Test Report

Report Number: 3183595MPK-001A
Project Number: 3183595
February 25, 2010

Testing performed on the
Quantum 1000 Base Station
Model Number: QUANTUM 1000
FCC ID: XN3-QUANTUM1036

to

FCC Part 90 Subpart Z

for

PUREWAVE NETWORKS

Test Performed by:	**Test Authorized by:**
Intertek Testing Services NA, Inc	PUREWAVE NETWORKS
1365 Adams Court	2660-C Marine Way
Menlo Park, CA 94025	Mountain View, CA 94043 USA

Prepared by: _____ **Date:** February 25, 2010
Krishna Vemuri, Senior EMC Engineer

Reviewed by: _____ **Date:** February 25, 2010
Ollie Moyrong, Engineering Manager

Report No. 3183595MPK-001A

Equipment Under Test:	Quantum 1000 Base Station
Trade Name:	PUREWAVE NETWORKS
Model No.:	QUANTUM 1000
Serial No.:	EMCProto1
FCC ID:	XN3-QUANTUM1036
Applicant:	PUREWAVE NETWORKS
Contact:	Mr. Jas Dhaliwal
Address:	2660-C Marine Way Mountain View, CA 94043
Country	USA
Tel. number:	650-528-5200
Fax number:	650-528-5222
Applicable Regulation:	FCC Part 90 Subpart Z
Test Site Location:	1365 Adams Court Menlo Park, CA 94025
Date of Test:	February 22 – 24, 2010

We attest to the accuracy of this report:

Krishna Vemuri	Ollie Moyrong
Senior EMC Engineer	Engineering Manager

TABLE OF CONTENTS

1.0 Introduction

1.1 Product Description

The Quantum 1000 employs an extremely flexible and versatile hardware architecture. The heart of the base station is a sophisticated and highly integrated ASIC that combines 6 DSP and general purpose processor cores along with specialized DSP hardware. A Linux based subsystem supports applications, SNMP and other management functions. Finally, the Quantum 1000 includes 2 RF transmitters and associated PAs, and 4 RF receivers.

Important characteristics of the Quantum 1000 Base Station Sector are:

- Board-to-board communications for scaling up to 6 antennas.
- 10 MHz profile
- WiMAX OFDMA compliance
- All layers implemented in software.
- 2.3 – 2.7 GHz and 3.3 – 3.8 GHz operations.

PureWave has implemented a scalable architecture that lets service providers upgrade their Base Stations by:

- Adding more Base Station Sector to a location
- Adding antennas (and corresponding RF module sets) within a sector
- Adding processing capability in order to process traffic within additional spectrum
- Upgrading software to allow for changes in features and standards.

Specification of the EUT	
Maximum Measured RF Output Power	25.7 dBm for 5 MHz, (0.37 W) 25.3 dBm for 10 MHz, 0.34W)
Frequency Ranges, MHz	3652.5 – 3672.5 for 5 MHz 3655 – 3670 for 10 MHz
Type of Modulation	QPSK, 16QAM, 64QAM
Channel Bandwidth	5 MHz, 10 MHz
Antenna Gain	Varies[1,2], refer to Report Section 1.4 for antenna details
Emission Designator	4M63W7D for 5 MHz 9M26W7D for 10 MHz
Operating Temperature	From -30^0C to $+50^0$C

[1] Peak EIRP Power allowed is 10W/10MHz for 10 MHz Channel Spacing. The RF Output Power will be varied depending on the antenna system assembly gain employed to ensure the total Peak EIRP is less than 40.0 dBm.

[2] Peak EIRP Power allowed is 5W/5MHz for 5 MHz Channel Spacing. The RF Output Power will be varied depending on the antenna system assembly gain employed to ensure the total Peak EIRP is less than 37.0 dBm.

EUT receive date: February 22, 2010
EUT receive condition: The prototype version of the EUT was received in good condition with no apparent damage. As declared by the Applicant it is identical to the production units.
Test start date: February 22, 2010
Test completion date: February 24, 2010

1.2 Summary of Test Results

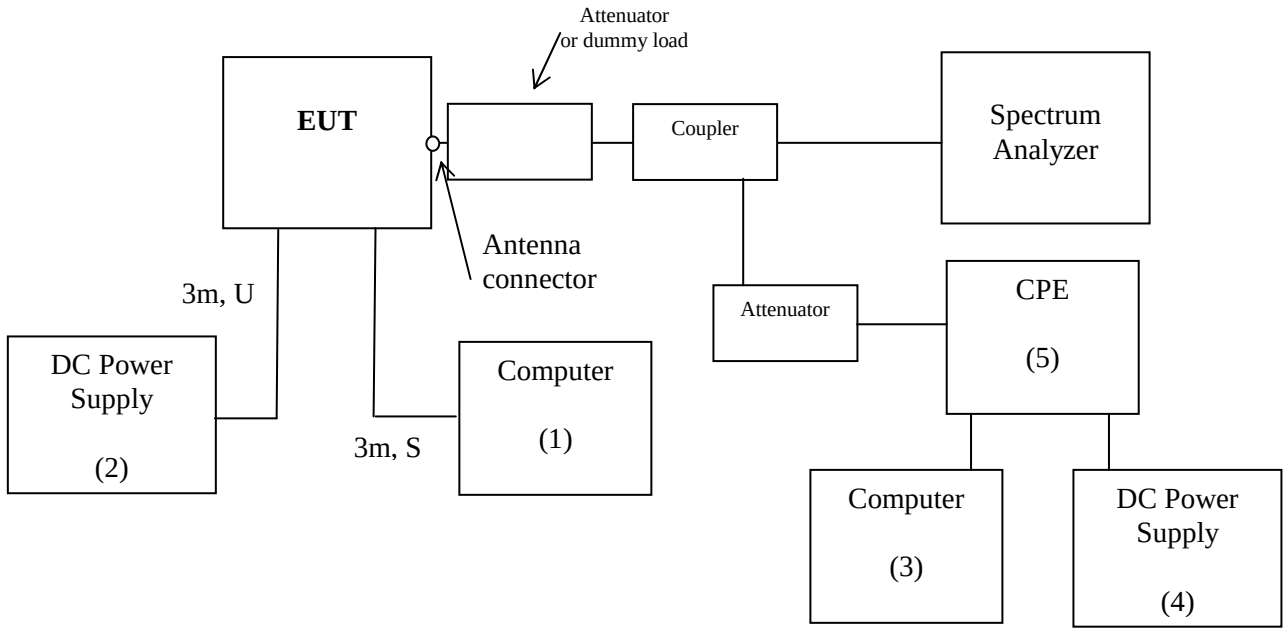
FCC Rule	Description of Test	Result
2.1046, 90.1321	RF Power Output and Antenna Limits	Complies
2.1049	Occupied Bandwidth	Complies
2.1051, 90.1323	Out of Band Emissions at Antenna Terminals	Complies
2.1053, 90.1323	Spurious Radiation	Complies
2.1055	Frequency Stability vs. Temperature and Voltage	Complies
15.109, 15.111	Emissions from Digital Parts, Receiver and Transmitter Spurious from 30 MHz to 1 GHz	Complies

1.3 Test Configuration

1.3.1 Support Equipment

Item #	Description	Model No.	S/N
1	Dell Personal Computer	Optiplex 320	9B32KC1
2	Agilent DC Power Supply	6644A	MY40001367
3	Dell Personal Computer	Optiplex 320	3RND5J1
4	Phihong DC Power Supply	PSUI6U-480	P72809868A1
5	Gemtek CPE	WIXS-177	002682124972

1.3.2 Block diagram of Test Setup



S = Shielded **U** = Unshielded	**F** = With Ferrite **m** = Length in Meters

1.4 Antenna Specifications

The Quantum 1000 3.65 GHz product line can be used with antennas supplied by PureWave Networks or any commercially available antenna. The table below lists antenna products that provide a representative sample of the range of antennas that may be used.

Description	Gain dBi	Az BW degrees	Manufacturer	Manufacturer P/N
4 element, vertical linear polarized array	14.5	120	Mars Antenna	MA-WE36-15PW4
4 element, vertical linear polarized array	15.5	90	Mars Antenna	MA-WD36-16PW4
2 element, dual polarized, +/- 45 degree slant	15	90	Mars Antenna	MA-WD35-DS15
2 element, dual polarized, +/- 45 degree slant	16.5	65	Mars Antenna	MA-WC35-DS17
Omni, vertical polarized	11	360	L-com	HG3511U-PRO
Omni, vertical polarized	8	360	Air802 LLC	ANOM3508
Omni, vertical polarized	12	360	Air802 LLC	ANOM3512

2.0 RF Power Output and Antenna Limits

FCC 2.1046, 90.1321

Base and fixed stations are limited to 25 watts/25 MHz equivalent isotropically radiated power (EIRP). In any event, the peak EIRP power density shall not exceed 1 Watt in any one-megahertz slice of spectrum.

Power Limit for 5 MHz Channel Spacing = 37 dBm
Power Limit for 10 MHz Channel Spacing = 40 dBm

2.1 Test Procedure

The EUT RF output was connected as shown on the diagram in report section 1.3.2. The EUT was setup to transmit continuously the maximum power.

The spectrum analyzer was setup to measure a peak power using the Channel Power Function. The attenuation and cable loss were added to the spectrum analyzer reading by using OFFSET function.

The EUT was set to transmit at maximum power. Measurements were performed at three frequencies (low, middle, and high channels).

2.2 Test Equipment

Rohde & Schwarz FSP40 Spectrum Analyzer

2.3 Test Results

Peak EIRP Power

Frequency (GHz)	Channel Spacing (MHz)	Measured Power (dBm)	Antenna Gain (dBi)	Calculated Max EIRP (dBm)	EIRP Limit (dBm)	Graph
Modulation: QPSK						
3.6525	5	25.16	*	37	37	2.1
3.6625	5	25.46	*	37	37	2.2
3.6725	5	25.27	*	37	37	2.3
Modulation: 16 QAM						
3.6525	5	25.27	*	37	37	2.4
3.6625	5	25.16	*	37	37	2.5
3.6725	5	25.7	*	37	37	2.6
Modulation: 64 QAM						
3.6525	5	25.09	*	37	37	2.7
3.6625	5	25.67	*	37	37	2.8
3.6725	5	25.74	*	37	37	2.9

Notes: Peak EIRP Power allowed is 5W/5MHz for 5 MHz Channel Spacing.
*The RF Output Power will be varied depending on the antenna system assembly gain employed to ensure the total Peak EIRP is less than 37.0 dBm

Peak EIRP Power

Frequency (GHz)	Channel Spacing (MHz)	Measured Power (dBm)	Antenna Gain (dBi)	Calculated Max EIRP (dBm)	EIRP Limit (dBm)	Graph
Modulation: QPSK						
3.655	10	25.04	*	40	40	2.10
3.6625	10	24.93	*	40	40	2.11
3.67	10	25.09	*	40	40	2.12
Modulation: 16 QAM						
3.655	10	24.93	*	40	40	2.13
3.6625	10	25.3	*	40	40	2.14
3.67	10	25.27	*	40	40	2.15
Modulation: 64 QAM						
3.655	10	24.96	*	40	40	2.16
3.6625	10	25.01	*	40	40	2.17
3.67	10	25.04	*	40	40	2.18

Notes: Peak EIRP Power allowed is 10W/10MHz for 10 MHz Channel Spacing.
*The RF Output Power will be varied depending on the antenna system assembly gain employed to ensure the total Peak EIRP is less than 40.0 dBm

EIRP Power Density

Frequency (MHz)	Channel Spacing (MHz)	Measured Power (dBm)	Antenna Gain (dBi)	Calculated Max EIRP (dBm)	EIRP Limit (dBm/MHz)	Graph
Modulation: QPSK						
3.6525	5	21.68	*	30	30	2.19
3.6625	5	22.01	*	30	30	2.20
3.6725	5	22.46	*	30	30	2.21
Modulation: 16 QAM						
3.6525	5	21.99	*	30	30	2.22
3.6625	5	22.09	*	30	30	2.23
3.6725	5	22.53	*	30	30	2.24
Modulation: 64 QAM						
3.6525	5	22.04	*	30	30	2.25
3.6625	5	22.59	*	30	30	2.26
3.6725	5	22.88	*	30	30	2.27

Notes: *The RF Output Power will be varied depending on the antenna system assembly gain employed to ensure the total EIRP Power Density is less than 30.0 dBm

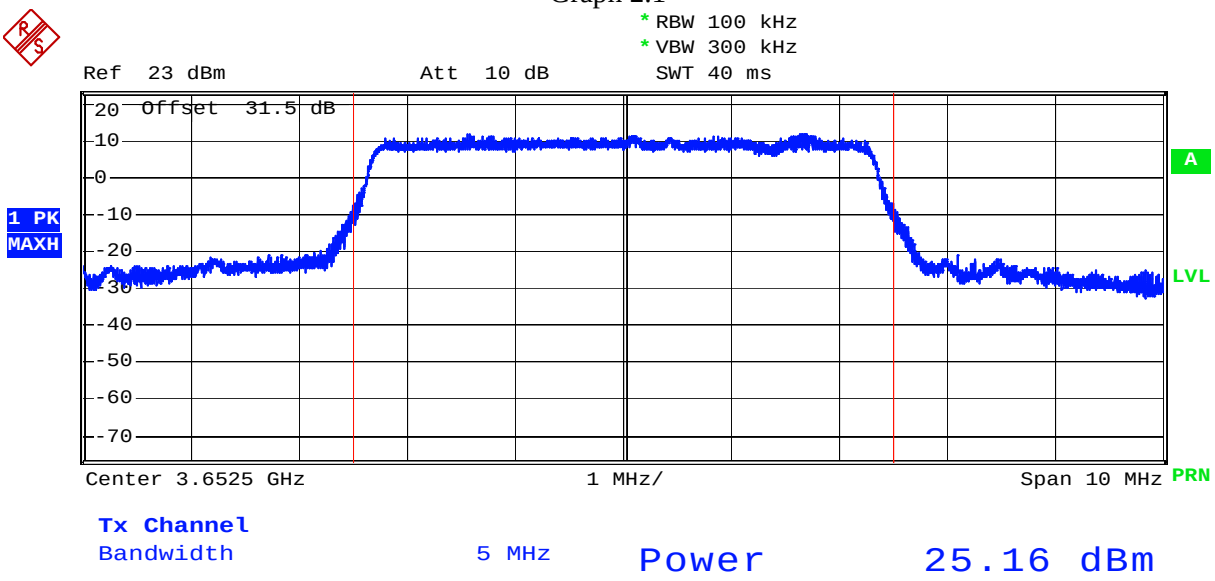
EIRP Power Density

Frequency (MHz)	Channel Spacing (MHz)	Measured Power (dBm)	Antenna Gain (dBi)	Calculated Max EIRP (dBm)	EIRP Limit (dBm/MHz)	Graph
Modulation: QPSK						
3.655	10	18.65	*	30	30	2.28
3.6625	10	19.06	*	30	30	2.29
3.67	10	18.51	*	30	30	2.30
Modulation: 16 QAM						
3.655	10	18.8	*	30	30	2.31
3.6625	10	18.72	*	30	30	2.32
3.67	10	19.12	*	30	30	2.33
Modulation: 64 QAM						
3.655	10	18.59	*	30	30	2.34
3.6625	10	19.11	*	30	30	2.35
3.67	10	18.68	*	30	30	2.36

Notes: *The RF Output Power will be varied depending on the antenna system assembly gain employed to ensure the total EIRP Power Density is less than 30.0 dBm

For more details refer to the attached Graphs.

Output Power
Graph 2.1



Comment: QPSK, LOW CHANNEL
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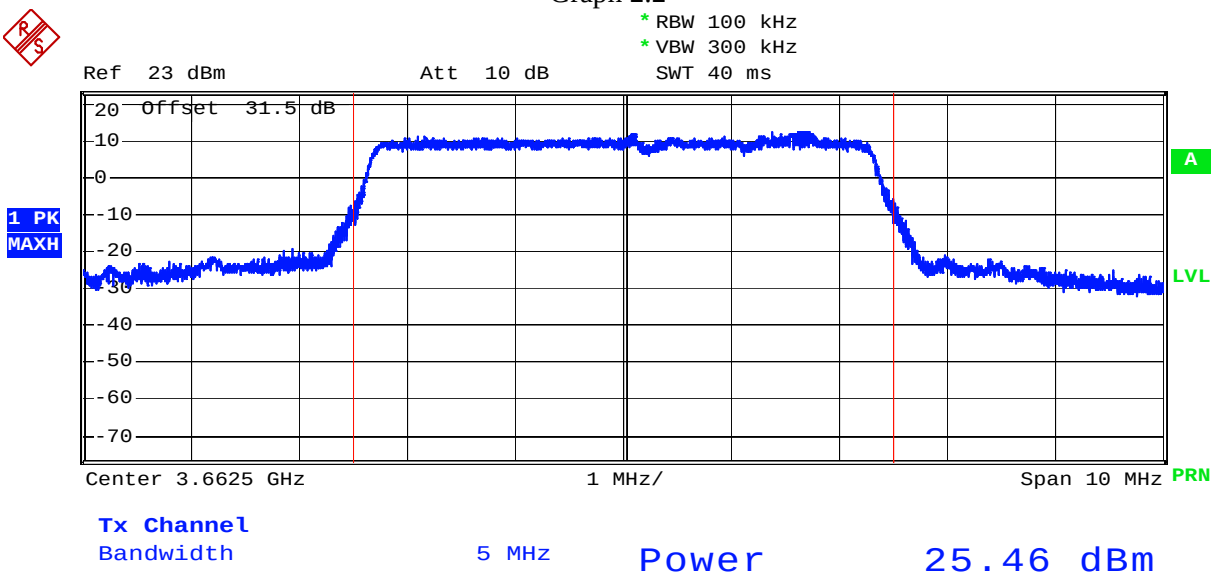
Output Power
Graph 2.2



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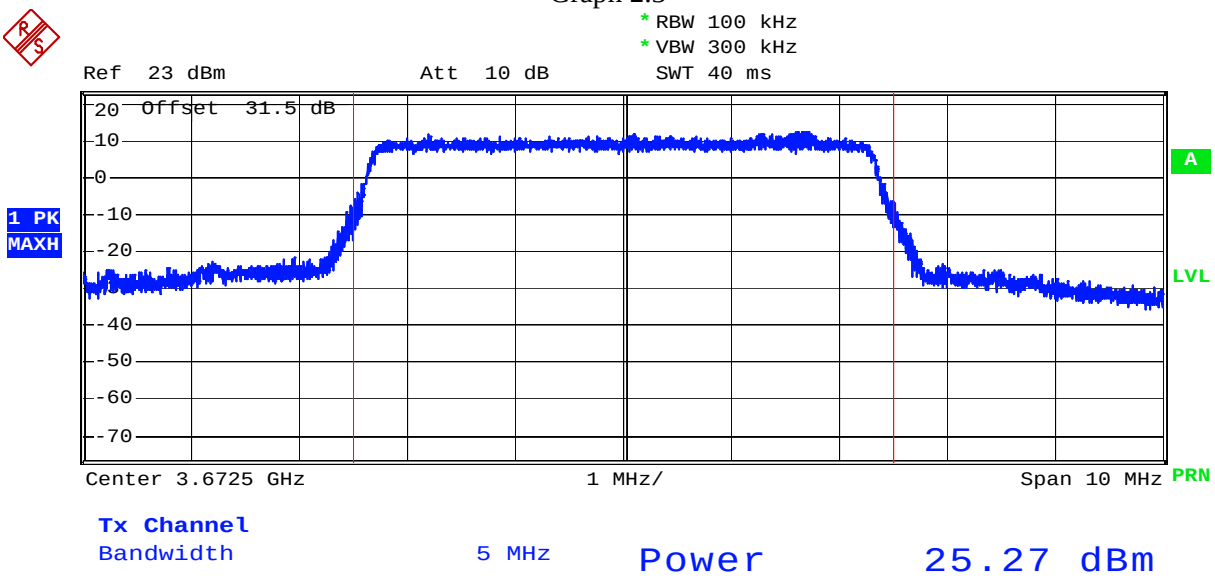
Output Power
Graph 2.3



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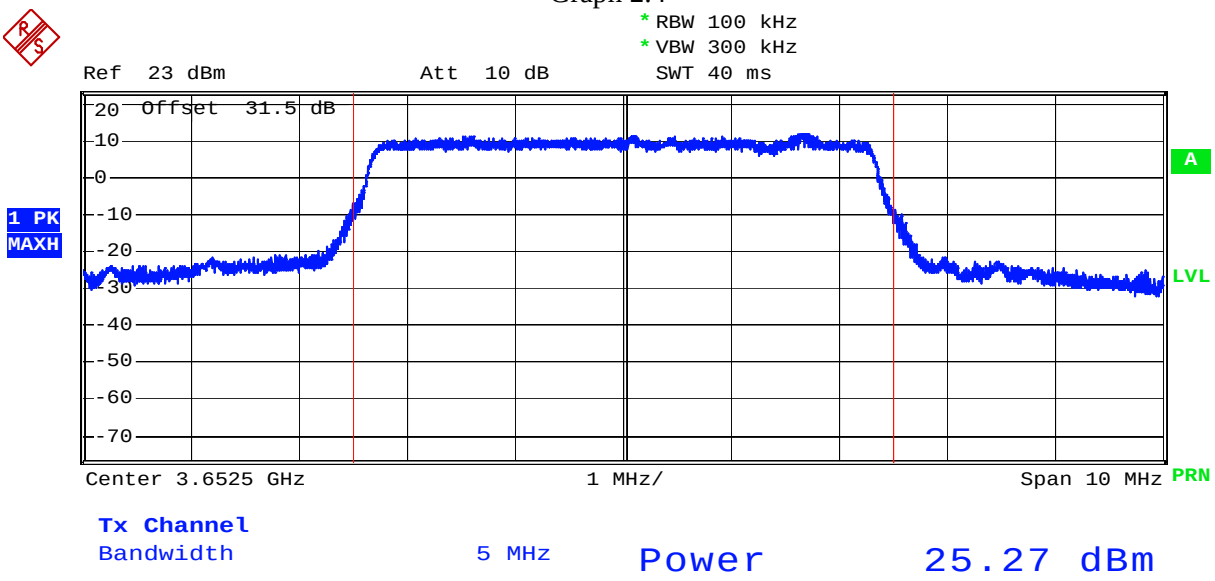
Output Power
Graph 2.4



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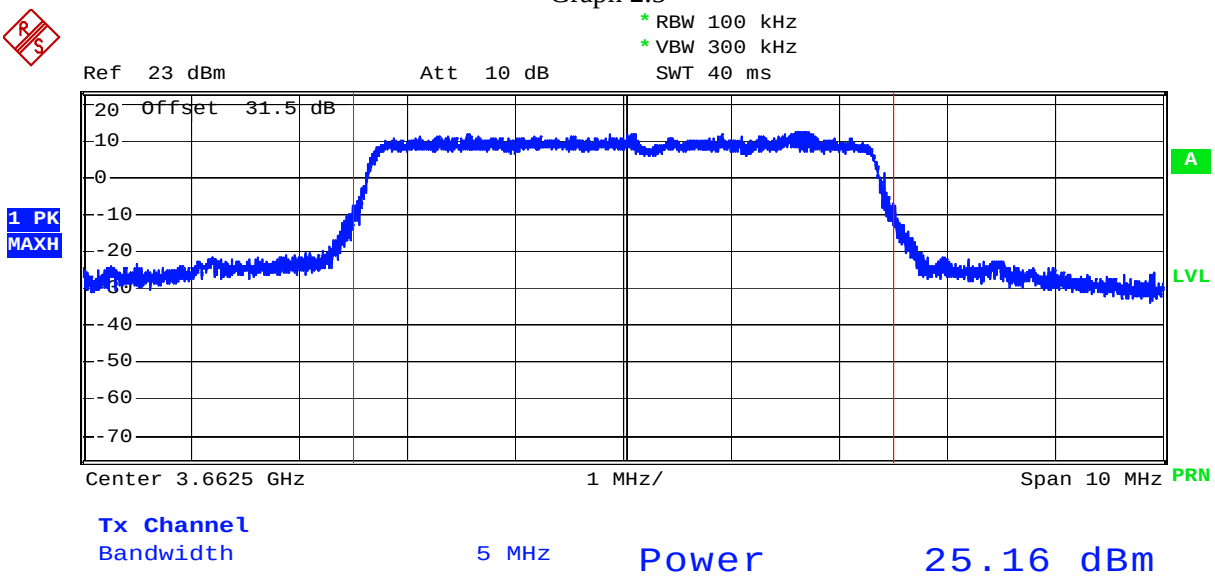
Output Power
Graph 2.5



