Test of Axxcelera EHD-CPE3320-C10

To: FCC Part 90 SubPart Z, RSS-197

Test Report Serial No.: AXXC15-U1 Rev A

# TEST REPORT

FROM

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
Phone: +1 (925) 462-0304
Fax: +1 (925) 462-0306
www.micomlabs.com

ACCREDITED

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

## 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)<br>Bureau of Standards, Metrology and Inspection (BSMI) | I<br>I | |
| Vietnam | Ministry of Information and Communications | I | |

# DOCUMENT HISTORY

| Document History | | |
|---|---|---|
| Revision | Date | Comments |
| Draft | | |
| A | 5th October 2010 | Initial Release |
| | | |
| | | |
| | | |

# 1. TEST RESULT CERTIFICATE

| | | | |
|---|---|---|---|
| Manufacturer: | Axxcelera Broadband Wireless, Inc<br>1600 E.Parham Road<br>Richmond Virginia 23228<br>USA | Tested By: | MiCOM Labs, Inc.<br>440 Boulder Court<br>Suite 200<br>Pleasanton<br>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.

ACCREDITED
TESTING CERTIFICATE #2381.01

**Approved & Released for MiCOM Labs, Inc. by:**

Graeme Grieve
Quality Manager MiCOM Labs,

Gordon Hurst
President & CEO MiCOM Labs, Inc.

# 2. REFERENCES AND MEASUREMENT UNCERTAINTY

## 2.1. Normative References

| Ref. | Publication | Year | Title |
|---|---|---|---|
| **(i)** | FCC 47 CFR Part 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 | 9th June 2010 | Reference to A2LA Accreditation Status – A2LA Advertising Policy |
| **(xiv)** | 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-CPE3320-C10 to FCC Part 90 SubPart Z, RSS-197 regulations. | | |
| Applicant: | Axxcelera Broadband Wireless, Inc<br>1600 E.Parham Road<br>Richmond Virginia 23228<br>USA | | |
| Manufacturer: | As Applicant | | |
| Laboratory performing the tests: | MiCOM Labs, Inc.<br>440 Boulder Court, Suite 200<br>Pleasanton, California 94566 USA | | |
| Test report reference number: | AXXC15-U1 Rev A | | |
| Date EUT received: | 3rd 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<br>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 | 5 MHz | 7 MHz |
| | 3M1DXW | 4M5DXW | 6M3DXW |
| Transmit/Receive Operation: | OFDM Time Division Duplex (TDD) | | |
| Software Revision: | 3.8.3 | | |
| Hardware Revision: | Prototype | | |
| Rated Input Voltage and Current: | POE Operation<br>Input: 120Vac 60Hz<br>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, Video and Data Communication | | |

## 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

## 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

## 3.6. Test Configurations

Test Matrix V's Variants

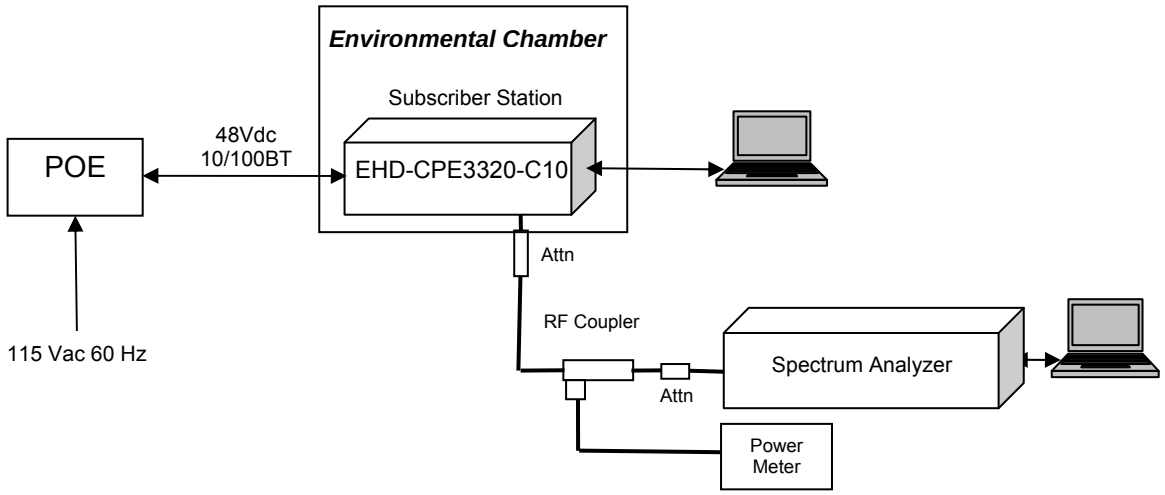
| Parameter | Operational Mode | Test Conditions | Bandwidths (MHz) |
|---|---|---|---|
| 99% Occupied BW | Modulated - BPSK QPSK, 16QAM, 64QAM | Ambient, 48 Vdc | 3.5, 5, 7 |
| Output power | | | |
| Spectrum Mask | | | |
| Power Spectral Density | | | |
| Frequency Stability | CW (Single Tone) | Temperature 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*

# 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.

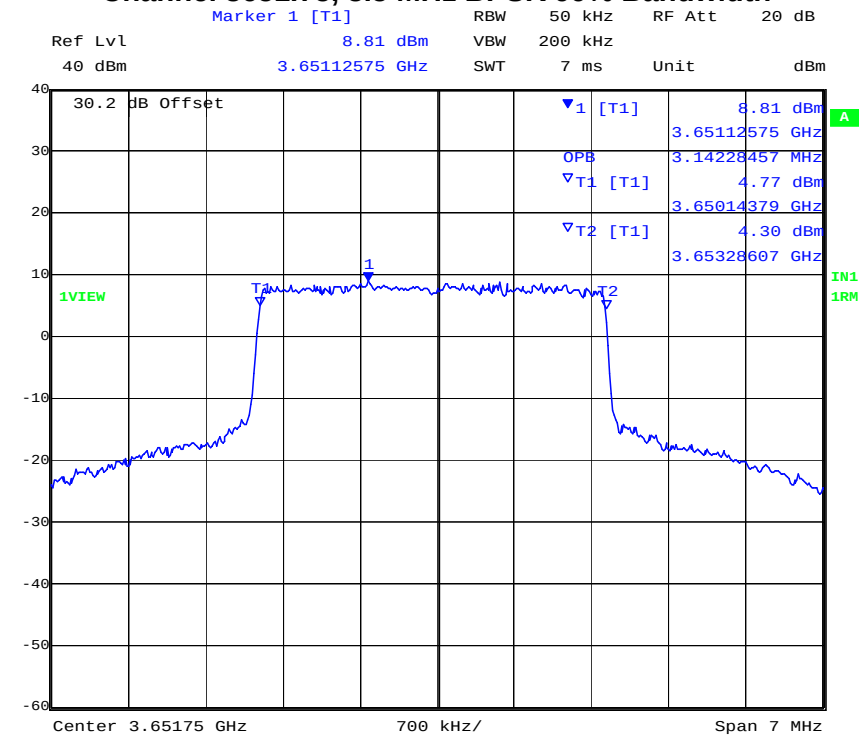
**Test Set-up is shown in Section 3.6 Test Configuration**

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

### 3.5 MHz Bandwidth

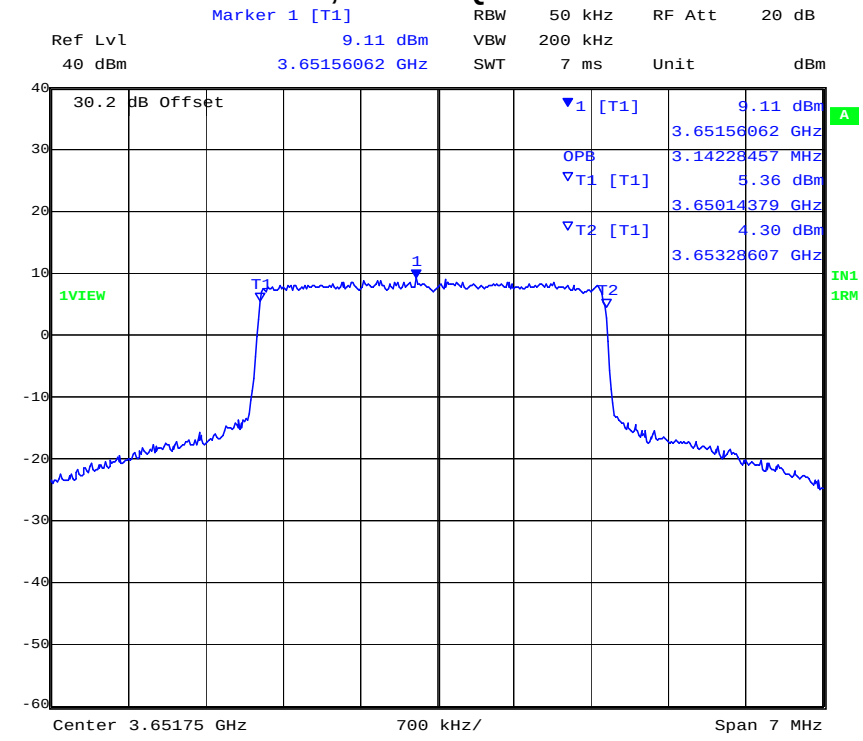
| | 99% Bandwidth | | | |
|---|---|---|---|---|
| Center Frequency (MHz) | BPSK | QPSK | 16 QAM | 64QAM |
| 3651.75 | 3.142 | 3.142 | 3.142 | 3.142 |
| 3675.00 | 3.142 | 3.142 | 3.142 | 3.142 |
| 3698.25 | 3.156 | 3.142 | 3.142 | 3.142 |

## Channel 3651.75, 3.5 MHz BPSK 99% Bandwidth




Date: 3.AUG.2010 10:41:00

## Channel 3651.75, 3.5 MHz QPSK 99% Bandwidth

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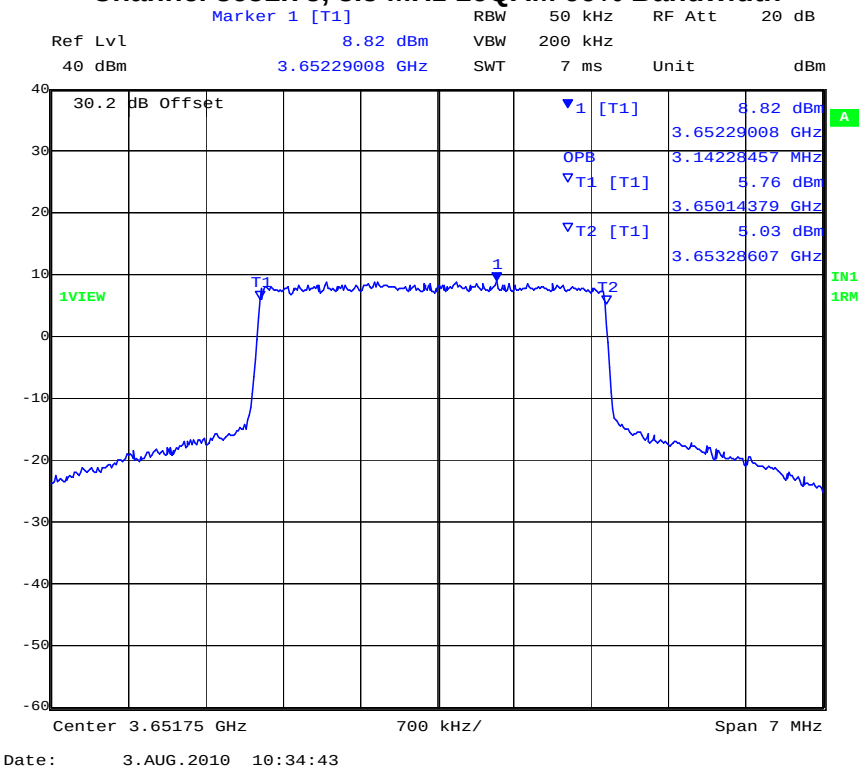
## Channel 3651.75, 3.5 MHz 16QAM 99% Bandwidth

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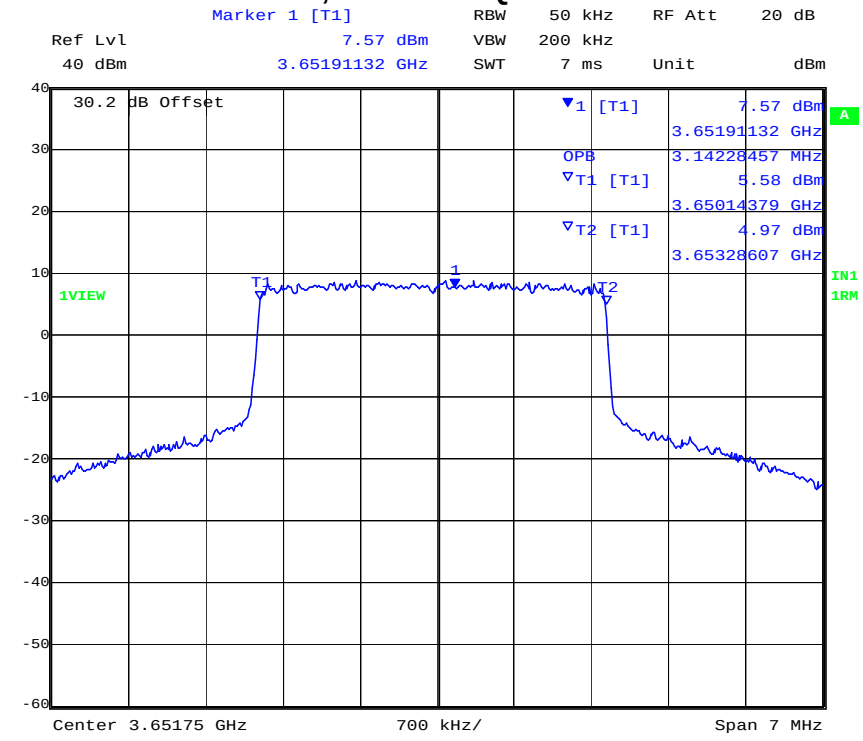
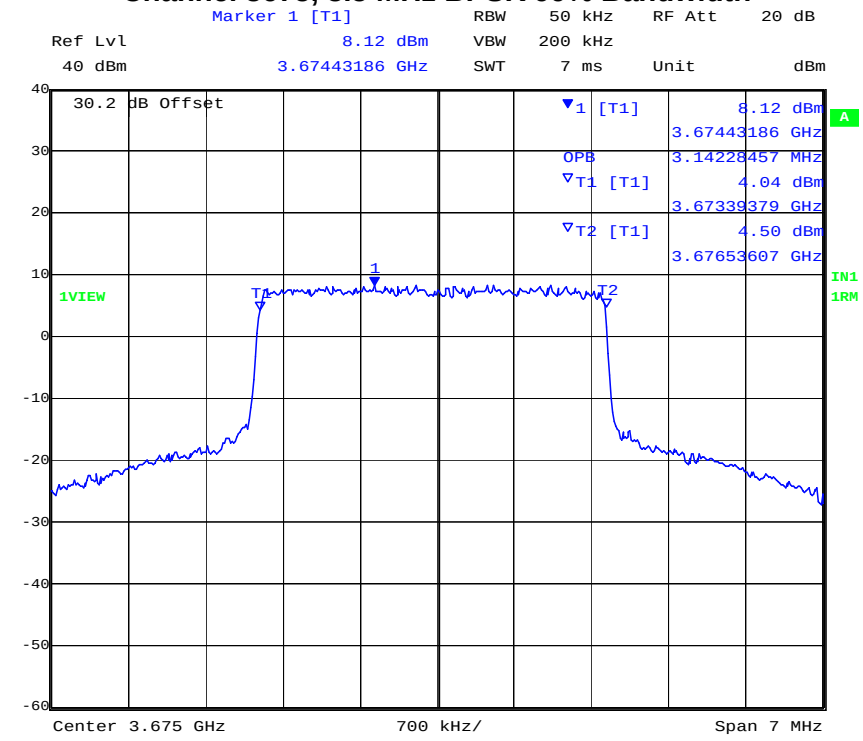
## Channel 3651.75, 3.5 MHz 64QAM 99% Bandwidth




Date: 3.AUG.2010 10:37:59

## Channel 3675, 3.5 MHz BPSK 99% Bandwidth

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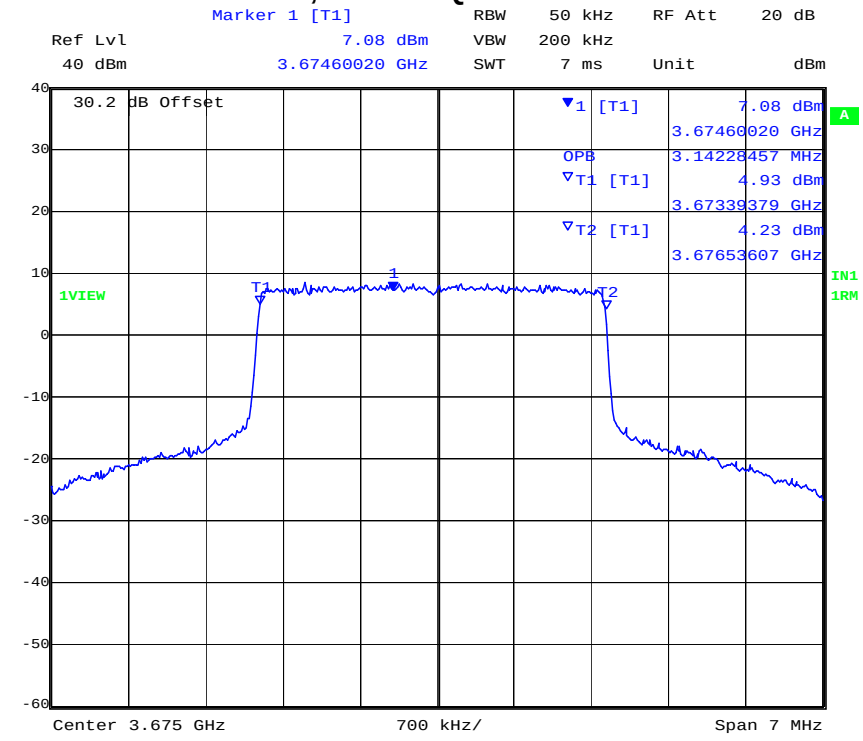
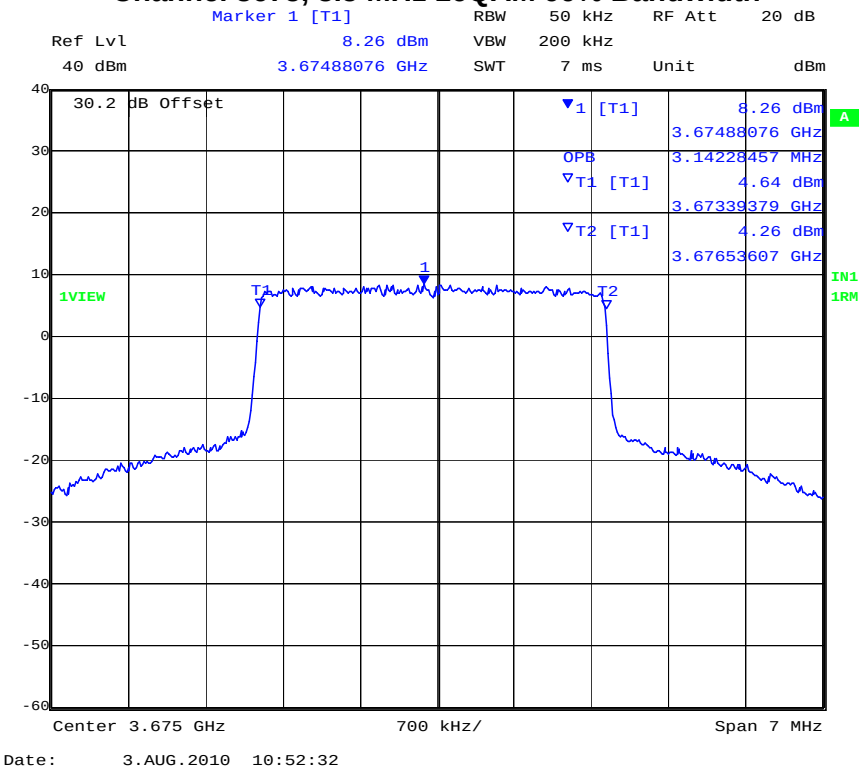
## Channel 3675, 3.5 MHz QPSK 99% Bandwidth




Date: 3.AUG.2010 10:56:48

## Channel 3675, 3.5 MHz 16QAM 99% Bandwidth

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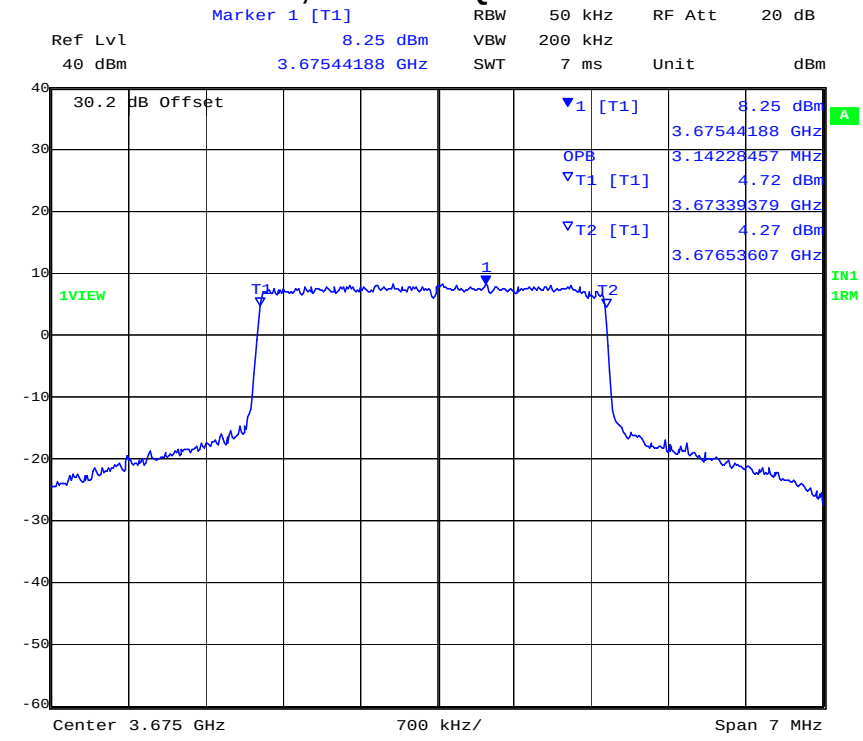
## Channel 3675, 3.5 MHz 64QAM 99% Bandwidth

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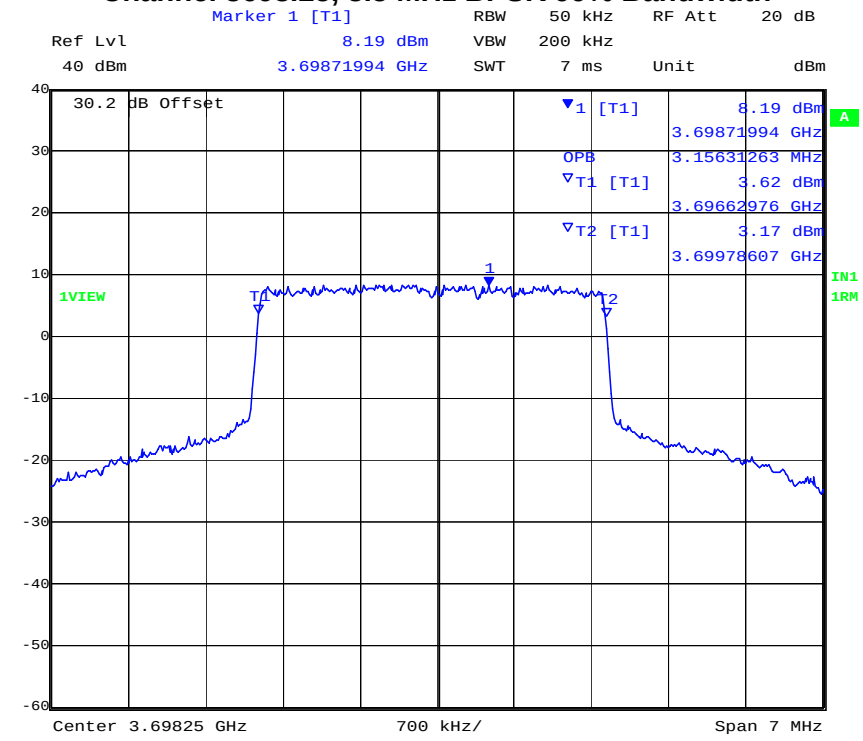
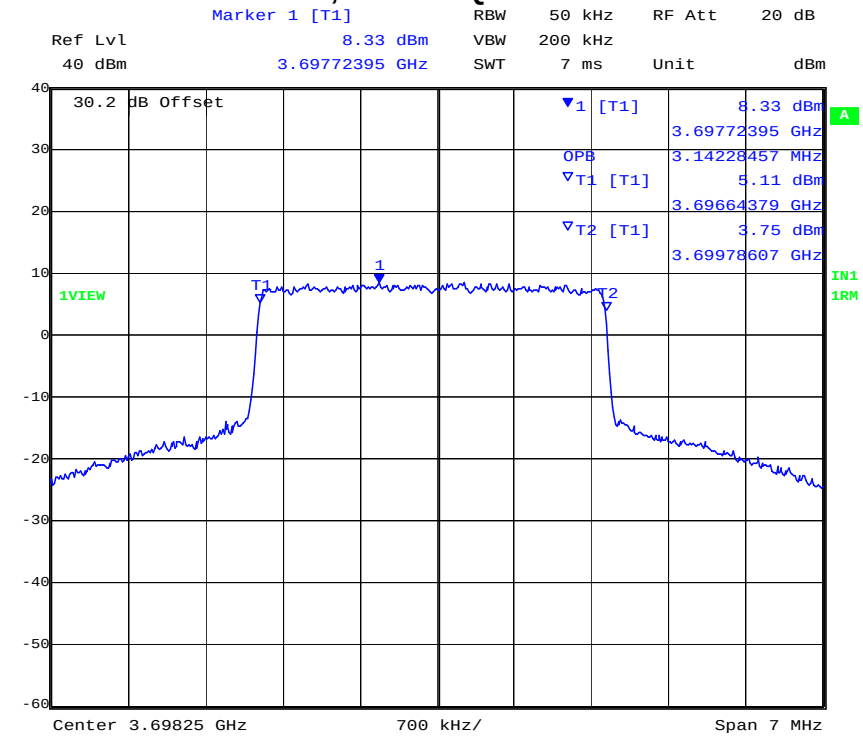
## Channel 3698.25, 3.5 MHz BPSK 99% Bandwidth




Date: 3.AUG.2010 11:00:51

## Channel 3698.25, 3.5 MHz QPSK 99% Bandwidth

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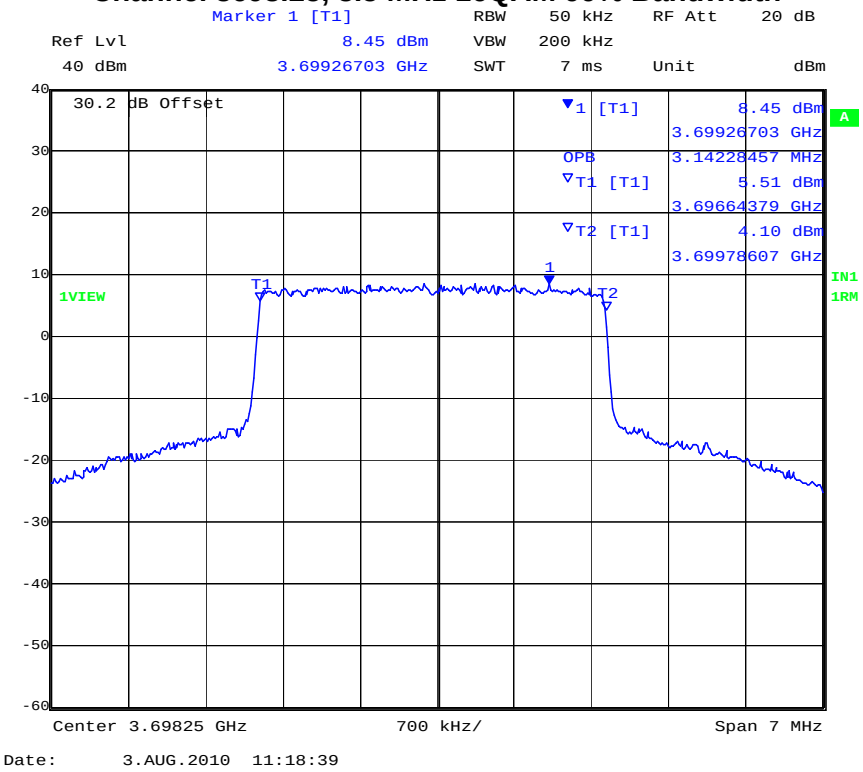
## Channel 3698.25, 3.5 MHz 16QAM 99% Bandwidth

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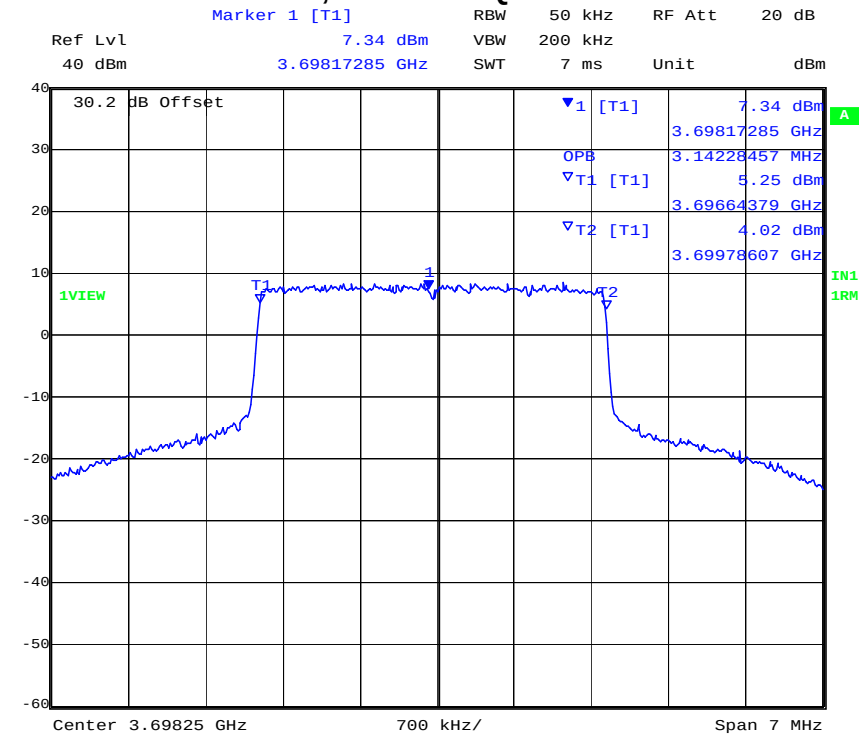
## Channel 3698.25, 3.5 MHz 64QAM 99% Bandwidth

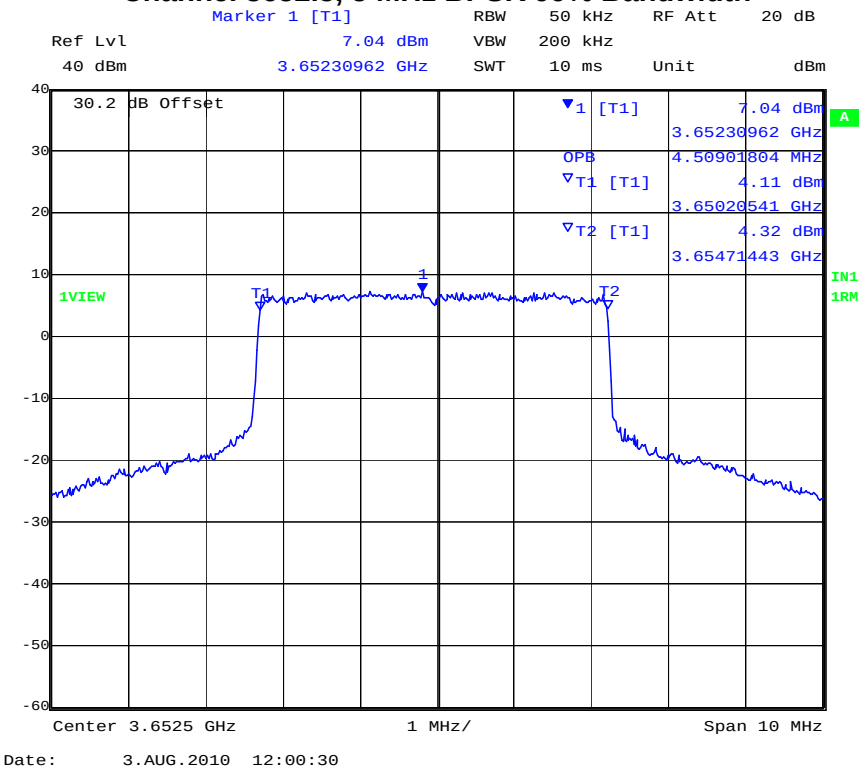



Date: 3.AUG.2010 11:21:12

**5 MHz Bandwidth**

| | 99% Bandwidth | | | |
|---|---|---|---|---|
| Center Frequency (MHz) | 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 |

## Channel 3652.5, 5 MHz BPSK 99% Bandwidth

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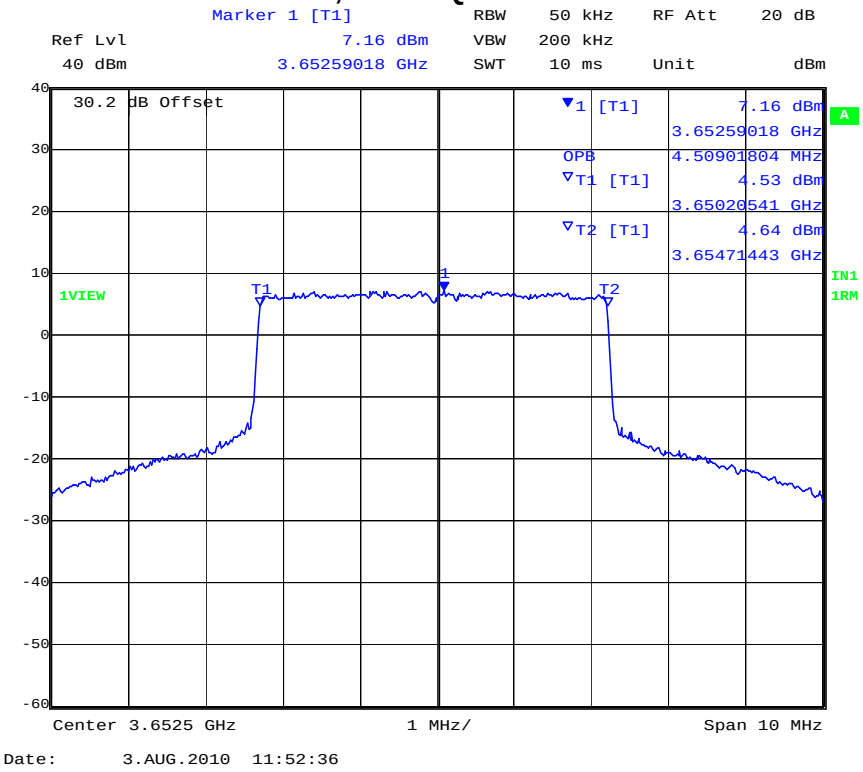


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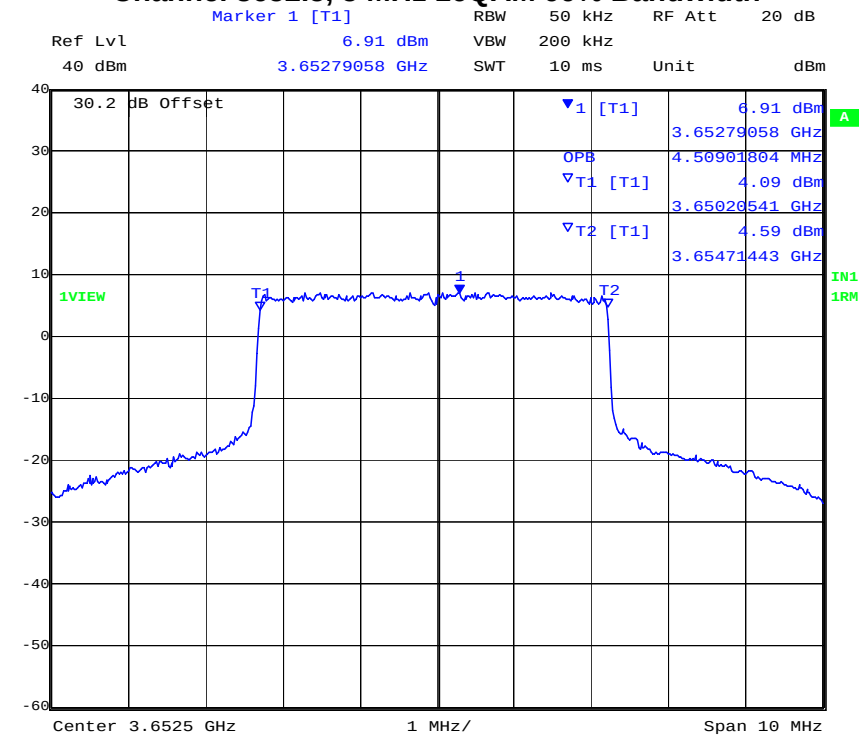
## Channel 3652.5, 5 MHz 16QAM 99% Bandwidth

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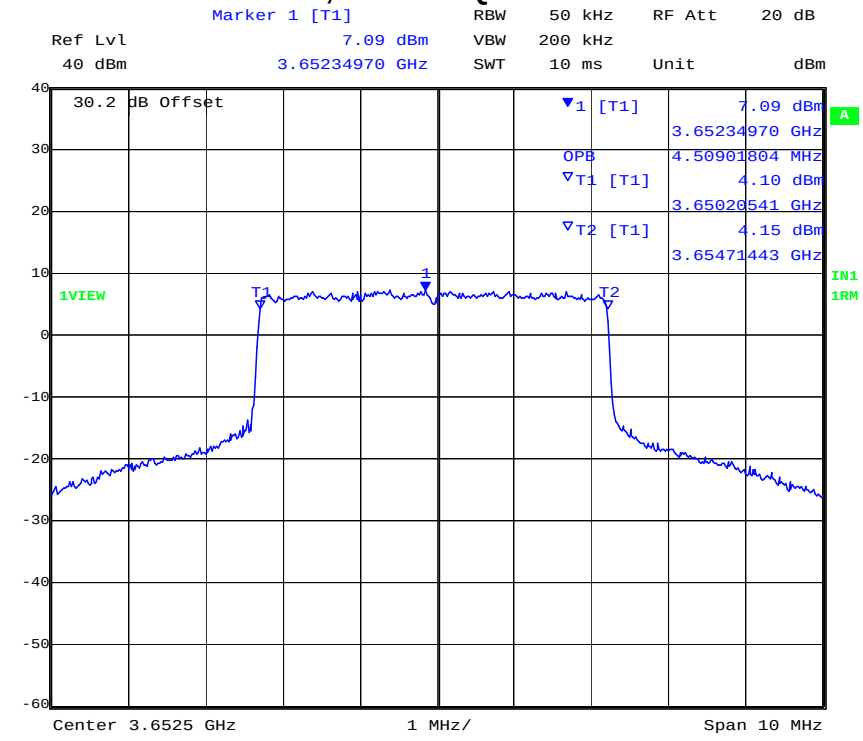
## Channel 3652.5, 5 MHz 64QAM 99% Bandwidth

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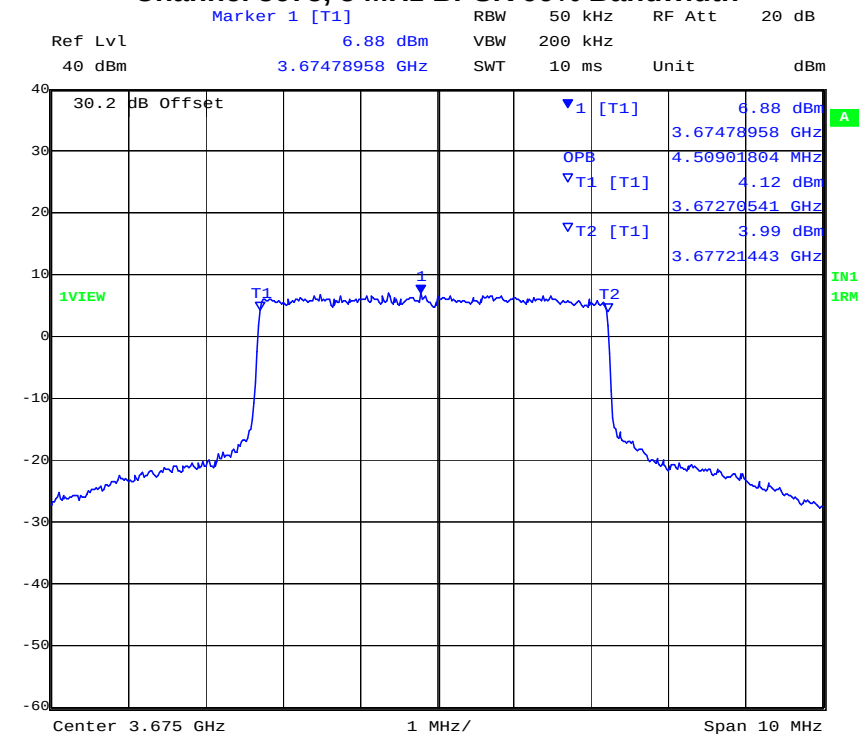
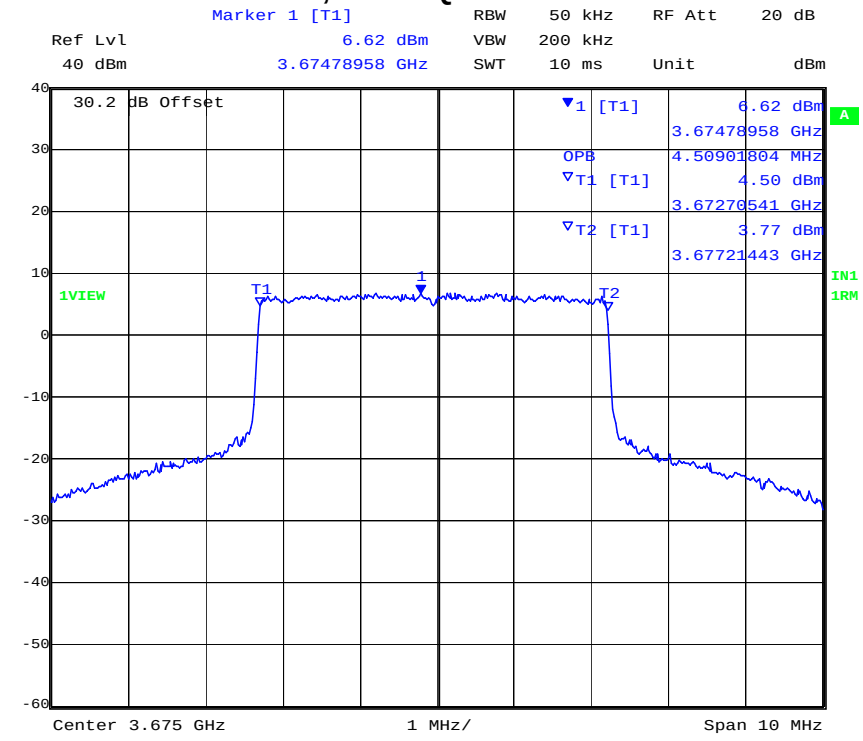
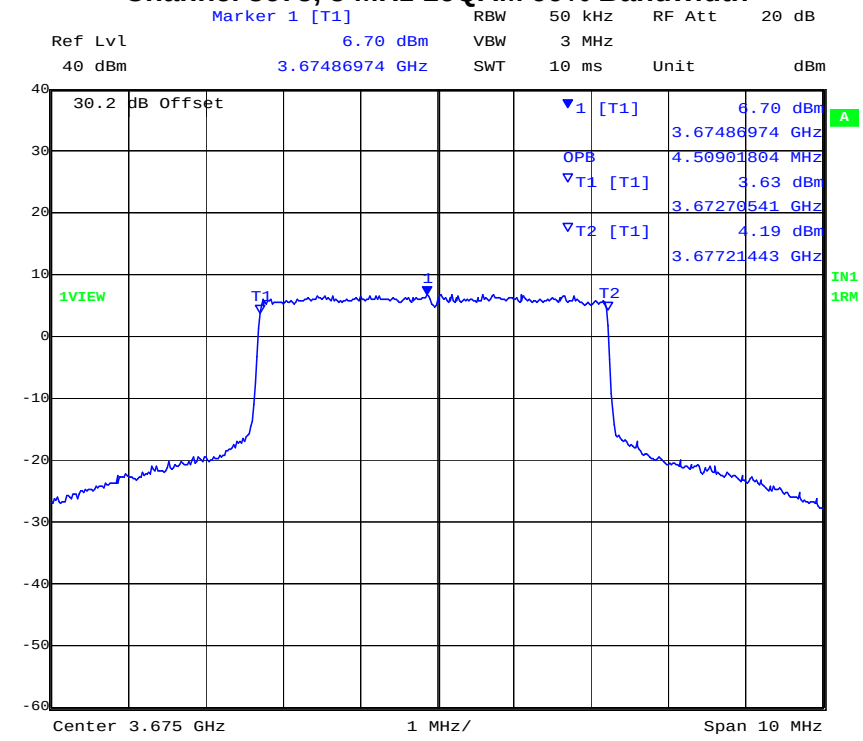



