TEST REPORT

Report Number: 100675010MPK-001
Project Number: 100675010
April 01, 2013

Testing performed on the
VHF Radio
Model Numbers: HPT204BT, HPT204, AW200BT and AW200
FCC ID: WJ4HPT204
IC: 3504A-HPT204
to

FCC Part 90
RSS-119 Issue 11
FCC Part 15, Subpart B
Industry Canada ICES-003
for

Javad GNSS, Inc.

Test Performed by:	**Test Authorized by:**
Intertek	Javad GNSS, Inc.
1365 Adams Court	900 Rock Avenue
Menlo Park, CA 94025 USA	San Jose, CA 95131, USA

Prepared by: Krishna K Vemuri **Date:** April 01, 2013

Reviewed by: David Chernomordik **Date:** April 01, 2013

Report No. 100675010MPK-001

Equipment Under Test:	VHF Radio
Trade Name:	Javad GNSS, Inc.
Model No.:	HPT204BT, HPT204, AW200BT and AW200
Serial No.:	00002
FCC ID:	WJ4HPT204
IC ID:	3504A-HPT204
Applicant:	Javad GNSS, Inc.
Contact:	Vladimir Zhukov
Address:	900 Rock Avenue San Jose, CA 95131
Country	USA
Tel. Number:	(408) 770-1770
Fax:	(408) 770-1799
Email:	v.zhukov@javad.com
Applicable Regulation:	FCC Part 90, RSS-119 Issue 11
Test Site Location:	ITS - Site 1 1365 Adams Drive Menlo Park, CA 94025 USA
Date of Test:	November 26, 2012 to March 15, 2013

We attest to the accuracy of this report:

Krishna K Vemuri
EMC Senior Staff Engineer

David Chernomordik
Senior EMC Engineer

TABLE OF CONTENTS

1.0 Introduction

1.1 Product Description

The EUT (Equipment Under Test) is a VHF Radio transceiver, model HPT204BT, designed for commercial application for indoor and outdoor use.

As declared by the Applicant, the models HPT204BT and AW200BT are identical except for their housing color and brand name (HPT for Javad; AW for ArWest). The models HPT204 and AW200 are exactly the same as models HPT204BT and AW200BT except for the removal of a modular approved Bluetooth Module (FCC ID: WJ4BT4EX8M and IC: 3504A-BT4EX8M).

More details on the EUT specification are in the following table 1.

Table 1

	USA	Canada
Type	VHF Radio	
Rated RF Output Power and Frequency Ranges	2 W - 217-220 MHz	4 W - 217-218 MHz and 219-220 MHz
	4 W - 220-222 MHz	4 W - 220-222 MHz
Transmission type	Data	
Type of modulation	BPSK, QPSK, 8PSK, 16QAM, GMSK	
Channel bandwidth and maximum data rate	6.25 kHz at 9.6 kbps	
	12.5 kHz at 19.2 kbps	
	25 kHz at 38.4 kbps	
6.25 kHz channels; band 217 – 220 MHz	in increments of 6.25 kHz from 217.00625 MHz to 219.99375 MHz	in increments of 6.25 kHz from 217.00625 MHz to 217.99375 MHz; from 219.00625 MHz to 219.99375 MHz
12.5 kHz channels; band 217 – 220 MHz	in increments of 12.5 kHz from 217.0125 MHz to 219.9875 MHz	in increments of 12.5 kHz from 217.0125 MHz to 217.9875 MHz; from 219.0125 MHz to 219.9875 MHz
25 kHz channels; band 217 – 220 MHz	in increments of 25 kHz from 217.025 MHz to 219.975 MHz	Aggregation of 2 contiguous channels
6.25 kHz channels; band 220 - 222 MHz	Aggregation of 2 contiguous channels	
12.5 kHz channels; band 220 - 222 MHz	Aggregation of 3 contiguous channels	
25 kHz channels; band 220 - 222 MHz	Aggregation of 6 contiguous channels	
Antenna & Gain	Whip, 2.4 dBi	
Detachable antenna	Yes	
External input	Data	
Operating temperature	From -30^0C to $+50^0$C	

EUT receive date: November 23, 2012
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: November 26, 2012
Test completion date: March 15, 2013

1.2 Summary of Test Results

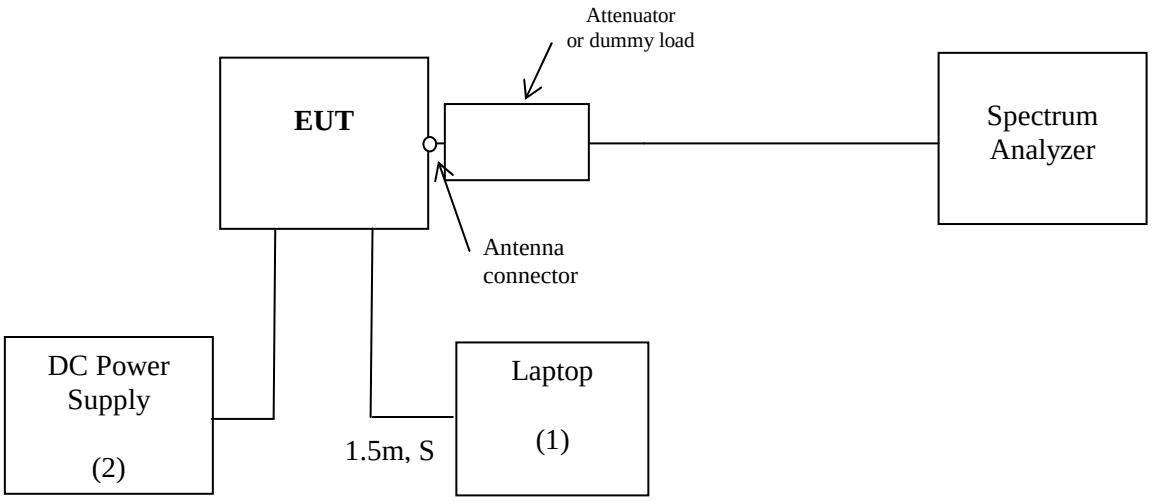
FCC Rule	RSS-119 Rule	Description of Test	Result
2.1046, 90.259(a)(4)	4.1, 5.4	RF Power Output	Complies
90.729(b)	-	ERP	Complies
2.1047	-	Modulation Characteristics	Not Applicable
2.1049, 90.209	RSS-GEN	Occupied Bandwidth	Complies
90.210, 90.209, 90.259	5.5.8	Emission Masks	Complies
2.1051, 90.210	5.8	Out of Band Emissions at Antenna Terminals	Complies
2.1053, 90.210	5.8	Spurious Radiation	Complies
2.1055, 90.213	5.3	Frequency Stability vs. Temperature and Voltage	Complies
2.1091	RSS-102	RF Exposure evaluation	Complies
15.109, 15.111	RSS-GEN	Emissions from Digital Parts and Receiver	Complies
15.207	RSS-GEN	AC Conducted Emission	Complies

1.3 Test Configuration

1.3.1 Support Equipment

Item #	Description	Model No.	S/N
1	Toshiba Laptop	A15-S129	Z3042027P
2	HP, DC Power Supply	6012B	US35430412

1.3.2 Block Diagram of Test Setup



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

1.4 Related Submittal(s) Grants

None

2.0 RF Power Output
FCC 2.1046

2.1 Requirement

FCC 90.259(a)(4)

In the 217-220 MHz band, the maximum transmitter output power is 2 W

RSS-119 sec 5.4

The output power shall be within ± 1 dB of the manufacturer's rated power.

2.2 Test Procedure

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

The spectrum analyzer was setup to measure the Average power. The attenuation and cable loss were added to the spectrum analyzer reading by using OFFSET function.

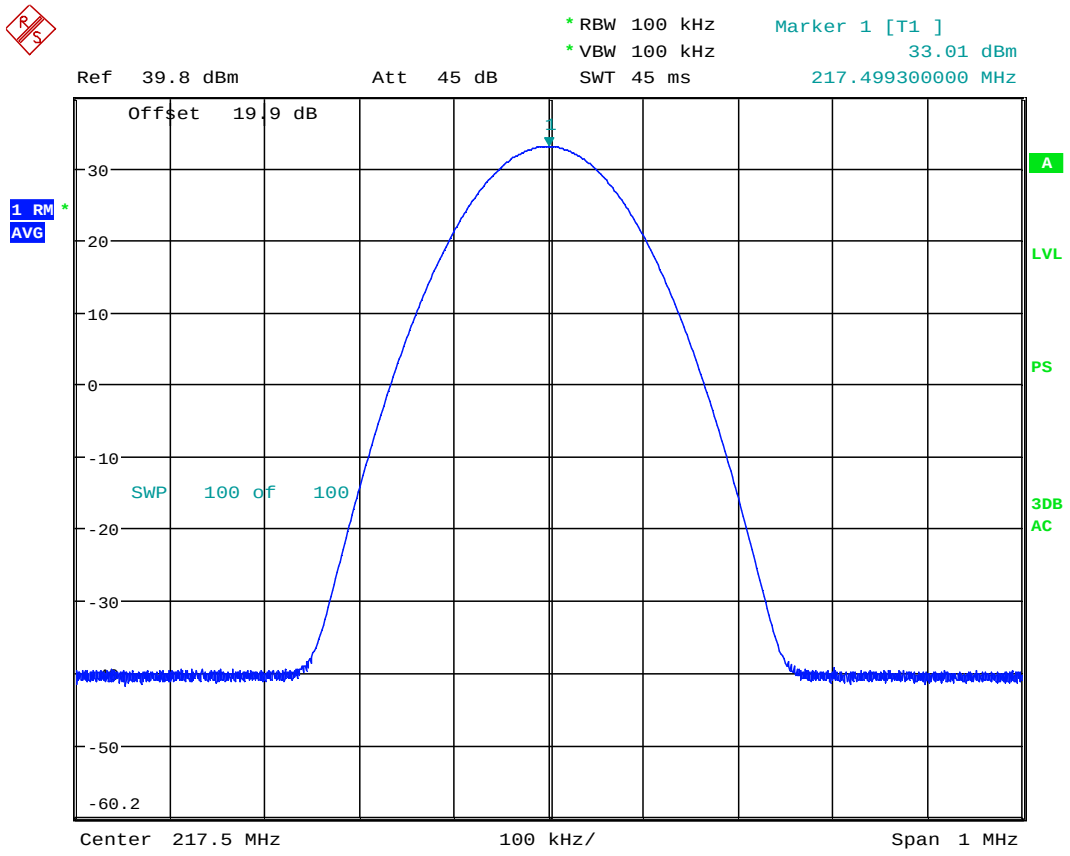
Measurements were performed at three frequencies (low, middle, and high channels).

2.3 Test Results

Frequency (MHz)	Measured Output Power (dBm)	Measured Output Power (Watt)	Graph
217.5**	33.0	2.0	2.1
217.5*	35.6	3.6	2.2
221.0	35.9	3.9	2.3

*RF Power Output for FCC only.
**RF Power Output for Canada only.
For more details refer to the following Graphs.

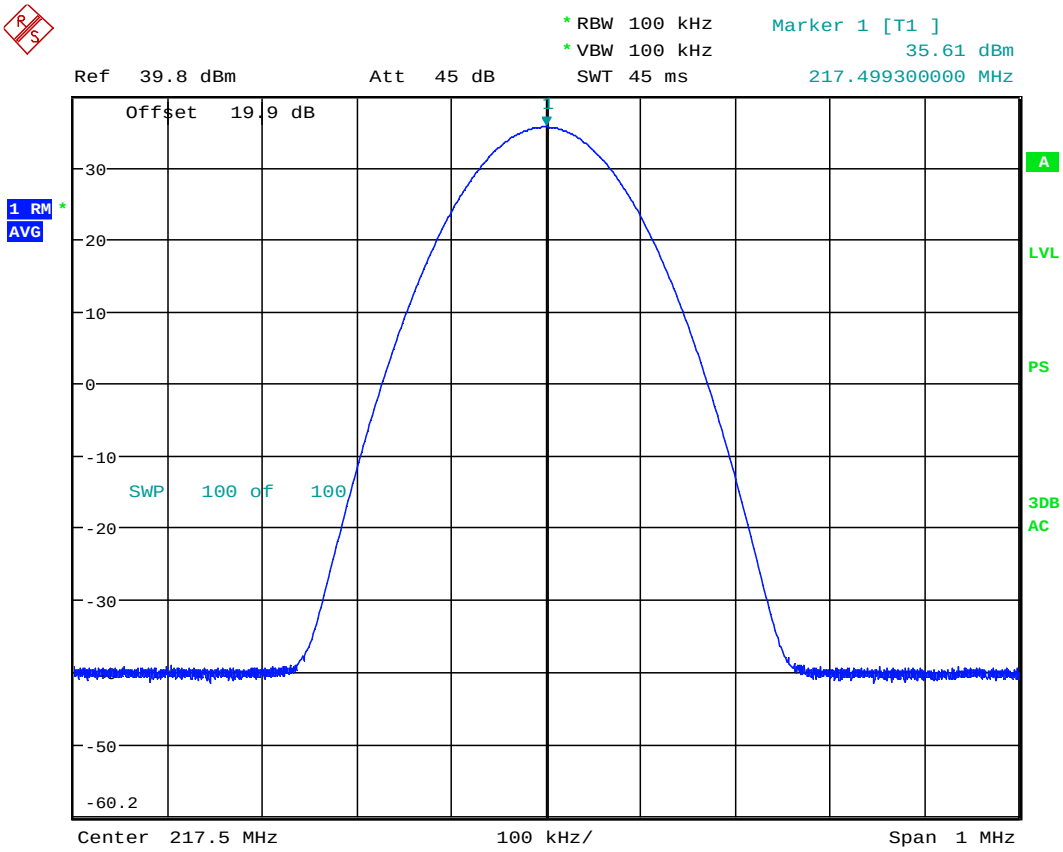
Graph 2. 1



Power output

Date: 3.JAN.2013 13:49:19

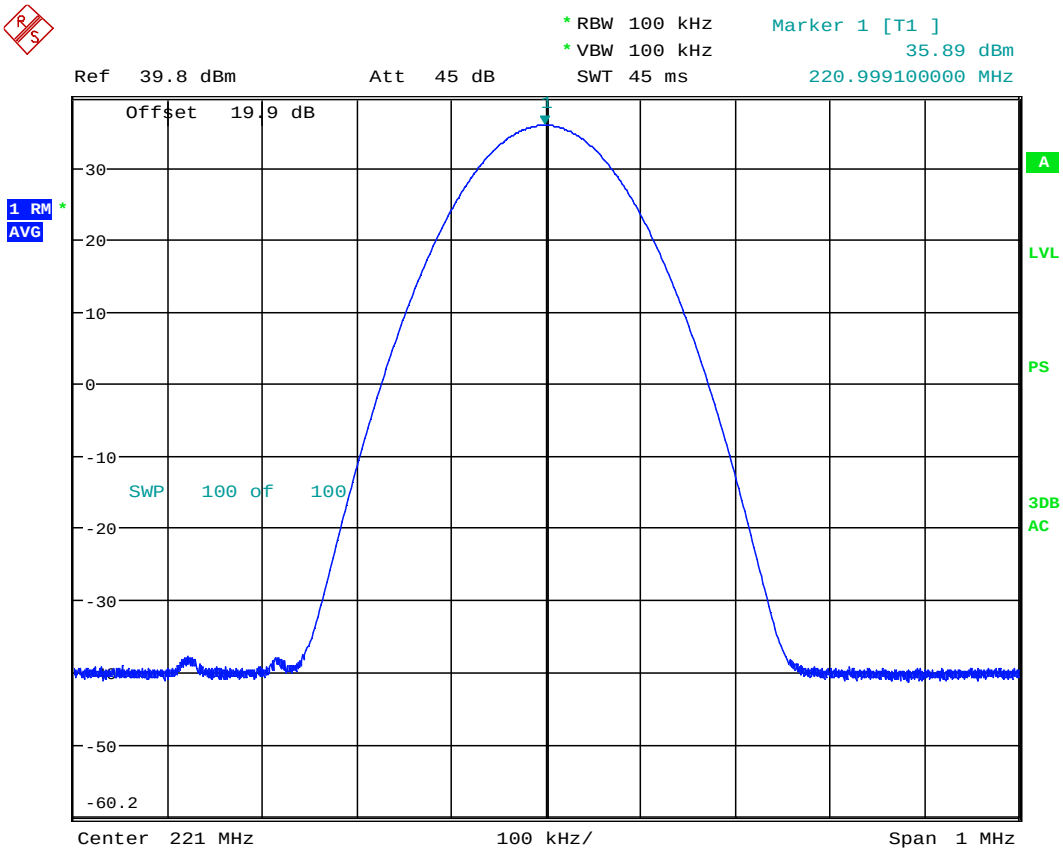
Graph 2. 2



Power output

Date: 3.JAN.2013 13:51:31

Graph 2. 3



Power output

Date: 3.JAN.2013 13:53:45

3.0 Radiated Power

3.1 Requirement

FCC 90.729(b)

In the 220 – 222 MHz band, the maximum Effective Radiated Power (ERP) is 50 Watts.

3.2 Test Procedure

The ERP was calculated by adding the antenna gain to the output power in dBm.

$ERP = P_{max} + G_{dBd}$

3.3 Test Results

According to the Installation Guide, a typical 2.4 dBi (0.3 dBd) gain antenna is used with the EUT. Therefore, the calculated radiated power is:

ERP = 35.9 + 0.3 = 36.2dBm (or 4.169 W);
EIRP= 35.9 + 2.4 = 38.3 dBm (or 6.760 W).

Result	**Complies**

4.0 Occupied Bandwidth

FCC 2.1049, 90.209(b)(5)

4.1 Test Procedure

The EUT RF output was connected as shown on the diagram in section1.3.2. The EUT was setup to transmit with maximum power.

The spectrum analyzer was setup to measure the Occupied Bandwidth (defined as the 99% Power Bandwidth). The Occupied Bandwidth was measured at 217.5 MHz and 221 MHz for all types of modulation and authorized bandwidths.

4.2 Test Results

The test results are summarized in the following tables and presented on the Graphs 4.1 – 4.45.

The following Emission Designators were determined:

For USA & Canada 220-222 MHz:	For USA 217-220 MHz:	For Canada 217-218 MHz and 219-220 MHz:
3K11G1D 2K90F1D 6K18G1D 5K78F1D 12K35G1D 11K42F1D	3K05G1D 2K92F1D 6K03G1D 5K82F1D 12K03G1D 11K50F1D	3K14G1D 2K89F1D 6K21G1D 5K76F1D 12K42G1D 11K41F1D

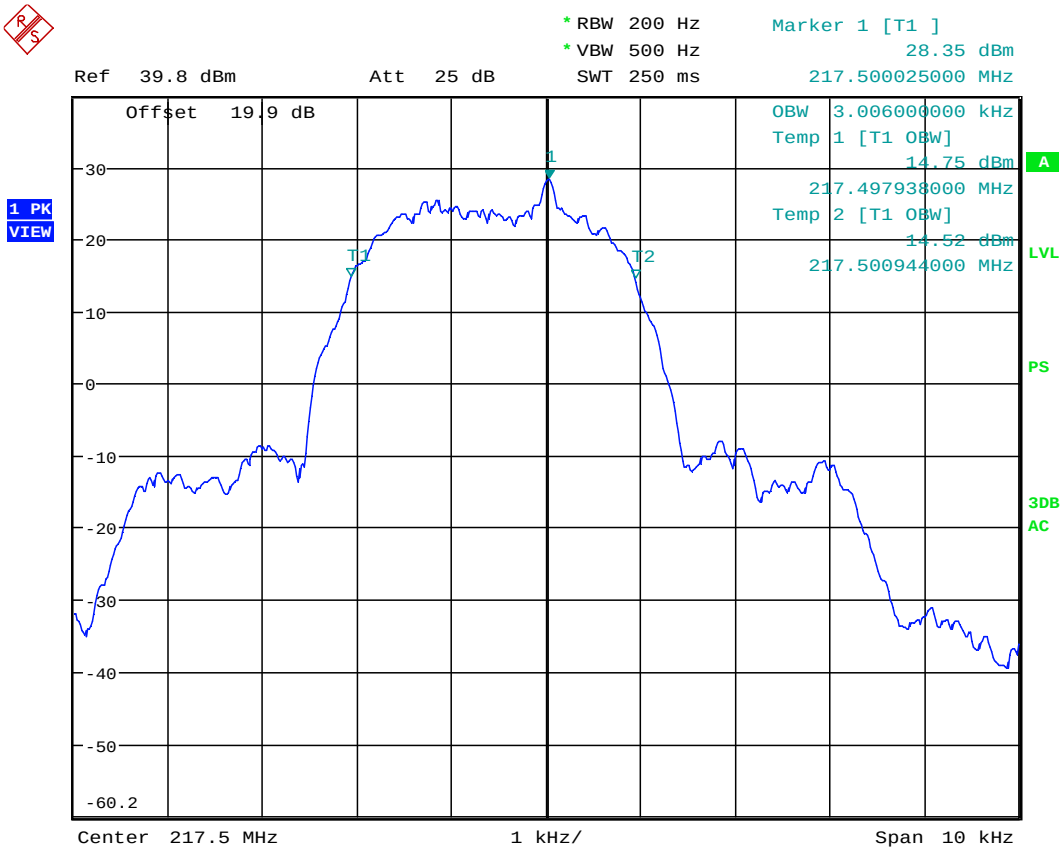
Frequency (MHz)	Modulation	Channel Bandwidth (kHz)	Authorized Bandwidth (kHz)	Measured Occupied Bandwidth (kHz)	Graph
217.5 (2 W)	BPSK	6.25	6.0	3.01	4.1
	QPSK			3.04	4.2
	8PSK			3.05	4.3
	16QAM			3.02	4.4
	GMSK			2.92	4.5
217.5 (2 W)	BPSK	12.5	11.25	5.95	4.6
	QPSK			6.03	4.7
	8PSK			6.00	4.8
	16QAM			6.00	4.9
	GMSK			5.82	4.10
217.5 (2 W)	BPSK	25.0	20.0	11.85	4.11
	QPSK			12.03	4.12
	8PSK			12.02	4.13
	16QAM			11.97	4.14
	GMSK			11.50	4.15

Frequency (MHz)	Modulation	Channel Bandwidth (kHz)	Authorized Bandwidth (kHz)	Measured Occupied Bandwidth (kHz)	Graph
217.5 (4 W)	BPSK	6.25	6.0	3.02	4.16
	QPSK			3.12	4.17
	8PSK			3.14	4.18
	16QAM			3.10	4.19
	GMSK			2.89	4.20
217.5 (4 W)	BPSK	12.5	11.25	6.00	4.21
	QPSK			6.21	4.22
	8PSK			6.19	4.23
	16QAM			6.14	4.24
	GMSK			5.76	4.25
217.5 (4 W)	BPSK	25.0	20.0	11.90	4.26
	QPSK			12.37	4.27
	8PSK			12.42	4.28
	16QAM			12.29	4.29
	GMSK			11.41	4.30

For more details refer to the attached Graphs.

Frequency (MHz)	Modulation	Channel Bandwidth (kHz)	Authorized Bandwidth (kHz)	Measured Occupied Bandwidth (kHz)	Graph
221 (4 W)	BPSK	6.25	6.0	3.00	4.31
	QPSK			3.11	4.32
	8PSK			3.11	4.33
	16QAM			3.07	4.34
	GMSK			2.90	4.35
221 (4 W)	BPSK	12.5	11.25	5.98	4.36
	QPSK			6.18	4.37
	8PSK			6.15	4.38
	16QAM			6.13	4.39
	GMSK			5.78	4.40
221 (4 W)	BPSK	25.0	20.0	11.91	4.41
	QPSK			12.31	4.42
	8PSK			12.35	4.43
	16QAM			12.23	4.44
	GMSK			11.42	4.45