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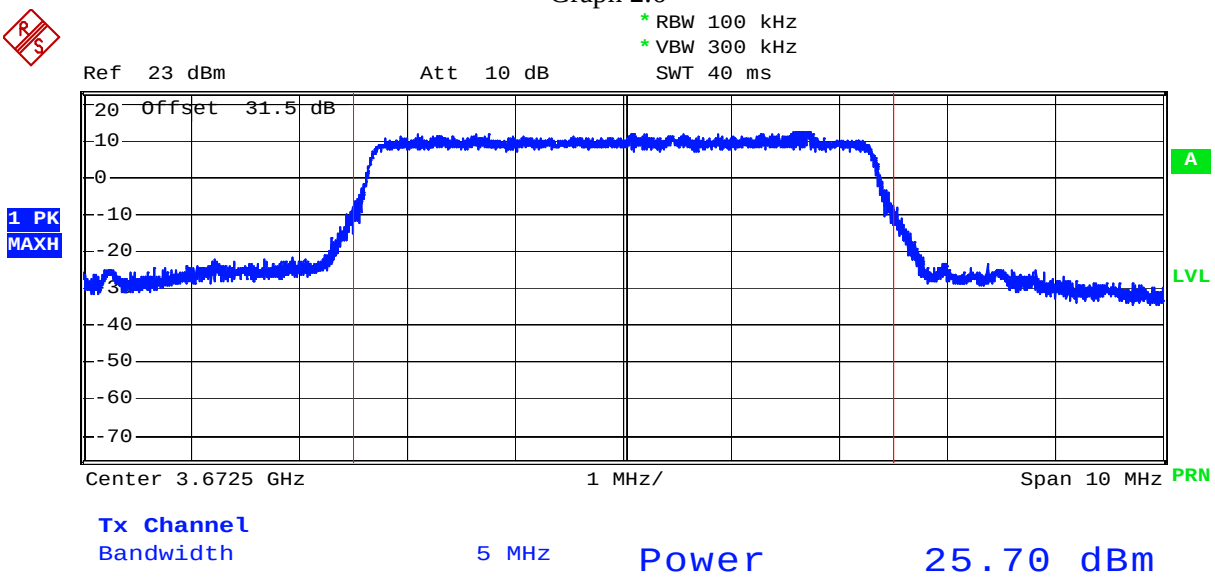
Output Power
Graph 2.6



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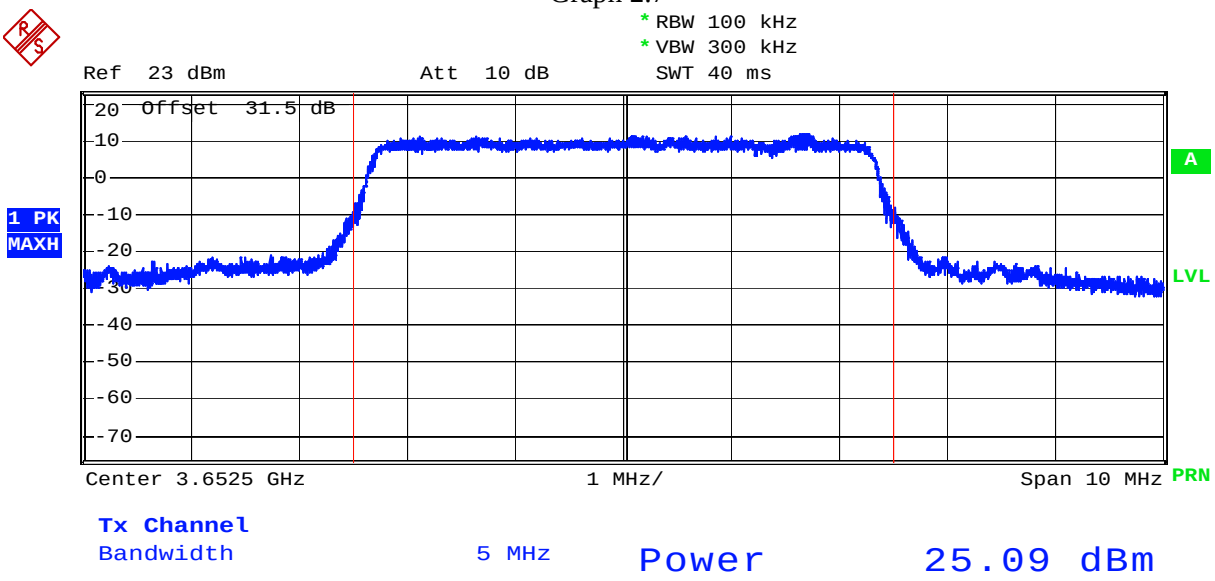
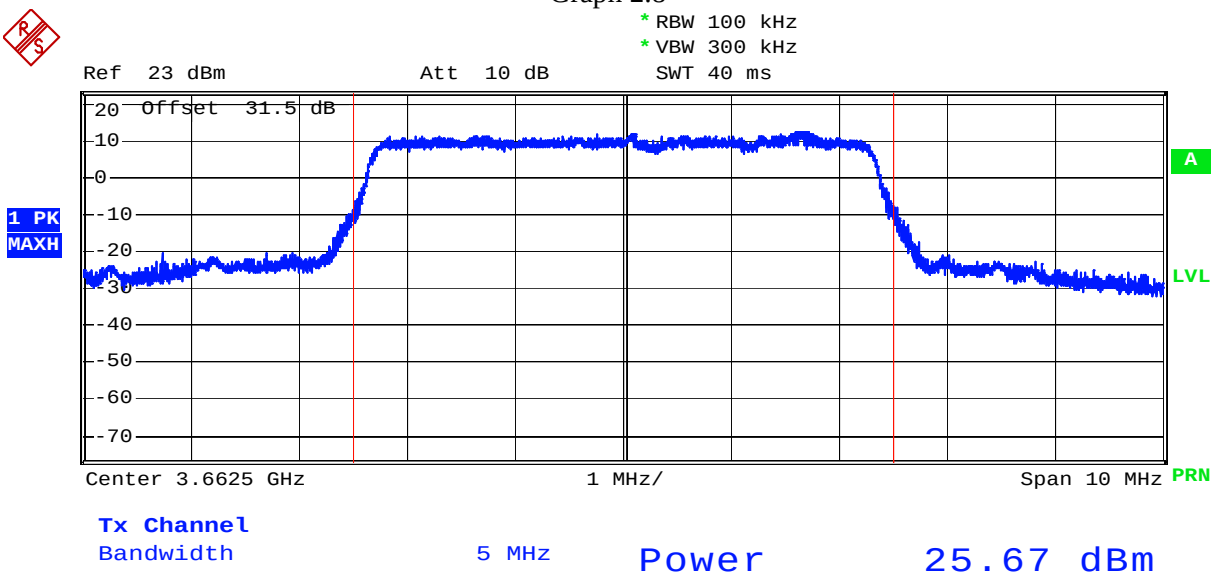
Output Power
Graph 2.7



Comment: 64QAM, LOW CHANNEL
Date: 23.FEB.2010 11:09:28

Output Power
Graph 2.8



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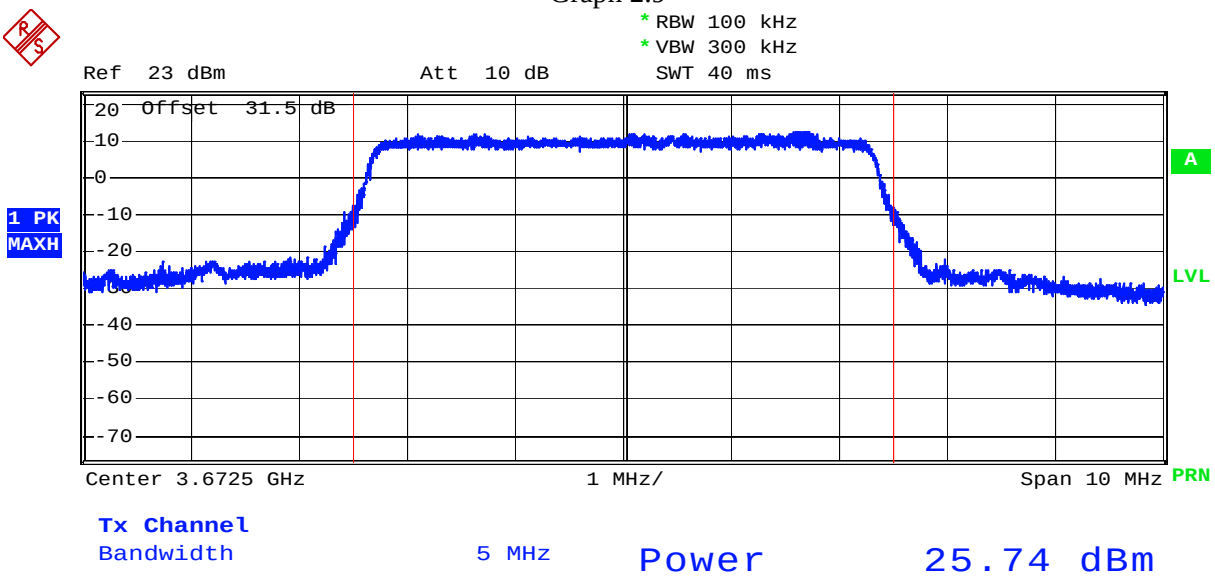
Date: 23.FEB.2010 11:12:18

Output Power
Graph 2.9



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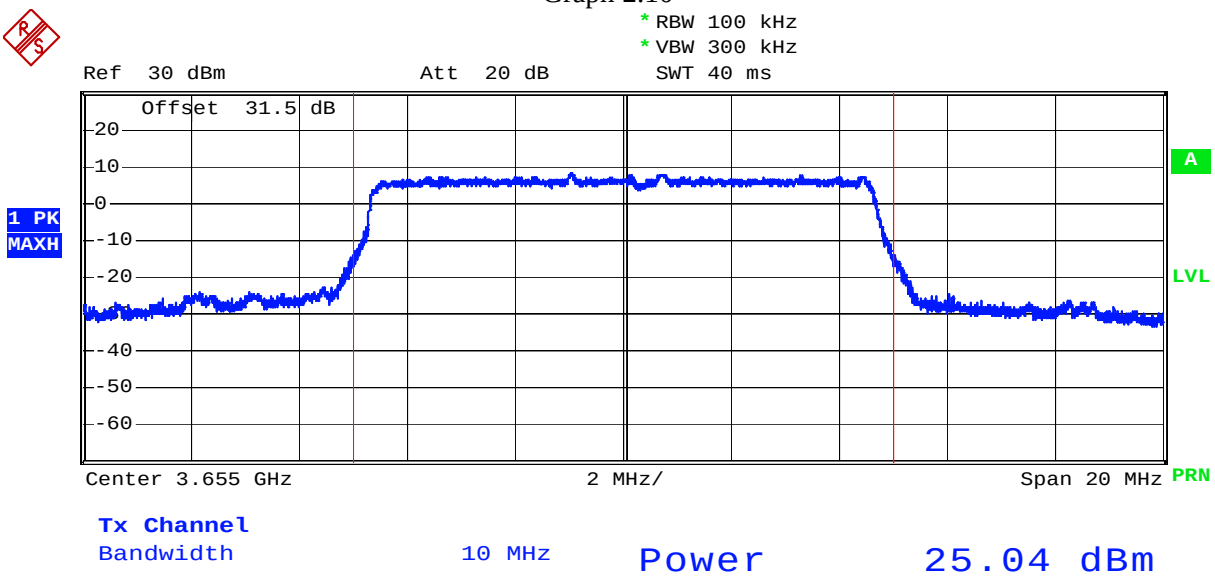
Output Power
Graph 2.10



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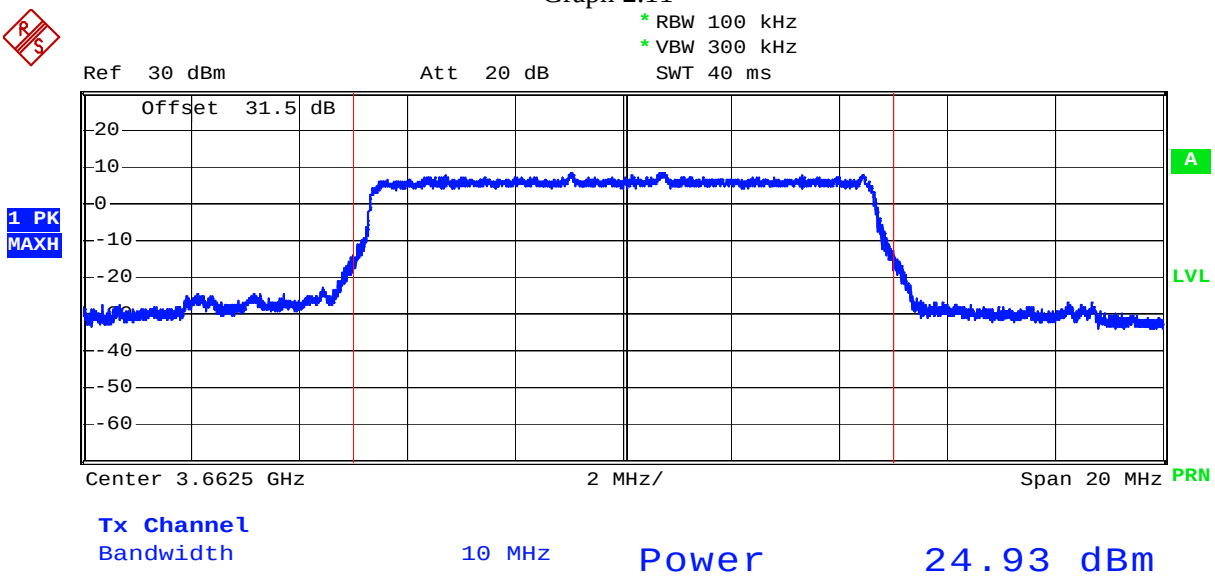
Date: 24.FEB.2010 10:08:24

Output Power
Graph 2.11



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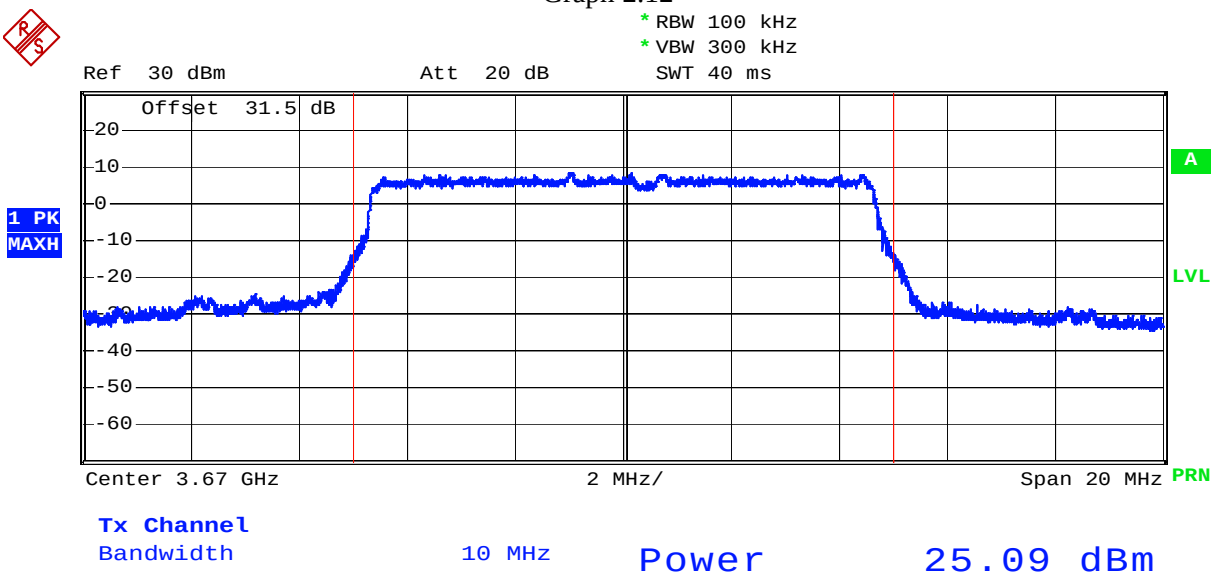
Date: 24.FEB.2010 09:59:05

Output Power
Graph 2.12



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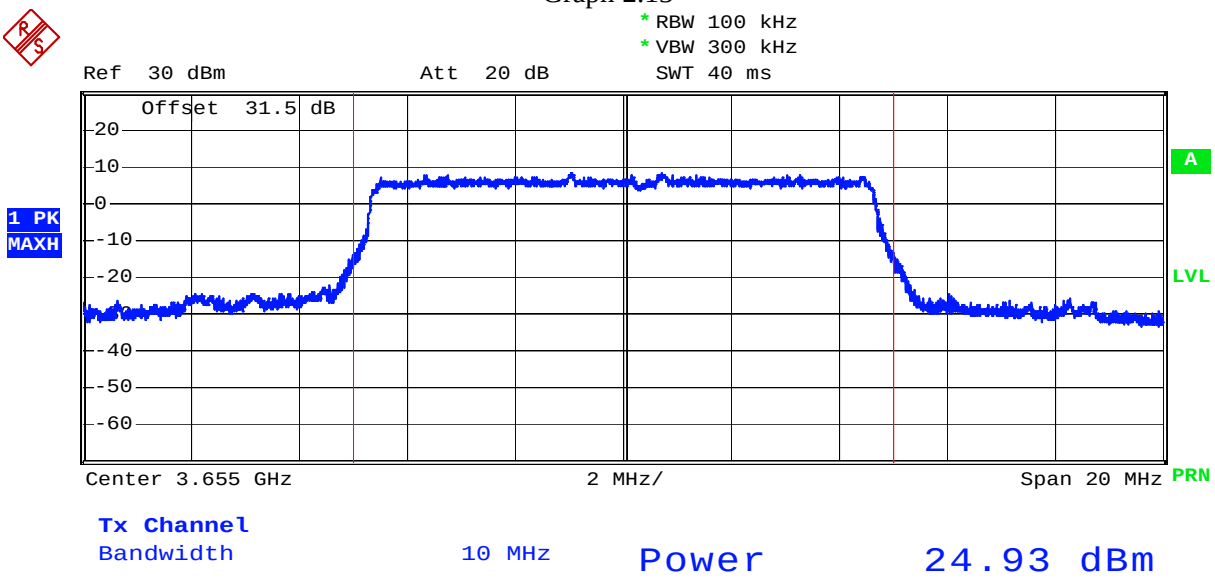
Date: 24.FEB.2010 09:54:28

Output Power
Graph 2.13



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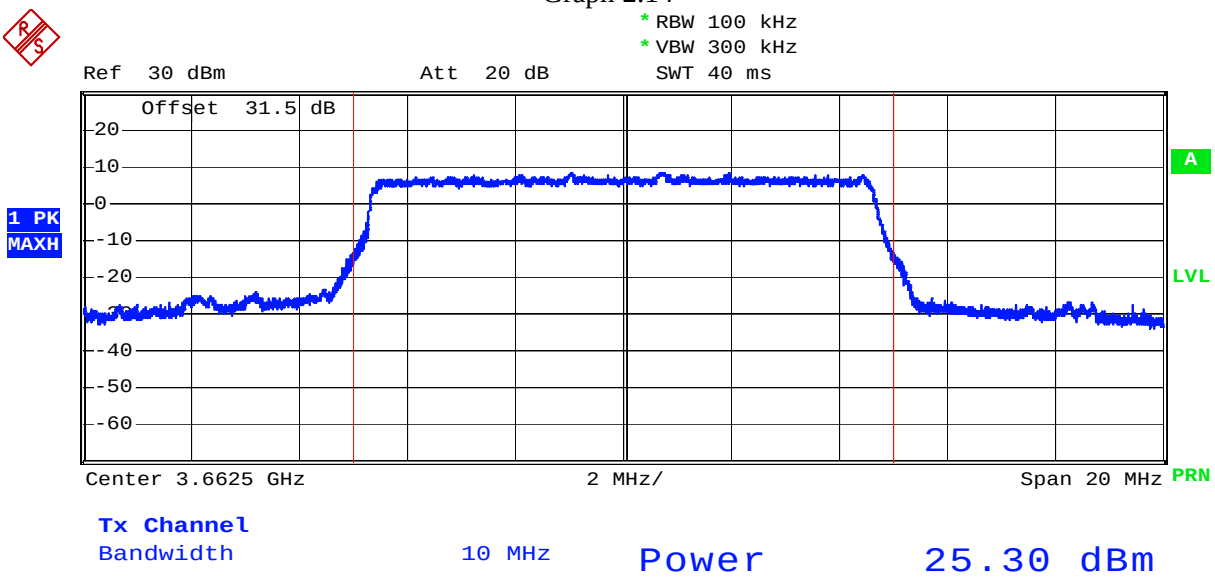
Output Power
Graph 2.14



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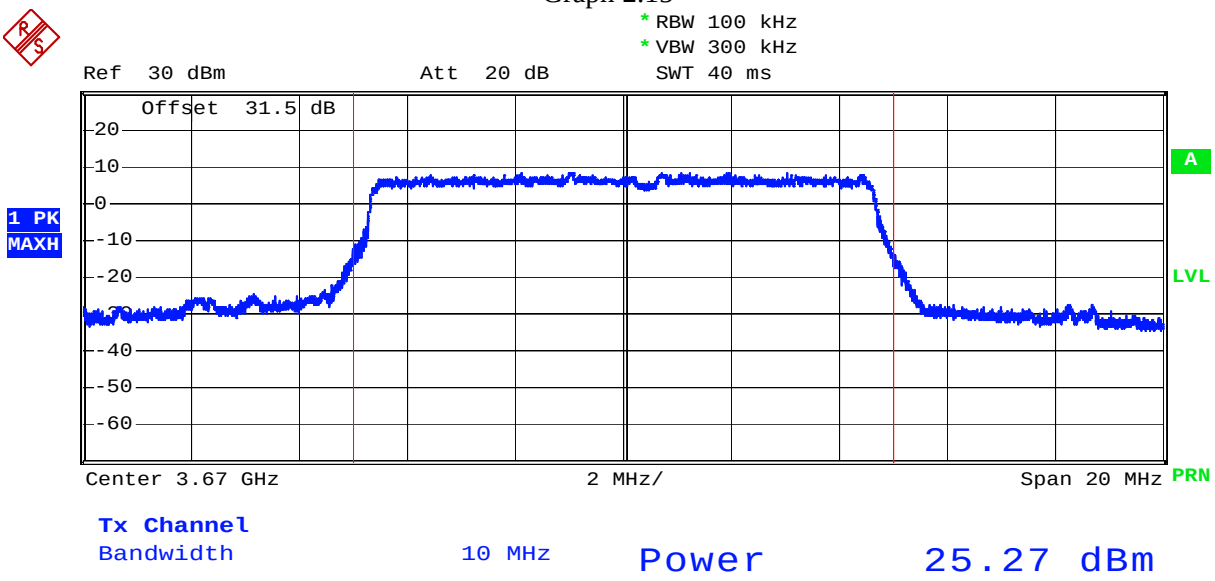
Output Power
Graph 2.15