## Channel 3675, 5 MHz QPSK 99% Bandwidth



## Channel 3675, 5 MHz 16QAM 99% Bandwidth

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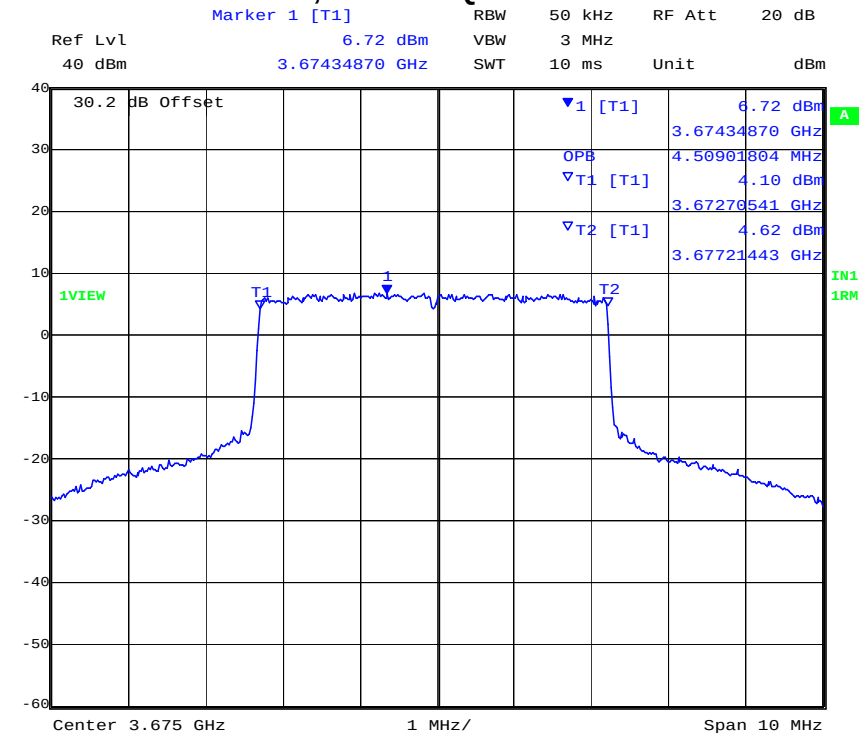
## Channel 3675, 5 MHz 64QAM 99% Bandwidth

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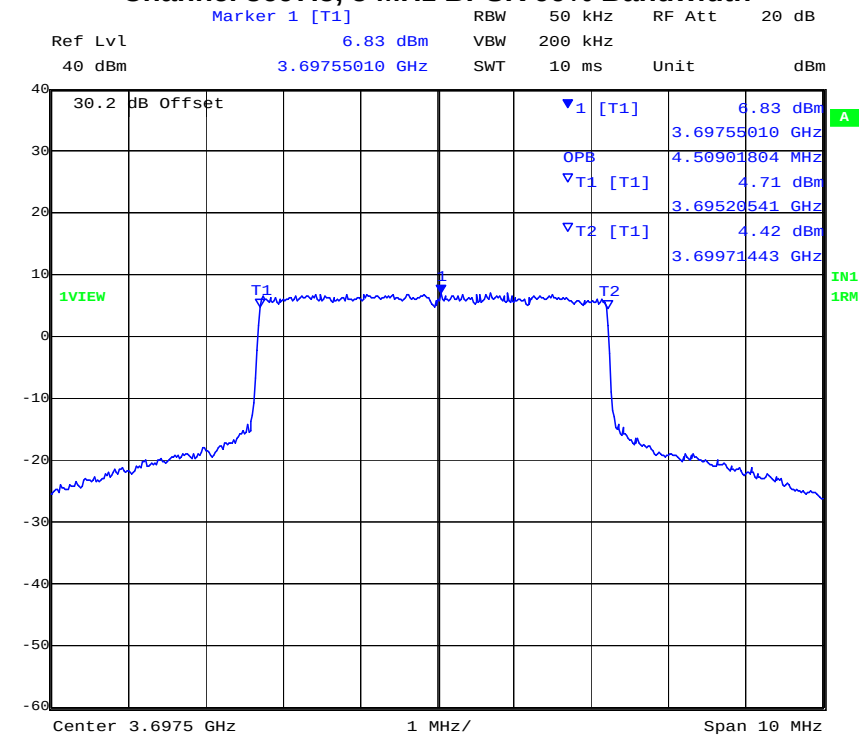
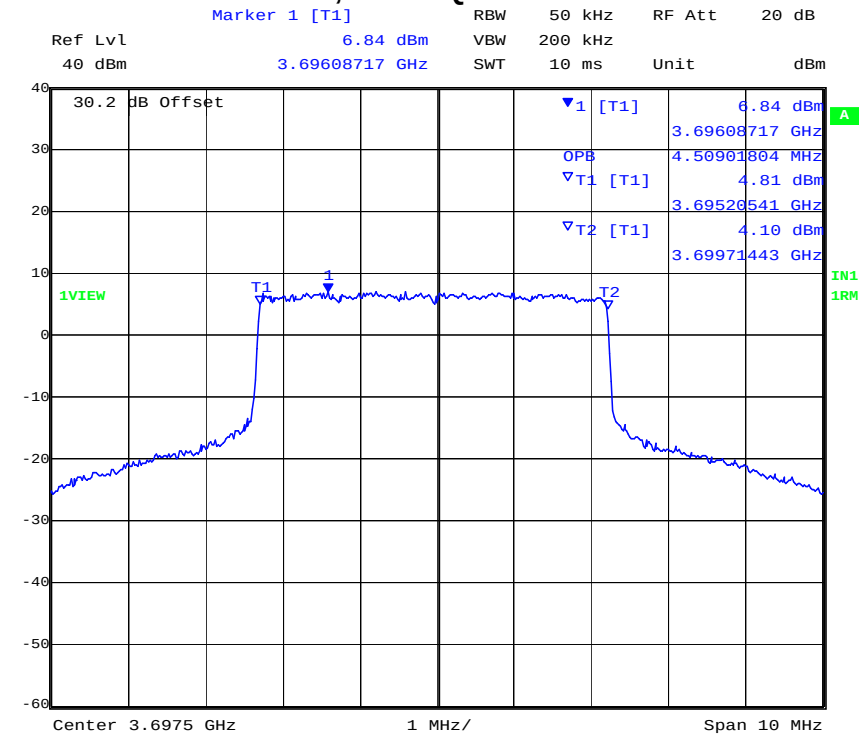


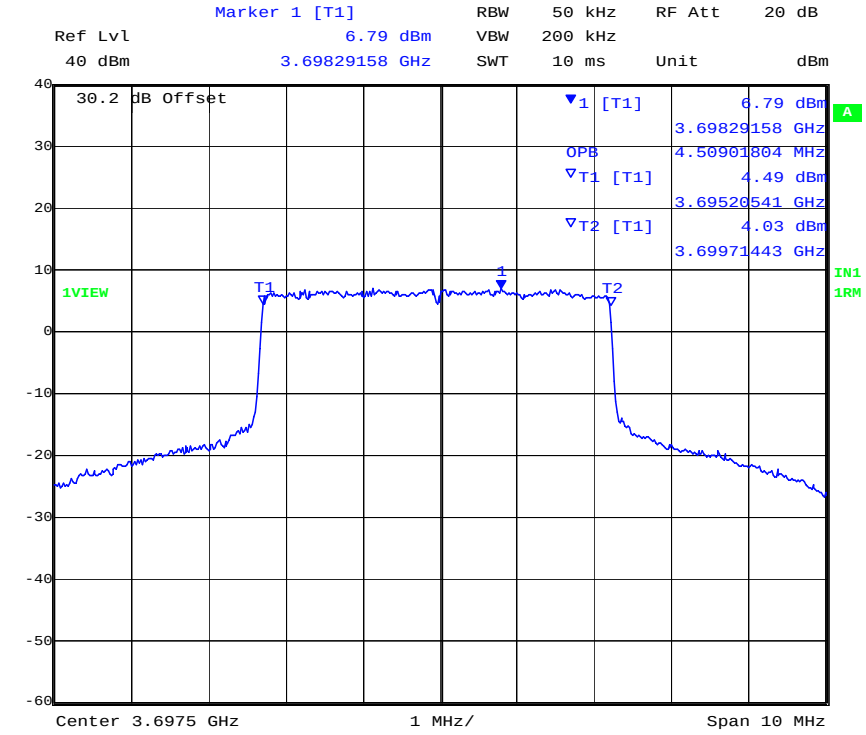

Date: 3.AUG.2010 12:16:39

## Channel 3697.5, 5 MHz QPSK 99% Bandwidth



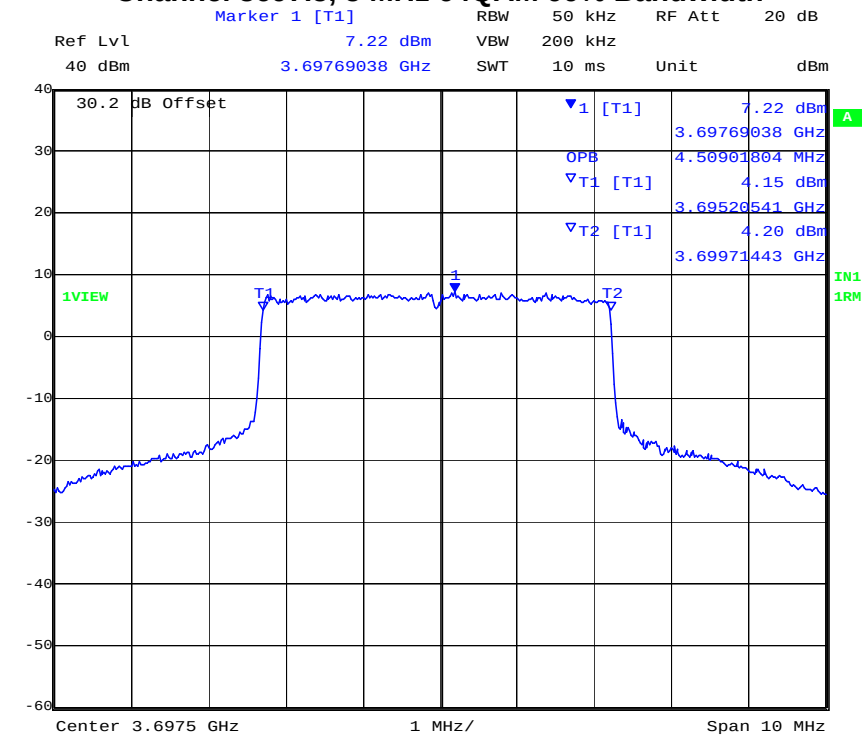

Date: 3.AUG.2010 12:18:15

## Channel 3697.5, 5 MHz 16QAM 99% Bandwidth




Date: 3.AUG.2010 12:20:40

## Channel 3697.5, 5 MHz 64QAM 99% Bandwidth

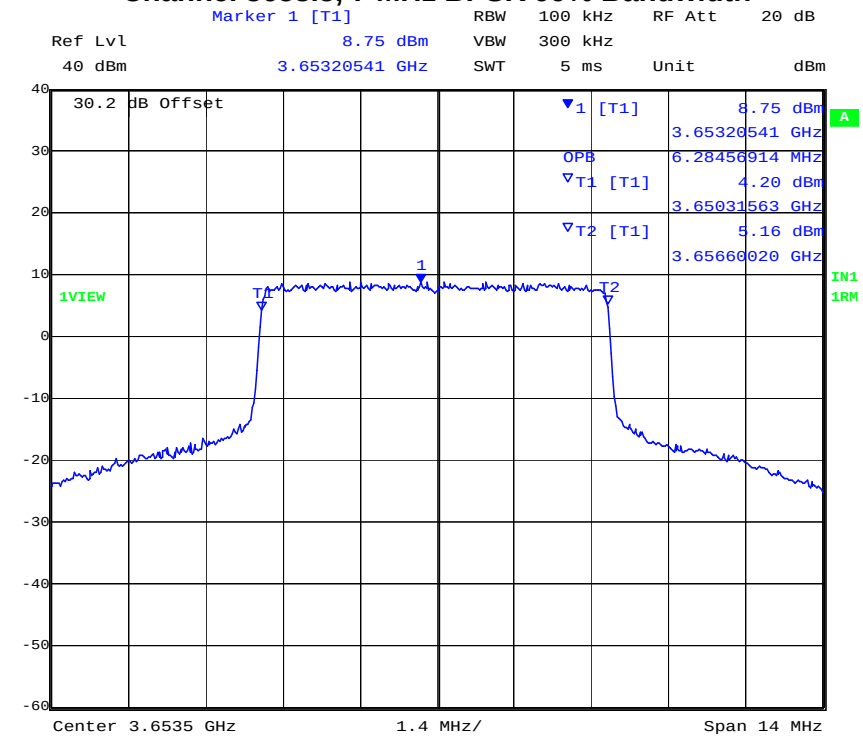



Date: 3.AUG.2010 12:22:11

**7 MHz Bandwidth**

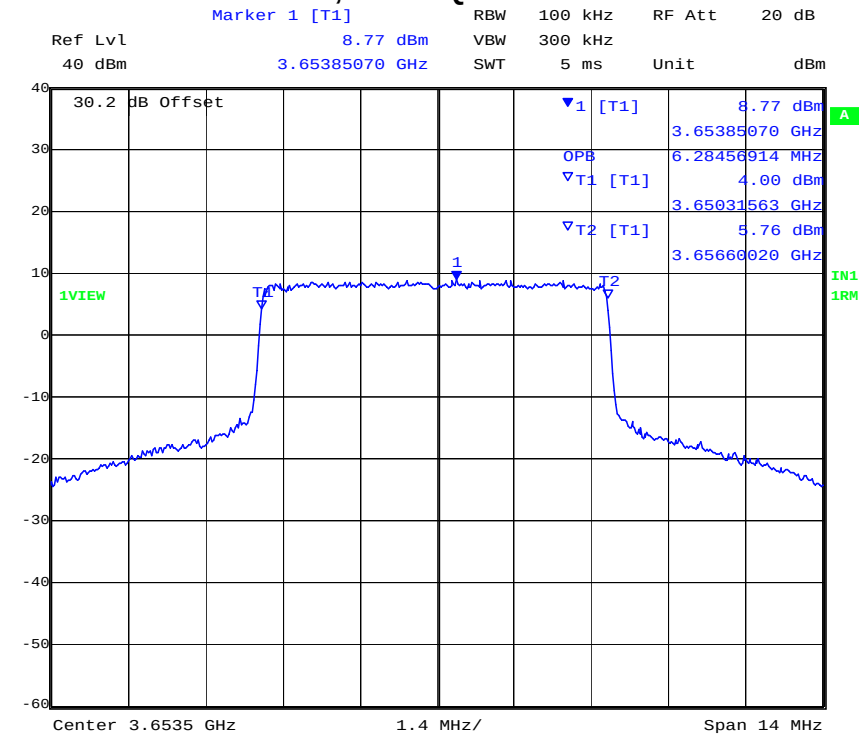
| | 99% Bandwidth | | | |
|---|---|---|---|---|
| Center Frequency (MHz) | BPSK | QPSK | 16 QAM | 64QAM |
| 3653.50 | 6.285 | 6.285 | 6.257 | 6.285 |
| 3675.00 | 6.285 | 6.257 | 6.257 | 6.285 |
| 3696.50 | 6.285 | 6.285 | 6.285 | 6.313 |

## Channel 3653.5, 7 MHz BPSK 99% Bandwidth



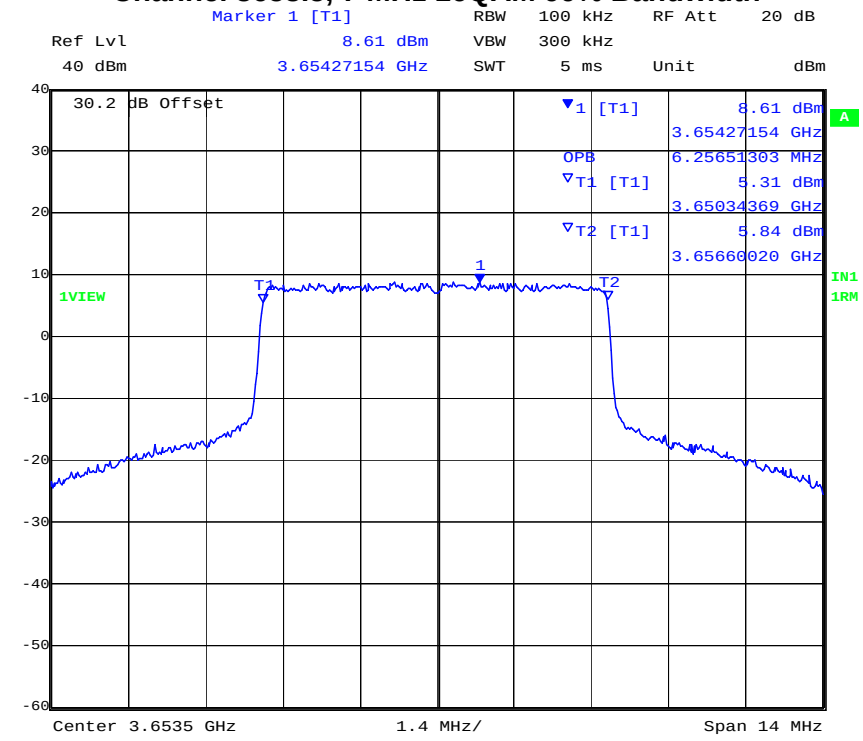

Date: 3.AUG.2010 12:26:08

## Channel 3653.5, 7 MHz QPSK 99% Bandwidth



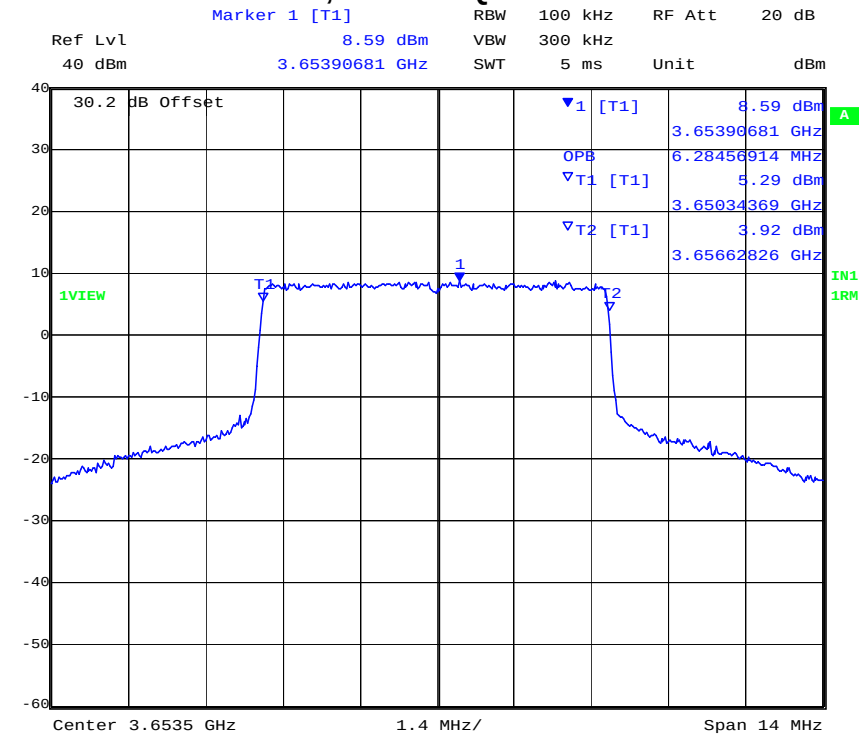

Date: 3.AUG.2010 12:27:48

## Channel 3653.5, 7 MHz 16QAM 99% Bandwidth



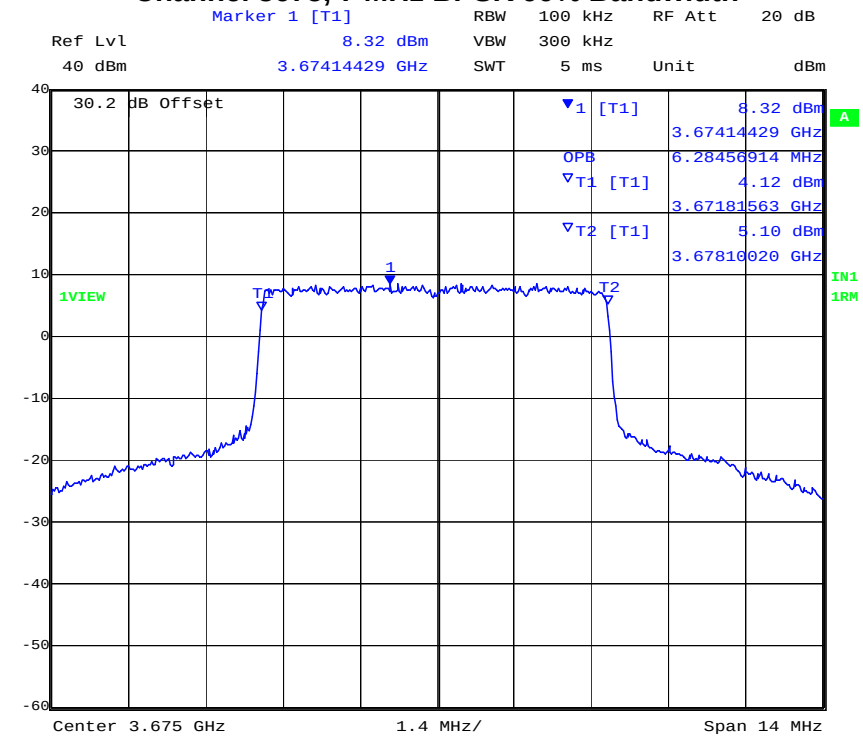

Date: 3.AUG.2010 12:29:57

## Channel 3653.5, 7 MHz 64QAM 99% Bandwidth



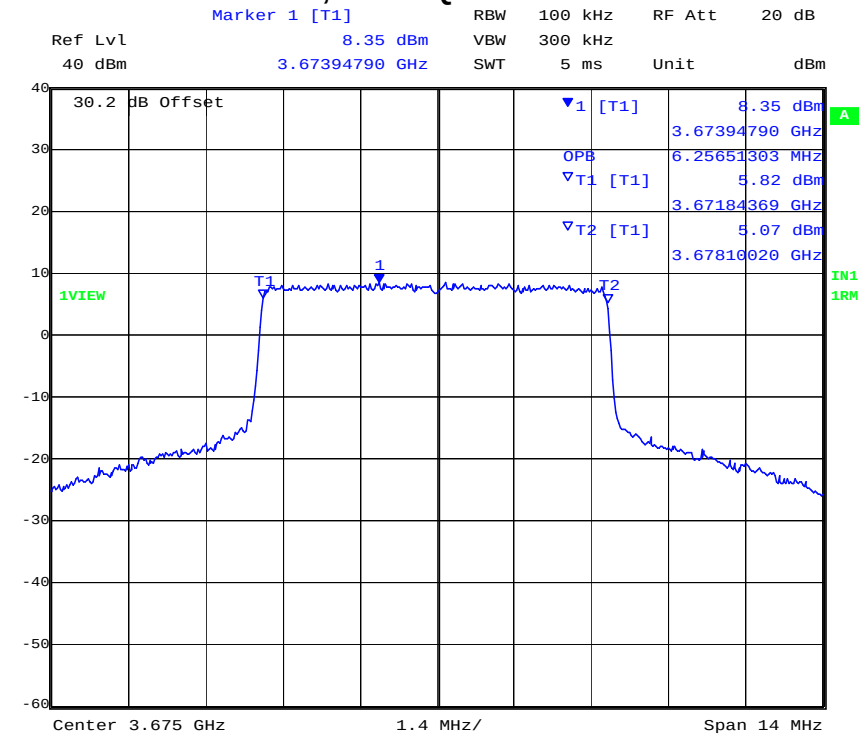

Date: 3.AUG.2010 12:31:15

## Channel 3675, 7 MHz BPSK 99% Bandwidth



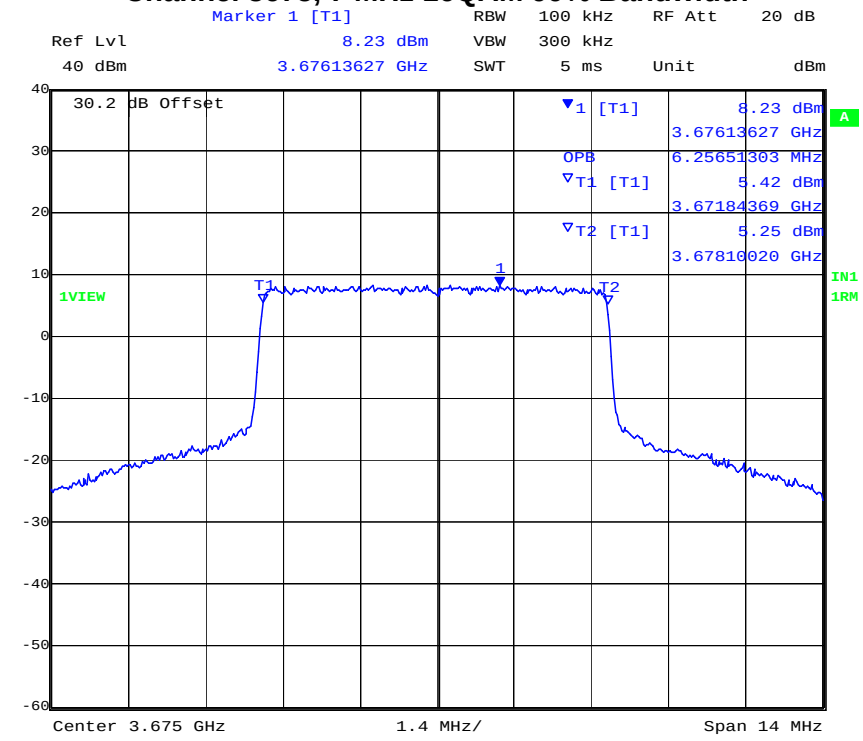

Date: 3.AUG.2010 12:34:26

## Channel 3675, 7 MHz QPSK 99% Bandwidth



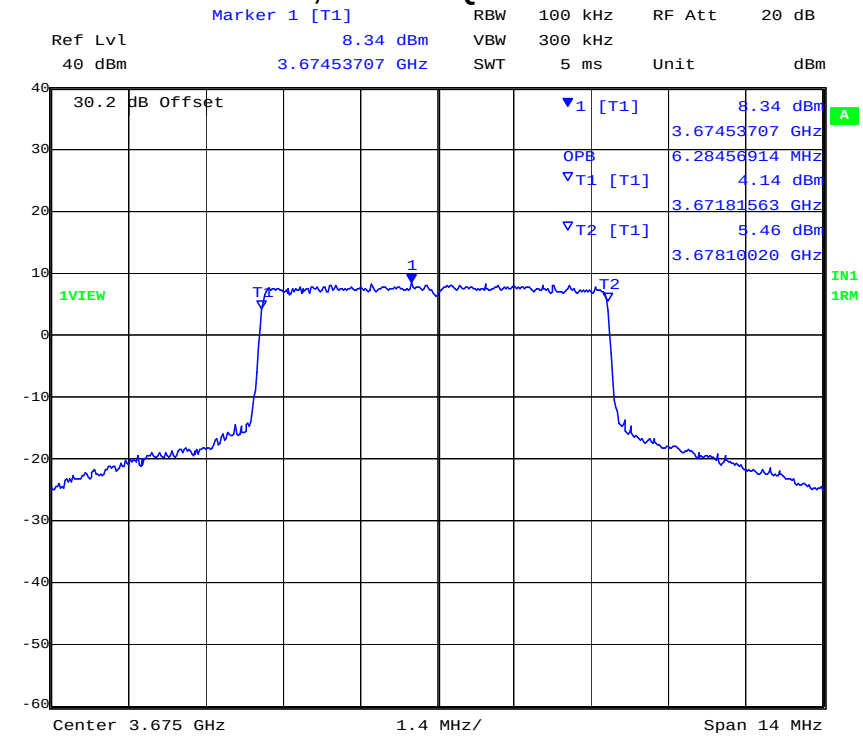

Date: 3.AUG.2010 12:35:42

## Channel 3675, 7 MHz 16QAM 99% Bandwidth



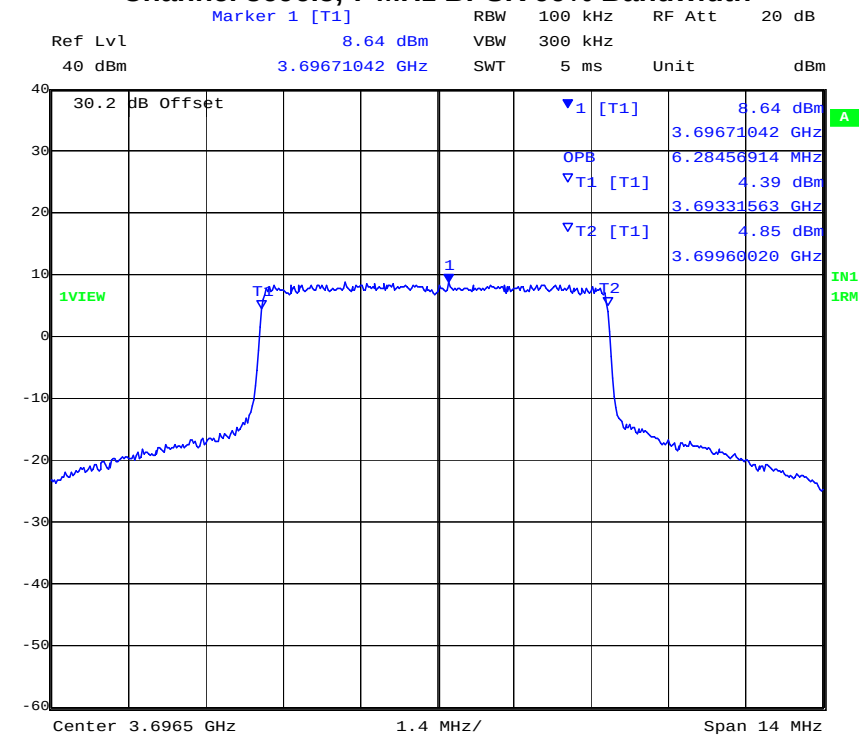

Date: 3.AUG.2010 12:37:54

## Channel 3675, 7 MHz 64QAM 99% Bandwidth



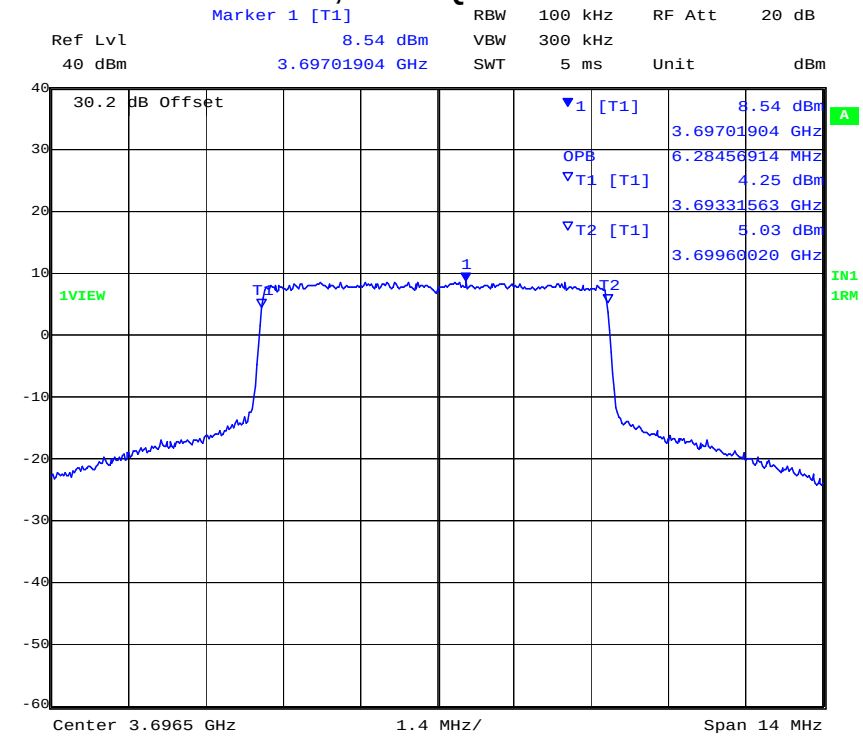

Date: 3.AUG.2010 12:39:42

## Channel 3696.5, 7 MHz BPSK 99% Bandwidth



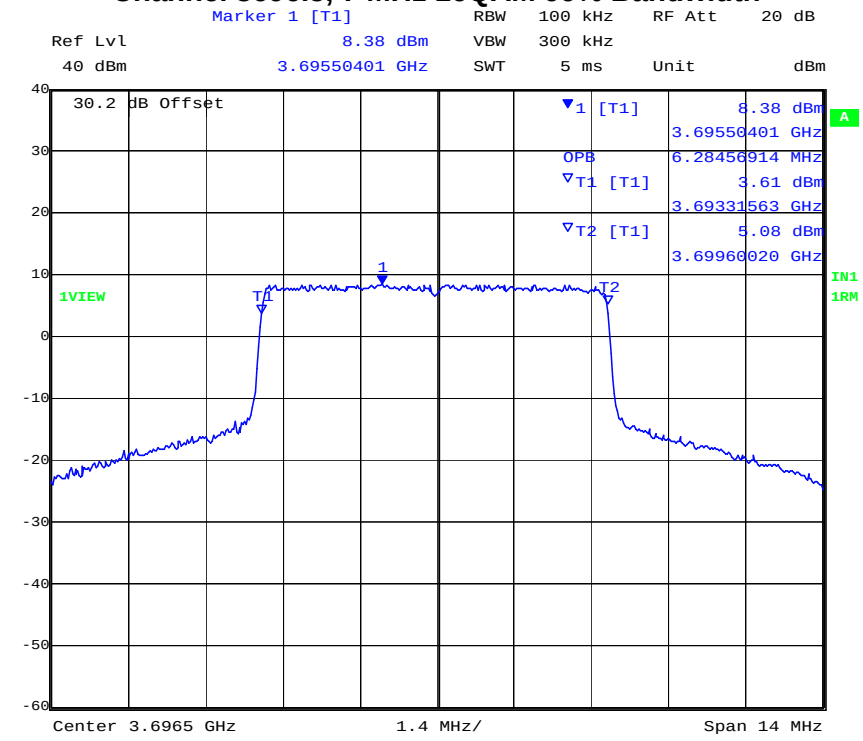

Date: 3.AUG.2010 12:42:06

## Channel 3696.5, 7 MHz QPSK 99% Bandwidth



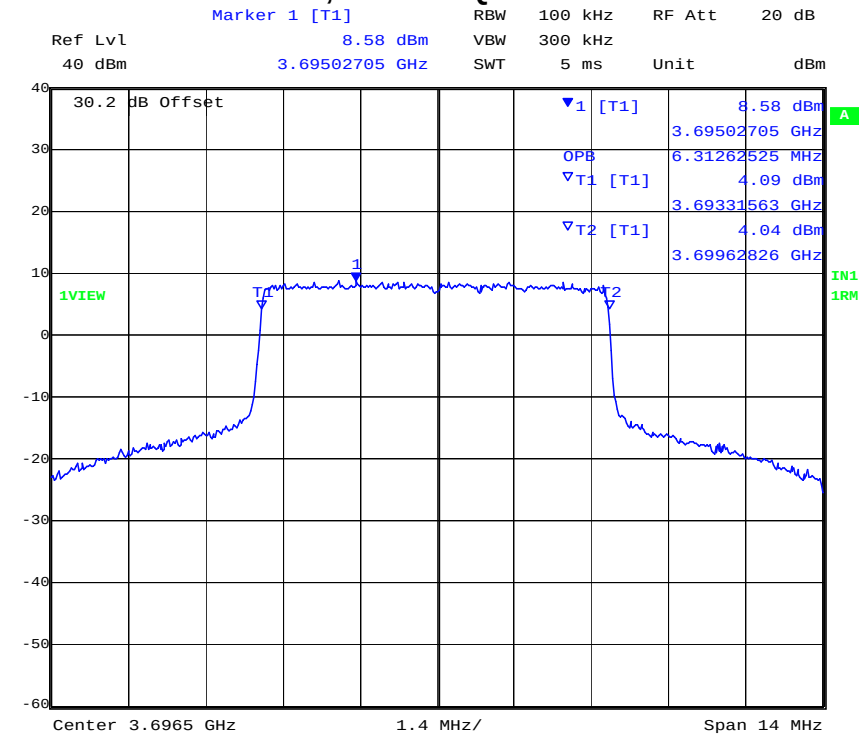

Date: 3.AUG.2010 12:43:32

## Channel 3696.5, 7 MHz 16QAM 99% Bandwidth




Date: 3.AUG.2010 12:45:32

## Channel 3696.5, 7 MHz 64QAM 99% Bandwidth




Date: 3.AUG.2010 12:47:00

**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)**

**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

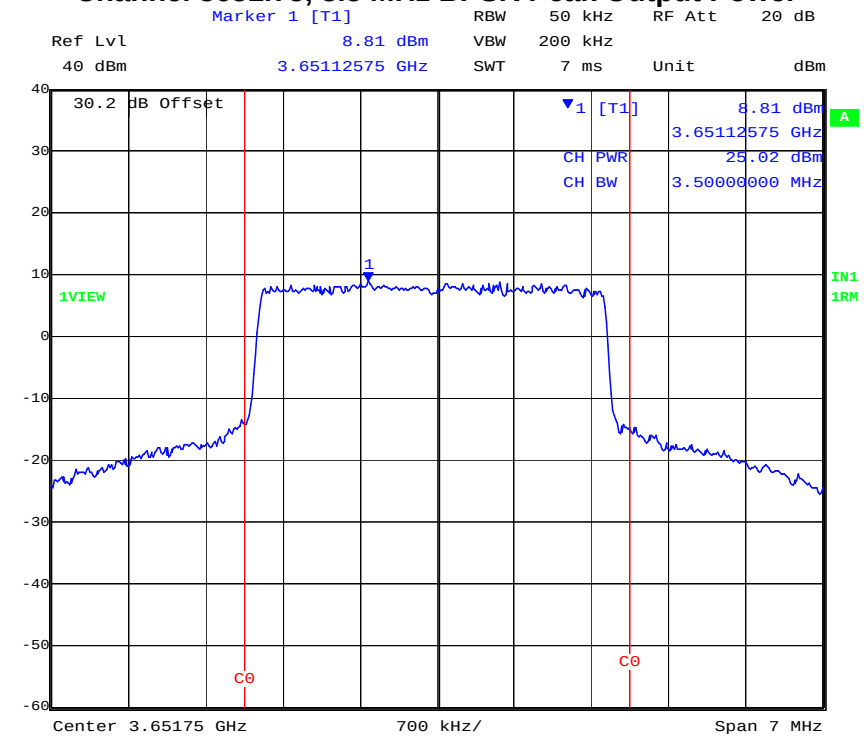
### 3.5 MHz Bandwidth

**Conducted Power Limit for 11 dBi antenna: +25.4 dBm**

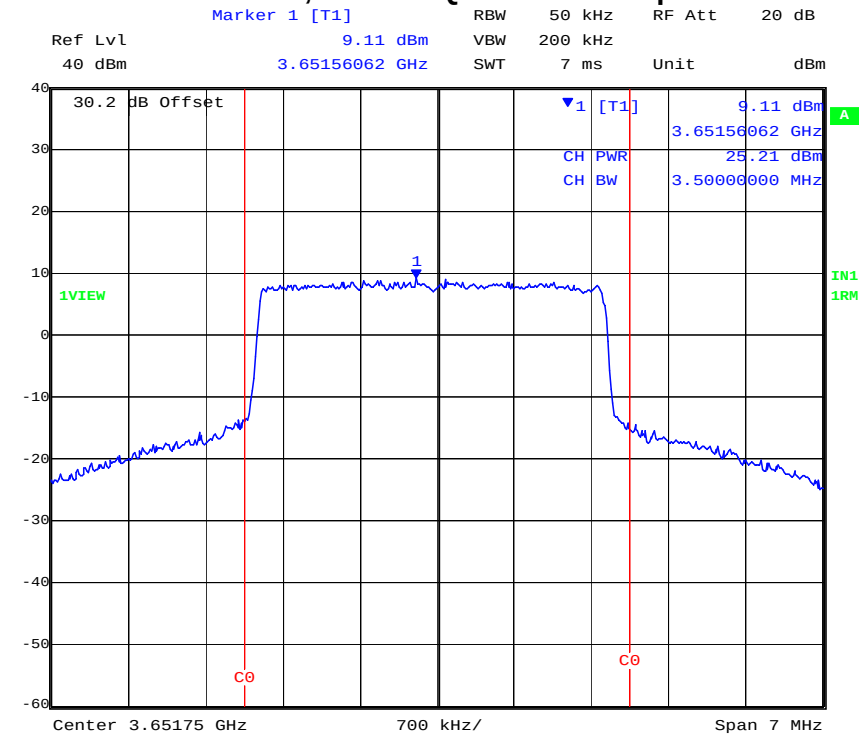
| | Peak Output Power | | | | |
|---|---|---|---|---|---|
| **Center Frequency (MHz)** | **BPSK (+dBm)** | **QPSK (+dBm)** | **16 QAM (+dBm)** | **64QAM (+dBm)** | **Minimum Margin (dB)** |
| 3651.75 | +25.02 | +25.21 | +25.15 | +25.10 | -0.19 |
| 3675.00 | +24.62 | +24.75 | +24.68 | +24.70 | -0.65 |
| 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)

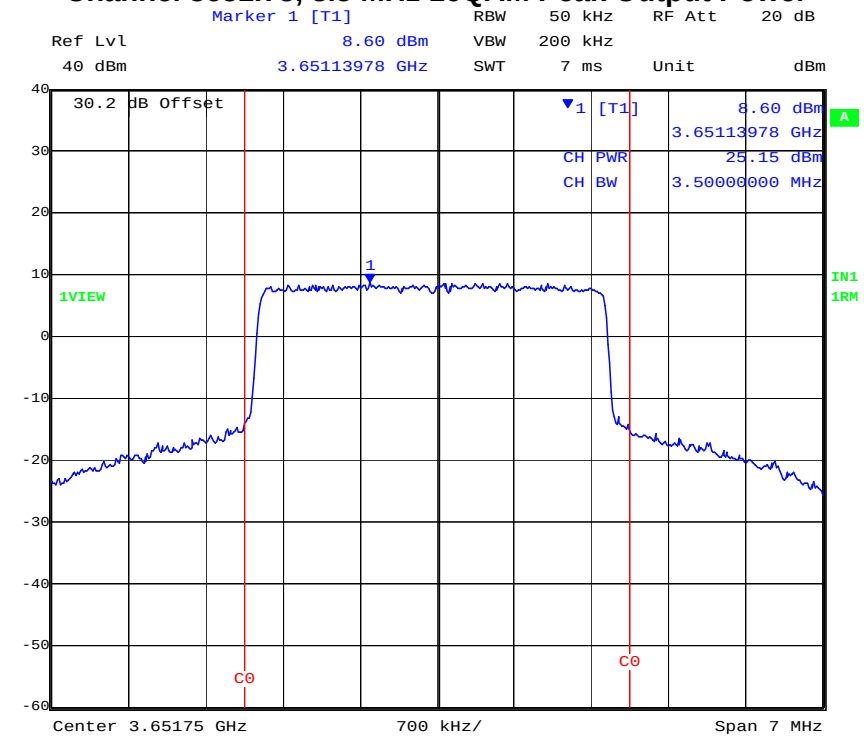
## Channel 3651.75, 3.5 MHz BPSK Peak Output Power




