

Test of Axxcelera EHD-CPE3320-C10
To: FCC Part 90 SubPart Z, RSS-197
Test Report Serial No.: AXXC15-U1 Rev A





Test of Axxcelera EHD-CPE3320-C10

To FCC Part 90 SubPart Z, RSS-197

Test Report Serial No.: AXXC15-U1 Rev A

This report supersedes NONE

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

Product Function: Wireless Voice and Data Communication

Copy No: pdf **Issue Date:** 5th October 2010

This Test Report is Issued Under the Authority of:

MiCOM Labs, Inc.
440 Boulder Court, Suite 200
Pleasanton, CA 94566 USA
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TESTING 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



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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	5 th October 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:	EHD-CPE3320-C10	Fax:	+1 925 462 0306
S/N:	Not Available		
Test Date(s):	2nd to 5th August 2010	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC Part 90 SubPart Z, RSS-197	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.

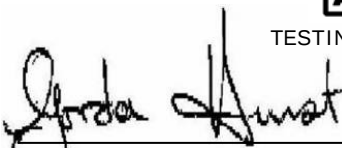
Notes:

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.



TESTING 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)	Industry Canada	February 2010	Wireless Broadband Access Equipment Operating in the Band 3650-3700 MHz
(iii)	ANSI C63.4	2009	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
(iv)	CISPR 22/ EN 55022	2008/ 2006 +A1:2007	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
(v)	M 3003	Edition 2 Jan. 2007	Expression of Uncertainty and Confidence in Measurements
(vi)	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
(vii)	ETSI TR 100 028	2001	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
(viii)	A2LA P101	9 th June 2010	Reference to A2LA Accreditation Status – A2LA Advertising Policy
(xiv)	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 EHD-CPE3320-C10 to FCC Part 90 SubPart Z, RSS-197 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:	AXXC15-U1 Rev A		
Date EUT received:	3 rd August 2010		
Dates of test (from - to):	2nd to 5th August 2010		
Standard(s) applied:	FCC Part 90 SubPart Z, RSS-197		
No of Units Tested:	1		
Type of Equipment:	Subscriber Station (CPE)		
Model:	EHD-CPE3320-C10		
Location for use:	Outdoor use only		
Installation Type:	Fixed Wireless		
Declared Frequency Range(s):	Transmit: 3650 - 3700 MHz Receiver: 3650 - 3700 MHz		
Type of Technology:	WiMAX, 802.16-2004		
Type of Modulation:	BPSK, QPSK, 16QAM, 64QAM		
Operational Bandwidths:	3.5, 5, 7 MHz		
Declared Maximum Output Power:	+24 dBm		
ITU Emission Designator:	3.5 MHz 3M1DXW	5 MHz 4M5DXW	7 MHz 6M3DXW
Transmit/Receive Operation:	OFDM Time Division Duplex (TDD)		
Software Revision:	3.8.3		
Hardware Revision:	Prototype		
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 8" X 8"		
Weight:	2 lbs		
Primary function of equipment:	Wireless Voice, Video and Data Communication		

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3.2. Scope of Test Program

The scope of the test program was to test the Axxcelera EHD-CPE3320-C10 for compliance against:-

FCC 47 CFR Part 90, Subpart Z and Industry Canada RSS-197 regulatory requirements.

The Axxcelera EHD-CPE3320-C10 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.

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".

The Axxcelera EHD-CPE3320-C10 (CPE) is a client device which operates under control of a master Access Point (ETDAP-C9). The master device incorporates an unrestricted contention based protocol and the frequency range covers the entire 50 MHz frequency band (3650 to 3700 MHz). As this is a CPE no contention based protocol results have been included in this report. Unrestricted contention based protocol results are provided in MiCOM Labs test report AXXC14-U1 dated 28th May 2010.

Axxcelera EHD-CPE3320-C10



Axxcelera EHD-CPE3320-C10



Axxcelera EHD-CPE3320-C10 Rear





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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	EHD- CPE3320-C10	Not Available
EUT	PowerDSine	DC Power Injector ac/dc Adapter 100-240Vac 50-60Hz, 0.6A DC O/P 48Vdc 1A	3001	R08486050055 652101
Support	Dell Laptop	Computer		

3.4. Antenna Details

Antenna Type	Gain (dBi)	Manufacturer	Model No.	Serial No.
Integral – Directional	16.0	Gemtek	AWM2M-50000	N/A

3.5. Cabling and I/O Ports

Number and type of I/O ports

1. 10/100 BT Ethernet with POE 48 Vdc
2. Antenna Port

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3.6. Test Configurations

Test Matrix V's Variants

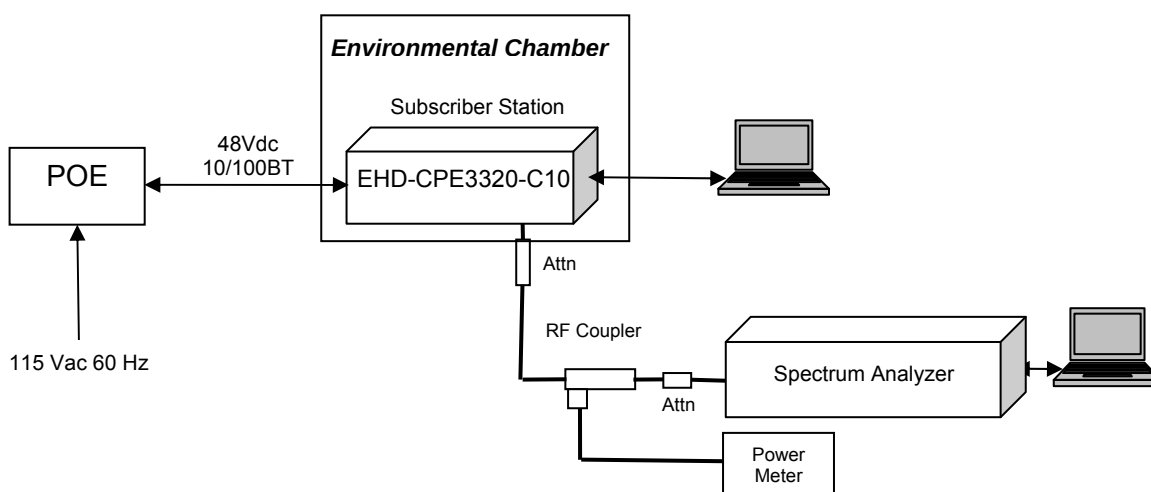
Parameter	Operational Mode	Test Conditions	Bandwidths (MHz)
99% Occupied BW	Modulated - BPSK QPSK, 16QAM, 64QAM	Ambient, 48 Vdc	3.5, 5, 7
Output power			
Spectrum Mask			
Power Spectral Density			
Frequency Stability	CW (Single Tone)	Temperature and Voltage Variations	N/A
Conducted Spurious Emissions	Modulated - BPSK	Ambient, 48 Vdc	3.5
Radiated Spurious Emissions	Modulated - BPSK	Ambient, 48 Vdc	3.5
AC Wireline Emissions	Modulated - BPSK	Ambient, 48 Vdc	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 Subscriber Station and the equipment was tested using the following test configuration.



Test Set-Up

3.7. Equipment Modifications

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

1. Internal Ethernet connection between the chassis and PCB, requires use of a ferrite bead. Gemtek cable assembly part number 220-300-0047R (Supplied by LTW).

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

4. TEST SUMMARY

List of Measurements

The following table represents the list of measurements required under the **FCC CFR47 Part 90, Subpart Z** and **Industry Canada RSS-197** and **Industry Canada RSS-Gen**.

Section(s)	Test Items	Description	Condition	Result	Test Report Section
2.1049 5.2	Occupied Bandwidth	Bandwidth measurement(s)	Conducted	Complies	5.1.1
2.1046; 90.1321 (a) 5.6	EIRP Rated Power	Modulated Output Power	Conducted	Complies	5.1.2
2.1046; 90.1321 (a) 5.6	Power Spectral Density	Maximum Spectral Density	Conducted	Complies	5.1.3
Subpart C 90.1217 5.5	Maximum Permissible Exposure	Exposure to radio frequency energy levels	Radiated	Calculation	5.1.4
2.1055(a)(1) 5.3	Frequency Stability	Includes temperature and voltage variations	Conducted	Complies	5.1.5
2.1051; 90.1323 5.7	Spectrum Mask & Spurious Emissions	Emissions from the antenna port	Conducted	Complies	5.1.6
2.1053; 90.1323 ANSI/TIA-603, 5.7	Radiated Spurious Emissions	Spurious emissions	Radiated	Complies	5.1.7
2.1053; 90.1323 ANSI/TIA-603 5.8	Receiver Spurious Emissions	Spurious emissions	Radiated	Complies	5.1.8
15.107 ICES-003	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;
Industry Canada RSS-197 Section 5.2

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

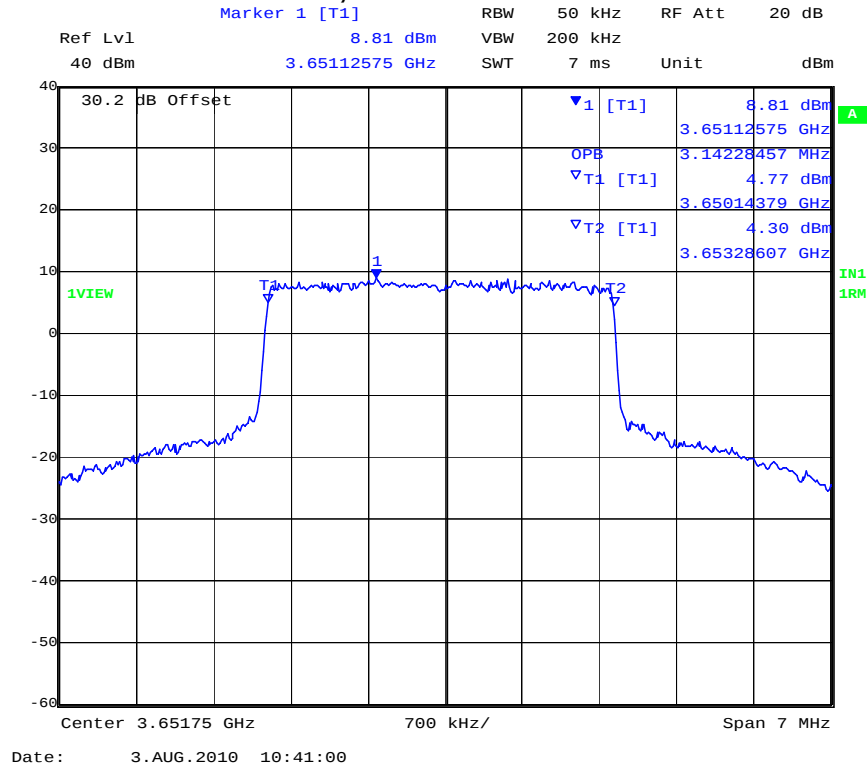
Center Frequency (MHz)	99% Bandwidth			
	BPSK	QPSK	16 QAM	64QAM
3651.75	3.142	3.142	3.142	3.142
3675.00	3.142	3.142	3.142	3.142
3698.25	3.156	3.142	3.142	3.142

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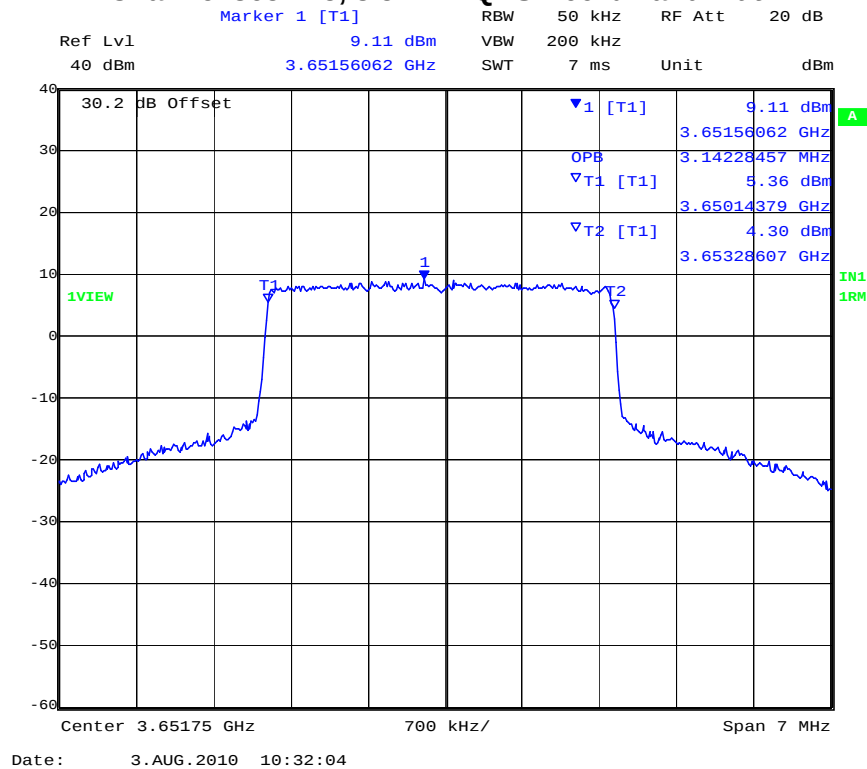


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Channel 3651.75, 3.5 MHz BPSK 99% Bandwidth



Channel 3651.75, 3.5 MHz QPSK 99% Bandwidth

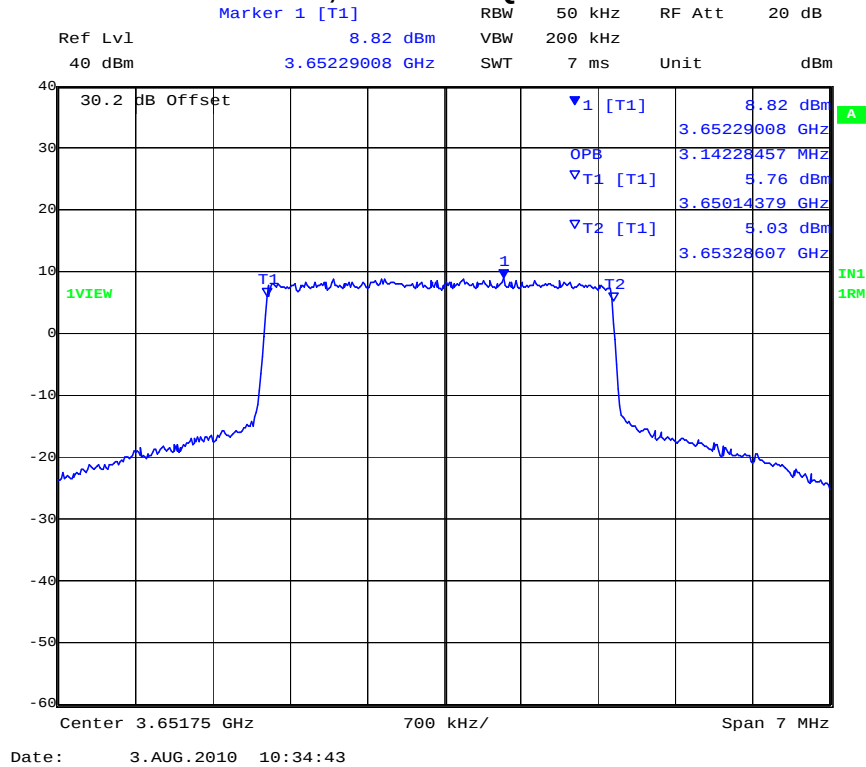


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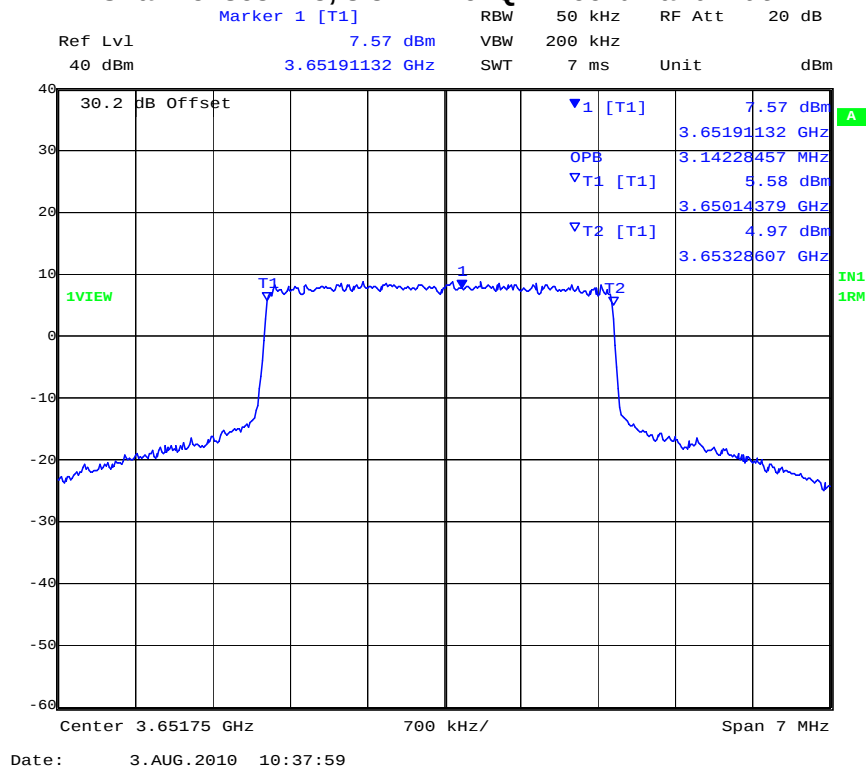


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Channel 3651.75, 3.5 MHz 16QAM 99% Bandwidth



Channel 3651.75, 3.5 MHz 64QAM 99% Bandwidth

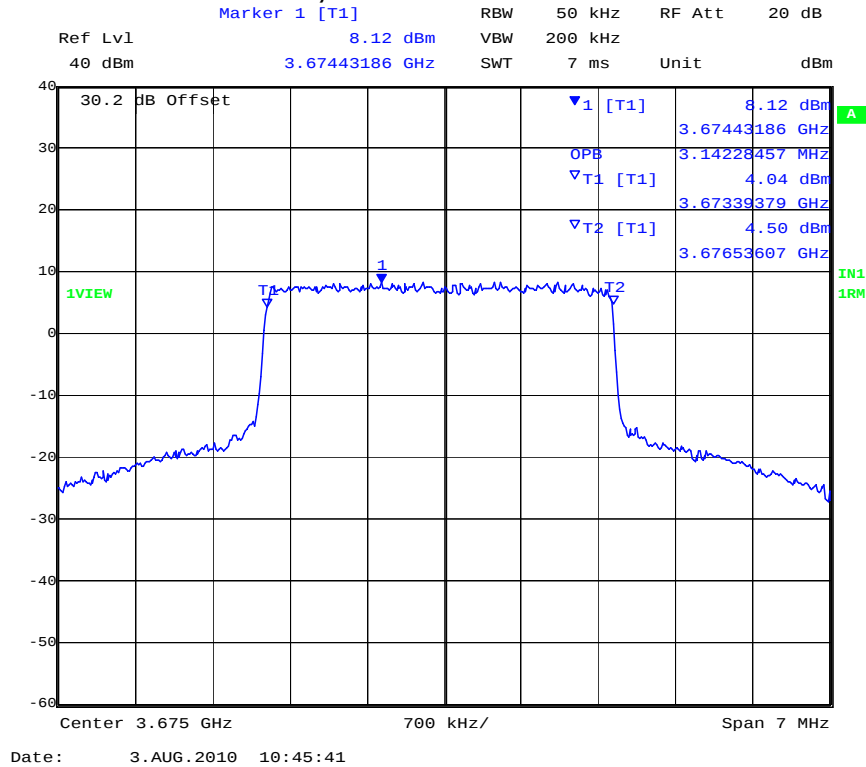


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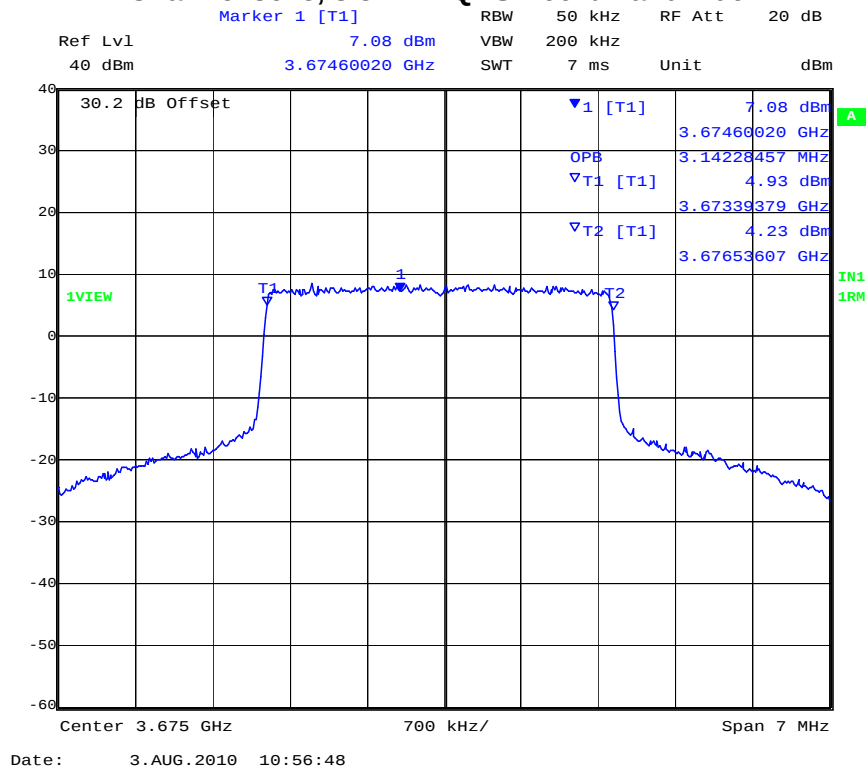


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Channel 3675, 3.5 MHz BPSK 99% Bandwidth



Channel 3675, 3.5 MHz QPSK 99% Bandwidth

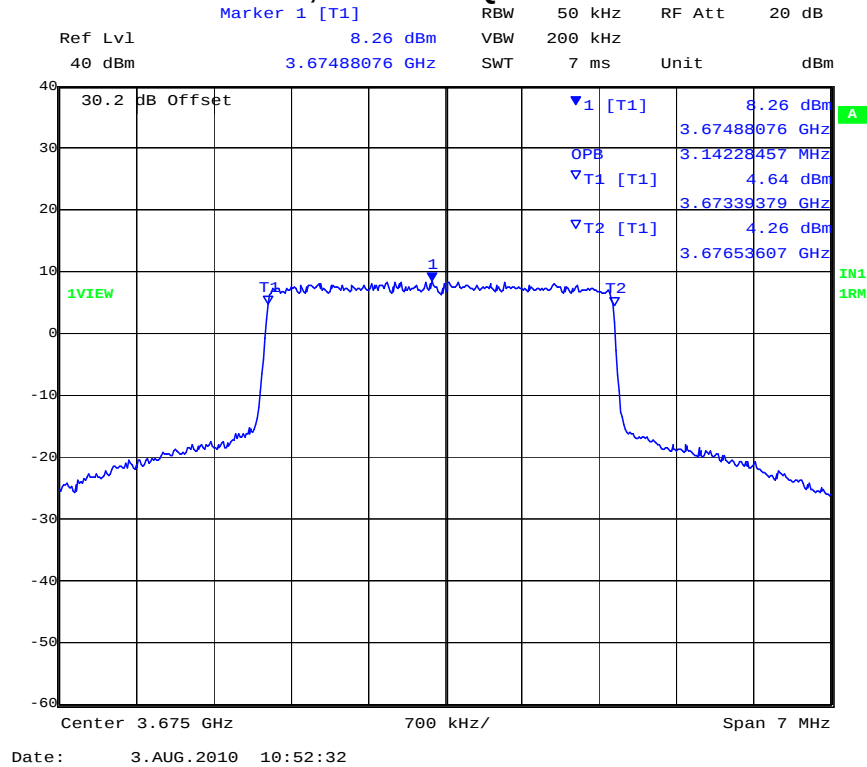


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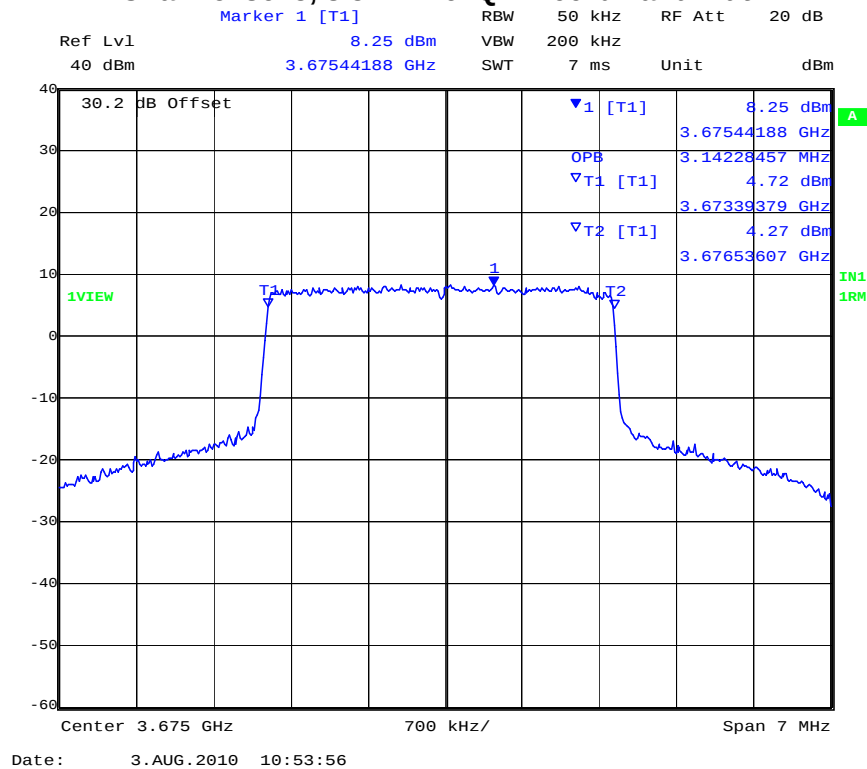


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Channel 3675, 3.5 MHz 16QAM 99% Bandwidth



Channel 3675, 3.5 MHz 64QAM 99% Bandwidth

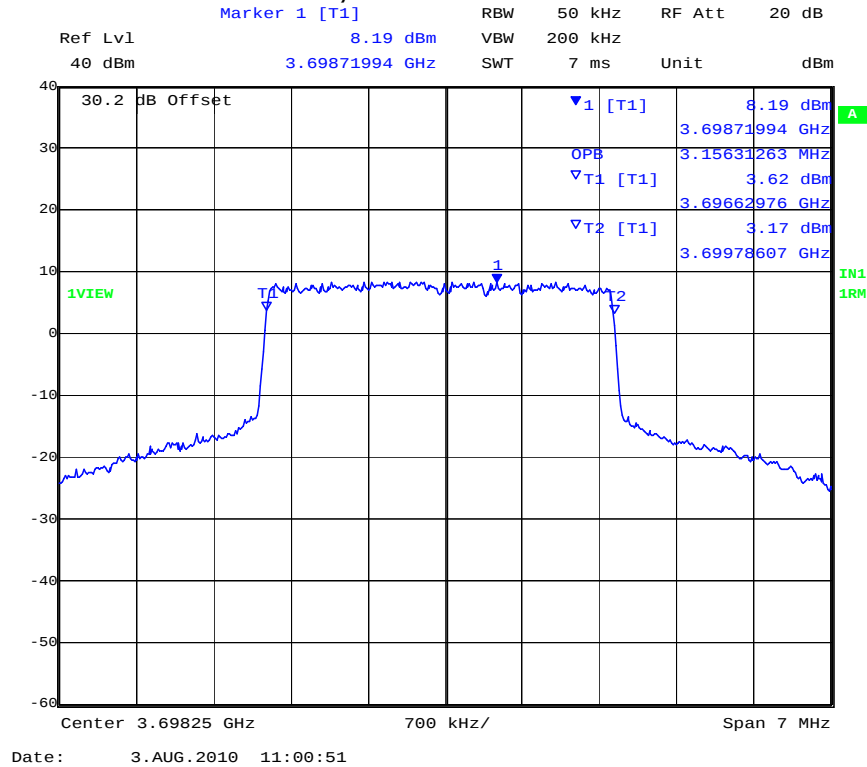


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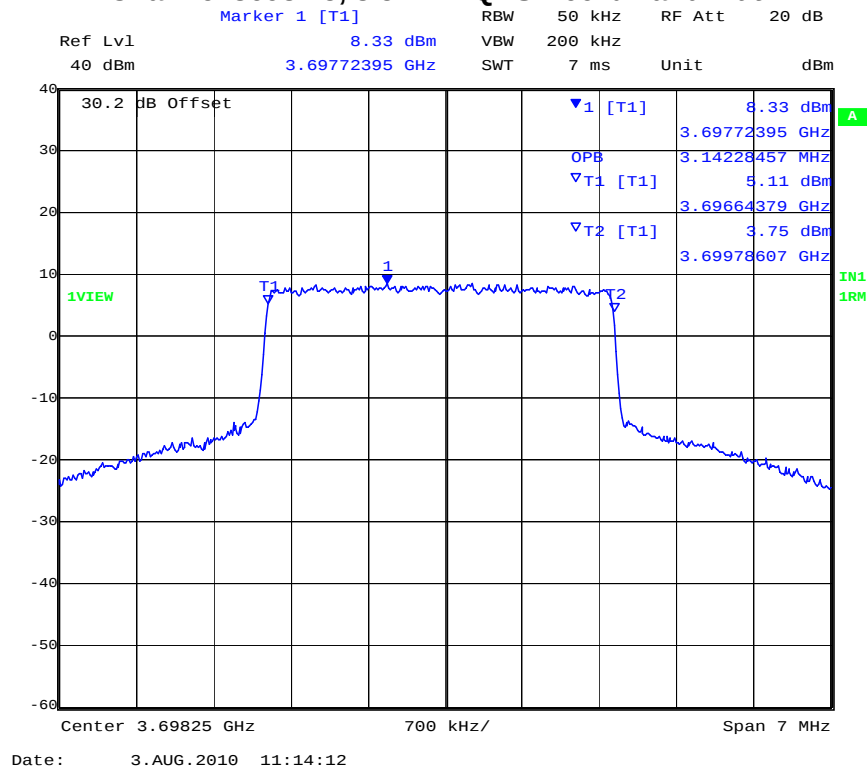


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Channel 3698.25, 3.5 MHz BPSK 99% Bandwidth



Channel 3698.25, 3.5 MHz QPSK 99% Bandwidth

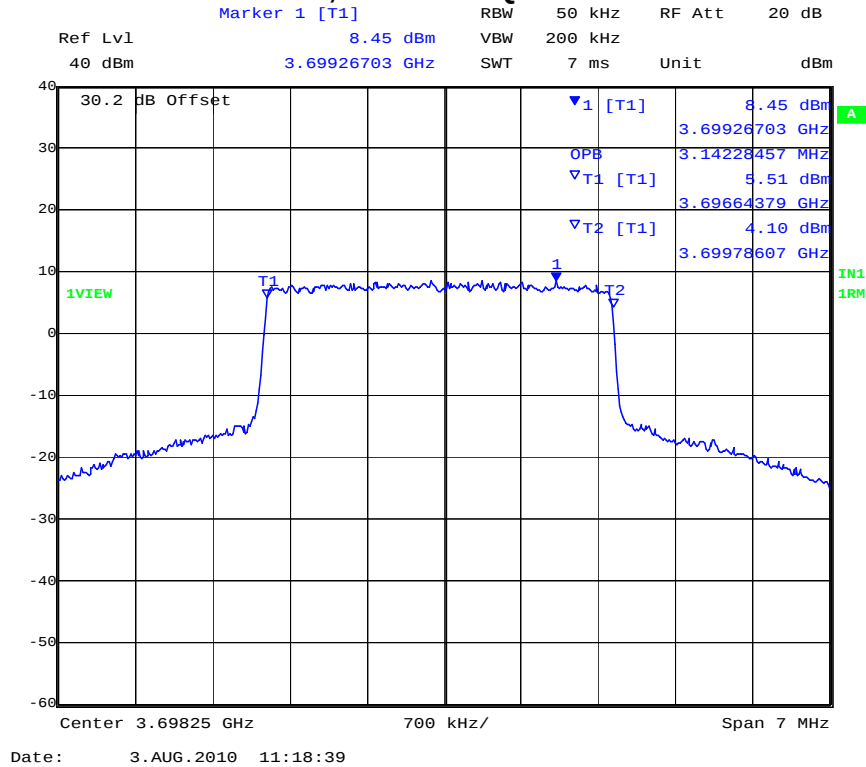


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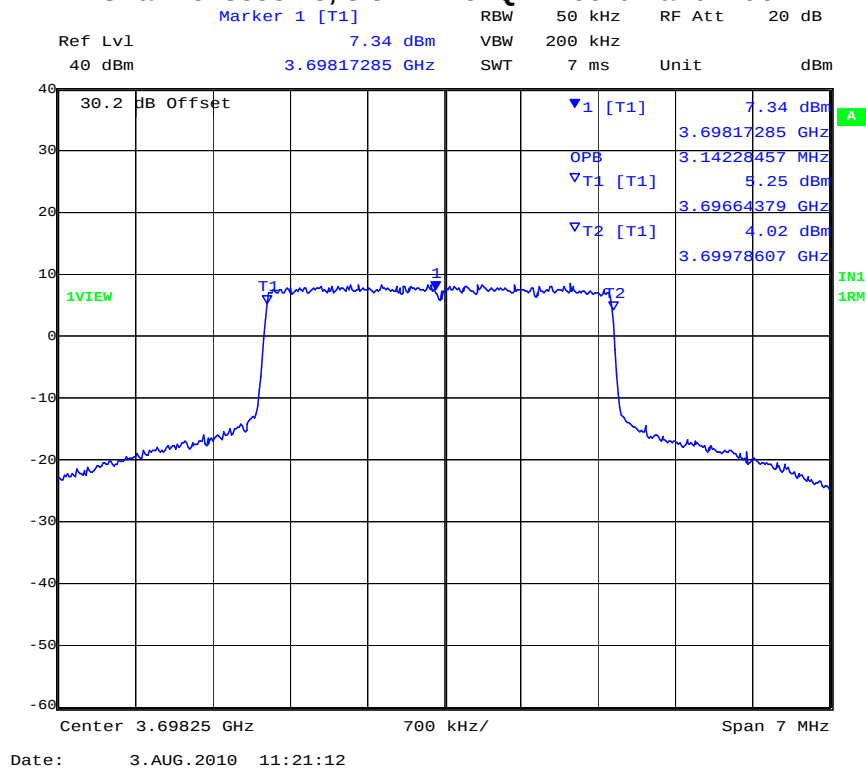


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Channel 3698.25, 3.5 MHz 16QAM 99% Bandwidth



Channel 3698.25, 3.5 MHz 64QAM 99% Bandwidth



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5 MHz Bandwidth

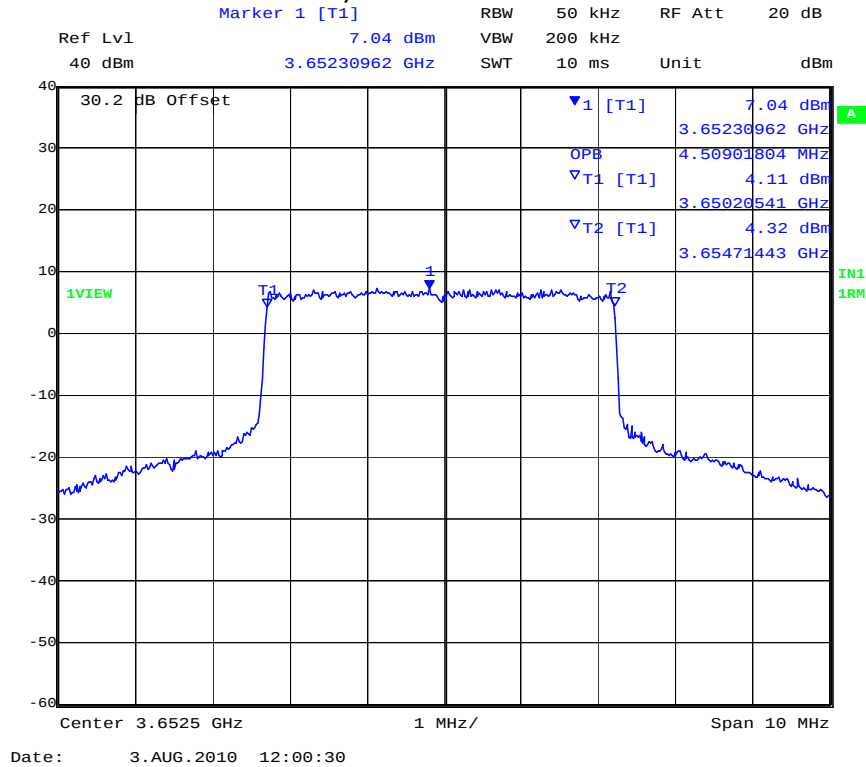
Center Frequency (MHz)	99% Bandwidth			
	BPSK	QPSK	16 QAM	64QAM
3652.50	4.509	4.509	4.509	4.509
3675.00	4.509	4.509	4.509	4.509
3697.50	4.509	4.509	4.509	4.509

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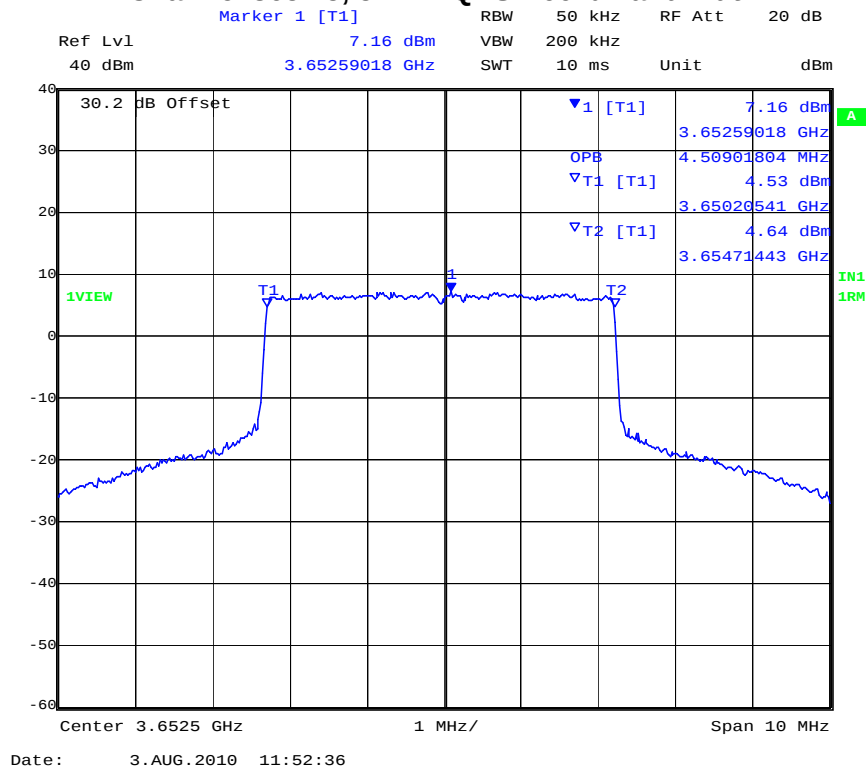


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Channel 3652.5, 5 MHz BPSK 99% Bandwidth



Channel 3652.5, 5 MHz QPSK 99% Bandwidth

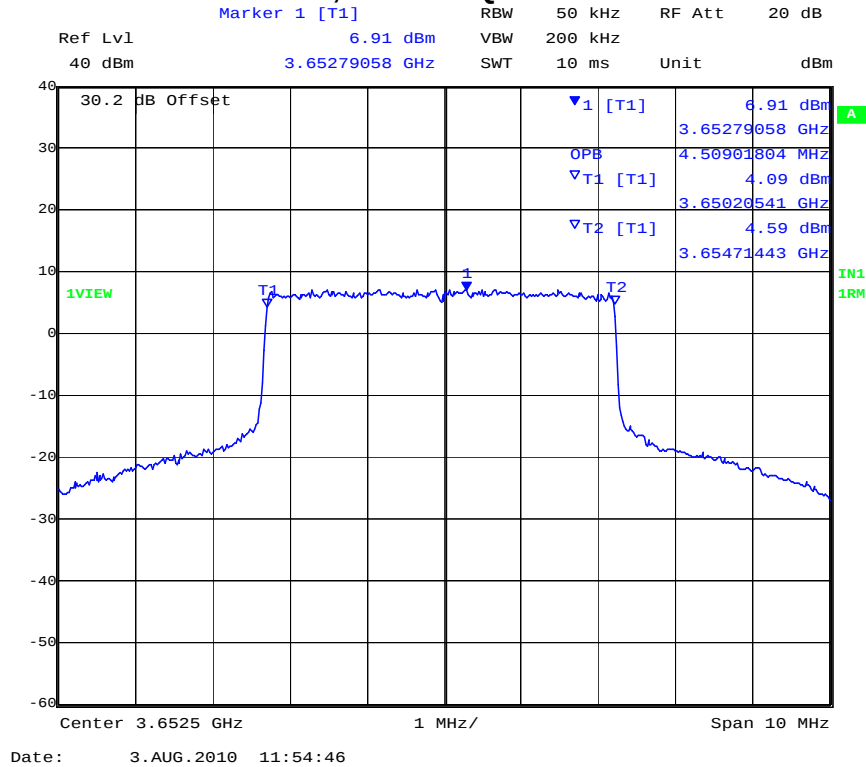


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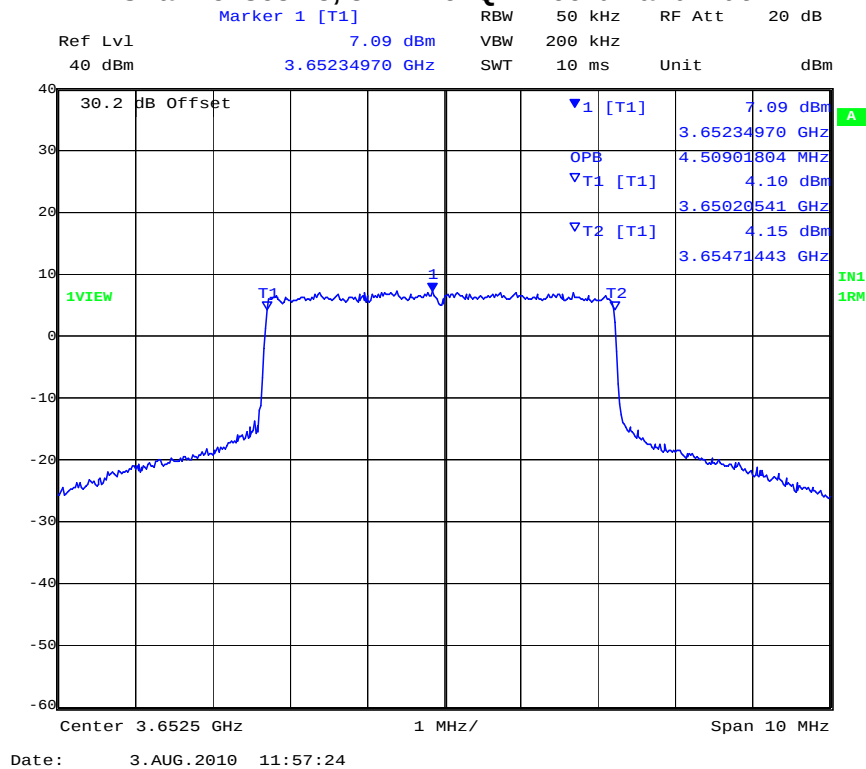


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Channel 3652.5, 5 MHz 16QAM 99% Bandwidth



Channel 3652.5, 5 MHz 64QAM 99% Bandwidth

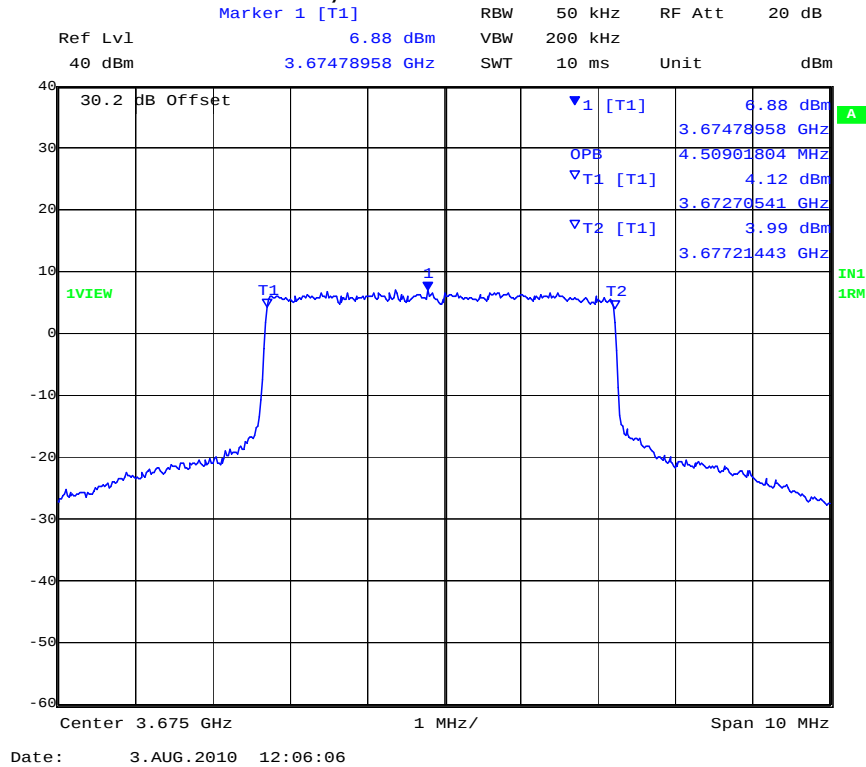


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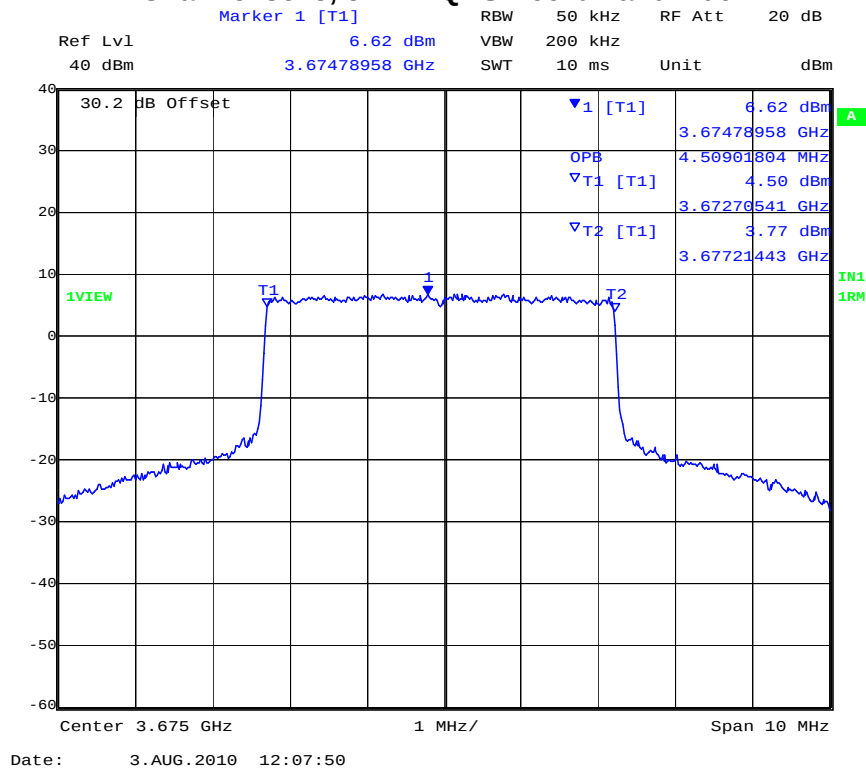


