

Test of Axxcelera ETDAP-C9AC
To: FCC 47 CFR Part 90 SubPart Z
Test Report Serial No.: AXXC14-U1 Rev A





Test of Axxcelera ETDAP-C9AC

To FCC 47 CFR Part 90 SubPart Z

Test Report Serial No.: AXXC14-U1 Rev A

This report supersedes None

Manufacturer: Axxcelera Broadband Wireless, Inc
1600 E.Parham Road
Richmond Virginia 23228
USA

Product Function: Wireless Broadband Access Point

Copy No: pdf **Issue Date:** 28th May 2010

This Test Report is Issued Under the Authority of:

MiCOM Labs, Inc.
440 Boulder Court, Suite 200
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CERTIFICATE #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory



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ACCREDITATION, LISTINGS & RECOGNITION

ACCREDITATION

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



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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 (IC) Listing #: 4143A

Japan Registration

VCCI Membership Number: 2959

- Radiated 3 meter site; Registration No. R-2881
- Line Conducted, Registration Nos. C-3181 & T-1470
- Emissions; Registration Nos. C-3180 & T-1469

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	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)	I	
Vietnam	Ministry of Information and Communications	I	

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DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft		
A	28 th May 2010	Initial Release

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1. TEST RESULT CERTIFICATE

Manufacturer:	Axxcelera Broadband Wireless, Inc 1600 E.Parham Road Richmond Virginia 23228 USA	Tested By:	MiCOM Labs, Inc. 440 Boulder Court Suite 200 Pleasanton California, 94566, USA
EUT:	Wireless Voice and Data Communication	Telephone:	+1 925 462 0304
Model:	ETDAP-C9AC	Fax:	+1 925 462 0306
S/N:	N/A		
Test Date(s):	13th to 20th May 2010	Website:	www.micomlabs.com

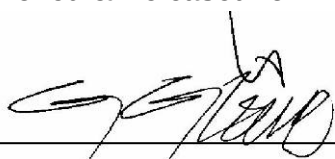
STANDARD(S)	TEST RESULTS
FCC 47 CFR Part 90 SubPart Z (3.5, 5 and 7 MHz channel spacing)	EQUIPMENT COMPLIES

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.

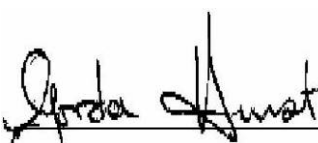
Notes:

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,



Gordon Hurst
President & CEO MiCOM Labs, Inc.



CERTIFICATE #2381.01

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2. REFERENCES AND MEASUREMENT UNCERTAINTY

2.1. Normative References

Ref.	Publication	Year	Title
(i)	FCC 47 CFR Part 90 SubPart Z	2007	Code of Federal Regulations
(ii)	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
(iii)	CISPR 22/ EN 55022	1997 1998	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
(iv)	M 3003	Edition 1 Dec. 1997	Expression of Uncertainty and Confidence in Measurements
(v)	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
(vi)	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
(vii)	A2LA	14 th September 2005	Reference to A2LA Accreditation Status – A2LA Advertising Policy
(viii)	FCC (OET)	15 th April 2010	Compliance Management Guidance for Wireless Broadband Services Operating in the 3650-3700 MHz Band

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 ETDAP-C9AC to FCC 47 CFR Part 90 SubPart Z regulations.		
Applicant:	Axxcelera Broadband Wireless, Inc 1600 E.Parham Road Richmond Virginia 23228 USA		
Manufacturer:	As Applicant		
Laboratory performing the tests:	MiCOM Labs, Inc. 440 Boulder Court, Suite 200 Pleasanton, California 94566 USA		
Test report reference number:	AXXC14-U1 Rev A		
Date EUT received:	13 th May 2010		
Dates of test (from - to):	13th to 20th May 2010		
Standard(s) applied:	FCC 47 CFR Part 90 SubPart Z		
No of Units Tested:	1		
Type of Equipment:	Access Point		
Model:	ETDAP-C9AC Note: the C9 is equal to the C4 except it has the regulatory file installed for the US only		
Location for use:	Outdoor use only		
Declared Frequency Range(s):	Transmit: 3650 - 3700 MHz Receiver: 3650 - 3700 MHz		
Type of Modulation:	BPSK, QPSK, 16QAM, 64QAM		
Operational Bandwidths:	3.5, 5, 7 MHz		
Declared Maximum Output Power:	+27 dBm		
ITU Emission Designator:	3.5 MHz 3M1DXW	5 MHz 4M5DXW	7 MHz 6M3DXW
Transmit/Receive Operation:	OFDM Time Division Duplex (TDD)		
Software Revision:	3.8.0		
Rated Input Voltage and Current:	POE Operation Input: 120Vac 60Hz Output: 48Vdc 0.6A		
Operating Temperature Range:	Client declared: -33°C to +55°C		
Clock/Oscillator(s):	160kHz, 40MHz, 200 MHz		
Frequency Stability:	±20 ppm /year		
Equipment Dimensions:	3" X 10" X 10"		
Weight:	7 lbs		
Primary function of equipment:	Wireless Broadband Access Point		

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3.2. Scope of Test Program

The scope of the test program was to test the Axxcelera ETDAP-C9AC for compliance against:-

FCC 47 CFR Part 90, Subpart Z regulatory requirements.

The Axxcelera ETDAP-C9AC has three operational bandwidths 3.5, 5, 7 MHz and employs four modulation schemes BPSK, QPSK, 16QAM, 64QAM in the frequency range 3650 to 3700 MHz.

Model Naming Convention

E = ExcelMax
TD = TDD system
AP = Access Point
C9 = Version
AC = Power Option

Applicable Variants

This report contains data with respect to a three bandwidths (3.5, 5, 7 MHz).

Transmission Restrictions

Per Part 90 SubPart Z, 90.1319 "equipment incorporating a restricted contention based protocol may operate in and shall only tune over, the lower 25 MHz of this frequency band".

As the Axxcelera ETDAP-C9AC incorporates an unrestricted contention based protocol the frequency range is the entire 50 MHz frequency band (3650 to 3700 MHz).

Contention Based Protocol

As a result of no formal FCC procedure for testing Contention Based Protocol the Access Point was exercised using a manufacturer's specification. Details of the test protocol can be found under the "Contention Based Protocol" test heading.

Axxcelera ETDAP-C9AC



Axxcelera ETDAP-C9AC Product Label

	 WARNING	 
	RADIATION HAZARD Consult Equipment Manual for MPE Specification	

 This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.





FCC ID: OJB-APC4-365


020-44154-2101

Axxcelera ETDAP-C9AC Product Label Position



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

EUT/ Support	Manufacturer	Equipment Description (Including Brand Name)	Model No.	Serial No.
EUT	Axxcelera	ExcelMAX 3650 MHz Transceiver	ETDAP-C9AC	N/A
EUT	Cinnon Electronics Co.	DC POE Power Injector ac/dc Adapter 120-240Vac 50-60Hz, 0.6A O/P 48Vdc 0.5A	TR60A-POE-L	N/A
Support	Dell Laptop	Computer		

3.4. Antenna Details

Antenna Type	Gain (dBi)	Manufacturer	Model No.	Serial No.
External Sector 60°, 90°, Omni	16 , 14, 10	Various	3.3 – 3.8 GHz	N/A

3.5. Cabling and I/O Ports

Number and type of I/O ports

1. 10/100 BT Ethernet non-shielded cable (includes POE Power)
2. N-Type RF Antenna Port
3. GPS Antenna Port

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3.6. Test Configurations

Test Matrix V's Variants

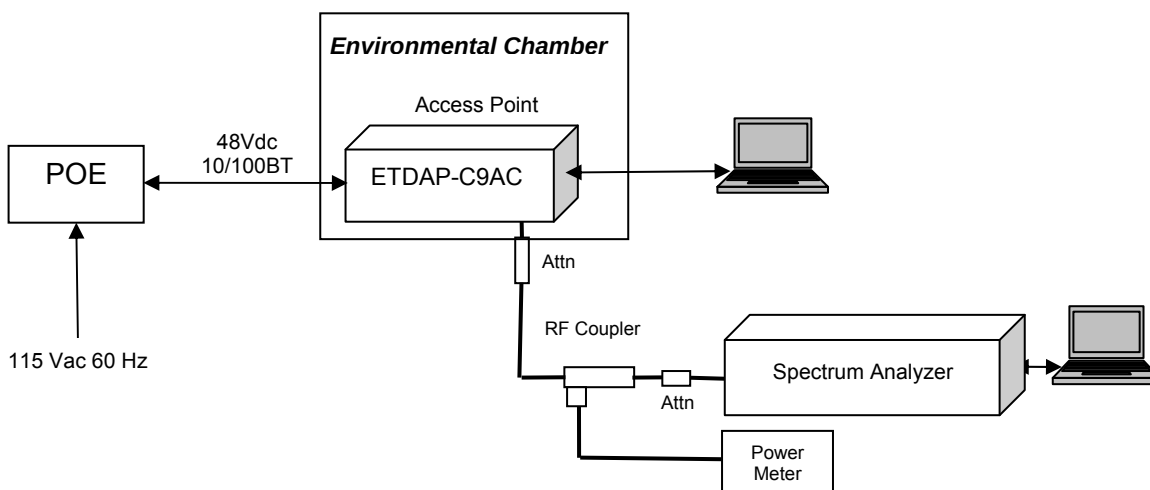
Parameter	Operational Mode	Test Conditions	Bandwidths (MHz)
99% Occupied BW	Modulated - BPSK QPSK, 16QAM, 64QAM	Ambient, 48Vdc	3.5, 5, 7
Output power			
Spectrum Mask			
Power Spectral Density			
Frequency Stability	Single Tone (CW)	-33°C to +55°C + voltage variation	N/A
Conducted Spurious Emissions	BPSK	Ambient, 48Vdc	3.5
Contention Based Protocol	N/A	Ambient, 48Vdc	3.5, 5, 7
Radiated Spurious Emissions	BPSK	Ambient, 48Vdc	3.5
AC Wireline Emissions	BPSK	Ambient, 48Vdc	3.5

Test Frequencies

Bandwidth (MHz)	Modulation BPSK, QPSK, 16QAM, 64QAM		
	Low (MHz)	Mid (MHz)	High (MHz)
3.5	3651.75	3675.00	3698.25
5	3652.5	3675.00	3697.5
7	3653.5	3675.00	3696.5

Test Set-Up

Test software was available to exercise the Access Point and the equipment was tested using the following test configuration.



General Test Set-Up

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

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 90, Subpart Z**.

Section(s)	Test Items	Description	Condition	Result	Test Report Section
2.1049	Occupied Bandwidth	Bandwidth measurement(s)	Conducted	Complies	5.1.1
2.1046; 90.1321 (a)	Peak Output Power	Modulated Output Power	Conducted	Complies	5.1.2
2.1046; 90.1321 (a)	Power Spectral Density	Maximum Spectral Density	Conducted	Complies	5.1.3
Subpart C 90.1217	Maximum Permissible Exposure	Exposure to radio frequency energy levels	Calculated	Complies	5.1.4
2.1055(a)(1)	Frequency Stability	Includes temperature and voltage variations	Conducted	Complies	5.1.5
2.1051; 90.1323	Spectrum Mask and Spurious Emissions	Emissions from the antenna port	Conducted	Complies	5.1.6
Not Available	Contention Based Protocol	Detection of Interference	Conducted	Complies	5.1.7
2.1053; 90.1323 ANSI/TIA-603	Radiated Spurious Emissions	Spurious emissions	Radiated	Complies	5.1.8
15.207	AC Wireline Conducted	Emissions 150 kHz–30 MHz	Conducted	Complies	5.1.9

Note 1: Test results reported in this document relate only to the items tested

Note 2: The required tests demonstrated compliance as per client declaration of test configuration, monitoring methodology and associated pass/fail criteria

Note 3: Section 3.7 'Equipment Modifications' highlight the equipment modifications that were required to bring the product into compliance with the above matrix

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5. TEST RESULTS

5.1. Device Characteristics

5.1.1. Occupied Bandwidth

FCC 47 CFR Part 90, Subpart Z; 2.1049;

Test Procedure

The transmitter terminal of EUT was connected to the input of the spectrum analyzer set to measure the 99% occupied bandwidth. The system highest power setting was selected with modulation ON.

The test methodology employed for measuring Occupied Bandwidth can be found in Section 2.1 Normative References, ref viii "Compliance Management Guidance for Wireless Broadband Services Operating in the 3650-3700 MHz Band", see Band Power Measurement.

Test Set-up is shown in Section 3.6 Test Configuration

Ambient conditions.

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

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3.5 MHz Bandwidth

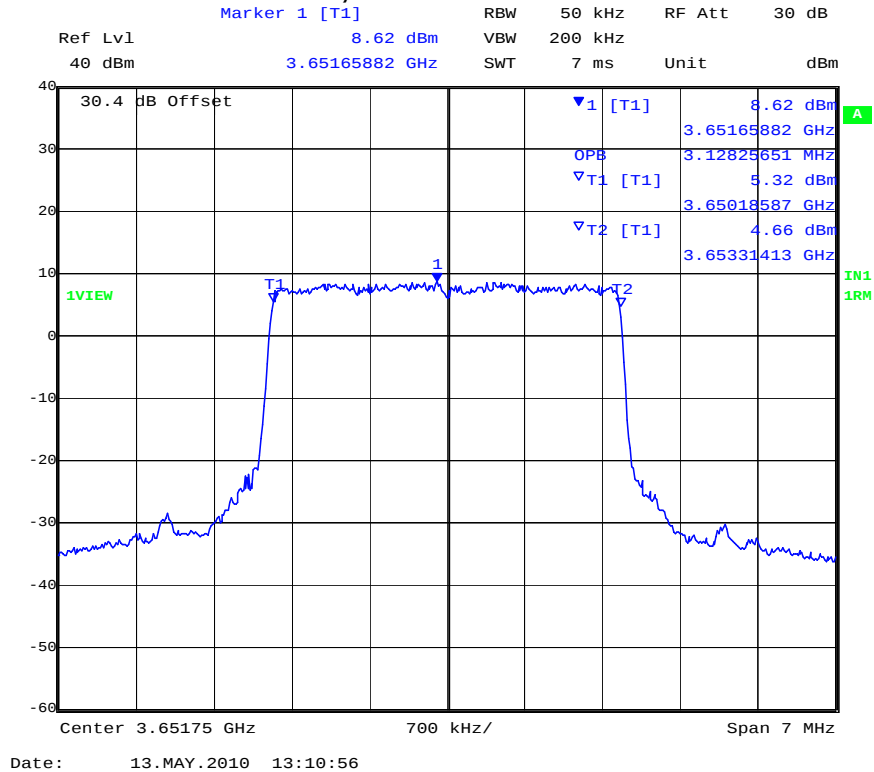
99% Bandwidth				
Center Frequency (MHz)	BPSK	QPSK	16 QAM	64QAM
3651.75	3.128	3.128	3.142	3.128
3675.00	3.128	3.128	3.128	3.114
3698.25	3.128	3.128	3.114	3.114

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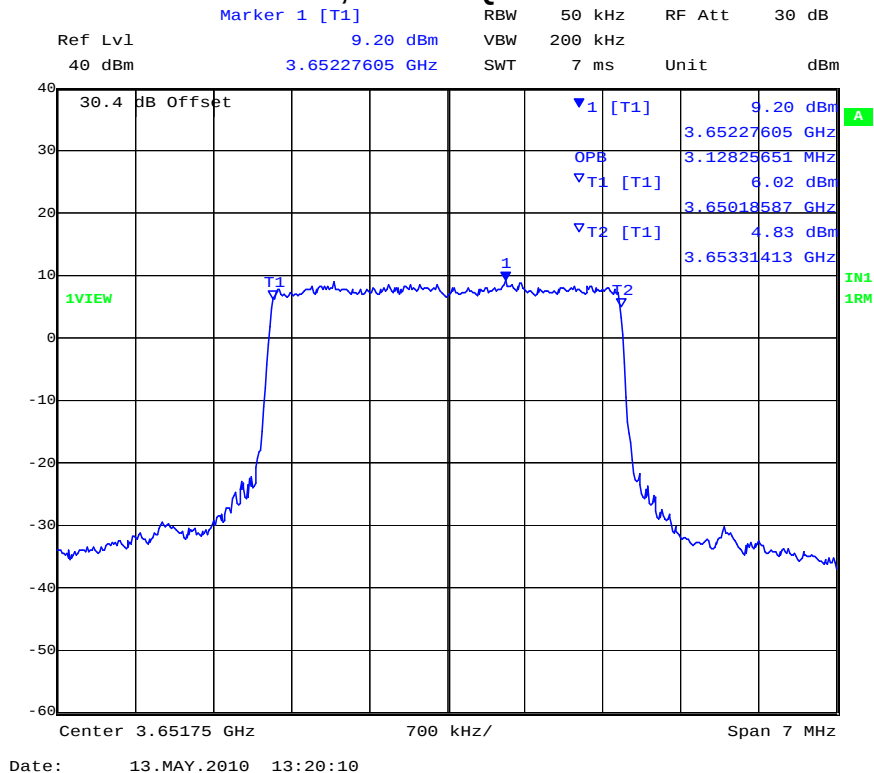


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Channel 3651.75, 3.5 MHz BPSK 99% Bandwidth



Channel 3651.75, 3.5 MHz QPSK 99% Bandwidth

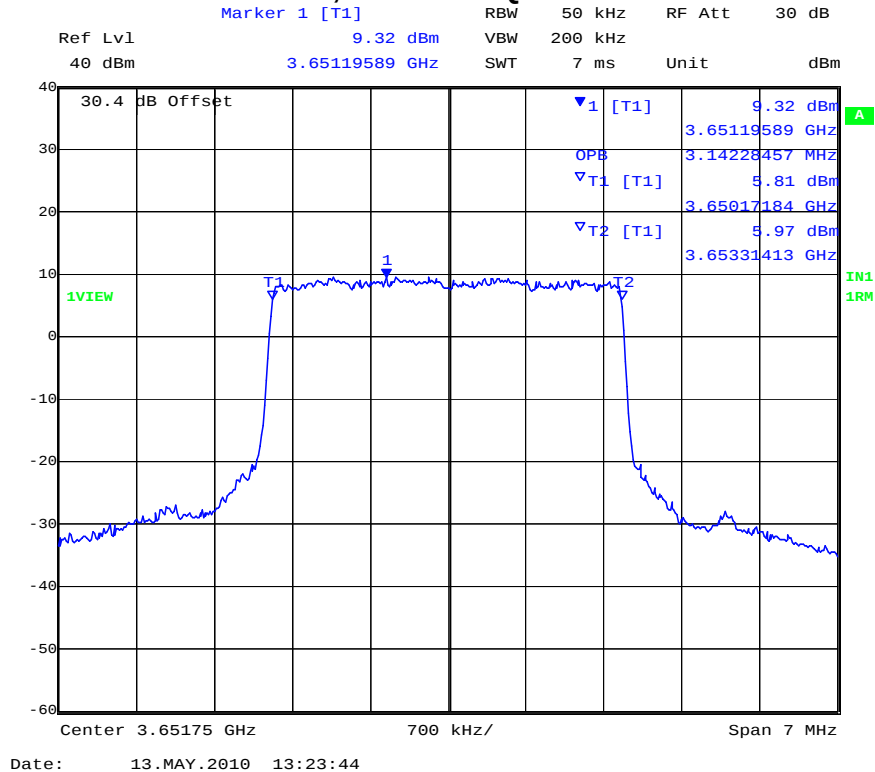


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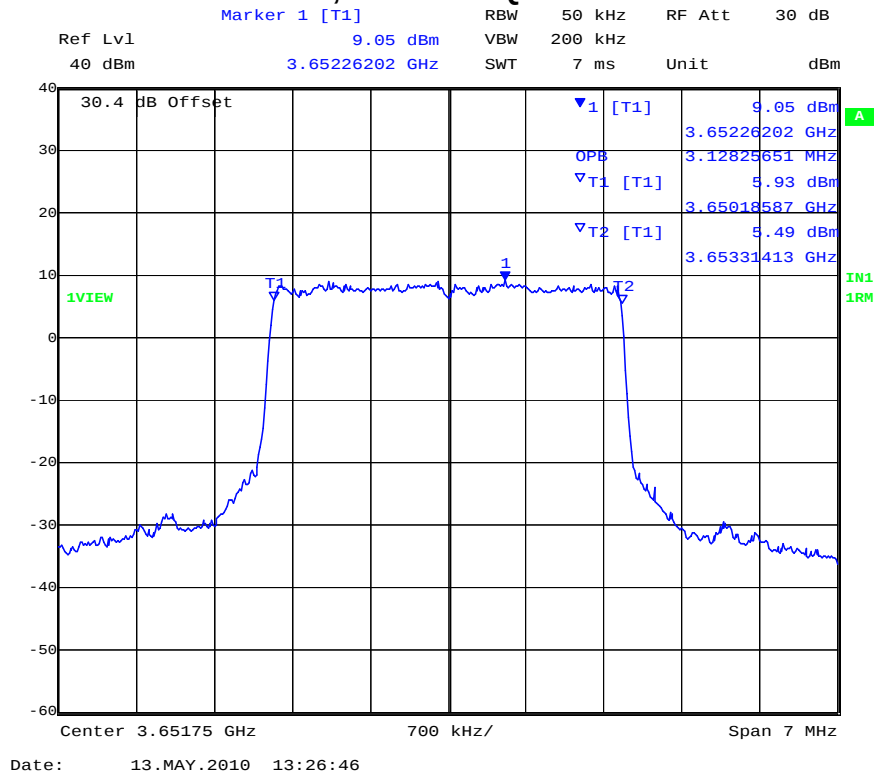


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Channel 3651.75, 3.5 MHz 16QAM 99% Bandwidth



Channel 3651.75, 3.5 MHz 64QAM 99% Bandwidth

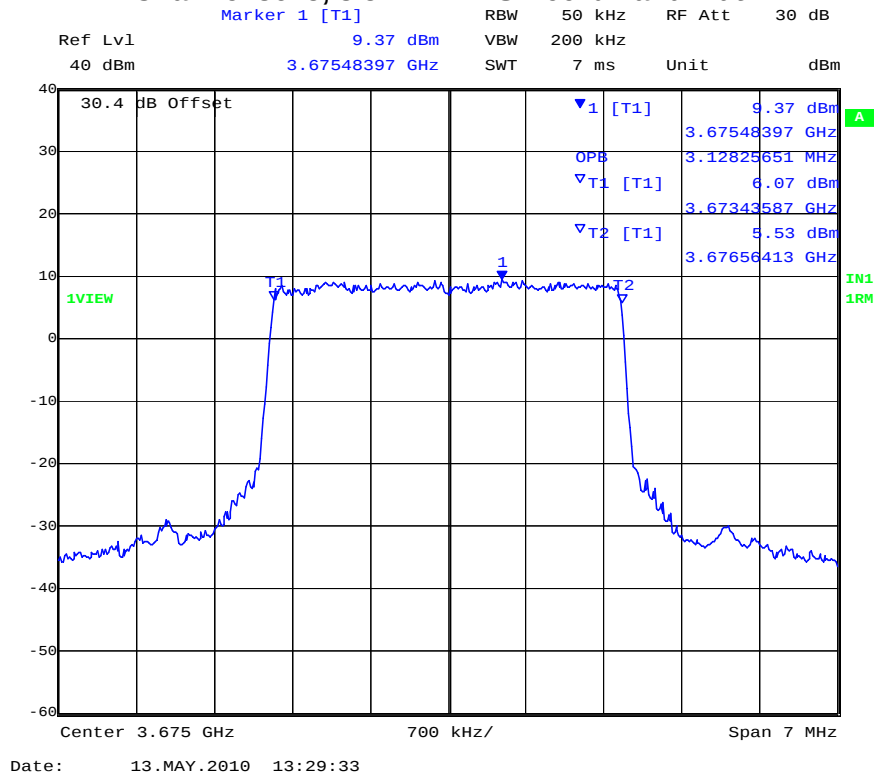


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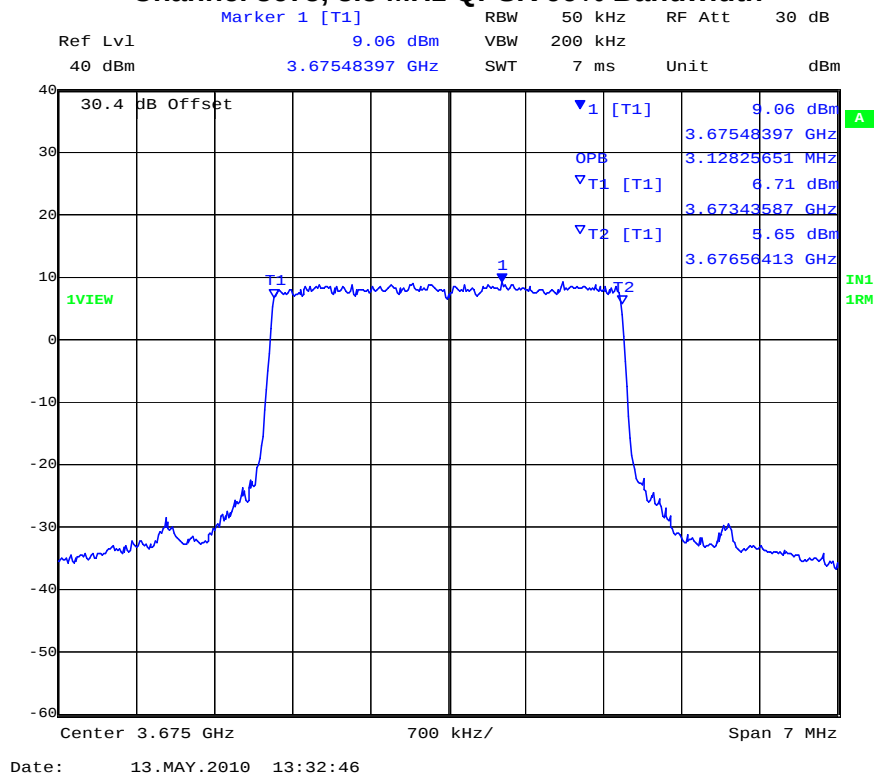


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Channel 3675, 3.5 MHz BPSK 99% Bandwidth



Channel 3675, 3.5 MHz QPSK 99% Bandwidth

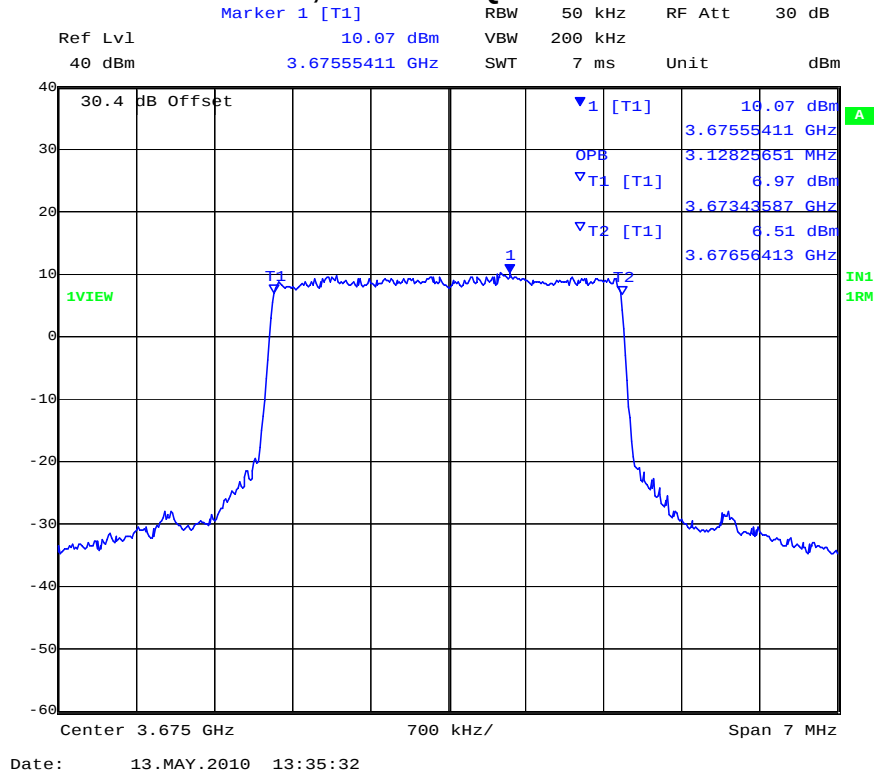


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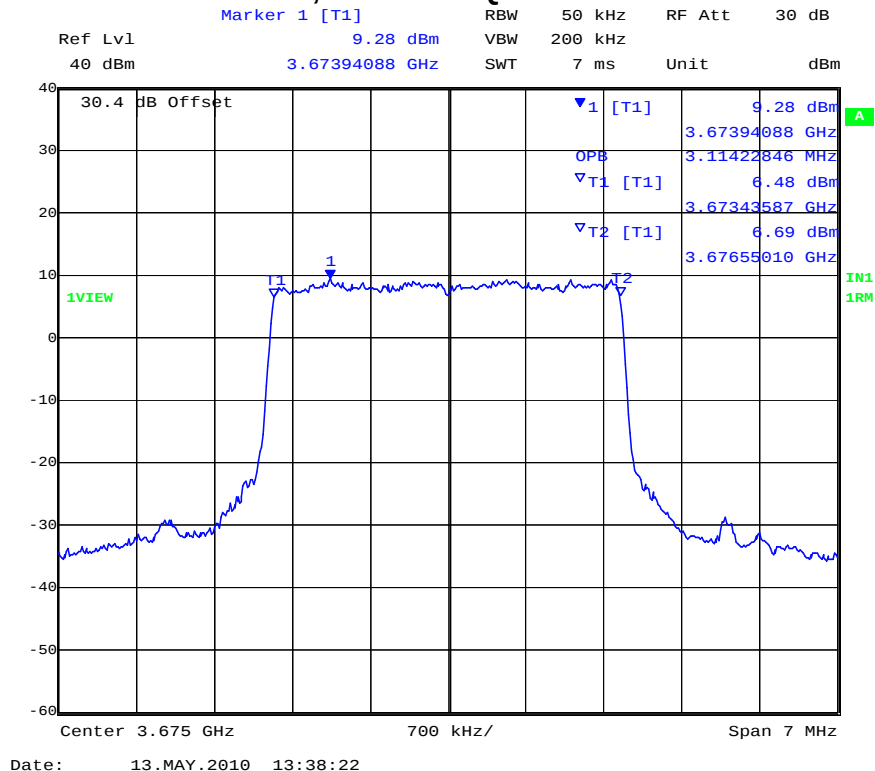


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Channel 3675, 3.5 MHz 16QAM 99% Bandwidth



Channel 3675, 3.5 MHz 64QAM 99% Bandwidth

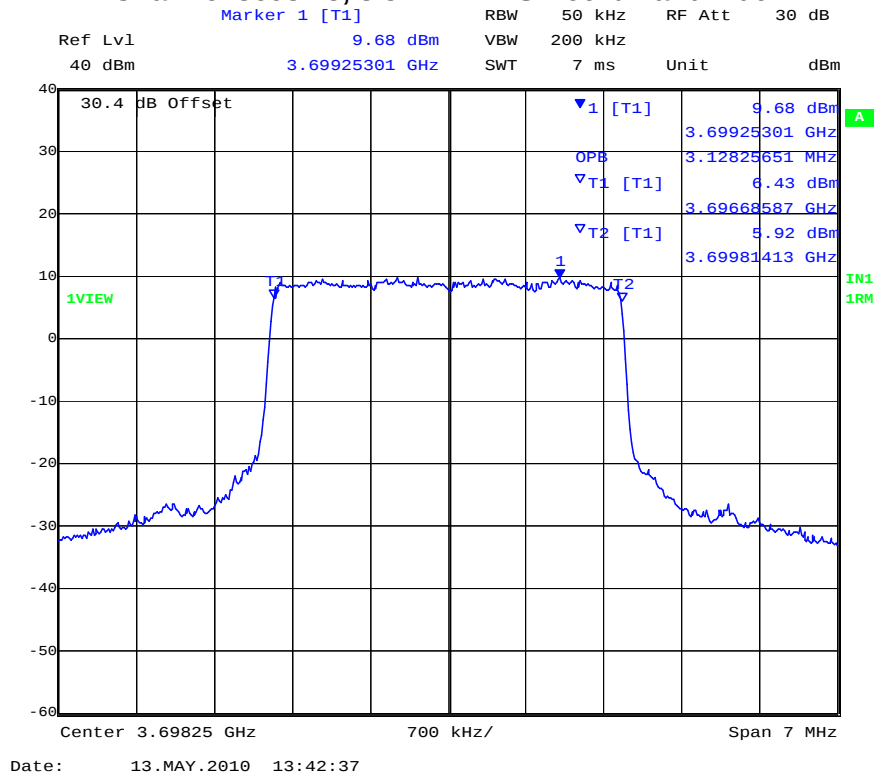


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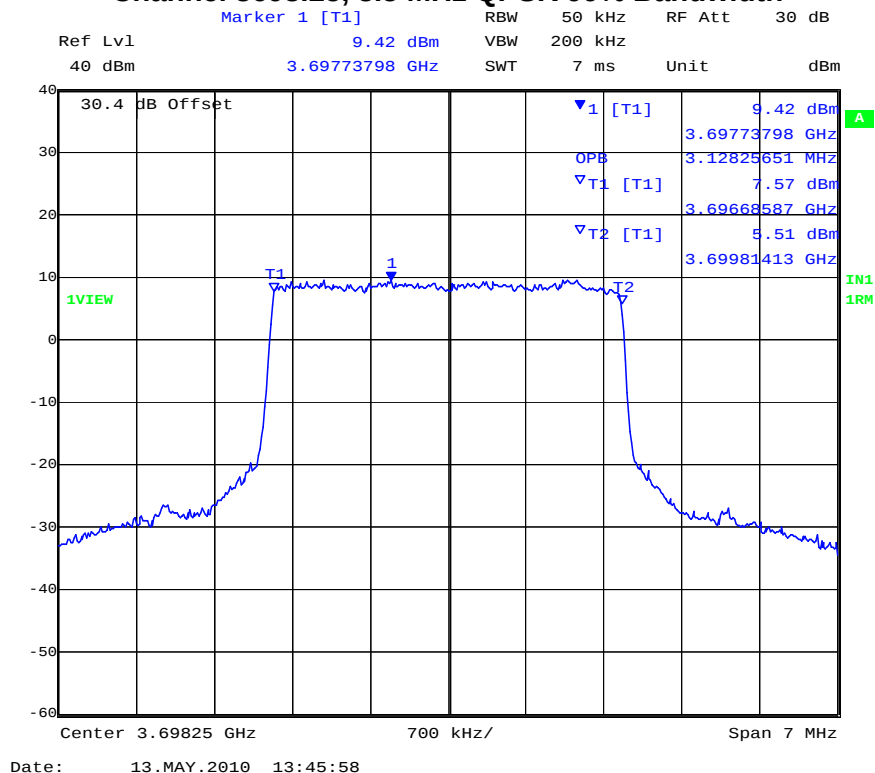


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Channel 3698.25, 3.5 MHz BPSK 99% Bandwidth



Channel 3698.25, 3.5 MHz QPSK 99% Bandwidth

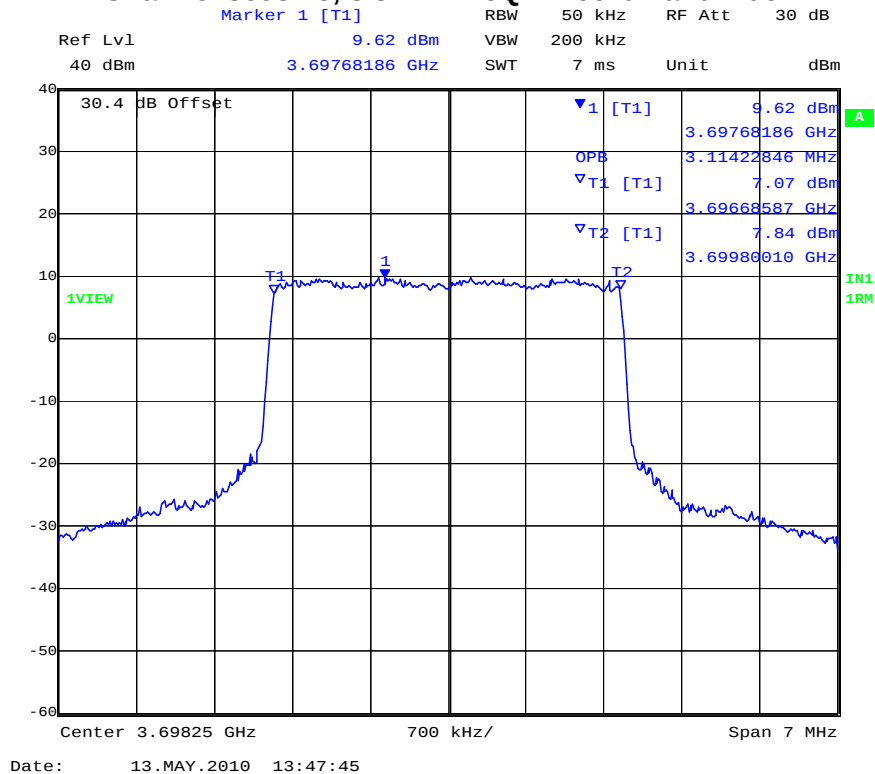


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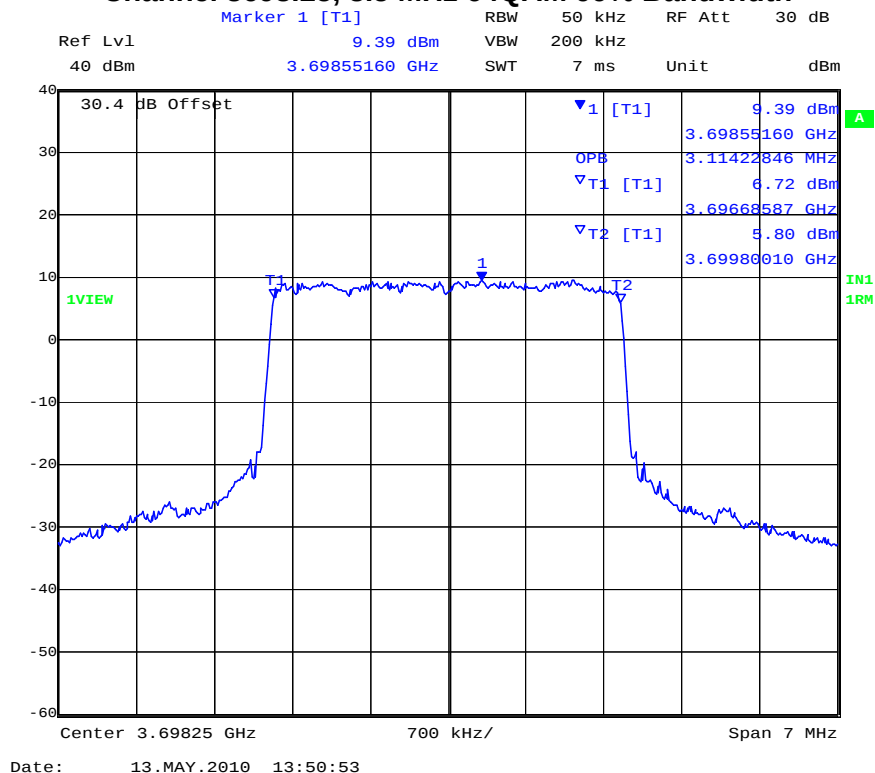


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Channel 3698.25, 3.5 MHz 16QAM 99% Bandwidth



Channel 3698.25, 3.5 MHz 64QAM 99% Bandwidth



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5 MHz Bandwidth

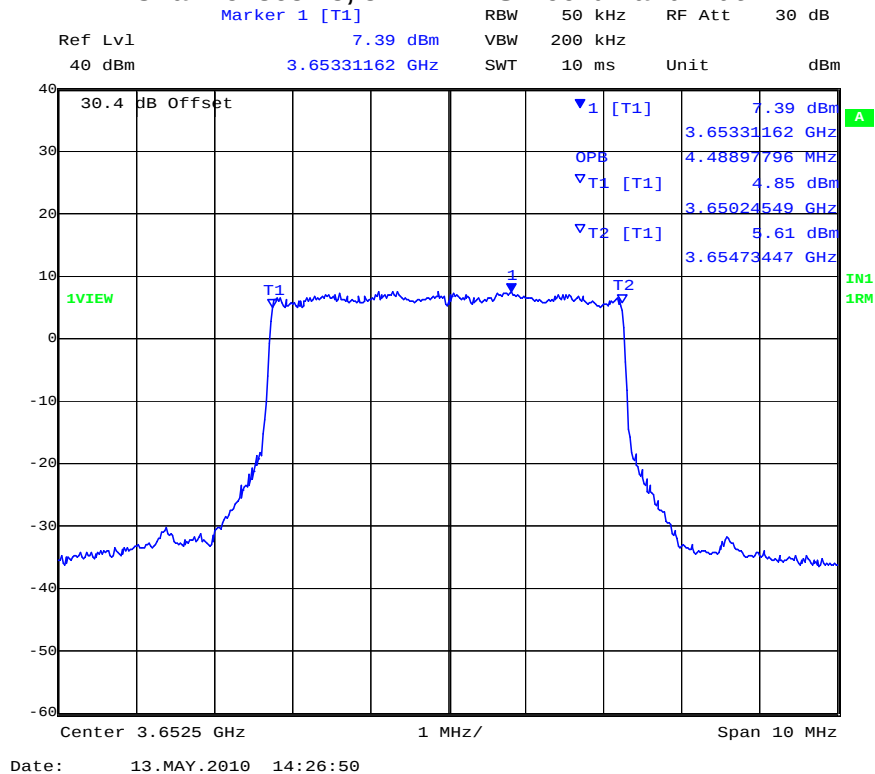
99% Bandwidth				
Center Frequency (MHz)	BPSK	QPSK	16 QAM	64QAM
3652.50	4.489	4.489	4.509	4.489
3675.00	4.489	4.489	4.489	4.489
3697.50	4.489	4.489	4.489	4.489

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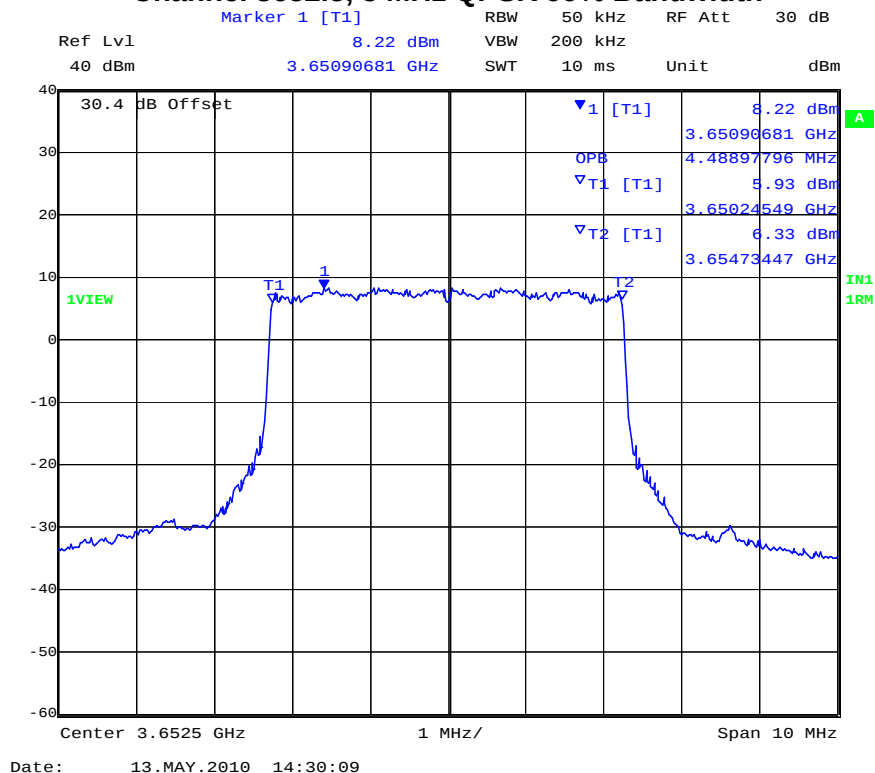


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Channel 3652.5, 5 MHz BPSK 99% Bandwidth



Channel 3652.5, 5 MHz QPSK 99% Bandwidth

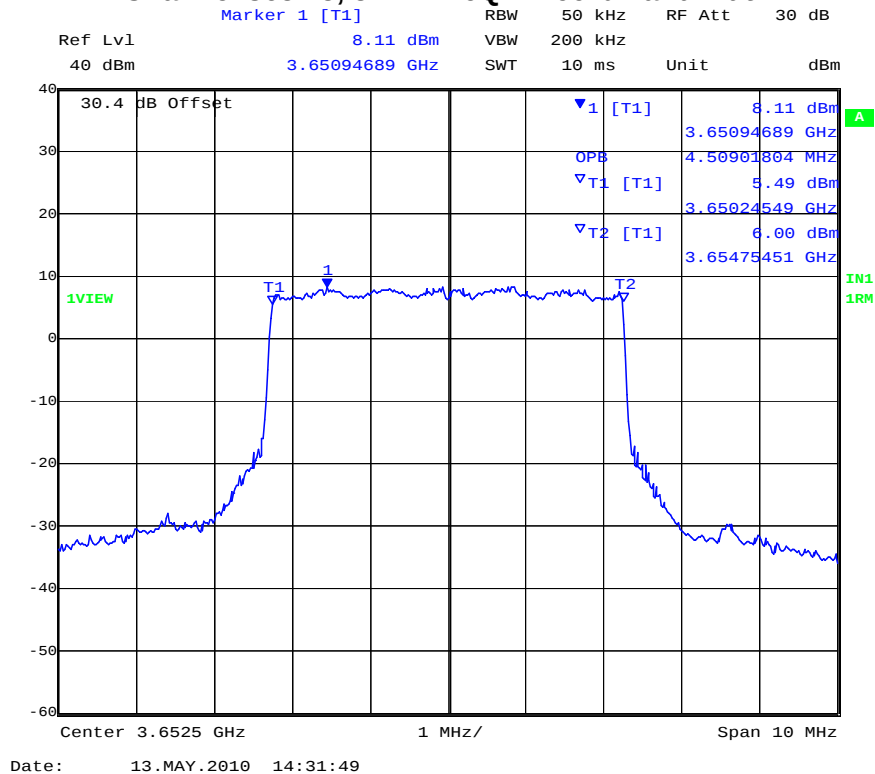


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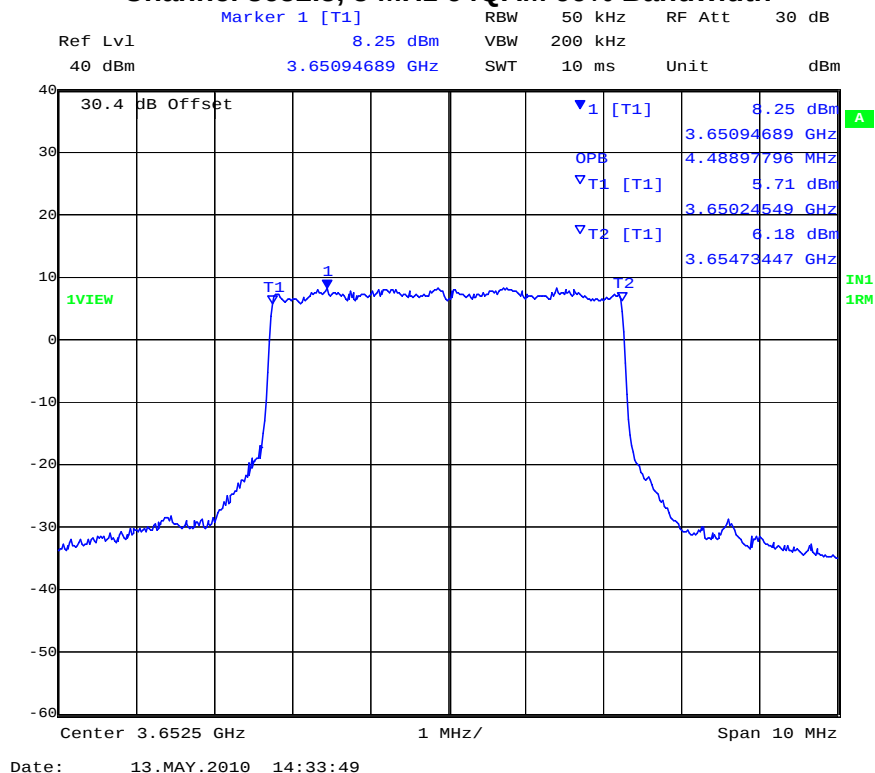


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Channel 3652.5, 5 MHz 16QAM 99% Bandwidth



