Test of M/A-COM RFID Inc.
Mobil UHF Reader System

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

Test Report Serial No.: MACM05-A5 Rev A

TEST REPORT

FROM

MiCOM Labs

Test of M/A-COM RFID Inc. Mobil UHF Reader System

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

Test Report Serial No.: MACM05-A5 Rev A

This report supersedes: None

Applicant: M/A-COM RFID Inc. Corporation
1011 Pawtucket Blvd
Lowell, MA 01854
USA

Product Function: 915 MHz & 2.4 GHz WiFi RFID Reader

Copy No: pdf **Issue Date:** 17th December '08

This Test Report is Issued Under the Authority of;

MiCOM Labs, Inc.
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Pleasanton, CA 94566 USA
Phone: +1 (925) 462-0304
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A2LA ACCREDITED
CERTIFICATE #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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ACCREDITATION, LISTINGS & RECOGNITION

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

ilac-MRA

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 18 June 2005*).

Presented this 26th day of February 2008.

President
For the Accreditation Council
Certificate Number 2381.01
Valid to November 30, 2009

For the 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

Canada
Industry Canada (IC) Listing #: 4143A

RECOGNITION

APEC MRA (Asia-Pacific Economic Community Mutual Recognition Agreement)

Conformity Assessment Body (CAB) – MiCOM Labs

Test data generated by MiCOM Labs is accepted in the following countries under the APEC MRA.

Country	Recognition Body	Phase	CAB Identification No.
Australia	Australian Communications and Media Authority (ACMA)	I	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)	I	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	I	
Singapore	Infocomm Development Authority (IDA)	I	
Taiwan	Directorate General of Telecommunications (DGT) Bureau of Standards, Metrology and Inspection (BSMI)	I I	

DOCUMENT HISTORY

Document History		
Revision	**Date**	**Comments**
Draft		
Rev A	17th December '08	Initial Release

1. TEST RESULT CERTIFICATE

Applicant:	M/A-COM RFID Inc. 1011 Pawtucket Blvd Lowell, MA 01854 USA	Tested By:	MiCOM Labs, Inc. 440 Boulder Court Suite 200 Pleasanton California, 94566, USA
EUT:	915 MHz & 2.4 GHz WiFi RFID Reader	Telephone:	+1 925 462 0304
Model:	MAID-000012-ID0001	Fax:	+1 925 462 0306
S/N:	ID16 R0821 XXX2		
Test Date(s):	17th June - 28th October '08	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	2007	Code of Federal Regulations
(ii)	Industry Canada RSS-210	Issue 7 June 2007	Low Power License-Exempt Radiocommunication Devices (All Frequency Bands)
(iii)	Industry Canada RSS-Gen	Issue 2 June 2007	General Requirements and Information for the Certification of Radiocommunication Equipment.
(iv)	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
(v)	CISPR 22/ EN 55022	1997 1998	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	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 Mobil UHF Reader System to FCC Part 15.247 and Industry Canada RSS-210 regulations
Applicant:	M/A-COM RFID Inc. 1011 Pawtucket Blvd Lowell, MA 01854, USA
Manufacturer:	Viasystems Technologies Corp. LLC 9300 Billy the Kid El Paso, TX 79907
Laboratory performing the tests:	MiCOM Labs, Inc. 440 Boulder Court, Suite 200 Pleasanton, California 94566, USA
Test report reference number:	MACM05-A5 Rev A
Date EUT received:	20th June 2008
Standard(s) applied:	FCC 47 CFR Part15.247 & IC RSS-210
Dates of test (from - to):	17th June - 28th October '08
No of Units Tested:	Two; 1).. conducted testing 2).. radiated testing
Type of Equipment:	Mobil UHF Reader System
Model:	MAID-000012-ID0001
Location for use:	Indoor
Antenna:	Internal + external
Declared Frequency Range(s):	RFID: 902 - 928 MHz WiFi: 2,400 – 2,483.5 MHz
Transmitter Operation:	RFID and WiFi transmitter operation are independent
Type of Modulation:	FHSS
Declared Nominal Output Power:	RFID: +30 dBm (CW) WiFi: +17 dBm
Software Version:	3.1.165.240 & Char206
EUT Modes of Operation:	FHSS
Transmit/Receive Operation:	Transceiver, Simplex
ITU Emission Designator:	170KF1W 16M6D1D
Rated Input Voltage and Current:	+24 Vdc Battery Operated, Current 2.5A
Operating Temperature Range:	Client declared range : -30ºC to +50ºC
EUT Dimensions:	Upper/Primary: 13.5” W x 11.0” H x 3.875” D Lower/Secondary: 16.75” W x 10.0” H X 2.0” (D) Laser: 2.625” x 5.625” x 2.25” D:
EUT Weight :	Upper/Primary: 9.4 lbs Lower/Secondary: 15.7 lbs Laser: 2.2 lbs Cable: 0.8 lbs Total = 28.1 lbs
Primary function of equipment:	RFID tag interrogation

3.2. Scope of Test Program

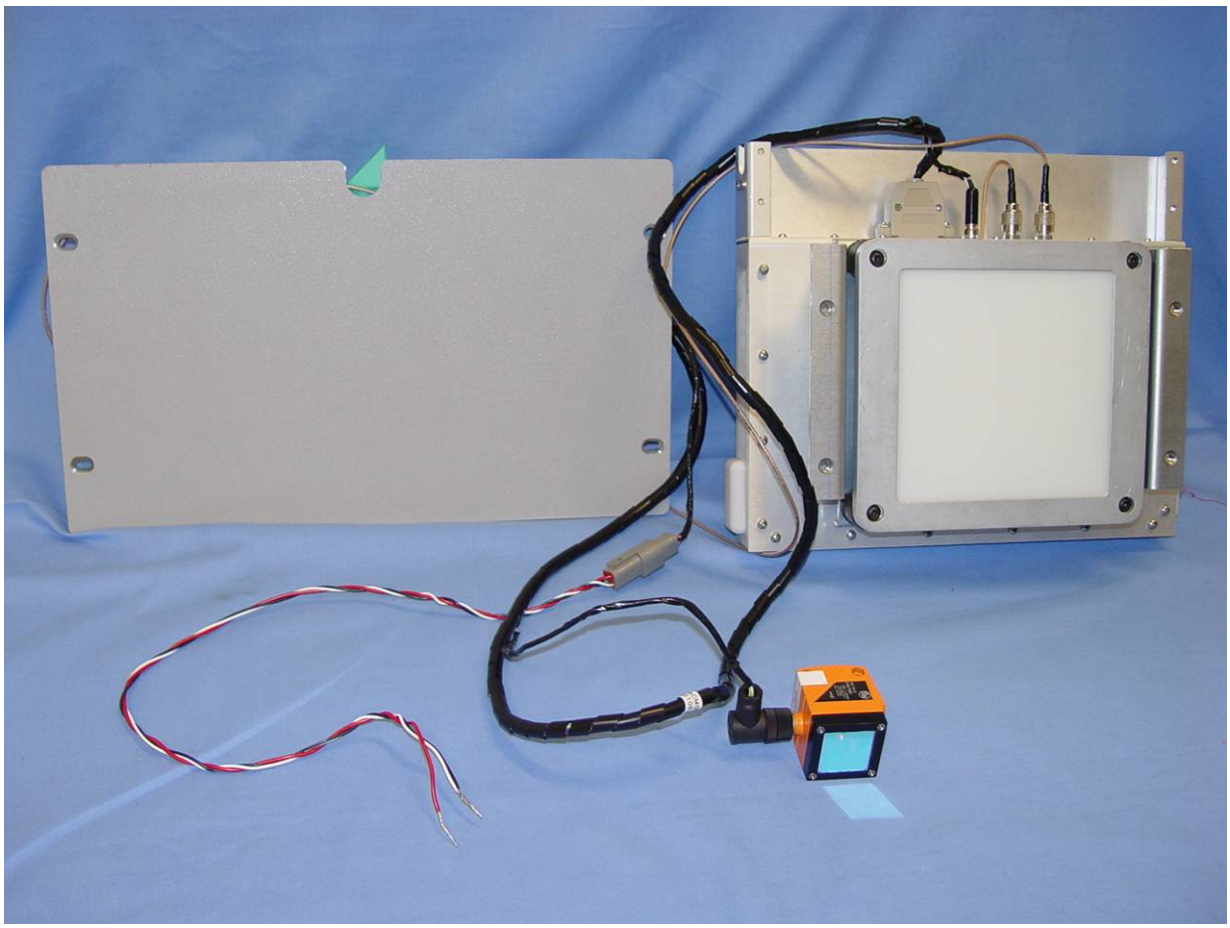
The scope of the test program was to test the Mobil UHF Reader System in the frequency ranges 902 - 928 MHz against FCC 47 CFR Part 15.247 and Industry Canada RSS-210 specifications for radiated and conducted emissions for intentional radiators. The intentional radiator was tested in a simulated typical installation to demonstrate compliance with the stated standards i.e. for radiated emissions both the transmitter and receiver tested simultaneously.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of the EUT, orientation of the power and I/O cabling, antenna search height and antenna polarization.

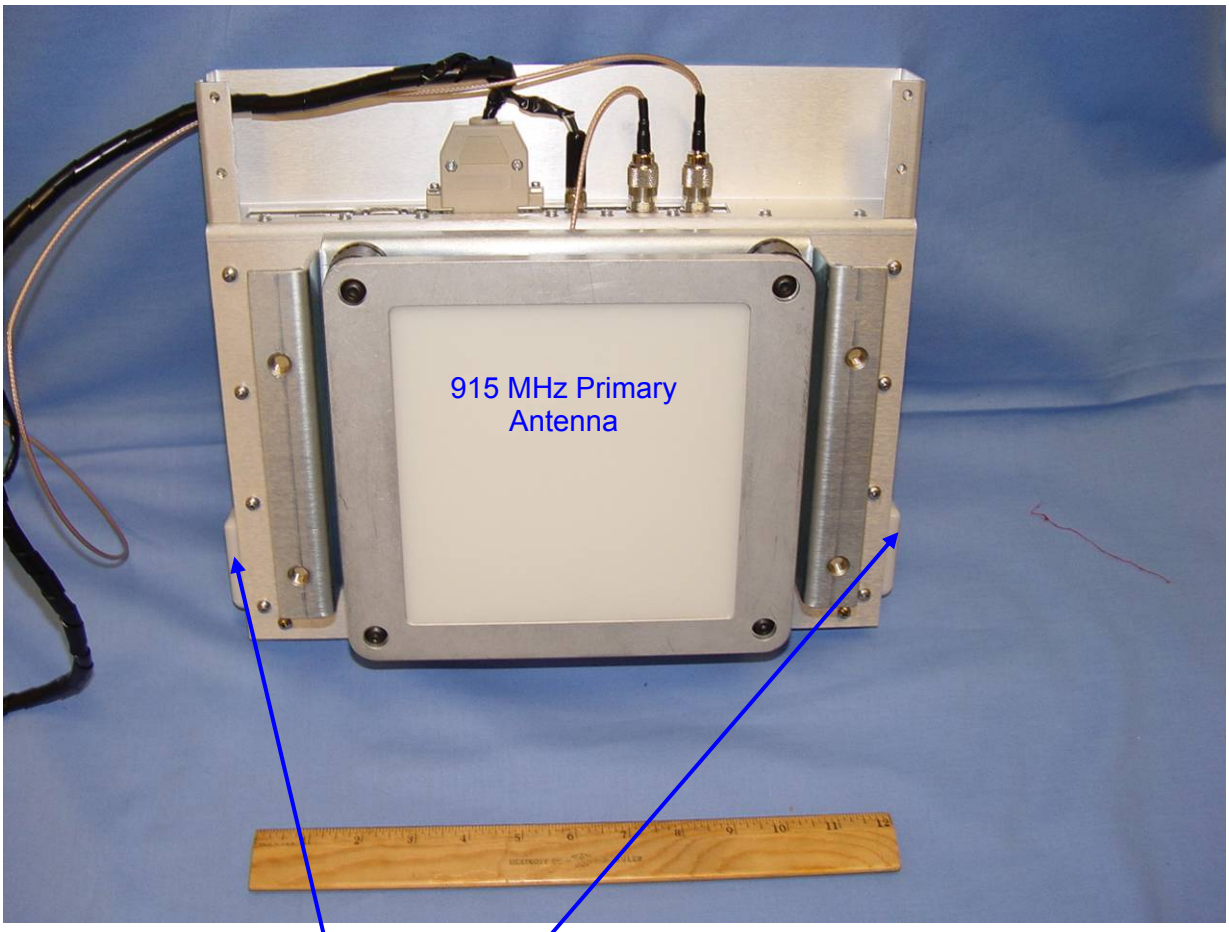
Every effort was made to perform an impartial test using appropriate test equipment of known calibration.

The Mobil UHF Reader System (EUT) reader is a 915 MHz Frequency Hoping Spread Spectrum (FHSS) transceiver. The EUT required modifications to bring it into compliance, see Section 3.7 “Equipment Modifications”.

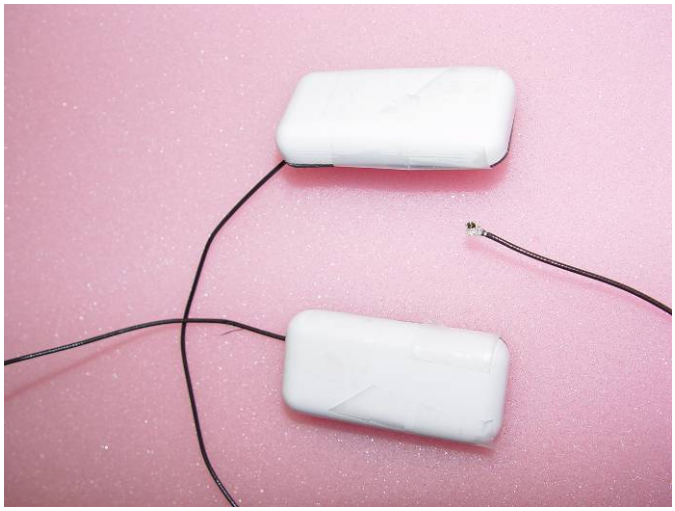
M/A-COM 915 MHz RFID Reader with Laser



M/A-COM 915 MHz RFID Reader



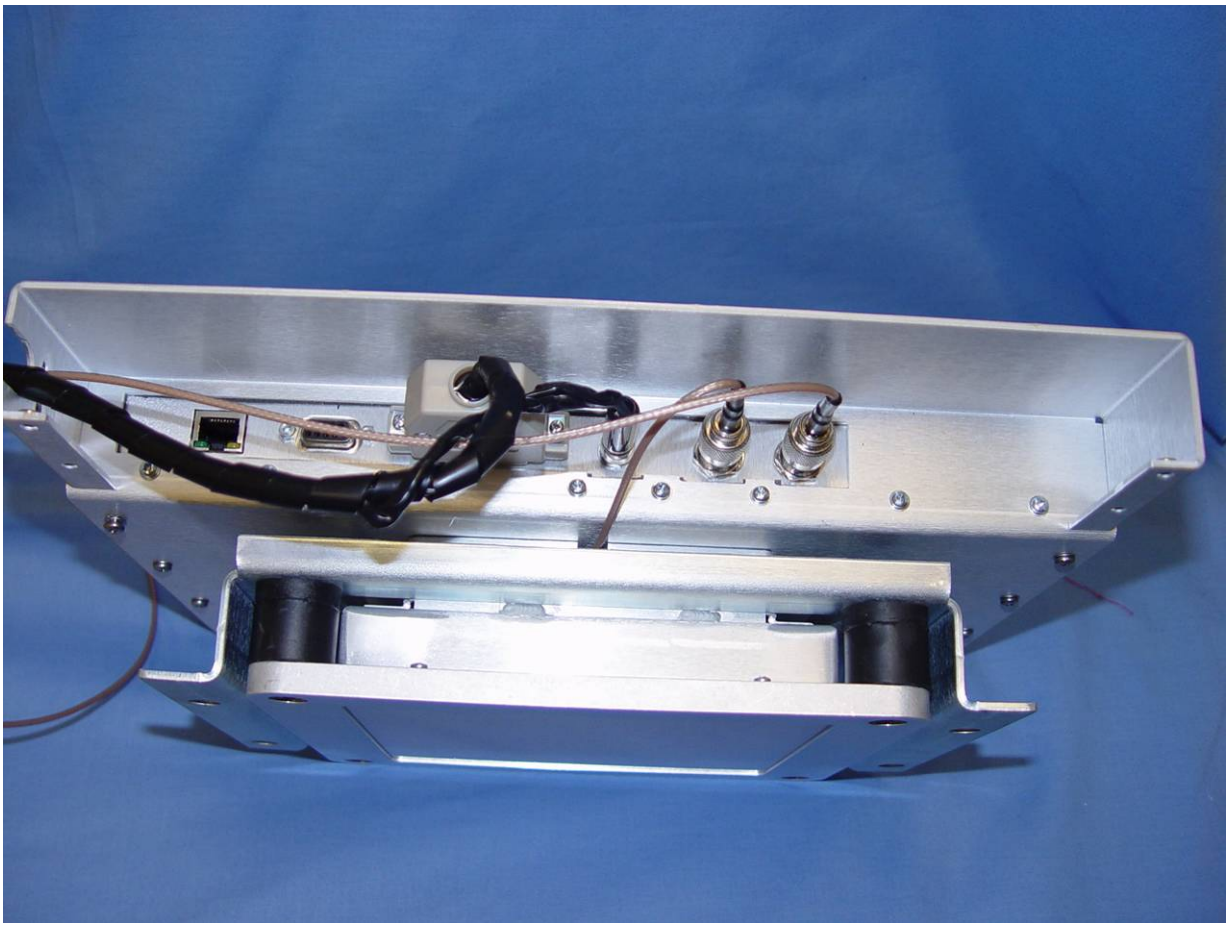
2.4 GHz Dual WiFi
Antenna (1.7 dBi)



M/A-COM 915 MHz RFID Secondary Antenna

M/A-COM 915 MHz Laser

M/A-COM 915 MHz RFID Reader Connections



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

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	RFID Reader + Secondary Antenna+ Laser	Tyco Electronics	MAID-000012-ID0000	ID16 R0821 XXX2
EUT (Component)	RFID Reader	Tyco Electronics	MAID-000017-ID0000	ID16 R0821 XXX2
EUT (Component)	Secondary Antenna	Tyco Electronics	MAID-000019-ID0000	ID16 R0821 XXX2
EUT (Component)	Class II Laser Power: 18 – 30 Vdc, <200mA Range: 0.2 – 10m Max Power: ≤4.1 mW Wavelength: 650 nM Pulse: 1.3 nS	iFm	M0194801D LF3KG	--
Support	Laptop Computer	IBM	--	--
Support	Power Supply	HP	--	--

3.4. Antenna Details

1. Primary Antenna: Right hand circularly polarized, cavity backed, chamfered corner air patch antenna, 6 dBi
2. Secondary Antenna: Horizontally polarized, cavity backed, Microstrip slot array, 6 dBi
3. WiFi Antenna – 1.7 dBi Inverted-F Antenna

3.5. Cabling and I/O Ports

Number and type of I/O ports

4. +24 Vdc Jack Switchcraft L712RA (unscreened)
5. 2 X TNC Connectors for antenna connection (1 x 1 meter, 1 x 0.5 meters)
6. 25 pin D-Type (unscreened) 1.5 meters
7. 9 pin D-Type Maintenance/Troubleshooting port with no typical usage
8. Ethernet 10B/T (unscreened) 2 meters

3.6. Test Configurations

Test configurations

Operating Channel (RFID)	Frequencies (MHz)	Operating Channel (RFID)	Frequencies (MHz)
1	902.75	1	902.75
26	915.25	26	915.25
50	927.25	50	927.25

Results for the above configurations are provided in this report.

3.7. Equipment Modifications

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

1. Radiated Emission

   Problem
   EUT radiated emissions were found to radiated in excess of Class A from the Class II laser

   Solution to bring into compliance - Description of changes

   Step 1: The metal housing of the laser device works as a Faraday cage. The cable length of the bypass capacitor has been reduced to avoid a antenna-like structure within this Faraday cage.

   Step 2: Further optimization of the filter structure solved the remaining noise issue.

   Damping of the new filter structure has increased by about 20dB. The device now complies with Class A limits.

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

4. TEST SUMMARY

List of Measurements

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

915 MHz RFID Specific Test Headings

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(a)(1) **A8.1**	20 dB BW	20 dB Bandwidth	Conducted	Complies	5.1.1
15.247(a)(1) **A8.1**	Transmitter Channels	Channel Spacing	Conducted	Complies	5.1.2
15.247(a)(1) **A8.1**	Transmitter Channels	Number of Channels	Conducted	Complies	5.1.3.1
		Channel Occupancy	Conducted	Complies	5.1.3.2
15.247(b)(2) **A8.4**	Output Power	Transmit Power	Conducted	Complies	5.1.4
15.247(i) **5.5**	Maximum Permissible Exposure	Exposure to radio frequency energy levels	Conducted	Complies	5.1.5
15.247(d) **A8.5**	Conducted Spurious Emissions	Band Edge	Conducted	Complies	5.1.6
		Spurious Emissions Transmitter (1 to 10 GHz)	Conducted	Complies	

List of Measurements

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

2.4 GHz WiFi Specific Test Headings

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(a)(2) **A8.2(1)** **4.4**	6 dB and 99 % Bandwidths	≥500 kHz	Conducted	Complies	5.2.1
15.247(b)(3) **15.31(e)** **A8.4(4)**	Peak Output Power Voltage Variation	Shall not exceed 1W Variation of supply voltage 85 % -115 %	Conducted	Complies	5.2.2
15.247(e) **A8.2**	Peak Power Spectral Density	Shall not be greater than +8 dBm in any 3 kHz band	Conducted	Complies	5.2.3
15.247(d) **15.205 /** **15.209** **A8.5** **2.2** **4.7**	Spurious Emissions (30MHz - 26 GHz)	The radiated emission in any 100 kHz of out-band shall be at least 20 dB below the highest in-band spectral density	Conducted	Complies	5.2.4

List of Measurements

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

Common Test Headings

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(d) **15.205** **15.209** **A8.5** **2.2** **2.6** **4.9**	Transmitter Radiated Spurious Emissions (above 1GHz)	Transmitter	Radiated	Complies	5.1.7
4.10 **§7.2.3**		Standby	Radiated	Complies	5.1.8
15.247(d) **15.205** **15.209** **A8.5** **2.2** **2.6**	Radiated Emissions below 1 GHz	Battery operated + ac/dc converter operated	Radiated	Complies (Class A)	5.1.9
15.207 **7.2.2**	Conducted	AC Wireline Conducted Emissions	Conducted	N/A Battery Operated	5.1.10

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

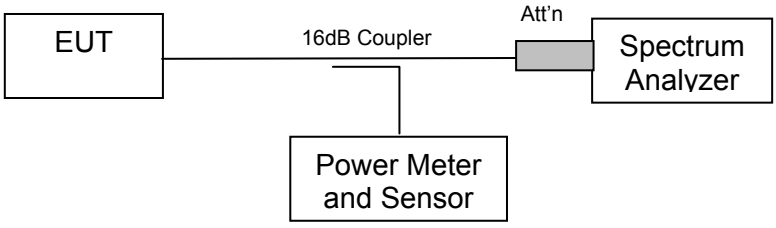
5.1. 915 MHz RFID Device Characteristics

5.1.1. 20 dB Bandwidth

FCC, Part 15 Subpart C §15.247(a)(1)
Industry Canada RSS-210 §A8.1

Test Procedure
The 20 dB bandwidth was 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.

Test Measurement Set up



Measurement set up for 20 dB bandwidth test

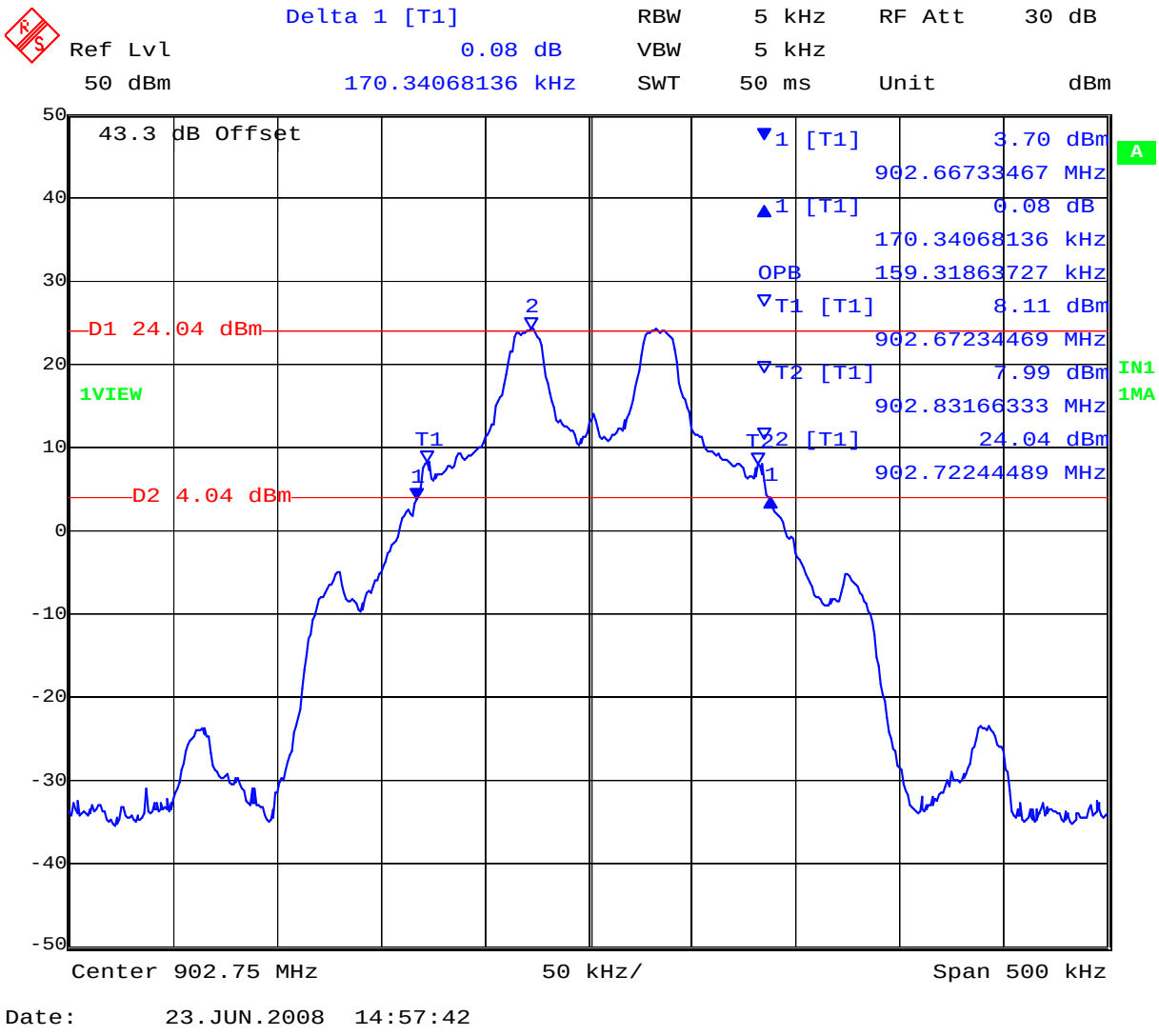
Test Results for 20 dB Bandwidth

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

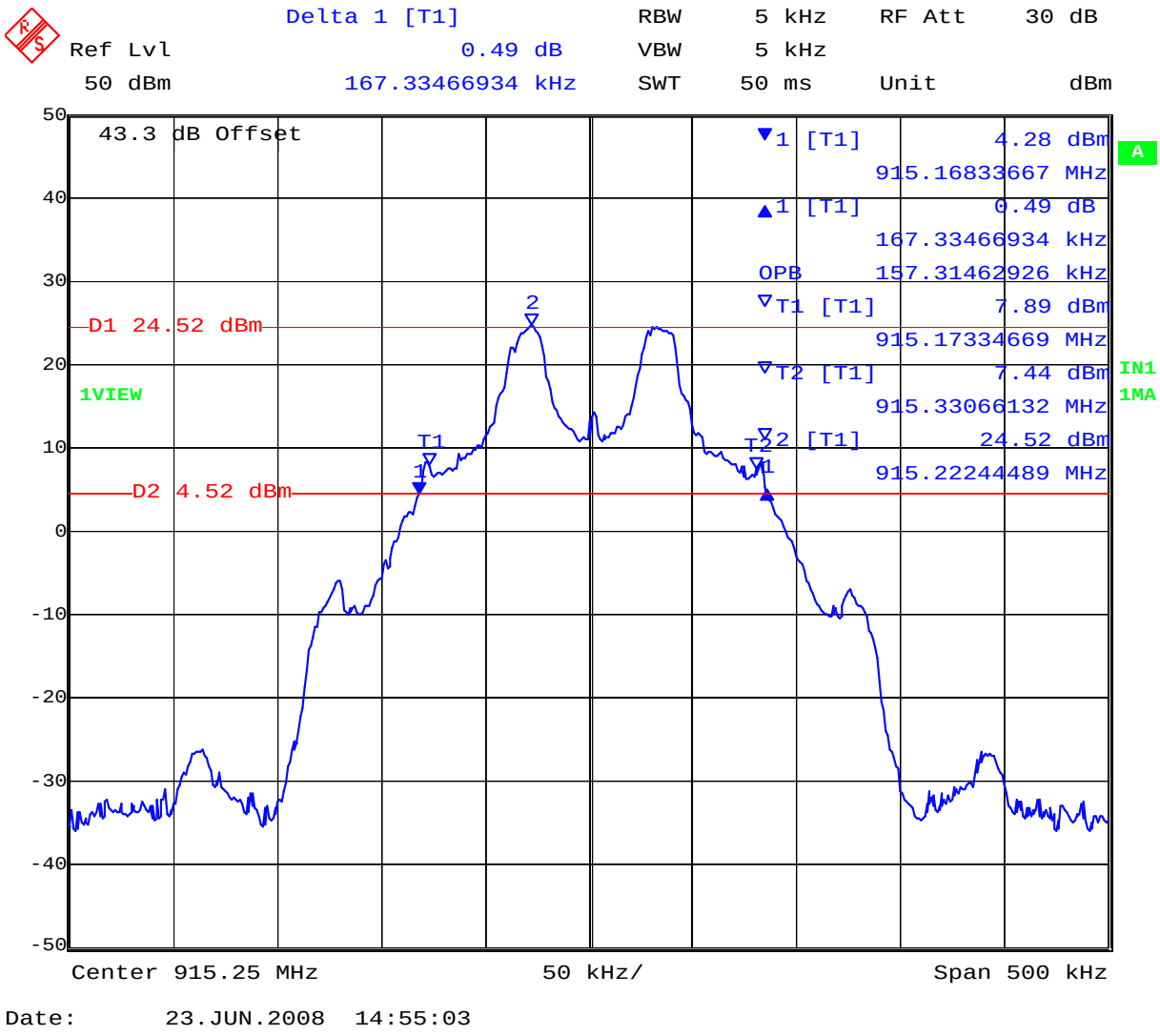
TABLE OF RESULTS

Channel #	Center Frequency (MHz)	20 dB Bandwidth (kHz)	Specification
1	902.75	170.341	If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies # of hopping frequencies = 50
25	915.25	167.335	
50	927.25	167.335	

CH 1 902.75 MHz 20 dB Bandwidth



CH 25 915.25 MHz 20 dB Bandwidth



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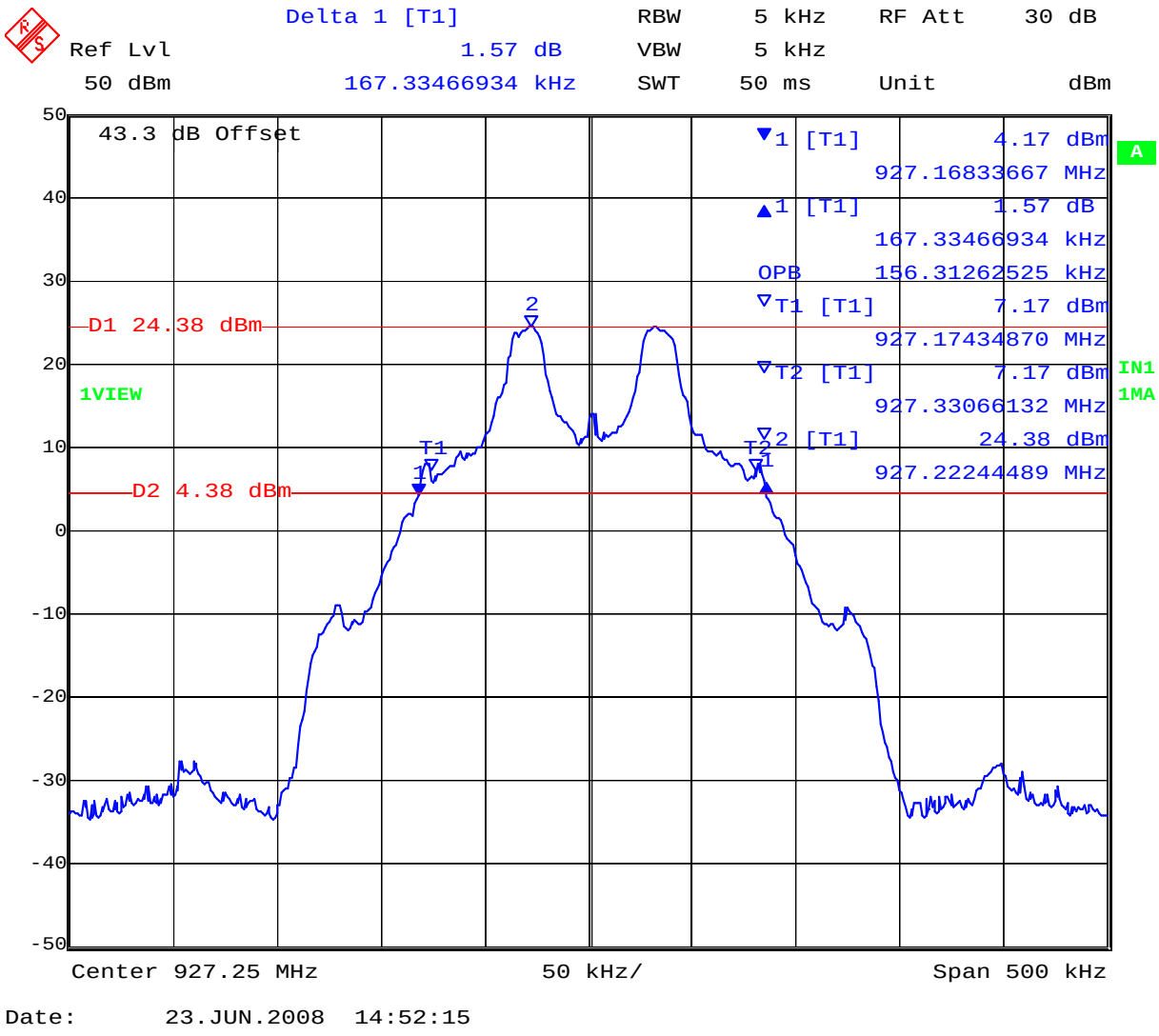
CH 50 927.25 MHz 20 dB Bandwidth



Specification

Limits

FCC §15.247 (a)(1)
Industry Canada RSS-210 §8.1

(i) 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.

