Test of Tempsys CP-500

To: FCC 47 CFR Part15.249 & IC RSS-210

Test Report Serial No.: TEHA02-U1 Rev A

TEST REPORT

FROM

Test of Tempsys CP-500

To FCC 47 CFR Part15.249 & IC RSS-210

Test Report Serial No.: TEHA02-U1 Rev A

This report supersedes: None

Manufacturer: Tempsys
5701 Hollis Street, CA
Emeryville
California 94103, USA

Product Function: Remote Sensor

Copy No: pdf **Issue Date:** 31st January 2012

This Test Report is Issued Under the Authority of;

MiCOM Labs, Inc.
440 Boulder Court, Suite 200
Pleasanton, CA 94566 USA
Phone: +1 (925) 462-0304
Fax: +1 (925) 462-0306
www.micomlabs.com

ACCREDITED

TESTING CERTIFICATE #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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ACCREDITATION, LISTINGS & RECOGNITION

TESTING ACCREDITATION

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard 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

ilac-MRA

A2LA World Class Accreditation

The American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

MICOM LABS

Pleasanton, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 14th day of April 2010.

President & CEO
For the Accreditation Council
Certificate Number 2381.01
Valid to March 31, 2012
Revised January 20, 2012

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

RECOGNITION

MiCOM Labs, Inc has widely recognized Electrical testing capabilities. Our international recognition includes Conformity Assessment Body designation by APEC MRA** countries. Our test reports are widely accepted for global type approvals.

Country	Recognition Body	Status	Phase	Identification No.
USA	Federal Communications Commission (FCC)	TCB	-	Listing #: 102167
Canada	Industry Canada (IC)	FCB	APEC MRA 2	Listing #: 4143A
Japan	VCCI	-	-	No. 2959
Europe	European Commission	NB	EU MRA	NB 2280
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)	CAB	APEC MRA 1	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	CAB	APEC MRA 1	
Singapore	Infocomm Development Authority (IDA)	CAB	APEC MRA 1	
Taiwan	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)	CAB	APEC MRA 1	
Vietnam	Ministry of Communication (MIC)	CAB	APEC MRA 1	

**APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement.
Is a recognition agreement under which test lab is accredited to regulatory standards of the APEC member countries.
Phase I - recognition for product testing
Phase II – recognition for both product testing and certification
N/A – Not Applicable

**EU MRA – European Union Mutual Recognition Agreement.
Is a recognition agreement under which test lab is accredited to regulatory standards of the EU member countries.

**NB – Notified Body

PRODUCT CERTIFICATION

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard EN ISO/IEC Guide 65. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-02.pdf

United States of America – Telecommunication Certification Body (TCB)

TCB Identifier – US0159

Industry Canada – Certification Body

CAB Identifier – US0159

Europe – Notified Body

Notified Body Identifier - 2280

DOCUMENT HISTORY

Document History		
Revision	**Date**	**Comments**
Draft		
Rev A	31st January 2012	Initial release.

1. TEST RESULT CERTIFICATE

Manufacturer:	Tempsys 5701 Hollis Street Emeryville California 94608 USA	Tested By:	MiCOM Labs, Inc. 440 Boulder Court Suite 200 Pleasanton California, 94566, USA
EUT:	RFID Client Device	Telephone:	+1 925 462 0304
Model:	CP-500	Fax:	+1 925 462 0306
S/N:	54954		
Test Date(s):	13th - 14th April 2011	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC 47 CFR Part15.249 & IC RSS-210	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:

A2LA ACCREDITED
TESTING CERTIFICATE #2381.01

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 15.249	2010	Code of Federal Regulations
(ii)	Industry Canada RSS-210	Issue 8 Dec 2010	Low Power License-Exempt Radiocommunication Devices (All Frequency Bands)
(iii)	Industry Canada RSS-Gen	Issue 3 Dec 2010	General Requirements and Information for the Certification of Radiocommunication Equipment.
(iv)	ANSI C63.4	2009	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
(v)	CISPR 22/ EN 55022	2008 2006+A1:2007	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
(vi)	M 3003	Edition 1 Dec. 1997	Expression of Uncertainty and Confidence in Measurements
(vii)	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
(viii)	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
(ix)	A2LA P101	9th June 2010	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

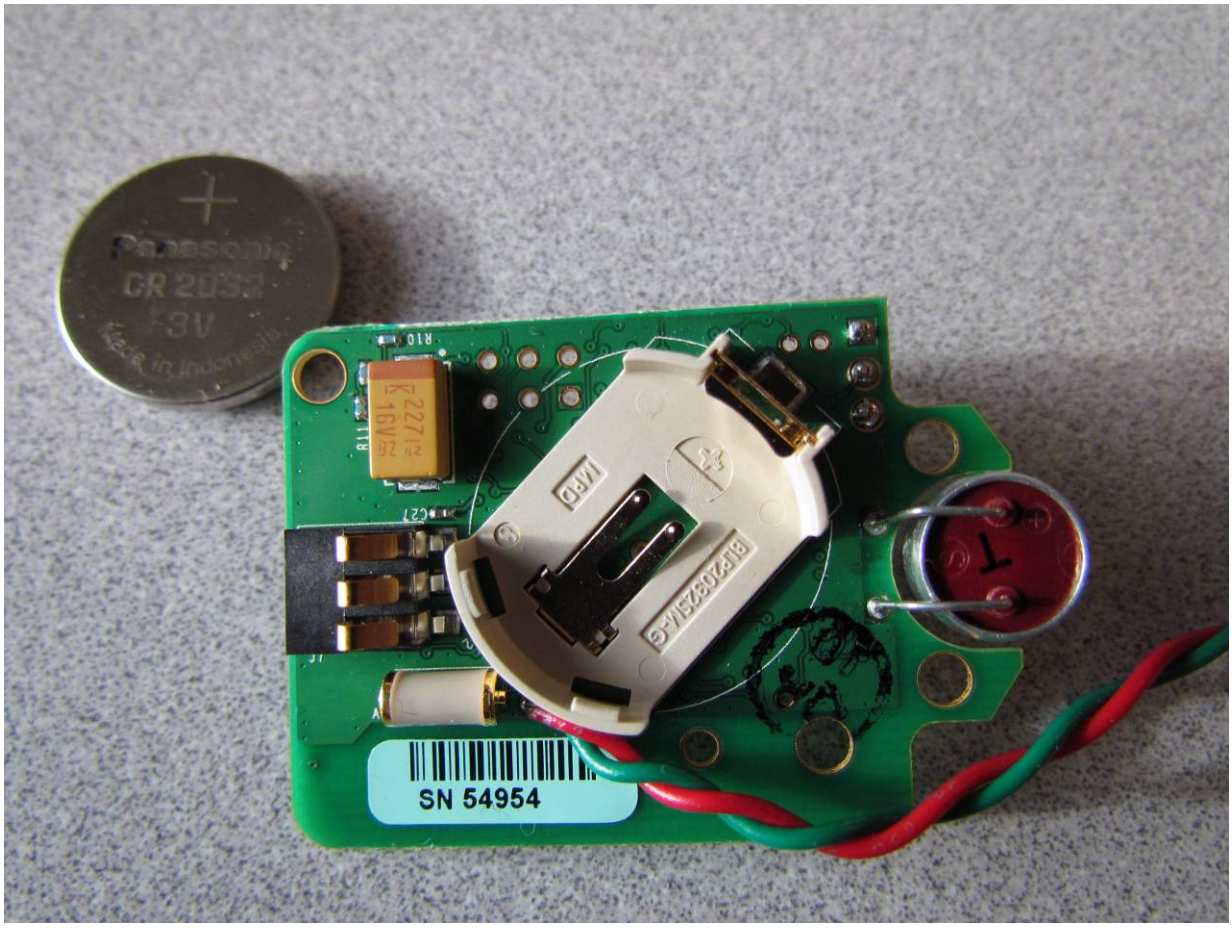
3.1. Technical Details

Details	Description
Purpose:	Test of the Tempsys CP-500 to FCC Part 15.249 and Industry Canada RSS-210 regulations
Applicant:	As Manufacturer
Manufacturer:	Tempsys 5701 Hollis Street Emeryville California 94608 USA
Laboratory performing the tests:	MiCOM Labs, Inc. 440 Boulder Court, Suite 200 Pleasanton, California 94566 USA
Test report reference number:	TEHA02-U1 Rev A
Standard(s) applied:	FCC 47 CFR Part15.249 & IC RSS-210
Date EUT received:	12th April 2011
Dates of test (from - to):	13th - 14th April 2011
No of Units Tested:	One
Type of Equipment:	915 MHz RFID Reader
Manufacturers Trade Name:	Tempsys
Model:	CP-500
Location for use:	Indoor only
Declared Frequency Range(s):	902 - 928 MHz
Type of Modulation:	FSK
Declared Nominal Output Power:	-2 dBm (±2 dB)
EUT Modes of Operation:	FHSS
Transmit/Receive Operation:	Transceiver, Simplex
Rated Input Voltage and Current:	3 VDC (Battery Powered)
Operating Temperature Range:	-20 - +50 C (Client Declared) Not Tested
Microprocessor(s) Model:	Atmel AVR Micro (8MHz internal LC oscillator)
Clock/Oscillator(s):	8 MHz, 2 MHz, 12.8 MHz, 32.768 kHz
Frequency Stability:	±20ppm
EUT Dimensions:	1.9” X 1.3” X 0.35”
EUT Weight :	1.0 oz
Primary function of equipment:	Asset ID Transmitter