Channel 3652.5, 5 MHz 64QAM 99% Bandwidth

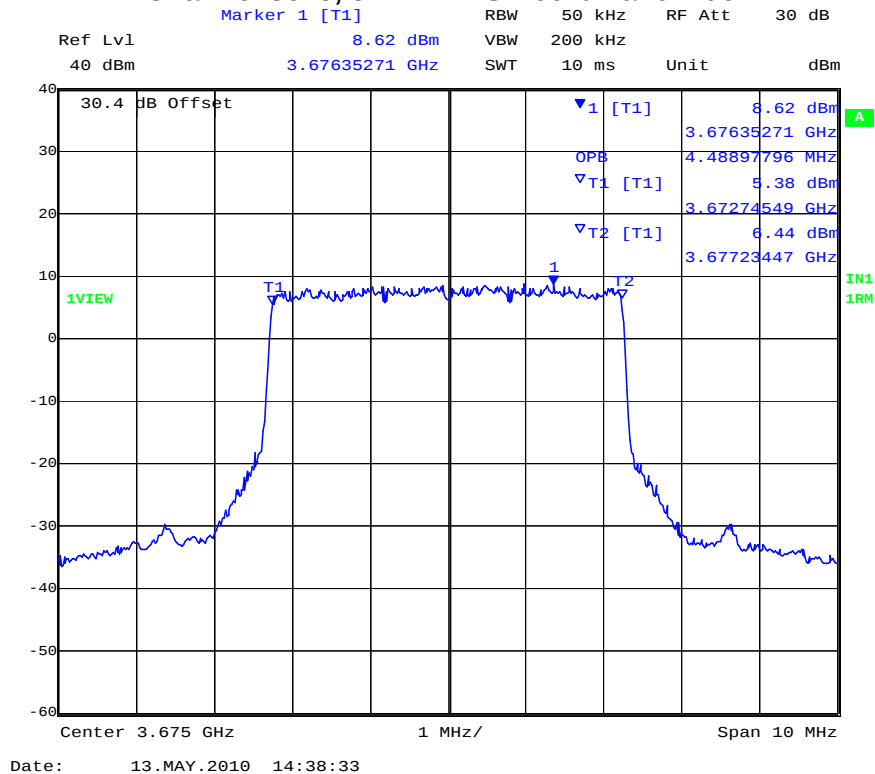


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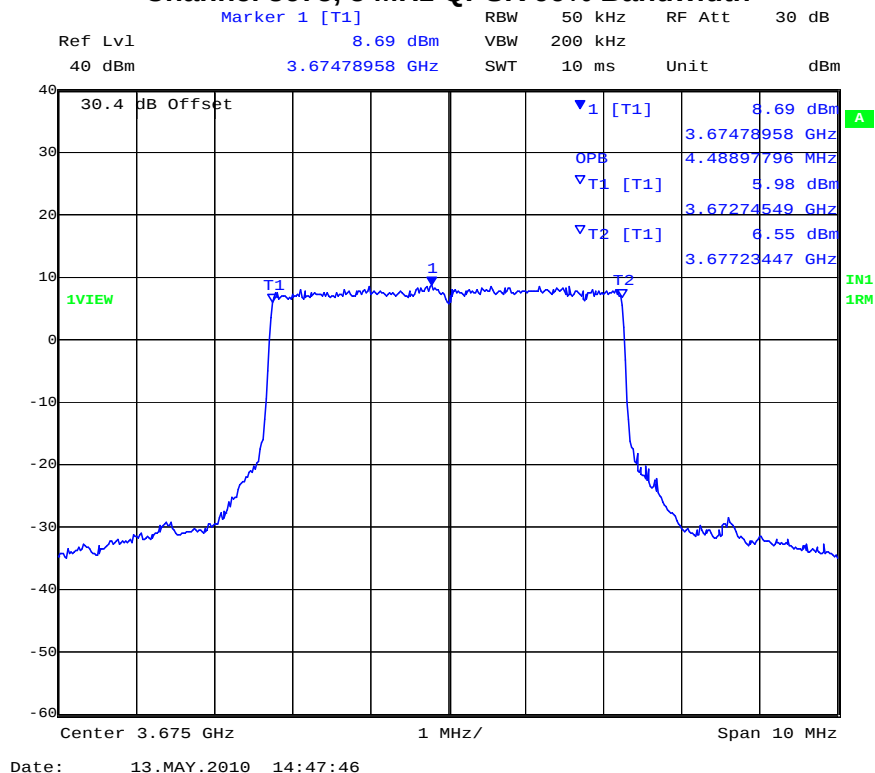


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Channel 3675, 5 MHz BPSK 99% Bandwidth



Channel 3675, 5 MHz QPSK 99% Bandwidth

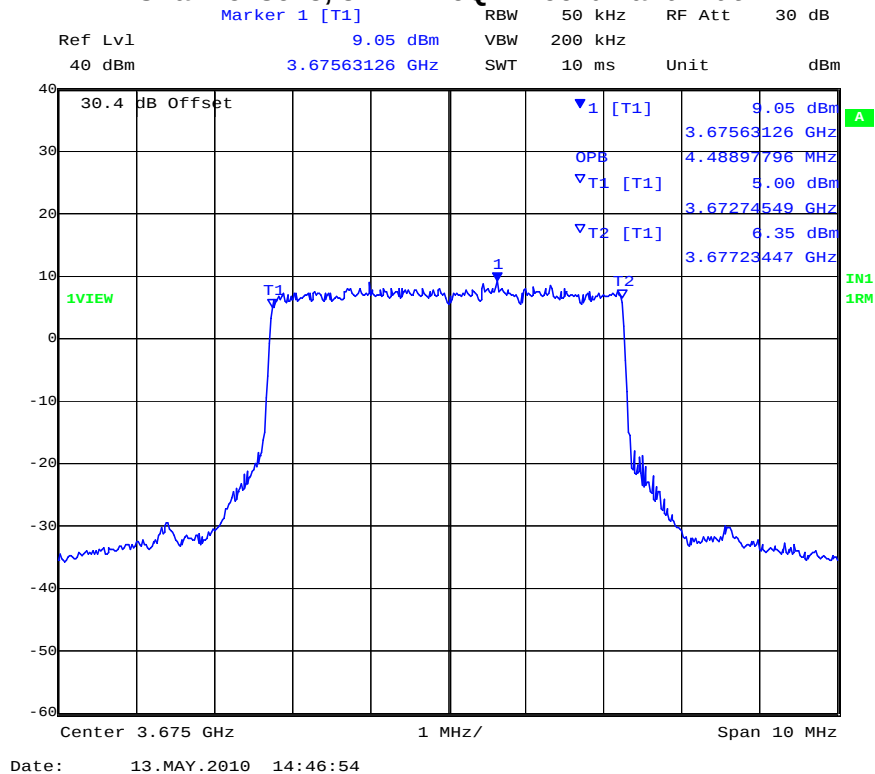


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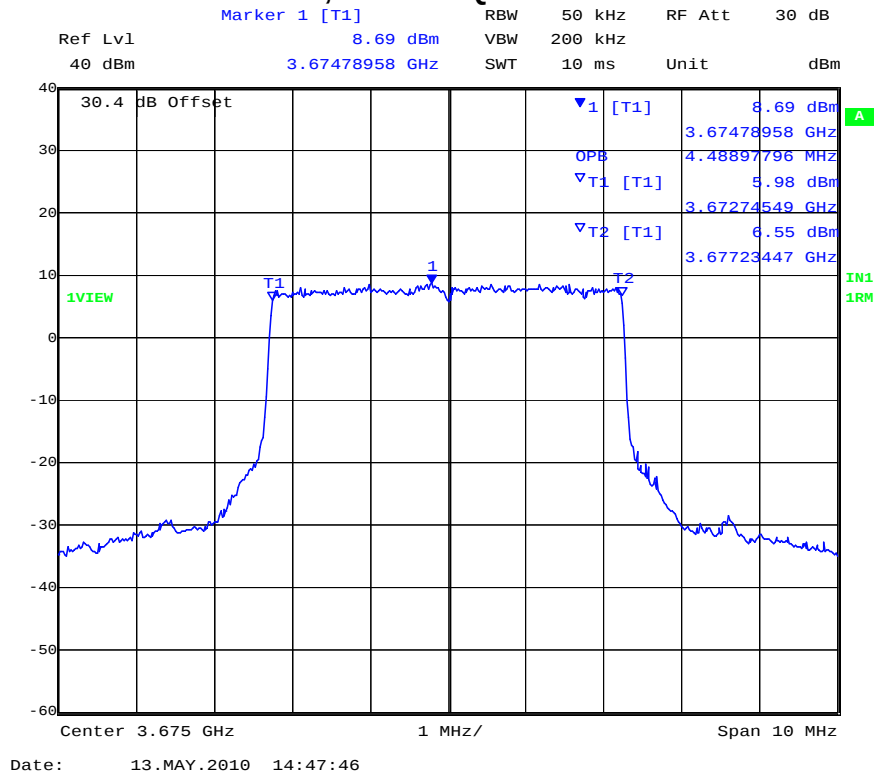


Title: Axxcelera ETDAP-C9AC
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Channel 3675, 5 MHz 16QAM 99% Bandwidth



Channel 3675, 5 MHz 64QAM 99% Bandwidth

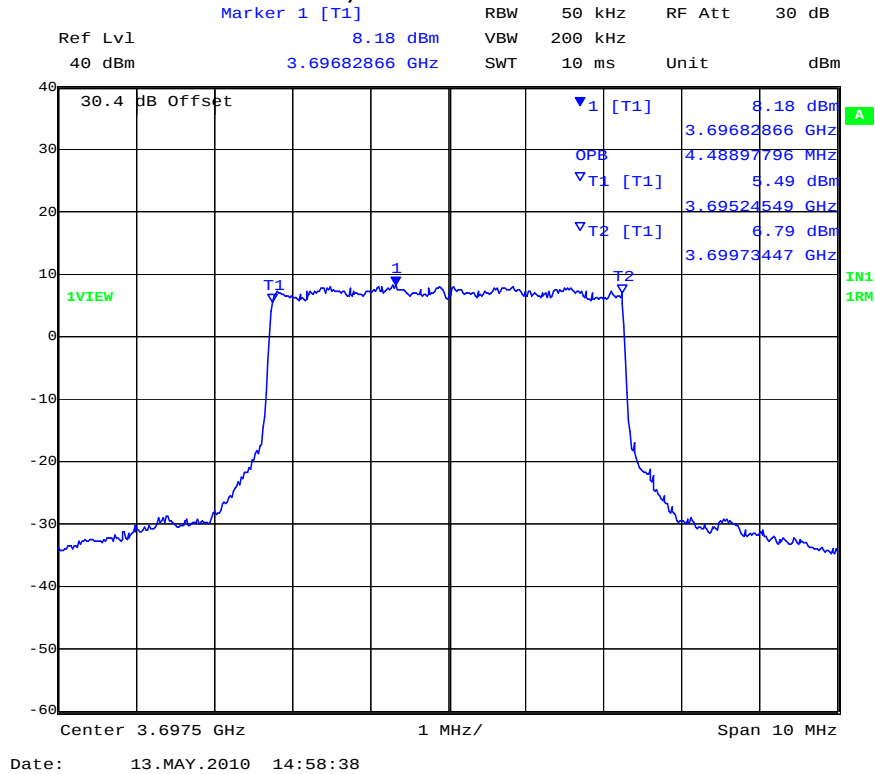


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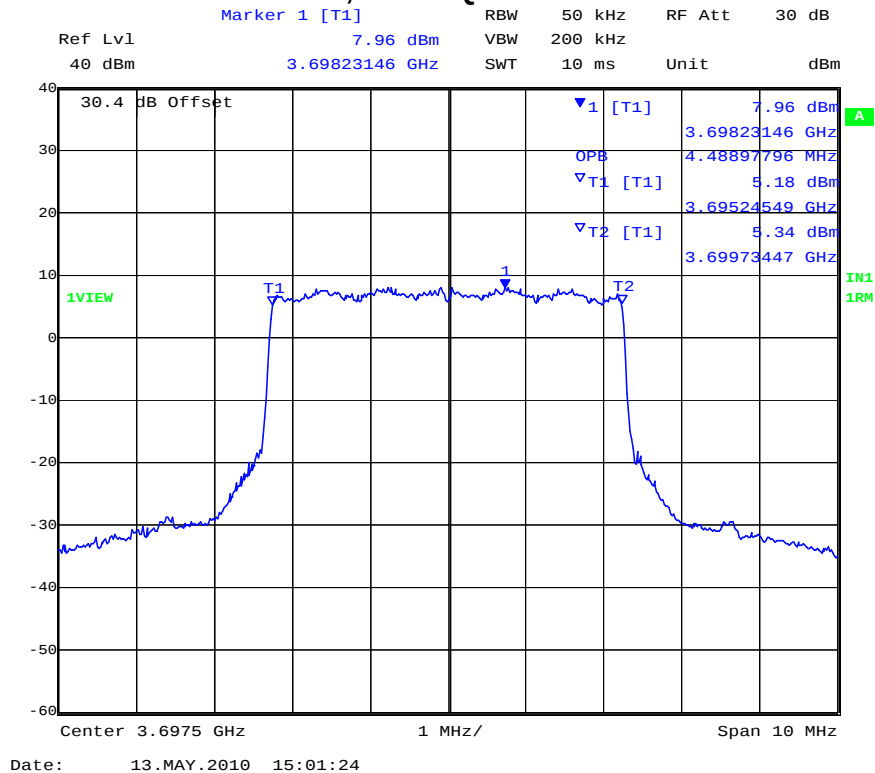


Title: Axxcelera ETDAP-C9AC
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Channel 3697.5, 5 MHz BPSK 99% Bandwidth



Channel 3697.5, 5 MHz QPSK 99% Bandwidth

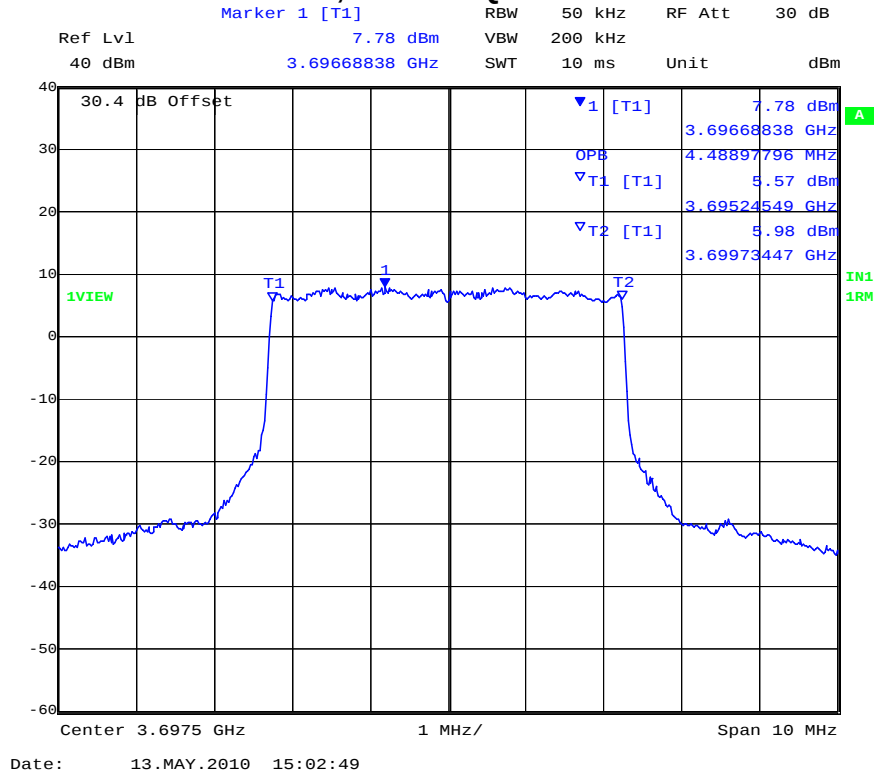


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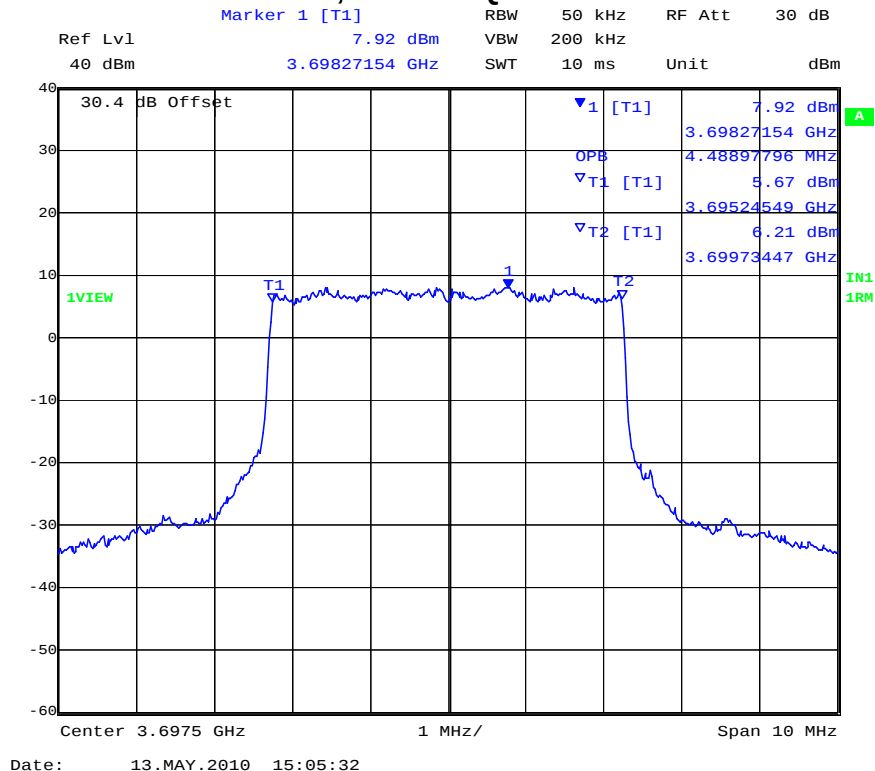


Title: Axxcelera ETDAP-C9AC
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Channel 3697.5, 5 MHz 16QAM 99% Bandwidth



Channel 3697.5, 5 MHz 64QAM 99% Bandwidth



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7 MHz Bandwidth

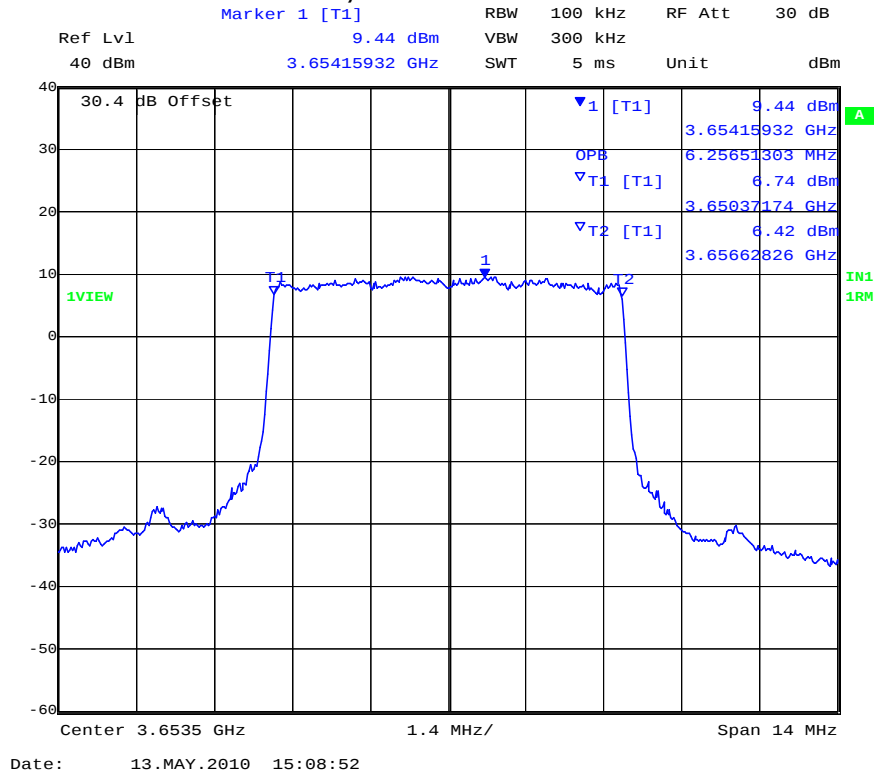
99% Bandwidth				
Center Frequency (MHz)	BPSK	QPSK	16 QAM	64QAM
3653.50	6.257	6.257	6.257	6.257
3675.00	6.257	6.228	6.228	6.257
3696.50	6.257	6.257	6.257	6.257

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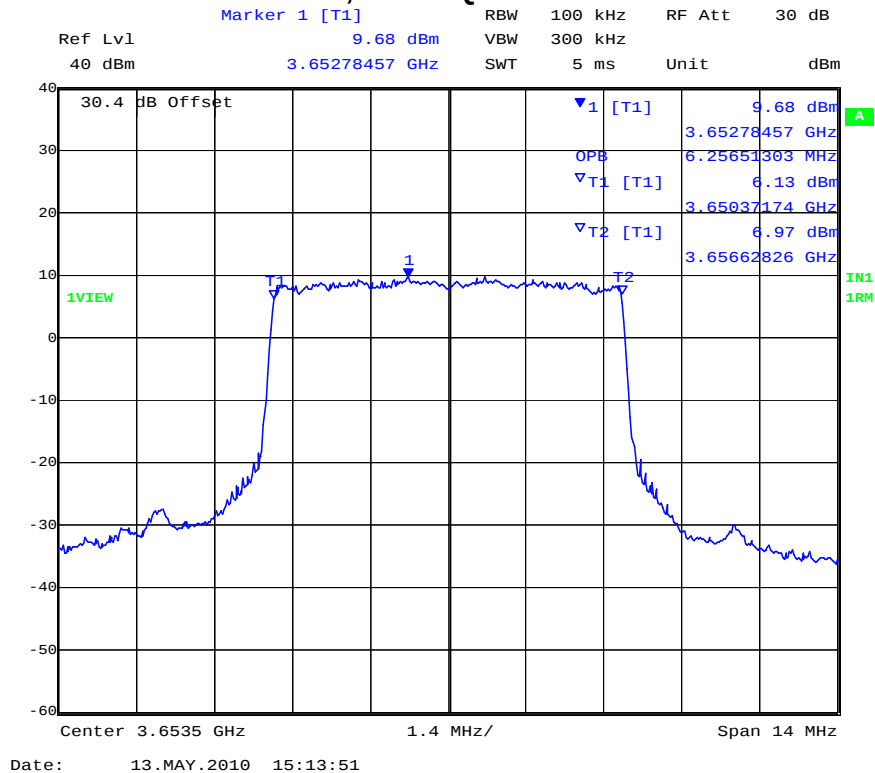


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Channel 3653.5, 7 MHz BPSK 99% Bandwidth



Channel 3653.5, 7 MHz QPSK 99% Bandwidth

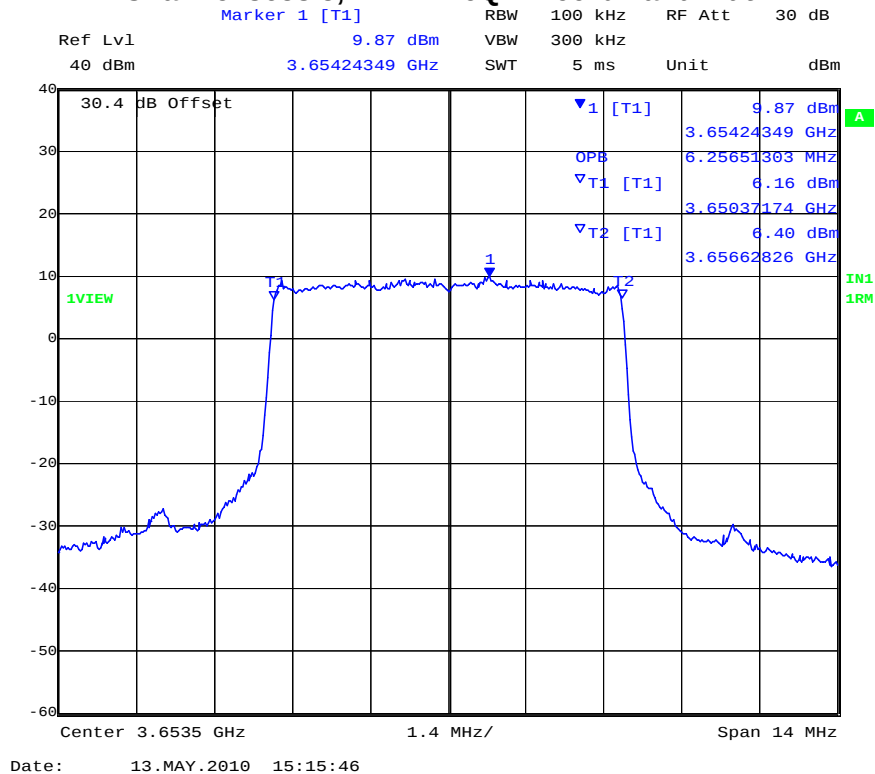


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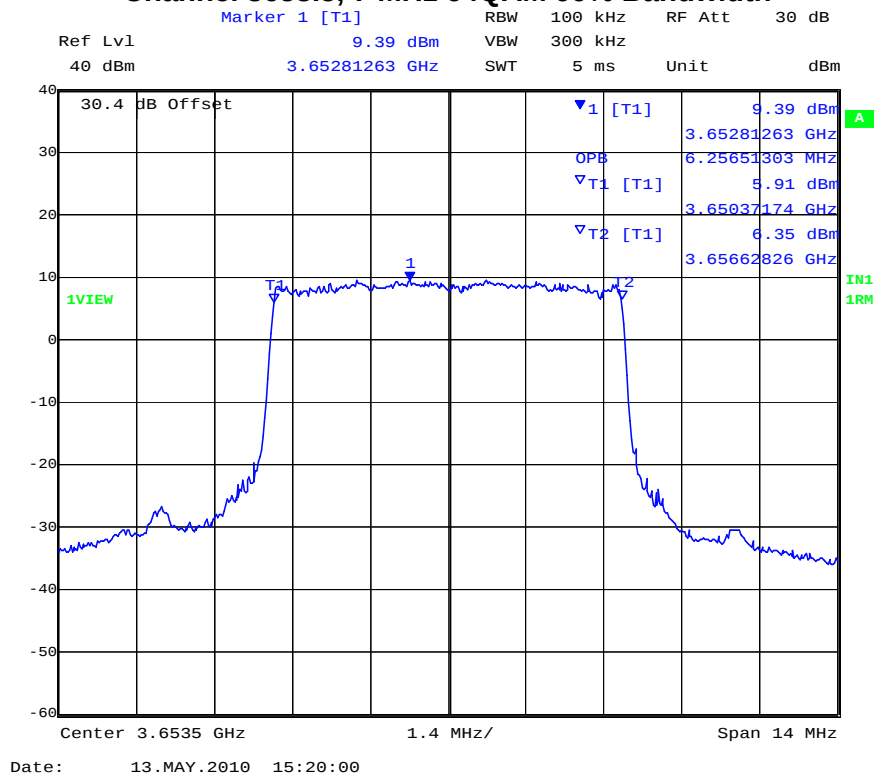


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Channel 3653.5, 7 MHz 16QAM 99% Bandwidth



Channel 3653.5, 7 MHz 64QAM 99% Bandwidth

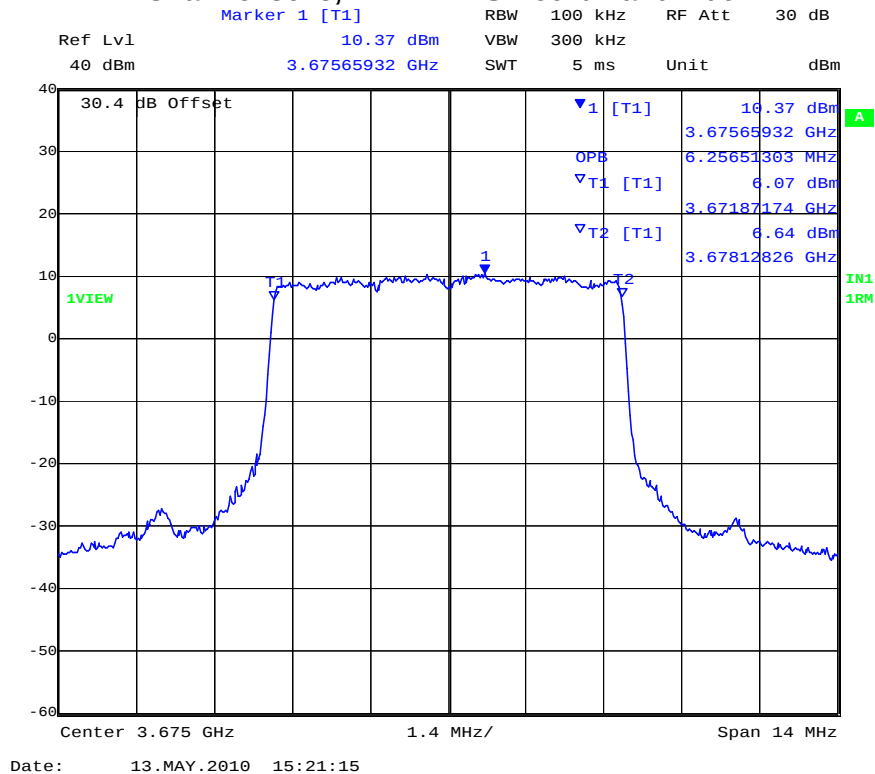


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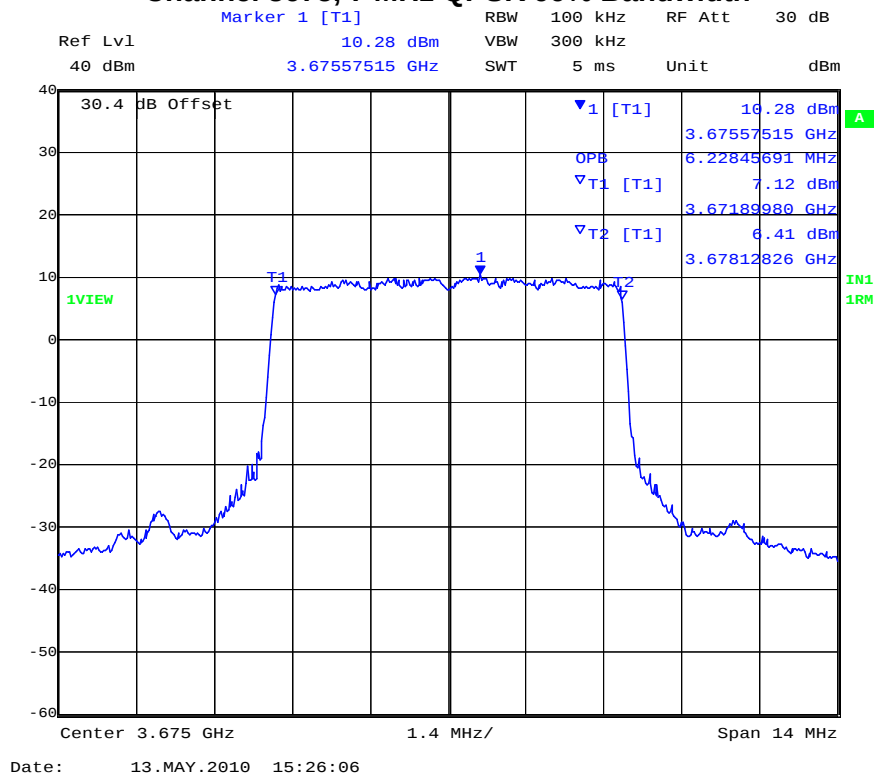


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Channel 3675, 7 MHz BPSK 99% Bandwidth



Channel 3675, 7 MHz QPSK 99% Bandwidth

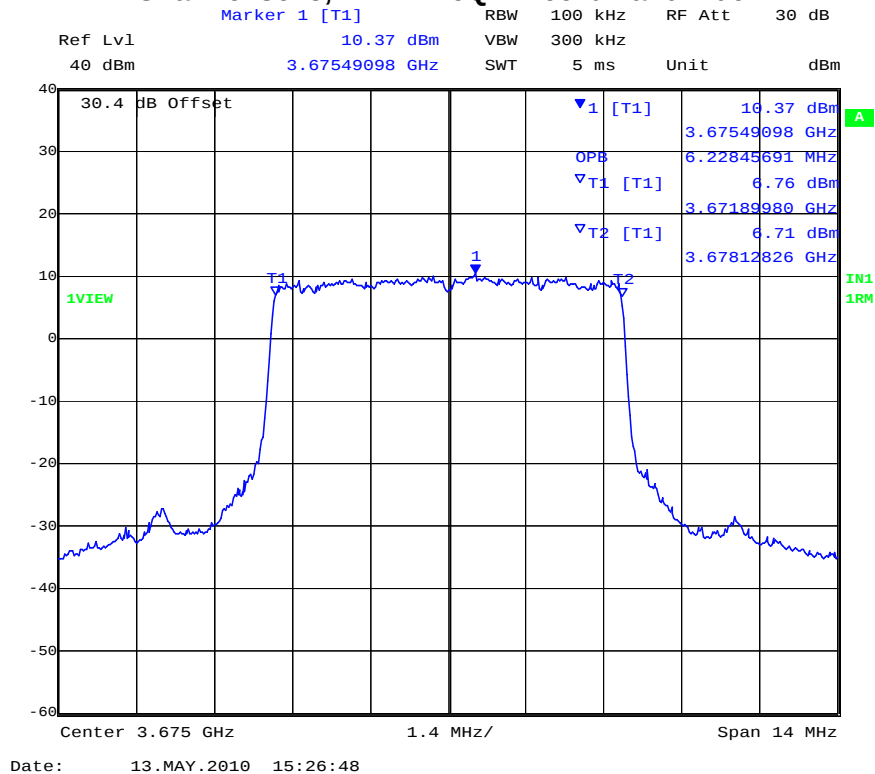


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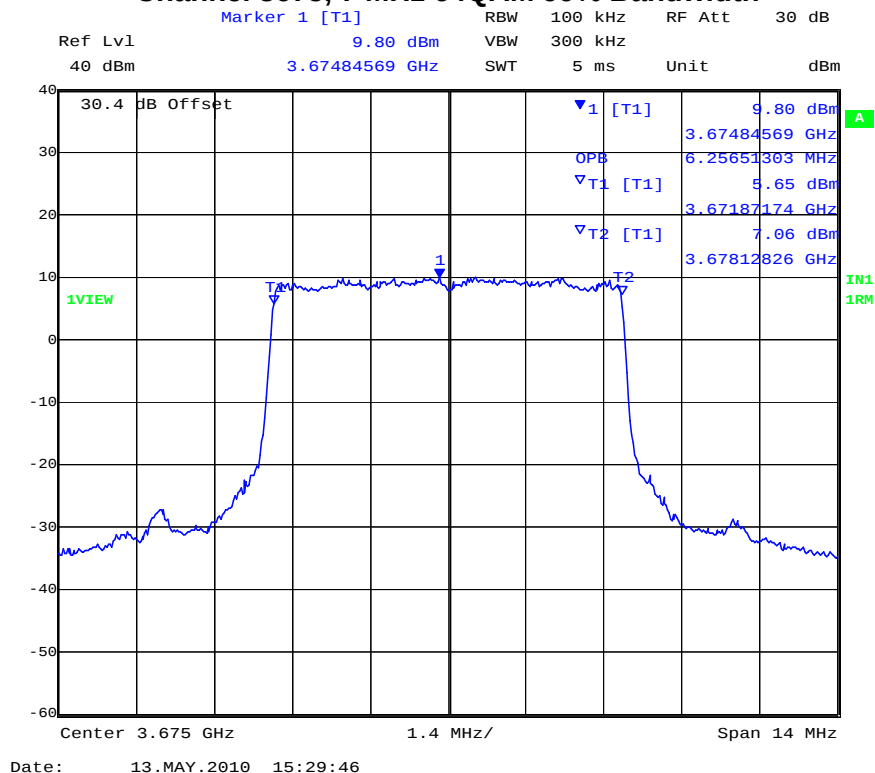


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Channel 3675, 7 MHz 16QAM 99% Bandwidth



Channel 3675, 7 MHz 64QAM 99% Bandwidth

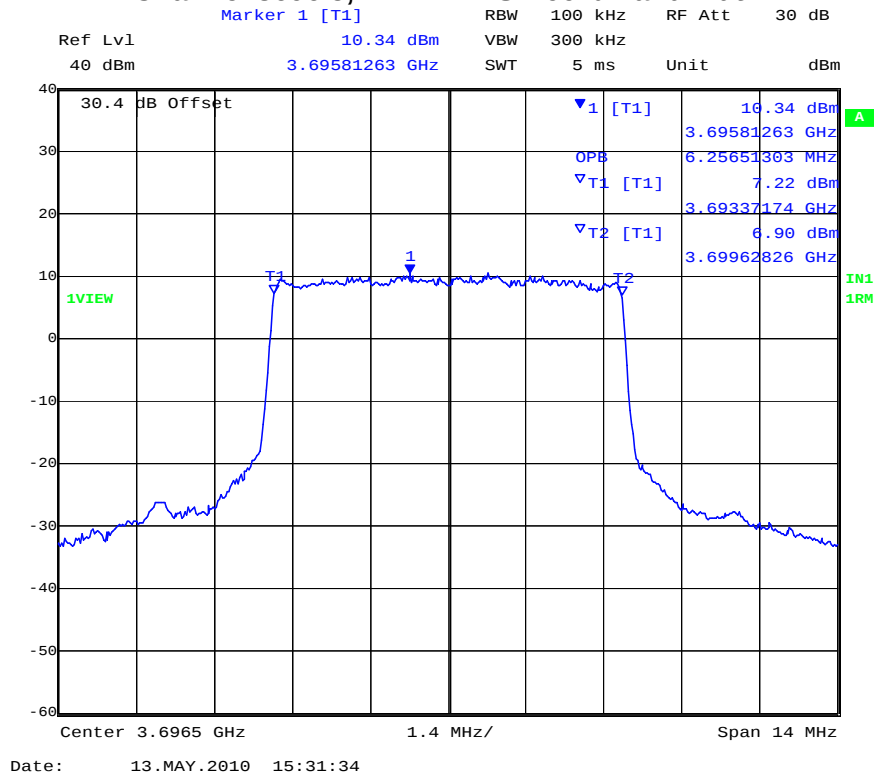


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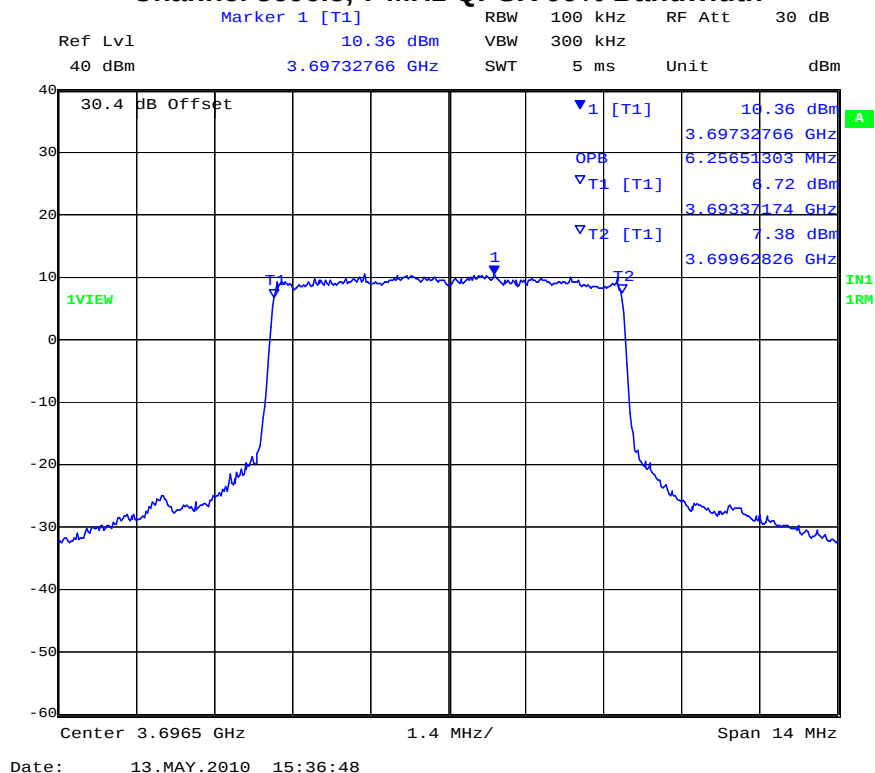


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Channel 3696.5, 7 MHz BPSK 99% Bandwidth



Channel 3696.5, 7 MHz QPSK 99% Bandwidth

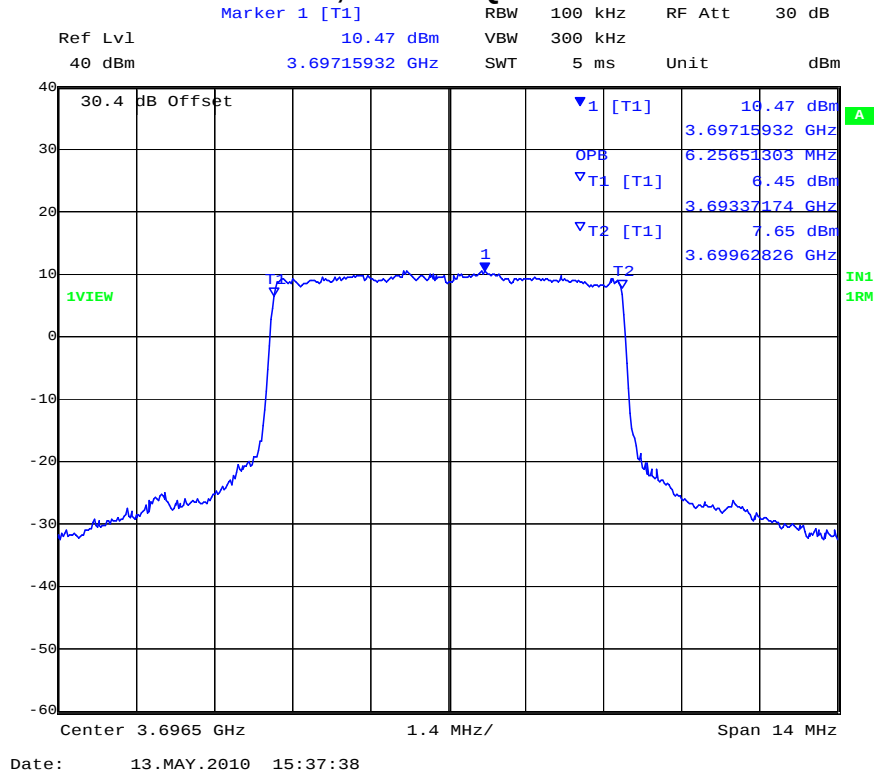


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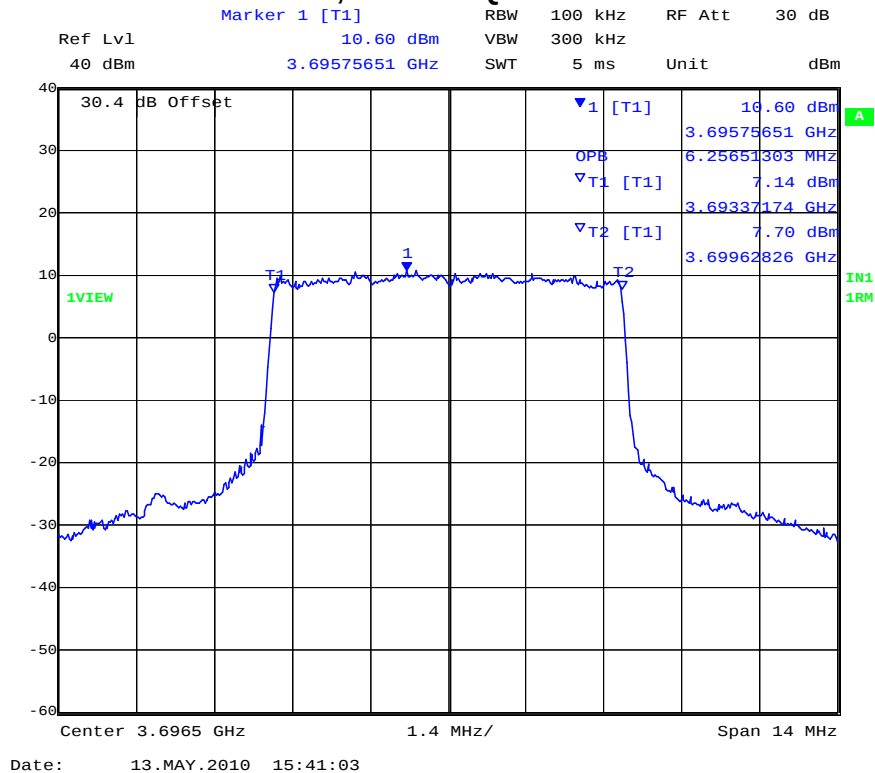


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Channel 3696.5, 7 MHz 16QAM 99% Bandwidth



Channel 3696.5, 7 MHz 64QAM 99% Bandwidth



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Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	± 1.33 dB
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Traceability

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

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5.1.2. Peak Output Power

FCC 47 CFR Part 90, Subpart Z; §90.1321(a)

The following power limits apply to the 3650 – 3675 MHz band.

Base and fixed stations are limited to 25W/25 MHz equivalent isotropically radiated power (EIRP). In any event the peak EIRP power density shall not exceed 1 Watt (+30 dBm) in any one Megahertz slice of spectrum.

EIRP Power Limit 3.5 MHz Channel Spacing = +35.4 dBm

EIRP Power Limit 5 MHz Channel Spacing = +37.0 dBm

EIRP Power Limit 7 MHz Channel Spacing = +38.4 dBm

Test Procedure

The test methodology employed for measuring Output Power can be found in Section 2.1

Normative References, ref viii “Compliance Management Guidance for Wireless Broadband Services Operating in the 3650-3700 MHz Band”, see Band Power Measurement.

Test Set-up is shown in Section 3.6 Test Configuration

Ambient conditions.

