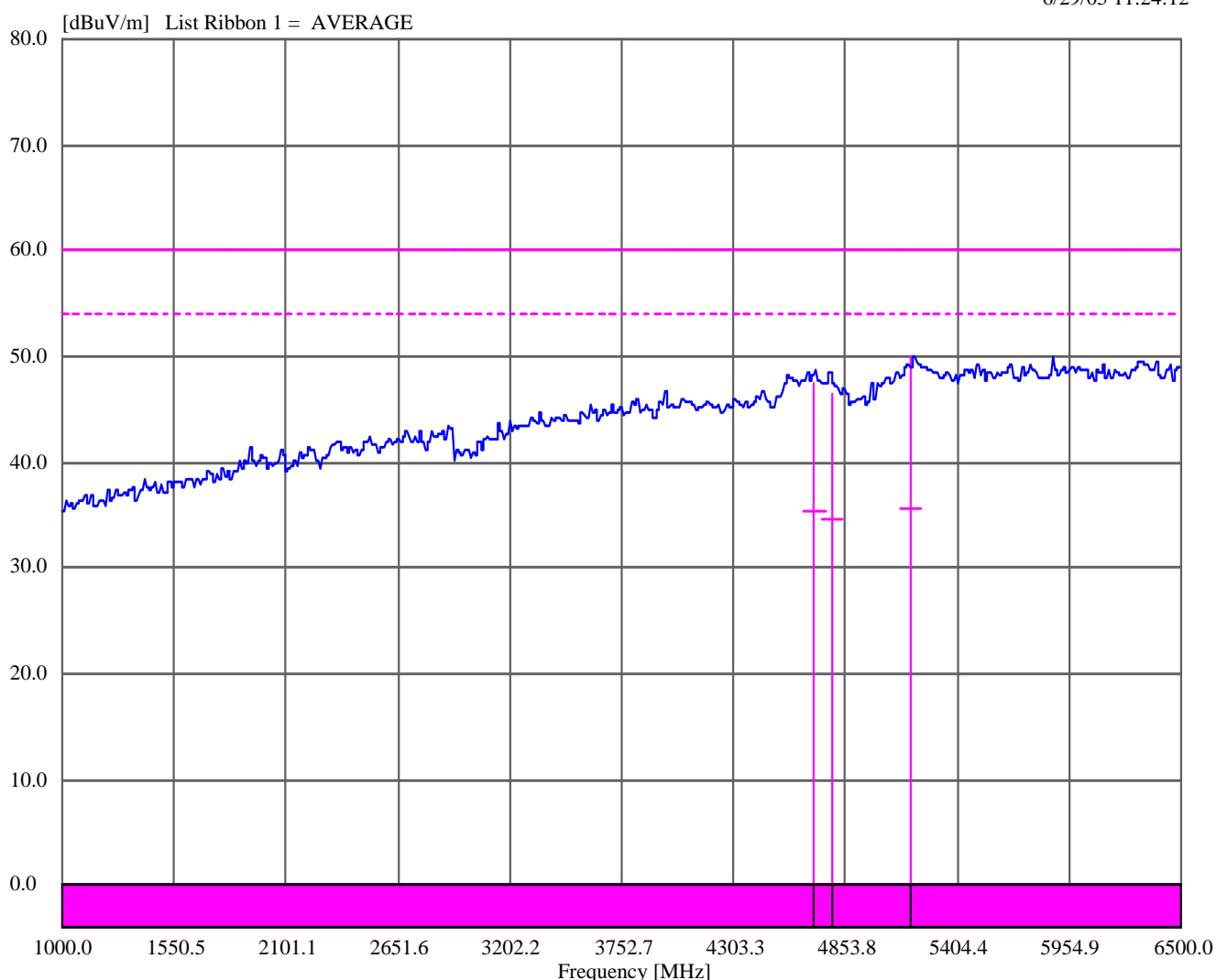


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## Emissions 1 to 6.5 GHz

Frequency	Peak	QP	QP Lmt	QP Margin	Angle	Hgt	Pol	Total Correction
MHz	dBuV/m	dBuV/m	dBuV/m	dB	deg	cm		Factor
4700.071313	47.45	35.45	60.00	-24.55	176	301	H	9.70
4788.677240	46.40	34.62	60.00	-25.38	60	397	H	9.66
5176.643790	50.04	35.70	60.00	-24.30	56	398	H	9.80