## Channel 3651.75, 3.5 MHz QPSK Peak Output Power

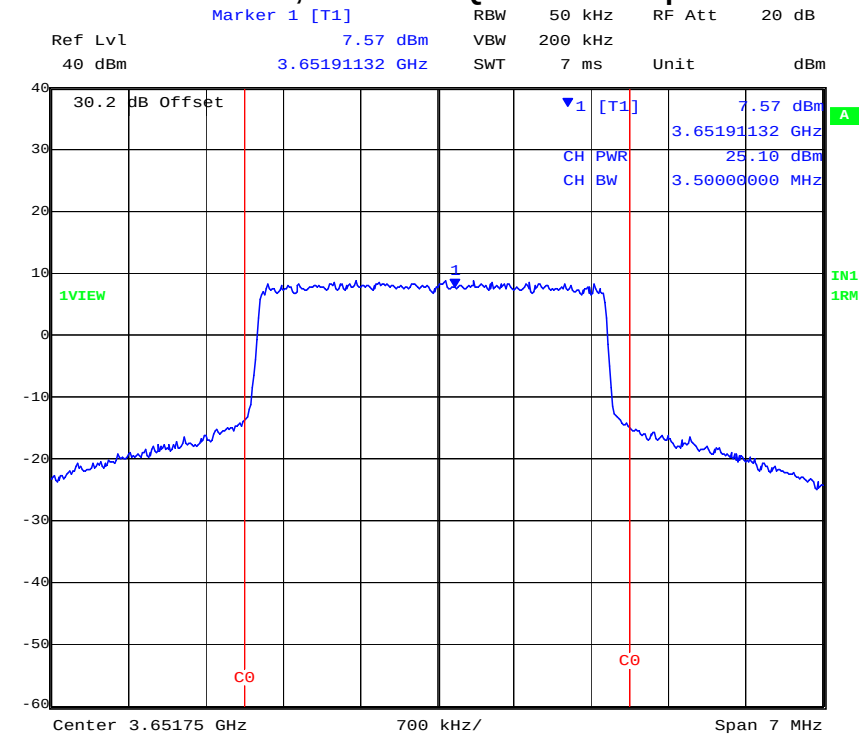


## Channel 3651.75, 3.5 MHz 16QAM Peak Output Power



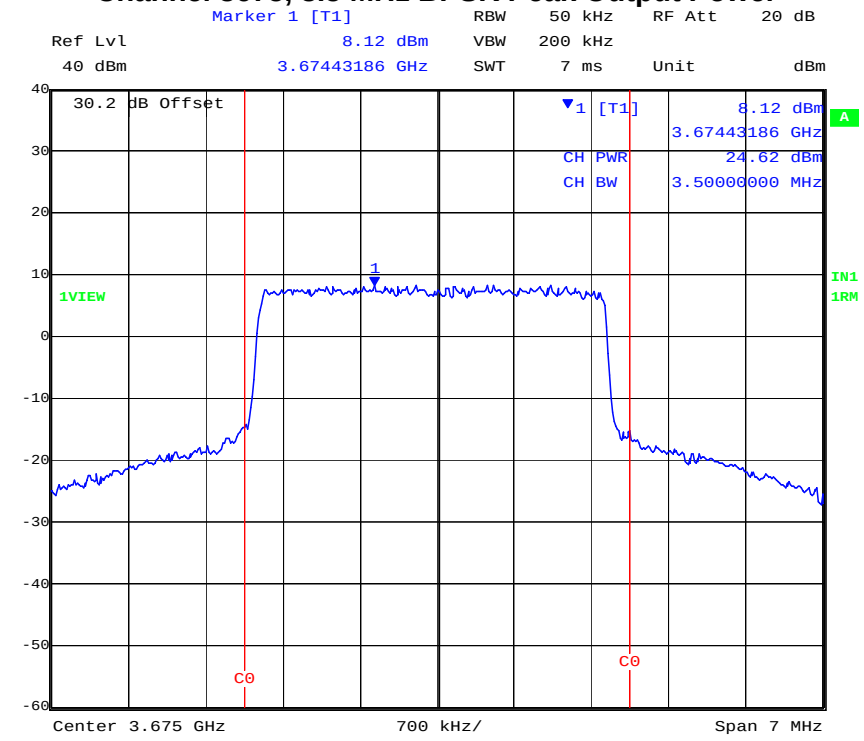

Date: 3.AUG.2010 10:33:44

## Channel 3651.75, 3.5 MHz 64QAM Peak Output Power

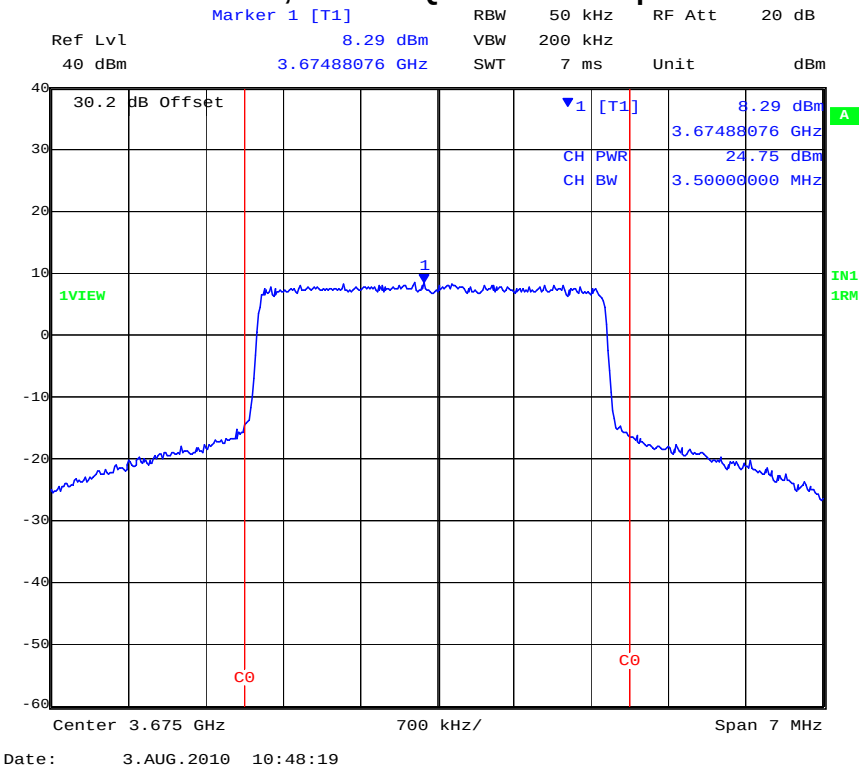



Date: 3.AUG.2010 10:38:43

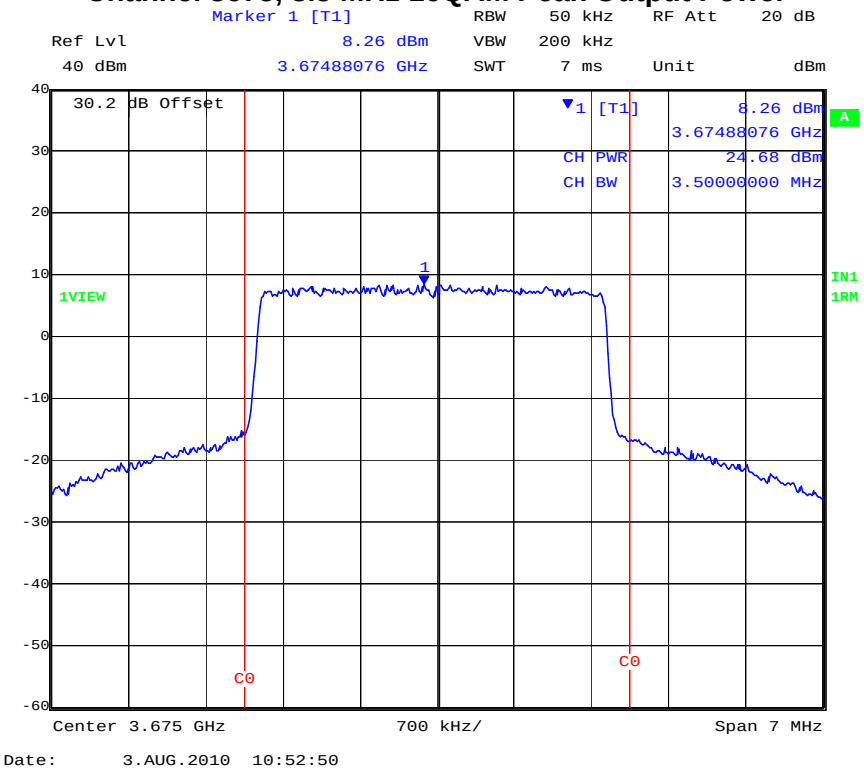
## Channel 3675, 3.5 MHz BPSK Peak Output Power



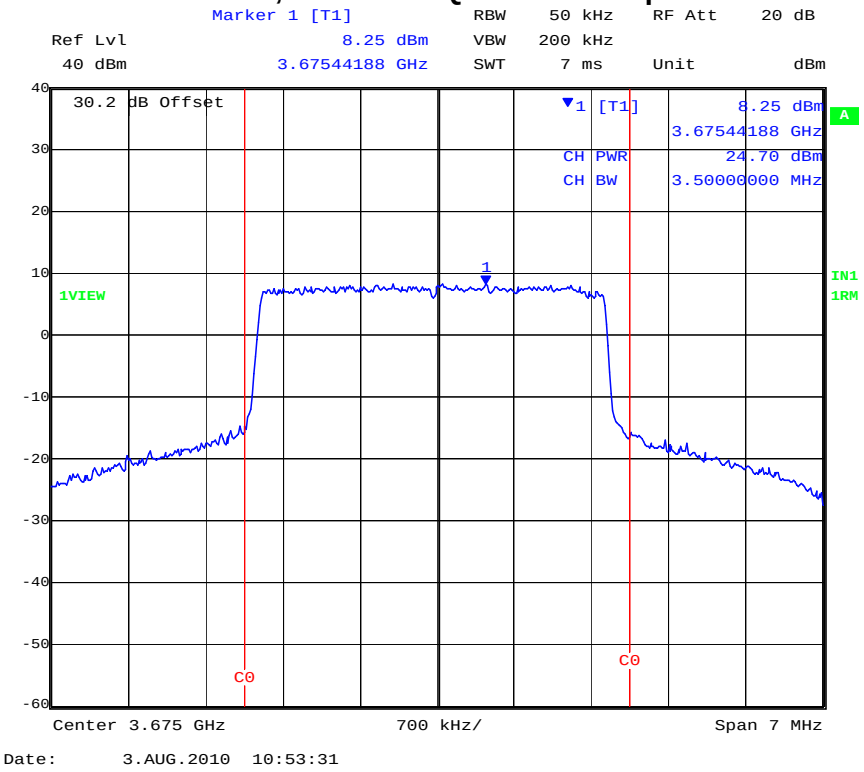

## Channel 3675, 3.5 MHz QPSK Peak Output Power



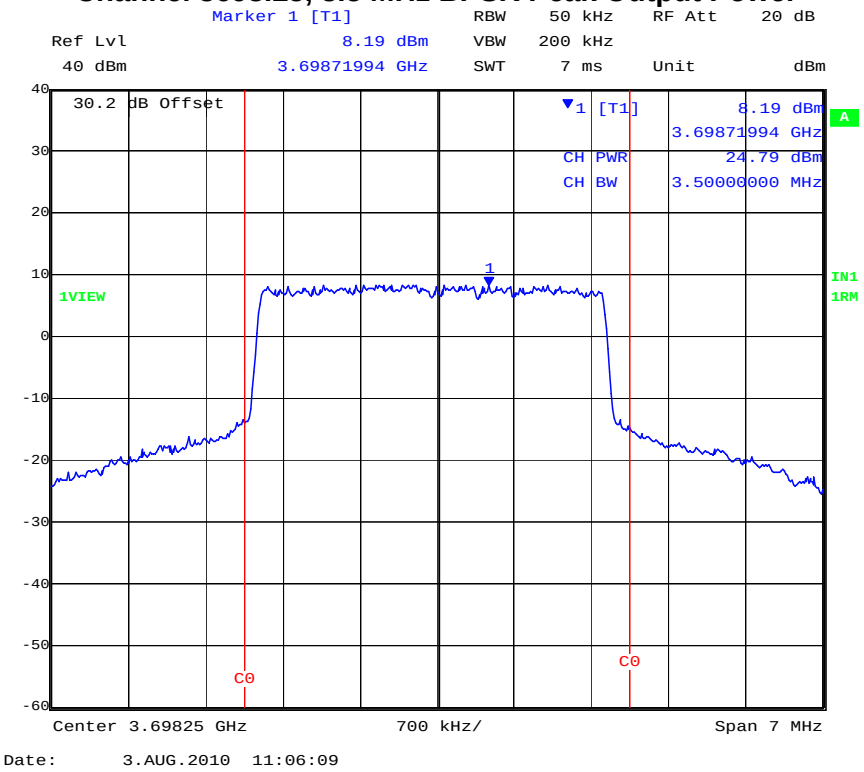
## Channel 3675, 3.5 MHz 16QAM Peak Output Power



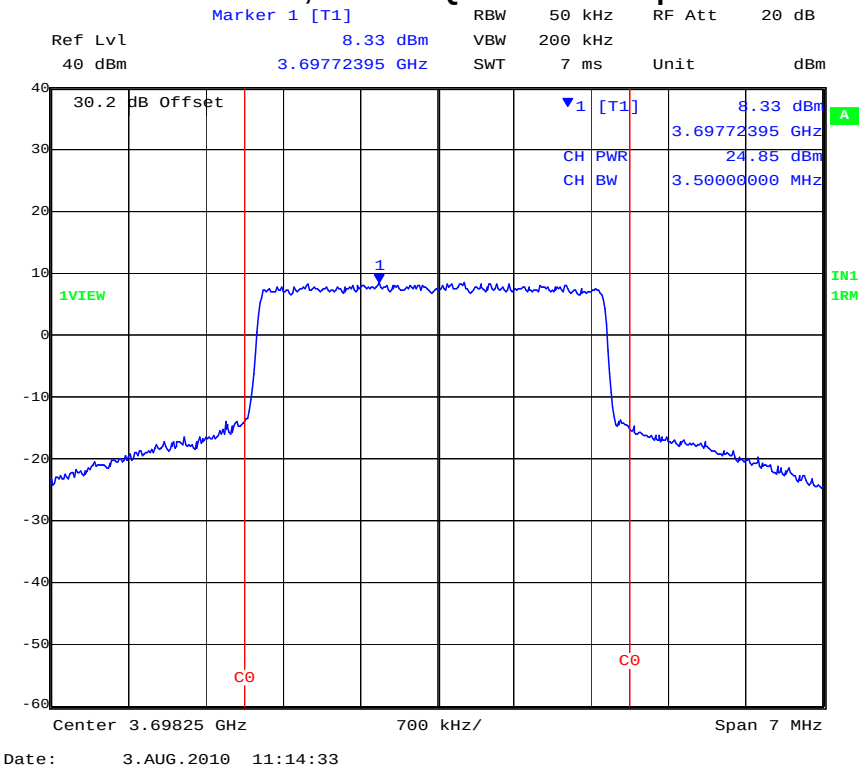

## Channel 3675, 3.5 MHz 64QAM Peak Output Power



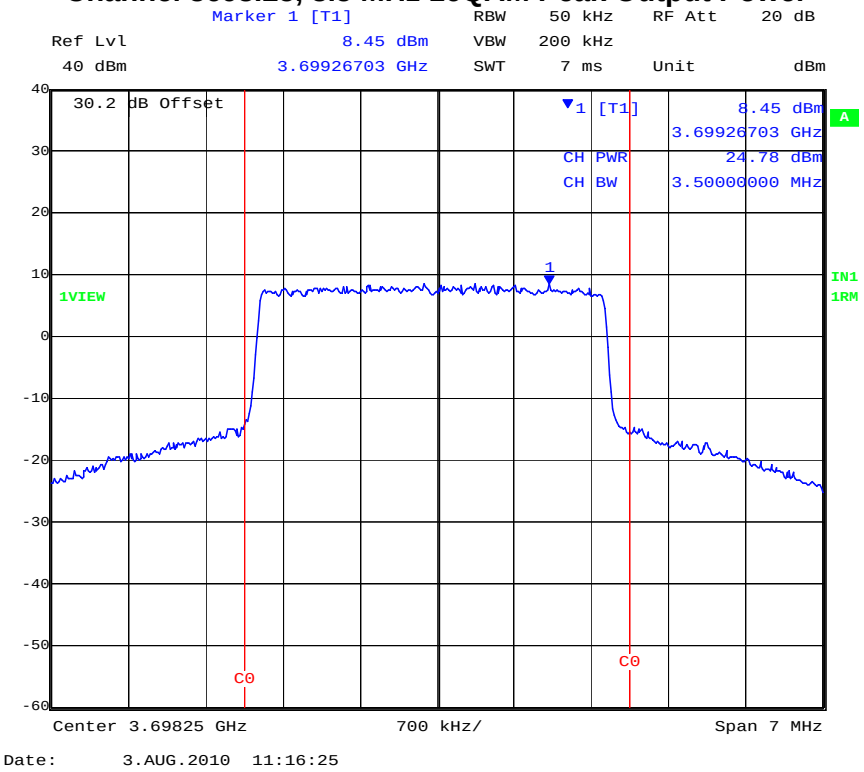
## Channel 3698.25, 3.5 MHz BPSK Peak Output Power




## Channel 3698.25, 3.5 MHz QPSK Peak Output Power

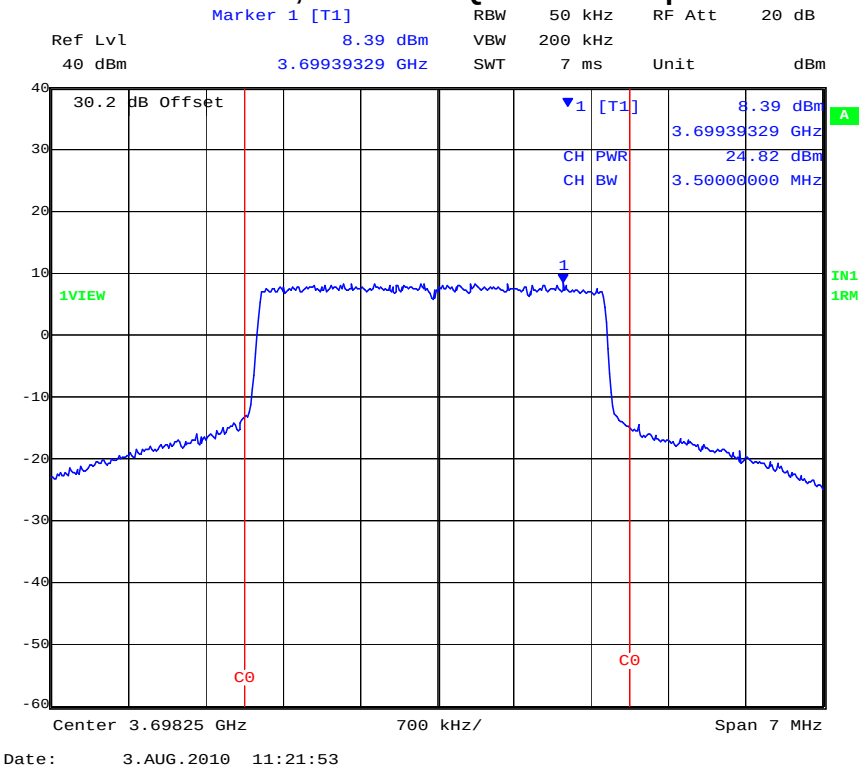


## Channel 3698.25, 3.5 MHz 16QAM Peak Output Power




Date: 3.AUG.2010 11:16:25

## Channel 3698.25, 3.5 MHz 64QAM Peak Output Power




Date: 3.AUG.2010 11:21:53

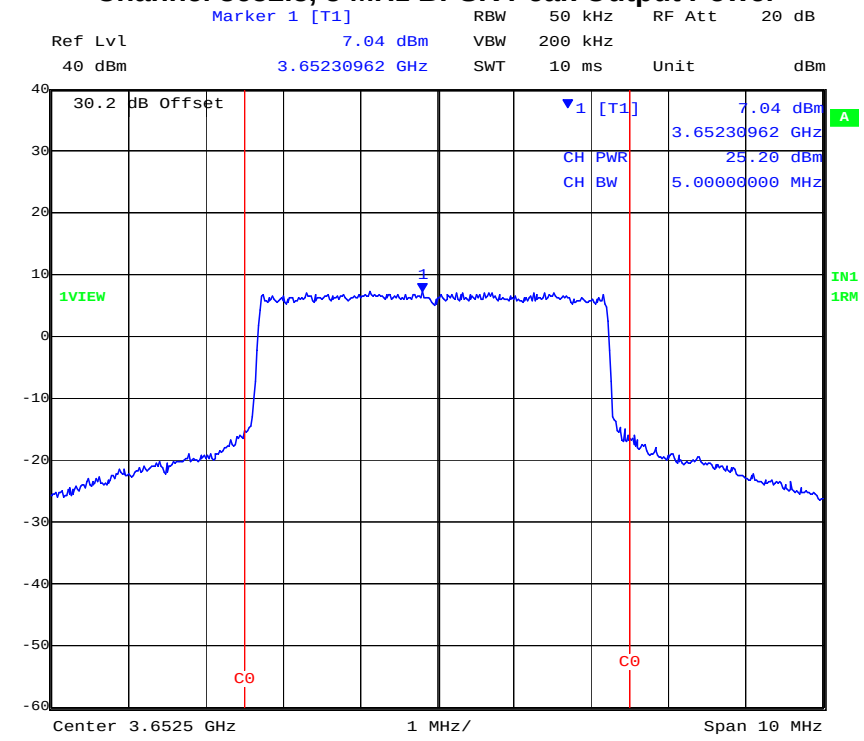
**5 MHz Bandwidth**

**Conducted Power Limit for 11 dBi antenna: +27.0 dBm**

| | Peak Output Power | | | | |
|---|---|---|---|---|---|
| **Center Frequency (MHz)** | **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 |

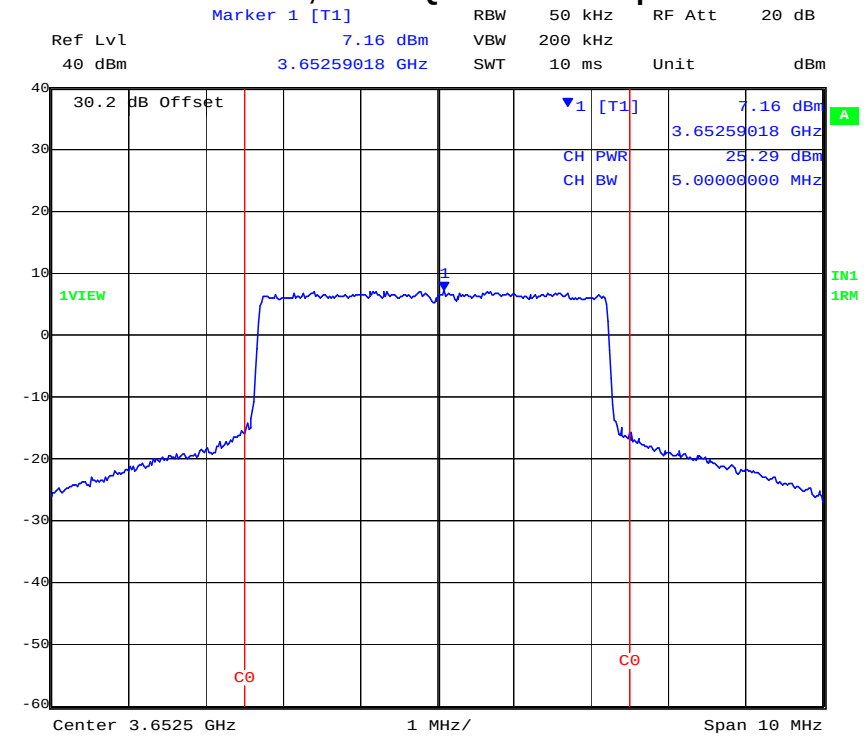
Note: Output power must be attenuated 4 dB for use with 16 dBi antenna (limit +22.0 dBm)

## Channel 3652.5, 5 MHz BPSK Peak Output Power



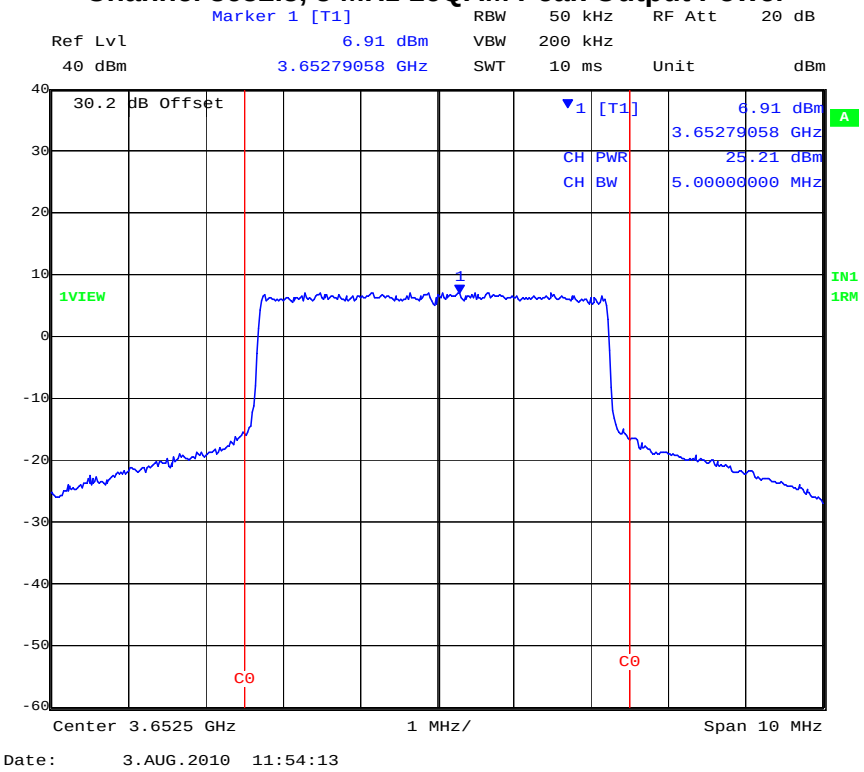

Date: 3.AUG.2010 12:00:02

## Channel 3652.5, 5 MHz QPSK Peak Output Power



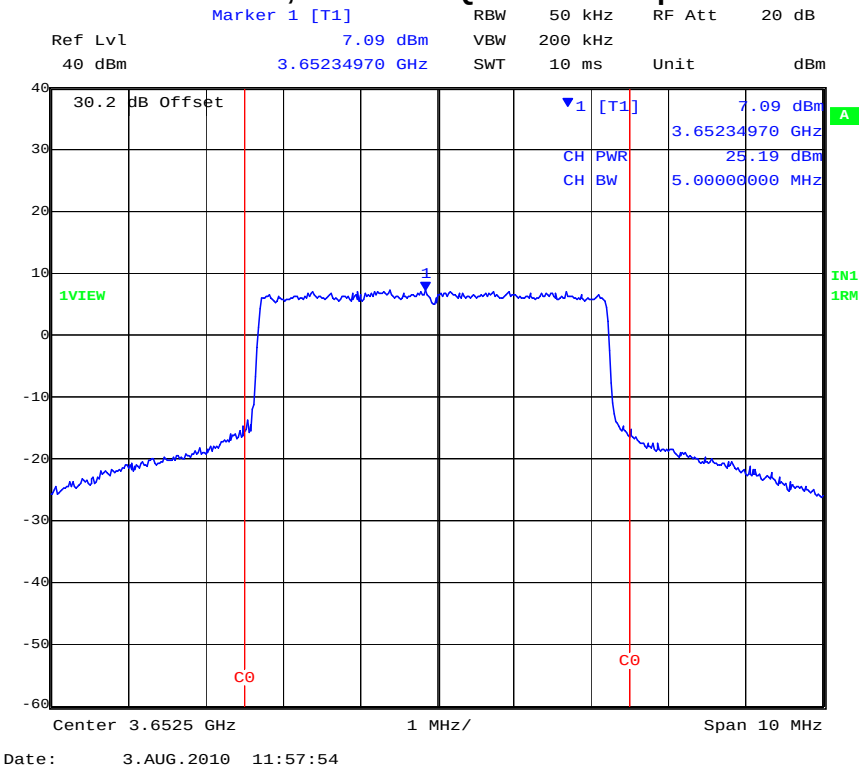

Date: 3.AUG.2010 11:52:55

## Channel 3652.5, 5 MHz 16QAM Peak Output Power



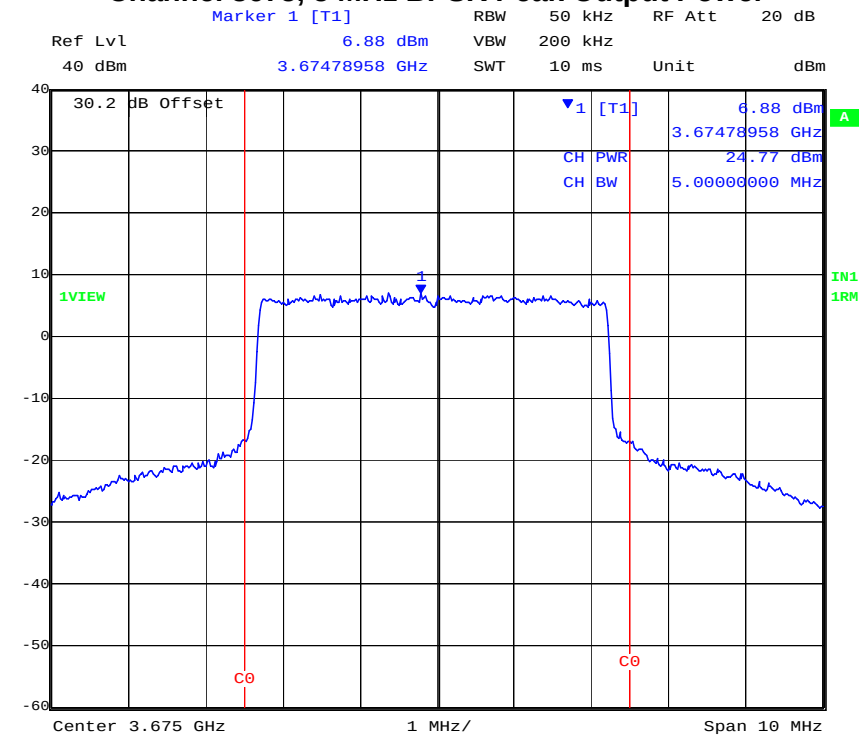

Date: 3.AUG.2010 11:54:13

## Channel 3652.5, 3.5 MHz 64QAM Peak Output Power

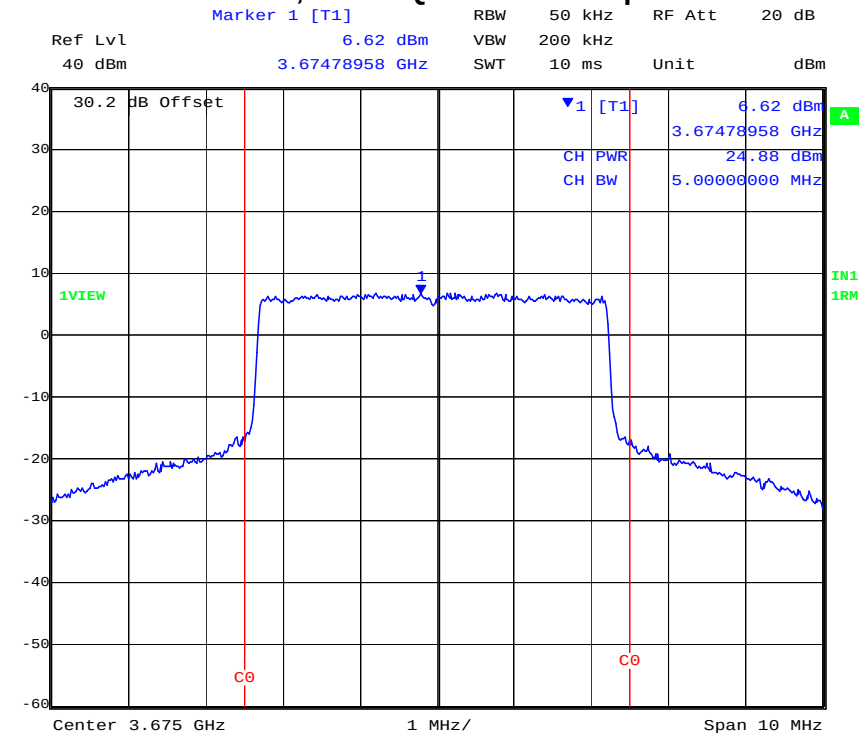



Date: 3.AUG.2010 11:57:54

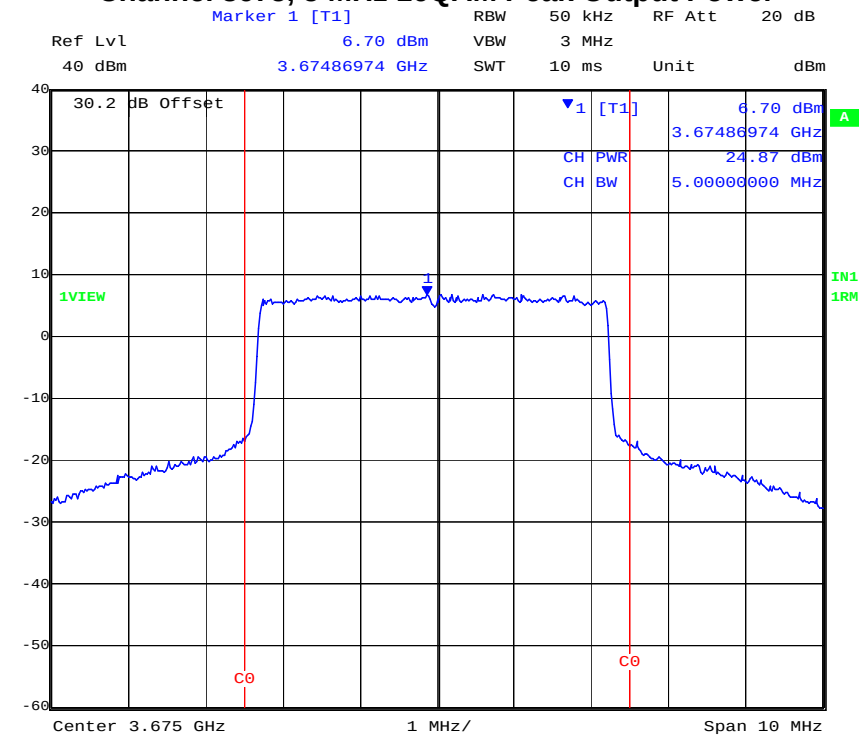
## Channel 3675, 5 MHz BPSK Peak Output Power



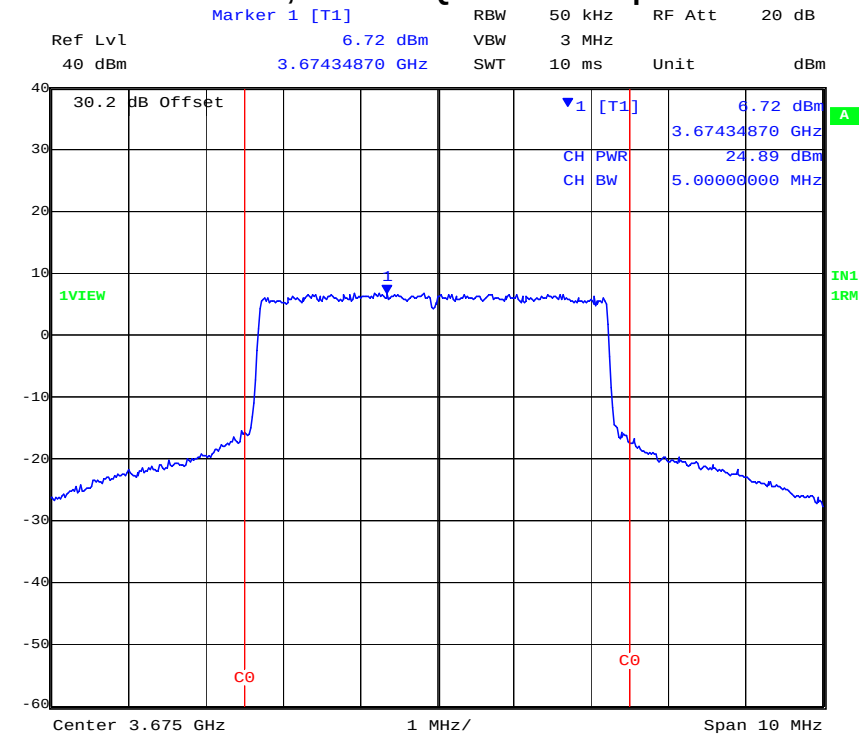

## Channel 3675, 5 MHz QPSK Peak Output Power



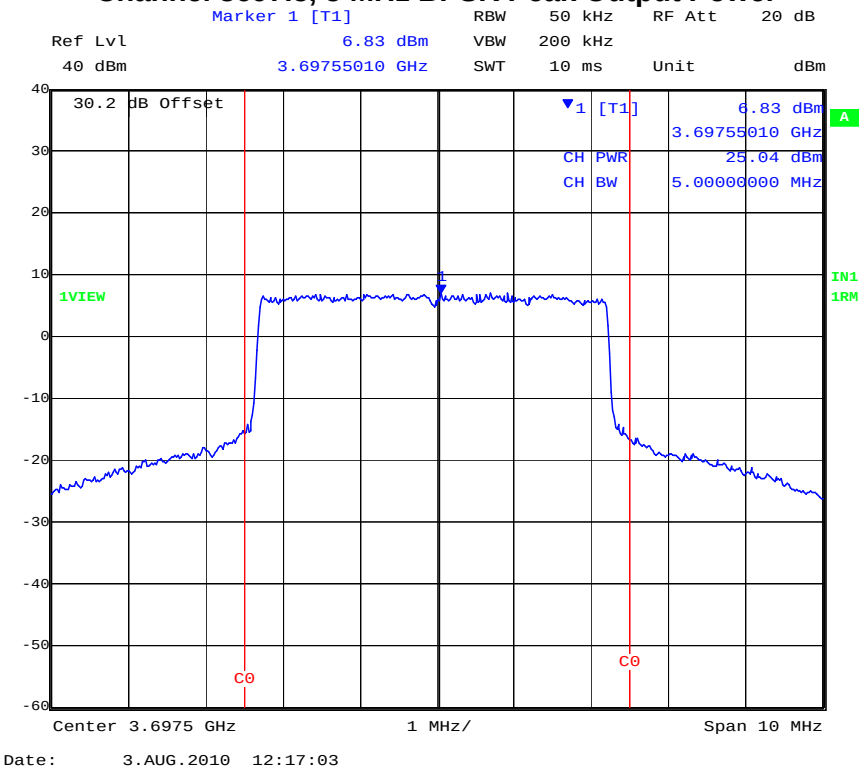
## Channel 3675, 5 MHz 16QAM Peak Output Power



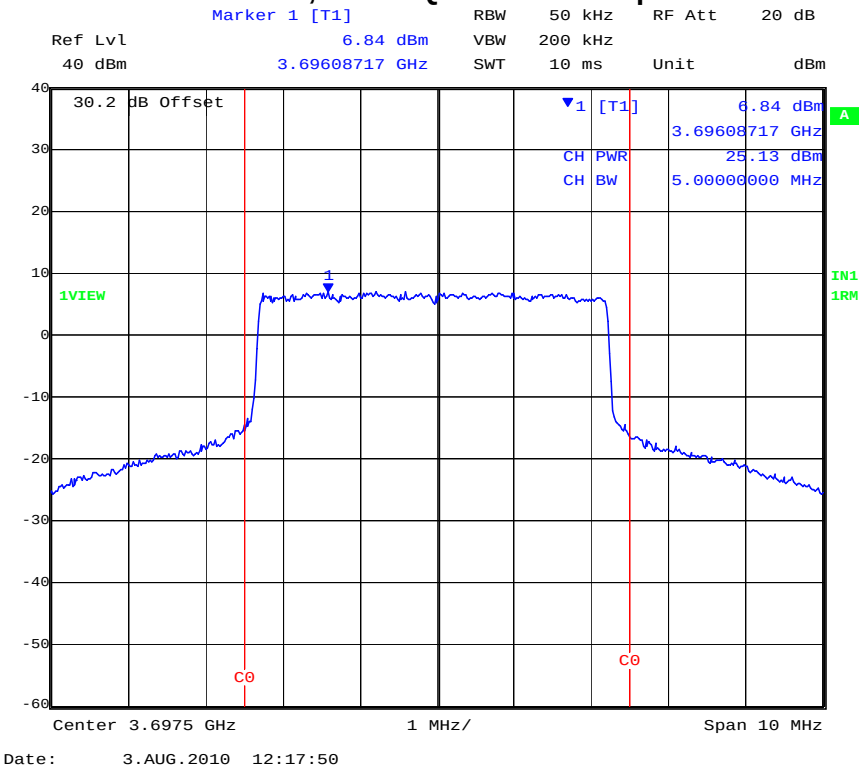

## Channel 3675, 5 MHz 64QAM Peak Output Power



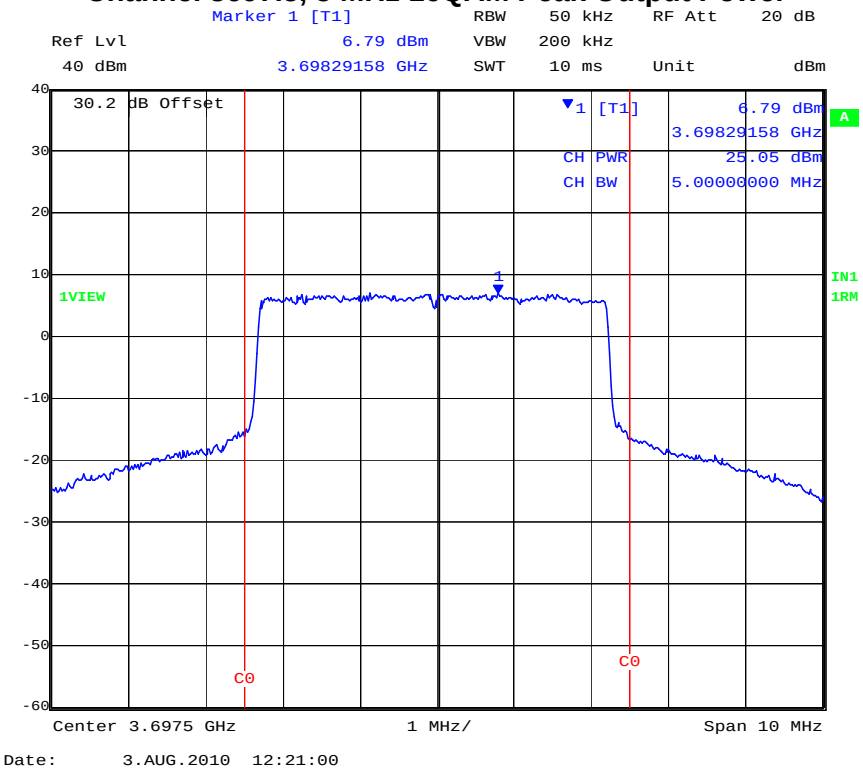
## Channel 3697.5, 5 MHz BPSK Peak Output Power




## Channel 3697.5, 5 MHz QPSK Peak Output Power

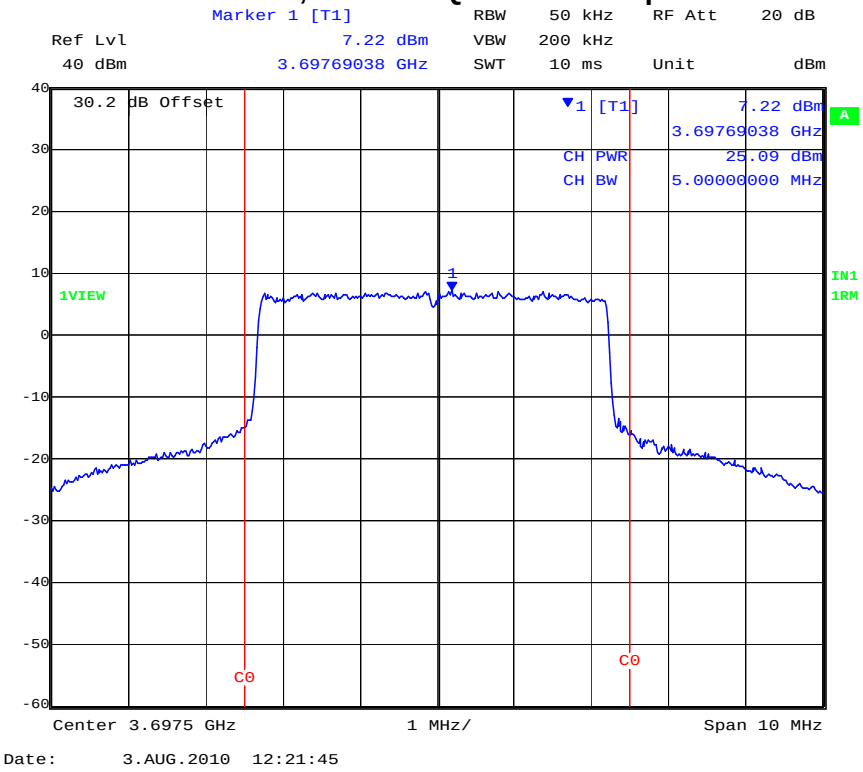


## Channel 3697.5, 5 MHz 16QAM Peak Output Power




Date: 3.AUG.2010 12:21:00

## Channel 3697.5, 5 MHz 64QAM Peak Output Power




Date: 3.AUG.2010 12:21:45

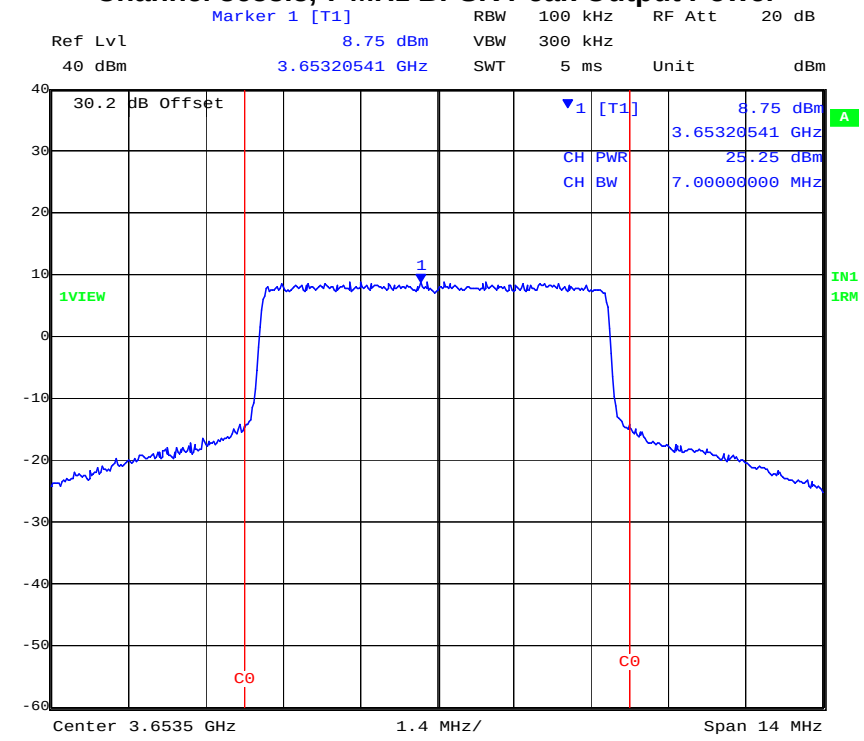
**7 MHz Bandwidth**

**Conducted Power Limit for 11 dBi antenna: +28.4 dBm**

| | Peak Output Power | | | | |
|---|---|---|---|---|---|
| **Center Frequency (MHz)** | **BPSK (+dBm)** | **QPSK (+dBm)** | **16 QAM (+dBm)** | **64QAM (+dBm)** | **Minimum Margin (dB)** |
| 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 |