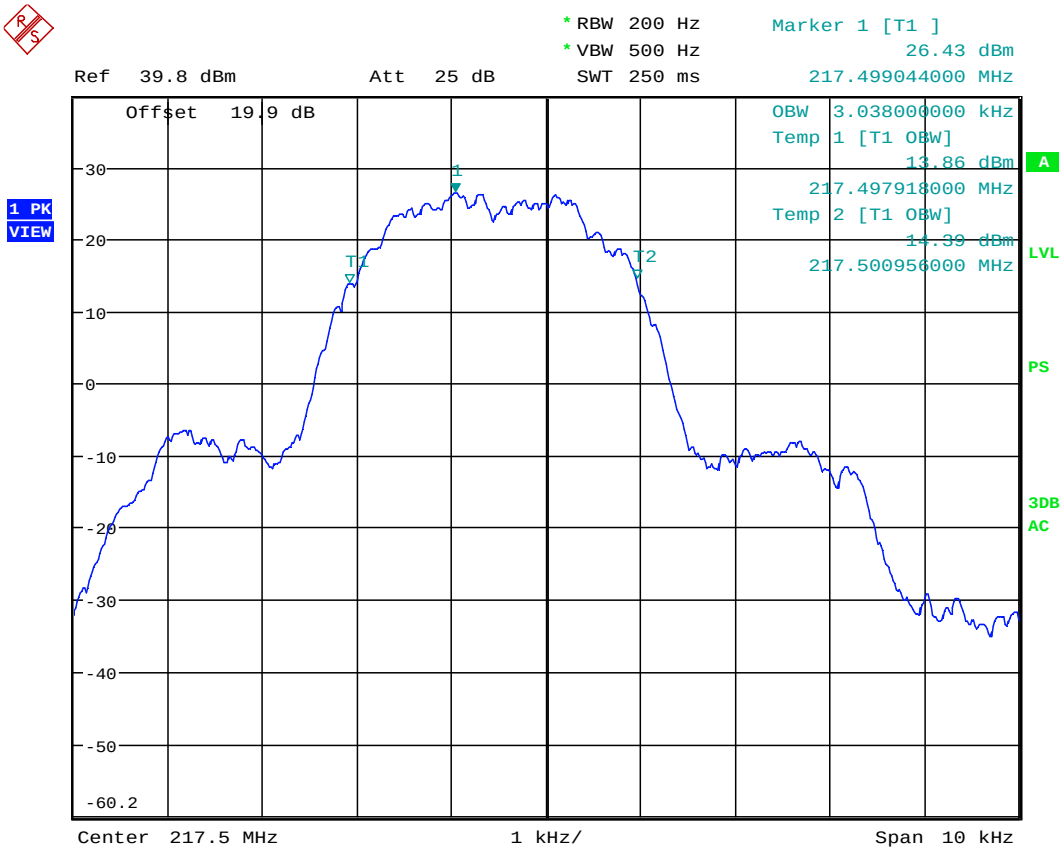
Graph 4.1



Occupied bandwidth, 6 kHz authorized bandwidth, BPSK

Date: 3.JAN.2013 14:13:17

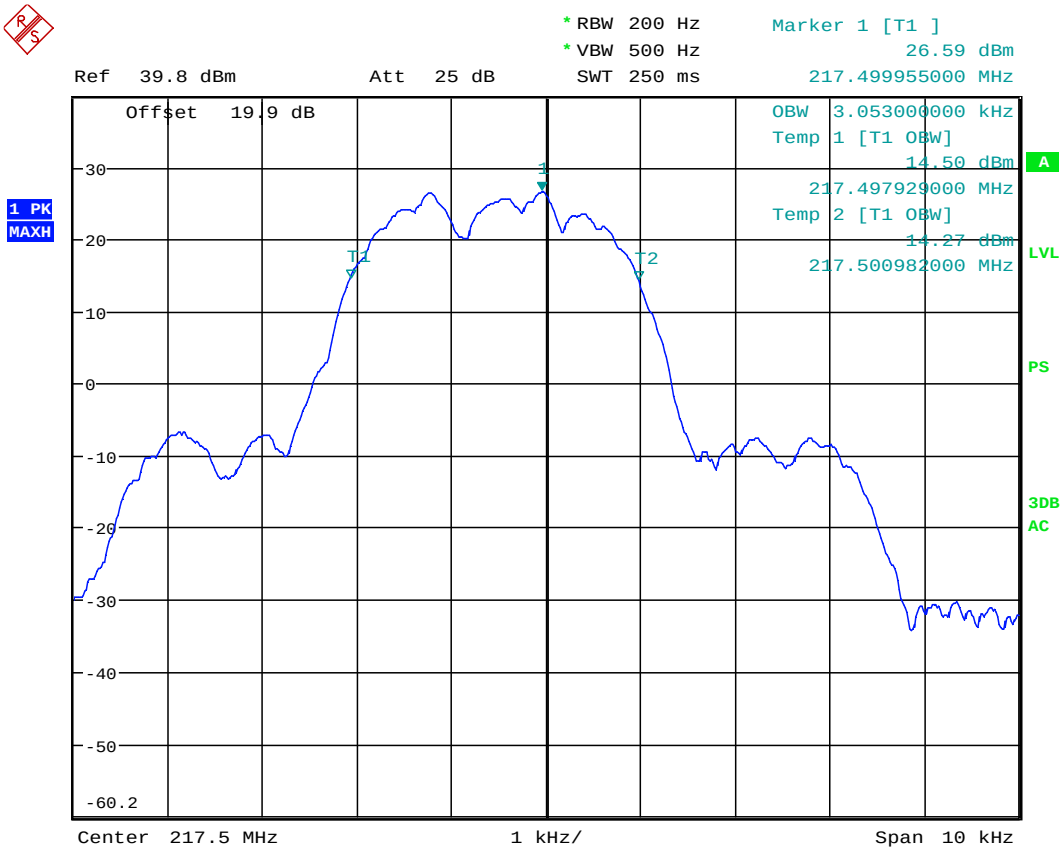
Graph 4.2



Occupied bandwidth, 6 kHz authorized bandwidth, QPSK

Date: 3.JAN.2013 14:17:48

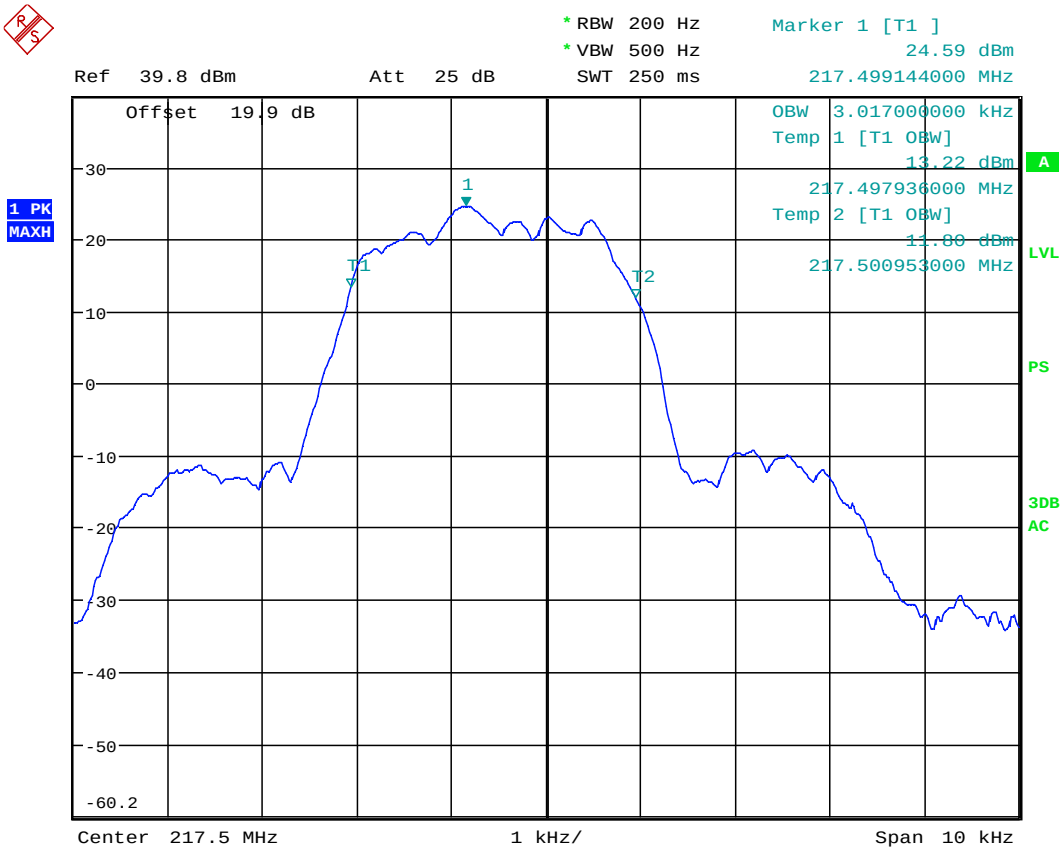
Graph 4.3



Occupied bandwidth, 6 kHz authorized bandwidth, 8PSK

Date: 3.JAN.2013 14:25:18

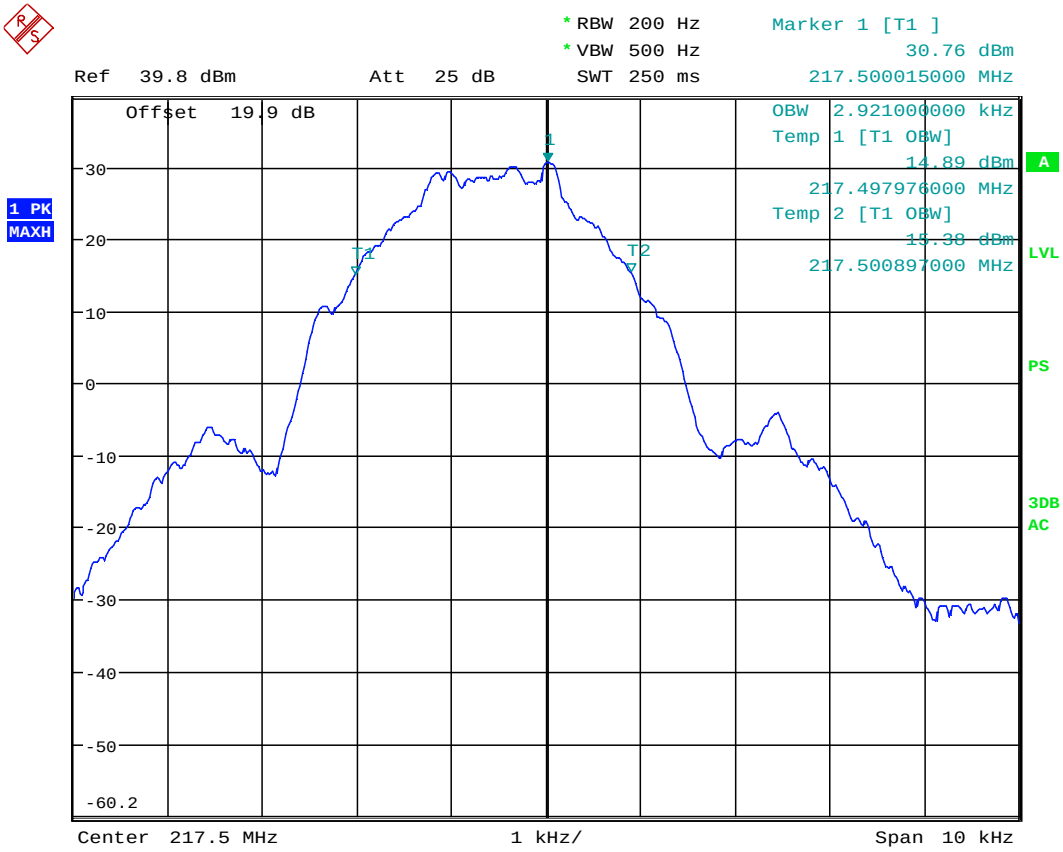
Graph 4.4



Occupied bandwidth, 6 kHz authorized bandwidth, 16QAM

Date: 3.JAN.2013 14:30:46

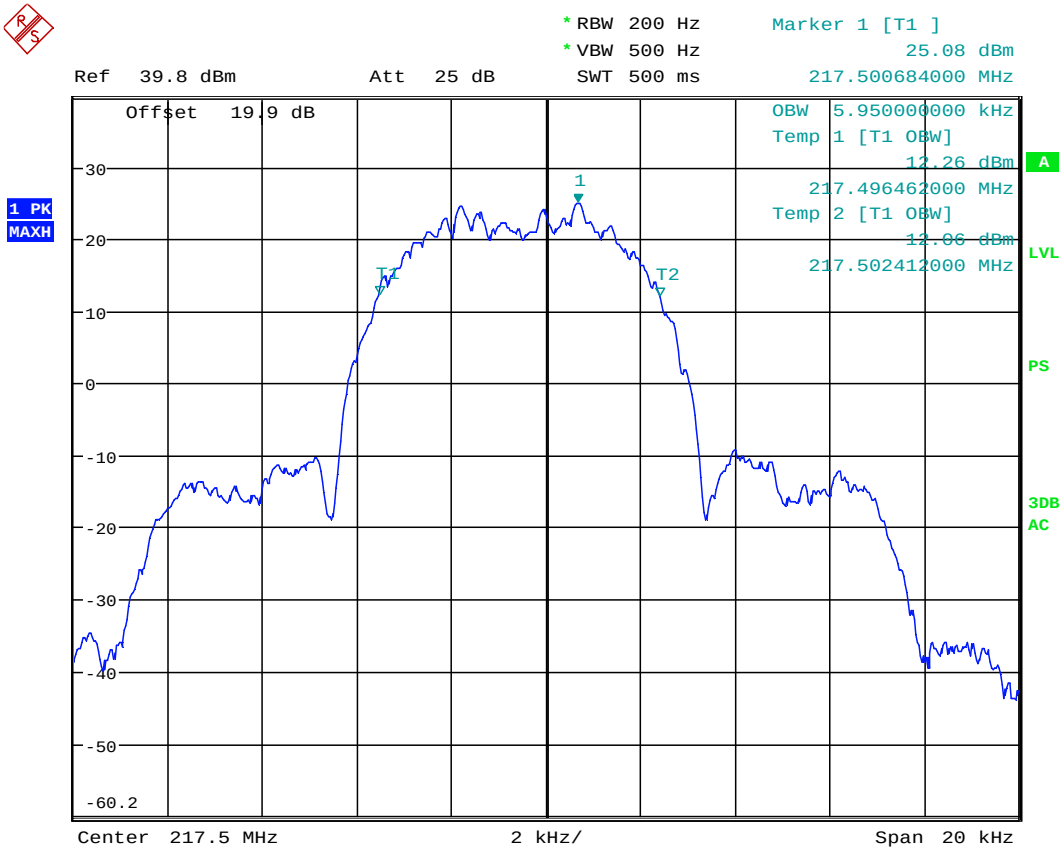
Graph 4.5



Occupied bandwidth, 6 kHz authorized bandwidth, GMSK

Date: 3.JAN.2013 14:34:46

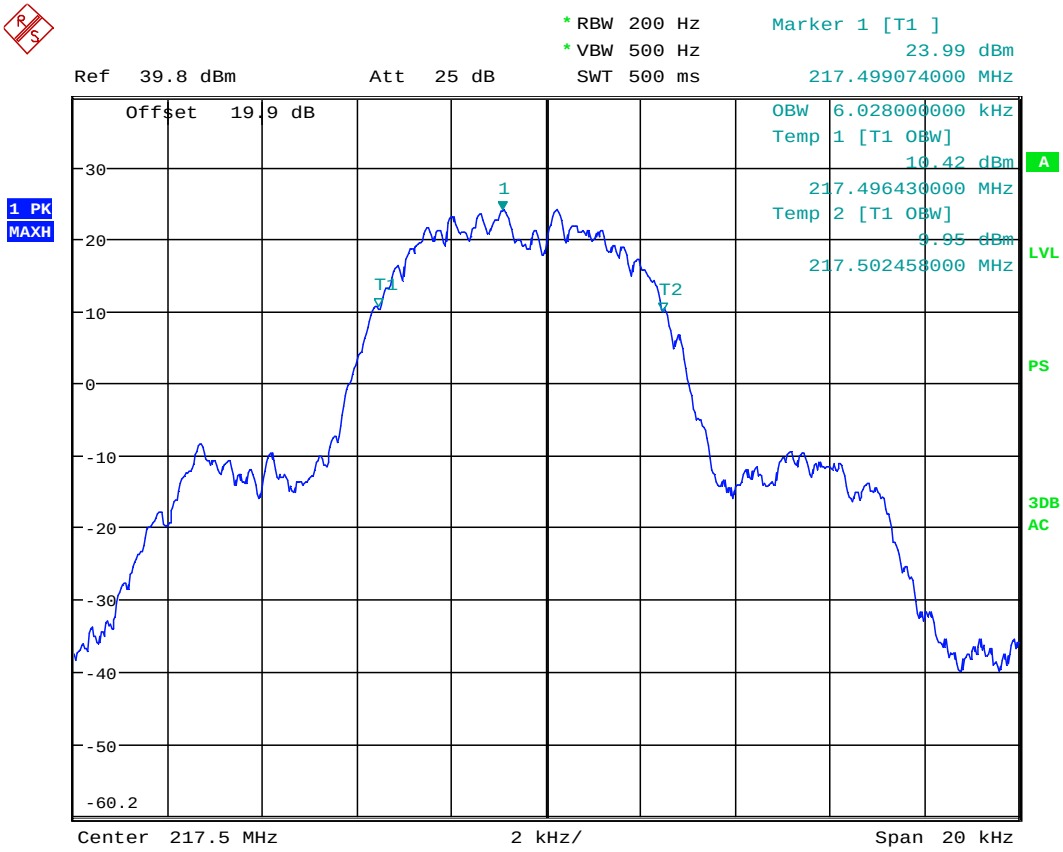
Graph 4.6



Occupied bandwidth, 11.25 kHz authorized bandwidth, BPSK

Date: 3.JAN.2013 14:50:40

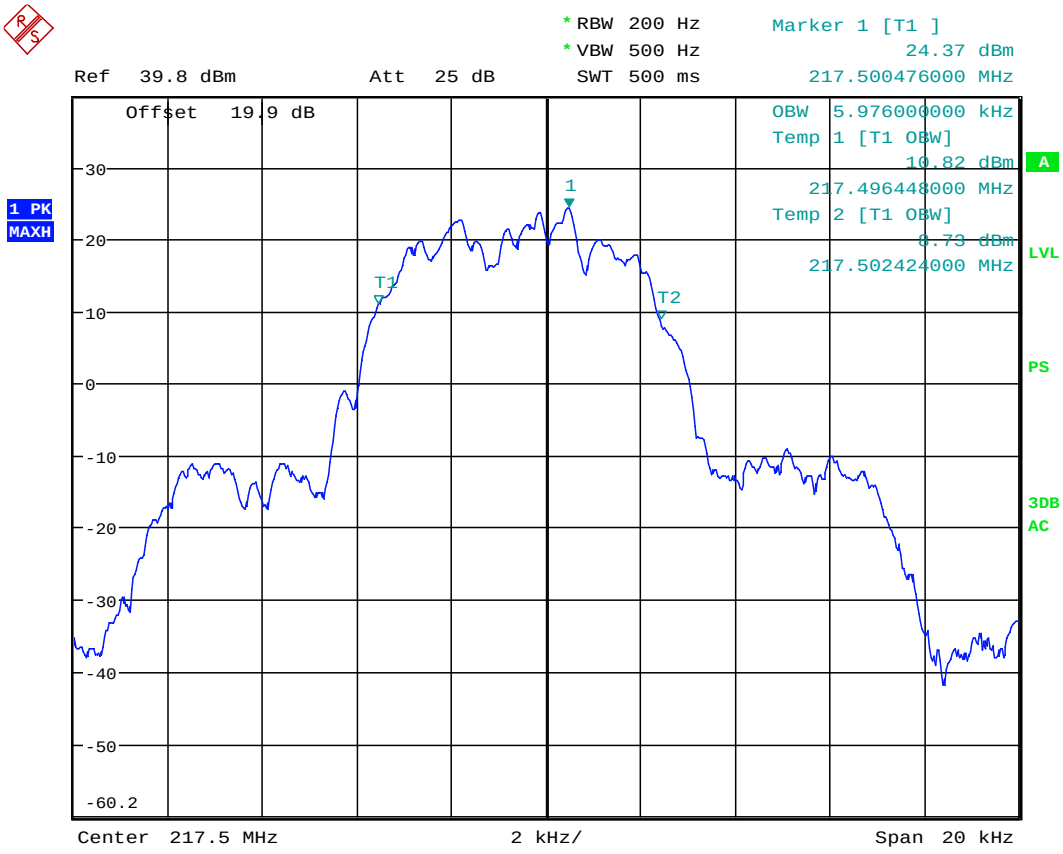
Graph 4.7



Occupied bandwidth, 11.25 kHz authorized bandwidth, QPSK

Date: 3.JAN.2013 14:53:47

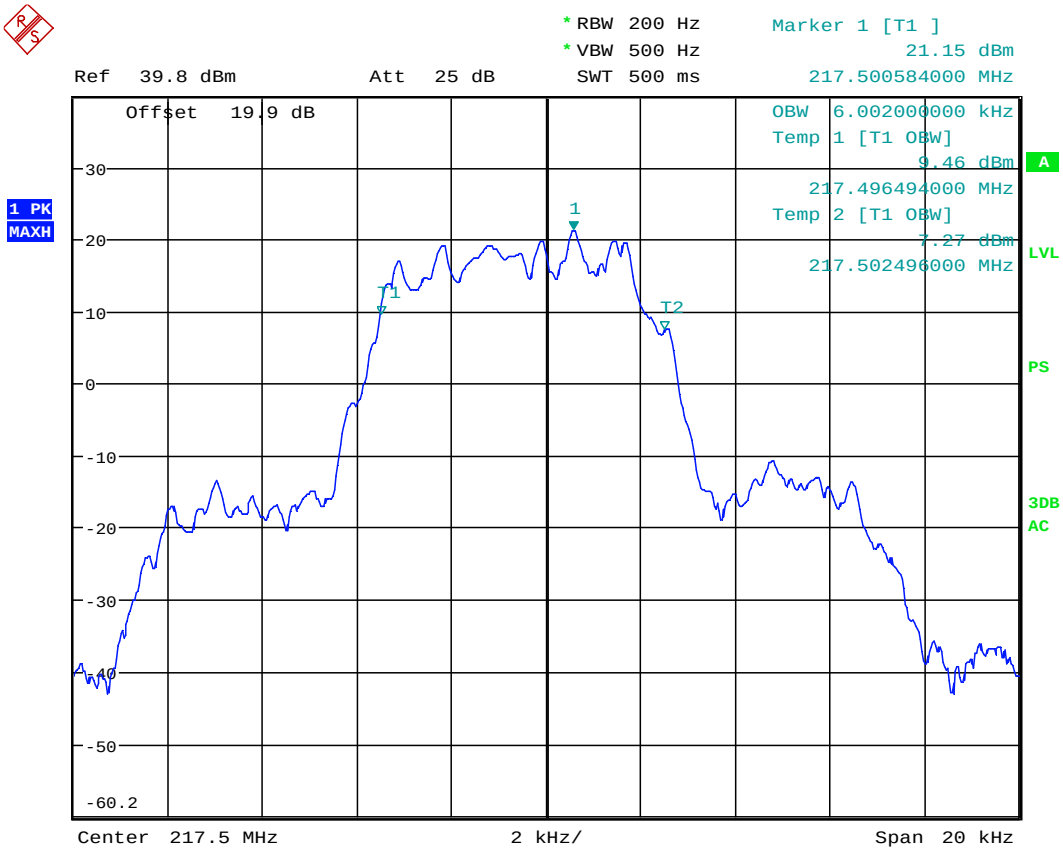
Graph 4.8



Occupied bandwidth, 11.25 kHz authorized bandwidth, 8PSK

Date: 3.JAN.2013 14:56:24

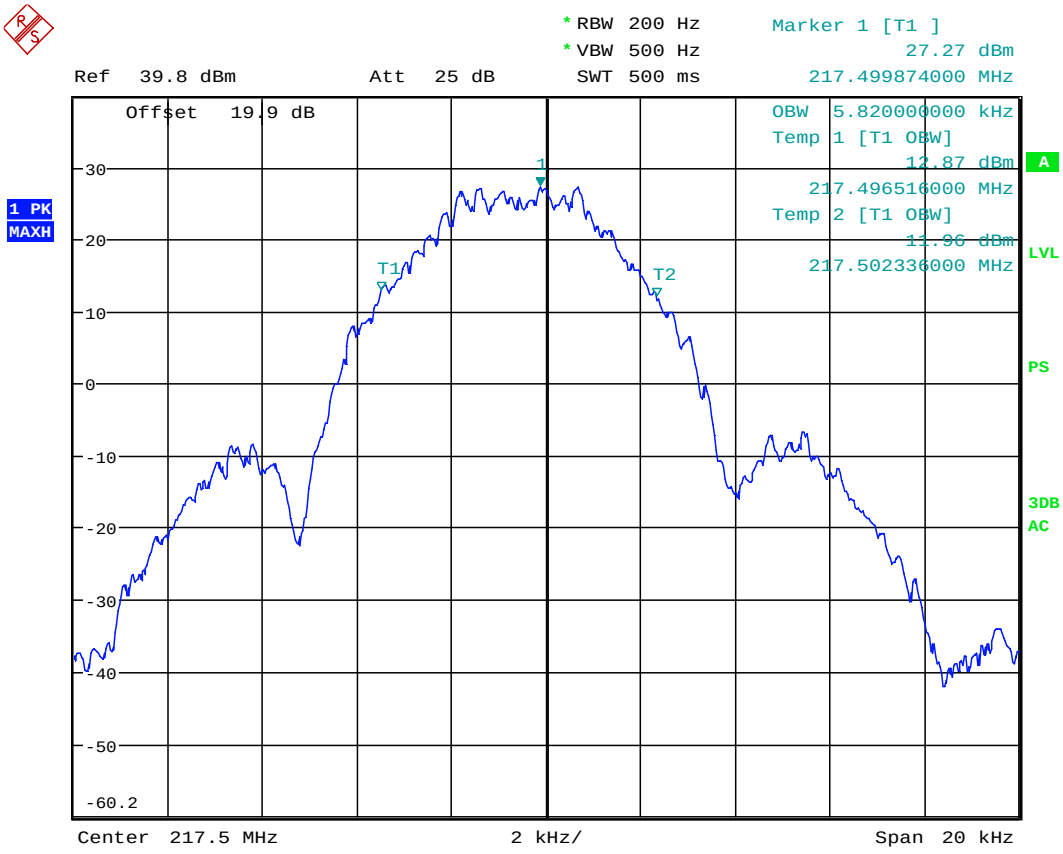
Graph 4.9



Occupied bandwidth, 11.25 kHz authorized bandwidth, 16QAM

Date: 3.JAN.2013 14:58:58

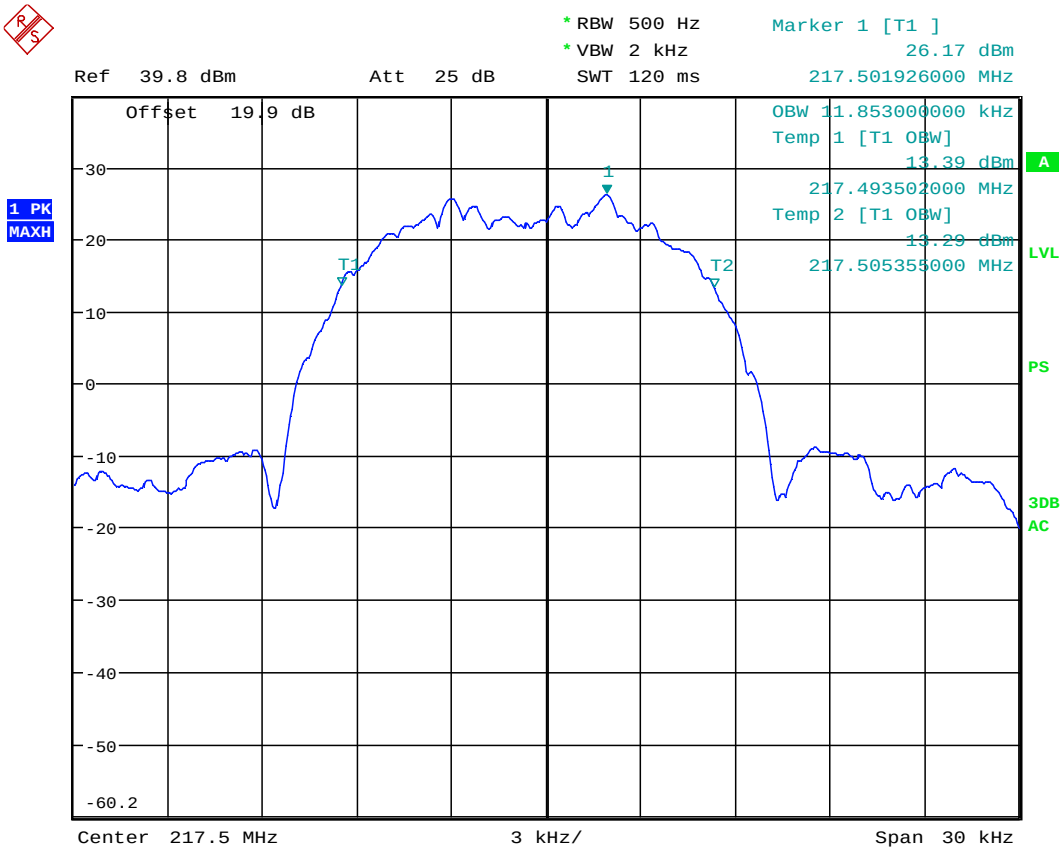
Graph 4.10



Occupied bandwidth, 11.25 kHz authorized bandwidth, GMSK

Date: 3.JAN.2013 15:01:37

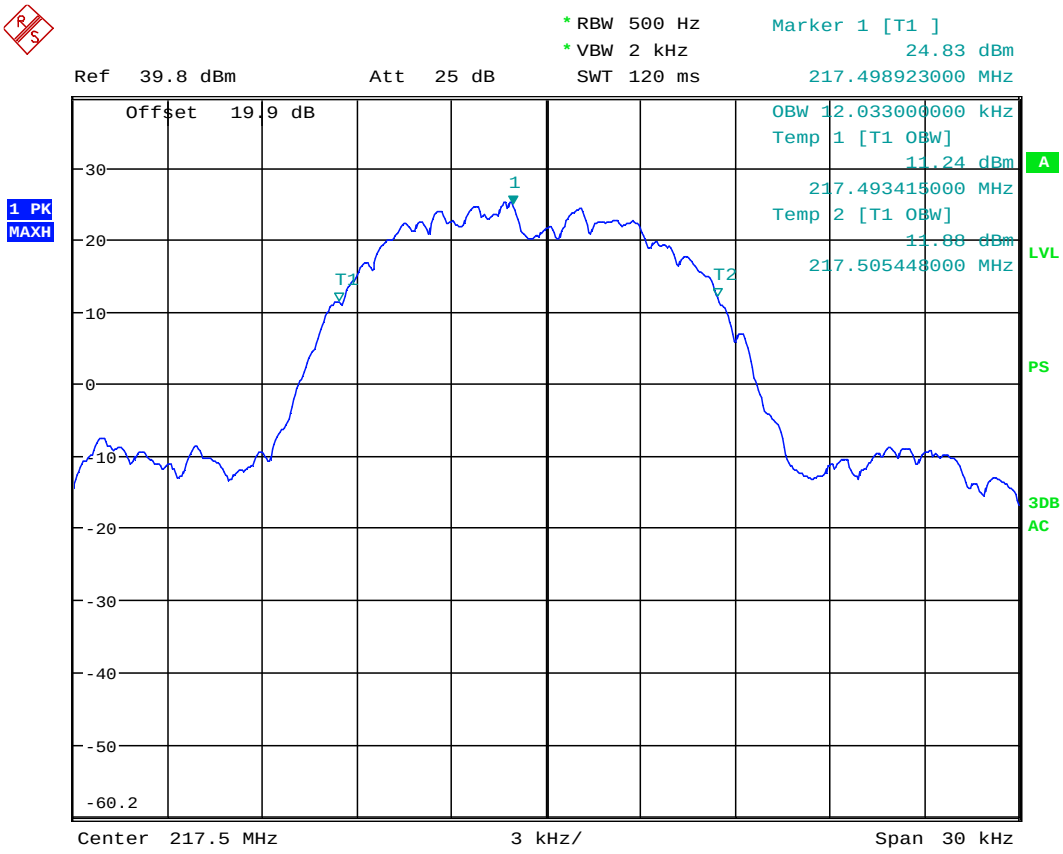
Graph 4.11



Occupied bandwidth, 20 kHz authorized bandwidth, BPSK

Date: 3.JAN.2013 15:43:39

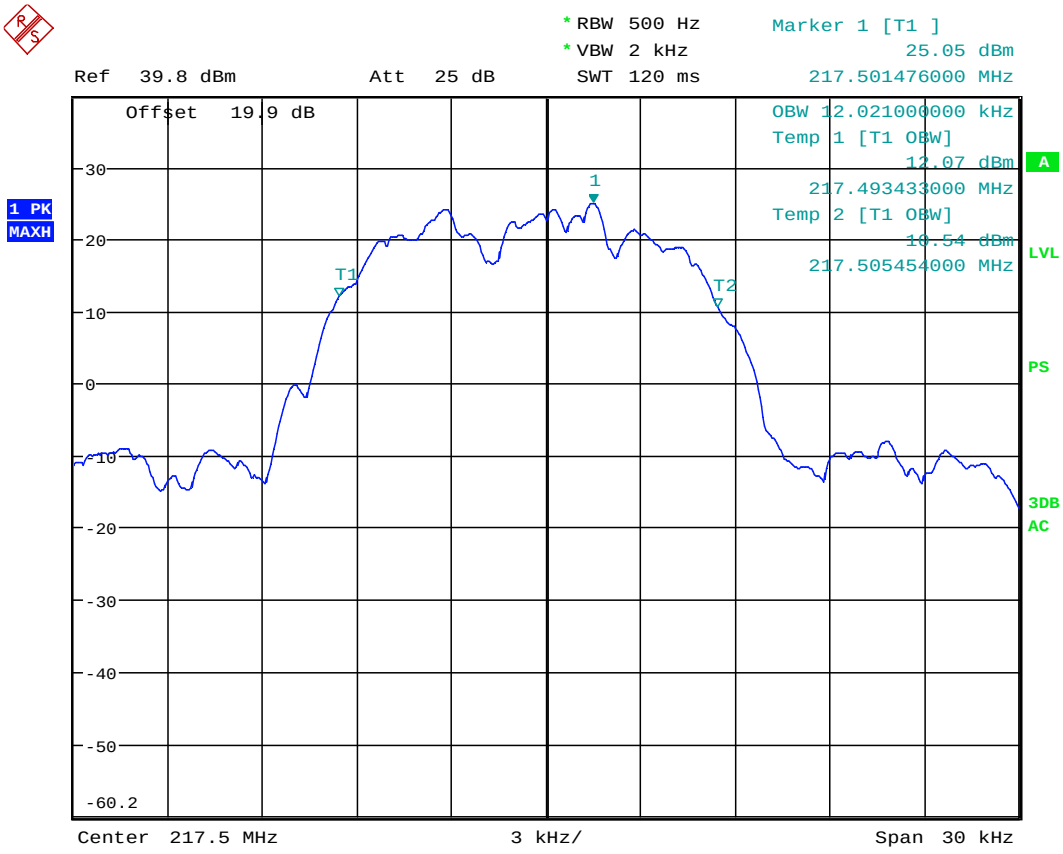
Graph 4.12



Occupied bandwidth, 20 kHz authorized bandwidth, QPSK

Date: 3.JAN.2013 15:46:24

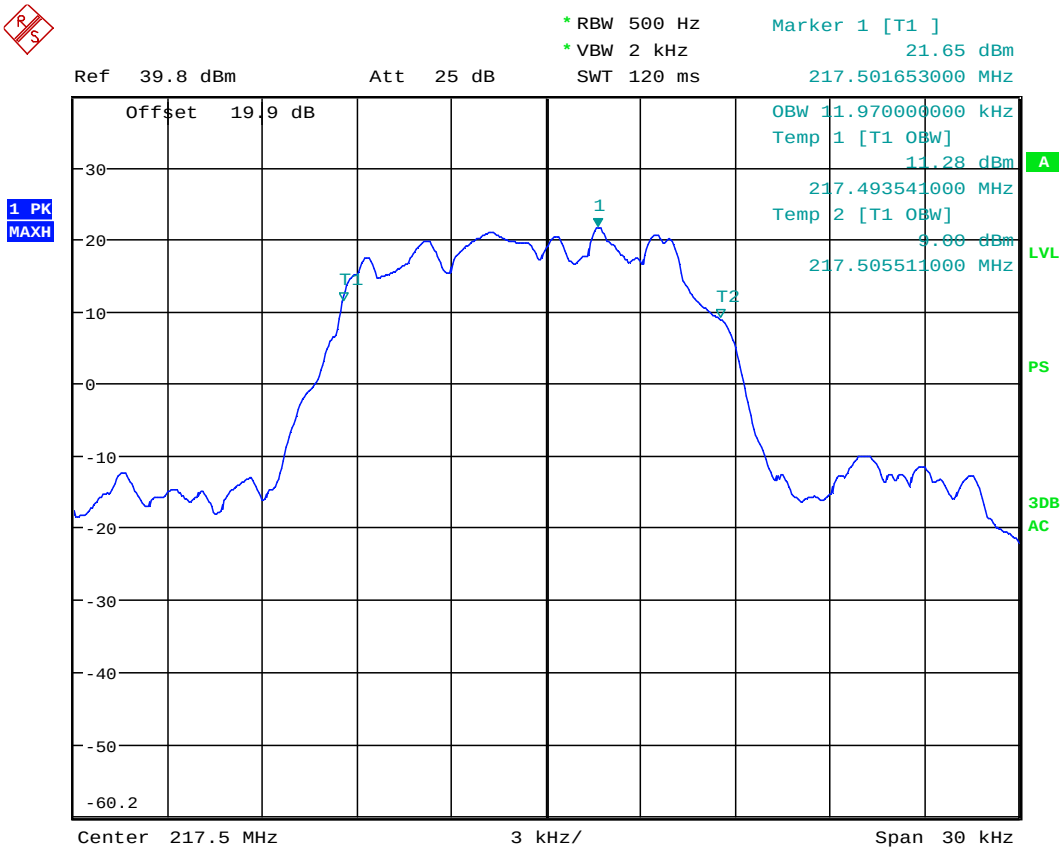
Graph 4.13



Occupied bandwidth, 20 kHz authorized bandwidth, 8PSK

Date: 3.JAN.2013 15:49:07

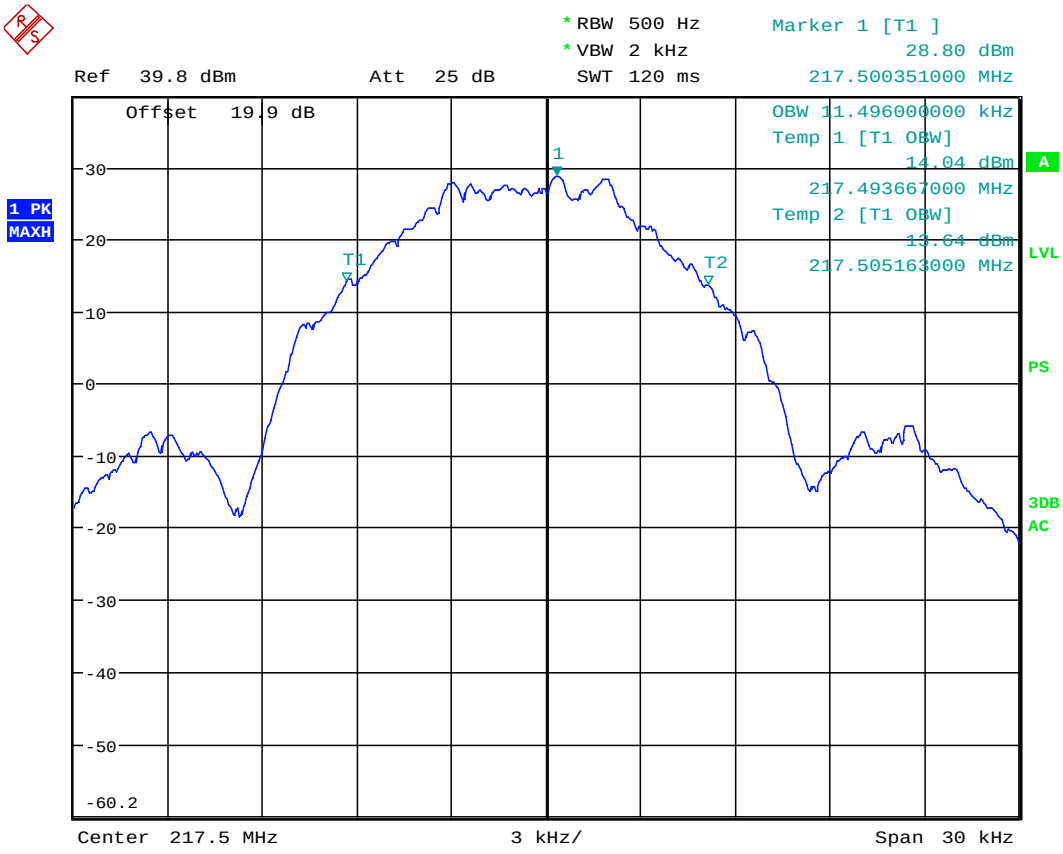
Graph 4.14



Occupied bandwidth, 20 kHz authorized bandwidth, 16QAM

Date: 3.JAN.2013 15:51:33

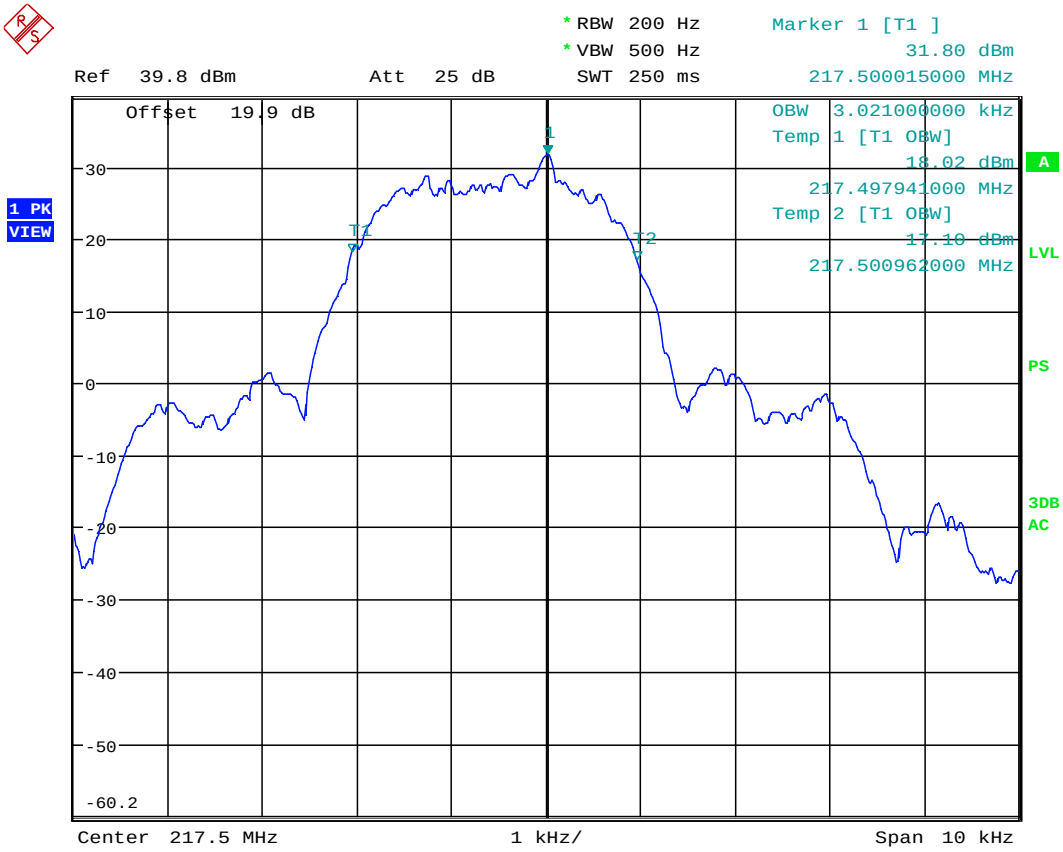
Graph 4.15



Occupied bandwidth, 20 kHz authorized bandwidth, GMSK

Date: 3.JAN.2013 15:57:47

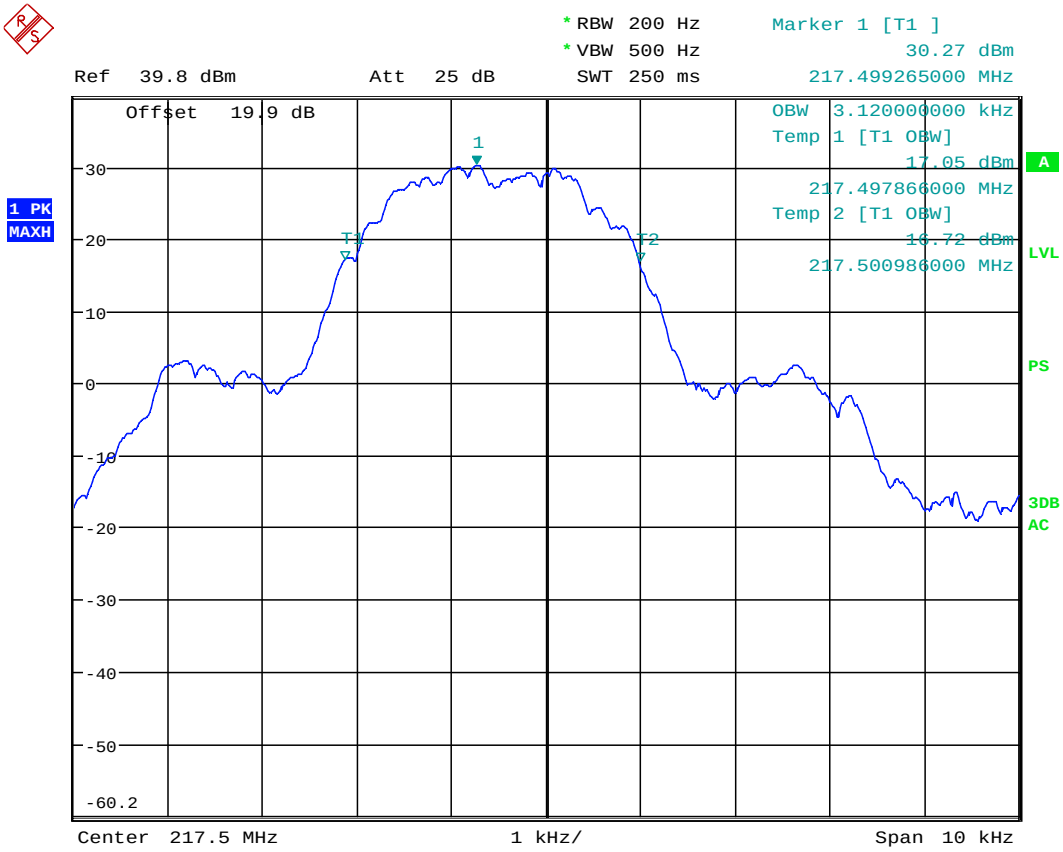
Graph 4.16



Occupied bandwidth, 6 kHz authorized bandwidth, BPSK

Date: 3.JAN.2013 14:15:59

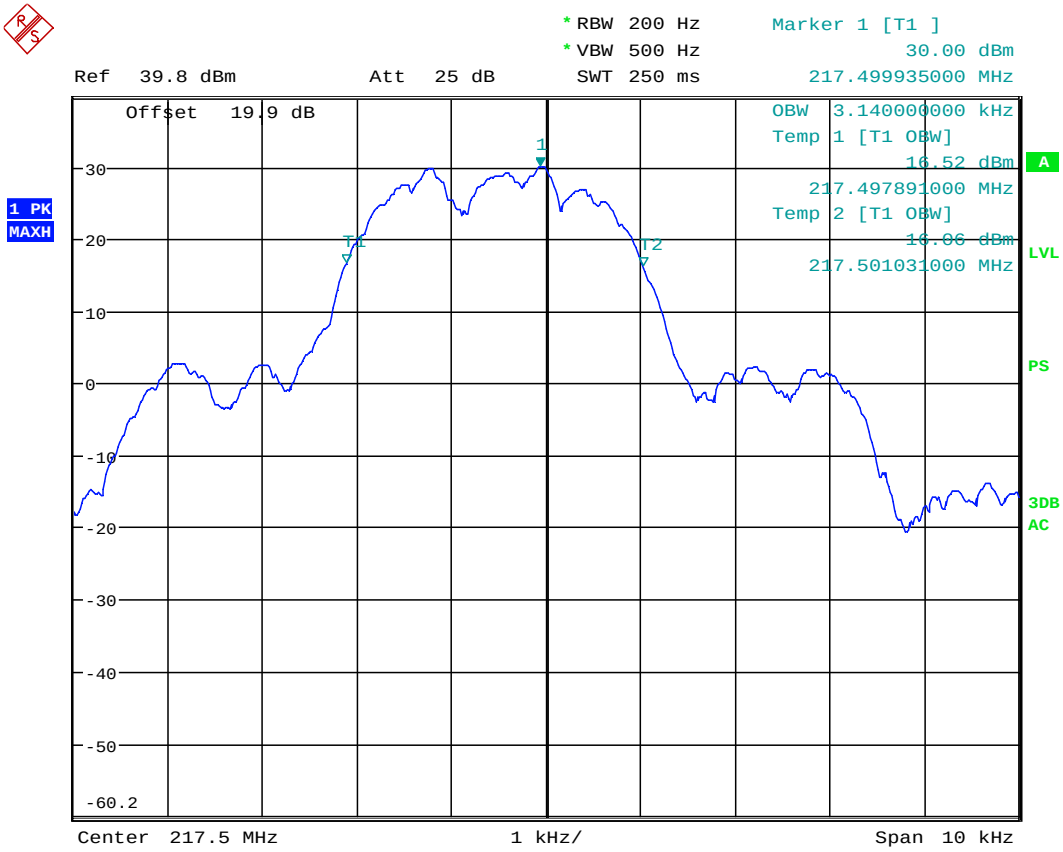
Graph 4.17



Occupied bandwidth, 6 kHz authorized bandwidth, QPSK

Date: 3.JAN.2013 14:22:51

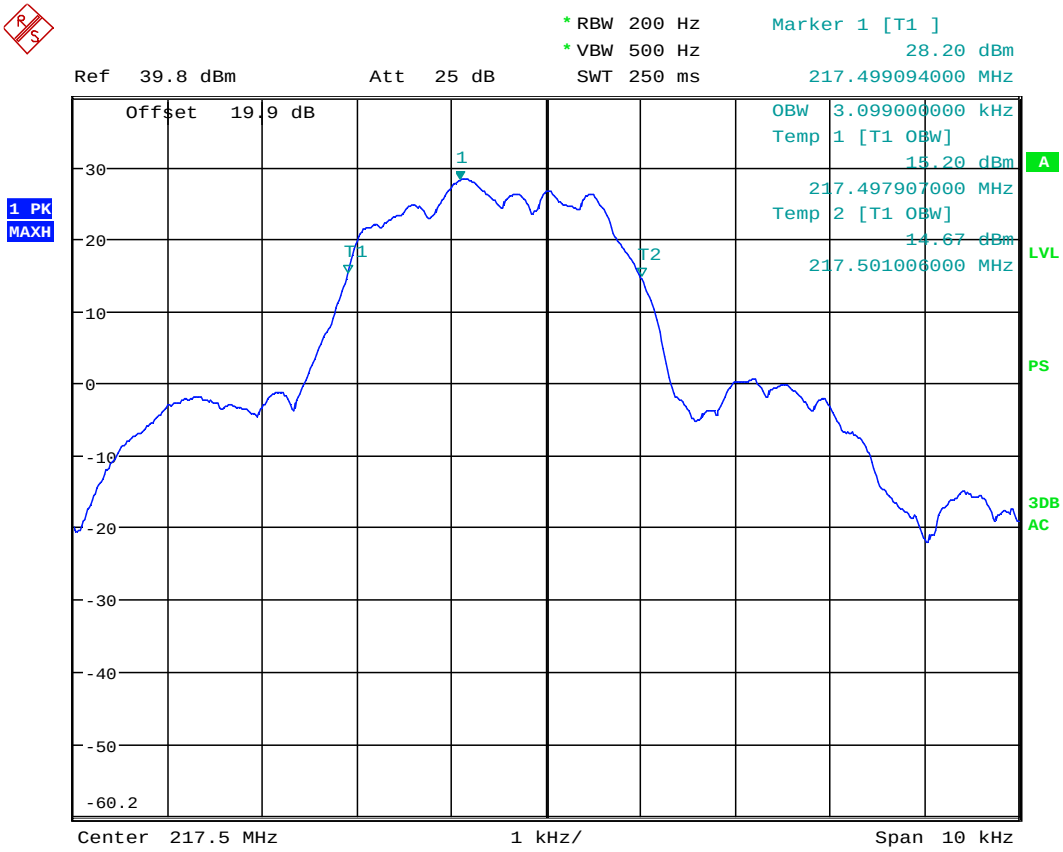
Graph 4.18



Occupied bandwidth, 6 kHz authorized bandwidth, 8PSK

Date: 3.JAN.2013 14:27:21

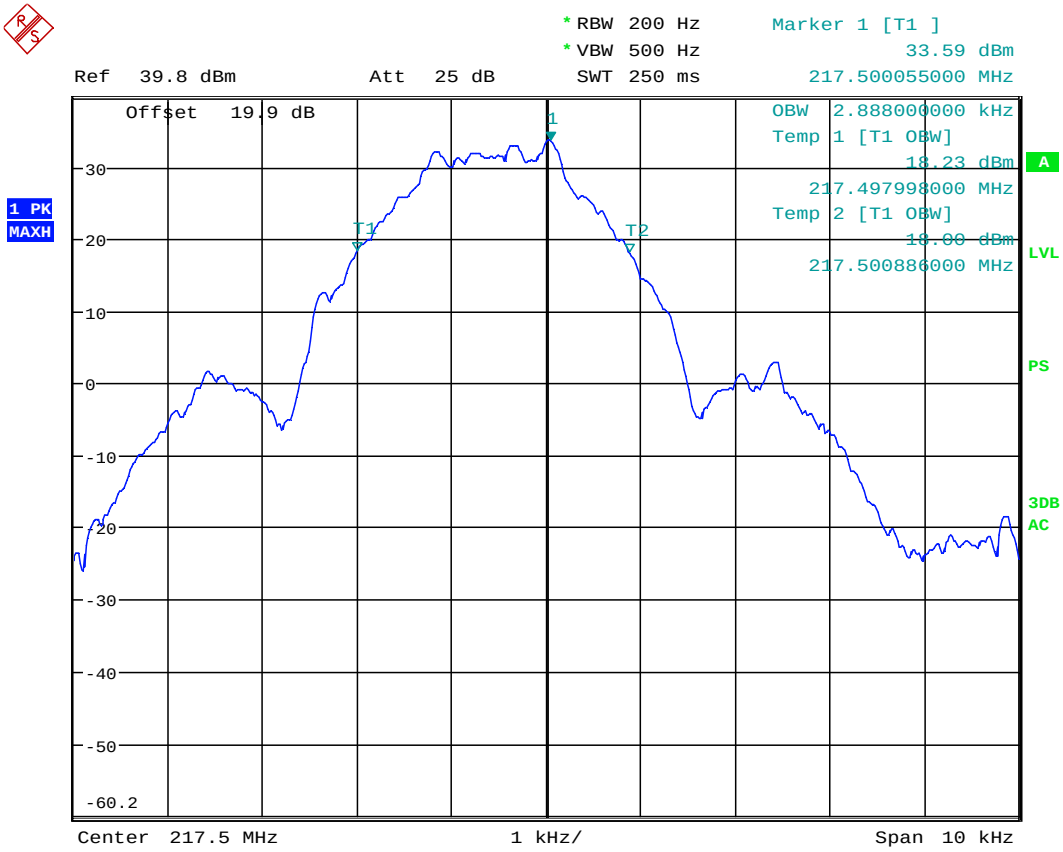
Graph 4.19



Occupied bandwidth, 6 kHz authorized bandwidth, 16QAM

Date: 3.JAN.2013 14:32:55

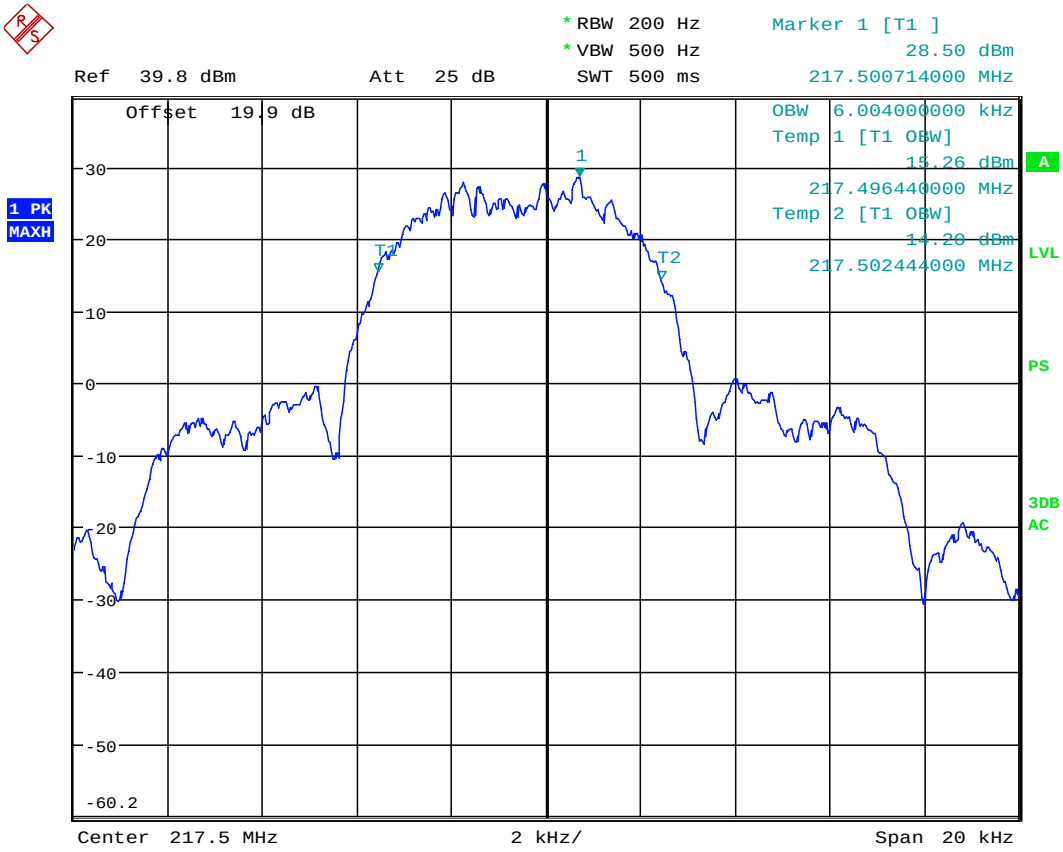
Graph 4.20



Occupied bandwidth, 6 kHz authorized bandwidth, GMSK

Date: 3.JAN.2013 14:36:16

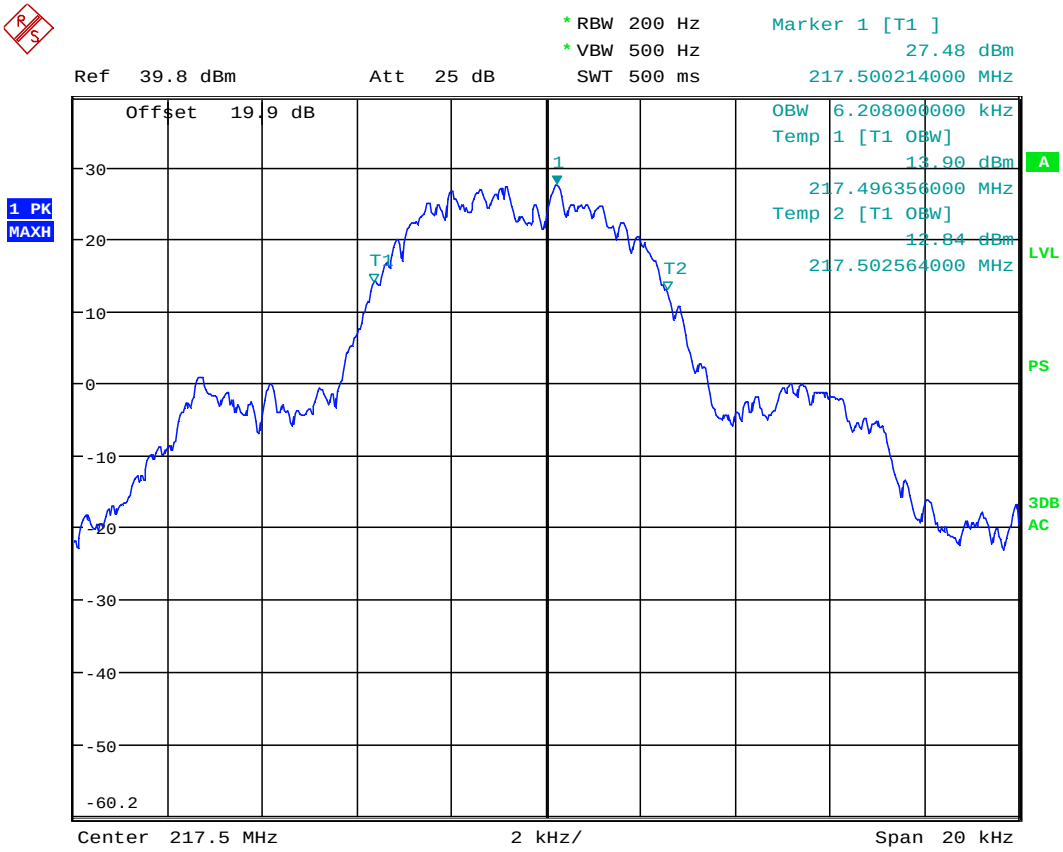
Graph 4.21



Occupied bandwidth, 11.25 kHz authorized bandwidth, BPSK

Date: 3.JAN.2013 14:52:06

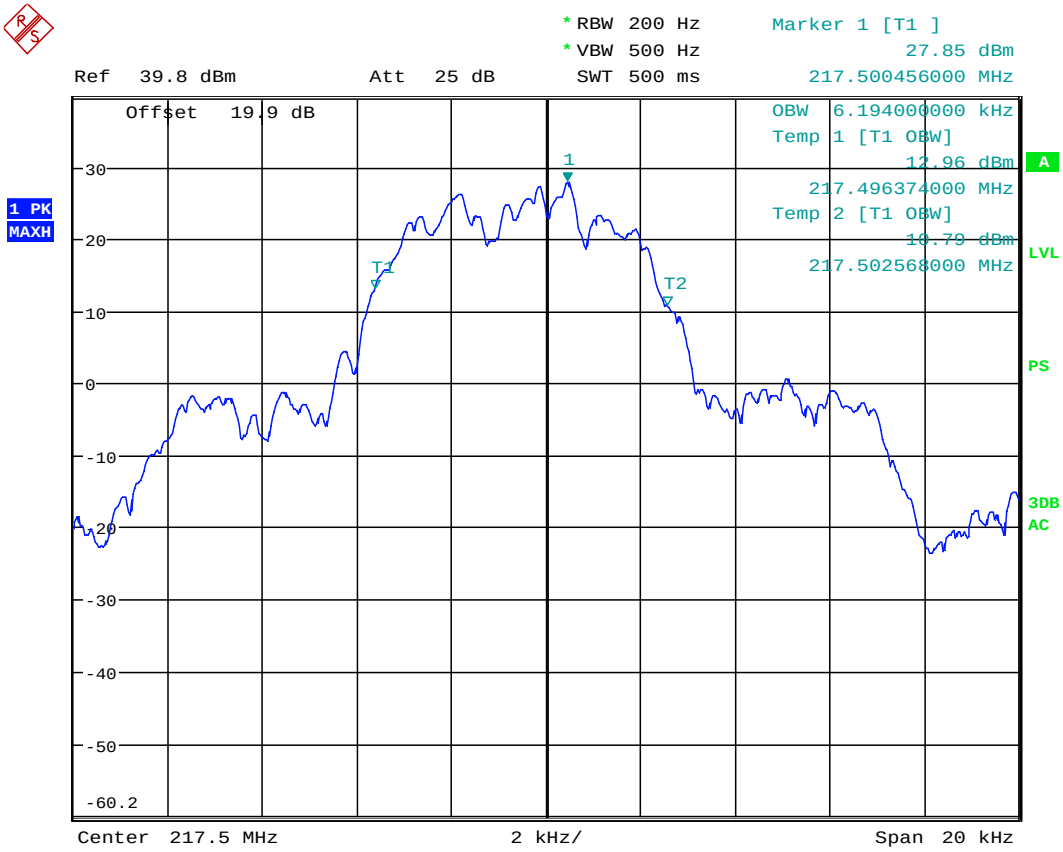
Graph 4.22



Occupied bandwidth, 11.25 kHz authorized bandwidth, QPSK

Date: 3.JAN.2013 14:54:54

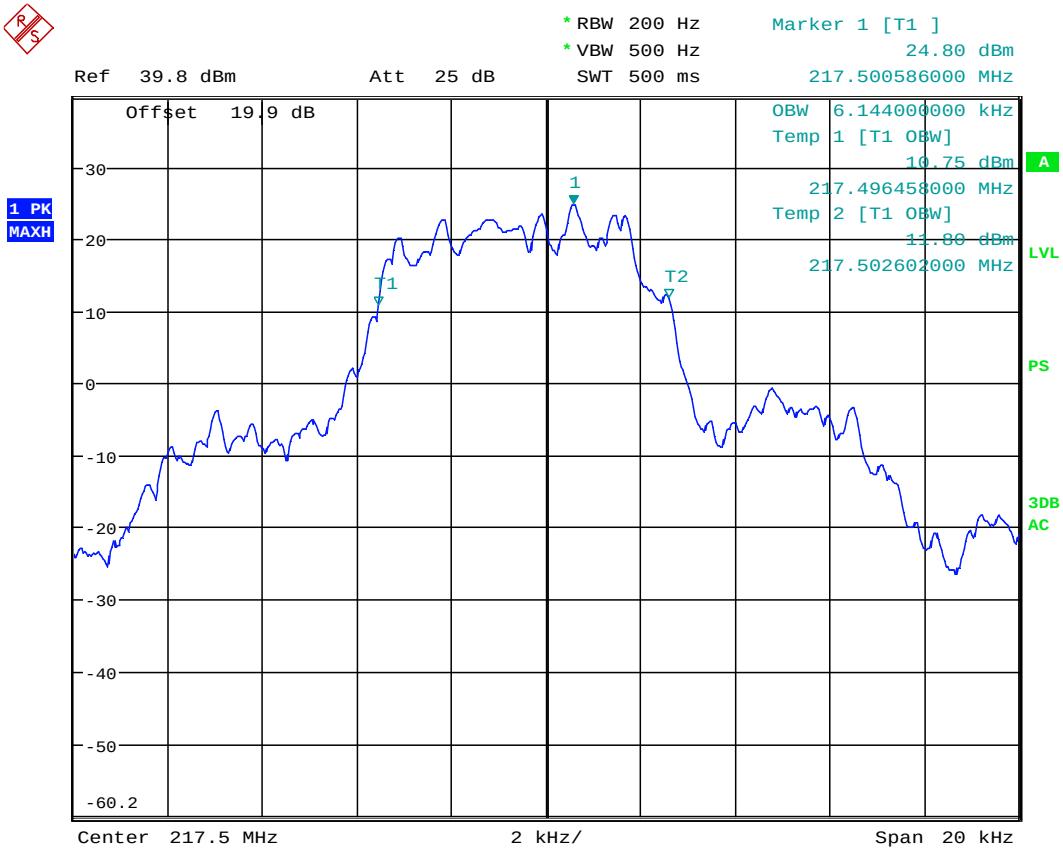
Graph 4.23



Occupied bandwidth, 11.25 kHz authorized bandwidth, 8PSK

Date: 3.JAN.2013 14:57:35

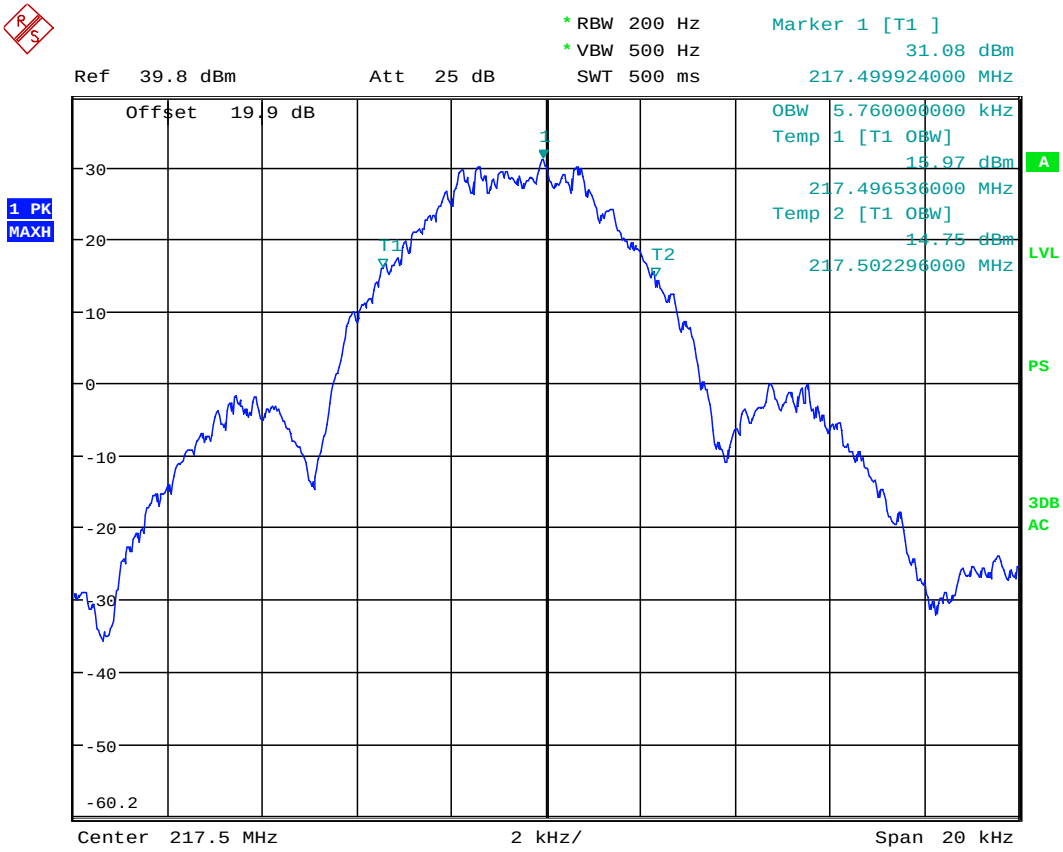
Graph 4.24



