Test of SpectraLink 602X Telephone

To: FCC 47 CFR Part15.247 & IC RSS-210

Test Report Serial No.: TUVR89-A7 Rev A

TEST REPORT

FROM

Test of SpectraLink 602X Telephone

To FCC 47 CFR Part15.247 & IC RSS-210

Test Report Serial No.: TUVR89-A7 Rev A

This report supersedes None

Manufacturer: SpectraLink Corporation
5755 Central Avenue
Boulder
Colorado 80301, USA

Product Function: 900 MHz Wireless Telephone

Copy No: pdf **Issue Date:** 6th March 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

CERTIFICATE #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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TABLE OF CONTENTS

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	6th March 2006	First issue.

1. TEST RESULT CERTIFICATE

Manufacturer:	SpectraLink Corporation 5755 Central Avenue Boulder Colorado 80301, USA	Tested By:	MiCOM Labs, Inc. 3922 Valley Avenue 'B' Pleasanton California, 94566, USA
EUT:	Product Description	Telephone:	+1 925 462 0304
Model:	602X	Fax:	+1 925 462 0306
S/N:	33F		
Test Date(s):	9th to 26th Jan 2006	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC 47 CFR Part15.247 & 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.

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 15.247	Sept 2005	Code of Federal Regulations
(ii)	Industry Canada RSS-210	Issue 6 Sept. 2005	Low Power License-Exempt Radiocommunication Devices (All Frequency Bands)
(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	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 SpectraLink 602X Telephone to FCC Part 15.247 and Industry Canada RSS-210 regulations
Applicant:	As Manufacturer
Manufacturer:	SpectraLink Corporation 5755 Central Avenue Boulder Colorado 80301, USA
Laboratory performing the tests:	MiCOM Labs, Inc. 3922 Valley Avenue, Suite "B" Pleasanton, California 94566 USA
Test report reference number:	TUVR89-A7 Rev A
Date EUT received:	6TH December 2005
Standard(s) applied:	FCC 47 CFR Part15.247 & IC RSS-210
Dates of test (from - to):	9th to 26th Jan 2006
No of Units Tested:	One handset in combination with five different headsets.
Type of Equipment:	Wireless Telephone
Manufacturers Trade Name:	Link Wireless Telephone
Model:	602X
Location for use:	Indoor
Declared Frequency Range(s):	902 - 928 MHz
Type of Modulation:	GFSK
Declared Nominal Output Power:	+20 dBm
EUT Modes of Operation:	FHSS
Transmit/Receive Operation:	Duplex
Rated Input Voltage and Current:	Battery Operated
Operating Temperature Range:	-10 to +50ºC
ITU Emission Designator:	373KF2E
Microprocessor(s) Model:	TMS320VC5507 DSP
Clock/Oscillator(s):	23.04 MHz, 32.768 KHz
Frequency Stability:	±15 ppm
Primary function of equipment:	Wireless Telephone Handset

3.2. Scope of Test Program

The scope of the test program was to test the SpectraLink 602X wireless telephone handset in the frequency ranges 902 - 928 MHz in combinations with five different headsets, and two different phone stand/charger units for compliance against FCC 47 CFR Part 15.247 and Industry Canada RSS-210 specifications.

The SpectraLink 602X telephone is a Frequency Hoping Spread Spectrum (FHSS) device employing GFSK modulation.

SpectraLink Corporation
602X Wireless Telephone Handset

Photos of the headsets that were tested in combination with the 602X phone.

PTH100 Headset

H251/N Headset

PTH200 Headset

H251N/A Headset

H81N/A Headset

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

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	Wireless phone	SpectraLink	602X	33F
EUT	Phone stand and single battery charger	SpectraLink	PCS1850	None
EUT	Phone stand and dual battery charger	SpectraLink	PCD1850	None
EUT	Headset	Plantronics	PTH100	None
EUT	Headset	Plantronics	PTH200	None
EUT	Headset	Plantronics	H251/N	None
EUT	Headset	Plantronics	H251N/A	None
EUT	Headset	Plantronics	H81N/A	None

3.4. Antenna Details

1. 0 dBi integral antenna

3.5. Cabling and I/O Ports

Number and type of I/O ports

1. 2.4mm socket for headset or earpiece
2.

3.6. Test Configurations

Matrix of test configurations

Telephone Model #	Headsets					Desktop Phone stand & Battery Charger	
	PTH 100	PTH200	H251/N	H251N/A	H81N/A	Single	Dual
602X Serial no 33F	√	√	√	√	√	√	√

Telephone test configurations

Operating Channel	Frequencies (MHz)
1	902.4817
27	915.2272
52	927.4826

Only worst case plots are provided for each test parameter are 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

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

Radiated emission testing 30 MHz-1 GHz (Section 5.1.6) and AC Wireline Conducted Emissions 150 kHz – 30 MHz (Section 5.1.7) were subcontracted to the following test facility;

Sanmina-SCI
Homologation Services
EMI Test Laboratory
2305 Mission College Blvd.
Santa Clara, California 95054
USA

Sanmina-SCI, NVLAP (National Voluntary Laboratory Accreditation Program) Lab Code 100411-0 are ISO/IEC 17025 accredited for emission testing 30 MHz-1 GHz.

Sanmina SCI: FCC Registration Number: 90844

IC Registration Number: IC5541

4. TEST SUMMARY

List of Measurements

The following table represents the list of measurements required under the **FCC CFR47 Part 15.247** and **Industry Canada RSS-210**.

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(a)(1)(i) §**6.2.2(o)(a2)**	20 dB BW	20 dB BW	Conducted	Complies	5.1.1
15.247(a)(1) §**6.2.2 (o)(a)(a1)**	Transmitter Channels	Channel Spacing	Conducted	Complies	5.1.2
15.247(a)(1)(i) §**6.2.2 (o)(a)(a2)**	Transmitter Channels	Number of Channels	Conducted	Complies	5.1.3.1
		Channel Occupancy	Conducted	Complies	5.1.3.2
		Channel Dwell Time	Conducted	Complies	5.1.3.3
15.247(b)(2) §**6.2.2 (o)(a)**	Transmit Power	Transmit Power	Conducted	Complies	5.1.4
15.247(d) §**6.2.2 (o)(e1)**	Conducted Emissions	Band Edge	Conducted	Complies	5.1.5
		Spurious Emissions (1 to 10 GHz)	Conducted	Complies	

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(a1)(i) §**6.2.2 (o)(e1)**	Radiated Emissions above 1 GHz	Transmitter	Radiated	Complies	*5.1.6.1*
		Receiver	Radiated	Complies	*5.1.6.2*
§15.247(c)/ §15.209 §**6.2.2(o)(a)**	Radiated Emissions below 1 GHz		Radiated	Complies	*5.1.7*
15.207 **§6.6, §7.4**	Conducted	AC Wireline Conducted Emissions	Conducted	Complies	*5.1.8*

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

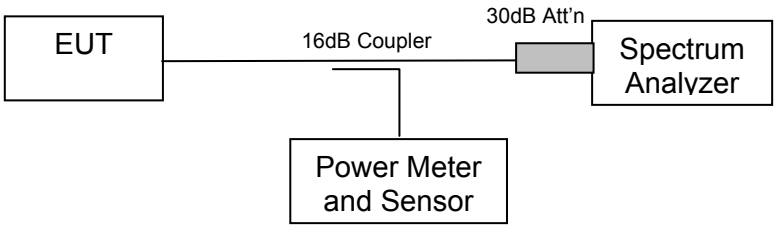
5.1.1. 20 dB Bandwidth

FCC, Part 15 Subpart C §15.247(a)(1)(i)
Industry Canada RSS-210 §5.9.1

Test Procedure
The 20 dB bandwidth is measured with a spectrum analyzer connected to the antenna terminal, while the EUT is operating in transmission mode at the appropriate center frequency and modulation. Using a minimum 10 kHz resolution bandwidth filter setting the spectrum analyzer was set to the following;-

RBW=50 MHz, VBW=50 kHz, Span=2 MHz, Sweep = 5 mS

Test Measurement Set up



Measurement set up for 20 dB bandwidth test

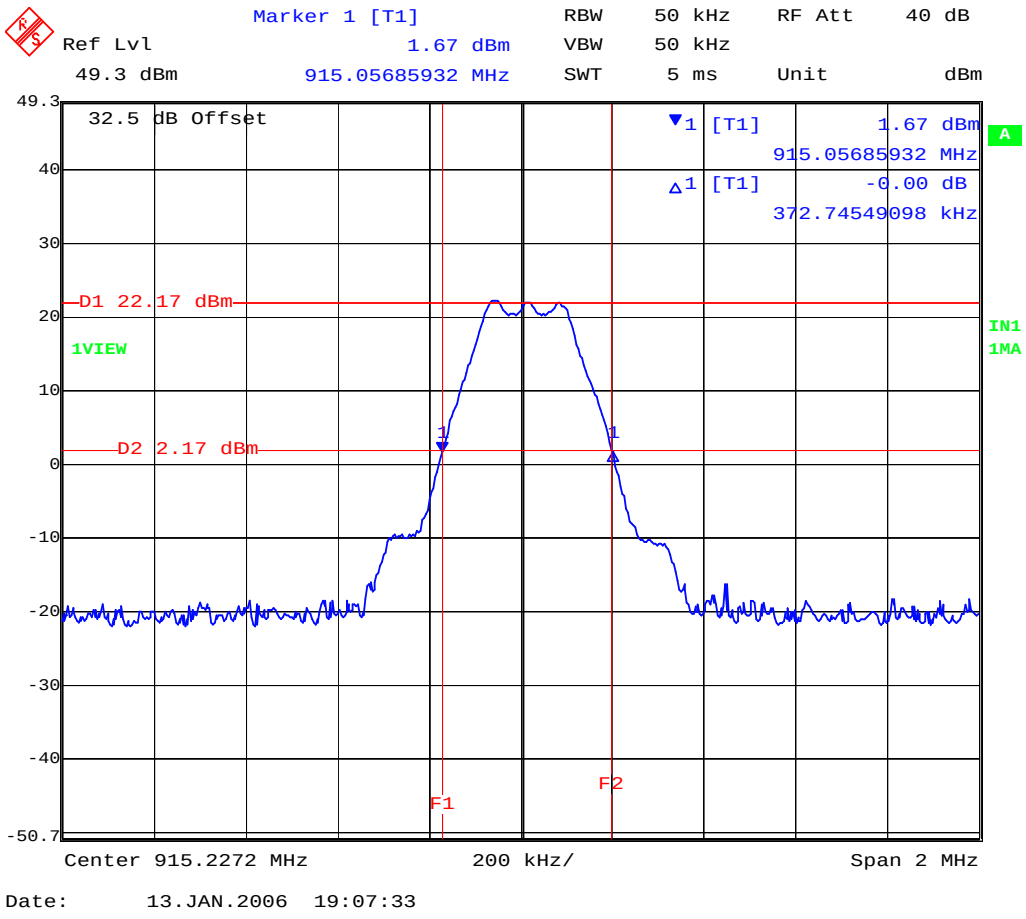
Test Results for 20 dB Bandwidth

Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

TABLE OF RESULTS –

Channel #	Center Frequency (MHz)	20 dB Bandwidth (kHz)	Specification (kHz)	20 dB Plot #
1	902.4817	372.74549098	<500	On File
27	915.2272	372.74549098	<500	01
52	927.4826	372.74549098	<500	On File

Plot 01
CH 27 915.2272 MHz 20 dB Bandwidth



Specification

Limits

§15.247 (a)(1)(i)
Industry Canada RSS-210 §6.2.2(o)(a2)

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Laboratory Measurement Uncertainty for Spectrum Measurement

Measurement uncertainty	±2.81 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of RF Spectrum Mask'	0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117

5.1.2. Transmitter Channels - Channel Spacing

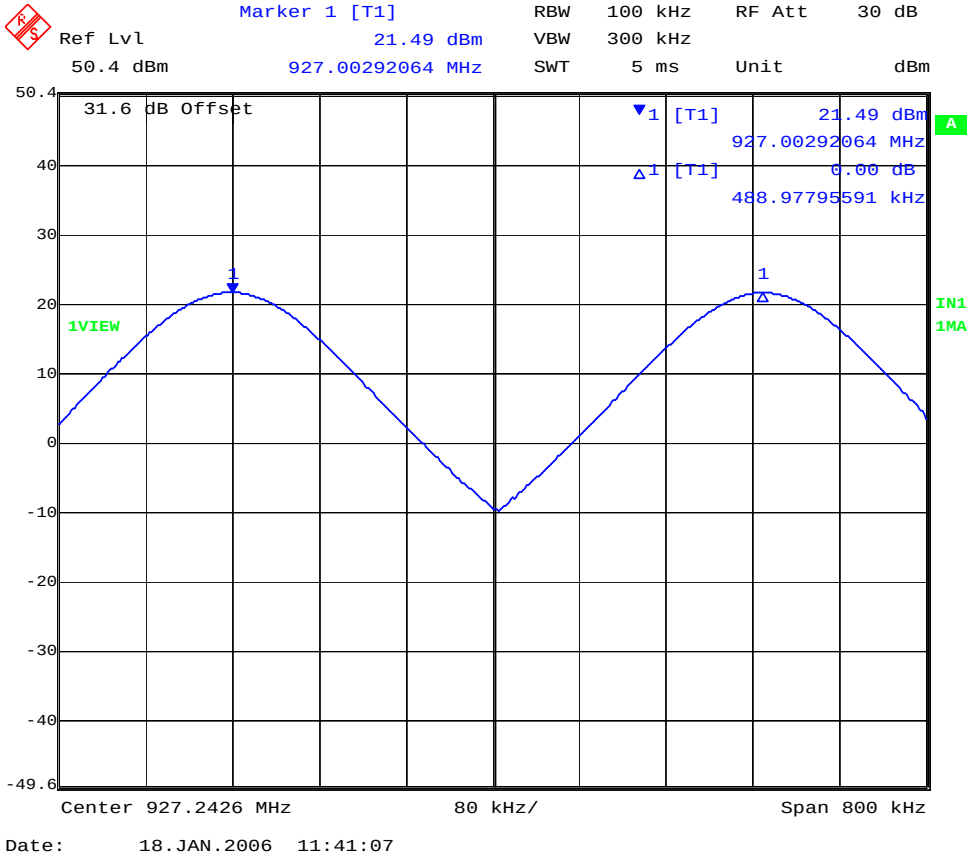
FCC, Part 15 Subpart C §15.247(a)(1)
Industry Canada RSS-210 §6.2.2(o)(a2)

Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

TABLE OF RESULTS –

Channel #	Channel Spacing (MHz)	Specification	Plot #
1-2	493.78757515	20 dB Bandwidth	On File
27-28	491.21650779	20 dB Bandwidth	On File
51-52	488.97795591	20 dB Bandwidth	02

Plot 02
Channel Spacing for CH 51 – CH 52



Channel Spacing (continued)

Specification for Channel Spacing

Limits

§15.247 (a)(1)
Industry Canada RSS-210 §6.2.2(o)(a)(a1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Laboratory Uncertainty for Frequency Measurements

Measurement uncertainty	±0.86ppm

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-02 'Frequency Measurement"	0078, 0134, 0156, 0184, 0193, 0250,0252 0310, 0312.

