

Test of Axxcelera AB-MAX Customer Premise
Equipment

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

Test Report Serial No.: AXXC08-A8b Rev A



TEST REPORT
FROM
MiCOMLabs

Test of Axxcelera AB-MAX Customer Premise Equipment
to
To FCC 47 CFR Part15.247 & IC RSS-210

Test Report Serial No.: AXXC08-A8b Rev A

Note: this report only contains data with regards to the 5.8 GHz operational modes of the Axxcelera AB-MAX Customer Premise Equipment. 5,470-5,725 MHz test data is reported in MiCOM Labs test report AXXC02-A3b

This report supersedes: None

Manufacturer: Axxcelera
1600 E.Parham Road
Richmond
Virginia 23228 USA

Product Function: 802.16 Customer Premise Equipment

Copy No: pdf **Issue Date:** 2nd November 2007

This Test Report is Issued Under the Authority of:

MiCOM Labs, Inc.
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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>



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LISTINGS

MiCOM Labs test facilities are listed by the following organizations;

North America

United States of America

Federal Communications Commission (FCC) Listing #: 102167

Canada

Industry Canada: 4143A

RECOGNITION

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

Conformity Assessment Body (CAB) – MiCOM Labs

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

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

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DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft		
Rev A	2 nd November 2007	First issue.

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1. TEST RESULT CERTIFICATE

Manufacturer:	Axxcelera 1600 E.Parham Road Richmond Virginia 23228 USA	Tested By:	MiCOM Labs, Inc. 440 Boulder Court Suite 200 Pleasanton California, 94566, USA
EUT:	Client Device for Wireless PMP cellular coverage	Telephone:	+1 925 462 0304
Model:	AB-MAX CPE	Fax:	+1 925 462 0306
S/N:	CPE 001		
Test Date(s):	12th to 27th September 2007	Website:	www.micomlabs.com

STANDARD(S)

FCC 47 CFR Part15.247 & IC RSS-210

TEST RESULTS

EQUIPMENT COMPLIES

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

Notes:

1. This document reports conditions under which testing was conducted and the results of testing performed.
2. Details of test methods used have been recorded and kept on file by the laboratory.
3. Test results apply only to the item(s) tested.

Approved & Released for MiCOM Labs, Inc. by:


Graeme Grieve
Quality Manager MiCOM Labs,



CERTIFICATE #2381.01


Gordon Hurst
President & CEO MiCOM Labs, Inc.

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2. REFERENCES AND MEASUREMENT UNCERTAINTY

2.1. Normative References

Ref.	Publication	Year	Title
(i)	FCC 47 CFR Part 15.247	2007	Code of Federal Regulations
(ii)	Industry Canada RSS-210	Issue 7 June 2007	Low Power License-Exempt Radiocommunication Devices (All Frequency Bands)
(iii)	Industry Canada RSS-Gen	Issue 2 June 2007	General Requirements and Information for the Certification of Radiocommunication Equipment.
(iv)	ANSI C63.4	2003	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
(v)	CISPR 22/ EN 55022	1997 1998	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
(vi)	M 3003	Edition 1 Dec. 1997	Expression of Uncertainty and Confidence in Measurements
(vii)	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
(viii)	ETSI TR 100 028	2001	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
(ix)	A2LA	14 th 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.

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3. PRODUCT DETAILS AND TEST CONFIGURATIONS

3.1. Technical Details

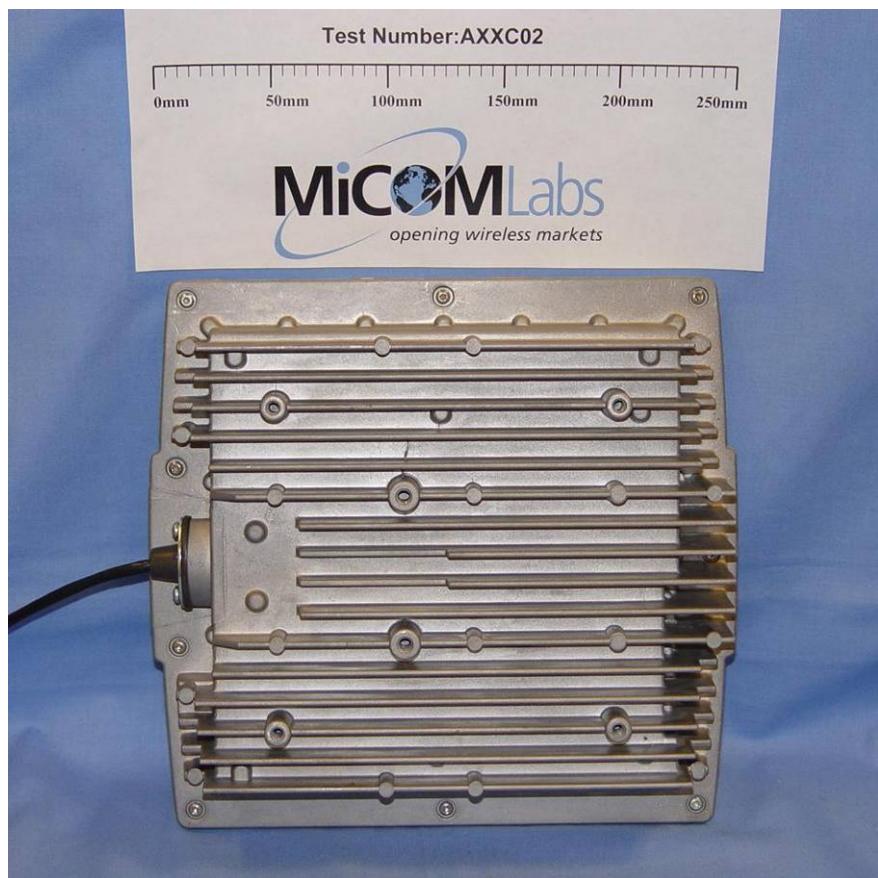
Details	Description
Purpose:	Test of the Axxcelera AB-MAX Customer Premise Equipment to FCC Part 15.247 and Industry Canada RSS-210 regulations.
Applicant:	As Manufacturer
Manufacturer:	Axxcelera 1600 E.Parham Road Richmond Virginia 23228 USA
Laboratory performing the tests:	MiCOM Labs, Inc. 440 Boulder Court, Suite 200 Pleasanton, California 94566 USA
Test report reference number:	AXXC08-A8b Rev A
Date EUT received:	12 TH September 2007
Standard(s) applied:	FCC 47 CFR Part15.247 & IC RSS-210
Dates of test (from - to):	12th to 27th September 2007
No of Units Tested:	1
Type of Equipment:	802.16 Wireless Customer Premise Equipment
Manufacturers Trade Name:	AB MAX Customer Premise Equipment
Model:	AB-MAX CPE
Location for use:	Outdoor
Declared Frequency Range(s):	5725 - 5850 MHz
Type of Modulation:	BPSK, QPSK, 16QAM, 64QAM
Declared Nominal Output Power:	+18 dBm
EUT Modes of Operation:	Modulation Types: BPSK, QPSK, 16QAM, 64QAM Bandwidths: 5, 10 & 15 MHz
Transmit/Receive Operation:	Time Division Duplex
Rated Input Voltage and Current:	48 Vdc, 250 mA
Operating Temperature Range:	Declared range -33 to +55°C
ITU Emission Designator:	5 MHz BW – 4M7W7D 10 MHz BW – 9M1W7D 15 MHz BW – 13M6W7D
Microprocessor(s) Model:	Sequans Semiconductor 1010 SC
Clock/Oscillator(s):	18 MHz, 198 MHz,
Frequency Stability:	±20 ppm max
Equipment Dimensions:	10" X 18" X 3"
Weight:	3 lbs
Primary function of equipment:	Client device for wireless PMP cellular coverage.

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3.2. Scope of Test Program

The scope of the test program was to test the Axxcelera AB-MAX CPE wireless Customer Premise Equipment in the frequency range 5725 – 5850 MHz for compliance against FCC 47 CFR Part 15.247 and Industry Canada RSS-210 specifications.

Axxcelera AB-MAX CPE Wireless Customer Premise Equipment



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

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	Wireless AP	Axxcelera	AB-MAX CPE	CPE 001
EUT	Power Supply	Cincon Electronics Co, Ltd	TR36A-POE-480	36480- 007281
Support	Laptop PC	Dell	Inspiron	None

3.4. Antenna Details

1. Maximum Antenna Gain = +16.0 dBi

3.5. Cabling and I/O Ports

Number and type of I/O ports

1. POE 10/100 Ethernet

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3.6. Test Configurations

Testing was performed to determine the worst case test scenario. It was found through exercising each modulation with each bandwidth that there was no difference. Test data is available and held on file by the laboratory identifying cross checks performed.

Matrix of channel test configurations.

Operational Mode	Frequencies (MHz)
802.16	5,735 5,785 5,840

Plots not included are held on file by the test laboratory and available upon request with client permission.

3.7. Equipment Modifications

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

1. None

3.8. Deviations from the Test Standard

The following deviations from the test standard were required in order to complete the test program:

1. None



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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 b/g and 30 MHz - 40 GHz a)	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

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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 Industry Canada only RSS-Gen §4.8, §6	Radiated Emissions	Restricted Bands	Radiated	Complies	5.1.6
	Transmitter Radiated Spurious Emissions	Emissions above 1 GHz		Complies	5.1.6.1
	Receiver Radiated Spurious Emissions	Emissions above 1 GHz		Complies	5.1.6.2
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

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

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5. TEST RESULTS

5.1. Device Characteristics

5.1.1. 6 dB and 99 % Bandwidth

FCC, Part 15 Subpart C §15.247(a)(2)

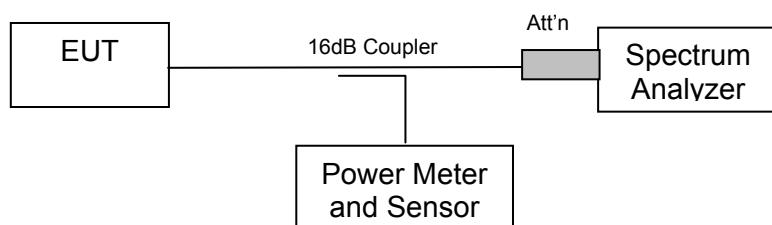
Industry Canada RSS-210 §A8.2

Industry Canada RSS-Gen §4.4

Test Procedure

The bandwidth at 6 dB and 99 % is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

Test Measurement Set up



Measurement set up for 6 dB and 99 % bandwidth test

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

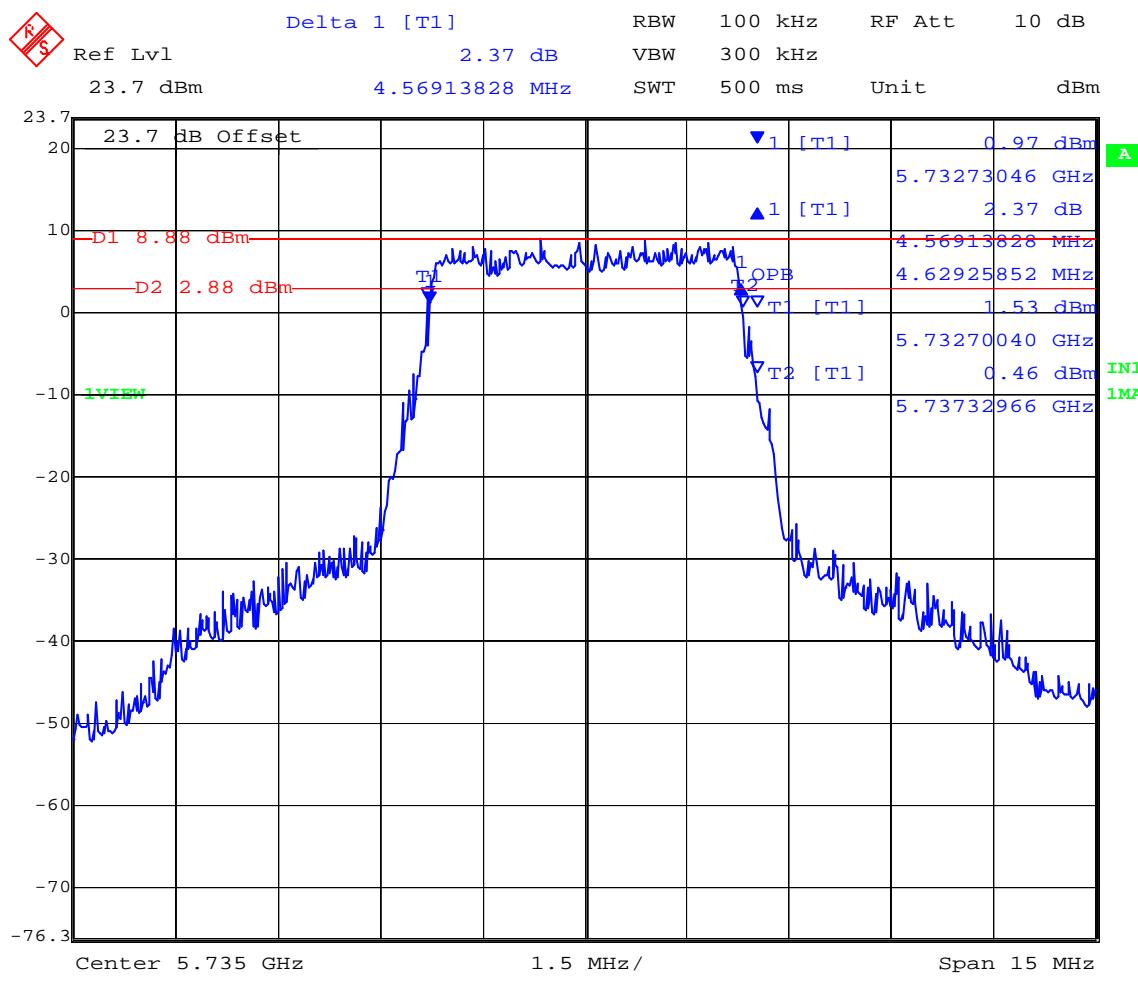
Ambient conditions.

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

TABLE OF RESULTS – 64 QAM 5 MHz BW

Center Frequency (MHz)	6 dB Bandwidth (MHz)	99 % BW (MHz)
5,735	4.56913828	4.62925852
5,785	4.50901804	4.59919840
5,840	4.56913828	4.59919840

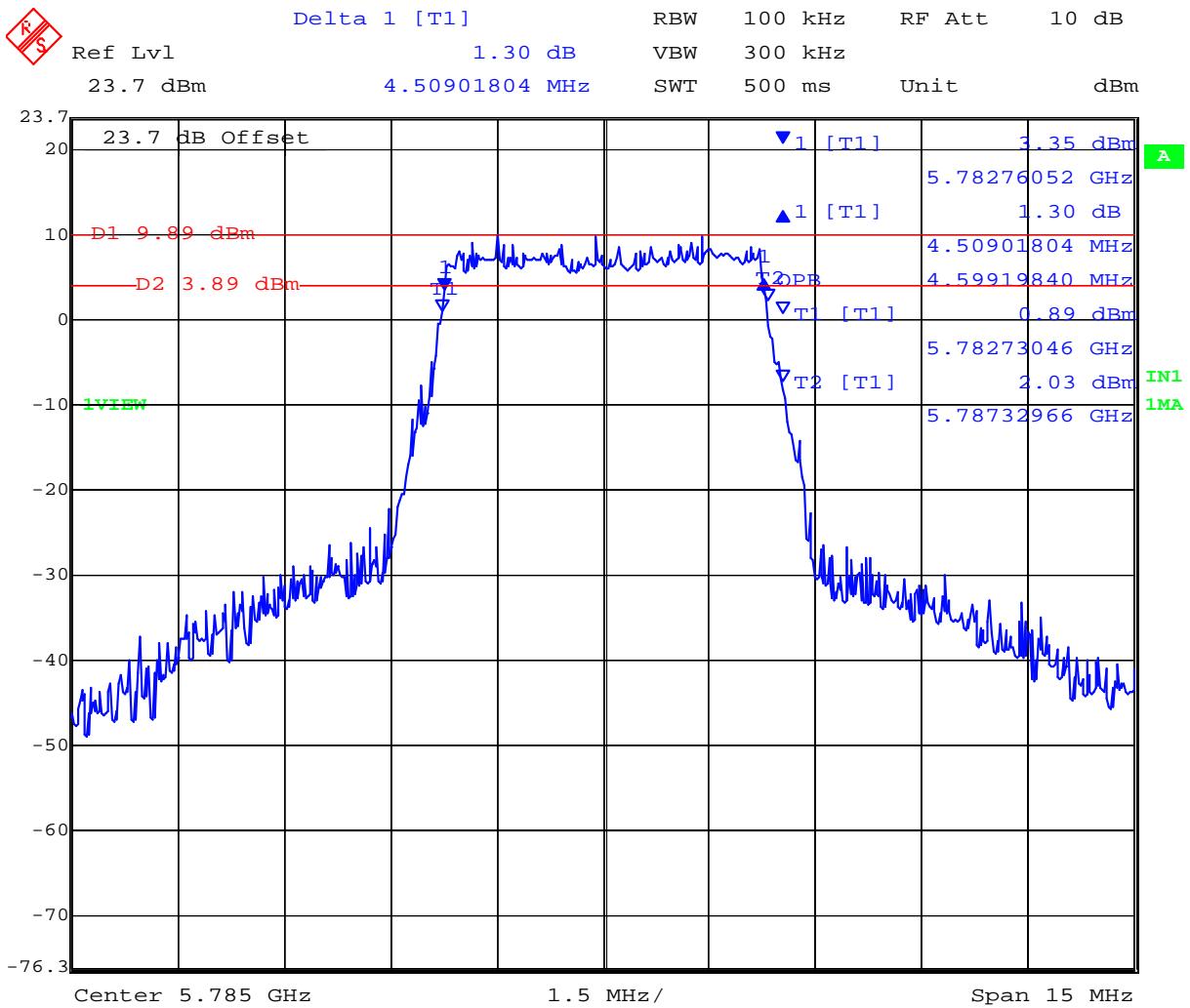
5,735 MHz 64 QAM 5 MHz BW 6 dB and 99% Bandwidth



Date: 27.SEP.2007 13:27:46

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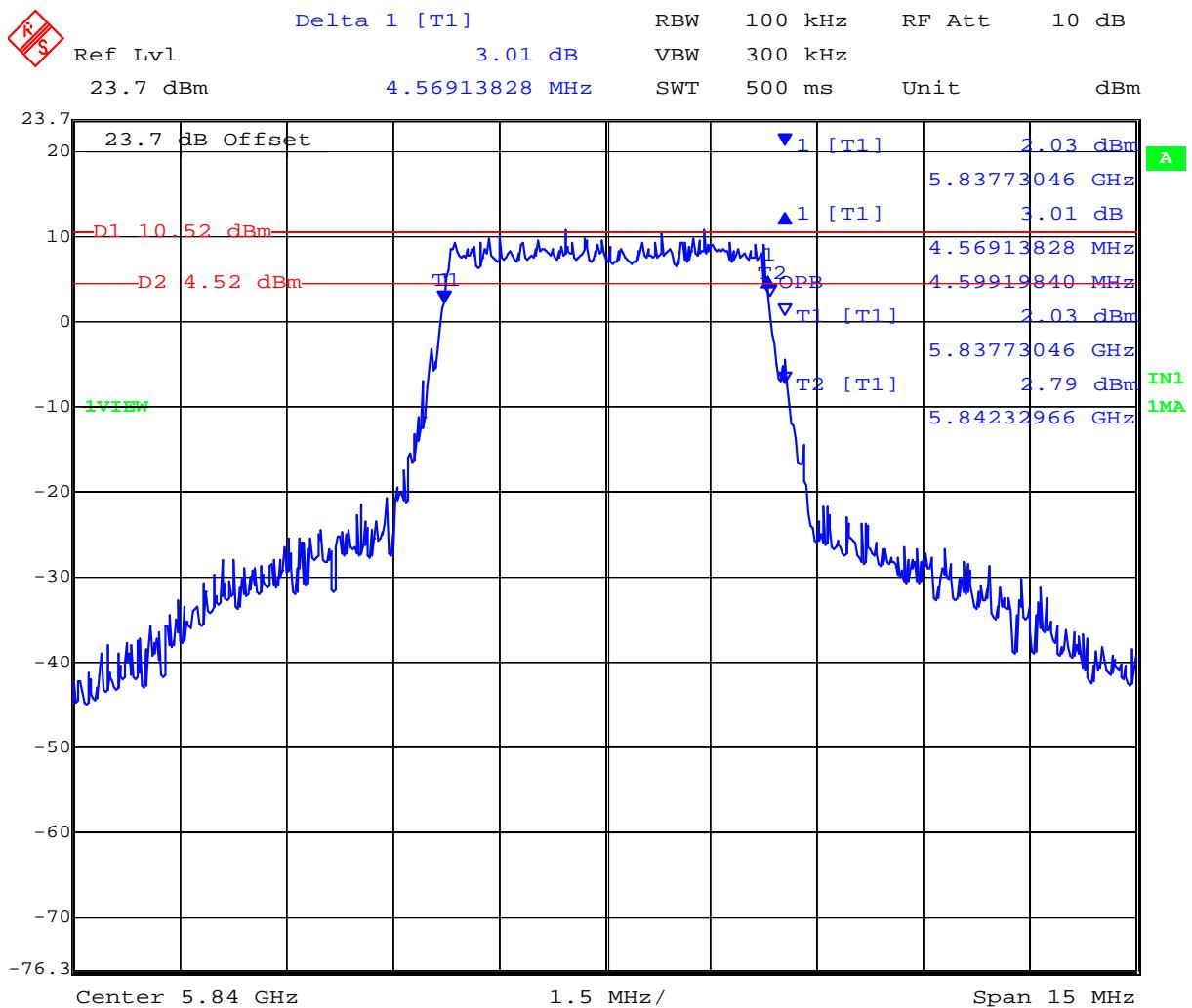
5,785 MHz 64 QAM 5 MHz BW 6 dB and 99% Bandwidth



Date: 27.SEP.2007 13:15:58

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5,840 MHz 64 QAM 5 MHz BW 6 dB and 99% Bandwidth



