Test of Model EX-5r (Dual Polarized)

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

Test Report Serial No.: EXLT03-A2 Rev A

TEST REPORT

FROM

Test of Model EX-5r (Dual Polarized)
to
FCC 47 CFR Part15.247 & IC RSS-210

Test Report Serial No.: EXLT03-A2 Rev A

Note: this report only contains data with regard to the 5.8 GHz operational modes of the EX-5r. 5250-5350 MHz test data is reported in MiCOM Labs test report EXLT03-A5

This report supersedes: None

Manufacturer: Exalt Communications, Inc
580 Division Street
Campbell, California 95008
USA

Product Function: 5 GHz (Dual Polarized) Point to Point Fixed Link Radio

Copy No: pdf **Issue Date:** 10th July 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

ACCREDITED
CERTIFICATE #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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ACCREDITATION & LISTINGS

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

THE AMERICAN
ASSOCIATION
FOR LABORATORY
ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

MICOM LABS
Pleasanton, CA

for technical competence in the field of

Electrical Testing

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

Presented this 14th day of September 2005.

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

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

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

LISTINGS

MiCOM Labs test facilities are listed by the following organizations;

North America

United States of America
Federal Communications Commission (FCC) Listing #: 102167

DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft		
Rev A	10th July '06	Initial Release

1. TEST RESULT CERTIFICATE

Manufacturer:	Exalt Communications, Inc 580 Division Street Campbell, California 95008 USA	Tested By:	MiCOM Labs, Inc. 3922 Valley Avenue 'B' Pleasanton California, 94566, USA
EUT:	EX-5r 5 GHz (Dual Polarized) Point to Point Fixed Link Radio	Telephone:	+1 925 462 0304
Model:	EX-5r	Fax:	+1 925 462 0306
S/N:	001		
Test Date(s):	19th May to 7th June '06	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	2006	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 Exalt Communications Inc Model EX-5r (Dual Polarized) to FCC Part 15.247 and Industry Canada RSS-210 regulations
Applicant:	As Manufacturer
Manufacturer:	Exalt Communications, Inc 580 Division Street Campbell, California 95008 USA
Laboratory performing the tests:	MiCOM Labs, Inc. 3922 Valley Avenue, Suite "B" Pleasanton, California 94566 USA
Test report reference number:	EXLT03-A2 Rev A
Date EUT received:	19TH May 2006
Standard(s) applied:	FCC 47 CFR Part15.247 & IC RSS-210
Dates of test (from - to):	19th May to 7th June '06
No of Units Tested:	1
Type of Equipment:	5 GHz Point to Point Fixed Link Radio
Manufacturers Trade Name:	Model EX-5r (Dual Polarized)
Model:	EX-5r
Location for use:	Indoor and Outdoor use
Declared Frequency Range(s):	5,725 to 5,850 MHz
Type of Modulation:	QPSK; 16QAM; 64QAM
Declared Nominal Output Power:	+24 dBm
EUT Modes of Operation:	QPSK; 16QAM; and 64QAM modulation available at 7.5 MHz, 15 MHz, 30 MHz, & 60 MHz Bandwidths.
Transmit/Receive Operation:	Time Division Duplex (TDD)
Rated Input Voltage and Current:	+48 Vdc 0.8 A and/or 24Vdc 1.6A.
Operating Temperature Range:	Declared -25 to +65ºC
ITU Emission Designator:	7.5 MHz Bandwidth - 8M5W7D 15 MHz Bandwidth - 16M6W7D 30 MHz Bandwidth - 33M1W7D 60 MHz Bandwidth - 65M8W7D
Microprocessor(s) Model:	MPC852T
Clock/Oscillator(s):	25MHz, 1.544 MHz, 2.048 MHz, 12.880 MHz, 44.736 MHz, 34.368 MHz, 100 MHz, 120 MHz
Frequency Stability:	±7 ppm
Equipment Dimensions:	12" x 12" x 4"
Weight:	15 lbs
Primary function of equipment:	Point to Point Transmission of T1/E1/Ethernet Data

3.2. Scope of Test Program

The scope of the test program was to test the Exalt Communications EX-5r radio for compliance against FCC 47 CFR Part 15.247 and Industry Canada RSS-210 specifications.

The Exalt Communications EX-5r employs QPSK, 16QAM & 64QAM modulation in the frequency ranges 5.725 to 5.850 GHz. There are four selectable transmission bandwidths;

- 7.5 MHz
- 15 MHz
- 30 MHz
- 60 MHz

The EX-5r is a fixed point to point radio that may be deployed in several configurations.;-

(1) As a dual polarized radio, operating on the same frequency with a coherent transmitter on both polarizations, into an external dual-polarized antenna (parabolic dish or panel);

(2) As a dual-polarized radio, operating on the same frequency with a coherent transmitter on both polarizations, with and integrated dual-polarized antenna;

(3) As a single polarity radio, connected to a single external antenna (parabolic dish or panel);

(4) As a single pole radio with diversity polarization switching, connected to a dual-pole external antenna (parabolic dish or panel);

(5) As a single-pole radio with diversity polarization switching with an integrated dual pole panel antenna.

The EX-5r, when operated in dual-polarization mode, uses a coherent transmitter driven from the same reference oscillator(s). In addition, all cabling is done by identical length of phase and amplitude matched cable to ensure that the two transmitted signals are always coherent in both phase and power. As a result of the commonality, all conducted measurements were made on a single antenna port.

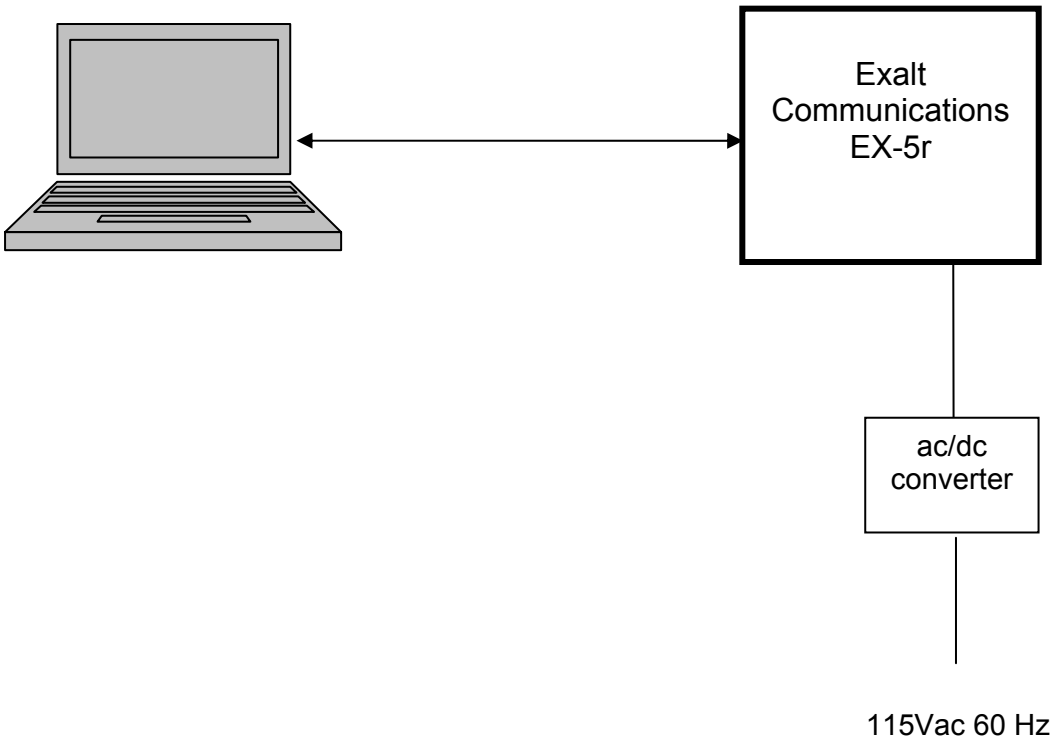
The EX-5i was configured as a dual-polarized transmitter for Radiated Emission testing purposes as this represents the highest emissions. An external dual polarized parabolic dish and external single-polarized panel antenna were used for testing as these represent the highest emissions possible and the highest gain antennas for the above configurations. In addition, testing was performed using the integrated dual-panel antenna to illustrate that the emissions were not impacted by the minor mechanical change to the integrated panel antenna (with lower gain antenna).

Exalt Communications Model EX-5r
5 GHz Point to Point Fixed Link Radio

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

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	5 GHz (Dual Polarized) Point to Point Microwave Radio	Exalt Communications Inc	EX-5r	001
Support	Power supply 115Vac 60Hz to +48Vdc, 0.8A	International Power Sources	CUP70-18 B2	70480-0000106

Test Measurement Set Up



3.4. Antenna Details

Antenna Type	Gain (dBi)	Manufacturer	Model No.	Serial No.
Dual Polarized Parabolic	37.5	Radio Waves	SPD6-5.2	14734
Single Polarized Panel	28.0	MTI	MT-486001	00213
Dual Polarized Integral Panel	20.0	Exalt	N/A	None

3.5. Cabling and I/O Ports

Number and type of I/O ports

1. 10/100 BT: 1 ports
2. T1/E1: 2 ports
3. Sync in

3.6. Test Configurations

Matrix of test configurations

BW (MHz)	Modulation								
	QPSK			16QAM			64QAM		
	Low (MHz)	Mid (MHz)	High (MHz)	Low (MHz)	Mid (MHz)	High (MHz)	Low (MHz)	Mid (MHz)	High (MHz)
7.5	5731	5788	5844	5731	5788	5844	5731	5788	5844
15	5735	5788	5840	5735	5788	5840	5735	5788	5840
30	5745	5788	5830	5745	5788	5830	5745	5788	5830
60	5762	5788	5813	5762	5788	5813	5762	5788	5813

It was established at the start of the test program that the equipment when configured with either the 28 dBi or 37.5 dBi antenna and operating with QPSK modulation scheme has the highest Radiated Emission and Peak Emission levels. For the sake of brevity in reporting the test results the report includes results for all of the QPSK configurations shown in the table above (and in the Radiated Emissions section of the report, results for the 28 dBi and 37.5 dBi antenna configurations).

Appendix A of the report contains selected worst case test results for 16QAM and 64QAM configurations, and for the 20 dBi integral antenna.

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

Conducted Emissions Testing

The EUT has two antenna ports and can be configured (see description of other possible configurations in Section 3.2) as a dual polarized radio, operating on the same frequency with a coherent transmitter on both polarizations, into an external dual-polarized antenna. All conducted measurements were made on a single antenna port.

Radiated Emissions Testing

The following table describes the two configurations of equipment that were tested for radiated emissions. As previously mentioned these antenna configurations operating with QPSK modulation scheme have the highest Radiated Emission and Peak Emission levels of any configuration.

Antenna Configuration	EUT Configuration	Max. Allowable Conducted Power Setting (dBm)	
		Antenna port #1	Antenna port #2
37.5 dBi Dual Polarized Parabolic Antenna	Two antenna ports, dual polarized radio, operating on the same frequency with a coherent transmitter on both polarizations, into an external dual-polarized antenna.	+27.0	+27.0
28 dBi Single Polarized Patch Panel	One antenna port connected to a single pole external antenna.	+30.0	

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 emissions are tested below and verified above 1 GHz at TUV Rheinland of North America's 10m chamber located at the following address;-

2305 Mission College Blvd.
Santa Clara
California 95054
USA

TUV Rheinland of North America IC Registration Number: IC 4453-1

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** and **Industry Canada RSS-Gen.**

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	5.1.1
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	5.1.2
15.247(e) **A8.2**	Peak Power Spectral Density	Shall not be greater than +8 dBm in any 3 kHz band	Conducted	Complies	5.1.3
15.247(i) **5.5**	Maximum Permissible Exposure	Exposure to radio frequency energy levels	Conducted	Complies	5.1.4
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	5.1.5

List of Measurements (continued)

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.**

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(d) **15.205 /** **15.209** **A8.5** **2.2** **2.6** **4.7**	Radiated Emissions	Restricted Bands	Radiated	Complies	5.1.6
	Transmitter Radiated Spurious Emissions	Emissions above 1 GHz		Complies	*5.1.6.1*
Industry Canada only **RSS-Gen §4.8, §6**	Receiver Radiated Spurious Emissions	Emissions above 1 GHz		Complies	*5.1.6.2*
	Radiated Band Edge	Band edge results		Complies	*5.1.6.2.1*
15.205 / **15.209** **2.2**	Radiated Spurious Emissions	Emissions <1 GHz (30M-1 GHz)	Radiated	Complies	*5.1.6.3*
15.207 **7.2.2**	AC Wireline Conducted Emissions 150 kHz–30 MHz	Conducted Emissions	Conducted	Complies	*5.1.7*

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

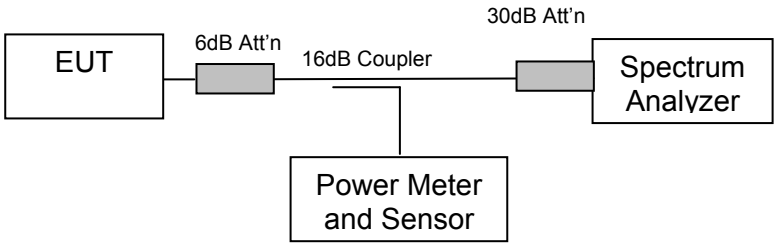
5.1.1. 6 dB and 99 % Bandwidth

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 the transmit power set to maximum and a spectrum analyzer connected to each of the EUT's two antenna ports in turn, while the EUT is operating in transmission mode at the appropriate center frequency. The analyzer was set for a 6 dB resolution bandwidth filter during the measurement.

Resolution bandwidth was set at approximately 1% of the emission bandwidth.

Test Measurement Set up



Measurement set up for 6 dB and 99 % bandwidth test

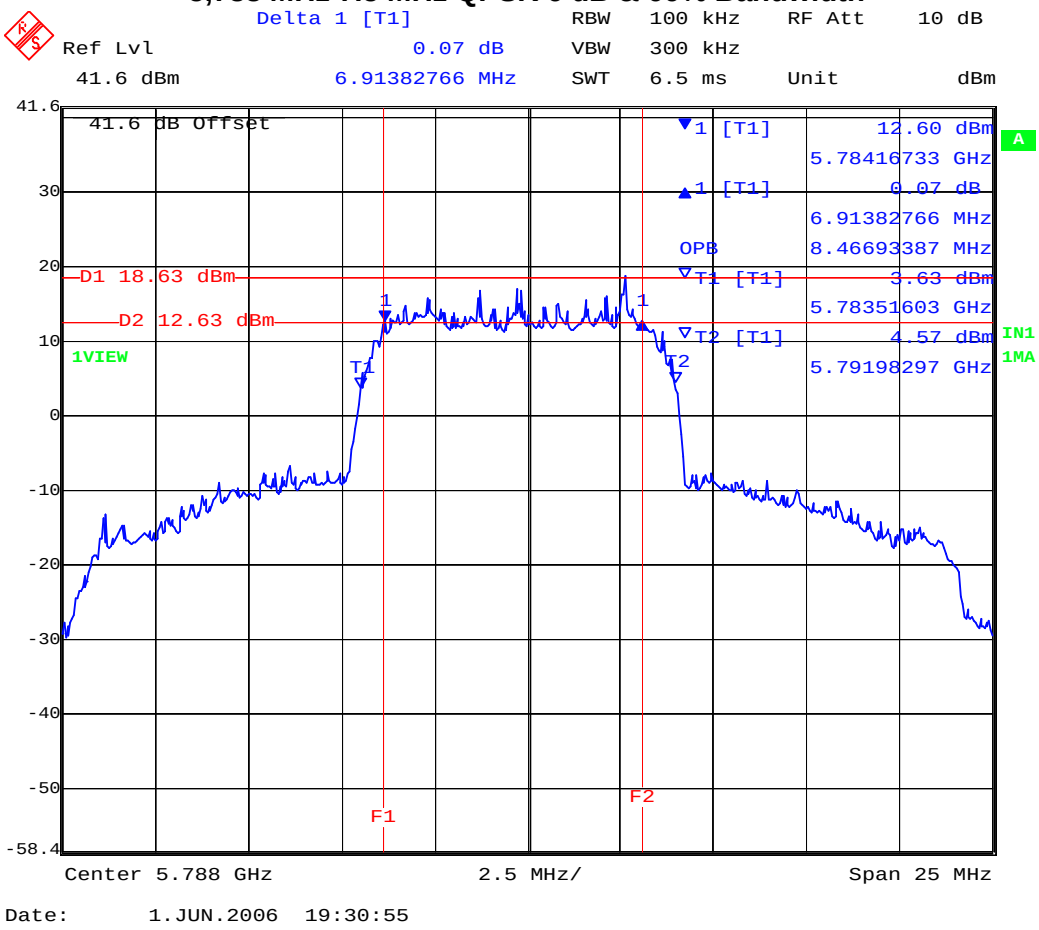
Measurement Results for 6 dB and 99 % Operational Bandwidth(s)

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

TABLE OF RESULTS – 7.5 MHz Bandwidth QPSK

Center Frequency (MHz)	Antenna Port #1				Antenna Port #2 Verification			
	6 dB BW (MHz)	6 dB Plot #	99 % BW (MHz)	99 % BW Plots	6 dB BW (MHz)	6 dB Plot #	99 % BW (MHz)	99 % BW Plots
5,731	6.794	On File	8.347	On File				
5,788	6.914	01	8.467	01	7.315	01a	8.367	01a
5,844	6.854	On File	8.467	On File				

Plot 01
5,788 MHz 7.5 MHz QPSK 6 dB & 99% Bandwidth



Plot 01a Port 2 Verification
5,788 MHz 7.5 MHz QPSK 6 dB & 99% Bandwidth

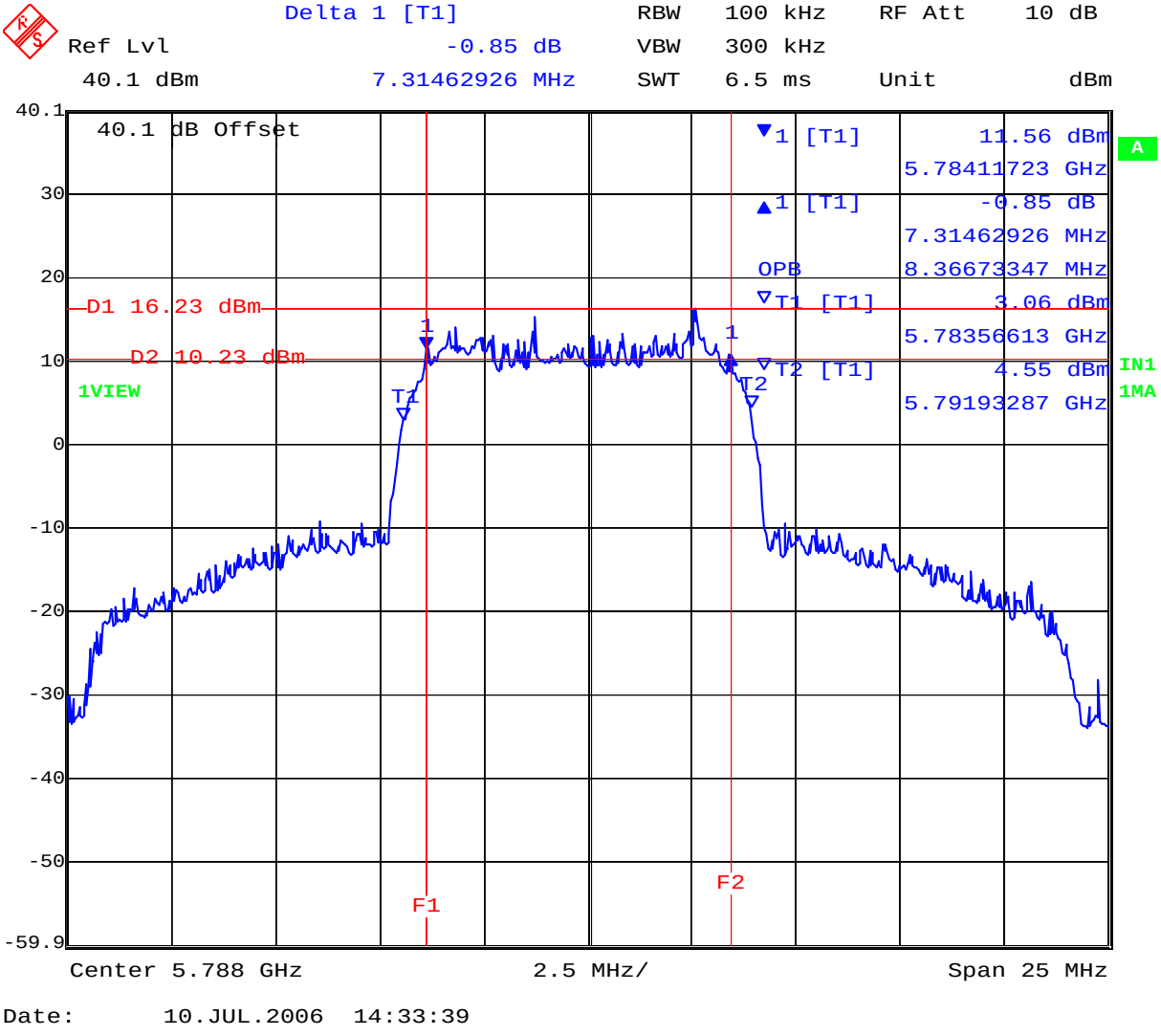
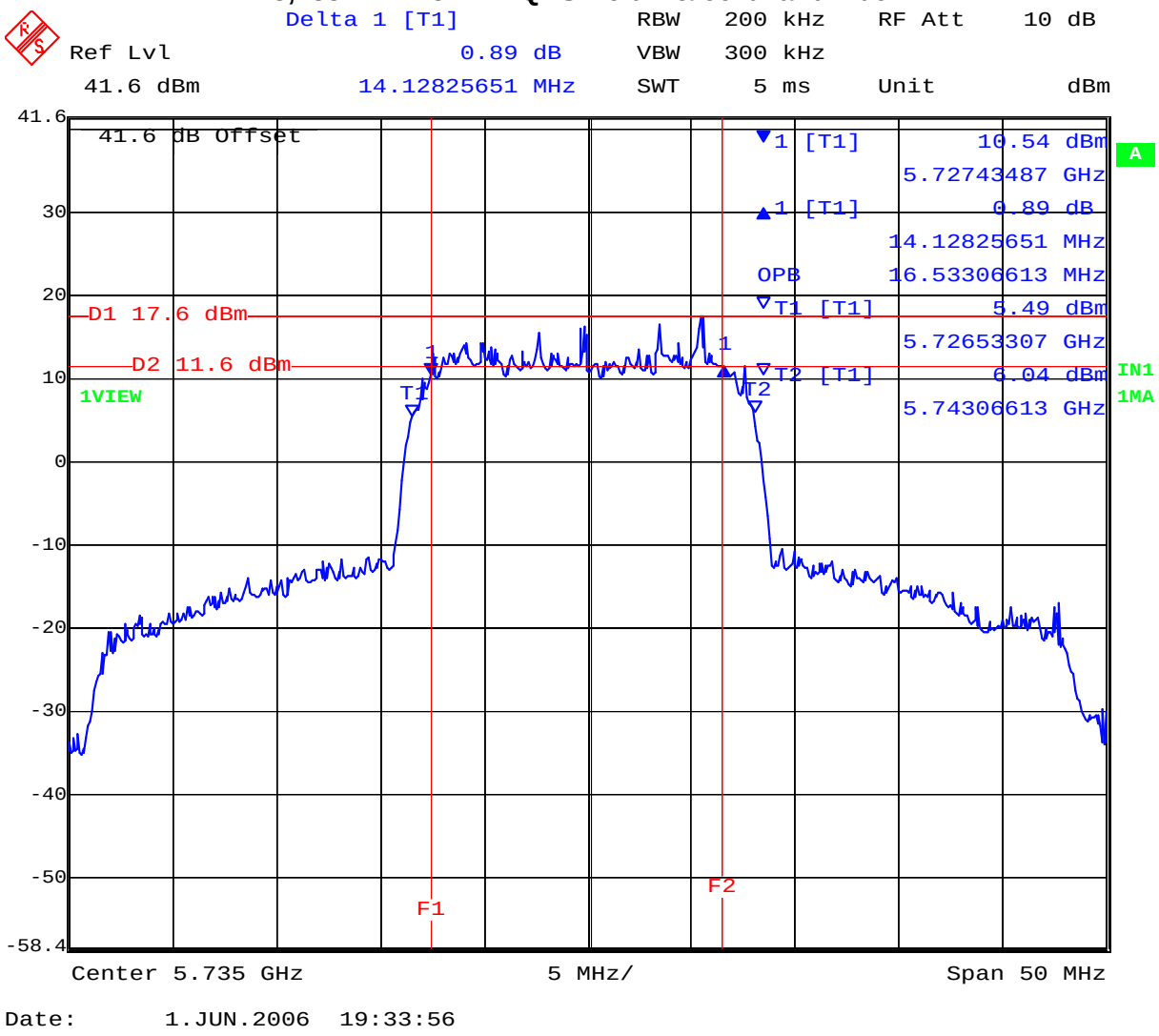


TABLE OF RESULTS – 15 MHz Bandwidth QPSK

Center Frequency (MHz)	Antenna Port #1				Antenna Port #2 Verification			
	6 dB BW (MHz)	6 dB Plot #	99 % BW (MHz)	99 % BW Plots	6 dB BW (MHz)	6 dB Plot #	99 % BW (MHz)	99 % BW Plots
5,735	14.120	02	16.533	02				
5,788	14.000	On File	16.533	On File	13.727	02a	16.733	02a
5,840	13.880	On File	16.413	On File				

Plot 02
5,735 MHz 15 MHz QPSK 6 dB & 99%Bandwidth



Plot 02a Port 2 Verification
5,788 MHz 15 MHz QPSK 6 dB & 99%Bandwidth

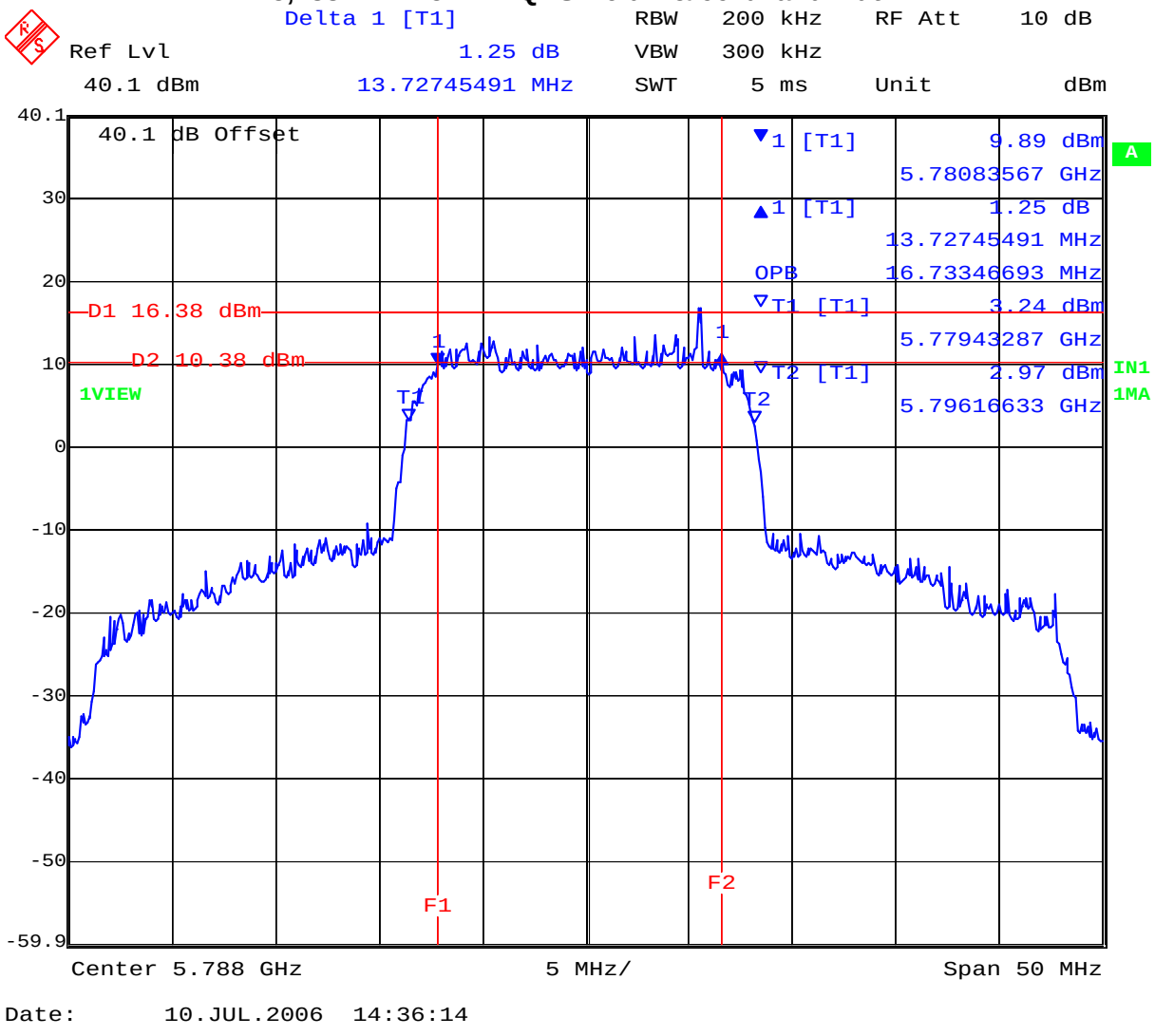
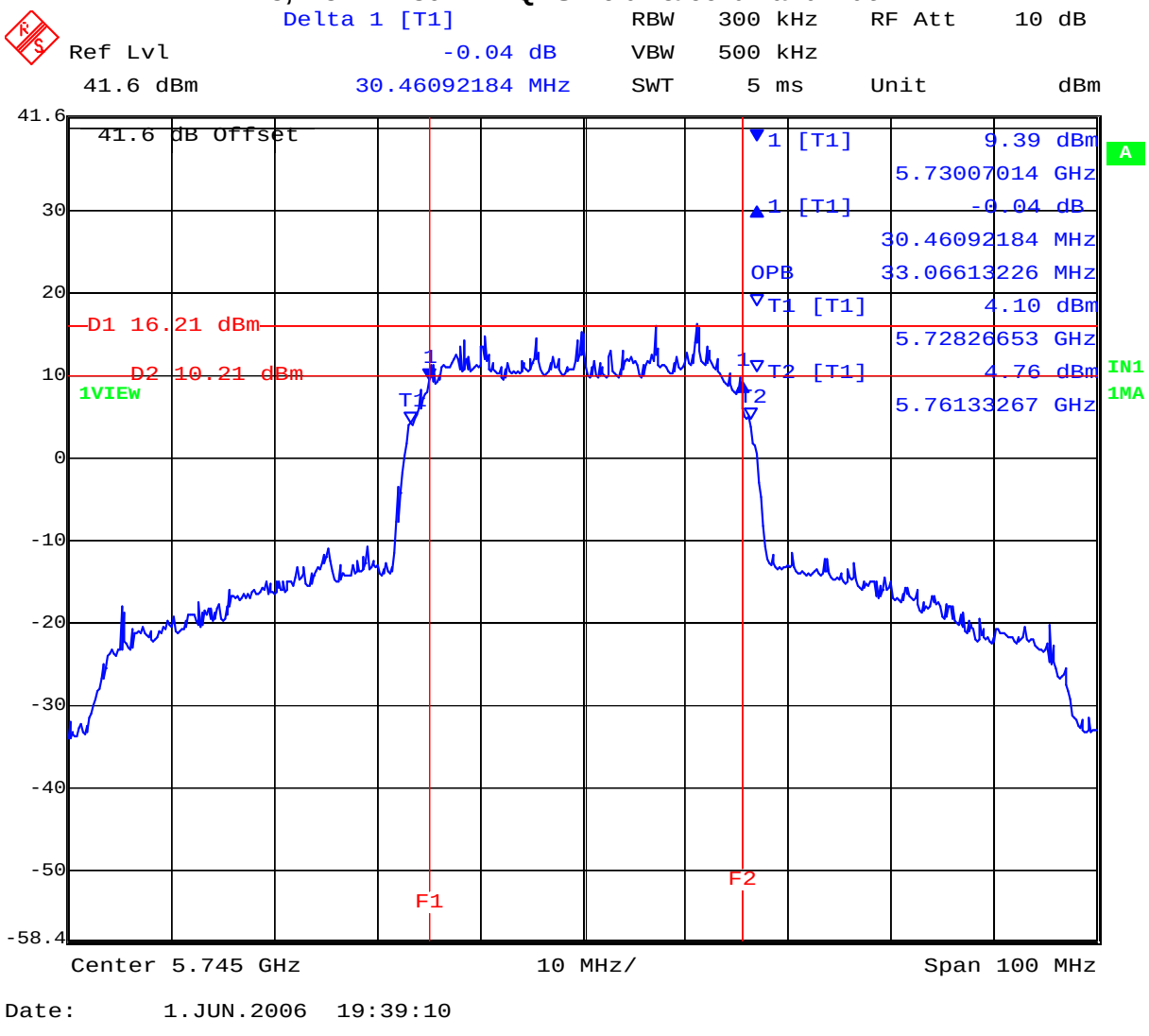


TABLE OF RESULTS – 30 MHz Bandwidth QPSK

Center Frequency (MHz)	Antenna Port #1				Antenna Port #2 Verification			
	6 dB BW (MHz)	6 dB Plot #	99 % BW (MHz)	99 % BW Plots	6 dB BW (MHz)	6 dB Plot #	99 % BW (MHz)	99 % BW Plots
5,745	30.461	03	33.066	03	29.459	03a	33.066	03a
5,788	30.507	On File	32.866	On File				
5,830	29.152	On File	32.465	On File				

Plot 03
5,745 MHz 30 MHz QPSK 6 dB& 99% Bandwidth



Plot 03a Port 2 Verification
5,745 MHz 30 MHz QPSK 6 dB& 99% Bandwidth

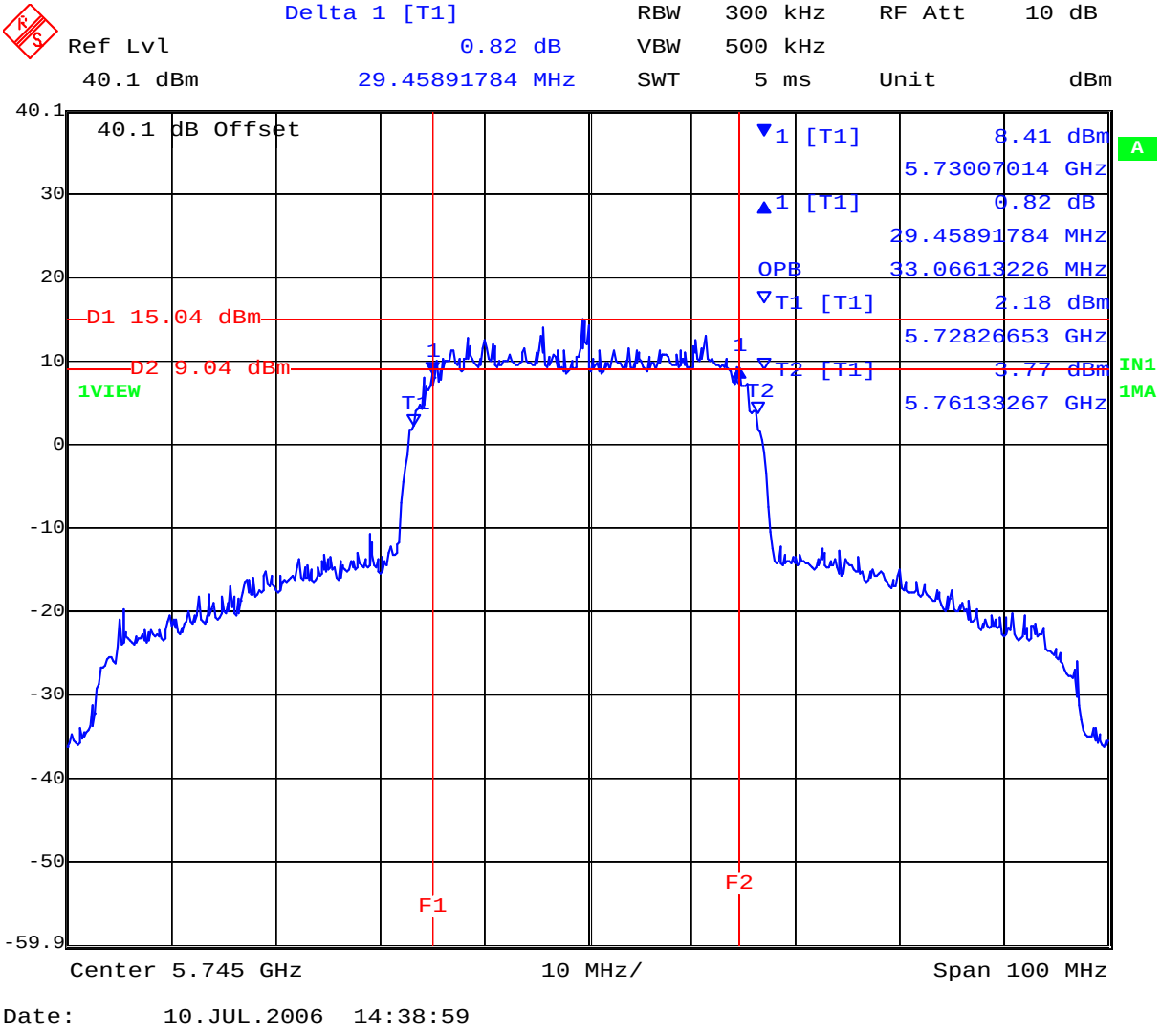
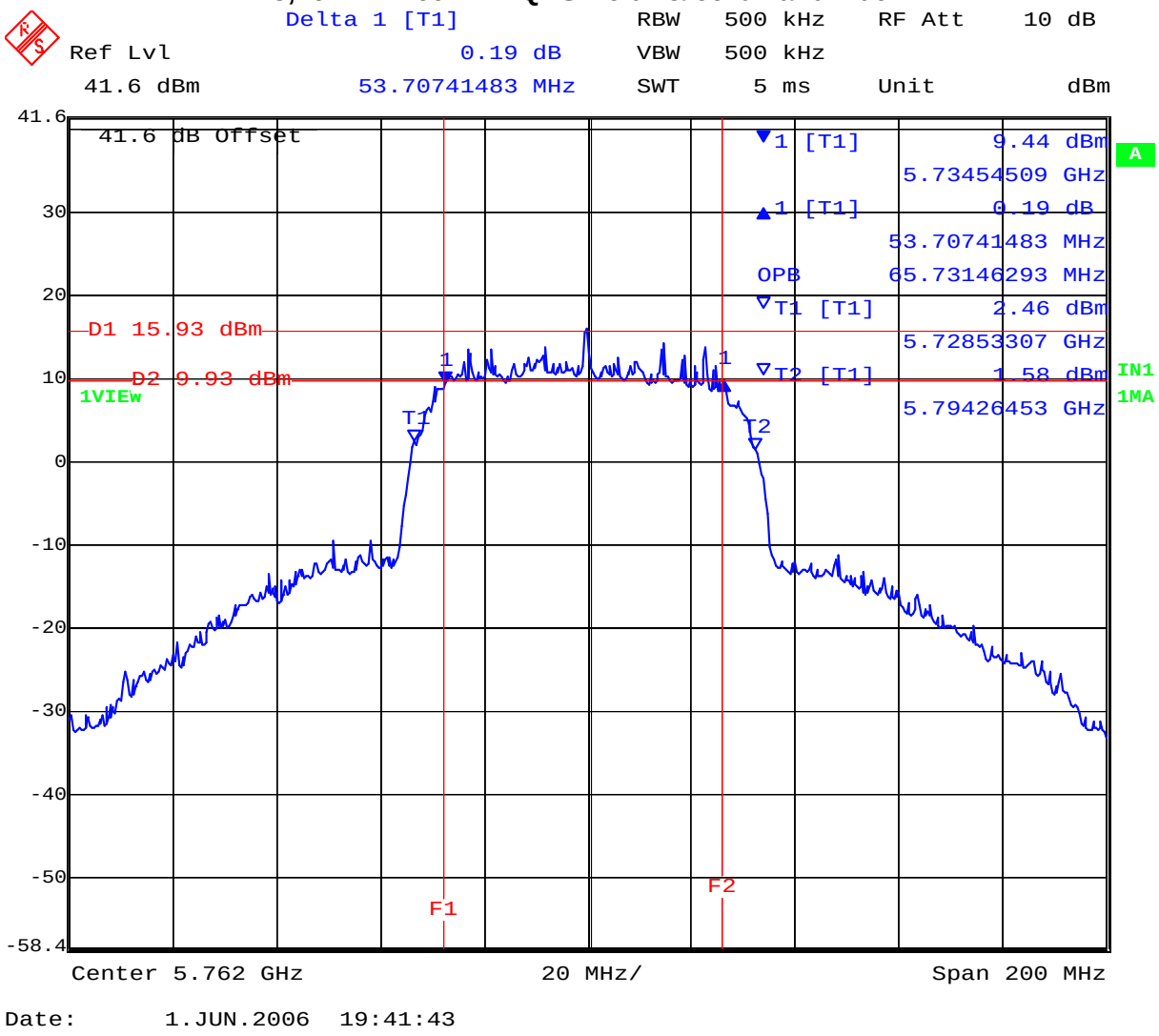