3.2. Scope of Test Program

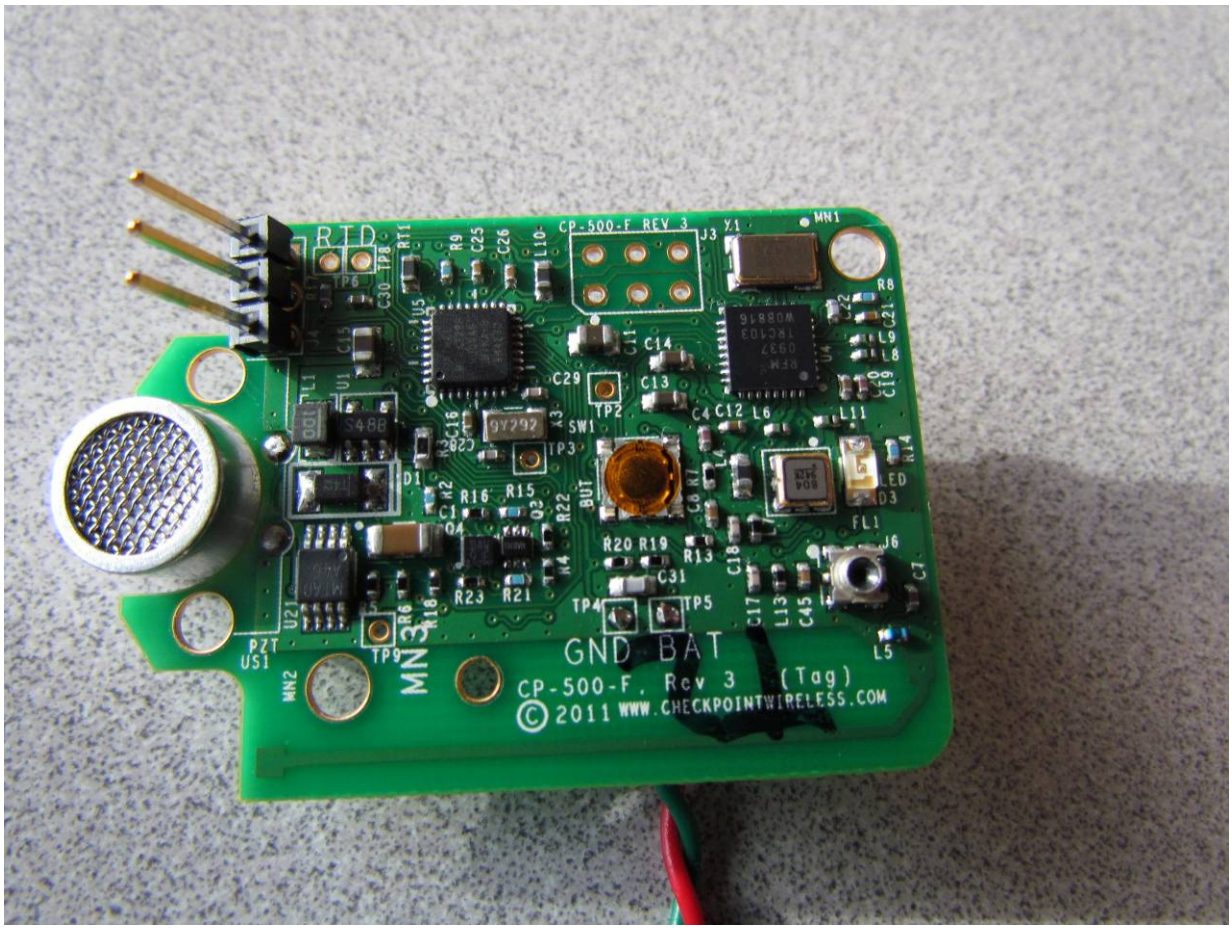
The scope of the test program was to test the Tempsys CP-500 in the frequency ranges 902 - 928 MHz against FCC 47 CFR Part 15.249 and Industry Canada RSS-210 specifications for radiated and conducted emissions for intentional radiators.

CP-500 PCB Top



CP-500 with test leads to supply 3 Vdc power. CR2032 button battery to power under normal conditions

CP-500 PCB Underside



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

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	CP-500 with FCC test code	Tempsys	CP-500	54954
Support	Laboratory DC Power Supply	Hewlett Packard	6274B	2713A-09023
Support	IBM ThinkPad – Hyperterminal control over EUT (FCC test code)	IBM	T30	

3.4. Antenna Details

- Integral PCB Whip Antenna: Antenna gain, -10 dBi

3.5. Cabling and I/O Ports

Number and type of I/O ports

- RF Port (915 MHz)
- Single Battery Terminal CR2032 (button type)
- Serial Port (3 pin) Local Maintenance Terminal

3.6. Test Configurations

EUT was set to 100% duty cycle by FCC Test Code for testing purposes.

Frequency Bands:

Start Freq. (MHz)	Stop Freq. (MHz)	Rated Output Power (dBm)	Frequency Tolerence (p.p.m.)	20dB BW (KHz)	Emission Designator	Microprocessor
903	926	-1.5	20	304K	304KF1D	ATMega 644

Operating Channel	Frequencies (MHz)	Data Rate	Deviation	Channel Spacing
0	903.0	200 Kbits/S	200 kHz	350 kHz
31	914.9	200 Kbits/S	200 kHz	350 kHz
59	926.0	200 Kbits/S	200 kHz	350 kHz
0	903.0	200 Kbits/S	200 kHz	350 kHz
31	914.9	200 Kbits/S	200 kHz	350 kHz
59	926.0	200 Kbits/S	200 kHz	350 kHz
0	903.0	200 Kbits/S	200 kHz	175 kHz
31	908.425	200 Kbits/S	200 kHz	175 kHz
59	913.325	200 Kbits/S	200 kHz	175 kHz
0	914.775	200 Kbits/S	200 kHz	175 kHz
31	921.1	200 Kbits/S	200 kHz	175 kHz
59	926.0	200 Kbits/S	200 kHz	175 kHz

TESTED DATA RATE 7 – what does this relate to?

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

The following tests were performed by a MiCOM Labs approved test facility;-

1. NONE

4. TEST SUMMARY

List of Measurements

The following table represents the list of measurements required under the **FCC CFR47 Part 15.249**, **Industry Canada RSS-210** and **Industry Canada RSS-Gen.**

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.249(a) **15.205** **15.209** **A2.9** **2.2** **4.9**	Radiated Emissions above 1 GHz	Transmitter Radiated Spurious Emissions	Radiated	Complies	*5.1.1*
15.249(d) **15.205** **15.209** **A2.9** **2.2**	Radiated Emissions	Digital Emissions Peak Emissions	Radiated	Complies	*5.1.2*
2.3 **4.10**	Receiver Radiated Emissions above 1 GHz	Receiver Emissions	Radiated	Complies	*5.1.3*

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*
Note 3: *Section 3.7 - Equipment Modifications highlights the equipment modifications that were required to bring the product into compliance with the above test matrix*