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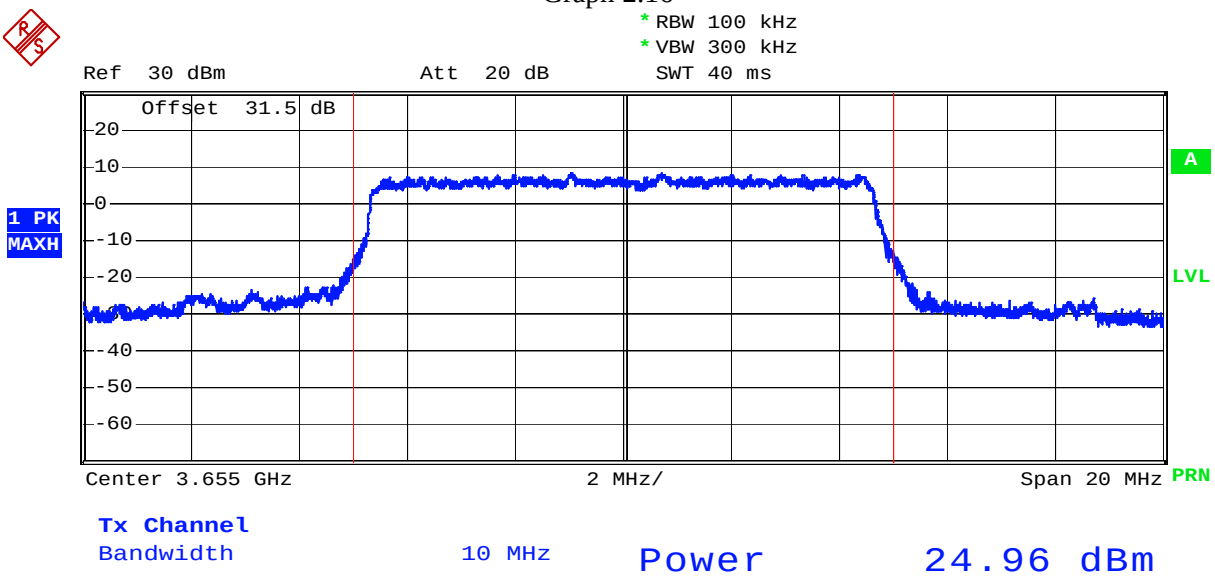
Output Power
Graph 2.16



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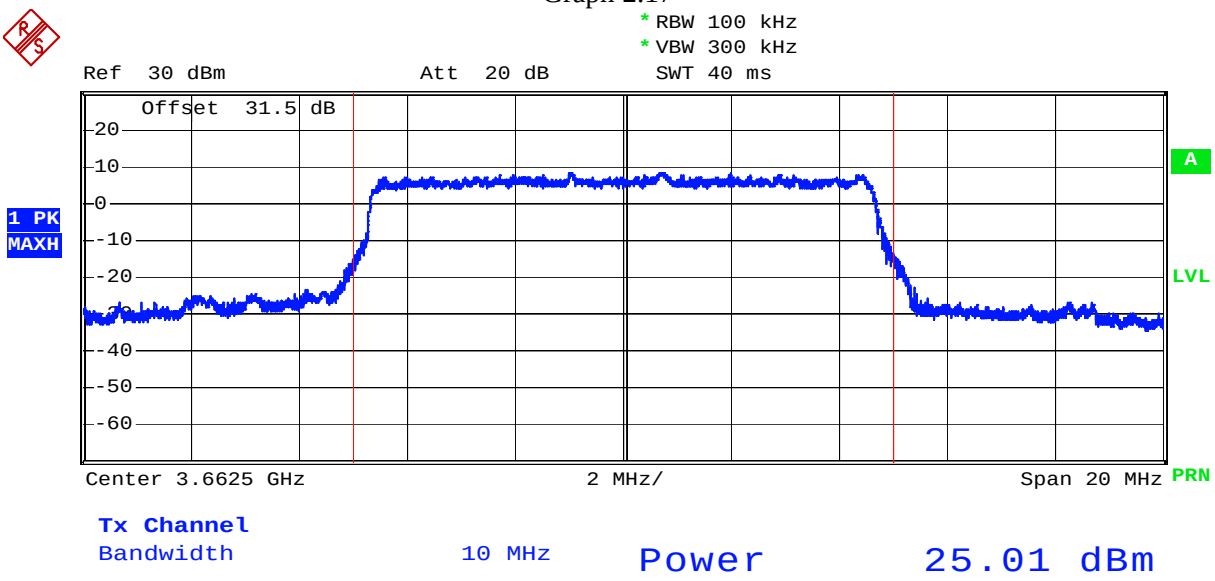
Date: 24.FEB.2010 11:04:32

Output Power
Graph 2.17



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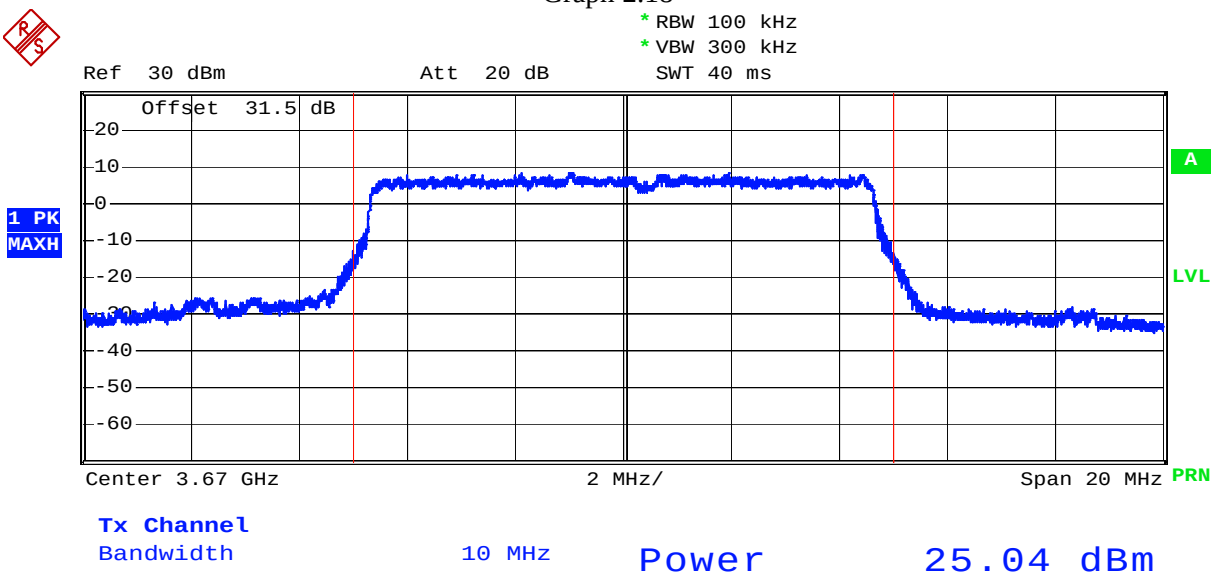
Date: 24.FEB.2010 10:54:08

Output Power
Graph 2.18



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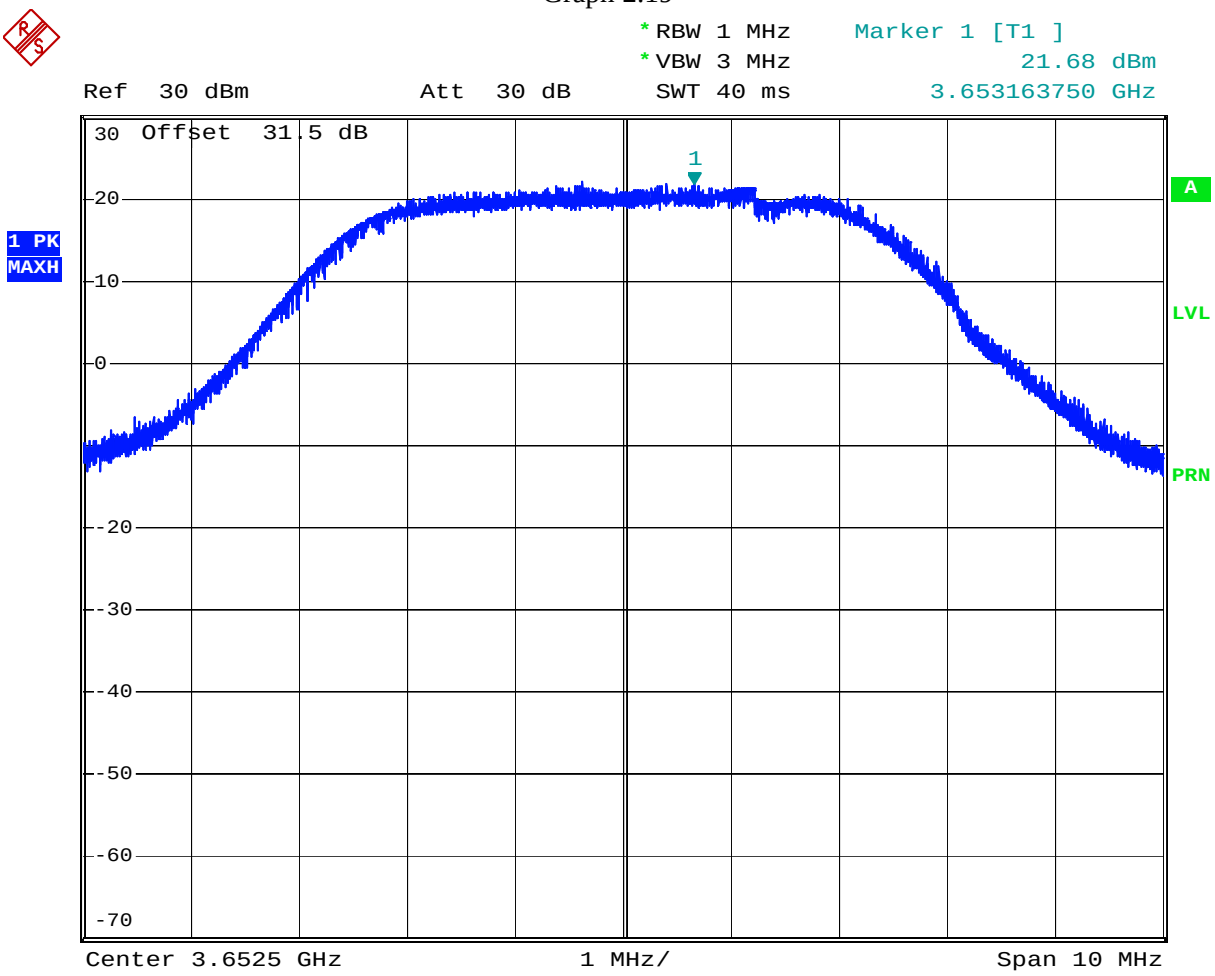
Date: 24.FEB.2010 10:45:39

EIRP Power Density
Graph 2.19



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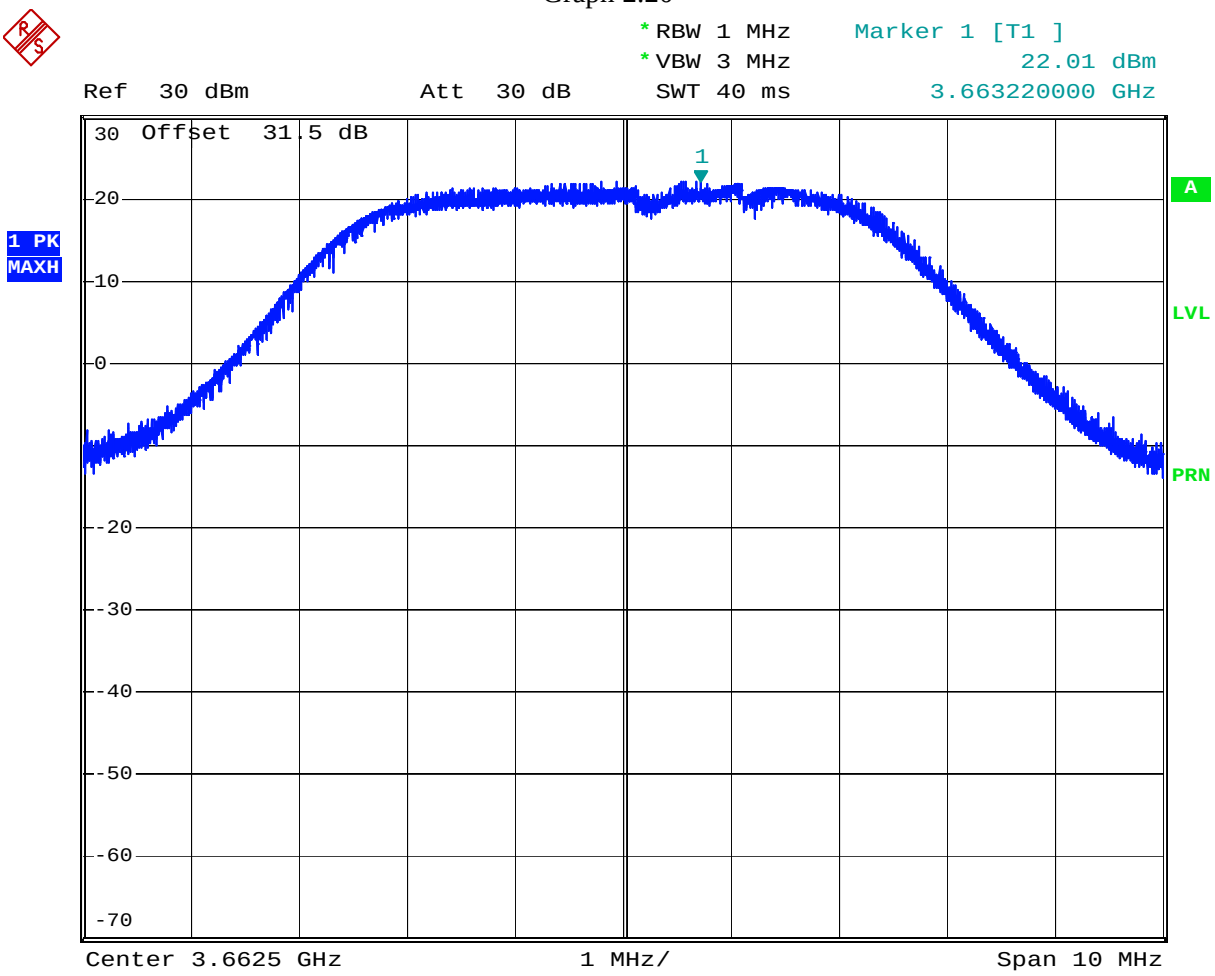
EIRP Power Density
Graph 2.20



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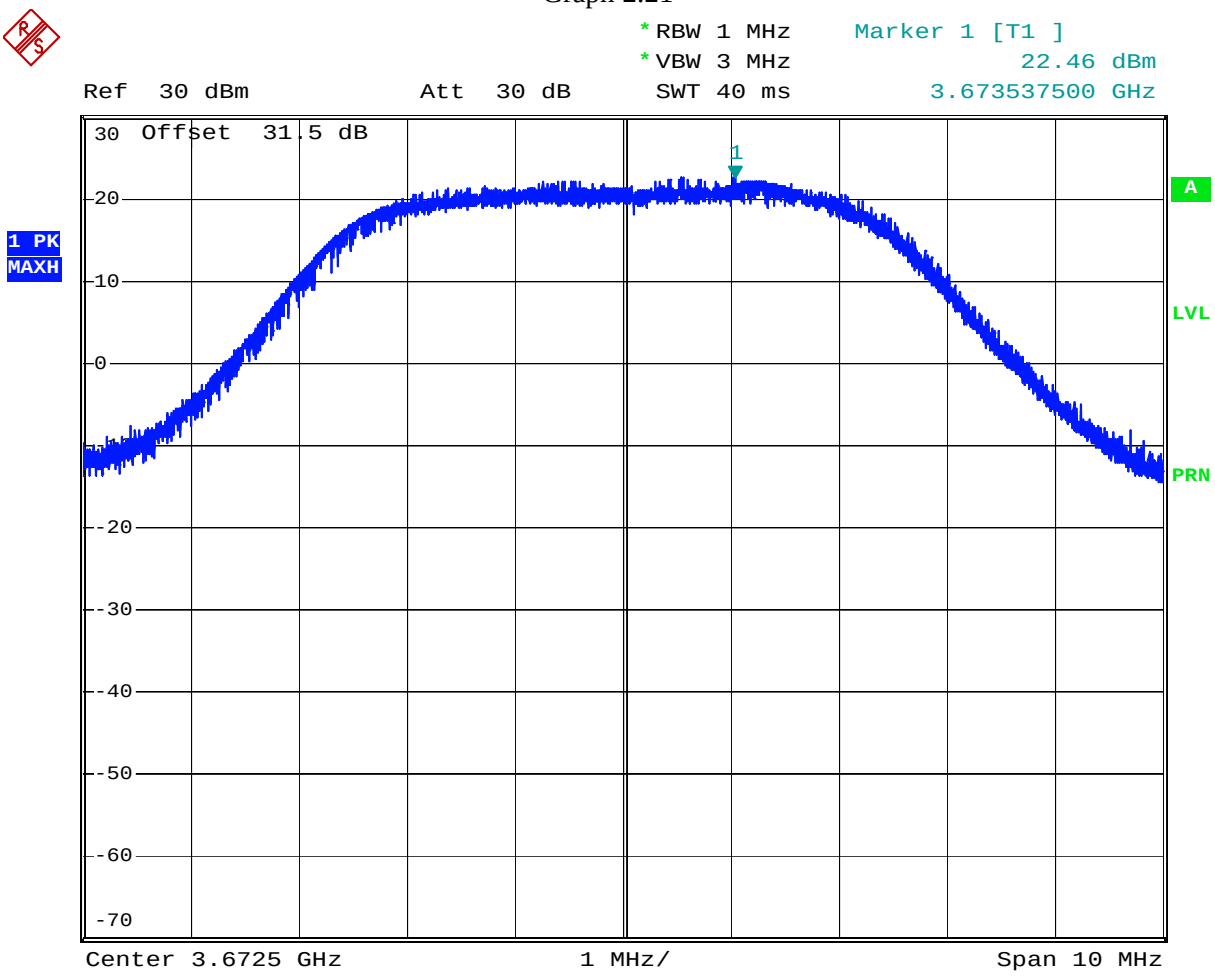
EIRP Power Density
Graph 2.21



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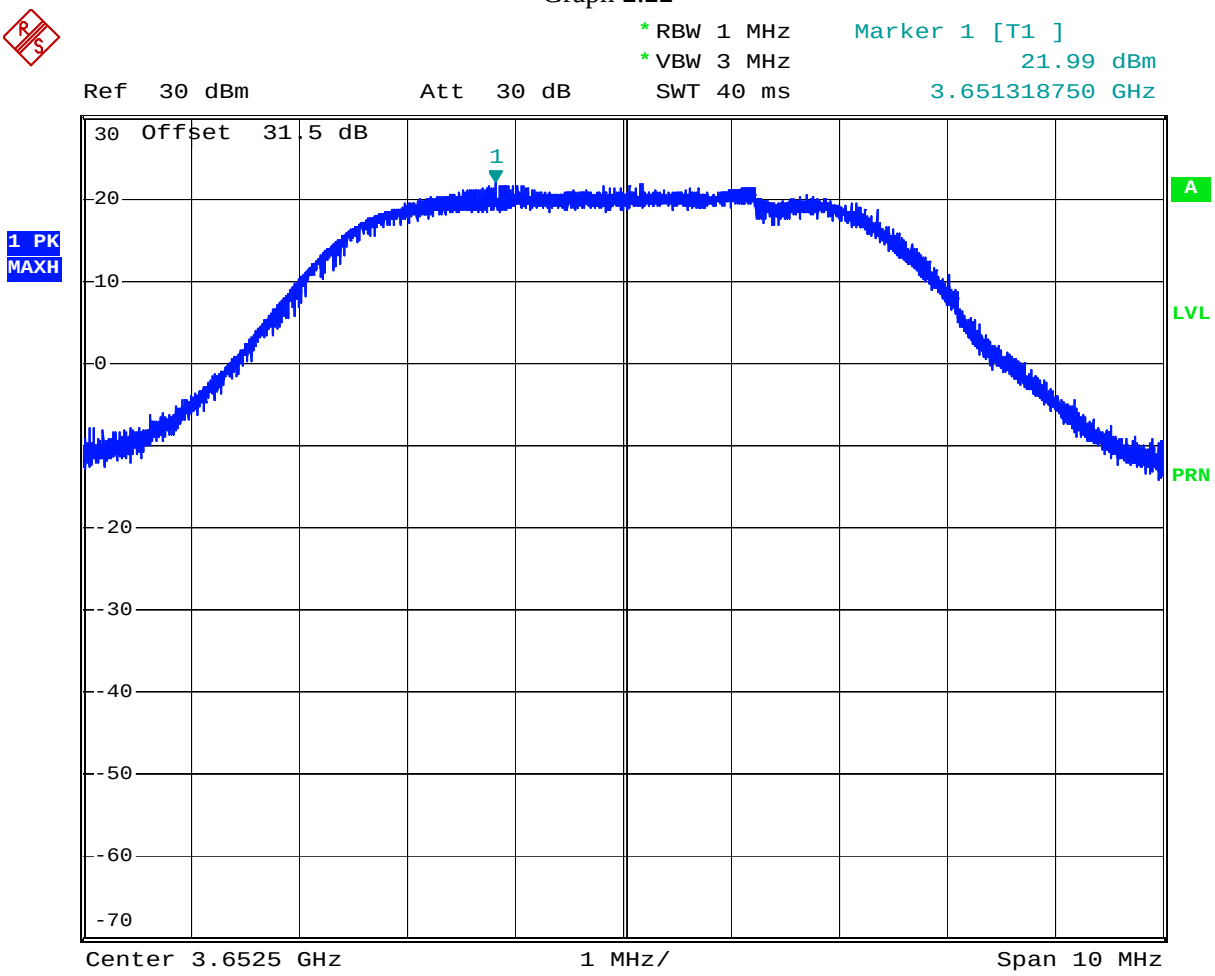
EIRP Power Density
Graph 2.22



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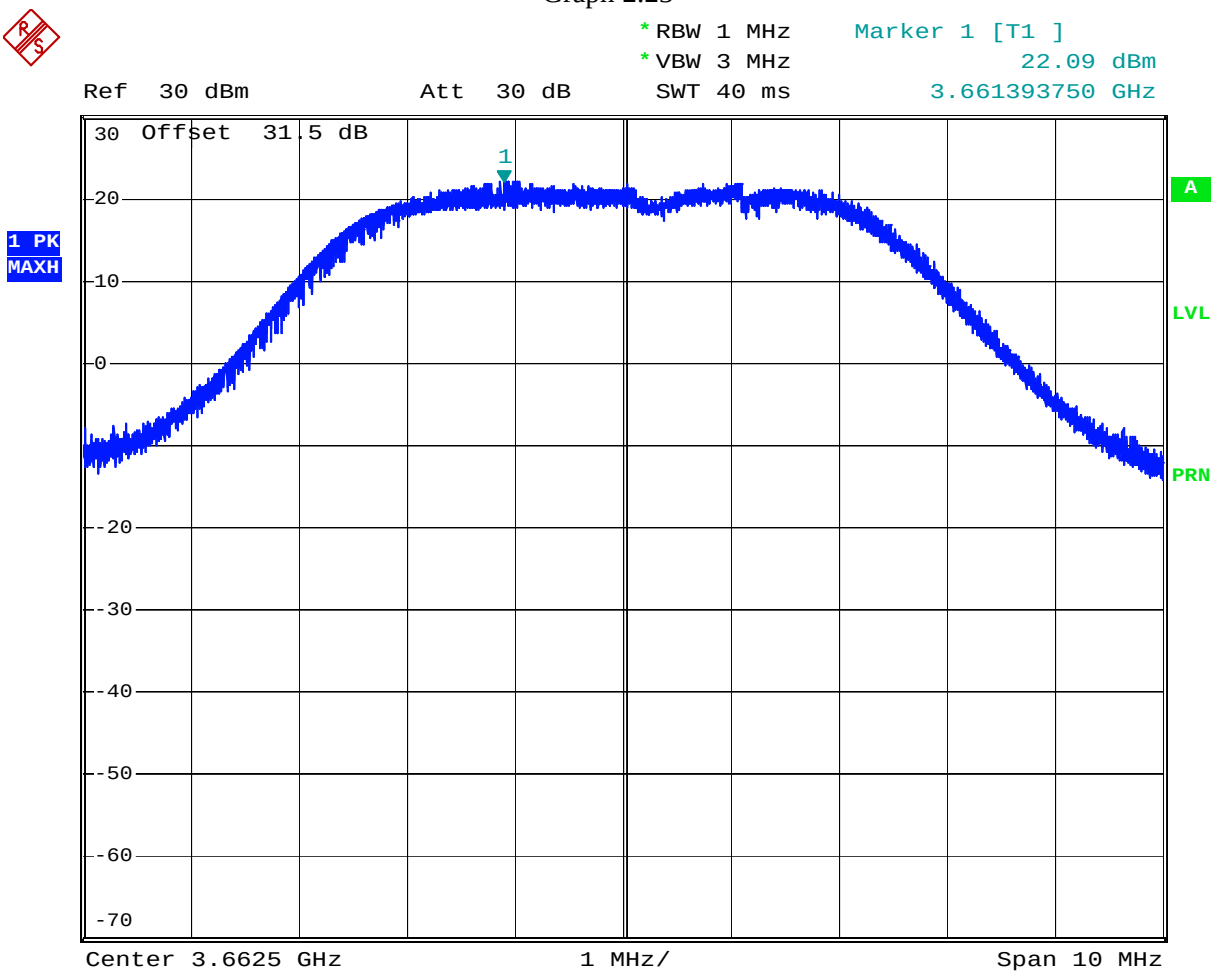
EIRP Power Density
Graph 2.23