5.1.3. Transmitter Channels

5.1.3.1. Number of Channels

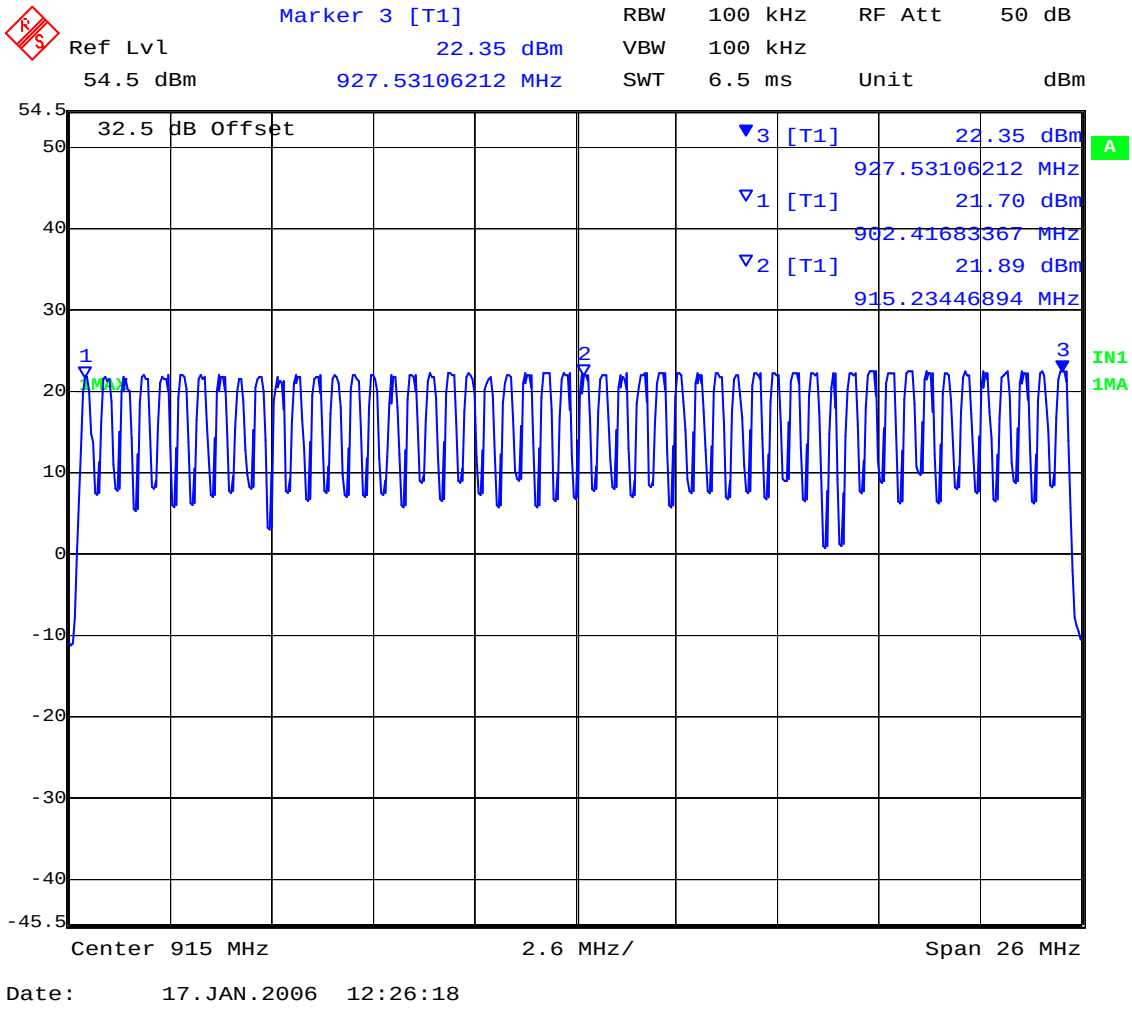
FCC, Part 15 Subpart C §15.247(a)(1)(i)
Industry Canada RSS-210 §6.2.2(o)(a2)

Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

TABLE OF RESULTS –

Number of Channels	Specification	Plot #
52	>= 25 Channels for a 20 dB Bandwidth > 250 kHz	03

Plot 03
Number of Channels



5.1.3.2. Channel Occupancy

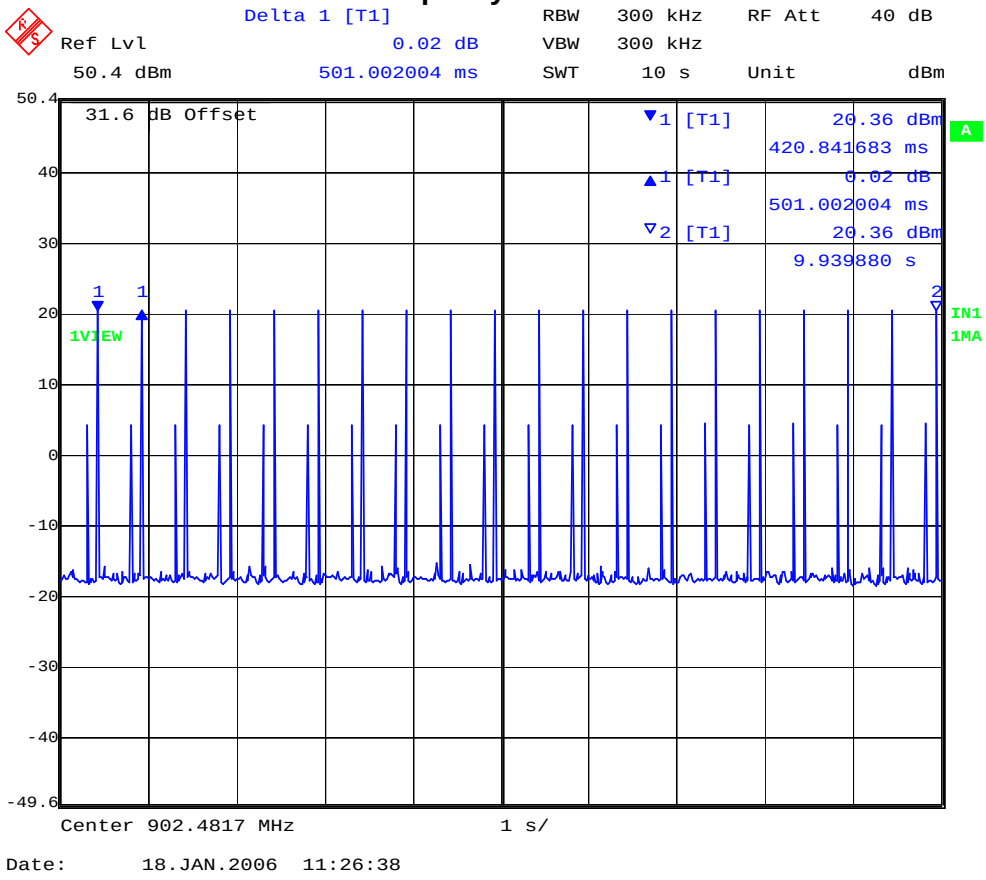
FCC, Part 15 Subpart C §15.247(a)(1)(i)
Industry Canada RSS-210 §6.2.2(o)(a2)

Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

TABLE OF RESULTS –

Channel #	Center Frequency (MHz)	Channel Occupancy (mSeconds)	Plot #
1	902.4817	20.5	04
27	915.2272	20.5	On File
52	927.4826	20.5	On File

Plot 04
Channel Occupancy Ch 1 902.4817 MHz

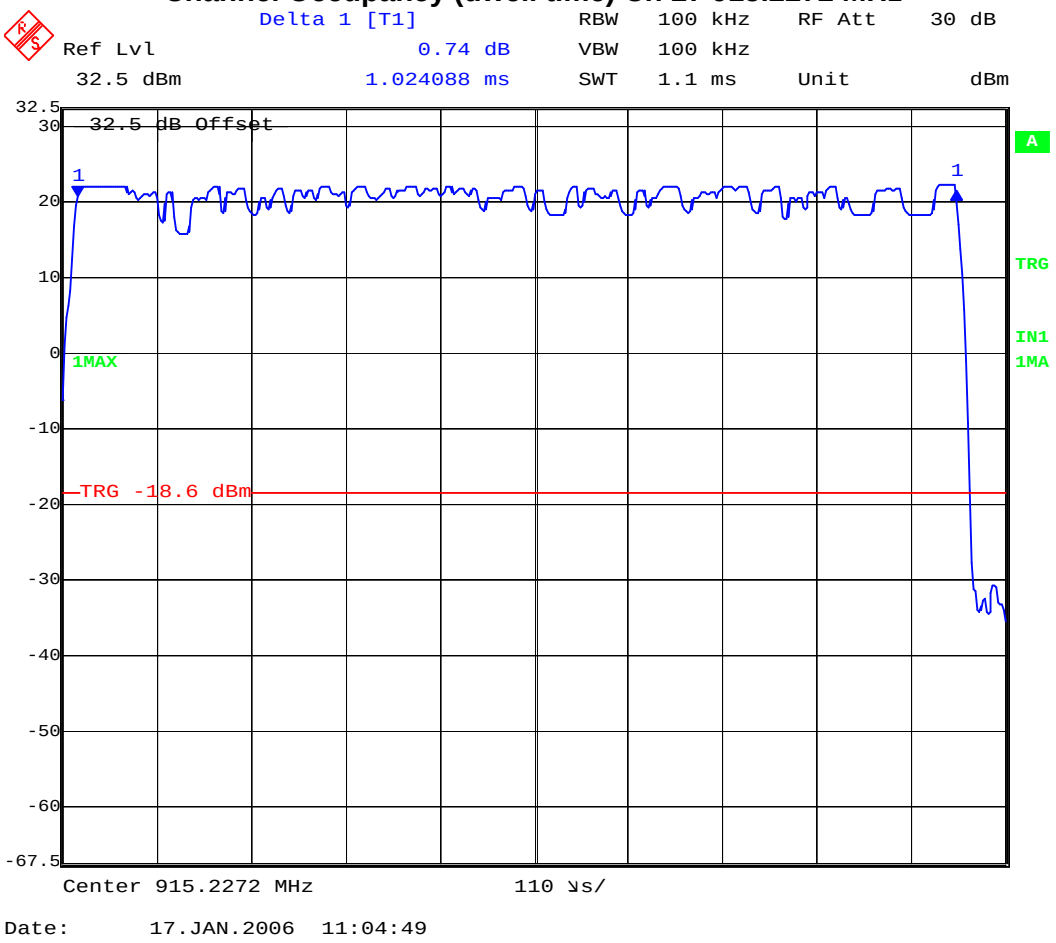


5.1.3.3. Channel Occupancy (dwell time)

TABLE OF RESULTS –

Channel #	Center Frequency (MHz)	Channel Occupancy (mSeconds)	Plot #
1	902.4817	1.017635	On File
27	915.2272	1.024088	05
52	927.4826	1.019840	On File

Plot 05
Channel Occupancy (dwell time) Ch 27 915.2272 MHz



Specification for Number of Channels, Channel Occupancy, and Dwell Time

Limits

§15.247 (a)(1)(i)
Industry Canada RSS-210 §6.2.2(o)(a)(a2)

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Laboratory Uncertainty for Frequency Measurements

Measurement uncertainty	±0.86ppm

Traceability

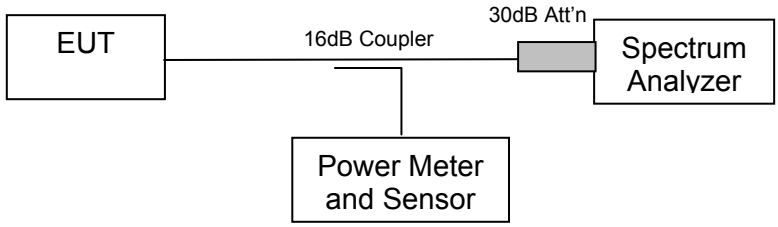
Method	Test Equipment Used
Measurements were made per work instruction WI-02 'Frequency Measurement"	0078, 0134, 0156, 0184, 0193, 0250, 0252 0310, 0312.

5.1.4. Output Power

FCC, Part 15 Subpart C §15.247(b)(2)
Industry Canada RSS-210 §6.2.2(o)(a)

Test Procedure
The transmitter terminal of EUT was connected to the input of the spectrum analyzer set to measure power. The resolution filter bandwidth was set to 6 dB, peak detector selected and the analyzer built-in power function was used to measure power over the 99 % bandwidth.

Test Measurement Set up



Measurement set up for Transmitter Output Power

Measurement Results for Output Power

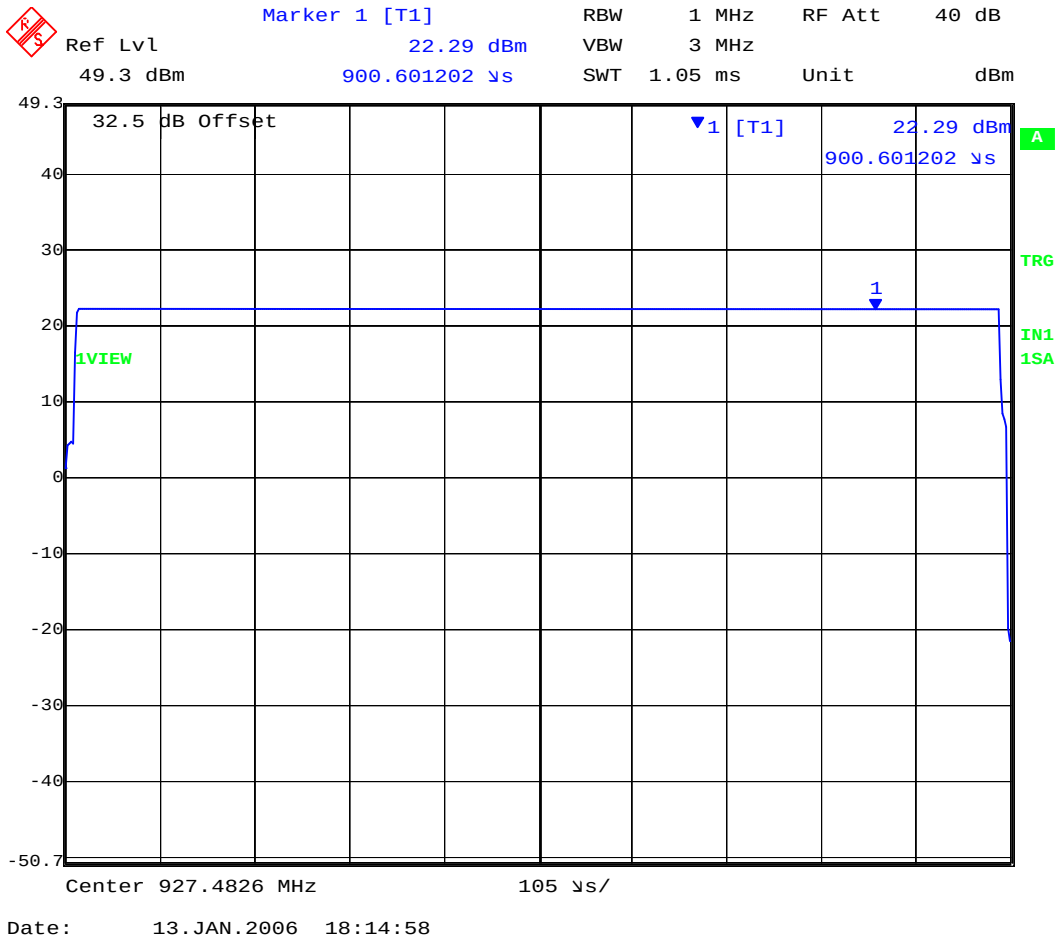
Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

TABLE OF RESULTS –

Channel #	Center Frequency (MHz)	Power (dBm)	Plot #
1	902.4817	21.40	On File
27	915.2272	22.19	On File
52	927.4826	22.29	06

Plot 06

CH 52 927.4826 MHz Power (dBm)



Specification

Limits

§15.247 (b)(2) The maximum output power of the intentional radiator shall not exceed the following:
(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

§6.2.2(o)(a) The output power is not to exceed 1.0 watt and the EIRP not to exceed 6 dBW if the hopset uses 50 or more frequencies.