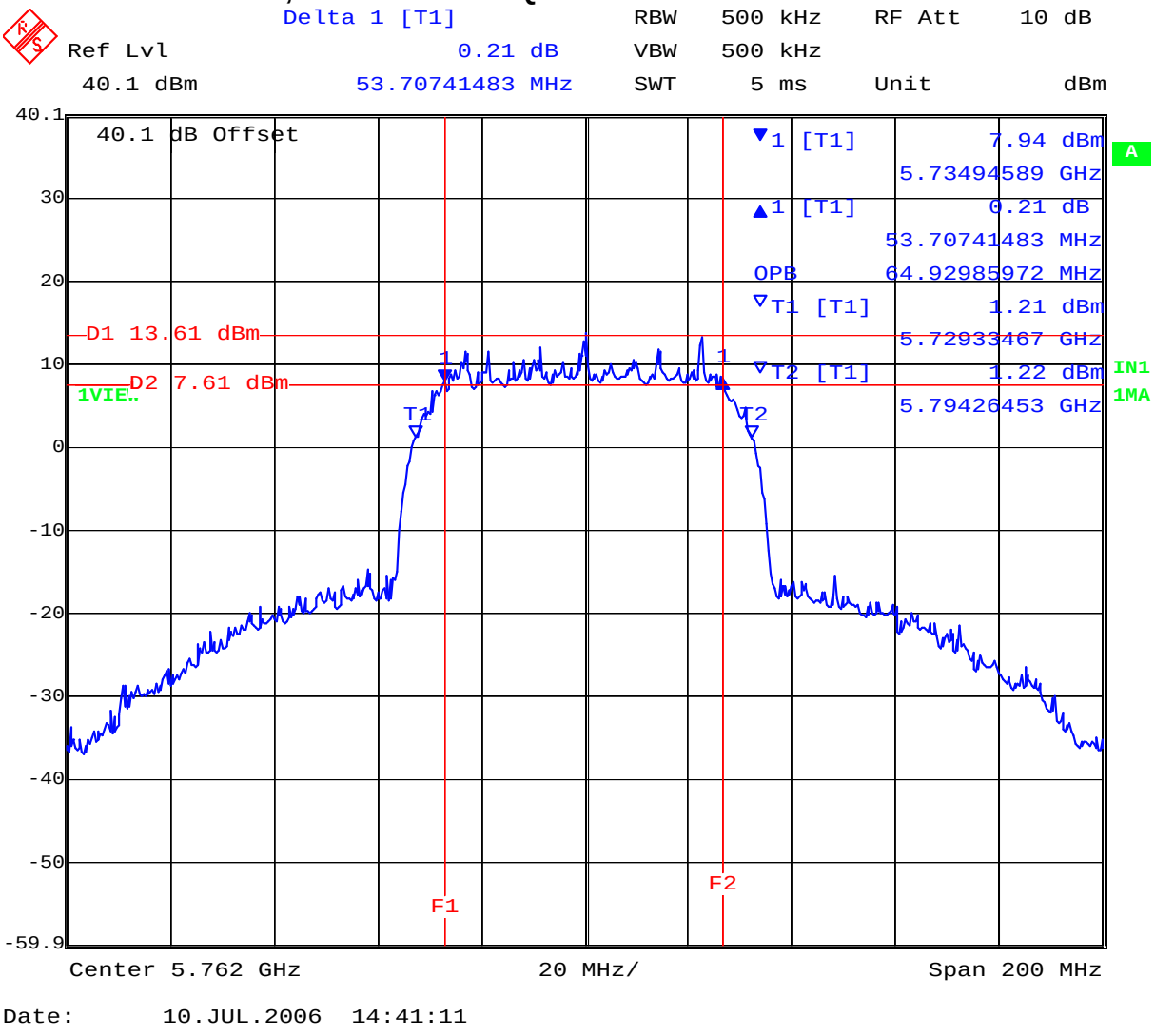
TABLE OF RESULTS – 60 MHz Bandwidth QPSK

Center Frequency (MHz)	Antenna Port #1				Antenna Port #2 Verification			
	6 dB BW (MHz)	6 dB Plot #	99 % BW (MHz)	99 % BW Plots	6 dB BW (MHz)	6 dB Plot #	99 % BW (MHz)	99 % BW Plots
5,762	53.707	04	65.731	04	53.707	04a	64.930	04a
5,788	52.537	On File	65.731	On File				
5,813	49.010	On File	64.770	On File				

Plot 04
5,762 MHz 60 MHz QPSK 6 dB& 99% Bandwidth



Plot 04a Port 2 Verification
5,762 MHz 60 MHz QPSK 6 dB& 99% Bandwidth



Date: 10.JUL.2006 14:41:11

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

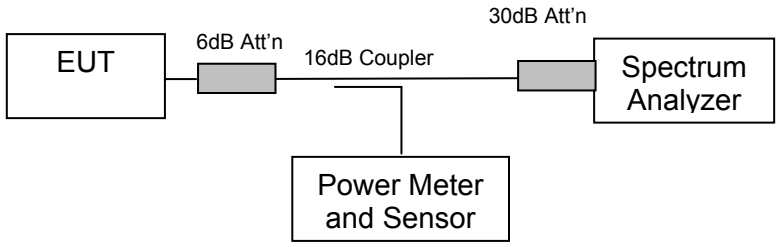
5.1.2. Peak Output Power

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

Test Procedure

The Peak Power is measured with the transmit power set to maximum and a spectrum analyzer connected to each of the EUT's two antenna ports in turn. 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:

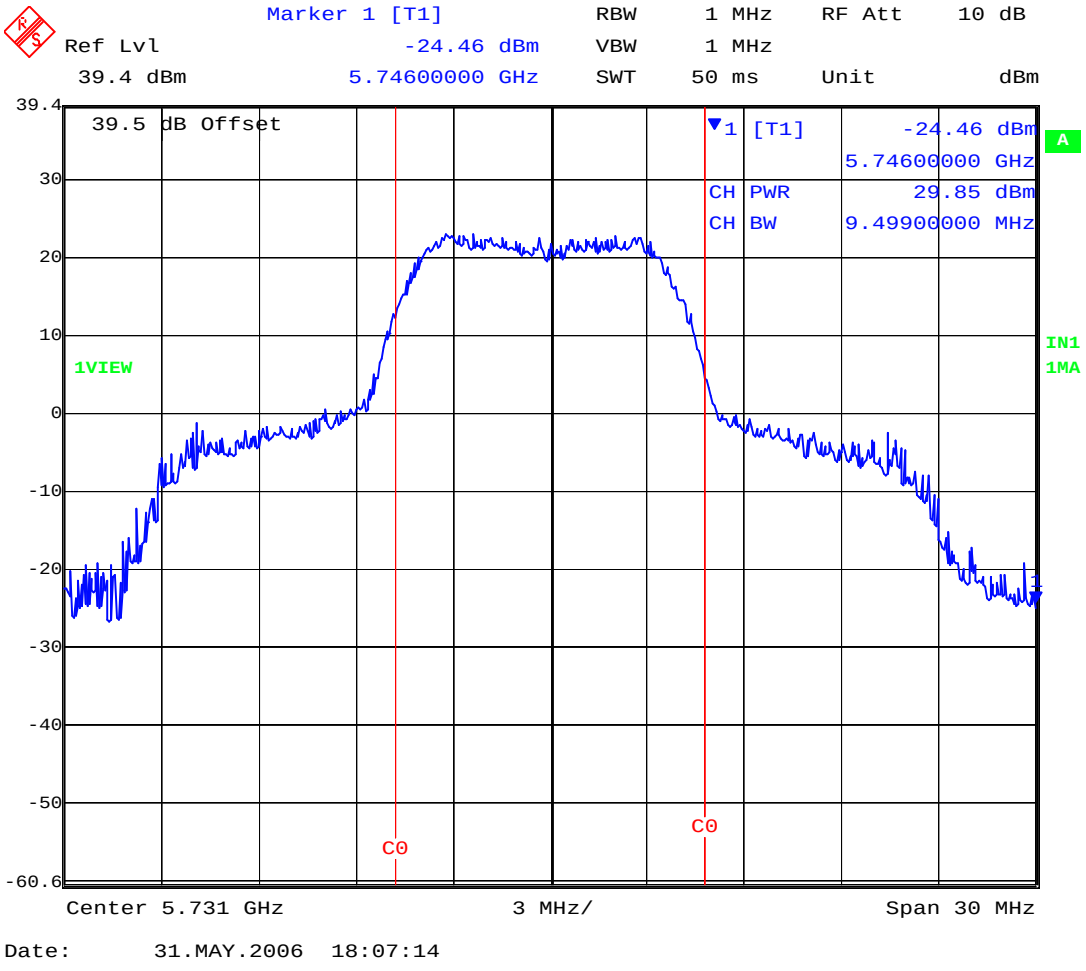
(ii) Systems operating in the 5725-5850 MHz band that are used exclusively for point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

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

TABLE OF RESULTS – 7.5 MHz Bandwidth QPSK

Center Frequency (MHz)	Antenna Port #1			Antenna Port #2 Verification		
	99% Measurement Bandwidth (MHz)	Peak Power (dBm)	Plot #	99% Measurement Bandwidth (MHz)	Peak Power (dBm)	Plot #
5,731	9.499	+29.85	05	8.367	+29.75	05a
5,788	9.499	+29.62	On File			
5,844	9.499	+29.82	On File			

Plot 05
5,731 MHz 7.5 MHz QPSK Peak Power (dBm)



Plot 05a Port 2 Verification
5,731 MHz 7.5 MHz QPSK Peak Power (dBm)

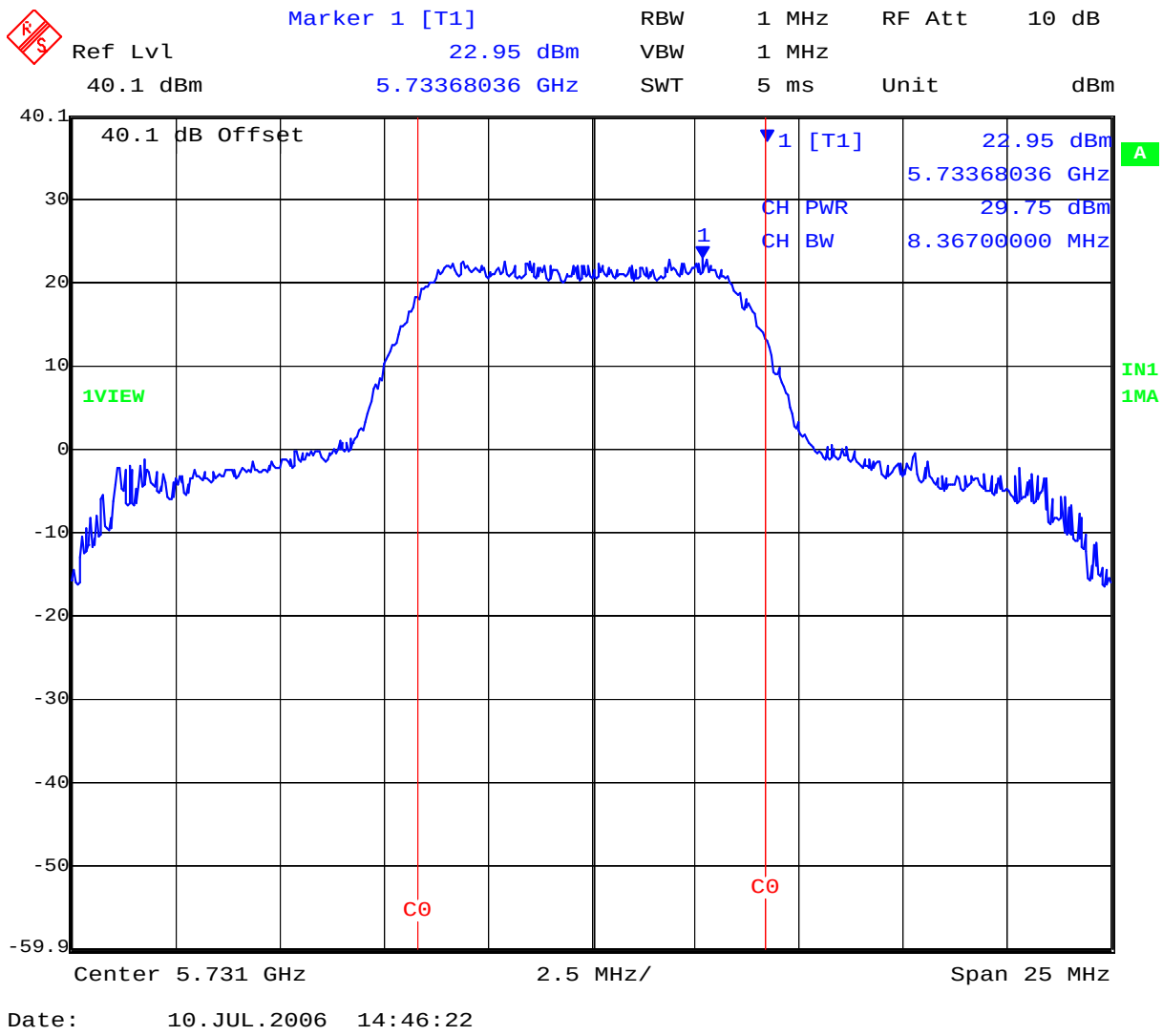
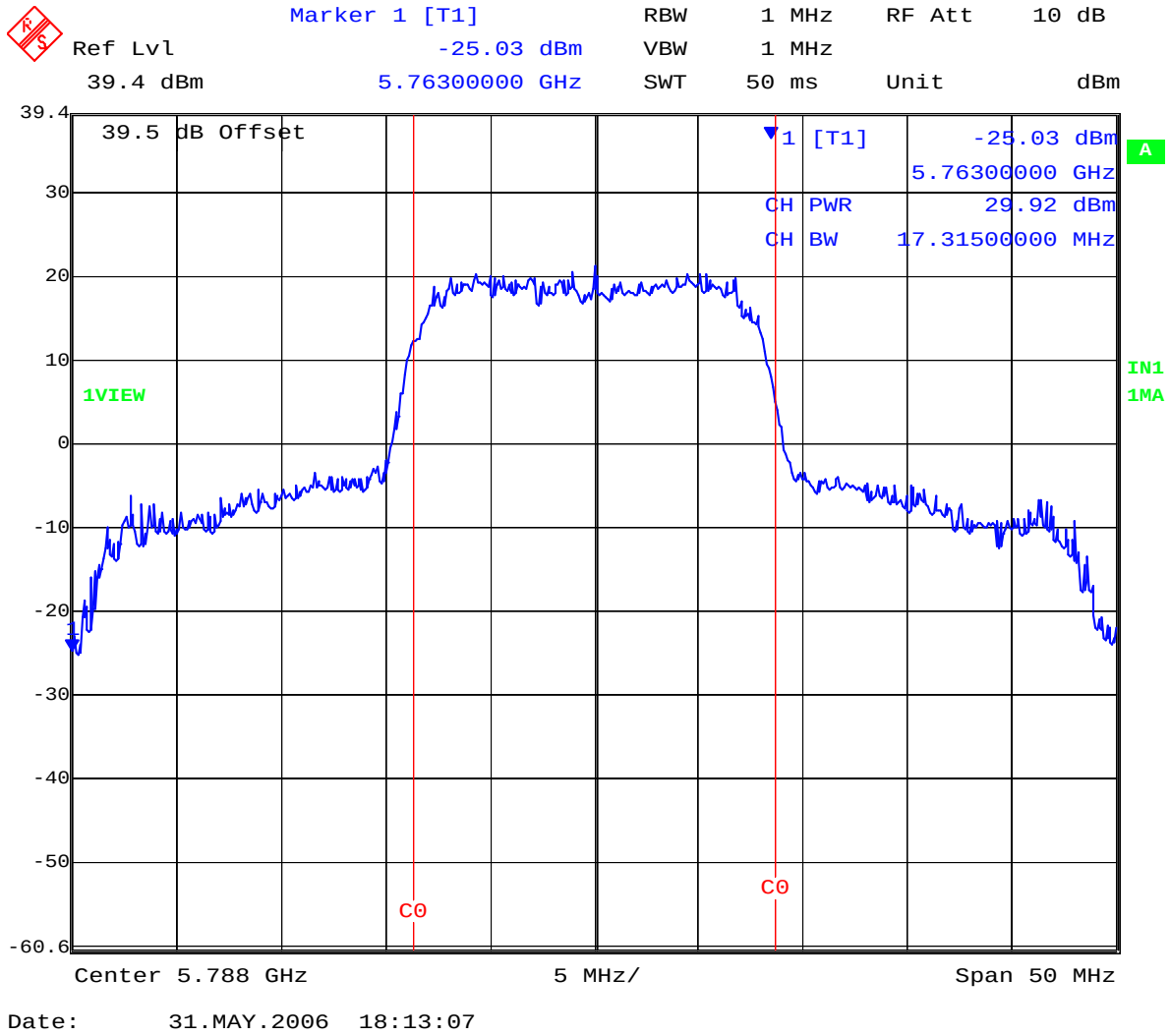


TABLE OF RESULTS – 15 MHz Bandwidth QPSK

Center Frequency (MHz)	Antenna Port #1			Antenna Port #2 Verification		
	99% Measurement Bandwidth (MHz)	Peak Power (dBm)	Plot #	99% Measurement Bandwidth (MHz)	Peak Power (dBm)	Plot #
5,735	17.315	+29.91	On File			
5,788	17.315	+29.92	06	16.733	+29.81	06a
5,840	17.315	+29.70	On File			

Plot 06
5,788 MHz 15 MHz QPSK Peak Power (dBm)



Plot 06a Port 2 Verification
5,788 MHz 15 MHz QPSK Peak Power (dBm)

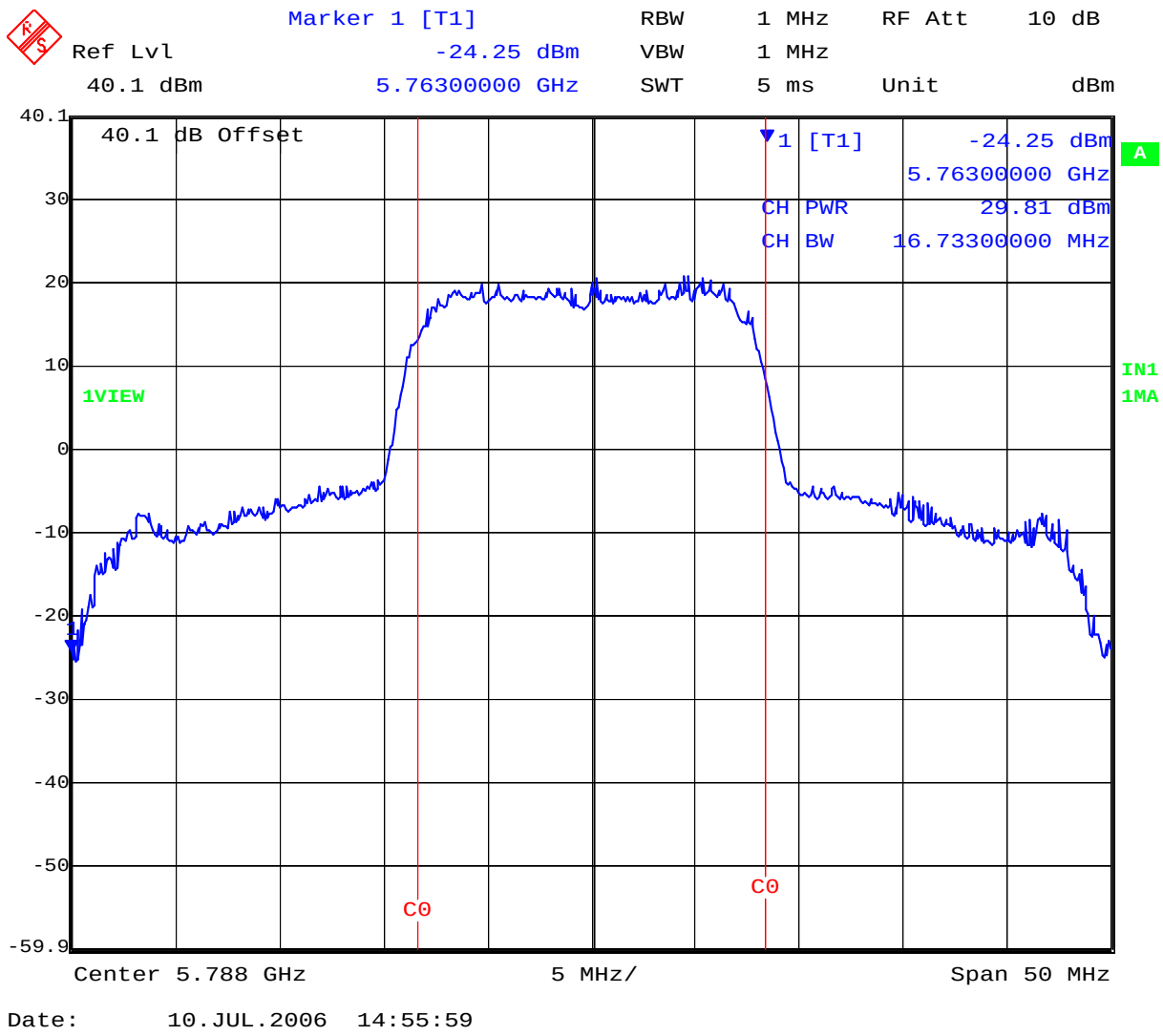
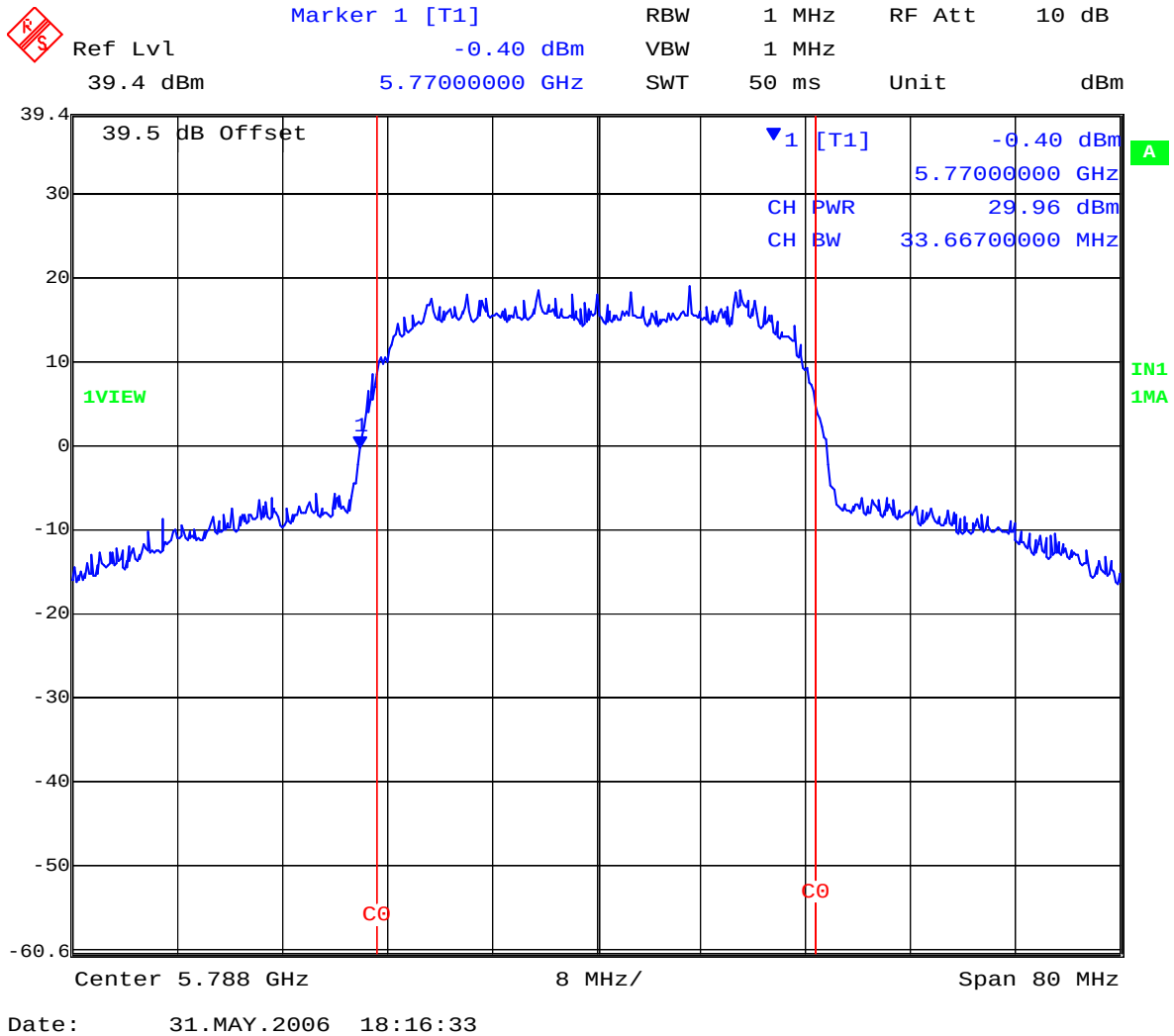


TABLE OF RESULTS – 30 MHz Bandwidth QPSK

Center Frequency (MHz)	Antenna Port #1			Antenna Port #2 Verification		
	99% Measurement Bandwidth (MHz)	Peak Power (dBm)	Plot #	99% Measurement Bandwidth (MHz)	Peak Power (dBm)	Plot #
5,745	33.667	+29.81	On File			
5,788	33.667	+29.96	07	33.066	+29.94	07a
5,830	33.667	+29.92	On File			

Plot 07
5,788 MHz 30 MHz QPSK Peak Power (dBm)



Plot 07a Port 2 Verification
5,788 MHz 30 MHz QPSK Peak Power (dBm)

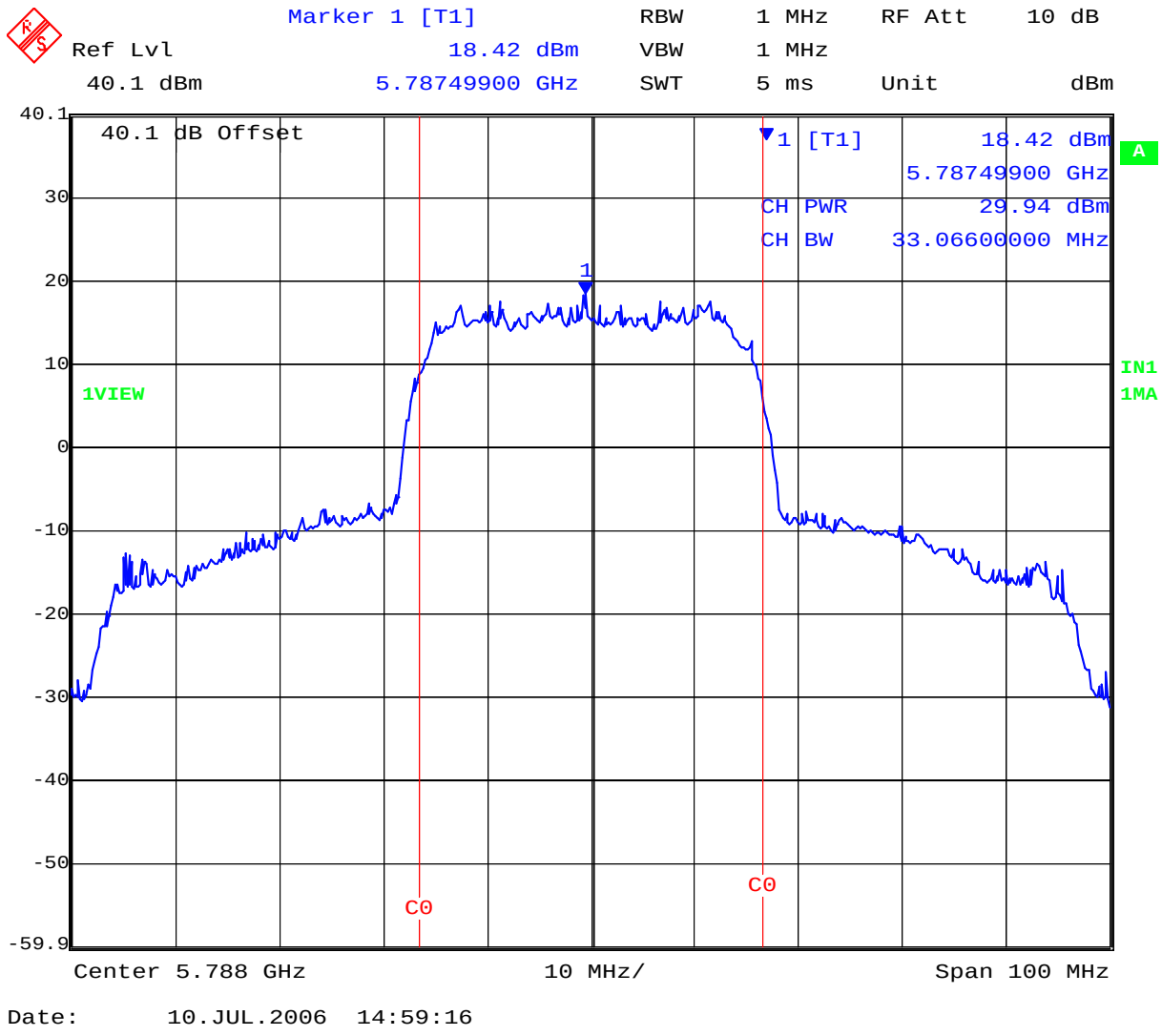
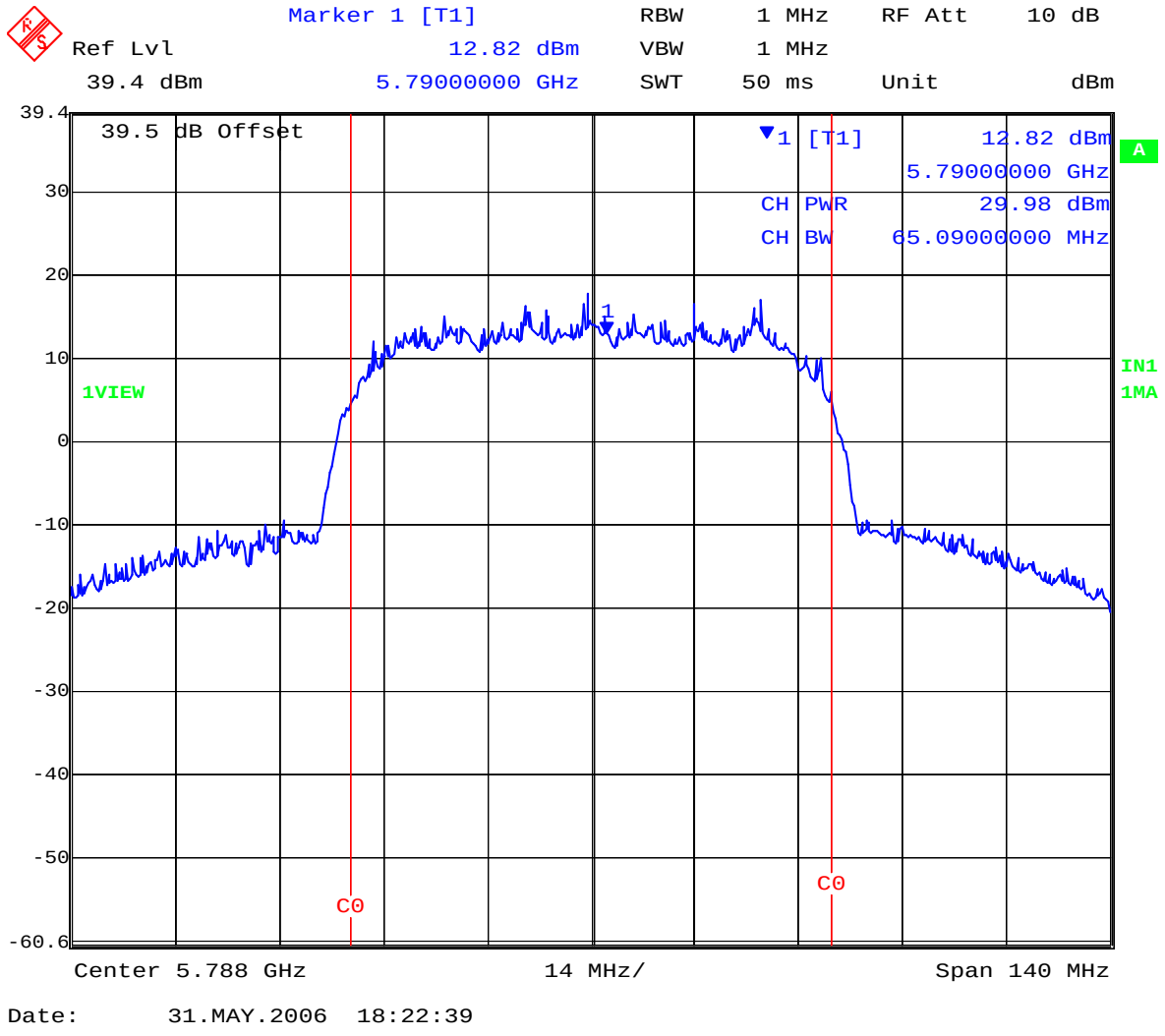


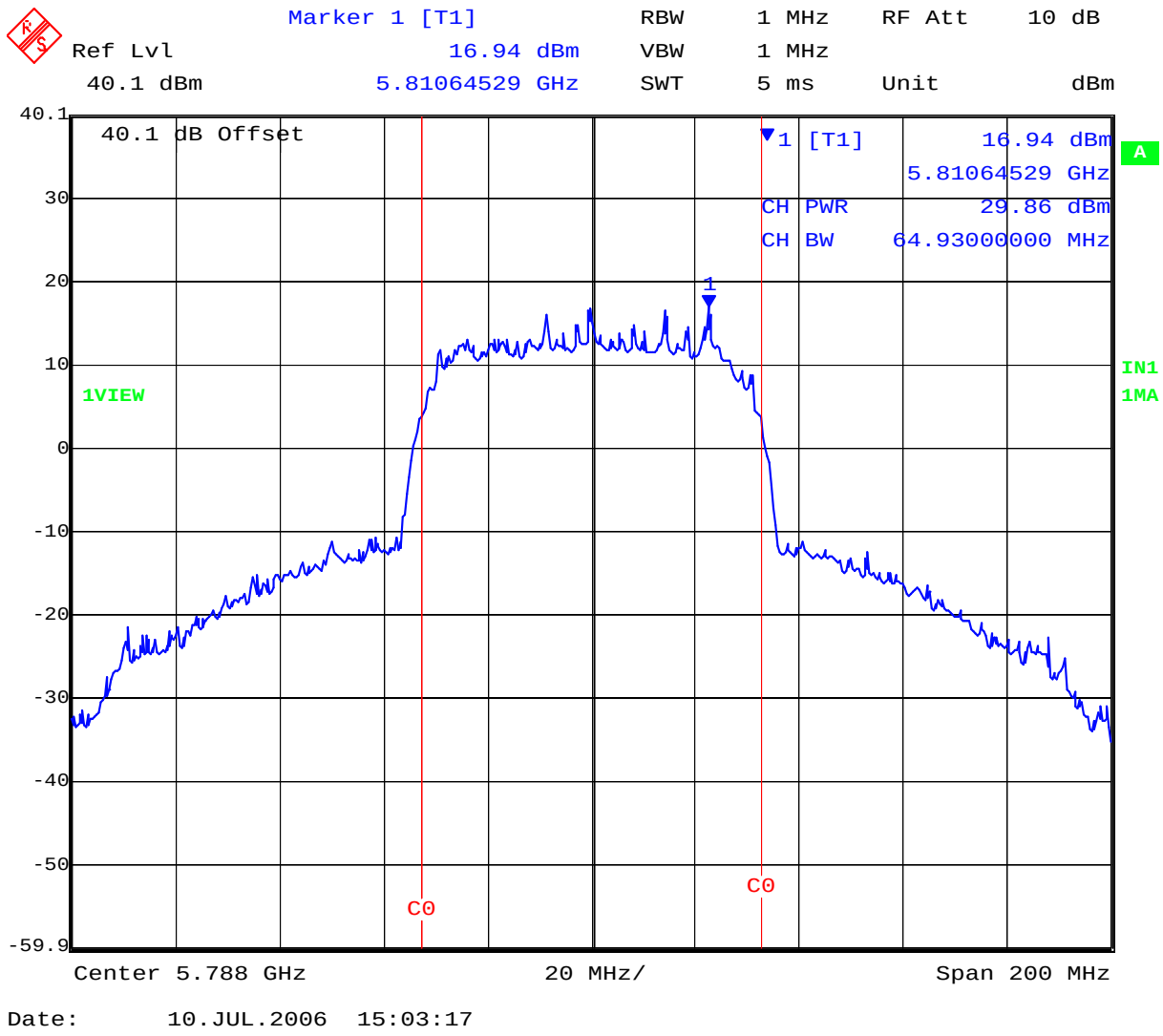
TABLE OF RESULTS – 60 MHz Bandwidth QPSK

Center Frequency (MHz)	Antenna Port #1			Antenna Port #2 Verification		
	99% Measurement Bandwidth (MHz)	Peak Power (dBm)	Plot #	99% Measurement Bandwidth (MHz)	Peak Power (dBm)	Plot #
5,762	65.090	+29.70	On File			
5,788	65.090	+29.98	08	64.930	+29.86	08a
5,813	65.090	+29.67	On File			

Plot 08
5,788 MHz 60 MHz QPSK Peak Power (dBm)



Plot 08a Port 2 Verificaqtion
5,788 MHz 60 MHz QPSK Peak Power (dBm)



Supply Voltage Variation

The supply voltage was varied between 97.75 VAC and 132.25 VAC. The system operated as intended at either extreme with no change in the above measurement bandwidths.