5. TEST RESULTS

5.1. Device Characteristics

5.1.1. Radiated Emissions above 1 GHz

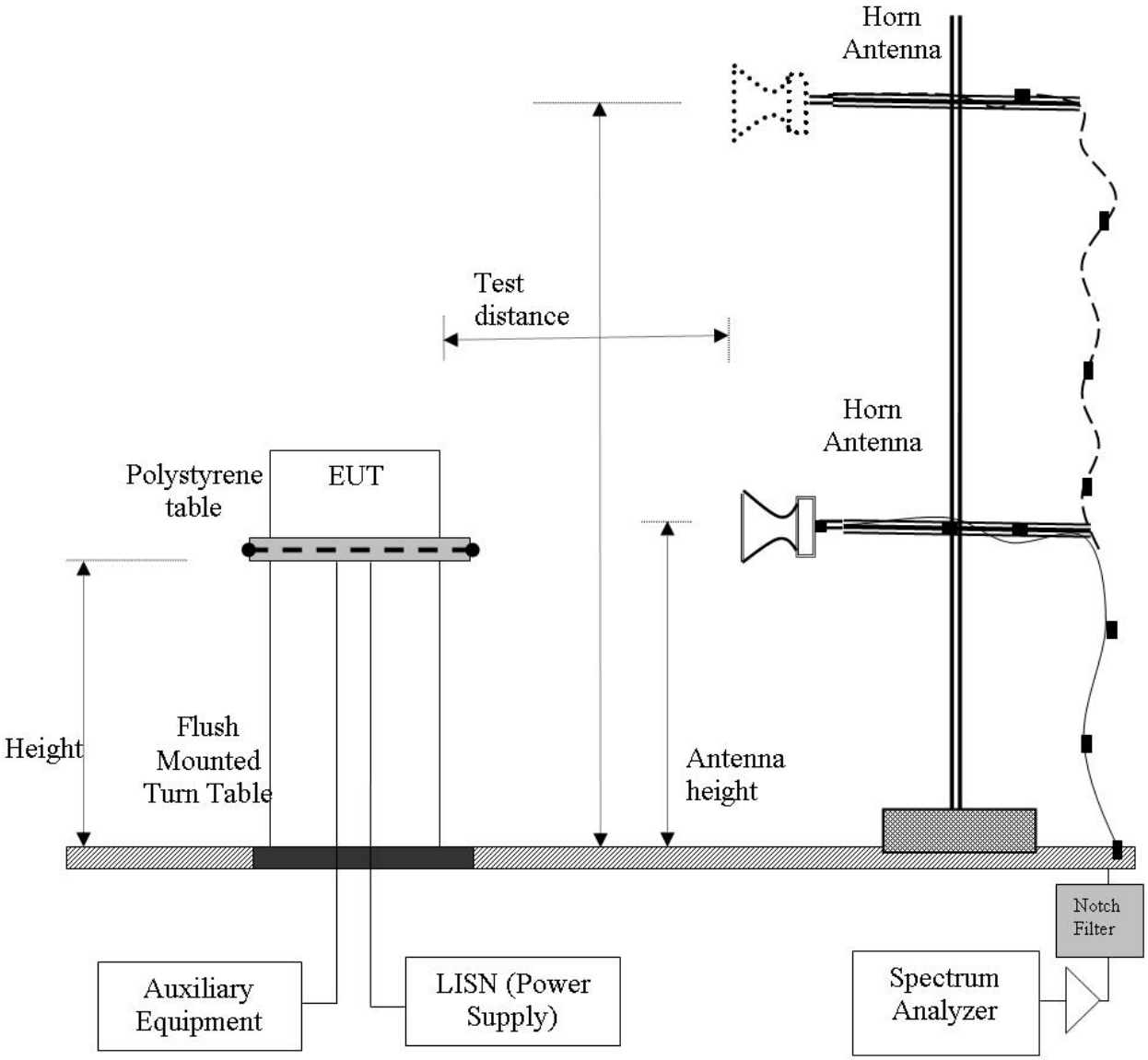
FCC, Part 15 Subpart C §15.249(a)
Industry Canada RSS-210 §A2.9

Test Procedure

Testing was performed in a 3-meter anechoic chamber. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. Preliminary emissions were recorded with in Spectrum Analyzer mode, using a maximum peak detector while in peak hold mode.

Emissions nearest the limits were chosen for maximization and formal measurement using a CISPR Compliant receiver. Emissions above 1000 MHz are measured utilizing a CISPR compliant average detector with a tuned receiver, using a bandwidth of 1 MHz.

Test Measurement Set Up



Radiated Emission Measurement Setup – Above 1 GHz

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

FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor

CORR = Correction Factor = CL – AG + NFL

CL = Cable Loss
AG = Amplifier Gain
FO = Distance Falloff Factor
NFL = Notch Filter Loss or Waveguide Loss

Field Strength Calculation 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 and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3 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

Specification

Radiated Spurious Emissions

FCC §15.249(a)

A2.9

(a)The field strength of emissions from the intentional radiators operated within these bands shall comply with the following;

Fundamental Frequencies	Field Strength (millivolts/m)	
	Fundamental	Harmonics
902 – 928 MHz	50	500
2400 – 2438.5 MHz	50	500
5725 – 5875 MHz	50	500

(c) Field strength limits are specified at a distance of 3 meters

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation

(e) As shown in in Section 15.35 (b), for frequencies above 1,000 MHz, the above field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any conditions of modulation.

FCC §15.205 (a) Except as shown in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

FCC §15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.

Laboratory Measurement Uncertainty for Spectrum Measurement

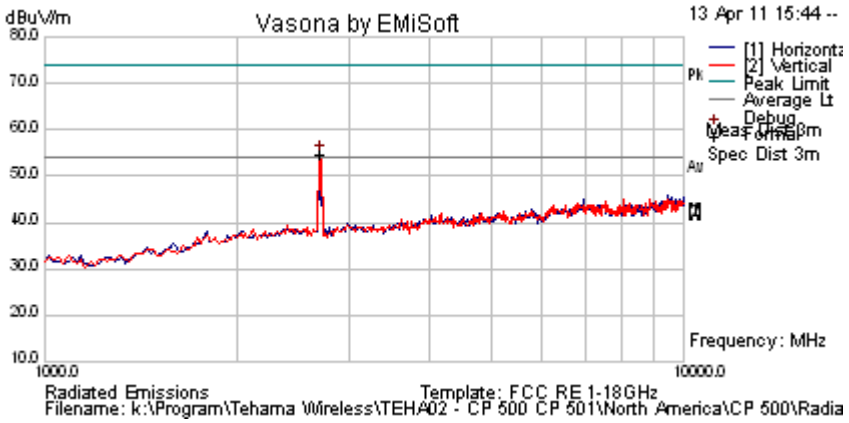
Measurement Uncertainty	+5.6/ -4.5 dB

Traceability:

Method	Test Equipment Used
Work instruction WI-03	0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312

Radiated Emissions Measurement Results

Test Freq.	903 MHz	**Engineer**	GMH
Variant	CP500	**Temp (ºC)**	21
Freq. Range	902-928	**Rel. Hum.(%)**	35
Power Setting	4 (maximum)	**Press. (mBars)**	1010
Antenna	Integral PCB	**Duty Cycle (%)**	100
Test Notes 1	Device positioned verticaly on test table		
Test Notes 2			

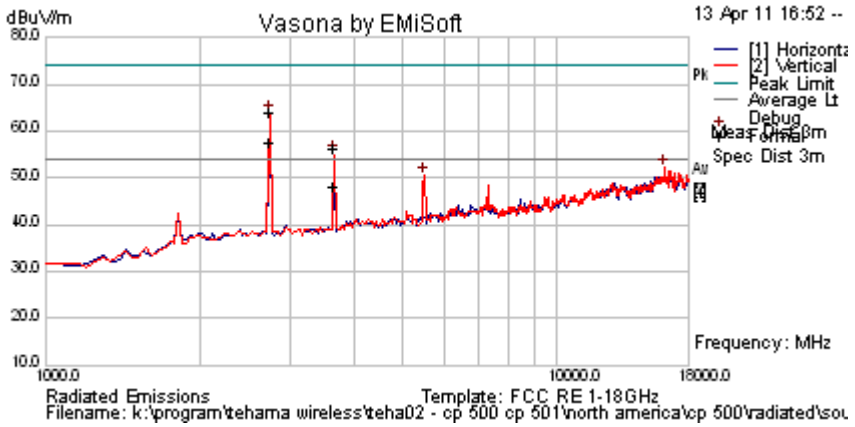


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
2708.434	58.1	3.2	-11.2	50.1	Peak Max	H	202	27	74.0	-24.0	Pass	
2708.434	49.8	3.2	-11.2	41.8	Average Max	H	202	27	54.0	-12.2	Pass	

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	NRB = Non-Restricted Band. RB = Restricted Band.

Test Freq.	914.9 MHz	**Engineer**	GMH
Variant		**Temp (ºC)**	21
Freq. Range	902-928	**Rel. Hum.(%)**	35
Power Setting	4 (maximum)	**Press. (mBars)**	1010
Antenna	Integral PCB	**Duty Cycle (%)**	100
Test Notes 1	Device positioned vertically on test table		
Test Notes 2			

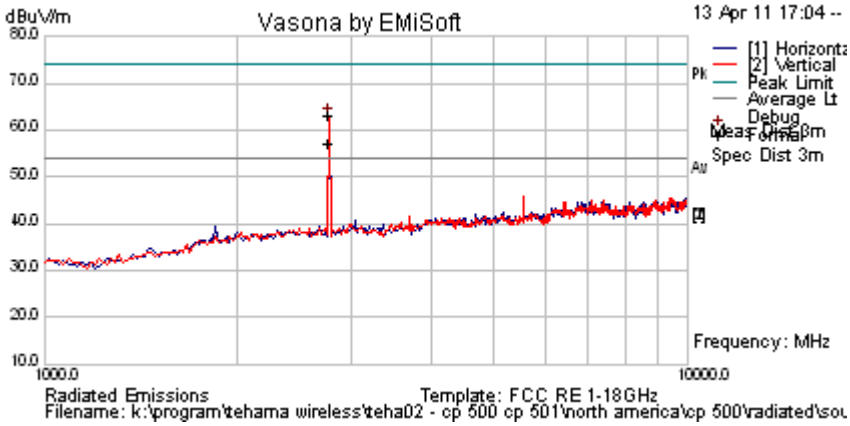


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
2744.114	72.5	3.2	-11.6	64.2	Peak Max	V	195	8	74.0	-9.9	Pass	
3660.358	63.4	3.7	-10.7	56.4	Peak Max	V	99	65	74.0	-17.6	Pass	
2744.114	62.3	3.2	-11.6	53.9	Average Max	V	195	8	54	-0.1	Pass	
3660.358	55.3	3.7	-10.7	48.3	Average Max	V	99	65	54	-5.7	Pass	

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	NRB = Non-Restricted Band. RB = Restricted Band.