6/29/05 11:24:12



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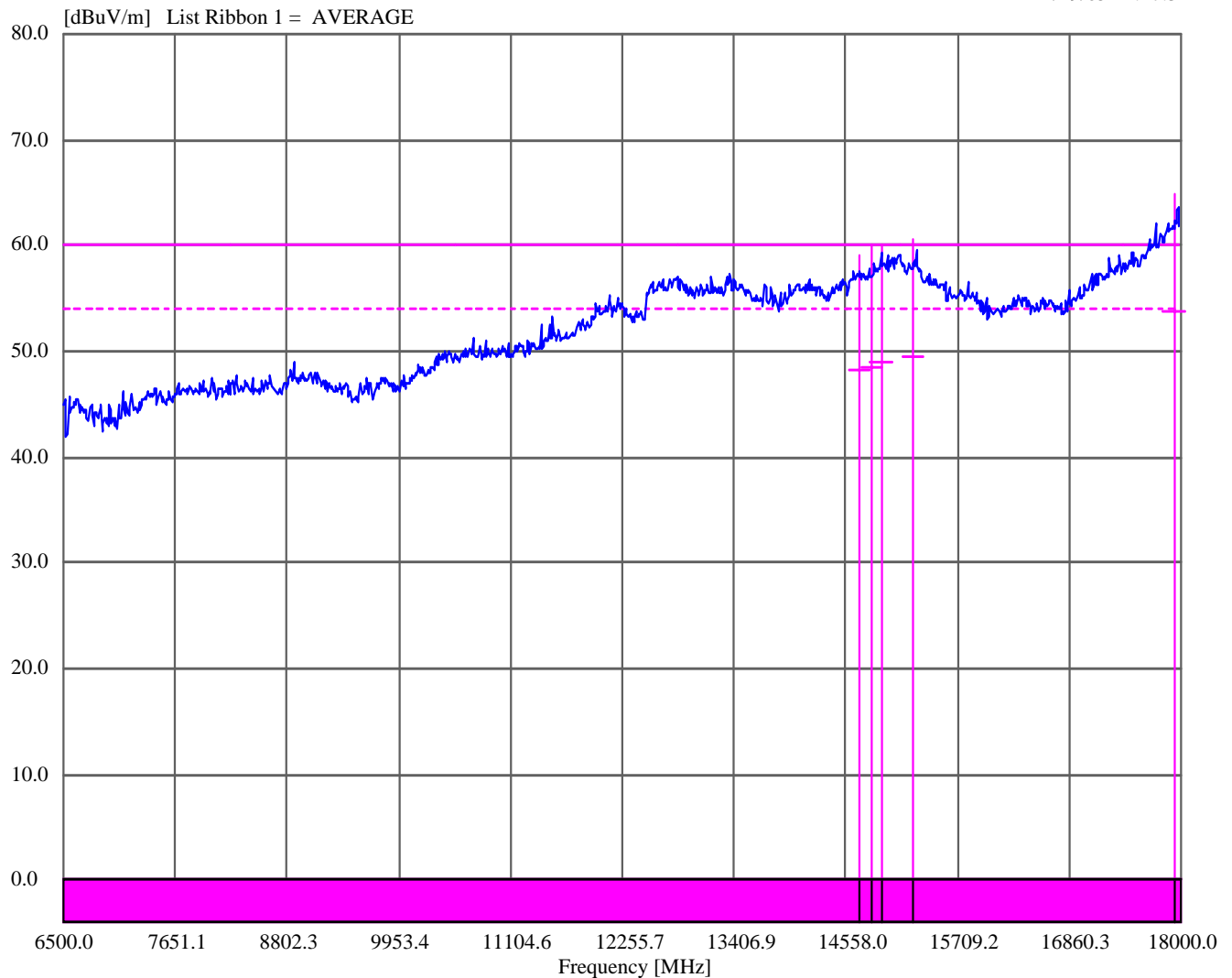