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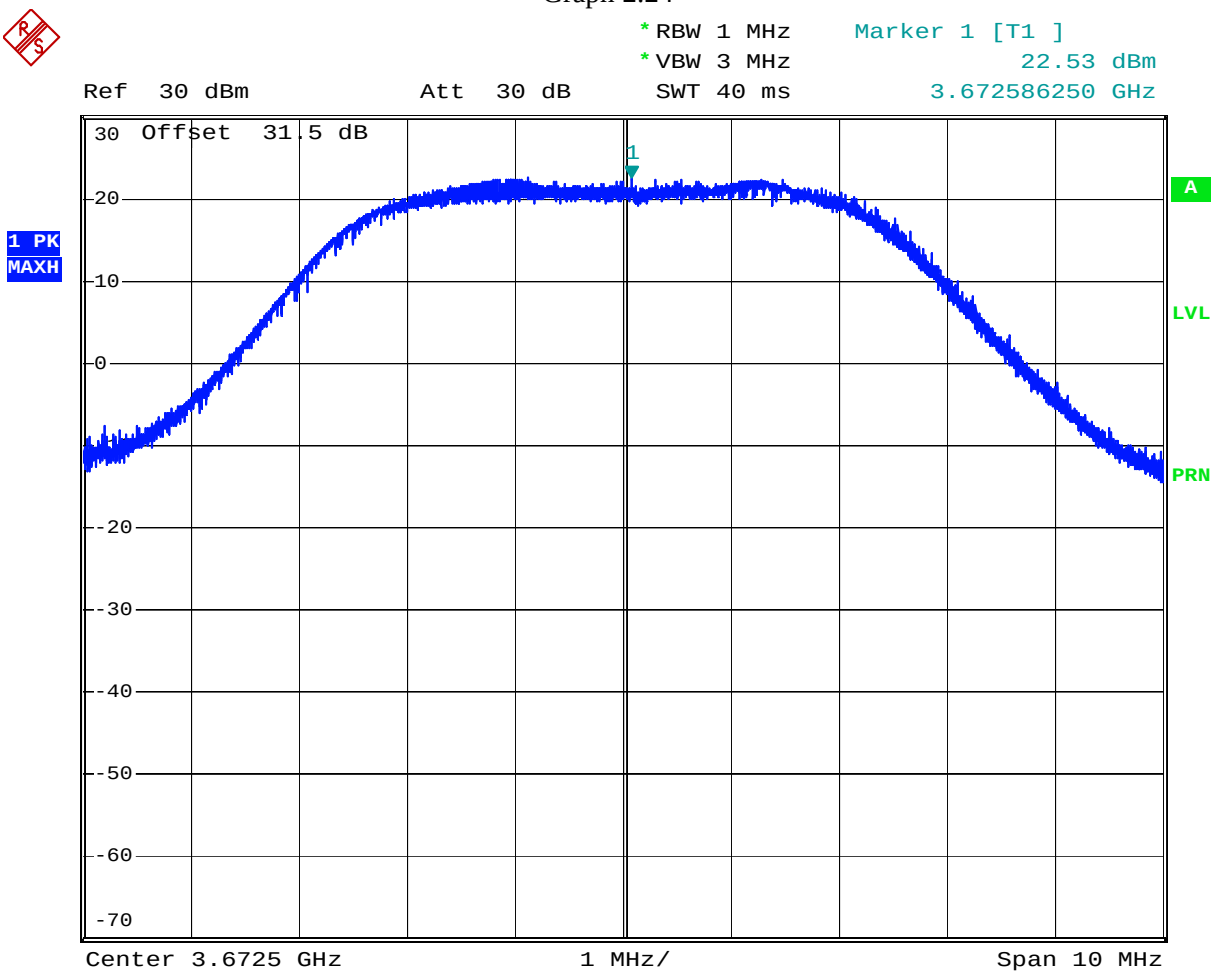
EIRP Power Density
Graph 2.24



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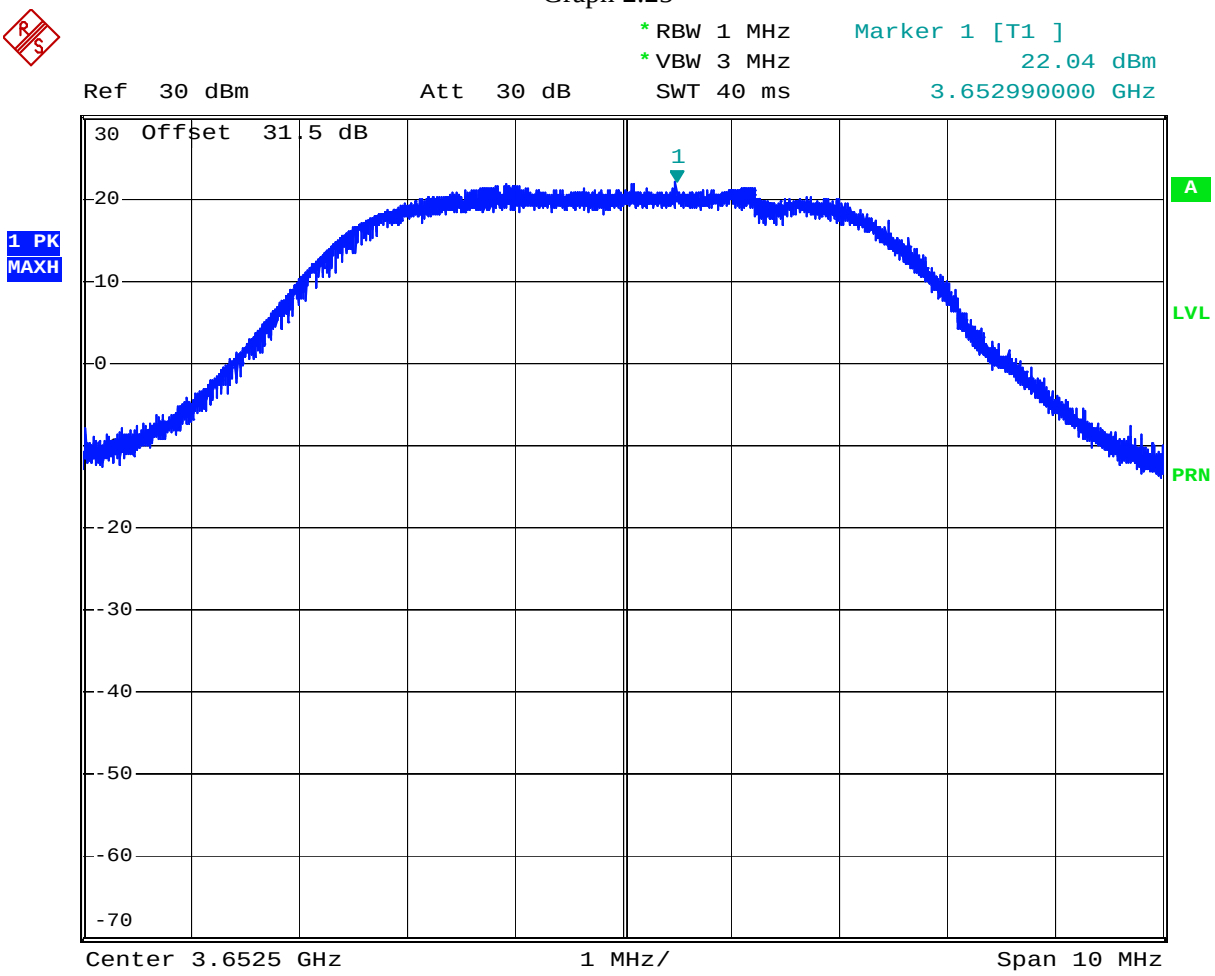
EIRP Power Density
Graph 2.25



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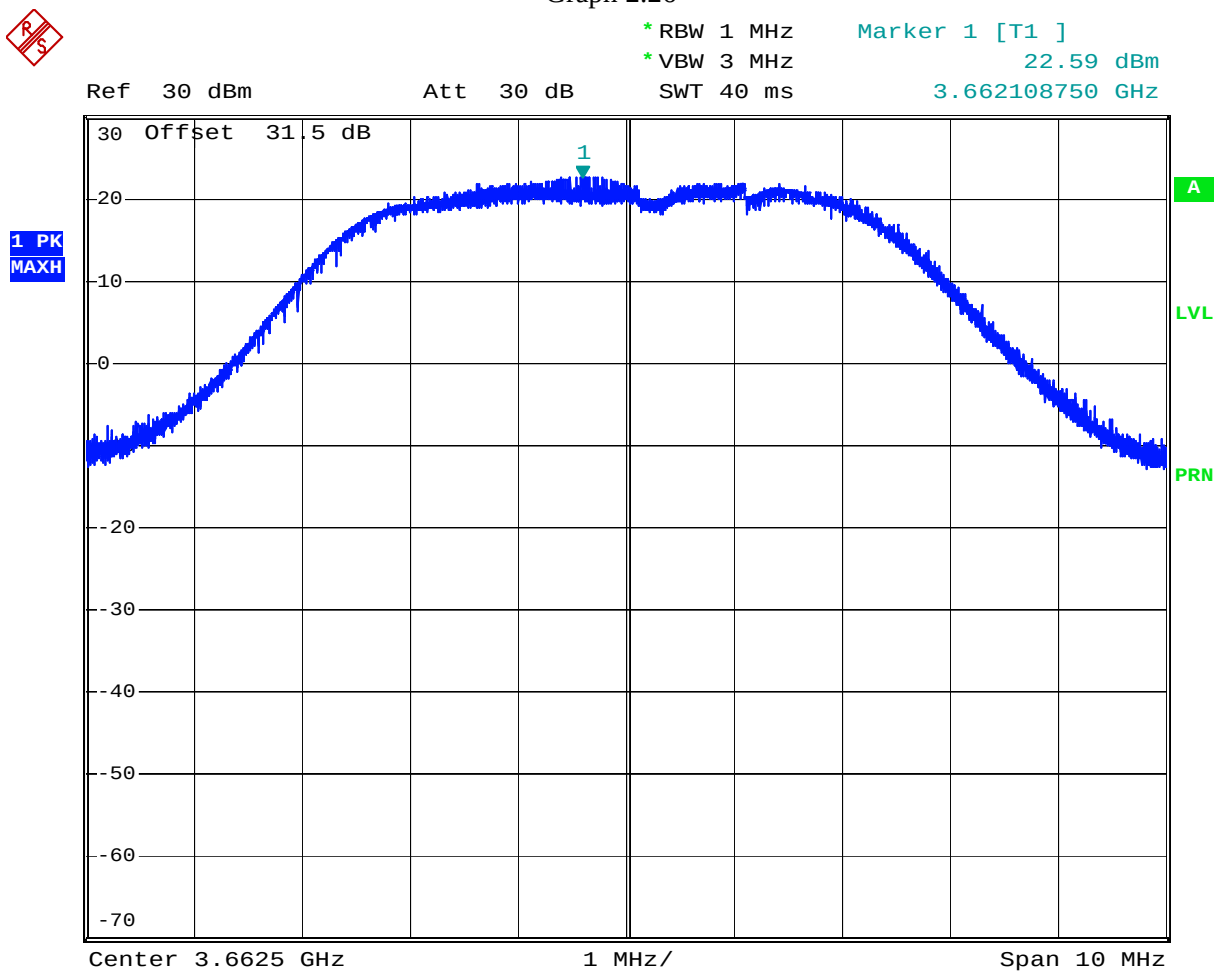
EIRP Power Density
Graph 2.26



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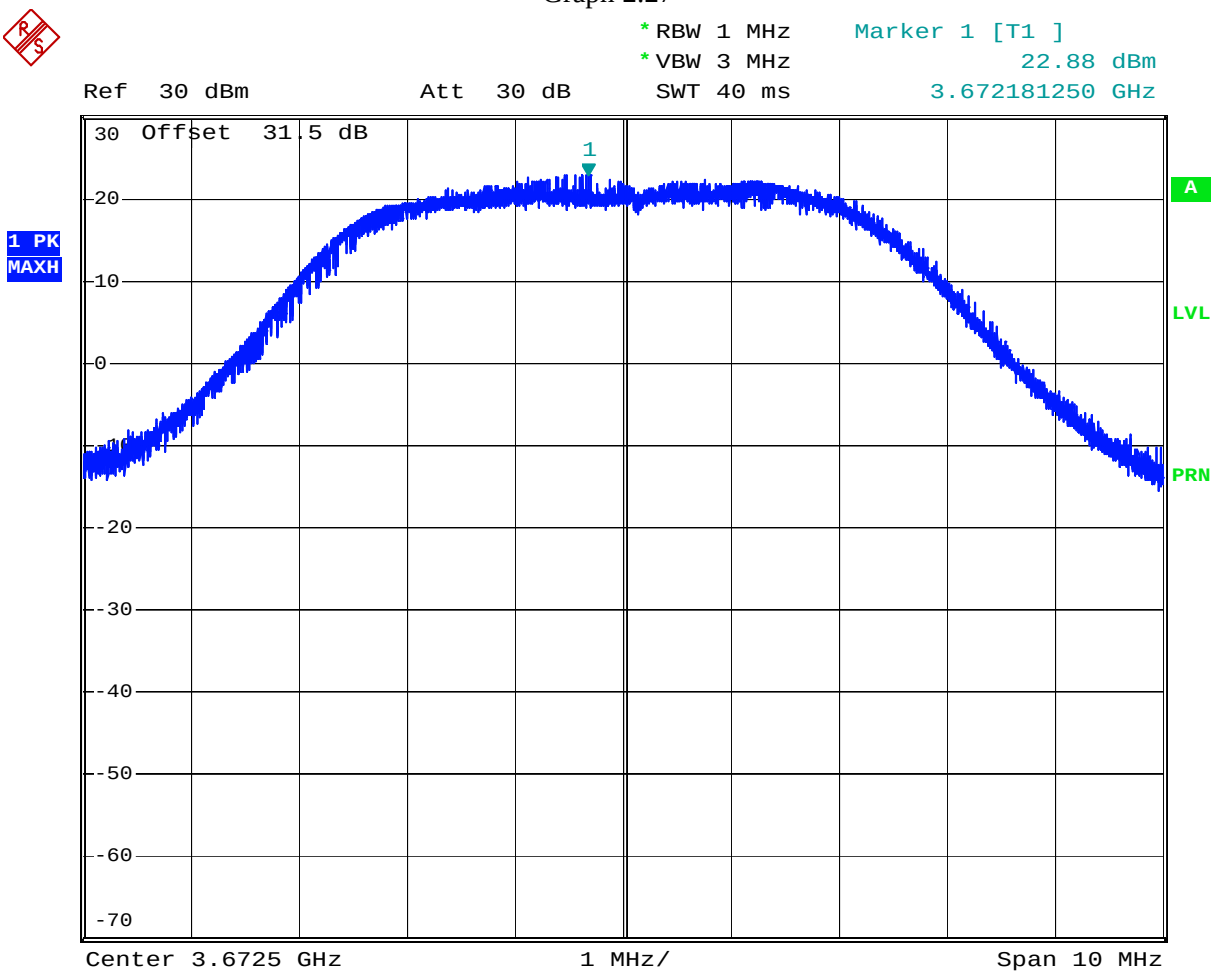
EIRP Power Density
Graph 2.27



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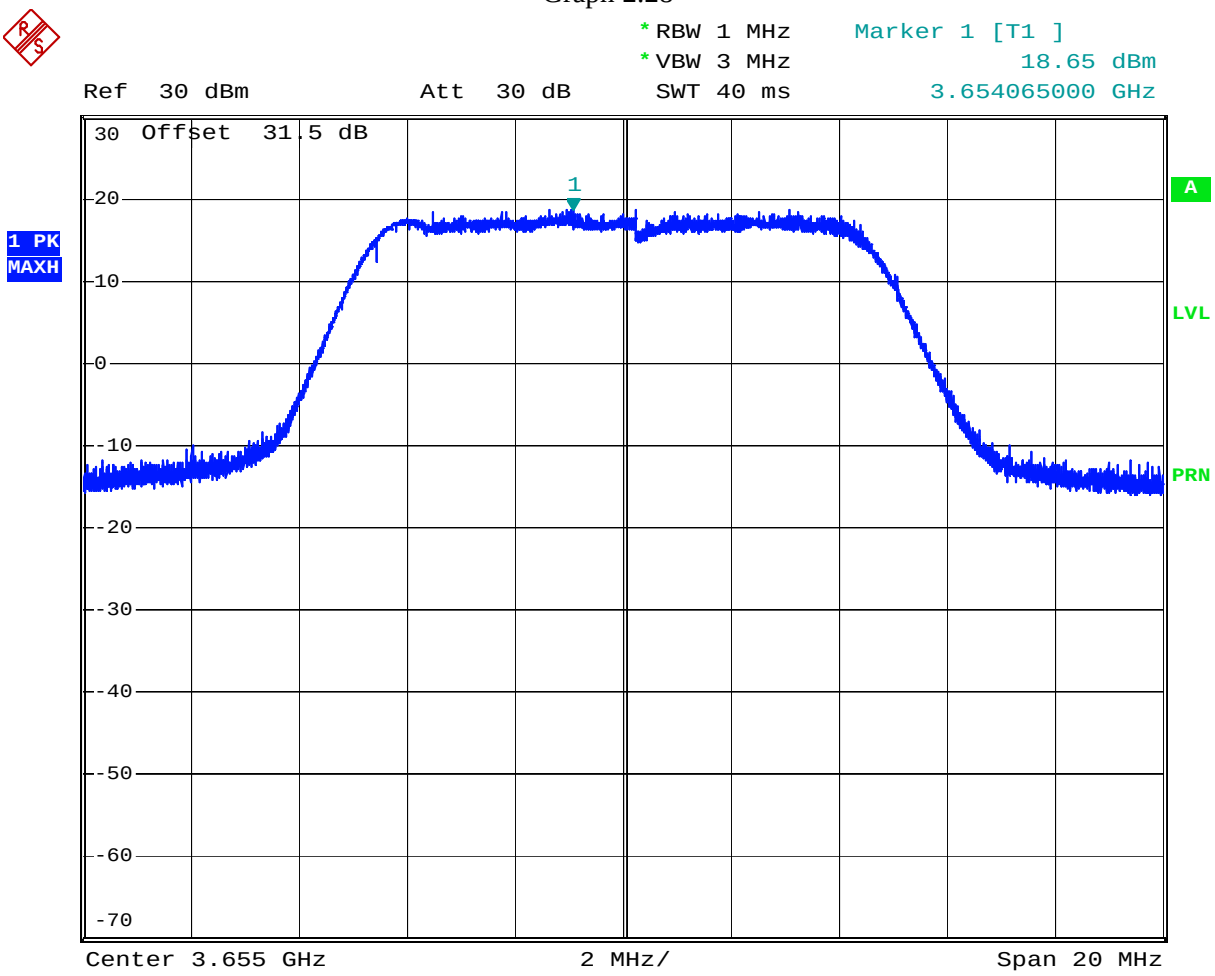
EIRP Power Density
Graph 2.28



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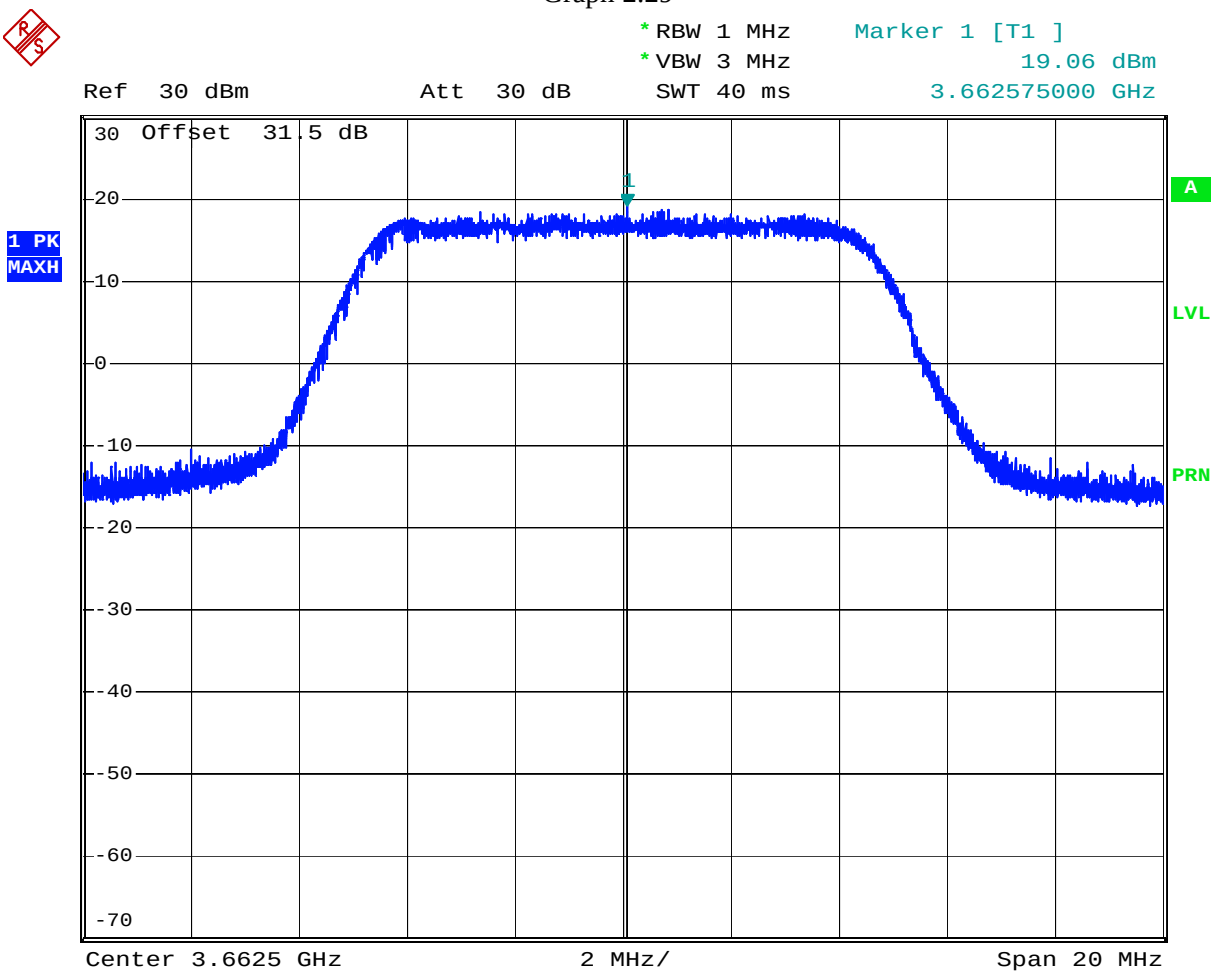
EIRP Power Density
Graph 2.29