Test Freq.	926 MHz	**Engineer**	GMH
Variant		**Temp (ºC)**	21
Freq. Range	902-928	**Rel. Hum.(%)**	35
Power Setting	4 (maximum)	**Press. (mBars)**	1010
Antenna	Integral PCB	**Duty Cycle (%)**	100
Test Notes 1	Device positioned verticaly on test table		
Test Notes 2			



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
2777.477	71.6	3.2	-11.6	63.2	Peak Max	V	193	9	74.0	-10.8	Pass	
2777.477	62.3	3.2	-11.6	53.9	Average Max	V	193	9	54.0	-0.1	Pass	

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	NRB = Non-Restricted Band. RB = Restricted Band.

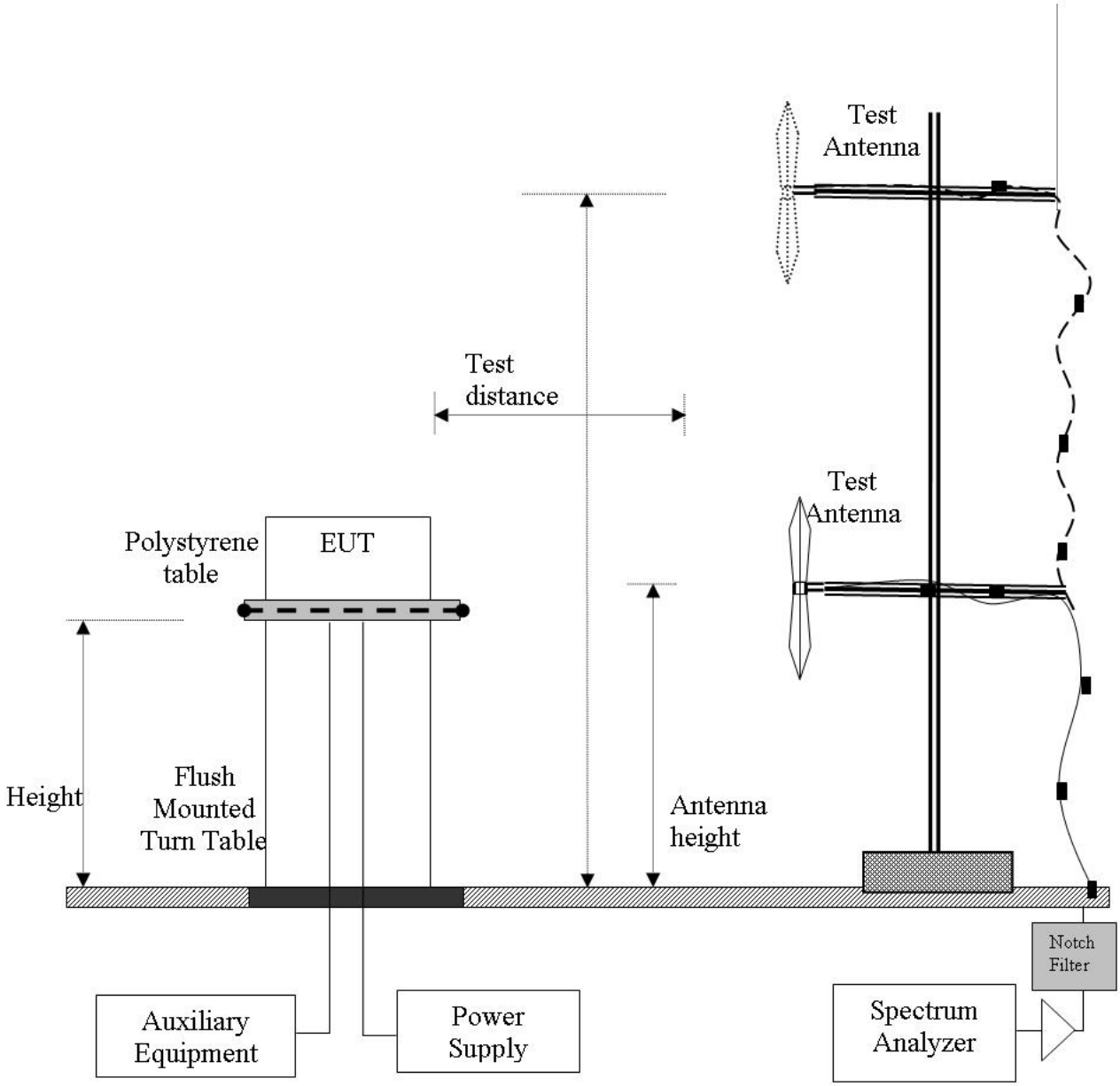
5.1.2. Radiated Emissions – Below 1 GHz (Fundamental + Spurious)

FCC, Part 15 Subpart C §15.249(a), §15.205, 15.109
Industry Canada RSS-210 §A2.9

Test Procedure

Testing was performed in a 3-meter anechoic chamber. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. Preliminary emissions were recorded with in Spectrum Analyzer mode, using a maximum peak detector while in peak hold mode.

Emissions nearest the limits were chosen for maximization and formal measurement using a CISPR Compliant receiver. Emissions above 1000 MHz are measured utilizing a CISPR compliant average detector with a tuned receiver, using a bandwidth of 1 MHz. Emissions from 30 MHz – 1000 MHz are measured utilizing a CISPR compliant quasi-peak detector with a tuned receiver, using a bandwidth of 120 kHz. Only the highest emissions relative to the limit are listed.



Radiated Emission Measurement Setup – Below 1 GHz

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

FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor

CORR = Correction Factor = CL – AG + NFL

CL = Cable Loss
AG = Amplifier Gain
FO = Distance Falloff Factor
NFL = Notch Filter Loss or Waveguide Loss

Field Strength Calculation 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 and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3 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

Radiated Spurious Emissions

FCC §15.249(a)

Industry Canada RSS-210 A2.9
(a)The field strength of emissions from the intentional radiators operated within these bands shall comply with the following;

Fundamental Frequencies	Field Strength (millivolts/m)	
	Fundamental	Harmonics
902 – 928 MHz	50	500
2400 – 2438.5 MHz	50	500
5725 – 5875 MHz	50	500

(c) Field strength limits are specified at a distance of 3 meters

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation

(e) As shown in in Section 15.35 (b), for frequencies above 1,000 MHz, the above field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any conditions of modulation.

FCC §15.205 (a) Except as shown in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

FCC §15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.

Laboratory Measurement Uncertainty for Spectrum Measurement

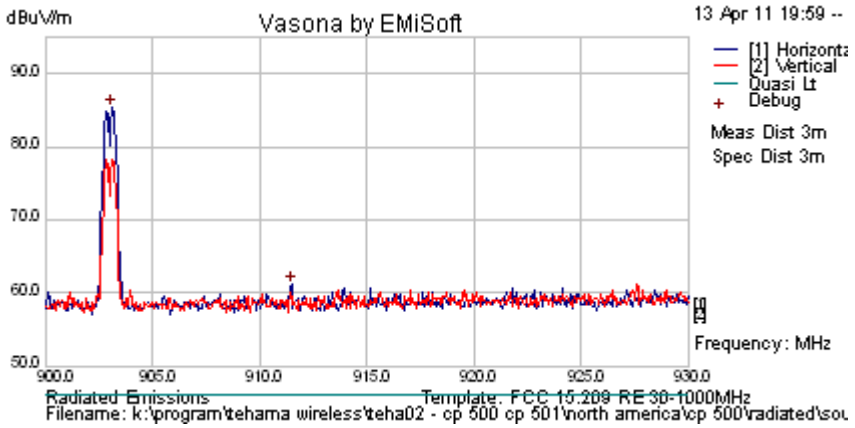
Measurement Uncertainty	+5.6/ -4.5 dB

Traceability:

Method	**Test Equipment Used**
Work instruction WI-03	0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312