Title: Axxcelera EHD-CPE3320-C10
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Channel 3675, 5 MHz BPSK 99% Bandwidth



Channel 3675, 5 MHz QPSK 99% Bandwidth

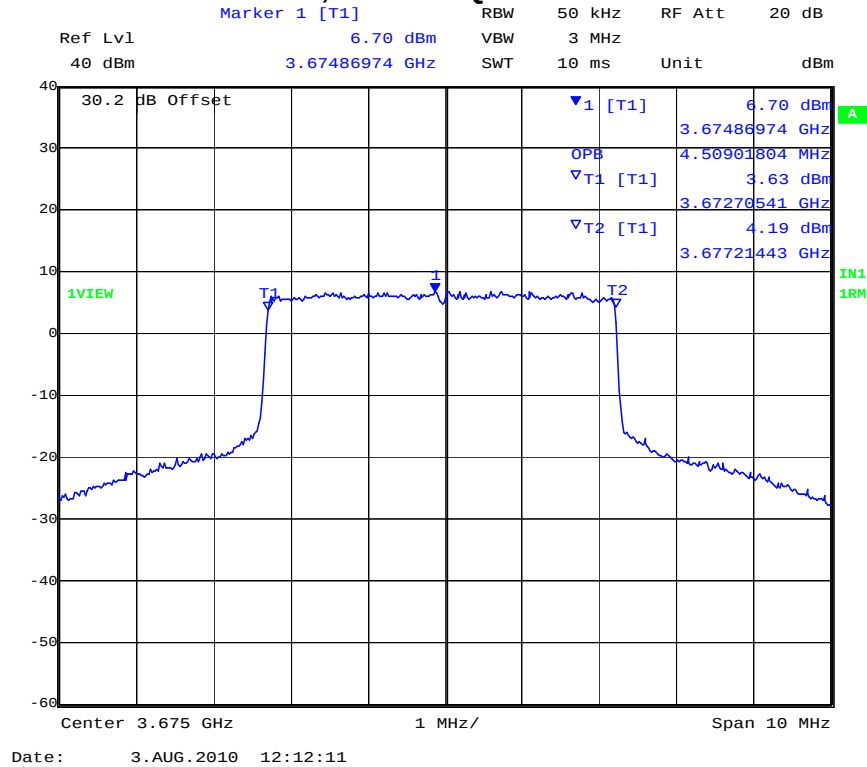


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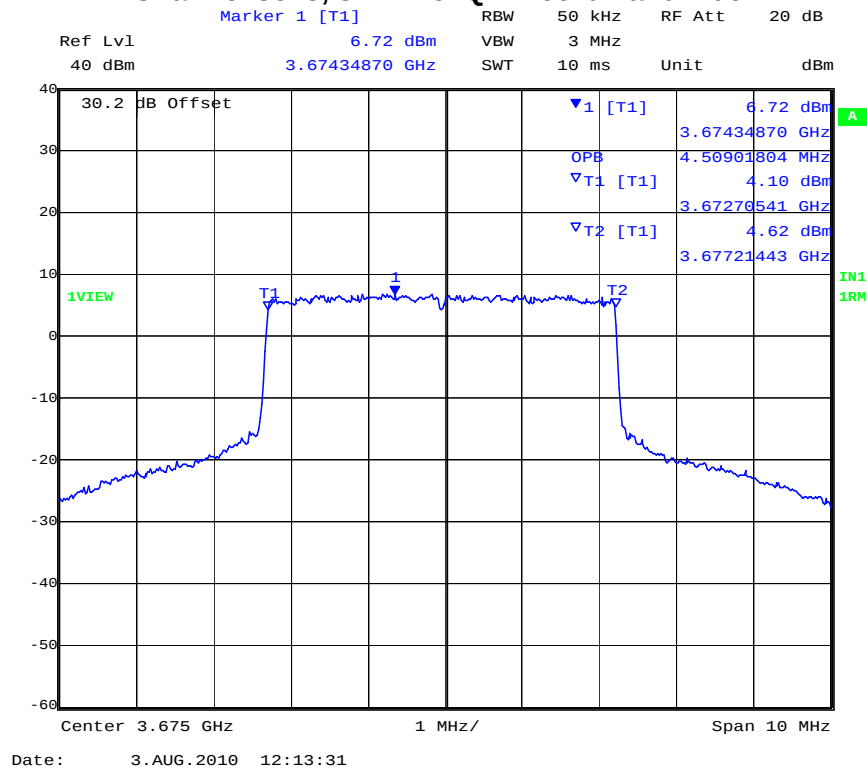


Title: Axxcelera EHD-CPE3320-C10
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Channel 3675, 5 MHz 16QAM 99% Bandwidth



Channel 3675, 5 MHz 64QAM 99% Bandwidth

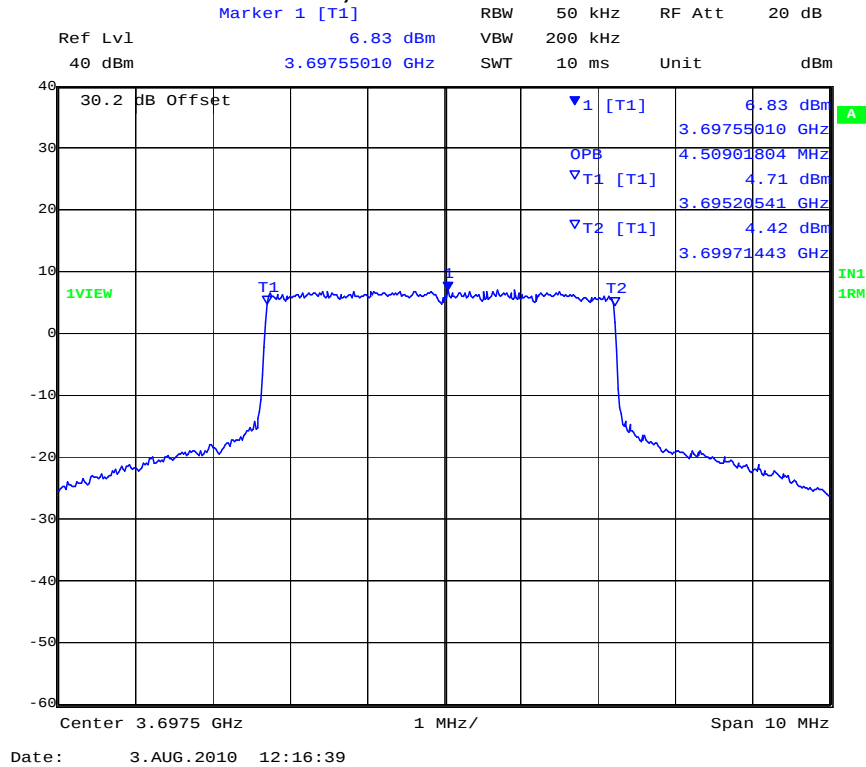


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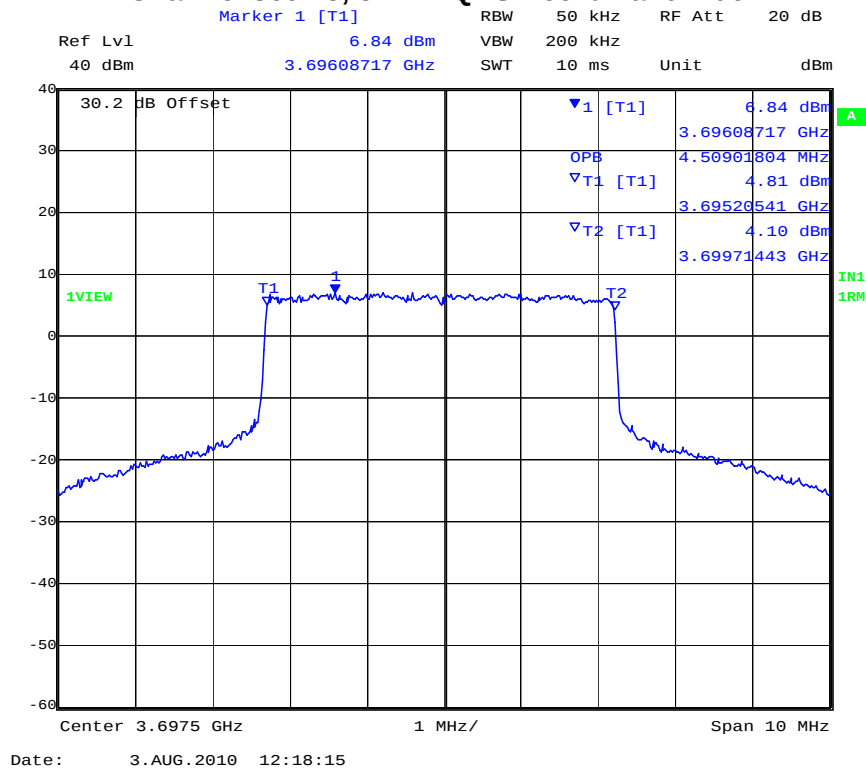


Title: Axxcelera EHD-CPE3320-C10
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Channel 3697.5, 5 MHz BPSK 99% Bandwidth



Channel 3697.5, 5 MHz QPSK 99% Bandwidth

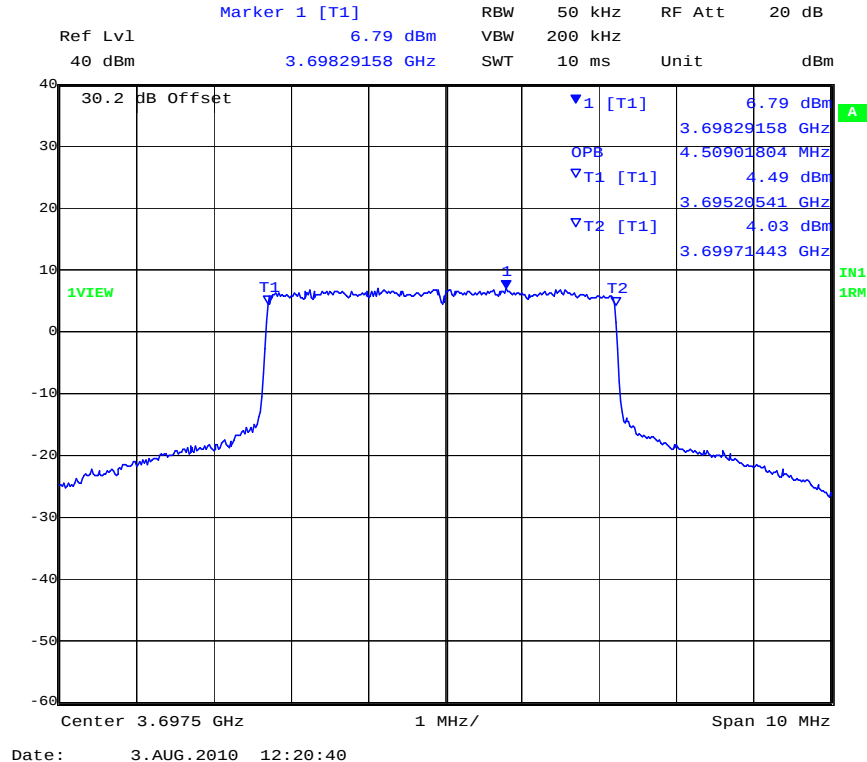


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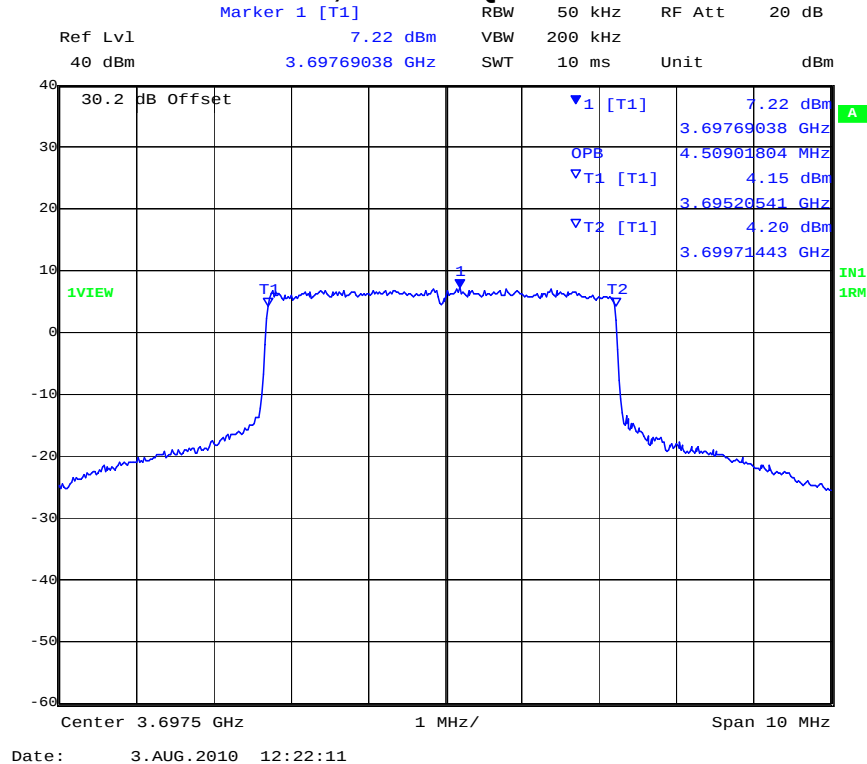


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Channel 3697.5, 5 MHz 16QAM 99% Bandwidth



Channel 3697.5, 5 MHz 64QAM 99% Bandwidth



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7 MHz Bandwidth

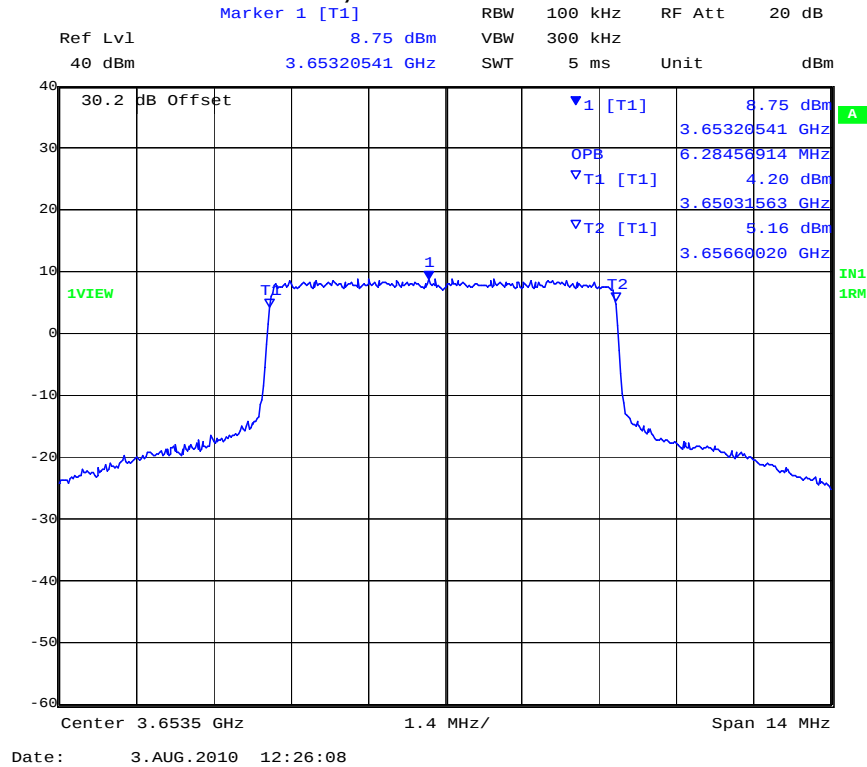
Center Frequency (MHz)	99% Bandwidth			
	BPSK	QPSK	16 QAM	64QAM
3653.50	6.285	6.285	6.257	6.285
3675.00	6.285	6.257	6.257	6.285
3696.50	6.285	6.285	6.285	6.313

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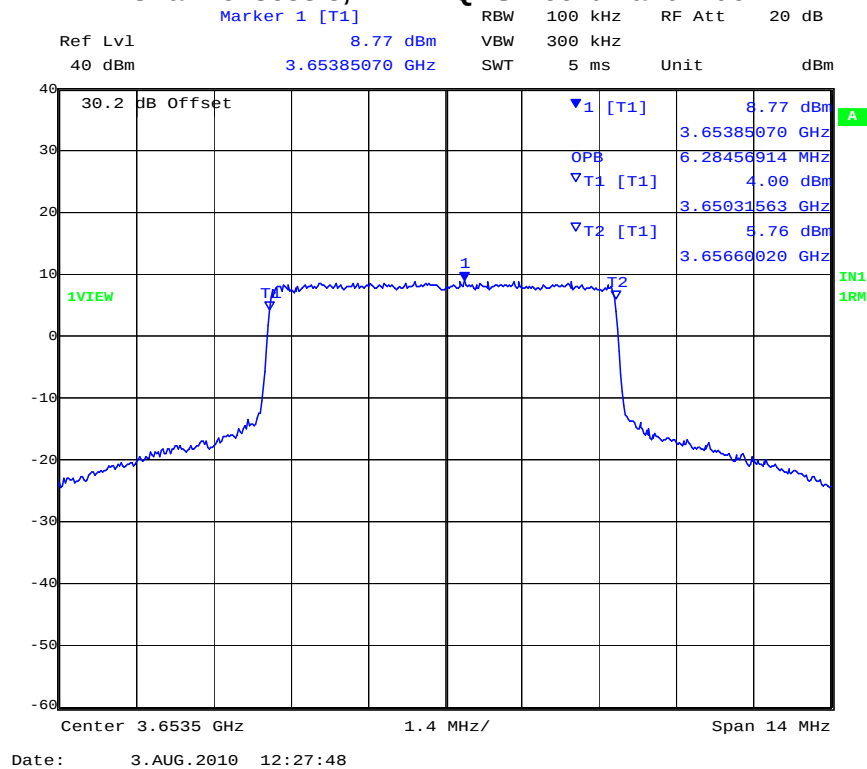


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Channel 3653.5, 7 MHz BPSK 99% Bandwidth



Channel 3653.5, 7 MHz QPSK 99% Bandwidth

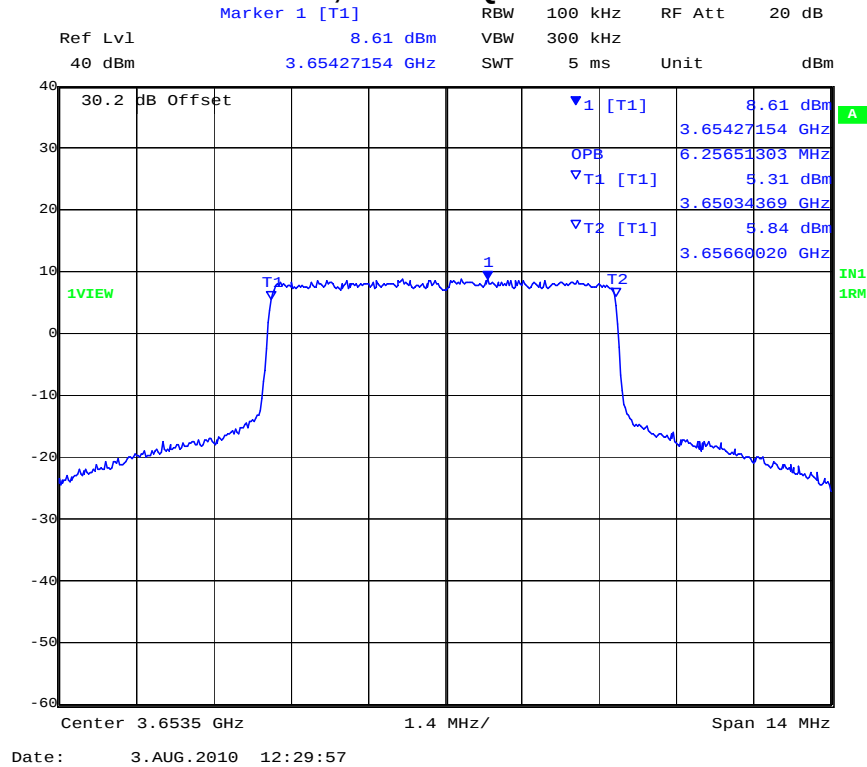


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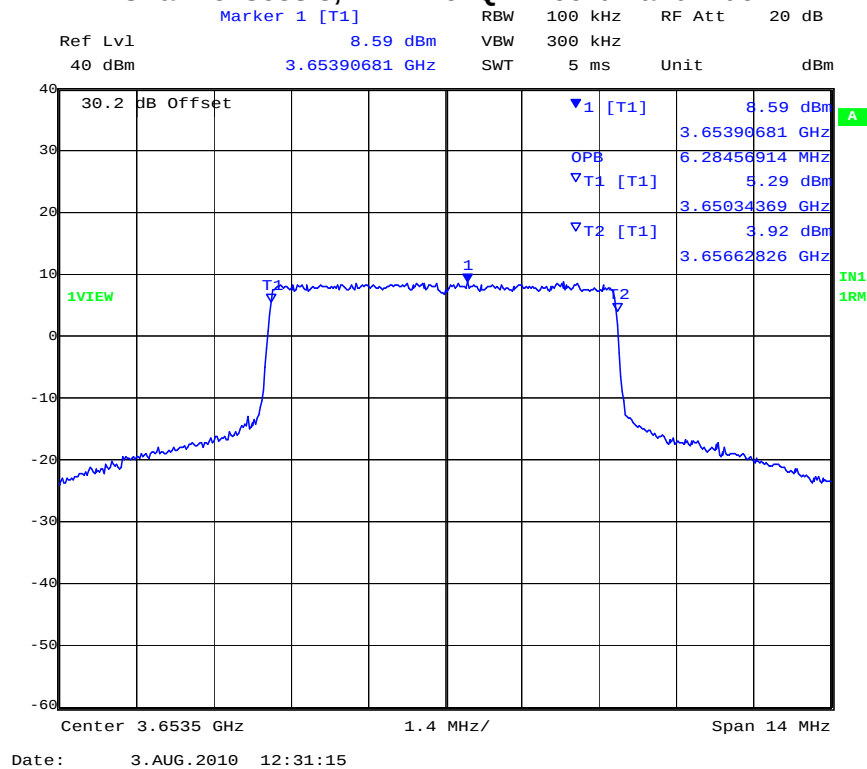


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Channel 3653.5, 7 MHz 16QAM 99% Bandwidth



Channel 3653.5, 7 MHz 64QAM 99% Bandwidth

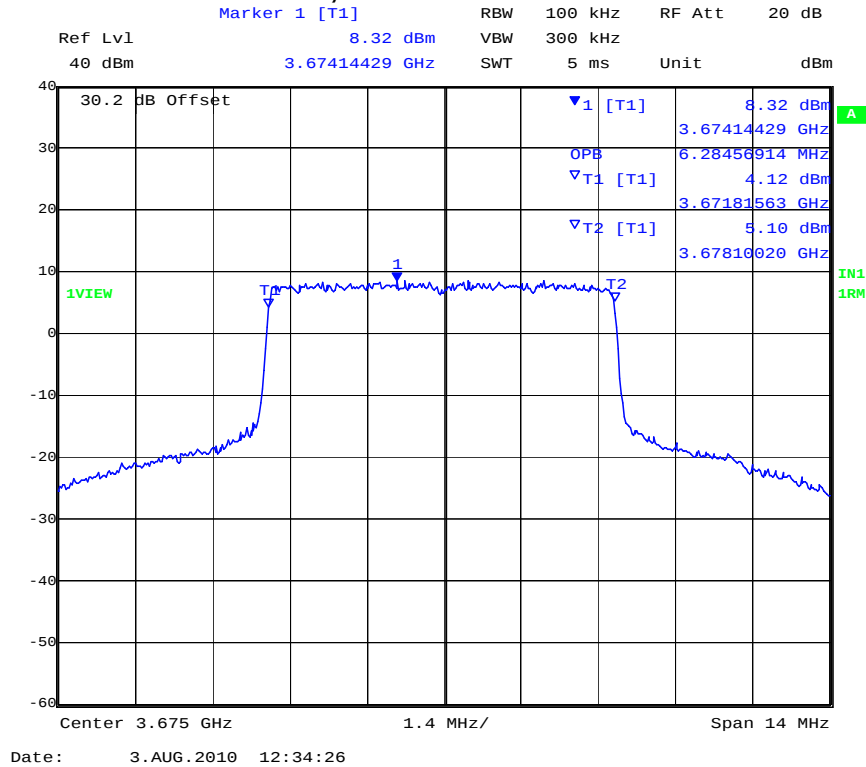


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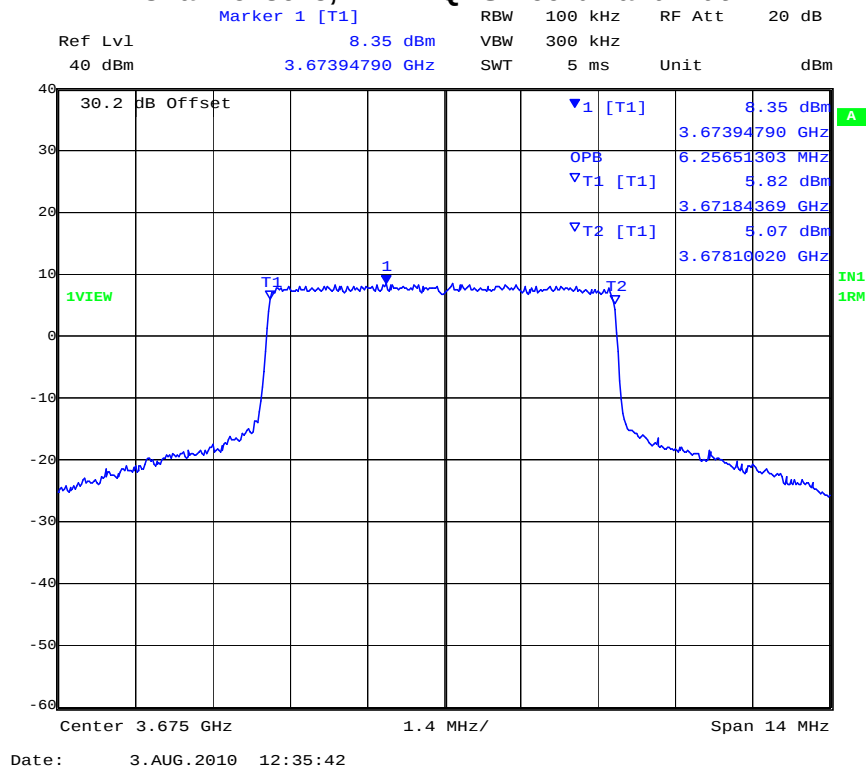


Title: Axxcelera EHD-CPE3320-C10
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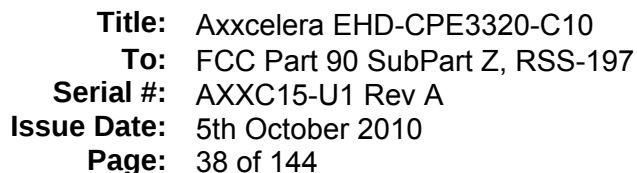
Channel 3675, 7 MHz BPSK 99% Bandwidth



Channel 3675, 7 MHz QPSK 99% Bandwidth



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Channel 1, RBW 100 kHz, RF Att 20 dB

Ref Lvl 40 dBm

Marker 1 [T1] 8.23 dBm

VBW 300 kHz

SWT 5 ms

Unit dBm

30.2 dB Offset

▼ 1 [T1] 8.23 dBm

3.67613627 GHz

OPB 6.25651303 MHz

▼ T1 [T1] 5.42 dBm

▼ T2 [T1] 5.25 dBm

3.67810020 GHz

1VIEW

IN1 1RM

Center 3.675 GHz

1.4 MHz/

Span 14 MHz

Date: 3.AUG.2010 12:37:54

Ref Lvl 40 dBm

Marker 1 [T1] 8.34 dBm 3.67453707 GHz

RBW 100 kHz RF Att 20 dB

VBW 300 kHz

SWT 5 ms Unit dBm

30.2 dB Offset

▼1 [T1] 8.34 dBm 3.67453707 GHz

OPB 6.28456914 MHz

▽T1 [T1] 4.14 dBm 3.67181563 GHz

▽T2 [T1] 5.46 dBm 3.67810020 GHz

1VIEW

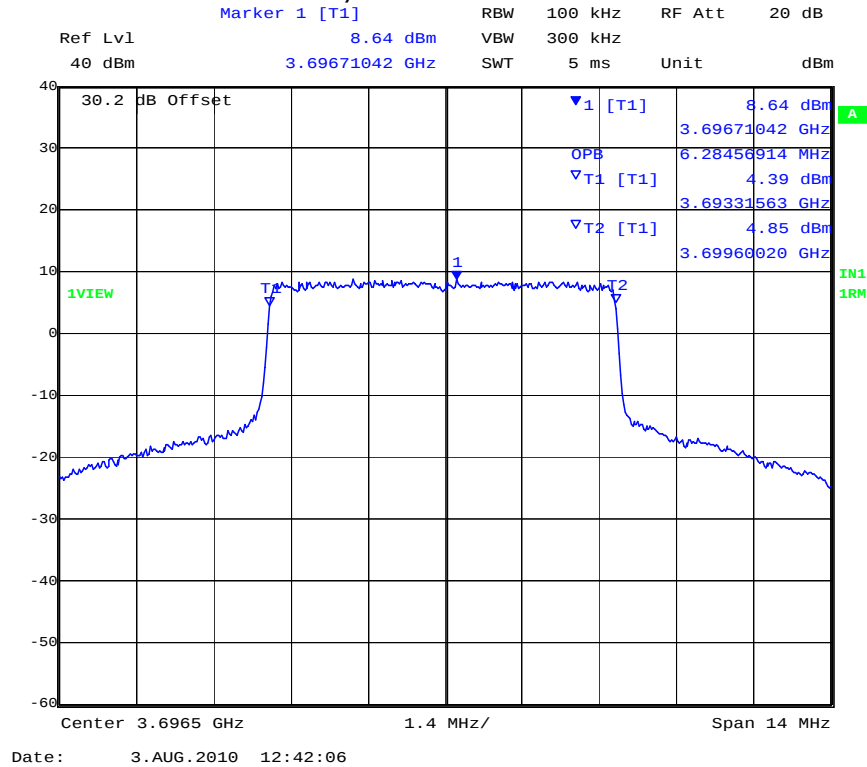
Center 3.675 GHz 1.4 MHz/ Span 14 MHz

Date: 3.AUG.2010 12:39:42

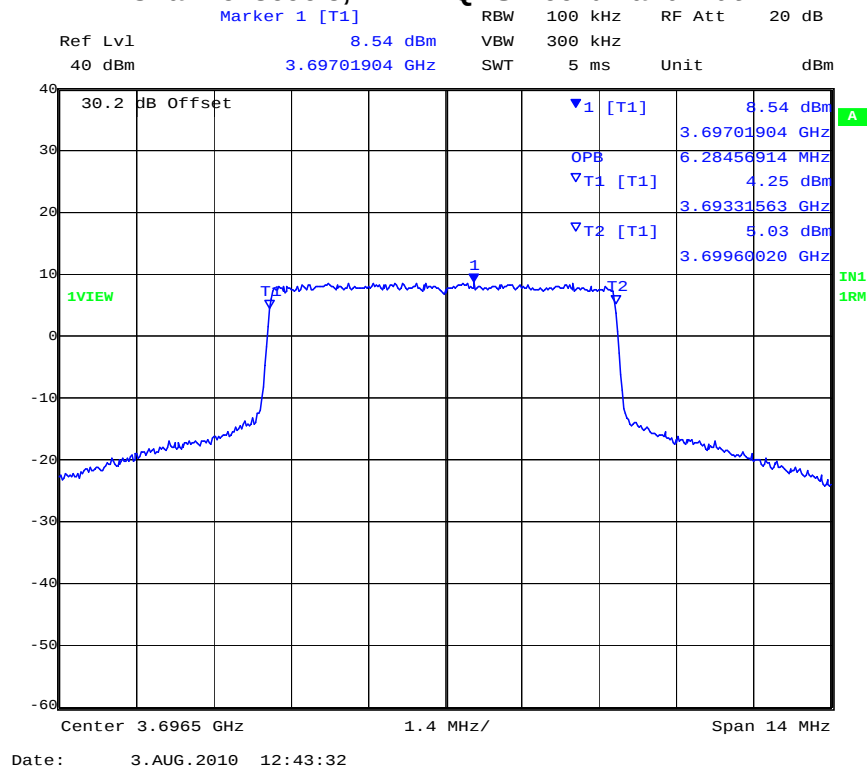


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Channel 3696.5, 7 MHz BPSK 99% Bandwidth



Channel 3696.5, 7 MHz QPSK 99% Bandwidth

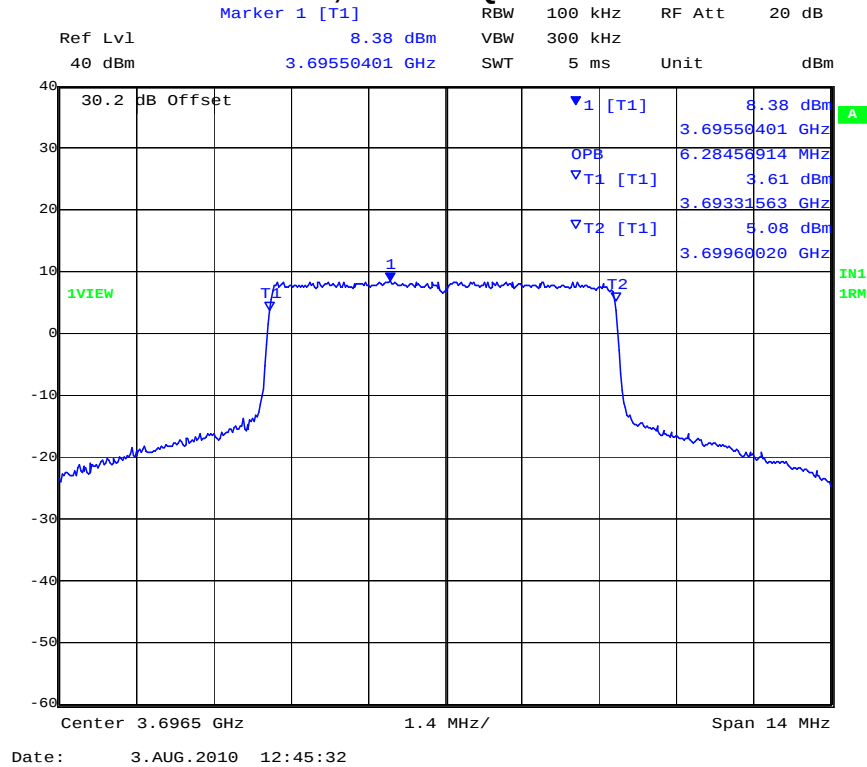


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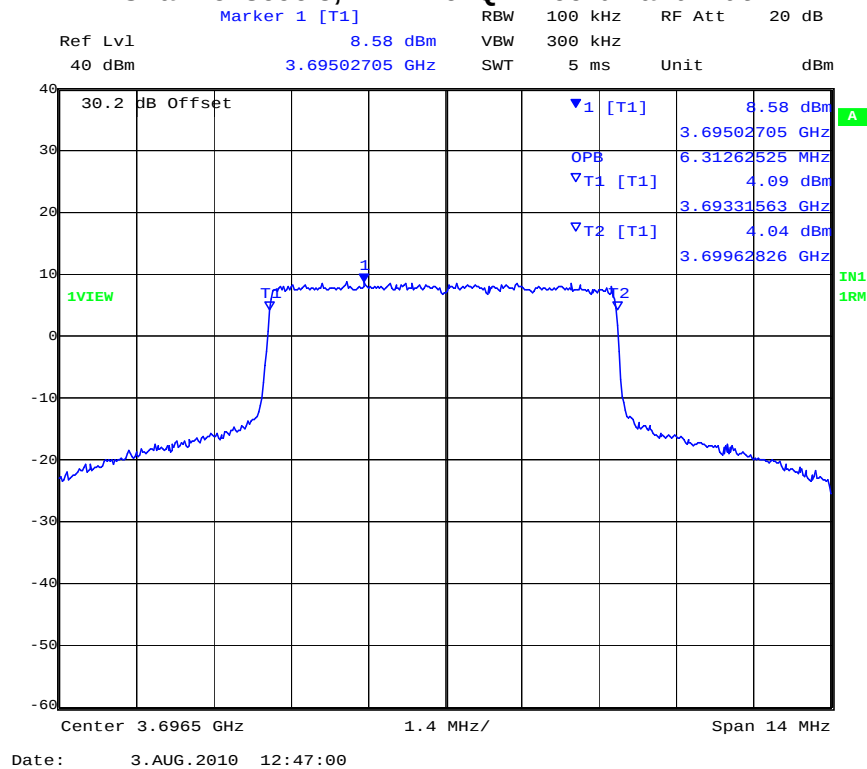


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Channel 3696.5, 7 MHz 16QAM 99% Bandwidth



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)

Industry Canada RSS-197 Section 5.6

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.

Power Limit 3.5 MHz Channel Spacing = +35.4 dBm

Power Limit 5 MHz Channel Spacing = +37.0 dBm

Power Limit 7 MHz Channel Spacing = +38.4 dBm

Test Procedure

The test methodology employed for measuring Peak 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)
Directional	3.5	16.0	+35.4	+20.4
	5		+37.0	+22.0
	7		+38.4	+23.4
	3.5	11.0	+35.4	+25.4
	5		+37.0	+27.0
	7		+38.4	+28.4

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

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3.5 MHz Bandwidth

Conducted Power Limit for 11 dBi antenna: +25.4 dBm

Center Frequency (MHz)	Peak Output Power				Minimum Margin (dB)
	BPSK (+dBm)	QPSK (+dBm)	16 QAM (+dBm)	64QAM (+dBm)	
3651.75	+25.02	+25.21	+25.15	+25.10	-0.19
3675.00	+24.62	+24.75	+24.68	+24.70	-0.65
3698.25	+24.79	+24.85	+24.78	+24.82	-0.55

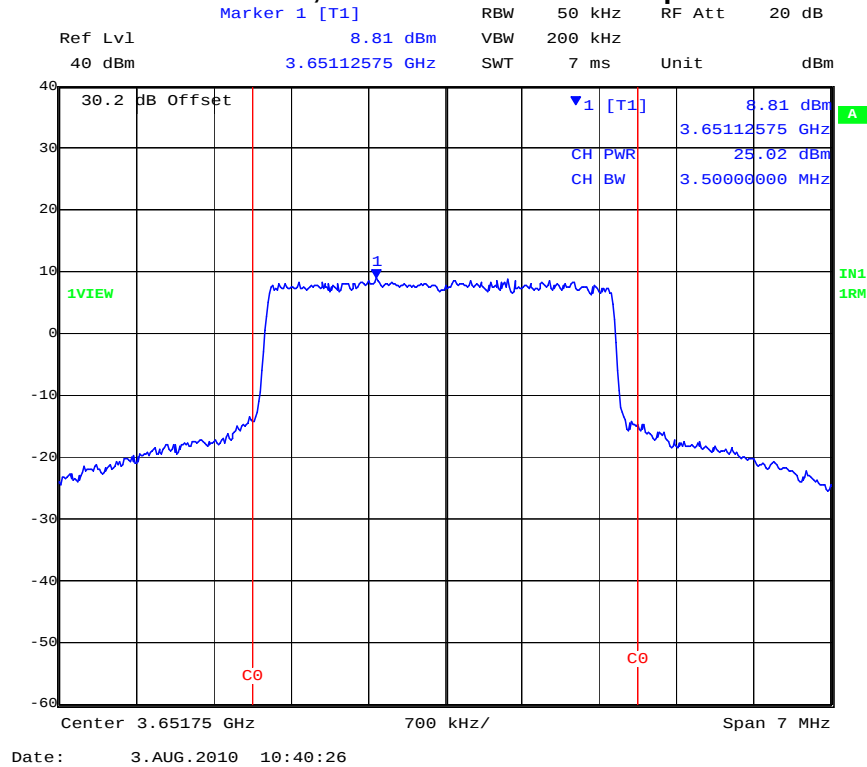
Note: Output power must be attenuated 5 dB for use with 16 dBi antenna (limit +20.4 dBm)

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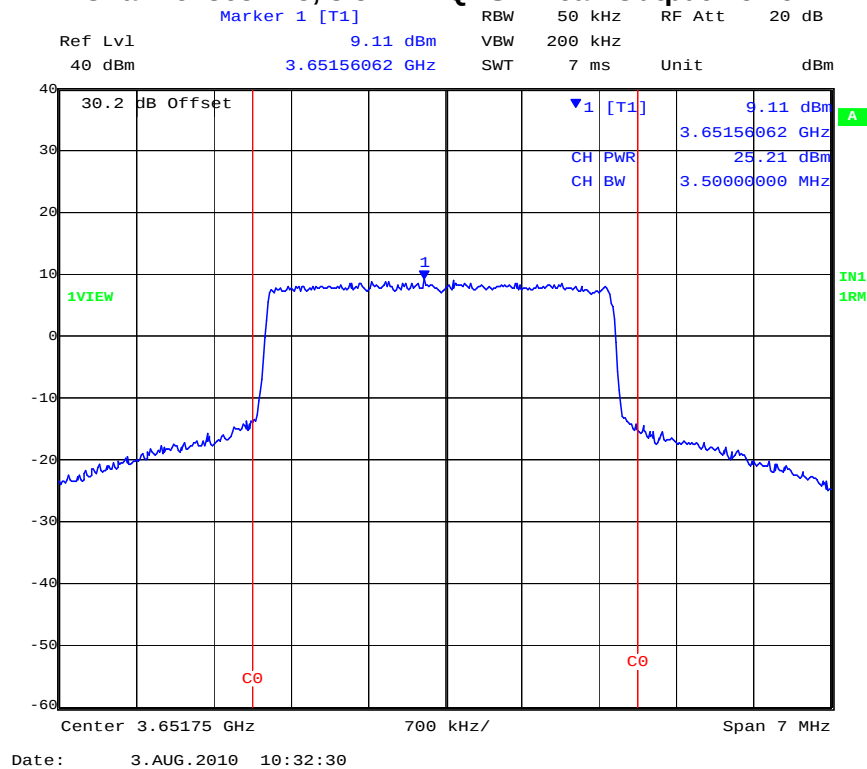


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Channel 3651.75, 3.5 MHz BPSK Peak Output Power



Channel 3651.75, 3.5 MHz QPSK Peak Output Power

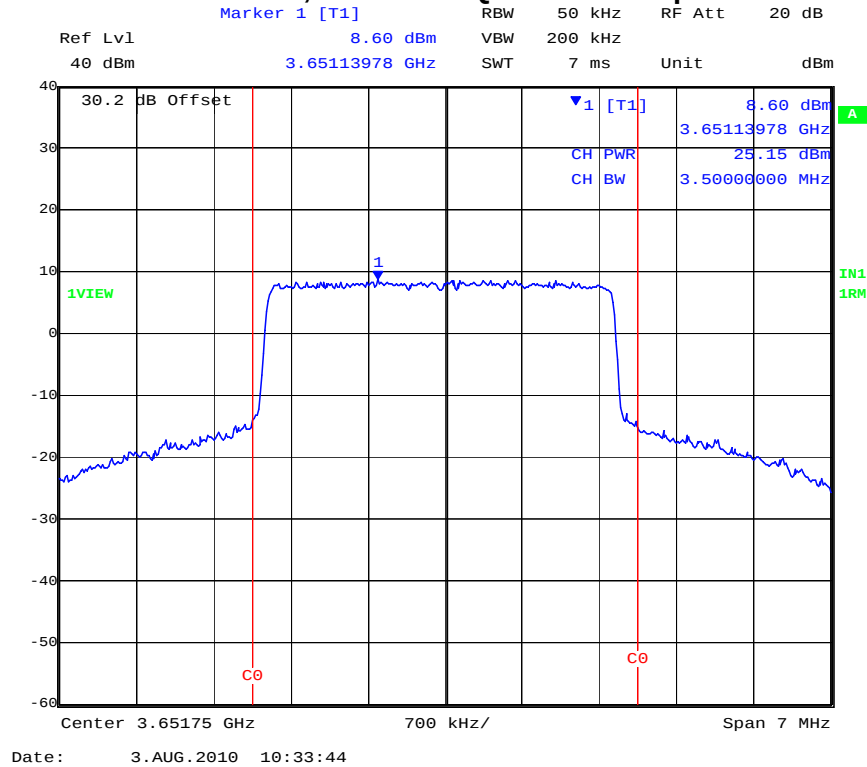


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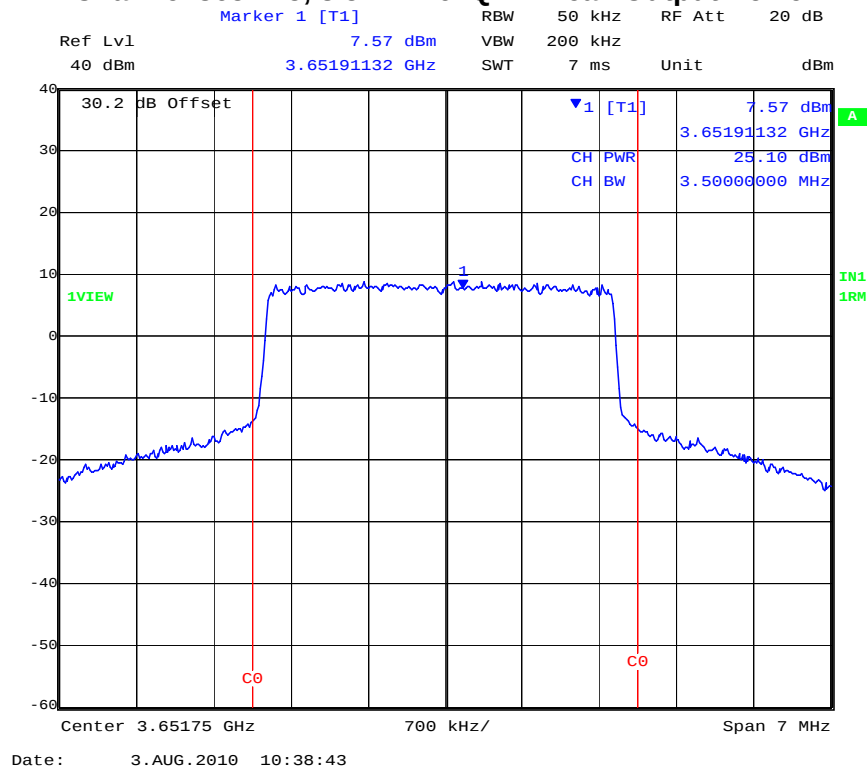


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Channel 3651.75, 3.5 MHz 16QAM Peak Output Power