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB

Traceability

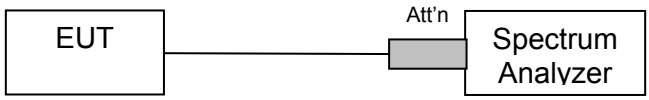
Method	Test Equipment Used
Measurements were made per work instruction WI-01 'Measuring RF Output Power'	0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117

5.1.5. Conducted Spurious Emissions

FCC, Part 15 Subpart C §15.247(d)
Industry Canada RSS-210 §5.9.1, §6.2.2 (o)(e1)

Test Procedure
Conducted emissions were measured at a limit of 20 dB below the highest in-band spectral density measured with a spectrum analyzer connected to the antenna terminal. Emissions at the band edge were measured and recorded. Measurements were made while EUT was operating in transmit mode of operation at the appropriate center frequency.

Test Measurement Set up



Band-edge measurement test configuration

Measurement Results of Conducted Spurious Emissions

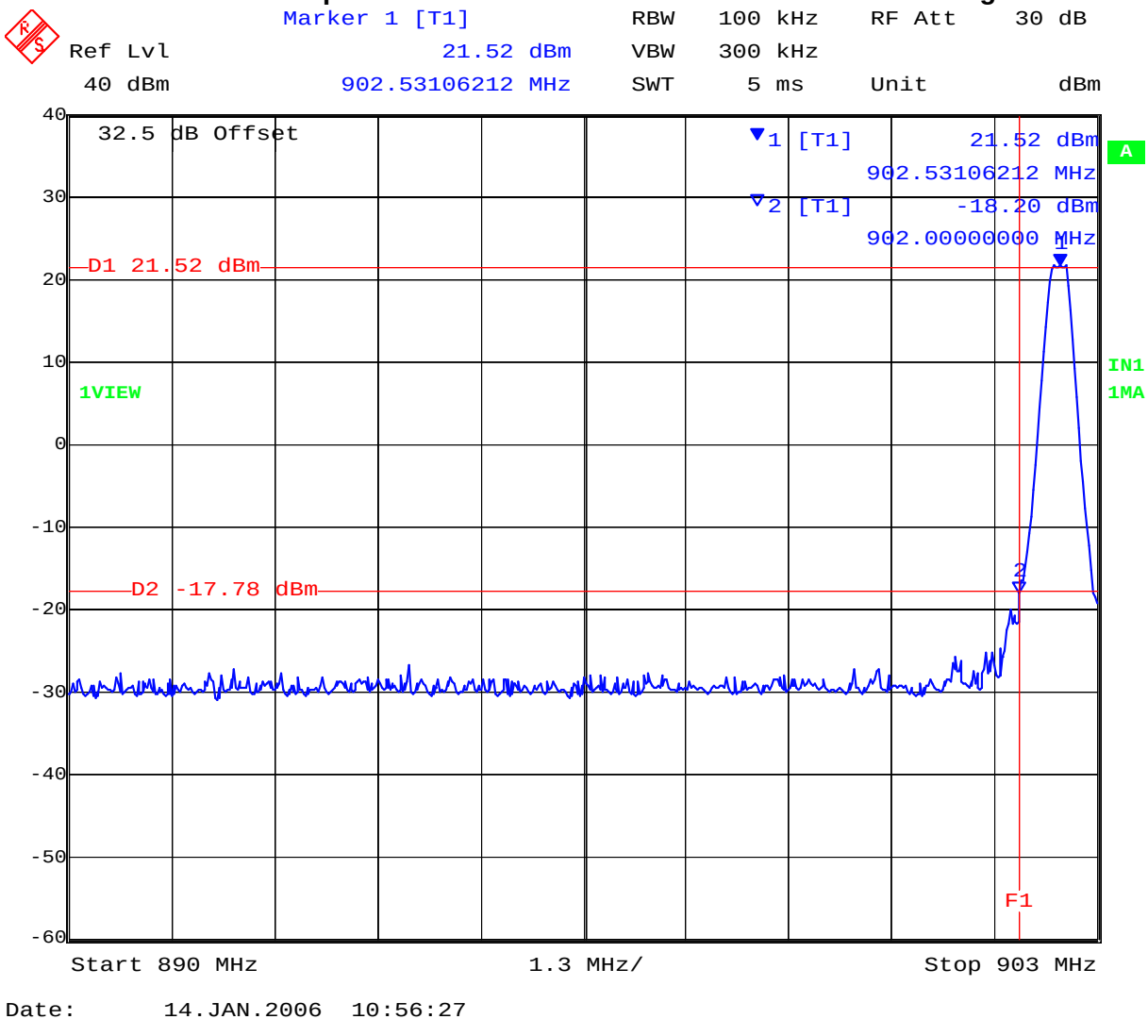
Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

Conducted Band-Edge Results

TABLE OF RESULTS – **802.11b**

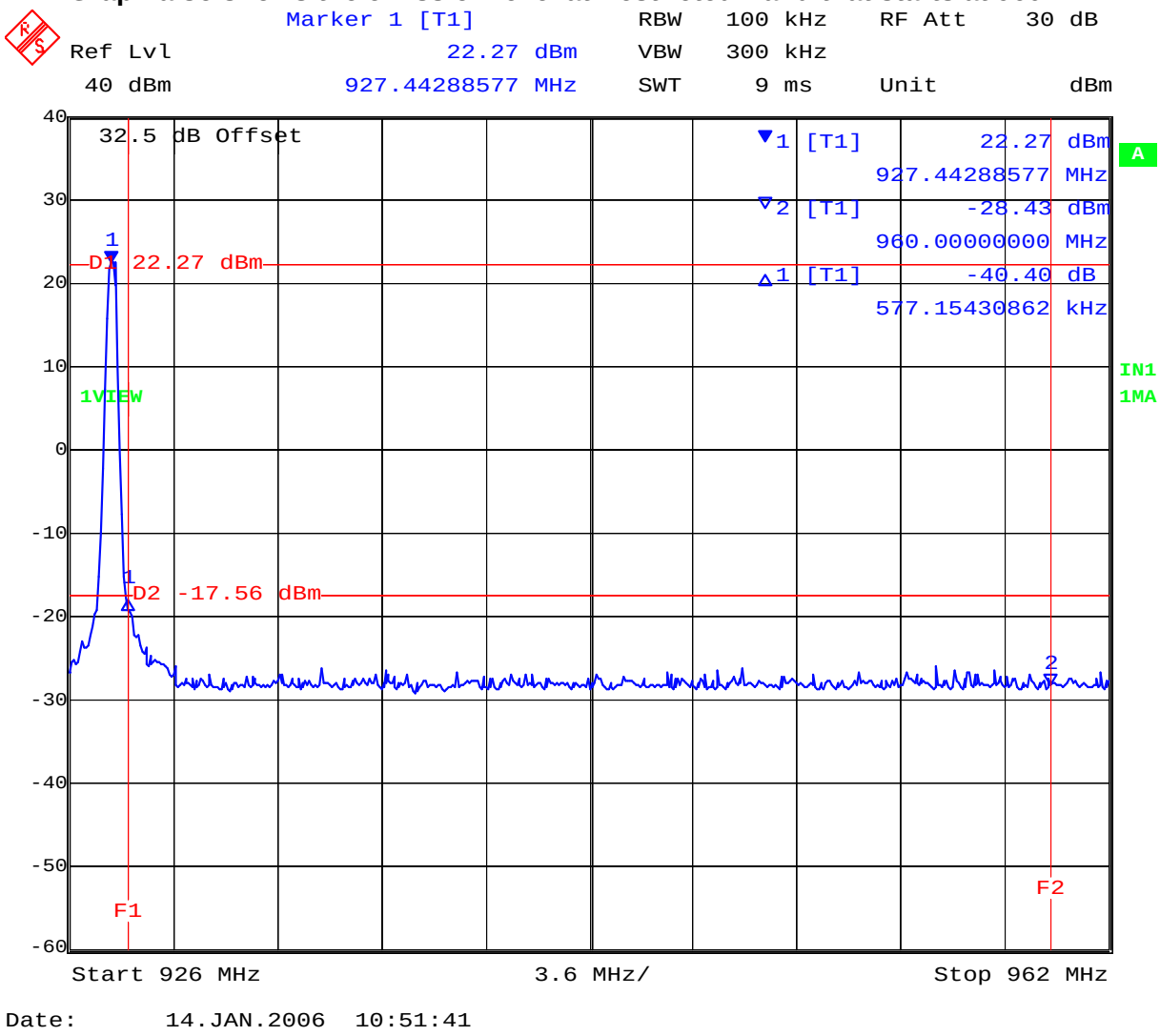
Channel #	Center Frequency (MHz)	Band edge Frequency (MHz)	Limit (dBm)	Amplitude @ Band edge (dBm)	Plot #	Margin (dB)
1	902.4817	902.0	+1.52	-17.70	07	-19.22
52	927.4826	928.0	+1.52	-17.56	08	-19.08

Plot 07
Conducted Spurious Emissions at the 902 MHz Lower Band Edge



Plot 08
Conducted Spurious Emissions at the 928 MHz Upper Band Edge

Graph also shows the emission level at Restricted Band that starts at 960 MHz



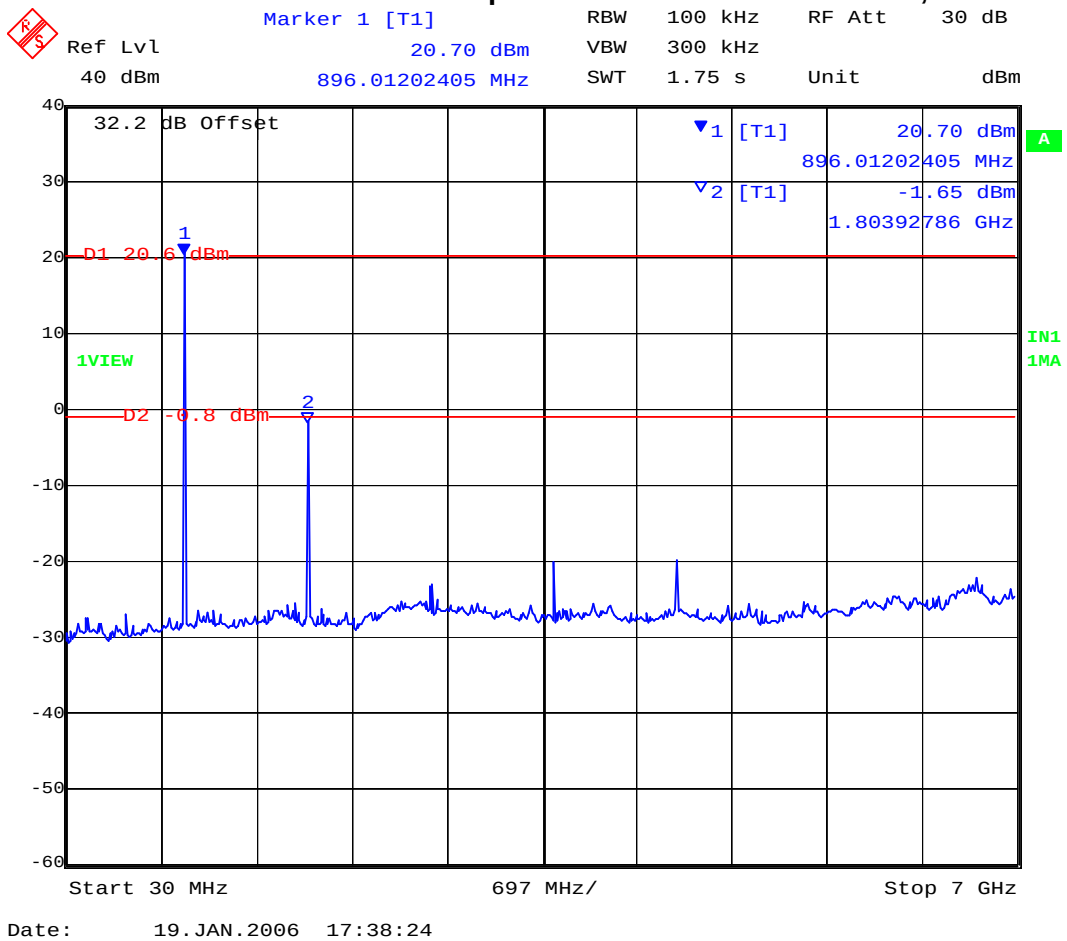
Spurious Emissions (1-10 GHz)

Conducted spurious emissions (1-10 GHz) are provided indicated by the following matrix. Measurements were performed with the transmitter tuned to the channel closest to the band-edge being measured. All emissions were maximized during measurement. Limits which were derived from the band-edge measurements provided below are drawn on each plot.

