Test of Axxcelera EHD-CPE3310-C9

To: FCC 47 CFR Part 90 SubPart Z

Test Report Serial No.: AXXC14-U3 Rev A

TEST REPORT

FROM

MiCOM Labs

Test of Axxcelera EHD-CPE3310-C9

To FCC 47 CFR Part 90 SubPart Z

Test Report Serial No.: AXXC14-U3 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 June 2010

This Test Report is Issued Under the Authority of;

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A2LA ACCREDITED
CERTIFICATE #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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ACCREDITATION, LISTINGS & RECOGNITION

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

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 I	
Vietnam	Ministry of Information and Communications	I	

DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft		
A	5th June 2010	Initial Release

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-CPE3310-C9	Fax:	+1 925 462 0306
S/N:	AG-08-39-0161		
Test Date(s):	13th to 20th May 2010	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC 47 CFR Part 90 SubPart Z	EQUIPMENT COMPLIES

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

Notes:

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

ACCREDITED
ERTIFICATE #2381.01

Approved & Released for MiCOM Labs, Inc. by:

Graeme Grieve
Quality Manager MiCOM Labs,

Gordon Hurst
President & CEO MiCOM Labs, Inc.

2. REFERENCES AND MEASUREMENT UNCERTAINTY

2.1. Normative References

Ref.	Publication	Year	Title
(i)	FCC 47 CFR Part 90 SubPart Z	2010	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	14th September 2005	Reference to A2LA Accreditation Status – A2LA Advertising Policy
(viii)	FCC (OET)	15th 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.

3. PRODUCT DETAILS AND TEST CONFIGURATIONS

3.1. Technical Details

Details	Description		
Purpose:	Test of the Axxcelera EHD-CPE3310-C9 to FCC 47 CFR Part 90 SubPart Z regulations.		
Applicant:	Axxcelera Broadband Wireless, Inc 1600 E.Parham Road Richmond Virginia 23228 USA		
Manufacturer:	As ApplicantApplicantAddress		
Laboratory performing the tests:	MiCOM Labs, Inc. 440 Boulder Court, Suite 200 Pleasanton, California 94566 USA		
Test report reference number:	AXXC14-U3 Rev A		
Date EUT received:	13th 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:	Subscriber Station (CPE)		
Model:	EHD-CPE3310-C4		
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:	+21 dBm		
ITU Emission Designator:	3.5 MHz	5 MHz	7 MHz
	3M1DXW	4M5DXW	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: -33ºC to +55ºC		
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 and Data Communication		

3.2. Scope of Test Program

The scope of the test program was to test the Axxcelera EHD-CPE3310-C9 for compliance against;-

FCC 47 CFR Part 90, Subpart Z regulatory requirements.

The Axxcelera EHD-CPE3310-C9 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-CPE3310-C9 (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-CPE3310-C9

Axxcelera EHD-CPE3310-C9 Product Label

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-CPE3310-C9	AG-08-39-0161
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

3.6. Test Configurations

Test Matrix V's Variants

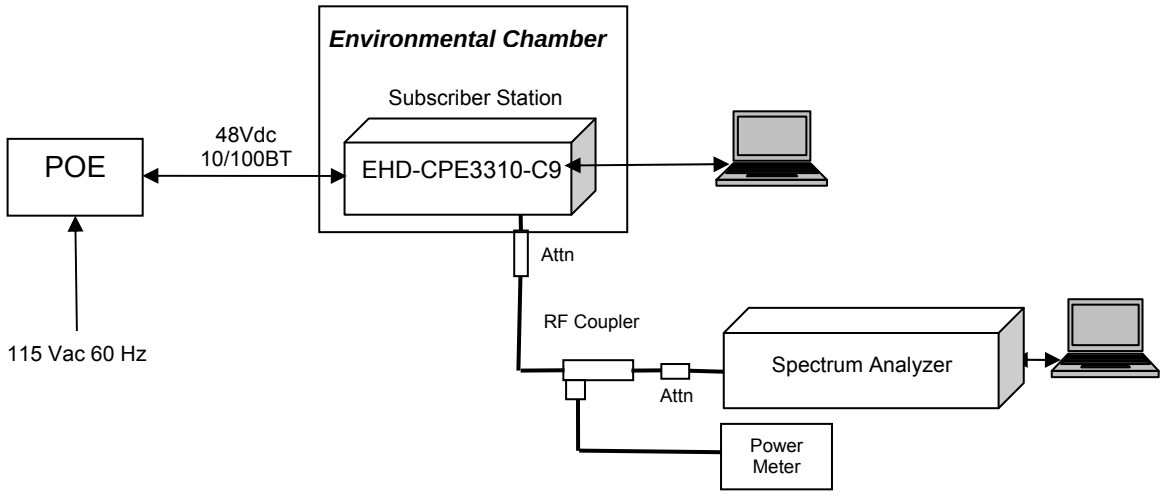
Parameter	Operational Mode	Test Conditions	Bandwidths (MHz)
99% Occupied BW	Modulated - BPSK QPSK, 16QAM, 64QAM	Ambient, 48 Vdc	3.5, 5, 7
Output power			
Spectrum Mask			
Power Spectral Density			
Frequency Stability	CW	Temperature and Voltage Variations	N/A
Conducted Spurious Emissions	Modulated - BPSK	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. NONE

3.8. Deviations from the Test Standard

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

2. 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.**

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)	EIRP Rated 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	Radiated	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 & Conducted Spurious Emissions	Emissions from the antenna port	Conducted	Complies	5.1.6
2.1053; 90.1323 ANSI/TIA-603	Radiated Spurious Emissions	Spurious emissions	Radiated	Complies	5.1.7
15.207	AC Wireline Conducted	Emissions 150 kHz–30 MHz	Conducted	Complies	5.1.8

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*

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.

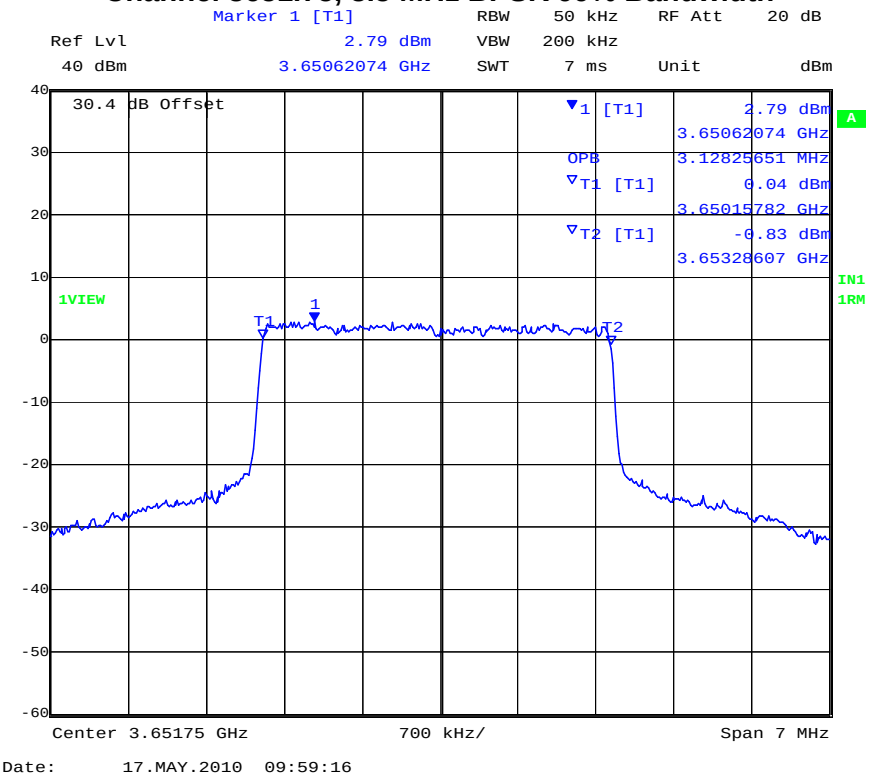
Test Set-up is shown in Section 3.6 Test Configuration

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

3.5 MHz Bandwidth

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

Channel 3651.75, 3.5 MHz BPSK 99% Bandwidth



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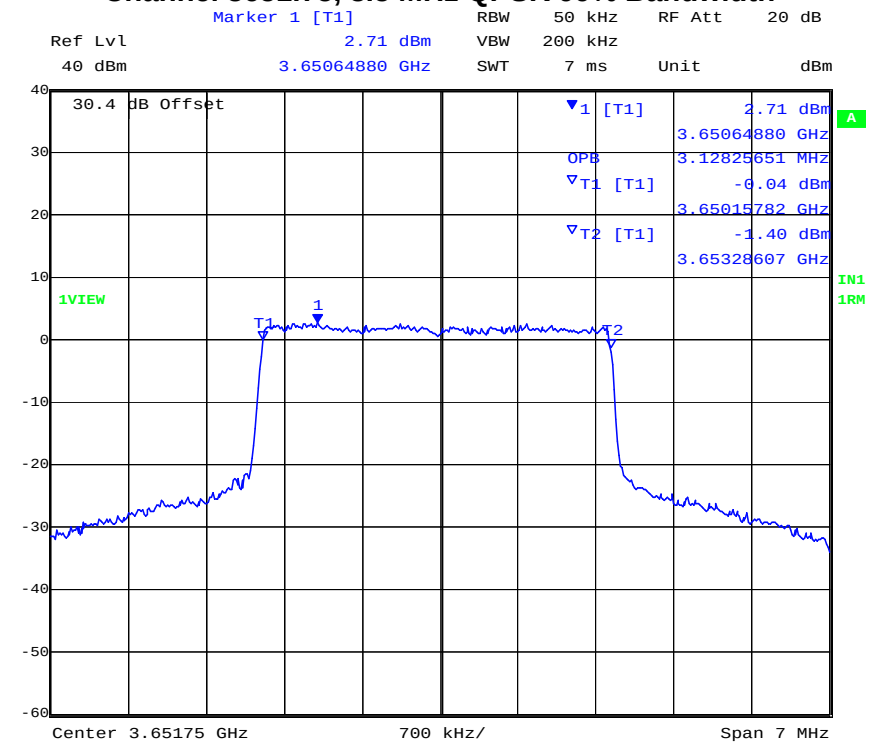
Channel 3651.75, 3.5 MHz QPSK 99% Bandwidth



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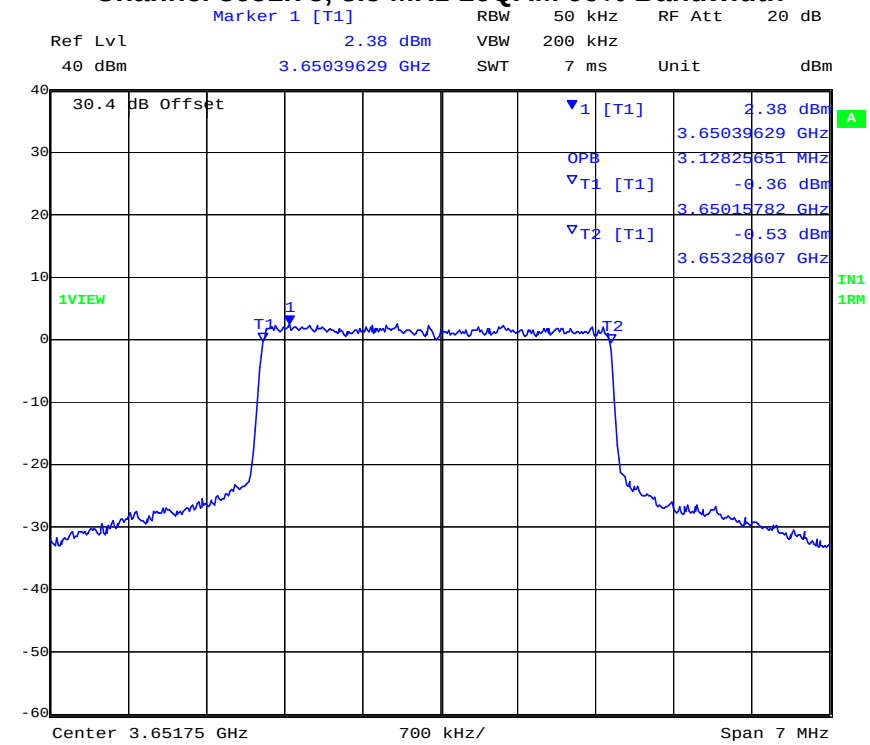
Channel 3651.75, 3.5 MHz 16QAM 99% Bandwidth



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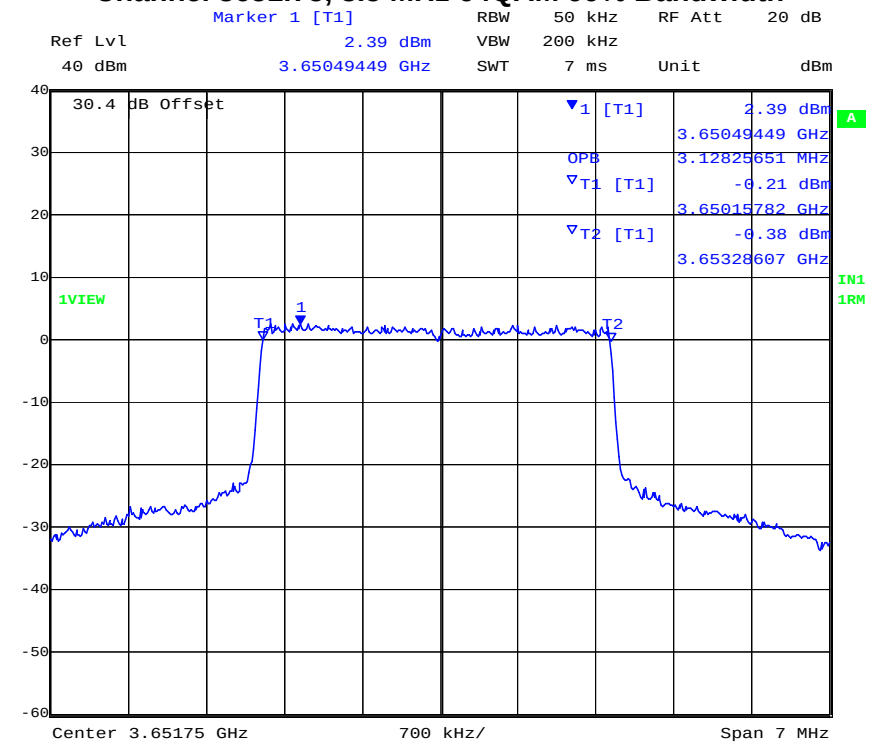
Channel 3651.75, 3.5 MHz 64QAM 99% Bandwidth



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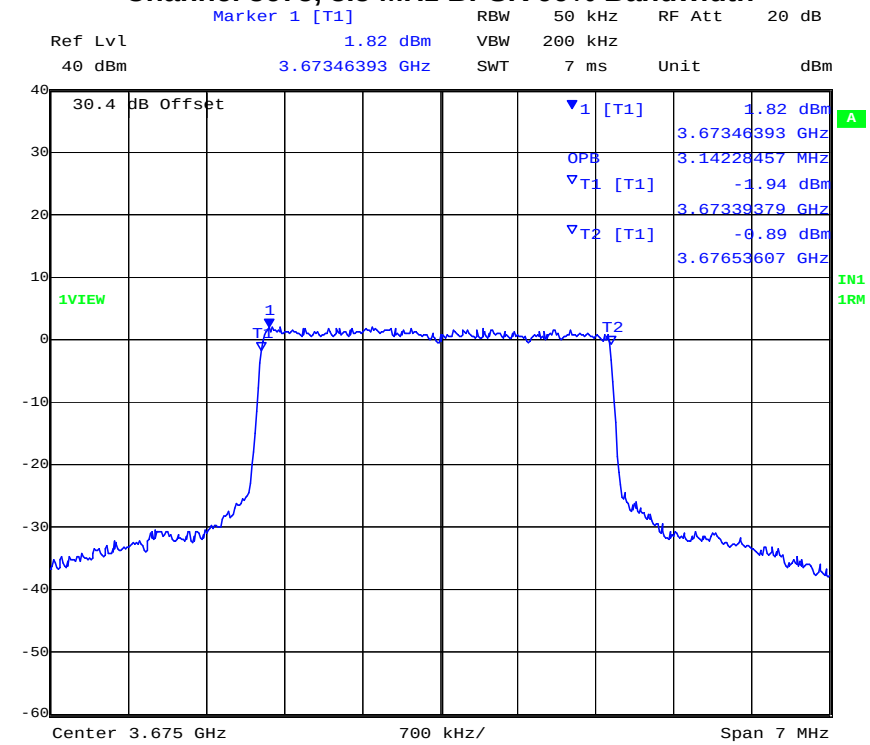
Channel 3675, 3.5 MHz BPSK 99% Bandwidth



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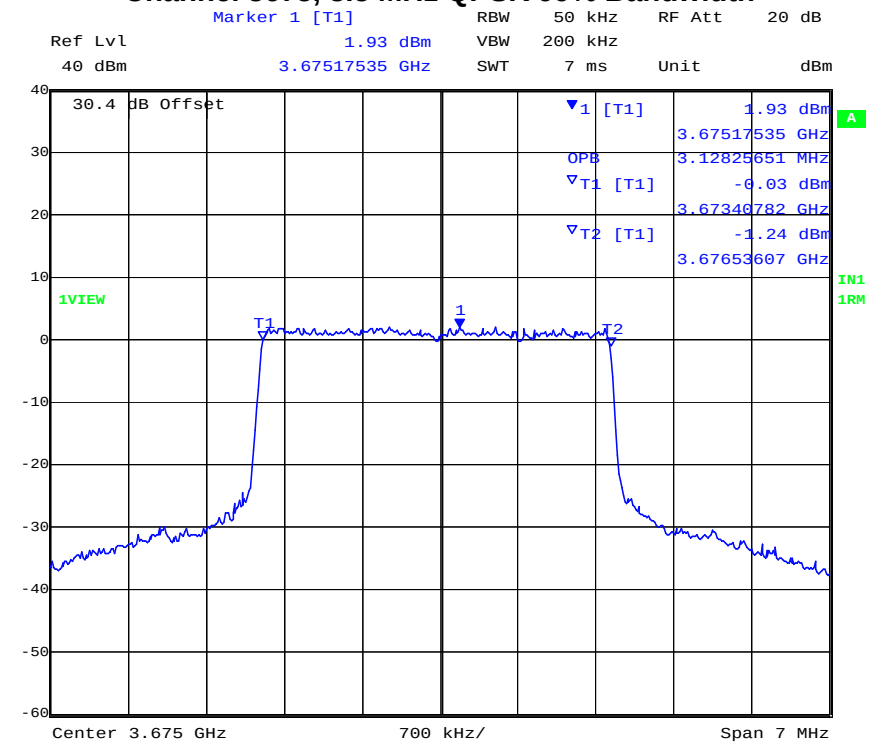
Channel 3675, 3.5 MHz QPSK 99% Bandwidth



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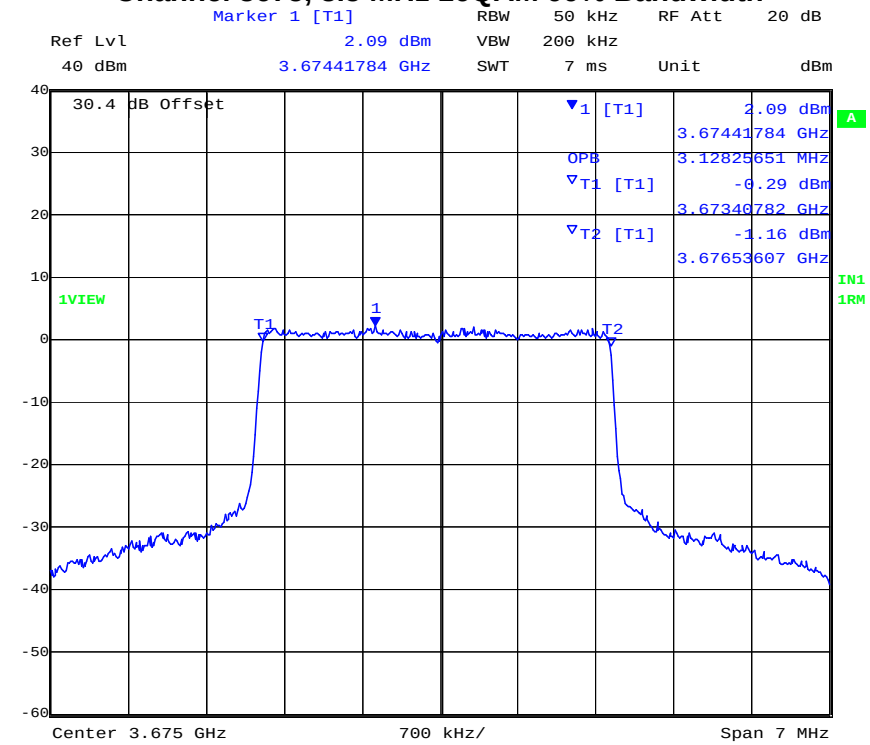
Channel 3675, 3.5 MHz 16QAM 99% Bandwidth



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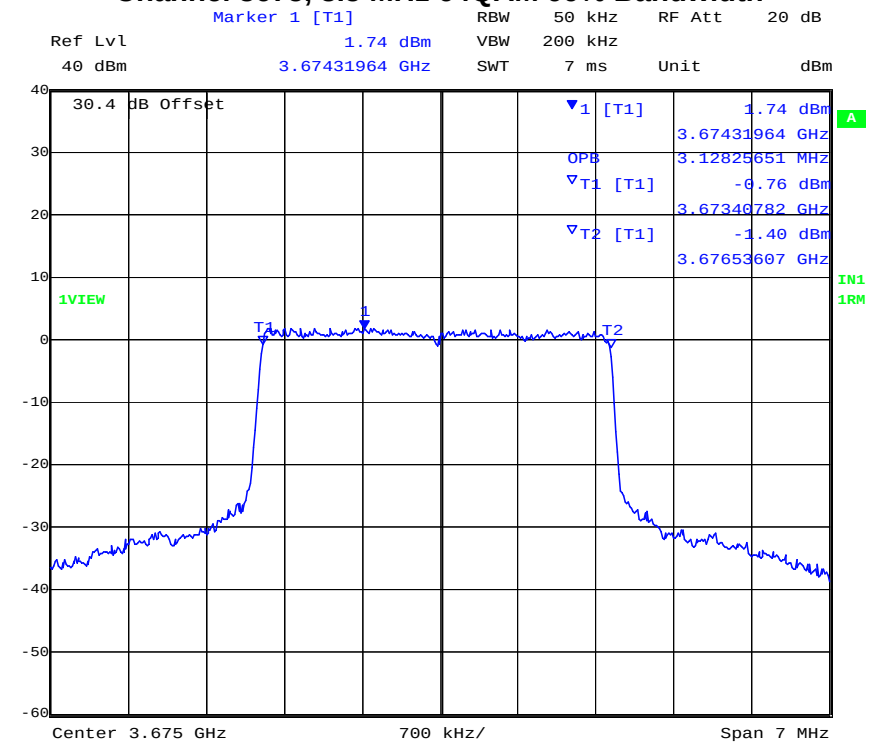
Channel 3675, 3.5 MHz 64QAM 99% Bandwidth



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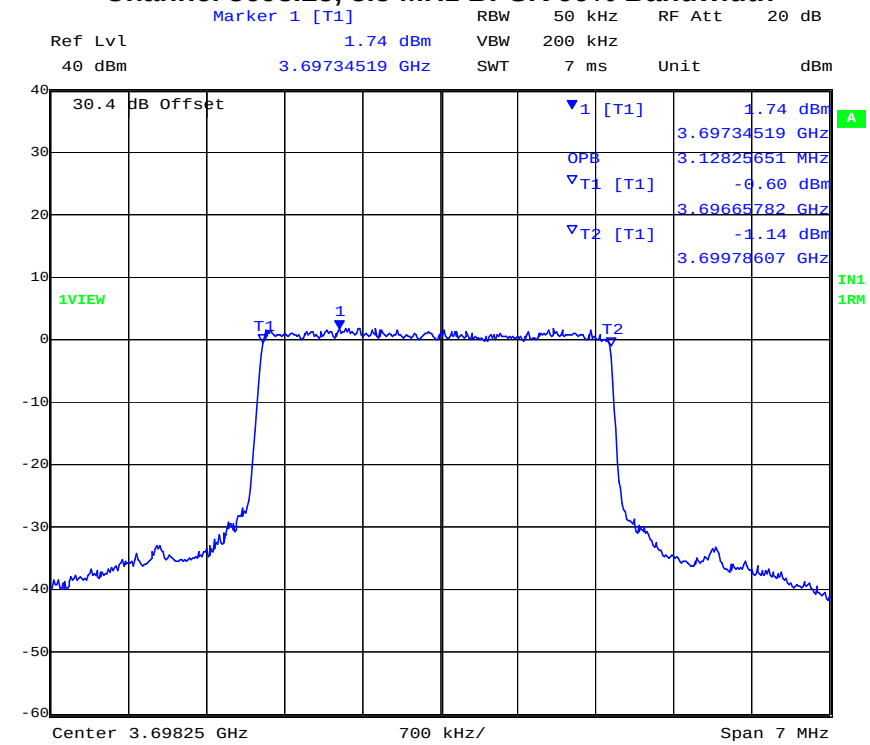
Channel 3698.25, 3.5 MHz BPSK 99% Bandwidth



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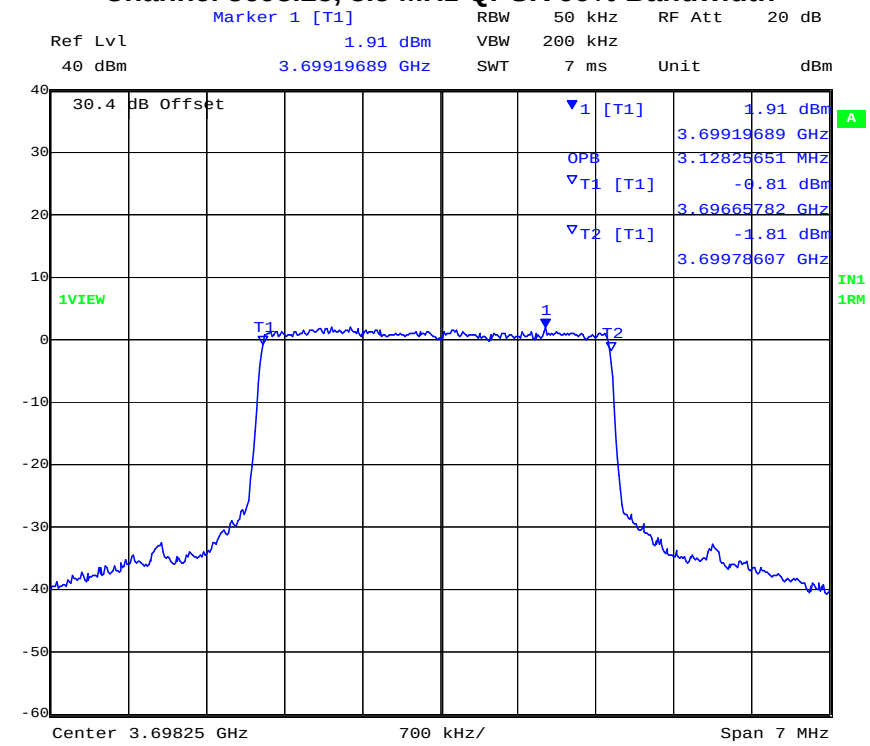
Channel 3698.25, 3.5 MHz QPSK 99% Bandwidth



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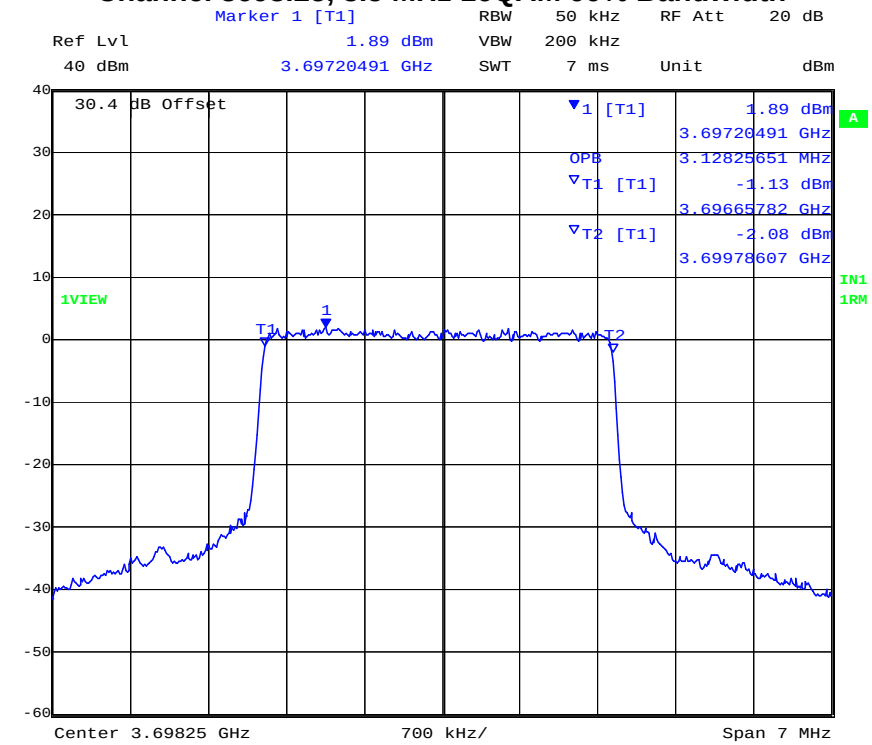
Channel 3698.25, 3.5 MHz 16QAM 99% Bandwidth



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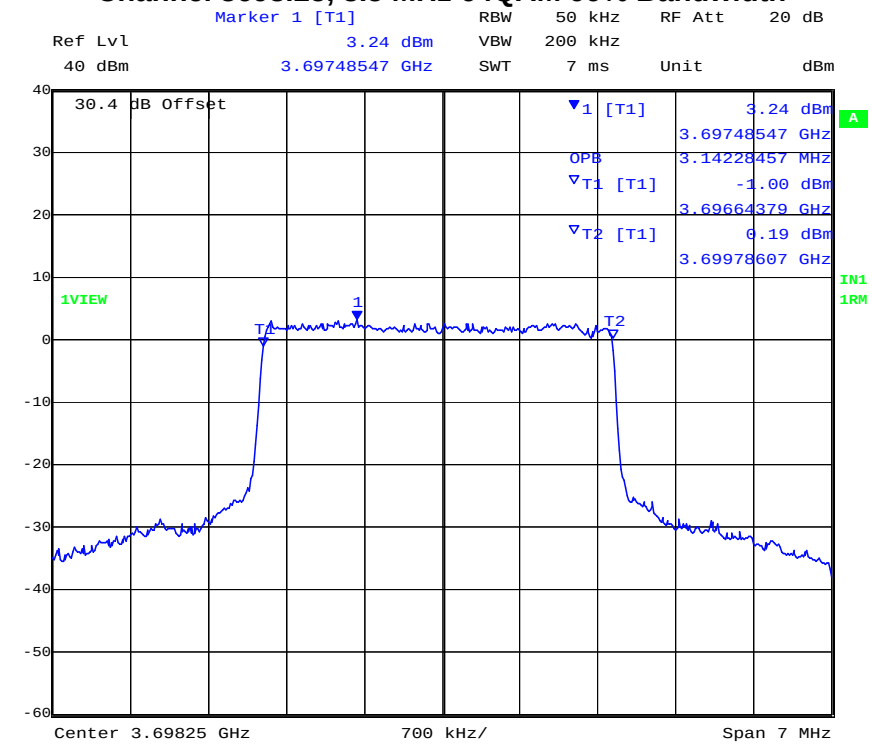
Channel 3698.25, 3.5 MHz 64QAM 99% Bandwidth



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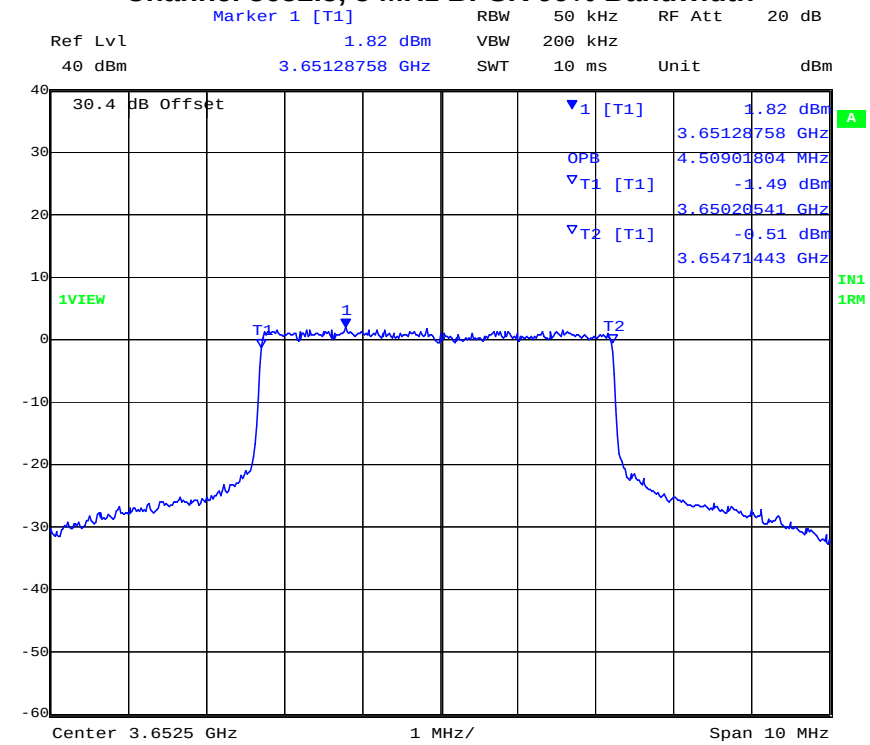
5 MHz Bandwidth

	99% Bandwidth			
Center Frequency (MHz)	BPSK	QPSK	16 QAM	64QAM
3652.50	4.509	4.509	4.529	4.529
3675.00	4.509	4.509	4.509	4.509
3697.50	4.509	4.509	4.489	4.489

Channel 3652.5, 5 MHz BPSK 99% Bandwidth



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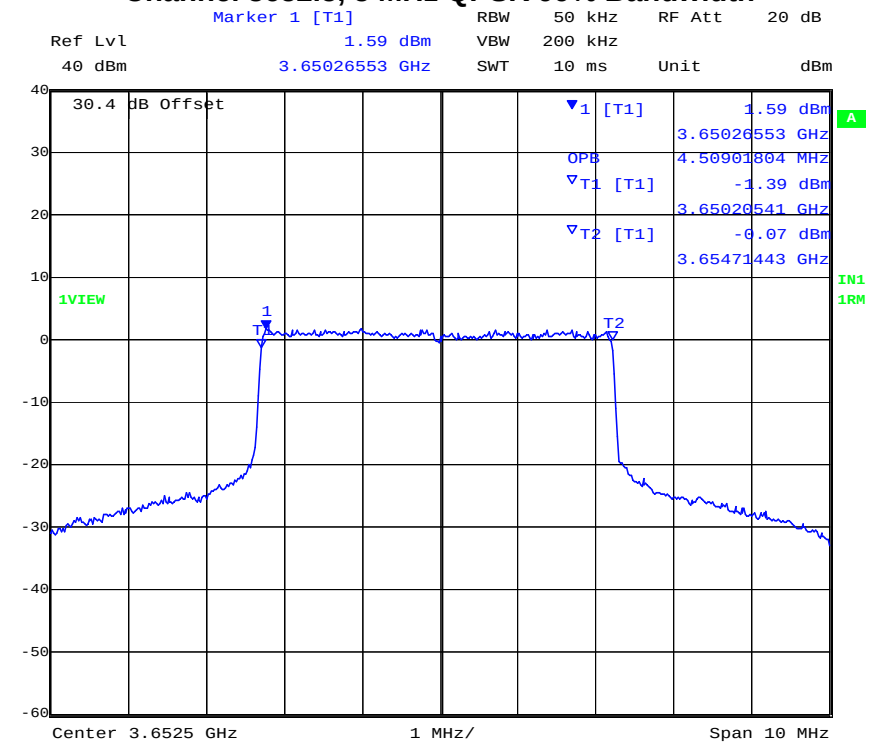
Channel 3652.5, 5 MHz QPSK 99% Bandwidth



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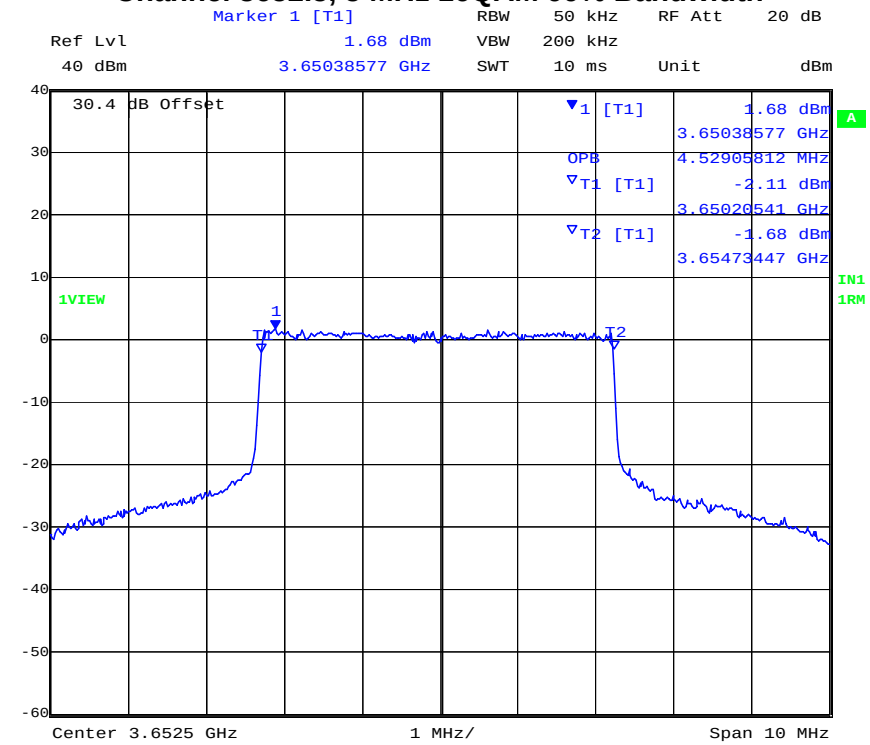
Channel 3652.5, 5 MHz 16QAM 99% Bandwidth



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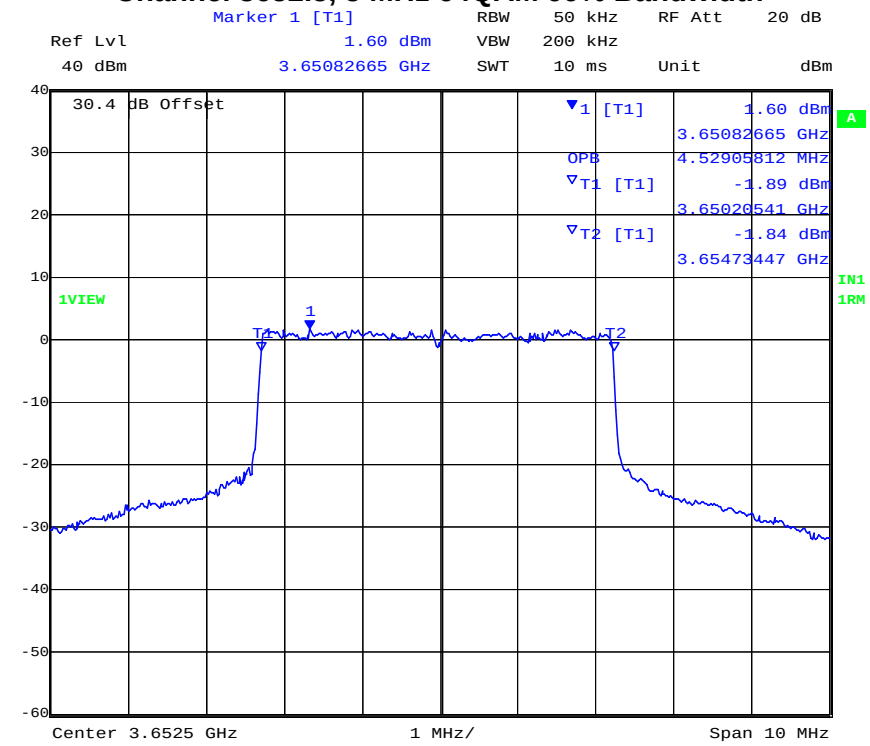
Channel 3652.5, 5 MHz 64QAM 99% Bandwidth



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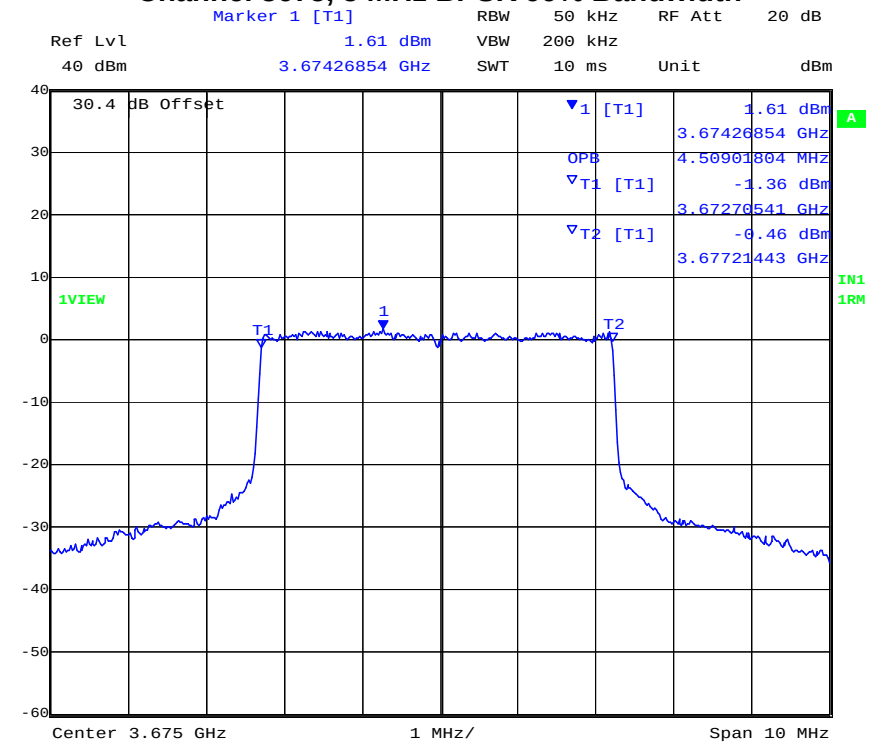
Channel 3675, 5 MHz BPSK 99% Bandwidth



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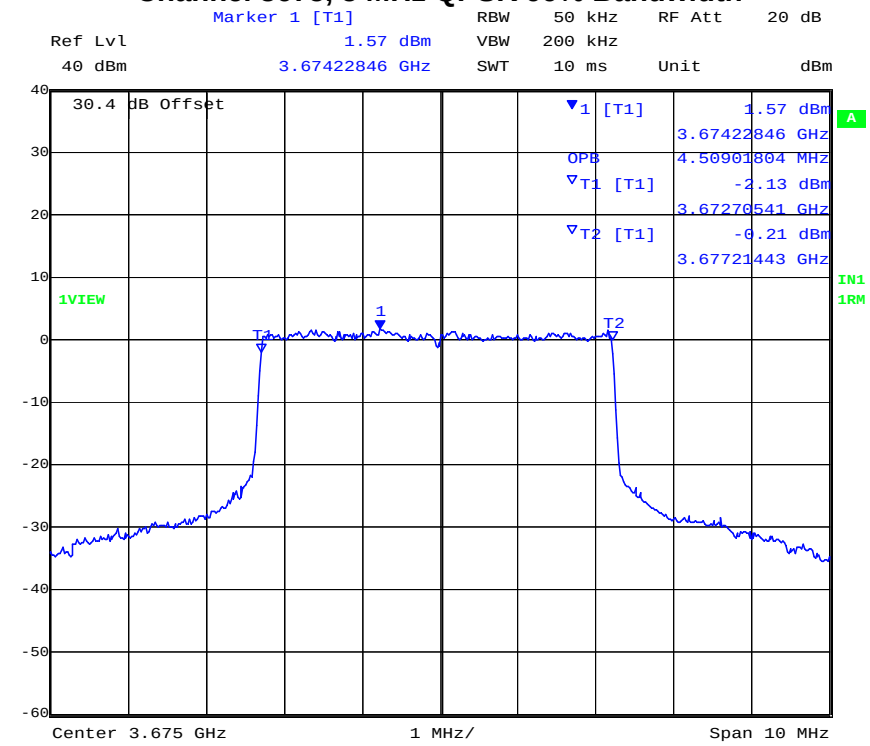
Channel 3675, 5 MHz QPSK 99% Bandwidth



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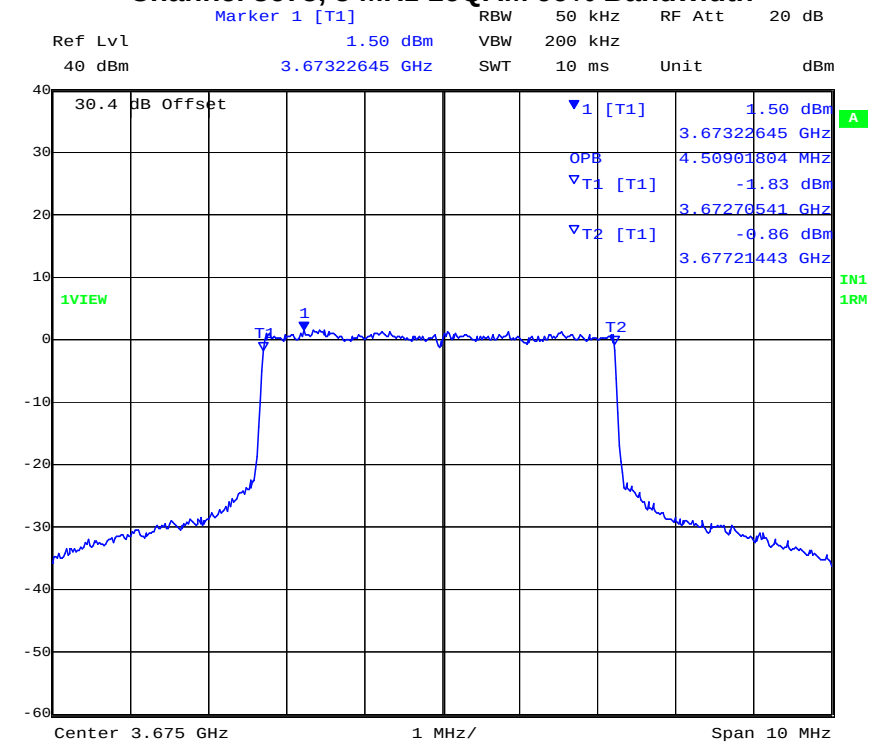
Channel 3675, 5 MHz 16QAM 99% Bandwidth