Channel 3651.75, 3.5 MHz 64QAM Peak Output Power

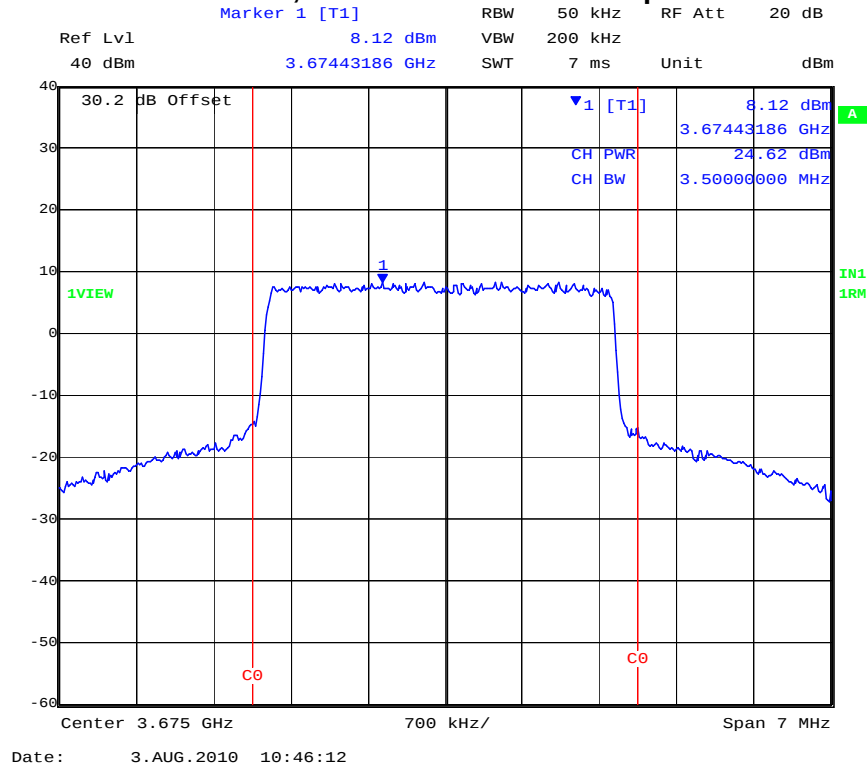


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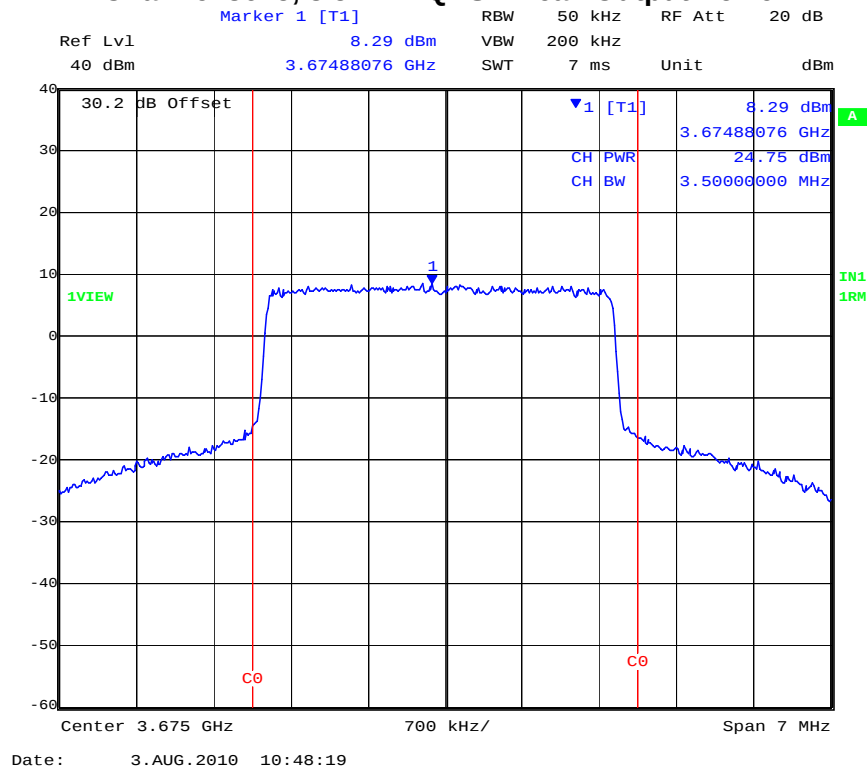


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Channel 3675, 3.5 MHz BPSK Peak Output Power



Channel 3675, 3.5 MHz QPSK Peak Output Power

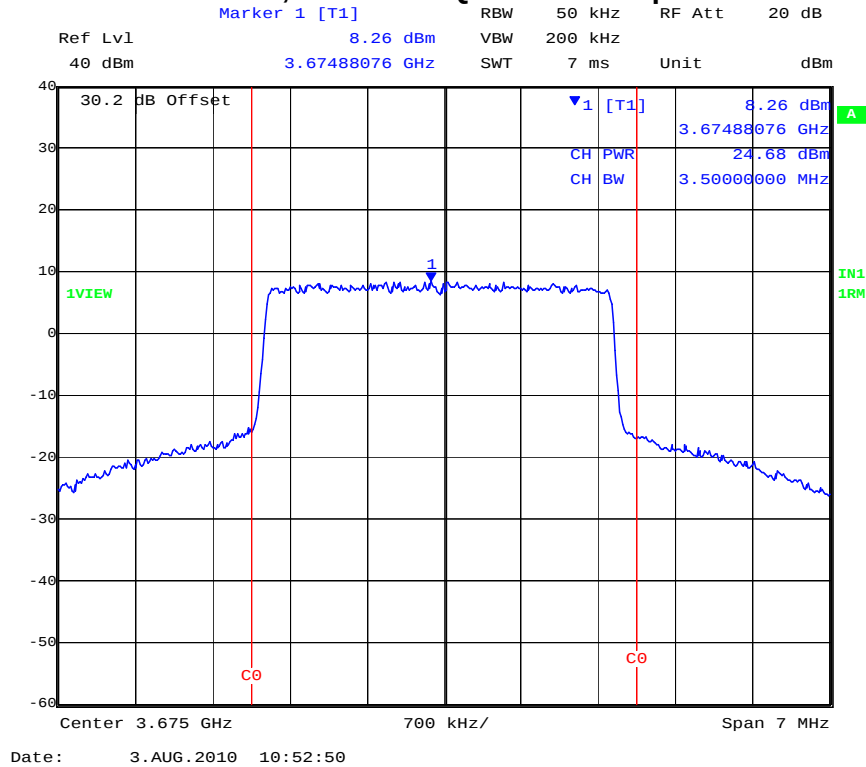


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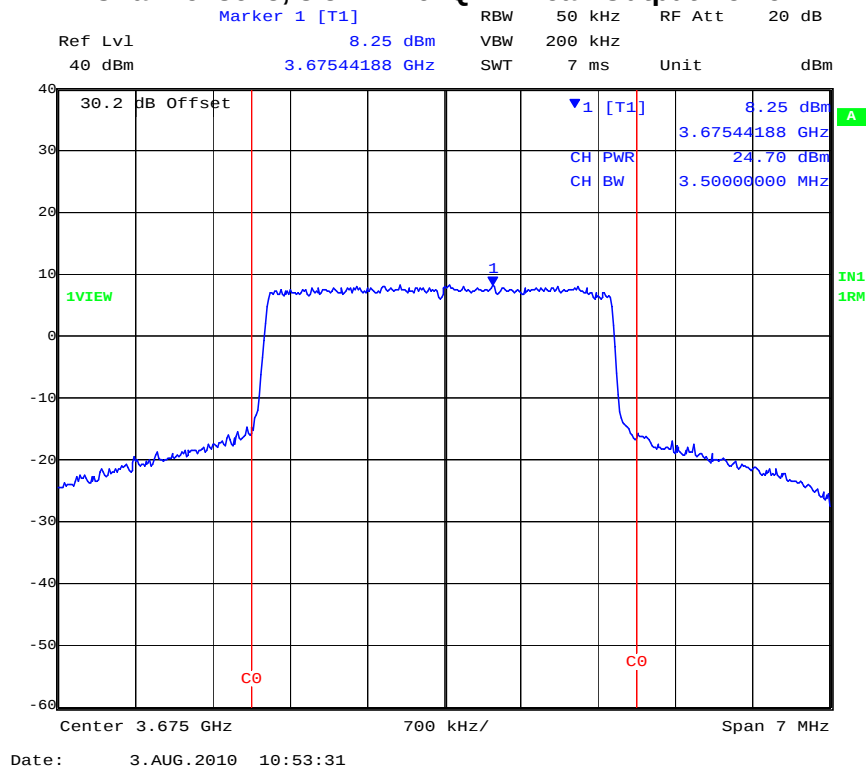


Title: Axxcelera EHD-CPE3320-C10
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Channel 3675, 3.5 MHz 16QAM Peak Output Power



Channel 3675, 3.5 MHz 64QAM Peak Output Power

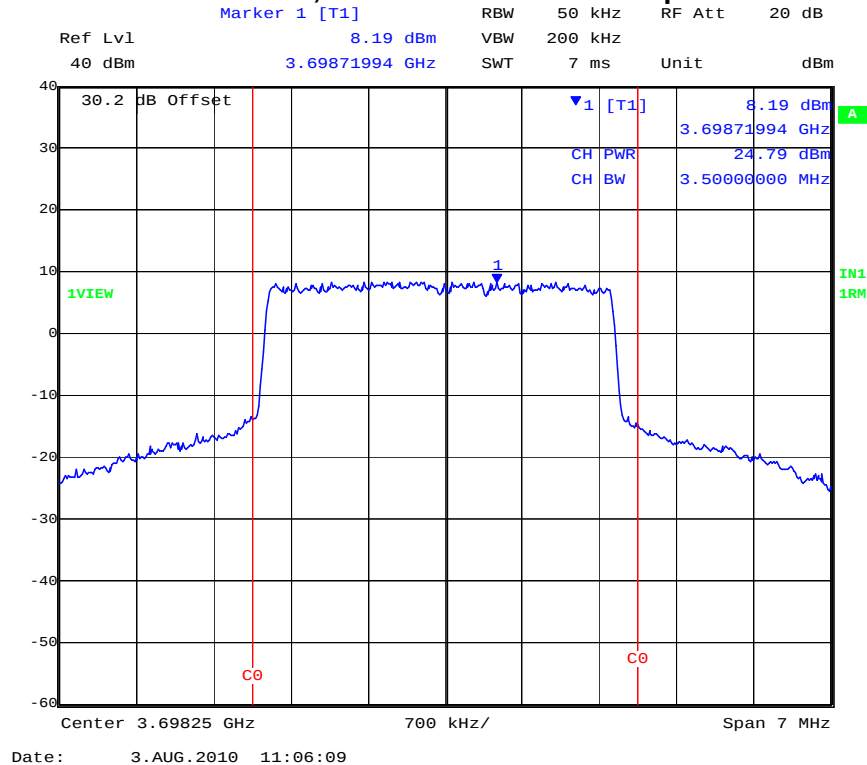


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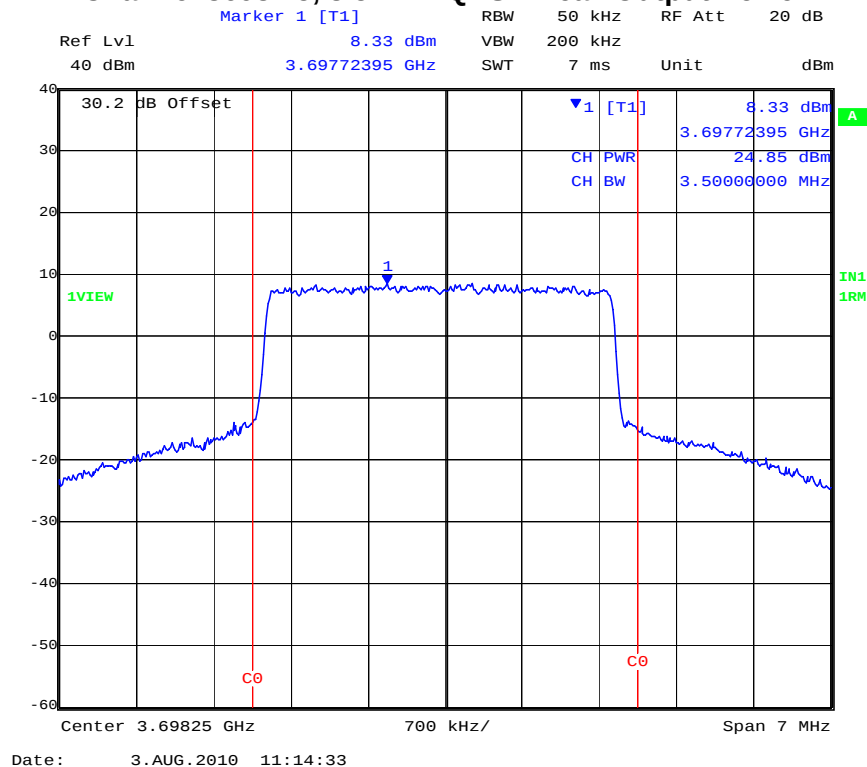


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Channel 3698.25, 3.5 MHz BPSK Peak Output Power



Channel 3698.25, 3.5 MHz QPSK Peak Output Power

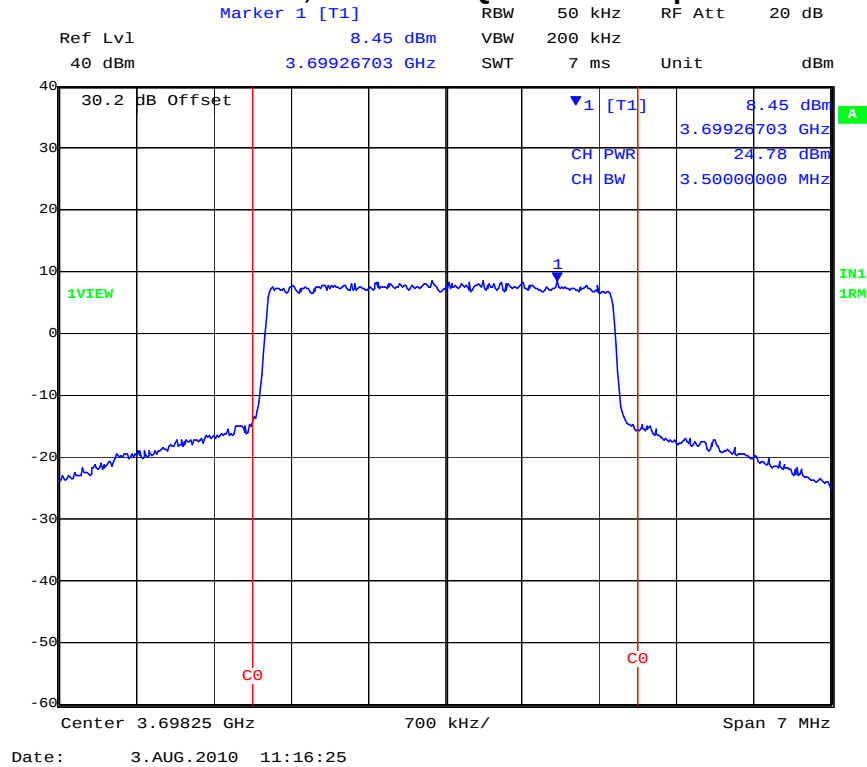


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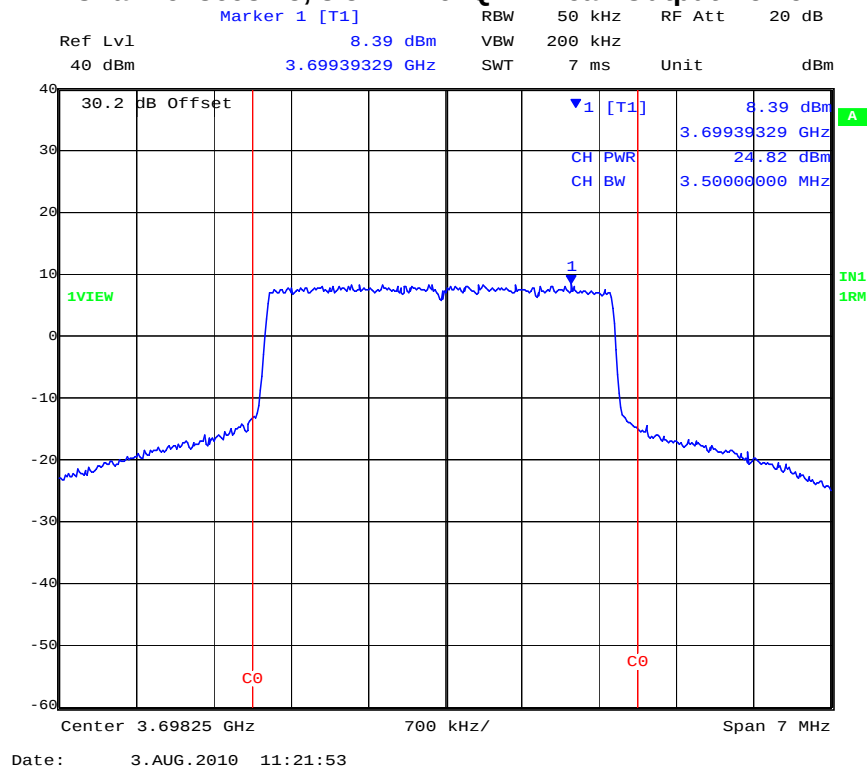


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Channel 3698.25, 3.5 MHz 16QAM Peak Output Power



Channel 3698.25, 3.5 MHz 64QAM Peak Output Power



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5 MHz Bandwidth

Conducted Power Limit for 11 dBi antenna: +27.0 dBm

Center Frequency (MHz)	Peak Output Power				
	BPSK (+dBm)	QPSK (+dBm)	16 QAM (+dBm)	64QAM (+dBm)	Minimum Margin (dB)
3652.50	+25.20	+25.29	+25.21	+25.19	-1.71
3675.00	+24.77	+24.88	+24.87	+24.89	-2.11
3697.50	+25.04	+25.13	+25.05	+25.09	-1.87

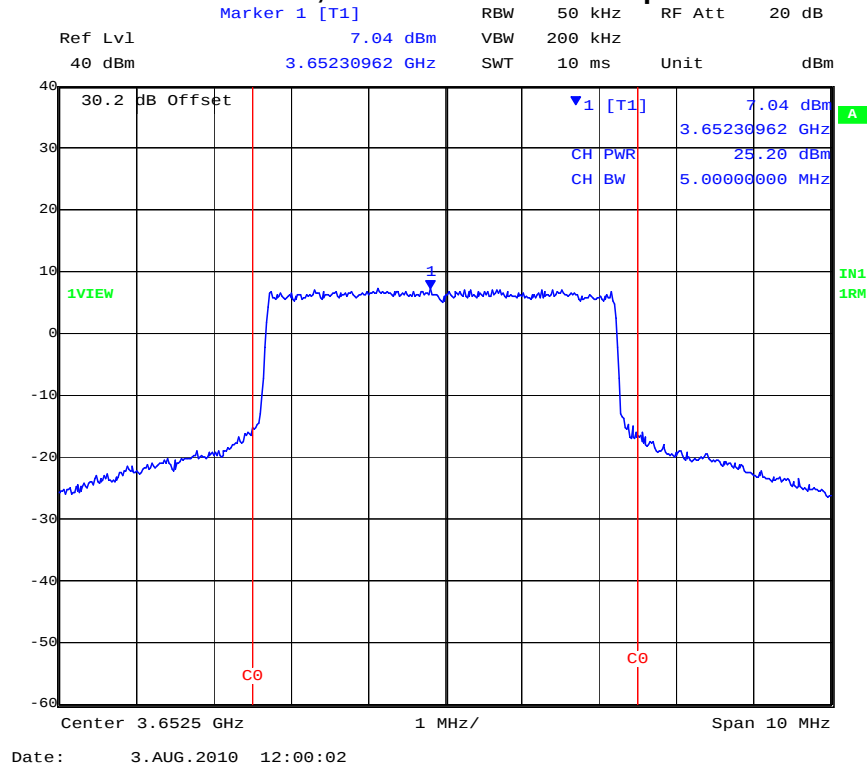
Note: Output power must be attenuated 4 dB for use with 16 dBi antenna (limit +22.0 dBm)

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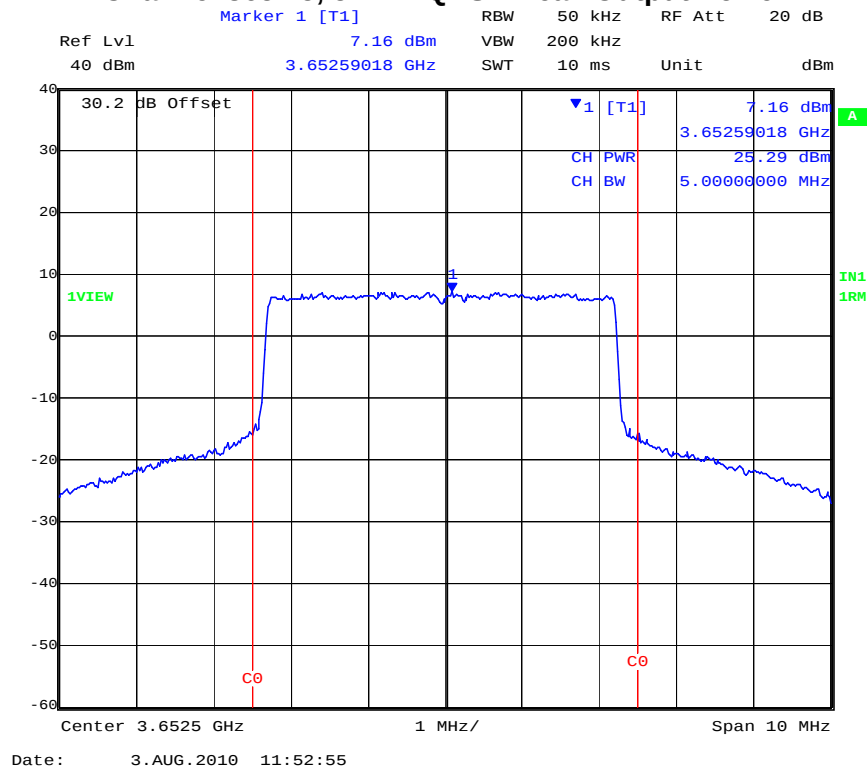


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Channel 3652.5, 5 MHz BPSK Peak Output Power



Channel 3652.5, 5 MHz QPSK Peak Output Power

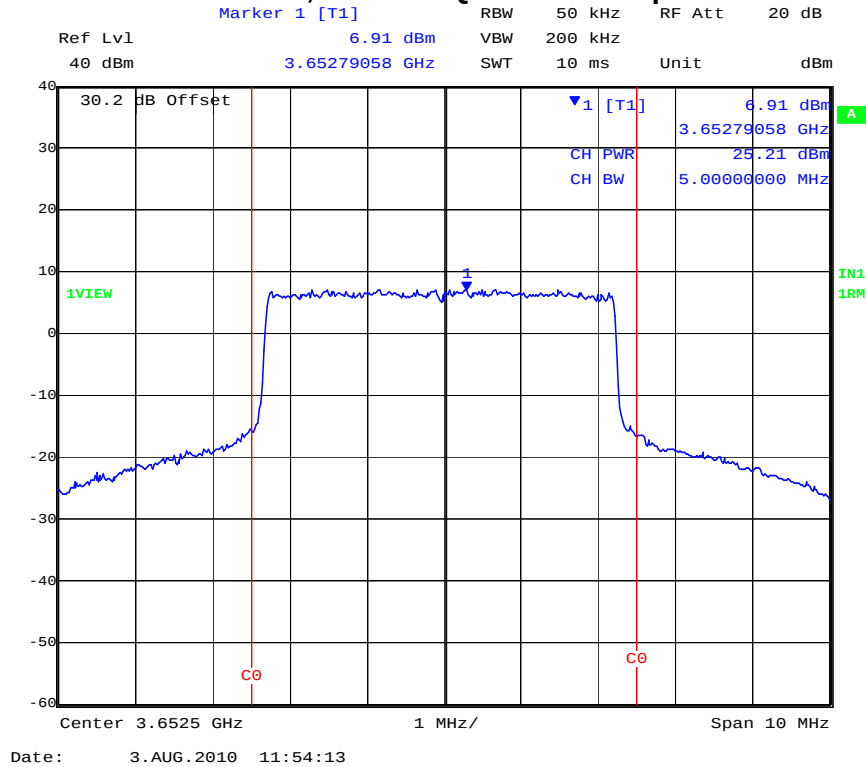


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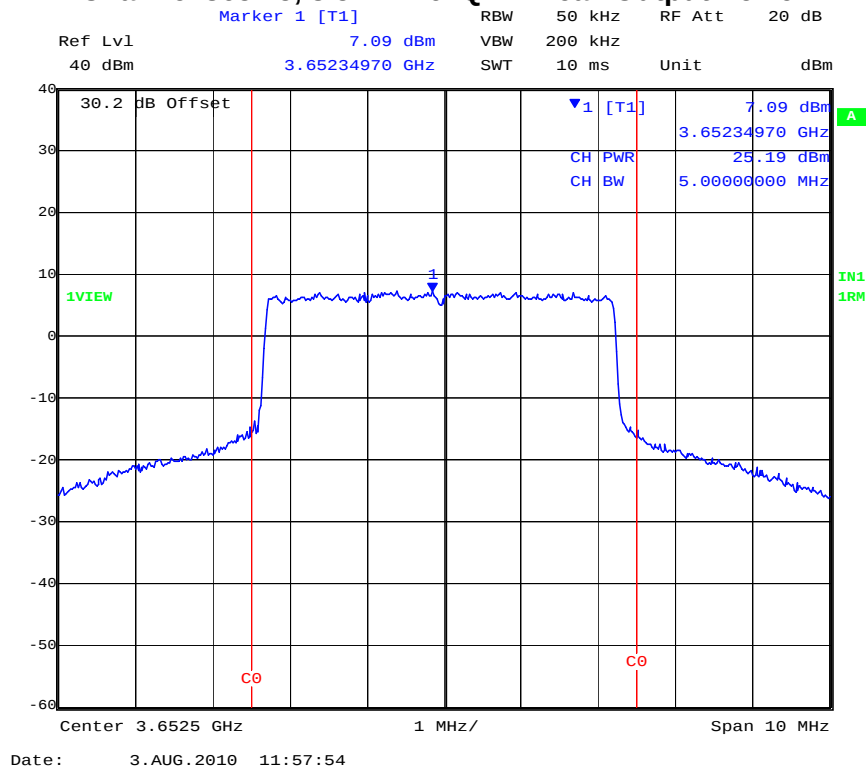


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Channel 3652.5, 5 MHz 16QAM Peak Output Power



Channel 3652.5, 3.5 MHz 64QAM Peak Output Power

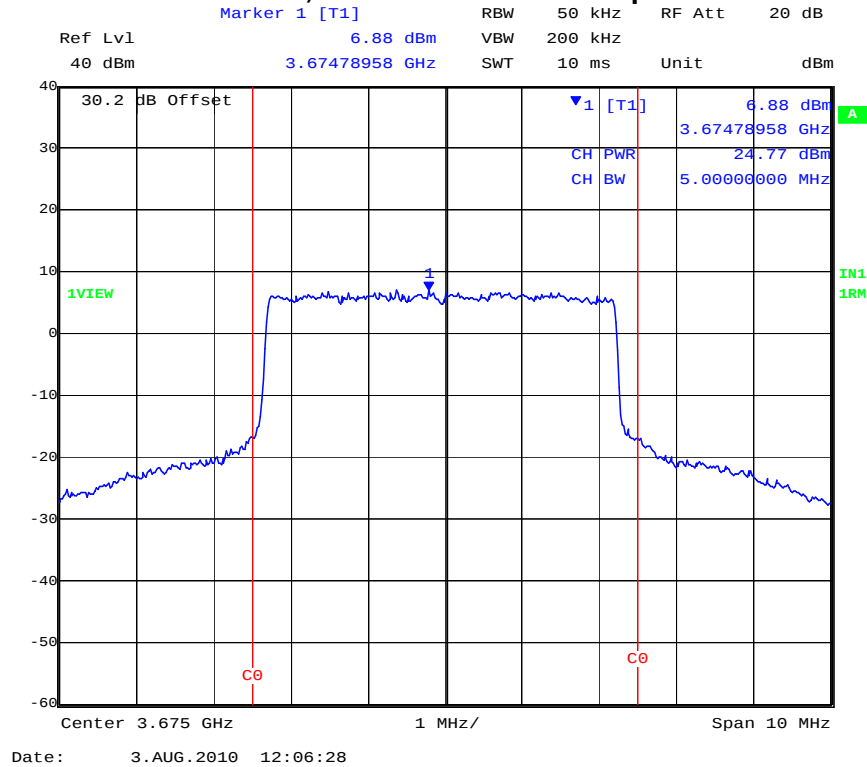


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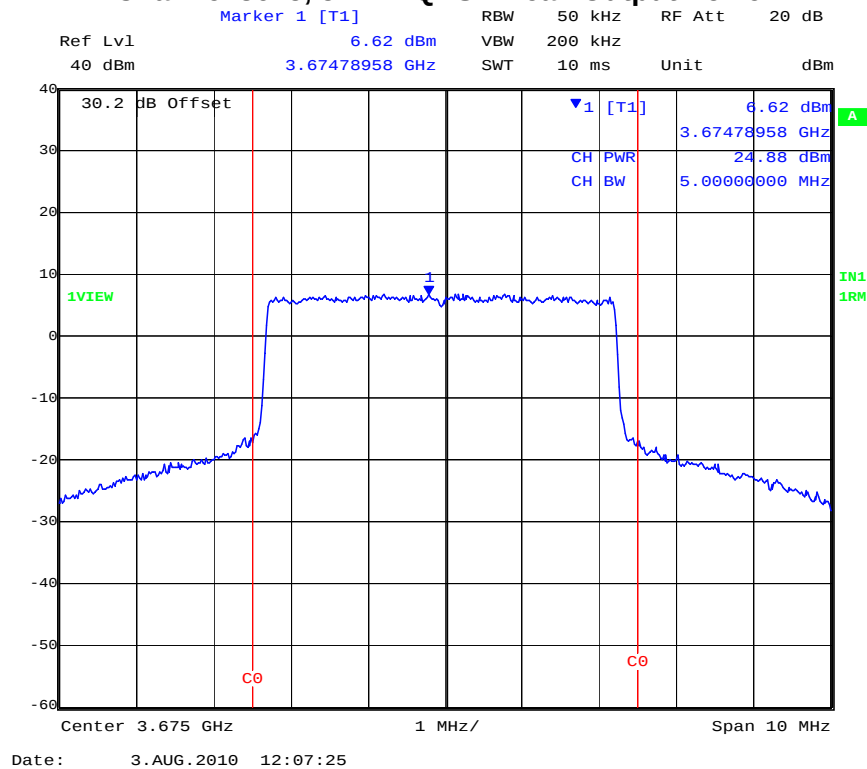


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Channel 3675, 5 MHz BPSK Peak Output Power



Channel 3675, 5 MHz QPSK Peak Output Power

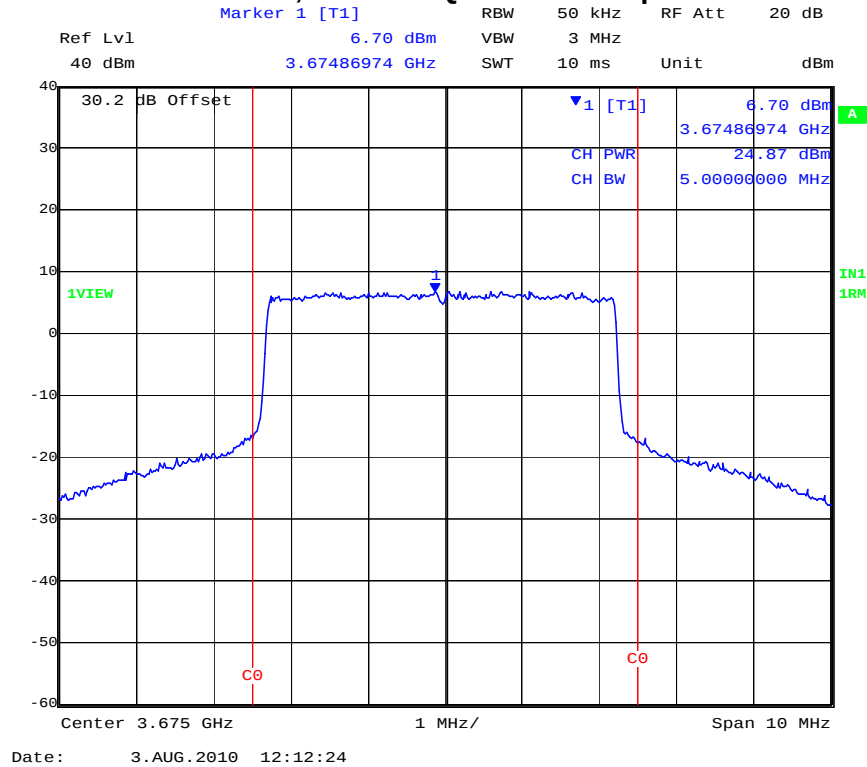


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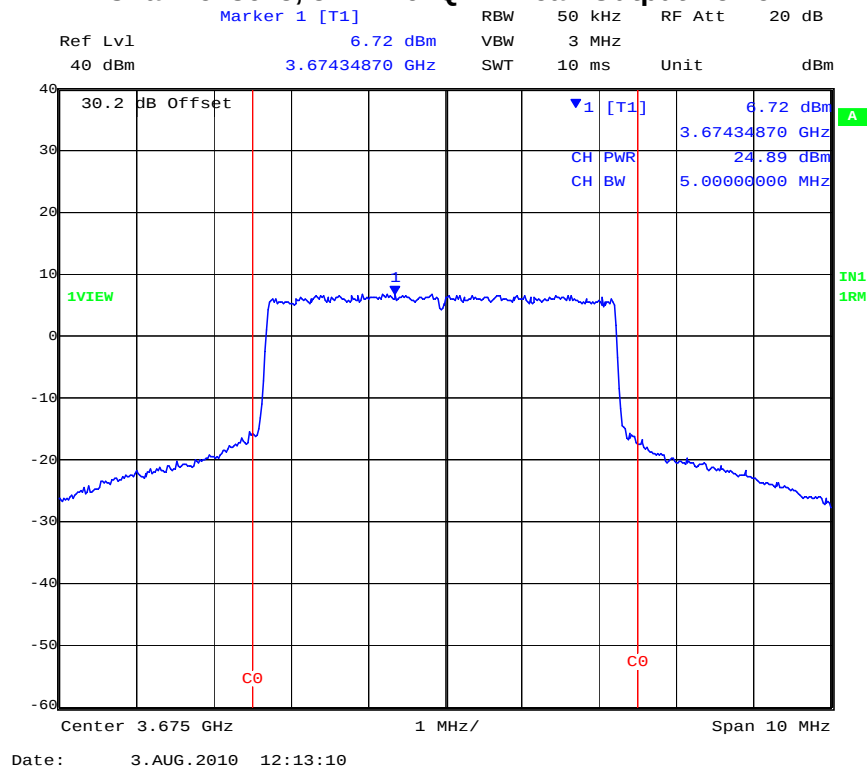


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Channel 3675, 5 MHz 16QAM Peak Output Power



Channel 3675, 5 MHz 64QAM Peak Output Power

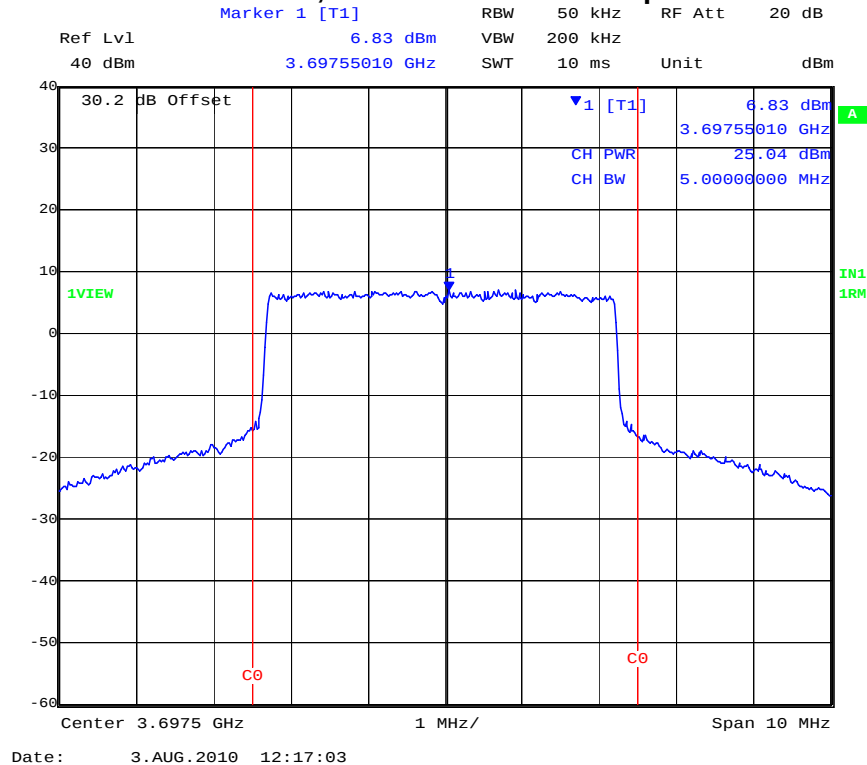


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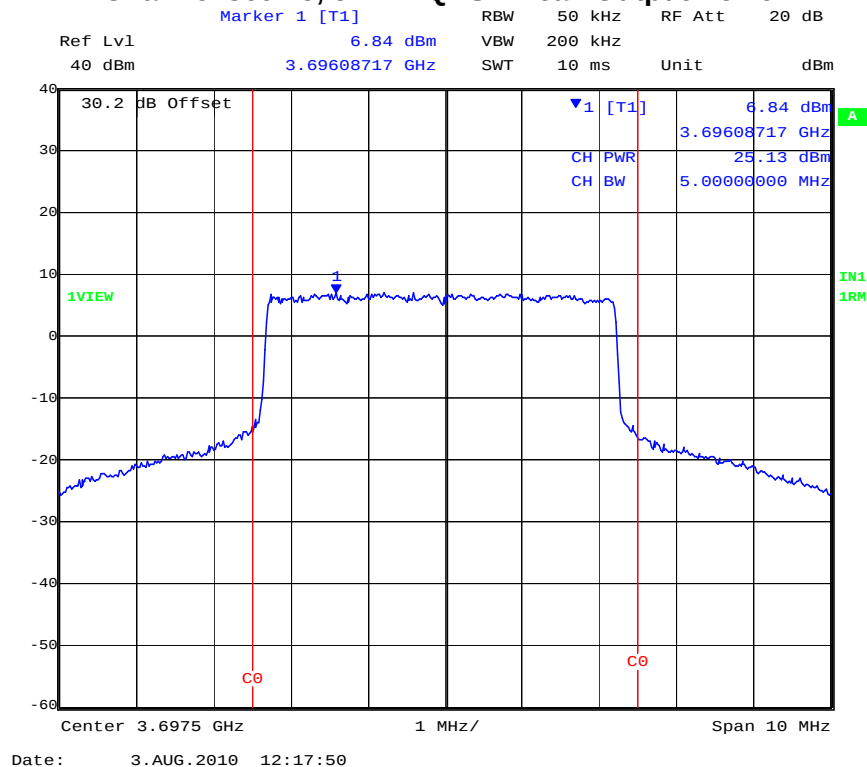


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Channel 3697.5, 5 MHz BPSK Peak Output Power



Channel 3697.5, 5 MHz QPSK Peak Output Power

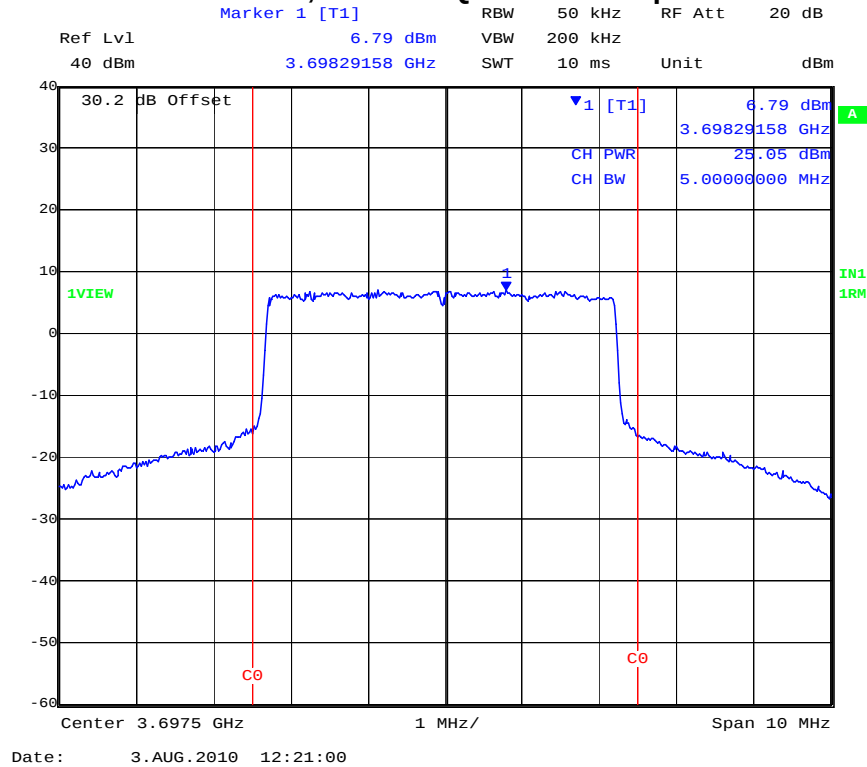


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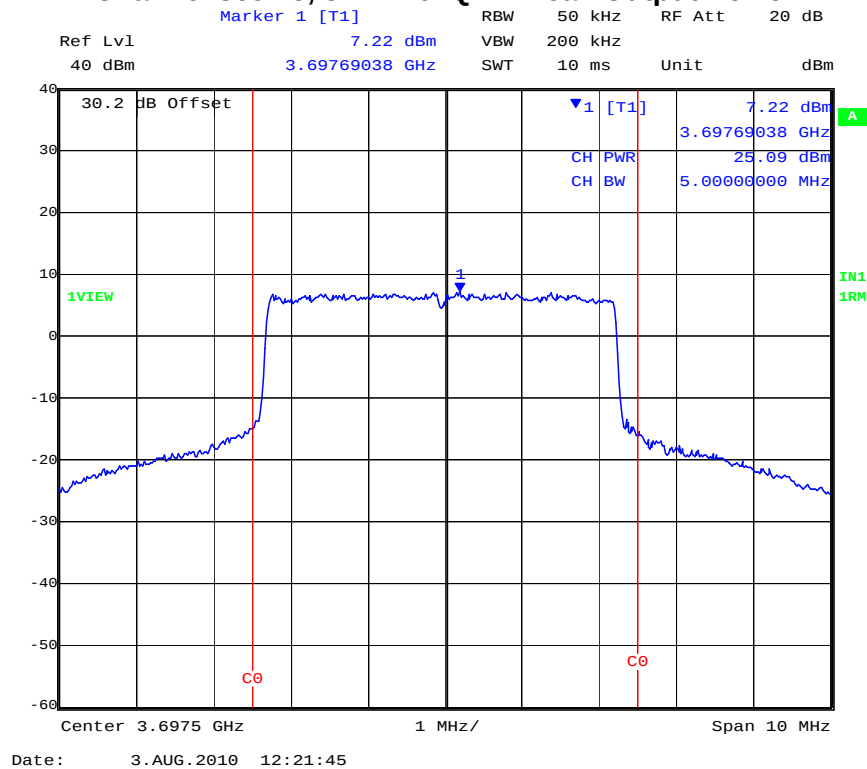


Title: Axxcelera EHD-CPE3320-C10
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Channel 3697.5, 5 MHz 16QAM Peak Output Power



Channel 3697.5, 5 MHz 64QAM Peak Output Power



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7 MHz Bandwidth

Conducted Power Limit for 11 dBi antenna: +28.4 dBm

Center Frequency (MHz)	Peak Output Power				Minimum Margin (dB)
	BPSK (+dBm)	QPSK (+dBm)	16 QAM (+dBm)	64QAM (+dBm)	
3653.50	+25.25	+25.35	+25.24	+25.25	-3.05
3675.00	+24.84	+24.95	+24.87	+24.53	-3.45
3696.50	+25.11	+25.19	+25.12	+25.13	-3.21

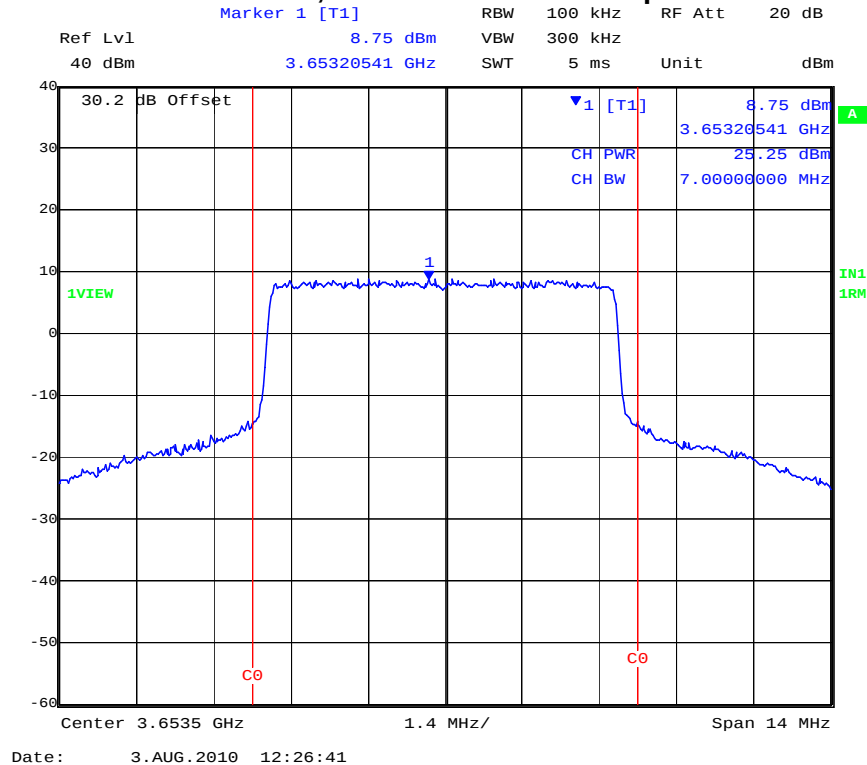
Note: Output power must be attenuated 2 dB for use with 16 dBi antenna (limit +23.4 dBm)

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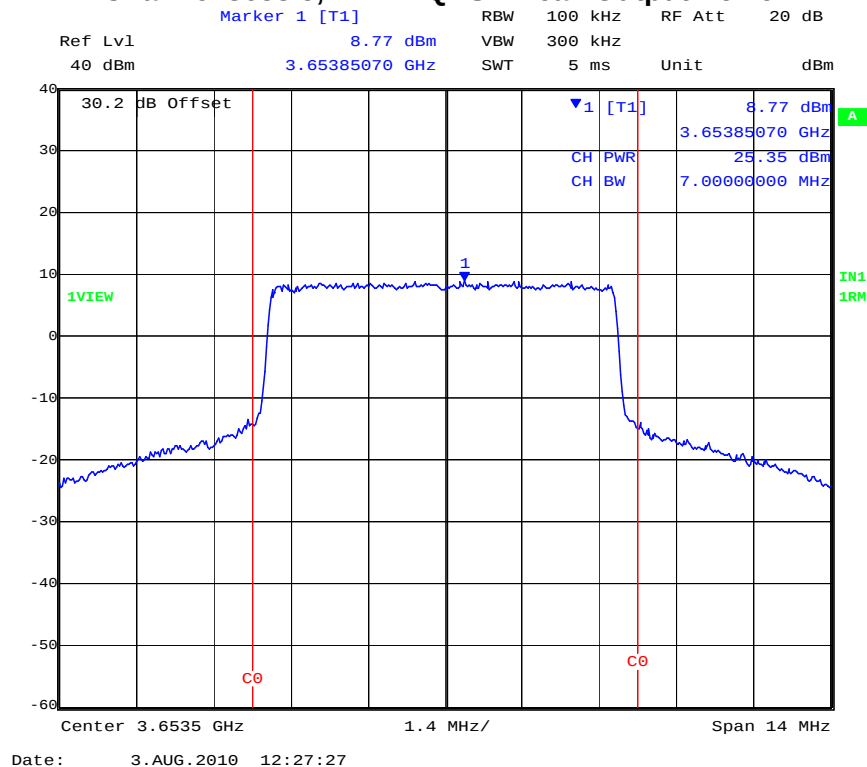