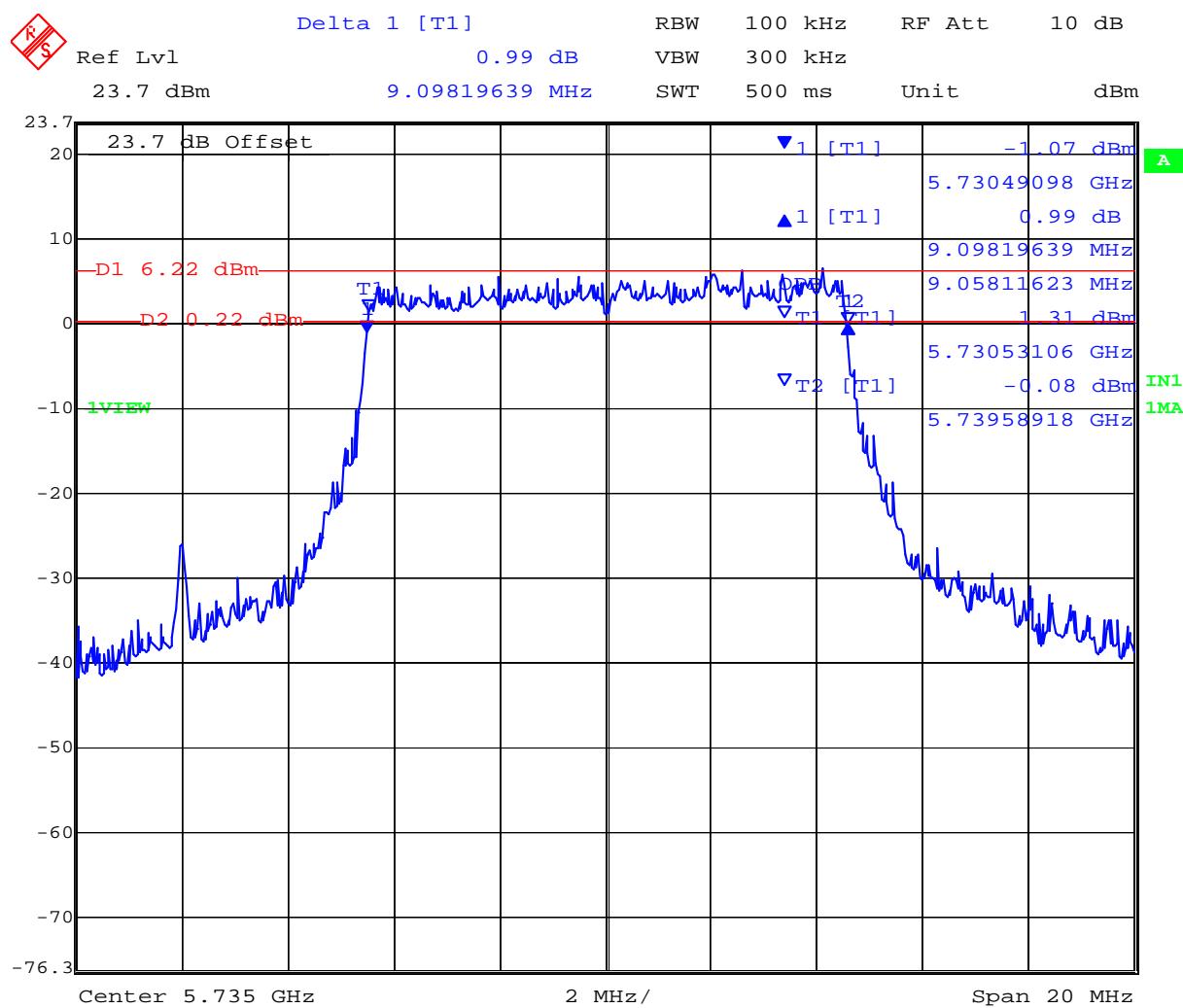
Date: 27.SEP.2007 13:11:10

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TABLE OF RESULTS - 64 QAM 10 MHz BW

Center Frequency (MHz)	6 dB Bandwidth (MHz)	99 % BW (MHz)
5,735	9.09819639	9.05811623
5,785	9.01803607	9.01803607
5,840	9.01803607	9.01803607

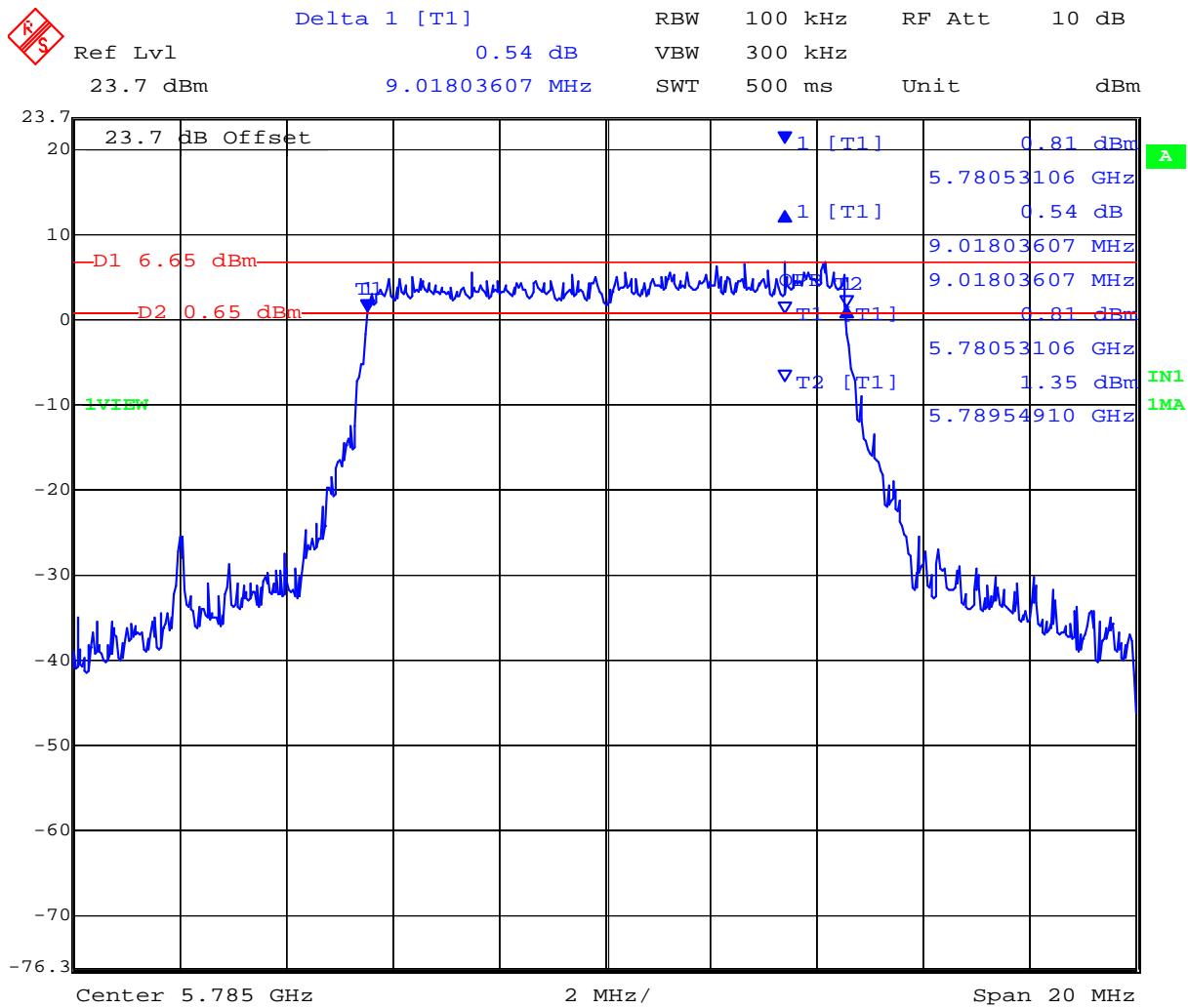
5,735 MHz 64 QAM 10 MHz BW 6 dB and 99% Bandwidth



Date: 27.SEP.2007 13:02:53

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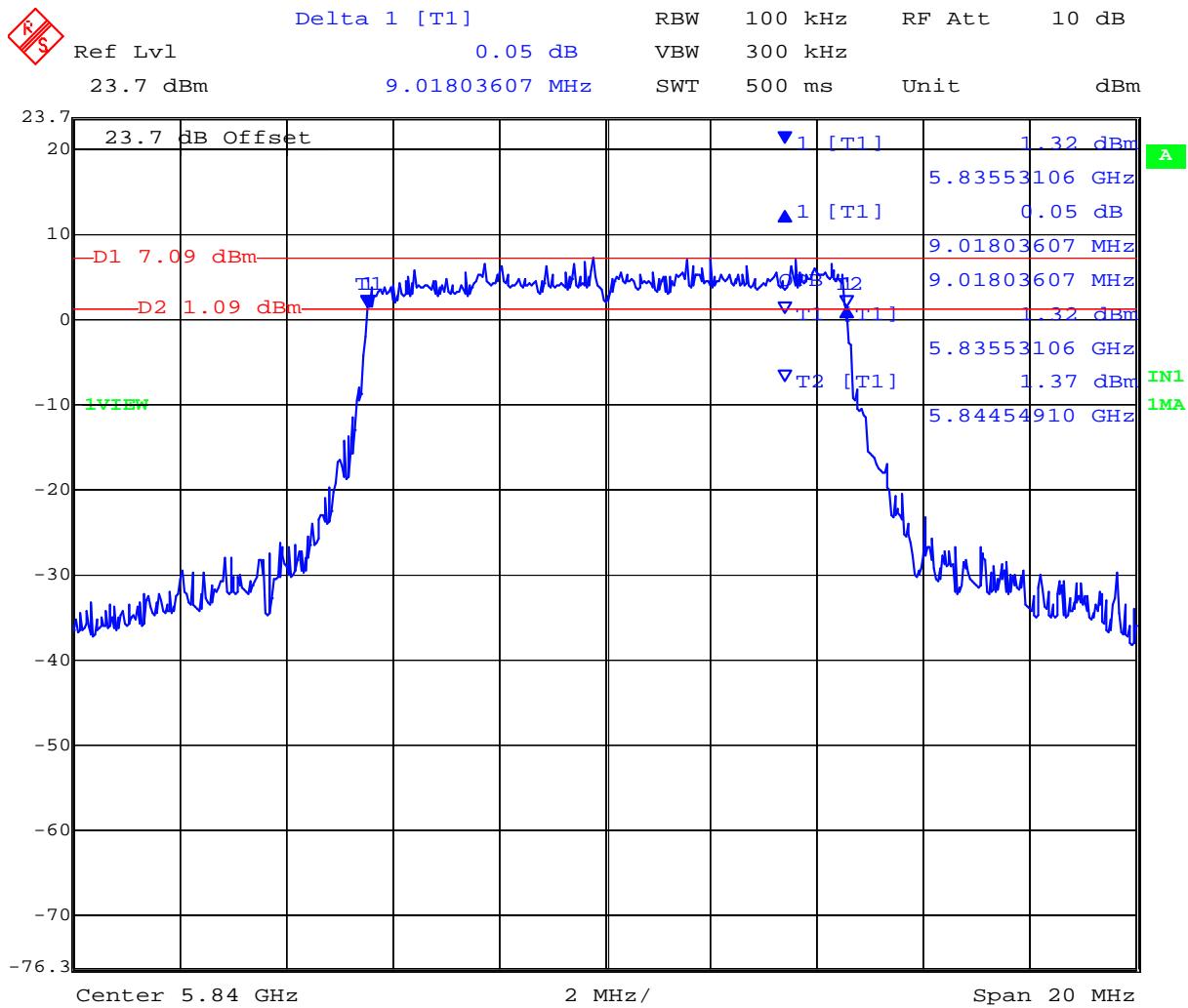
5,785 MHz 64 QAM 10 MHz BW 6 dB and 99% Bandwidth



Date: 27.SEP.2007 13:04:55

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5,840 MHz 64 QAM 10 MHz BW 6 dB and 99% Bandwidth



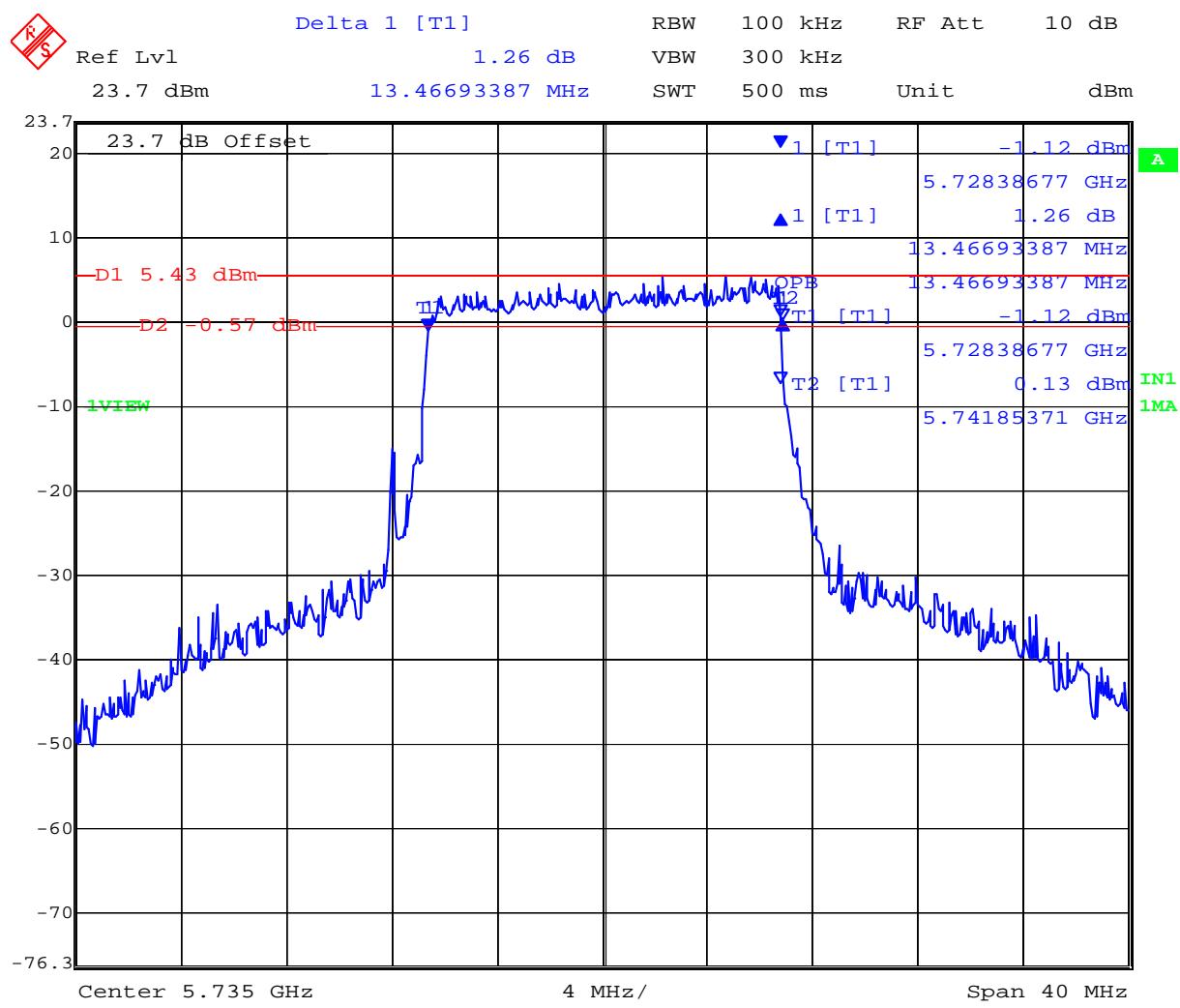
Date: 27.SEP.2007 13:08:09

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TABLE OF RESULTS – 64 QAM 15 MHz BW

Center Frequency (MHz)	6 dB Bandwidth (MHz)	99 % BW (MHz)
5,735	13.46693387	13.46693387
5,785	13.38677355	13.38677355
5,840	13.46693387	13.46693387

5,735 MHz 64 QAM 15 MHz BW 6 dB and 99% Bandwidth



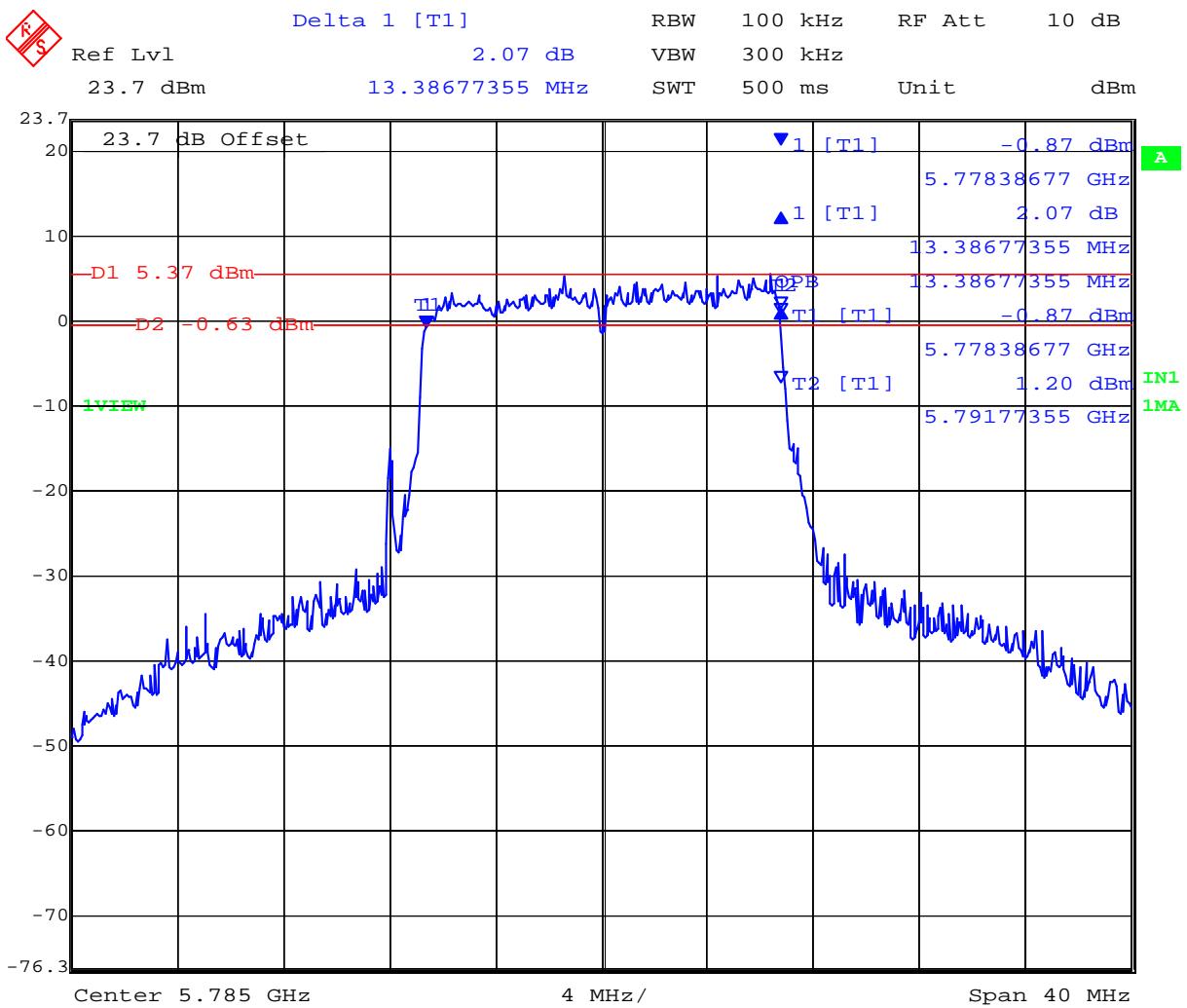
Date: 27.SEP.2007 12:35:27

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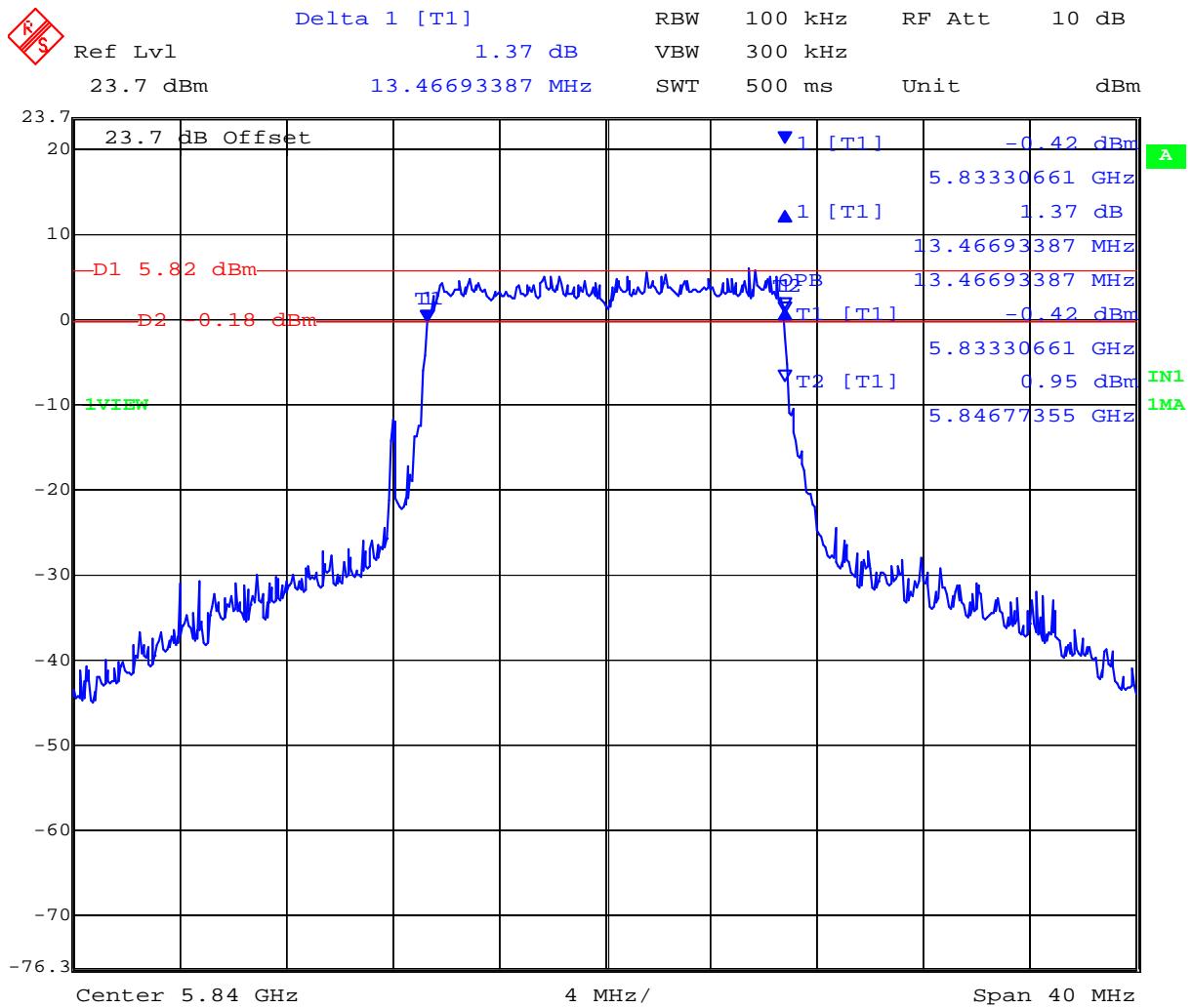
5,785 MHz 64 QAM 15 MHz BW 6 dB and 99% Bandwidth



Date: 27.SEP.2007 12:38:17

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5,840 MHz 64 QAM 15 MHz BW 6 dB and 99% Bandwidth



Date: 27.SEP.2007 12:48:05

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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

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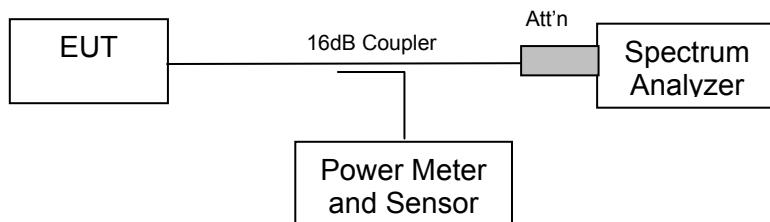
5.1.2. Peak Output Power

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

Test Procedure

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

Test Measurement Set up



Measurement set up for Transmitter Peak Output Power

Ambient conditions.

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

Maximum Antenna Gain = + 16.0 dBi

For fixed point to point operation.