(ii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

(iii) Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

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

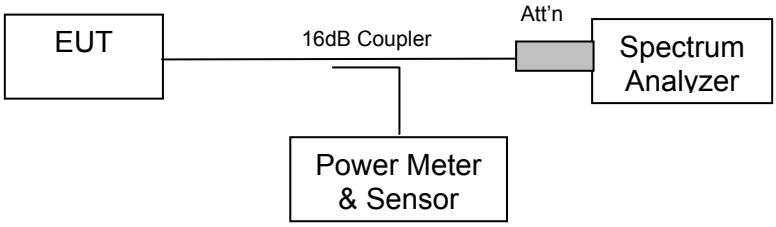
5.1.2. Transmitter Channels - Channel Spacing

FCC, Part 15 Subpart C §15.247(a)(1)
Industry Canada RSS-210 §8.1(2)

Test Procedure

The channel spacing 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.

Test Measurement Set up



Measurement set up for Channel Spacing Test

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

TABLE OF RESULTS

Channel(s)	Channel Spacing (kHz)	Specification
25-26	501.002	Greater than maximum 20 dB Bandwidth

Channel Spacing

Specification for Channel Spacing

Limits

FCC §15.247 (a)(1)
Industry Canada RSS-210 §A8.1(2)

(1) 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. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo-randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

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, 0158, 0184, 0193, 0250,0252 0310, 0312.

5.1.3. Transmitter Channels

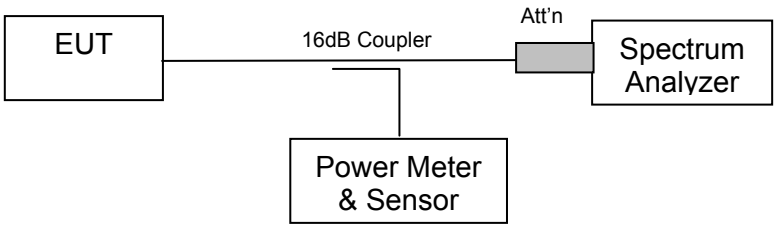
5.1.3.1. Number of Channels

FCC, Part 15 Subpart C §15.247(a)(1)
Industry Canada RSS-210 §A8.1

Test Procedure

The number of channels and channel occupancy 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.

Test Measurement Set up



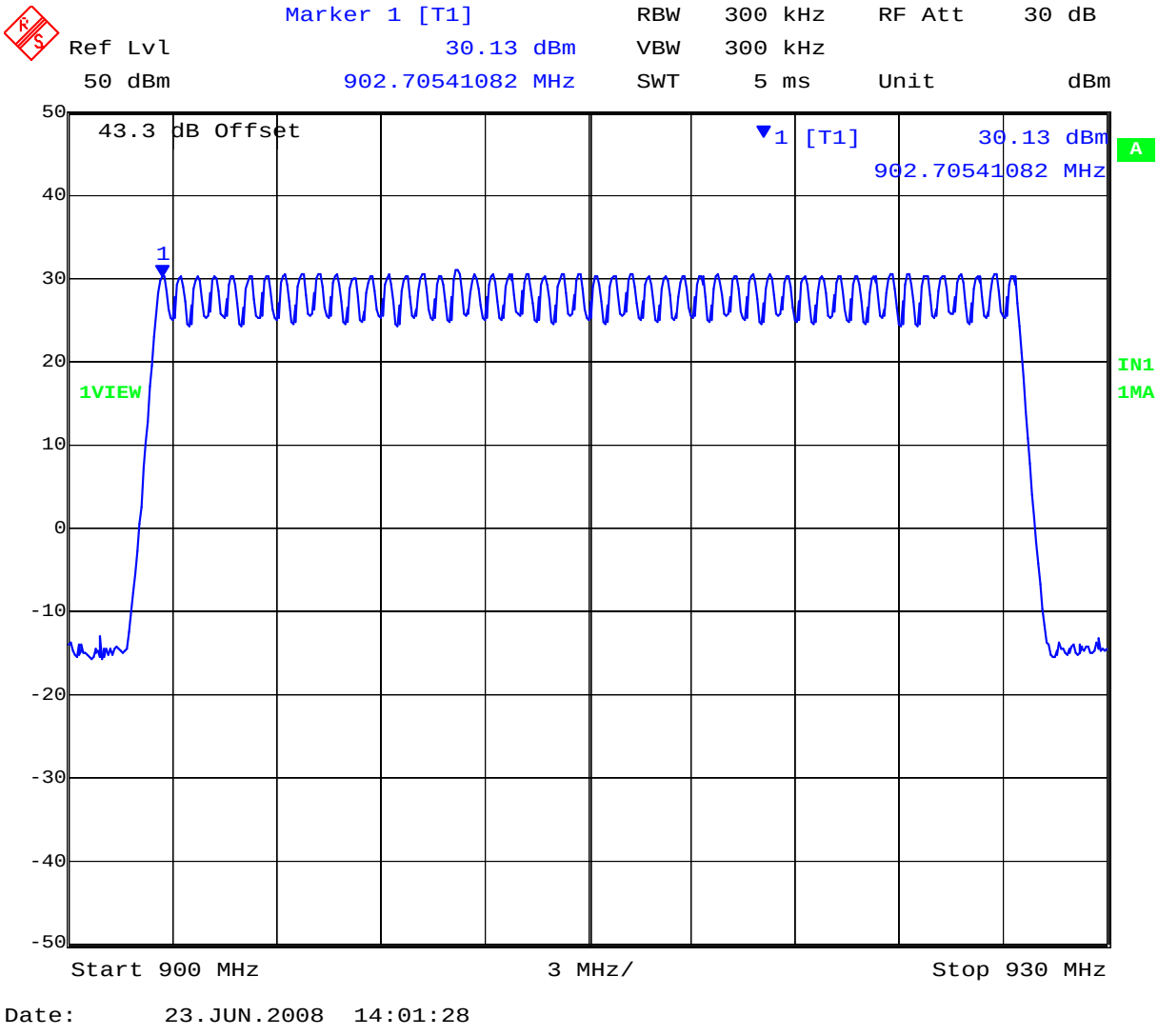
Test set up to measure the number of channels and channel occupancy

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

TABLE OF RESULTS

Number of Channels	Specification
50	If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies

Number of Transmission Channels



5.1.3.2. Channel Occupancy

FCC, Part 15 Subpart C §15.247(a)(1)
Industry Canada RSS-210 §A8.1

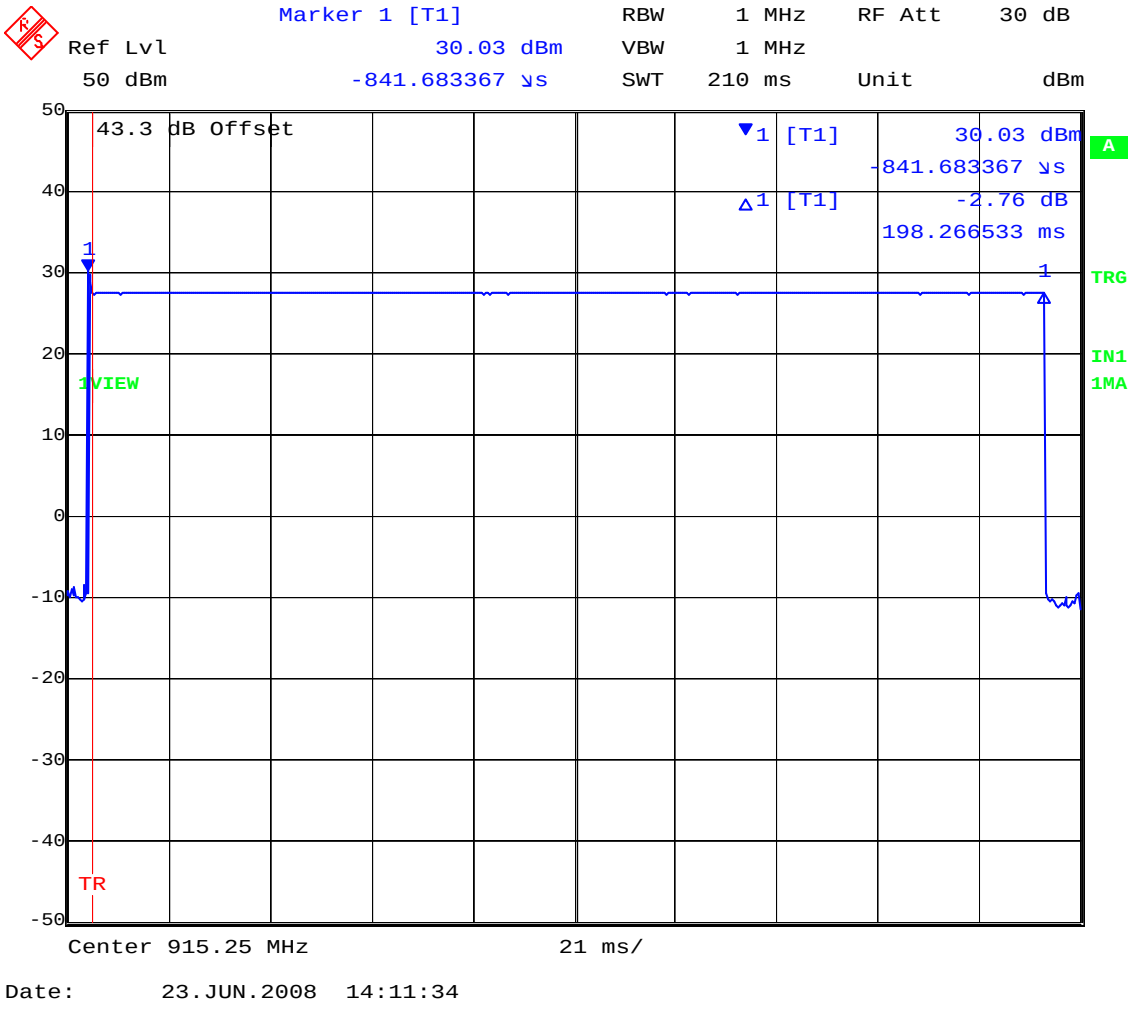
Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

Channel Dwell Time

TABLE OF RESULTS

Channel #	Center Frequency (kHz)	Channel Dwell Time (single channel) (mSecs)
26	915.75	198.2665

Channel dwell time Ch

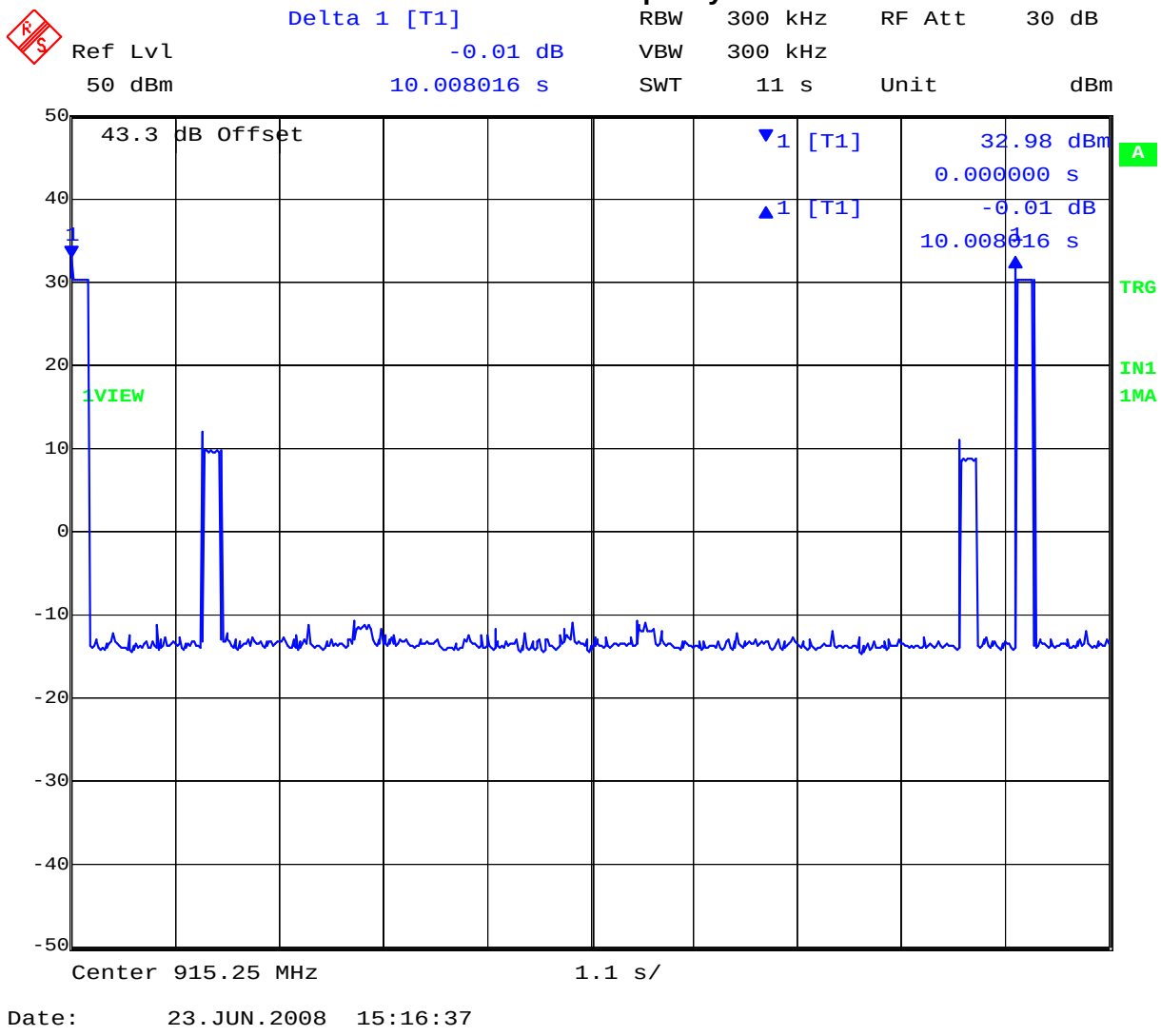


Channel Occupancy

TABLE OF RESULTS

Channel #	Center Frequency (MHz)	Channel Occupancy (Seconds)
26	915.25	10.008016

Channel Occupancy



Average Time of Occupancy = dwell time * number of times channel occupied in 20 secs
= 0.1982665 mS * 2 = 0.396533 S

Specification for Number of Channels and Channel Occupancy

Limits

FCC, Part 15 Subpart C §15.247(a)(1)
Industry Canada RSS-210 §A8.1

(i) 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.

(ii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

(iii) Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

Laboratory Uncertainty for Frequency Measurements

Measurement uncertainty	±0.86ppm

Traceability

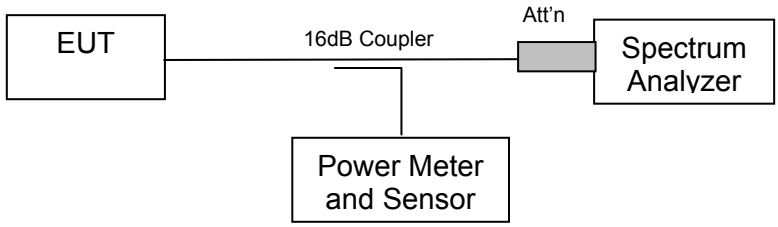
Method	Test Equipment Used
Measurements were made per work instruction WI-02 ‘Frequency Measurement”	0078, 0134, 0158, 0184, 0193, 0250, 0252 0310, 0312.

5.1.4. Output Power

FCC, Part 15 Subpart C §15.247(b)(2)
Industry Canada RSS-210 §A8.4

Test Procedure
The transmitter terminal of EUT was set for CW (continuous wave) operation and connected to the input of the power meter which was calibrated to measure power. The value of measured power including antenna cable loss was reported.

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

Antenna Gain – 6 dBi

TABLE OF RESULTS

Channel #	Center Frequency (MHz)	Modulated Power			CW Power		
		(mW)	(dBm)	EIRP (dBm)	(mW)	(dBm)	EIRP (dBm)
0	902.75	648.63	+28.12	+34.12	924.70	+29.66	+35.66
26	915.25	639.73	+28.06	+34.06	950.60	+29.78	+35.78
50	927.25	638.26	+28.05	+34.05	954.99	+29.80	+35.80

Specification

Limits

FCC, Part 15 Subpart C §15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

(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.

Industry Canada RSS-210 §A8.4 Transmitter Output Power & EIRP Requirements
(1) For frequency hopping systems operating in the band 902-928 MHz, the maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p. shall not exceed 4 W, if the hopset uses 50 or more hopping channels; the maximum peak conducted output power shall not exceed 0.25 W, and the e.i.r.p. shall not exceed 1 W, if the hopset uses less than 50 hopping channels.

(2) For frequency hopping systems operating in the band 2400-2483.5 MHz employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W. Except as provided in Section A8.4(5), the e.i.r.p. shall not exceed 4W.

(3) For frequency hopping systems operating in the band 5725-5850 MHz, the maximum peak conducted output power shall not exceed 1 W. Except as provided in Section A8.4(5), the e.i.r.p. shall not exceed 4 W.

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. Maximum Permissible Exposure

FCC, Part 15 Subpart C §15.247(i)
Industry Canada RSS-Gen §5.5

Calculations for Maximum Permissible Exposure Levels

Power Density = Pd (mW/cm^2) = $EIRP/(4\pi d^2)$

EIRP = P * G

P = Peak output power (mW)

G = Antenna numeric gain (numeric)

d = Separation distance (cm)

Numeric Gain = 10 ^ (G (dBi)/10)

Although the Mobil UHF Reader System has two 915 MHz antennas only one is used for transmitting purposes.

Because the EUT belongs to the General Population/Uncontrolled Exposure the limit of power density is 1.0 mW/cm^2

Freq. Band (MHz)	Antenna Gain (dBi)	Numeric Gain (numeric)	Peak Modulated O/P Power (dBm)	Peak Output Power (mW)	Calculated Safe Distance @ 1mW/cm² Limit(cm)	Minimum Separation Distance (cm)
915	6	3.981	+28.12	648.63	14.33	20

*Note: for mobile or fixed location transmitters the minimum separation distance is 20cm, even if calculations indicate the MPE distance to be less.

Specification

Maximum Permissible Exposure Limits

§15.247(i) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency levels in excess of the Commission's guidelines.

FCC §1.1310 Limit = 1mW / cm^2 from 1.310 Table 1

RSS-Gen §5.5 Before equipment certification is granted, the applicable requirements of RSS-102 shall be met.

Laboratory Measurement Uncertainty for Power Measurements

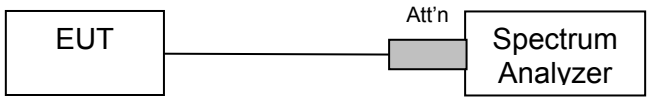
Measurement uncertainty	±1.33 dB

5.1.6. Conducted Spurious Emissions Transmitter

FCC, Part 15 Subpart C §15.247(d)
Industry Canada RSS-210 §A8.5

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

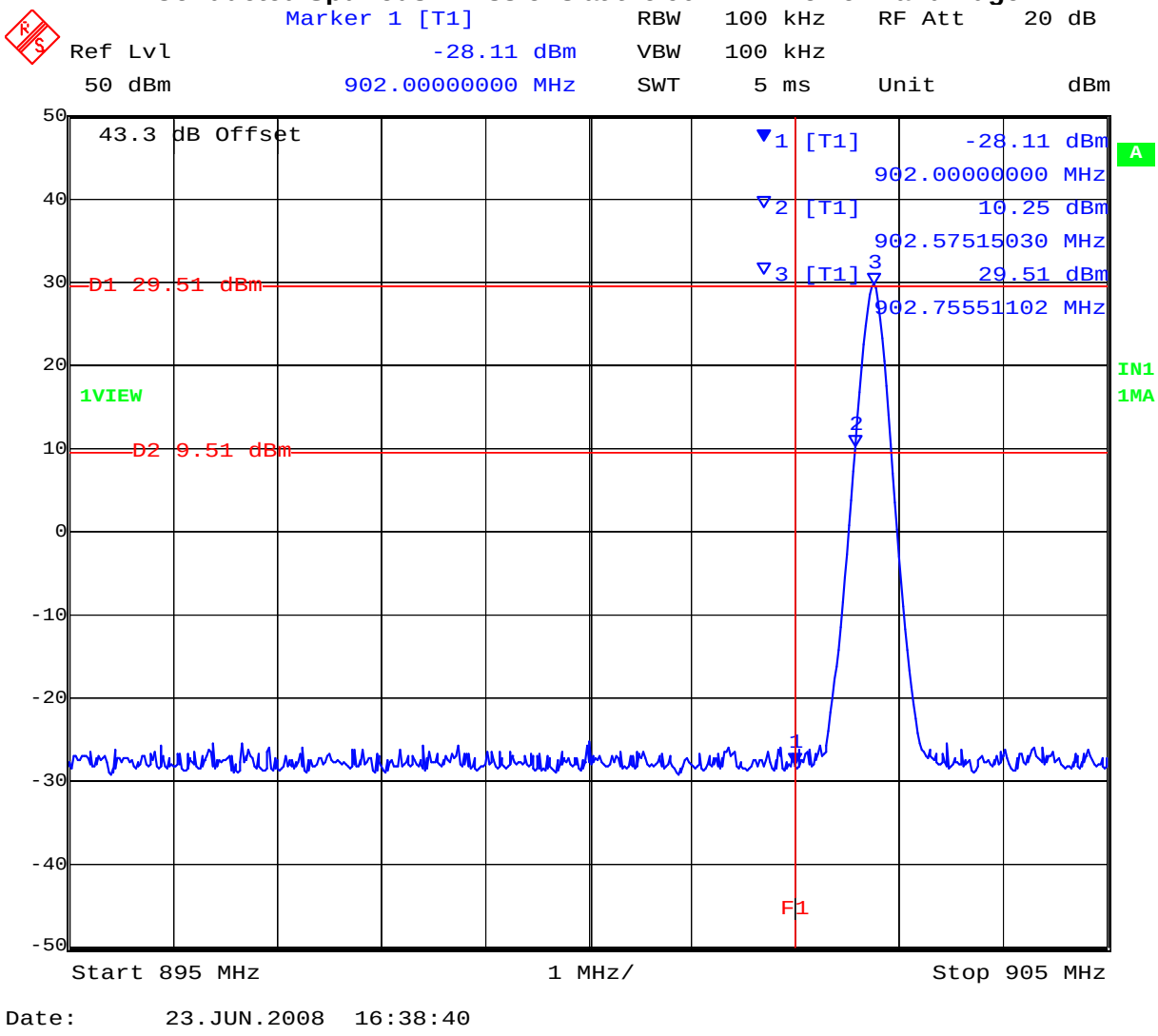
Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

Conducted Band-Edge Results

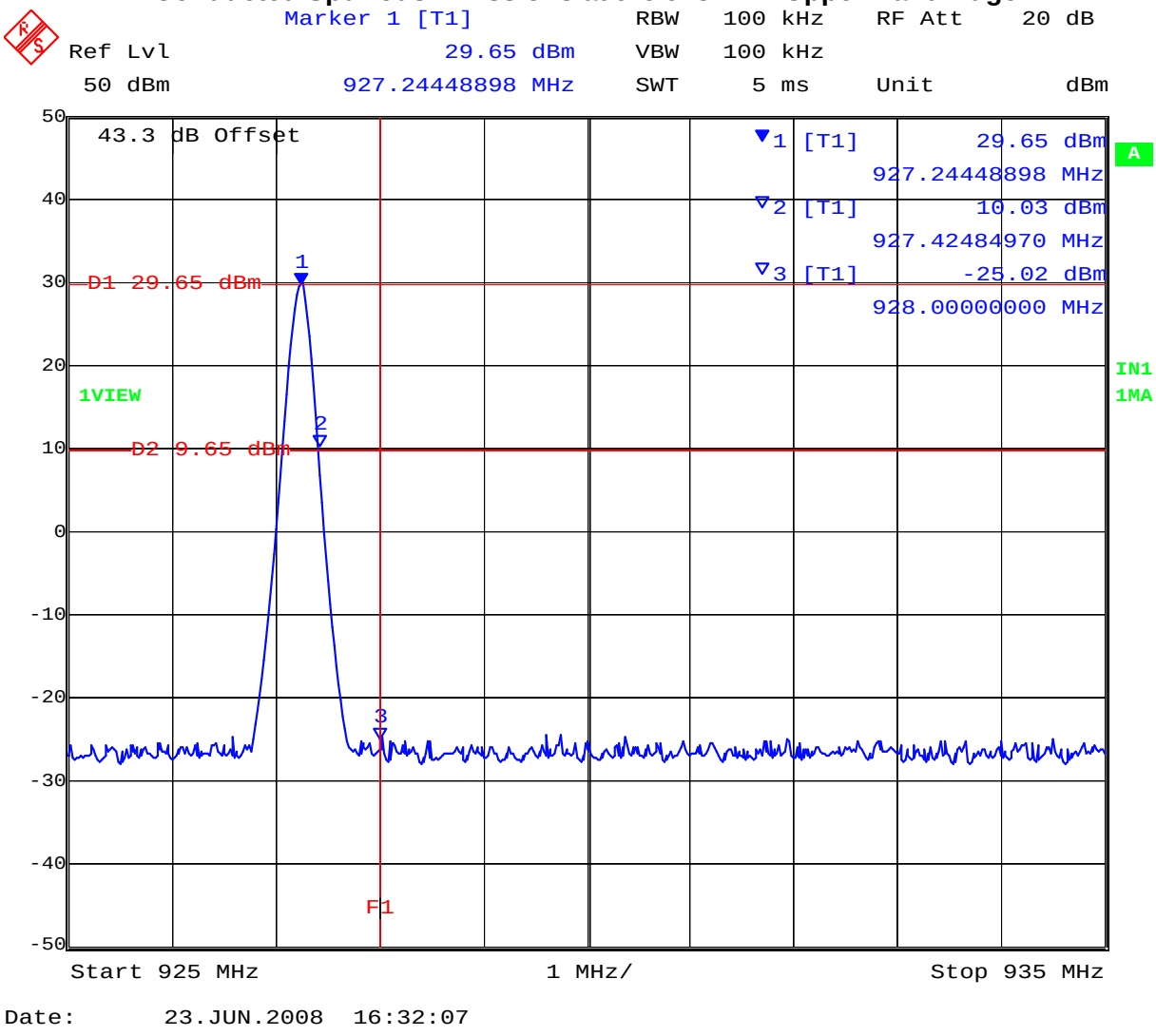
TABLE OF RESULTS

Channel #	Center Frequency (MHz)	Band-edge Frequency (MHz)	Limit (dBm)	Amplitude @ Band-edge (dBm)	Margin (dB)
1	902.75	902.0	+9.51	-28.11	-37.62
50	927.25	928.0	+9.65	-25.02	-34.67

Conducted Spurious Emissions at the 902 MHz Lower Band Edge



Conducted Spurious Emissions at the 928 MHz Upper Band Edge



Spurious Emissions (0.03 - 26.5 GHz)

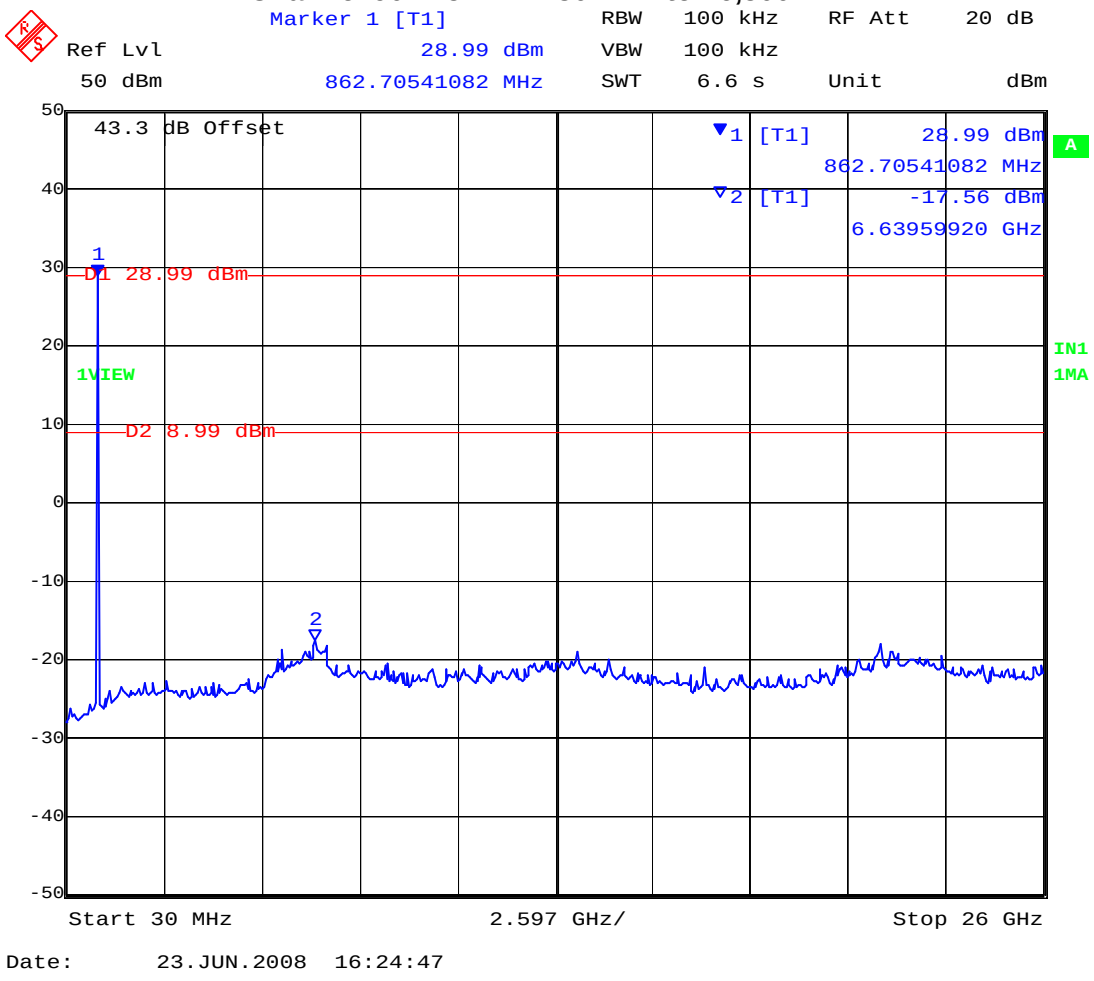
Conducted spurious emissions (0.03-26.5 GHz) are provided indicated by the following matrix. Measurements were performed with the transmitter tuned to the channel closest to the band-edge being measured. All emissions were maximized during measurement. Limits which were derived from the band-edge measurements provided below are drawn on each plot.

TABLE OF RESULTS

Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
902.75	30	26,500	-17.56	+8.99	-26.55

The emission breaking the limit line is the carrier.