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### Emissions 6.5 – 18 GHz

Frequency	Peak	Avg	Avg Lmt	Avg Margin	Angle	Hgt	Pol	Total Correction
MHz	dBuV/m	dBuV/m	dBuV/m	dB	deg	cm		Factor
14702.456877	59.11	48.29	60.00	-11.71	61	101	H	13.61
14823.135117	60.13	48.57	60.00	-11.43	245	104	V	14.23
14927.962032	60.06	49.13	60.00	-10.87	246	296	V	14.76
15247.071612	60.71	49.49	60.00	-10.51	319	342	H	13.71
17937.681828	64.90	53.77	60.00	-6.23	291	311	V	18.00
18287.681828	64.79	54.02	60.00	-5.98	291	311	V	18.00

4/29/05 14:17:32



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## Emissions 18 – 40 GHz

3 signals were found using manual methods in the 18 - 40 GHz range with the Rhode Schwarz ESI40 receiver. The basic method we used was for each frequency band of interest scan all around the EUT manually holding the horn, and then when we found a frequency pull back to 1 meter and take a reading. The 3 signals found are all peak readings referenced to the average 3m limit line.

Frequency MHz	Avg dBuV/m	Avg Lmt dBuV/m	Avg Margin dB
19500	54.51	60	5.49
22400	58.81	60	1.19
33600	51.76	60	8.24

## Substitution Test Method

As per TIA/EIA-603-A 2.2.12 the EUT Transmitter was set up on a turntable on our FCC listed 10m Semi-Anechoic Chamber with the transmitter connected to a standard transmitter load with the connecting RF cable of minimum length. A substitution antenna and a signal generator was used to determine power dissipated with the equivalent setup.

## Substitution Results

power into substitution antenna

Frequency	Sig Gen dBm	Cable Loss dB	Ant Gain dB	Pd dBm = Pg - Cable Loss + Antenna Gain
19.5	-67.8	2.9	24	-46.7
22.4	-64.5	3.1	24	-43.6
33.6	-72.2	4.6	24	-52.8

Transmitter Power = 0.624 W

Radiated spurious emissions Limits:

Spurious Emissions Attenuation in dB =  $43 + 10\log(\text{Power out of Transmitter in Watts})$