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

MAXIMUM OUTPUT POWER V'S ANTENNA GAIN

Power Limit Channel Spacing V's Antenna Gain

Antenna Type	Channel Spacing (MHz)	Gain (dBi)	EIRP Limit (dBm)	Maximum Permissible Conducted Power (dBm)
OMNI / Sector	3.5	10.0	+35.4	+26.4
		14.0		+22.4
		16.0		+20.4
OMNI / Sector	5	10.0	+37.0	+28.0
		14.0		+24.0
		16.0		+22.0
OMNI / Sector	7	10.0	+38.4	+29.4
		14.0		+25.4
		16.0		+23.4

Maximum Permissible Conducted Power = EIRP – Antenna Gain + 1 dB antenna cable loss



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3.5 MHz Bandwidth

Center Frequency (MHz)	Peak Output Power				
	BPSK (+dBm)	QPSK (+dBm)	16 QAM (+dBm)	64QAM (+dBm)	Minimum Margin (dB)
3651.75	24.92	25.01	25.82	25.17	-0.58
3675.00	25.55	25.42	26.18	25.51	-0.22
3698.25	26.02	25.86	26.08	25.83	-0.32

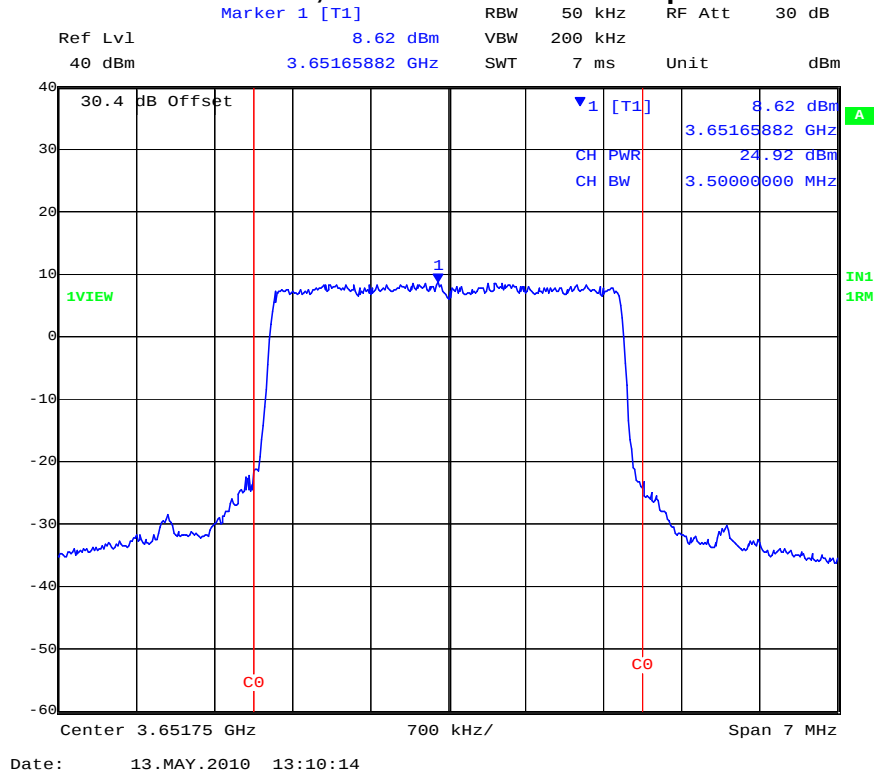
Conducted Power Limit: +26.4 dBm

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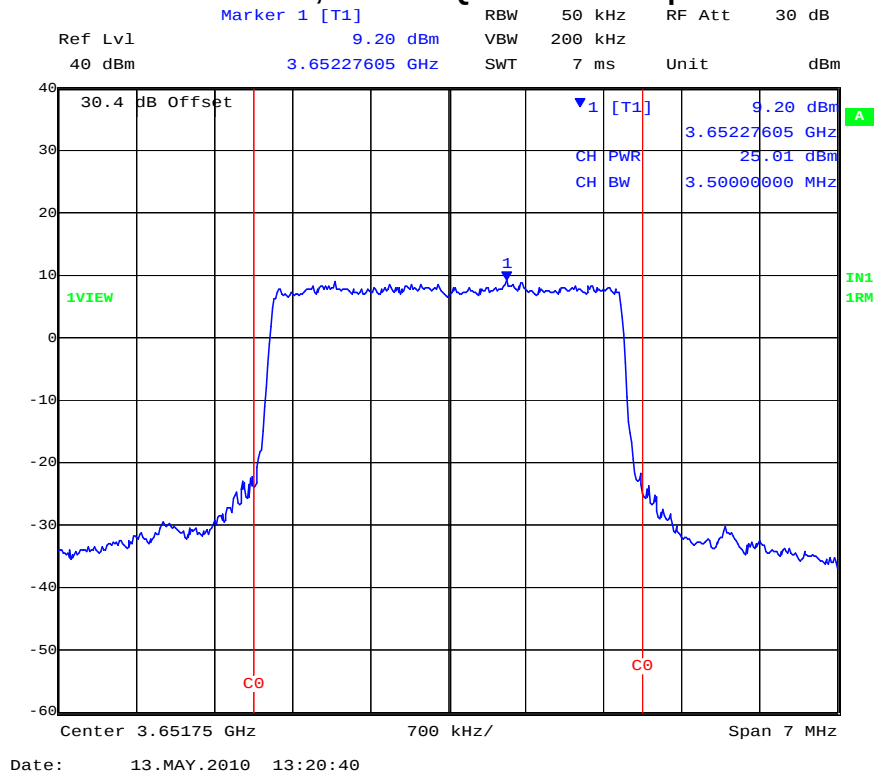


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Channel 3651.75, 3.5 MHz BPSK Peak Output Power



Channel 3651.75, 3.5 MHz QPSK Peak Output Power

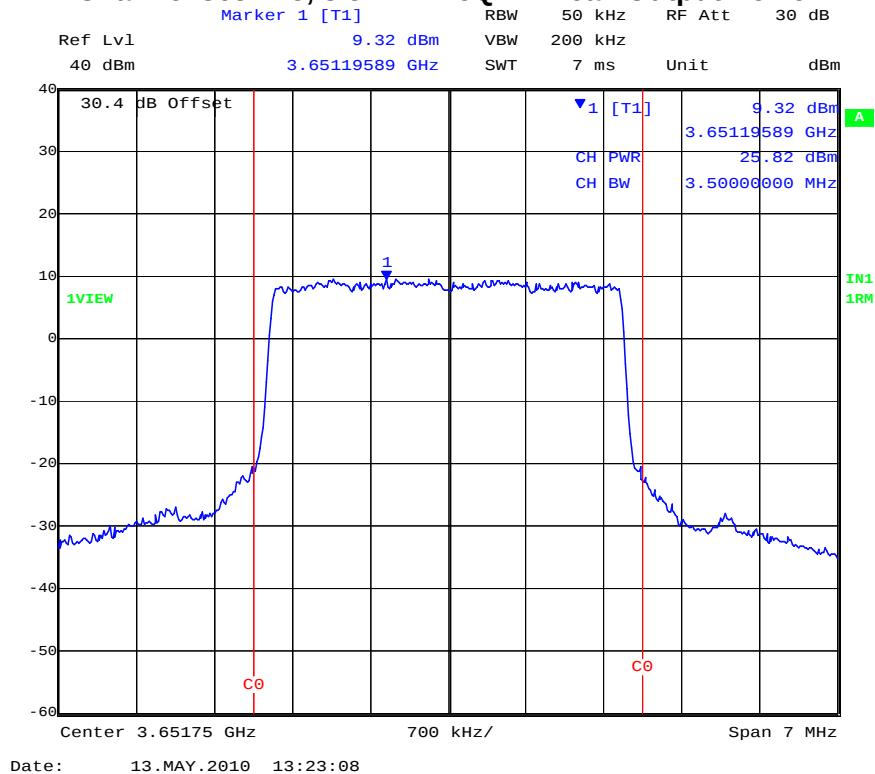


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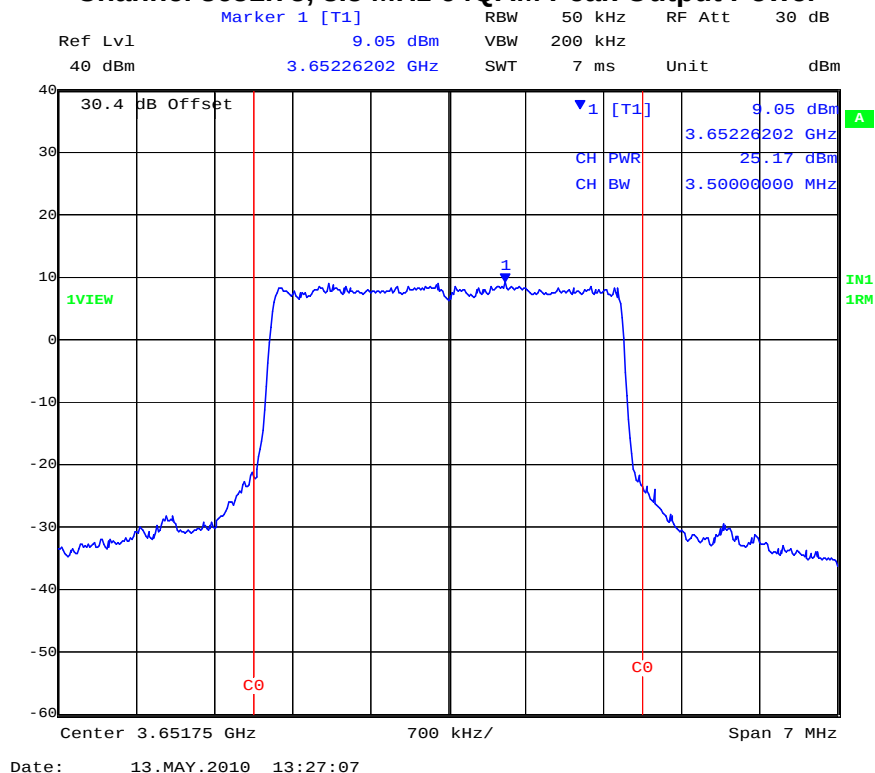


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Channel 3651.75, 3.5 MHz 16QAM Peak Output Power



Channel 3651.75, 3.5 MHz 64QAM Peak Output Power

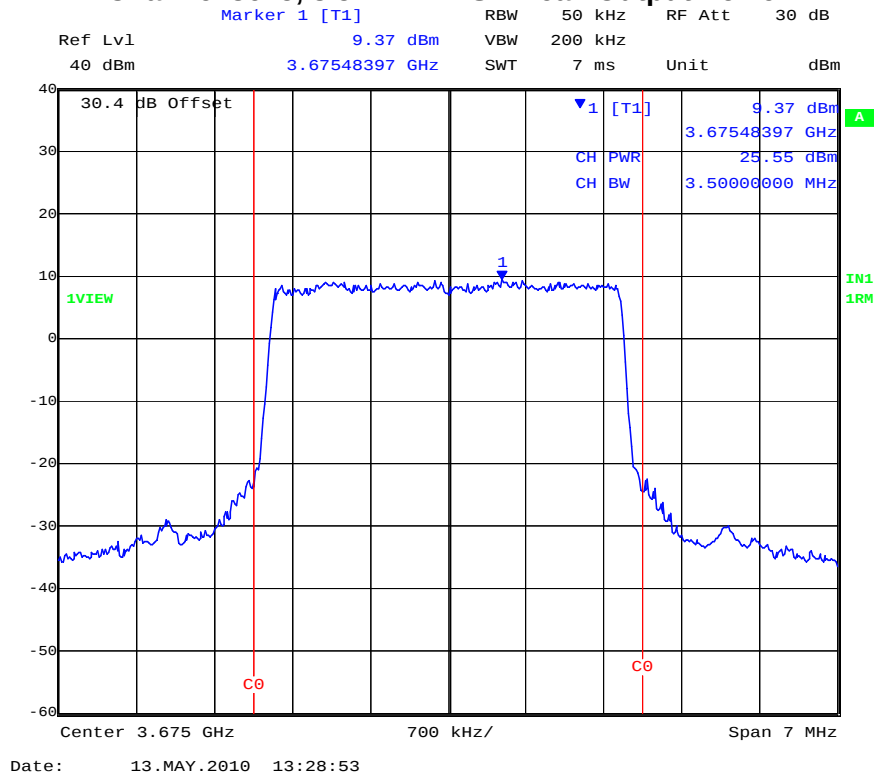


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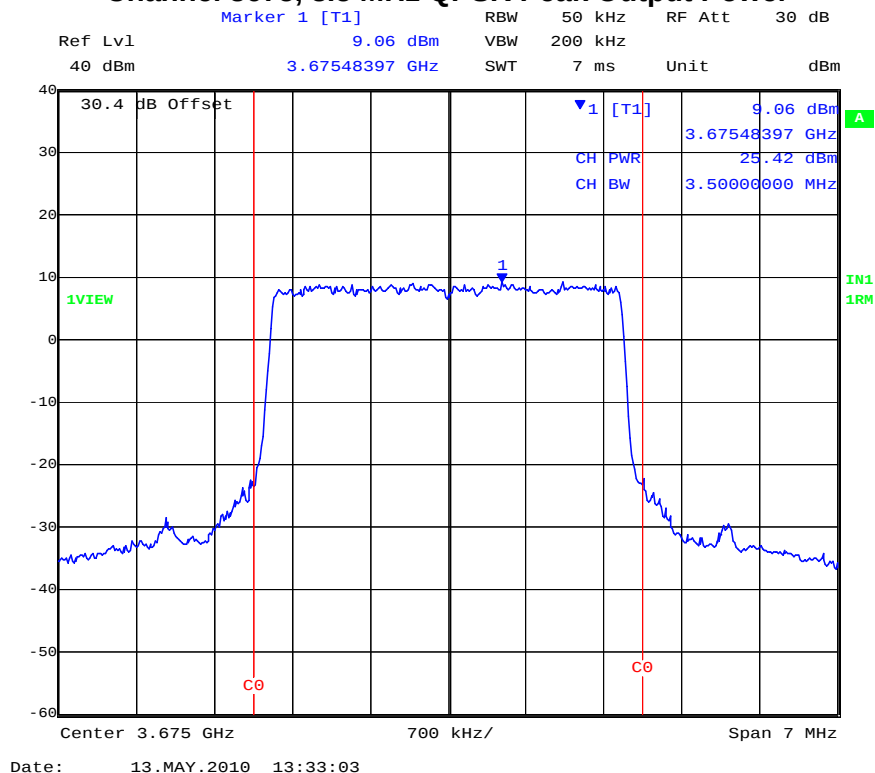


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Channel 3675, 3.5 MHz BPSK Peak Output Power



Channel 3675, 3.5 MHz QPSK Peak Output Power

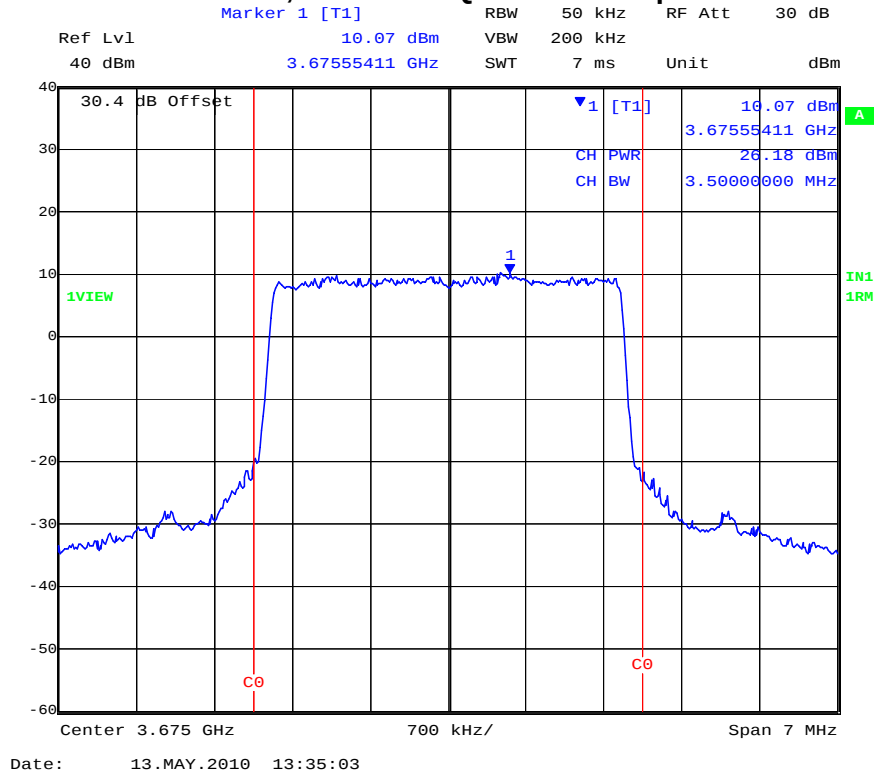


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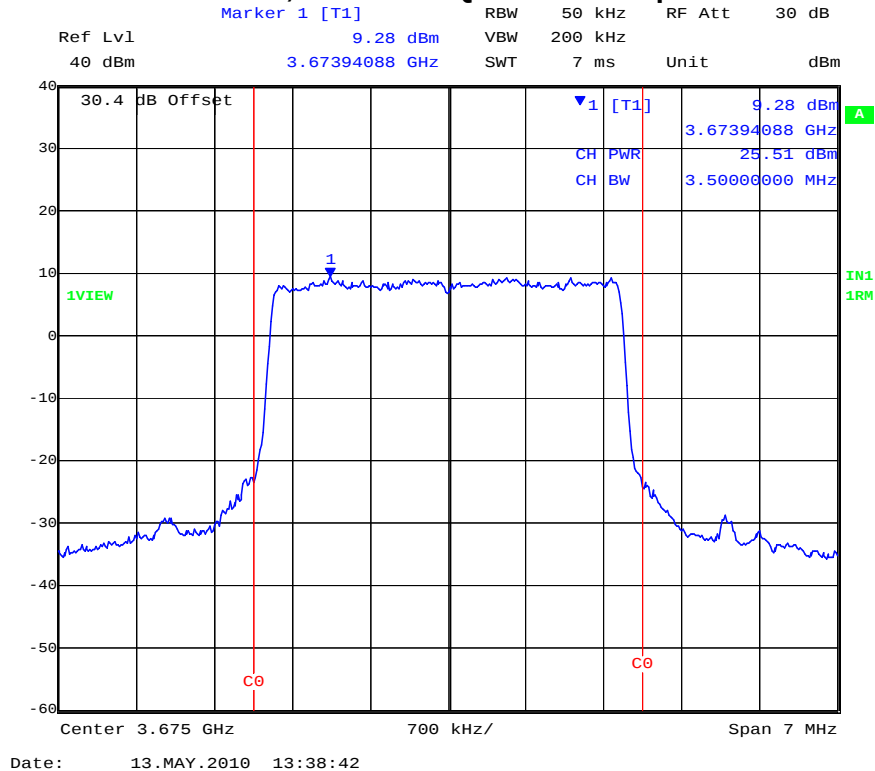


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Channel 3675, 3.5 MHz 16QAM Peak Output Power



Channel 3675, 3.5 MHz 64QAM Peak Output Power

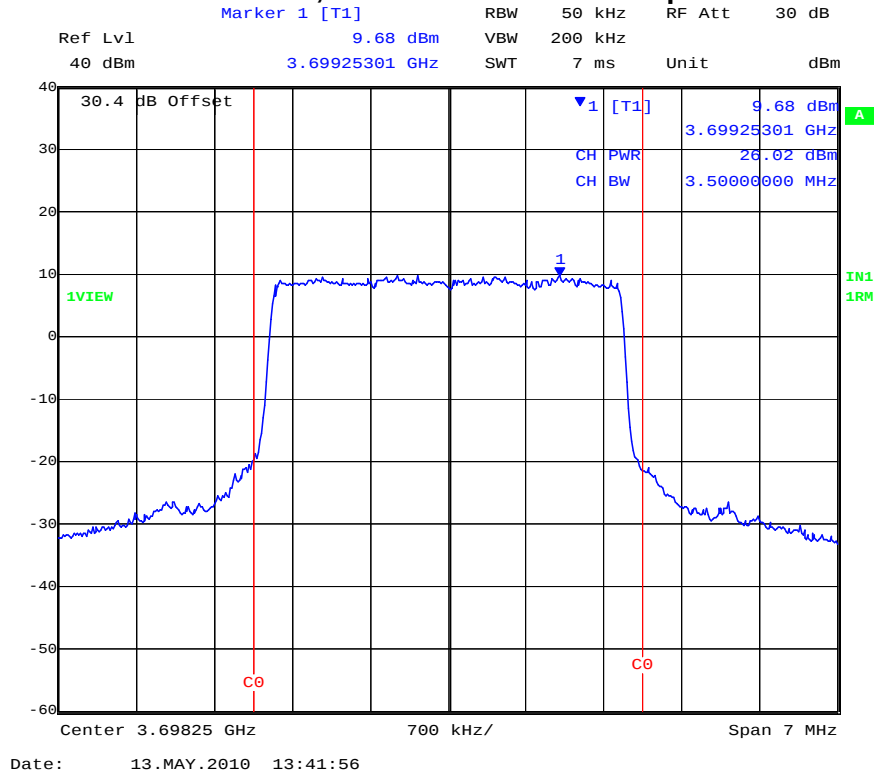


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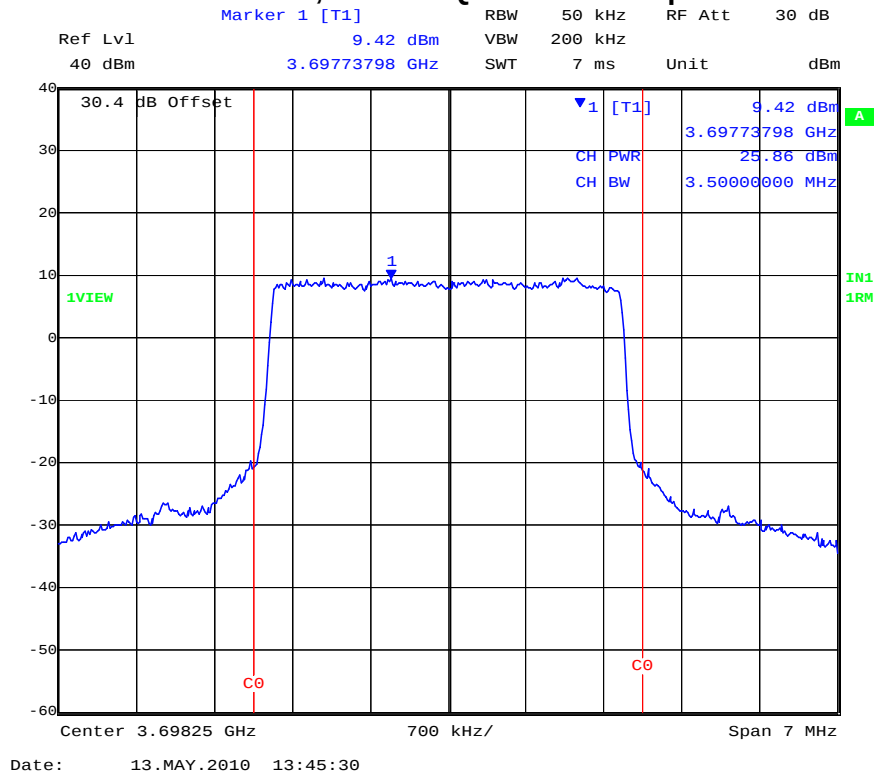


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Channel 3698.25, 3.5 MHz BPSK Peak Output Power



Channel 3698.25, 3.5 MHz QPSK Peak Output Power

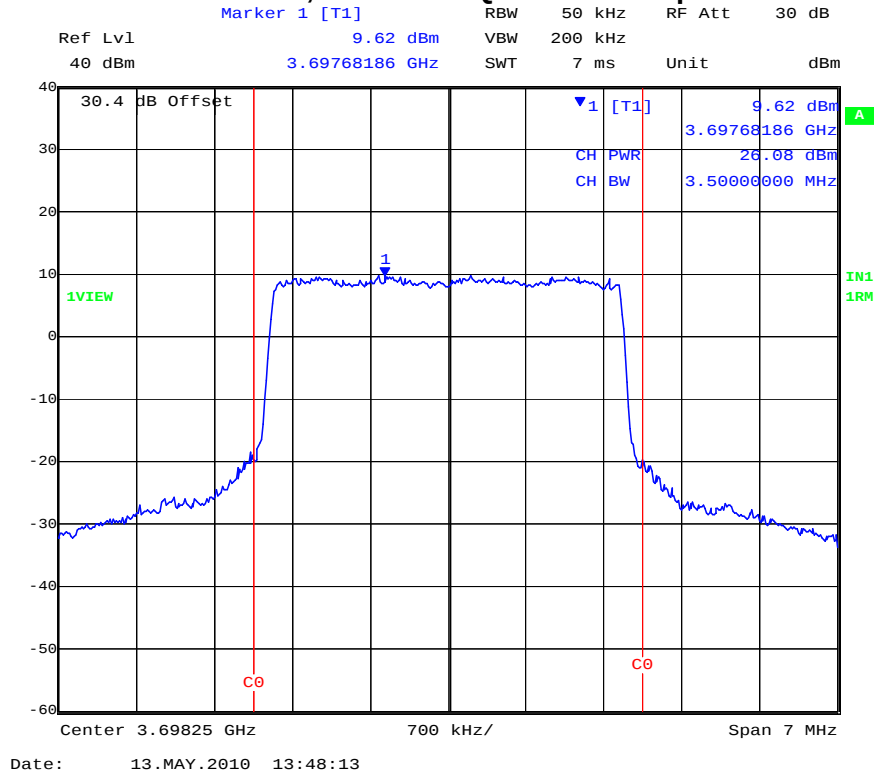


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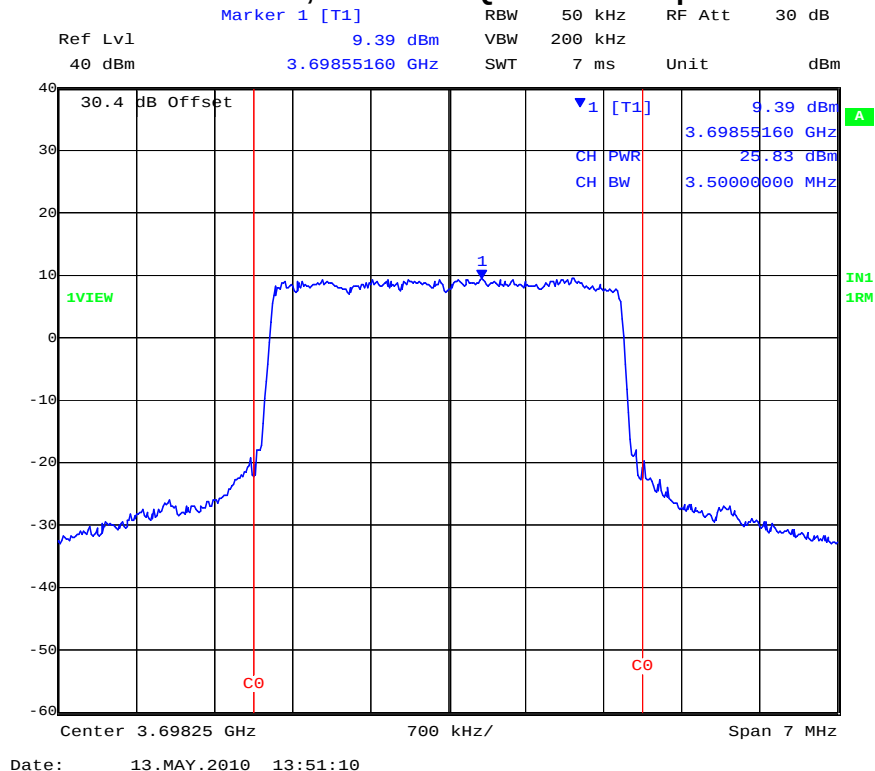


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Channel 3698.25, 3.5 MHz 16QAM Peak Output Power



Channel 3698.25, 3.5 MHz 64QAM Peak Output Power



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5 MHz Bandwidth

Center Frequency (MHz)	Peak Output Power				
	BPSK (+dBm)	QPSK (+dBm)	16 QAM (+dBm)	64QAM (+dBm)	Minimum Margin (dB)
3652.50	25.32	26.20	26.09	26.15	-1.80
3675.00	26.50	26.30	26.08	26.46	-1.50
3697.50	26.02	25.73	25.69	25.74	-1.98

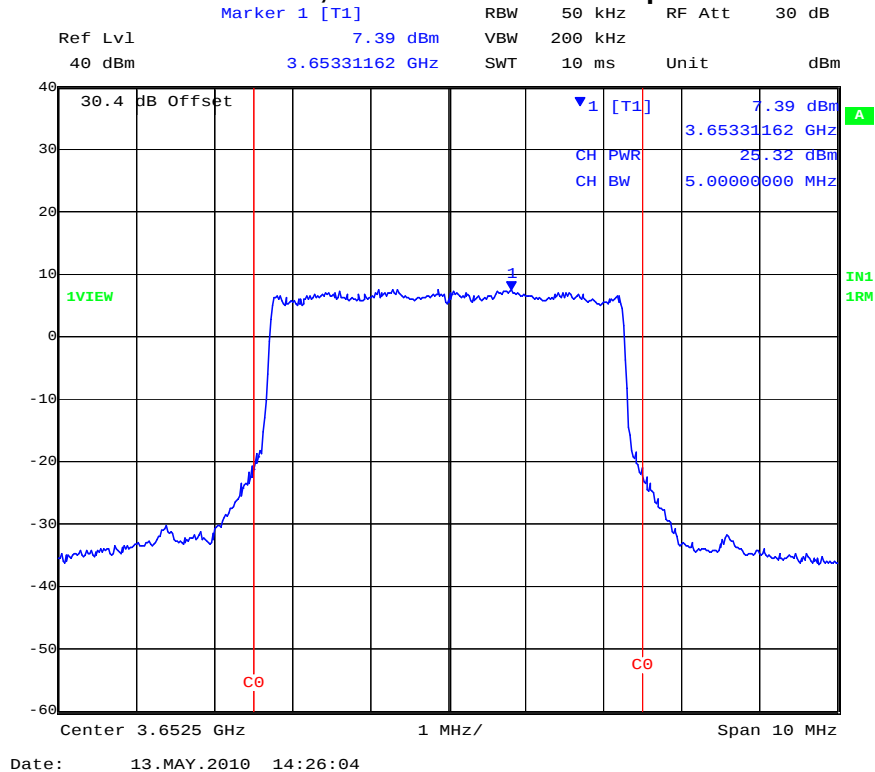
Conducted Power Limit: +28.0 dBm

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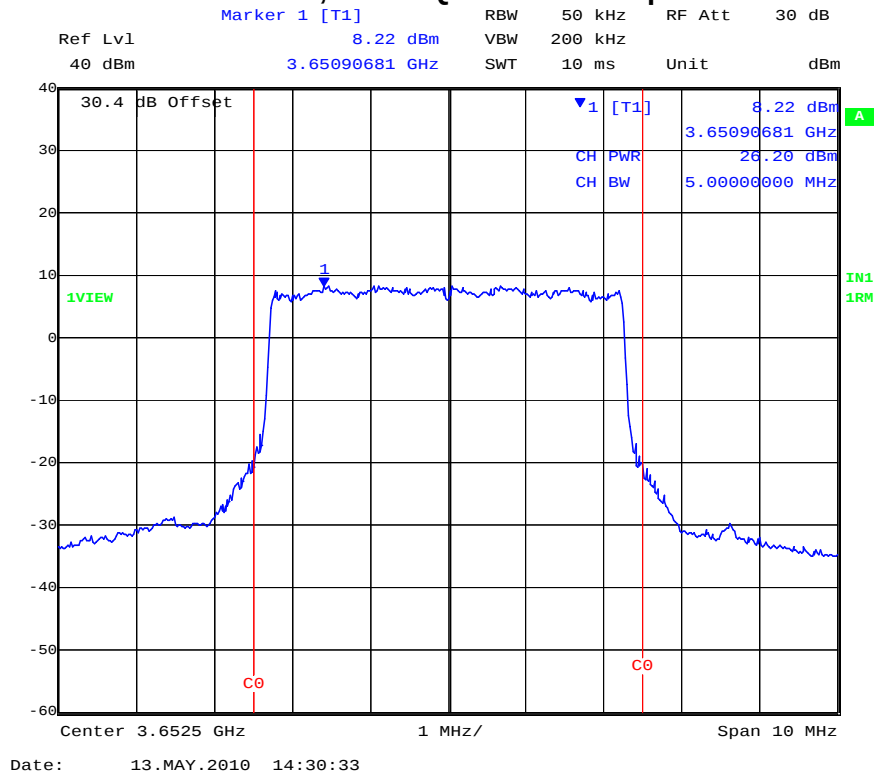


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Channel 3652.5, 5 MHz BPSK Peak Output Power



Channel 3652.5, 5 MHz QPSK Peak Output Power

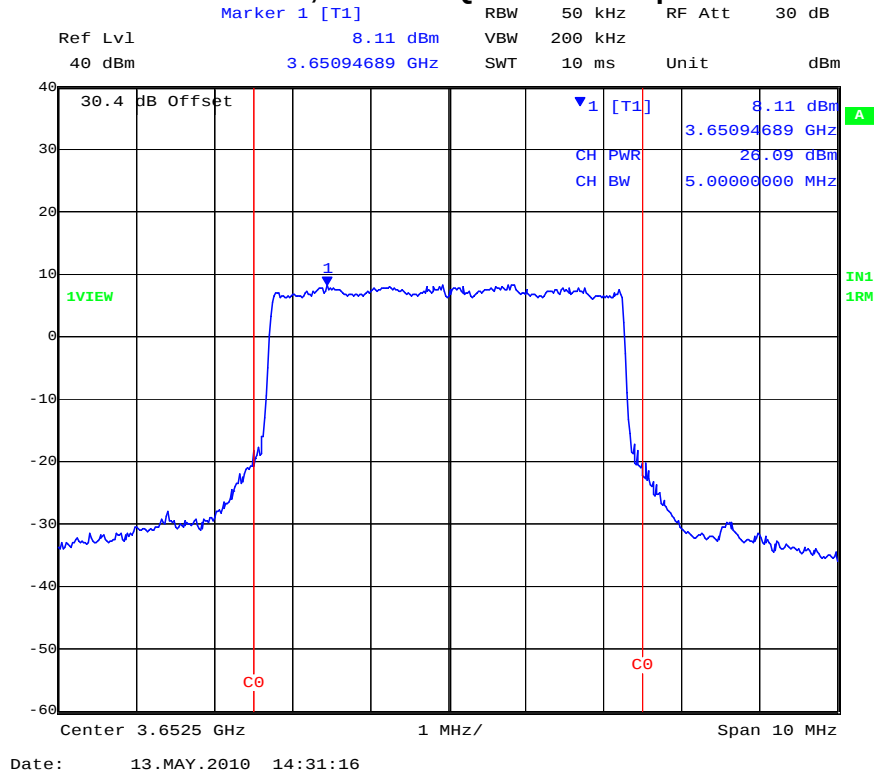


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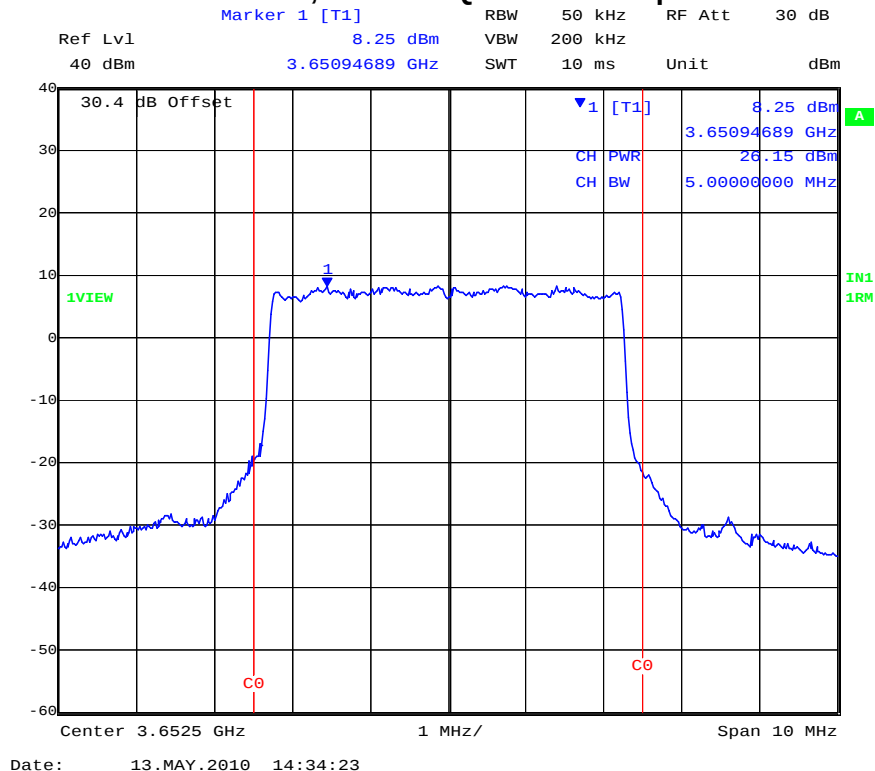


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Channel 3652.5, 5 MHz 16QAM Peak Output Power



Channel 3652.5, 5 MHz 64QAM Peak Output Power

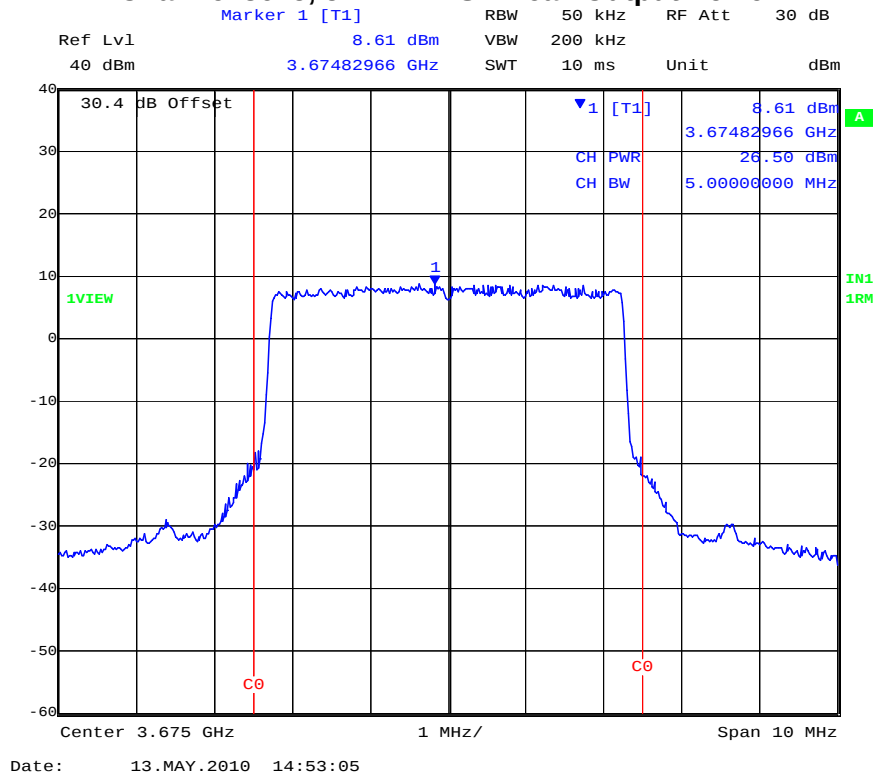


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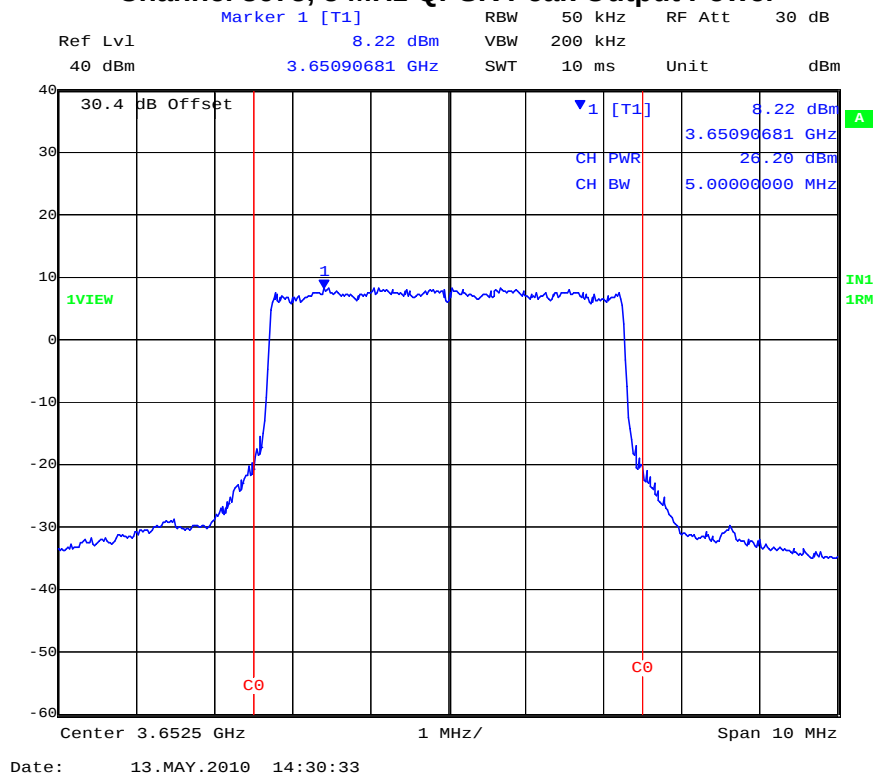


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Channel 3675, 5 MHz BPSK Peak Output Power



Channel 3675, 5 MHz QPSK Peak Output Power

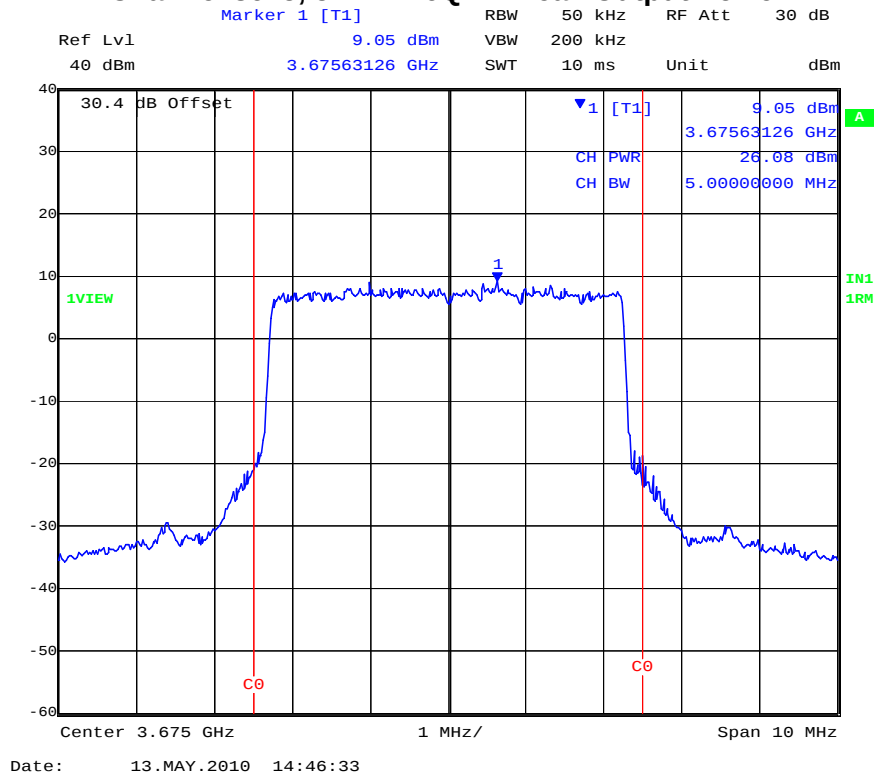


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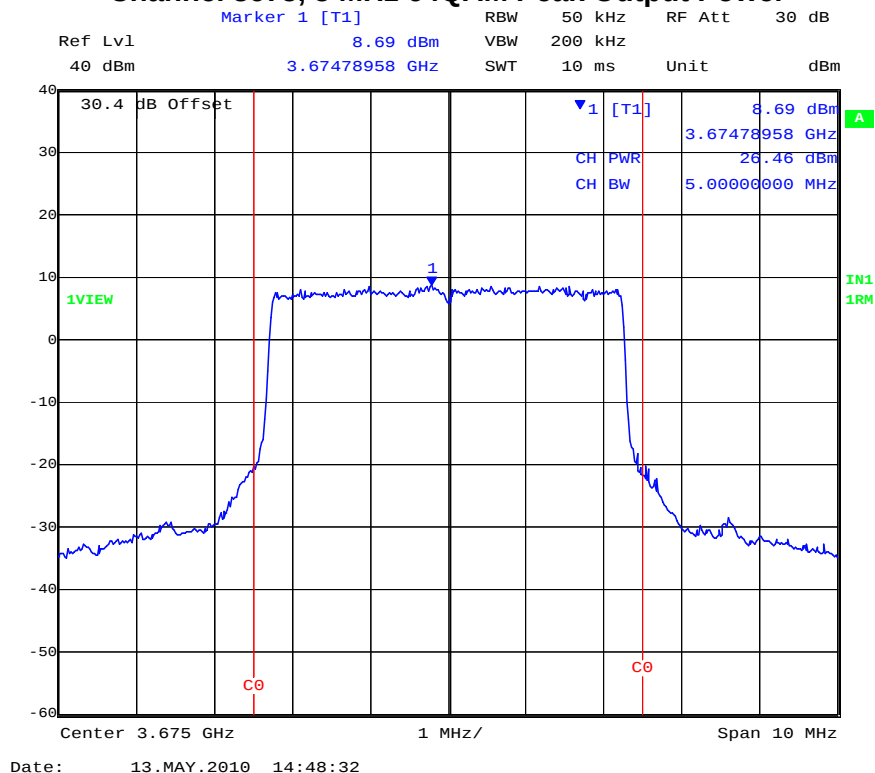


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Channel 3675, 5 MHz 16QAM Peak Output Power



Channel 3675, 5 MHz 64QAM Peak Output Power

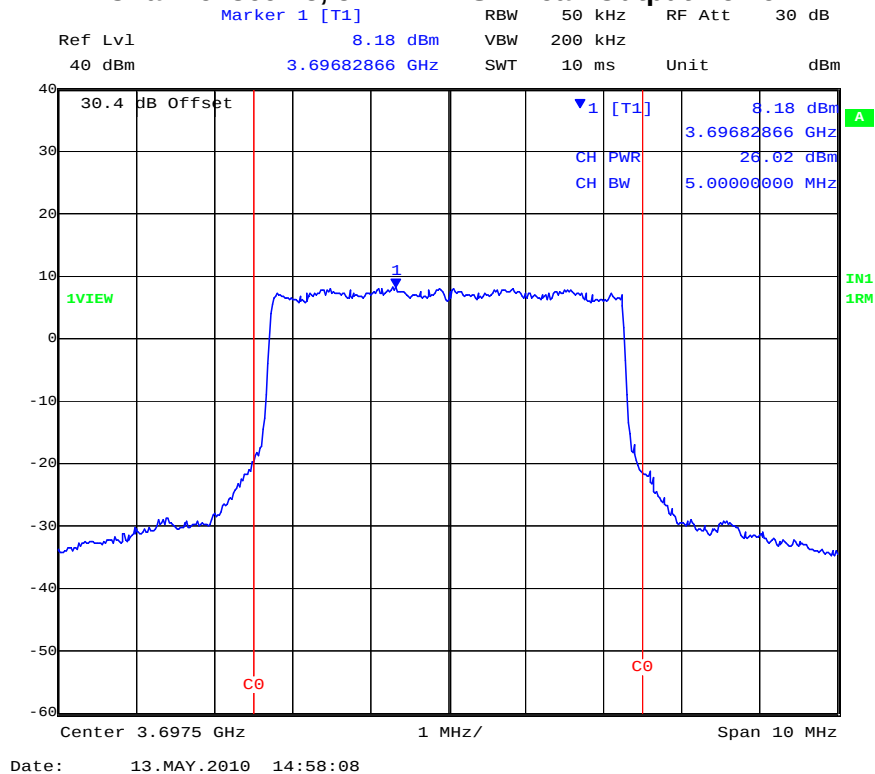


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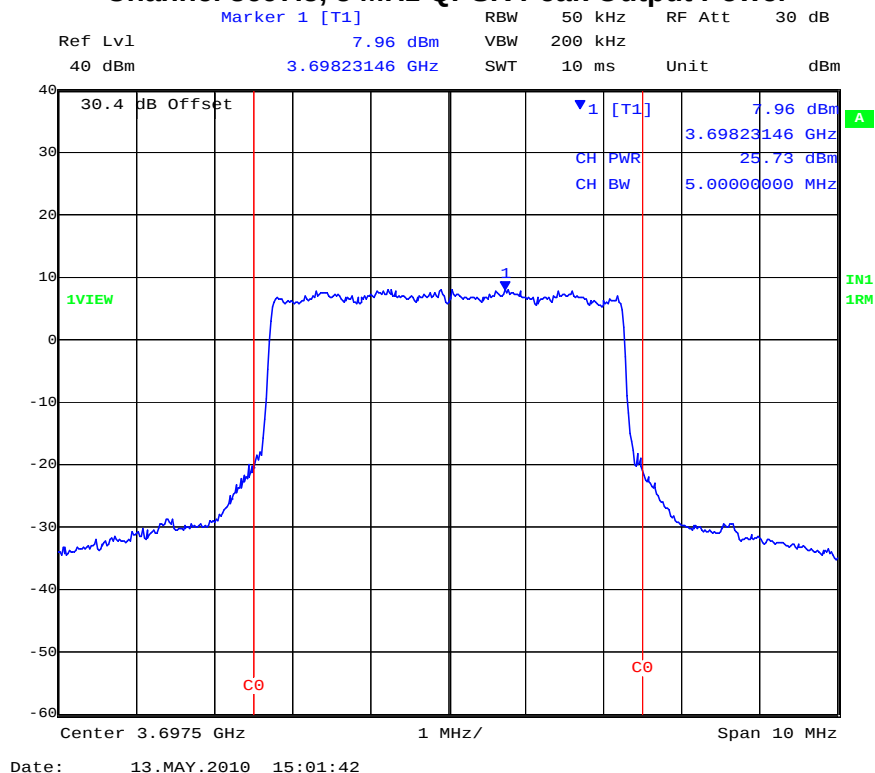


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Channel 3697.5, 5 MHz BPSK Peak Output Power



Channel 3697.5, 5 MHz QPSK Peak Output Power

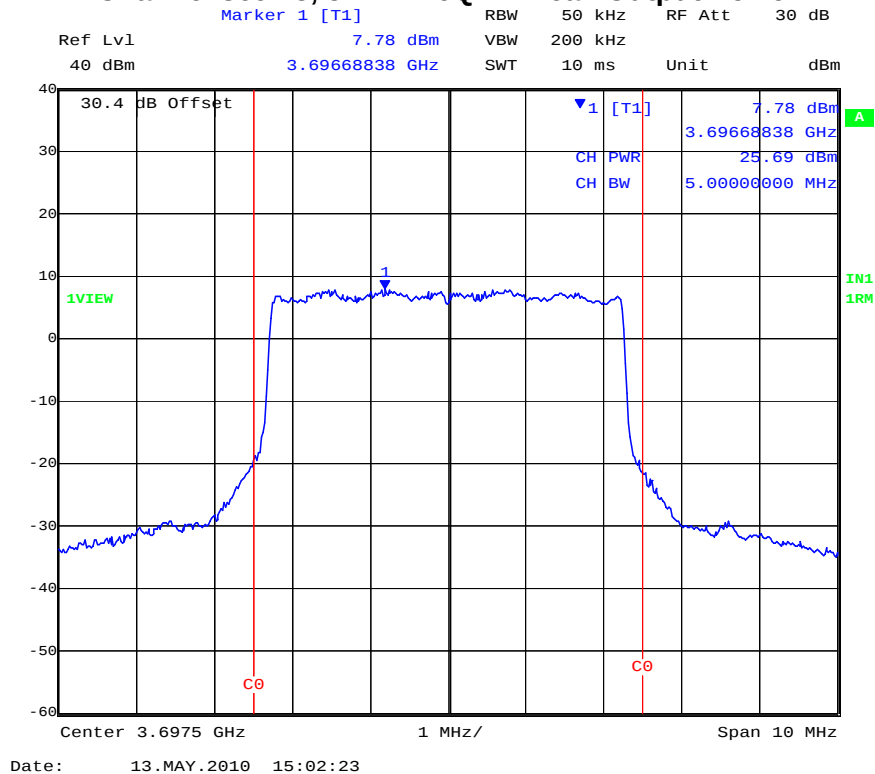


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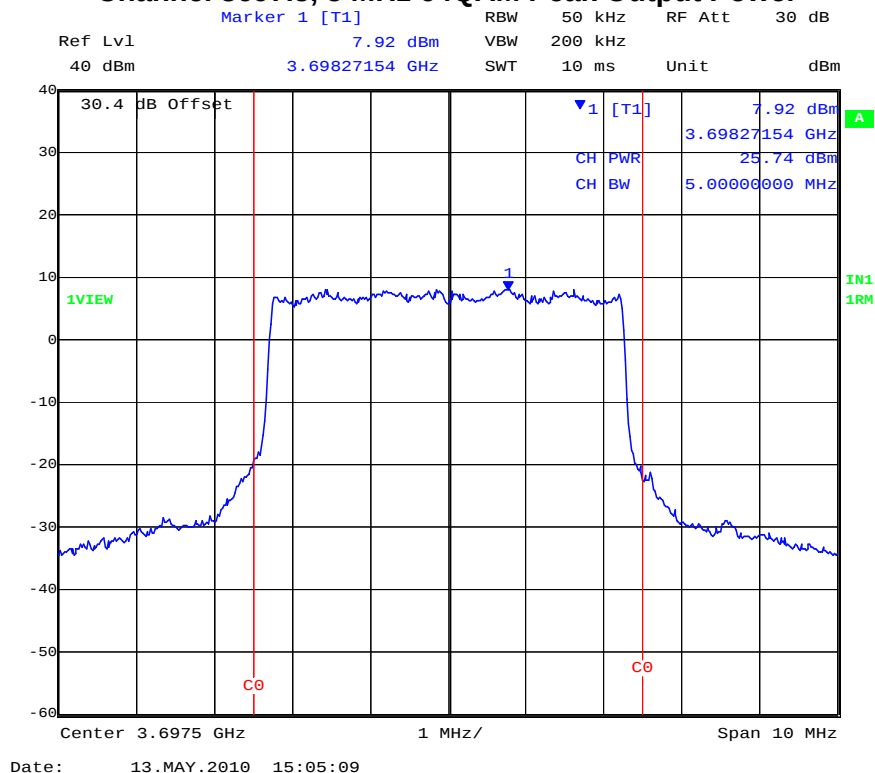


Title: Axxcelera ETDAP-C9AC
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Channel 3697.5, 5 MHz 16QAM Peak Output Power



Channel 3697.5, 5 MHz 64QAM Peak Output Power



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7 MHz Bandwidth

Center Frequency (MHz)	Peak Output Power				
	BPSK (+dBm)	QPSK (+dBm)	16 QAM (+dBm)	64QAM (+dBm)	Minimum Margin (dB)
3653.50	25.79	25.77	25.72	25.74	-3.61
3675.00	26.44	26.27	26.20	26.23	-2.96
3696.50	26.40	26.65	26.58	26.61	-2.75