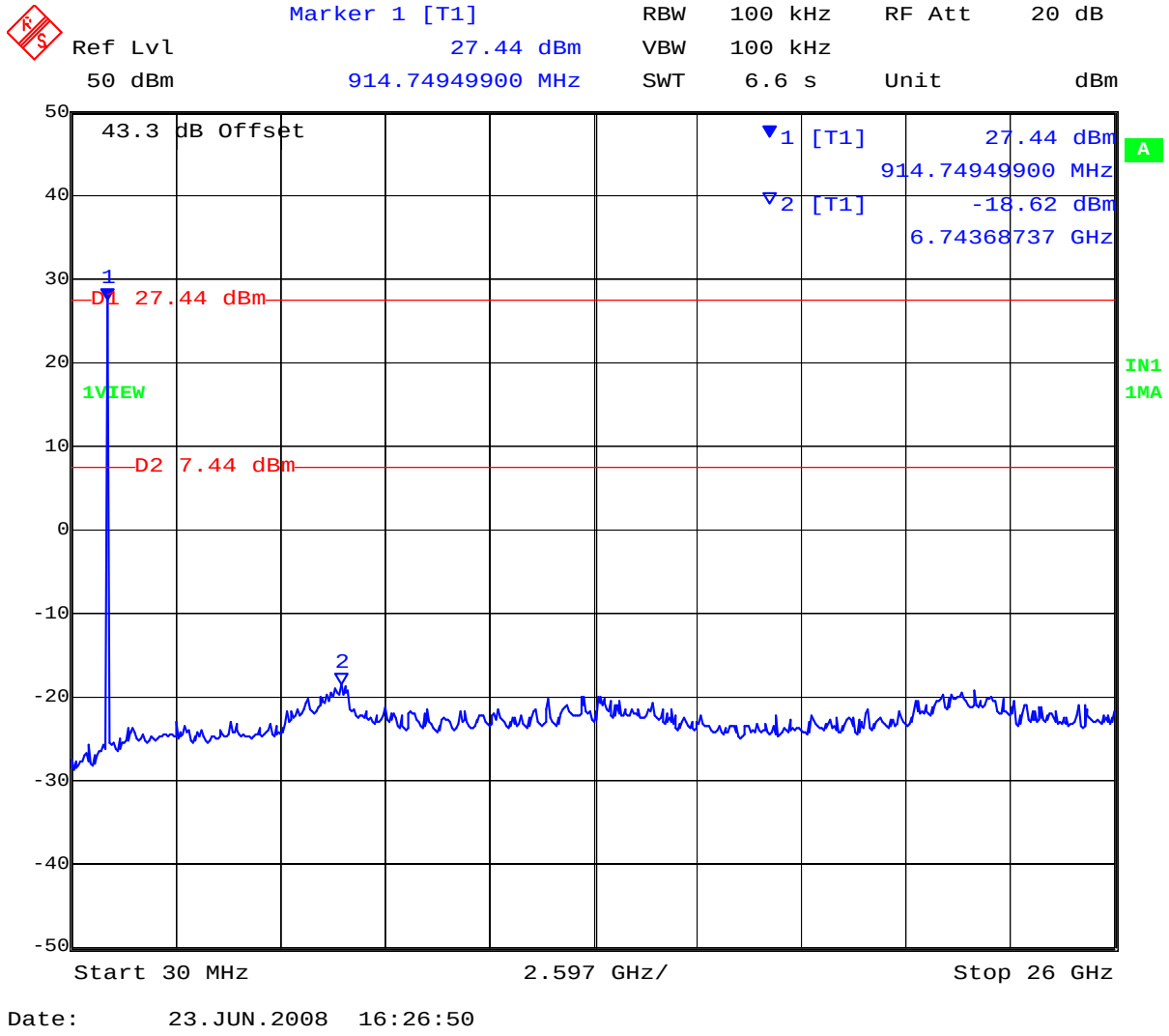
Conducted Transmitter Spurious Emissions
Channel 902.75 MHz - 30 MHz to 26,500 MHz



Mid Channel

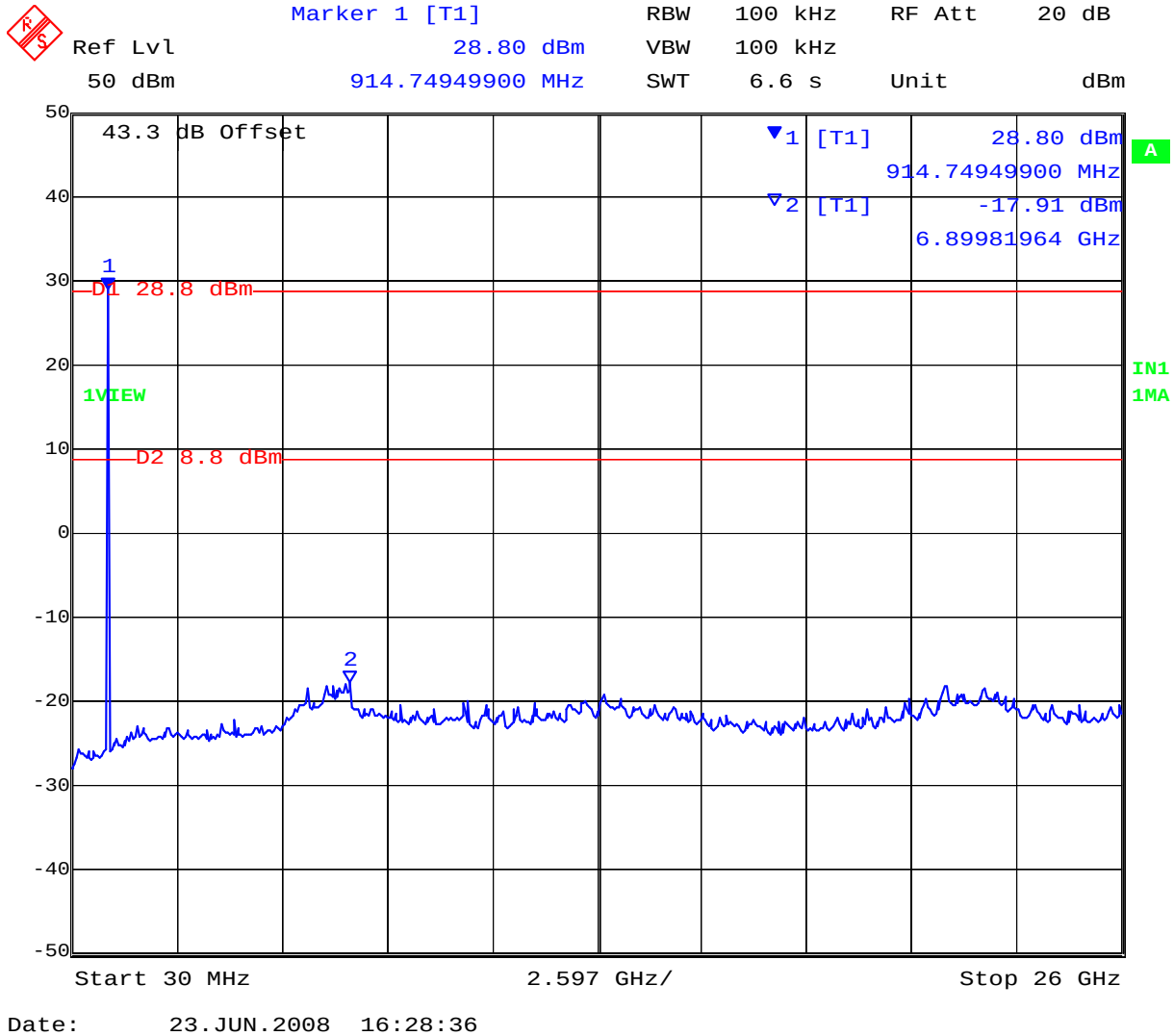
Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
915.25	30	26,500	-18.62	+7.44	-26.06

Conducted Transmitter Spurious Emissions
Channel 915.25 MHz - 30 MHz to 26,500 MHz



Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
927.25	30	26,500	-17.91	+8.80	-26.71

Conducted Transmitter Spurious Emissions
Channel 927.25 MHz - 30 MHz to 26,500 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
2400 MHz	2483.5 MHz	≥ 20 dB

FCC, Part 15 Subpart C §15.247(d)

Industry Canada RSS-210 §A.5

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.

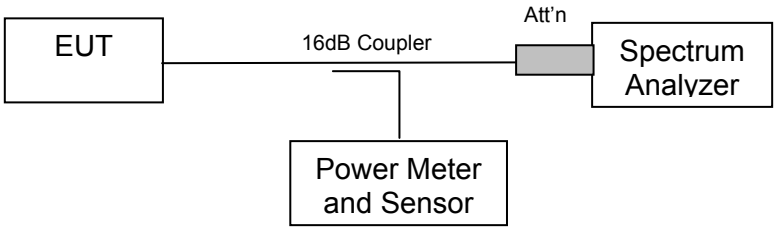
5.2. 2.4 GHz WiFi Device Characteristics

5.2.1. 6 dB and 99 % Bandwidth

FCC, Part 15 Subpart C §15.247(a)(2)
Industry Canada RSS-210 §A8.2
Industry Canada RSS-Gen §4.4

Test Procedure
The bandwidth at 6 dB and 99 % is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency. The analyzer was set for a 6 dB resolution bandwidth filter during this measurement.

Test Measurement Set up



Measurement set up for 6 dB and 99 % bandwidth test

Measurement Results for 6 dB and 99 % Operational Bandwidth(s)

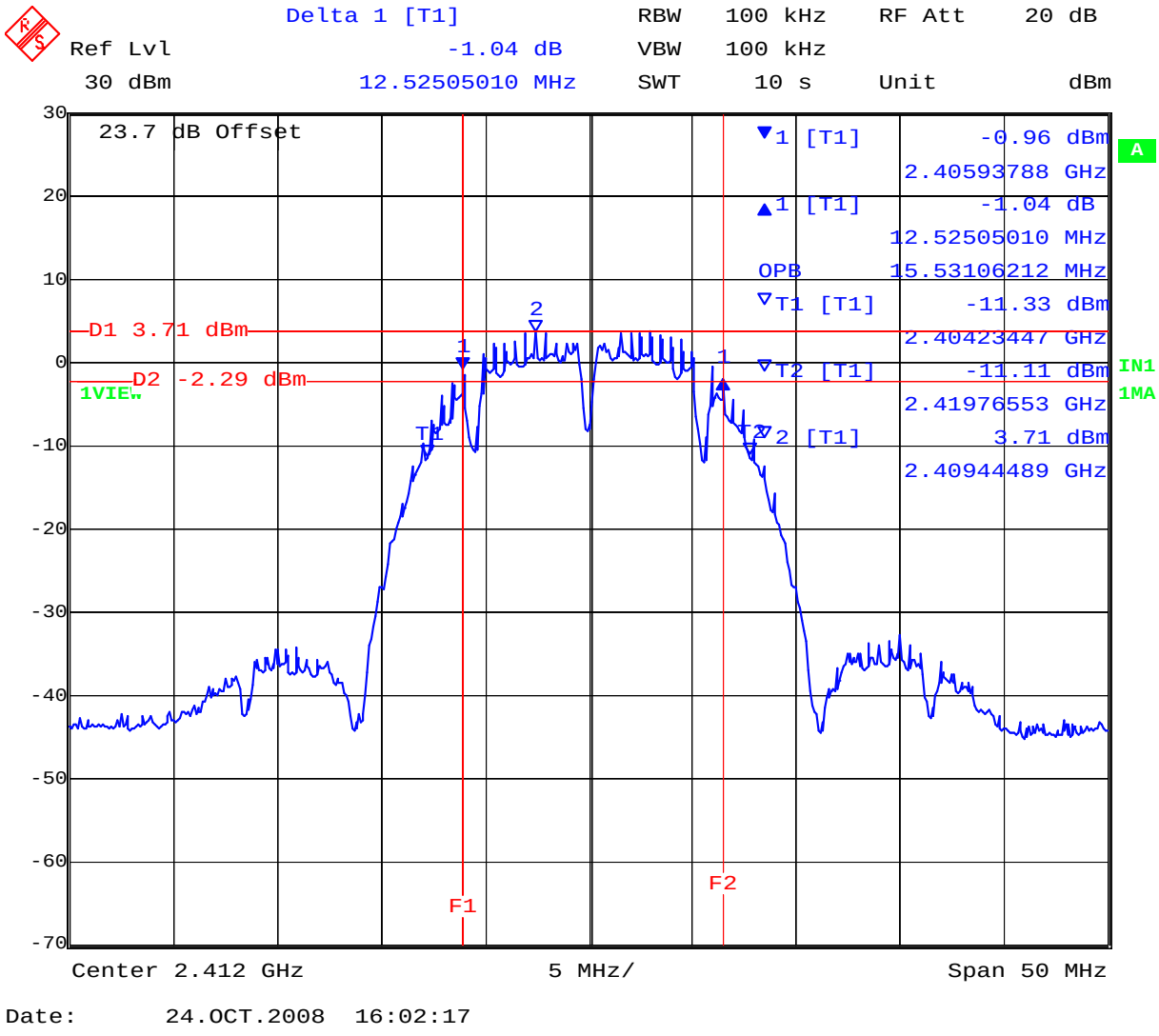
Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

TABLE OF RESULTS – 802.11b

Center Frequency (MHz)	6 dB Bandwidth (MHz)	99 % BW (MHz)
2412	12.525	15.531
2437	11.122	15.731
2462	11.022	15.531

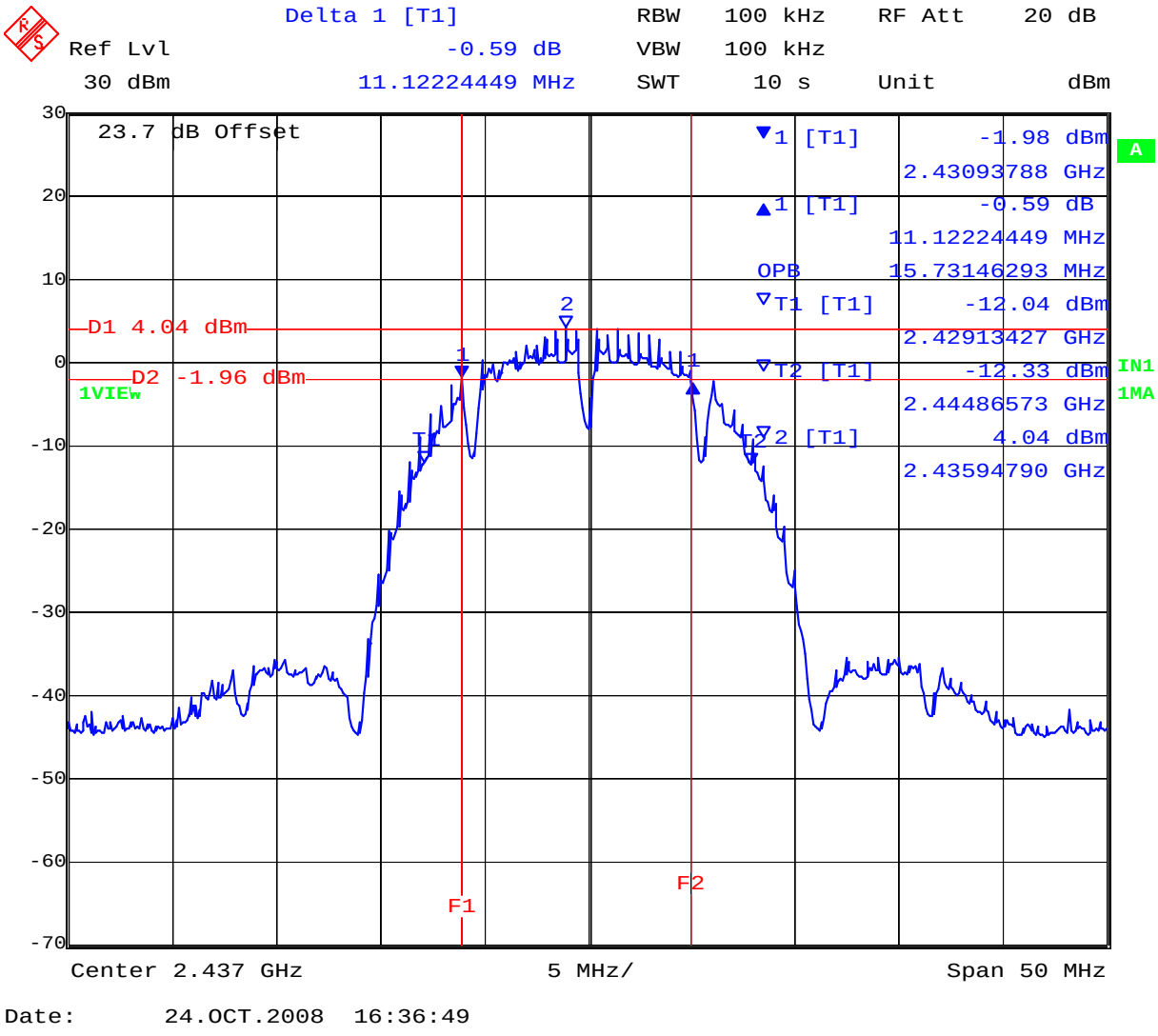
802.11b

2412 MHz 6 dB and 99% Bandwidth



802.11b

2437 MHz 6 db and 99 % Bandwidth



802.11b

2462 MHZ 6 dB and 99% Bandwidth

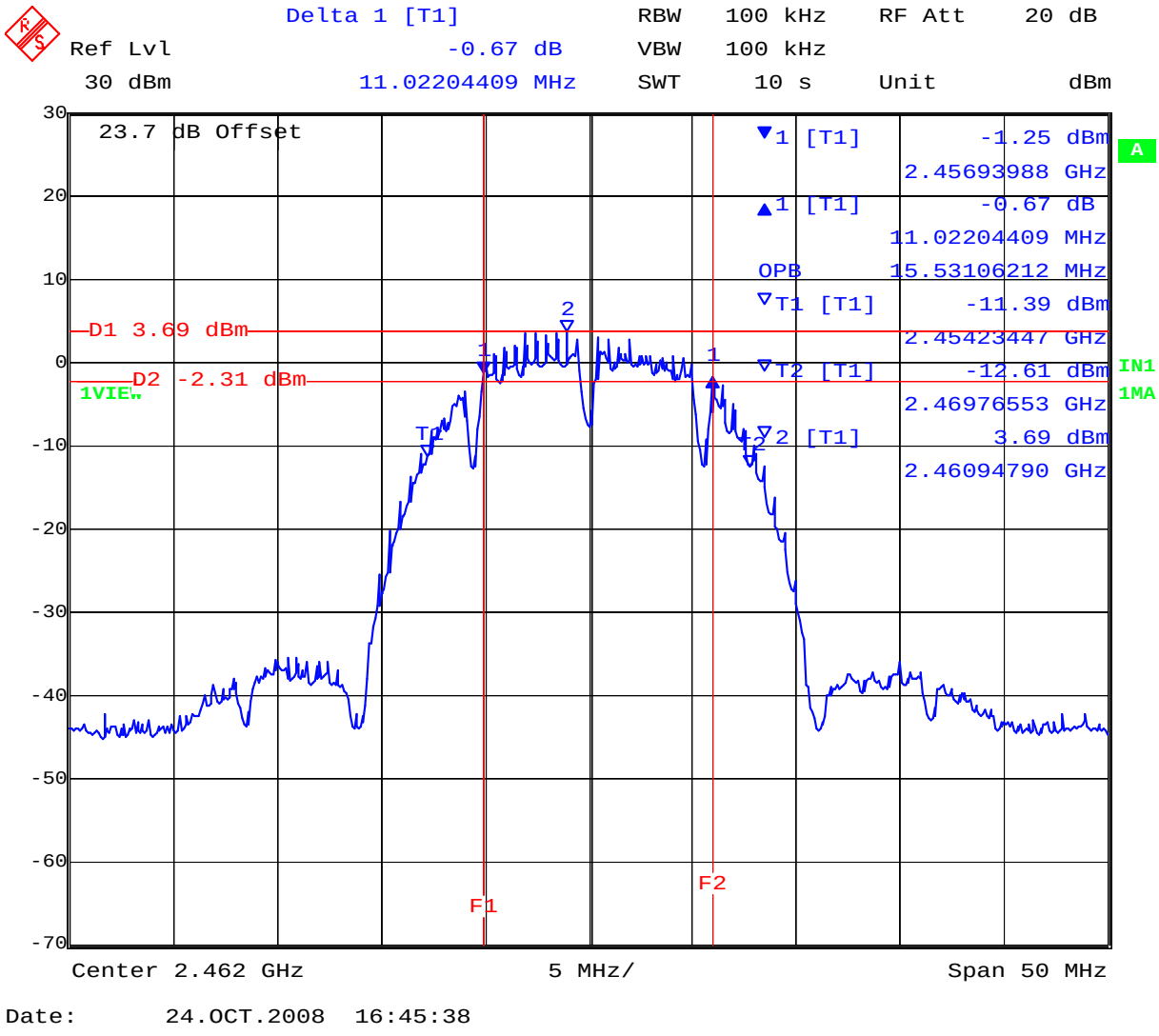
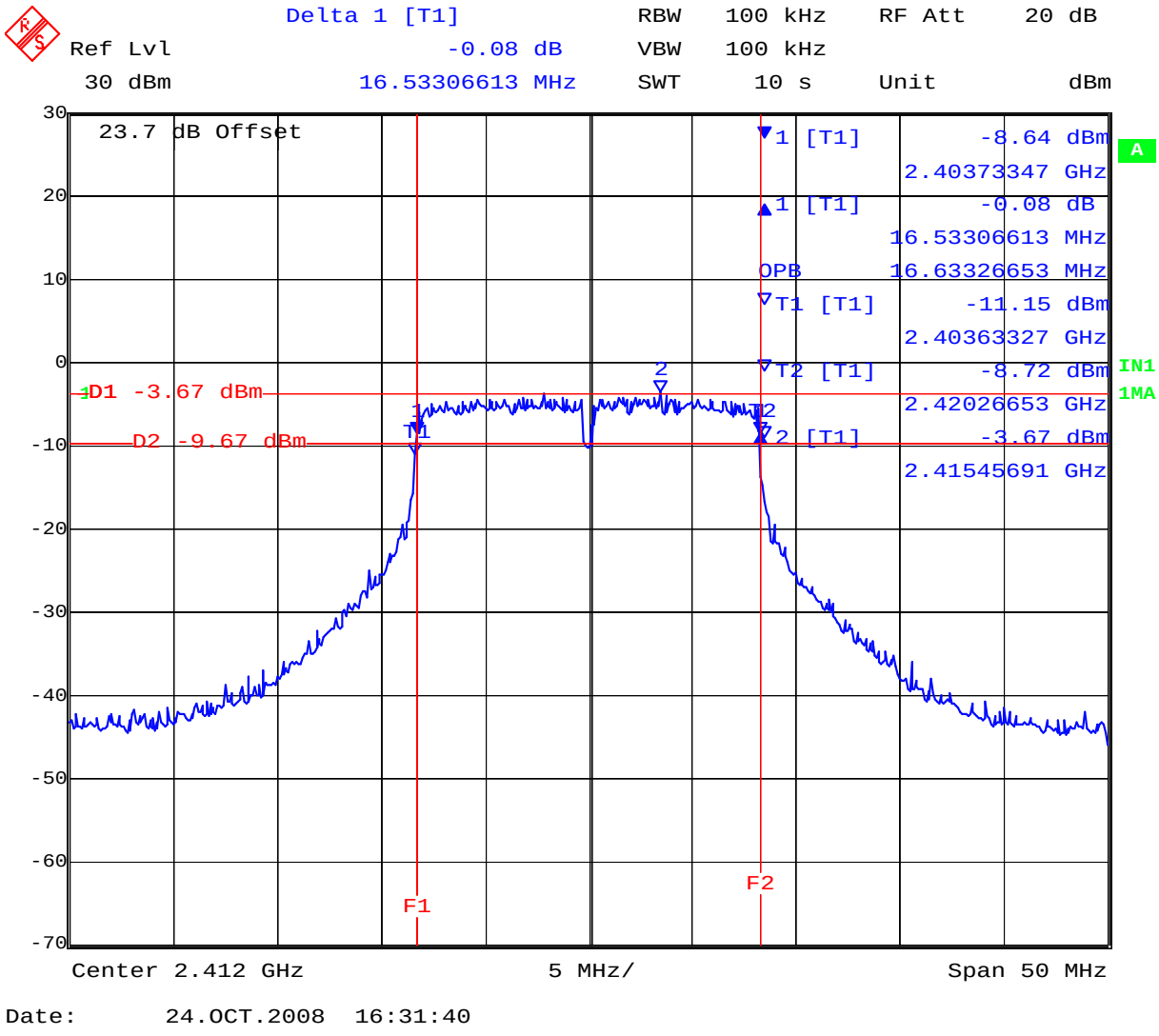


TABLE OF RESULTS – 802.11g

Center Frequency (MHz)	6 dB Bandwidth (MHz)	99 % BW (MHz)
2412	16.533	16.633
2437	16.633	16.633
2462	16.633	16.633

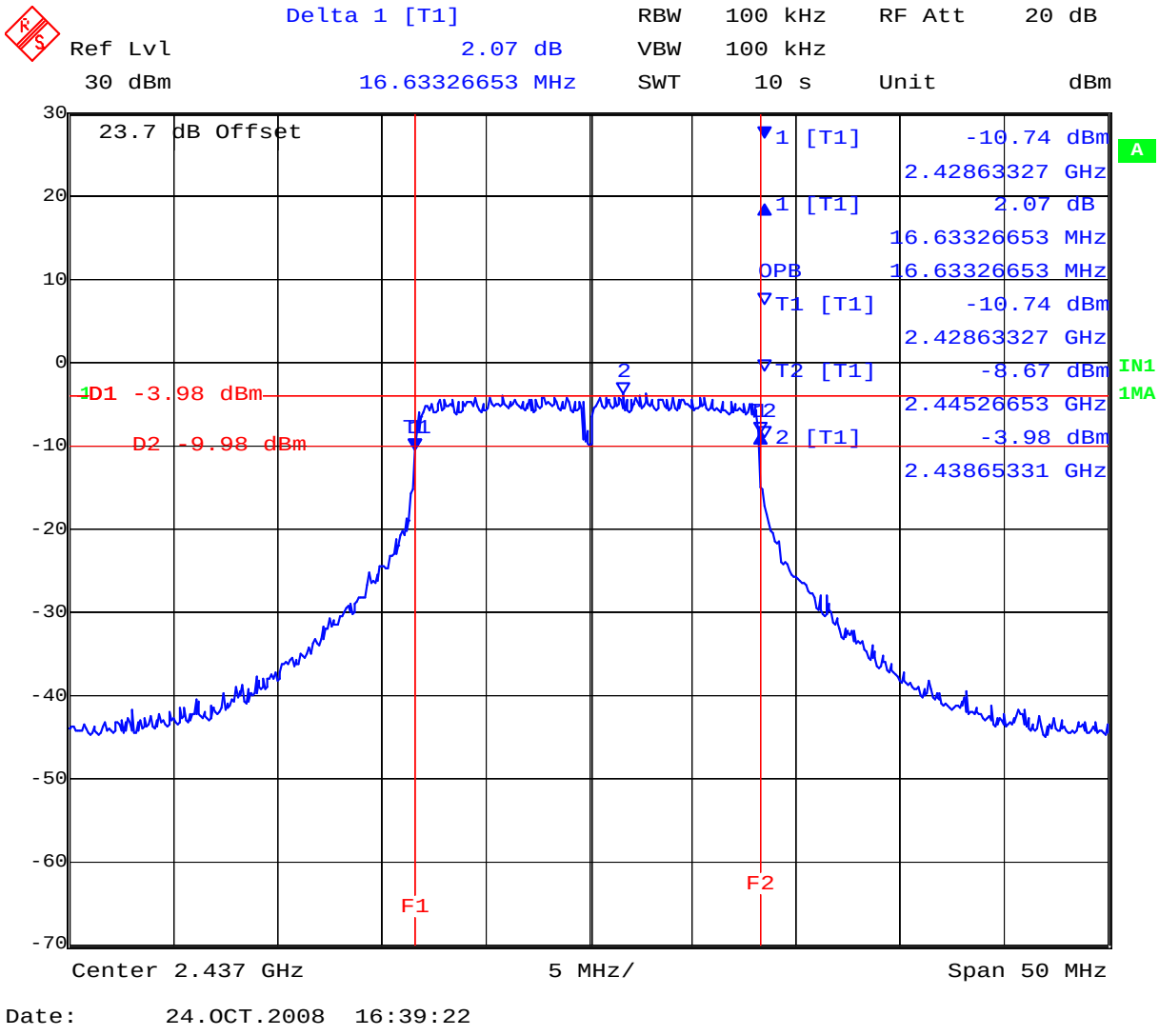
802.11g

2412 MHz 6 dB and 99% Bandwidth



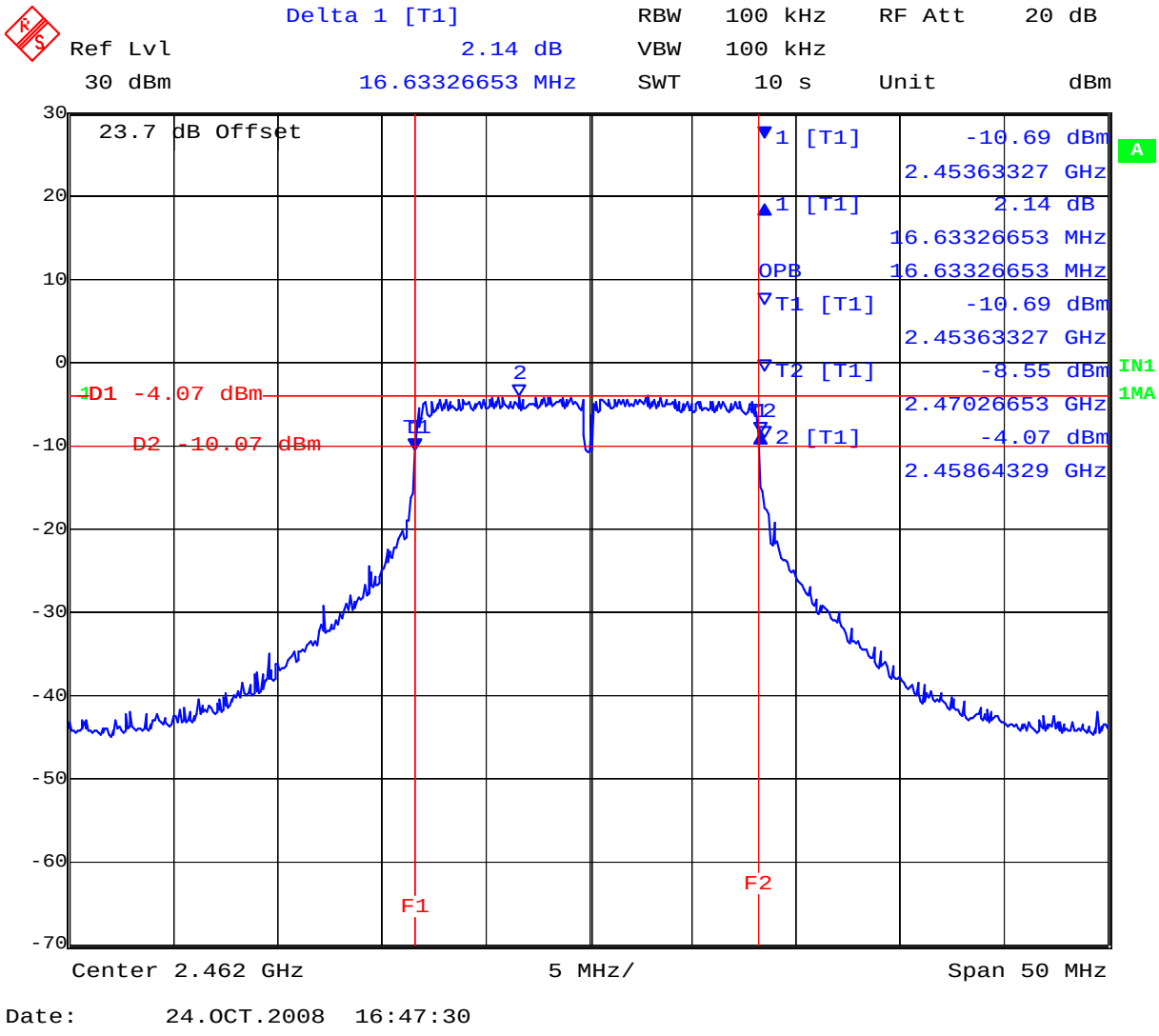
802.11g

2437 MHz 6 db and 99 % Bandwidth



802.11g

2462 MHZ 6 dB and 99% Bandwidth



Specification

Limits

§15.247 (a)(2) & RSS-210 §A8.2(1)
The minimum 6 dB bandwidth shall be at least 500 kHz.

§ IC RSS-Gen 4.4.1 Occupied Bandwidth When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.

§ IC RSS-Gen 4.4.2 6 dB Bandwidth Where indicated, the 6 dB bandwidth is measured at the points when the spectral density of the signal is 6 dB down from the in –band spectral density of the modulated signal, with the transmitter modulated by a representative signal.

Laboratory Measurement Uncertainty for Spectrum Measurement

Measurement uncertainty	±2.81 dB

Traceability

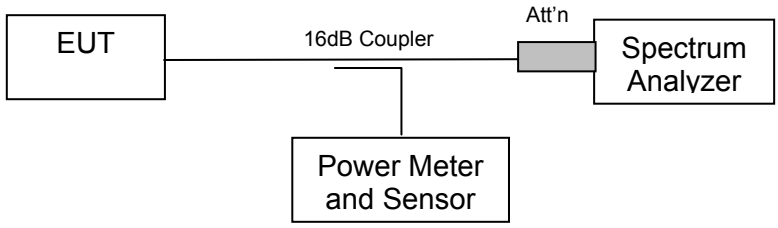
Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of RF Spectrum Mask'	0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117

5.2.2. Peak Output Power

FCC, Part 15 Subpart C §15.247(b)(3), §15.31(e)
Industry Canada RSS-210 §A8.4(4)

Test Procedure
The transmitter terminal of EUT was connected to the input of the spectrum analyzer set to measure peak power. The resolution filter bandwidth was set to 6 dB, peak detector selected and the analyzer built-in power function was used to measure peak power over the 99 % bandwidth. Initial measurements were employed to define which data rate provided the highest output power. Measurements were made while EUT was operating in a continuous transmission mode i.e. 100 % duty cycle at the appropriate center frequency.

Test Measurement Set up



Measurement set up for Transmitter Peak Output Power

15.247 (c) Operation with directional antenna gains greater than 6 dBi

(1) Fixed point –to-point operation:

(i) Systems operating in the 2400 – 2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725-5850 MHz band that are used exclusively for point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Antenna Type	Gain (dBi)	Antenna Gain >6dBi (dB)	Max. Allowable Peak Power (dBm)	Maximum EIRP (dBm)
Integral	1.7	No	30	36

Ambient conditions.