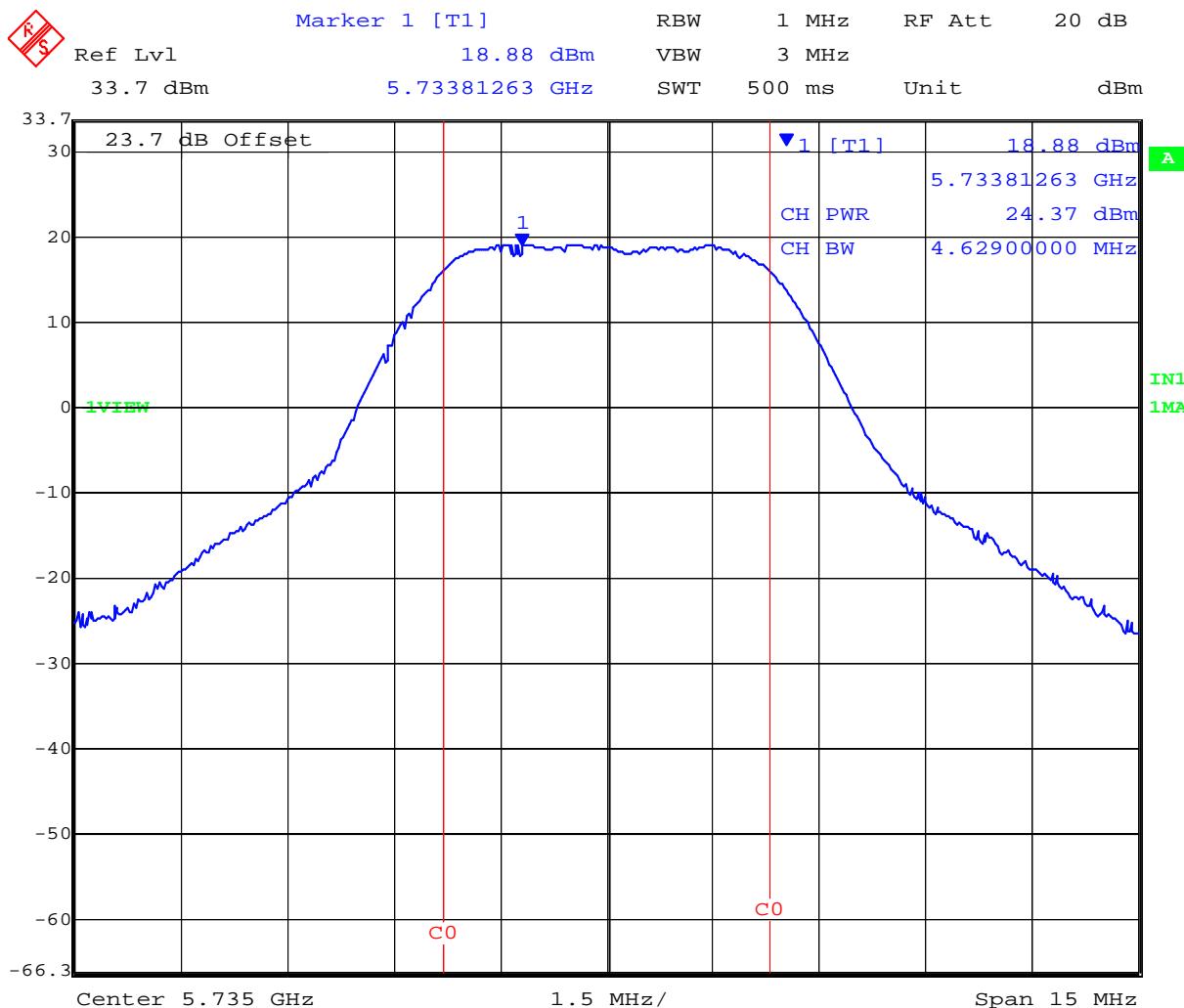
(b)(4)(ii) Systems operating in the 5725–5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

TABLE OF RESULTS – 64 QAM 5 MHz BW

Maximum Antenna Gain = +16.0 dBi

Center Frequency (MHz)	99% Measurement Bandwidth (MHz)	Peak Power (dBm)	EIRP (dBm)
5,735	4.62925852	+24.37	+40.37
5,785	4.59919840	+24.80	+40.80
5,840	4.59919840	+25.47	+41.47

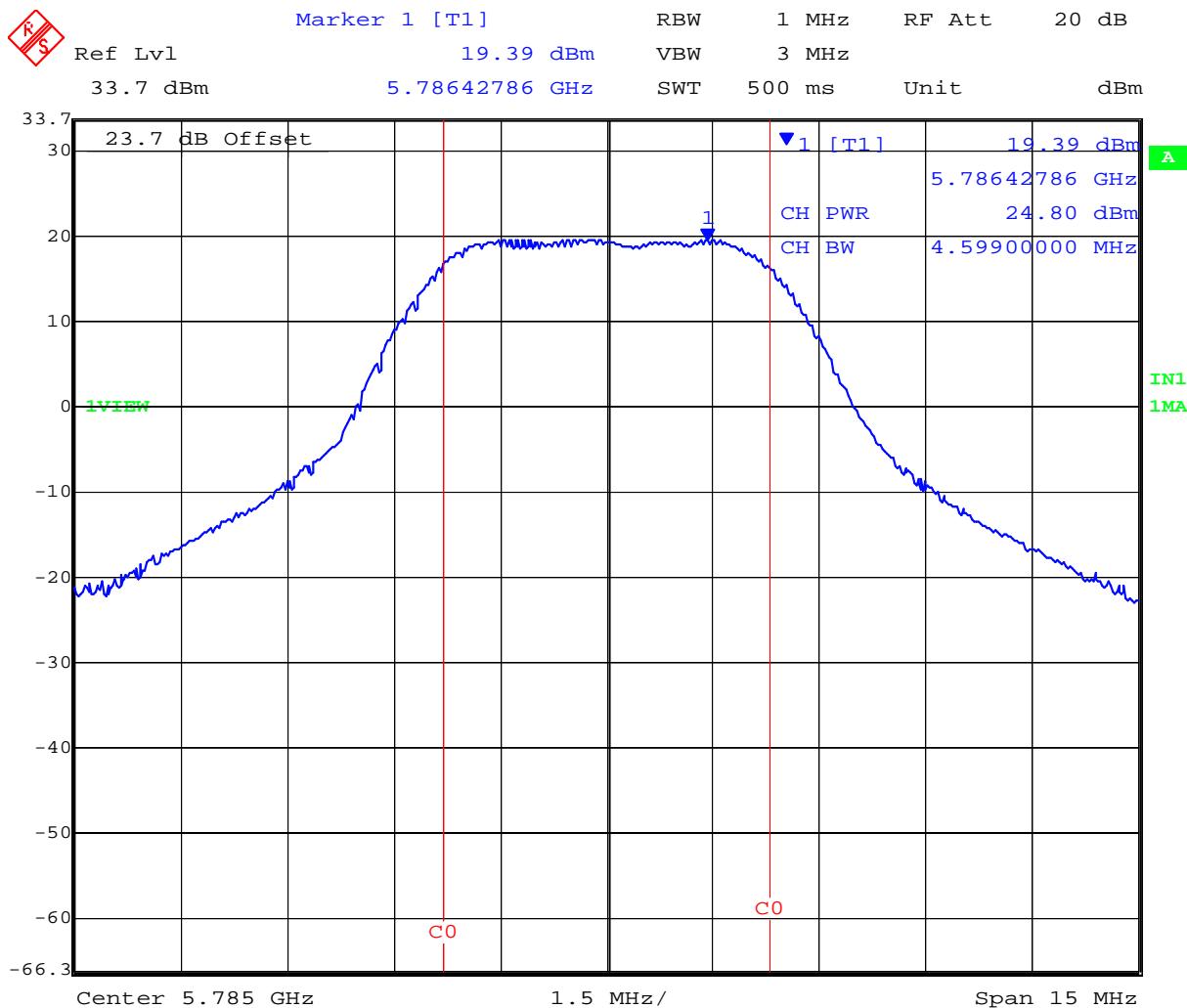
5,735 MHz 64 QAM 5 MHz Peak Power (dBm)



Date: 27.SEP.2007 16:43:48

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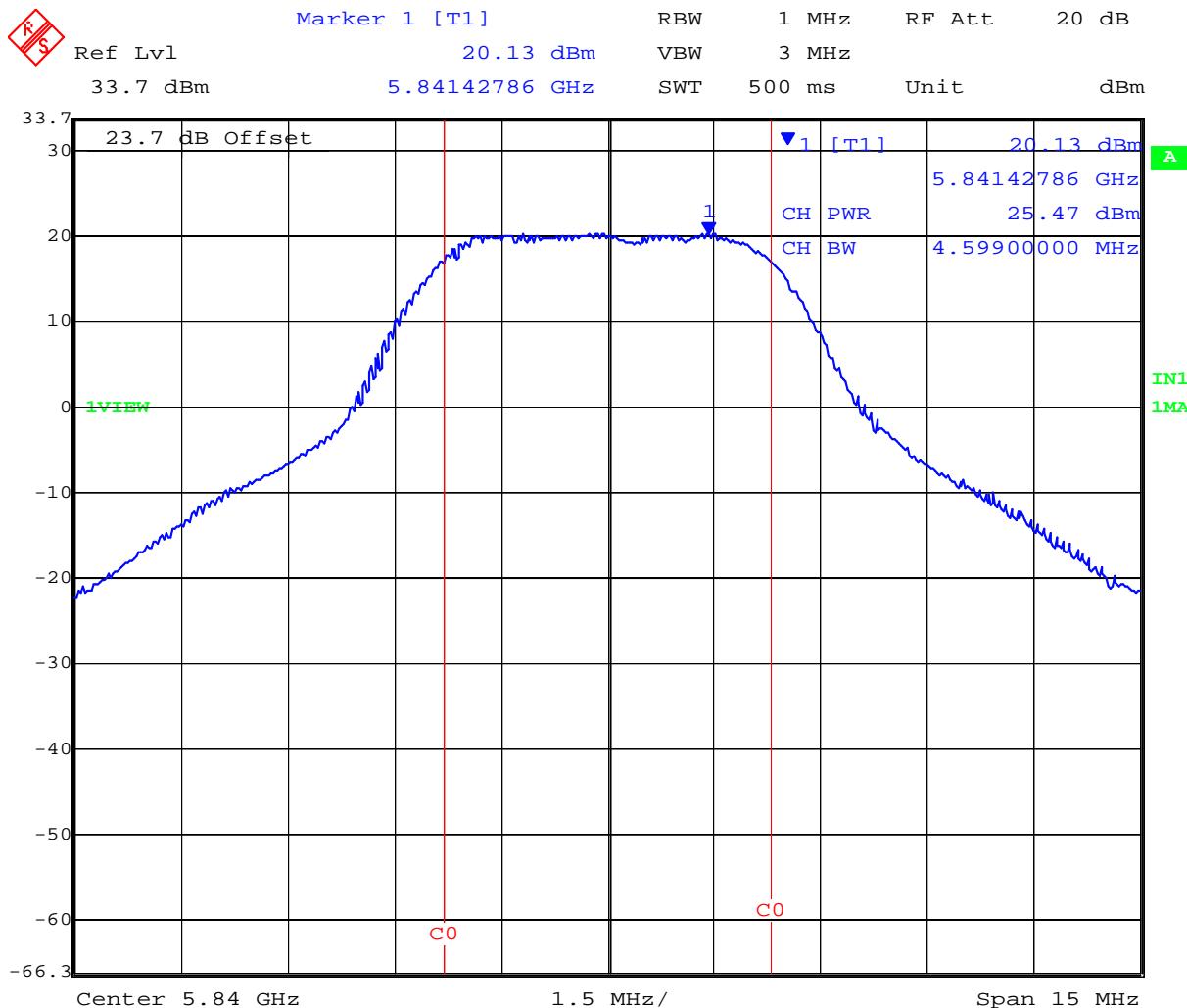
5,785 MHz 64 QAM 5 MHz Peak Power (dBm)



Date: 27.SEP.2007 16:42:41

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5,840 MHz 64 QAM 5 MHz Peak Power (dBm)



Date: 27.SEP.2007 16:41:41

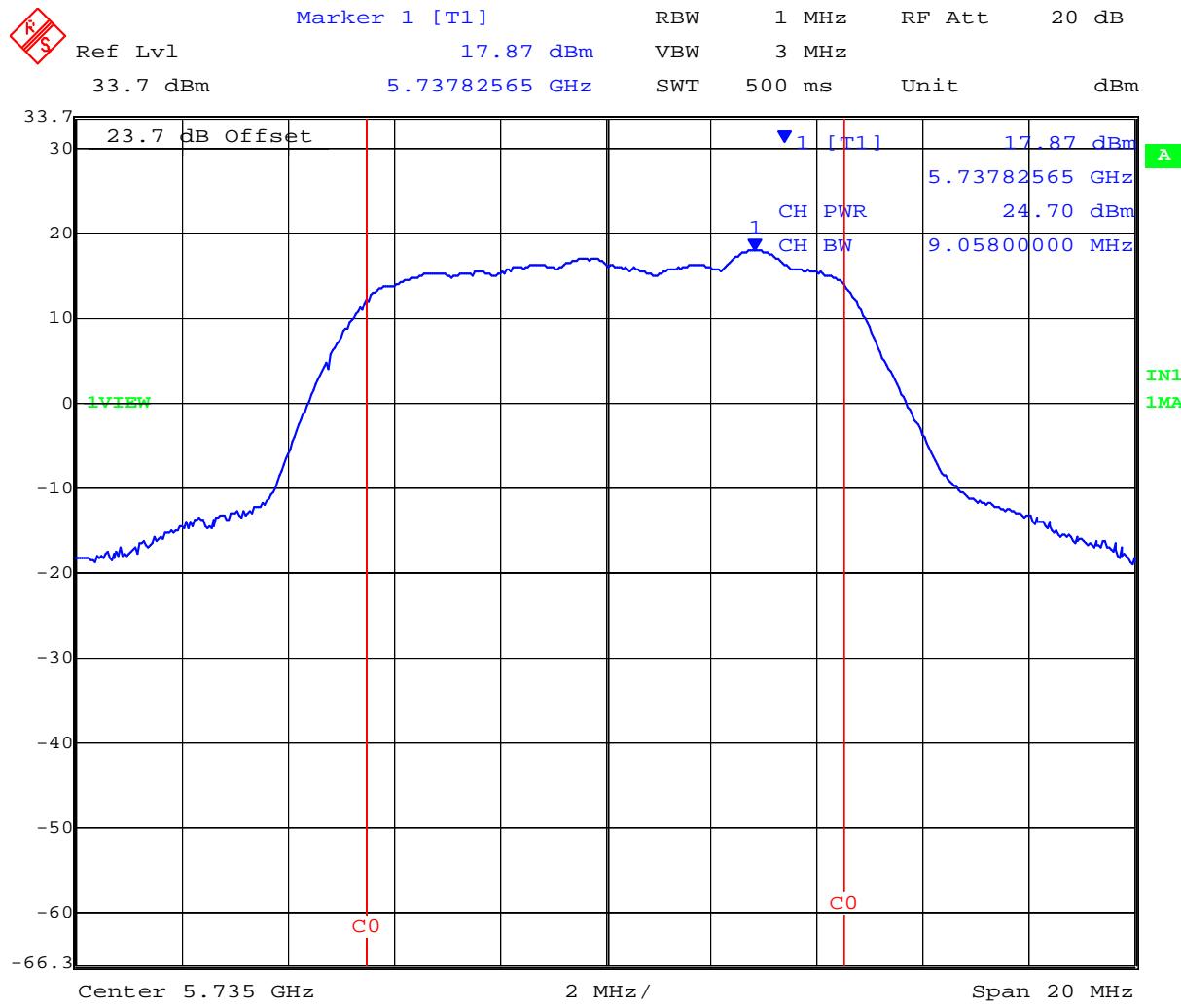
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TABLE OF RESULTS – 64 QAM 10 MHz BW

Maximum Antenna Gain = +16.0 dBi

Center Frequency (MHz)	99% Measurement Bandwidth (MHz)	Peak Power (dBm)	EIRP (dBm)
5,735	9.05811623	+24.70	+40.70
5,785	9.01803607	+25.18	+41.18
5,840	9.01803607	+25.84	+41.84

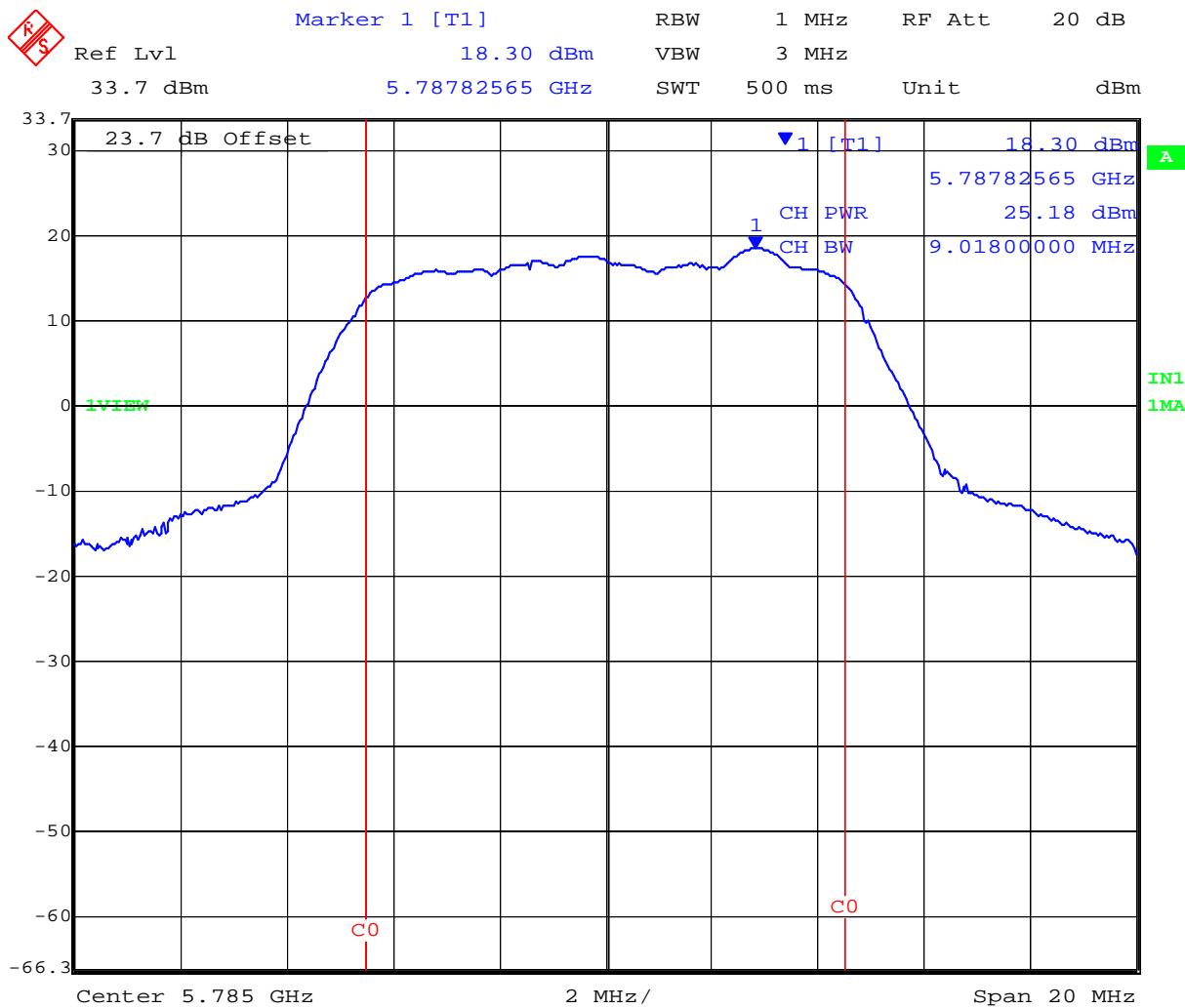
5,735 MHz 64 QAM 10 MHz Peak Power (dBm)



Date: 27.SEP.2007 16:36:27

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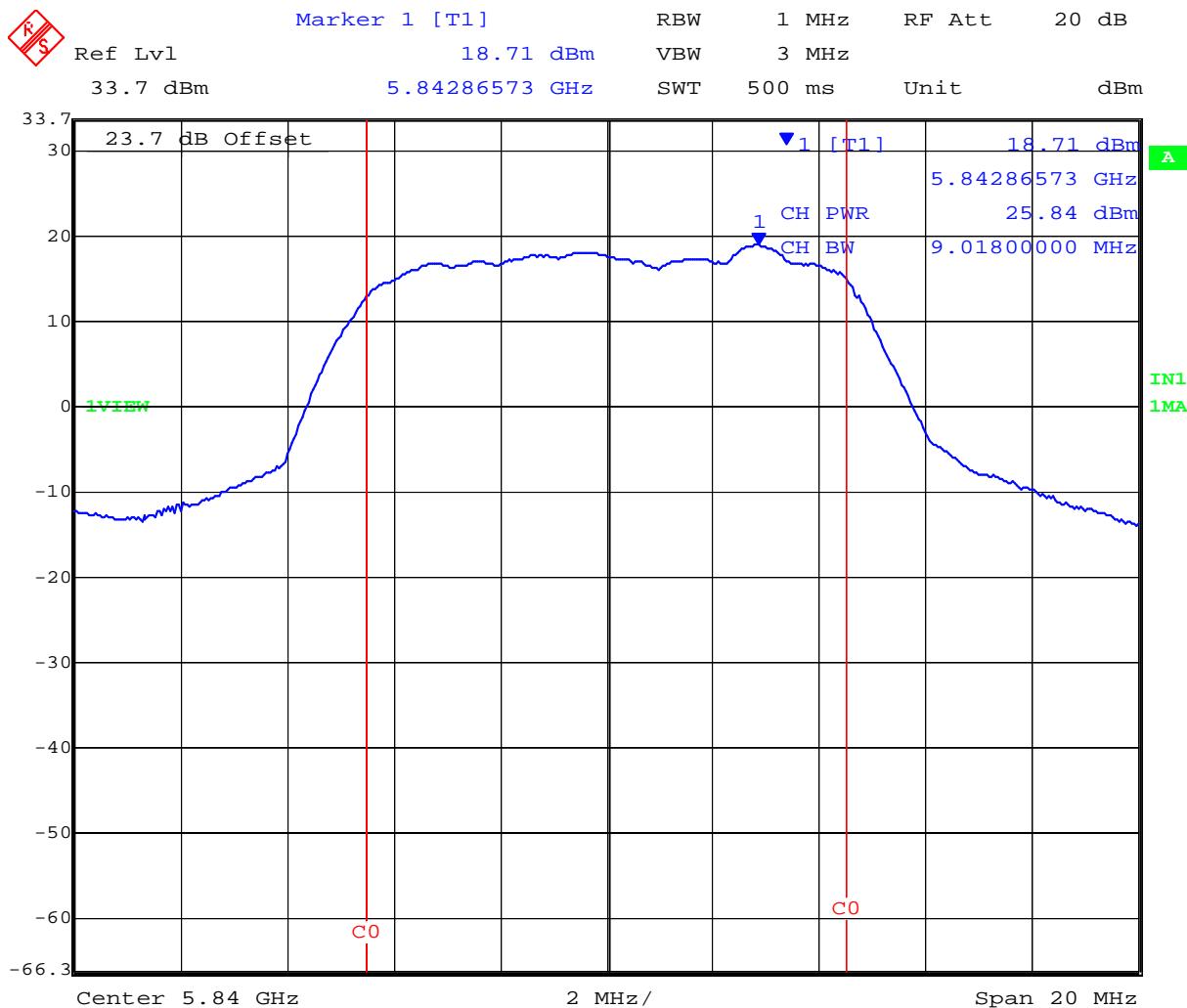
5,785 MHz 64 QAM 10 MHz Peak Power (dBm)



Date: 27.SEP.2007 16:37:45

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5,840 MHz 64 QAM 10 MHz Peak Power (dBm)



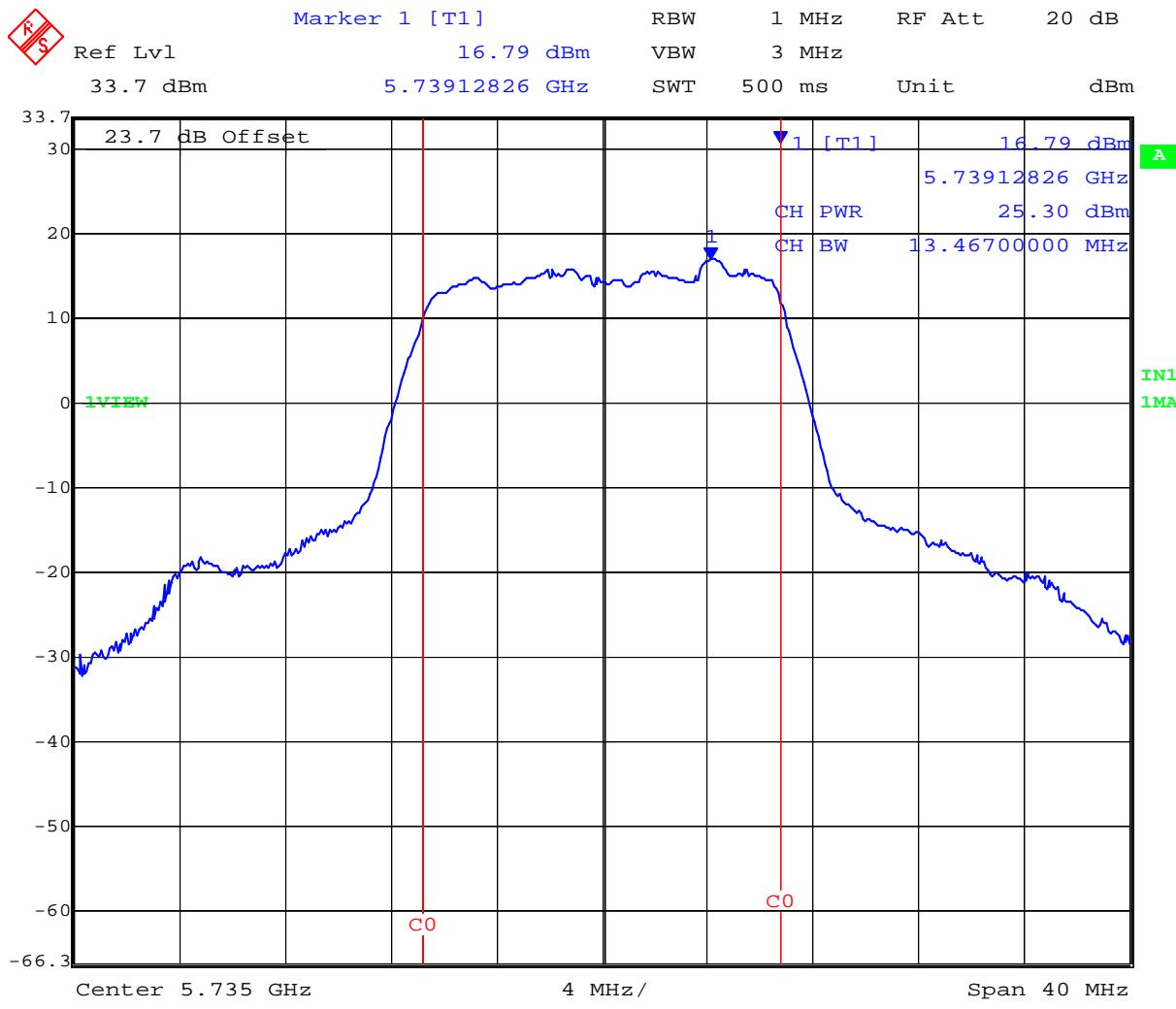
This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.