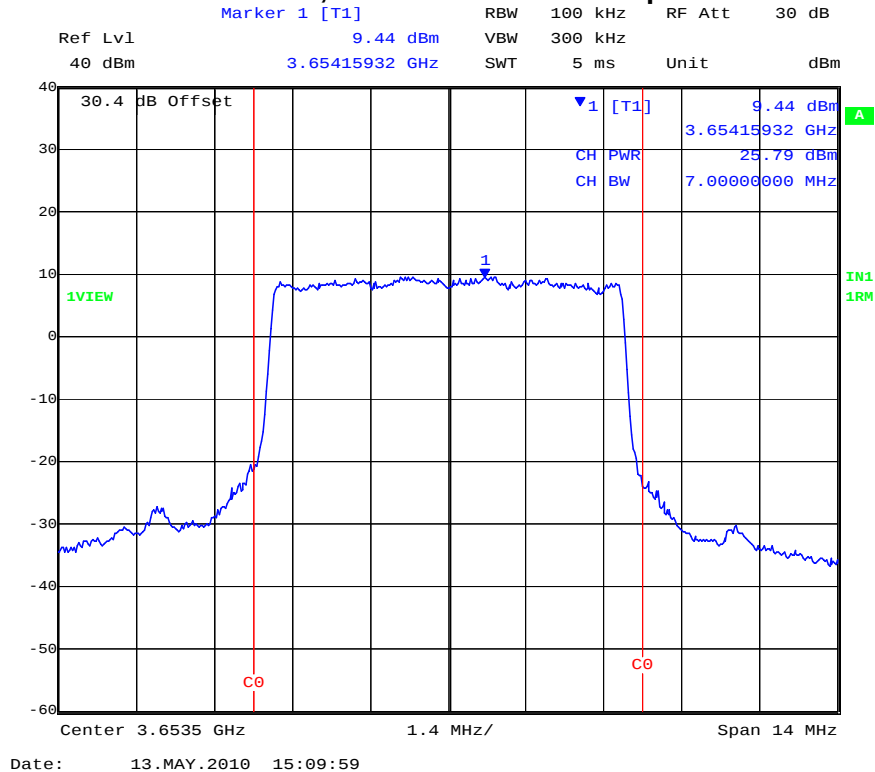
Conducted Power Limit: +29.4 dBm

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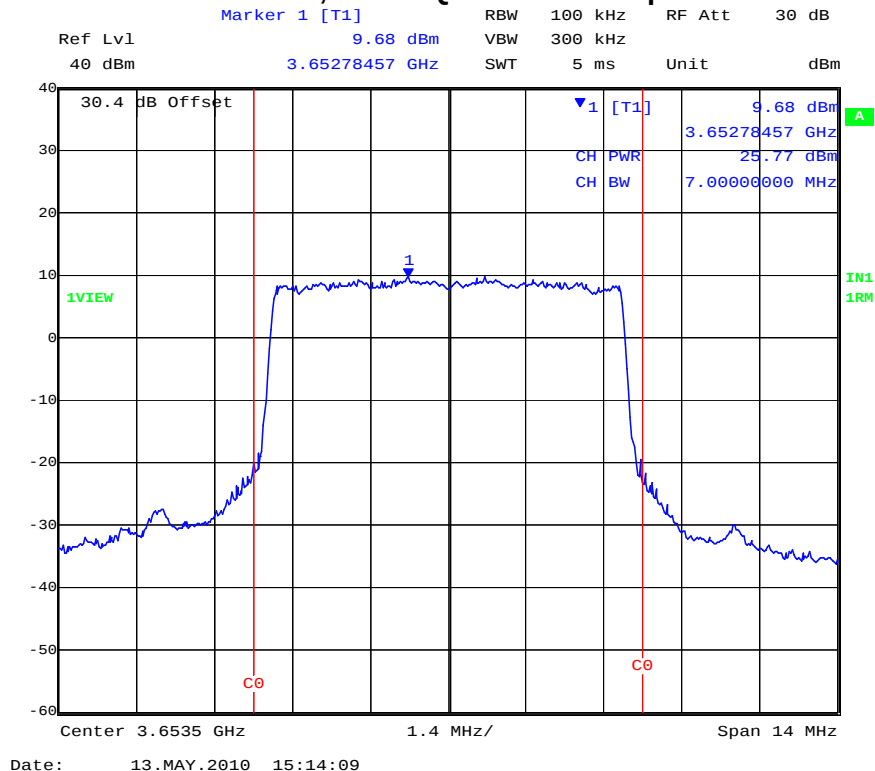


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Channel 3653.5, 7 MHz BPSK Peak Output Power



Channel 3653.5, 7 MHz QPSK Peak Output Power

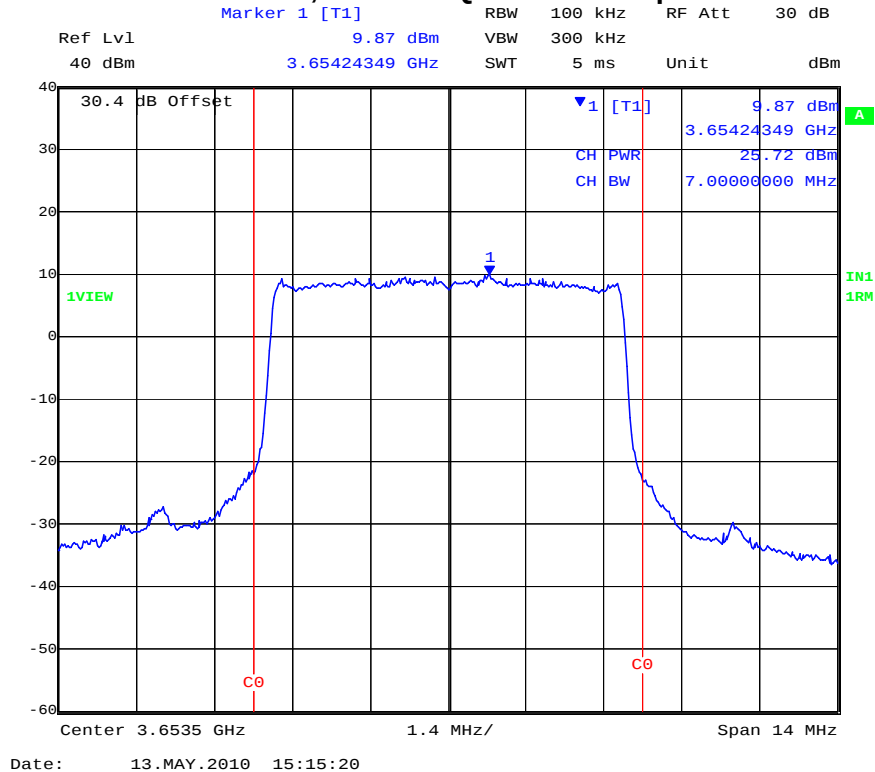


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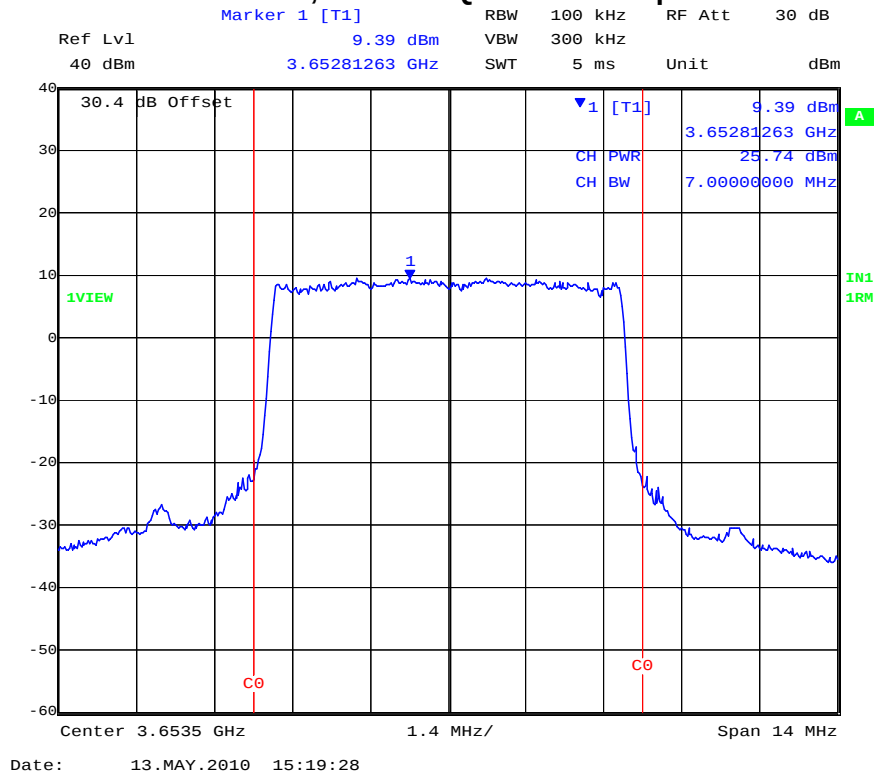


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Channel 3653.5, 7 MHz 16QAM Peak Output Power



Channel 3653.5, 7 MHz 64QAM Peak Output Power

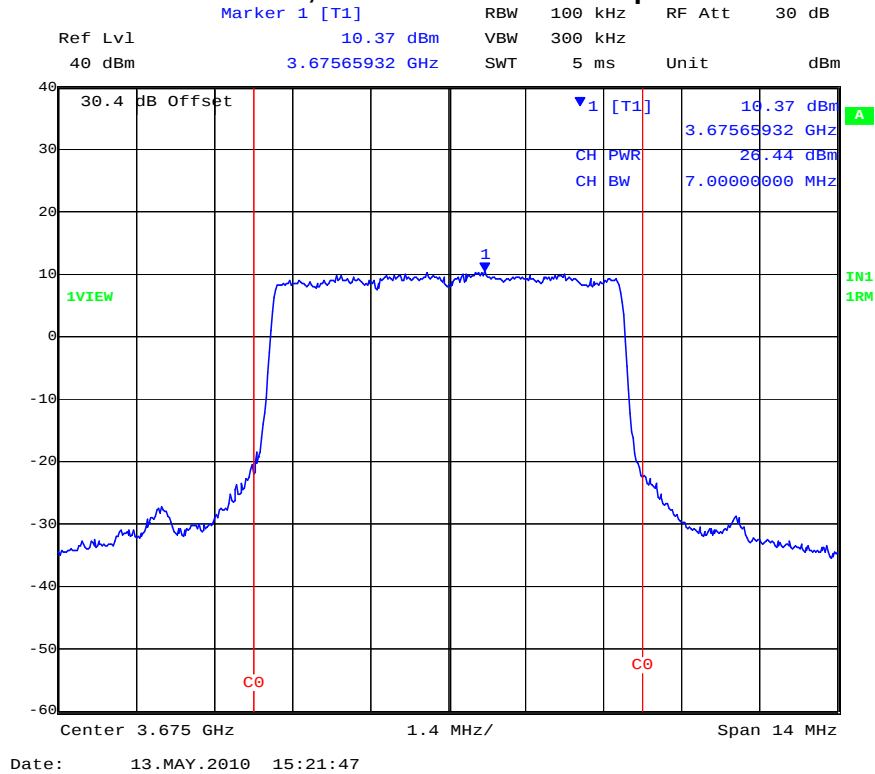


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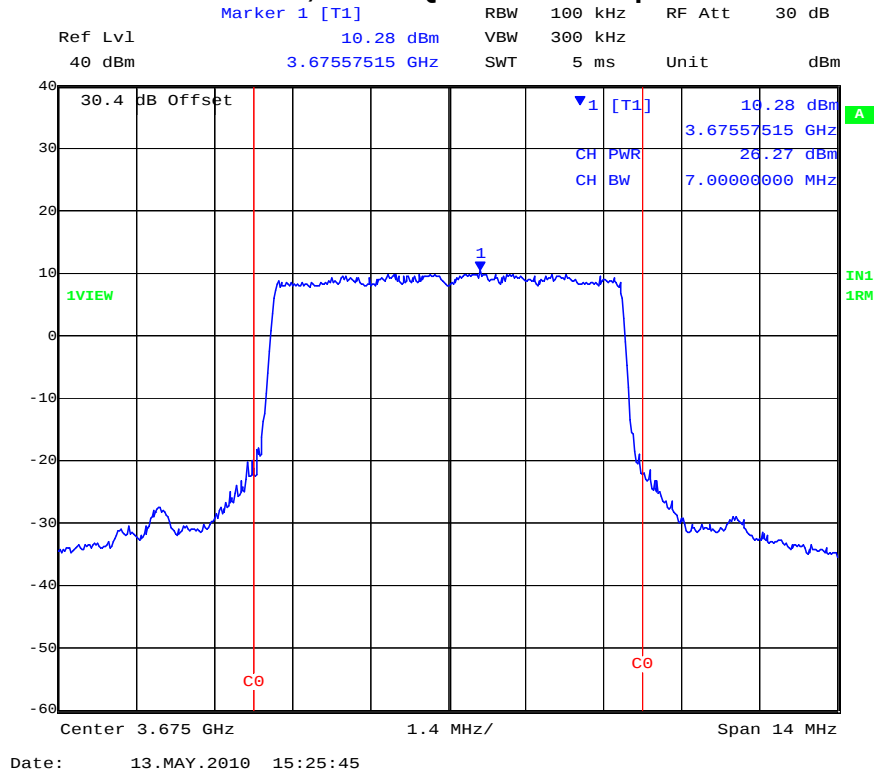


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Channel 3675, 7 MHz BPSK Peak Output Power



Channel 3675, 7 MHz QPSK Peak Output Power

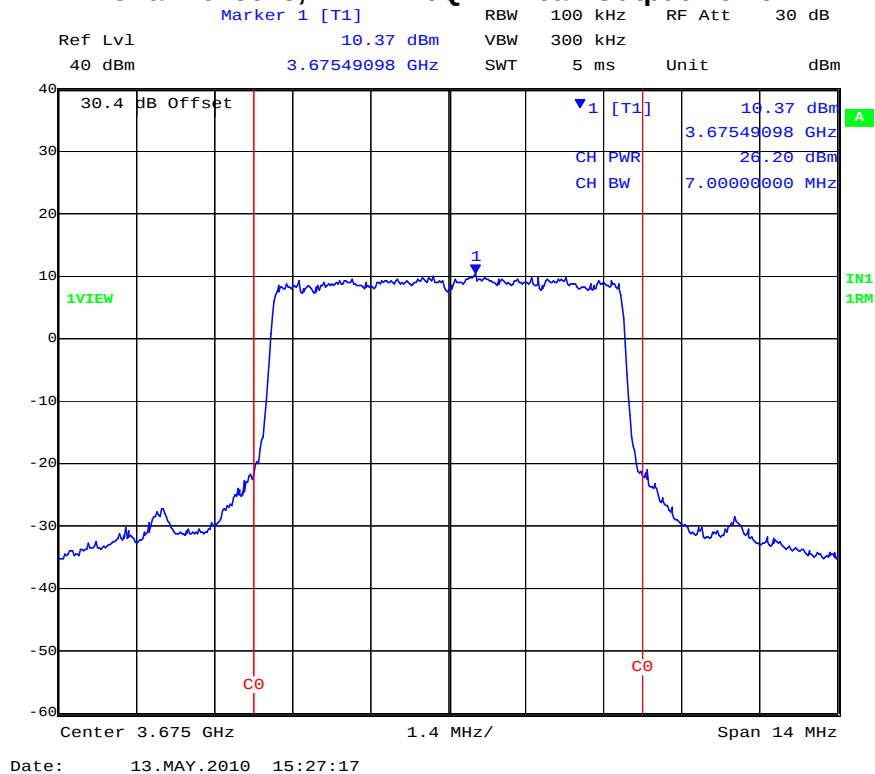


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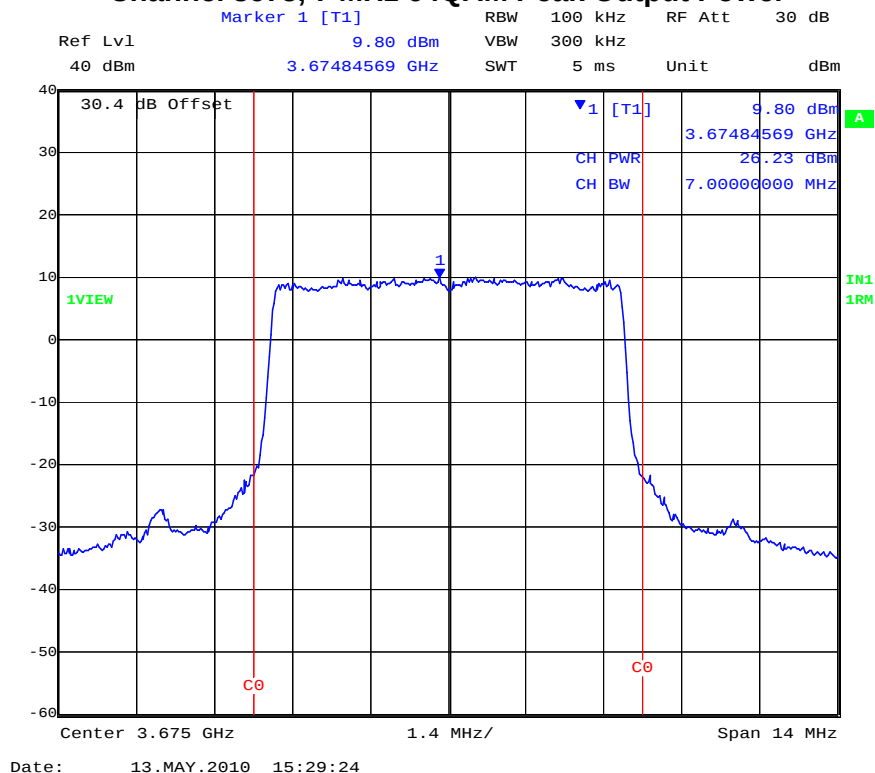


Title: Axxcelera ETDAP-C9AC
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Channel 3675, 7 MHz 16QAM Peak Output Power



Channel 3675, 7 MHz 64QAM Peak Output Power

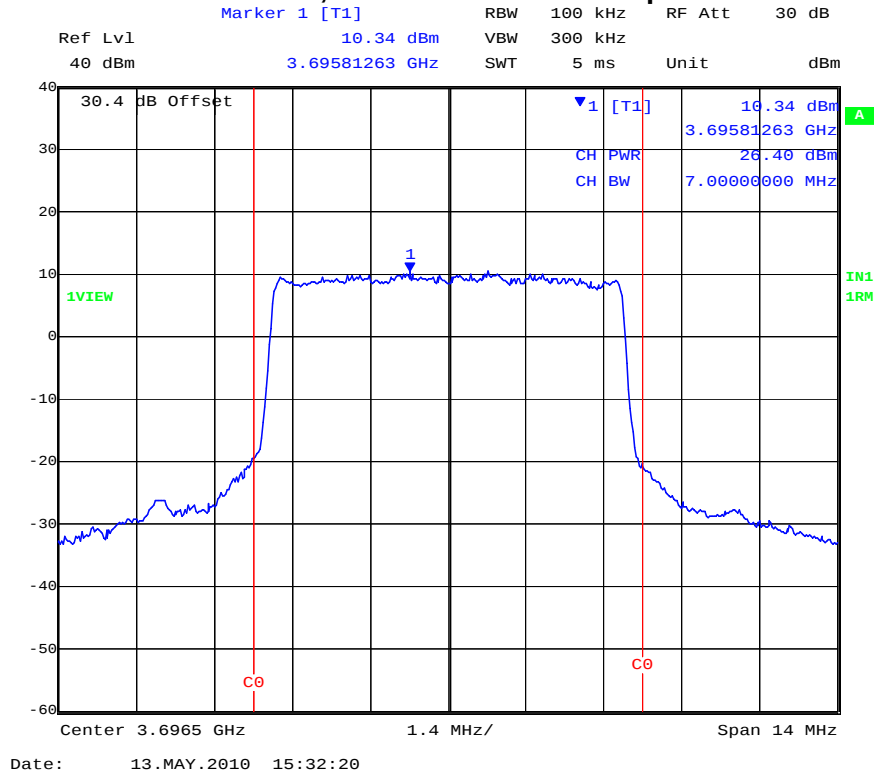


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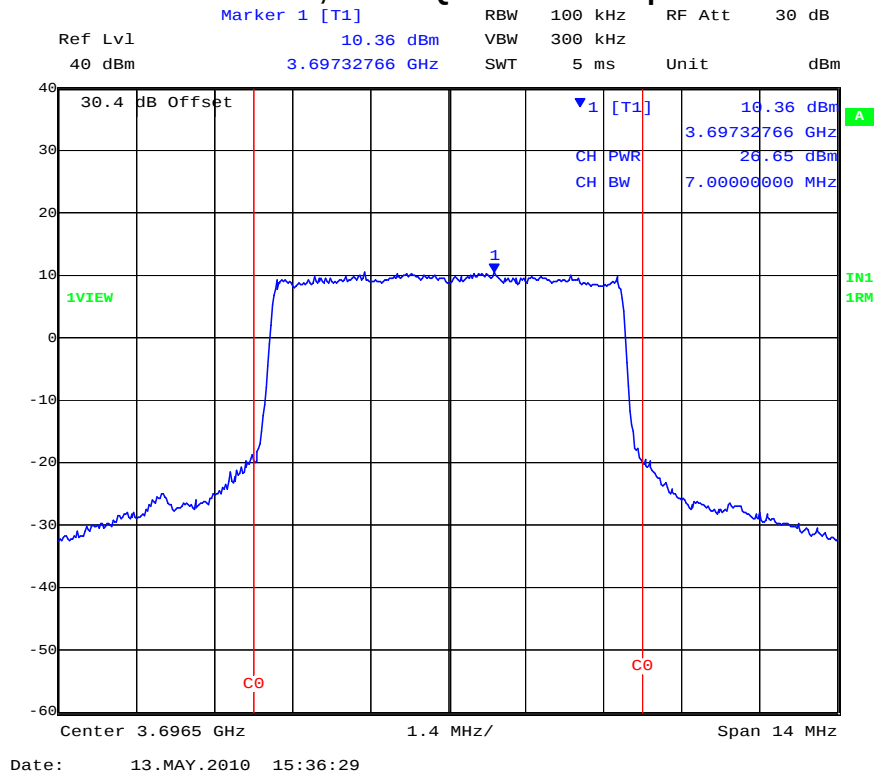


Title: Axxcelera ETDAP-C9AC
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Channel 3696.5, 7 MHz BPSK Peak Output Power



Channel 3696.5, 7 MHz QPSK Peak Output Power

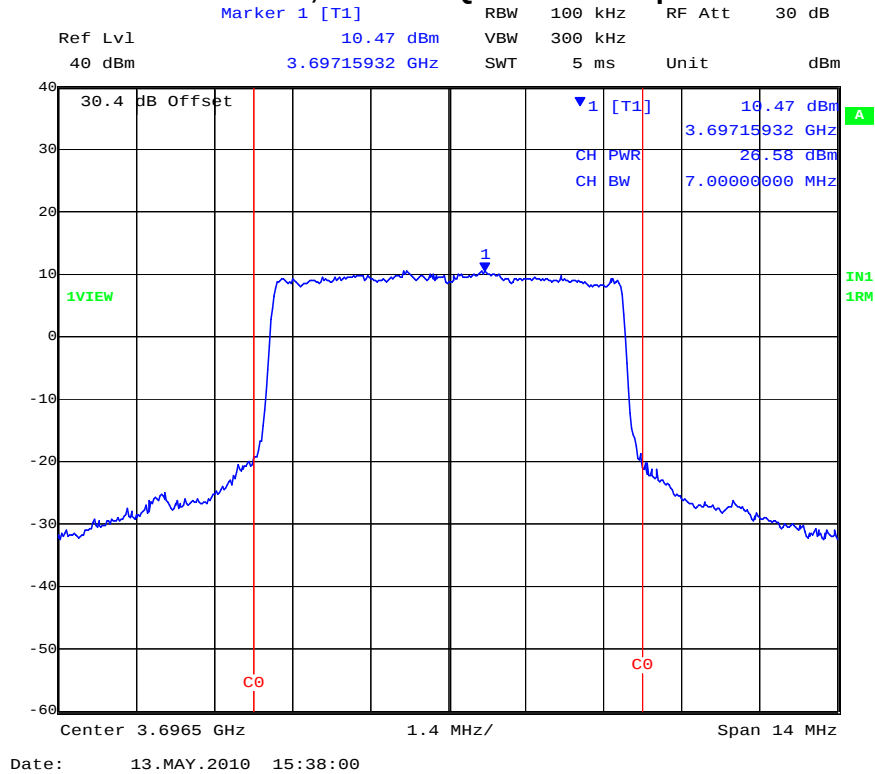


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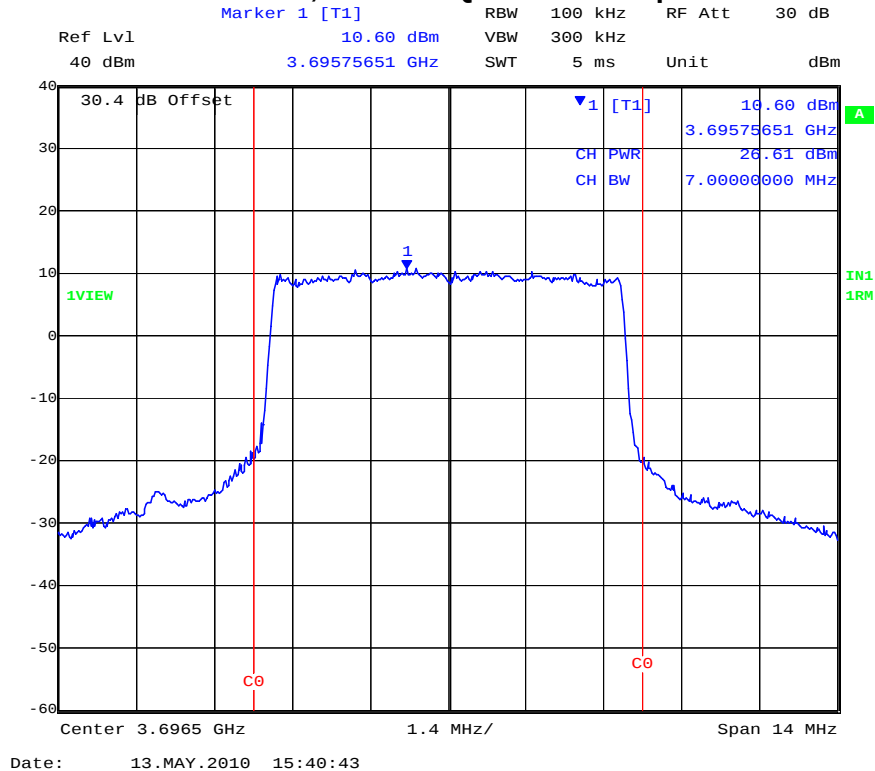


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Channel 3696.5, 7 MHz 16QAM Peak Output Power



Channel 3696.5, 7 MHz 64QAM Peak Output Power



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Laboratory Measurement Uncertainty for Power Measurement

Measurement uncertainty	± 1.33 dB
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Traceability

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

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5.1.3. Power Spectral Density

FCC 47 CFR Part 90, Subpart Z; §90.1321(a)

The following power limits apply to the 3650 – 3700 MHz band.

Base and fixed stations are limited to 25W/25 MHz equivalent isotropically radiated power (EIRP). In any event the peak EIRP power density shall not exceed 1 Watt (+30 dBm) in any one Megahertz slice of spectrum.

Limit

Power Spectral Density 3.5, 5, 7 MHz Channel Spacing = +30 dBm/MHz

Test Procedure

The test methodology employed for measuring Power Spectral Density can be found in Section 2.1 Normative References, ref viii “Compliance Management Guidance for Wireless Broadband Services Operating in the 3650-3700 MHz Band”, see Power Density Measurement.

Test Set-up is shown in Section 3.6 Test Configuration

Ambient conditions.

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



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3.5 MHz Bandwidth

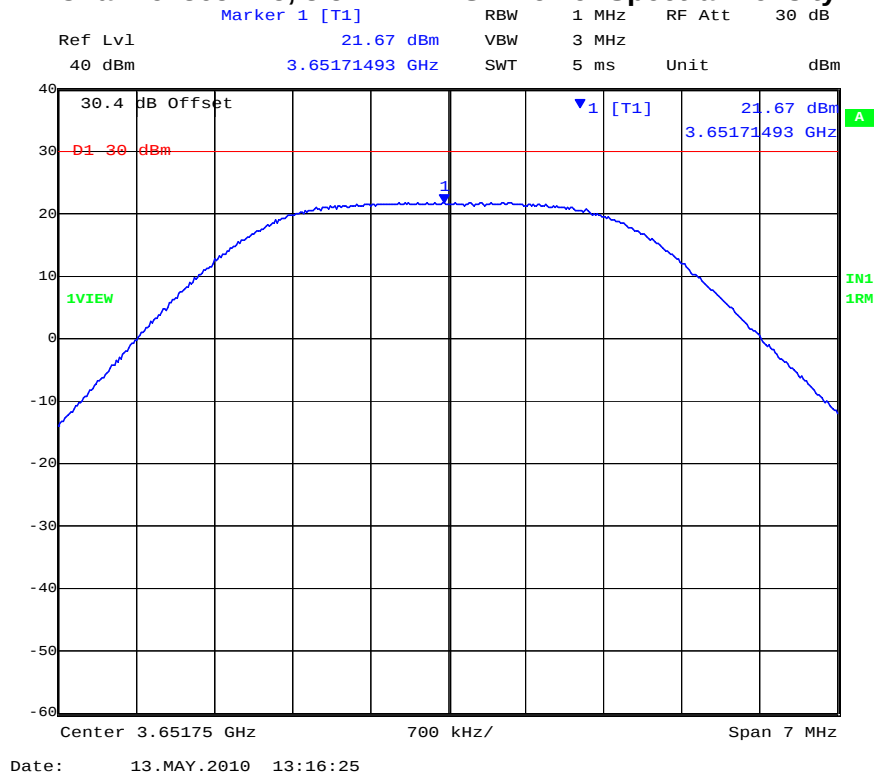
Power Spectral Density (dBm/MHz)					
Center Frequency (MHz)	BPSK	QPSK	16 QAM	64QAM	Minimum Margin (dB)
3651.75	+21.67	+21.94	+22.44	+22.23	-7.56
3675.00	+22.06	+22.46	+22.97	+22.47	-7.03
3698.25	+22.54	+22.77	+22.67	+22.66	-7.23

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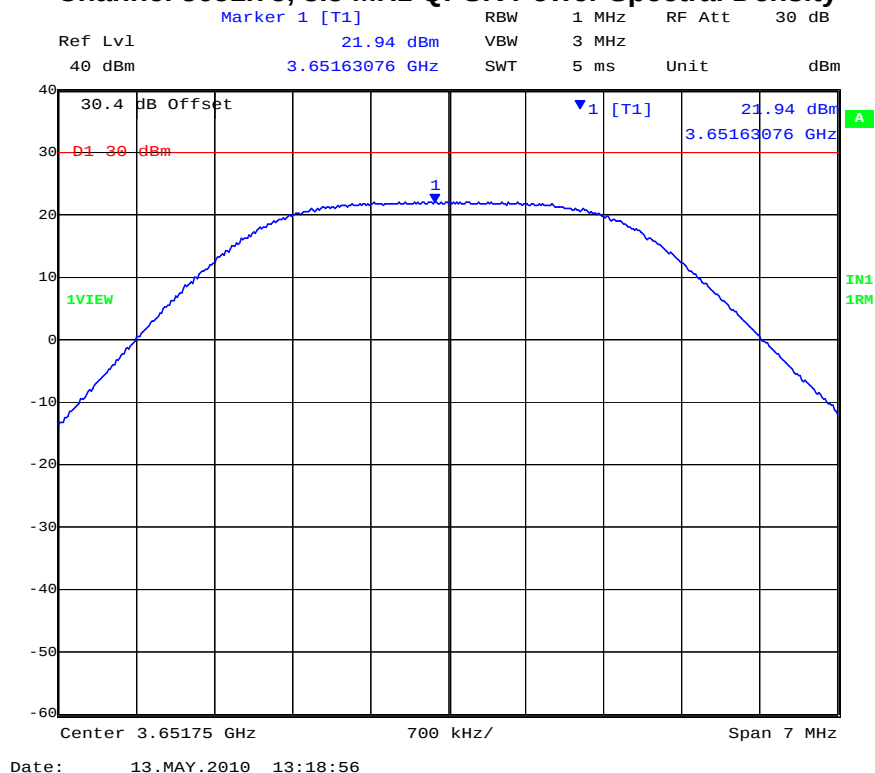


Title: Axxcelera ETDAP-C9AC
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Channel 3651.75, 3.5 MHz BPSK Power Spectral Density



Channel 3651.75, 3.5 MHz QPSK Power Spectral Density

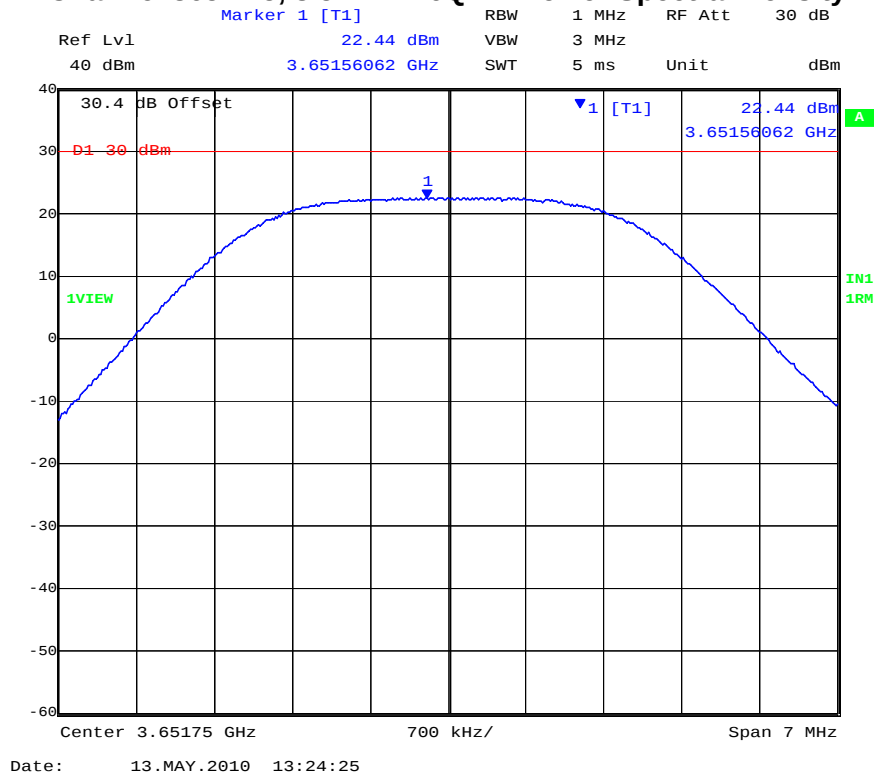


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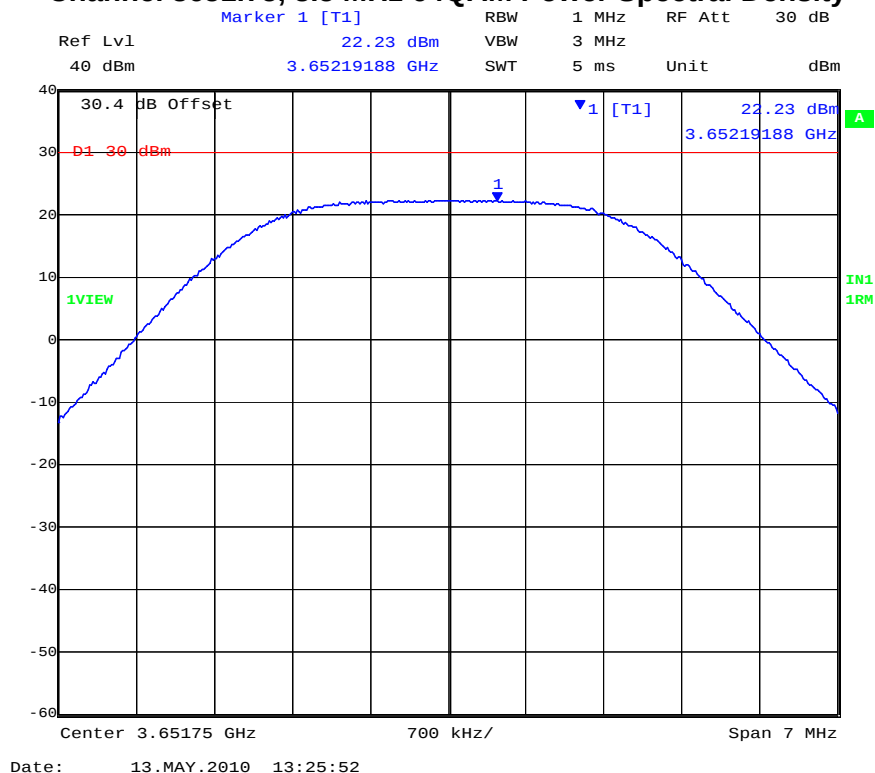


Title: Axxcelera ETDAP-C9AC
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Channel 3651.75, 3.5 MHz 16QAM Power Spectral Density



Channel 3651.75, 3.5 MHz 64QAM Power Spectral Density

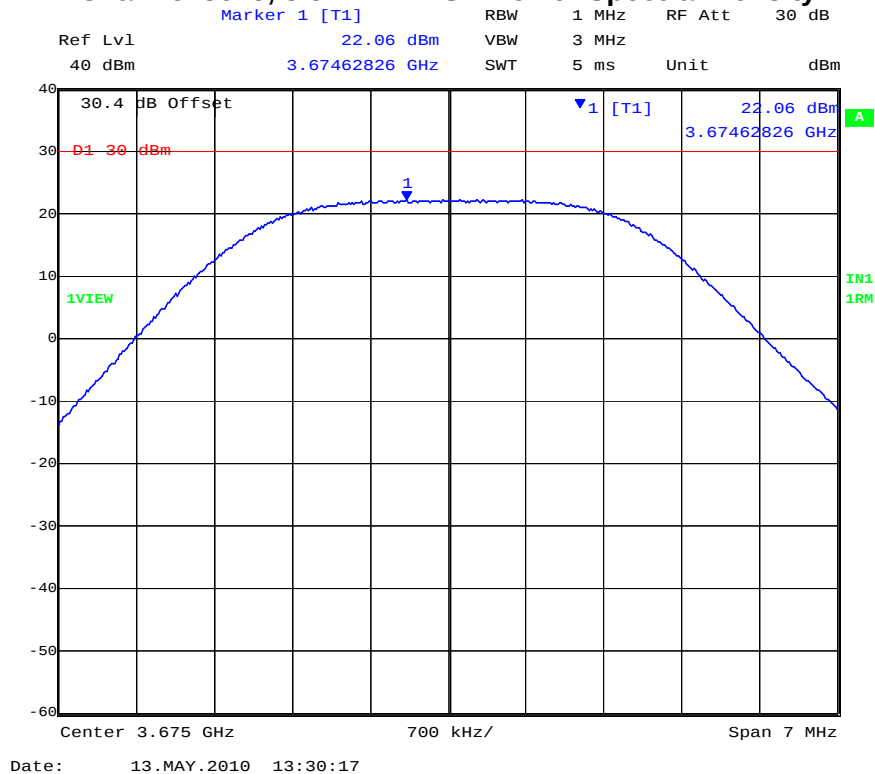


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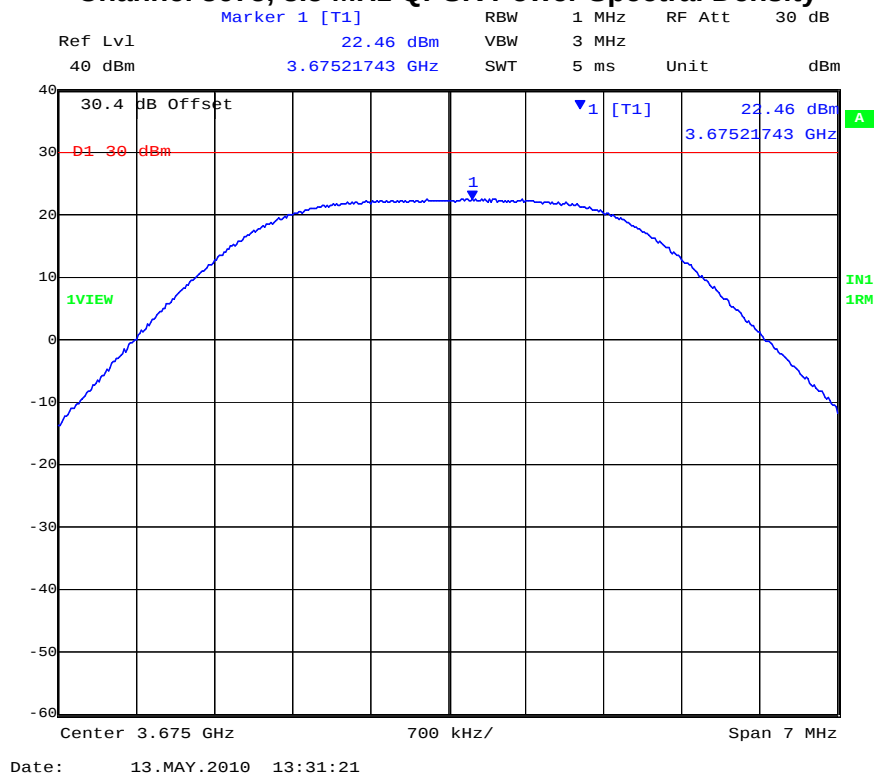


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Channel 3675, 3.5 MHz BPSK Power Spectral Density



Channel 3675, 3.5 MHz QPSK Power Spectral Density

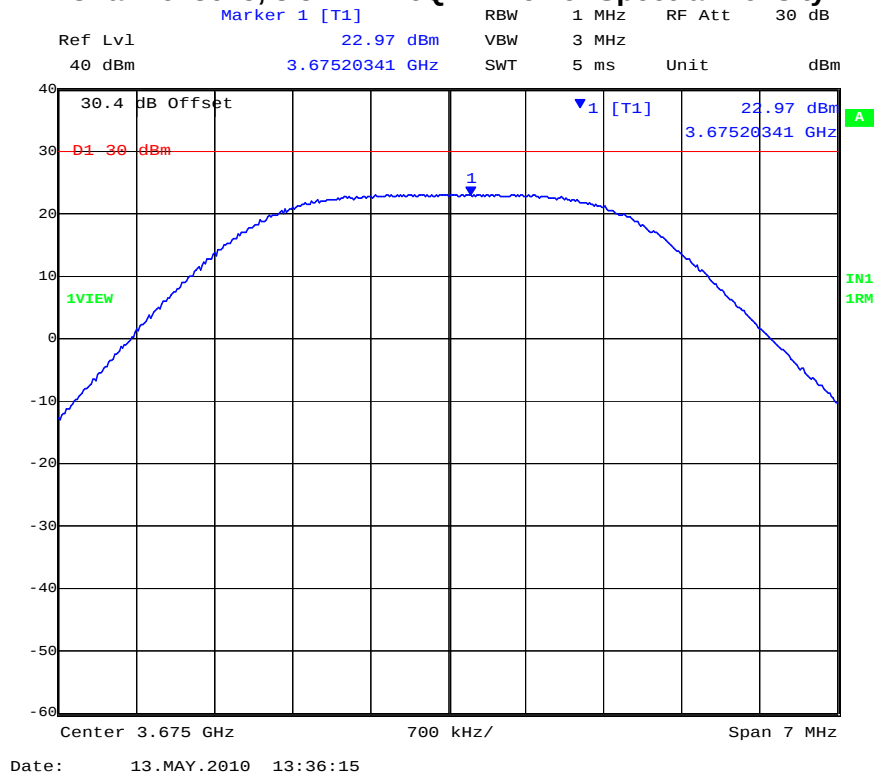


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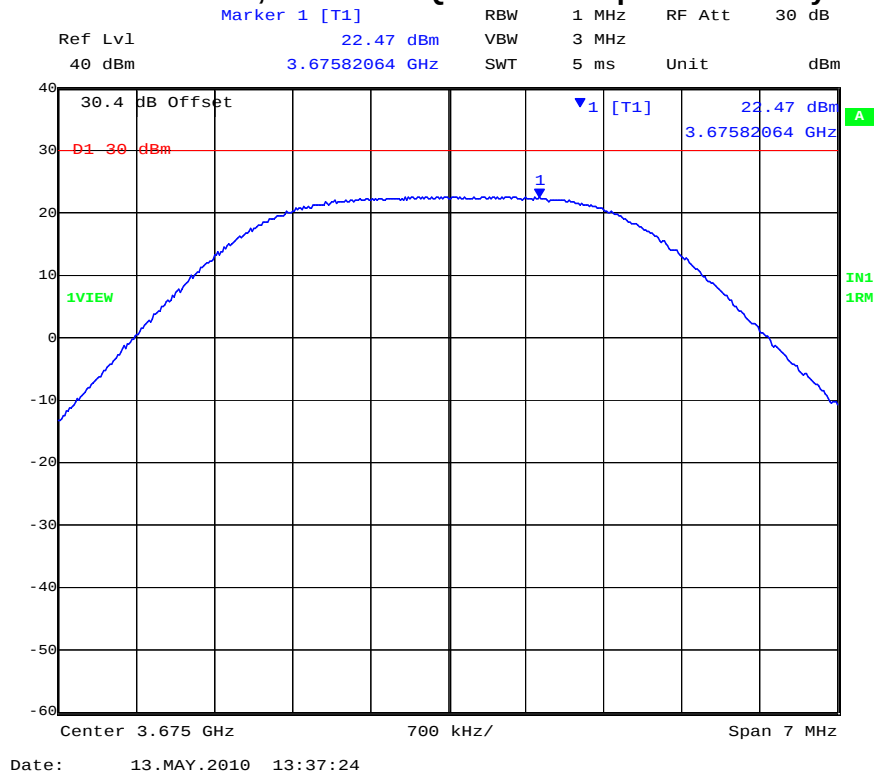


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Channel 3675, 3.5 MHz 16QAM Power Spectral Density



Channel 3675, 3.5 MHz 64QAM Power Spectral Density

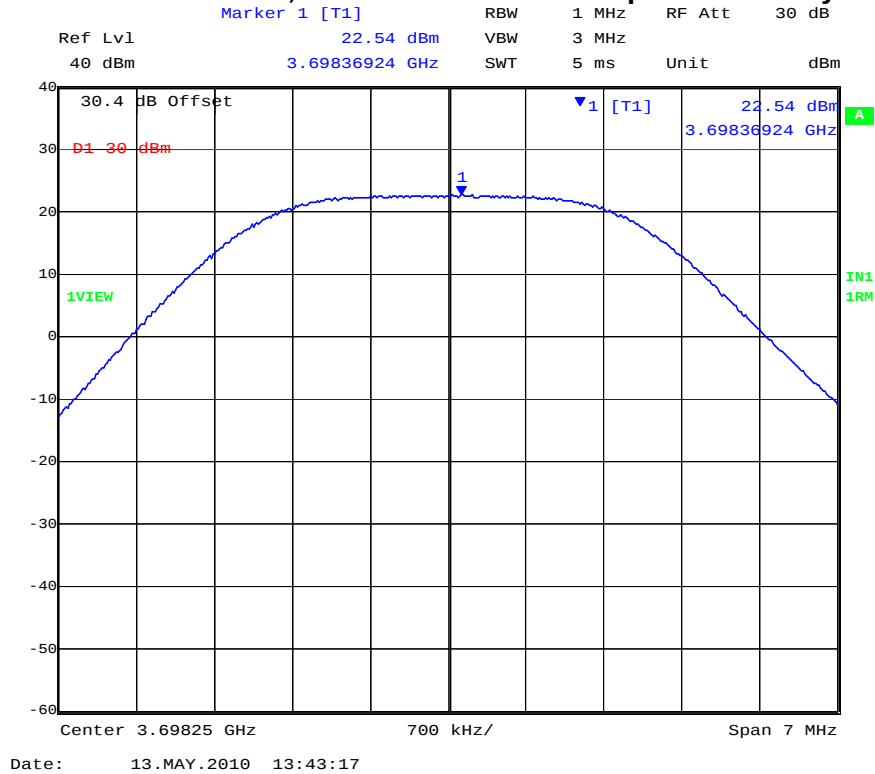


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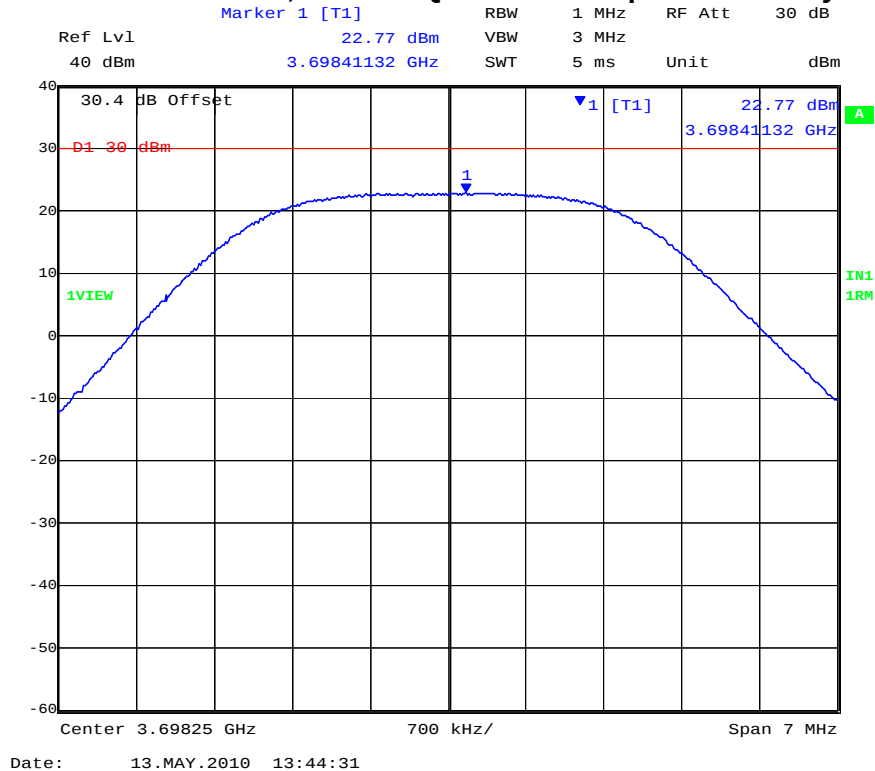


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Channel 3698.25, 3.5 MHz BPSK Power Spectral Density