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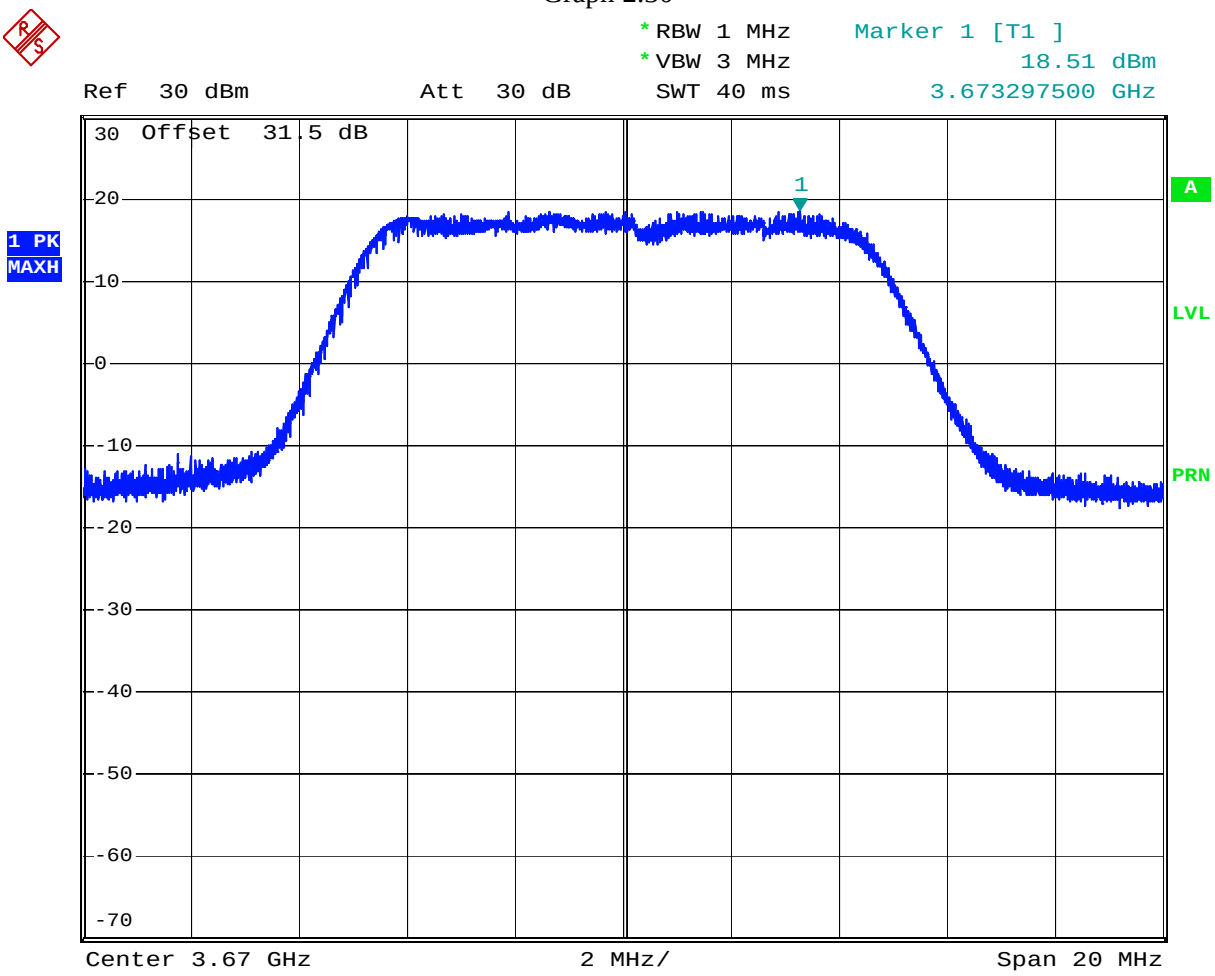
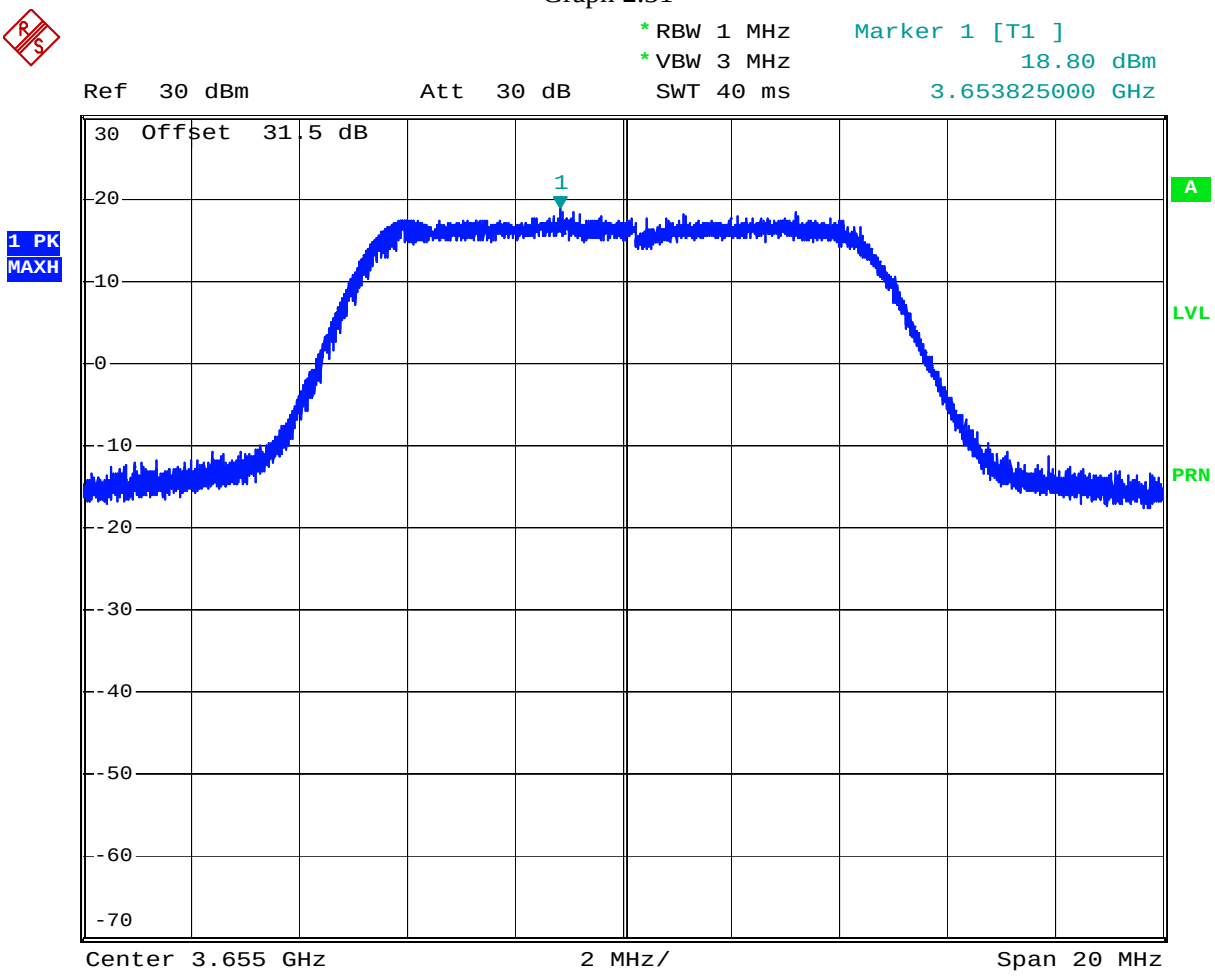
Date: 24.FEB.2010 09:45:46

EIRP Power Density
Graph 2.30



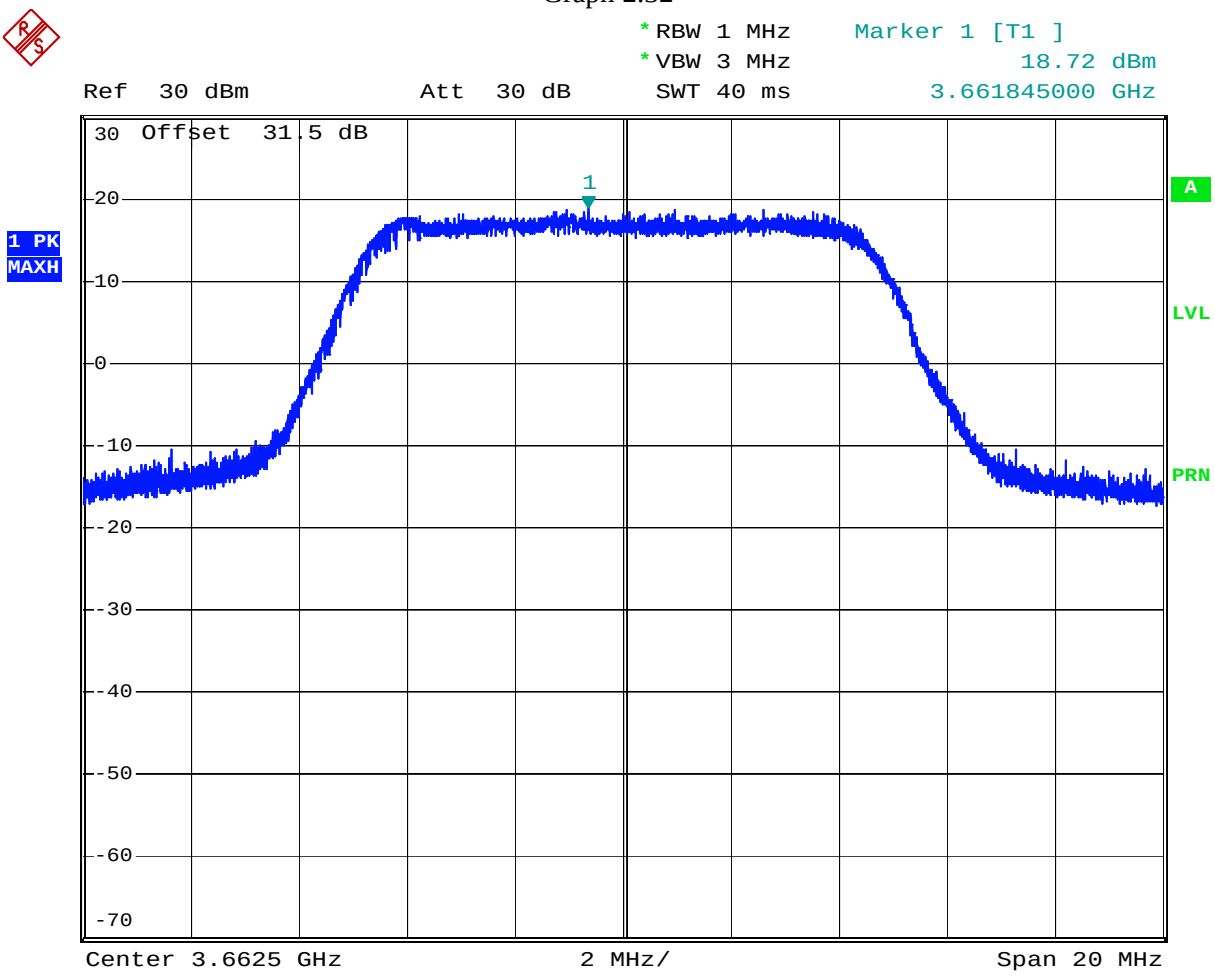
Comment: QPSK, HIGH CHANNEL
Date: 24.FEB.2010 09:48:12

EIRP Power Density
Graph 2.31



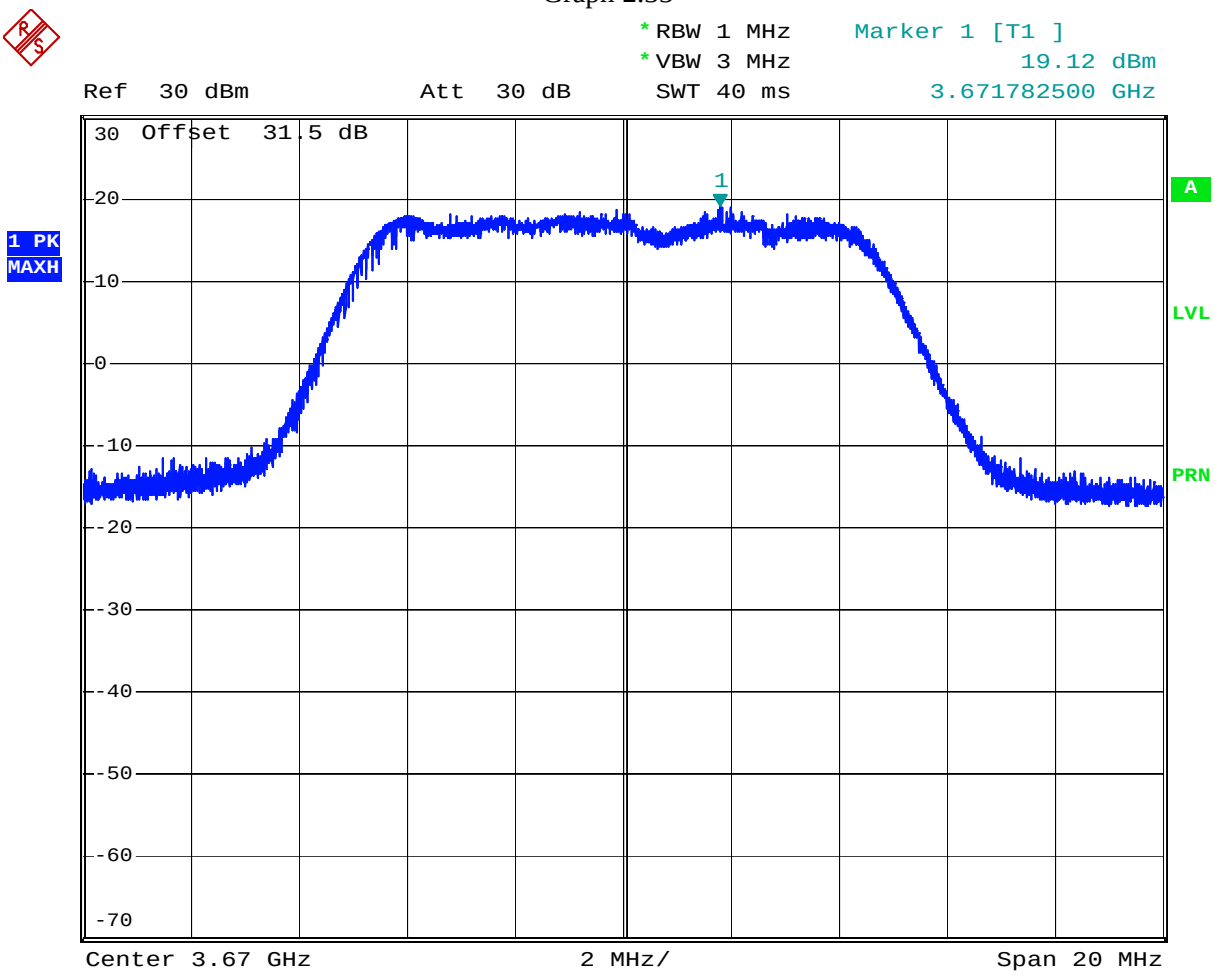
Comment: 16QAM, LOW CHANNEL
Date: 24.FEB.2010 09:38:11

EIRP Power Density
Graph 2.32



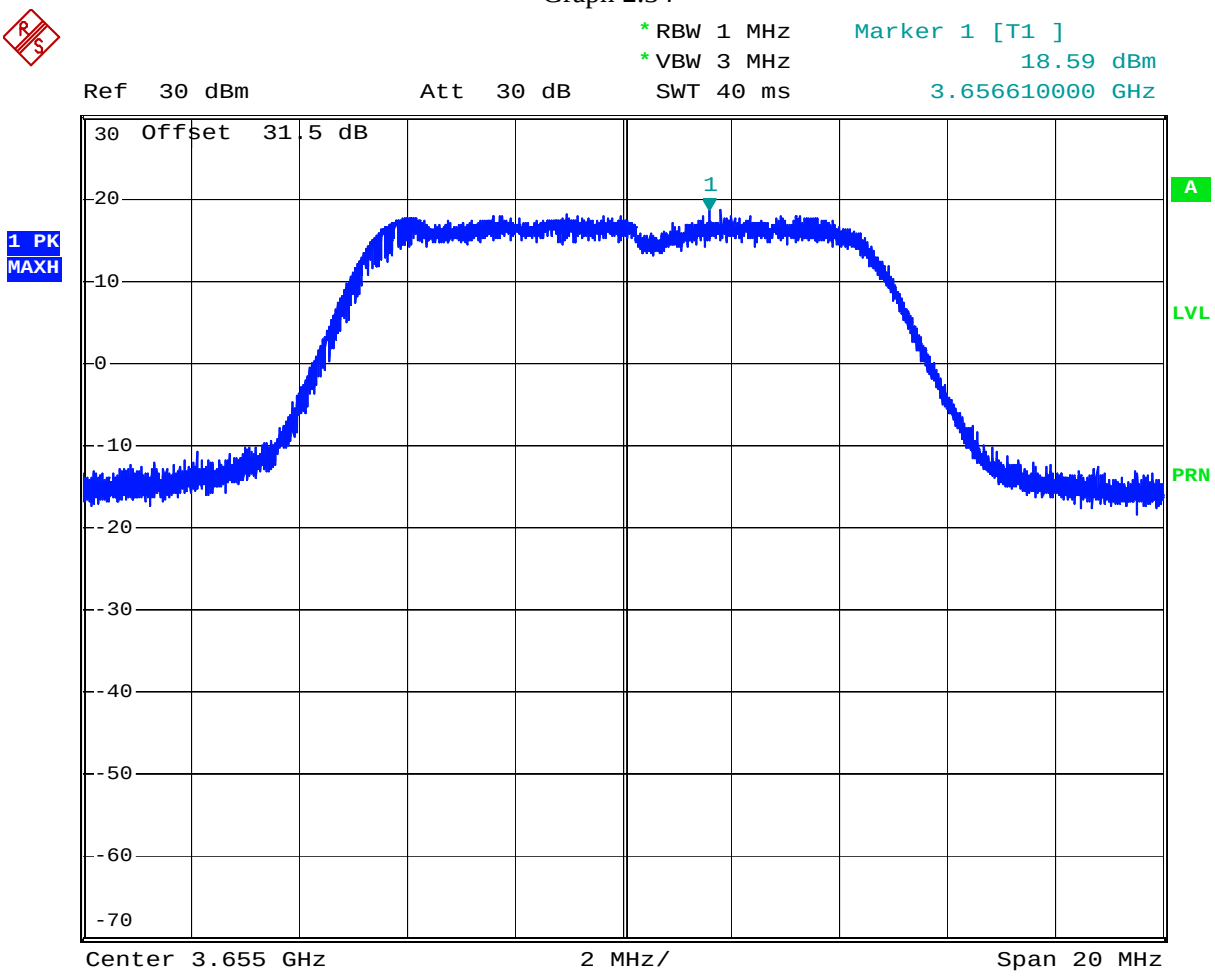
Comment: 16QAM, MID CHANNEL
Date: 24.FEB.2010 09:35:48

EIRP Power Density
Graph 2.33



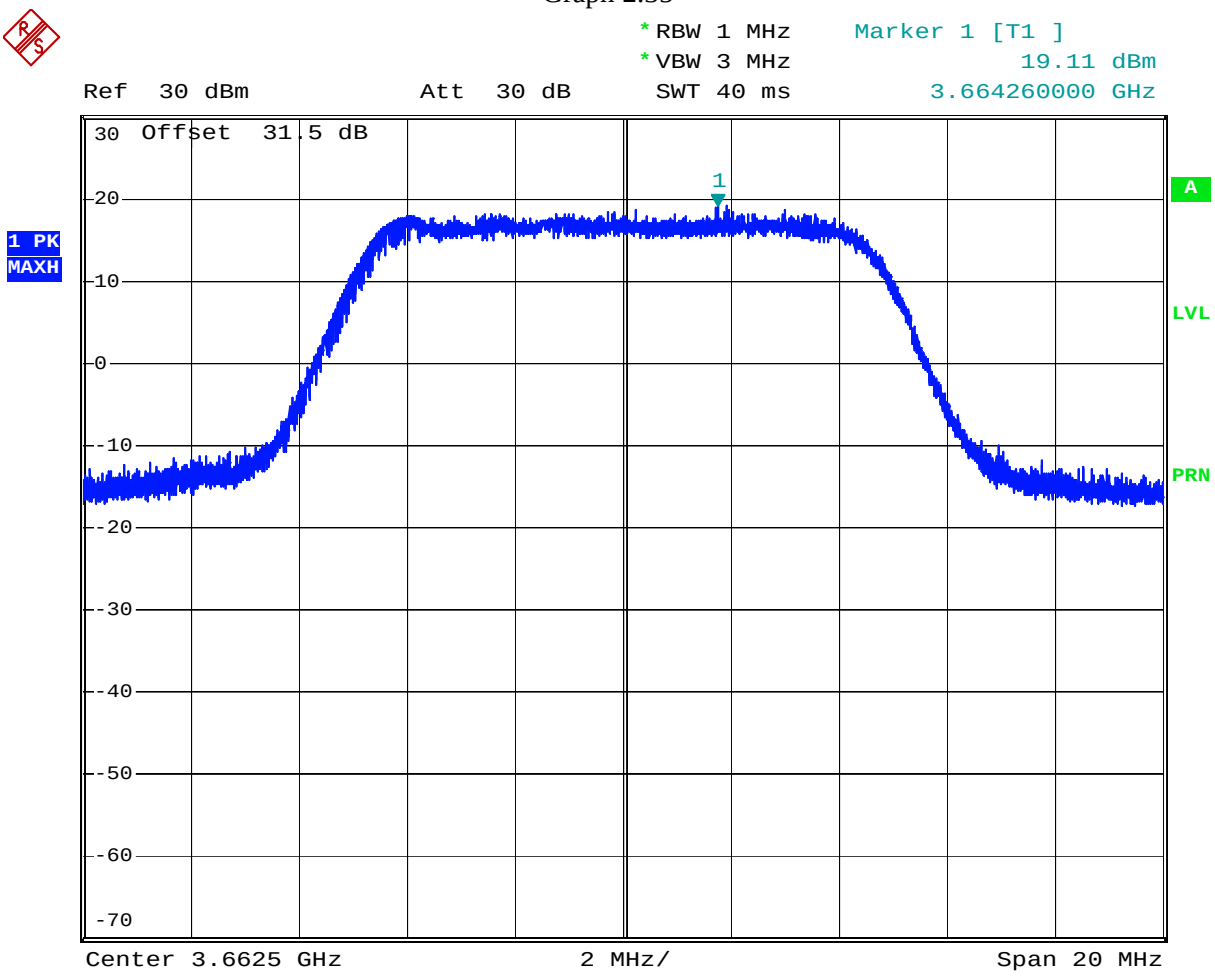
Comment: 16QAM, HIGH CHANNEL
Date: 24.FEB.2010 09:33:45

EIRP Power Density
Graph 2.34



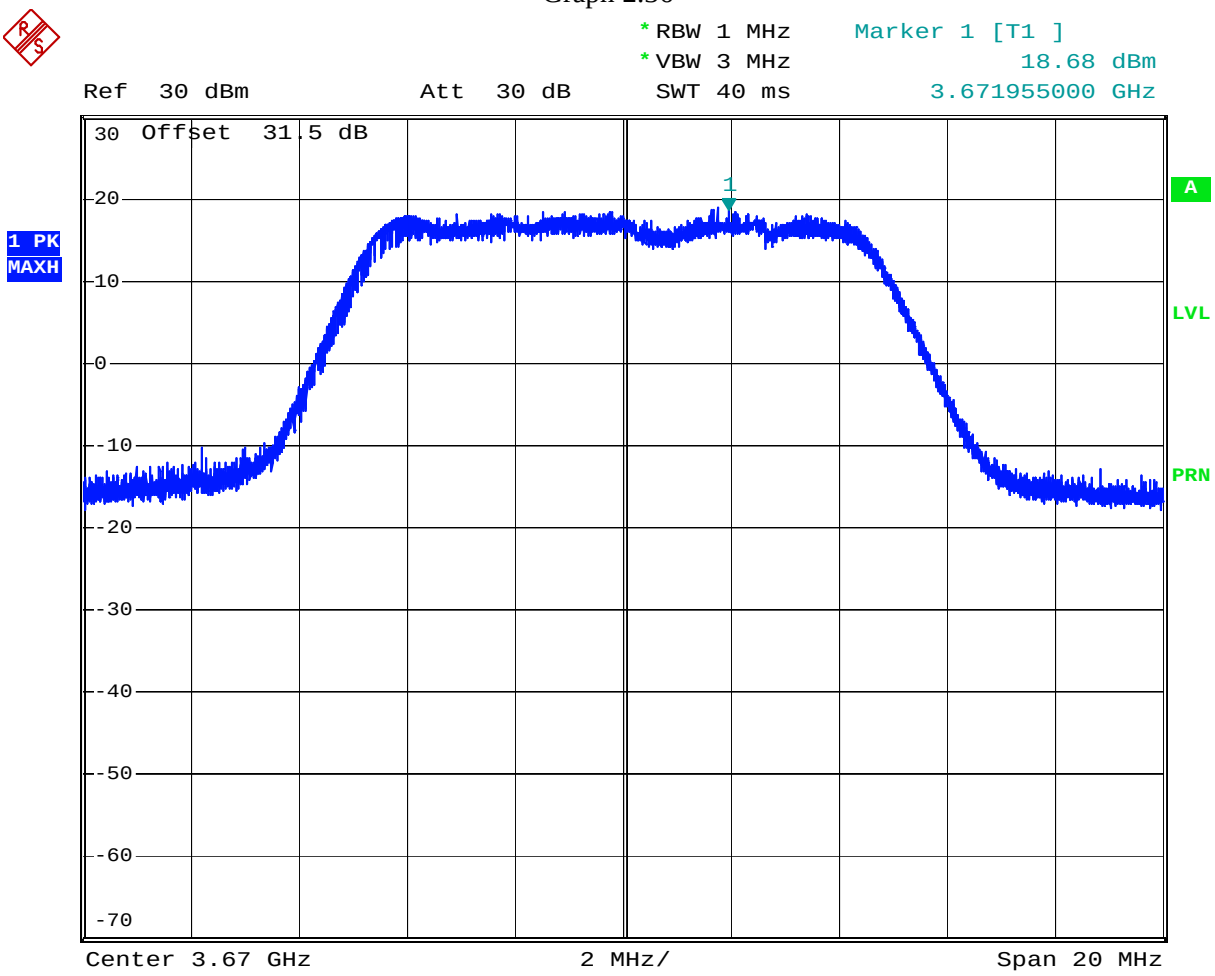
Comment: 64QAM, LOW CHANNEL
Date: 24.FEB.2010 09:29:34

EIRP Power Density
Graph 2.35



Comment: 64QAM, MID CHANNEL
Date: 24.FEB.2010 09:21:01

EIRP Power Density
Graph 2.36



Comment: 64QAM, HIGH CHANNEL
Date: 24.FEB.2010 09:31:36

3.0 Occupied Bandwidth

FCC 2.1049, 90.209(b)(5)

3.1 Test Procedure

The EUT RF output was connected as shown on the diagram in report section 1.3.2. The EUT was setup to transmit the maximum power.