TABLE OF RESULTS – 64 QAM 15 MHz BW

Maximum Antenna Gain = +16.0 dB

Center Frequency (MHz)	99% Measurement Bandwidth (MHz)	Peak Power (dBm)	EIRP (dBm)
5,735	13.46693387	+25.30	+41.30
5,785	13.38677355	+25.68	+41.68
5,840	13.46693387	+26.62	+42.62

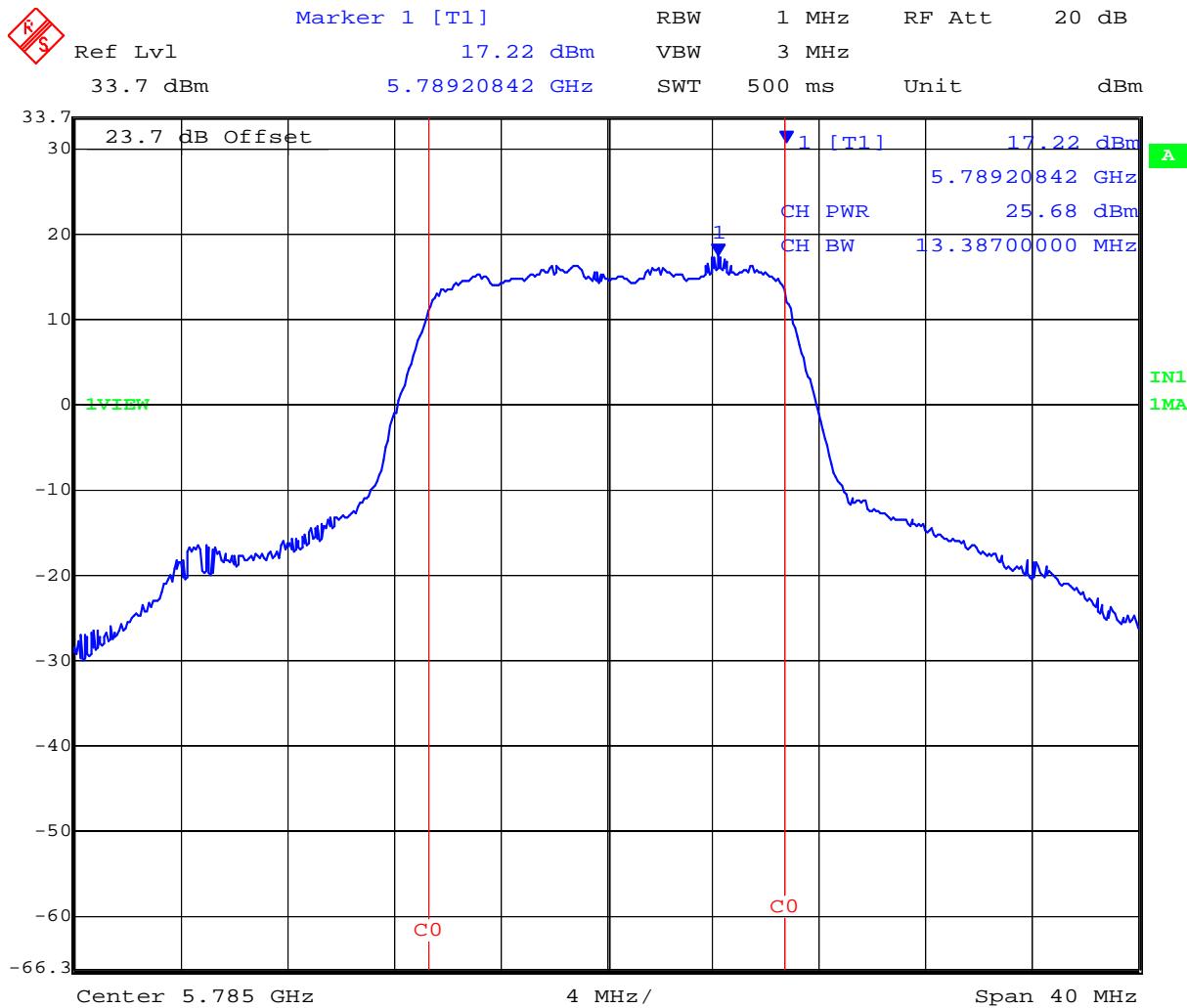
5,735 MHz 64 QAM 15 MHz Peak Power (dBm)



Date: 27.SEP.2007 16:29:15

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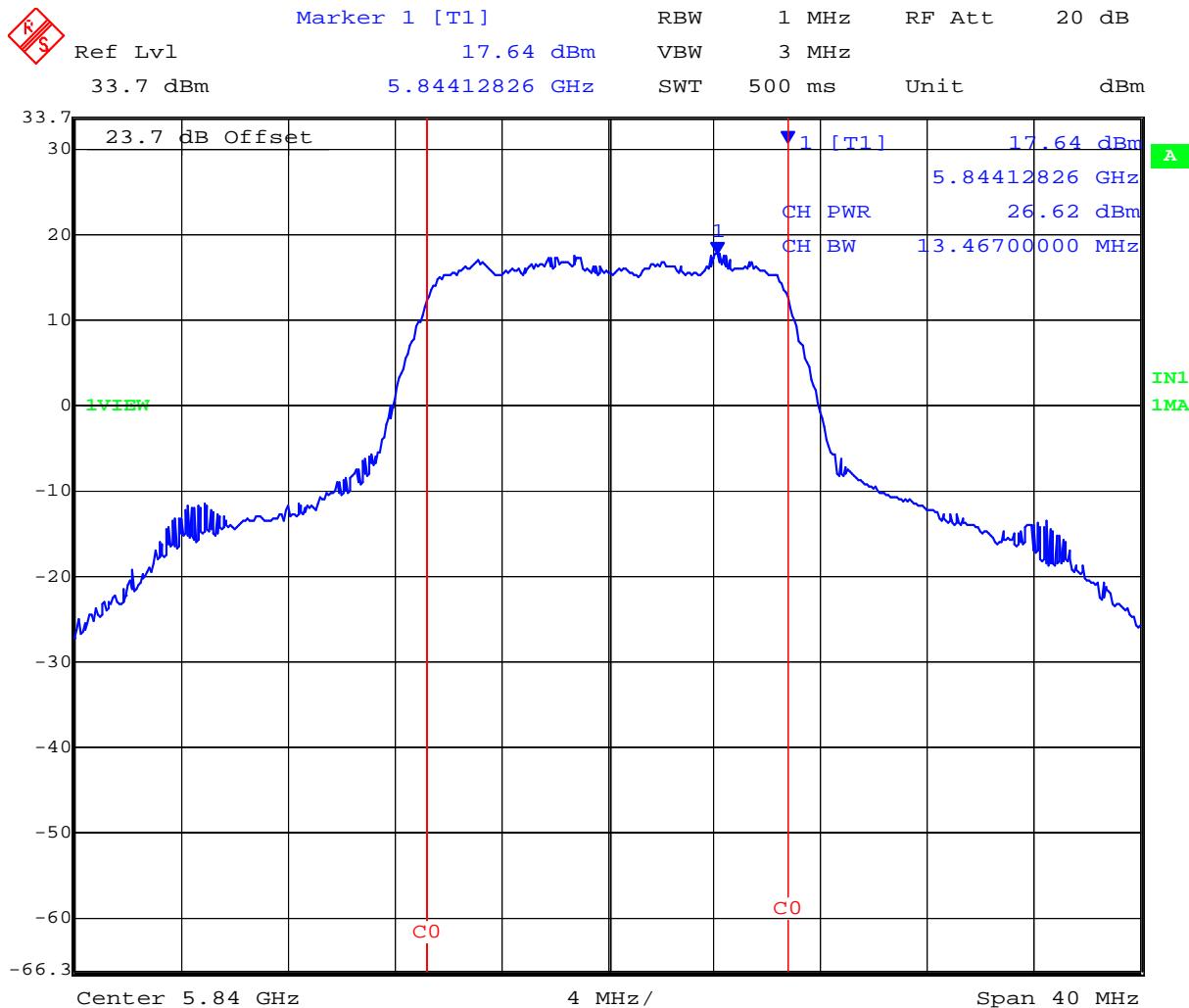
5,785 MHz 64 QAM 15 MHz BW 6 dB Bandwidth Peak Power (dBm)



Date: 27.SEP.2007 16:27:46

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5,840 MHz 64 QAM 15 MHz BW 6 dB Bandwidth Peak Power (dBm)



Date: 27.SEP.2007 16:26:00

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Title: Axxcelera AB-MAX Customer Premise Equipment
To: FCC 47 CFR Part15.247 & IC RSS-210
Serial #: AXXC08-A8b Rev A
Issue Date: 2nd November 2007
Page: 37 of 91

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

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5.1.3. Peak Power Spectral Density

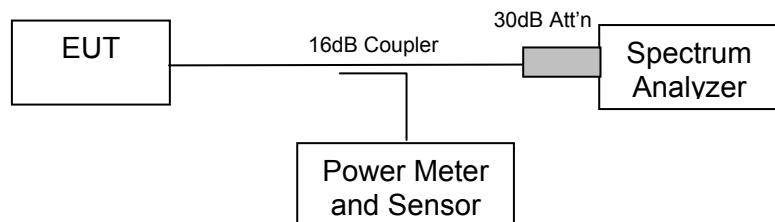
FCC, Part 15 Subpart C §15.247(e)

Industry Canada RSS-210 §A8.2

Test Procedure

The transmitter output was connected to a spectrum analyzer and the maximum level in a 3 kHz bandwidth was measured. A peak value was found over the full emission bandwidth and the frequency span reduced to obtain enhanced resolution. Sweep time \geq 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.

Test Measurement Set up



Measurement set up for Peak Power Spectral Density

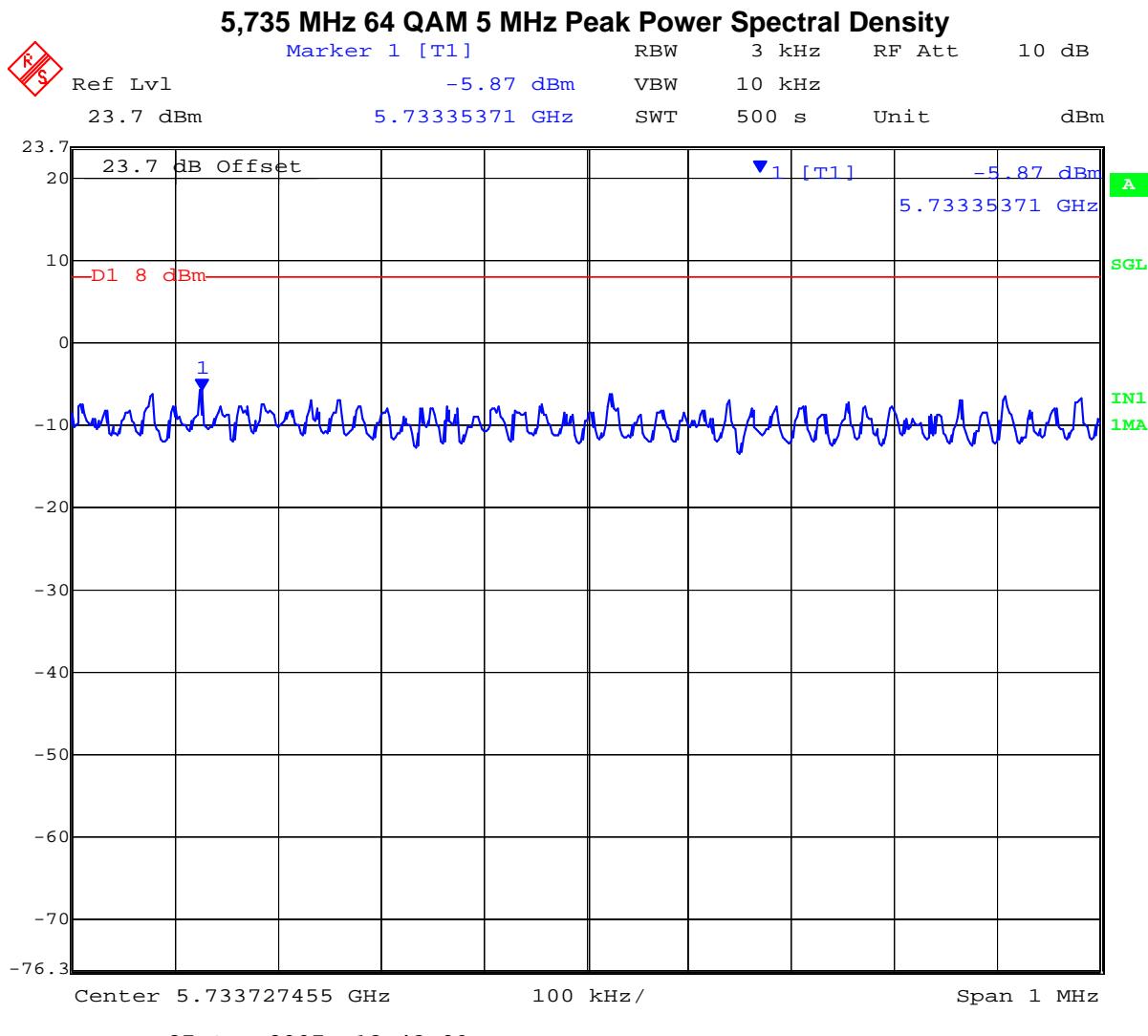
Measurement Results for Peak Power Spectral Density

Ambient conditions.

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

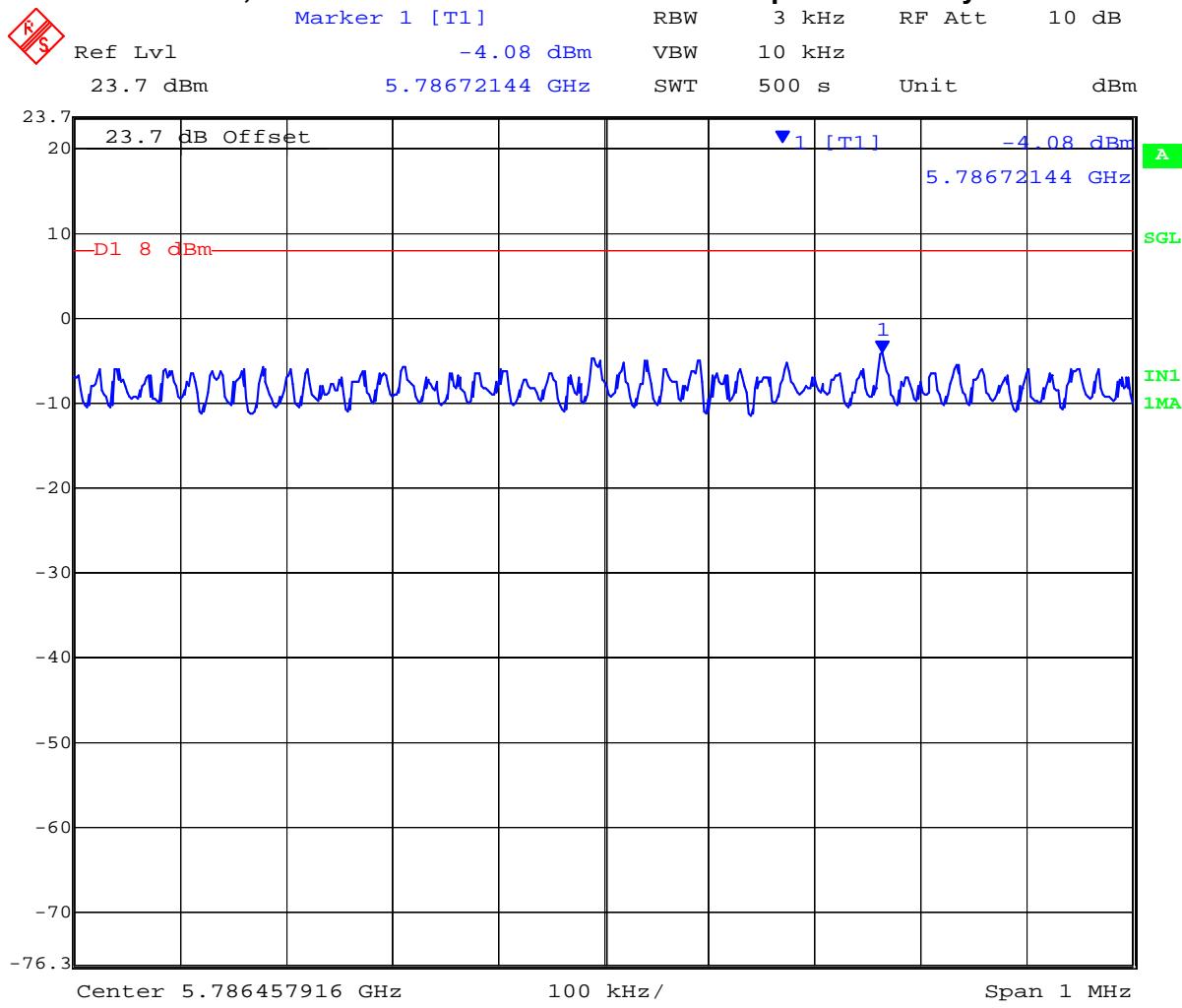
TABLE OF RESULTS – 64 QAM 5 MHz BW

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dBm)
5,735	5733.35371	-5.87	+8	-13.87
5,785	5786.72144	-4.08	+8	-12.08
5,840	5841.72144	-4.21	+8	-12.21



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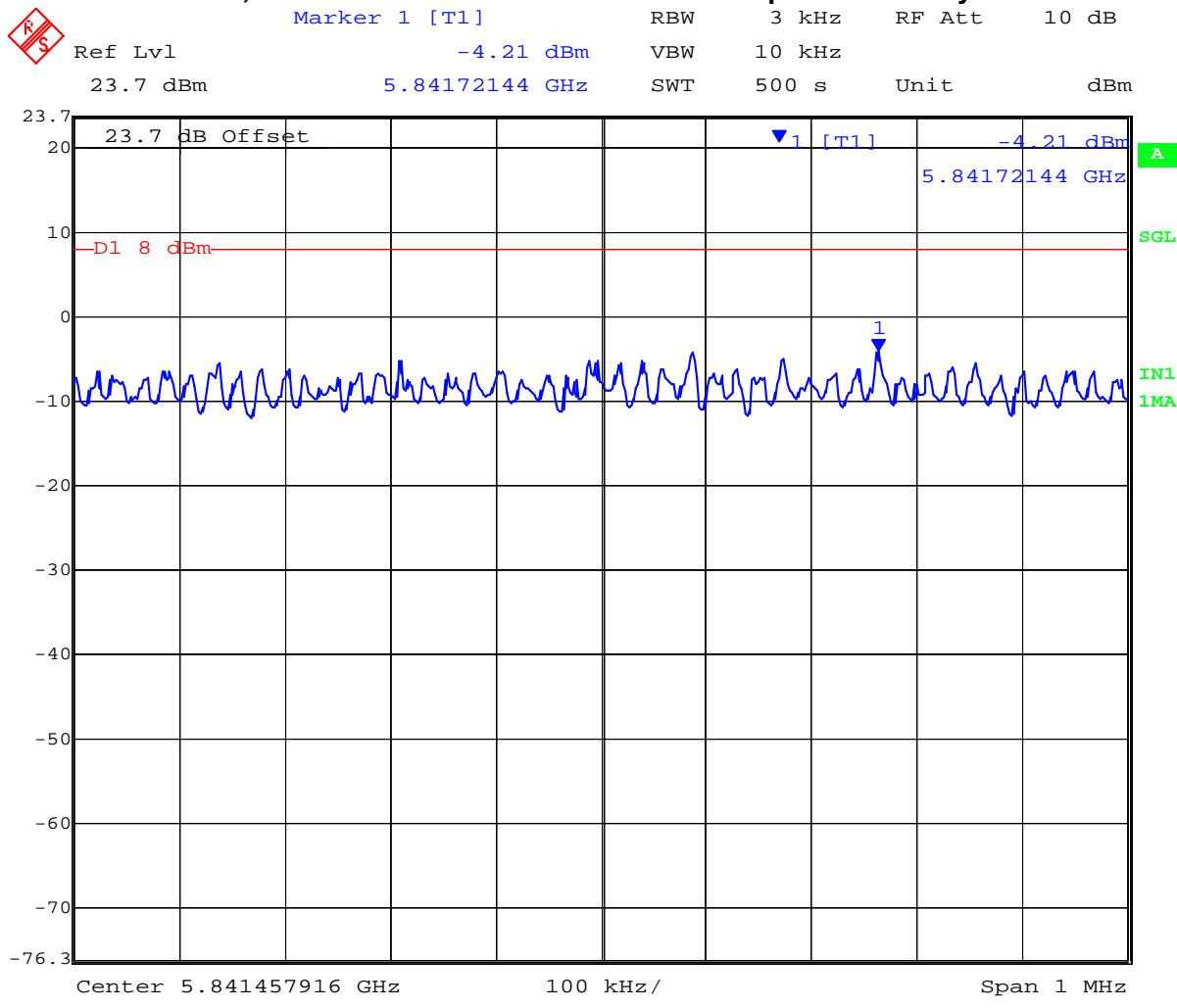
5,785 MHz 64 QAM 5 MHz Peak Power Spectral Density