Channel 3698.25, 3.5 MHz QPSK Power Spectral Density

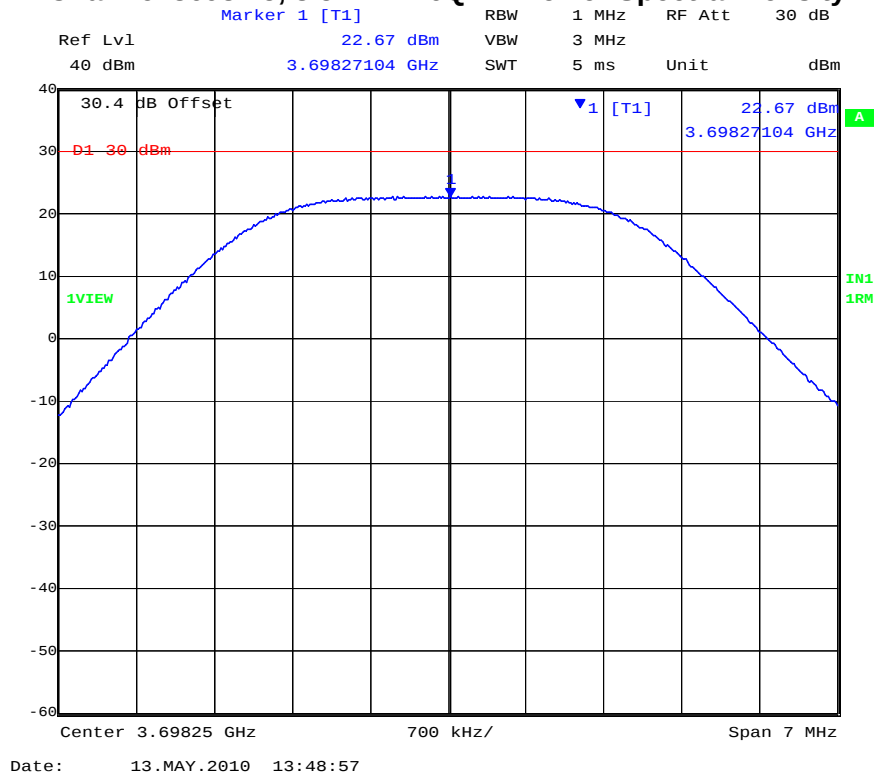


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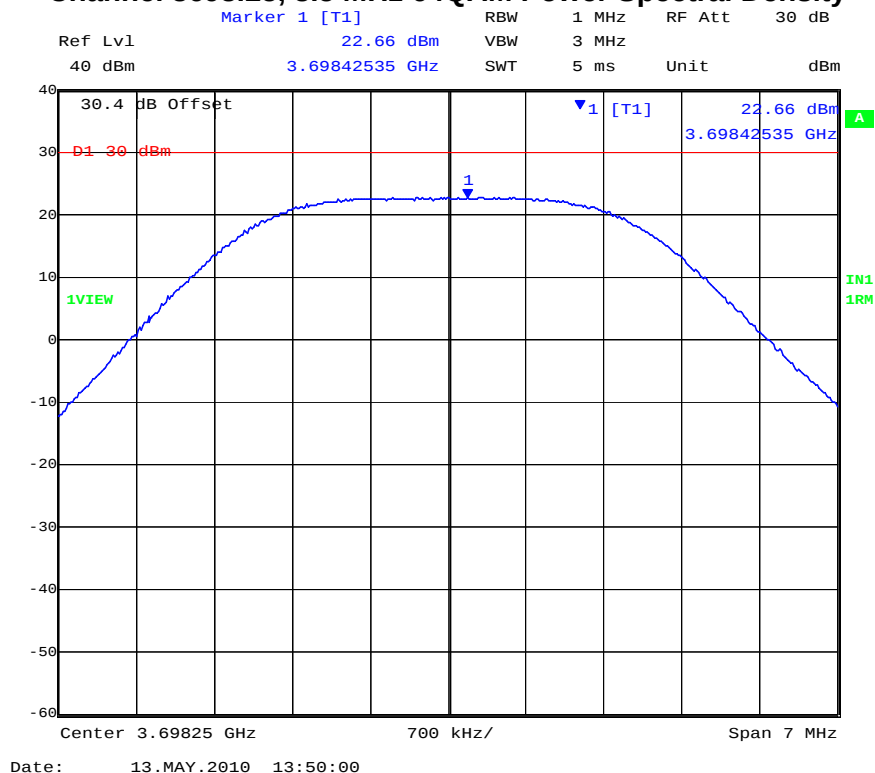


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Channel 3698.25, 3.5 MHz 16QAM Power Spectral Density



Channel 3698.25, 3.5 MHz 64QAM Power Spectral Density



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5 MHz Bandwidth

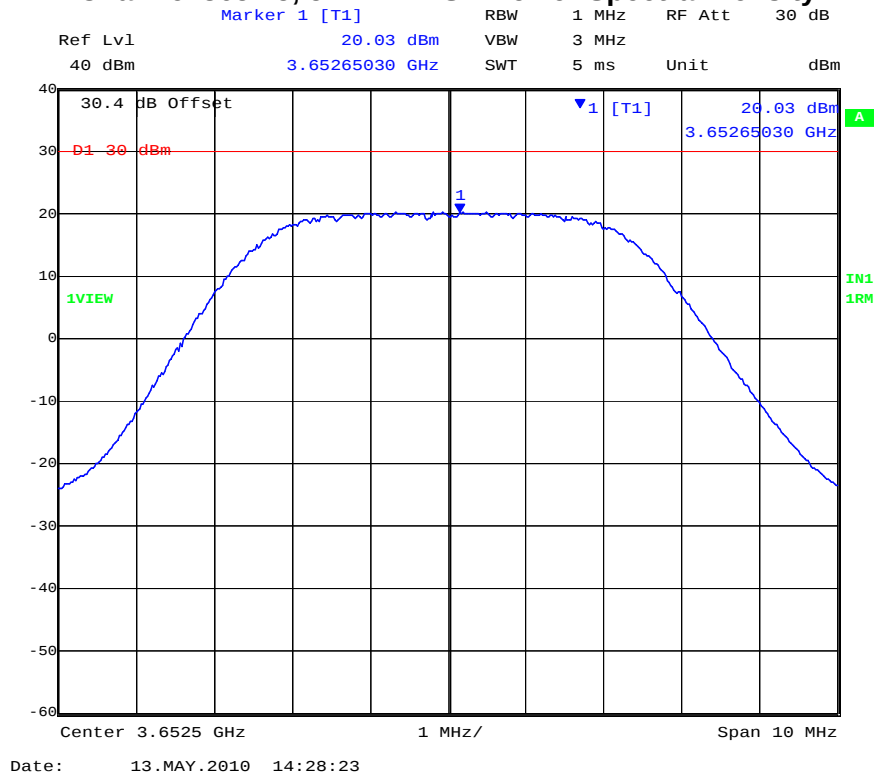
Center Frequency (MHz)	Power Spectral Density (dBm/MHz)				
	BPSK (+dBm)	QPSK (+dBm)	16 QAM (+dBm)	64QAM (+dBm)	Margin (dB)
3652.50	+20.03	+20.10	+20.43	+21.27	-8.73
3675.00	+21.16	+21.49	+21.28	+21.53	-8.47
3697.50	+20.81	+20.83	+20.77	+20.82	-9.17

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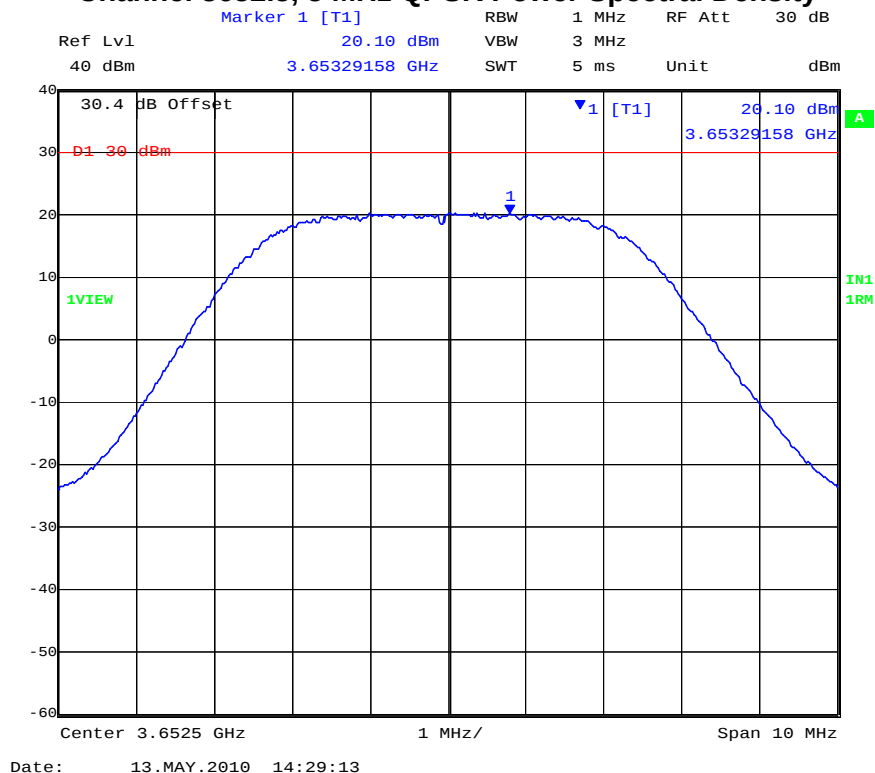


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Channel 3652.5, 5 MHz BPSK Power Spectral Density



Channel 3652.5, 5 MHz QPSK Power Spectral Density

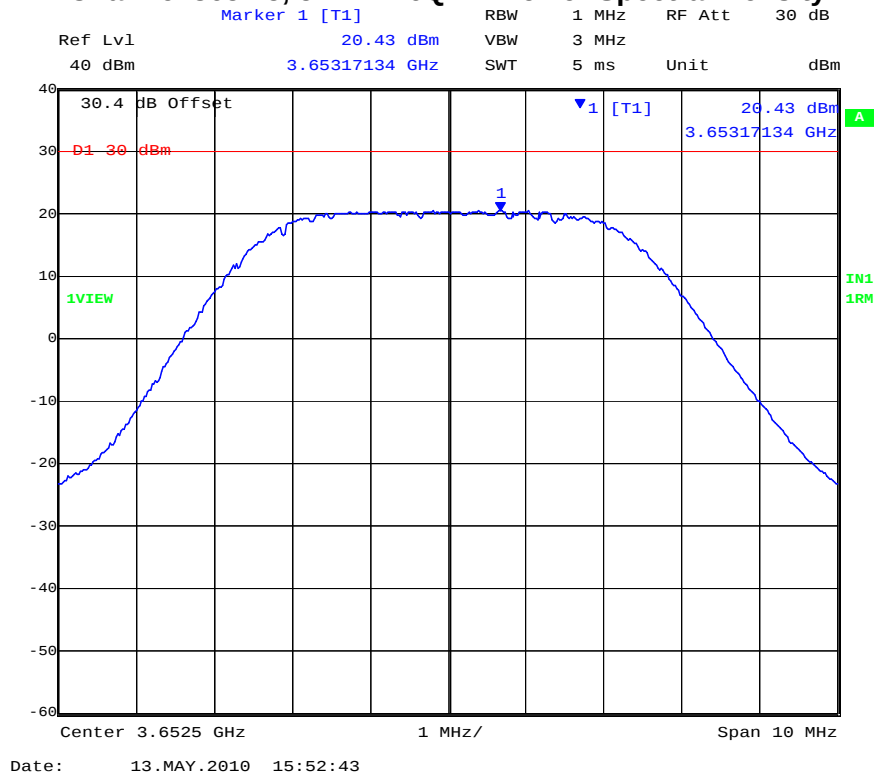


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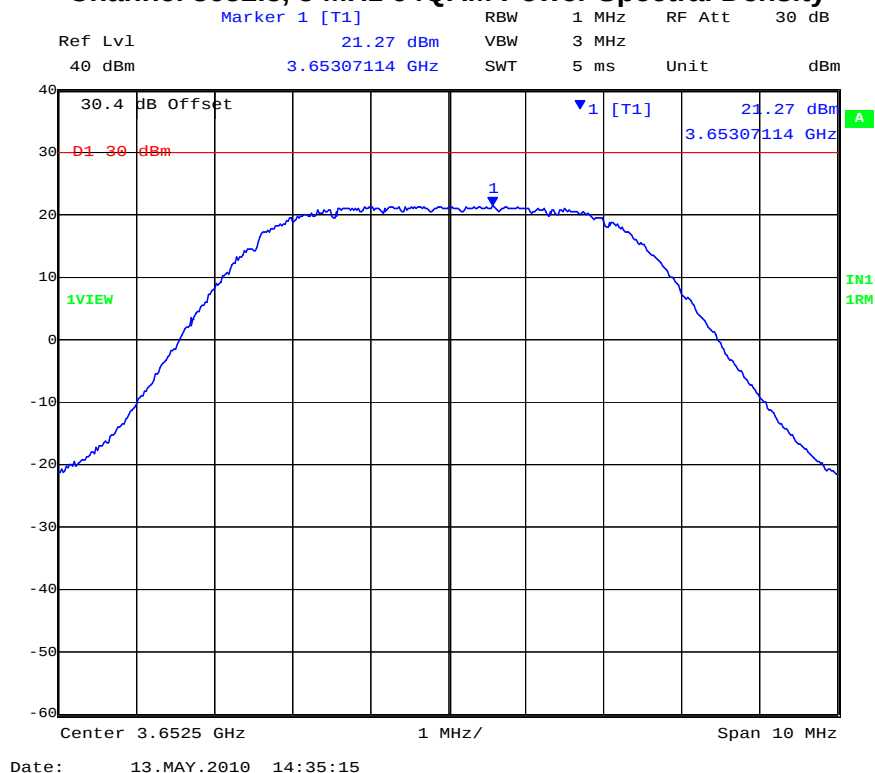


Title: Axxcelera ETDAP-C9AC
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Channel 3652.5, 5 MHz 16QAM Power Spectral Density



Channel 3652.5, 5 MHz 64QAM Power Spectral Density

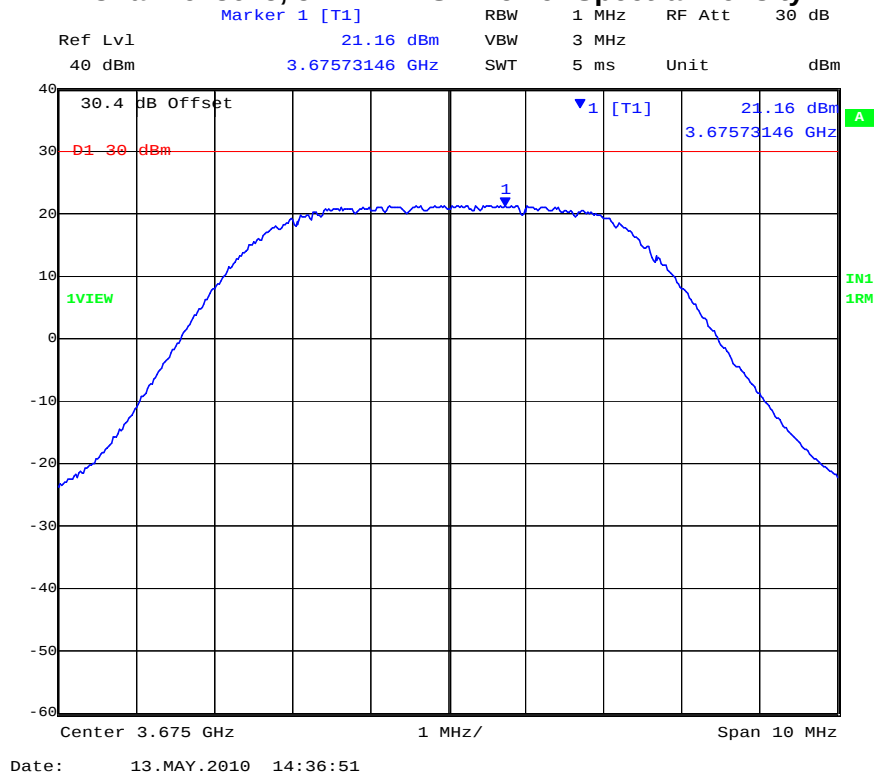


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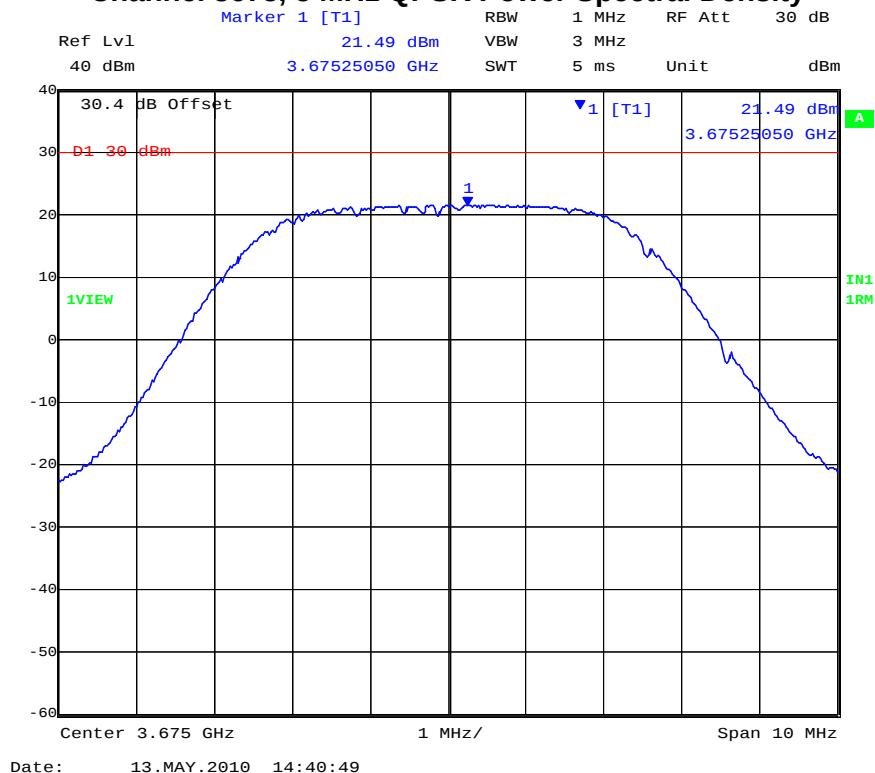


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Channel 3675, 5 MHz BPSK Power Spectral Density



Channel 3675, 5 MHz QPSK Power Spectral Density

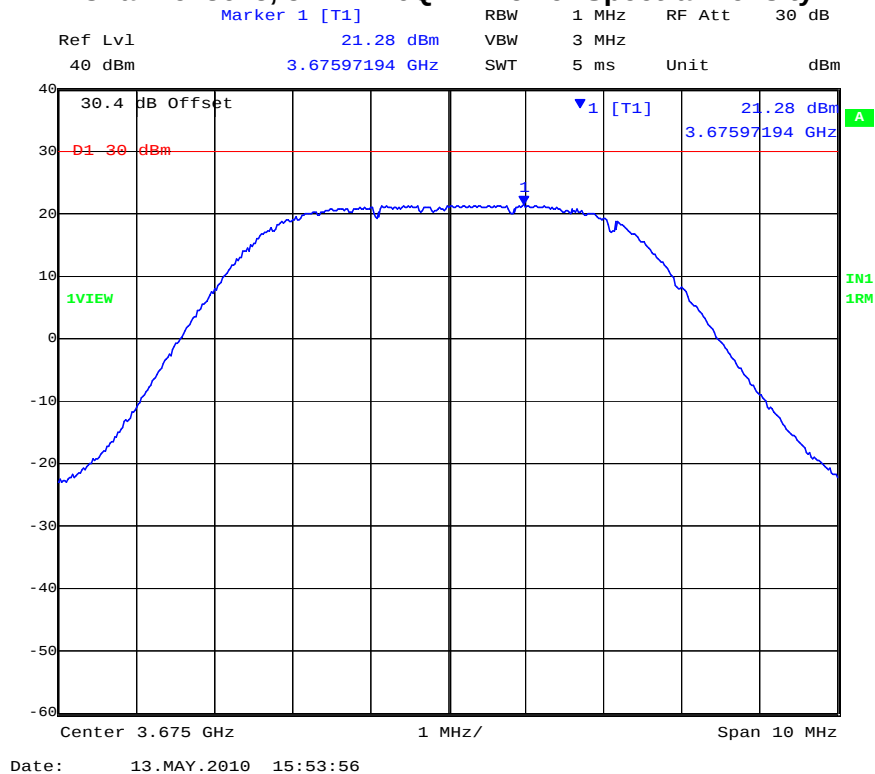


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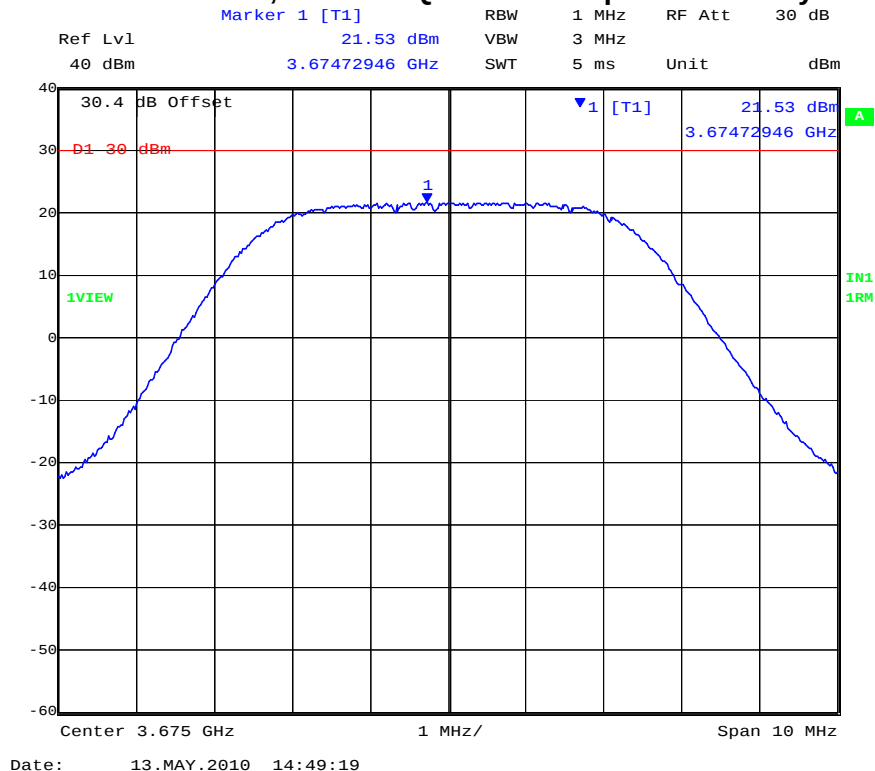


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Channel 3675, 5 MHz 16QAM Power Spectral Density



Channel 3675, 5 MHz 64QAM Power Spectral Density

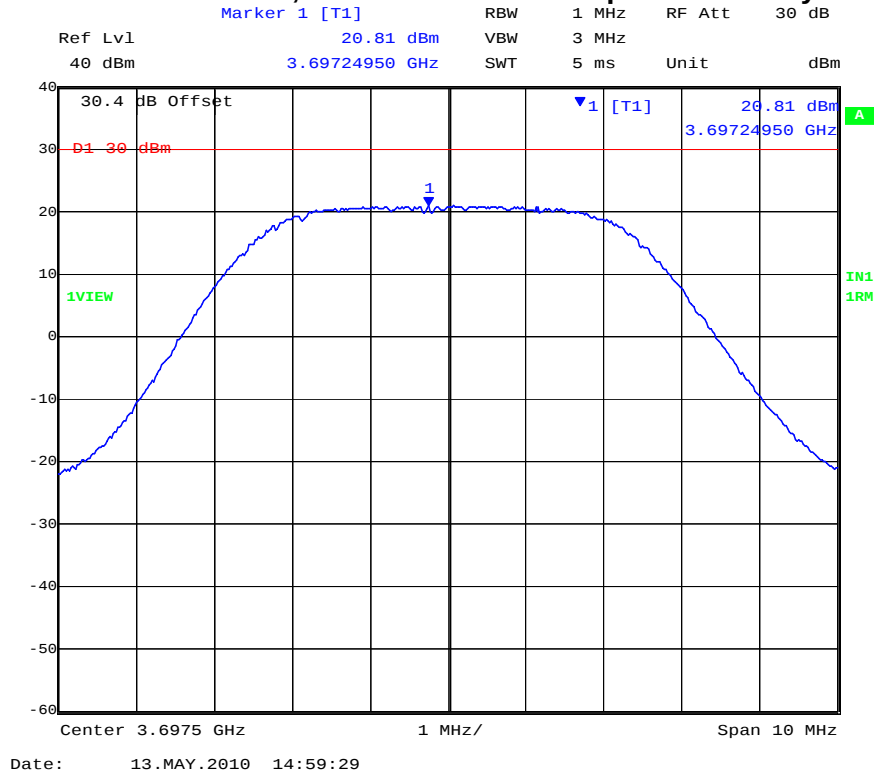


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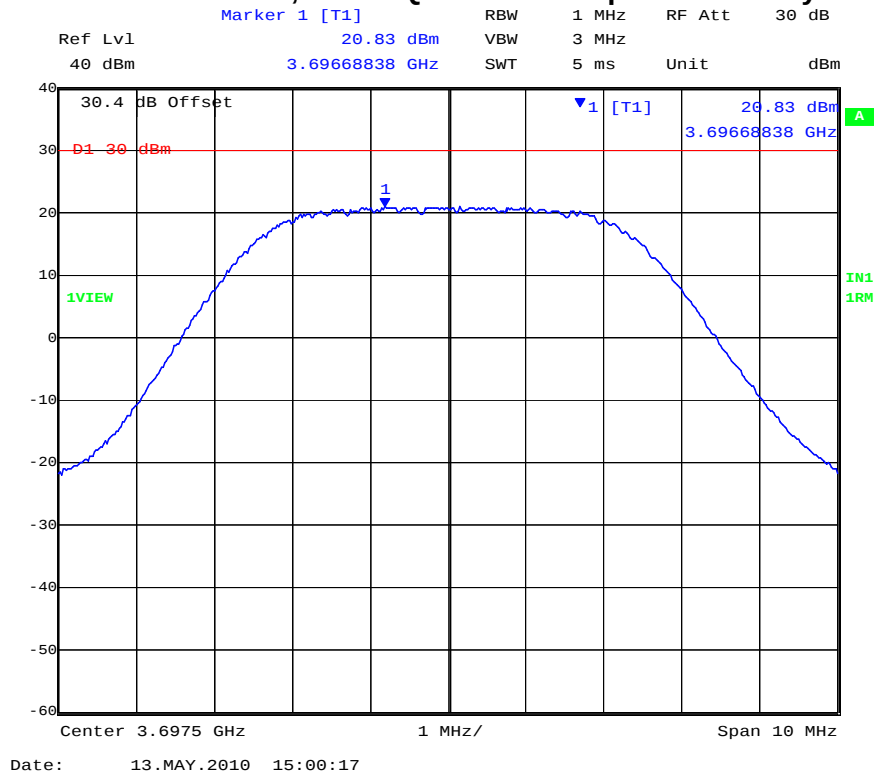


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Channel 3697.5, 5 MHz BPSK Power Spectral Density

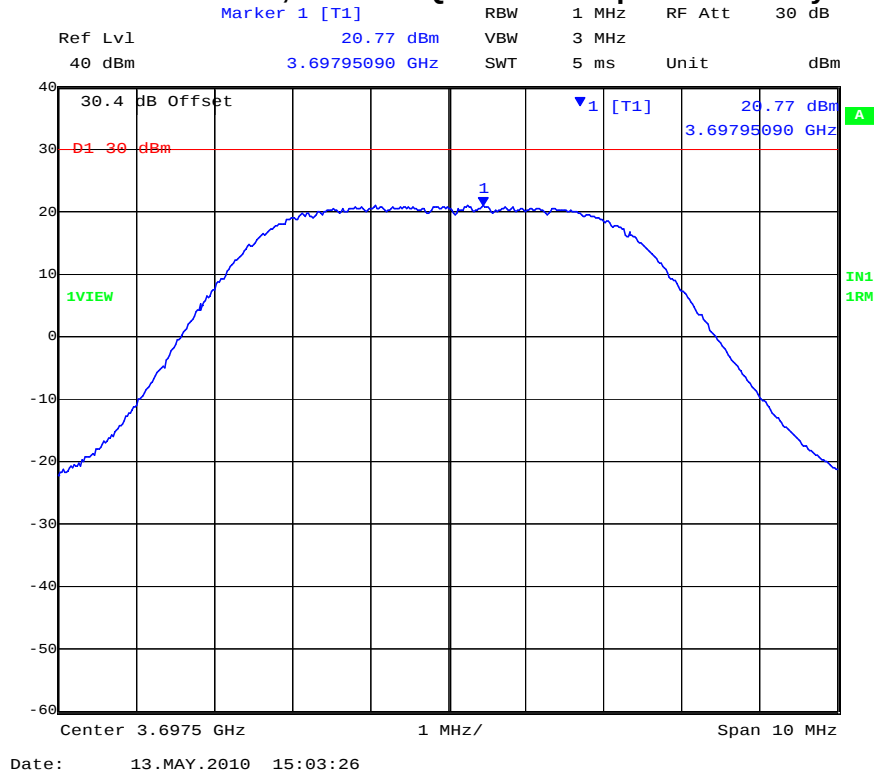


Channel 3697.5, 5 MHz QPSK Power Spectral Density

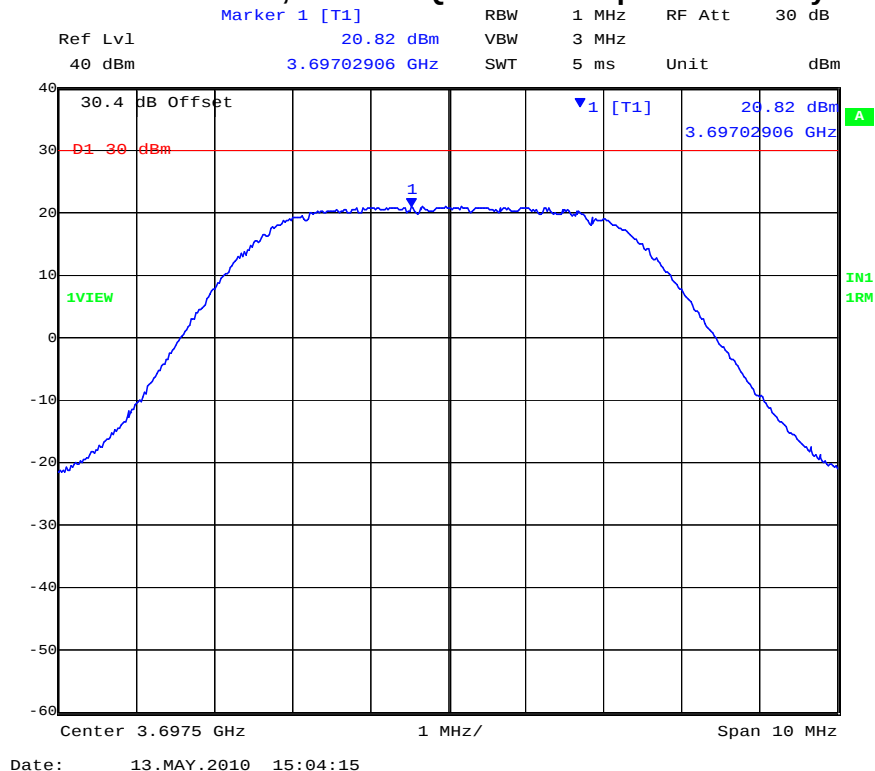


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Channel 3697.5, 5 MHz 16QAM Power Spectral Density



Channel 3697.5, 5 MHz 64QAM Power Spectral Density



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7 MHz Bandwidth

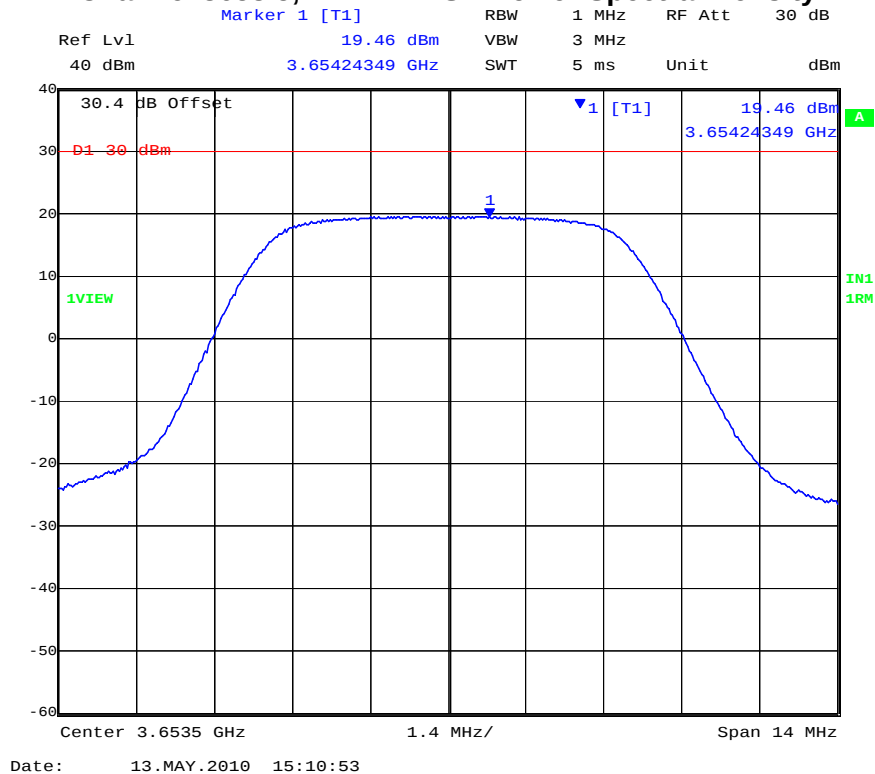
Power Spectral Density (dBm/MHz)					
Center Frequency (MHz)	BPSK (+dBm)	QPSK (+dBm)	16 QAM (+dBm)	64QAM (+dBm)	Margin (dB)
3653.50	+19.46	+19.51	+19.44	+19.54	-10.46
3675.00	+20.03	+20.03	+20.12	+20.03	-9.88
3696.50	+19.90	+20.33	+20.39	+20.42	-9.58

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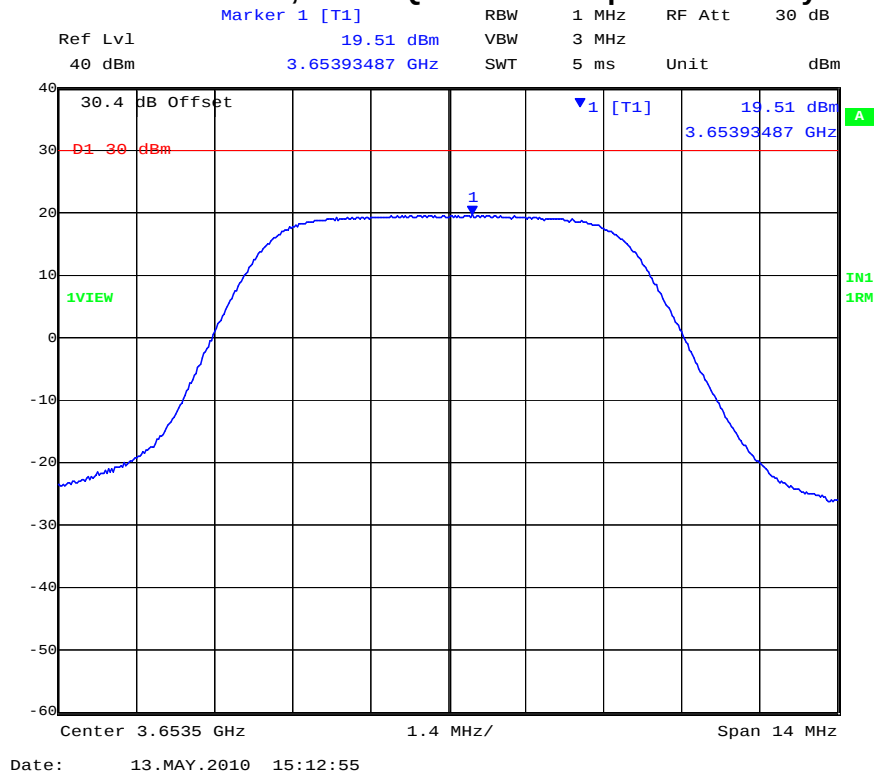


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Channel 3653.5, 7 MHz BPSK Power Spectral Density

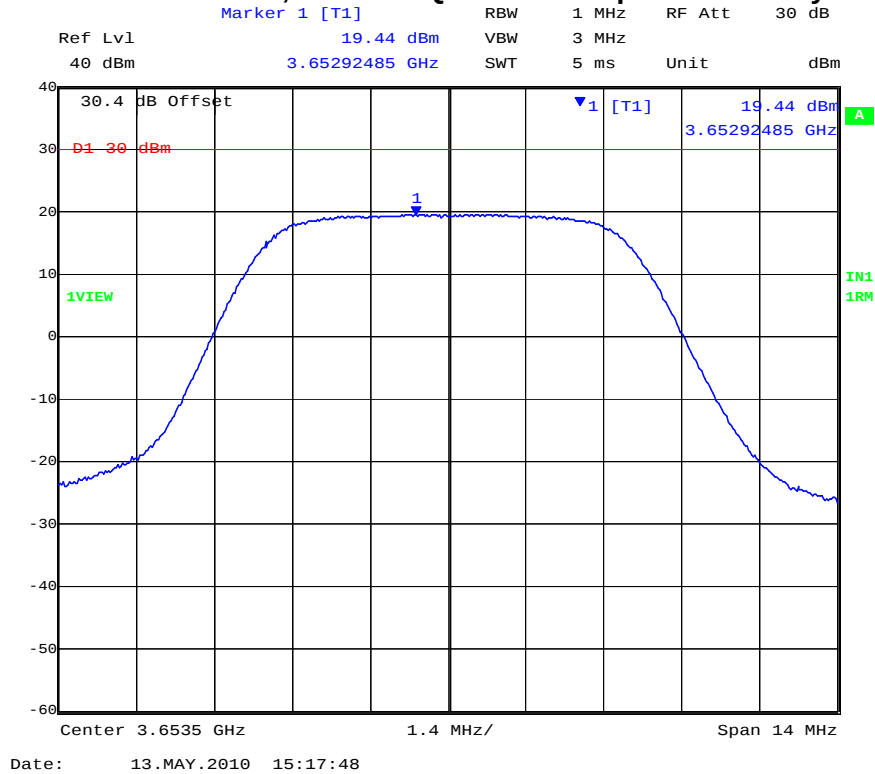


Channel 3653.5, 7 MHz QPSK Power Spectral Density

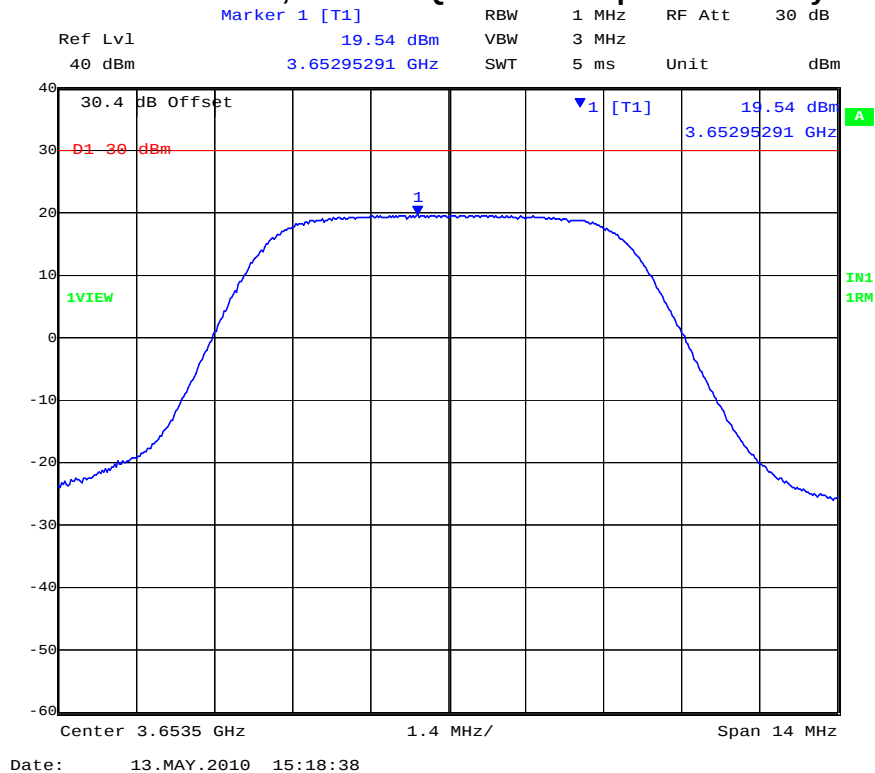


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Channel 3653.5, 7 MHz 16QAM Power Spectral Density



Channel 3653.5, 7 MHz 64QAM Power Spectral Density

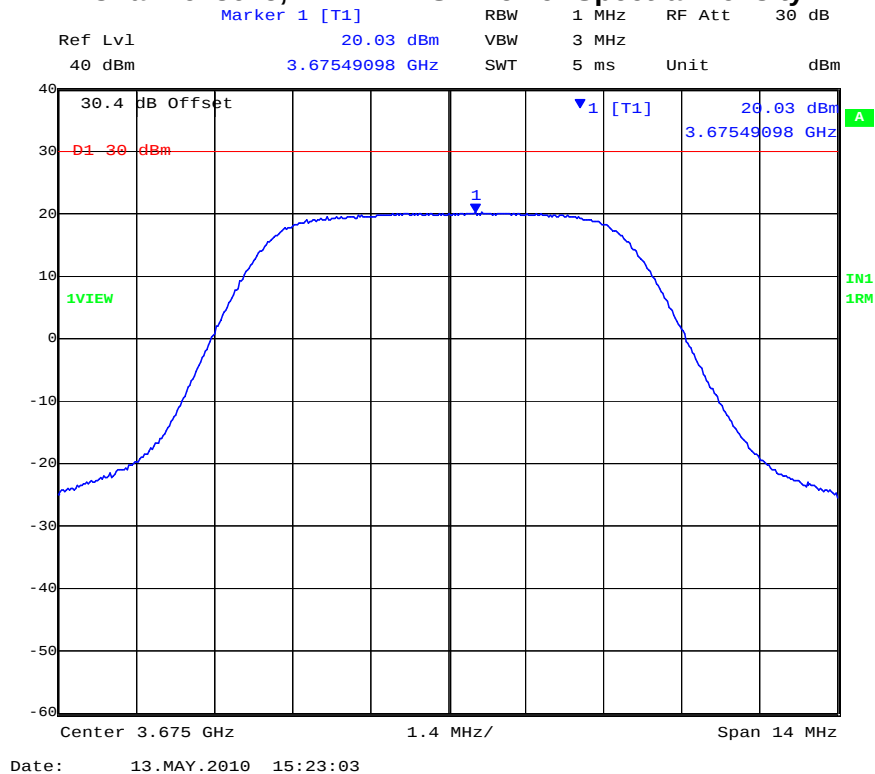


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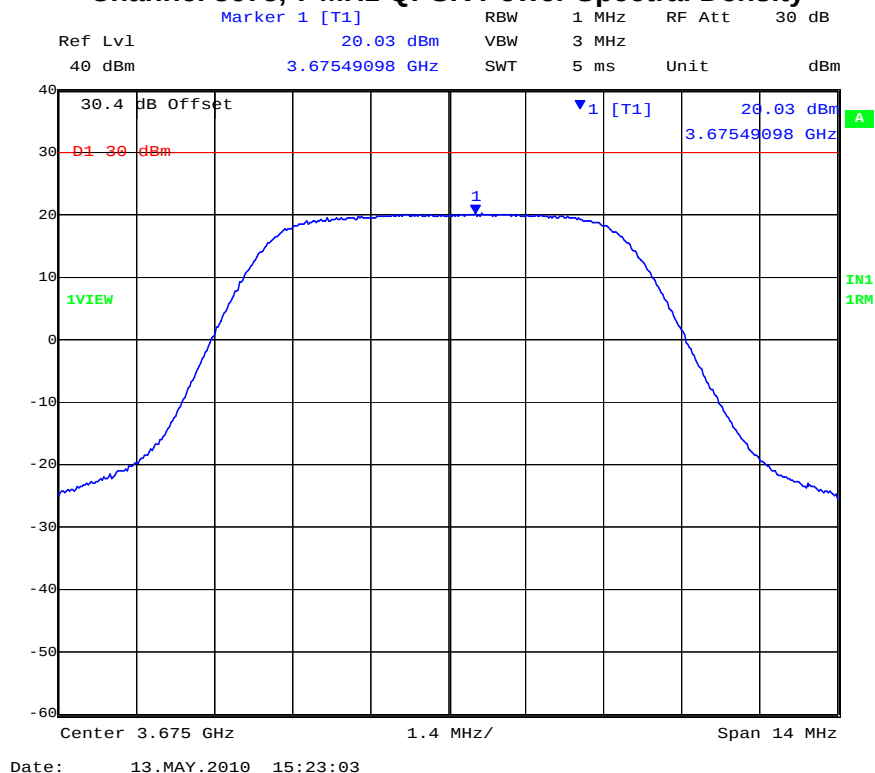


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Channel 3675, 7 MHz BPSK Power Spectral Density



Channel 3675, 7 MHz QPSK Power Spectral Density

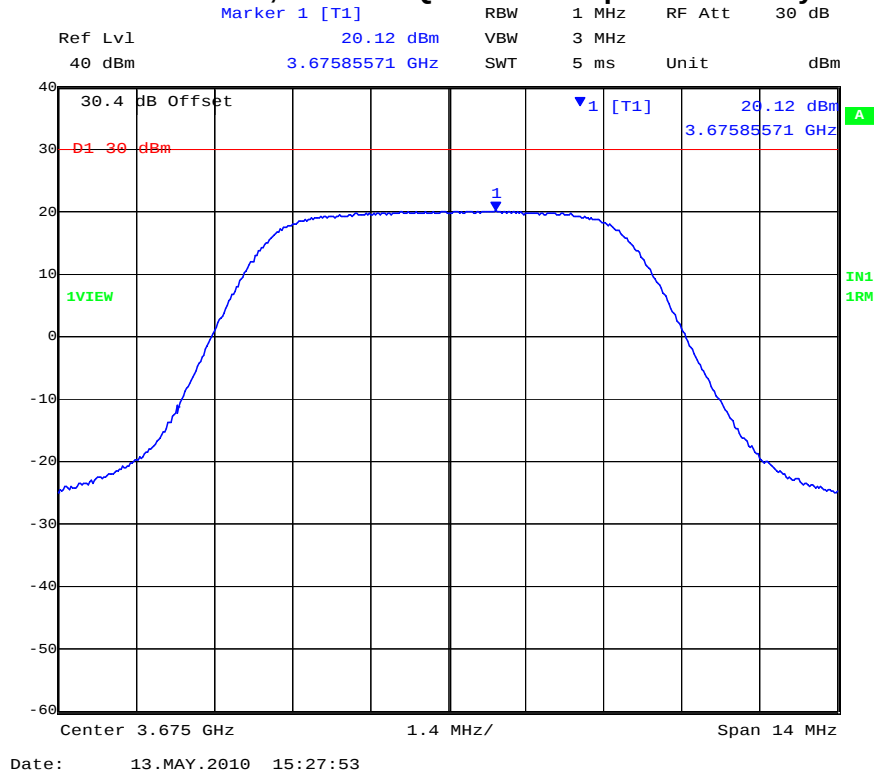


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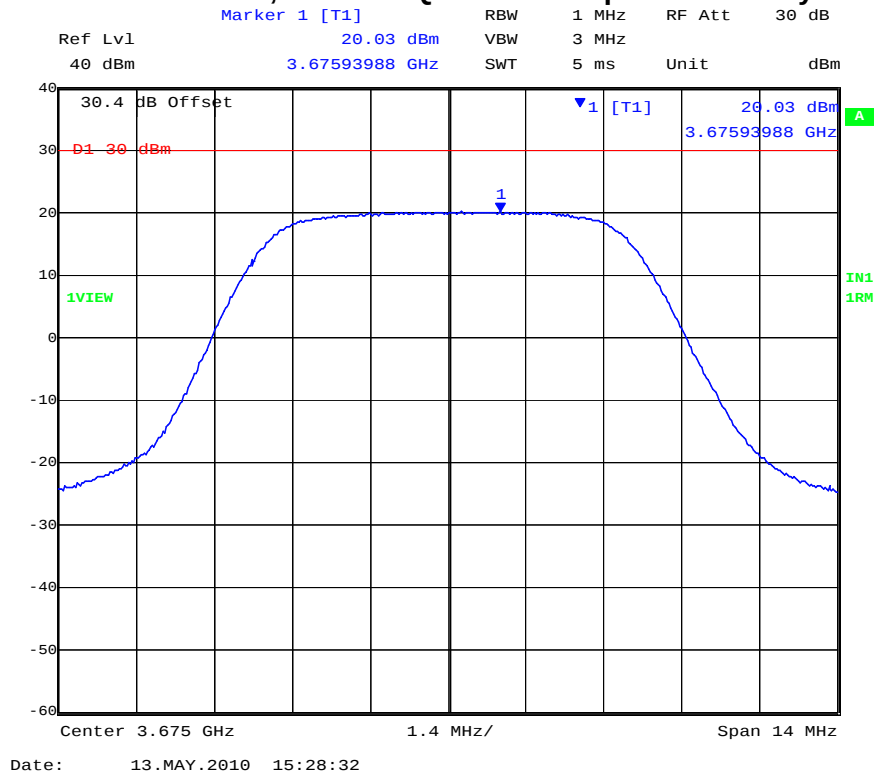


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Channel 3675, 7 MHz 16QAM Power Spectral Density