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

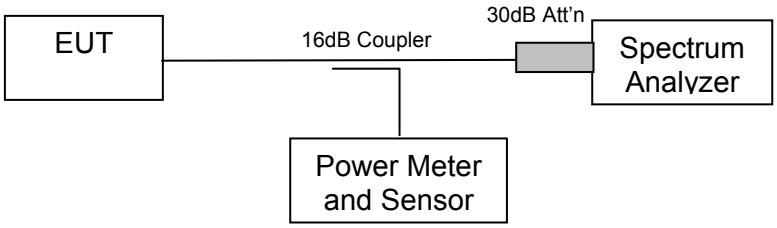
5.1.3. Peak Power Spectral Density

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

Test Procedure

The Peak Power Spectral Density is measured with the transmit power set to maximum and a spectrum analyzer connected to each of the EUT's two antenna ports in turn. The maximum level in a 3 kHz bandwidth was measured. Using a max. hold on the analyzer the peak emission was found over the full emission bandwidth. The frequency span and resolution/video bandwidth was reduced for fin al measurement. 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. The peak power spectral density measurement was completed for all bandwidths.

Test Measurement Set up



Measurement set up for Peak Power Spectral Density

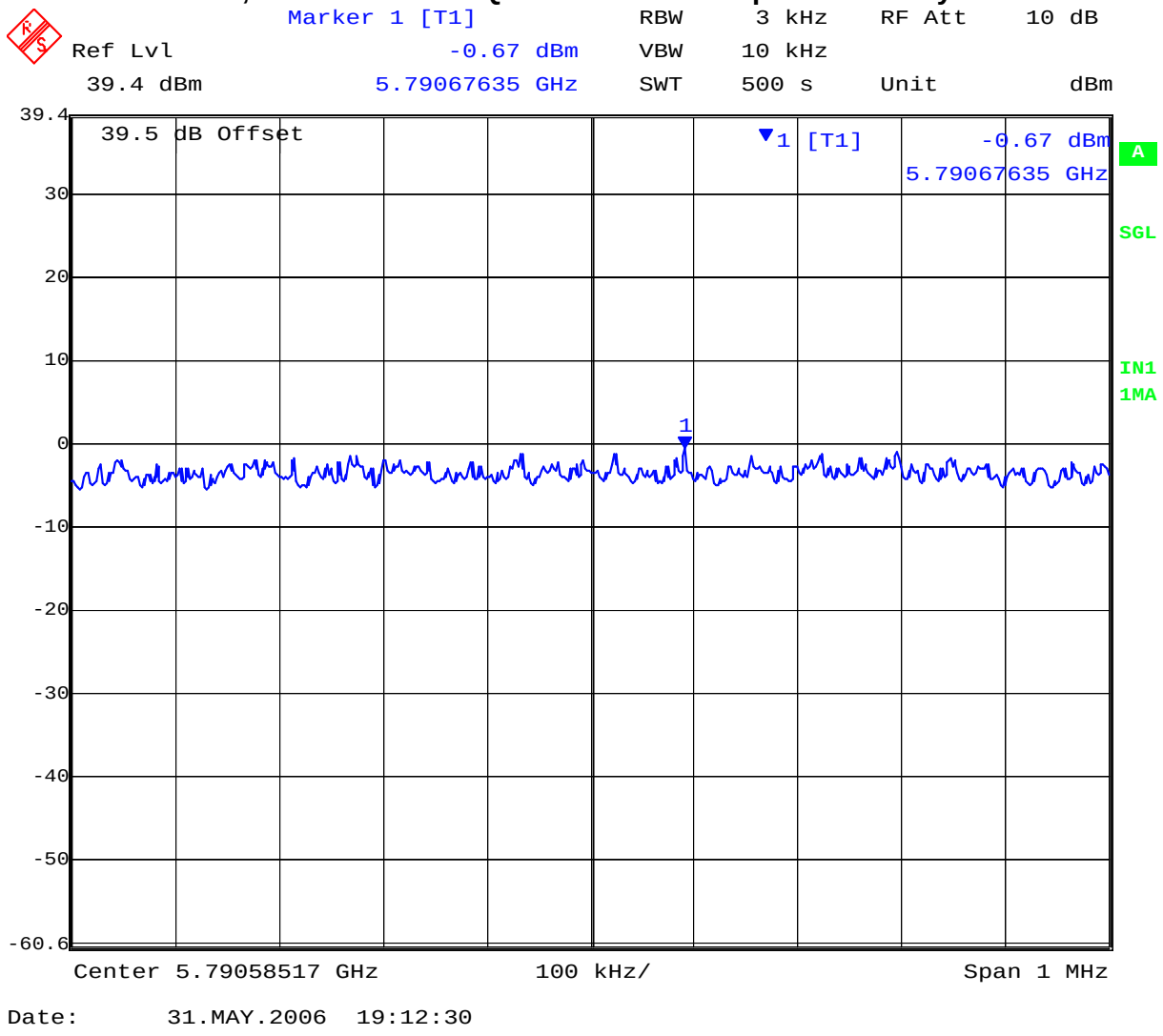
Measurement Results for Peak Power Spectral Density

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

TABLE OF RESULTS – 7.5 MHz Bandwidth QPSK

Center Freq (MHz)	Limit (dBm)	Antenna Port #1				Antenna Port #2 Verification			
		Peak Freq (MHz)	PPSD (dBm)	Margin (dBm)	Plot #	Peak Freq (MHz)	PPSD (dBm)	Margin (dBm)	Plot #
5,731	8	5729.109	-1.54	-9.54	On File				
5,788	8	5790.676	-0.67	-8.67	09	5790.676	-0.74	-8.74	09a
5,844	8	5842.105	-1.50	-9.50	On File				

Plot 09
5,788 MHz 7.5 MHz QPSK Peak Power Spectral Density



Plot 09a Port 2 Verification
5,788 MHz 7.5 MHz QPSK Peak Power Spectral Density

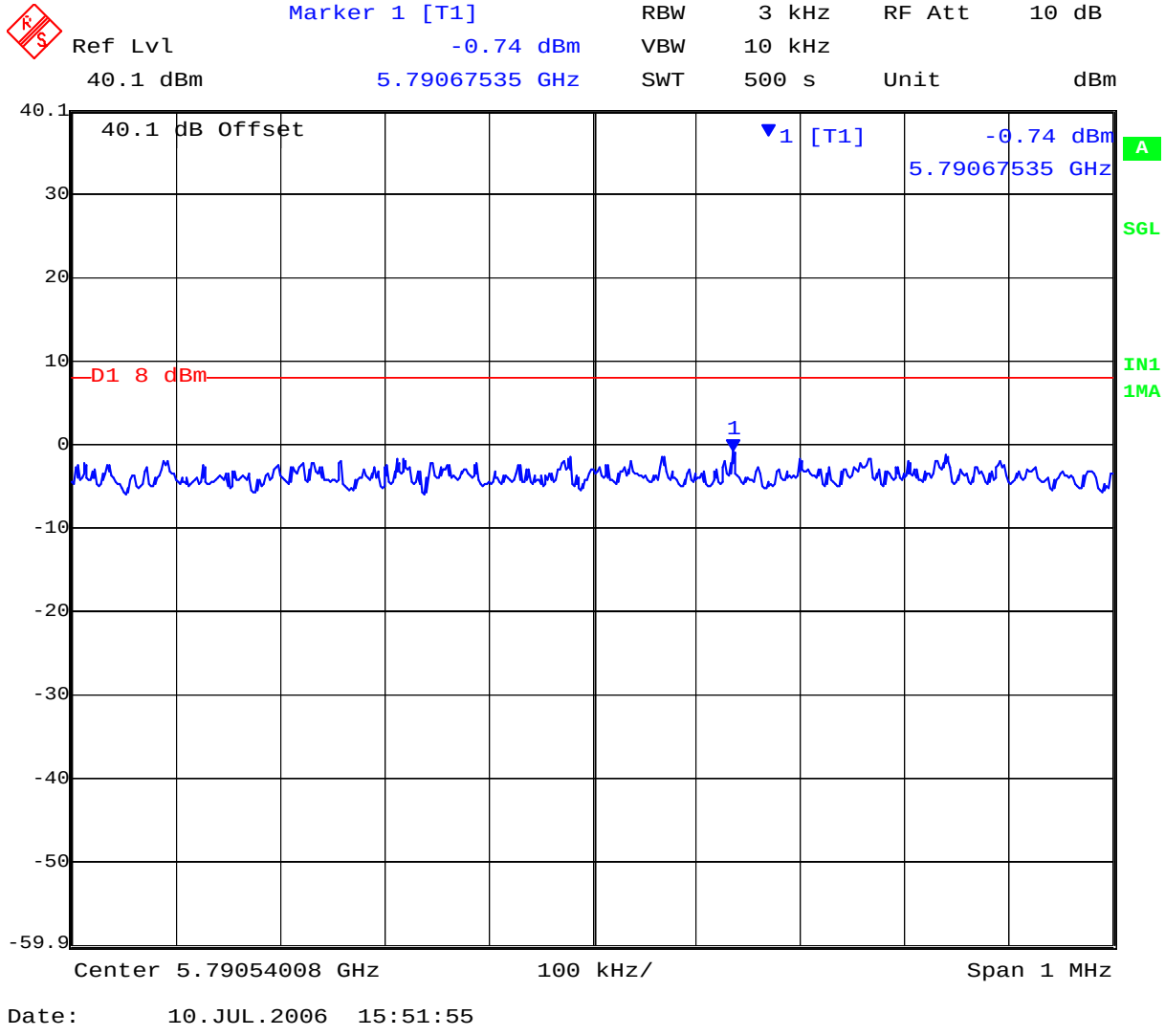
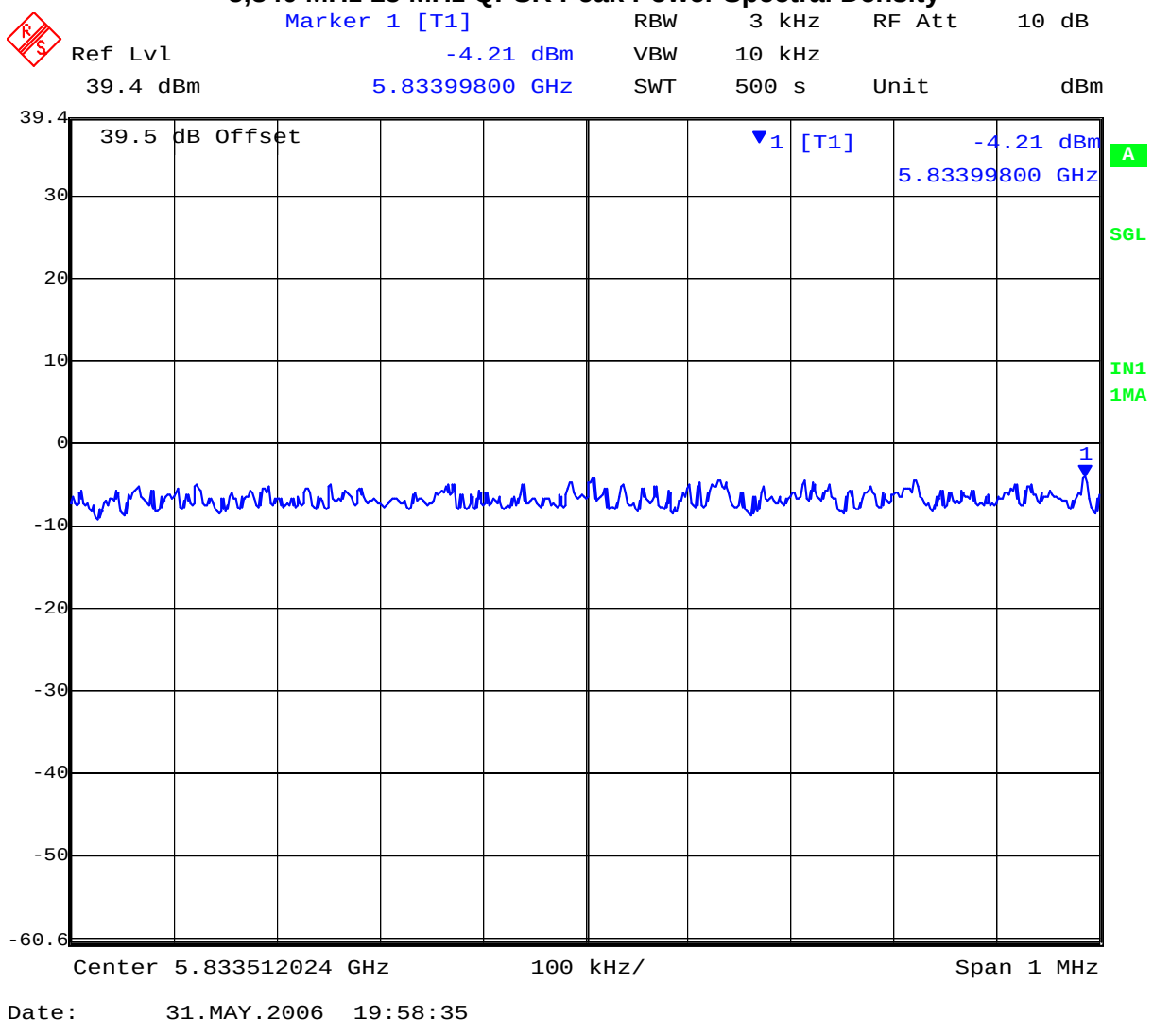


TABLE OF RESULTS – 15 MHz Bandwidth QPSK

Center Freq (MHz)	Limit (dBm)	Antenna Port #1				Antenna Port #2 Verification			
		Peak Freq (MHz)	PPSD (dBm)	Margin (dBm)	Plot #	Peak Freq (MHz)	PPSD (dBm)	Margin (dBm)	Plot #
5,735	8	5740.720	-4.94	-12.94	On File				
5,788	8	5793.719	-4.67	-12.67	On File				
5,840	8	5833.998	-4.21	-12.21	10	5833.997	-4.90	-12.90	10a

Plot 10
5,840 MHz 15 MHz QPSK Peak Power Spectral Density



Plot 10a Port 2 Verification
5,840 MHz 15 MHz QPSK Peak Power Spectral Density

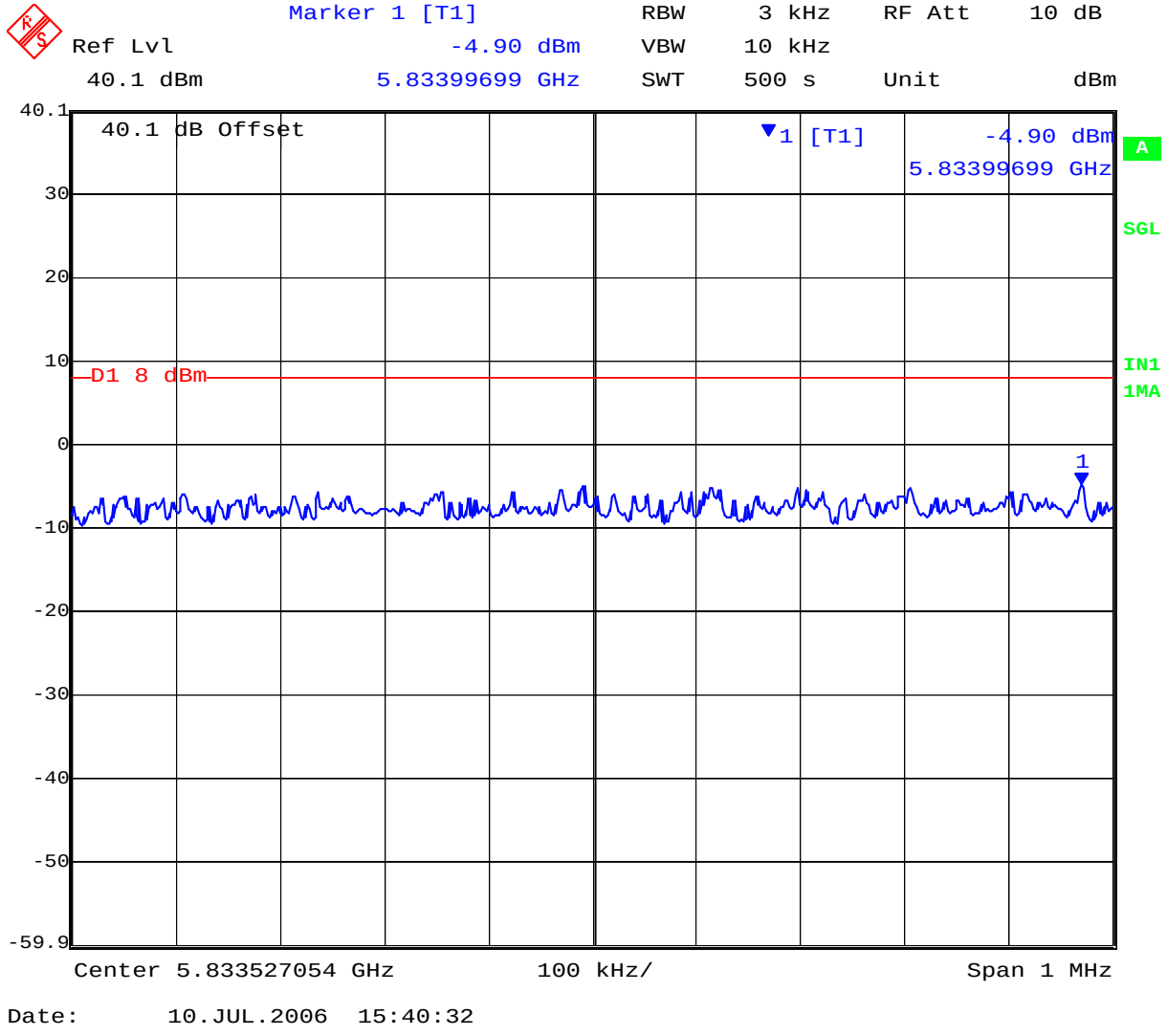
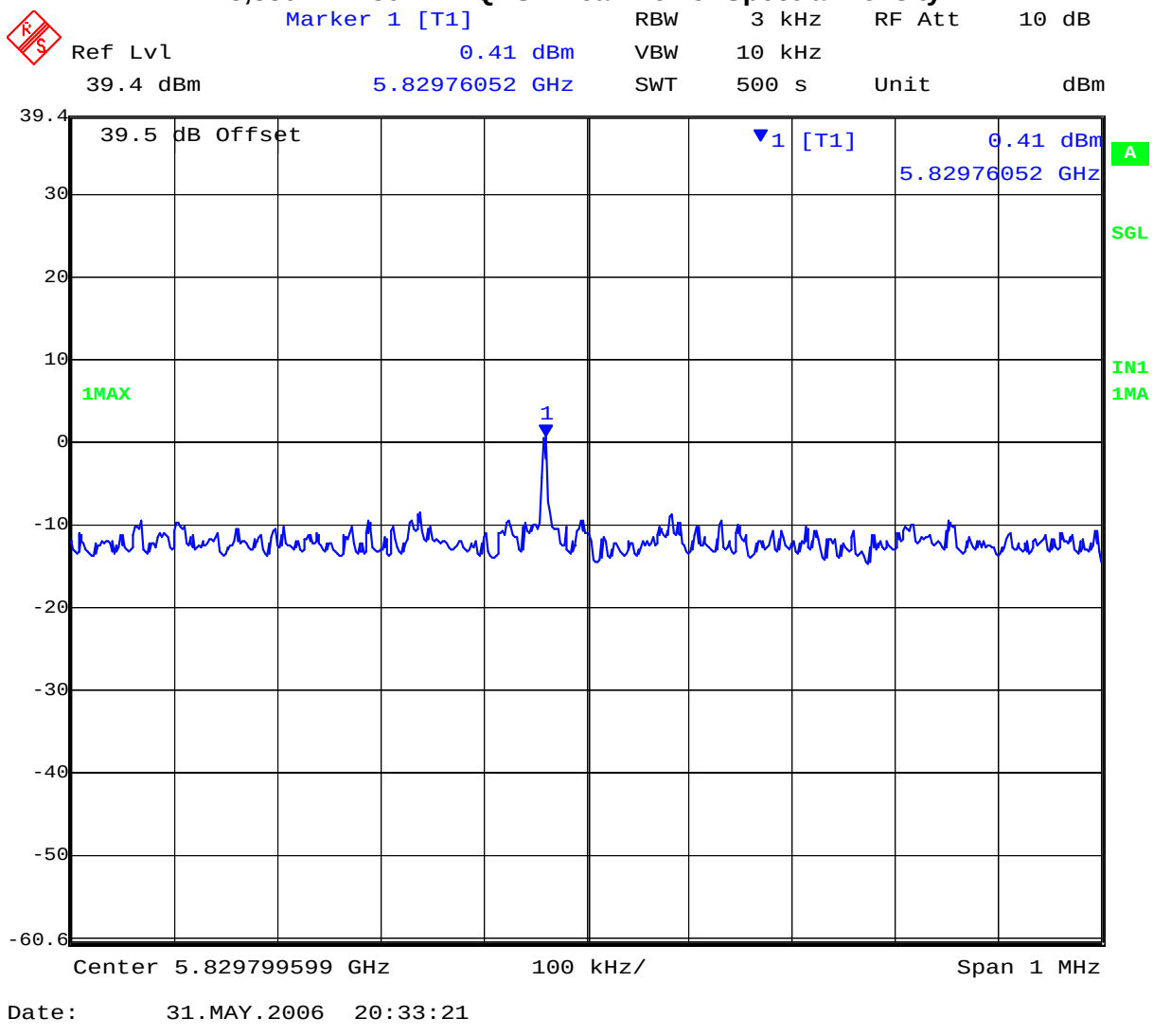


TABLE OF RESULTS – 30 MHz Bandwidth QPSK

Center Freq (MHz)	Limit (dBm)	Antenna Port #1				Antenna Port #2 Verification			
		Peak Freq (MHz)	PPSD (dBm)	Margin (dBm)	Plot #	Peak Freq (MHz)	PPSD (dBm)	Margin (dBm)	Plot #
5,745	8	5756.182	-9.19	-17.19	On File				
5,788	8	5798.772	-9.77	-17.77	On File				
5,830	8	5829.760	+0.41	-7.59	11	5829.759	-0.51	8.51	11a

Plot 11
5,830 MHz 30 MHz QPSK Peak Power Spectral Density



Plot 11a Port 2 Verification
5,830 MHz 30 MHz QPSK Peak Power Spectral Density

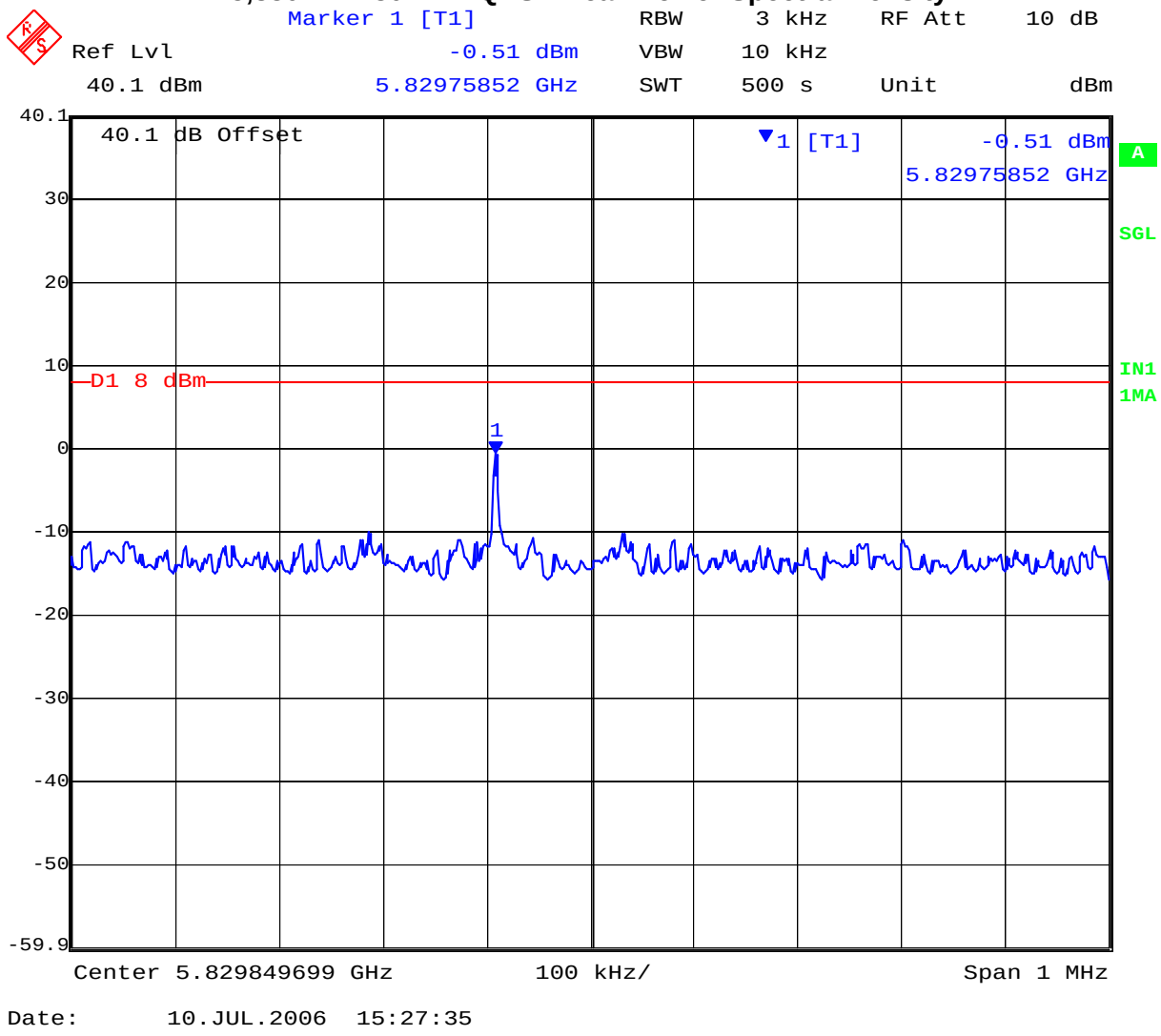
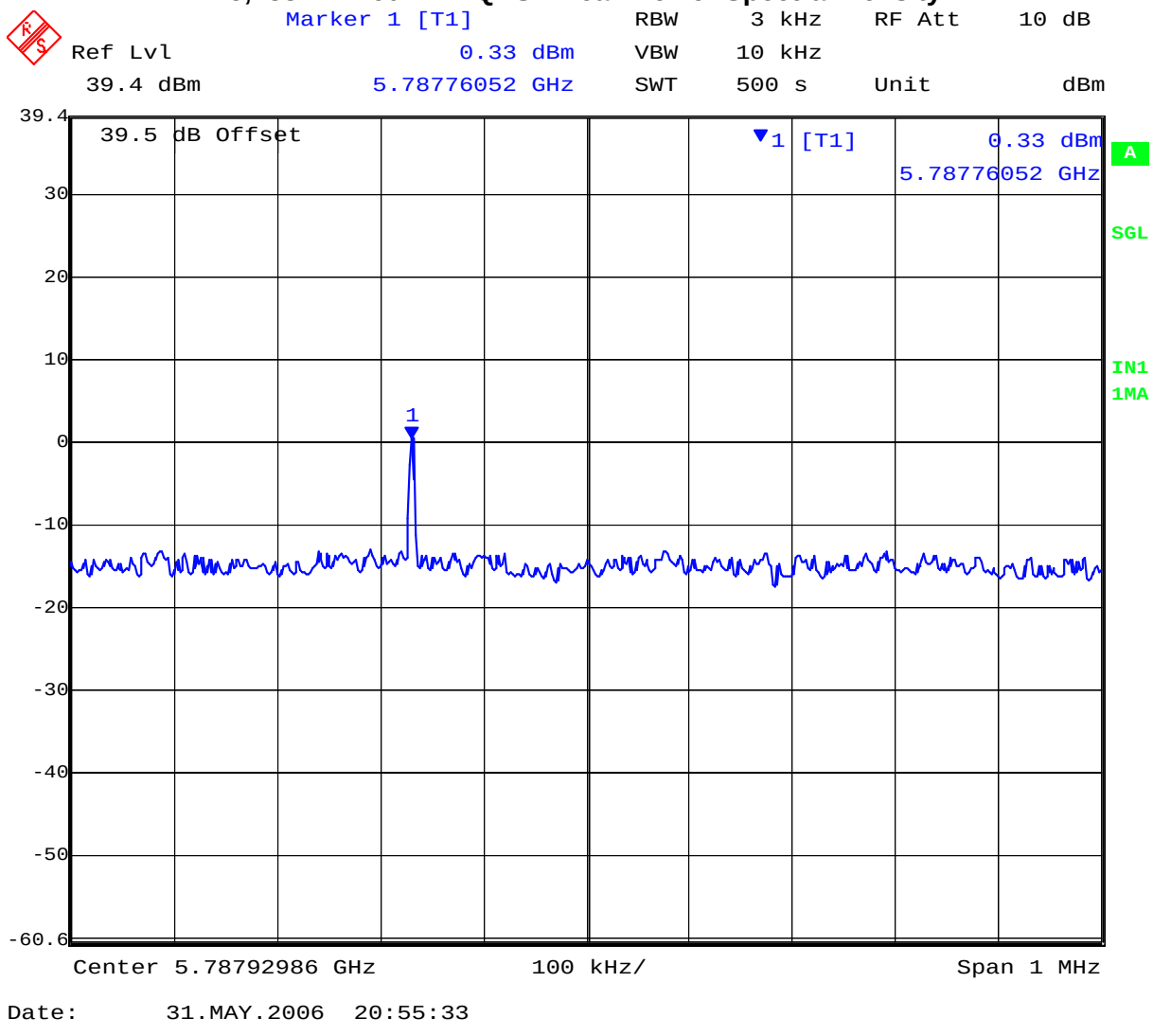


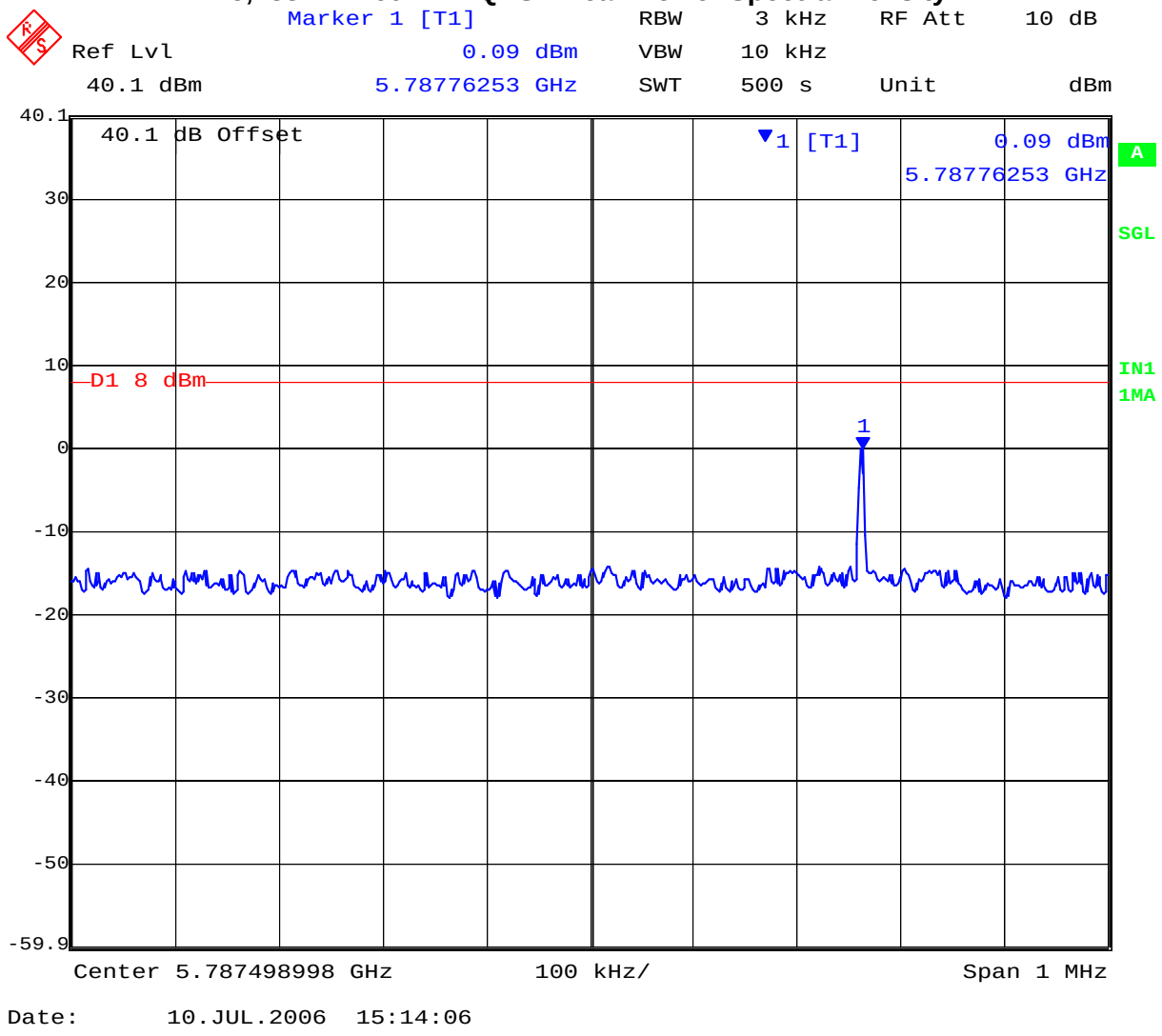
TABLE OF RESULTS – 60 MHz Bandwidth QPSK

Center Freq (MHz)	Limit (dBm)	Antenna Port #1				Antenna Port #2 Verification			
		Peak Freq (MHz)	PPSD (dBm)	Margin (dBm)	Plot #	Peak Freq (MHz)	PPSD (dBm)	Margin (dBm)	Plot #
5,762	8	5784.087	-14.99	-22.99	On File				
5,788	8	5787.760	+0.33	-7.67	12	5787.763	+0.09	-7.91	12a
5,813	8	5822.536	-12.70	-20.70	On File				

Plot 12
5,788 MHz 60 MHz QPSK Peak Power Spectral Density



Plot 12a Port 2 Verification
5,788 MHz 60 MHz QPSK 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

5.1.4. 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)

P (Worst case) = +29.98 dBm, (995.4 num)

Antenna gains = 20 dBi (100 num), 28 dBi (631 num.), 37.5 dBi (5623 num.)

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

Antenna Gain (dBi)	Single/ Dual Pole	Numeric Gain (numeric)	Peak Output Power (dBm)		Peak Output Power (mW)		Calculated Safe Distance @ 1mW/cm^2 Limit (cm)
			Ant Port #1	Ant Port #2	Ant Port #1	Ant Port #2	
20.0	Dual	100	+26.98	+26.98	498.9	498.9	89.0
28.0	Single	631	+29.98		995.4		223.6
37.5	Dual	5623	+26.98	+26.98	498.9	498.9	667.4

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.