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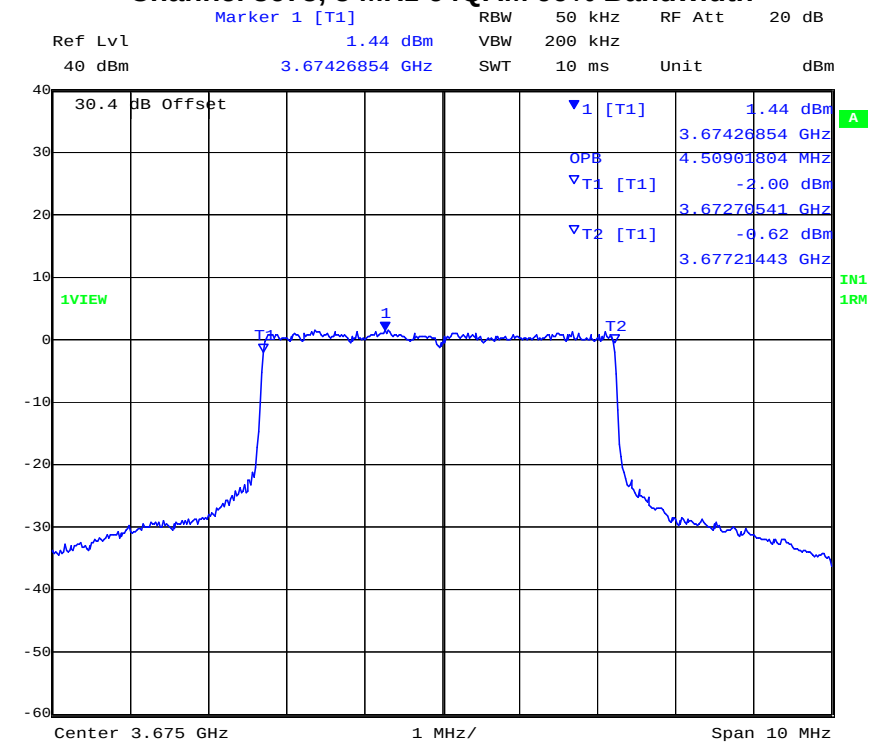
Channel 3675, 5 MHz 64QAM 99% Bandwidth



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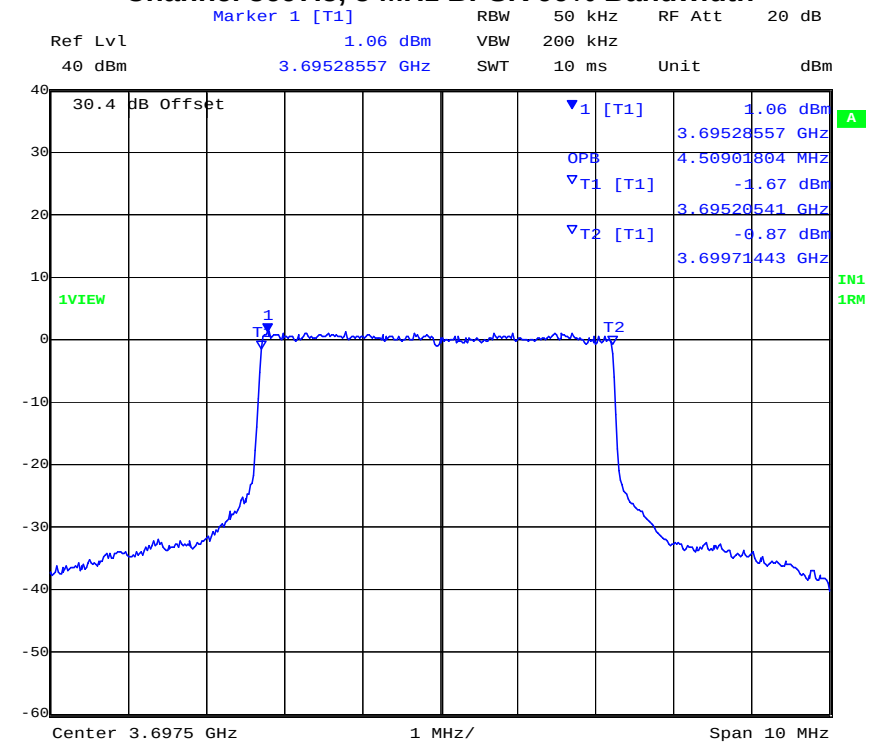
Channel 3697.5, 5 MHz BPSK 99% Bandwidth



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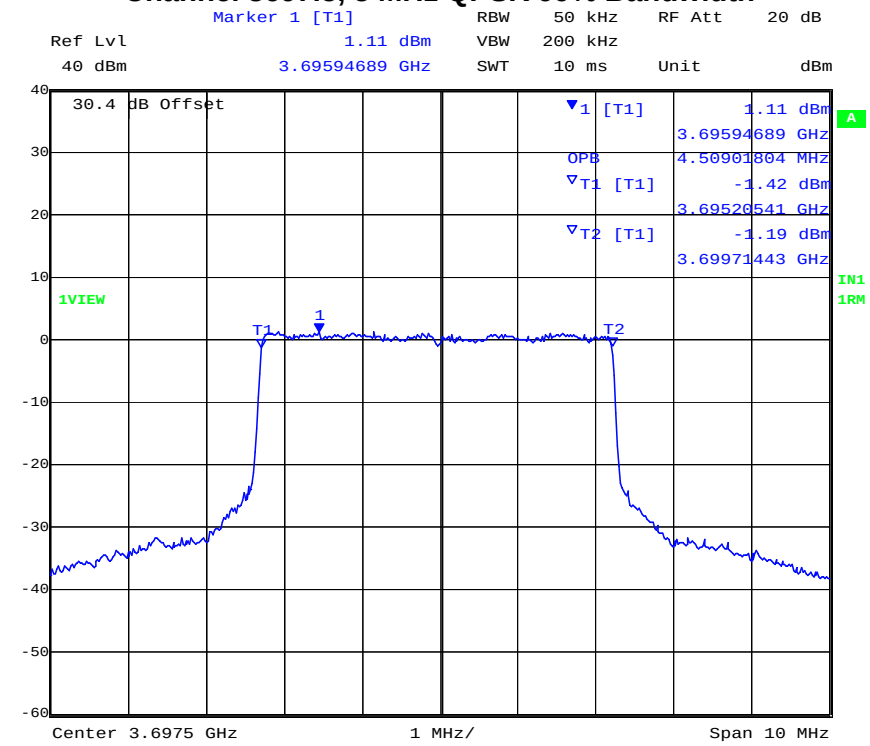
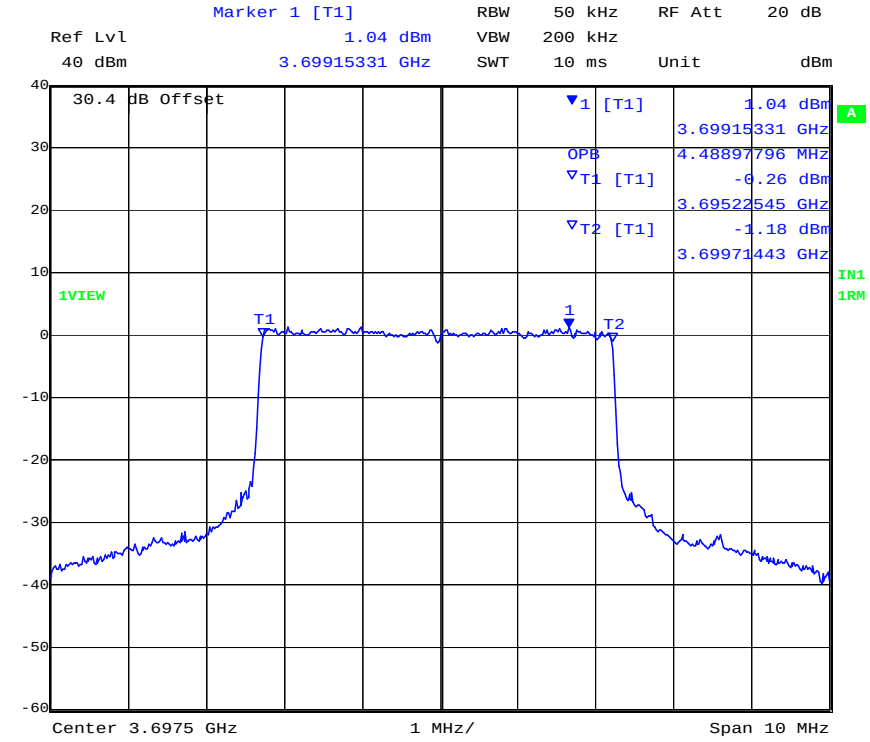
Channel 3697.5, 5 MHz QPSK 99% Bandwidth



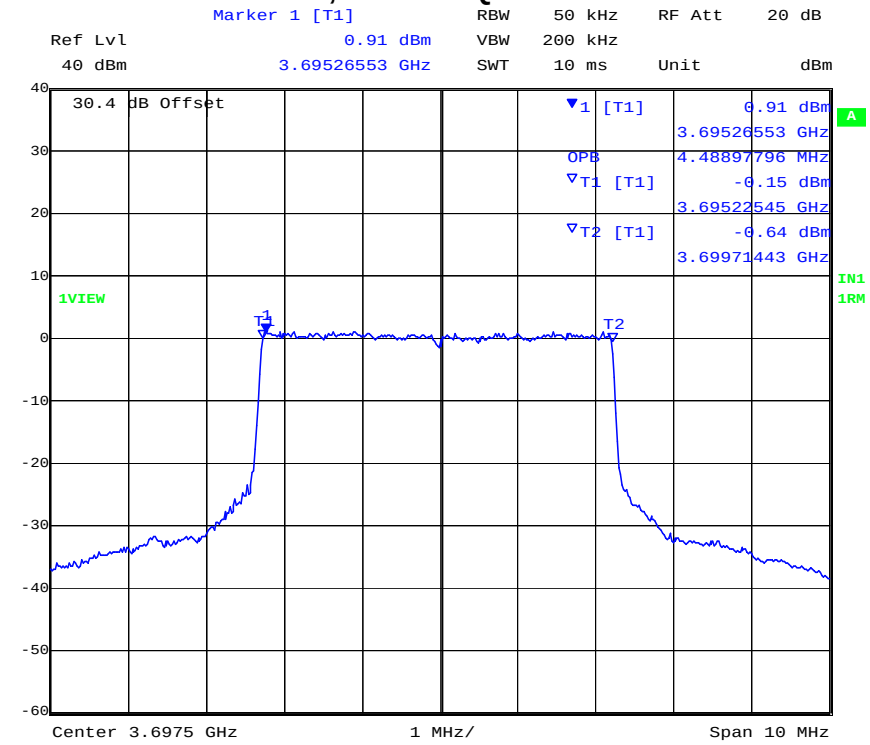
Date: 17.MAY.2010 11:10:55

Channel 3697.5, 5 MHz 16QAM 99% Bandwidth



Date: 17.MAY.2010 11:13:47

Channel 3697.5, 5 MHz 64QAM 99% Bandwidth

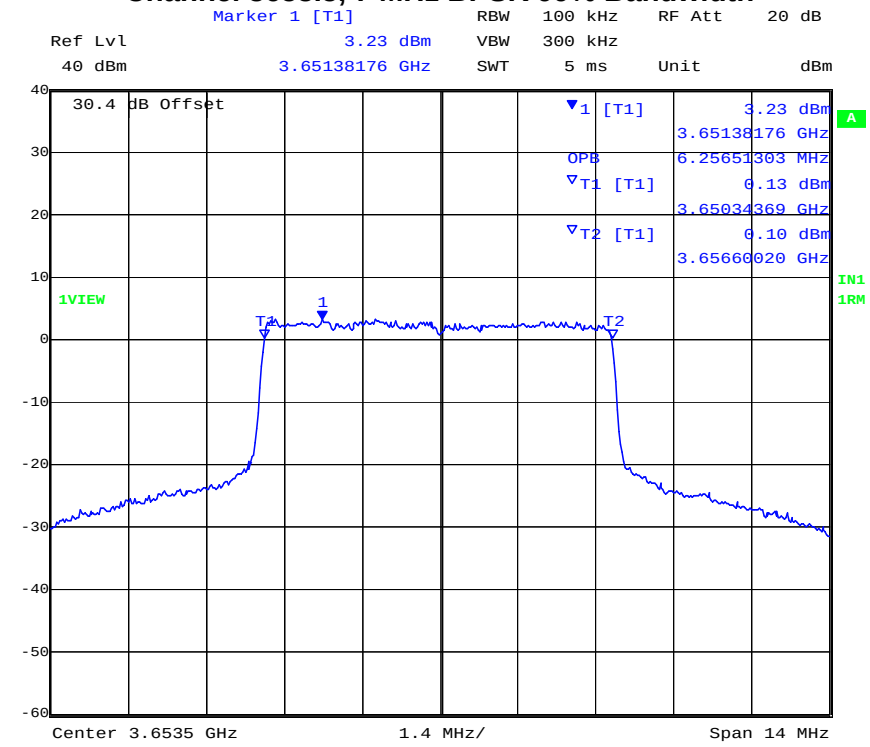


Date: 17.MAY.2010 11:15:13

7 MHz Bandwidth

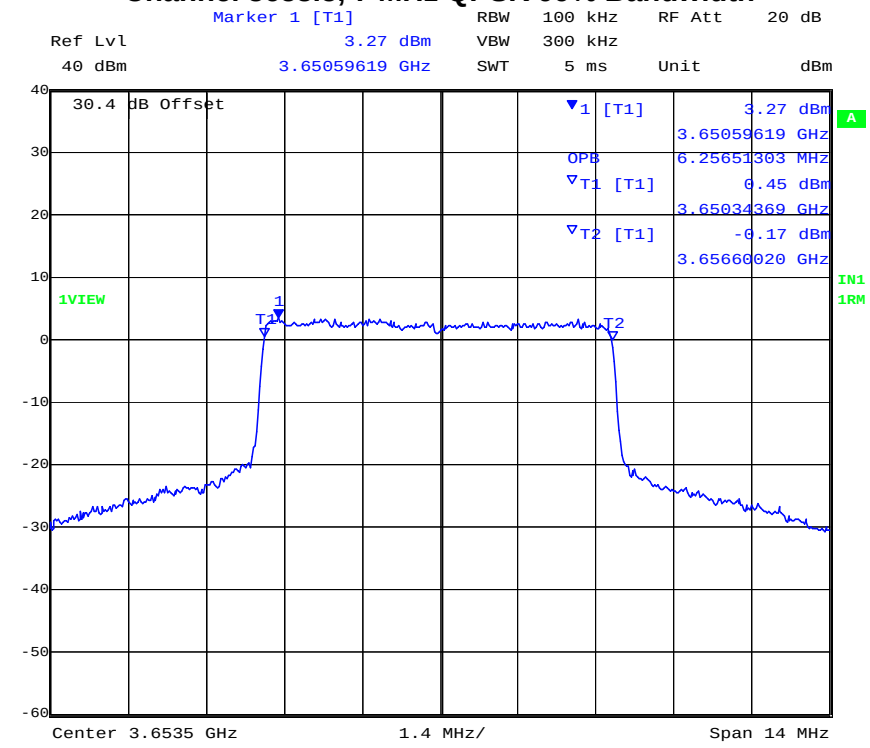
	99% Bandwidth			
Center Frequency (MHz)	**BPSK**	**QPSK**	**16 QAM**	**64QAM**
3653.50	6.257	6.257	6.257	6.257
3675.00	6.257	6.257	6.257	6.257
3696.50	6.257	6.257	6.257	6.257

Channel 3653.5, 7 MHz BPSK 99% Bandwidth



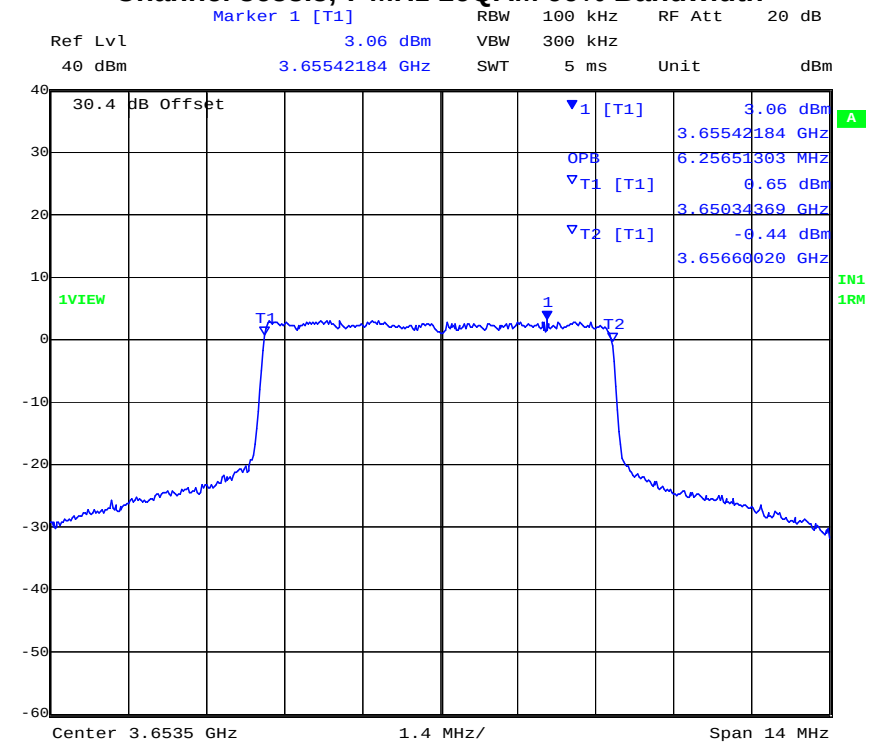
Date: 17.MAY.2010 11:21:31

Channel 3653.5, 7 MHz QPSK 99% Bandwidth

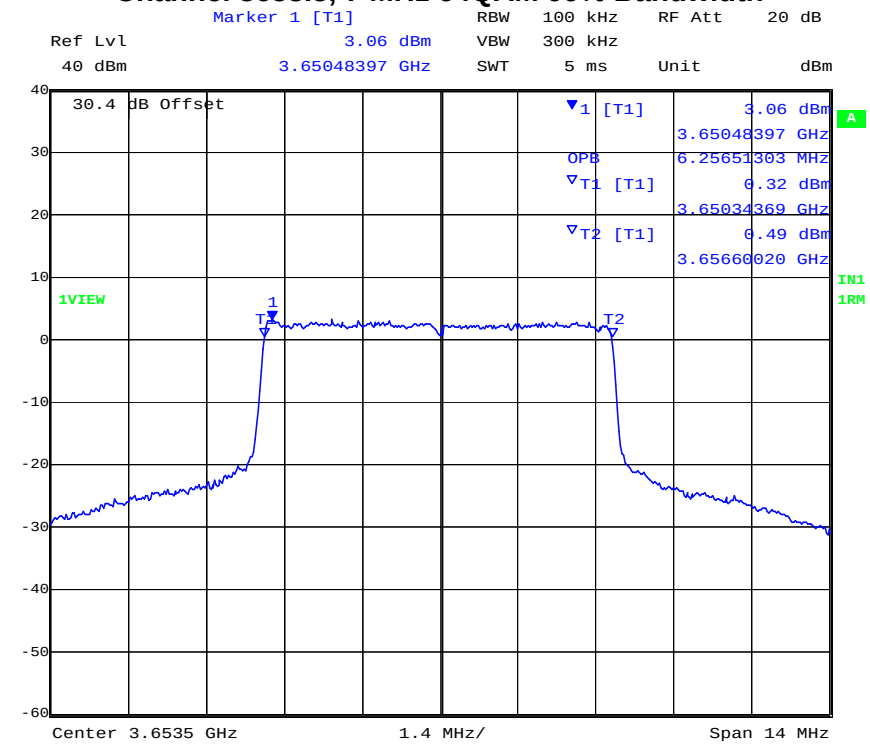


Date: 17.MAY.2010 11:22:56

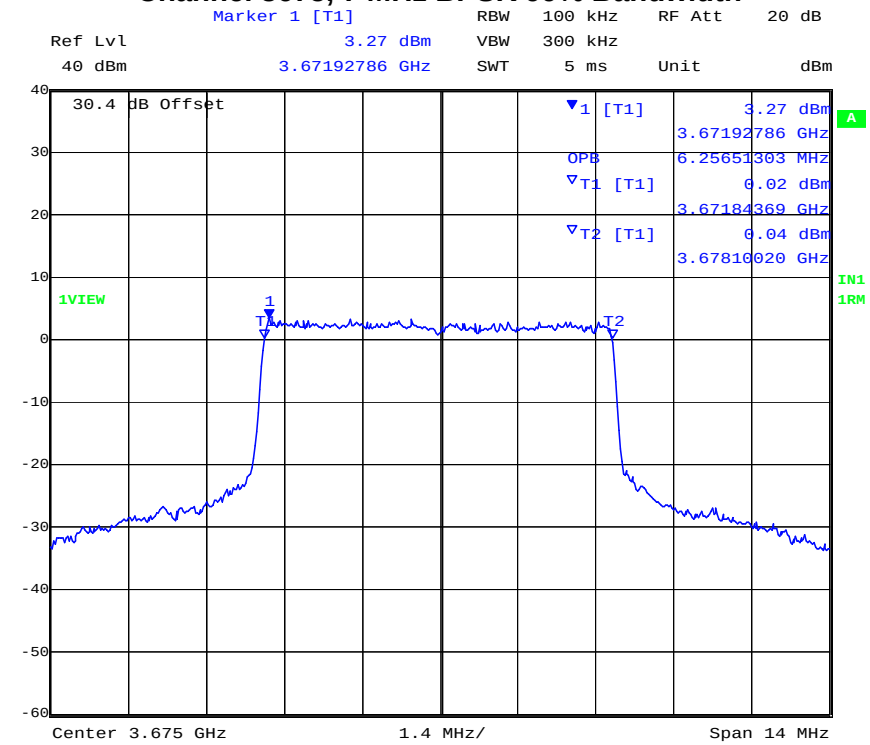
Channel 3653.5, 7 MHz 16QAM 99% Bandwidth



Channel 3653.5, 7 MHz 64QAM 99% Bandwidth

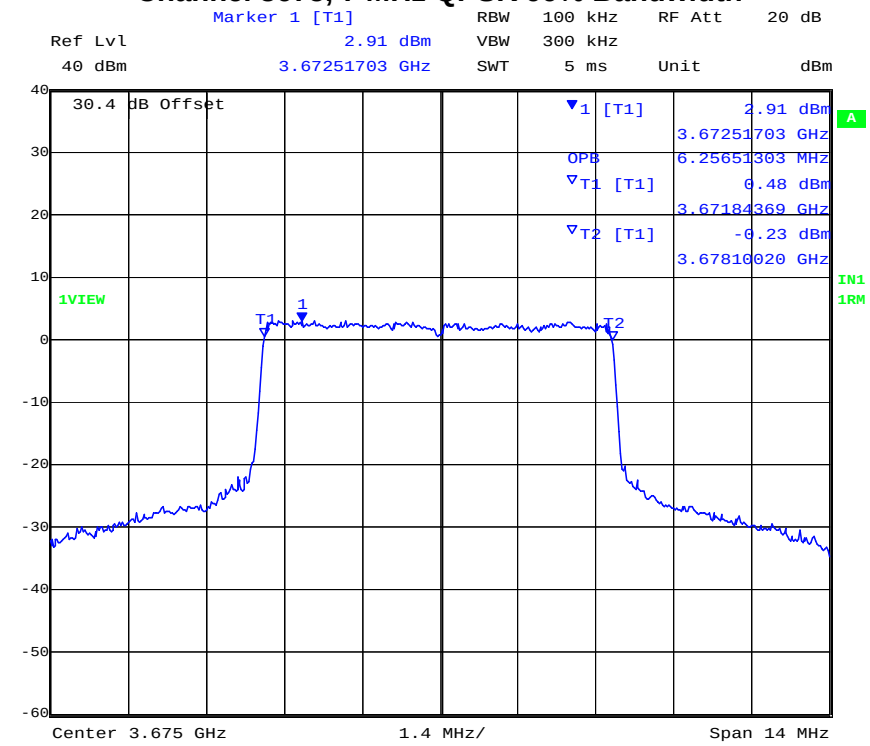


Channel 3675, 7 MHz BPSK 99% Bandwidth



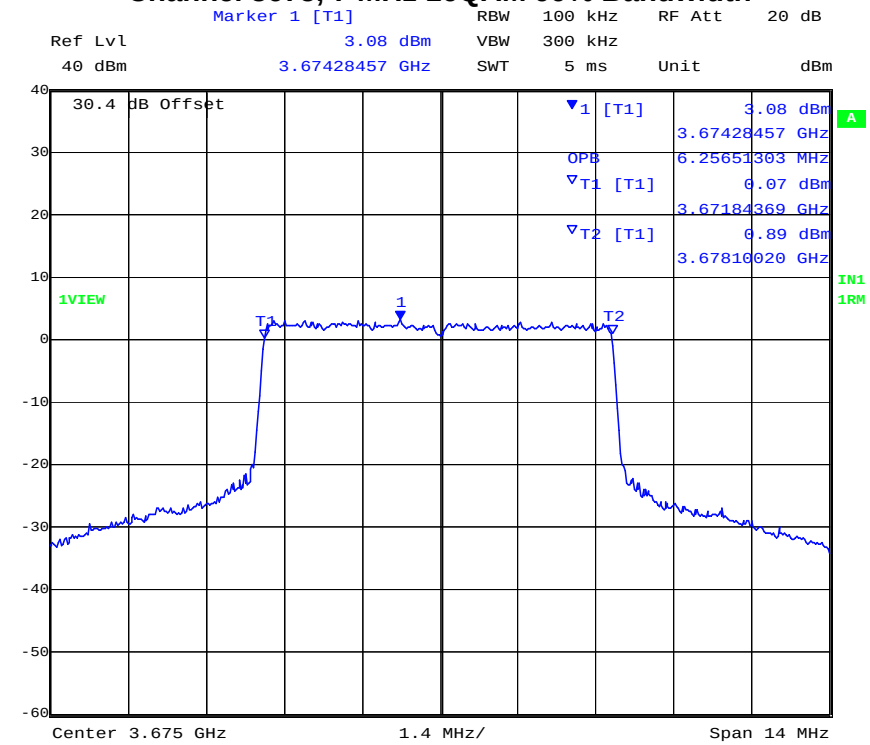
Date: 17.MAY.2010 11:30:36

Channel 3675, 7 MHz QPSK 99% Bandwidth



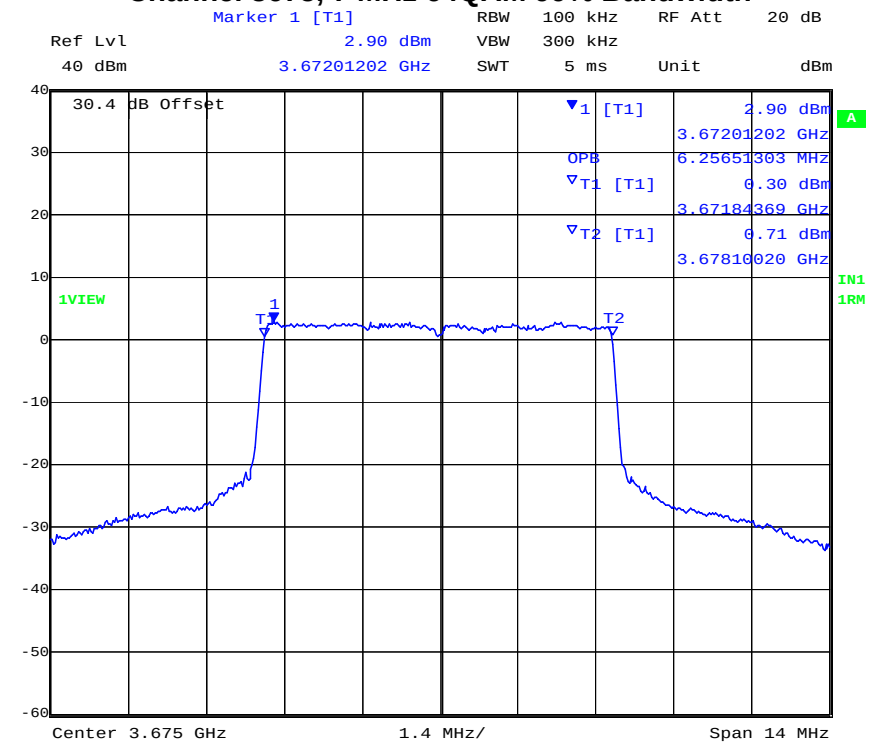
Date: 17.MAY.2010 11:37:58

Channel 3675, 7 MHz 16QAM 99% Bandwidth



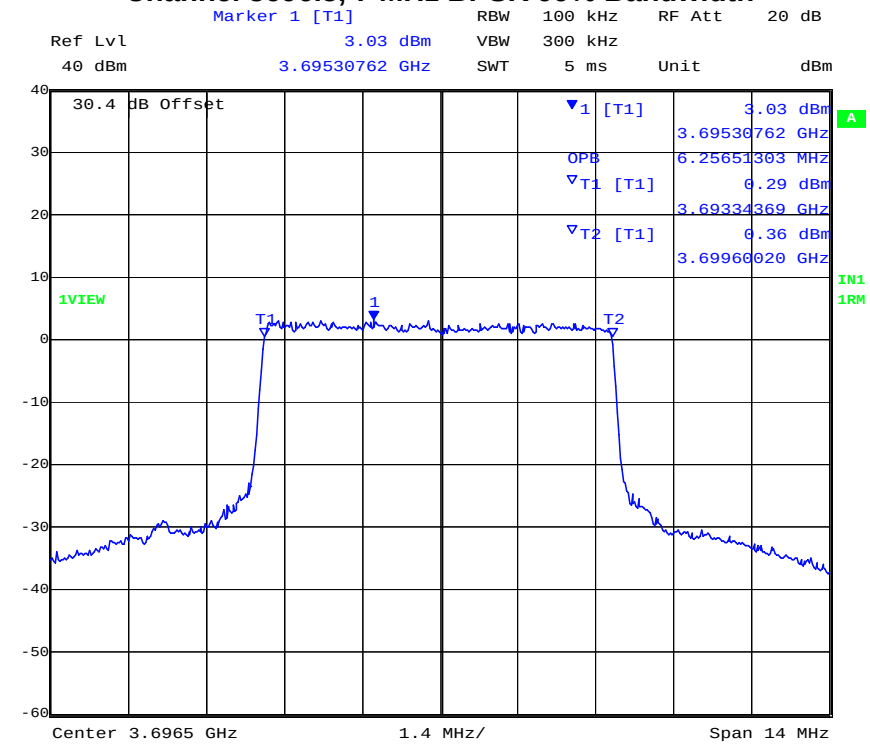
Date: 17.MAY.2010 11:41:59

Channel 3675, 7 MHz 64QAM 99% Bandwidth



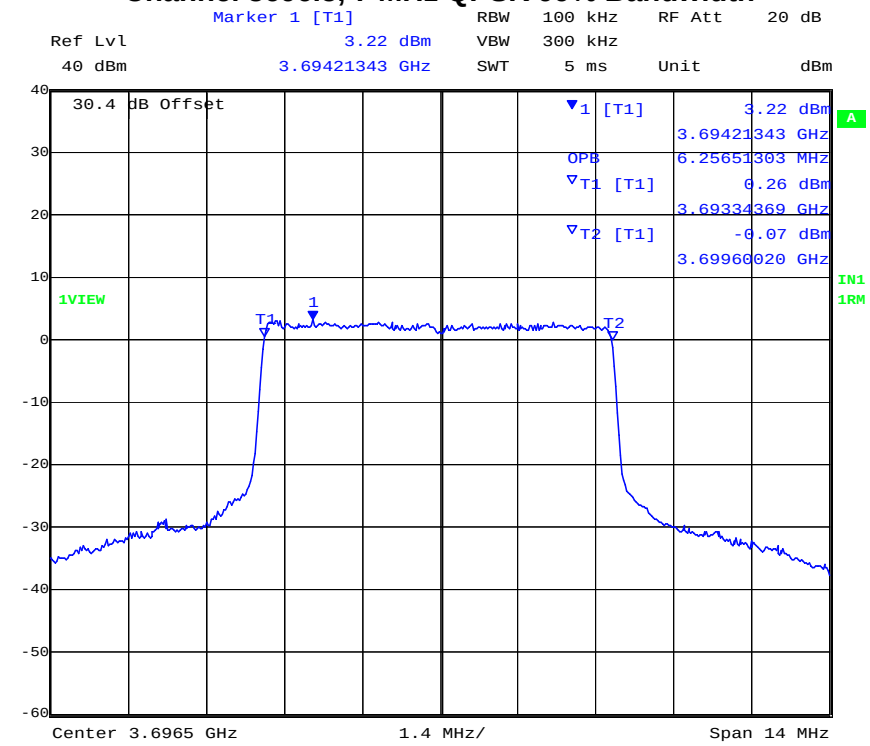
Date: 17.MAY.2010 11:44:16

Channel 3696.5, 7 MHz BPSK 99% Bandwidth



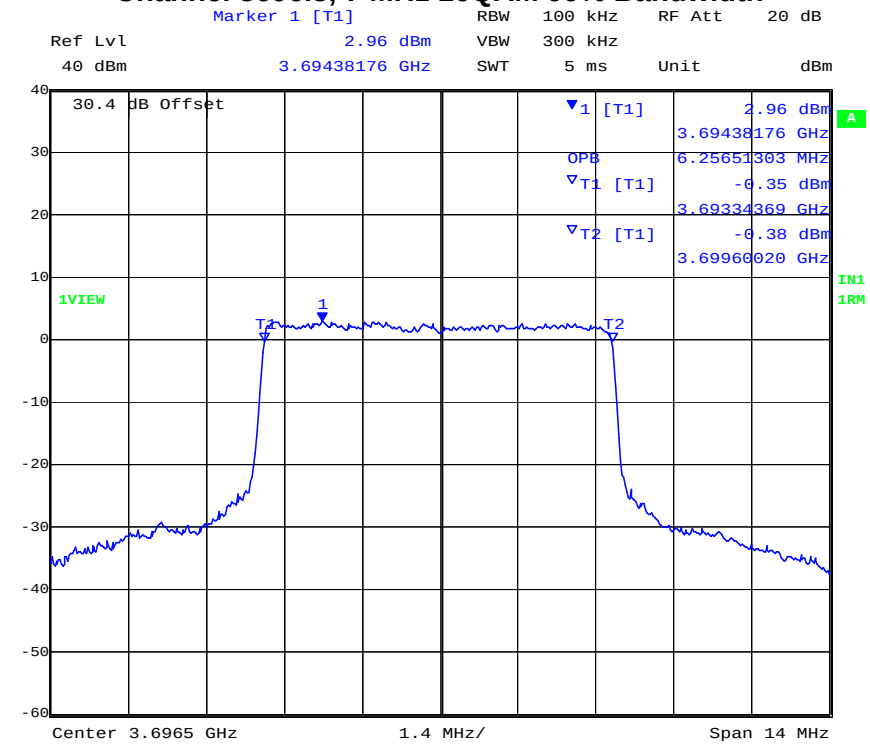
Date: 17.MAY.2010 11:48:22

Channel 3696.5, 7 MHz QPSK 99% Bandwidth



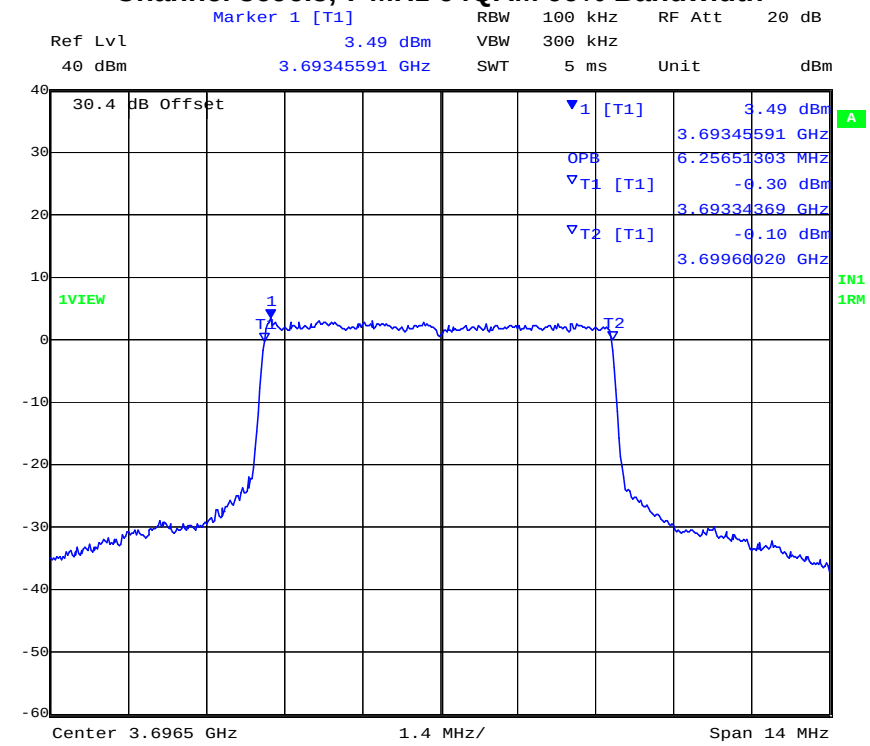
Date: 17.MAY.2010 11:50:19

Channel 3696.5, 7 MHz 16QAM 99% Bandwidth



Date: 17.MAY.2010 11:53:39

Channel 3696.5, 7 MHz 64QAM 99% Bandwidth



Date: 17.MAY.2010 11:54:16

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB

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.

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.

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

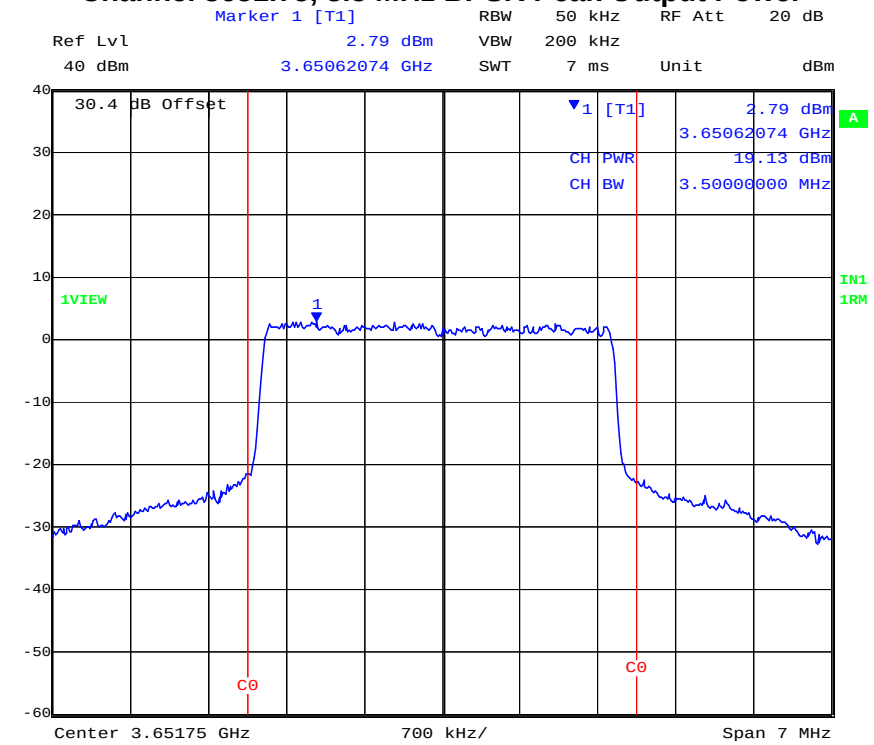
Maximum Permissible Conducted Power = EIRP – Antenna Gain + 1 dB antenna cable loss

3.5 MHz Bandwidth

	Peak Output Power				
Center Frequency (MHz)	BPSK (+dBm)	QPSK (+dBm)	16 QAM (+dBm)	64QAM (+dBm)	Minimum Margin (dB)
3651.75	19.13	19.04	18.80	18.79	-1.27
3675.00	18.31	18.43	18.27	18.24	-1.97
3698.25	18.13	18.29	18.17	19.22	-1.18