TABLE OF RESULTS –

CH #	Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Plot #	Margin (dB)
1	902.4817	30	7,000	-1.65	-0.8	09	-0.85
1	902.4817	7,000	10,000	-36.66	-0.8	10	-35.86

Plot 09
Ch 1 902.4817 MHz Conducted Spurious Emissions 30 MHz to 7,000 MHz



Plot 10
902.4817 MHz Conducted Spurious Emissions 7,000 MHz to 10,000 MHz

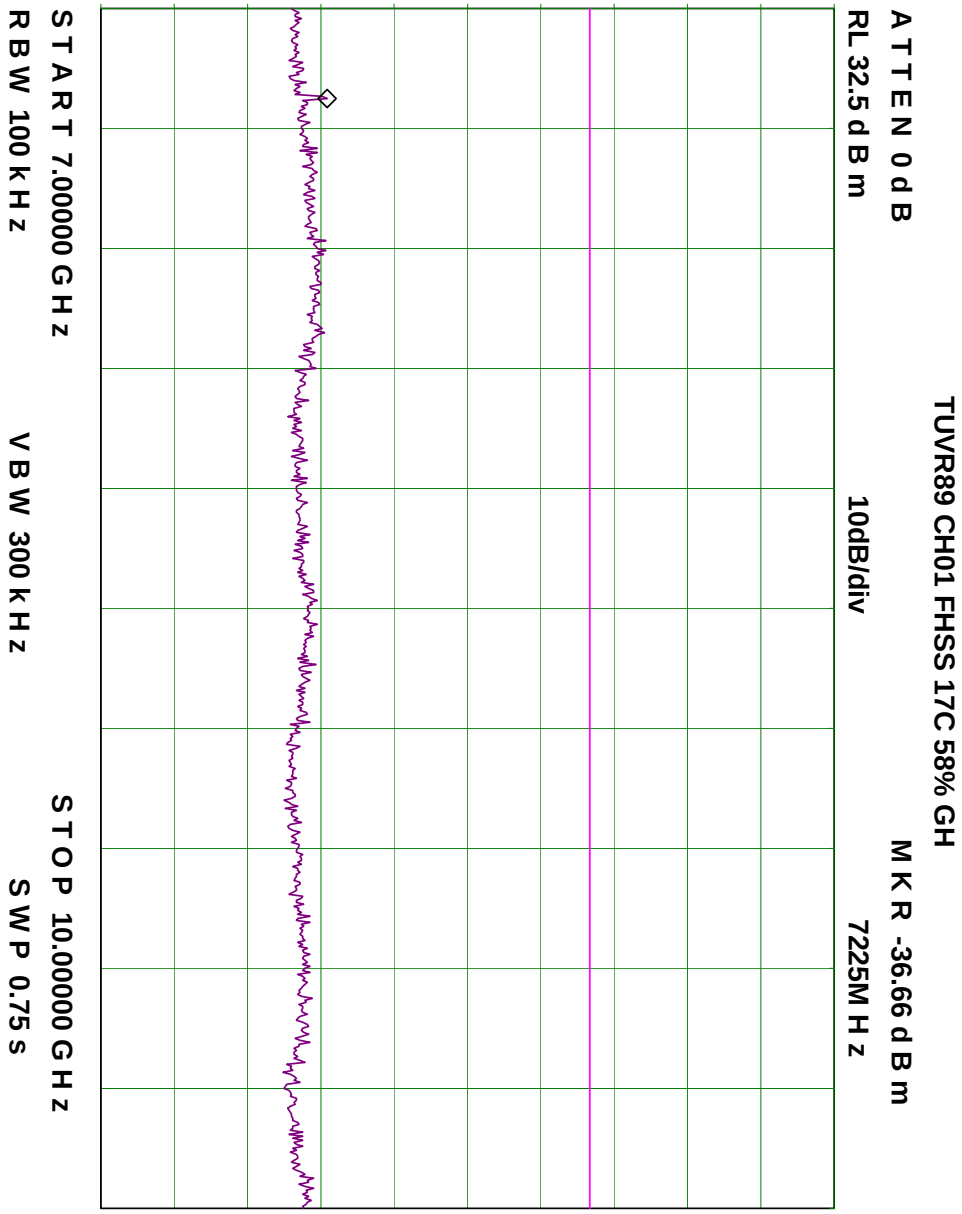
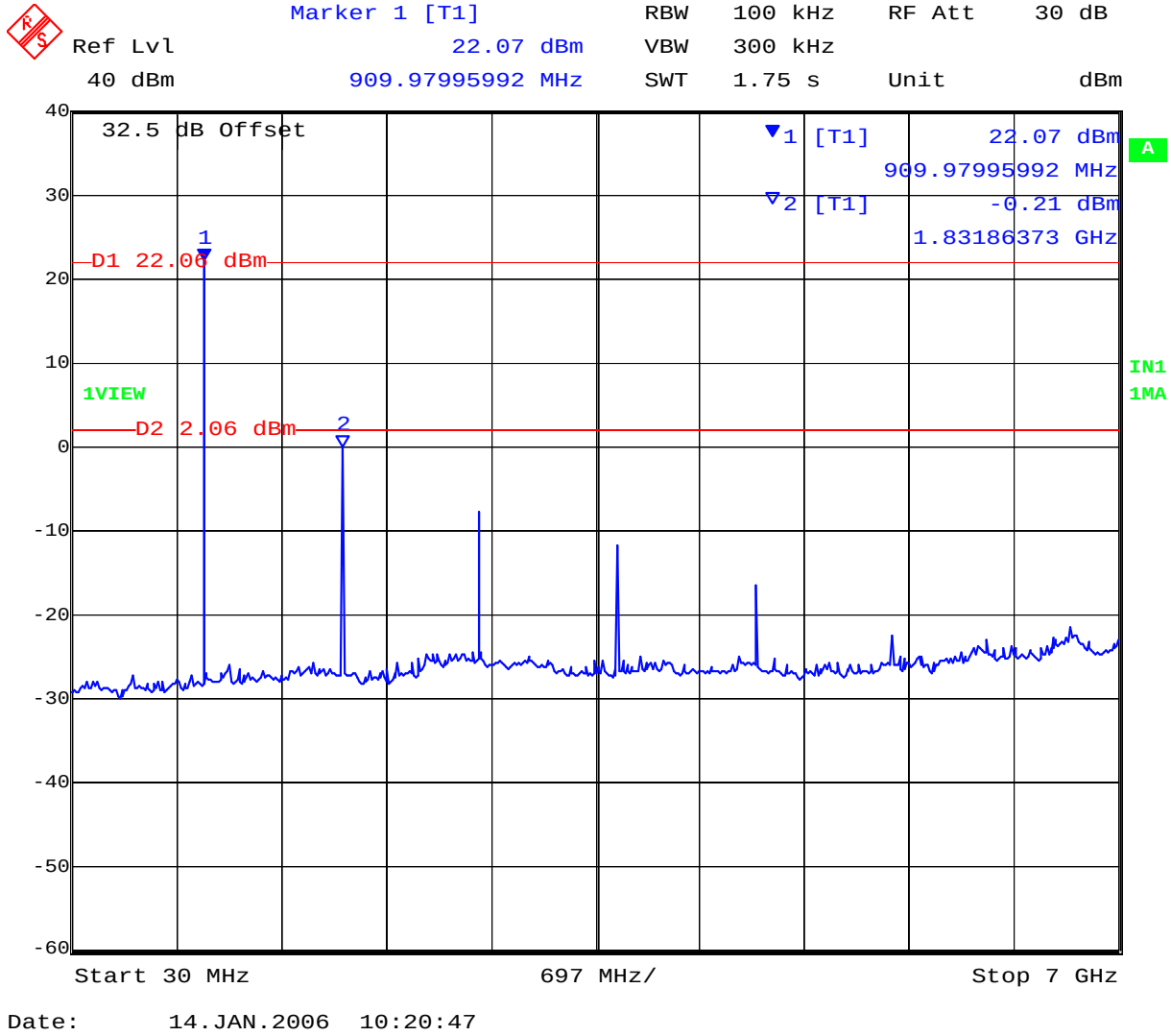


TABLE OF RESULTS –

CH #	Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Plot #	Margin (dB)
27	915.2272	30	7,000	-0.21	+2.06	11	-2.27
27	915.2272	7,000	10,000	-37.00	+2.06	12	-39.06

Plot 11
Ch 27 Conducted Spurious Emissions 30 MHz to 7,000 MHz



Plot 12
Ch 27 Conducted Spurious Emissions 7,000 MHz to 10,000 MHz

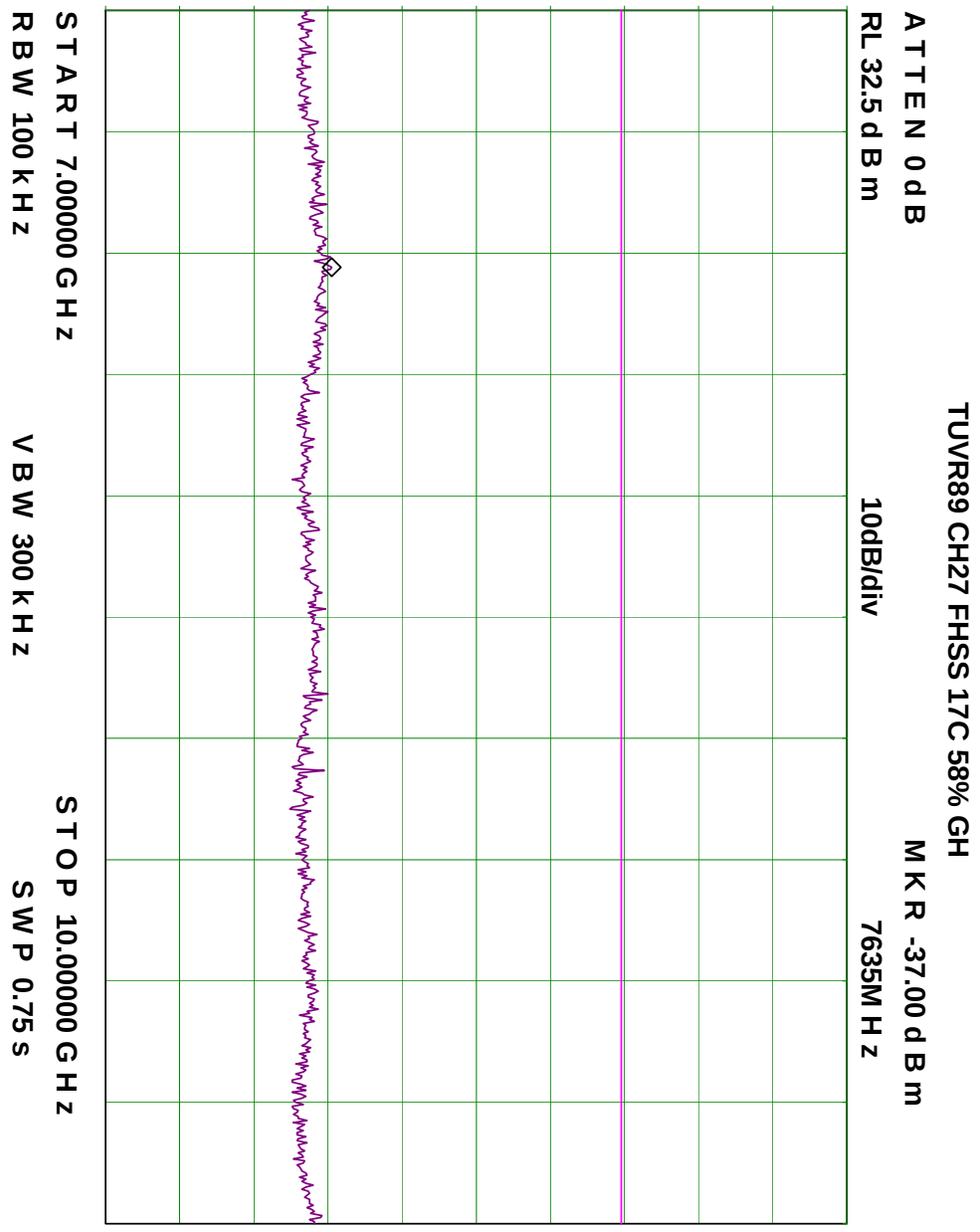
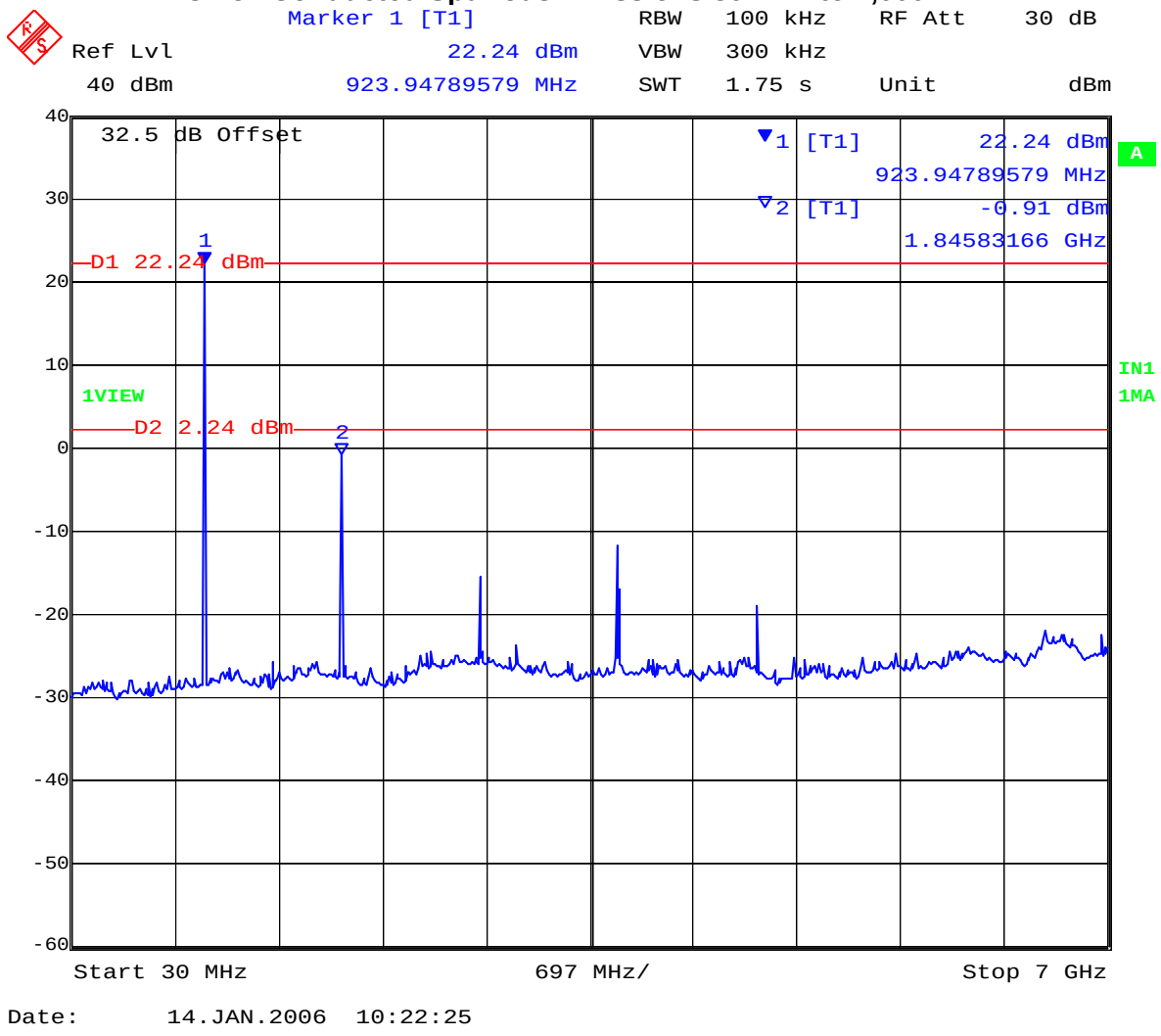