Occupied bandwidth, 11.25 kHz authorized bandwidth, 16QAM

Date: 3.JAN.2013 15:00:04

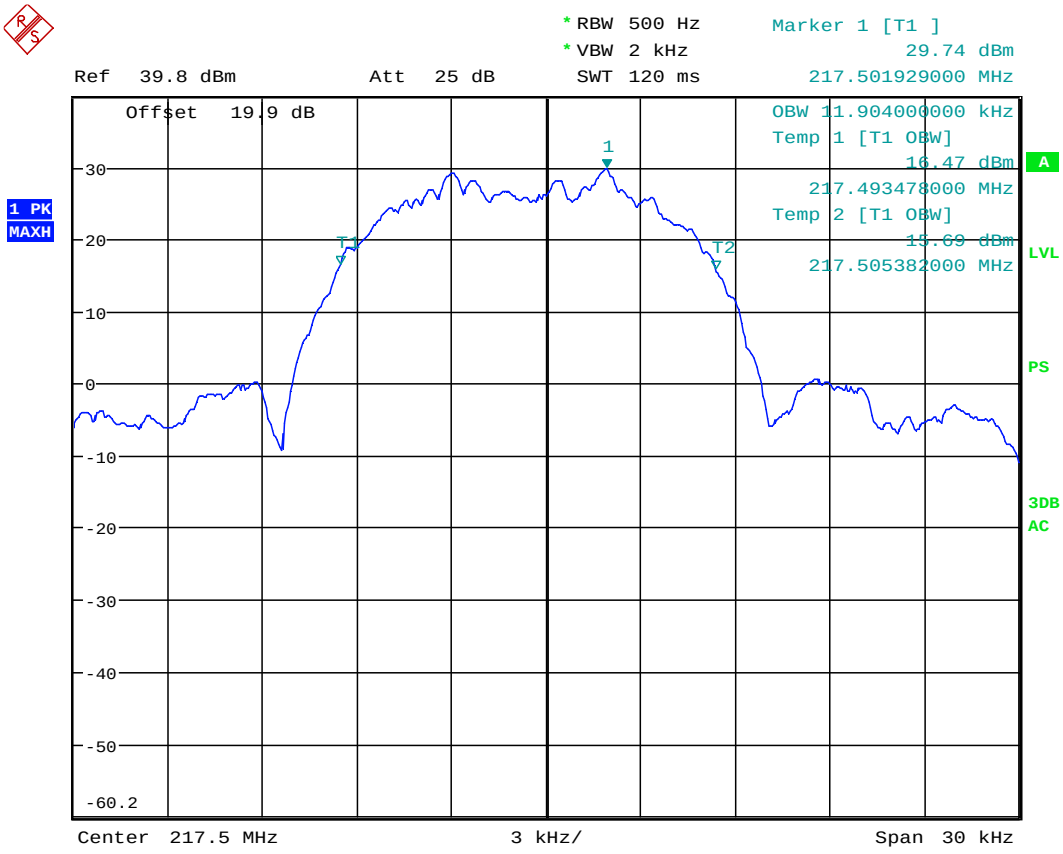
Graph 4.25



Occupied bandwidth, 11.25 kHz authorized bandwidth, GMSK

Date: 3.JAN.2013 15:02:49

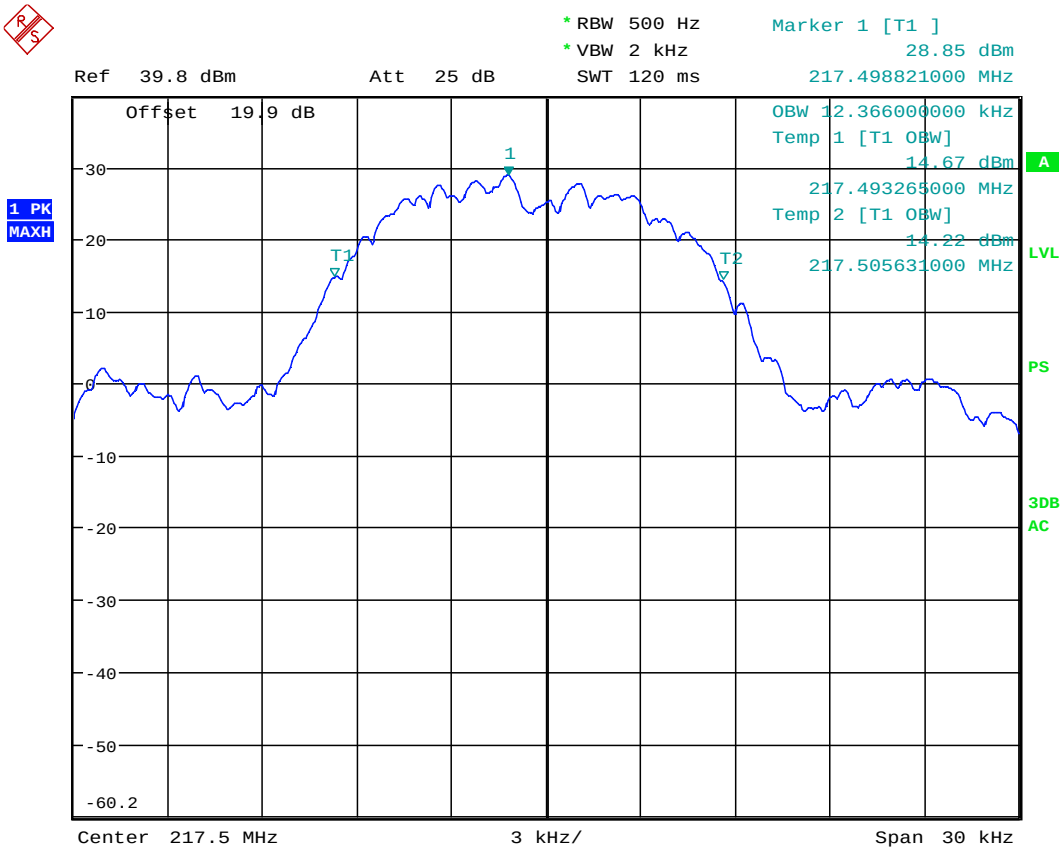
Graph 4.26



Occupied bandwidth, 20 kHz authorized bandwidth, BPSK

Date: 3.JAN.2013 15:45:05

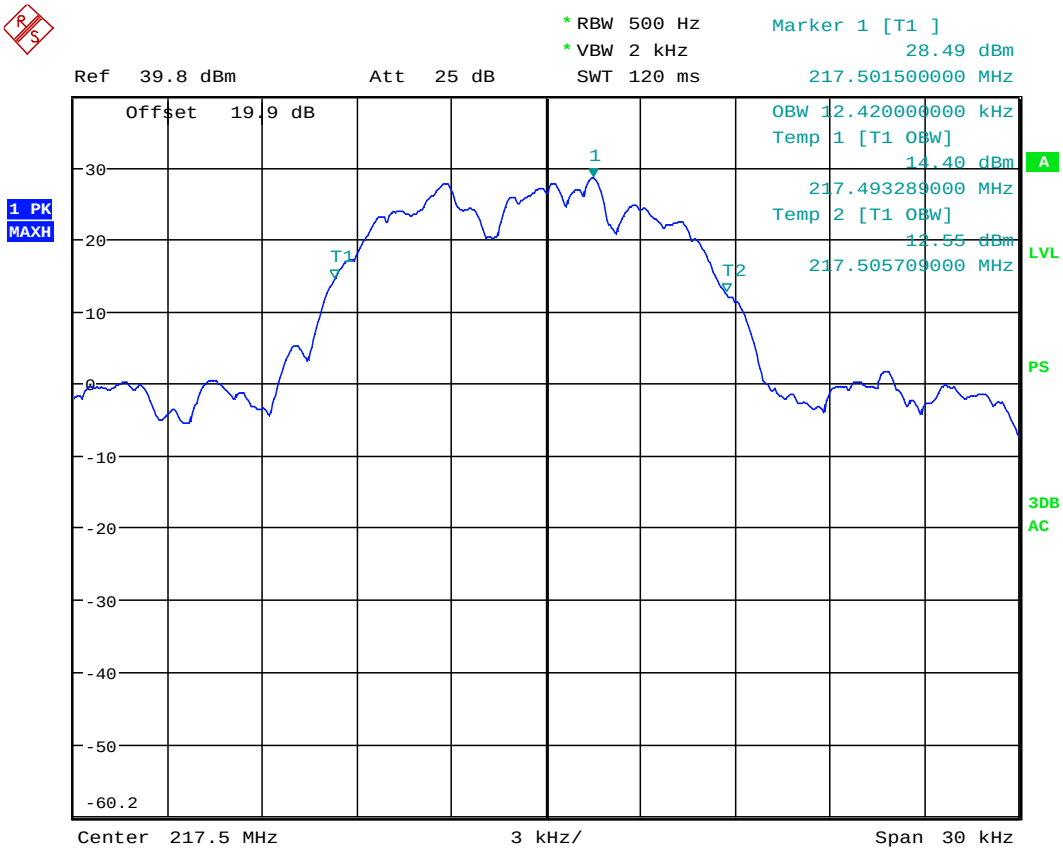
Graph 4.27



Occupied bandwidth, 20 kHz authorized bandwidth, QPSK

Date: 3.JAN.2013 15:47:34

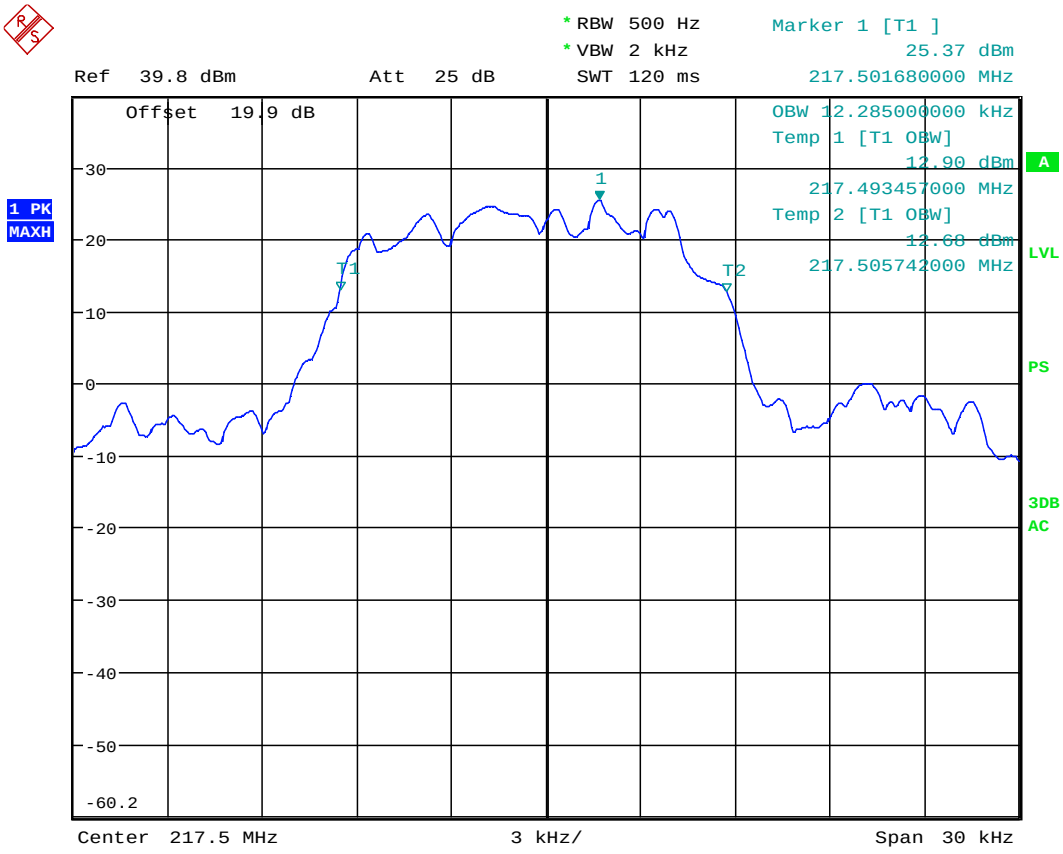
Graph 4.28



Occupied bandwidth, 20 kHz authorized bandwidth, 8PSK

Date: 3.JAN.2013 15:50:18

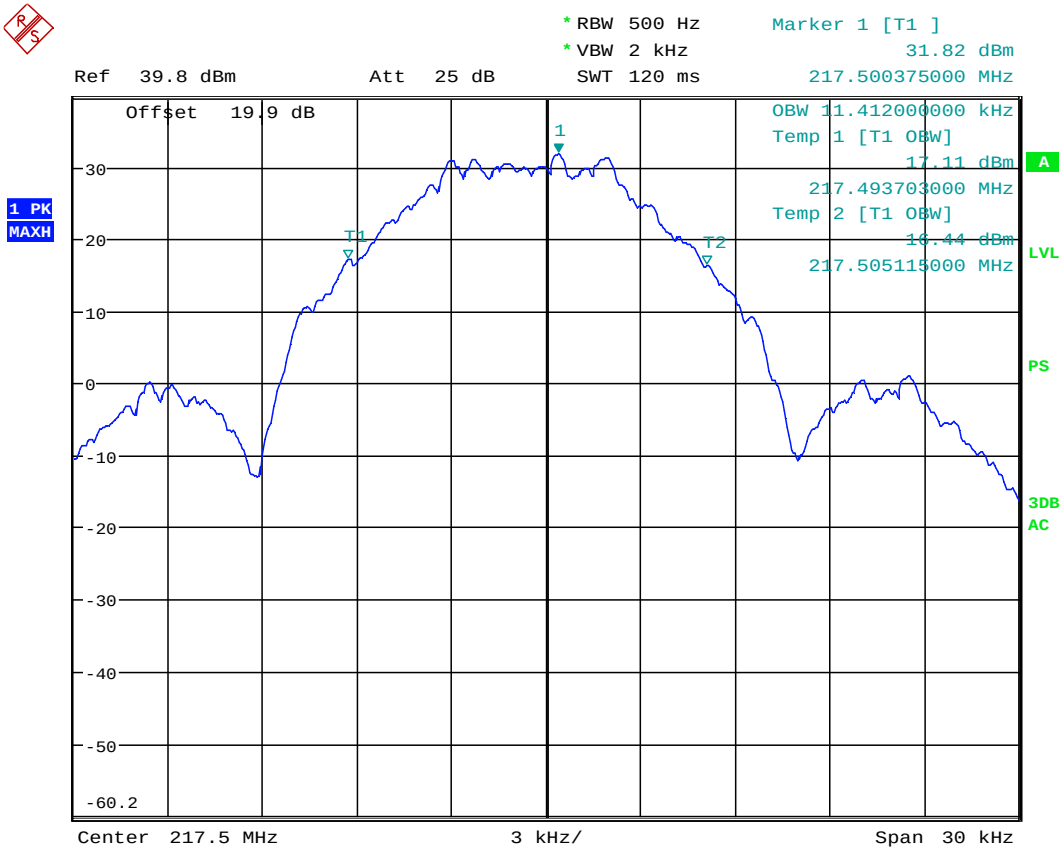
Graph 4.29



Occupied bandwidth, 20 kHz authorized bandwidth, 16QAM

Date: 3.JAN.2013 15:56:08

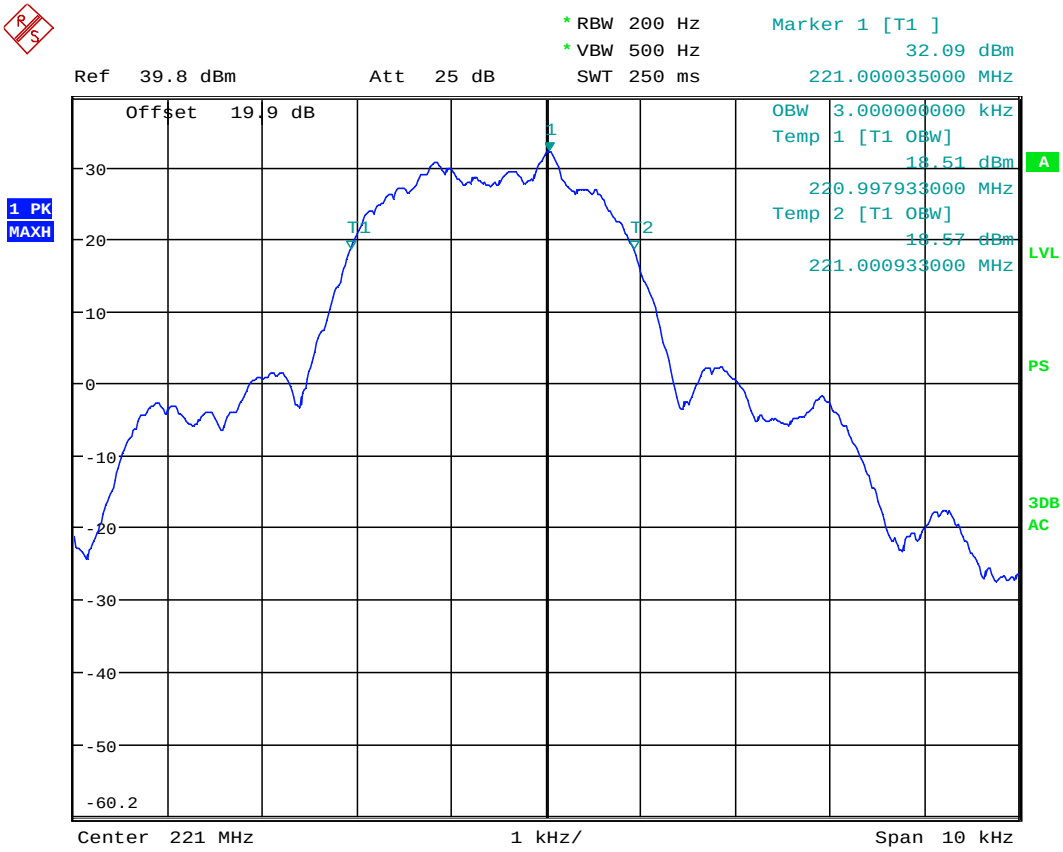
Graph 4.30



Occupied bandwidth, 20 kHz authorized bandwidth, GMSK

Date: 3.JAN.2013 15:58:55

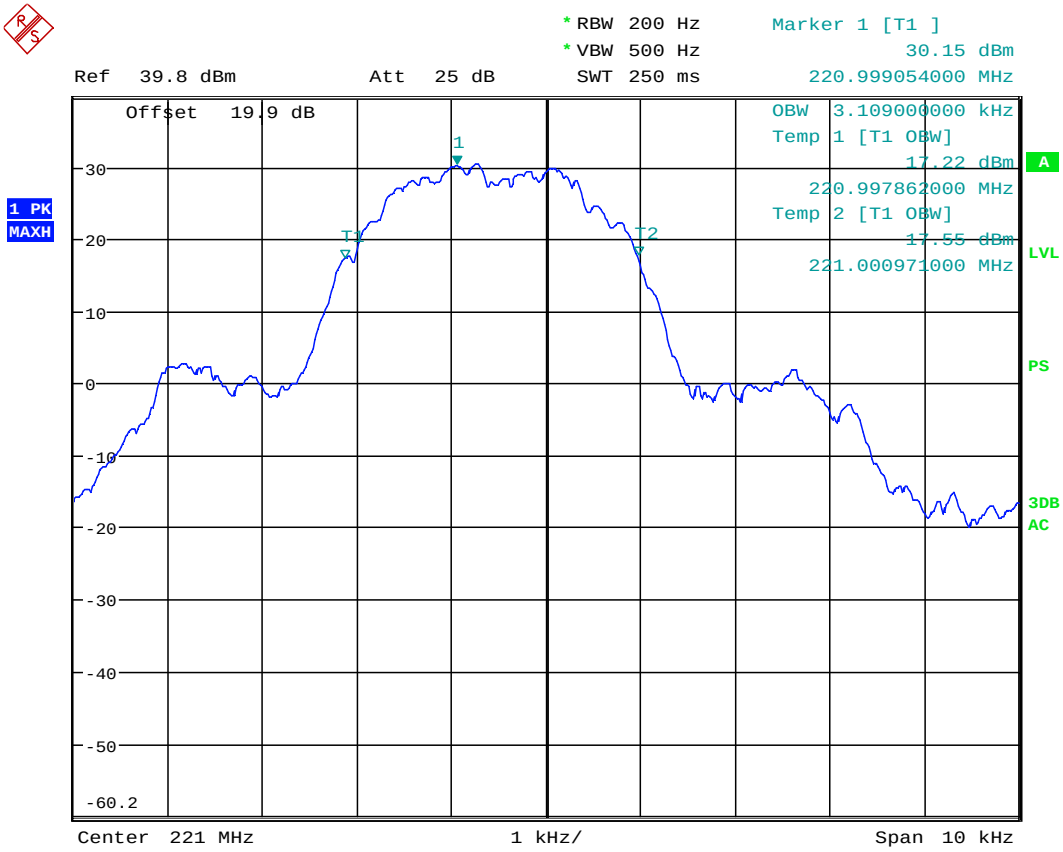
Graph 4.31



Occupied bandwidth, 6 kHz authorized bandwidth, BPSK

Date: 3.JAN.2013 14:39:59

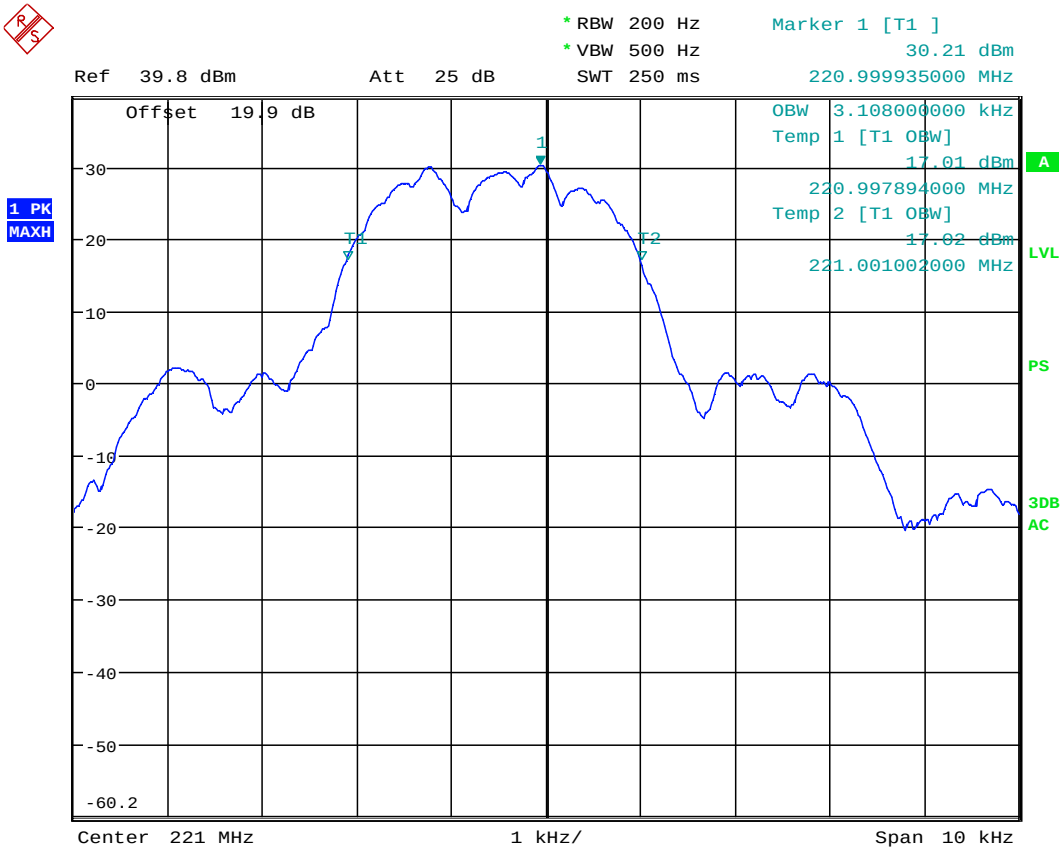
Graph 4.32



Occupied bandwidth, 6 kHz authorized bandwidth, QPSK

Date: 3.JAN.2013 14:41:21

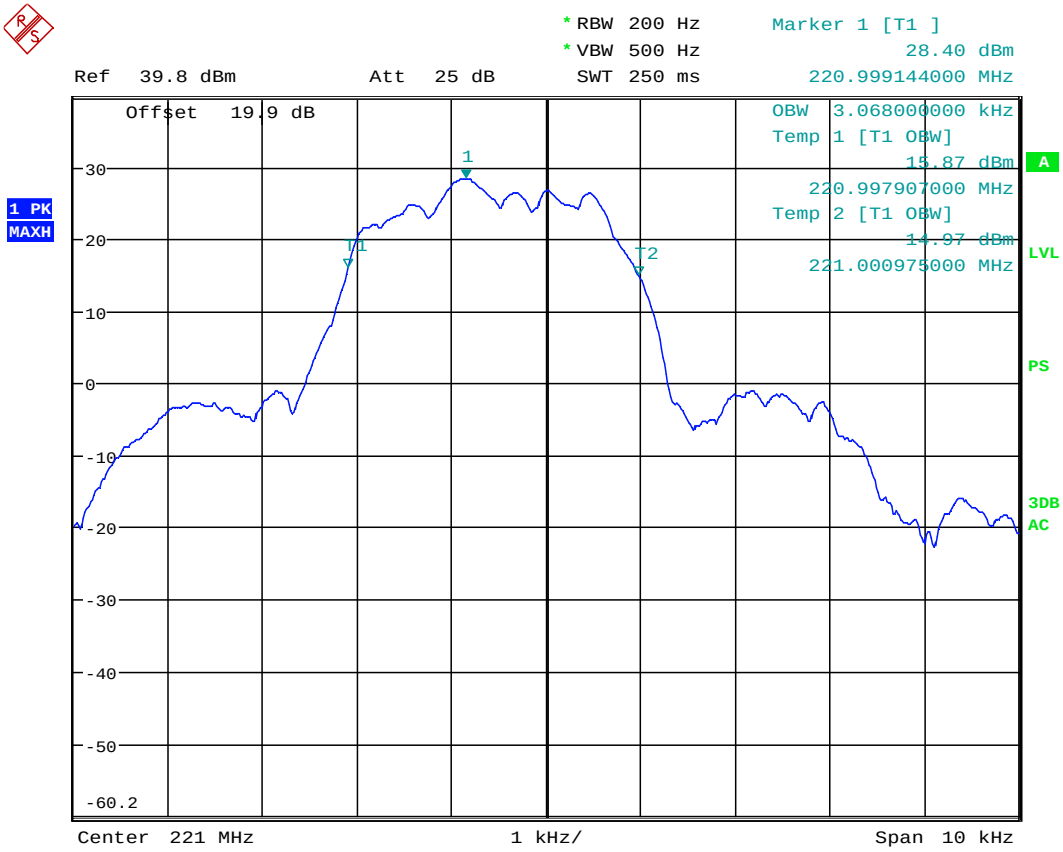
Graph 4.33



Occupied bandwidth, 6 kHz authorized bandwidth, 8PSK

Date: 3.JAN.2013 14:42:52

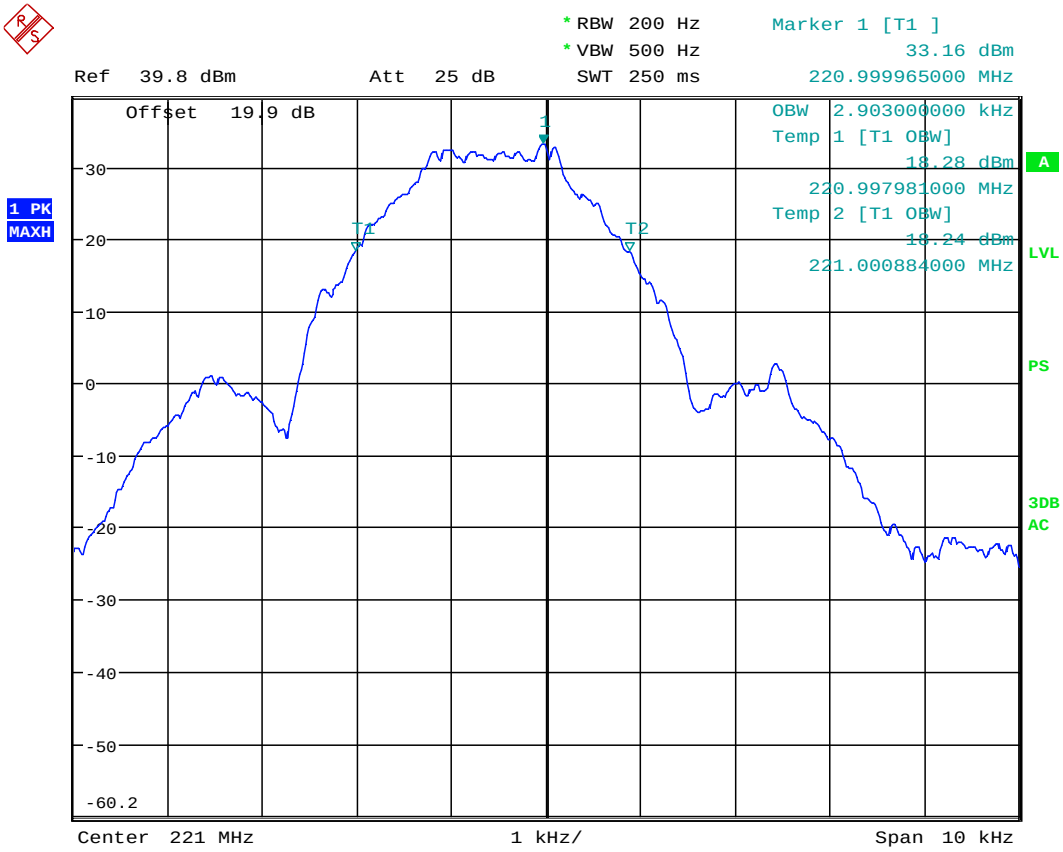
Graph 4.34



Occupied bandwidth, 6 kHz authorized bandwidth, 16QAM

Date: 3.JAN.2013 14:44:30

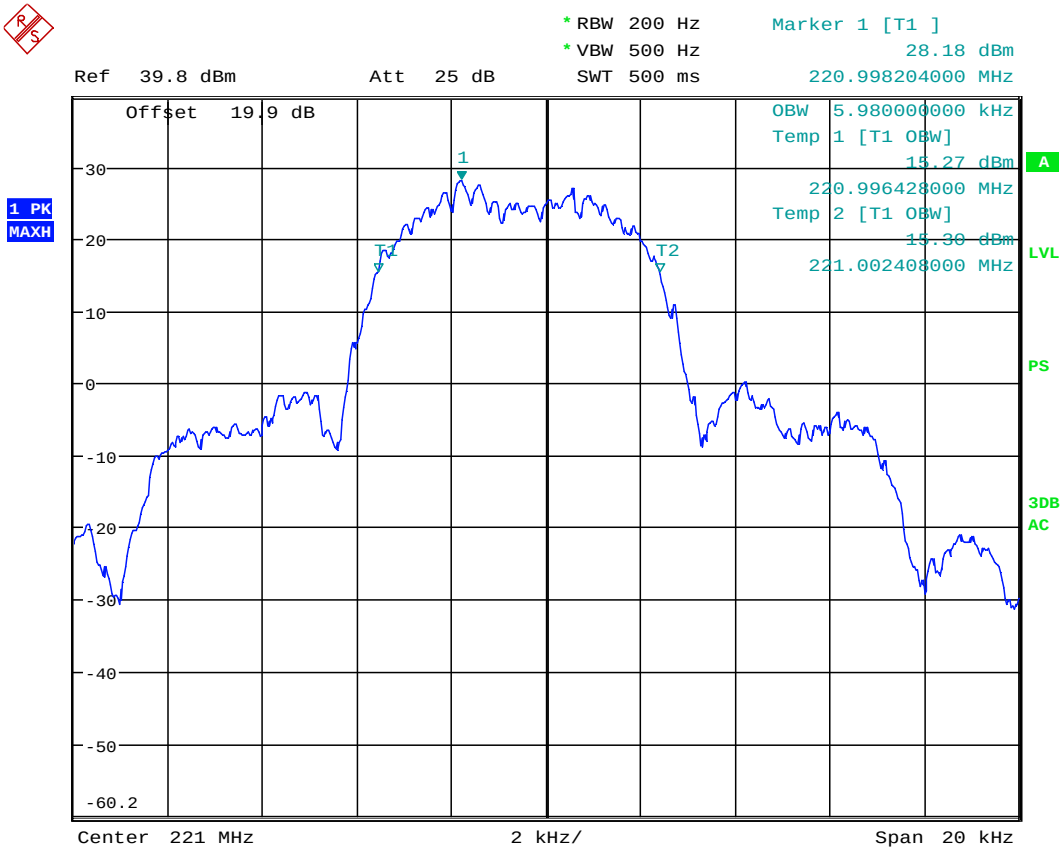
Graph 4.35



Occupied bandwidth, 6 kHz authorized bandwidth, GMSK

Date: 3.JAN.2013 14:45:57

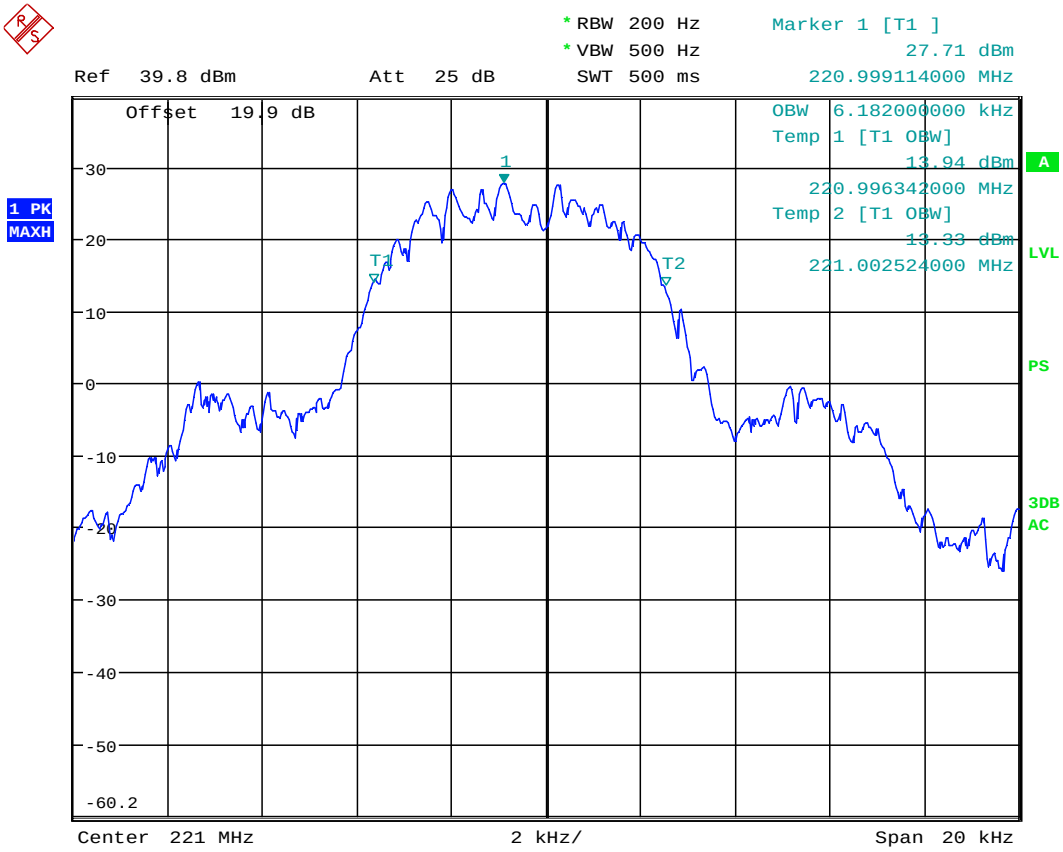
Graph 4.36



Occupied bandwidth, 11.25 kHz authorized bandwidth, BPSK

Date: 3.JAN.2013 15:05:06

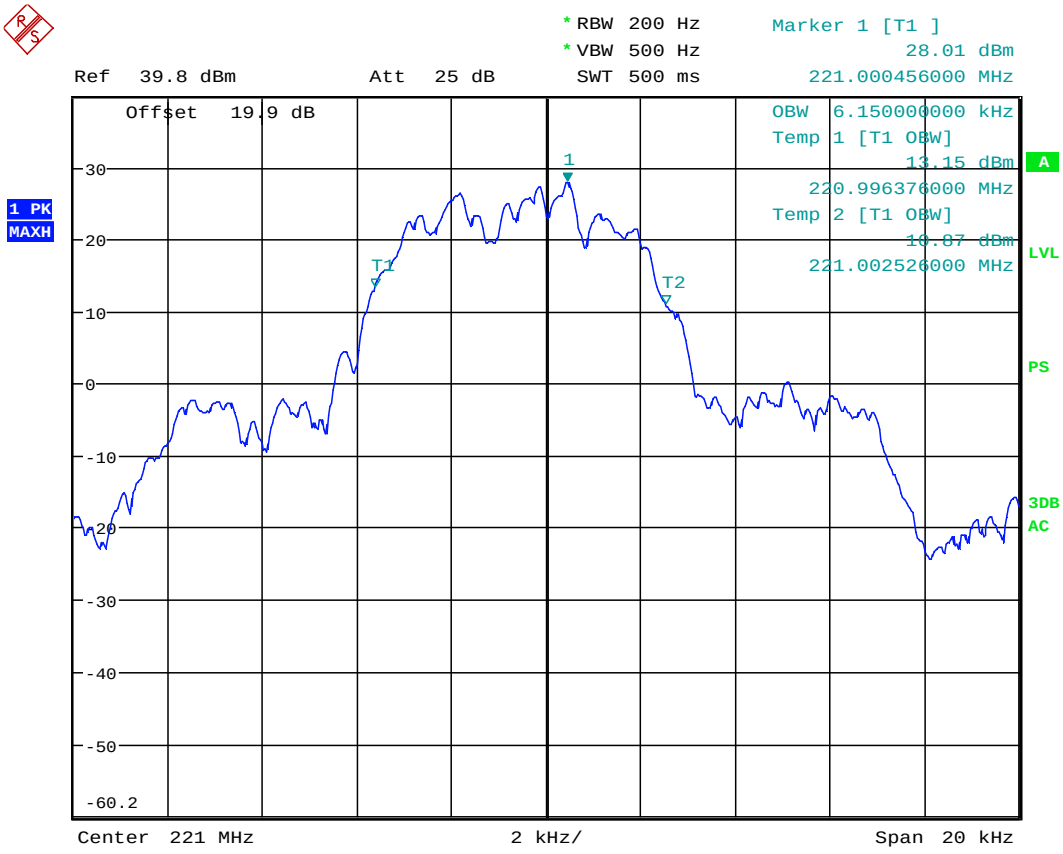
Graph 4.37



Occupied bandwidth, 11.25 kHz authorized bandwidth, QPSK

Date: 3.JAN.2013 15:08:18

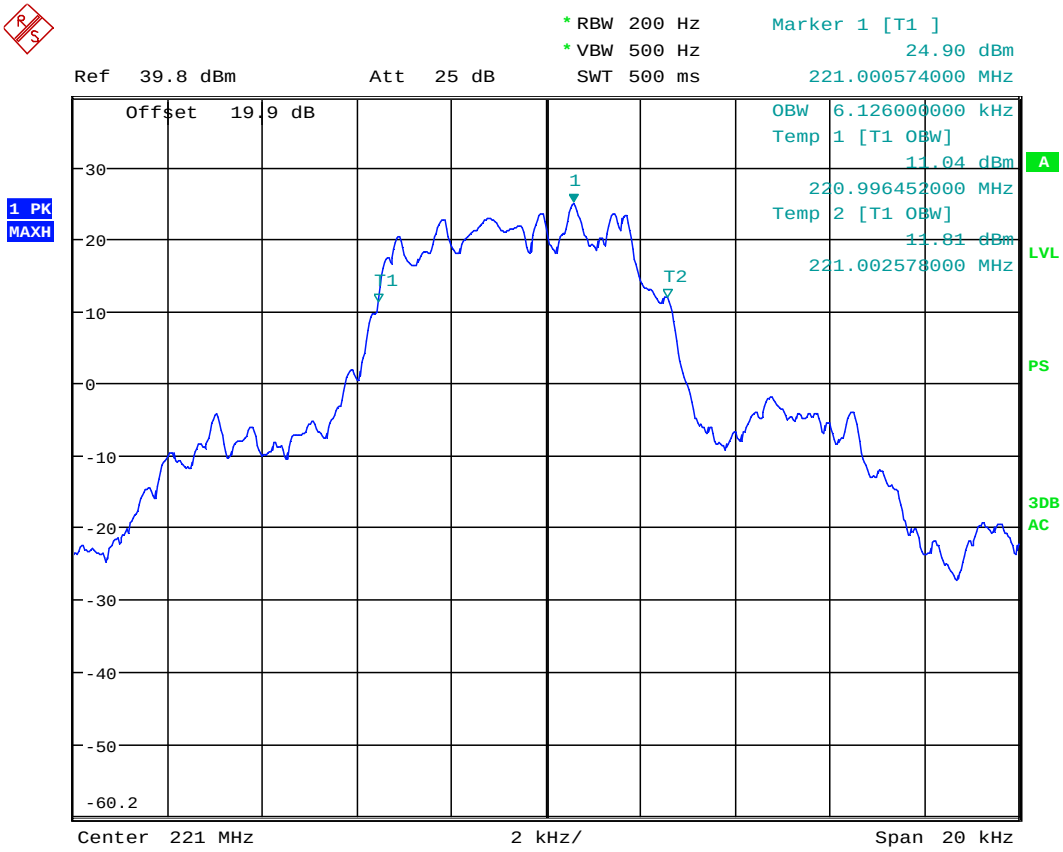
Graph 4.38



Occupied bandwidth, 11.25 kHz authorized bandwidth, 8PSK

Date: 3.JAN.2013 15:09:39

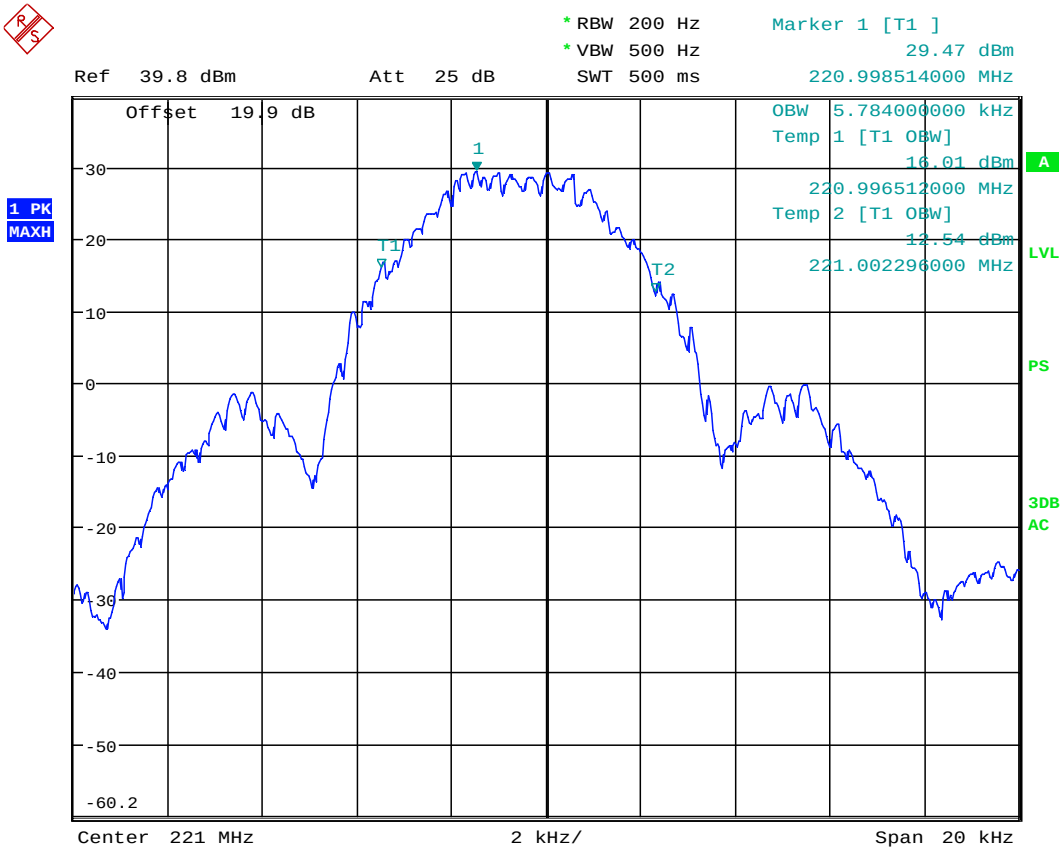
Graph 4.39



Occupied bandwidth, 11.25 kHz authorized bandwidth, 16QAM

Date: 3.JAN.2013 15:11:09

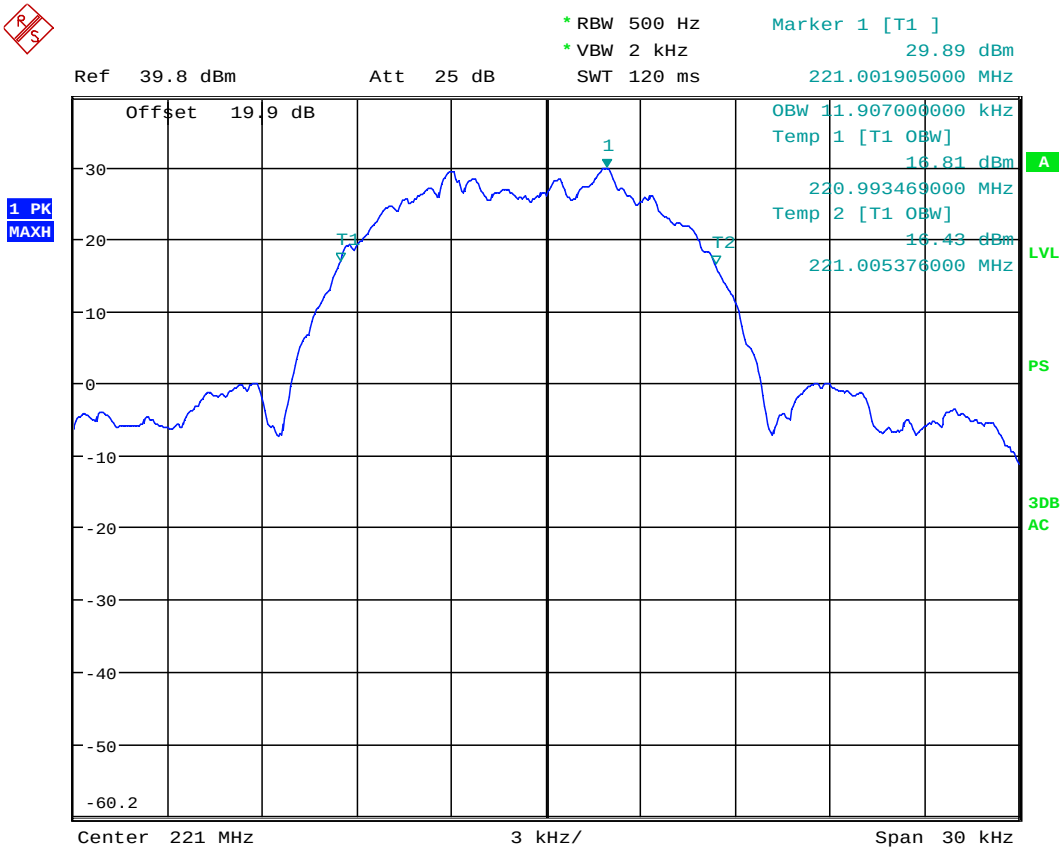
Graph 4.40



Occupied bandwidth, 11.25 kHz authorized bandwidth, GMSK

Date: 3.JAN.2013 15:12:34

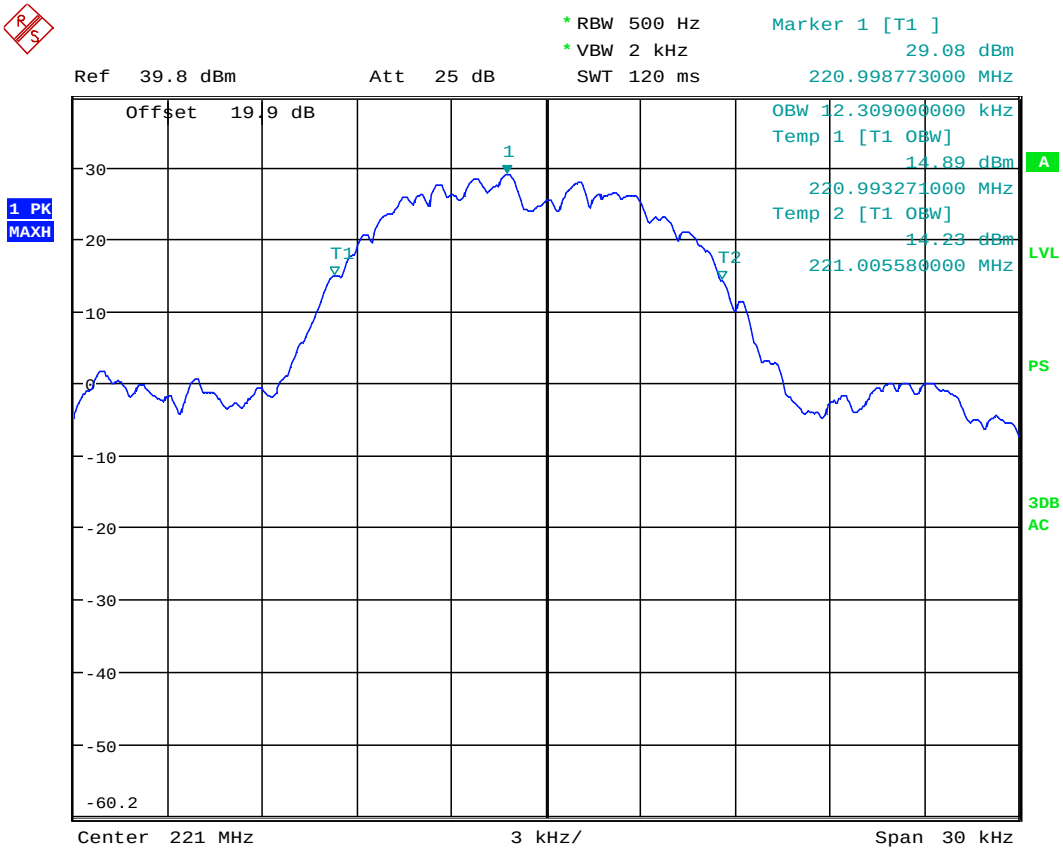
Graph 4.41



Occupied bandwidth, 20 kHz authorized bandwidth, BPSK

Date: 3.JAN.2013 16:00:33

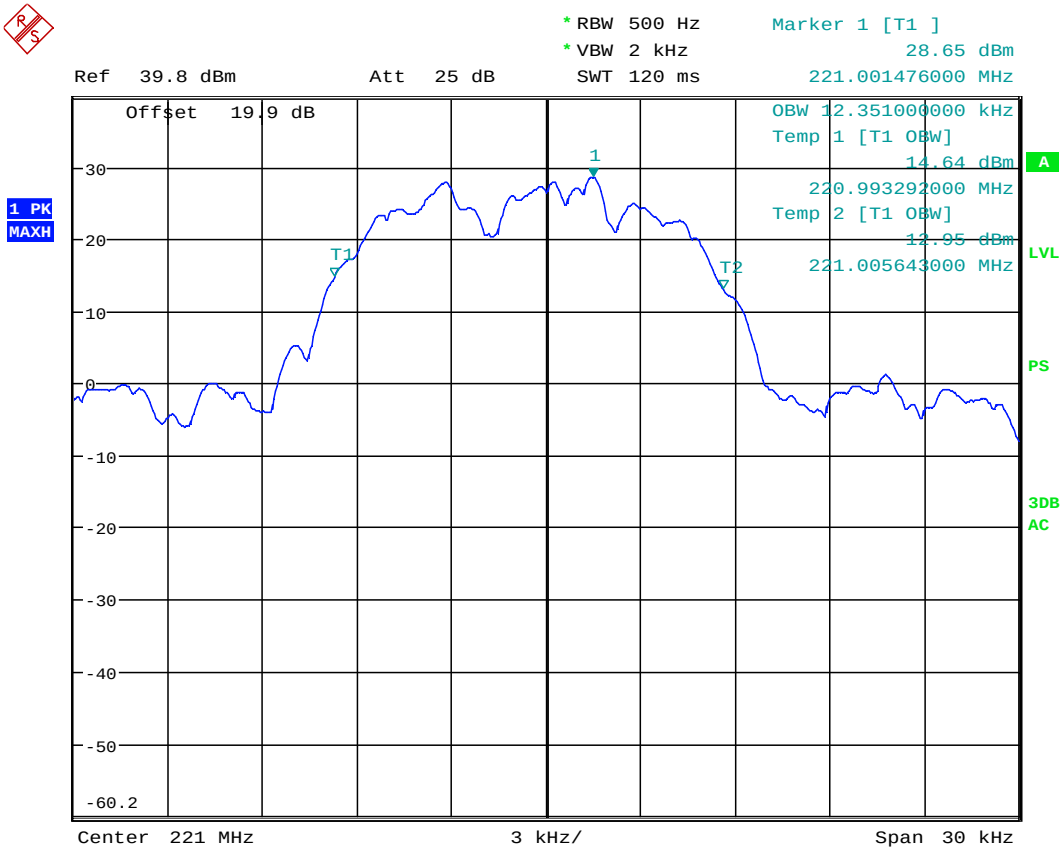
Graph 4.42



Occupied bandwidth, 20 kHz authorized bandwidth, QPSK

Date: 3.JAN.2013 16:01:50

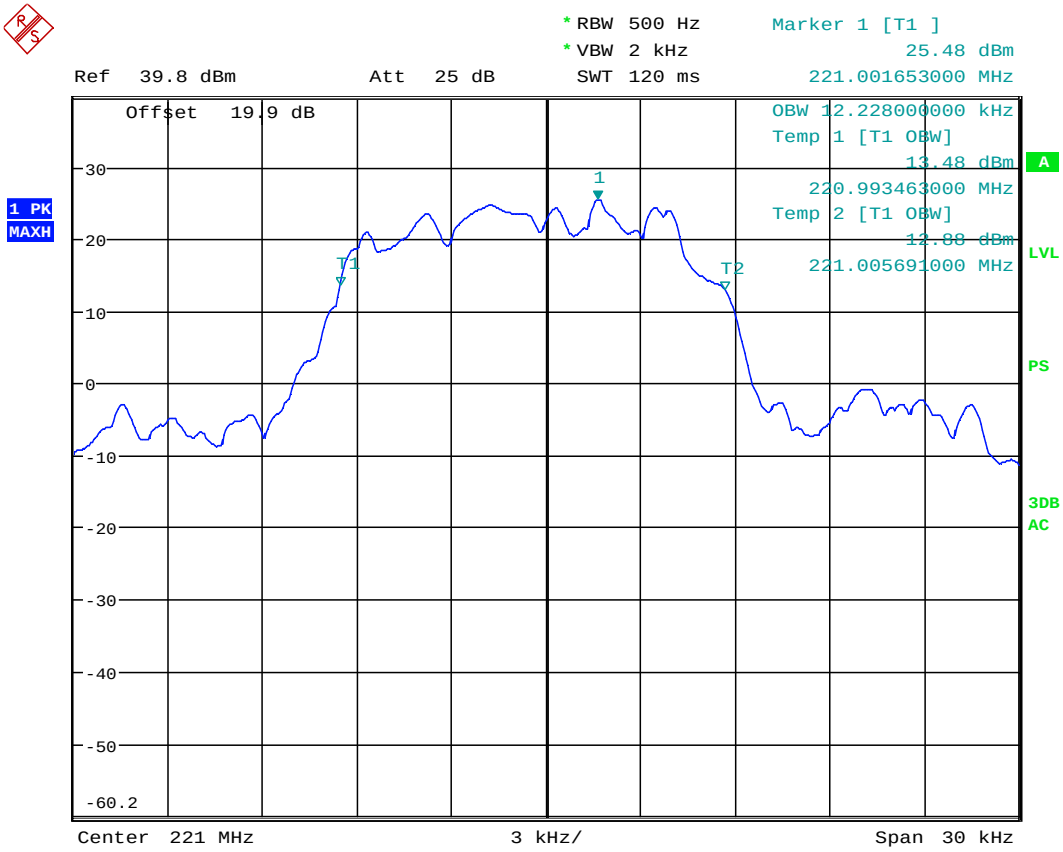
Graph 4.43



Occupied bandwidth, 20 kHz authorized bandwidth, 8PSK

Date: 3.JAN.2013 16:02:50

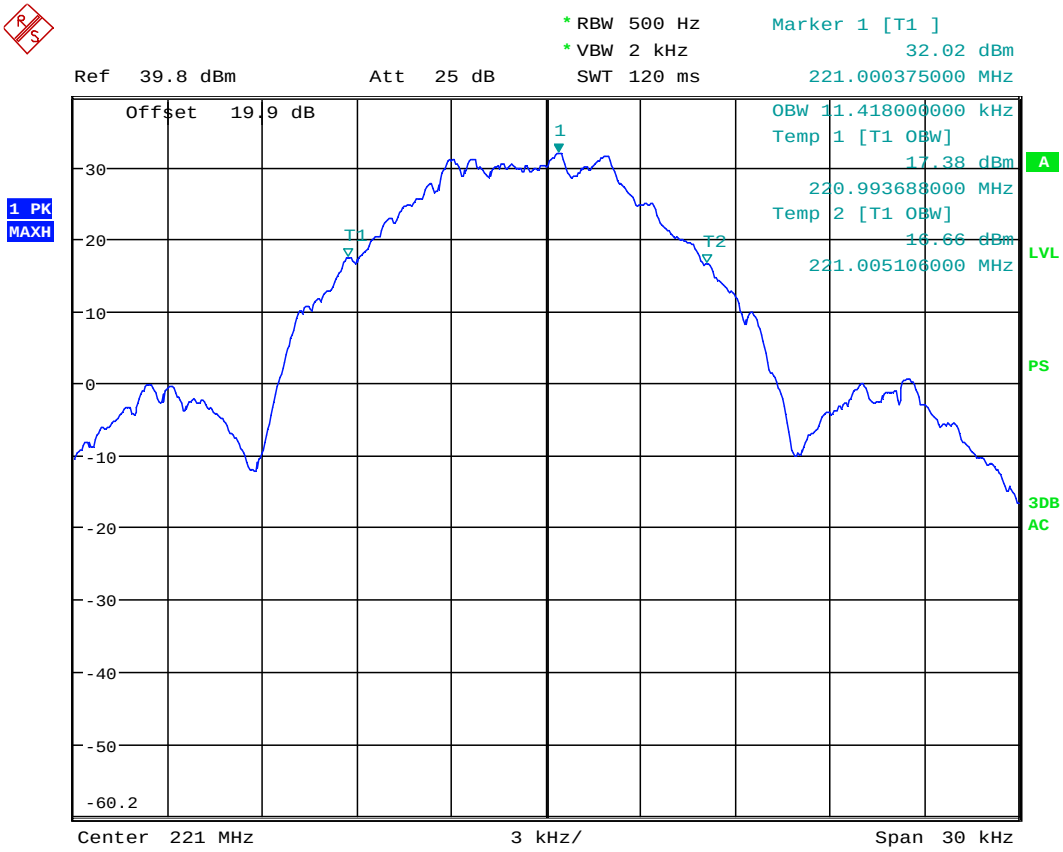
Graph 4.44



Occupied bandwidth, 20 kHz authorized bandwidth, 16QAM

Date: 3.JAN.2013 16:04:02

Graph 4.45



Occupied bandwidth, 20 kHz authorized bandwidth, GMSK

Date: 3.JAN.2013 16:05:12

5.0 Emission Mask

5.1 Requirement

FCC 90.210, 90.209, 90.259
Equipment designed to operate in 217-220 MHz band with 6 kHz or 11.25 kHz or 20 kHz authorized bandwidths must meet the requirements of Emission Mask C (for equipment without an audio low pass filter).