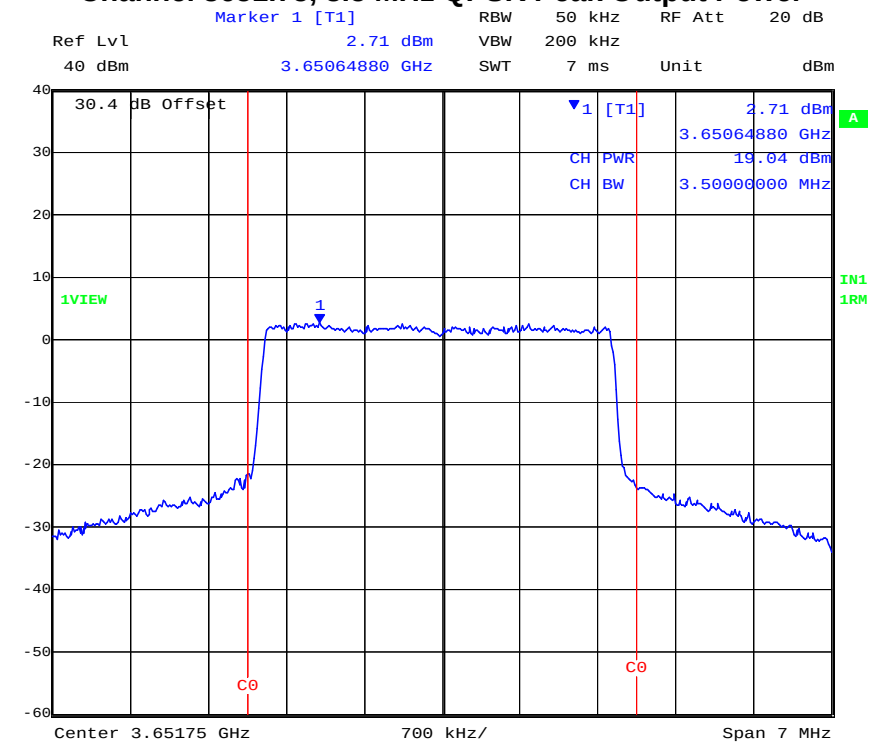
Conducted Power Limit: +20.4 dBm

Channel 3651.75, 3.5 MHz BPSK Peak Output Power



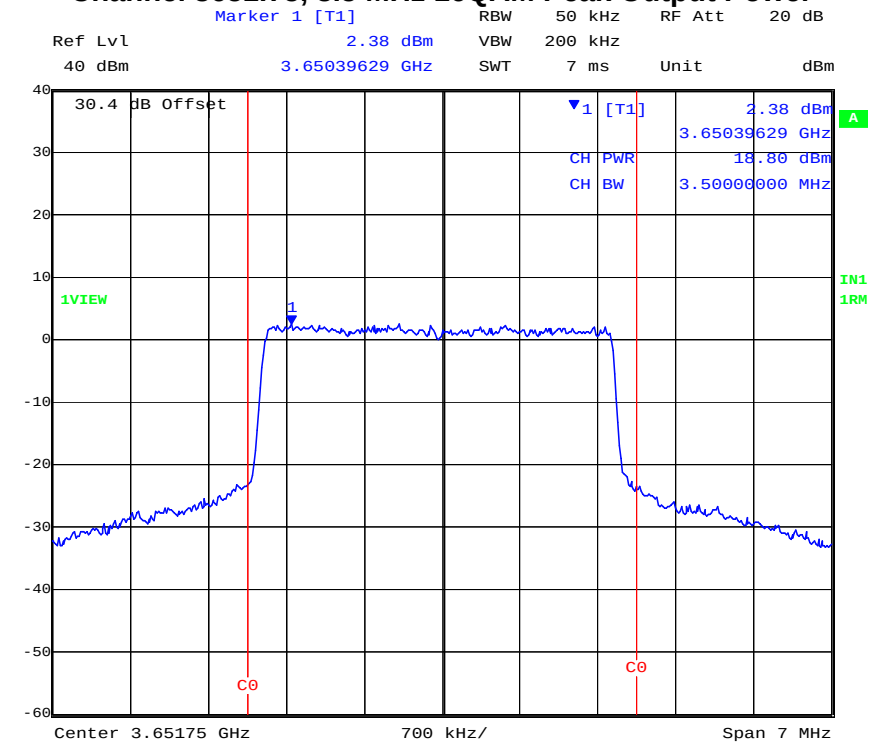
Date: 17.MAY.2010 10:00:37

Channel 3651.75, 3.5 MHz QPSK Peak Output Power



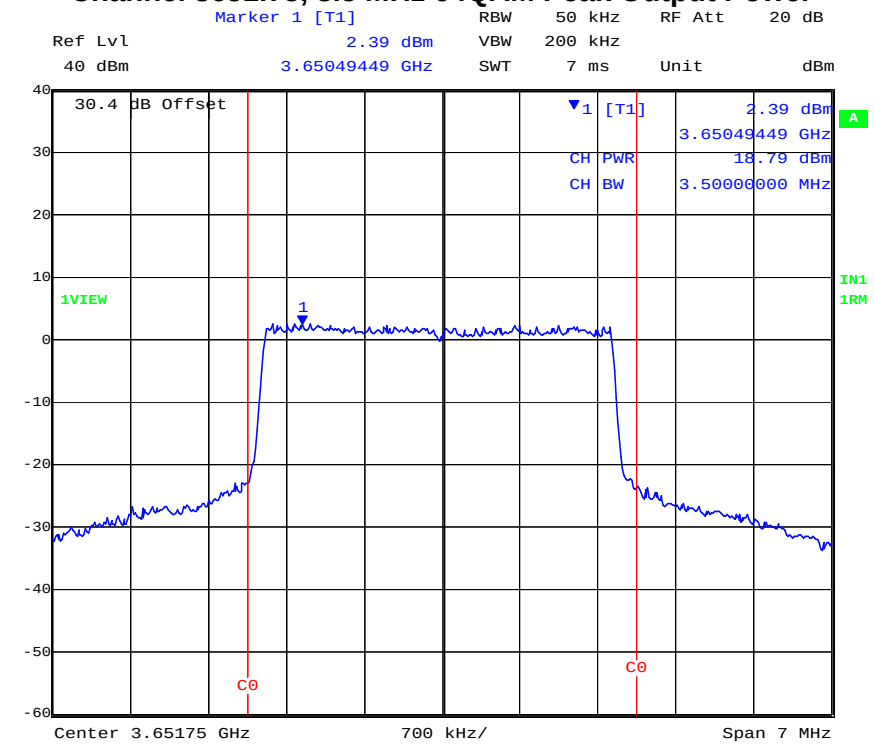
Date: 17.MAY.2010 10:03:26

Channel 3651.75, 3.5 MHz 16QAM Peak Output Power



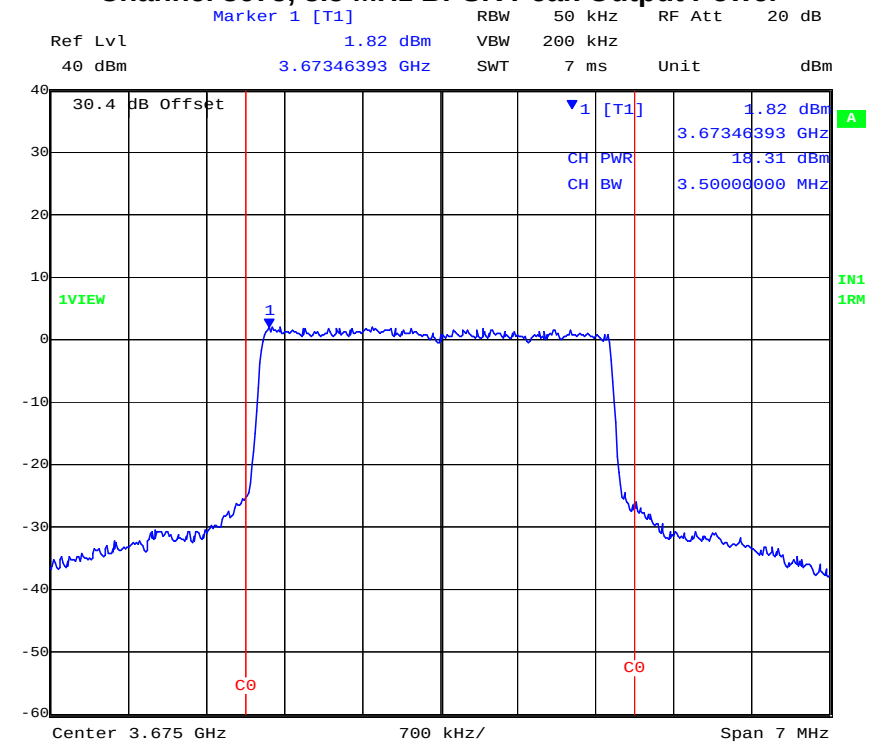
Date: 17.MAY.2010 10:08:29

Channel 3651.75, 3.5 MHz 64QAM Peak Output Power



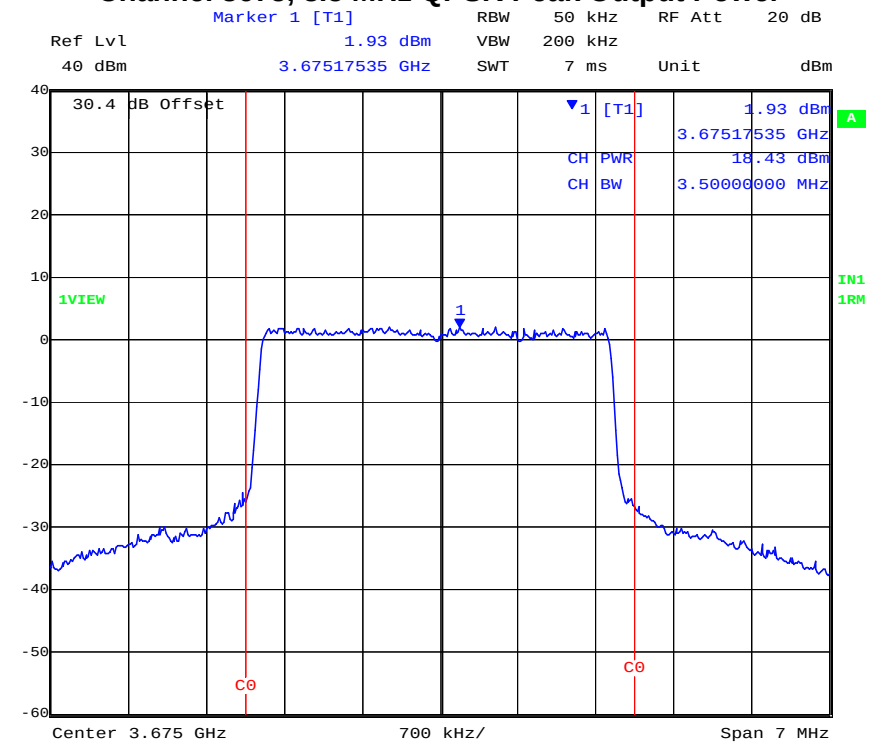
Date: 17.MAY.2010 10:09:24

Channel 3675, 3.5 MHz BPSK Peak Output Power



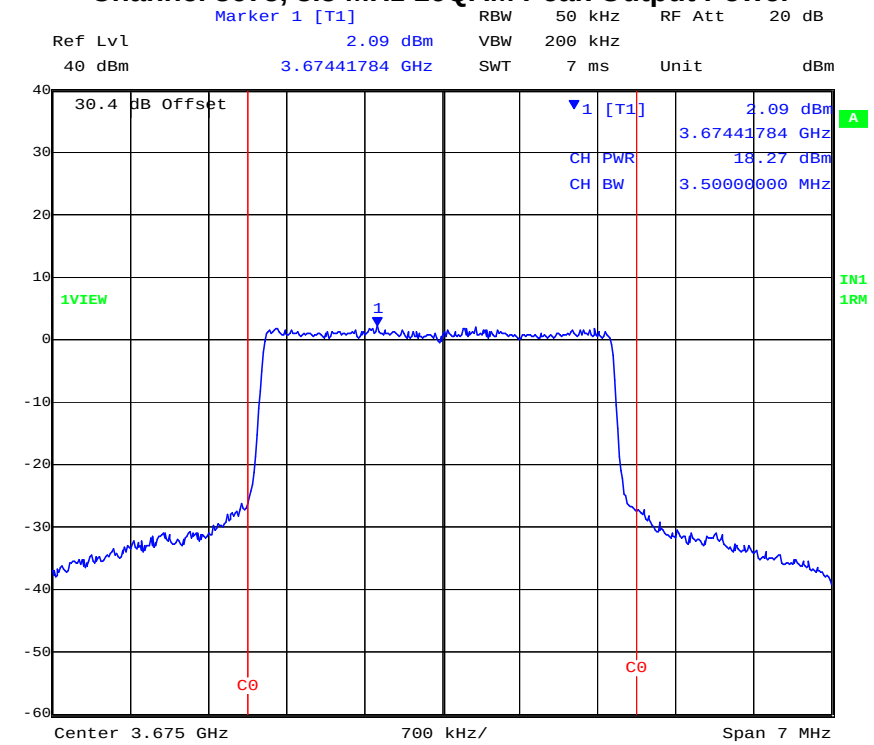
Date: 17.MAY.2010 10:14:57

Channel 3675, 3.5 MHz QPSK Peak Output Power



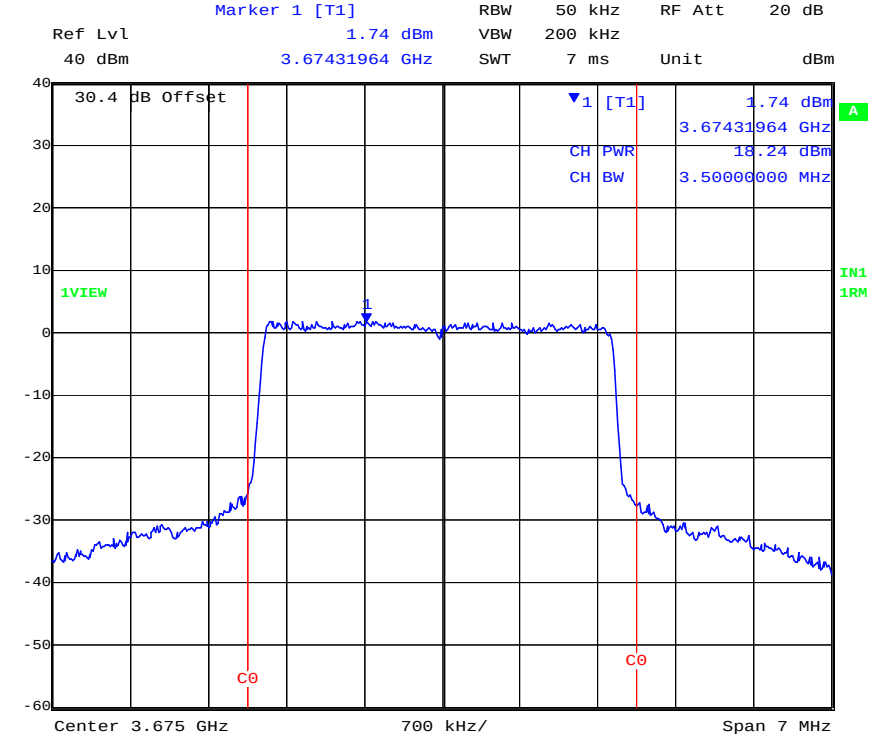
Date: 17.MAY.2010 10:16:02

Channel 3675, 3.5 MHz 16QAM Peak Output Power



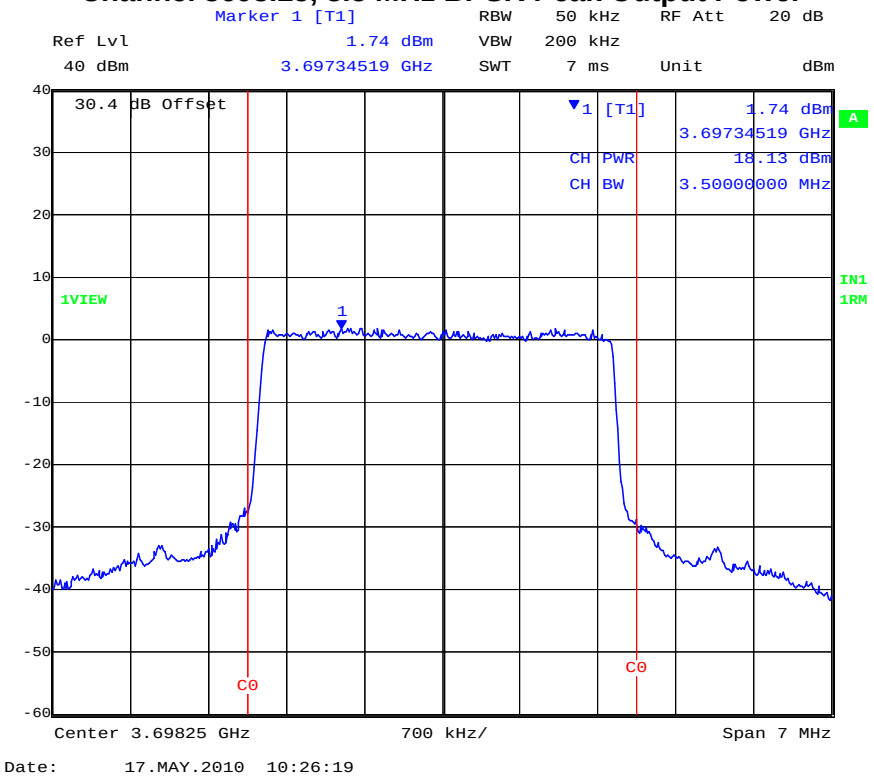
Date: 17.MAY.2010 10:19:46

Channel 3675, 3.5 MHz 64QAM Peak Output Power



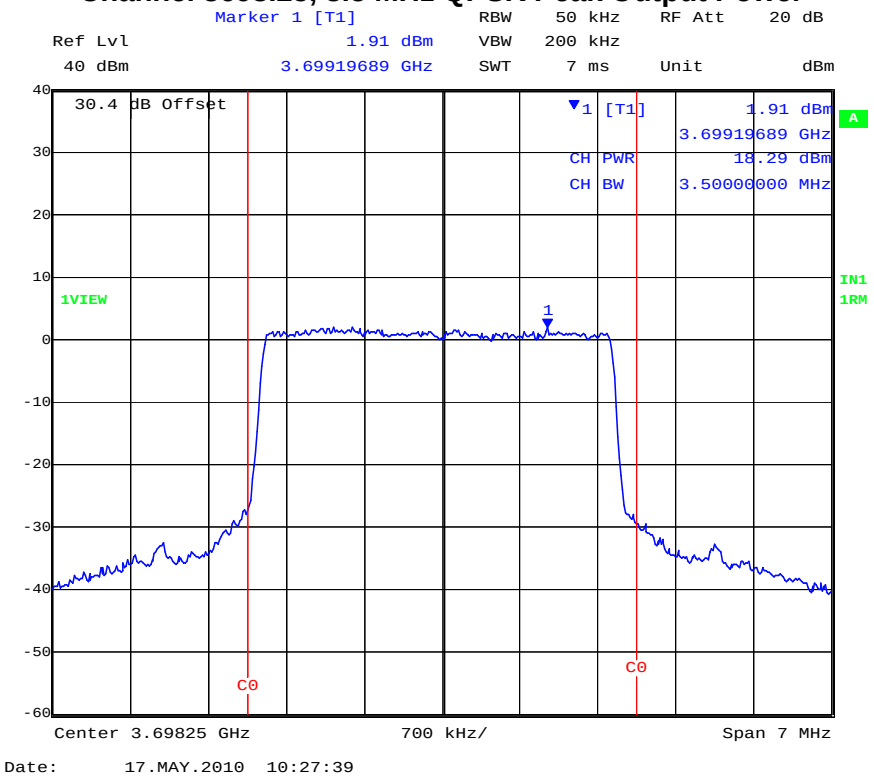
Date: 17.MAY.2010 10:21:17

Channel 3698.25, 3.5 MHz BPSK Peak Output Power



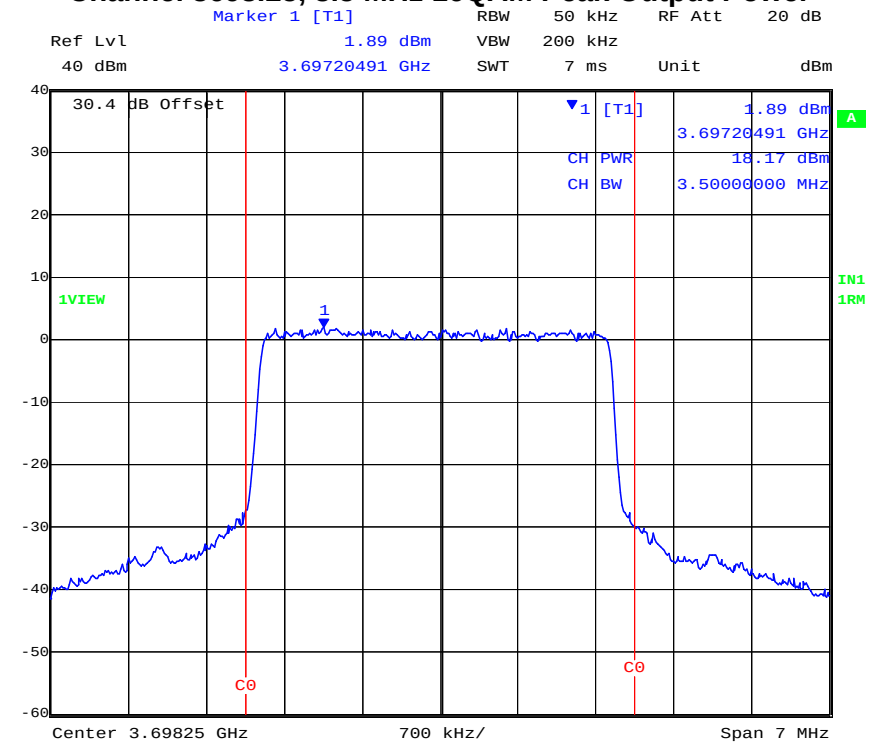
Date: 17.MAY.2010 10:26:19

Channel 3698.25, 3.5 MHz QPSK Peak Output Power



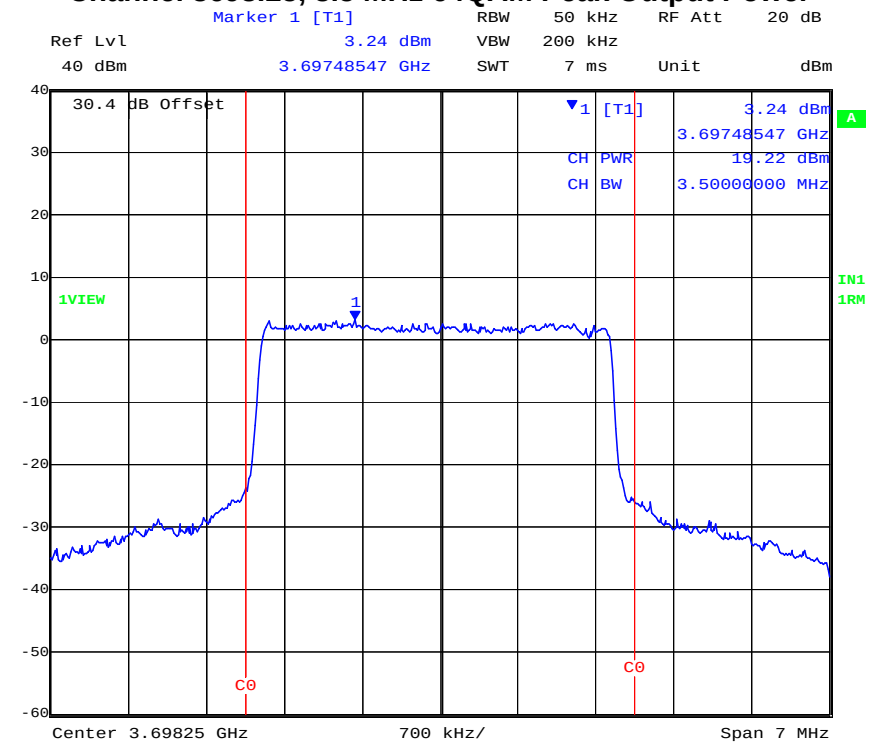
Date: 17.MAY.2010 10:27:39

Channel 3698.25, 3.5 MHz 16QAM Peak Output Power



Date: 17.MAY.2010 10:31:37

Channel 3698.25, 3.5 MHz 64QAM Peak Output Power



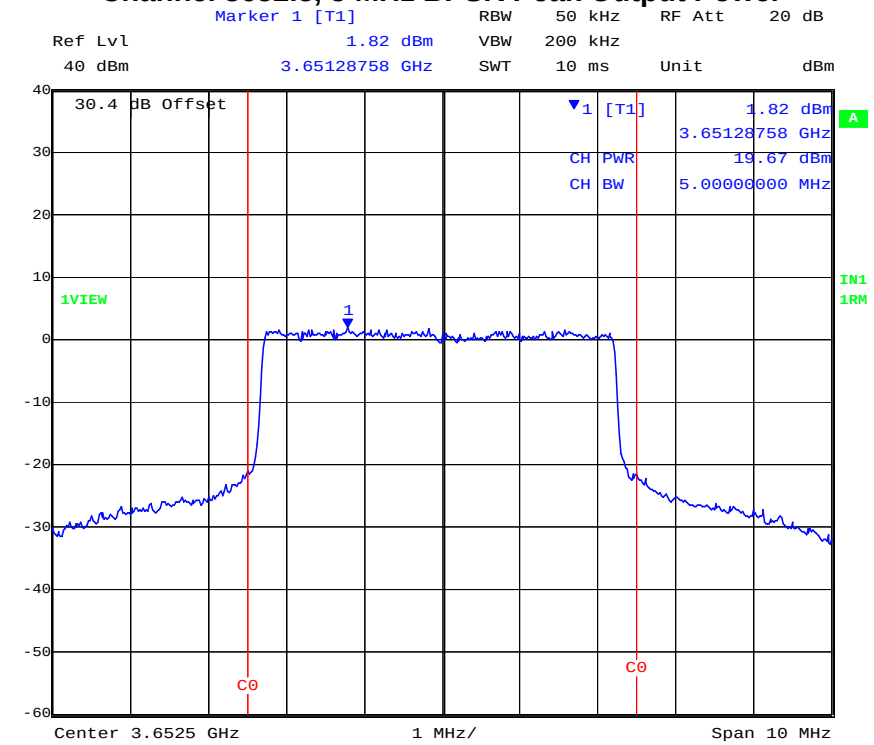
Date: 17.MAY.2010 10:32:29

5 MHz Bandwidth

	Peak Output Power				
Center Frequency (MHz)	BPSK (+dBm)	QPSK (+dBm)	16 QAM (+dBm)	64QAM (+dBm)	Minimum Margin (dB)
3652.50	+19.67	+19.76	+19.60	+19.61	-2.24
3675.00	+19.42	+19.50	+19.39	+19.42	-2.50
3697.50	+19.25	+19.33	+19.26	+19.24	-2.67

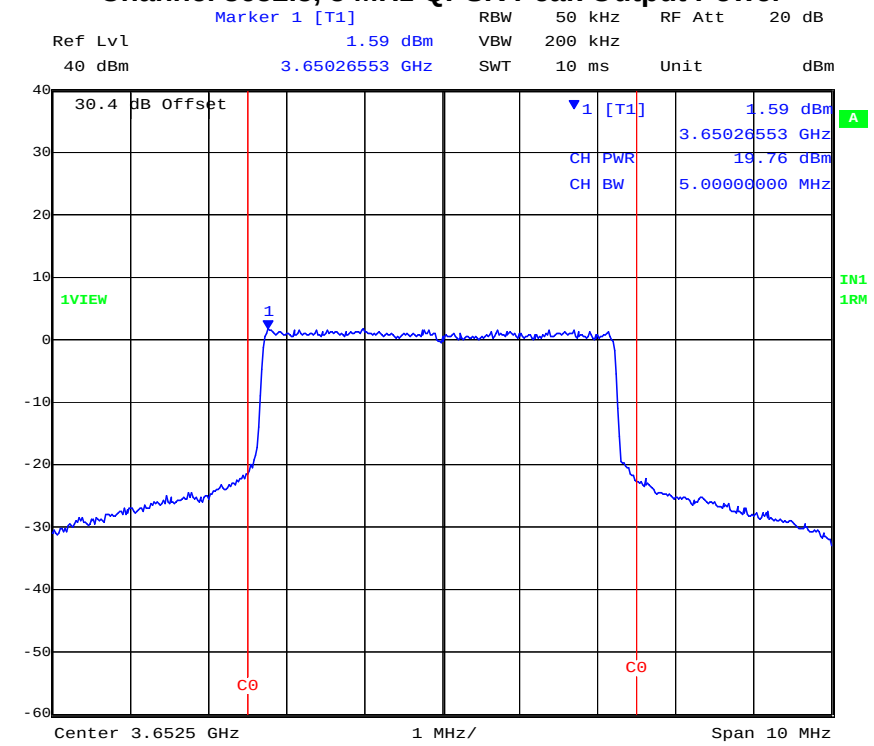
Conducted Power Limit: +22.0 dBm

Channel 3652.5, 5 MHz BPSK Peak Output Power



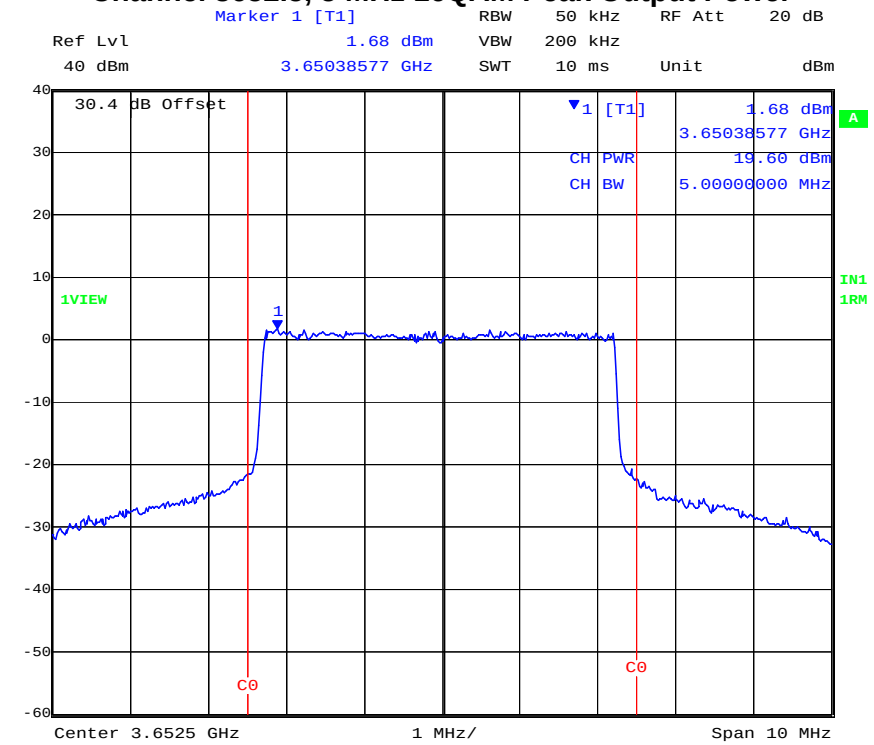
Date: 17.MAY.2010 10:39:52

Channel 3652.5, 5 MHz QPSK Peak Output Power



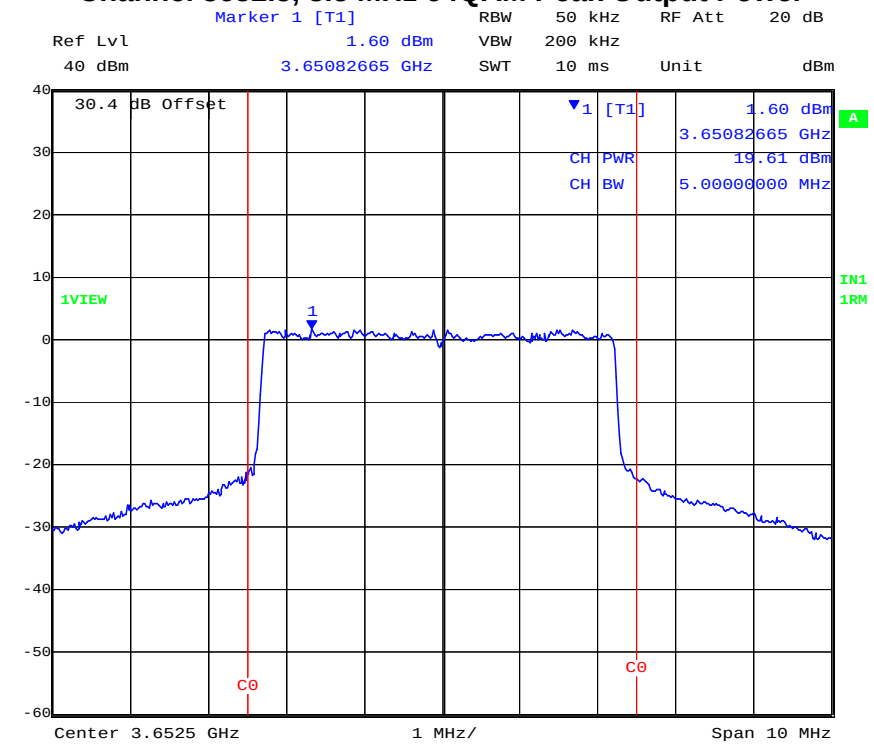
Date: 17.MAY.2010 10:41:08

Channel 3652.5, 5 MHz 16QAM Peak Output Power



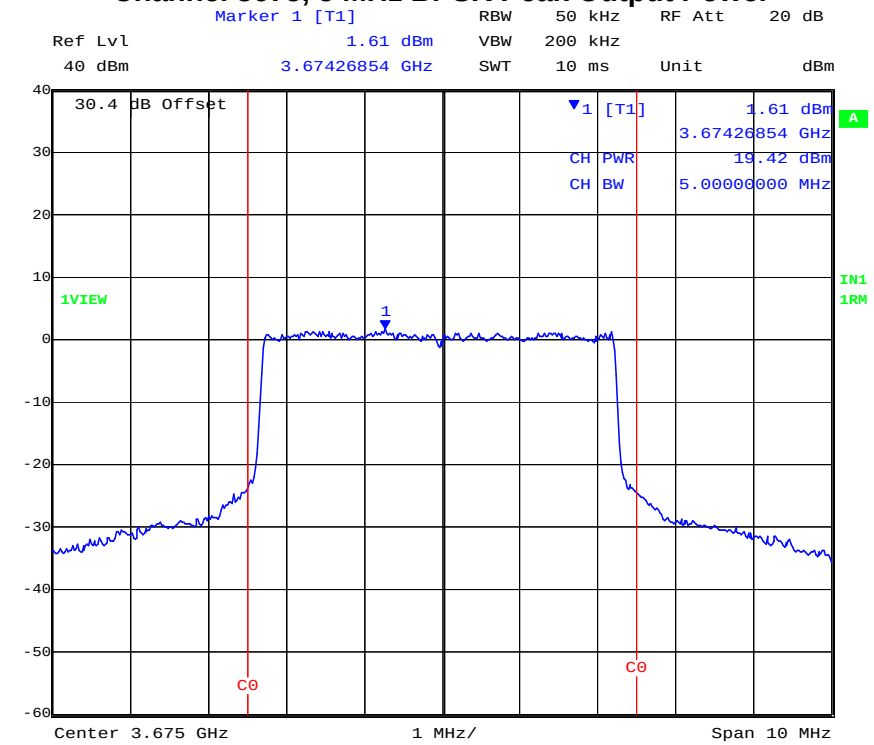
Date: 17.MAY.2010 10:46:35

Channel 3652.5, 3.5 MHz 64QAM Peak Output Power



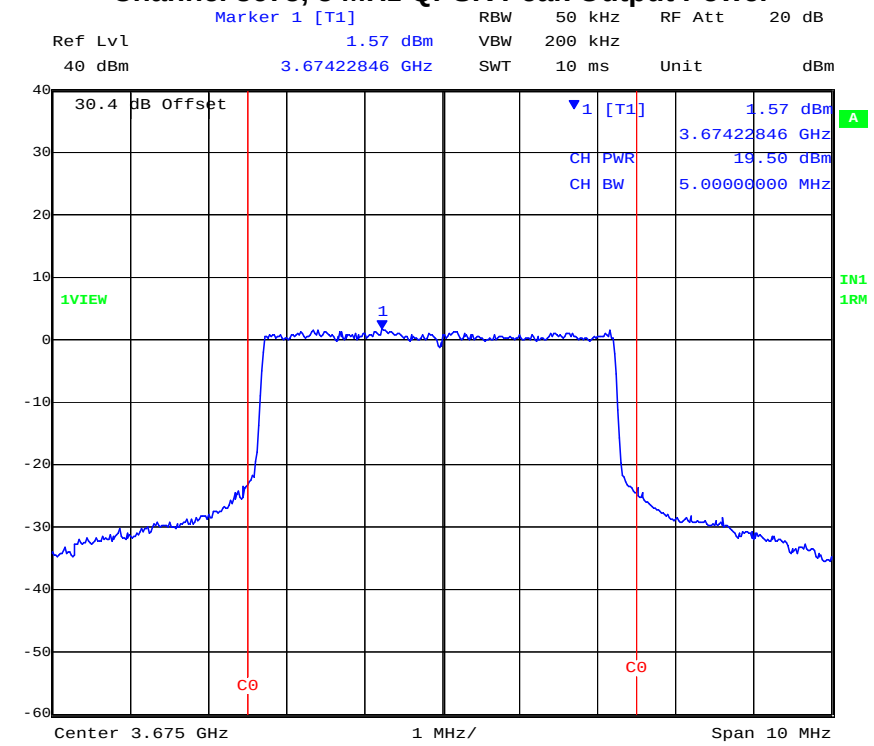
Date: 17.MAY.2010 10:49:51

Channel 3675, 5 MHz BPSK Peak Output Power



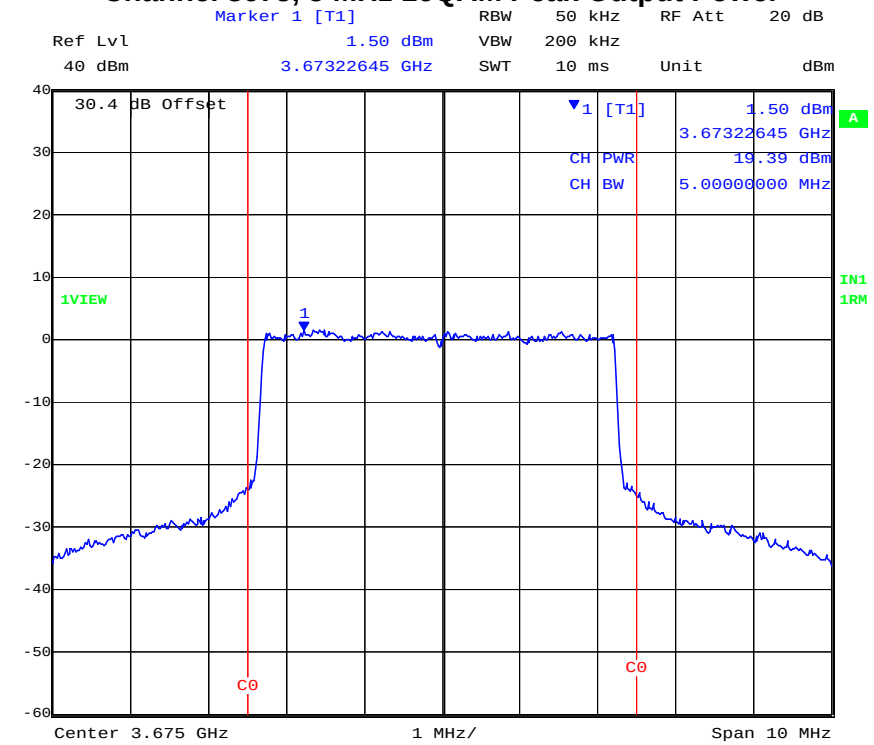
Date: 17.MAY.2010 10:54:34

Channel 3675, 5 MHz QPSK Peak Output Power



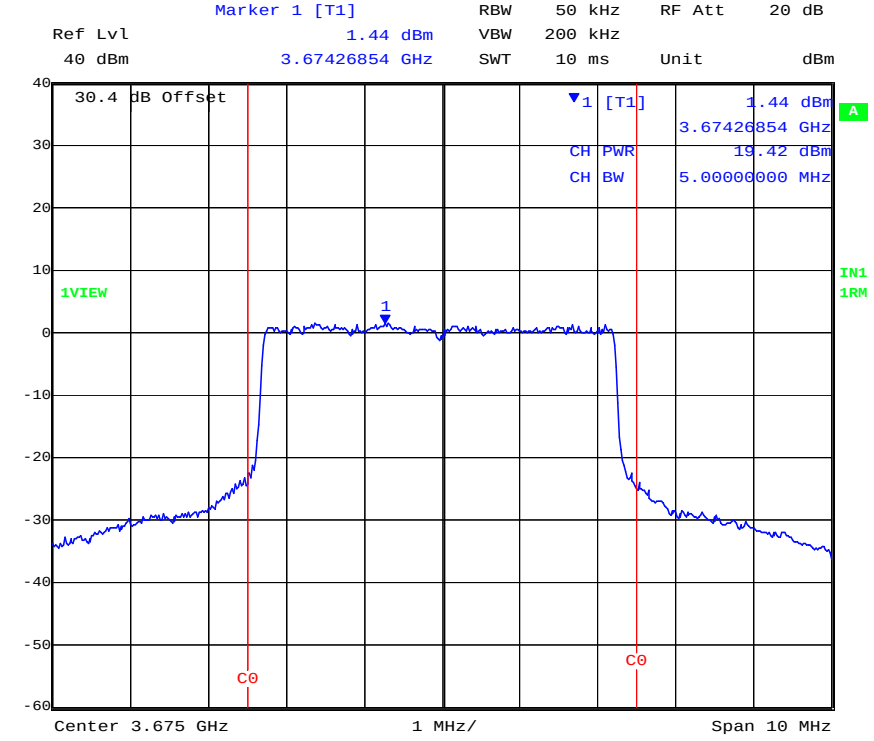
Date: 17.MAY.2010 10:55:19

Channel 3675, 5 MHz 16QAM Peak Output Power



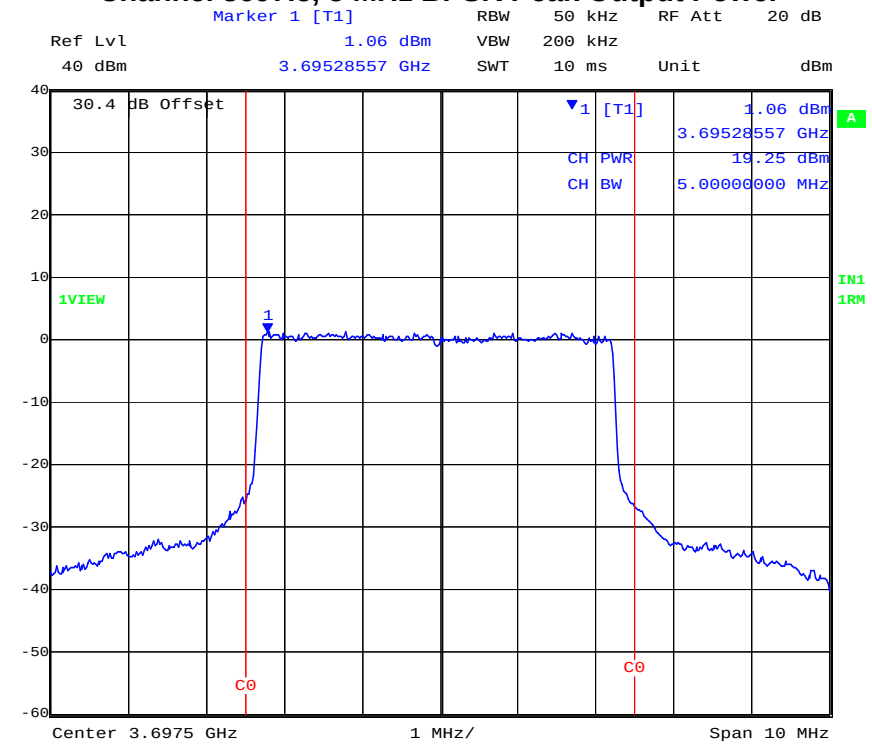
Date: 17.MAY.2010 10:58:27

Channel 3675, 5 MHz 64QAM Peak Output Power



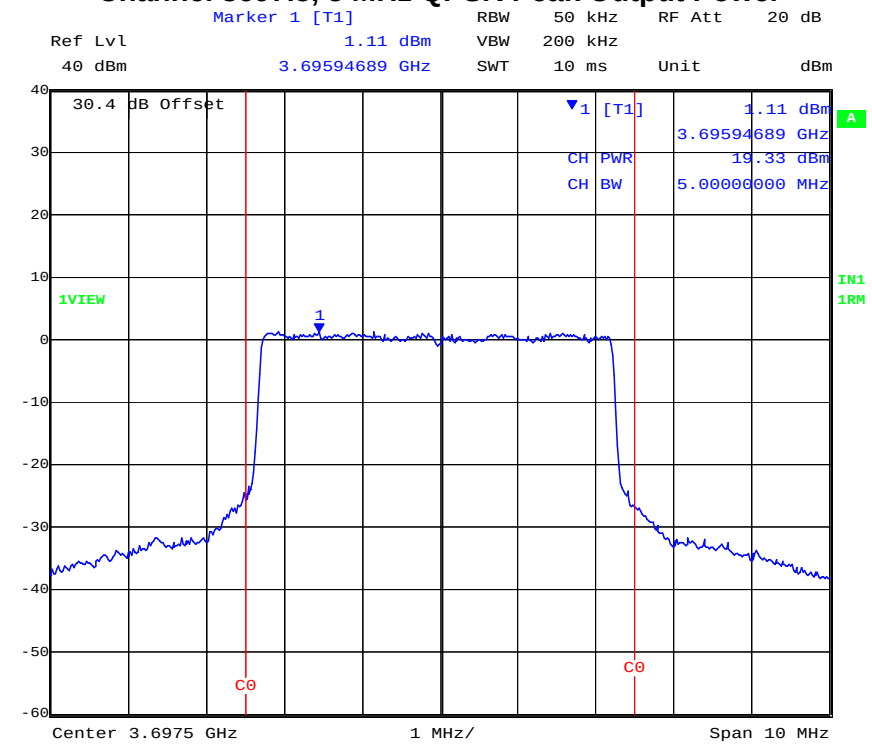
Date: 17.MAY.2010 11:00:22

Channel 3697.5, 5 MHz BPSK Peak Output Power



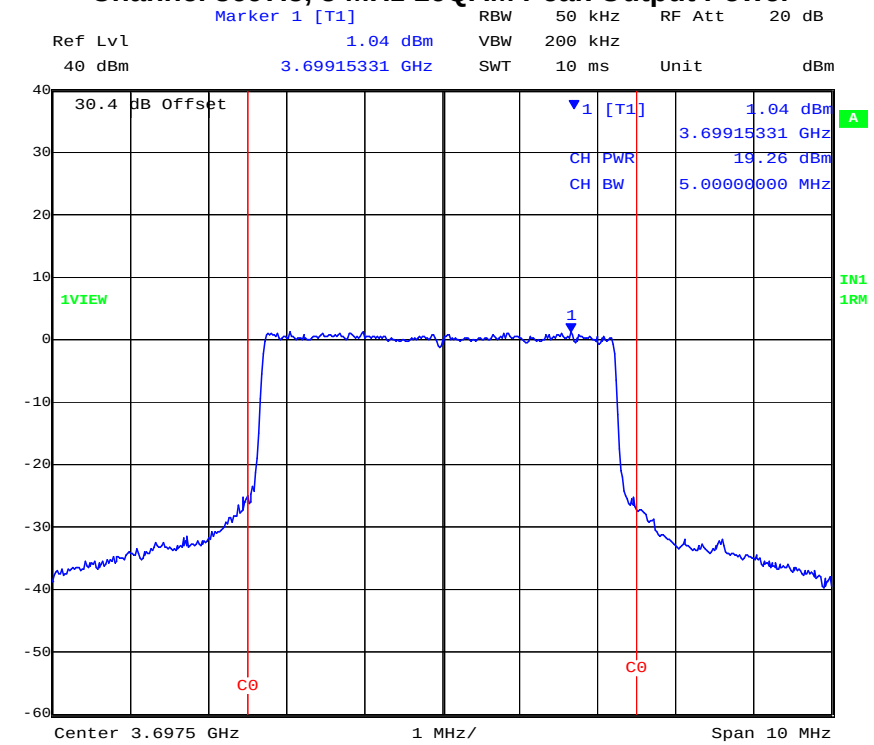
Date: 17.MAY.2010 11:06:20

Channel 3697.5, 5 MHz QPSK Peak Output Power



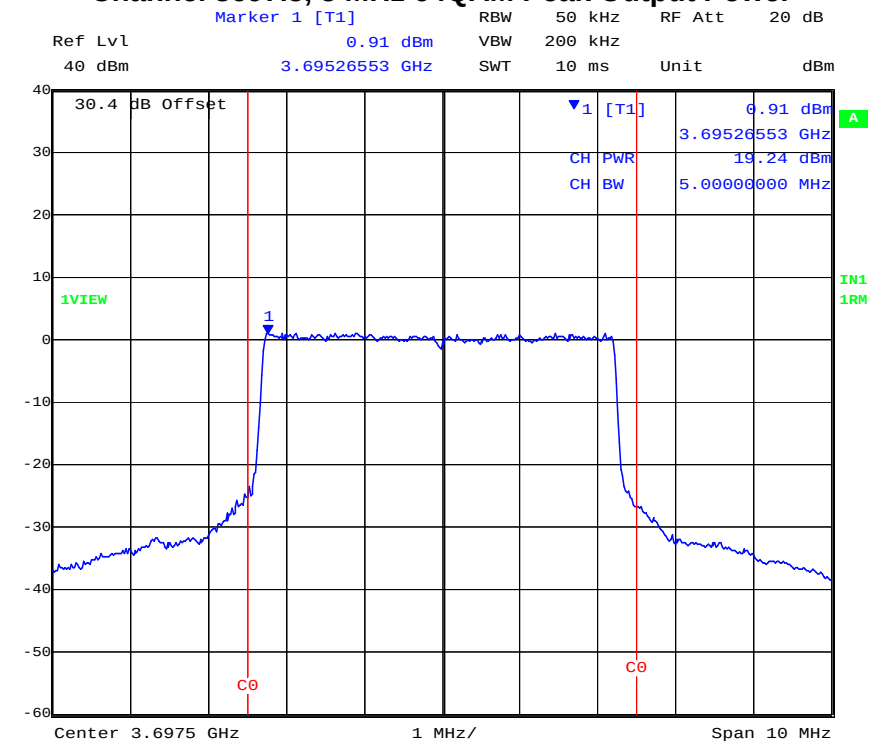
Date: 17.MAY.2010 11:10:16

Channel 3697.5, 5 MHz 16QAM Peak Output Power



Date: 17.MAY.2010 11:13:22

Channel 3697.5, 5 MHz 64QAM Peak Output Power



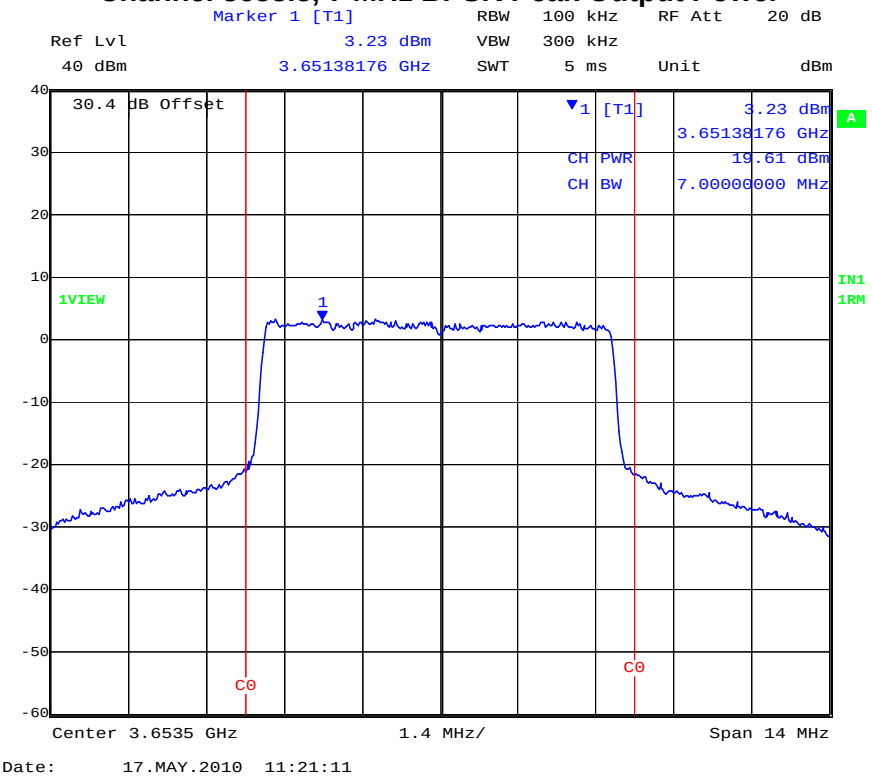
Date: 17.MAY.2010 11:15:36

7 MHz Bandwidth

	Peak Output Power				
Center Frequency (MHz)	**BPSK (+dBm)**	**QPSK (+dBm)**	**16 QAM (+dBm)**	**64QAM (+dBm)**	**Minimum Margin (dB)**
3653.50	+19.61	+19.70	+19.60	+19.60	-3.70
3675.00	+19.48	+19.50	+19.47	+19.46	-3.90
3696.50	+19.35	+19.44	+19.34	+19.38	-3.96