Date: 27.SEP.2007 13:53:25

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5,840 MHz 64 QAM 5 MHz Peak Power Spectral Density

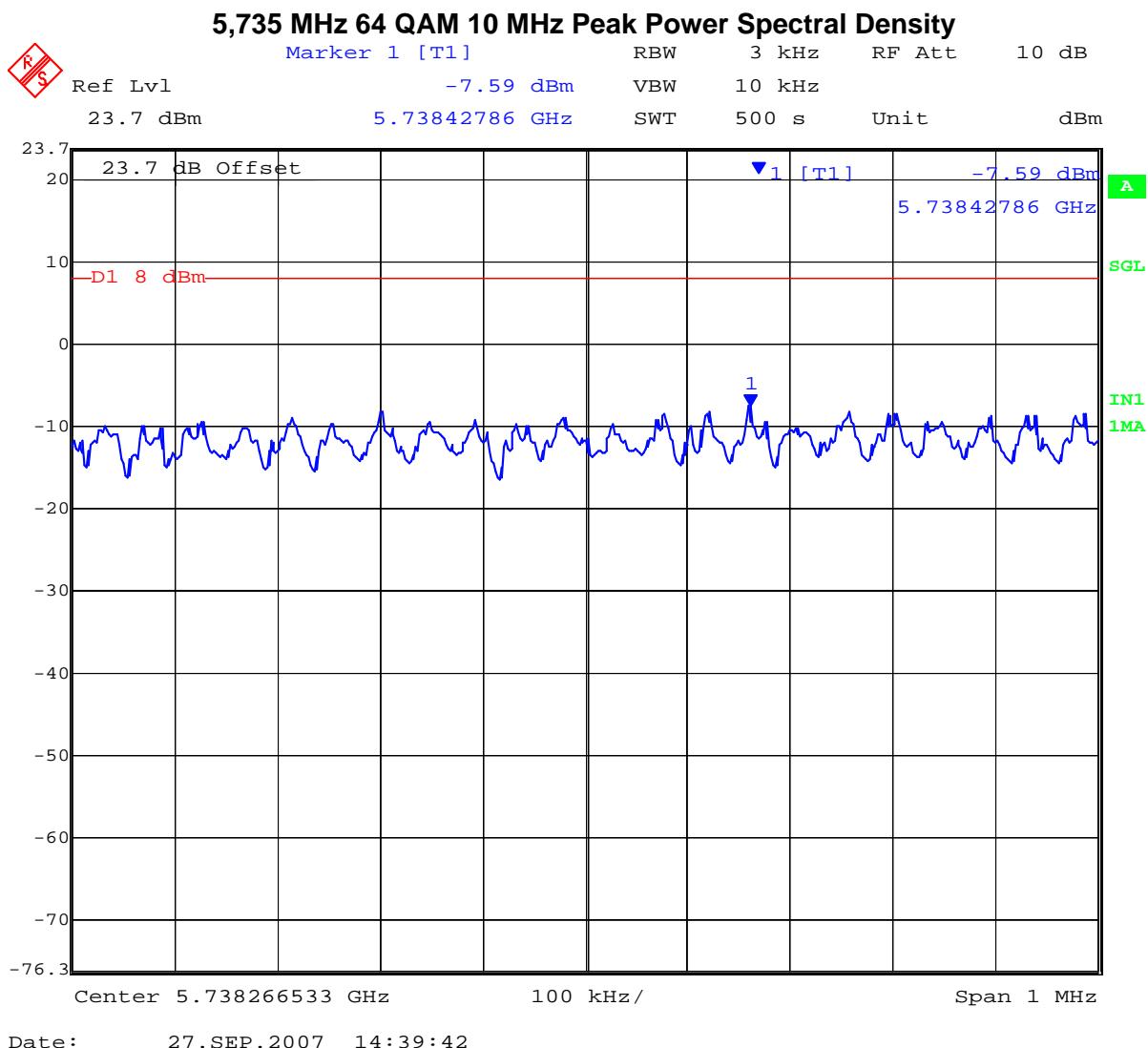


Date: 27.SEP.2007 14:05:33

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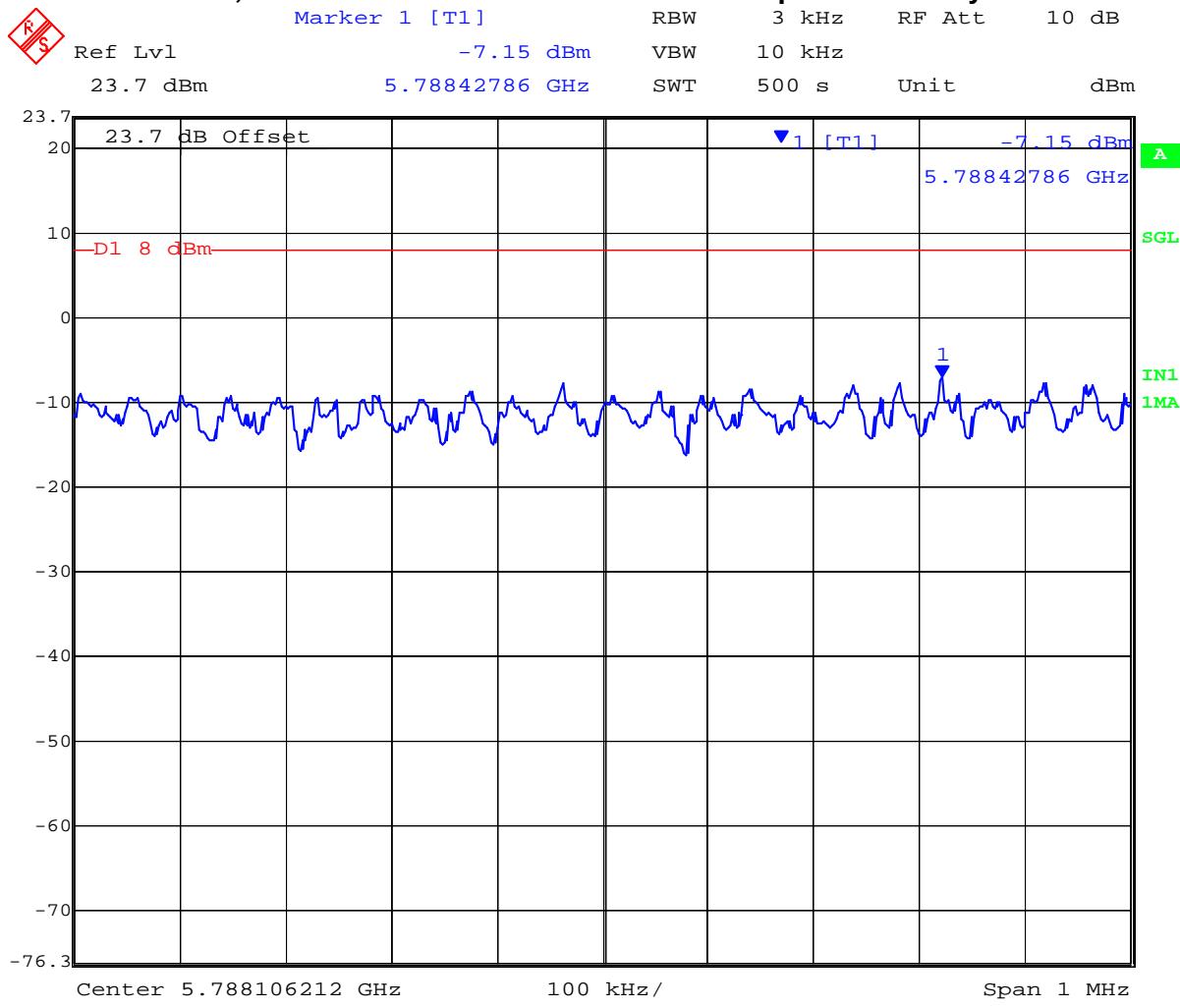
TABLE OF RESULTS – 64 QAM 10 MHz BW

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dBm)
5,735	5738.42786	-7.59	+8	-15.59
5,785	5788.42786	-7.15	+8	-15.15
5,840	5843.42786	-6.74	+8	-14.74



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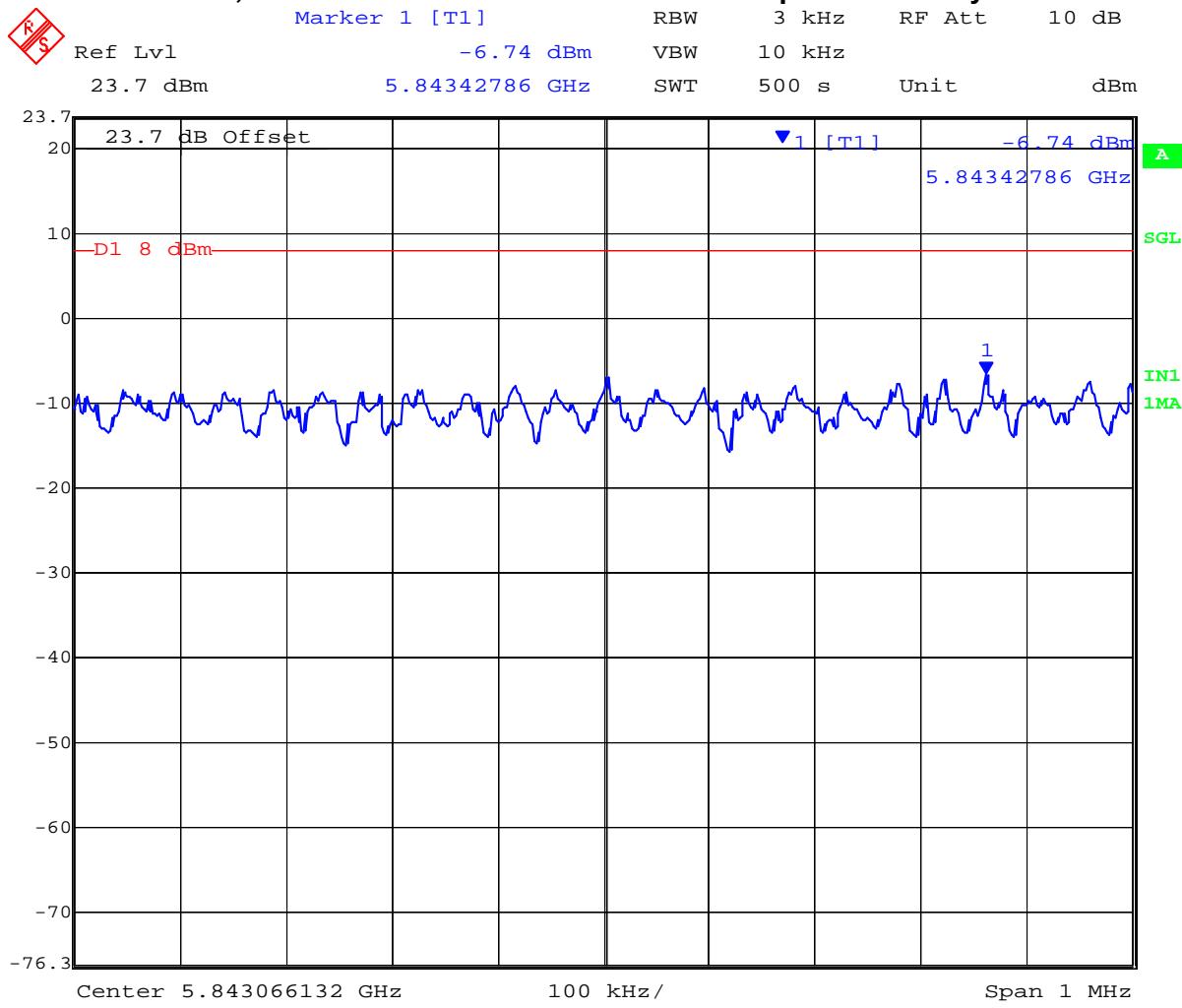
5,785 MHz 64 QAM 10 MHz Peak Power Spectral Density



Date: 27.SEP.2007 14:27:53

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5,840 MHz 64 QAM 10 MHz Peak Power Spectral Density

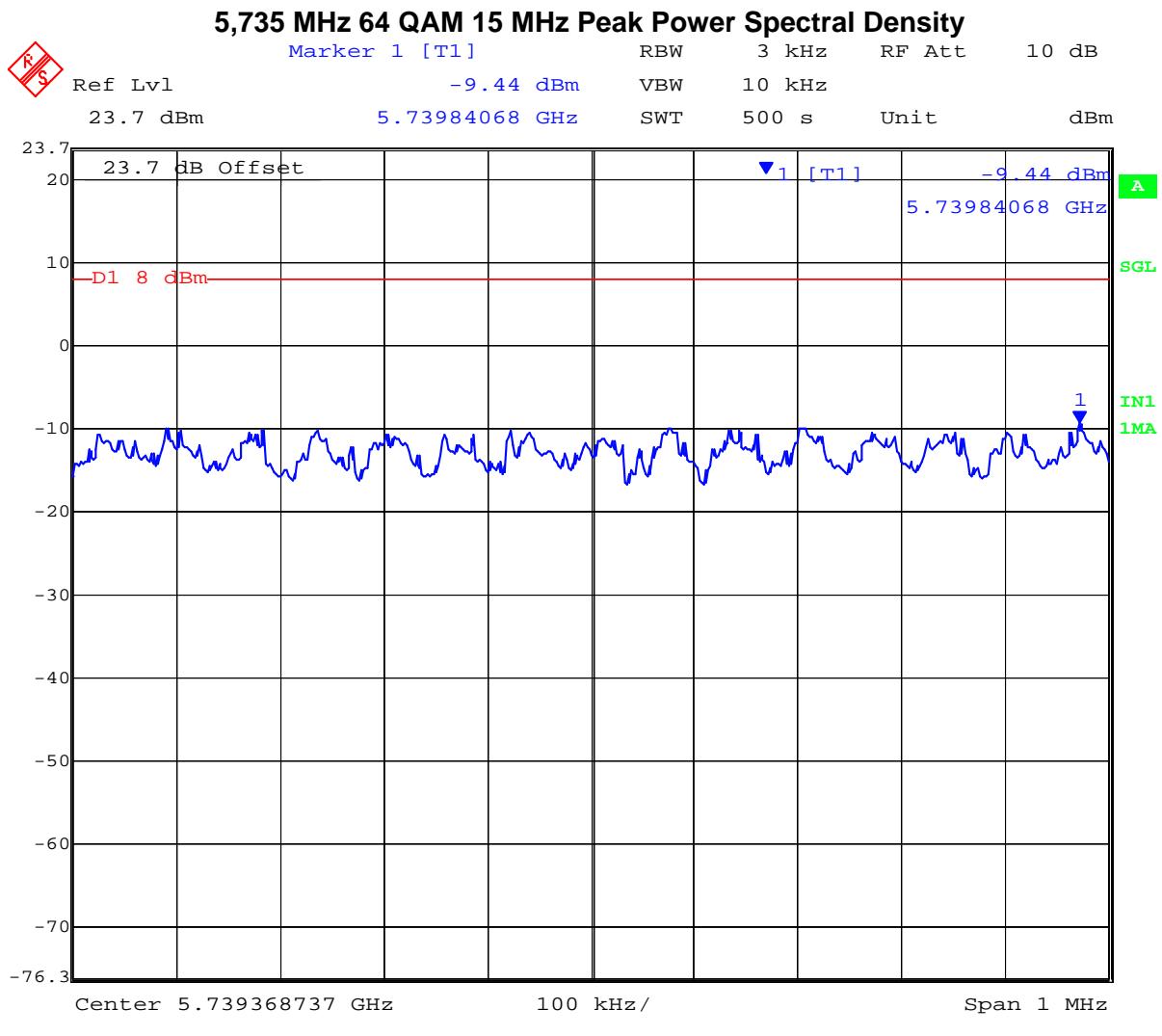


Date: 27.SEP.2007 14:17:52

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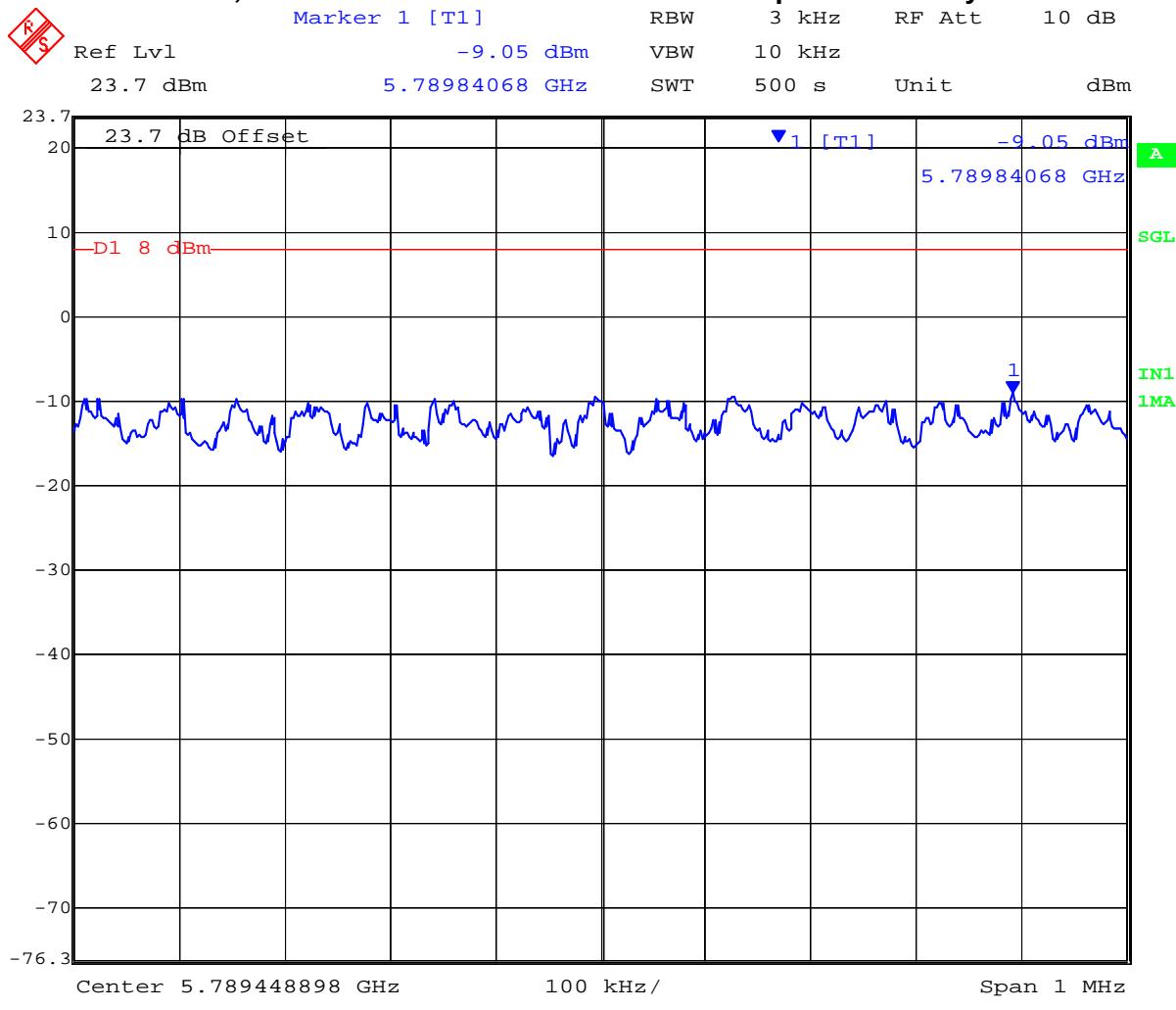
TABLE OF RESULTS – 64 QAM 15 MHz BW

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dBm)
5,735	5739.84068	-9.44	+8	-17.44
5,785	5789.84068	-9.05	+8	-17.05
5,840	5837.45591	-8.25	+8	-16.25



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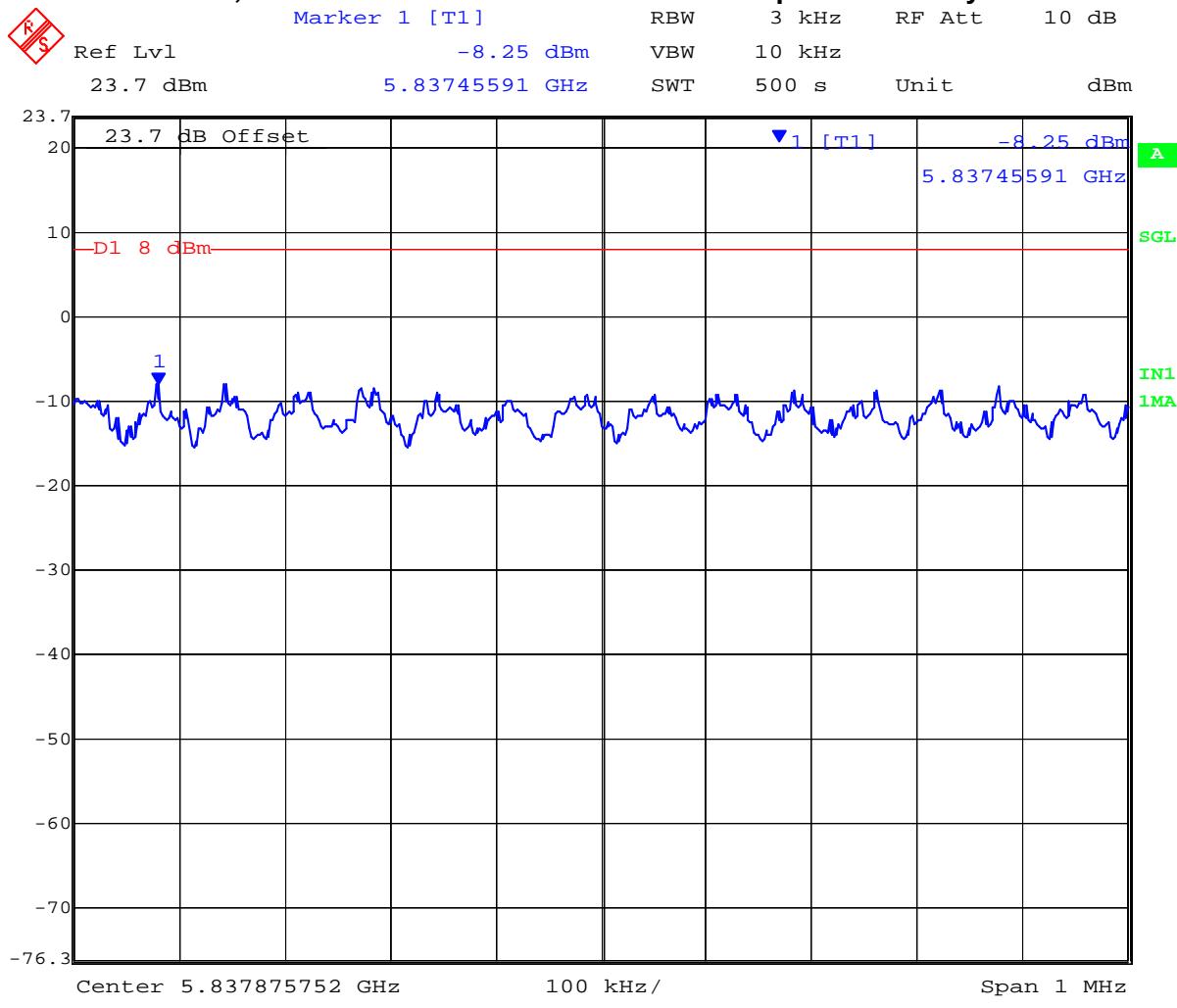
5,785 MHz 64 QAM 15 MHz Peak Power Spectral Density