Radiated Fundamental Emission

Test Freq.	903 MHz	**Engineer**	GMH
Variant		**Temp (ºC)**	21.5
Freq. Range	902-928 MHz	**Rel. Hum.(%)**	34
Power Setting	4 (maximum)	**Press. (mBars)**	1011
Antenna	integral PCB	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			



Formally measured emission peaks

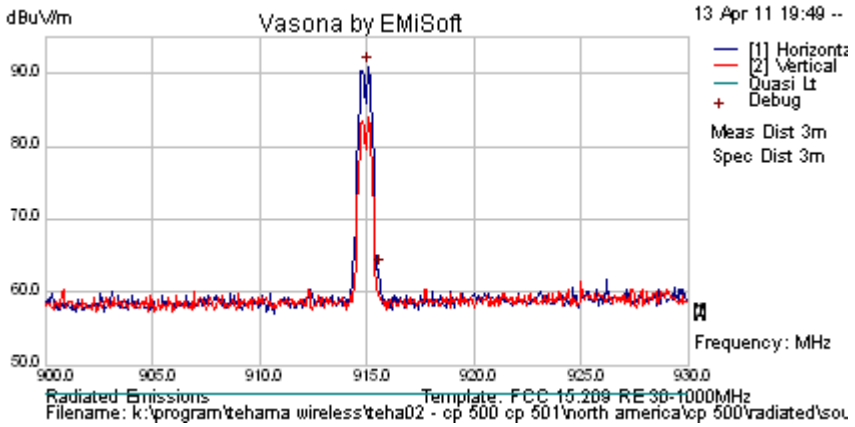
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
903.126	55.3	7.3	22.8	85.4	Peak [Scan]	H						FUND

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	NRB = Non-Restricted Band. RB = Restricted Band.

Peak Field Strength 85.4 dBµV/m

Limit 93.97 dBµV/m

Test Freq.	914.9 MHz	**Engineer**	GMH
Variant		**Temp (°C)**	21.5
Freq. Range	902-928 MHz	**Rel. Hum.(%)**	34
Power Setting	4 (maximum)	**Press. (mBars)**	1011
Antenna	integral PCB	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			



Formally measured emission peaks

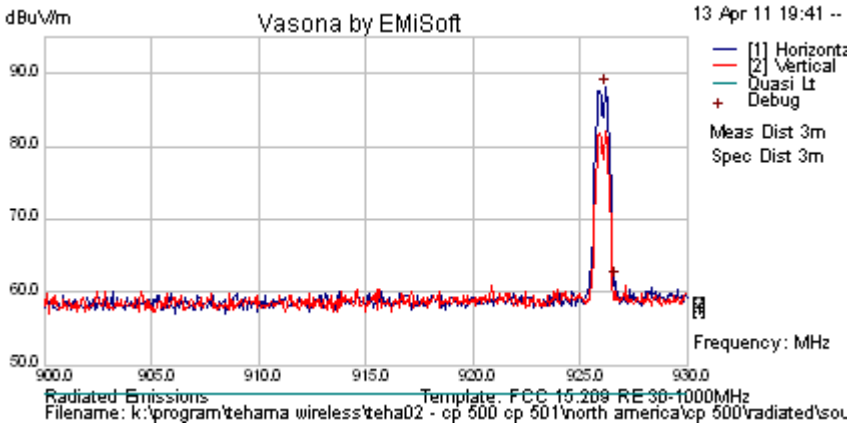
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
915.090	60.8	7.4	22.9	91.1	Peak [Scan]	H						FUND

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	NRB = Non-Restricted Band. RB = Restricted Band.

Peak Field Strength 91.1 dBµV/m

Limit 93.97 dBµV/m

Test Freq.	926 MHz	**Engineer**	GMH
Variant		**Temp (°C)**	21.5
Freq. Range	902-928 MHz	**Rel. Hum.(%)**	34
Power Setting	4 (maximum)	**Press. (mBars)**	1011
Antenna	integral PCB	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
926.152	57.7	7.4	23.0	88.1	Peak [Scan]	H						FUND

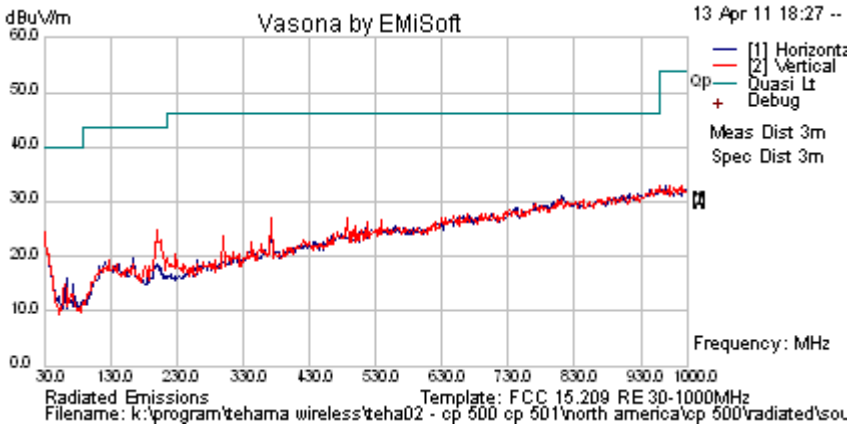
Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	NRB = Non-Restricted Band. RB = Restricted Band.

Peak Field Strength 88.1 dBµV/m

Limit 93.97 dBµV/m

Radiated Digital Emissions

Test Freq.	903 MHz	**Engineer**	GMH
Variant		**Temp (ºC)**	21.5
Freq. Range	902-928 MHz	**Rel. Hum.(%)**	34
Power Setting	4 (maximum)	**Press. (mBars)**	1011
Antenna	integral PCB	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			



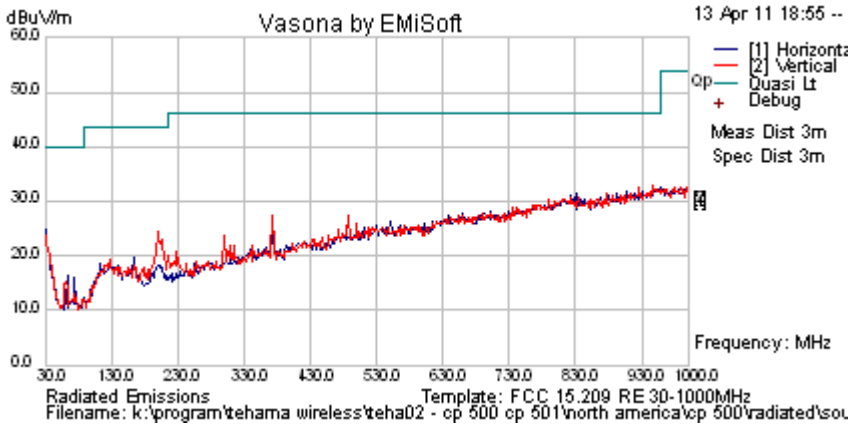
Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	NRB = Non-Restricted Band. RB = Restricted Band.

915 MHz notch filter removed fundamental

Test Freq.	914.9 MHz	**Engineer**	GMH
Variant		**Temp (°C)**	21.5
Freq. Range	902-928 MHz	**Rel. Hum.(%)**	34
Power Setting	4 (maximum)	**Press. (mBars)**	1011
Antenna	integral PCB	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			



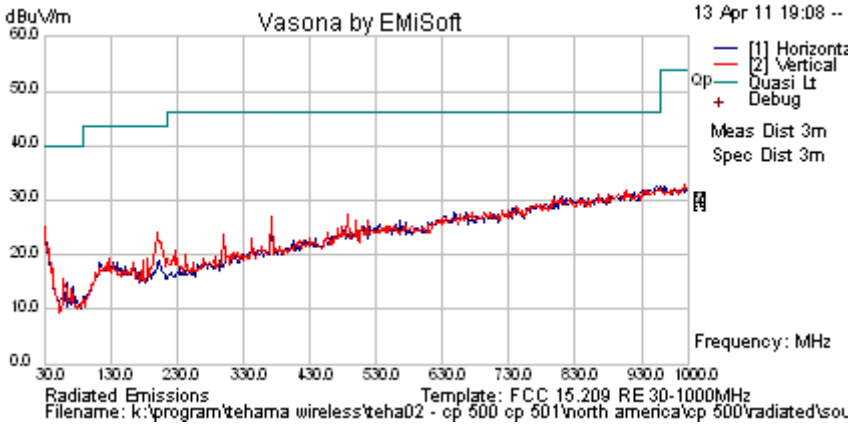
Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	NRB = Non-Restricted Band. RB = Restricted Band.

915 MHz notch filter removed fundamental

Test Freq.	926 MHz	**Engineer**	GMH
Variant		**Temp (ºC)**	21.5
Freq. Range	902-928 MHz	**Rel. Hum.(%)**	34
Power Setting	4 (Maximum)	**Press. (mBars)**	1011
Antenna		**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
0.000	0.0	0.0	0.0	0.0	Peak [Scan]		0	0	0.0	0.0	Pass	

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	NRB = Non-Restricted Band. RB = Restricted Band.