FCC 90.210, 90.209, 90.259, RSS -119 sec 5.5.8
Equipment designed to operate in 220-222 MHz band with a 4 kHz authorized bandwidth must meet the requirements of Emission Mask F (for equipment without an audio low pass filter).
Note: according to sec. 90.733(d), Licensees, except for licensees authorized on Channels 161 through 170 and 181 through 185, may combine any number of their authorized, contiguous channels (including channels derived from multiple authorizations) to form channels wider than 5 kHz.

RSS -119 sec 5.5.8
Equipment designed to operate in 217-218 MHz and 219-220 MHz bands with 11.25 kHz authorized bandwidths must meet the requirements of Emission Masks D or J (for equipment without an audio low pass filter).
Note: according to sec. 5.6, fixed equipment requiring an occupied bandwidth larger than the authorized bandwidth, may be permitted. The equipment shall employ an emission mask which does not result in more adjacent channel interference than that of the standard narrowband channel equipment.

5.2 Test Procedure

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

The spectrum analyzer was setup to measure the Emission at frequencies ± 10 kHz from the fundamental frequency – for 6.25 kHz channel bandwidth, ± 20 kHz – for 12.5 kHz channel bandwidth, ± 30 kHz – for 25 kHz channel bandwidth. The RMS detector and MAX HOLD is used for these measurements.

According to FCC 90.210, equipment designed to operate in 217-220 MHz band without audio low pass filter, emission Mask C was applicable for channel spacing of 25 kHz or less. All FCC emissions mask tests for 6.25 kHz or 12.5 kHz or 25 kHz channel bandwidths in this band were performed with Mask C limits.

According to RSS-119, equipment designed to operate in 217-218 MHz and 219-220 MHz band without audio low pass filter, emission Masks D or J was applicable for channel spacing 12.5 kHz or less. All Canada emissions masks tests for 6.25 kHz or 12.5 kHz channel bandwidths in this band were performed with Mask D limits. All Canada emission masks tests in this band with 25 kHz channel bandwidth were performed with Mask D limits with 2 channel aggregation.

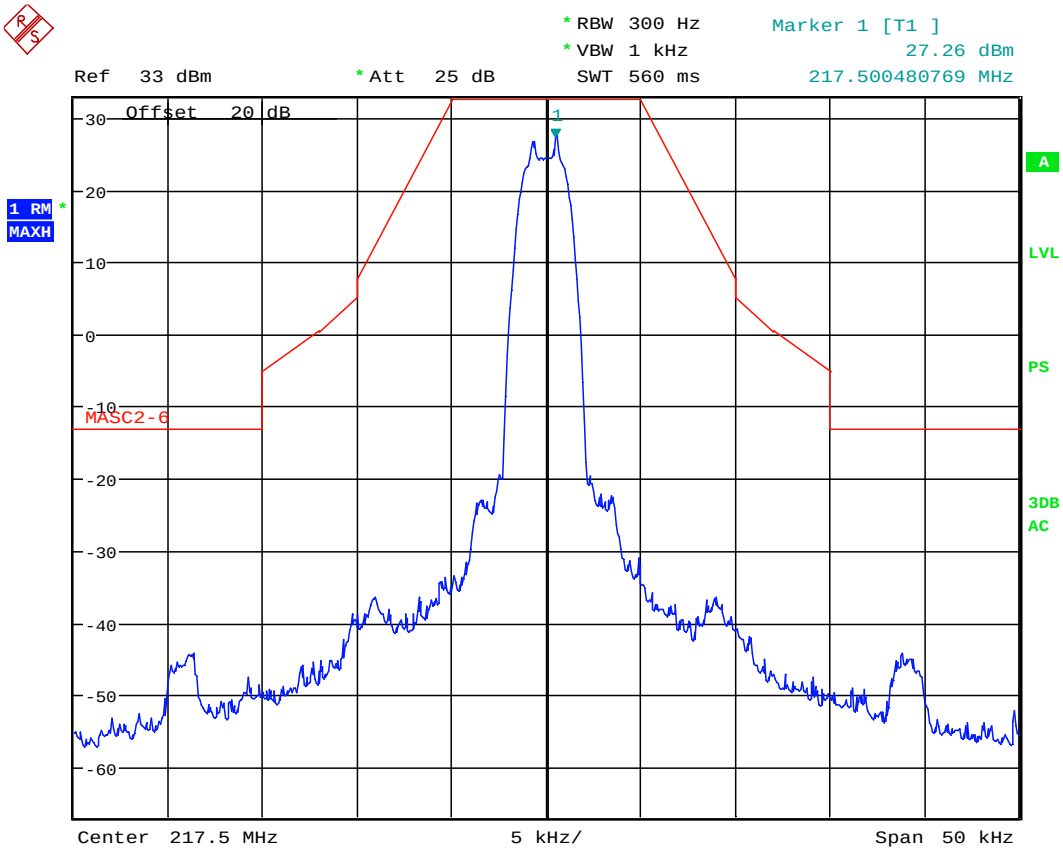
According to FCC 90.210 and RSS-119, equipment designed to operate in 220-222 MHz band without audio low pass filter, emission Mask F was applicable for channels having channel spacing of 5 kHz or less. All FCC emissions masks tests in this band with 6.25 kHz channel bandwidth were performed with Mask F limits. All FCC emission masks tests in this band with 12.5 kHz channel bandwidth were performed with Mask F limits with channel aggregation of two channels. All FCC emission masks tests in this band with 25 kHz channel bandwidth were performed with Mask F limits with 6 channel aggregation.

The Emission Mask was measured at 217.5 MHz and 221 MHz for all five types of modulation.

5.3 Test Results

Complies with Emission Mask Requirements. For more details refer to the attached Graphs: 5.1 – 5.45.