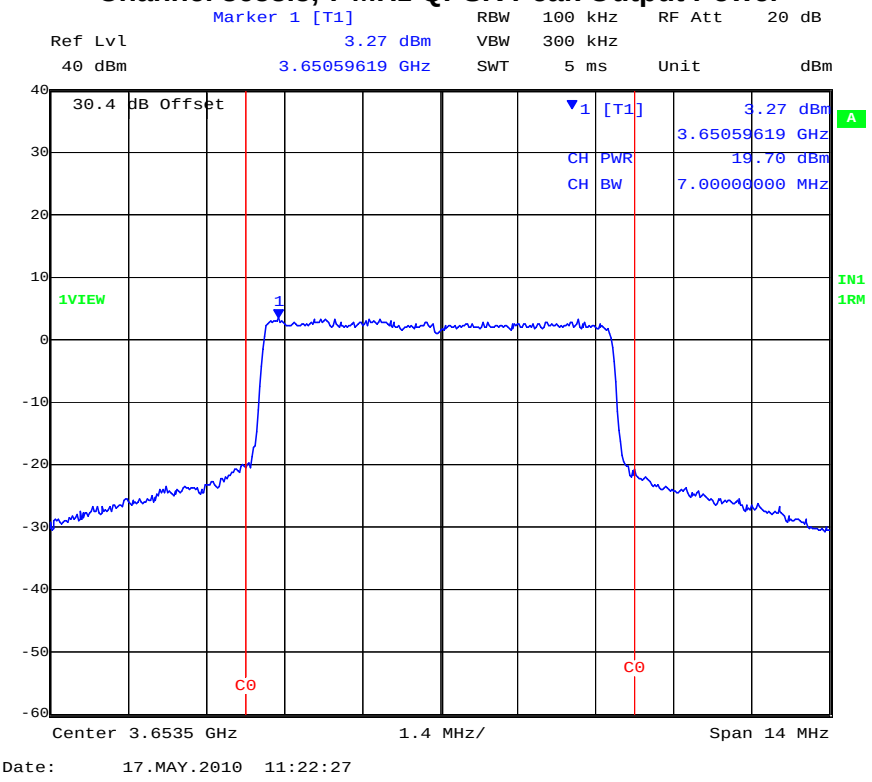
Conducted Power Limit: +23.4 dBm

Channel 3653.5, 7 MHz BPSK Peak Output Power



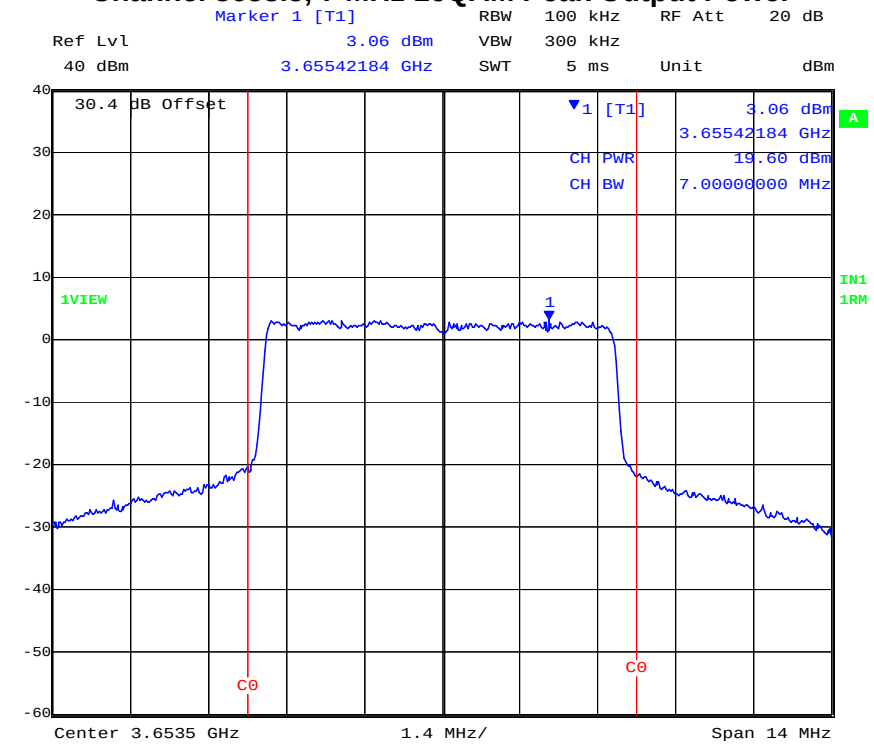
Date: 17.MAY.2010 11:21:11

Channel 3653.5, 7 MHz QPSK Peak Output Power



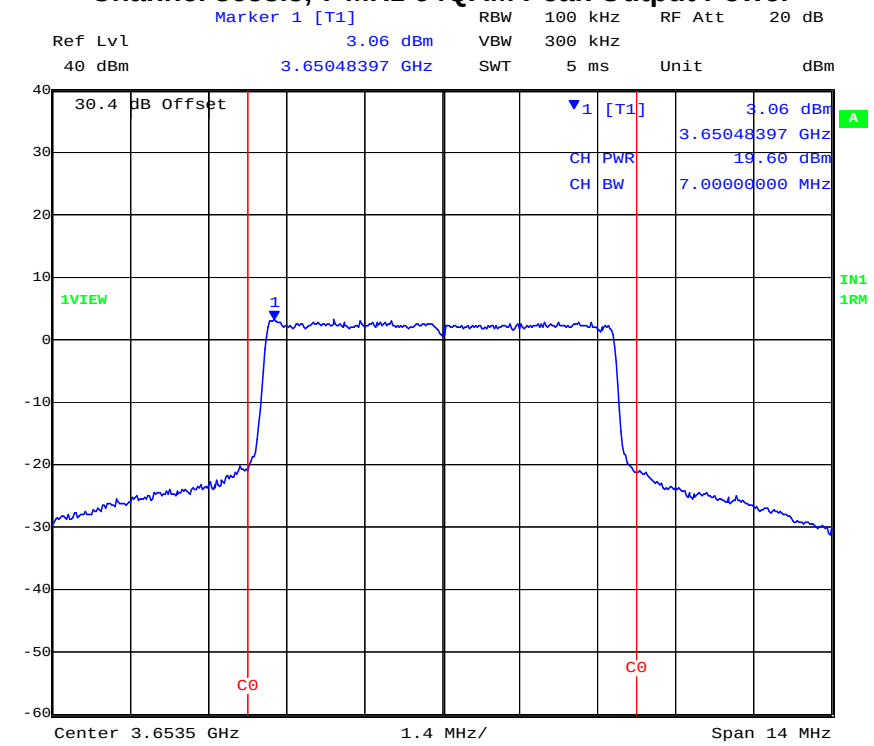
Date: 17.MAY.2010 11:22:27

Channel 3653.5, 7 MHz 16QAM Peak Output Power



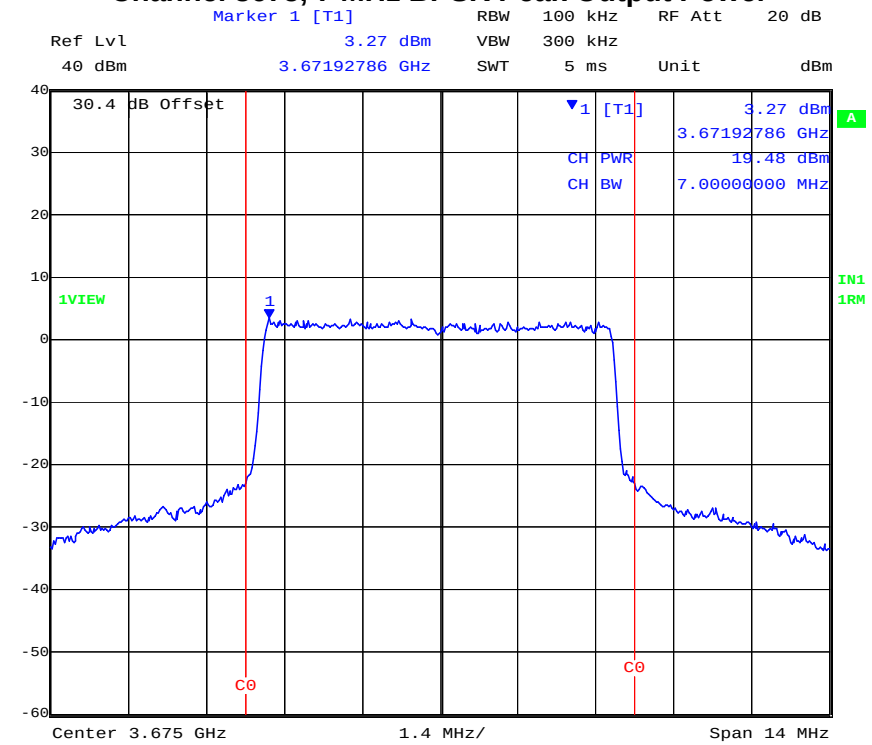
Date: 17.MAY.2010 11:25:56

Channel 3653.5, 7 MHz 64QAM Peak Output Power



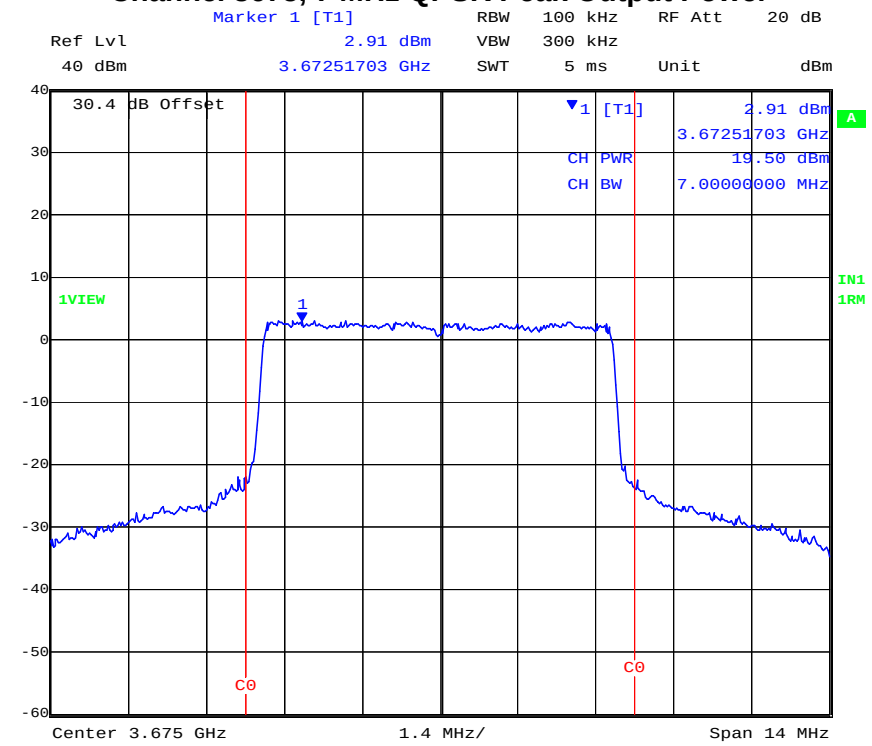
Date: 17.MAY.2010 11:27:17

Channel 3675, 7 MHz BPSK Peak Output Power



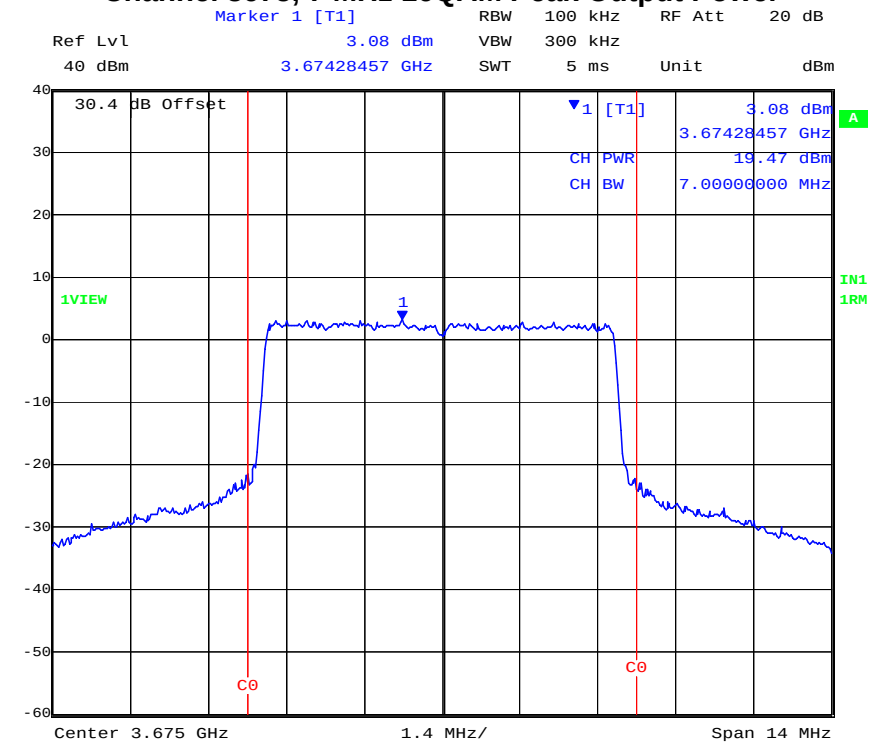
Date: 17.MAY.2010 11:30:23

Channel 3675, 7 MHz QPSK Peak Output Power



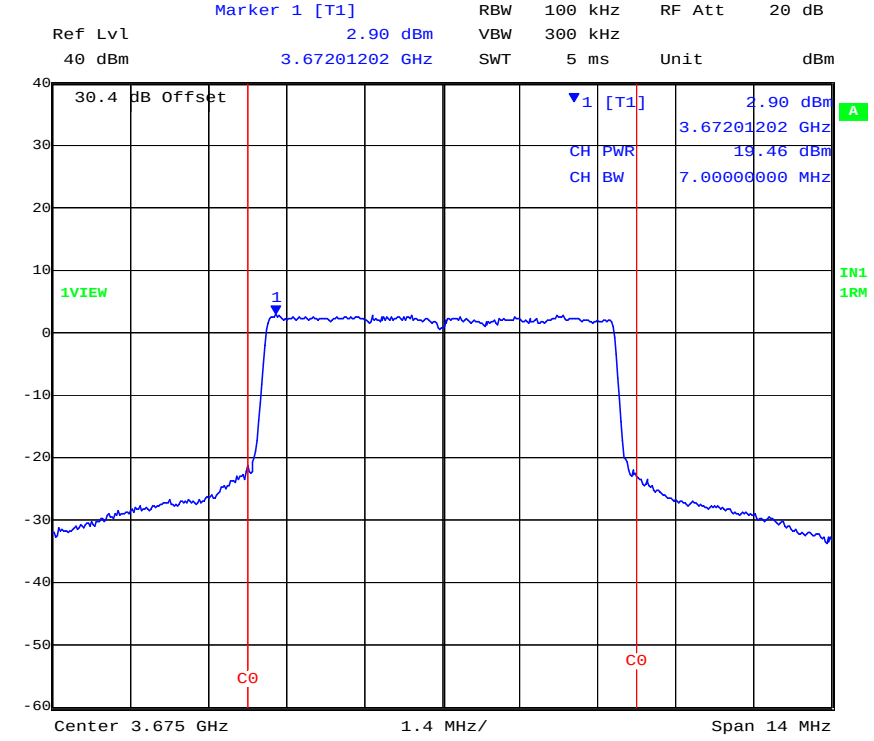
Date: 17.MAY.2010 11:38:46

Channel 3675, 7 MHz 16QAM Peak Output Power



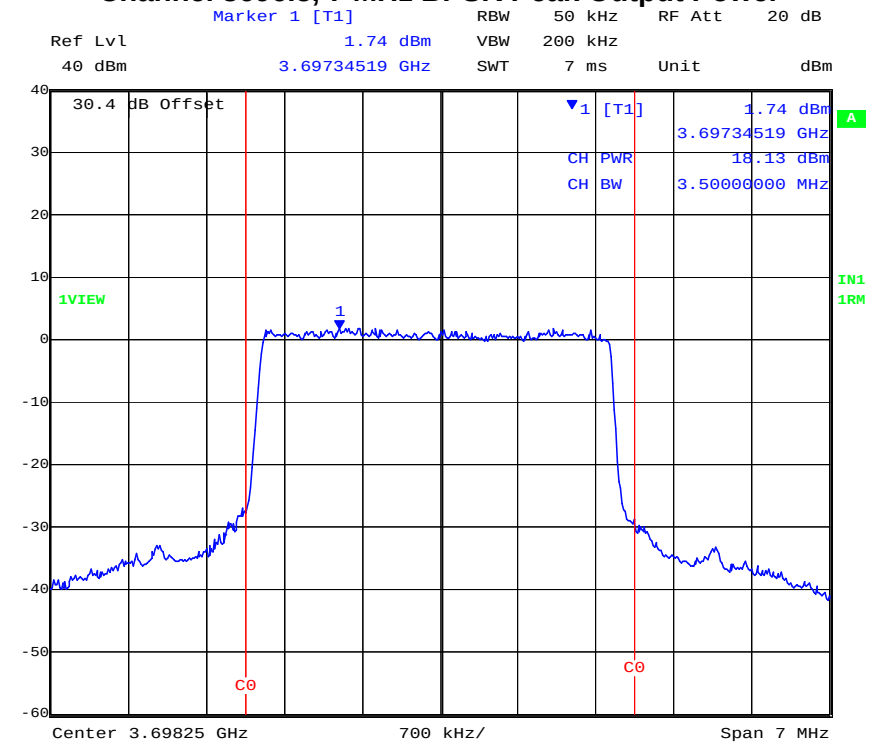
Date: 17.MAY.2010 11:41:32

Channel 3675, 7 MHz 64QAM Peak Output Power



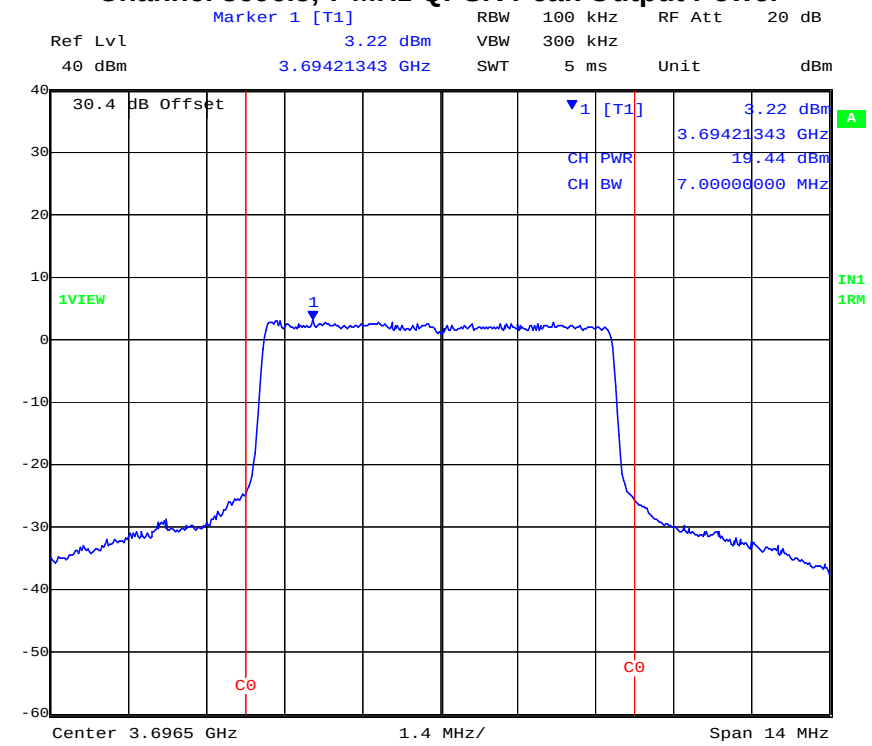
Date: 17.MAY.2010 11:43:49

Channel 3696.5, 7 MHz BPSK Peak Output Power



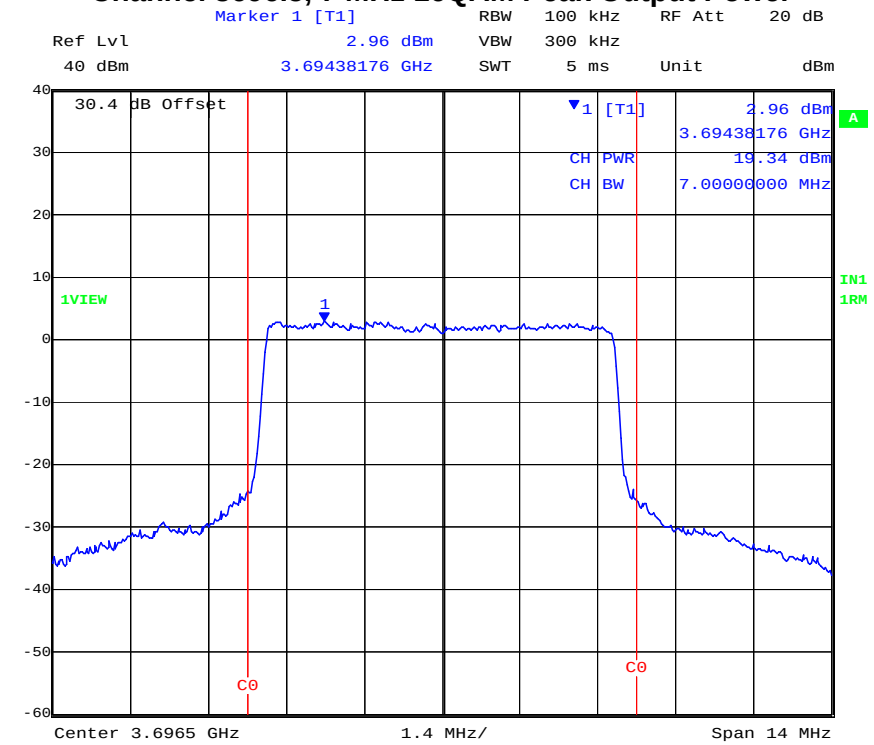
Date: 17.MAY.2010 10:26:19

Channel 3696.5, 7 MHz QPSK Peak Output Power



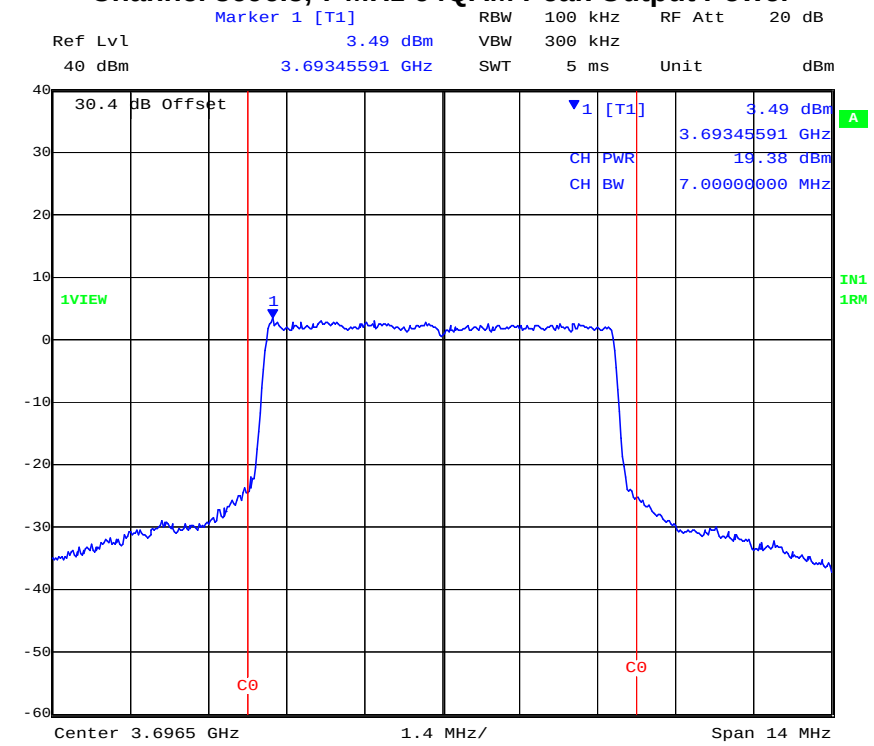
Date: 17.MAY.2010 11:49:45

Channel 3696.5, 7 MHz 16QAM Peak Output Power



Date: 17.MAY.2010 11:53:21

Channel 3696.5, 7 MHz 64QAM Peak Output Power



Date: 17.MAY.2010 11:54:40

Laboratory Measurement Uncertainty for Power Measurement

Measurement uncertainty	±1.33 dB

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.

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.

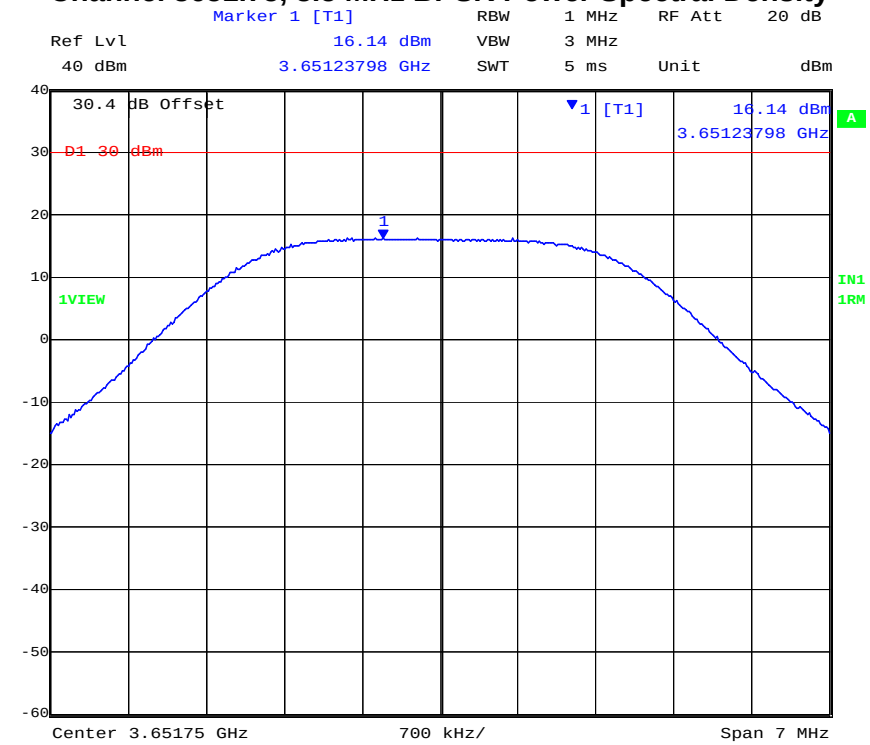
Test Set-up is shown in Section 3.6 Test Configuration

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

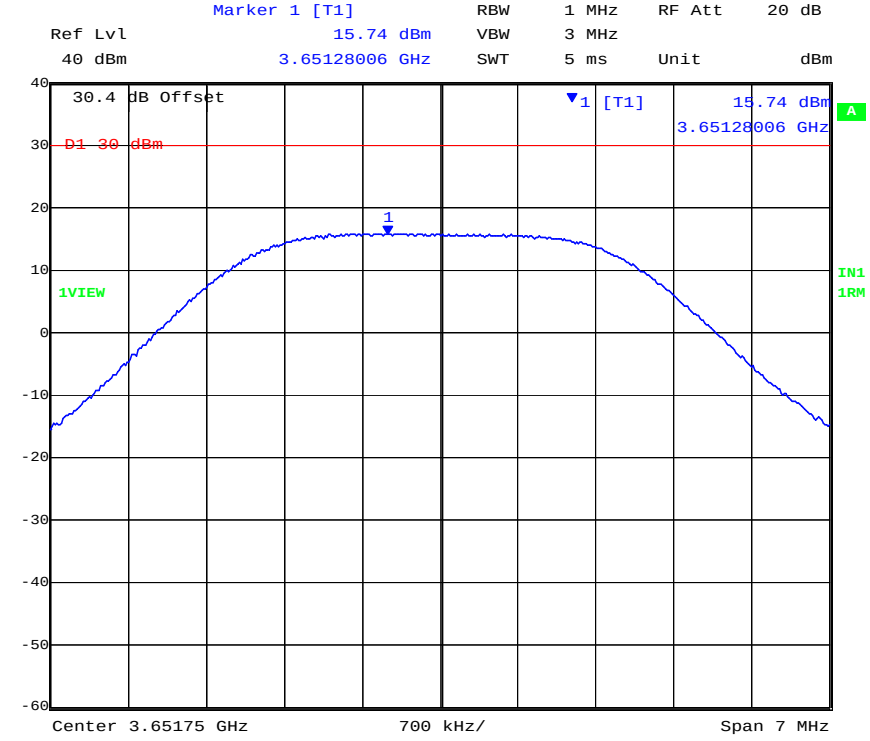
3.5 MHz Bandwidth

	Power Spectral Density (dBm/MHz)				
Center Frequency (MHz)	BPSK	QPSK	16 QAM	64QAM	Minimum Margin (dB)
3651.75	+16.14	+15.74	+15.75	+15.62	-13.86
3675.00	+15.45	+15.29	+15.29	+15.21	-14.55
3698.25	+15.20	+15.07	+15.13	+16.13	-13.87

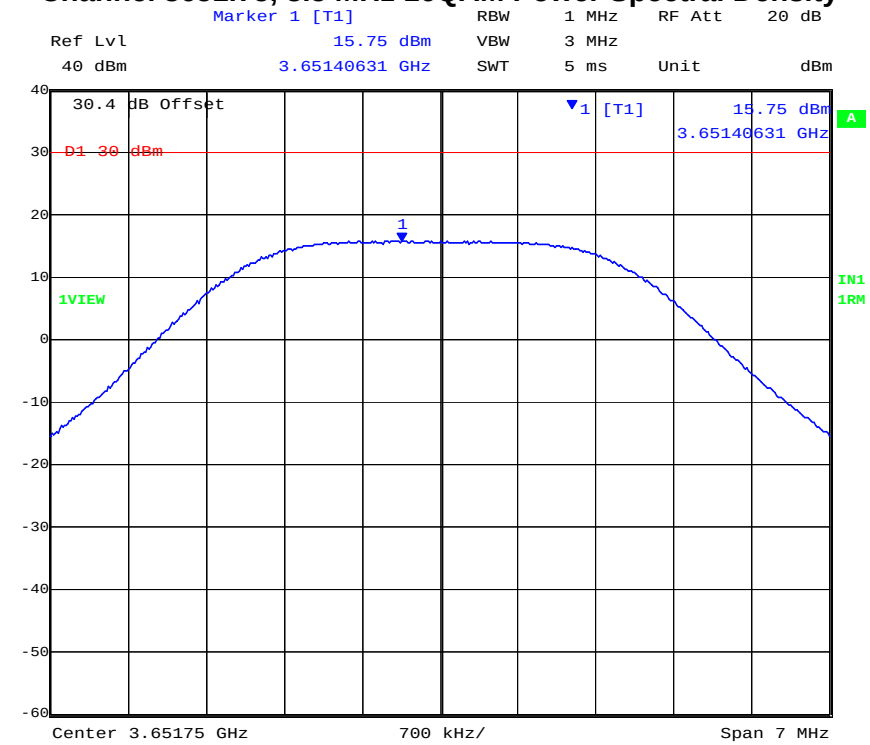
Channel 3651.75, 3.5 MHz BPSK Power Spectral Density



Channel 3651.75, 3.5 MHz QPSK Power Spectral Density

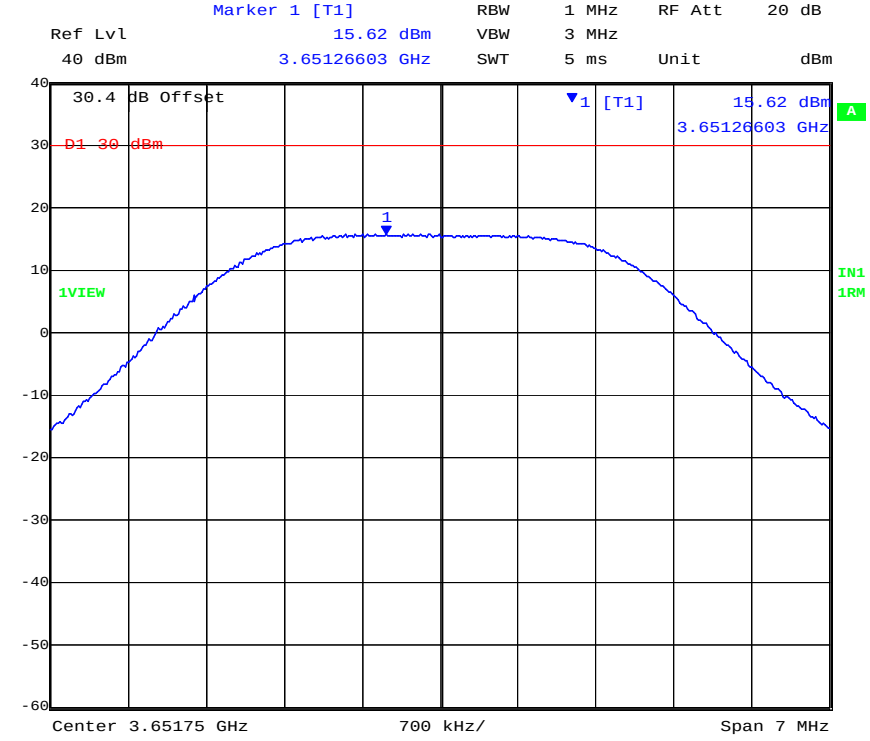


Channel 3651.75, 3.5 MHz 16QAM Power Spectral Density



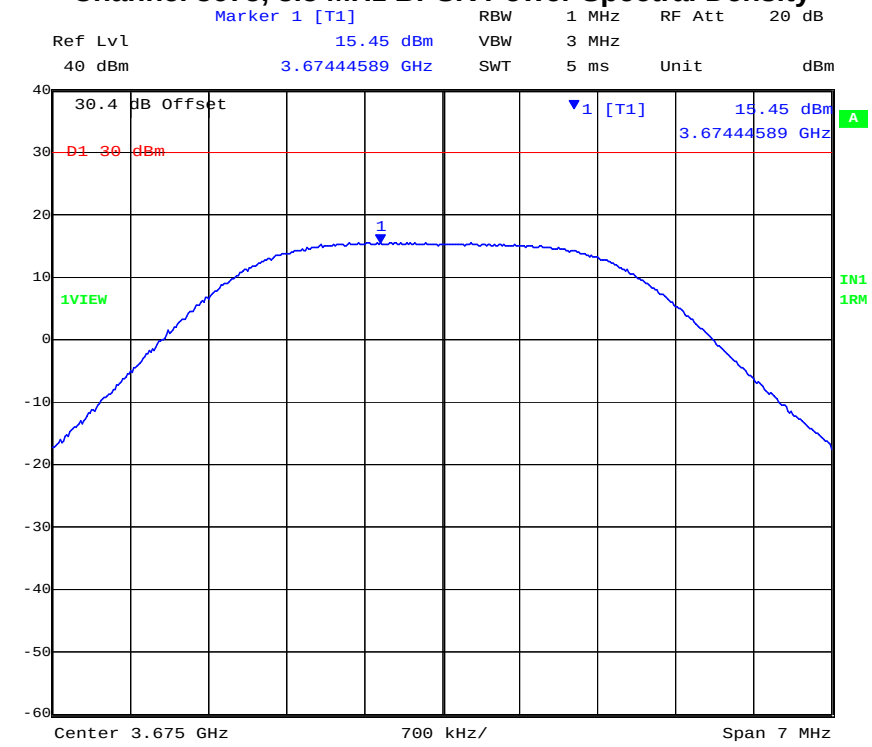
Date: 17.MAY.2010 10:07:03

Channel 3651.75, 3.5 MHz 64QAM Power Spectral Density

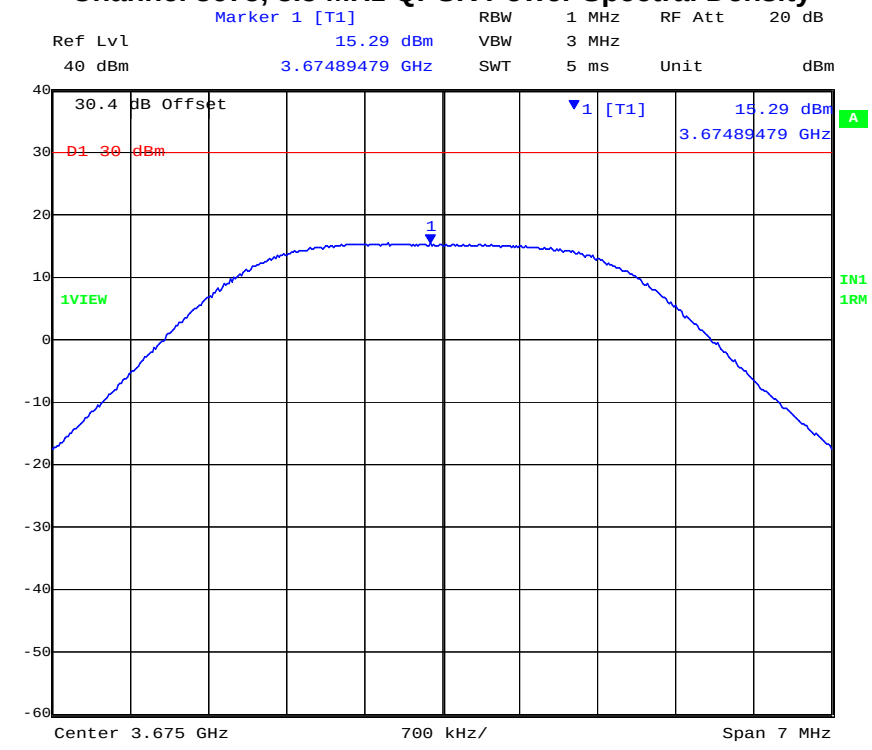


Date: 17.MAY.2010 10:10:51

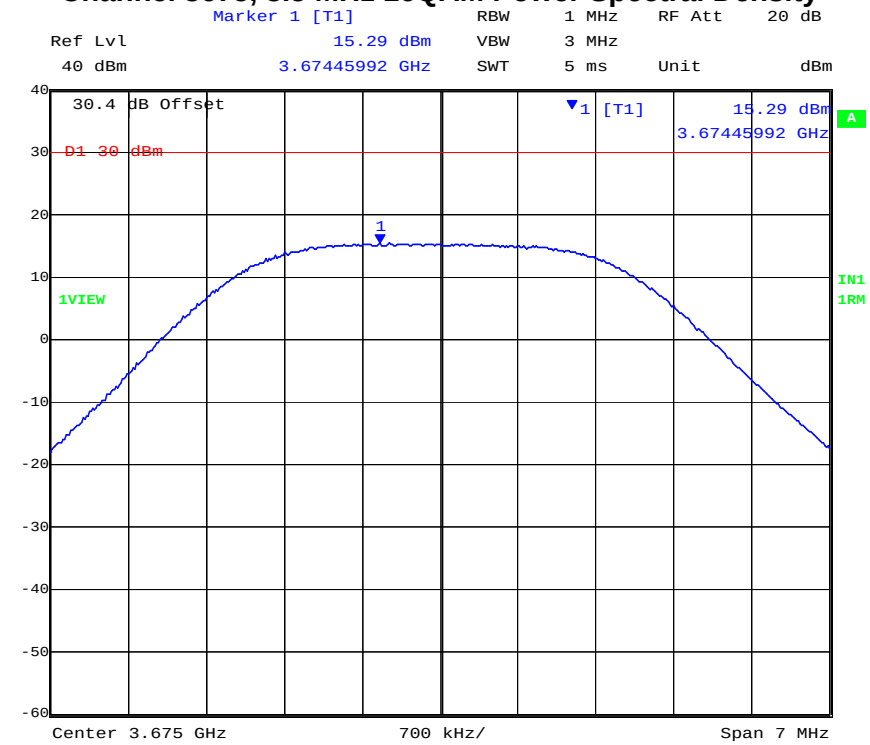
Channel 3675, 3.5 MHz BPSK Power Spectral Density



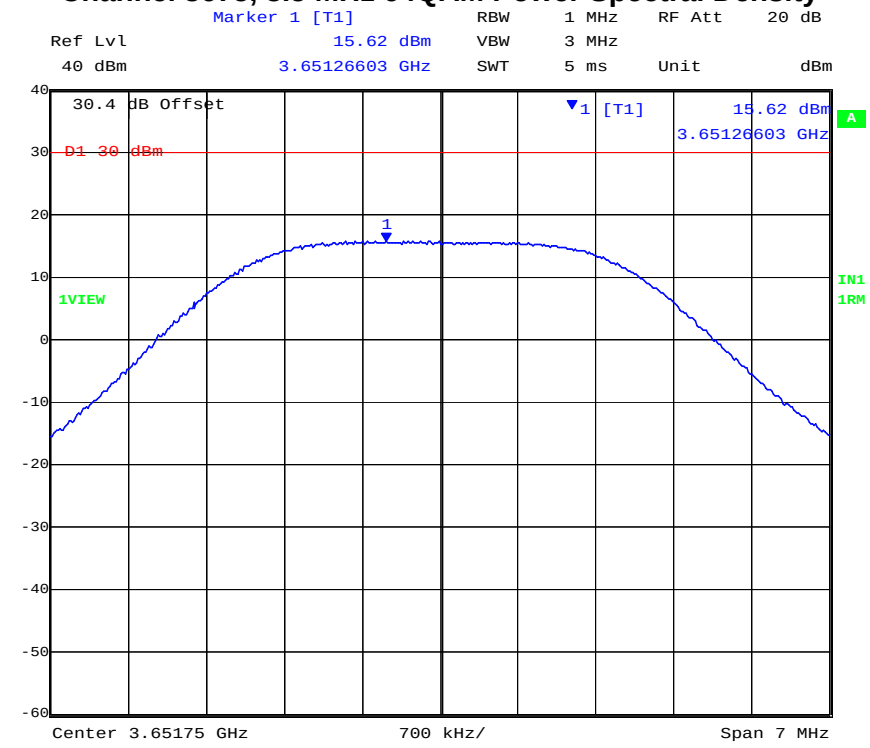
Channel 3675, 3.5 MHz QPSK Power Spectral Density



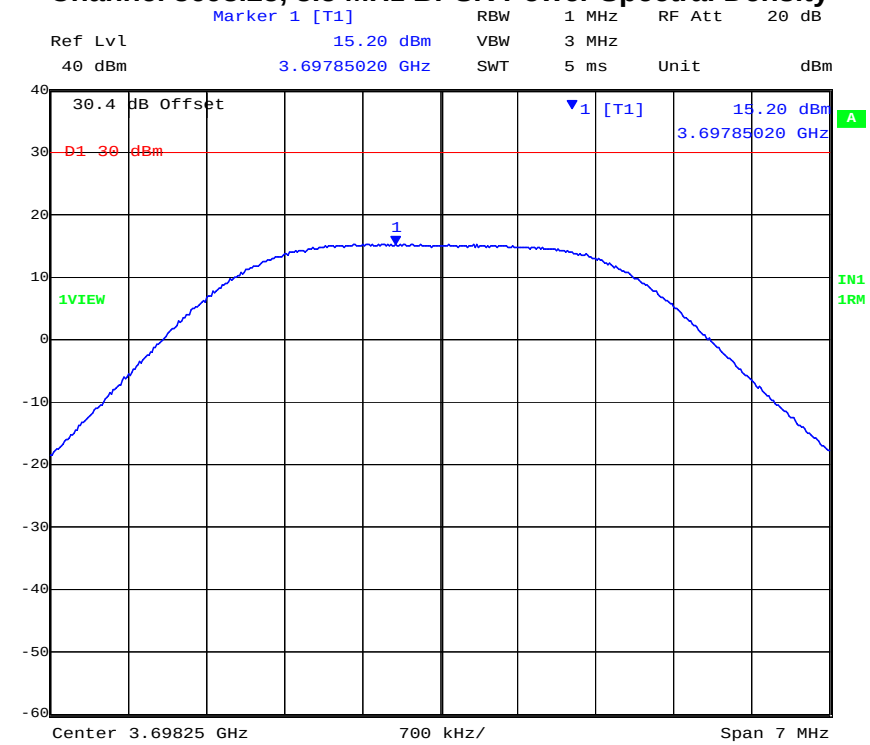
Channel 3675, 3.5 MHz 16QAM Power Spectral Density



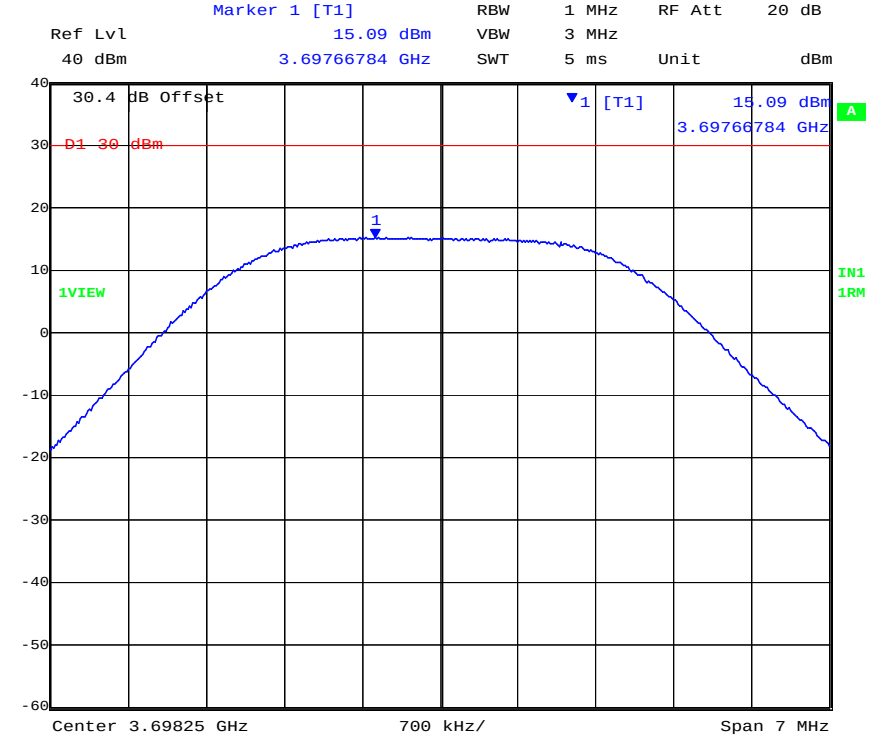
Channel 3675, 3.5 MHz 64QAM Power Spectral Density



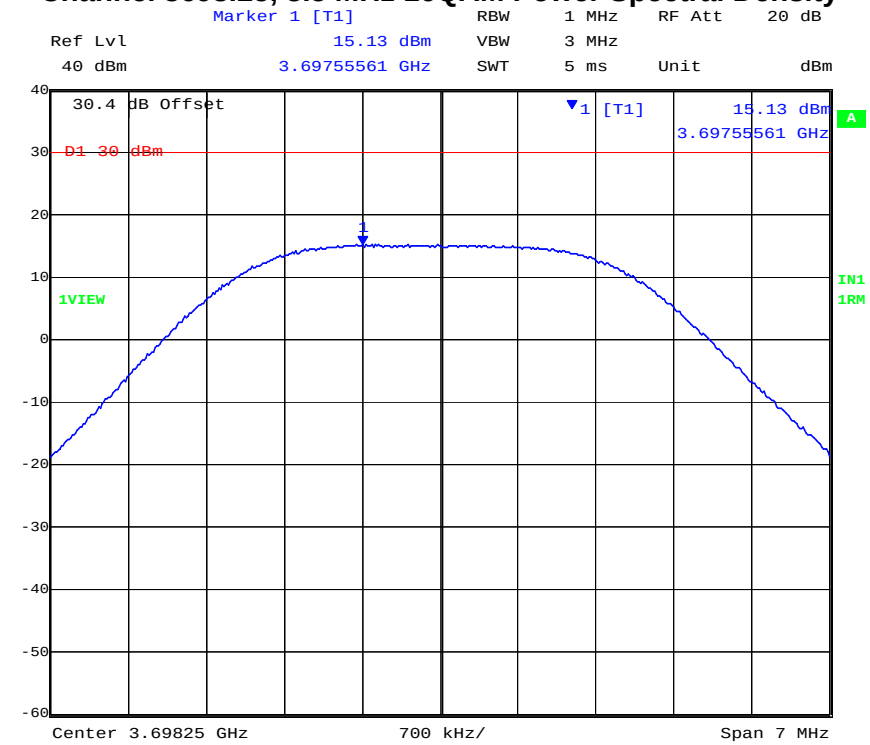
Channel 3698.25, 3.5 MHz BPSK Power Spectral Density