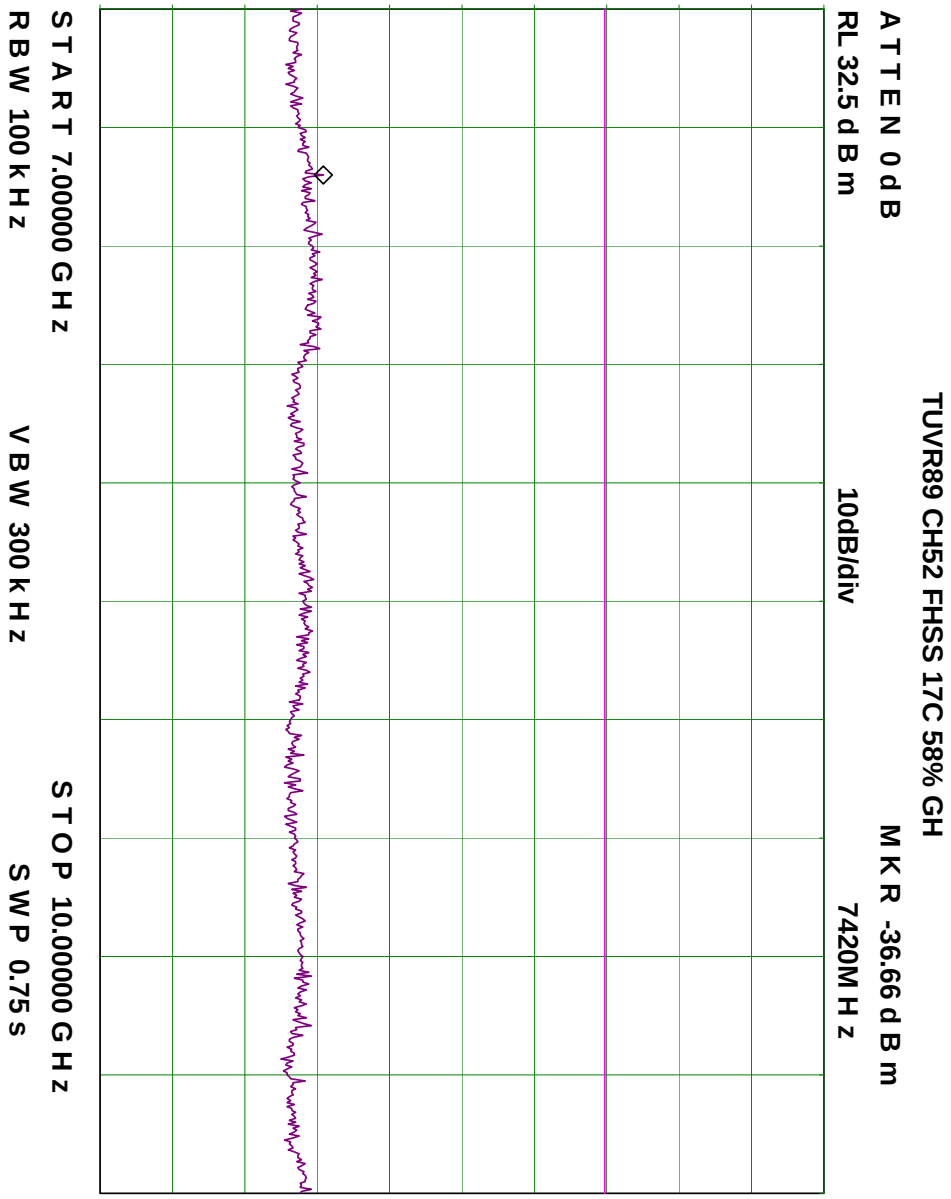
TABLE OF RESULTS –

CH #	Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Plot #	Margin (dB)
52	927.4826	30	7,000	-0.91	+2.24	13	-3.15
52	927.4826	7,000	10,000	-36.66	+2.24	14	-38.9

Plot 13
Ch 52 Conducted Spurious Emissions 30 MHz to 7,000 MHz



Plot 14
Ch 52 Conducted Spurious Emissions 7,000 MHz to 10,000 MHz



Specification

Limits Band-Edge

Lower Limit Band-edge	Upper Limit Band-edge	Limit below highest level of desired power
902 MHz	928 MHz	≥ 20 dB

§**15.247(d)**

§**6.2.2 (o)(e1)**

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 a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Laboratory Measurement Uncertainty for Conducted Spurious Emissions

Measurement uncertainty	±2.37 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-05 'Measurement of Spurious Emissions'	0088, 0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117.

5.1.6. Radiated Emissions

5.1.6.1. Transmitter Radiated Spurious Emissions (above 1 GHz)

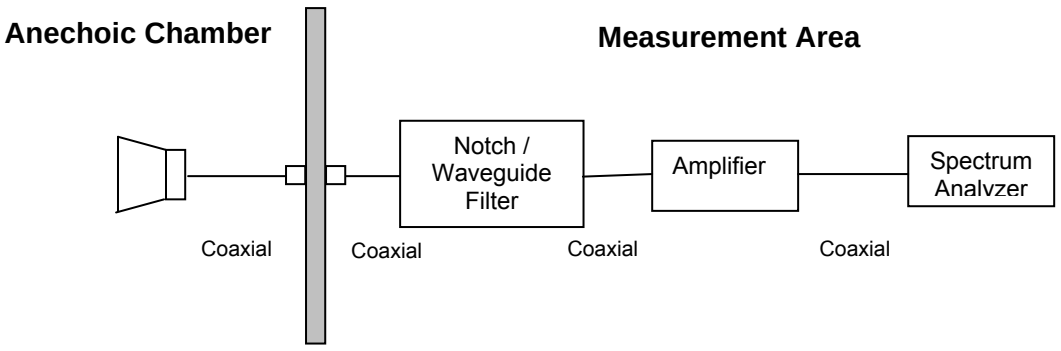
FCC, Part 15 Subpart C §15.247(d)
Industry Canada RSS-210 §6.2.2 (o)(e1)

Test Procedure

Radiated emissions above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter and waveguide filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned.

All measurements on any frequency or frequencies over 1 MHz are based on the use of measurement instrumentation employing an average detector function. All measurements above 1 GHz were performed using a minimum 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 + NFL
CL = Cable Loss
AG = Amplifier Gain
FO = Distance Falloff Factor
NFL = Notch Filter Loss or Waveguide Loss

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 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

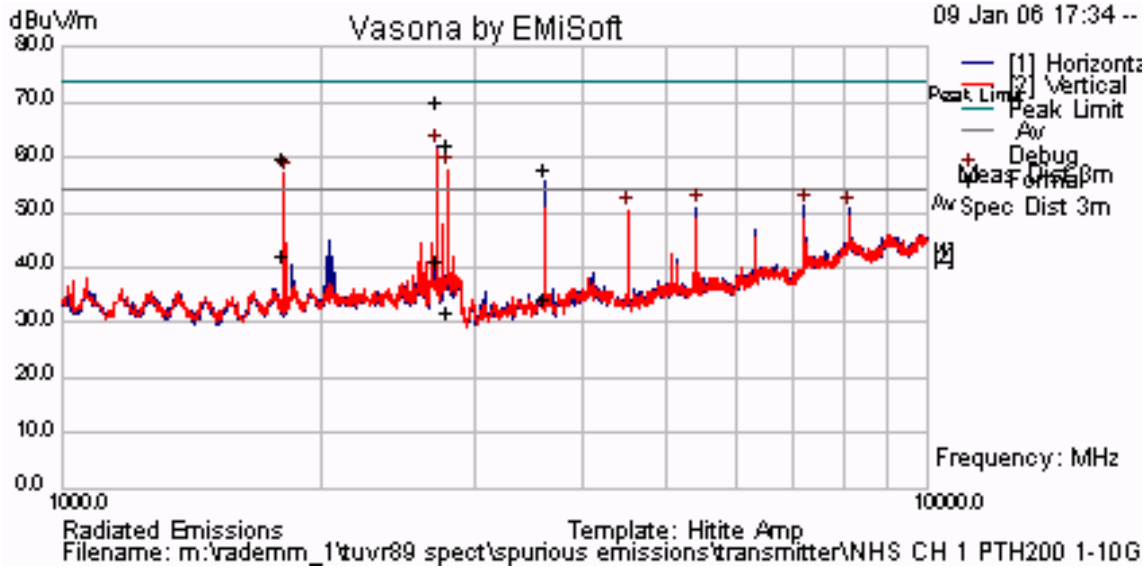
Radiated Spurious Emissions above 1 GHz

Ambient conditions.
Temperature: 17 to 23°C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

TABLE OF RESULTS – **Channel # 1 Duty Cycle = 42%**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2707.396	V	44.32	-5.38	38.94	54	-15.06
2786.94	V	34.33	-4.62	29.71	54	-24.29
1804.886	V	44.64	-4.86	39.78	54	-14.22
3609.964	V	35.24	-3.44	31.80	54	-22.20

Plot 15
Radiated Emissions for Channel 1

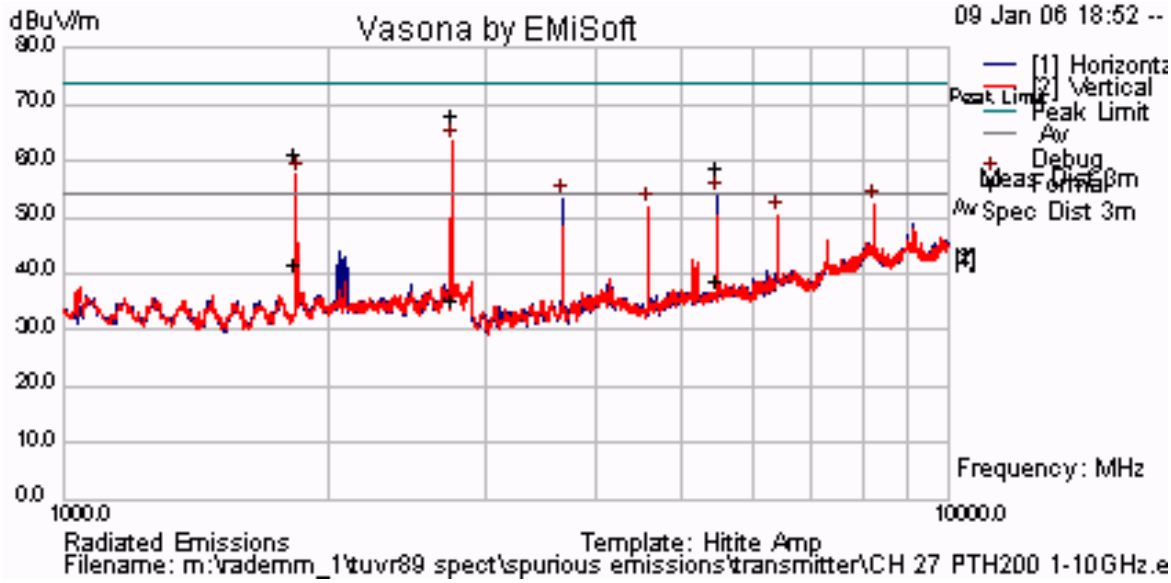


Radiated Spurious Emissions above 1 GHz (continued)

TABLE OF RESULTS – **Channel # 27 Duty Cycle = 42%**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2745.633	V	37.95	-4.88	33.07	54	-20.93
1830.453	V	44.16	-4.79	39.37	54	-14.63
5491.437	V	36.63	-0.30	36.23	54	-17.77

Plot 16
Radiated Emissions for Channel 27

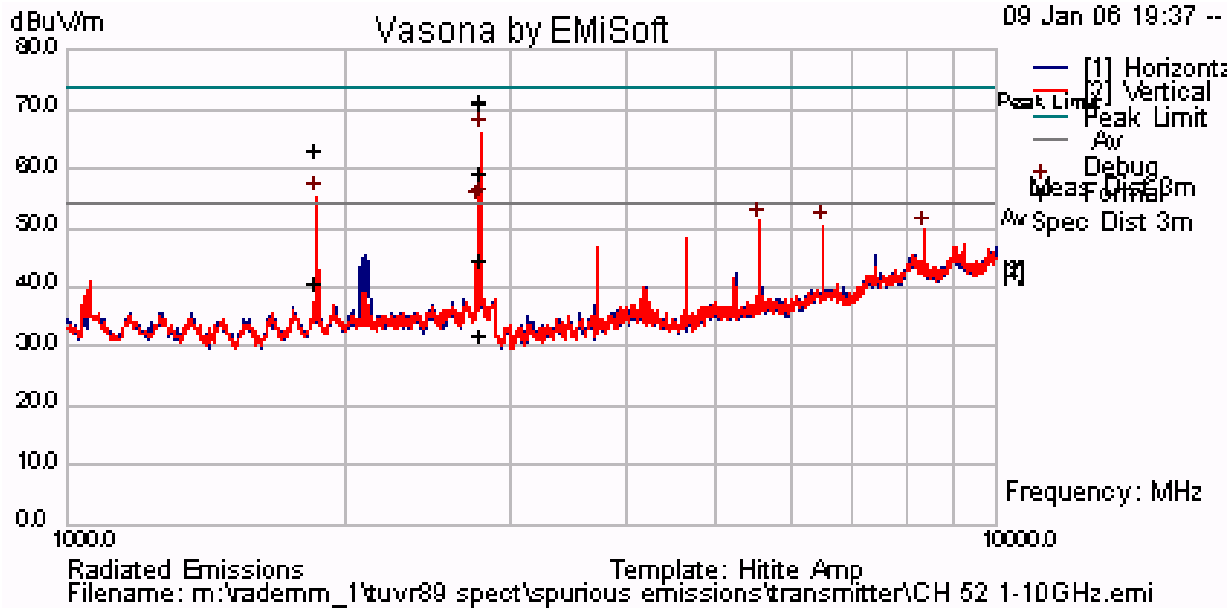


Radiated Spurious Emissions above 1 GHz (continued)

TABLE OF RESULTS – **Channel # 52 Duty Cycle = 42%**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2782.517	H	46.65	-4.64	42.01	54	-11.99
1855.032	V	43.2	-4.74	38.46	54	-15.54
2794.847	V	34.26	-4.62	29.64	54	-24.36
2782.420	H	46.64	-4.64	42.00	54	-12.00

Plot 17
Radiated Emissions for Channel 52



Radiated Spurious Emissions above 1 GHz (continued)

Specification

§**15.247(d)**

§**6.2.2 (o)(e1)**

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 a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions'	0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312

5.1.6.2. Receiver Radiated Spurious Emissions (above 1 GHz)

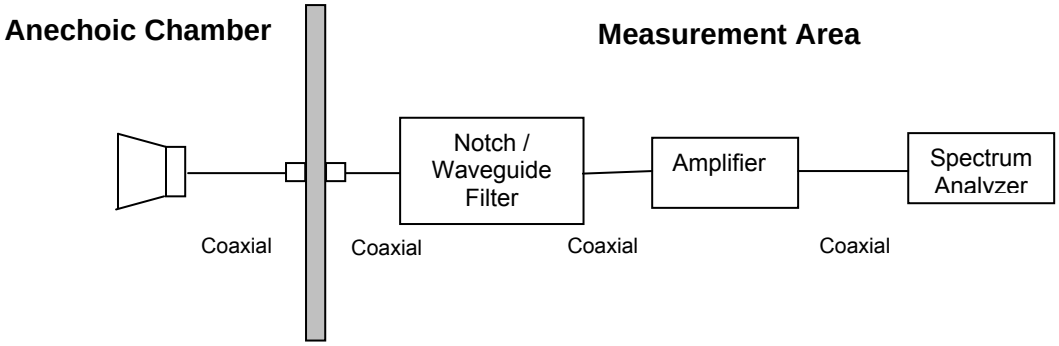
FCC, Part 15 Subpart C §15.247(d)
Industry Canada RSS-210 §6.2.2 (o)(e1)

Test Procedure

Radiated emissions above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter and waveguide filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned.