Date: 27.SEP.2007 15:55:10

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5,840 MHz 64 QAM 15 MHz Peak Power Spectral Density



Date: 27.SEP.2007 16:04:52

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Title: Axxcelera AB-MAX Customer Premise Equipment
To: FCC 47 CFR Part15.247 & IC RSS-210
Serial #: AXXC08-A8b Rev A
Issue Date: 2nd November 2007
Page: 48 of 91

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
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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

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Title: Axxcelera AB-MAX Customer Premise Equipment
To: FCC 47 CFR Part15.247 & IC RSS-210
Serial #: AXXC08-A8b Rev A
Issue Date: 2nd November 2007
Page: 49 of 91

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 = P_d (mW/cm²) = EIRP/(4πd²)

EIRP = P * G P = Peak output power (mW)

G = Antenna numeric gain (numeric)

d = Separation distance (cm)

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

Because the EUT belongs to the General Population/Uncontrolled Exposure the limit of power density is 1.0 mW/cm²

Freq. Band (GHz)	Antenna Gain (dBi)	Numeric Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Calculated Safe Distance @ 1mW/cm ² Limit(cm)	Minimum Separation Distance (cm)
5.8	16.0	39.81	+26.62	459.2	38.10	38.10

Specification

Maximum Permissible Exposure Limits

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

FCC §1.1310 Limit = 1mW / cm² from 1.310 Table 1

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

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB
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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

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

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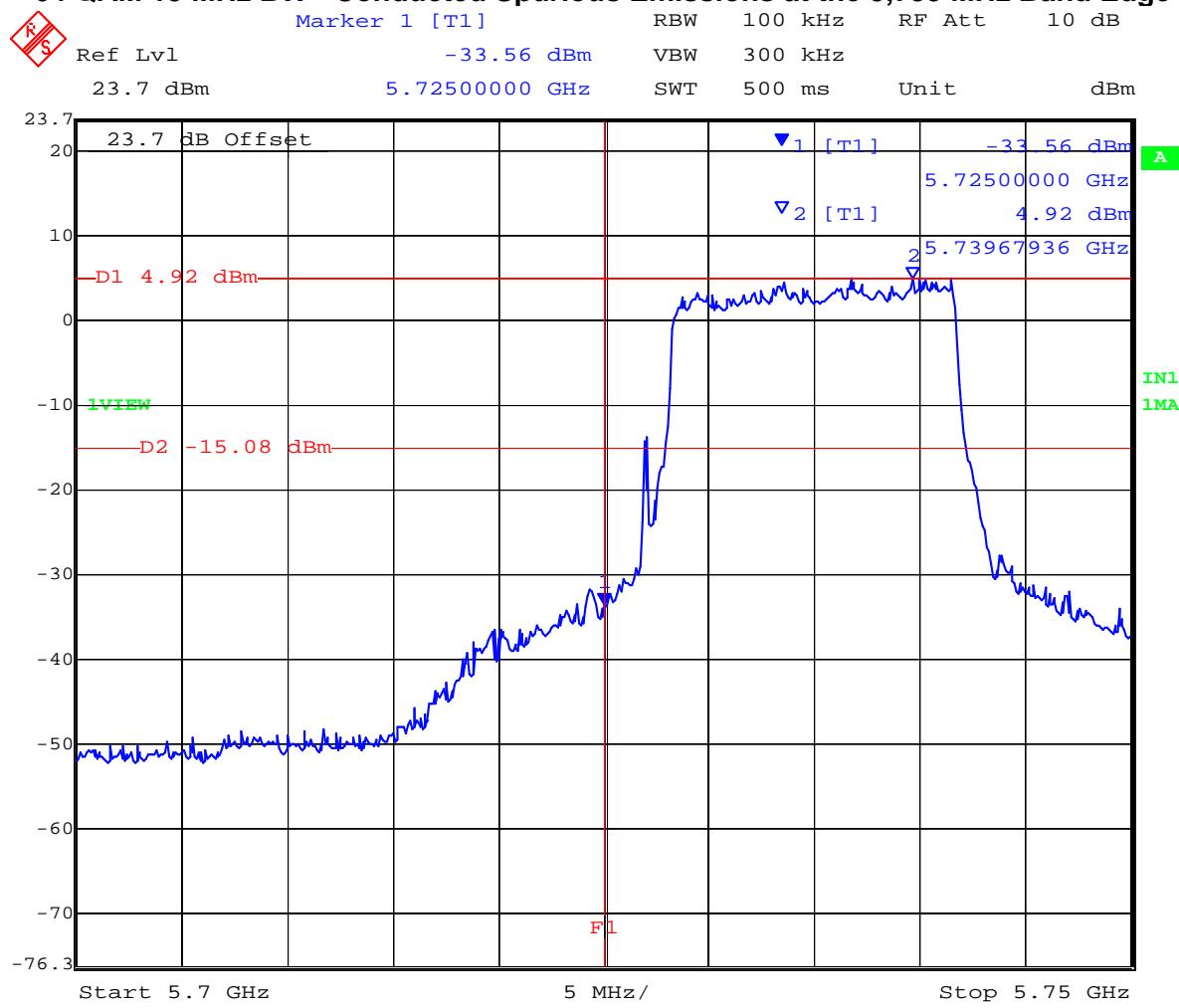
Conducted Band-Edge Results

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

TABLE OF RESULTS – 64 QAM 15 MHz BW

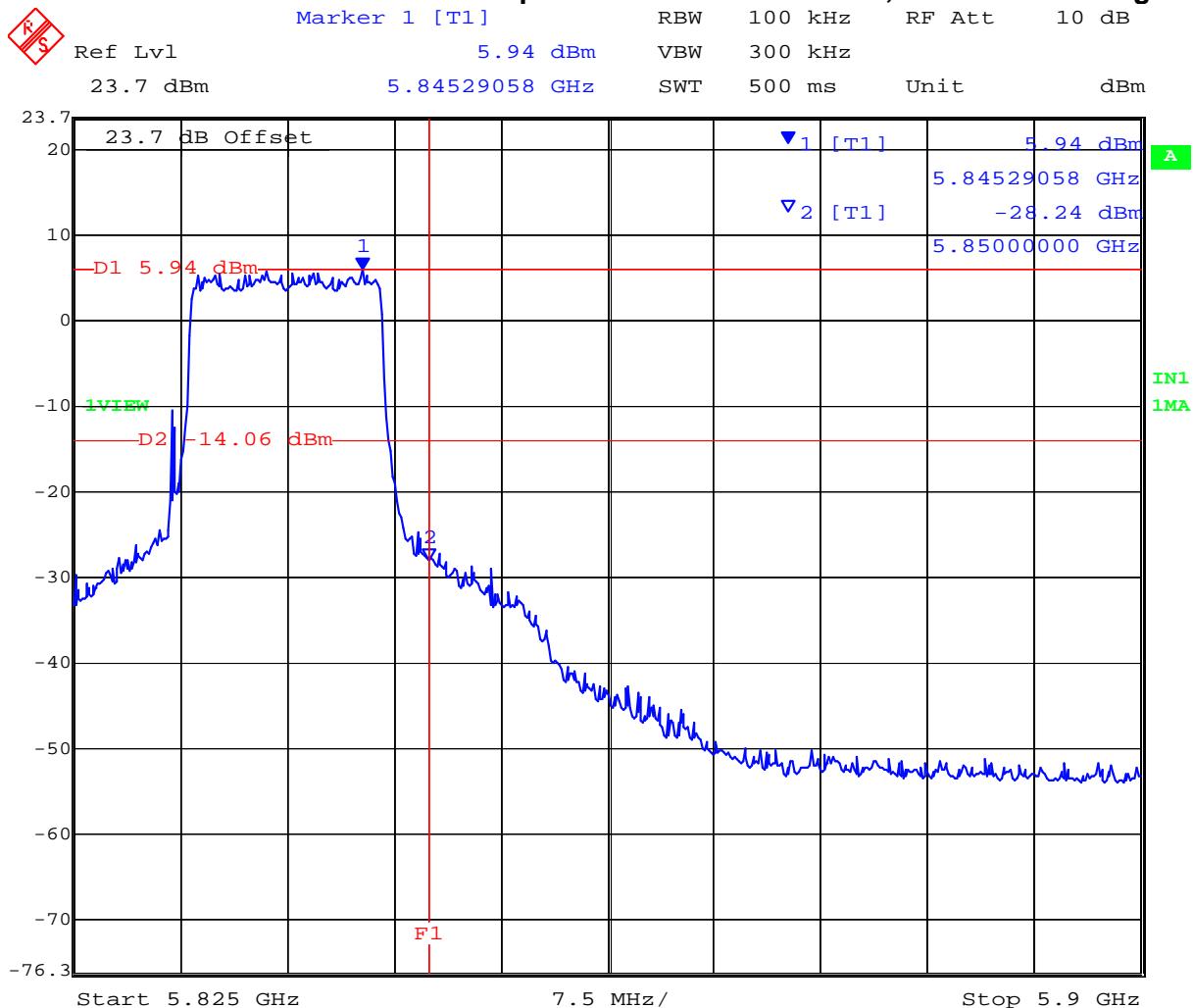
Center Frequency (MHz)	Band edge Frequency (MHz)	Limit (20 dB below peak of fundamental)	Amplitude @ Band edge (dBm)	Margin (dB)
5,735	5,725	-15.08	-33.56	-18.48
5,840	5,850	-14.06	-28.24	-14.18

64 QAM 15 MHz BW - Conducted Spurious Emissions at the 5,735 MHz Band Edge



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64 QAM 15 MHz BW - Conducted Spurious Emissions at the 5,840 MHz Band Edge



Date: 27.SEP.2007 16:08:33

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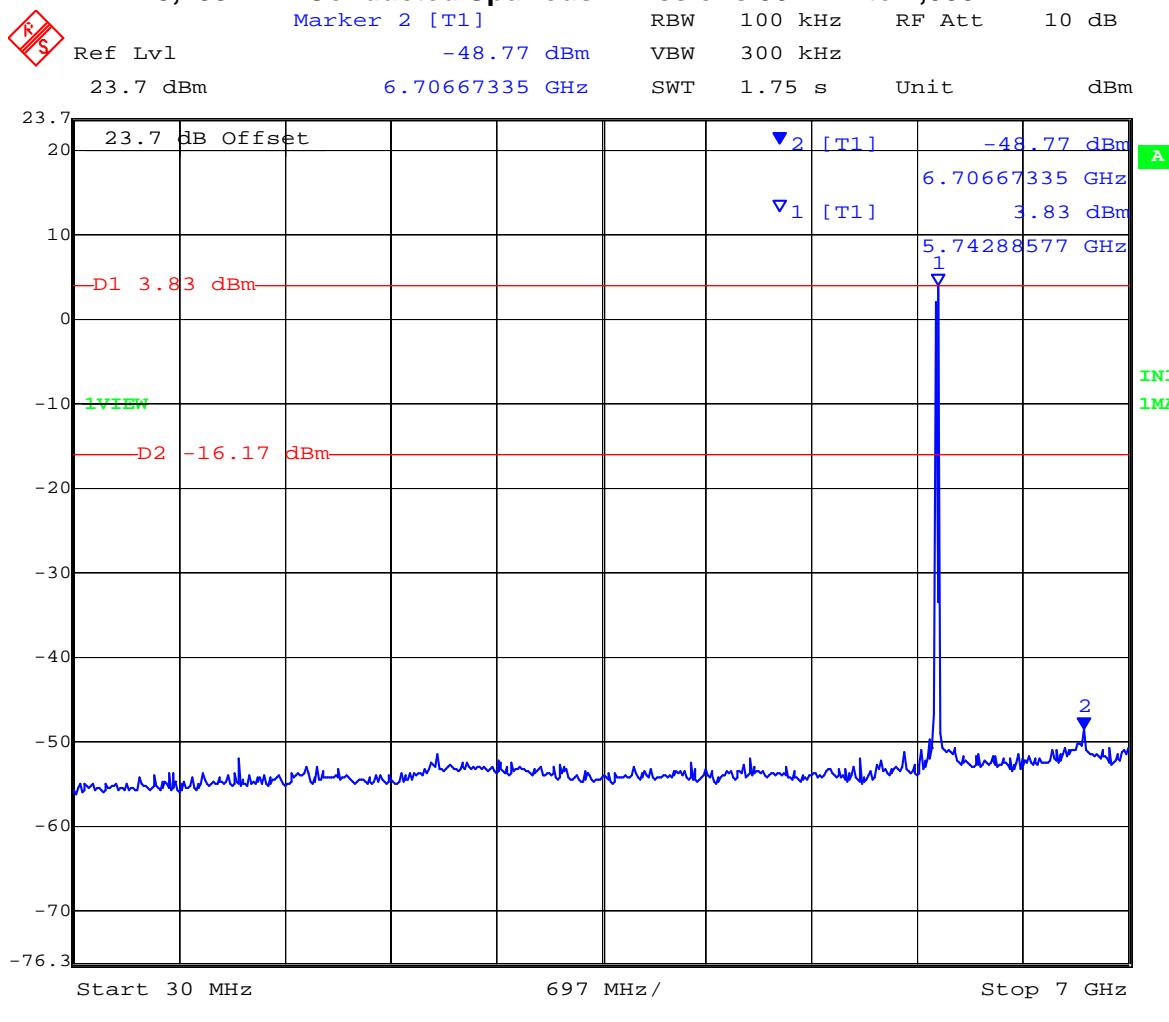
Spurious Emissions (30 - 40,000 MHz)

TABLE OF RESULTS – 64 QAM 15 MHz BW

Channel Centre Frequency (MHz)	Start Frequency(MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
5,735	30	7,000	-48.77	-16.17	-32.60
5,735	7,000	40,000	-43.00	-16.17	-26.83

64 QAM 15 MHz BW

5,735 MHz Conducted Spurious Emissions 30 MHz to 7,000 MHz

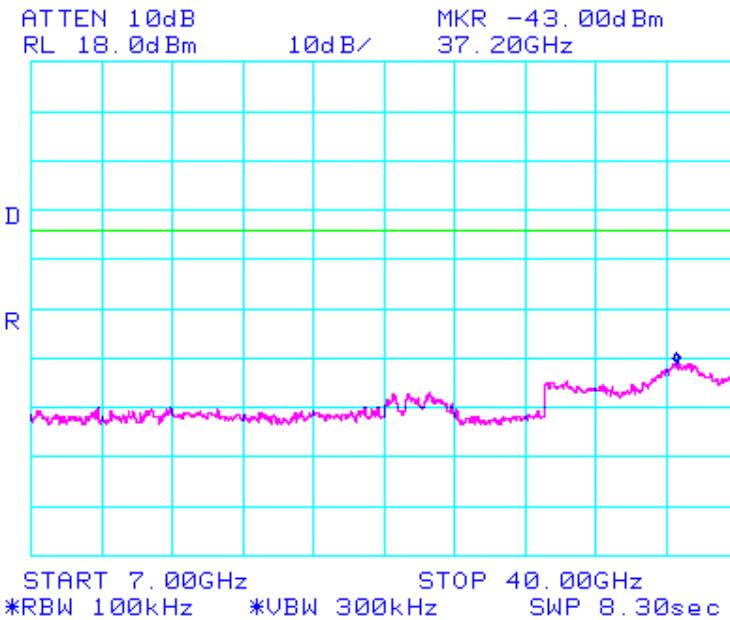


Date: 27.SEP.2007 16:15:13

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64 QAM 15 MHz BW

5,735 MHz Conducted Spurious Emissions 7,000 MHz to 40,000 MHz



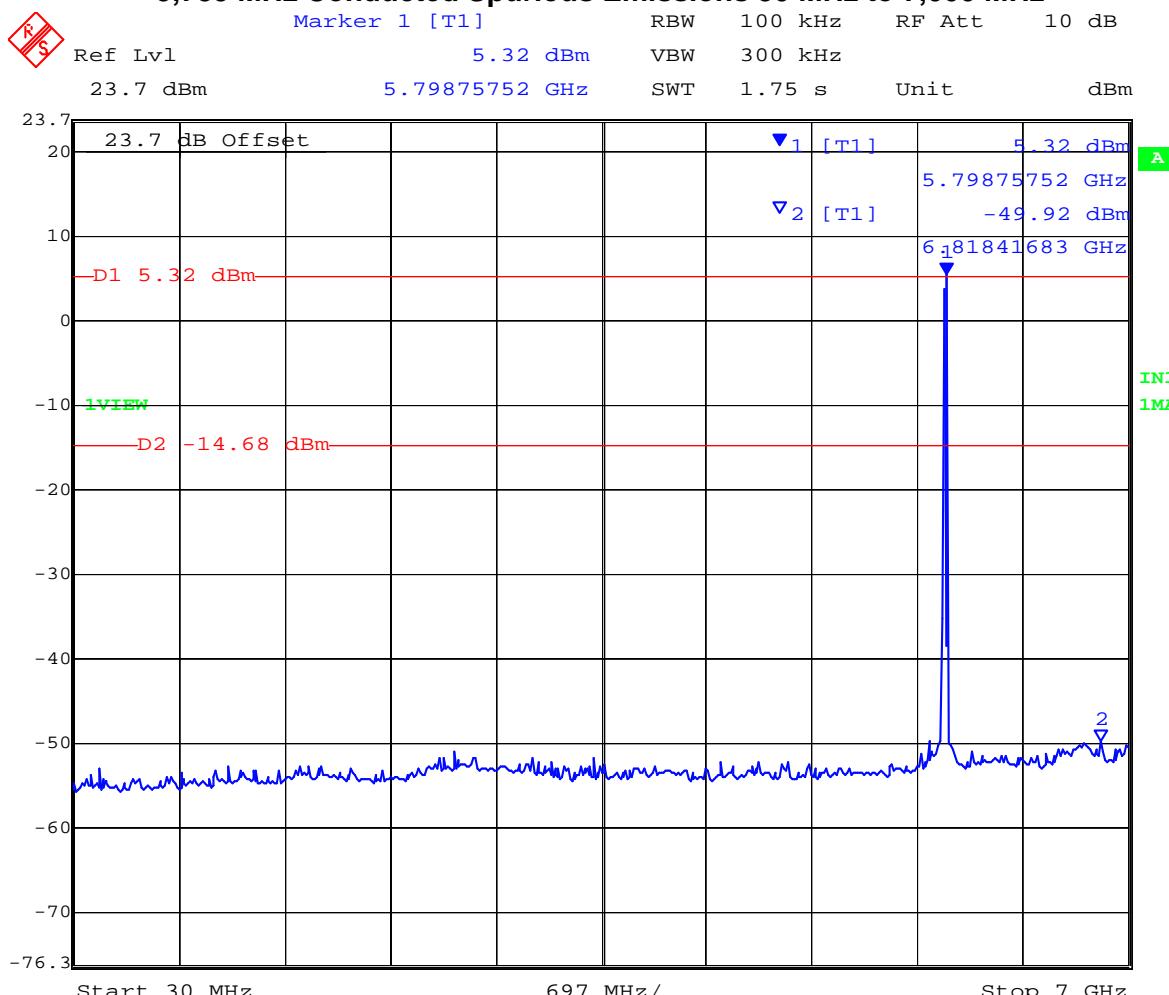
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TABLE OF RESULTS – 64 QAM 15 MHz BW

Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
5,785	30	7,000	-49.92	-14.68	-35.24
5,785	7,000	40,000	-42.83	-14.68	-28.15

64 QAM 15 MHz BW

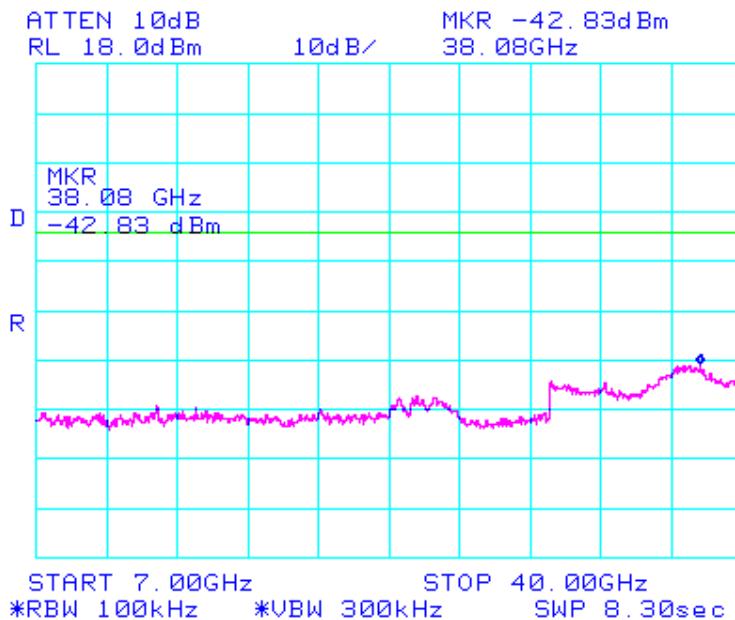
5,785 MHz Conducted Spurious Emissions 30 MHz to 7,000 MHz



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64 QAM 15 MHz BW

5,785 MHz Conducted Spurious Emissions 7,000 MHz to 40,000 MHz



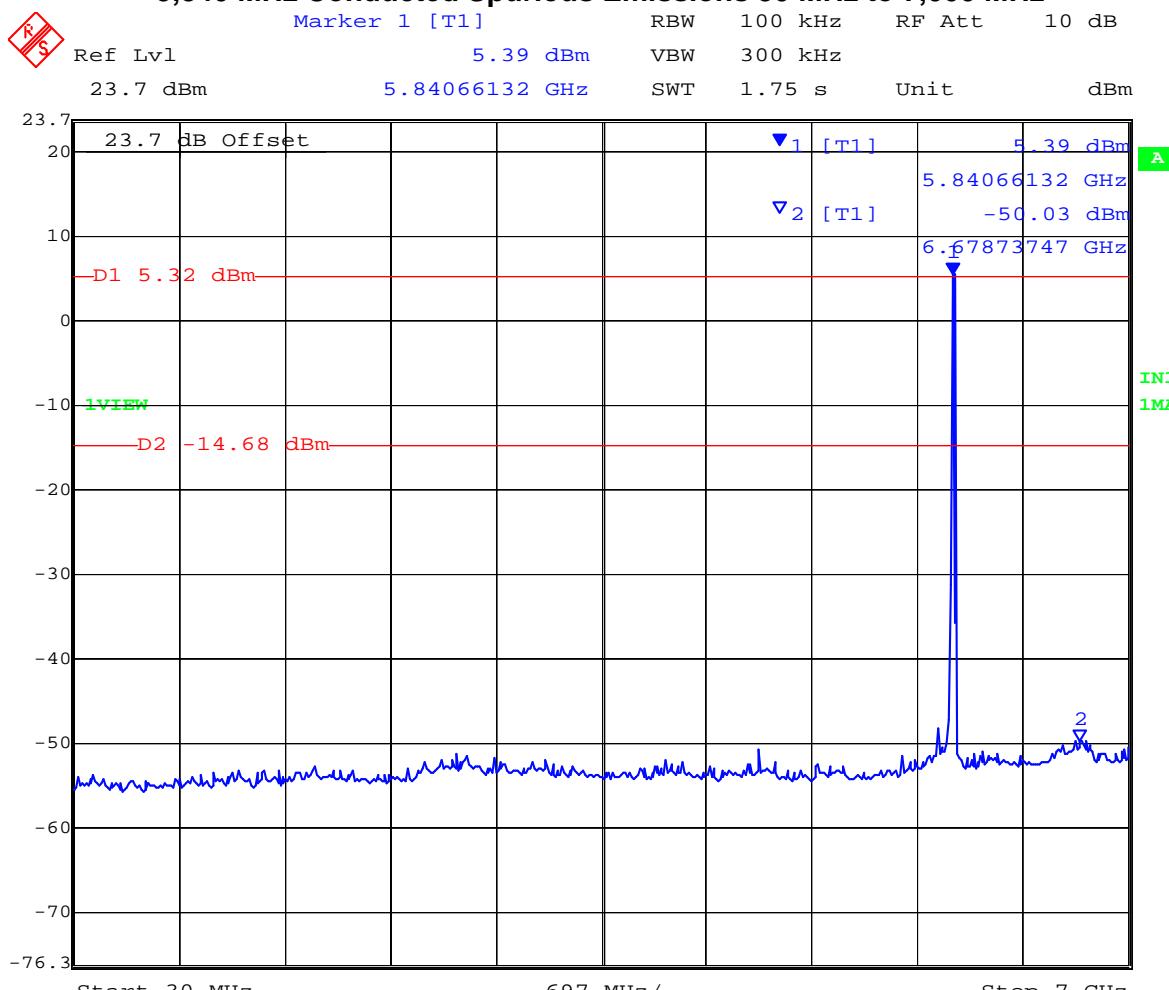
This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.