915 MHz notch filter removed fundamental

5.1.3. Radiated Spurious Emissions – Digital Emissions

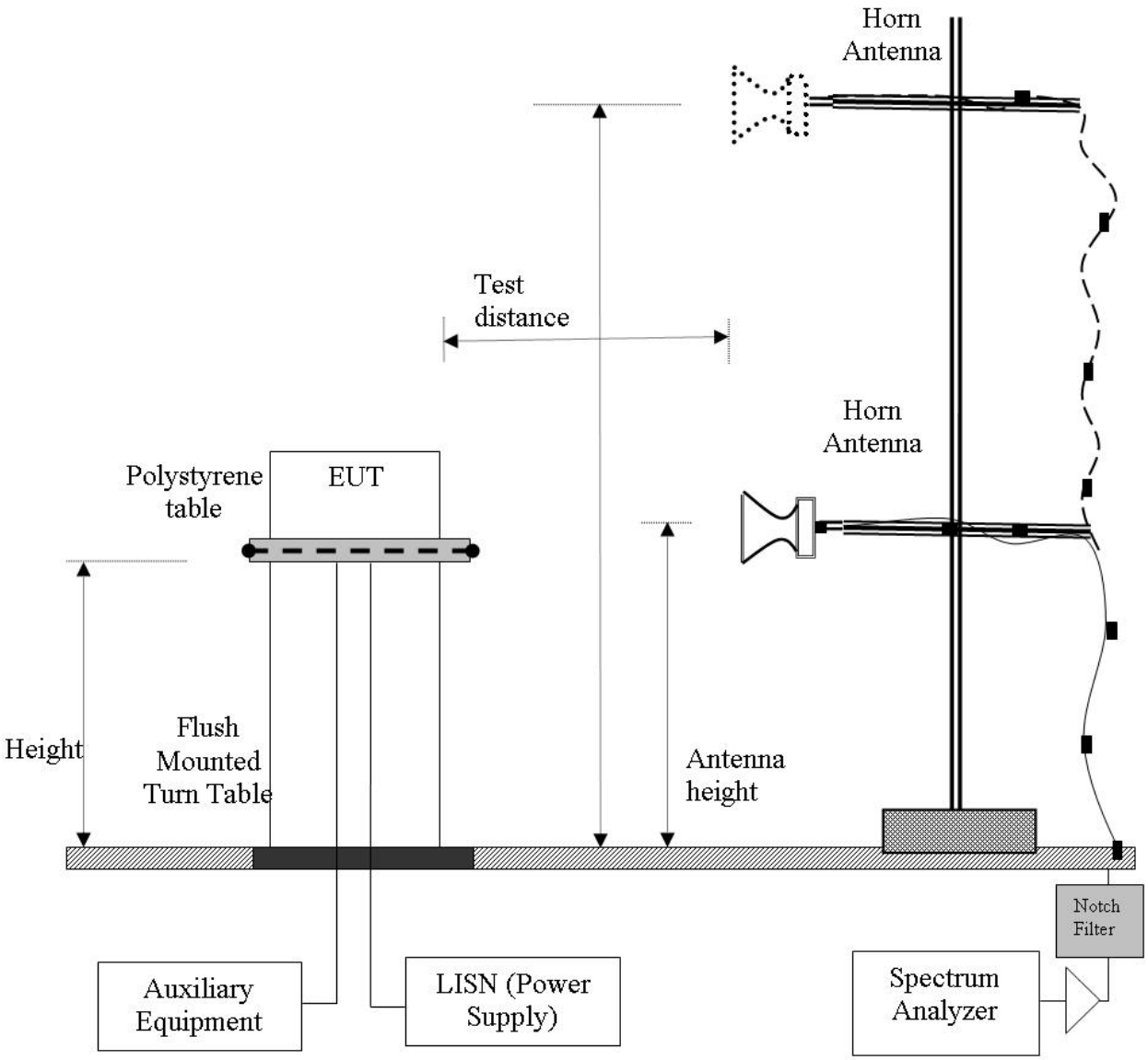
Industry Canada RSS-210 A2.3
RSS-Gen 4.10

Test Procedure

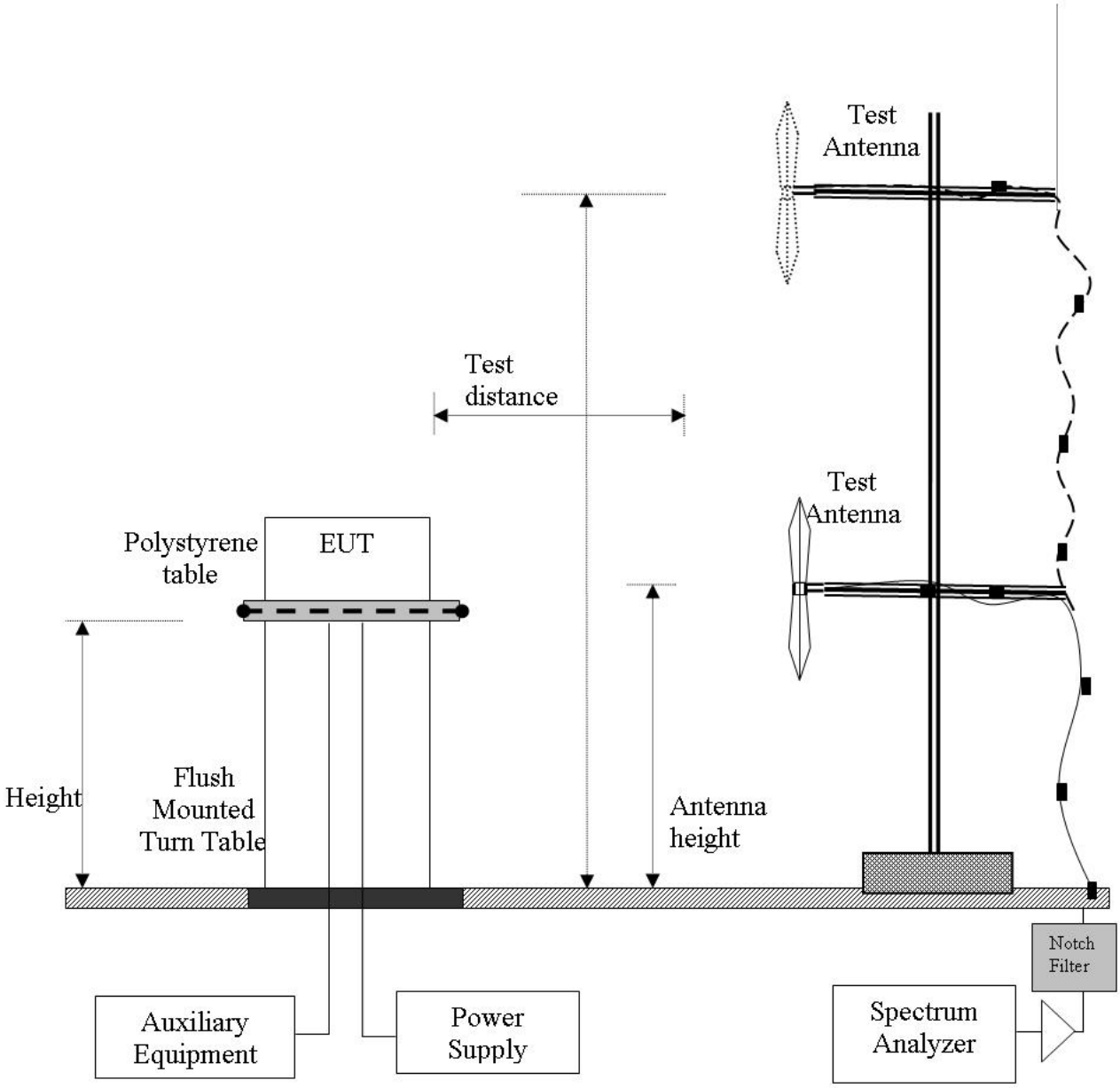
Testing was performed in a 3-meter anechoic chamber. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. Preliminary emissions were recorded with in Spectrum Analyzer mode, using a maximum peak detector while in peak hold mode.

Emissions nearest the limits were chosen for maximization and formal measurement using a CISPR Compliant receiver. Emissions above 1000 MHz are measured utilizing a CISPR compliant average detector with a tuned receiver, using a bandwidth of 1 MHz. Emissions from 30 MHz – 1000 MHz are measured utilizing a CISPR compliant quasi-peak detector with a tuned receiver, using a bandwidth of 120 kHz. Only the highest emissions relative to the limit are listed.