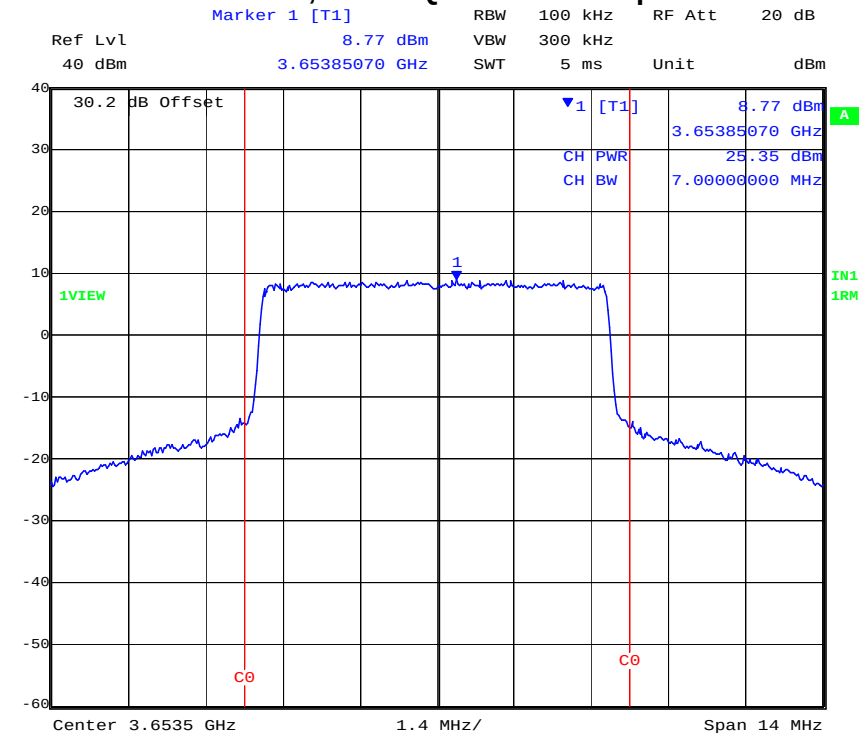
Note: Output power must be attenuated 2 dB for use with 16 dBi antenna (limit +23.4 dBm)

## Channel 3653.5, 7 MHz BPSK Peak Output Power



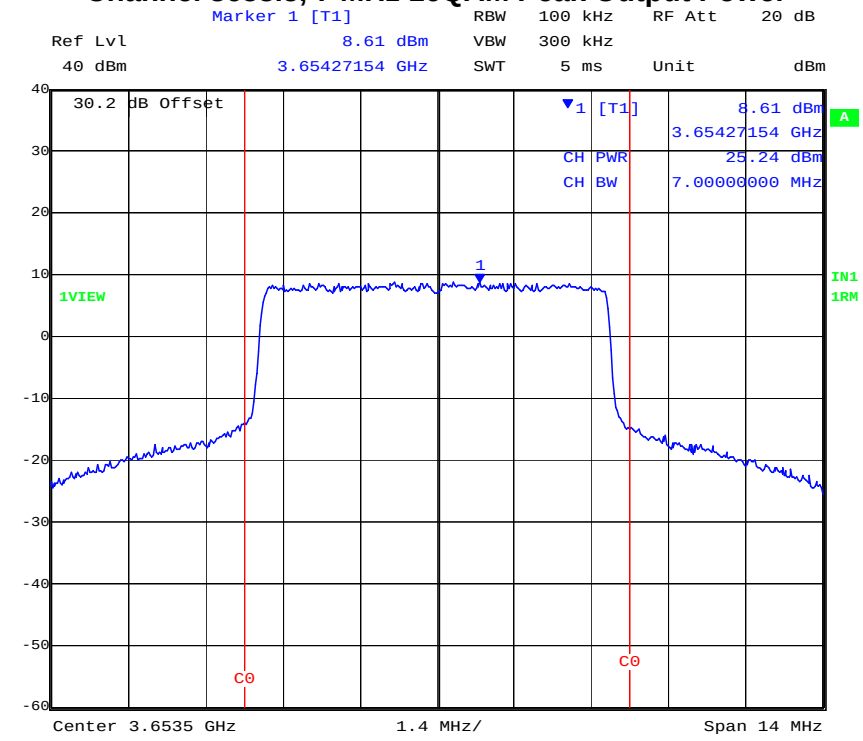

Date: 3.AUG.2010 12:26:41

## Channel 3653.5, 7 MHz QPSK Peak Output Power

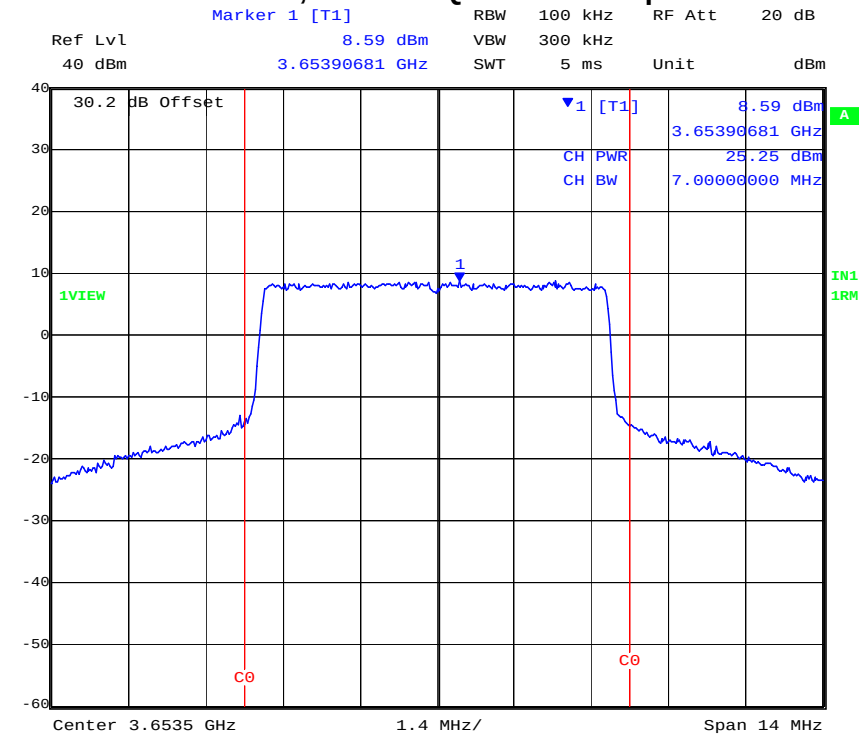



Date: 3.AUG.2010 12:27:27

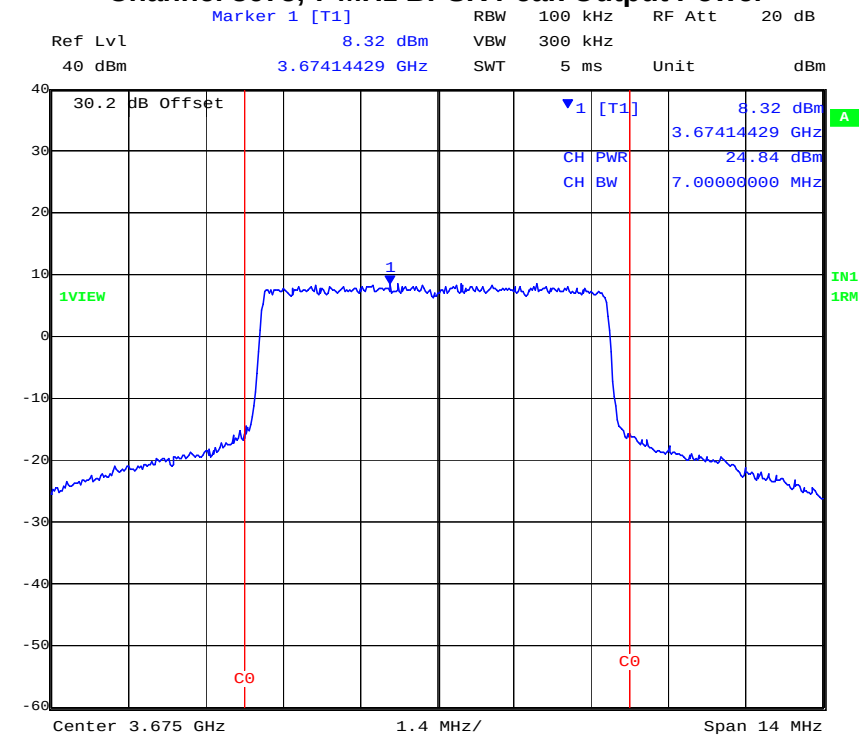
## Channel 3653.5, 7 MHz 16QAM Peak Output Power




## Channel 3653.5, 7 MHz 64QAM Peak Output Power

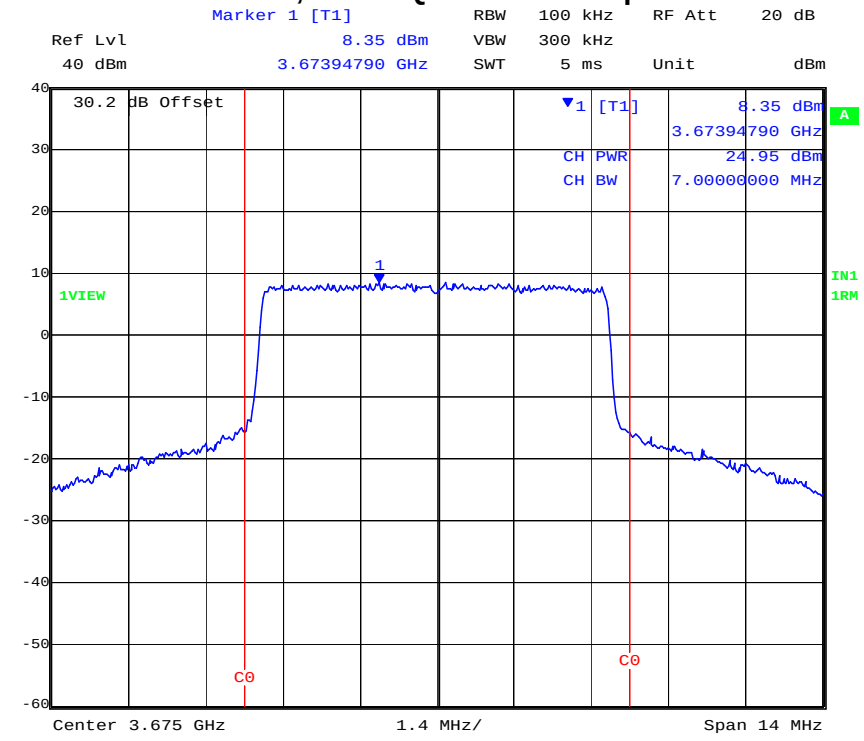


## Channel 3675, 7 MHz BPSK Peak Output Power



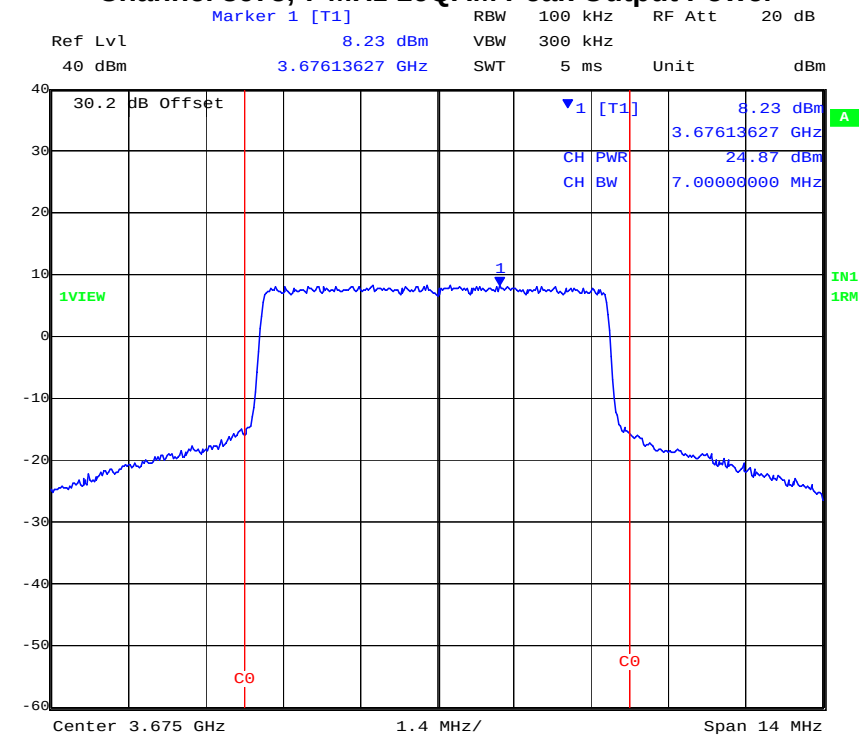

Date: 3.AUG.2010 12:34:40

## Channel 3675, 7 MHz QPSK Peak Output Power



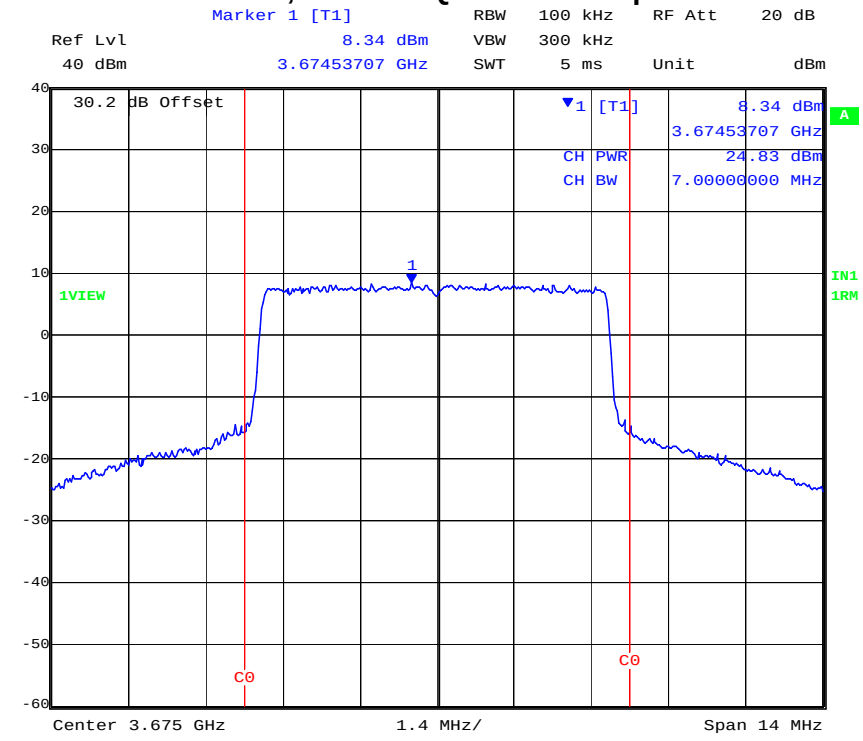

Date: 3.AUG.2010 12:35:20

## Channel 3675, 7 MHz 16QAM Peak Output Power



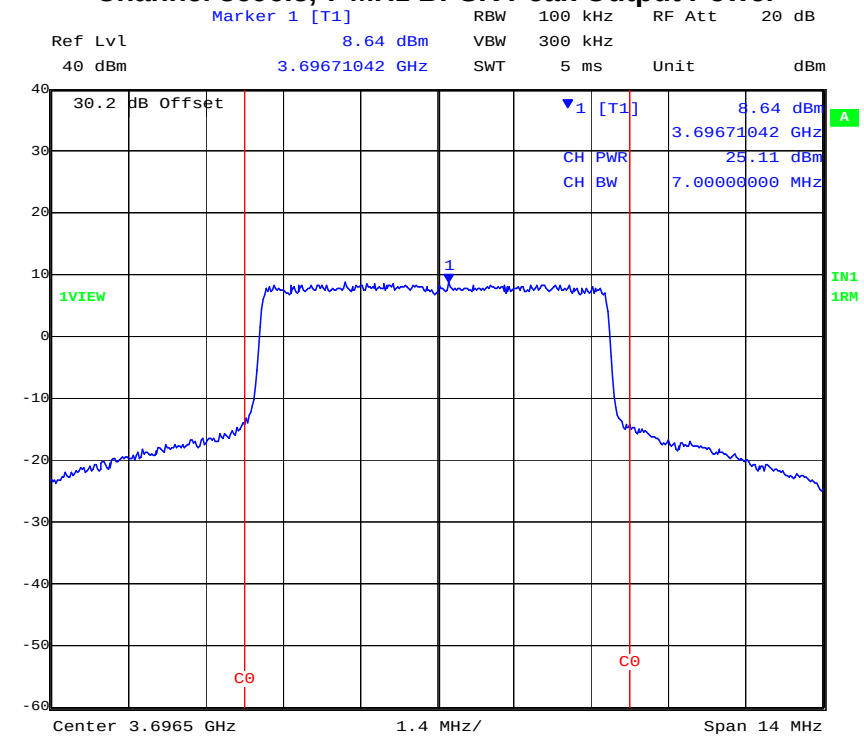

Date: 3.AUG.2010 12:38:13

## Channel 3675, 7 MHz 64QAM Peak Output Power

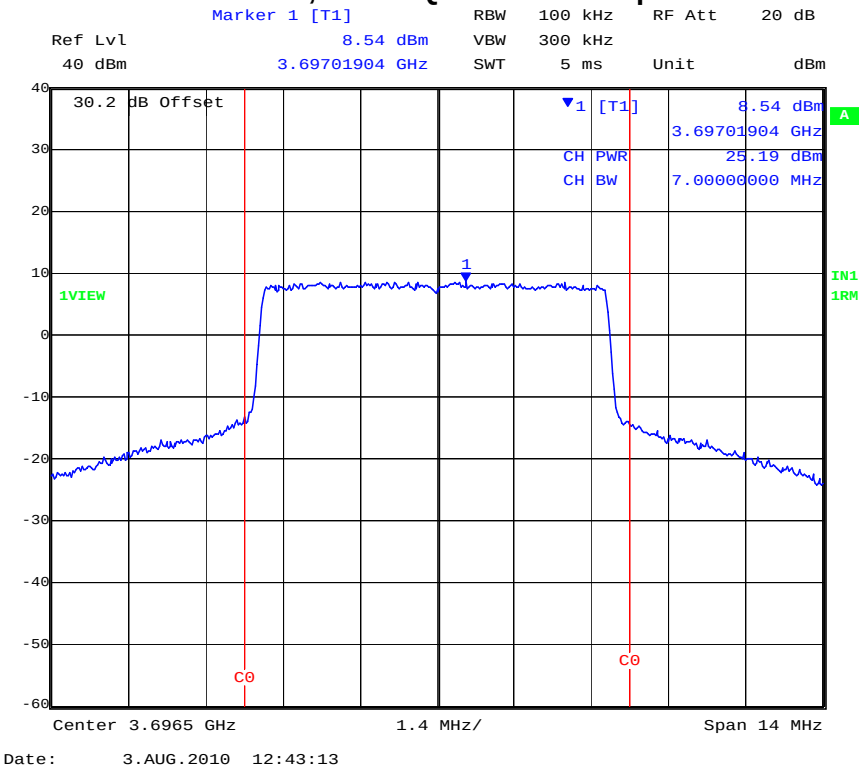



Date: 3.AUG.2010 12:39:00

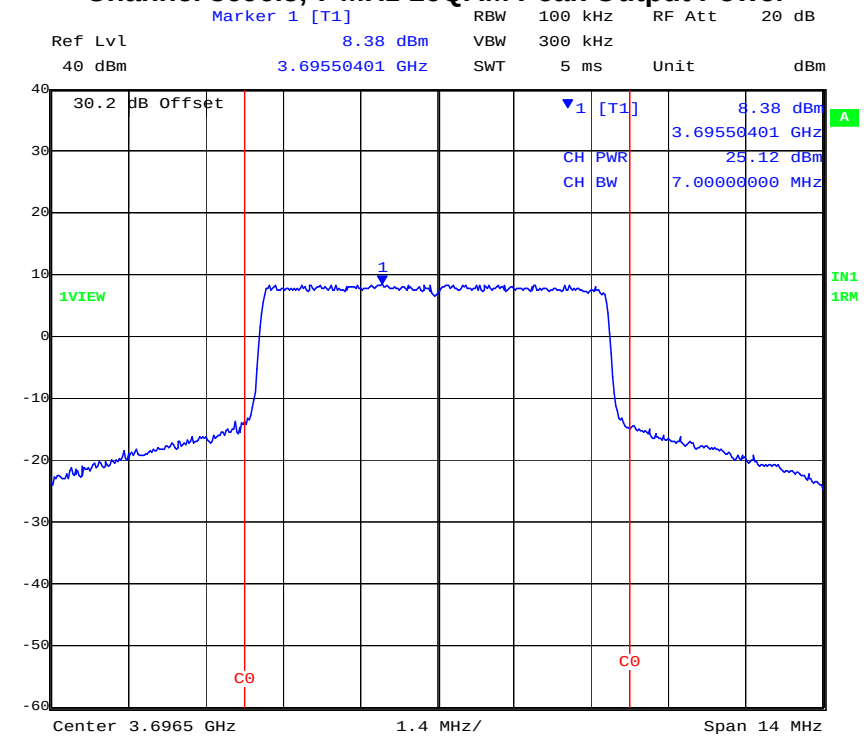
## Channel 3696.5, 7 MHz BPSK Peak Output Power




## Channel 3696.5, 7 MHz QPSK Peak Output Power

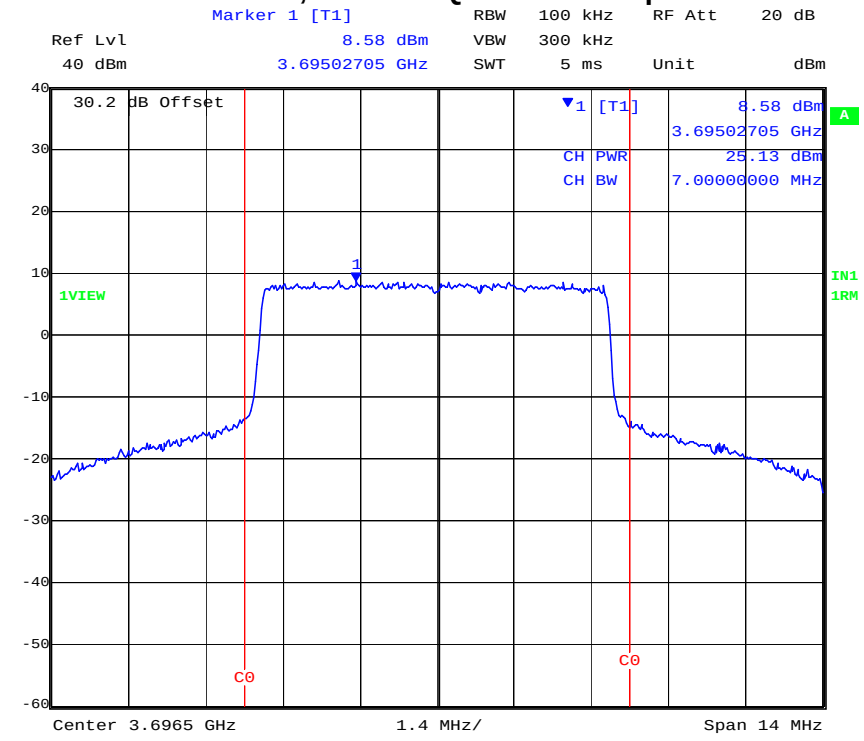


## Channel 3696.5, 7 MHz 16QAM Peak Output Power




Date: 3.AUG.2010 12:45:53

## Channel 3696.5, 7 MHz 64QAM Peak Output Power




Date: 3.AUG.2010 12:46:33

**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)**

**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**

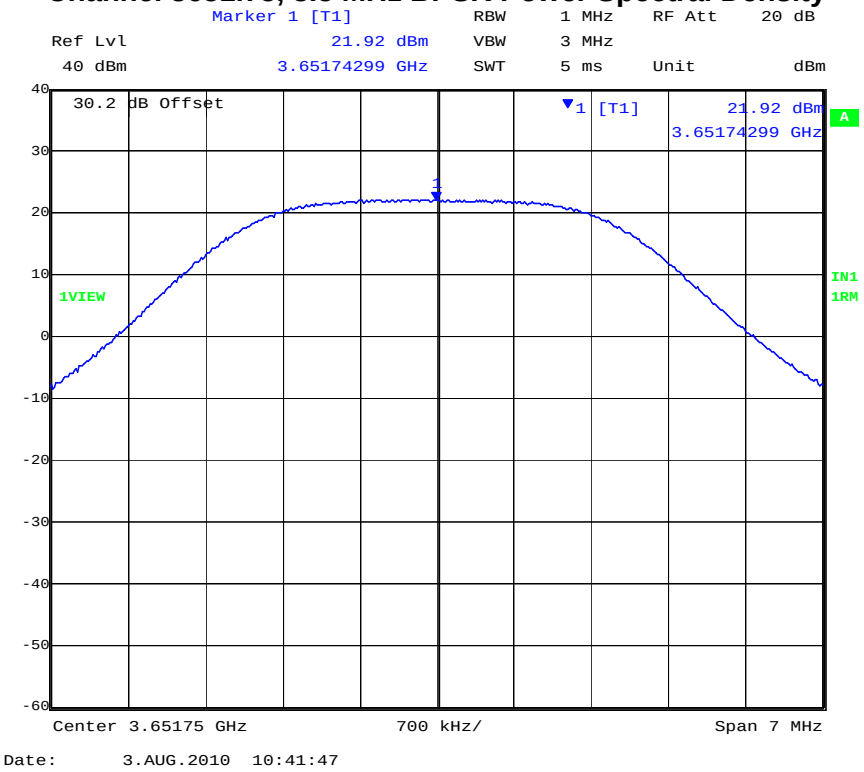
Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

### 3.5 MHz Bandwidth

| | Power Spectral Density (dBm/MHz) | | | | |
|---|---|---|---|---|---|
| Center Frequency (MHz) | BPSK | QPSK | 16 QAM | 64QAM | Minimum Margin (dB) |
| 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 |