The spectrum analyzed was setup to measure the Occupied Bandwidth (defined as the 99% Power Bandwidth). The Occupied Bandwidth was measured at the low, middle and high channels for all types of modulation and authorized bandwidths.

3.2 Test Equipment

Rohde & Schwarz FSP40 Spectrum Analyzer

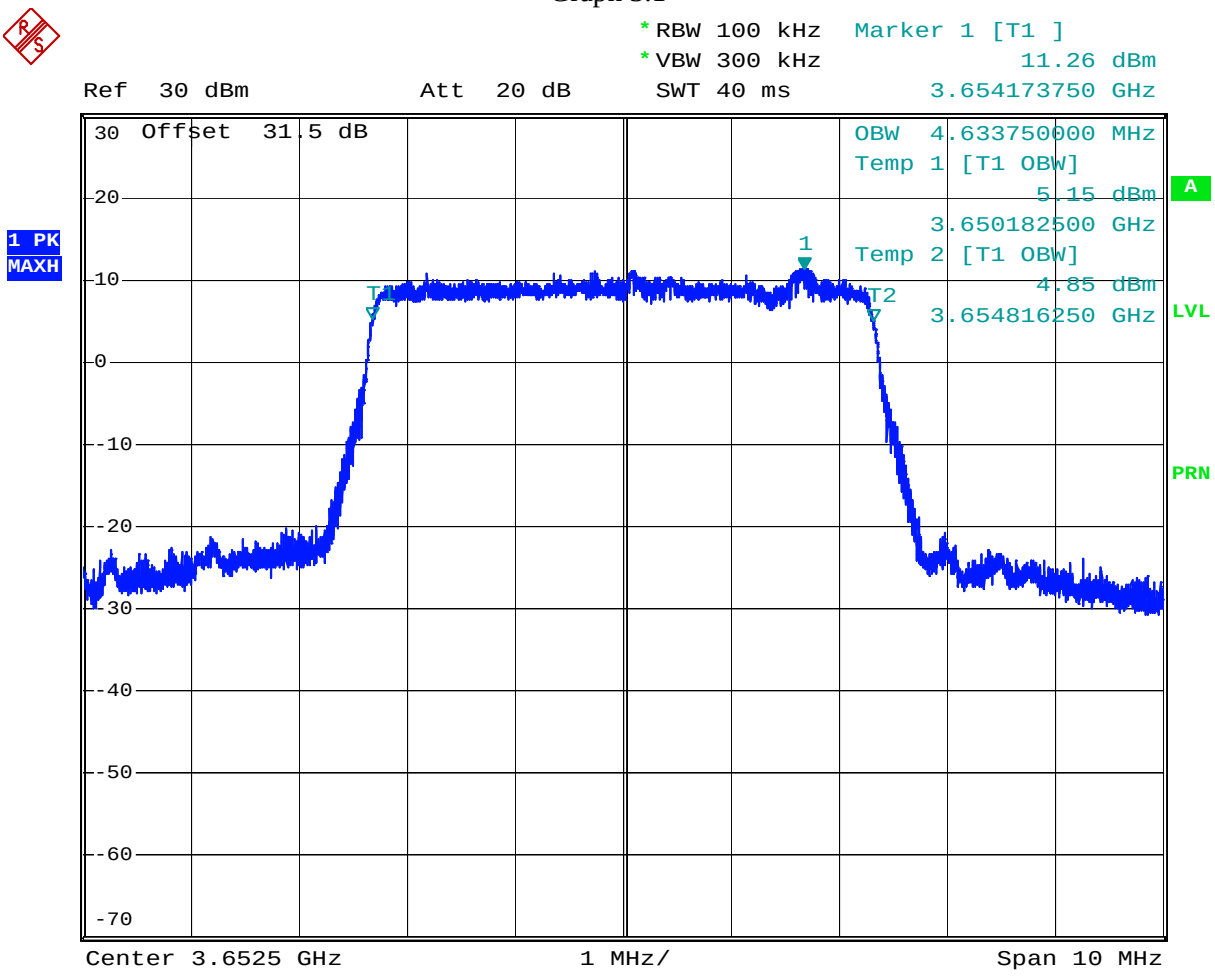
3.3 Test Results

Frequency (GHz)	Modulation	Channel Bandwidth (MHz)	Measured Occupied Bandwidth (MHz)	Graph
3.6525	QPSK	5	4.63	3.1
	16 QAM		4.63	3.2
	64 QAM		4.63	3.3
3.6625	QPSK	5	4.63	3.4
	16 QAM		4.63	3.5
	64 QAM		4.63	3.6
3.6725	QPSK	5	4.63	3.7
	16 QAM		4.63	3.8
	64 QAM		4.63	3.9

Frequency (GHz)	Modulation	Channel Bandwidth (MHz)	Measured Occupied Bandwidth (MHz)	Graph
3.655	QPSK	10	9.26	3.10
	16 QAM		9.24	3.11
	64 QAM		9.26	3.12
3.6625	QPSK	10	9.26	3.13
	16 QAM		9.26	3.14
	64 QAM		9.26	3.15
3.67	QPSK	10	9.24	3.16
	16 QAM		9.24	3.17
	64 QAM		9.26	3.18

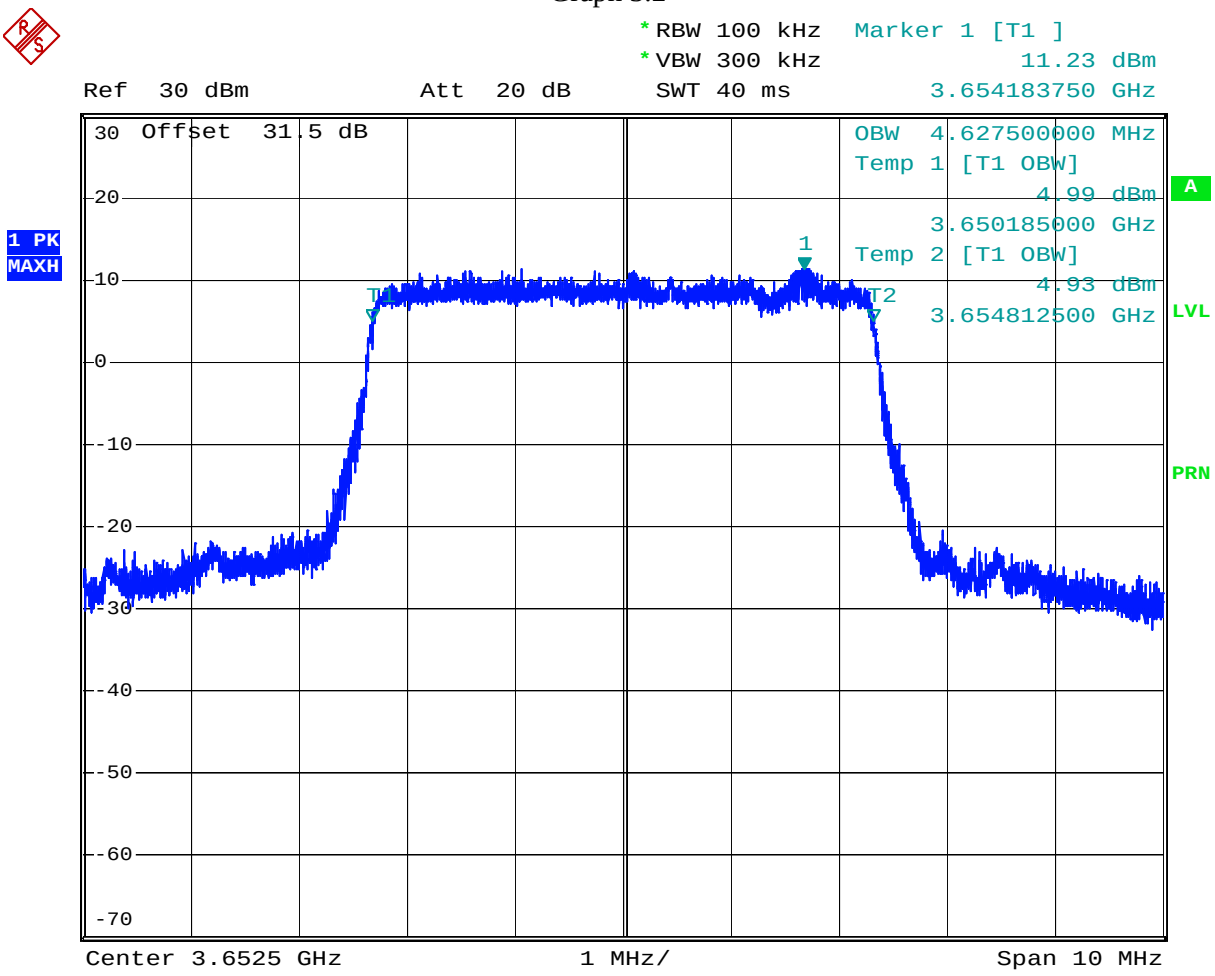
For more details refer to the attached Graphs.

Graph 3.1



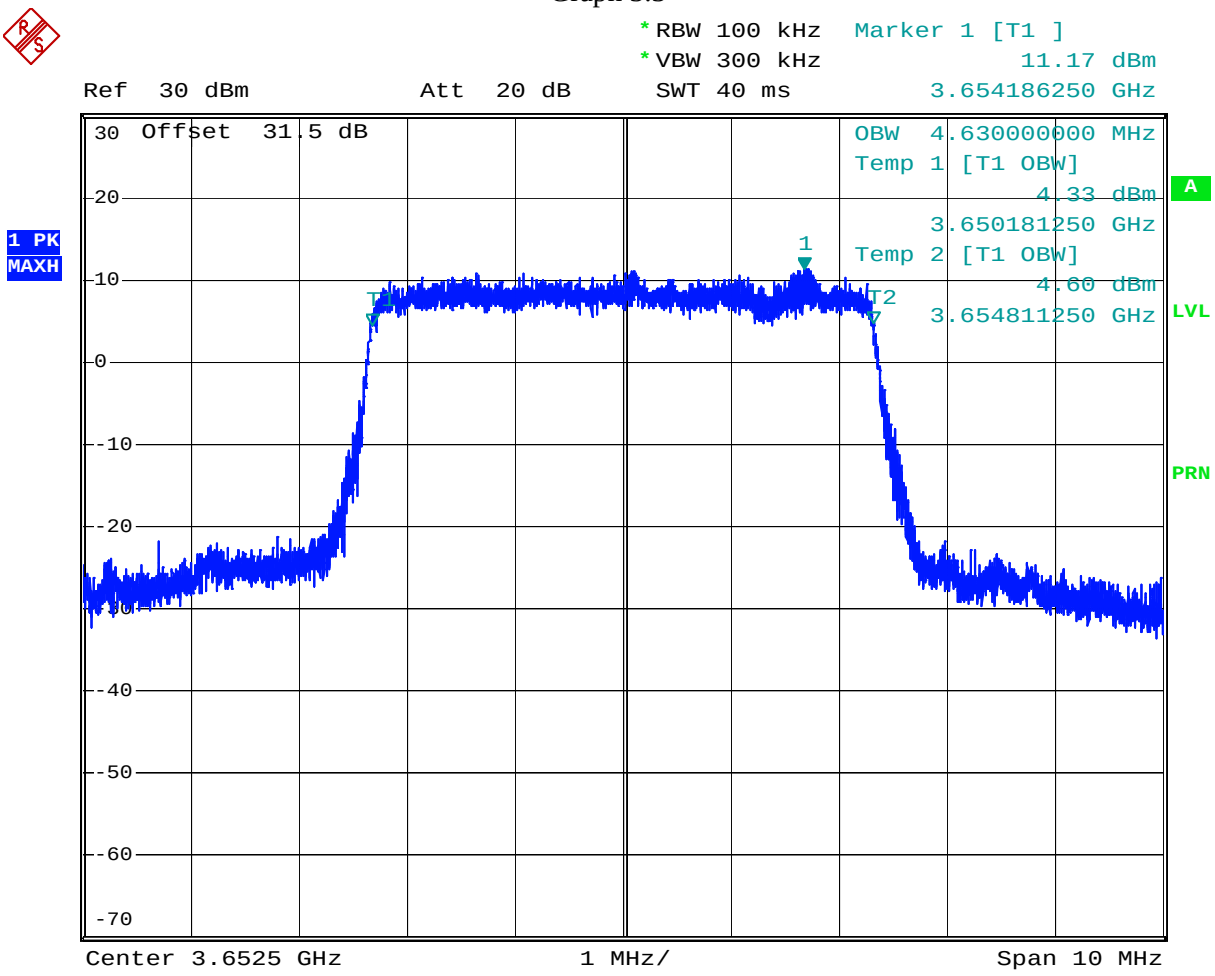
Comment: QPSK, LOW CHANNEL
Date: 23.FEB.2010 12:01:36

Graph 3.2



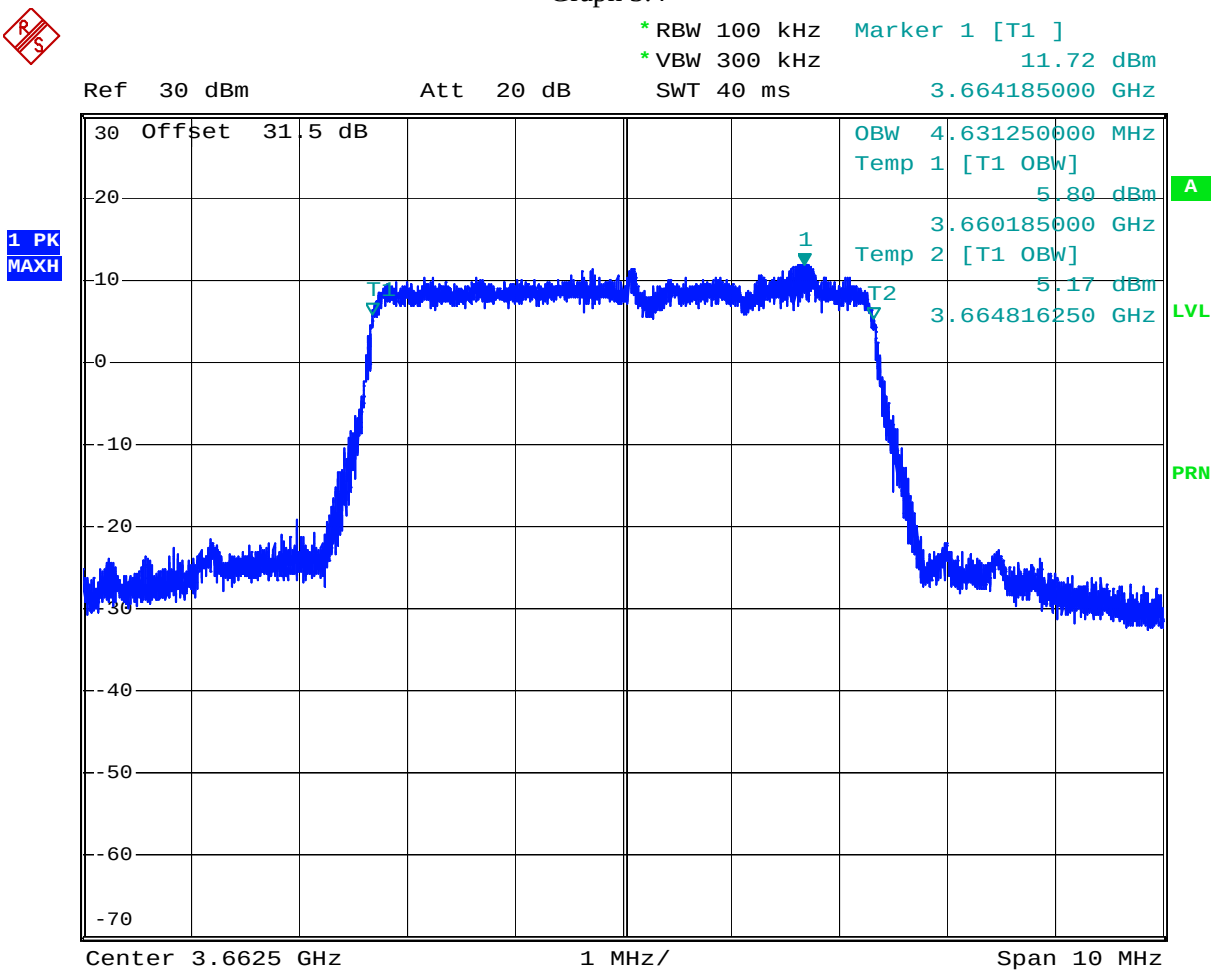
Comment: 16QAM, LOW CHANNEL
Date: 23.FEB.2010 12:16:07

Graph 3.3



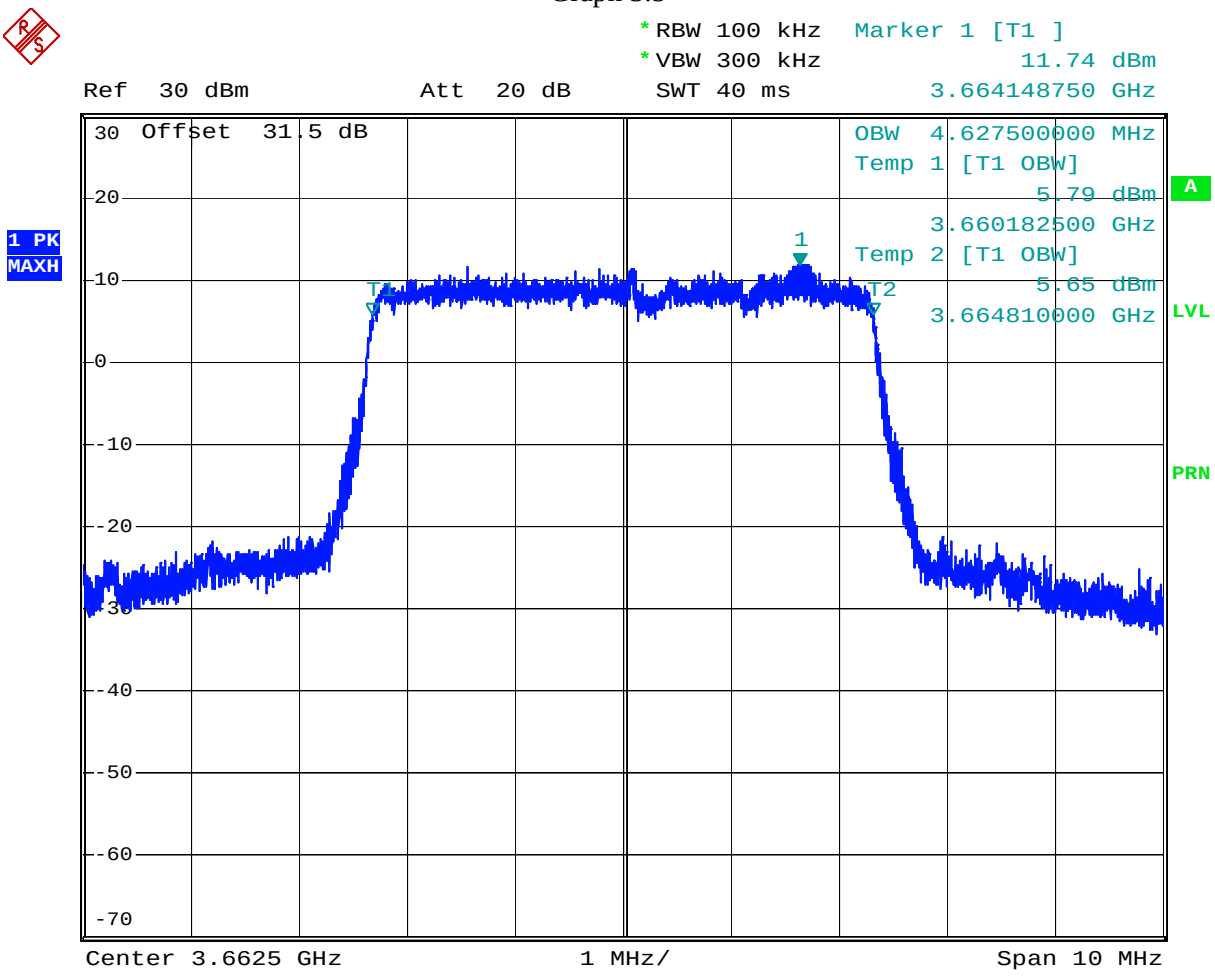
Comment: 64QAM, LOW CHANNEL
Date: 23.FEB.2010 12:19:48