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

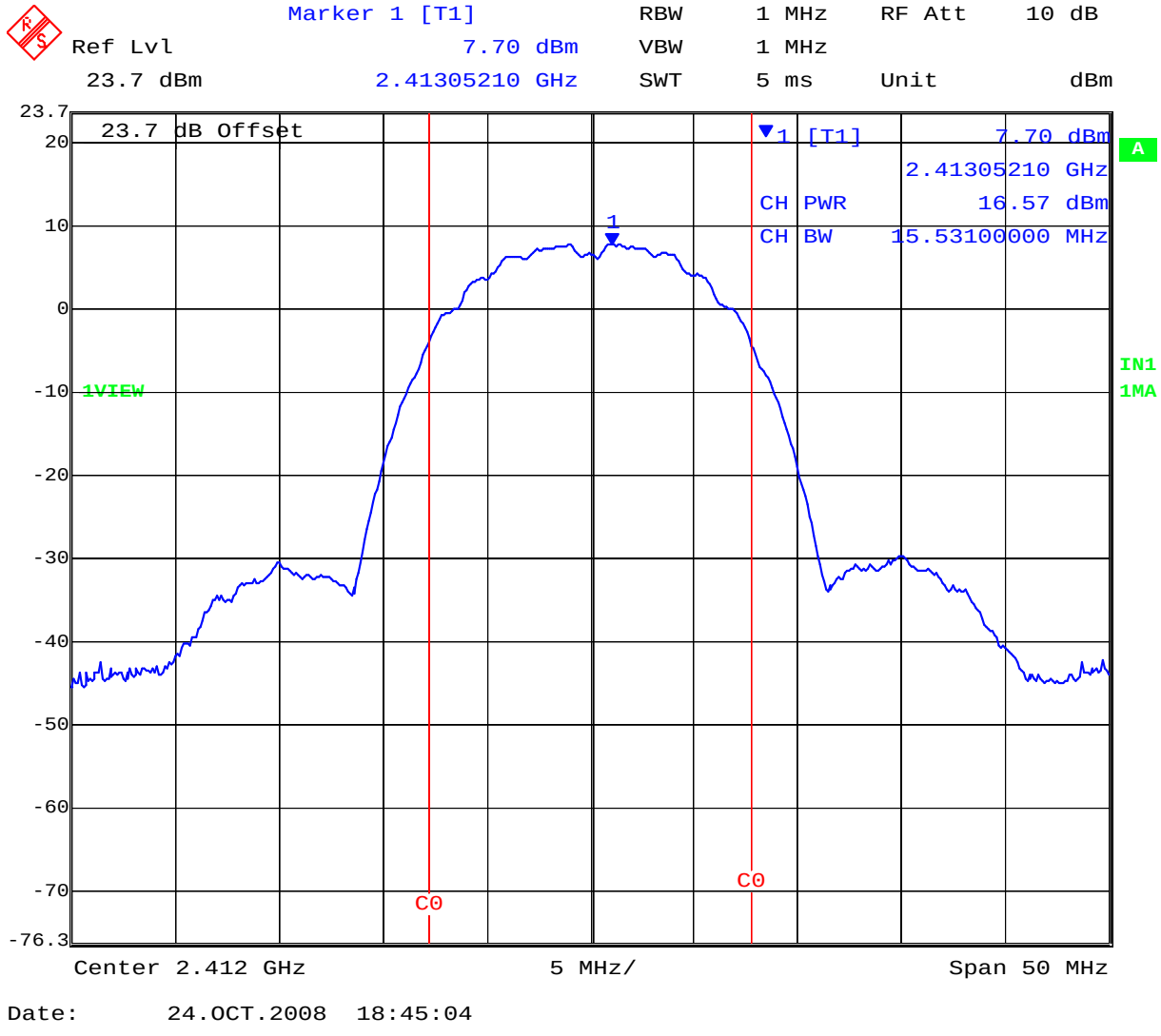
Antenna Gain: 1.7 dBi

TABLE OF RESULTS – 802.11b

Center Frequency (MHz)	99% Measurement Bandwidth (MHz)	Peak Power (dBm)	EIRP (dBm)
2412	15.531	+16.57	+18.27
2437	15.731	+16.66	+18.36
2462	15.531	+15.93	+17.63

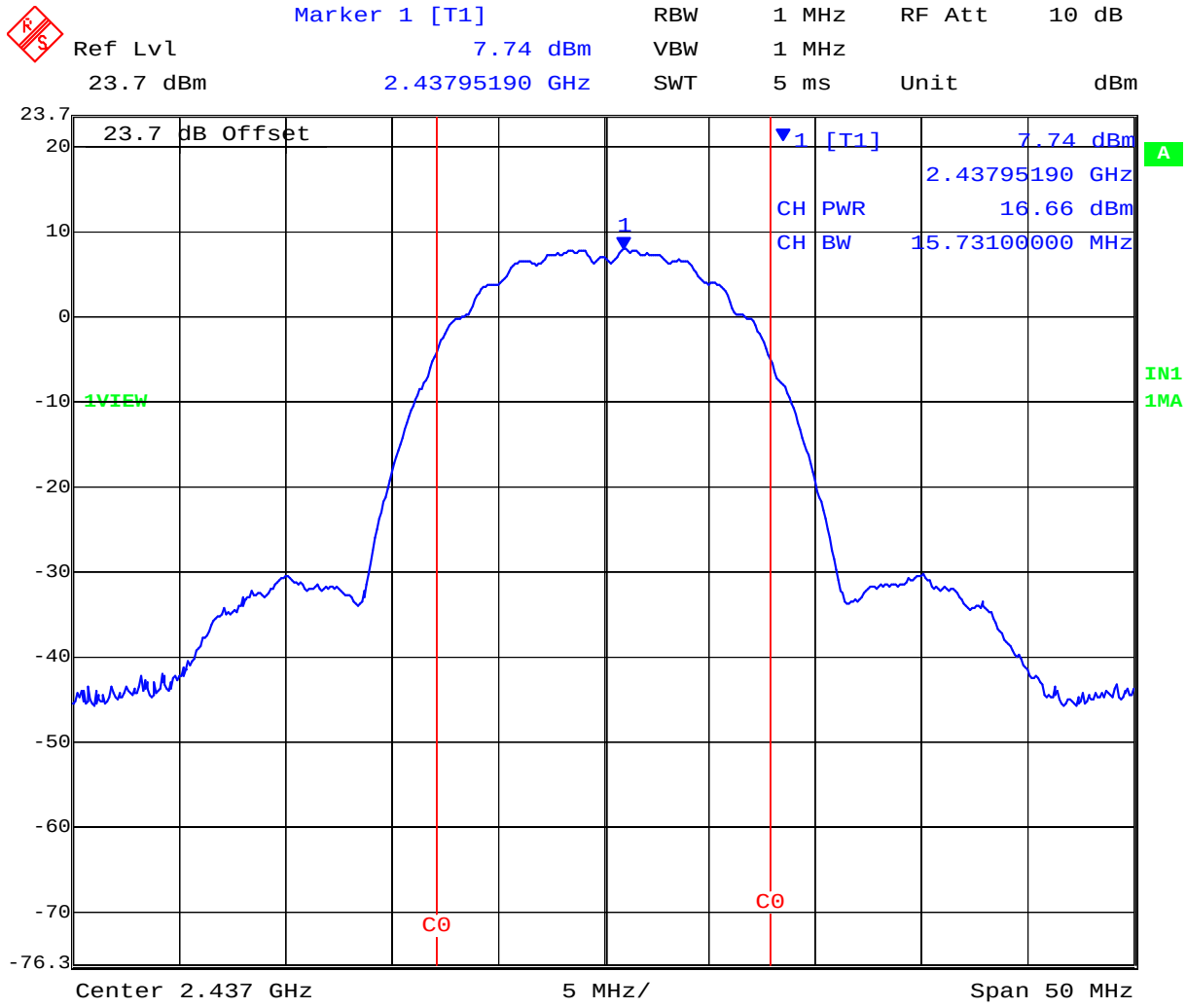
802.11b

2,412 MHz Peak Power (dBm)



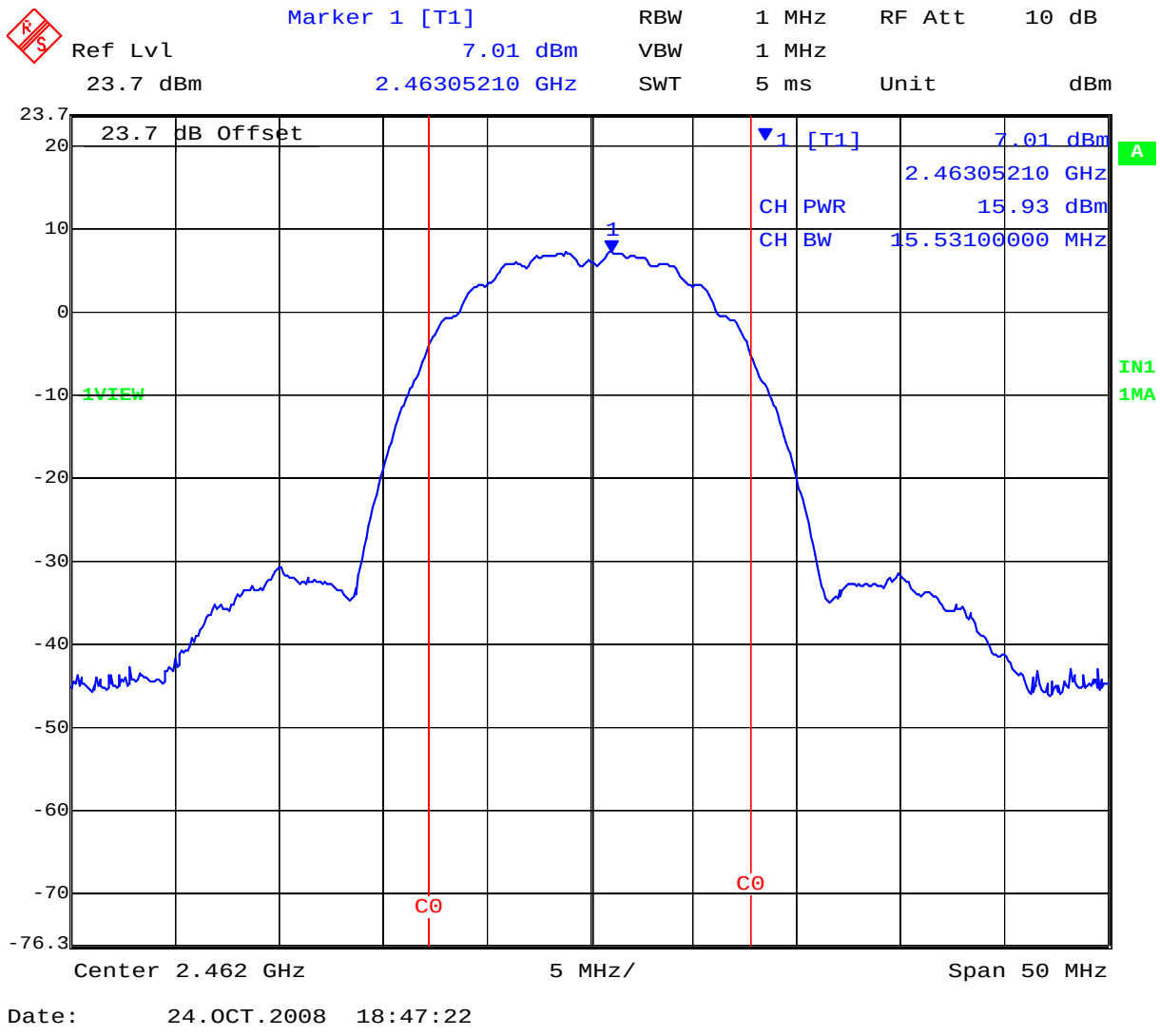
802.11b

915.25 MHz Peak Power (dBm)



802.11b

2,462 MHz Peak Power (dBm)



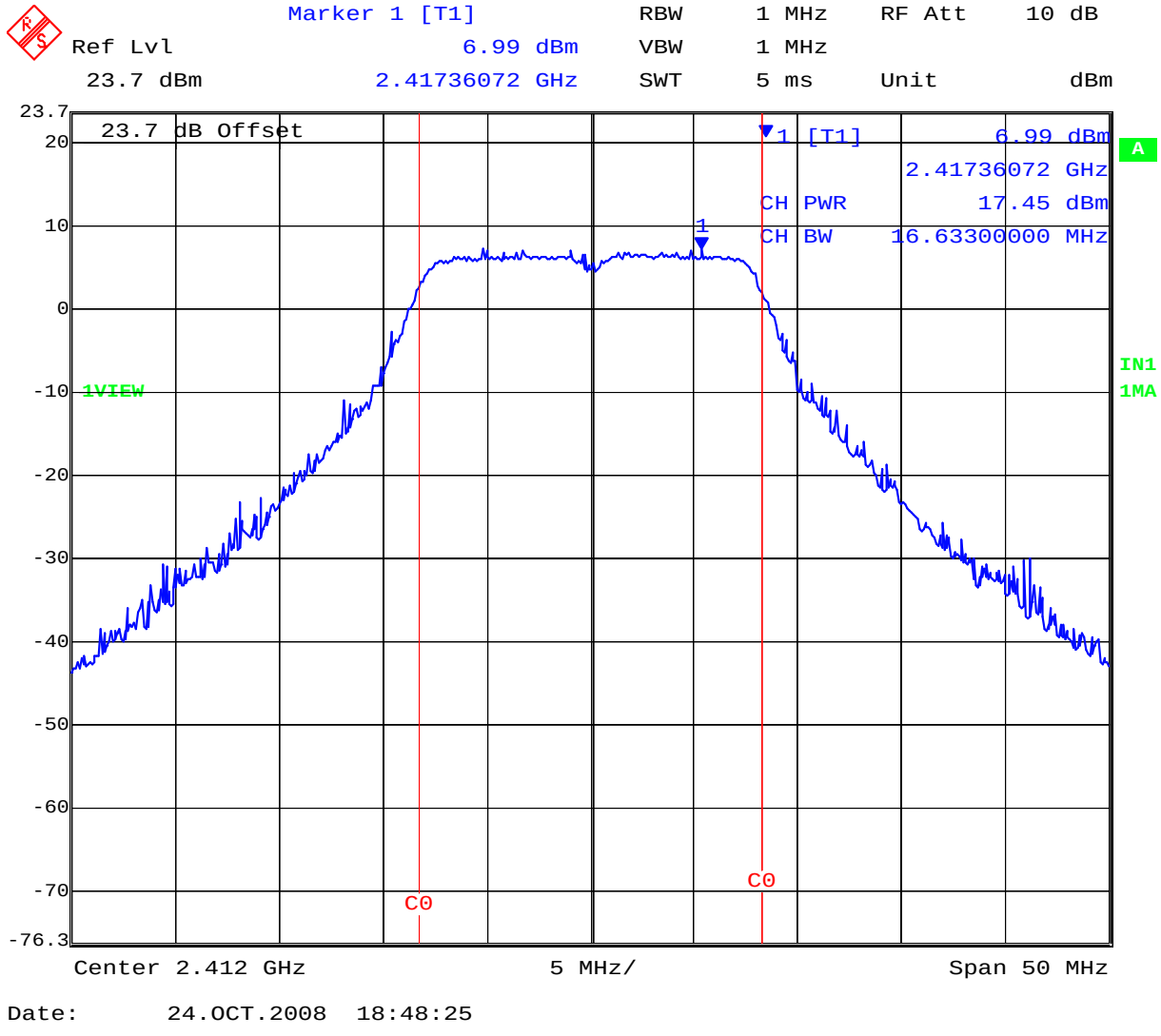
Antenna Gain: 1.7 dBi

TABLE OF RESULTS – 802.11g

Center Frequency (MHz)	99% Measurement Bandwidth (MHz)	Peak Power (dBm)	EIRP (dBm)
2412	16.633	+17.45	+19.15
2437	16.633	+17.01	+18.71
2462	16.633	+17.19	+18.89

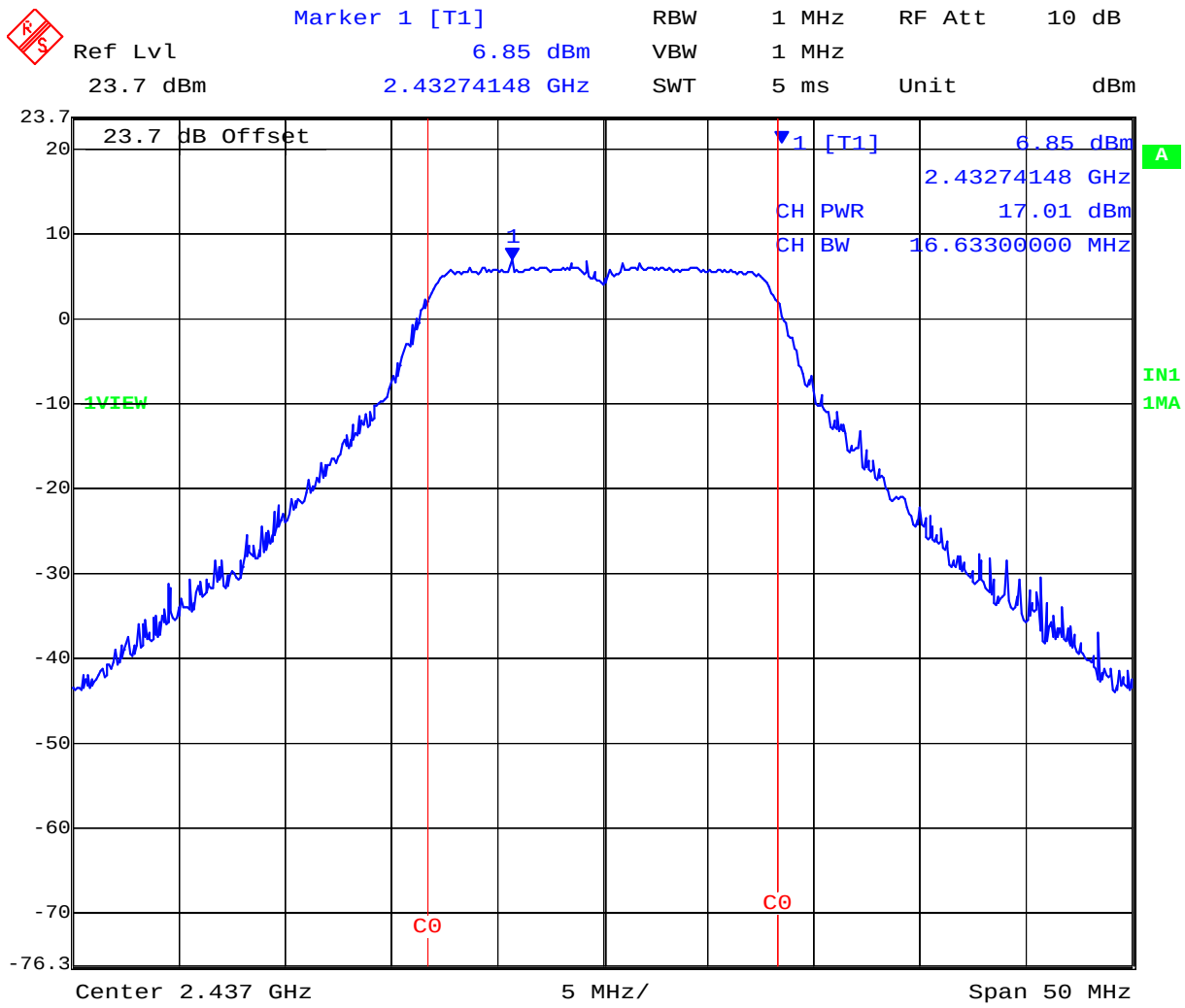
802.11g

2,412 MHz Peak Power (dBm)



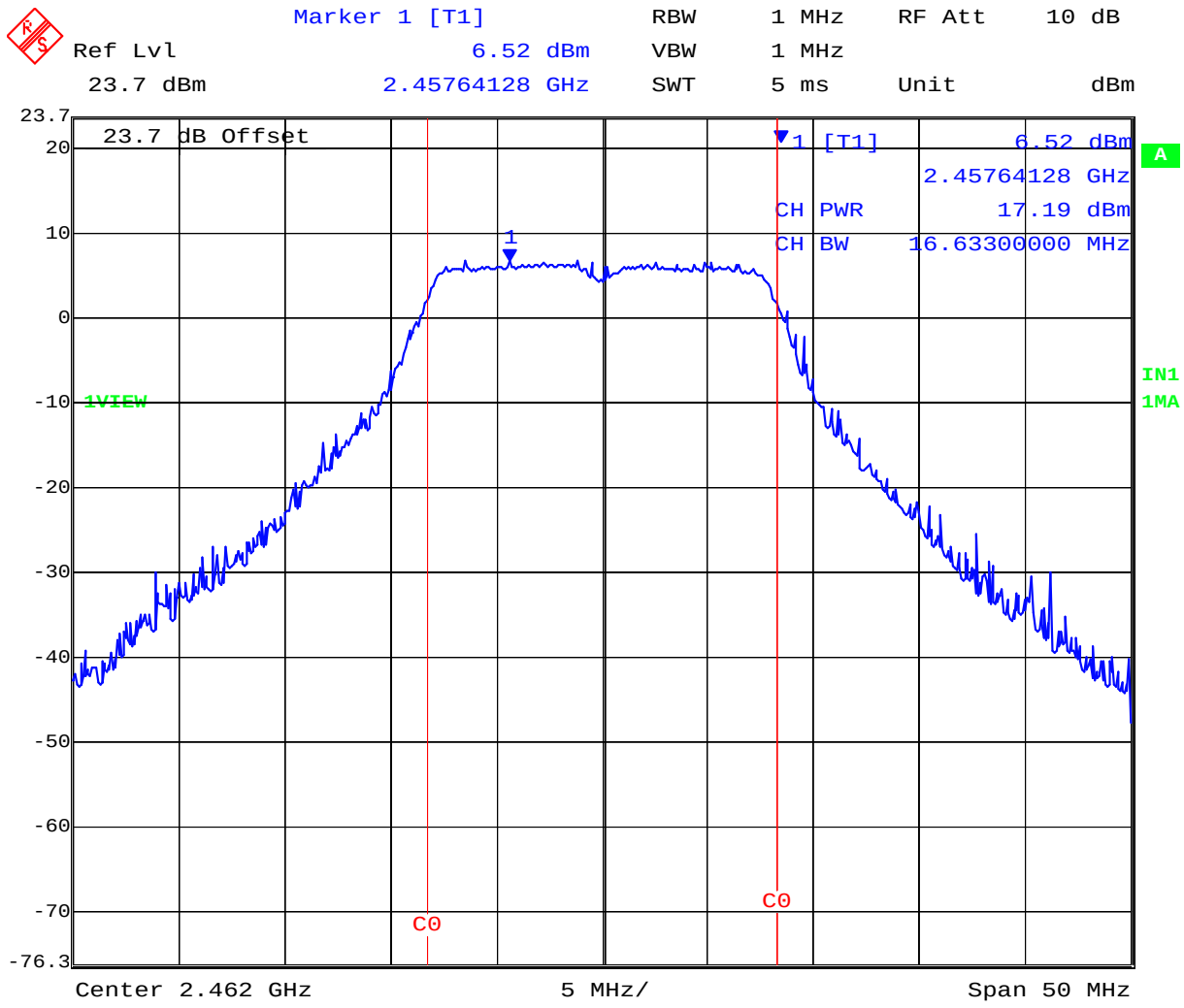
802.11g

915.25 MHz Peak Power (dBm)



802.11g

2,462 MHz Peak Power (dBm)



Supply Voltage Variation

The supply voltage was varied ±15%. The system operated as intended with no change in the above measurements.

Specification

Limits

§15.247 (b) The maximum peak output power of the intentional radiator shall not exceed the following:

> **§15.247 (b) (3)** For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands: 1.0 watt.

§15.31 (e) For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

§ RSS-210 A8.4(4) For systems employing digital modulation techniques operating in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands the maximum peak conducted power shall not exceed 1 watt.

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB

Traceability

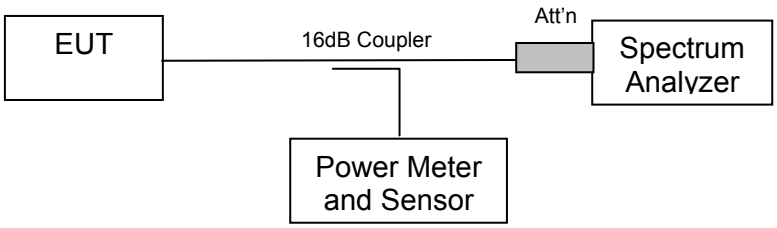
Method	Test Equipment Used
Measurements were made per work instruction WI-01 'Measuring RF Output Power'	0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117

5.2.3. Peak Power Spectral Density

FCC, Part 15 Subpart C §15.247(e)
Industry Canada RSS-210 §A8.2

Test Procedure
The transmitter output was connected to a spectrum analyzer and the maximum level in a 3 kHz bandwidth was measured. A peak value was found over the full emission bandwidth and the frequency span reduced to obtain enhanced resolution. Sweep time => span / 3 kHz with video averaging turned off. The Peak Power Spectral Density is the highest level found across the emission in a 3 kHz resolution bandwidth. Spectrum analyzer settings:

Test Measurement Set up



Measurement set up for Peak Power Spectral Density

Measurement Results for Peak Power Spectral Density

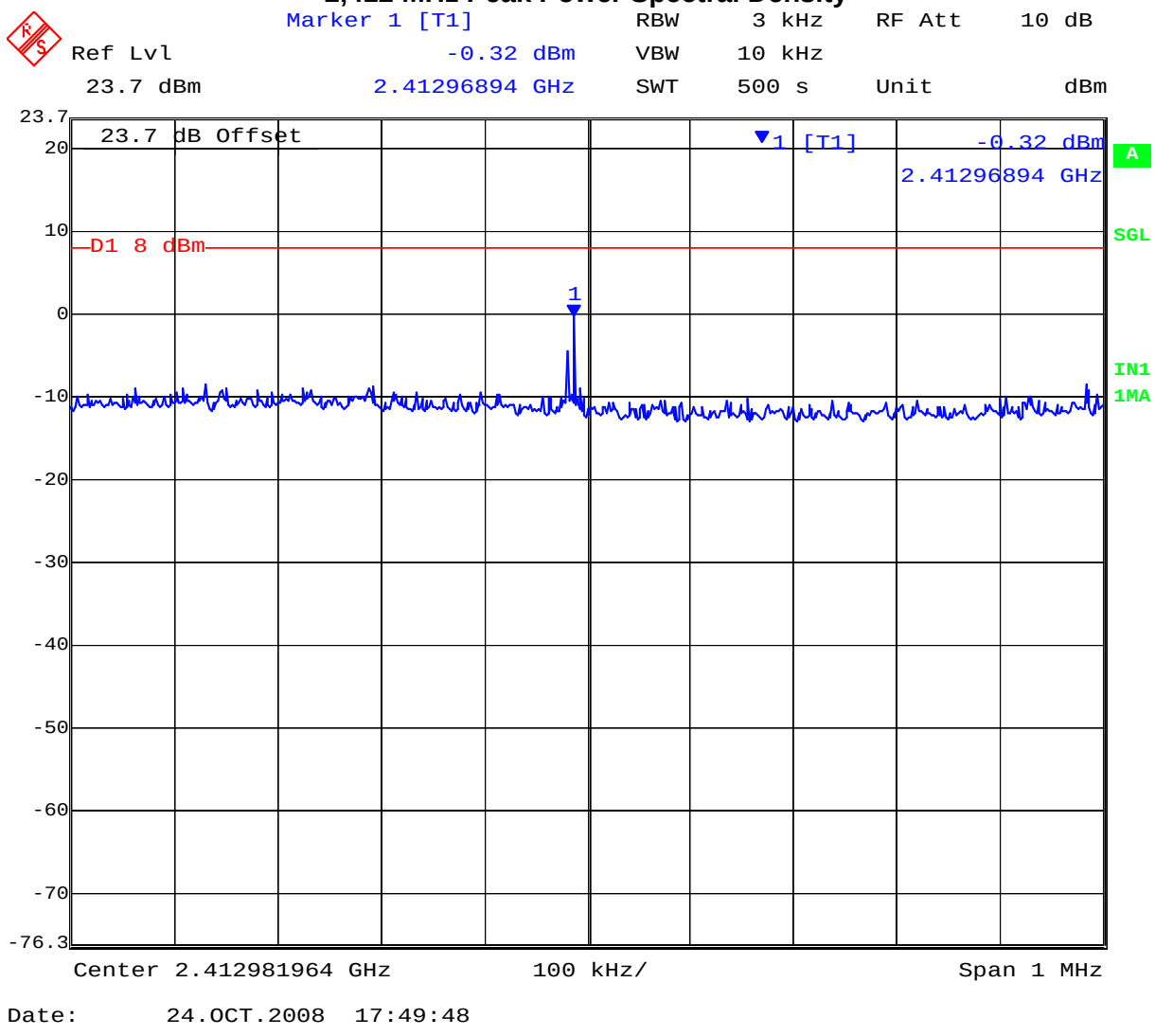
Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

TABLE OF RESULTS – 802.11b

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dBm)
902.75	2412.96894	-0.32	+8.0	-8.32
915.25	2437.96693	-7.60	+8.0	-15.6
927.25	2462.96293	+1.79	+8.0	-6.21

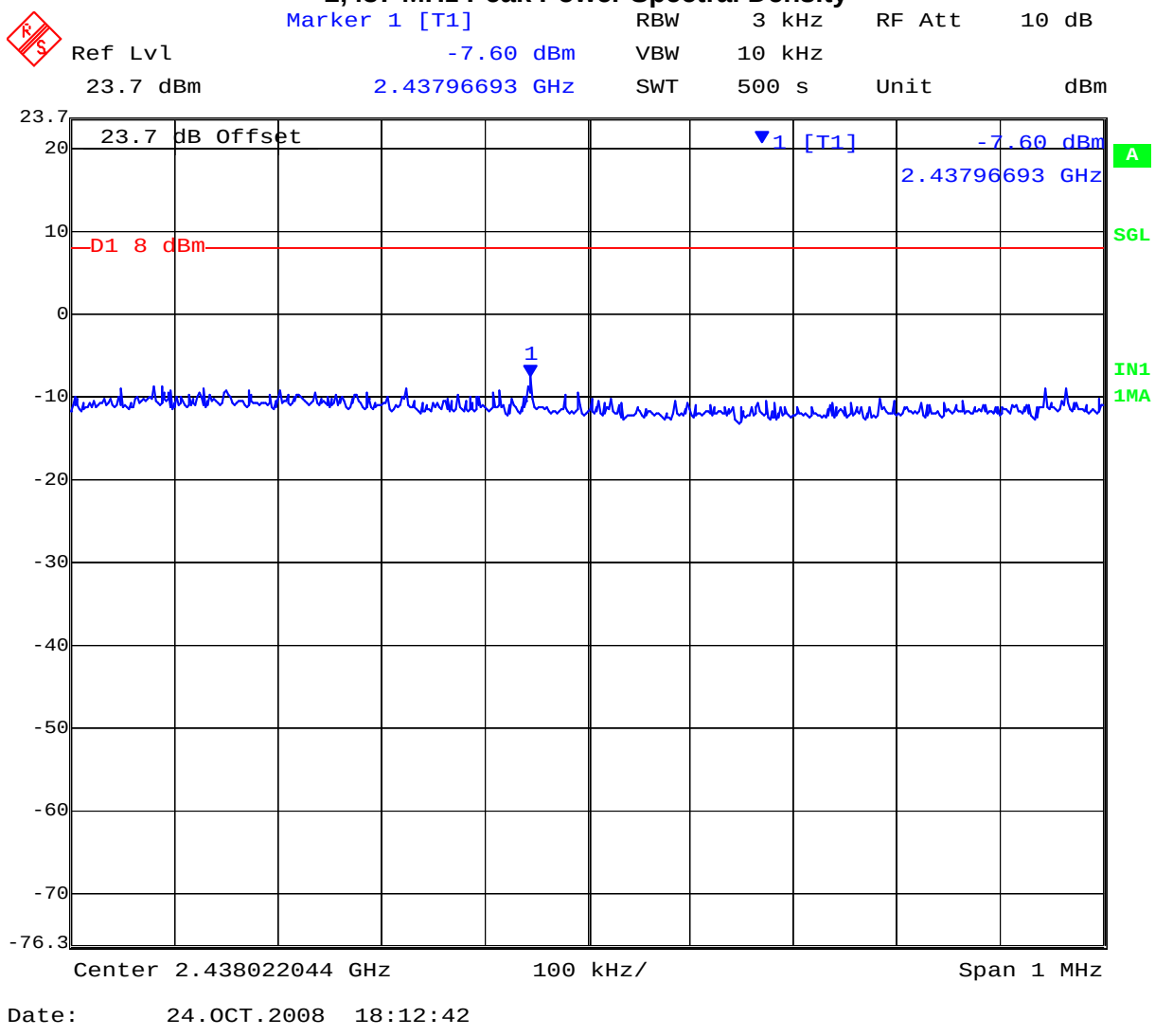
802.11b

2,412 MHz Peak Power Spectral Density



802.11b

2,437 MHz Peak Power Spectral Density



802.11b

2,462 MHz Peak Power Spectral Density

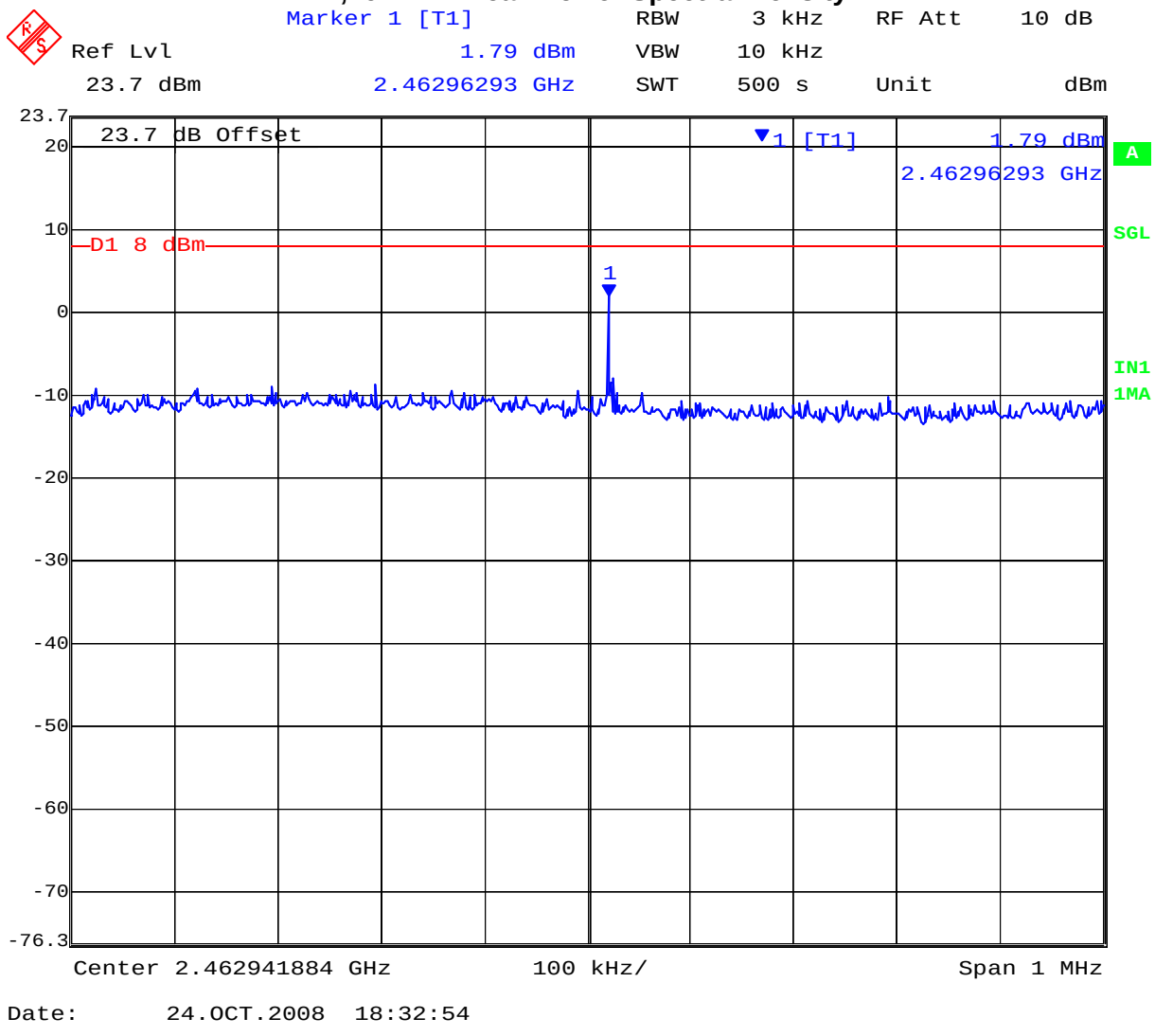
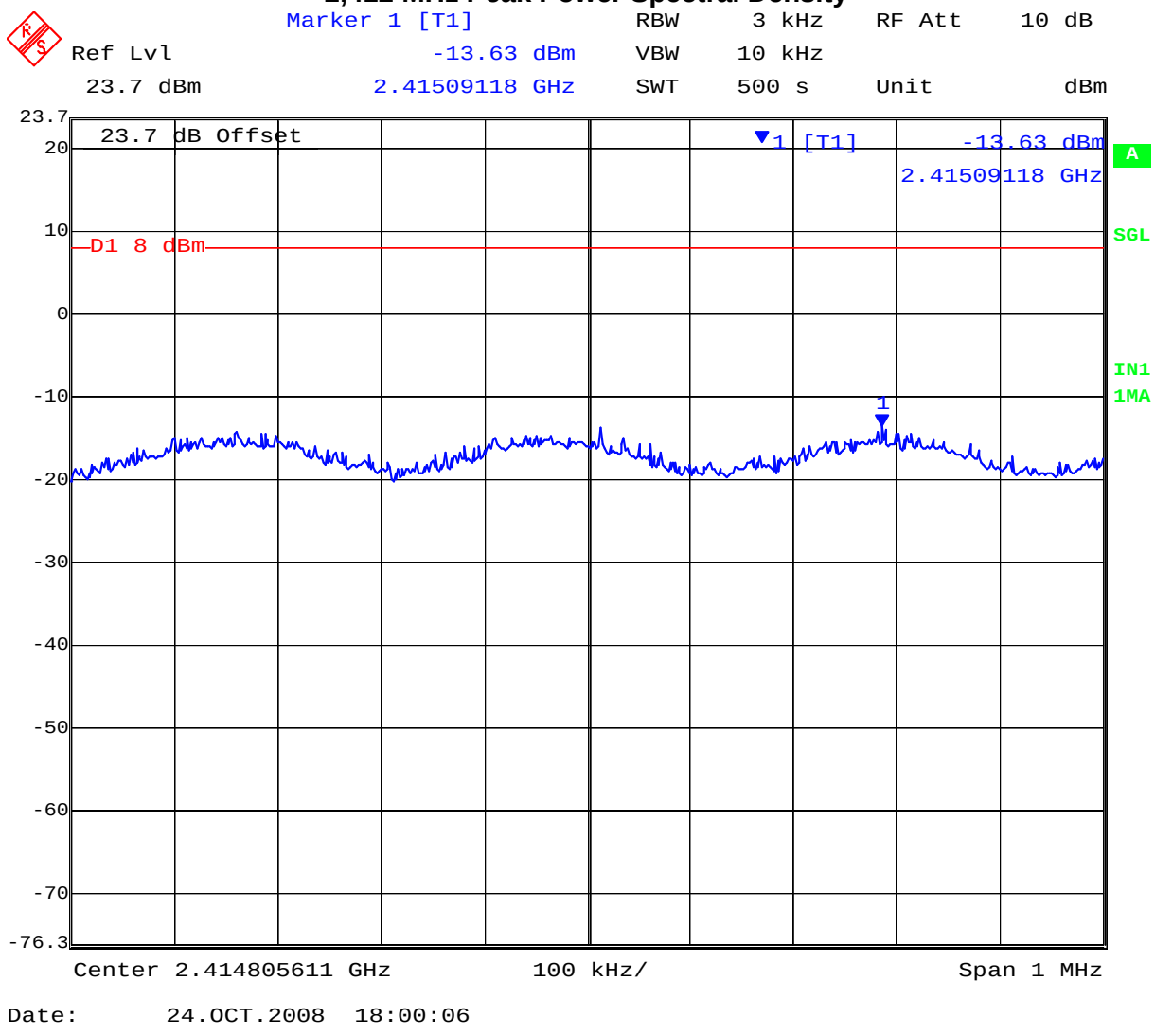