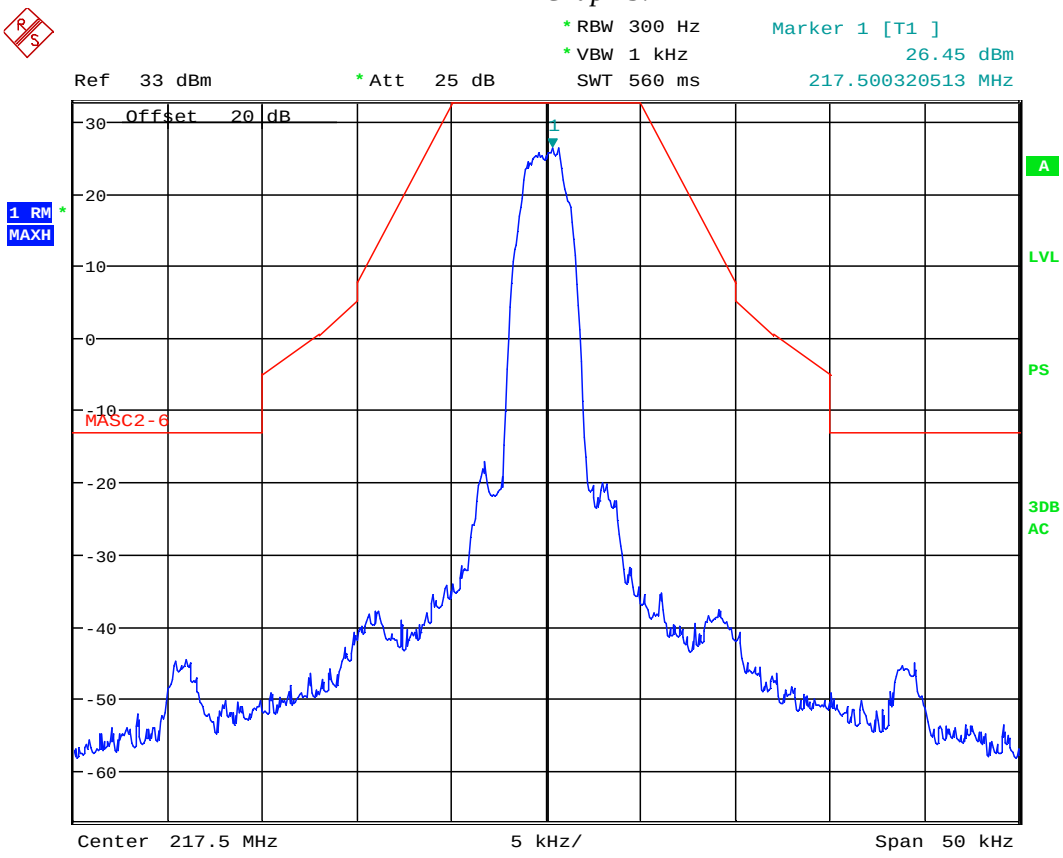
Graph 5. 1



Emission Mask type C, 6 kHz Authorized bandwidth, BPSK

Date: 11.FEB.2013 10:18:18

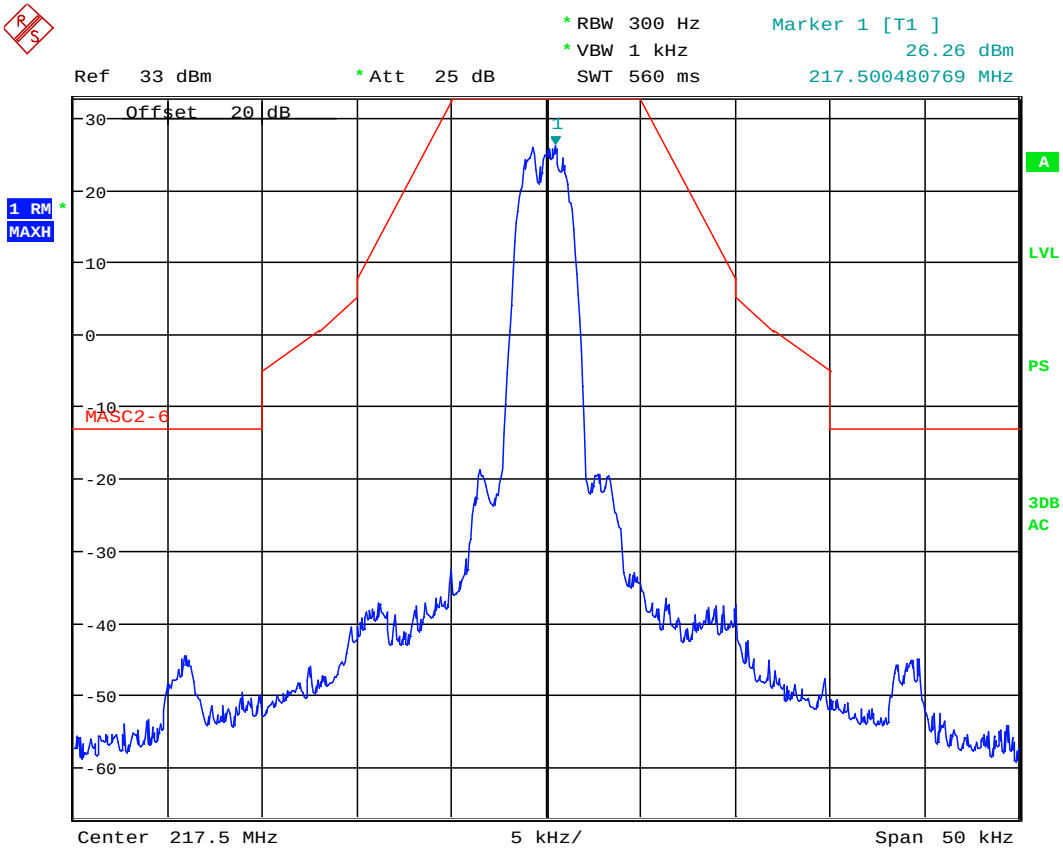
Graph 5. 2



Emission Mask type C, 6 kHz Authorized bandwidth, QPSK

Date: 11.FEB.2013 10:20:02

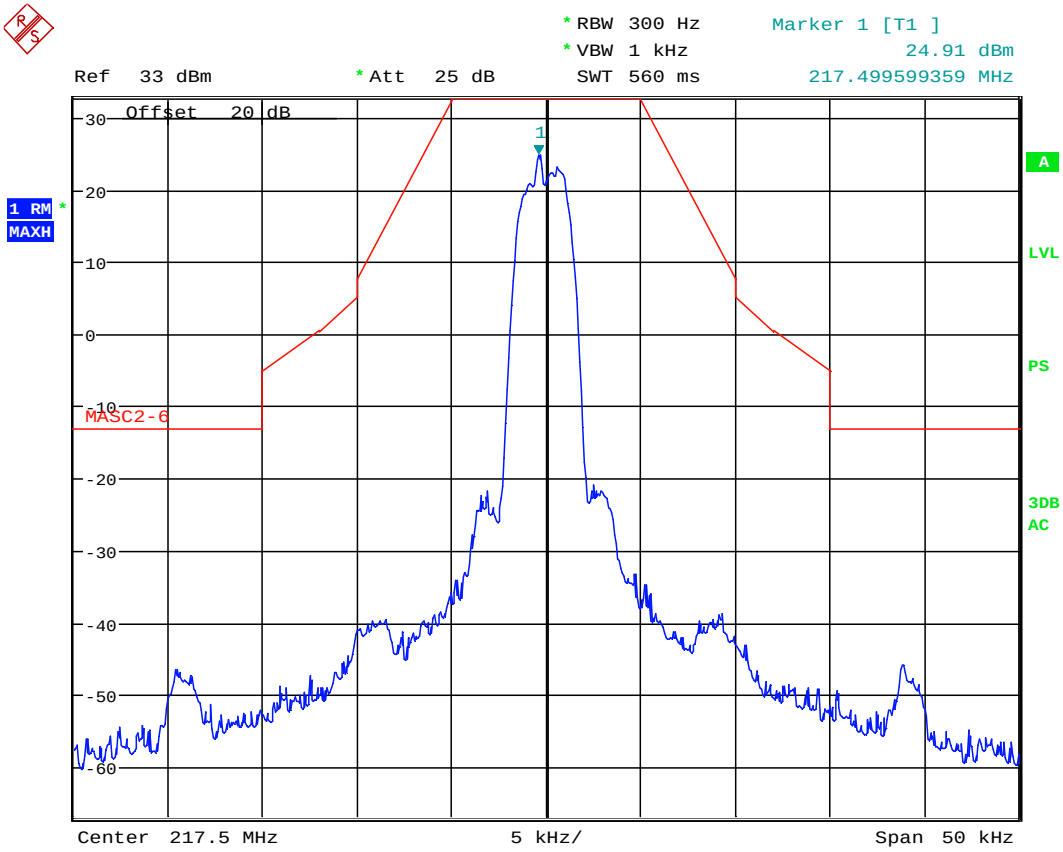
Graph 5. 3



Emission Mask type C, 6 kHz Authorized bandwidth, 8PSK

Date: 11.FEB.2013 10:21:16

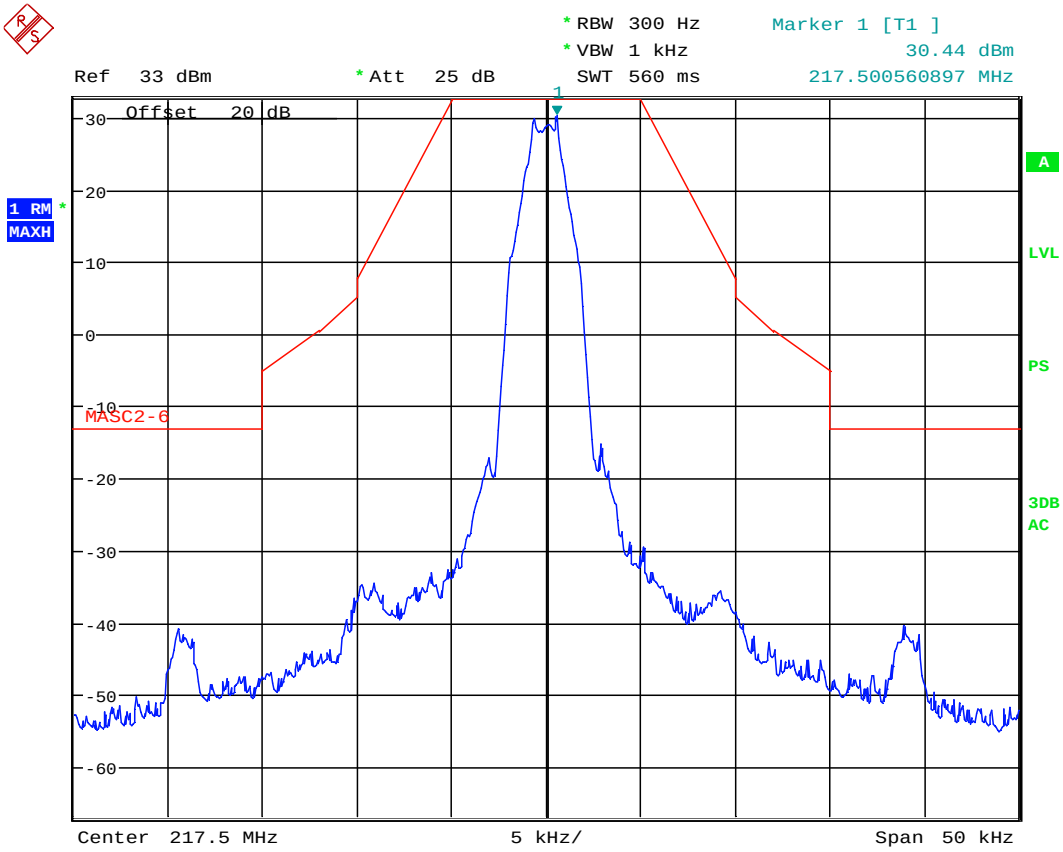
Graph 5. 4



Emission Mask type C, 6 kHz Authorized bandwidth, 16QAM

Date: 11.FEB.2013 10:22:45

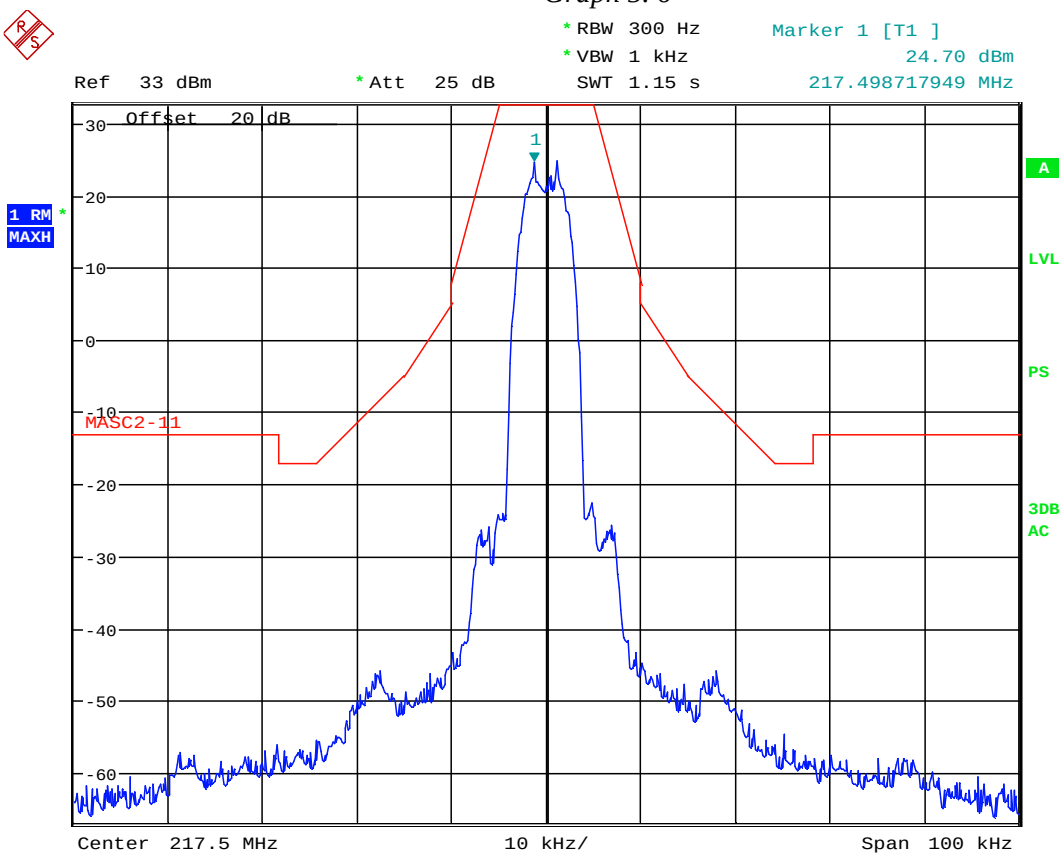
Graph 5. 5



Emission Mask type C, 6 kHz Authorized bandwidth, GMSK

Date: 11.FEB.2013 10:24:18

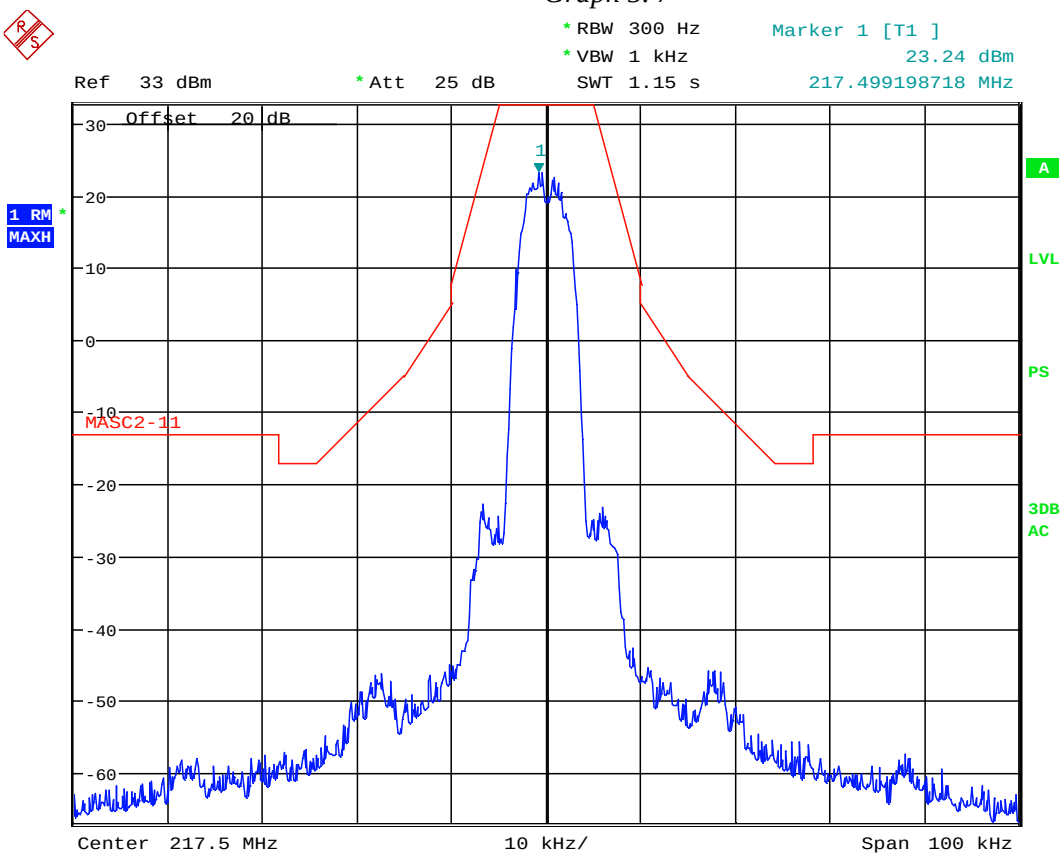
Graph 5. 6



Emission Mask type C, 11 kHz Authorized bandwidth, BPSK

Date: 11.FEB.2013 11:26:35

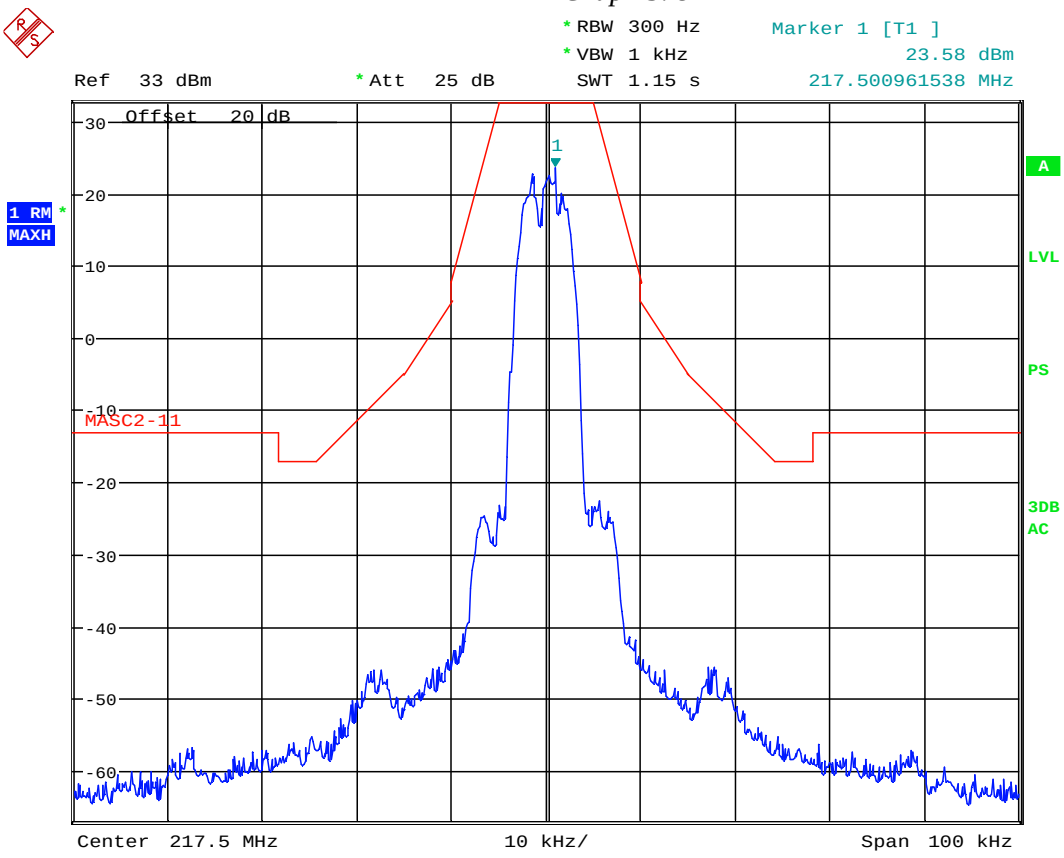
Graph 5. 7



Emission Mask type C, 11 kHz Authorized bandwidth, QPSK

Date: 11.FEB.2013 10:30:44

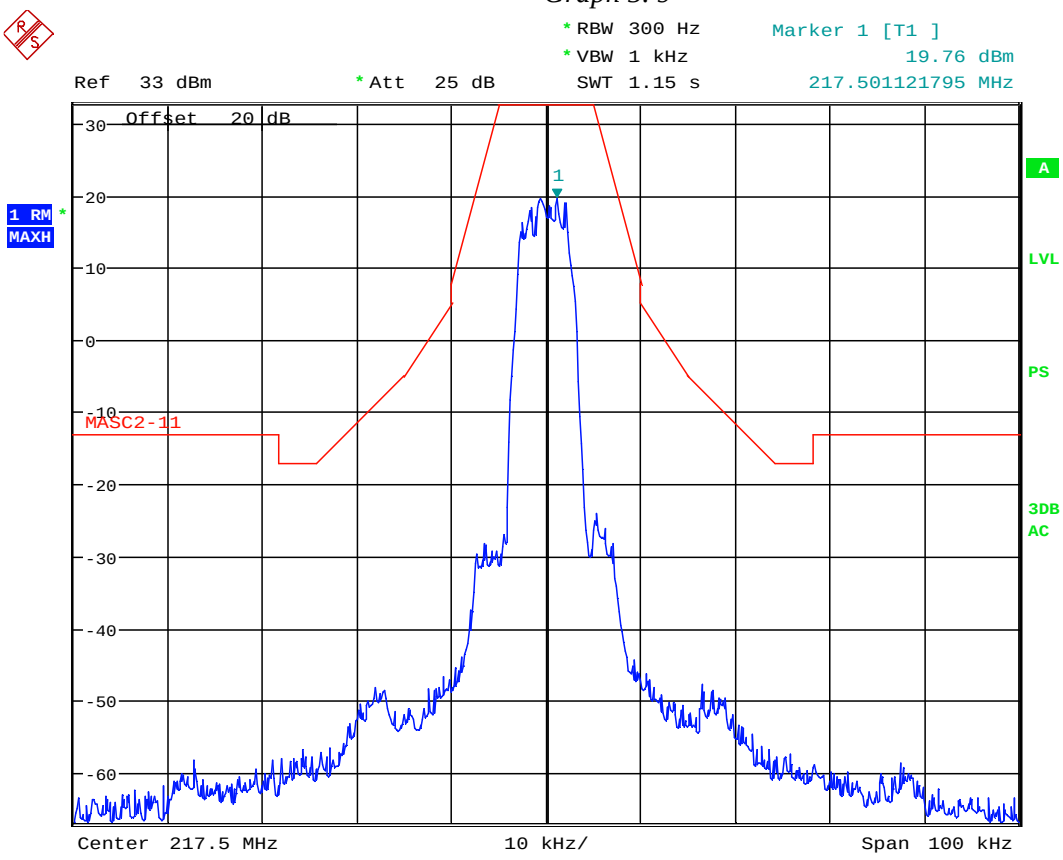
Graph 5. 8



Emission Mask type C, 11 kHz Authorized bandwidth, 8PSK

Date: 11.FEB.2013 10:34:18

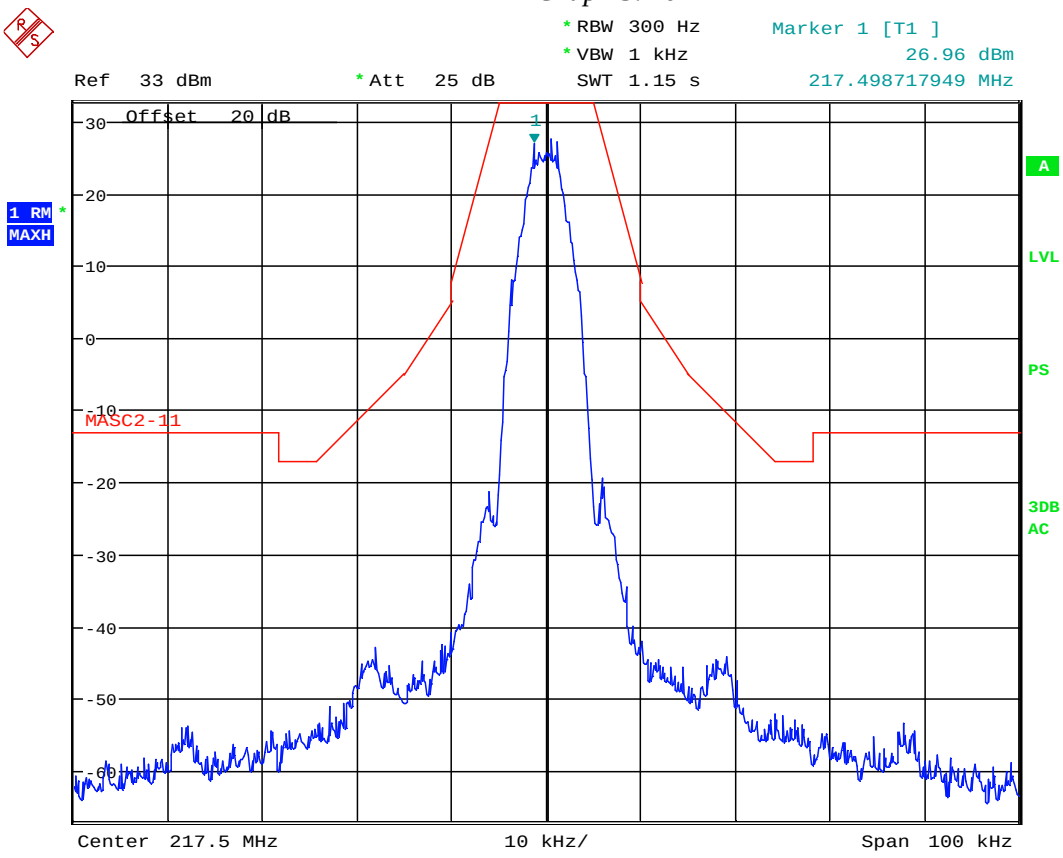
Graph 5. 9



Emission Mask type C, 11 kHz Authorized bandwidth, 16QAM

Date: 11.FEB.2013 10:35:54

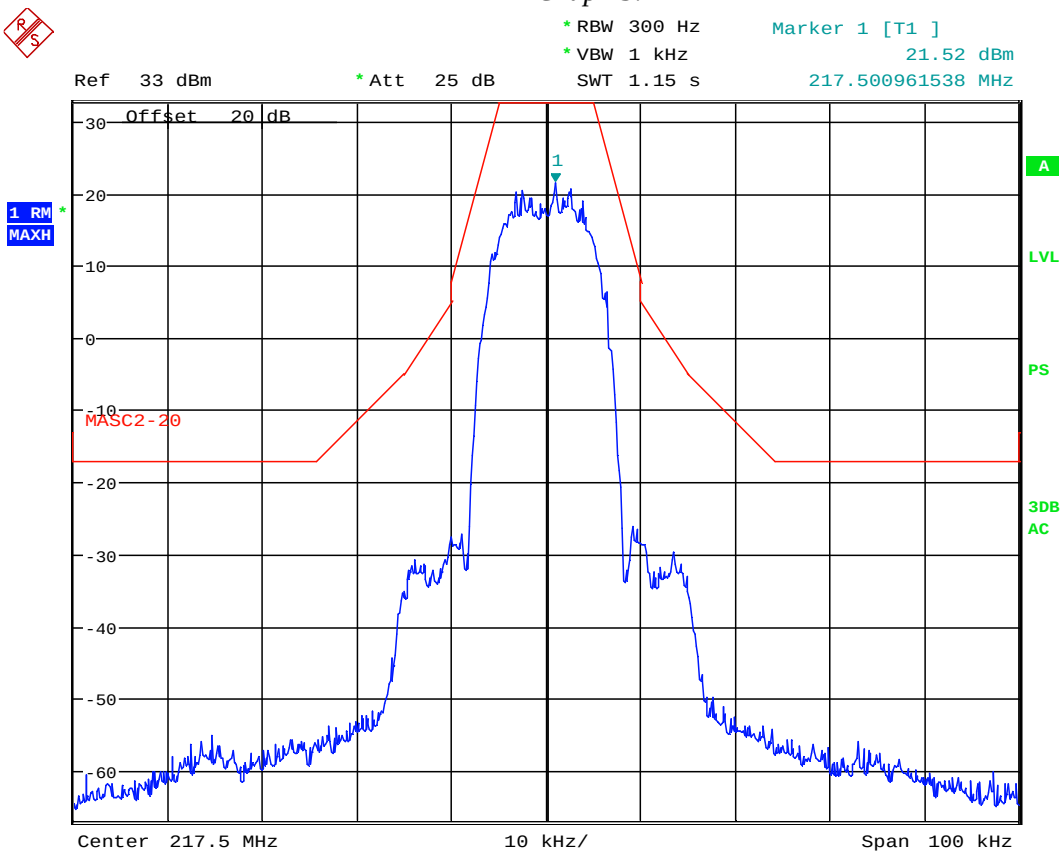
Graph 5. 10



Emission Mask type C, 11 kHz Authorized bandwidth, GMSK

Date: 11.FEB.2013 10:37:16

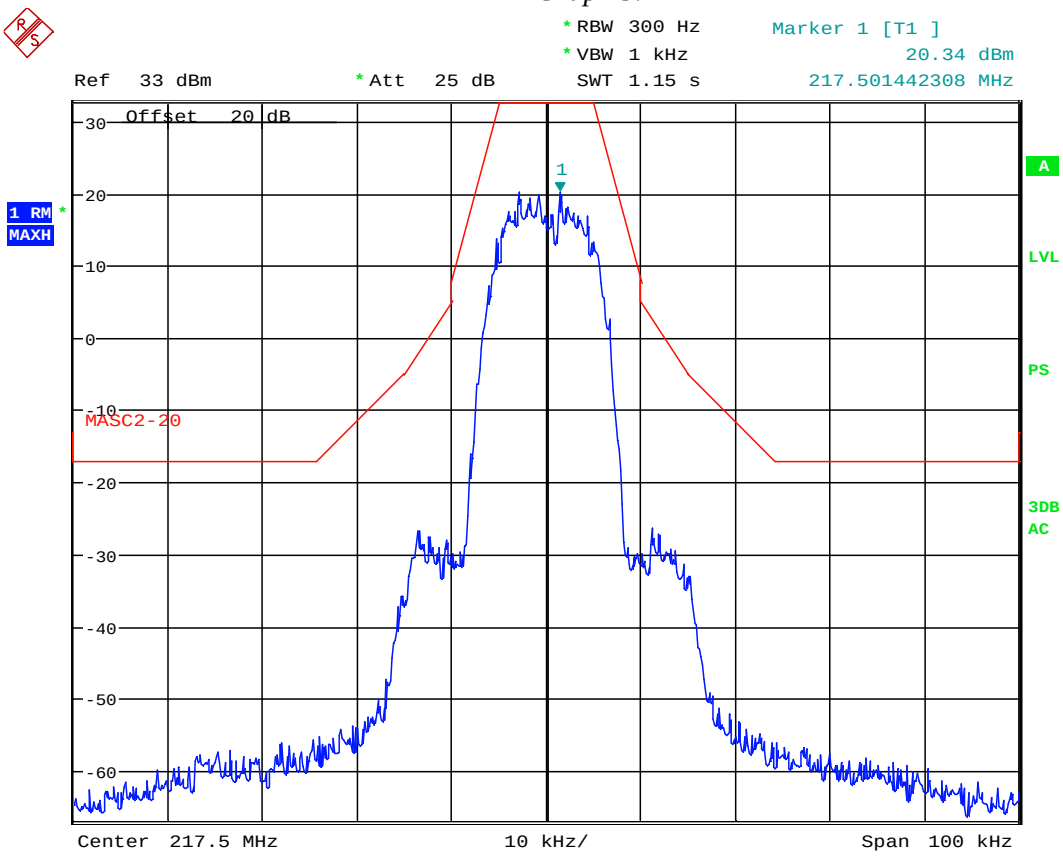
Graph 5. 11



Emission Mask type C, 20 kHz Authorized bandwidth, BPSK

Date: 11.FEB.2013 10:41:19

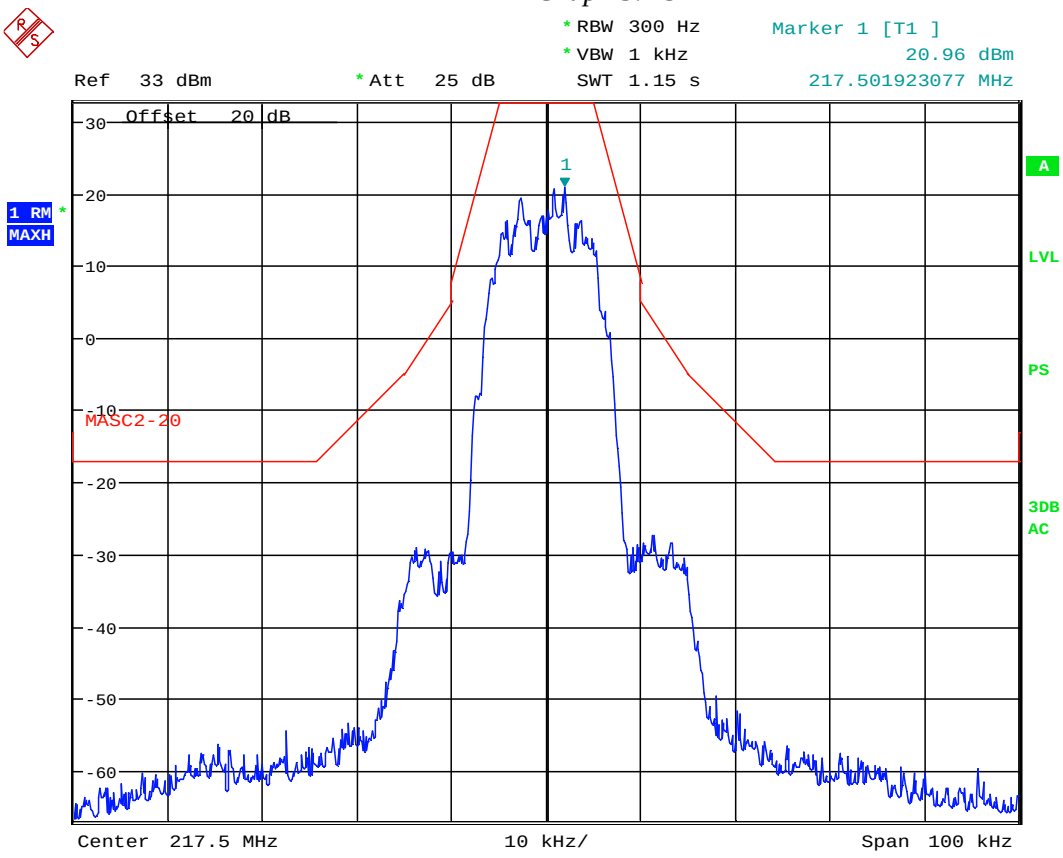
Graph 5. 12



Emission Mask type C, 20 kHz Authorized bandwidth, QPSK

Date: 11.FEB.2013 10:42:45

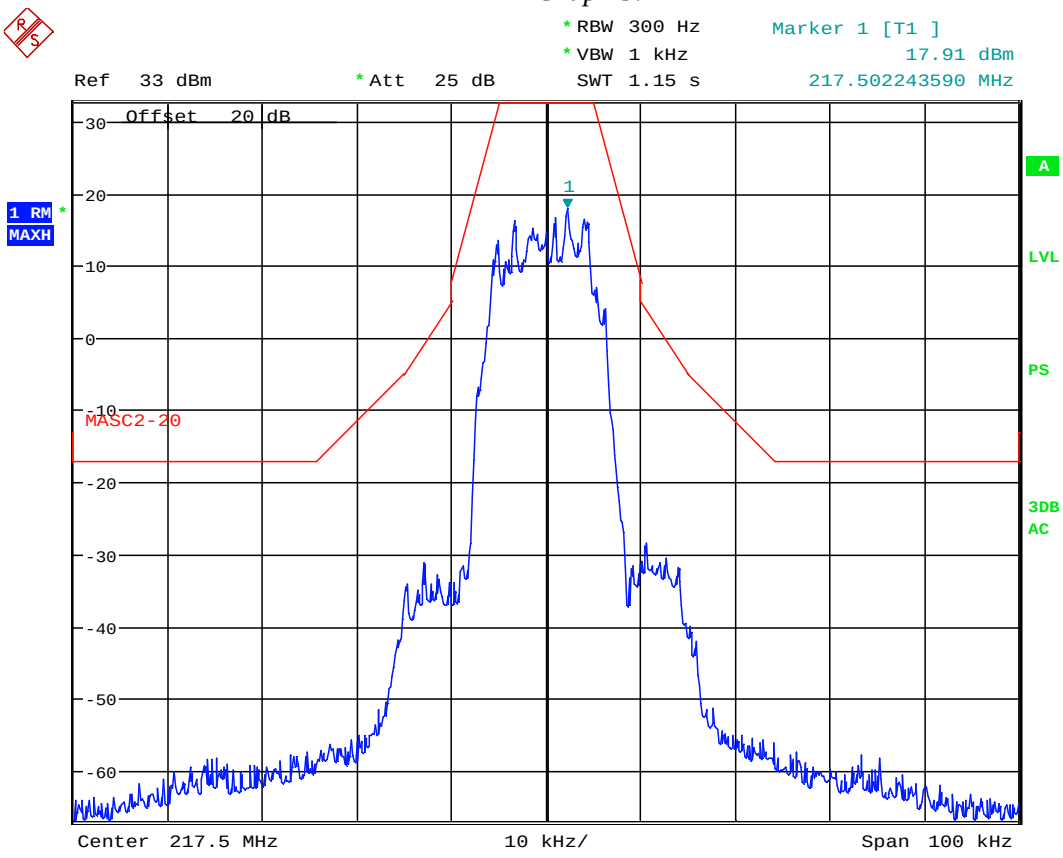
Graph 5. 13



Emission Mask type C, 20 kHz Authorized bandwidth, 8PSK

Date: 11.FEB.2013 10:43:57

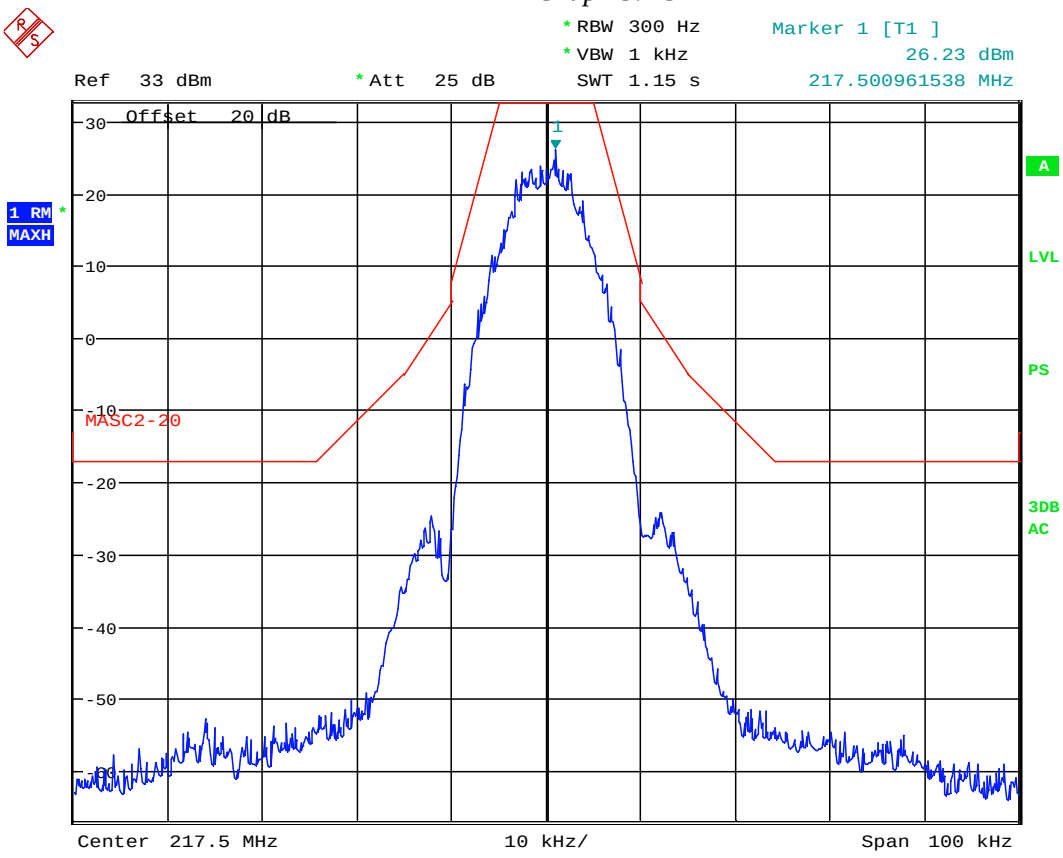
Graph 5. 14



Emission Mask type C, 20 kHz Authorized bandwidth, 16QAM

Date: 11.FEB.2013 10:46:20

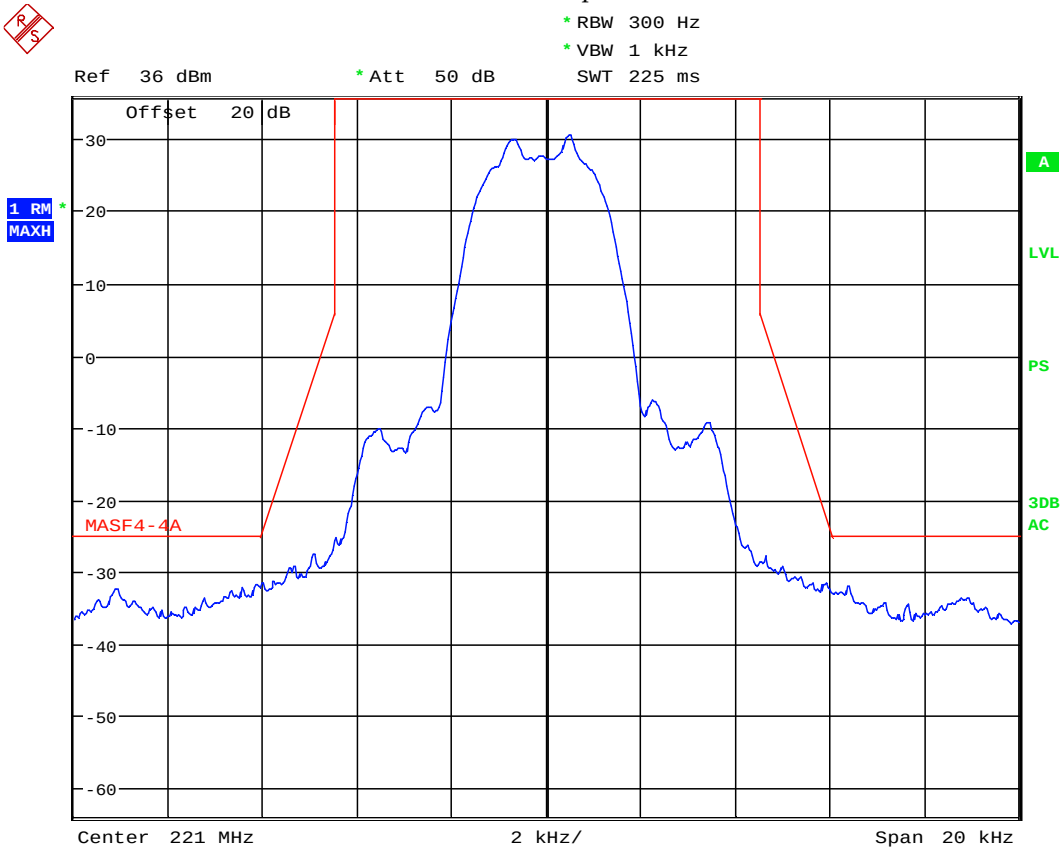
Graph 5. 15



Emission Mask type C, 20 kHz Authorized bandwidth, GMSK

Date: 11.FEB.2013 10:47:59

Graph 5. 16

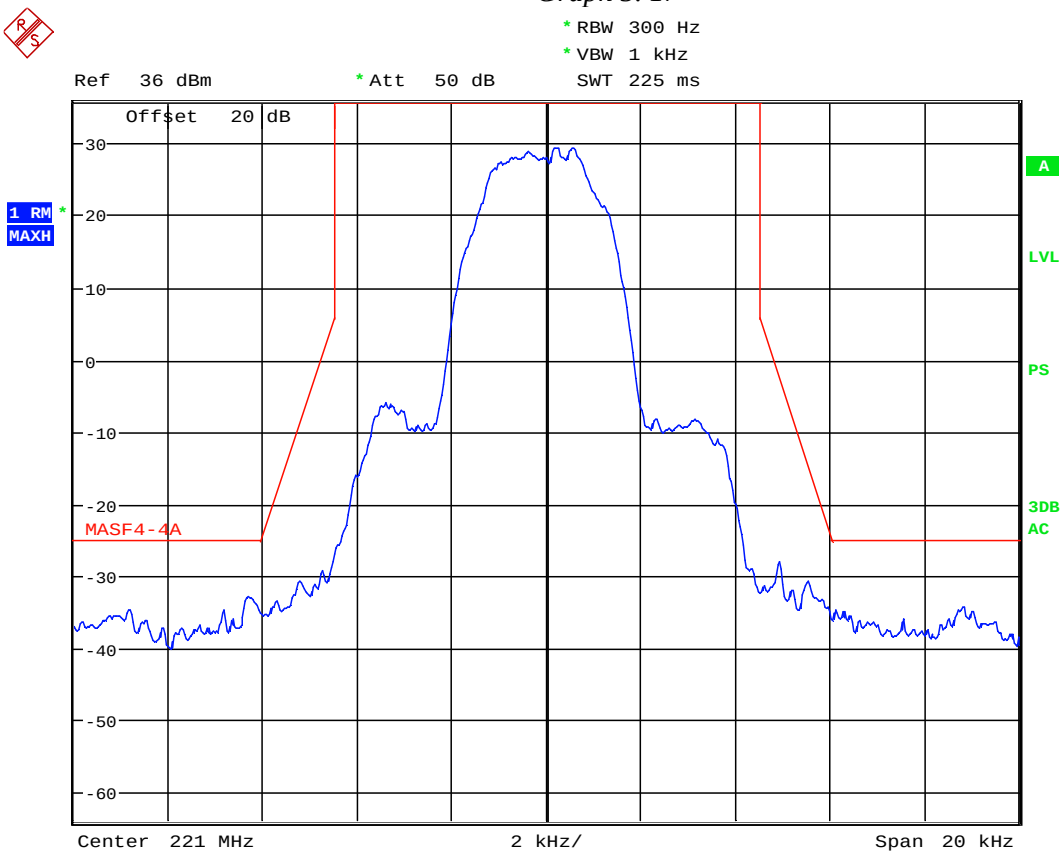


Emission mask type F, 6.25 kHz ch. bandwidth, BPSK

Date: 4.MAR.2013 14:13:08

2 channel aggregation

Graph 5. 17

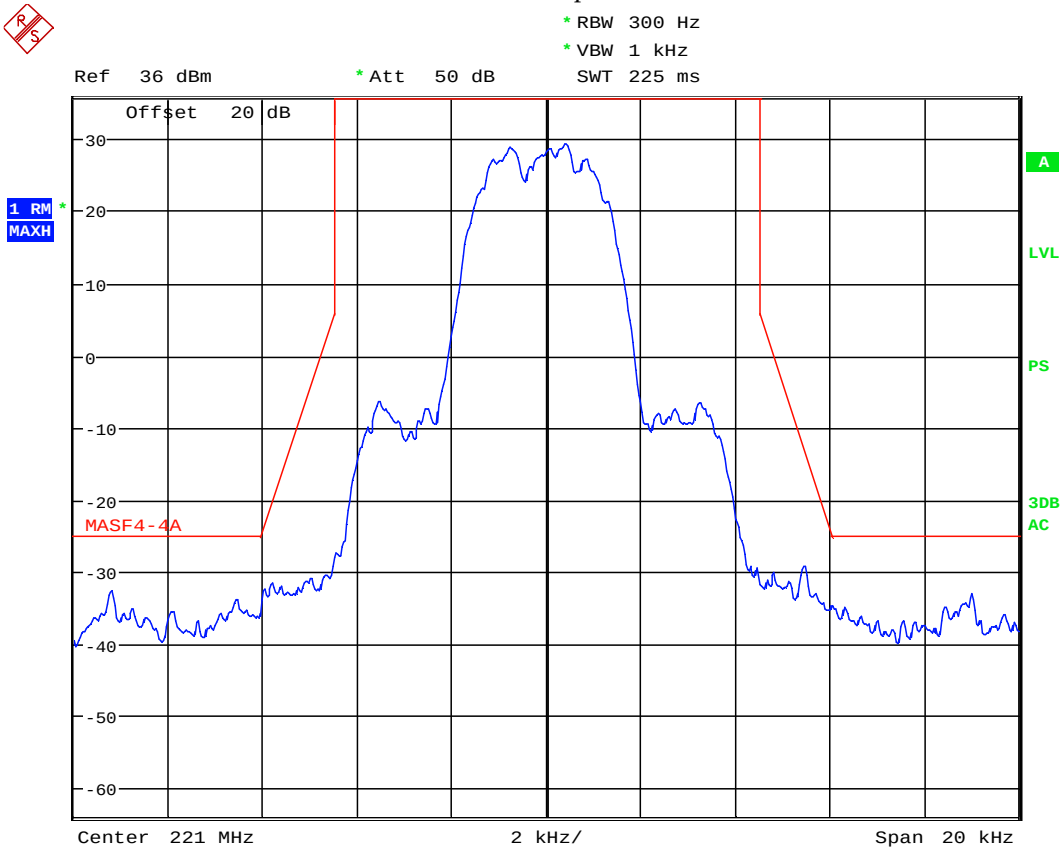


Emission mask type F, 6.25 kHz ch. bandwidth, QPSK

Date: 4.MAR.2013 14:14:09

2 channel aggregation

Graph 5. 178

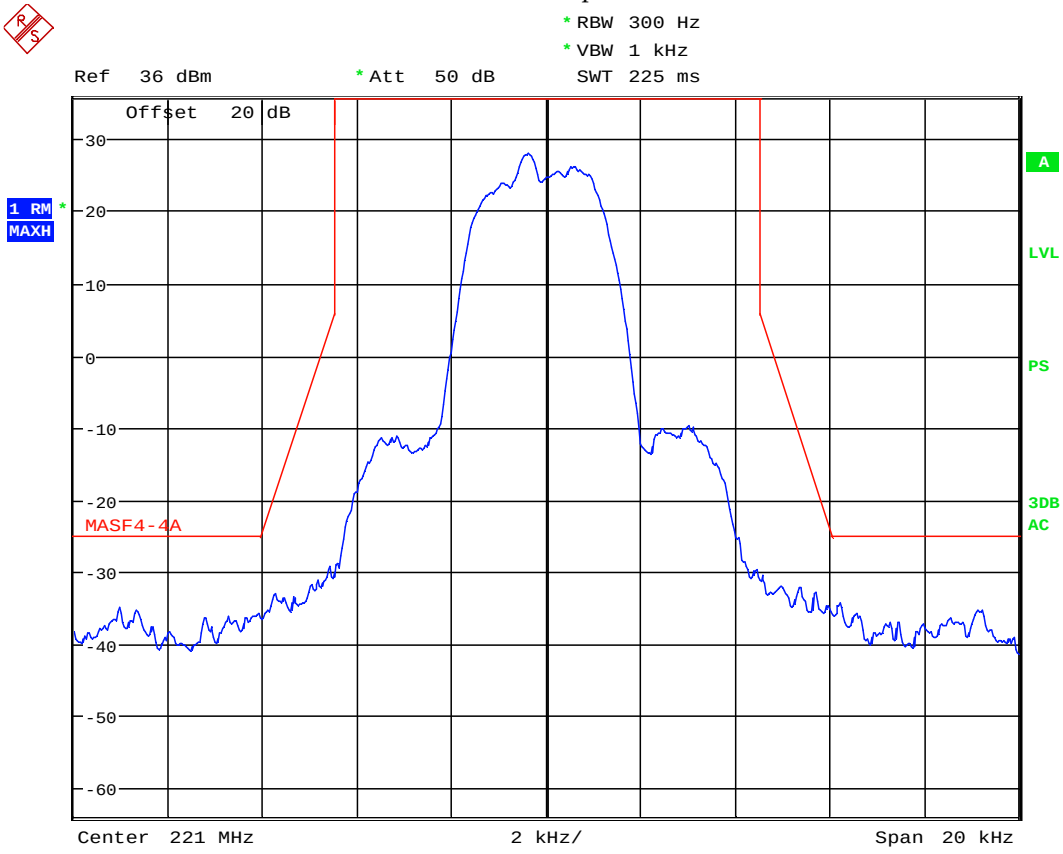


Emission mask type F, 6.25 kHz ch. bandwidth, 8PSK

Date: 4.MAR.2013 14:15:18

2 channel aggregation

Graph 5. 19

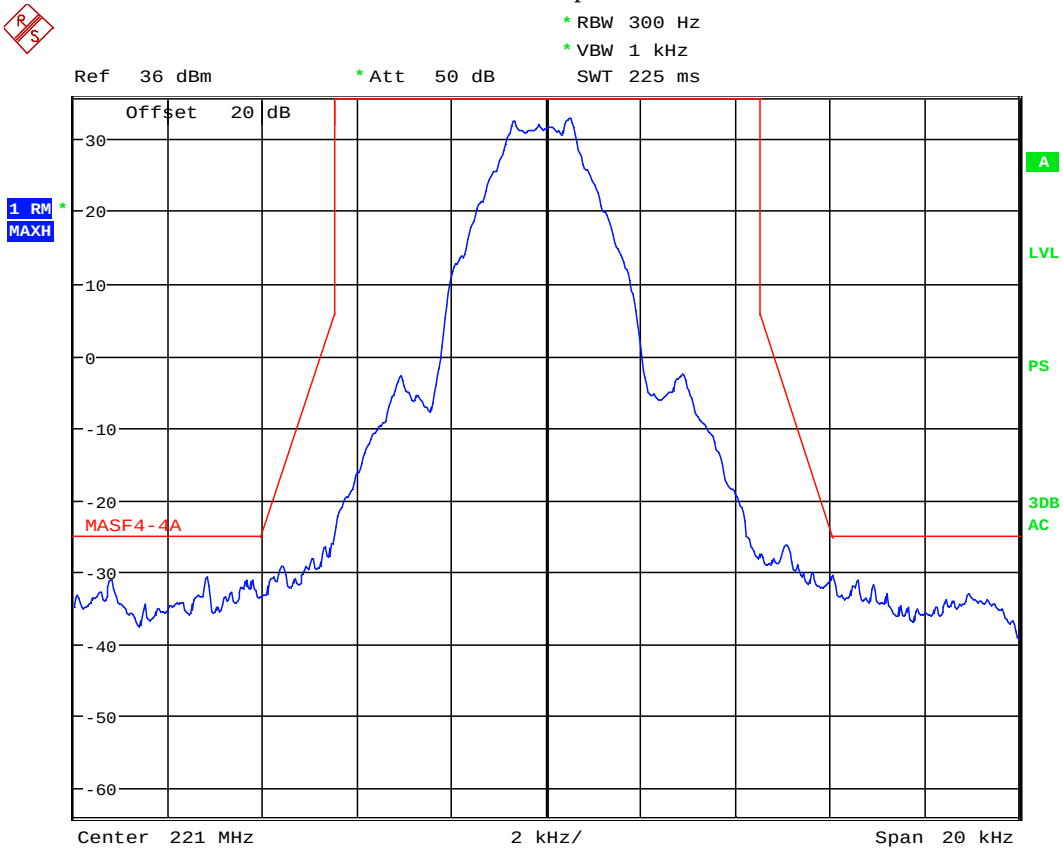


Emission mask type F, 6.25 kHz ch. bandwidth, 16QAM

Date: 4.MAR.2013 14:16:30

2 channel aggregation

Graph 5. 180

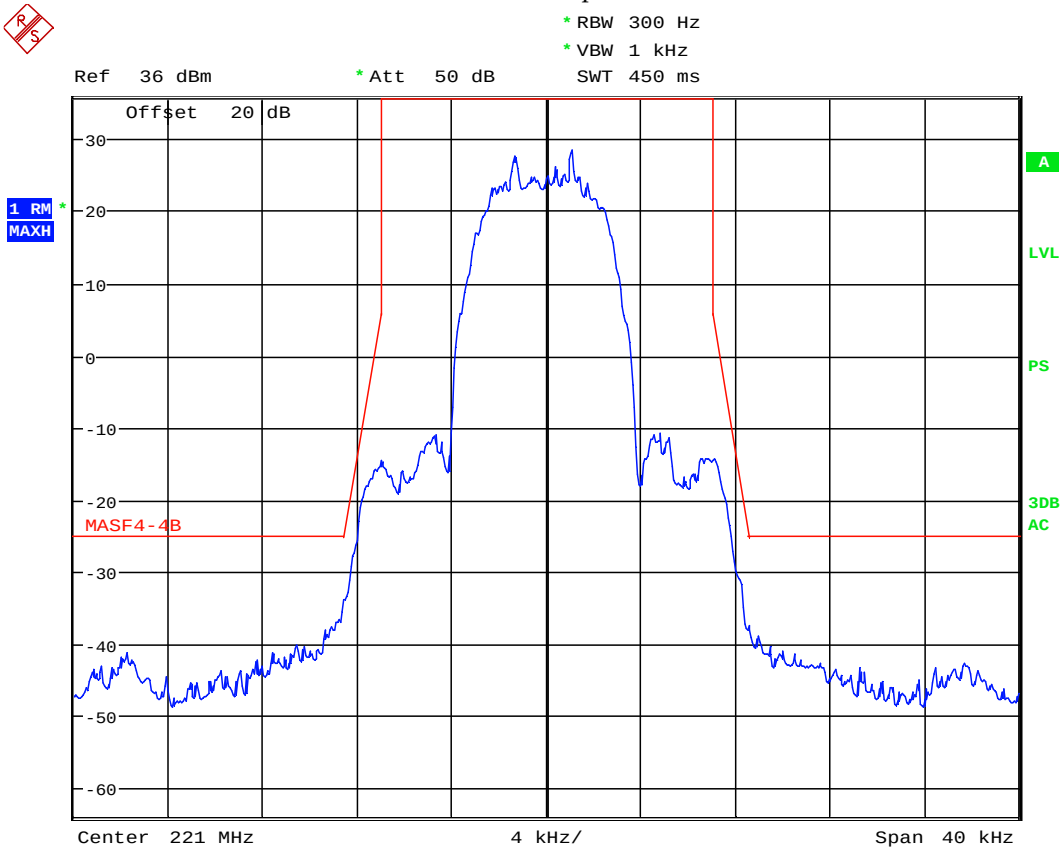


Emission mask type F, 6.25 kHz ch. bandwidth, GMSK

Date: 4.MAR.2013 14:17:36

2 channel aggregation

Graph 5. 21

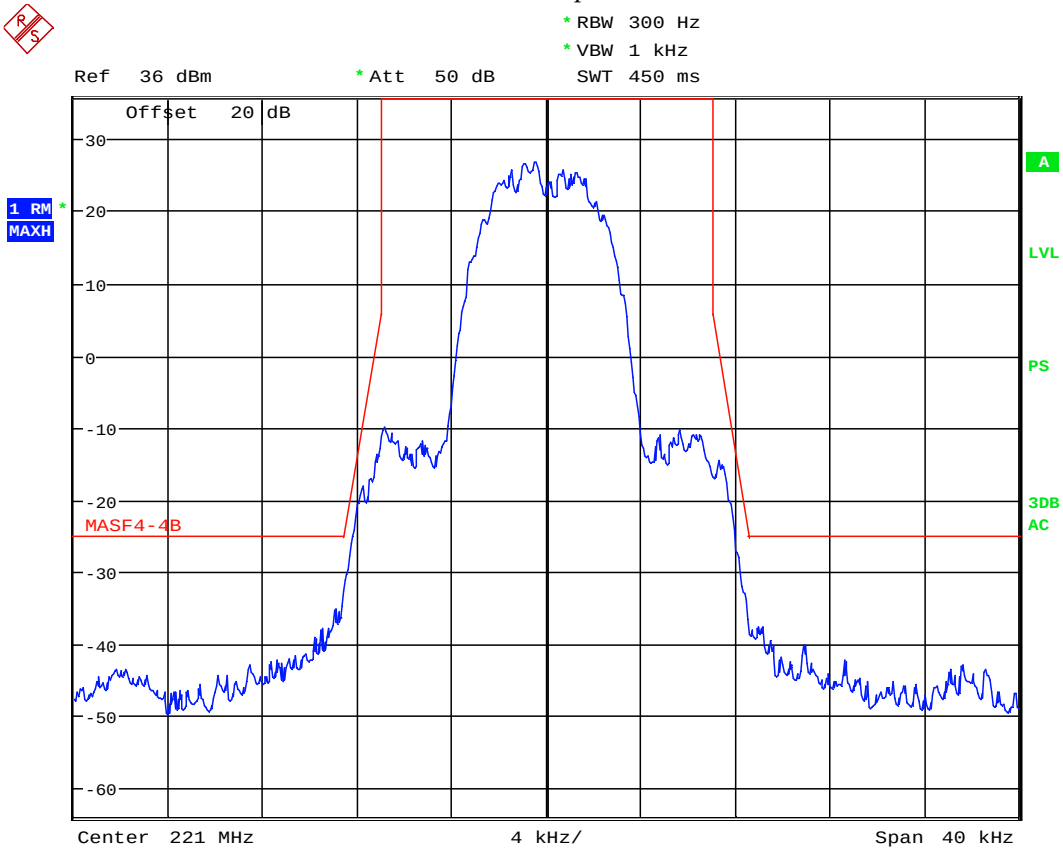


Emission mask type F, 12.5 kHz ch. bandwidth, BPSK

Date: 4.MAR.2013 14:23:14

3 channel aggregation

Graph 5. 192

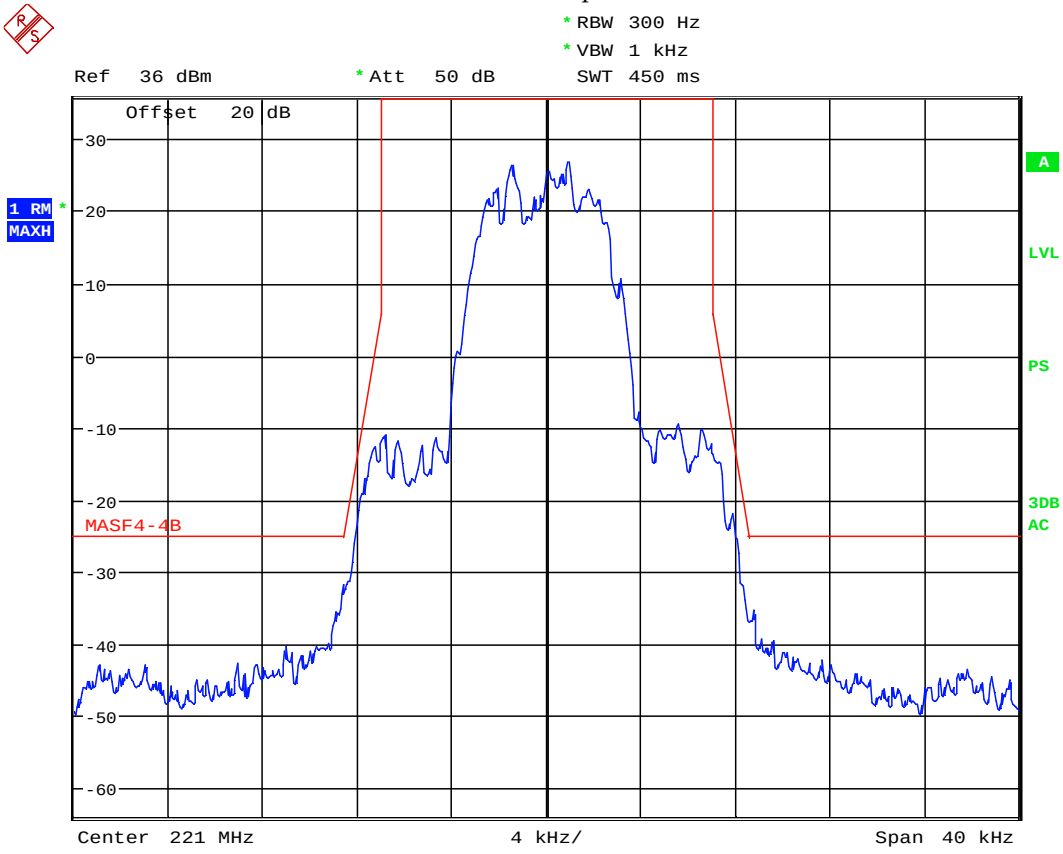


Emission mask type F, 12.5 kHz ch. bandwidth, QPSK

Date: 4.MAR.2013 14:24:11

3 channel aggregation

Graph 5. 23

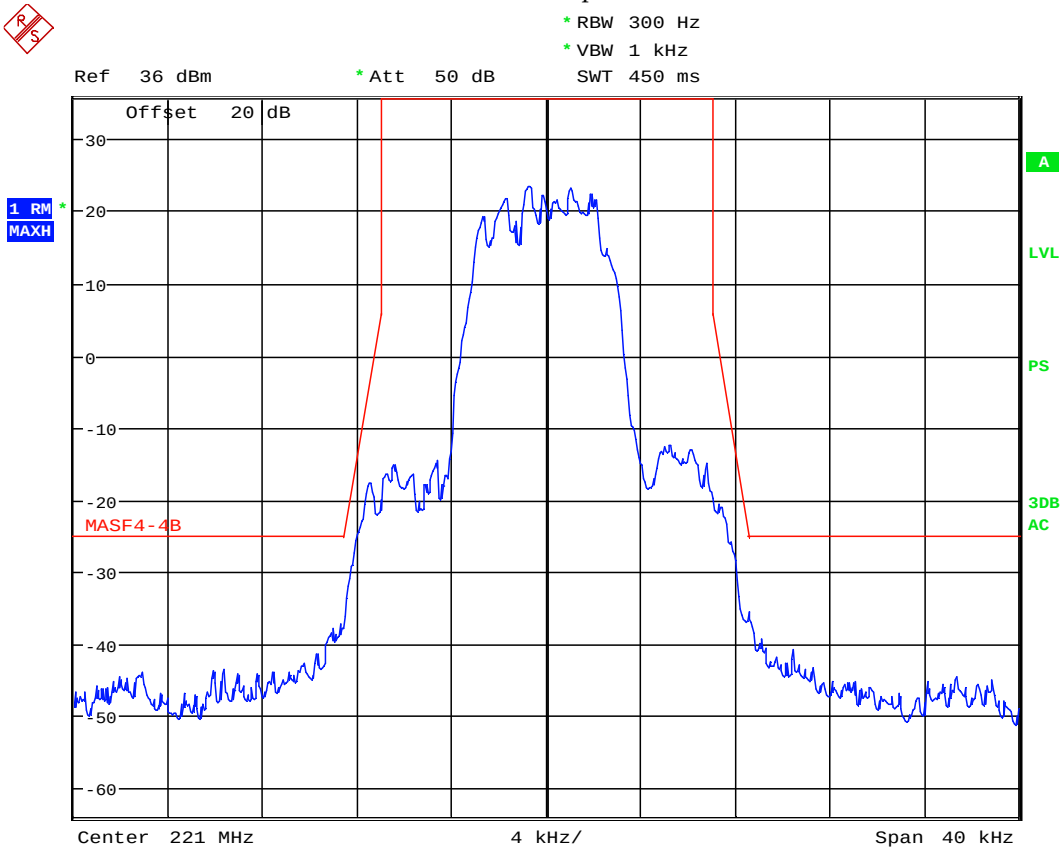


Emission mask type F, 12.5 kHz ch. bandwidth, 8PSK

Date: 4.MAR.2013 14:25:11

3 channel aggregation

Graph 5. 24

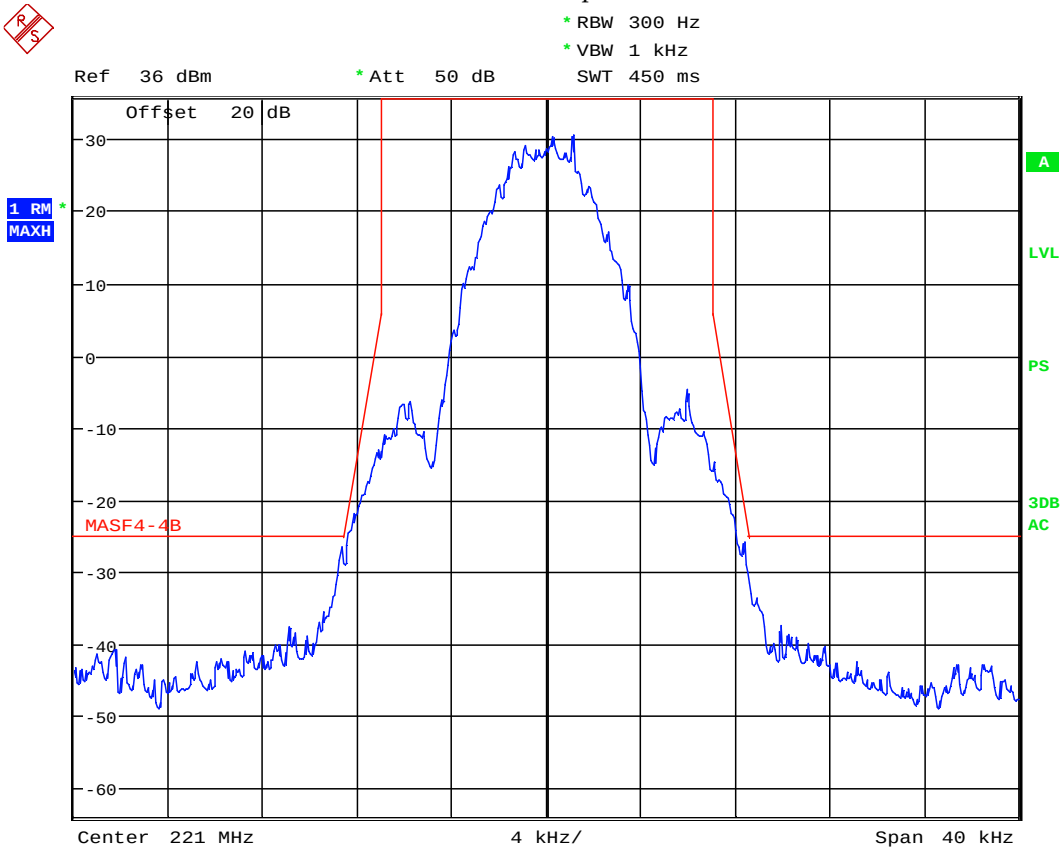


Emission mask type F, 12.5 kHz ch. bandwidth, 16QAM

Date: 4.MAR.2013 14:26:13

3 channel aggregation

Graph 5. 25

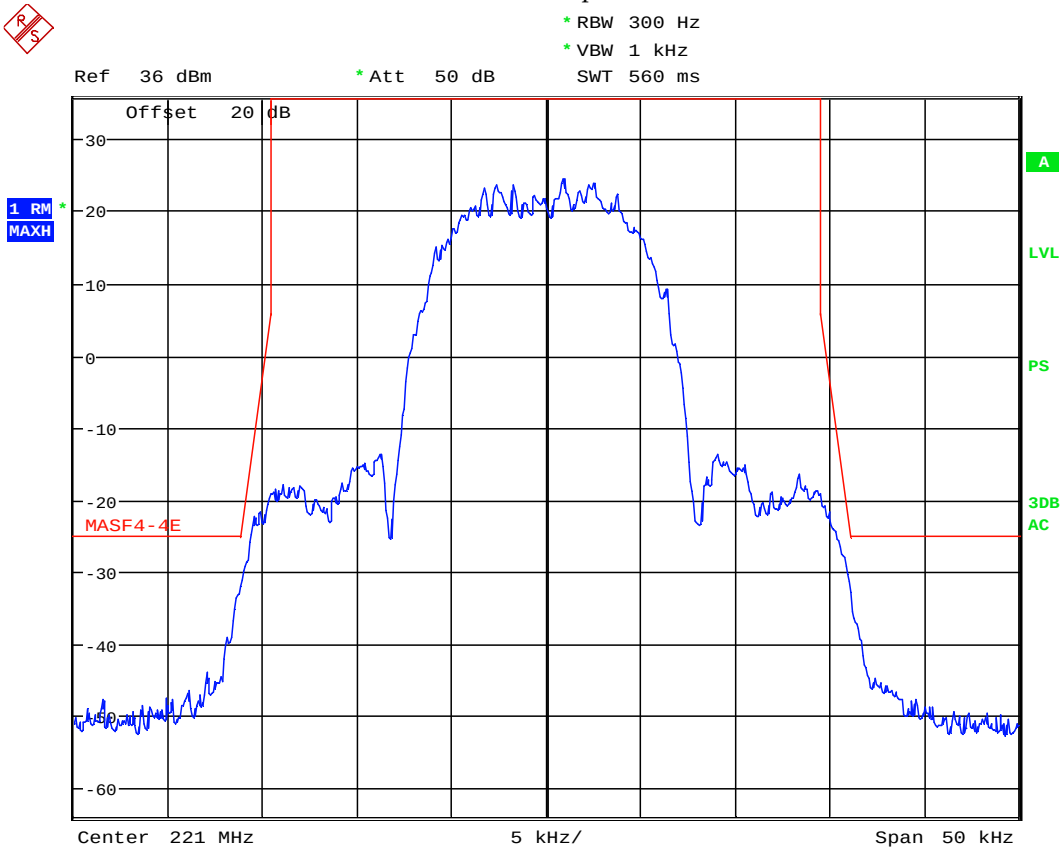


Emission mask type F, 12.5 kHz ch. bandwidth, GMSK

Date: 4.MAR.2013 14:28:37

3 channel aggregation

Graph 5. 26

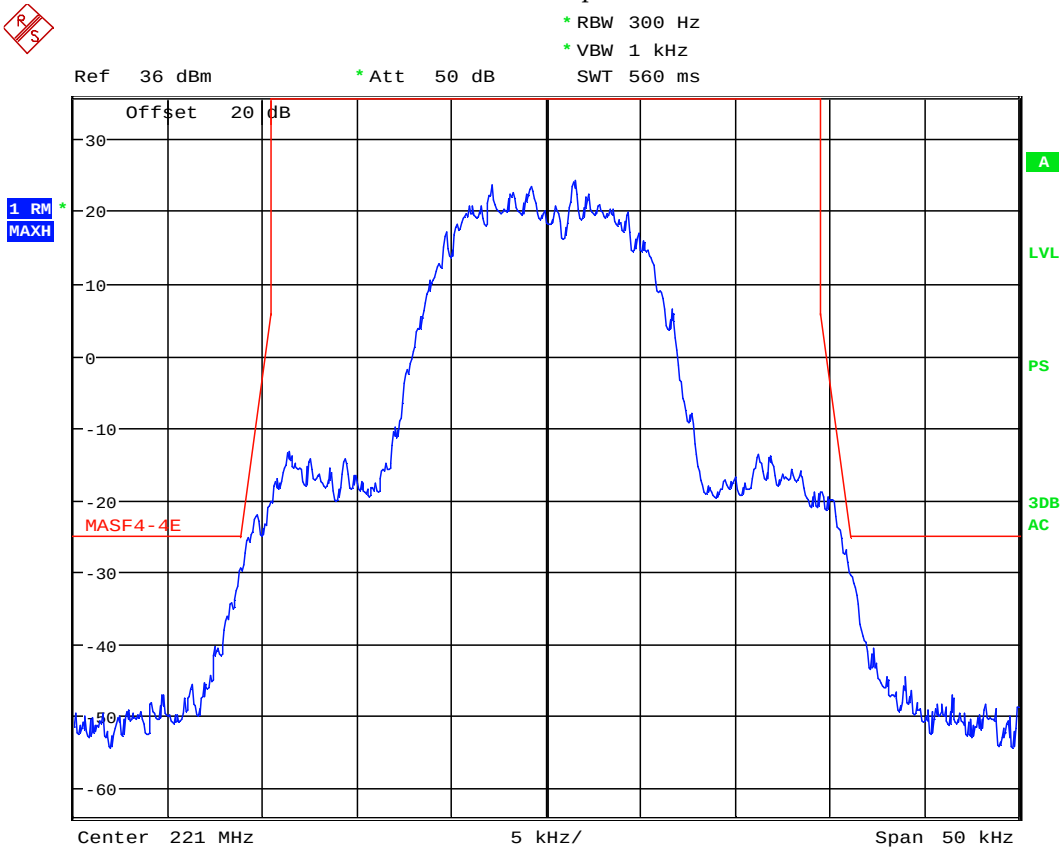


Emission mask type F, 25 kHz ch. bandwidth, BPSK

Date: 4.MAR.2013 15:52:13

6 channel aggregation

Graph 5. 27

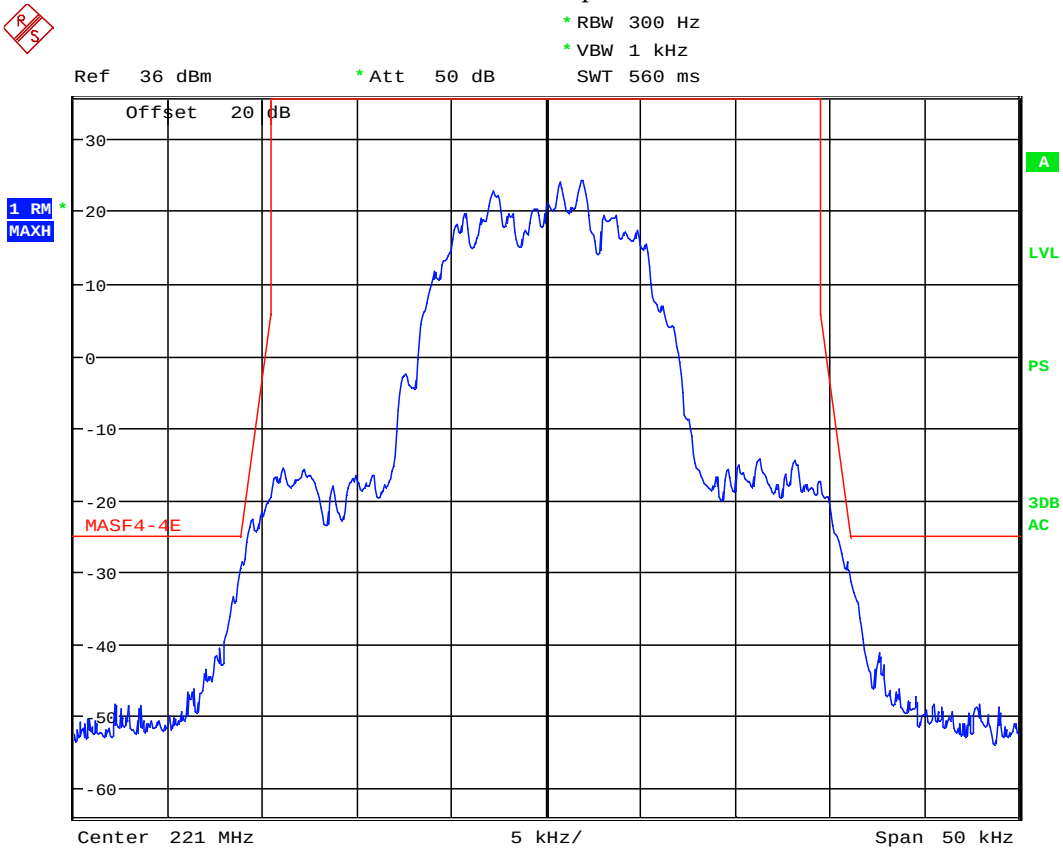


Emission mask type F, 25 kHz ch. bandwidth, QPSK

Date: 4.MAR.2013 15:53:03