All measurements on any frequency or frequencies over 1 MHz are based on the use of measurement instrumentation employing an average detector function. All measurements above 1 GHz were performed using a minimum 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 + NFL
CL = Cable Loss
AG = Amplifier Gain
FO = Distance Falloff Factor
NFL = Notch Filter Loss or Waveguide Loss

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 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

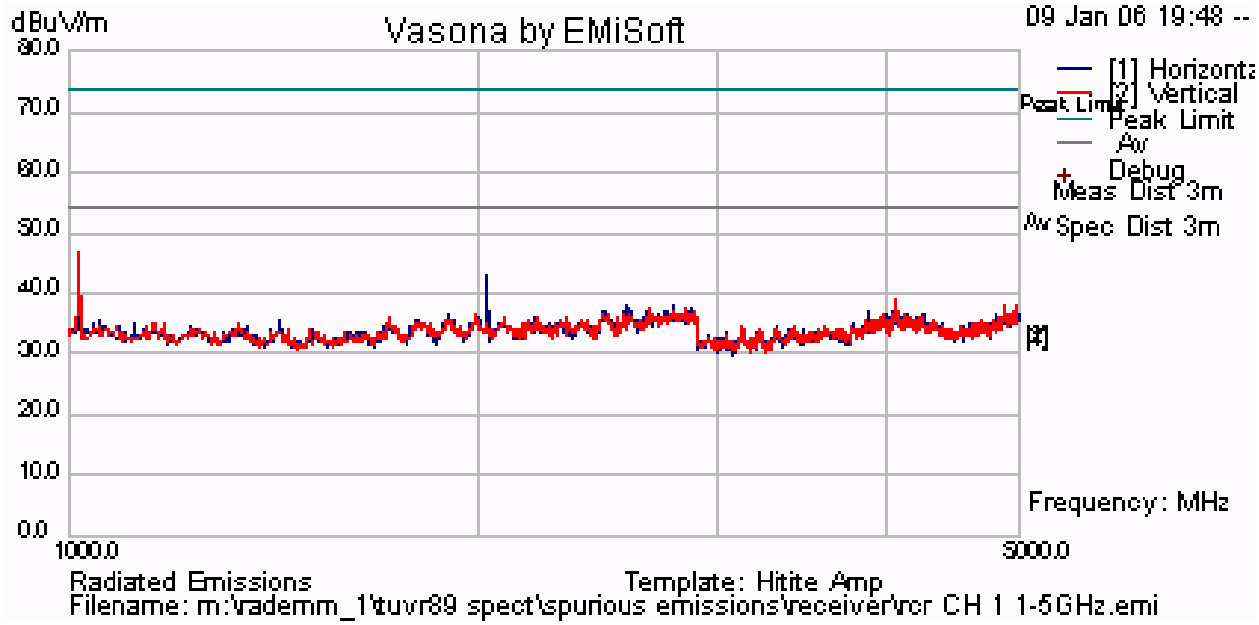
Receiver Radiated Spurious Emissions above 1 GHz

TABLE OF RESULTS – **Channel # 1**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)

No emissions were observed that were close to the limit.

Plot 18
Receiver Radiated Emissions for Ch 1



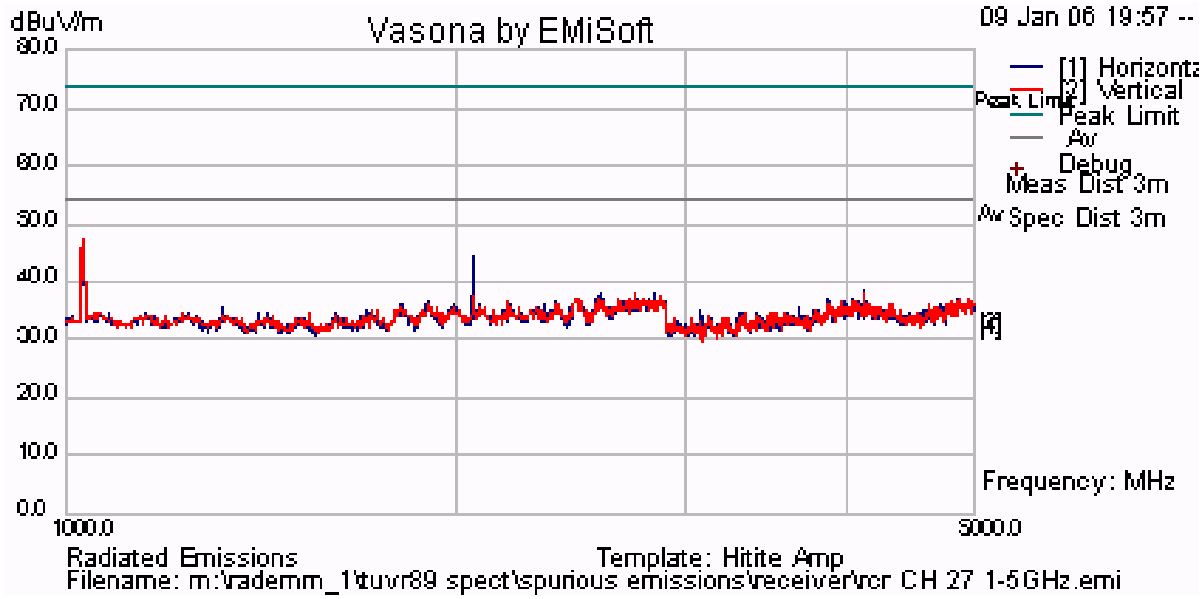
Receiver Radiated Spurious Emissions above 1 GHz

TABLE OF RESULTS – **Channel # 27**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)

No emissions were observed that were close to the limit.

Plot 19
Receiver Radiated Emissions for Ch 27



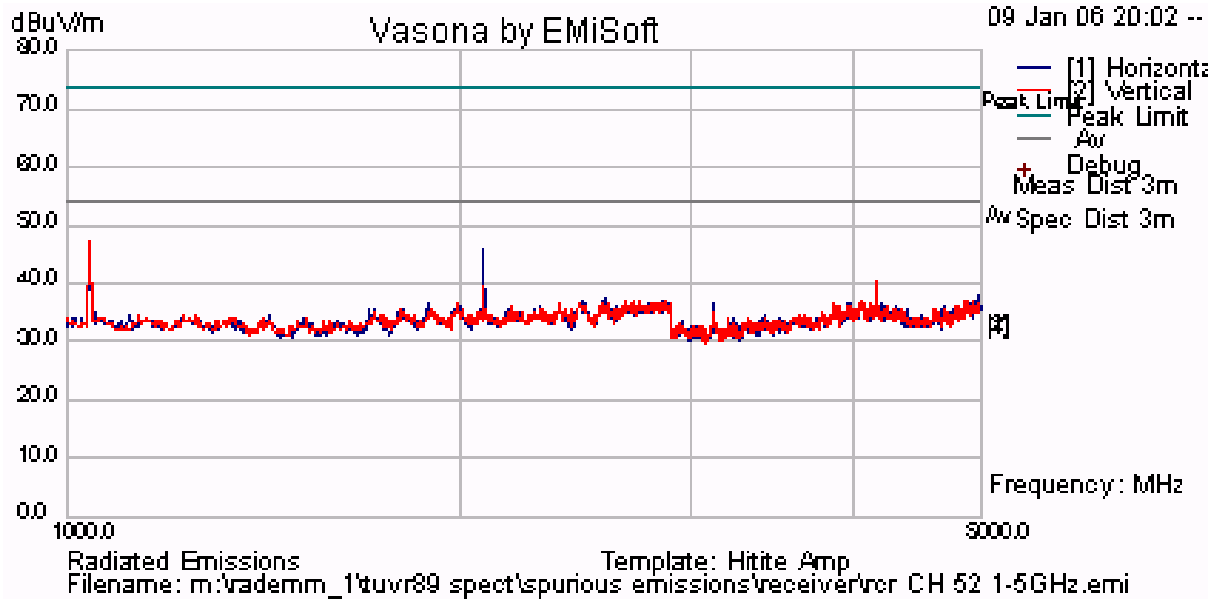
Receiver Radiated Spurious Emissions above 1 GHz

TABLE OF RESULTS – **Channel # 52**

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)

No emissions were observed that were close to the limit.

Plot 20
Receiver Radiated Emissions for Ch 52



Spurious Emissions above 1 GHz (continued)

Specification

§**15.247(d)**

§**6.2.2 (o)(e1)**

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 a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions'	0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312

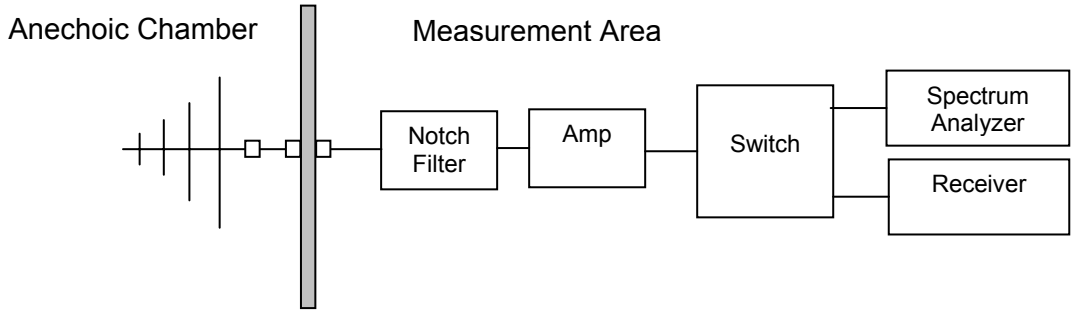
5.1.7. Radiated Spurious Emissions (30M-1 GHz)

FCC, Part 15 Subpart C §15.247(c)/ §15.209
Industry Canada RSS-210 §6.2.2(o)(a)

Test Procedure

Testing 30M-1 GHz was subcontracted to the company identified in Section 3.9 Subcontracted Testing. Preliminary radiated emissions are measured in the anechoic chamber at a 10-meter distance on every azimuth in both horizontal and vertical polarity. The emissions are recorded with a spectrum analyzer in peak hold mode. Emissions closest to the limits are measured in the quasi-peak mode with the tuned receiver using a bandwidth of 120 kHz. Only the highest emissions relative to the limit are listed. The anechoic chamber test set-up is identified in Section 6 Test Set-Up Photographs.

Test Measurement Set up



Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. In this test facility, the Antenna Factor, Cable Loss, and Amplifier Gains are loaded into the Rohde & Schwarz Receiver and the corrected field strength can be read directly on the receiver.

$$FS = R + AF + CORR$$

where:

FS = Field Strength
R = Measured Receiver Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG + NFL
CL = Cable Loss
AG = Amplifier Gain

For example:
Given a Receiver input reading of 51.5dBμV; Antenna Factor of 8.5dB; Cable Loss of 1.3dB; Falloff Factor of 0dB, an Amplifier Gain of 26dB and Notch Filter Loss of 1dB. The Field Strength of the measured emission is:

FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3dBμV/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 = 100μV/m
48 dBμV/m = 250μV/m

Measurement Results for Spurious Emissions (30 MHz – 1 GHz)

Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

Pre Scans of Radiated Emissions Below 1 GHz

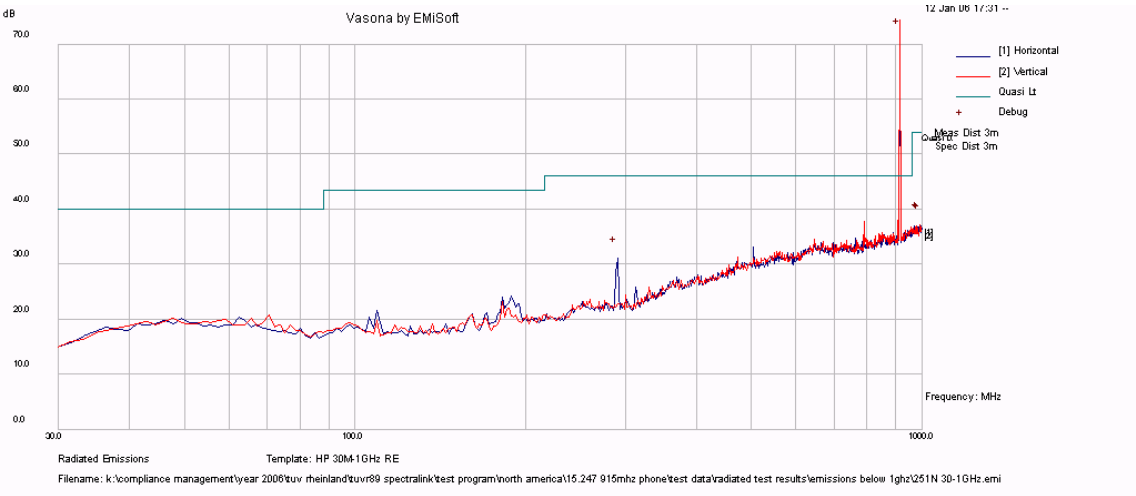
602X handset tested with H251N headset.

TABLE OF RESULTS –

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)

Note. No peak emissions were observed above the limit. The emission breaking the limit line is the carrier.

Plot 21
Radiated Emissions Below 1 GHz for EUT and H251N Head Set



Pre Scans of Radiated Emissions Below 1 GHz (continued)

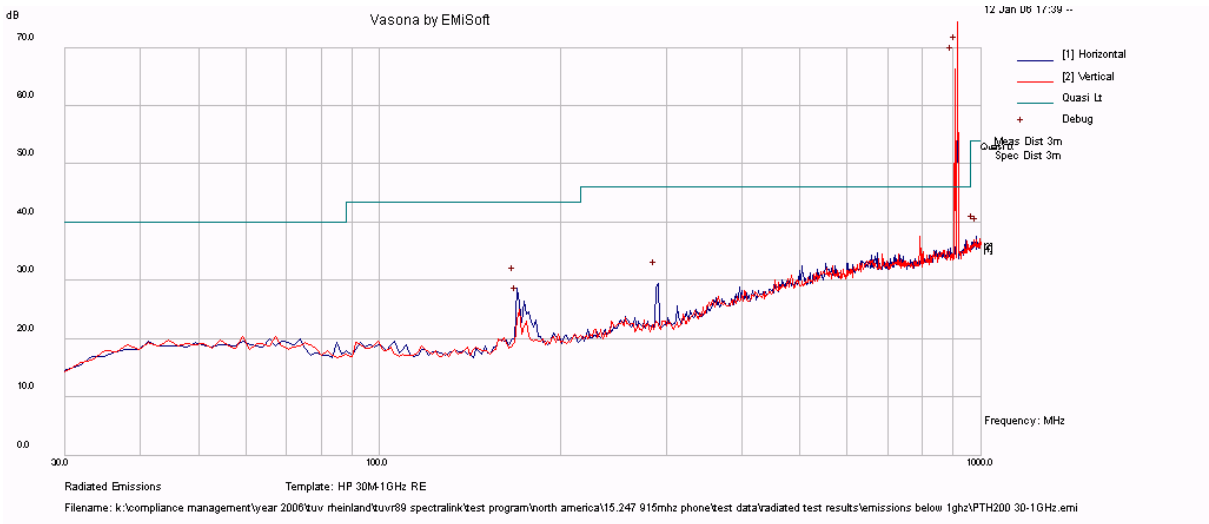
602X handset tested with PTH200 headset.

TABLE OF RESULTS –

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)

Note. No peak emissions were observed above the limit. The emission breaking the limit line is the carrier.