TABLE OF RESULTS – 802.11g

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dBm)
902.75	2415.09118	-13.63	+8.0	-21.63
915.25	2435.71443	-13.75	+8.0	-21.75
927.25	2465.09118	-13.42	+8.0	-21.42

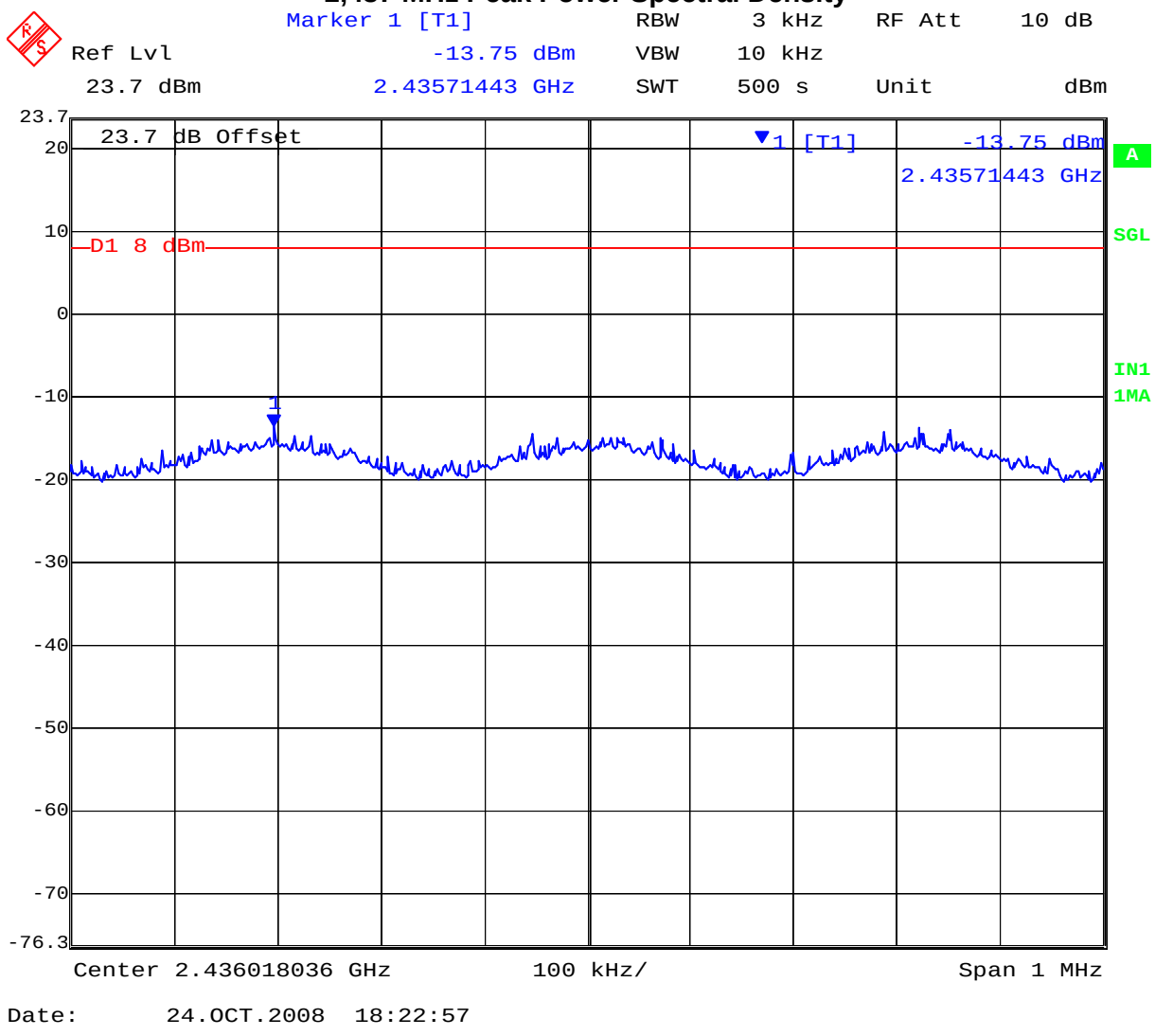
802.11g

2,412 MHz Peak Power Spectral Density



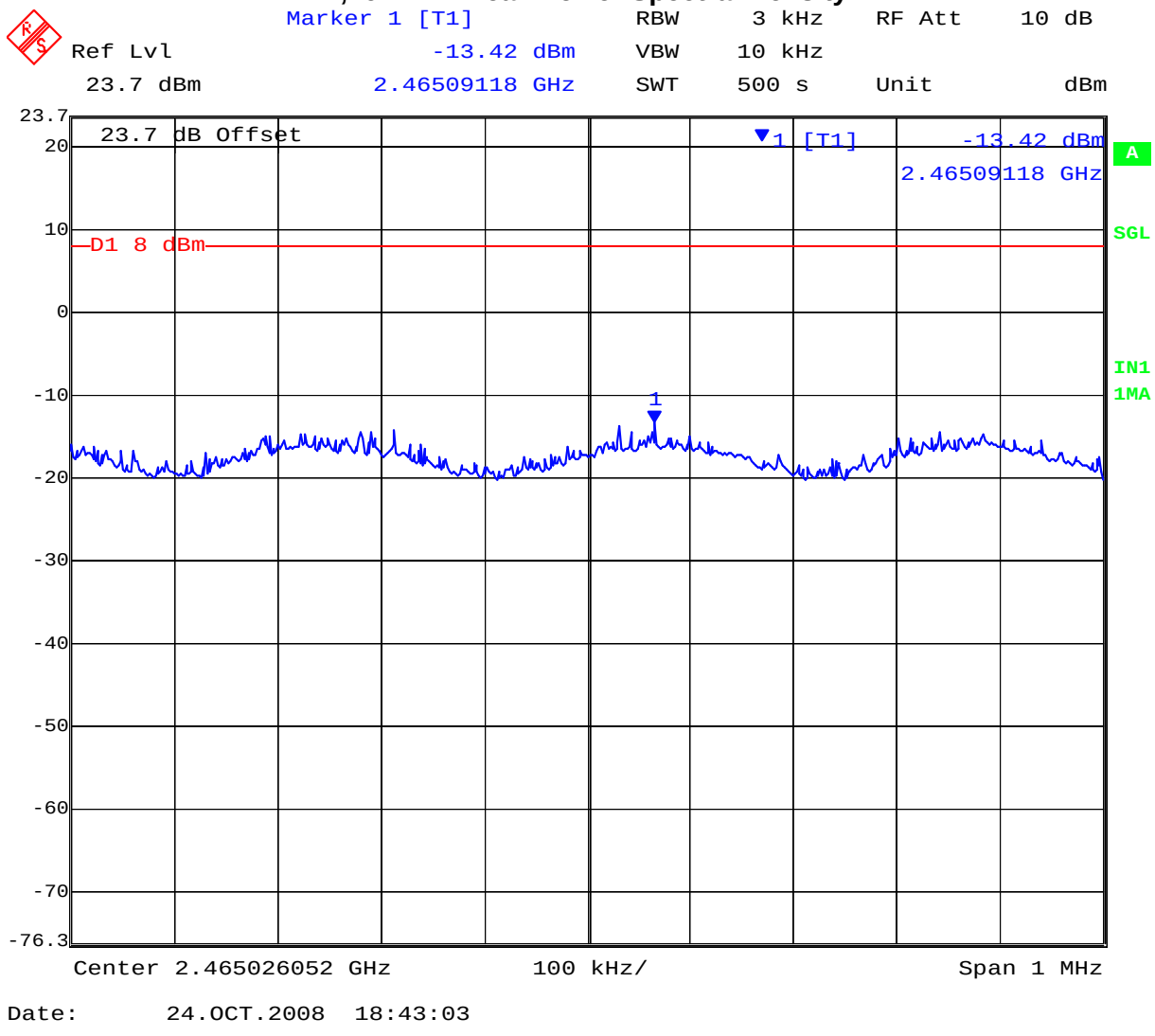
802.11g

2,437 MHz Peak Power Spectral Density



802.11g

2,462 MHz Peak Power Spectral Density



Specification
Peak Power Spectral Density Limits

§15.247(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission **RSS-210** §**A8.2(2)** The transmitter power spectral density (into the antenna) shall not be greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission or over 1.0 second if the transmission exceeds 1.0 second duration.

Laboratory Measurement Uncertainty for Spectral Density

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

5.2.4. Maximum Permissible Exposure

FCC, Part 15 Subpart C §15.247(i)
Industry Canada RSS-Gen §5.5

Calculations for Maximum Permissible Exposure Levels

Power Density = Pd (mW/cm^2) = EIRP/(4πd^2)

EIRP = P * G

P = Peak output power (mW)

G = Antenna numeric gain (numeric)

d = Separation distance (cm)

Numeric Gain = 10 ^ (G (dBi)/10)

Because the EUT belongs to the General Population/Uncontrolled Exposure the limit of power density is 1.0 mW/cm^2

Freq. Band (GHz)	Antenna Gain (dBi)	Numeric Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Calculated Safe Distance @ 1mW/cm^2 Limit(cm)	Minimum Separation Distance (cm)
2.4	1.7	1.48	19.15	82.2	3.11	20

*Note: for mobile or fixed location transmitters the minimum separation distance is 20cm, even if calculations indicate the MPE distance to be less.

Specification

Maximum Permissible Exposure Limits

§15.247(i) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency levels in excess of the Commission's guidelines.

FCC §1.1310 Limit = 1mW / cm^2 from 1.310 Table 1

RSS-Gen §5.5 Before equipment certification is granted, the applicable requirements of RSS-102 shall be met.

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB

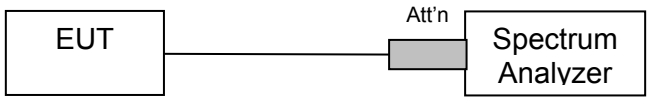
5.2.5. Conducted Spurious Emissions

FCC, Part 15 Subpart C §15.247(d); 15.205; 15.209
Industry Canada RSS-210 §A8.5, §2.2
Industry Canada RSS-Gen 4.7

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

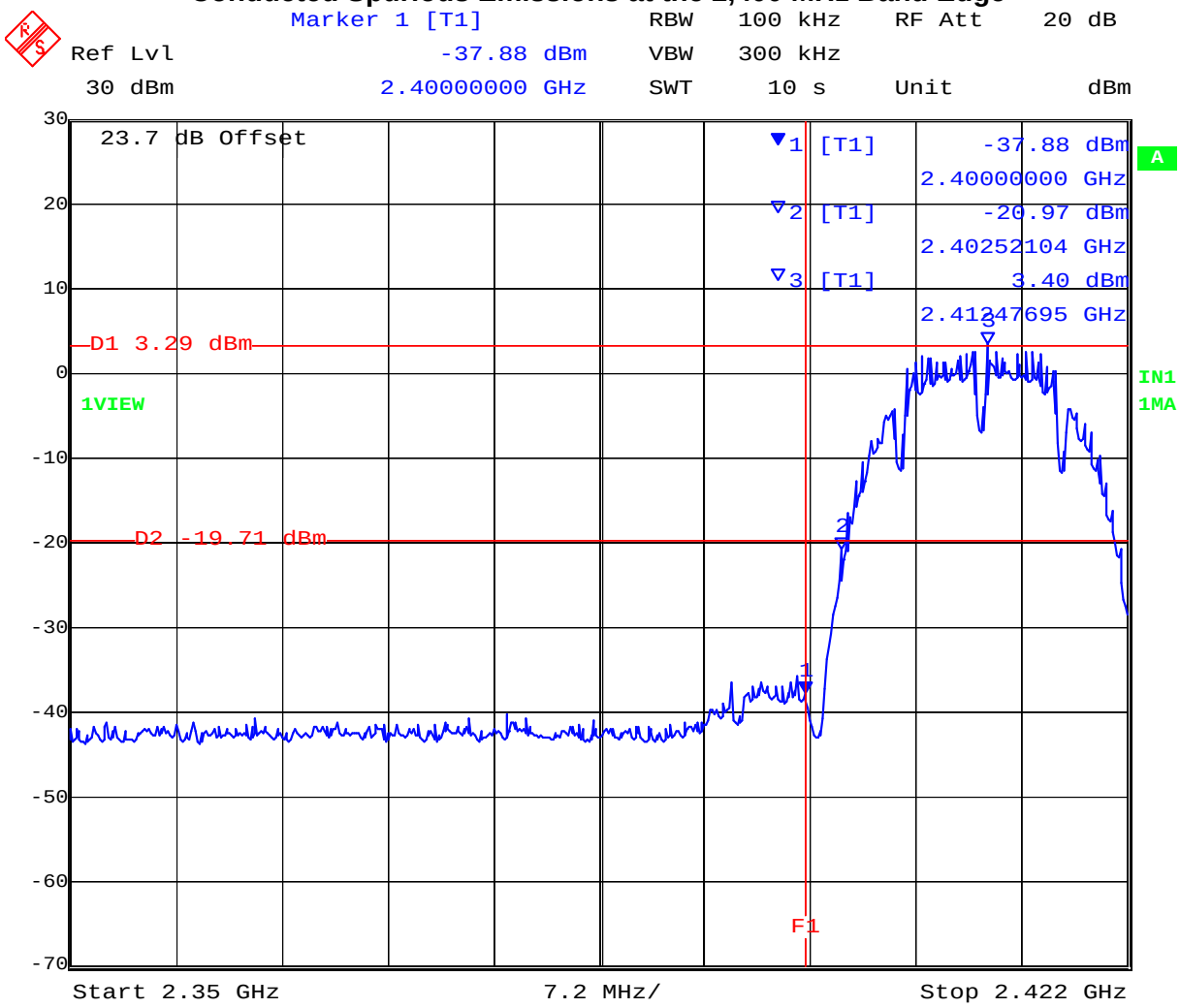
Measurements were performed with the transmitter tuned to the channel closest to the band-edge being measured. All emissions were maximized during measurement. Limits which were derived from the band-edge measurements provided below are drawn on each plot.

802.11b

Center Frequency (MHz)	Band edge Frequency (MHz)	Limit (20 dB below peak of fundamental) (dBm)	Amplitude @ Band edge (dBm)	Margin (dB)
2412	2,400	-19.71	-37.88	-18.17
2462	2,483.5	-15.75	-42.79	-27.04

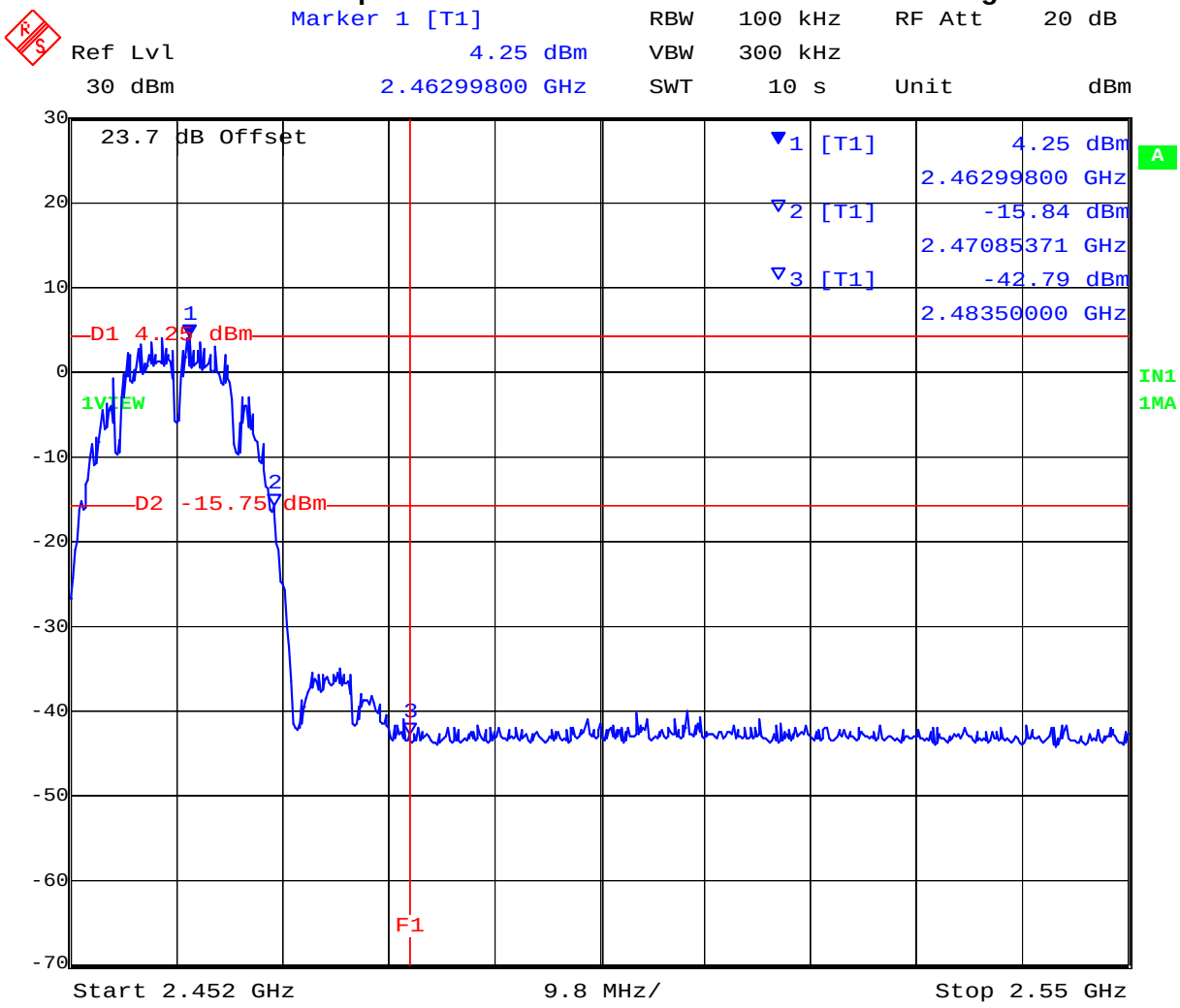
802.11b

Conducted Spurious Emissions at the 2,400 MHz Band Edge



802.11b

Conducted Spurious Emissions at the 2483.5 MHz Band Edge

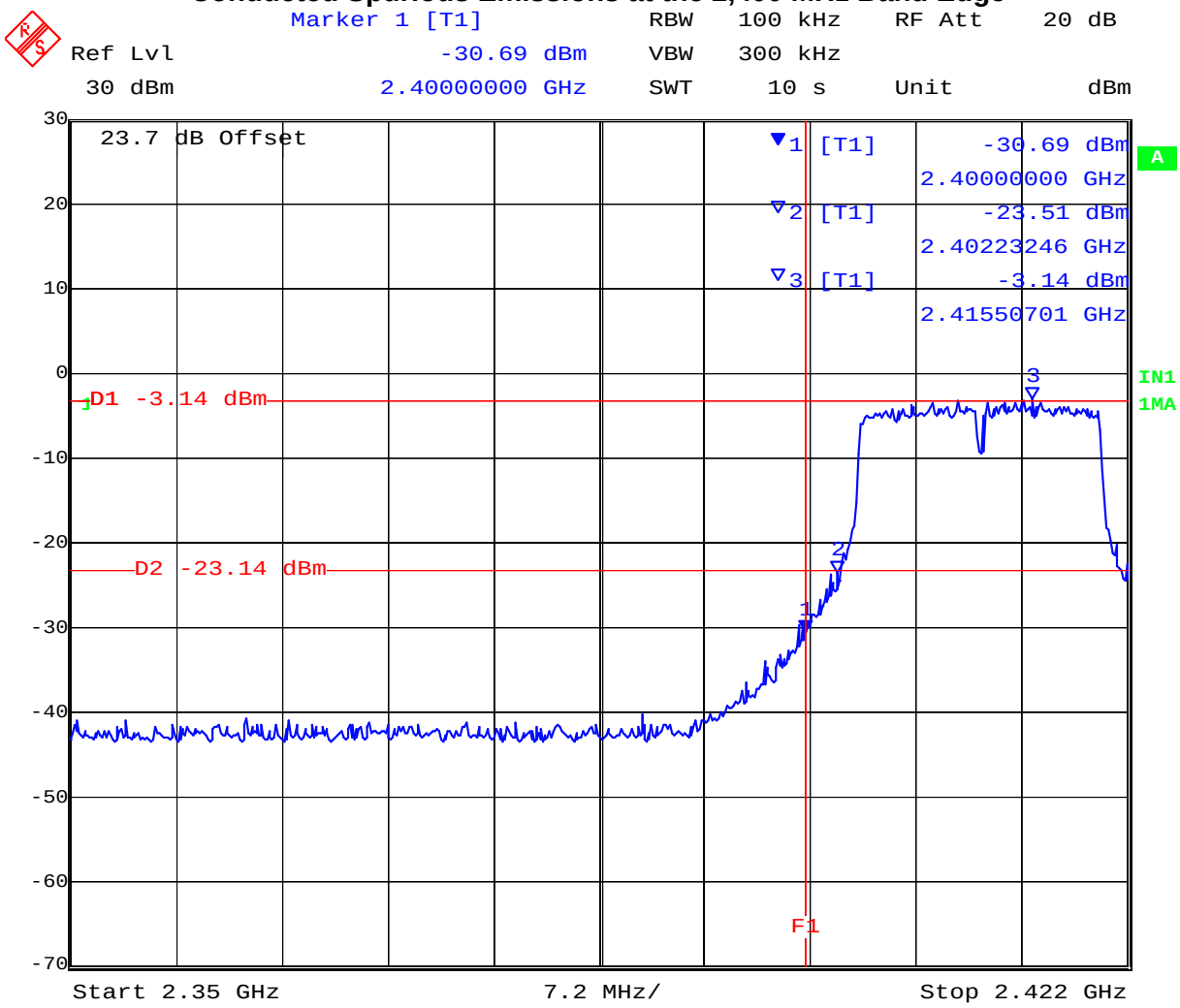


802.11g

Center Frequency (MHz)	Band edge Frequency (MHz)	Limit (20 dB below peak of fundamental) (dBm)	Amplitude @ Band edge (dBm)	Margin (dB)
2412	2,400	-23.14	-30.69	-7.55
2462	2,483.5	-22.63	-41.49	-18.86

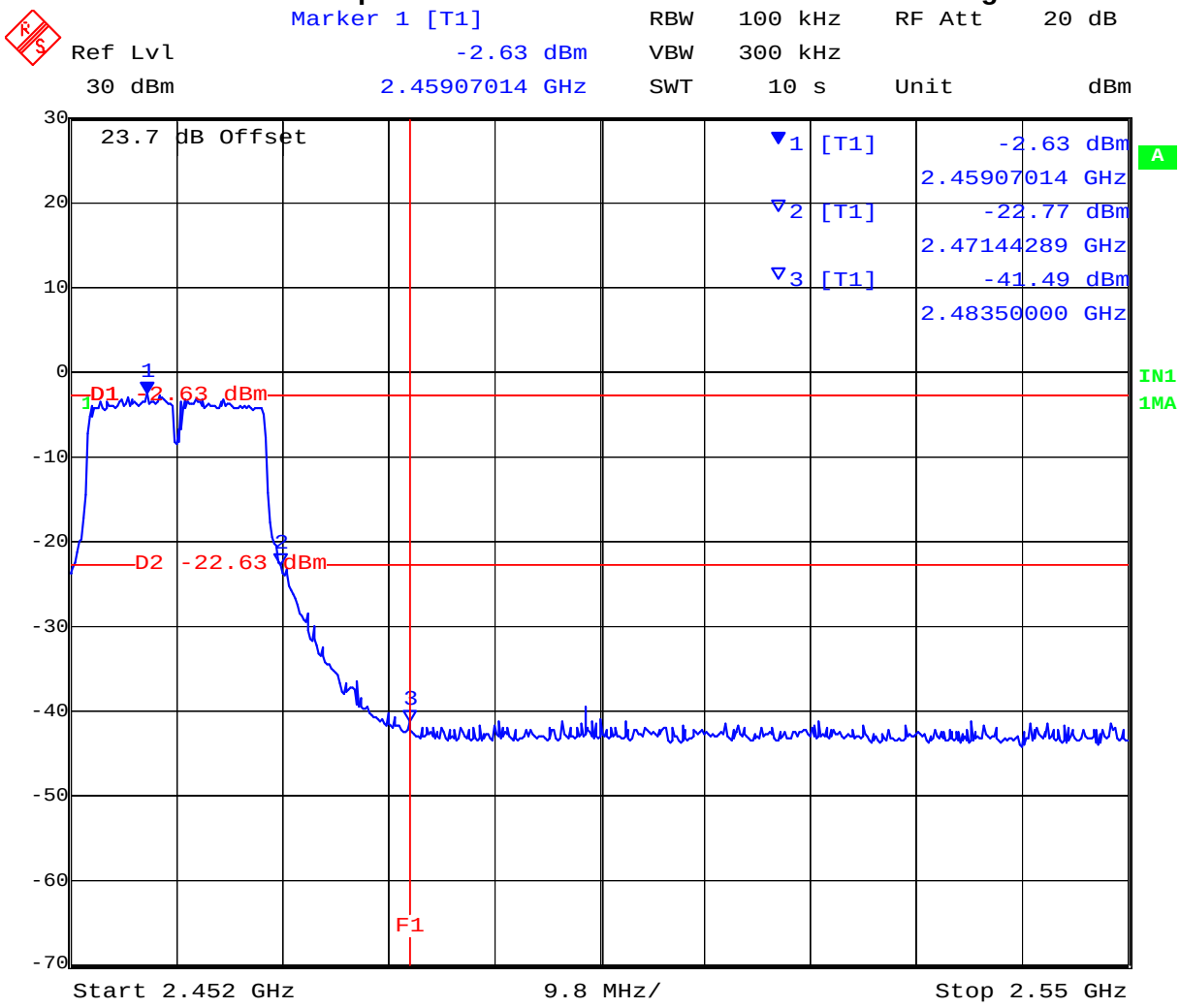
802.11g

Conducted Spurious Emissions at the 2,400 MHz Band Edge



802.11g

Conducted Spurious Emissions at the 2483.5 MHz Band Edge



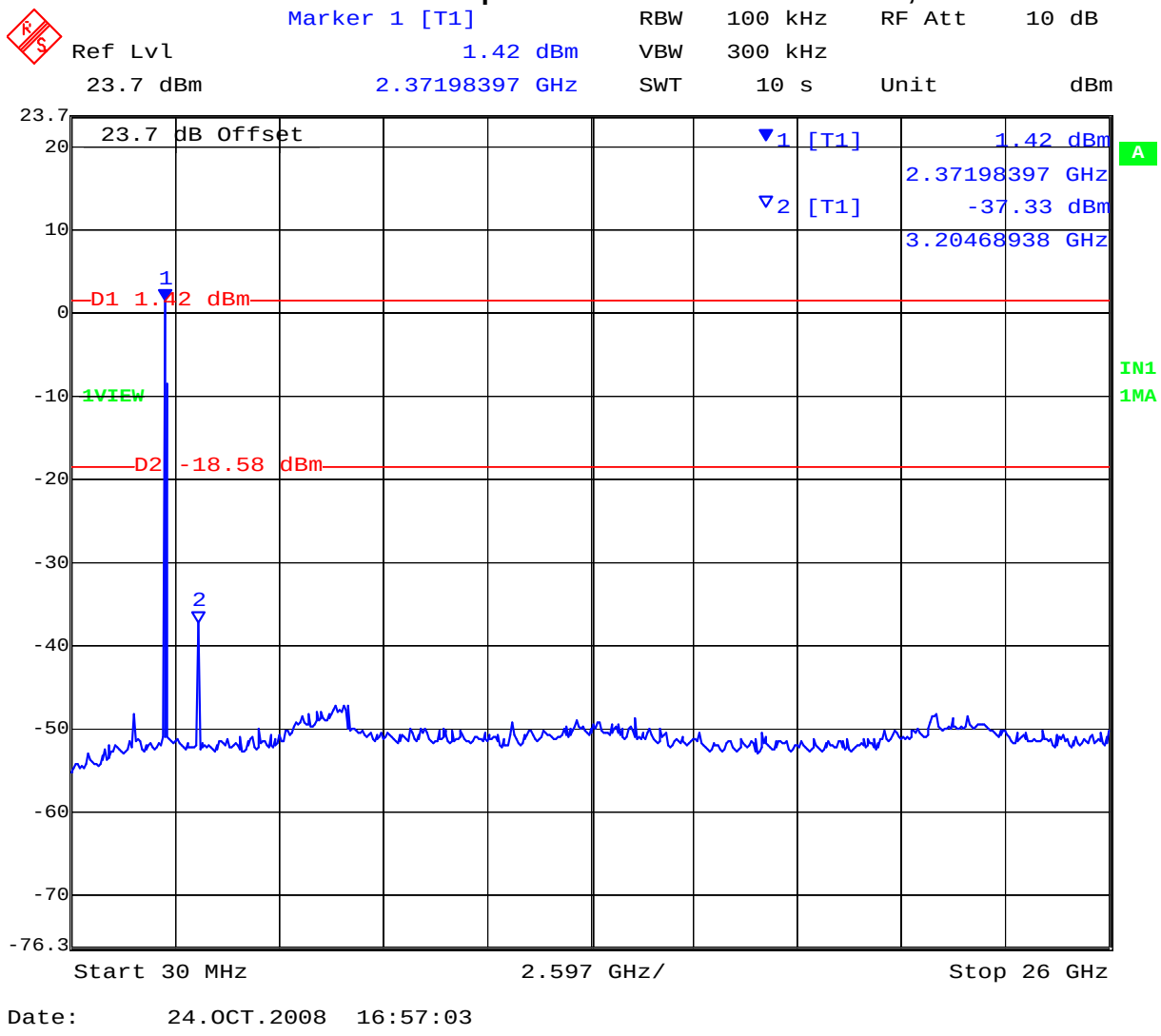
Spurious Emissions (1-26 GHz)

TABLE OF RESULTS – 802.11b

Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
902.75	30	26,000	-37.33	-18.58	-18.75
915.25	30	26,000	-38.34	-16.30	-22.04
927.25	30	26,000	-39.75	-19.83	-19.92