Limit S = 1mW / cm^2 from 1.310 Table 1

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

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

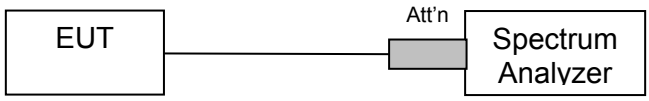
5.1.5. Conducted Spurious Emissions

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

The Conducted Spurious Emissions were measured with the transmit power set to maximum and a spectrum analyzer connected to one of the EUTs two antenna ports. 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

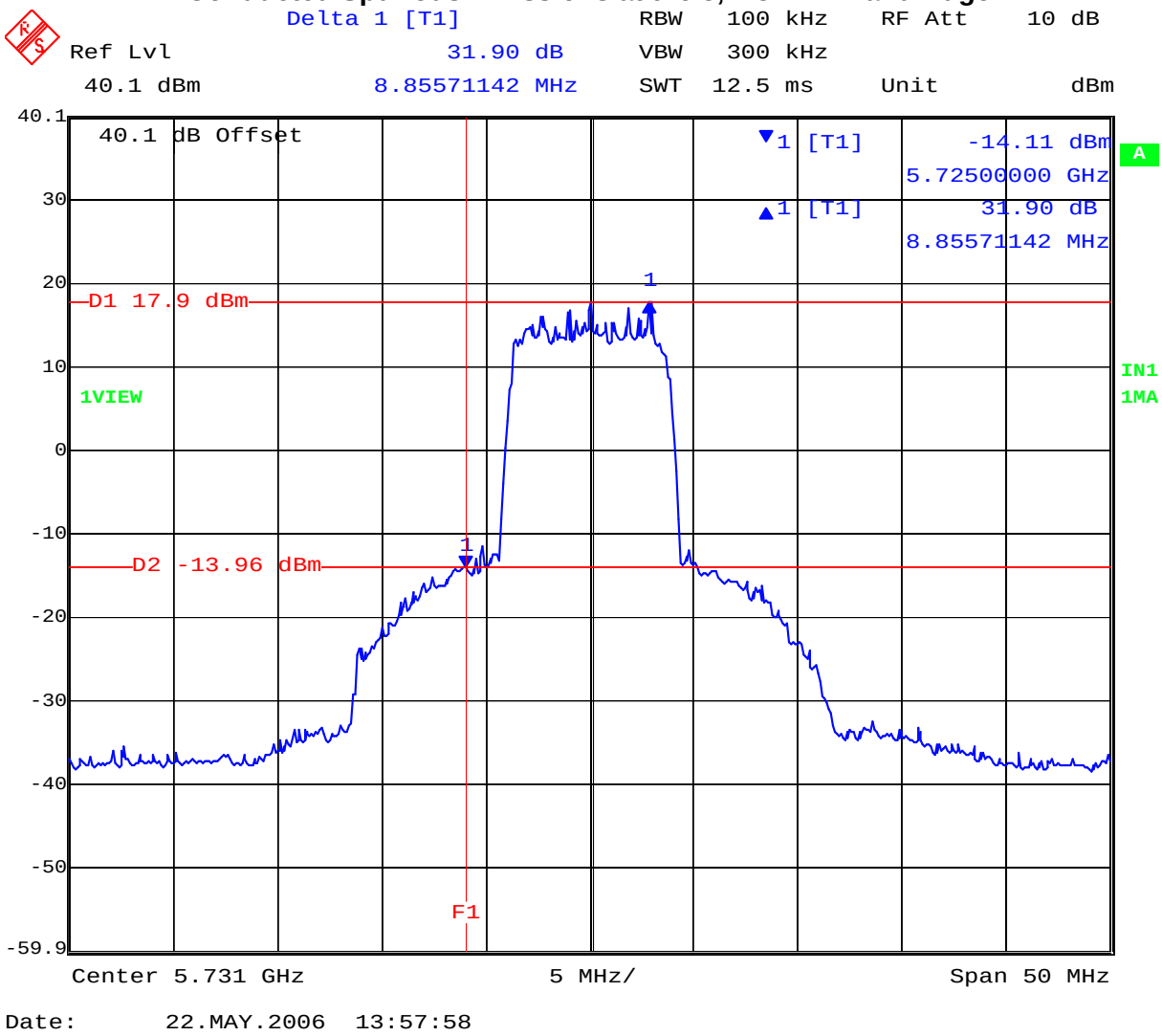
Conducted Band-Edge Results

TABLE OF RESULTS – 7.5 MHz Bandwidth QPSK

Center Frequency (MHz)	Band edge Frequency (MHz)	Limit (20 dB below peak of fundamental)	Amplitude @ Band edge (dBm)	Plot #	Margin (dB)
5,731	5,725	-2.10	-13.96	13	-11.86
5,844	5,850	-2.20	-14.96	14	-12.76

Plot 13 7.5 MHz Bandwidth QPSK

Conducted Spurious Emissions at the 5,725 MHz Band Edge



Plot 14 7.5 MHz Bandwidth QPSK

Conducted Spurious Emissions at the 5,850 MHz Band Edge

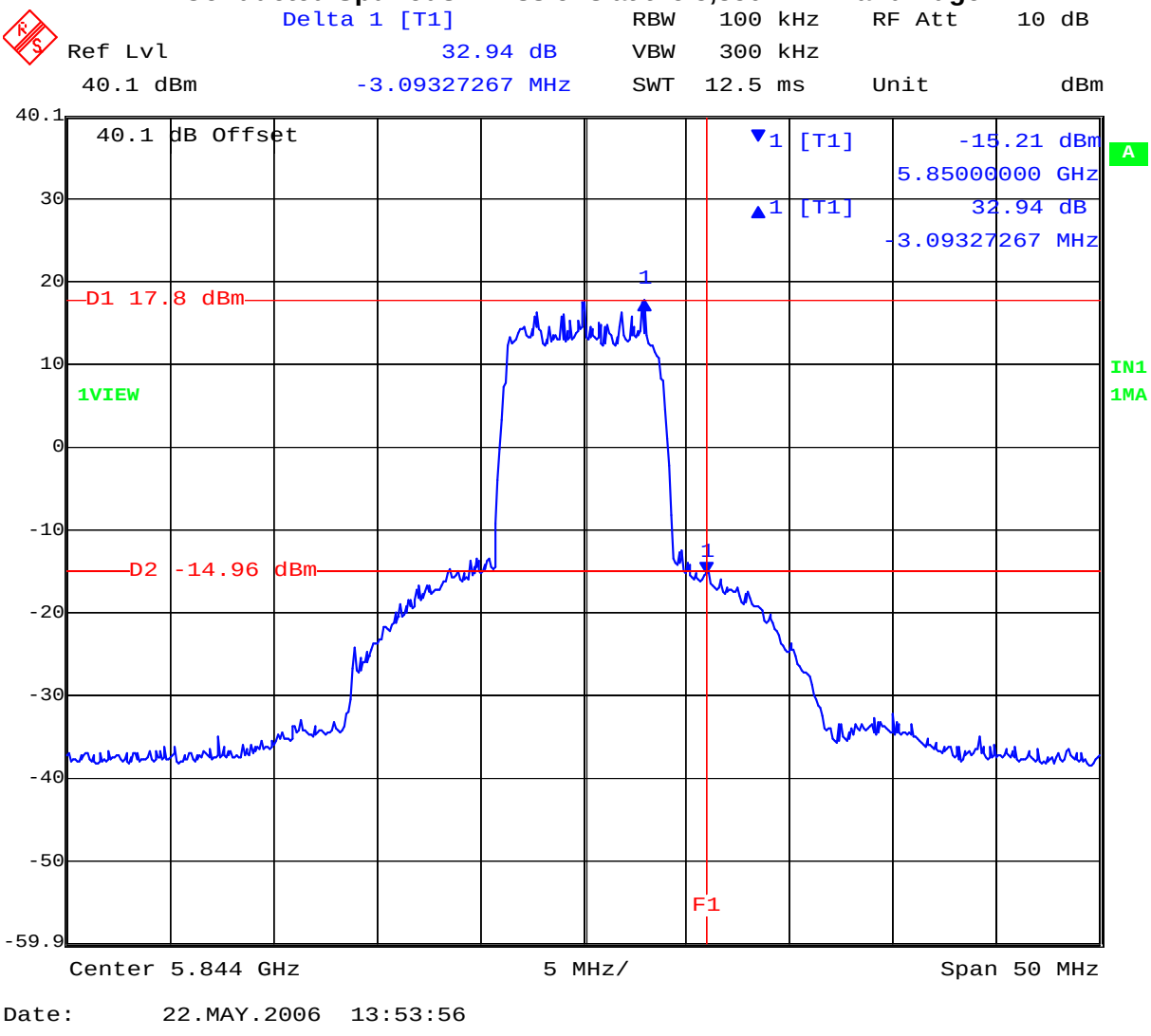
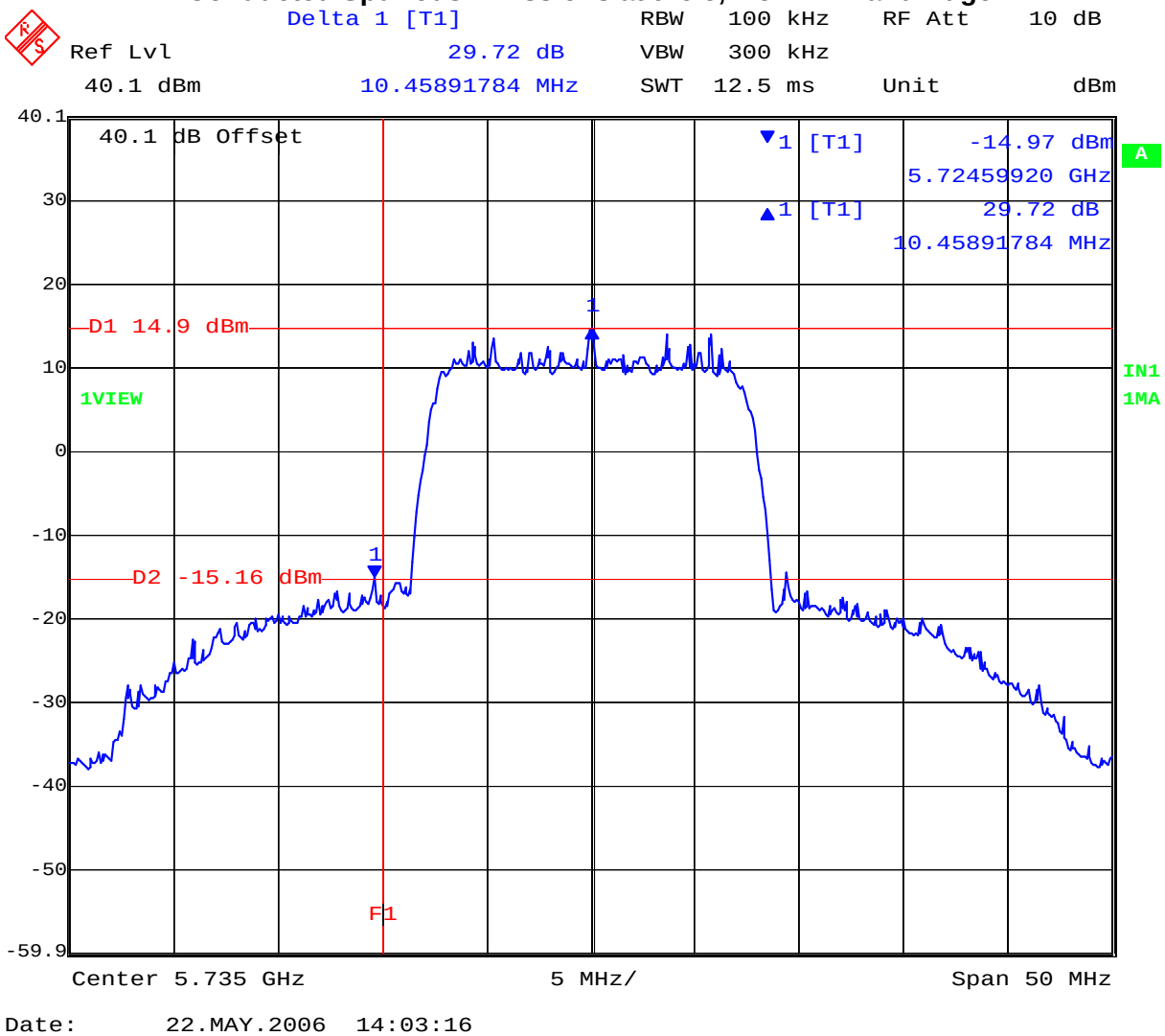


TABLE OF RESULTS – 15 MHz Bandwidth QPSK

Center Frequency (MHz)	Band edge Frequency (MHz)	Limit (20 dB below peak of fundamental)	Amplitude @ Band edge (dBm)	Plot #	Margin (dB)
5,735	5,725	-5.10	-15.16	15	-10.06
5,840	5,850	-5.16	-17.36	16	-12.20

Plot 15 15 MHz Bandwidth QPSK

Conducted Spurious Emissions at the 5,725 MHz Band Edge



Plot 16 15 MHz Bandwidth QPSK

Conducted Spurious Emissions at the 5,850 MHz Band Edge

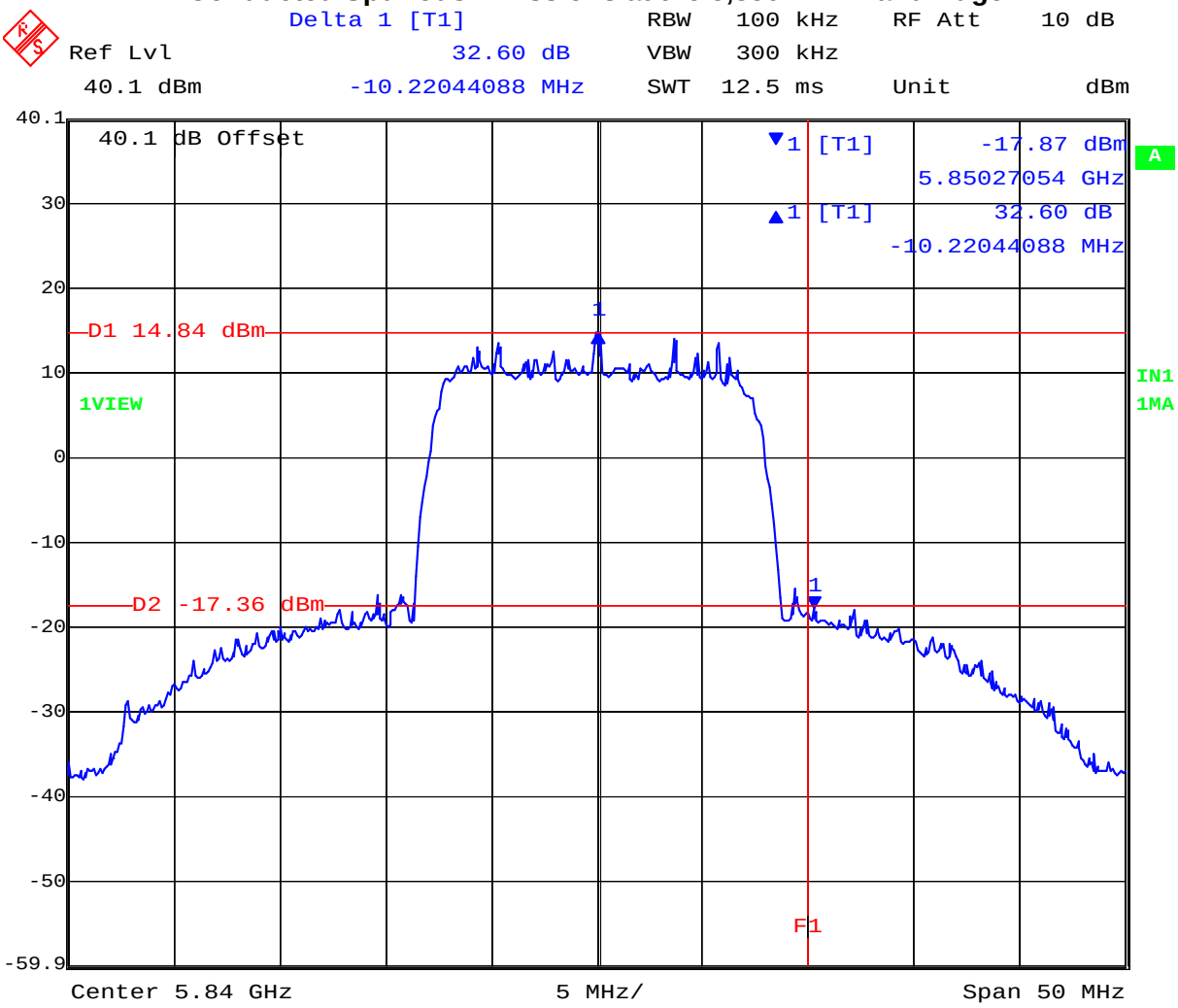
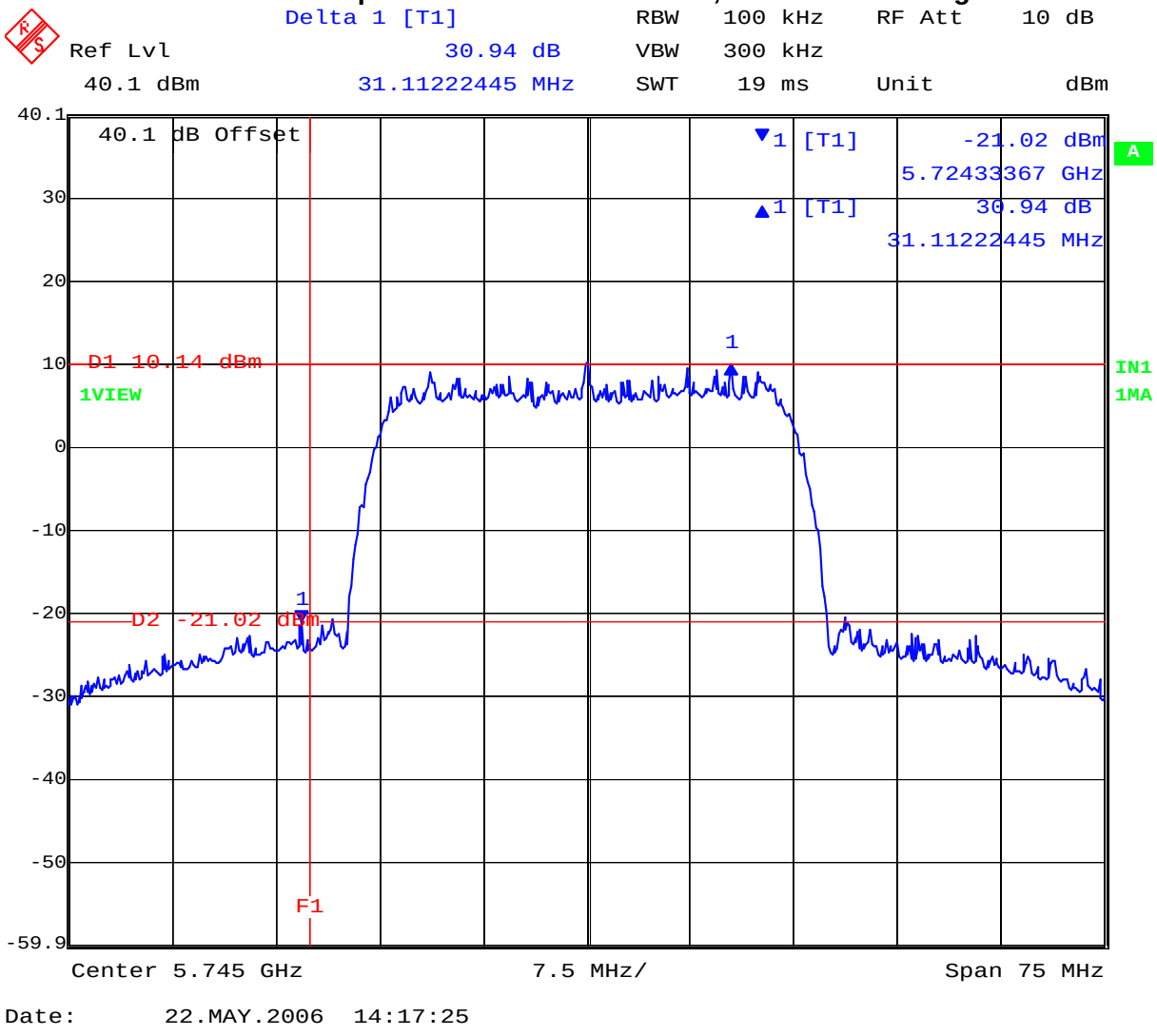


TABLE OF RESULTS – 30 MHz Bandwidth QPSK

Center Frequency (MHz)	Band edge Frequency (MHz)	Limit (20 dB below peak of fundamental)	Amplitude @ Band edge (dBm)	Plot #	Margin (dB)
5,745	5,725	-9.86	-21.02	17	-11.16
5,830	5,850	-8.96	-21.19	18	-12.23

Plot 17 30 MHz Bandwidth QPSK

Conducted Spurious Emissions at the 5,725 MHz Band Edge



Plot 18 30 MHz Bandwidth QPSK

Conducted Spurious Emissions at the 5,850 MHz Band Edge

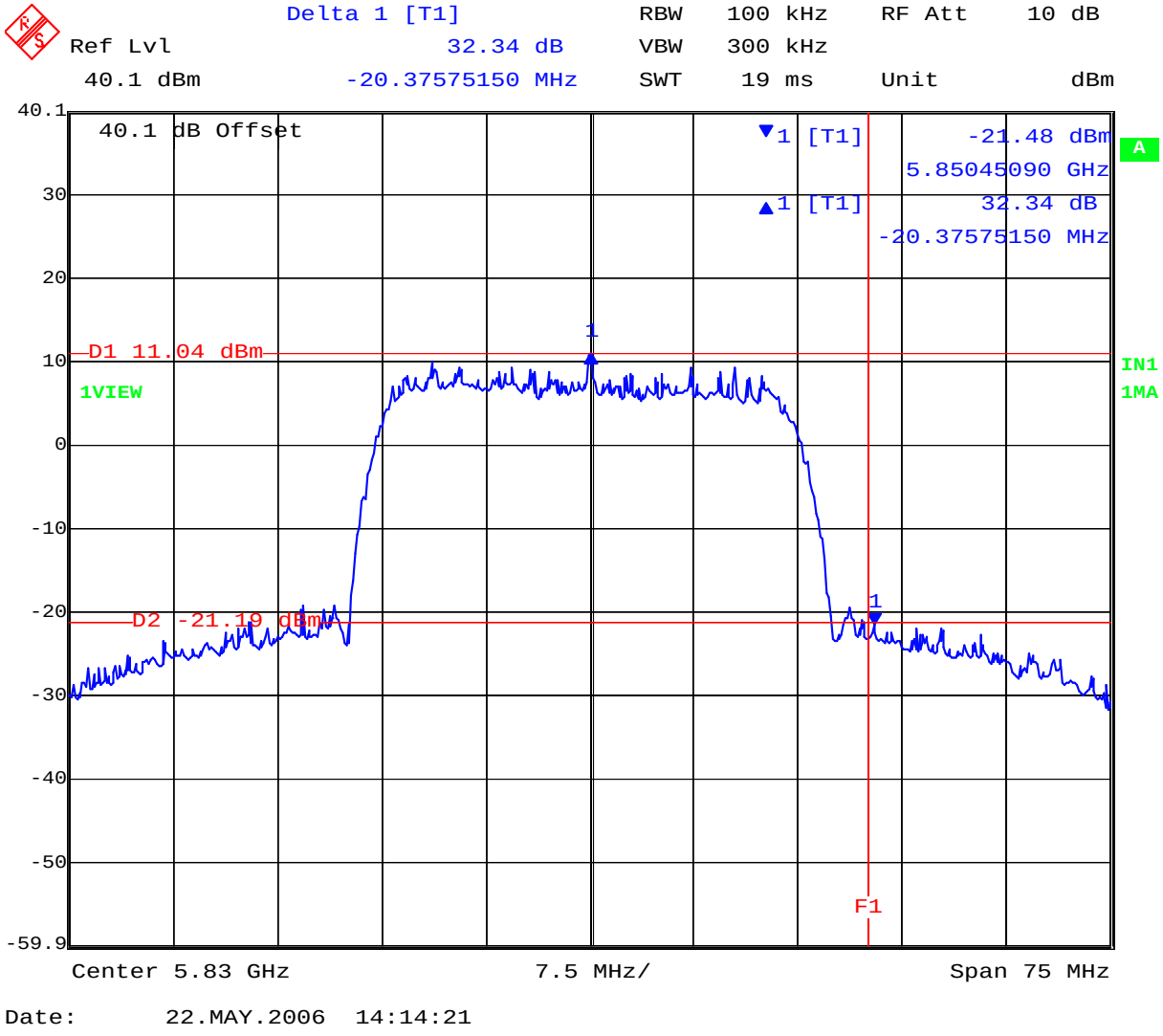
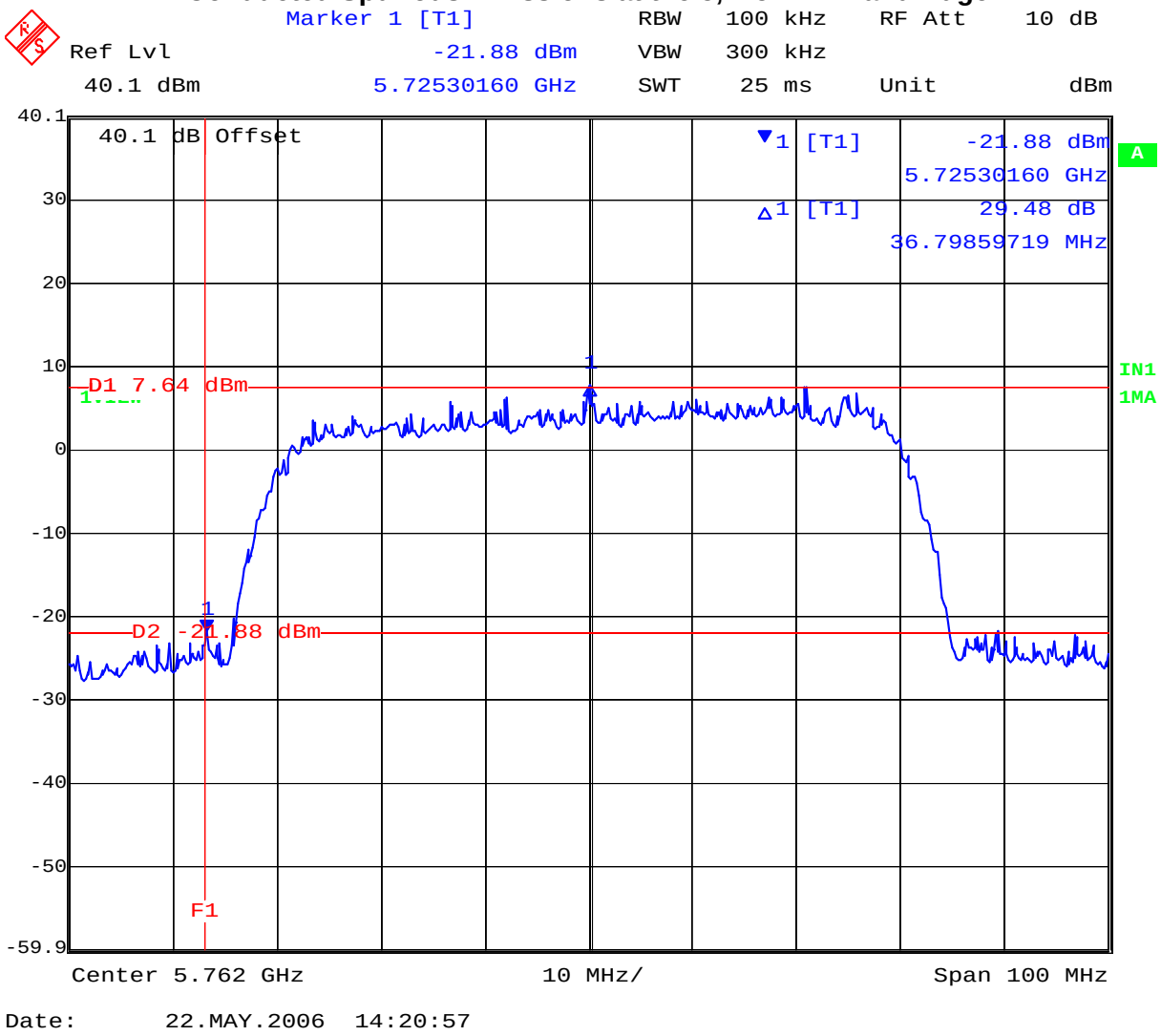


TABLE OF RESULTS – 60 MHz Bandwidth QPSK

Center Frequency (MHz)	Band edge Frequency (MHz)	Limit (20 dB below peak of fundamental)	Amplitude @ Band edge (dBm)	Plot #	Margin (dB)
5,762	5,725	-12.36	-21.88	19	-9.52
5,813	5,850	-11.36	-23.48	20	-12.12

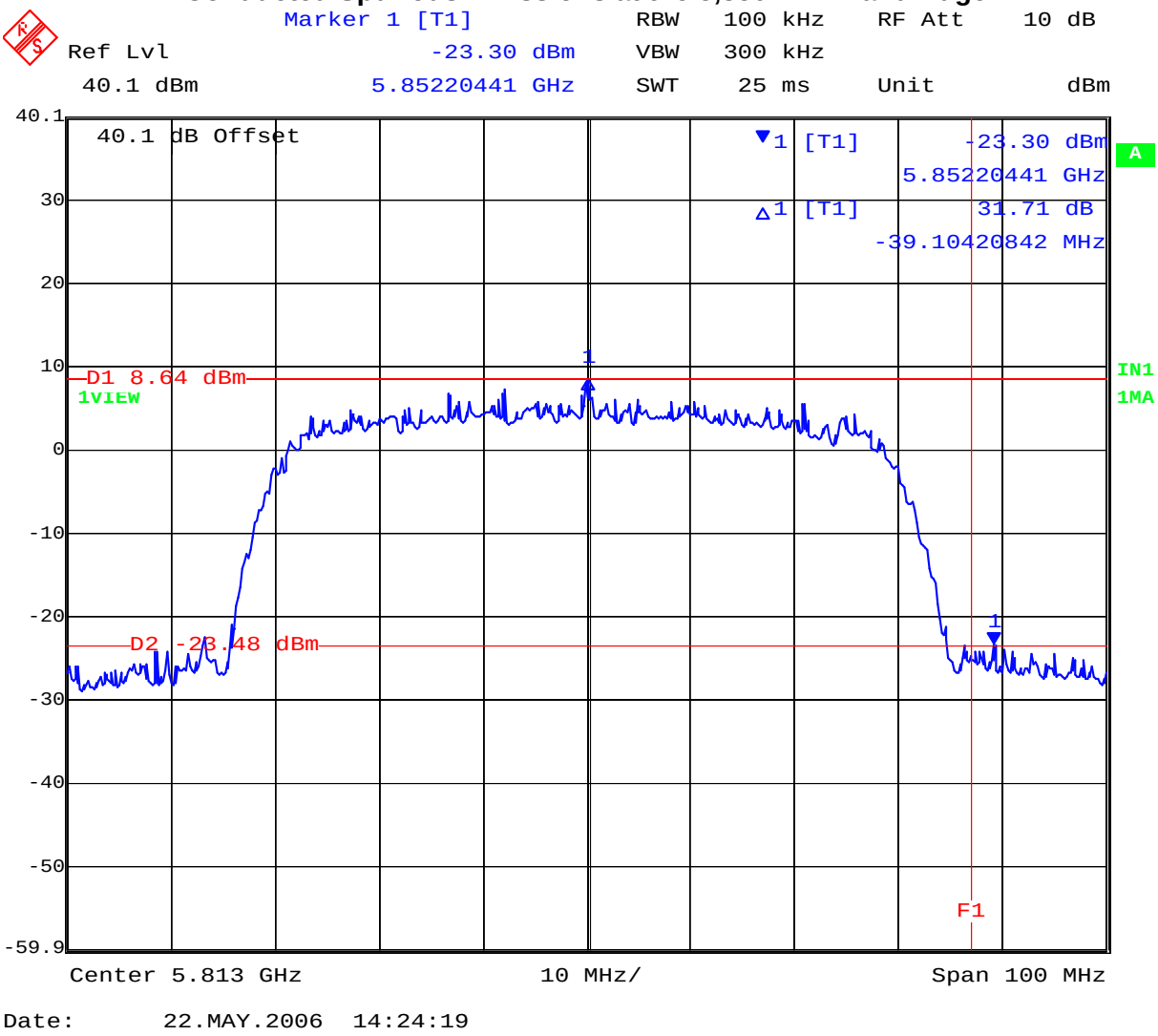
Plot 19 60 MHz Bandwidth QPSK

Conducted Spurious Emissions at the 5,725 MHz Band Edge



Plot 20 60 MHz Bandwidth QPSK

Conducted Spurious Emissions at the 5,850 MHz Band Edge



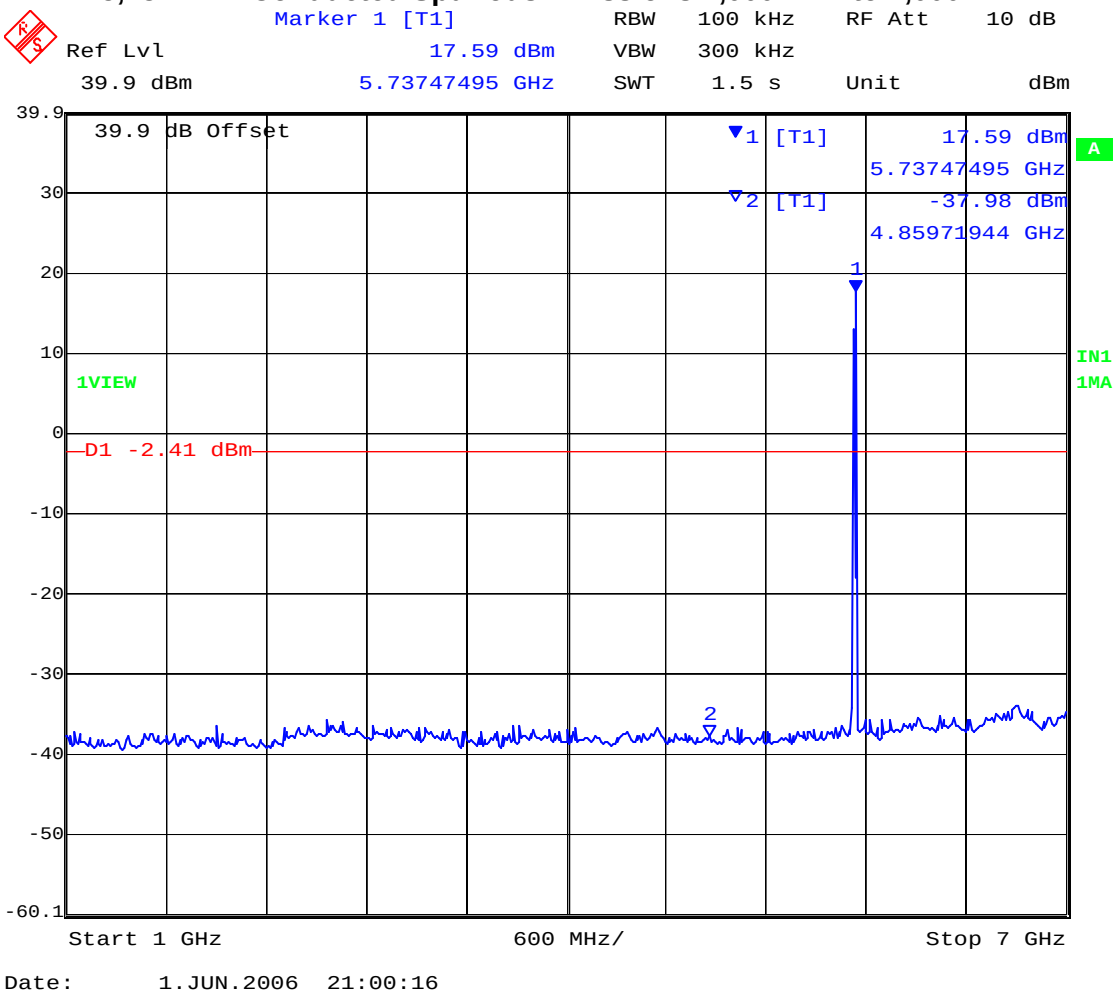
Conducted Spurious Emissions (1-40 GHz)

Conducted Spurious Emissions were measured for QPSK 7.5 MHz bandwidth only.