Channel 3675, 7 MHz 64QAM Power Spectral Density

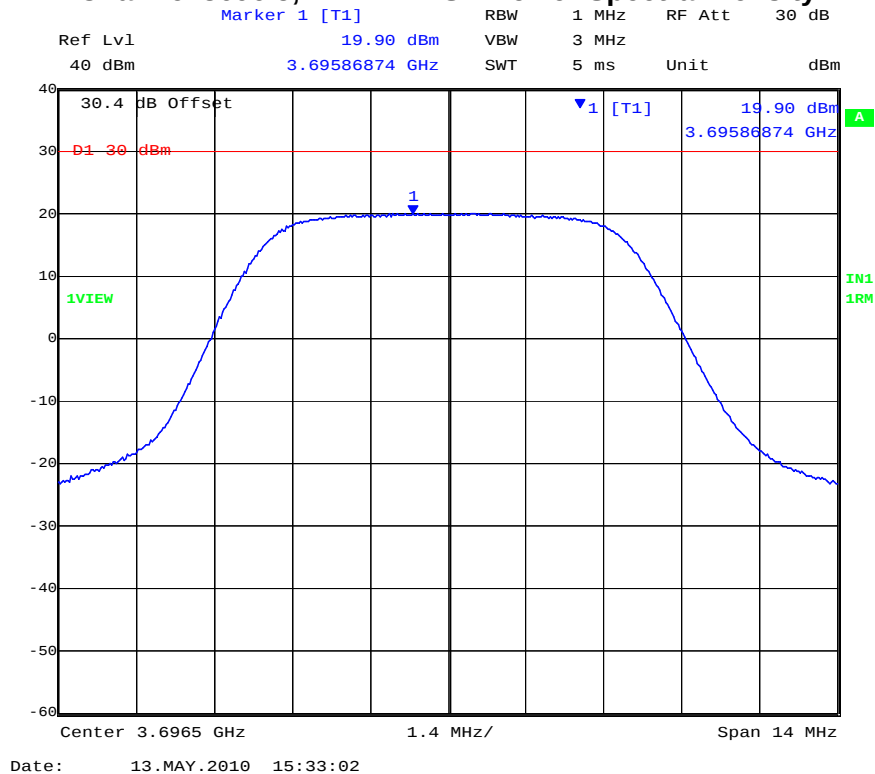


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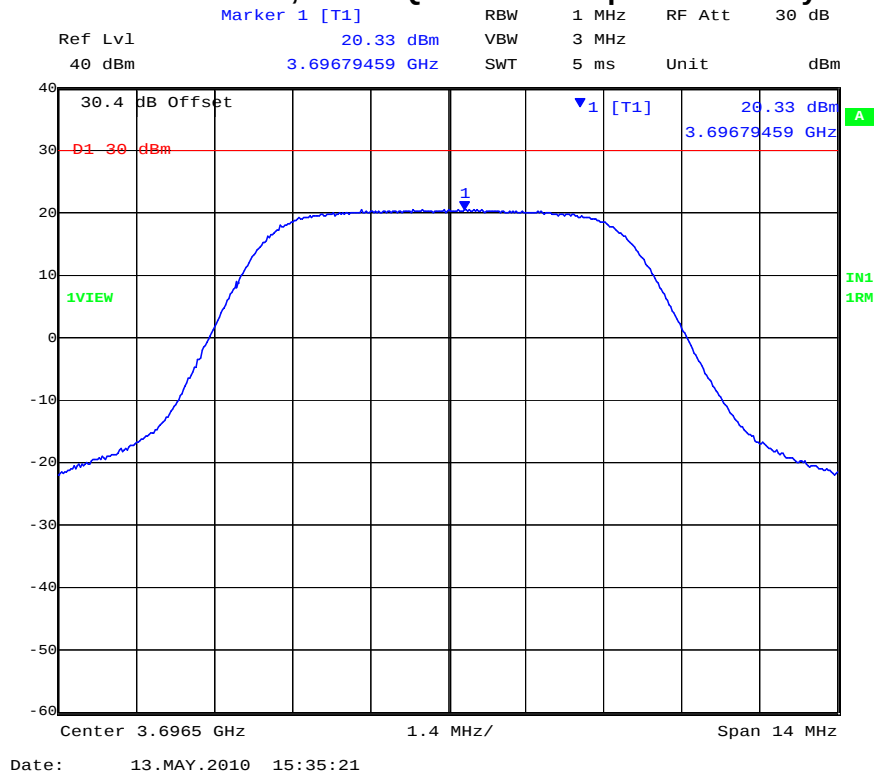


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Channel 3696.5, 7 MHz BPSK Power Spectral Density

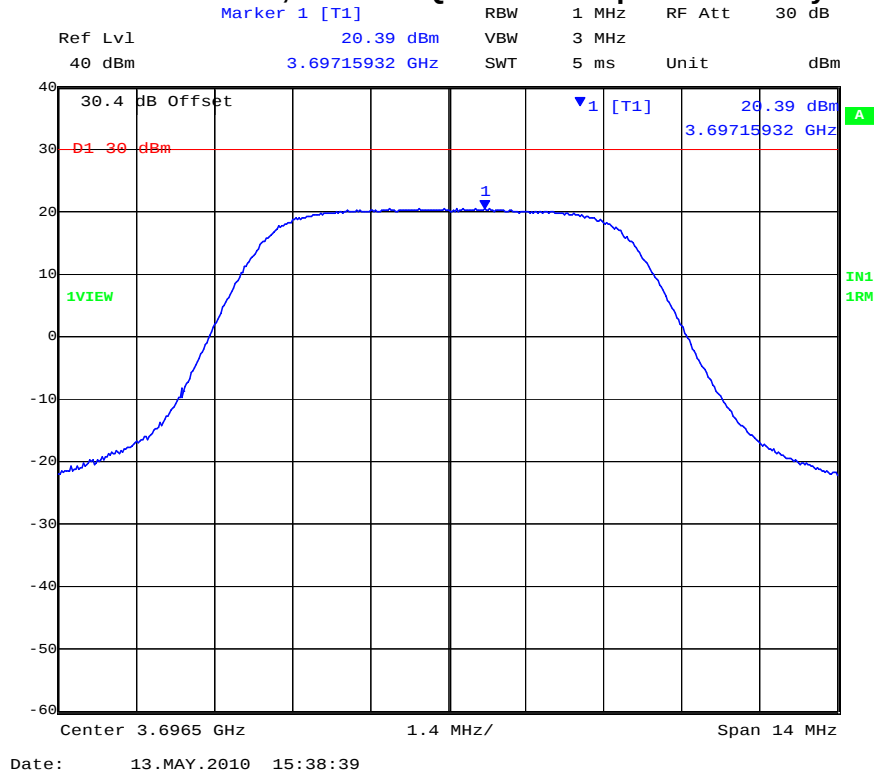


Channel 3696.5, 7 MHz QPSK Power Spectral Density

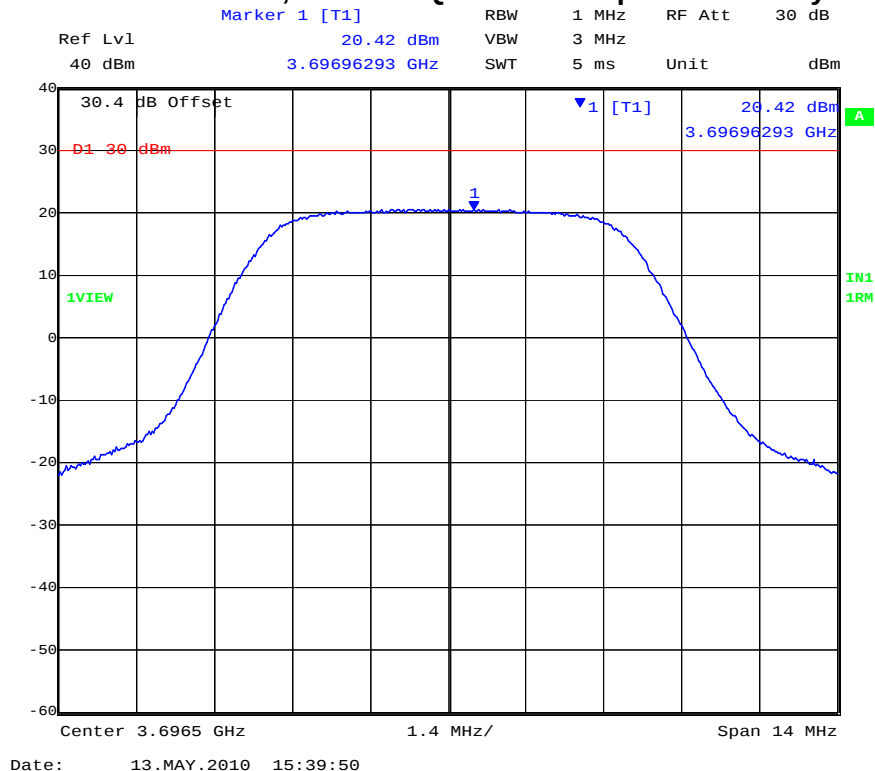


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Channel 3696.5, 7 MHz 16QAM Power Spectral Density



Channel 3696.5, 7 MHz 64QAM Power Spectral Density



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Laboratory Measurement Uncertainty for Power Measurement

Measurement uncertainty	± 1.33 dB
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Traceability

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

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5.1.4. Maximum Permissible Exposure

FCC, Part 90 Subpart C §90.1217

Calculations for Maximum Permissible Exposure Levels

$$\text{Power Density} = P_d (\text{mW/cm}^2) = \text{EIRP} / (4\pi d^2)$$

$$\text{EIRP} = P * G$$

P = Peak output power (mW)

G = Antenna numeric gain (numeric)

d = Separation distance (cm)

$$\text{Numeric Gain} = 10^{(G (\text{dBi})/10)}$$

The Axxcelera ETDAP-C9AC has a single transmitter. The peak power in the table below is calculated by assuming a worst case scenario for the maximum gain antenna and output power. The calculated separation distance is for worst case highest power level.

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)	Max Peak Output Power (dBm)	Peak Output Power (mW)	Calculated Safe Distance @ 1mW/cm ² Limit(cm)	Minimum Separation Distance (cm)
3650	10	10.00	+26.65 ¹	462.4	19.18	20.0*
3650	16	39.81	+21.00	125.9	19.97	20.0*

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

¹ Maximum power measured during test program - can only be used with 10 dBi antenna gain

Specification

Maximum Permissible Exposure Limits

§90.1217 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. See §1.1307 (b)(1) of this chapter.

Limit = 5mW / cm² 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.

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty

±1.33dB

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5.1.5. Frequency Stability; Temperature Variations, and Voltage Variations

FCC 47 CFR Part 90, Subpart Z; 2.1055(a)(1)

Test Procedure

The transmitter output was connected to a spectrum analyzer and the frequency stability was measured using a un-modulated (CW) single tone.

Frequency stability was measured through the extremes of temperature and voltage on the mid channel only. Before measurements were taken at each temperature the equipment waited until thermal balance was obtained.

Test Set-up is shown in Section 3.6 Test Configuration

Ambient conditions.

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



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TABLE OF RESULTS Frequency Stability – Channel Measured 3675 MHz

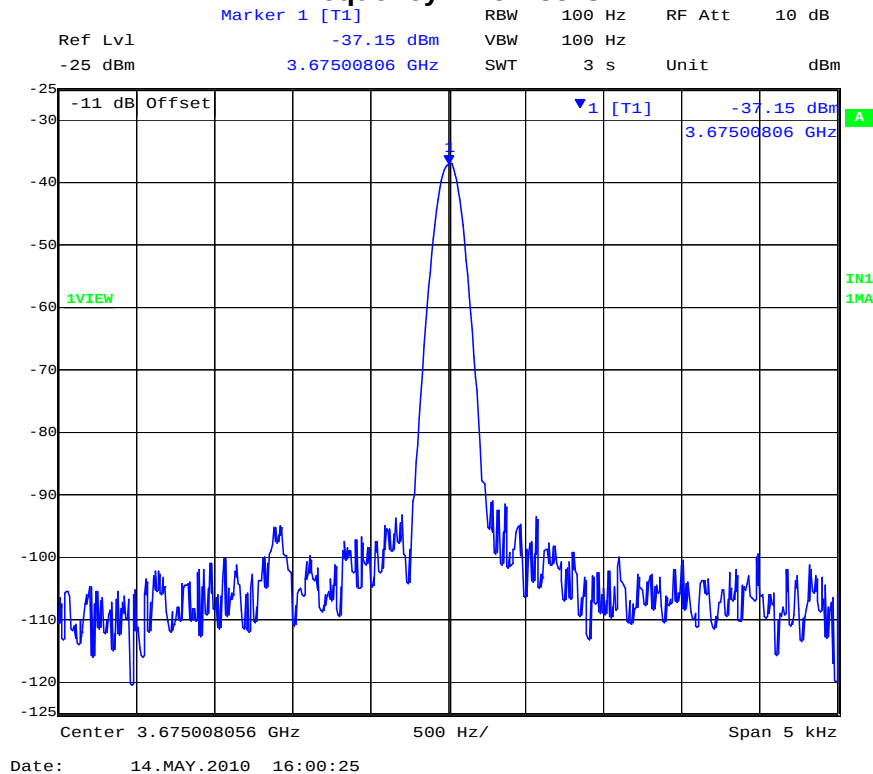
Voltage	Temperature (°C)	Center Frequency (MHz)	Delta (kHz)	ppm
48 Vdc	-33	3675.00806	8.06	2.193
	-30	3675.00845	8.45	2.299
	-20	3675.00748	7.48	2.035
	-10	3675.00553	5.53	1.505
	+0	3675.00373	3.73	1.015
	+10	3675.00224	2.24	0.610
	+20	3675.00158	1.58	0.430
43.2 Vdc	+20	3675.00158	1.58	0.430
52.8 Vdc	+20	3675.00151	1.51	0.411
48 Vdc	+30	3675.00047	0.47	0.128
	+40	3674.99988	-0.12	-0.033
	+50	3674.99889	-1.11	-0.302
	+55	3674.99818	-1.82	-0.495
Maximum Frequency Drift with respect to the nominal frequency		+8.45 kHz / -1.82 kHz +2.299 ppm / -0.495 ppm		

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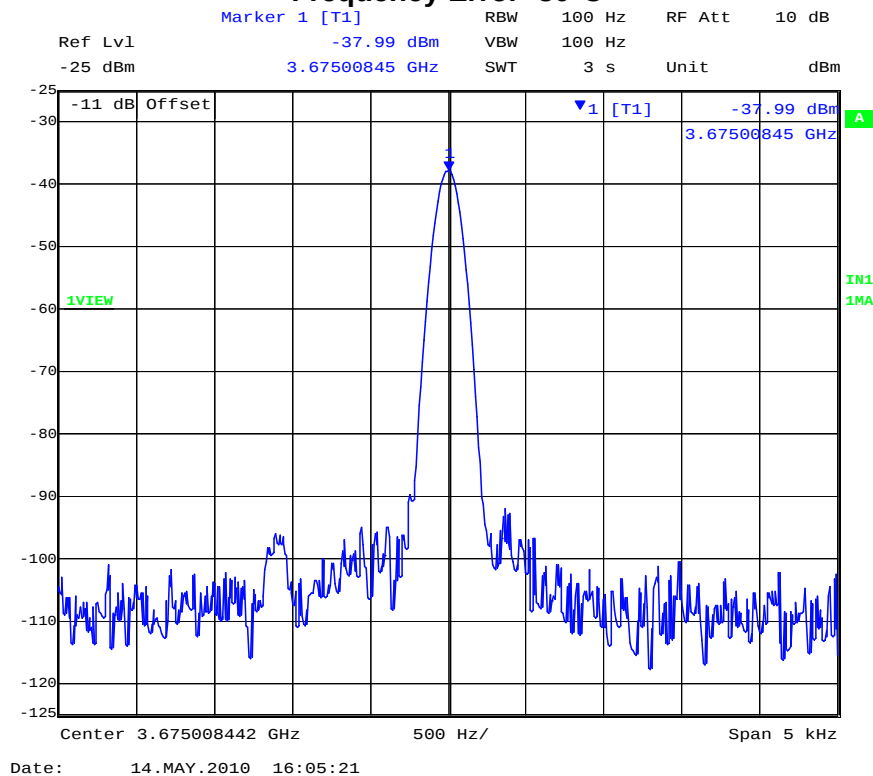


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Frequency Error -33°C



Frequency Error -30°C

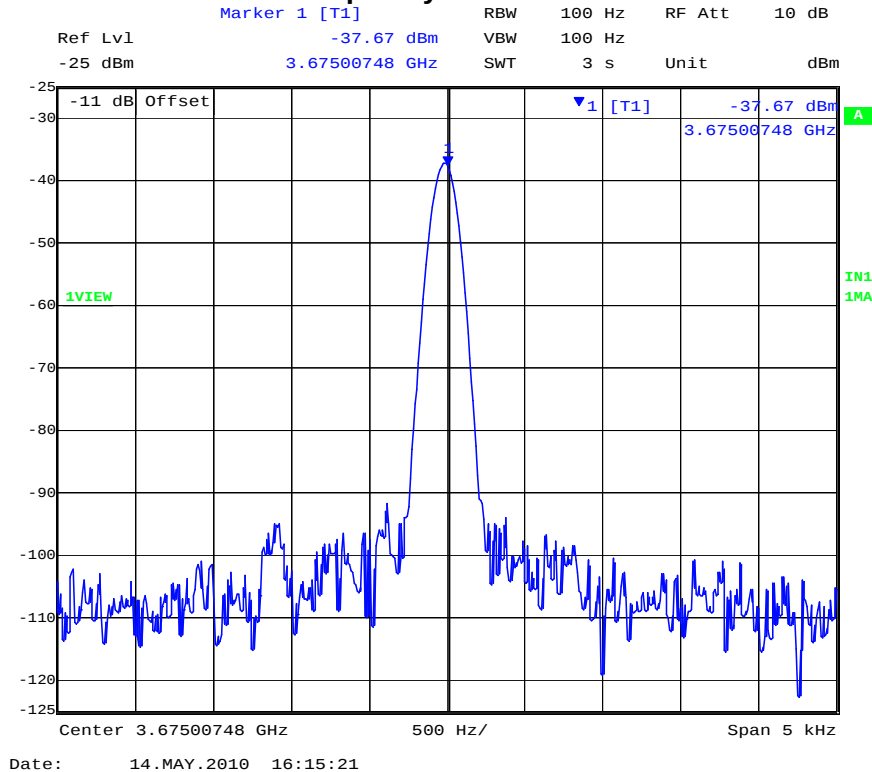


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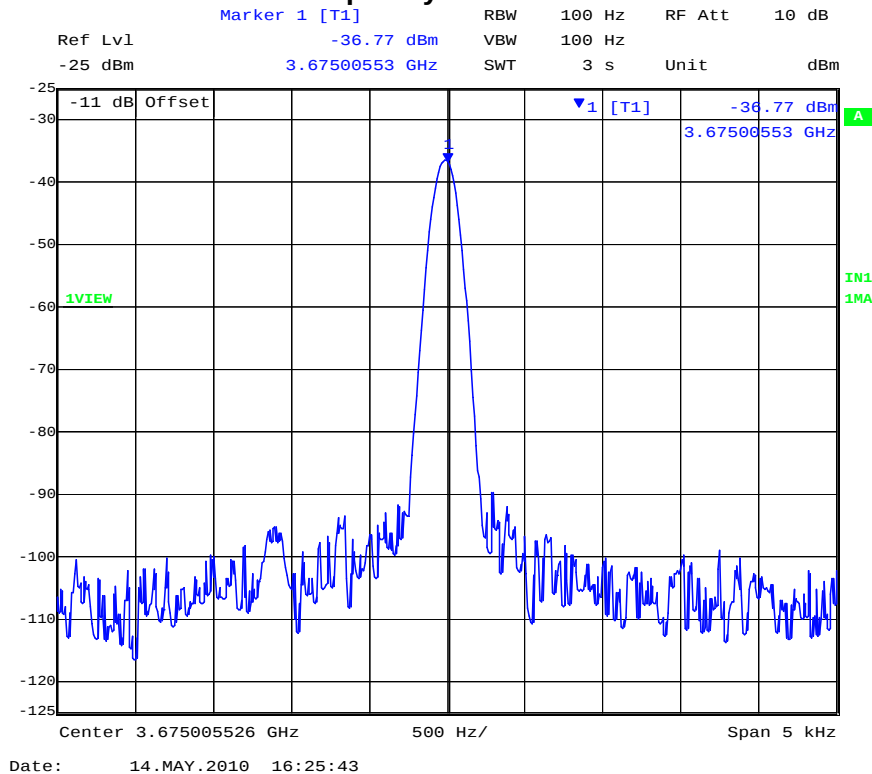


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Frequency Error -20°C



Frequency Error -10°C

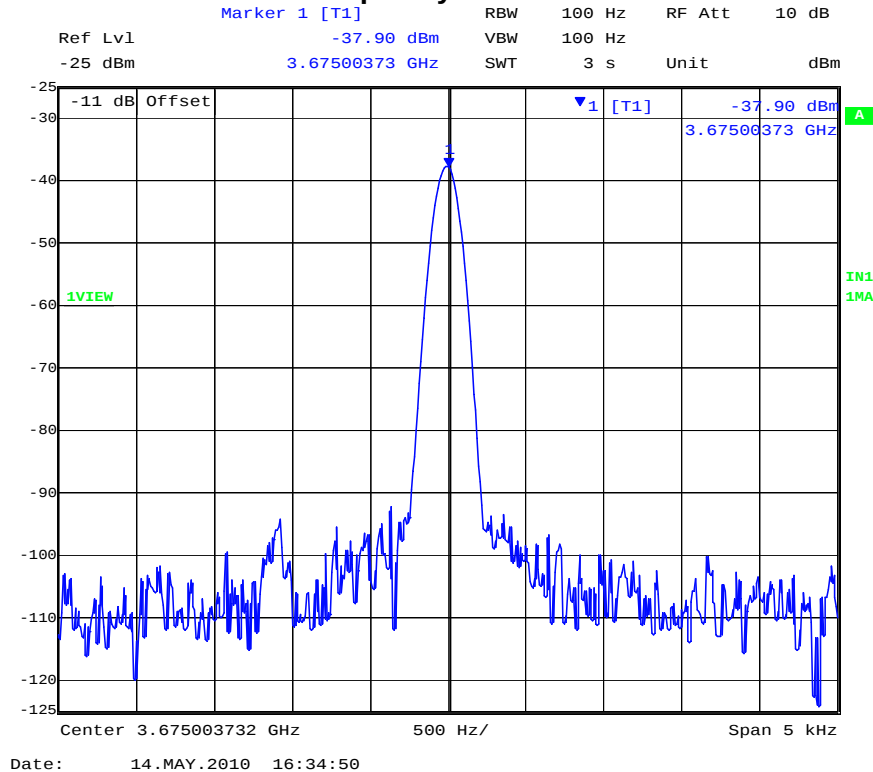


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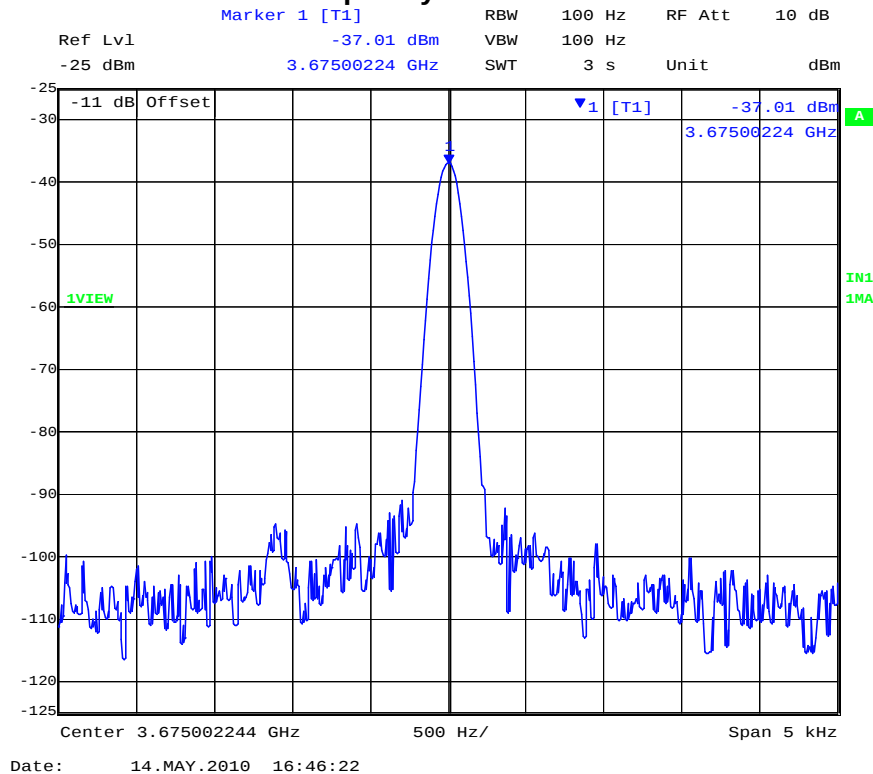


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Frequency Error 0°C



Frequency Error +10°C

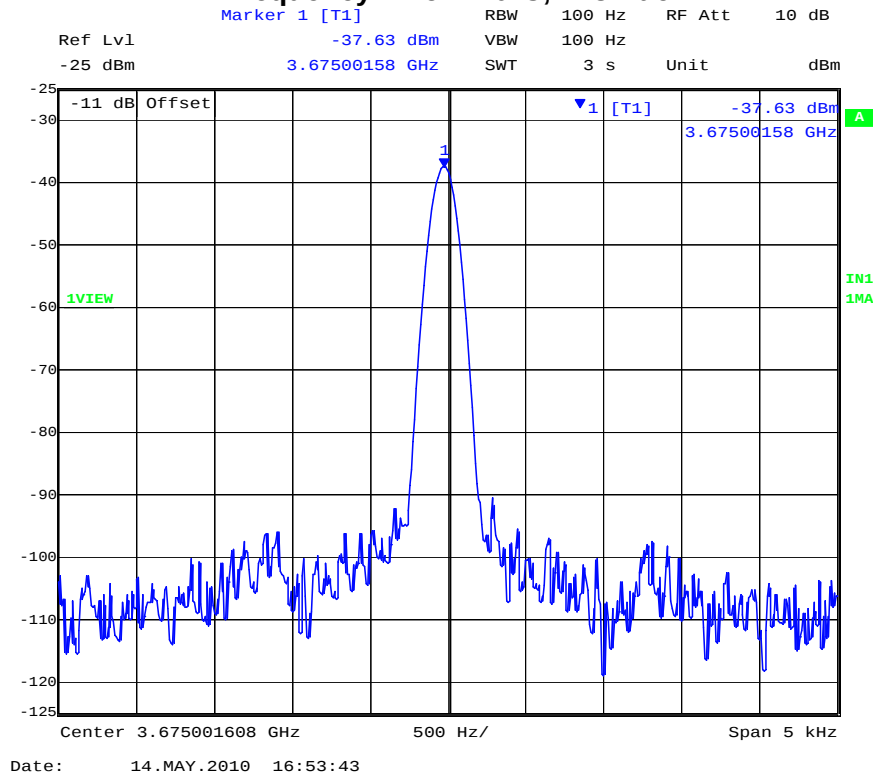


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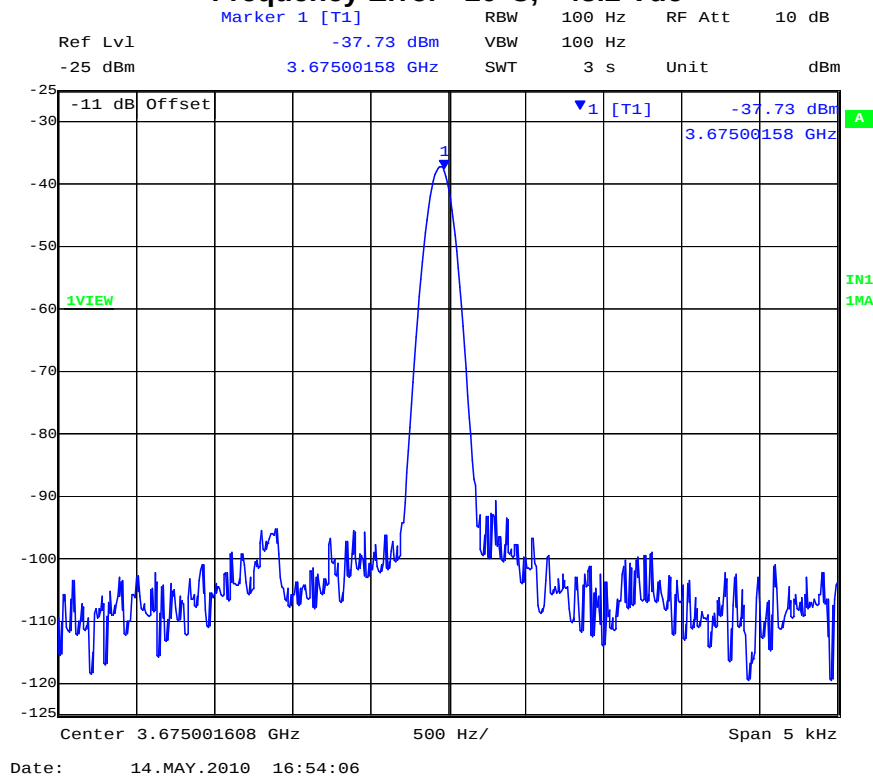


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Frequency Error +20°C, +48 Vdc



Frequency Error +20°C, +43.2 Vdc

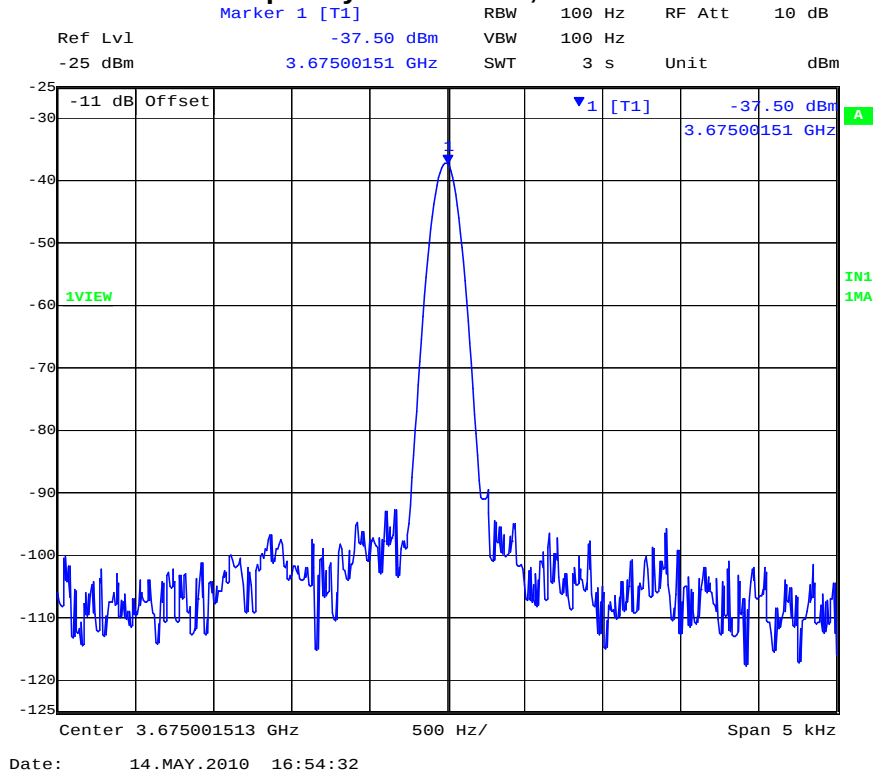


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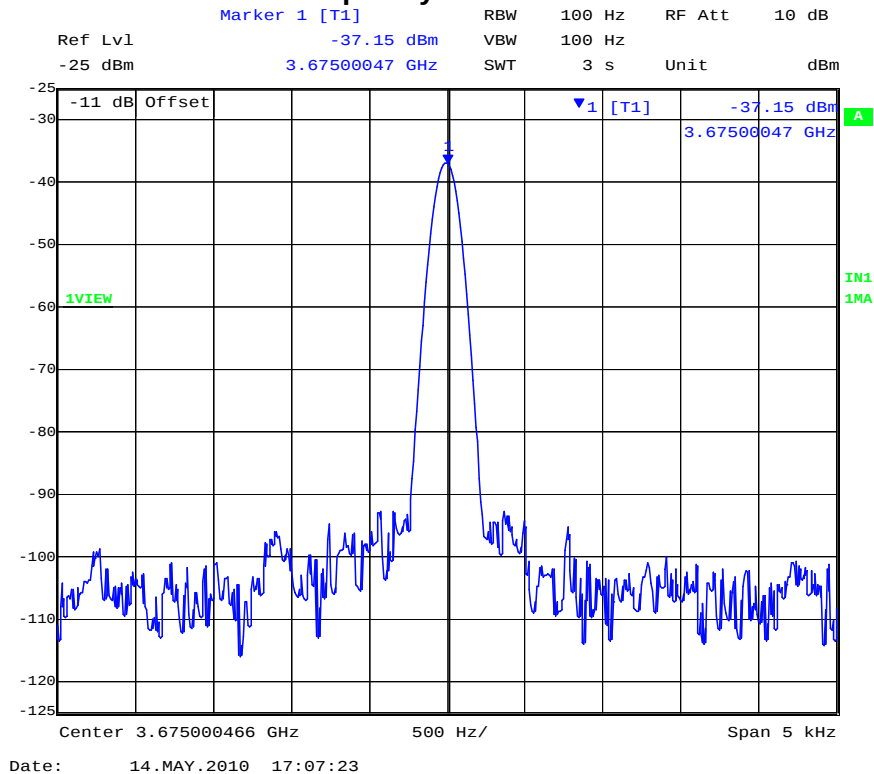


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Frequency Error +20°C, +52.8 Vdc



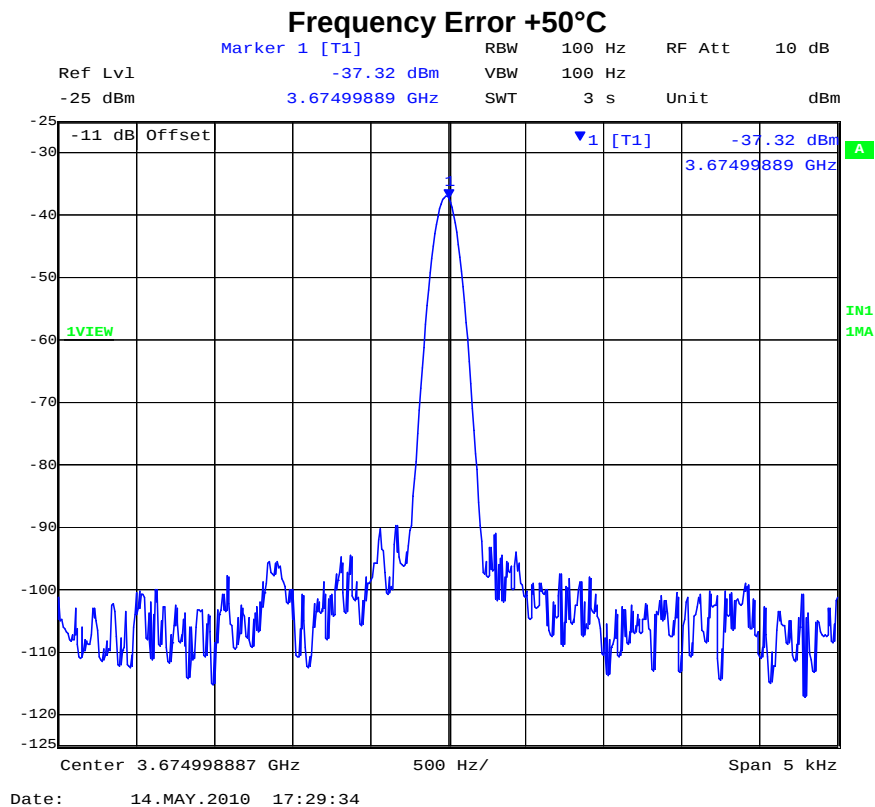
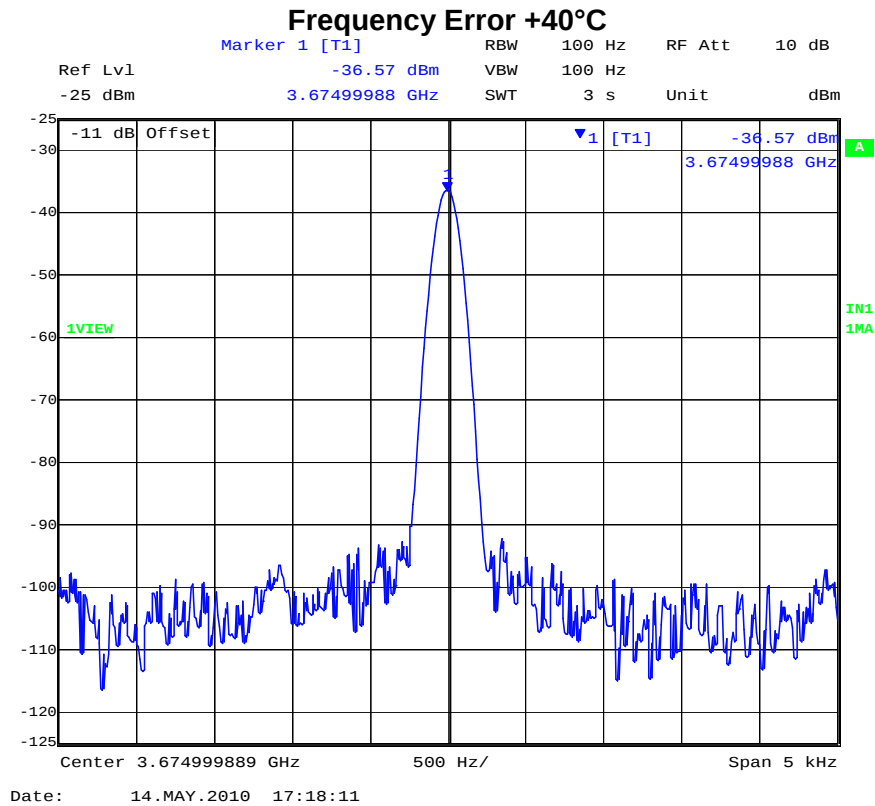
Frequency Error +30°C



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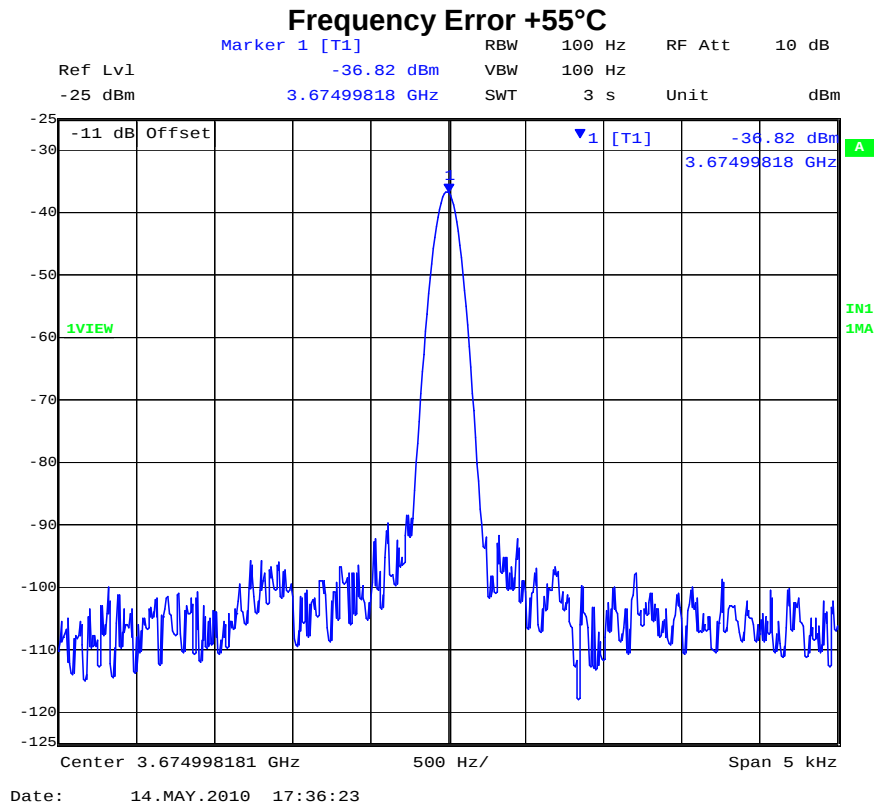
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5.1.6. Spectrum Mask (Band-Edge) & Spurious Emissions

FCC 47 CFR Part 90, Subpart Z; §90.1323, 2.1051

5.1.6.1. Spectrum Mask (Band-Edge)

Test Procedure

Transmitter spectrum mask was measured for all modulation schemes and channel bandwidths at the 3,650 and 3,700 MHz band-edges. Transmitter conducted spurious emissions were measured for 3.5, 5, 7 MHz all modulation states. The CW tone was superimposed on the plot identifying maximum output power.

Measurement were made while EUT was operating in a modulated transmit mode of operation, at the appropriate center frequency. Conducted spurious emissions were measured to 40 GHz in a peak hold mode.

Test Set-up is shown in Section 3.6 Test Configuration

Limit

For operation in the 3650 – 3700 band the power of any emission outside the frequency band of operation shall be attenuated below the transmitter power (P) within the licensed band of operation, measured in Watts, by at least $43 + 10 \cdot \log(P) = -13\text{dBm}$.

Ambient conditions.

Temperature: 17 to 23 °C

Relative humidity: 31 to 57 %

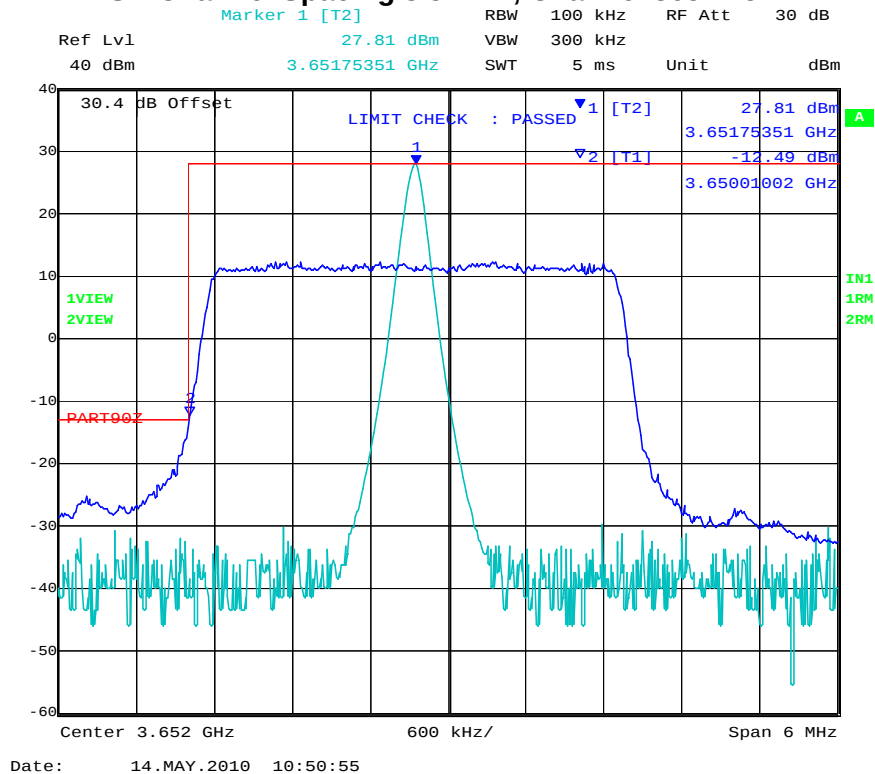
Pressure: 999 to 1012 mbar

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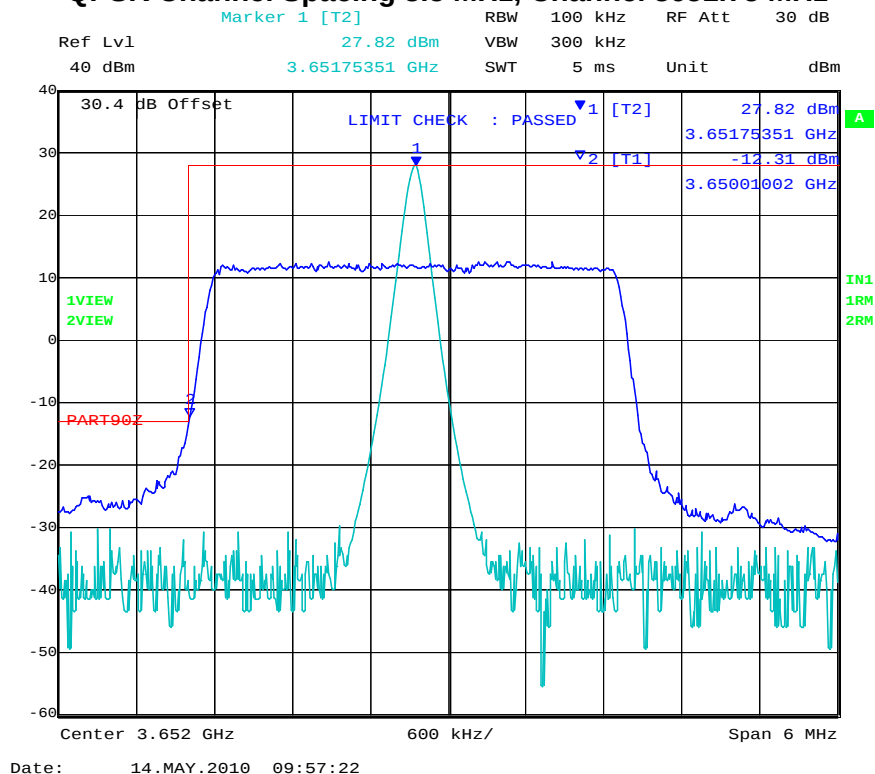


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BPSK Channel Spacing 3.5 MHz, Channel 3651.75 MHz



QPSK Channel Spacing 3.5 MHz, Channel 3651.75 MHz

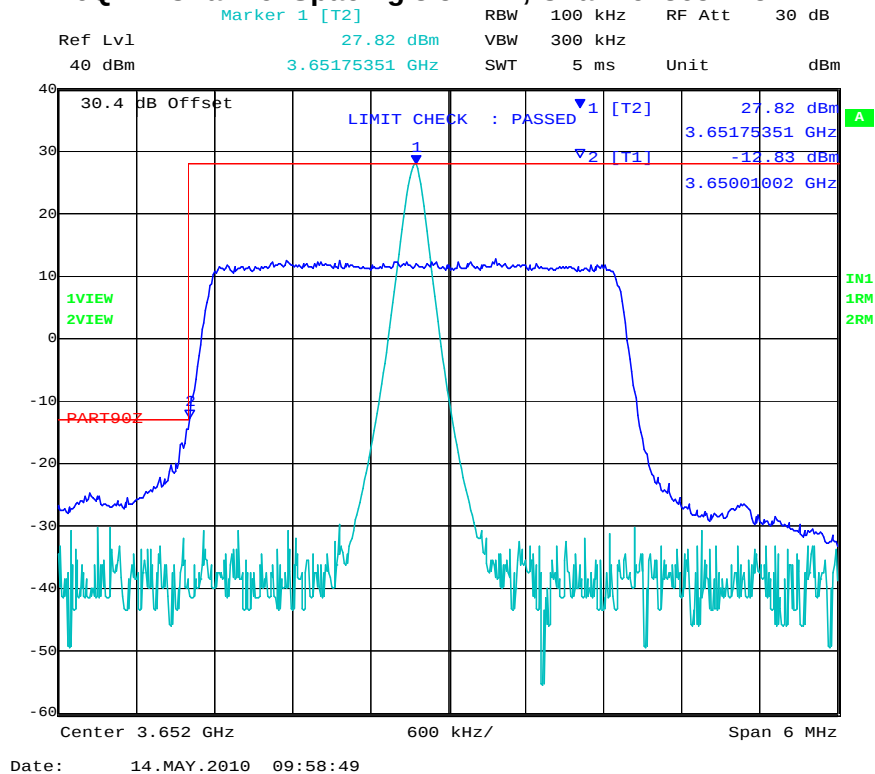


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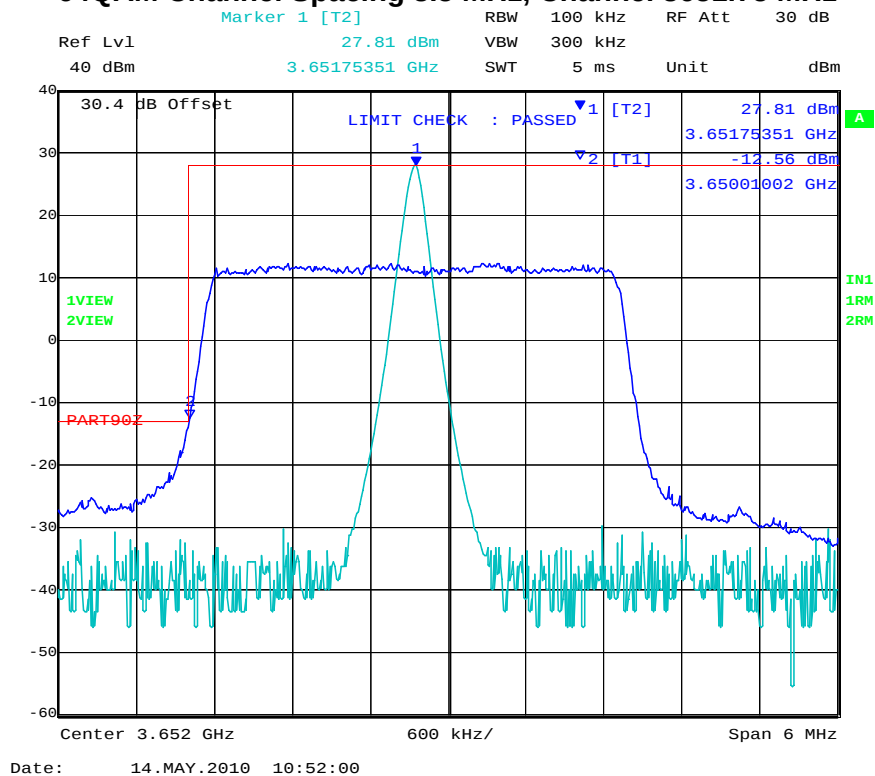


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16QAM Channel Spacing 3.5 MHz, Channel 3651.75 MHz