40.9518459 dB or an equivalent absolute Level of -13 dBm

Radiated Spurious emissions (dB) =

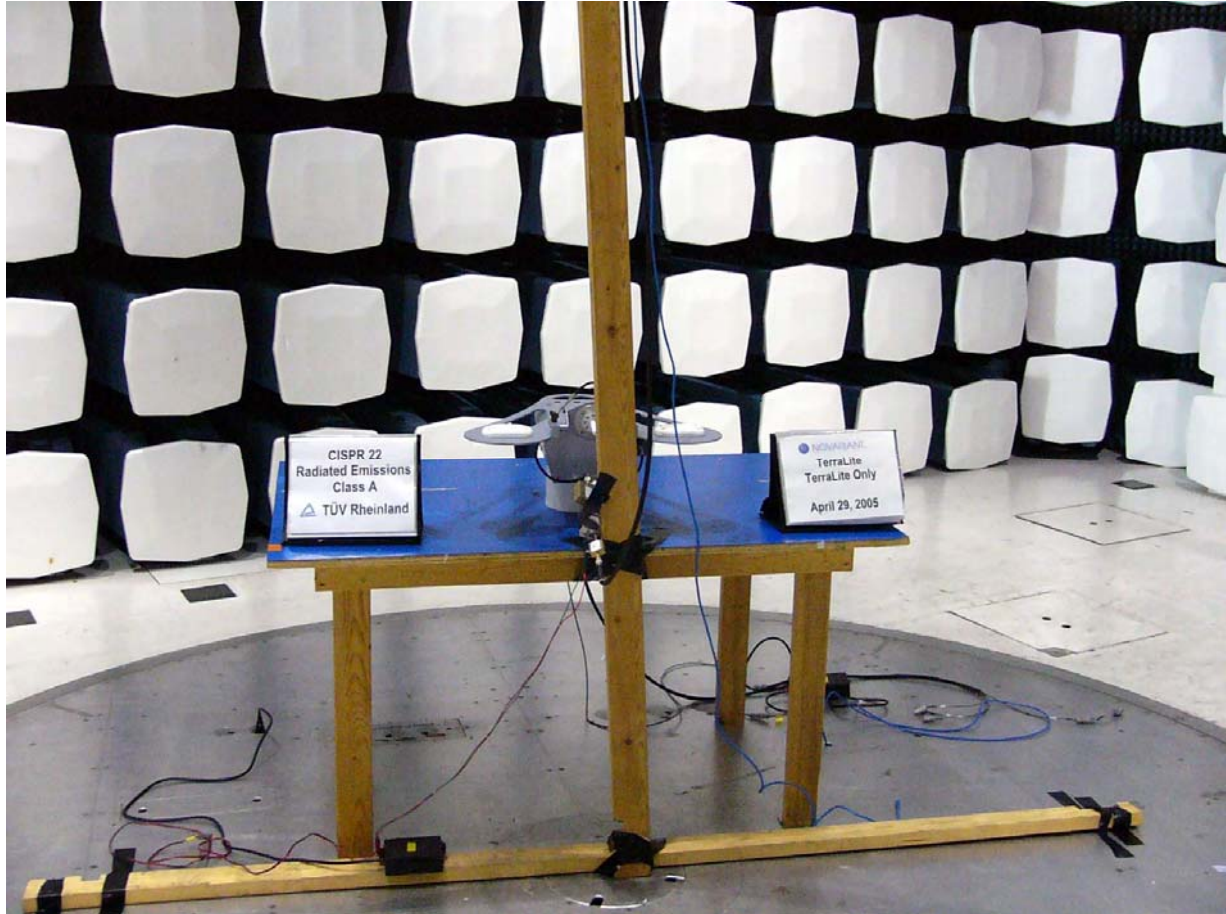
$10\log(\text{TX Power}/0.001) - \text{Pd}$

$10\log(\text{TX Power}/0.001) = 27.9518459$

Frequency (GHz)	Pd dBm	Measured attenuation dBc	Minimum Attenuation dBc	Margin
19.5	-46.7	74.6518459	40.9518459	-33.7
22.4	-43.6	71.5518459	40.9518459	-30.6
33.6	-52.8	80.7518459	40.9518459	-39.8