TABLE OF RESULTS – 7.5 MHz Bandwidth QPSK

Channel Centre Frequency	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Plot #	Margin (dB)
5,731	1,000	7,000	-34.50	-2.41	21	-32.09
5,731	7,000	40,000	-38.10	-2.41	22	-35.69

Plot 21 7.5 MHz QPSK
5,731 MHz Conducted Spurious Emissions 1,000 MHz to 7,000 MHz



Plot 22 7.5 MHz QPSK
5,731 MHz Conducted Spurious Emissions 7,000 MHz to 40,000 MHz

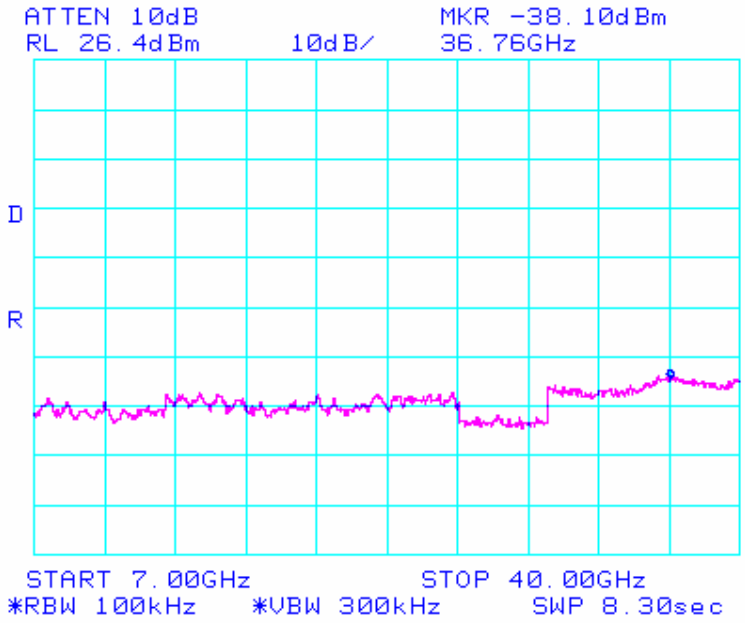
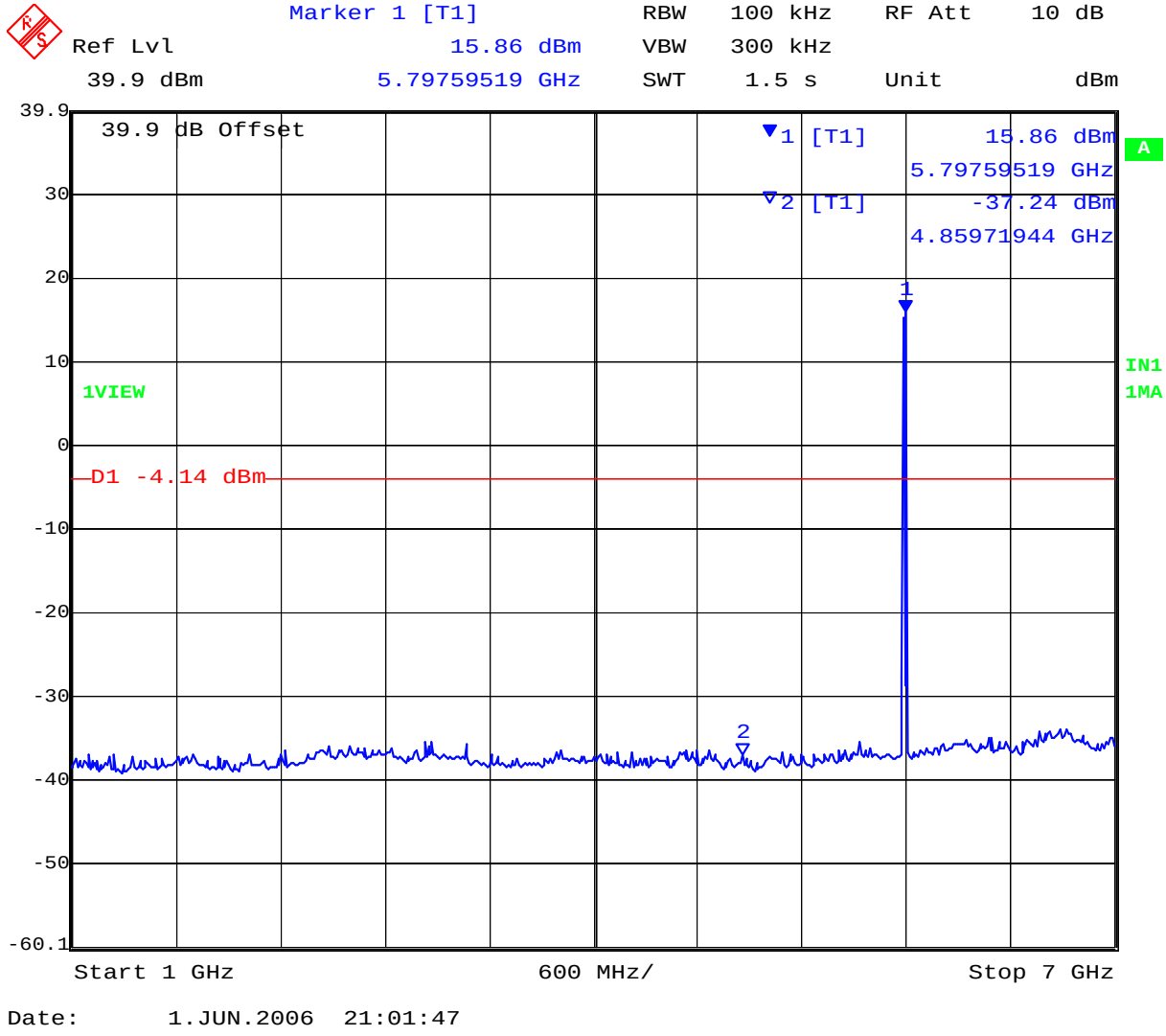


TABLE OF RESULTS – 7.5 MHz Bandwidth QPSK

Channel Centre Frequency	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Plot #	Margin (dB)
5,788	1,000	7,000	-34.50	-4.14	23	-30.36
5,788	7,000	40,000	-36.93	-4.14	24	-32.79

Plot 23 7.5 MHz QPSK
5,788 MHz Conducted Spurious Emissions 1,000 MHz to 7,000 MHz



Plot 24 7.5 MHz QPSK
5,788 MHz Conducted Spurious Emissions 7,000 MHz to 40,000 MHz

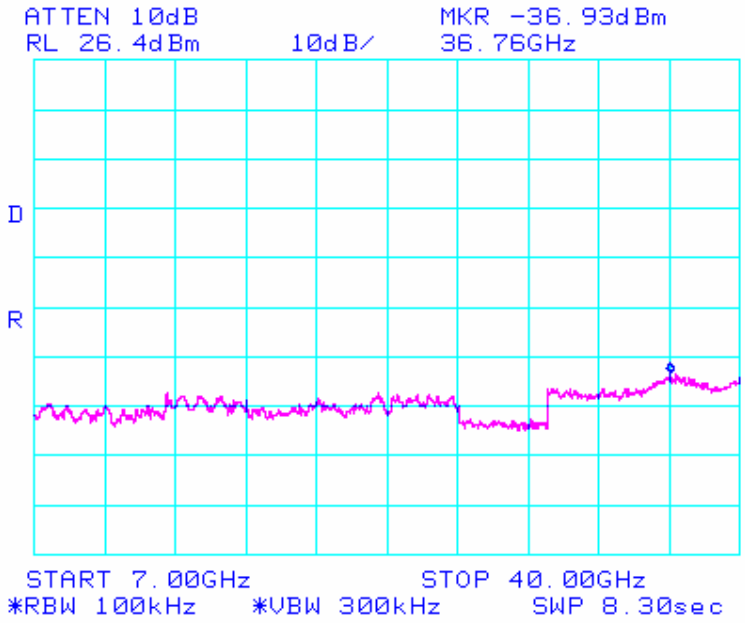
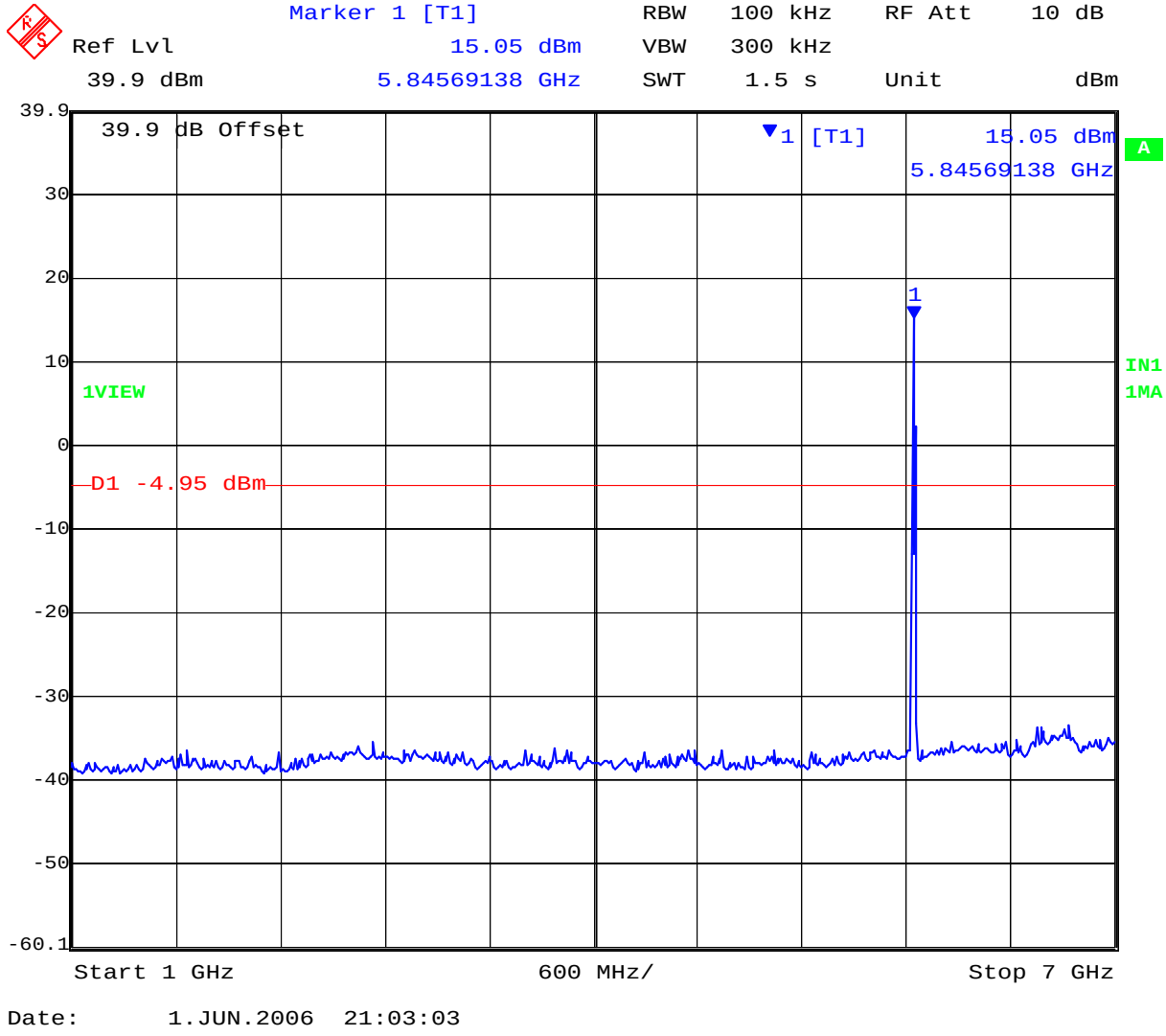


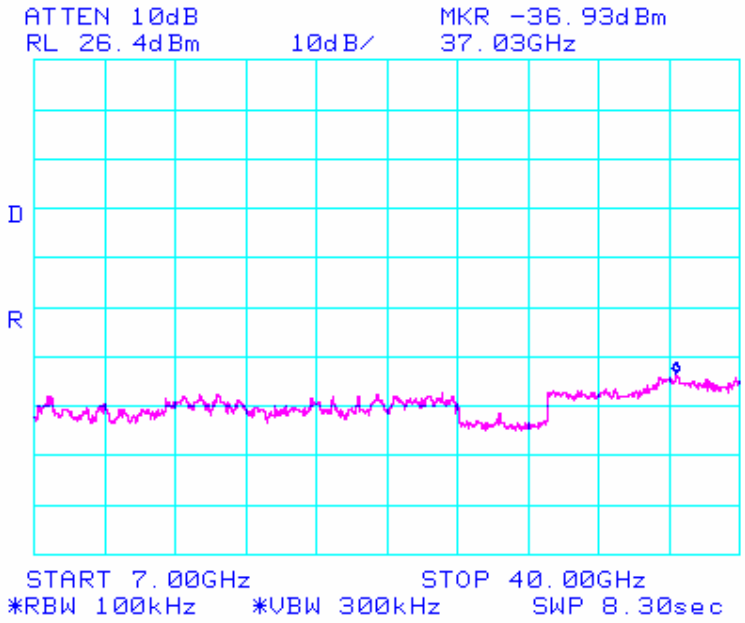
TABLE OF RESULTS – 7.5 MHz Bandwidth QPSK

Channel Centre Frequency	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Plot #	Margin (dB)
5,844	1,000	7,000	-34.00	-4.95	25	-29.05
5,844	7,000	40,000	-36.93	-4.95	26	-31.98

Plot 25 7.5 MHz QPSK
5,844 MHz Conducted Spurious Emissions 1,000 MHz to 7,000 MHz



Plot 26 7.5 MHz QPSK
5,844 MHz Conducted Spurious Emissions 7,000 MHz to 40,000 MHz



Specification

§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.

5.1.6. Radiated Emissions

5.1.6.1. Transmitter Radiated Spurious Emissions (above 1 GHz)

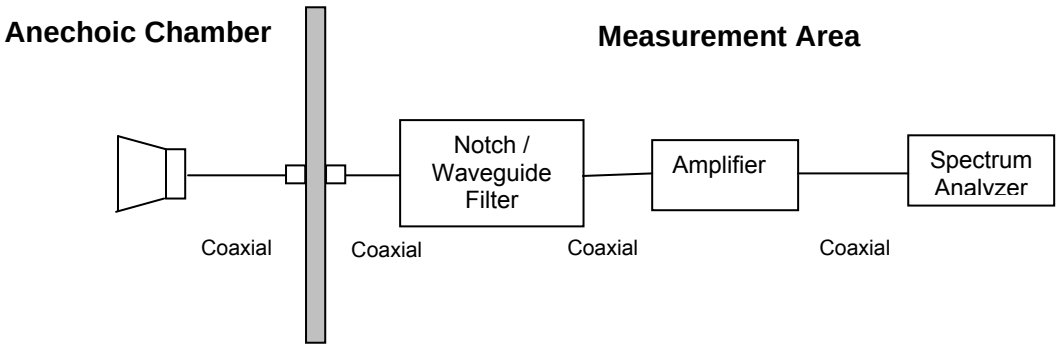
FCC, Part 15 Subpart C §15.247(d) 15.205; 15.209
Industry Canada RSS-210 §A8.5, §2.2, §2.6
Industry Canada RSS-Gen §4.7

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

EUT Test Configuration

The following table describes the two configurations of equipment that were tested for radiated emissions.

Antenna Configuration	EUT Configuration	Max. Allowable Conducted Power Setting (dBm)	
		Antenna port #1	Antenna port #2
37.5 dBi Dual Polarized Parabolic Antenna	Two antenna ports, dual polarized radio, operating on the same frequency with a coherent transmitter on both polarizations, into an external dual-polarized antenna.	+27.0	+27.0
28 dBi Single Polarized Patch Panel	One antenna port connected to a single pole external antenna.	+30.0	

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 – 5,788 MHz 28 dBi Antenna 7.5 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Measurement Type Peak/Avg	Field Strength (dBµV/m)	RB/ NRB	Limit (dBµV/m)	Margin (dB)
9966.66	V	Peak	51.7	NRB	120.62	-68.92
11571.8	V	Peak Max	60.55	RB	74	-13.45
11571.8	V	Average Max	49.17	RB	54	-4.83

RB - Restricted Band / NRB – Non-Restricted Band.

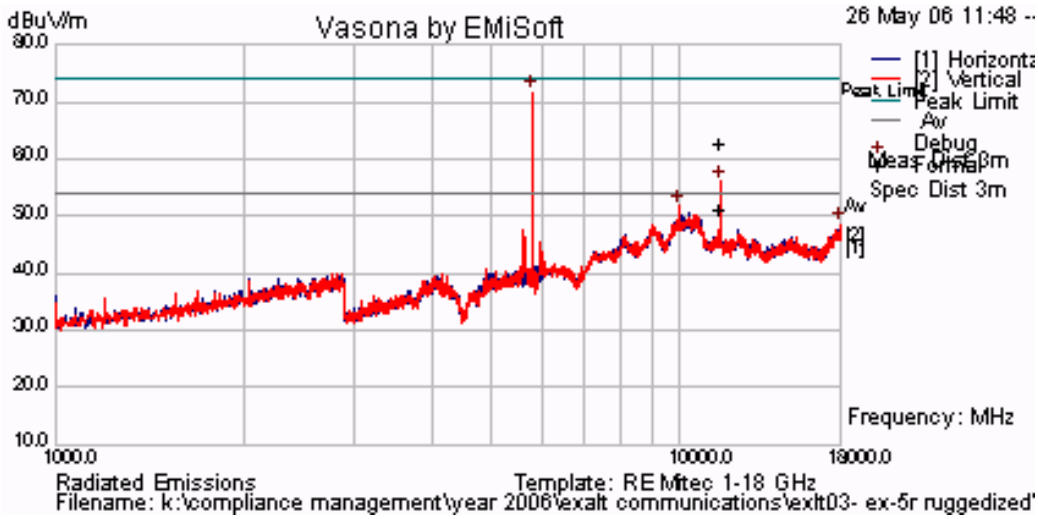
One emission is in a non restricted Band. The emissions limit is 20 dB below the peak field strength measured and reported in Section 5.1.6.1.1 of this report for this configuration of radio.

Note. The peak emission shown in the graph below is fundamental breaking through the notch filter.

Worst case plot shown for 7.5 MHz Bandwidth QPSK Modulation. All other results for this bandwidth are held on file.

Plot 27

5,788 MHz Radiated Emissions for 28 dBi Antenna 7.5 MHz Bandwidth QPSK



Radiated Spurious Emissions above 1 GHz (continued)

TABLE OF RESULTS – 5,735 MHz 28 dBi Antenna 15 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Measurement Type Peak/Avg	Field Strength (dBµV/m)	RB/ NRB	Limit (dBµV/m)	Margin (dB)

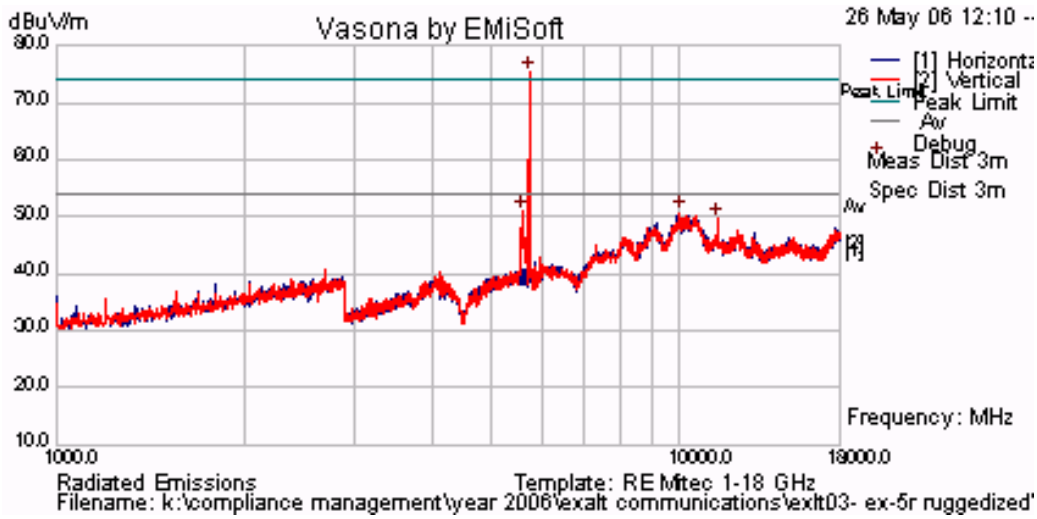
RB - Restricted Band / NRB – Non-Restricted Band.

The peak emission shown in the graph below is fundamental breaking through the notch filter. No other emissions were observed above the limit.

Worst case plot shown for 15 MHz Bandwidth QPSK Modulation. All other results for this bandwidth are held on file.

Plot 28

5,735 MHz Radiated Emissions for 28 dBi Antenna 15 MHz Bandwidth QPSK



Radiated Spurious Emissions above 1 GHz (continued)

TABLE OF RESULTS – 5,745 MHz 28 dBi Antenna 30 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Measurement Type Peak/Avg	Field Strength (dBµV/m)	RB/ NRB	Limit (dBµV/m)	Margin (dB)
5555.66	V	Peak	58.95	NRB	117.71	-58.76
5700.33	V	Peak	55.70	NRB	117.71	-62.01

RB - Restricted Band / NRB – Non-Restricted Band.

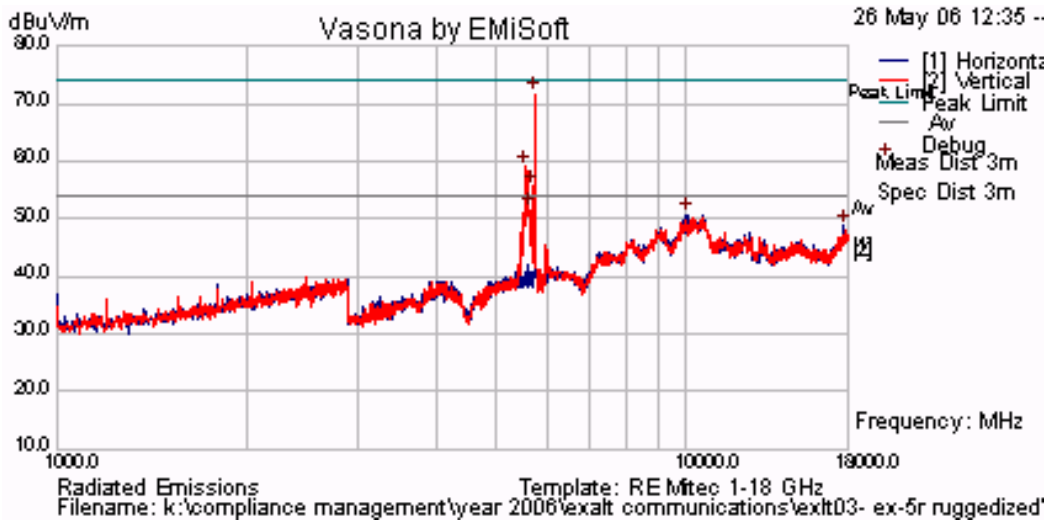
Two emissions are in a non restricted Band. The emissions limit is 20 dB below the peak field strength measured and reported in Section 5.1.6.1.1 of this report for this configuration of radio.

Note. The peak emission shown in the graph below is fundamental breaking through the notch filter.

Worst case plot shown for 30 MHz Bandwidth QPSK Modulation. All other results for this bandwidth are held on file.

Plot 29

5,745 MHz Radiated Emissions for 28 dBi Antenna 30 MHz Bandwidth QPSK



Radiated Spurious Emissions above 1 GHz (continued)

TABLE OF RESULTS – 5,762 MHz 28 dBi Antenna 60 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Measurement Type Peak/Avg	Field Strength (dBµV/m)	RB/ NRB	Limit (dBµV/m)	Margin (dB)
5602.16	V	Peak	64.91	NRB	116.41	-51.50
5633.16	V	Peak	60.10	NRB	116.41	-56.31
5741.66	V	Peak	68.75	NRB		
5777.83	V	Peak	62.36	NRB		
5974.16	V	Peak	55.82	NRB	116.41	-60.59
6000	V	Peak	53.95	NRB	116.41	-62.46

RB - Restricted Band / NRB – Non-Restricted Band.

All emissions are in a non restricted Band. Emissions highlighted in the table are the fundamental breaking through the notch filter. The emissions limit is 20 dB below the peak field strength measured and reported in Section 5.1.6.1.1 of this report for this configuration of radio.

Note. The peak emission shown in the graph below is fundamental breaking through the notch filter.

Plot 30

5,762 MHz Radiated Emissions for 28 dBi Antenna 60 MHz Bandwidth QPSK

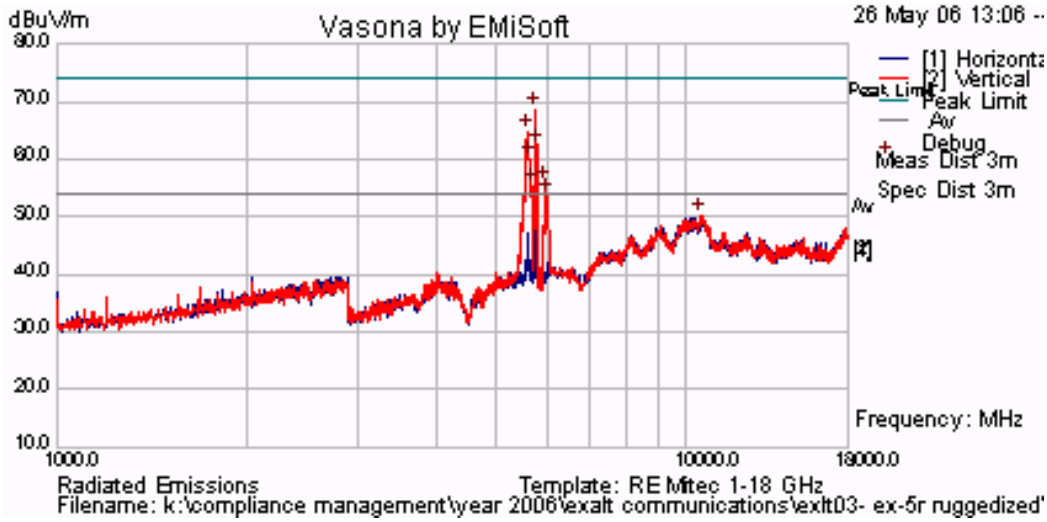


TABLE OF RESULTS – 5,788 MHz 28 dBi Antenna 60 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Measurement Type Peak/Avg	Field Strength (dBμV/m)	RB/ NRB	Limit (dBμV/m)	Margin (dB)
5576.333	V	Peak	61.11	NRB	117.55	-56.44
5638.333	V	Peak	56.28	NRB	117.55	-61.27
5798.500	V	Peak	64.09	NRB		
5979.333	V	Peak	61.51	NRB	117.55	-56.04
9978.333	H	Peak	51.10	NRB	117.55	-66.45

RB - Restricted Band / NRB – Non-Restricted Band.

All emissions are in a non restricted Band. Emissions highlighted in the table are the fundamental breaking through the notch filter. The emissions limit is 20 dB below the peak field strength measured and reported in Section 5.1.6.1.1 of this report for this configuration of radio.

Note. The peak emission shown in the graph below is fundamental breaking through the notch filter.

Plot 31

5,788 MHz Radiated Emissions for 28 dBi Antenna 60 MHz Bandwidth QPSK

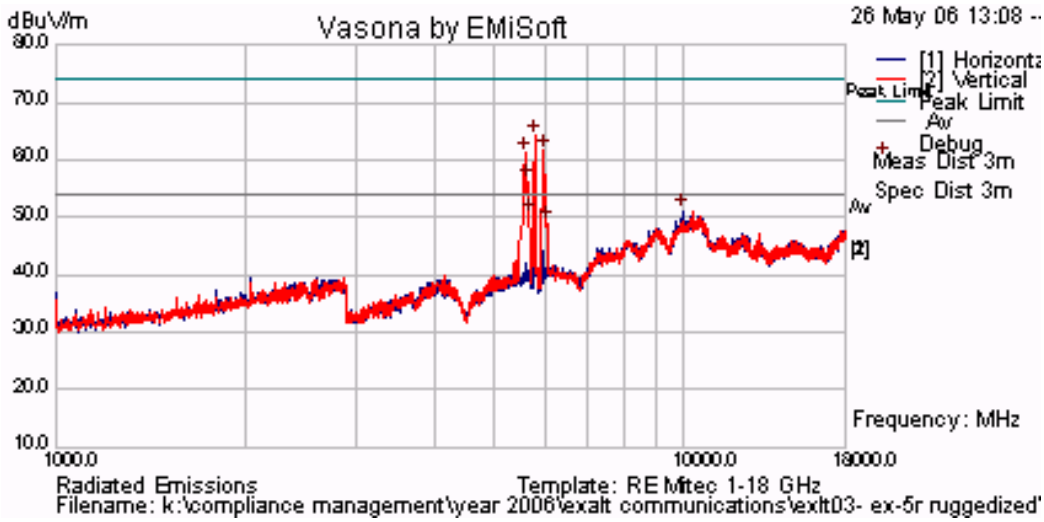


TABLE OF RESULTS – 5,813 MHz 28 dBi Antenna 60 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Measurement Type Peak/Avg	Field Strength (dBμV/m)	RB/ NRB	Limit (dBμV/m)	Margin (dB)
5597.000	V	Peak	58.26	NRB	115.25	-56.99
5798.500	V	Peak	64.59	NRB		
5834.667	V	Peak	57.66	NRB		
5979.333	V	Peak	65.18	NRB	115.25	-50.07
6000.000	V	Peak	62.78	NRB	115.25	-52.47

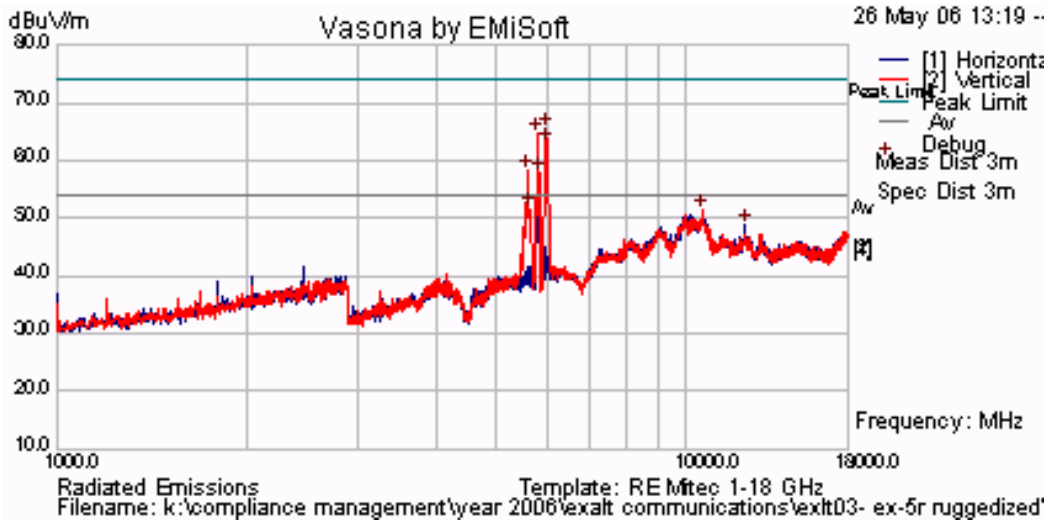
RB - Restricted Band / NRB – Non-Restricted Band.

All emissions are in a non restricted Band. Emissions highlighted in the table are the fundamental breaking through the notch filter. The emissions limit is 20 dB below the peak field strength measured and reported in Section 5.1.6.1.1 of this report for this configuration of radio.

Note. The peak emission shown in the graph below is fundamental breaking through the notch filter.

Plot 32

5,813 MHz Radiated Emissions for 28 dBi Antenna 60 MHz Bandwidth QPSK



37.5 dBi Antenna - 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 – 5,844 MHz 37.5 dBi Antenna 7.5 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Measurement Type Peak/Avg	Field Strength (dBµV/m)	RB/ NRB	Limit (dBµV/m)	Margin (dB)
5974.16	V	Peak	58.32	NRB	122.18	-63.86
11680.2	V	Peak Max	62.29	RB	74	-11.71
11680.2	V	Average Max	48.18	RB	54	-5.82

RB - Restricted Band / NRB – Non-Restricted Band.

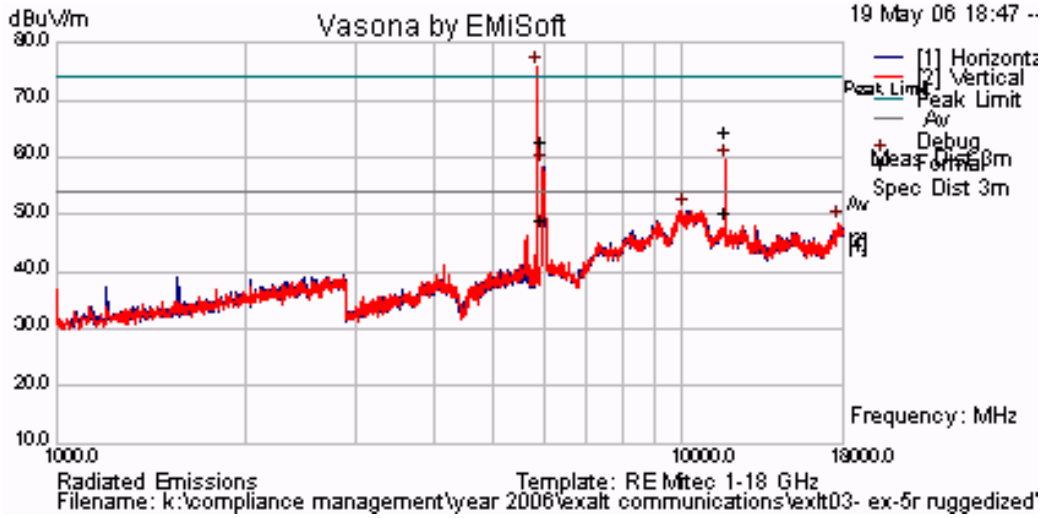
One emission is in a non restricted Band. The emissions limit is 20 dB below the peak field strength measured and reported in Section 5.1.6.1.1 of this report for this configuration of radio.

Note. The peak emission shown in the graph below is fundamental breaking through the notch filter.

Worst case plot shown for 7.5 MHz Bandwidth QPSK Modulation. All other results for this bandwidth are held on file.

Plot 33

5,844 MHz Radiated Emissions for 37.5 dBi Antenna 7.5 MHz Bandwidth QPSK



Radiated Spurious Emissions above 1 GHz (continued)

TABLE OF RESULTS – 5,840 MHz 37.5 dBi Antenna 15 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Measurement Type Peak/Avg	Field Strength (dBµV/m)	RB/ NRB	Limit (dBµV/m)	Margin (dB)
5989.66	H	Peak	57.56	NRB	120.61	-63.05
11676.1	V	Peak Max	61.65	RB	74	-12.35
11676.1	V	Average Max	50.92	RB	54	-3.08

RB - Restricted Band / NRB – Non-Restricted Band.

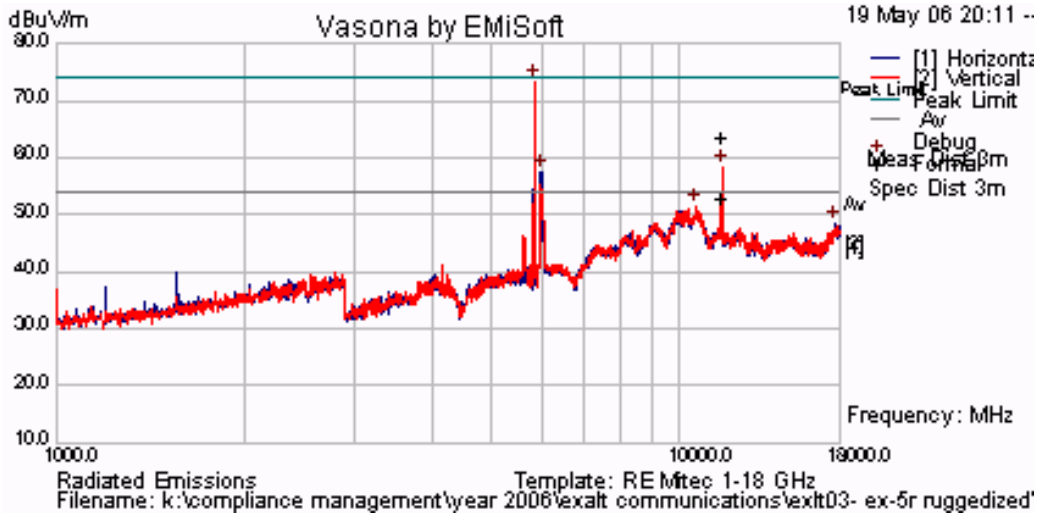
One emission is in a non restricted Band. The emissions limit is 20 dB below the peak field strength measured and reported in Section 5.1.6.1.1 of this report for this configuration of radio.

Note. The peak emission shown in the graph below is fundamental breaking through the notch filter.

Worst case plot shown for 15 MHz Bandwidth QPSK Modulation. All other results for this bandwidth are held on file.

Plot 34

5,840 MHz Radiated Emissions for 37.5 dBi Antenna 15 MHz Bandwidth QPSK



Radiated Spurious Emissions above 1 GHz (continued)

TABLE OF RESULTS – 5,745 MHz 37.5 dBi Antenna 30 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Measurement Type Peak/Avg	Field Strength (dBµV/m)	RB/ NRB	Limit (dBµV/m)	Margin (dB)
5566.00	V	Peak	65.62	NRB	118.86	-53.24
5612.50	V	Peak	61.90	NRB	118.86	-56.96
5664.16	H	Peak	55.48	NRB	118.86	-63.38
5700.33	V	Peak	59.87	NRB	118.86	-58.99
5969.00	V	Peak	58.45	NRB	118.86	-60.41
6011.66	V	Peak	53.30	NRB	118.86	-65.56
11491.0	V	Peak Max	57.02	RB	74	-16.98
11491.0	V	Average Max	44.22	RB	54	-9.78

RB - Restricted Band / NRB – Non-Restricted Band.

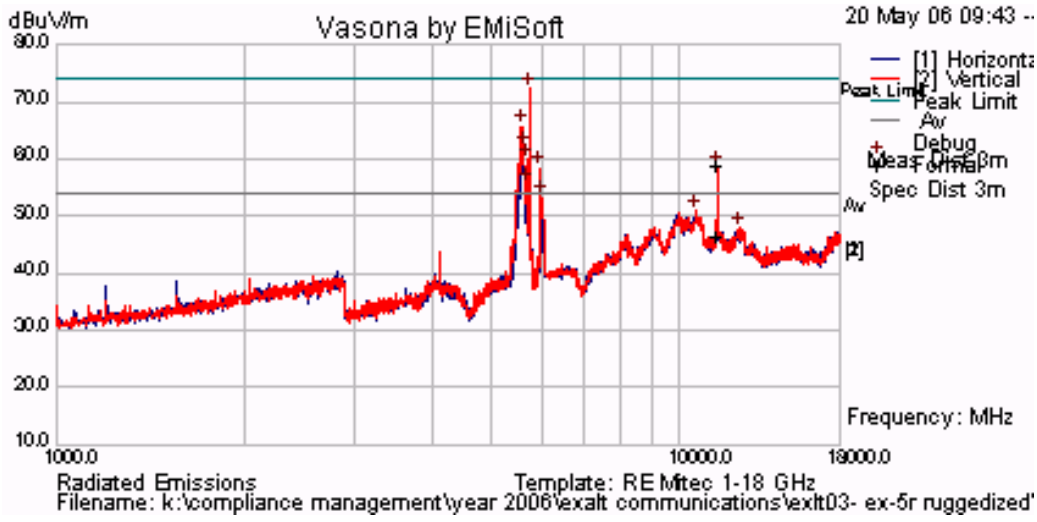
All but one emission are in a non restricted Band. The emissions limit is 20 dB below the peak field strength measured and reported in Section 5.1.6.1.1 of this report for this configuration of radio.

Note. The peak emission shown in the graph below is fundamental breaking through the notch filter.

Worst case plot shown for 30 MHz Bandwidth QPSK Modulation. All other results for this bandwidth are held on file.

Plot 35

5,745 MHz Radiated Emissions for 37.5 dBi Antenna 30 MHz Bandwidth QPSK



Radiated Spurious Emissions above 1 GHz (continued)

TABLE OF RESULTS – 5,762 MHz 37.5 dBi Antenna 60 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Measurement Type Peak/Avg	Field Strength (dBµV/m)	RB/ NRB	Limit (dBµV/m)	Margin (dB)
5602.16	H	Peak	71.08	NRB	118.55	-47.47
5617.66	H	Peak	66.24	NRB	118.55	-52.31
5679.66	H	Peak	61.00	NRB	118.55	-57.55
5741.66	V	Peak	67.25	NRB		
5788.16	H	Peak	68.39	NRB		
5974.16	H	Peak	65.82	NRB	118.55	-52.73
6046.66	H	Peak	55.51	NRB	118.55	-63.04
9978.33	V	Peak	51.27	NRB	118.55	-67.28

RB - Restricted Band / NRB – Non-Restricted Band.

All emissions are in a non restricted Band. Emissions highlighted in the table are the fundamental breaking through the notch filter. The emissions limit is 20 dB below the peak field strength measured and reported in Section 5.1.6.1.1 of this report for this configuration of radio.

Note. The peak emission shown in the graph below is fundamental breaking through the notch filter.

Plot 36

5,762 MHz Radiated Emissions for 37.5 dBi Antenna 60 MHz Bandwidth QPSK

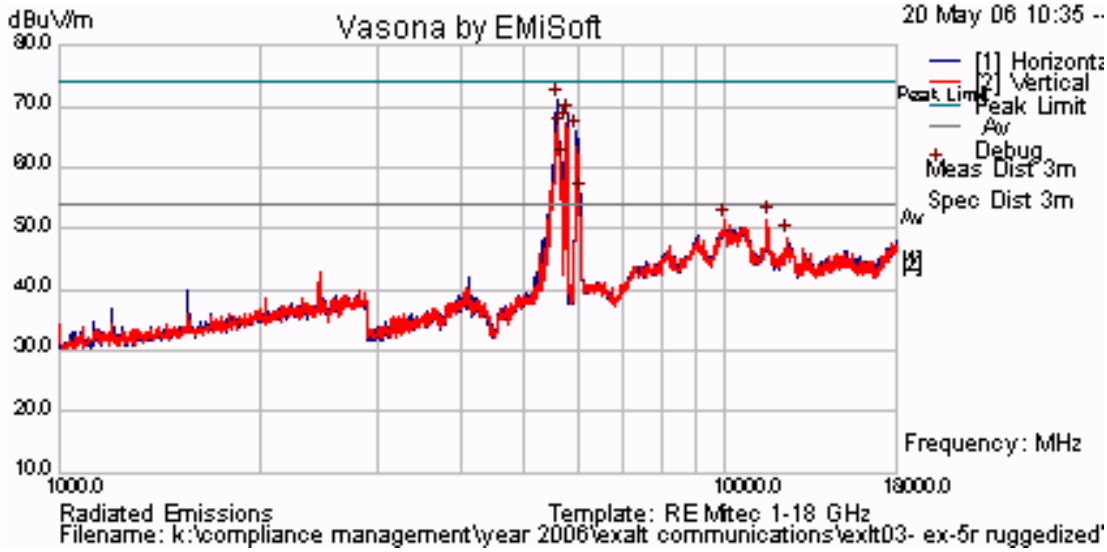


TABLE OF RESULTS – 5,788 MHz 37.5 dBi Antenna 60 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Measurement Type Peak/Avg	Field Strength (dBµV/m)	RB/ NRB	Limit (dBµV/m)	Margin (dB)
5586.66	V	Peak	66.77	NRB	117.55	-50.78
5617.66	H	Peak	60.74	NRB	117.55	-56.81
5664.16	H	Peak	55.32	NRB	117.55	-62.23
5700.33	H	Peak	48.03	NRB	117.55	-69.52
5783.00	V	Peak	68.54	NRB		
5974.16	H	Peak	69.48	NRB	117.55	-48.07
6046.66	H	Peak	60.34	NRB	117.55	-57.21

RB - Restricted Band / NRB – Non-Restricted Band.

All emissions are in a non restricted Band. The emission highlighted in the table is the fundamental breaking through the notch filter. The emissions limit is 20 dB below the peak field strength measured and reported in Section 5.1.6.1.1 of this report for this configuration of radio.