TABLE OF RESULTS – 64 QAM 15 MHz BW

Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
5,840	30	7,000	-50.03	-14.68	-35.35
5,840	7,000	40,000	-42.17	-14.68	-27.49

64 QAM 15 MHz BW

5,840 MHz Conducted Spurious Emissions 30 MHz to 7,000 MHz

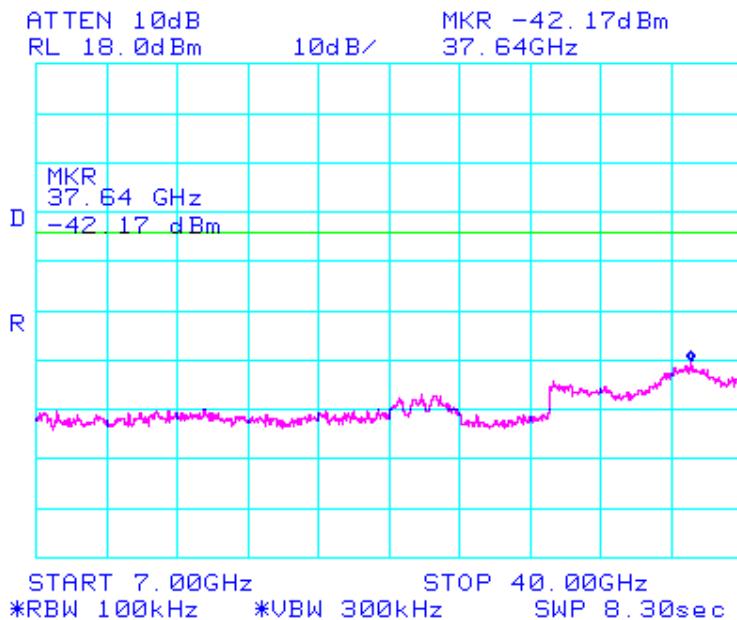


Date: 27.SEP.2007 16:20:51

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64 QAM 15 MHz BW

5,840 MHz Conducted Spurious Emissions 7,000 MHz to 40,000 MHz



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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
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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.

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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

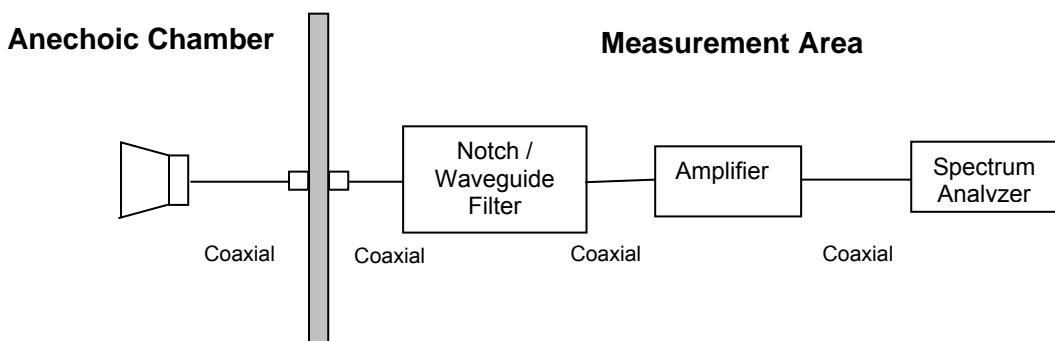
Industry Canada RSS-Gen §4.7

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

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Title: Axxcelera AB-MAX Customer Premise Equipment
To: FCC 47 CFR Part15.247 & IC RSS-210
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For example:

Given receiver input reading of 51.5 dB μ V; 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:

$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3 \text{ dB}\mu\text{V/m}$$

Conversion between dB μ V/m (or dB μ V) and μ V/m (or μ V) are done as:

$$\text{Level (dB}\mu\text{V/m)} = 20 * \text{Log} (\text{level (}\mu\text{V/m)})$$

$$40 \text{ dB}\mu\text{V/m} = 100 \mu\text{V/m}$$

$$48 \text{ dB}\mu\text{V/m} = 250 \mu\text{V/m}$$

Maximum Emissions

It was found that the CPE lying flat on the polystyrene table was the worst case orientation for radiated emissions.

Some evaluation testing was performed first of all to determine which of the four different modulation schemes (BPSK, QPSK, 16QAM AND 64QAM) had the worst radiated emissions. It was determined as a result of these test that the 64QAM modulation represent the worst case radiated emissions.

The results of these tests are held on file.

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Radiated Spurious Emissions above 1 GHz -

TABLE OF RESULTS - 5,785 MHz BPSK 10 MHz BW

Peak

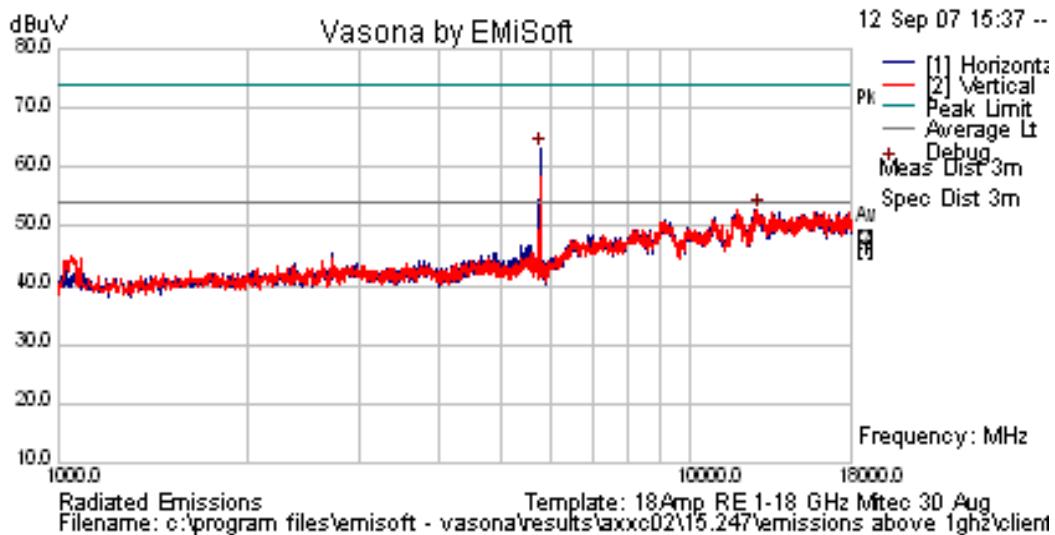
Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Peak Field Strength (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)

Average

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

The emission breaking the Average limit line is the Transmitter fundamental.

Radiated Emissions - 5,785 MHz BPSK 10 MHz BW



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Radiated Spurious Emissions above 1 GHz

Ambient conditions.

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

Radiated Spurious Emissions above 1 GHz

TABLE OF RESULTS - 5,735 MHz 64 QAM 5 MHz BW

Peak

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Peak Field Strength (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)
*1855.000	H	58.00	-7.57	50.43	74	-23.57
12663.170	V	48.91	+6.38	55.24	74	-18.76

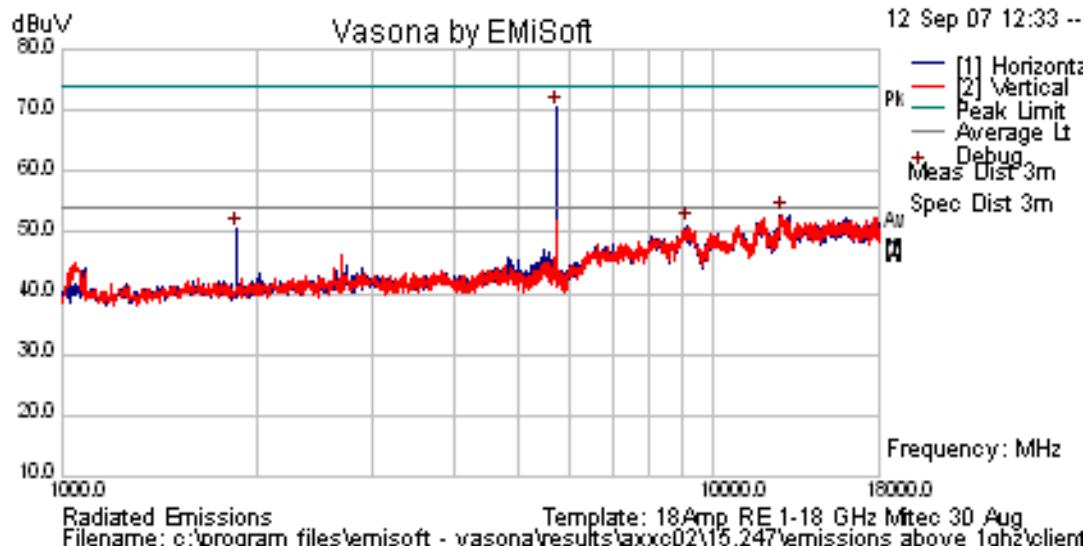
* Non-restricted band. No further investigation of the emission is required.

Average

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Average Field Strength (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)
12663.170	H	35.91	+6.38	42.24	54	-11.76

The peak emission crossing the Average Emission limit line is the transmitter Fundamental Frequency.

Radiated Emissions - 5,735 MHz 64 QAM 5 MHz BW



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Radiated Spurious Emissions above 1 GHz

TABLE OF RESULTS - 5,785 MHz 64 QAM 5 MHz BW

Peak

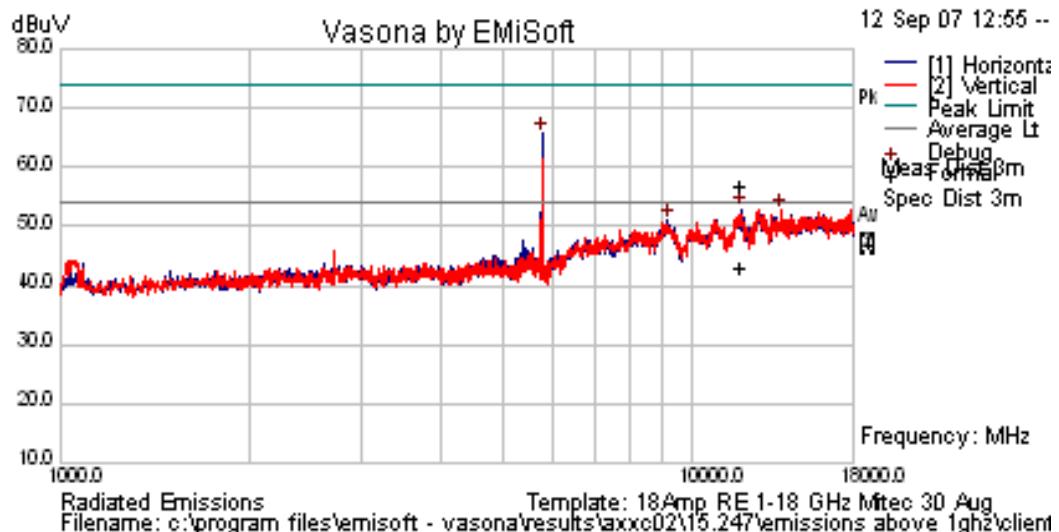
Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Peak Field Strength (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)
11938.79	V	48.90	+6.1	55.00	74	-19.00

Average

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Average Field Strength (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)
11938.79	V	35.07	+6.1	41.17	54	-12.83

The peak emission crossing the Average Emission limit line is the transmitter Fundamental Frequency.

Radiated Emissions - 5,785 MHz 64 QAM 5 MHz BW



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Radiated Spurious Emissions above 1 GHz

TABLE OF RESULTS - 5,840 MHz 64 QAM 5 MHz BW

Peak

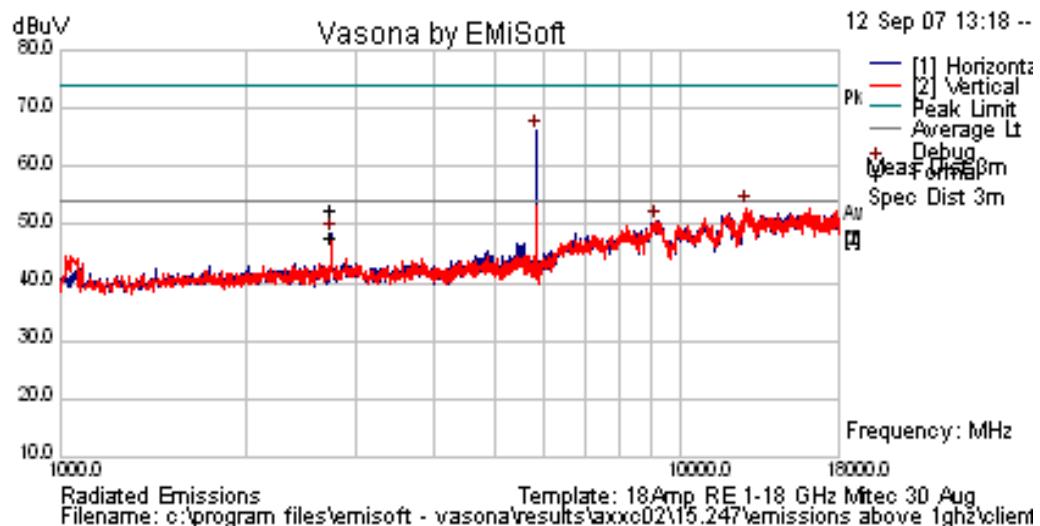
Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Peak Field Strength (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)
2736.189	H	57.71	-7.03	50.68	74	-23.32

Average

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Average Field Strength (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)
2736.189	H	52.69	-7.03	45.66	54	-8.34

The peak emission crossing the Average Emission limit line is the transmitter Fundamental Frequency.

Radiated Emissions - 5,840 MHz 64 QAM 5 MHz BW



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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 - 5,735 MHz 64 QAM 10 MHz BW

Peak

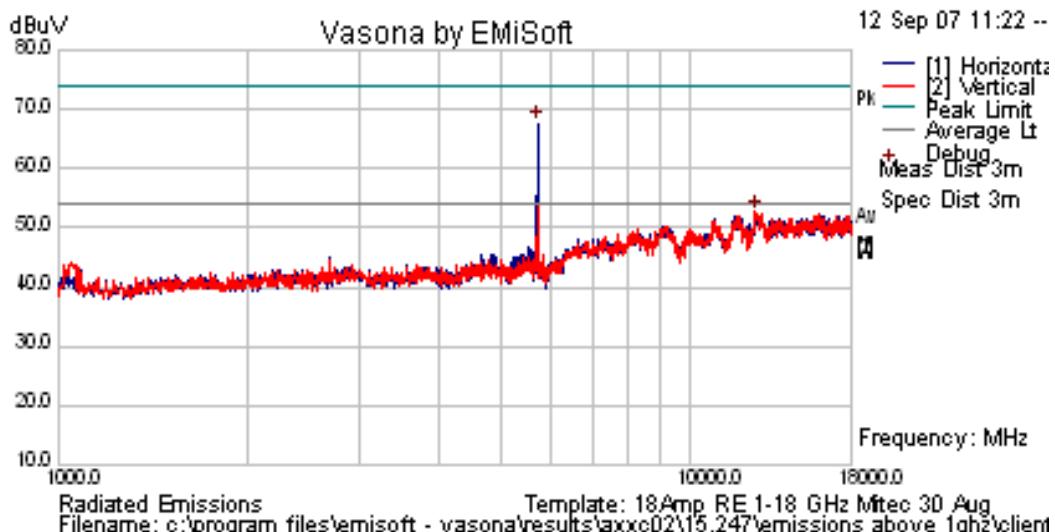
Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Peak Field Strength (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)
12663.170	V	48.91	+6.38	55.19	74	-18.81

Average

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Average Field Strength (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)
12663.170	H	35.91	+6.38	42.19	54	-11.81

The peak emission crossing the Average Emission limit line is the transmitter Fundamental Frequency.

Radiated Emissions - 5,735 MHz 64 QAM 10 MHz BW



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Radiated Spurious Emissions above 1 GHz

TABLE OF RESULTS - 5,785 MHz 64 QAM 10 MHz BW

Peak

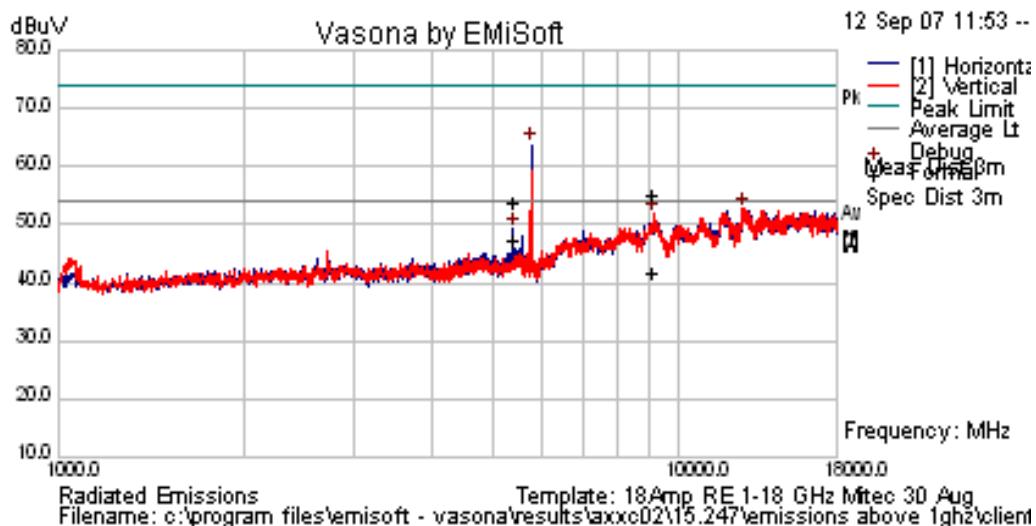
Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Peak Field Strength (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)
5416.031	H	55.63	-3.86	51.77	74	-22.23
9137.22	H	47.42	+5.65	53.07	74	-20.93
126661.70	V	48.91	+6.38	55.29	74	-18.71

Average

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Average Field Strength (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)
5416.031	H	49.35	-3.86	45.49	54	-8.51
9137.22	H	34.01	+5.65	39.66	54	-14.34
12661.70	H	35.91	+6.38	42.29	54	-11.71

The peak emission crossing the Average Emission limit line is the transmitter Fundamental Frequency.

Radiated Emissions - 5,785 MHz 64 QAM 10 MHz BW



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Radiated Spurious Emissions above 1 GHz

TABLE OF RESULTS - 5,840 MHz 64 QAM 10 MHz BW

Peak

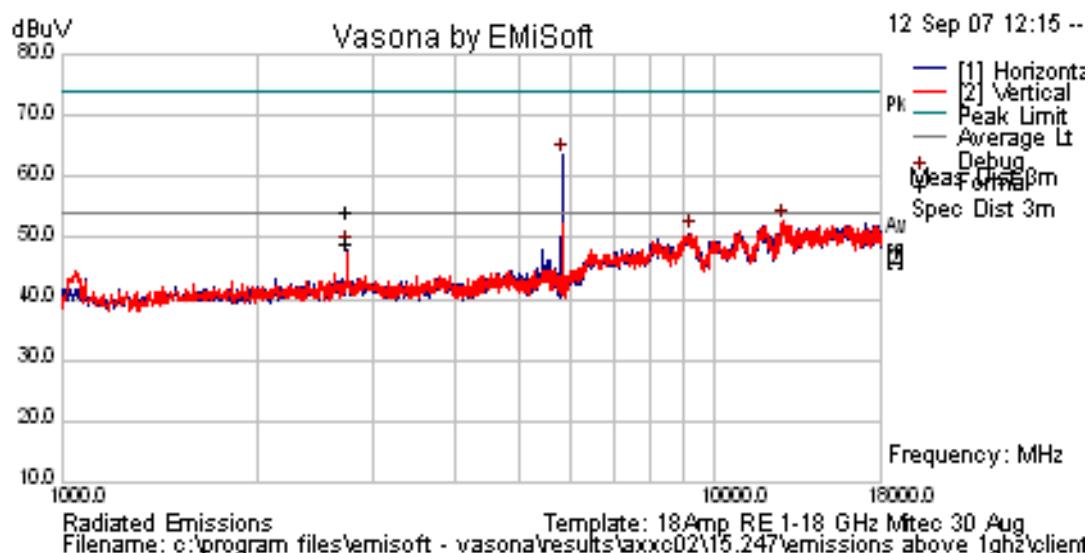
Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Peak Field Strength (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)
2736.01	H	59.09	-7.03	52.06	74	-21.94

Average

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Average Field Strength (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)
2736.01	H	54.19	-7.03	47.16	54	-6.84

The peak emission crossing the Average Emission limit line is the transmitter Fundamental Frequency.

Radiated Emissions - 5,840 MHz 64 QAM 10 MHz BW



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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 - 5,735 MHz 64 QAM 15 MHz BW

Peak

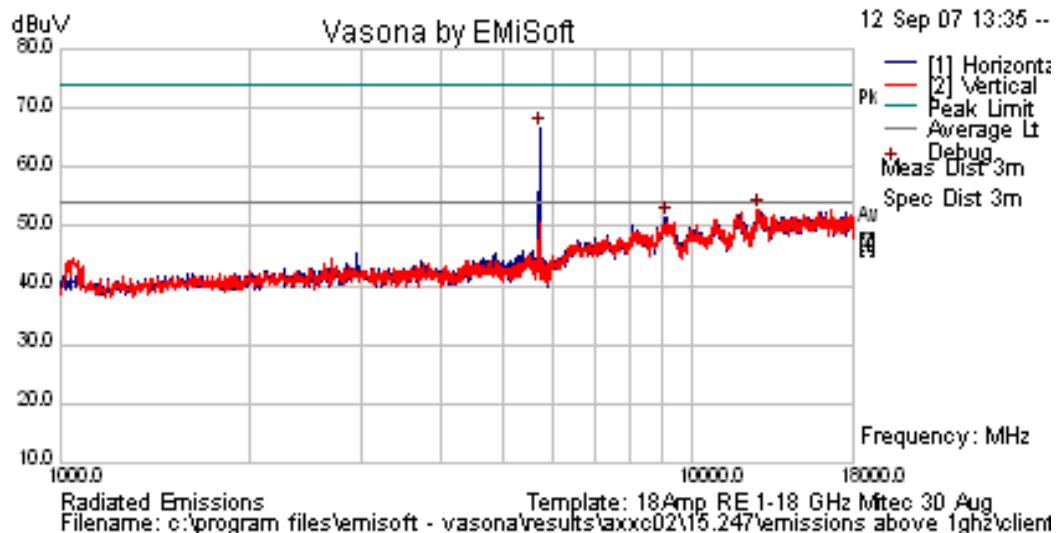
Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Peak Field Strength (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)

Average

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

The peak emission crossing the Average Emission limit line is the transmitter Fundamental Frequency.