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Channel 3653.5, 7 MHz BPSK Peak Output Power



Channel 3653.5, 7 MHz QPSK Peak Output Power

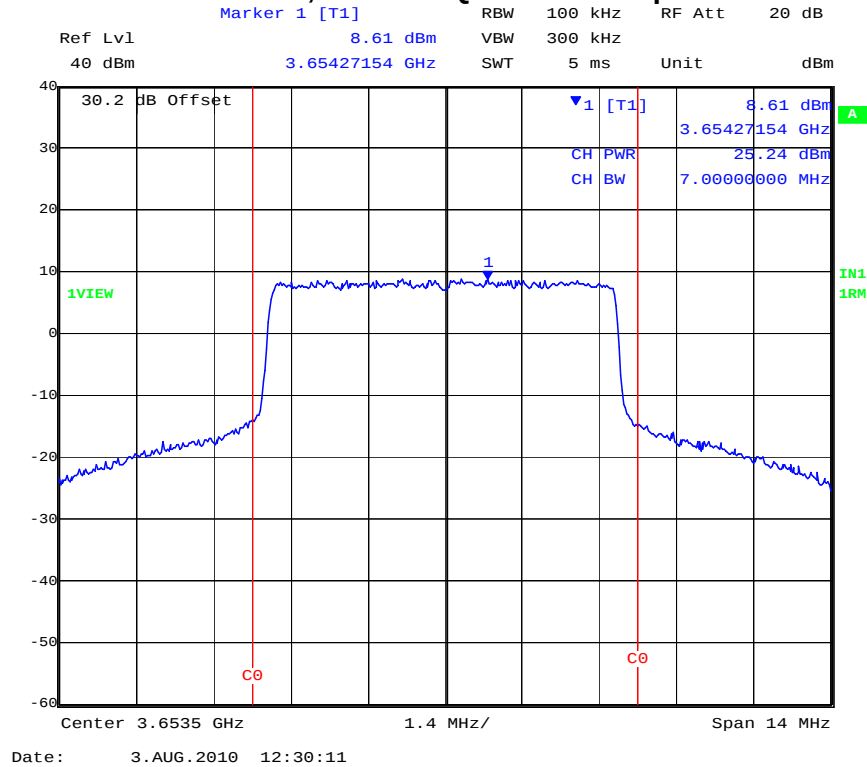


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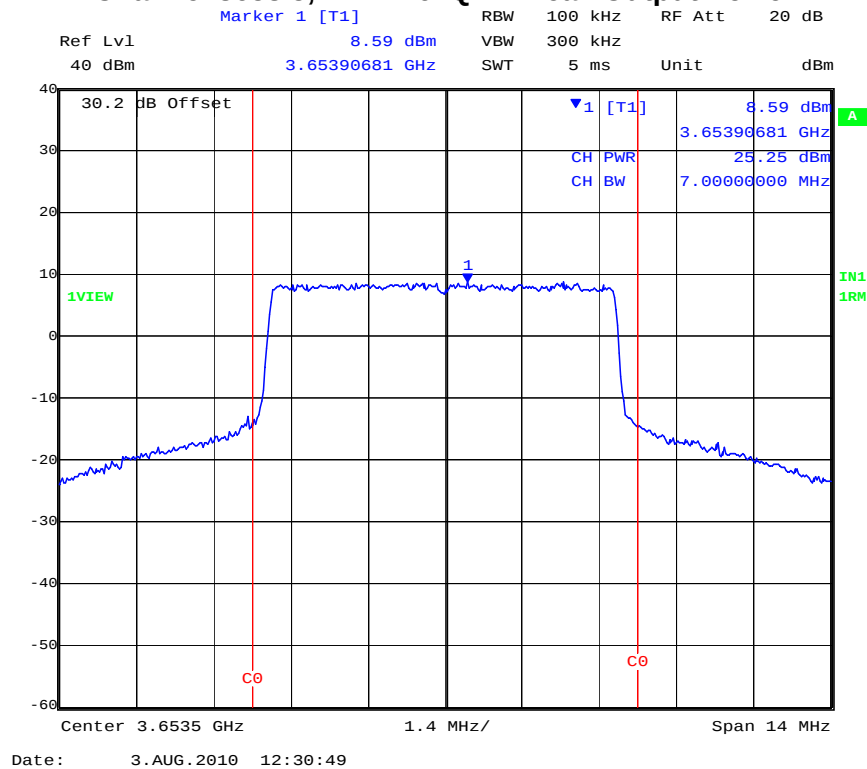


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Channel 3653.5, 7 MHz 16QAM Peak Output Power



Channel 3653.5, 7 MHz 64QAM Peak Output Power

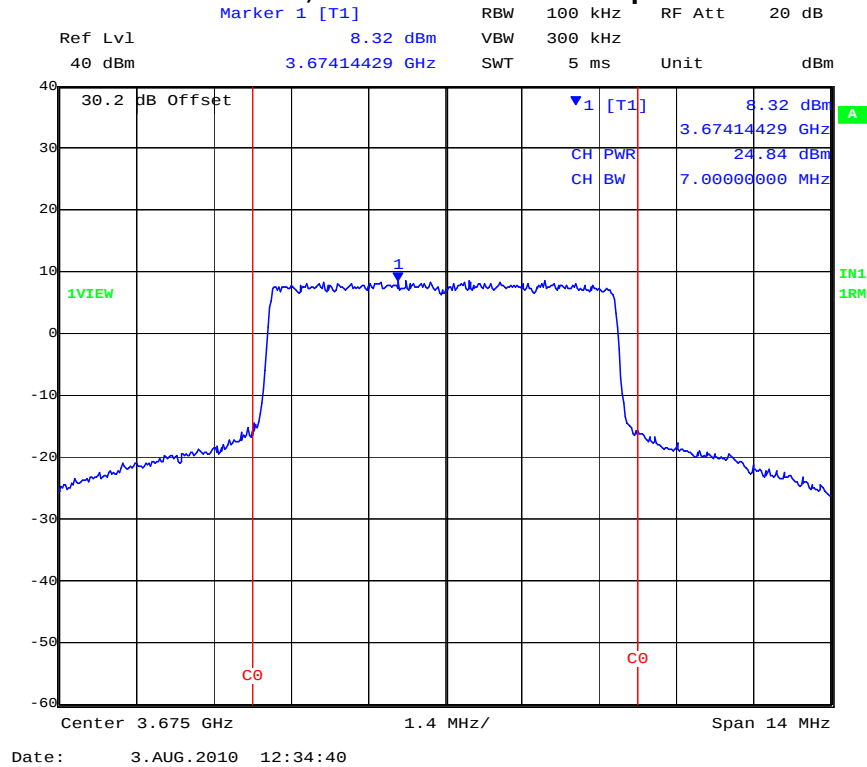


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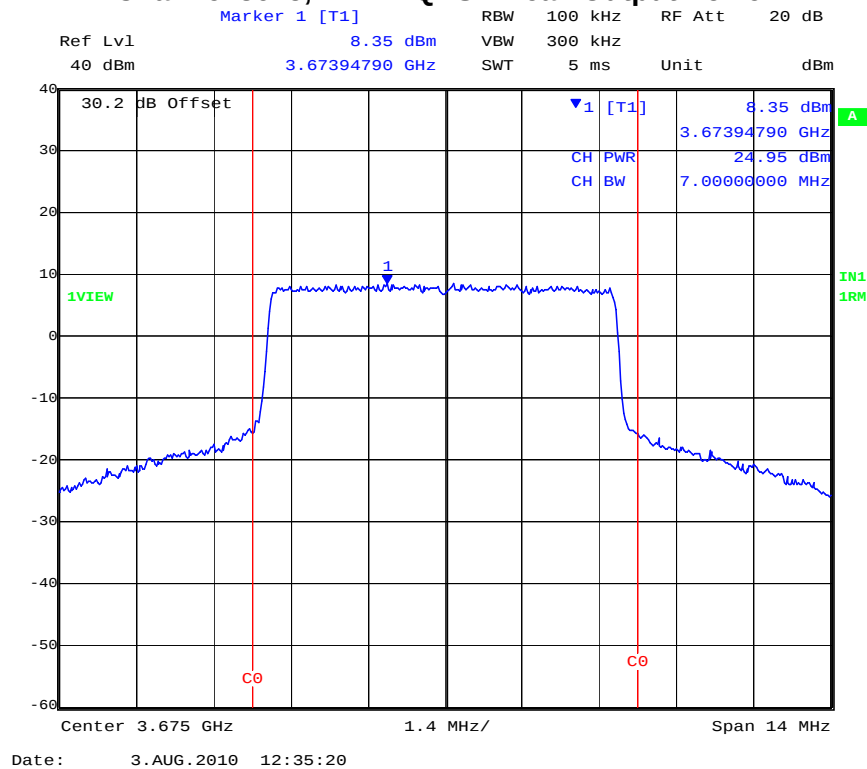


Title: Axxcelera EHD-CPE3320-C10
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Channel 3675, 7 MHz BPSK Peak Output Power



Channel 3675, 7 MHz QPSK Peak Output Power

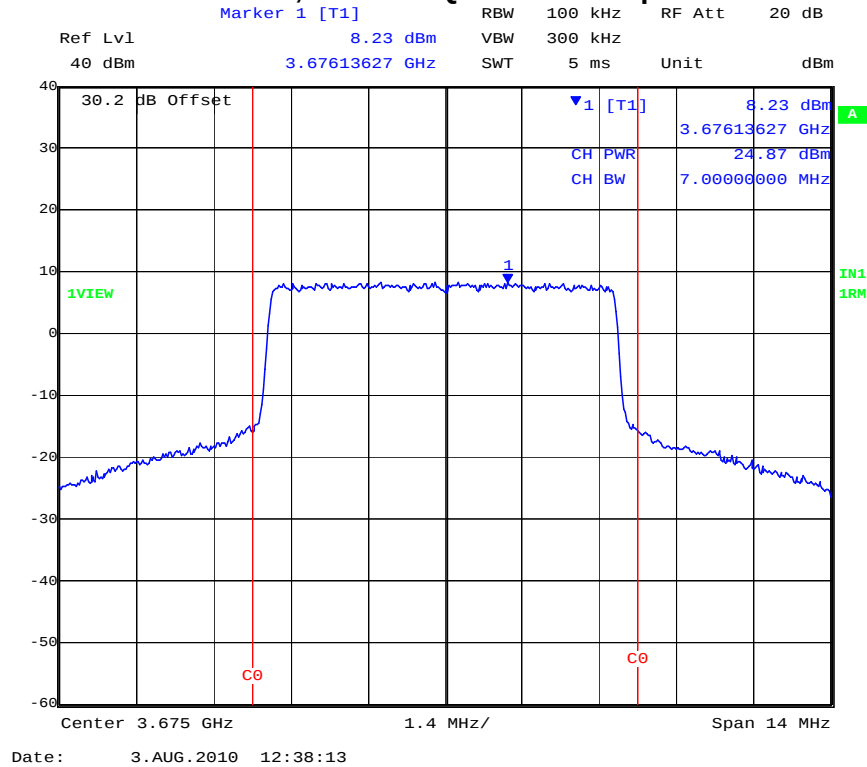


This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.

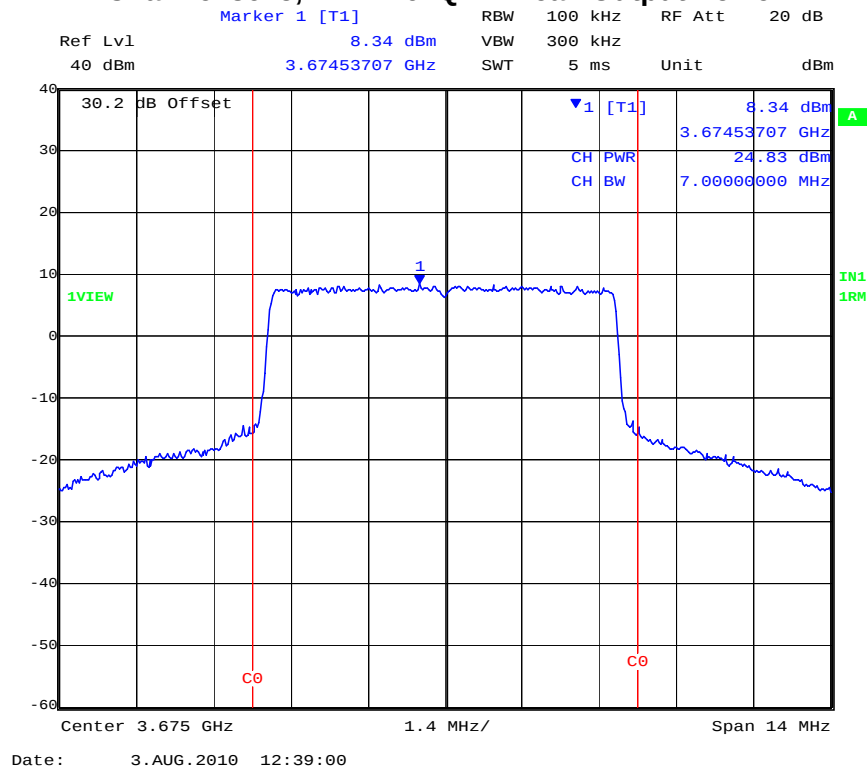


Title: Axxcelera EHD-CPE3320-C10
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Channel 3675, 7 MHz 16QAM Peak Output Power



Channel 3675, 7 MHz 64QAM Peak Output Power

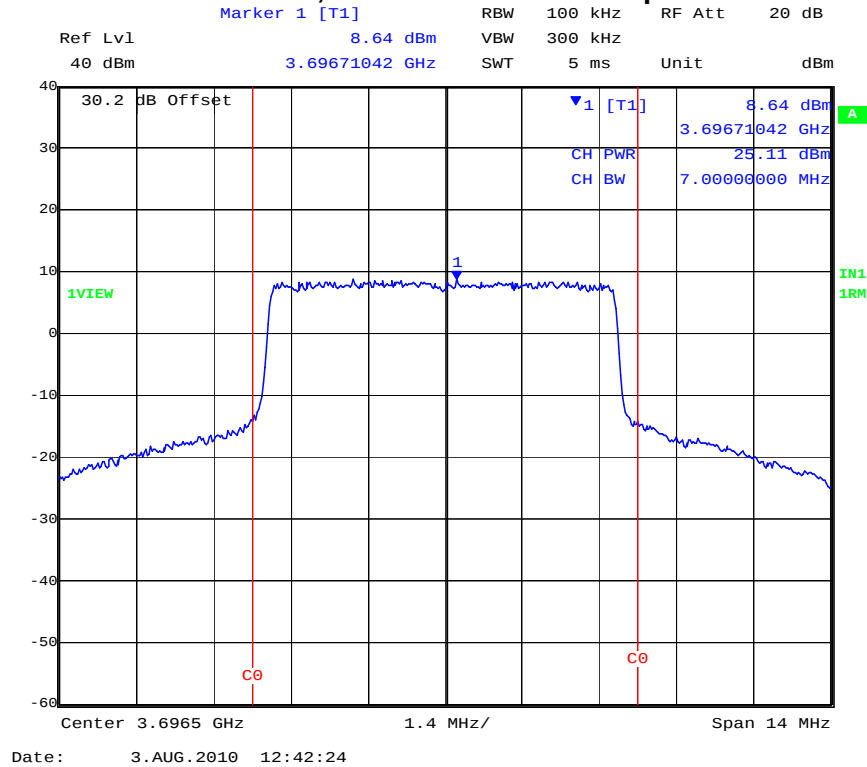


This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.

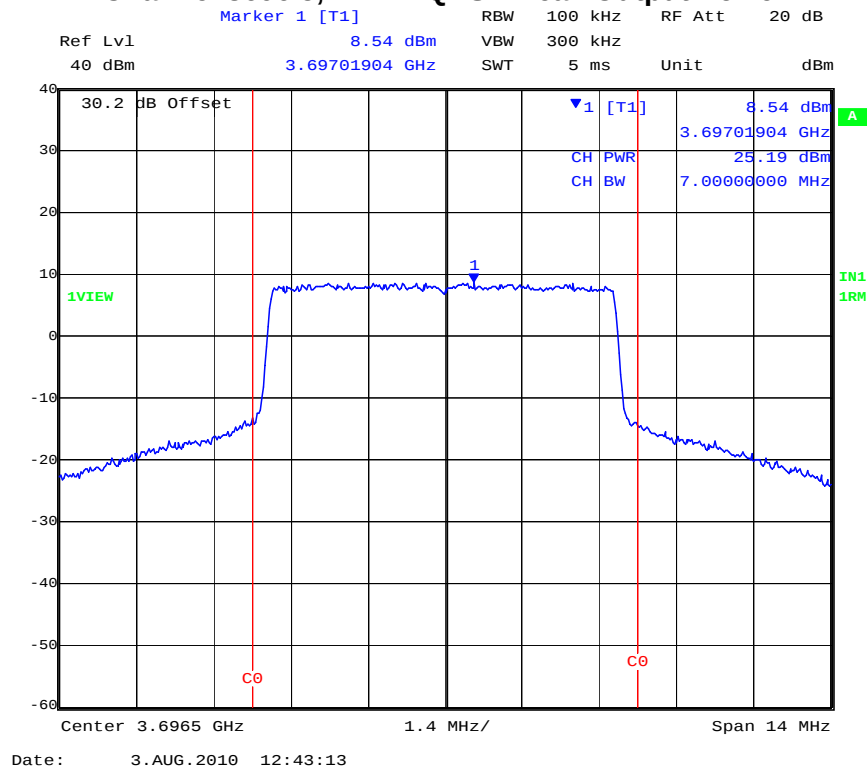


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Channel 3696.5, 7 MHz BPSK Peak Output Power



Channel 3696.5, 7 MHz QPSK Peak Output Power

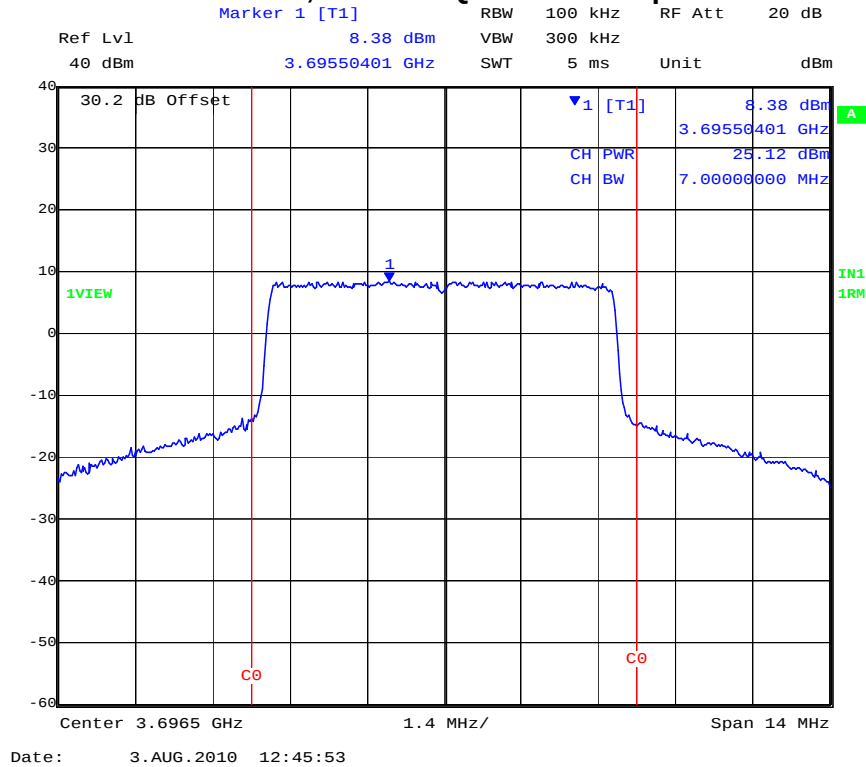


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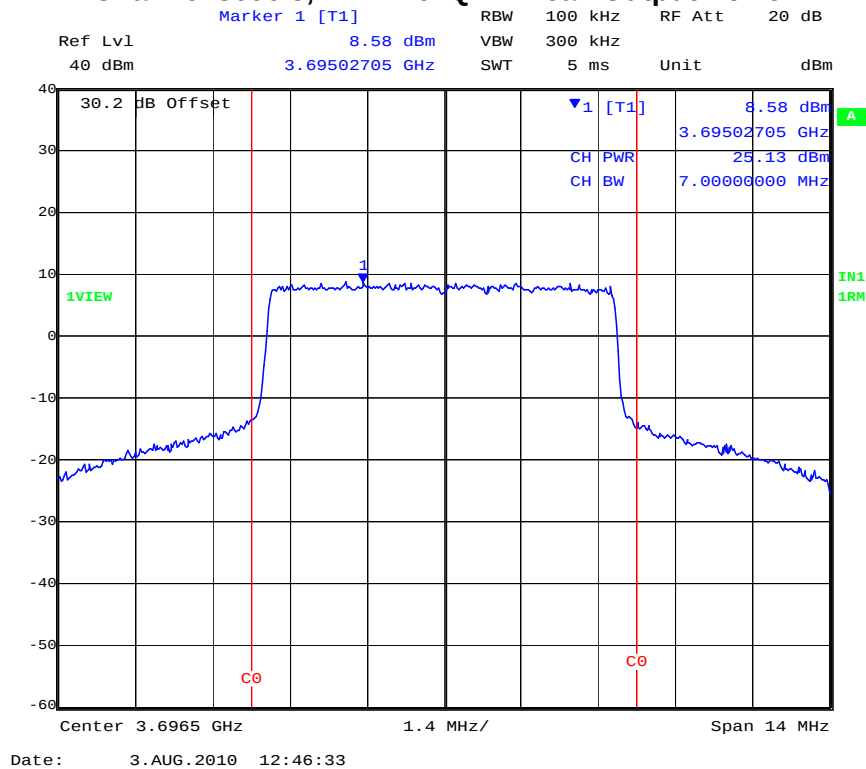


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Channel 3696.5, 7 MHz 16QAM Peak Output Power



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)

Industry Canada RSS-197 Section 5.6

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

Center Frequency (MHz)	Power Spectral Density (dBm/MHz)				Minimum Margin (dB)
	BPSK	QPSK	16 QAM	64QAM	
3651.75	+21.92	+22.07	+22.10	+22.12	-7.88
3675.00	+21.61	+21.76	+21.66	+21.65	-8.24
3698.25	+21.71	+21.73	+21.78	+21.76	-8.22

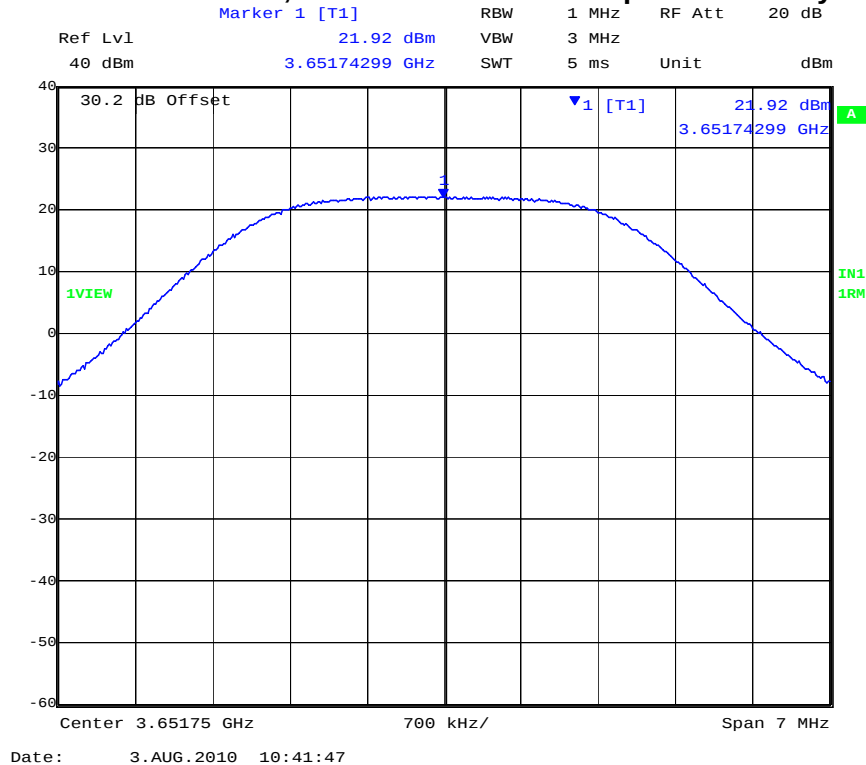
Limit: +30 dBm/MHz

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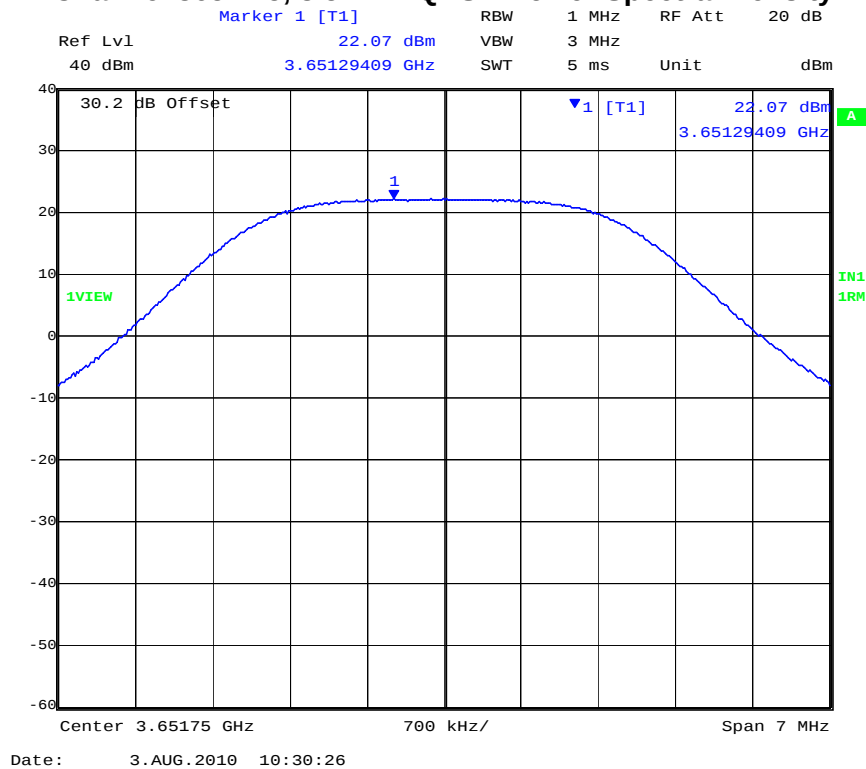


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Channel 3651.75, 3.5 MHz BPSK Power Spectral Density



Channel 3651.75, 3.5 MHz QPSK Power Spectral Density

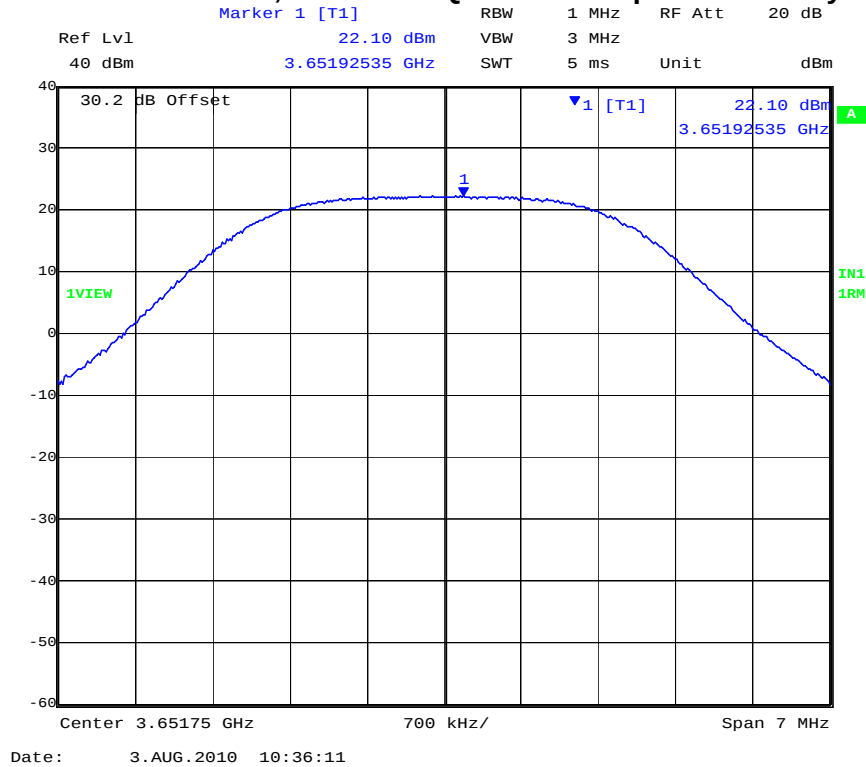


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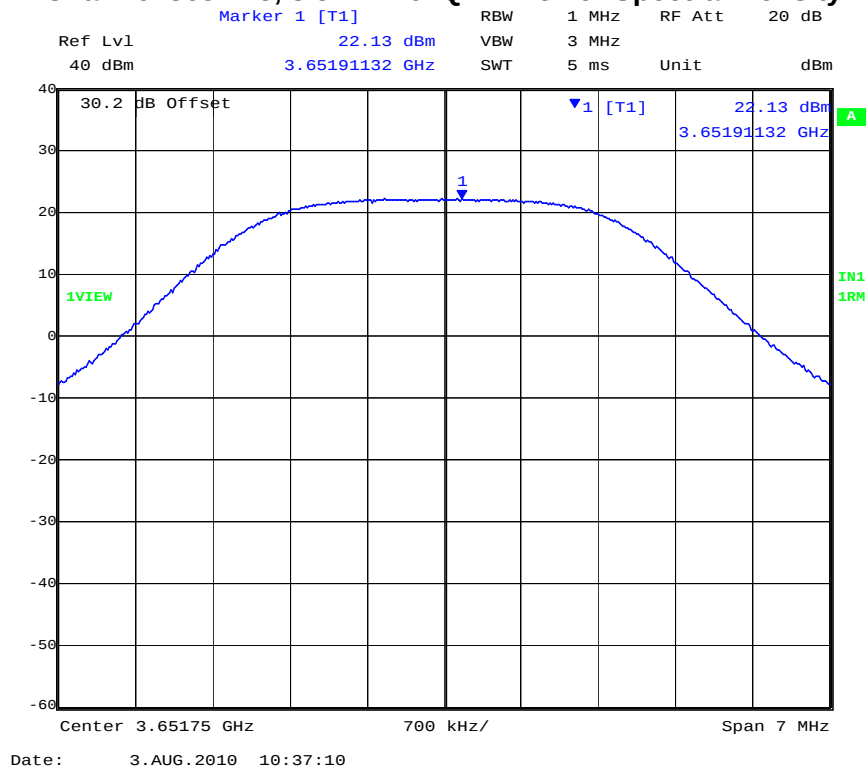


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Channel 3651.75, 3.5 MHz 16QAM Power Spectral Density



Channel 3651.75, 3.5 MHz 64QAM Power Spectral Density

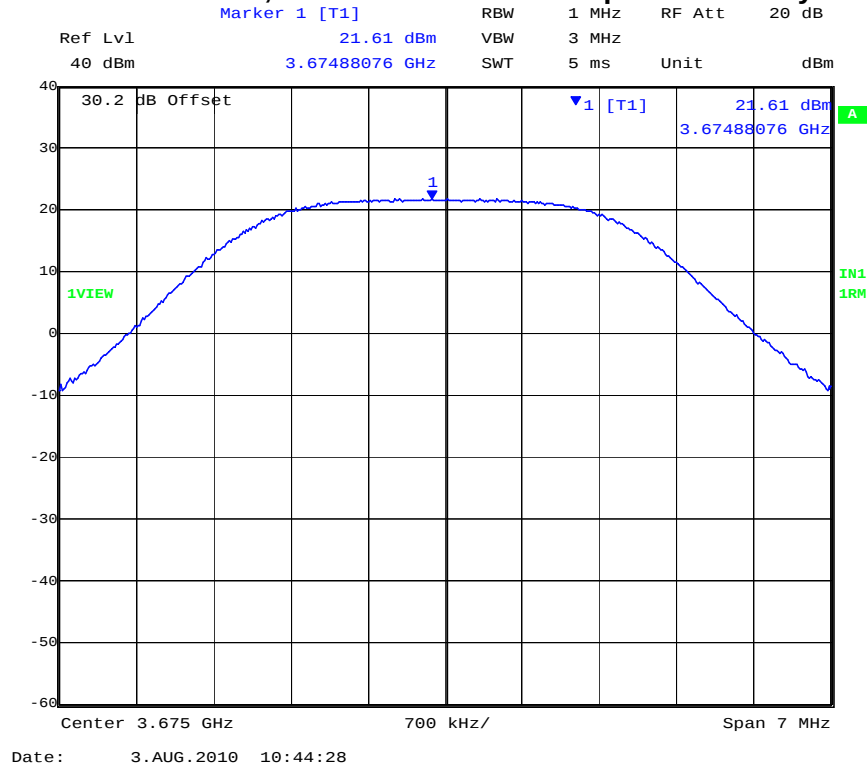


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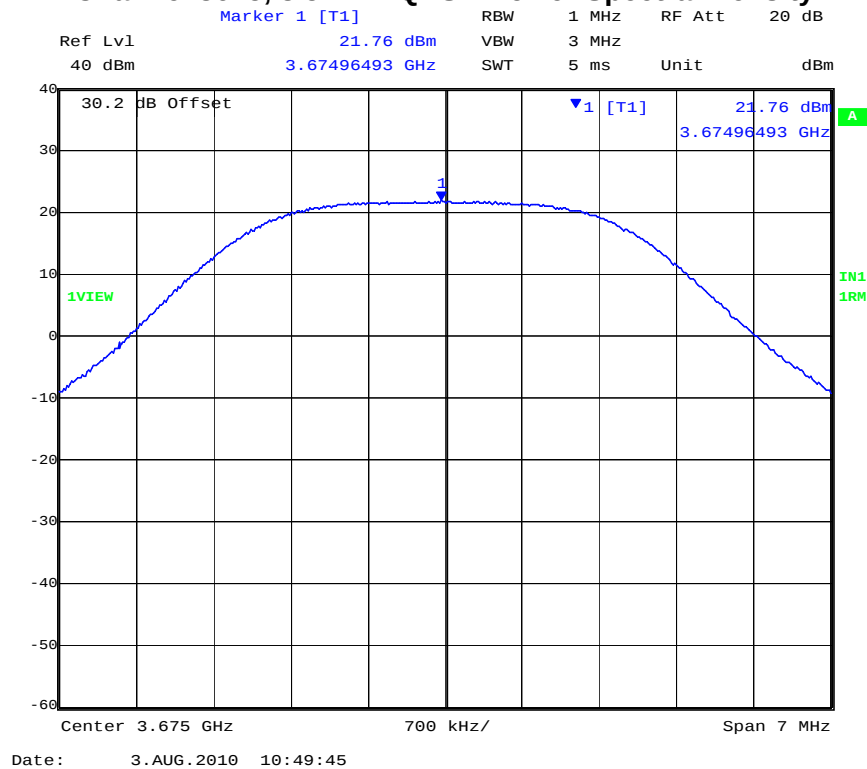


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Channel 3675, 3.5 MHz BPSK Power Spectral Density



Channel 3675, 3.5 MHz QPSK Power Spectral Density

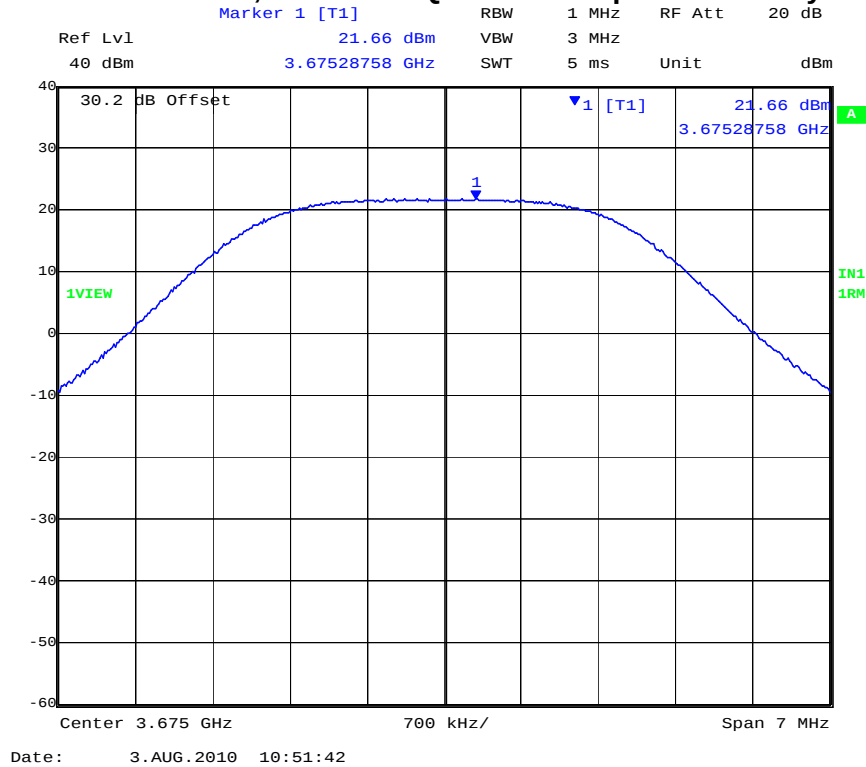


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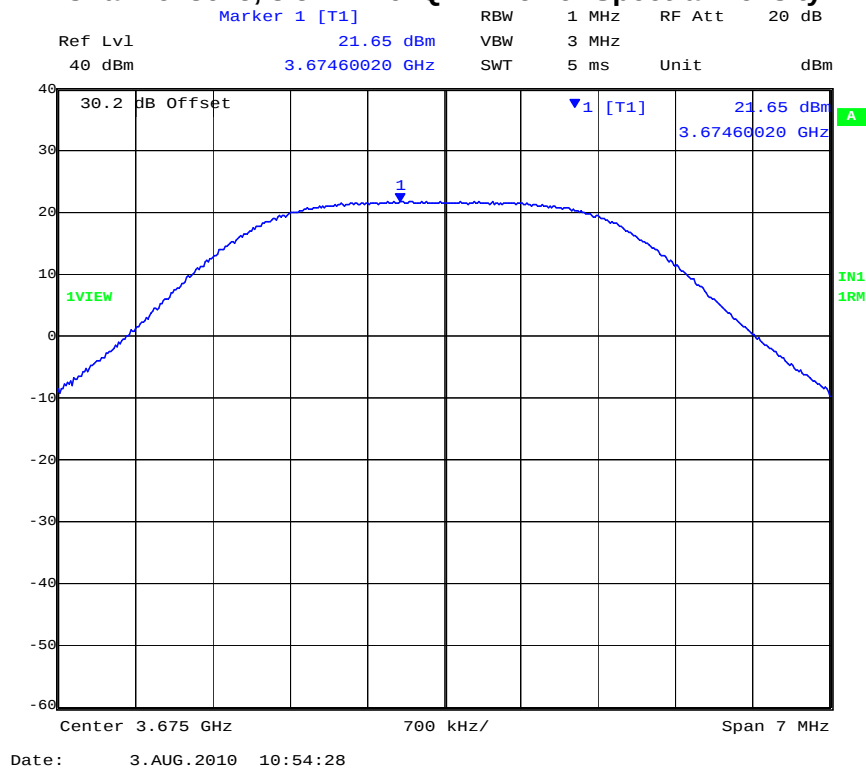


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Channel 3675, 3.5 MHz 16QAM Power Spectral Density



Channel 3675, 3.5 MHz 64QAM Power Spectral Density

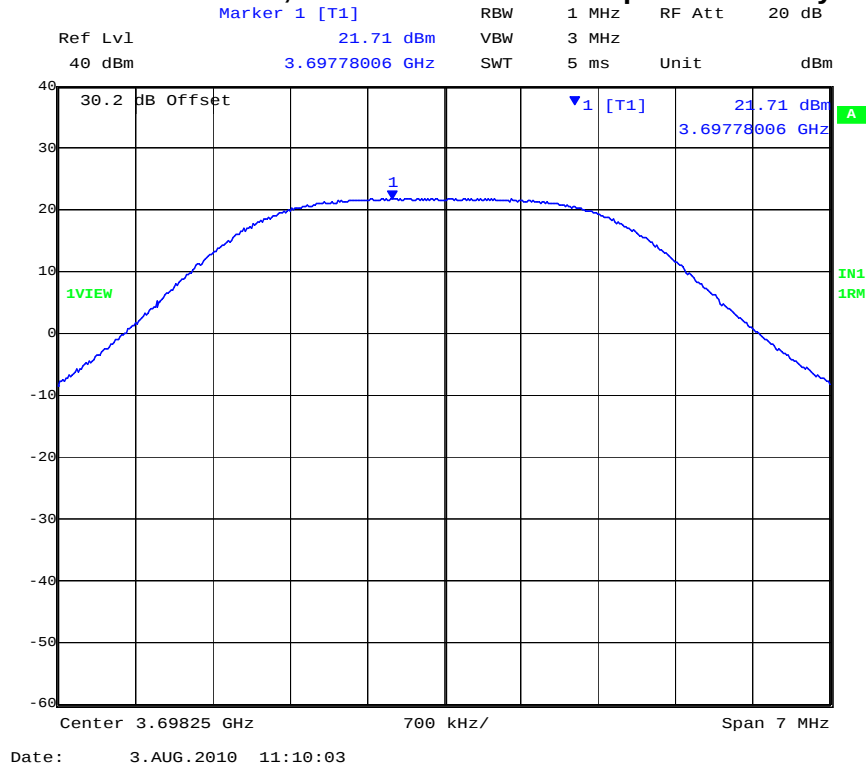


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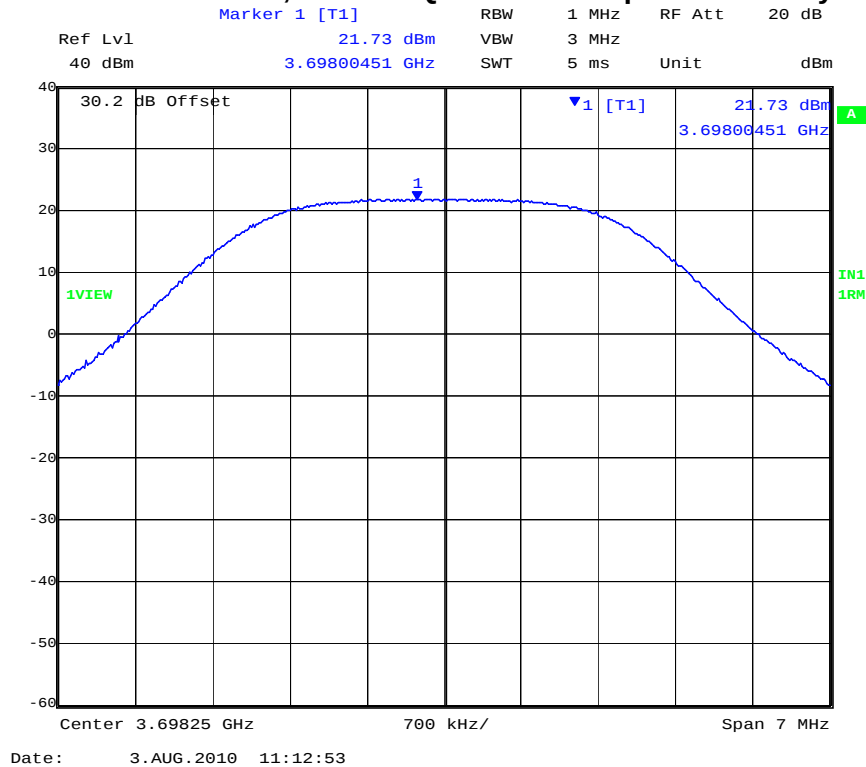


Title: Axxcelera EHD-CPE3320-C10
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Channel 3698.25, 3.5 MHz BPSK Power Spectral Density



Channel 3698.25, 3.5 MHz QPSK Power Spectral Density

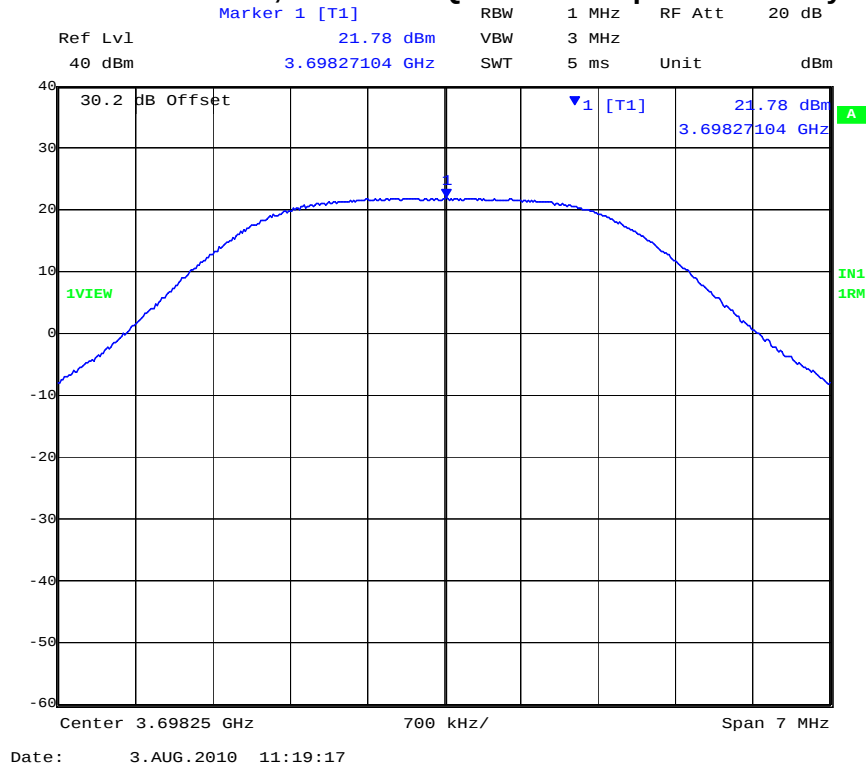


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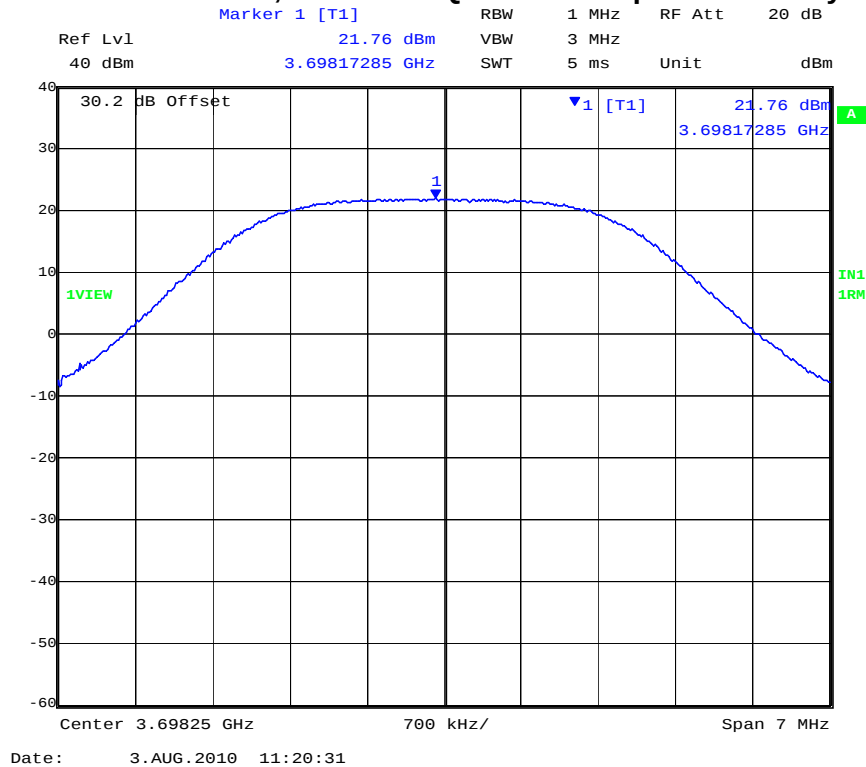