6 channel aggregation

Graph 5. 28

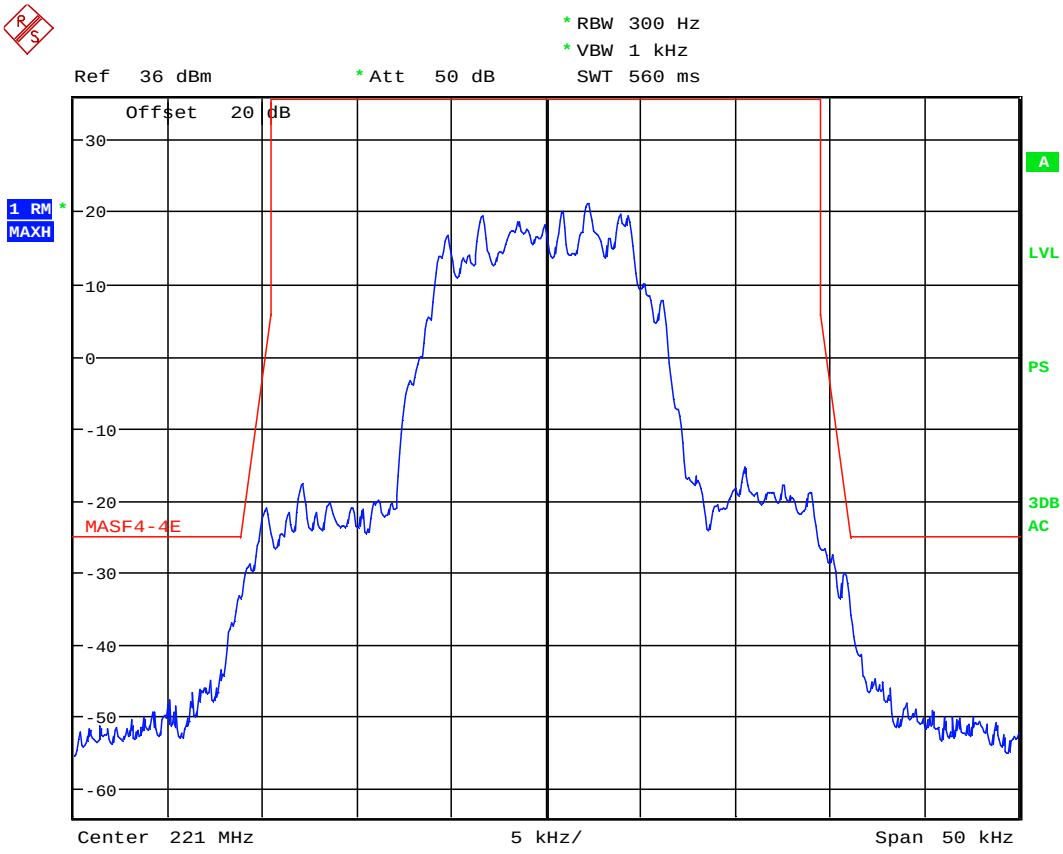


Emission mask type F, 25 kHz ch. bandwidth, 8PSK

Date: 4.MAR.2013 15:53:48

6 channel aggregation

Graph 5.29

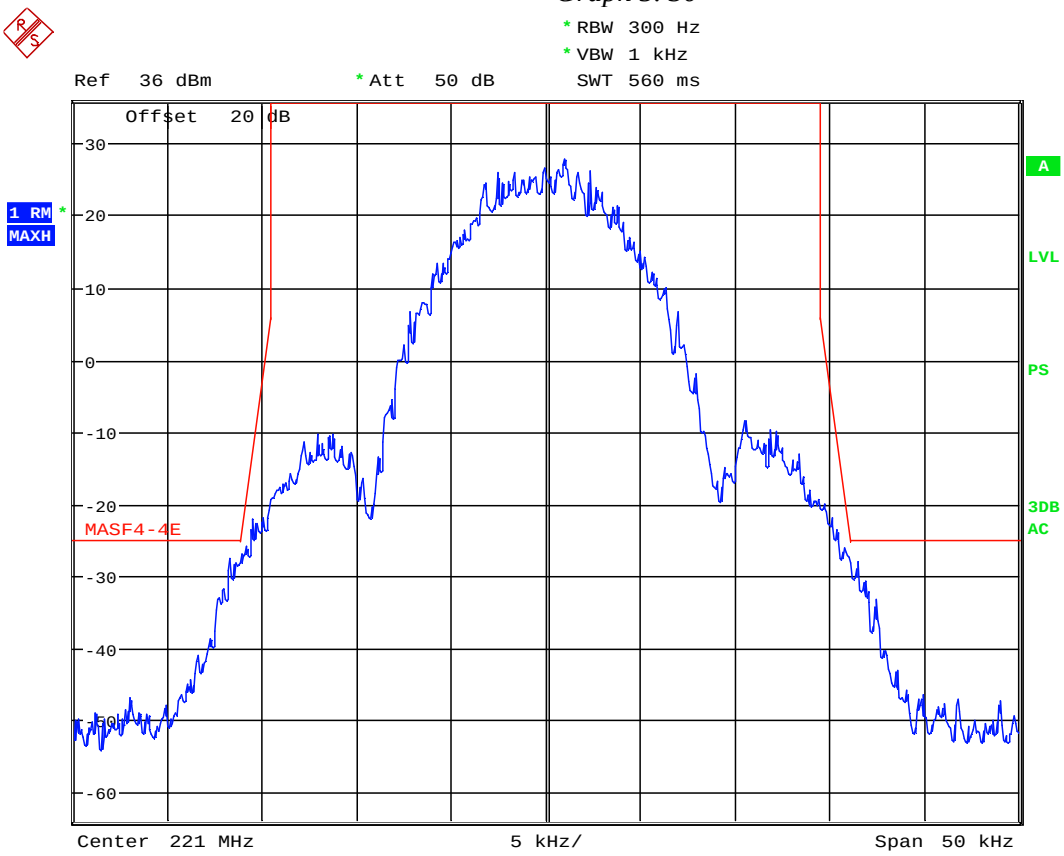


Emission mask type F, 25 kHz ch. bandwidth, 16QAM

Date: 4.MAR.2013 15:54:43

6 channel aggregation

Graph 5. 30

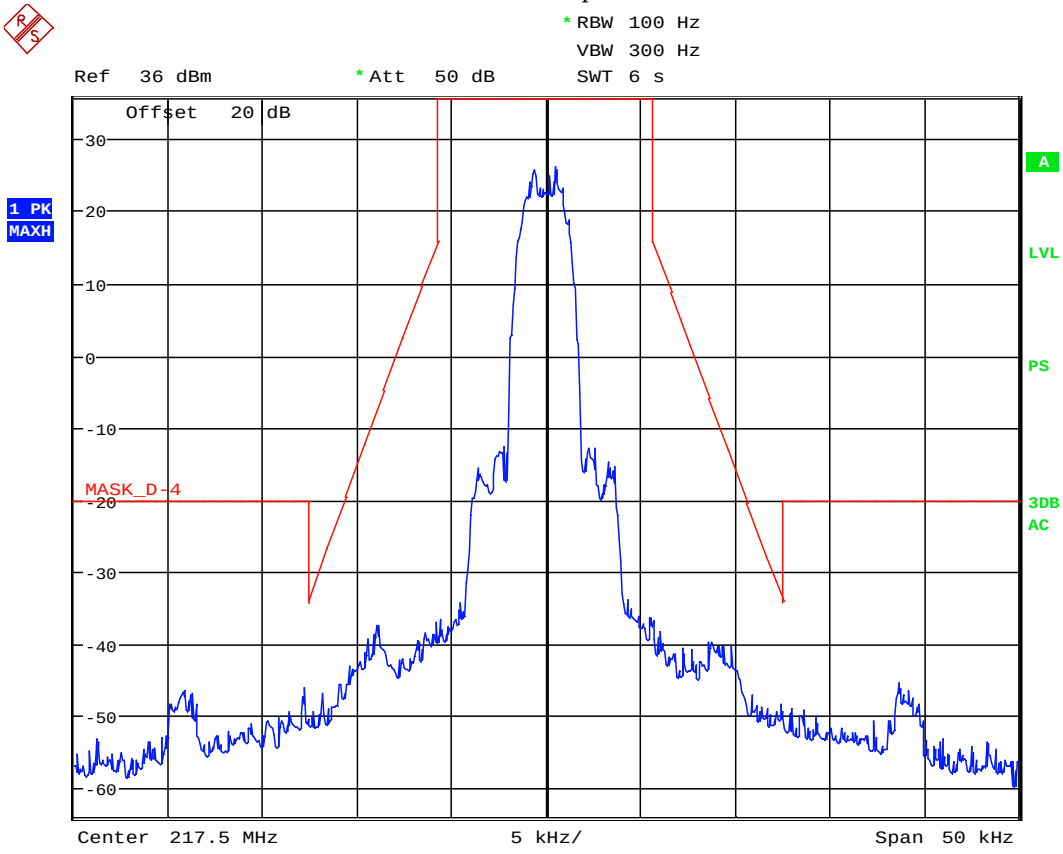


Emission mask type F, 25 kHz ch. bandwidth, GMSK

Date: 4.MAR.2013 15:57:03

6 channel aggregation

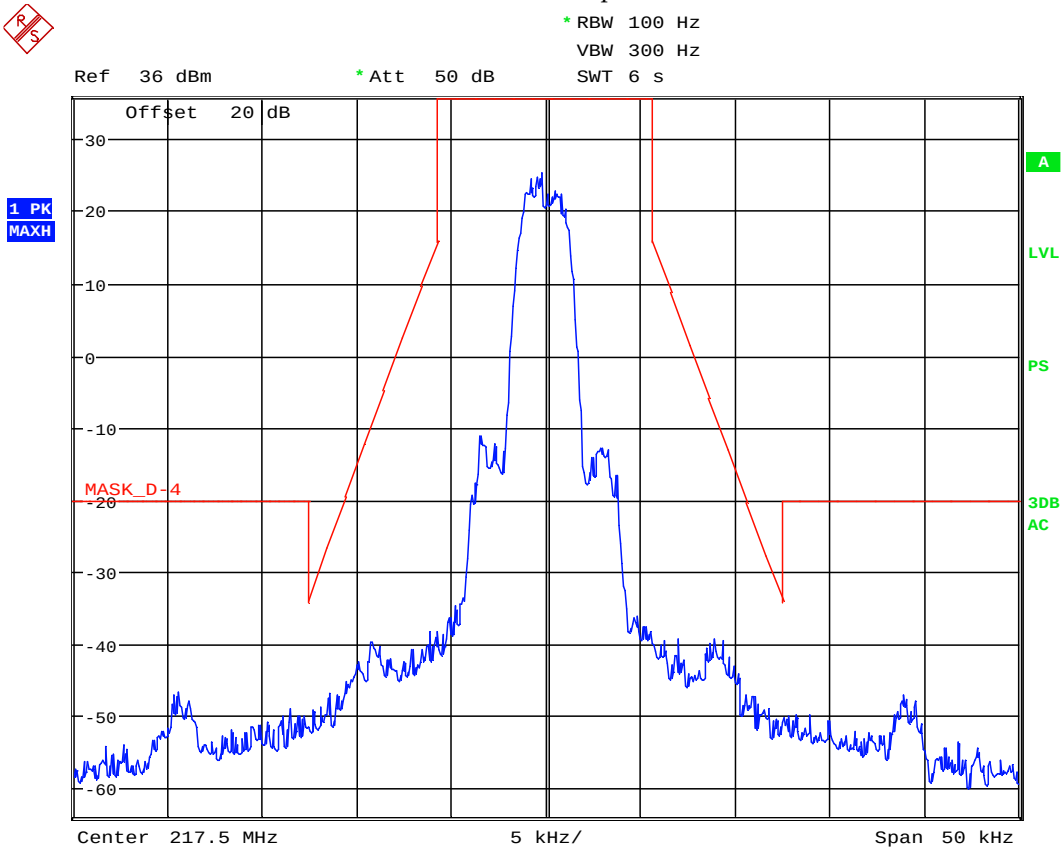
Graph 5. 31



Emission mask type D, 6.25 kHz ch. space, BPSK

Date: 15.MAR.2013 14:27:09

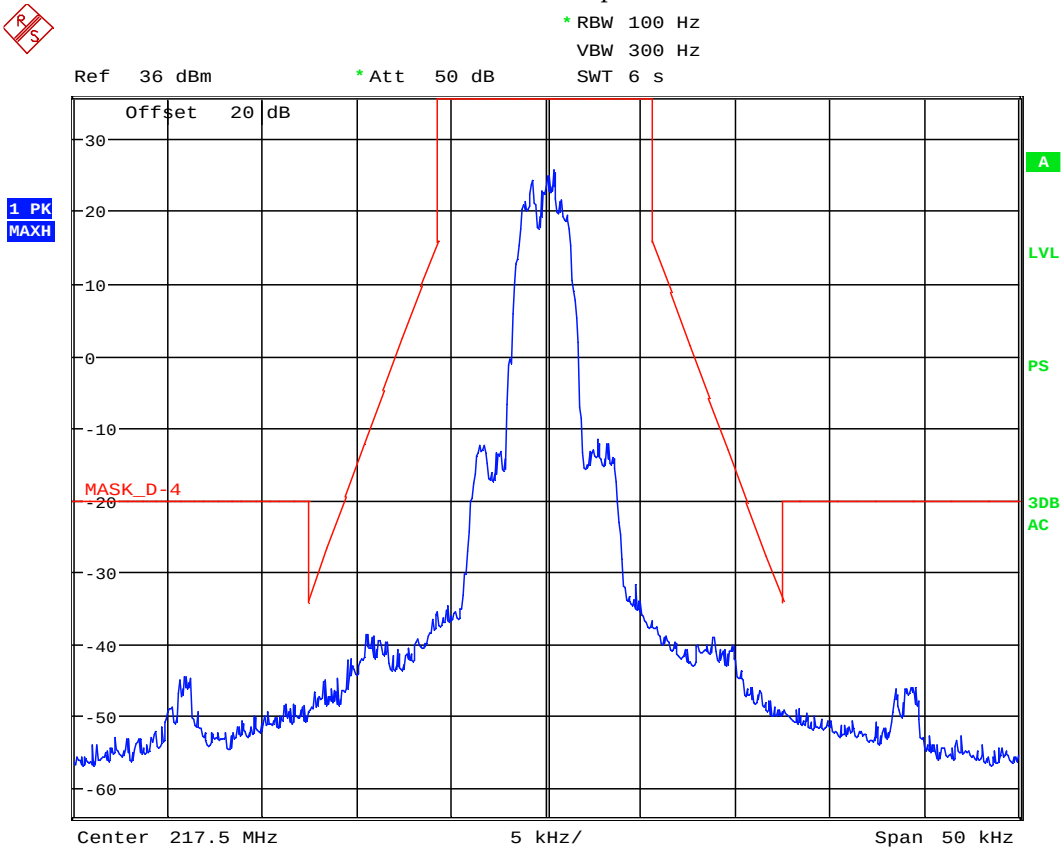
Graph 5. 32



Emission mask type D, 6.25 kHz ch. space, QPSK

Date: 15.MAR.2013 14:29:00

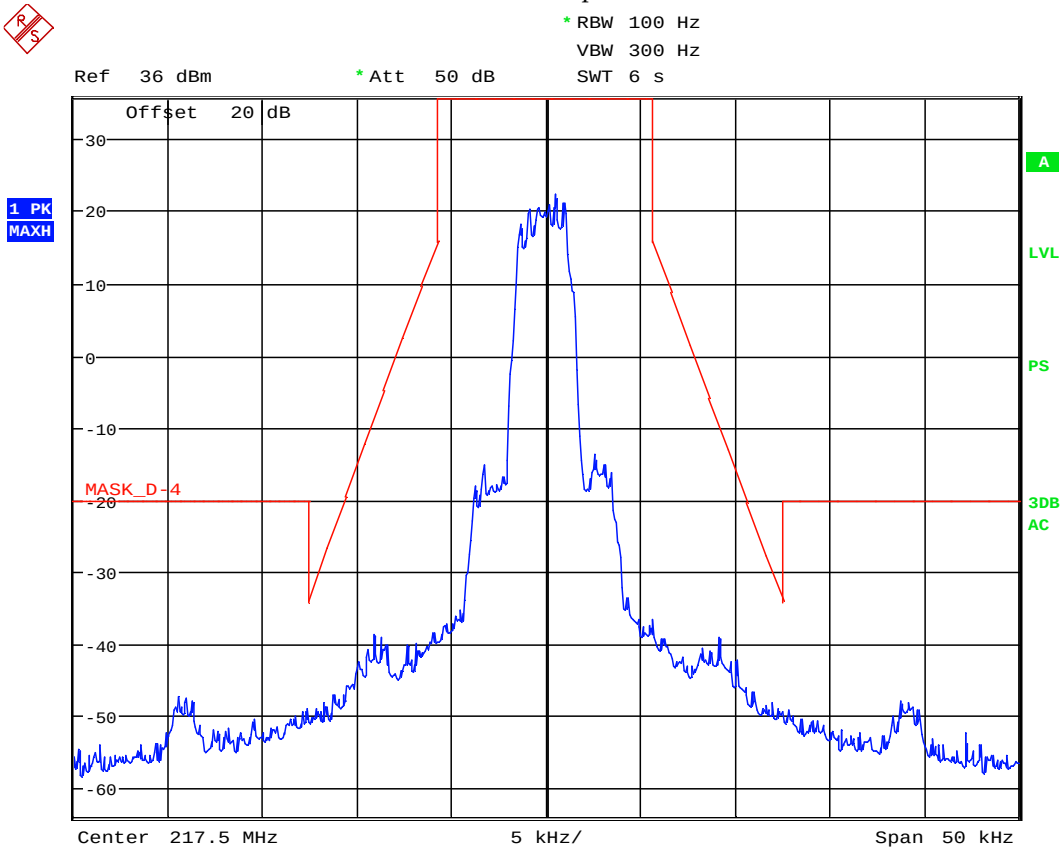
Graph 5. 33



Emission mask type D, 6.25 kHz ch. space, 8PSK

Date: 15.MAR.2013 14:37:05

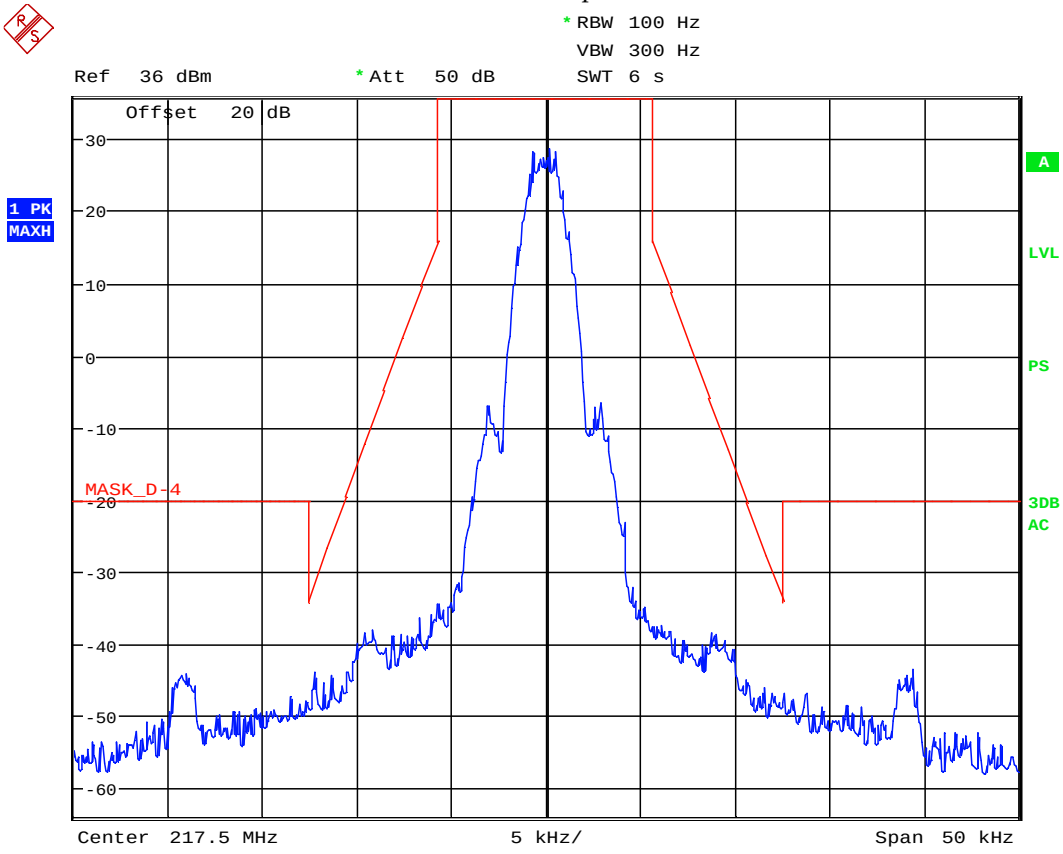
Graph 5. 34



Emission mask type D, 6.25 kHz ch. space, 16QAM

Date: 15.MAR.2013 14:46:27

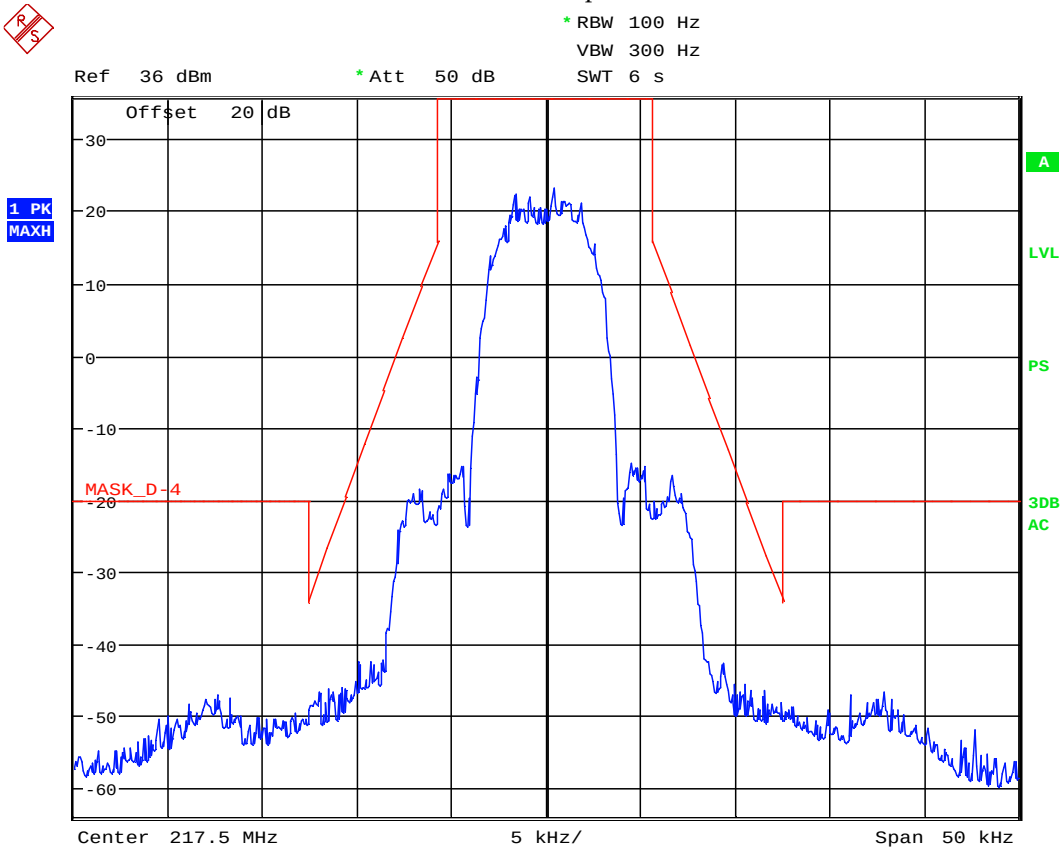
Graph 5. 35



Emission mask type D, 6.25 kHz ch. space, GMSK

Date: 15.MAR.2013 14:48:12

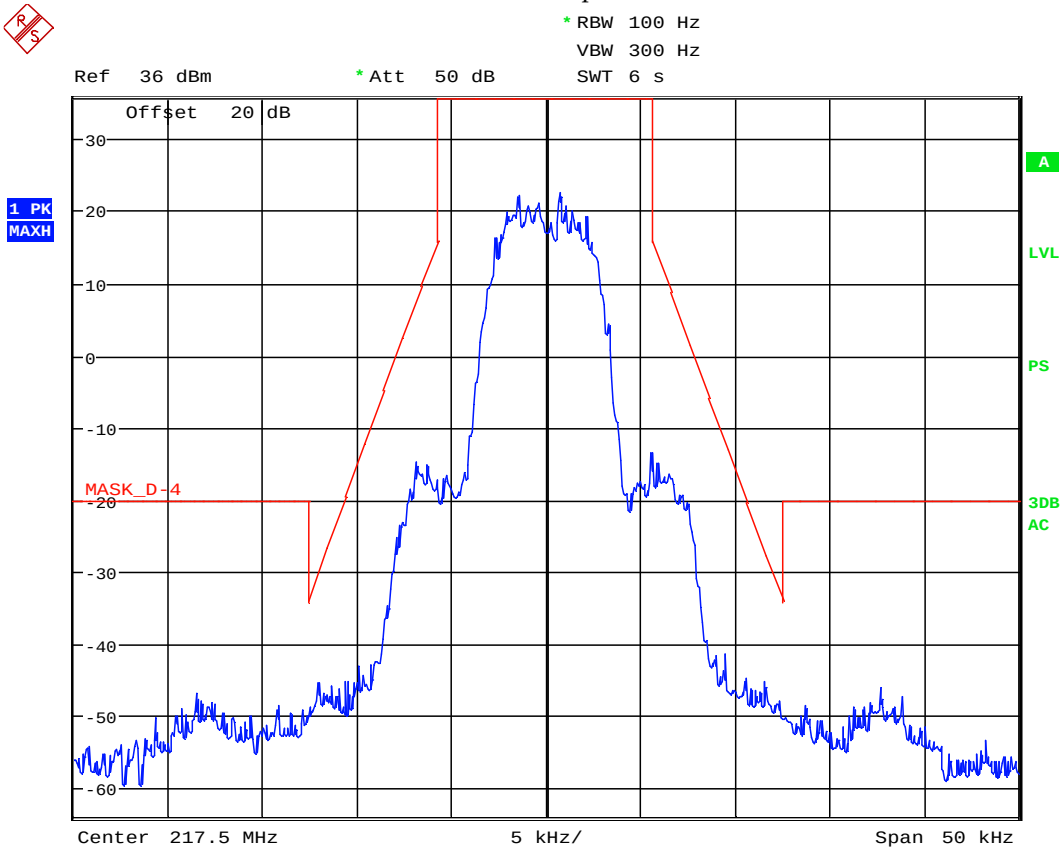
Graph 5.36



Emission mask type D, 12.5 kHz ch. space, BPSK

Date: 15.MAR.2013 14:50:08

Graph 5. 37



Emission mask type D, 12.5 kHz ch. space, QPSK

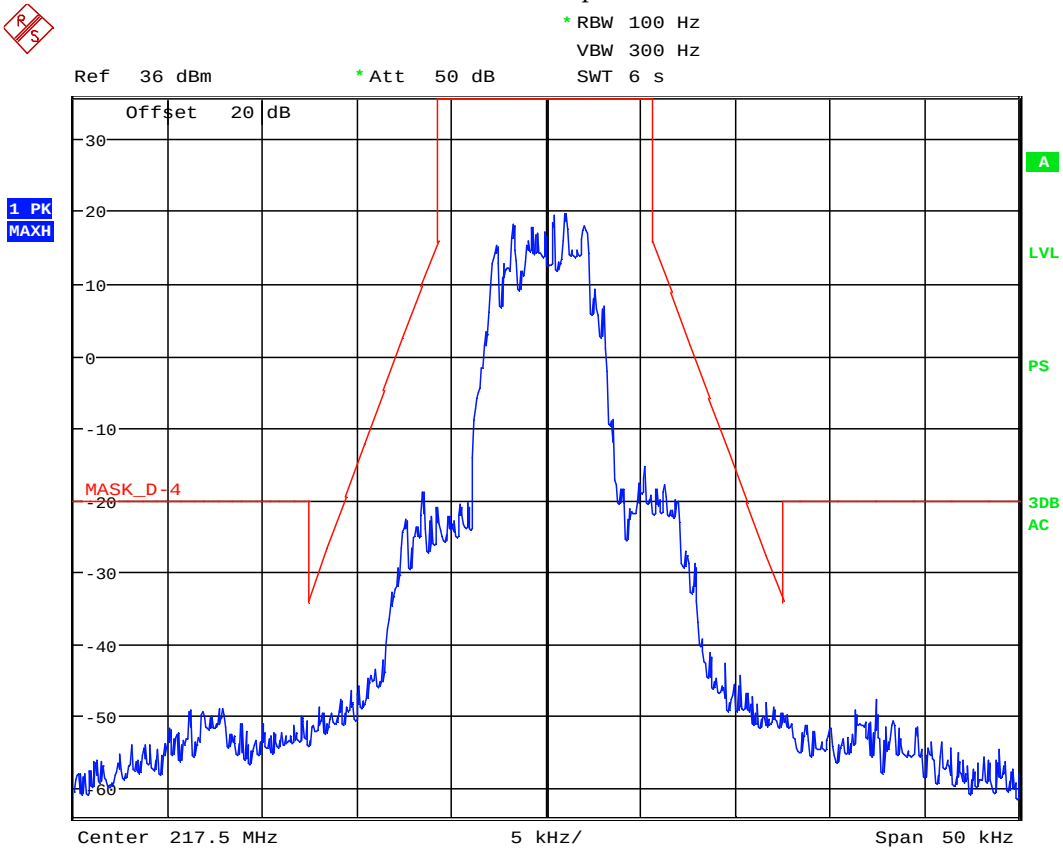
Date: 15.MAR.2013 14:52:14

Graph 5. 38

Emission mask type D, 12.5 kHz ch. space, 8PSK

Date: 15.MAR.2013 14:53:55

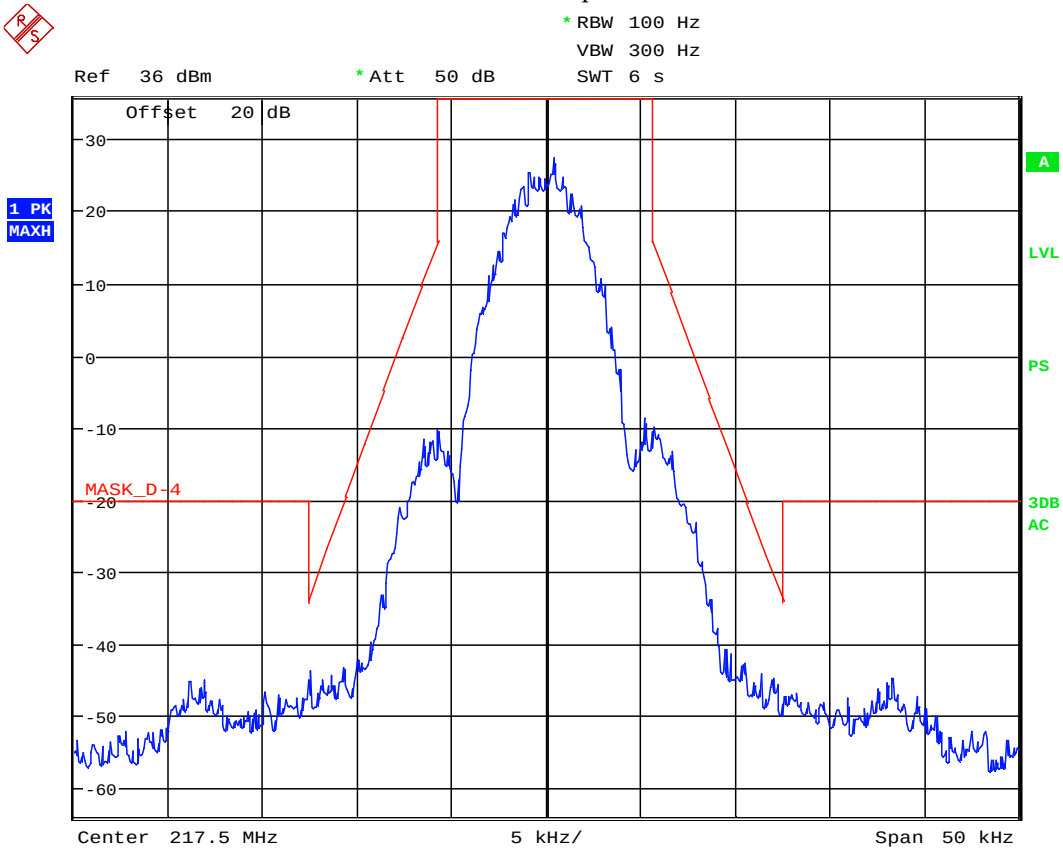
Graph 5. 39



Emission mask type D, 12.5 kHz ch. space, 16QAM

Date: 15.MAR.2013 14:55:28

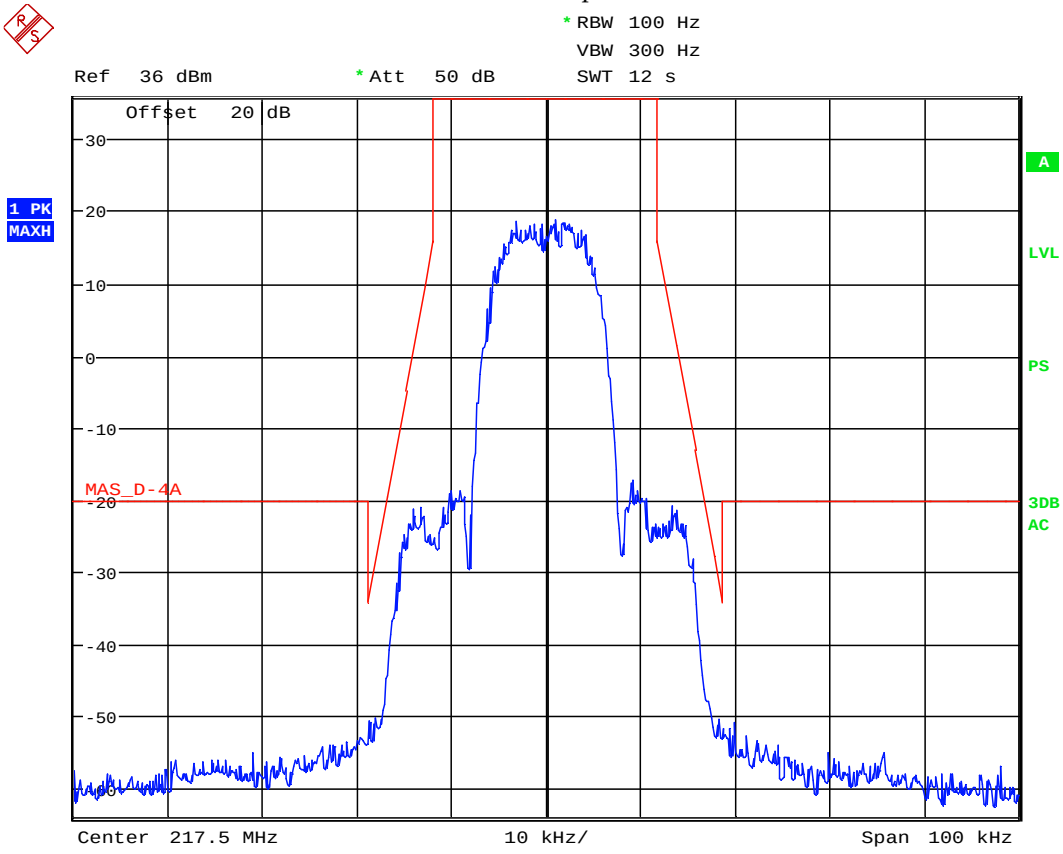
Graph 5. 40



Emission mask type D, 12.5 kHz ch. space, GMSK

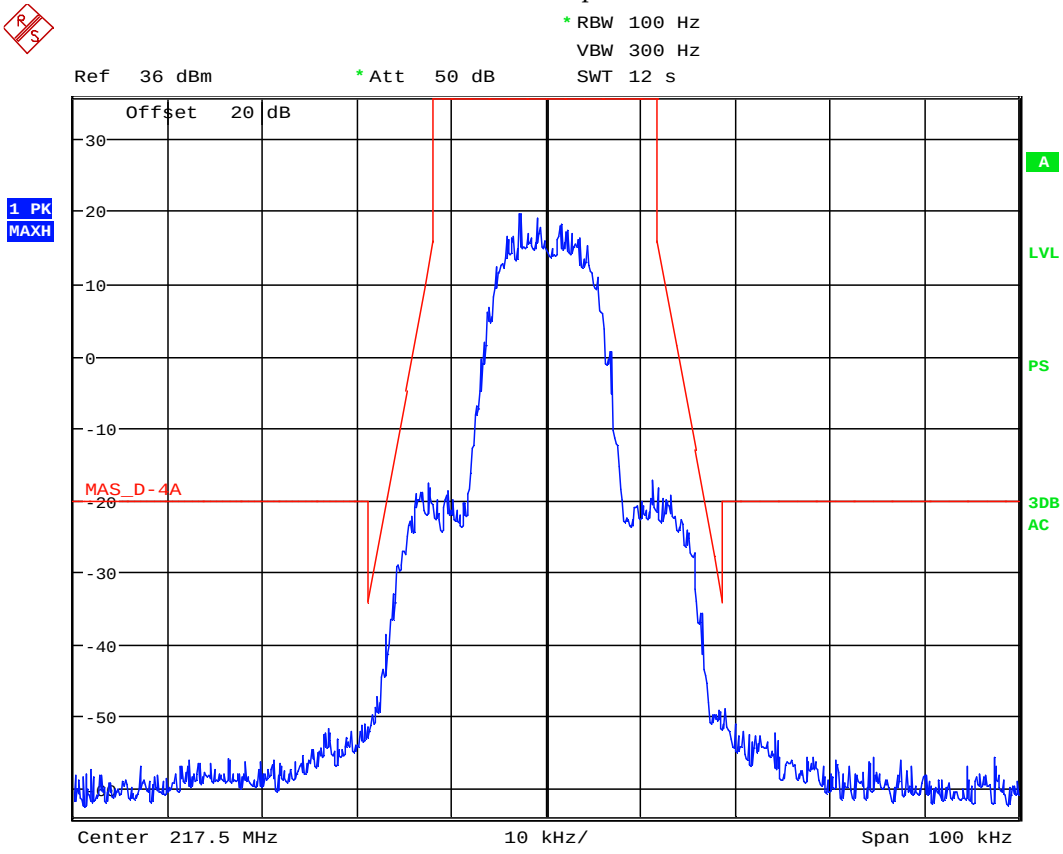
Date: 15.MAR.2013 14:57:21

Graph 5. 41



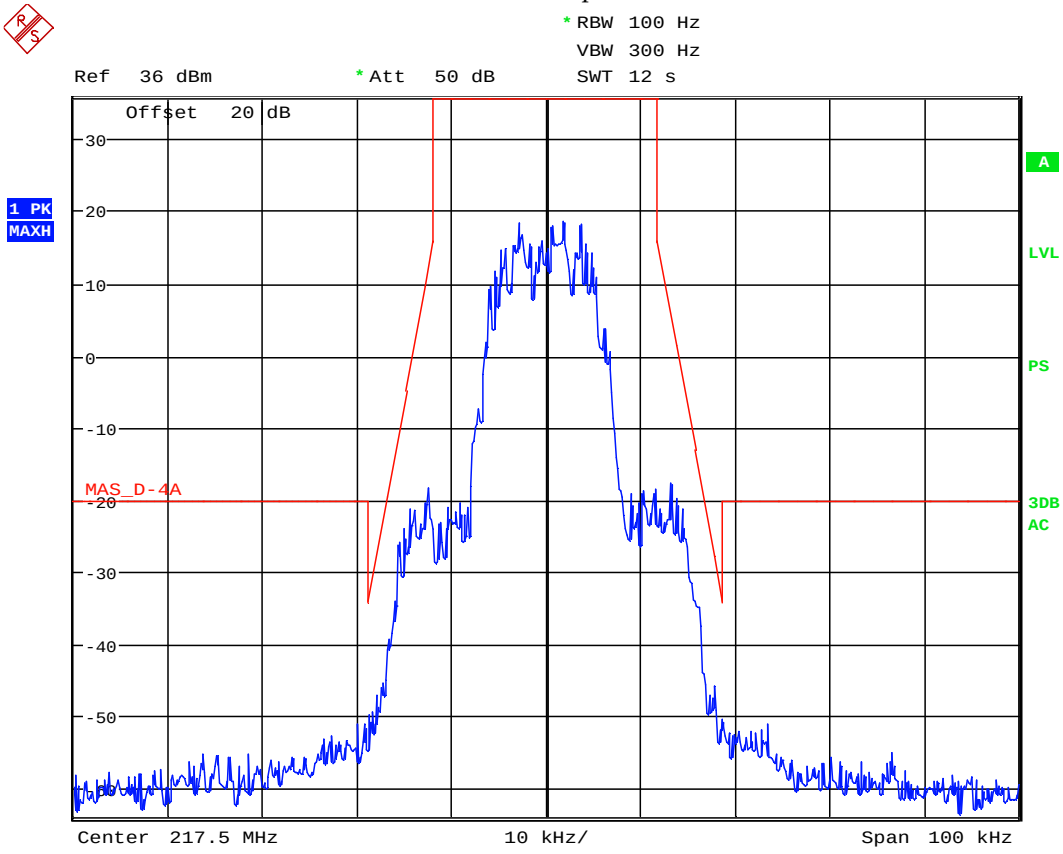
Emission mask type D, 25 kHz ch. space, BPSK, Two ch. aggreg
ation
Date: 15.MAR.2013 15:03:44

Graph 5. 42



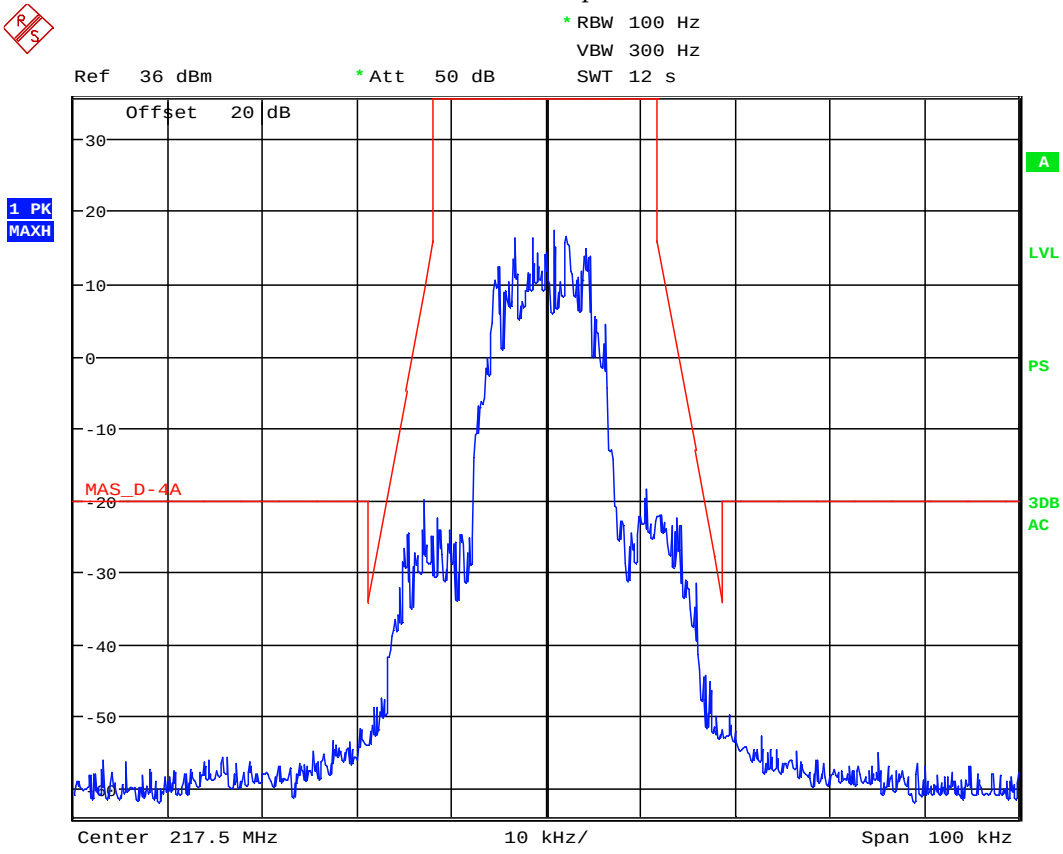
Emission mask type D, 25 kHz ch. space, QPSK, Two ch. aggreg
ation
Date: 15.MAR.2013 15:07:09

Graph 5. 43



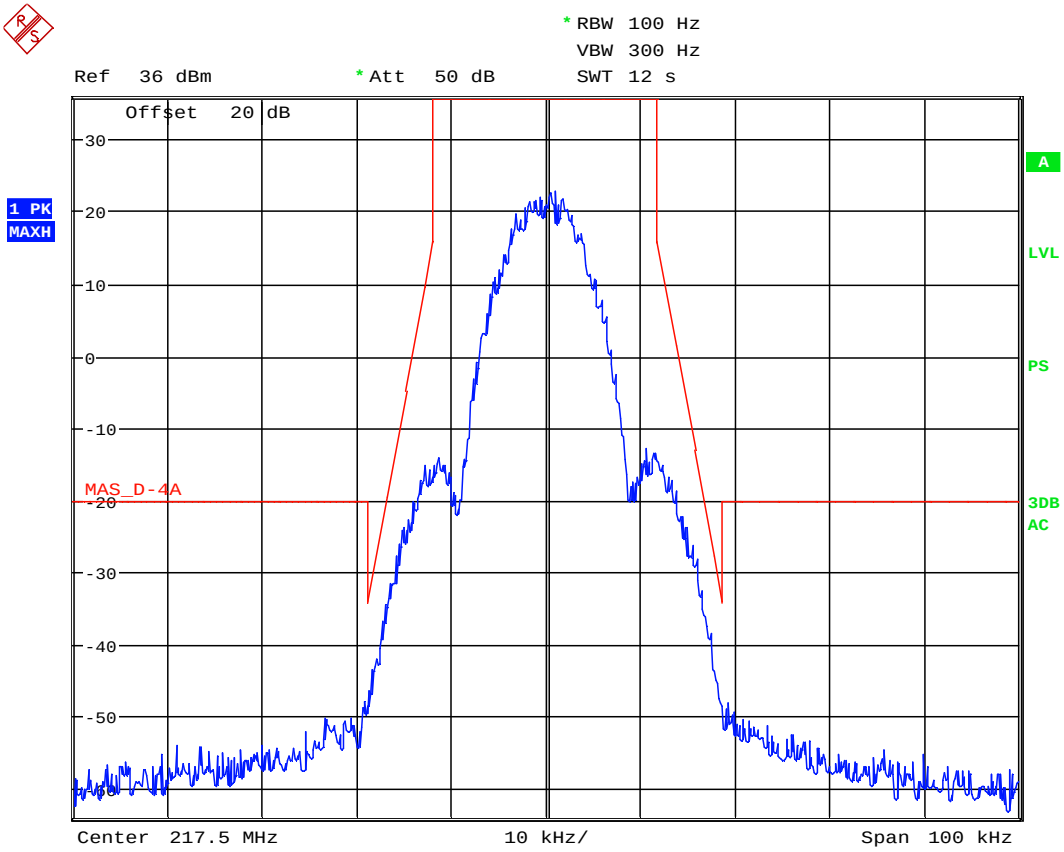
Emission mask type D, 25 kHz ch. space, 8PSK, Two ch. aggreg
ation
Date: 15.MAR.2013 15:08:59

Graph 5. 44



Emission mask type D, 25 kHz ch. space, 16QAM, Two ch. aggre
gation
Date: 15.MAR.2013 15:12:55

Graph 5.45



Emission mask type D, 25 kHz ch. space, GMSK, Two ch. aggreg
ation
Date: 15.MAR.2013 15:14:54

6.0 Spurious Emissions at Antenna Terminals

FCC 2.1051, 90.210

6.1 Requirement

Emission Mask C

The power of any emissions must be attenuated below the unmodulated carrier output power (P): at least (43 + 10 log P) dB.

Note: The worst case corresponding level of -13 dBm for any out-of-band and spurious emissions for FCC.

Emission Mask D

The power of any emissions must be attenuated below the unmodulated carrier output power (P): at least 70 dB or (50 + 10 log P) dB, whichever is lesser attenuation.

Note: The worst case corresponding level of -20 dBm for any out-of-band and spurious emissions for Canada.

Emission Mask F

The power of any emissions must be attenuated below the unmodulated carrier output power (P):at least (55 + 10 log P) dB or 65 dB, whichever is lesser attenuation.

Note: The worst case corresponding level of -25 dBm for any out-of-band and spurious emissions for FCC and Canada.

6.2 Test Procedure

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

For measurements at frequencies below 1 GHz, the spectrum analyzer resolution bandwidth was set to 10 kHz. For measurements at frequencies above 1 GHz, the spectrum analyzer resolution bandwidth was set to 1 MHz. An average detector was used for these measurements.

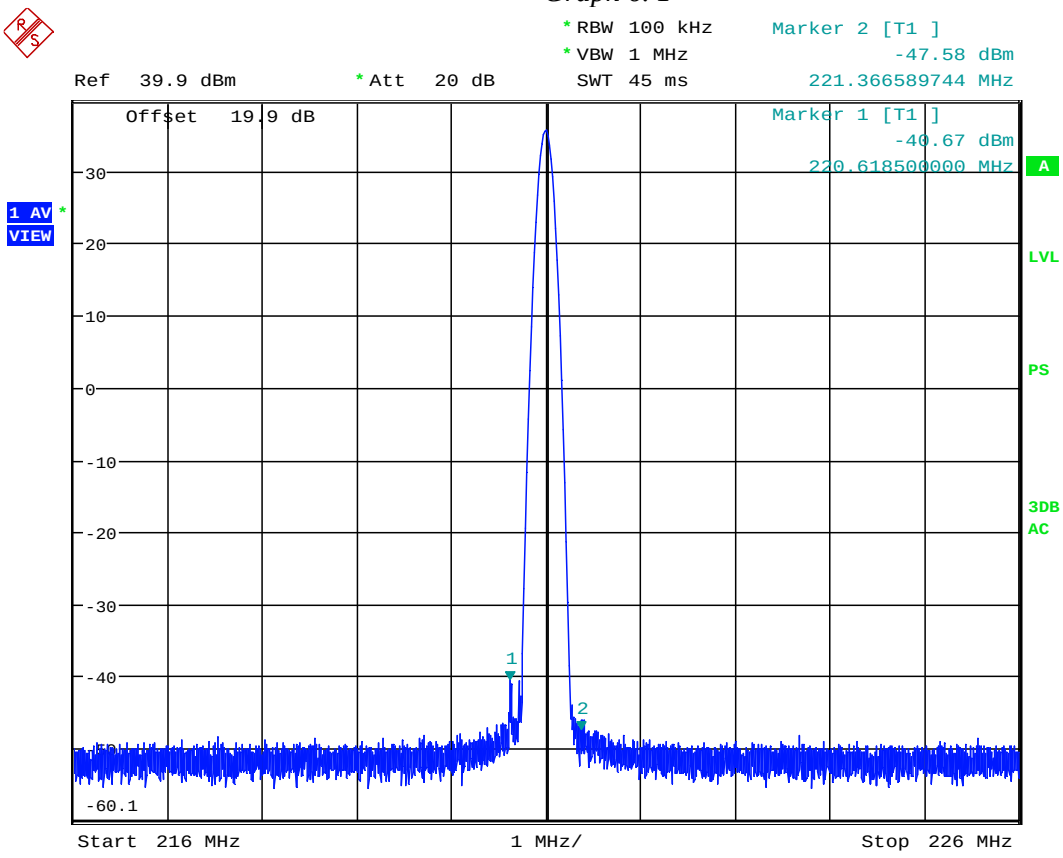
Sufficient scans were taken to show the spurious emissions up to 10th harmonic.

Measurements were performed at different modulations and channel bandwidths. The worst case data was reported.