Radiated Emissions - 5,735 MHz 64 QAM 15 MHz BW



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Radiated Spurious Emissions above 1 GHz

TABLE OF RESULTS - 5,785 MHz 64 QAM 15 MHz BW

Peak

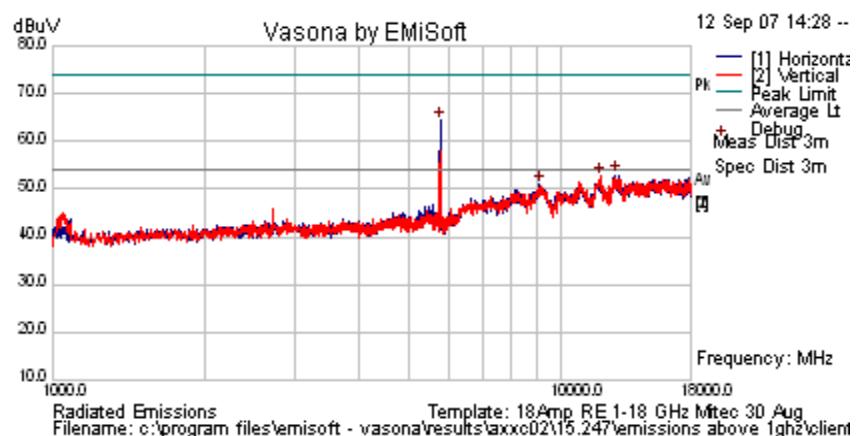
Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Peak Field Strength (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)
					74	
					74	

Average

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Average Field Strength (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)
					54	
					54	

The peak emission crossing the Average Emission limit line is the transmitter Fundamental Frequency.

Radiated Emissions - 5,785 MHz 64 QAM 15 MHz BW



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Radiated Spurious Emissions above 1 GHz

TABLE OF RESULTS - 5,840 MHz 64 QAM 15 MHz BW

Peak

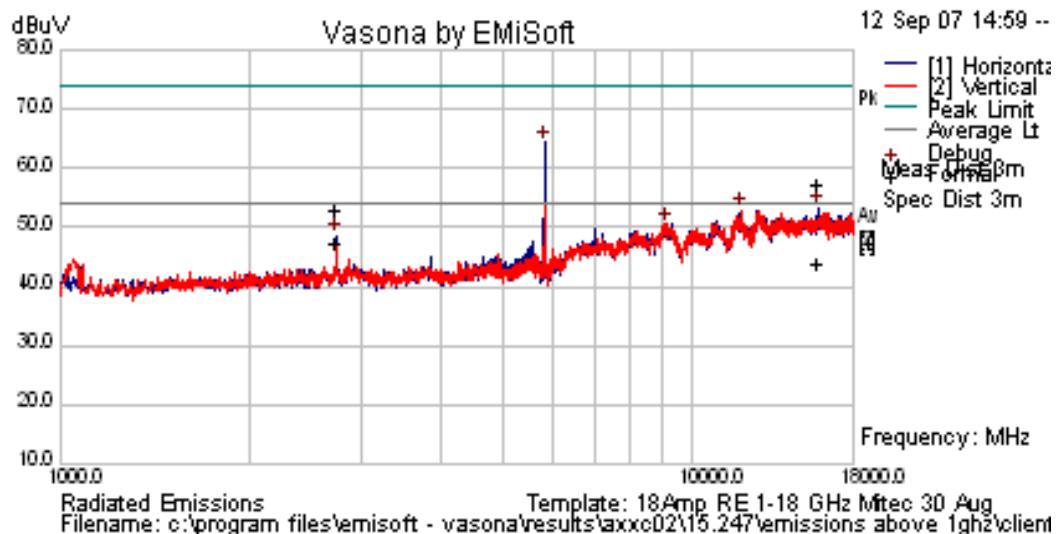
Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Peak Field Strength (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)
2733.886	H	57.79	-7.03	50.76	74	-23.24
15841.44	H	47.59	+7.82	55.41	74	-18.59

Average

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Average Field Strength (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)
2733.886	H	52.42	-7.03	45.39	54	-8.61
15841.44	V	34.00	+7.82	41.82	54	-12.19

The peak emission crossing the Average Emission limit line is the transmitter Fundamental Frequency.

Radiated Emissions - 5,840 MHz 64 QAM 15 MHz BW



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Peak Field Strength Measurements

Peak Field Strength Measurements

TABLE OF RESULTS – - 64 QAM 5 MHZ BW

Tx Freq. (MHz)	Measured Peak Field Strength Emission (dBuV/m)
5,735	130.34
5,785	131.41
5,840	130.15

TABLE OF RESULTS – - 64 QAM 10 MHZ BW

Tx Freq. (MHz)	Measured Peak Field Strength Emission (dBuV/m)
5,785	127.58

TABLE OF RESULTS – - 64 QAM 15 MHZ BW

Tx Freq. (MHz)	Measured Peak Field Strength Emission (dBuV/m)
5,785	127.85

Peak field strength emission plots are held on file by the laboratory

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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.



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Frequency (MHz)	Field Strength (μ V/m)	Field Strength (dB μ V/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
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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

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5.1.6.2. Receiver Radiated Spurious Emissions (above 1 GHz)

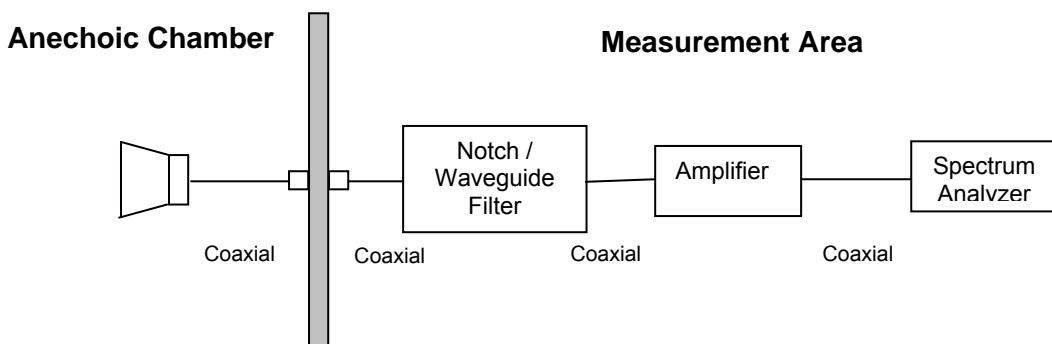
Industry Canada RSS-Gen §4.8, §6

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



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For example:

Given receiver input reading of 51.5 dB μ V; 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:

$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3 \text{ dB}\mu\text{V/m}$$

Conversion between dB μ V/m (or dB μ V) and μ V/m (or μ V) are done as:

$$\text{Level (dB}\mu\text{V/m)} = 20 * \text{Log} (\text{level} (\mu\text{V/m}))$$

$$40 \text{ dB}\mu\text{V/m} = 100 \mu\text{V/m}$$

$$48 \text{ dB}\mu\text{V/m} = 250 \mu\text{V/m}$$

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Receiver Radiated Spurious Emissions above 1 GHz

TABLE OF RESULTS - 64 QAM 10 MHz BW

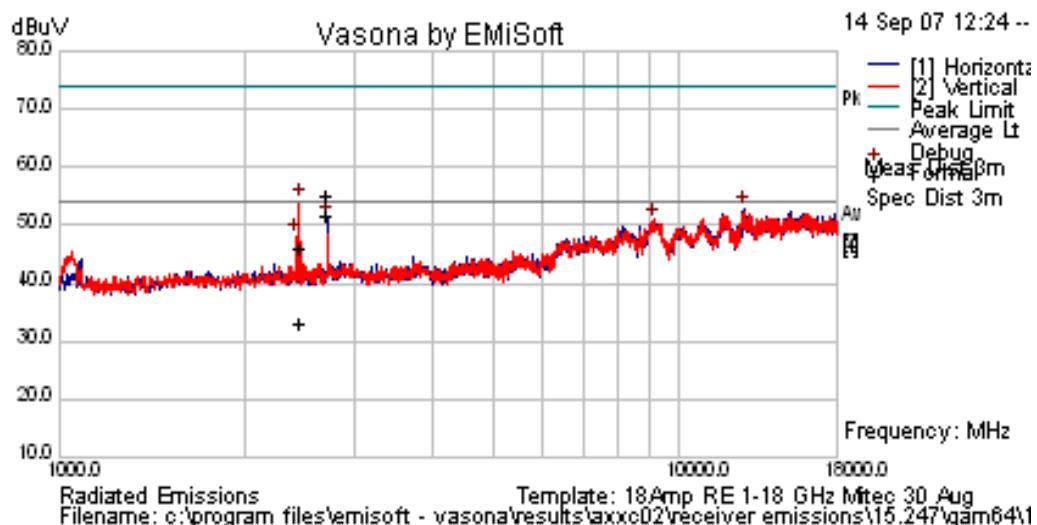
Peak

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Peak Field Strength (dB μ V/m)	Peak Limit (dB μ V/m)	Margin (dB)
2449.159	V	51.22	-7.05	44.17	74	-29.83
2708.014	H	60.10	-7.05	53.05	74	-20.95

Average

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB μ V)	Correction Factor (dB)	Corrected Average Field Strength (dB μ V/m)	Average Limit (dB μ V/m)	Margin (dB)
2449.159	V	38.29	-7.05	31.24	54	-22.76
2708.014	H	56.53	-7.05	49.48	54	-4.52

Radiated Emissions



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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 shall comply with the limits of Table 1.

Frequency (MHz)	Field Strength (μ V/m)	Field Strength (dB μ V/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
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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

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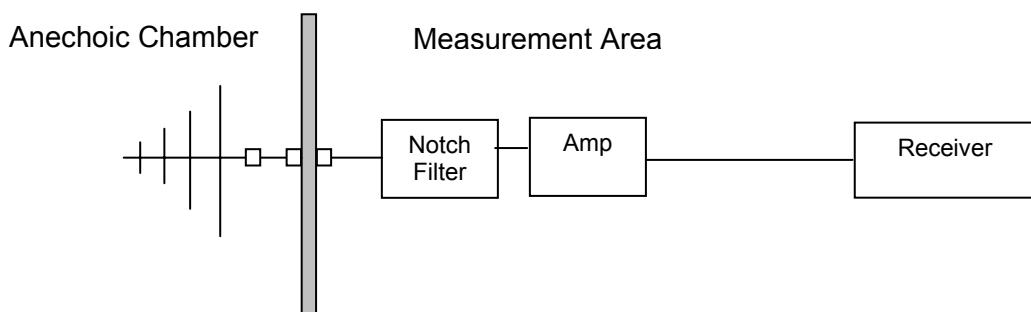
5.1.6.3. Radiated Spurious Emissions (30M-1 GHz)

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

Test Procedure

Testing 30M-1 GHz was performed in a 3-meter anechoic chamber using a CISPR compliant receiver. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. To further maximize emissions the receive antenna was varied between 1 and 4 meters. The emissions are recorded with receiver 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



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For example:

Given a Receiver input reading of 51.5dB μ V; 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:

$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3 \text{ dB}\mu\text{V/m}$$

Conversion between dB μ V/m (or dB μ V) and μ V/m (or μ V) are done as:

$$\text{Level (dB}\mu\text{V/m)} = 20 * \text{Log} (\text{level (}\mu\text{V/m)})$$

$$40 \text{ dB}\mu\text{V/m} = 100\mu\text{V/m}$$

$$48 \text{ dB}\mu\text{V/m} = 250\mu\text{V/m}$$

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

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Test Setup

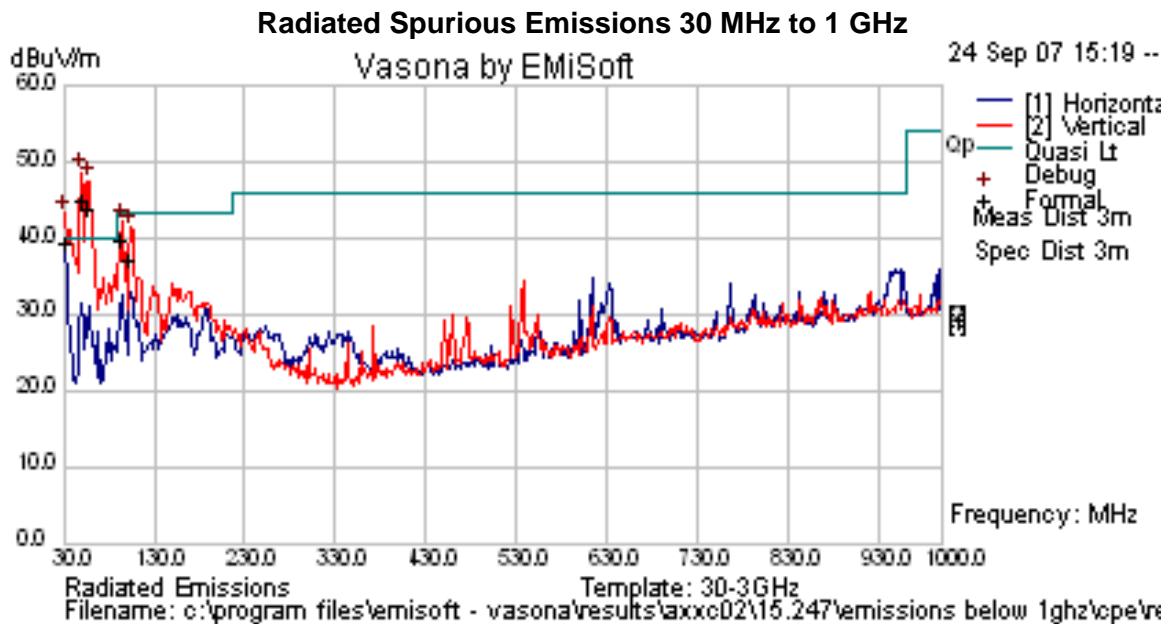
POE TR36A-POE-480

S/N 8593

Positioned vertically

TABLE OF RESULTS - 64 QAM 10 MHz BW

Freq. (MHz)	Peak (dBuV/m)	QP (dBuV/m)	QP Lmt (dBuV/m)	QP Margin (dB)	Angle (deg)	Height (cm)	Polarity
31.944	43.19	37.67	40.0	-2.33	246	111	V
49.439	48.74	37.1	40.0	-2.90	338	100	V
57.214	47.61	31.74	40.0	-8.26	319	120	V
94.148	42.11	38.00	43.5	-5.50	137	131	V
103.868	41.50	35.46	43.5	-8.04	95	102	V



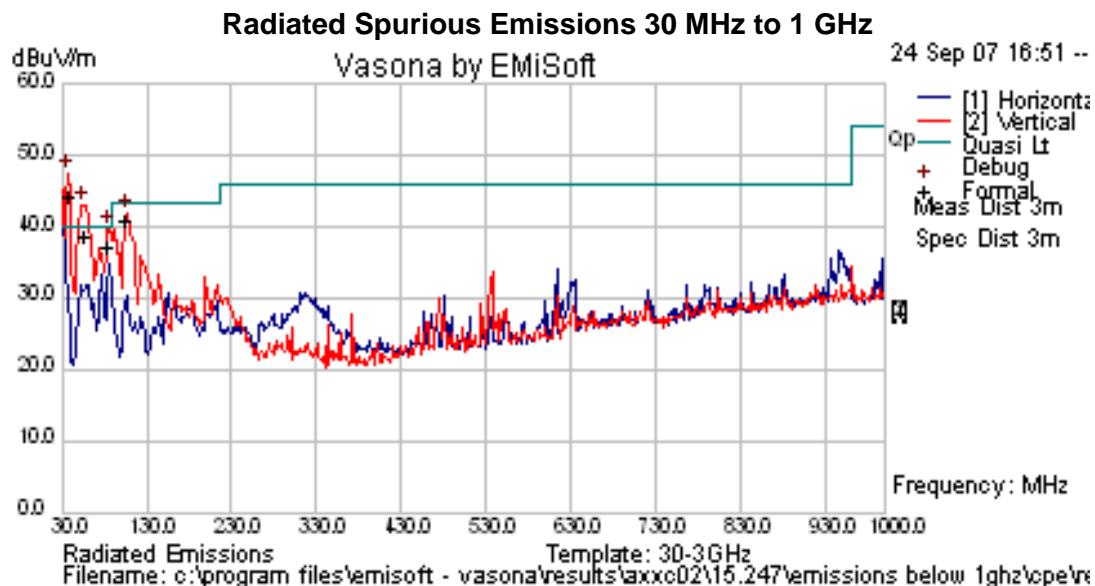
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Test Setup

POE TR36A-POE-480
 S/N 8593
 Positioned horizontally

TABLE OF RESULTS - 64 QAM 10 MHz BW

Freq. (MHz)	Peak (dBuV/m)	QP (dBuV/m)	QP Lmt (dBuV/m)	QP Margin (dB)	Angle (deg)	Height (cm)	Polarity
37.776	47.60	36.17	40.0	-3.83	333	126	V
55.271	43.12	37.03	40.0	-2.97	360	144	V
86.373	39.88	35.38	40.0	-4.62	31	98	V
105.812	42.00	39.14	43.5	-4.36	148	110	V



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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 (μ V/m)	Field Strength (dB μ V/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
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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

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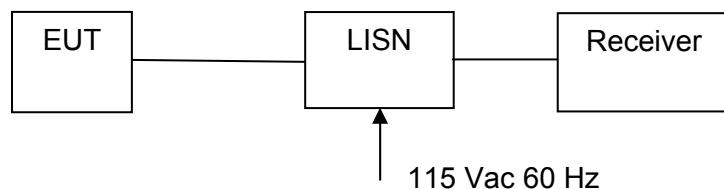
5.1.7. AC Wireline Conducted Emissions (150 kHz – 30 MHz)

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.

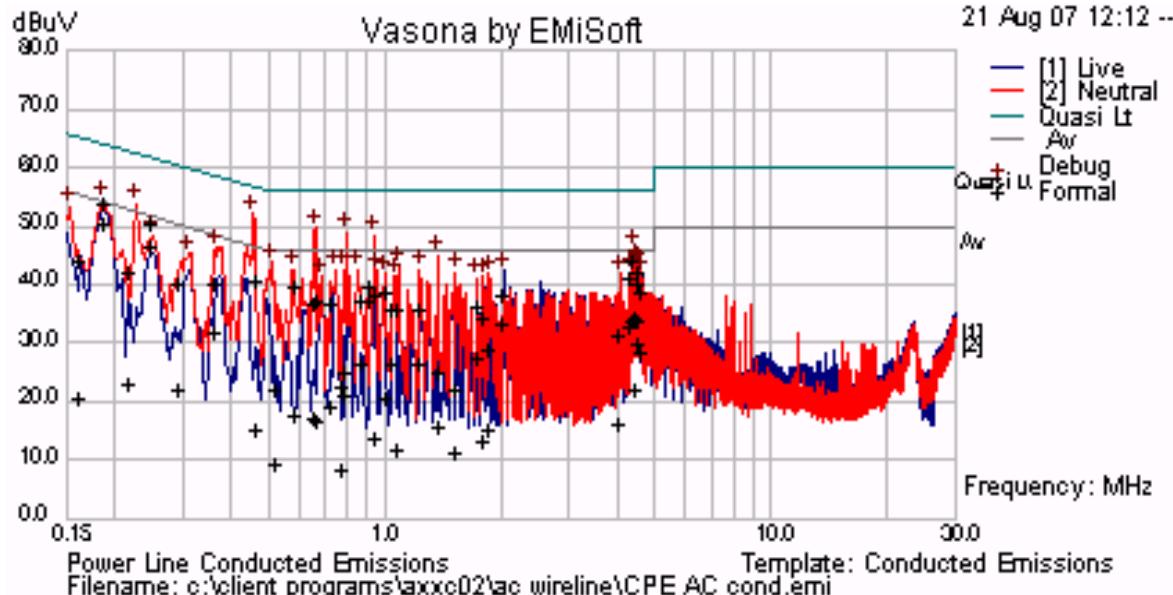
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

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TABLE OF RESULTS –

Freq (MHz)	Line	Peak (dB μ V)	QP (dB μ V)	QP Limit (dB μ V)	QP Margin (dB)	Ave. (dB μ V)	Ave. Limit (dB μ V)	Ave. Margin (dB)
0.154	Neutra	53.30	41.52	65.33	-23.81	18.06	55.33	-37.27
0.187	Neutra	54.46	51.75	64.14	-12.39	48.25	54.14	-5.88
0.229	Neutra	53.74	39.75	62.89	-23.14	20.71	52.89	-32.18
0.367	Neutra	46.32	37.73	58.61	-20.89	29.67	48.61	-18.94
0.457	Neutra	52.11	38.20	56.5	-18.30	12.78	46.50	-33.72
0.513	Neutra	43.81	19.60	56	-36.40	6.77	46	-39.23
0.662	Neutra	49.64	34.32	56	-21.68	14.87	46	-31.13
0.801	Neutra	48.90	22.57	56	-33.43	18.83	46	-27.17
0.943	Neutra	48.51	35.92	56	-20.08	11.36	46	-34.64
1.380	Neutra	45.00	22.63	56	-33.37	13.51	46	-32.49
4.423	Live	46.37	41.87	56	-14.13	31.52	46	-14.48
4.487	Neutra	43.86	32.10	56	-23.90	19.72	46	-26.28

AC Wireline Conducted Emissions – Live and Neutral Lines (150 kHz – 30 MHz)



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To: FCC 47 CFR Part15.247 & IC RSS-210
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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 $\mu\Omega$ 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 (dB μ V)	
	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
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Traceability

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

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6. PHOTOGRAPHS

6.1. Radiated Spurious Emissions >1 GHz



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6.2. AC Wireline Emissions (150 kHz - 30 MHz)



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6.3. General Measurement Test Set-Up



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7. TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Part #	Serial #
0088	Spectrum Analyzer	Hewlett Packard	8564E	3410A00141
0134	Amplifier	Com Power	PA 122	181910
0158	Barometer /Thermometer	Control Co.	4196	E2846
0193	EMI Receiver	Rhode & Schwartz	ESI 7	838496/007
0252	SMA Cable	Megaphase	Sucoflex 104	None
0310	2m SMA Cable	Micro-Coax	UFA210A-0-0787-3G03G0	209089-001
0312	3m SMA Cable	Micro-Coax	UFA210A-1-1181-3G0300	209092-001
0313	Coupler	Hewlett Packard	86205A	3140A01285
0314	30dB N-Type Attenuator	ARRA	N9444-30	1623
0070	Power Meter	Hewlett Packard	437B	3125U11552
0116	Power Sensor	Hewlett Packard	8485A	3318A19694
0117	Power Sensor	Hewlett Packard	8487D	3318A00371
0184	Pulse Limiter	Rhode & Schwartz	ESH3Z2	357.8810.52
0190	LISN	Rhode & Schwartz	ESH3Z5	836679/006
0293	BNC Cable	Megaphase	1689 1GVT4	15F50B001
0301	5.6 GHz Notch Filter	Micro-Tronics	RBC50704	001
0302	5.25 GHz Notch Filter	Micro-Tronics	BRC50703	002
0303	5.8 GHz Notch Filter	Micro-Tronics	BRC50705	003
0304	2.4GHzHz Notch Filter	Micro-Tronics	--	001
0307	BNC Cable	Megaphase	1689 1GVT4	15F50B002
0335	1-18GHz Horn Antenna	ETS- Lindgren	3117	00066580
0337	Amplifier	MiCOM Labs	--	--
0338	Antenna	Sunol Sciences	JB-3	A052907

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