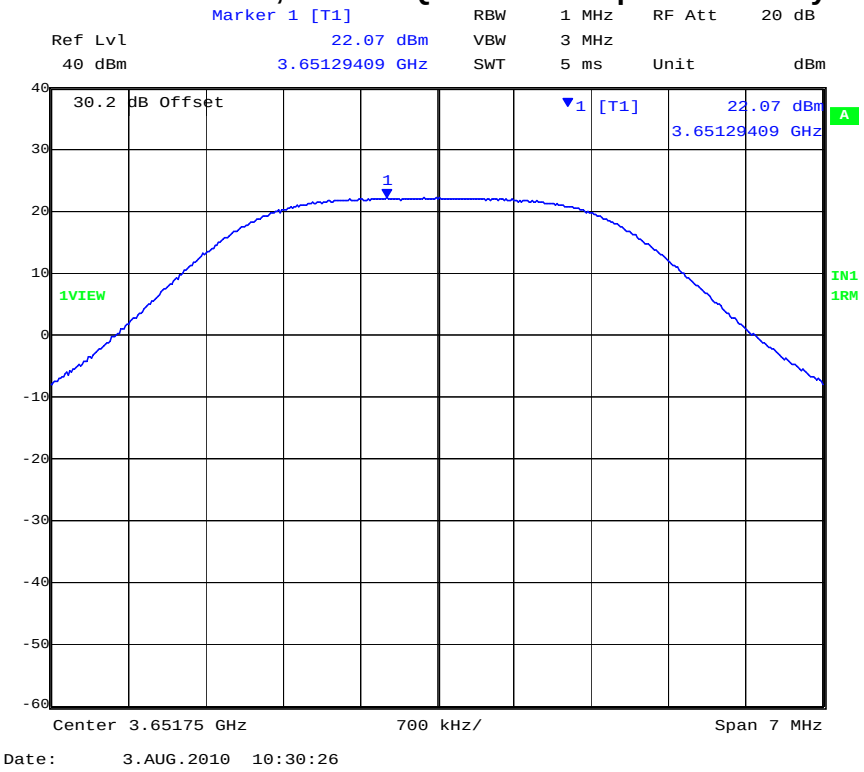
Limit: +30 dBm/MHz

## Channel 3651.75, 3.5 MHz BPSK Power Spectral Density



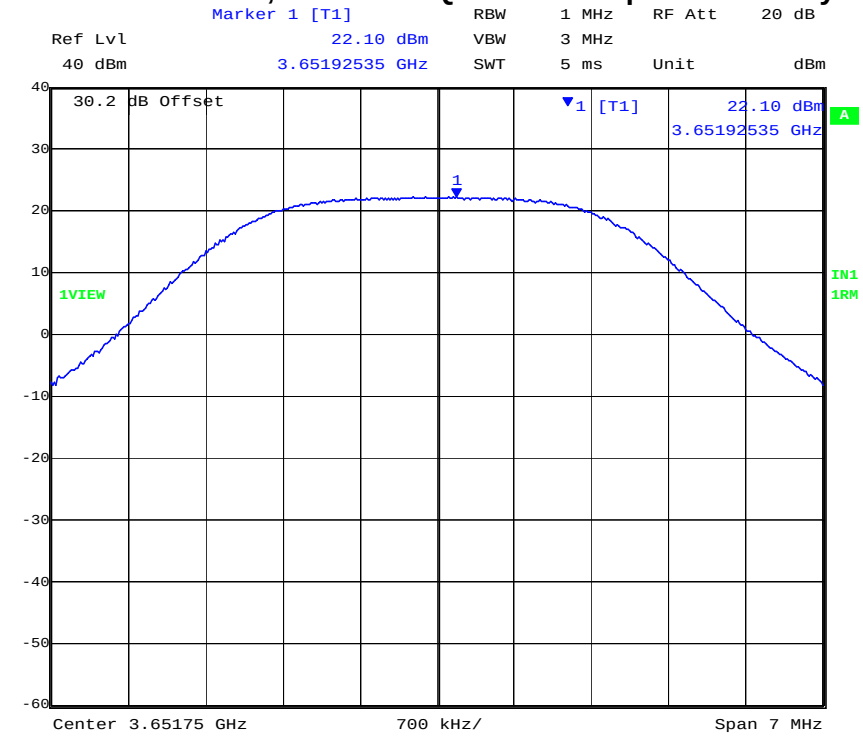

Date: 3.AUG.2010 10:41:47

## Channel 3651.75, 3.5 MHz QPSK Power Spectral Density



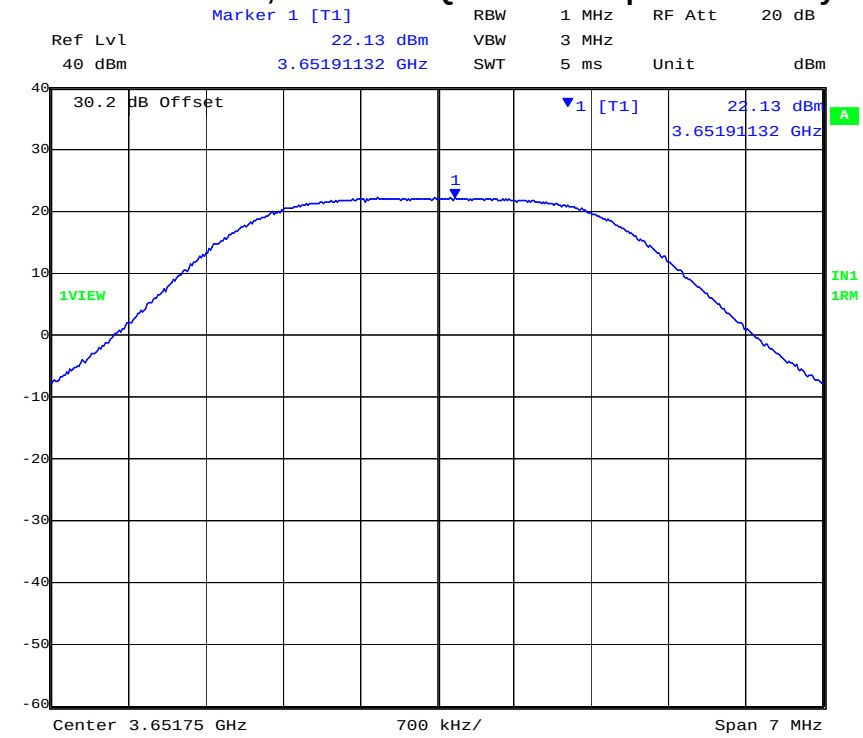

Date: 3.AUG.2010 10:30:26

## Channel 3651.75, 3.5 MHz 16QAM Power Spectral Density



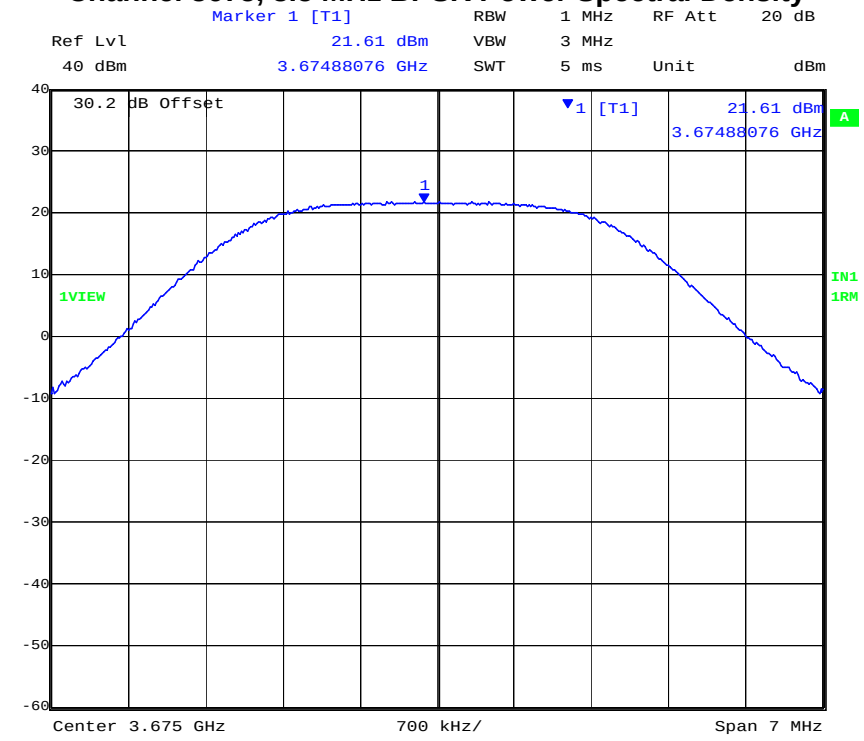

Date: 3.AUG.2010 10:36:11

## Channel 3651.75, 3.5 MHz 64QAM Power Spectral Density



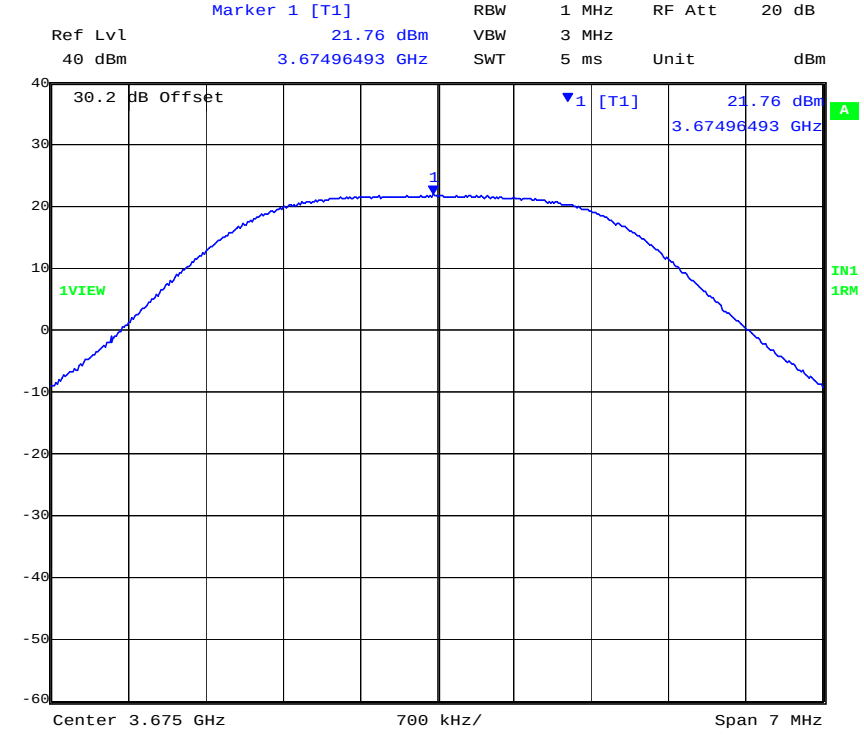

Date: 3.AUG.2010 10:37:10

## Channel 3675, 3.5 MHz BPSK Power Spectral Density



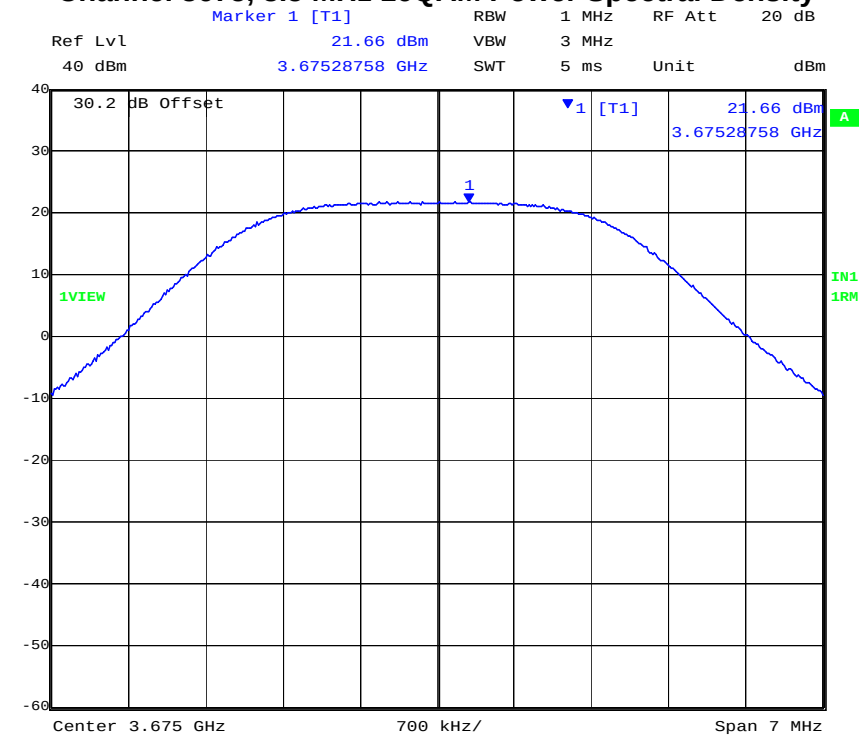

Date: 3.AUG.2010 10:44:28

## Channel 3675, 3.5 MHz QPSK Power Spectral Density



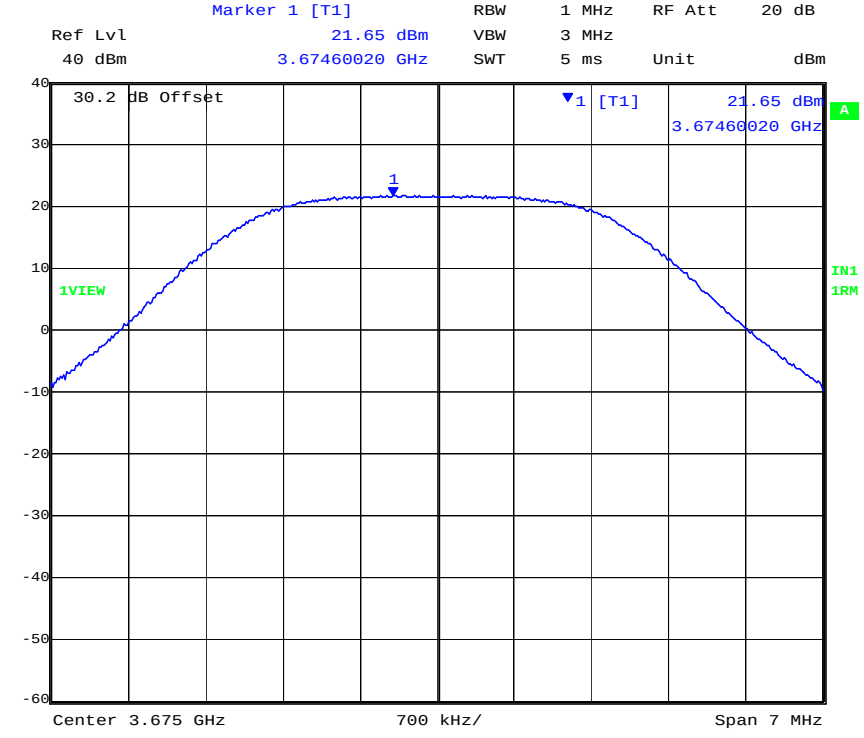

Date: 3.AUG.2010 10:49:45

## Channel 3675, 3.5 MHz 16QAM Power Spectral Density



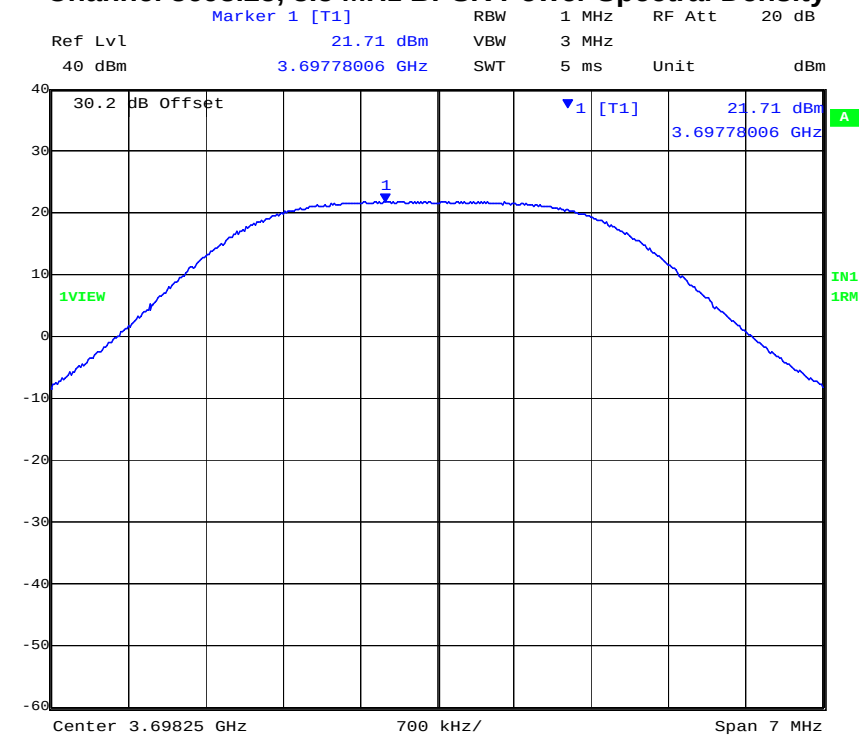

Date: 3.AUG.2010 10:51:42

## Channel 3675, 3.5 MHz 64QAM Power Spectral Density



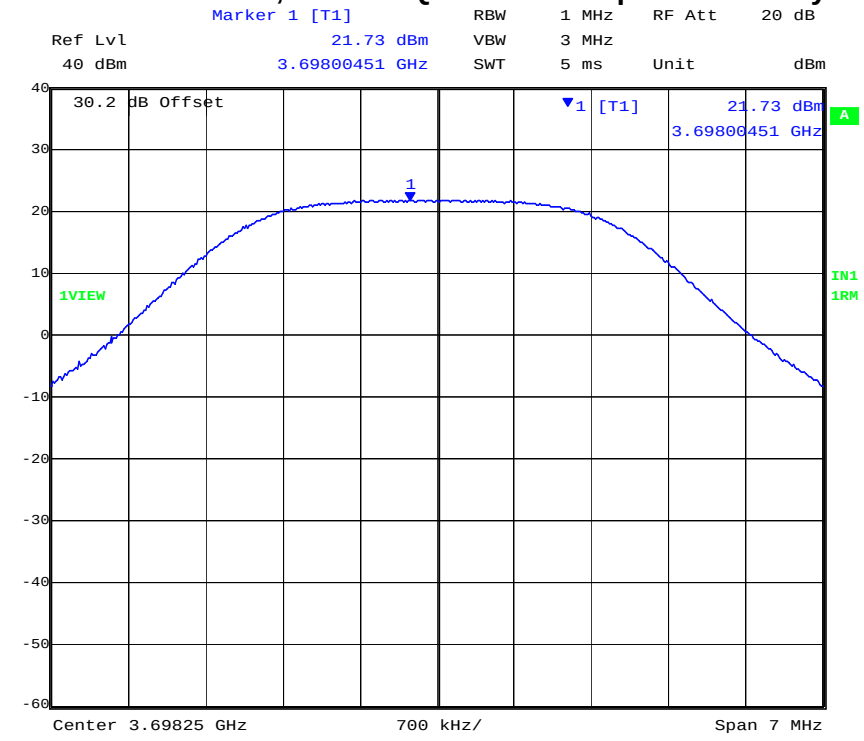

Date: 3.AUG.2010 10:54:28

## Channel 3698.25, 3.5 MHz BPSK Power Spectral Density



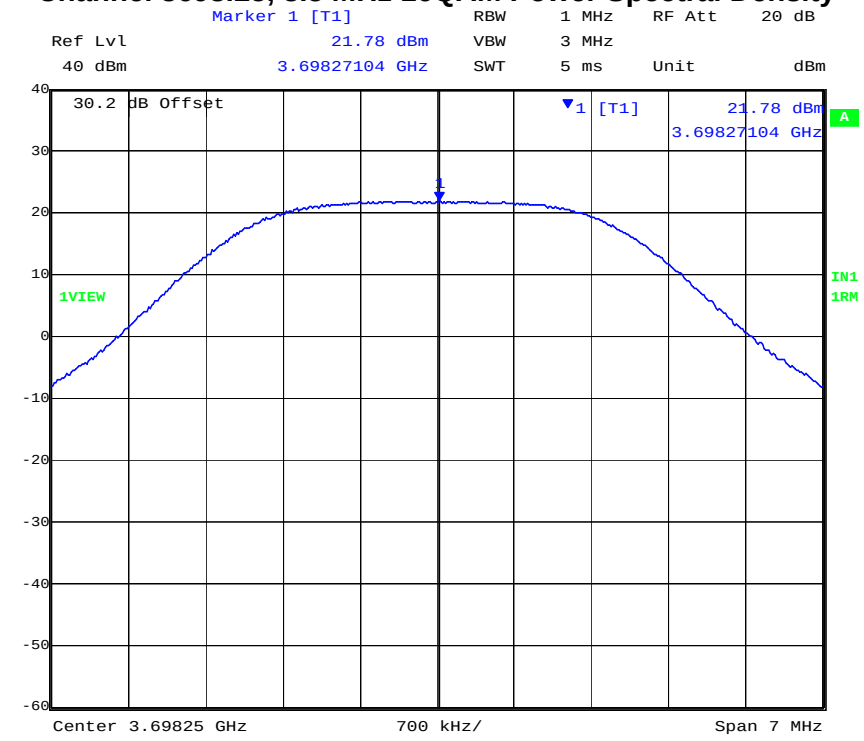

Date: 3.AUG.2010 11:10:03

## Channel 3698.25, 3.5 MHz QPSK Power Spectral Density



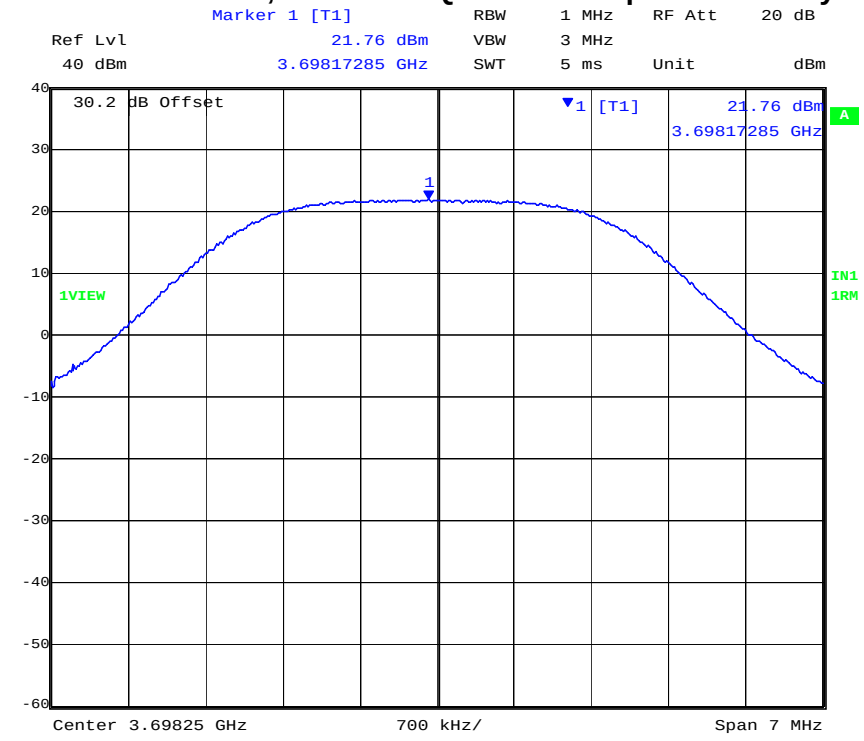

Date: 3.AUG.2010 11:12:53

## Channel 3698.25, 3.5 MHz 16QAM Power Spectral Density




Date: 3.AUG.2010 11:19:17

## Channel 3698.25, 3.5 MHz 64QAM Power Spectral Density



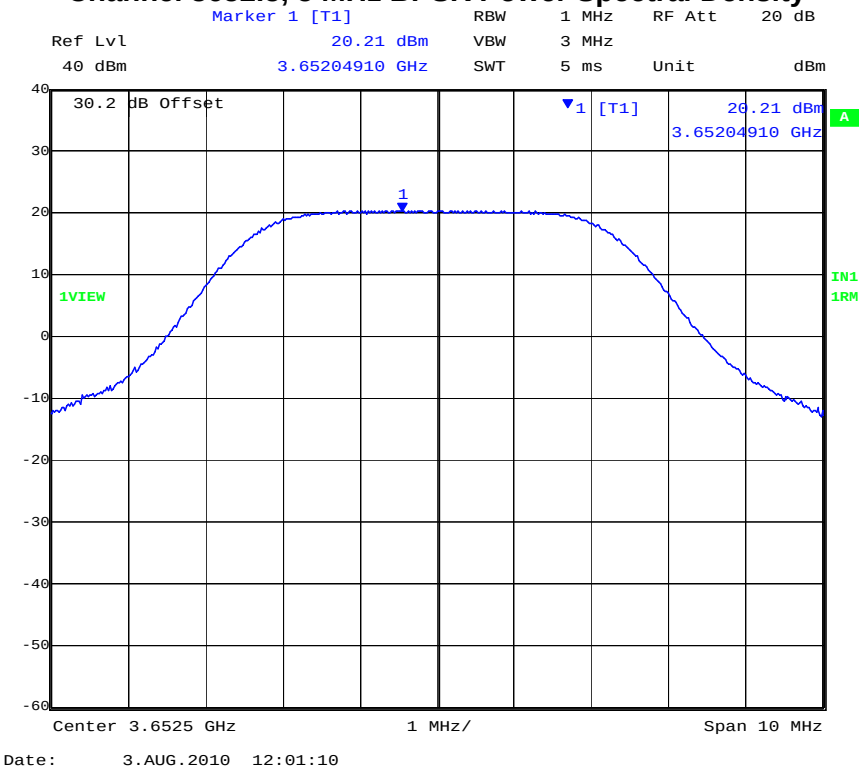

Date: 3.AUG.2010 11:20:31

**5 MHz Bandwidth**

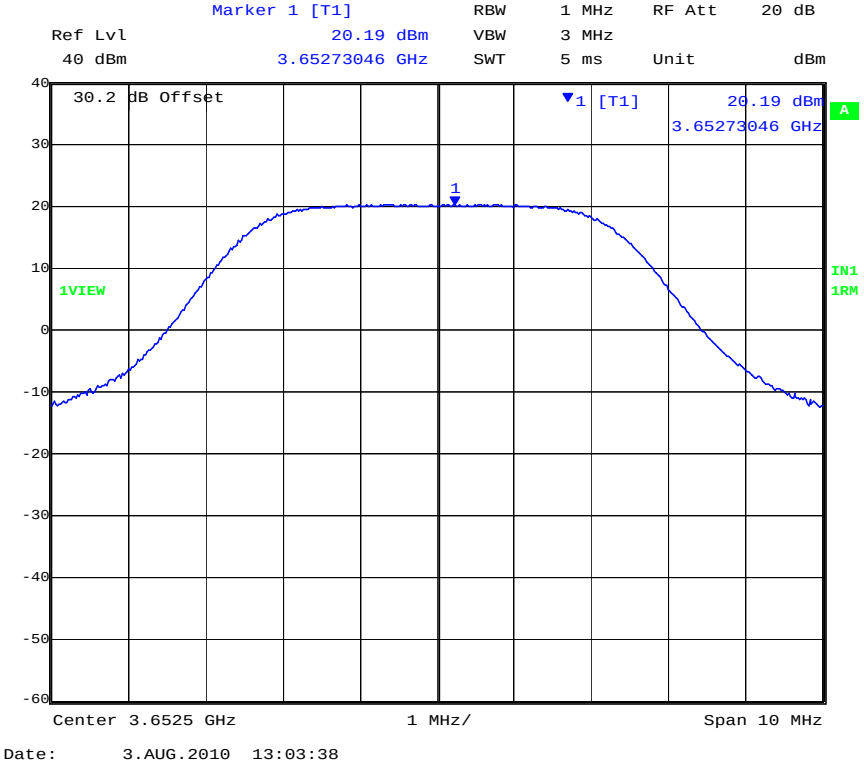
| | Power Spectral Density (dBm/MHz) | | | | |
|---|---|---|---|---|---|
| **Center Frequency (MHz)** | **BPSK** | **QPSK** | **16 QAM** | **64QAM** | **Minimum Margin (dB)** |
| 3652.50 | +20.21 | +20.19 | +20.24 | +20.36 | -9.64 |
| 3675.00 | +19.84 | +19.86 | +19.88 | +19.98 | -10.02 |
| 3697.50 |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

Limit: +30 dBm/MHz

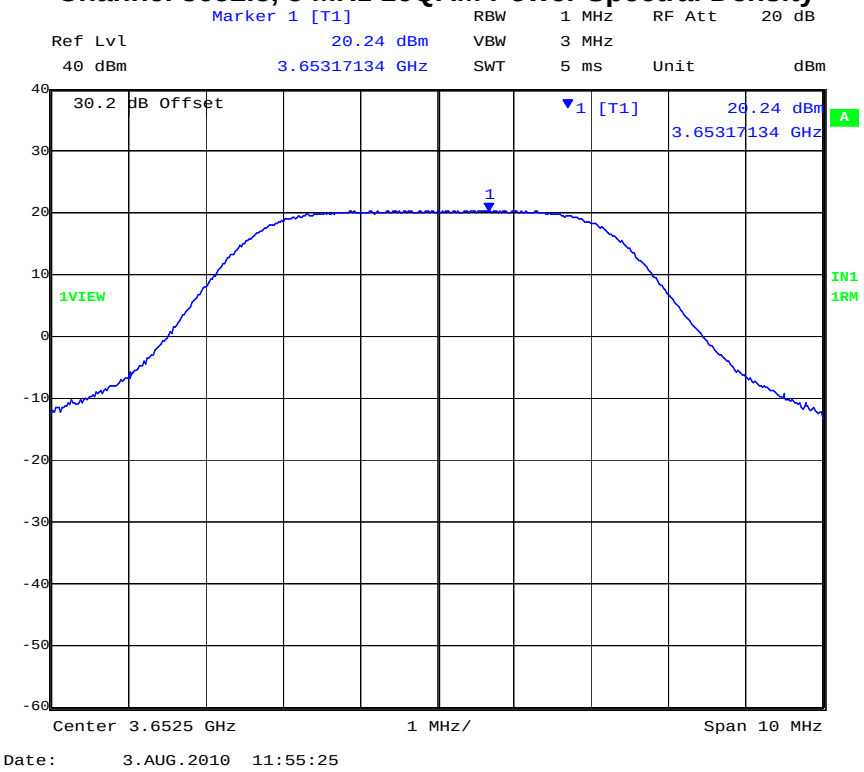
## Channel 3652.5, 5 MHz BPSK Power Spectral Density




## Channel 3652.5, 5 MHz QPSK Power Spectral Density

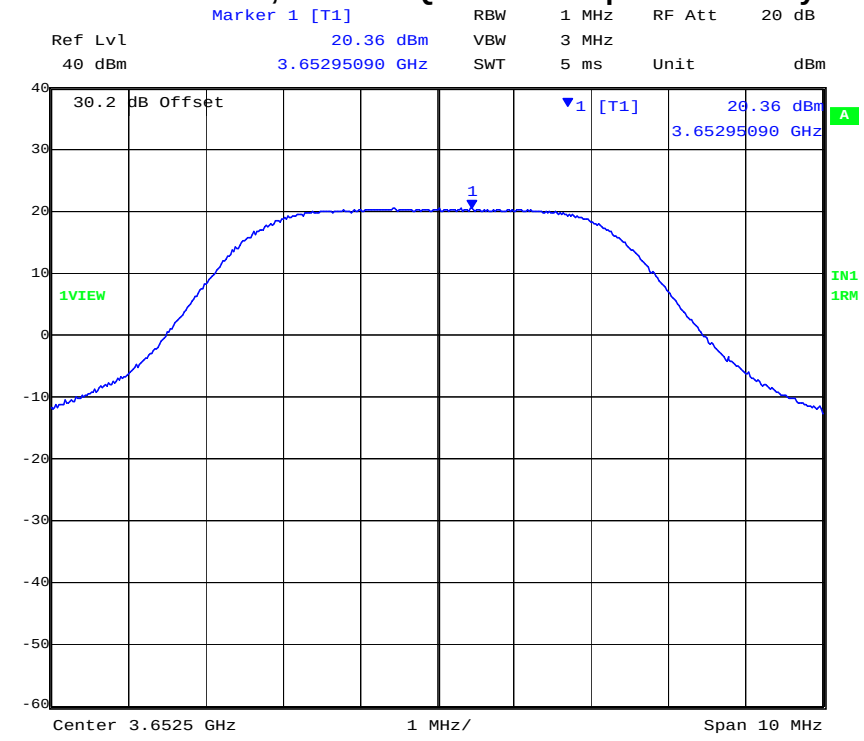


## Channel 3652.5, 5 MHz 16QAM Power Spectral Density



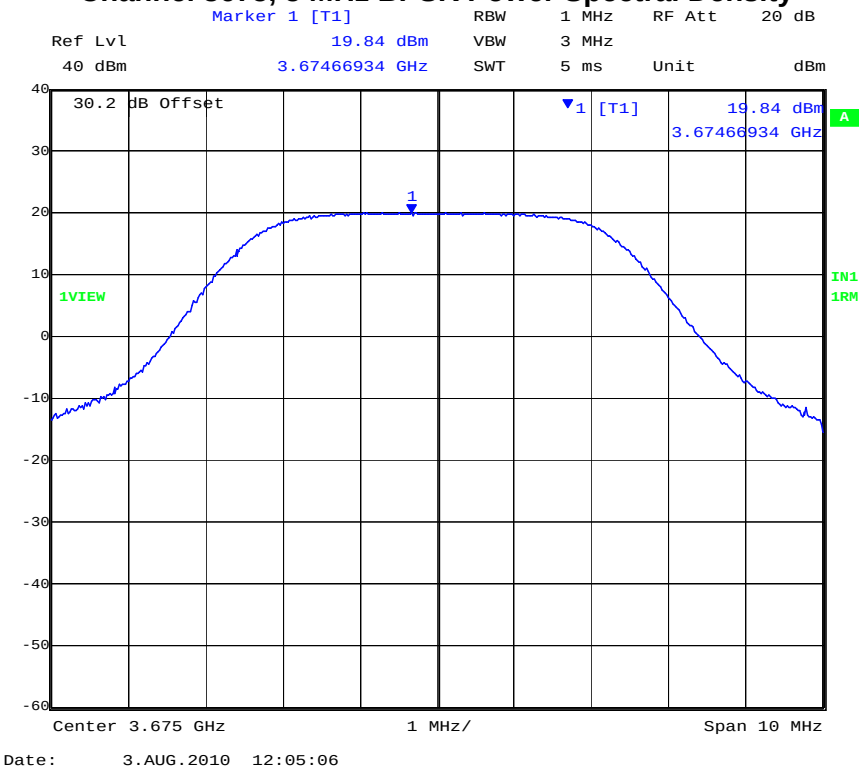

Date: 3.AUG.2010 11:55:25

## Channel 3652.5, 5 MHz 64QAM Power Spectral Density

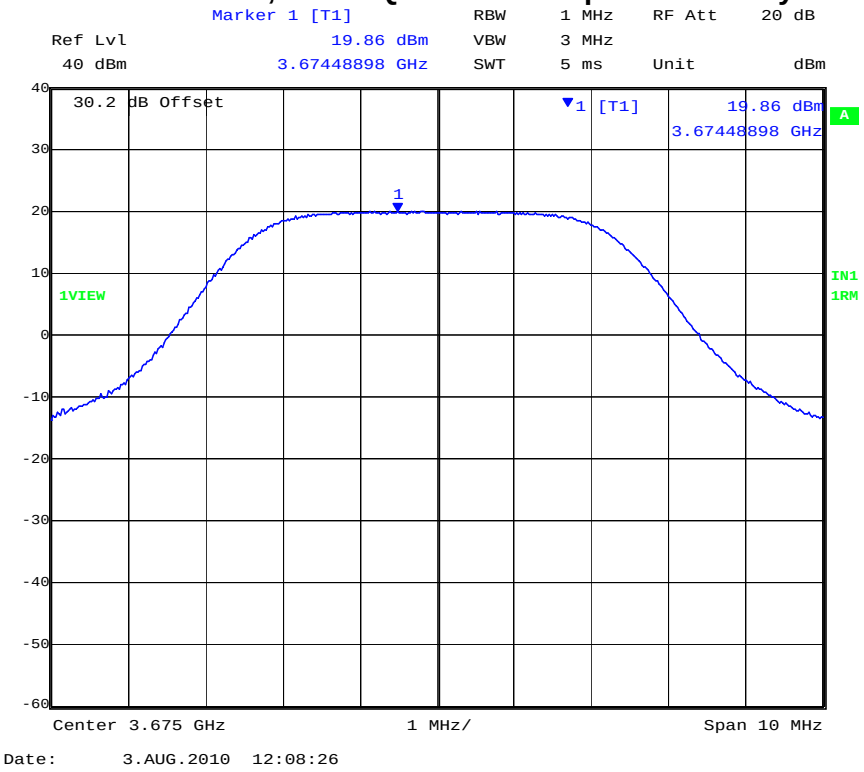



Date: 3.AUG.2010 11:56:34

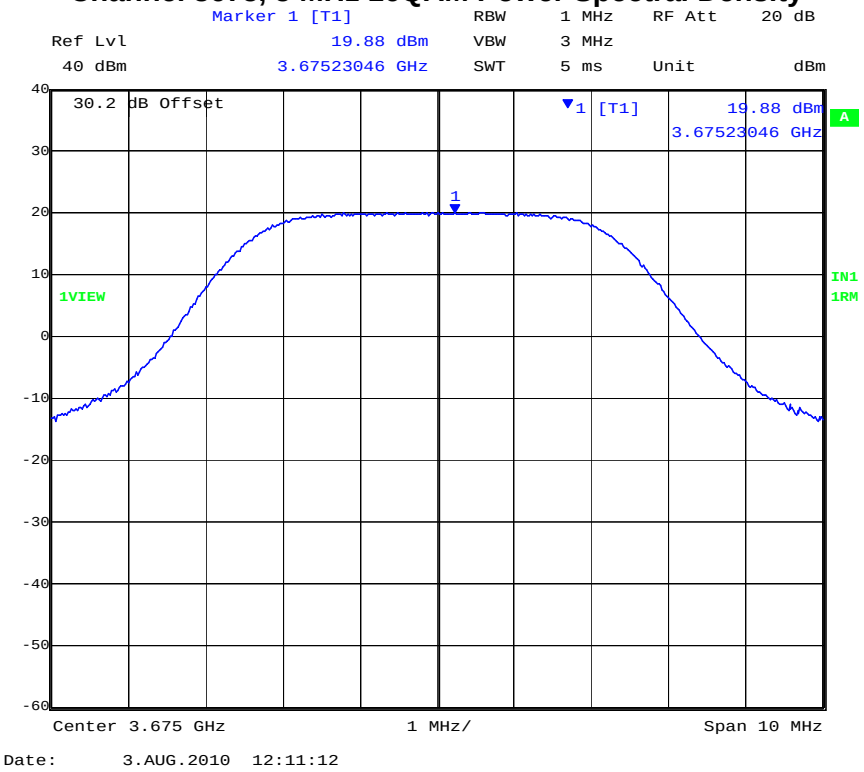
## Channel 3675, 5 MHz BPSK Power Spectral Density



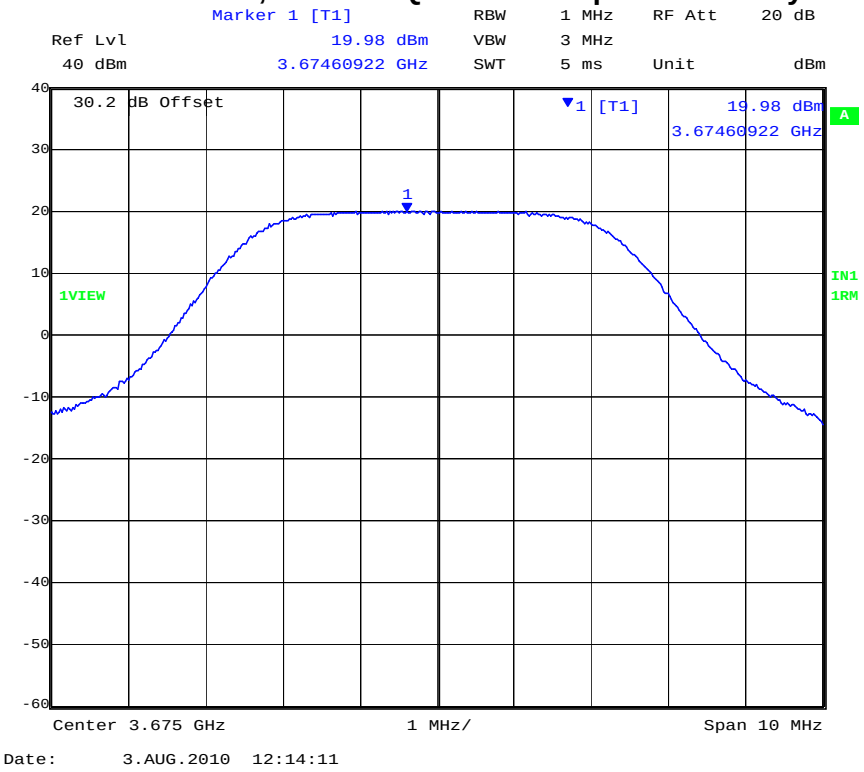

## Channel 3675, 5 MHz QPSK Power Spectral Density



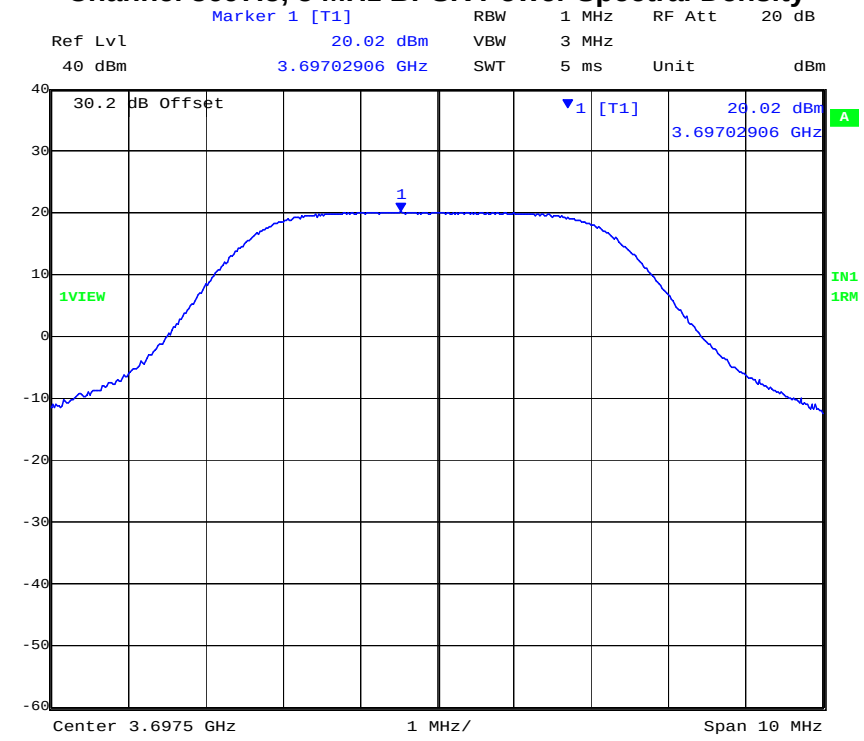
## Channel 3675, 5 MHz 16QAM Power Spectral Density




## Channel 3675, 5 MHz 64QAM Power Spectral Density

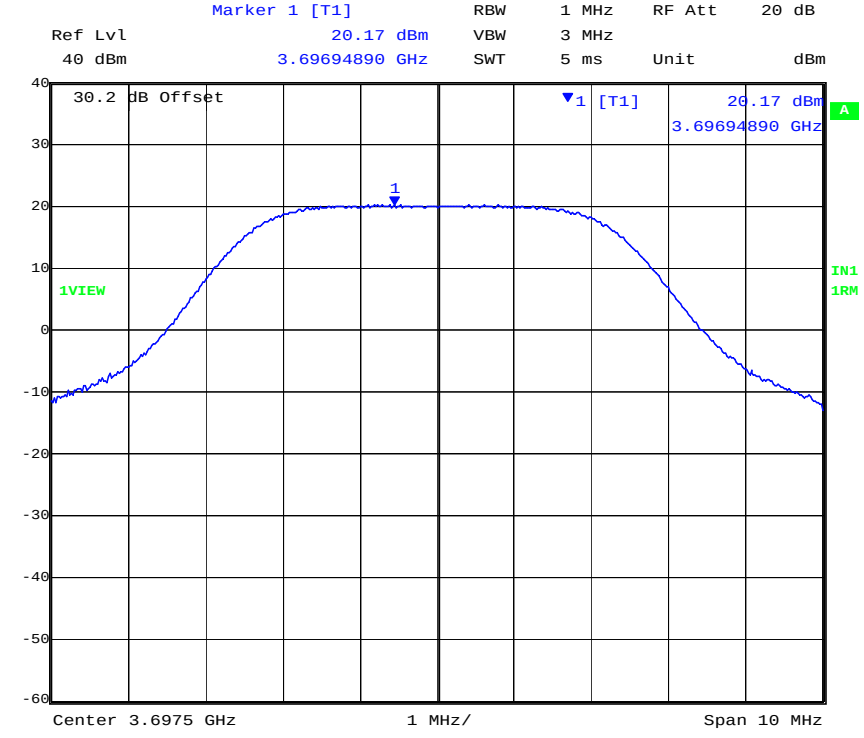


## Channel 3697.5, 5 MHz BPSK Power Spectral Density



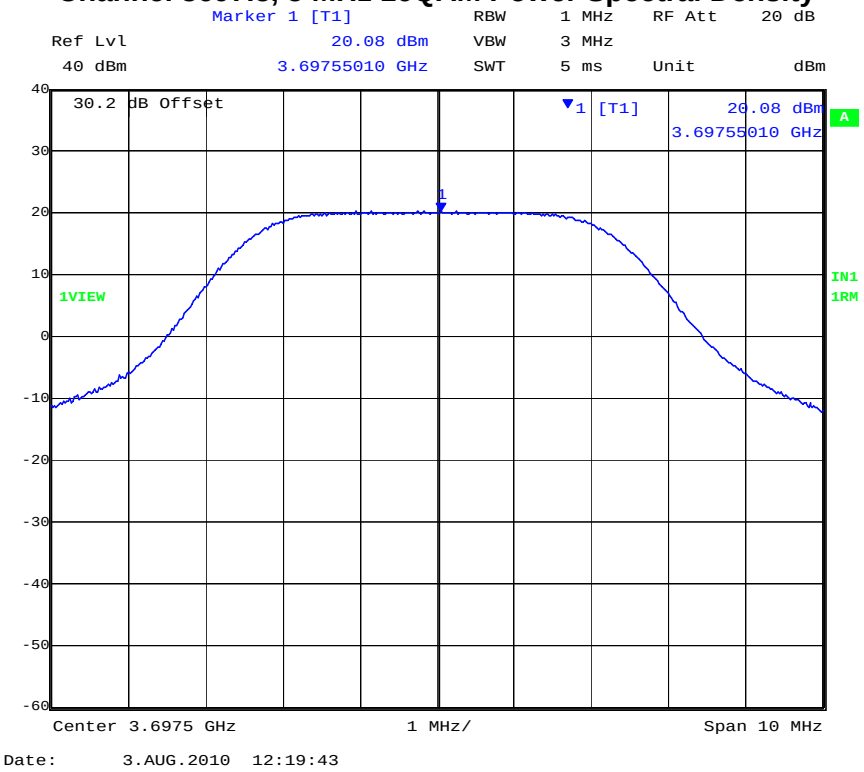

Date: 3.AUG.2010 13:02:09

## Channel 3697.5, 5 MHz QPSK Power Spectral Density



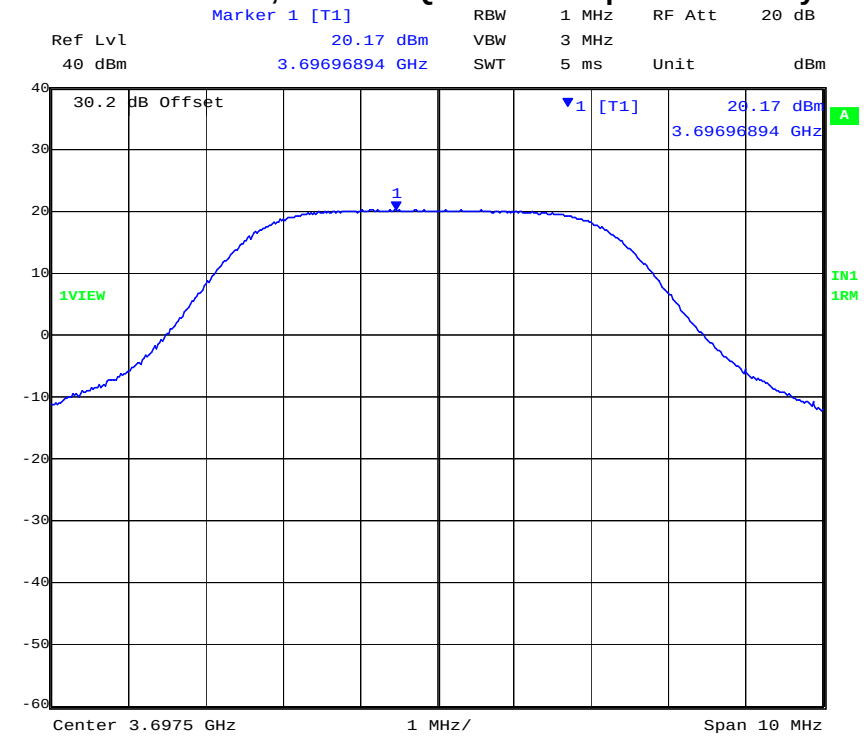

Date: 3.AUG.2010 12:18:53

## Channel 3697.5, 5 MHz 16QAM Power Spectral Density




Date: 3.AUG.2010 12:19:43

## Channel 3697.5, 5 MHz 64QAM Power Spectral Density



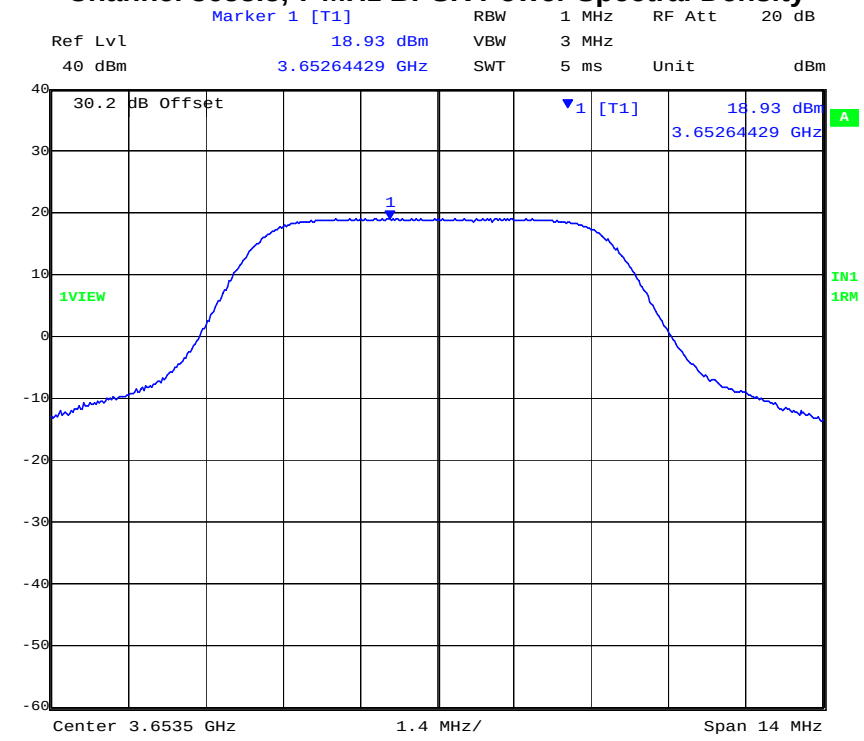

Date: 3.AUG.2010 12:22:46

**7 MHz Bandwidth**

| | Power Spectral Density (dBm/MHz) | | | | |
|---|---|---|---|---|---|
| Center Frequency (MHz) | BPSK | QPSK | 16 QAM | 64QAM | Minimum Margin (dB) |
| 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 |