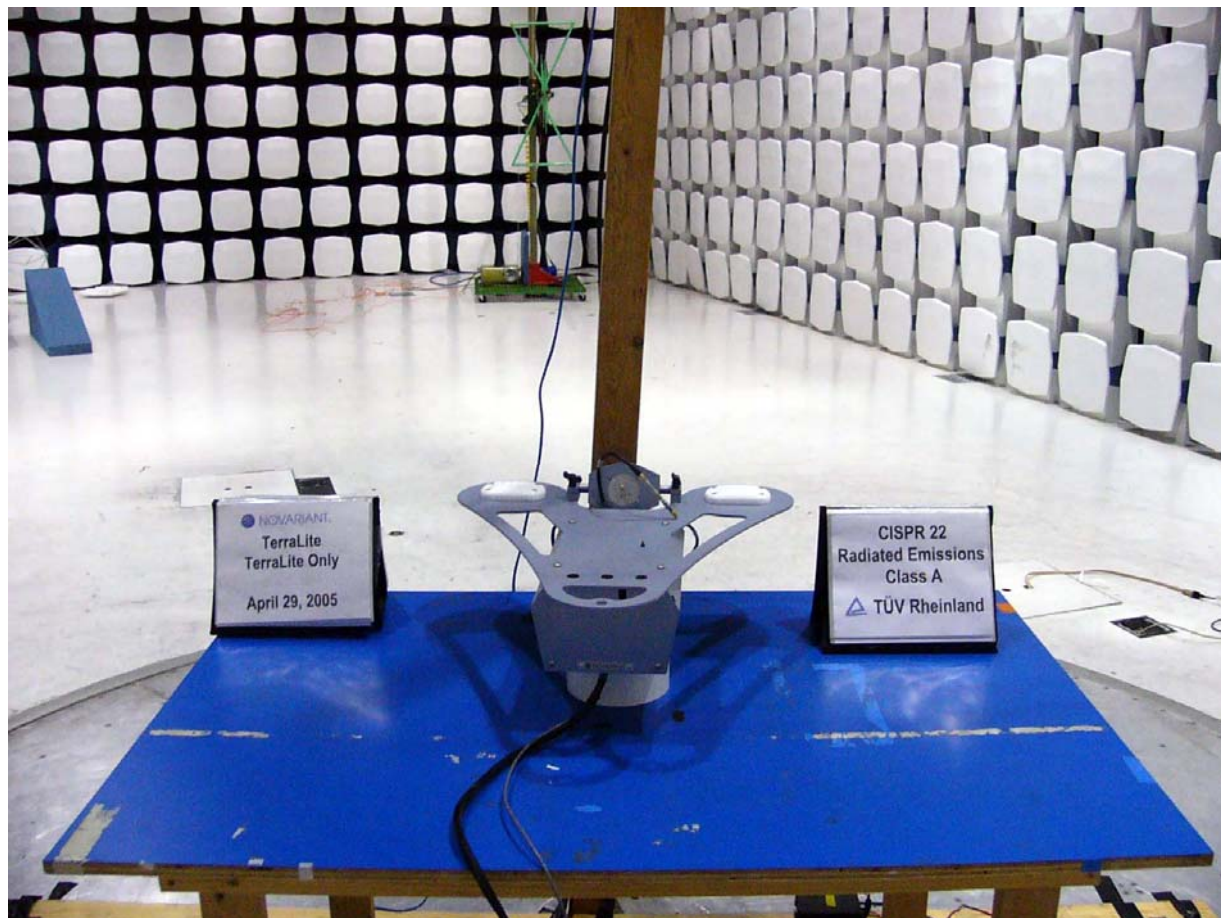
EUT meets required Minimum Attenuation of 40.95