Graph 3.4



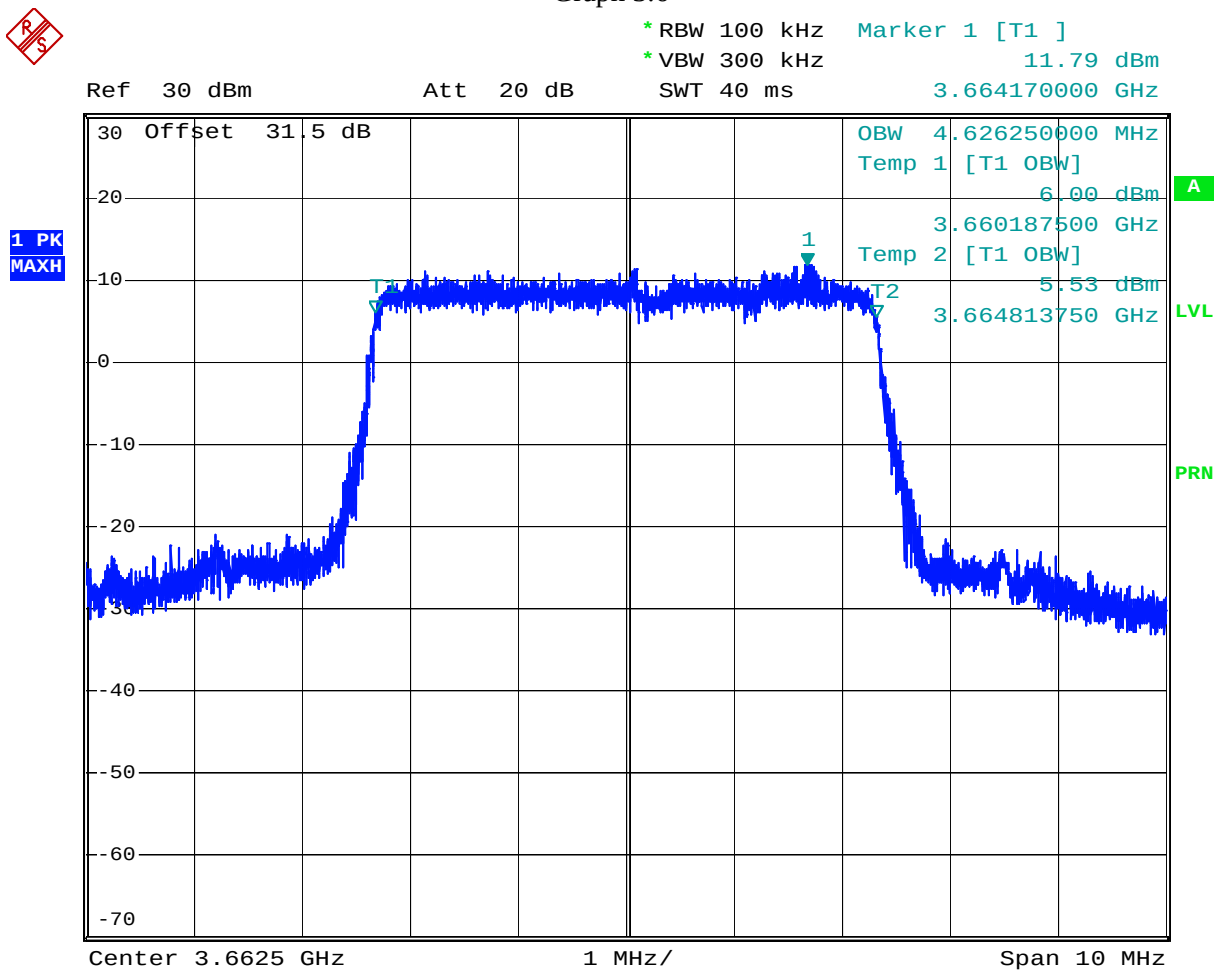
Comment: QPSK, MID CHANNEL
Date: 23.FEB.2010 12:05:36

Graph 3.5



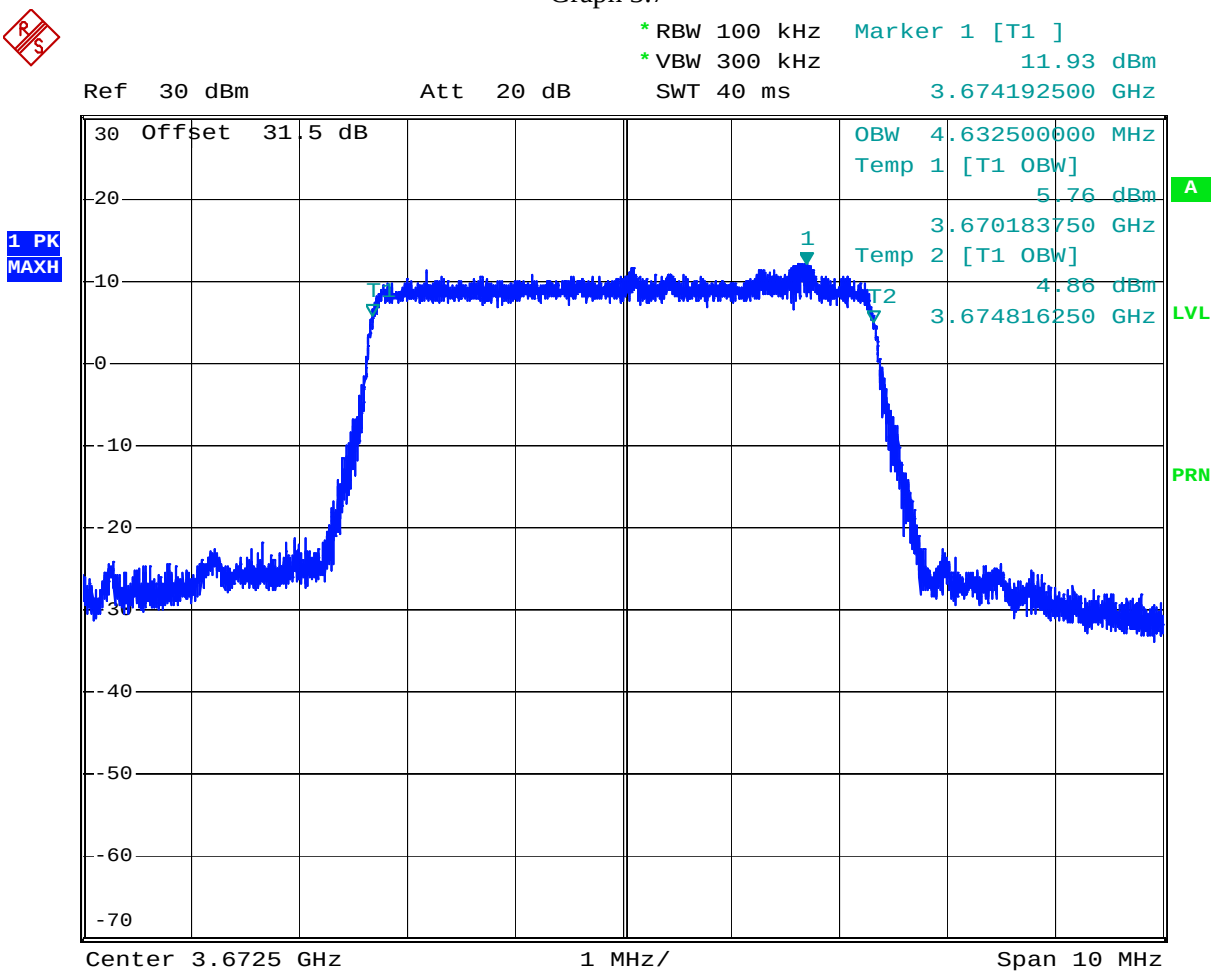
Comment: 16QAM, MID CHANNEL
Date: 23.FEB.2010 12:13:41

Graph 3.6



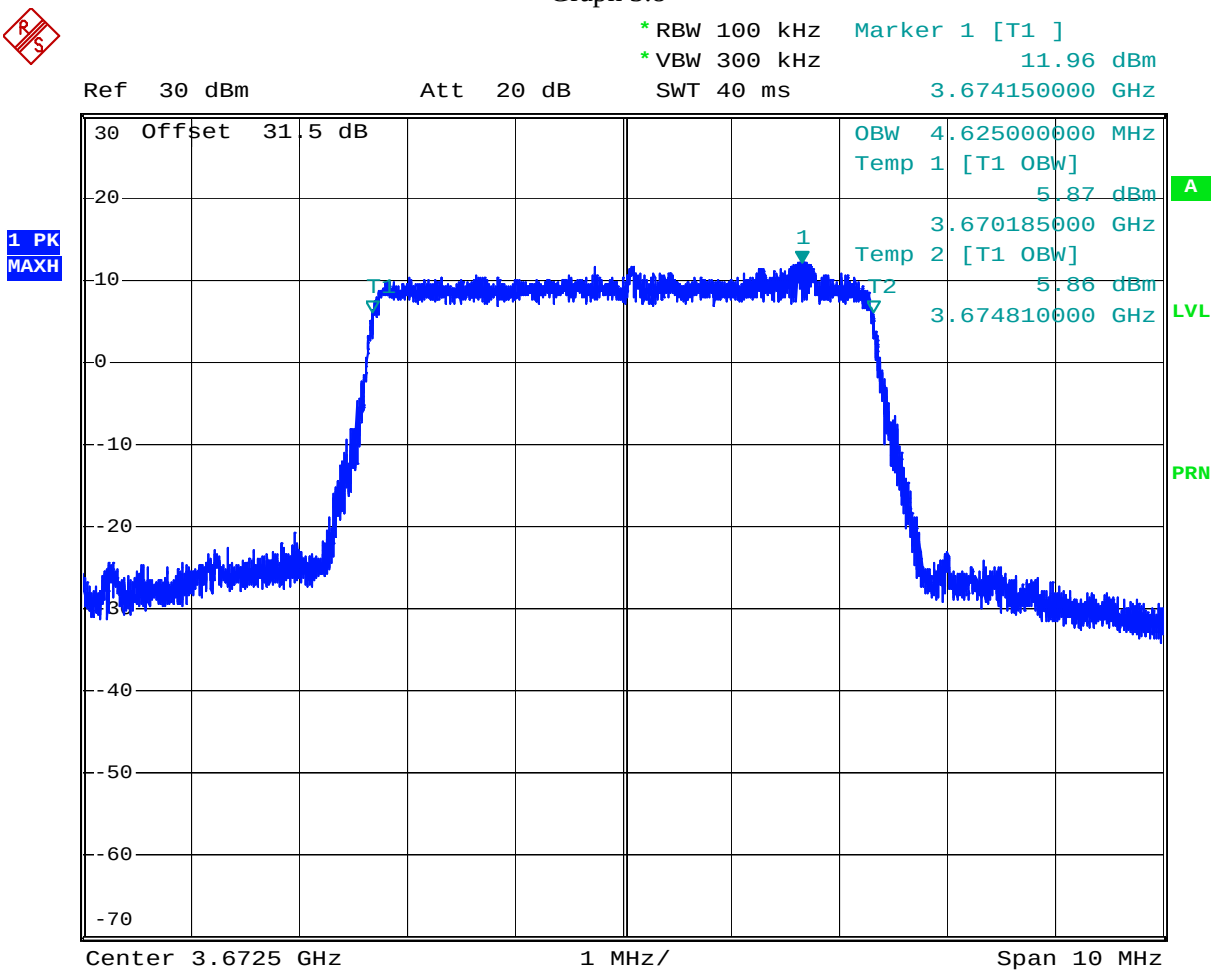
Comment: 64QAM, MID CHANNEL
Date: 23.FEB.2010 12:21:22

Graph 3.7



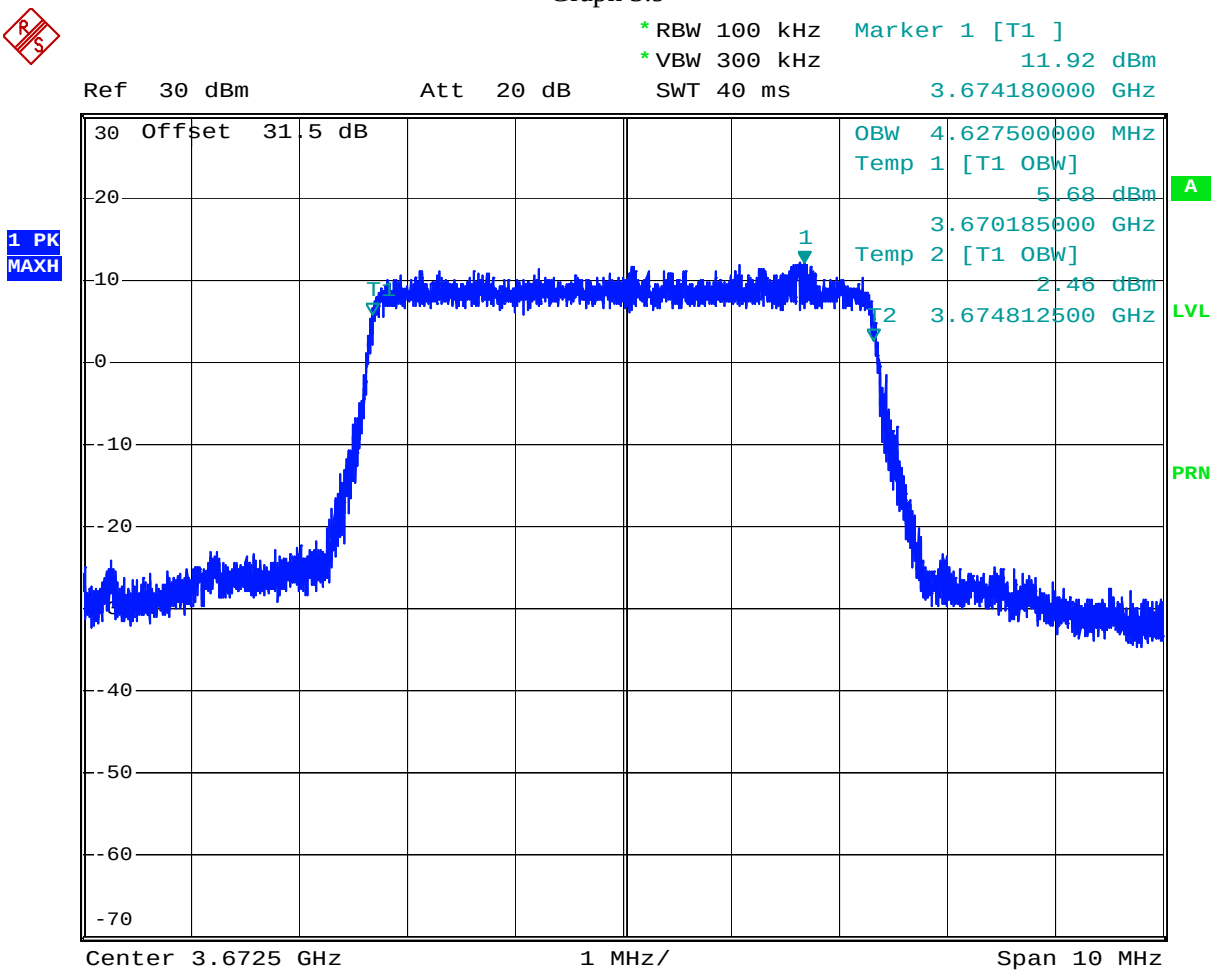
Comment: QPSK, HIGH CHANNEL
Date: 23.FEB.2010 12:08:03

Graph 3.8



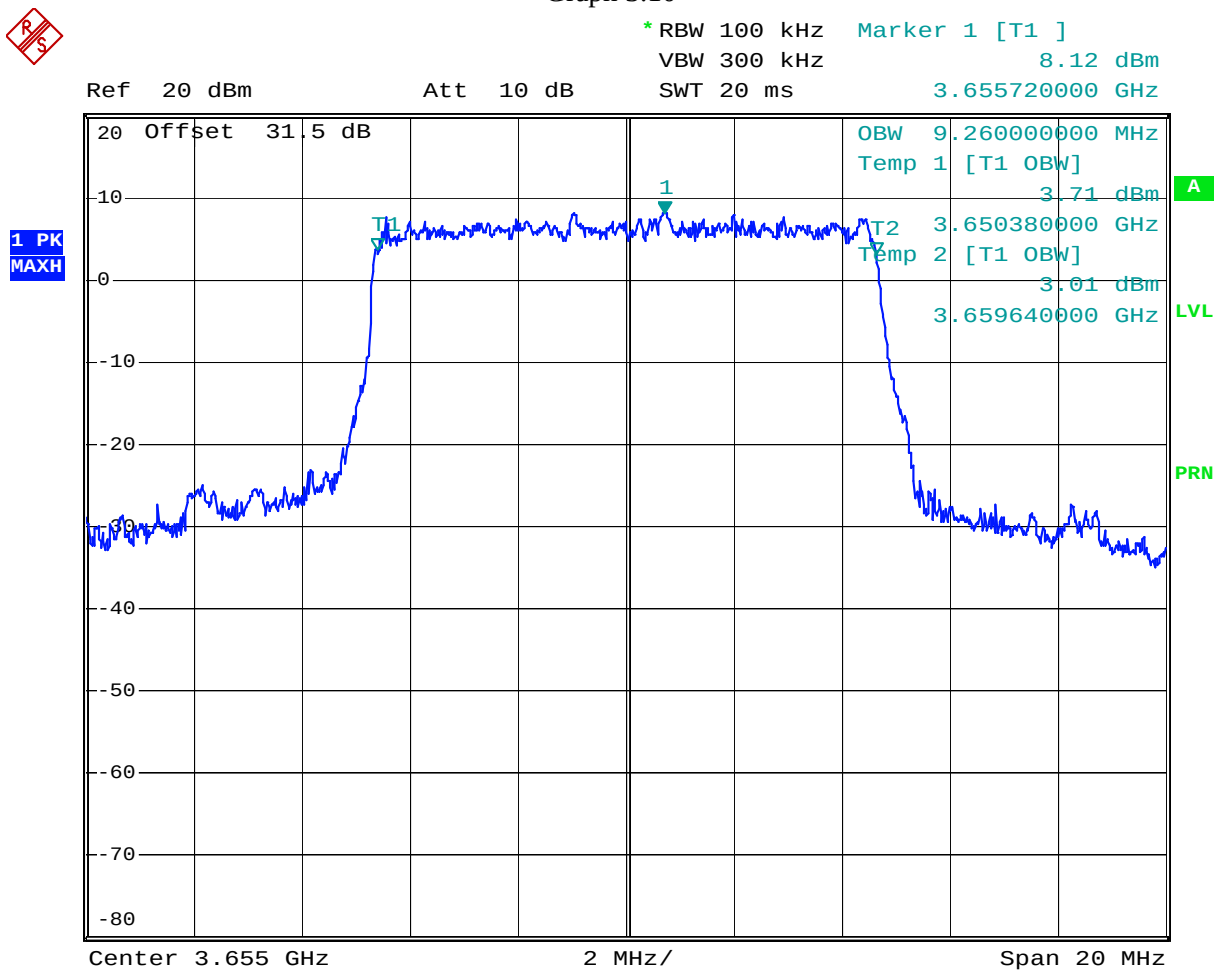
Comment: 16QAM, HIGH CHANNEL
Date: 23.FEB.2010 12:09:57

Graph 3.9



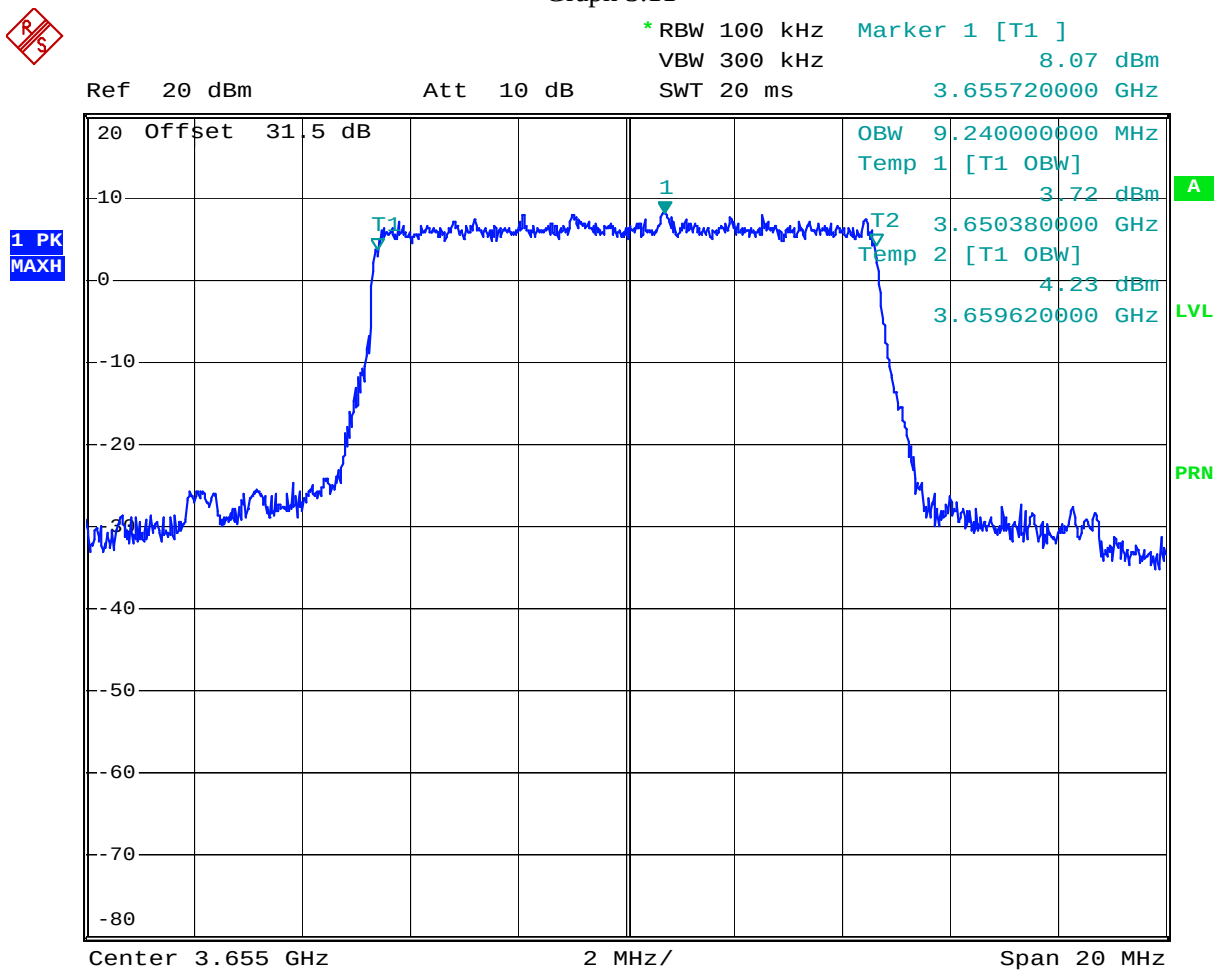
Comment: 64QAM, HIGH CHANNEL
Date: 23.FEB.2010 12:22:41

Graph 3.10



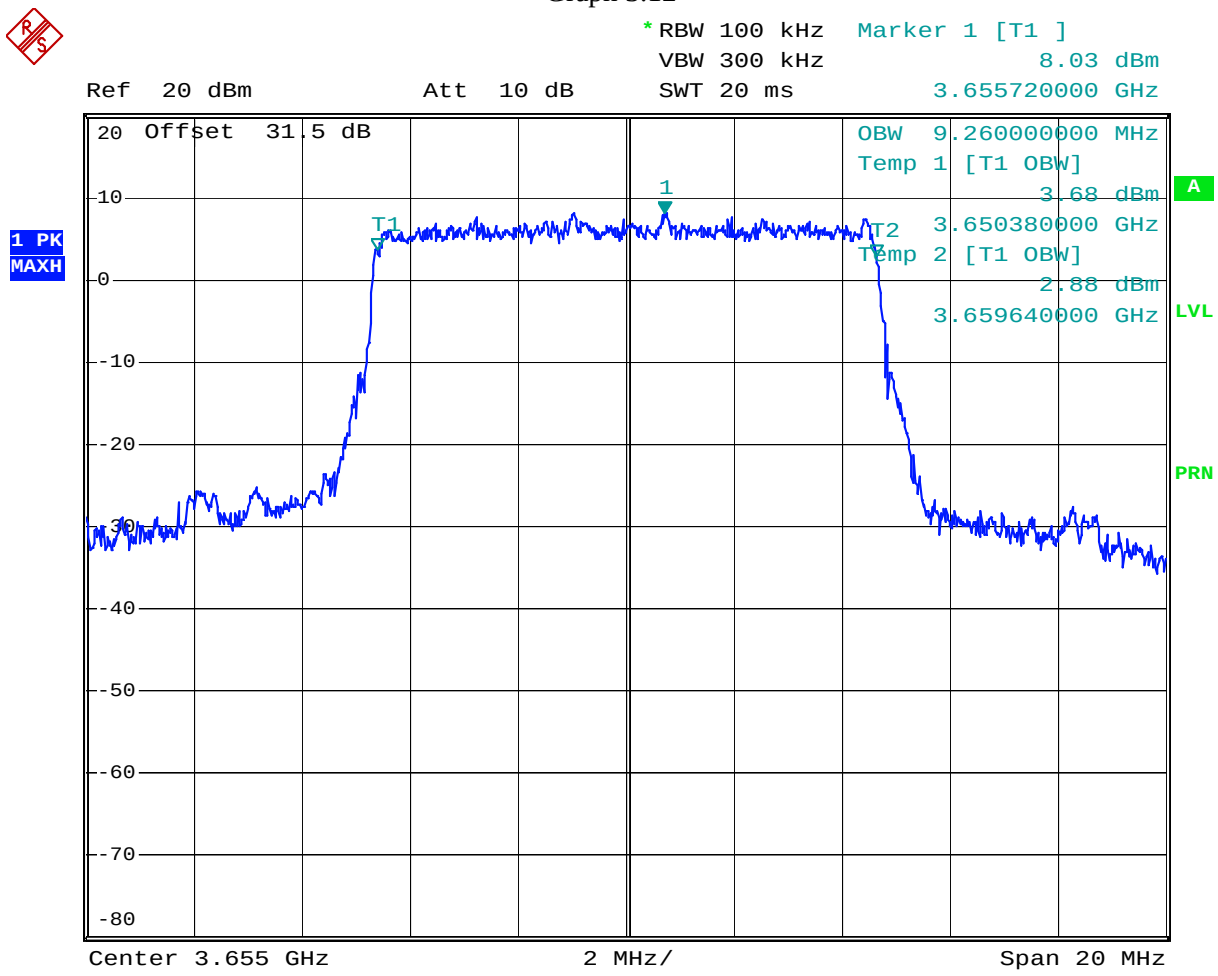
Comment: QPSK, LOW CHANNEL
Date: 23.FEB.2010 16:42:26