64QAM Channel Spacing 3.5 MHz, Channel 3651.75 MHz

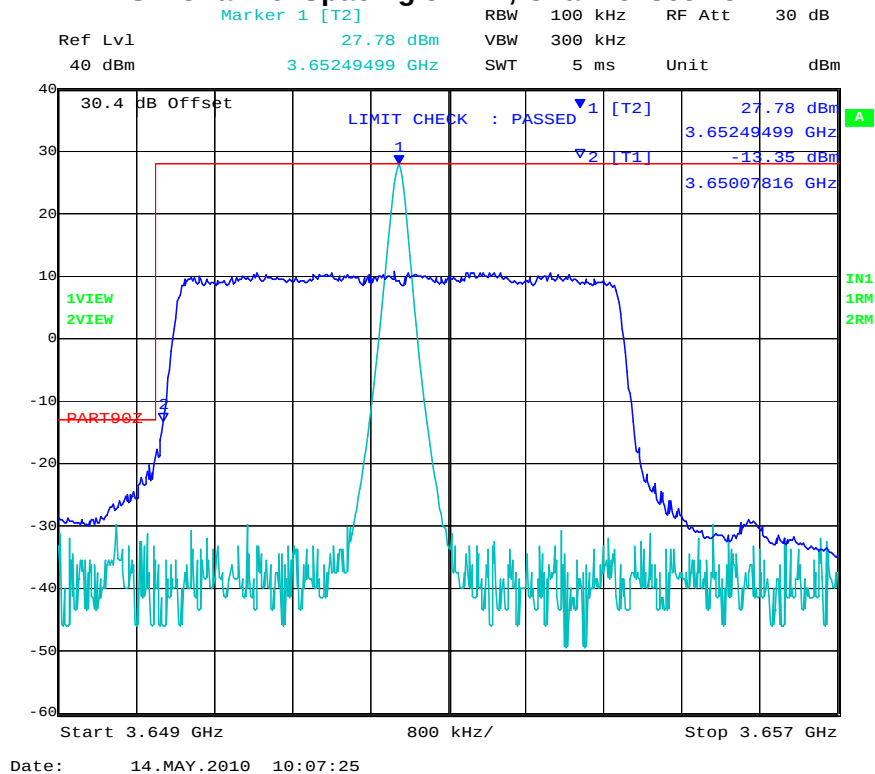


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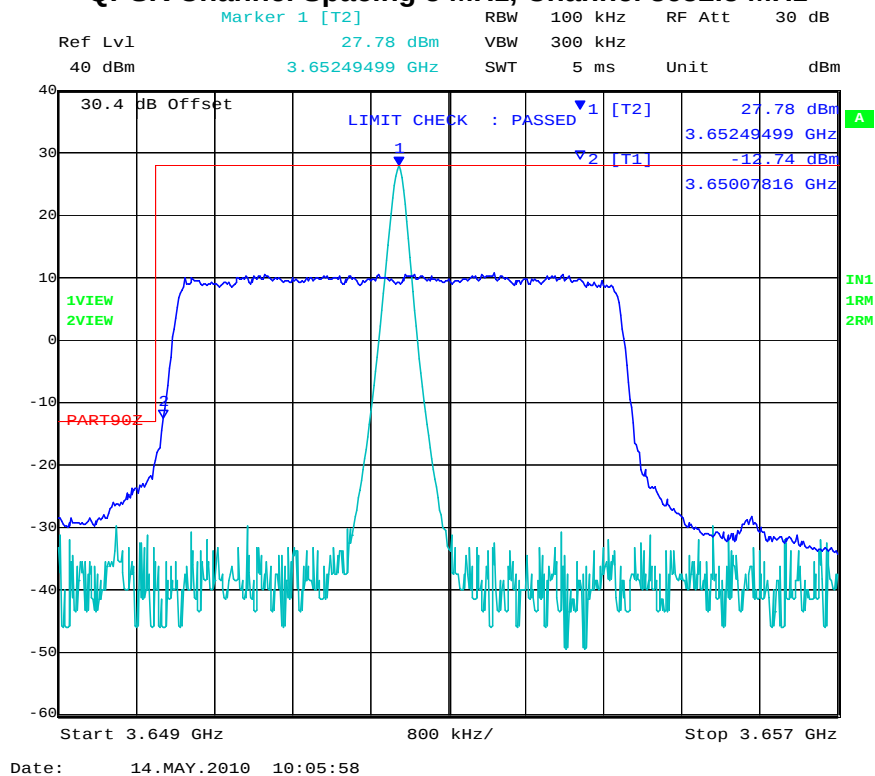


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BPSK Channel Spacing 5 MHz, Channel 3652.5 MHz



QPSK Channel Spacing 5 MHz, Channel 3652.5 MHz

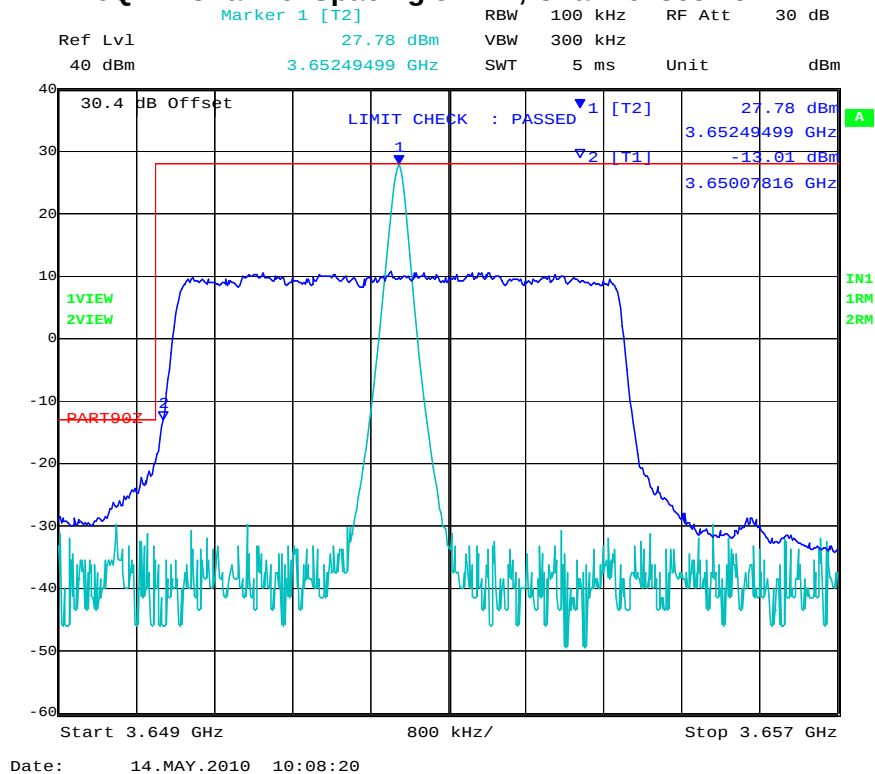


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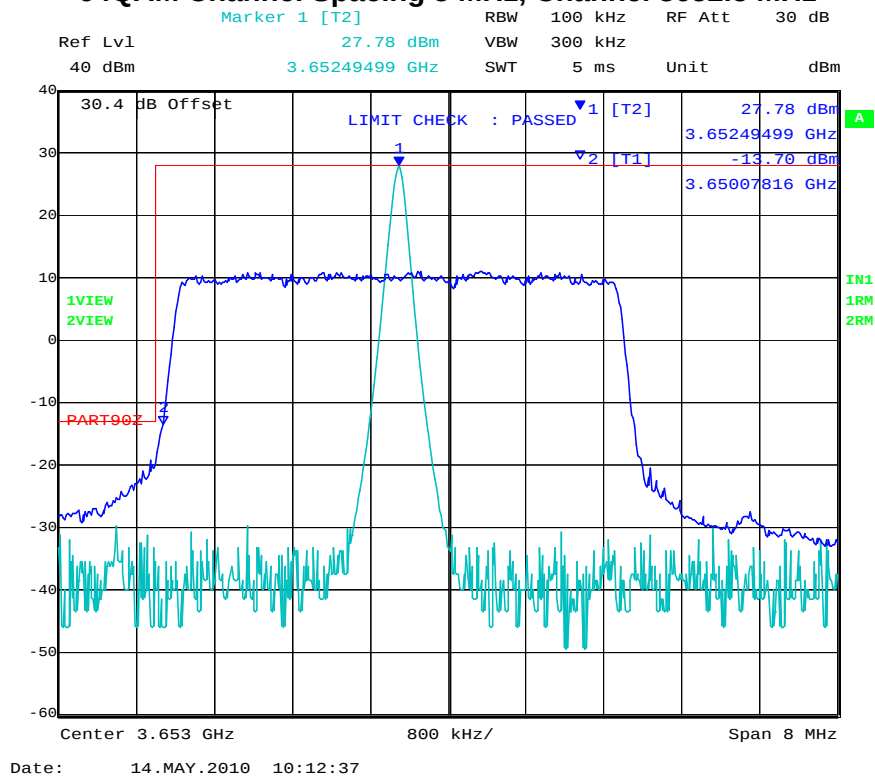


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16QAM Channel Spacing 5 MHz, Channel 3652.5 MHz



64QAM Channel Spacing 5 MHz, Channel 3652.5 MHz

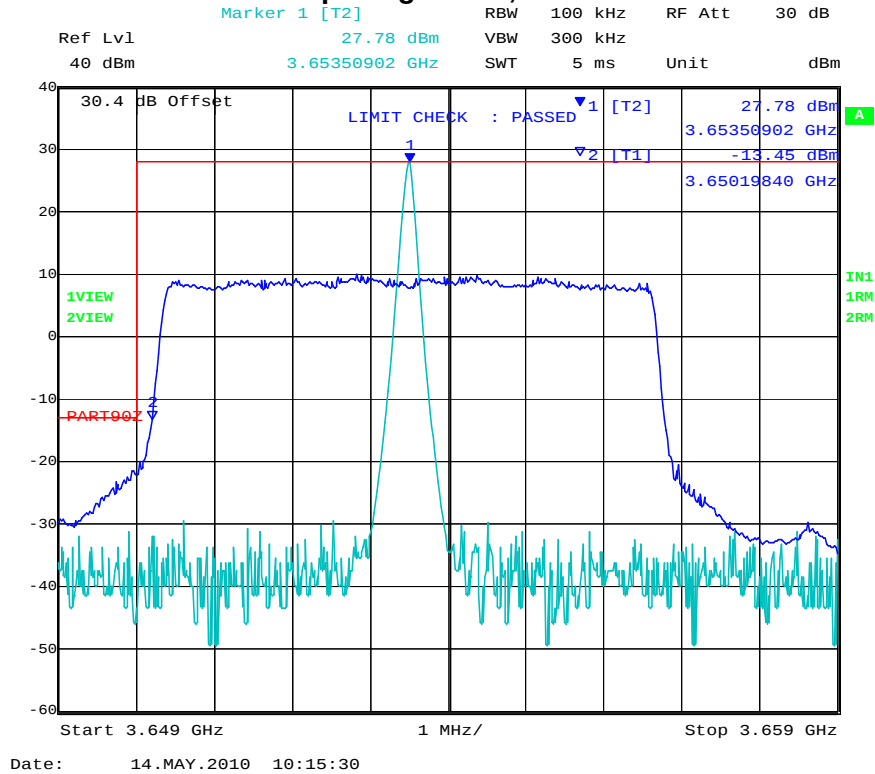


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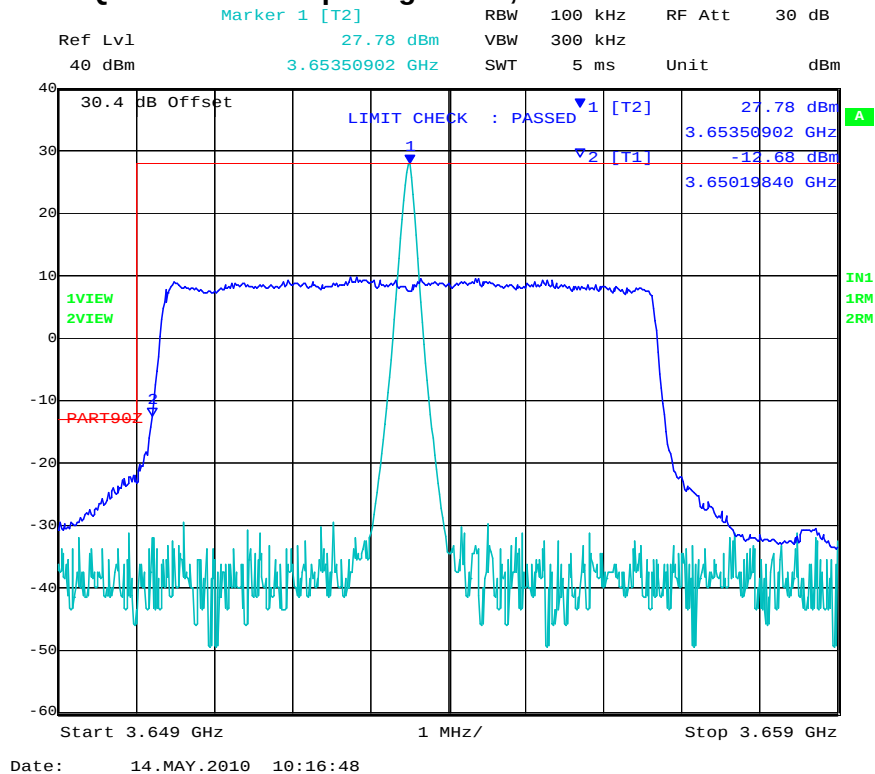


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BPSK Channel Spacing 7 MHz, Channel 3653.5 MHz



QPSK Channel Spacing 7 MHz, Channel 3653.5 MHz

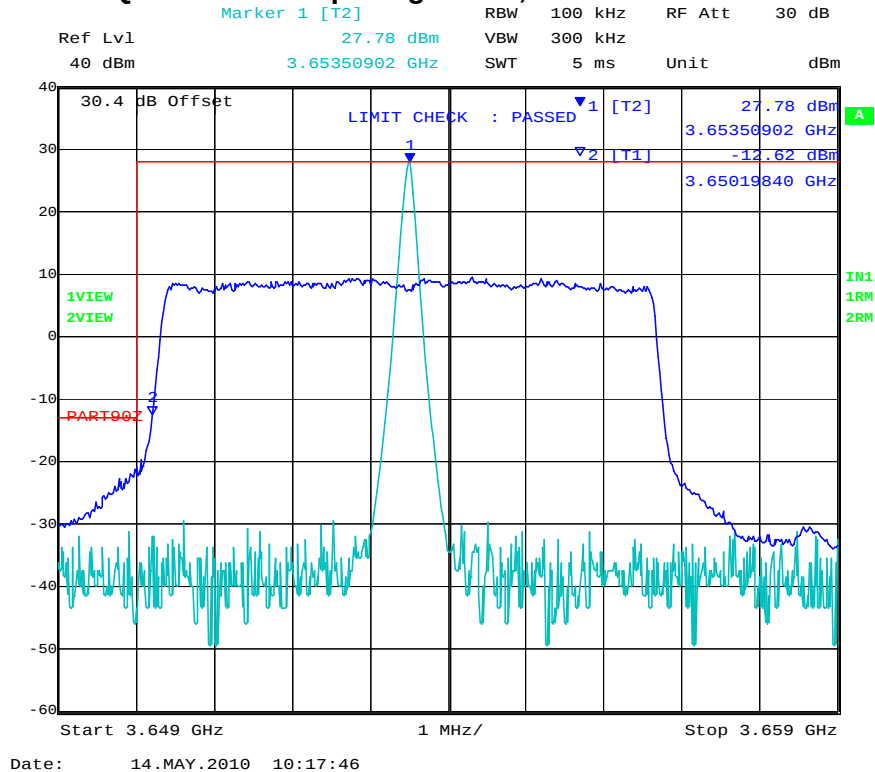


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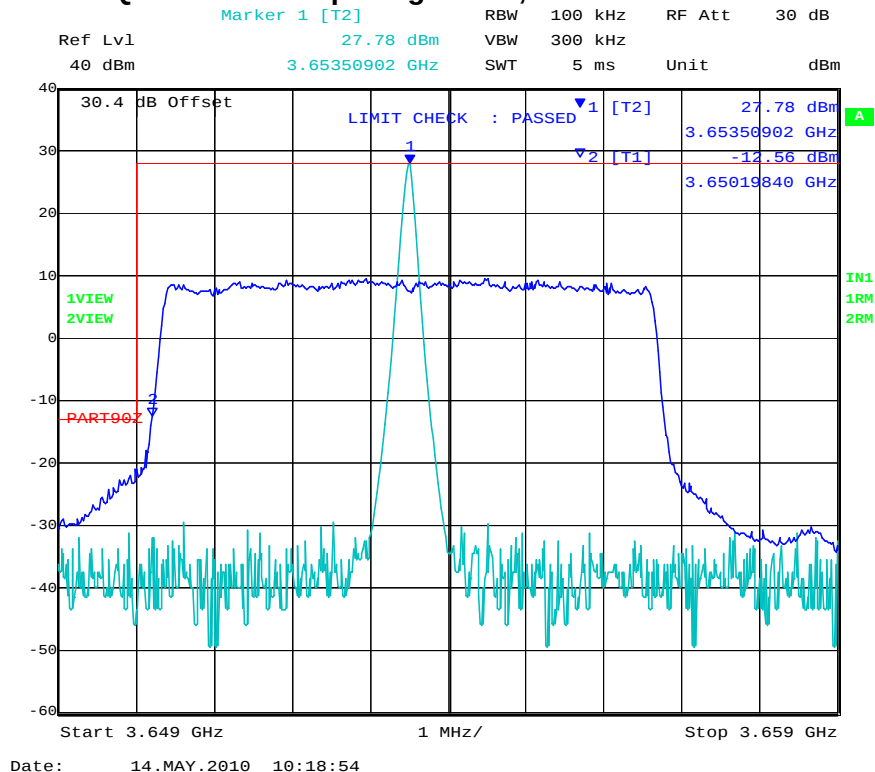


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16QAM Channel Spacing 7 MHz, Channel 3653.5 MHz



64QAM Channel Spacing 7 MHz, Channel 3653.5 MHz

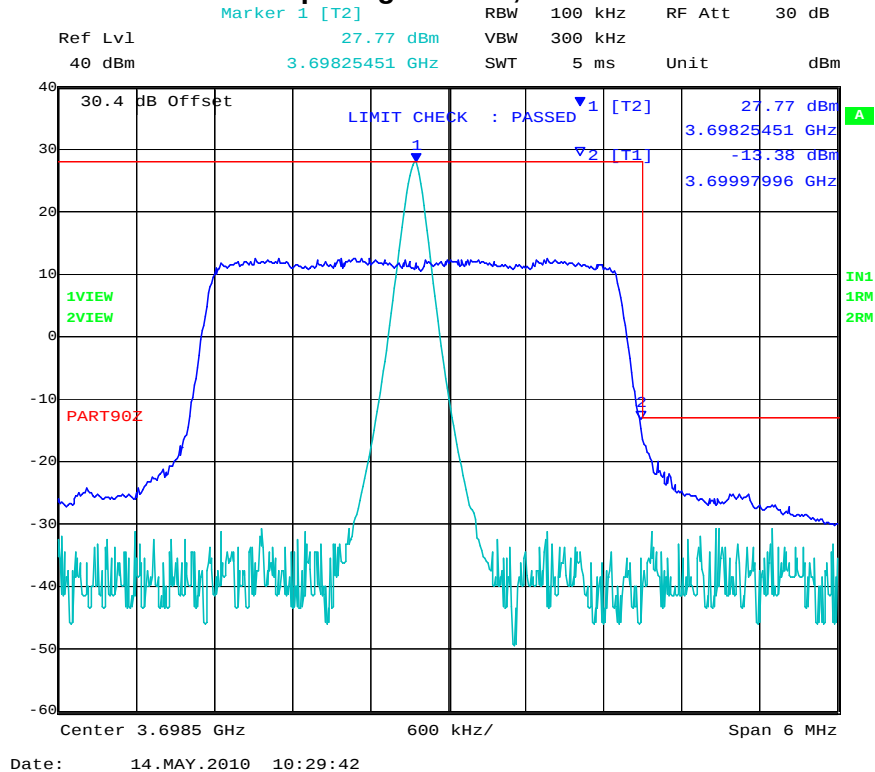


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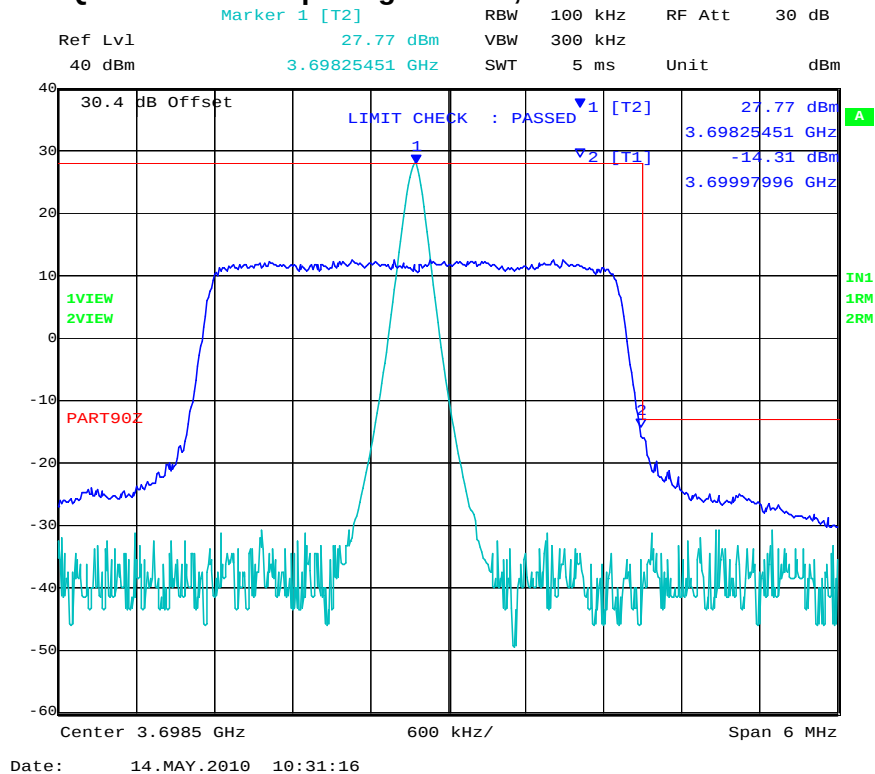


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BPSK Channel Spacing 3.5 MHz, Channel 3698.25 MHz



QPSK Channel Spacing 3.5 MHz, Channel 3698.25 MHz

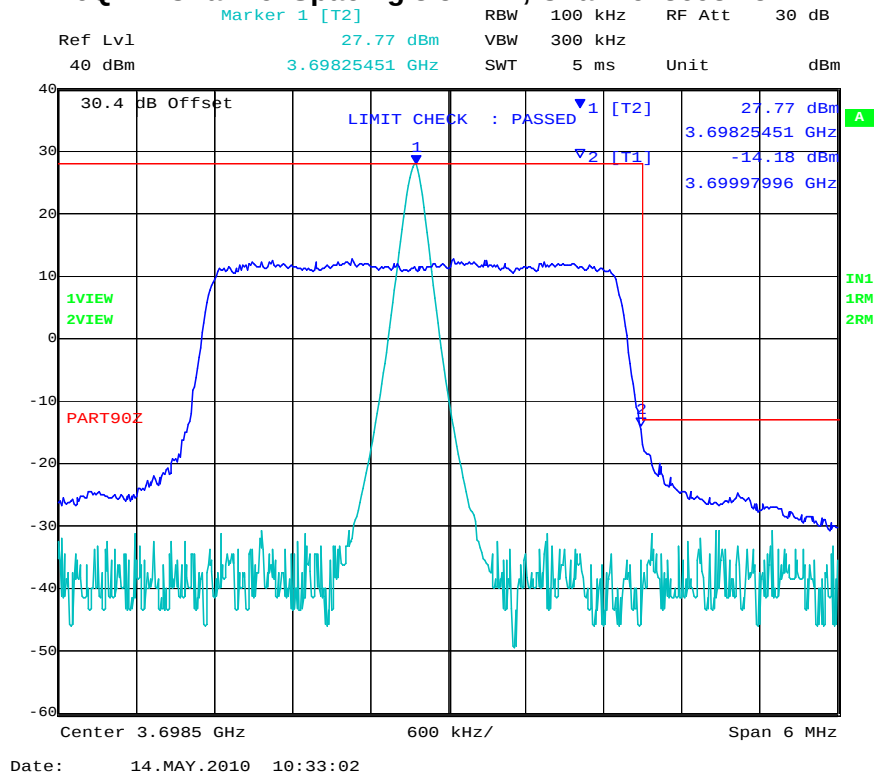


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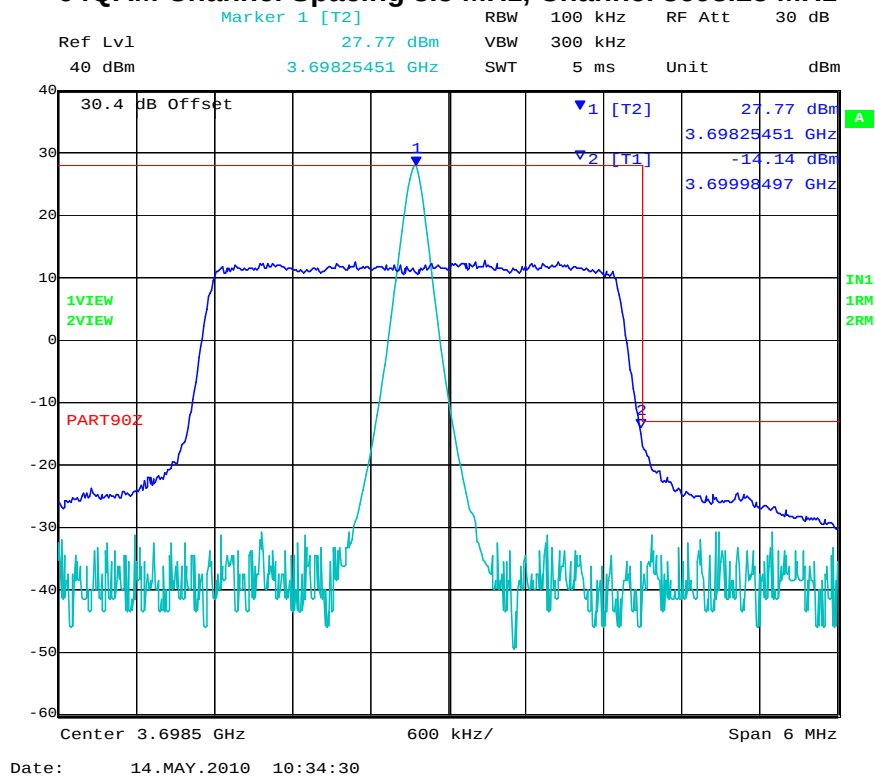


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16QAM Channel Spacing 3.5 MHz, Channel 3698.25 MHz



64QAM Channel Spacing 3.5 MHz, Channel 3698.25 MHz

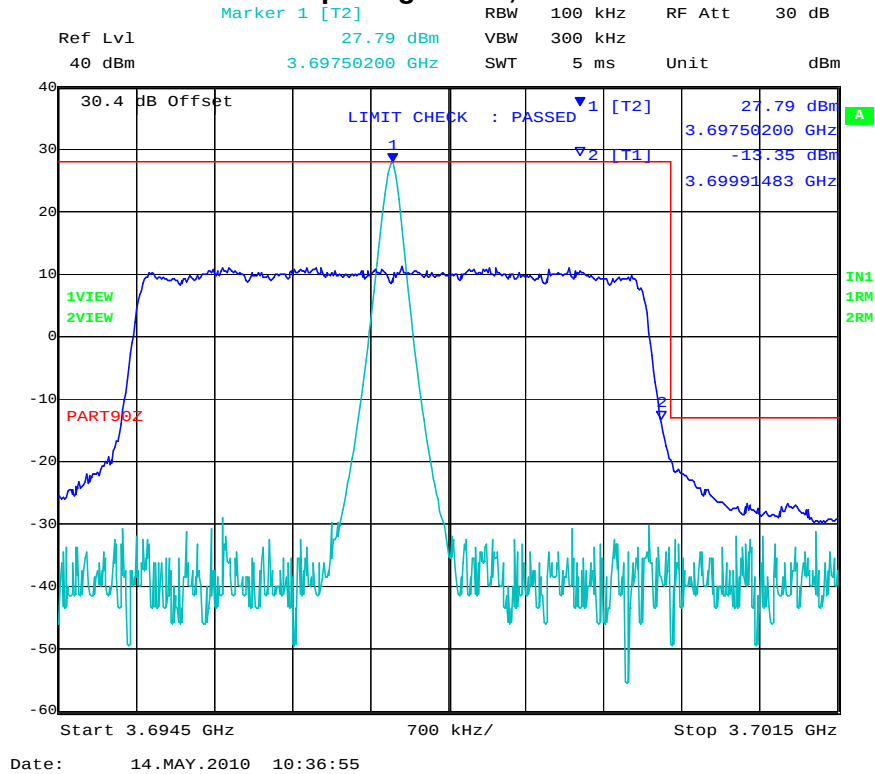


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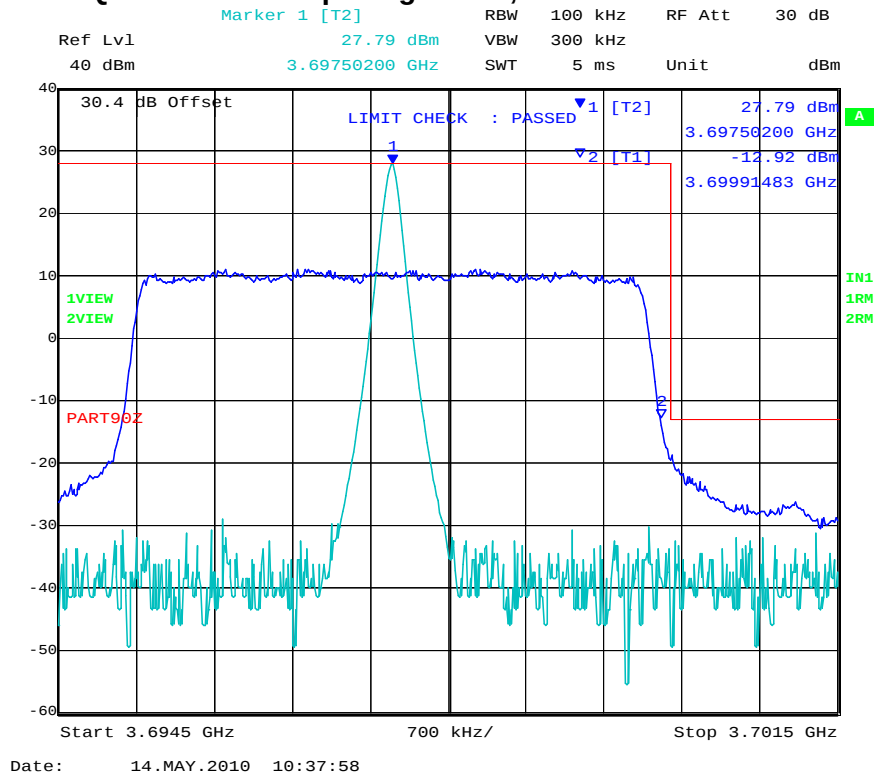


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BPSK Channel Spacing 5 MHz, Channel 3697.5 MHz



QPSK Channel Spacing 5 MHz, Channel 3697.5 MHz

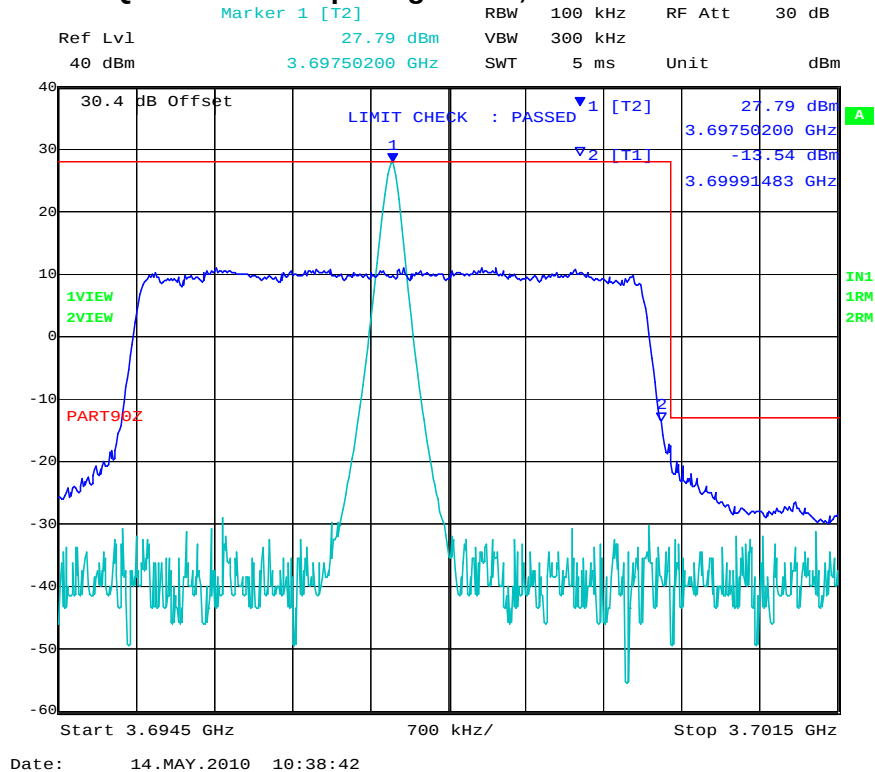


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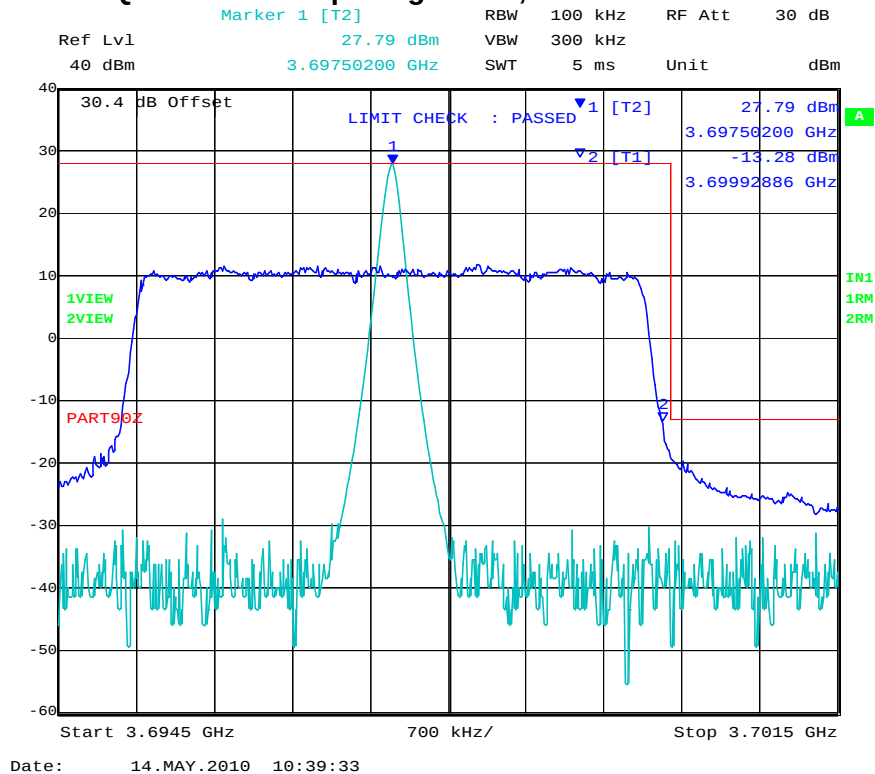


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16QAM Channel Spacing 5 MHz, Channel 3697.5 MHz



64QAM Channel Spacing 5 MHz, Channel 3697.5 MHz

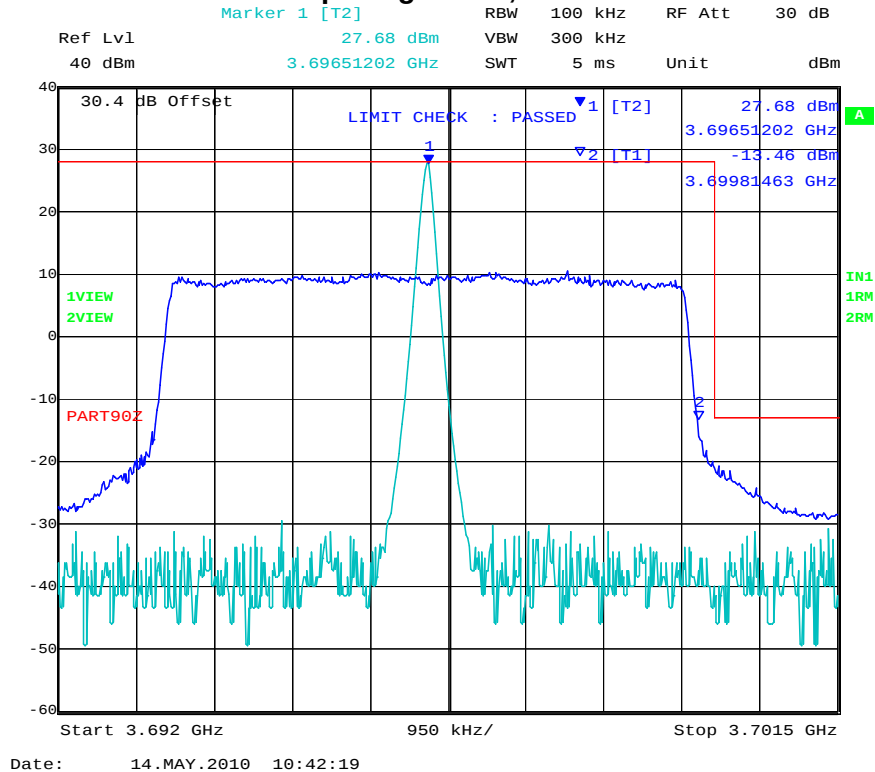


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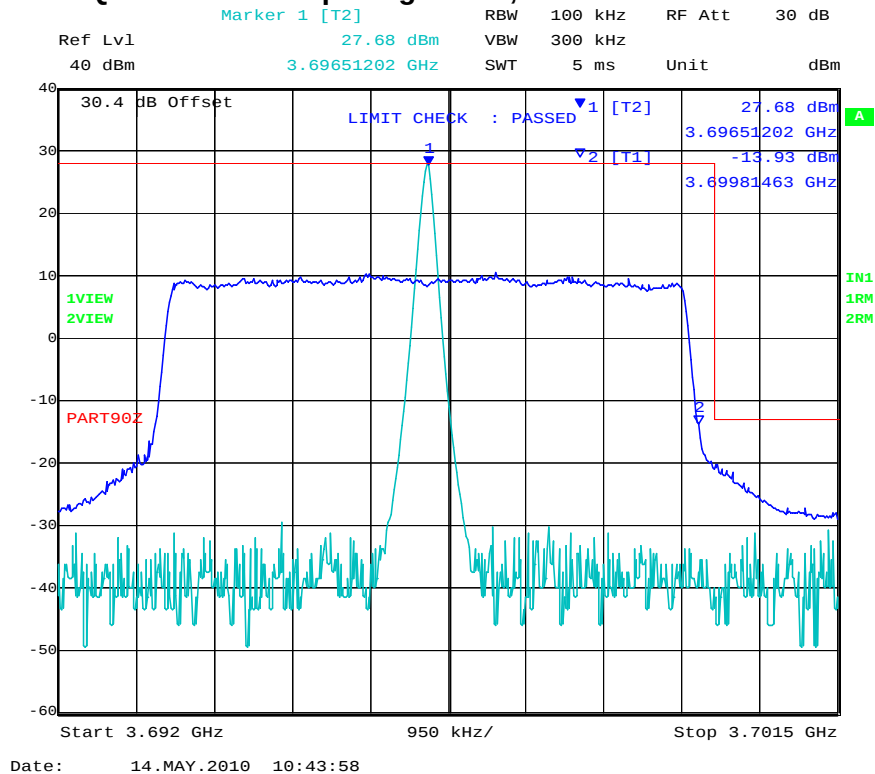


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BPSK Channel Spacing 7 MHz, Channel 3696.5 MHz



QPSK Channel Spacing 7 MHz, Channel 3696.5 MHz

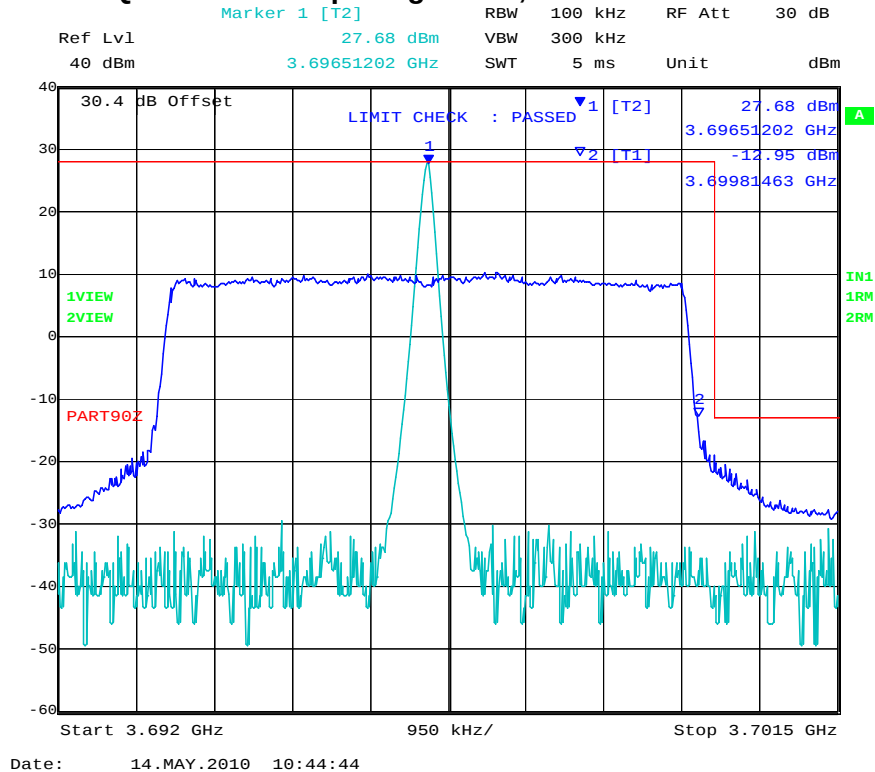


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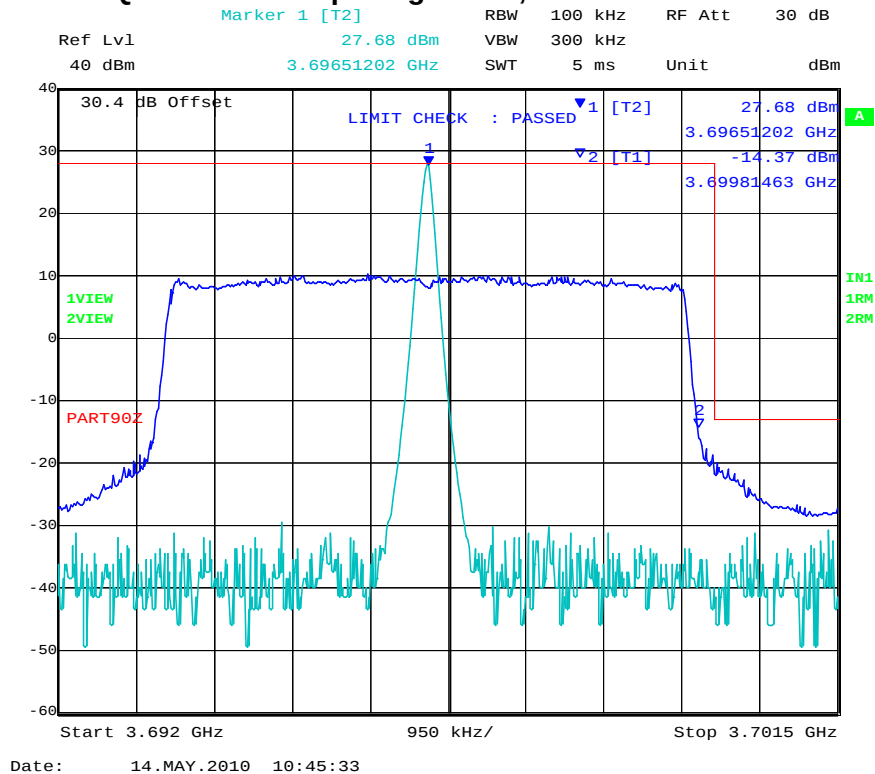


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16QAM Channel Spacing 7 MHz, Channel 3696.5 MHz



64QAM Channel Spacing 7 MHz, Channel 3696.5 MHz



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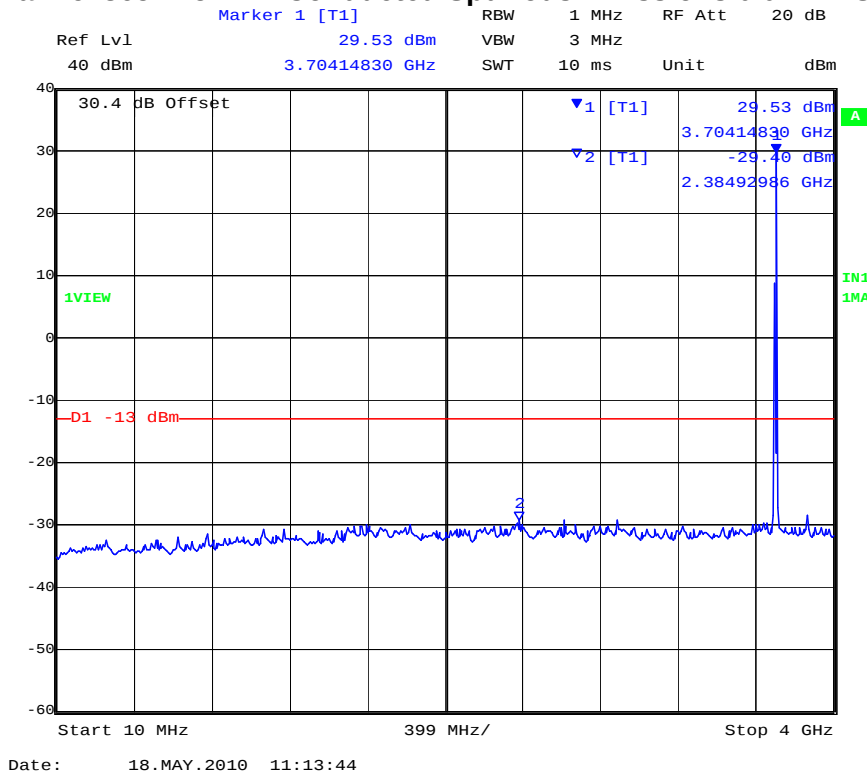
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5.1.6.2. Transmitter Conducted Spurious Emissions (30 M- 40 GHz)

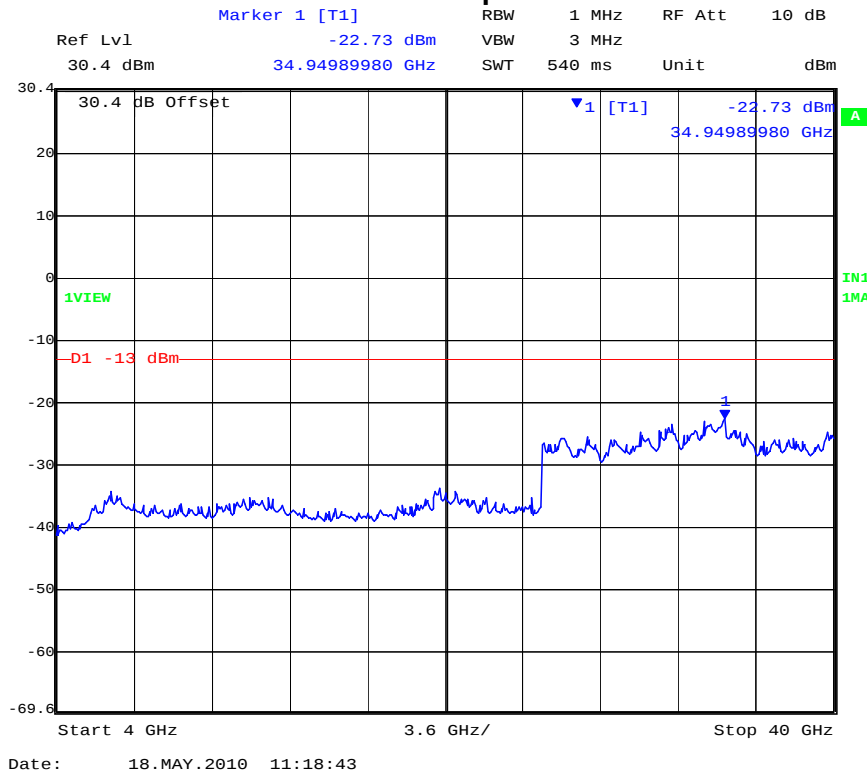
Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
3651.75	10	4,000	-29.53	-13.0	-16.53
	4,000	40,000	-22.73		-9.73

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Channel 3651.75 MHz Conducted Spurious Emissions 0.01 – 4 GHz



Channel 3651.75 MHz Conducted Spurious Emissions 4 - 40 GHz



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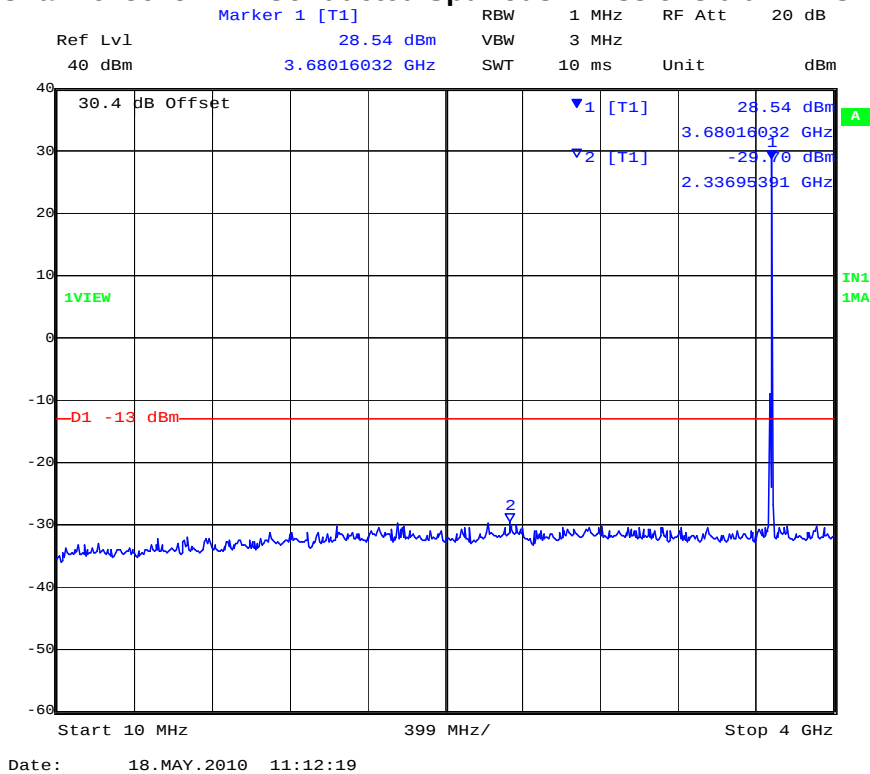
Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
3675.0	10	4,000	-29.70	-13.0	-16.70
	4,000	40,000	-23.08		-10.08