6.3 Test Results

Complies	Refer to the following Graphs

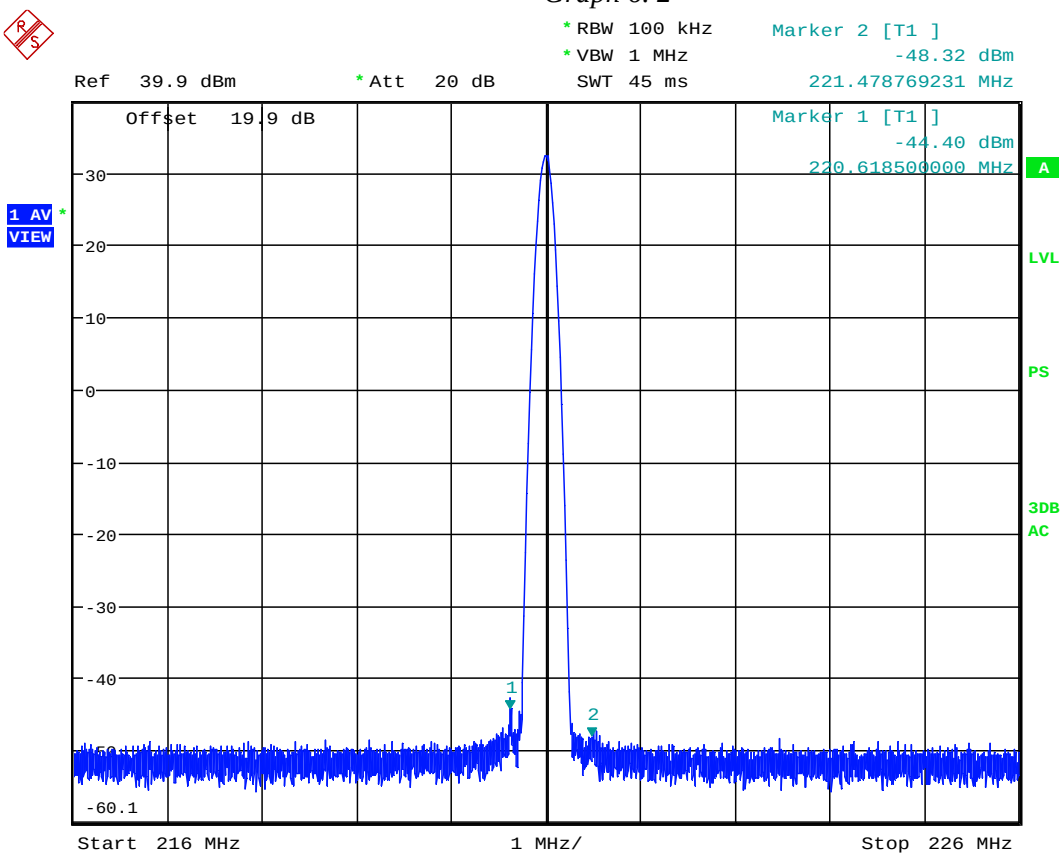
Graph 6. 1



Conducted spurious, 221 MHz, unmodulated

Date: 7.JAN.2013 10:02:14

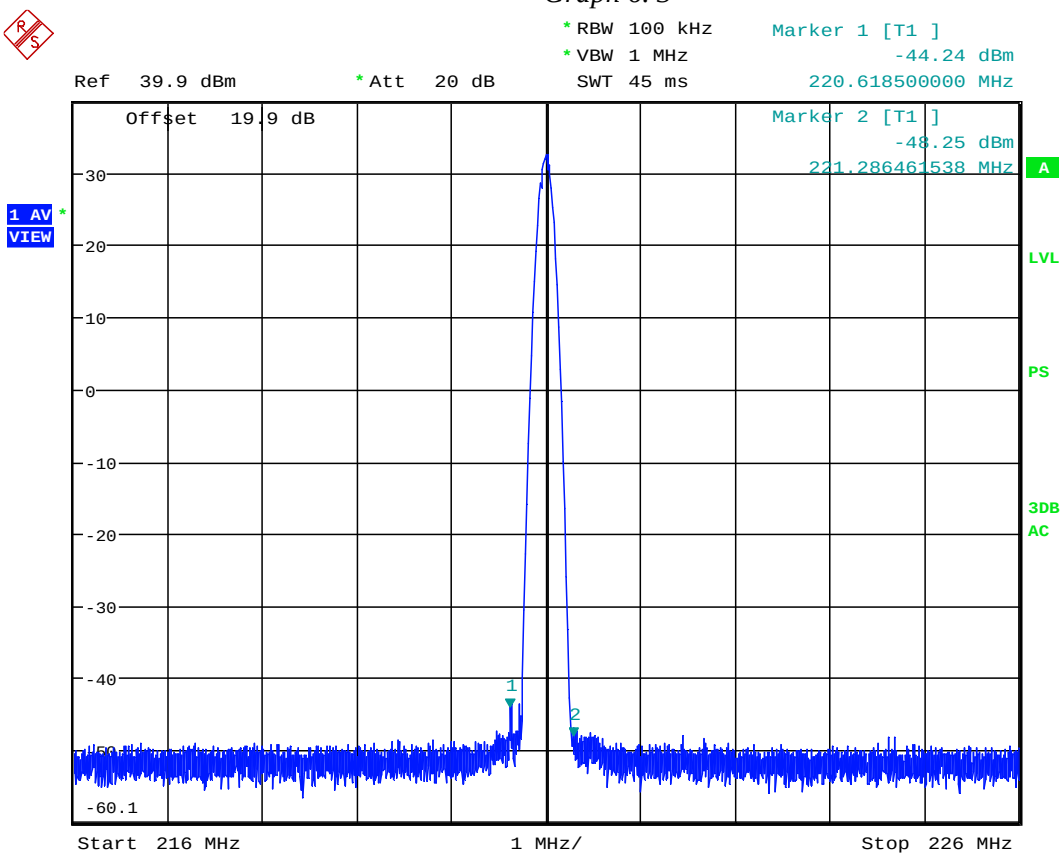
Graph 6. 2



Conducted spurious, 221 MHz, BPSK

Date: 7.JAN.2013 10:05:18

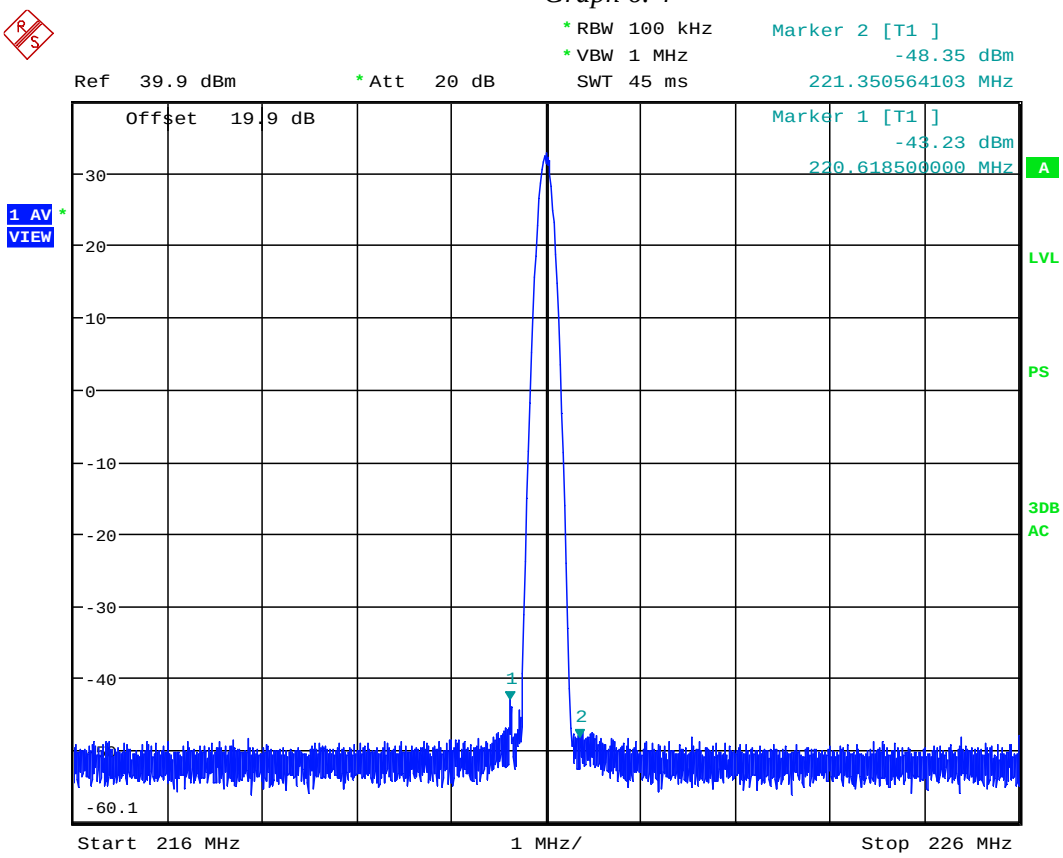
Graph 6. 3



Conducted spurious, 221 MHz, QPSK

Date: 7.JAN.2013 10:07:20

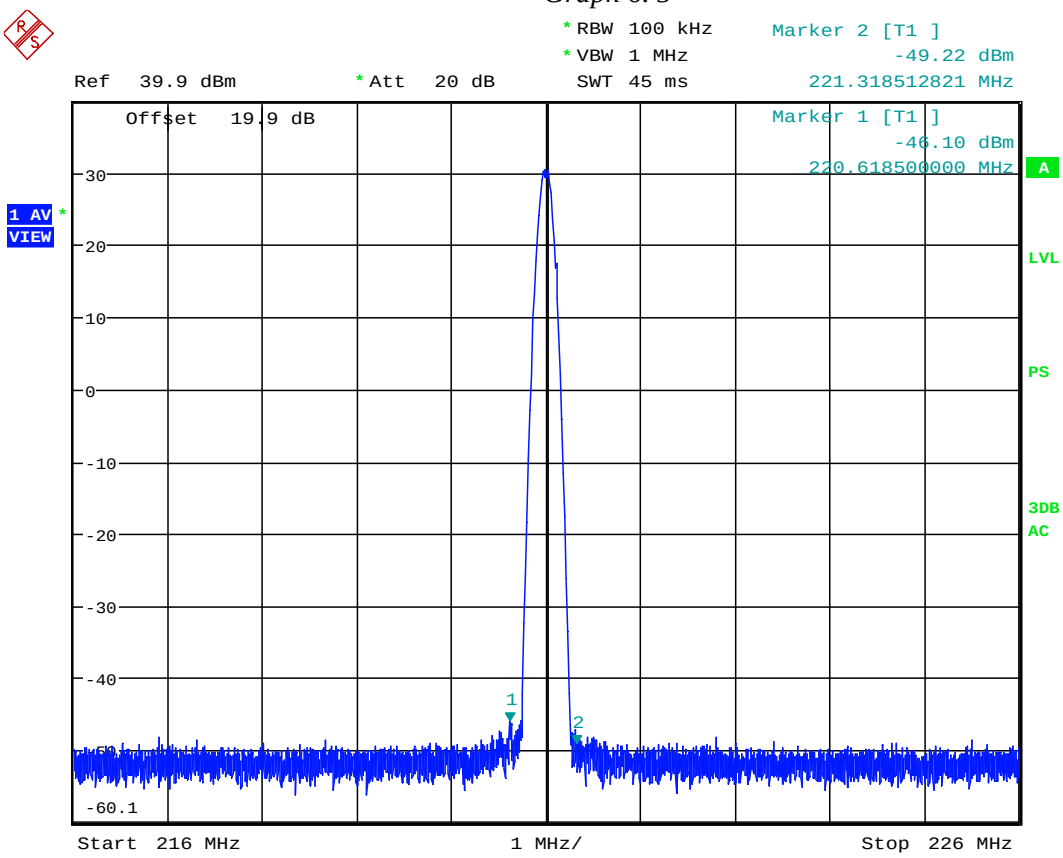
Graph 6. 4



Conducted spurious, 221 MHz, 8PSK

Date: 7.JAN.2013 10:08:51

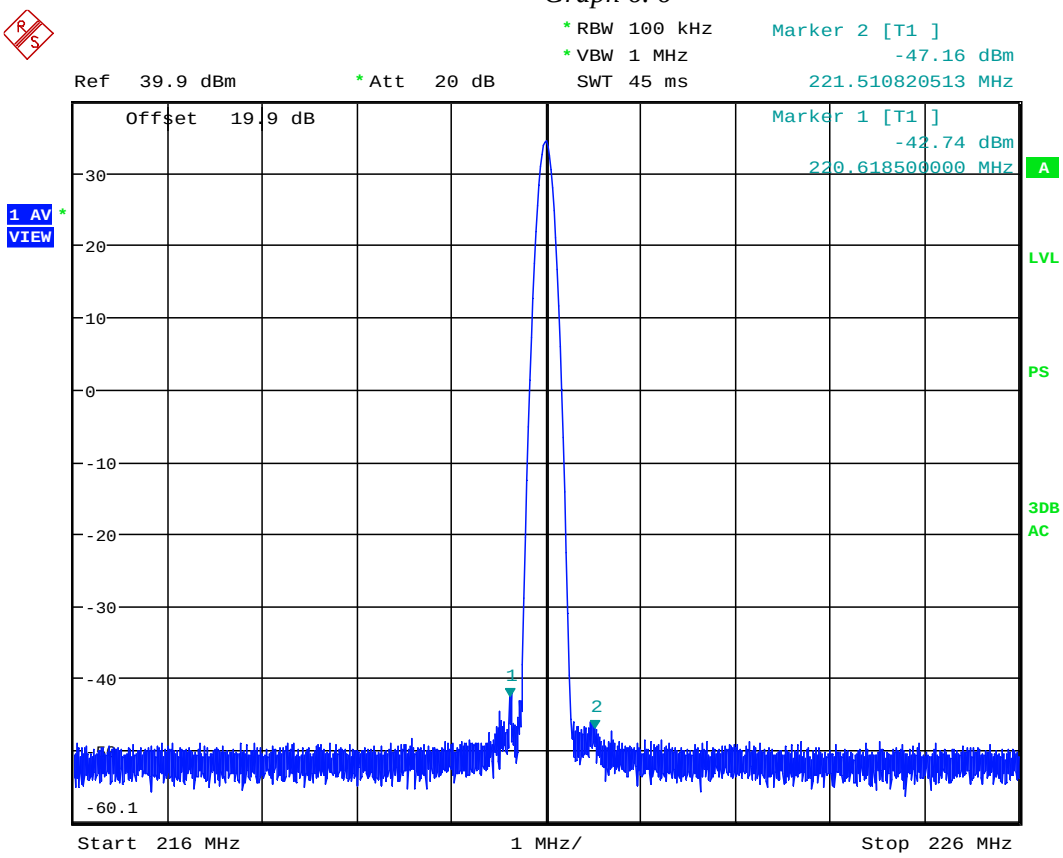
Graph 6. 5



Conducted spurious, 221 MHz, 16QAM

Date: 7.JAN.2013 10:19:39

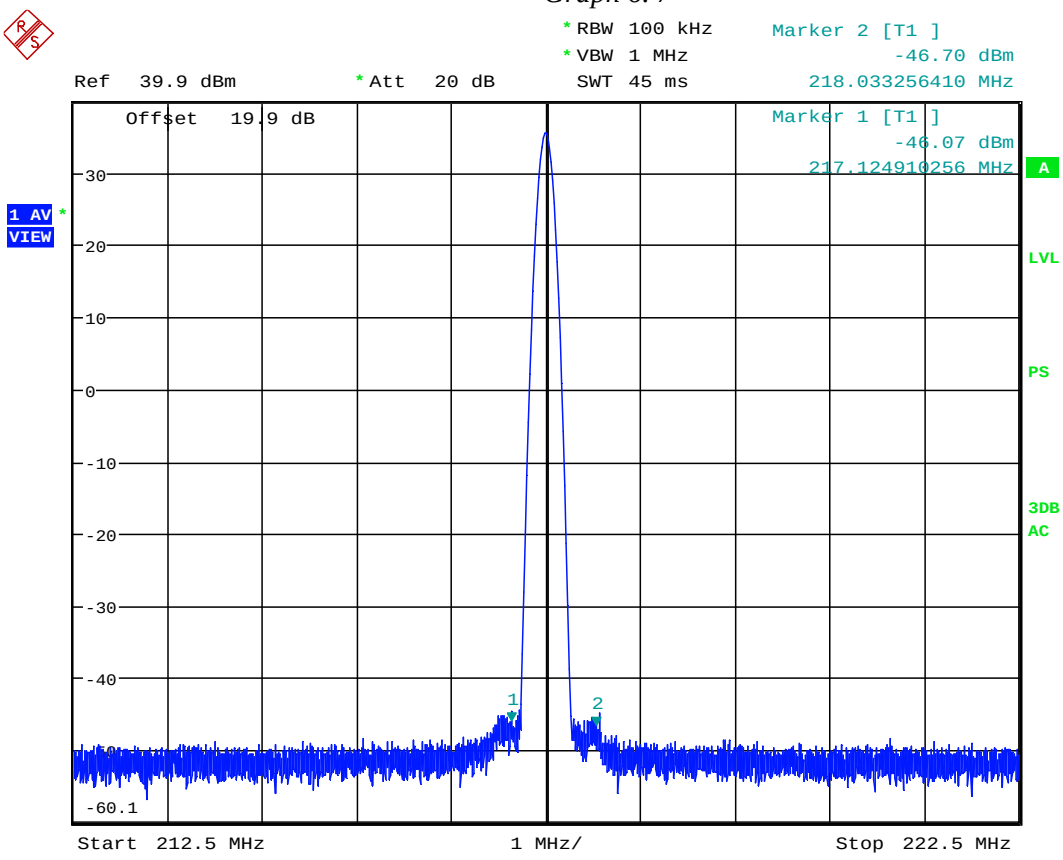
Graph 6. 6



Conducted spurious, 221 MHz, GMSK

Date: 7.JAN.2013 10:21:13

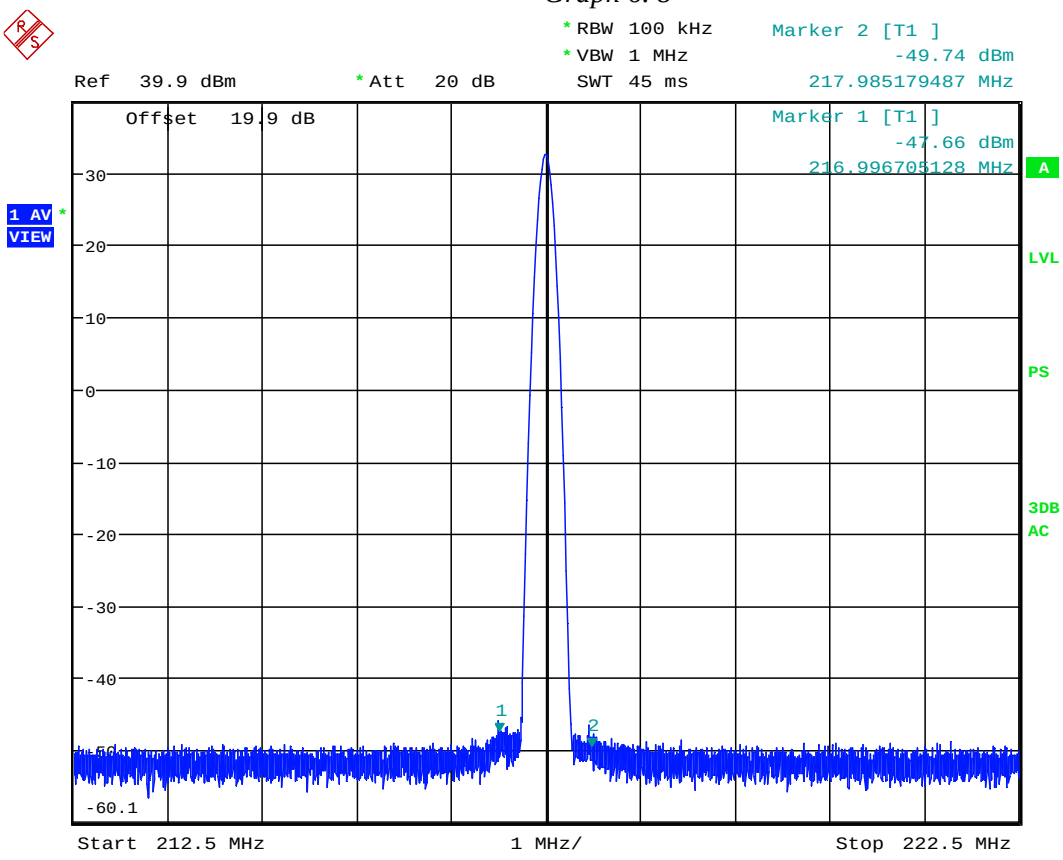
Graph 6. 7



Conducted spurious, 217.5 MHz, unmodulated

Date: 7.JAN.2013 10:26:19

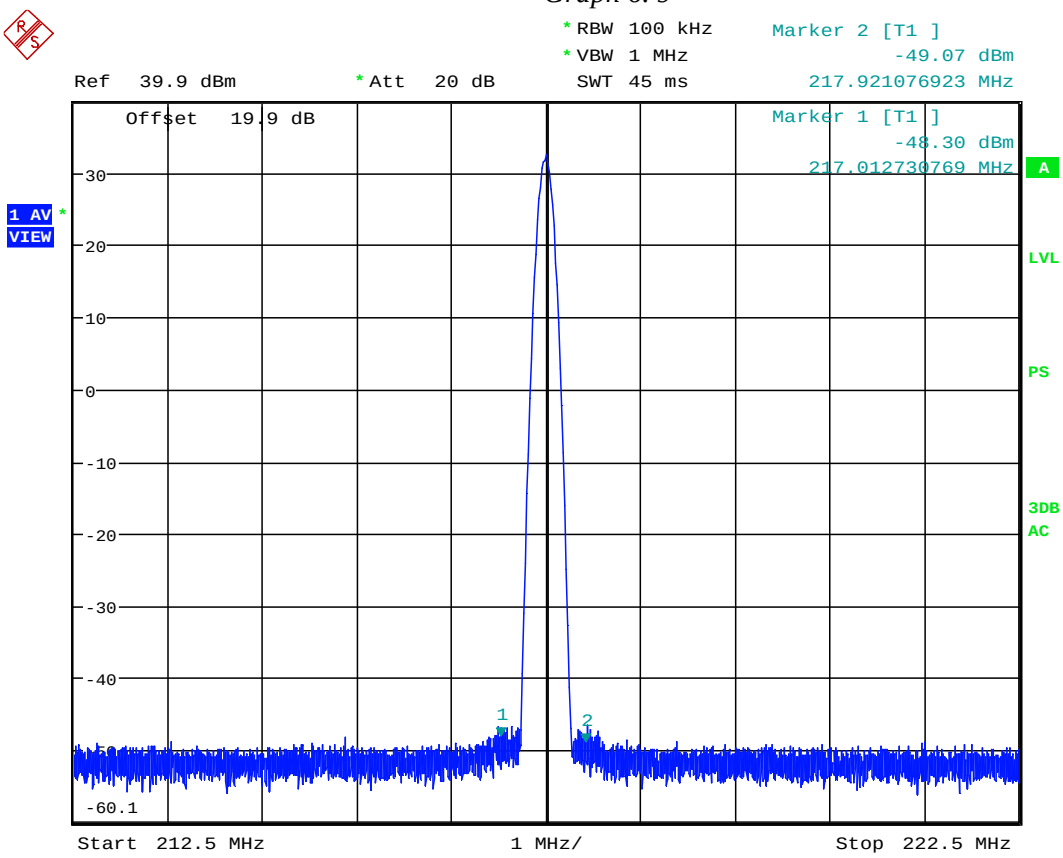
Graph 6. 8



Conducted spurious, 217.5 MHz, BPSK

Date: 7.JAN.2013 10:28:31

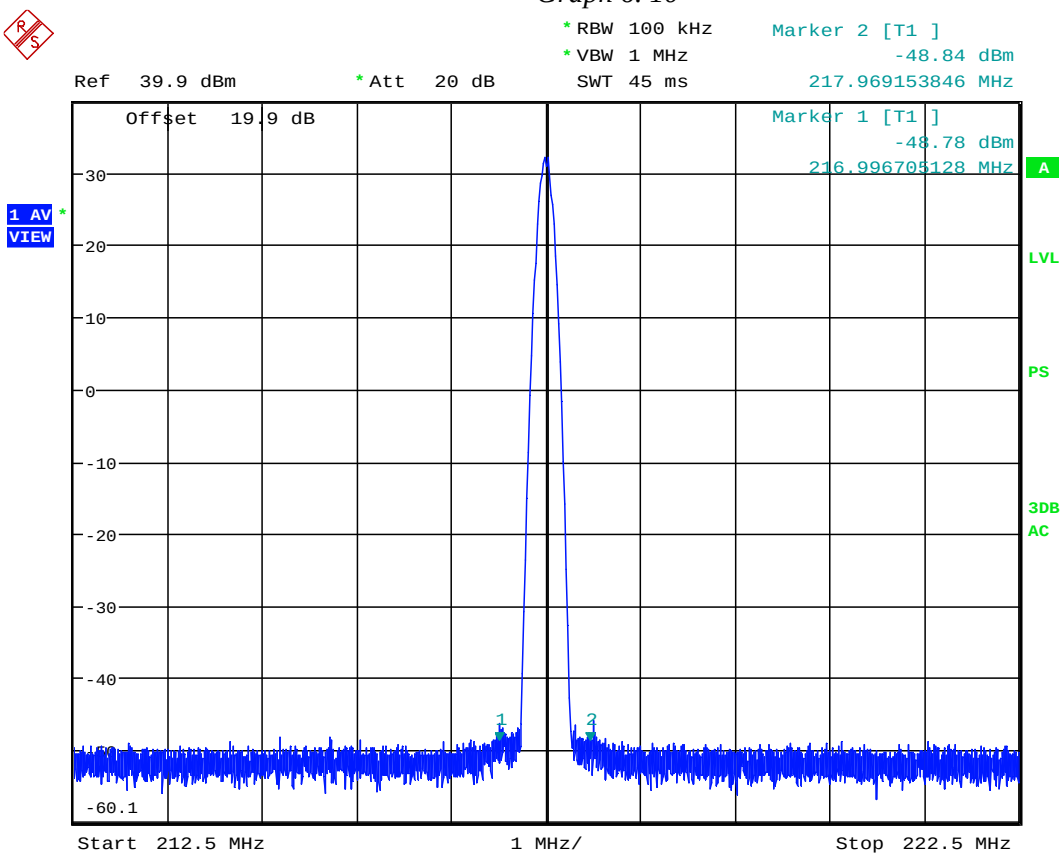
Graph 6. 9



Conducted spurious, 217.5 MHz, QPSK

Date: 7.JAN.2013 10:30:08

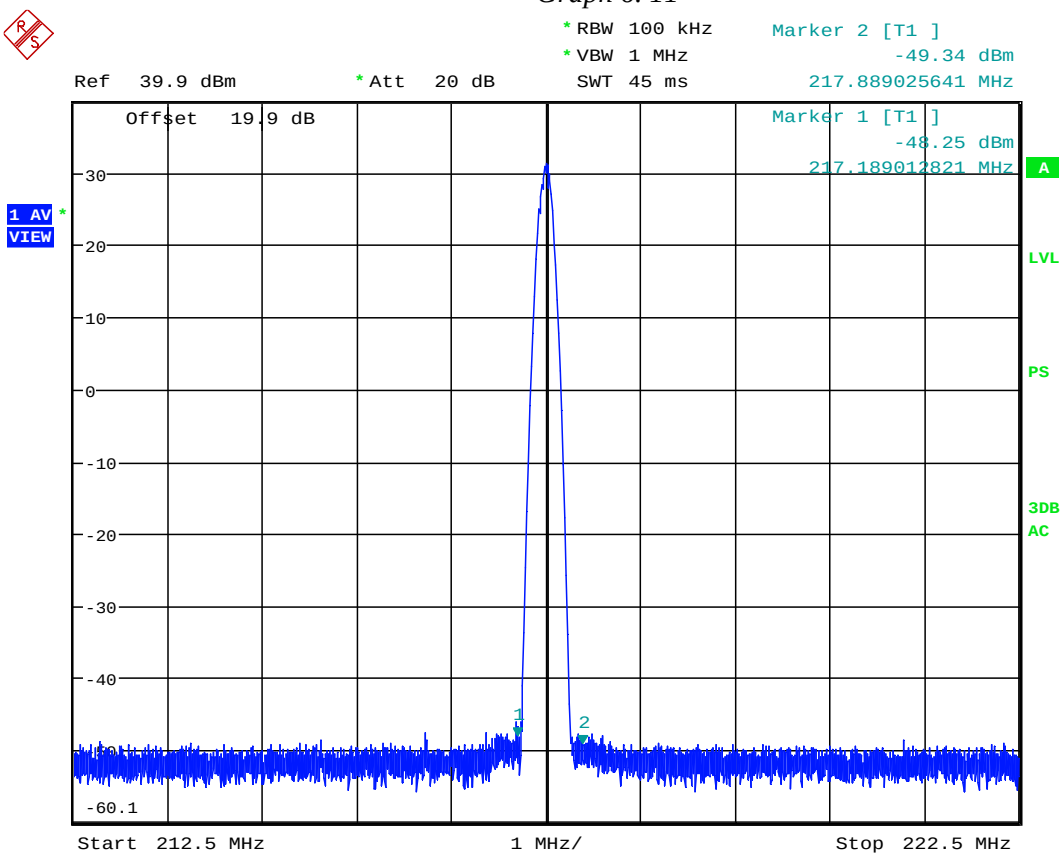
Graph 6. 10



Conducted spurious, 217.5 MHz, 8PSK

Date: 7.JAN.2013 10:31:44

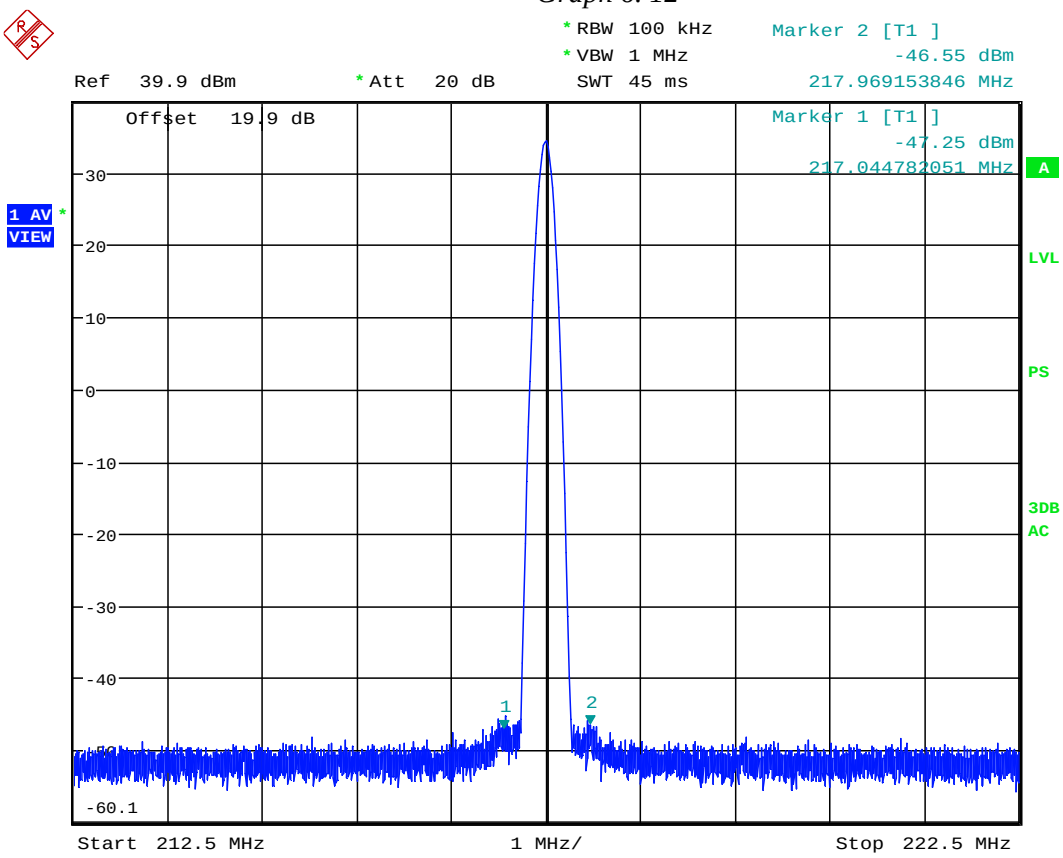
Graph 6. 11



Conducted spurious, 217.5 MHz, 16QAM

Date: 7.JAN.2013 10:34:47

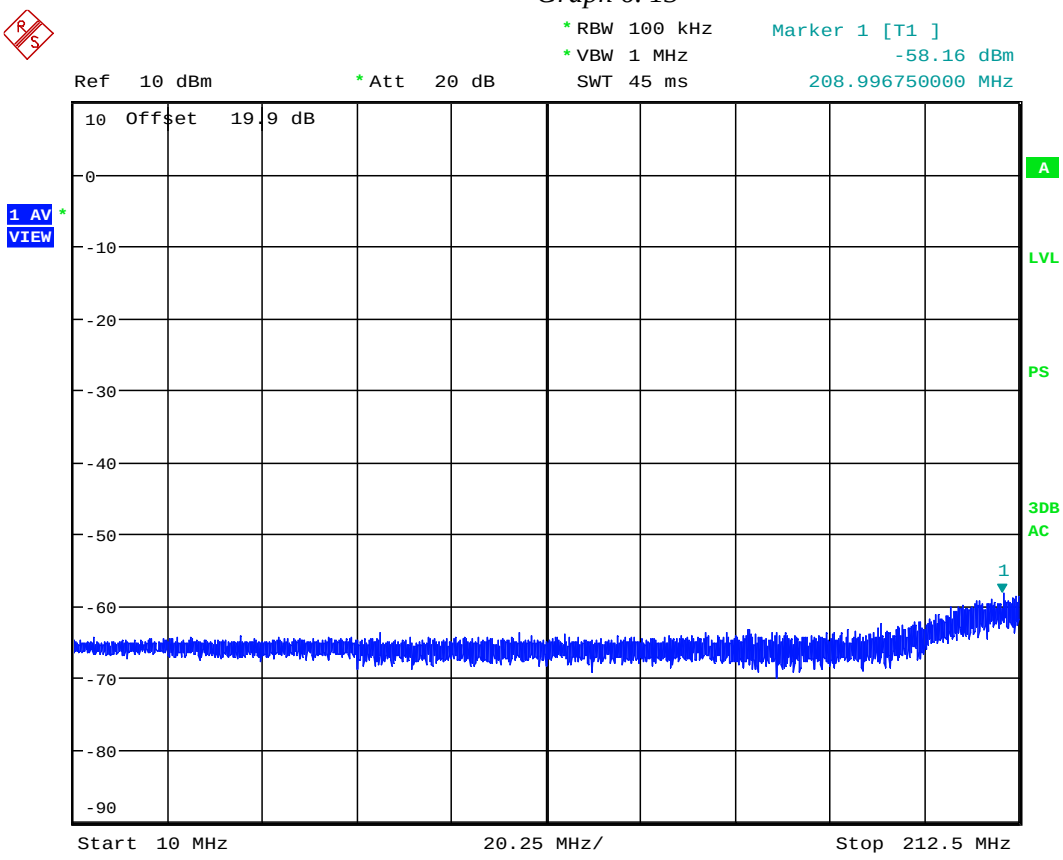
Graph 6. 12



Conducted spurious, 217.5 MHz, GMSK

Date: 7.JAN.2013 10:36:19

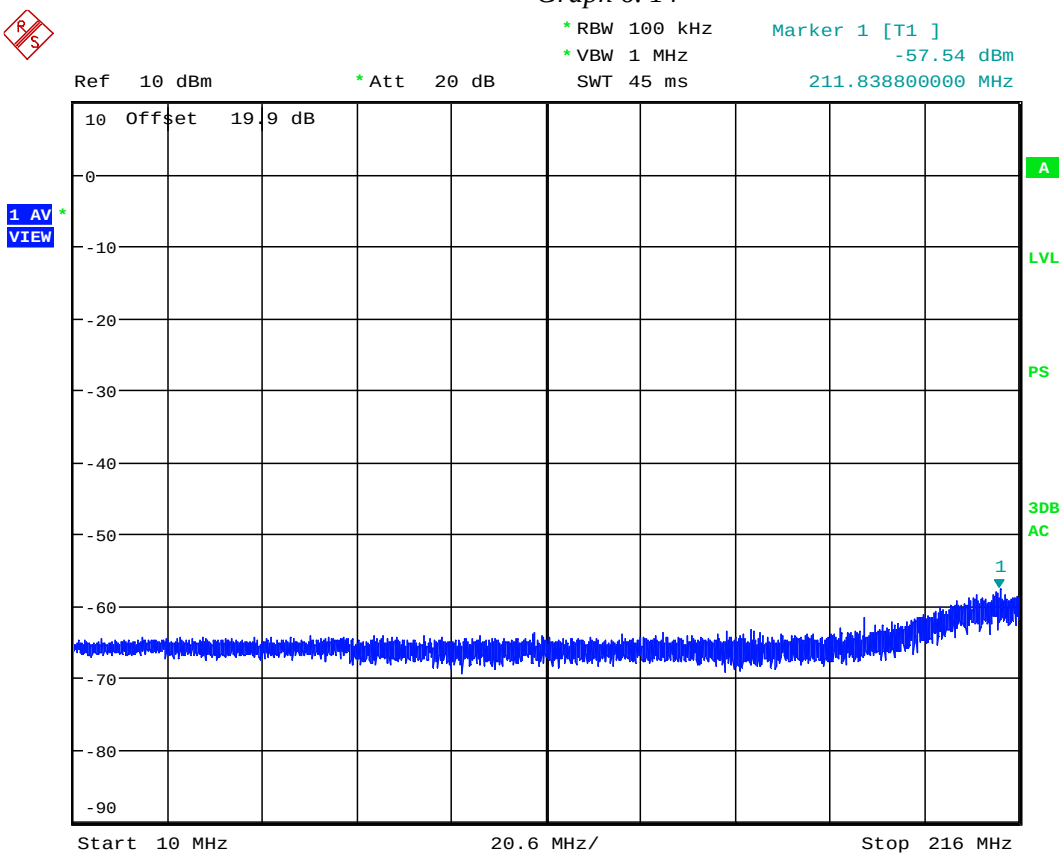
Graph 6. 13



Conducted spurious, 217.5 MHz, GMSK

Date: 7.JAN.2013 10:52:31

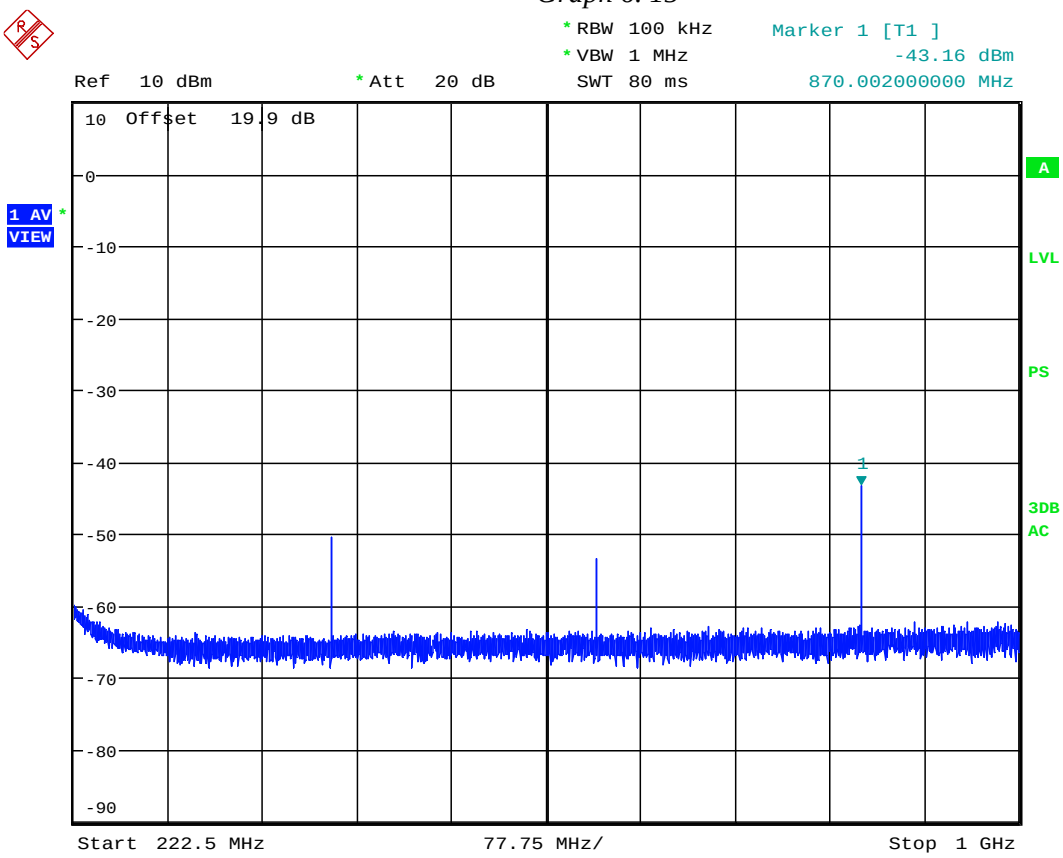
Graph 6. 14



Conducted spurious, 221 MHz, GMSK

Date: 7.JAN.2013 10:54:20

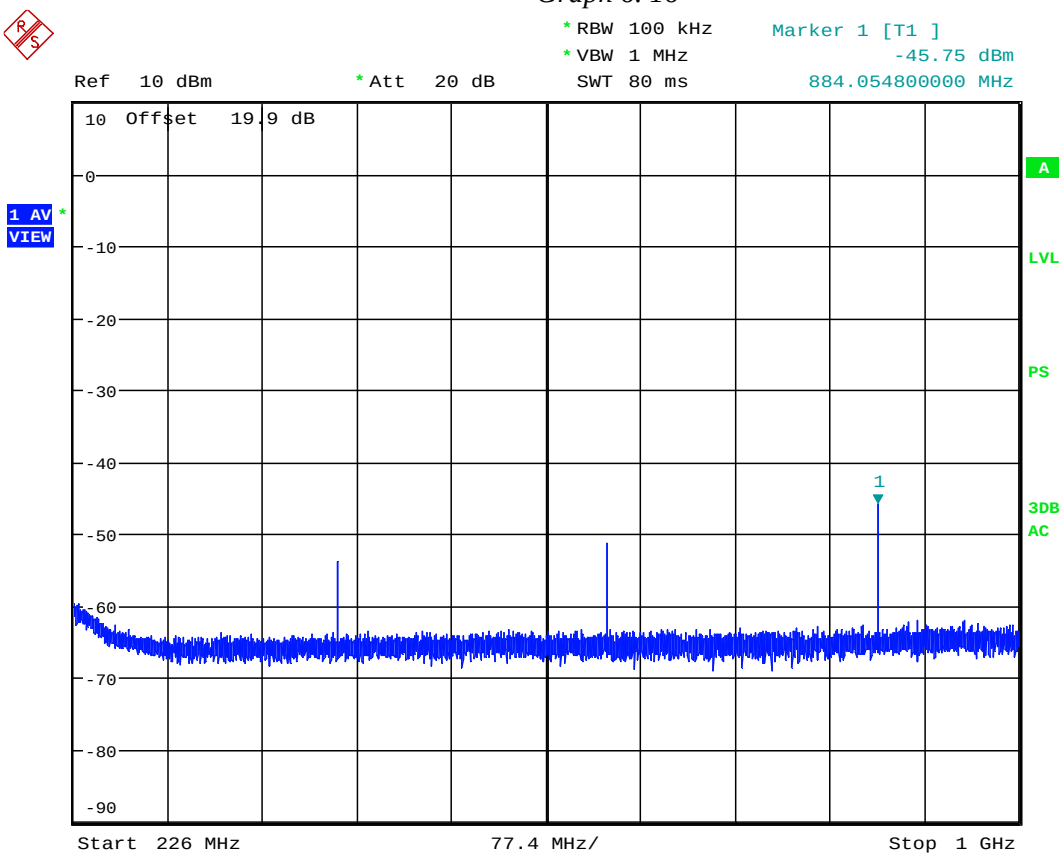
Graph 6. 15



Conducted spurious, 217.5 MHz, GMSK

Date: 7.JAN.2013 11:03:07

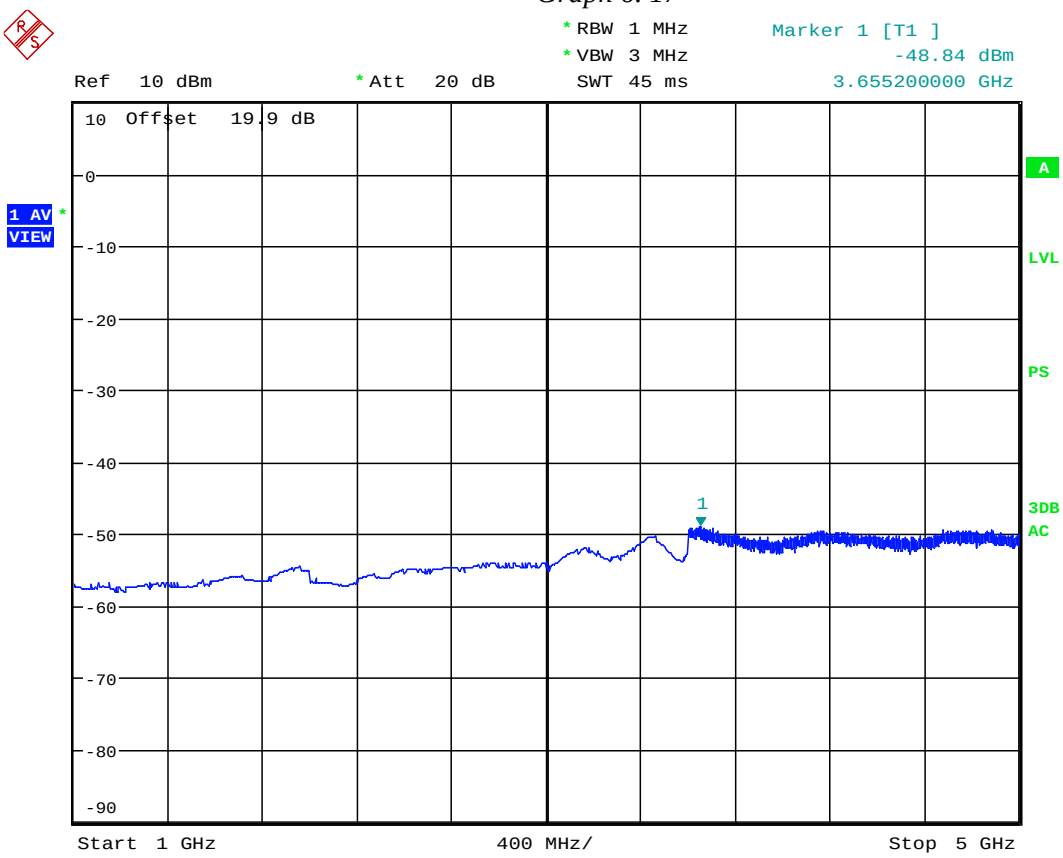
Graph 6. 16



Conducted spurious, 221 MHz, GMSK

Date: 7.JAN.2013 11:05:14

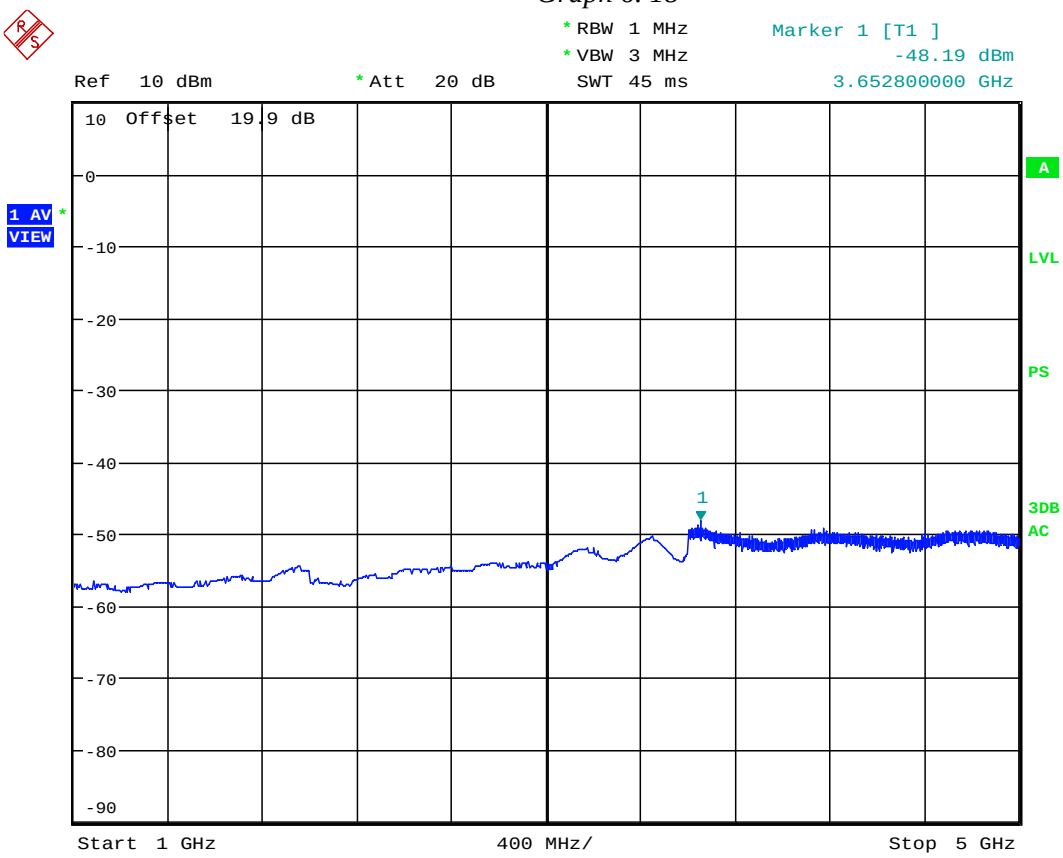
Graph 6. 17



Conducted spurious, 221 MHz, GMSK

Date: 7.JAN.2013 11:09:08

Graph 6. 18



Conducted spurious, 217.5 MHz, GMSK

Date: 7.JAN.2013 11:11:17

7.0 Spurious Radiation

FCC 2.1053, 90.210

7.1 Requirement

The mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency outside the frequency band by at least (55 + 10 log P) dB or 65 dB, whichever is lesser attenuation.

Note: The worst case corresponding level of -25 dBm for any out-of-band and spurious emissions for FCC and Canada.

7.2 Test Procedure

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The frequency range up to 10th harmonic was investigated. The worst case of emissions was reported.

For spurious emissions attenuation, the substitution method was used. The EUT was substituted by a reference antenna (half-wave dipole - below 1 GHz, or Horn antenna - above 1GHz), connected to a signal generator. The signal generator output level ($\mathbf{V_g}$ in dBm) was adjusted to obtain the same reading as from EUT. The ERP at the spurious emissions frequency was calculated as follows.

$$ERP_{(dBm)} = \mathbf{V_g + G_{(dBd)}}$$

The spurious emissions attenuation is the difference between ERP at the fundamental frequency (see section 3) and at the spurious emissions frequency.

7.3 Test Results

Spurious Radiated Emissions

Frequency	SA Reading (from EUT)	Signal Generator Output required to have the same SA Reading as from EUT	ERP*	ERP Limit	ERP Margin
MHz	**dB(µV)**	**V_g dBm**	**dBm**	**dBm**	**dB**
Tx 217.5 MHz (4 W)					
36.47	38.3	-62.9	-62.9	-25.0	-37.9
50.21	38.5	-65.1	-65.1	-25.0	-40.1
94.67	52.3	-56.5	-56.5	-25.0	-31.5
141.55	37.2	-71.7	-71.7	-25.0	-46.7
211.88	45.2	-61.5	-61.5	-25.0	-36.5
435.00	57.5	-43.0	-43.0	-25.0	-18.0
458.42	35.9	-64.2	-64.2	-25.0	-39.2
652.50	50.9	-46.4	-46.4	-25.0	-21.4
802.77	30.8	-64.7	-64.7	-25.0	-39.7
870.00	39.2	-55.1	-55.1	-25.0	-30.1
1087.50	44.3	-66.8	-61.6	-25.0	-36.6
1305.00	38.8	-69.8	-64.9	-25.0	-39.9
5953.12	32.2	-65.8	-57.4	-25.0	-32.4

* ERP is calculated as: $ERP_{(dBm)} = V_{g(dBm)} + G_{(dBd)}$

All other emissions not reported are more than 20 dB below the limit.

Frequency	SA Reading (from EUT)	Signal Generator Output required to have the same SA Reading as from EUT	ERP*	ERP Limit	ERP Margin
MHz	**dB(µV)**	**V_g dBm**	**dBm**	**dBm**	**dB**
Tx 217.5 MHz (2 W)					
36.47	37.3	-63.8	-63.8	-25.0	-38.8
51.83	39.3	-64.8	-64.8	-25.0	-39.8
95.48	51.9	-56.7	-56.7	-25.0	-31.7
121.34	36.4	-69.9	-69.9	-25.0	-44.9
435.00	57.3	-43.2	-43.2	-25.0	-18.2
652.50	43.8	-53.6	-53.6	-25.0	-28.6
870.00	33.0	-61.3	-61.3	-25.0	-36.3
1087.50	34.8	-76.3	-71.1	-25.0	-46.1
1305.00	33.8	-74.8	-69.9	-25.0	-44.9
5956.25	31.8	-66.2	-57.8	-25.0	-32.8

* ERP is calculated as: $ERP_{(dBm)} = V_{g(dBm)} + G_{(dBd)}$

All other emissions not reported are more than 20 dB below the limit.

Spurious Radiated Emissions

Frequency	SA Reading (from EUT)	Signal Generator Output required to have the same SA Reading as from EUT	ERP*	ERP Limit	ERP Margin
MHz	**dB(µV)**	**V_g dBm**	**dBm**	**dBm**	**dB**
Tx 221 MHz (4 W)					
36.47	38.3	-62.8	-62.8	-25.0	-37.8
51.83	39.9	-64.2	-64.2	-25.0	-39.2
95.48	51.6	-57.1	-57.1	-25.0	-32.1
153.68	36.4	-73.0	-73.0	-25.0	-48.0
212.68	42.8	-63.7	-63.7	-25.0	-38.7
442.00	54.4	-46.2	-46.2	-25.0	-21.2
663.00	53.0	-43.8	-43.8	-25.0	-18.8
884.00	37.5	-56.8	-56.8	-25.0	-31.8
1105.00	42.9	-68.2	-62.9	-25.0	-37.9
1326.00	38.3	-70.3	-65.3	-25.0	-40.3
4936.88	34.2	-67.6	-58.5	-25.0	-33.5
5943.75	31.5	-66.6	-58.1	-25.0	-33.1

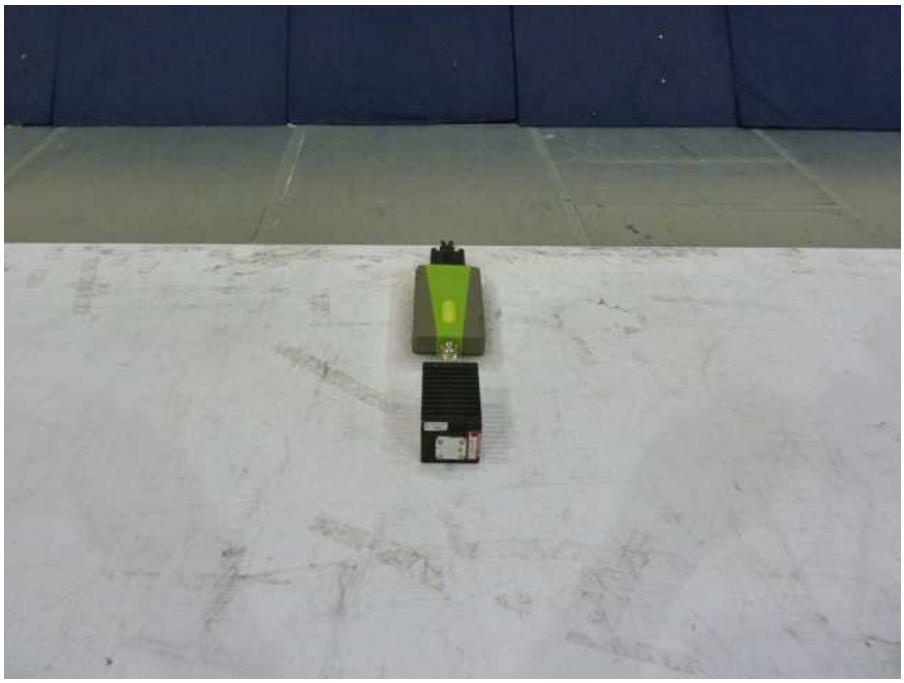
* ERP is calculated as: $ERP_{(dBm)} = \mathbf{V_{g(dBm)} + G_{(dBd)}}$

All other emissions not reported are more than 20 dB below the limit.