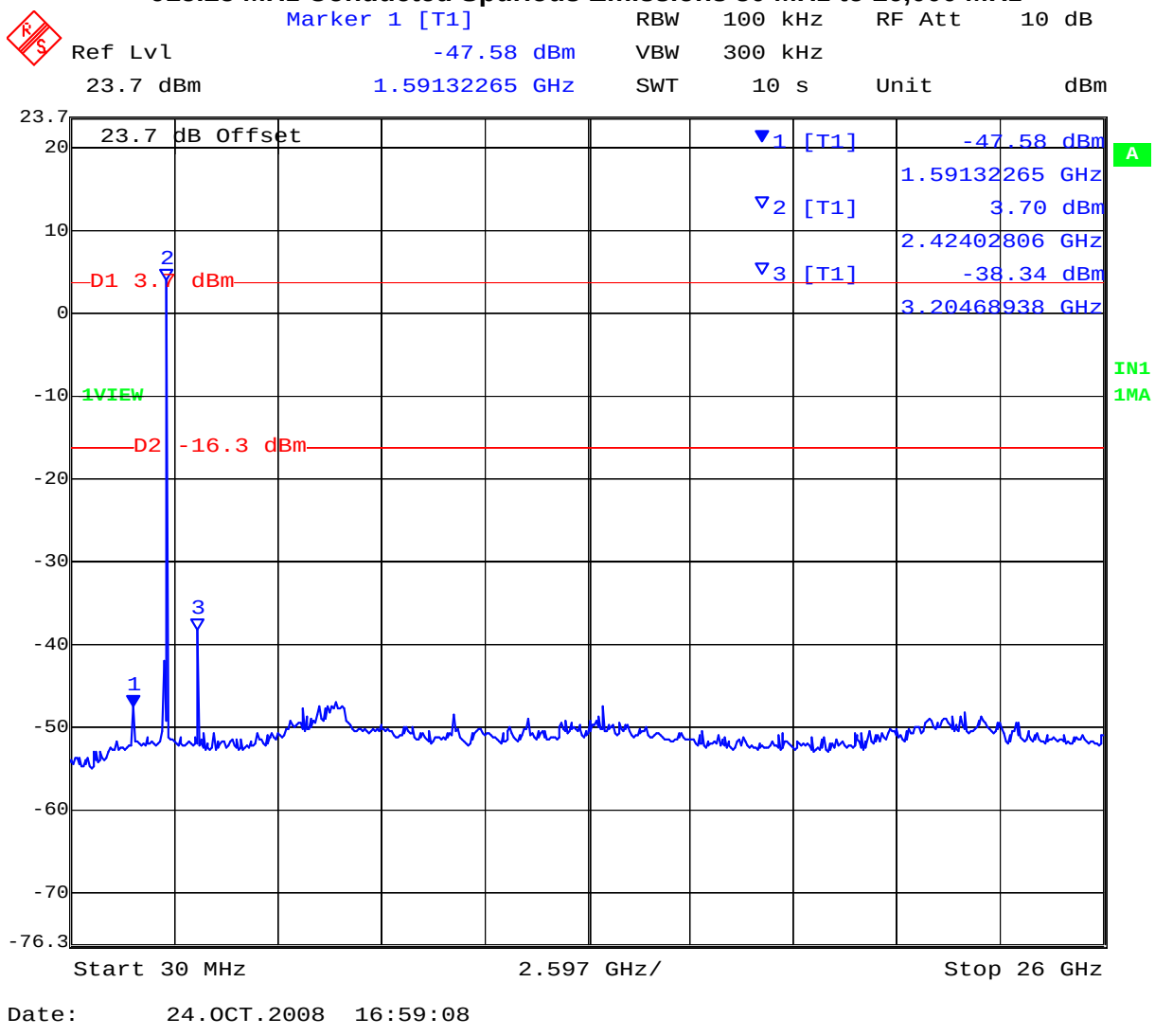
802.11b

902.75 MHz Conducted Spurious Emissions 30 MHz to 26,000 MHz



802.11b

915.25 MHz Conducted Spurious Emissions 30 MHz to 26,000 MHz



802.11b

927.25 MHz Conducted Spurious Emissions 30 MHz to 26,000 MHz

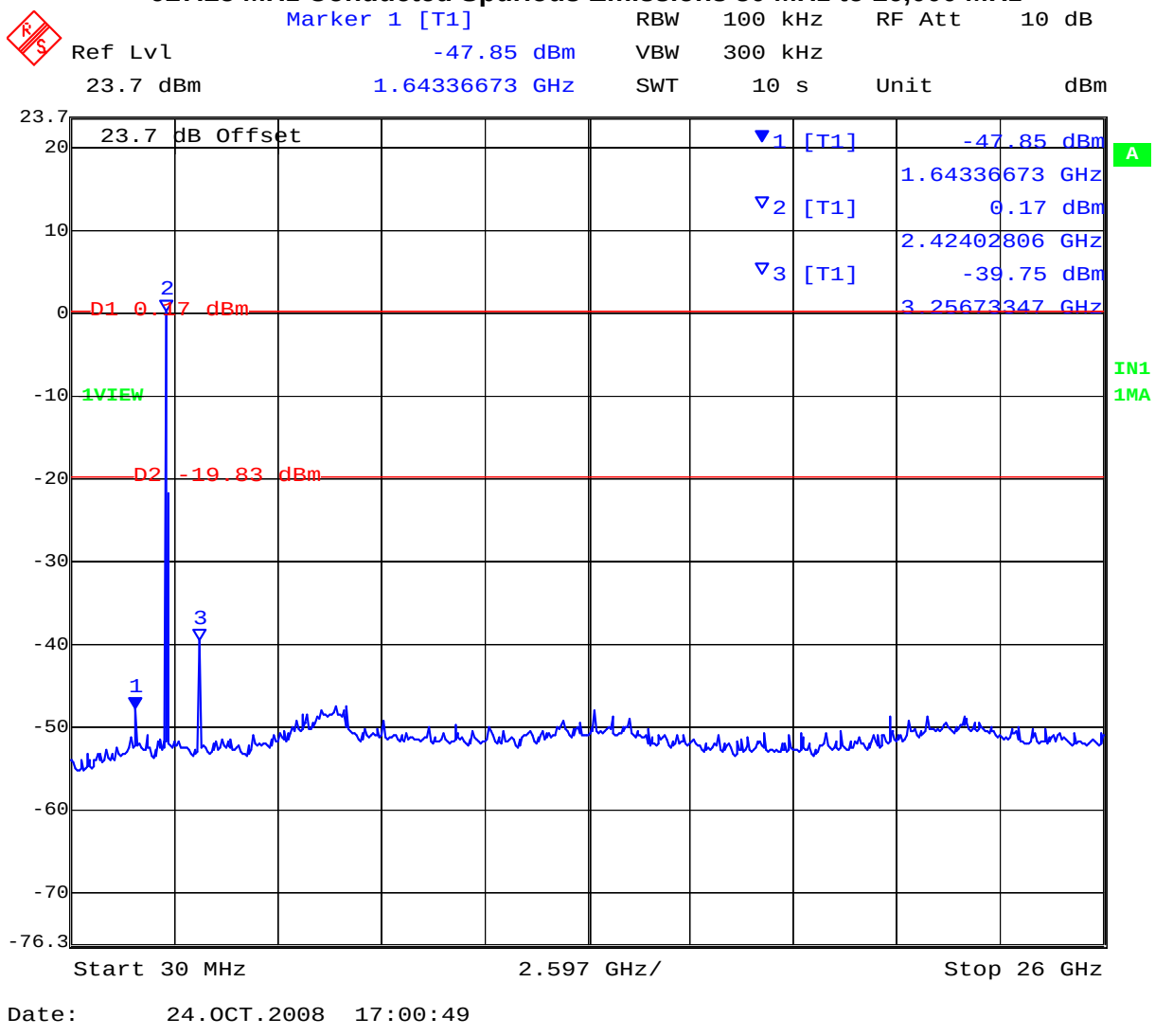
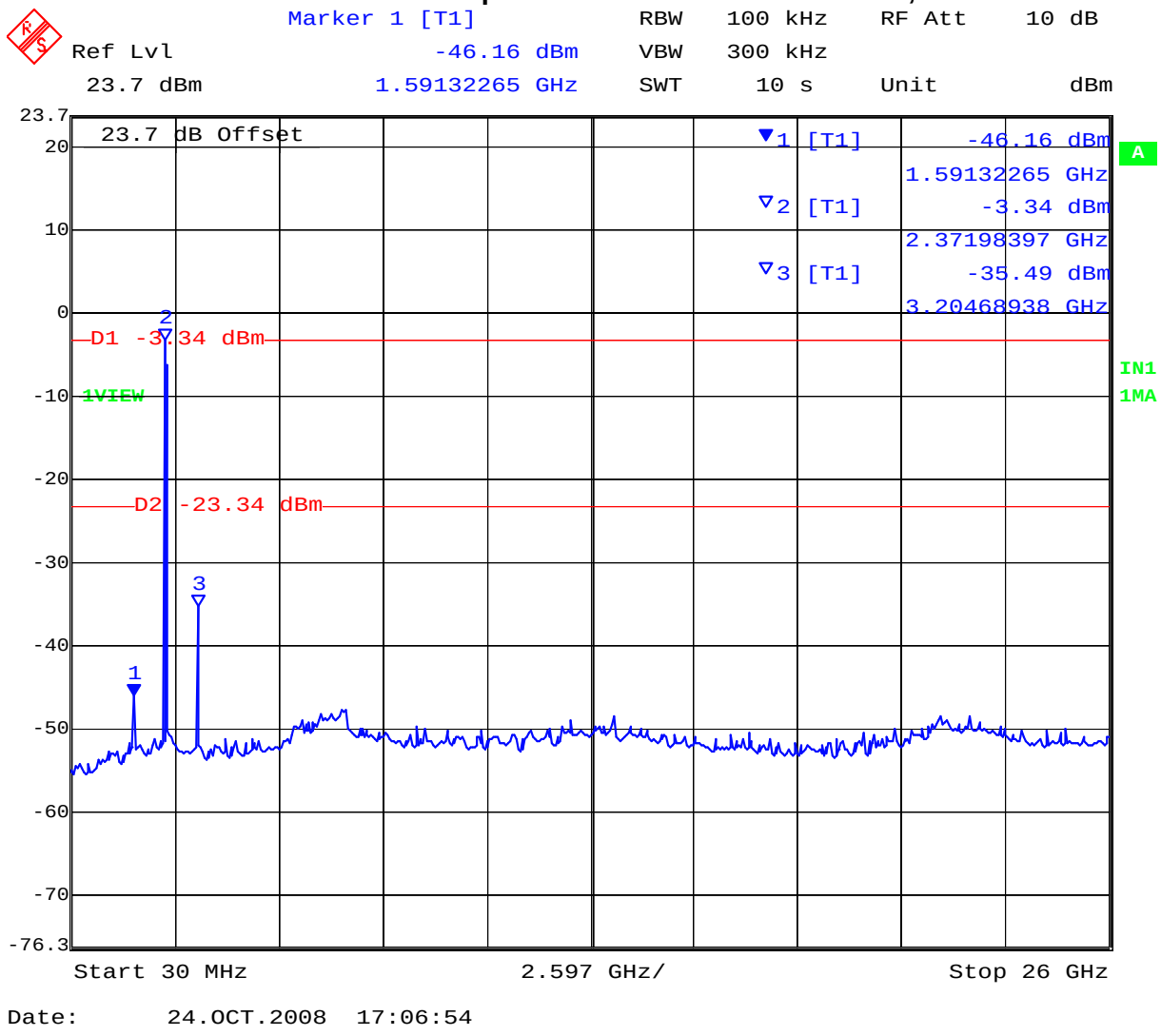


TABLE OF RESULTS – 802.11g

Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
902.75	30	26,000	-35.49	-23.34	-12.15
915.25	30	26,000	-37.66	-23.90	-13.76
927.25	30	26,000	-38.36	-24.55	-13.81

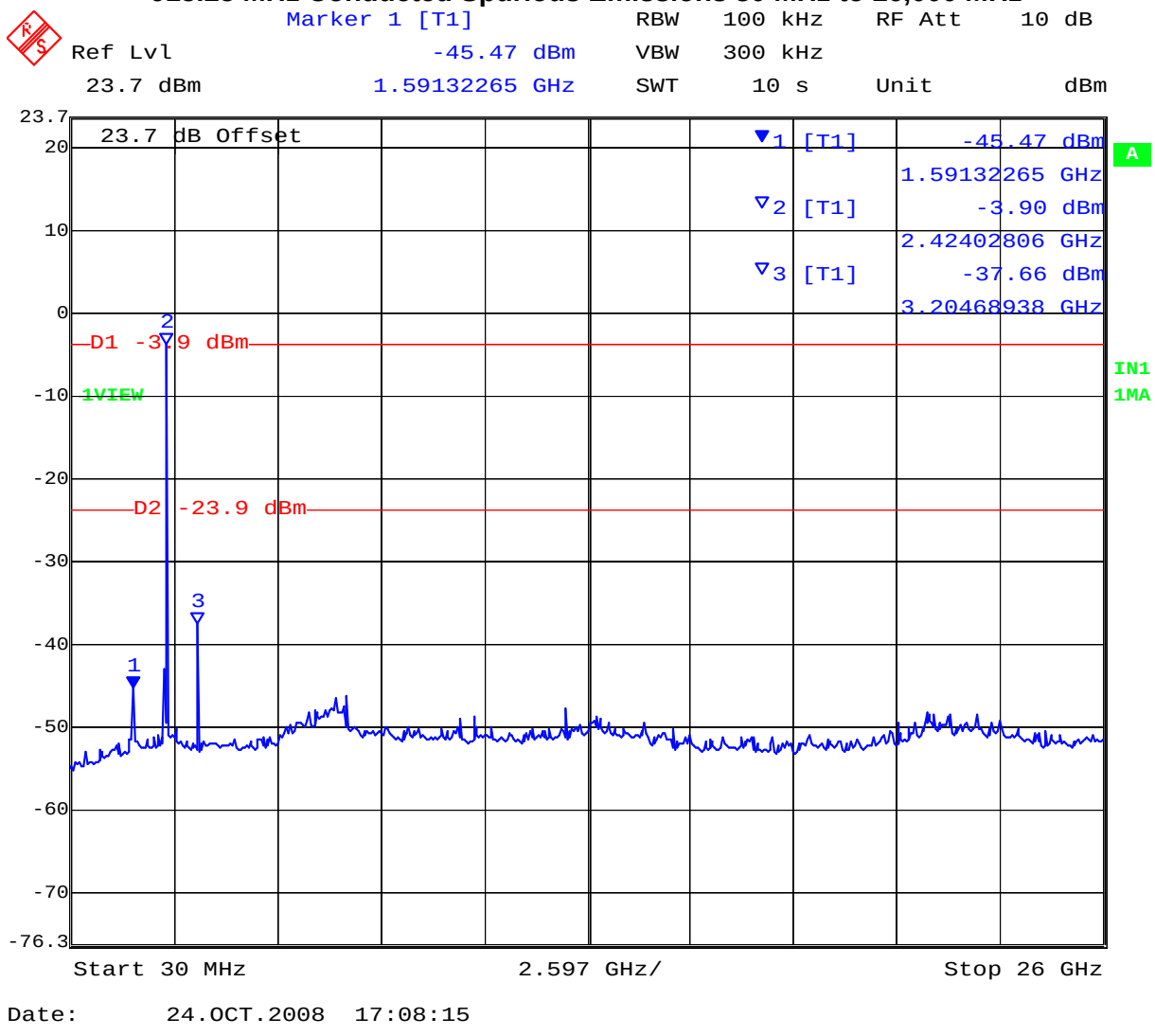
802.11g

902.75 MHz Conducted Spurious Emissions 30 MHz to 26,000 MHz



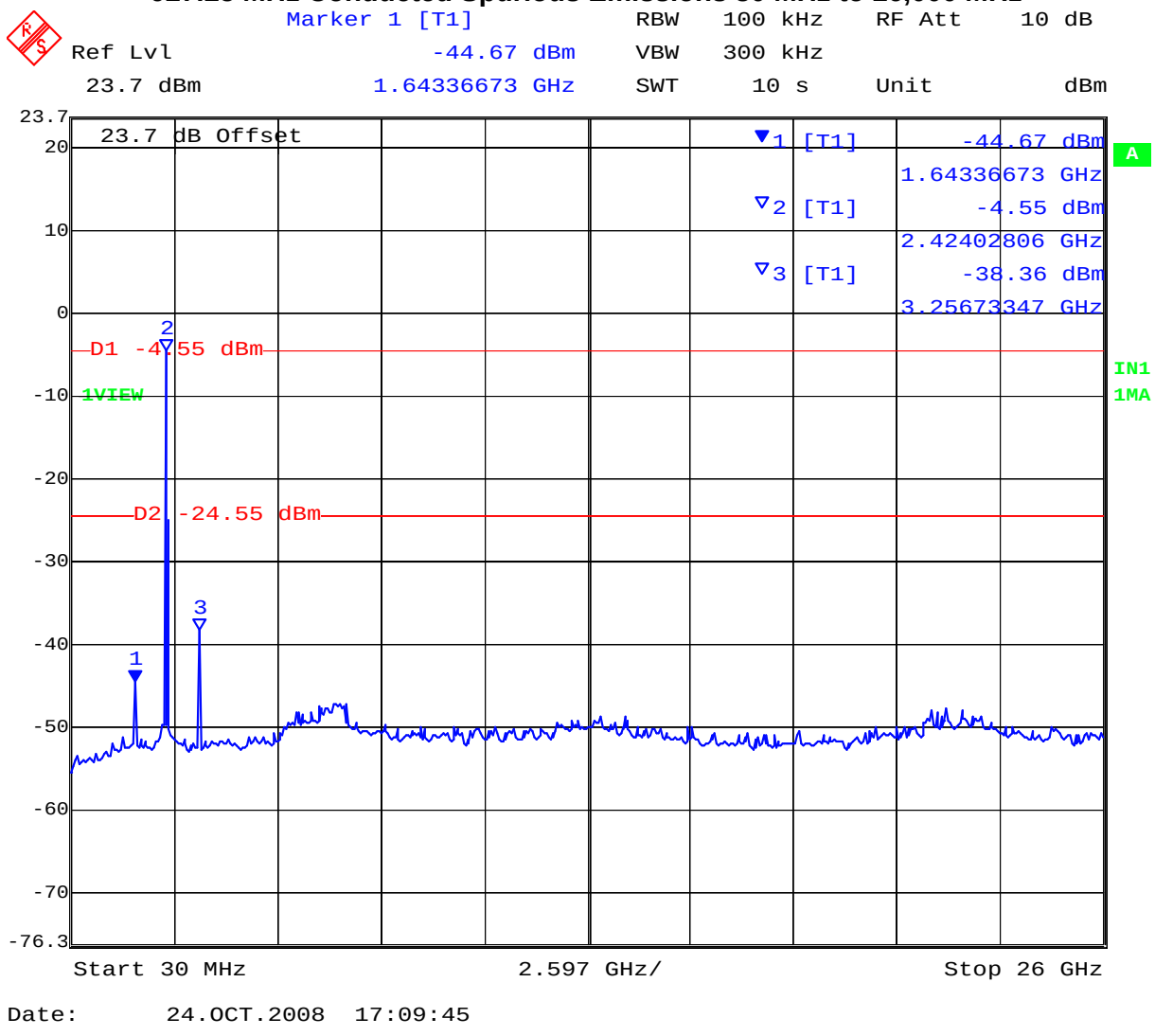
802.11g

915.25 MHz Conducted Spurious Emissions 30 MHz to 26,000 MHz



802.11g

927.25 MHz Conducted Spurious Emissions 30 MHz to 26,000 MHz



Specification

Limits Band-Edge

Lower Limit Band-edge	Upper Limit Band-edge	Limit below highest level of desired power
2,400 MHz	2,483.5 MHz	≥ 20 dB

§15.247(d) and RSS-210 §A8.5 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.

§15.247(d)
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)).

RSS-210 §A8.5 If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emission limits specified in Tables 2 and 3.

RSS-Gen §4.7
The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate of carrier frequency), or from 30 MHz , whichever is the lowest frequency, to the 5th harmonic of the highest frequency generated without exceeding 40 GHz.

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.

5.3. 915 MHz RFID & 2.4 GHz WiFi Characteristics

5.3.1. Transmitter Radiated Spurious Emissions (above 1 GHz)

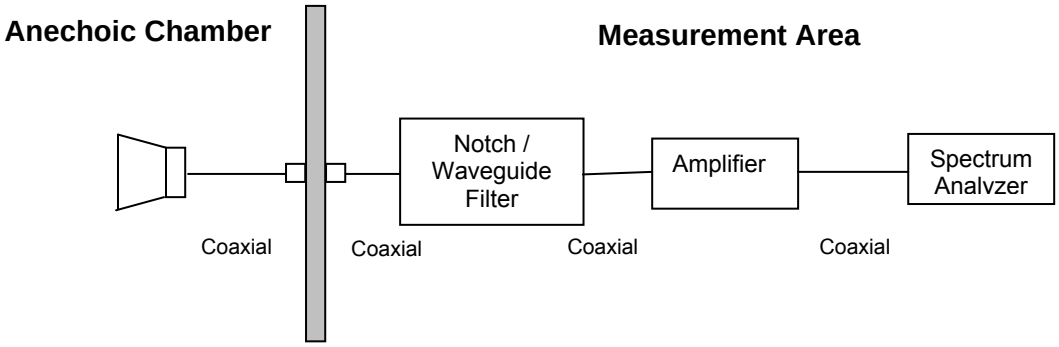
FCC, Part 15 Subpart C §15.247(d)
Industry Canada RSS-210 §A8.5

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

5.3.1.1. 915 MHz RFID Radiated Emissions

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

Integral Antenna
Channel 1 – 920.75 MHz

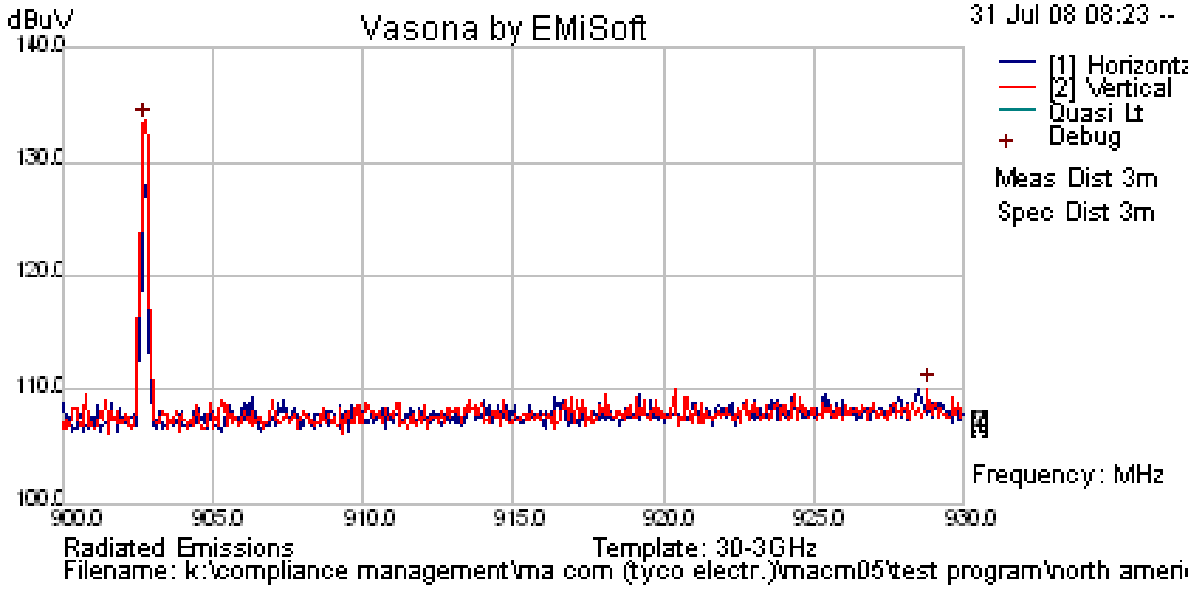
TABLE OF RESULTS

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
902.766	73.49	37.32	22.71	133.5	Peak [Scan]	V					Pass	Fundamental
609.446	39.55	6.43	-23.82	22.15	Peak [Scan]	H	98	360	57.5	-35.35	Pass	Band-edge
1000.000	65.27	1.95	-15.82	51.4	Peak Max	V	102	323	74	-22.6	Pass	
9027.524	46.92	6.21	0.01	53.15	Peak Max	H	130	82	74	-20.85	Pass	
5416.334	55.41	4.62	-8.43	51.6	Peak Max	V	113	332	74	-22.4	Pass	
3611.178	58.25	3.67	-11.08	50.84	Peak Max	H	98	73	74	-23.16	Pass	
1000.000	54.07	1.95	-15.82	40.2	Average Max	V	102	323	54	-13.8	Pass	
9027.524	53.79	6.21	0.01	47.57	Average Max	H	130	82	54	-6.43	Pass	
5416.334	51.39	4.62	-8.43	47.58	Average Max	V	113	332	54	-6.42	Pass	
3611.178	55.73	3.67	-11.08	48.32	Average Max	H	98	73	54	-5.68	Pass	
1805.611	69.88	2.61	-12.18	60.31	Peak [Scan]	H	100	0	113.5	-53.19	Pass	NRB

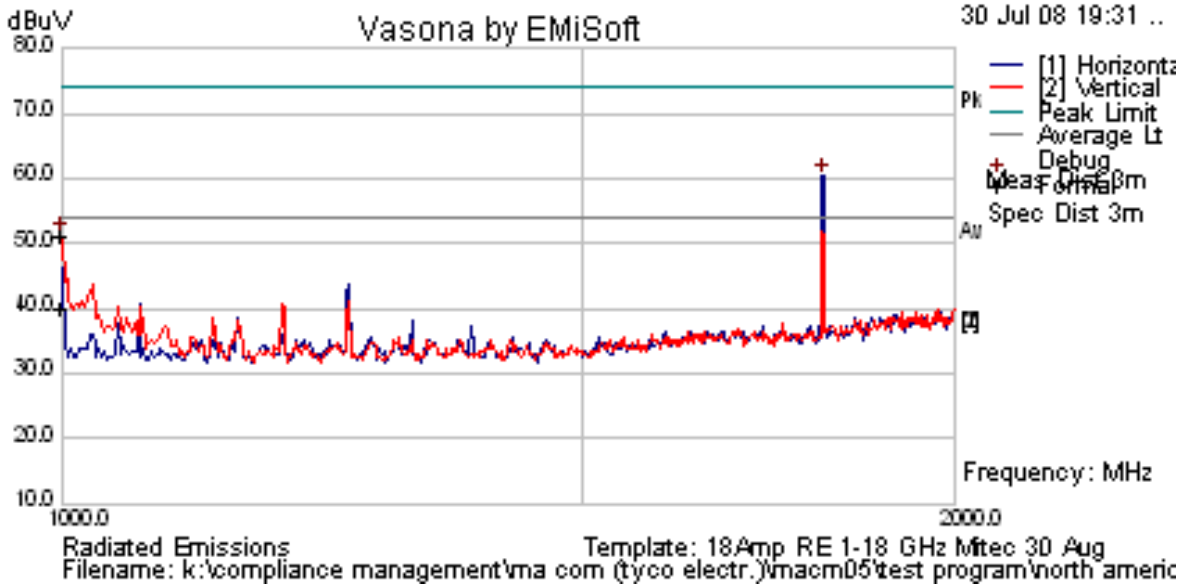
Fundamental – Carrier Peak Emission
NRB – Non-restricted band emission

NRB Limit = Peak Fundamental Emission – 20 dB = 133.5 – 20 = 113.5 dBµV/m

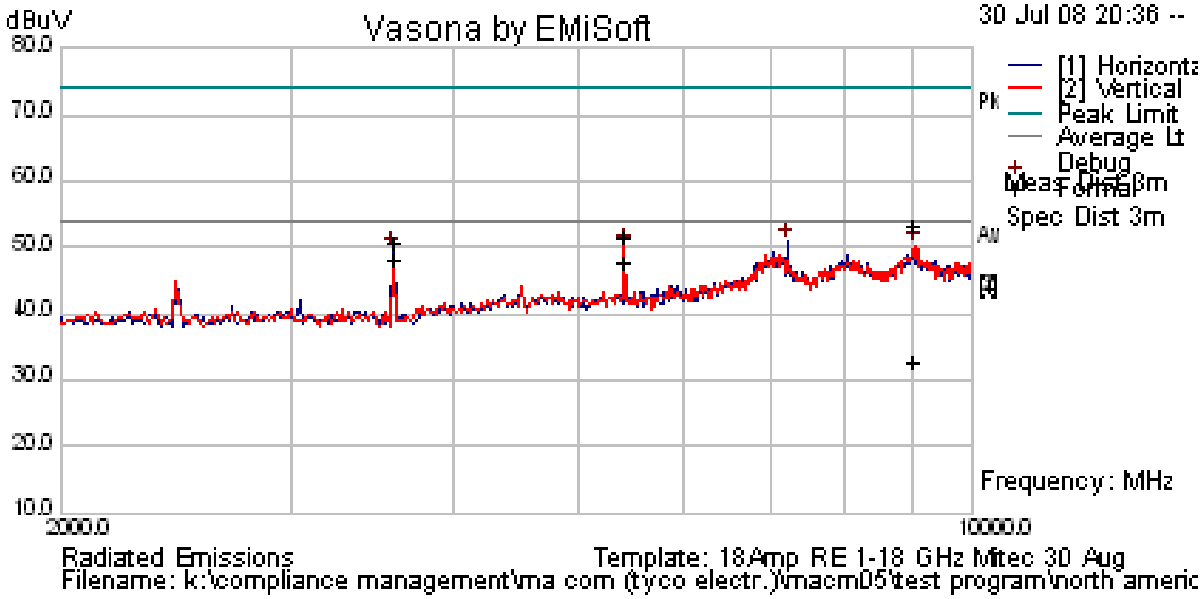
Ch 1 Peak Fundamental Emission



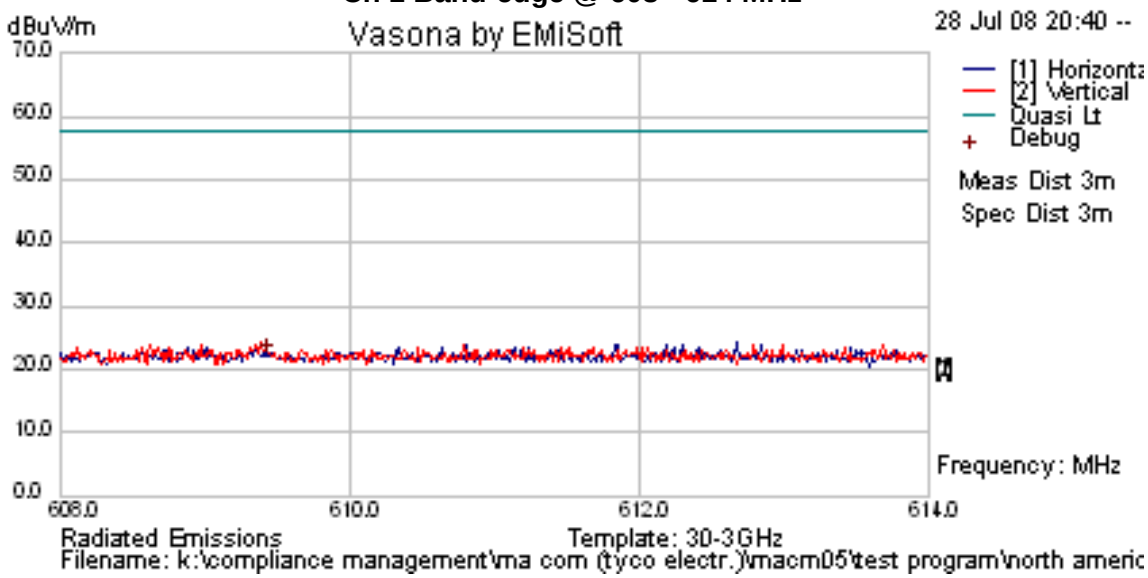
Ch 1 Radiated Emissions 1-2 GHz



Ch 1 Radiated Emissions 2-10 GHz



Ch 1 Band-edge @ 608 - 614 MHz



Integral Antenna

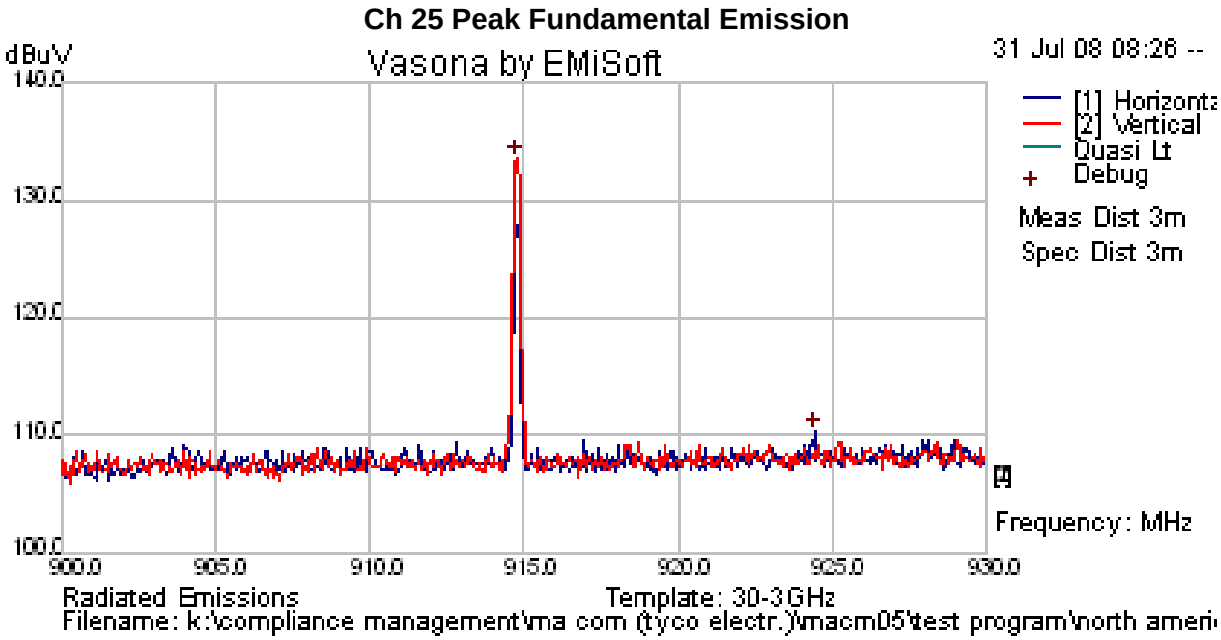
Channel 25 – 914.75 MHz

TABLE OF RESULTS

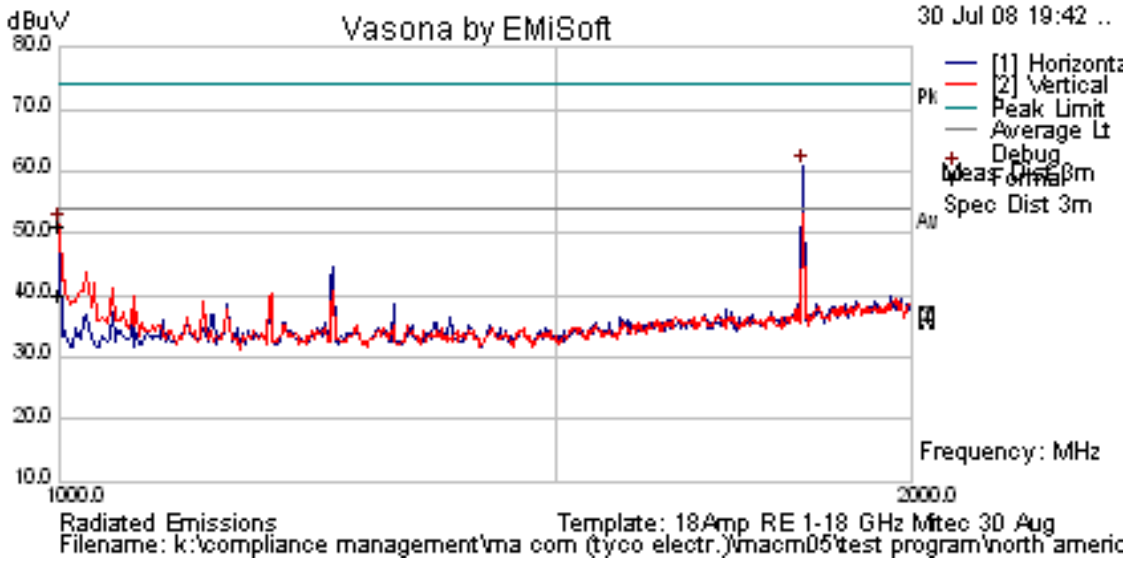
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
914.79	73.27	37.38	22.9	133.54	Peak [Scan]	V						Fundamental
1000	65.14	1.95	-15.82	51.27	Peak Max	V	108	328	74	-22.73	Pass	
2744.316	63.61	3.19	-11.01	55.79	Peak Max	V	121	42	74	-18.21	Pass	
1000	53.91	1.95	-15.82	40.04	Average Max	V	108	328	54	-13.96	Pass	
2744.316	61.67	3.19	-11.01	53.85	Average Max	V	121	42	54	-0.15	Pass	
1829.659	70.1	2.63	-12.01	60.73	Peak [Scan]	H	100	0	113.54	-52.81	Pass	NRB
5488.645	55.1	4.6	-8.3	51.37	Peak [Scan]	H	100	0	113.54	-62.17	Pass	NRB