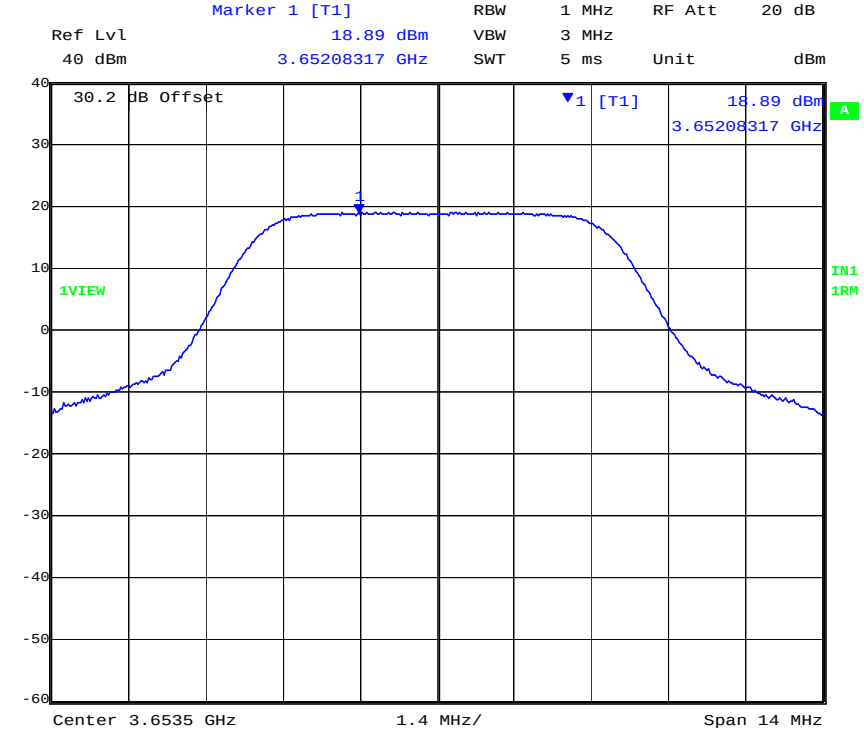
Limit: +30 dBm/MHz

## Channel 3653.5, 7 MHz BPSK Power Spectral Density



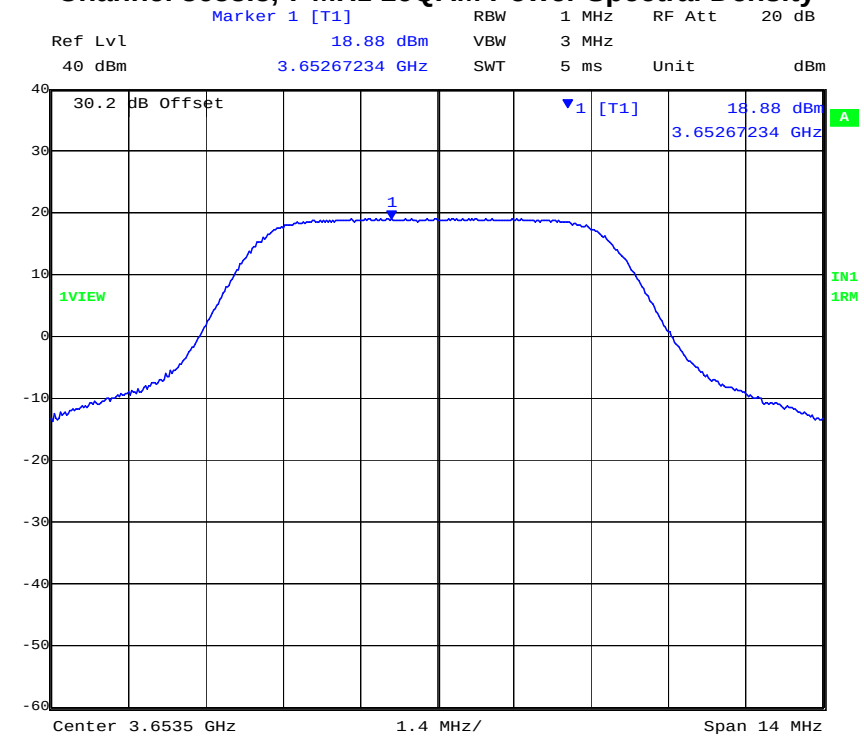

Date: 3.AUG.2010 12:24:57

## Channel 3653.5, 7 MHz QPSK Power Spectral Density



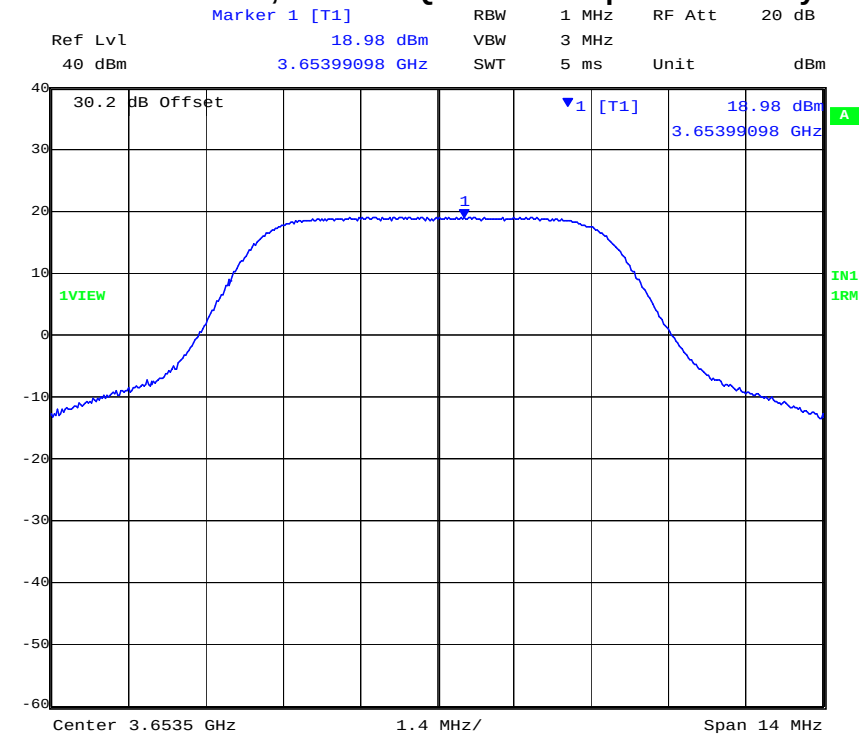

Date: 3.AUG.2010 12:28:22

## Channel 3653.5, 7 MHz 16QAM Power Spectral Density



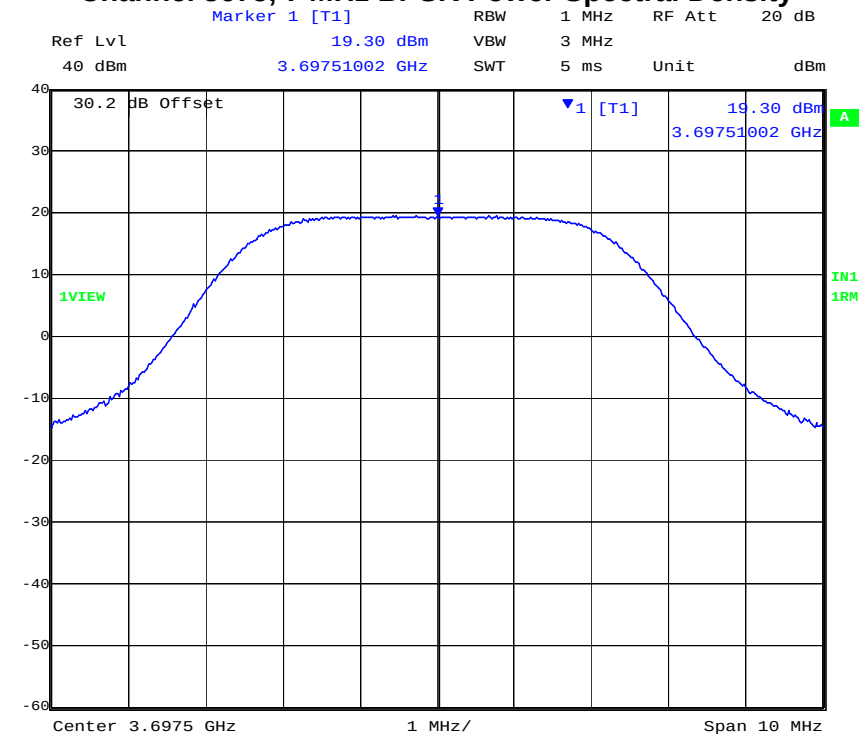

Date: 3.AUG.2010 12:29:06

## Channel 3653.5, 7 MHz 64QAM Power Spectral Density



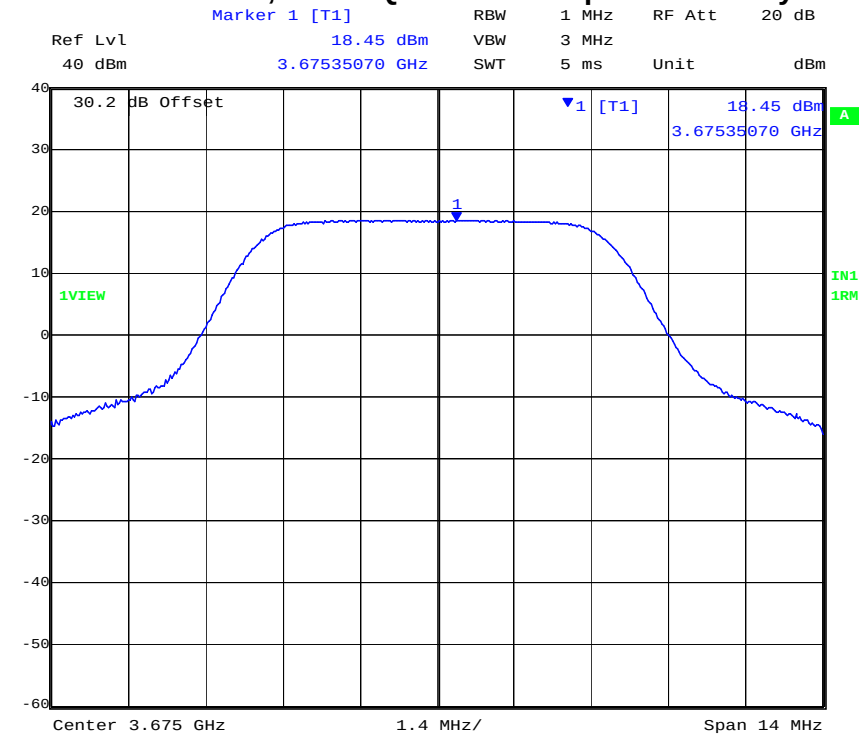

Date: 3.AUG.2010 12:31:52

## Channel 3675, 7 MHz BPSK Power Spectral Density



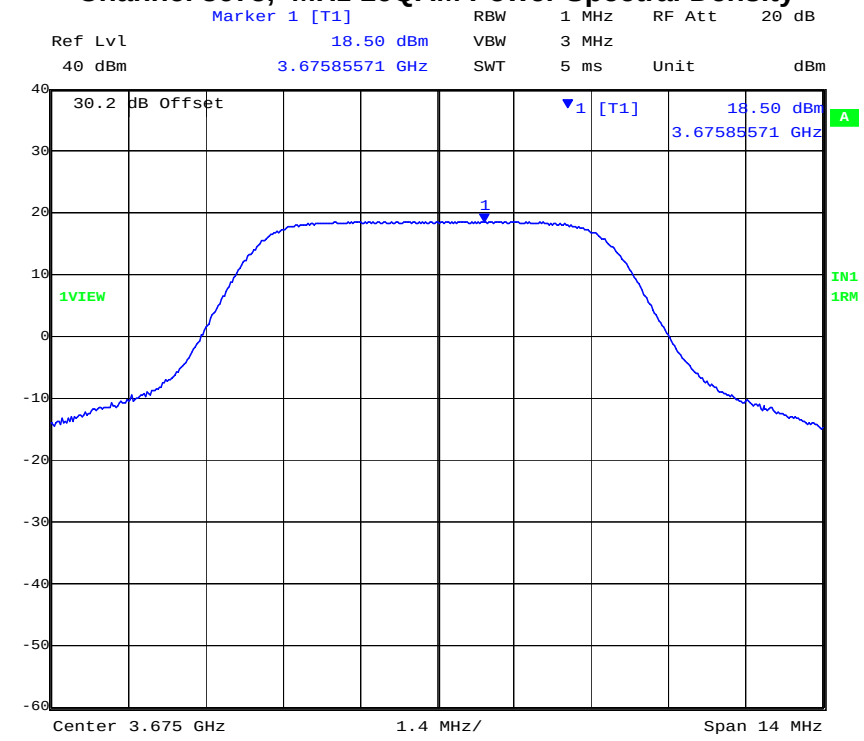

Date: 3.AUG.2010 13:00:33

## Channel 3675, 7 MHz QPSK Power Spectral Density



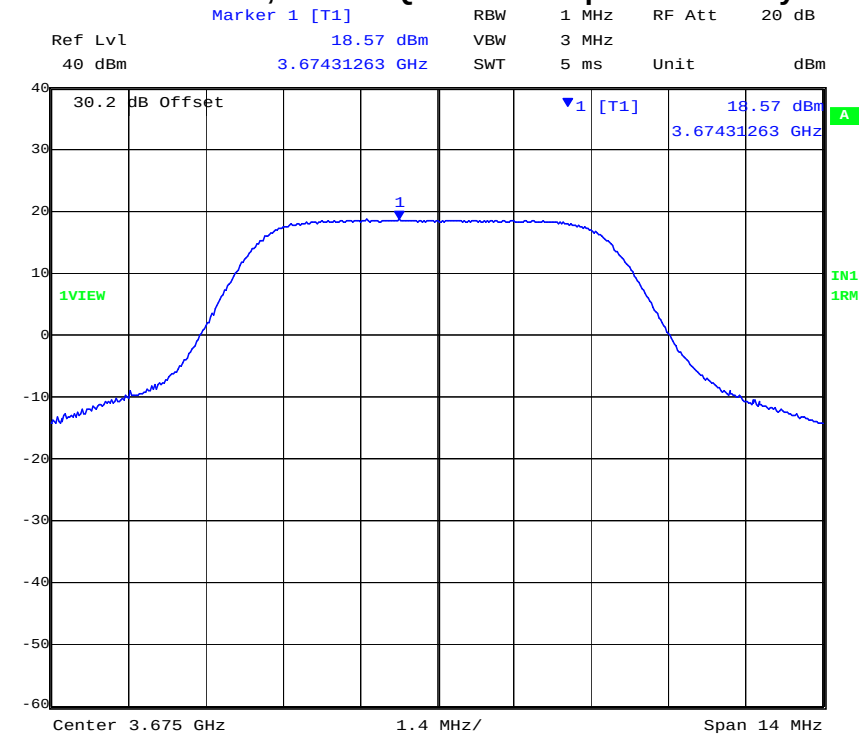

Date: 3.AUG.2010 12:36:15

## Channel 3675, MHz 16QAM Power Spectral Density



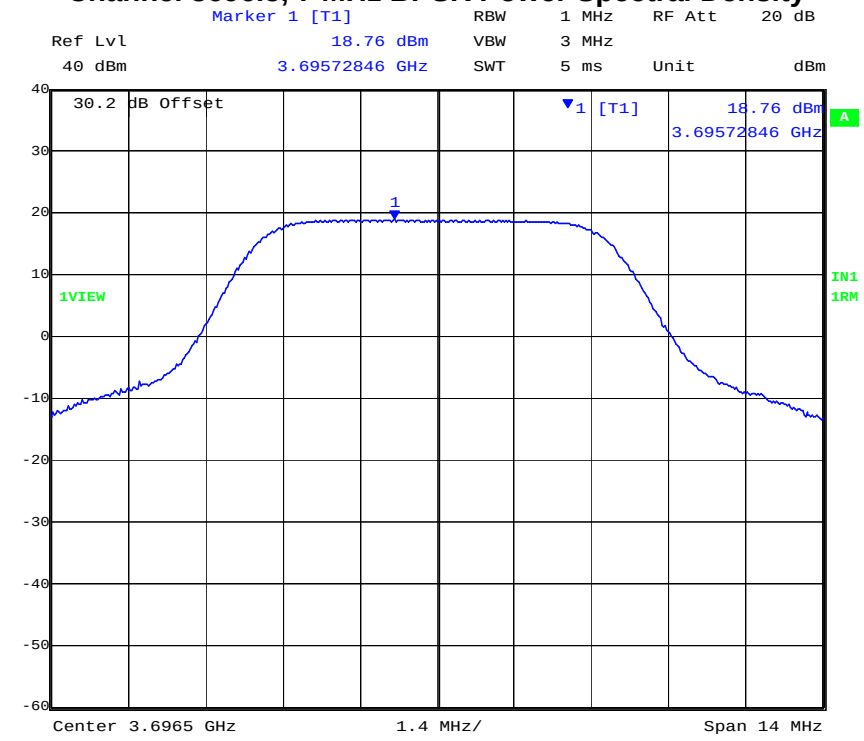

Date: 3.AUG.2010 12:36:58

## Channel 3675, MHz 64QAM Power Spectral Density



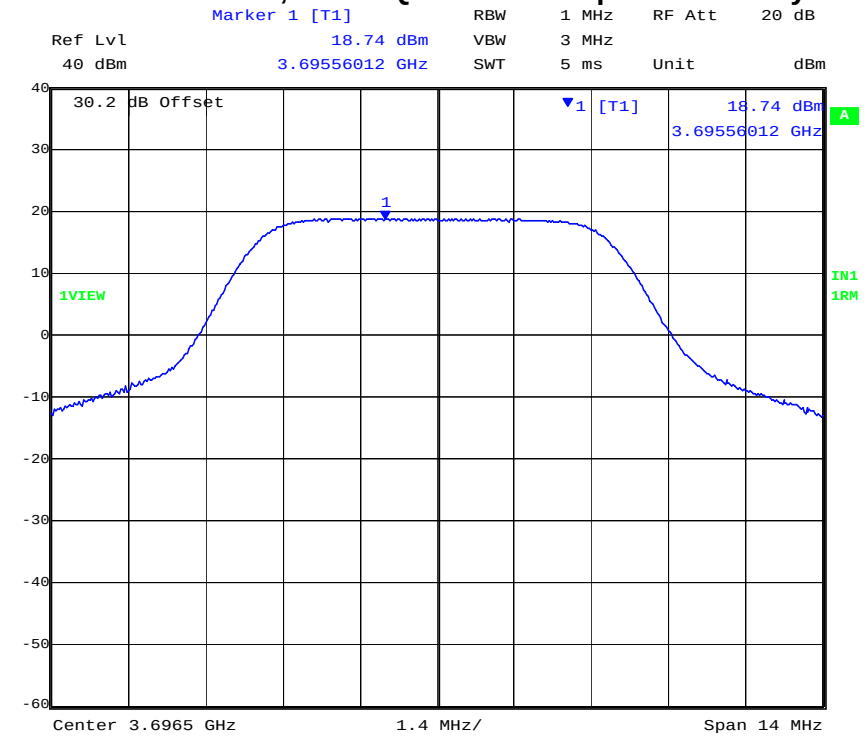

Date: 3.AUG.2010 12:40:17

## Channel 3696.5, 7 MHz BPSK Power Spectral Density



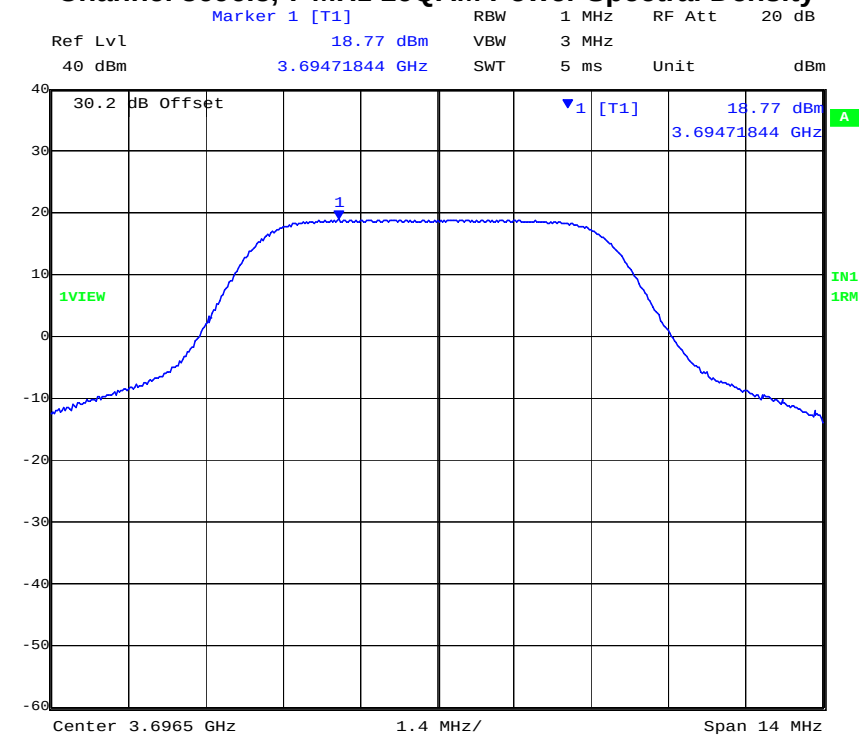

Date: 3.AUG.2010 12:41:09

## Channel 3696.5, 7 MHz QPSK Power Spectral Density



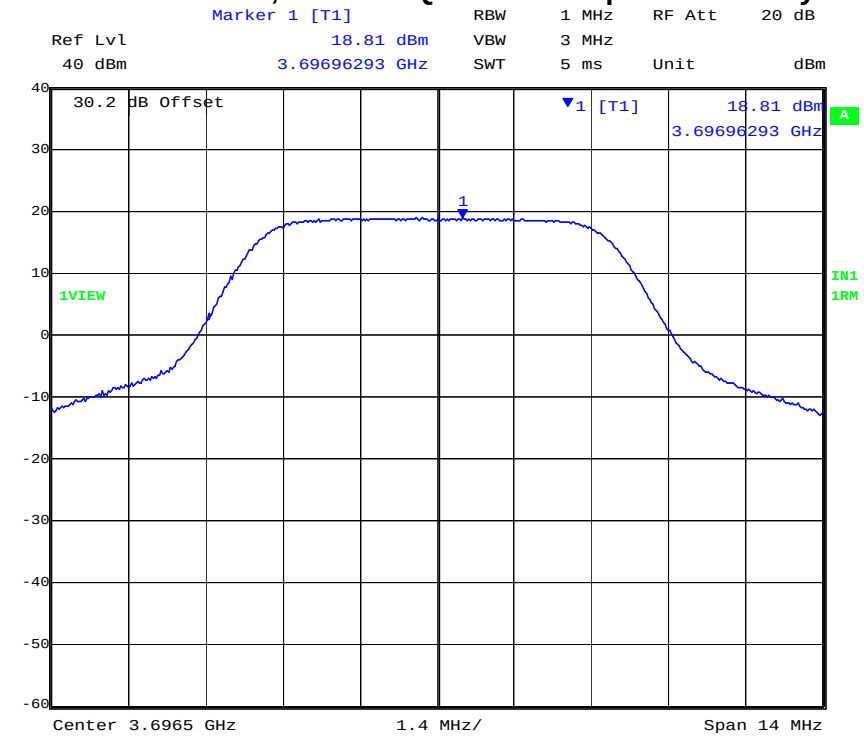

Date: 3.AUG.2010 12:44:05

## Channel 3696.5, 7 MHz 16QAM Power Spectral Density




Date: 3.AUG.2010 12:44:43

## Channel 3696.5, 7 MHz 64QAM Power Spectral Density




Date: 3.AUG.2010 12:47:33

**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**
**Industry Canada RSS-Gen 5.5**

**Calculations for Maximum Permissible Exposure Levels**

Power Density = Pd (mW/cm$^2$) = EIRP/(4$\pi$d$^2$)

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-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/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 | 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 / 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)**

**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.

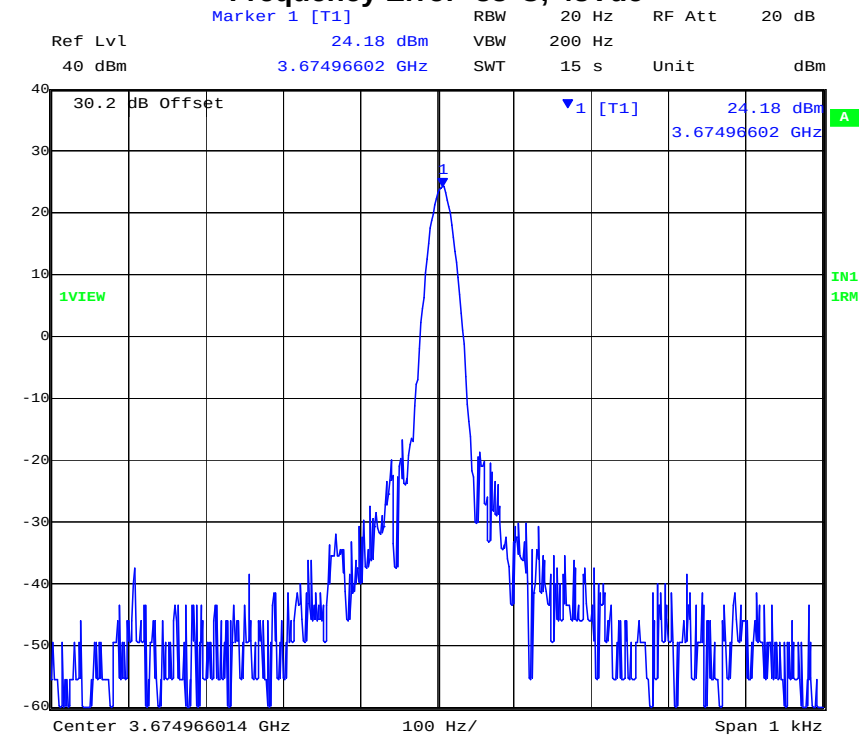
**Test Set-up is shown in Section 3.6 Test Configuration**

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

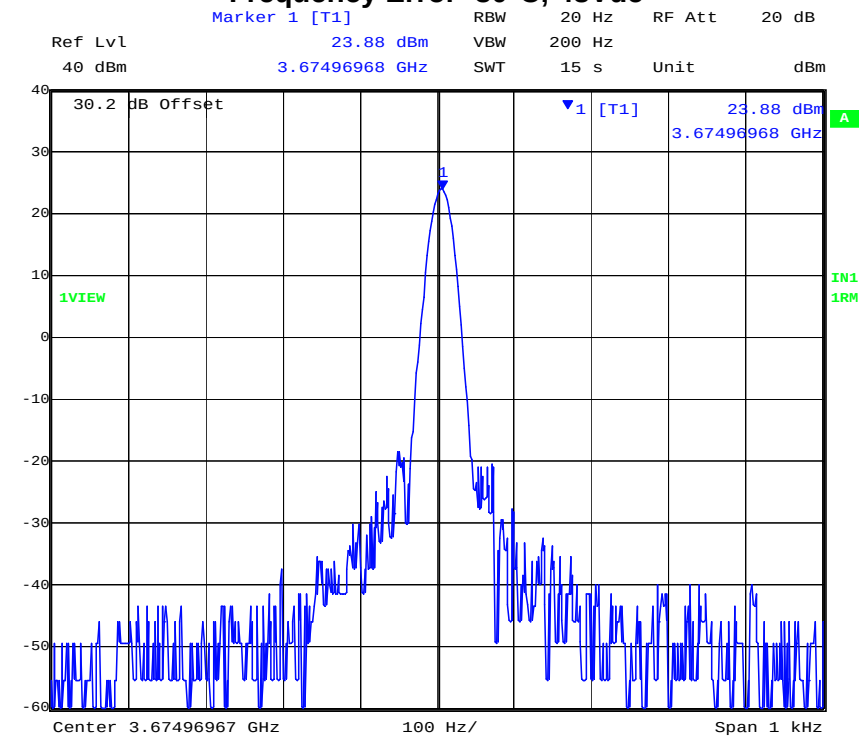
TABLE OF RESULTS Frequency Stability – Channel Measured 3675 MHz

| 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 | | |

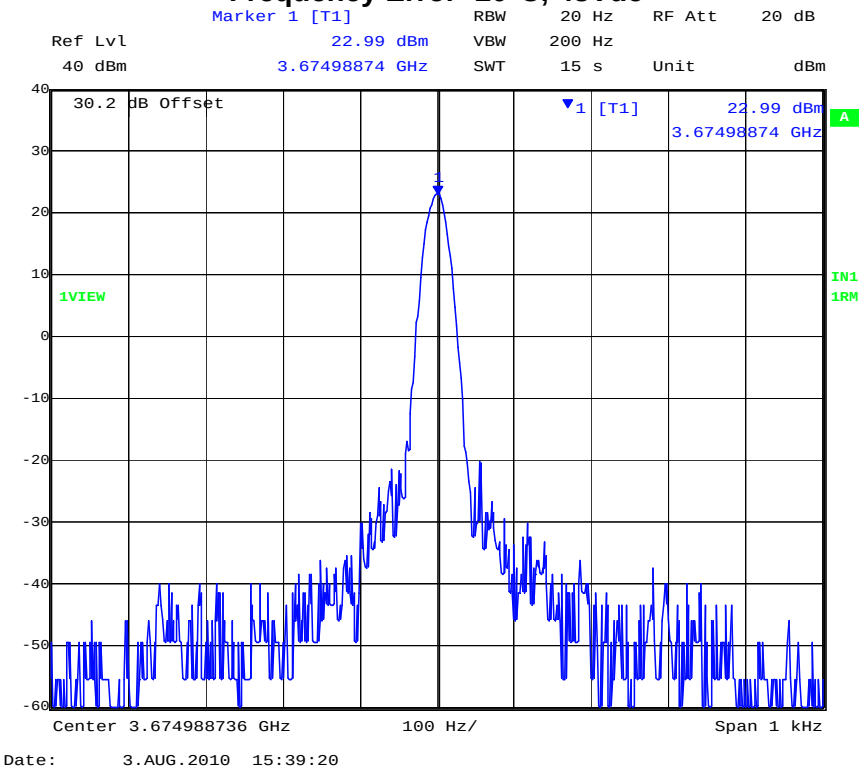
## Frequency Error -33°C, 48Vdc



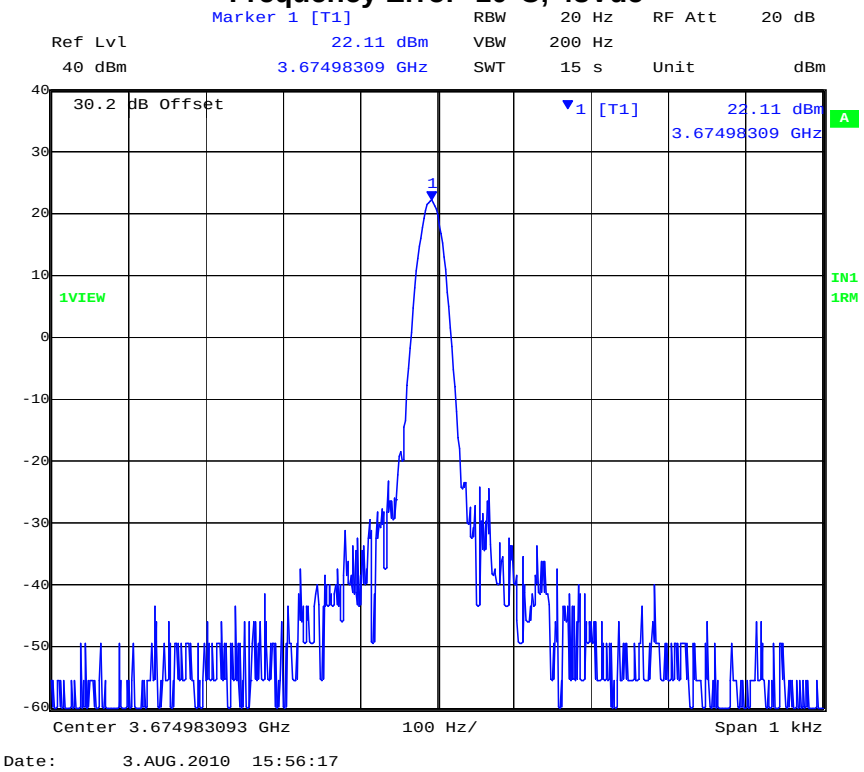

## Frequency Error -30°C, 48Vdc



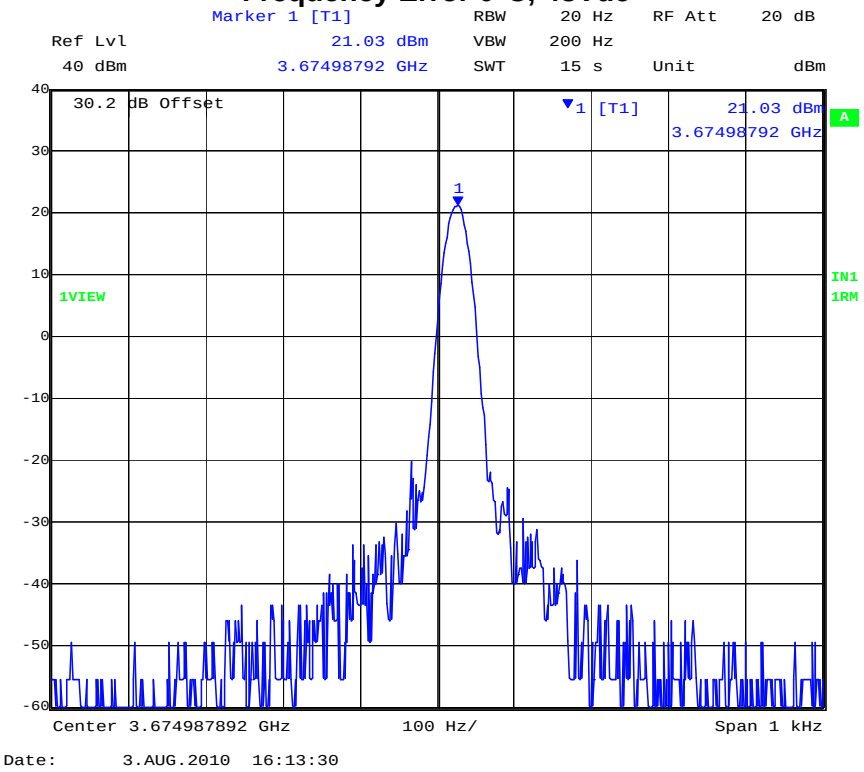
## Frequency Error -20°C, 48Vdc



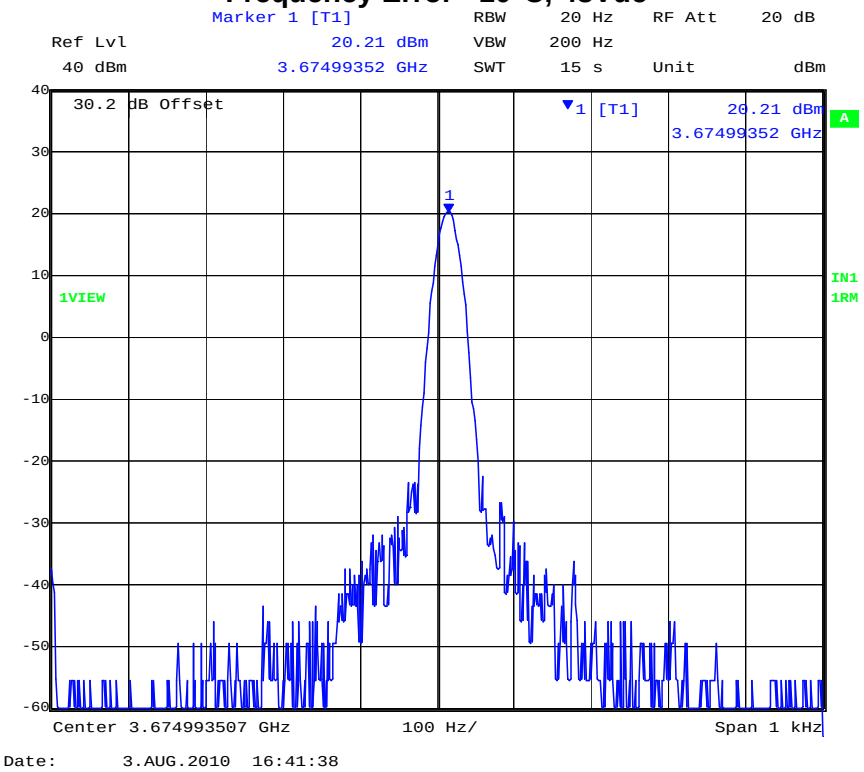

## Frequency Error -10°C, 48Vdc



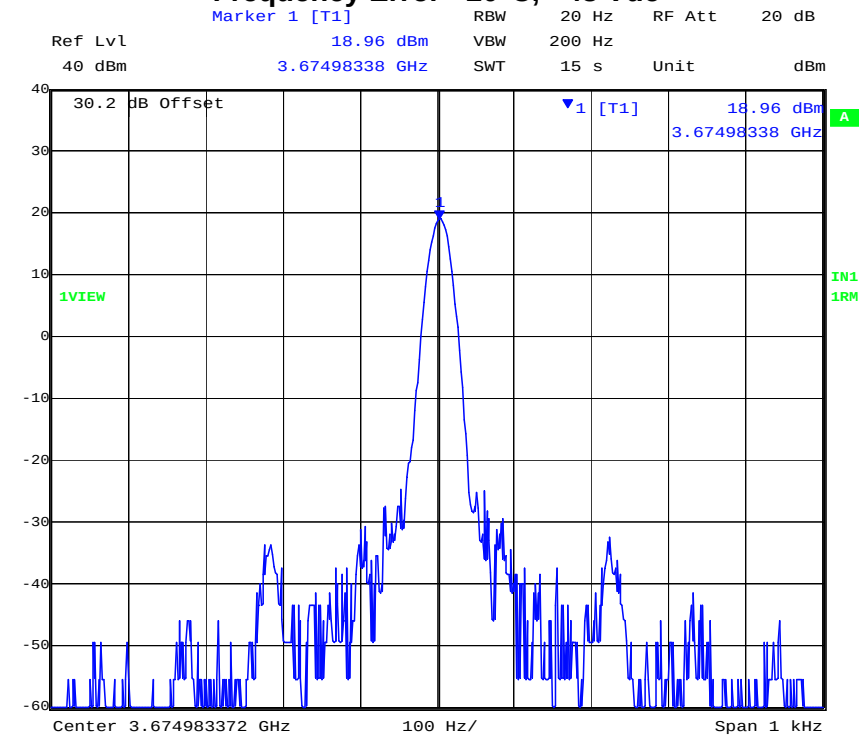
## Frequency Error 0°C, 48Vdc




## Frequency Error +10°C, 48Vdc



## Frequency Error +20°C, +48 Vdc

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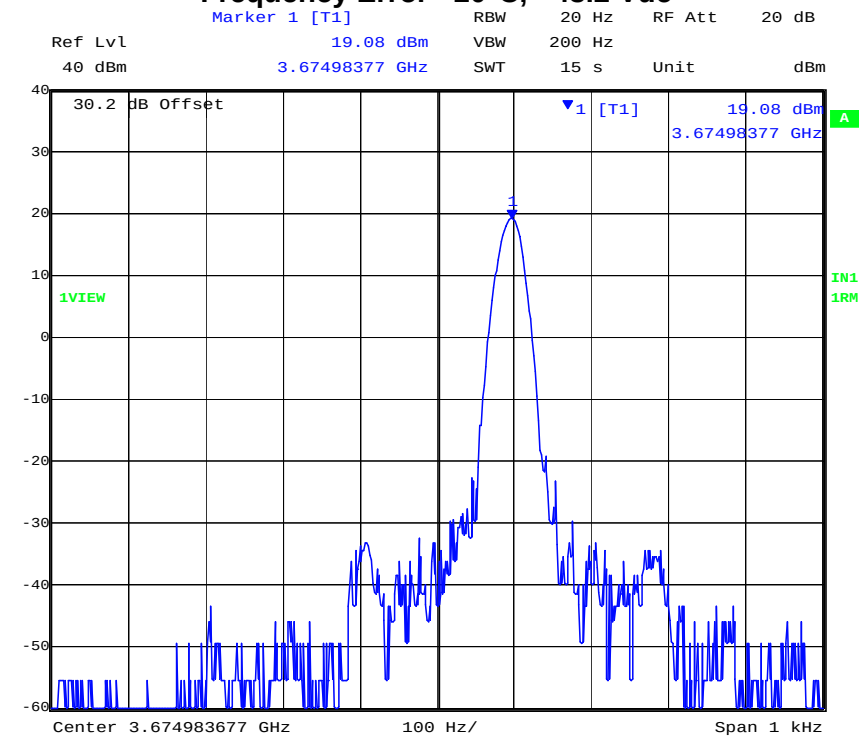
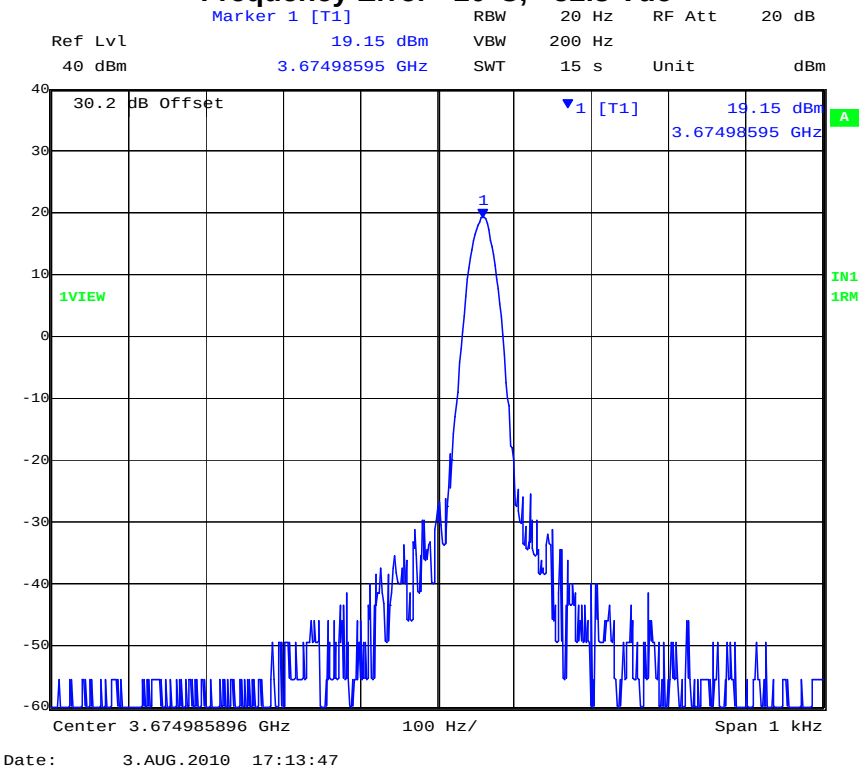
## Frequency Error +20°C, +43.2 Vdc

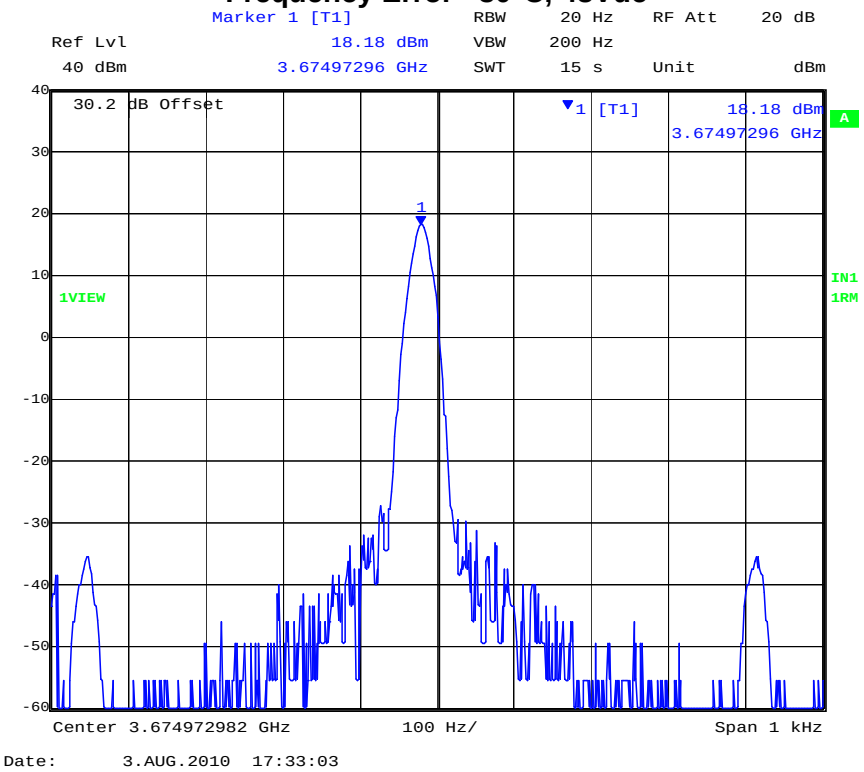



Date: 3.AUG.2010 17:08:33

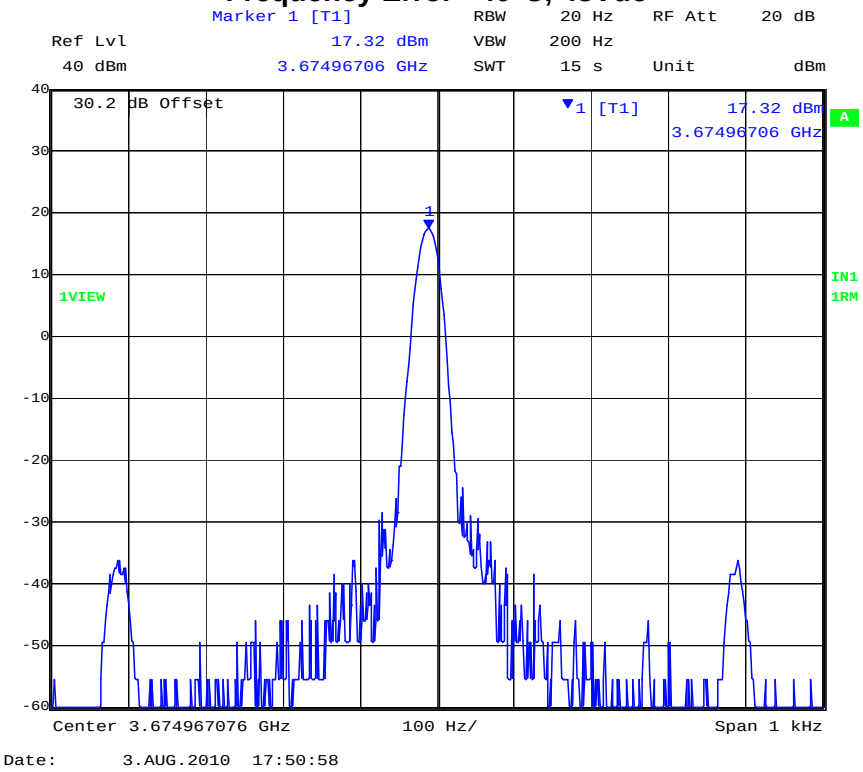
## Frequency Error +20°C, +52.8 Vdc



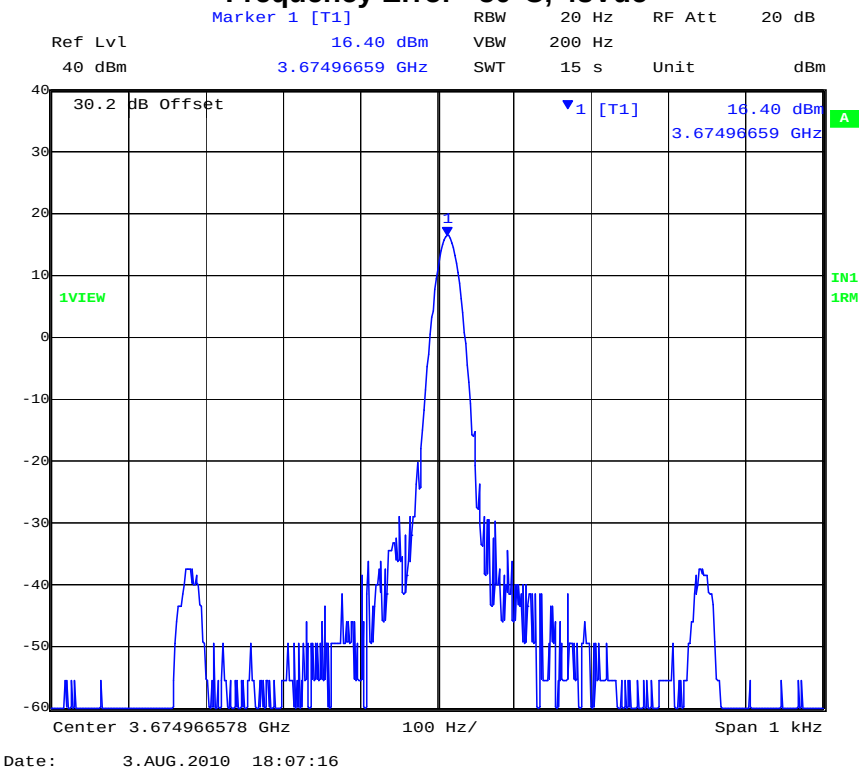

## Frequency Error +30°C, 48Vdc



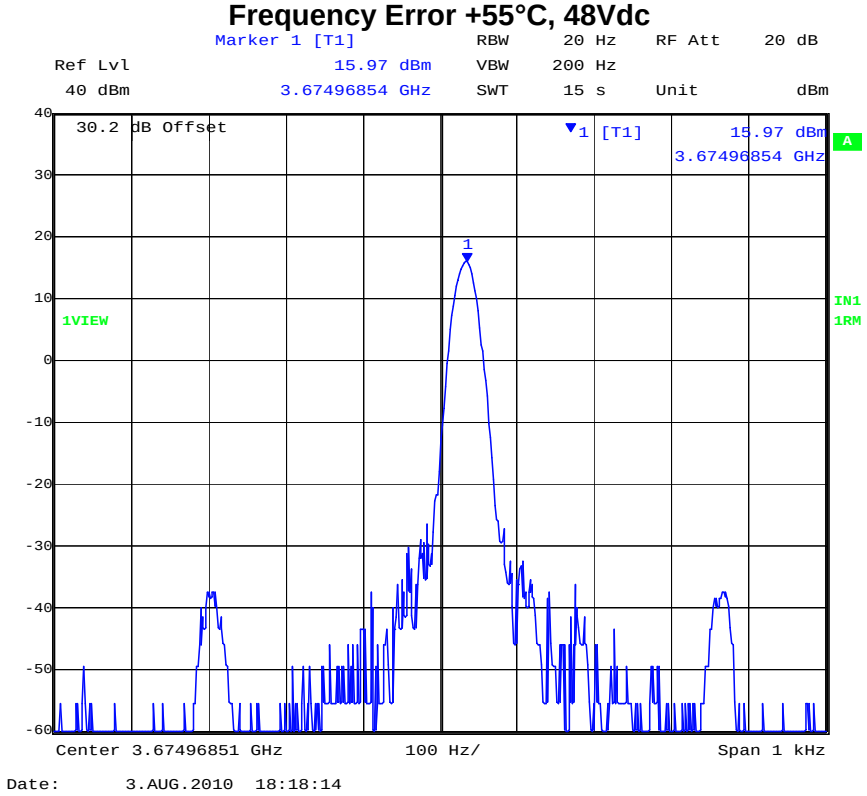
## Frequency Error +40°C, 48Vdc




## 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**

**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**

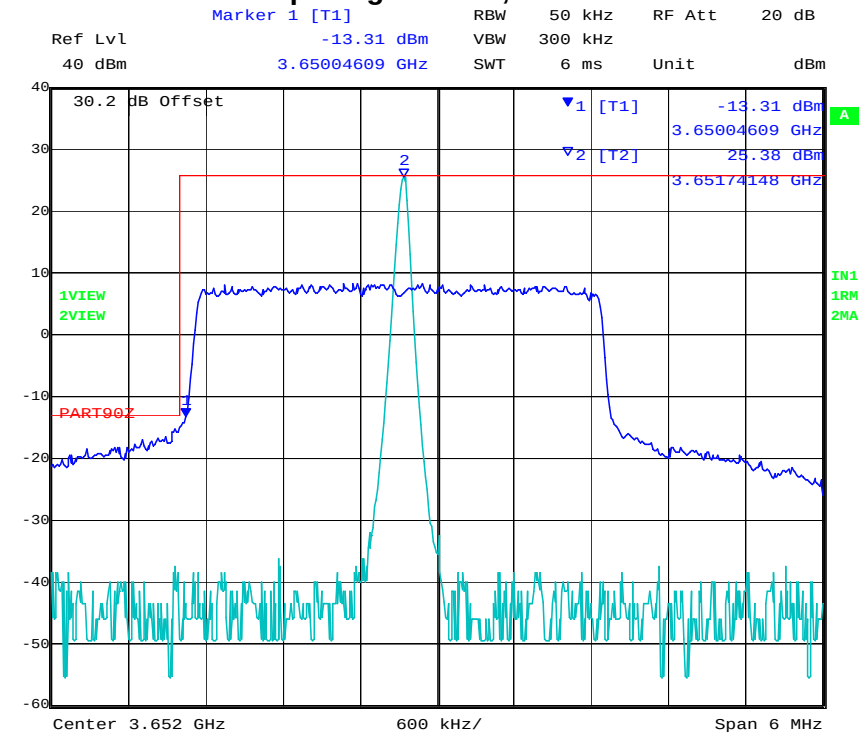
Limit

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*Log (P) = -13dBm.

Ambient conditions.