Result	Complies

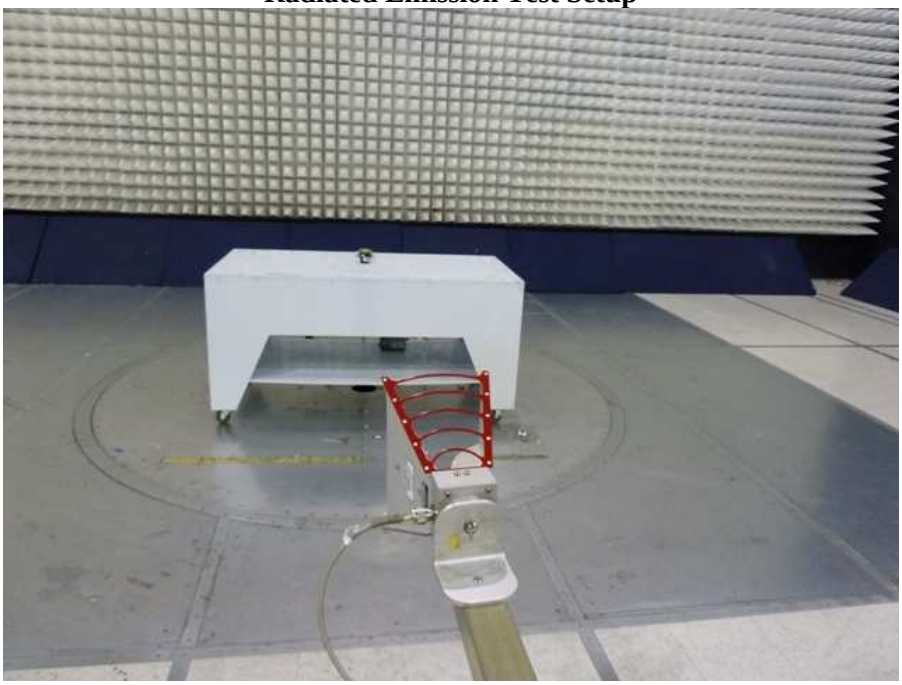
7.4 Test Setup Photographs

Radiated Emission Test Setup



7.4 Test setup photographs

Radiated Emission Test Setup



8.0 Frequency Stability vs Temperature and Voltage

FCC 2.1055, 90.213

8.1 Requirement

According to 90.213, the frequency stability for mobile stations designed to operate in 217-220 MHz must have a frequency stability of 1.0 ppm. Mobile stations designed to operate in 220-222 MHz must have a frequency stability of 1.5 ppm.

Note: according to RSS-119, the frequency stability for mobile stations designed to operate in 217-218 and 219-220 MHz must have a frequency stability of 5.0 ppm. Mobile stations designed to operate in 220-222 MHz must have a frequency stability of 1.5 ppm

8.2 Test Procedure

The EUT was placed inside a temperature chamber. The RF power output was connected to frequency counter. The EUT was setup to transmit with maximum power.

After the temperature stabilized for approximately 20 minutes, the transmitting frequency was measured by the frequency counter and recorded.

At the room temperature, the frequency was measured when the EUT was powered with the nominal voltage and with 85% and 115% of the nominal voltage.

8.3 Test Results

Nominal frequency: 217.5 MHz (4 W or 2 W)

Temperature (°C)	**Maximum deviation from frequency at 20°C,** Hz	**Maximum deviation from frequency at 20°C,** ppm
-30	-19	-0.09
-20	-17	-0.08
-10	-8	-0.04
0	-4	-0.02
10	-1	0.0
20	0	0.00
30	-17	-0.08
40	-27	-0.12
50	-33	-0.15

Nominal frequency: 221 MHz

Temperature (°C)	**Maximum deviation from frequency at 20°C,** Hz	**Maximum deviation from frequency at 20°C,** ppm
-30	-26	-0.12
-20	-19	-0.09
-10	-15	-0.07
0	-4	-0.02
10	-2	-0.01
20	0	0.0
30	-23	-0.10
40	-46	-0.21
50	-52	-0.24

Nominal frequency: 217.5 MHz (4 W or 2 W)

DC Voltage, V	**Maximum deviation from nominal,** Hz	**Maximum deviation from nominal,** ppm
9.0	-42	-0.19
12.0	-44	-0.20
36.0	-44	-0.20

Nominal frequency: 221 MHz

DC Voltage, V	**Maximum deviation from nominal,** Hz	**Maximum deviation from nominal,** ppm
9.0	-33	-0.15
12.0	-34	-0.15
36.0	-35	-0.16

Result	Complies

9.0 RF Exposure Evaluation

FCC 2.1091

The EUT is a wireless device used in a mobile application, at least 100 cm from any body part of the user or nearby persons.

The maximum calculated EIRP is 38.3 dBm (or 6.760 W), and ERP is 36.2dBm (or 4.169 W).

As declared by the Applicant, the EUT transmits with the maximum source-based Duty Cycle of 50% - see the document “HPT204BT VHF OEM Module Duty Cycle evaluation”.
Therefore, the average EIRP is 3.38 W

Using the formula for the Power Density $S = EIRP/ 4\pi D^2$, the distance D, where the Maximum Permissible Exposure (MPE) satisfies the FCC 1.1310 limit for General Population/Uncontrolled Exposure, can be calculated as:

$$D \geq \sqrt{(EIRP/ 4\pi S)}$$

According to FCC 1.1310, the MPE Limit in this band is 2.0 W/m^2, therefore $D \geq 0.37$ m.

A warning statement that a minimum separation distance of at least 100 cm between the antenna and any persons must be maintained is included in the user’s manual.

10.0 Emission from Digital Parts and Receiver

10.1 Radiated Emissions
FCC 15.109

10.1.1 Test Limit

Radiated Emission Limit for FCC Part 15 Subpart B and ICES 003

Radiated Emission Limits for Class A at 10 meters	
Frequency (MHz)	**Quasi-Peak limits, dB (µV/m)**
30 to 88	39.1
88 to 216	43.5
216 to 960	46.4
960 and up	49.5
Radiated Emission Limits for Class B at 3 meters	
Frequency (MHz)	**Quasi-Peak limits, dB (µV/m)**
30 to 88	40.0
88 to 216	43.5
216 to 960	46.0
960 and up	54.0

10.1.2 Test Procedure

Measurements are conducted with a quasi-peak detector instrument in the frequency range of 30 MHz to 1000 MHz and with the average detector instrument in the frequency range above 1000 MHz. The measuring receiver meets the requirements of Section One of CISPR 16 and the measuring antenna correlates to a balanced dipole.

Measurements of the radiated field are made with the antenna located at a distance of 10 meters from the EUT. If the field-strength measurements at 10m cannot be made because of high ambient noise level or for other reasons, measurements of Class B equipment may be made at a closer distance, for example 3m. An inverse proportionality factor of 20 dB per decade should be used to normalize the measured data to the specified distance for determining compliance.

The antenna is adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each test frequency.

The antenna-to-EUT azimuth is varied during the measurement to find the maximum field-strength readings.

The antenna-to-EUT polarization (horizontal and vertical) is varied during the measurements to find the maximum field-strength readings.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for a larger EUT.

Floor standing EUTs are placed on a horizontal metal ground plane and isolated from the ground plane by 3 to 12 mm of insulating material.

Equipment setup for radiated disturbance tests followed the guidelines of ANSI C63.4 (2003).

Example Field Strength Calculation
The field strength is calculated by adding the Antenna Factor and Cable Factor. Then by subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF – PA
Where FS = Field Strength in dB (µV/m)
RA = Receiver Amplitude (including preamplifier) in dB (µV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB (1/m)
PA= Preamplifier Factor in dB

Assume a receiver reading of 52.0 dB (µV) is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB (µV/m).

RA = 52.0 dB (µV)
AF = 7.4 dB (1/m)
CF = 1.6 dB
PA = 29.0 dB
FS = RF + AF + CF – PA
FS = 52.0 + 7.4 + 1.6 – 29.0
FS = 32 dB (µV/m)

10.1.3 Test Results

Result	Complies by 10.4 dB

Intertek Testing Services								
Radiated Emissions 30 MHz - 1000 MHz								
FCC Part 15 Class B (Pk-Horizontal)								
Operator: RS				Model Number: HPT204BT				
January 03, 2013				Company: Javad GNSS, Inc.				
Frequency (MHz)	**Peak FS dB(uV/m)**	**Limit@3m dB(uV/m)**	**Margin dB**	**RA dB(uV)**	**CF dB**	**AG dB**	**DCF dB**	**AF dB(1/m)**
36.4	25.2	40.0	-14.8	28.9	0.7	32.1	10.5	17.2
93.05	28.6	43.5	-14.9	40.1	1.1	32.1	10.5	9.0
991.9	31.9	54.0	-22.1	25.2	3.8	30.9	10.5	23.3
Mode: Rx mode Temp: 22 C, Humidity: 35%								

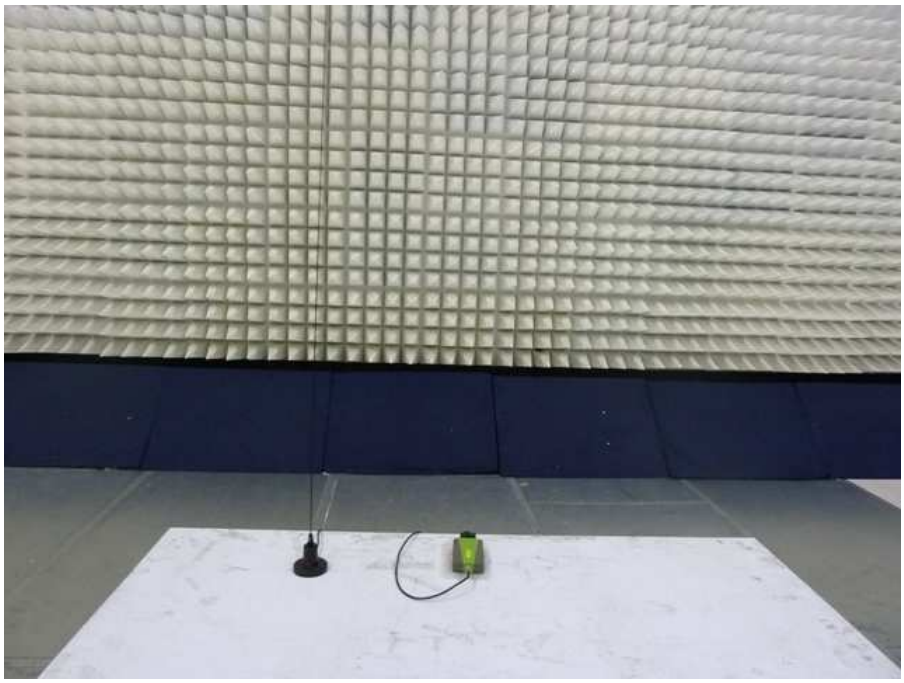
Intertek Testing Services								
Radiated Emissions 30 MHz - 1000 MHz								
FCC Part 15 Class B (QP-Vertical)								
Operator: RS				Model Number: HPT204BT				
January 03, 2013				Company: Javad GNSS, Inc.				
Frequency (MHz)	**QP FS dB(uV/m)**	**Limit@3m dB(uV/m)**	**Margin dB**	**RA dB(uV)**	**CF dB**	**AG dB**	**DCF dB**	**AF dB(1/m)**
36.47	29.0	40.0	-11.0	32.7	0.7	32.1	10.5	17.2
60.72	27.4	40.0	-12.6	38.1	0.9	32.1	10.5	10.0
72.84	27.3	40.0	-12.7	41.2	1.0	32.1	10.5	6.7
107.6	33.1	43.5	-10.4	42.7	1.2	32.1	10.5	10.8
121.3	30.9	43.5	-12.6	39.7	1.3	32.0	10.5	11.4
983.0	32.7	54.0	-21.3	26.7	3.7	31.0	10.5	22.8
Mode: Rx mode Temp: 22 C, Humidity: 35%								

Intertek Testing Services							
Radiated Emissions 1 GHz - 5 GHz							
FCC Part 15 Class B (Pk-Horizontal)							
Operator: RS				Model Number: HPT204BT			
January 03, 2013				Company: Javad GNSS, Inc.			
Frequency (MHz)	**Pk Level (dBuV/m)**	**Limit@3m (dBuV/m)**	**Pk Margin (dB)**	**RA (dBuV)**	**CF (dB)**	**AG (dB)**	**AF dB(1/m)**
5939	38.7	54	-15.3	31	5.3	32.8	35.2
Test mode: Rx mode Temp: 22 C, Humidity: 35%							

Intertek Testing Services							
Radiated Emissions 1 GHz - 5 GHz							
FCC Part 15 Class B (Pk-Vertical)							
Operator: RS				Model Number: HPT204BT			
January 03, 2013				Company: Javad GNSS, Inc.			
Frequency (MHz)	**Pk Level (dBuV/m)**	**Limit@3m (dBuV/m)**	**Pk Margin (dB)**	**RA (dBuV)**	**CF (dB)**	**AG (dB)**	**AF dB(1/m)**
5946	39.2	54	-14.8	31.6	5.3	32.8	35.1
Test mode: Rx mode Temp: 22 C, Humidity: 35%							

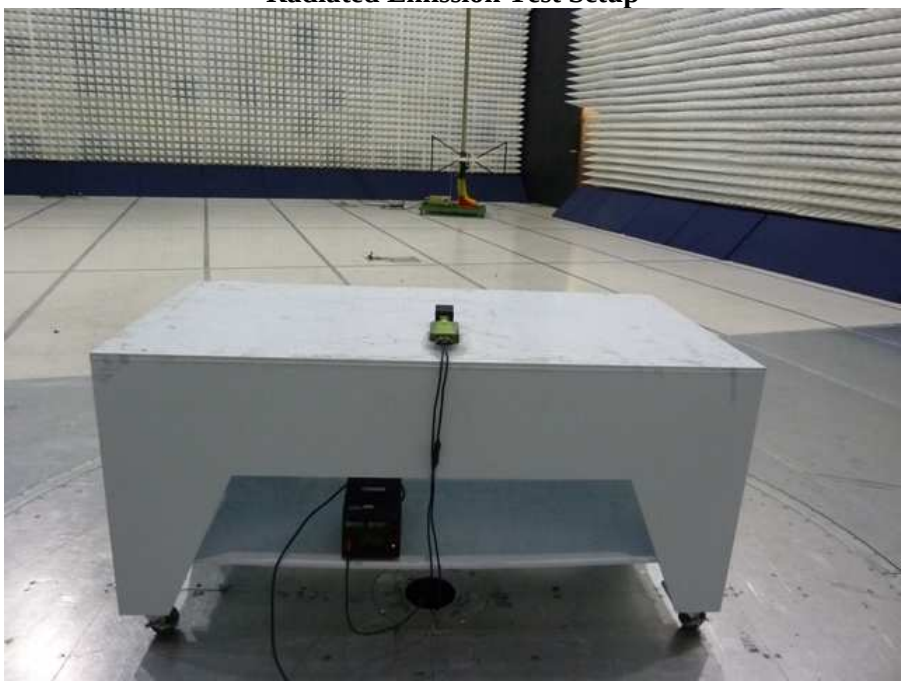
10.1.4 Test Setup Photographs

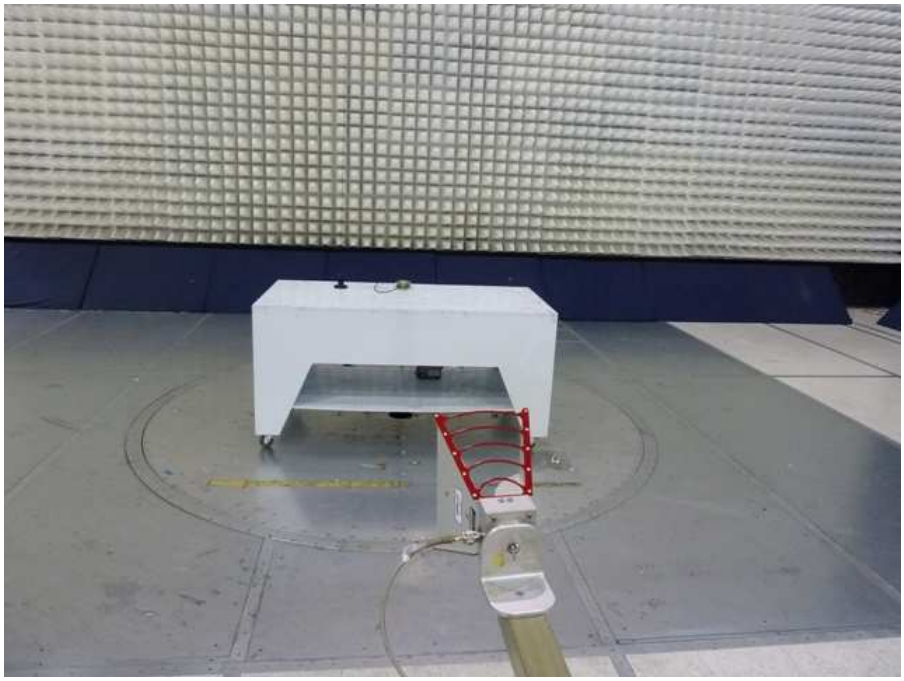
Radiated Emission Test Setup



10.1.4 Test Setup Photographs

Radiated Emission Test Setup





10.2 Receiver Antenna Conducted Emissions
FCC 15.111(a)

10.2.1 Limit

The power at the antenna terminal shall not exceed 2.0 nanowatts (-57 dBm).

10.2.2 Test Procedure

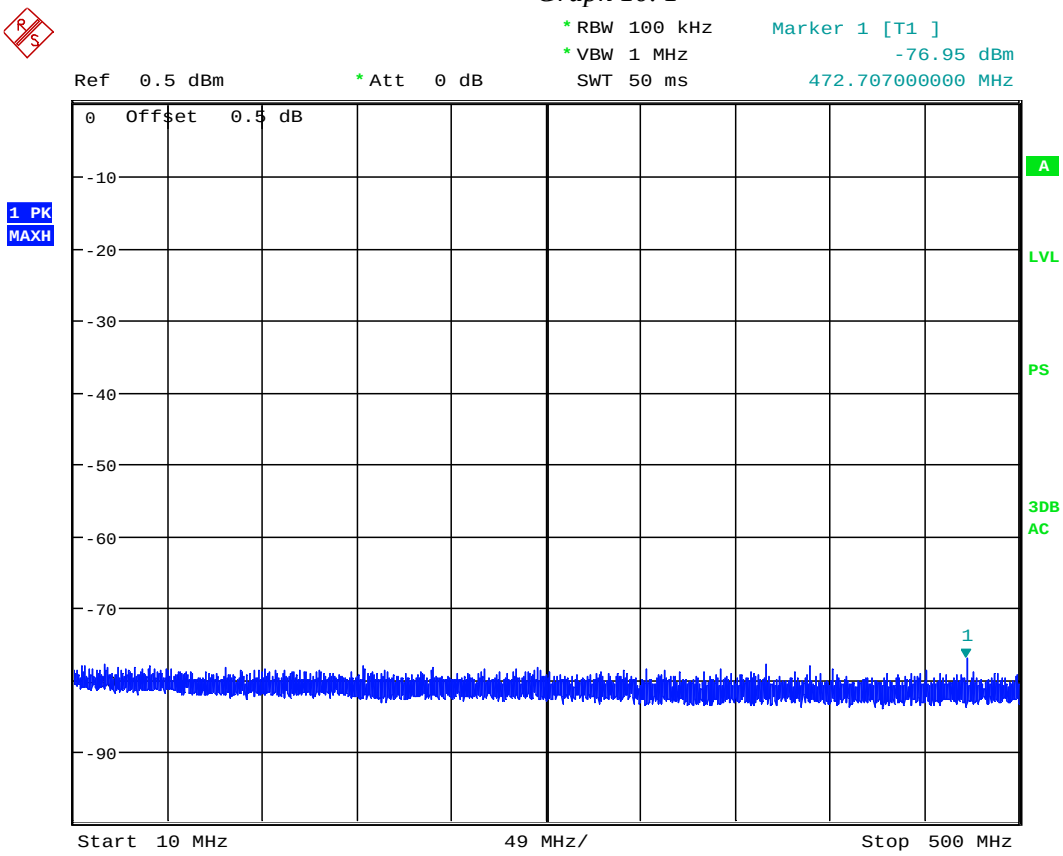
The spectrum analyzer was connected to the RF output of the EUT. The EUT was setup in receiving mode.

10.2.3 Test Results

The test results are presented on the following graphs.

Result	Complies by 19.2 dB

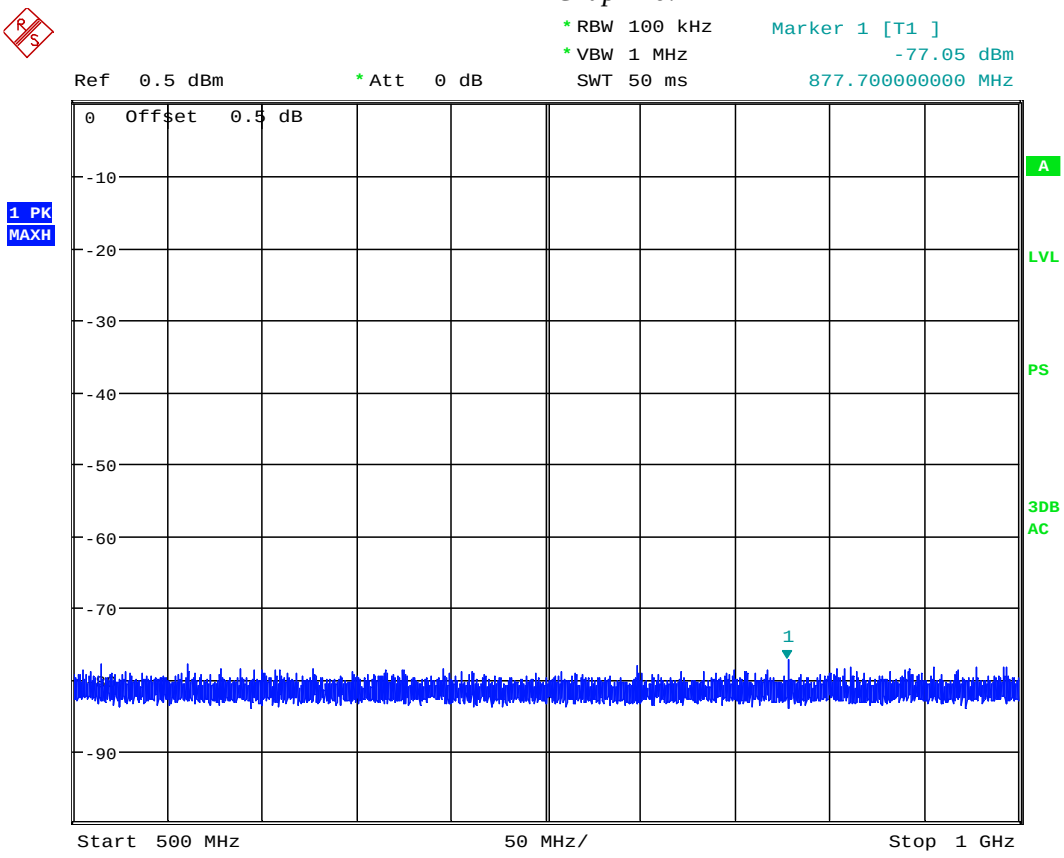
Graph 10. 1



Receiver conducted spurious, 217.5MHz

Date: 7.JAN.2013 16:23:32

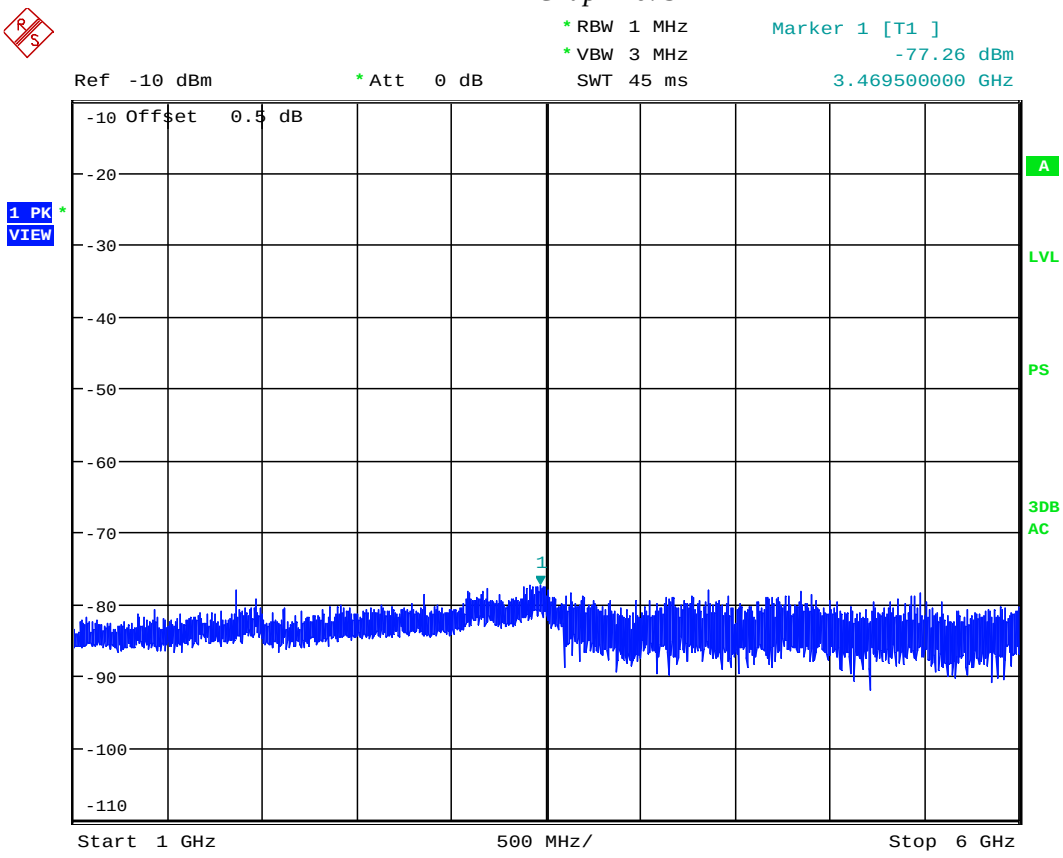
Graph 10. 2



Receiver conducted spurious, 217.5MHz

Date: 7.JAN.2013 16:26:48

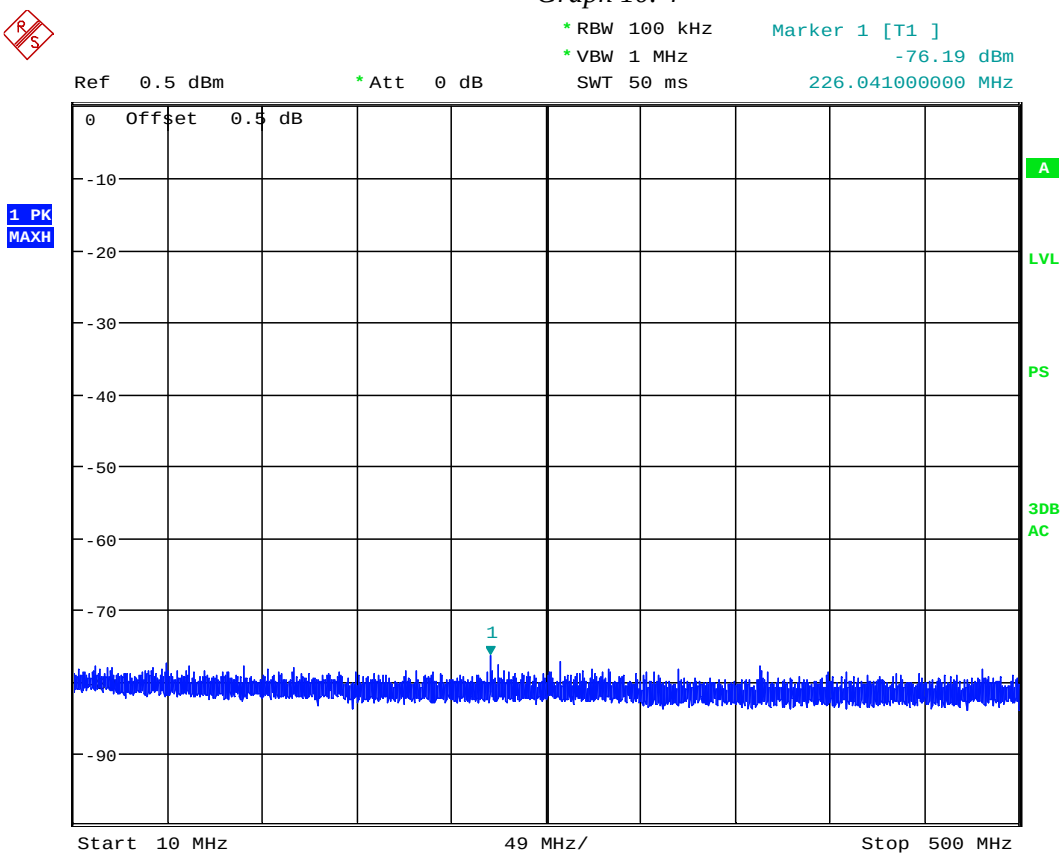
Graph 10. 3



Receiver conducted spurious, 217.5MHz

Date: 7.JAN.2013 16:38:21

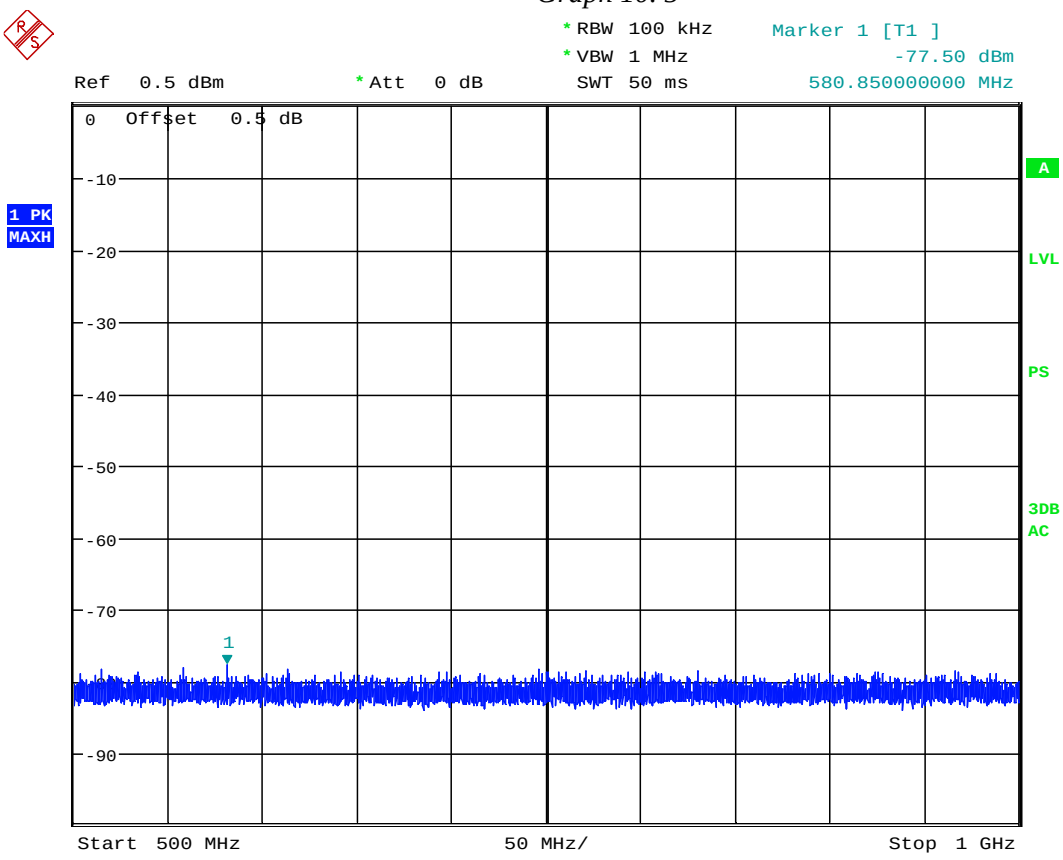
Graph 10. 4



Receiver conducted spurious, 221MHz

Date: 7.JAN.2013 16:25:42

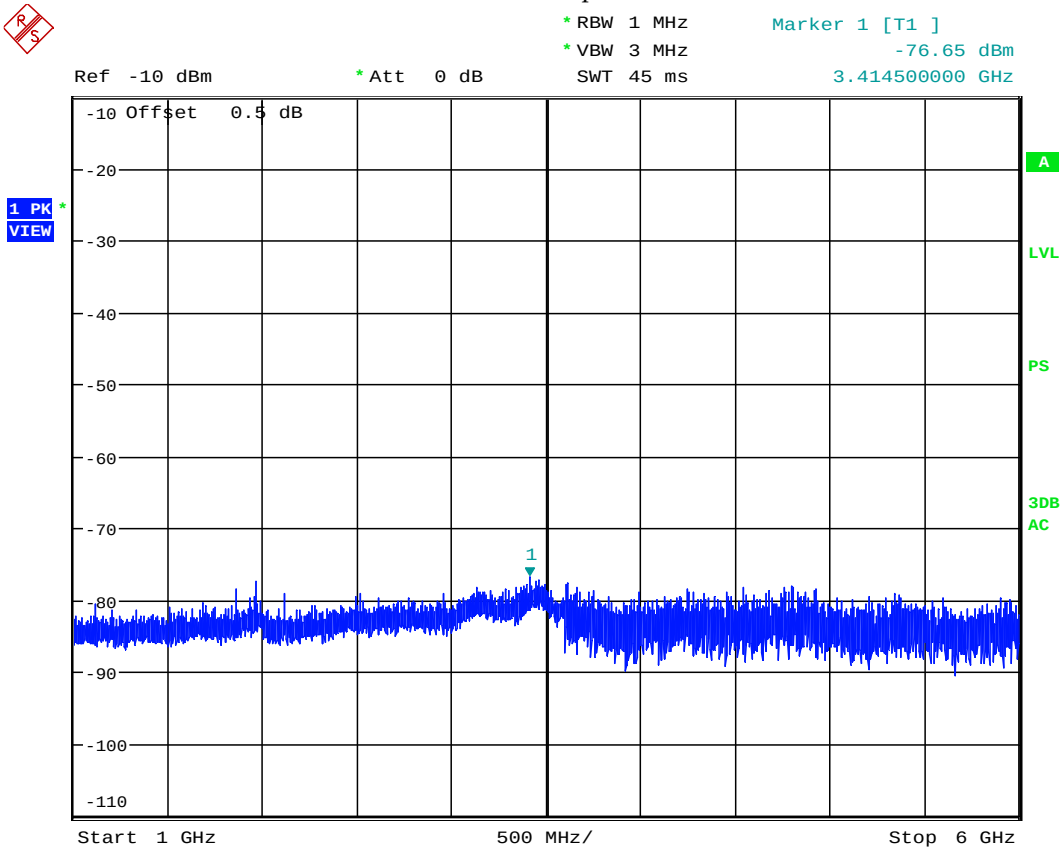
Graph 10. 5



Receiver conducted spurious, 221MHz

Date: 7.JAN.2013 16:27:44

Graph 10. 6



Receiver conducted spurious, 221MHz

Date: 7.JAN.2013 16:39:09

10.3 AC Line Conducted Emission
FCC 15.207

10.3.1 Test Limits

FCC Part 15 Subpart B and ICES 003Limits for Conducted Disturbance at the Mains Ports

Frequency Band MHz	**Class B Limit dB (µV)**	
	Quasi-Peak	**Average**
0.15-0.50	66 to 56 Decreases linearly with the logarithm of the frequency	56 to 46 Decreases linearly with the logarithm of the frequency
0.50-5.00	56	46
5.00-30.00	60	50

Note: At the transition frequency the lower limit applies.

10.3.2 Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

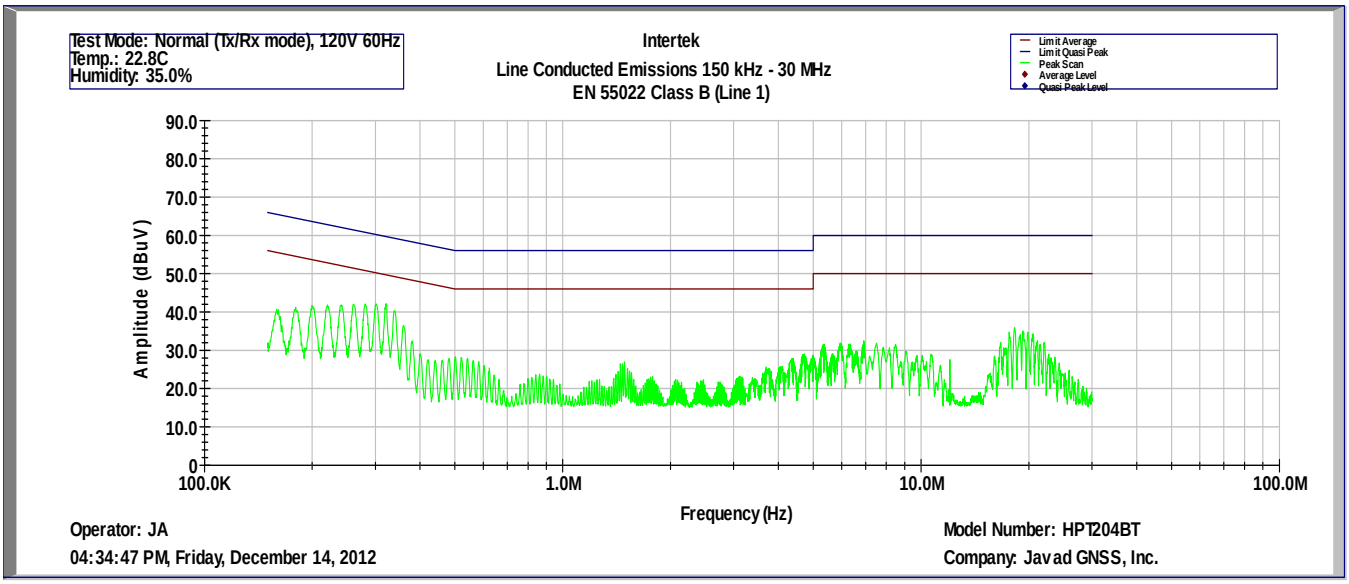
Floor standing EUTs are placed on a horizontal metal ground plane and isolated from the ground plane by 3 to 12 mm of insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

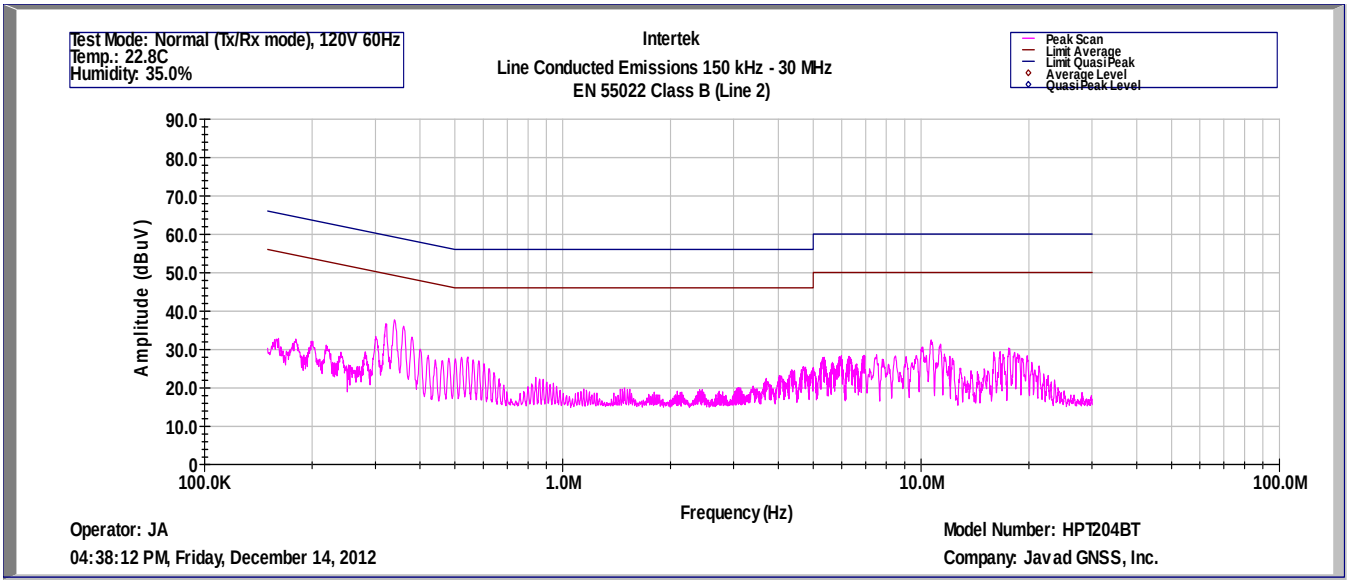
Equipment setup for conducted disturbance tests followed the guidelines of ANSI C63.4.

10.3.3 Test Result

Results	**Complies** by 9.0 dB

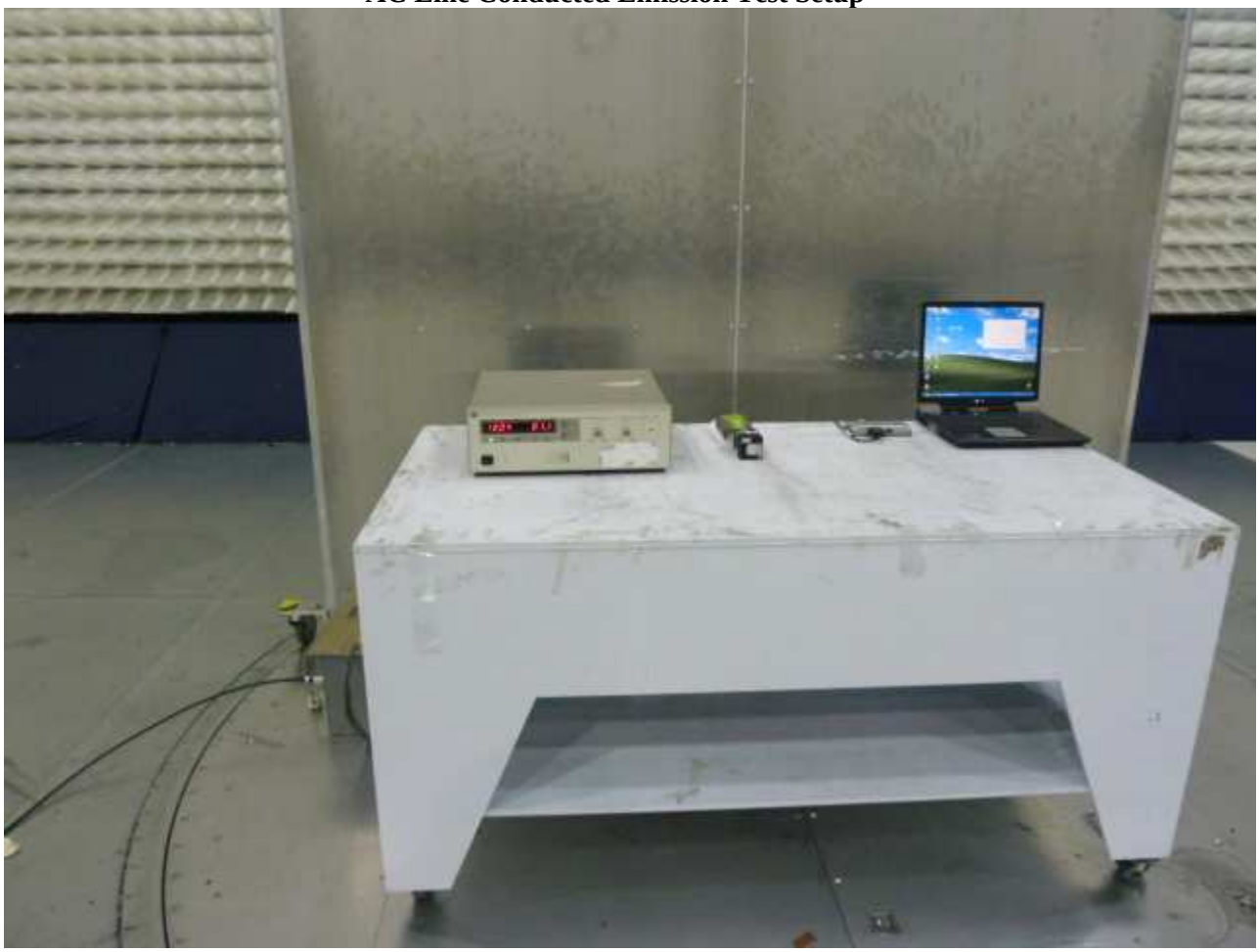
Conducted Disturbance at AC Mains





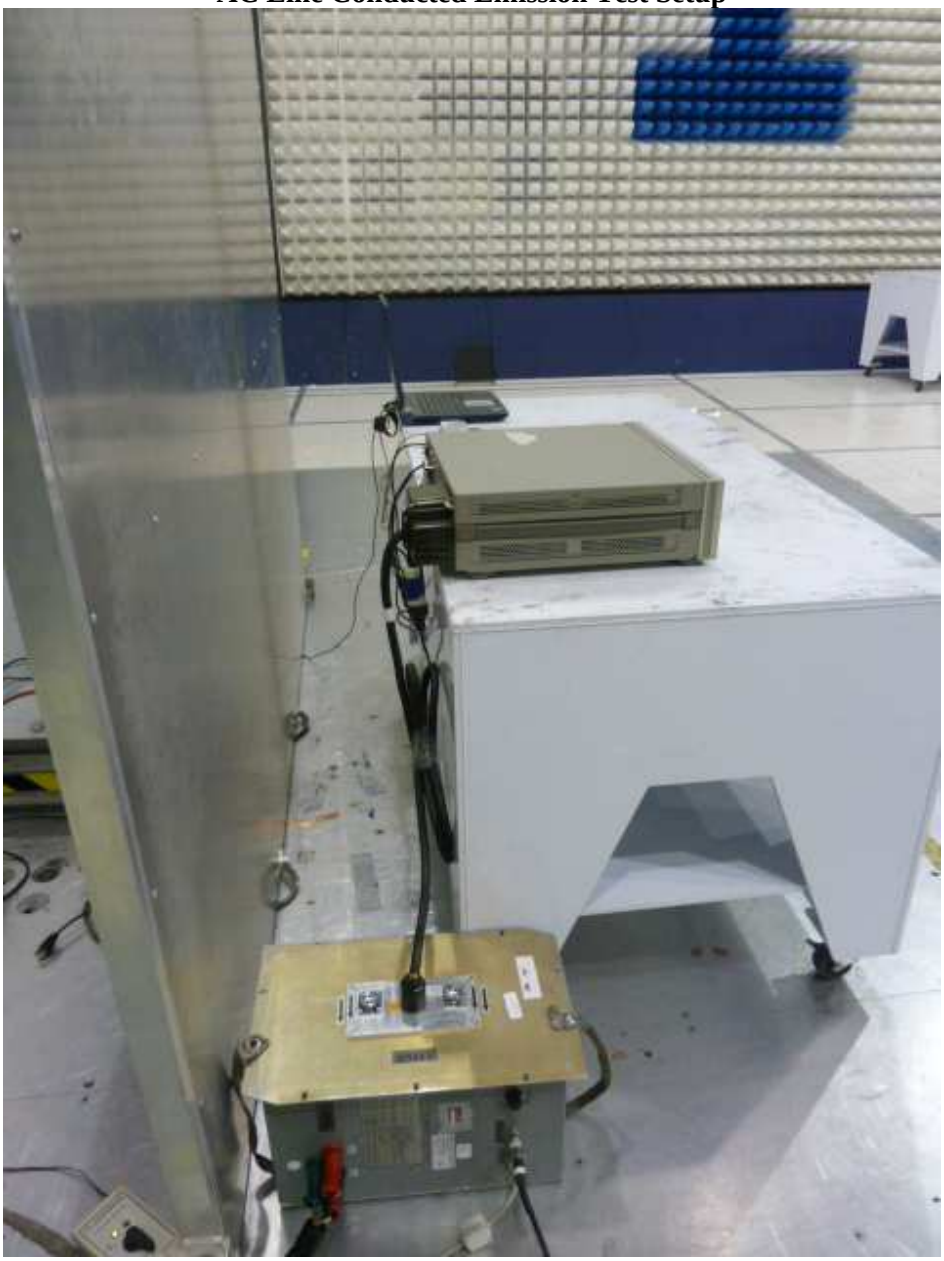
10.3.4 Test Setup Photographs

AC Line Conducted Emission Test Setup



10.3.4 Test Setup Photographs

AC Line Conducted Emission Test Setup



11.0 List of Test Equipment

Measurement equipment used for compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
RF Filter Section	Hewlett Packard	85460A	3448A00267	12	03/09/13
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	03/09/13
Spectrum Analyzer	Rohde&Schwarz	FSU	200482	12	03/22/13
Spectrum Analyzer	Rohde&Schwarz	FSP-40	100030	12	11/19/13
Spectrum Analyzer	Rohde&Schwarz	ESU	100172	12	10/05/13
BI-Log Antenna	ARA	LPB-2513/A	1154	12	07/12/13
Horn Antenna	EMCO	3115	9107-3712	12	12/06/13
Horn Antenna	EMCO	3115	00126795	12	11/15/13
Pyramidal Horn Antenna	EMCO	3160-09	Not Labeled	#	#
Pyramidal Horn Antenna	EMCO	3160-10	Not Labeled	#	#
Pre-Amplifier	Sonoma	310N	293620	12	11/20/13
Pre-Amplifier	Miteq	AMF-4D-001180-24-10P	799159	12	09/10/13
Pre-Amplifier	Miteq	JSD44-18004000-30-5P	1071636	12	05/11/13
Signal Generator	Hewlett Packard	SMR40	100445	12	09/06/13
Signal Generator	Rohde&Schwarz	845.4002.44	883983/010	12	02/13/13
LISN	FCC	FCC-LISN-50-50-M-H	2011	12	02/02/13

No Calibration required

12.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / 100675010	KK	March 16, 2013	Original document