Test Measurement Set Up



Radiated Emission Measurement Setup – Above 1 GHz



Radiated Emission Measurement Setup – Below 1 GHz

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

FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor

CORR = Correction Factor = CL – AG + NFL

CL = Cable Loss
AG = Amplifier Gain
FO = Distance Falloff Factor
NFL = Notch Filter Loss or Waveguide Loss

Field Strength Calculation 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 and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3 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

Specification

Radiated Spurious Emissions

FCC §15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section §15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(a)).

FCC §15.205 (a) Except as shown in paragraph (d) of 15.205 (a), only spurious emissions are permitted in any of the frequency bands listed.

FCC §15.205 (a) Except as shown in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

FCC §15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.

Table 1: FCC 15.209 Spurious Emissions Limits

Frequency (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

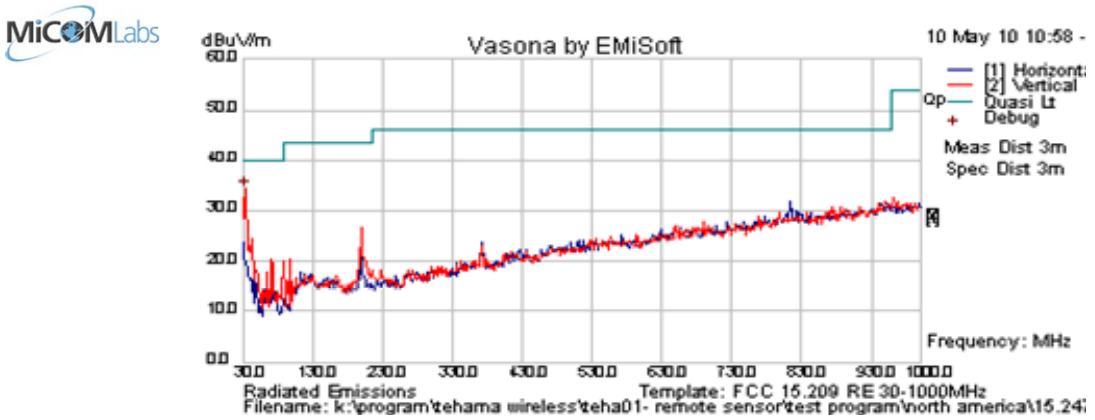
Laboratory Measurement Uncertainty for Spectrum Measurement

Measurement Uncertainty	+5.6/ -4.5 dB

Traceability:

Method	**Test Equipment Used**
Work instruction WI-03	0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312

Test Freq.	913.5 MHz	**Engineer**	CSB
Variant	FSK	**Temp (°C)**	21.5
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	37
Power Setting	Maximum	**Press. (mBars)**	1009
Antenna	Integral Whip	**Duty Cycle (%)**	100
Test Notes 1	EUT Vertical on Test Table		
Test Notes 2			



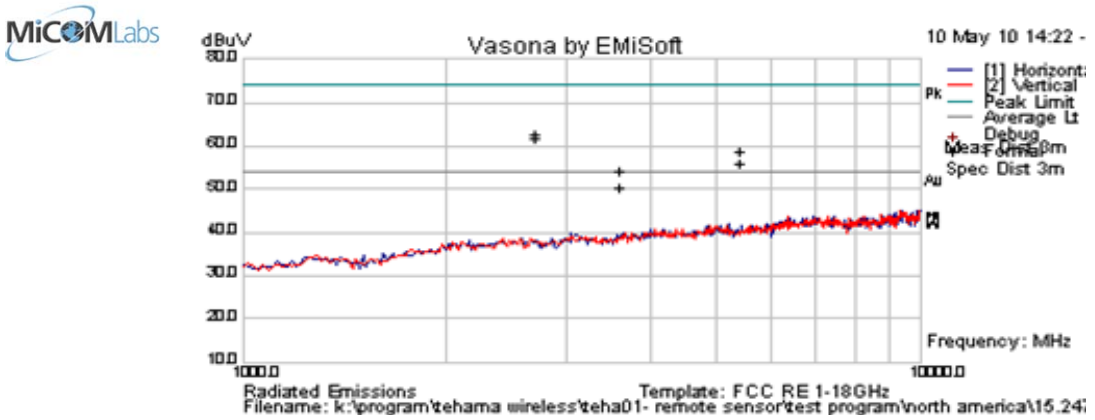
Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
No radio emissions within 6dB of limit												

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission

No receiver emissions within 6 dB of the limit

Test Freq.	2437 MHz	**Engineer**	CSB
Variant	FSK	**Temp (ºC)**	21.5
Freq. Range	1 - 10 GHz	**Rel. Hum.(%)**	37
Power Setting	Maximum	**Press. (mBars)**	1009
Antenna	Integral Whip	**Duty Cycle (%)**	100
Test Notes 1	EUT Vertical on Test Table		
Test Notes 2	0		



Formally measured emission peaks

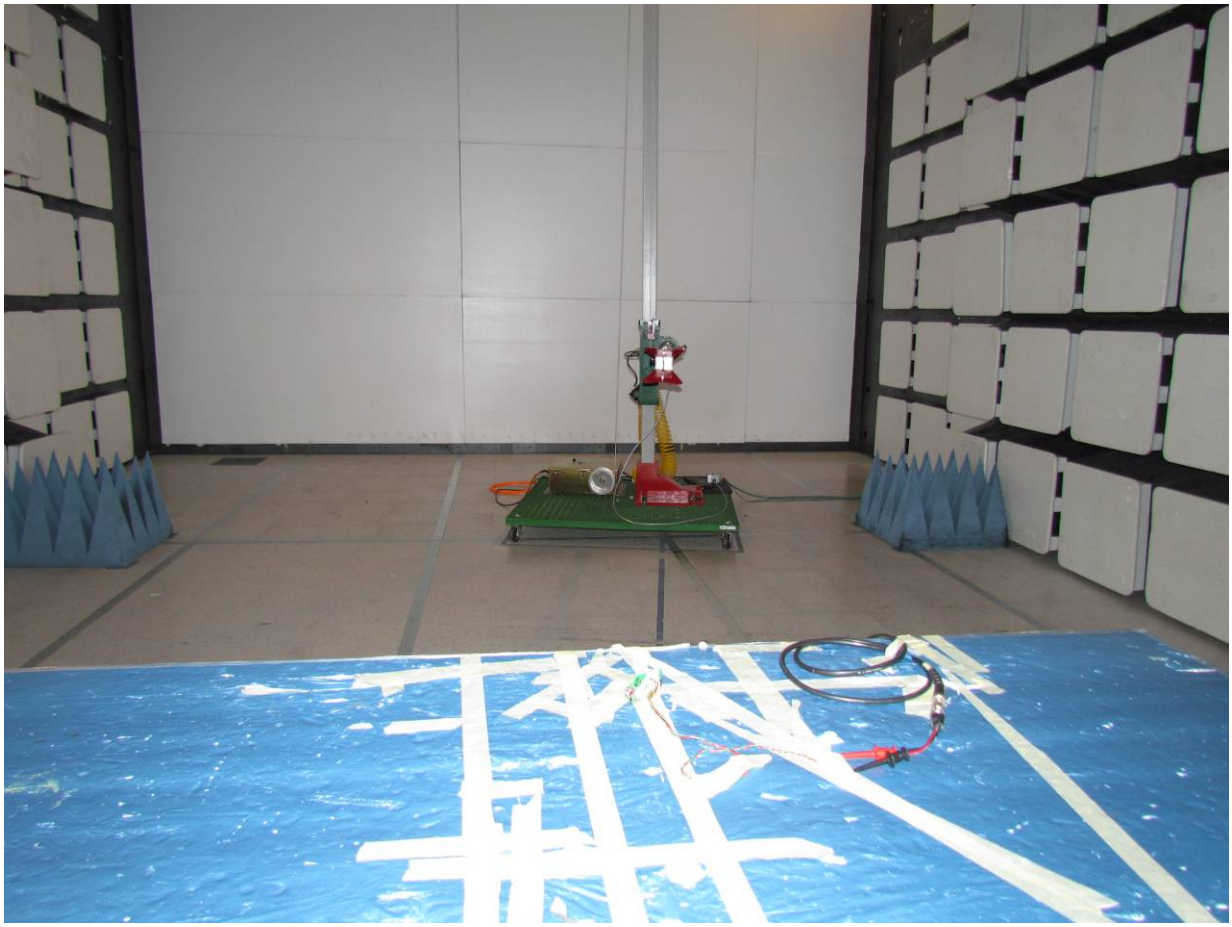
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
No radio emissions within 6dB of limit.												