Graph 3.11



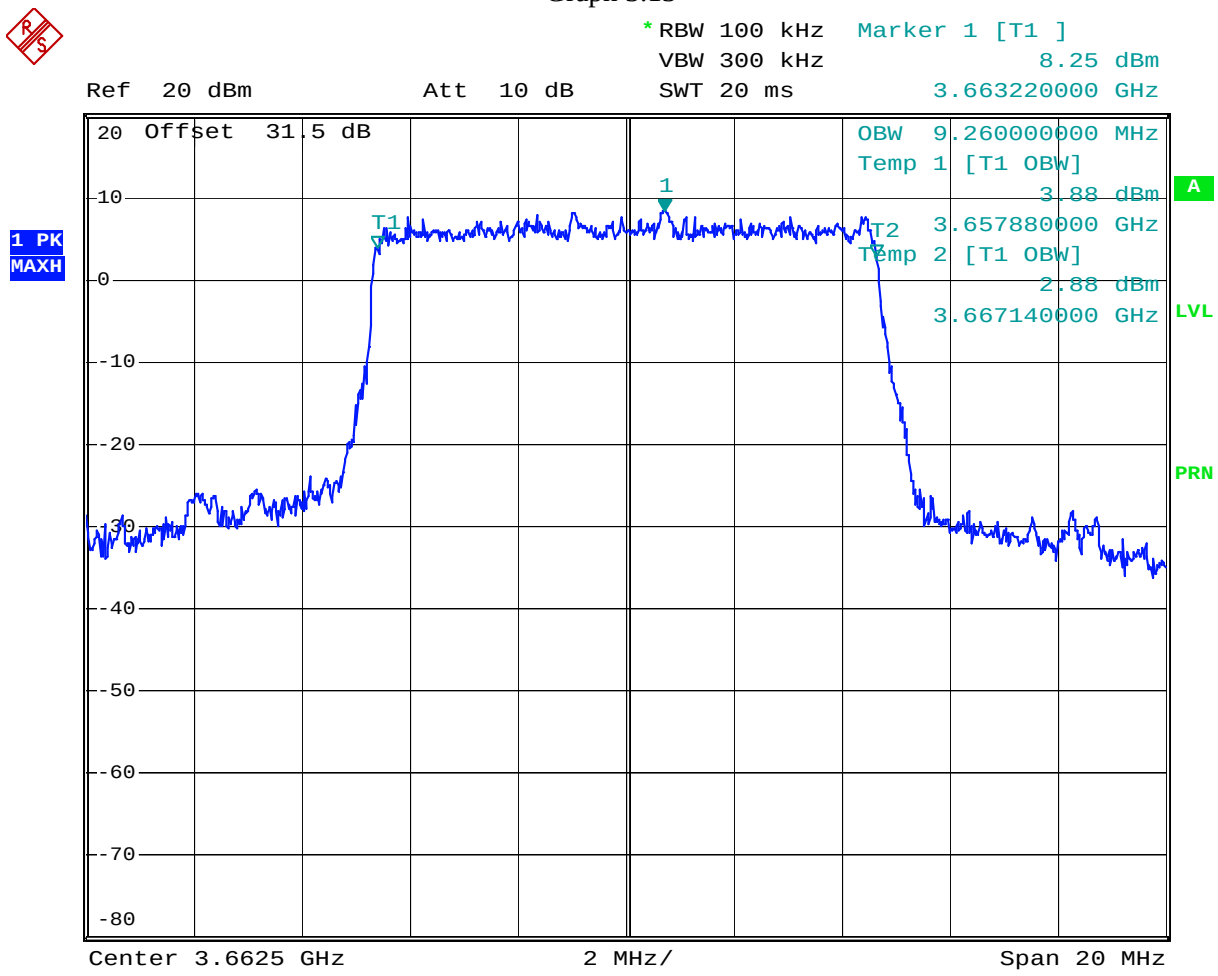
Comment: 16QAM, LOW CHANNEL
Date: 23.FEB.2010 16:49:13

Graph 3.12



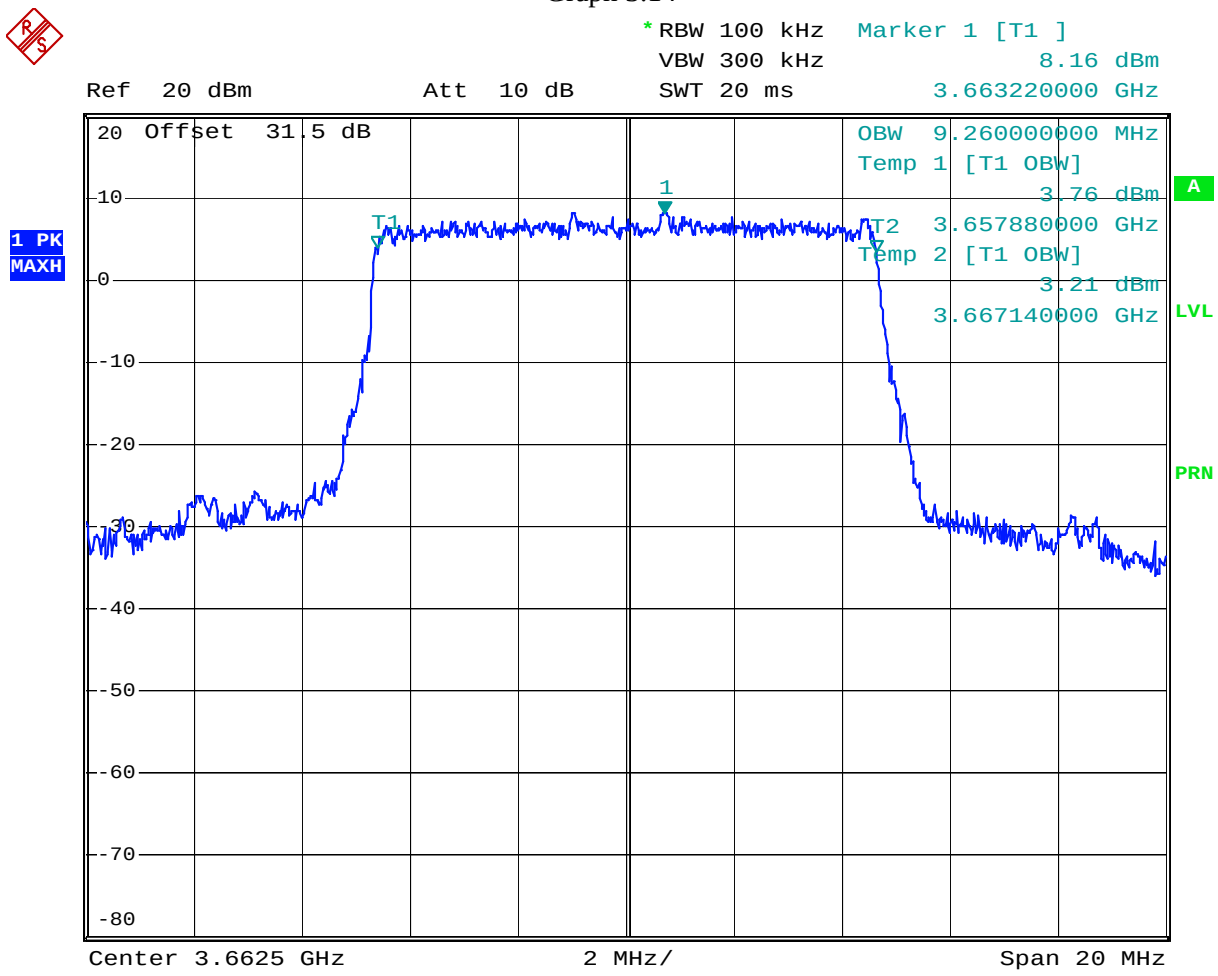
Comment: 64QAM, LOW CHANNEL
Date: 23.FEB.2010 16:50:25

Graph 3.13



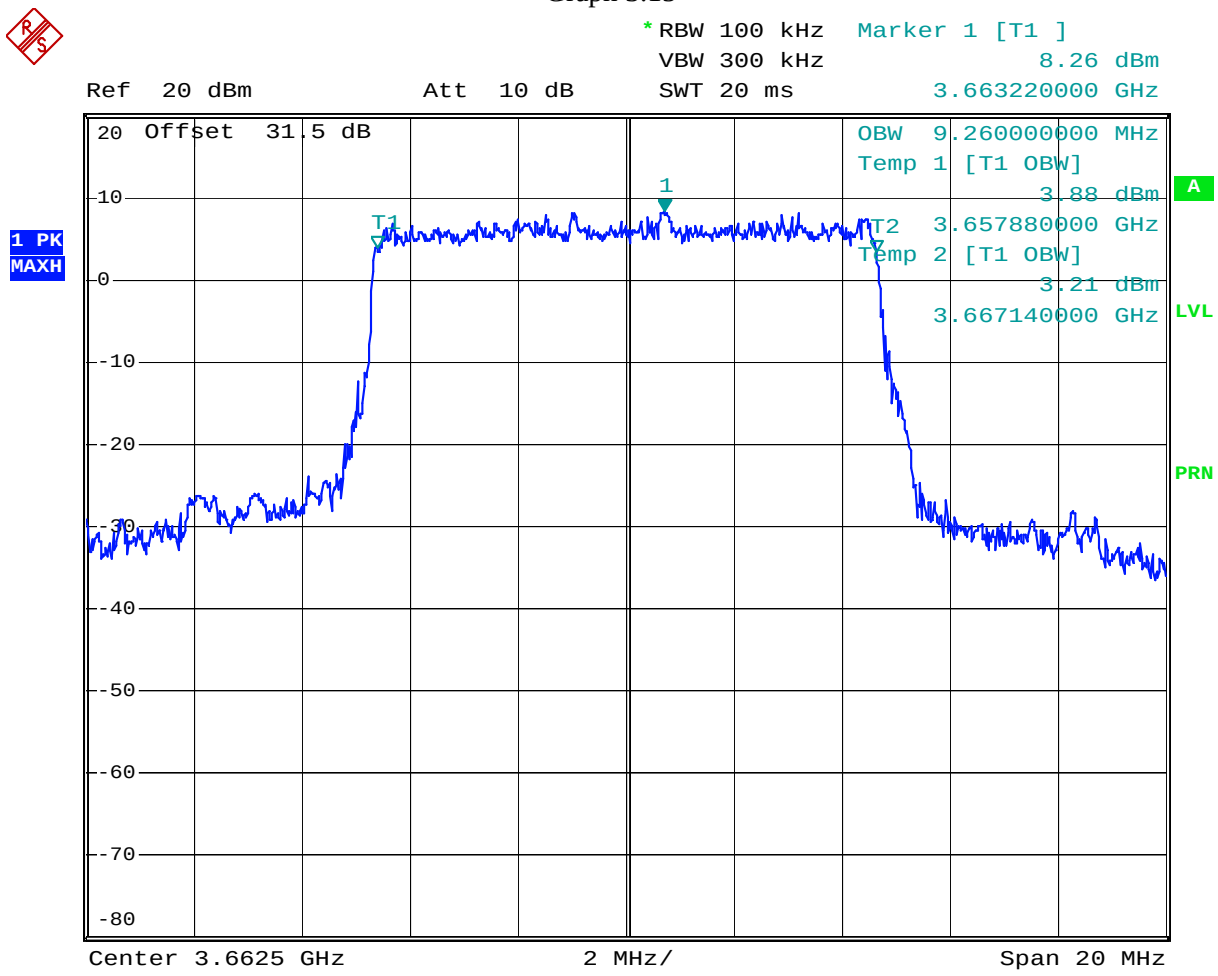
Comment: QPSK, MID CHANNEL
Date: 23.FEB.2010 16:45:03

Graph 3.14



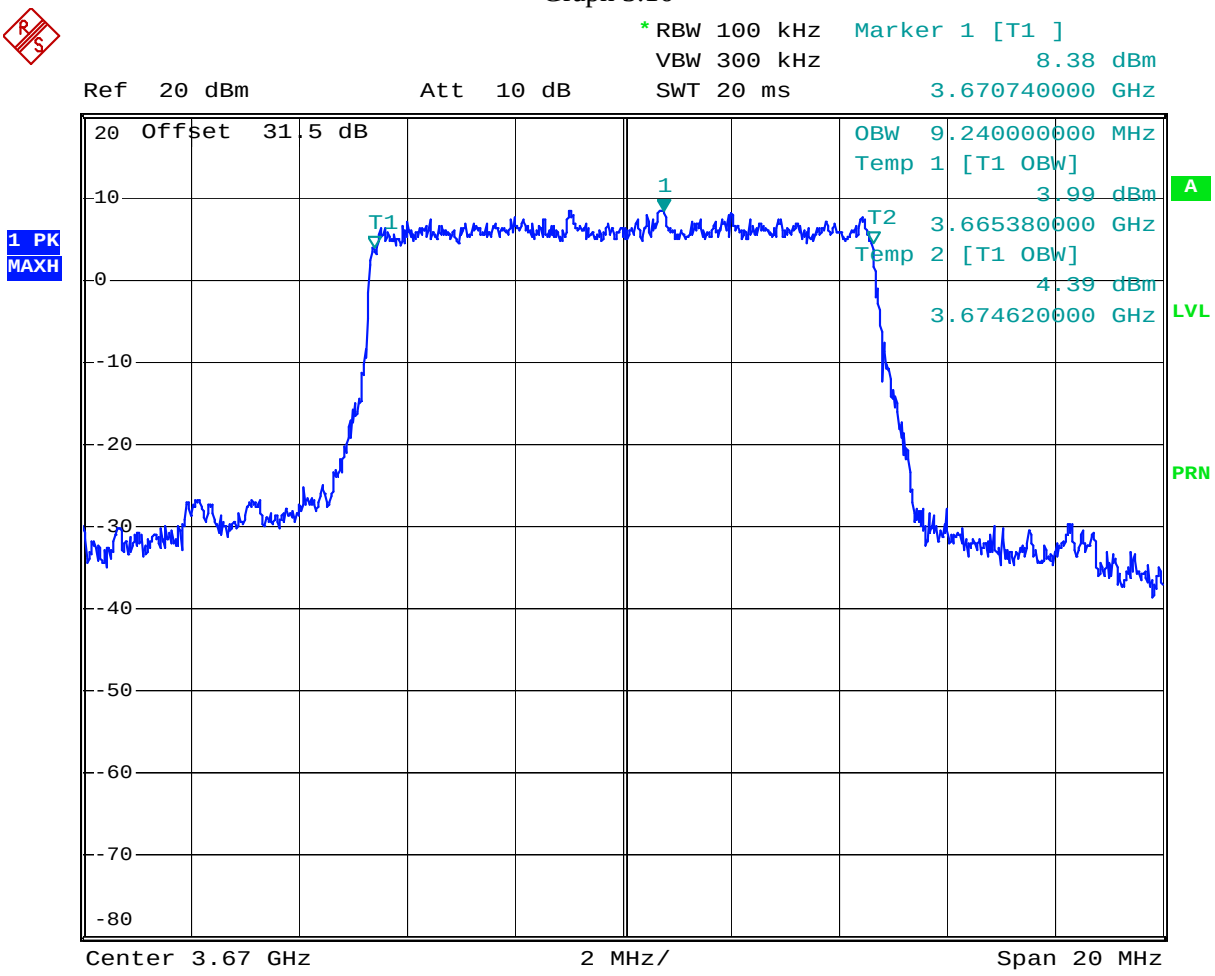
Comment: 16QAM, MID CHANNEL
Date: 23.FEB.2010 16:48:12

Graph 3.15



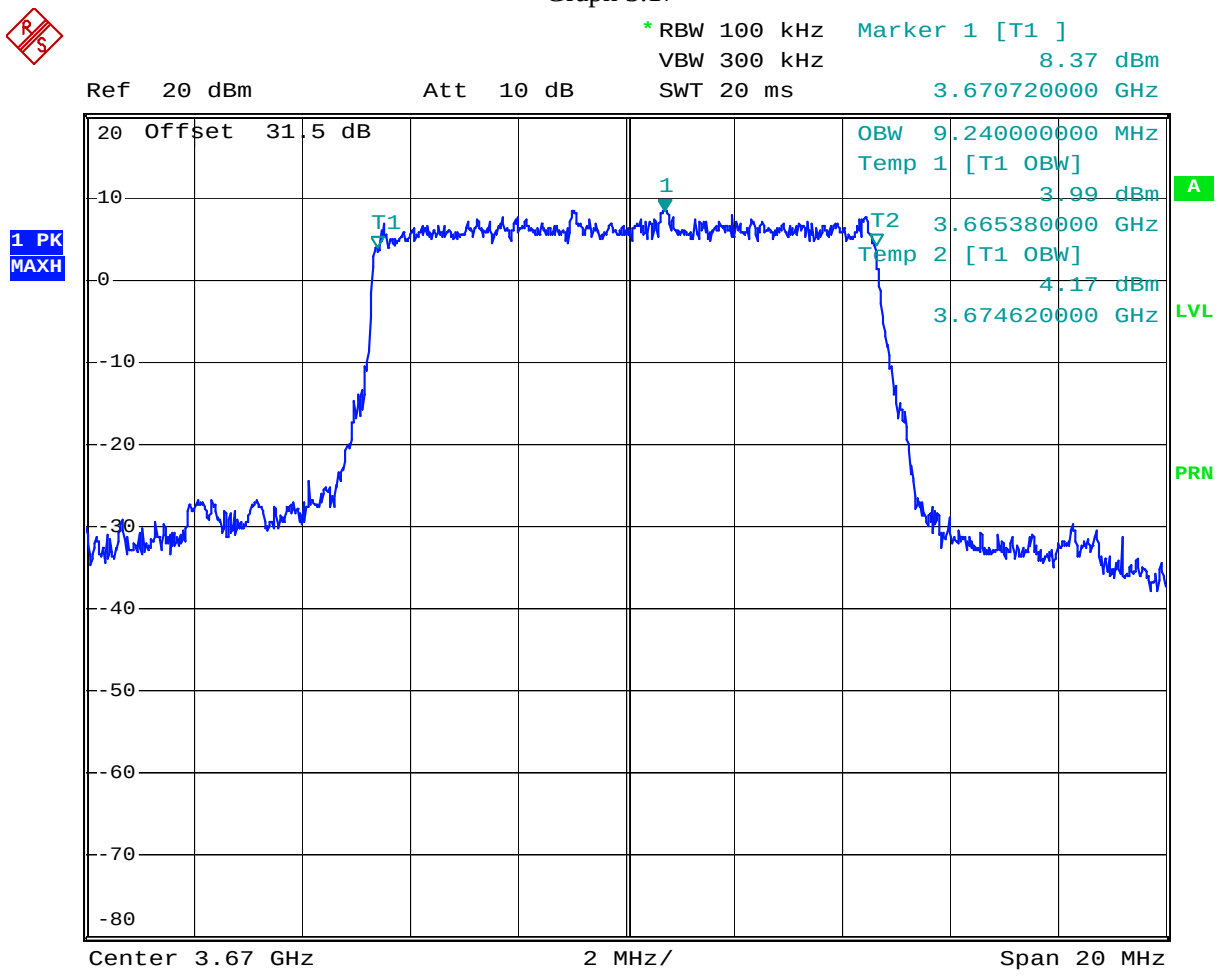
Comment: 64QAM, MID CHANNEL
Date: 23.FEB.2010 16:51:55

Graph 3.16



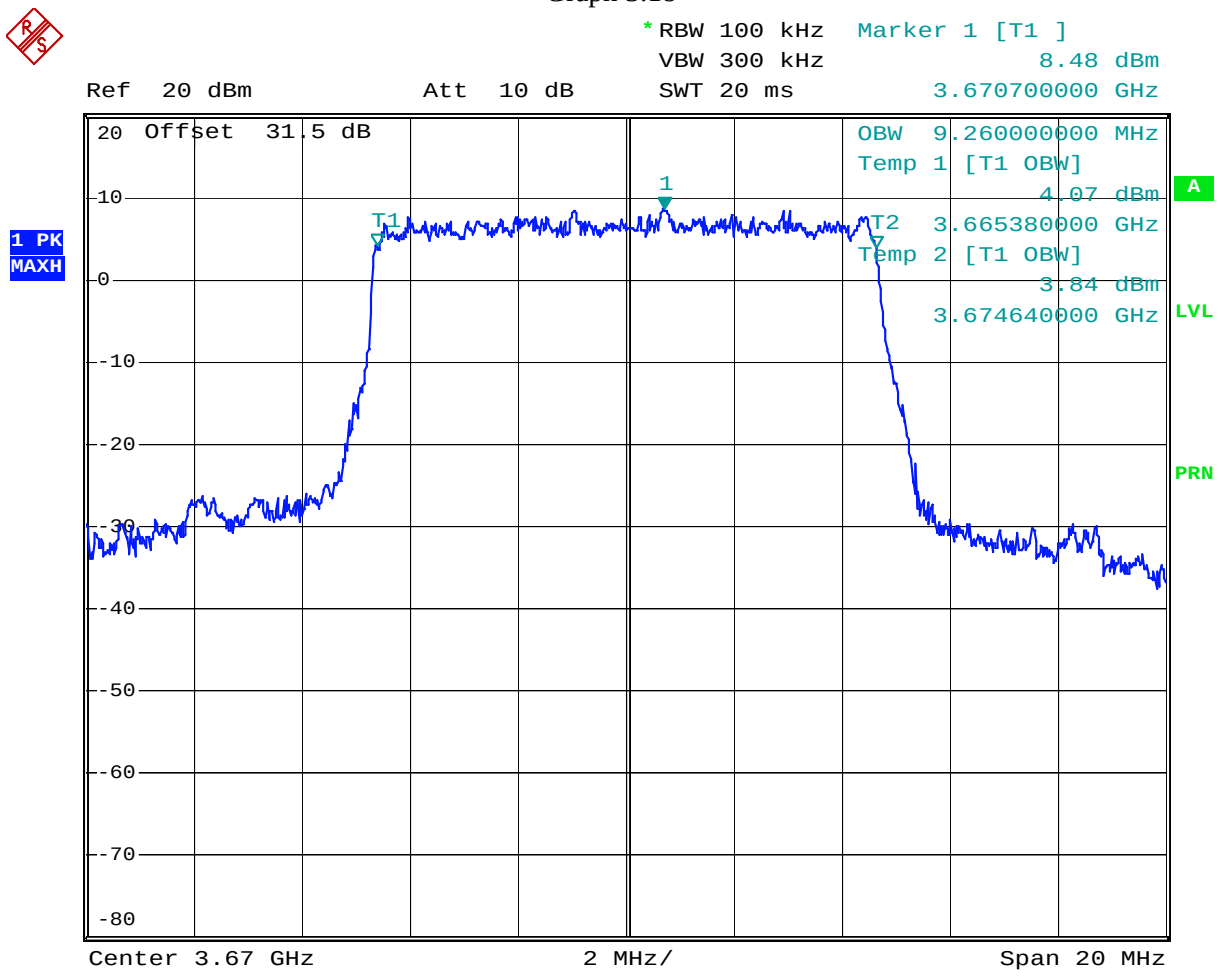
Comment: QPSK, HIGH CHANNEL
Date: 23.FEB.2010 16:46:12

Graph 3.17



Comment: 16QAM, HIGH CHANNEL
Date: 23.FEB.2010 16:47:03

Graph 3.18



Comment: 64QAM, HIGH CHANNEL
Date: 23.FEB.2010 16:53:42