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Channel 3698.25, 3.5 MHz 16QAM Power Spectral Density



Channel 3698.25, 3.5 MHz 64QAM Power Spectral Density



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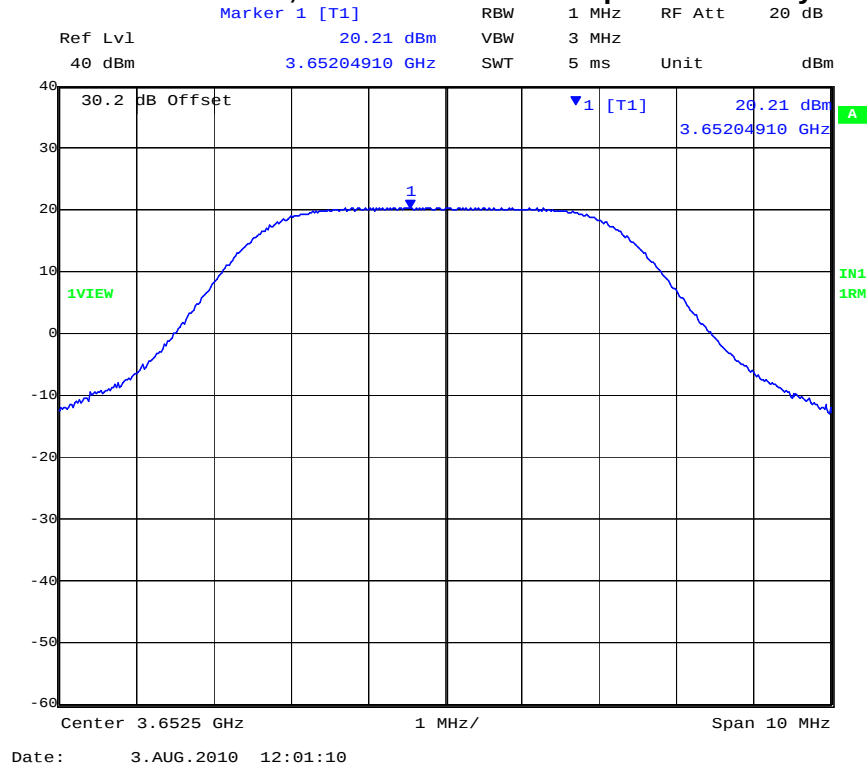
5 MHz Bandwidth

Center Frequency (MHz)	Power Spectral Density (dBm/MHz)				Minimum Margin (dB)
	BPSK	QPSK	16 QAM	64QAM	
3652.50	+20.21	+20.19	+20.24	+20.36	-9.64
3675.00	+19.84	+19.86	+19.88	+19.98	-10.02
3697.50	+20.02	+20.17	+20.08	+20.17	-9.83

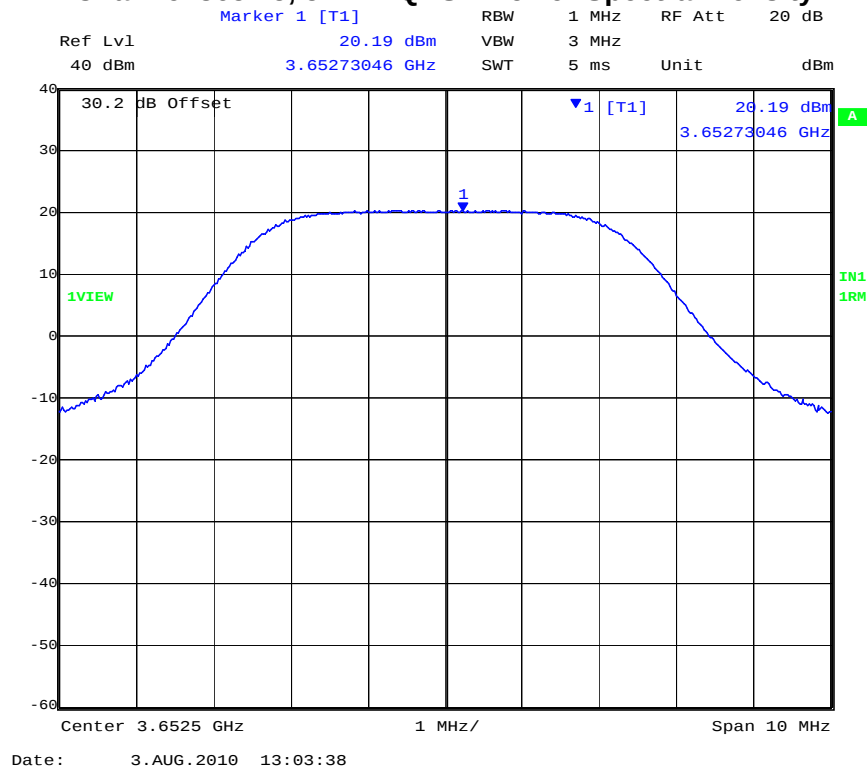
Limit: +30 dBm/MHz

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Channel 3652.5, 5 MHz BPSK Power Spectral Density



Channel 3652.5, 5 MHz QPSK Power Spectral Density

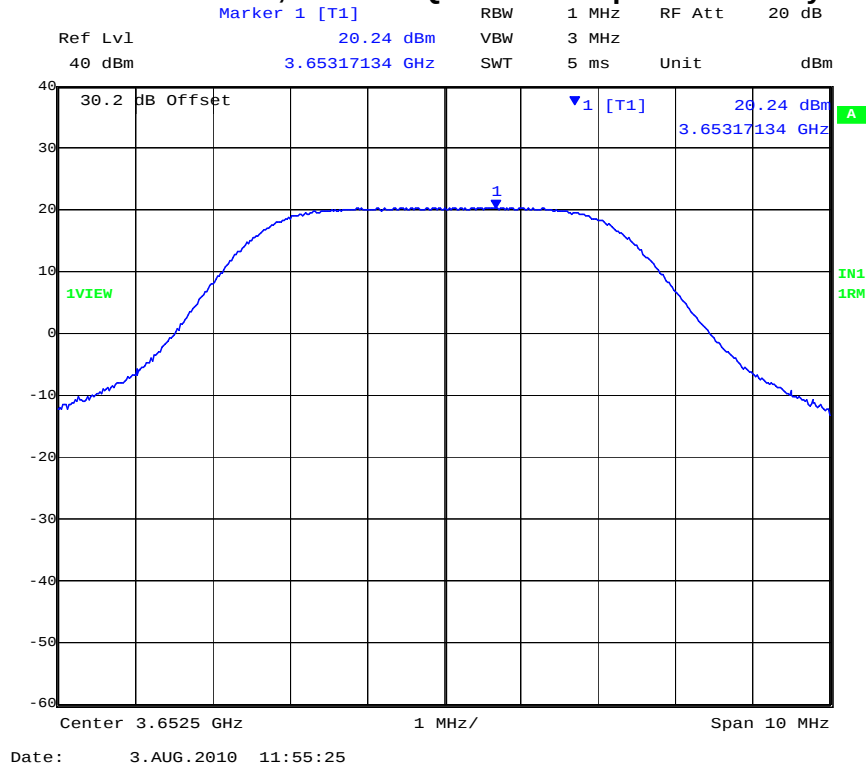


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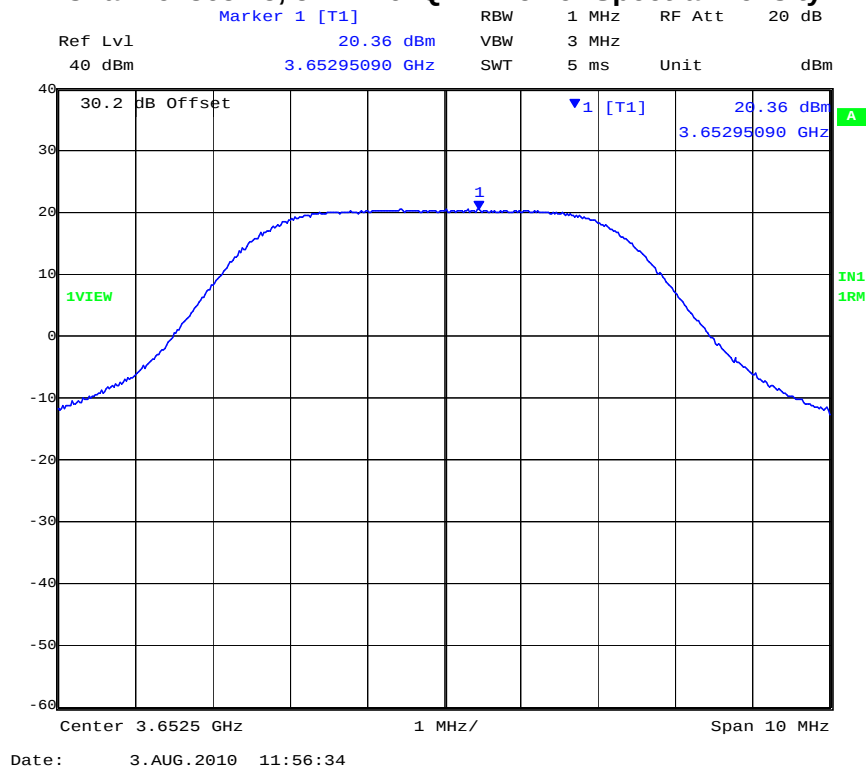


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Channel 3652.5, 5 MHz 16QAM Power Spectral Density



Channel 3652.5, 5 MHz 64QAM Power Spectral Density

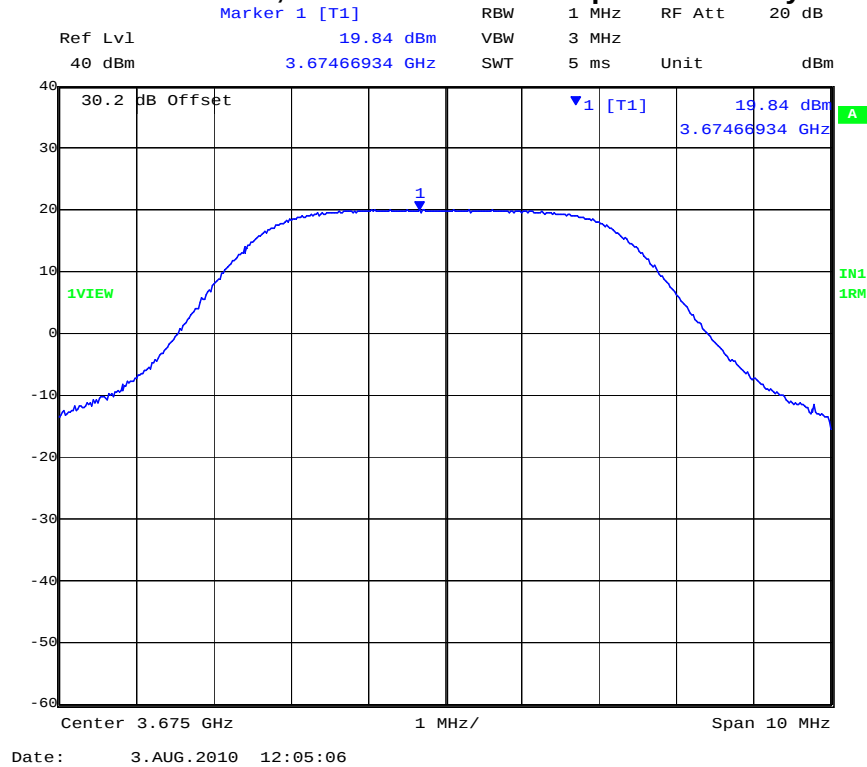


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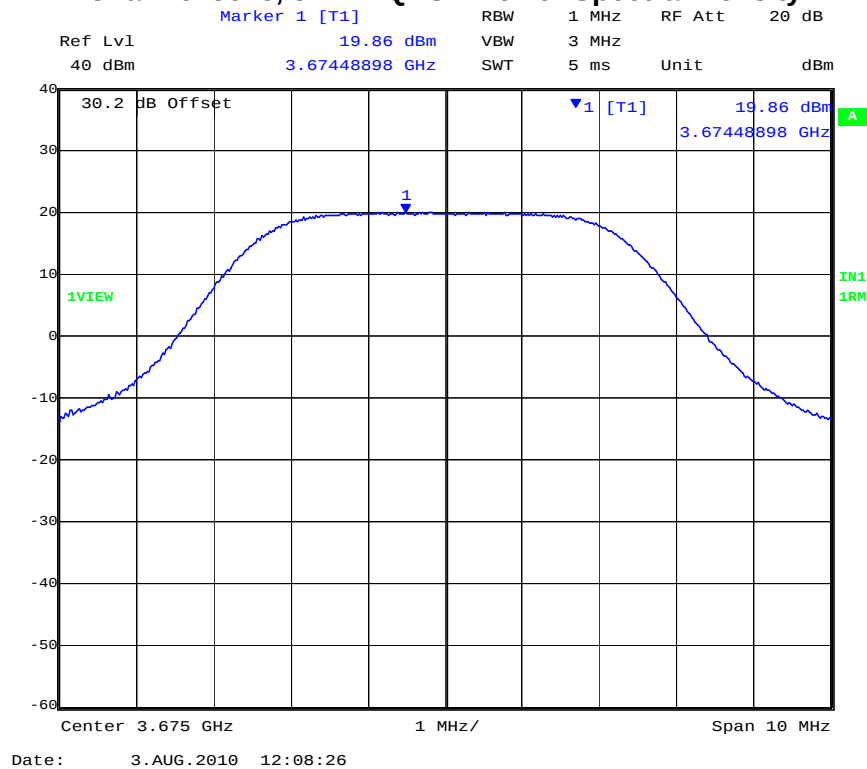


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Channel 3675, 5 MHz BPSK Power Spectral Density



Channel 3675, 5 MHz QPSK Power Spectral Density

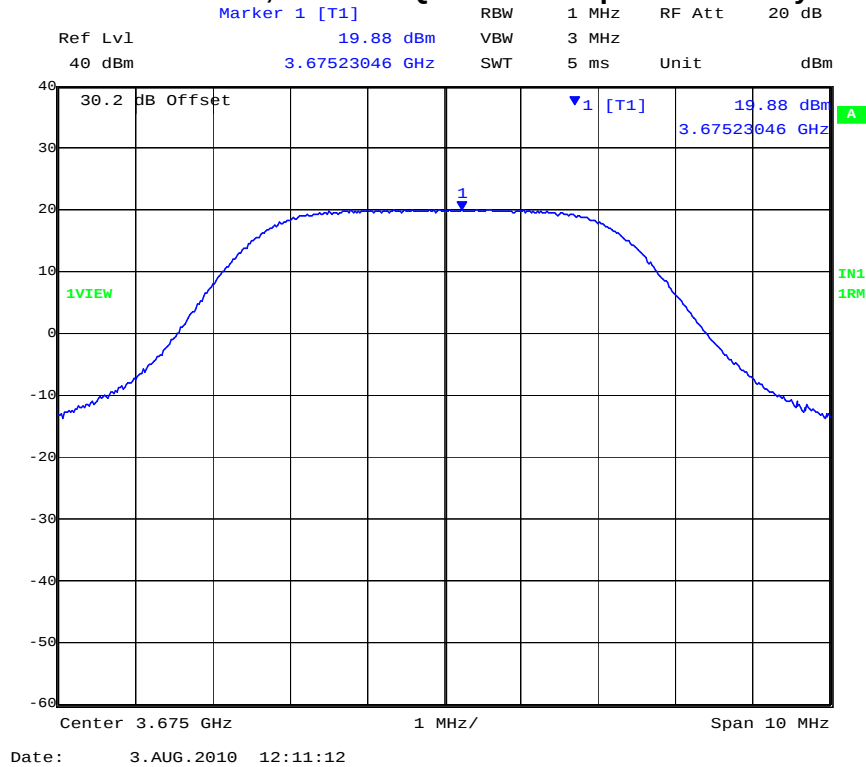


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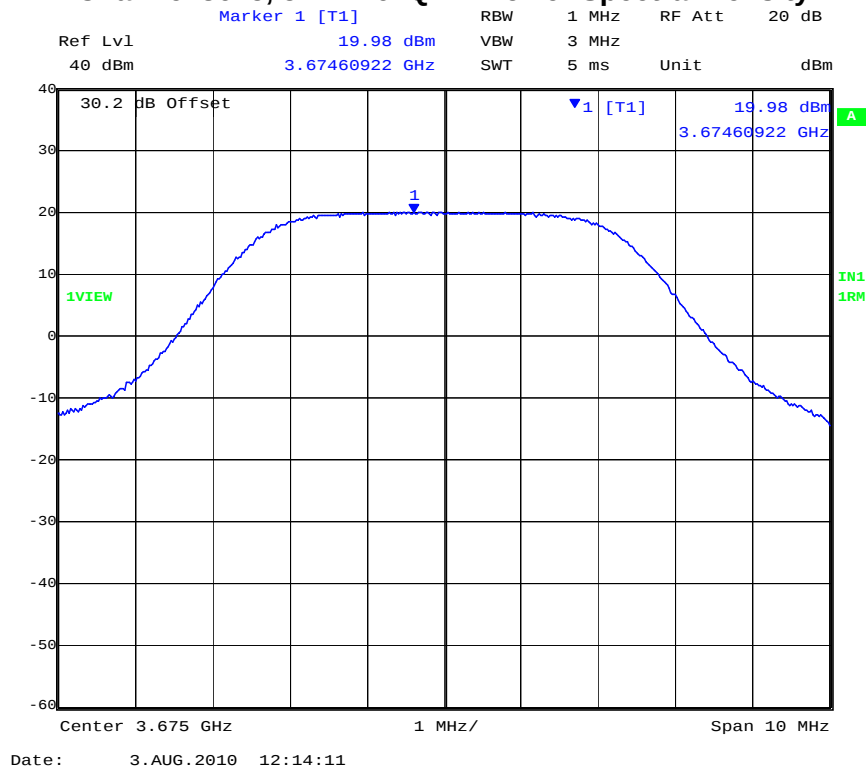


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Channel 3675, 5 MHz 16QAM Power Spectral Density



Channel 3675, 5 MHz 64QAM Power Spectral Density

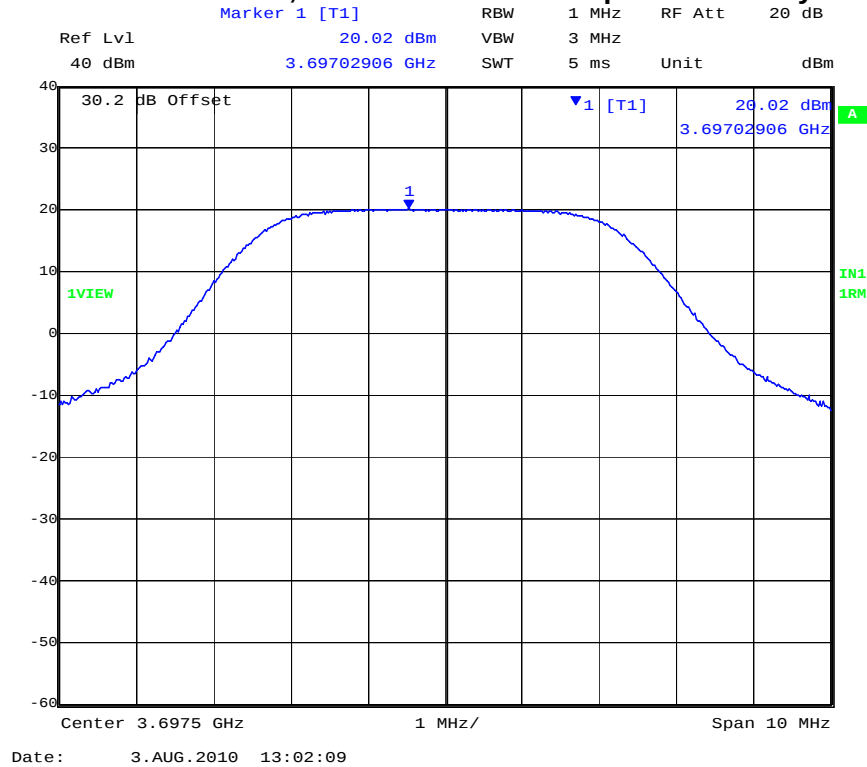


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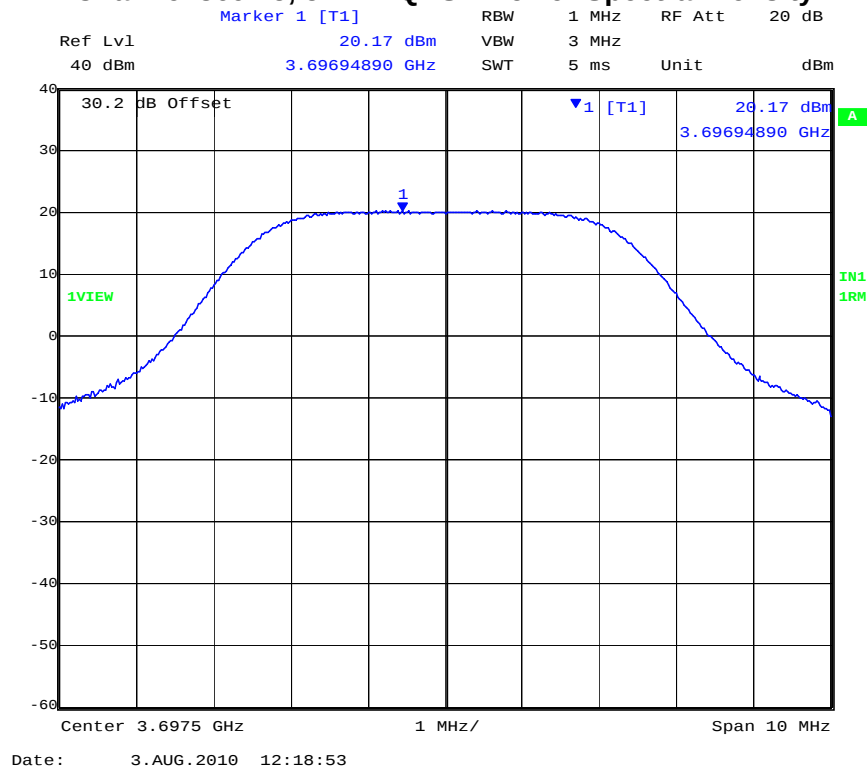


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Channel 3697.5, 5 MHz BPSK Power Spectral Density



Channel 3697.5, 5 MHz QPSK Power Spectral Density

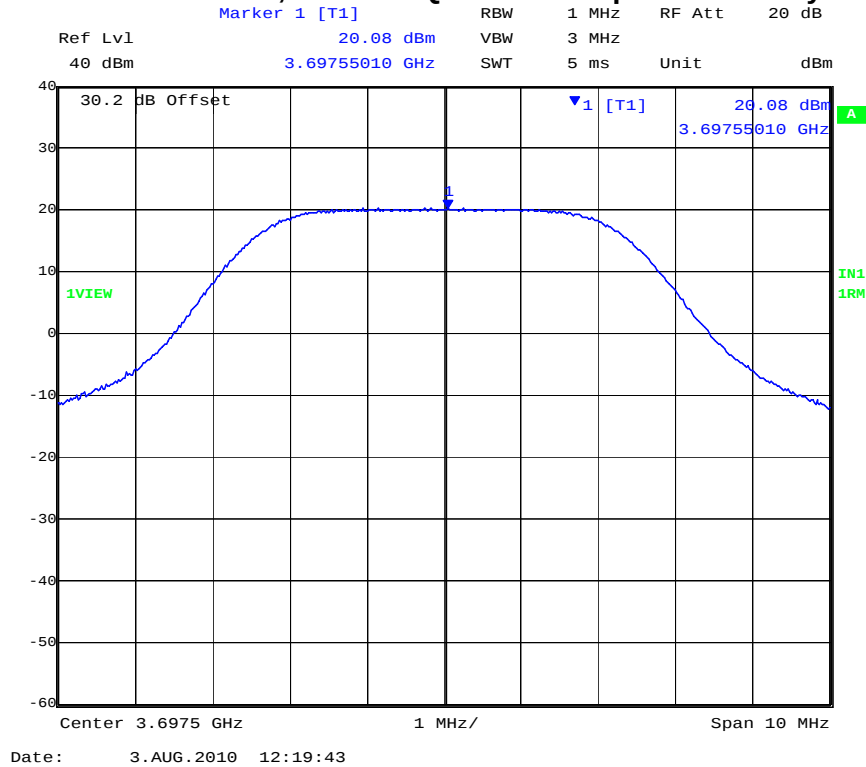


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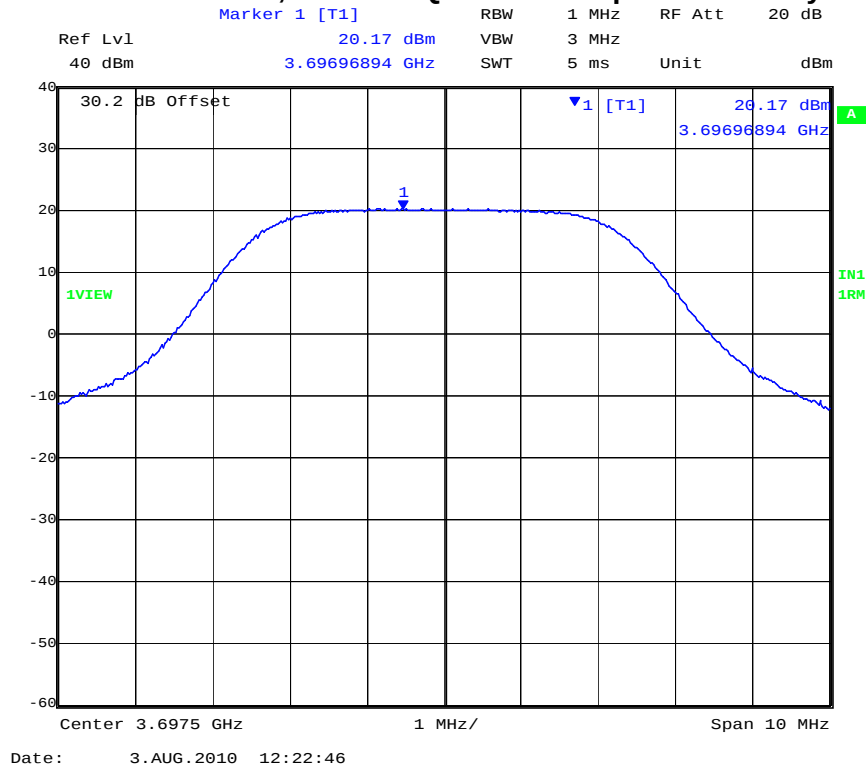


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Channel 3697.5, 5 MHz 16QAM Power Spectral Density



Channel 3697.5, 5 MHz 64QAM Power Spectral Density



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7 MHz Bandwidth

Center Frequency (MHz)	Power Spectral Density (dBm/MHz)				Minimum Margin (dB)
	BPSK	QPSK	16 QAM	64QAM	
3653.50	+18.93	+18.89	+18.88	+18.98	-11.02
3675.00	+19.30	+18.45	+18.50	+18.57	-10.70
3696.50	+18.76	+18.74	+18.77	+18.81	-11.19

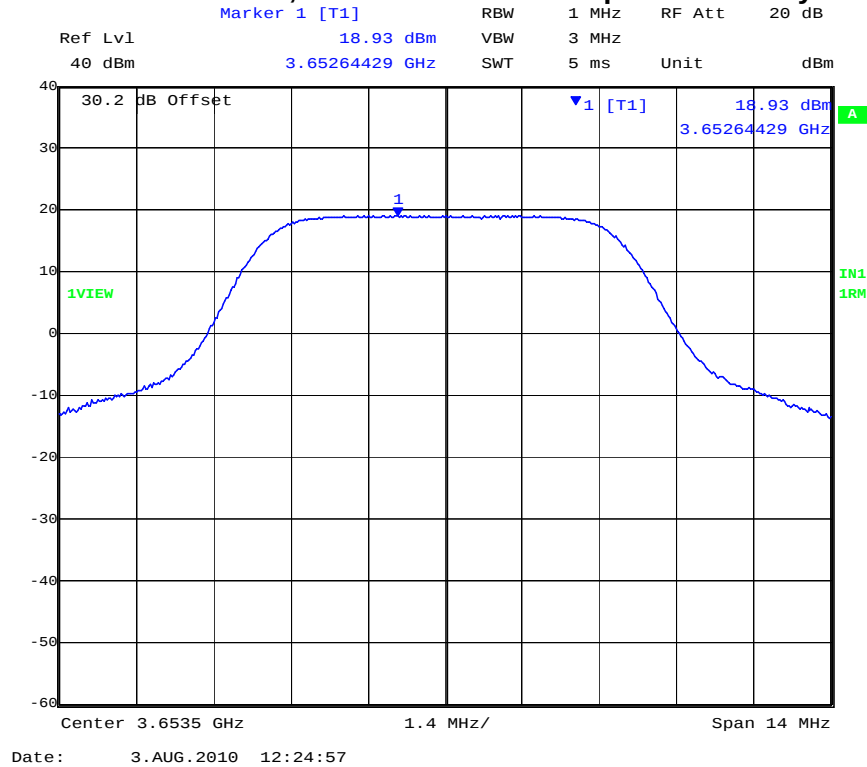
Limit: +30 dBm/MHz

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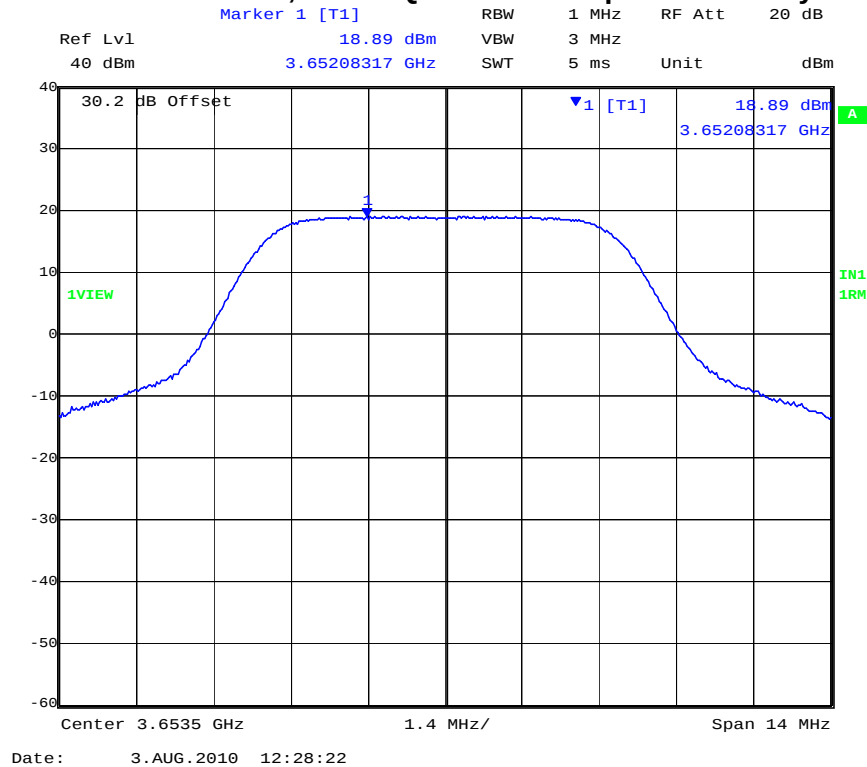


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Channel 3653.5, 7 MHz BPSK Power Spectral Density



Channel 3653.5, 7 MHz QPSK Power Spectral Density

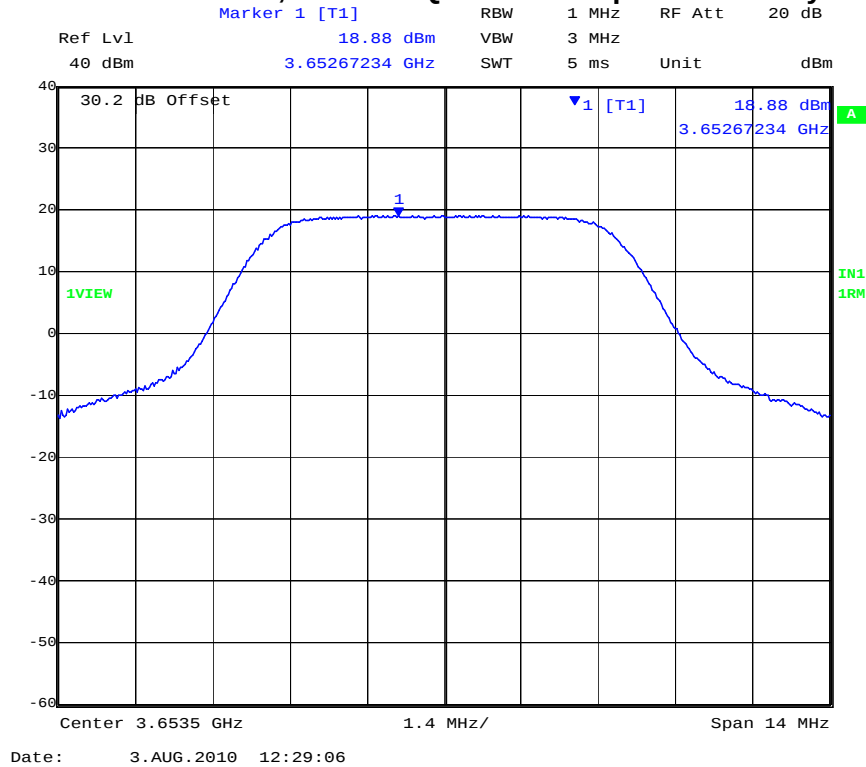


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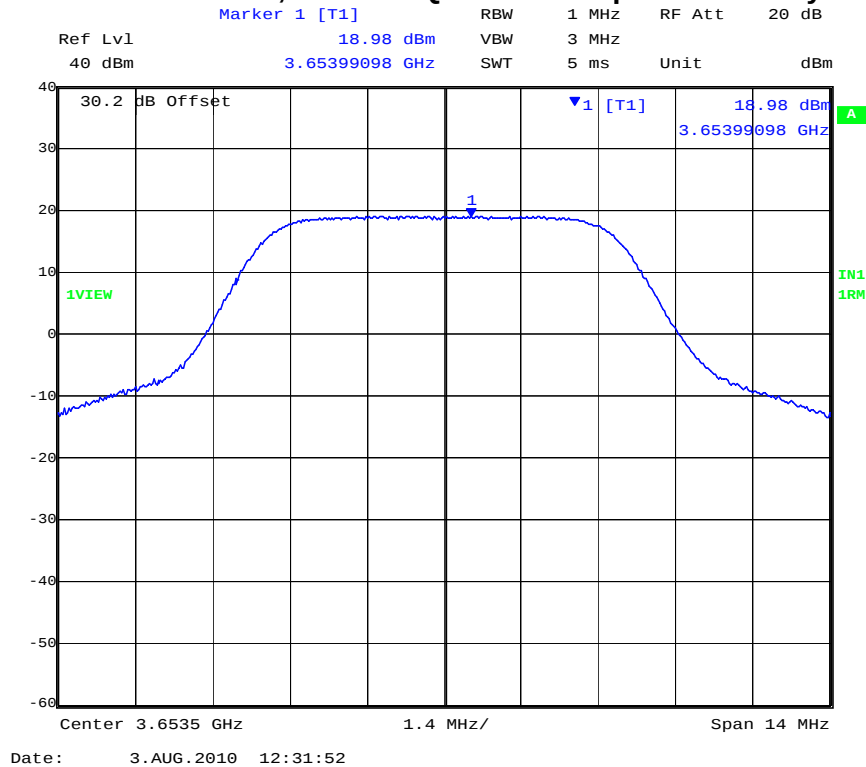


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Channel 3653.5, 7 MHz 16QAM Power Spectral Density



Channel 3653.5, 7 MHz 64QAM Power Spectral Density

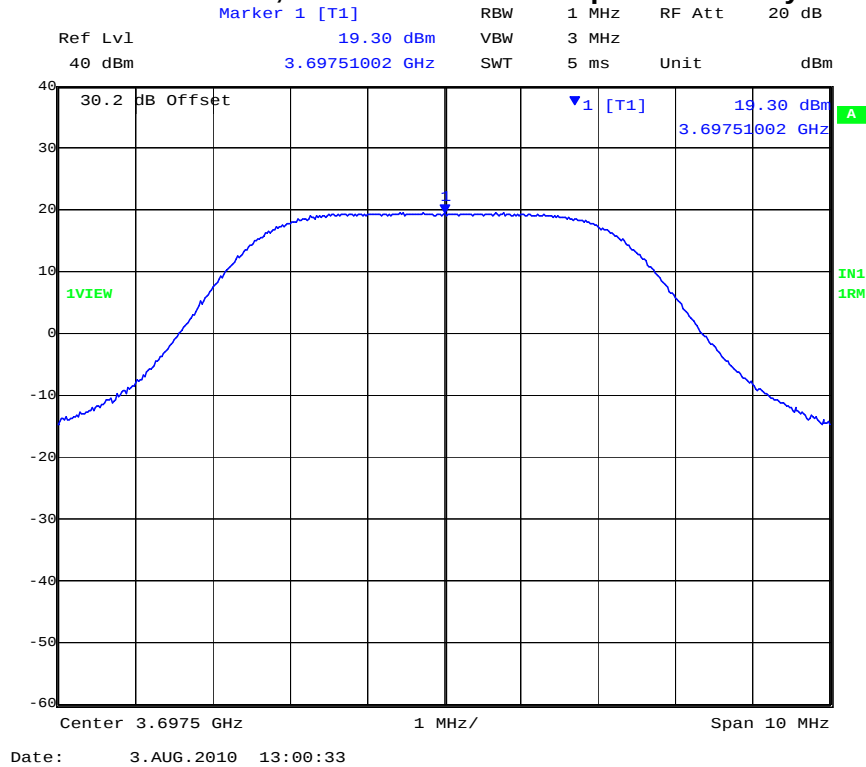


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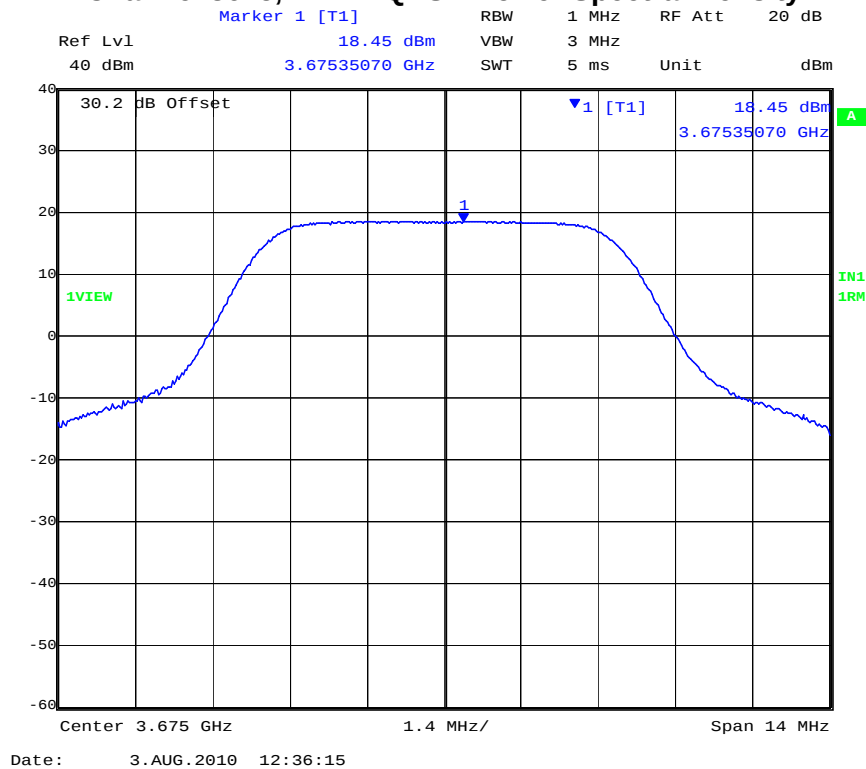


Title: Axxcelera EHD-CPE3320-C10
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Channel 3675, 7 MHz BPSK Power Spectral Density



Channel 3675, 7 MHz QPSK Power Spectral Density

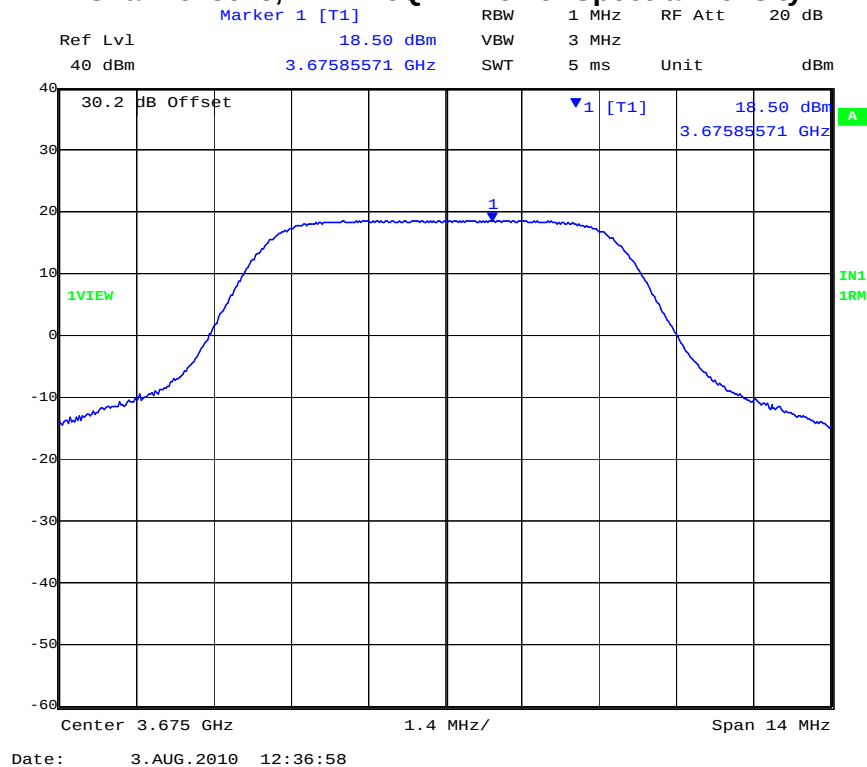


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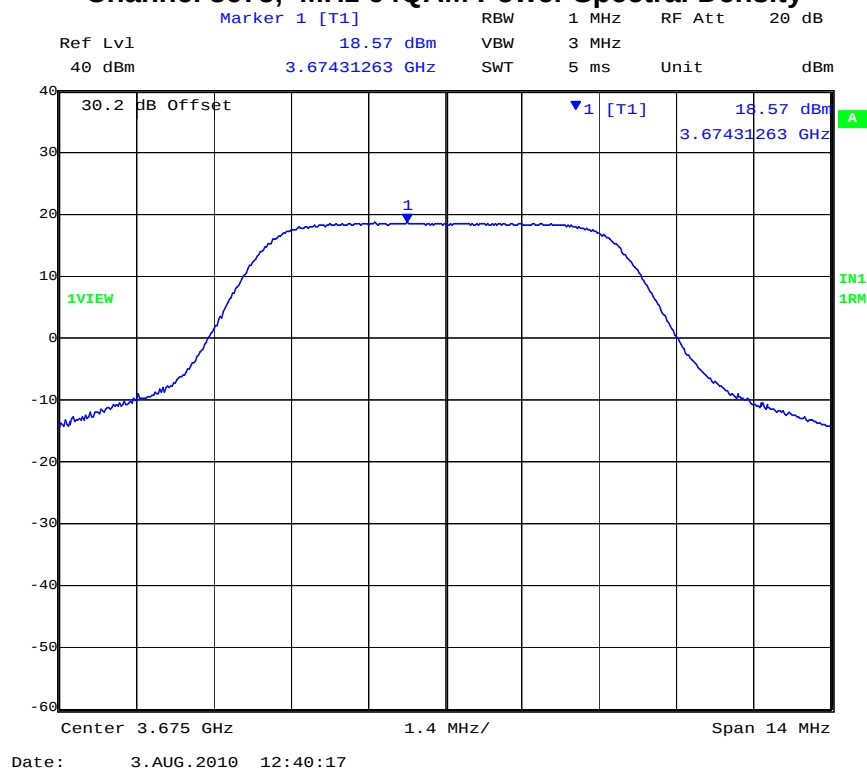


Title: Axxcelera EHD-CPE3320-C10
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Channel 3675, MHz 16QAM Power Spectral Density



Channel 3675, MHz 64QAM Power Spectral Density

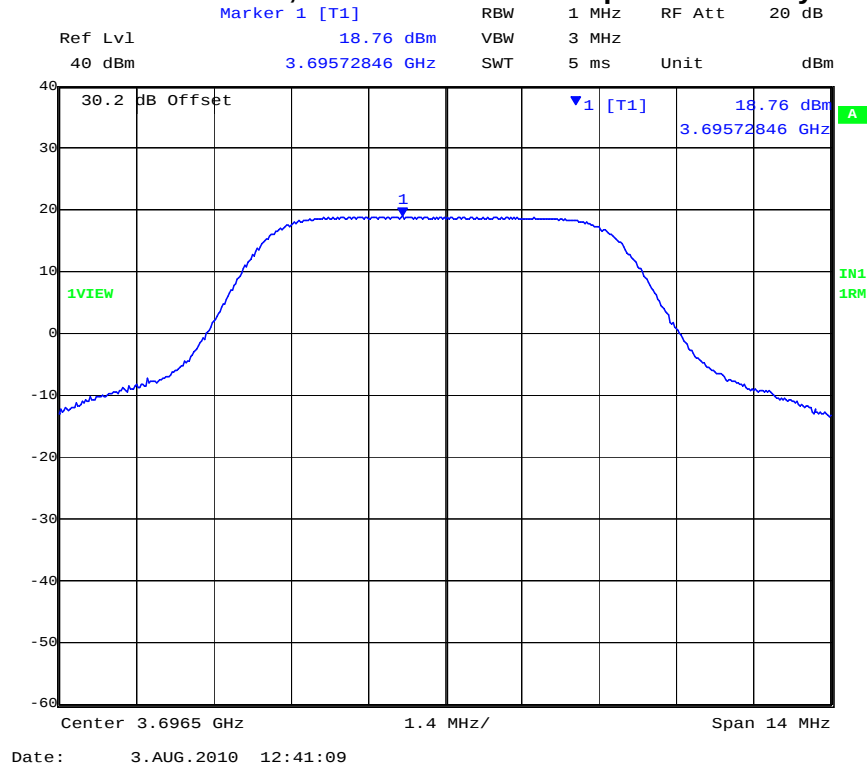


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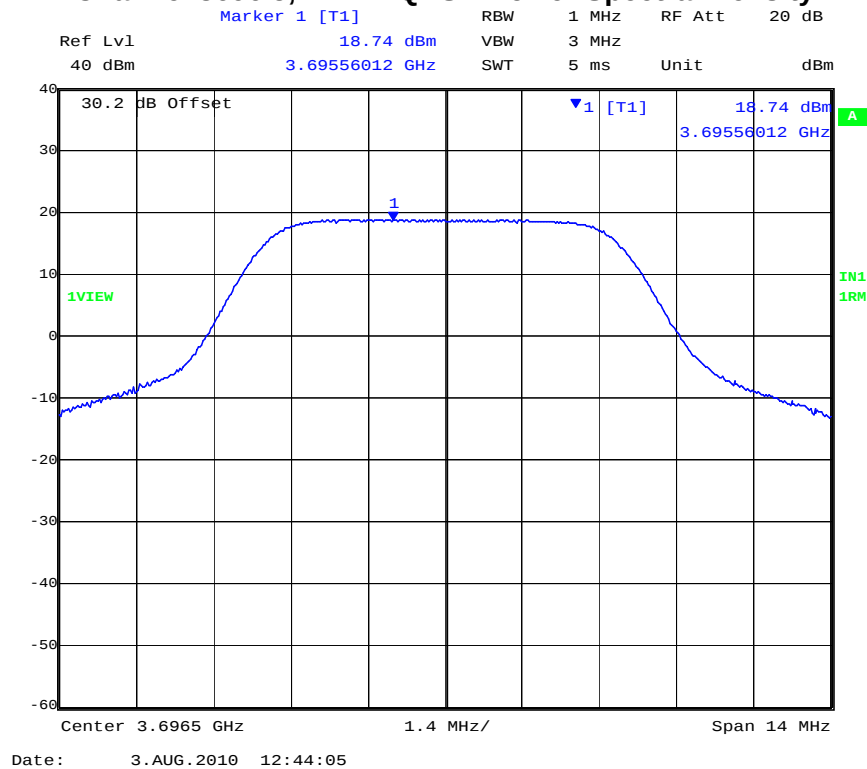


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Channel 3696.5, 7 MHz BPSK Power Spectral Density



Channel 3696.5, 7 MHz QPSK Power Spectral Density

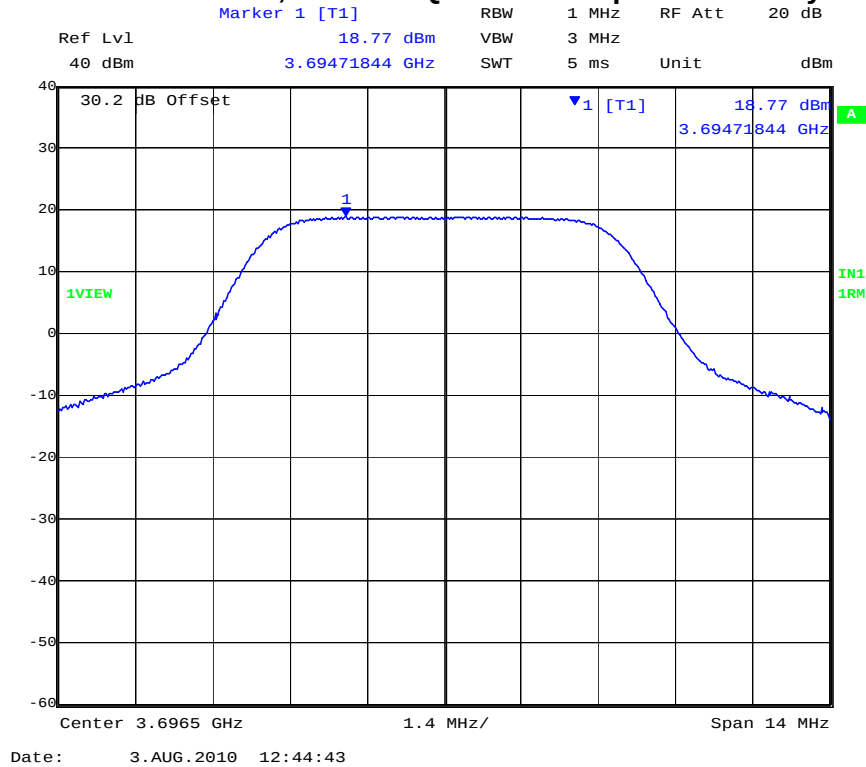


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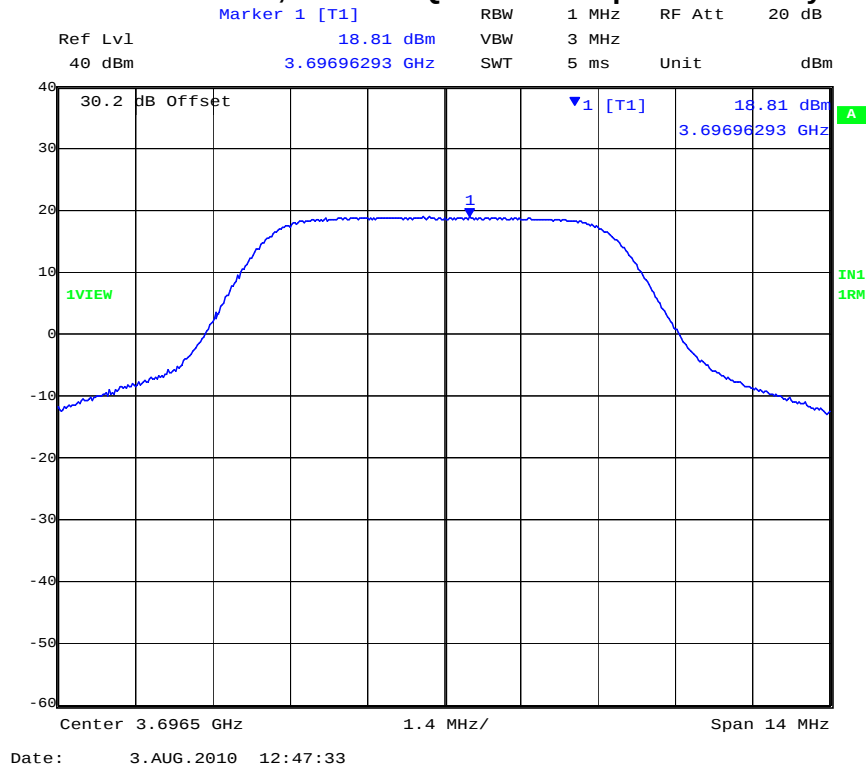


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Channel 3696.5, 7 MHz 16QAM Power Spectral Density



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
Industry Canada RSS-Gen 5.5

Calculations for Maximum Permissible Exposure Levels

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

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

P = Peak output power (mW)

G = Antenna numeric gain (numeric)

d = Separation distance (cm)

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

The Axxcelera EHD-CPE3320-C10 has a single transmitter. The calculated safe distance is computed using;

the highest conducted power measured (+25.35dBm) when used with the 11dBi antenna;

the calculated maximum conducted power (+23.4dBm) that can be used with the 16dBi antenna to meet EIRP requirements.