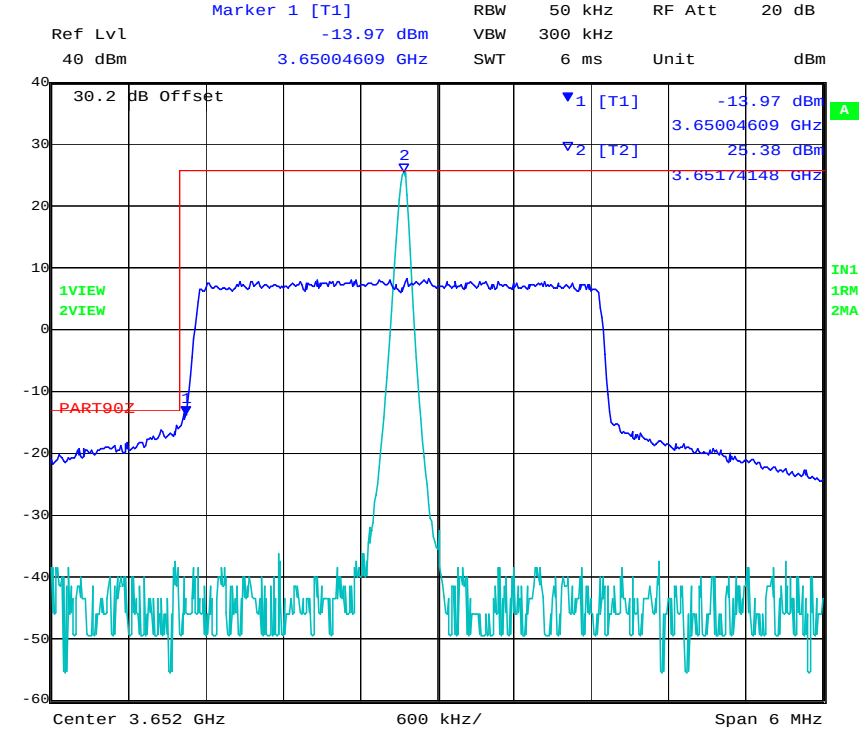
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

## BPSK Channel Spacing 3.5 MHz, Channel 3651.75 MHz



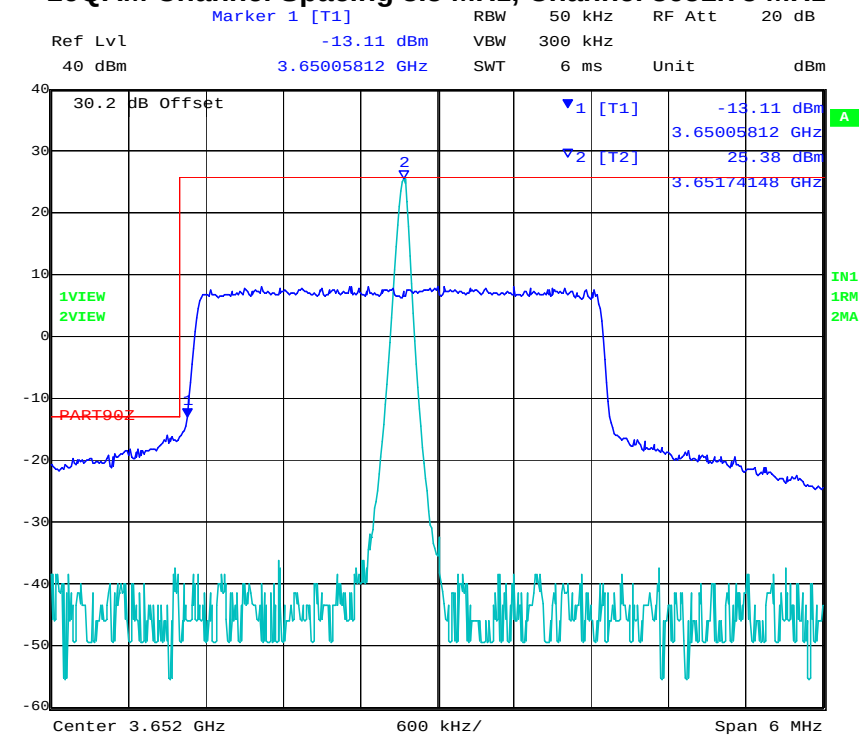

Date: 4.AUG.2010 10:11:46

## QPSK Channel Spacing 3.5 MHz, Channel 3651.75 MHz



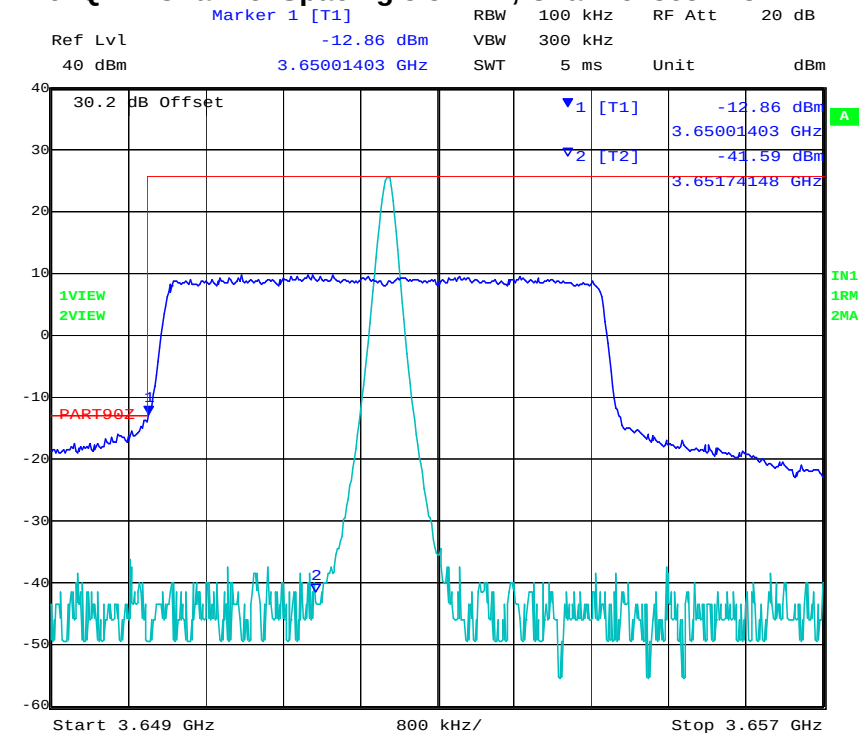

Date: 4.AUG.2010 10:13:54

## 16QAM Channel Spacing 3.5 MHz, Channel 3651.75 MHz



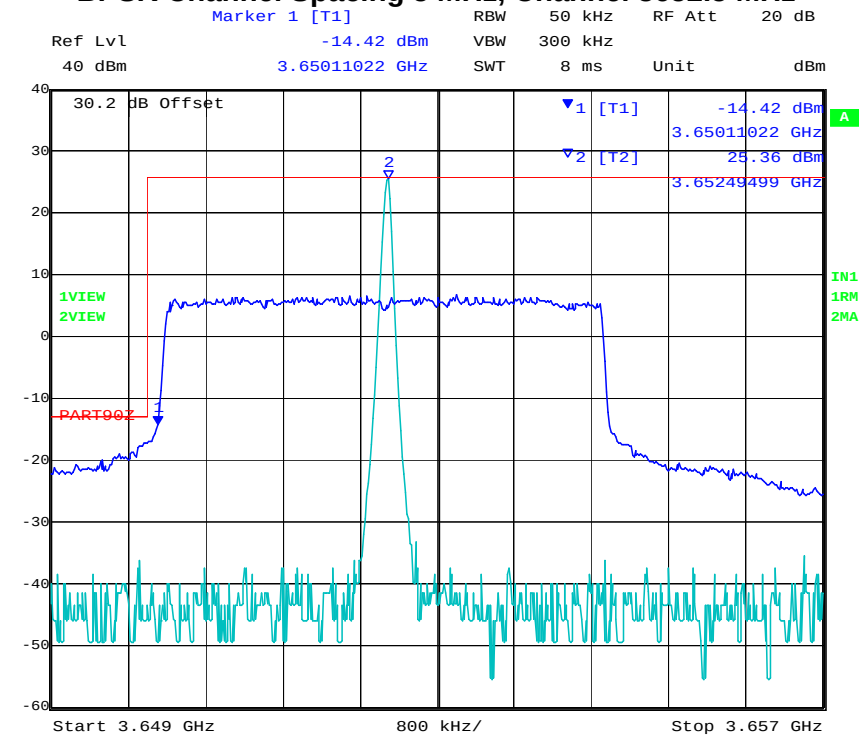

Date: 4.AUG.2010 10:14:51

## 64QAM Channel Spacing 3.5 MHz, Channel 3651.75 MHz



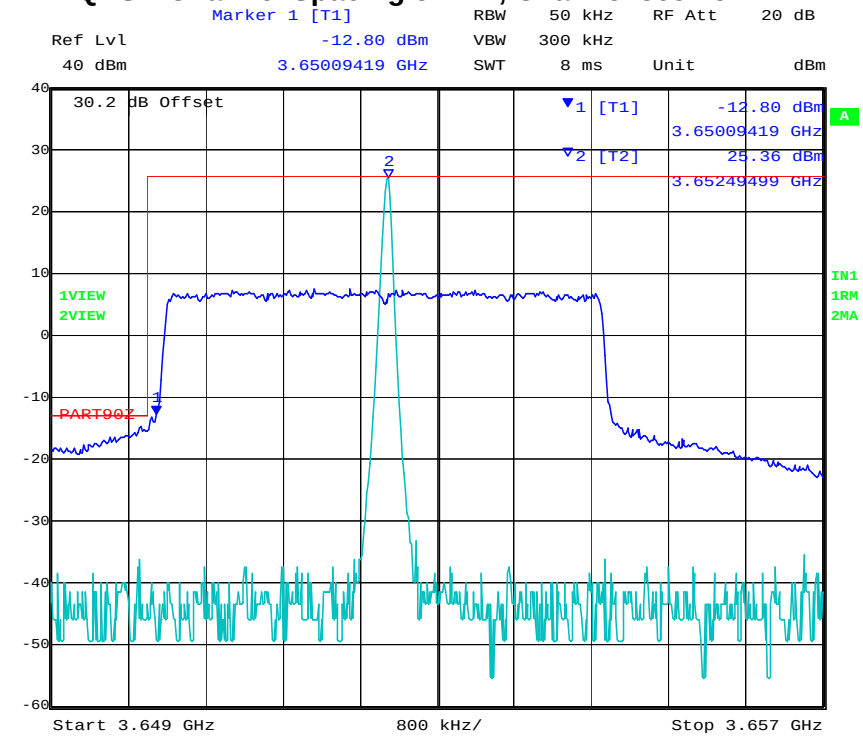

Date: 4.AUG.2010 10:21:42

## BPSK Channel Spacing 5 MHz, Channel 3652.5 MHz



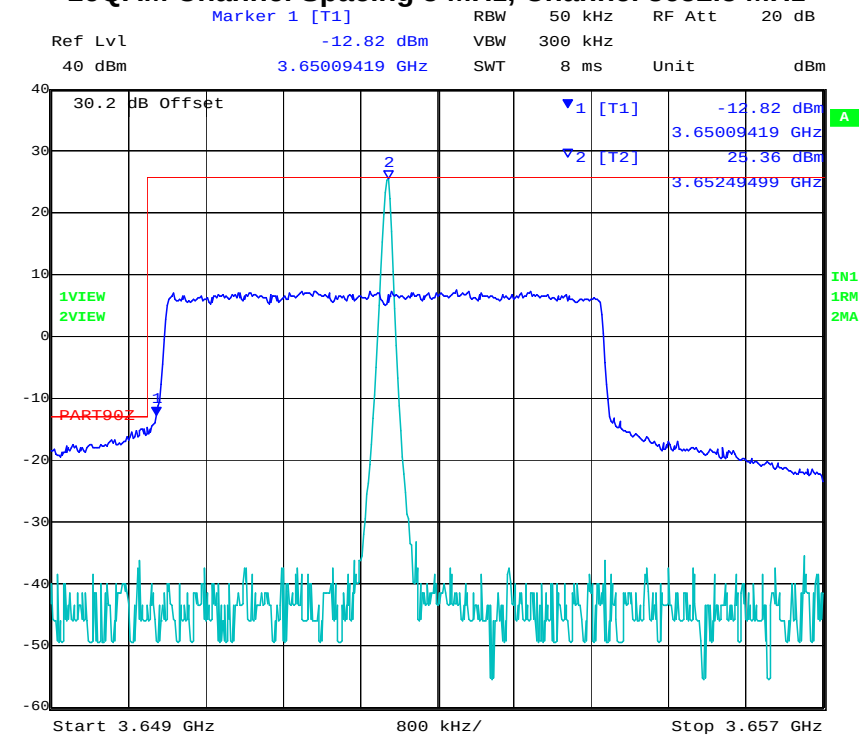

Date: 4.AUG.2010 10:24:21

## QPSK Channel Spacing 5 MHz, Channel 3652.5 MHz



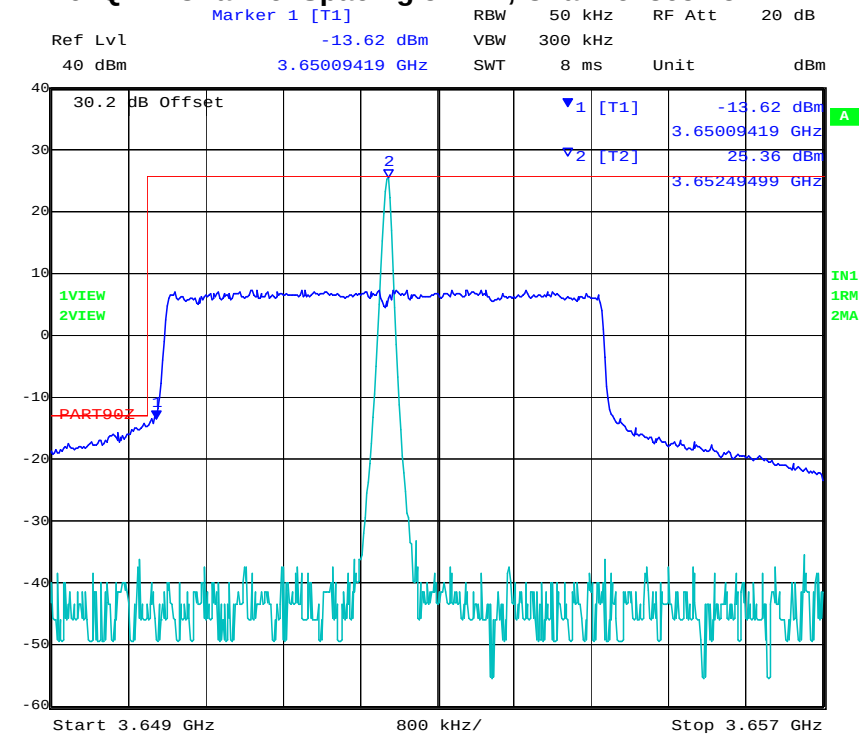

Date: 4.AUG.2010 10:26:11

## 16QAM Channel Spacing 5 MHz, Channel 3652.5 MHz



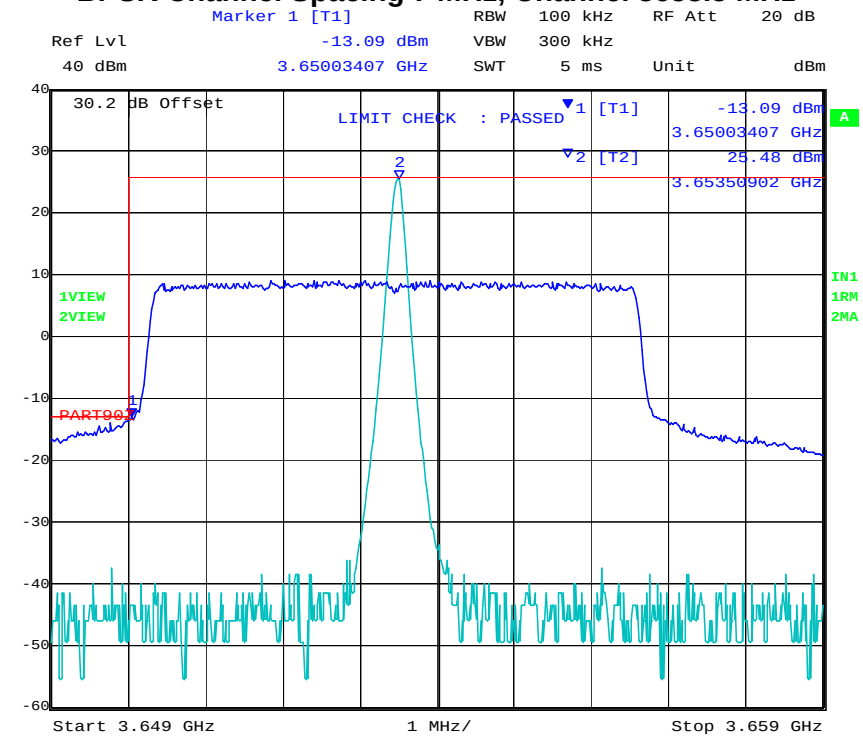

Date: 4.AUG.2010 10:27:23

## 64QAM Channel Spacing 5 MHz, Channel 3652.5 MHz



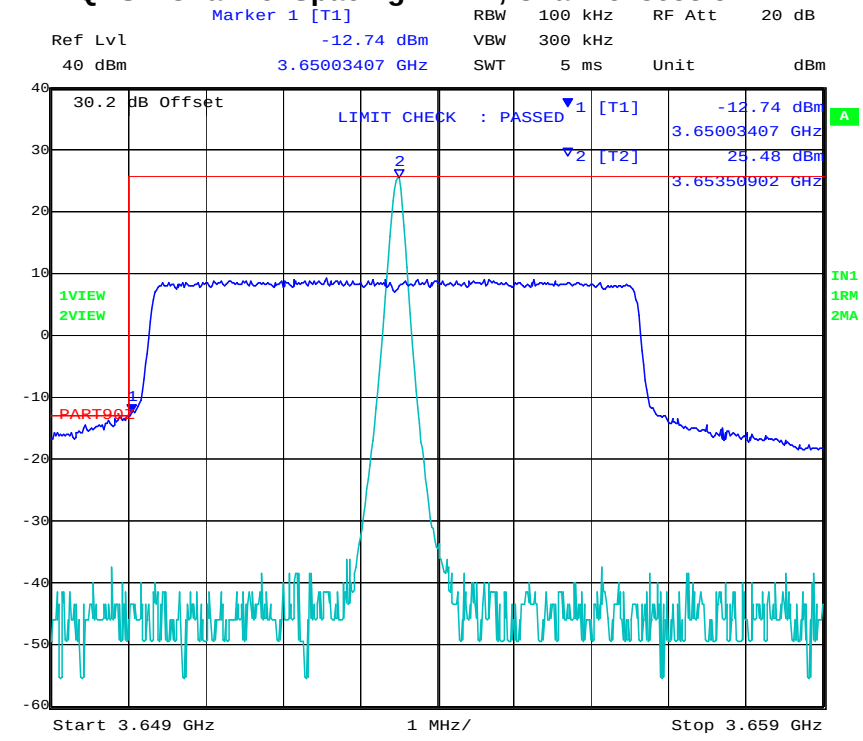

Date: 4.AUG.2010 10:28:03

## BPSK Channel Spacing 7 MHz, Channel 3653.5 MHz



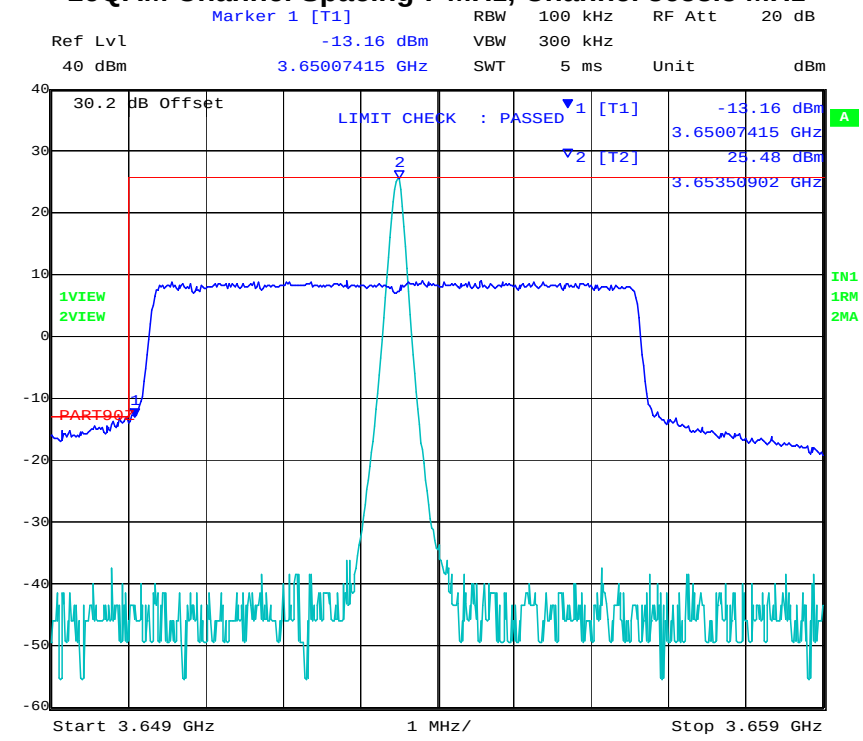

Date: 4.AUG.2010 10:43:51

## QPSK Channel Spacing 7 MHz, Channel 3653.5 MHz



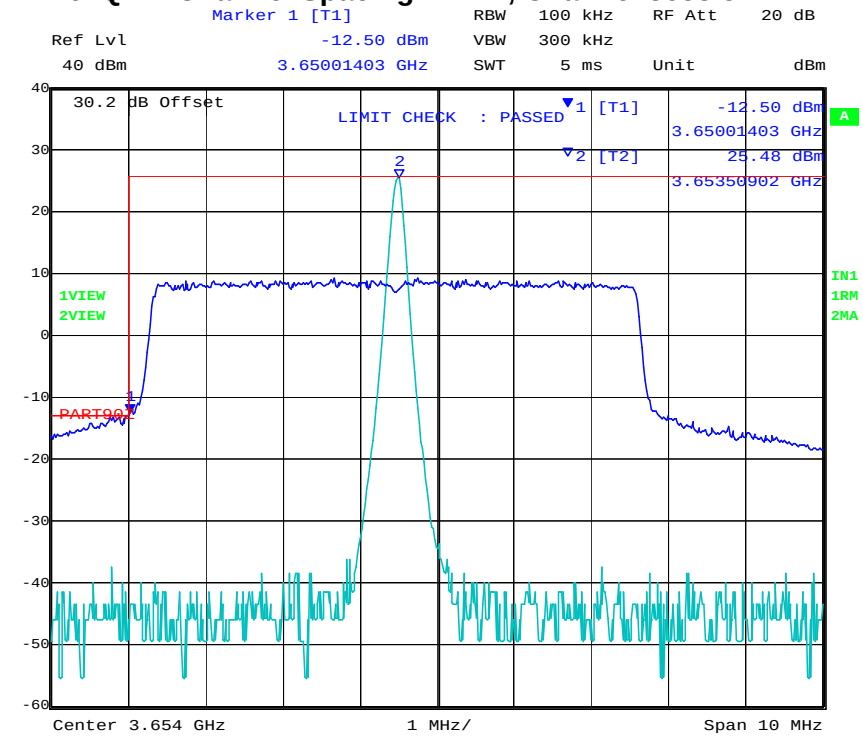

Date: 4.AUG.2010 10:41:16

## 16QAM Channel Spacing 7 MHz, Channel 3653.5 MHz



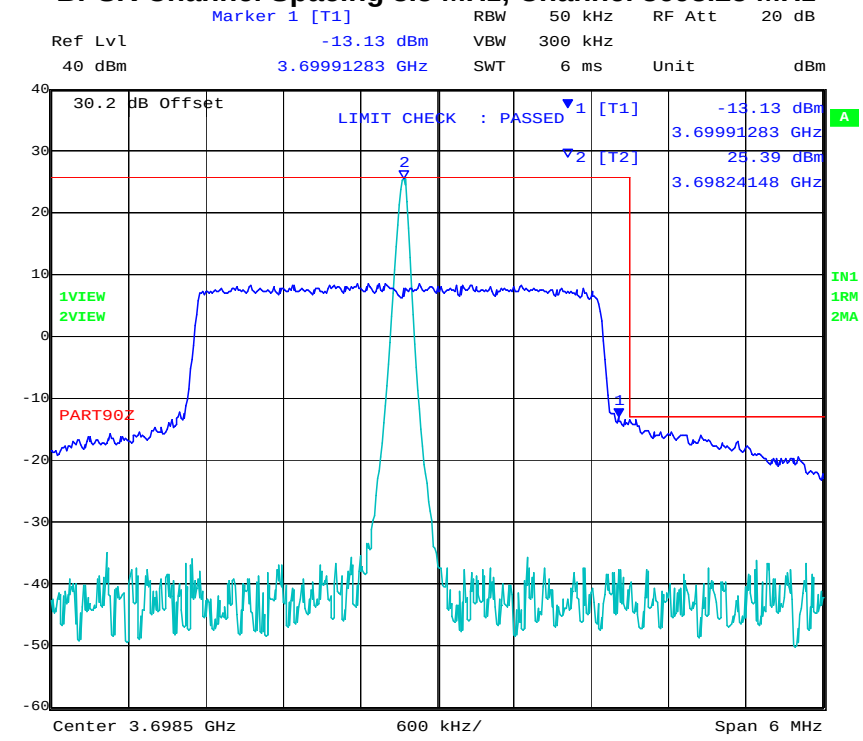

Date: 4.AUG.2010 10:45:15

## 64QAM Channel Spacing 7 MHz, Channel 3653.5 MHz



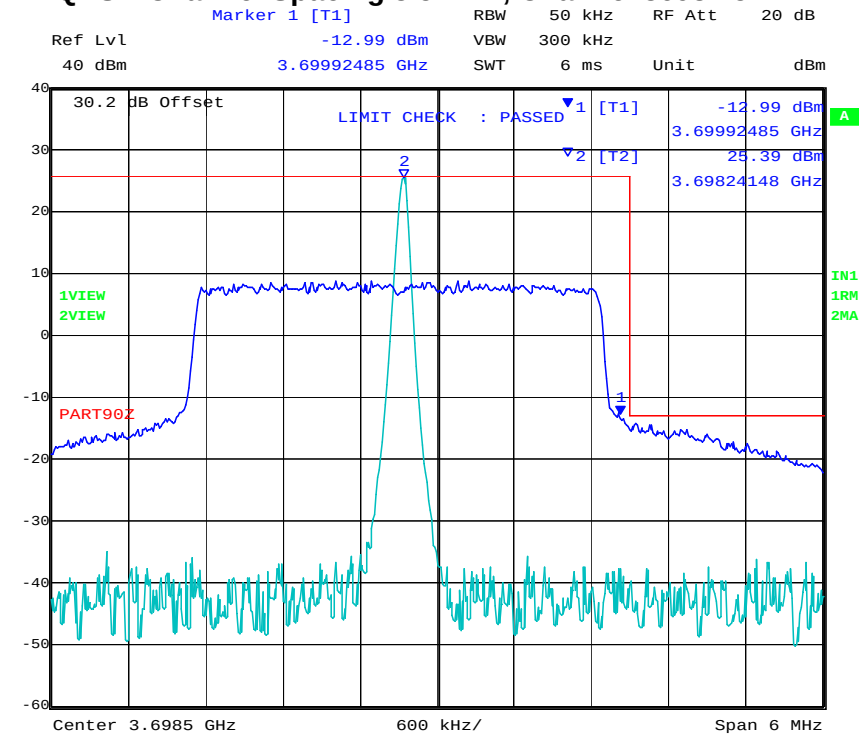

Date: 4.AUG.2010 10:46:28

## BPSK Channel Spacing 3.5 MHz, Channel 3698.25 MHz



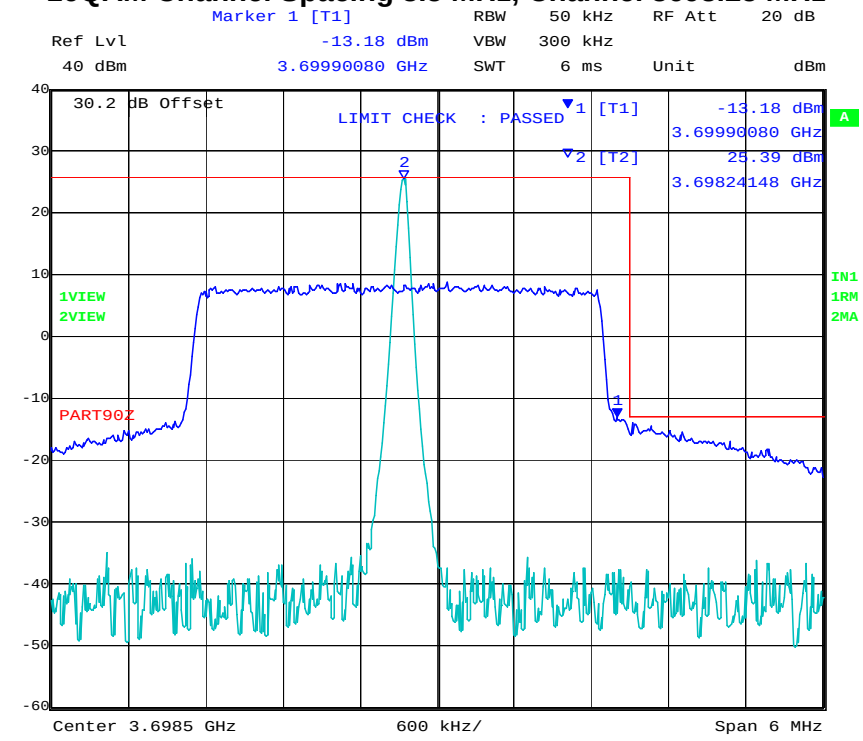

Date: 4.AUG.2010 11:09:03

## QPSK Channel Spacing 3.5 MHz, Channel 3698.25 MHz



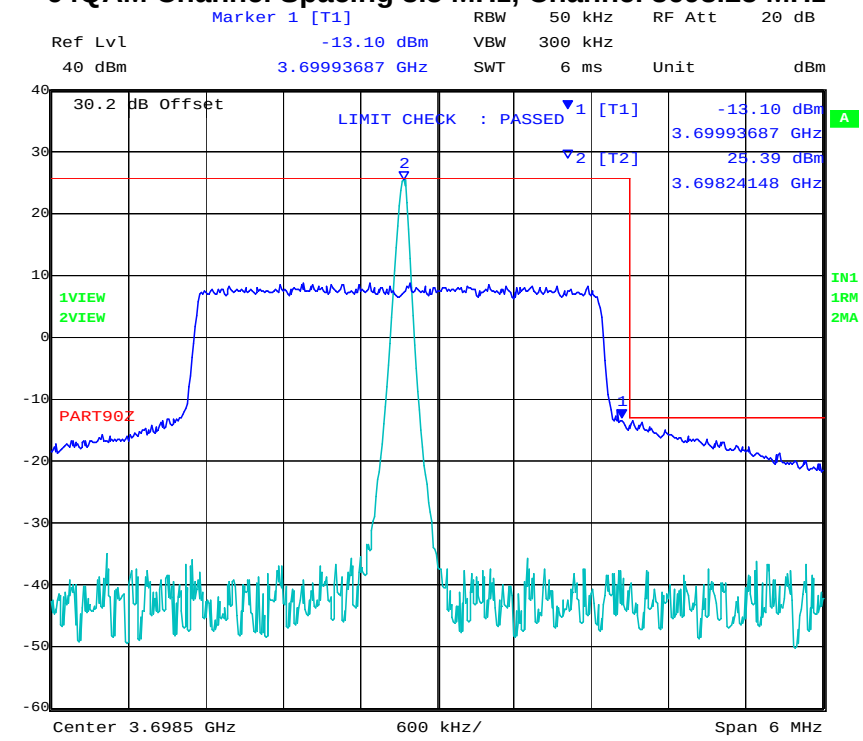

Date: 4.AUG.2010 11:10:25

## 16QAM Channel Spacing 3.5 MHz, Channel 3698.25 MHz



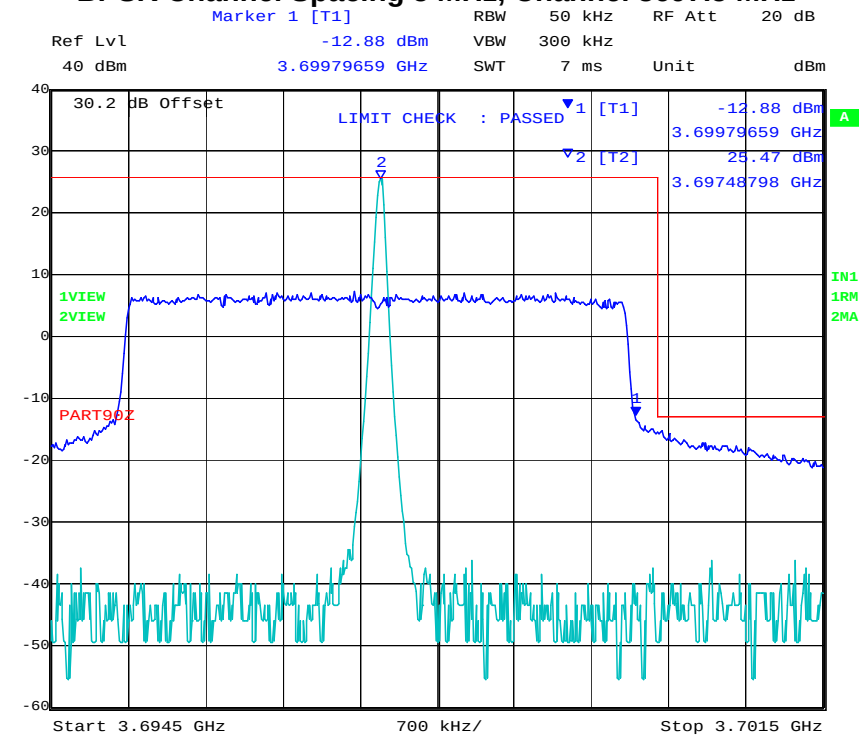

Date: 4.AUG.2010 11:11:53

## 64QAM Channel Spacing 3.5 MHz, Channel 3698.25 MHz



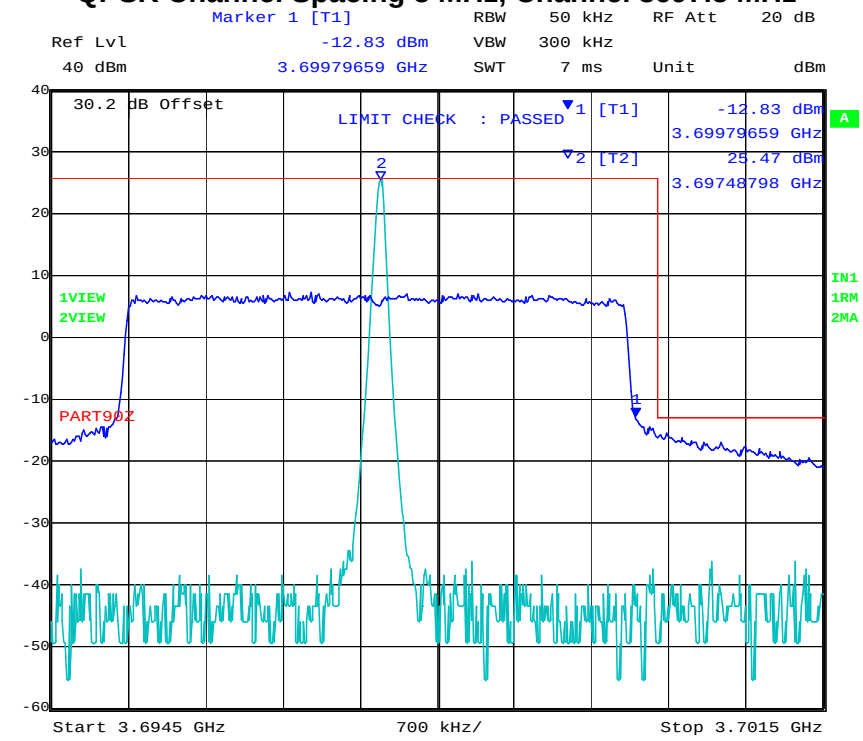

Date: 4.AUG.2010 11:13:25

## BPSK Channel Spacing 5 MHz, Channel 3697.5 MHz



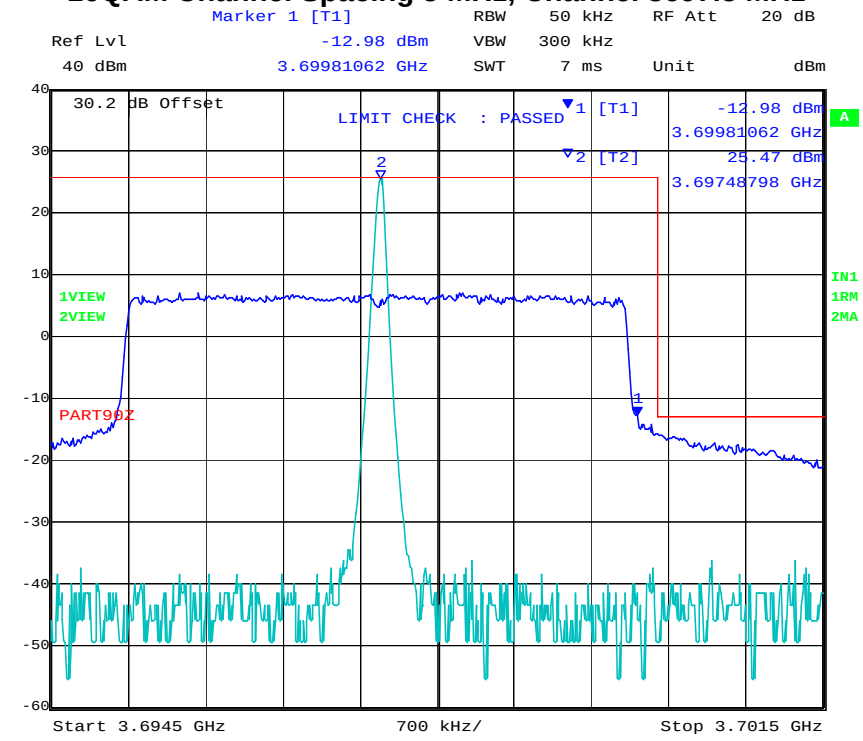

Date: 4.AUG.2010 11:17:41

## QPSK Channel Spacing 5 MHz, Channel 3697.5 MHz



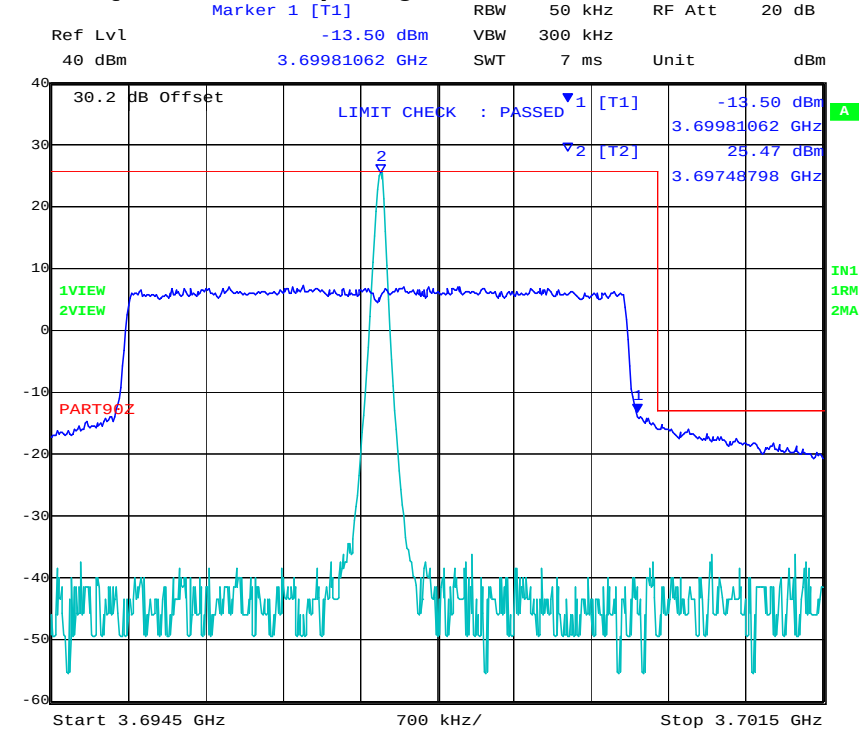

Date: 4.AUG.2010 11:19:50

## 16QAM Channel Spacing 5 MHz, Channel 3697.5 MHz



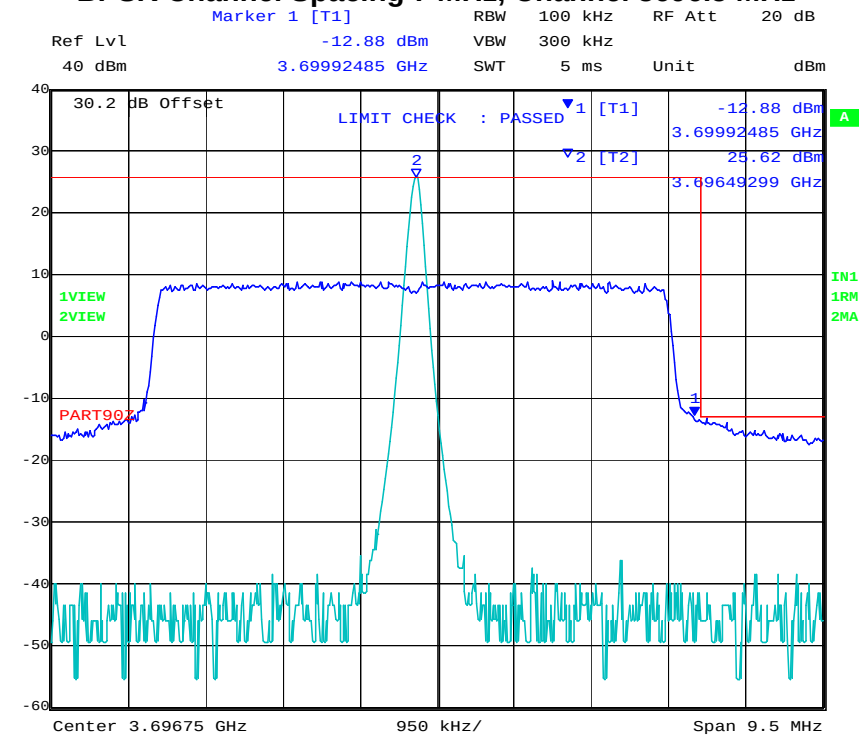

Date: 4.AUG.2010 11:20:55

## 64QAM Channel Spacing 5 MHz, Channel 3697.5 MHz



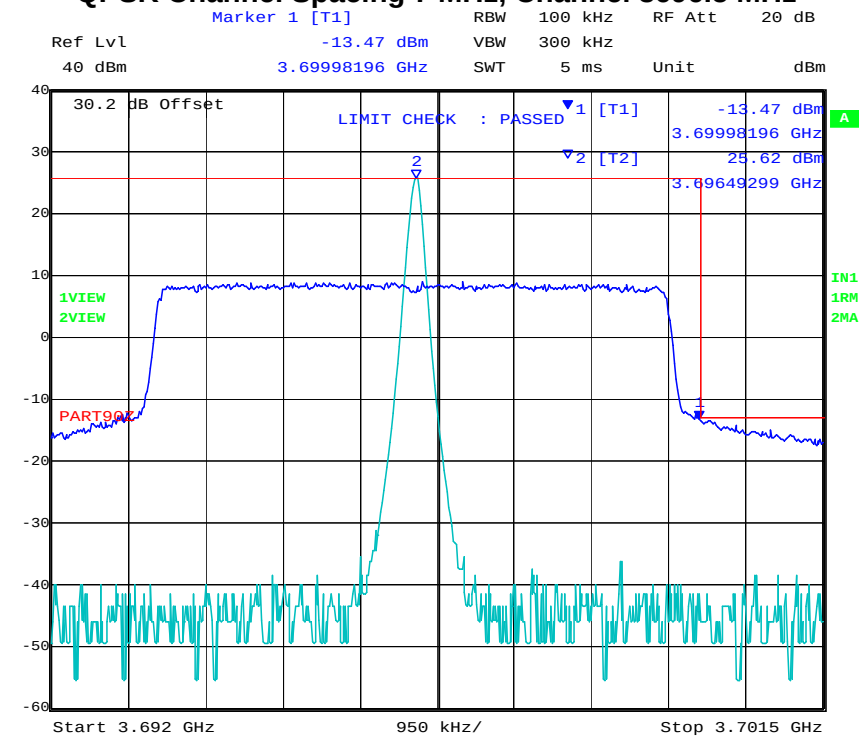

Date: 4.AUG.2010 11:21:46

## BPSK Channel Spacing 7 MHz, Channel 3696.5 MHz



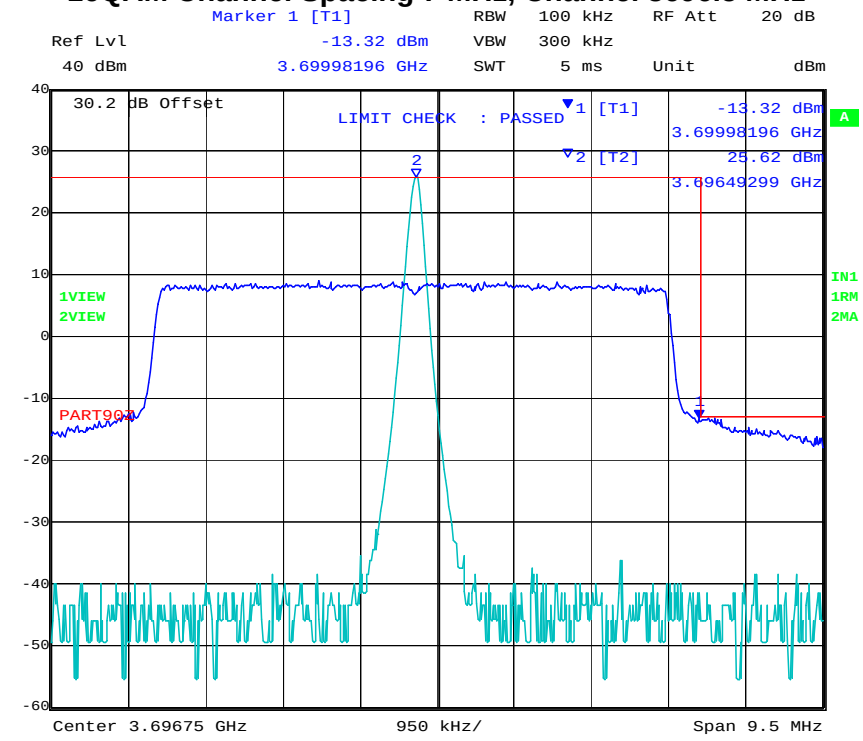

Date: 4.AUG.2010 11:27:55

## QPSK Channel Spacing 7 MHz, Channel 3696.5 MHz



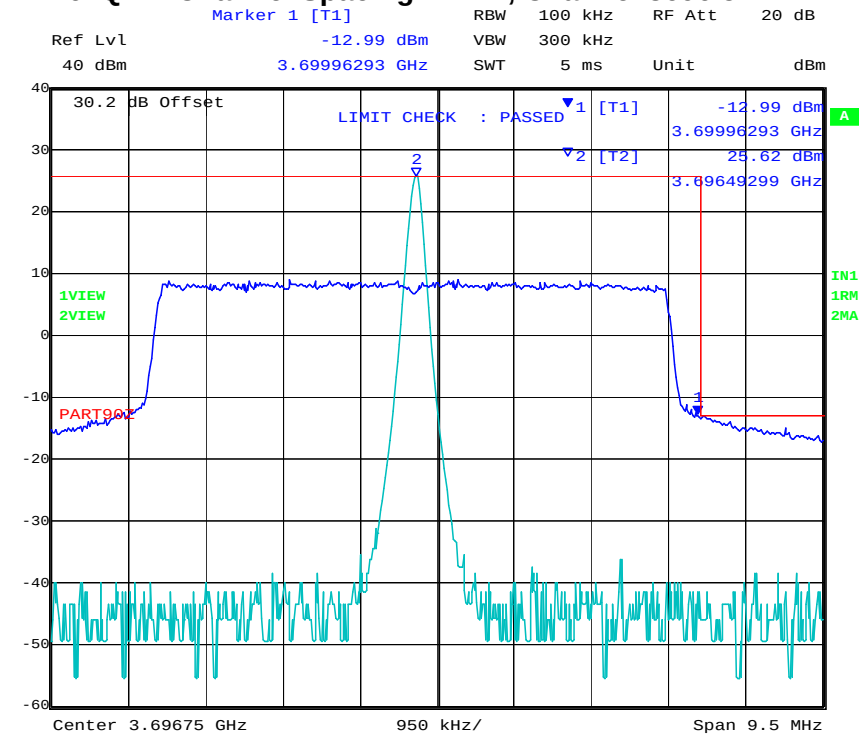

Date: 4.AUG.2010 11:26:26

## 16QAM Channel Spacing 7 MHz, Channel 3696.5 MHz




Date: 4.AUG.2010 11:28:50

## 64QAM Channel Spacing 7 MHz, Channel 3696.5 MHz

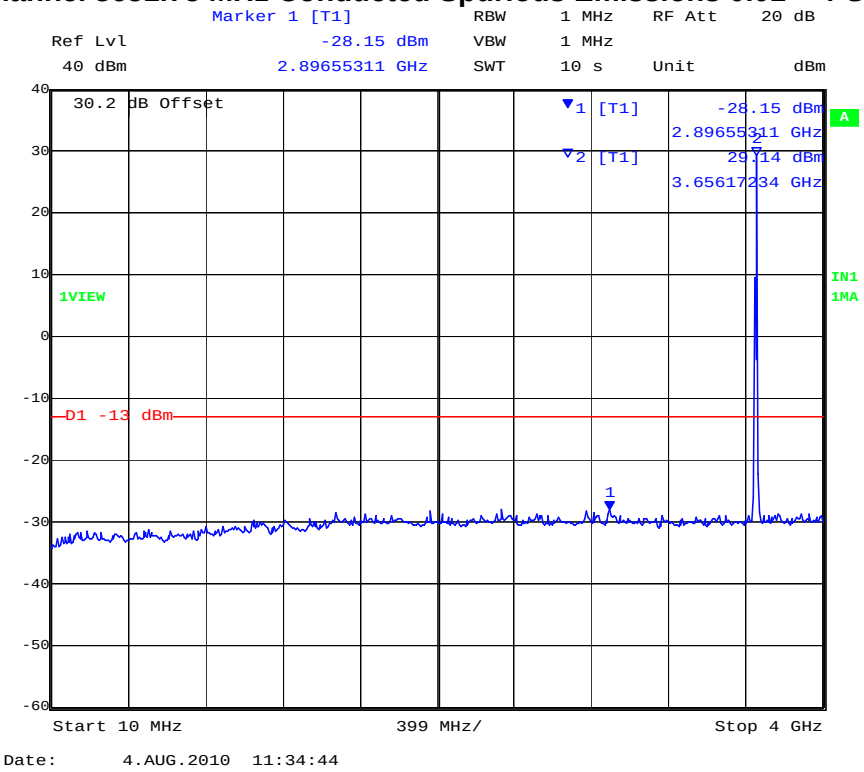



Date: 4.AUG.2010 11:30:11

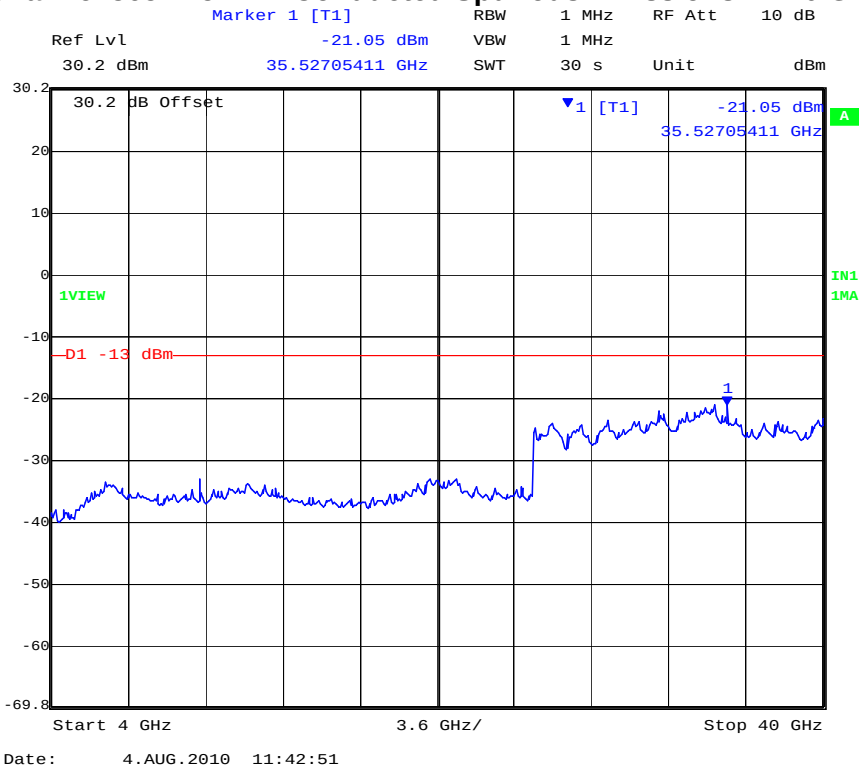
### 5.1.6.2. Transmitter Conducted Spurious Emissions (30 M- 40 GHz)