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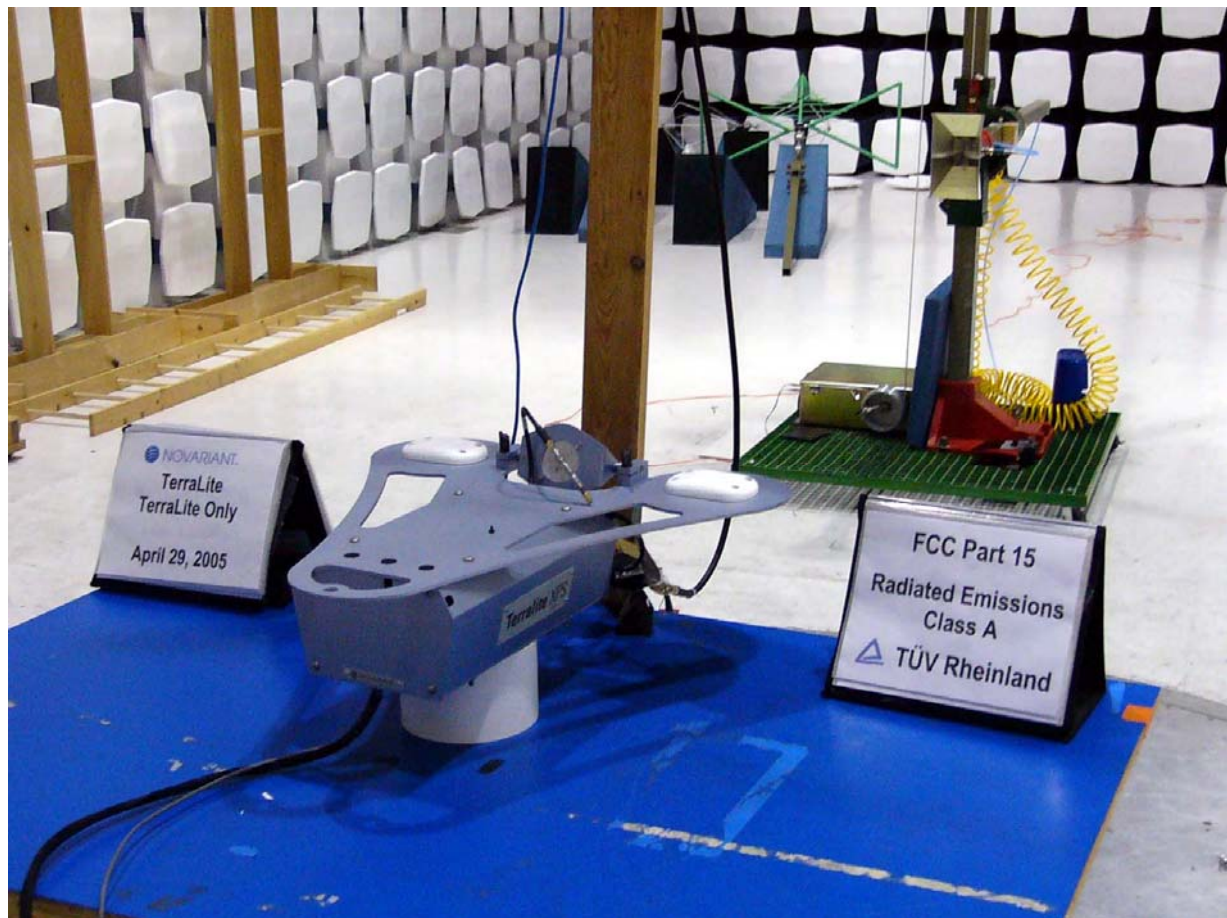