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	11	12.6	+25.35	342.8	18.5	20.0*
3650	16	39.8	+23.40	218.8	26.3	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.

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 = 1mW / 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)

Industry Canada RSS-197 Section 5.3

Test Procedure

The transmitter output was connected to a spectrum analyzer and the frequency stability was measured in a Continuous Wave (CW).

Frequency stability was measured through the extremes of temperature 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

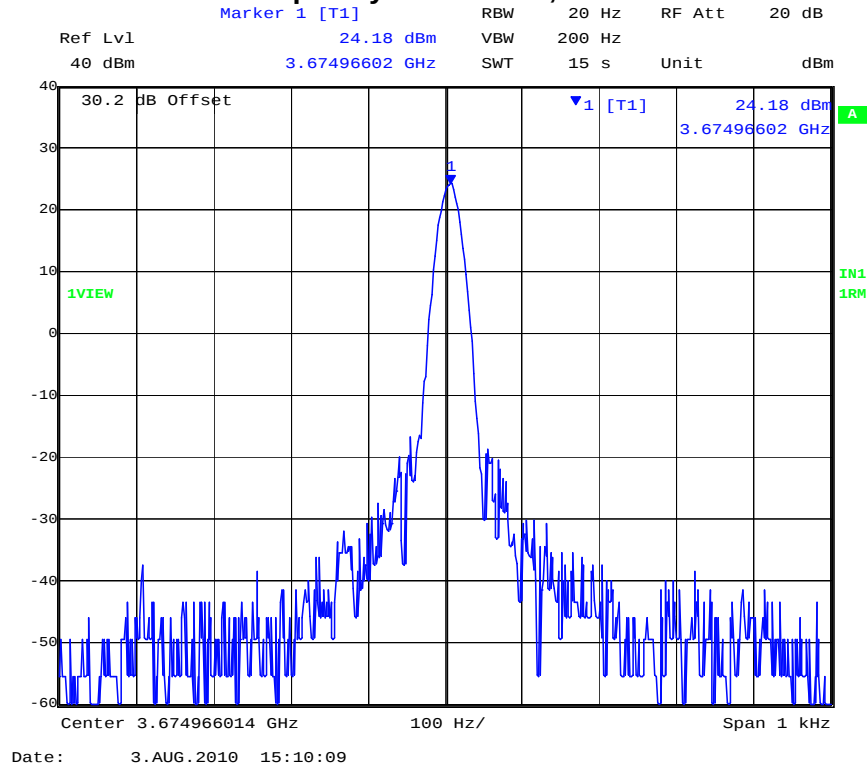
Voltage	Temperature (°C)	Center Frequency (MHz)	Delta (kHz)	ppm
48 Vdc	-33	3674.96602	-33.98	-9.25
	-30	3674.96968	-30.32	-8.25
	-20	3674.98874	-11.26	-3.06
	-10	3674.98309	-16.91	-4.60
	+0	3674.98792	-12.08	-3.29
	+10	3674.99352	-6.48	-1.76
	+20	3674.98338	-16.62	-4.52
43.2 Vdc	+20	3674.98377	-16.23	-4.42
52.8 Vdc	+20	3674.98595	-14.05	-3.82
48 Vdc	+30	3674.97296	-27.04	-7.36
	+40	3674.96706	-32.94	-8.96
	+50	3674.96659	-33.41	-9.09
	+55	3674.96854	-31.46	-8.56
Maximum Frequency Drift with respect to the nominal frequency		-33.98 kHz, -9.25 ppm		

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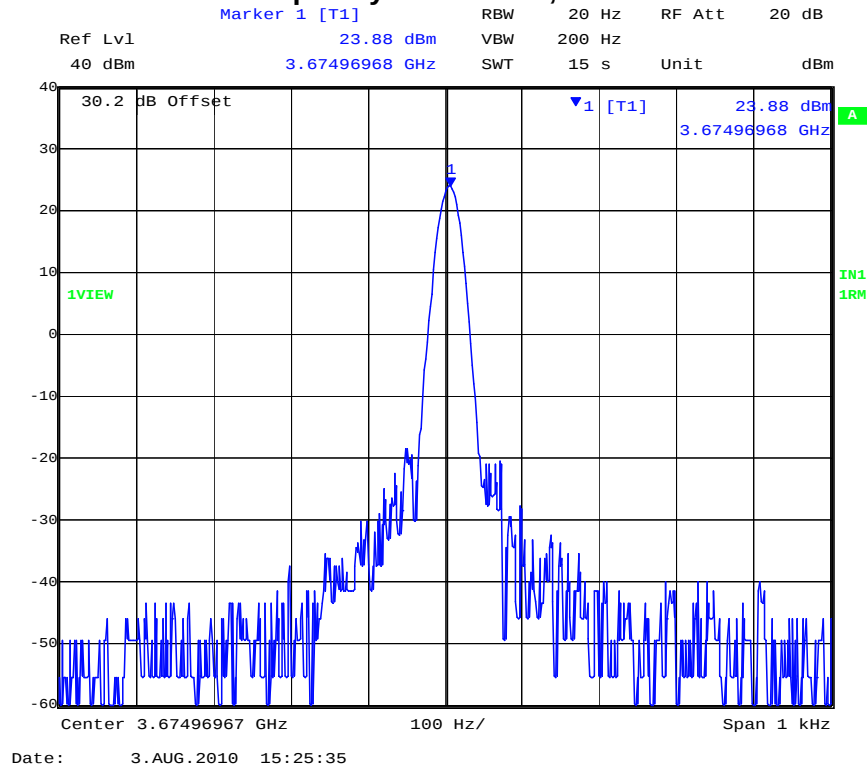


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Frequency Error -33°C, 48Vdc



Frequency Error -30°C, 48Vdc

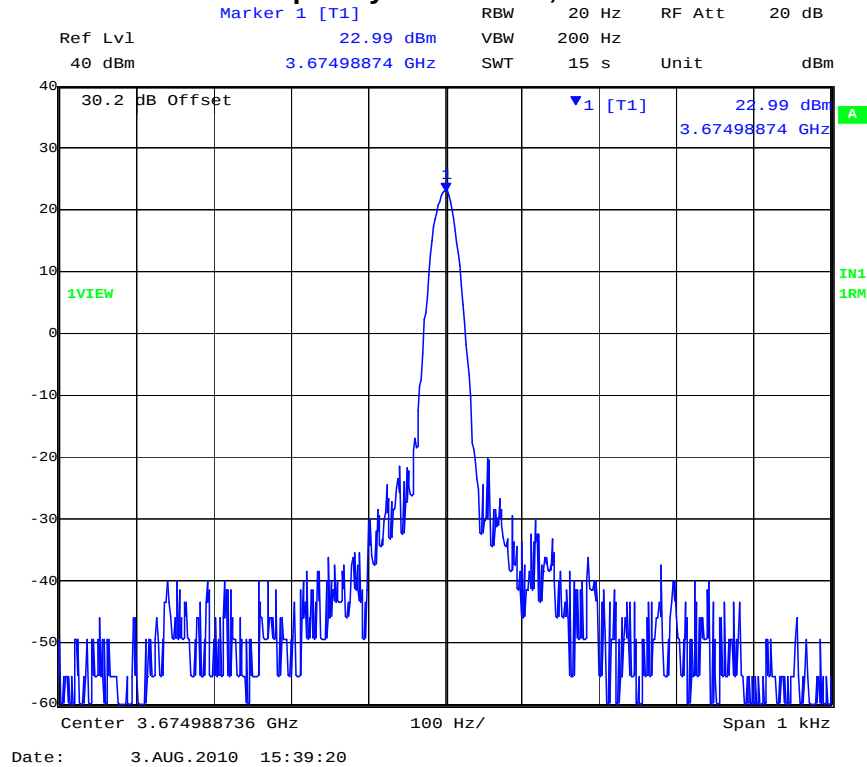


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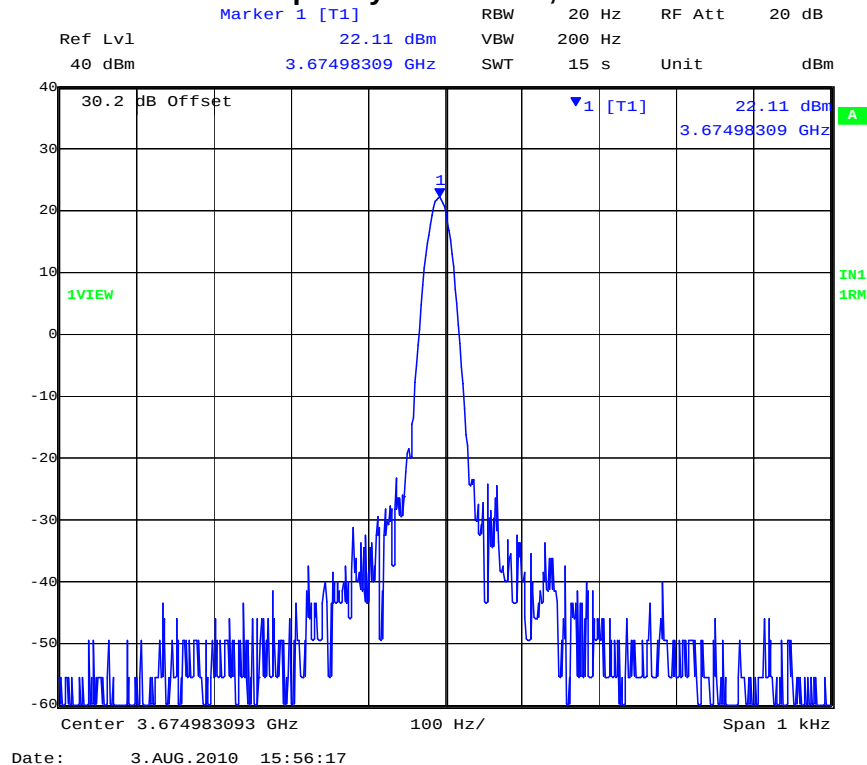


Title: Axxcelera EHD-CPE3320-C10
To: FCC Part 90 SubPart Z, RSS-197
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Frequency Error -20°C, 48Vdc



Frequency Error -10°C, 48Vdc

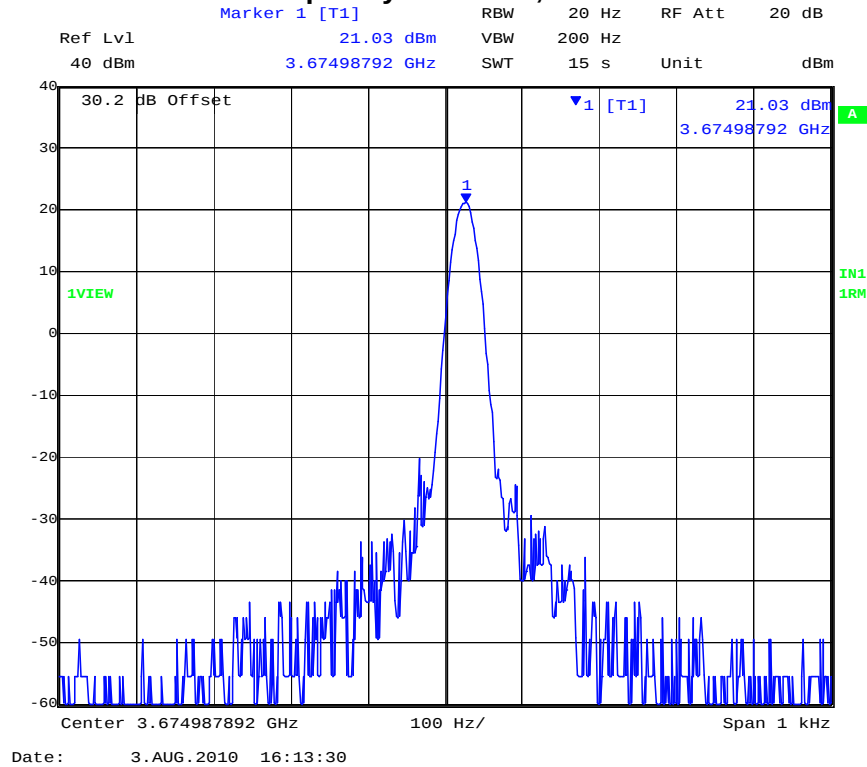


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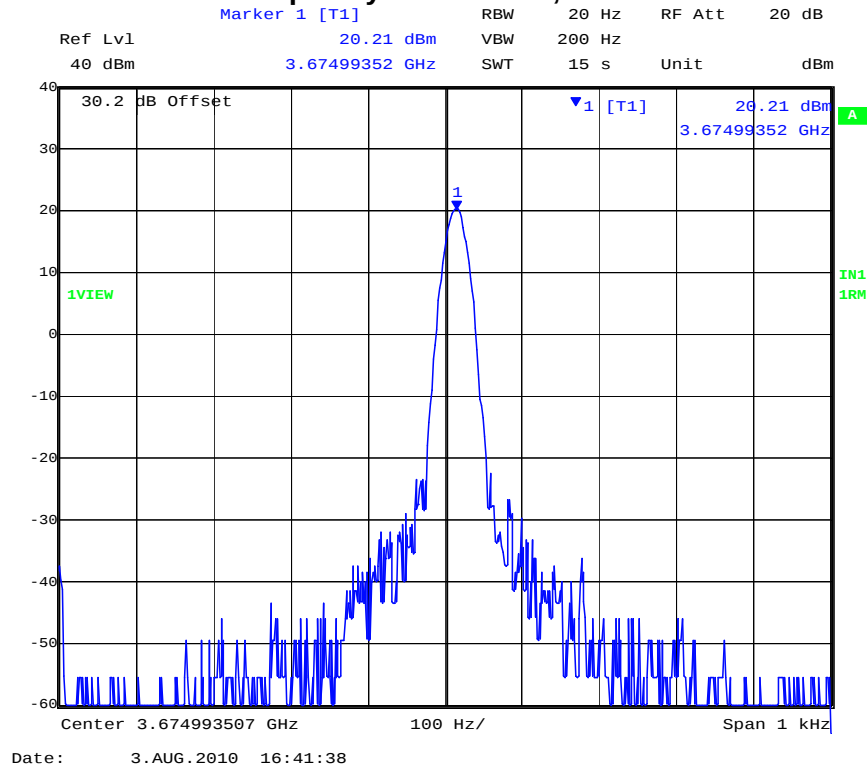


Title: Axxcelera EHD-CPE3320-C10
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Frequency Error 0°C, 48Vdc



Frequency Error +10°C, 48Vdc

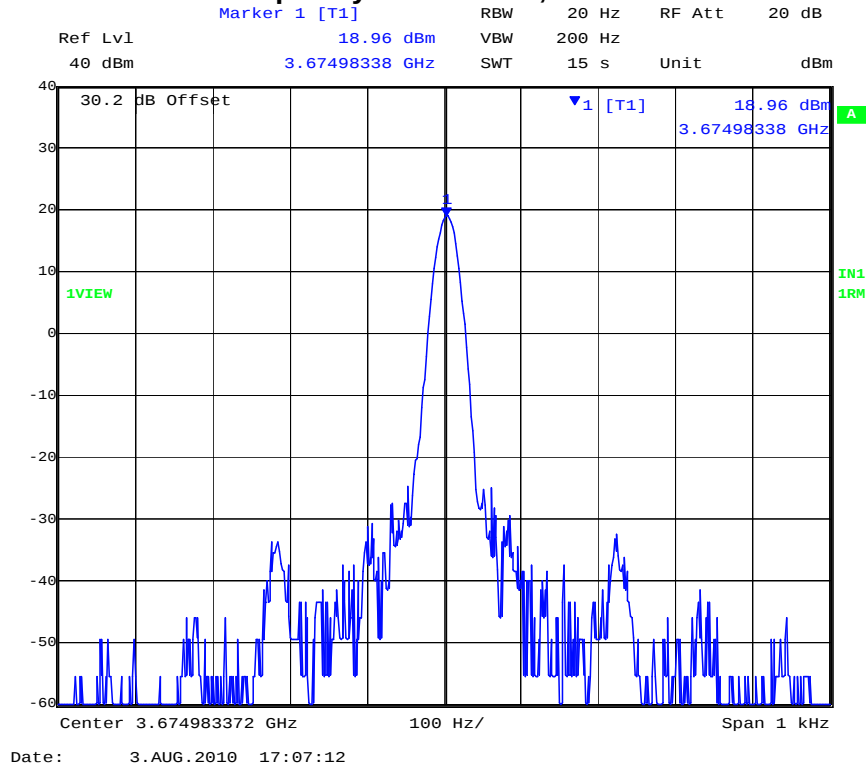


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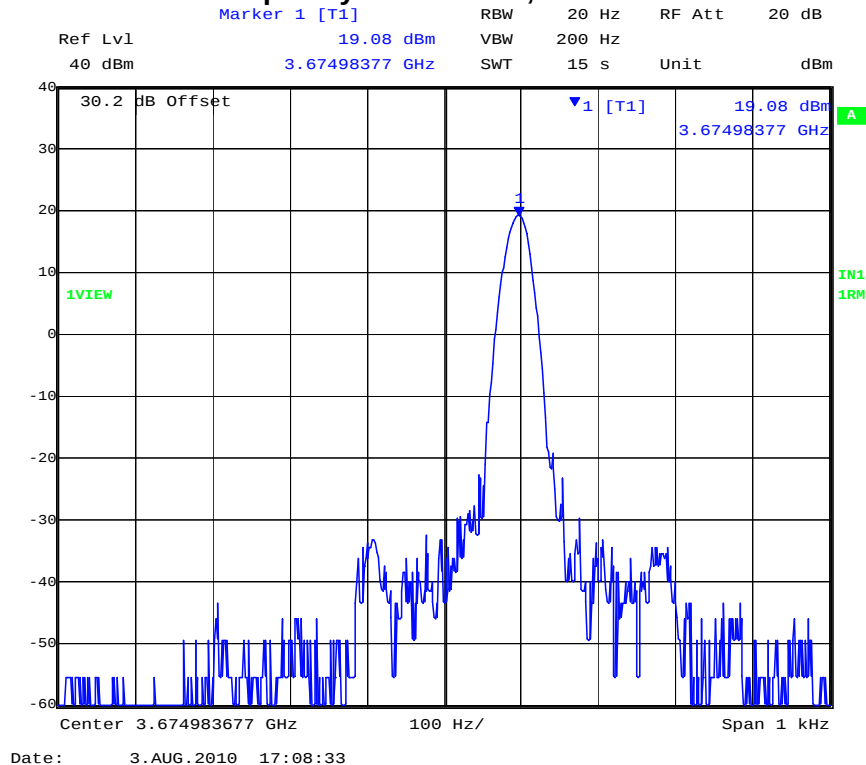


Title: Axxcelera EHD-CPE3320-C10
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Frequency Error +20°C, +48 Vdc



Frequency Error +20°C, +43.2 Vdc

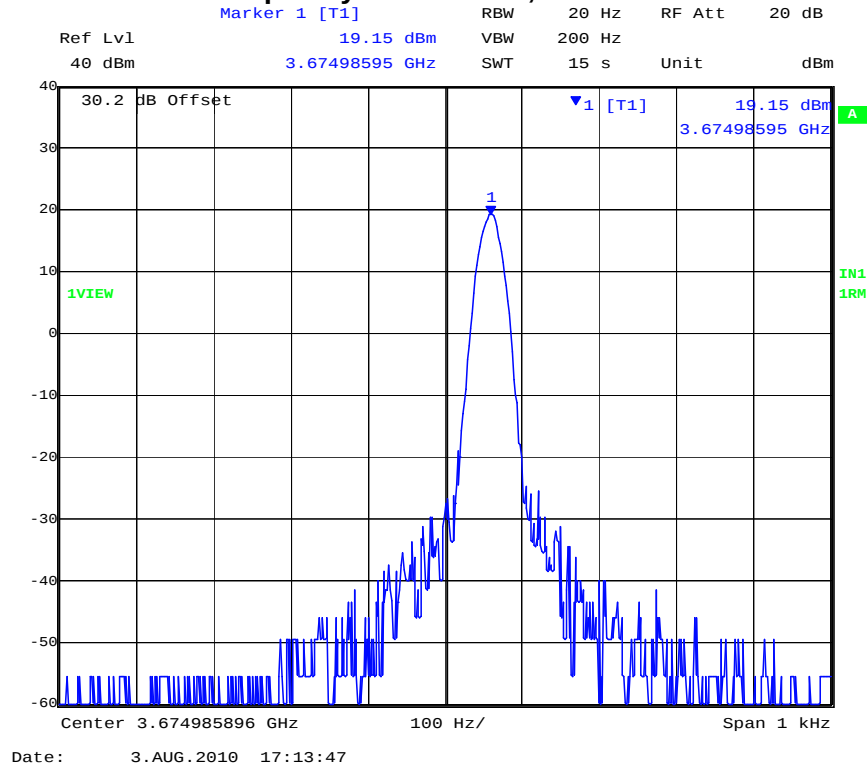


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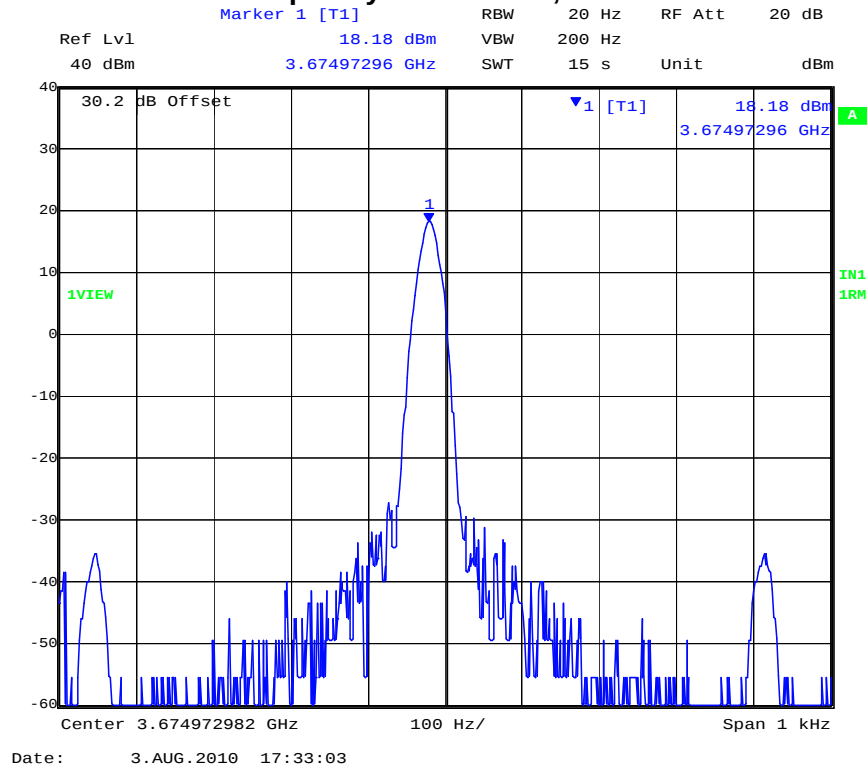


Title: Axxcelera EHD-CPE3320-C10
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Frequency Error +20°C, +52.8 Vdc



Frequency Error +30°C, 48Vdc

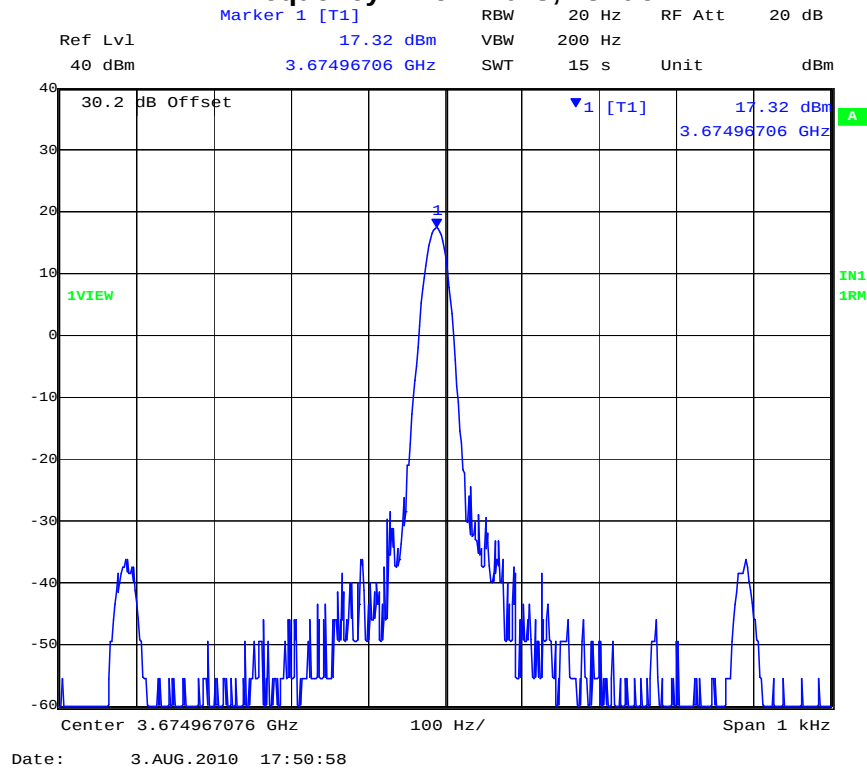


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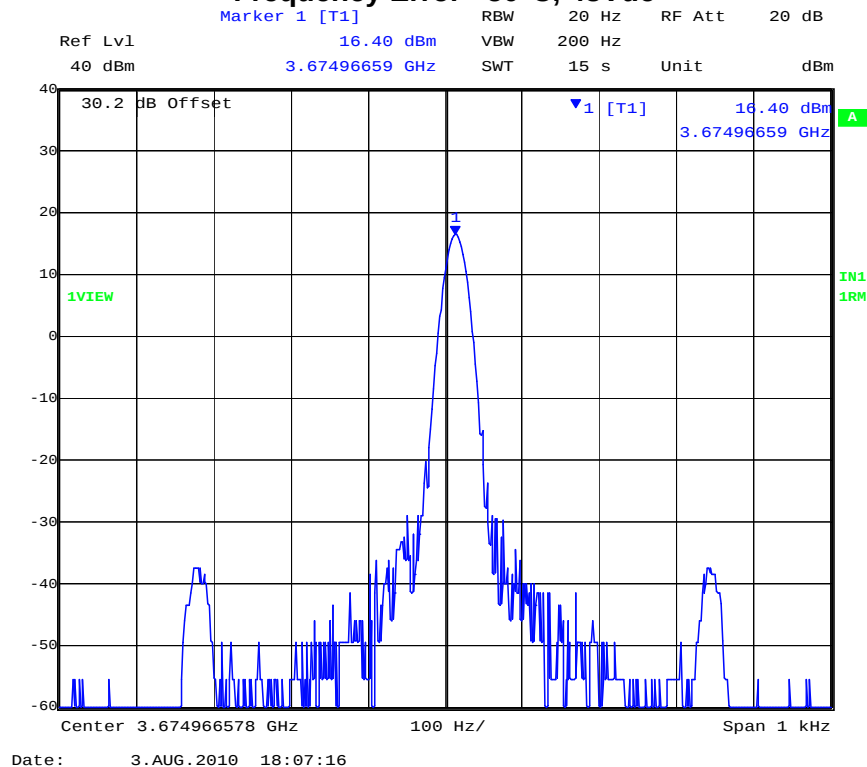


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Frequency Error +40°C, 48Vdc



Frequency Error +50°C, 48Vdc

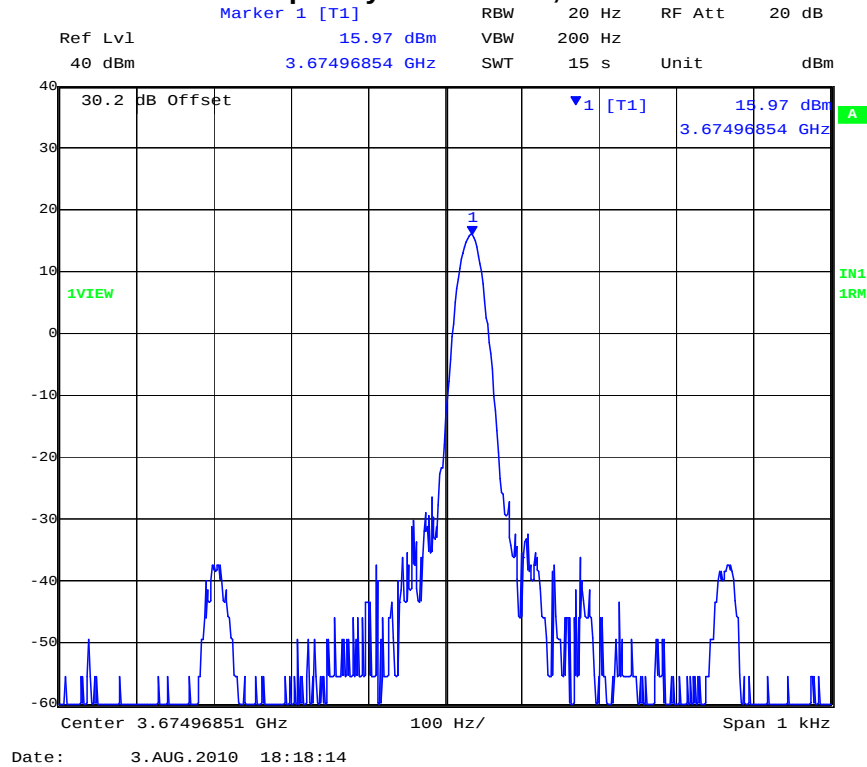


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Frequency Error +55°C, 48Vdc



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Laboratory Measurement Uncertainty for Frequency Stability

Measurement uncertainty	± 0.866 ppm
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Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-02 'Frequency Measurement'	0070, 0116, 0158, 0193, 0252, 0313, 0314.

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5.1.6. Spectrum Mask & Spurious Emissions at Antenna Terminal

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

Industry Canada RSS-197 Section 5.7

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

Test Procedure

Transmitter spectrum mask was measured for all modulation schemes and channel bandwidths at the 3,650 MHz and 3700 MHz band-edges. Transmitter conducted spurious emissions were measured on the low, middle and high channels in BPSK 3.5 MHz bandwidth mode to prove compliance. 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 %

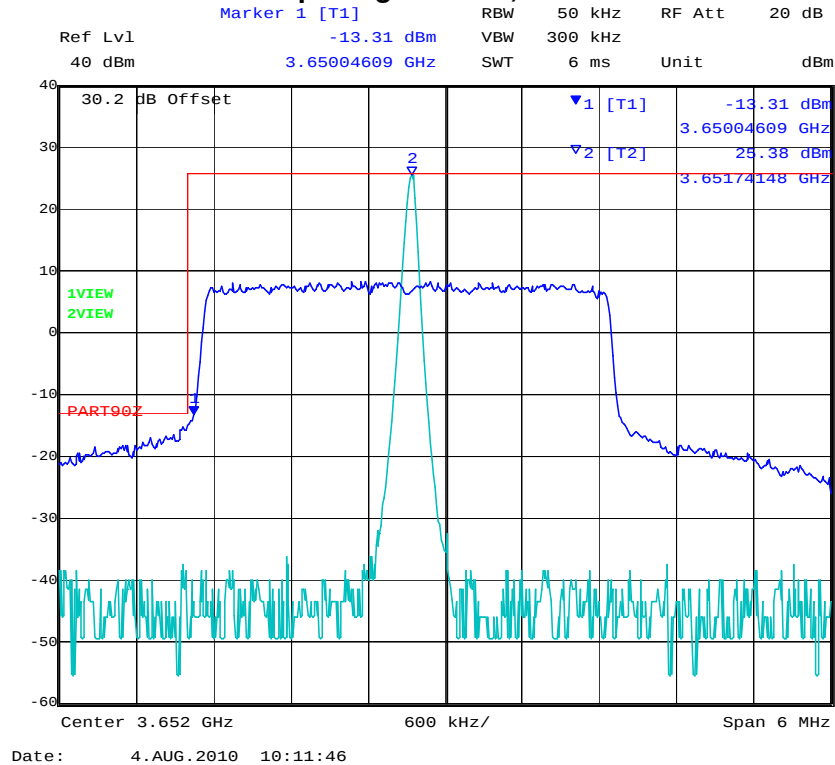
Pressure: 999 to 1012 mbar

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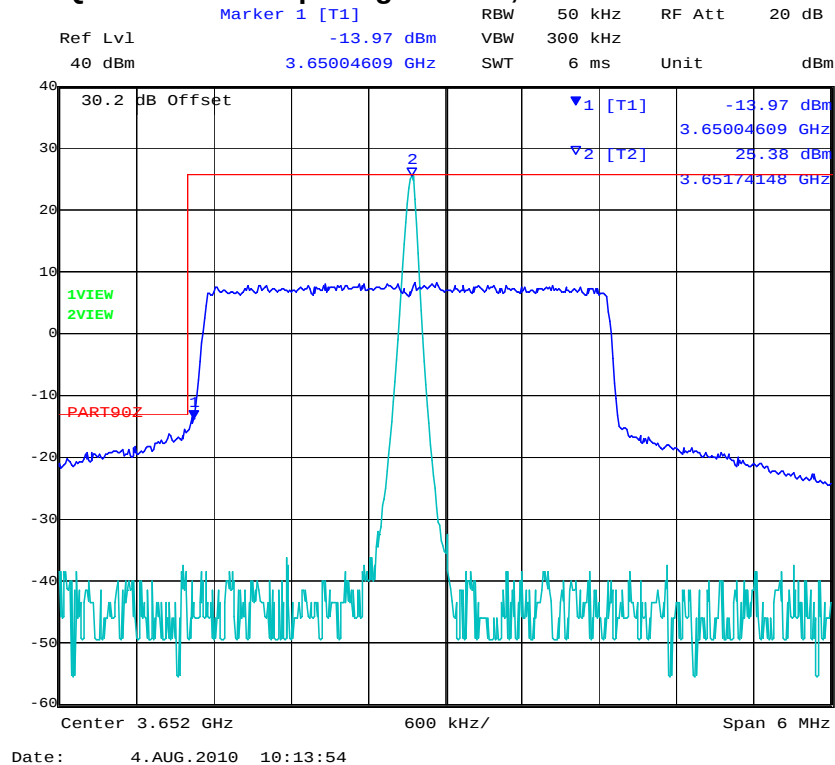


Title: Axxcelera EHD-CPE3320-C10
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BPSK Channel Spacing 3.5 MHz, Channel 3651.75 MHz



QPSK Channel Spacing 3.5 MHz, Channel 3651.75 MHz

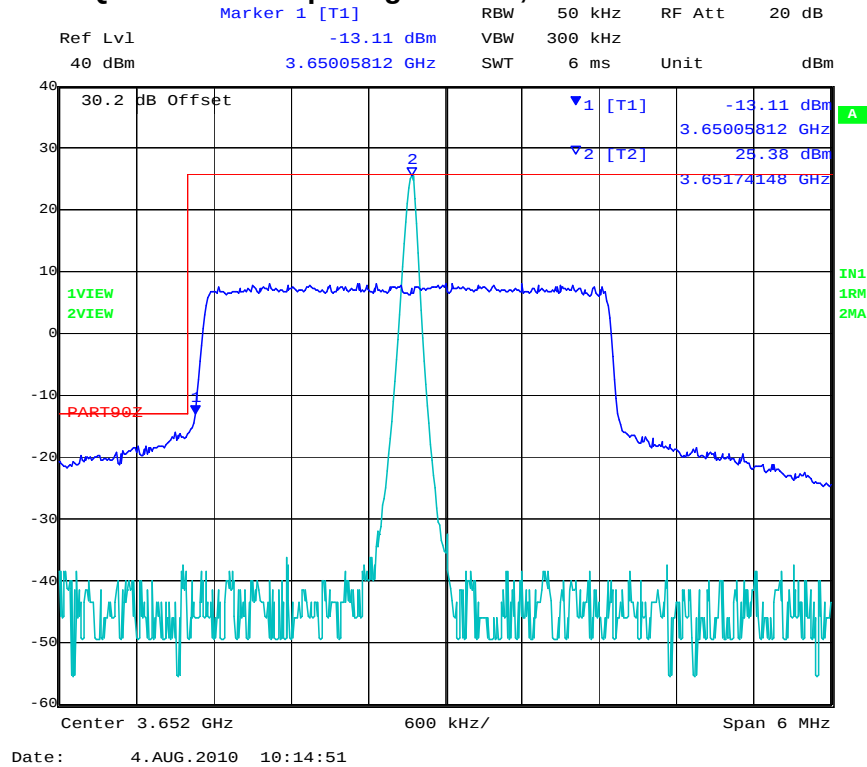


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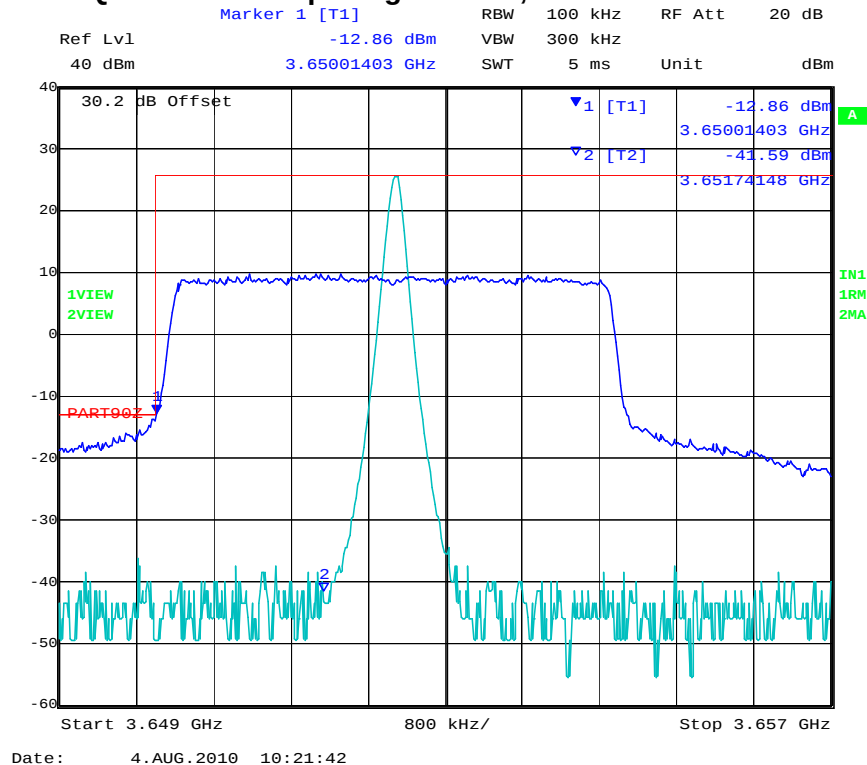


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16QAM Channel Spacing 3.5 MHz, Channel 3651.75 MHz



64QAM Channel Spacing 3.5 MHz, Channel 3651.75 MHz

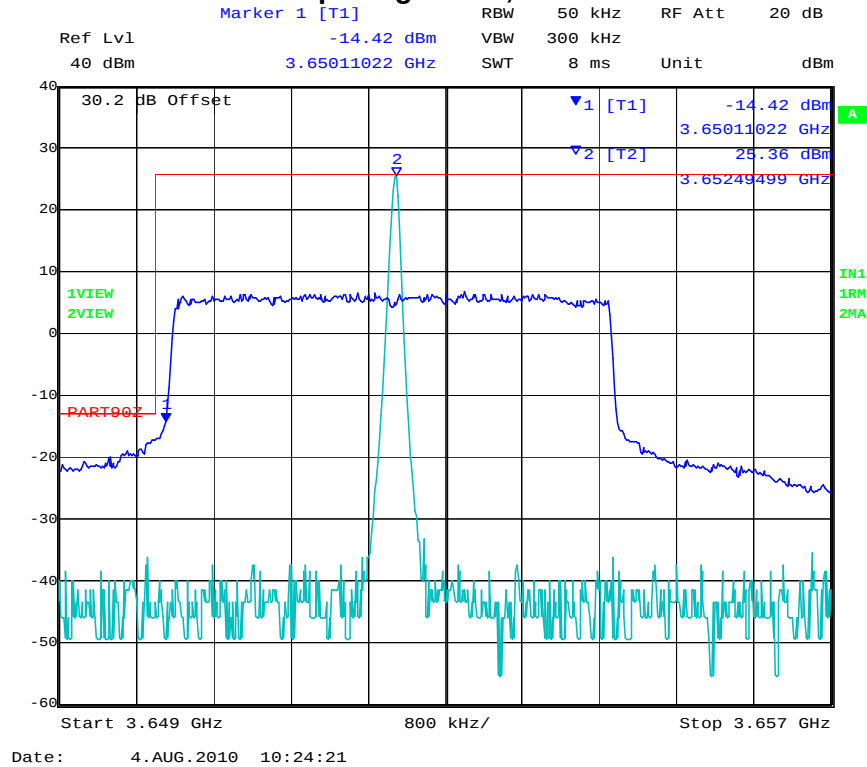


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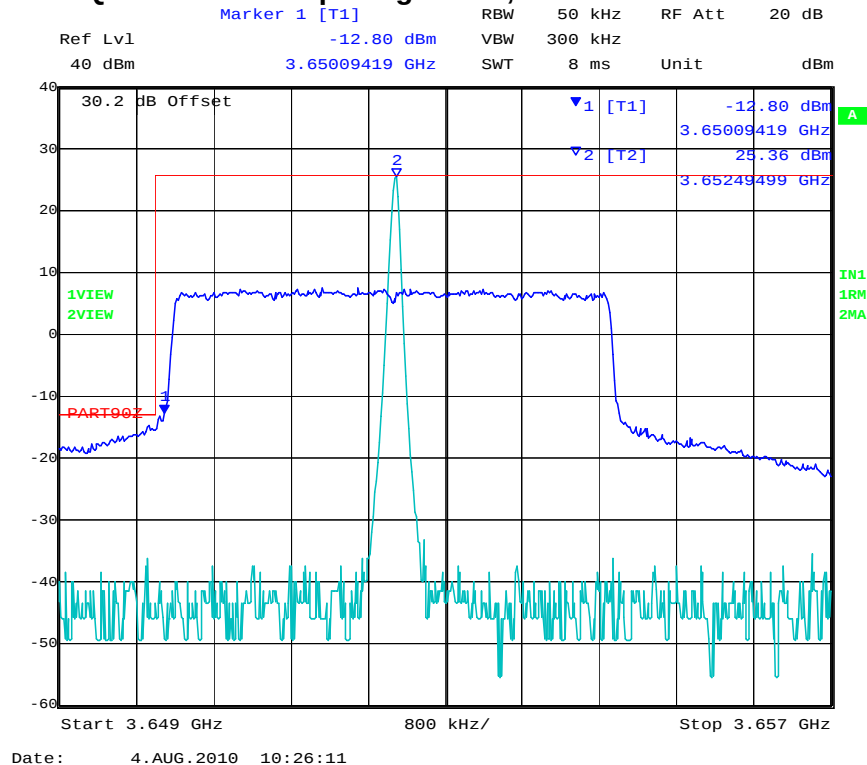