| 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 |

## Channel 3651.75 MHz Conducted Spurious Emissions 0.01 – 4 GHz

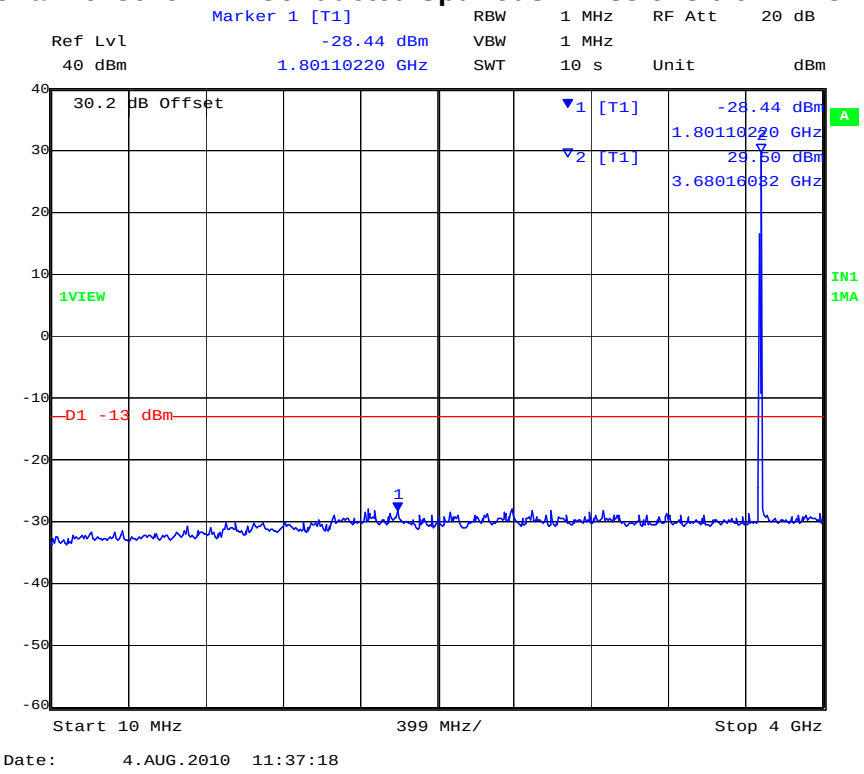



## Channel 3651.75 MHz Conducted Spurious Emissions 4 - 40 GHz



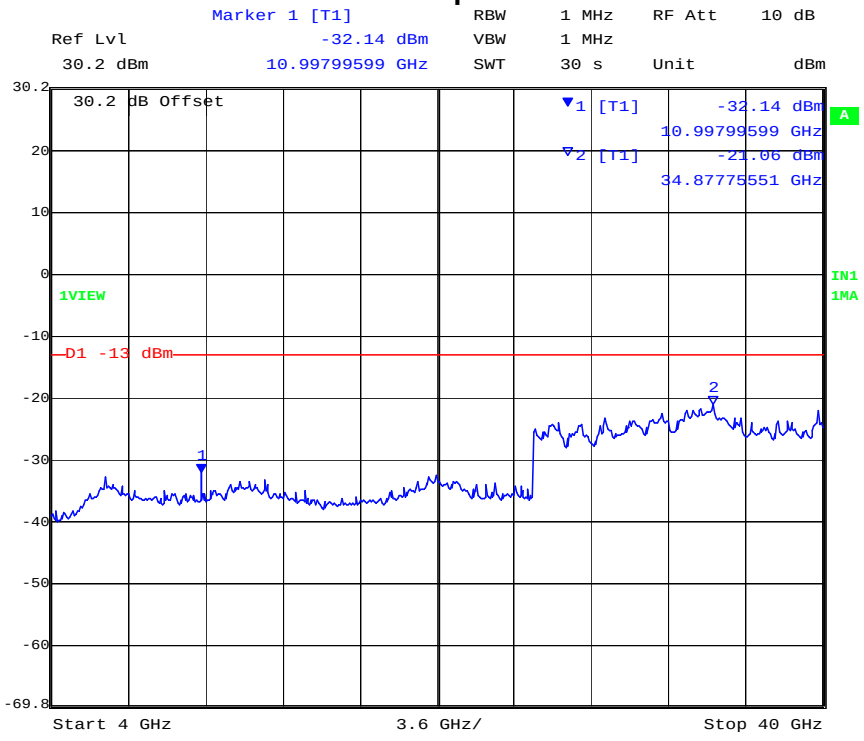
| Channel Centre Frequency (MHz) | Start Frequency (MHz) | Stop Frequency (MHz) | Maximum Emission Observed (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|
| 3675.0 | 10 | 4,000 | -28.44 | -13.0 | -15.44 |
| | 4,000 | 40,000 | -21.06 | | -8.06 |

## Channel 3675 MHz Conducted Spurious Emissions 0.01 – 4 GHz




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

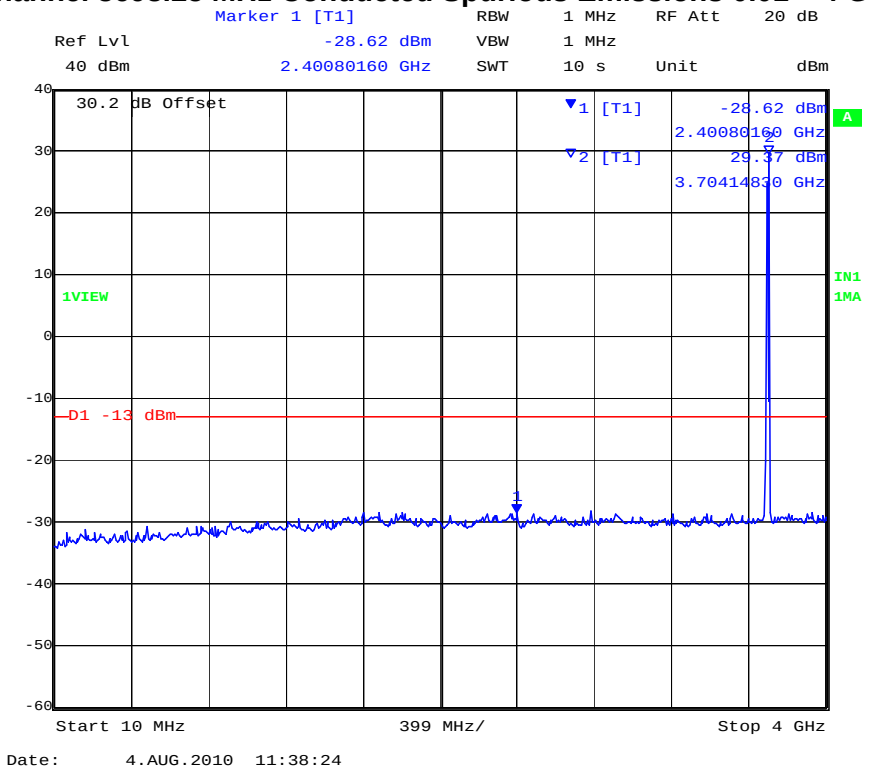
## Channel 3675 MHz Conducted Spurious Emissions 4 - 40 GHz



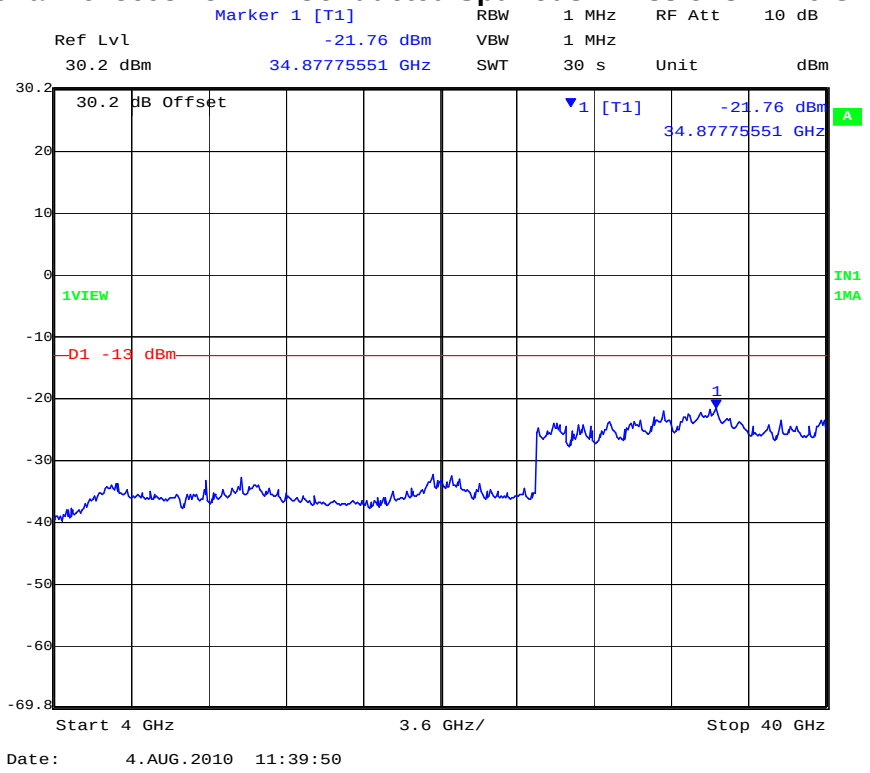

Date: 4.AUG.2010 11:41:21

| 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 |

## 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

**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.

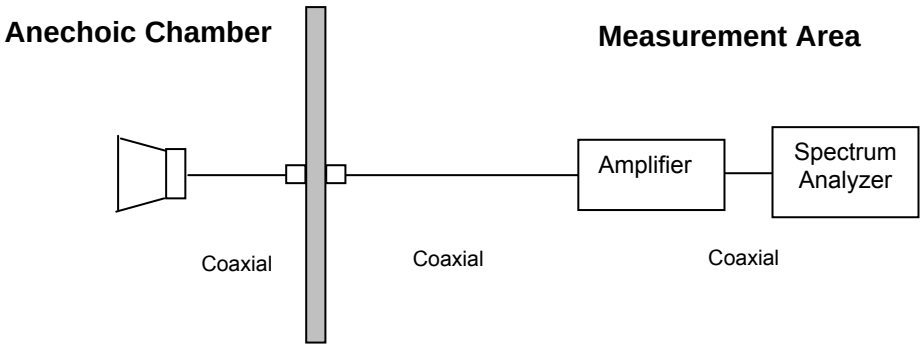
As no antennae were required for testing purposes and only BPSK 3.5 MHz bandwidth was tested to prove compliance.

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*Log (P) = -13dBm.

**Test Measurement Set up**

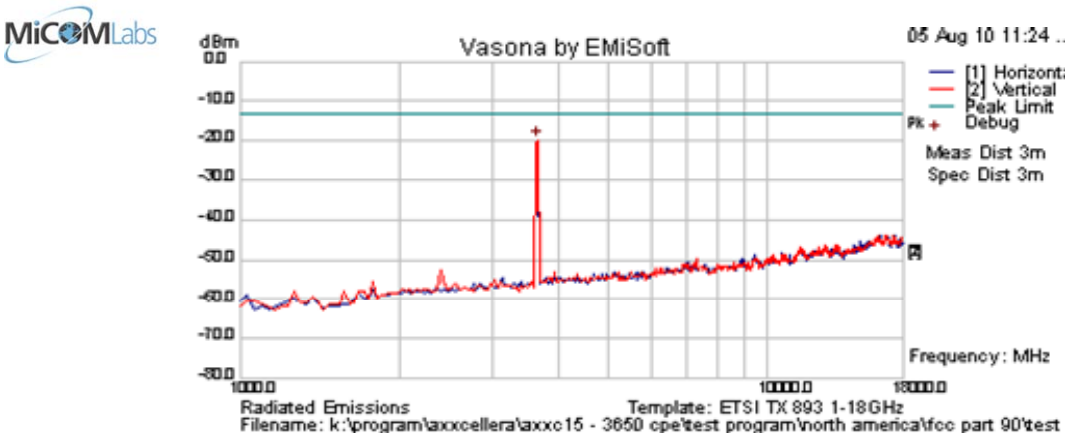



Measurement set up for Radiated Emission Test

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 (ºC)** | 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** | | | |

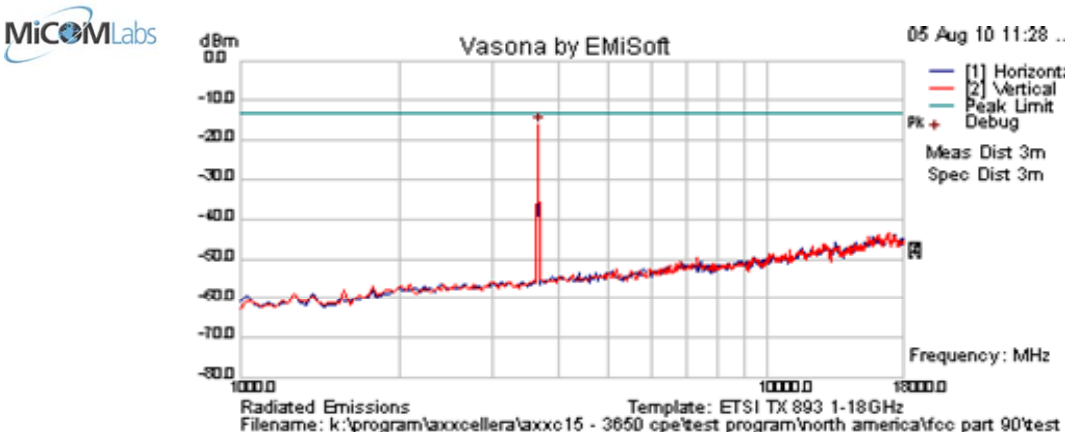



## Formally measured emission peaks

| 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 (ºC)** | 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** | | | |

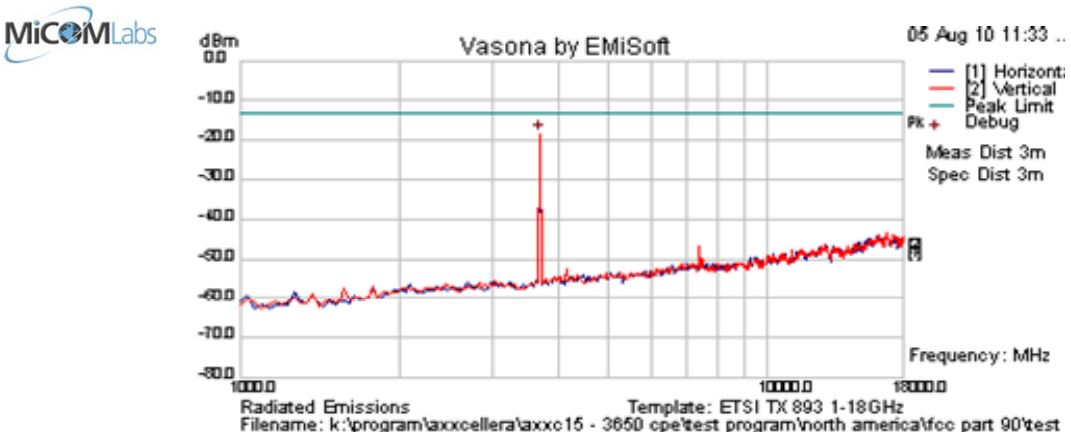



## Formally measured emission peaks

| 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. |

**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. 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**

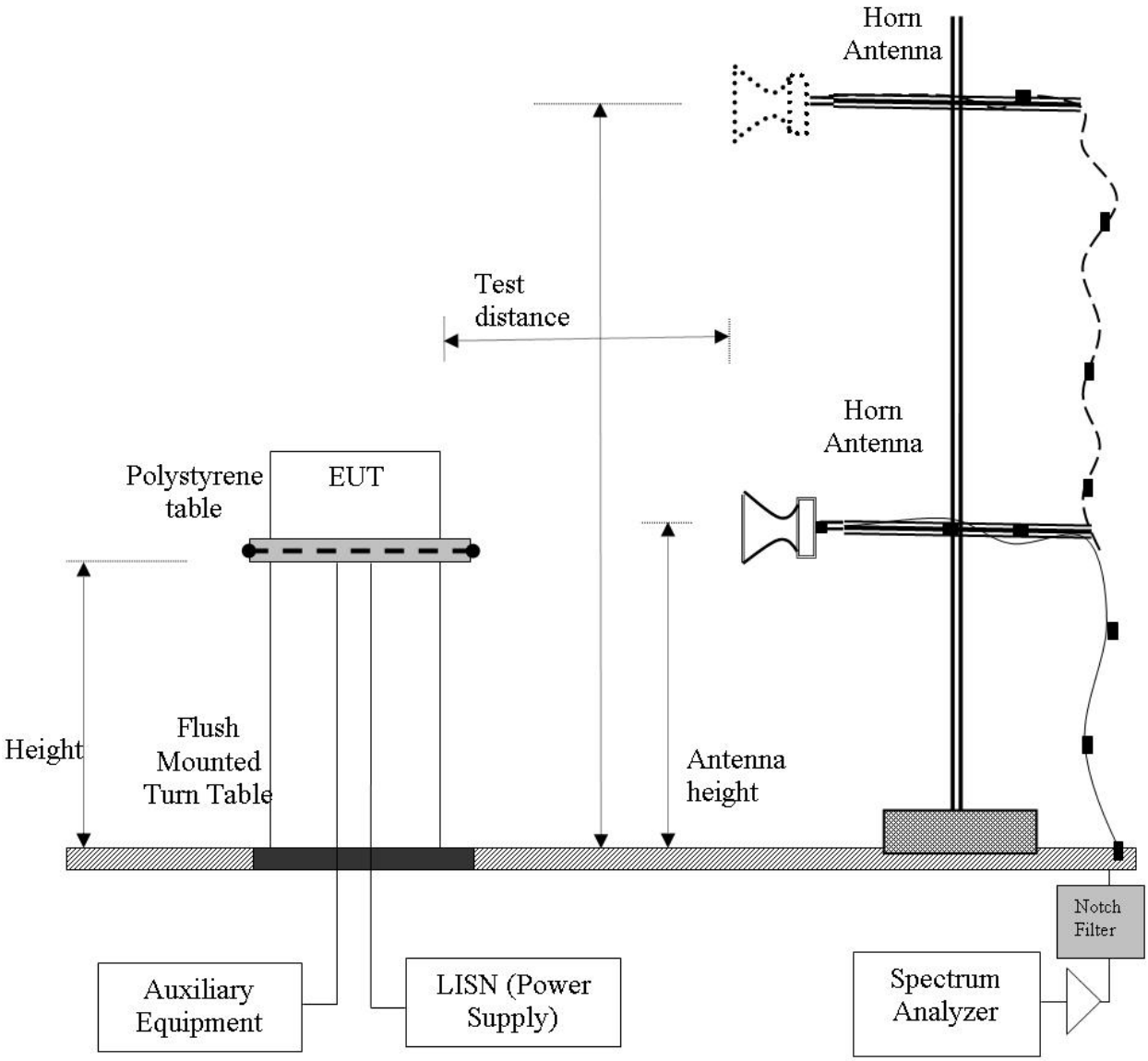
FCC, Part 15 Subpart B §15.109
Industry Canada ICES-003 §5

**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

## 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 = 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 dBμV; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

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

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

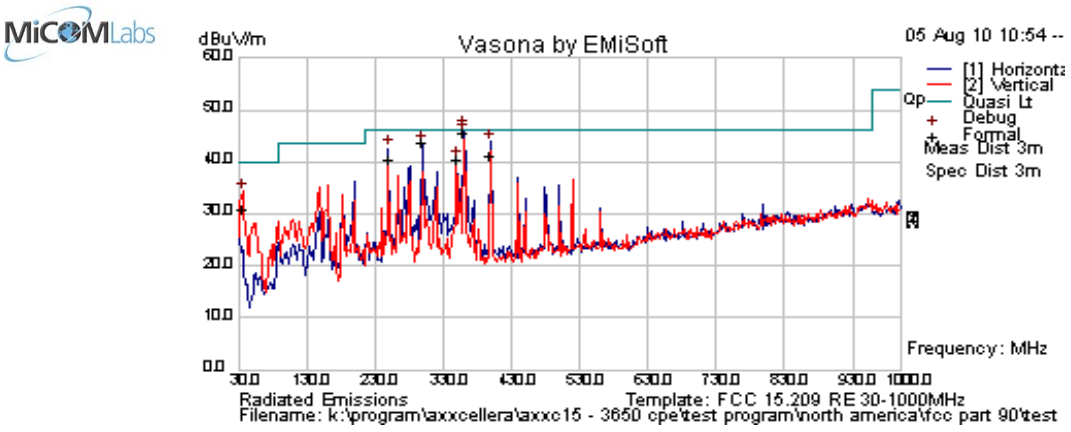
Level (dBμV/m) = 20 * Log (level (μV/m))

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

## 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 (ºC)** | 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

## 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 |

## 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**

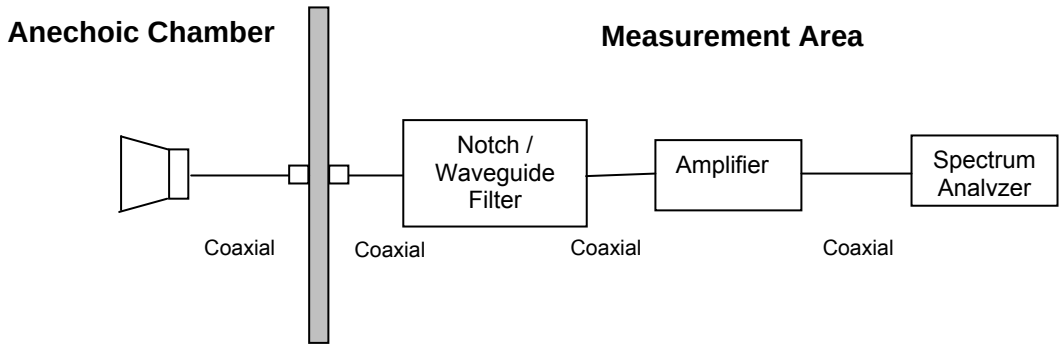
**Test Procedure**

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 dBμV; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

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

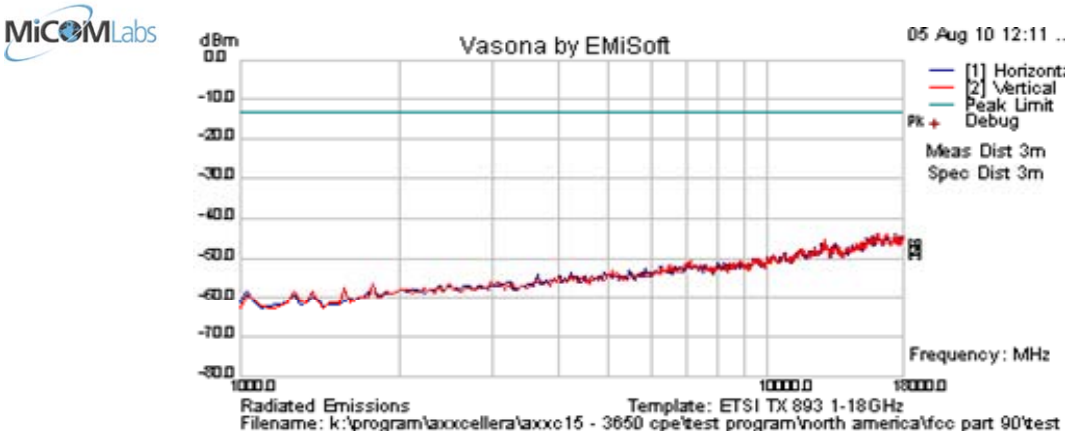
Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

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

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

## Receiver Radiated Spurious Emissions above 1 GHz

| | | | |
|---|---|---|---|
| **Test Freq.** | 3651.75 MHz | **Engineer** | CSB |
| **Variant** | BPSK 3.5MHz CH BW | **Temp (ºC)** | 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. |

## Specification

### Receiver Radiated Spurious Emissions

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

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

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

### Laboratory Measurement Uncertainty for Radiated Emissions

| | |
|---|---|
| Measurement uncertainty | +5.6/ -4.5 dB |

### Traceability

| Method | Test Equipment Used |
|---|---|
| Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions' | 0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312 |

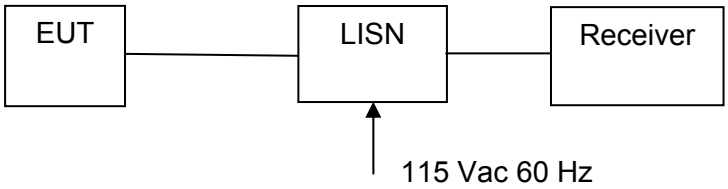
### 5.1.8. AC Wireline Conducted Emissions (150 kHz – 30 MHz)

**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.

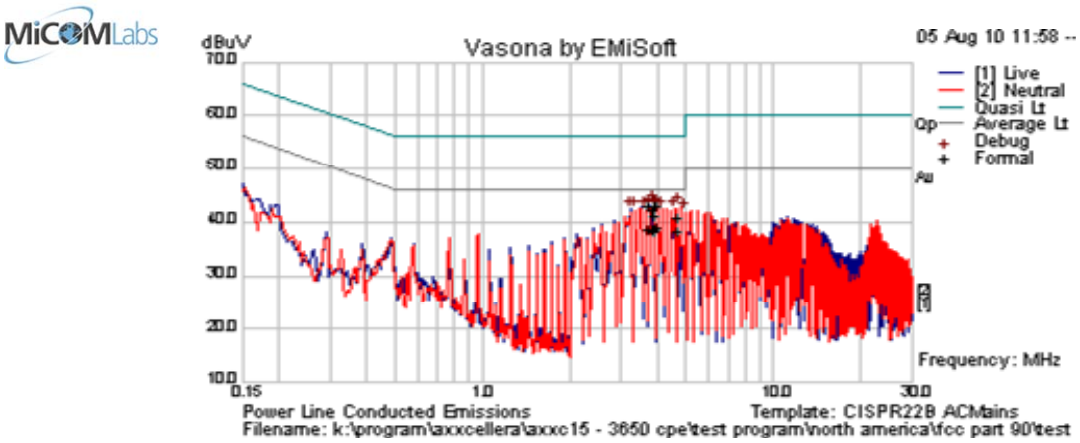
**Test Measurement Set up**




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 (ºC)** | 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 μH/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 (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

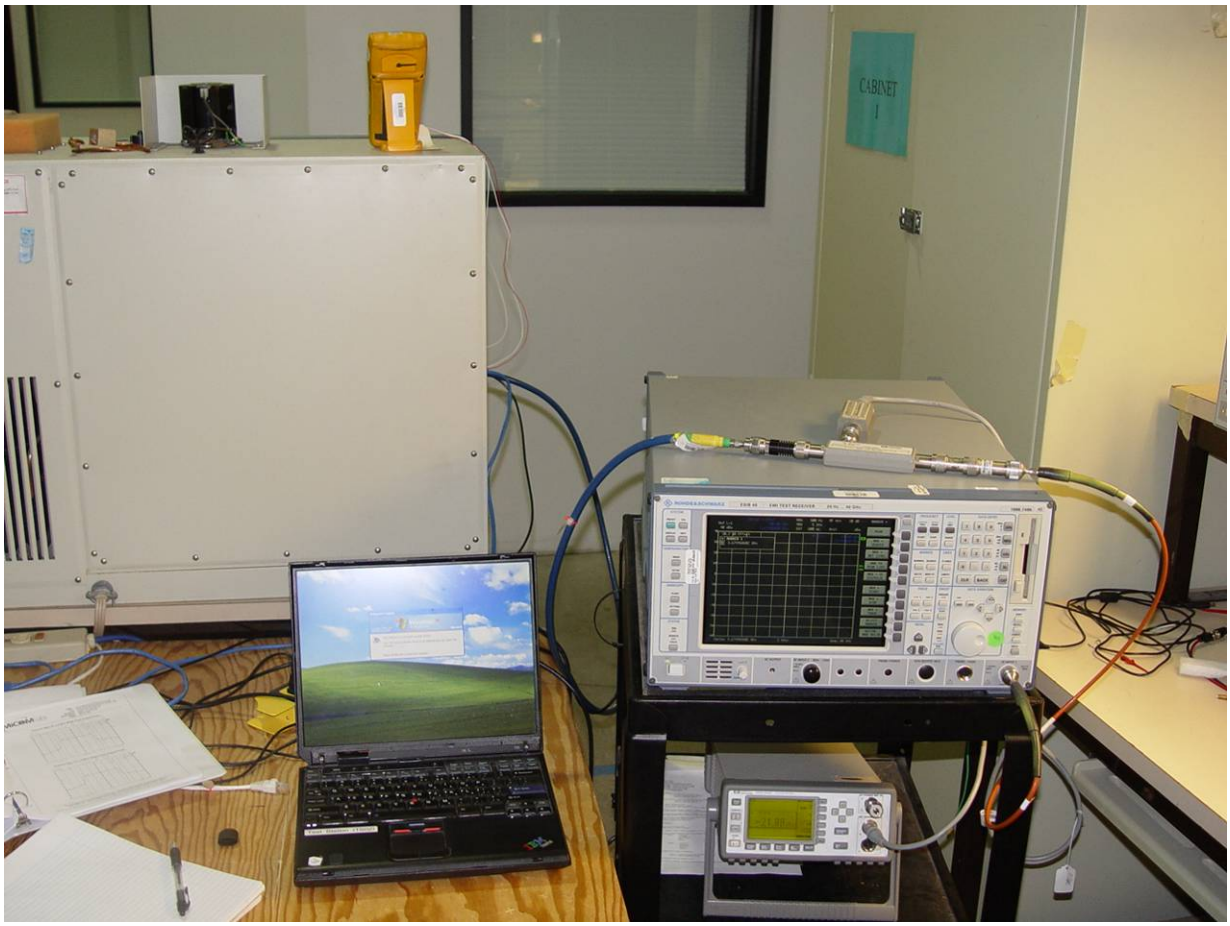
| | |
|---|---|
| Measurement uncertainty | ±2.64 dB |

### Traceability

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

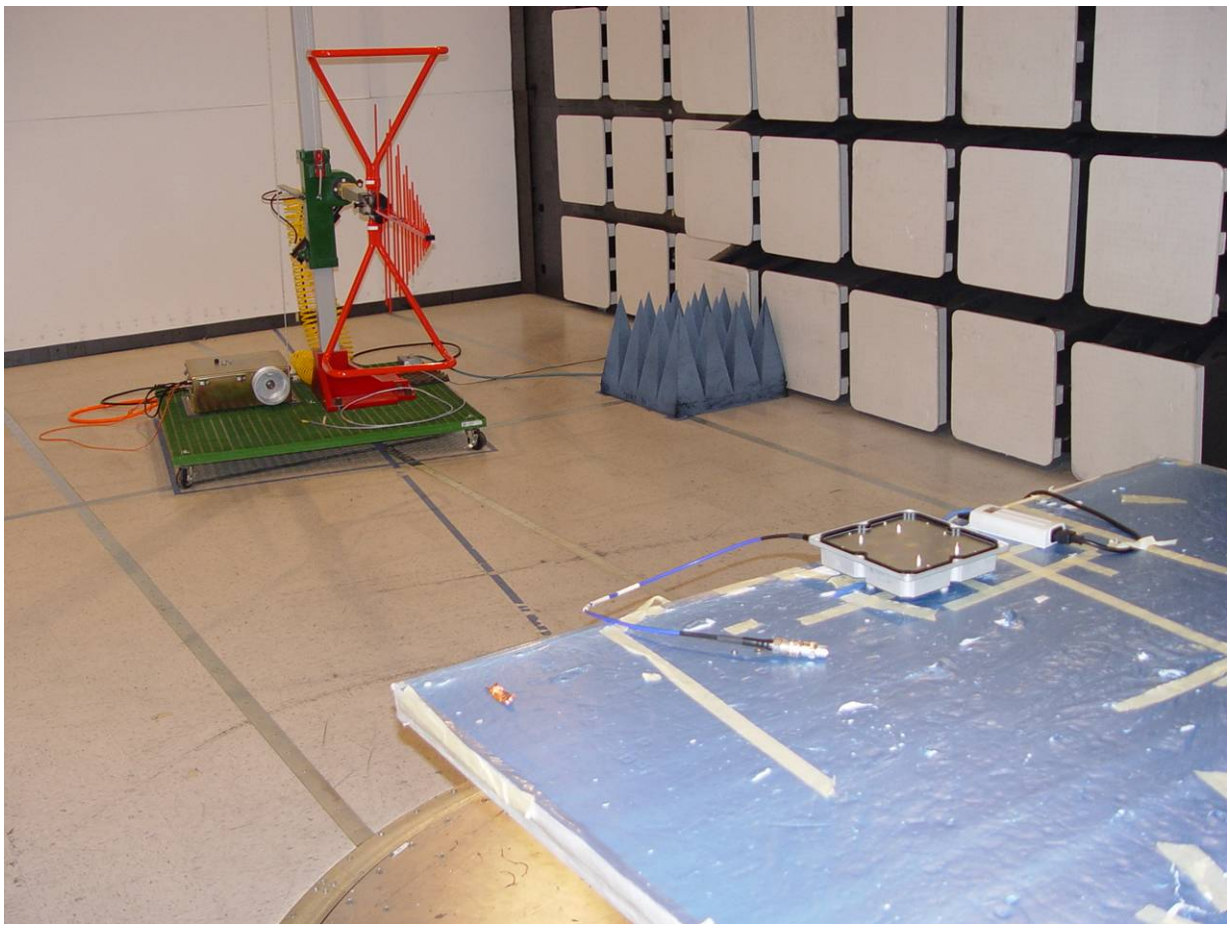
# 6. TEST SET-UP PHOTOGRAPHS

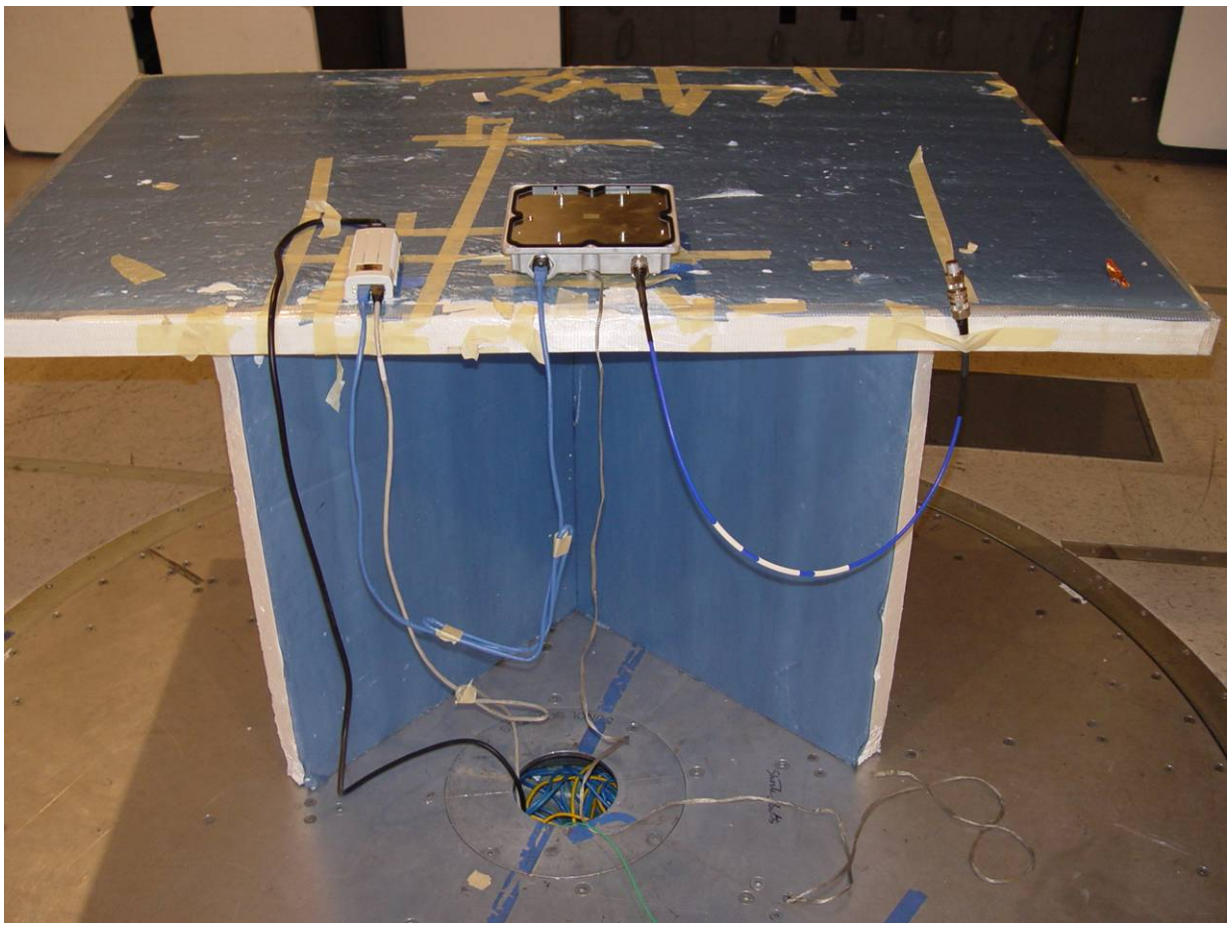
## 6.1. General Measurement Test Set-Up



## 6.2. Environmental Chamber

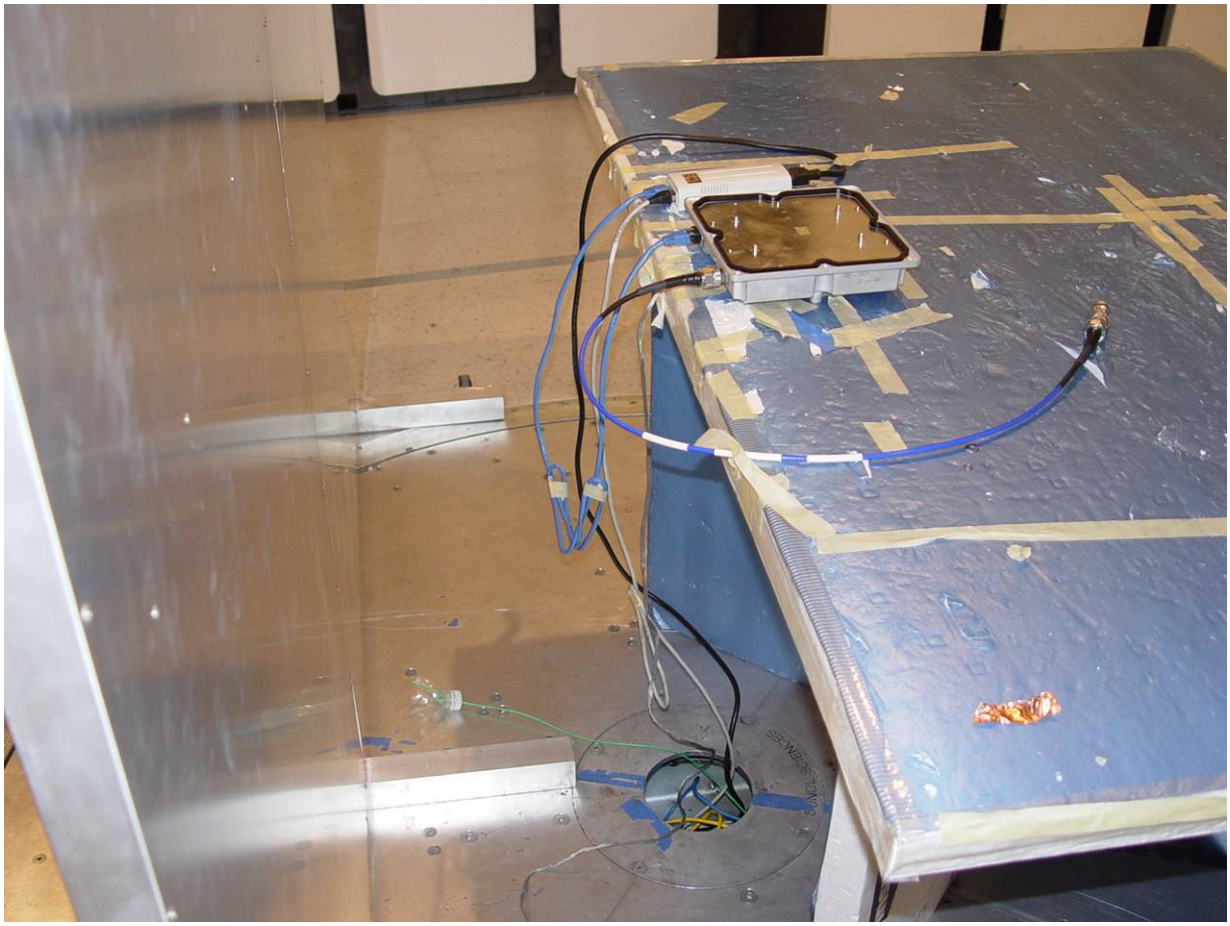
## 6.3. Radiated Spurious Emissions below 1GHz





## 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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