Channel 3698.25, 3.5 MHz QPSK Power Spectral Density

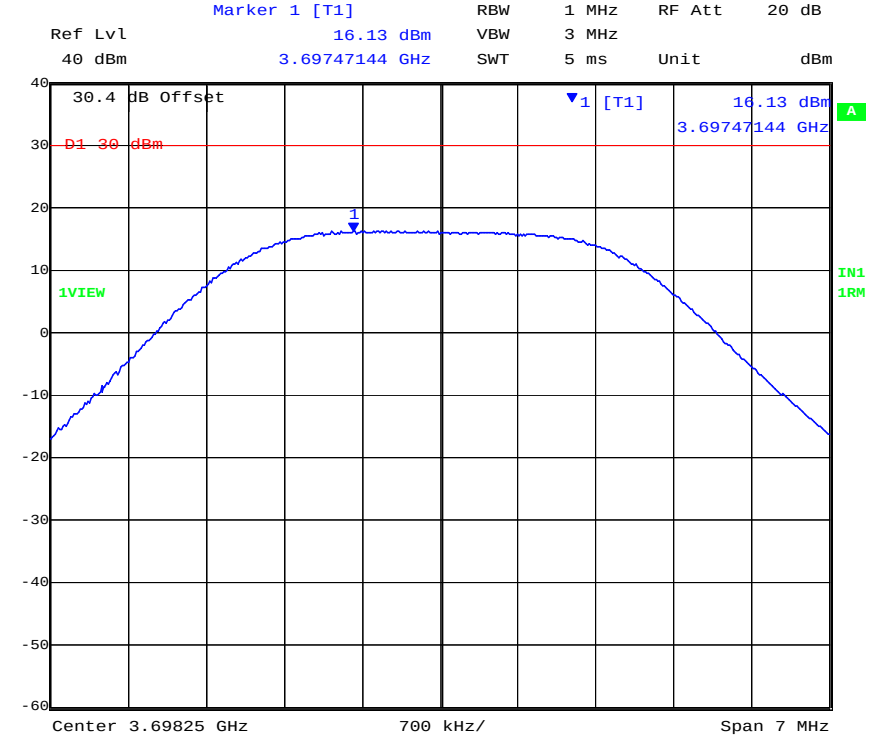


Channel 3698.25, 3.5 MHz 16QAM Power Spectral Density



Date: 17.MAY.2010 10:30:05

Channel 3698.25, 3.5 MHz 64QAM Power Spectral Density

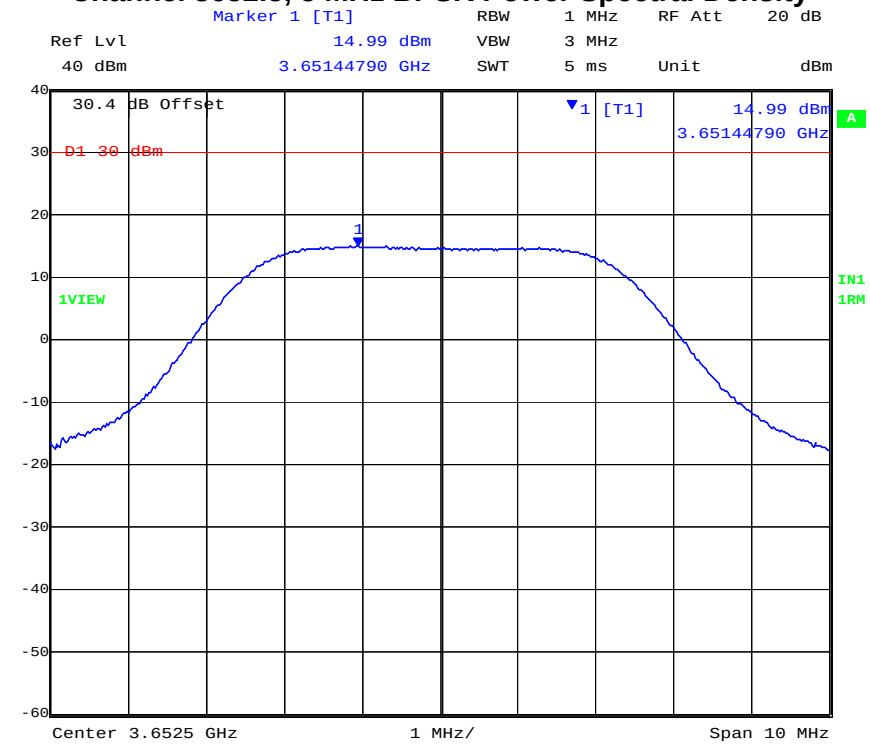


Date: 17.MAY.2010 10:33:51

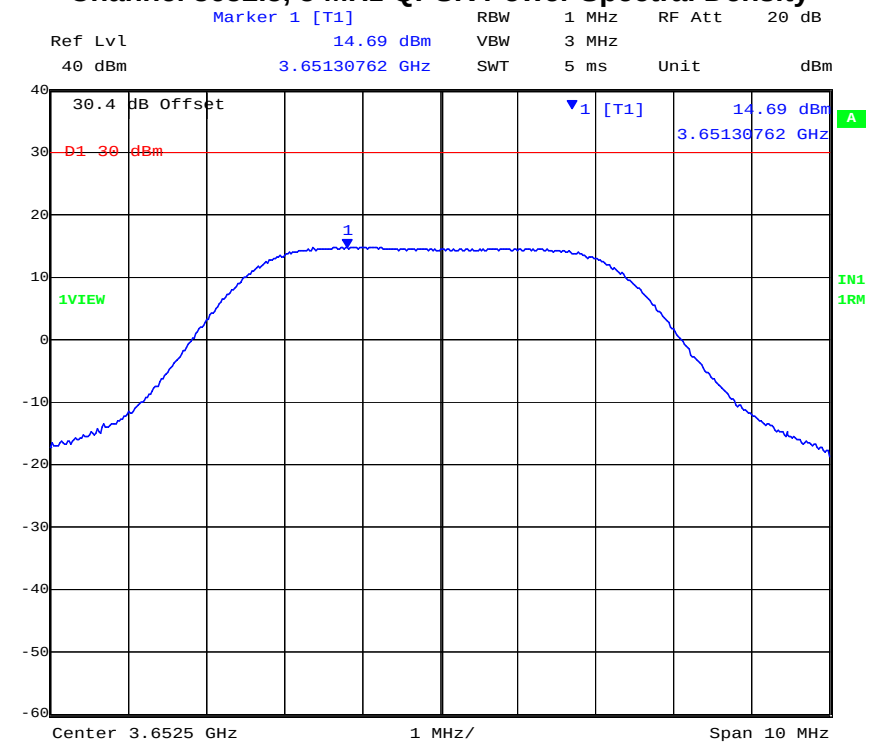
5 MHz Bandwidth

	Power Spectral Density (dBm/MHz)				
Center Frequency (MHz)	BPSK (+dBm)	QPSK (+dBm)	16 QAM (+dBm)	64QAM (+dBm)	Margin (dB)
3652.50	+14.99	+14.69	+14.66	+14.77	-15.01
3675.00	+13.30	+14.63	+14.46	+14.62	-15.37
3697.50	+13.37	+14.32	+14.20	+14.35	-15.65

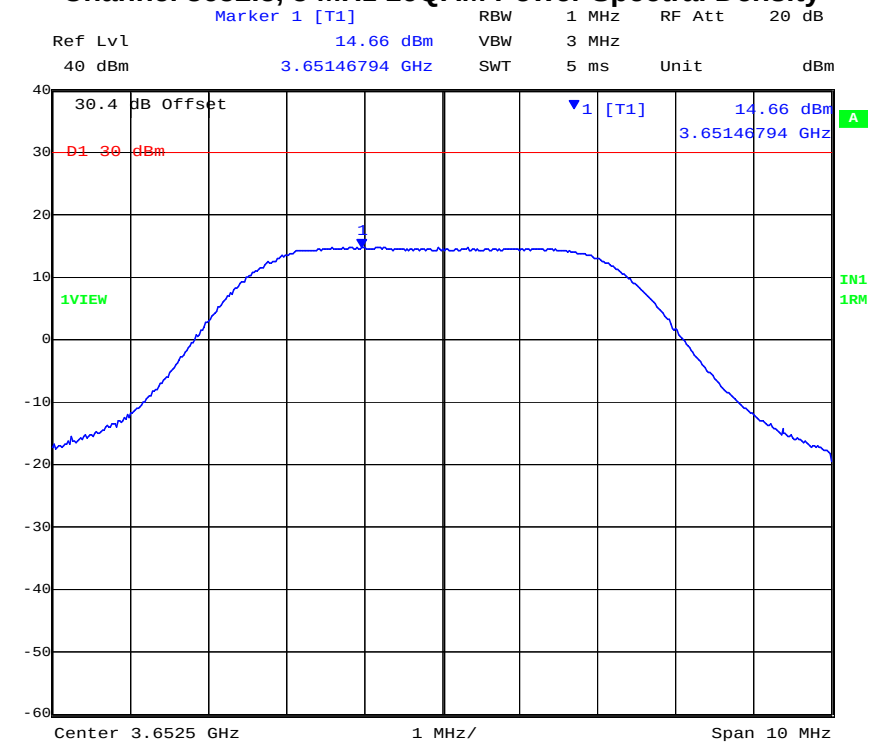
Channel 3652.5, 5 MHz BPSK Power Spectral Density



Channel 3652.5, 5 MHz QPSK Power Spectral Density

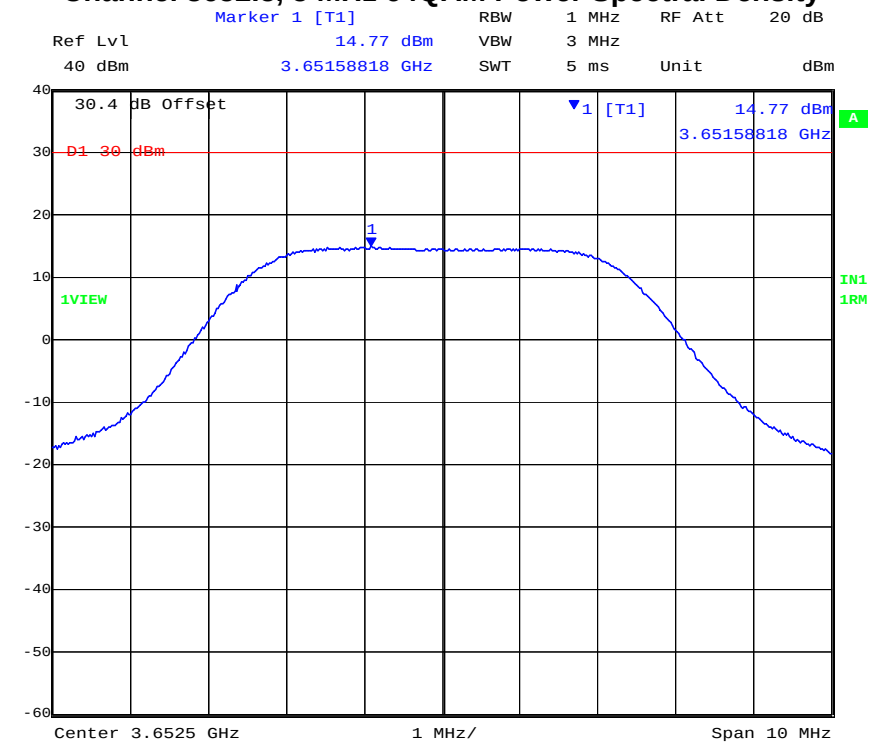


Channel 3652.5, 5 MHz 16QAM Power Spectral Density



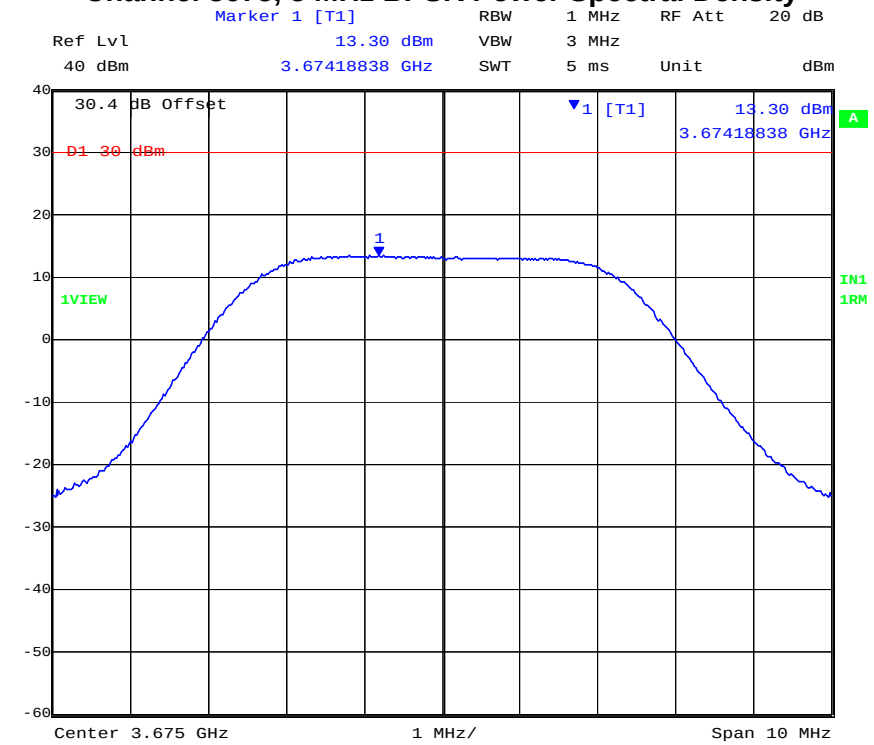
Date: 17.MAY.2010 10:45:07

Channel 3652.5, 5 MHz 64QAM Power Spectral Density



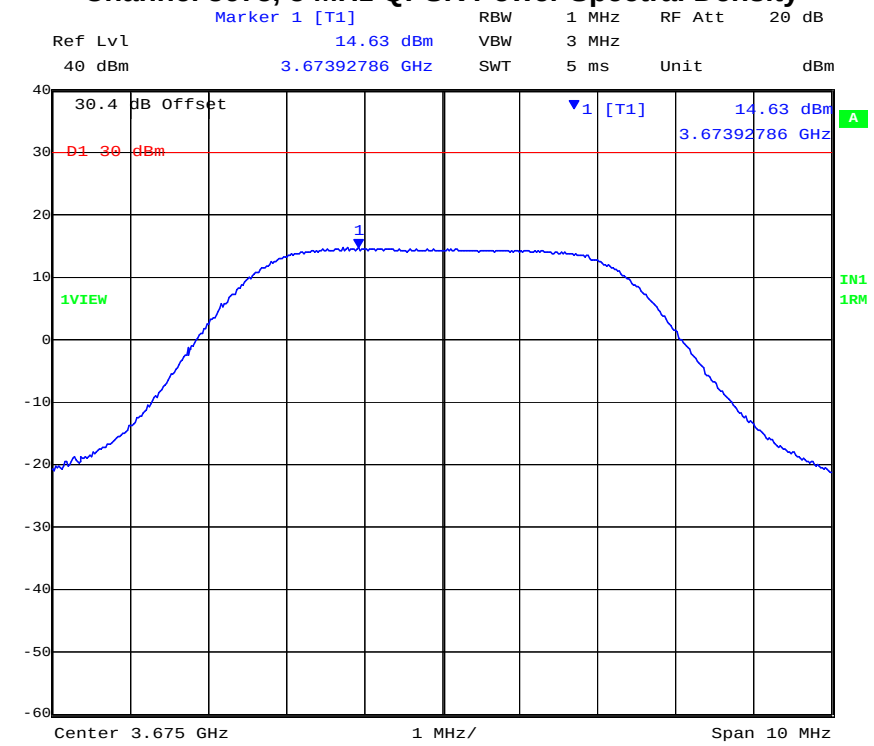
Date: 17.MAY.2010 10:51:34

Channel 3675, 5 MHz BPSK Power Spectral Density



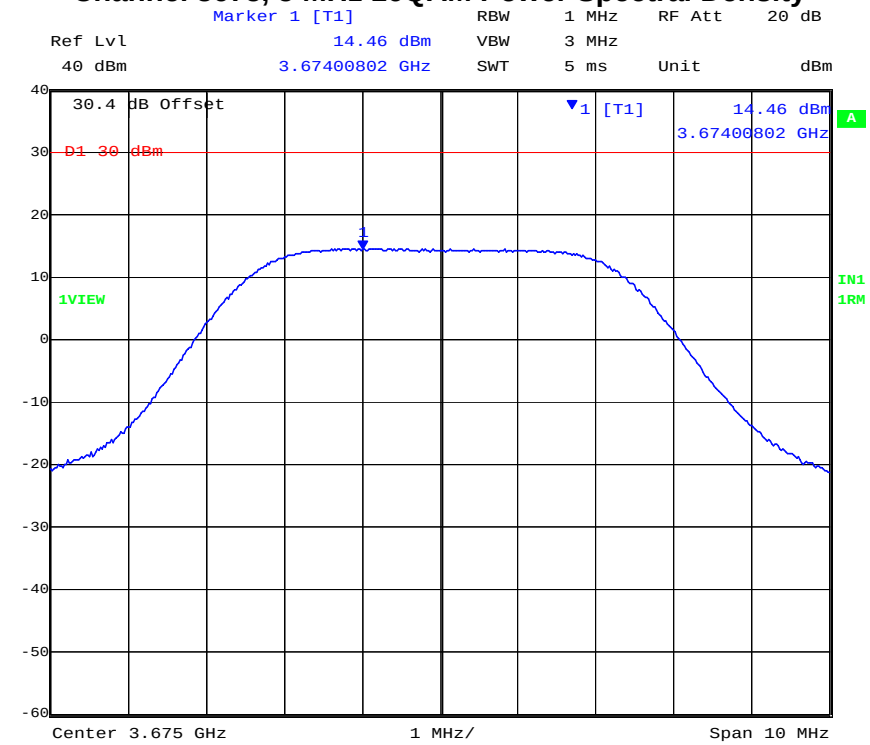
Date: 17.MAY.2010 10:53:10

Channel 3675, 5 MHz QPSK Power Spectral Density



Date: 17.MAY.2010 10:56:42

Channel 3675, 5 MHz 16QAM Power Spectral Density



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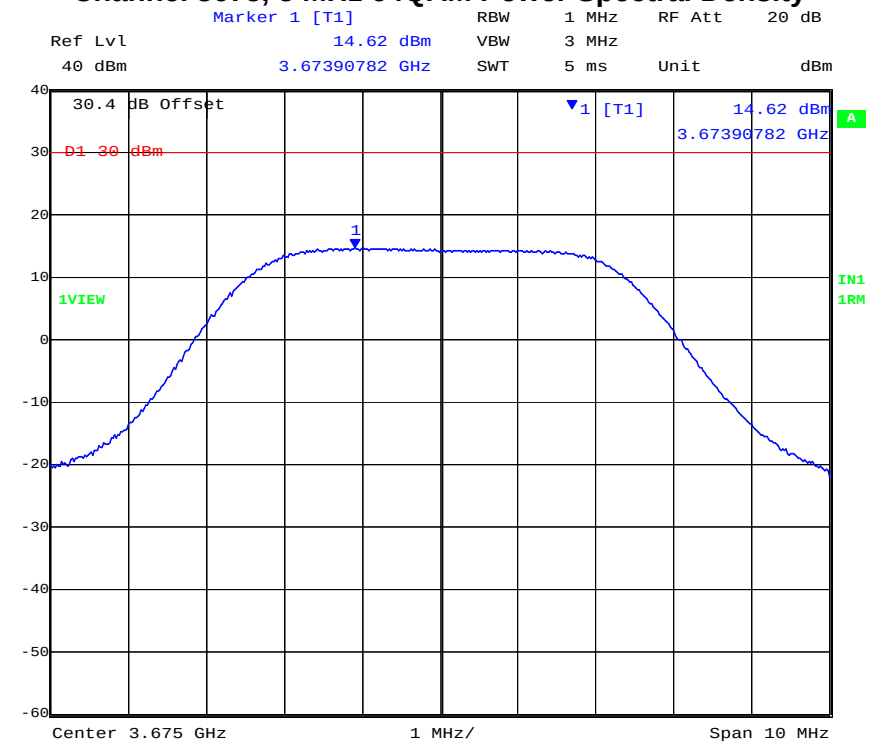
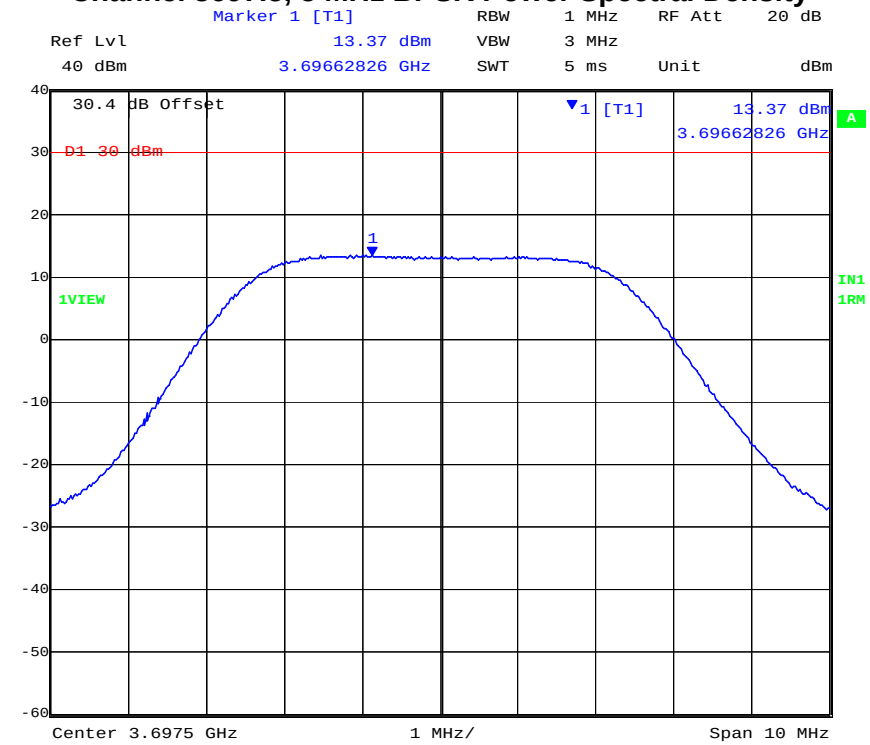
Channel 3675, 5 MHz 64QAM Power Spectral Density

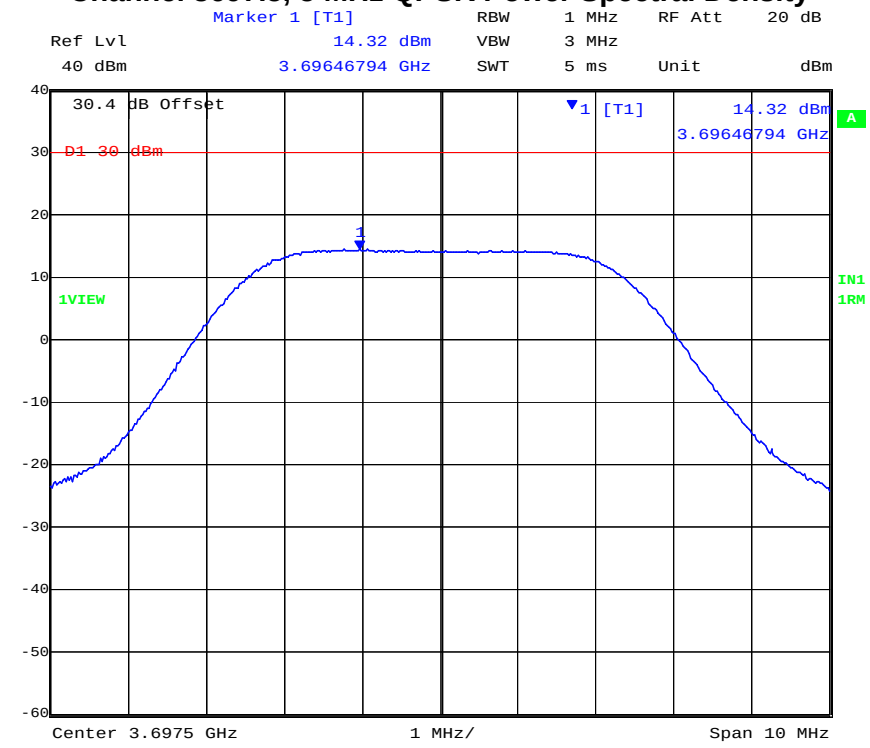


Date: 17.MAY.2010 11:01:29

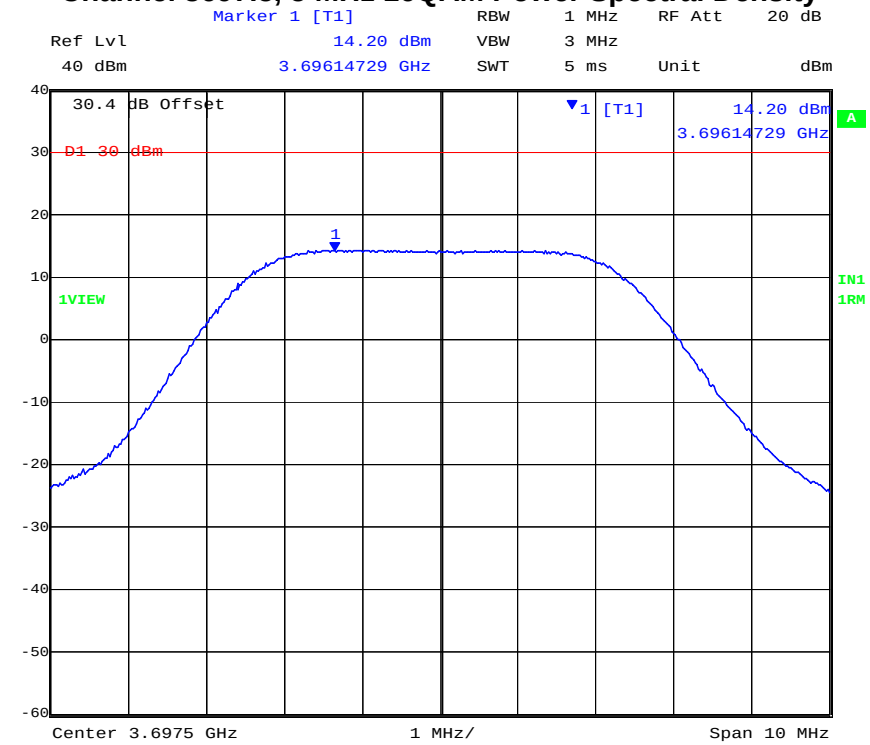
Channel 3697.5, 5 MHz BPSK Power Spectral Density



Channel 3697.5, 5 MHz QPSK Power Spectral Density

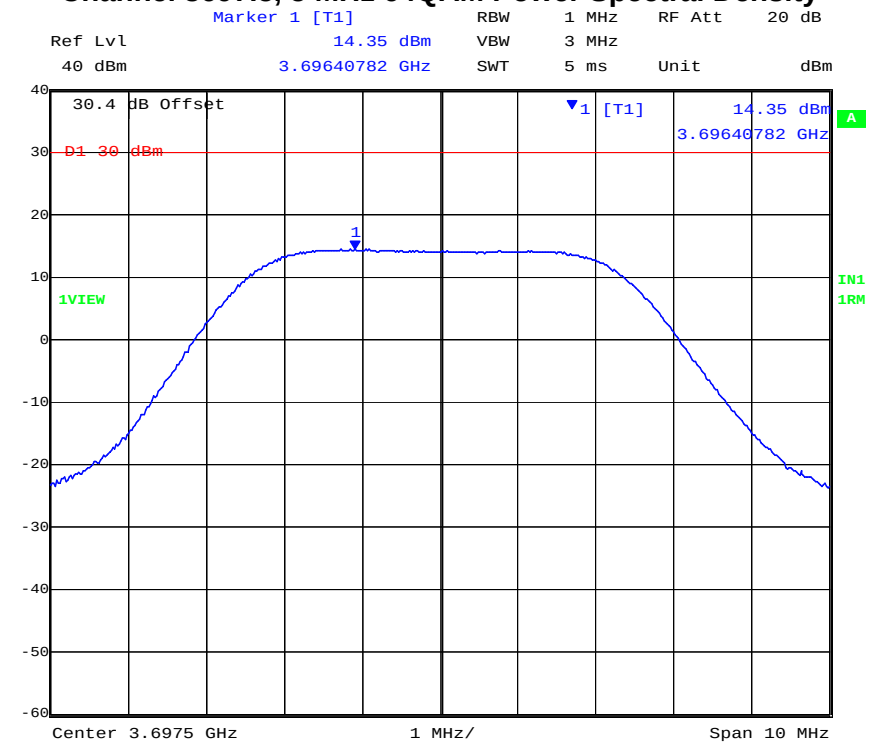


Channel 3697.5, 5 MHz 16QAM Power Spectral Density



Date: 17.MAY.2010 11:12:19

Channel 3697.5, 5 MHz 64QAM Power Spectral Density

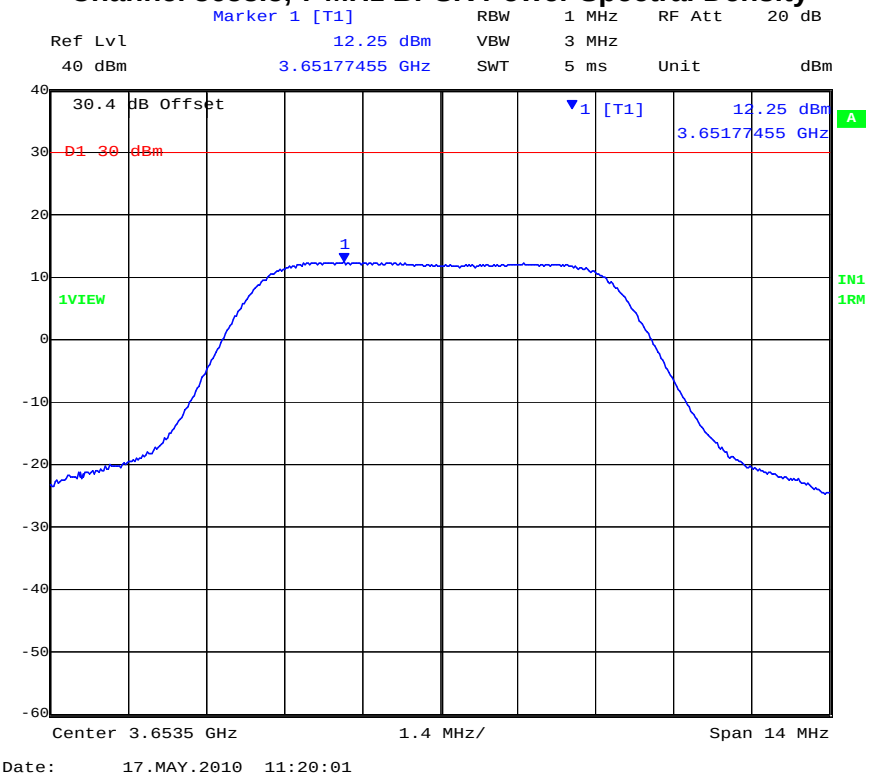


Date: 17.MAY.2010 11:16:13

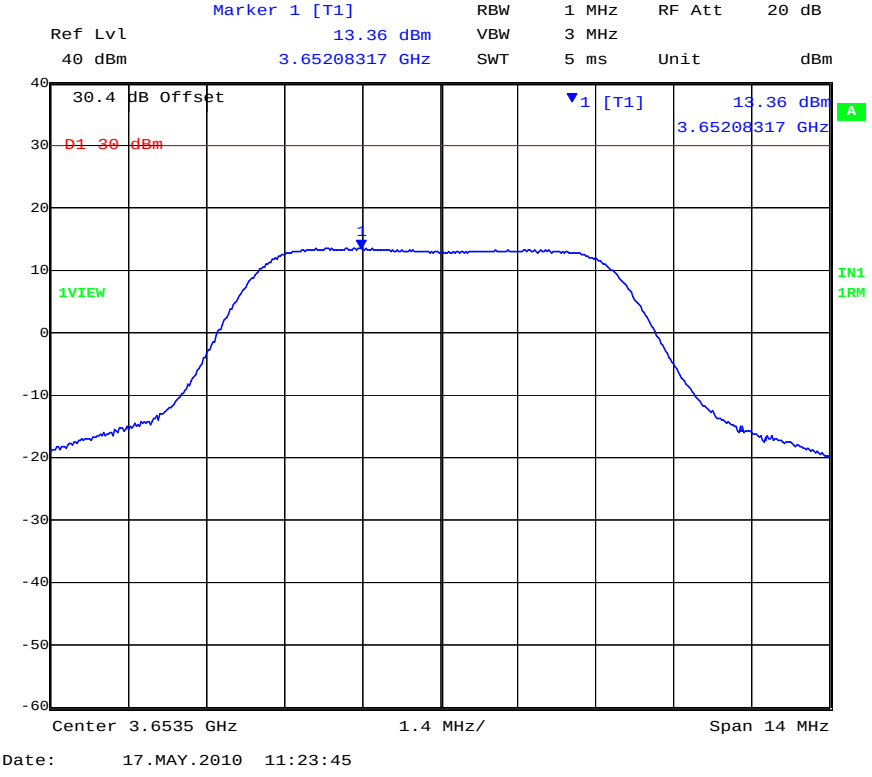
7 MHz Bandwidth

	Power Spectral Density (dBm/MHz)				
Center Frequency (MHz)	BPSK (+dBm)	QPSK (+dBm)	16 QAM (+dBm)	64QAM (+dBm)	Margin (dB)
3653.50	+12.25	+13.36	+13.37	+13.44	-16.56
3675.00	+12.16	+13.21	+13.11	+13.23	-16.77
3696.50	+12.12	+13.12	+13.16	+13.23	-16.77

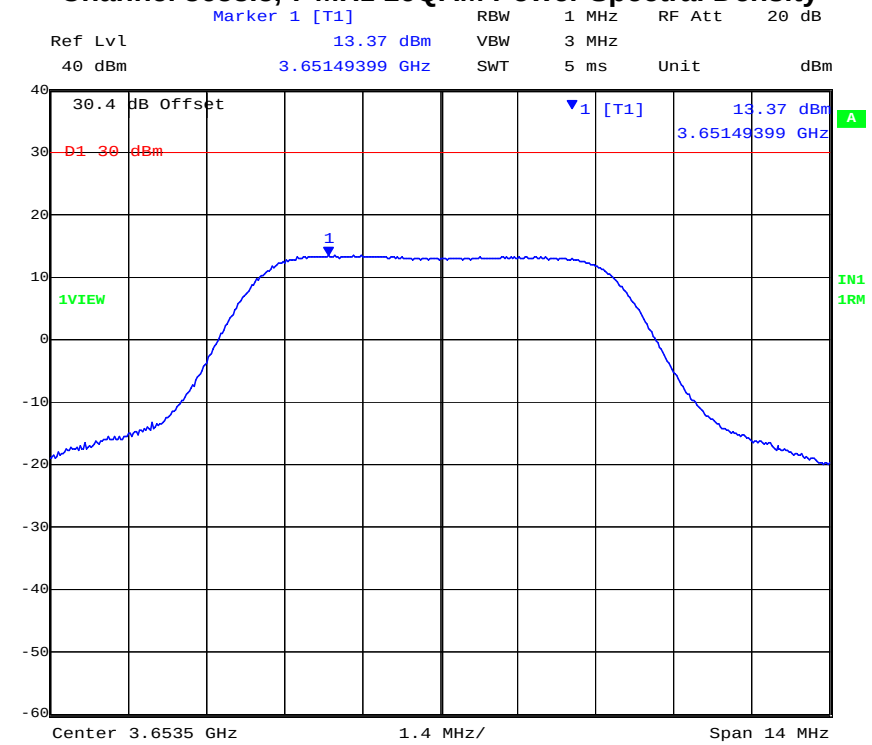
Channel 3653.5, 7 MHz BPSK Power Spectral Density



Channel 3653.5, 7 MHz QPSK Power Spectral Density

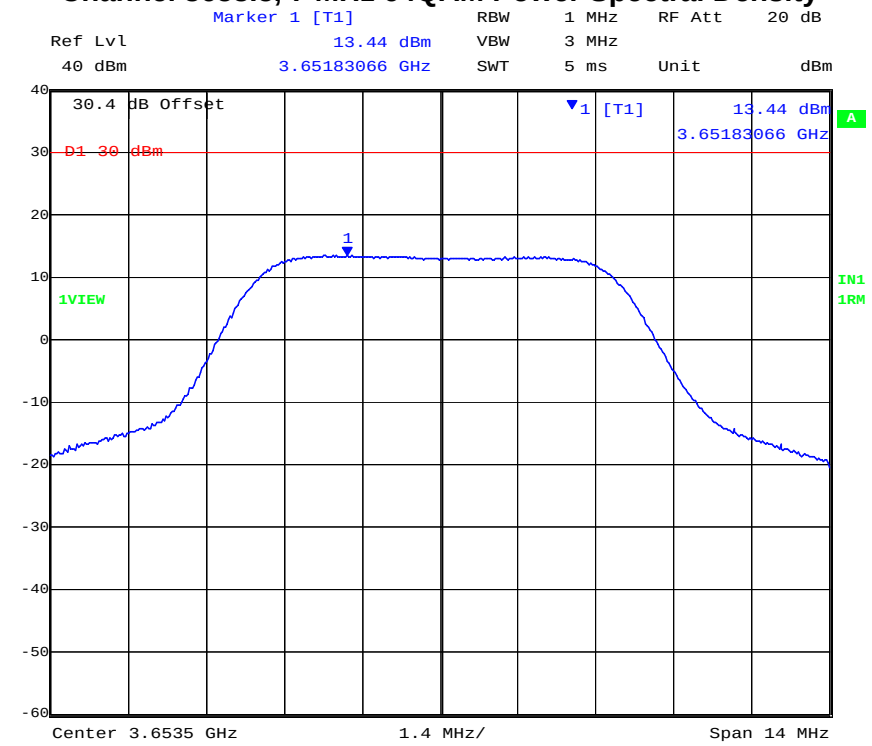


Channel 3653.5, 7 MHz 16QAM Power Spectral Density



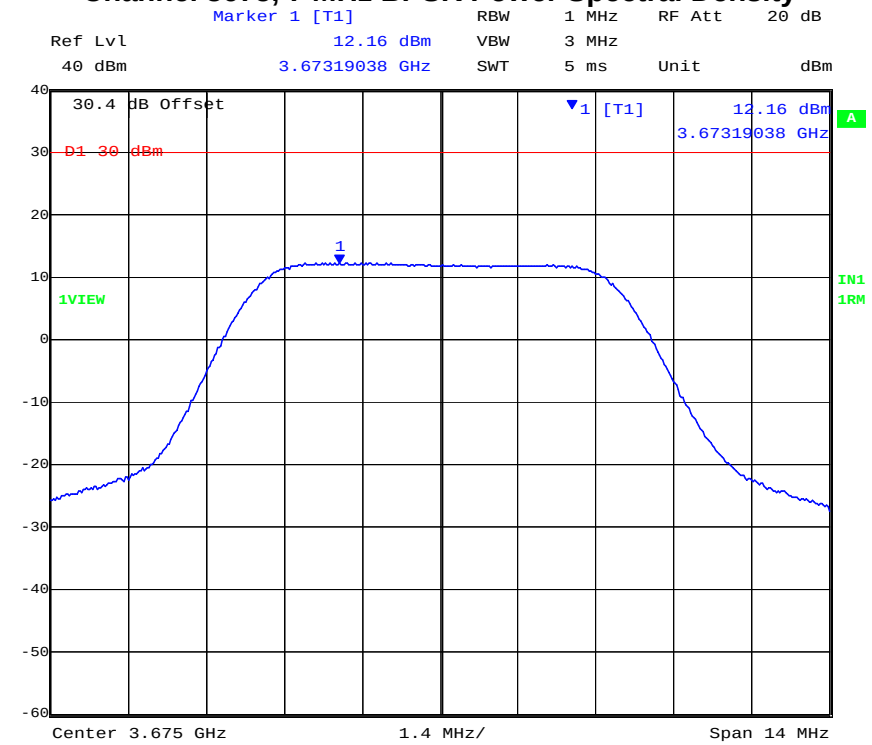
Date: 17.MAY.2010 11:24:55

Channel 3653.5, 7 MHz 64QAM Power Spectral Density



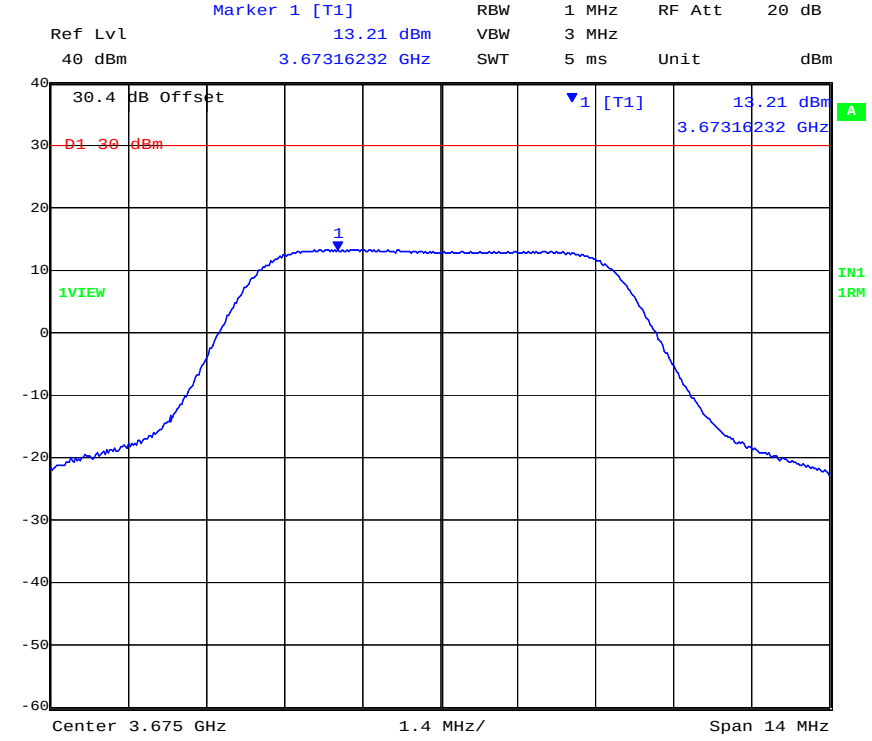
Date: 17.MAY.2010 11:28:09

Channel 3675, 7 MHz BPSK Power Spectral Density



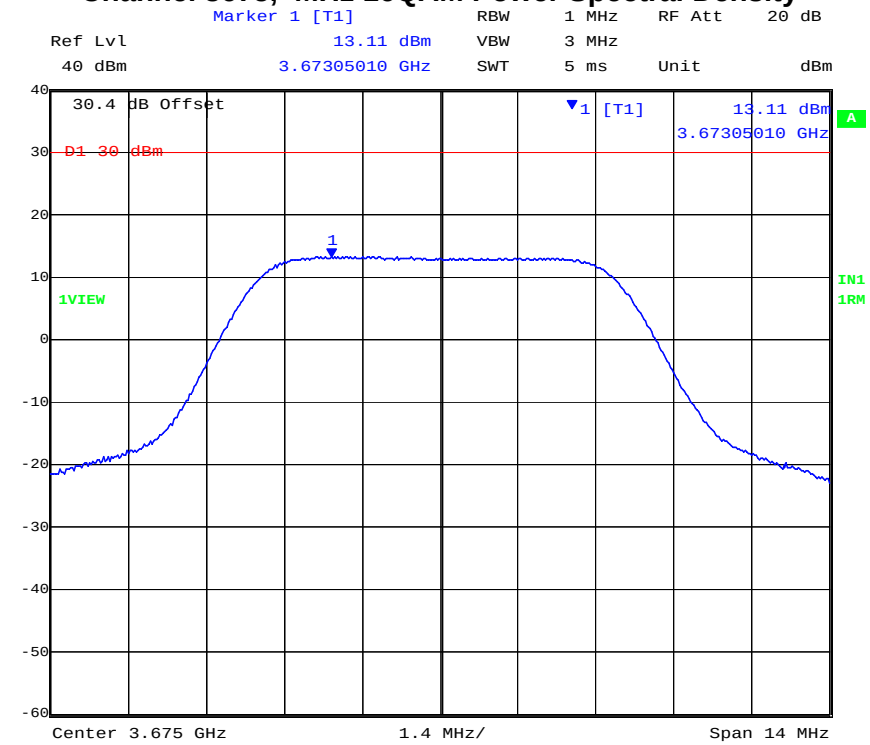
Date: 17.MAY.2010 11:29:20

Channel 3675, 7 MHz QPSK Power Spectral Density



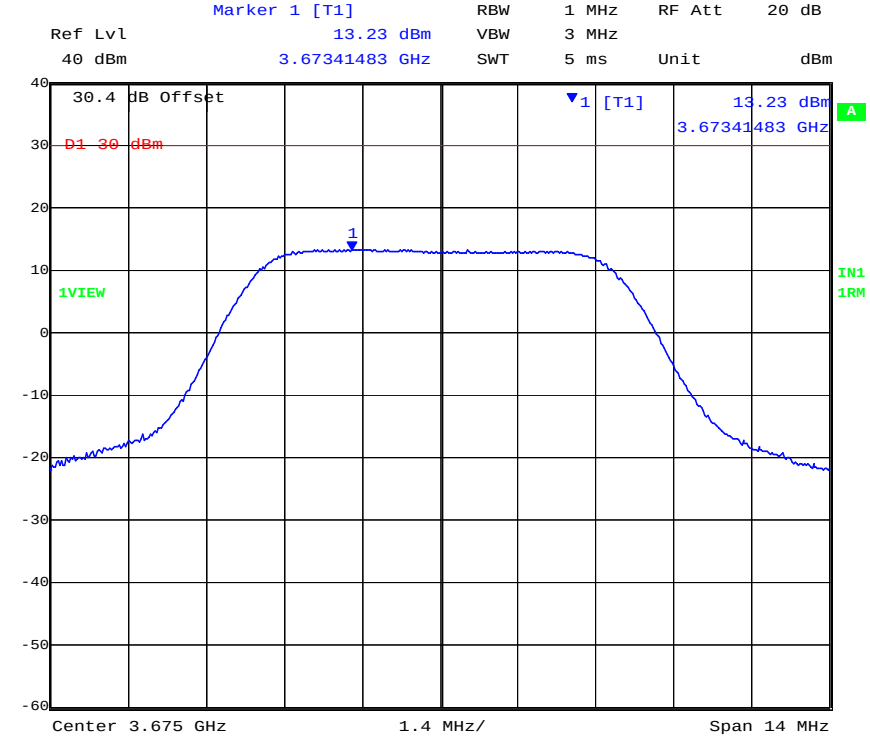
Date: 17.MAY.2010 11:39:34

Channel 3675, MHz 16QAM Power Spectral Density



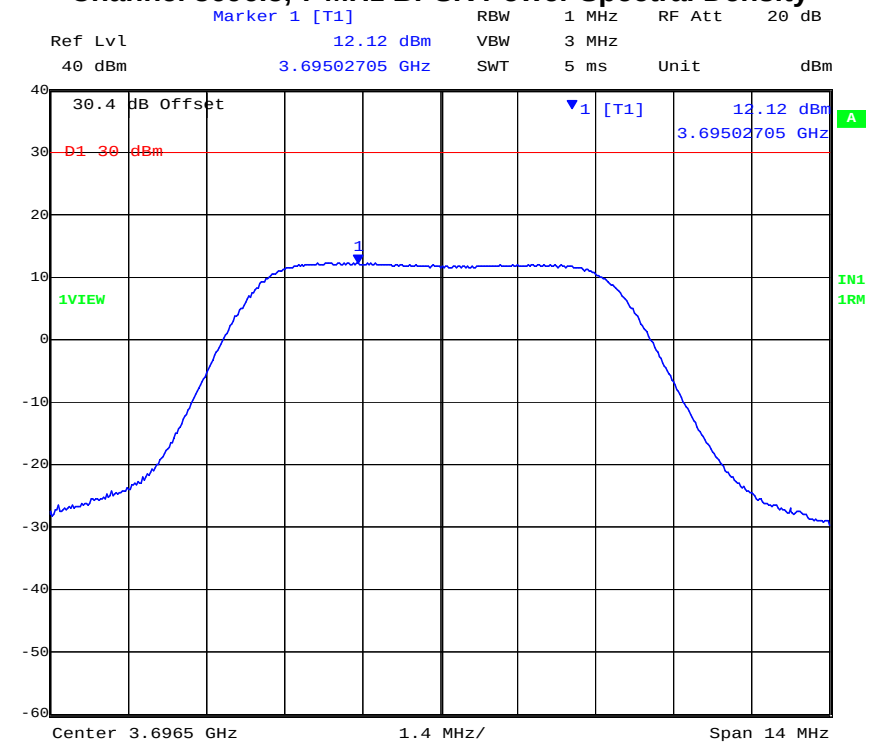
Date: 17.MAY.2010 11:40:24

Channel 3675, MHz 64QAM Power Spectral Density

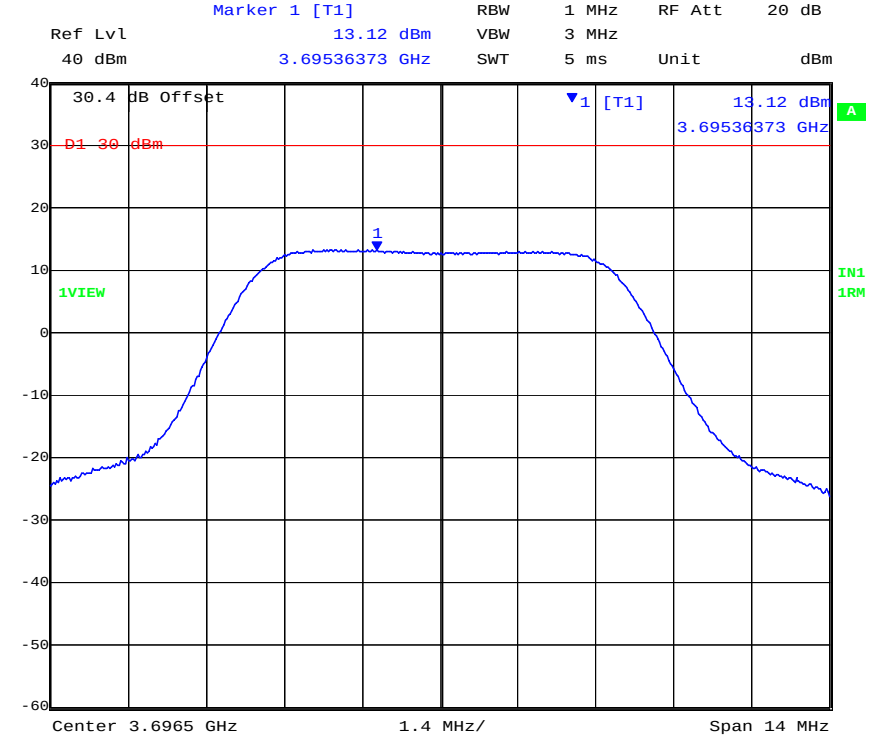


Date: 17.MAY.2010 11:45:21

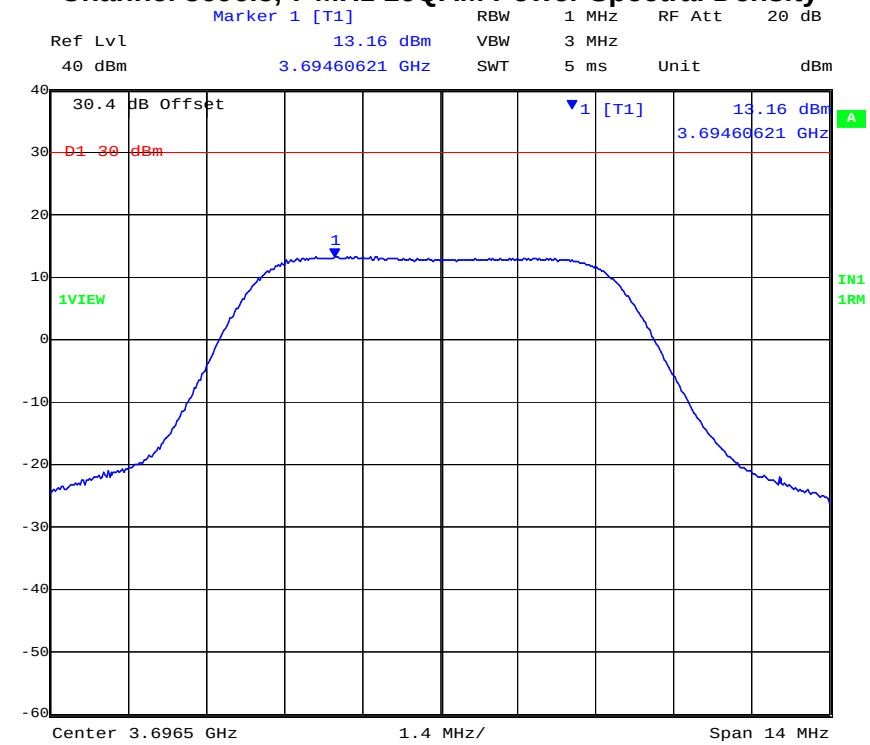
Channel 3696.5, 7 MHz BPSK Power Spectral Density