Title: Axxcelera EHD-CPE3320-C10
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BPSK Channel Spacing 5 MHz, Channel 3652.5 MHz

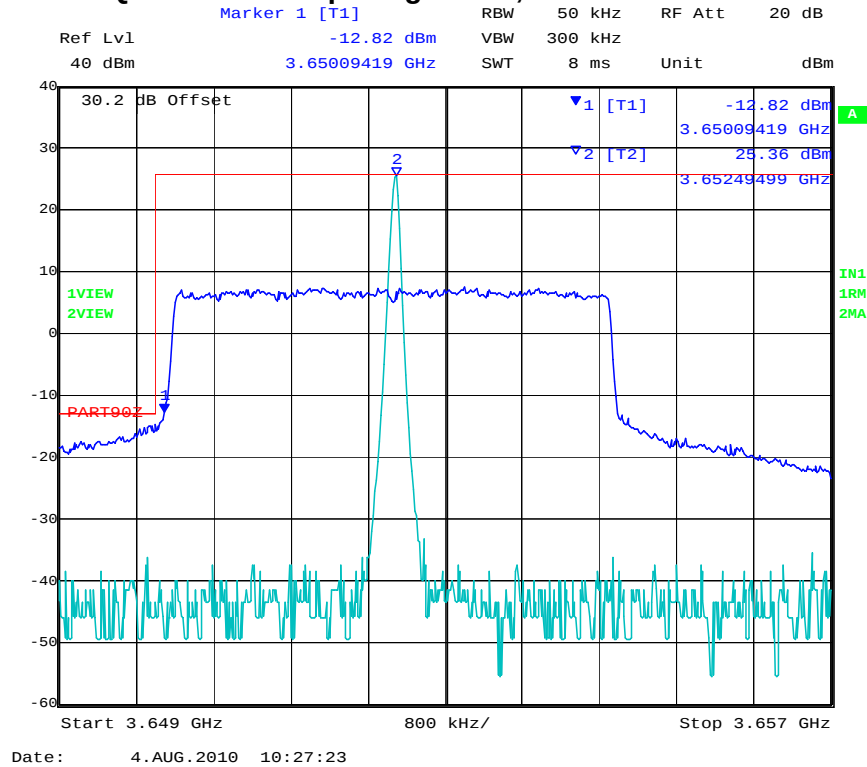


QPSK Channel Spacing 5 MHz, Channel 3652.5 MHz

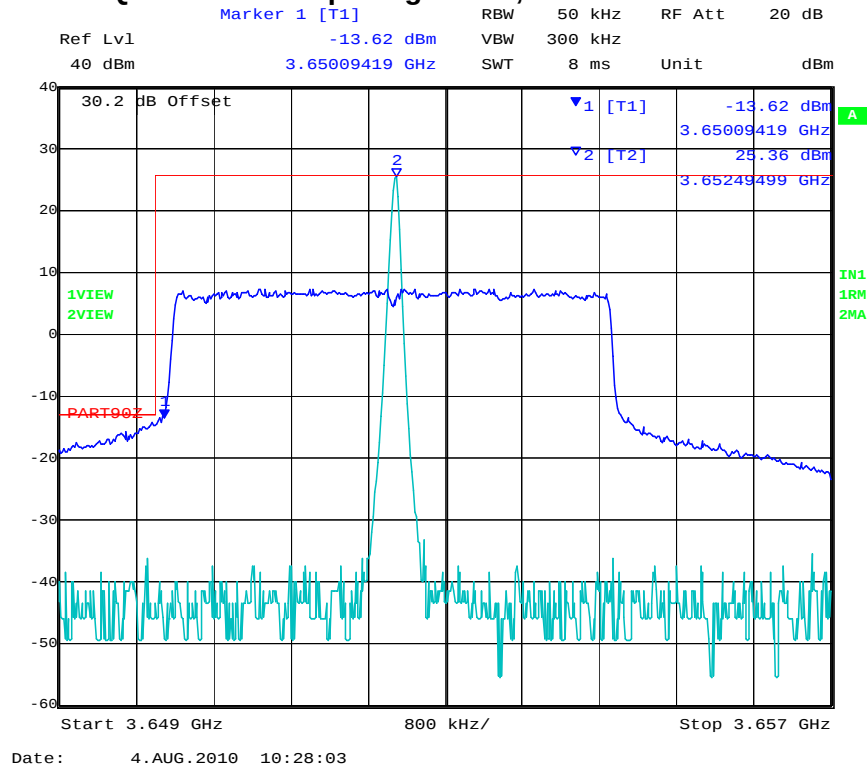


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16QAM Channel Spacing 5 MHz, Channel 3652.5 MHz



64QAM Channel Spacing 5 MHz, Channel 3652.5 MHz

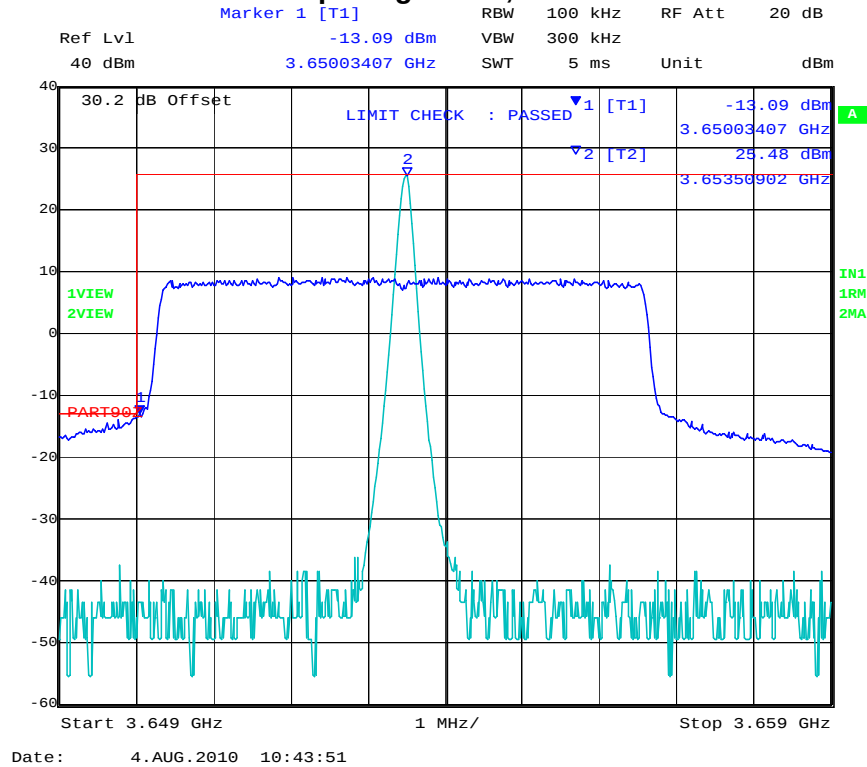


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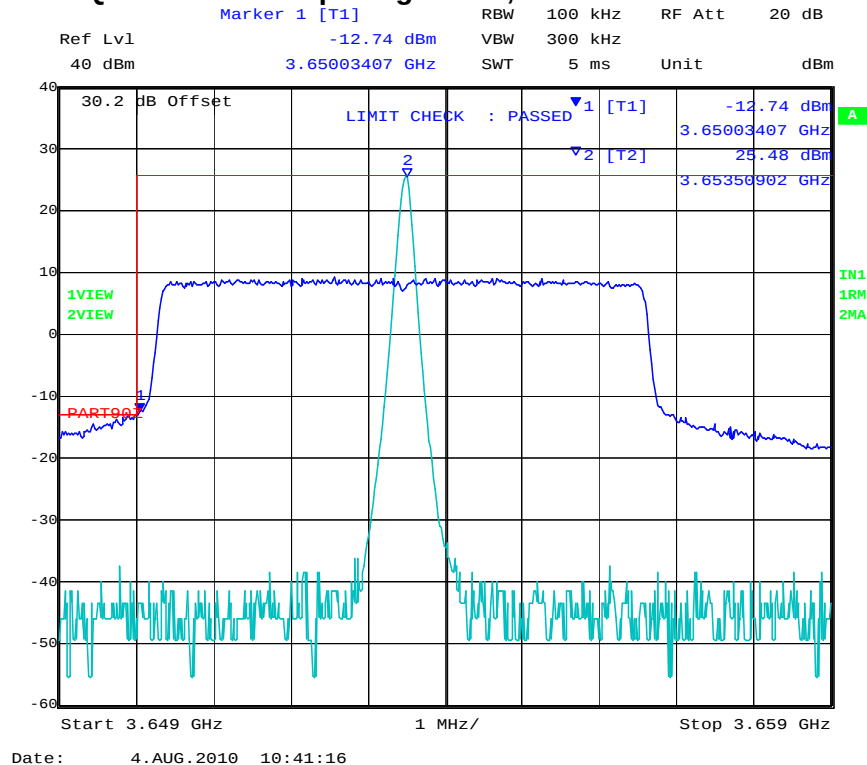


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BPSK Channel Spacing 7 MHz, Channel 3653.5 MHz



QPSK Channel Spacing 7 MHz, Channel 3653.5 MHz

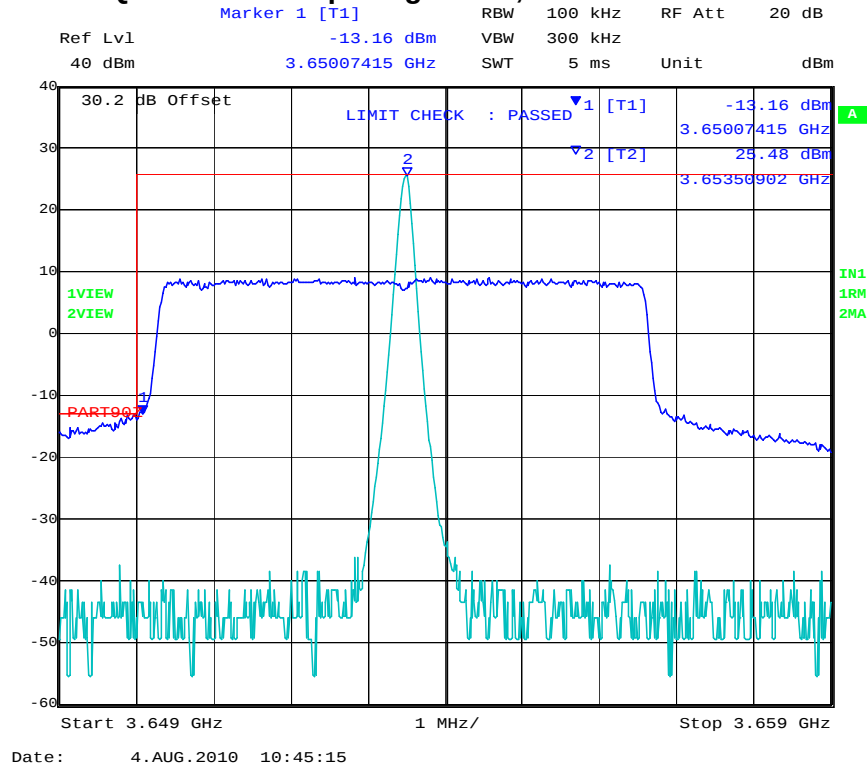


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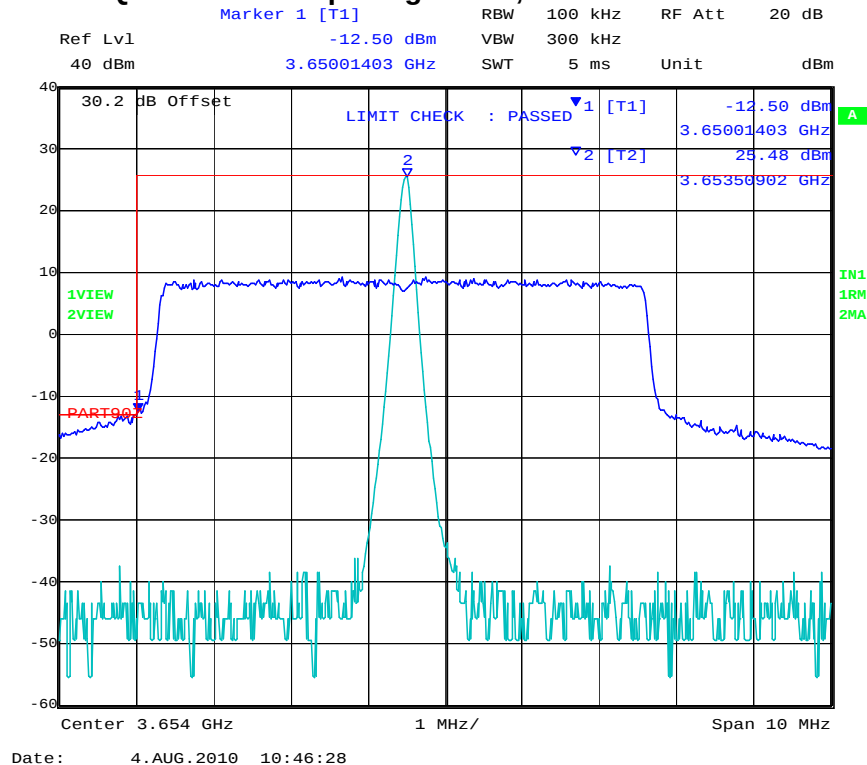


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16QAM Channel Spacing 7 MHz, Channel 3653.5 MHz



64QAM Channel Spacing 7 MHz, Channel 3653.5 MHz

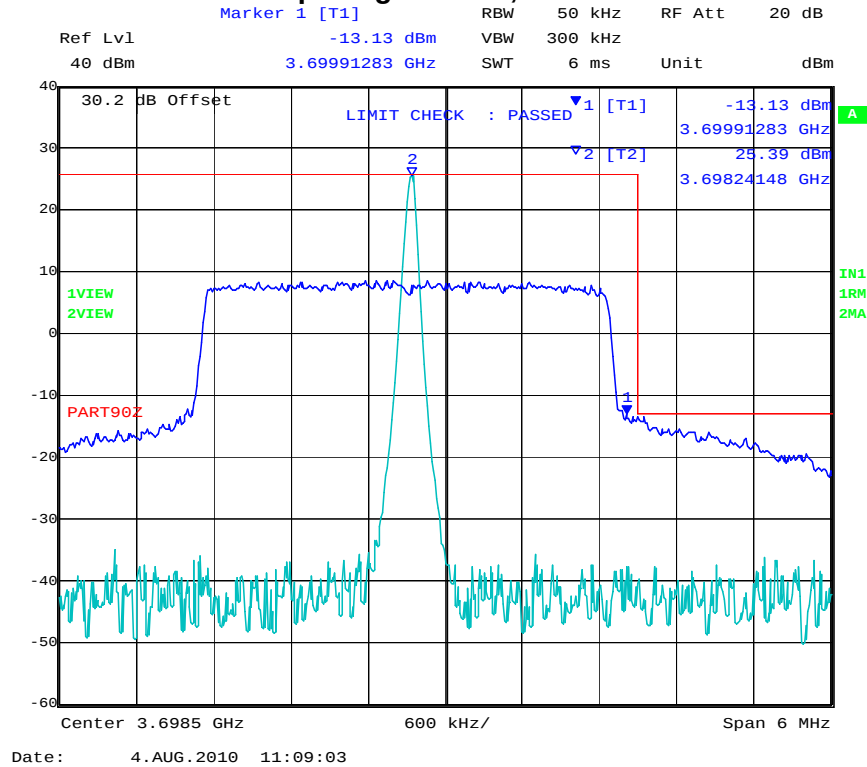


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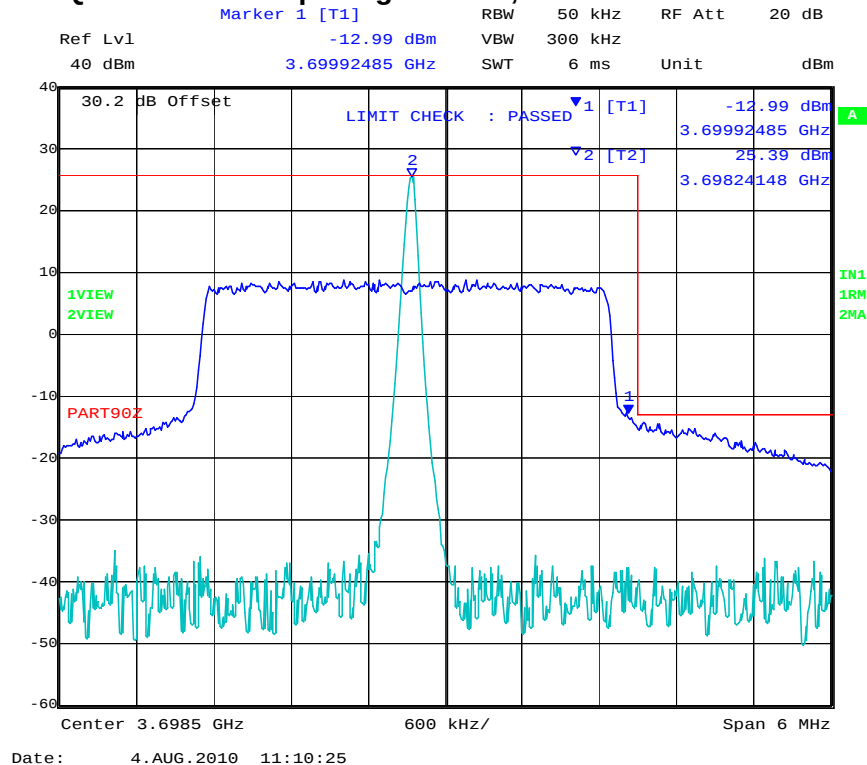


Title: Axxcelera EHD-CPE3320-C10
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BPSK Channel Spacing 3.5 MHz, Channel 3698.25 MHz



QPSK Channel Spacing 3.5 MHz, Channel 3698.25 MHz

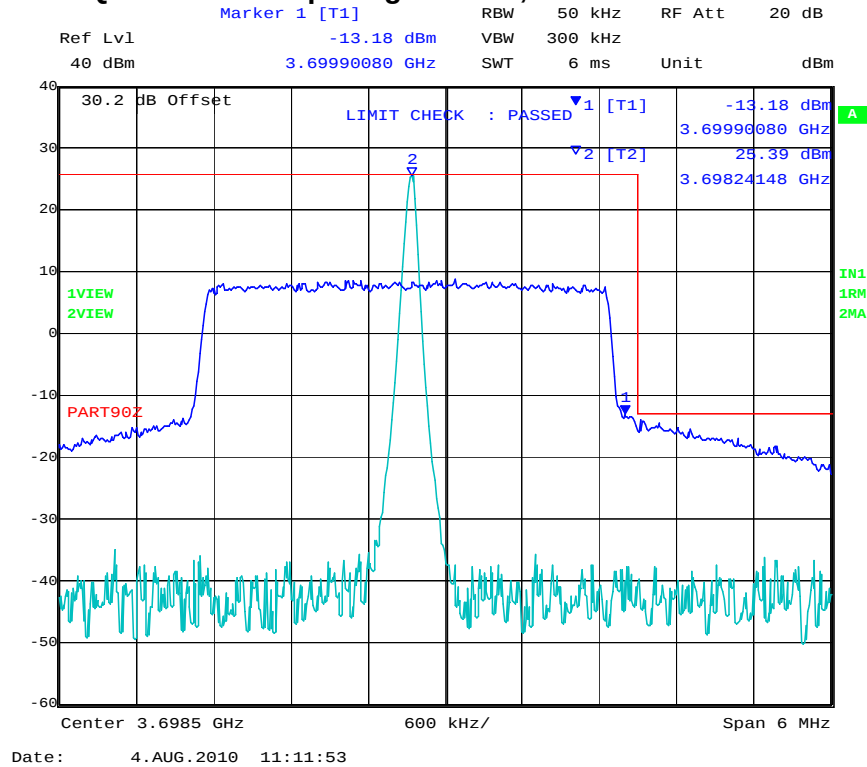


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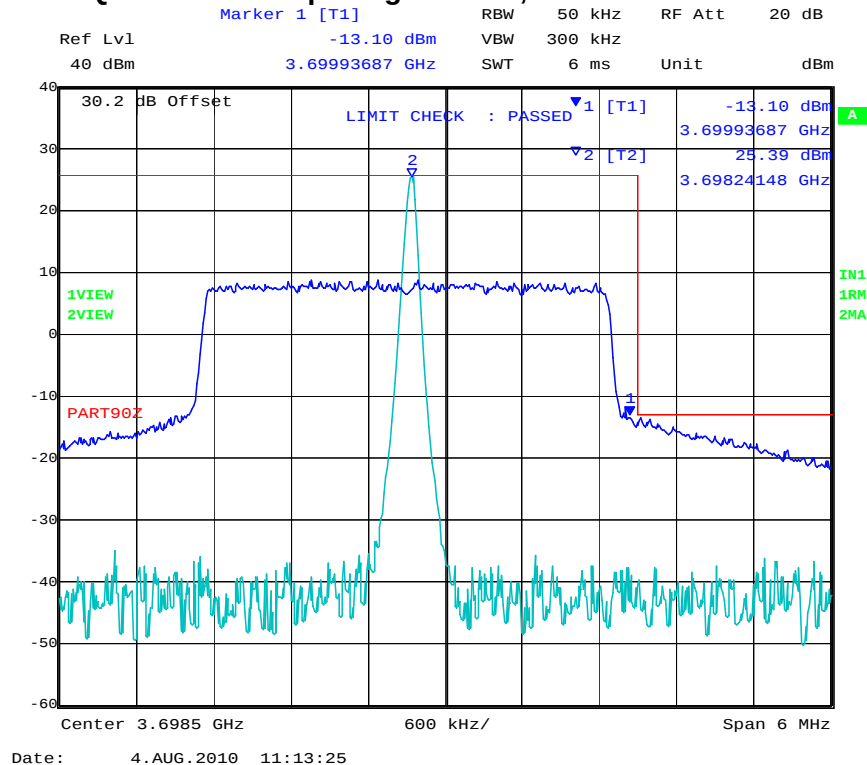


Title: Axxcelera EHD-CPE3320-C10
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16QAM Channel Spacing 3.5 MHz, Channel 3698.25 MHz



64QAM Channel Spacing 3.5 MHz, Channel 3698.25 MHz

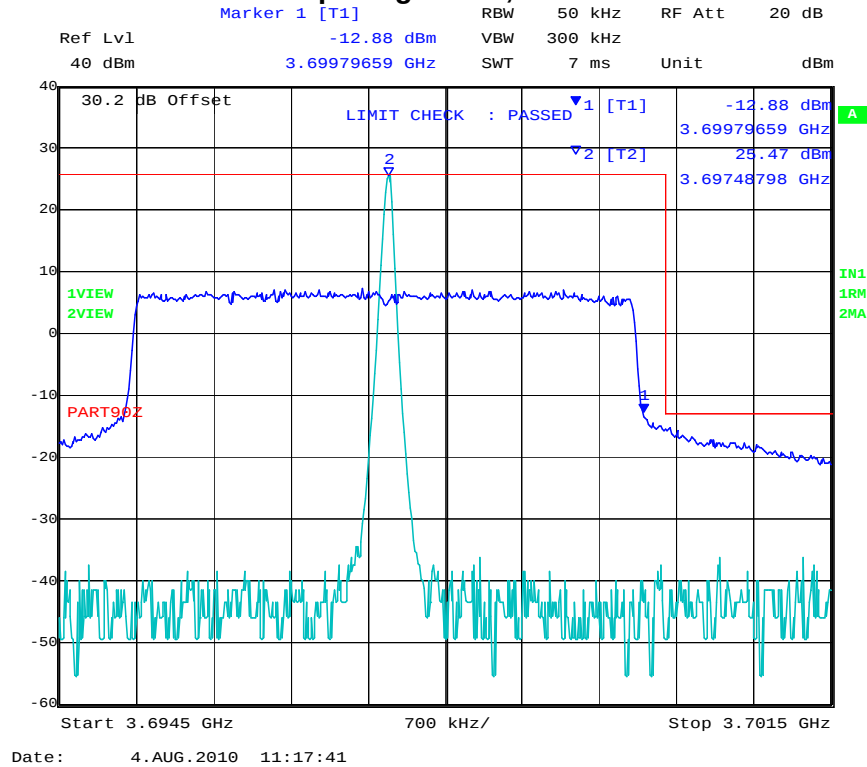


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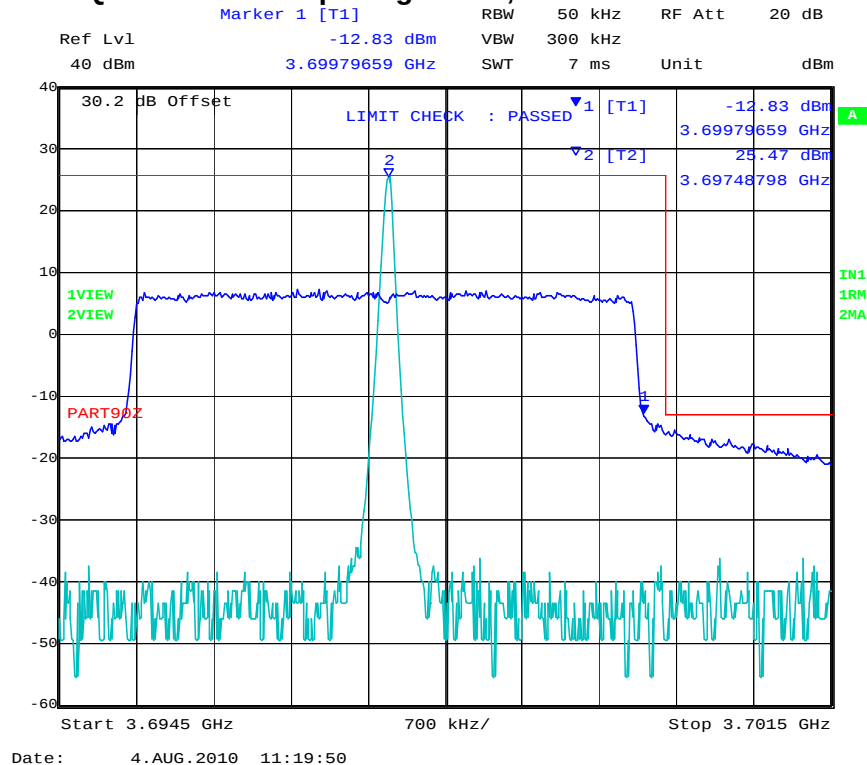


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BPSK Channel Spacing 5 MHz, Channel 3697.5 MHz

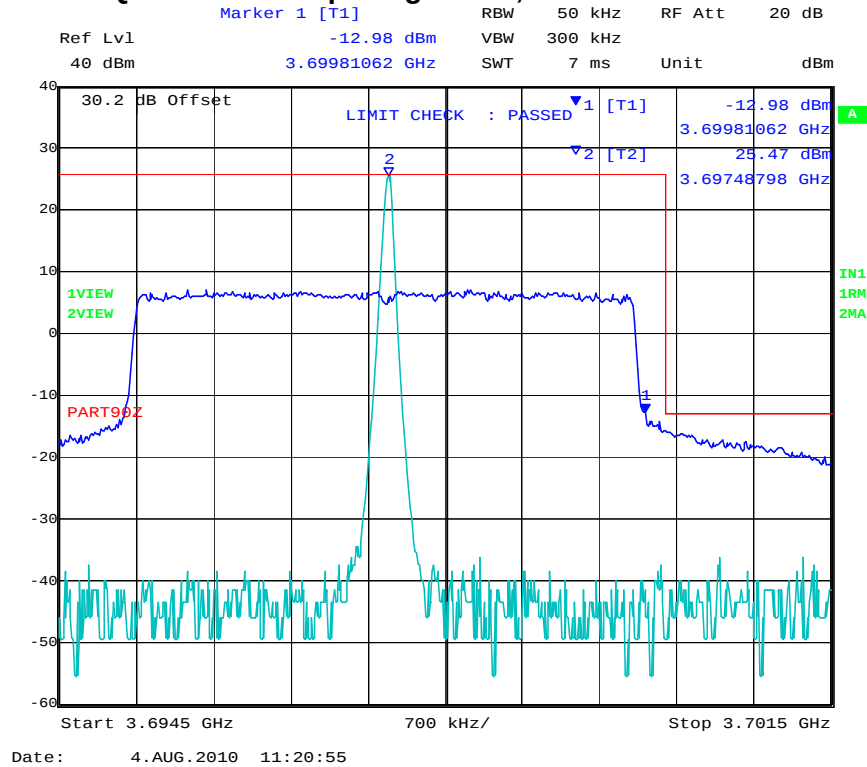


QPSK Channel Spacing 5 MHz, Channel 3697.5 MHz

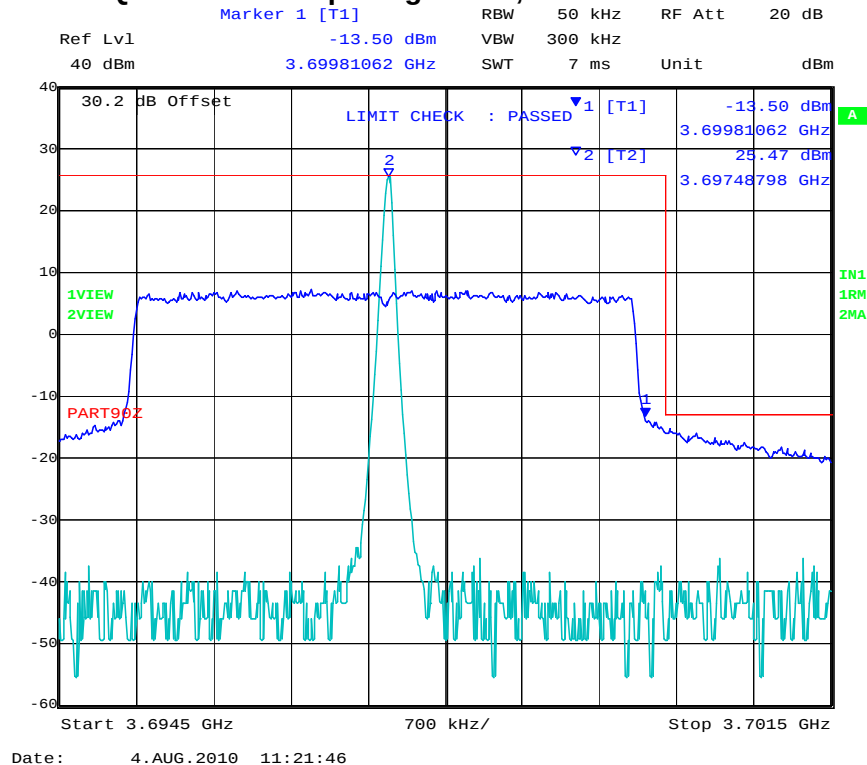


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16QAM Channel Spacing 5 MHz, Channel 3697.5 MHz



64QAM Channel Spacing 5 MHz, Channel 3697.5 MHz

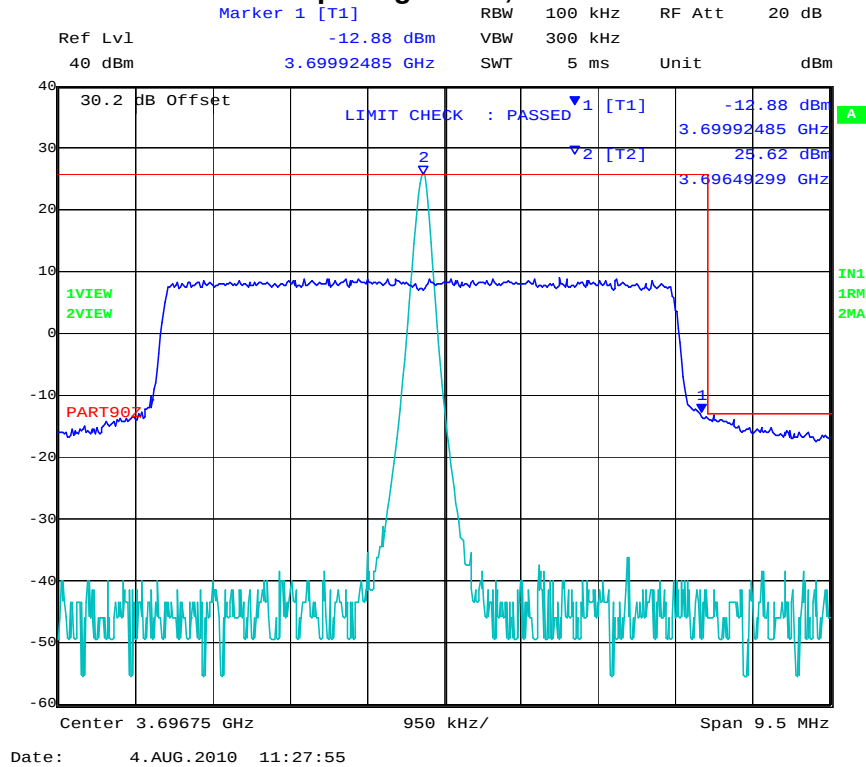


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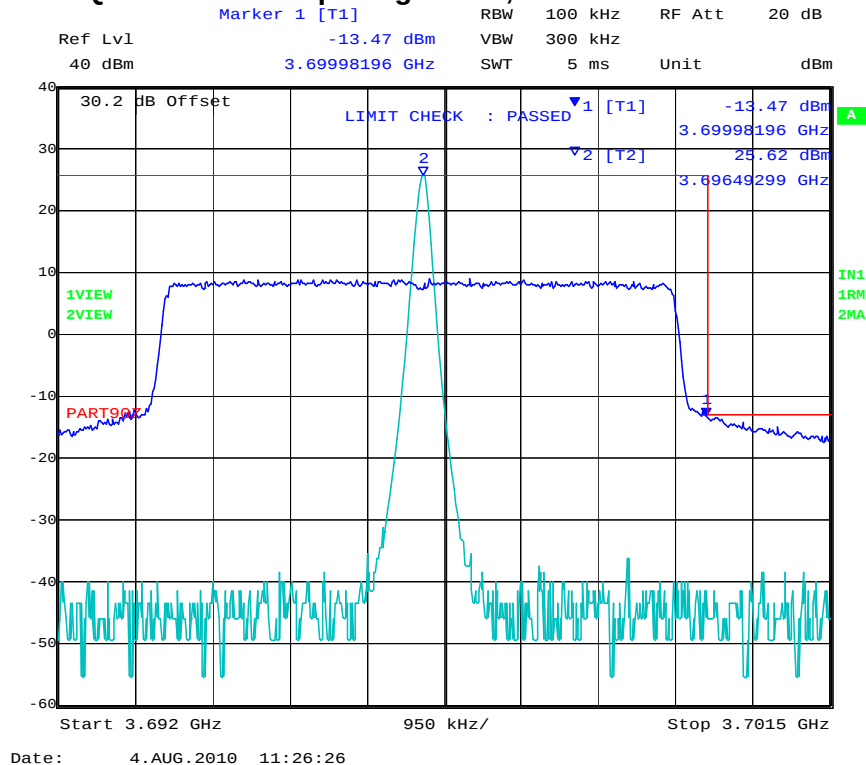


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BPSK Channel Spacing 7 MHz, Channel 3696.5 MHz



QPSK Channel Spacing 7 MHz, Channel 3696.5 MHz

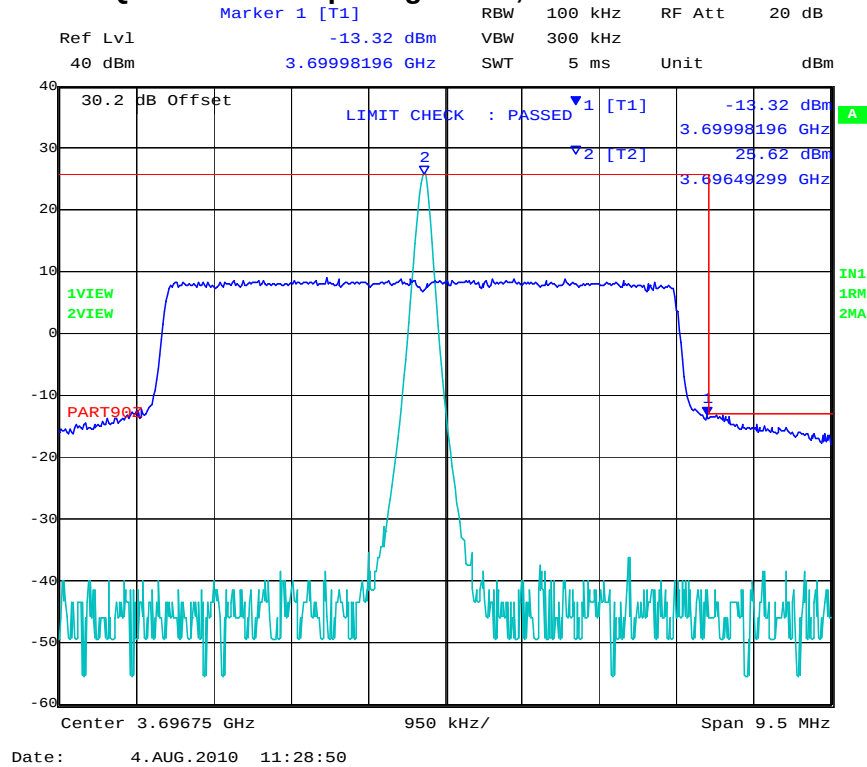


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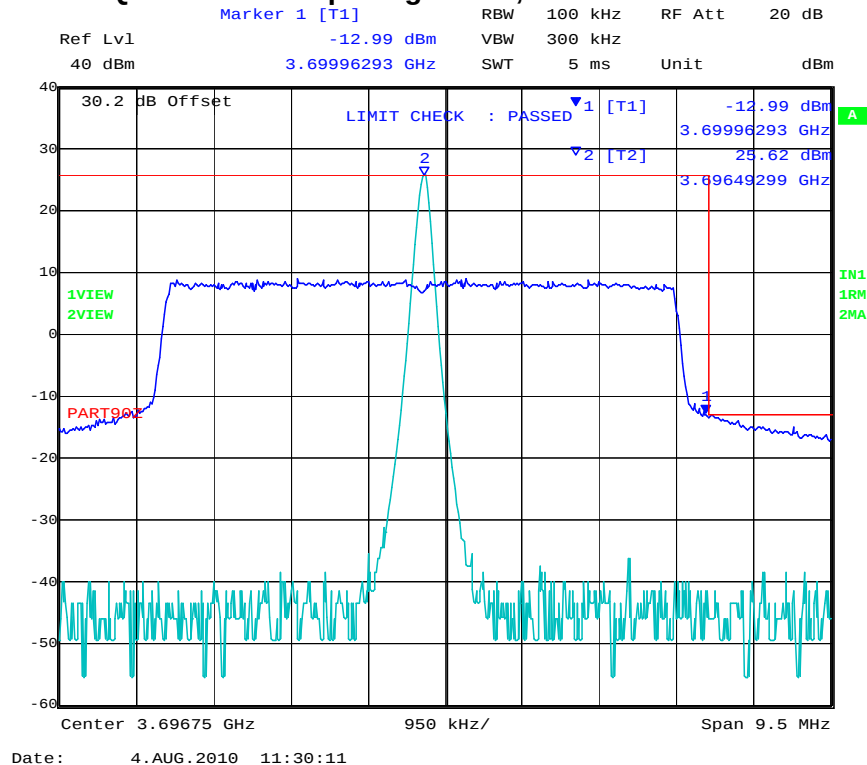


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16QAM Channel Spacing 7 MHz, Channel 3696.5 MHz



64QAM Channel Spacing 7 MHz, Channel 3696.5 MHz



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

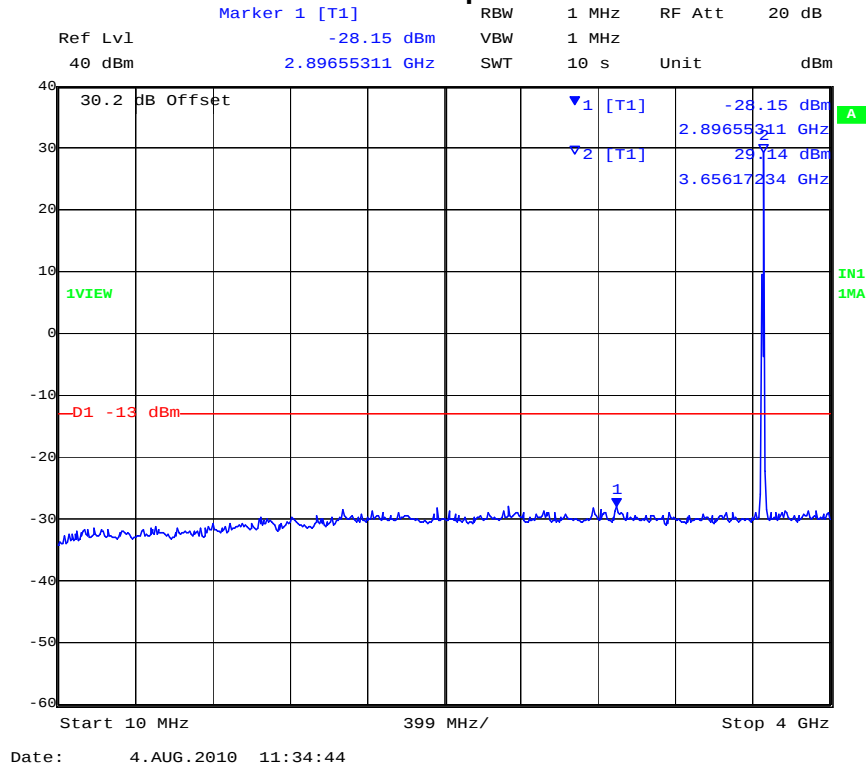
Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
3651.75	10	4,000	-28.15	-13.0	-15.15
	4,000	40,000	-21.05		-8.05

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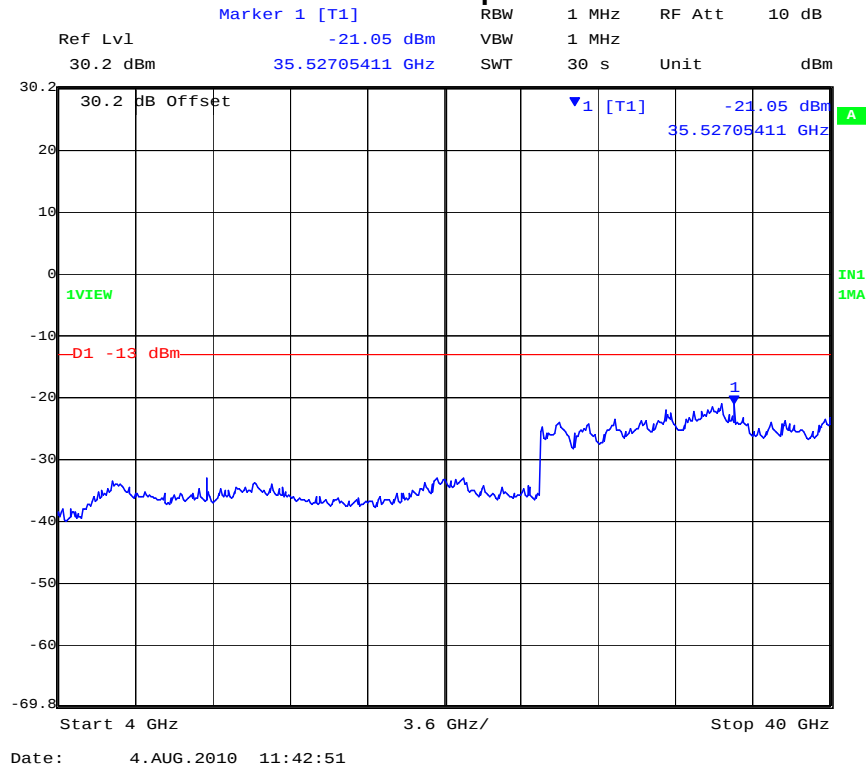


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Channel 3651.75 MHz Conducted Spurious Emissions 0.01 – 4 GHz



Channel 3651.75 MHz Conducted Spurious Emissions 4 - 40 GHz



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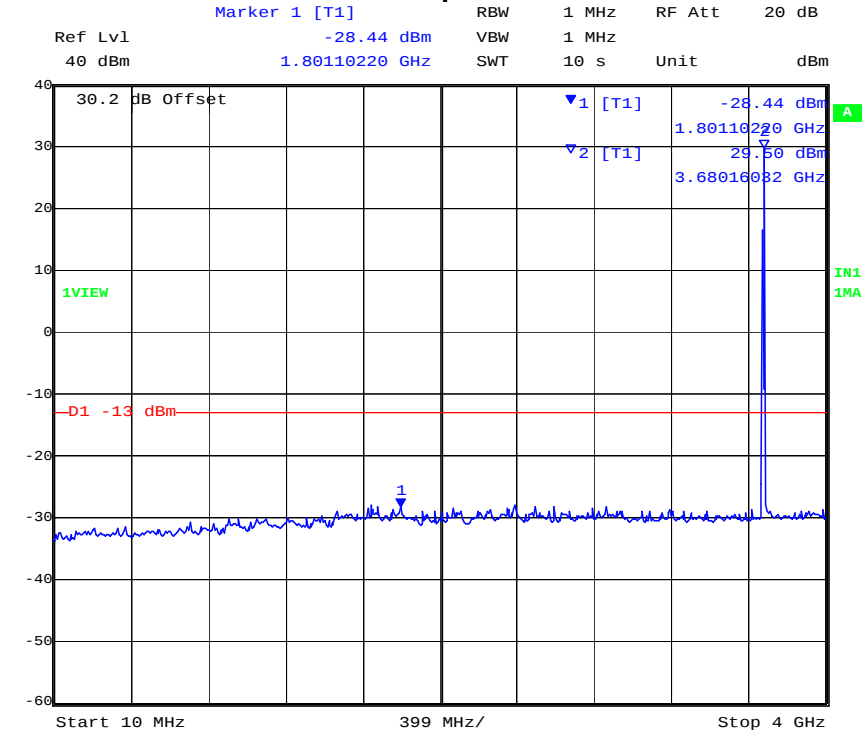


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Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
3675.0	10	4,000	-28.44	-13.0	-15.44
	4,000	40,000	-21.06		-8.06

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Channel 3675 MHz Conducted Spurious Emissions 0.01 – 4 GHz



Date: 4.AUG.2010 11:37:18

Channel 3675 MHz Conducted Spurious Emissions 4 - 40 GHz



Date: 4.AUG.2010 11:41:21

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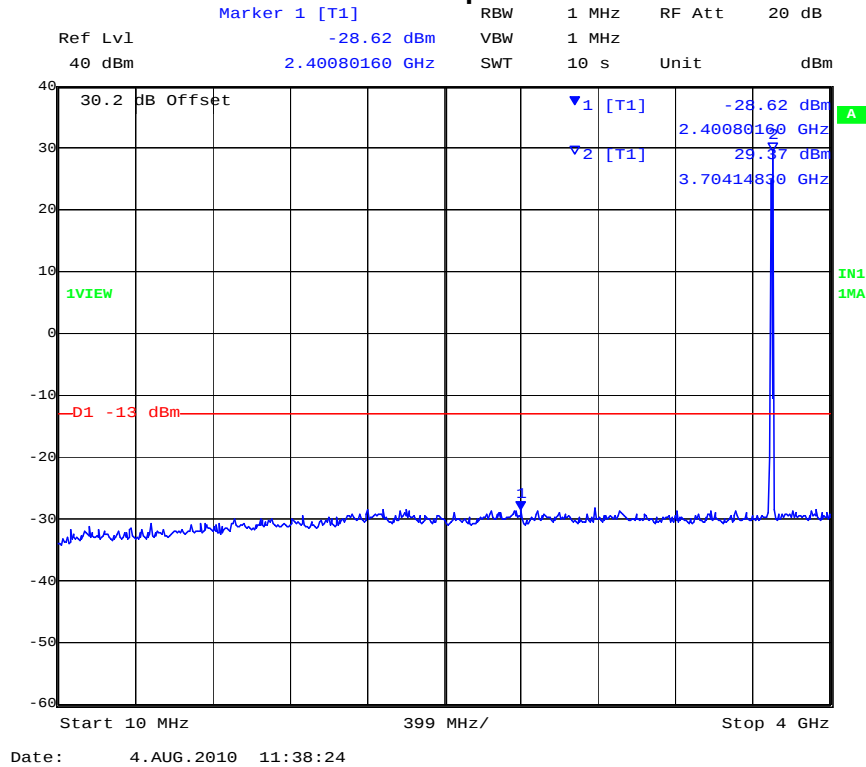
Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
3698.25	10	4,000	-28.62	-13.0	-15.62
	4,000	40,000	-21.76		-8.76

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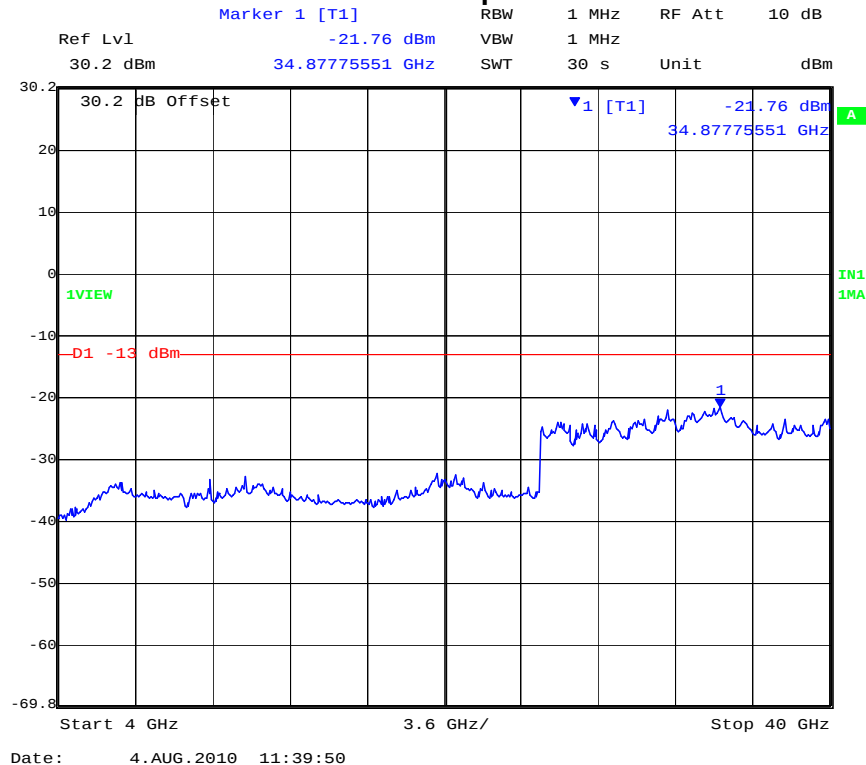


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Channel 3698.25 MHz Conducted Spurious Emissions 0.01 – 4 GHz



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. Radiated Spurious Emissions

5.1.7.1. Transmitter Radiated Emissions

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

Industry Canada RSS-197 Section 5.7

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.