Peak – Peak Emission
NRB – Non-restricted band emission

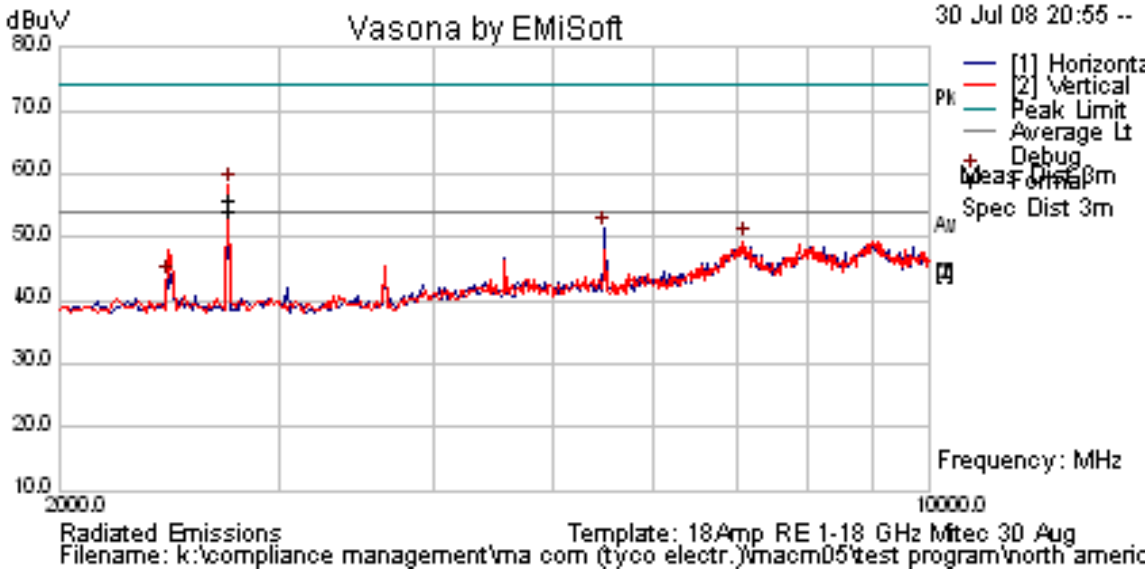
NRB Limit = Peak Fundamental Emission – 20 dB = 133.54 – 20 = 113.54 dBµV/m



Ch 25 Radiated Emissions 1-2 GHz



Ch 25 Radiated Emissions 2-10 GHz



Channel 50 – 927.25 MHz

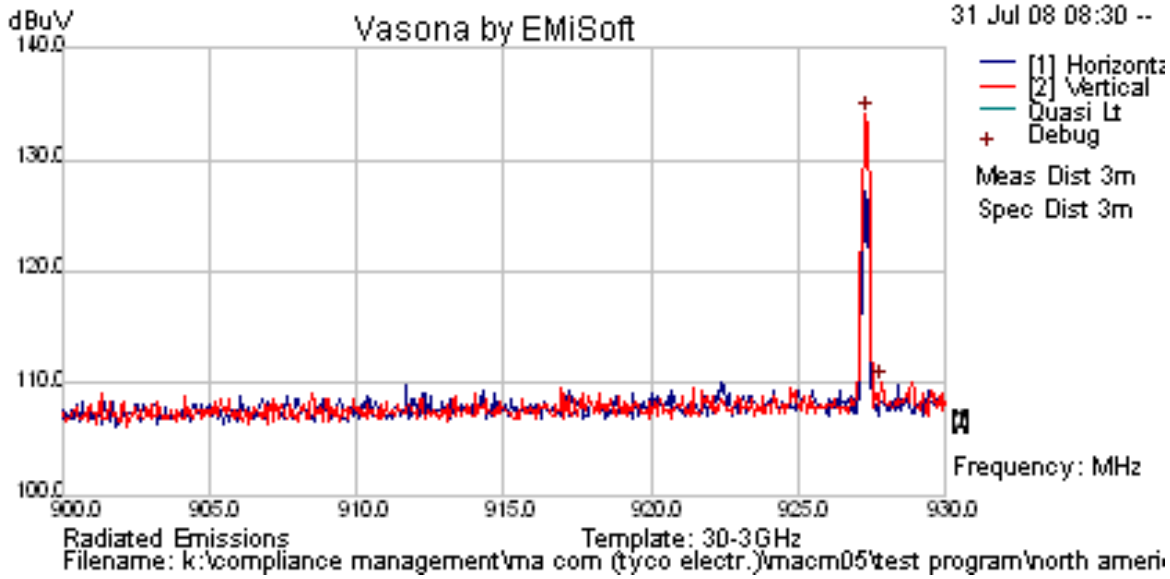
TABLE OF RESULTS

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
927.295	73.52	37.43	23.1	134.06	Peak [Scan]	V						Fundamental
962.534	58.59	1.92	-16.04	44.47	Quasi Max	V	98	36	54	-9.53	Pass	Band-edge
1000.042	53.25	1.95	-15.82	39.38	Average Max	V	98	18	54	-14.62	Pass	Band-edge
3708.939	61.95	3.73	-10.77	54.91	Peak Max	H	137	60	74	-19.09	Pass	
2781.716	60.43	3.22	-10.95	52.7	Peak Max	V	123	38	74	-21.3	Pass	
7417.865	49.48	5.46	-3.4	51.55	Peak Max	H	144	103	74	-22.45	Pass	
3708.939	60.43	3.73	-10.77	53.39	Average Max	H	137	60	54	-0.61	Pass	
2781.716	58.33	3.22	-10.95	50.6	Average Max	V	123	38	54	-3.4	Pass	
7417.865	42.93	5.46	-3.4	44.99	Average Max	H	144	103	54	-9.01	Pass	
1856.192	72.46	2.65	-11.78	63.33	Peak [Scan]	H	100	0	54	-50.73	Pass	NRB

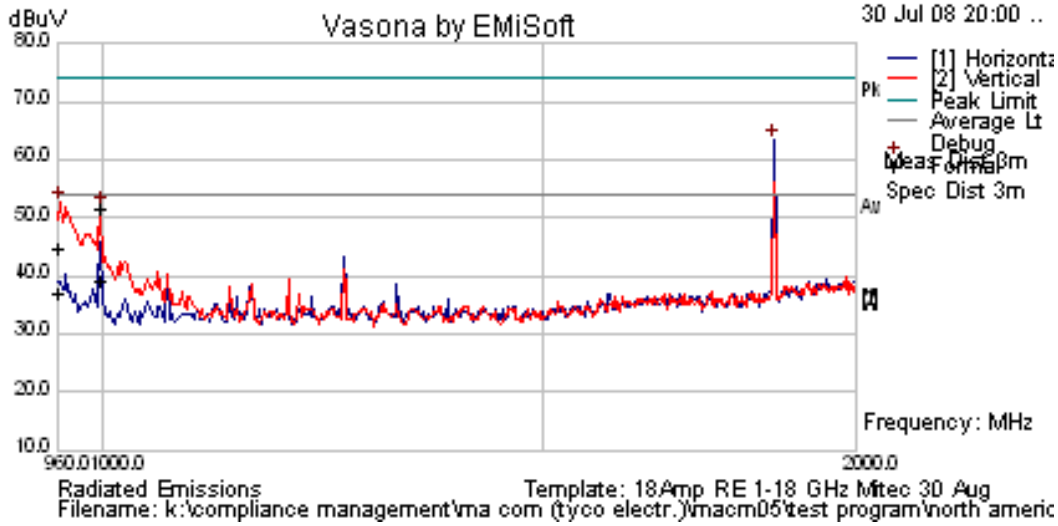
Peak – Peak Emission
NRB – Non-restricted band emission

NRB Limit = Peak Fundamental Emission – 20 dB = 134.06 – 20 = 114.06 dBµV/m

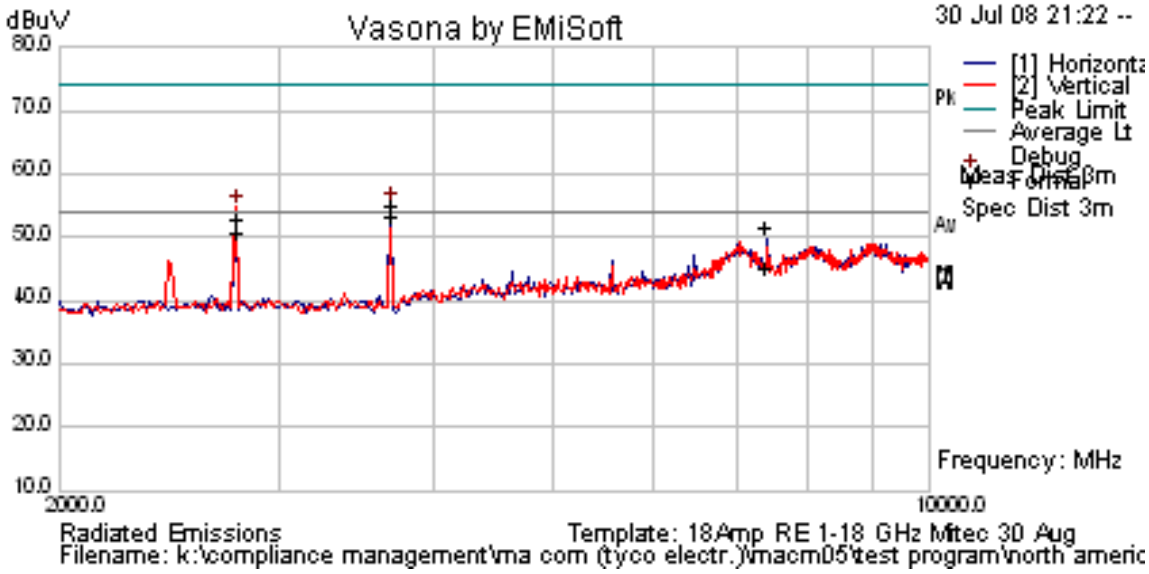
Ch 50 Peak Fundamental Emission



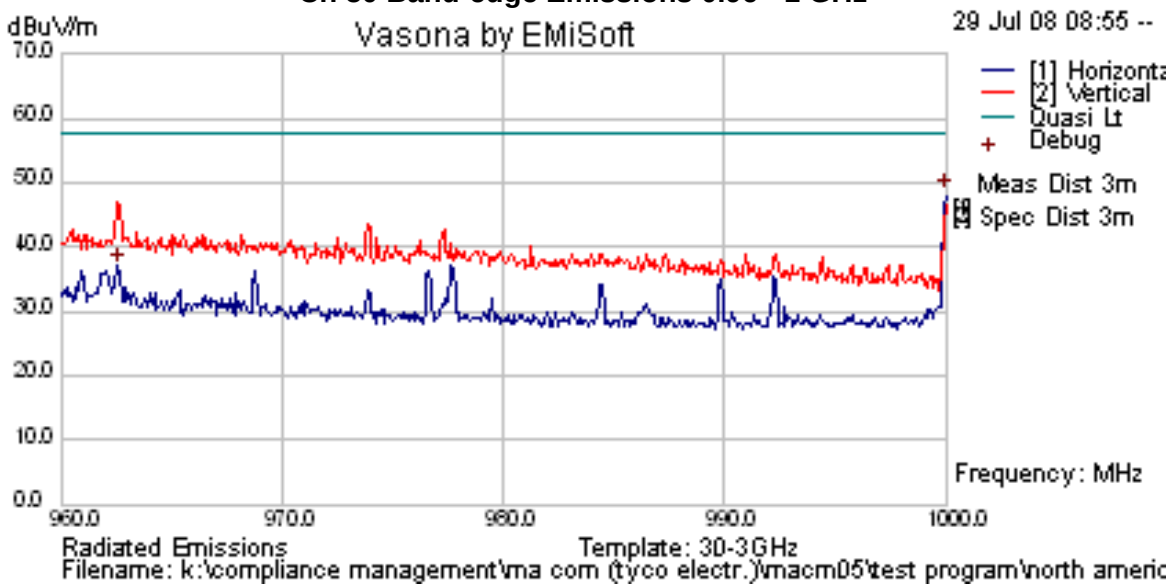
Ch 50 Radiated Emissions 0.96 - 2 GHz



Ch 50 Radiated Emissions 2 - 10 GHz



Ch 50 Band-edge Emissions 0.96 - 1 GHz



5.3.1.2. 2.4 GHz WiFi Radiated Emissions

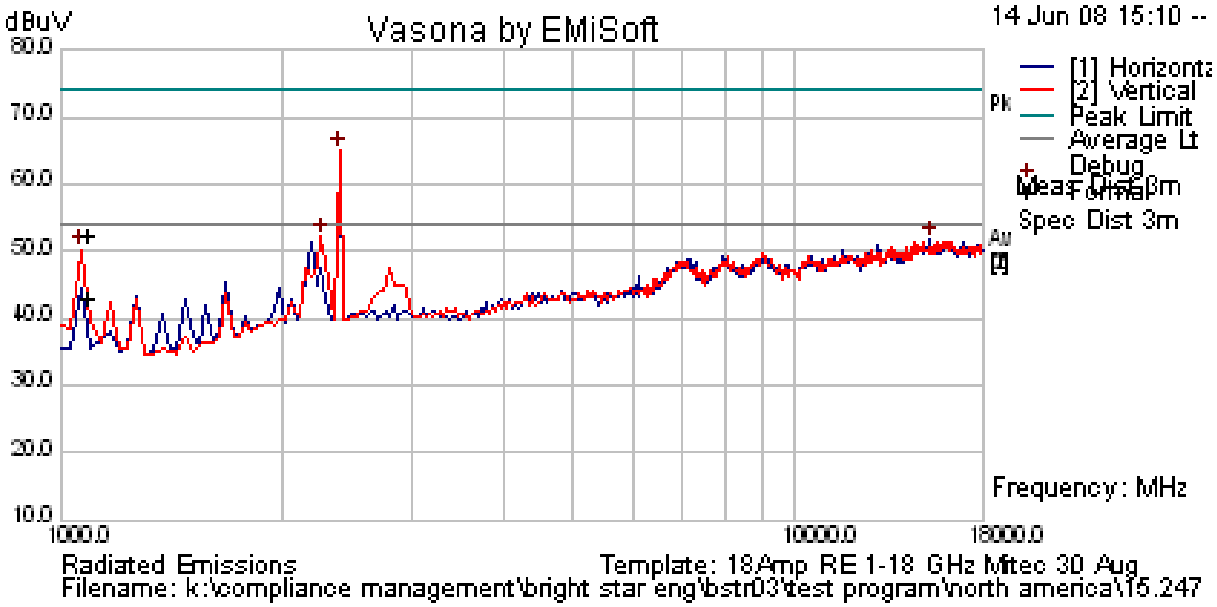
Ambient conditions.
Temperature: 17 to 23°C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

TABLE OF RESULTS – 802.11b – 1 Mb/s 2,412 MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
2413.052	79.98	32.96	-10.56	112.38	Peak Emission	V					N/A	Peak
1092.86	66.05	2.04	-15.6	52.50	Peak Max	V	110	10	74	-21.5	Pass	
1092.86	56.78	2.04	-15.6	43.22	Average Max	V	110	10	54	-10.78	Pass	
15240.48	44.46	8.15	-0.92	51.70	Peak [Scan]	H	100	0	82.38	-30.68	Pass	NRB

Peak – Peak of the fundamental Emission i.e. carrier
NRB – Non-restricted band emission (limit 20 dB down from peak emission)

The following plot identifies peak emissions only



Band-Edge

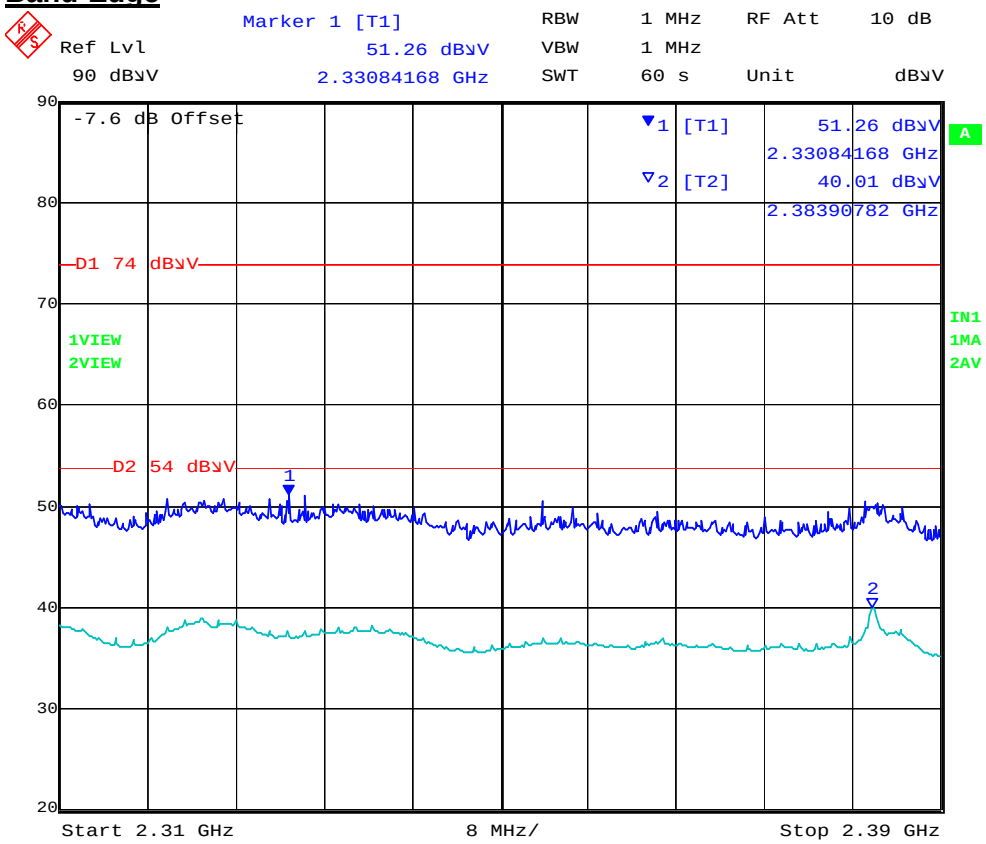


TABLE OF RESULTS – 802.11b – 1 Mb/s 2,437 MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
2435.977	80.24	32.97	-10.57	112.65	Peak [Scan]	V	100	0	54	48.65	N/A	Peak
1059.358	55.28	2.01	-15.65	41.64	Peak Max	V	102	188	74	-32.36	Pass	
4873.973	52.62	4.51	-8.75	48.38	Peak Max	V	98	269	74	-25.62	Pass	
1059.358	35.99	2.01	-15.65	22.35	Average Max	V	102	188	54	-31.65	Pass	
4873.973	47.06	4.51	-8.75	42.82	Average Max	V	98	269	54	-11.18	Pass	

Peak – Peak of the fundamental Emission i.e. carrier

The following plot identifies peak emissions only

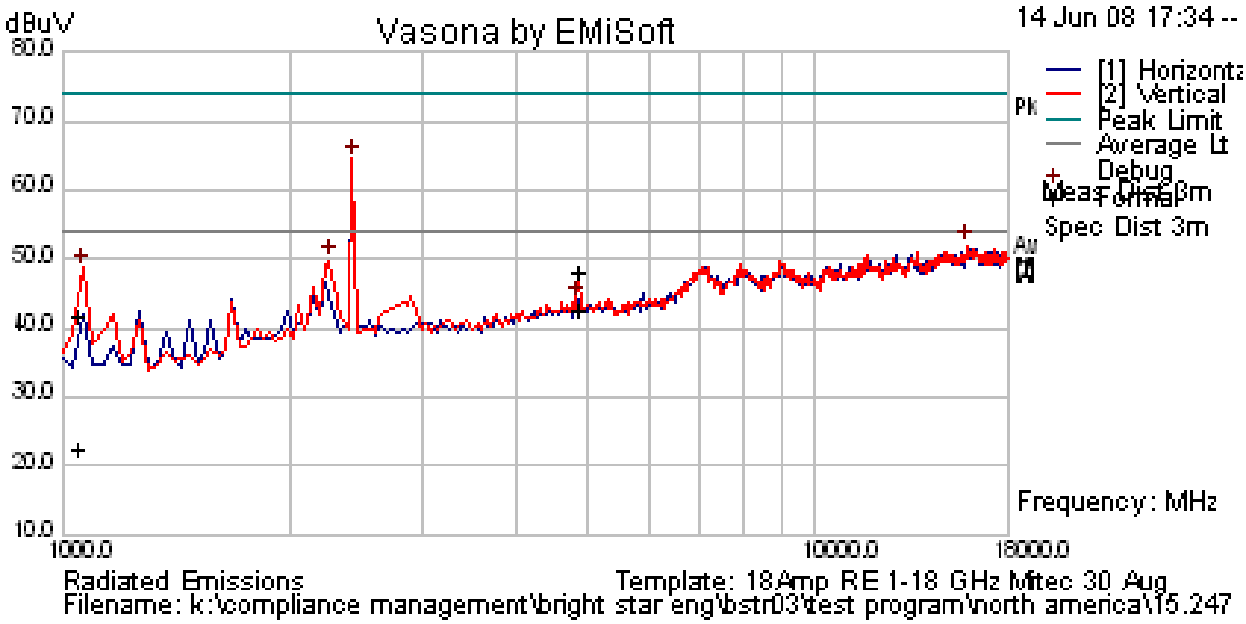
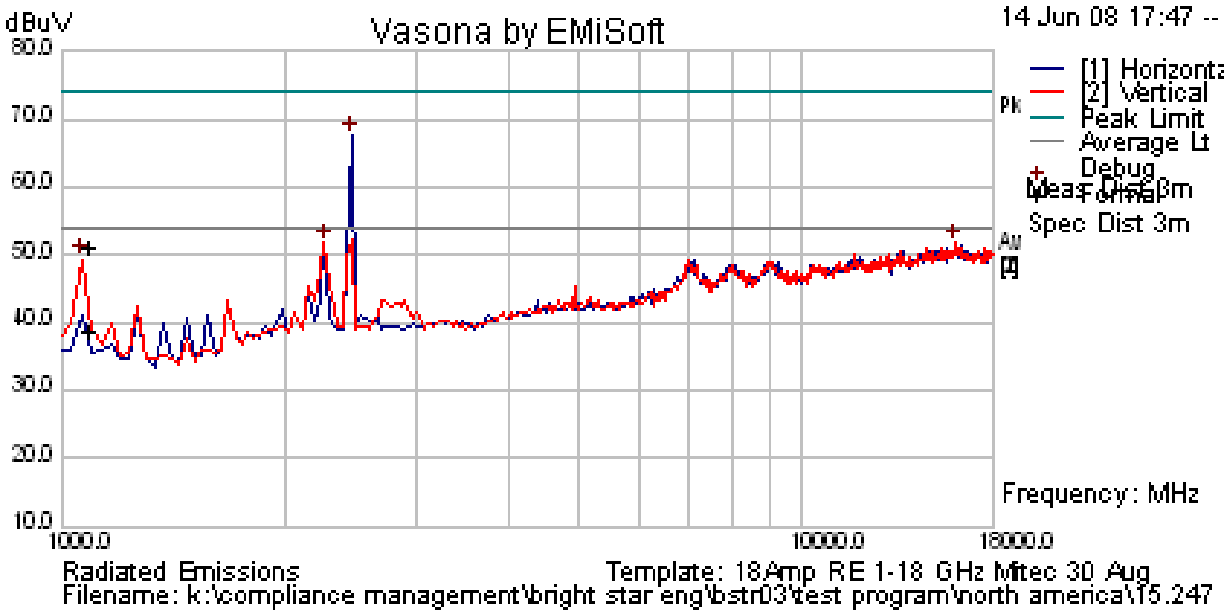


TABLE OF RESULTS – 802.11b – 1 Mb/s 2,462 MHz

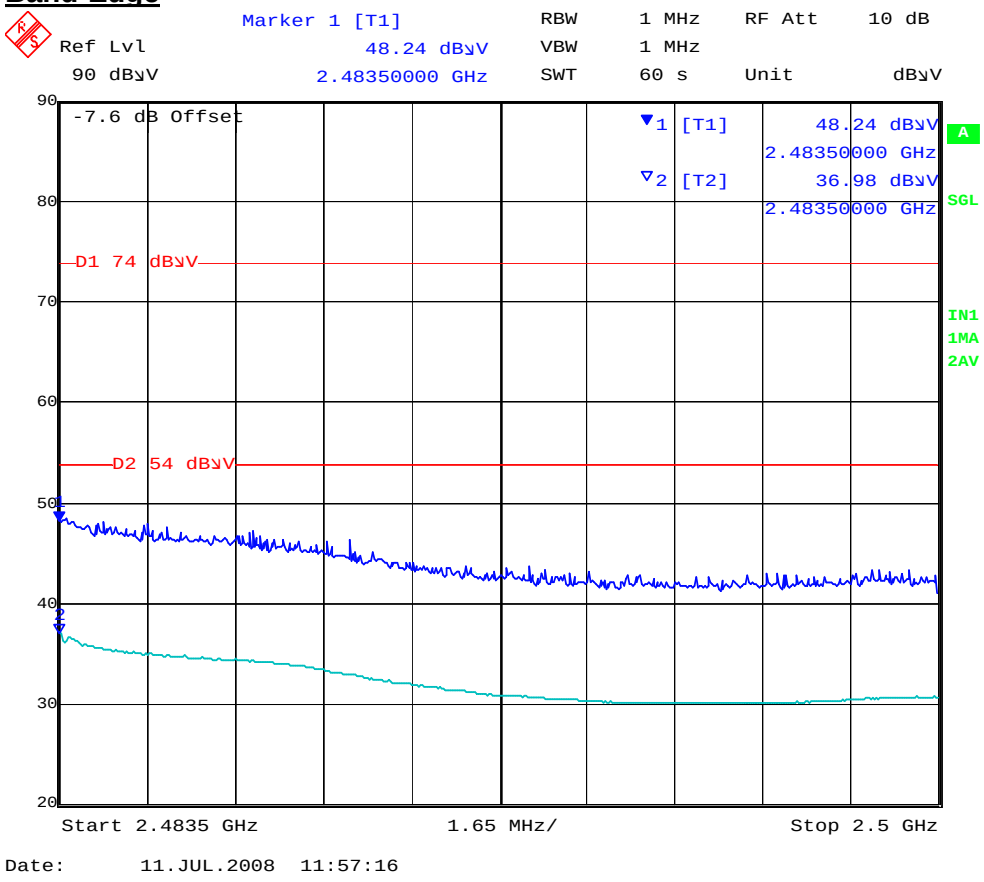
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
2413.052	79.98	32.96	-10.56	112.38	Peak Emission	V					N/A	Peak
1092.86	66.05	2.04	-15.6	52.50	Peak Max	V	110	10	74	-21.5	Pass	
1092.86	56.78	2.04	-15.6	43.22	Average Max	V	110	10	54	-10.78	Pass	
15240.48	44.46	8.15	-0.92	51.70	Peak [Scan]	H	100	0	82.38	-30.68	Pass	NRB
2483.5				48.24	Peak Max	V			74	-25.76	Pass	Band-Edge
2483.5				36.98	Average Max	V			54	-17.02	Pass	Band-Edge

Peak – Peak of the fundamental Emission i.e. carrier
NRB – Non-restricted band emission (limit 20 dB down from peak emission)

The following plot identifies peak emissions only



Band-Edge



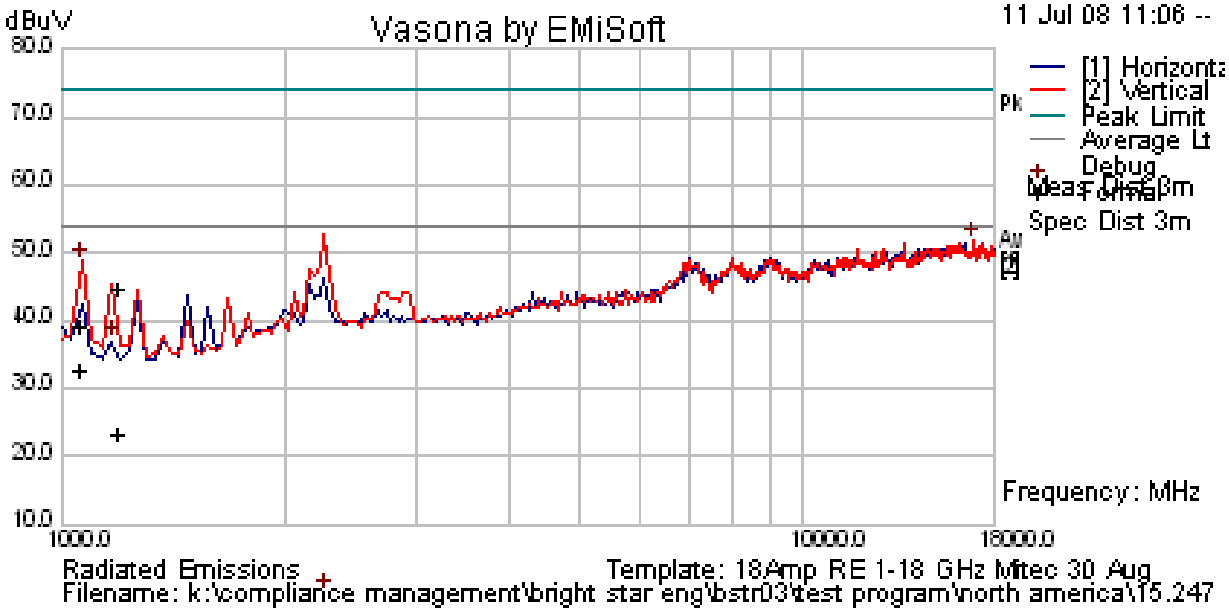
802.11g Results

TABLE OF RESULTS – 802.11g – 6 Mb/s 2,412 MHz

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
2405.355	80.75	32.96	-10.56	113.14	Peak [Scan]	V	100				N/A	Peak
1067.927	52.62	2.02	-15.64	39	Peak Max	H	133	302	74	-35	Pass	
1192.724	57.73	2.13	-15.31	44.56	Peak Max	V	100	131	74	-29.44	Pass	
1067.927	46.2	2.02	-15.64	32.58	Average Max	H	133	302	54	-21.42	Pass	
1192.724	36.29	2.13	-15.31	23.11	Average Max	V	100	131	54	-30.89	Pass	
2383.908				51.53	Peak Max	V			74	-22.47	Pass	Band-Edge
2383.908				39.54	Average Max	V			54	-14.46	Pass	Band-Edge

Peak – Peak of the fundamental Emission i.e. carrier
NRB – Non-restricted band emission (limit 20 dB down from peak emission)

The following plot identifies peak emissions only



Band-Edge

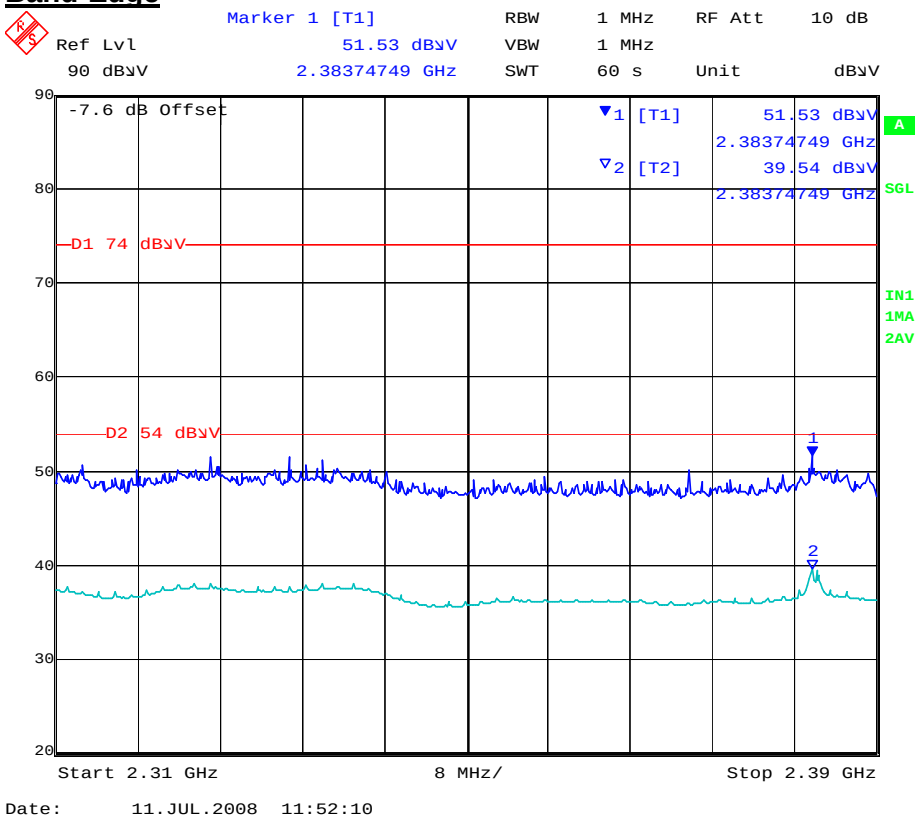
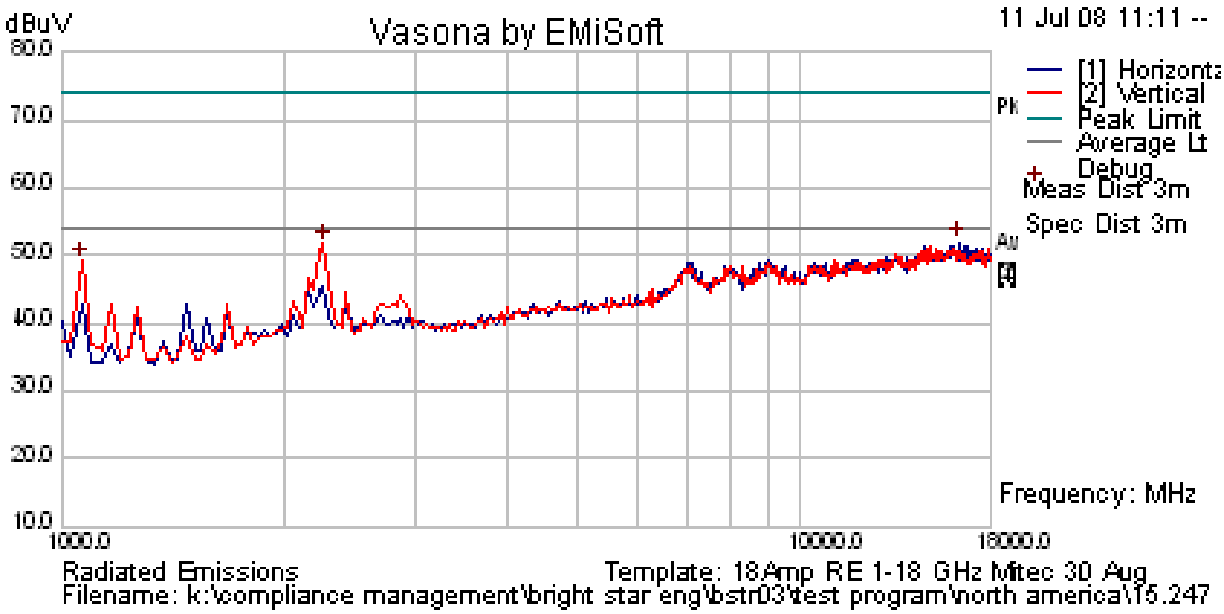