Channel 3696.5, 7 MHz QPSK Power Spectral Density

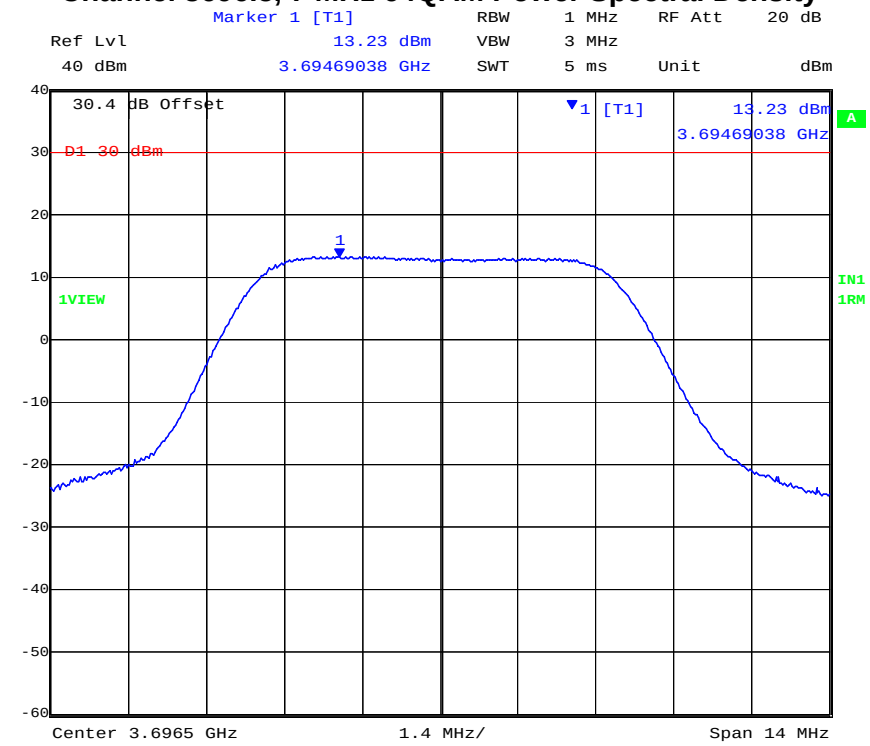


Channel 3696.5, 7 MHz 16QAM Power Spectral Density



Date: 17.MAY.2010 11:51:44

Channel 3696.5, 7 MHz 64QAM Power Spectral Density



Date: 17.MAY.2010 11:55:19

Laboratory Measurement Uncertainty for Power Measurement

Measurement uncertainty	±1.33 dB

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.

5.1.4. Maximum Permissible Exposure

FCC, Part 90 Subpart C §90.1217

Calculations for Maximum Permissible Exposure Levels

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

EIRP = P * G

P = Peak output power (mW)

G = Antenna numeric gain (numeric)

d = Separation distance (cm)

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

The Axxcelera EHD-CPE3310-C9 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/cm^2

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	16	39.81	+19.76	94.6	17.31	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 = 5mW / cm^2 from 1.310 Table 1

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

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33dB

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 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.

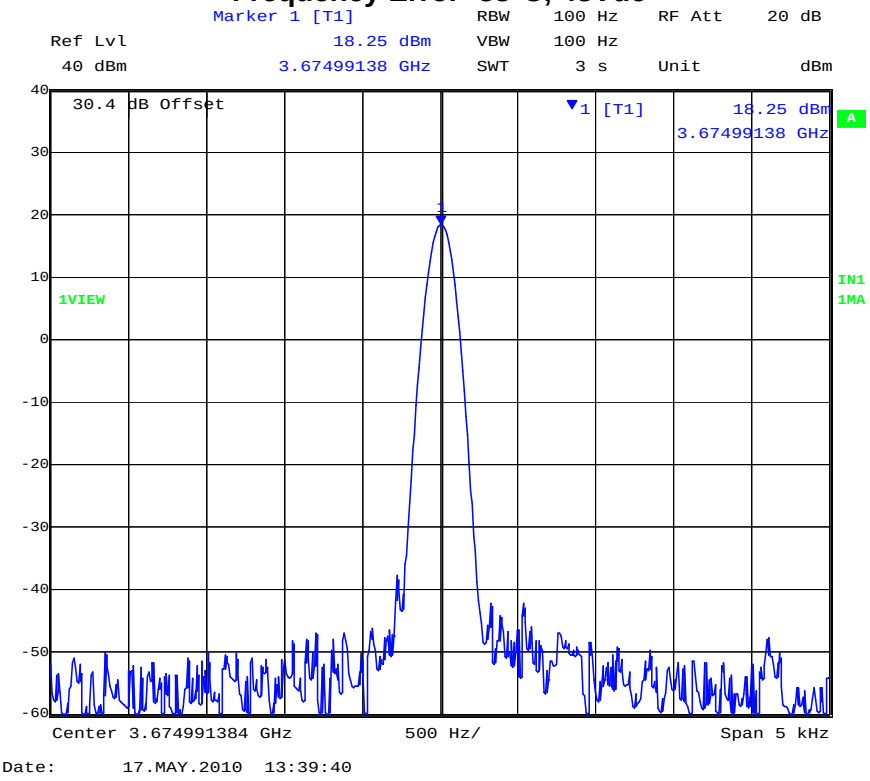
Test Set-up is shown in Section 3.6 Test Configuration

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

TABLE OF RESULTS Frequency Stability – Channel Measured 3675 MHz

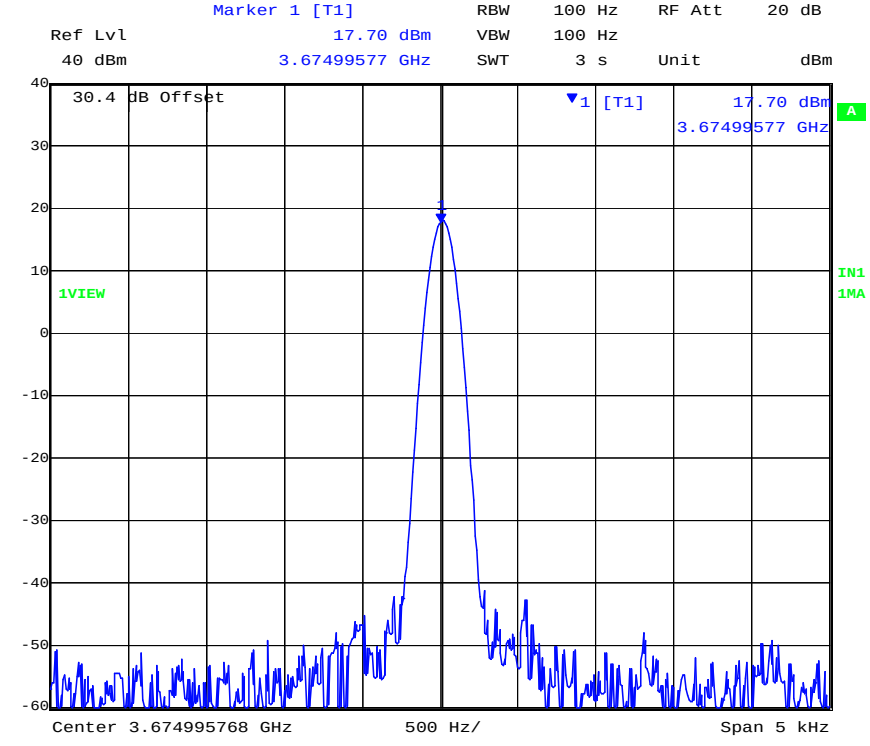
Voltage	Temperature (°C)	Center Frequency (MHz)	Delta (kHz)	ppm
48 Vdc	-33	3674.99138	-8.62	-2.35
	-30	3674.99577	-4.23	-1.15
	-20	3675.00399	3.99	1.09
	-10	3675.005267	5.267	1.43
	+0	3675.00111	1.11	0.30
	+10	3674.99362	-6.38	-1.74
	+20	3674.98366	-16.34	-4.45
43.2 Vdc	+20	3674.98360	-16.4	-4.46
52.8 Vdc	+20	3674.98352	-16.48	-4.48
48 Vdc	+30	3674.97498	-25.02	-6.81
	+40	3674.96897	-31.03	-8.44
	+50	3674.96967	-30.33	-8.25
	+55	3674.97557	-24.43	-6.65
Maximum Frequency Drift with respect to the nominal frequency		+1.11 kHz / -31.03 kHz +0.30 ppm / -8.44 ppm		

Frequency Error -33°C, 48Vdc



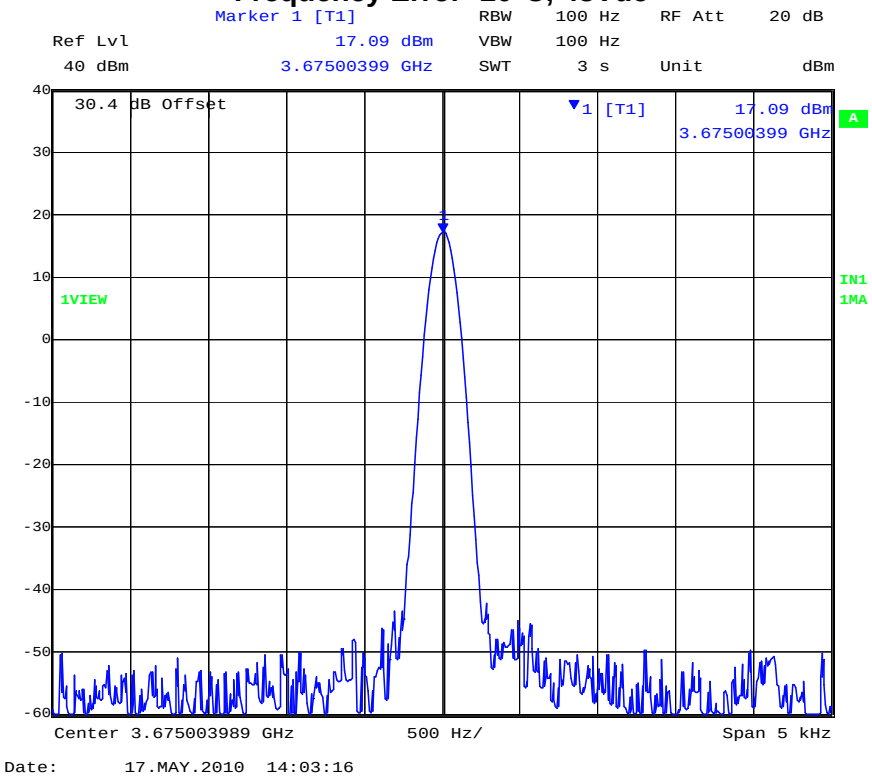
Date: 17.MAY.2010 13:39:40

Frequency Error -30°C, 48Vdc



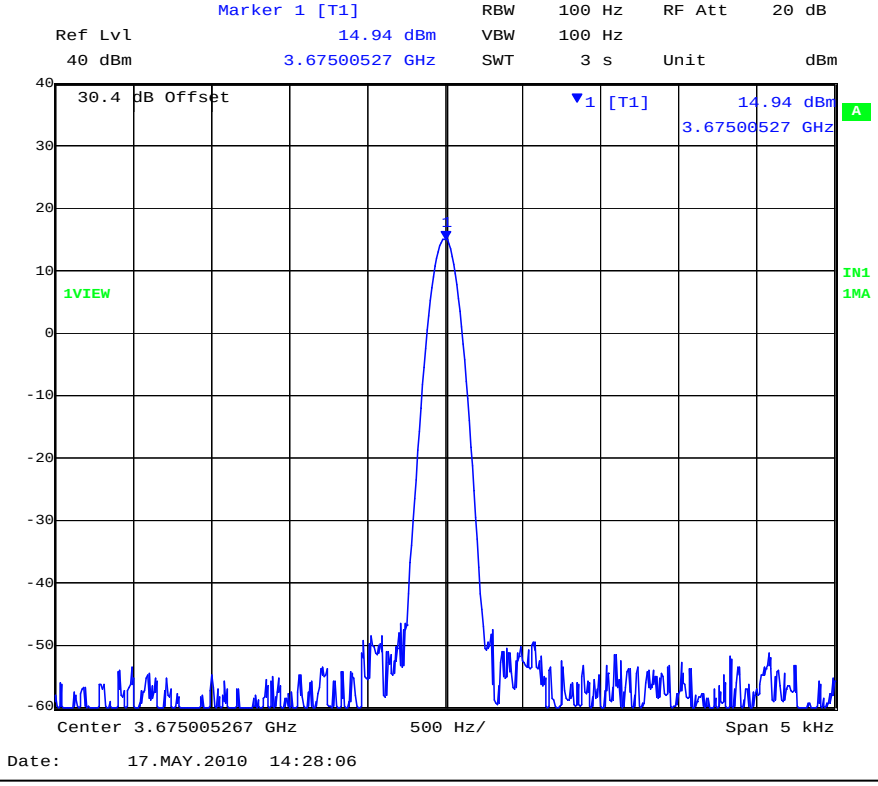
Date: 17.MAY.2010 13:51:47

Frequency Error -20°C, 48Vdc



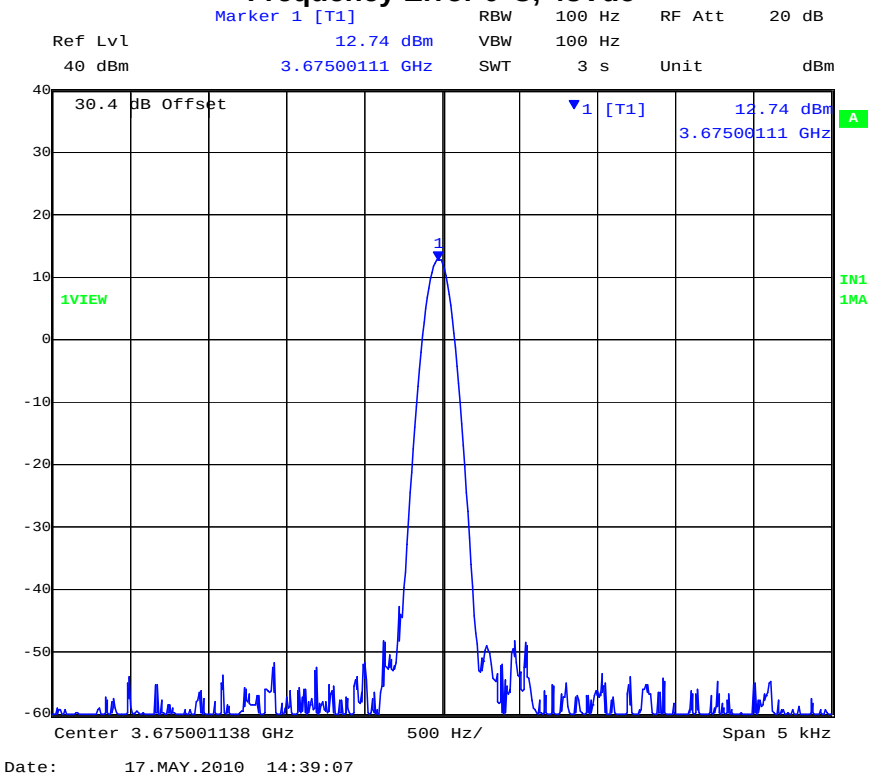
Date: 17.MAY.2010 14:03:16

Frequency Error -10°C, 48Vdc

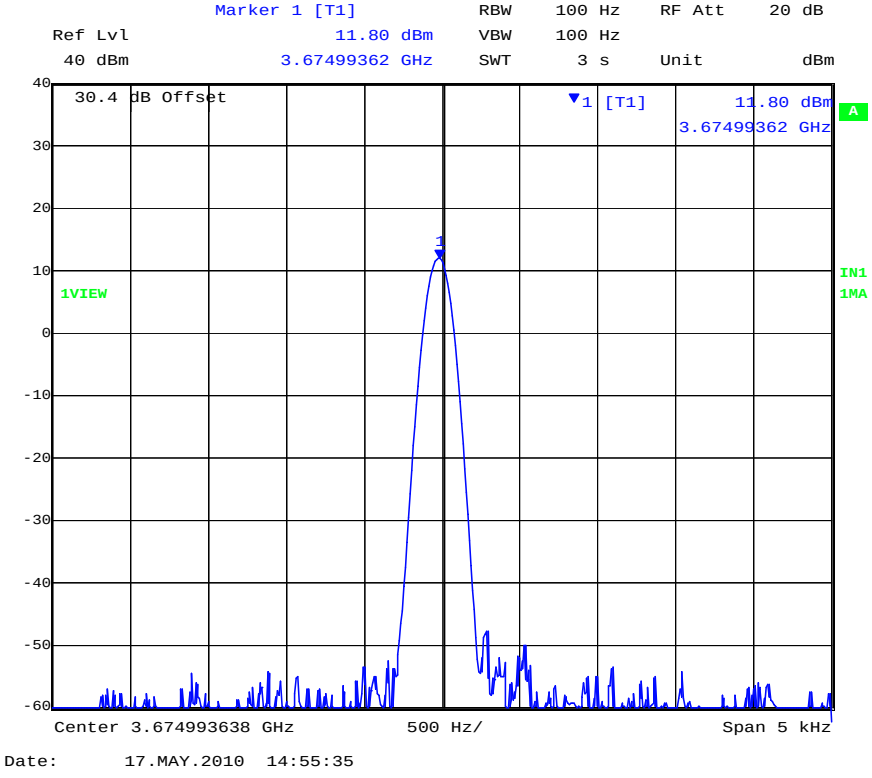


Date: 17.MAY.2010 14:28:06

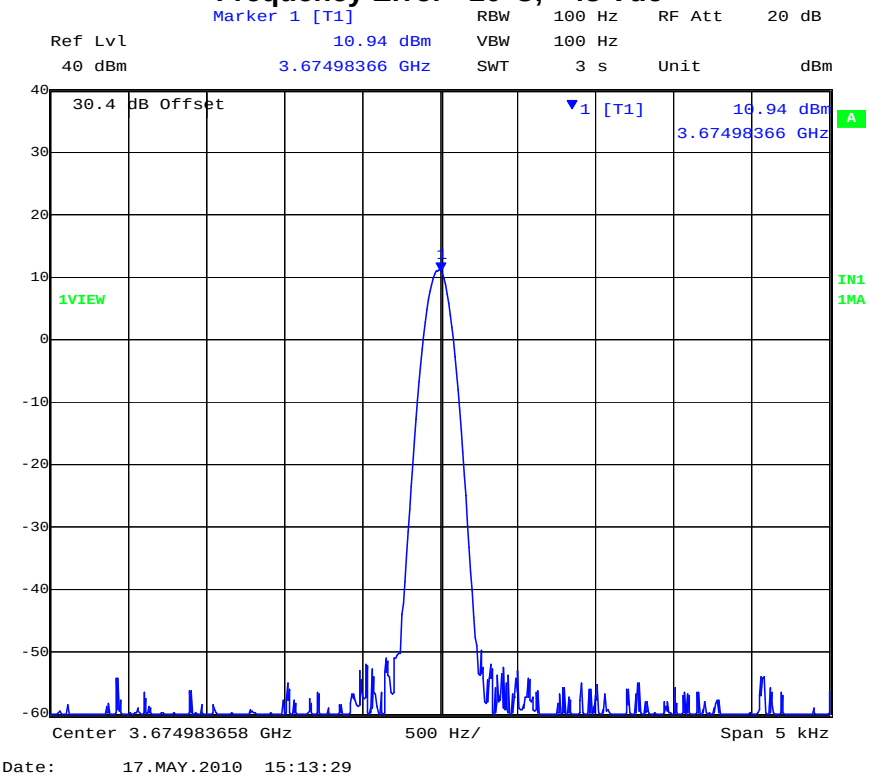
Frequency Error 0°C, 48Vdc



Frequency Error +10°C, 48Vdc

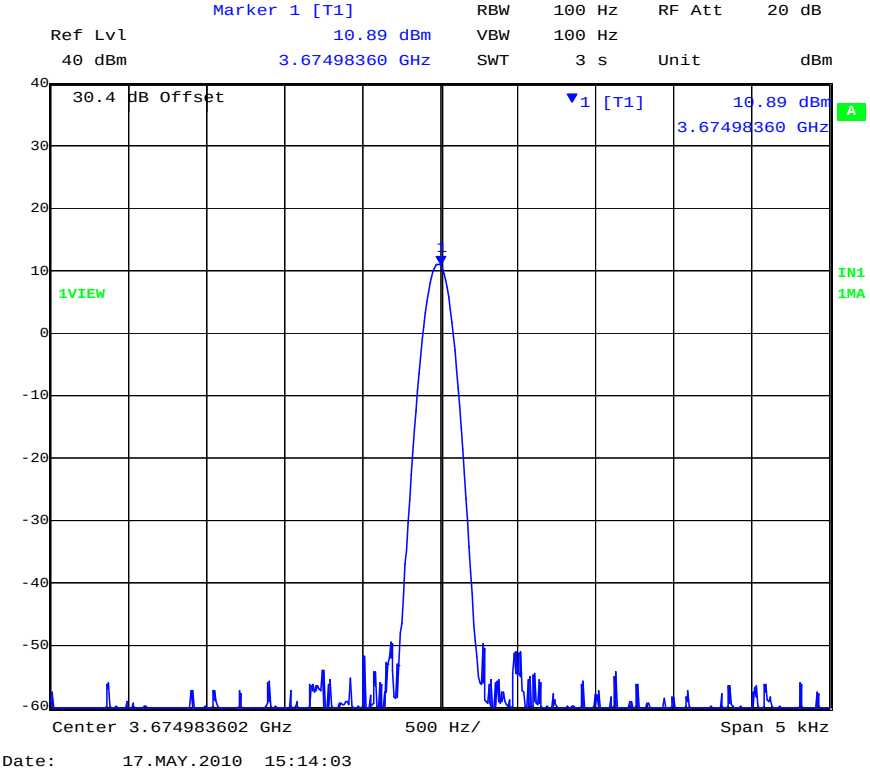


Frequency Error +20°C, +48 Vdc



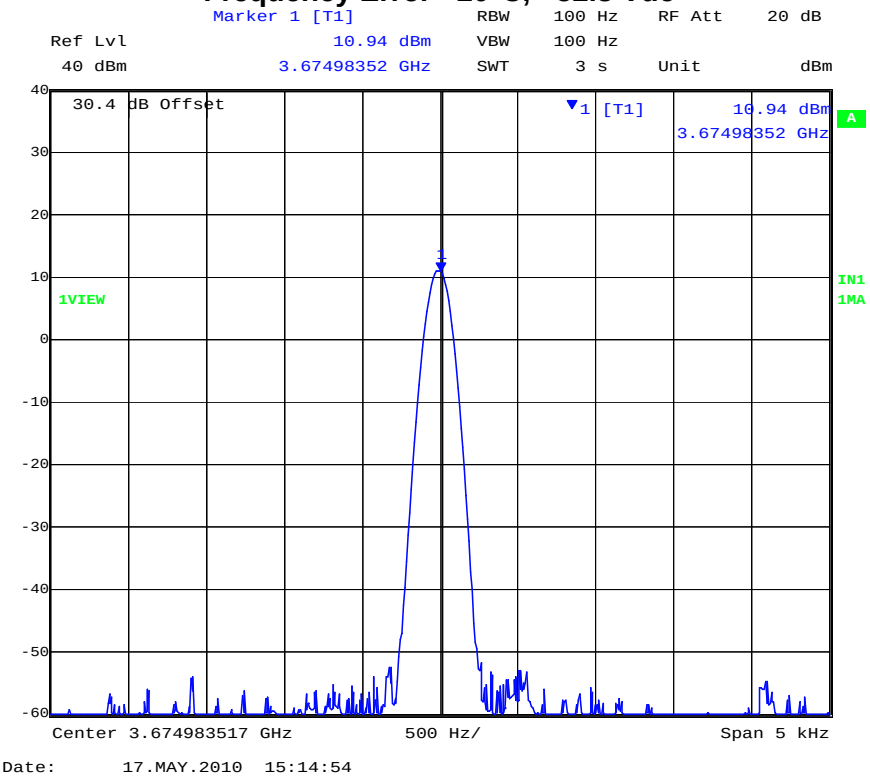
Date: 17.MAY.2010 15:13:29

Frequency Error +20°C, +43.2 Vdc



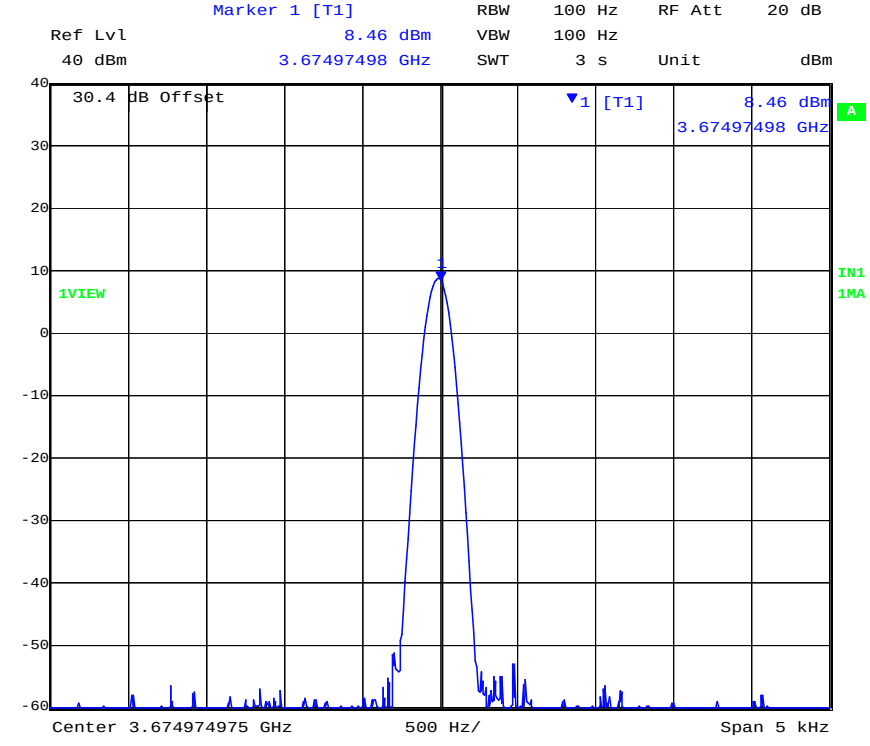
Date: 17.MAY.2010 15:14:03

Frequency Error +20°C, +52.8 Vdc



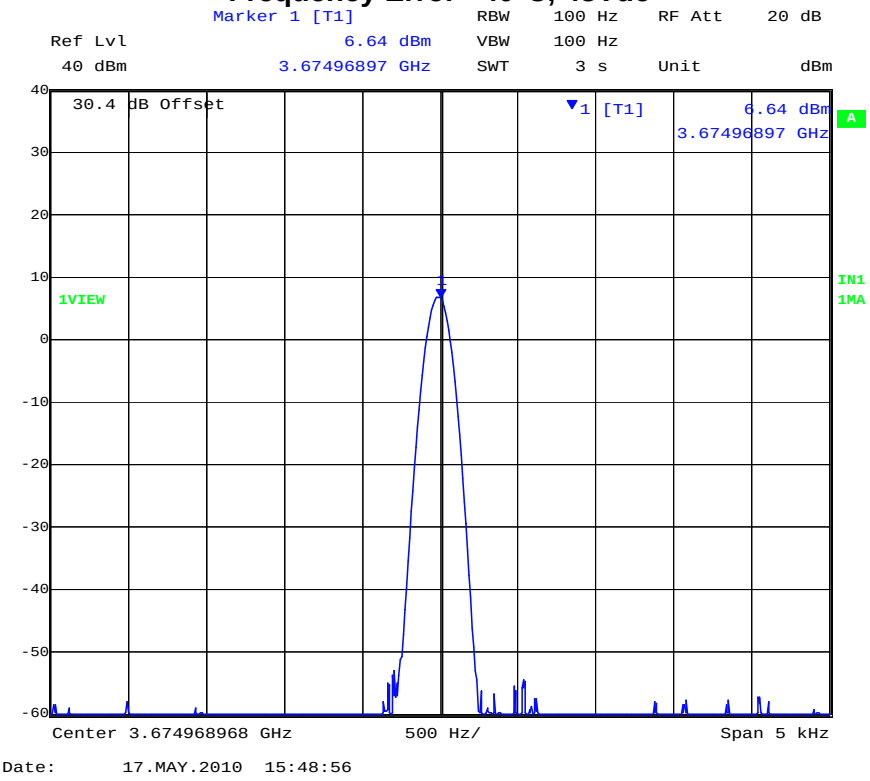
Date: 17.MAY.2010 15:14:54

Frequency Error +30°C, 48Vdc

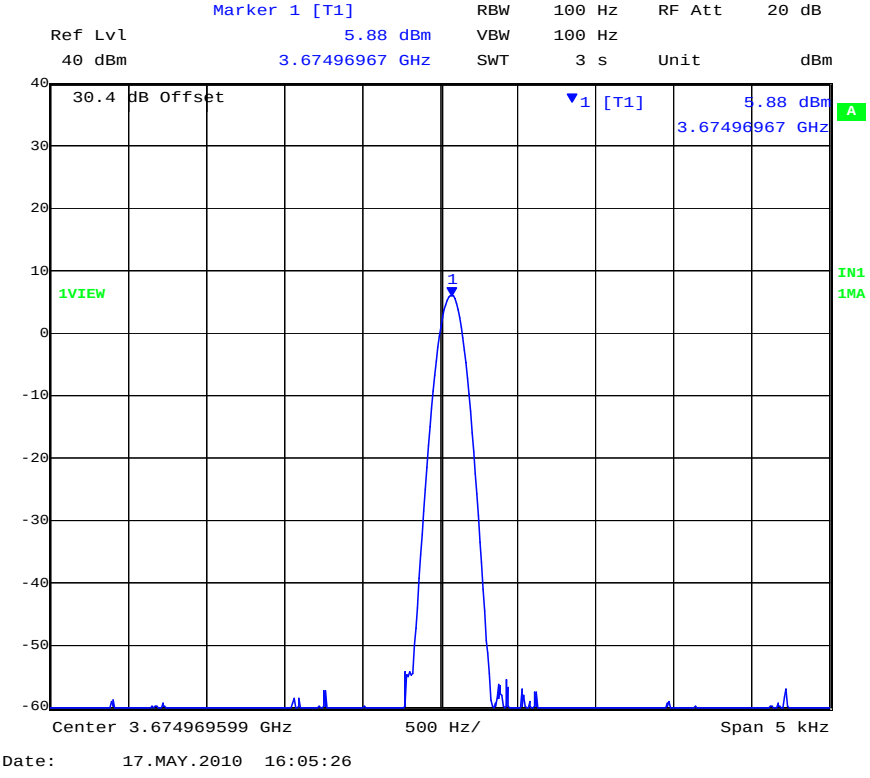


Date: 17.MAY.2010 15:33:23

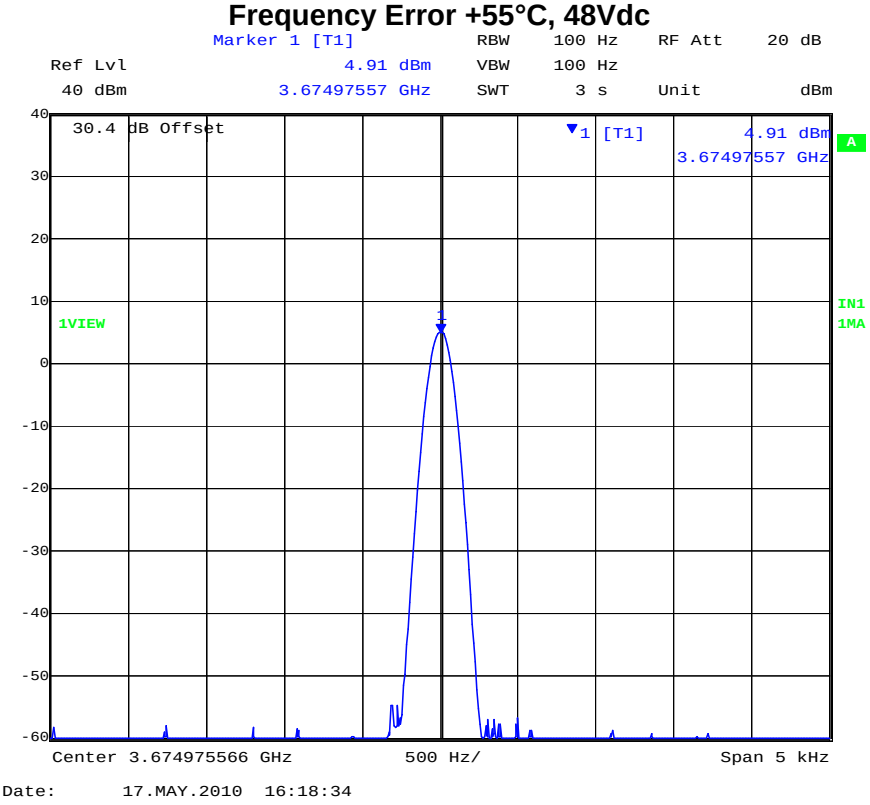
Frequency Error +40°C, 48Vdc



Frequency Error +50°C, 48Vdc



Frequency Error +55°C, 48Vdc



Laboratory Measurement Uncertainty for Frequency Stability

Measurement uncertainty	±0.866 ppm

Traceability

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

5.1.6. Spectrum Mask & Spurious Emissions at Antenna Terminal

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

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

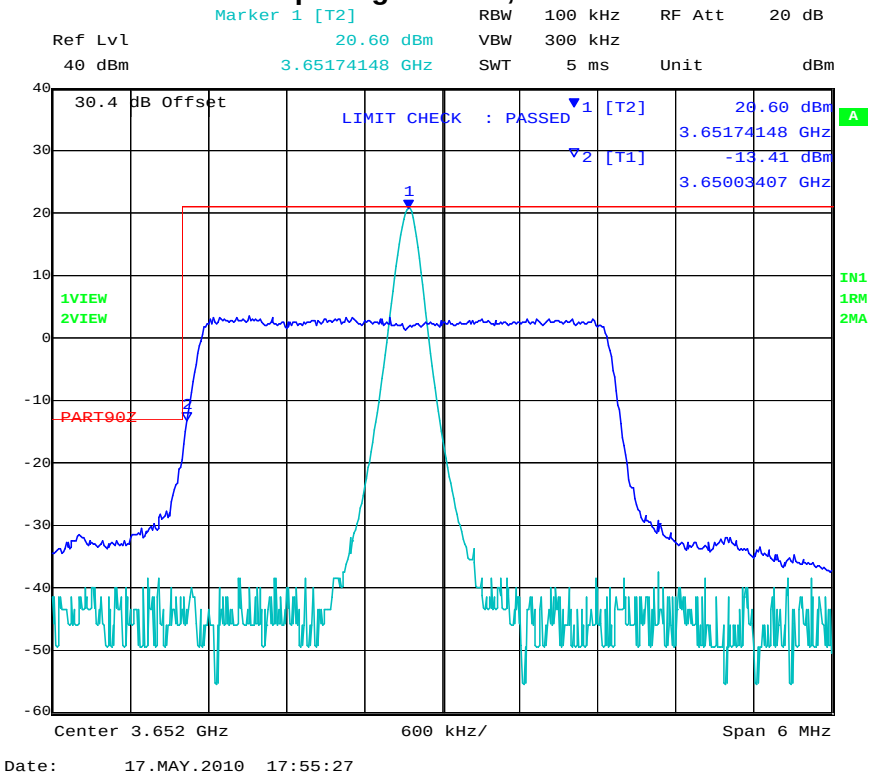
Test Procedure
Transmitter spectrum mask was measured for all modulation schemes and channel bandwidths at the 3,650 MHz band-edge only. Transmitter conducted spurious emissions were measured for all channel bandwidths and modulation states. Measurement were made while EUT was operating in a modulated 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

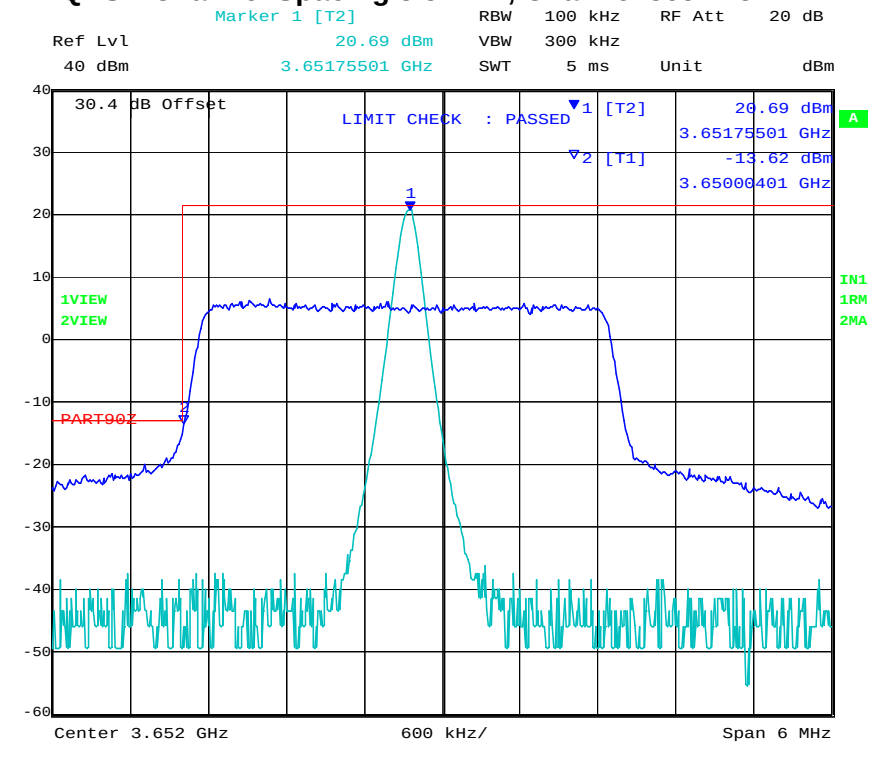
Limit
For operation in the 3650 – 3700 band the power of any emission outside the frequency band of operation shall be attenuated below the transmitter power (P) within the licensed band of operation, measured in Watts, by at least 43 + 10*Log (P) = -13dBm.