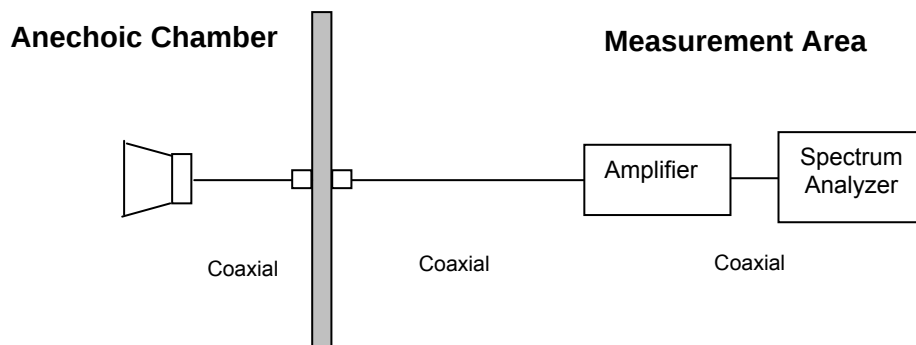
The measurement equipment was set to measure in peak hold mode. The emissions were measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum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



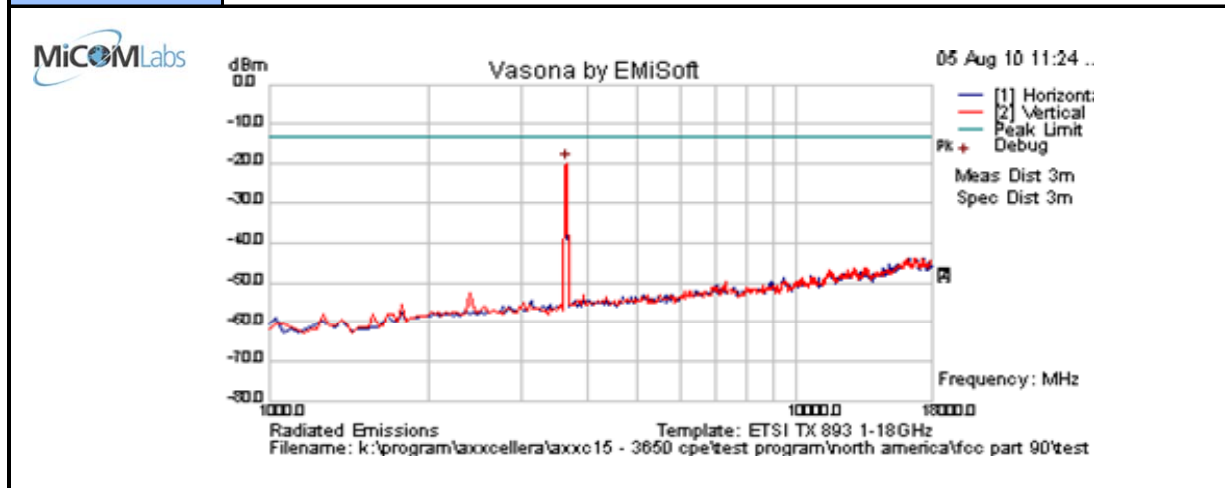
Measurement set up for Radiated Emission Test

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Radiated spurious emissions from the transmitter were investigated from 30 - 1000MHz. No radio emissions were witnessed during the test. Please see Section 5.1.7.2 for radiated emissions results from 30 - 1000 MHz.

No spurious emissions were witnessed above 1 GHz. Only the fundamental was present during testing.

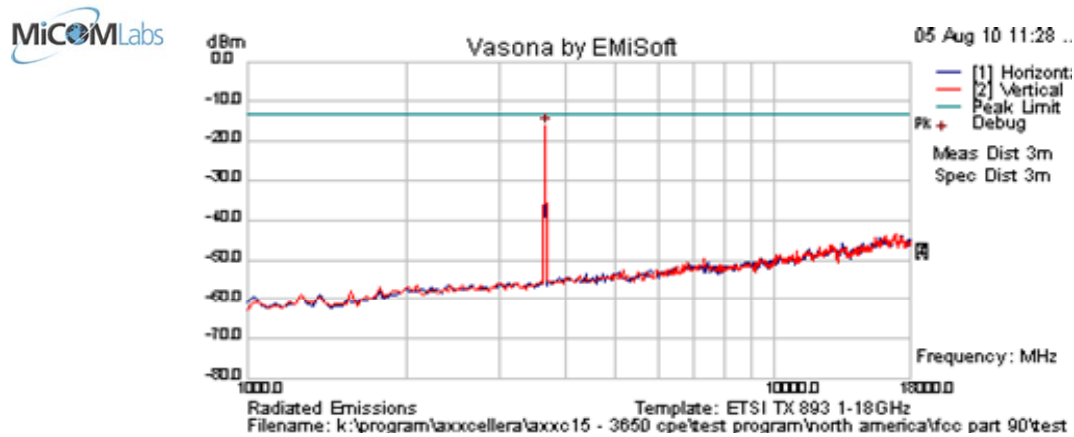
Test Freq.	3651.75 MHz	Engineer	CSB
Variant	BPSK 3.5MHz CH BW	Temp (°C)	26.5
Freq. Range	1 - 18 GHz	Rel. Hum.(%)	32
Power Setting	Maximum Power / 100% duty cycle	Press. (mBars)	999
Antenna	3ft shielded cable + 50 Ohm Load	Duty Cycle (%)	100
Test Notes 1	Only fundamental emission is present above 1GHz.		
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
3655.225	-25.8	3.7	2.4	-19.7	Peak [Scan]	V	151	--	--	--	--	FUND
Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission NRB = Non-Restricted Band. RB = Restricted Band.												

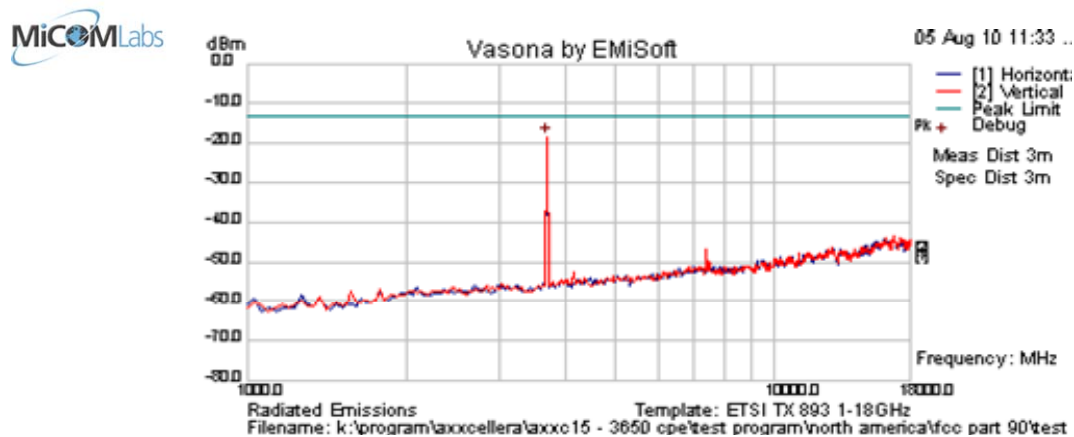
Test Freq.	3675 MHz	Engineer	CSB
Variant	BPSK 3.5MHz CH BW	Temp (°C)	26.5
Freq. Range	1 - 18 GHz	Rel. Hum.(%)	32
Power Setting	Maximum Power / 100% duty cycle	Press. (mBars)	999
Antenna	3ft shielded cable + 50 Ohm Load	Duty Cycle (%)	100
Test Notes 1	Only fundamental emission is present above 1GHz.		
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
3674.709	-22.2	3.7	2.3	-16.1	Peak [Scan]	V	--	--	--	--	Pass	FUND
Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission NRB = Non-Restricted Band. RB = Restricted Band.												

Test Freq.	3698.25	Engineer	CSB
Variant	BPSK 3.5MHz CH BW	Temp (°C)	26.5
Freq. Range	1 - 18 GHz	Rel. Hum.(%)	32
Power Setting	Maximum Power / 100% duty cycle	Press. (mBars)	999
Antenna	3ft shielded cable + 50 Ohm Load	Duty Cycle (%)	100
Test Notes 1	Only fundamental emission is present above 1GHz.		
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
3698.657	-24.5	3.7	2.5	-18.3	Peak [Scan]	V	--	--	--	--	Pass	FUND
Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission NRB = Non-Restricted Band. RB = Restricted Band.												



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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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5.1.7.2. Digital Device Radiated Spurious Emissions

FCC, Part 15 Subpart C §15.105

Industry Canada ICES-003

FCC Part 15.109 limits were applied based on:

(1) the definition of Digital Device [FCC Part 15.3(k)] which states: "A radio frequency device that is specifically subject to an emanation requirement in any other FCC Rule part or an intentional radiator subject to subpart C of this part that contains a digital device is not subject to the standards for digital devices, provided the digital device is used only to enable operation of the radio frequency device and the digital device does not control additional functions or capabilities.

and

(2) the functions of the EUT

Since the digital portion of the device controls additional functions other than just controlling the radio (controls data I/O communications via the Ethernet port) the device was also tested as a digital device.

Standard Reference

FCC, Part 15 Subpart B §15.109

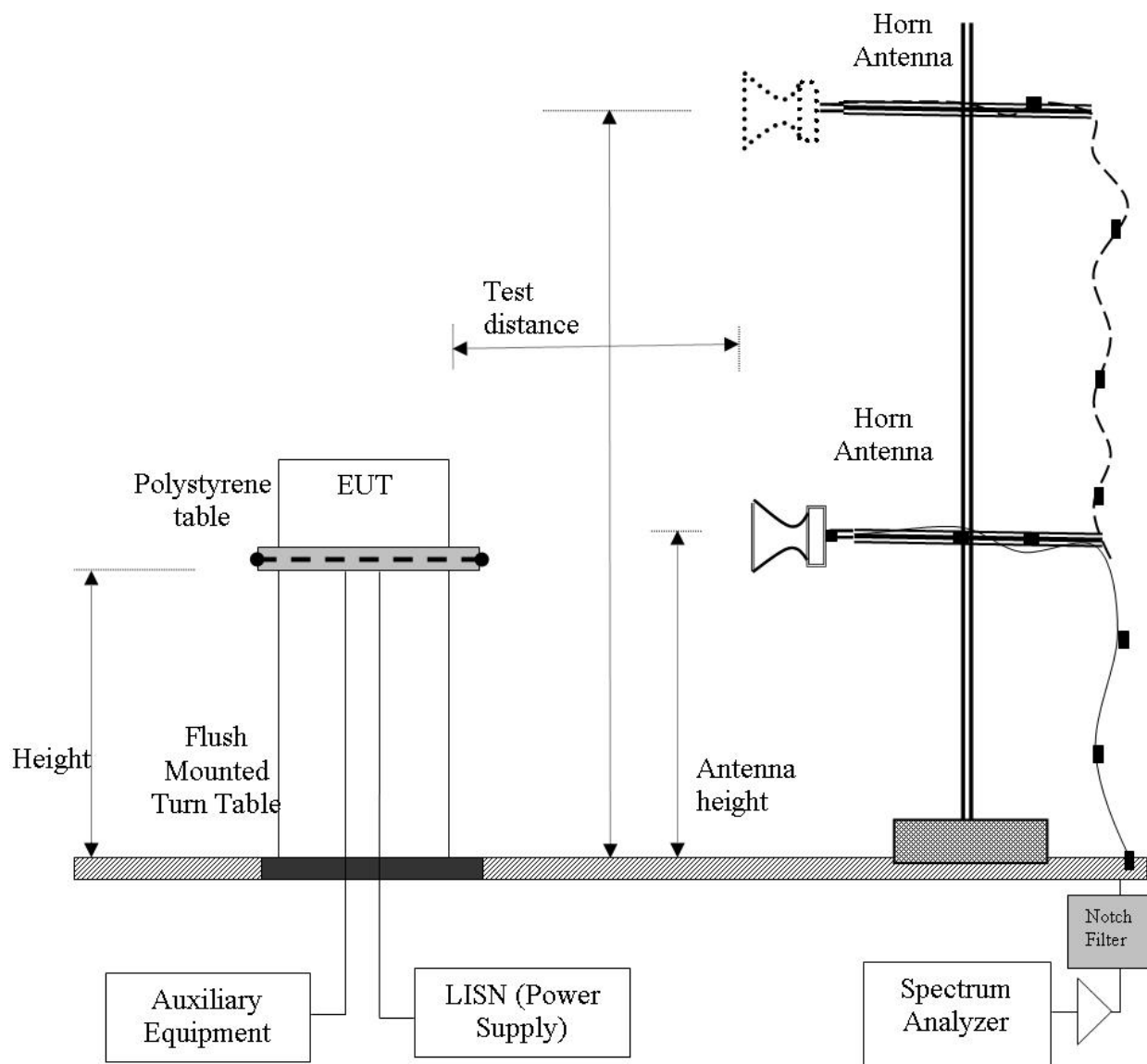
Industry Canada ICES-003 §5

Test Procedure

Testing was performed in a 3-meter anechoic chamber. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. Preliminary emissions were recorded with in Spectrum Analyzer mode, using a maximum peak detector while in peak hold mode.

Emissions nearest the limits were chosen for maximization and formal measurement using a CISPR Compliant receiver. Emissions from 30 MHz – 1000 MHz are measured utilizing a CISPR compliant quasi-peak detector with a tuned receiver, using a bandwidth of 120 kHz. Emissions above 1000 MHz are measured utilizing a CISPR compliant average detector with a tuned receiver, using a bandwidth of 1 MHz. Only the highest emissions relative to the limit are listed.

Test Measurement Set up



Measurement set up for Radiated Emission Test



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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.

$$FS = R + AF + CORR - FO$$

FS = Field Strength

R = Measured Spectrum analyzer Input Amplitude

AF = Antenna Factor

$$CORR = \text{Correction Factor} = CL - AG + NFL$$

CL = Cable Loss

AG = Amplifier Gain

FO = Distance Falloff Factor

NFL = Notch Filter Loss or Waveguide Loss

Field Strength Calculation 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:

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

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

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

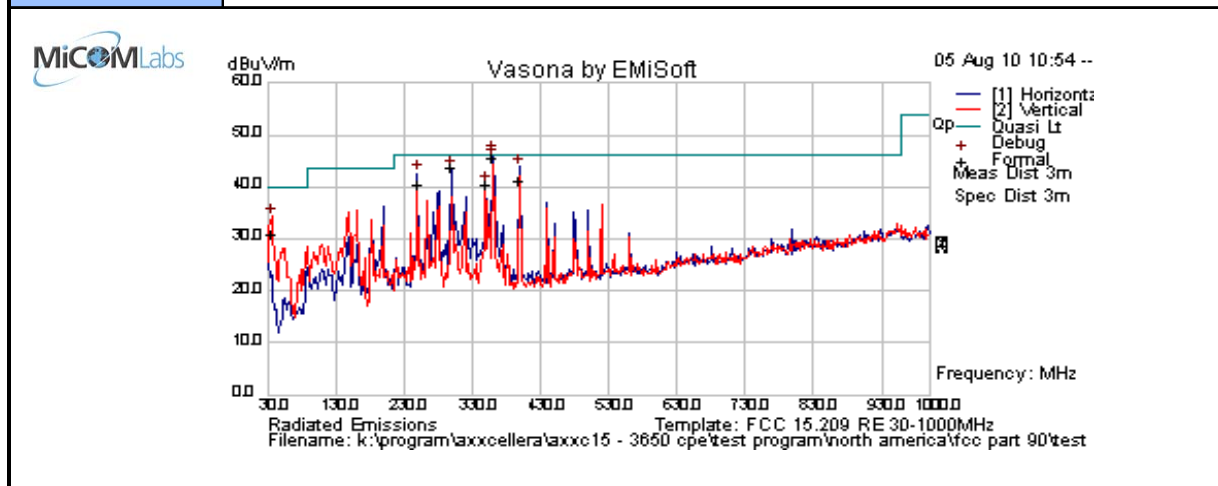


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Measurement Results for Radiated Spurious Emissions – Digital Apparatus

No Radio Emissions were witnessed below 1 GHz. Emissions present are from the digital portion of the device.

Test Freq.	3651.75 MHz	Engineer	CSB
Variant	BPSK 3.5MHz CH BW	Temp (°C)	26.5
Freq. Range	30 MHz - 1000 MHz	Rel. Hum.(%)	32
Power Setting	Maximum Power / 100% duty cycle	Press. (mBars)	999
Antenna	3ft shielded cable terminated with 50 Ohm Load		
Test Notes 1	No radio emissions were witnessed below 1 GHz.		
Test Notes 2			



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
36.107	41.5	3.5	-14.1	31.0	Quasi Max	V	98	93	40	-9.0	Pass	DIG
249.983	54.2	5.0	-18.8	40.4	Quasi Max	H	122	276	46	-5.6	Pass	DIG
299.983	55.4	5.2	-16.9	43.8	Quasi Max	H	118	280	46	-2.2	Pass	DIG
349.982	50.6	5.5	-15.5	40.5	Quasi Max	H	98	207	46	-5.5	Pass	DIG
359.984	55.4	5.5	-15.1	45.8	Quasi Peak	H	166	182	46	-0.2	Pass	DIG
399.979	50.0	5.7	-14.4	41.2	Quasi Max	H	135	225	46	-4.8	Pass	DIG
Legend: DIG = Digital Device Emission; RX = Receiver Emissions; FUND = Fundamental Frequency												

Note: see Section 3.7 Equipment Modifications, EUT required modification in order to comply

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Specification

Radiated Spurious Emissions – Digital Apparatus

FCC, Part 15 Subpart B §15.109

A representative type or model of each digital apparatus shall be tested in accordance with the measurement methods described in FCC Part 15; Subpart A - General and FCC Subpart B – Unintentional Radiators.

Industry Canada ICES-003

A representative type or model of each digital apparatus shall be tested in accordance with the measurement method described in the publication referred to in Section 7.1 [Canadian Standards Association Standard CAN/CSA-CEI/IEC CISPR 22:02, "Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment."].

FCC, Part 15 Subpart B §15.109 Spurious Emissions Limits

Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values.

Frequency (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Field Strength of radiated emissions for a Class A digital device are as follows.

Frequency (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance (meters)
30-88	100	49.5	3
88-216	150	54.0	3
216-960	200	57.0	3
Above 960	500	60.0	3

RSS-ICES §5 Spurious Emissions Limits

Class A Digital Device: The field intensity of radio noise emissions that are radiated from a Class A digital apparatus shall not exceed the limits specified in Table 5 of the publication referred to in Section 7.1, within the indicated frequency range.

Frequency range MHz	Quasi-peak limits dB(μV/m) @ 10m	Quasi-peak limits dB(μV/m) @ 3m
30 to 230	40	50.5
230 to 1 000	47	57.5
NOTE 1	The lower limit shall apply at the transition frequency.	
NOTE 2	Additional provisions may be required for cases where interference occurs	

Class B Digital Device: The field intensity of radio noise emissions that are radiated from a Class B digital apparatus shall not exceed the limits specified in Table 6 of the publication referred to in Section 7.1, within the indicated frequency range.

Frequency range MHz	Quasi-peak limits dB(μV/m) @ 10m	Quasi-peak limits dB(μV/m) @ 3m
30 to 230	30	40.5
230 to 1 000	37	47.5
NOTE 1	The lower limit shall apply at the transition frequency.	
NOTE 2	Additional provisions may be required for cases where interference occurs	

Laboratory Measurement Uncertainty for Spectrum Measurement

Measurement Uncertainty	+5.6/ -4.5 dB
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Traceability

Method	Test Equipment Used
Work instruction WI-03	0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312

5.1.7.3. Receiver Radiated Spurious Emissions (above 1 GHz)

Industry Canada RSS-Gen §4.8, §6

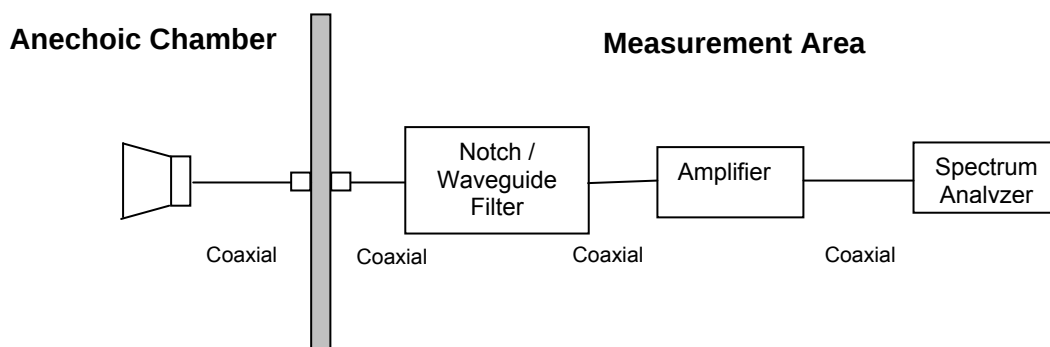
Test Procedure

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.

All Sectors of the EUT were tested simultaneously

Test Measurement Set up



Measurement set up for Radiated Emission Test

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.

$$FS = R + AF + CORR - FO$$

where: FS = Field Strength

R = Measured Spectrum analyzer Input Amplitude

AF = Antenna Factor

CORR = Correction Factor = CL – AG + NFL

CL = Cable Loss

AG = Amplifier Gain

FO = Distance Falloff Factor

NFL = Notch Filter Loss or Waveguide Loss

For example:

Given receiver input reading of 51.5 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:

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

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

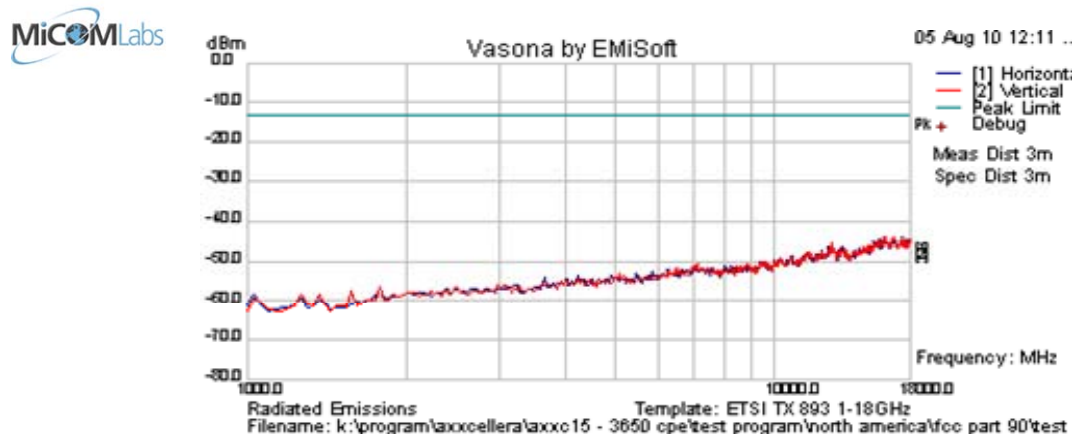
$$48 \text{ dB}\mu\text{V/m} = 250 \mu\text{V/m}$$



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Receiver Radiated Spurious Emissions above 1 GHz

Test Freq.	3651.75 MHz	Engineer	CSB
Variant	BPSK 3.5MHz CH BW	Temp (°C)	26.5
Freq. Range	1 - 18 GHz	Rel. Hum.(%)	32
Power Setting	Maximum Power / 100% duty cycle	Press. (mBars)	999
Antenna	3ft shielded cable + 50 Ohm Load	Duty Cycle (%)	100
Test Notes 1	No Receiver emissions present.		
Test Notes 2			



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
No receiver emissions present during test.												
Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission												
NRB = Non-Restricted Band. RB = Restricted Band.												

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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 ($\mu\text{V/m}$)	Field Strength (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

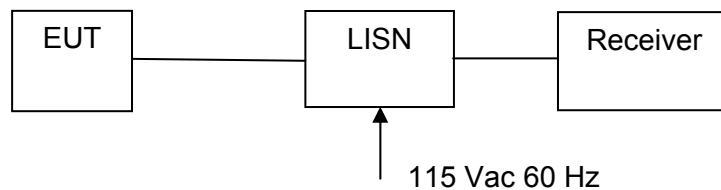
5.1.8. AC Wireline Conducted Emissions (150 kHz – 30 MHz)

FCC, Part 15 Subpart C §15.107
Industry Canada ICES-003 §5.3

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.

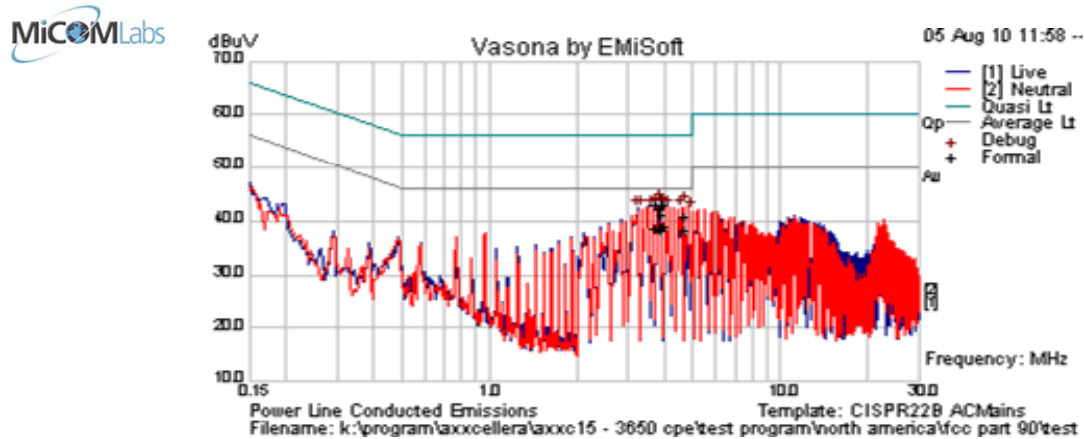
Test Measurement Set up



Measurement set up for AC Wireline Conducted Emissions Test

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

Test Freq.	3651.75 MHz	Engineer	CSB
Variant	AC Line Emissions	Temp (°C)	26.5
Freq. Range	0.150 MHz - 30 MHz	Rel. Hum.(%)	32
Power Setting	Maximum Power / 100% duty cycle	Press. (mBars)	999
Antenna	3ft shielded cable terminated with 50 Ohm Load		
Test Notes 1	EUT tested in worst case conditions with radio at maximum power. No radio emissions were		
Test Notes 2	witnessed below 1 GHz.		



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	Factors	Level dBuV/m	Measurement Type	Line	Limit dBuV/m	Margin dB	Pass /Fail	Comments
3.750	32.6	10.1	0.2	42.9	Quasi Peak	Neutral	56	-13.1	Pass	
3.750	28.4	10.1	0.2	38.7	Average	Neutral	46	-7.3	Pass	
3.845	32.0	10.1	0.2	42.3	Quasi Peak	Neutral	56	-13.7	Pass	
3.845	28.4	10.1	0.2	38.7	Average	Neutral	46	-7.3	Pass	
3.941	30.9	10.1	0.2	41.2	Quasi Peak	Neutral	56	-14.8	Pass	
3.941	28.1	10.1	0.2	38.3	Average	Neutral	46	-7.7	Pass	
3.942	28.5	10.1	0.2	38.8	Average	Live	46	-7.2	Pass	
3.942	32.9	10.1	0.2	43.2	Quasi Peak	Live	56	-12.8	Pass	
4.038	32.6	10.1	0.2	42.9	Quasi Peak	Live	56	-13.1	Pass	
4.038	28.8	10.1	0.2	39.0	Average	Live	46	-7.0	Pass	
4.710	30.4	10.1	0.2	40.7	Quasi Peak	Neutral	56	-15.3	Pass	
4.710	27.8	10.1	0.2	38.2	Average	Neutral	46	-7.8	Pass	

Legend: DIG = Digital Device Emission; RX = Receiver Emissions; FUND = Fundamental Frequency

Specification

Limit

§15.107 (a) Except for Class A digital devices, for equipment 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 μ H/50 ohms line impedance stabilization network (LISN). 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. The lower limit applies at the band edges.

§15.107 (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

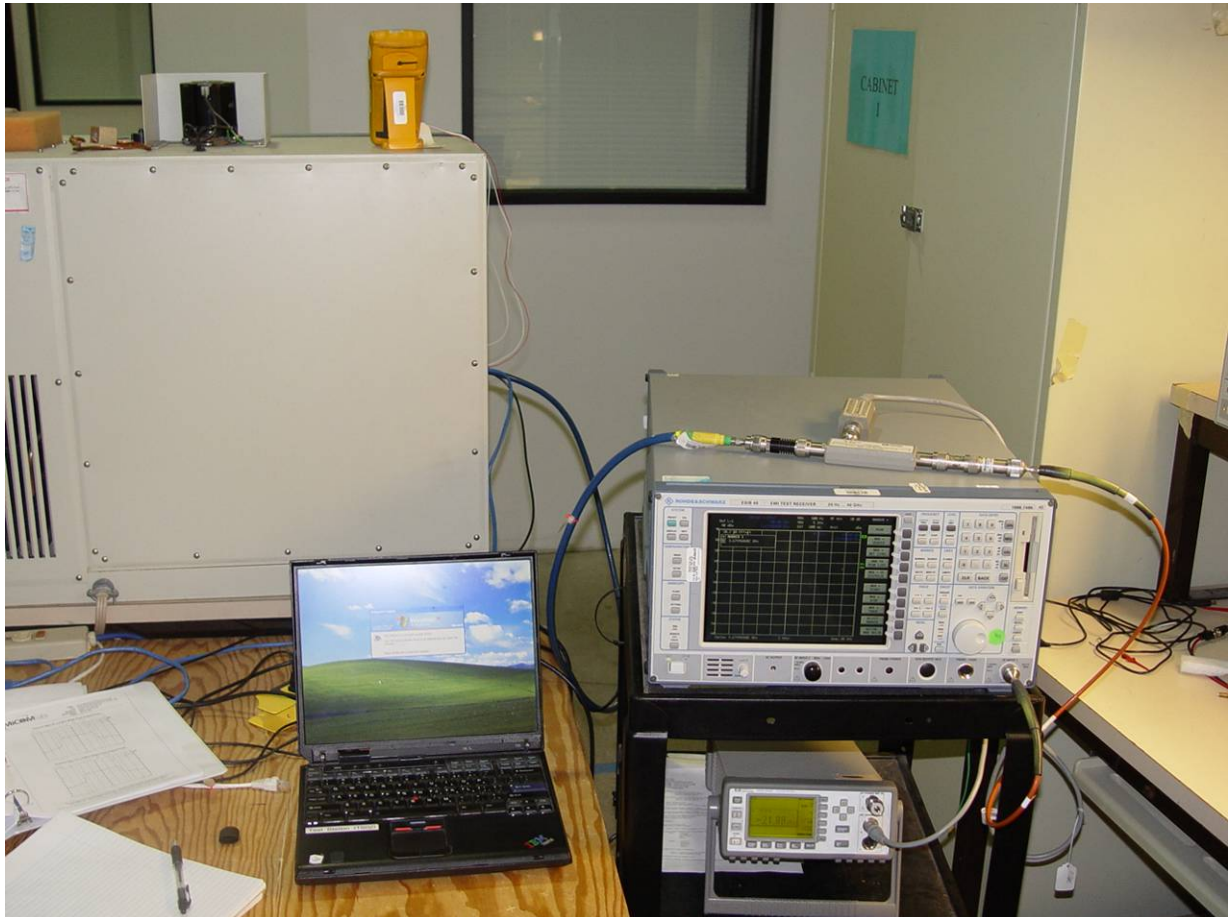
Measurement uncertainty	± 2.64 dB
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Traceability

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



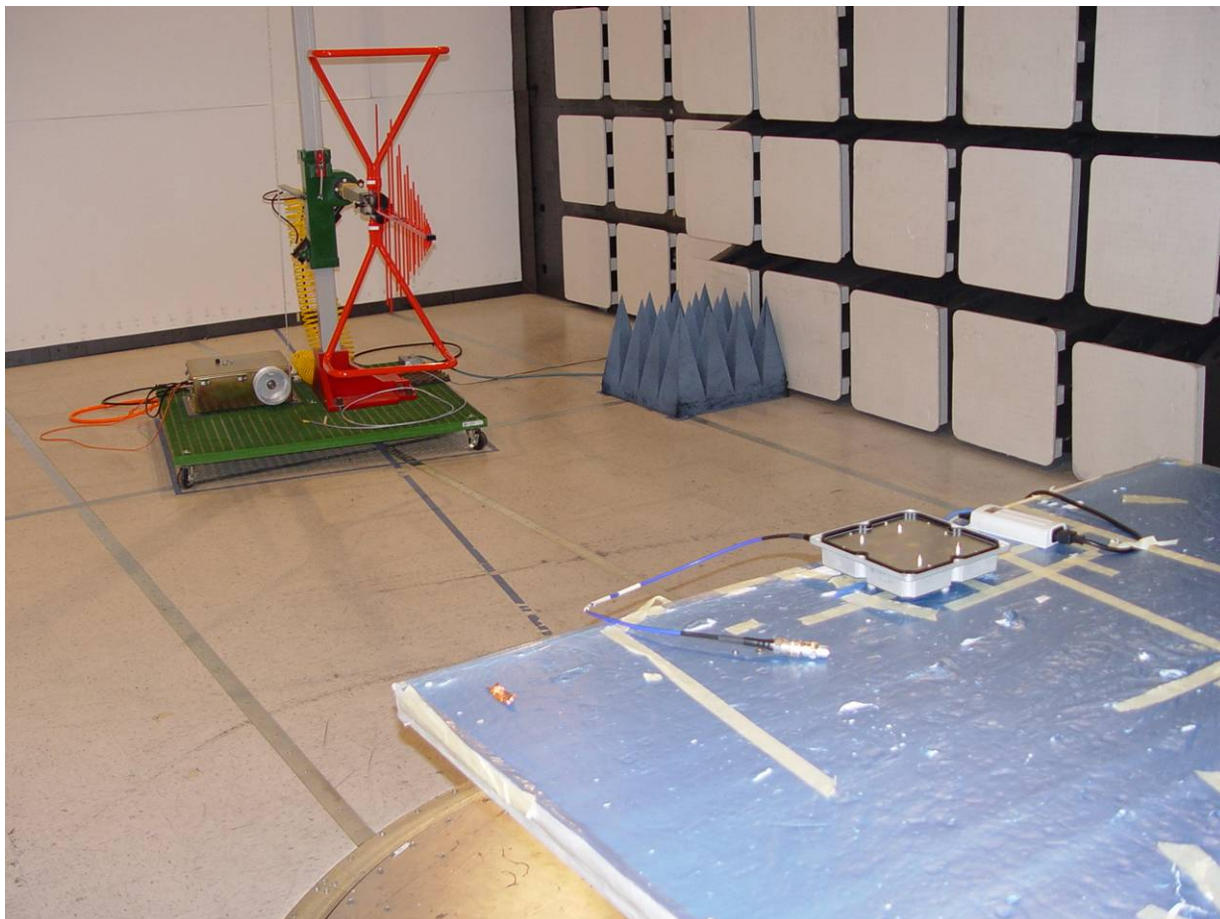
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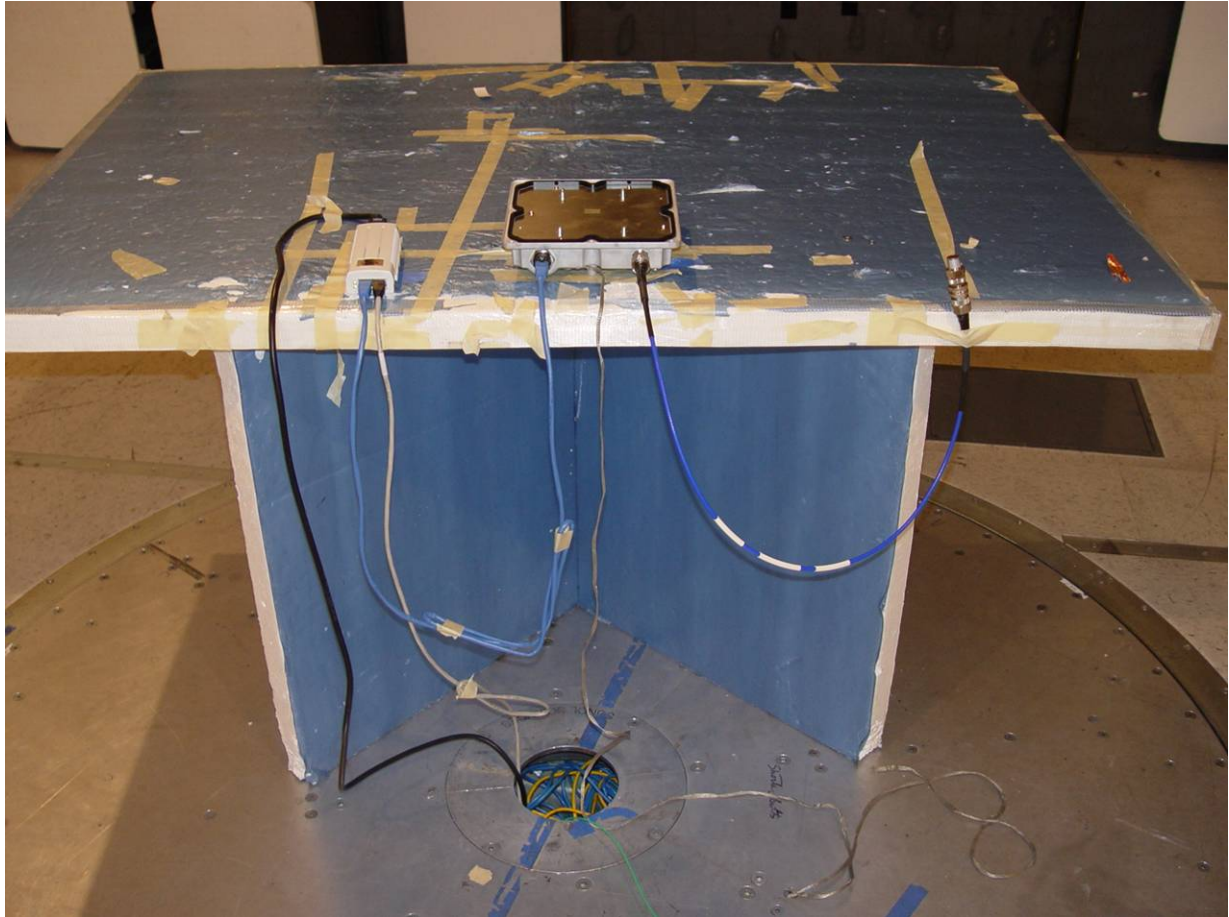
6.2. Environmental Chamber



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6.3. Radiated Spurious Emissions below 1GHz





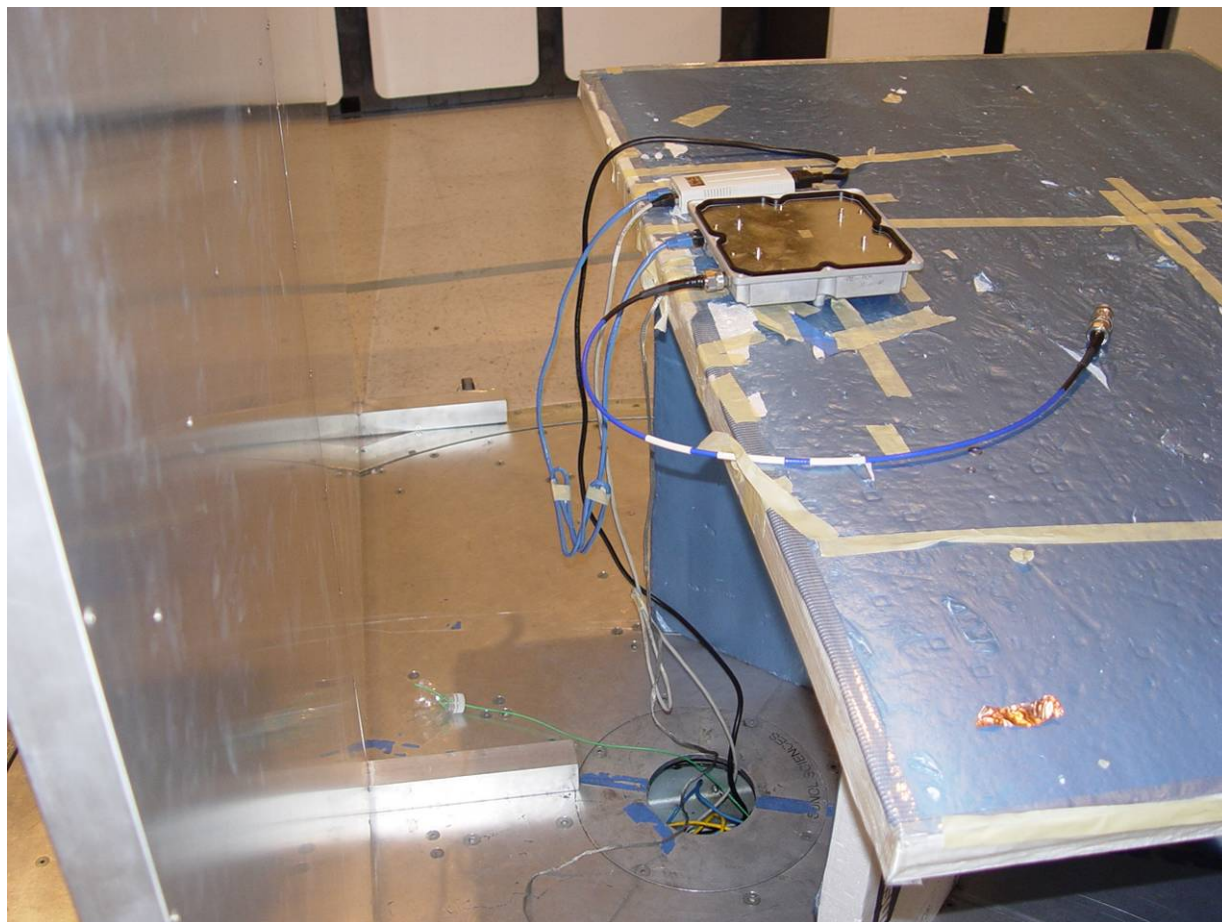
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6.4. Radiated Spurious Emissions above 1GHz



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6.5. Conducted Emissions (150 kHz - 30 MHz)



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Title: Axxcelera EHD-CPE3320-C10
To: FCC Part 90 SubPart Z, RSS-197
Serial #: AXXC15-U1 Rev A
Issue Date: 5th October 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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