Emission Test Set Up





Emissions Below 1 GHz



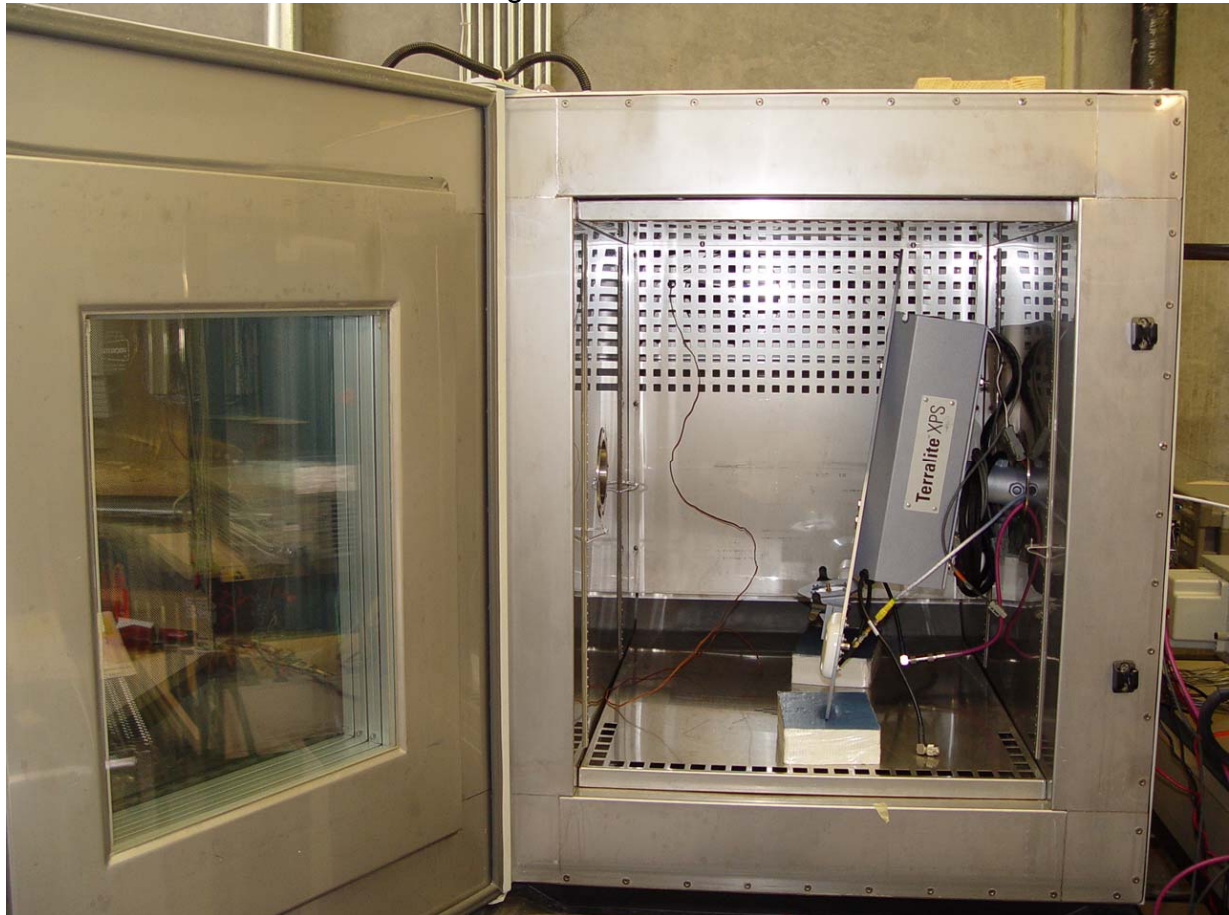
High Frequency Emissions



## **6. TEST SET-UP PHOTOGRAPHS**

### **6.1. General Measurement Test Set-Up**

#### **Environmental Chamber Test Configuration**



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## 7. TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Part #	Serial #
0070	Power Meter	Hewlett Packard	437B	3125U13554
0073	Power Supply	Hewlett Packard	HP6574A	US36340203
0075	Environmental Chamber	Thermotron	SE-300-2-2	27946
0088	Spectrum Analyzer	Hewlett Packard	HP 8564E	3410A00141
0116	Power Sensor	Hewlett Packard	8485A	3318A19694
0158	Barometer /Thermometer	Control Co.	4196	E2844
0197	Antenna	Aero Antenna	--	36279
0206	GPS	Fluke	910	802622
0231	Power Supply	Hewlett Packard	HP6274A	2713A-09023
SMA CBL 05	SMA Cable	Huber & Sunner	Sucoflex 104	None
0148	Antenna 26.6 – 40 GHz	Millimeter Products Inc	261A/599	None
0145	Antenna 18 – 26.5 GHz	Millimeter Products Inc	261K/595	None
0091	Synthesized Sweeper	Hewlett Packard	83640L	3722A00349
0117	Power Sensor	Hewlett Packard	8485D	3318A

### Client Test Equipment

Asset	Instrument	Manufacturer	Part #	Serial #
ClientPSU	4A/13.8Vdc Power Supply	Com	1CT12012-4A	4A014015734

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**Test Equipment used for Radiated Spurious Emission testing (Section 5.1.5) performed by TUV Rheinland of North America**

**RECEIVERS**

Description	Model	Serial Number
HP 8546A EMI Receiver (Receiver Section) 9Khz – 6.5Ghz	85462A	3325A00168
HP8546A EMI Receiver (RF Filter Section)	85460A	3330A00174
HP 8566B Spectrum Analyzer ( Display Section) 100hz – 22Ghz	85662A	2816A16142
HP 8566B Spectrum Analyzer Analyzer Section) 100hz – 22Ghz	85660BR	3138A07655
R&S Receiver (20Hz-40Ghz)	ES1	832427/002

**PREAMPS**

Description	Model	Serial Number
HP 9 KHz – 1 GHz Ant. Preamplifier	310N	185516
HP 1 GHz- 26.5 GHz Ant. Preamplifier	8449B	3008A01013
R&S 1-18 GHz Preamp	TS-PR18	100019
R&S 18-26 GHz Preamp	TS-PR26	100011
R&S 26-40GHz Preamp	TS-PR40	100012

**ANTENNAS**

Description	Model	Serial Number
EMCO Biconilog (Imm/ Em))	3142	1117
Schaffner Biconilog (Emissions)	CBL6112B	2505
EMCO Horn	3115	9710-5301
EMCO Horn	3115	9211-3969
EMCO Horn	3160-09	1285
EMCO Horn	3160-10	1186

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