Note. The peak emission shown in the graph below is fundamental breaking through the notch filter.

Plot 37

5,788 MHz Radiated Emissions for 37.5 dBi Antenna 60 MHz Bandwidth QPSK

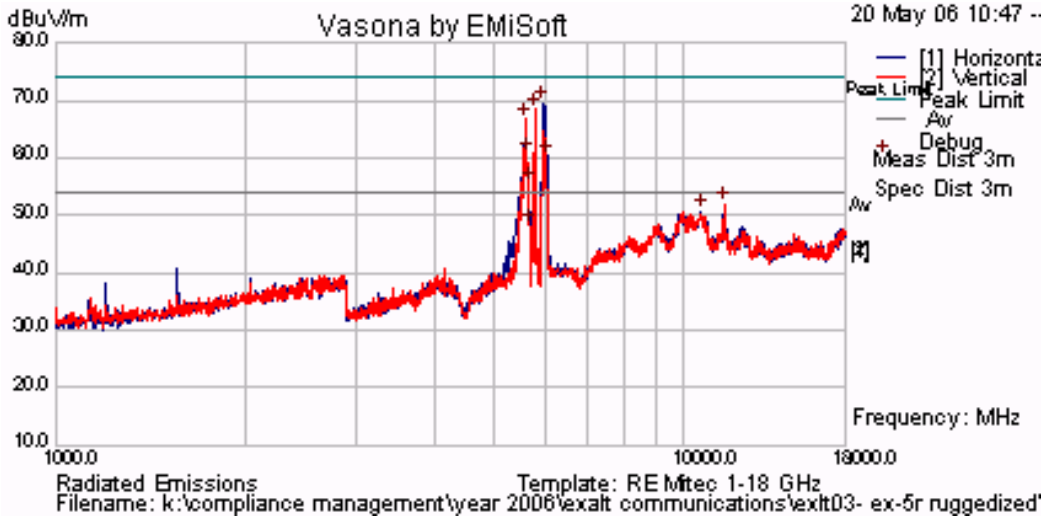


TABLE OF RESULTS – 5,813 MHz 37.5 dBi Antenna 60 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Measurement Type Peak/Avg	Field Strength (dBµV/m)	RB/ NRB	Limit (dBµV/m)	Margin (dB)
5597.00	H	Peak	61.42	NRB	116.85	-55.43
5638.33	H	Peak	55.44	NRB	116.85	-61.41
5798.50	V	Peak	66.42	NRB		
5839.83	V	Peak	68.67	NRB		
5969.00	H	Peak	72.29	NRB	116.85	-44.56
6046.66	H	Peak	66.01	NRB	116.85	-50.84

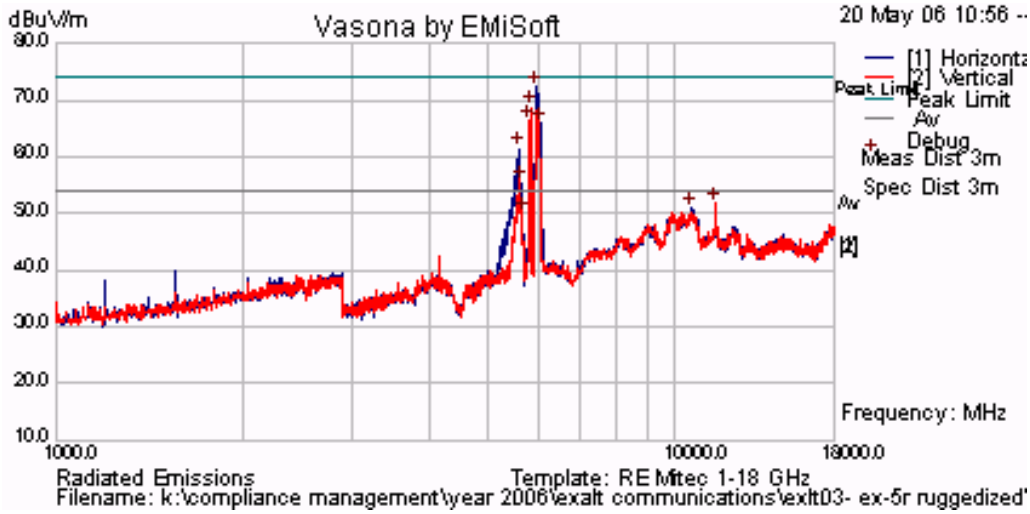
RB - Restricted Band / NRB – Non-Restricted Band.

All emissions are in a non restricted Band. Emissions highlighted in the table are the fundamental breaking through the notch filter. The emissions limit is 20 dB below the peak field strength measured and reported in Section 5.1.6.1.1 of this report for this configuration of radio.

Note. The peak emission shown in the graph below is fundamental breaking through the notch filter.

Plot 38

5,813 MHz Radiated Emissions for 37.5 dBi Antenna 60 MHz Bandwidth QPSK



Specification Limits

FCC §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.

FCC §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)).

IC 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.

IC 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.

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

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

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

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

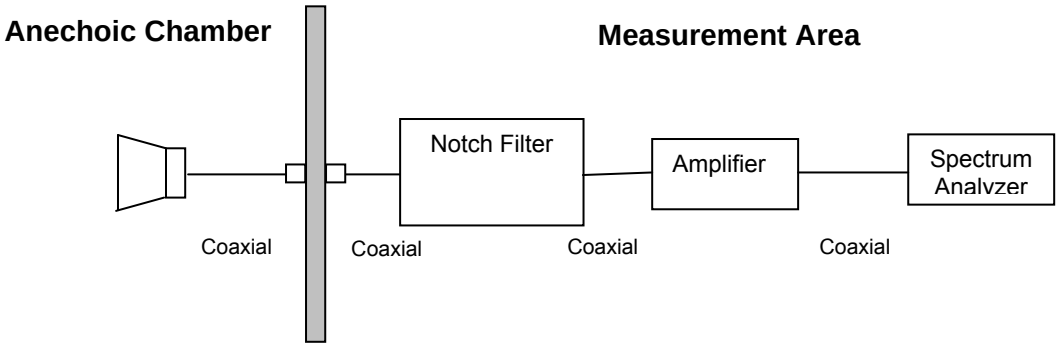
5.1.6.1.1. Peak Field Strength Measurements

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.

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 = Band-stop 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

Peak Field Strength Measurements - Test Configurations

The following table describes the two configurations of equipment that were tested.

Antenna Configuration	EUT Configuration	Max. Allowable Conducted Power Setting (dBm)	
		Antenna port #1	Antenna port #2
37.5 dBi Dual Polarized Parabolic Antenna	Two antenna ports, dual polarized radio, operating on the same frequency with a coherent transmitter on both polarizations, into an external dual-polarized antenna.	+27.0	+27.0
28 dBi Single Polarized Patch Panel	One antenna port connected to a single pole external antenna.	+30.0	