Plot 22
Radiated Emissions Below 1 GHz for EUT and PTH200 Head Set



Pre Scans of Radiated Emissions Below 1 GHz (continued)

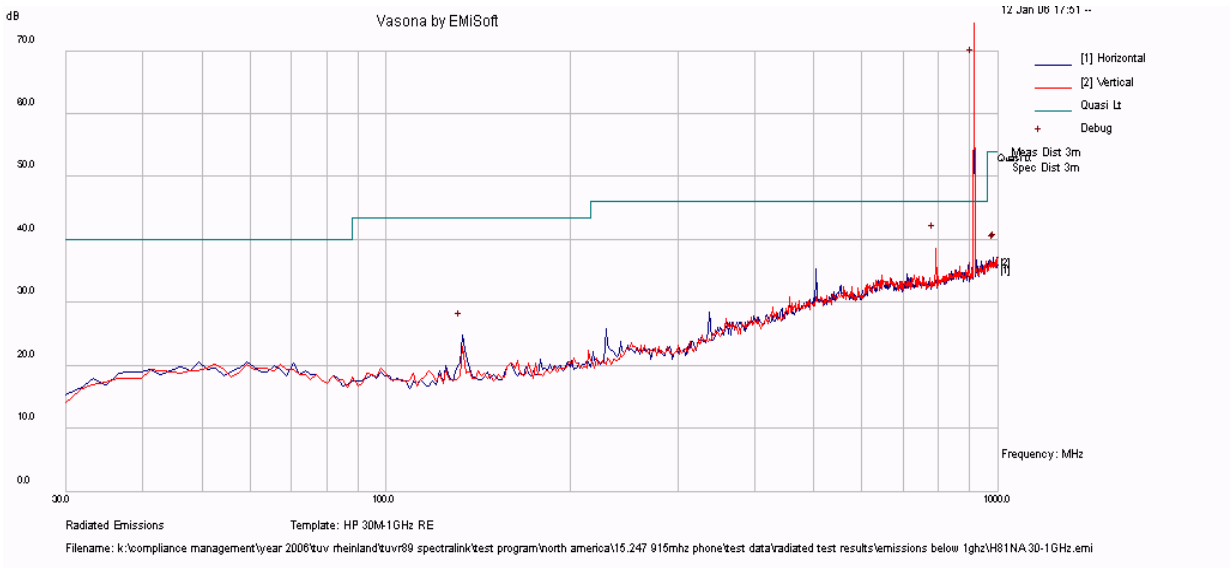
602X handset tested with H81NA headset.

TABLE OF RESULTS –

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)

Note. No peak emissions were observed above the limit. The emission breaking the limit line is the carrier.

Plot 23
Radiated Emissions Below 1 GHz for EUT and H81NA Head Set



Pre Scans of Radiated Emissions Below 1 GHz (continued)

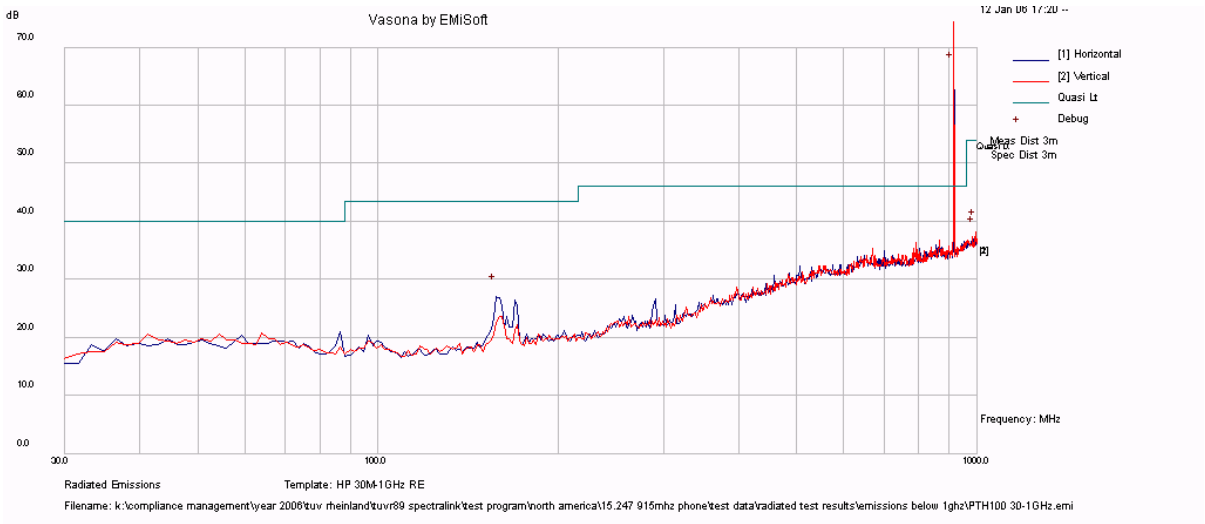
602X handset tested with PTH100 headset.

TABLE OF RESULTS –

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)

Note. No peak emissions were observed above the limit. The emission breaking the limit line is the carrier.

Plot 24
Radiated Emissions Below 1 GHz for EUT and PTH100 Head Set



Pre Scans of Radiated Emissions Below 1 GHz (continued)

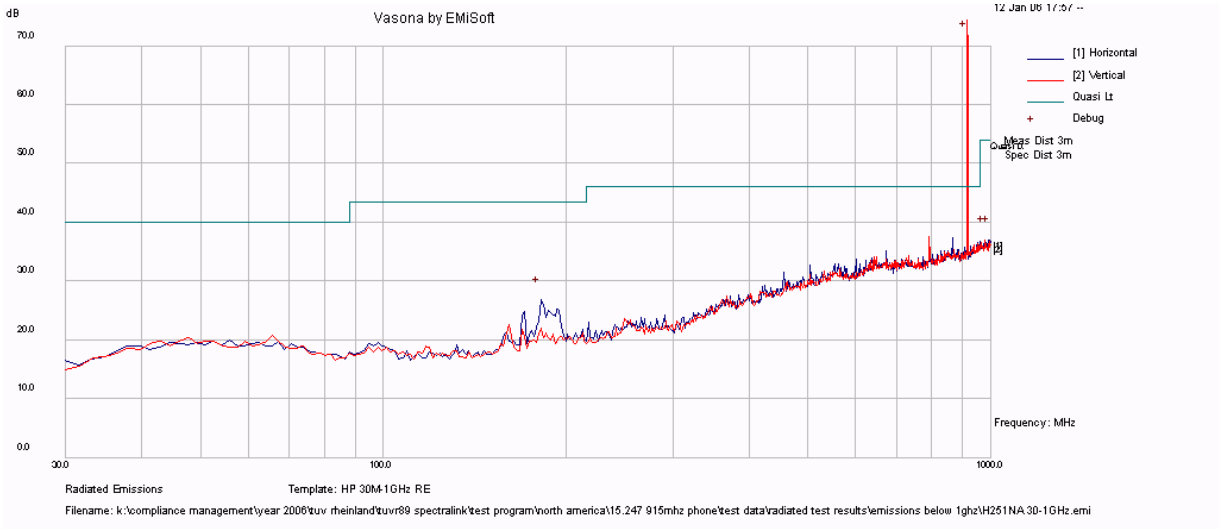
602X handset tested with H251NA headset.

TABLE OF RESULTS –

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)

Note. No peak emissions were observed above the limit. The emission breaking the limit line is the carrier.

Plot 25
Radiated Emissions Below 1 GHz for EUT and H251NA Head Set



Pre Scans of Radiated Emissions Below 1 GHz (continued)

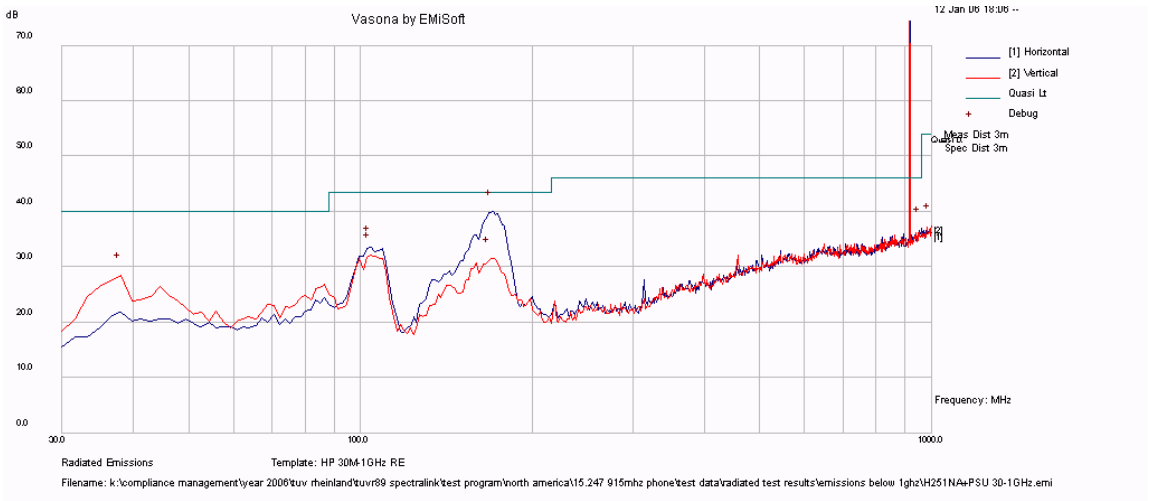
602X handset tested with H251NA headset and battery charger unit.

TABLE OF RESULTS –

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)

Note. No peak emissions were observed above the limit. The emission breaking the limit line is the carrier.

Plot 26
Radiated Emissions Below 1 GHz for EUT and H251NA Head Set and Battery Charger unit



Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions'	0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312

Maximized Results for Radiated Spurious Emissions (30 MHz–1 GHz)

Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

Configuration # 1 - 602X handset tested with H251NA headset and phone stand and single battery charger unit.
Test Setup: Phone in charger, headset connected setup in mode 3 and channel 27

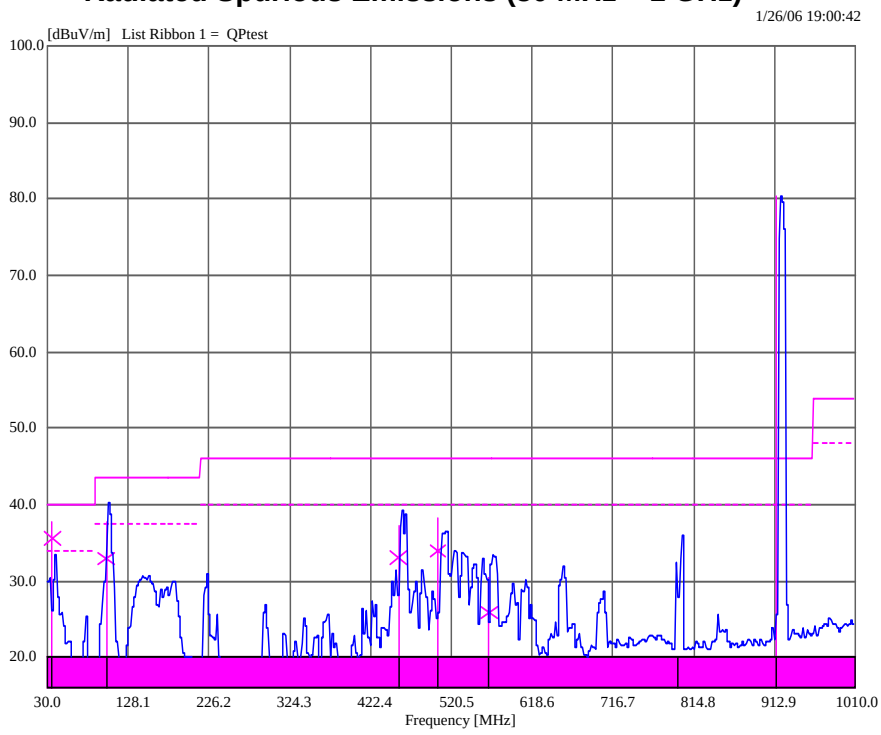
TABLE OF RESULTS

Freq. (MHz)	Peak (dBuV/m)	QP (dBuV/m)	QP Lmt (dBuV/m)	QP Margin (dB)	Angle (deg)	Height (cm)	Pol	Total Correction Factor
36.004292	37.81	35.58	40.00	-4.42	83	102	Vert	-15.23
101.424074	37.78	32.94	43.50	-10.56	176	102	Vert	-21.47
456.015982	37.15	33.12	46.00	-12.88	164	119	Vert	-10.41
504.087122	38.28	33.91	46.00	-12.09	33	102	Vert	-9.30
565.636008	30.54	25.88	46.00	-20.12	76	101	Vert	-8.03
796.676482	18.14	13.00	46.00	-33.00	48	100	Vert	-4.68
914.800000	--.--	--.--	N/A	--.--	35	96	Vert	-2.58

The peek emission breaking through the limit line is the carrier.

Plot 27

Radiated Spurious Emissions (30 MHz – 1 GHz)



Configuration # 2 - 602X handset tested with H251NA headset and phone stand and dual battery charger unit.
Test Setup: Phone in charger, headset connected setup in mode 3 and channel 27

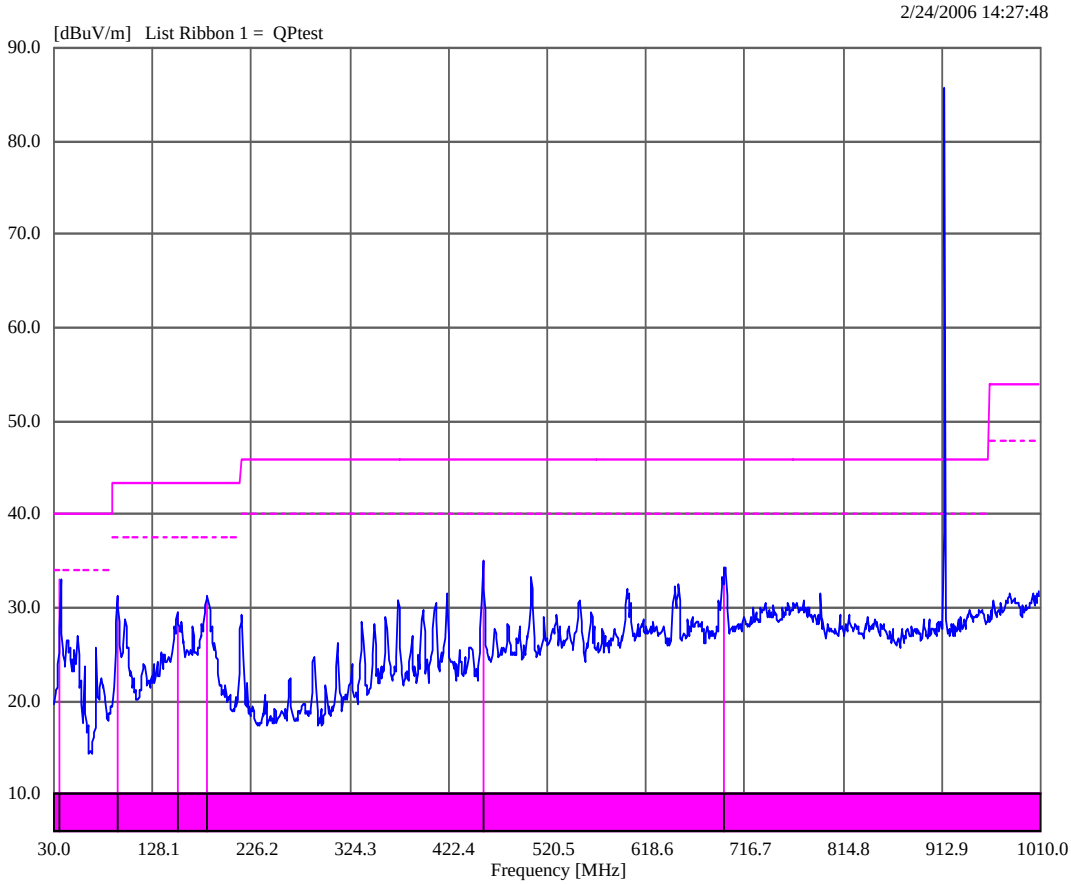
TABLE OF RESULTS

Freq. (MHz)	Peak (dBuV/m)	QP (dBuV/m)	QP Lmt (dBuV/m)	QP Margin (dB)	Angle (deg)	Height (cm)	Pol	Total Correction Factor
36.183334	32.99	--.--	40.00	--.--	314	100	Vert	-4.85
92.650000	31.25	--.--	43.50	--.--	0	100	Vert	-11.47
152.383333	29.61	--.--	43.50	--.--	134	398	Horz	-10.06
182.250000	31.24	--.--	43.50	--.--	0	100	Vert	-8.50
456.183333	35.02	--.--	46.00	--.--	0	100	Horz	0.06
696.283333	34.41	--.--	46.00	--.--	134	398	Horz	5.09

The peek emission breaking through the limit line is the carrier.