TABLE OF RESULTS – 802.11g – 6 Mb/s 2,437 MHz

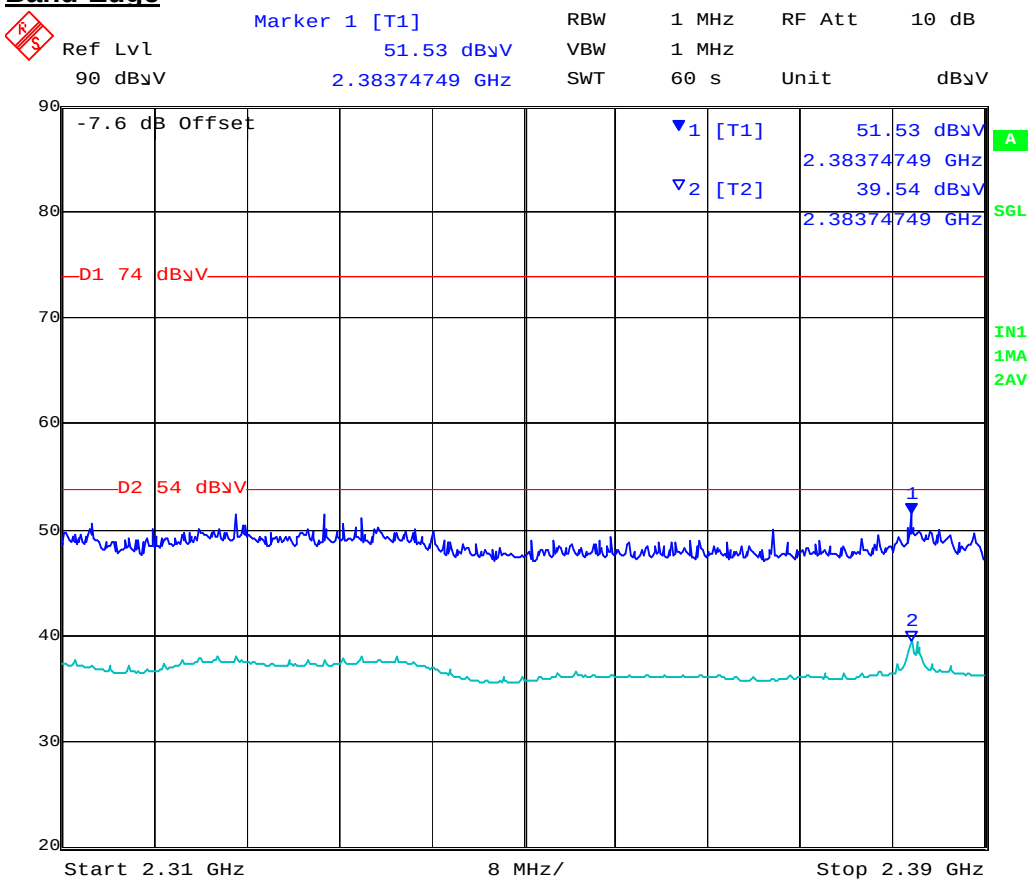
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
2444.009	78.71	32.97	-10.57	111.11	Peak [Scan]	V					N/A	Peak
1192.635	56.53	2.13	-15.31	43.36	Peak Max	V	98	131	74	-30.64	Pass	
1192.635	36.59	2.13	-15.31	23.41	Average Max	V	98	131	54	-30.59	Pass	

Peak – Peak of the fundamental Emission i.e. carrier

The following plot identifies peak emissions only



Band-Edge



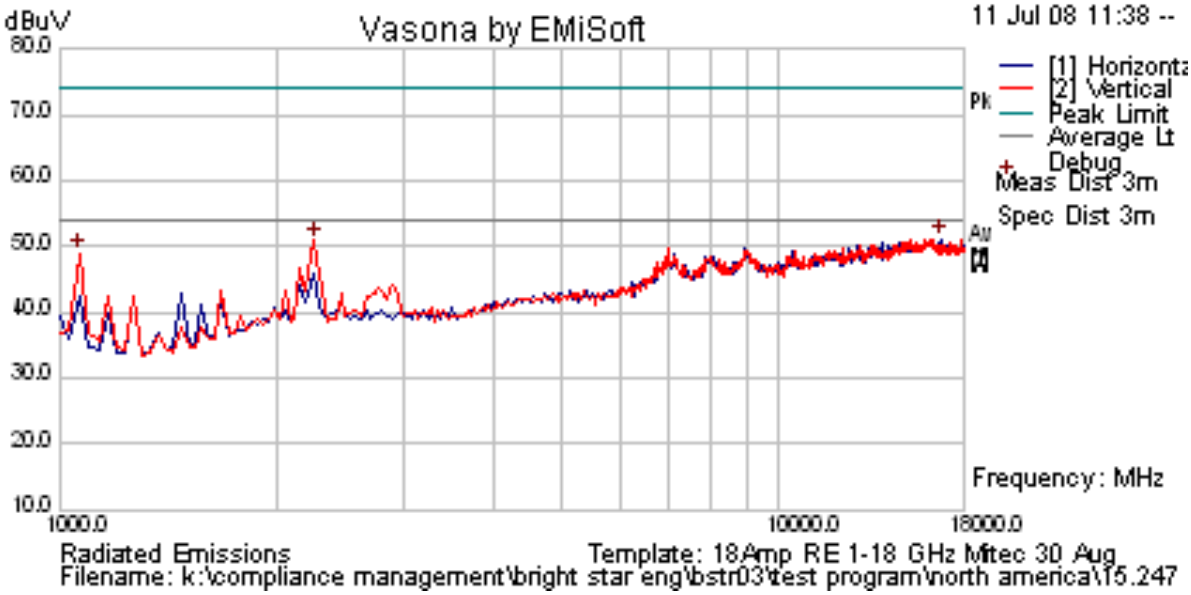
Date: 11.JUL.2008 11:52:10

TABLE OF RESULTS – 802.11g – 6 Mb/s 2,462 MHz

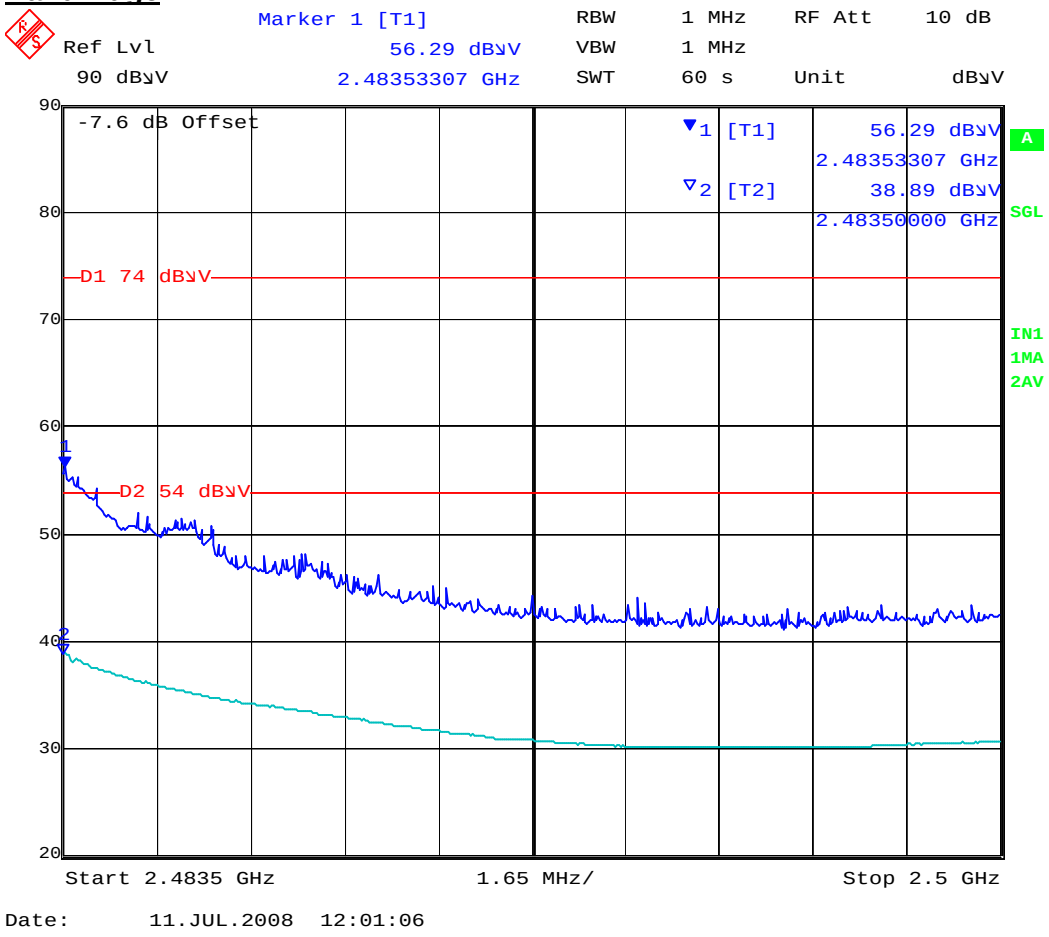
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
2466.767	78.13	32.99	-10.59	110.53	Peak [Scan]	V					N/A	Peak
16807.62	42.94	8.6	-0.44	51.1	Peak [Scan]	H	100	0	54	-2.9	Pass	
1068.136	62.58	2.02	-15.64	48.96	Peak [Scan]	V	100	0	54	-5.04	Pass	
2483.5				56.29	Peak Max	V			74	-17.71	Pass	Band-Edge
2483.5				38.89	Average Max	V			54	-15.11	Pass	Band-Edge

Peak – Peak of the fundamental Emission i.e. carrier
NRB – Non-restricted band emission (limit 20 dB down from peak emission)

The following plot identifies peak emissions only



Band-Edge



Specification

FCC Part 15 Subpart C §15.247(d)

Industry Canada §A8.5

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

5.3.2. Receiver Radiated Spurious Emissions

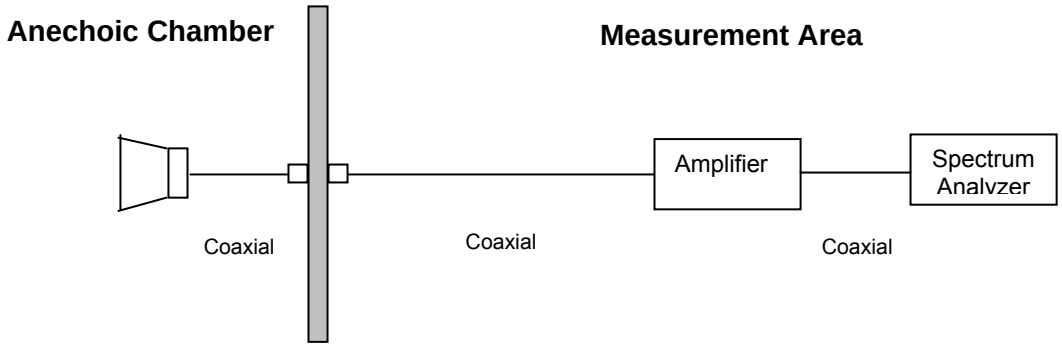
Industry Canada RSS-Gen §7.2.3

Test Procedure

Radiated receiver emissions were measured on the device on the low and high channel. The EUT was placed in receive mode and emissions measured. Emissions above 1 GHz were 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. The highest emissions relative to the limit are listed for each frequency spanned.

All measurements on any frequency or frequencies over 1 GHz 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, measurements below 1 GHz use a resolution bandwidth of 100 kHz.

Test Measurement Set up



Receiver spurious emissions test configuration

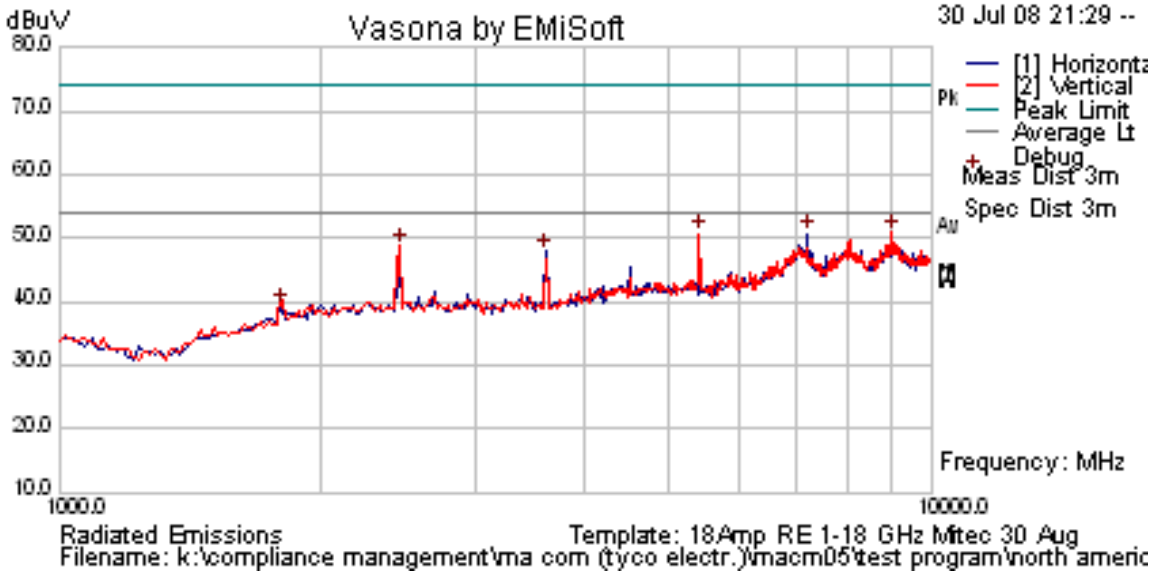
Measurement Results

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

5.3.2.1. Receiver Radiated Emissions

Spurious Emissions 1 – 12.75 GHz Channel 2403.33 MHz

Spurious Emissions Stand-By Mode 1 – 12.75 GHz



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
9026.052	44.55	6.21	0.02	50.78	Peak [Scan]	V	100	0	54	-3.22	Pass	
7222.445	47.71	5.43	-2.4	50.73	Peak [Scan]	H	100	0	54	-3.27	Pass	
5418.838	54.46	4.62	-8.44	50.64	Peak [Scan]	V	100	0	54	-3.36	Pass	
2460.922	56.37	2.98	-10.58	48.77	Peak [Scan]	V	100	0	54	-5.23	Pass	
3615.196	55.31	3.67	-11.06	47.92	Peak [Scan]	H	98	0	54	-6.08	Pass	
1798.584	48.69	2.61	-12.24	39.06	Peak [Scan]	H	98	0	54	-14.94	Pass	

Specification
Antenna Conducted Measurement
Industry Canada RSS-Gen §7.2.3

If the device has a detachable antenna of known antenna impedance, then the antenna conducted method is permitted in lieu of a radiated measurement.
Receiver spurious emissions at any discrete frequency shall not exceed 2 nanowatts (-57 dBm) in the band 30-1000 MHz, or 5 nanowatts (-53 dBm) above 1 GHz.

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.

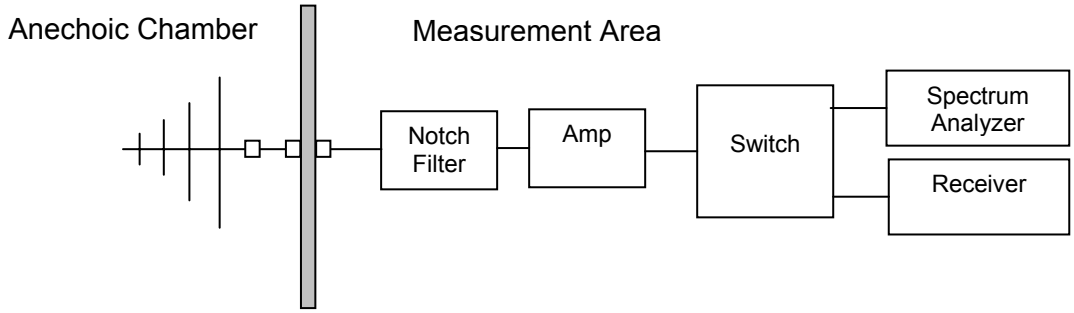
5.3.3. Radiated Spurious Emissions (30M-1 GHz)

FCC, Part 15 Subpart C §15.247(d), §15.205, 15.209
Industry Canada RSS-210 §A8.5, 2.2, 2.6.

Test Procedure
Preliminary radiated emissions were measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarity. The emissions are recorded with a CISPR compliant 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.

A notch filter with approximately 70 dB of rejection was used to remove the fundamental frequency.

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

The following measurement results include the 802.11b/g WiFi emissions

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

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

Radiated Emissions Below 1 GHz (Class A)

TABLE OF RESULTS – DIGITAL EMISSIONS 30M – 1 GHz

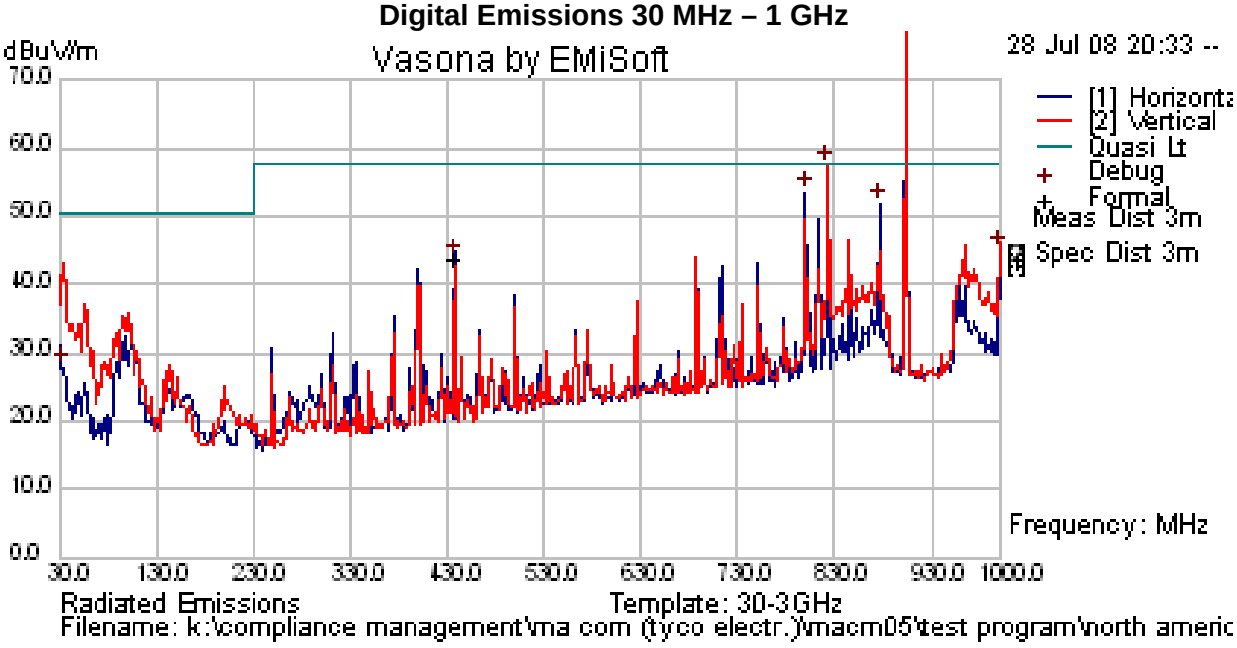
EUT Transmitting Maximum Output Power

+24 Vdc Operation

Ch 1 - 902.75 MHz

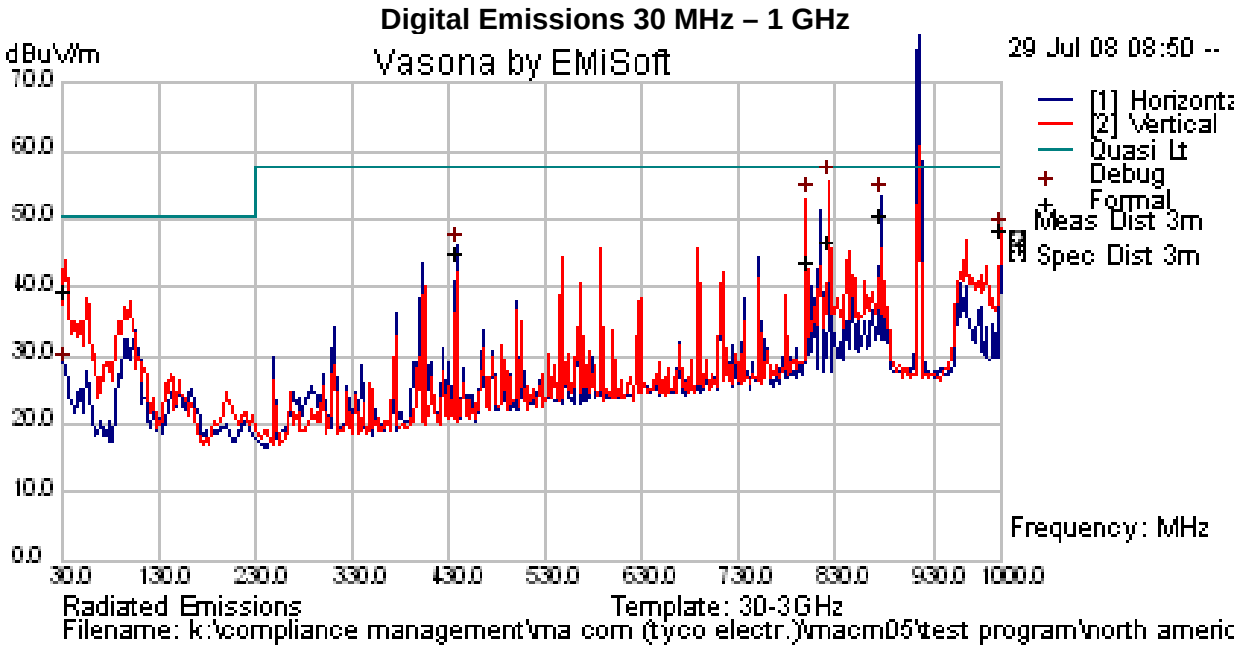
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
822.074	65.6	7.18	-20.89	51.89	Quasi Max	V	126	35	57.5	-5.61	Pass
875.015	64.82	7.24	-20.73	51.34	Quasi Max	H	98	211	57.5	-6.16	Pass
799.862	65.3	7.18	-21.25	51.23	Quasi Max	V	98	360	57.5	-6.27	Pass
999.99	59.11	7.69	-19.22	47.57	Quasi Max	V	98	21	57.5	-9.93	Pass
34.645	53.62	3.47	-18.33	38.76	Quasi Max	V	131	306	50.5	-11.74	Pass
437.496	64.43	5.79	-26.29	43.92	Quasi Max	H	98	250	57.5	-13.58	Pass

Digital Emissions 30 MHz – 1 GHz



Ch 25 - 914.75 MHz

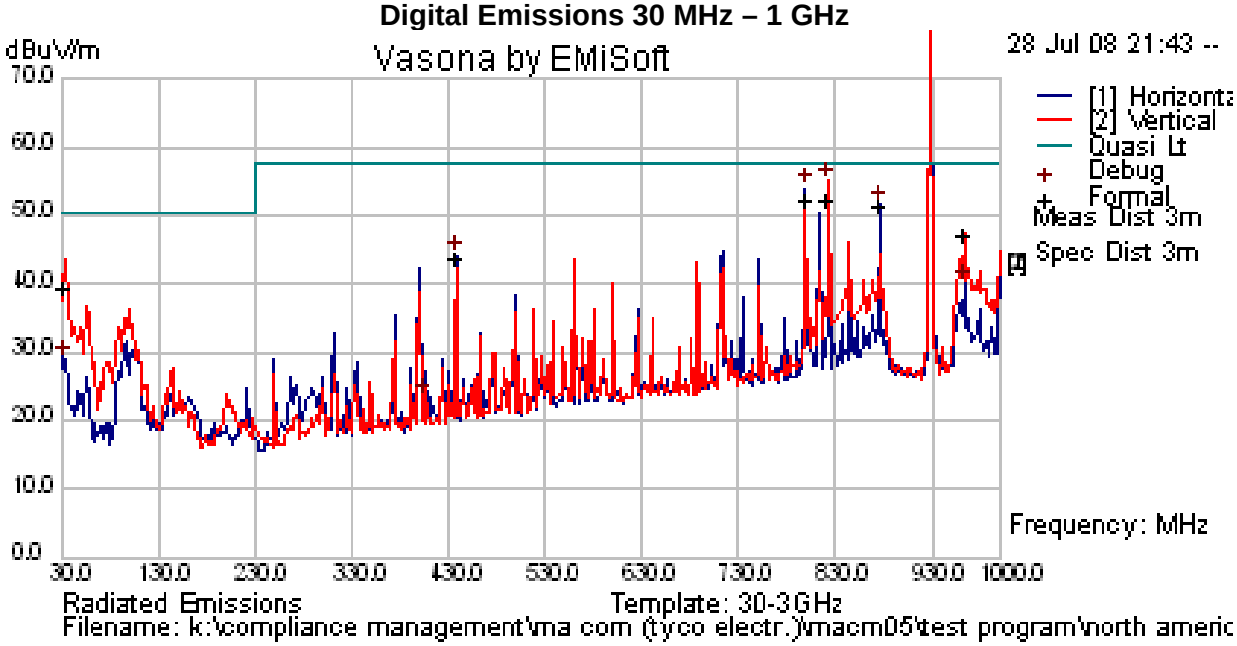
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail
822.099	60.28	7.18	-20.89	46.57	Quasi Max	V	104	179	57.5	-10.93	Pass
874.98	64.29	7.24	-20.73	50.8	Quasi Max	H	171	347	57.5	-6.7	Pass
799.78	57.9	7.18	-21.25	43.83	Quasi Max	V	109	11	57.5	-13.67	Pass
999.979	60.05	7.69	-19.22	48.52	Quasi Max	H	141	188	57.5	-8.98	Pass
437.515	65.45	5.79	-26.29	44.95	Quasi Max	H	101	242	57.5	-12.55	Pass
34.654	54.55	3.47	-18.34	39.69	Quasi Max	V	98	18	50.5	-10.81	Pass



Ch 50 - 927.25 MHz

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
799.857	66.51	7.18	-21.25	52.44	Quasi Max	H	172	280	57.5	-5.06	Pass
822.069	66.01	7.18	-20.89	52.3	Quasi Max	V	146	12	57.5	-5.2	Pass
874.973	64.78	7.24	-20.73	51.3	Quasi Max	H	98	353	57.5	-6.2	Pass
437.494	64.09	5.79	-26.29	43.58	Quasi Max	H	106	246	57.5	-13.92	Pass
962.564	59.07	7.57	-19.65	46.99	Quasi Max	V	98	22	57.5	-10.51	Pass
34.646	54.38	3.47	-18.33	39.52	Quasi Max	V	98	325	50.5	-10.98	Pass

Digital 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.

§15.209 (a) and **RSS-Gen §2.2** Limit Matrix

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

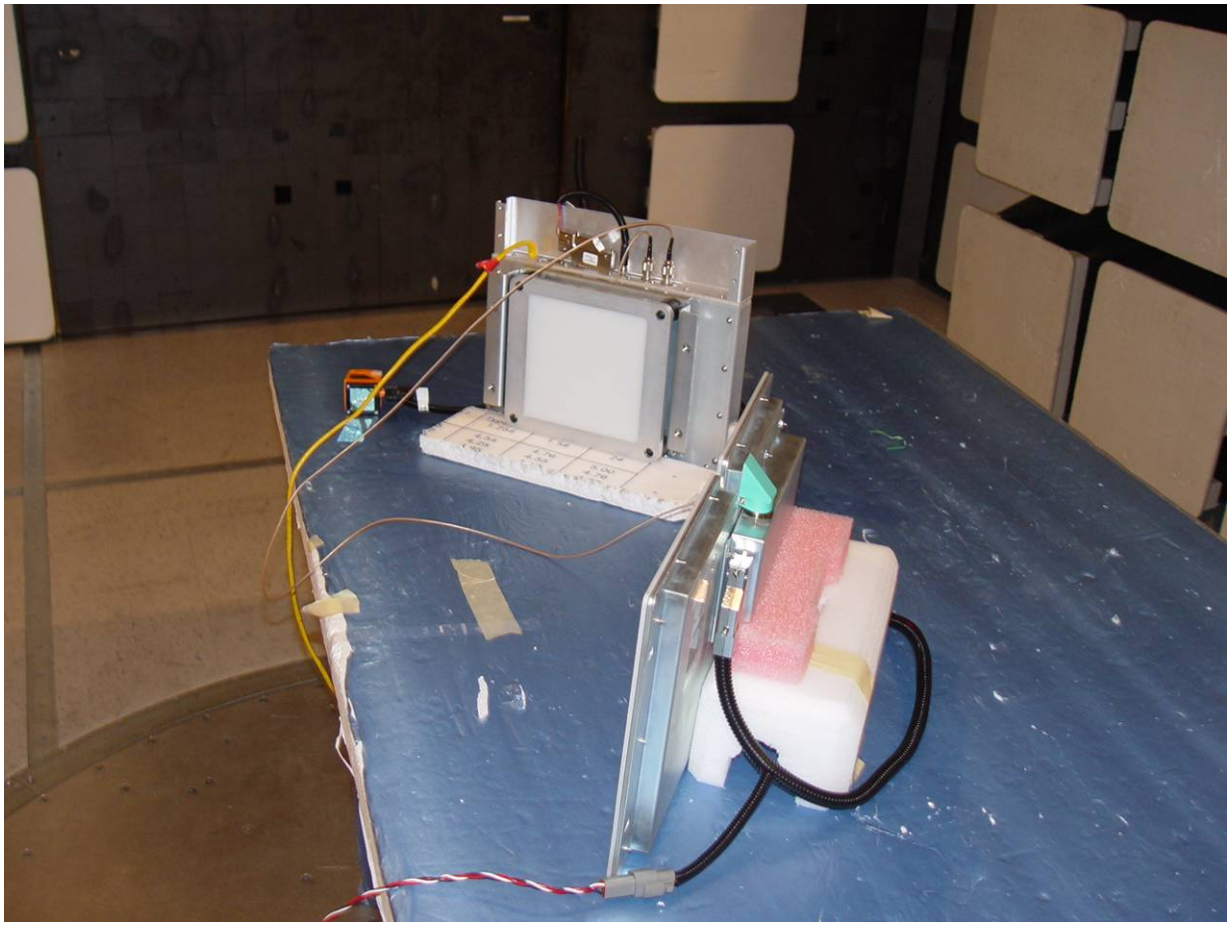
Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions'	0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312, 0341

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

Note: no requirement to test battery operated

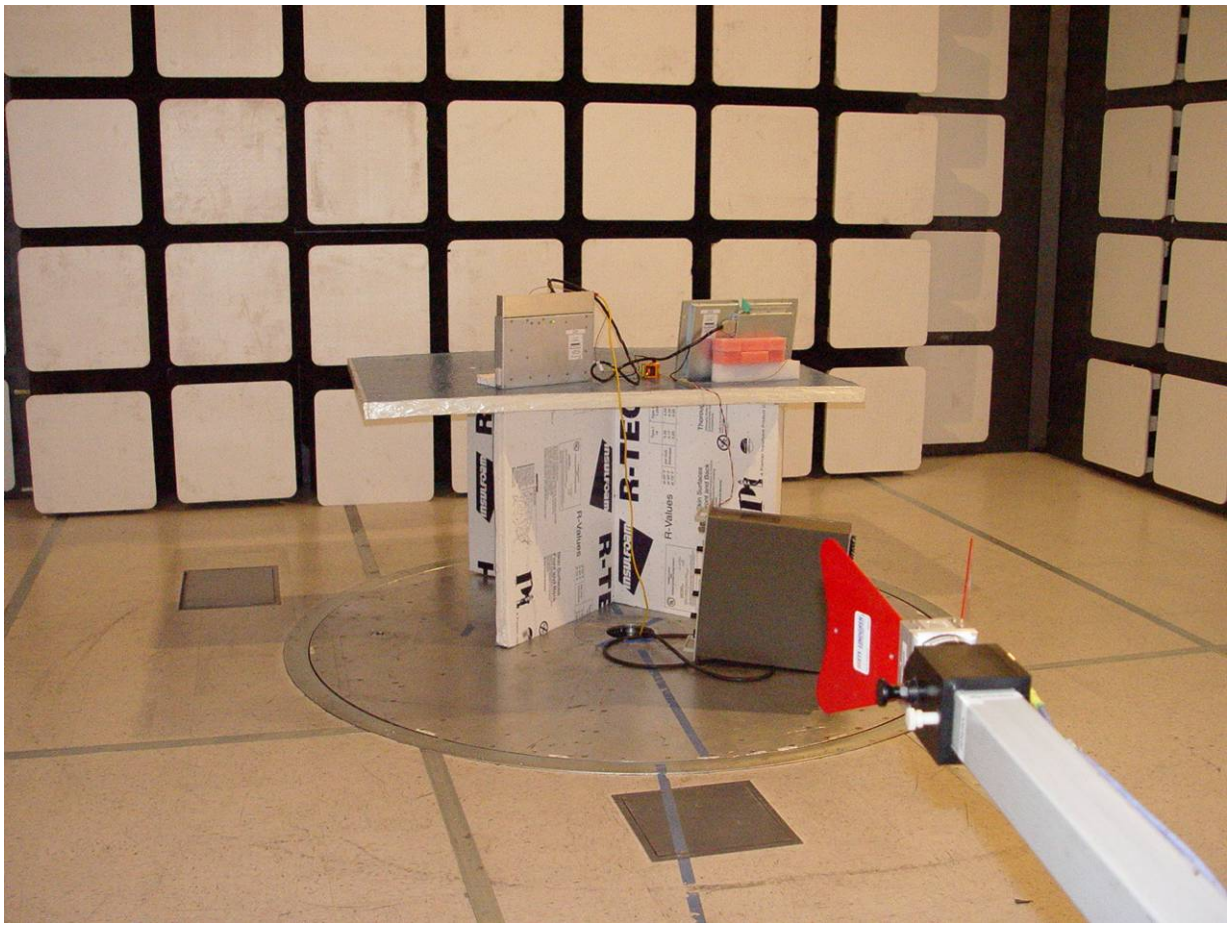
6. PHOTOGRAPHS

6.1. Radiated Emissions Test Set-up



6.2. Radiated Emissions <1GHz

6.3. Radiated Emissions >1GHz



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
0190	LISN	Rhode & Schwartz	ESH3Z5	836679/006
0293	BNC Cable	Megaphase	1689 1GVT4	15F50B001
0307	BNC Cable	Megaphase	1689 1GVT4	15F50B002

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