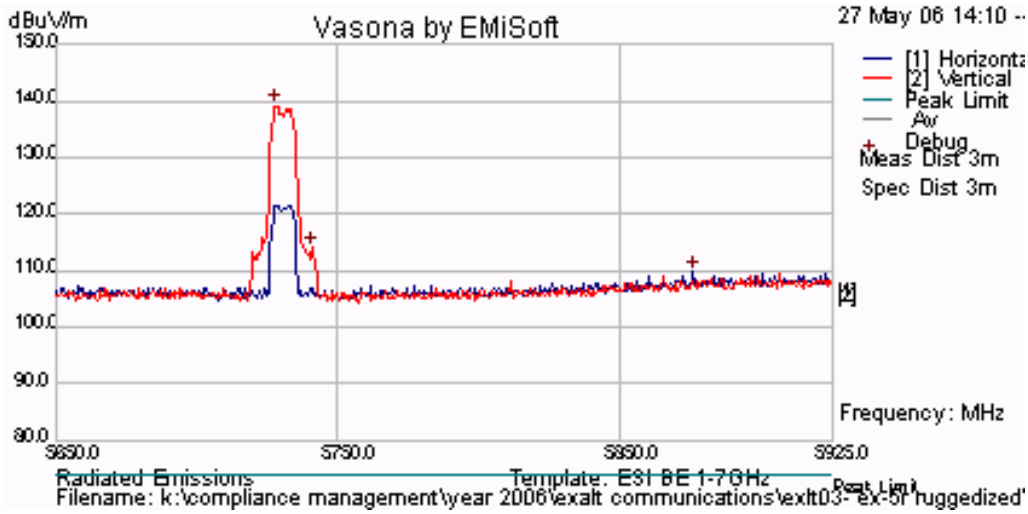
Peak Field Strength Measurements

Peak Field Strength for 28 dBi Antenna

Plot 39

28 dBi Antenna 5,731 MHz 7.5 MHz Bandwidth QPSK

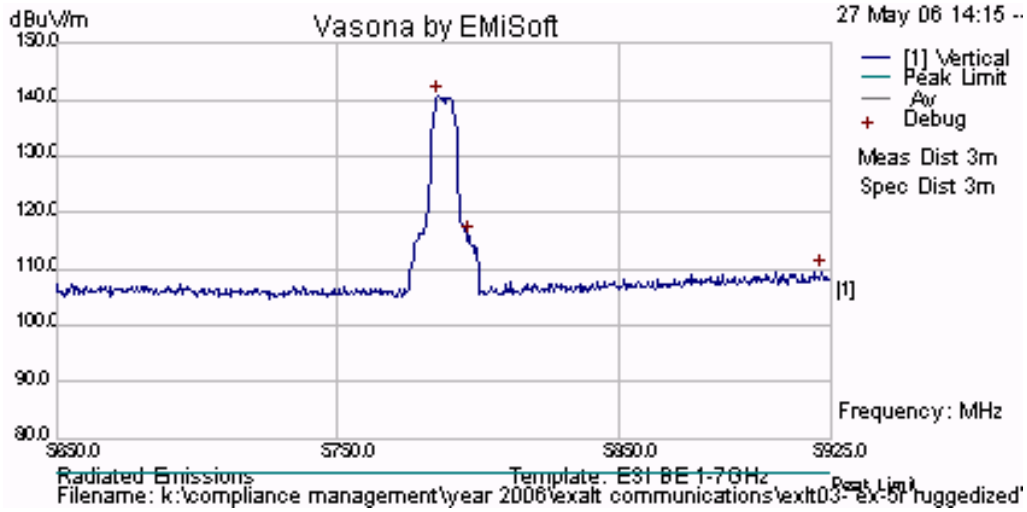
Peak Emission = 139.21 dBµV/m



Plot 40

28 dBi Antenna 5,788 MHz 7.5 MHz Bandwidth QPSK

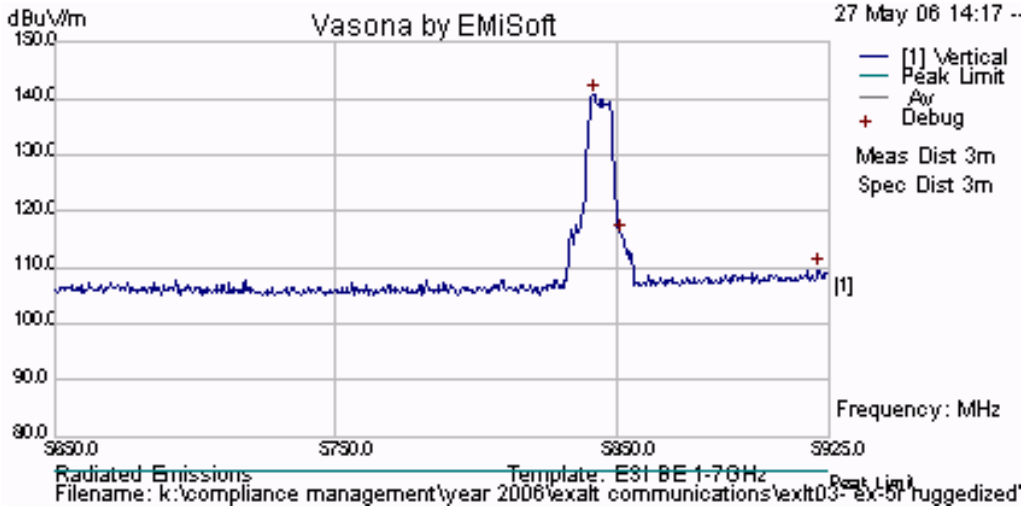
Peak Emission = 140.62 dBµV/m



Plot 41

28 dBi Antenna 5,844 MHz 7.5 MHz Bandwidth QPSK

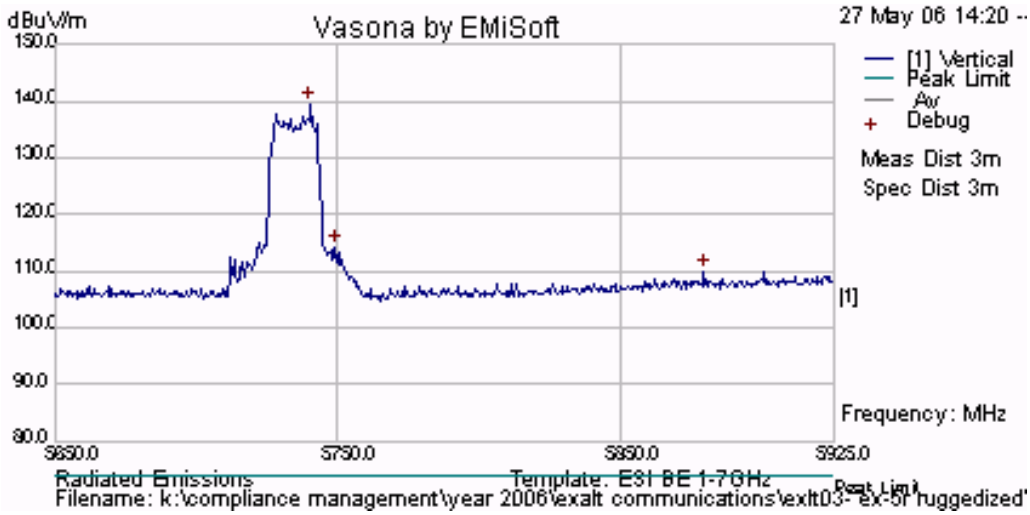
Peak Emission = 140.74 dBµV/m



Plot 42

28 dBi Antenna 5,735 MHz 15 MHz Bandwidth QPSK

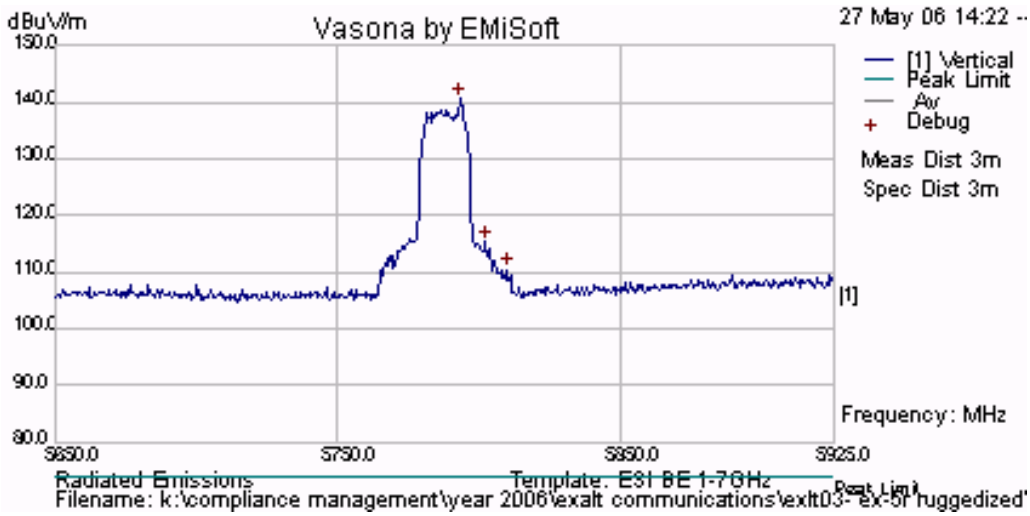
Peak Emission = 139.63 dBµV/m



Plot 43

28 dBi Antenna 5,788 MHz 15 MHz Bandwidth QPSK

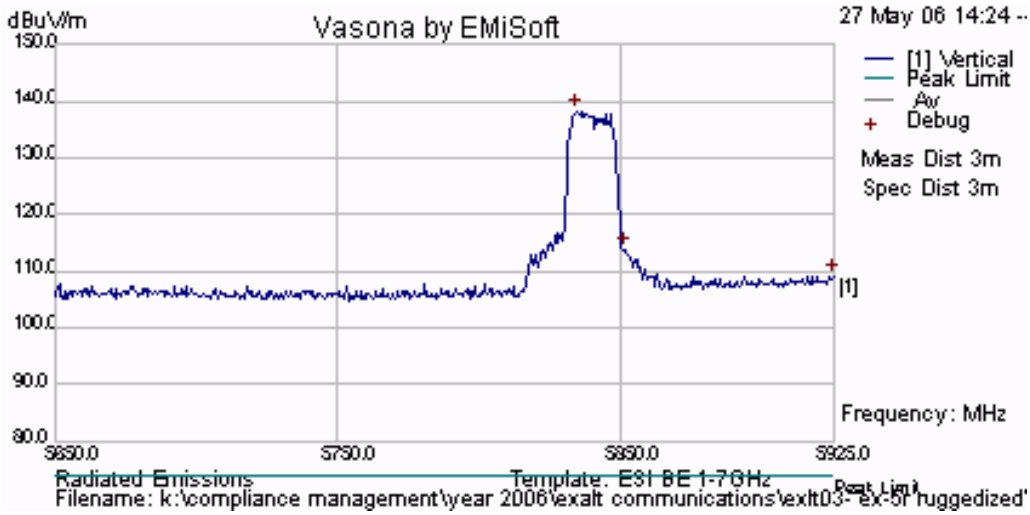
Peak Emission = 140.56 dBµV/m



Plot 44

28 dBi Antenna 5,840 MHz 15 MHz Bandwidth QPSK

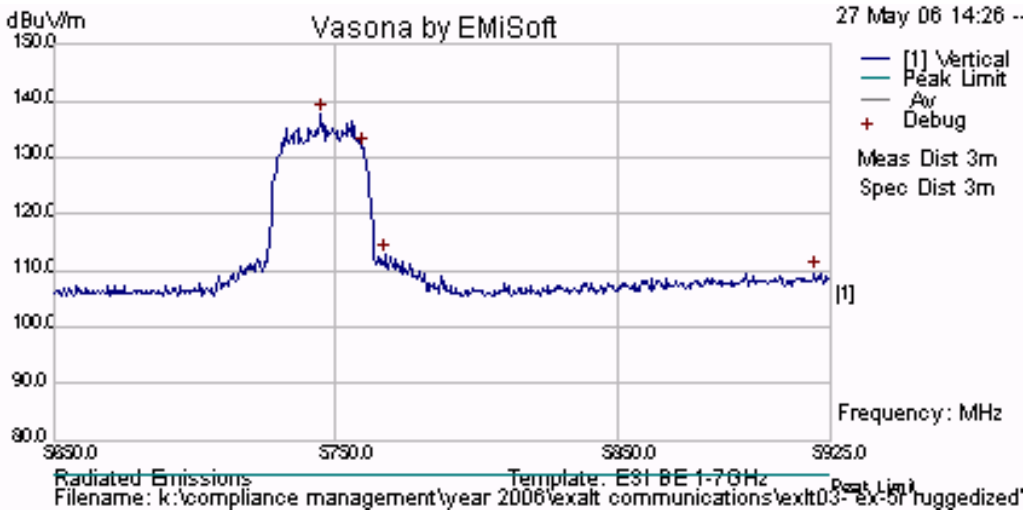
Peak Emission = 138.25 dBµV/m



Plot 45

28 dBi Antenna 5,745 MHz 30 MHz Bandwidth QPSK

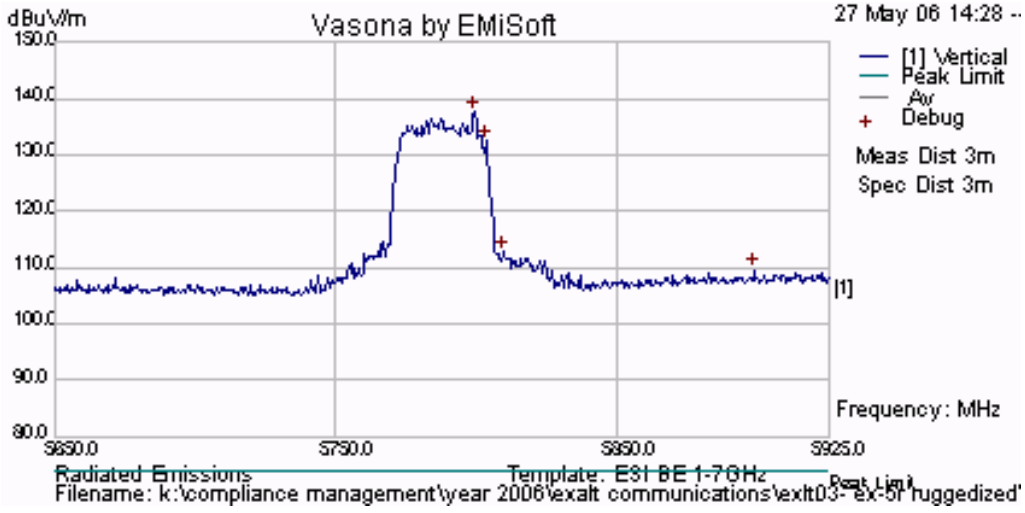
Peak Emission = 137.71 dBµV/m



Plot 46

28 dBi Antenna 5,788 MHz 30 MHz Bandwidth QPSK

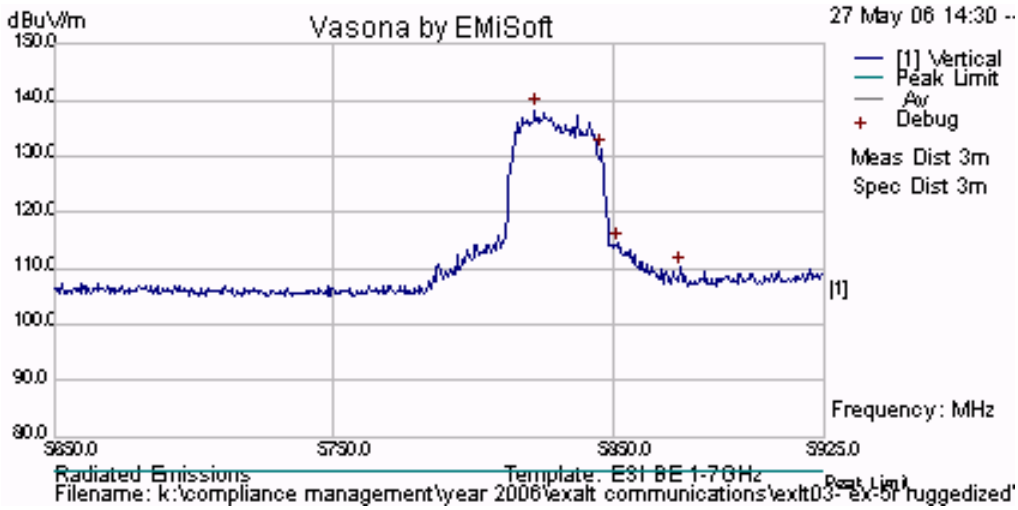
Peak Emission = 137.57 dBµV/m



Plot 47

28 dBi Antenna 5,830 MHz 30 MHz Bandwidth QPSK

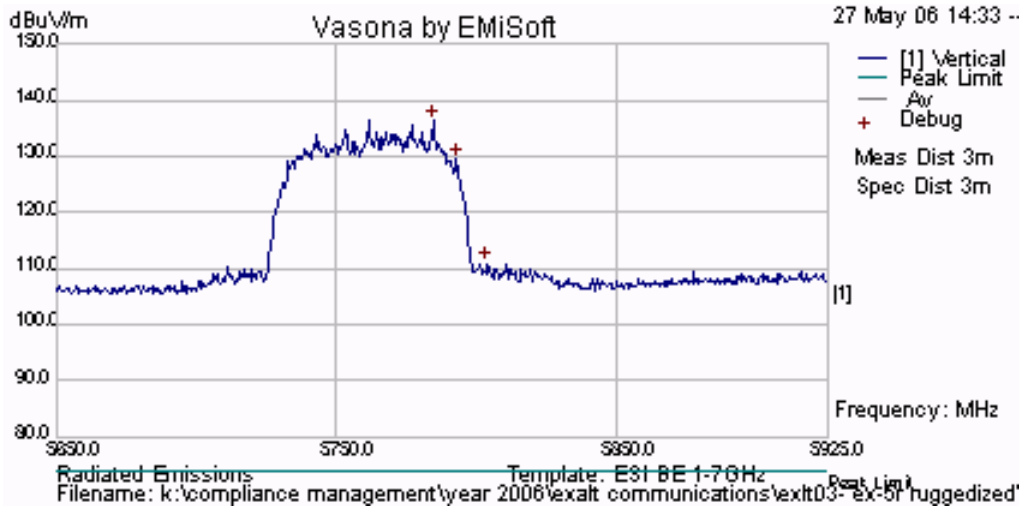
Peak Emission = 138.2 dBµV/m



Plot 48

28 dBi Antenna 5,762 MHz 60 MHz Bandwidth QPSK

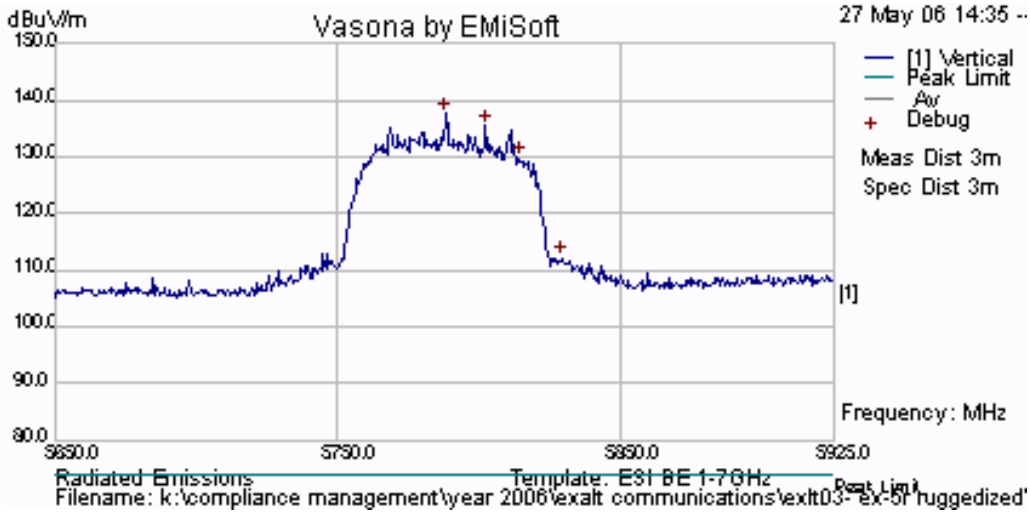
Peak Emission = 136.41 dBµV/m



Plot 49

28 dBi Antenna 5,788 MHz 60 MHz Bandwidth QPSK

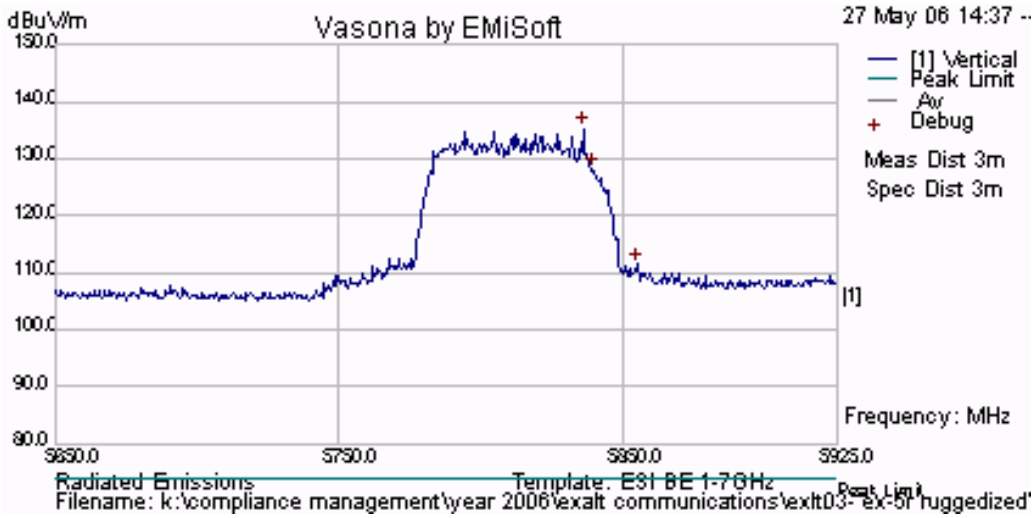
Peak Emission = 137.55 dBµV/m



Plot 50

28 dBi Antenna 5,813 MHz 60 MHz Bandwidth QPSK

Peak Emission = 135.25 dBµV/m

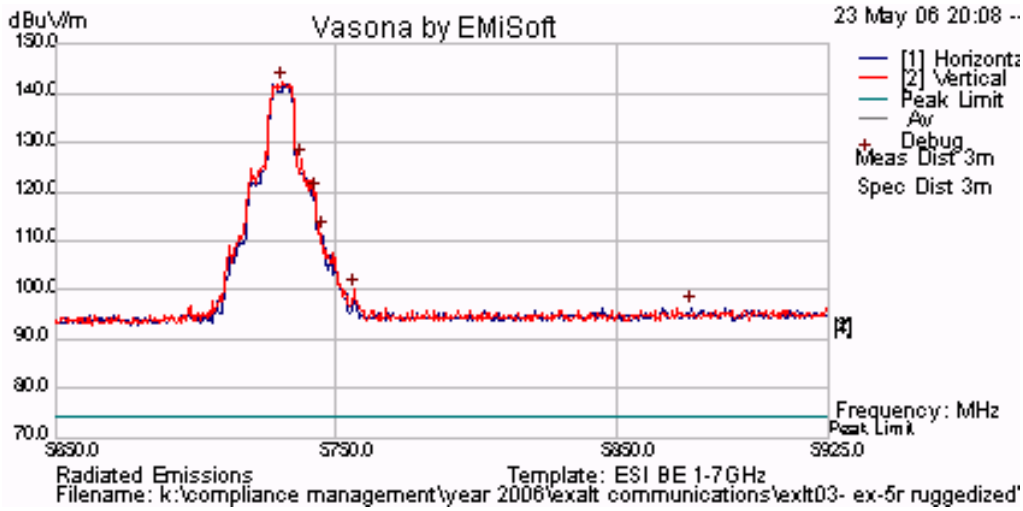


Peak Field Strength for 37.5 dBi Antenna

Plot 51

37.5 dBi Antenna 5,731 MHz 7.5 MHz Bandwidth QPSK

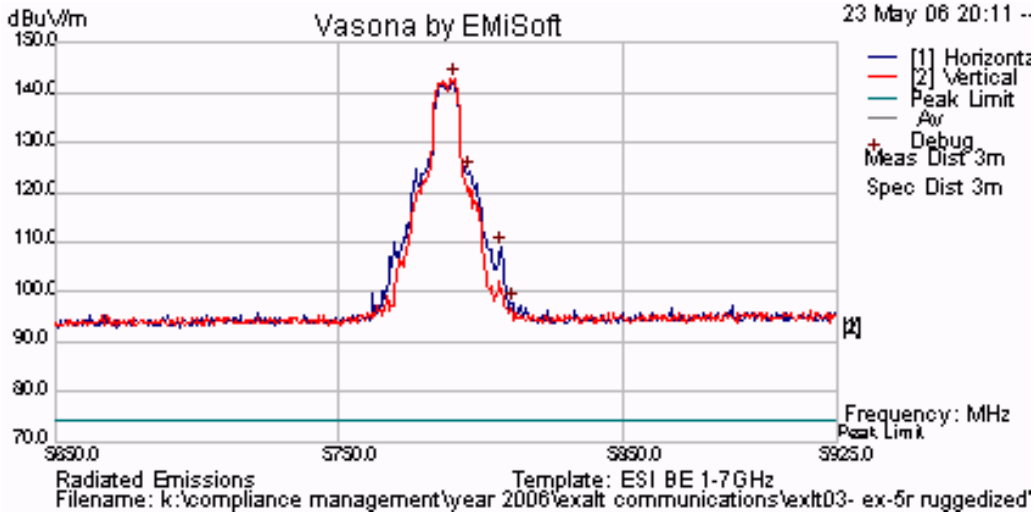
Peak Emission = 142.19 dBµV/m



Plot 52

37.5 dBi Antenna 5,788 MHz 7.5 MHz Bandwidth QPSK

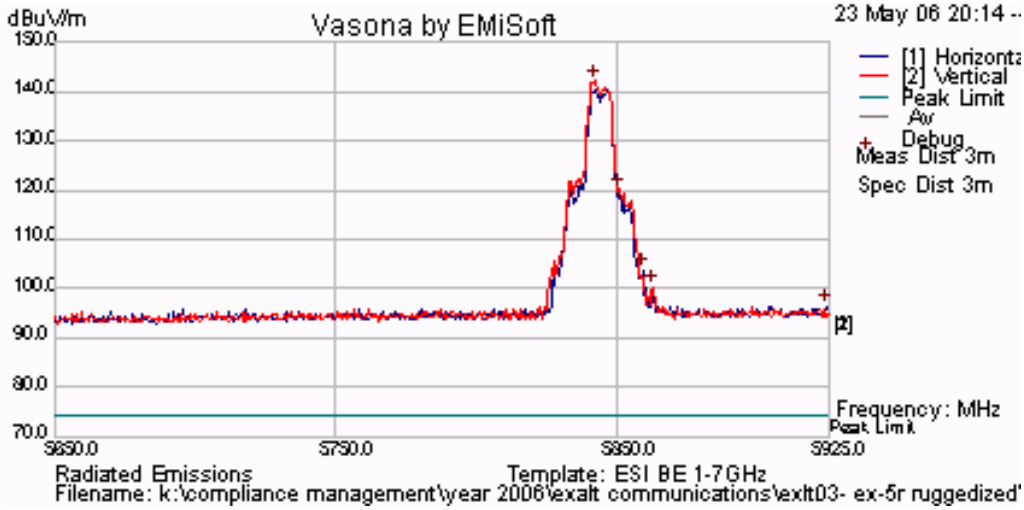
Peak Emission = 142.61 dBµV/m



Plot 53

37.5 dBi Antenna 5,844 MHz 7.5 MHz Bandwidth QPSK

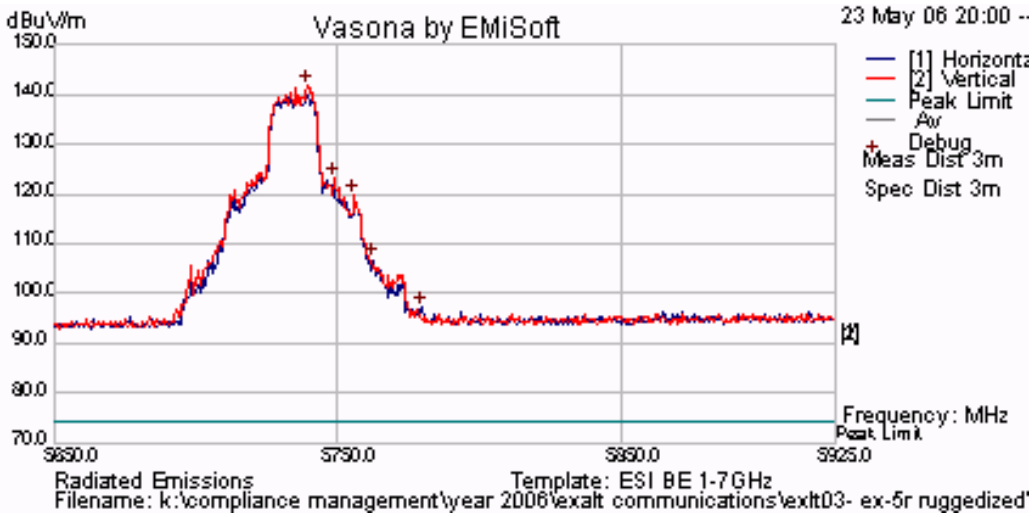
Peak Emission = 142.18 dBµV/m



Plot 54

37.5 dBi Antenna 5,735 MHz 15 MHz Bandwidth QPSK

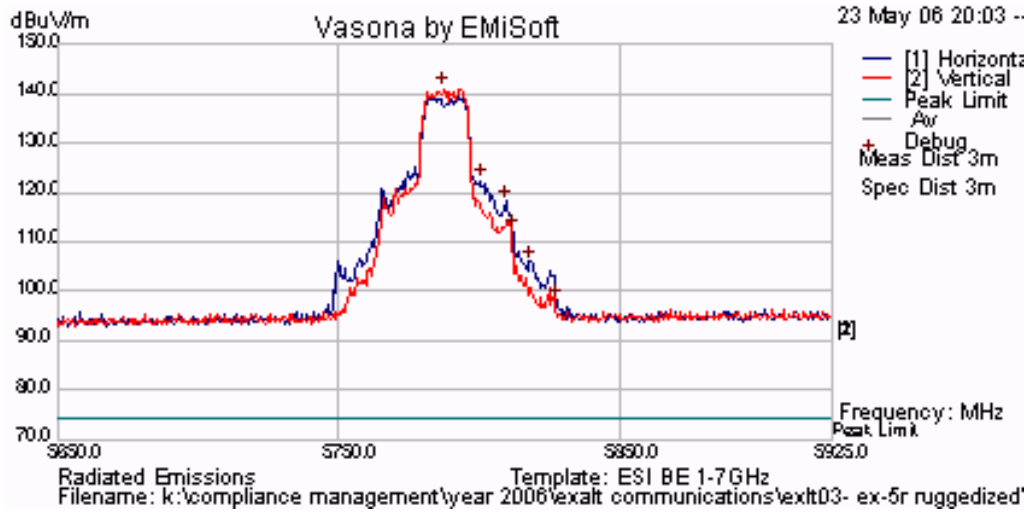
Peak Emission = 141.71 dBµV/m



Plot 55

37.5 dBi Antenna 5,788 MHz 15 MHz Bandwidth QPSK

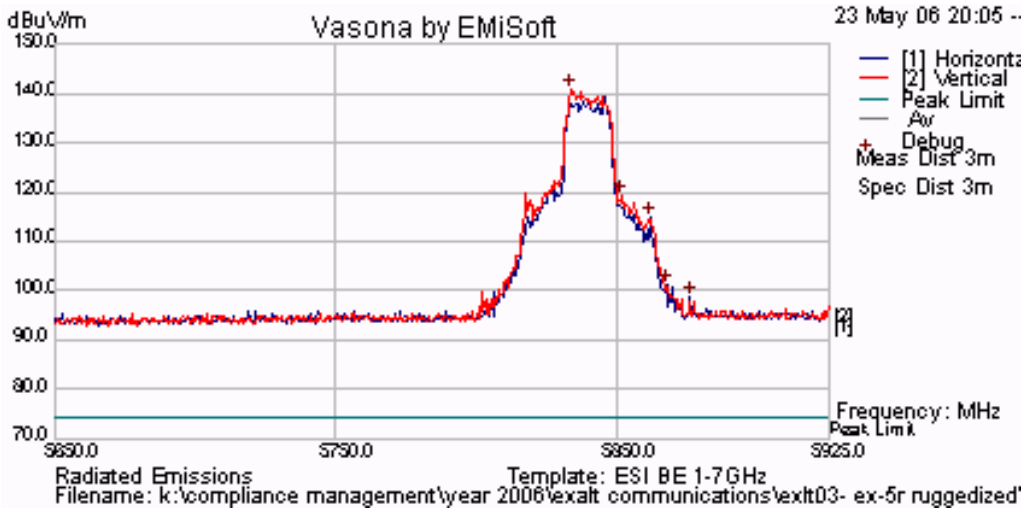
Peak Emission = 141.05 dBµV/m



Plot 56

37.5 dBi Antenna 5,840 MHz 15 MHz Bandwidth QPSK

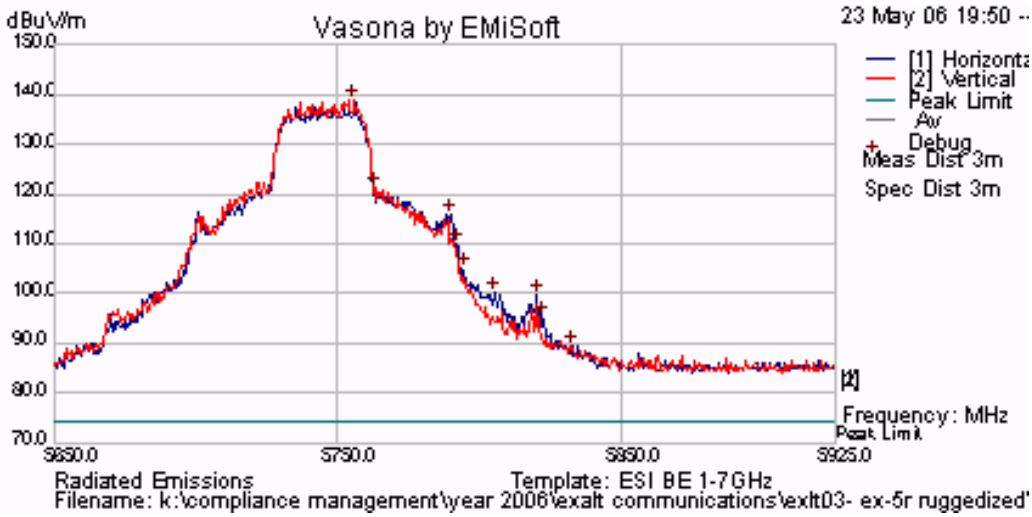
Peak Emission = 140.61 dBµV/m



Plot 57

37.5 dBi Antenna 5,745 MHz 30 MHz Bandwidth QPSK

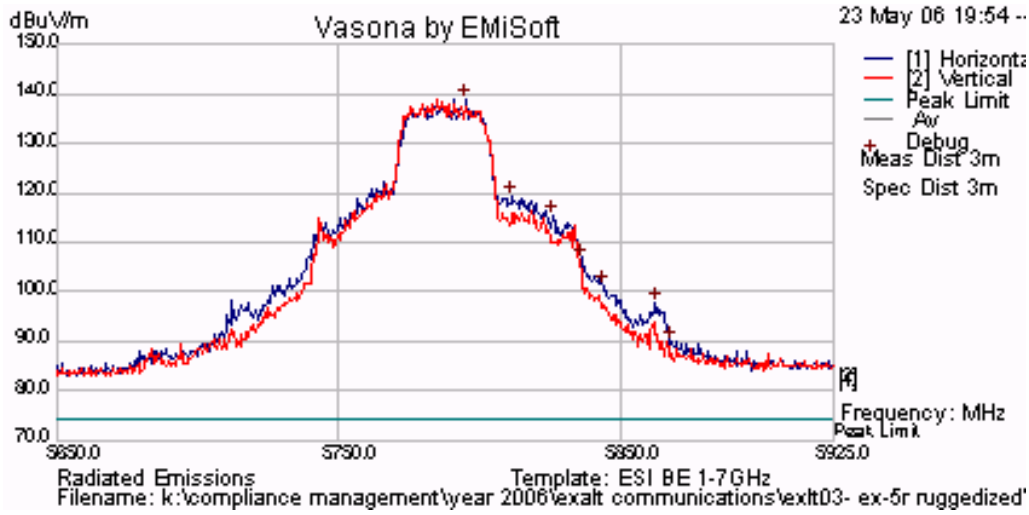
Peak Emission = 138.86 dBµV/m



Plot 58

37.5 dBi Antenna 5,788 MHz 30 MHz Bandwidth QPSK

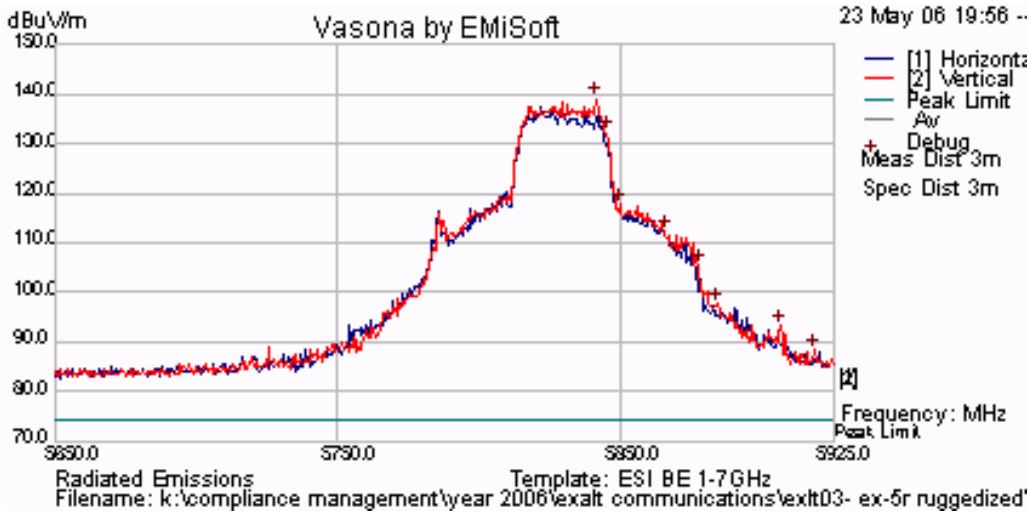
Peak Emission = 138.89 dBµV/m



Plot 59

37.5 dBi Antenna 5,830 MHz 30 MHz Bandwidth QPSK

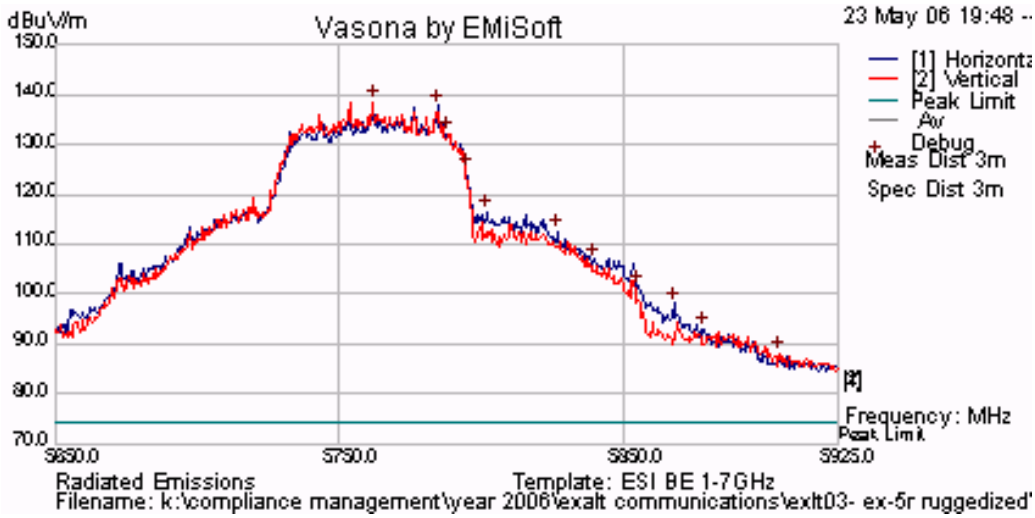
Peak Emission = 138.99 dBµV/m



Plot 60

37.5 dBi Antenna 5,762 MHz 60 MHz Bandwidth QPSK

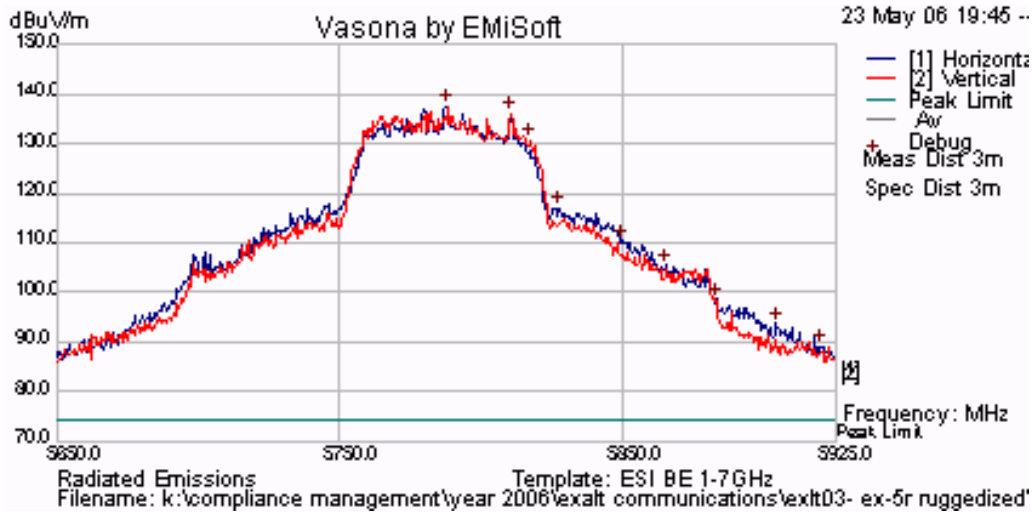
Peak Emission = 138.55 dBµV/m



Plot 61

37.5 dBi Antenna 5,788 MHz 60 MHz Bandwidth QPSK

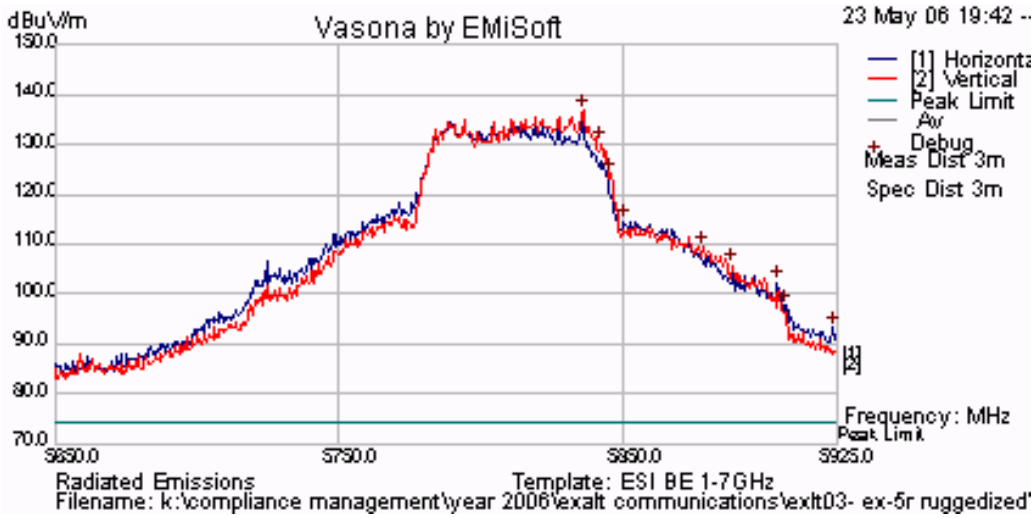
Peak Emission = 137.55 dBµV/m



Plot 62

37.5 dBi Antenna 5,813 MHz 60 MHz Bandwidth QPSK

Peak Emission = 136.85 dBµV/m



Specification Limits

FCC §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.

FCC §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)).

IC 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.

IC 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.

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

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

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

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

5.1.6.2. Receiver Radiated Spurious Emissions (above 1 GHz)

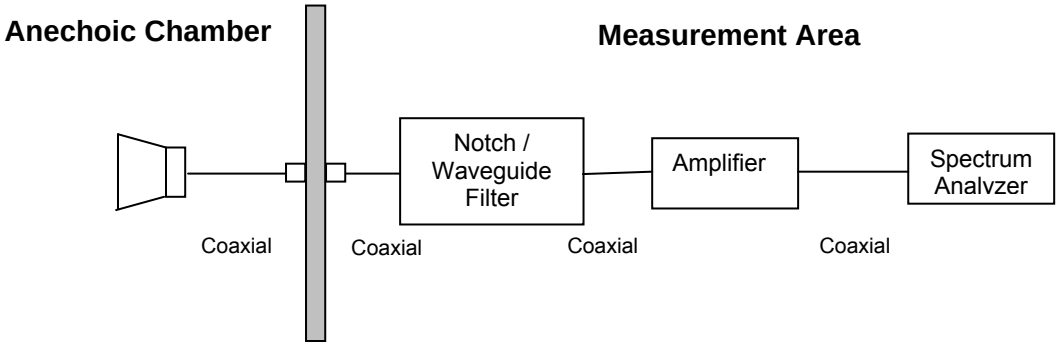
Industry Canada RSS-Gen §4.8, §6

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 - Test Configurations

The EUT was tested with two different antennas in the following two configurations.

Antenna Configuration	EUT Configuration
37.5 dBi Dual Polarized Parabolic Antenna	Two antenna ports, dual polarized radio into an external dual-polarized antenna.
28 dBi Single Polarized Patch Panel	One antenna port connected to a single pole external antenna.

Receiver Radiated Spurious Emissions above 1 GHz

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

28 dBi Antenna - Receiver Radiated Spurious Emissions above 1 GHz

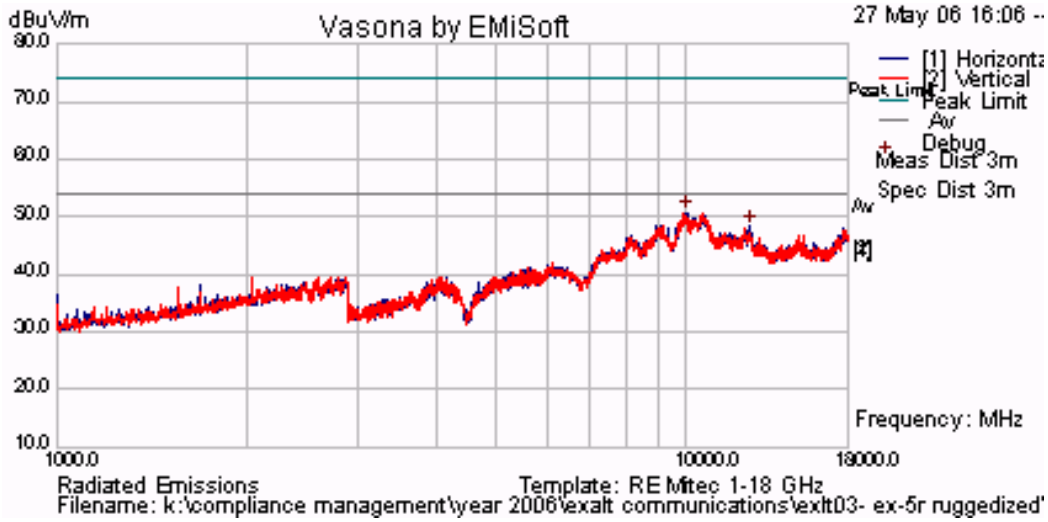
TABLE OF RESULTS – 5,788 MHz 28 dBi Antenna 7.5 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10025	H	39.84	+10.88	50.72	54	-3.28
12615	H	41.34	+6.93	48.27	54	-5.73

As no peak emissions were greater than the Average Limit (54 dBµV/m) peak emissions are reported in the above matrix.

Plot 63

5,788 MHz Radiated Emissions for 28 dBi Antenna 7.5 MHz Bandwidth QPSK



28 dBi Antenna - Receiver Radiated Spurious Emissions above 1 GHz

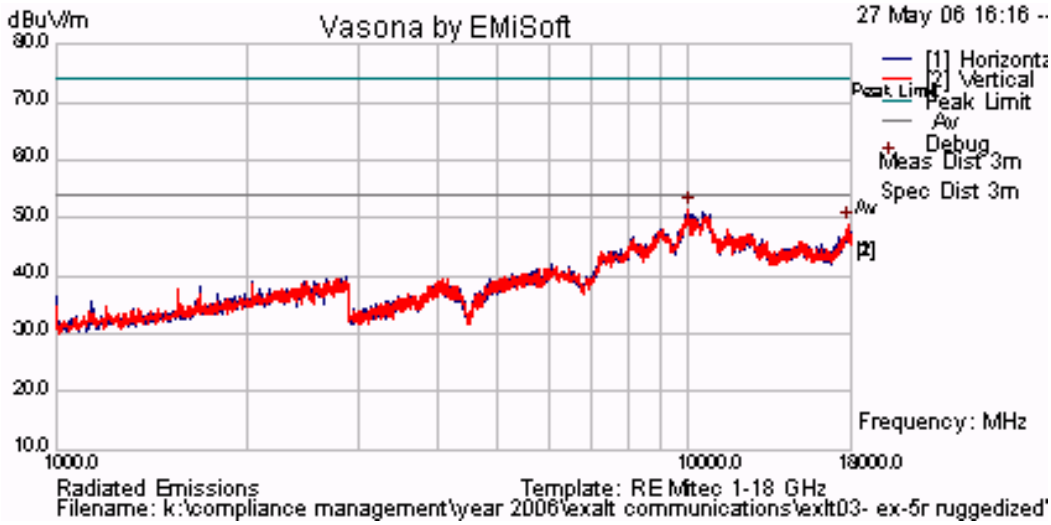
TABLE OF RESULTS – 5,788 MHz 28 dBi Antenna 15 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBμV/m)	Correction Factor (dB)	Corrected Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
9990	V	40.5	+10.99	51.49	54	-2.51
17808.33	V	36.34	+12.61	48.95	54	-5.05

As no peak emissions were greater than the Average Limit (54 dBμV/m) peak emissions are reported in the above matrix.

Plot 64

5,788 MHz Radiated Emissions for 28 dBi Antenna 15 MHz Bandwidth QPSK



28 dBi Antenna - Receiver Radiated Spurious Emissions above 1 GHz

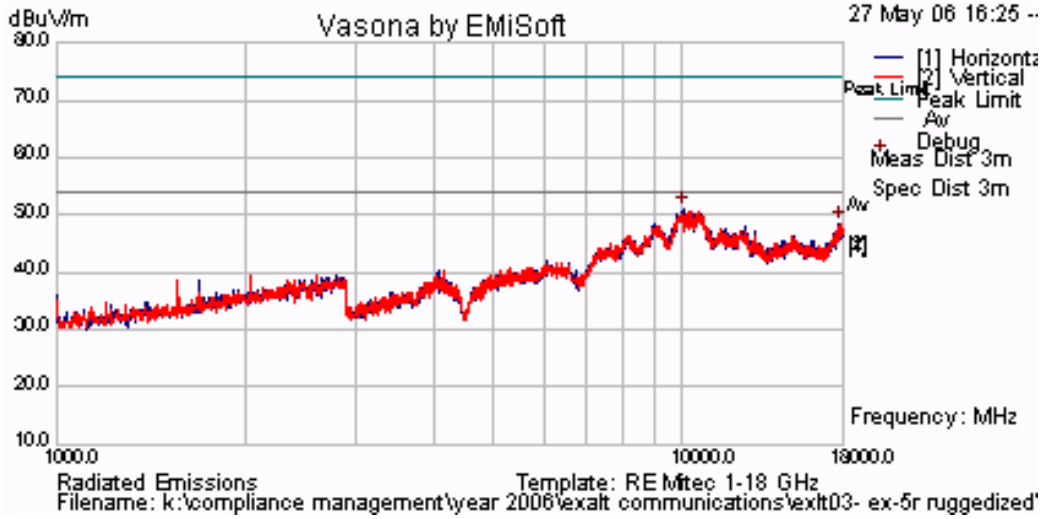
TABLE OF RESULTS – 5,788 MHz 28 dBi Antenna 30 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBμV/m)	Correction Factor (dB)	Corrected Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
10025	H	40.17	+10.88	51.05	54	-2.95
17800	H	36.00	+12.54	48.54	54	-5.46

As no peak emissions were greater than the Average Limit (54 dBμV/m) peak emissions are reported in the above matrix.

Plot 65

5,788 MHz Radiated Emissions for 28 dBi Antenna 30 MHz Bandwidth QPSK



28 dBi Antenna - Receiver Radiated Spurious Emissions above 1 GHz

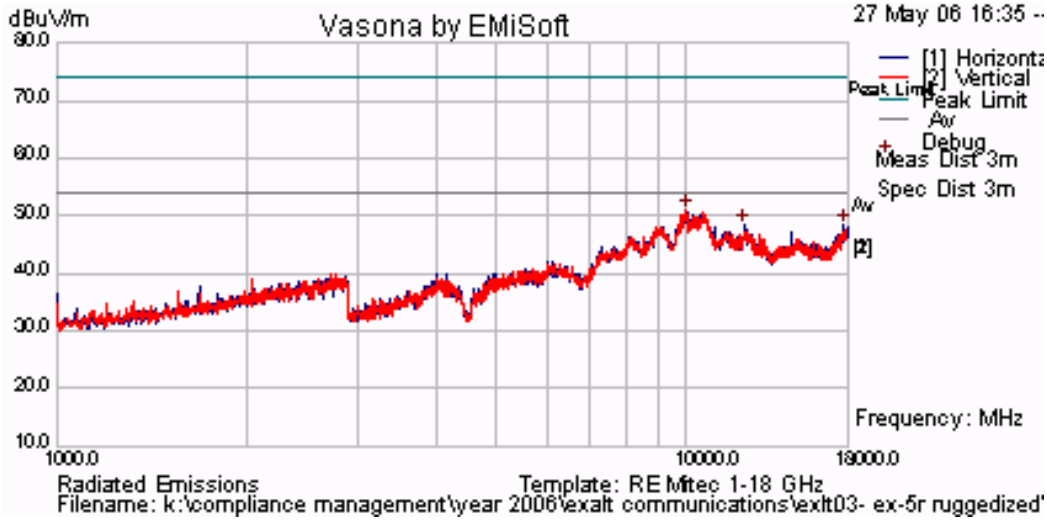
TABLE OF RESULTS – 5,788 MHz 28 dBi Antenna 60 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBμV/m)	Correction Factor (dB)	Corrected Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
9990	V	39.84	+10.99	50.83	54	-3.17
12358.33	H	41.5	+6.93	48.43	54	-5.57
17775	H	36	+12.32	48.32	54	-5.68

As no peak emissions were greater than the Average Limit (54 dBμV/m) peak emissions are reported in the above matrix.

Plot 66

5,788 MHz Radiated Emissions for 28 dBi Antenna 60 MHz Bandwidth QPSK



37.5 dBi Antenna - Receiver Radiated Spurious Emissions above 1 GHz

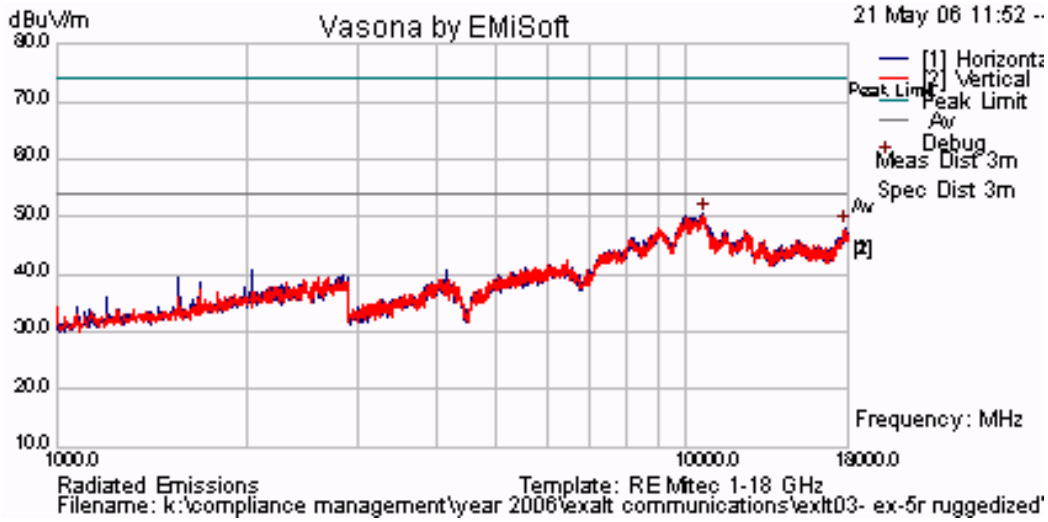
TABLE OF RESULTS – 5,788 MHz 37.5 dBi Antenna 7.5 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBμV/m)	Correction Factor (dB)	Corrected Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
10655	H	41.5	+8.91	50.41	54	-3.59
17900	H	35.5	+12.62	48.12	54	-5.88

As no peak emissions were greater than the Average Limit (54 dBμV/m) peak emissions are reported in the above matrix.

Plot 67

5,788 MHz Radiated Emissions for 37.5 dBi Antenna 7.5 MHz Bandwidth QPSK



37.5 dBi Antenna - Receiver Radiated Spurious Emissions above 1 GHz

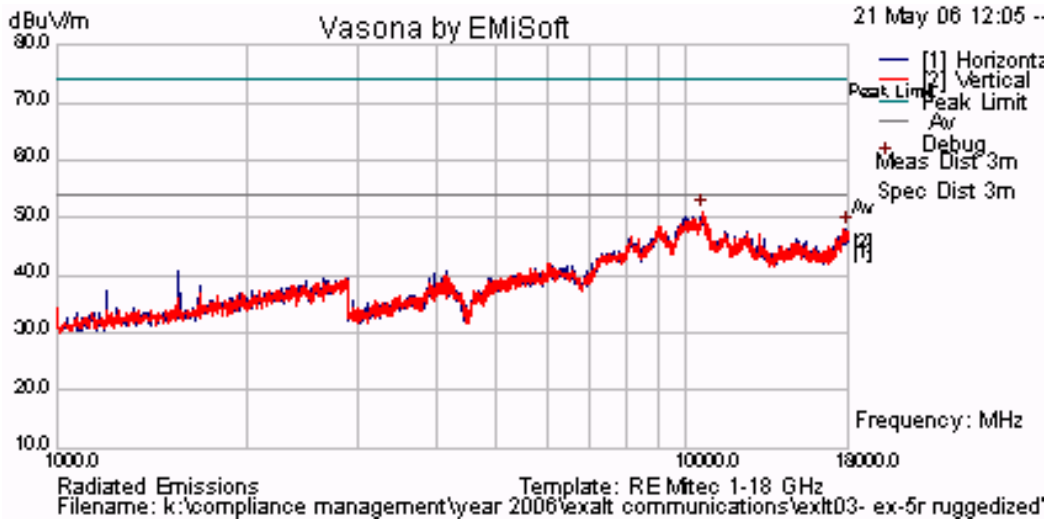
TABLE OF RESULTS – 5,788 MHz 37.5 dBi Antenna 15 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV/m)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10620	V	42.00	+9.03	51.03	54	-2.97
18000	V	35.17	+12.91	48.08	54	-5.92

As no peak emissions were greater than the Average Limit (54 dBµV/m) peak emissions are reported in the above matrix.

Plot 68

5,788 MHz Radiated Emissions for 37.5 dBi Antenna 15 MHz Bandwidth QPSK



37.5 dBi Antenna - Receiver Radiated Spurious Emissions above 1 GHz

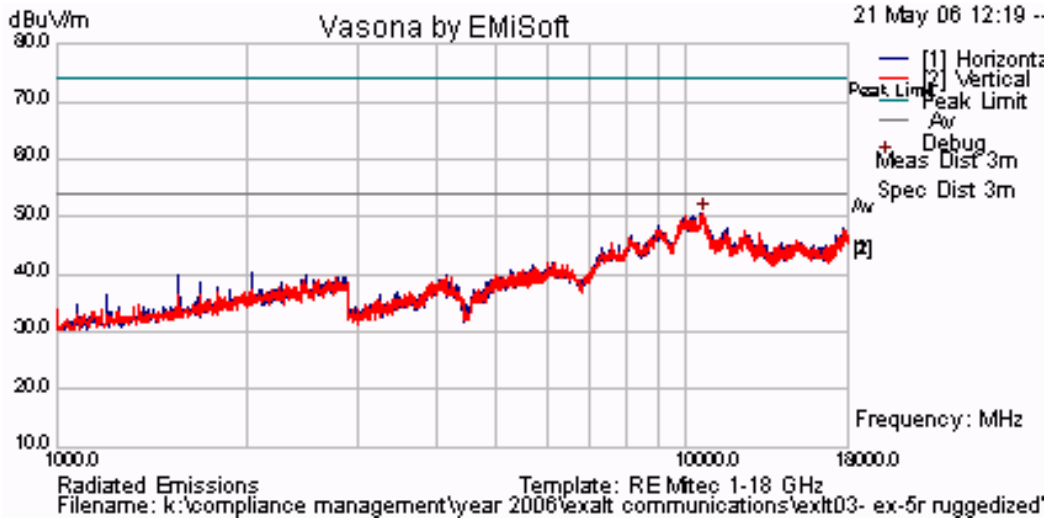
TABLE OF RESULTS – 5,788 MHz 37.5 dBi Antenna 30 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBμV/m)	Correction Factor (dB)	Corrected Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
10655	V	41.67	+8.91	50.58	54	-3.42

As no peak emissions were greater than the Average Limit (54 dBμV/m) peak emissions are reported in the above matrix.

Plot 69

5,788 MHz Radiated Emissions for 37.5 dBi Antenna 30 MHz Bandwidth QPSK



37.5 dBi Antenna - Receiver Radiated Spurious Emissions above 1 GHz

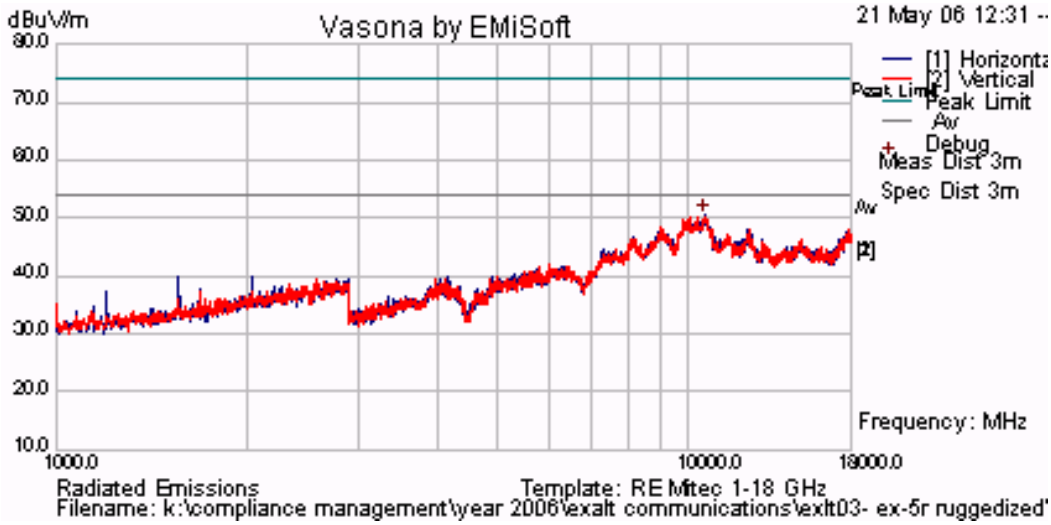
TABLE OF RESULTS – 5,788 MHz 37.5 dBi Antenna 60 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBμV/m)	Correction Factor (dB)	Corrected Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
10608.33	H	41.34	+9.08	50.42	54	-3.58

As no peak emissions were greater than the Average Limit (54 dBμV/m) peak emissions are reported in the above matrix.

Plot 70

5,788 MHz Radiated Emissions for 37.5 dBi Antenna 60 MHz Bandwidth QPSK



Specification

Receiver Radiated Spurious Emissions

Industry Canada RSS-Gen §4.8,
The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is the higher, to at least 3 times the highest tunable or local oscillator frequency, whichever is the higher, without exceeding 40 GHz.

RSS-Gen §6
The following receiver spurious emission limits shall be complied with;
(a) If a radiated measurement is made, all spurious emissions hall comply with the limits of Table 1.

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

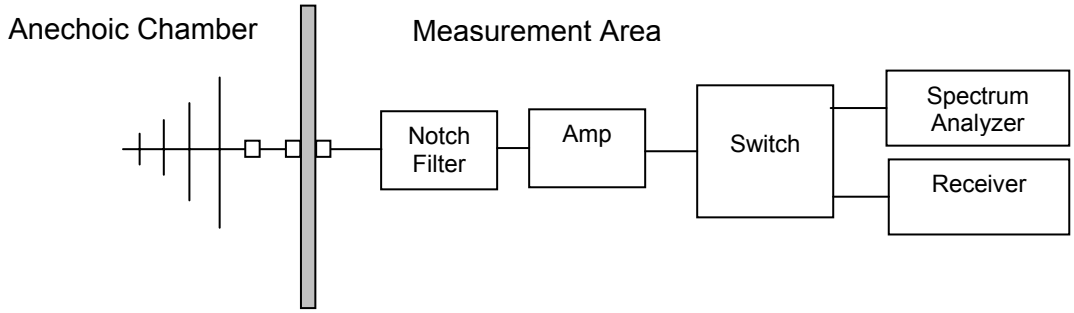
5.1.6.3. Radiated Spurious Emissions (30M-1 GHz)

FCC, Part 15 Subpart C §15.205/ §15.209
Industry Canada RSS-210 §2.2

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

Radio parameters.

5800 MHz
7.5 MHz BW
QPSK Modulation

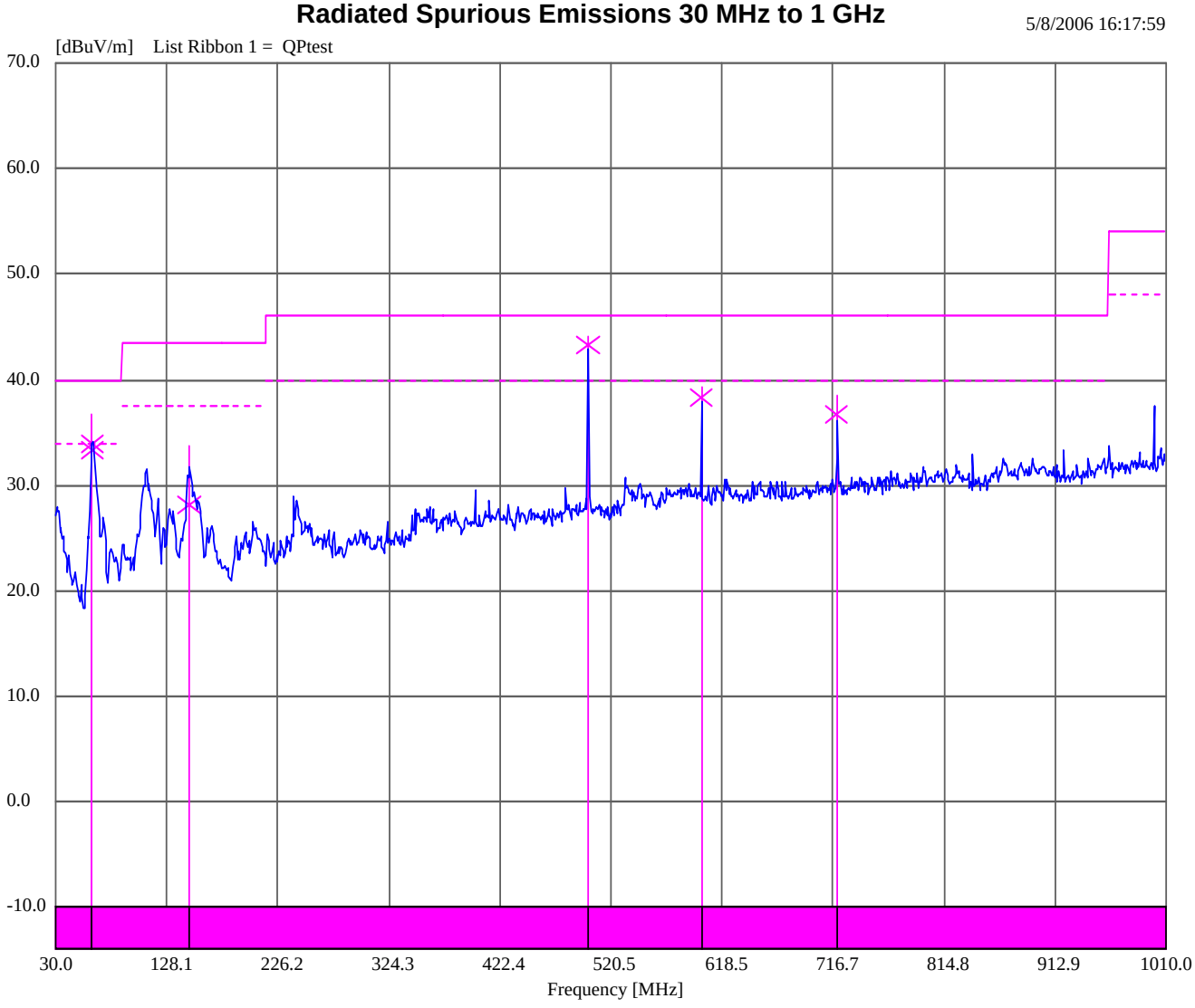
The following table describes the configurations of equipment that was tested.