Plot 28

Radiated Spurious Emissions (30 MHz – 1 GHz)



Specification

Limits

§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.

§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.

§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.

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 Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

Traceability

Method	Test Equipment Used
Measurements were made per Sanmina work instruction	8546A HP Receiver and RF Filter, HP Pre-amp, Antenna EMCO Biconilog

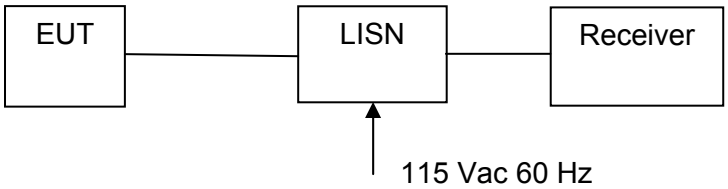
5.1.8. AC Wireline Conducted Emissions (150 kHz – 30 MHz)

FCC, Part 15 Subpart C §15.207
Industry Canada RSS-210 §6.6, §7.4

Test Procedure

The EUT is configured in accordance with ANSI C63.4. The conducted emissions are measured in a shielded room with a spectrum analyzer in peak hold in the first instance. Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation. The highest emissions relative to the limit are listed.

Test Measurement Set up



Measurement set up for AC Wireline Conducted Emissions Test

Measurement Results for AC Wireline Conducted Emissions (150 kHz – 30 MHz)

Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

TABLE OF RESULTS

120v 60 Hz Neutral Line

Frequency (MHz)	Peak (dBµV)	QP (dBµV)	QP Limit (dBµV)	QP Margin (dB)	Ave. (dBµV)	Ave. Limit (dBµV)	Ave. Margin (dB)
0.375890	44.43	37.44	58.41	-20.97	6.83	48.41	-41.58
0.386215	44.25	37.28	58.16	-20.88	6.24	48.16	-41.92
0.418506	44.18	36.83	57.52	-20.70	5.88	47.52	-41.64
0.432422	43.93	36.64	57.26	-20.62	5.72	47.26	-41.54
0.440838	43.74	36.48	57.11	-20.62	5.44	47.11	-41.66
0.472105	43.36	35.79	56.52	-20.73	4.64	46.52	-41.88
0.482238	42.87	35.43	56.33	-20.90	4.47	46.33	-41.86
0.497015	42.26	34.91	56.06	-21.15	5.17	46.06	-40.88

Plot 28
AC Neutral Wireline - Conducted Emissions (150 kHz – 30 MHz)

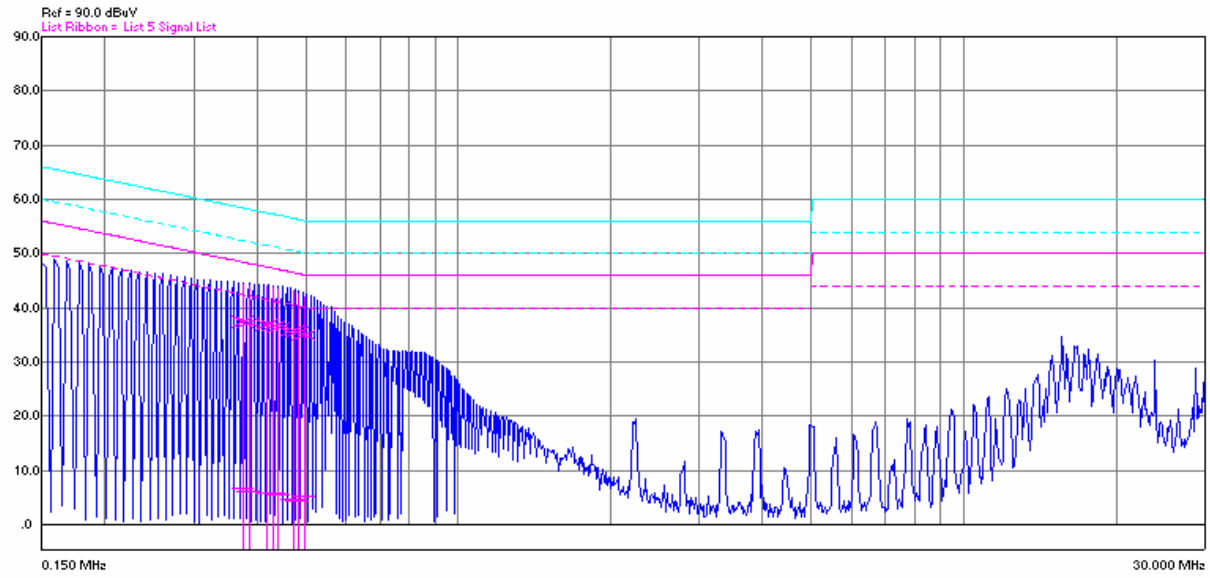
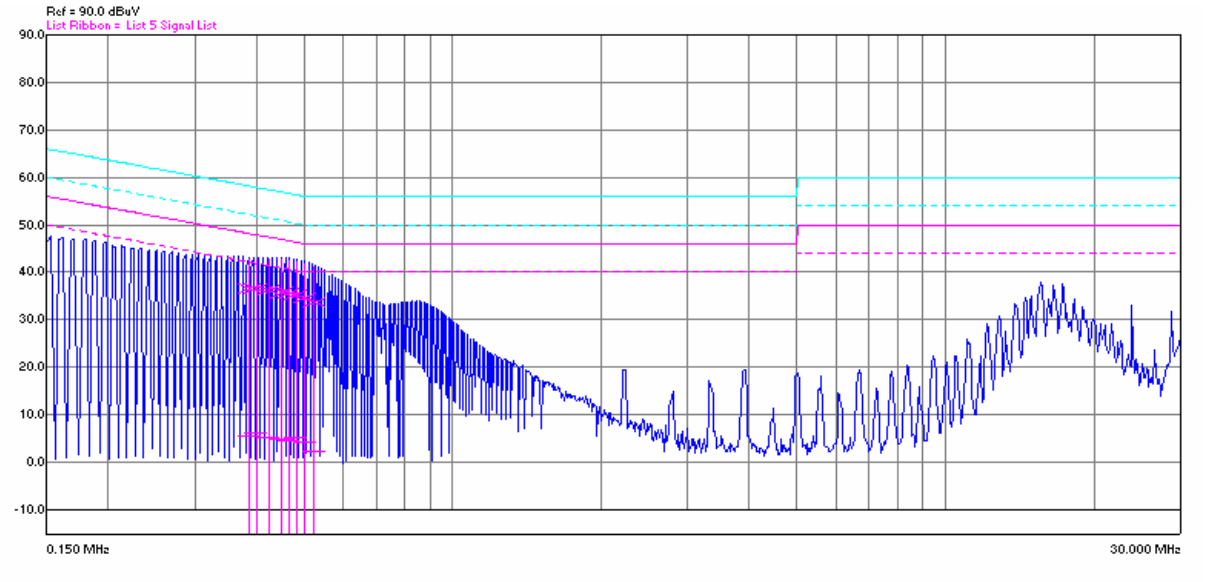


TABLE OF RESULTS

120v 60 Hz Live Line

Frequency (MHz)	Peak (dBµV)	QP (dBµV)	QP Limit (dBµV)	QP Margin (dB)	Ave. (dBµV)	Ave. Limit (dBµV)	Ave. Margin (dB)
0.388102	43.17	36.71	58.12	-21.41	5.63	48.12	-42.49
0.400077	43.13	36.54	57.87	-21.33	6.20	47.87	-41.66
0.423941	43.06	36.18	57.42	-21.24	5.24	47.42	-42.18
0.450353	42.99	35.82	56.93	-21.11	4.90	46.93	-42.03
0.466744	42.85	35.54	56.62	-21.08	4.69	46.62	-41.93
0.482167	42.54	35.22	56.33	-21.11	5.08	46.33	-41.25
0.502478	42.19	34.64	56.00	-21.36	4.36	46.00	-41.64
0.524933	41.43	33.80	56.00	-22.20	2.16	46.00	-43.84

Plot 29
AC Live Wireline - Conducted Emissions (150 kHz – 30 MHz)



Specification

Limit

§15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μΩ line impedance stabilization network (LISN), see §15.207 (a) matrix below. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

6.6(a) On any frequency or frequencies within the band of 0.15-30 MHz, the measured RF voltage (CISPR meter) shall not exceed 250 μV, 48 dBμV (across 50 ohms)

(b) Transmitters marketed for use only in a commercial, industrial or business environment and not intended for use in homes are permitted a limit of 1000 μV (60 dBμV, 0.45 - 1.705 MHz) and 3000 μV (69.5 dBμV, 1.705 - 30 MHz).

§15.207 (a) Limit Matrix

The lower limit applies at the boundary between frequency ranges

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

Laboratory Measurement Uncertainty for Conducted Emissions

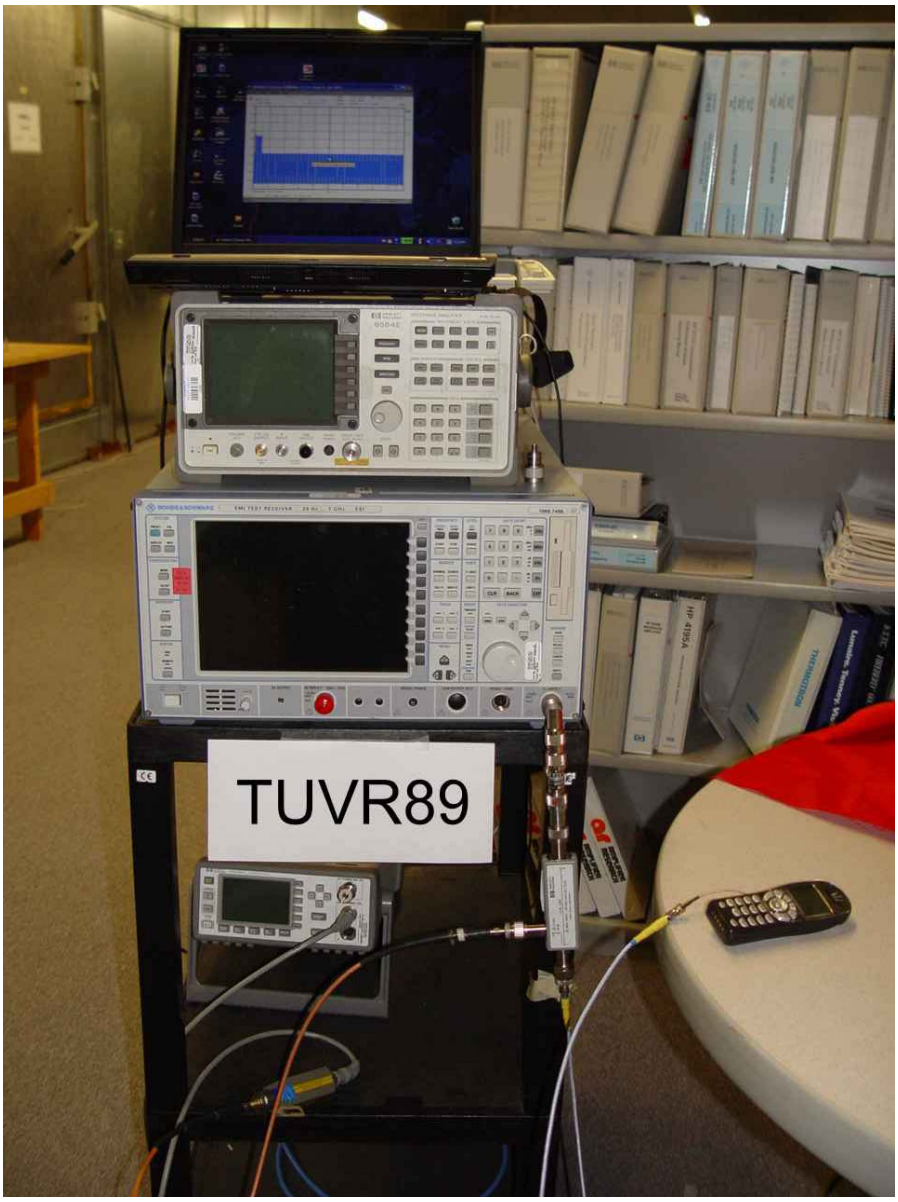
Measurement uncertainty	±2.64 dB

Traceability

Method	Test Equipment Used
Measurements were made per Sanmina work instruction	LISN

6. PHOTOGRAPHS

6.1. General Measurement Test Set-Up



6.2. Radiated Emissions >1 GHz

6.3. Radiated Emissions (30 MHz-1 GHz)

6.4. AC Wireline Conducted Emissions (150 kHz – 30 MHz)

7. TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Part #	Serial #
0088	Spectrum Analyzer	Hewlett Packard	8564E	3410A00141
0104	1-18GHz Horn Antenna	The Electro-Mechanics Company	3115	9205-3882
0134	Amplifier	Com Power	PA 122	181910
0158	Barometer /Thermometer	Control Co.	4196	E2846
0193	EMI Receiver	Rhode & Schwartz	ESI 7	838496/007
0252	SMA Cable	Megaphase	Sucoflex 104	None
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	30dB N-Type Attenuator	ARRA	N9444-30	1623
0070	Power Meter	Hewlett Packard	437B	3125U11552
0116	Power Sensor	Hewlett Packard	8485A	3318A19694
0117	Power Sensor	Hewlett Packard	8487D	3318A00371
0184	Pulse Limiter	Rhode & Schwartz	ESH3Z2	357.8810.52
0293	BNC Cable	Megaphase	1689 1GVT4	15F50B001
0307	BNC Cable	Megaphase	1689 1GVT4	15F50B002

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