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

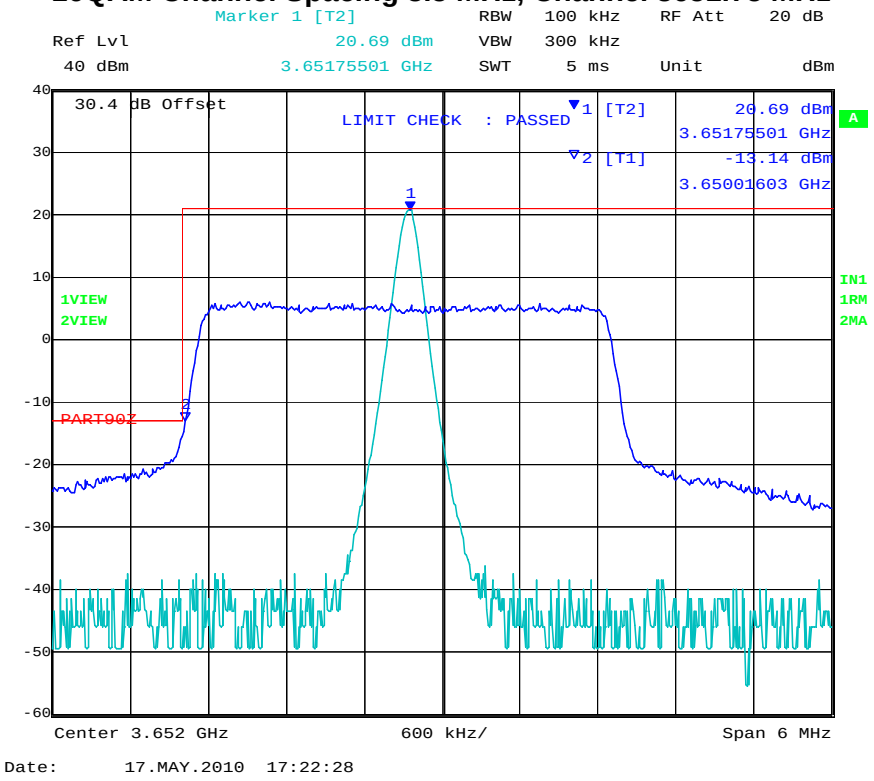
BPSK Channel Spacing 3.5 MHz, Channel 3651.75 MHz



QPSK Channel Spacing 3.5 MHz, Channel 3651.75 MHz

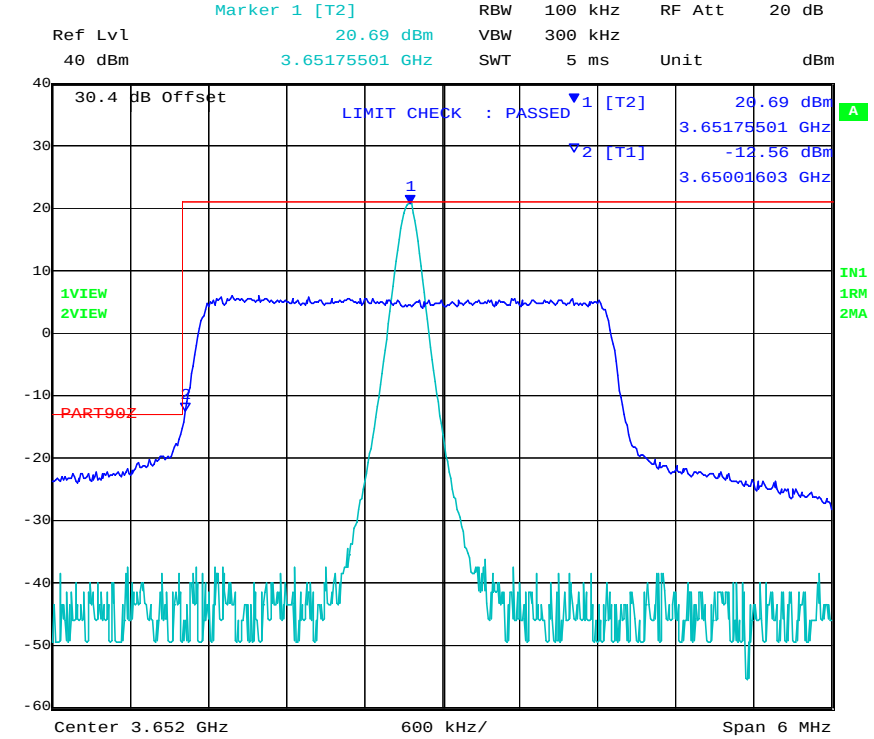


16QAM Channel Spacing 3.5 MHz, Channel 3651.75 MHz



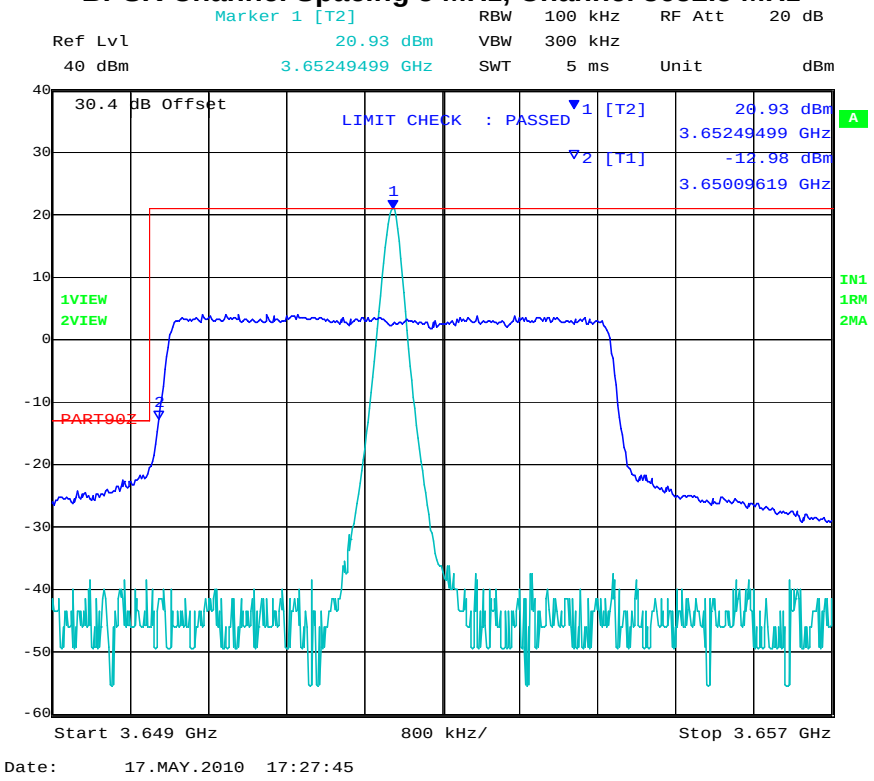
Date: 17.MAY.2010 17:22:28

64QAM Channel Spacing 3.5 MHz, Channel 3651.75 MHz



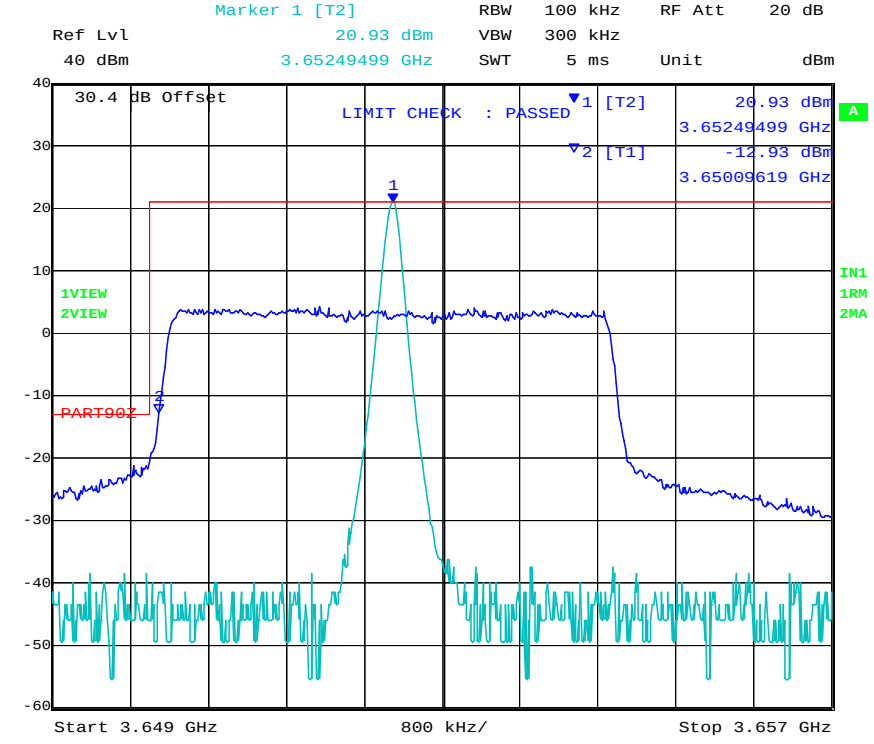
Date: 17.MAY.2010 17:23:19

BPSK Channel Spacing 5 MHz, Channel 3652.5 MHz



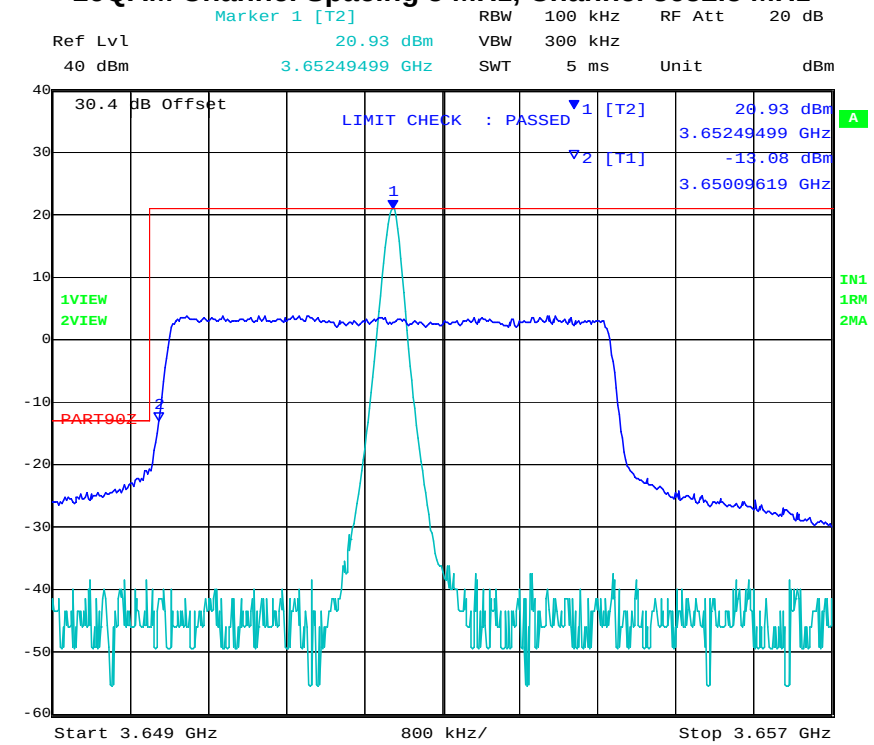
Date: 17.MAY.2010 17:27:45

QPSK Channel Spacing 5 MHz, Channel 3652.5 MHz



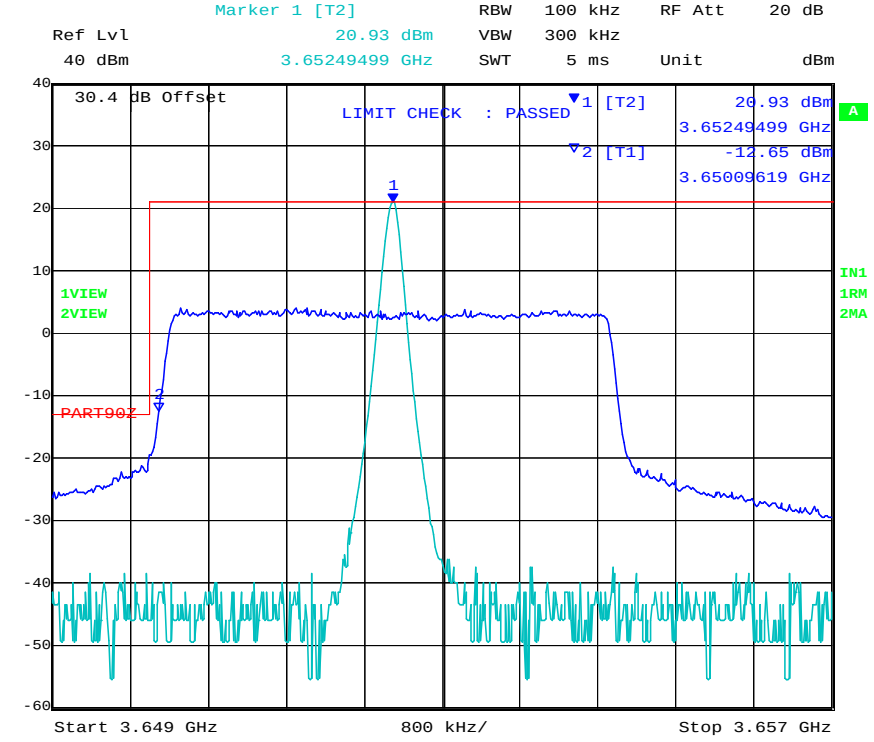
Date: 17.MAY.2010 17:28:48

16QAM Channel Spacing 5 MHz, Channel 3652.5 MHz



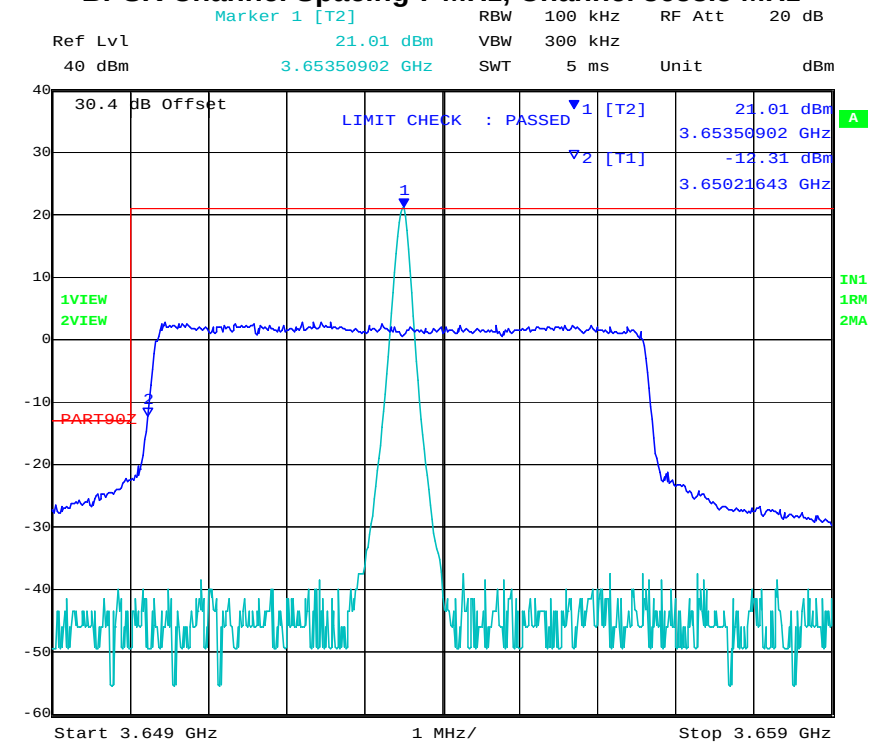
Date: 17.MAY.2010 17:29:35

64QAM Channel Spacing 5 MHz, Channel 3652.5 MHz



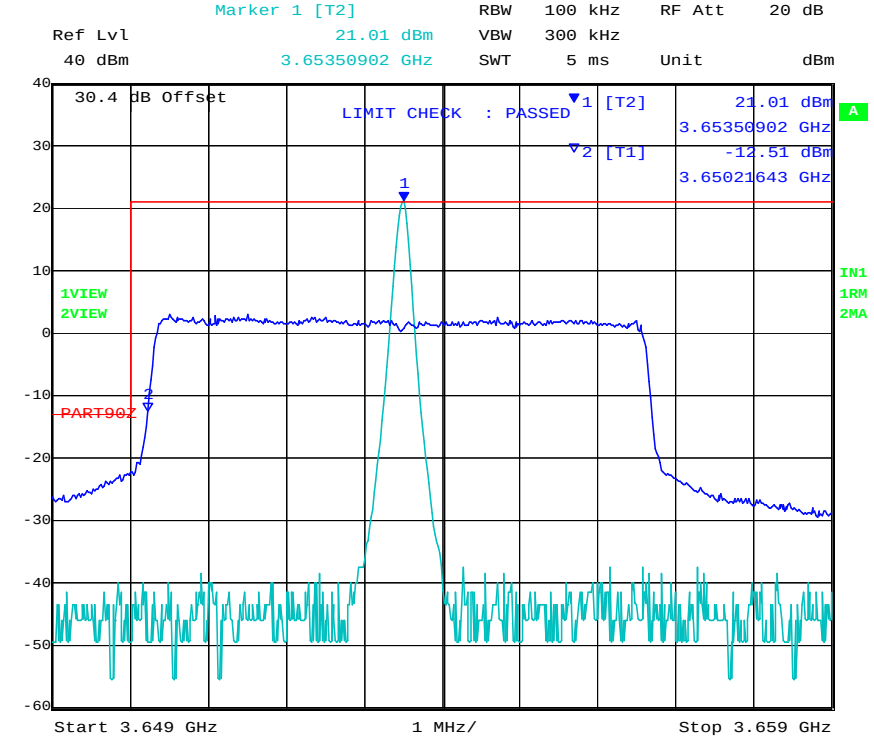
Date: 17.MAY.2010 17:30:17

BPSK Channel Spacing 7 MHz, Channel 3653.5 MHz



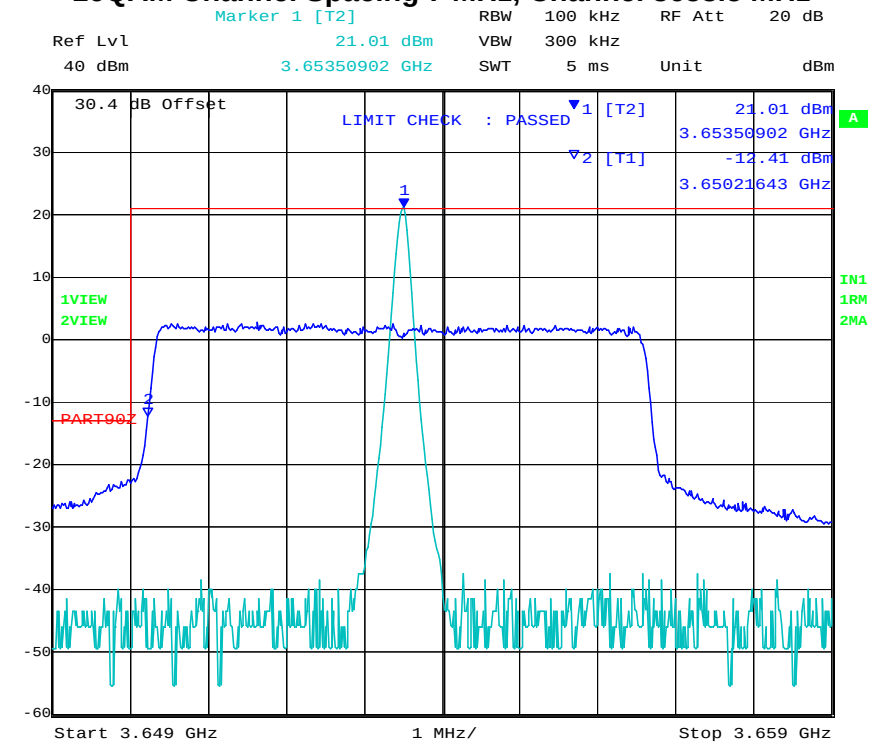
Date: 17.MAY.2010 17:32:51

QPSK Channel Spacing 7 MHz, Channel 3653.5 MHz



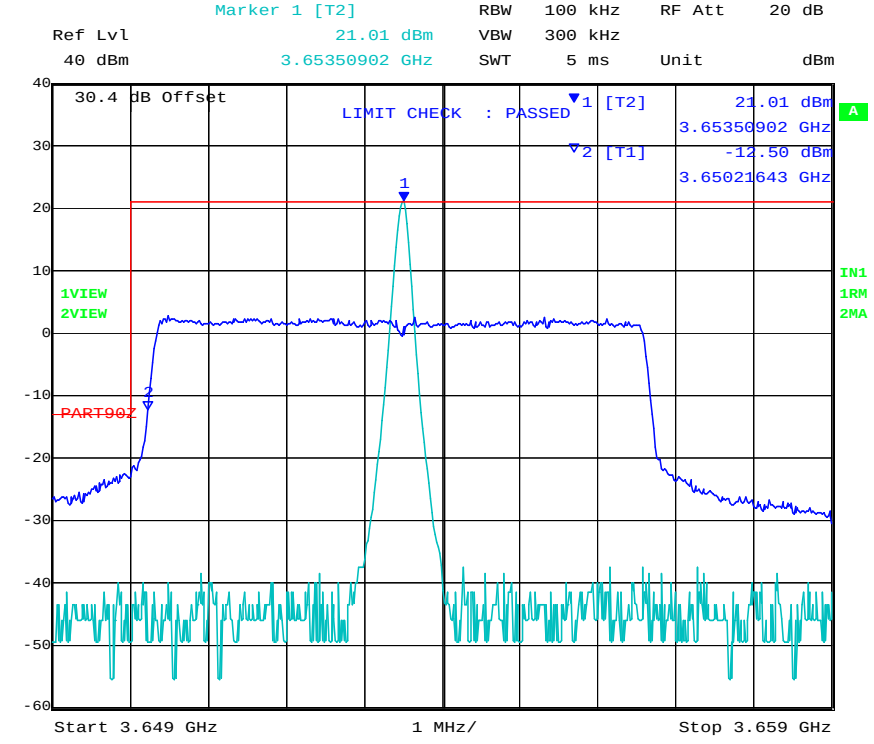
Date: 17.MAY.2010 17:33:48

16QAM Channel Spacing 7 MHz, Channel 3653.5 MHz



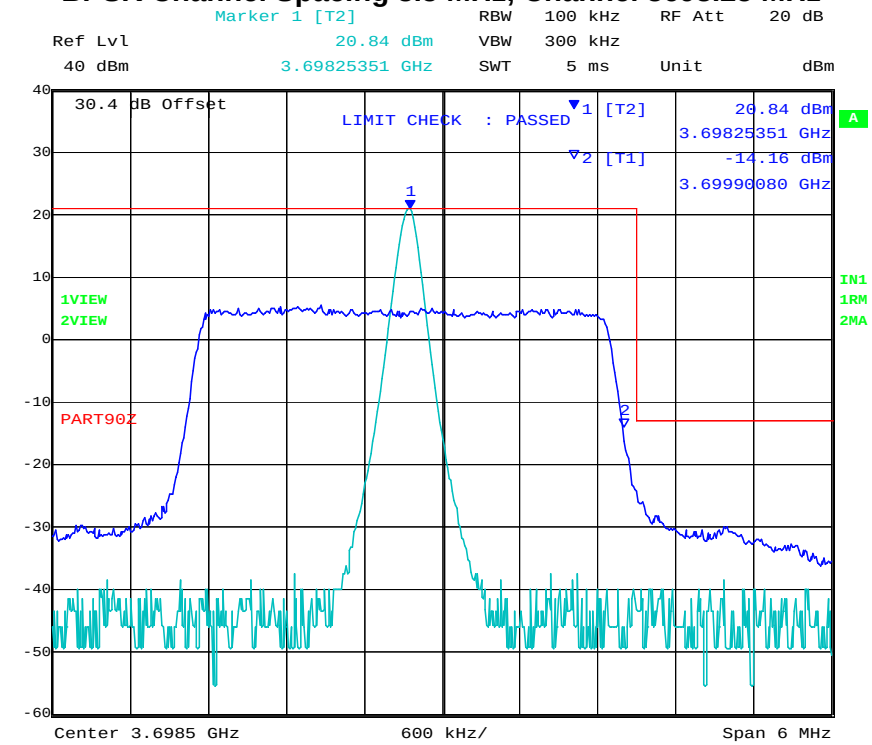
Date: 17.MAY.2010 17:34:32

64QAM Channel Spacing 7 MHz, Channel 3653.5 MHz

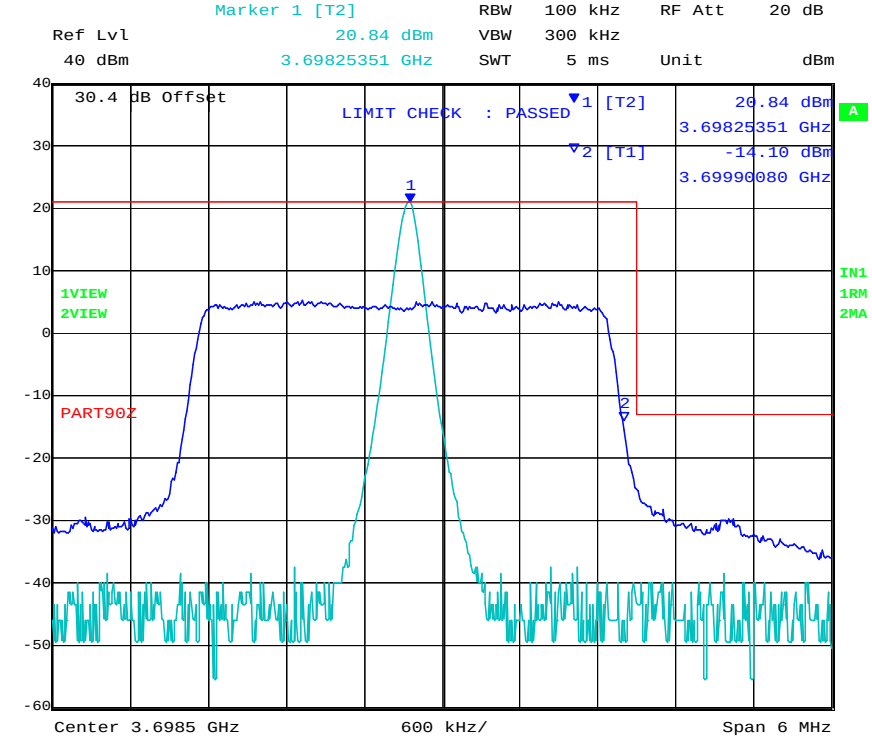


Date: 17.MAY.2010 17:35:11

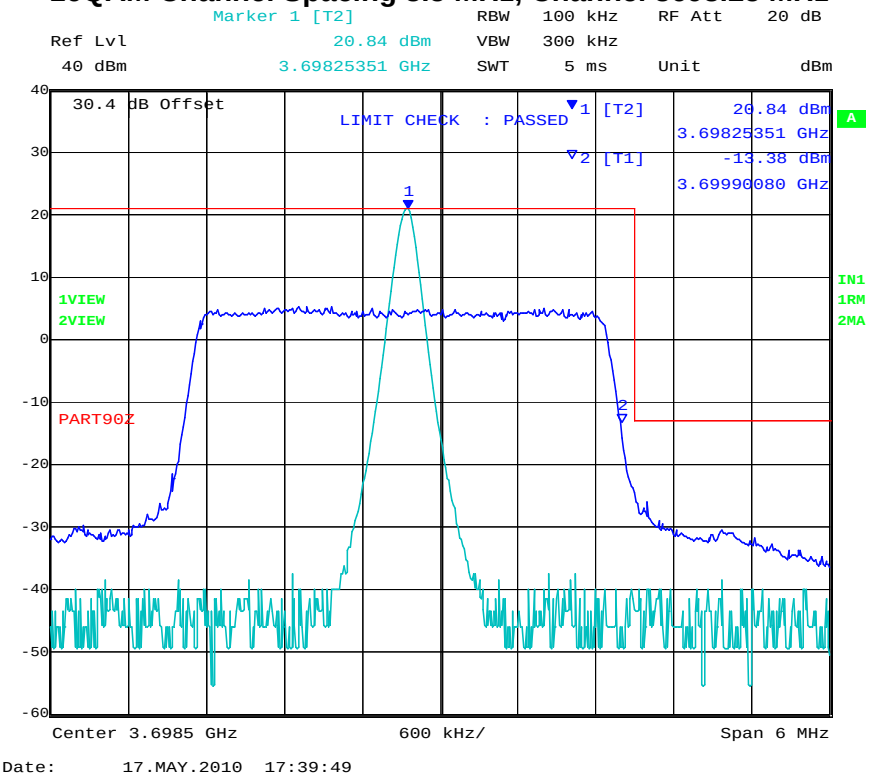
BPSK Channel Spacing 3.5 MHz, Channel 3698.25 MHz



QPSK Channel Spacing 3.5 MHz, Channel 3698.25 MHz

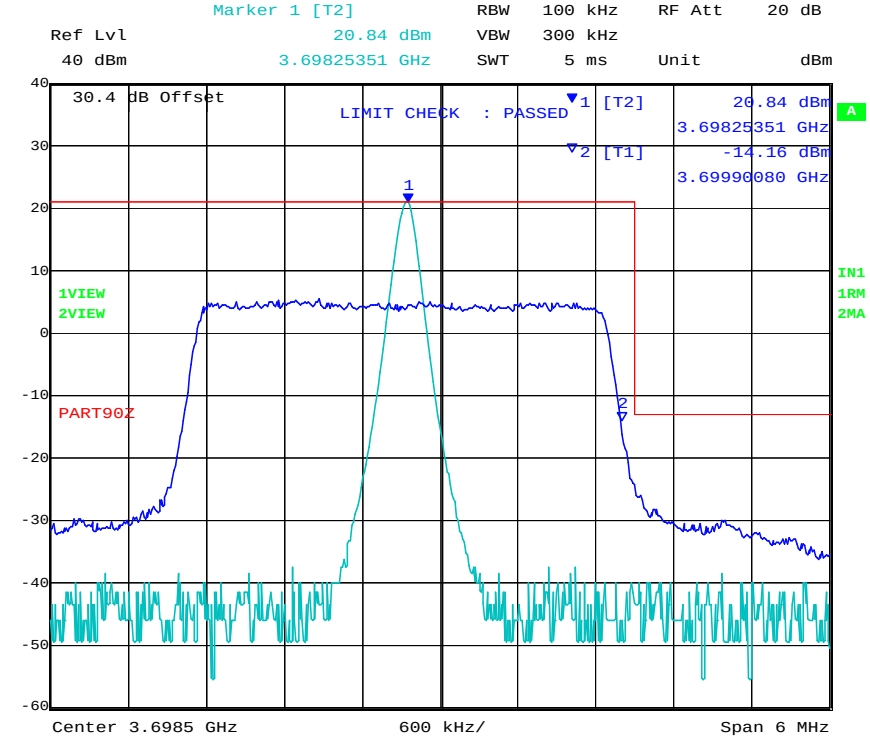


16QAM Channel Spacing 3.5 MHz, Channel 3698.25 MHz



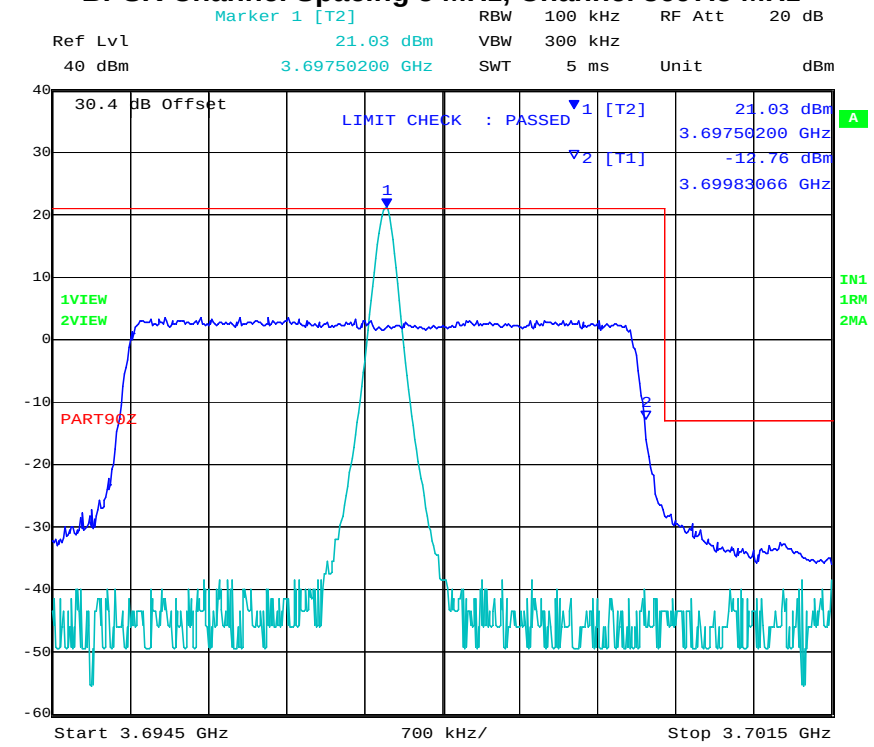
Date: 17.MAY.2010 17:39:49

64QAM Channel Spacing 3.5 MHz, Channel 3698.25 MHz



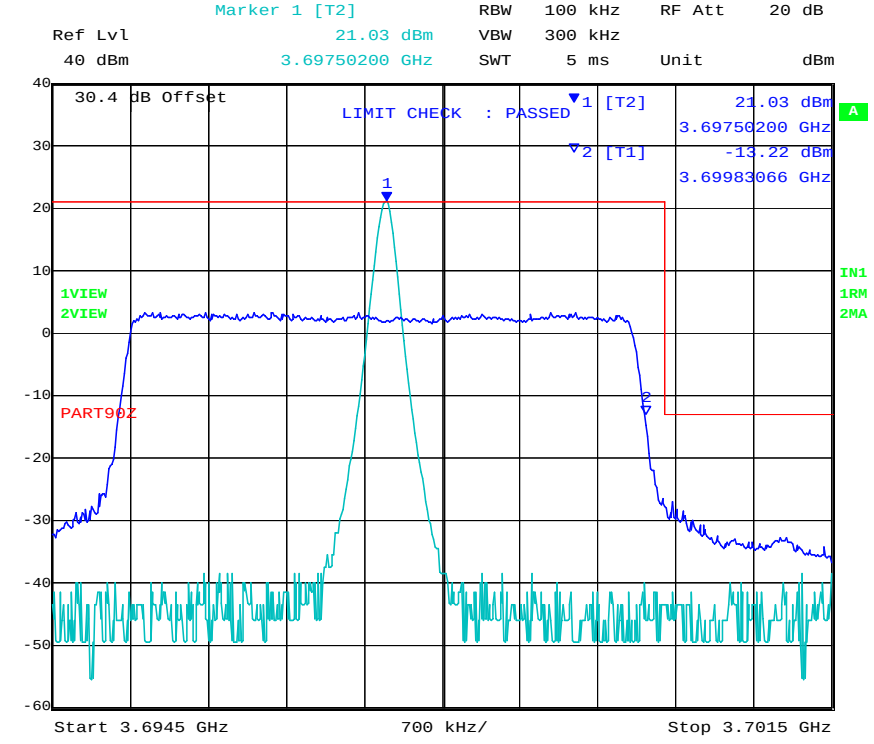
Date: 17.MAY.2010 17:37:46

BPSK Channel Spacing 5 MHz, Channel 3697.5 MHz



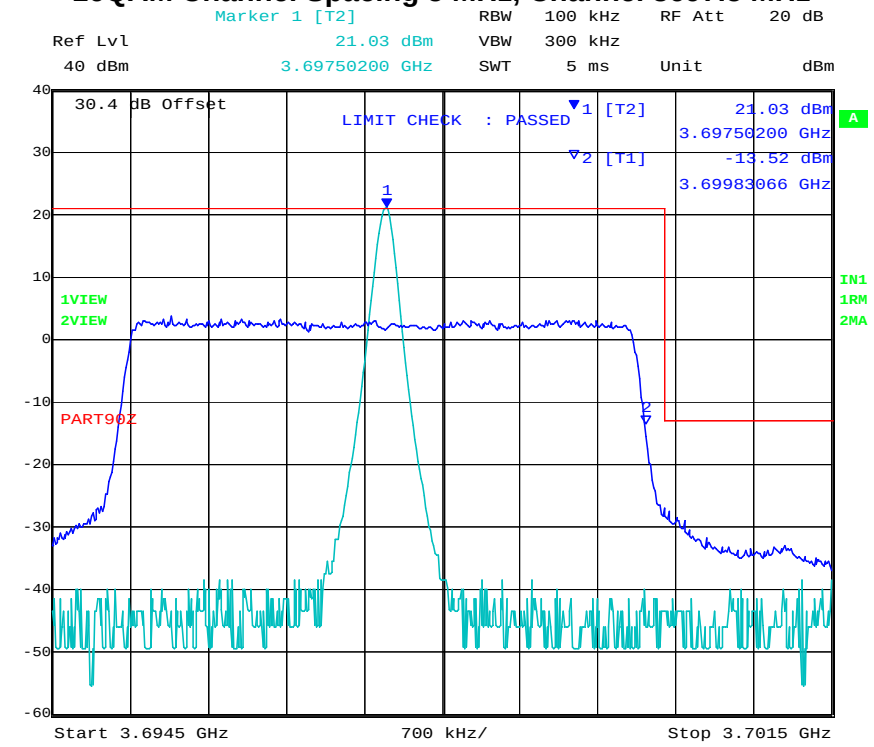
Date: 17.MAY.2010 17:43:28

QPSK Channel Spacing 5 MHz, Channel 3697.5 MHz



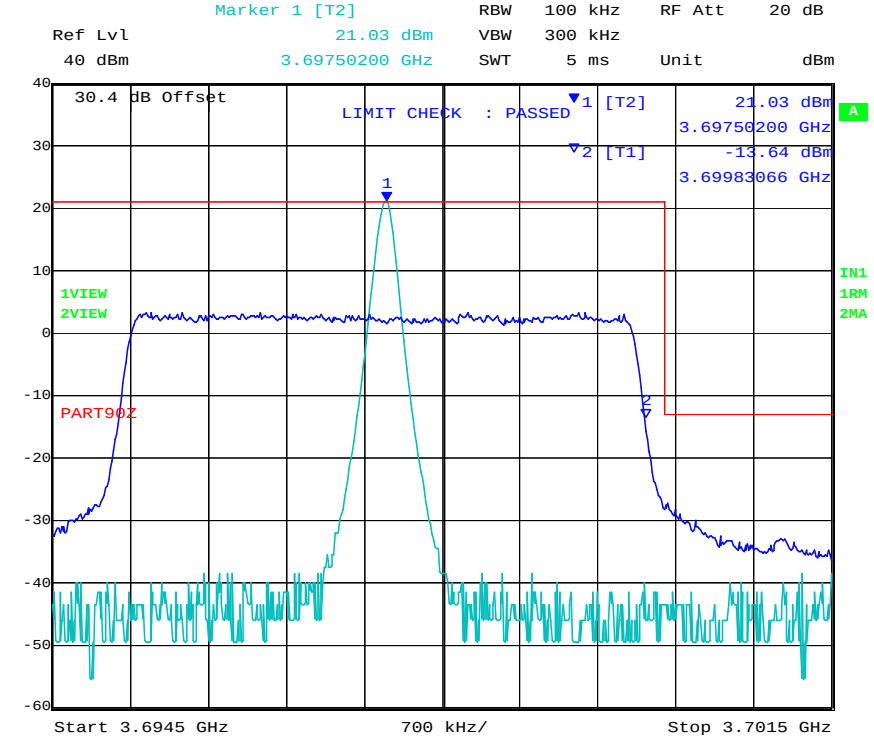
Date: 17.MAY.2010 17:44:23

16QAM Channel Spacing 5 MHz, Channel 3697.5 MHz



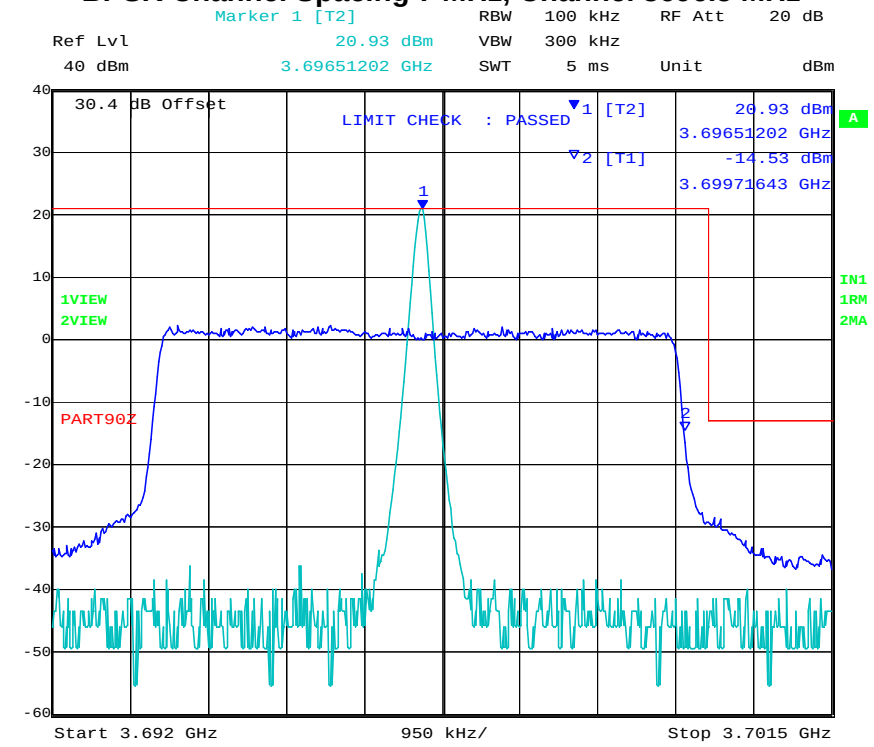
Date: 17.MAY.2010 17:45:22

64QAM Channel Spacing 5 MHz, Channel 3697.5 MHz



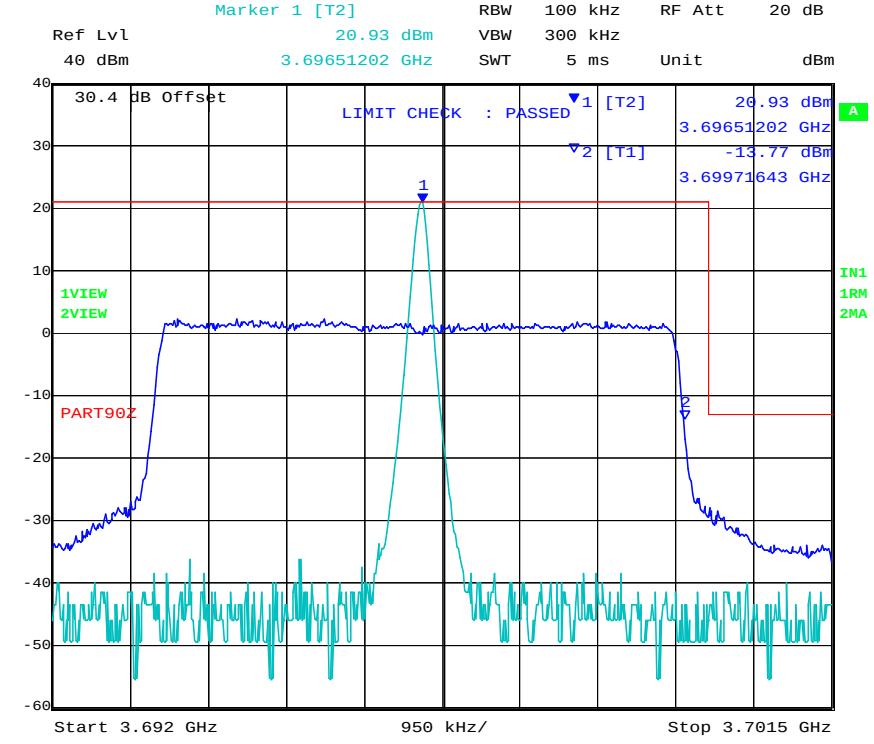
Date: 17.MAY.2010 17:46:04

BPSK Channel Spacing 7 MHz, Channel 3696.5 MHz



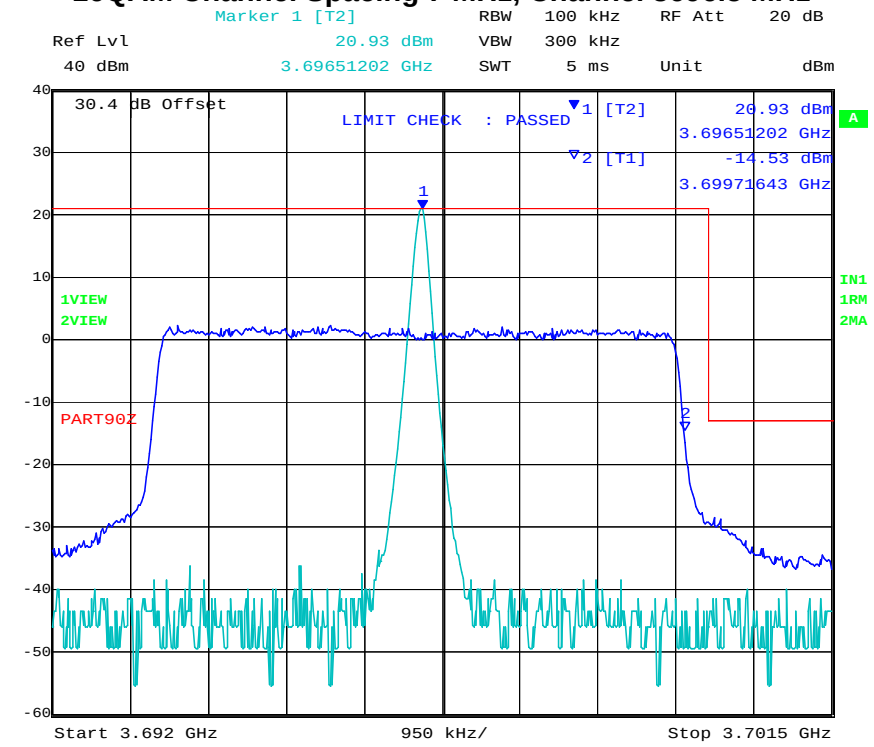
Date: 17.MAY.2010 17:48:31

QPSK Channel Spacing 7 MHz, Channel 3696.5 MHz



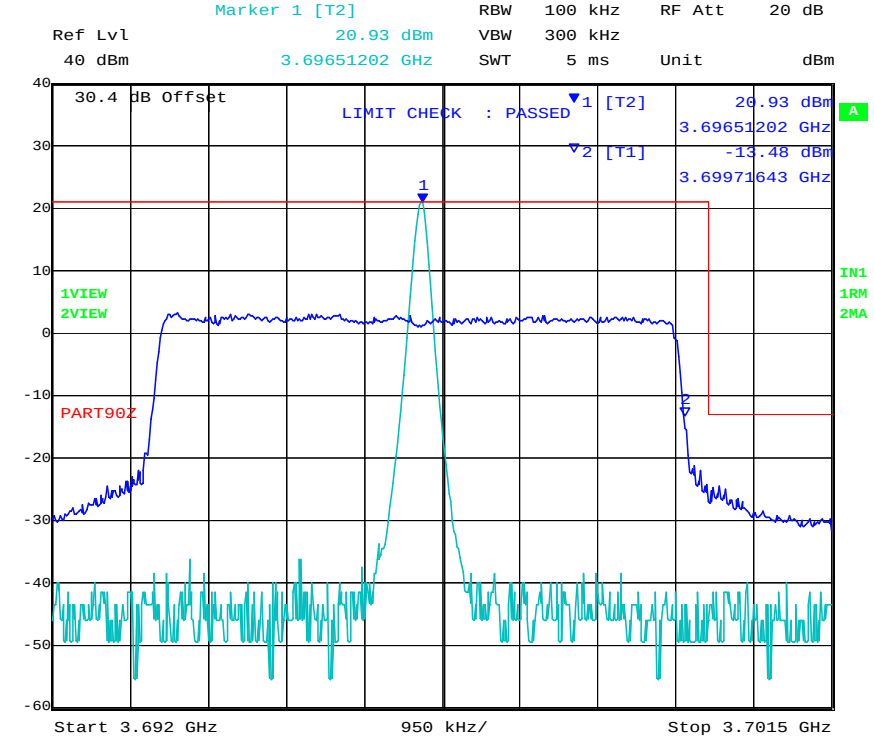
Date: 17.MAY.2010 17:49:32

16QAM Channel Spacing 7 MHz, Channel 3696.5 MHz



Date: 17.MAY.2010 17:48:31

64QAM Channel Spacing 7 MHz, Channel 3696.5 MHz

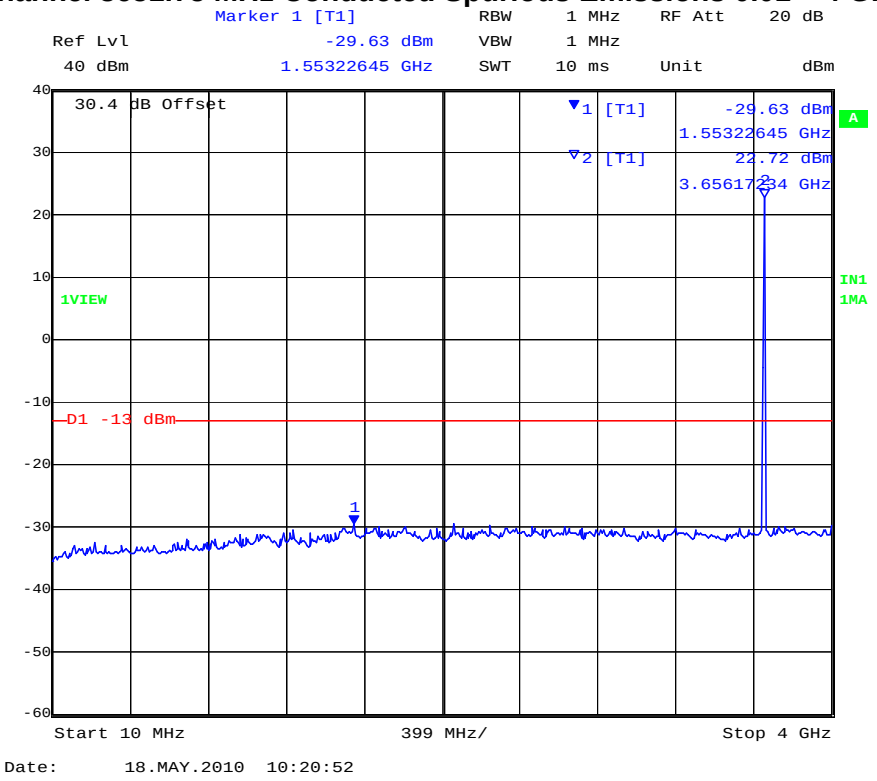


Date: 17.MAY.2010 17:50:59

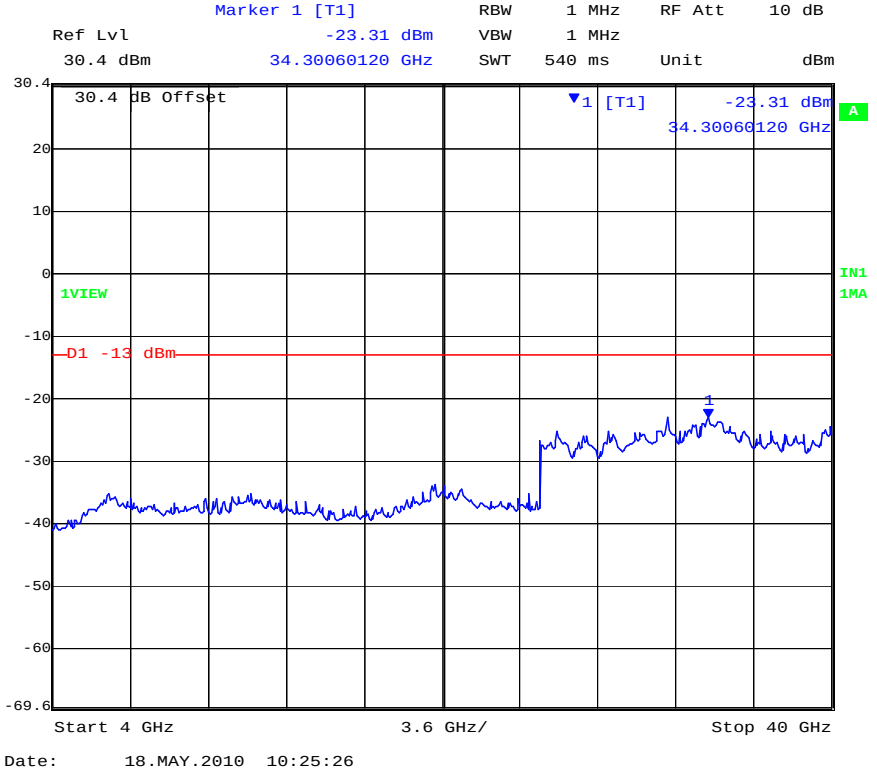
5.1.6.2. Transmitter Conducted Spurious Emissions (30 M- 40 GHz)

Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
3651.75	10	4,000	-29.63	-13.0	-16.63
	4,000	40,000	-23.31		-10.31

Channel 3651.75 MHz Conducted Spurious Emissions 0.01 – 4 GHz

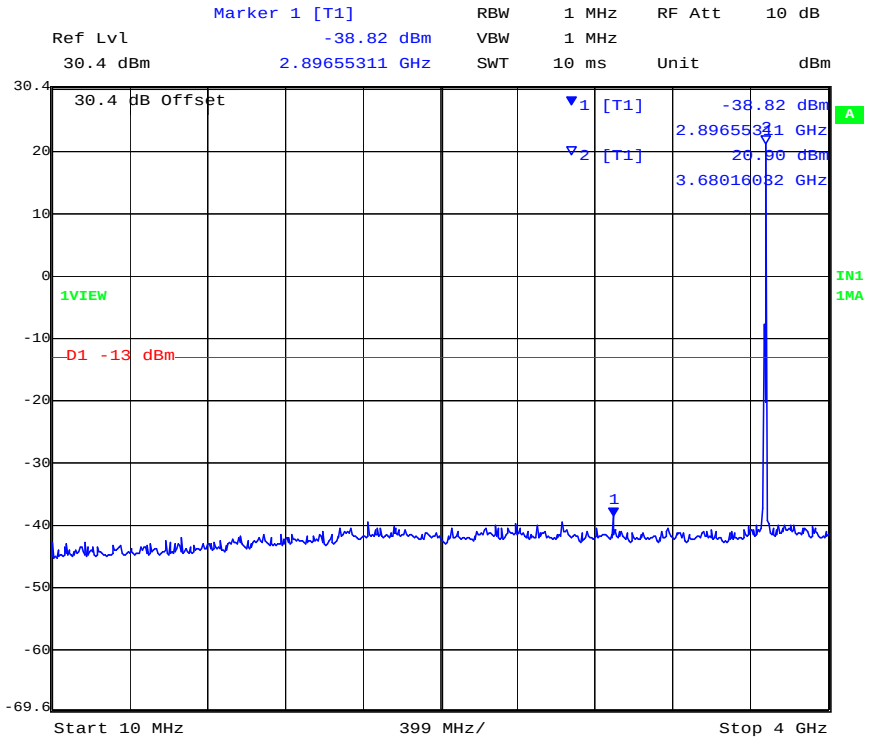


Channel 3651.75 MHz Conducted Spurious Emissions 4 - 40 GHz

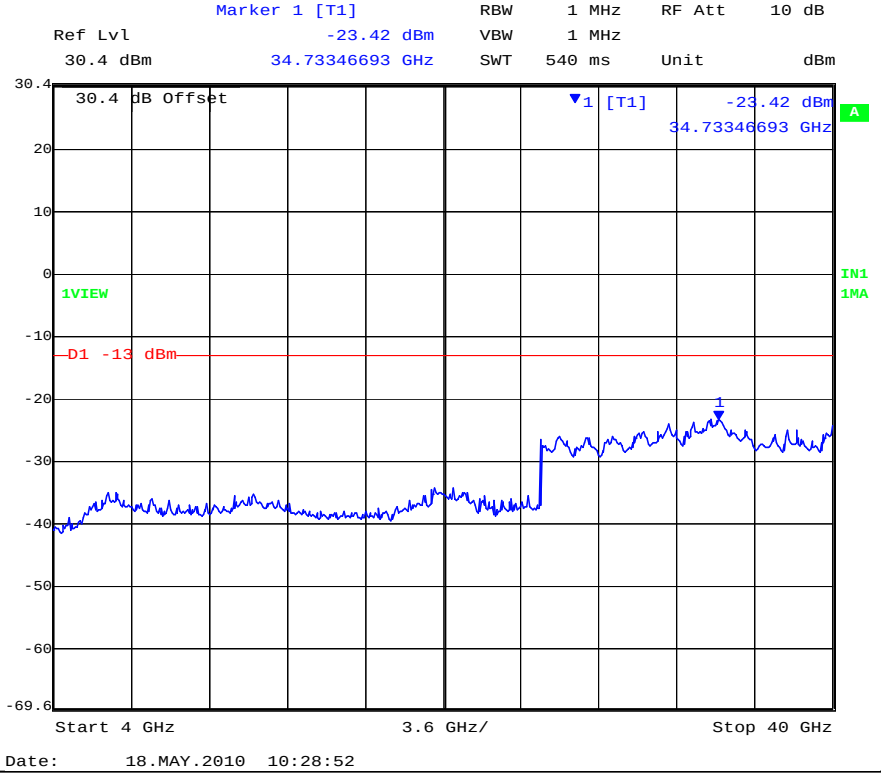


Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
3675.0	10	4,000	-38.82	-13.0	-25.82
	4,000	40,000	-23.42		-10.42

Channel 3675 MHz Conducted Spurious Emissions 0.01 – 4 GHz

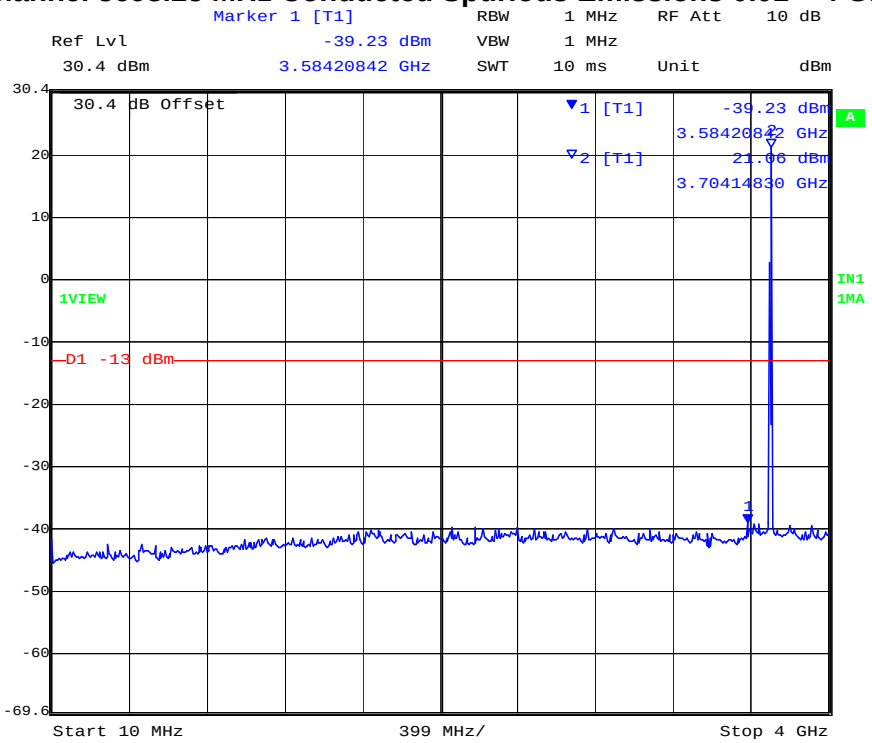


Channel 3675 MHz Conducted Spurious Emissions 4 - 40 GHz

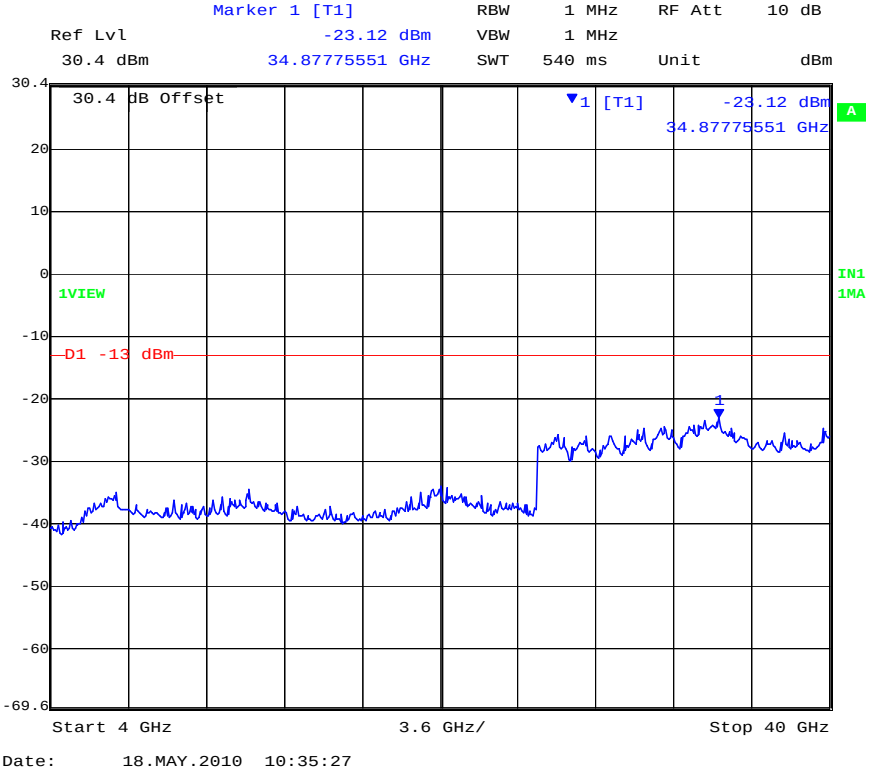


Channel Centre Frequency (MHz)	Start Frequency (MHz)	Stop Frequency (MHz)	Maximum Emission Observed (dBm)	Limit (dBm)	Margin (dB)
3698.25	10	4,000	-39.23	-13.0	-26.23
	4,000	40,000	-23.12		-10.12

Channel 3698.25 MHz Conducted Spurious Emissions 0.01 – 4 GHz



Channel 3698.25 MHz Conducted Spurious Emissions 4 - 40 GHz



Laboratory Measurement Uncertainty for Conducted Spurious Emissions

Measurement uncertainty	±2.37 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-05 'Measurement of Spurious Emissions'	0070, 0116, 0158, 0088, 0252, 0313, 0314

5.1.7. Radiated Spurious Emissions

5.1.7.1. 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.

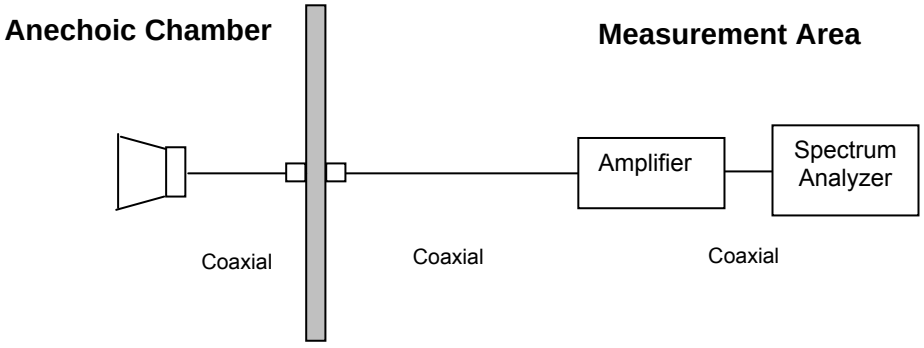
As no antennae were required for testing purposes and only BPSK 3.5 MHz bandwidth was tested to prove compliance.

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.

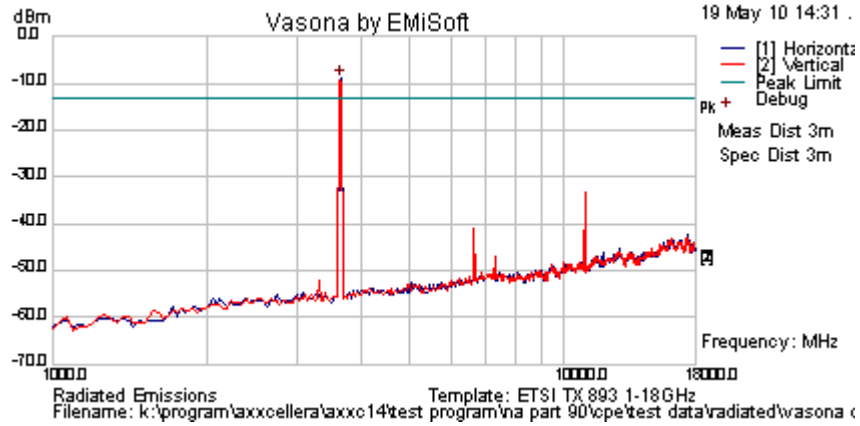
Limit
For operation in the 3650 – 3700 band the power of any emission outside the frequency band of operation shall be attenuated below the transmitter power (P) within the licensed band of operation, measured in Watts, by at least 43 + 10*Log (P) = -13dBm.

Test Measurement Set up



Measurement set up for Radiated Emission Test

Test Freq.	3651.75 MHz	**Engineer**	GMH
Variant	CPE BPSK 3.5 MHz	**Temp (ºC)**	24
Freq. Range	1-18 GHz	**Rel. Hum.(%)**	39
Power Setting	Maximum	**Press. (mBars)**	1011
Antenna	50 Ohm Load	**Duty Cycle (%)**	N/A
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 cable on antenna port terminated in 50 Ohm		



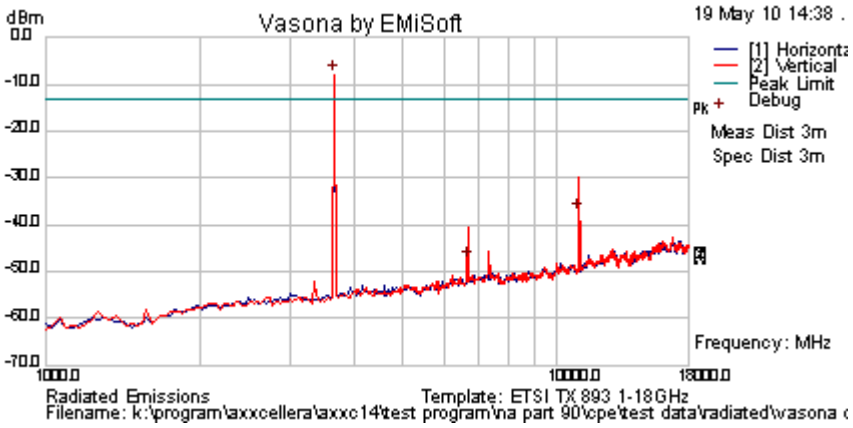
Formally measured emission peaks

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	-15.0	3.7	2.3	-9.0	Peak [Scan]	H	150	0	-13.0	4.0	Fail	FUND
6659.834	-58.9	5.2	6.8	-46.9	Peak [Scan]	H	151	360	-13.0	-33.9	Pass	
10947.241	-55.0	7.0	10.8	-37.3	Peak [Scan]	H	151	360	-13	-24.3	Pass	

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. The emission breaking the limit line is the fundamental.

Test Freq.	3675 MHz	**Engineer**	GMH
Variant	CPE BPSK 3.5 MHz	**Temp (ºC)**	24
Freq. Range	1-18 GHz	**Rel. Hum.(%)**	39
Power Setting	Maximum	**Press. (mBars)**	1011
Antenna	50 Ohm Load	**Duty Cycle (%)**	N/A
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 cable on antenna port terminated in 50 Ohm		



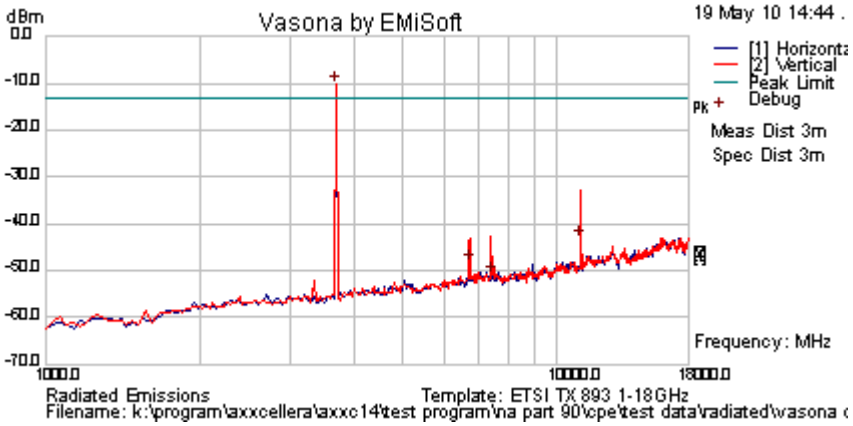
Formally measured emission peaks

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	-13.9	3.7	2.3	-7.9	Peak [Scan]	V	150	0	-13.0	5.2	Fail	FUND
6697.262	-59.5	5.2	6.7	-47.6	Peak [Scan]	H	151	360	-13.0	-34.6	Pass	
11014.860	-54.5	7.0	10.0	-37.5	Peak [Scan]	H	151	360	-13	-24.5	Pass	

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. The emission breaking the limit line is the fundamental.

Test Freq.	3698.25 MHz	**Engineer**	GMH
Variant	CPE BPSK 3.5 MHz	**Temp (ºC)**	24
Freq. Range	1-18 GHz	**Rel. Hum.(%)**	39
Power Setting	Maximum	**Press. (mBars)**	1011
Antenna	50 Ohm Load	**Duty Cycle (%)**	N/A
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 cable on antenna port terminated in 50 Ohm		



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	-16.5	3.7	2.4	-10.3	Peak [Scan]	V	150	0	-13.0	2.7	Fail	FUND
6763.15	-61.0	5.3	7.0	-48.7	Peak [Scan]	H	151	360	-13.0	-35.7	Pass	
7419.597	-65.0	5.5	8.3	-51.2	Peak [Scan]	H	151	360	-13	-38.2	Pass	
11085.746	-60.0	6.9	9.8	-43.3	Peak [Scan]	H	151	360	-13	-30.3	Pass	

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. The emission breaking the limit line is the fundamental.

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions'	0088, 0104, 0158, 0134, 0310, 0312, Dipole.

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

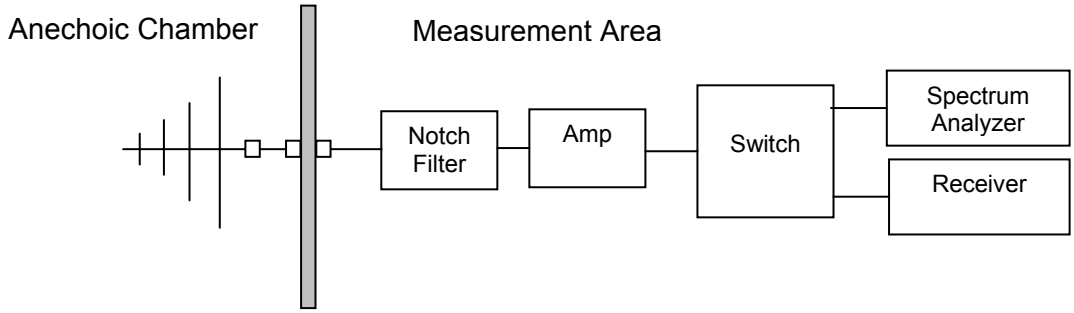
FCC 47 CFR Part 90, Subpart Z; §90.1323, 2.1053;
ANSI/TIA-603
Industry Canada RSS-111 §4.4

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*Log (P) = -13dBm.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. In this test facility, the Antenna Factor, Cable Loss, and Amplifier Gains are loaded into the Rohde & Schwarz Receiver and the corrected field strength can be read directly on the receiver.

$$FS = R + AF + CORR$$

where:

FS = Field Strength
R = Measured Receiver Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG + NFL
CL = Cable Loss
AG = Amplifier Gain

For example:
Given a Receiver input reading of 51.5dBμV; Antenna Factor of 8.5dB; Cable Loss of 1.3dB; Falloff Factor of 0dB, an Amplifier Gain of 26dB and Notch Filter Loss of 1dB. The Field Strength of the measured emission is:

FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3dBμV/m

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

Level (dBμV/m) = 20 * Log (level (μV/m))

40 dBμV/m = 100μV/m
48 dBμV/m = 250μV/m

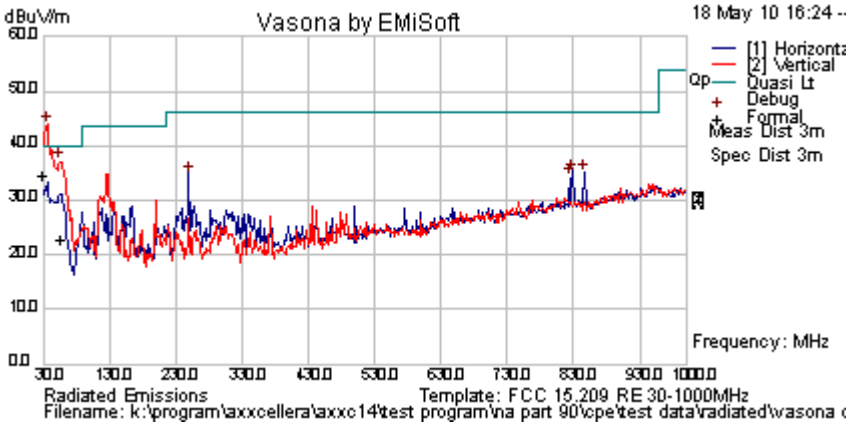
Measurement Results for Spurious Emissions (30 MHz – 1 GHz)

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

Radio parameters.

3.5 MHz BW
Modulation: BPSK
Output Power: Maximum

Test Freq.	3651.75 MHz	**Engineer**	GMH
Variant	CPE BPSK 3.5 MHz	**Temp (ºC)**	24
Freq. Range	30-1000 MHz	**Rel. Hum.(%)**	41
Power Setting	Maximum	**Press. (mBars)**	1009
Antenna	50 Ohm Load	**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 cable on antenna port terminated in 50 Ohm		

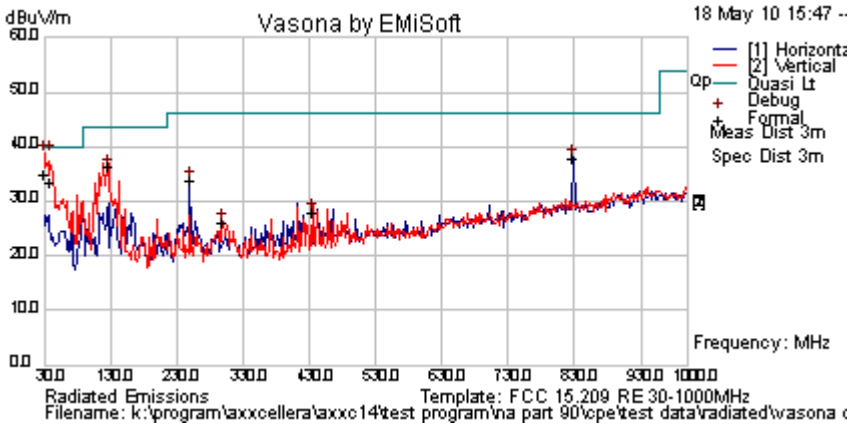


Formally measured emission peaks

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
30.431	40.7	3.4	-9.6	34.5	Quasi Max	V	124	105	40.0	-5.5	Pass	
56.149	42.9	3.8	-23.8	22.9	Quasi Max	V	116	305	40.0	-17.1	Pass	
249.801	48.35	4.99	-18.8	34.57	Peak [Scan]	H	98	0	46	-11.43	Pass	
825.083	34.76	7.17	-7.88	34.06	Peak [Scan]	H	98	0	46	-11.94	Pass	
828.858	35.76	7.17	-7.87	35.07	Peak [Scan]	H	98	0	46	-10.93	Pass	
846.432	35.64	7.17	-7.81	35	Peak [Scan]	H	98	0	46	-11	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**	CSB
Variant	CPE BPSK 3.5 MHz	**Temp (ºC)**	24
Freq. Range	30-1000 MHz	**Rel. Hum.(%)**	41
Power Setting	Maximum	**Press. (mBars)**	1009
Antenna	50 Ohm Load	**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 cable on antenna port terminated in 50 Ohm		

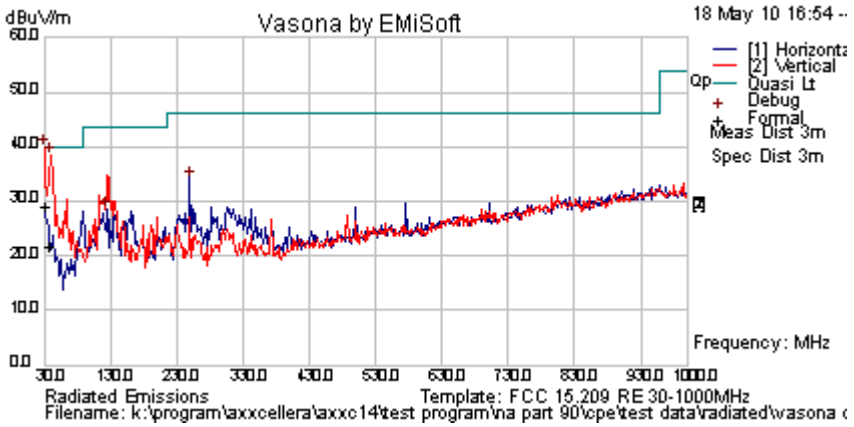


Formally measured emission peaks

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
30.924	41.8	3.4	-10.2	35.1	Quasi Peak	V	104	0	40.0	-4.9	Pass	
40.524	47.2	3.6	-17.2	33.6	Quasi Peak	V	100	170	40.0	-6.4	Pass	
127.566	49.0	4.4	-17.1	36.2	Peak [Scan]	V	98	360	43.5	-7.3	Pass	
249.989	47.7	5.0	-18.8	33.9	Peak [Scan]	H	98	360	46	-12.1	Pass	
299.988	37.7	5.2	-16.9	26.0	Peak [Scan]	V	98	360	46	-20.0	Pass	
434.961	35.9	5.8	-13.6	28.0	Peak [Scan]	V	98	360	46	-18.0	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	CPE BPSK 3.5 MHz	**Temp (ºC)**	24
Freq. Range	30-1000 MHz	**Rel. Hum.(%)**	41
Power Setting	Maximum	**Press. (mBars)**	1009
Antenna	50 Ohm Load	**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 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
33.369	37.6	3.5	-11.9	29.2	Quasi Max	V	197	41	40.0	-10.8	Pass	
39.719439	35.2	3.6	-17.1	21.7	Quasi Max	V	144	198	40.0	-18.3	Pass	
125.217	40.8	4.3	-16.8	28.3	Peak [Scan]	V	144	198	43.5	-15.2	Pass	
249.834	47.7	5.0	-18.8	34.0	Peak [Scan]	V	144	198	46	-12.1	Pass	

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

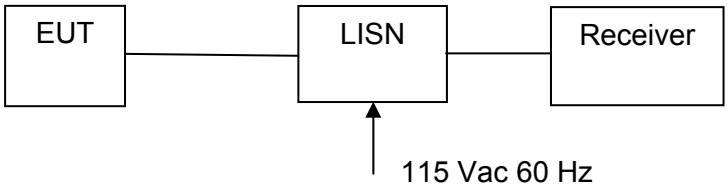
5.1.8. AC Wireline Conducted Emissions (150 kHz – 30 MHz)

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

Test Procedure

The EUT is configured in accordance with ANSI C63.4. The conducted emissions are measured in a shielded room with a spectrum analyzer in peak hold in the first instance. Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation. The highest emissions relative to the limit are listed.

Test Measurement Set up



Measurement set up for AC Wireline Conducted Emissions Test

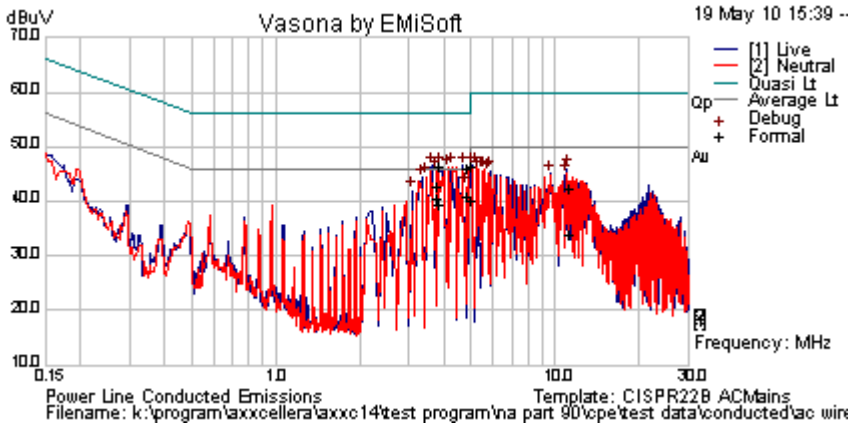
Measurement Results for AC Wireline Conducted Emissions (150 kHz – 30 MHz)

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

Radio parameters.

Output power: Maximum
Transmitter Port: Terminated in 50 Ohm load

Test Freq.	3698.25 MHz	**Engineer**	GMH
Variant	CPE AC Line Emissions	**Temp (ºC)**	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
3.782	32.4	10.1	0.2	42.6	Quasi Peak	Neutral	56	-13.4	Pass	
3.782	30.2	10.1	0.2	40.5	Average	Neutral	46	-5.5	Pass	
3.877	36.2	10.1	0.2	46.5	Quasi Peak.	Live	56	-9.6	Pass	
3.877	29.0	10.1	0.2	39.3	Average	Live	46	-6.7	Pass	
4.559	31.9	10.1	0.2	42.3	Quasi Peak	Neutral	56	-13.8	Pass	
4.559	27.8	10.1	0.2	38.2	Average	Neutral	46	-7.8	Pass	
4.844	35.8	10.1	0.2	46.1	Quasi Peak	Neutral	56	-9.9	Pass	
4.844	30.7	10.1	0.2	41.0	Average	Neutral	46	-5.0	Pass	
5.026	29.9	10.2	0.2	46.5	Quasi Peak	Live	60	-13.6	Pass	
5.026	29.9	10.2	0.2	40.3	Average	Live	50	-9.8	Pass	
11.423	31.7	10.3	0.4	42.4	Quasi Peak	Live	60	-17.6	Pass	
11.423	23.1	10.3	0.4	33.8	Average	Live	50	-16.2	Pass	

Legend:	

Specification

Limit

§15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μΩ line impedance stabilization network (LISN), see §15.207 (a) matrix below. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

§15.207 (a) Limit Matrix

The lower limit applies at the boundary between frequency ranges

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

Laboratory Measurement Uncertainty for Conducted Emissions

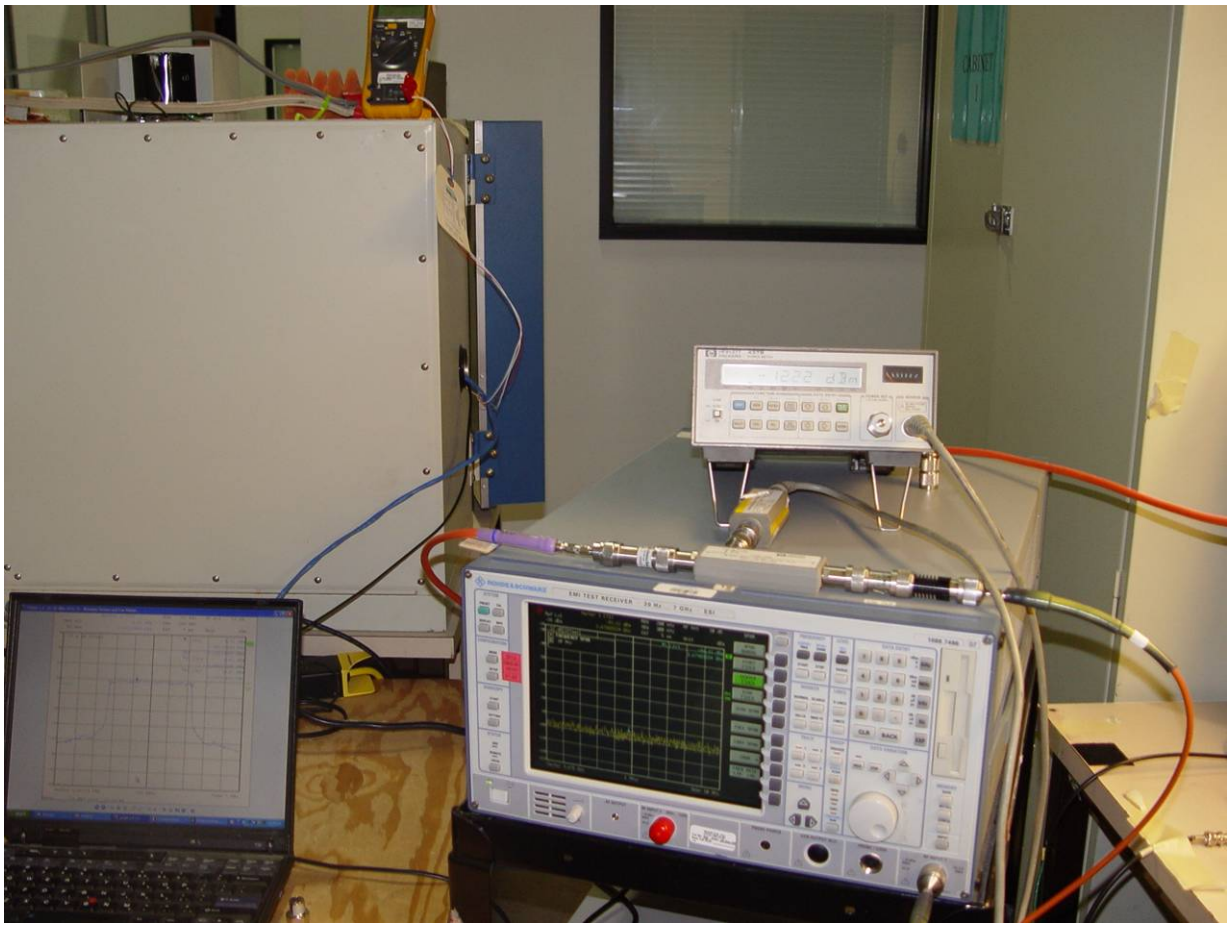
Measurement uncertainty	±2.64 dB

Traceability

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

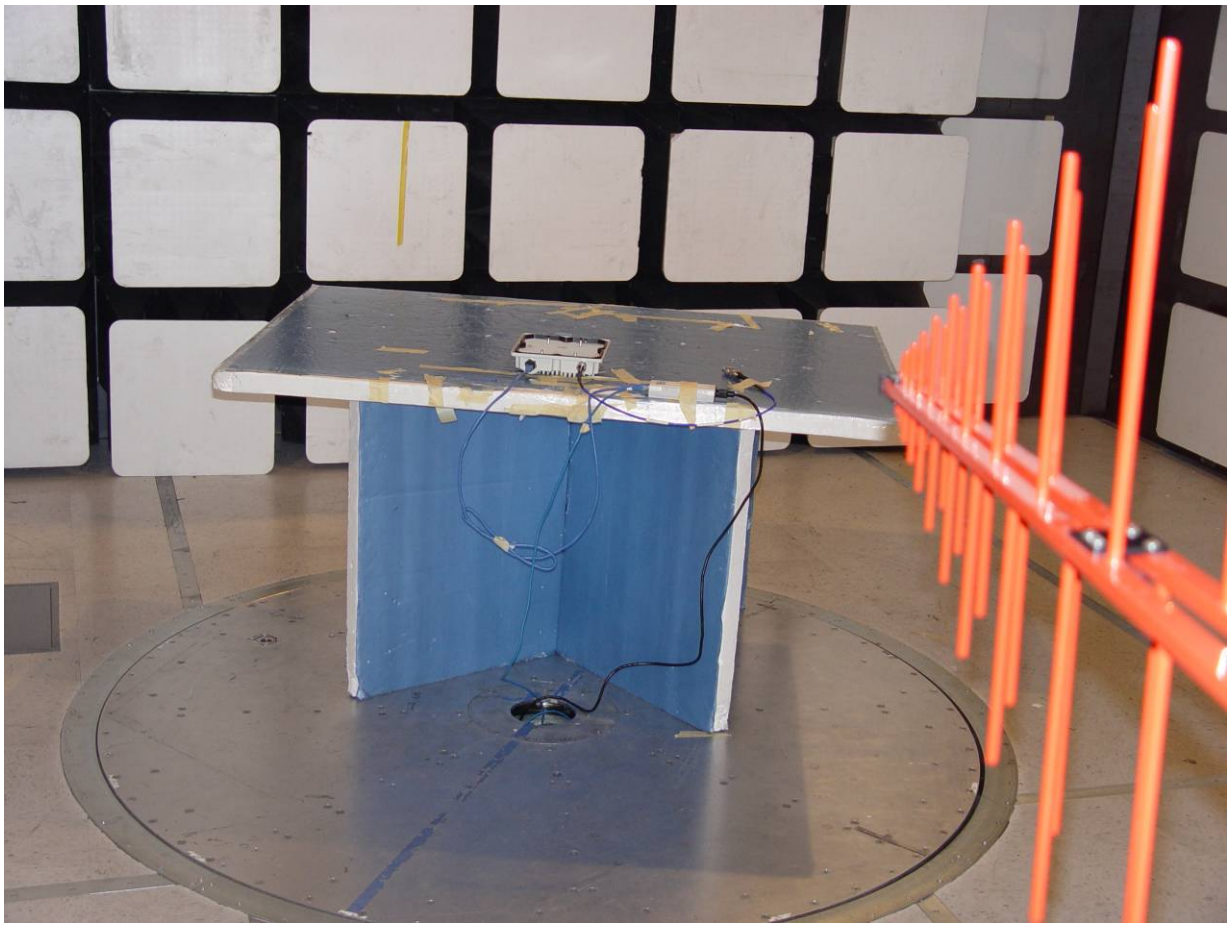
6. TEST SET-UP PHOTOGRAPHS

6.1. General Measurement Test Set-Up

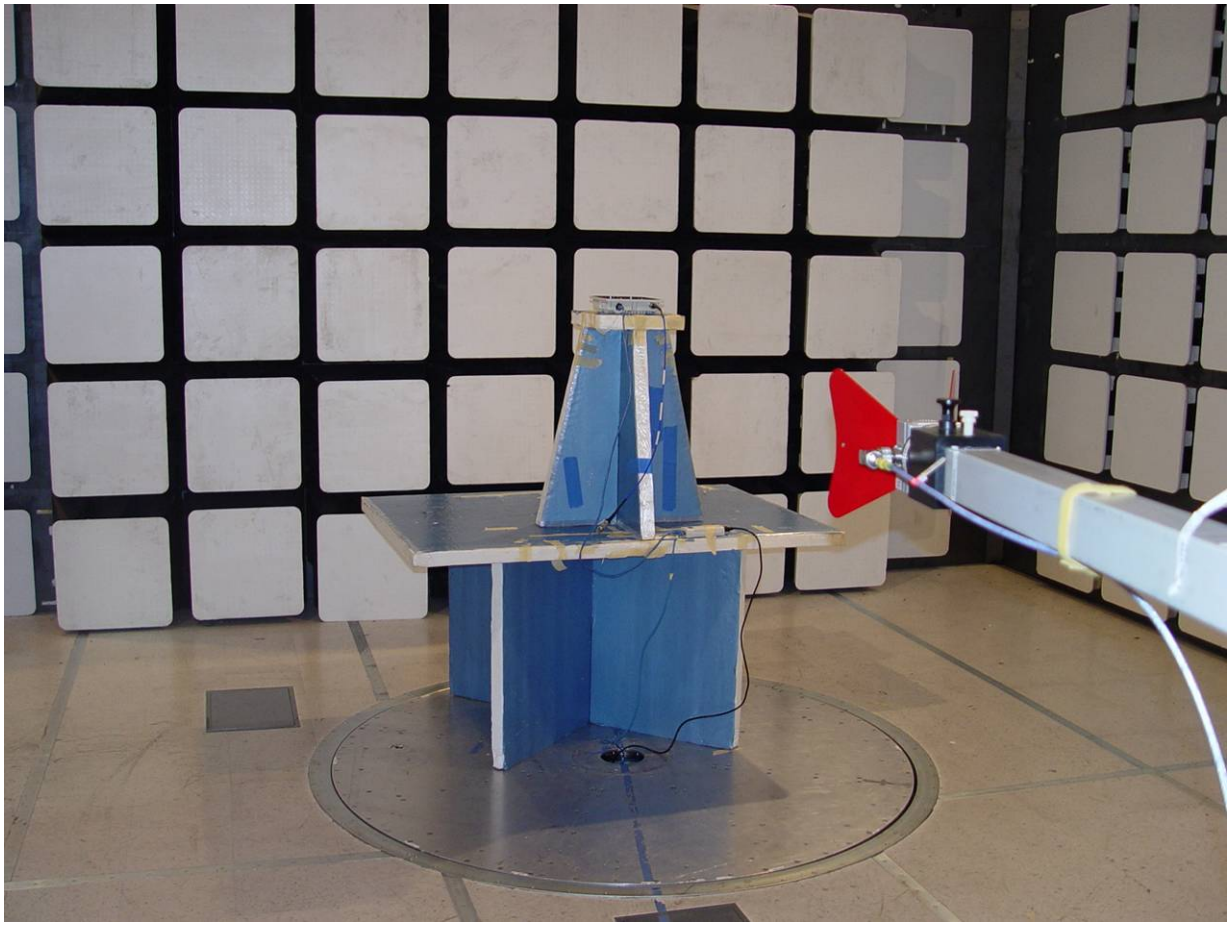


6.2. Environmental Chamber

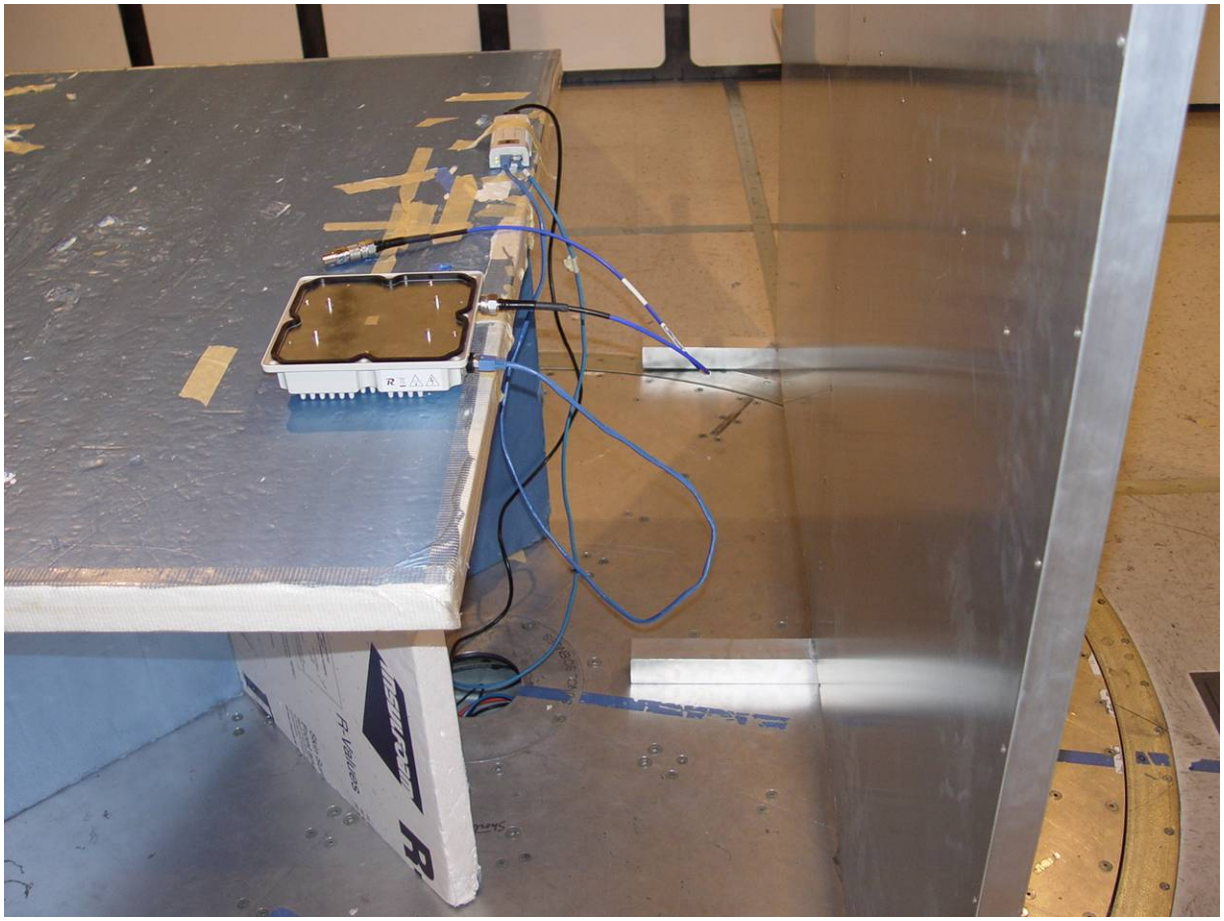
6.3. Radiated Spurious Emissions below 1GHz



6.4. Radiated Spurious Emissions above 1GHz



6.5. Conducted Emissions (150 kHz - 30 MHz)



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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