Antenna Configuration	EUT Configuration	Power Setting (dBm)
28 dBi Single Polarized Patch Panel	One antenna port connected to a single pole external antenna.	+30.0

TABLE OF RESULTS

Freq. (MHz)	Peak (dBuV/m)	QP (dBuV/m)	QP Lmt (dBuV/m)	QP Margin (dB)	Angle (deg)	Height (cm)	Polarity
62.069537	36.20	33.33	40.00	-6.67	109	376	Vert
62.344704	36.75	33.83	40.00	-6.17	186	350	Vert
147.797148	33.70	28.05	43.50	-15.45	355	397	Horz
499.985419	44.00	43.31	46.00	-2.69	353	201	Horz
599.971986	39.39	38.41	46.00	-7.59	220	143	Horz
719.961254	38.50	36.71	46.00	-9.29	315	154	Horz

Plot 71
Radiated Spurious Emissions 30 MHz to 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 Sanmina work instruction	8546A HP Receiver and RF Filter, HP Pre-amp, Antenna EMCO Biconilog

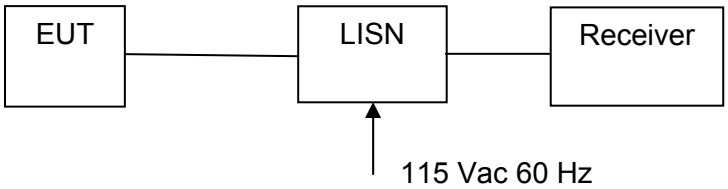
5.1.7. AC Wireline Conducted Emissions (150 kHz – 30 MHz)

FCC, Part 15 Subpart C §15.207
Industry Canada RSS-Gen §7.2.2

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

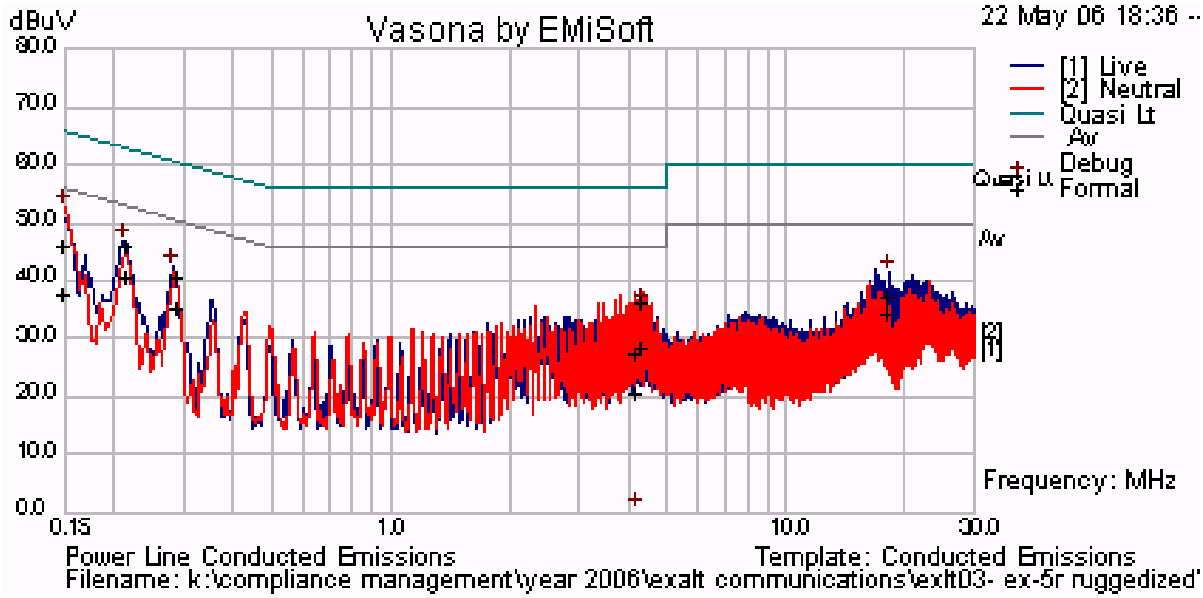
Radio parameters.

Transmitter: Freq 5731 MHz
Power: Full power both ports
Transmitter Ports: Terminated in 50 Ohm load
Duty Cycle: 100%

TABLE OF RESULTS

Freq (MHz)	Line	Peak (dBµV)	QP (dBµV)	QP Limit (dBµV)	QP Margin (dB)	Ave. (dBµV)	Ave. Limit (dBµV)	Ave. Margin (dB)
0.150	Neut	52.50	43.52	66.00	-22.48	35.16	56.00	-20.84
0.215	Live	46.71	43.63	63.02	-19.40	38.39	53.02	-14.63
0.290	Neut	42.12	38.32	60.54	-22.22	32.83	50.54	-17.71
4.381	Neut	35.51	33.70	56.00	-22.30	26.26	46.00	-19.74
18.243	Neut	41.47	34.66	60.00	-25.34	32.02	50.00	-17.98

Plot 72
AC 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.

RSS-Gen §7.2.2
The radio frequency voltage that is conducted back into the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in the table below. The tighter limit applies at the frequency range boundaries.

§15.207 (a) and **RSS-Gen §7.2.2** 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

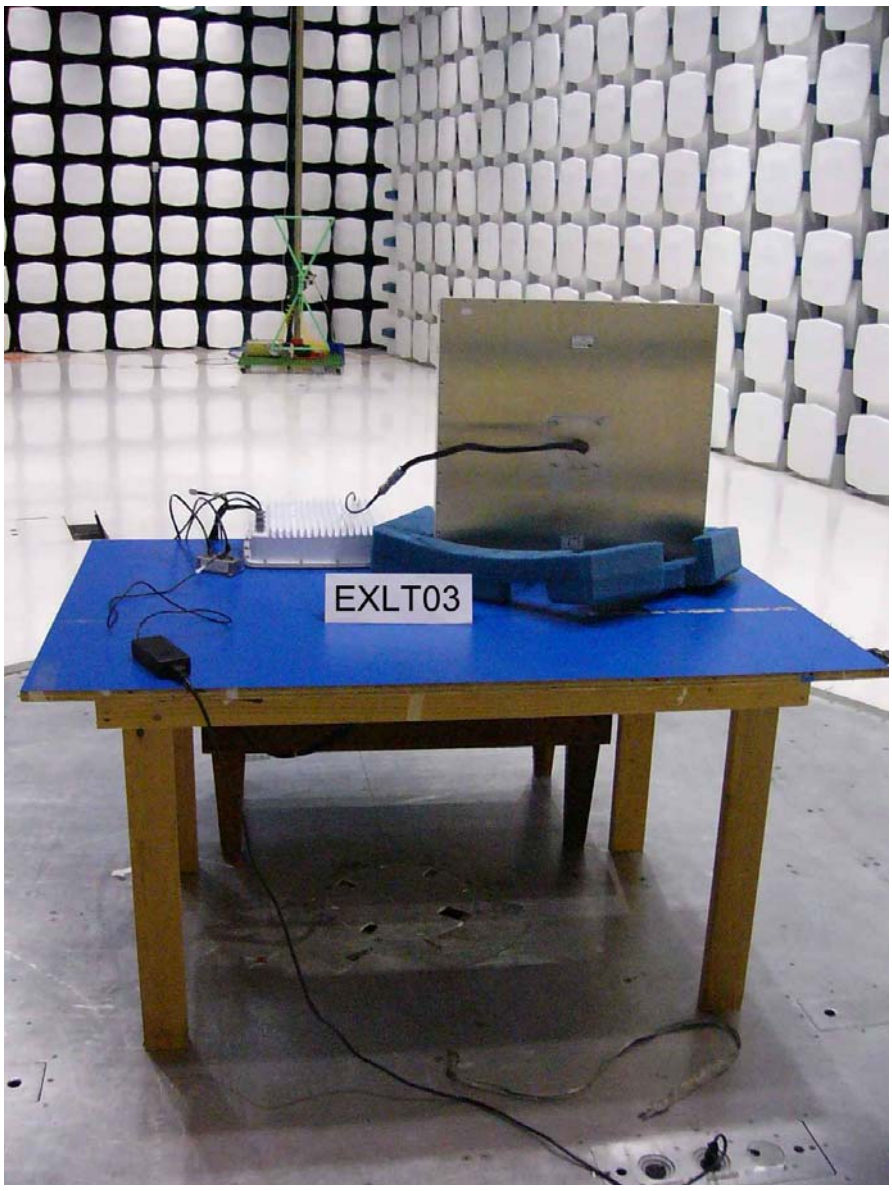
Measurement uncertainty	±2.64 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-EMC-01 'Measurement of Conducted Emissions'	0158, 0184, 0193, 0190, 0293, 0307

6. PHOTOGRAPHS

6.1. Radiated Emissions (30 MHz-1 GHz)



6.2. Radiated Emissions >1 GHz

6.3. Conducted Emissions (150 kHz - 30 MHz)

6.4. General Measurement Test Set-Up

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
0304	2.4GHzHz Notch Filter	Micro-Tronics	--	001
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

Appendix A

16 QAM and 64 QAM configurations and the 20 dBi Dual Polarized Integral Panel antenna Verification Data

Appendix A - 16 QAM and 64 QAM Verification Data

and the
20 dBi Dual Polarized Integral Panel antenna Verification Data

As mentioned previously in Section 3.6 “Test Configurations”, it was established at the start of the test program that the QPSK modulation scheme has the highest Radiated Emission and Peak Emission levels. The Test Report includes results for all of the QPSK configurations and selected worst case test results for 16QAM and 64QAM configurations.

The worst case test results for 16QAM and 64QAM configurations and the 20 dBi Dual Polarized Integral Panel antenna are reported in this appendix.

List of Measurements

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

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(d) **15.205 /** **15.209** **A8.5** **2.2** **4.7**	Band Edge	Band Edge	Conducted	Complies	A.1.1
15.247(d) **15.205 /** **15.209** **A8.5** **2.2** **2.6** **4.7**	Transmitter Radiated Spurious Emissions	Emissions above 1 GHz	Radiated	Complies	A.1.2
	Radiated Emissions	Peak Field Strength Measurement	Radiated	Complies	A.1.3

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

BW (MHz)	Modulation					
	16QAM			64QAM		
	Low (MHz)	Mid (MHz)	High (MHz)	Low (MHz)	Mid (MHz)	High (MHz)
7.5	5731	5788	5844	5731	5788	5844
15	5735	5788	5840	5735	5788	5840
30	5745	5788	5830	5745	5788	5830
60	5762	5788	5813	5762	5788	5813

Conducted Emissions Testing

The EUT has two antenna ports and can be configured (see description of other possible configurations in Section 3.2) as a dual polarized radio, operating on the same frequency with a coherent transmitter on both polarizations, into a dual-polarized antenna. All conducted measurements were made on a single antenna port.

Radiated Emissions Testing

The following table describes the configuration of equipment tested for radiated emissions.

Antenna Configuration	EUT Configuration	Max. Allowable Conducted Power Setting (dBm)	
		Antenna port #1	Antenna port #2
20 dBi Dual Polarized Integral Antenna	Two antenna ports, dual polarized radio, operating on the same frequency with a coherent transmitter on both polarizations, into an external dual-polarized antenna.	+27.0	+27.0

A.1. Device Characteristics

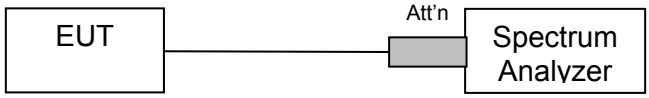
A.1.1. Conducted Band Edge

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

The Conducted emissions were measured with a spectrum analyzer connected to one of the EUTs two antenna ports and set to maximum power. 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

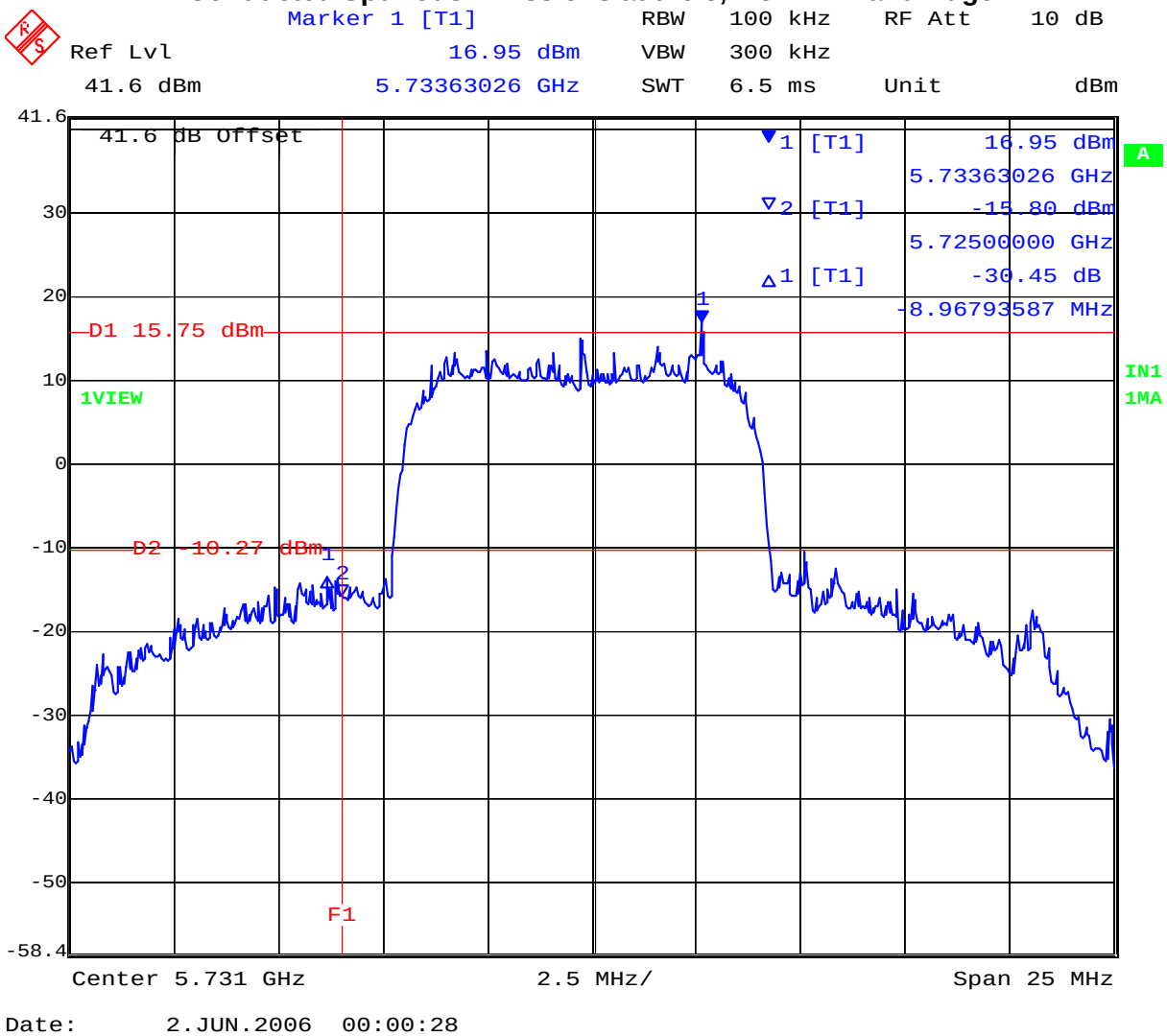
Conducted Band-Edge Results

TABLE OF RESULTS – 7.5 MHz Bandwidth 16QAM

Center Frequency (MHz)	Band edge Frequency (MHz)	Limit (20 dB below peak of fundamental)	Amplitude @ Band edge (dBm)	Plot #	Margin (dB)
5,731	5,725	-4.25	-10.27	A01	-6.02
5,844	5,850	-3.76	-14.17	A02	-10.41

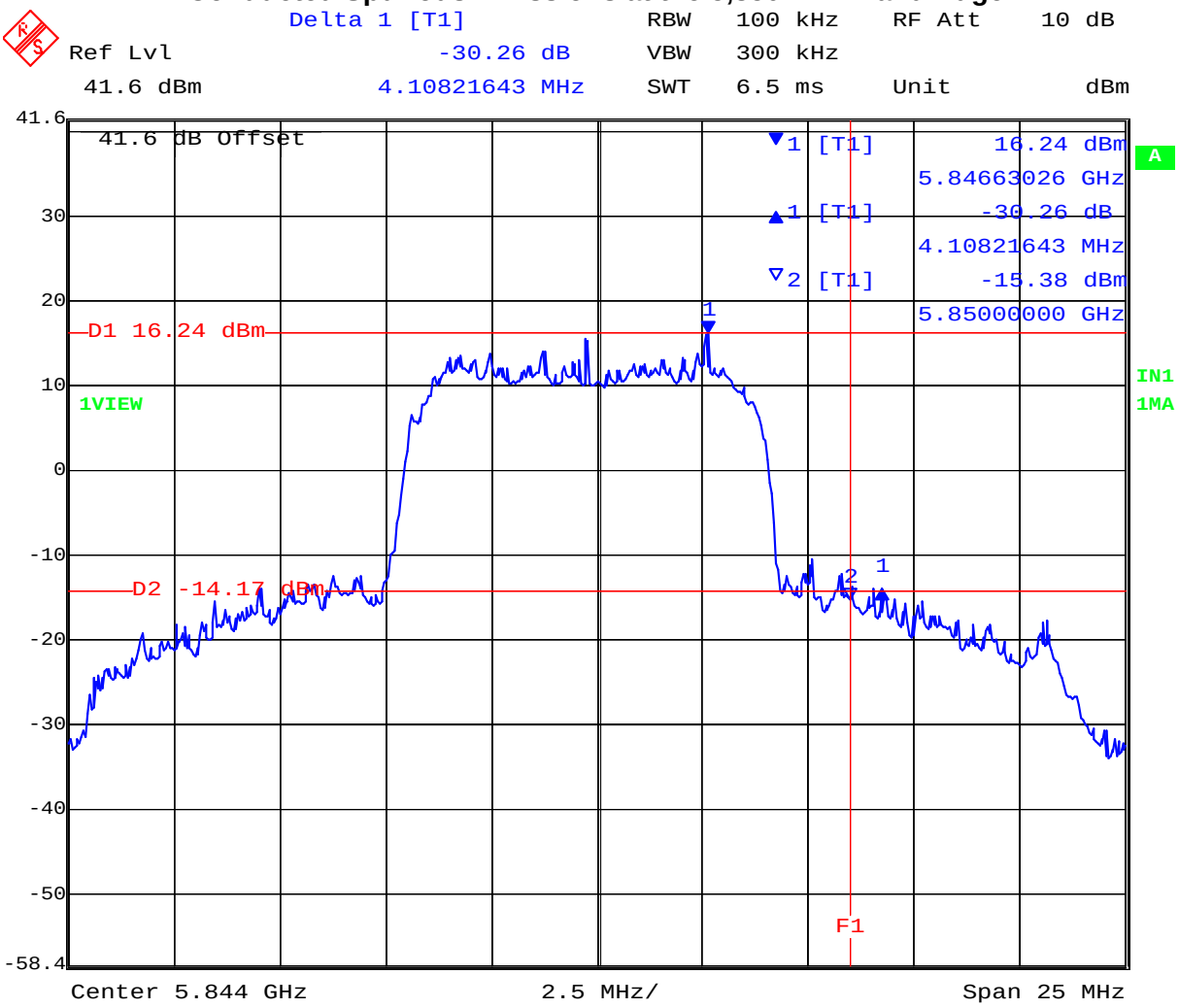
Plot A01 7.5 MHz Bandwidth 16QAM

Conducted Spurious Emissions at the 5,725 MHz Band Edge



Plot A02 7.5 MHz Bandwidth 16QAM

Conducted Spurious Emissions at the 5,850 MHz Band Edge



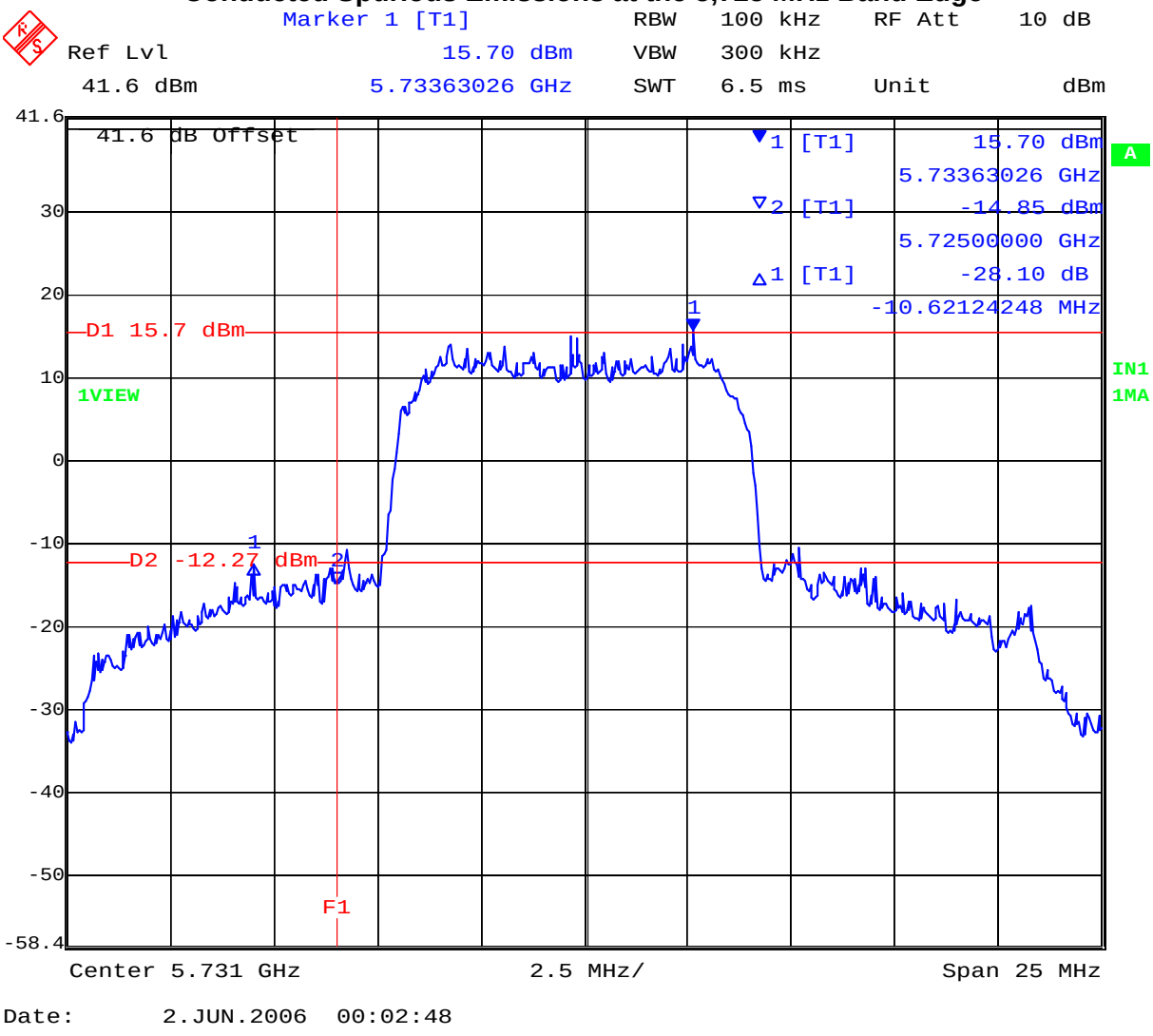
Conducted Band-Edge Results

TABLE OF RESULTS – 7.5 MHz Bandwidth 64QAM

Center Frequency (MHz)	Band edge Frequency (MHz)	Limit (20 dB below peak of fundamental)	Amplitude @ Band edge (dBm)	Plot #	Margin (dB)
5,731	5,725	-4.30	-12.27	A03	-7.97
5,844	5,850	-3.95	-12.27	A04	-8.32

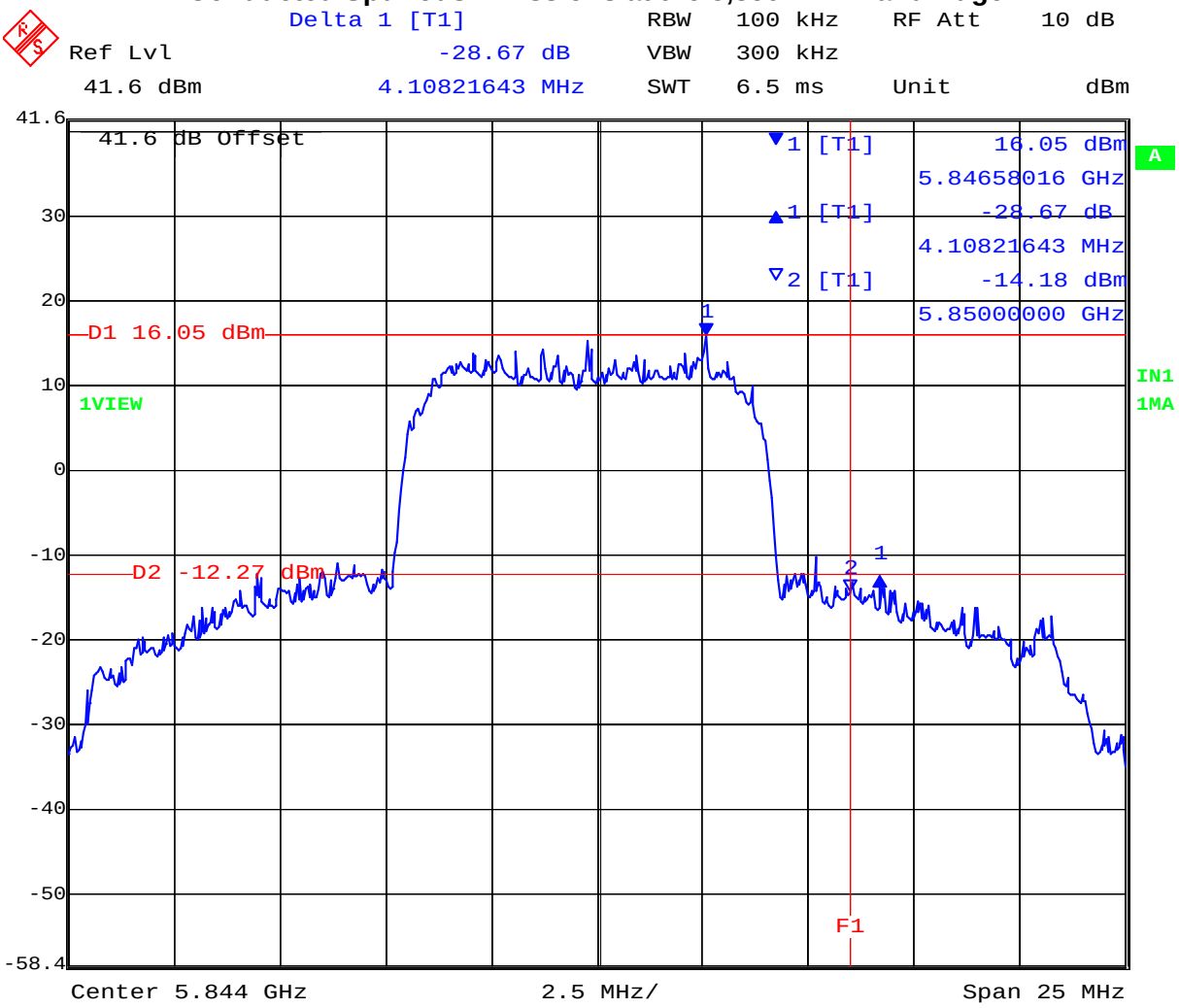
Plot A03 7.5 MHz Bandwidth 64QAM

Conducted Spurious Emissions at the 5,725 MHz Band Edge



Plot A04 7.5 MHz Bandwidth 64QAM

Conducted Spurious Emissions at the 5,850 MHz Band Edge



Specification

§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.

A.1.2. Radiated Emissions Transmitter Radiated Spurious Emissions

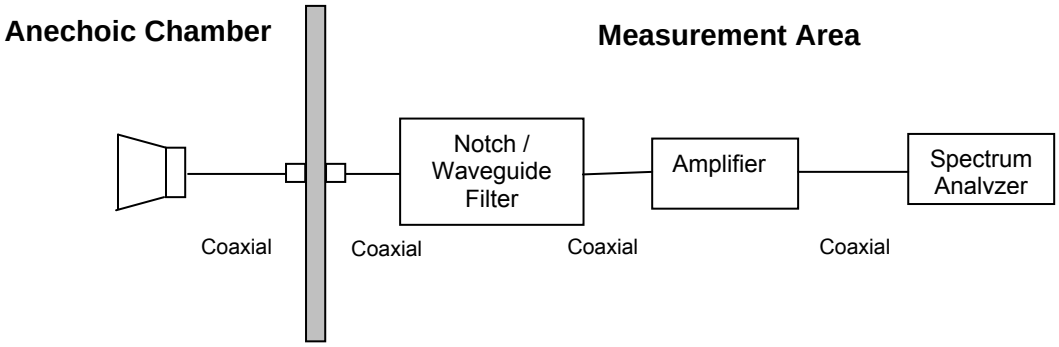
FCC, Part 15 Subpart C §15.247(d) 15.205; 15.209
Industry Canada RSS-210 §A8.5, §2.2, §2.6
Industry Canada RSS-Gen §4.7

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

EUT Test Configuration

The following table describes the configuration of equipment tested for radiated emissions.

Antenna Configuration	EUT Configuration	Max. Allowable Conducted Power Setting (dBm)	
		Antenna port #1	Antenna port #2
20 dBi Dual Polarized Integral Antenna	Two antenna ports, dual polarized radio, operating on the same frequency with a coherent transmitter on both polarizations, into an external dual-polarized antenna.	+27.0	+27.0

QPSK Radiated Emissions - 20 dBi Dual Polarized Integral Antenna

TABLE OF RESULTS –5788 MHz 20 dBi Antenna 7.5 MHz Bandwidth QPSK

Freq. (MHz)	Pol. (H/V)	Measurement Type Peak/Avg	Field Strength (dBµV/m)	RB/ NRB	Limit (dBµV/m)	Margin (dB)
11577.8	H	Peak Max	61.93	RB	74	-12.07
11577.8	H	Average Max	51.73	RB	54	-2.27

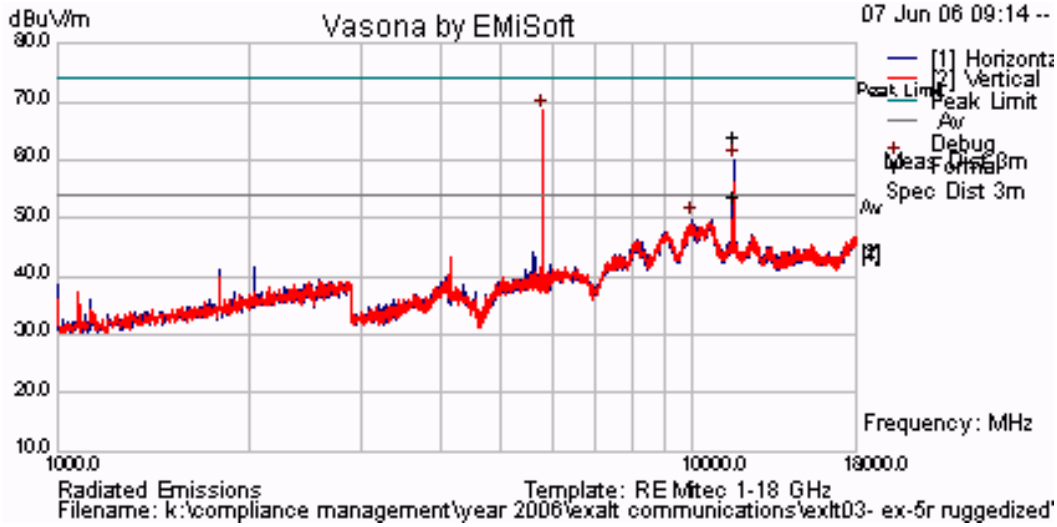
RB - Restricted Band / NRB – Non-Restricted Band.

Note. The peak emission shown in the graph below is fundamental breaking through the notch filter.

Radiated Emissions for 20 dBi Antenna

Plot A05

5788 MHz Radiated Emissions for 20 dBi Antenna 7.5 MHz Bandwidth QPSK



16QAM Radiated Emissions 37.5 dBi Dual Polarized Parabolic Antenna

TABLE OF RESULTS – 5,813 MHz 37.5 dBi Antenna 60 MHz Bandwidth 16QAM

Freq. (MHz)	Pol. (H/V)	Measurement Type Peak/Avg	Field Strength (dBµV/m)	RB/ NRB	Limit (dBµV/m)	Margin (dB)
5597.00	H	Peak	56.92	NRB	116.85	-59.93
5798.50	V	Peak	64.09	NRB		
5969.00	H	Peak	71.45	NRB	116.85	-45.40

RB - Restricted Band / NRB – Non-Restricted Band.

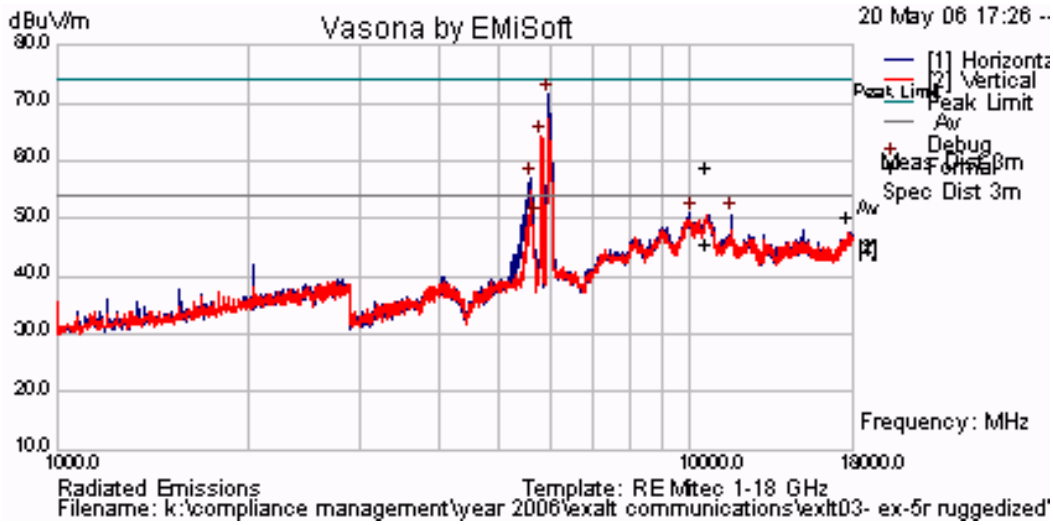
All emissions above the limit are in a non restricted Band. The emission highlighted in the table are the fundamental breaking through the notch filter. The emissions limit is 20 dB below the peak field strength.

Note. The peak emission shown in the graph below is fundamental breaking through the notch filter.

Radiated Emissions for 37.5 dBi Antenna

Plot A06

5,813 MHz Radiated Emissions for 37.5 dBi Antenna 60 MHz Bandwidth 16QAM



64QAM Radiated Emissions 37.5 dBi Dual Polarized Parabolic Antenna

TABLE OF RESULTS – 5,813 MHz 37.5 dBi Antenna 60 MHz Bandwidth 64QAM

Freq. (MHz)	Pol. (H/V)	Measurement Type Peak/Avg	Field Strength (dBµV/m)	RB/ NRB	Limit (dBµV/m)	Margin (dB)
5597.00	H	Peak	58.76	NRB	116.85	-58.09
5628.00	H	Peak	54.59	NRB	116.85	-62.26
5798.50	V	Peak	64.59	NRB		
5969.00	H	Peak	71.62	NRB	116.85	-45.23
6011.66	H	Peak	67.30	NRB	116.85	-49.55

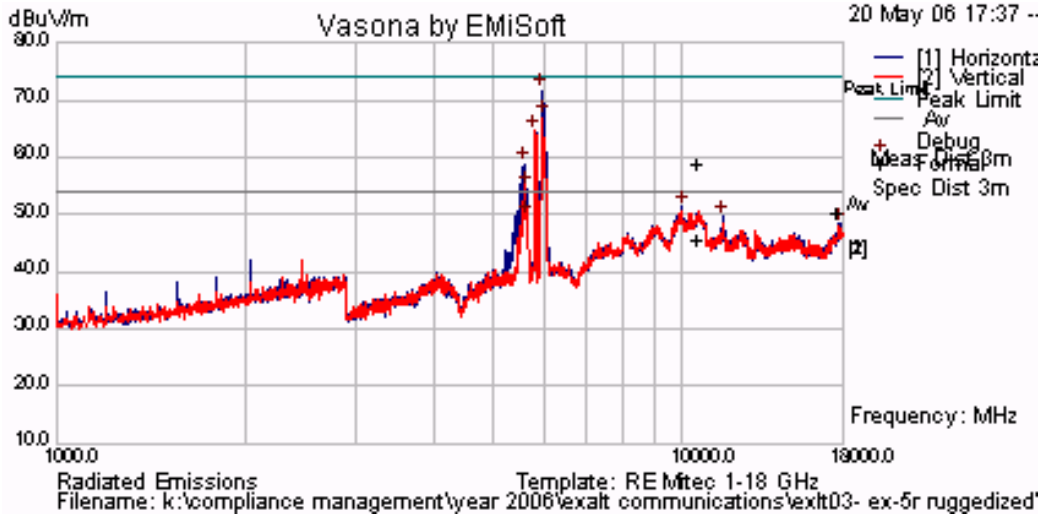
RB - Restricted Band / NRB – Non-Restricted Band.

All emissions above the limit are in a non restricted Band. The emission highlighted in the table is the fundamental breaking through the notch filter. The emissions limit is 20 dB below the peak field strength.

Note. The peak emission shown in the graph below is fundamental breaking through the notch filter.

Plot A07

5,813 MHz Radiated Emissions for 37.5 dBi Antenna 60 MHz Bandwidth 64QAM



A.1.3. Peak Field Strength Measurements

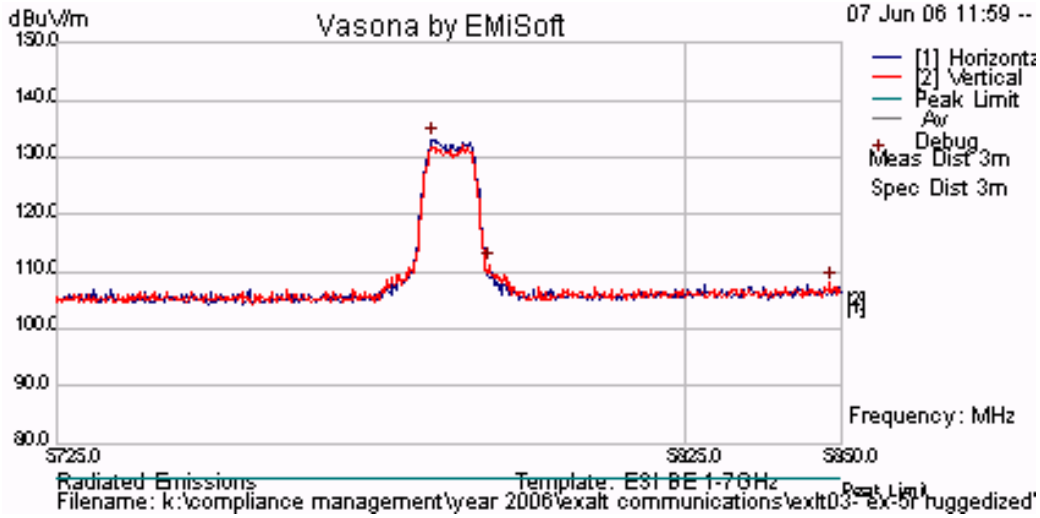
Peak Field Strength Measurements for 20 dBi Dual Polarized Integral Antenna

20 dBi Antenna 5788 MHz 7.5 MHz Bandwidth QPSK

Plot A08

20 dBi Antenna 5788 MHz 7.5 MHz Bandwidth QPSK

Peak Emission = 133.07 dBµV/m



Specification Limits

FCC §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.

FCC §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)).

IC 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.

IC 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.

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

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

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

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

3922 Valley Avenue, Suite “B”
Pleasanton, CA 94566, USA
Tel: 1.925.462.0304
Fax: 1.925.462.0306
www.micomlabs.com