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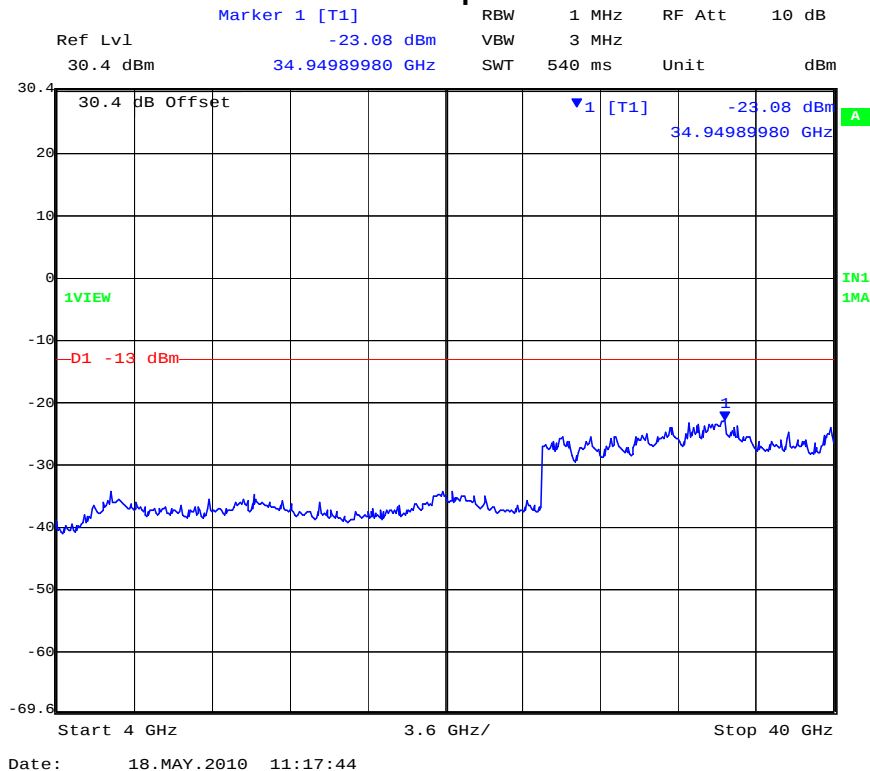


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Channel 3675 MHz Conducted Spurious Emissions 0.01 – 4 GHz



Channel 3675 MHz Conducted Spurious Emissions 4 - 40 GHz



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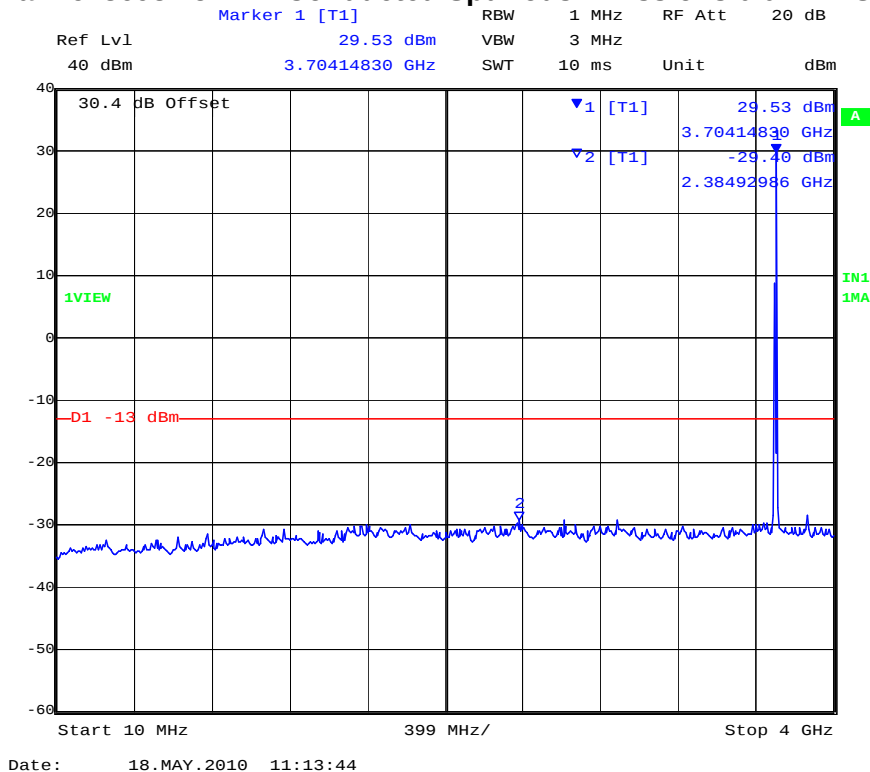
Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
3698.25	10	4,000	-29.40	-13.0	-16.40
	4,000	40,000	-22.48		-9.48

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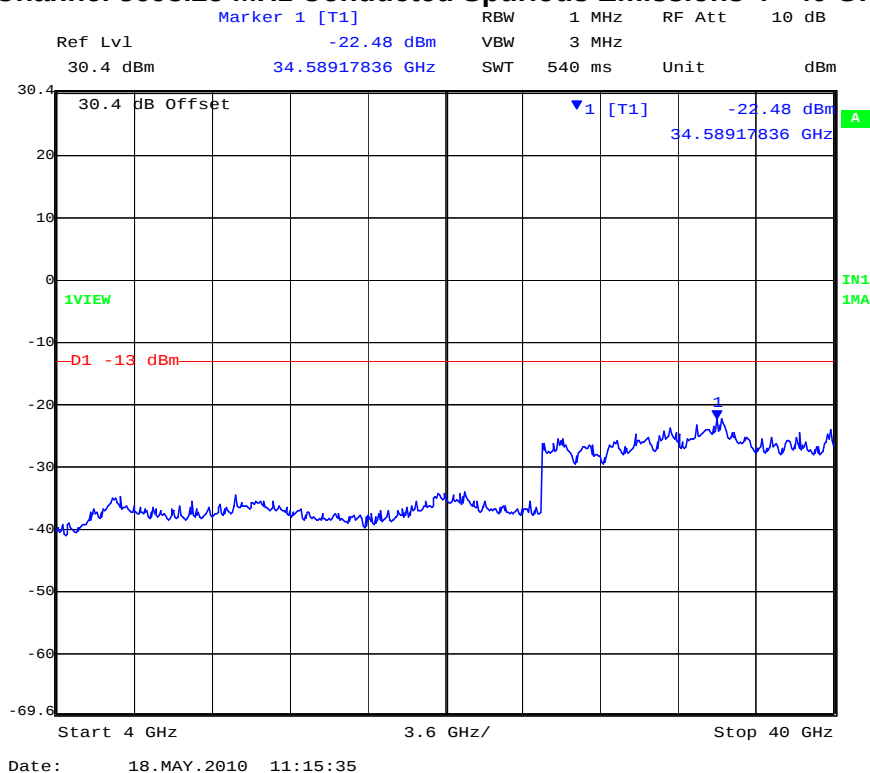


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Channel 3698.25 MHz Conducted Spurious Emissions 0.01 – 4 GHz



Channel 3698.25 MHz Conducted Spurious Emissions 4 - 40 GHz



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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'	0070, 0116, 0158, 0088, 0252, 0313, 0314

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5.1.7. Contention Based Protocol

The Contention Based Protocol measurement procedure was based upon a test strategy developed by Axxcelera. Testing was performed conductively and measurements show that the EUT stops transmission in the presence of an interferer on the same channel. The EUT was evaluated with various transmission back-off times in the presence of an interferer.

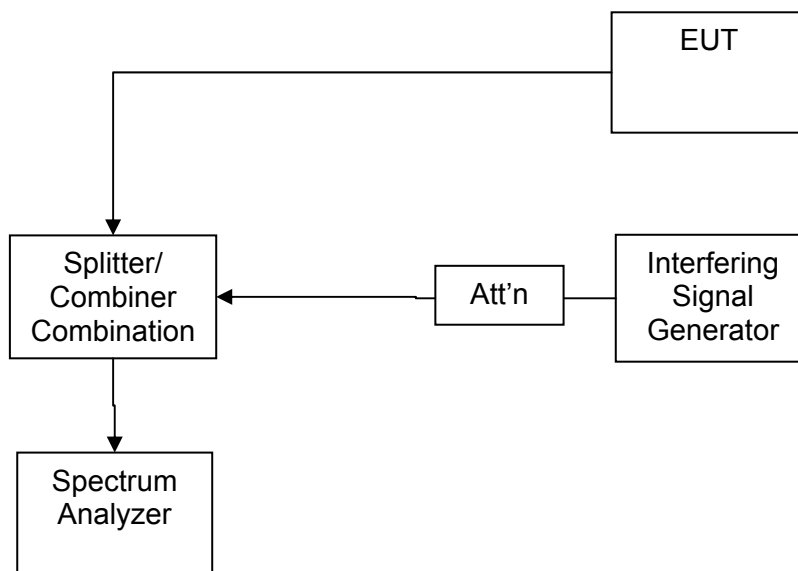
All channel bandwidths were measured 3.5, 5, 7 MHz in order to prove compliance.

Test Setup

A calibrated interfering signal was introduced at a various levels and frequency offset from the wanted carrier. A matrix of test configuration is provided following. The test result matrix identifies the received signal level strength and offset from the carrier that was injected to achieve the desired result.

The EUT output was monitored by a spectrum analyzer in zero span mode.

Test Configuration





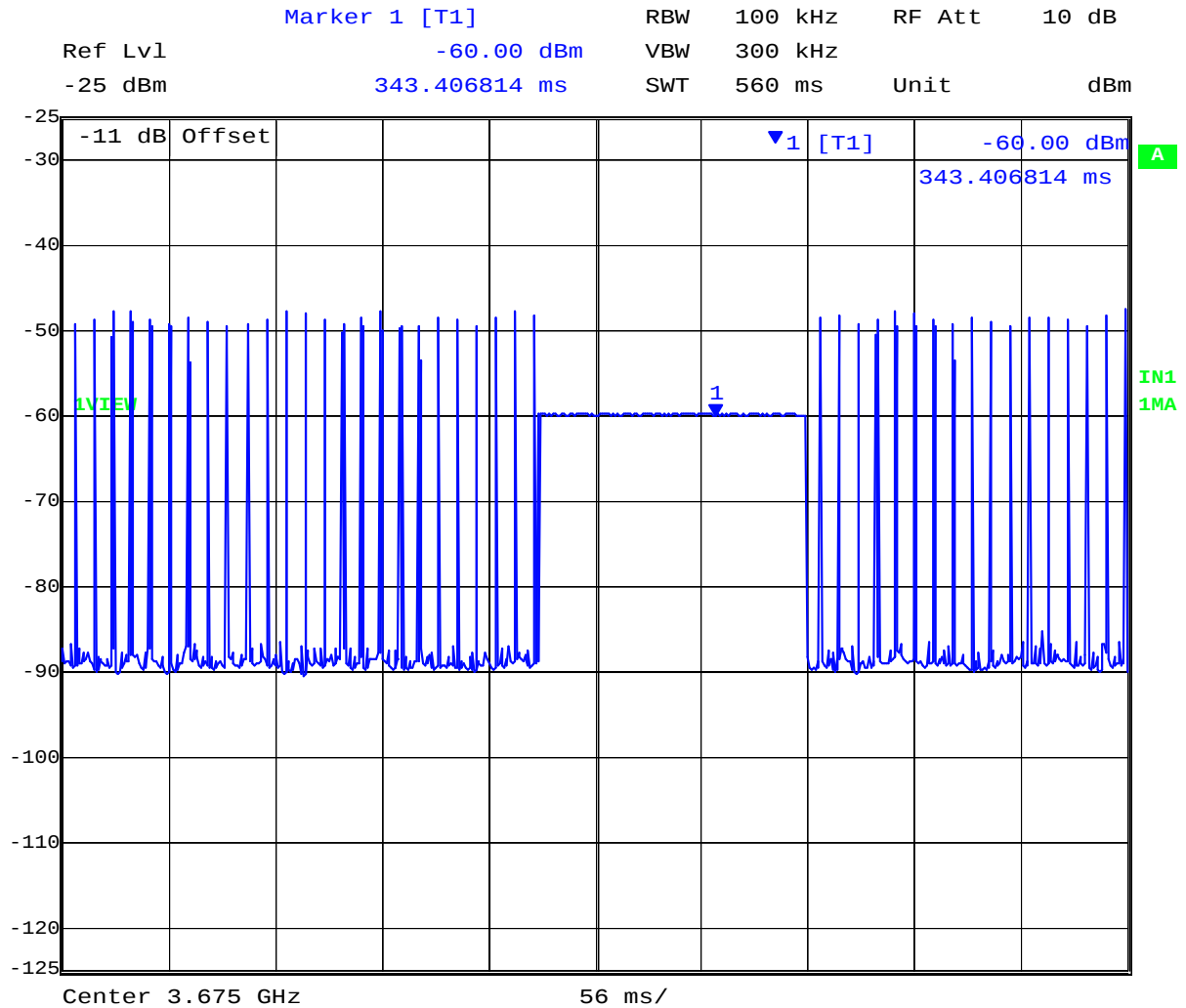
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Test No	EUT Channel Frequency (MHz)	EUT Channel Bandwidth (MHz)	EUT RSL Turn-Off Level (dBm)	Interferer frequency relative to EUT (MHz)	Interferer Level at EUT (dBm)	EUT TX-Off (Y/N)	Result
1	3651.75	3.5	-60	-1.75	-60	Y	Pass
2	3651.75	3.5	-60	-1.75	-65	N	Pass
3	3651.75	3.5	-65	0	-65	Y	Pass
4	3651.75	3.5	-65	0	-70	N	Pass
5	3651.75	3.5	-70	1.75	-70	Y	Pass
6	3651.75	3.5	-70	1.75	-75	N	Pass
7	3651.75	3.5	-70	-3.5	-45	N	Pass
8	3651.75	3.5	-70	3.5	-45	N	Pass
9	3675	5	-60	-2.5	-60	Y	Pass
10	3675	5	-60	-2.5	-65	N	Pass
11	3675	5	-65	0	-65	Y	Pass
12	3675	5	-65	0	-70	N	Pass
13	3675	5	-70	2.5	-70	Y	Pass
14	3675	5	-70	2.5	-75	N	Pass
15	3675	5	-70	-5	-45	N	Pass
16	3675	5	-70	5	-45	N	Pass
17	3696.5	7	-60	-3.5	-60	Y	Pass
18	3696.5	7	-60	-3.5	-65	N	Pass
19	3696.5	7	-65	0	-65	Y	Pass
20	3696.5	7	-65	0	-70	N	Pass
21	3696.5	7	-70	3.5	-70	Y	Pass
22	3696.5	7	-70	3.5	-75	N	Pass
23	3696.5	7	-70	-7	-45	N	Pass
24	3696.5	7	-70	7	-45	N	Pass

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Date: 14.MAY.2010 13:00:37

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Measurement Uncertainty Time/Power

Measurement uncertainty	
- Time	4%
- Power	1.33dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-01 'Measuring RF Output Power'	0072, 0083, 0287, 0223, 0116, 0158, 0310, 0312, 0313, 0314, 0193, 0252, 0253, 0251.

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5.1.8. Radiated Spurious Emissions

5.1.8.1. Transmitter Radiated Emissions above 1 GHz

**FCC 47 CFR Part 90, Subpart Z; §90.1323, 2.1053;
ANSI/TIA-603**

Test Procedure

Measurements were made while EUT was operating in a modulated transmit mode of operation, at the appropriate center frequency. Substitution was performed on any emissions observed. The antenna port was attenuated with a 50 Ω termination.

As no antennae were required for testing purposes and only BPSK 3.5 MHz bandwidth was tested to prove compliance.

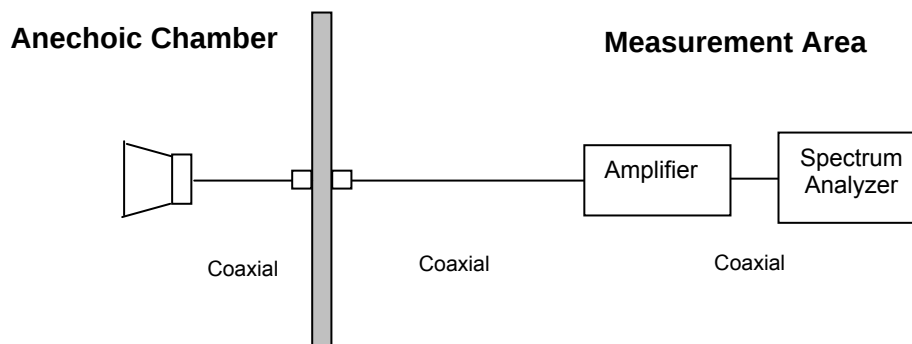
The measurement equipment was set to measure in peak hold mode. The emissions were measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode.

The highest emissions relative to the limit are listed for each frequency band measured.

Limit

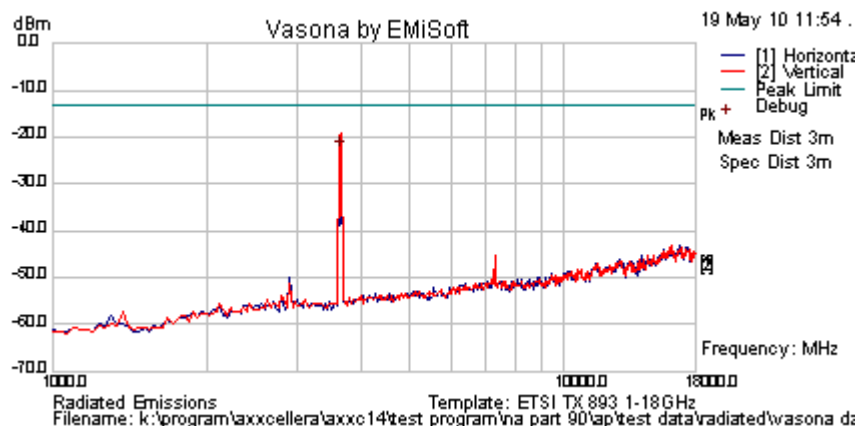
For operation in the 3650 – 3700 band the power of any emission outside the frequency band of operation shall be attenuated below the transmitter power (P) within the licensed band of operation, measured in Watts, by at least $43 + 10 \cdot \log(P) = -13\text{dBm}$.

Test Measurement Set up



Measurement set up for Radiated Emission Test

Test Freq.	3651.75 MHz	Engineer	GMH
Variant	Access Point BPSK 3.5 MHz	Temp (°C)	24
Freq. Range	1-18 GHz	Rel. Hum.(%)	41
Power Setting	Maximum	Press. (mBars)	1009
Antenna	50 Ohm Load Termination	Duty Cycle (%)	100
Test Notes 1	Laptop to control EUT in control room. 1m length sma cable on antenna port terminated in 50 Ohm		
Test Notes 2			

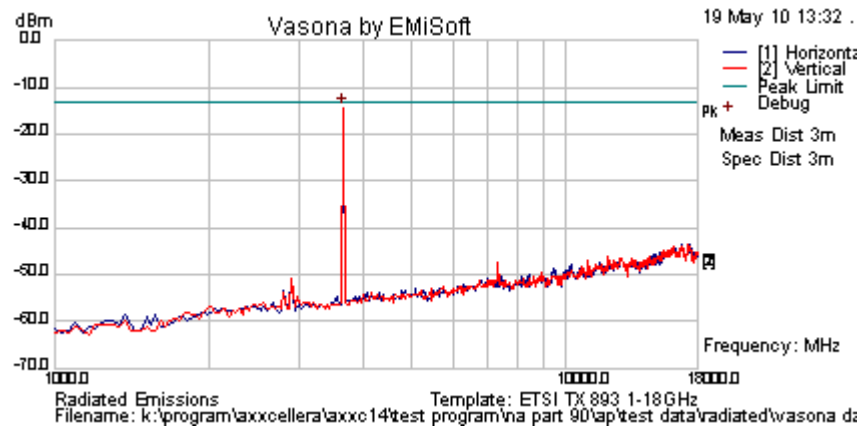


Formally measured emission peaks

Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass /Fail	Comments
3646.597	-28.6	3.7	2.4	-22.6	Peak [Scan]	H	151	0	-13.0	-9.6	Pass	FUND
Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission NRB = Non-Restricted Band. RB = Restricted Band.												

No emissions found within 6 dB of the limit. Emission close the limit is the carrier

Test Freq.	3675 MHz	Engineer	GMH
Variant	Access Point BPSK 3.5 MHz	Temp (°C)	24
Freq. Range	1-18 GHz	Rel. Hum.(%)	37
Power Setting	Maximum	Press. (mBars)	1011
Antenna	50 Ohm Load Termination	Duty Cycle (%)	100
Test Notes 1	Laptop to control EUT in control room. 1m length sma cable on antenna port terminated in 50 Ohm		
Test Notes 2			

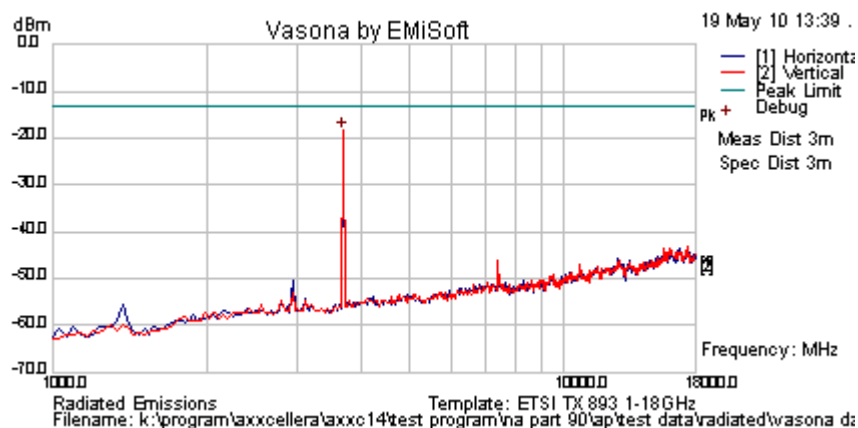


Formally measured emission peaks

Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass /Fail	Comments
3657.315	-20.4	3.7	2.3	-14.4	Peak [Scan]	V	150	0	-13.0	-1.4	Pass	FUND
Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission NRB = Non-Restricted Band. RB = Restricted Band.												

No emissions found within 6 dB of the limit. Emission close to the limit is the carrier

Test Freq.	3698.25 MHz	Engineer	GMH
Variant	Access Point BPSK 3.5 MHz	Temp (°C)	24
Freq. Range	1-18 GHz	Rel. Hum.(%)	37
Power Setting	Maximum	Press. (mBars)	1011
Antenna	50 Ohm Load Termination	Duty Cycle (%)	100
Test Notes 1	Laptop to control EUT in control room. 1m length sma cable on antenna port terminated in 50 Ohm		
Test Notes 2			



Formally measured emission peaks

Frequency MHz	Raw dBm	Cable Loss	AF dB	Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass /Fail	Comments
3691.383	-24.6	3.7	2.4	-18.5	Peak [Scan]	V	150	0	-13.0	-5.5	Pass	FUND
Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission NRB = Non-Restricted Band. RB = Restricted Band.												

No emissions found within 6 dB of the limit. Emission close to the limit is the carrier



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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, 0104, 0158, 0134, 0310, 0312, Dipole.

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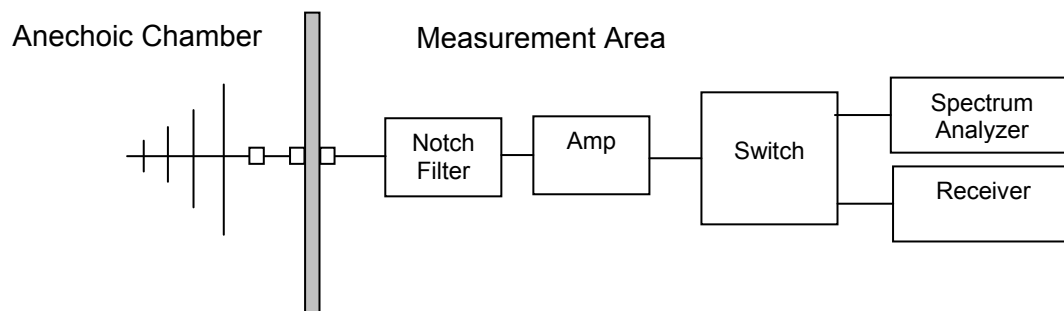
5.1.8.2. Transmitter Radiated Spurious Emissions (30M-1 GHz)

FCC, Part 15 Subpart C §15.205/ §15.209
Industry Canada RSS-111 §4.4

Test Procedure

Preliminary radiated emissions were 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



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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:

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

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

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

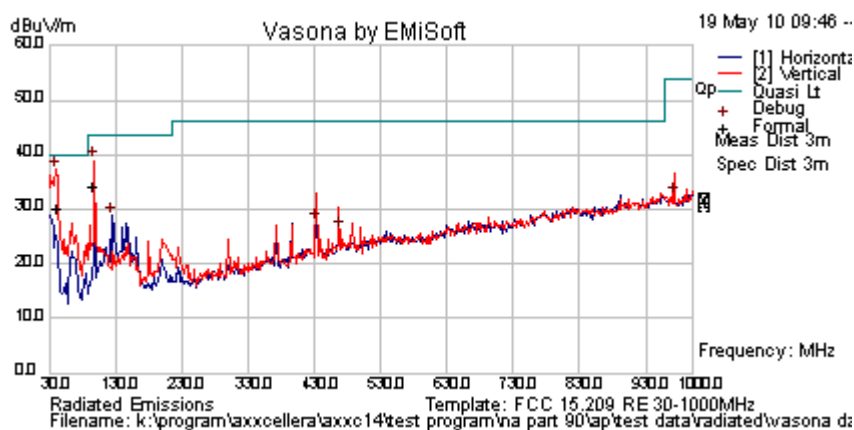
Measurement Results for Spurious Emissions (30 MHz – 1 GHz)

Ambient conditions.

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

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Test Freq.	3651.75 MHz	Engineer	GMH
Variant	Access Point BPSK 3.5 MHz	Temp (°C)	24
Freq. Range	30-1000 MHz	Rel. Hum.(%)	37
Power Setting	Maximum	Press. (mBars)	1011
Antenna	50 Ohm Load Termination	Duty Cycle (%)	100
Test Notes 1	Shielded cable from PoE to EUT. PoE adaptor on test table with EUT. Non-shielded cable to PoE.		
Test Notes 2	Laptop to control EUT in control room. 1m length sma cable on antenna port terminated in 50 Ohm		

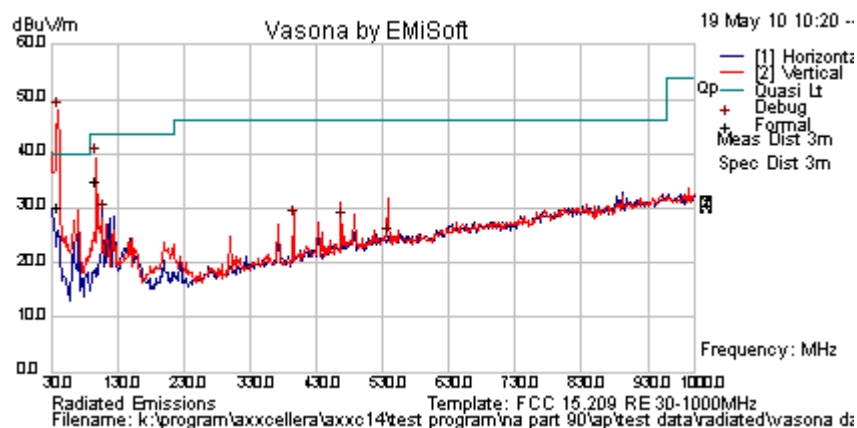


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
40.978	44.2	3.6	-17.7	30.1	Quasi Max	V	190	59	40.0	-9.9	Pass	
98.1	51.8	4.1	-21.6	34.3	Quasi Max	V	98	0	43.5	-9.2	Pass	
432.518	35.5	5.8	-13.8	27.48	Peak [Scan]	V	98	0	46	-18.5	Pass	
467.54	33.2	5.9	-13	26.14	Peak [Scan]	V	98	0	46	-19.9	Pass	
972.766	31.27	7.6	-6.47	32.41	Peak [Scan]	H	98	0	54	-21.59	Pass	
123.279	41.56	4.32	-17	28.86	Peak [Scan]	H	98	0	43.5	-14.64	Pass	

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

Test Freq.	3675 MHz	Engineer	GMH
Variant	Access Point BPSK 3.5 MHz	Temp (°C)	24
Freq. Range	30-1000 MHz	Rel. Hum.(%)	37
Power Setting	Maximum	Press. (mBars)	1011
Antenna	50 Ohm Load Termination	Duty Cycle (%)	100
Test Notes 1	Shielded cable from PoE to EUT. PoE adaptor on test table with EUT. Non-shielded cable to PoE.		
Test Notes 2	Laptop to control EUT in control room. 1m length sma cable on antenna port terminated in 50 Ohm		

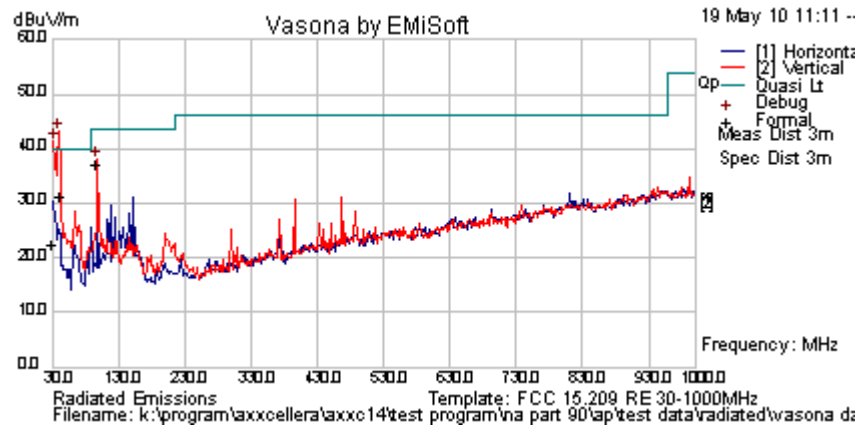


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
40.638	43.9	3.6	-17.3	30.1	Quasi Max	V	135	63	40.0	-9.9	Pass	
98.097	52.3	4.1	-21.6	34.9	Quasi Max	V	98	351	43.5	-8.7	Pass	
537.913	30.4	6.2	-11.9	24.7	Peak [Scan]	V	98	360	46	-21.3	Pass	
467.371	34.8	5.9	-13.0	27.7	Peak [Scan]	V	98	360	46	-18.3	Pass	
107.822	43.8	4.2	-18.7	29.3	Peak [Scan]	H	98	360	43.5	-14.2	Pass	
395.430	36.9	5.7	-14.7	27.8	Peak [Scan]	H	98	360	46	-18.2	Pass	

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

Test Freq.	3698.25 MHz	Engineer	GMH
Variant	Access Point BPSK 3.5 MHz	Temp (°C)	24
Freq. Range	30-1000 MHz	Rel. Hum.(%)	37
Power Setting	Maximum	Press. (mBars)	1011
Antenna	50 Ohm Load Termination	Duty Cycle (%)	100
Test Notes 1	Shielded cable from PoE to EUT. PoE adaptor on test table with EUT. Non-shielded cable to PoE.		
Test Notes 2	Laptop to control EUT in control room. 1m length sma cable on antenna port terminated in 50 Ohm		



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
41.041	45.4	3.6	-17.7	31.2	Quasi Max	V	145	0	40.0	-8.8	Pass	
30.840	29.3	3.4	-10.1	22.5	Quasi Max	V	115	0	40.0	-17.5	Pass	
98.040	54.5	4.1	-21.6	37.1	Quasi Max	V	99	16	43.5	-6.4	Pass	

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



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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) Limit Matrix

Frequency(MHz)	Field Strength ($\mu\text{V/m}$)	Field Strength ($\text{dB}\mu\text{V/m}$)	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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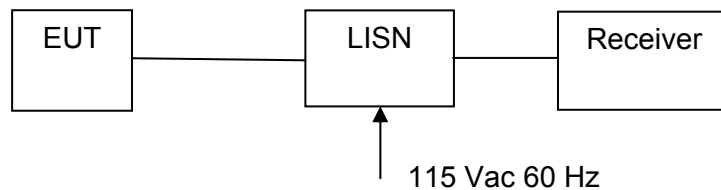
5.1.9. AC Wireline Conducted Emissions (0.15 – 30 MHz)

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



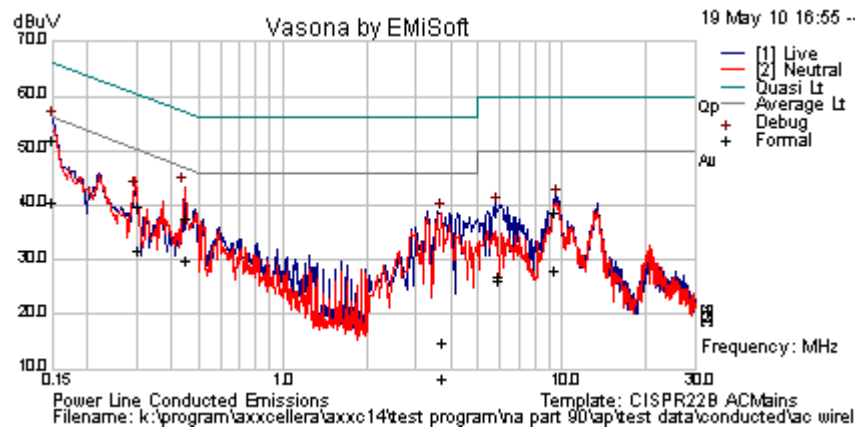
Measurement set up for AC Wireline Conducted Emissions Test

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

Test Freq.	3698.25 MHz	Engineer	GMH
Variant	AP AC Line Emissions	Temp (°C)	25
Freq. Range	0.150 MHz - 30 MHz	Rel. Hum.(%)	39
Power Setting	Maximum	Press. (mBars)	1010
Antenna	N/A		
Test Notes 1	115 Vac 60 Hz operation		
Test Notes 2			



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail	Comments
0.150	30.4	9.9	0.1	40.4	Average	Live	56	-15.6	Pass	
0.150	42.0	9.9	0.1	51.9	Quasi Peak	Live	66	-14.1	Pass	
0.303	21.7	9.9	0.1	31.7	Average	Neutral	50.15	-18.5	Pass	
0.303	29.7	9.9	0.1	39.7	Quasi Peak	Neutral	60.15	-20.5	Pass	
0.455	19.8	9.9	0.1	29.8	Average	Neutral	46.79	-17.0	Pass	
0.455	27.5	9.9	0.1	37.4	Quasi Peak	Neutral	56.79	-19.4	Pass	
3.751	4.5	10.1	0.2	14.8	Quasi Peak	Neutral	56	-41.2	Pass	
3.751	-2.0	10.1	0.2	8.2	Average	Neutral	46	-37.8	Pass	
5.986	16.5	10.2	0.3	27.0	Average	Live	50	-23.0	Pass	
5.986	15.6	10.2	0.3	26.0	Quasi Peak	Live	60	-34.0	Pass	
9.490	17.5	10.3	0.4	28.1	Average	Live	50	-21.9	Pass	
9.490	28.0	10.3	0.4	38.7	Quasi Peak	Live	60	-21.3	Pass	
Legend:										

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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.

§15.207 (a) 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

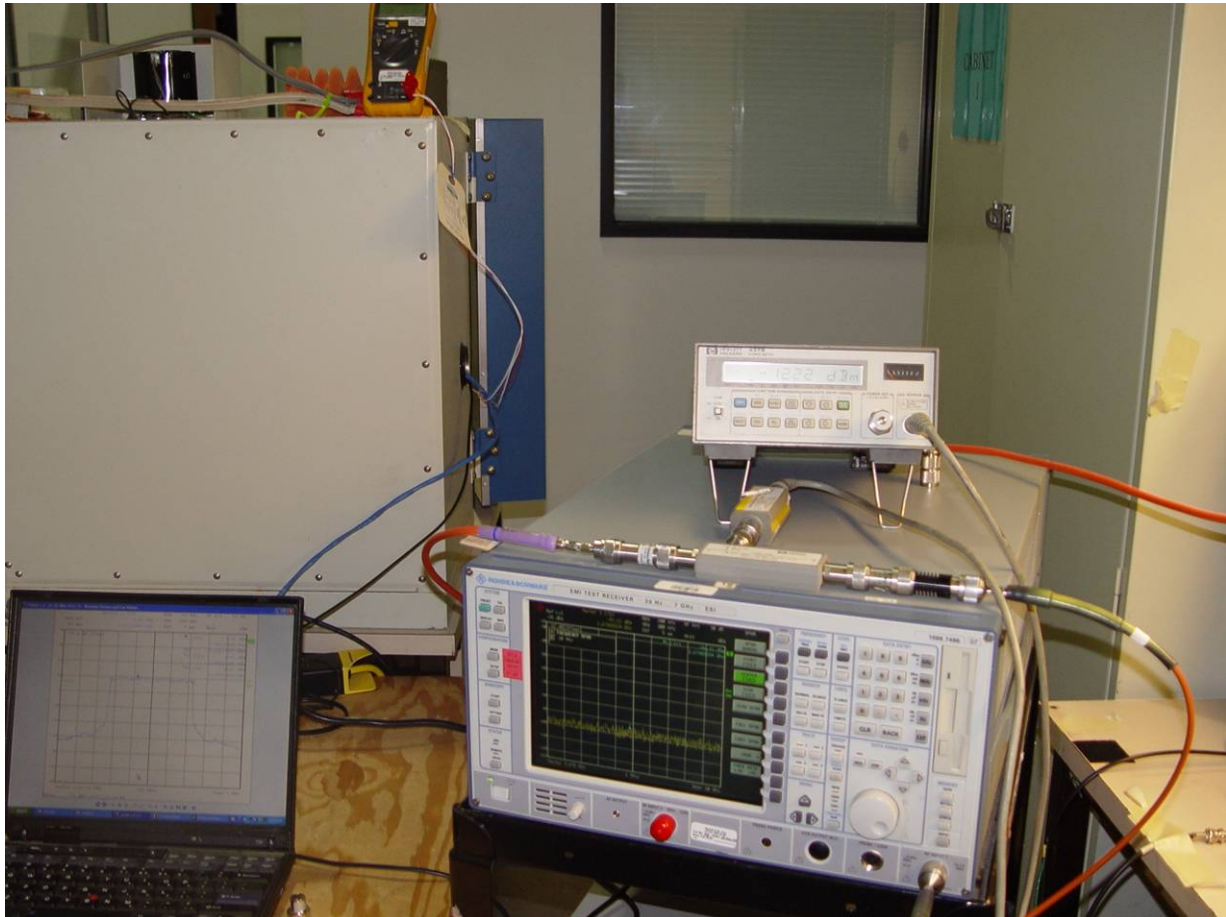
Measurement uncertainty	± 2.64 dB
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Traceability

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

6. TEST SET-UP PHOTOGRAPHS

6.1. General Measurement Test Set-Up



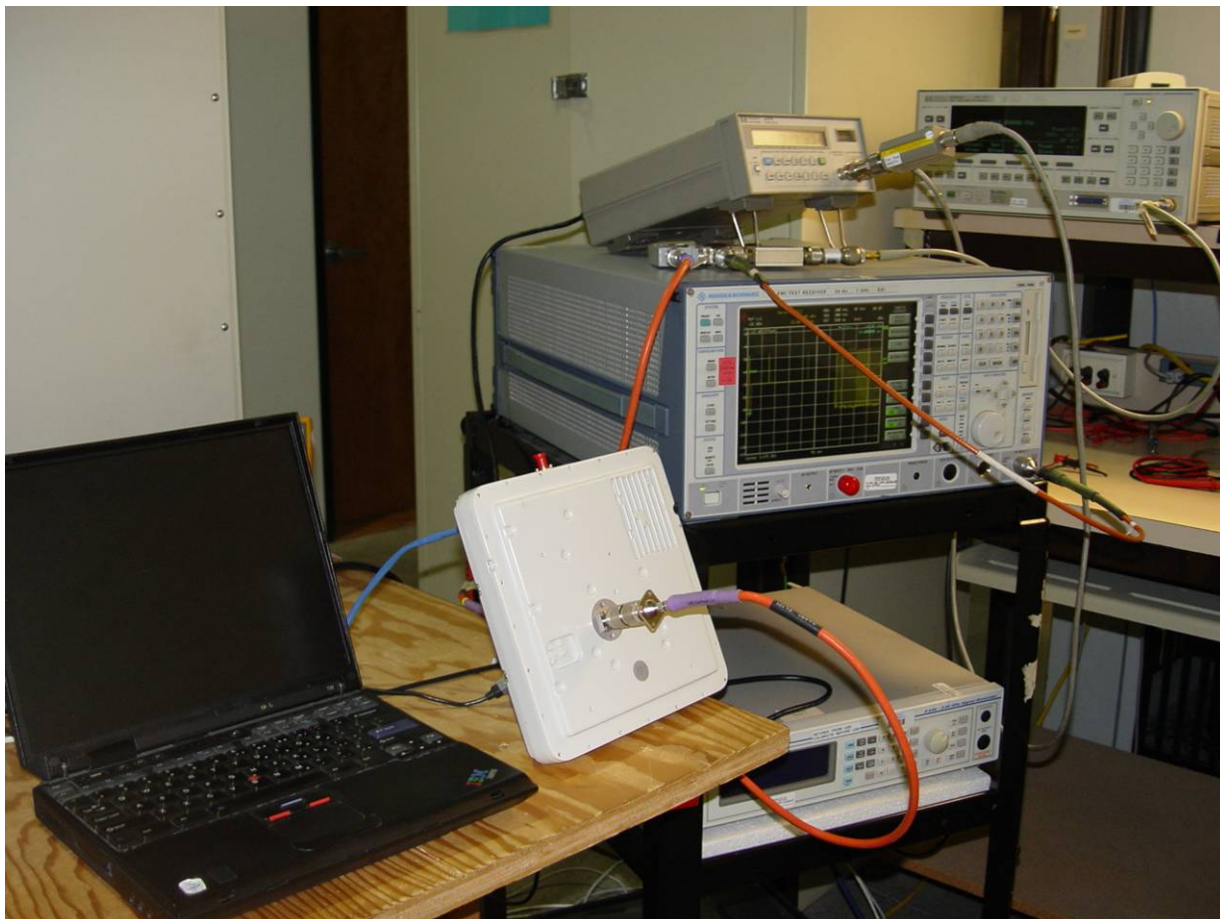
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6.2. General Measurement – Environmental Chamber



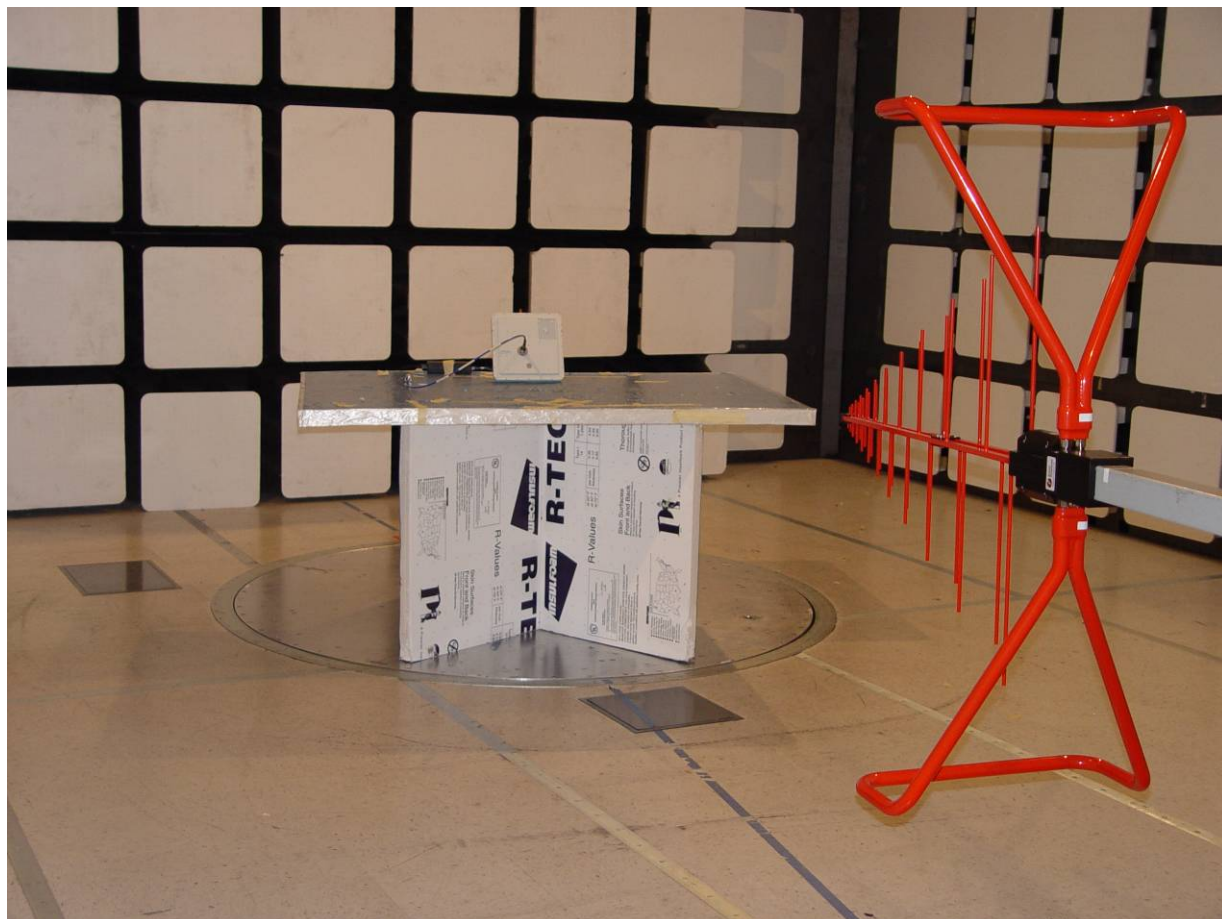
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6.3. Contention Based Protocol



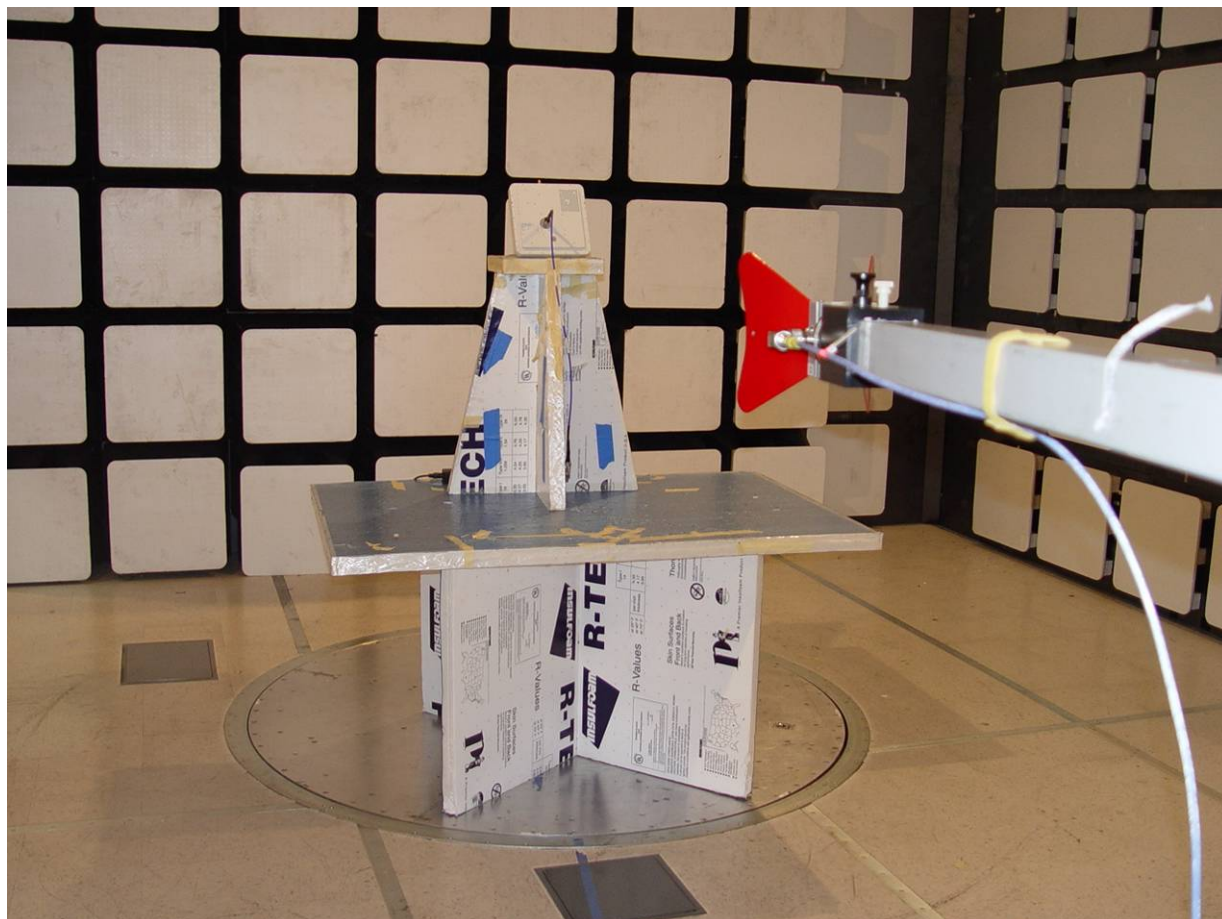
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6.4. Radiated Emissions below 1 GHz



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6.5. Radiated Emissions above 1 GHz



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6.6. AC Wireline Emissions



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To: FCC 47 CFR Part 90 SubPart Z
Serial #: AXXC14-U1 Rev A
Issue Date: 28th May 2010
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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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