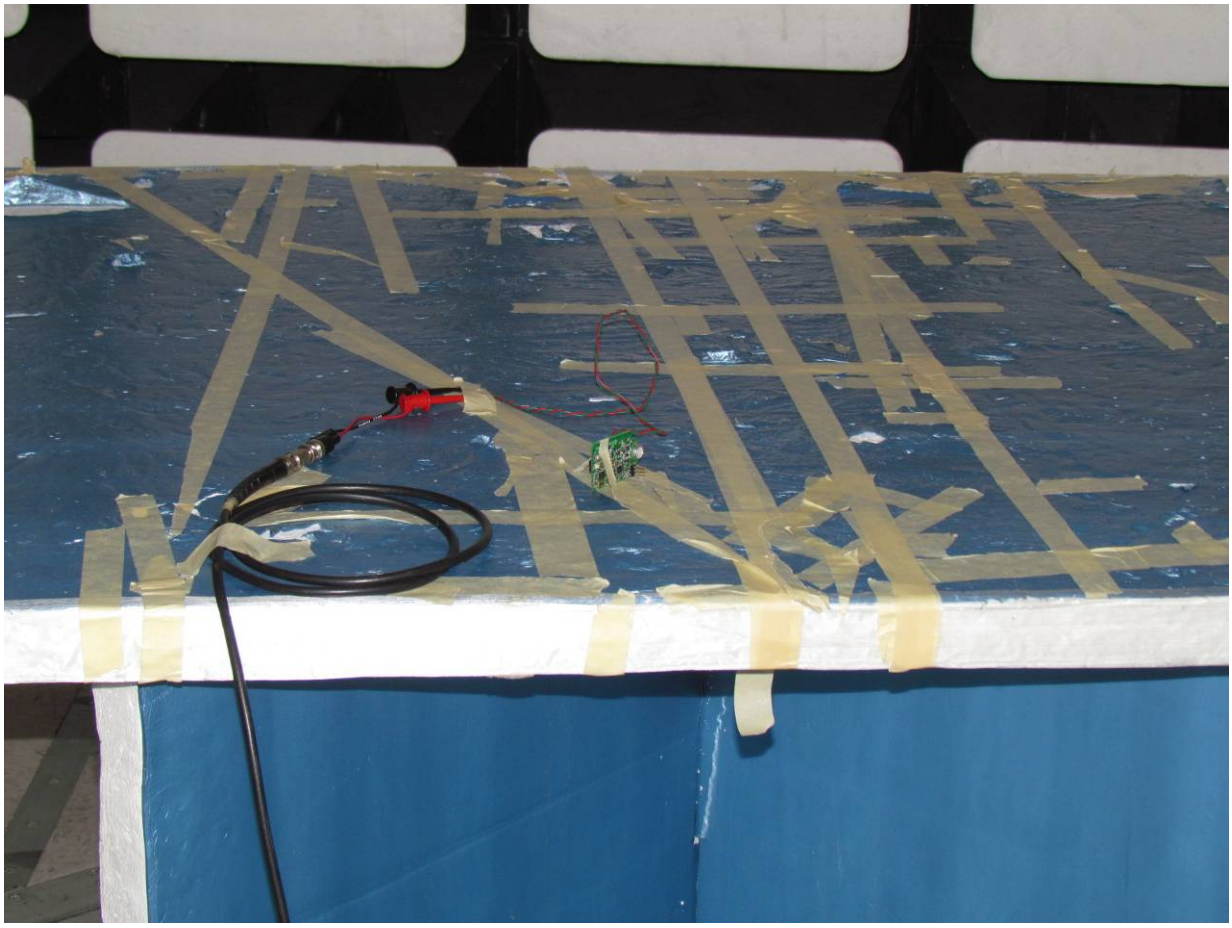
Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission

No receiver emissions within 6 dB of the limit

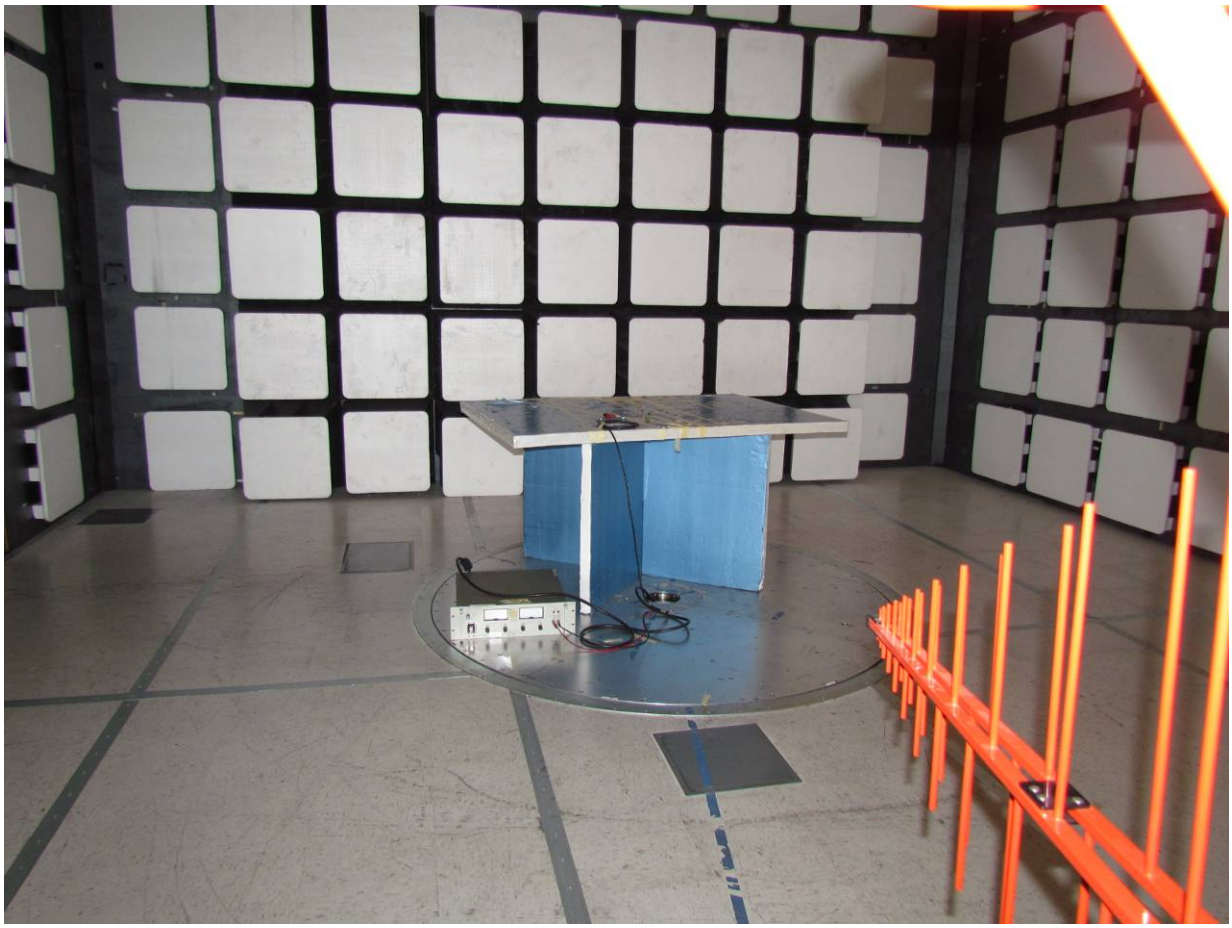
6. PHOTOGRAPHS

6.1. Radiated Emissions >1 GHz





6.2. Radiated Emissions <1 GHz



7. TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Part #	Serial #
0070	Power Meter	Hewlett Packard	437B	3125U11552
0116	Power Sensor	Hewlett Packard	8485A	3318A19694
0117	Power Sensor	Hewlett Packard	8487D	3318A00371
0158	Barometer /Thermometer	Control Co.	4196	E2844
0184	Pulse Limiter	Rhode & Schwarz	ESH3Z2	357.8810.52
0190	LISN	Rhode & Schwarz	ESH3Z5	836679/006
0223	Power Meter	Hewlett Packard	HP EPM-442A	US37480256
0251	K-Cable	Megaphase	Sucoflex 104	Unknown
0252	K-Cable	Megaphase	Sucoflex 104	Unknown
0253	K-Cable	Megaphase	Sucoflex 104	Unknown
0256	K-Cable	Megaphase	Sucoflex 104	Unknown
0271	Amplifier	1 to 26.5 GHz	MiCOM	--
0287	EMI Receiver	Rhode & Schwarz	ESIB 40	100201
0293	BNC Cable	Megaphase	1689 1GVT4	15F50B001
0307	BNC Cable	Megaphase	1689 1GVT4	15F50B002
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	3140A01285
0314	30 dB N-Type Attenuator	ARRA	N944-30	1623
0335	Horn Antenna	The Electro-Mechanics Company	3117	00066580
0337	Amplifier	30 MHz – 3 GHz	MiCOM	--
0338	Antenna (30M-3GHz)	Sunol Sciences	JB3	A052907
0341	902-928 MHz Notch Filter	EWT	EWT-14-0199	H1
0363	Switch	MiCOM Labs	--	--

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